# volume 2

CONTAINS:
PAGES 2457-4666

MANUFACTURERS'
CATALOG PAGES
eem PRODUCT SECTIONS
2450-6000

---

SEE VOLUME 1 FOR:

- eem Product Sections 1100-2400
- Product Index and Directory
- Manufacturers and Sales Offices Directory
- Trade Mark Directory

## 21st edition

# eem 78 79

# electronic engineers master catalog

Published Annually By
united
technical
publications

# LOOKING FOR POWER SUPPLIES? SPECIFY ACOPIAN,

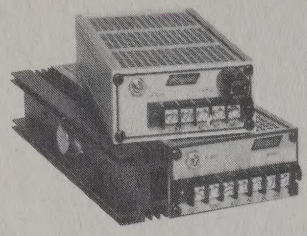
## 5V OR ±15V POWER FOR PCB'S

Mount these mini power modules, as small as 2.3" x 1.8" x 1.0", directly on printed circuit boards to save space and simplify wiring. Ratings at 5 volts from .250 to 2.5 amps; at ±15 volts from .025 to .5 amps. Short circuit protected. Prices start at $24. Guaranteed 3-day shipment.

Acopian

Corp., Easton, Pa. 18042 Tel: (215) 258-5441

## SUPPLIES THAT FIT IN THIN SPACES

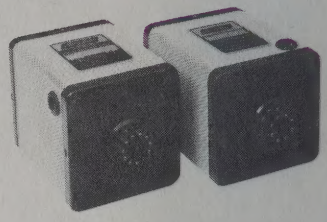


Measuring only 1.68" high, Acopian narrow profile power supplies fit where many others cannot. Available in a wide range of ratings from 1 to 150 volts, to 4 amps. Regulation to ±0.005%. Tracking dual output models for op amps also available. Guaranteed 3-day shipment.

Acopian

Corp., Easton, Pa. 18042 Tel: (215) 258-5441

## SINGLE, DUAL PLUG-IN POWER

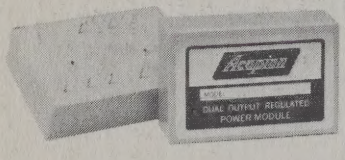


A plug-in power module can be installed in seconds. Simply plug it into a standard octal-type socket. Single output models from 1 to 200 volts. Duals combining two matched or dissimilar outputs in one case available in over 10,000 combinations. Warranty: 5 years. Shipment: 3 days.

Acopian

Corp., Easton, Pa. 18042 Tel: (215) 258-5441

## MULTIPLE VOLTAGES FOR PCB'S

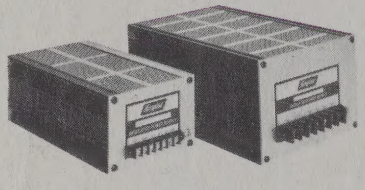


Simplify pc board layout with multiple output power mini's. Duals supply two isolated like or dissimilar outputs, 1 to 28 volts each. Op amp supplies provide ±12 or ±15 volts. Triples have two balanced, tracking outputs, a third for powering other circuits. Guaranteed 3-day shipment.

Acopian

Corp., Easton, Pa. 18042 Tel: (215) 258-5441

## GENERAL PURPOSE POWER

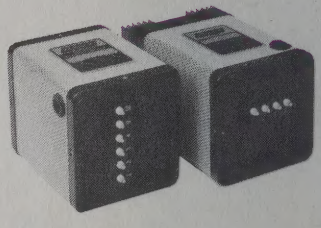


Series A offers premium performance, with regulation to ±0.005%, ripple of 0.25 mv maximum and electronic current limiting. Series B supplies provide a lower-cost approach, with regulation typically ±0.1%. Ratings to 200 volts, to 32 amps. Guaranteed 3-day shipment.

Acopian

Corp., Easton, Pa. 18042 Tel: (215) 258-5441

## SOLDER TERMINAL MODULES

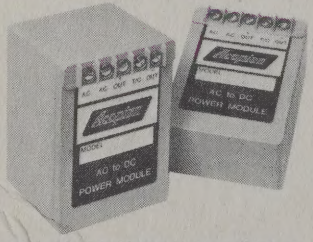


For applications where hard wiring is desired, Acopian offers modules with solder terminals. Included are single output models (regulated and unregulated) duals with two like or dissimilar voltages and high isolation supplies. Guaranteed 3-day shipment.

Acopian

Corp., Easton, Pa. 18042 Tel: (215) 258-5441

## POWER MINI'S FOR LOGIC OR OP AMPS

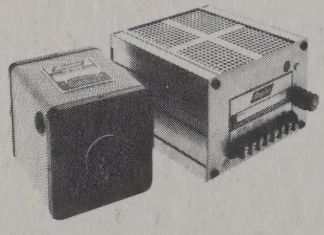


Terminal strip input/output connections on these miniature power modules eliminate the need for sockets or soldering. They mount in an area only 3.5" x 2.5". Ratings: 5 volt models to 2.5 amps, ±15 volts to .5 amps. Other models from 1 to 75 volts, all with 3-day shipment guaranteed.

Acopian

Corp., Easton, Pa. 18042 Tel: (215) 258-5441

## MATCHED OR DISSIMILAR DUAL OUTPUT

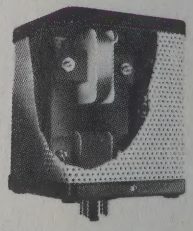


Select the combination of matched or dissimilar outputs that you require. Hundreds of ratings available, from 1.5 to 150 volts. Outputs are isolated, and may be used in the same or opposite polarities. Acopian's 3-day shipment promise applies for any combination.

Acopian

Corp., Easton, Pa. 18042 Tel: (215) 258-5441

## HIGHLY ISOLATED POWER



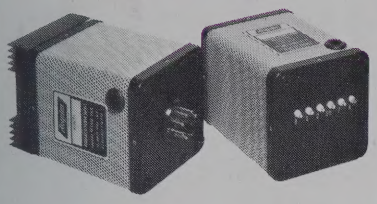
For applications requiring a power supply with unusually high isolation, such as for powering strain gage or other transducer circuits, Acopian offers models with ratings from 5 to 36 volts. Input-output isolation: 10,000 megohms minimum, 1 pF maximum. Guaranteed 3-day shipment.

Acopian

Corp., Easton, Pa. 18042 Tel: (215) 258-5441

# FAMOUS FOR 3-DAY SHIPMENTS . . . GUARANTEED

## MIL-TESTED PLUG-IN POWER



MIL-tested power supplies withstand unusually severe environmental conditions. These extended-temperature plug-in modules exceed MIL specs for humidity, altitude, vibration and shock. Hundreds of single output models, thousands of dual output combinations, all guaranteed for 3-day shipment.

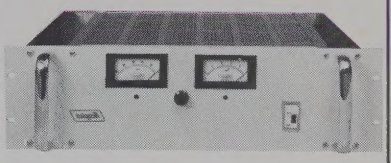
Acopian Corp., Easton, Pa. 18042 Tel: (215) 258-5441

## BENCHTOP POWER ...FROM $99

Reliable yet low-cost power supplies for circuit development and component evaluation. Single, dual and triple output models. Ratings from 0-7 to 0-50 volts. All have adjustable current limiting, coarse and fine voltage adjustments and two meters. They may be stacked to conserve bench space. Regulation, ±0.01% or 2 mv. Ripple, 0.25 mv rms.

Acopian Corp., Easton, Pa. 18042 Tel: (215) 258-5441

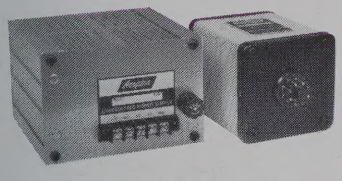
## RACK MOUNT POWER ...TO 60 AMPS



Designed for mounting in standard 19" RETMA cabinet racks, these power supplies are available in 76 different output ratings from 1 to 50 volts, and from 5 to 60 amps. Regulation, ±0.05% or better; ripple, 1 mv rms or better. Options include metering and overvoltage protection. Shipment, 9 days after receipt of your order.

Acopian Corp., Easton, Pa. 18042 Tel: (215) 258-5441

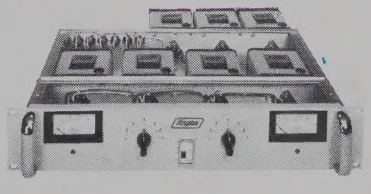
## POWER FOR RELAYS AND DISPLAYS



Drive relays, lamps, small motors and similar loads with low-cost Acopian unregulated power modules. Built-in fusing protects against overloads or shorts. Series U models use terminal strip connections. Plug-in modules mount in standard octal sockets; many have adjustable outputs. Guaranteed 3-day shipment.

Acopian Corp., Easton, Pa. 18042 Tel: (215) 258-5441

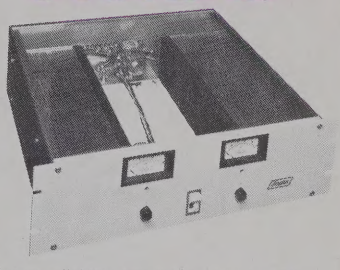
## NEED A POWER SYSTEM?



Order multiple output power systems without searching through a catalog, preparing mechanical layouts, item-by-item pricing and detailed purchase requisitions. Instead, call Acopian. We'll listen to your needs, quote a firm price, and then ship your built-to-order system, fully wired and tested, in just 9 days.

Acopian Corp., Easton, Pa. 18042 Tel: (215) 258-5441

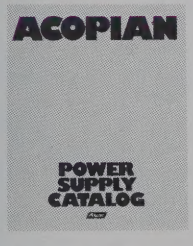
## REDUNDANT POWER SYSTEMS



Output reliability is maximized by including two power modules for each voltage. If either fails, the other will continue to provide an uninterrupted output. Ratings from 3.6 to 28 volts, to 32 amps. Shipment, 9 days after receipt of your order.

Acopian Corp., Easton, Pa. 18042 Tel: (215) 258-5441

## GUARANTEED 3 DAY SHIPMENT




Every power module listed in the Acopian catalog is shipped within 3 days of order. Guaranteed! Miniaturized supplies, narrow profile and plug-in modules, premium performance models, and a wide choice of other types are described in detail. Write for your copy or call toll free: (800) 523-9478.

Acopian Corp., Easton, Pa. 18042 Tel: (215) 258-5441

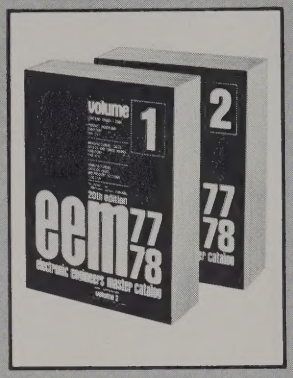
**See EEM pages 3165 to 3195, for detailed information about Acopian's broad line of power supplies and power systems.**

**Call Acopian toll free: (800) 523-9478**

# WE KNOW OUR STUFF

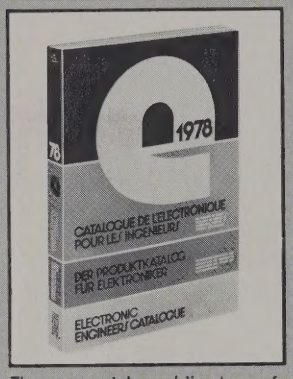
## 41 YEARS OF EXPERIENCE IN CATALOGING, 21 EDITIONS OF eem

### eem/ELECTRONIC ENGINEERS MASTER CATALOG —



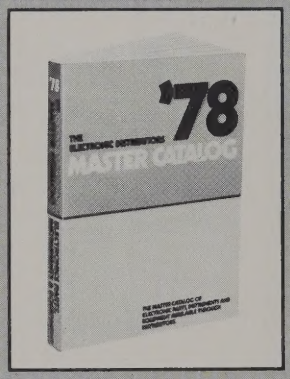

The "blue-ribbon" catalog/directory that has become "the standard of the industry" for electronic engineers, buyers and specifiers.

### ELECTRONIC ENGINEERS CATALOGUE



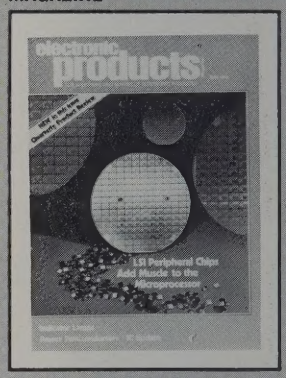

The new catalogue/directory of electronic products available to and from Western Europe and the United Kingdom. Designed especially for the European electronics engineer.

### ELECTRONIC DISTRIBUTORS MASTER CATALOG —



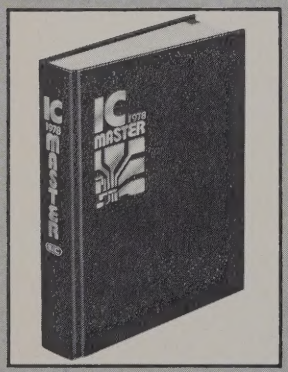

The only national catalog designed exclusively for distributors and their customers featuring electronic parts, instruments and equipment.

### ELECTRONIC PRODUCTS MAGAZINE —




The products magazine . . . A 100% product-oriented magazine including hundreds of new products and special features every month.

### IC MASTER AND THE UPDATES —




The only complete single-source directory including all IC devices manufactured in the United States. Updated three times yearly with accumulative supplements.

### eem FILE SYSTEM —

The only filing system designed especially for the electronics engineer. Instant retrieval and organization of data sheets and catalogs.

### UTP CUSTOM CATALOGS —

The Cadillac of individualized catalogs for the electronic parts distributor, featuring solely his lines and services.

### UNITED COST AND PRICING SERVICES —

The electronic distributors' proven method of being up to the minute on his cost and selling prices.

*United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Ave., Garden City, N.Y. 11530 / (516) 222-2500 TWX 510-222-1673*

publisher
LEE ALWARD

production director
DAVID GETLEN

asst. production director
LANNY LEVIN

catalog production manager
RICHARD D'AMBROSE

art production supervisor
JAY LEVINE

art director
MICHELLE ARNOLD

artists
CHRISTINE BENITH
DALE GIAMBRUNO
WILLIAM J. HENNESSEY
CONSTANCE MILLER
KATHY PENSON
RANDAL WOLFER RAKSIN

administrative production manager
MARTHA FINCK

production assistant
BRENDA BUFF

typography consultant
DAVE ROSEMAN

circulation director
DOROTHY RENOUD

directory manager
RUTH GEIST

directory assistant
GLORIA FORSYTH
LINDA VAN TRESS

marketing services manager
GEORGEANN JOHNSON

advertising/promotion manager
BILL EGAN

vice president & general manager
HARRY A. BIRSE

**eem**/Electronics Engineers Master
Electronic Engineers Catalogue
Electronic Distributors
MASTER CATALOG
Electronic Products Magazine
Electronic Products
Direct Response Cards
Custom Catalogs
Cost & Pricing Service
Audio File
Direct Mail List Rentals

president
ARTHUR I. RABB

executive vice president
ROBERT J. MALES

# eem 78 79

1

**VOLUME 1 ..... PAGES 1-2456**

- Product Index and Directory
- Manufacturers and Sales Offices Directory
- Trade Marks Directory
- Alphabetical Index of Manufacturers' Catalog Pages
- Manufacturers' Index to Catalog Pages by **eem** Product Section Number
- Manufacturers' Catalog Pages — **eem** Product Section Number 1100-2400

- Alphabetical Index of Distributors' Pages

2

**VOLUME 2 ..... PAGES 2457-4666**

- Alphabetical Index of Manufacturers' Catalog Pages
- Manufacturers' Index to Catalog Pages by **eem** Product Section Number
- Manufacturers' Catalog Pages — **eem** Product Section Number 2450-6000

- Alphabetical Index of Distributors' Pages

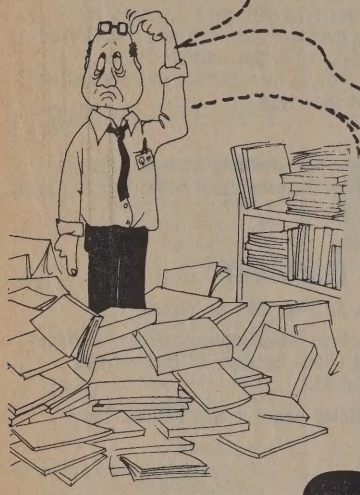
Published annually by United Technical Publications, Inc.
Division of Cox Broadcasting Corporation
645 Stewart Ave., Garden City, NY 11530 (516) 222-2500
TWX 510-222-1673

© United Technical Publications, Inc., 1978
Printed in the U.S.A.

BPA

***What can I use to keep all the manufacturers' product data I receive in order?***

***What system makes filing or retrieving manufacturers' catalogs fast and easy?***



***Which file system have thousands of engineers purchased because they know it works?***

# eem FILE SYSTEM

## THE ONLY FILE SYSTEM DESIGNED SPECIALLY FOR THE ELECTRONIC ENGINEER!

The publishers of **eem** have put together a unique filing system for electronic product information. The complete system includes: a product index booklet which classifies electronic products into 3,000 listings both alphabetically and by product group, and 45 file folders imprinted with the **eem** product sections (extra gummed labels included for expanding the system.)

As you receive manufacturers' catalog data sheets, technical bulletins, or clip magazine articles, jot down the proper Product Section Numbers from the **eem** PRODUCT-TO-SECTION INDEX. Then simply file in order. When you require information on a specific product, refer to PRODUCT-TO-SECTION INDEX again to locate the correct file folder. It's simple, and you'll always have the necessary data to compare, specify and buy, right at your fingertips.

**Here's how to order your eem FILE SYSTEM:**

For the complete system send $10 (plus tax; N.Y., 8%, CA, 6½%) in check or money order to:

United Technical Publications, Inc.,
645 Stewart Avenue, Garden City, N.Y. 11530
Att: Circulation dept.

For an **eem FILE SYSTEM** without file folders send $7.50 (plus tax; N.Y. 8%; CA, 6½%).

*UNITED TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500*

# eem 78 79

## ALPHABETICAL INDEX OF MANUFACTURERS' CATALOG PAGES

This index provides an alphabetical listing of manufacturers' pages and where to find them.


| Manufacturer | Page No. |
|---|---|
| **A** | |
| Aavid Engineering, Inc. | 3919 |
| Abacus Elctrns. Corp. | 3163 |
| Abbott Transistor Labs., Inc. | 3150-3162, 4325-4329 |
| Ind'l Div. | 3150-3154 |
| Power Supply Div. | 3150 3155-3162 |
| Transformer Div. | 4325-4329 |
| Accutronics | 2280, 2281 |
| ACDC Electronics | 3164 |
| Acme Electric Corp. | 3196, 3197 |
| Acopian Corp. | 3165-3195, Inside Front Cover, Vol. 2 |
| Active Control Instrumentation | 2256 |
| A.D. Data Systems, Inc. | 2661 |
| Adams & Westlake Co., THE | 3411 |
| Adret/Comstron (see, Comstron Adret) | |
| Advance Conversion Devices Co. | 3354, 3355 |
| Advanced High Voltage Co., Inc. | 3199 |
| Ad-Vance Magnetics, Inc. | 2552 |
| AEG Telefunken | 3920 |
| Aeroflex Labs, Inc. Integrated Microsystems Div. | 2851 |
| Magnetic Prods. Div. | 2257 3069-3071 |
| Airborn, Inc. | 1676-1681 |
| Airflyte Elec .Co. | 3072, 3073 |
| Airpax Electronics, Inc. Cambridge Div. | 1022, 3978, 3979 |
| Controls Div. | 2258 |
| Alberox Corp. | 2553 |
| Alco Electronic Prods., Inc. | 2418, 2457, 3980-3983 |
| Alden Products Co. | 1682 |
| Allen Avionics, Inc. | 2380-2382, 2610-2612 |
| Allen-Bradley Co. | 3626-3632, 3783-3785 |
| Allied Systems Corp. | 1683 |
| All-Tronics, Inc. | 2614 |
| Almond Instruments Co., Inc. | 3200, 3201 |
| Alpha Components, Inc. | 2282 |
| Alpha Power, | 3202, 3203 |
| Alpha Wire Corp. | 4464-4479 |
| A.L.S. Elec. Corp. | 3204, 3205 |
| AMCO Engineering Co. | 1023 |
| Amerace Control Products Div. | 1748, 1749 |
| American Aerospace Controls | 4298, 4299 |
| American Components, Inc. | 1058, 1059, 3634-3637 |
| American Elec. Laboratories, Inc. | 1381 |
| American Switch Corp. | 3984 |
| American Technical Ceramics Div. of Phase Ind., Inc. | 1060, 1061 |
| American Time Prods. Bulova Watch | 2261,3365 |
| American Zettler, Inc. | 3412, 3413 |
| AMF/Potter & Brumfield (see Potter & Brumfield Div., AMF, Inc.) | |
| AMF/RCL (see RCL Electronics Div., AMF, Inc.) | |
| AMF/UID (see UID Electronics Div., AMF, Inc.) | |
| AMP, Inc., Capitron Div. AMP, Inc. | 1382, 1383, 1684, 1685, 2616, 2617, 3206 |
| AMP, Inc. Ind'l. Div. | 3985-3996 |
| Amphenol North American Div. Bunker Ramo Corp. | 1686-1704 3998, 3999 |
| Amplifier Research Corp. | 1001 |
| Amuneal Mfg. Corp. | 2554 |
| AMD | 2458, 2459 |
| Andersen Laboratories, Inc. | 2618, 2619 |
| Angstrohm Precision, Inc. | 3638 |
| A.P. Circuit Corp. | 2613 |
| APM-Hexseal Corp. | 3997 |
| Appleton Electronics Div., Appleton Elec. Co. | 1708-1715 |
| Applied Circuits, Inc. | 1295 |
| Applied Microwave Div. EPSCO Inc. | 2861 |
| Applied Research, Inc. | 2866, 2867 |
| Arcolectric Corp. | 4001 |
| Arco Electronics, Inc. | 1057 |
| Aries Electronics, Inc. | 1716-1718 |
| Arnold Magnetics Corp. | 3207-3209 |
| Aromat Corp. | 3414-3425 |
| Arra, Inc. | 2865 |
| Arrow Hart (see Crouse-Hinds) | |
| Arrow M (see Aromat Corp.) | |
| Artronic Instrument Co. | 2379 |
| ATR Electronics, Inc. | 3357 |
| Augat Inc. | 1720-1723 |
| Austron, Inc. | 2283 |
| Autronics Corp. | 2259 |
| AVA Electronics Corp. | 1724-1727 |
| Avionic Instruments, Inc. | 3358-3361 |
| Avtel Div., Unitron Corp. | 3362-3364 |
| AVX Ceramics | 1063-1071 |
| Axel Electronics, Inc. | 1073-1077, 2615 |
| **B** | |
| Bafco, Inc. | 2662 |
| Baldwin Electronics, Inc. (see BEI Electronics, Inc.) | |
| Ballantine Laboratories, Inc. | 2663 |
| Barber-Colman Co., Motor Div. | 3074, 3075 |
| Beau Products Div. Vernitron Corp. | 2250-2252 |
| BBN Instrument Co. Div. Bolt Beranek and Newman, Inc. | 4301 |
| Beckman Instruments Helipot Div. | 2466, 2852-2854, 3646, 3647, 3786, 3790 |
| Information Displays Operation | 2462-2466 |
| Beede Electrical Instrument Co., Inc. | 2664 |
| Behlman Eng. Corp. | 3366-3369 |
| BEI Electronics, Inc. | 1384-1387 |
| Belden Corp. | 4480-4539 |
| Bel Fuse, Inc. | 2384-2390 |
| Bell, Inc., F.W. | 2666, 2667, 4300 |
| Bell Indus., J. W. Miller Div. | 1322, 1323 |
| Beman Mfg., Inc. | 3648, 3649 |
| Bendix Corp. Electrical Components Divi. | 1756-1762 |
| Berg Electronics Div. E.I. duPont de Nemours & Co. | 1729-1736 |
| Berger-Lahr Corp. | 3076 |
| Berkeley/Teltronic (see Teltronic/Berkeley) | |
| Berk-Tek, Inc. | 4540, 4541 |
| Bertan Associates, Inc. | 3212 |
| Best Electronics Div., Harry Levinson Co. | 4278 |
| Bikor Corp. | 3210, 3211 |
| B&K Precision Products of Dynascan | 2670-2679 |
| Bird Electronic Corp. | 2668, 2669 |
| Bivar, Inc. | 1024 |
| Bliley Electrict Co. | 2284-2289 |
| Blue M Electric Co. | 2570 |
| Bodine Electric Co. | 3077 |
| Bolt Beranek & Newman, Inc. | 4301 |
| Boonton Eelectronics Corp. | 2665 |
| Borg-Warner Thermoelectrics | 2576, 2577 |
| Bourns, Magnetic Prods | 1324-1327 2383, 4331-4336, |
| Trimpot Prods | 3639-3645, 3791-3871, Back Cover, Vol. 2 |
| Bowmar/TIC, Inc. | 3872 |
| Breeze Illinois, Inc. | 4542 |
| Buckeye Stamping Co., THE | 1025, 2419 |
| Bulova Watch Co. Elect. Div. | 2261, 3365, 3974 |
| Freq. Controls Prod. | 2290, 2291 |
| Bunker Ramo (see Amphenol) | |
| Burr-Brown Research Corp. | 1388-1390, 2856, 2857 |
| Bussmann Manufacturing Div. McGraw Edison Co. | 4002-4007 |
| **C** | |
| Cable Concepts Corp. | 1737 |
| Caddel-Burns Mfg. Co., Inc. | 1328-1333 |
| Caddock Electronics, Inc. | 3650-3665 |
| Calabro Plastics-Unitrack Div. | 1050, 1051 |
| California Instruments A Norlin Technology Co. | 3370, 3371 |
| Cambridge Div., Airpax Electronics | 1022, 3978, 3979 |
| Cambridge Prod. Corp., A Hi-G Co. | 1738 |
| Canon U.S.A., Inc. | 3078 |
| Capar Components Corp. | 1079-1085, 3666-3668 |
| Capitron Div. Amp, Inc. | 1382, 1383, 1684, 1685, 2616, 2617, 3206 |

# INDEX OF MANUFACTURERS' CATALOG PAGES


Manufacturer — Page No.

Carborundum Co. ..... 3670-3673, 4270, 4271
Carlingswitch, Inc. ..... 4009-4013
Carter Mfg. Corp. ..... 3873
Caton Connector Corp. ..... 1739
CEA, Div. Berkleonics, Inc. 3213-3218
Centre Engineering ..... 1088-1090
Channellock, Inc. ..... 4287
Chassis-Trak Div. of General Devices Co., Inc. ..... 1032, 1033
Chatsworth Data Corp. ..... 2680
Cherry Electrical Products Corp. ..... 4014, 4015
Chesterfield Products, Inc. ..... 2620
Chicago Lock Co. ..... 4008
Chicago Miniature/Drake 2467-2473
Chicago Switch, Inc..... 4016, 4017
Chomerics, Inc. ..... 4019
Christie Electric Corp. .... 3220-3223
Chrono-log Corp. ..... 1391
Cinch (see TRW/Cinch)
Cincinnati Sub-Zero Products, Inc. ..... 2571
C&K Components, Inc. .... 4020, 4021
Clairex Electronics, Inc. .. 3132-3134
Clare & Co., C. P. ..... 3426-3432, 4022-4024
Clarke-Hess Communication Research Corp. ..... 2681
Clary Corp. Precision Instrument Div. ..... 3373
Clifton Precision Litton Systems, Inc. ..... 3079
Clinton Electronics Corp. 4459-4461
CML MaCarr Inc. (see Marine Electric RPD, Inc.)
Cober Electronics, Inc. ..... 2862
Cole Instrument ..... 4025
Colorado Crystal Corp. ..... 2293
Colorado Video, Inc. ..... 1370-1377
Columbia Chase Corp. Humiseal Div. ..... 1292, 1293
Columbia Components, Div. Computer Instruments ..... 2391
Columbia Electronic Cables ..... 4543-4552
Compac ..... 1026, 1027
Component Research Co., Inc. ..... 1100-1143
Computer Conversions Corp. ..... 1392, 1393
Computer Devices of Calif. (see Rapidsyn Co.)
Computer Devices Corp. ..... 2392
Computer Instruments Corp., Columbia Components Div. .. 2391
Computer Power, Inc. .... 3334, 3335
Comstron/Adret ..... 2682, 2683
Comstron/Seg ..... 2294, 2621, 2684
Concord Electronics Corp. ..... 1741
Conditioning Semiconductor Devices Corp. ..... 3921
Connector Corp. ..... 1742, 1743
Connor-Winfield Corp. .... 2296, 2297
Consolidated Wire & Associated Corps. ..... 4554-4586
Continental Connector Corp. ..... 1744-1747
Continental Rentals Div. (see Continental Resources Inc.)
Continental Resources, Inc. ..... 2685
Continental Specialties Corp. ..... 1296, 1297
Control Electronics Co., Inc. .... 2393
Control Div., Airpax Electronics, Inc. ..... 2258
Control Products Div. Amerace ..... 1748, 1749
Control Sciences, Inc. ..... 1395
Control Technology Co. ..... 3975
Corcom, Inc. ..... 2622, 2623
Cornell-Dubilier Electric Corp. ..... 1091-1099, 2624, 2625, 3433
Corning Glass Works, Corning Electronics ..... 1087, 3669
Coto Coil Co., Inc. ..... 3434-3440
Cramer Coil Co. Div. Digital Magnetics, Inc. ..... 1335
Crestronics, Inc. ..... 3219
Crouse-Hinds Co., Arrow Hart Div. ..... 4026-4039
Croven, Ltd. ..... 2295
Crown Industrial Div. ..... 1010
Crydom Controls ..... 3552, 3553
Crystek Crystals Corp. ..... 2299
CTS of Berne..... 3675-3679, 3875
CTS Knights, Inc. ..... 2300-2313..
Curtis Instruments, Inc. ..... 2686
Custom Electronics, Inc. ..... 1146
Cutler Hammer, Inc. ..... 3674 Specialty Products Group ..... 4041-4043
CW Industries ..... 1740, 4040

D

Daburn Electronics & Cable Corp. ..... 4587-4591
Daico Industries, Inc. ..... 2869
Dale Electronics, Inc. .... 1336-1338, 1750, 2314-2317, 3680-3695 3878, 3879, 4338, 4339
Damon Corp. ..... 2319
Data Delay Devices ..... 2395-2400, 2626
Data Precision Corp. ..... 2706-2708
Data Specialties, Inc. ..... 1397
Data Translation, Inc. ..... 1398
Datak Corp., The ..... 1298, 2420
Datametrics ..... 1396
Datel Systems, Inc. ..... 1401-1466, 2687-2705, 3225-3241
Datron Systems, Inc. (see Electronic Specialty Div.)
D-B-Developments ..... 1399
Dearborn Wire & Cable Co. ..... 4592-4607
Del Electronics ..... 3242, 3243
Delbert Blinn Co. Inc. ..... 3923
Delco Electronics Div. General Motors Corp. .. 3924, 3925
Delevan Div., American Precision Inds., Inc. ..... 1340, 1341, 3080
Deltec Corp. ..... 3376, 3377
Deltrol Controls Div. Deltrol Corp. ..... 3442-3447
Dialight ..... 2474, 2475
Digital Equipment Corp. ..... 1468-1640 Vol. 2 Spine
Digitran Co. ..... 4044-4049
Display Devices, Inc. .... 2476, 2477
Diversified Electronics, Inc. ..... 3448, 3449
Doric Scientific Div. Emerson Electric Co. ..... 2714-2717
Dormeyer, Industries Inc. ..... 3244, 3245, 3450-3457, 4340-4342
Douglas Randall Div. Walter Kidde & Co., Inc. ..... 2627, 3458-3464
Dow Key (see Kilovac)
Dranetz Engineering Laboratories, Inc. ..... 2709-2713
Duncan Electronics ..... 3880-3882
Durakool, Inc. ..... 3465-3473, 4050-4052
Dynamic Instrument Corp. ..... 3246
Dynamics Div. Waugh Controls Corp. ..... 1002
Dynatech Corp. ..... 1751
Dynatech R/D Co., Microsystems Dept. ..... 1641
Dytronics Co., Inc. ..... 2718

E

Eagle Magnetic Co., Inc. ..... 2555
Eagle-Picher, Indus., Inc. Commercial Prods. Dept. ..... 3247
Eanco, Inc. Mid-Eastern Prods .. 3287
Eastern Air Devices Motor Div. Electro Audio Dynamics ..... 3081
Eby Co. Sub. of Redm Corp. ..... 1752, 1753
Ectron Corp. ..... 2719
Edsyn, Inc. ..... 4288, 4289
EG&G, Inc. Electro-Optics Div. ..... 3135-3137
E.I. duPont de Nemours and Co. (see Berg Electronics)
E & L Instruments, Inc. ..... 1299
E-Systems Memcor Div. .. 3697, 3883
Elco Corp., ..... 1754, 1755
Elec-Trol, Inc. ..... 3474-3477
Electrical Components Div., Bendix Corp. ..... 1756-1762
Electrical Instrument Service, Inc. (see Sensitive Research Instr.)
Electro-Craft Corp. ..... 3083
Electro Dynamics Div. General Time Corp. ..... 2260
Electro Impulse, Inc. ..... 2578, 2720
Electro Industries ..... 2721
Electro-Mech. Components, Inc. ..... 4054, 4055
Electro-Mechanical Inst. Div. Sheller Globe Corp. .... 2722, 2723
Electro Switch Corp. ..... 4053
Electro-Techniques, Inc. .. 3885-3887
Electronic Applications Co. ..... 3479
Electronic Development Corp. ..... 2724, 2725
Electronic Hardware Corp. ..... 2421
Electronic Instrument & Specialty Corp. ..... 3480-3483 MC Div. ..... 2422
Electronic Measurements, Inc. ..... 3249-3252
Electronic Molding Corp. 1764, 1765
Electronic Navigation Industries ..... 1003-1005
Electronic Products Div. 3M Co. ..... 2058-2077
Electronic Specialty Div. Datron Systems, Inc. .... 3484-3487
Electro Statics, Inc. ..... 3248
Electroweave, Inc. ..... 4608
Elfab Corp. ..... 1763
Elgar Corp. ..... 3378-3383
Elgenco, Inc. ..... 2726-2731
Elmwood Sensors, Inc. ..... 4272
Elpac Components Div. Elpac Electronics Inc. ..... 1147, 3253
EMC (see Electronic Molding Corp.)
Emerson Electric (see Doric Scientific)
Emico Sheller-Globe Corp. ..... 2722, 2723
Empro Mfg. Co., Inc. ..... 2732
Encoder Div. Litton Industries .. 1653
Endicott Coil Co., Inc. .... 1342, 2478
ENI (see Electronic Navigation Industries Inc.)
Environmental Container Systems, Inc. ..... 1028, 1029
Epsco Applied Microwave Div. .. 2861
Epsco, Inc. ..... 3260
Equipto Electronics Corp. ..... 1030
ERA Transpac Corp. ..... 3254-3259
Erie Frequency Control Div. Erie Technological Prod. .... 2320-2323
ESC Electronics Corp. .... 2402, 2403, 2628, 2629
ESE ..... 2734, 2735
Esterline Angus Instrument Corp. ..... 2838, 2839
ETRI, Inc. ..... 2580-2582
Evans Corp., The George ..... 2579
EWC, Inc. ..... 4344, 4345
Exact Electronics, Inc. ..... 2733
Excel Products Co., Inc. ..... 1767

F

F-Dyne Electronics Co. ..... 1148
Fabricast, Inc. ..... 3084-3086
Fair-Rite Prods., Corp. ..... 2556
Faria Meter Corp. ..... 2747
Fenwal Electronics ..... 4273
Ferrotran Electronics Co., Inc. .. 3261
Fifth Dimension, Inc. ..... 3489, 4056
Filter Technology, Inc. ..... 2327
Flite-Tronics Co., Inc. .... 3384, 3385
Fluke Mfg. Co., Inc. John .. 2736-2746
Formica Metal Products Co., Inc. ..... 1031
Freed Transformers Co. ..... 2748, 2749, 4346-4349
Frequency Electronics, Inc. ..... 2324, 2325
Frequency Selective Networks, Inc. ..... 2326
Fujitsu America, Inc. ..... 1149, 1766, 3490, 3491

G

Gamble Inds., Charles T. .. 3698, 3699
Gardiner Solder Co. ..... 4290, 4291
Garry Mfg., Inc. ..... 1768
GC Electronics ..... 1290
Gemcor (see General Electro Mechanical Corp.)
General Devices Co., Inc. (see Chassis-Trak and Vent-Rack)
General Electric Co. ..... 3087
General-Electro Mechanical ..... 3090
General Magnetics, Inc. .. 2262-2266
General Microwave Corp. 2870, 2871
General Time Corp. (see Electro Dynamics)
Gen Rad ..... 4350-4352
Georator Corp. ..... 3262-3264, 3386-3388
Glassman High Voltage Computer Power Inc. ..... 3265
GNT Automatic Inc. ..... 1642
Gordos Corp. ..... 3492-3499, 4076, 4077
Gould, Inc. Circuit Protection & Controls Div. ..... 3500-3506 Electronic Components ..... 3266 Instruments Div. ..... 2752, 2842
Gralex Inds. Div. General Microwave ..... 2750, 2751
Grangers Associates (see Filter Technology)
Graphite Metallizing Corp. ..... 3088, 3089
Grayhill, Inc. ..... 1769, 3507, 4057-4075, 4609
Greenray Inds., Inc. ..... 2328
GRM Corp. ..... 1378, 1379
GTE Sylvania, Inc. Connector Prods. Oper. ..... 1770, 1771 Miniature Lighting Prods. ..... 2479-2481
Guardian Electric Co. ..... 3509-3520
Guildline Instruments, Inc. ..... 2753
Gulton Inds., Inc. Measurement & Control Systems Div. ..... 2840, 2841

# INDEX OF MANUFACTURERS' CATALOG PAGES


**Manufacturer — Page No.**

**H**

Hamlin, Inc. ..... 2482, 3522, 3523, 4079
Harbison Industrial Prods., Inc. Sub. of the Polymer Corp. .... 1343
Hardman, Inc. ..... 1291
Harrel, Inc. ..... 2267
Harry Levinson Co. ..... 4278
Heinemann Electric Co. ..... 4080
Hertz Filter Corp. ..... 2633
Hewlett Packard ..... 3267
Hexacon Electric Co. ..... 4293-4296
Heyco (see Heyman Mfg. Co.)
Heyman Mfg., Co. ..... 4610
Hickok Electrical Instrument Co., THE ..... 1643
Hi-G Co. Inc.
Cambridge Prods. ..... 1738
Electronic Prods. ..... 3542-3546
Magnetec Corp. ..... 3524-3529
Relay Prods. ..... 3530-3541
High Energy Corp. ..... 1150
Hipotronics, Inc. ..... 2754, 2755, 3268, 3269
Hiram Jones ..... 1772, 1773
Hisonic, Inc. 2630, 2631, 3270, 4353
Honeywell Inc. Test Instruments Div. ..... 2756,2843
Hope Electronics ..... 1006, 2329, 2872, 2873, 3272, 3273
Hopkins Engineering Co. ..... 2632
Houston Instrument Div.
Bausch and Lomb ..... 2844
Hoyt Electrical Instrument Works
Burton Rogers Co., Sls. Div. .. 2757
Hughes Aircraft Co.
Connecting Devices ..... 1774
Fact Systems ..... 2758
Microelectronics ..... 2331
Humiseal Div./Columbia Chase Corp. ..... 1292, 1293
Hybrid Prod. Div., Aeroflex Laboratories, Inc. .... 2851

**I**

IBM Instrument Systems ..... 2759
ILC Data Device Corp. .... 1644, 1645
Illinois Capacitor, Inc. ..... 1151
IMC Magnetics Corp. .... 2584, 2585, 3091
IMS, Inc. ..... 3700
Independent Cable/Midwec ..... 1188
Inductive Components, Inc. .....4354-4356
Industrial Control Co. .... 3976, 3977
Industrial Devices, Inc. .. 2484, 2485
Industrial Div., Amp., Inc. ..... 3985-3996
Industrial Elec. Engineers ..... 2483
Industrial Test Equipment Co. .. 3389
Infodex, Inc. ..... 2486, 2487
Info-Lite Corp. ..... 2488, 4081
Information Transfer Industrial, Inc. ..... 1646
Integrated Microsystems Div. (see Aeroflex Labs)
Instrument Specialties Co., Inc. ..... 2558, 2559
Instruments for Industry, Inc. .. 2763
Integrated Circuits, Inc. ..... 3274, 3275
Interelectronics Corp. ..... 3276
Interface Engineering, Inc. ..... 1648, 1649
Interlok ..... 1037, 2423
International Components Corp. ..... 1155
International Crystal Mfg. Co., Inc. ..... 2332-2335
International Electro-Magnetics, Inc. ..... 1011
International Mfg. Services, Inc. ..... 3700
International Rectifier Corp.
Crydom Controls ..... 3552, 3553
Semiconductor Div. ..... 3926-3928
Interstate Electronics Corp. ..... 2760, 2761
Interswitch ..... 4082-4085
Inter-Technical Group, Inc., The ..... 2557, 4463
Iskra/ISL Products Ltd. .. 1152-1154, 3701, 3929
ISL Products/Ltd. ..... 1152-1154, 3701, 3929
Isotemp Research, Inc. ..... 2337
Ithaco, Inc. ..... 1007, 2634
Itek Corp. Measurement Systems Div. ..... 1655
Itoh Electronics, Inc. ..... 1647
ITT Cannon Electric ..... 1777-1964 Back Cover, Vol. 1
ITT Components Group .. 1156-1159, 3554-3561
Capacitors ..... 1156-1159
Relays ..... 3554-3561
ITT Jennings Div. Int'l Telephone & Telegraph Corp. ..... 1160-1162, 2762, 3547-3551, 4086, 4087
ITT North Electric Microsystems Div. ..... 2858
ITT Pomona Electronics .... 1965-2044
ITT Schadow, Inc. ..... 4088-4093
ITT Thermotech ..... 2560, 2561
IVO Industries, Inc. ..... 2268, 2269

**J**

Jackson Bros. (London) Ltd. .... 1163
Jan Hardware Mfg. Co. .. 2424-2439
Janco Corp. ..... 4096, 4097
Japanese Products Corp. ..3093-3096
Jerome Industries Corp. ..... 3277
Jettron Products, Inc. ..... 2045
Jewell Electrical Instruments, Inc. ..... 2764, 2765
JM Transformer Co. ..... 4357
Johanson Dielectrics ..... 1165
Johanson Mfg. Corp. ..... 1164
Johnson Co., E. F. ..... 1166-1168, 2046-2050
Julie Research Laboratories, Inc. ..... 2766, 2769, 3702
J. W. Miller (see Bell Industries, J. W. Miller)

**K**

Kappa Networks, Inc. ..... 2404, 2405
Kay Elemetrics Corp. ..... 2770
KDI Pyrofilm Corp. ..... 3728, 3729
Keithley Instruments, Inc. ..... 2771
Kelvin ..... 3704, 3705
Kepco, Inc. ..... 3278-3283
Kessler-Ellis Products .. 1650, 1651, 2270-2272
Keystone Carbon Co. ..... 4275-4277
Keystone Electronics Corp. ..... 2052-2056
KGS Electronics ..... 3390
Kilovac Corp. ..... 3563-3568
KR Electronics, Inc. ..... 2635
KRL Electronics, Inc. ..... 3703
Krohn-Hite Corp. ..... 2772, 2773
Krystinel Corp. ..... 2562
Kulite Semiconducor Products, Inc. ..... 4302

**L**

LaFrance Corp. ..... 1038, 1039
Leach Corp. ..... 3570-3577
Leader Instruments Corp. ..... 2774, 2775
Lear Siegler, Inc. ..... 2057
Ledco Div. Wilbrecht Electronics ..... 2489-2491
Ledex, Inc. .. 3578, 3579, 4098, 4099
Leecraft Mfg. Co., Inc. ..... 2492
Leeds & Northrup Co. .... 2776-2778, 2845
Levinson Co., Harry ..... 4278
LH Research, Inc. ..... 3284, 3285
Liberty Controls, Inc. ..... 3580, 3581
Lipps, Inc. ..... 1012, 1013
Litronix ..... 2493
Littelfuse, Inc. ..... 2494, 2495, 4100, 4101
Litton Encoder Div. ..... 1653
LSI Computer Systems, Inc. .... 2859
LVC Inds., Inc.
Co-Ord Switch Block Lite Div. ..... 4102, 4103

**M**

3M Company Electronic Prods Div. .. 2058-2077
3M Co., Static Control Systems ..... 3408, 3409
Mac Panel Co. ..... 2079
Magnetec Hi-G ..... 3524-3529
Magnetic Shield Div. Perfection Mica ..... 2563-2565
Magnetics Products Div. Aeroflex Laboratories, Inc. .... 2257
Magnetico, Inc. ..... 4359
Magnetic Technology Vernitron Corp. ..... 3098, 3099
Mallory Capacitor Co. .... 1014-1017, 1170-1185
Marconi Instruments Div. of Marconi Electronics Inc. 2780-2782
Marine Electric RPD, Inc.. 3391-3395
Markel Corp. ..... 2847, 4611
Marlow Industries, Inc. ..... 2587
Matrix Corp. ..... 1654
Matrix Systems Corp. .... 2874, 3582
Maxi Switch Co. ..... 4104, 4105
MC Div. Electronic Instrument Specialty ..... 2422
McCoy Electronics Co. .... 2338-2345
MCG Electronics, Inc. ..... 4106
McGill Mfg. Co., Inc. ..... 4107
McGraw Edison Electronics ..... 4108
MCL, Inc. ..... 2863
McLean Engineering Laboratories ..... 2588-2591
Measurements Systems, Inc. .... 2273
Measurement Systems, Itek .... 1655
Mechanical Enterprises, Inc. ..... 4160, 4161
Megavolt Corp. ..... 3286
Melcor/Materials Electric Products Corp. ..... 2592, 2593
Metex Corp. Electronic Shielding Group ..... 2566
Methode Electronics, Inc. ..... 2080, 2081
MF Electronics Corp. ..... 2346, 2347
Micro Mo Electronics Inc. ..... 3100, 3101
Microplex, Inc. ..... 1186, 1187, 3706, 3707
Microsonics Div. Sangamo Weston ..... 2348
Microswitch Div. Honeywell ..... 4109-4158
Microtran Co., Inc. ..... 4360-4363
Mid-Eastern Industries A Div. of Eanco, Inc. ..... 3287
Midisco ..... 2876-2889
Midtex, Inc. ..... 3583
Midwec Div. Independent Cable (see Independent Cable/Midwec)
Midwest Components, Inc. ..... 4279-4282
Millivac Instruments, Inc. ..... 2784, 2785
Mills Resistor Co. ..... 3708
Milwaukee Resistor Corp. ..... 3710, 3711
Minelco A Talley Inds. Co. ..... 2496, 4159
Mini-Circuits Lab. ..... 2890-3058 Inside Front Cover, Vol. 1
Mini-Systems Inc. ..... 2860, 3709
Modutec, Inc. ..... 2786-2789
Molex, Inc. ..... 2082-2085
Monitor Products Co., Inc. ..... 2349
Motorola, Inc. ..... 2350
Motor Products Div. Aeroflex Laboratories, Inc. ..... 3069, 3070
Mueller Electric Co. ..... 2086, 2087
MuShield Co. ..... 2567

**N**

Natel Engineering Co., Inc. ..... 1656
National Semiconductors Ltd. .. 3138
National Tel-Tronics ..... 2088, 2089
National Wire & Cable Corp. 4612-4626
Nationwide Electronic Systems, Inc. (see NES, Inc.)
Neff Instrument Corp. ..... 1657
NES, Inc. ..... 2790
New England Instrument Co. 3888-3893
Newport Laboratories, Inc. 2792, 2793
Nicolet Instrument Corp. ..... 2791
Non-Linear Systems, Inc. ..... 2794
North American Philips .. 2274, 3102, 3103, 3584, 3585
Controls, Inc. ..... 4219
North Atlantic Industries, Inc. 1658, 2795
North Hills Electronics, Inc. .... 1361, 2275, 3060, 3061, 3288, 4364
Northern Engineering Labs., Inc. 2351
Nova Electric Mfg. Co. .... 3396, 3397
NWL Transformers ..... 3289, 4365
Nytronics Components Group, Inc. 1190-1201, 1344-1360, 2406, 2407, 3713-3715

**O**

Oak Industries, Inc., Switch Div. 2497-2537, 3586-3588, 4163-4215
Ohio Semitronics, Inc. .... 4303-4322
Ohmite Mfg. Co. ....3589, 3716-3721, 3894, 3895, 4162, 4366
Omega Engineering, Inc. 4284, 4285
Omron Electronics, Inc. ..... 3591
Opamp Labs, Inc. ..... 1018
OPT Industries, Inc. ..... 2352, 3291
Optima Enclosures Div. Scientific Atlanta ..... 1040
Oshino Electric Lamp Works, Ltd. 2539
Oslo Controls, Inc. ..... 4218
Otto Controls Div. Otto Engineering 4216, 4217
Ovenaire Div. Walter Kidde & Co., Inc. ..... 2354-2357

**P**

Pacific Electronic Enterprises, Inc., Pacific Power Source Div. ..... 8398, 3399

# INDEX OF MANUFACTURERS' CATALOG PAGES


Pamotor ..... 2594-2598
Panasonic Electronic Components Div. Matsushita Electric Corp. Amer. 1202-1204, 3292, 3293, 3722, 3931
Panduit Corp. ..... 4628-4632
Perfection Mica (see Magnetic Shield Div.)
Perkin Elmer Corp. ..... 4367
PFC, Inc. ..... 1206, 1207
Panduit Corp. ..... 4628-4632
Perfection Mica, (see Magnetic Shield Div.)
Perkin Elmer Corp. ..... 4367
PFC Inc. ..... 1206, 1207
Phase Ind. Inc. American Technical Ceramics Div. 1060, 1061
Philadelphia Insulated Wire Co., Inc. ..... 4633-4652
Philamon, Inc. ..... 2353
Philips Test & Measuring Instruments Inc. ..... 2796-2799
Phoenix Data, Inc. ..... 1660-1663
Pico Electronics, Inc. ..... 4368-4387
Piezo Technology, Inc. .... 2358, 2359
Pioneer Magnetics ..... 3294, 3295
Pittman Corp., The ..... 3104
Plessey Electro-Products ..... 2276
Polytron Devices, Inc. .... 3296, 3297
Pomona Electronics (see ITT Pomona)
Polarad Electronics Corp. ..... 2800
Portescapus ..... 3105
Potter & Brumfield, Div. AMF ..... 3592-3607
Power Designs, Inc. ..... 3298-3301
Power, Inc. ..... 3302, 3303
Power/Mate Corp. ..... 3304, 3305
Power-One, Inc. ..... 3306
Power Systems, Inc. ..... 3308-3311
Powertec Inc. ..... 3312, 3313
PowerTech, Inc. ..... 3932, 3933
Power Technology, Inc. ..... 3307
PPM, Inc. ..... 2801
Practical Automation ..... 1659
PRC (see Precision Resistor Co., Inc.)
Precision Filters, Inc. ..... 2637
Precision Resistor Co., Inc. ..... 3723-3727
Premier Metal Products Co. Div. of Sunshine Mining Corp. ..... 1041-1046
Preston Scientific, Inc. .. 1008, 1009, 1664, 1665
Protective Controls, Inc. Div. North American Philips .. 4219
Pulsar Associates, Inc. ..... 2802
Pyle-National Co. ..... 2090-2095
Pyrofilm Resistor Co. (see KDI Pyrofilm Corp.)

Q

Q-Tech Corp. ..... 2360, 2361
Quam-Nichols Co. ..... 1019

R

Radiometer Electronics (London) Co. ..... 2803
Ransco Industries ..... 2572
Rapidsyn Co. (Formerly Computer Devices of Calif.) ..... 3106, 3107
Raytheon Co., Distributor Products Operation .... 2096, 2097, 2443-2452, 2660, 3139-3146, 4221-4229
RCL Electronics Div. AMF Inc. .....2408-2414, 2440-2442, 3730-3740, 4230-4239
RDI/Reed Devices, Inc. .... 2101-2103
Re-el Circuits, Inc. ..... 1380
Reeves Hoffman Div., Dynamics Corp. of America ..... 2363-2365
Refac Electronics Pinlite Wild Rover ..... 2540, 2541, 4220
Regdon Corp. ..... 3608
Relco Products, Inc. ..... 4323
Republic Electronics Corp. .... 1208
Resistors, Inc. ..... 3741
RF Interonics, Inc. ..... 2640
RFL Industries, Inc. ..... 2807, 4286
RO Associates, Inc. ..... 3314
Rockland Systems Corp. .. 2804-2806
R-Ohm ..... 3742
Ross Engineering Corp. ..... 3609
Rotating Components Div. Aeroflex Laboratories, Inc. .. 3071
Rotron, Inc. ..... 2600-2605
Rowe Industries Inc. ..... 2098-2100, 4643
Rtron Corp. ..... 2638, 2639

S

Sanford-Miller Corp. ..... 3935
Sangamo Weston Capacitor Div. ..... 1209
Components & Controls .. 3896-3903
Weston Instruments .... 2808-2819
Sanyo Electric, Inc. ..... 3315
Schrack Electrical Sales Corp. .. 3610
Scientific Atlanta, Optima Enclosures ..... 1040
Sealectro Corp. ..... 1666, 2157
Semiconductor Circuits, Inc. ..... 3316-3327
Semtech Corp. ..... 1210, 1211, 3936-3965
Sensitive Research Instruments, Electrical Instrument Service, Inc. ..... 2825
Servo-Tek Products Co. ..... 3109
SGL Waber Electric ..... 4654
Shallco, Inc. ..... 4240-4243
Shigoto Far East Ltd. ..... 4244
Sigma Power ..... 3328, 3329
Signal Transformer Co. .... 4389-4403
Simpson Electric Co. .... 2820, 2821
Skydyne Div. Brooks & Perkins Co. ..... 1047
Slaughter Co. ..... 2822, 2823
Sloan Co., The ..... 2542-2545
Smith, Inc., Herman H. .... 2104-2156
Sola Electric ..... 3342
So Li Co. ..... 2546, 2547
Sorenson Lighted Control, Inc. ..... 2546, 2547
Soshin Electric Co., Ltd. ..... 1212
Southern Electronics Co. ..... 1213
Spectra Strip Corp. ..... 4655
Spectrol Electronics Corp. 3904-3910
Spectrum Control, Inc. .. 2642-2649
Spectrum Technology, Inc. ..... 2366, 2367
Spellman High Voltage Electronics Corp. ..... 3330, 3331
Sprague-Goodman Electronics .. 1215
Sprague Products Co. .... 1216, 1217
Stackpole Carbon Co. .... 2568-2569, 3743-3745
Stackpole Components Co. .....4245-4253
Staco, Inc. ..... 4404, 4405
Standard Grigsby, Inc. .. 4254, 4255
Standard Power, Inc. ..... 3332-3335
Standard Wire & Cable Co. ..... 4656
Standex Electronics ..... 3256
Stantron Div. Wyco Metal Products ..... 1048
Star Micronics, Inc. ..... 1020, 1021
Statek Corp. ..... 2369-2373
Static Control Systems 3M Co. ..... 3408, 3409
Staver Co., The ..... 2549
Sterling Transformer Corp. .....2641, 4407-4411
Stevens-Arnold, Inc. DC Input Pwr Supply Div. ..... 3336-3339
Superior Electric Co., The ..... 2159, 3110, 3111, 3401, 4412, 4413
Syntronic Instruments, Inc. ..... 1362, 1363
Systron Donner Corp. .... 3340, 3341

T

Tapeswitch Corp. of America .... 4257
Tauber Electronics, Inc. ..... 3343
Taurus Corp. ..... 1667
T-Bar, Inc. ..... 3611, 4259
Tech Laboratories, Inc. .. 4260, 4261
Techmar Corp. ..... 1049
Technipower, Inc. A Penril Div. ..... 3344
Techni-Tool, Inc. ..... 4297
Technitrol, Inc. ..... 2416, 2417, 4414, 4415
Tecnetics, Inc. ..... 3345
Tel Labs Inc. ..... 3747-3751
Teledyne Relays ..... 3612-3621
Telonic/Berkeley ..... 3063
Tenney Engineering, Inc. ..... 2573
Texas Instruments ..... 2160-2165
Texscan Corp. ..... 2830
Thermalloy, Inc. ..... 3966
Thordarson Meissner, Inc. ..... 4417-4428
Todd Systems, Inc. ..... 4430-4433
Topaz Electronics ..... 3402-3406
Torin Corp. ..... 2606, 2607
Torotel, Inc. ..... 1364-1369, 4434-4439
Torotron Corp. ..... 2831
Torque Systems, Inc. Sub. Rotron.EG&G Co. ..... 3128
Torwico Electronics, Inc. 4440, 4441
Toyo Communication Equipment Co., Ltd. ..... 2374
Trak Microwave Div. ..... 3064, 3065
Trak Systems ..... 1668-1671
Transmagnetics, Inc. ..... 1673
Triad-Utrad Distr. Svcs. .. 4442-4448
Trimm, Inc. ..... 2247
Triplett Corp. ..... 2826-2829
TRW Electronic Components Dept. ..... Inside back cover, Vol. 1
Capacitors ..... 1218-1221, 3967
Cinch Connectors ..... 2166-2246
Globe Motors ..... 2608, 2609, 3112-3127
IRC Resistors ..... 3752-3773
Holyoke Wire & Cable ..4657-4661
RF Semiconductors .... 3969, 3970
UTC Transformers .... 2650-2653, 4449-4458
TT Electronics, Inc. ..... 2654-2656

U

UID Electronics Div. AMF, Inc. .... 2248, 4262-4267
Unholtz-Dickie Corp. ..... 2575
Uniform Tubes, Inc. ..... 3066, 3067
Unimax Switch Corp. ..... 4268
Union Carbide Corp. Battery Products Div. .. 3346, 3347
Electronics Div. ..... 1222-1282
United States Crystal Corp. .... 2375
United Systems Corp. ..... 2832
United Wiring & Mfg. Co. ..... 1300-1311
Unitrack Div. Calabro Plastics, Inc. ..... 1050, 1051
Unitron, Inc. ..... 3362-3364
Universal Voltronics Corp. ..... 3348, 3349

V

Vactec, Inc. ..... 3148, 3149
Varadyne Inds., Inc. ..... 1284, 1285
Varflex Corp. ..... 2848
Varo Inc. Power Systems Div. ..... 3407
Vector Electronics Co., Inc. ..... 1052-1056, 1312-1319, 2249
Vectron Labs, Inc. ..... 2376-2378
Veetronix, Inc. ..... 4269
Vega Precision Labs, Inc. ..... 2864
Vemaline Products ..... 2454-2456, 3970-3972
Vent-Rak Div. of General Devices Co., Inc. ..... 1034, 1035
Venus Scientific, Inc. ..... 3351
Vernitech Div. of Vernitron Corp. ..... 1674, 1675, 2278, 2279, 3130, 3131
Vernitron Elec Comps Beau Prods. ..... 2250-2252
Vernitron Corp., Control Components Div. ..... 2277, 3129
Vernitron Corp. Magnetic Technology ..... 3098, 3099
Vernitron Corp. Piezoelectric Div. ..... 2658, 2659
Vernitron Corp. Vernitech Div. (see Vernitech)
Vernitron Corp. VRN Div. (see VRN)
Vero Electronics, Inc. ..... 1320
Victoreen, Inc. ..... 3774-3778
Virginia Panel Corp. ..... 2253
Vishay Resistive Systems Group ..... 3780, 3781, 3911
Visual Communications Co. ..... 2550, 2551
Viz Mfg. Co. ..... 2833
VRN Div. Vernitron Corp. .. 3913-3918

W

Wabash Relay & Electronics Div. ..... 3622-3625
Waldom Electronics, Inc. ..... 2254
Wavetek Indiana ..... 2835
San Diego ..... 2836
Wesco Electrical Co. ..... 1286-1289
Westinghouse Electric Corp. Semiconductor Div. ..... 3973
Whitmor Wire & Cable Corp. .... 4662
Wilbrecht Electronics, LEDCO Div. ..... 2489-2491
Wild Rover Div. of Refac ..... 4220
Wilmore Electronics Co., Inc. ..... 3352, 3353
W & M Manufacturing ..... 2255
Woven Electronics ..... 4663
Wyco Metal Products/Stanton .. 1048

Y

Yokogawa Corp. of America ..... 2837, 2846

Z

Zeus Industrial Products, Inc. .. 2849

# eem 78 79

## ALPHABETICAL INDEX OF DISTRIBUTOR ADVERTISEMENTS

Many of the manufacturers who catalog their products in this edition of eem/Electronic Engineers Master offer their products to you through electronic parts distributors. To aid you in locating supplies, the following progressive distributors have placed their advertisements in **eem.**

Distributors' line cards are shown in the white catalog section, pages 1001 through 4666. In addition, distributors emphasizing their ability to supply specific manufacturers' items in depth have placed advertisements near the manufacturers' own listing in the Manufacturers and Sales Offices Directory, pages 601 through 860.

For your convenience, many manufacturers have included listings of their electronic parts distributors immediately following their local sales offices in the Manufacturers' Directory..


**BARBEY ELECTRONICS** ..... 755, 783, 817, 4000
Reading, PA

**DIPLOMAT** ..... 1062, 1705, 2460, 2657,
Woodbury, NY 3441, 3696, 3884,
Farmington, MI 3922, 4018, 4553
Totowa, NJ
Elk Grove Village, IL
Chicopee Falls, MA
Minneapolis, MN
Mt. Laurel, NJ
Salt Lake City, UT
St. Louis, MO
Holliston, MA
Sunnyvale, CA
Clearwater, FL
Ft. Lauderdale, FL

**ELECTRIC SWITCHES, INC.** ..... 608, 621, 637,
Los Angeles, CA 643, 644, 679, 703, 729, 742, 756

**FAIRMONT ELECTRONIC SALES CORP.** ..... 1169
Plainview, NY

**FUSES UNLIMITED** ..... 639, 743
Chatsworth, CA

**GENESIS ELECTRONICS, INC.** .....1775
Subsidiary of Radio Distributing Co., Inc.
South Bend, IN
Dayton, OH
Cleveland, OH
Indianapolis, IN
Chicago, IL
St. Paul, MN

**LECTRONIX** ..... 745
St. Charles, MO

**MICROWAVE DISTRIBUTORS CO.** ..... 2875
Commack, NY

**PARTS MASTERS** ..... 1321
Wayne, NJ

**POCO SALES** ..... 709, 4258
Woodland Hills, CA

**ZACK ELECTRONICS** ..... 615, 619, 705,
San Francisco, CA 718, 748, 807
Palo Alto, CA



## THE ELECTRONIC DISTRIBUTORS PRICING BIBLE...

*NOW AVAILABLE TO YOU*

Electronic Parts Distributors must keep up-to-date on prices for the components they sell to you. Since 1949, they have depended on the United Pricing Reports to keep them constantly up-dated with accurate up-to-the-minute pricing information.

You can eliminate time-consuming searches, telephone calls and letters through a subscription to this same indispensable service.

Your Pricing Report will be complete and current. Over 400,000 electronic components are listed. Individual pages are there for each of more than 600 manufacturers selling through electronic parts distributors. His products are listed in alpha-numerical order to facilitate your immediate locating of pricing information.

Twice weekly you'll receive a 4-page industry newsletter including a summary of price changes. With this are replacement pages, clearly indicating price increases, decreases, new products and discontinued items.

Save time. Save bother. Save money. Turn to United Pricing Reports when you need today's accurate price information.

To subscribe, or for further information, contact:

Curt Glanville
United Pricing Reports
645 Stewart Avenue
Garden City, New York 11530
(516) 222-2500

# eem 78 79

## MANUFACTURERS' INDEX TO CATALOG PAGES BY eem PRODUCT SECTION NUMBER

## THE FOLLOWING 43 eem PRODUCT SECTIONS MAKE UP UNITED TECHNICAL PUBLICATIONS' TIME-SAVING PRODUCT INFORMATION SYSTEM.


| Section | Description | Page No. |
|---|---|---|
| 1100 | Amplifier Assemblies | 1001 |
| 1300 | Audio Equipment & Accessories | 1010 |
| 1400 | Enclosures/Packaging Systems | 1022 |
| 1500 | Capacitors (All Types) | 1057 |
| 1600 | Chemicals/Cleaners/Coatings/Materials | 1290 |
| 1700 | Circuit Boards & Assemblies/Breadboarding Kits | 1295 |
| 1800 | Coils & Chokes/Assemblies/Forms | 1322 |
| 1900 | Communications/Telemetering Equipment | 1370 |
| 2000 | Computing, Data Handling Equipment & Accessories | 1381 |
| 2100 | Connectors, Terminals, Sockets, etc. | 1676 |
| 2200 | Control Systems & Components | 2256 |
| 2300 | Crystals/Oscillators/Crystal Filters | 2280 |
| 2350 | Delay Lines | 2379 |
| 2400 | Panel Components (excluding Lighting & Displays) | 2418 |
| 2450 | Displays & Readouts (including Lamps & Lights) | 2457 |
| 2500 | Mechanical Components (Bearings, Cores, Magnets, etc.) | 2552 |
| 2550 | Environmental Test Equipment | 2570 |
| 2600 | Fans/Blowers/Cooling Equipment | 2576 |
| 2700 | Filters (excluding Crystal) | 2610 |
| 2800 | Hardware (Non-Current Carrying) | 2660 |
| 2900 | Instruments, Measuring & Test | 2661 |
| 3000 | Instruments, Graphic Recording | 2838 |
| 3100 | Insulators/Insulation | 2847 |
| 3130 | Integrated Circuits & Hybrids | 2851 |
| 3400 | Microwave Systems & Subsystems | 2861 |
| 3450 | Microwave Components & Accessories | 2865 |
| 3500 | Motor & Drives | 3069 |
| 3700 | Electro-Optical Components & Accessories | 3132 |
| 4000 | DC Power Sources | 3150 |
| 4050 | AC Power Sources | 3354 |
| 4100 | Production Equipment/Manufacturing Services | 3408 |
| 4500 | Relays & Solenoids | 3411 |
| 4700 | Resistors, Fixed | 3626 |
| 4750 | Resistors, Variable | 3783 |
| 4800 | Semiconductors | 3919 |
| 4900 | Servomechanisms | 3974 |
| 5100 | Switches/Keyboards/Protective Components | 3978 |
| 5300 | Thermocouples, Elements & Accessories | 4270 |
| 5400 | Tools (Hand & Power)/Soldering Supplies | 4287 |
| 5500 | Transducers | 4298 |
| 5600 | Transformers | 4325 |
| 5700 | Tubes & Tube Parts | 4459 |
| 6000 | Wire/Cable/Harnesses & Accessories | 4464 |


## HERE ARE THE MANUFACTURERS WHOSE CATALOG PAGES APPEAR IN EACH OF THE eem PRODUCT SECTIONS. TO LOCATE SPECIFIC PRODUCTS REFER TO THE PRODUCT INDEX AND DIRECTORY.

### eem PRODUCT SECTION 1100

**Amplifier Assemblies ..... 1001-1009**

- Amplifier Research Corp.
- Dynamics Div. Waugh Controls Corp.
- ENI
- Hope Electronics
- Ithaco, Inc.
- Preston Scientific, Inc.

### eem PRODUCT SECTION 1300

**Audio Equipment & Accessories ..... 1010-1021**

- Crown Industrial
- International Electro Magnetics, Inc.
- Lipps, Inc.
- Mallory Capacitor Co.
- Quam-Nichols Co.
- Star Micronics, Inc.

### eem PRODUCT SECTION 1400

**Enclosures/ Packaging Systems .. 1022-1056**

- Airpax Electronics
- Amco Engineering Co.
- Bivar, Inc.
- Buckeye Stamping Co.
- Chassis-Trak Div. General Devices Co., Inc.
- Compac
- Environmental Container Systems, Inc.
- Equipto Electronics Corp.
- Formica Metal Products Co.
- Interlok
- La France
- Optima Scientific-Atlanta
- Premier Metal Products Co.
- Skydyne
- Stantron Div. Wyco Metal Products
- Techmar Corp.
- Unitrack Div. Calabro Plastics
- Vector Electronic Co.
- Vent-Rak Div. General Devices Co., Inc.

### eem PRODUCT SECTION 1500

**Capacitors (All Types) 1057-1289**

- American Components, Inc.
- American Technical Ceramics
- Arco Electronics
- AVX Ceramics
- Axel Electronics, Inc.
- Capar Components Corp.
- Corning Glass Works
- Centre Engineering
- Cornell-Dubilier Electric Corp.
- Component Research Corp.
- Custom Electronics, Inc.
- Elpac
- F-Dyne Electronics Co.
- Fujitsu America, Inc.
- High Energy Corp.
- Illinois Capacitor, Inc.
- Iskra ISL Products Ltd.
- International Components Corp.
- ITT Components
- ITT Jennings
- Jackson Bros. (London) Ltd.
- Johanson Dielectrics
- Johanson Mfg.
- E. F. Johnson Co.
- Mallory Capacitor Co.
- Microplex
- Midwec
- Nytronics Components Group, Inc.
- Panasonic Electronic Components Div.
- PFC
- Republic Electronics Corp.
- Sangano Weston
- Semtech Corp.
- Soshin Electric Co., Ltd.
- Southern Electronics Co.
- Sprague Goodman
- Sprague Capacitors
- TRW Capacitors
- Union Carbide
- Varadyne Industries, Inc.
- Wesco Electrical Co.

### eem PRODUCT SECTION 1600

**Chemicals/Cleaners/Coatings/ Materials ..... 1290-1294**

- GC Electronics
- Hardman, Inc.
- Humiseal Div. Columbia Chase Corp.

## eem PRODUCT SECTION 1700

**Circuit Boards & Assemblies/ Forms ..... 1295-1321**

Applied Circuits, Inc.
Continental Specialties Corp.
The Datak Corp.
E & L Instruments, Inc.
United Wiring & Mfg. Co.
Vector Electronic Co.
Vero Electronics, Inc.

## eem PRODUCT SECTION 1800

**Coils & Chokes/Assemblies/ Forms ..... 1322-1369**

Bell Industries J. W. Miller Div.
Bourns
Caddell-Burns
Cramer Coil Div.
Dale Electronics, Inc.
Delevan American Precision Div.
Endicott Coil Co., Inc.
Harbison Industrial Products, Inc.
North Hills
Nytronics Components Group, Inc.
Syntronic Instruments, Inc.
Torotel, Inc.

## eem PRODUCT SECTION 1900

**Communications/Telemetering Equipment ..... 1370-1380**

Colorado Video, Inc.
GRN Corp.
Re-el Circuits, Inc.

## eem PRODUCT SECTION 2000

**Computing, Data Handling Equipment & Accessories ..... 1381-1675**

American Electronic Laboratories, Inc.
AMP, Inc.
Baldwin Electronics, Inc.
Burr-Brown
Chrono-Log Corp.
Computer Conversions Corp.
Control Sciences, Inc.
Datametrics
Data Specialties, Inc.
Data Translation, Inc.
D-B Developments
Datel Systems, Inc.
Digital Equipment Corp.
Dynatech Microsystems
GNT Automatic, Inc.
Hickok Electrical Instrument Co.
ILC Data Device Corp.
Information Transfer Industrial, Inc.
C. Itoh Electronics, Inc.
Interface Engineering, Inc.
Kessler-Ellis Products
Litton Encoder Div.
Matrix Corp.
Itek Measurements Systems
Natel Engineering Co., Inc.
Neff Instrument Corp.
North Atlantic Industries, Inc.
Practical Automation, Inc.
Phoenix Data, Inc.
Preston Scientific, Inc.
Sealectro Corp.
Taurus Corp.
Trak Systems Div. Trak Microwave Corp.
Transmagnetics, Inc.
Vernitech Div. of Vernitron Corp.

## eem PRODUCT SECTION 2100

**Connectors, Terminals, Sockets, etc. ..... 1676-2255**

Airborn, Inc.
Alden Products Co.
Allied Systems Corp.
AMP Inc.
Amphenol
Appleton Electronics Div.
Aries Electronics, Inc.
Augat, Inc.
AVA Electronics Corp.
Berg Electronics
Cable Concepts Corp.
Cambridge
Caton Connector Corp.
C W Industries
Concord Electronics Corp.
Connector Corp.
Continental Connector Corp.
Control Products Div. Amerace
Dale Electronics, Inc.
Dynatech Corp.
Eby
Elco Corp.
Electrical Components Div. Bendix
Elfab
Electronic Molding Corp.
Fujitsu America, Inc.
Excel
Garry Mfg. Co.
Grayhill, Inc.
GTE Sylvania, Inc.
Hiram Jones
Hughes Aircraft Co. Connecting Devices Div.
ITT Cannon
ITT Pomona
Jettron Products, Inc.
E. F. Johnson
Keystone Electronics Corp.
Lear Siegler, Inc.
3M Co. Electronic Products Div.
Mac/Panel Co.
Methode Electronics, Inc.
Molex, Inc.
Mueller Electric Co.
National Tel-Tronics
Pyle-National Co.
Raytheon Co. Distributor Products Operation
Rowe Industries
RDI/Reed Devices Inc.
Sealectro Corp.
H. H. Smith
The Superior Electric Co.
Texas Instruments
TRW Cinch Connectors
Trimm, Inc.
UID Electronics Div. AMF
Vector Electronic Co.
Vernitron Div. Beau Products
Virginia Panel Corp.
Waldom Electronics
W & M Mfg. Corp.

## eem PRODUCT SECTION 2200

**Control Systems & Components ..... 2256-2279**

Active Control Instrumentation
Aeroflex Laboratories, Inc., Magnetics Products Div.
Airpax Controls Div.
Autronics Corp.
Bulova Electronics Div.
Electric Dynamics
General Magnetics, Inc.
Harrel, Inc.
IVO Industries, Inc.
Kessler-Ellis Products
Measurement Systems, Inc.
North American Philips Controls Corp.
North Hills Electronics, Inc.
Plessey Electro-Products
Vernitron Control Components
Vernitech Div. Vernitron Corp.

## eem PRODUCT SECTION 2300

**Crystals/Oscillators/ Crystal Filters ..... 2280-2378**

Accutronics
Alpha Components, Inc.
Austron
Bliley Electric Co.
Bulova Frequency Control Products
Colorado Crystal Corp.
Comstron-Seg
Croven Sub. of Walter Kidde & Co.
Connor-Winfield Corp.
Crystek
CTS Knights, Inc.
Dale Electronics, Inc.
Damon Electronics Div.
Erie Frequency Control
Frequency Electronics, Inc.
Frequency Selective Networks, Inc.
Filter Technology, Inc.
Greenray Industries, Inc.
Hope Electronics
Hughes Frequency Control Devices
International Crystal Mfg. Co., Inc.
Isotemp Research, Inc.
McCoy Electronics Co.
MF Electronics Corp.
Microsonics
Monitor Products Co., Inc.
Motorola, Inc.
Northern Engineering Laboratories, Inc.
Opt Industries, Inc.
Philamon, Inc.
Ovenaire Div. Walter Kidde Co.
Piezo Technology, Inc.
Q-Tech Corp.
Reeves Hoffman
Spectrum Technology
Statek Corp.
Toyo Communication Equipment Co., Ltd.
United States Crystal Corp.
Vectron Laboratories, Inc.

## eem PRODUCT SECTION 2350

**Delay Lines ..... 2379-2417**

Artronic Instrument Co.
Allen Avionics, Inc.
Bourns
Belfuse, Inc.
Computer Instruments Corp. Columbia Comps. Div.
Computer Devices Corp.
Control Electronics Co., Inc.
Data Delay Devices
ESC Electronics Corp.
Kappa Networks, Inc.
Nytronics Components Group, Inc.
RCL Electronics Div. AMF
Technitrol, Inc.

## eem PRODUCT SECTION 2400

**Knobs & Panel Components (excluding Lighting & Displays) ..... 2418-2456**

Alco Electronic Products, Inc.
Buckeye Stamping Co.
Datak Corp.
Electronic Hardware
Electronic Instrument & Specialty Corp. MC Div.
Interlok
Jan Hardware
RCL Electronics AMF Div.
Raytheon Co., Distributor Products Operation
Vemaline Products

## eem PRODUCT SECTION 2450

**Displays & Readouts (including Lighting & Displays) .. 2457-2551**

Alco Electronic Products, Inc.
AND
Beckman Instruments, Inc. Helipot Div.
Chicago Miniature Lamp Works
Dialight
Display Devices, Inc.
Endicott Coil Co., Inc.
GTE Sylvania
Hamlin
Industrial Electronic Engineers, Inc.
Industrial Devices, Inc.
Infodex, Inc.
Info-Lite Corp.
Ledco Div. of Wilbrecht Electronics
Leecraft Mfg. Co., Inc.
Litronix
Littelfuse
Minelco
Oak Industries
Oshino Electric Lamp Works, Ltd.
Refac Electronics Corp.
The Sloan Co.
Sorenson Lighted Controls, Inc.
Staver Co., Inc.
Visual Communications Co.

## eem PRODUCT SECTION 2500

**Mechanical Components (Bearings, Cores, Magnets, etc.) ..... 2552-2569**

Ad-Vance Magnetics, Inc.
Alberox
Amuneal Mfg. Corp.
Eagle Magnetic Co., Inc.
Fair-Rite Products Corp.
The Inter Technical Group, Inc.
Instrument Specialties Co., Inc.
ITT Thermotech
Krystinel Corp.
Metex Corp.
Mushield Co.
Perfection Mica Co.
Stackpole

## eem PRODUCT SECTION 2550

**Environmental Test Equipment ..... 2570-2575**

Blue M Equipment
Cincinnati Sub. Zero Products, Inc.
Ransco Industries
Tenney Engineering, Inc.
Unholtz-Dickie Corp.

## eem PRODUCT SECTION 2600

**Fans/Blowers/ Cooling Equipment .... 2576-2609**

Borg-Warner Thermoelectrics
Electro Impulse Inc.
The George Evans Corp.
ETRI
IMC Magnetics Corp.
Marlow Industries
McLean Engineering
Melcor
Pamotor
Rotron
Torin Corp.
TRW Globe Motors

## eem PRODUCT SECTION 2700

**Filters (excluding Crystal) ..... 2610-2659**

Allen Avionics, Inc.
A. P. Circuit Corp.
All-Tronics, Inc.
Axel Electronics, Inc.
AMP, Inc.
Andersen Laboratories, Inc.
Chesterfield Products, Inc.
Comstron-Seg.
Corcom
Cornell-Dubilier
Data Delay Devices
Douglas Randall Div. Walter Kidde & Co., Inc.
ESC Electronics Corp.
Hertz Filter Corp.
Hisonic, Inc.
Hopkins Engineering Co.
Ithaco
KR Electronics, Inc.
Precision Filters
R-Tron Corp.
R F Interonics, Inc.
Spectrum Control, Inc.
Sterling Transformer
TRW/UTC Transformers
TT Electronics
Vernitron Piezoelectric Div.

## eem PRODUCT SECTION 2800

**Hardware (Non-Current Carrying) ..... 2660**

Raytheon Co., Dist. Products Operation

## eem PRODUCT SECTION 2900

**Instruments, Measuring & Test ..... 2661-2837**

Analog Digital Data Systems, Inc.
Bafco, Inc.
Ballantine Laboratories, Inc.
Beede Electrical Instrument Co., Inc.
Boontoon Electronics Corp.
Bell, Inc., F. W.
Bird Electronic Corp.
B & K Precision
Chatsworth Data Corp.
Clark-Hess Communication Research Corp.
Comstron/Adret
Comstron/Seg
Continental Resources, Inc.
Curtis
Data Precision
Datel Systems
Dranetz Engineering Laboratories
Doric Scientific
Dytronics Co., Inc.
Ectron Corp.
Electro Impulse, Inc.
Electro Industries
Emico Sheller-Globe Corp.
Electronic Development
Elgenco Inc.
Empro Mfg. Co., Inc.
ESE
Exact Electronics, Inc.
Faria Meter Corp.
Fluke, John
Freed Transformer Co., Inc.
Gould
Gralex Industries
Guideline Instruments
Hipotronics, Inc.
Honeywell Test Instruments Div.
Hoyt Electrical
Hughes Aircraft Co., Industrial Products Div.
IBM Instrument Systems
Interstate Electronics Corp.
Instruments For Industry
ITT Jennings
Jewell Electrical Instruments, Inc.
Julie Research Laboratories, Inc.
Kay Elemetrics Corp.
Keithley Instruments, Inc.
Krohn Hite
Leader Instruments Corp.
Leeds and Northrup Co.
Marconi Instruments
Millivac Instruments
Modutec
Nationwide Electronic Systems
Newport Laboratories
Nicolet Instrument Corp.
Non-Linear Systems, Inc.
North Atlantic
Philps Test & Measuring Instruments
Polarad Electronics Corp.
PPM, Inc.
Pulsar Associates, Inc.
Radiometer Electronics (The London Co.)
RFL Industries. Inc.
Rockland Systems Corp.
Sangamo Weston
Sensitive Research
Simpson Electric Co.
Slaughter Co.
Texscan
Triplett Corp.
Torotron Corp.
United Systems Corp.
Viz Test Instruments Group
Wavetek Indiana
Wavetek San Diego
Yokogawa Corp. of America

## eem PRODUCT SECTION 3000

**Instruments, Graphic Recording ..... 2838-2846**

Esterline Angus Instrument Corp.
Gould, Inc.
Gulton Measurement & Control Systems Div.
Honeywell Test Instruments Div.
Houston Instrument
Leeds & Northrup Co.
Yokogawa Corp. of America

## eem PRODUCT SECTION 3100

**Insulators/Insulation 2847-2850**

Markel Corp.
Varflex Corp.
Zeus Industrial Products, Inc.

## eem PRODUCT SECTION 3130

**Integrated Circuits & Hybrids ..... 2851-2860**

Aeroflex Laboratories, Inc.
Beckman Instruments, Inc. Helipot Div.
Burr-Brown
ITT North Microsystems
LSI Computer Systems, Inc.
Mini-Systems, Inc.

## eem PRODUCT SECTION 3400

**Microwave Systems & Sub Systems ..... 2861-2864**

Cober Electronics
Epsco, Inc.
MCL, Inc.
Vega Precision Laboratories, Inc.

## eem PRODUCT SECTION 3450

**Microwave Components & Accessories ..... 2865-3068**

Arra
Applied Research, Inc.
Daico Industries, Inc.
General Microwave
Hope Electronics
Matrix Systems Corp.
Midisco
Mini-Circuits
North Hills Electronics, Inc.
Telonic/Berkeley
Trak Microwave Corp.
Uniform Tubes, Inc.

## eem PRODUCT SECTION 3500

**Motors & Drives ..... 3069-3131**

Aeroflex Laboratories, Inc., Motor Prods. Div.
Airflyte Electronics Co.
Barber-Colman Co.
Berger-Lahr Corp.
Bodine Electric Co.
Cannon U.S.A., Inc.
Clifton Precision
Delevan Div. American Precision
Eastern Air Devices
Electro-Craft Corp.
Fabricast, Inc.
General Electric
Graphite Metallizing Corp.
Gemcor — General Electro-Mechanical Corp.
IMC Magnetics Corp.
Japanese Products Corp.
Magnetic Technology
Micro Mo Electronics
North American Philips Controls Corp.
The Pittman Corp.
Portescap U.S.
Rapidsyn Co.
Servo-Tek Products Co.
The Superior Electric Co.
TRW Globe Motors
Torque Systems, Inc.
Vernitron Control Componemts
Vernitech Div. Vernitron Corp.

## eem PRODUCT SECTION 3700

**Electro-Optical Components & Accessories ..... 3132-3149**

Clairex Electronics
EG&G Electro-Optics Div.
National Semiconductors LTD.
Raython Co., Distributor Products Operation
Vactec, Inc.

## eem PRODUCT SECTION 4000

**DC Power Sources (including Batteries) 3150-3353**

Abbott Transistor Laboratories, Inc.
Abacus Controls, Inc.
ACDC Electronics
Acme Electric Corp.
Acopian Corp.
Advanced High Voltage Co., Inc.
Almond Instruments Co., Inc.
Alpha Power, Inc.
ALS Electronics Corp.
AMP, Inc.
Arnold Magnetics Corp.
Bertan Associaties, Inc.
Bikor Corp.
CEA A Div. of Berkleonics, Inc.
Crestronics, Inc.
Christie, Inc.
Datel Systems
Del Electronics Corp.
Dormeyer Industries
Dynamic Instrument Corp.
Eagle-Picher Industries, Inc.
Electrostatics, Inc.
Electronic Measurements, Inc.
Elpac Electronics, Inc.
Epsco, Inc.
Era Transpac Corp.
Ferrotran Electronics Co., Inc.
Gerator Corp.
Glassman High Voltage Computer Power
Gould
Hewlett-Packard
Hipotronics, Inc.
Hisonic, Inc.
Hope Electronics
Integrated Circuits, Inc.

Interelectronics Corp.
Jerome Industries
Kepco, Inc.
LH Research
Megavolt Corp.
Mid-Eastern Industries
North Hills Electronics, Inc.
NWL Transformers
Opt Industries, Inc.
Panasonic
Pioneer Magnetics
Polytron Devices, Inc.
Power Designs, Inc.
Power, Inc.
Power Mate
Power-One, Inc.
Power Technology, Inc.
Power Systems, Inc.
Powertec
Ro Associates, Inc.
Sanyo Electric, Inc.
Semiconductor Circuits, Inc.
Sigma Power
Spellman High Voltage Electronics Corp.
Standard Power, Inc.
Stevens Arnold, Inc.
Systron-Donner
Sola Electric
Tauber Electronics, Inc.
Technipower, Inc.
Tecnetics
Union Carbide Corp. Battery Products Div.
Universal Voltronics Corp.
Venus Scientific, Inc.
Wilmore Electronics Co., Inc.

**eem PRODUCT SECTION 4050**

**AC Power Sources .... 3354-3407**

Advance Conversion Devices Co.
ATR Electronics, Inc.
Avionic Instruments, Inc.
Avtel
Bulova Electronics Div.
Behlman Engineering Corp.
California Instruments
Clary Corp.
Computer Power, Inc.
Deltec Corp.
Elgar
Flite-Tronics Co., Inc.
Gerator Corp.
Industrial Test Equipment Co.
KGS Electronics
Marine Electric RPD, Inc.
Nova Electric Mfg. Co.
Pacific Electronic Ent., Inc.
The Superior Electric Co.
Topaz Electronics
Varo, Inc.

**eem PRODUCT SECTION 4100**

**Production Equipment/ Manufacturing Services ..... 3408-3410**

3M Co.

**eem PRODUCT SECTION 4500**

**Relays & Solenoids .. 3411-3625**

The Adams & Westlake Co.
American Zettler, Inc.
Aromat Corp.
C.P. Clare & Co.
Cornell Dubilier
Coto-Coil Co., Inc.
Deltrol Controls
Diversified Electronics, Inc.
Dormeyer Industries
Douglas Randall Div. Walter Kidde & Co., Inc.
Durakool, Inc.
Elec-Trol
Electronic Applications Co.
Electronic Instrument & Specialty Corp.
Electronic Specialty Div. Datron Systems, Inc.
Fifth Dimension, Inc.
Fujitsu America, Inc.
Gordos Corp.
Gould Inc., Controls Div.
Grayhill, Inc.
Guardian Electric
Hamlin, Inc.
Hi-G
ITT Components Group
ITT Jennings
International Rectifier
Kilovac Corp.
Leach Relays Div.
Ledex, Inc.
Liberty Controls, Inc.
Matrix Systems Corp.
Midtex, Inc.
North American Philips Controls Corp.
Oak Industries, Inc.
Ohmite Mfg. Co.
Omron Electronics, Inc.
Potter and Brumfield
Regdon Corp.
Ross Engineering Corp.
Schrack Electrical Sales Corp.
T-Bar, Inc.
Teledyne Relays
Wabash Relay & Electronics Div.

**eem PRODUCT SECTION 4700**

**Resistors Fixed ..... 3626-3782**

Allen Bradley
American Components, Inc.
Angstrohm Precision, Inc.
Beckman Instruments, Helipot Div.
Beman Mfg., Inc.
Bourns
Caddock Electronics, Inc.
Capar Components Corp.
The Carborundum Co.
Corning Glass Works
CTS of Berne
Cutler-Hammer/Shallcross
Dale Electronics, Inc.
E-Systems Memcor Div.
Charles Gamble Industries
IMS, Inc.
ISKRA/ISL Products Ltd.
Julie Research Laboratories, Inc.
KRL Electronics, Inc.
Kelvin
Microplex
Mills Resistor Co.
Milwaukee Resistor Corp.
Mini-Systems, Inc.
Nytronics Components Group, Inc.
Ohmite Mfg. Co.
Panasonic
Precision Resistor Co., Inc.
Pyrofilm
RCL Electronics
Resistors, Inc.
Rohm
Stackpole Components Co.
Tel Labs
TRW/IRC Resistors
Victoreen, Inc.
Vishay Resistive Systems Group

**eem PRODUCT SECTION 4750**

**Resistors Variable .... 3783-3918**

Allen Bradley
Beckman Instruments, Inc. Helipot Div.
Bourns
Bowmar/TIC, Inc.
Carter Mfg., Corp.
CTS of Berne
Dale
Duncan Electronics
E-Systems Memcor Div.
Electro-Techniques, Inc.
New England Instrument Co.
Ohmite Mfg. Co.
Sangamo Weston
Spectrol
Vishay Resistive Systems Group
VRN

**eem PRODUCT SECTION 4800**

**Semiconductors ..... 3919-3973**

Aavid Engineering, Inc.
Aeg-Telefunken
Conditioning Semiconductor Devices Corp.
The Delbert Blinn Co.
Delco
International Rectifier
ISKRA/ISL Products Ltd.
Panasonic
Power Tech, Inc.
Sanford-Miller Corp.
Semtech Corp.
Thermalloy, Inc.
TRW Capacitors
TRW RF Semiconductors
Vemaline Products
Westinghouse

**eem PRODUCT SECTION 4900**

**Servomechanisms .... 3974-3977**

Bulova
Control Technology Co., Inc.
Industrial Control Co.

**eem PRODUCT SECTION 5100**

**Switches/Keyboards/ Protective Components ..... 3978-4269**

Airpax Electronics
Alco Electronic Products, Inc.
American Switch Corp.
AMP, Inc.
APM-Hexseal
Amphenol
Arcolectric Corp.
Bussmann Mfg. Div.
Carlingswitch, Inc.
Cherry Electrical Products Corp.
Chicago Lock Co.
Chicago Switch, Inc.
Chomerics
C&K Components, Inc.
C.P. Clare & Co.
Cole Instrument Corp.
Crouse-Hinds
CW Industries
Cutler Hammer
Digitran Co.
Durakool, Inc.
Electro Switch Corp.
Electro-Mech Components, Inc.
Fifth Dimension, Inc.
Gordos Corp.
Grayhill
Hamlin
Heinemann Electric Co.
Info-Lite Corp.
Interswitch
ITT Jennings
ITT Schadow, Inc.
Janco Corp.
Ledex, Inc.
Littelfuse
LVC Industries, Inc.
Maxi-Switch Co.
MCG Electronics, Inc.
McGill Mfg. Co., Inc.
McGraw-Edison/Edison Electronics
Mechanical Enterprises, Inc.
Micro Switch
Minelco
Oak Industries, Inc.
Ohmite Mfg. Co.
Oslo Controls, Inc.
Otto Controls Div./Otto Engineering, Inc.
Protective Controls, Inc.
Raytheon Co. Distributor Products Operation
Refac
RCL Electronics
Shallco, Inc.
Shigoto Far East Ltd.
Stackpole Components Co.
Standard Grigsby, Inc.
Standex Electronics
Tapeswitch Corp. of America
T-Bar, Inc.
Tech Laboratories, Inc.
Uid Electronics Div.
Unimax Switch
Veetronix

**eem PRODUCT SECTION 5300**

**Thermocouples, Elements & Accessories ..... 4270-4286**

The Carborundum Co.
Elmwood Sensors
Fenwal Electronics
Keystone Carbon Co.
Harry Levinson Co.
Midwest Components, Inc.
Omega Engineering, Inc.
RFL Industries, Inc.

## eem PRODUCT SECTION 5400

**Tools (Hand & Power) Soldering Supplies .... 4287-4297**

Channellock
Edsyn
Gardiner Solder Co.
Hexacon Electric Co.
Techni-Tool, Inc.

## eem PRODUCT SECTION 5500

**Transducers ..... 4298-4324**

American Aerospace Controls, Inc.
F. W. Bell, Inc.
BBN Instrument Co. A Div. of Bolt Beranek & Newman, Inc.
Kulite Semiconductor Products
Ohio Semitronics, Inc.
Relco Products, Inc.

## eem PRODUCT SECTION 5600

**Transformers ..... 4325-4458**

Abbott Transistor
Bourns
Dale Electronics, Inc.
Dormeyer Industries
EWC, Inc.
Freed Transformer Co., Inc.
Genrad
Hisonic, Inc.
Inductive Components, Inc.
JM Transformer Co.
Magnetico, Inc.
Microtran Co., Inc.
North Hills Electronics, Inc.
NWL Transformers
Ohmite Mfg. Co.
Perkin Elmer
Pico
Signal Transformer
Staco, Inc.
Sterling Transformers
The Superior Electric Co.
Technitrol, Inc.
Thordarson Meissner, Inc.
Todd Systems, Inc.
Torotel, Inc.
Torwico Electronics, Inc.
Triad/Utrad
TRW/UTC Transformers

## eem PRODUCT SECTION 5700

**Tubes & Tube Parts ..... 4459-4463**

Clinton Electronics Corp.
The Inter-Technical Group, Inc.

## eem PRODUCT SECTION 6000

**Wire/Cable/Harnesses & Accessories ..... 4464-4666**

Alpha Wire Corp.
Belden
Berk-Tek
Breeze Illinois, Inc.
Columbia Electronic Cables
Consolidated Wire
Daburn Electronics & Cable Corp.
Dearborn Wire and Cable Co.
Electro Weave, Inc.
Grayhill, Inc.
Heyman Mfg. Co.
Markel Corp.
National Wire and Cable Corp.
Panduit Corp.
Philadelphia Insulated Wire Co., Inc.
Rowe Industries
SGL Waber
Spectra Strip
Standard Wire & Cable Co.
TRW/Holyoke Wire & Cable
Whitmor Wire and Cable Corp.
Woven Electronics

# ALCOLITE

**Subminiature indicators with built-in LEDs. Contemporary styling. Ribbed body provides "anti-turn" mounting. Use table for limiting resistor.**

**BLF-2 flasher has built-in IC that produces a light pulse 3 times per second. Requires 5 VDC @ 20mA peak or may be controlled by TTL and CMOS circuits.**

**DISCOUNT SCHEDULE**

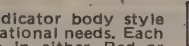
X-FACTOR
For quantities over 24

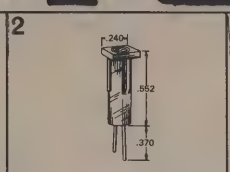
| | | |
|---|---|---|
| 25-99 | Multiply by | .80 |
| 100-499 | Multiply by | .72 |
| 500-Over | Multiply by | .64 |

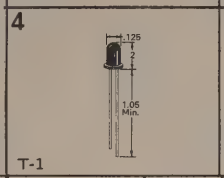
■ Select the indicator body style to fit your applicational needs. Each type is available in either Red or Green as listed below.

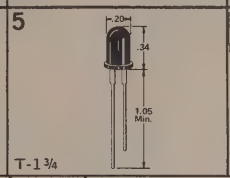
**LIMITING RESISTOR VALUES**

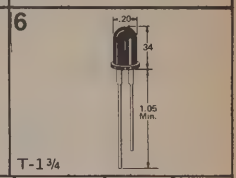
| SUPPLY VOLTAGE | Series Resistance Ω Red LEDs | Green LEDs |
|---|---|---|
| 2 VDC | 18 | None |
| 3 VDC | 68 | 22 |
| 5 VDC | 180 | 120 |
| 6 VDC | 220 | 180 |
| 12 VDC | 470 | 470 |
| Over 12V, add: | 50Ω/V | 50Ω/V |

NOTE: Cathode lead is short lead. 






| Model | ■ | Color | Maximum Dissipation | Max. $I_{FWD}$ | Max. $V_{FWD}$ @ 20mA | One-24 |
|---|---|---|---|---|---|---|
| BLD-62 | 1 | Red | 80mW @ 25°C | 40mA | 2VDC | $ .69 |
| BLD-65 | 1 | Green | 80mW @ 25°C | 30mA | 3VDC | .89 |
| BLD-72 | 2 | Red | 80mW @ 25°C | 40mA | 2VDC | .69 |
| BLD-75 | 2 | Green | 80mW @ 25°C | 30mA | 3VDC | .89 |
| BLD-82 | 3 | Red | 80mW @ 25°C | 40mA | 2VDC | .69 |
| BLD-85 | 3 | Green | 80mW @ 25°C | 30mA | 3VDC | .89 |
| BL-102 | 4 | Red | 80mW @ 25°C | 40mA | 2VDC | $ .37 |
| BL-105 | 4 | Green | 80mW @ 25°C | 30mA | 3VDC | .57 |
| BL-172 | 5 | Red | 200mW @ 25°C | 100mA | 2VDC | .42 |
| BL-175 | 5 | Green | 120mW @ 25°C | 30mA | 3VDC | .62 |
| BLF-2 | 6 | Red | 200mW @ 25°C | — | — | 1.47 |

**Aging and selection is essential in the manufacture of quality lamps. High reliability is assured by 100% aging for a minimum of 4 to 16 hours. Aging eliminates weak lamps and stabilizes their characteristics. After aging, lamps are tested at the design voltage and selected for current drain and light output. ALCOLITE lamps operate with 10% of specified ma.**

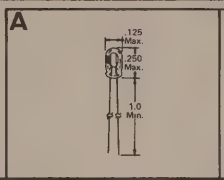
**DISCOUNT SCHEDULE**

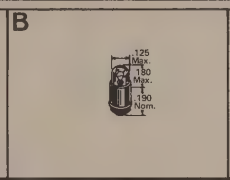
X-FACTOR
For quantities over 10

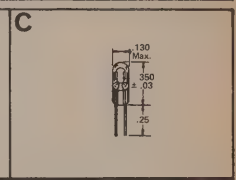
| | | |
|---|---|---|
| 20-90 | Multiply by | .90 |
| 100-Over | Multiply by | .80 |

All lamps are available only in handy packages of ten. Please order in this multiple.

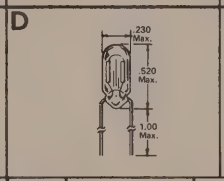
▲ **A.** T-1, Wire Terminals
**B.** T-1, Sub Midget Flange
**C.** T-1, Sub Midget Bi Pin

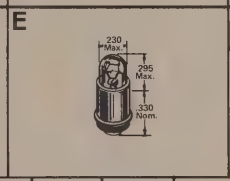


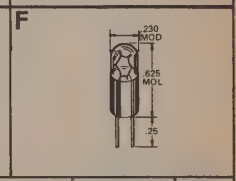




**D.** T-1¾, Wire Terminals
**E.** T-1¾, Midget Flange
**F.** T-1¾, Midget Bi Pin




| Line No. | Model | ▲ | Rated Volts | Design Amps | Rated MSCP | Average Rated Hours | Each (Min. 10) |
|---|---|---|---|---|---|---|---|
| 1. | 7207 | A | 3 | .060 | .032 | 50,000 | $ .45 |
| 2. | 8602 | A | 5 | .015 | .032 | 50,000 | .55 |
| 3. | 7210 (RM-3) | A | 5 | .030 | .030 | 20,000 | .42 |
| 4. | 680AS15 | A | 5 | .060 | †.032 | 100,000 | .57 |
| 5. | 680 | A | 5 | .060 | .032 | 100,000 | .37 |
| 6. | 683AS15 | A | 5 | .060 | †.053 | 100,000 | .57 |
| 7. | 683 | A | 5 | .060 | .053 | 100,000 | .37 |
| 8. | 713AS15 | A | 5 | .075 | †.088 | 60,000 | .57 |
| 9. | 713 | A | 5 | .075 | .088 | 60,000 | .37 |
| 10. | 715AS15 | A | 5 | .115 | †.147 | 40,000 | .57 |
| 11. | 715 | A | 5 | .115 | .147 | 40,000 | .37 |
| 12. | 7219 | A | 12 | .060 | .15 | 16,000 | .42 |
| 13. | 8111 | A | 14 | .065 | .15 | 16,000 | .42 |
| 14. | 7220 | A | 18 | .026 | .15 | 16,000 | .59 |
| 15. | 6838 | A | 28 | .024 | .15 | 16,000 | .59 |
| 16. | 7234 | B | 5 | .030 | .05 | 50,000 | .89 |
| 17. | 685 | B | 5 | .060 | .09 | 100,000 | .75 |
| 18. | 714 | B | 5 | .075 | .15 | 25,000 | .75 |
| 19. | 718 | B | 5 | .115 | .16 | 40,000 | .75 |
| 20. | 32 | B | 12 | .060 | .15 | 16,000 | 1.12 |
| 21. | 1112 | B | 14 | .065 | .15 | 12,000 | .97 |
| 22. | 7241 | B | 18 | .026 | .15 | 16,000 | 1.39 |
| 23. | 6839/856 | B | 28 | .024 | .15 | 16,000 | 1.39 |
| 24. | 7683 | C | 5 | .060 | .05 | 50,000 | .69 |
| 25. | 7715 | C | 5 | .115 | .15 | 40,000 | .69 |
| 26. | 1738 | D | 2.7 | .06 | .032 | 6,000 | .29 |
| 27. | 2200 | D | 5.0 | .060 | .05 | 40,000 | .31 |
| 28. | 1784 | D | 6.0 | .20 | .60 | 1,000 | $ .29 |
| 29. | 2180 | D | 6.3 | .04 | .02 Nom. | 50,000 | .29 |
| 30. | 2181 | D | 6.3 | .20 | .40 | 50,000 | .29 |
| 31. | 1869 | D | 10 | .014 | .002 Nom. | 10,000 | .33 |
| 32. | 2182 | D | 14 | .08 | .30 | 50,000 | .29 |
| 33. | 2102 | D | 18 | .04 | .15 | 10,000 | .29 |
| 34. | 2187 | D | 28 | .04 | .30 | 25,000 | .29 |
| 35. | 1764 | D | 28 | .04 | .34 | 7,000 | .29 |
| 36. | 7333 | E | 5 | .060 | .05 | 40,000 | .53 |
| 37. | 815 | E | 5 | .115 | .147 | 40,000 | .47 |
| 38. | 345 | E | 6 | .04 | .03 | 10,000 | .47 |
| 39. | 380 | E | 6.3 | .04 | .02 Nom. | 50,000 | .47 |
| 40. | 381 | E | 6.3 | .20 | .40 | 50,000 | .47 |
| 41. | 344 | E | 10 | .014 | .002 Nom. | 10,000 | .53 |
| 42. | 382 | E | 14 | .08 | .30 | 50,000 | .47 |
| 43. | 330 | E | 14 | .08 | .50 | 750 | .47 |
| 44. | 370 | E | 18 | .04 | .15 | 10,000 | .47 |
| 45. | 385 | E | 28 | .04 | .20 | 50,000 | .47 |
| 46. | 387 | E | 28 | .04 | .30 | 25,000 | .45 |
| 47. | 327 | E | 28 | .04 | .34 | 7,000 | .47 |
| 48. | 7945 | F | 6.0 | .040 | .03 | 10,000 | .43 |
| 49. | 7380 | F | 6.3 | .040 | .02 Nom. | 50,000 | .43 |
| 50. | 7381 | F | 6.3 | .20 | .40 | 50,000 | .43 |
| 51. | 7344 | F | 10 | .014 | .002 Nom. | 10,000 | .49 |
| 52. | 7382 | F | 14 | .080 | .30 | 50,000 | .43 |
| 53. | 7370 | F | 18 | .04 | .15 | 10,000 | .45 |
| 54. | 7387 | F | 28 | .04 | .30 | 25,000 | .43 |
| 55. | 7876 | F | 28 | .06 | .34 | 25,000 | .53 |

## EASY FIND LAMP INDEX

LOOK UP LAMP NUMBER AND CROSS TO LINE LISTING

| Line No. | Lamp No. | Line No. | Lamp No. | Line No. | Lamp No. | Line No. | Lamp No. | Line No. | Lamp No. | Line No. | Lamp No. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 20. | 32 | 46. | 387 | 10. | 715AS15 | 29. | 2180 | 14. | 7220 | 24. | 7683 |
| 47. | 327 | 5. | 680 | 19. | 718 | 30. | 2181 | 16. | 7234 | 25. | 7715 |
| 43. | 330 | 4. | 680AS15 | 37. | 815 | 32. | 2182 | 22. | 7241 | 55. | 7876 |
| 41. | 344 | 7. | 683 | 23. | 856 | 34. | 2187 | 36. | 7333 | 48. | 7945 |
| 38. | 345 | 6. | 683AS15 | 21. | 1112 | 27. | 2200 | 51. | 7344 | 13. | 8111 |
| 44. | 370 | 17. | 685 | 26. | 1738 | 15. | 6838 | 53. | 7370 | 2. | 8602 |
| 39. | 380 | 9. | 713 | 35. | 1764 | 23. | 6839 | 49. | 7380 | | |
| 40. | 381 | 8. | 713AS15 | 28. | 1784 | 1. | 7207 | 50. | 7381 | | |
| 42. | 382 | 18. | 714 | 31. | 1869 | 3. | 7210 | 52. | 7382 | | |
| 45. | 385 | 11. | 715 | 33. | 2102 | 12. | 7219 | 54. | 7387 | | |

ALCO® ELECTRONIC PRODUCTS, INC.
1551 Osgood Street, North Andover, Ma. 01845 U.S.A.
Tel: (617) 685-4371 TWX: 710 342-0552

Prices and specifications subject to change without notice.

# Liquid Crystal Displays

AND

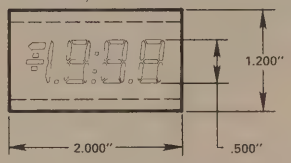
770 AIRPORT BOULEVARD, BURLINGAME, CALIFORNIA 94010 • TEL (415) 347-9916 • TWX 910-374-2353

## Field Effect and Dynamic Scattering Liquid Crystal Displays

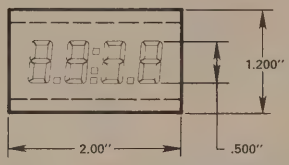
- Proven reliability
- Exceptional readability
- High contrast ratio
- Wide viewing angle
- Rapid response time
- Wide temperature range
- "High quality" connector pins
- Transmissive/reflective/transflective versions
- Low power consumption
- CMOS compatible

## Field Effect Displays

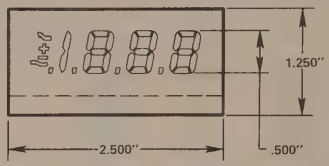
### FE0201



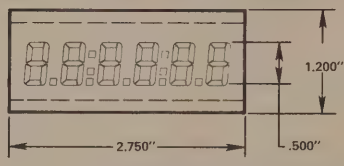

### FE0202



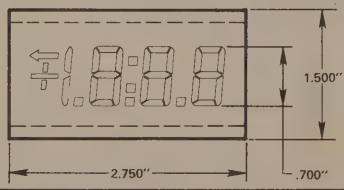

### FE0301



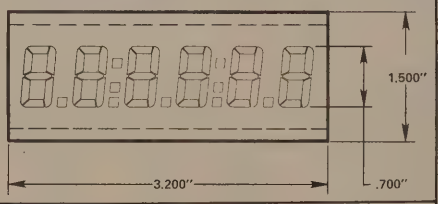

### FE0401*



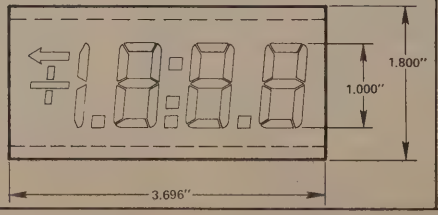

### FE0501*




### FE0601*

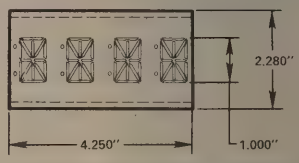



### FE0701*

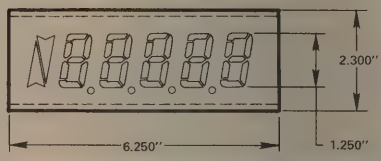



## Dynamic Scattering Displays

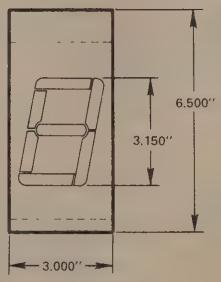
### DS0101



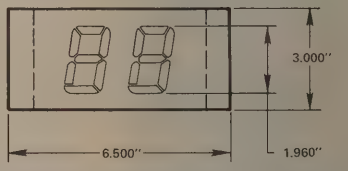

### DS0201



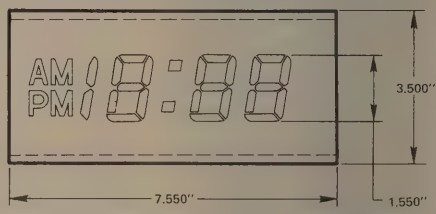

### DS0301




### DS0302




### DS0401




### DS0501*

**5 x 7 Dot Matrix Liquid Crystal Display**

- 11.000" x 6.500" glass package
- 256 characters (32 per row - 8 rows)
- 0.272" x 0.193" character size

*COMING SOON

One Single Digit

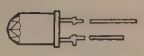
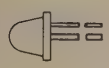
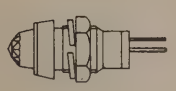
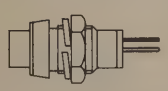
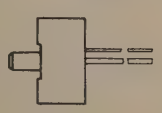
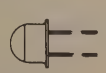
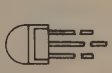
(Scale: 4 to 1)

# Gallium Phosphide Light Emitting Diodes

AND

770 AIRPORT BOULEVARD, BURLINGAME, CALIFORNIA 94010 • TEL (415) 347-9916 • TWX 910-374-2353

## Quick Reference Guide

| Size | Package & Number | Model | Luminous Intensity (mcd) | Forward Current (mA) | Material/Wavelength (nm) | Lens Configuration | Package Number |
|---|---|---|---|---|---|---|---|
| T1¾ | 1 | AND113R | 3.5 | 15 | GaP/700 | Red Clear | 1 |
| | | AND114R | 1.5 | 15 | GaP/700 | Red Diffused | 1 |
| | | AND116R | 1.8 | 15 | GaP/700 | Milk White Diffused | 1 |
| | | AND120R | 4.0 | 15 | GaP/700 | Transparent Clear | 1 |
| | 2  | AND115R | 3.0 | 15 | GaP/700 | Red Clear, Diamond Cut | 2 |
| | | AND113G | 17.0 | 15 | GaP/565 | Green Clear | 1 |
| | | AND114G | 5.0 | 15 | GaP/565 | Green Diffused | 1 |
| | | AND115G | 16.0 | 15 | GaP/565 | Green Clear, Diamond Cut | 2 |
| | 3  | AND113Y | 9.0 | 15 | GaAsP on GaP/590 | Yellow Clear | 1 |
| | | AND114Y | 5.0 | 15 | GaAsP on GaP/590 | Yellow Diffused | 1 |
| | | AND113O | | | | Orange Clear | 1 |
| | | AND114O | | | | Orange Clear | 1 |
| | 4 | AND103R | 3.0 | 15 | GaP/700 | Red Clear | 3 |
| | | AND104R | 1.5 | 15 | GaP/700 | Red Diffused | 3 |
| | | AND106R | 1.7 | 15 | GaP/700 | Milk White Diffused | 3 |
| | | AND110R | 4.0 | 15 | GaP/700 | Transparent Clear | 3 |
| | 5 | AND105R | 1.7 | 15 | GaP/700 | Red Clear, Diamond Cut | 4 |
| | | AND107R | 1.2 | 15 | GaP/700 | Red Clear, Flat Top | 5 |
| | | AND103G | 25.0 | 20 | GaP/565 | Green Clear | 3 |
| | | AND105G | 15.0 | 20 | GaP/565 | Green Clear, Diamond Cut | 4 |
| | | AND107G | 5.0 | 20 | GaP/565 | Green Clear, Flat Top | 5 |
| | 6 | AND103RK | 3.0 | 15 | GaP/700 | Red Clear | 6 |
| | | AND104RK | 1.5 | 15 | GaP/700 | Red Diffused | 6 |
| | | AND106RK | 1.7 | 15 | GaP/700 | Milk White Diffused | 6 |
| | | AND110RK | 4.0 | 15 | GaP/700 | Transparent Clear | 6 |
| | 7  | AND105RK | 1.7 | 15 | GaP/700 | Red Clear, Diamond Cut | 7 |
| | | AND107RK | 1.2 | 15 | GaP/700 | Red Clear, Flat Top | 8 |
| | | AND103GK | 25.0 | 20 | GaP/565 | Green Clear | 6 |
| | | AND105GK | 15.0 | 20 | GaP/565 | Green Diffused, Diamond Cut | 7 |
| | | AND107GK | 5.0 | 20 | GaP/565 | Green Clear, Flat Top | 8 |
| | 8  | AND123R | 1.5 | 10 | GaP/700 | Red Clear | 9 |
| | | AND124R | 1.0 | 10 | GaP/700 | Red Diffused | 9 |
| | | AND102RKB | 0.5 | 10 | GaP/700 | Red Diffused | 10 |
| | | AND102RKW | 0.5 | 10 | GaP/700 | Red Diffused | 10 |
| | | AND108RKB | 0.7 | 10 | GaP/700 | Transparent Clear | 10 |
| | | AND108RKW | 0.7 | 10 | GaP/700 | Transparent Clear | 10 |
| | | AND109RKB | 0.6 | 10 | GaP/700 | Milk White Diffused | 10 |
| | | AND109RKW | 0.6 | 10 | GaP/700 | Milk White Diffused | 10 |
| T1 | 9 | AND102R | 0.5 | 10 | GaP/700 | Red Diffused | 11 |
| | | AND108R | 0.7 | 10 | GaP/700 | Transparent Clear | 11 |
| | | AND109R | 0.6 | 10 | GaP/700 | Milk White Diffused | 11 |
| | 10 | AND123G | 0.7 | 10 | GaP/555 | Green Clear | 9 |
| | | AND124G | 0.4 | 10 | GaP/555 | Green Diffused | 9 |
| | | AND102GKB | 0.45 | 15 | GaP/560 | Green Diffused | 10 |
| | | AND102GKW | 0.45 | 15 | GaP/560 | Green Diffused | 10 |
| | 11 | AND108GKB | 2.5 | 15 | GaP/560 | Green Clear | 10 |
| | | AND108GKW | 2.5 | 15 | GaP/560 | Green Clear | 10 |
| SPECIALS | 12 | AND102G | 0.45 | 15 | GaP/560 | Green Diffused | 11 |
| | | AND108G | 2.5 | 15 | GaP/560 | Green Clear | 11 |
| | | AND123Y | 2.0 | 10 | GaAsP on GaP/585 | Yellow Clear | 9 |
| | | AND124Y | 1.0 | 10 | GaAsP on GaP/585 | Yellow Diffused | 9 |
| | | AND123O | | | | Orange Clear | 9 |
| | 13  | AND124O | | | | Orange Diffused | 9 |
| | | AND121R | 0.7 | 10 | GaP/700 | Transparent Clear | 12 |
| | | AND122R | 0.6 | 10 | GaP/700 | Red Clear | 12 |
| | | AND121G | 3.0 | 20 | GaP/560 | Transparent Clear | 12 |
| | | AND122G | 2.0 | 20 | GaP/560 | Green Clear | 12 |
| | | AND122O | | | | Orange Clear | 12 |
| | 14  | AND202R | 0.5 | 10 | GaP/700 | Red Clear | 13 |
| | | AND202G | 0.1 | 15 | GaP/560 | Green Clear | 13 |
| | 15  | AND101R | 0.7 | 15 | GaP/700 | Red Diffused | 14 |
| | | AND101RG | 0.6 | 20 | GaP/700, GaP/560 | Milk White Diffused | 15 |
| | 16 | AND205R | | | | Red Diffused | 16 |
| | | AND205G | | | | Green Diffused | 16 |
| | | AND205Y | | | | Yellow Diffused | 16 |

Alpha suffix on part no. denotes color (i.e., R=Red; G=Green; Y=Yellow; O=Orange). K=Mounting Hardware; B=Black; W=White.

# for prompt service and "off-the-shelf" availability, call... DIPLOMAT

FOR OUR COMPLETE COMPREHENSIVE INVENTORY SELECTION

## SEMICONDUCTORS AND IC's
Alpha (Microwave)
AmPower
Carter Semiconductor
CDI Compensated Devices
Computer Diode
Crystalonics/Teledyne
Delco
EDI
Exar
General Instrument
General Semiconductor
ITT
Intersil
Kertron Semiconductor
Microsemiconductor Corp.
Microwave Associates
Monolithic Memories
Mostek
NAE North American Electronics
NEC Microcomputer Inc.
Optron
Semicon
Semtech
Sensitron
Signetics
Silicon General
Silicon Transistor Corp.
Solid Power Corp.
Solid State Devices
Solid State Scientific
Solitron Devices
SMC Microsystems Corp.
Syntron
Teledyne
Texas Instruments
Western Digital
Xciton

## CAPACITORS AND FILTERS
ARCO
Capar
CAL-R
Cornel Dubilier
ITT
Johanson
Mallory
NCI
San Fernando/Westcap
Sangamo

## CONNECTORS AND SOCKETS
Amphenol
Cinch
Robinson Nugent
Sullins
Texas Instruments

## CONTROLS AND SWITCHES
Alco Switch
Cherry
CTS
Hamlin
Mallory
Omron

## FANS & BLOWERS
Howard Industries

## FUSES AND HOLDERS
Bussman
Littelfuse

## HARDWARE AND CABINETS
Bud Radio
Hammond
H.H. Smith
Hollingsworth
Ungar

## METERS OF TEST EQUIPMENT
Simpson
Triplett

## OPTOELECTRONICS
Chicago Miniature
General Electric
Monsanto
Optron
Xciton

## POTENTIOMETERS AND TRIMMERS
Clarostat
CTS
Spectrol
Weston/Sangamo
VRN (IRC)

## RELAYS
Allied Controls
Deltrol
Electrol
Guardian
Hamlin
IDEC
Potter & Brumfield
Omron

## RESISTORS
American Corp.
CAL-R
Capar
Clarostat
Mallory
Memcor
RCL
Shallcross
Stackpole
Ward-Leonard

## R.F. CHOKES
J.W. Miller

## THERMISTORS AND RF FILTERS
CORCOM
Fenwal
Gulton Industries

## TRANSFORMERS AND POWERSTATS
Chicago Stancor

## TUBES
Amperex

## WIRE, CABLE, INSULATION PRODUCTS
Alpha
Belden
Cable-Tech
Cimco
Coleflex
Columbia
Dearborn
DeWire
Electronized Chemical Corp.
Harbor Industries
Hi Temp
Insultab
ITT
Manhattan
Norflex
Rainbow

**Each of the Above Listed Lines are Franchised at one or more of the Following Locations.**

DIPLOMAT

**DIPLOMAT ELECTRONICS, INC.**
Woodbury, N.Y.
(516) 921-9373

**DIPLOMAT ELECTRONICS, INC.**
Farmington, Mich.
(313) 477-3200

**DIPLOMAT ELECTRONICS, INC.**
Totowa, N.J.
(201) 785-1830

**DIPLOMAT ELECTRONICS, INC.**
Elk Grove Village, Ill.
(312) 595-1000

**DIPLOMAT ELECTRONICS, INC.**
Chicopee Falls, Mass.
(413) 592-9441

**DIPLOMAT ELECTRONICS, INC.**
Minneapolis, Minn.
(612) 788-8601

**DIPLOMAT ELECTRONICS, INC.**
Mt. Laurel, N.J.
(609) 234-8080

**DIPLOMAT ELECTRONICS, INC.**
Salt Lake City, Utah
(801) 486-4134

**DIPLOMAT ELECTRONICS, INC.**
St. Louis, Mo.
(314) 645-8550

**DIPLOMAT ELECTRONICS, INC.**
Holliston, Mass.
(617) 429-4120

**DIPLOMAT ELECTRONICS, INC.**
Sunnyvale, Calif.
(408) 734-1900

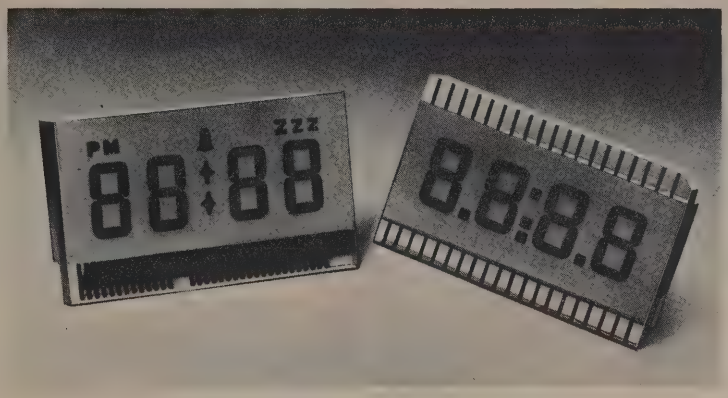
**DIPLOMAT ELECTRONICS, INC.**
Clearwater, Fla.
(813) 443-4514

**DIPLOMAT ELECTRONICS, INC.**
Ft. Lauderdale, Fla.
(305) 771-0440

**DIPLOMAT ELECTRONICS, INC.**
Woodbury, N.Y.
(516) 921-7920

BECKMAN

# DESIGN BECKMAN LIQUID CRYSTAL DISPLAYS IN. DESIGN PROBLEMS OUT.




## Available Models

| Series | Type | Description |
|---|---|---|
| 706 | 3½ Digit Watch | Unisex, Two Digit Sizes |
| 708 | 3½ Digit Watch | Men's |
| 710 | 3½ Digit Watch | Ladies', Two Digit Sizes |
| 711 | 6 Digit Watch | With A/N Fifth and Sixth Digit |
| 712 | 4 Digit Watch | With A/N First and Second Digit |
| 713 | 4 Digit Watch | With A/N First and Second Digit |
| 734 | 4 Digit General Purpose | .25″ (6.35mm) Digits; Colon and Decimal Points |
| 735 | 3½ Digit General Purpose | .25″ (6.35mm) Digits; ± Sign, Colon and Decimal Points |
| 736* | 4 Digit Clock | .5″ (12.7mm) Digits; Alarm, PM, Snooze Annunciators |
| 738* | General Purpose | .5″ (12.7mm) Digits; Colon and Decimal Points |

*Specifications included do not apply to this model series.

## Performance Specifications

| Parameters | | Minimum | Typical | Maximum | Units |
|---|---|---|---|---|---|
| Operating Voltage | | 2.7 | 3.0 | | Vrms |
| DC Drive Component Allowable | | | | 25 | mV |
| Operating Frequency Range (Note 1) | | 25 | | 100 | Hz |
| Dynamic Current (all segments ON) (Note 2) | | | 150 | 400 | nA |
| Capacitance (all segments ON) (Note 2) | | | 325 | 650 | pF |
| DC Resistance (all segments ON) | | 1000 | | | MΩ |
| Threshold 10% ON (Visual) | | 0.5 | | | Vrms |
| 90% of Saturation (Visual) | | | 2.25 | 2.7 | Vrms |
| Response Time (Note 3) | Segment ON ($T_A = +25°C$) | | 120 | 200 | msec. |
| | Segment OFF ($T_A = +25°C$) | | 185 | 300 | msec. |
| | Segment ON ($T_A = 0°C$) | | 600 | 1,000 | msec. |
| | Segment OFF ($T_A = 0°C$) | | 700 | 1,200 | msec. |
| | Colon (½ sec. ON; ½ sec. OFF, $T_A = 0°C$) | | visible blink | | — |
| Contrast Ratio | | 20:1 | | | — |
| Operating Temperature Range (Note 4) | | 0 | | +50 | °C |
| Storage Temperature Range (Note 4) | | −20 | | +65 | °C |

Unless otherwise specified, $T_A = +25°C$ and test voltages are 32 Hz square wave, 3.0 ±0.1Vrms.

**Notes:**

1. The limits shown avoid flicker below 25 Hz and increase power consumption above 100 Hz.
2. The values specified are for Model 708. Other Models will vary 50 to 100 nA in current and 100 to 150 pF in capacitance depending on digit areas.
3. Time is measured from initial change of state of drive voltage to 90% in visual state.
4. Extended storage at high temperatures listed will cause polarizer degradation.

Prices and specifications subject to change without notice.

BECKMAN INSTRUMENTS, INC. HELIPOT DIVISION
2500 Harbor Boulevard, Fullerton, California 92634
(714) 871-4848 · TWX No. 910-592-1260

BECKMAN

# SP-300 Series Displays

| SPECIFICATIONS | SP-330 SERIES | | | SP-350 SERIES | | |
|---|---|---|---|---|---|---|
| **DC Characteristics** | **Minimum** | **Typical** | **Maximum** | **Minimum** | **Typical** | **Maximum** |
| Display Supply Voltage(1) | 160 Vdc | 180 Vdc | Note 2 | 160 Vdc | 180 Vdc | Note 2 |
| Anode-to-Anode Differential Voltage (3) | — | — | 14 Vdc | — | — | 14 Vdc |
| Anode-to-Cathode Voltage Drop (Typical Current) | — | 135 Vdc | — | — | 135 Vdc | — |
| Cathode Current — Typical Segment (Seg. "b")(4) | 70 μA | 180 μA | 250 μA | 130 μA | 330 μA | 420 μA |
| Cathode Current — Decimal Point(4) | 60 μA | 135 μA | 190 μA | 65 μA | 135 μA | 190 μA |
| Cathode Current — Plus Sign | 110 μA | 290 μA | 400 μA | 260 μA | 585 μA | 820 μA |
| Cathode Current — Minus Sign | 50 μA | 135 μA | 185 μA | 120 μA | 270 μA | 380 μA |
| Cathode Current — Keep Alive | 10 μA | 50 μA | — | 10 μA | 50 μA | — |
| Power Dissipation per digit (With all segments lighted and assuming typical segment current) | — | 175 mW | — | — | 325 mW | — |
| Operating Temperature | 0°C | — | 70°C | 0°C | — | 70°C |
| Storage Temperature | −55°C | — | 125°C | −55°C | — | 125°C |

| Multiplex Characteristics | SP-330 SERIES | | | SP-351-356 SERIES | | |
|---|---|---|---|---|---|---|
| | **Minimum** | **Typical** | **Maximum** | **Minimum** | **Typical** | **Maximum** |
| Anode On Time (11) | 80 μsec. | 200 μsec. | — | 80 μsec | 200 μsec | — |
| Interdigit Blanking Time (12)(13) | 40 μsec | 55 μsec. | — | 40 μsec | 55 μsec | — |
| Refresh Period | — | — | Note 6 | — | — | Note 6 |
| Display Supply Voltage(8) | 160 Vdc | 180 Vdc | Note 2 | 160 Vdc | 180 Vdc | Note 2 |
| Anode Voltage Swing(8) | 30 Vdc | 45 Vdc | 90 Vdc | 30 Vdc | 45 Vdc | 90 Vdc |
| Cathode Voltage Swing(8) | 30 Vdc(8) | 50 Vdc | 120 Vdc | 30 Vdc(8) | 50 Vdc | 120 Vdc |
| Cathode Bias Voltage ("On" Anode to "Off" Cathode Voltage)(9) | 90 Vdc | 115 Vdc | 120 Vdc | 90 Vdc | 115 Vdc | 120 Vdc |

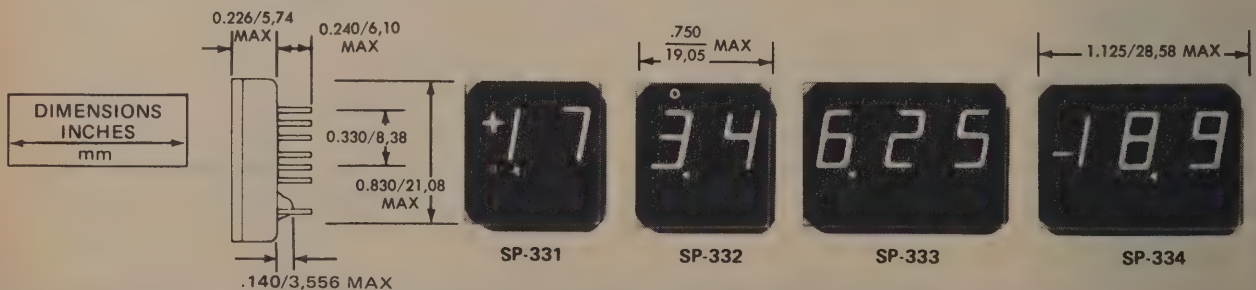
| Multiplex Characteristics | SP-357 and 358 Series | | |
|---|---|---|---|
| | **Minimum** | **Typical** | **Maximum** |
| Anode On Time (11) | 80 μsec. | 400 μsec. | — |
| Interdigit Blanking Time (12) (13) | 50 μsec. | 100 μsec. | — |
| Refresh Period | — | — | Note 6 |
| Display Supply Voltage (8) | 160 Vdc | 180 Vdc | Note 2 |
| Anode Voltage Swing (8) | 30 Vdc | 45 Vdc | 90 Vdc |
| Cathode Voltage Swing (8) | 30 Vdc | 50 Vdc | 120 Vdc |
| Cathode Bias Voltage ("On" Anode to "Off" Cathode Voltage) (9) | 90 Vdc | 115 Vdc | 120 Vdc |

**Notes:** Refer to notes on SP-101/102 page.

| FEATURES | SP-330 SERIES | SP-350 SERIES |
|---|---|---|
| Character Height | 0.330 inch/8,38 mm | 0.550 inch/13,97 mm |
| Color | Orange (Neon Glow) | Orange (Neon Glow) |
| Brightness | 210 foot lamberts at typical current | 210 foot lamberts at typical current |
| Viewing Angle | 130 degrees | 130 degrees |
| Viewing Distance | 20 feet/6,10 meters | 40 feet/12,20 meters |
| Life Expectancy | >10 years | >10 years |

The SP-330 and SP-350 Series Displays are designed for interfacing with MOS/LSI and are recommended for use in all dc or multiplexed applications, with or without suppressed (blanked) zeros. The displays can be quickly, easily read even in direct sunlight. Continuous, "no gap" characters make the displays most attractive to users. A keep-alive cathode provides an internal ion source that reduces reionization time to less than 30 microseconds, allows zero suppression, and improves the operation of the display in dark environments and at low temperatures. Units are horizontally stackable in any combination with uniform centerline spacing.

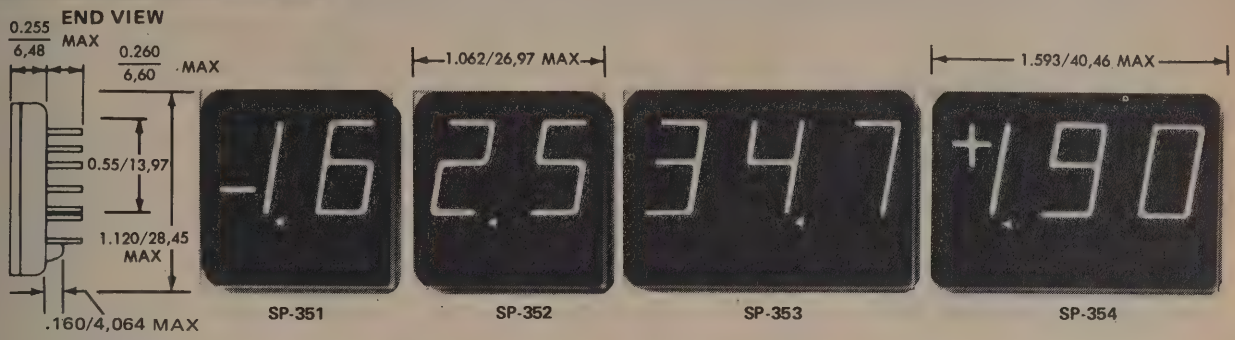
END VIEW

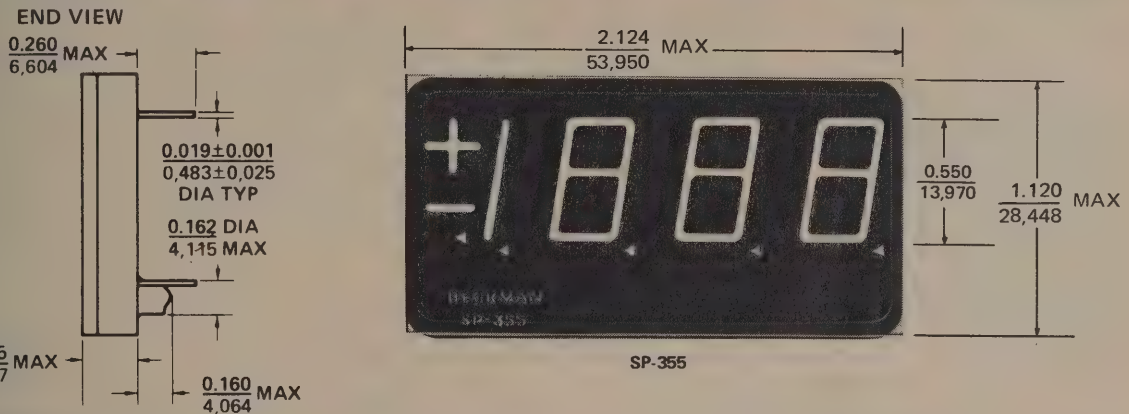



BECKMAN INSTRUMENTS, INC. INFORMATION DISPLAYS OPERATIONS 350 North Hayden Rd. P.O. Box 3579 Scottsdale, Arizona 85257 (602) 947-8371

BECKMAN

# SP-300 & SP-252 Displays




**SP-350 displays not shown:**
SP-356 — 4 digit, general application  SP-357 — 3 ½ digit + colon, 12-hr. clock  SP-358 — 4 digit + colon, 24-hr. clock

| SPECIFICATIONS | SP-252 |
|---|---|
| **DC Characteristics** | **Typical** |
| Display Supply Voltage (1)(2) | 180 Vdc |
| Anode-to-Anode Differential Voltage | Note 10 |
| Anode-to-Cathode Voltage Drop (1 Segment b = 330 μA) | 135 Vdc |
| Cathode Current — Per Segment | 330 μA |
| Cathode Current — Decimal Pt. | 135 μA |
| Cathode Current — Keep Alive | 50 μA |
| Power Dissipation (With All Segments Lighted @ 330 μA Typ.) | 575 mW |
| Operating Temperature | 0 — 70°C |
| Storage Temperature | −55 — 125°C |

| SPECIFICATIONS | SP-252 |
|---|---|
| **Multiplex Characteristics** | **Typical** |
| Anode On Time | 200 μsec |
| Interdigit Blanking Time(12) (1 Segment = 850 μA @ 180V) | 55 μsec |
| Refresh Period(6) | <10 msec |
| Display Supply Voltage(2) | 180 Vdc |
| Anode Voltage Swing | 45 Vdc |
| Cathode Voltage Swing(8) | 50 Vdc |
| Cathode Bias Voltage(9) (On "Anode to Off" Cathode Voltage) | 110 Vdc |

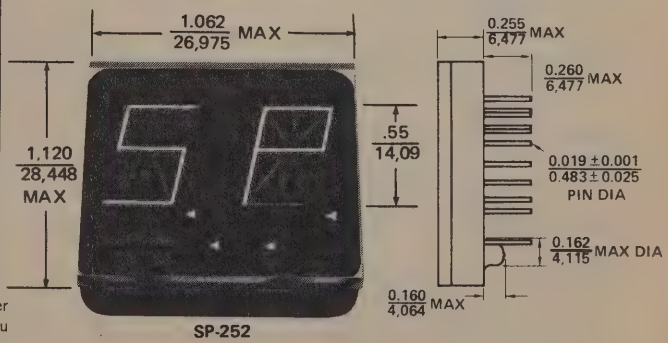
| Features | SP-252 |
|---|---|
| Character Height | 0.55 inch/13,97mm |
| Color | Orange (Neon Glow) |
| Brightness | 210 ft.-Lamberts Nom. (720 cd/m²) |
| Viewing Angle | 130 degrees |
| Viewing Distance | 40 feet/12,20 meters |
| Life Expectancy | > 10 years |

Mix-and-match versatility. Space and cost savings. That's what the new SP-252 is all about. It can be matched up with standard displays. And shows a mix of numeric and alphanumeric characters.

Specifically, the SP-252 can accommodate a set of approximately 60 characters. It can include all the letters in the alphabet, the numbers 0 to 9, plus some special symbols.

The SP-252 features a 0.55" (14.09) character height and the same character style as the Beckman SP-350 Series of numeric displays. Consequently, you can stack the SP-252 within the same series, as well as with the numeric displays, forming any desired field.

The modularity of the new SP-252 suggests a wide spectrum of applications, such as point-of-sale and terminal displays, showing status, monitoring, text and diagnostic information.




DIMENSIONS
INCH
(mm)

**BECKMAN INSTRUMENTS, INC.** **INFORMATION DISPLAYS OPERATIONS** 350 North Hayden Rd. P.O. Box 3579 Scottsdale, Arizona 85257 (602) 947-8371

BECKMAN®

# SP-101 and 102 Displays

| SPECIFICATIONS | SP-101 and 102 | | |
|---|---|---|---|
| | MIN | TYP | MAX |
| Display Supply Voltage[1] | 160 Vdc | 180 Vdc | Note 2 |
| Anode-to-Cathode Voltage Drop ('segment b = 700 μa) | — | 135 Vdc | — |
| Cathode Current — Per Segment[3,4] | 350 μa | 700 μa | 1000 μa |
| Cathode Current — Decimal Point | 100 μa | 200 μa | 300 μa |
| Cathode Current — Comma (decimal point included) | 200 μa | 400 μa | 600 μa |
| Cathode Current — Each Colon Segment[5] | 50 μa | 100 μa | 150 μa |
| Cathode Current — Keep-Alive | 15 μa | 75 μa | — |
| Cathode Current — Plus Sign (SP-102 only) | 650mA | 1300mA | 1900mA |
| Cathode Current — Minus Sign (SP-102 only) | 275mA | 550mA | 750mA |
| Power Dissipation (With All Segments Lighted @ 700 μa Typical)[4] | — | 725 mW | — |
| Operating Temperature | 0°C | — | 70°C |
| Storage Temperature | −55°C | — | 125°C |

**MULTIPLEX CHARACTERISTICS**

| | MIN | TYP | MAX |
|---|---|---|---|
| Anode On Time[11,7] | 80 μsec | 400 μsec | — |
| Refresh Period | — | — | Note 6 |
| Display Supply Voltage | 160 Vdc | 180 Vdc | Note 2 |
| Anode Voltage Swing | 30 Vdc | 45 Vdc | 90 Vdc |
| Cathode Voltage Swing | 30 Vdc[8] | 50 Vdc | 120 Vdc |
| Cathode Bias Voltage ("ON" Anode to "OFF" Cathode Voltage)[9] | 90 Vdc | 110 Vdc | 120 Vdc |

Notes:

(Apply to SP-300, SP-252, SP-101 and SP-102 Series Displays)

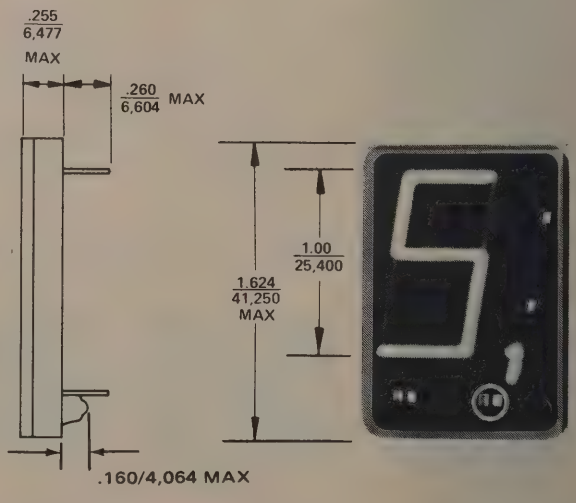
1. The minimum recommended supply voltage required to ionize the display is 160 volts DC. After the display has ionized, the voltage drop is approximately 135 volts at Typical cathode current.
2. Display supply voltage (including ripple) should not exceed 200 Vdc when display is used with DD-700 or decoder/driver. Higher display supply voltages are acceptable when the drive device breakdown exceeds 80 volts DC.
3. A segment currents are ratioed to b segment.
   a,d,f and g Current Ratio 1.00
   c Current Ratio 1.25
   e Current Ratio 1.20
4. The minimum current is required for even segment glow. Currents up to 1.5 times the typical current may be used; however, life expectancy may be reduced by operation at excessively higher currents. For multiplexed (time shared) operation segment, currents may be increased to four times typical current with 0.25 or smaller duty cycle.
5. To ensure uniform operation of the two colon cathodes, it is recomme nded that each cathode have its own current limiting device (resistor or current sink). The current listed is the current required for each colon segment.
6. Keep-alive is recommended in all multiplexed applications. Three (3) milliseconds is maximum refresh period without keep-alive. Ten (10) milliseconds is typical with keep-alive.
7. No anode or cathode blanking is required for the display to perform properly, however, some blanking may be advantageous to eliminate time overlap of signals due to circuit characters.
8. Under specific conditions, Cathode Voltage Swings of as low as 10 volts are acceptable.
9. The combination of Cathode Bias Voltage and Cathode Voltage Swing must be within recommended display supply voltage.
10. Lighted cathodes on all digits with independent current limiting. For bussed cathodes (multiplexed operation), 90 volts is permissible.
11. Anode On Time assumes typical keep-alive current and typical anode supply voltage.
12. Specified blanking time assumes 520 μA typical segment current for the SP-330 Series and 900 μA typical segment current for the SP-350 Series with 180 Vdc supply voltage. Blanking requirements are strongly dependent upon the mode of multiplex operation and upon the segment current used.
13. The colons must have same blanking as any other cathode, and are only enabled during their respective digit times.

The SP-101 and 102 are planar, neon gas discharge displays similar to the Beckman SP-300 Series alphanumeric product family. They are intended to fill the need for display readability at distances greater than 40 feet/12 meters.

Both are recommended for either dc or multiplexed applications, with or without suppressed zeros. The displays can be quickly and easily read even in direct sunlight. Continuous, "no gap" characters made the displays most attractive to users.

A keep-alive cathode provides an internal ion source that reduces reionization time to less than 30 micro-seconds. This enhances dynamic response and improves multiplex, low temperature, and dark ambient performance. The units may be evenly or randomly spaced to build any display field desired.

The SP-101 contains a colon, and a comma and/or decimal points as shown below. The SP-102 has a plus and minus sign, decimal point and over range numeric one.




BECKMAN INSTRUMENTS, INC. INFORMATION DISPLAYS OPERATIONS
350 North Hayden Rd. P.O. Box 3579
Scottsdale, Arizona 85257 (602) 947-8371

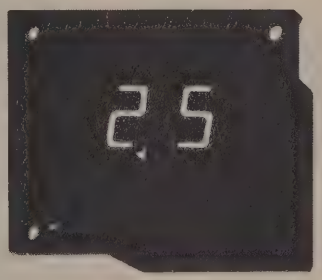
BECKMAN

# SM-800 Series Display Modules

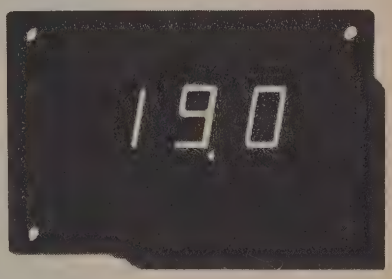
| Type | Description | | Electronics | Input |
|---|---|---|---|---|
| | Digit Positions | Digits | | |
| SM-851 | 2 | 1-1/2 | decoder, latch | BCD |
| SM-852 | 2 | 2 | decoder, latch | BCD |
| SM-853 | 3 | 3 | decoder, latch | BCD |
| SM-854 | 3 | 2-1/2 | decoder, latch | BCD |
| SM-855 | 2 | 1-1/2 | decoder, latch, counter | serial count |
| SM-856 | 2 | 2 | decoder, latch, counter | serial count |
| SM-857 | 3 | 3 | decoder, latch, counter | serial count |
| SM-858 | 3 | 2-1/2 | decoder, latch, counter | serial count |

SM-851

SM-852



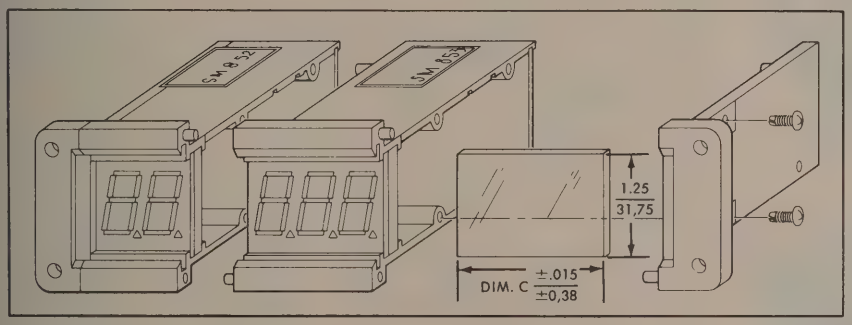

SM-853

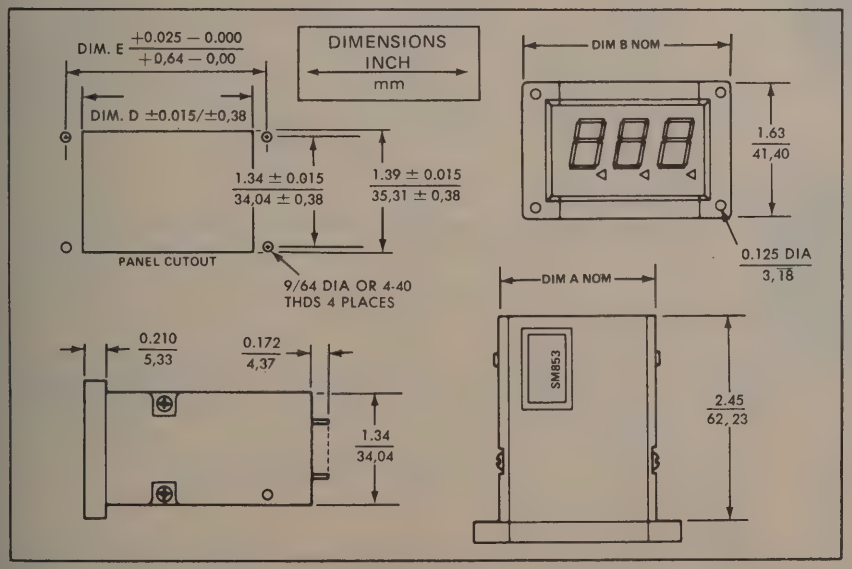



MECHANICAL SPECIFICATIONS, INCH/MM

| No. Digits | Body Width Dim A Nom | Bezel Width Dim B Nom | Filter Size 1.25/31,8x Dim C ± 0.015/,38 | Panel Cutout Dim D | Hole Spacing Dim E +0.25/0,64 −0.000/0,00 |
|---|---|---|---|---|---|
| 2 | 1.30/33,0 | 1.98/50,3 | 1.51/38,4 | 1.42/36,1 | 1.68/42,7 |
| 3 | 1.83/46,5 | 2.51/63,8 | 2.04/51,8 | 1.94/49,3 | 2.21/56,1 |
| 4 | 2.40/61,0 | 3.08/78,2 | 2.62/66,5 | 2.52/64,0 | 2.78/70.6 |
| 5 | 2.93/74,4 | 3.61/91,7 | 3.15/80,0 | 3.05/77,5 | 3.31/84,1 |
| 6* | 3.46/87,9 | 4.14/105,2 | 3.68/93,5 | 3.58/90,9 | 3.84/97,5 |
| 7 | 4.03/102,4 | 4.71/119,6 | 4.26/108.2 | 4.16/105,7 | 4.41/112,0 |
| 8** | 4.56/115,8 | 5.24/133,1 | 4.79/121.7 | 4.69/119,1 | 4.94/125,5 |

*Assumes two each three digit displays
**Assumes two each three digit displays and one each two digit displays



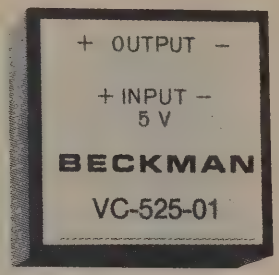

The SM-800 Series modules provide the user with a modularly expandable display, complete electronics, and ready-to-mount convenience. The series is available in 1-½-, 2-, 2-½-, and 3-digit configurations that can be mounted individually or as multi-digit displays. These expanded displays are achieved by horizontally stacking two or more modules together. The maximum number of digits thus attainable is theoretically unlimited since each module contains its own drive and decode electronics. The SM-855, SM-856, SM-857 and SM-858 modules are supplied with counters in addition to the decoder/drivers and the latch provided in the SM-851, SM-852, SM-853 and SM-854.

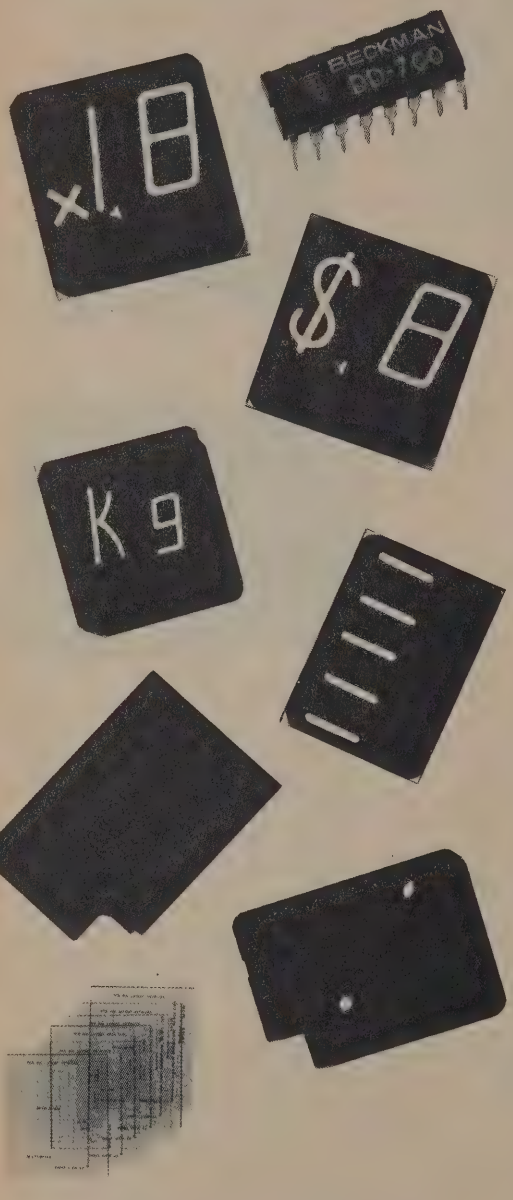
The physical design of the package allows for easy mounting of the module(s). The ease of assembly and expansion make Beckman's SM-800 Series an ideal unit for inclusion in low and medium volume display products. Character height is 0.55 inch (14,09) for all modules.

BECKMAN INSTRUMENTS, INC. INFORMATION DISPLAYS OPERATIONS 350 North Hayden Rd. P.O. Box 3579 Scottsdale, Arizona 85257 (602) 947-8371

BECKMAN

# Display Accessories




Beckman provides a full line of related accessories, providing the design engineer with convenience of application and ease of implementation. These accessories include:

**VC-525-01 Voltage Converters**

For the display user who prefers to buy rather than build a power supply, Beckman offers economically priced dc/dc voltage converters designed specifically to operate with the Beckman Displays. These reliable voltage converters are of compact modular construction that provides an adjustable output: 170 to 210 Volts dc. 180 Volts is recommended for most dc and multiplexed applications. Unit operates from 5 Volt dc TTL/DTL logic supply.

**Subassemblies**

Beckman SP-300 Series Information Displays are available mounted on circuit boards. These circuit boards can be supplied in Custom configurations.

Subassemblies are available with either a lead frame or with the edge board connector. Both of these standard packages allow the user to mount the displays conveniently to a panel cutout and connect them directly into the electronic circuitry by means of standard off-the-shelf connectors. The lead frame configuration can also be connnected to the electronic circuitry by flow soldering.

**Special Configurations**

Beckman has the capability to design and produce displays for unique applications. Alpha readouts such as OHMS, VOLTS, AMPS, MPH, GPM and others can be combined with NUMERIC digits for special displays. You are invited to discuss your custom requirements with the local Beckman sales office.

**CS-300 Connectors**

Designed for use with the SP-300 Series. Units help simplify assembly; they may be attached with screws or soldered directly to a circuit board.

**DD-700 Decoder/Driver with Current Regulated Outputs**

This monolithic integrated circuit accepts TTL/DTL 8-4-2-1 binary coded decimal (BCD) information to direct drive the seven segment Beckman Display. A blanking input feature on the DD-700 provides unconditional blanking of all outputs while a ripple blanking feature allows suppression of unwanted leading and trailing zeros. The DD-700 has seven regulated, current programmable outputs capable of between 0.18 to 1.5 mA each. Regulation ensures constant brightness display operation under a changing supply voltage situation.

**Pin Straighteners**

Inexpensive pin straighteners are available for each display series. They are useful in realigning pins misaligned through handling, assuring ease of assembly.

**Drafting Aids**

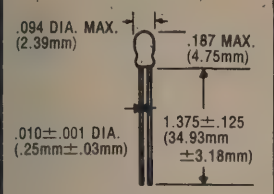
Pin location drafting guides, Drafting Aids, are available for each display model. These handy mylar, transparent overlays provide the designer with a 4X enlargement, template like drafting guide for pin and circuit layout drawings.

Prices and specifications subject to change without notice.

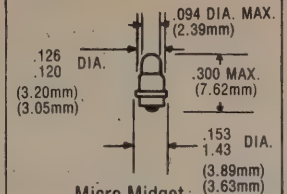
BECKMAN INSTRUMENTS, INC. INFORMATION DISPLAYS OPERATIONS
350 North Hayden Rd. P.O. Box 3579
Scottsdale, Arizona 85257 (602) 947-8371

CHICAGO MINIATURE LAMP WORKS
GENERAL INSTRUMENT CORPORATION

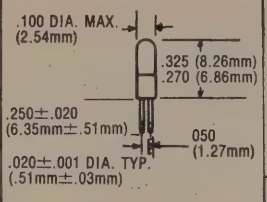
# SUBMINIATURE INCANDESCENT LAMPS




Wire Terminal




Micro Midget Flanged Base



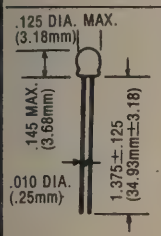

Bi-Pin Base

## T—3/4 Subminiature Incandescent Lamps

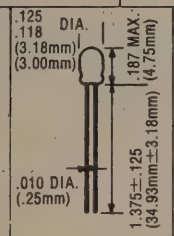
All Chicago Miniature T-3/4 Lamps are aged prior to selection for current (±10%) unless otherwise stated, and candlepower (MSCP). To specify a specific MSCP tolerance add AS (aged and selected) and ±25% or ±15%, whichever is applicable. (Example: CM7153AS15%). Other selection tolerances are available on request.

**APPLICABLE MILITARY LAMP DRAWINGS**
MS 90452(AS) (6803AS15, 6833AS15, 7133AS15, 7153AS15)

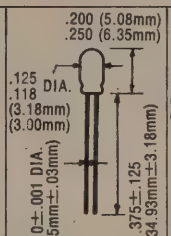
| Wire Terminal | Micro Midget Flanged Base | Bi-Pin Base | DESIGN Volts | DESIGN Amps (±10%) | M.S.C.P. (Approx.) | Life (Hours) | Filament Shape |
|---|---|---|---|---|---|---|---|
| CM-6833 | CM-8913 | CM-7114 | 5.0 | .060 | .05 | 100,000 | C-2R |
| CM-7153 | CM-8270 | CM-7118 | 5.0 | .115 | .15 | 40,000 | C-2R |



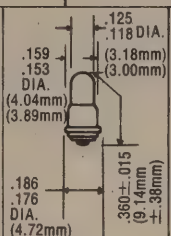

Short Wire Terminal .145 MAX.



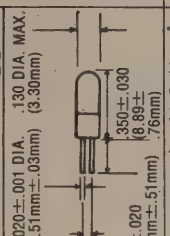

Intermediate Wire Terminal .187 MAX.




Standard Wire Terminal .250 MAX.




Sub-Midget Flanged Base



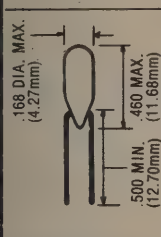

Bi-Pin Base

## T—1 Subminiature Incandescent Lamps

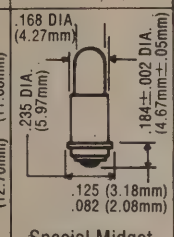
All Chicago Miniature T-1 Lamps are aged prior to selection for current (±10%) unless otherwise stated, and candlepower (MSCP). To specify a specific MSCP tolerance add AS (aged and selected) and ±25% or ±15%, whichever is applicable. (Example: CM715AS15%).

**APPLICABLE MILITARY LAMP DRAWINGS**
MS 3338 (6839AS25)
MS 24367 (680, 683, 713, 715)
MS 24515 (682, 685, 714, 718)
MS 90451(AS) (6802AS15, 6832AS15, 7132AS15, 7152AS15)

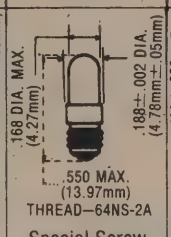
| Short Wire Terminal .145 MAX. | Intermediate Wire Terminal .187 MAX. | Standard Wire Terminal .250 MAX. | Sub-Midget Flanged Base | Bi-Pin Base | DESIGN Volts | DESIGN Amps (±10%) | M.S.C.P. (Approx.) | Life (Hours) | Filament Shape |
|---|---|---|---|---|---|---|---|---|---|
| CM-6832 | CM-6831 | CM-683 | CM-685 | CM-7683 | 5.0 | .060 | .05 | 100,000 | C-2R |
| CM-7152 | CM-7151 | CM-715 | CM-718 | CM-7715 | 5.0 | .115 | .15 | 40,000 | C-2R |
| ..... | ..... | CM-6838 | CM-6839 | CM-7839 | 28.0 | .024 | .15 | 16,000 | CC-2F |



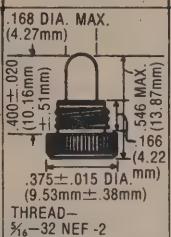

Wire Terminal



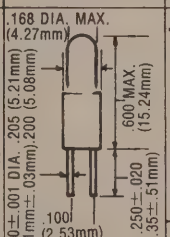

Special Midget Flanged Base




Special Screw Base




Knurled Screw Base



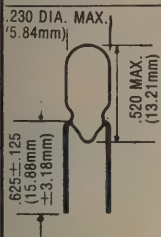

Bi-Pin Base

## T—1-1/4 Subminiature Incandescent Lamps

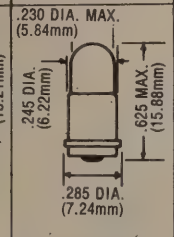
All Chicago Miniature T-1-3/4 Lamps are inspected for current and light up. To specify a specific tolerance add AS (aged and selected) and ±25% or ±15%, whichever is applicable. (Example: CM2114AS25%). Other selection tolerances are available on request.

**APPLICABLE MILITARY LAMP DRAWINGS**
MS 25236 (323AS25, 8623AS25, 8639AS25)
MS 28135 (8627AS25)
MS 51608 (325, 329, 673, 8635, 8641, 8644, 8662)

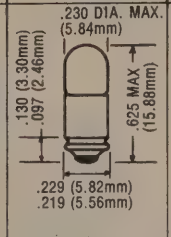
| Wire Terminal | Special Midget Flanged Base | Special Screw Base | Knurled Screw Base | Bi-Pin Base | DESIGN Volts | DESIGN Amps | M.S.C.P. (Approx.) | Life (Hours) | Filament Shape |
|---|---|---|---|---|---|---|---|---|---|
| CM-324 | CM-8637 | CM-325 | CM-323 | CM-7637 | 3.0 | .19 | .25 | 350 | C-2R |
| CM-8627 | CM-8632 | CM-8635 | CM-8623 | CM-7632 | 28.0 | .04 | .32 | 1,000 | C-2F |



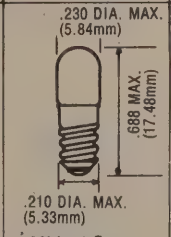

Wire Terminal



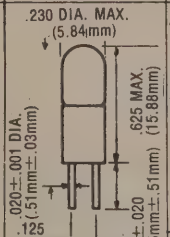

Midget Flanged Base




Midget Grooved Base




Midget Screw Base



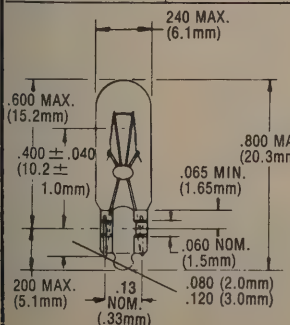

Bi-Pin Base

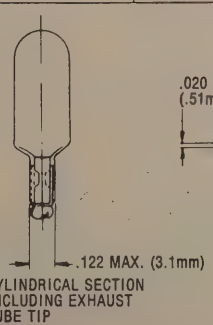
## T—1-3/4 Subminiature Incandescent Lamps

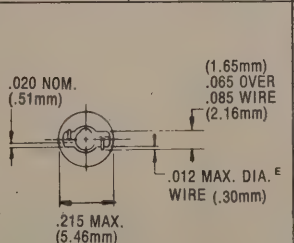
All Chicago Miniature T-1-3/4 Lamps are inspected for current and light up. To specify a specific MSCP tolerance add AS (aged and selected) and ±25% or ±15%, whichever is applicable. (Example: CM380AS25%). Other selection tolerances are available on request.

**APPLICABLE MILITARY LAMP DRAWINGS**
MS 15612 (335, 342, 1767, 1768, 1769)
MS 18209 (387AS25)
MS 25237 (327, 328, 330, 338, 368)
*Lamp to pass through .236" cylinder .625" long dia.

| Wire Terminal | Midget Flanged Base | Midget Grooved Base | Midget Screw Base | Bi-Pin Base | DESIGN Volts | DESIGN Amps | M.S.C.P. (Approx.) | Life (Hours) | Filament Shape |
|---|---|---|---|---|---|---|---|---|---|
| CM-1784 | CM-328 | CM-337 | CM-1768 | CM-7328 | 6.0 | .20 | .60 | 1,000 | C-2R |
| CM-2181 | CM-381 | CM-379 | CM-378 | CM-7381 | 6.3 | .20 | .40 | 50,000 | C-2R |
| CM-2182 | CM-382 | CM-386 | CM-8362 | CM-7382 | 14.0 | .08 | .30 | 50,000 | C-2F |
| CM-2187 | CM-387 | CM-388 | CM-399 | CM-7387 | 28.0 | .04 | .30 | 25,000 | C-2F |
| CM-1764 | CM-327 | CM-334 | CM-335 | CM-7327 | 28.0 | .04 | .34 | 7,000 | C-2F |



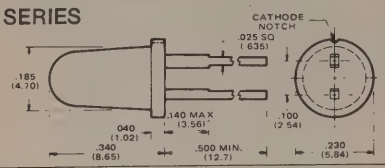
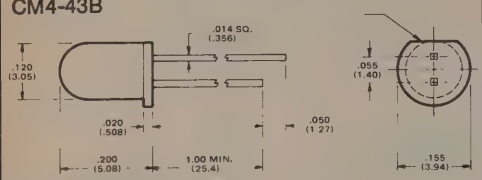
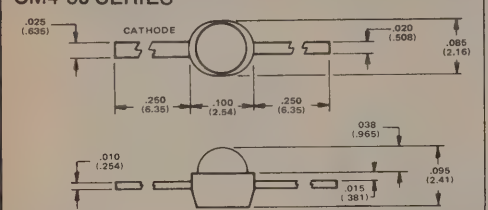
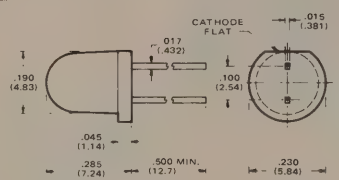
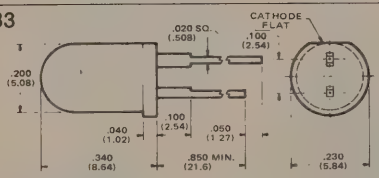
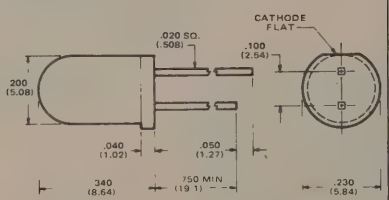

## T—1-3/4 (6mm) Subminiature Wedge Base Lamps

Chicago Miniature wedge base lamps are particularly suited for cost-sensitive applications. They can be designed for low-cost sockets. The fact that there is no metal base to these lamps also means lamps will not freeze in the sockets, corrosion is virtually eliminated.

| Lamp No. | Design Volts | Design Amps | M.S.C.P. | Life (Hours) | Filament Shape |
|---|---|---|---|---|---|
| CM-37 | 14.0 | .09 | .50 | 1,500 | C-2F |
| CM-73 | 14.0 | .08 | .30 | 15,000 | C-2F |
| CM-84 | 6.3 | .04 | .03 | 10,000 | C-2R |
| CM-85 | 28.0 | .04 | .30 | 7,000 | C-2F |
| CM-86 | 6.3 | .20 | .40 | 20,000 | C-2F |

# SOLID STATE LAMPS

CHICAGO MINIATURE LAMP WORKS
GENERAL INSTRUMENT CORPORATION

| SERIES | DEVICE NO. | LENS SHAPE | LENS TINT | LENS DIFFUSION | LIGHT COLOR | LUMINOUS INTENSITY, TYPICAL, @ IF = 20 mA, mcd | VIEWING ANGLE, TYPICAL |
|---|---|---|---|---|---|---|---|
| CM4-20 SERIES   | CM4-20 | Tapered | Clear | Transparent | Red | 2.0 | 90° |
| | CM4-21 | Tapered | Clear | Diffused | Red | 1.6 | 90° |
| | CM4-22 | Tapered | Red | Transparent | Red | 1.6 | 90° |
| | CM4-23 | Tapered | Red | Diffused | Red | .4 | 180° |
| | CM4-24 | Tapered | Red | Diffused | Red | 3.0 | 60° |
| | CM4-25 | Tapered | Red | Diffused | Red | 1.6 | 90° |
| CM4-43B   | CM4-43B | Cylindrical | Red | Diffused | Red | 1.0 | 90° |
| | CM4-244B | Cylindrical | Red | Diffused | Red | 5.0 | 90° |
| | CM4-344B | Cylindrical | Green | Diffused | Green | 1.0 | 90° |
| | CM4-444B | Cylindrical | Orange | Diffused | Orange | 5.0 | 90° |
| | CM4-544B | Cylindrical | Yellow | Diffused | Yellow | 4.0 | 90° |
| CM4-50 SERIES   | CM4-50 | (Axial Lead) | Clear | Transparent | Red | 1.4 | 90° |
| | CM4-53 | (Axial Lead) | Red | Diffused | Red | 1.0 | 80° |
| CM4-73A   | CM4-73A | Cylindrical | Red | Diffused | Red | 2.0 | 70° |
| CM4-83   | CM4-83 | Cylindrical | Red | Diffused | Red | 2.0+ | 24° |
| | CM4-83-2 | Cylindrical | Red | Diffused | Red | 3.0+ | 24° |
| | CM4-83-3 | Cylindrical | Red | Diffused | Red | 4.0+ | 24° |
| | | | | | | + @ IF = 10 mA | |
| CM4-80B SERIES AND CM4-X80B SERIES   | CM4-80B | Cylindrical | Clear | Transparent | Red | 2.0 | 50° |
| | CM4-81B | Cylindrical | Clear | Diffused | Red | 1.6 | 72° |
| | CM4-82B | Cylindrical | Red | Transparent | Red | 2.0 | 50° |
| | CM4-84B | Cylindrical | Red | Diffused | Red | 1.6 | 80° |
| | CM4-85B | Cylindrical | Red | Diffused | Red | .8 | 110° |
| | CM4-86B | Cylindrical | Red | Diffused | Red | .6 | 150° |
| | CM4-282B | Cylindrical | Red | Transparent | Red | 40.0 | 28° |
| | CM4-283B | Cylindrical | Red | Diffused | Red | 8.0 | 24° |
| | CM4-284B | Cylindrical | Red | Diffused | Red | 4.0 | 65° |
| | CM4-382B | Cylindrical | Green | Transparent | Green | 15.0 | 28° |
| | CM4-383B | Cylindrical | Green | Diffused | Green | 3.0 | 24° |
| | CM4-384B | Cylindrical | Green | Diffused | Green | 1.5 | 65° |
| | CM4-482B | Cylindrical | Orange | Transparent | Orange | 40.0 | 28° |
| | CM4-483B | Cylindrical | Orange | Diffused | Orange | 8.0 | 24° |
| | CM4-484B | Cylindrical | Orange | Diffused | Orange | 4.0 | 65° |
| | CM4-582B | Cylindrical | Yellow | Transparent | Yellow | 45.0 | 28° |
| | CM4-583B | Cylindrical | Yellow | Diffused | Yellow | 10.0 | 24° |
| | CM4-584B | Cylindrical | Yellow | Diffused | Yellow | 6.0 | 65° |

DIMENSIONS IN INCHES (MM)

## TO ORDER, SEE YOUR CHICAGO MINIATURE LAMP DISTRIBUTOR OR SALES REPRESENTATIVE

or contact us at 4433 N. Ravenswood Ave., Chicago, Il. 60640, Phone: (312) 784-1020. TWX 910-221-5445.

**CHICAGO MINIATURE LAMP WORKS**
**GENERAL INSTRUMENT CORPORATION**

# LED INDICATOR LIGHTS

## LED ASTROLITES

With Wire Leads
6039-004-304

With Wire Termin:
6039-005-304

Chicago Miniature/Drake's high brightness LED lamps may be operated directly from low-level logic circuitry which makes them ideal for computer, numerical control, medical instruments and other sophisticated applications. Available in green, red and amber. Long life expectancy (years). Bright light can be seen from across average room. Overall size—17/64" dia.; 6" leads; other lead lengths on special order.

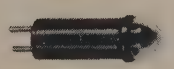
Mtg. hole dia. — .193"; max. panel thk. 3/16"; centers 11/32"; LED COLORS: green, red and yellow.

ELECTRICAL (25°C): Forward voltage: 2.1 VDC — Red. 2.6 VDC — Green & Yellow. Reverse voltage: 4.0 DC max. Forward current: (If) 15mA — Red. 40mA — Green & Amber. Power dissipation: 225 mw. max. Luminous intensity: Red @ 15mA=2.4 MCD. Green & Amber @ 40mA=4.5 MCD.

| CM/Drake No. | Lens Dia. | Bezel Dia. | Projection | |
|---|---|---|---|---|
| | | | Front | Rear |
| 6039-005-304 | 13/64" | 17/64" | 17/64" | 13/32" |
| 6039-004-304 | 13/64" | 17/64" | 17/64" | 13/32" |

## LED CARTRIDGE CM44 SERIES

CM44-11 style



CM44-21 style

Now available, two transparent cap-styled LED cartridges, interchangeable with MIL-L-3661 cartridges operating on DC. Internal fresnel ring pattern on round or short cylindrical caps provide optimum 180° visibility for these high brightness long life LEDs. Solid state reliability and IC compatibility are advanced operating features. Built-in resistor; polarized stainless steel pins — anode is marked "A"; cathode pin is "B". LED colors: red (GaAsP type), amber and green (GaP type). Blk. anodized alum. housing; nylon insulator same size as incandescent cartridges. Standard voltages range from 1.6V to 28V; other voltages available upon request.

| CM/Drake No. | DC Operating Characteristics | | | LED & LENS COLORS |
|---|---|---|---|---|
| | Rated Volts | Current mA | Operating Volts DC | |
| CM44-11-0021 | 5 | 20 | 2.5 — 7 | Red |
| CM44-11-0123 | 5 | 20 | 2.5 — 7 | Amber |
| CM44-21-0212 | 5 | 20 | 2.5 — 7 | Green |
| CM44-21-0101 | 28 | 20 | 10 — 30 | Red |

### "ULTRALITE"—.40" ROUND INDICATOR

**FEATURES**
- Unequaled brightness and spot size—up to 13 mcd with .40 in. diameter spot.
- Wide effective field of indication—up to 140°.
- Solid State—low power, long life, shock resistant, reliable.
- Push-in mounting.
- Current limiting resistors included.
- Available in red, amber and green.
- Choice of 6-inch leads or solder/faston terminals.
- Appealing chrome bezel.

**TYPICAL APPLICATIONS**
- Front panel indicator.
- Low power circuits.
- High shock and vibration environments.
- Extremely long life indication.

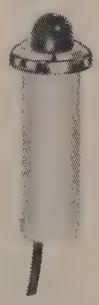
**OPTIONS**
- Other voltages and currents available.
- A.C. versions available.
- Legends hot stamped on face of lens.
- Clear lens.
- Speed nuts for added mounting security.

**MECHANICAL**
**Mounting:** Mounts in ½" dia. hole. Panel thickness 1" max. Mounting centers 5/8" min.
**Polarity:** White lead indicates cathode; (+) on base indicates anode.
**Materials:** Body Material: Nylon; Leads: 22 GA. topcoated.

**Same Voltage and Current and part number as on Data Sheet 7703 but the "4" changes to "3." Example:**
**Wire Term. Red**
**Ultralite .40 = 6340-302-505R**
**Ultralite .30 = 6330-302-505R**

### "ULTRALITES"—.20" ROUND INDICATORS

**FEATURES**
- Solid State—low power, long life, shock resistant, reliable.
- Push-in mounting.
- Current limiting resistors included.
- Available in standard red and hi-efficiency red, yellow, and green.
- Standard with 6-inch insulated leads.
- Appealing chrome bezel.
- Wide effective field of indication—up to 160°



**TYPICAL APPLICATIONS**
- Front panel indicator.
- Low power circuits.
- High shock and vibration environments.
- Extremely long life indication.

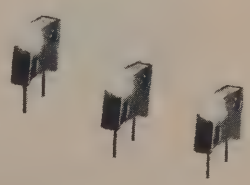
**OPTIONS**
- Other voltage and currents available.
- Other lead lengths available.
- Speed nuts for added mounting security.

**MECHANICAL**
**Mounting:** Mounts in .277" hole. Panel thickness ¾" max. Mounting centers 3/8" min.
**Polarity:** White lead indicates cathode.
**Materials:** Body Material Nylon; Leads tinned, 24 GA., stranded.

### STATUS/FAULT INDICATOR

**FEATURES**
- Solid State—low power, long life, shock resistant, reliable.
- Wide effective field of indication.
- Readily visible from **above** as well as **forward.**
- Current limiting resistor included.
- Pin Spacing—.300 inch—compatible with standard DIP pin spacing.
- Compatible with solid state driving circuits, DTL and TTL.

**TYPICAL APPLICATIONS**
- PC board status indication.
- Back panel status indication.
- Circuit fault indicator.
- DIP switch status indicator.



**OPTIONS**
- Other voltages and currents available.

**MECHANICAL**
**Leads:** Tinned copper base alloy.
**Body:** Polycarbonate.
**Mounting Centers:** .100"

**TO ORDER, SEE YOUR CHICAGO MINIATURE LAMP DISTRIBUTOR OR SALES REPRESENTATIVE**

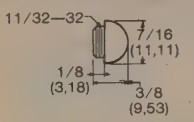
**or contact us at 4433 N. Ravenswood Ave., Chicago, Il. 60640, Phone: (312) 784-1020. TWX 910-221-5445.**

# INDICATOR LIGHTS

CHICAGO MINIATURE LAMP WORKS
GENERAL INSTRUMENT CORPORATION

## 121A—SERIES LENS CAPS FOR 5120-SERIES TINYLITE INDICATORS

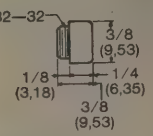
**TRANSLUCENT DOME LENSES**




| | |
|---|---|
| 121A-204 | Red |
| 121A-204 | Yellow |
| 121A-204 | White |
| 121A-207 | Green |

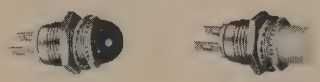
Red, Yellow and White Lenses Are Nylon.
Green Lenses Are Polycarbonate.

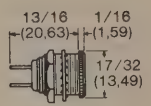
**TRANSLUCENT CYLINDRICAL LENSES**




| | |
|---|---|
| 121A-604 | Red |
| 121A-604 | Yellow |
| 121A-604 | White |
| 121A-607 | Green |

## 5120—SERIES TINYLITES






TINYLITES Are Supplied with Choice of Three Low Voltage Incandescent Lamps Installed, 7 Volts, 14 Volts or 28 Volts. Applications Include Alarm Systems, Medical Equipment, Control and Instrument Panels.

Housing: Nickel Plated Brass
Hardware: Zinc Plated Steel
Insulation: Glass Filled Nylon
Current-carrying Parts Are All Nonferrous Metals
Terminals: Solder Dipped Brass
Mounting Hole: 7/16" Dia.; Max Panel Thickness: 1/4"

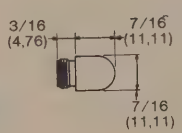
**HOW TO ORDER**

**51xx — 022 — xxx (Specify Color)**
- 26 for 7.0V, .065 Amp Lamp
- 27 for 14.0V, .065 Amp Lamp
- 28 for 28.0V .040 Amp Lamp

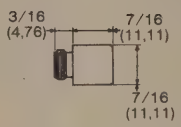
Use Last Three Digits from 121A Series Lens Caps

Example: 5127-022-607 Green is a Tinylite with a 14.0 Volt Lamp installed and having a Green Cylindrical Lens Cap.
To order body only (including Lamp) omit last three digits.

## 131A—SERIES LENS CAPS FOR 5131-038 MIDGET FLANGE INDICATORS




| Part No. | QPL Recog. as |
|---|---|
| **131A-304** Red | **LC12RT2** |
| **131A-304** Green | **LC12GT2** |
| **131A-304** Yellow | **LC12YT2** |

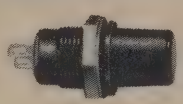


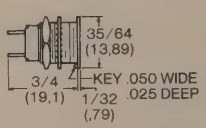

| Part No. | QPL Recog. as |
|---|---|
| **131A-604** Red | **LC29RT2** |
| **131A-604** Green | **LC29GT2** |
| **131A-604** Yellow | **LC29YT2** |

Built to conform to MIL-L-3661B
Lens: Butyrate
Lens Shank: Nickel Plated Brass

## 5131-038 MIDGET FLANGE INDICATOR

**QPL RECOGNIZED AS LH73/1**






**Accepts T-1¾ Midget Flange Lamps**

These Indicators Are for Military and Commercial Applications.
Built to Conform to MIL-L-3661B

Housing: Black Anodized Aluminum
Hardware: Cadmium Plus Cronak Over Steel
Insulation: Fiberglass Base Thermoplastic Liner
Current-carrying Parts: Nonferrous Metal Except Center Contact Spring Which Is Stainless Steel
Mounting Hole: 15/32"
Max. Panel Thickness: 9/32"

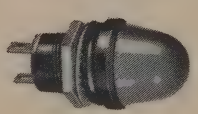
**HOW TO ORDER**

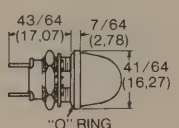
**5131-038-xxx (Specify Color)**
Last Three Digits from 131A-Series Lens Caps

Example: "5131-038-304 Yellow" is a midget flange indicator with a 131A-304 yellow dome style lens cap installed.
Body only 5131-038 less lens

## 5139-038 MILITARY WATERPROOF MIDGET FLANGE INDICATOR

**QPL RECOGNIZED AS LH89/1 AND LC35 - T2**






**Accepts T-1¾ Midget Flange Lamp**

Built to Conform to MIIL-L-3661B, These Indicators Have Neoprene "O" Rings for Waterproofing on Both Lens and Body.
Housing: Black Anodized Aluminum
Hardware: Cadmium Plus Cronak Over Steel
Insulation: Fiberglass Base, Thermoplastic Liner
Current-carrying Parts: Nonferrous Metal Except Center Contact Spring Which Is Stainless Steel
Lens: Butyrate
Lens Shank: Nickel Plated Brass
Mounting Hole: 15/32"
Max. Panel Thickness: 3/16"

**HOW TO ORDER**

| Body and Lens | Lens Only | Mil. No. of Lens |
|---|---|---|
| **5139-038-404** Red | **139A-404** Red | **LC35RT2** |
| **5139-038-404** Green | **139A-404** Green | **LC35GT2** |
| **5139-038-404** Yellow | **139A-404** Yellow | **LC35YT2** |

Body Only: 5139-038 Less Lens
MIL No. of Body Only LH89/1

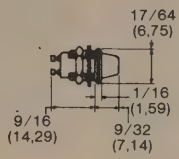
## TO ORDER, SEE YOUR CHICAGO MINIATURE LAMP DISTRIBUTOR OR SALES REPRESENTATIVE

**or contact us at 4433 N. Ravenswood Ave., Chicago, Il. 60640, Phone: (312) 784-1020. TWX 910-221-5445.**

CHICAGO MINIATURE LAMP WORKS
GENERAL INSTRUMENT CORPORATION

# INDICATOR LIGHTS

## 5160—SERIES GEMLITES




**Accepts T-1 Submidget Flange Lamp**

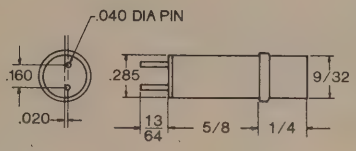
GEMLITES Are a High Quality, Reliable Indicator Used in Military and Commercial Applications Where Size and Ease of Lamp Replacement Are Prime Considerations.

Available in Red, Green, Amber and White
Housing: Black Nickel Plated Brass
Hex Nut: Brass
Lockwasher: Bronze
Terminations: Brass Turret Lugs Gold Plated Center Contact. Silver Plated Shell Contact
Lens: Translucent Butyrate, Red, Green, Amber and White
Mounting Hole: 5/16" diameter
Max. Panel Thickness: 7/32"

**HOW TO ORDER**

Part Number: 5160-458-604 (Specify Color)
Body Only Number: 5160-458
Lens Only Number: 160A-604 (Specify Color)

## CARTRIDGE INDICATOR LAMPS



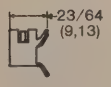

- Long life
- Built to meet MIL-L-3661
- High temperature polycarbonate lenses
- Three voltages: 6.3V; 14.0V; 28.0V
- Three colors: red, green and amber
- Hi Rel Look—Used on military and commercial instruments and in panels.

Housing: Clear Anodized Aluminum
Pins: Stainless Steel
Insulator: Nylon, Glass Filled
Lens: Translucent Polycarbonate

| Volts | Amps | MSCP (Approx.) | Life | Color | Part Number |
|---|---|---|---|---|---|
| 6.3V | .040 | .02 | 50,000 HR | Red | CML640271 |
| 6.3V | .040 | .02 | 50,000 HR | Green | CML640272 |
| 6.3V | .040 | .02 | 50,000 HR | Amber | CML640273 |
| 14.0V | .080 | .3 | 50,000 HR | Red | CML640281 |
| 14.0V | .080 | .3 | 50,000 HR | Green | CML640282 |
| 14.0V | .080 | .3 | 50,000 HR | Amber | CML640283 |
| 28.0V | .040 | .2 | 50,000 HR | Red | CML640401 |
| 28.0V | .040 | .2 | 50,000 HR | Green | CML640402 |
| 28.0V | .040 | .2 | 50,000 HR | Amber | CML640403 |

## CARTRIDGE HARDWARE

**CML 10204-1 CARTRIDGE HOLDER**
FOR CML SERIES CARTRIDGE LAMPS
Body, Facing Nut and Collar: Black Anodized Aluminum
Lockwasher and Hex Nut: Cadmium Plated Steel
Solder Lugs: Cadmium Plated Spring Brass
Insulation: Phenolic
Mounting Hole: 3/8" dia.
Max. Panel Thickness: 7/32"




**CM 21-3 CONNECTOR**
Low Cost Connector Mates with Cartridge Lamps.
Body: Phenolic
Solder Lugs: Cadmium Plated Spring Brass

**CML 10380 MOUNTING CLIP**
Low Cost Clip for Mounting Cartridge Lamps Directly into Panels. Squeez Tabs and Push Over Back of Cartridge.
Material: Spring Tempered Steel Black Rust Preventative Finish.

## 5201—SERIES DELUXE INDICATOR

**Accepts T-3¼" Miniature Bayonet Lamp.**

DELUXE INDICATOR: Chrome Bezel for Quality Appearance. U.L. and CSA Listed.
Use with 25 P-Series Lenses.
Mounting Bushing: Chrome Plated Brass
Housing: Molded Phenolic

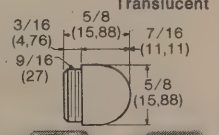
## 5100—SERIES STANDARD INDICATOR

**Accepts T-3¼ Miniature Bayonet Lamp**

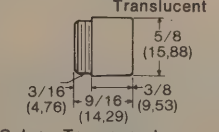
STANDARD INDICATOR: Attractive Nickel Plated Bezel. U.L. and CSA Listed.
Use with 25 P-Series Lenses.
Housing: Glass Filled Polyester
Bezel: Nickel Plated Steel
Terminals: Brass

## 25P LENSES FOR 5201 & 5100 SERIES

25P-326 Transparent
25P-306 Transparent
25P-307 Translucent

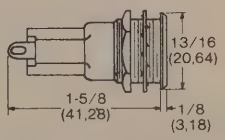


25P-626 Transparent
25P-606 Transparent
25P-607 Translucent




Colors: Transparent, Amber, or Clear.
Translucent is Red, Green, Yellow, or White.
Specify Color.

Terminals: Brass
Hardware: Zinc Plated Steel
Mounting Hole: 11/16"
Max. Panel Thickness: 13/32"

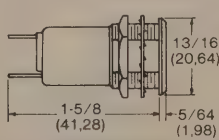



**HOW TO ORDER**

5201 — xxx — xxx (Specify Color)
222 for Incandescent Lamps
*232 for B2A Neon Lamp
*242 for B1A Neon Lamp
Use Last Three Digits from 25P-Series Lens Caps
*For 125V Operation

Example: "5201-232-326 Amber" is part number for Deluxe Indicator requiring B2A Lamp and with Amber Fluted Dome Lens.
Units requiring B2A Lamps have built-in 22K ohm resistor.
Units requiring B1A Lamps have built-in 100K ohm resistor.
When ordering body only, omit last three digits.

Hardware: Zinc Plated Steel
Mounting Hole: 11/16"
Max. Panel Thickness: 13/32"




**HOW TO ORDER**

5100 — xxx — xxx (Specify Color Here)
822 for Incandescent Lamps
*832 for B2A Neon Lamps
*842 for B1A Neon Lamps
Use Last Three Digits from 25P Series Lens Caps
*For 125V Operation

Example: 5100-822-607 red is part number for standard indicator requiring an incandescent lamp and having a 25P-607 Red Lens.
Units requiring B2A Lamps have built-in 22K ohm resistors.
Units requiring B1A Lamps have built-in 100K ohm resistors.
When ordering body only, omit last three digits.

# INDICATOR LIGHTS

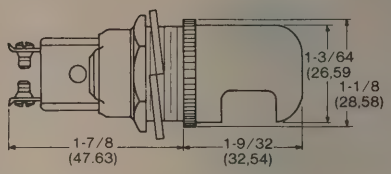
CHICAGO MINIATURE LAMP WORKS
GENERAL INSTRUMENT CORPORATION

## 900—SERIES INSTRUMENT LITES

**THE 900-SERIES INSTRUMENT LITES PROVIDE LOCALIZED LIGHT FOR ILLUMINATION OF PANELS, SWITCHES, METERS AND LEGEND PLATES**

### 900-006

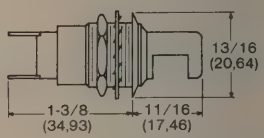
Hood and Face Nut: Chrome Plated Brass
Mounting Bushing: Nickel Plated Brass
Hardware: Cadmium and Cronak Plated Steel
Contacts, Terminals and Screws: Nonferrous Metal
Mounting Hole: 1″
Max. Panel Thickness: ½″
Max. Electrical Ratings: 250V, 1A, 75W
Insulation: Phenolic




**Accepts Both S-6 and C-7 Candelabra Screw Base Lamps**

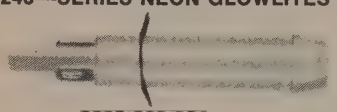
### 900-200

Screw-in Hood
Hood: Aluminum Black Outside, Clear Anodized Inside
Mounting Bushing: Black Anodized Aluminum
Current-carrying Parts: Nonferrous Metals
Hardware: Cadmium and Cronak Plated Over Steel
Insulation: Phenolic, Volcoid and Nylon
Mounting Hole: 11/16″
Max. Panel Thickness: 13/32″
Max. Electrical Ratings: 120V, 3W

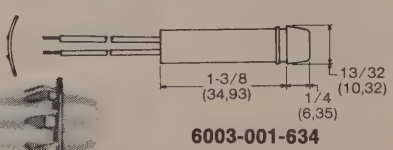



**Accepts T-3¼ Miniature Bayonet Lamps**

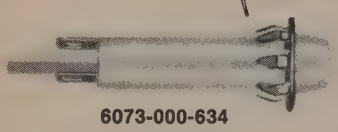
## 6063—SERIES, 6073—SERIES AND 6243—SERIES NEON GLOWLITES



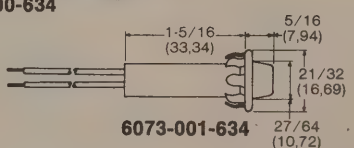
**6063-000-634**




**6003-001-634**



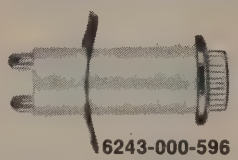
**6073-000-634**



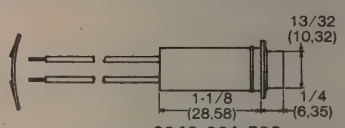

**6073-001-634**

U.L. and CSA Recognized. All GLOWLITES Have High Bright C2A Neon Lamps with Built-in 30K Resistor. Life Over 5000 Hours. Available with 10-inch Wire Leads or Quick Connect Terminals (accepts ¾ x .020 female terminal). Designed for 125V Operation
Insulation: Vulcoid
Quick Connect Terminals: Brass Solder Dipped
Wire Leads: Black #22 Bonded Wire with 105°C PVC Insulation .031 Thk.
Body and Lens: Nylon
Available in Red, Amber and White*
*6243-Series Available in Clear Instead of White

| Part No. | Mounting Hole Size | Max. Pnl. Thickness | Termination |
|---|---|---|---|
| **6063-000-634** (Specify Color) | ⅜″ | 1 5/16″ | Solder Lug |
| **6063-001-634** (Specify Color) | ⅜″ | 1 5/16″ | Wire Lead |
| **6073-000-634** (Specify Color) | ½″ | 5/64″ | Solder Lug |
| **6073-001-634** (Specify Color) | ½″ | 5/64″ | Wire Lead |
| **6243-000-596** (Specify Color) | ½″ | ¾″ | Solder Lug |
| **6243-001-596** (Specify Color) | ½″ | ¾″ | Wire Lead |

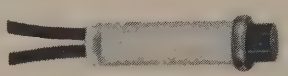


**6243-000-596**



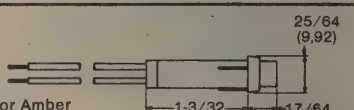

**6243-001-596**

## 6380—SERIES SLENDER GLOW INCANDESCENT INDICATORS



Available in 3 Voltages (6.3V, 14V, and 28V) and in Three Colors (Red, Green and Amber). 10-inch Black Leads, #22 GA. Bonded with .031″ of 105°C PC Insulation.

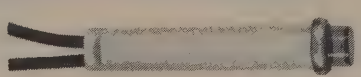
Housing: White Nylon
Bezel: Bright Stainless Steel
Lens: Translucent
Polycarbonate Red, Green or Amber
Mounting Hole: .312/.314″ Diameter




| Part Number | Voltage | Current | Life |
|---|---|---|---|
| **6386-001-607** (Specify Color) | 6.3V | .20A | 50,000 Hr. |
| **6387-001-607** (Specify Color) | 14.0V | .08A | 50,000 Hr. |
| **6388-001-607** (Specify Color) | 28.0V | .04A | 25,000 Hr. |

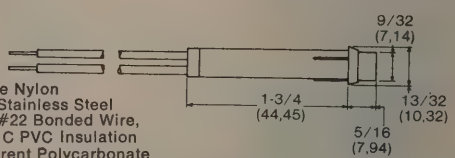
## 6483—SERIES SLENDER GLOW NEON INDICATORS

**6483-401-603** Red
**6483-401-603** Yellow
**6483-401-603** Clear



Units Are U.L. and CSA Recognized for 125V Operation. All Have High Bright C2A Neon Lamp with 33K-Series Resistor. 25,000 Hour Life. 10-inch Black Leads, #22 GA. Bonded with .031-inch 105°C PVC Insulation.

Housing: White Nylon
Bezel: Bright Stainless Steel
Leads: Black #22 Bonded Wire, .031″ of 105°C PVC Insulation
Lens: Transparent Polycarbonate
Mounting Hole: .312/.314″ Diameter



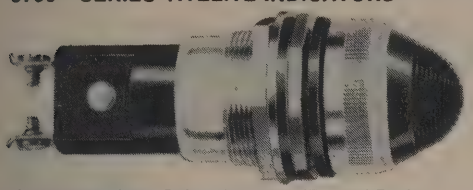

## TO ORDER, SEE YOUR CHICAGO MINIATURE LAMP DISTRIBUTOR OR SALES REPRESENTATIVE

**or contact us at 4433 N. Ravenswood Ave., Chicago, Il. 60640, Phone: (312) 784-1020. TWX 910-221-5445.**

CHICAGO MINIATURE LAMP WORKS
GENERAL INSTRUMENT CORPORATION

# INDICATORS & LAMPHOLDERS

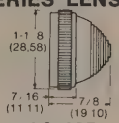
## 5796—SERIES TITELITE INDICATORS



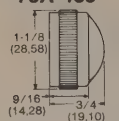
Transparent Lens Polycarbonate w/Frosted Back.
Lens Bezel Chrome Plated Brass.
**Accepts S-6 Screw or Double Contact Bayonet Lamps**

TITELITES Have Large 1" Diameter Lens for Distance and Off-Angle Visibility. Units Supplied with 2 Neoprene Gaskets to Seal Out Oil and Water. All Units Are U.L. and CSA Listed for Up to 75W Operation.

## 78A SERIES LENS CAPS

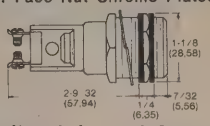



**78A-435**




**78A1-105**

Housing: Phenolic
Mounting Bushing: Nickel Plated Brass
Hardware: Cadmium and Cronak Plated Steel. Face Nut Chrome Plated Brass
Gaskets: Neoprene
Terminals: Brass with Brass Screws
Mounting Hole: 1"
Max. Panel Thickness: ⅜"




**HOW TO ORDER**

**5796 — xxx — xxx (Specify Color) — Red, Green, Yellow**

393 for Double Contact Bayonet Lamp
523 for Candelabra Screw Lamp

Use Last Three Digits from 78A-Series Lens Caps

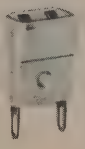
Example: 5796-393-435 Green is a Titelite that accepts S-6-type Double Contact Bayonet Lamps and has a 78A-435 Green Lens.

To order body only omit last three digits.

## LAMPHOLDERS

PHOTOS 3/4 ACTUAL SIZE

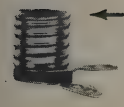
### 4772-001 LAMPHOLDER
For T-1-3/4 Wedge Base Lamps
Lugs: 2 Solder
Housing: Nylon
Spacing: 13/64"



### 4672-001 LAMPHOLDER
For T-3-1/4 Wedge Base Lamps
Lugs: 2 Solder
Housing: Nylon
Spacing: 3/8"

### 4060-014 LAMPHOLDER
For Miniature Screw Lamps
Lugs: 2 Solder
Shell: Brass
Mounting Bracket: Insulated from shell
Bracket: .033 Thick, 7/16" Wide.
1-7/32" Long after bend.
Slot 3/16" x 29/32"

### 4060-314 LAMPHOLDER
For Miniature Screw Lamps
Lugs: 2 Solder
Shell: Brass
Mounting Bracket: Insulated from shell
Bracket: .033" Thick. 7/16" Wide.
1-7/32" Long after bend.
Slot 3/16" x 29/32"



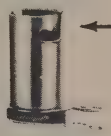
### 4070-054 LAMPHOLDER
For Miniature Screw Lamps
Lugs: 2 Solder
Shell: Brass

### 4099-017 LAMPHOLDER
For Miniature Bayonet Lamps
For Mounting in P.C. Boards
.062 Dia. Hole .400 Spacing

### 4151-014 LAMPHOLDER
For Miniature Bayonet Lamps
Mounting Bracket: Insulated from shell
Bracket: .033 Thick. 7/16" Wide.
1-7/32" Long after bend.
Slot 3/16" x 29/32".

### 4151-314 LAMPHOLDER
For Miniature Bayonet Lamps
Mounting Bracket: Insulated from shell
Bracket: .033" Thick., 7/16" Wide.
1-7/32" Long after bend.
Slot 3/16" x 29/32".

### 4157-314 LAMPHOLDER
For Miniature Bayonet Lamps
Leads: 10" Blk., #22 105° PVC
Mounting Bracket: Insulated from shell
Housing: Nylon over plated steel shell
Bracket: .033 Thick. 7/16" Wide.
1-7/32" Long after bend.
Slot 3/16" x 23/32"



### 4160-051 LAMPHOLDER
For Miniature Bayonet Lamps
Lugs: 2 Solder
Shell: Steel

### 4311-052 LAMPHOLDER
For Candelabra Screw Lamps
Lugs: 2 Solder
Shell: Brass

### 4327-312 LAMPHOLDER
For Candelabra Screw Lamps
Leads: 10 inch Blk., #18, 105°C PVC
Mounting Bracket: Insulated from shell
Bracket: .033" Thick, 5/8" Wide
1" Long after bend
Hole .170" Dia.
Slot.170" x .420"

### 4345-312 LAMPHOLDER
For Single Contact Bayonet Lamps
Leads: 10" Blk., #18, 60°V PVC
Bracket: .033" Thick, 5/8" Wide,
7/8" Long after bend.
Hole .170" Dia.
Slot .170" x .420"

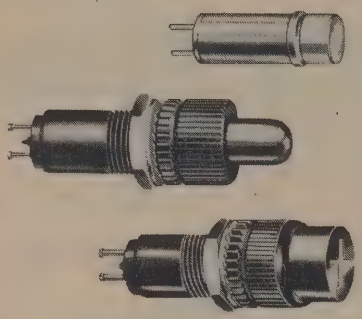
### 4365-312 LAMPHOLDER
For Double Contact Bayonet Lamps
Leads: 10" Blk., #18, 105°C PVC
Bracket: .033" Thick, 5/8" Wide
7/8" Long after bend
Hole .170" Dia.
Slot .170" x .420"

**TO ORDER, SEE YOUR CHICAGO MINIATURE LAMP DISTRIBUTOR OR SALES REPRESENTATIVE**

**or contact us at 4433 N. Ravenswood Ave., Chicago, Il. 60640, Phone: (312) 784-1020. TWX 910-221-5445.**

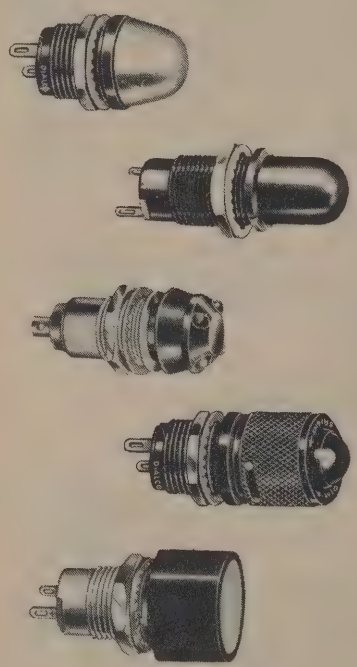
# 1,500,000 VISUAL INDICATORS

## INDICATOR LIGHTS, ILLUMINATED SWITCHES, READOUT DISPLAYS



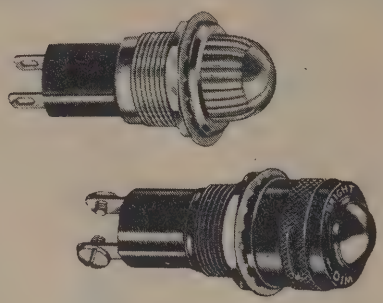
### ULTRA-MINIATURE INDICATORS

Meet requirements of MIL-L-3661B. Incandescent, neon and LED. Mount in 3/8" clearance hole.
**Ask for Catalog UM1200.**



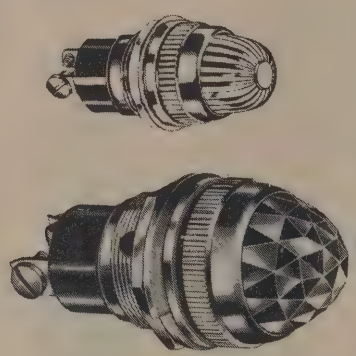
### SUB-MINIATURE INDICATORS

Incandescent and neon. Mount in 13/32" to 17/32" clearance holes. Meet or exceed environmental requirements of MIL-L-6723 and MIL-L-3661B.
**Ask for Catalogs L-157, L-158, L-178.**



### MINIATURE AND LARGE INDICATORS

Incandescent and neon. Miniature units mount in 9/16" or 11/16" clearance holes, large units in 1" or 1 3/16" hole. Wide choice of cap shapes and colors, also caps with mechanical dimming feature.
**Ask for Catalog L-161.**



### OIL-TIGHT INDICATORS

Incandescent and neon. Mount in 11/16", 1" or 1 3/16" clearance holes. For heavy duty.
**Ask for Catalog L-200.**

### LIGHTED SWITCHES AND MATCHING INDICATORS

Low-profile snap-in switches and standard mounting switches. Momentary non-snap, snap or alternate switch actions. Ratings up to 5 A. Cap sizes include 1/2" 5/8" and 3/4" round or square; 3/4" x 1" rectangle.
**Ask for Catalog L-210.**

### SINGLE-PLANE READOUTS

Incandescent and neon — 5 to 170 volts. 3/4" or 1" characters. Display 10 numbers and 10 letters. Compatible caption models.

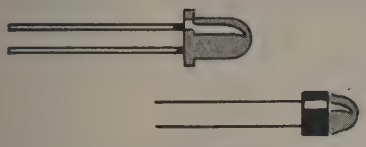
Send for FREE Indicator Light Product Selector Guide Catalog SG730.

**DIALIGHT**
A NORTH AMERICAN PHILIPS COMPANY

203 HARRISON PLACE, BROOKLYN, N.Y. 11237 • AREA CODE (212) 497-7600

# TO CHOOSE FROM DIALCO®

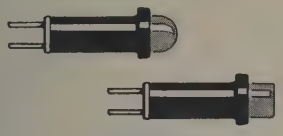
## . . . AND INDUSTRY'S BROADEST LINE OF LED DISPLAY DEVICES



**DIODE-LITE™ LIGHT SOURCES**

**RED • GREEN • YELLOW**

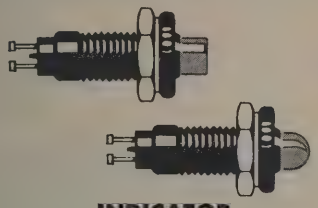
Diffusing particles in plastic encapsulant provide large, soft light source for panel light, status indicator and A/N display applications.



**INDICATOR LIGHT CARTRIDGES**

**RED • GREEN • YELLOW**

IC-compatible ultra-miniature cartridges with DIODE-LITE light source are interchangeable with incandescent types using DC power source.



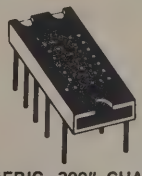
**INDICATOR LIGHT ASSEMBLIES**

**RED • GREEN • YELLOW**

Cartridge with DIODE-LITE in housing with mounting hardware ready for installation. Interchangeable with DIALCO ultra-miniature incandescent types.

.270″ CHARACTER

PLUS-MINUS ONE, .270″ CHARACTER



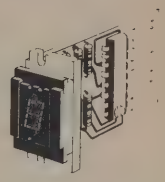
ALPHA-NUMERIC .300″ CHARACTER

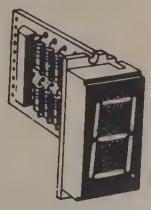
.270″ HEXADECIMAL

**READOUT MODULES**

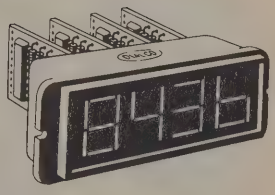
Character heights from .270″ to .625″. Dot, dot matrix and segmented formats for both numeric and full alpha-numeric displays. Wide angle (140°) viewing. IC compatible.

.270″ CHARACTER

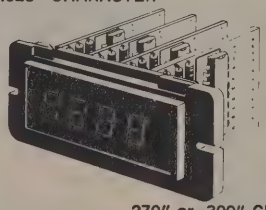




.625″ CHARACTER



.625″ CHARACTER



.270″ or .300″ CHARACTERS

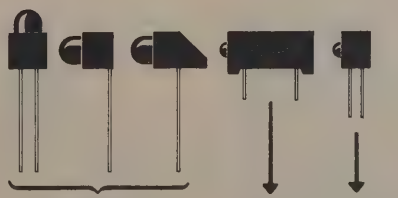
**READOUT PACKAGES AND ASSEMBLIES**

Single-digit packages in character heights from .270″ to .625″ include decoder/driver and resistors mounted on PC board. Bezel assemblies ready for panel mounting available with up to 10 display packages.

**ASK FOR LED PRODUCT SELECTOR GUIDE**

## LED LOGIC-STATE FAULT INDICATORS

**RED • GREEN • YELLOW**



Series 550 Series 547 Series 555

**550** series indicators, with/without built-in series resistors. For use as electronic circuit fault finders, as indicators or in binary data displays.

**547** series indicators, with built-in series resistor, permit dense packaging — 10 units to the inch. Pin spacing is compatible with DIP sockets.

**555** series indicators have built-in series resistor, are IC compatible, and can be p-c board mounted 10 units to the inch.

**DIALIGHT**

A NORTH AMERICAN PHILIPS COMPANY

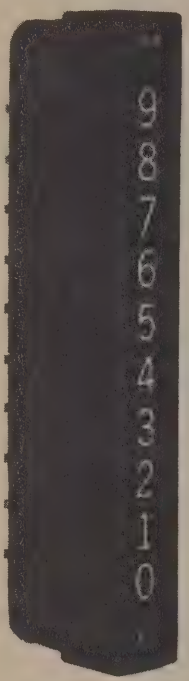
203 HARRISON PLACE, BROOKLYN, N. Y. 11237 • AREA CODE (212) 497-7600

# d² display devices

## DIGISTRIP front relampable DIGITAL DISPLAYS

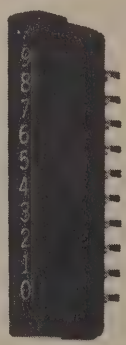
For a wide range of console and instrument display applications. Can be mounted horizontally or vertically, directly on p.c. boards, or ganged for high-density readout.

All Digistrip models are available with standard 0-9 legend, or with custom read-out information.



Digistrip II
3" legend area.

Digistrip I with high-gain transistor drivers on integral printed circuit board.



Digistrip I
1½" legend area.

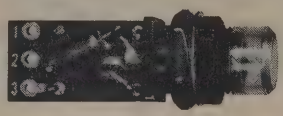
## MINIATURE T-1 INDICATOR LIGHTS

Designed to provide the brightest light in the least space. Available off-the-shelf, or designed to your application.

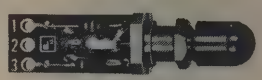
**QUICK-LENS**
Front-relampable miniature indicator light with built in light reflector for maximum brightness, even in high ambient light.

**MINI-LENS**
Front relampable, micro-miniature indicator light, featuring minimum panel spacing. Can be RFI shielded. Threaded body can mount directly to panel.

**FLUSH-LENS**
For panel mounting without protrusion. Available with RFI shield. Unit is relampable from rear of panel. No solder connections required.



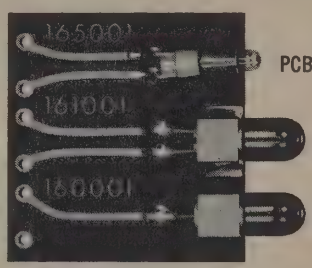
**TRANS-LENS**



**TDML**

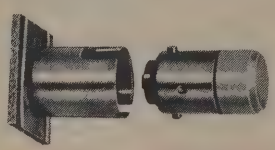
Each front relampable, with high-gain transistor driver on compact, integral p.c. board. Minimum depth behind panel. Both available in "bare board" configuration for customer to install own components. Trans-Lens is transistor-driven version of Quick-Lens; TDML is transistor-driven version of Mini-Lens.

## P.C. BOARD INDICATORS



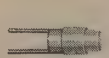
PCB LIGHT

SINGLE-SIDED BOARDS
DOUBLE-SIDED BOARDS
TEST LENS

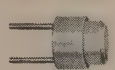


## ADAPTER LENS AND SOCKET

Midget T-1¾ flanged base lamp adaptor used with T-3¼ printed circuit mounted socket. Furnished with or without integral color filter.

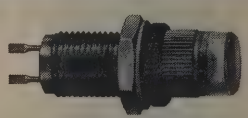


T-1 UNBASED



T-1¾ BI-PIN

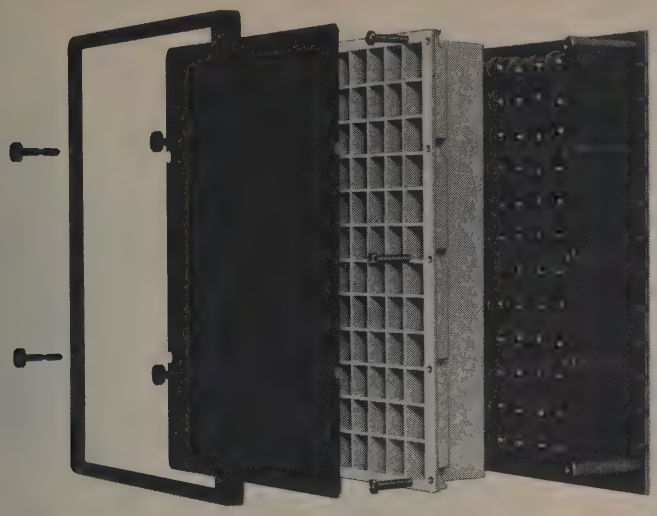
Basic sockets for custom designed lamp holders or p.c. board mounting used as lighting chassis for back lighted display. Also available in side mounting.



**TWIST-LENS**
Quick-change lens, available in clear or colors. Waterproof and RFI shielded units available. Uses T-1¾ Bi-Pin base lamp for high brightness.

All illustrations are actual size

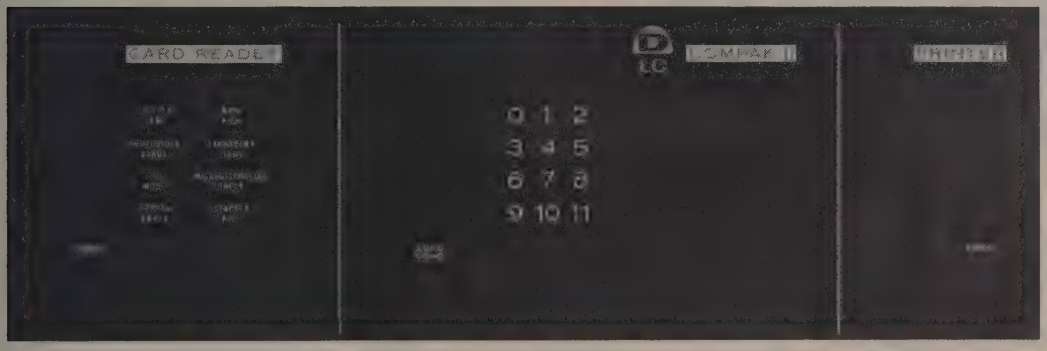
**d² display devices, inc**
*mailing address:* p. o. box 667 encinitas, california 92024
*plant location:* second and E streets (714) 753-0113



# panels and laminates

## BACK LIGHTED PANELS

Exploded view shows a typical backlighted panel application with printed circuit board lighting chassis containing lamps and sockets, light baffle (eggcrate) to divide message areas, and legend screen with front bezel. Application shown is relampable from front of panel. Rear relamping is also available.

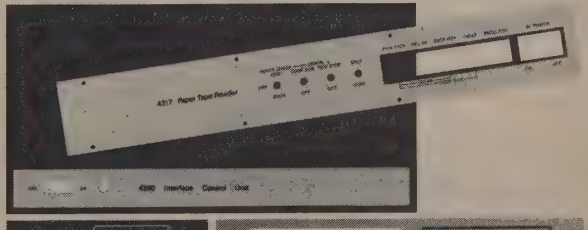


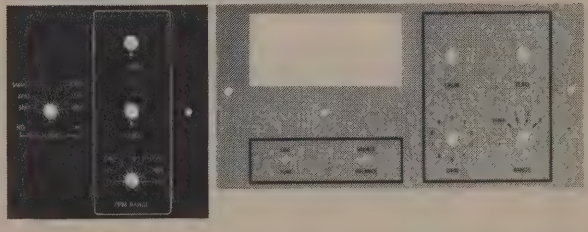

## POLYESTER DEAD FRONT LAMINATES

Used in conjunction with backlighted panels, or provided separately, are DF991 legend screen laminates. Except for permanently visible graphics that may be desired all nomenclature is invisible until backlighted. Standard background is black, but colored dead front laminates are also available. .010″ and double .010″ thickness are used.

## POLYCARBONATE AND ACRYLIC LAMINATES

Offered in dead front as noted above for polyester laminates. Thickness ranges from .020″ to .250″. Used for LED devices as well as incandescent lamps. All laminates are provided with or without pressure sensitive adhesive backing, depending upon application. All laminates feature color matching to FED STD 595, Pantone, or customer supplied color chips.





## NON-ILLUMINATED LAMINATES

Supplied on .010″ adhesive backed polyester film non-illuminated laminates are used to replace conventional painting and printing of metal panels. Screen printing of graphics is sub-surface to protect markings from being scratched off. Holes for switches, knobs, etc. are steel rule die cut. Background color is matched to customer requirements.

*Write for detailed specification sheets*

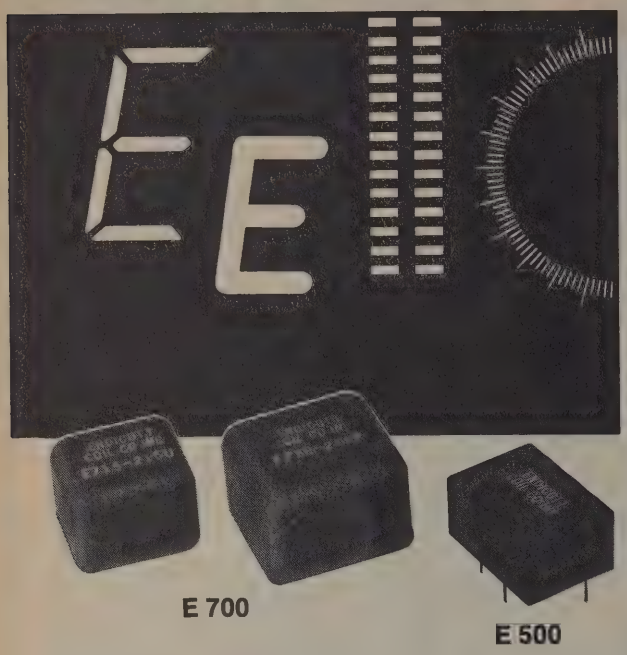
**display devices, inc**

*mailing address:* p. o. box 667 encinitas, california 92024

*plant location:* second and E streets (714) 753-0113

# Power your gas discharge displays from low DC voltage

When you must convert low DC voltages to nominal 200 or 250 V DC levels to activate your displays, choose the DC-to-DC power supply that's right for your application:



E 700

E 500

**E 700 Series** regulated or unregulated

**Input:** 5,9,12,15 V DC standard (others up to 48 V DC)

**Output:** 200 V DC @ 15 ma (or up to 3 W total)

**Size:** (unregulated) 1.1" (27.94mm) x 1.2" (30.48mm) x .910" (23.11mm) max. high
(regulated) 1.43" (36.32mm) x 1.5" (38.10mm) x 1.03" (26.16mm) max. high

**E 500 Series** unregulated

When you need high-volume units, the E 500 offers big savings while delivering the same dependable performance for which our E 700 is known.

**Input/Output:** Same as E 700

**Size:** 1.00" (25.4mm) x 1.38" (35.1mm) x 0.70" (17.8mm) high

MATRIX
SELF-SCAN II PANELS-THE MOST ADVANCED
DOT MATRIX DISPLAY AVAILABLE TODAY. W
COMPETITIVE PRICING, BETTER PERFORMANCE
THAN CRT'S FOR READABILITY, BRIGHTNESS
LINEARITY, SIZE, WEIGHT, LIFE
OVERALL PERFORMANCE CAPABILITIES.

for matrix formats up to 256 characters

E 900
or E 1200

**E 900 Series** unregulated

**Input:** 5, 12, or 15 V DC standard (other inputs available to your specifications)

**Output:** Available with either single or dual outputs, capable of up to 12 watts total. Single: 250 V DC @ 30 ma (48 ma on special order). Dual 250 V DC @ 30 ma, and -16 V DC @ up to 200 ma to provide the -12 V DC needed for the drive electronics in many applications using the Burroughs SELF-SCAN® or I.E.E. ARGUS® displays.

**Size:** 2" (50.8mm) x 2.5" (63.5mm) x .95" (24.1mm) high

**E 1200 Series** unregulated

**Input:** 12, 15 V DC standard (other inputs available to your specifications)

**Output:** 250 V DC @ 100 ma (other output voltages available to your specifications – up to 25 W)

**Size:** Same mounting dimensions as E 900; 1.19" (30.2mm) high

## Tell us about your display power needs!

- Custom designs
- Variations for multi-segment, bar graph and matrix gas discharge displays up to 256 characters
- Inputs from 5 V DC to 48 V DC
- Outputs from 5 V DC to 500 V DC
- Single and dual outputs (up to 25 W total)
- Regulated and unregulated

Although we developed these power supplies to activate gas discharge displays, our customers have used them for many other applications, including:

- Outputs to 1,500 V @ 1 ma for portable oscilloscopes and photomultiplier applications
- Multiple DC and/or AC outputs from battery sources
- LCD and electroluminescent display applications

*Gas discharge display power starts here!*

**Endicott Coil Co., Inc.**
30 Charlotte Street, Binghamton, N.Y. 13905
Phone: (607) 797-1263
TWX 510-252-0155

# THE SYLVANIA Mix 'n Match SYSTEM EXPLAINED

**Sylvania Mix 'n Match. The only system that offers you the universal parts flexibility built around two series of T-2 slide base lamps. The first is our Pilot Lamp series spanning 5 to 120 volts. The second is our Indicator Lamp series from 4 to 48 volts.**

**All the lamps in each series are physically identical. So sockets and lenses are fully compatible.**

**And in a number of instances, lenses and caps are even interchangeable between series.**

**As you can see, our system is calculated to make life a lot easier for everyone.**

**From the guy who builds the prototypes, to the guy who does the purchasing, to the guy who controls production inventory.**

## UNIVERSAL PILOT LAMP HOUSING

Actual Size

| TRANSLUCENT LENSES | |
|---|---|
| Qty. | Ea. |
| 1 | $.83 |
| 10 | .497 |
| 100 | .417 |
| 500 | .338 |

| JEWELED LENSES | |
|---|---|
| Qty. | Ea. |
| 1 | $.79 |
| 10 | .476 |
| 100 | .400 |
| 500 | .324 |

| TRANSPARENT LENSES | |
|---|---|
| Qty. | Ea. |
| 1 | $.45 |
| 10 | .268 |
| 100 | .225 |
| 500 | .182 |

| FLUTED LENSES | |
|---|---|
| Qty. | Ea. |
| 1 | $.40 |
| 10 | .238 |
| 100 | .200 |
| 500 | .162 |

| TRANSLUCENT LENSES | |
|---|---|
| Qty. | Ea. |
| 1 | $.45 |
| 10 | .268 |
| 100 | .225 |
| 500 | .182 |

**Choose your lens & color...**

| Color | Ordering Number |
|---|---|
| Red | 30200 |
| Green | 30212 |
| Blue | 30213 |
| Yellow | 30214 |

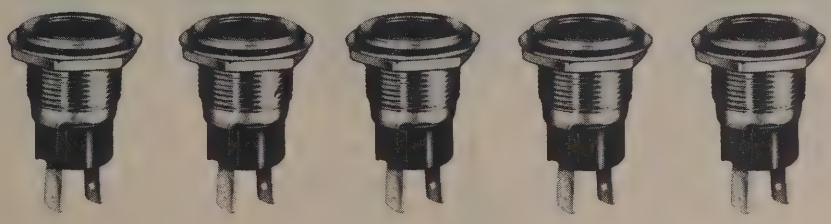
| Color | Ordering Number |
|---|---|
| Red | 30100 |
| Green | 30102 |
| Blue | 30103 |
| Amber | 30106 |

| Color | Ordering Number |
|---|---|
| Red | 30110 |
| Green | 30112 |
| Blue | 30113 |
| Amber | 30111 |
| Yellow | 30114 |
| Clear | 30116 |

| Color | Ordering Number |
|---|---|
| Red | 30120 |
| Green | 30122 |
| Blue | 30124 |
| Amber | 30126 |
| Clear | 30125 |

| Color | Ordering Number |
|---|---|
| Red | 30130 |
| Green | 30132 |
| Yellow | 30131 |
| White | 30133 |

**add a T-2 Pilot Lamp...**



**and insert into socket**

**PILOT LAMP SOCKET P/N 30099**

| Price each in quantity of | | | |
|---|---|---|---|
| 1 | 10 | 100 | 500 |
| $1.84 | $1.103 | $.926 | $.750 |

**PILOT LAMPS**

| LAMP NUMBER | DESIGN VOLTS | DESIGN AMPERES | DESIGN WATTS | FILAMENT | M.S.C.D. | AVERAGE END FOOT CANDLES | RATED AVERAGE LIFE (HOURS) | PRICE EACH IN QUANTITY OF 1 | 10 | 100 | 500 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5SLB | 5.0 | .120 | .60 | C-2V | — | 1,600 | 2,500 | $1.30 | $.778 | $.653 | $.529 |
| 6PSB | 6.0 | .140 | .80 | C-2F | .12 | 500 | 20,000 | 1.35 | .810 | .680 | .551 |
| 6SLB | 6.0 | .144 | .60 | C-2V | — | 1,700 | 2,500 | 1.13 | .778 | .653 | .529 |
| 12PSB | 12.0 | .170 | 2.0 | C-2F | .35 | 2,000 | 12,000 | 1.35 | .810 | .680 | .551 |
| 24PSB | 24.0 | .073 | 1.7 | C-2F | .50 | 3,000 | 10,000 | 1.35 | .810 | .680 | .551 |
| 28PSB | 28.0 | .040 | 1.1 | C-2F | .29 | 1,600 | 5,000 | 1.35 | .810 | .680 | .551 |
| 48PSB | 48.0 | .053 | 2.5 | C-7A | .70 | 1,800 | 7,500 | 1.35 | .810 | .680 | .551 |
| 60PSB | 60.0 | .050 | 3.0 | C-7A | .73 | 2,600 | 7,500 | 1.55 | .929 | .781 | .632 |
| 120PSB | 120.0 | .025 | 3.0 | CC-7A | .36 | 1,200 | 10,000 | 1.52 | .908 | .763 | .618 |

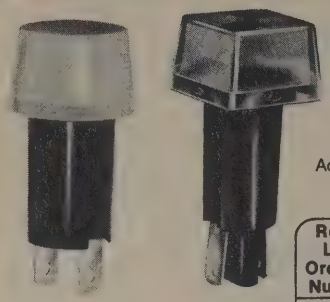
GTE SYLVANIA

West Main Street, Hillsboro, N.H. 03244
(603) 464-5533 • TWX 710 366-0387

# PANEL LAMP ASSEMBLIES

Mix 'n Match

# SINGLE SOCKET ASSEMBLIES



Actual Size

| Price each in quantity of | | | |
|---|---|---|---|
| 1 | 10 | 100 | 500 |
| .32 | .194 | .163 | .132 |

| Round Lens Ordering Number | Color | Square Lens Ordering Number |
|---|---|---|
| 30160 | Red | 30170 |
| 30161 | Clear | 30171 |
| 30162 | Amber | 30172 |
| 30163 | White | 30173 |
| 30164 | Green | 30174 |
| 30165 | Blue | 30175 |

Actual Size

**PYREX END CAPS[1]**

| Price each in quantity of | | | |
|---|---|---|---|
| 1 | 10 | 100 | 500 |
| .25 | .148 | .125 | .101 |

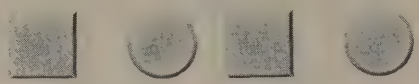
| Color | Ordering Number |
|---|---|
| Red | 38001 |
| Yellow | 38002 |
| White | 38003 |
| Pearl White | 38006 |
| Green | 38004 |
| Blue | 38005 |
| Orange | 38007 |

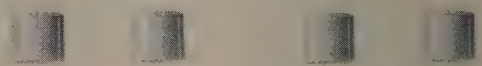
**PYREX END CAPS[2]**

| Price each in quantity of | | | |
|---|---|---|---|
| 1 | 10 | 100 | 500 |
| .29 | .173 | .146 | .118 |

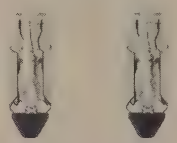
| Color | Ordering Number |
|---|---|
| Red | 38071 |
| Yellow | 38072 |
| White | 38073 |
| Green | 38074 |
| Blue | 38075 |

**Choose a cap or lens...**

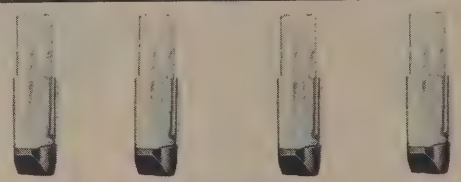




**add a T-2 Slide Base Lamp...**



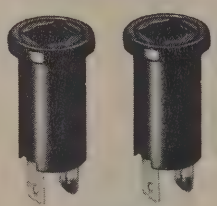
**INDICATOR LAMPS[3]**



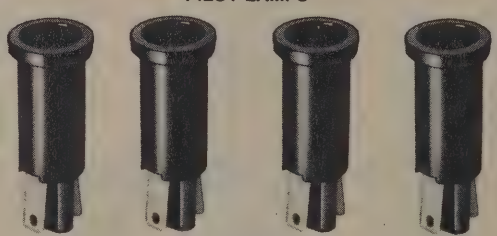
**PILOT LAMPS**

**INDICATOR LAMPS[3]**

**and insert into socket of your choice**

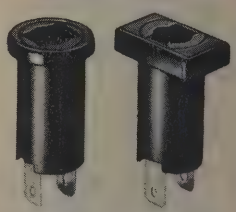


**INDICATOR LAMP SOCKETS**
P/N 30153



**PILOT LAMP SOCKET**
P/N 30152

| Price each in quantity of | | | |
|---|---|---|---|
| 1 | 10 | 100 | 500 |
| .72 | .432 | .363 | .294 |



**INDICATOR LAMP SOCKET**
P/N 30153

**INDICATOR LAMP SOCKET**
P/N 30151

**INDICATOR LAMP SOCKETS**

| Price each | | | | |
|---|---|---|---|---|
| QUANTITY | 1 | 10 | 100 | 500 |
| P/N 30151 | .47 | .284 | .238 | .193 |
| P/N 30153 | .47 | .284 | .238 | .193 |

**PILOT LAMPS**

| LAMP NUMBER | DESIGN VOLTS | DESIGN AMPERES | DESIGN WATTS | FILAMENT | M.S.C.D. | AVERAGE END FOOT CANDLES | RATED AVERAGE LIFE (HOURS) | PRICE EACH IN QUANTITY OF 1 | 10 | 100 | 500 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5SLB | 5.0 | .120 | .60 | C-2V | — | 1,600 | 2,500 | $1.30 | $.778 | $.653 | $.529 |
| 6PSB | 6.0 | .140 | .80 | C-2F | .12 | 500 | 20,000 | 1.35 | .810 | .680 | .551 |
| 6SLB | 6.0 | .144 | .60 | C-2V | — | 1,700 | 2,500 | 1.13 | .778 | .653 | .529 |
| 12PSB | 12.0 | .170 | 2.0 | C-2F | .35 | 2,000 | 12,000 | 1.35 | .810 | .680 | .551 |
| 24PSB | 24.0 | .073 | 1.7 | C-2F | .50 | 3,000 | 10,000 | 1.35 | .810 | .680 | .551 |
| 28PSB | 28.0 | .040 | 1.1 | C-2F | .29 | 1,600 | 5,000 | 1.35 | .810 | .680 | .551 |
| 48PSB | 48.0 | .053 | 2.5 | C-7A | .70 | 1,800 | 7,500 | 1.35 | .810 | .680 | .551 |
| 60PSB | 60.0 | .050 | 3.0 | C-7A | .73 | 2,600 | 7,500 | 1.55 | .929 | .781 | .632 |
| 120PSB | 120.0 | .025 | 3.0 | CC-7A | .36 | 1,200 | 10,000 | 1.52 | .908 | .763 | .618 |

[3]See opposite page for electrical data and pricing of indicator lamps.

GTE SYLVANIA

# STRIP SOCKET ASSEMBLIES

Mix 'n Match

# TWIN LIGHT ASSEMBLIES

### PROFAX END CAPS[1]

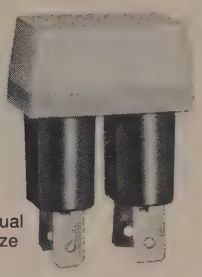
| Price each in quantity of | | | |
|---|---|---|---|
| 1 | 10 | 100 | 500 |
| .25 | .148 | .125 | .101 |

| Color | Ordering Number |
|---|---|
| Red | 38001 |
| Yellow | 38002 |
| White | 38003 |
| Pearl White | 38006 |
| Green | 38004 |
| Blue | 38005 |
| Orange | 38007 |

### PYREX END CAPS[2]

| Price each in quantity of | | | |
|---|---|---|---|
| 1 | 10 | 100 | 500 |
| .29 | .173 | .146 | .118 |

| Color | Ordering Number |
|---|---|
| Red | 38071 |
| Yellow | 38072 |
| White | 38073 |
| Green | 38074 |
| Blue | 38075 |



Actual Size

### TWIN LIGHT LENSES

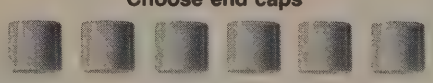
| Price each in quantity of | |
|---|---|
| 1 | $.79 |
| 10 | .476 |
| 100 | .400 |
| 500 | .324 |

| No. | Color |
|---|---|
| 30180 | Red |
| 30182 | Amber |
| 30183 | White |
| 30184 | Green |
| 30185 | Blue |

### INDICATOR LAMP STRIP SOCKETS

| ½" CENTERS | | ¾" CENTERS | |
|---|---|---|---|
| No. Skts. | Common Ground | Individual Contacts | Common Ground | Individual Contacts |
| 2 | 31301 | 31311 | 31321 | 31337 |
| 3 | 31302 | 31312 | 31322 | 31338 |
| 4 | 31303 | 31313 | 31323 | 31334 |
| 5 | 31304 | 31314 | 31324 | 31339 |
| 6 | 31305 | 31315 | 31325 | 31333 |
| 7 | 31306 | 31316 | 31326 | 31340 |
| 8 | 31307 | 31317 | 31327 | 31341 |
| 9 | 31308 | 31318 | 31328 | 31342 |
| 10 | 31309 | 31319 | 31329 | 31343 |
| 11 | 31310 | 31320 | 31330 | 31344 |
| 12 | 31250 | 33250 | 31275 | 33275 |

Choose end caps



add T-2 Lamps

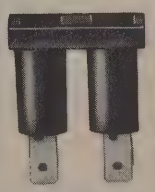
INDICATOR LAMPS

| Price each in quantity of | | | | |
|---|---|---|---|---|
| No. Skts. | 1 | 10 | 100 | 500 |
| 2 | $1.77 | $1.060 | $ .890 | $ .721 |
| 3 | 2.63 | 1.579 | 1.326 | 1.074 |
| 4 | 3.50 | 2.096 | 1.761 | 1.426 |
| 5 | 4.36 | 2.615 | 2.197 | 1.779 |
| 6 | 5.23 | 3.134 | 2.633 | 2.132 |
| 7 | 6.09 | 3.653 | 3.069 | 2.485 |
| 8 | 6.96 | 4.172 | 3.505 | 2.838 |
| 9 | 7.82 | 4.691 | 3.941 | 3.191 |
| 10 | 8.69 | 5.210 | 4.377 | 3.544 |
| 11 | 9.56 | 5.729 | 4.813 | 3.897 |
| 12 | 5.45 | 3.265 | 2.743 | 2.221 |

and insert Lamp into socket

### TWIN LIGHT SOCKETS

| No. | Description |
|---|---|
| 31351 | Both Sides Common (2 contacts) |
| 31352 | One Side Common (3 contacts) |
| 31353 | Individual Contacts (4 contacts) |



| Price each in quantity of | | | |
|---|---|---|---|
| 1 | 10 | 100 | 500 |
| $1.83 | $1.055 | $.880 | $.705 |

Dimensional drawings and listings of hundreds of other miniature lamps will be found in our four color catalog #301 available on request.

GTE Sylvania
Miniature Lighting Products
West Main Street
Hillsboro, N.H. 03244
Tel: 603-464-5533

### INDICATOR LAMPS

| LAMP NUMBER | DESIGN VOLTS | DESIGN AMPERES | DESIGN WATTS | FILAMENT | M.S.C.D. | AVERAGE END FOOT-CANDLES | RATED AVERAGE LIFE (HOURS) | PRICE EACH IN QUANTITY OF 1 | 10 | 100 | 500 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4ESB | 4.0 | .040 | .16 | C-6 | .03 | 200 | 10,000 | $1.48 | $.886 | $.745 | $.603 |
| 5ESB | 5.0 | .040 | .20 | C-6 | .04 | 225 | 8,000 | 1.48 | .886 | .745 | .603 |
| 6ESB | 6.0 | .040 | .24 | C-2V | .025 | 250 | 10,000 | .97 | .584 | .490 | .397 |
| 53B | 6.0 | .240 | 1.44 | C-2V | .24 | 2,000 | 5,000 | 1.07 | .639 | .537 | .435 |
| 10ASB | 10.0 | .010 | .10 | C-2F | .001 | • | 50,000 | 1.66 | .994 | .835 | .676 |
| 10CSB | 10.0 | .017 | .17 | C-2V | .01 | 60 | 20,000 | 1.48 | .886 | .745 | .603 |
| 10ESB | 10.0 | .040 | .40 | C-2V | .07 | 450 | 10,000 | 1.35 | .810 | .680 | .551 |
| 12ESB | 12.0 | .040 | .48 | C-2V | .09 | 650 | 10,000 | 1.35 | .810 | .680 | .551 |
| 14FSB | 14.0 | .080 | 1.12 | C-2F | .50 | 4,000 | 500 | 1.41 | .844 | .709 | .574 |
| 16CSB | 16.0 | .017 | .27 | C-2F | .016 | 80 | 15,000 | 1.48 | .886 | .745 | .603 |
| 16ESB | 16.0 | .040 | .64 | C-2F | .17 | 800 | 7,500 | 1.35 | .810 | .680 | .551 |
| 18ESB | 18.0 | .040 | .72 | C-2F | .14 | 850 | 5,000 | 1.35 | .810 | .680 | .551 |
| 24CSB | 24.0 | .017 | .42 | C-2F | .02 | 100 | 15,000 | 1.41 | .844 | .709 | .574 |
| 24ESB | 24.0 | .040 | .96 | C-2F | .12 | 850 | 8,000 | 1.35 | .810 | .680 | .551 |
| 28ESB | 28.0 | .040 | 1.12 | C-2F | .25 | 1,500 | 6,000 | 1.35 | .810 | .680 | .551 |
| 48ESB | 48.0 | .040 | 1.92 | CC-2F | .44 | 3,000 | 5,000 | 1.52 | .908 | .763 | .618 |

[1]Profax caps are press fit to lamp. Cannot be used with lamps rated over 1.1 watts.

[2]Pyrex caps must be cemented to bulb with a translucent silicone rubber adhesive.

GTE SYLVANIA

HAMLIN INC

REED SWITCHES / INDUSTRIAL SENSORS / LIQUID CRYSTAL DISPLAYS

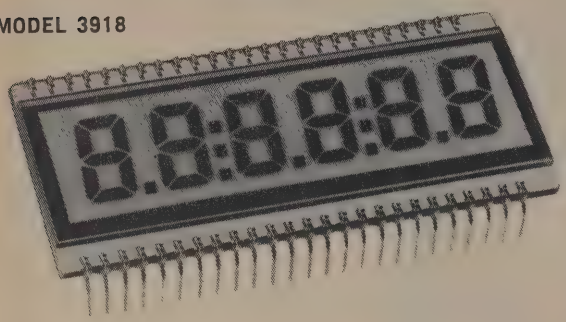
DEPT. EM, 628 LAKE STREET • LAKE MILLS, WISCONSIN 53551
PHONE: SALES (414) 648-2361 • TWX 910-260-3740

# LIQUID CRYSTAL DISPLAYS

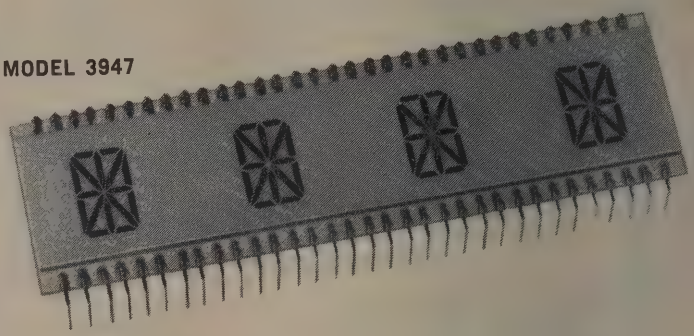
Hamlin field effect LCD's are available in Dual in-line or edge board connector packaging. Digits may be black or clear with a choice of transmissive, transflective or reflective background. Thermoplastic bonding provides maximum seal integrity.

Complete design/production services are available to provide custom displays with special format, electrical or environmental requirements. Contact our applications engineering department directly or through your nearest Hamlin sales representative.

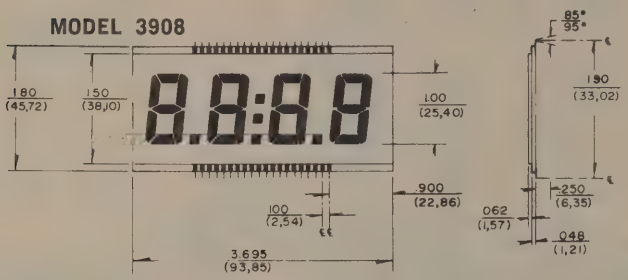
MODEL 3918



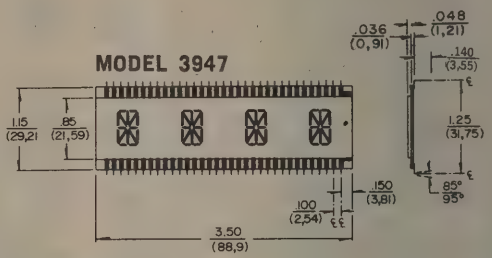
MODEL 3947



MODEL 3908




MODEL 3947




## PERFORMANCE SPECIFICATIONS

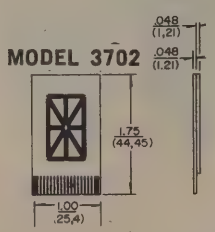
**Typical 4 Digit (.5") Numeric LCD**

| Characteristic | | | | |
|---|---|---|---|---|
| Unless otherwise specified $T_A$ = +25°C and test voltage is typical | Min. | Typical | Max. | Units |
| Operating Voltage | 4 | 5 | 17 | $V_{rms}$ |
| DC Drive component allowable | | 25 | | mV |
| Operating frequency range* | 30 | 60 | 100 | Hz |
| Current (all segments ON) | | 10 | 20 | μA |
| Capacitance (all segments ON) | | 3,000 | | pF |
| DC resistance (all segments ON) 10% ON 25°C | | 50<br>1.7 | | MΩ<br>$V_{peak}$ |
| Visual threshold 0°C<br>90% ON 25°C<br>0°C | | 2.1<br>2.5<br>2.9 | | $V_{peak}$<br>$V_{peak}$<br>$V_{peak}$ |
| Response time<br>Segment ON ($T_A$ = +25°C)<br>Segment OFF ($T_A$ = +25°C)<br>Segment ON ($T_A$ = +0°C)<br>Segment OFF ($T_A$ = +0°C) | | <br>75<br>150<br>150<br>600 | <br>150<br>300<br>300<br>1,200 | <br>ms<br>ms<br>ms<br>ms |
| Contrast ratio | | 20:1 | | |
| Operating temperature range | −10 | | +55 | °C |
| Storage temperature range** | −55 | | +60 | °C |
| Expected life | | 50,000 | | hours |

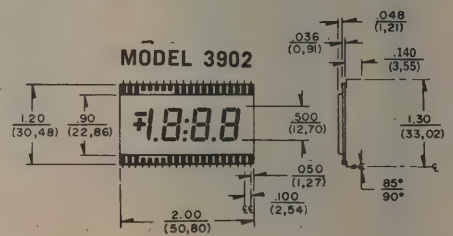
* Recommended; flicker may occur below 30 Hz, power consumption increases above 100 Hz.

** 40% maximum at 60°C relative humidity.

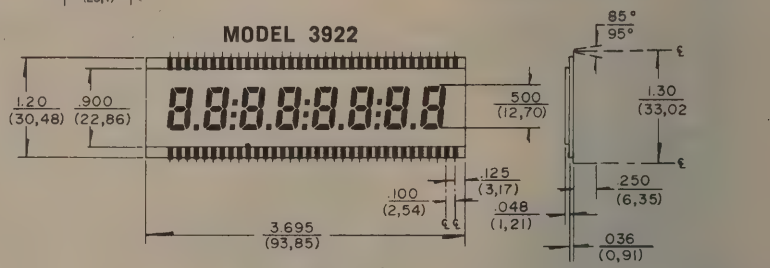
MODEL 3702



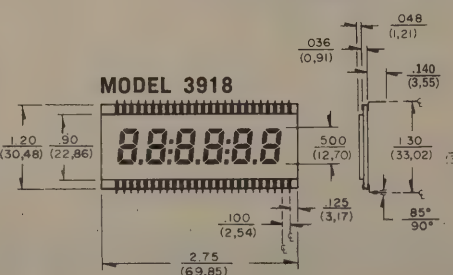

MODEL 3902



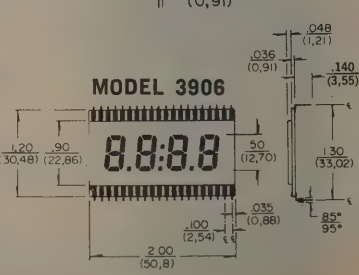

MODEL 3922




MODEL 3918




MODEL 3906




**NOTE:** To specify viewing mode, add following suffix numbers:

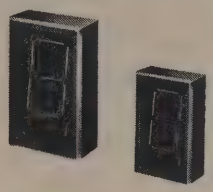
210 Transmissive clear on black
315 Transflective black on silver
313 Reflective black on silver

# IEE® The Display Maker . . .

### IEE • APOLLO INCANDESCENT TUBE DISPLAYS

Available in .4", .47" or .6' high, 7-segment characters with ±1 and decimal point options.

### IEE • AURORA INCANDESCENT FLATPACK DISPLAYS

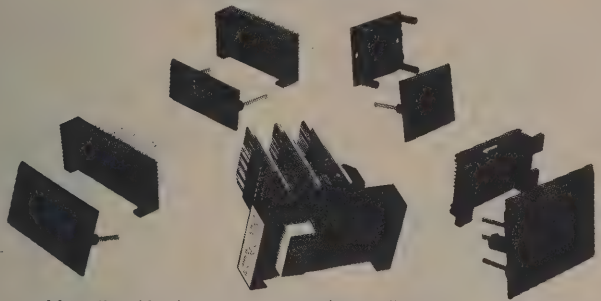


Available in .47" or .61" high, 7-segment characters and ± overflow 1 with decimal points.

### IEE • POLARIS LIQUID CRYSTAL DISPLAYS

Choice of reflective (ambient lighting) or transmissive (backlighting) types, DIP-packaging style.

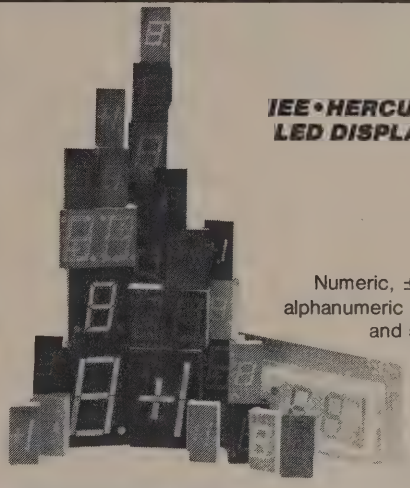
### IEE • ATLAS DISPLAY MOUNTING HARDWARE AND DECODER/DRIVER



Mounting Hardware accommodates all standard, DIP-packaged LED and other planar displays.

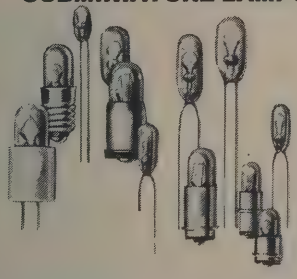
Decoder/Driver is designed to be integrally mounted onto the back of IEE-ATLAS Mounting Hardware

### IEE • HERCULES LED DISPLAYS



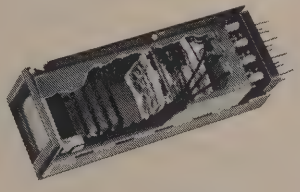
Numeric, ±1, hexadecimal or alphanumeric format; 7-segment and 5 x 7 dot matrix red characters from .270" to 1.02" high.

### IEE • ELECTRA SUBMINIATURE LAMPS



All standard sizes T-¾ through T-1¾; choice of all base configurations

### IEE • PROSWITCH MULTI-LEGEND ILLUMINATED PUSHBUTTON SWITCH



Takes the place of as many as 48 individual switches; legend surface doubles as a large pushbutton switch.

### IEE • JUPITER SOLID STATE INDICATORS

Choice of red, yellow, amber or green diffused light, T-1 through T-2 sizes.

### IEE • ARGUS ALPHANUMERIC DISPLAY SUBSYSTEMS

Available in 32, 64, 128, 256, 320, 480, 512, or 960-characters per panel; orange (filterable to red) or green, fourteen different configurations; a compact, readable alternative to a CRT.

### IEE • IRIS STATUS INDICATOR

Illuminate individual, combination, or all 12 message areas.

### IEE • TITAN PROJECTION DISPLAYS

Capable of displaying any image, color and message which is reproducible on film; 14 different models from .34" through 3.375" message areas.

**INDUSTRIAL ELECTRONIC ENGINEERS, INC., 7740 Lemona Ave., Van Nuys, California 91405 • Telephone: (213) 787-0311 • TWX 910-495-1707**

**FOR FURTHER INFORMATION, REQUEST DATA BY PRODUCT NAME**

# The busy designer's guide to IDI instant-delivery indicator lights

**The basic specs on the most popular indicator lights in the IDI line. On the shelf and ready for instant delivery, If you need to know more, ask Industrial Devices, Inc., Edgewater, NJ 07020; (201) 224-4700. We'll send you our complete, detailed catalog plus samples.**

## TINY-MITE™

**For tight spots and tight budgets.**

**Relampable sub-miniature wedge-base lamp indicator light assemblies and lamp sockets.**

Tiny-Mite sub-miniatures give you more room to work in when you're limited by small space and must keep costs down. The indicator light assemblies and sockets have a unique, patented socket construction which holds the incandescent lamp trimly and securely, makes reliable contact, won't loosen with vibration or shock, yet permits easy lamp removal and replacement. Available in wire lead, solder terminal, and printed circuit board versions.

Ruggedness and reliability of wedge-base lamps have been proved by hundreds of millions of them used every year. Wedge-base design reduces lamp cost because the base is formed from the glass of the bulb and its lead-in-wires — there are no separate parts or extra welded connections. Thirteen different relampable sub-miniature types available in a wide range of voltage ratings up to 120 Vac.

Tiny Mite indicator light assemblies are designed specifically for sub-miniature wedge-base lamps. Extraordinarily economical and compact. Two basic lens designs: hemispherical and flat-top. Stainless-steel bezels, polycarbonate lenses in red, clear, amber, white, green, blue, and yellow.

## MINI-SLIDE

**Secure seating, screw-in lenses, heavly-duty construction:**

**Relampable pilot light assemblies for high-quality products at low cost, in a wide voltage range up to 120 Vac.**

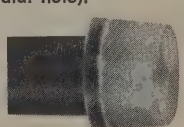
Solid-black plastic or mirror-finish stainless-steel bezels, round-light-diffusing screw-in lenses. Self-locking patented nylon torque-limiting nut eliminates stripped threads. The 120 Vac models are UL-listed and CSA-approved.

### SERIES 2800

For use with pilot lamps, in red, clear, amber, white, green, blue, yellow; .205″ quick-connect terminals. (1⅛″ dia. hole).

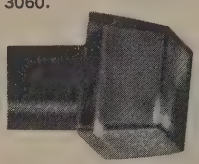
### SERIES 3060

For use with slide-base pilot lamps. Black phenolic socket accepts round, square, and angle snap-on/off lenses; .205″ quick connect terminals. Lamps can be replaced from front of panel. ½″ dia. hole).



### SERIES 3040

For use with short slide-base indicator lamps. Molded of black Nylon. Otherwise same as Series 3060.



### SERIES 3130

Dual-lamp legend lights for larger message area and brighter illumination. Rectangular incandescent pilot lights in 2, 3 and 4 terminal versions. Simple to install, easy to relamp. Lamps will not vibrate loose. In variety of lens colors with lamps or from 4 to 48 V. Quick-connect terminals. (Two ½″ dia. hole on ½″ centers, or .885″ x .500″ opening).

## LINE-O-LITE

**Distinctive design, and mounting is a snap:**

Attention-getters for warning and identification. If you need a bright, eye-catching rectangular bar of light, choose Line-O-Lite.

### SERIES 2330D

In red, amber, white, green, 120 Vac, with wire leads or .250″ terminals, (1$\frac{25}{32}$″ x 1$\frac{13}{32}$″ opening) for snap-fit into panels .055″ to .070″ thick, use speednuts for the rest.

### SERIES 3620D

In red, amber, white, green, 120 Vac, (⅝″ x ⅜″ opening) for snap-fit into panels .020″ to .130″ thick.

## GLO-DOT

**High visibility in tight spots:**

One-piece body and lens for fast installation. When you need a miniature general-purpose indicator light assembly for cramped locations, turn to the simple, compact construction of Glo-Dot. Tamper-proof, UL-recognized, CSA-approved.

### SERIES 2990D

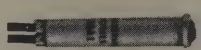
Incandescent, 6, 12, 28 V, in red, amber, white, green, blue, yellow, with wire leads. (⅜″ dia. hole).

### SERIES 2990P

Incandescent, 6, 12, 28 V with plug bezel and low-profile lens, in red, amber, white, green, blue, yellow, with wire leads. ½″ dia. hole).

### SERIES 2120A

Neon, 120 Vac, in red, amber, white, with wire leads. (⅜″ dia. hole).



### SERIES 2110A

Neon 120 Vac, incandescent 6, 12, 28 Vac, in red, clear, amber, white, green, with wire leads or quick-connect terminals.

### SERIES 2150A

Neon 120 Vac, incandescent 6, 12, 28 Vac, in red, clear, amber, white, green, with wire leads or quick-connect terminals.

# MINI-DOT

**Pilot lights you push through panel from the front, lock from the back.**

**For fast mass-production mounting:**

A smart-looking series of incandescents and neons that mount quickly by pushing lens through front panel opening, then locking body to lens behind the panel, for secure, tamper-proof installation.

**SERIES 4730J**
Incandescent, 6, 12, and 28 V in red, amber, white, green, blue, yellow, neon, 120 Vac, in red, amber, white, green. (.180″ dia. hole).

**SERIES 4700A**
Neon, 120 Vac, in red, amber, white, green (5/16″ dia. hole).

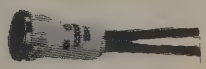
# OMNI-GLOW

**Closest thing to an all-purpose pilot light:**

Big on performance, wide in choice, long-lived, and low-cost. If you want a rugged, long-lived general-purpose indicator light assembly in a wide range of colors, lens shapes, round, flat, tapered; housing sizes and both lugs and leads, this is the one.

**SERIES 2620K**
Neon, 120 Vac, in red, amber, white, green with wire leads .250″ terminals, flush lens. (7/8″ dia. hole).

**SERIES 1030D**
With wire leads, 6, 12, 28 V. 120, 250 Vac, in red, amber, white, green lens. (1/2″ dia. hole). Also available with .187″ terminals for 120, 250 Vac.



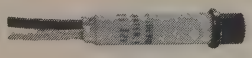
**SERIES 1050A, DOME**
**1050C HI-HAT; 1050N SQUARE**
Dome; 1050C hi-hat; 1050N square with wire leads, 6, 12, 28 V, 120, 250 Vac, in red, amber, white, green, bue; or with .187″ terminals; all with round lens. (1/2″ dia. mounting hole).

# LED SUPER-BRITE

**The brightest, highest-efficiency lights available:**

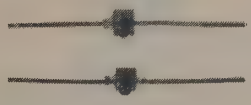
Red, green, or yellow light-emitting diodes. A lifetime approximately 100,000 hours long. Low voltage, low power drain — ideal for solid-state and battery applications. Highly resistant to shock and vibration.

**SERIES 2191**
High-hat and hemispherical lenses in red, green, yellow, 6, 12, 24 V, wire leads. Built-in current-limiting resistor and rectifier diode permit their use in AC and DC applications and protect against damage from improper polarity connection. (5/16″ dia. hole).



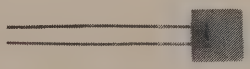
**SERIES 4303F**
T-1 LED for limited-space applications, in red, yellow, green; for voltage ratings 3 V up depending on resistor used.

**SERIES 4306R**
Rectangular LEDs in red, green, yellow, for voltage ratings 3 V up depending on resistor used.



**SERIES 4304H, 4305H**
T-1¾ LED in red, green, yellow, for voltage ratings 3 V up depending on resistor used, wire leads. Diffused and non-diffused (wide and narrow-angle) types. (17/64″ dia. hole).

**SERIES 4307T**
Micro-miniature LED for limited space, in red, green, yellow; for voltage ratings 3 V up depending on resistor used, wire leads.



**SERIES 5100H**
In black nylon snap-fit housing, wire leads, red, green, yellow, voltage ratings from 3 V up depending on resistor used. (1/4″ dia. hole).

# Can't find what you want here? Amazing.

**If it isn't here, IDI will modify a stock model for you, or custom-design and produce exactly what you want. High-volume production facilities hold prices down, speed delivery. If your only solution is a custom solution, ask for our catalog of special and custom indicator lights. Nothing can stop IDI from meeting your indicator light requirements.**

## INDUSTRIAL DEVICES INC.

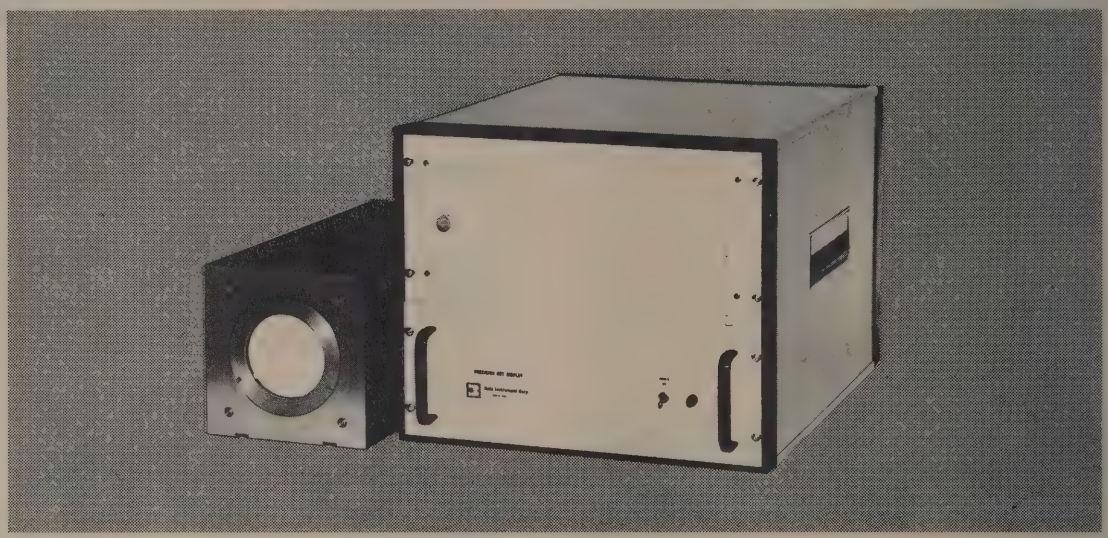
Edgewater, New Jersey 07020
(201) 224-4700

INFODEX
INCORPORATED

INFO/DATA

CRT DISPLAY SYSTEMS

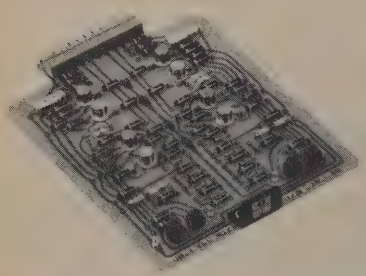
# Precision CRT displays



The Infodex line of Precision CRT Displays consists of a series of high resolution cathode ray tube displays utilizing all Silicon solid state circuitry for application in:

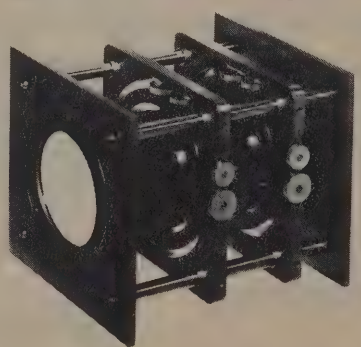
a. film and hard copy printing recorders
b. flying spot scanners
c. film readers
d. radar displays
e. computer output displays
f. TV monitors
g. Heads-Up displays

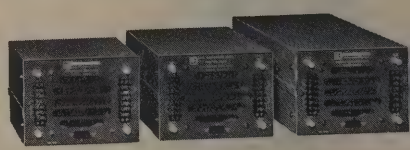
or any application requiring a precision programmable light source. They are capable of random access X-Y deflection or scanning at any rates from DC to the maximum bandwidth capability of the deflection system. A complete line of models is available.



## Modular CRT building block components

Individual, compatible plug-in circuits such as: DF2050 Dynamic Focus Generator; DF347 Dynamic Focus Amplifier; LC2656/2676 Precision Linearity Correction Circuit; VA2548 Video Amplifier (10 mhz); VA2549 Gamma-Corrected Video Amplifier (10 mhz); VA2077 Video Amplifier (30 mhz); SG1190 Sawtooth Generator; PP2425 Phosphor Protection Circuit; DA1340 Deflection Amplifier (±0.75 amperes); EDA800 Electrostatic Deflection Amplifier (350 volts plate-to-plate positive or negative); FR1882 Static Focus Regulator; BA1714 Blanking Amplifier. All circuitry features silicon semiconductors and temperature stable metal-film resistors throughout.





## ±35 Volt deflection amplifiers

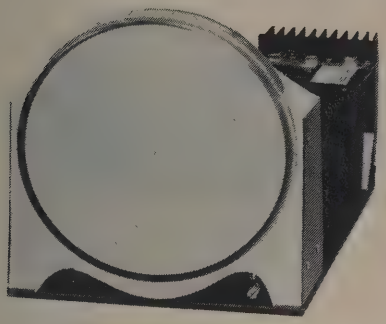
The models DA223, DA224 and DA225 are dc-coupled, all-silicon, solid-state modular packages capable of supplying up to ±2.0, ±4.0 and ±6.0 amperes of deflection current respectively to each axis of a directly-coupled deflection yoke. A unique method of damping optimizes the amplifier for the particular yoke being used by means of an adjustable potentiometer. The amplifiers also feature extremely fast settling time and high bandwidth. The user has the choice of operating the amplifiers Class A for achieving nonlinearities of ±0.02% maximum or Class AB for minimum power consumption.

7 CHERRY AVENUE • WATERBURY, CONNECTICUT 06702 • 203-757-9291

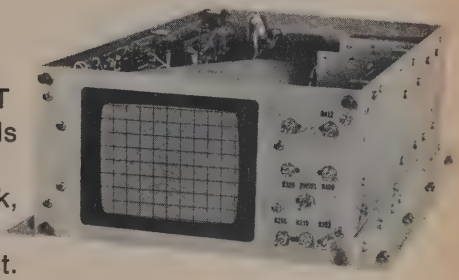
INFODEX
INCORPORATED
INFO/DATA

CRT DISPLAY SYSTEMS

# OEM CRT displays

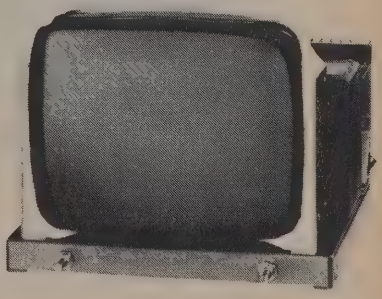


Infodex is a specialist in the design and manufacture of CRT Displays. Many standard models are available and because sub-assemblies are regularly in stock, custom designs can often be done in reasonable time and cost.



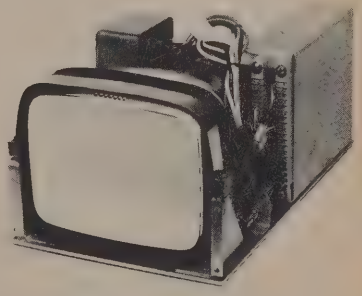
## STANDARD

6″ Flat Face X-Y
6″ Flat Face Raster Scan
9″ X-Y
17″ X-Y
7″ Flat Face Raster Scan
9″ Raster Scan
12″ Raster Scan
15″ Raster Scan
3″ Electrostatic, DC Powered



## CUSTOM

Screen sizes from one inch to twenty inches, X-Y and raster scan. On-off brightening and video modulation. Specials for the military, medical and marine markets.



7 CHERRY AVENUE • WATERBURY, CONNECTICUT 06702 • 203-757-9291

# NUMERIC READOUTS

"LINKS BETWEEN MAN AND MACHINE"

## INFO-LITE CORPORATION

46-10 104th STREET • CORONA, N. Y. 11368

212 / 476-1287

See our Programming and Switching Products in Section 5100.

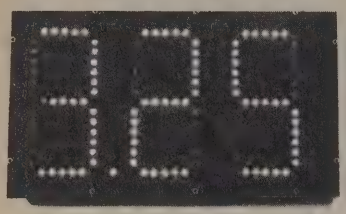
— FEATURING —

- Ready to mount into panel cutout
- Servicing from front without tools
- Supplied in attractive assemblies with bezel
- Includes anti-glare "Black-Out" panel & color filter
- Snap-in logic boards available with memory option
- All wear parts (lamps and logic) socket mounted
- Plus minus signs, colons, decimal, message modules optional

### Series 68031

**6 DIGIT CLOCK DISPLAY SHOWN**

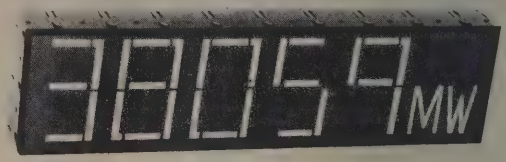
1.0" Characters — Viewing to 30 Ft.



### Series 68036 & OD68036

**3 DIGIT UNIT SHOWN**

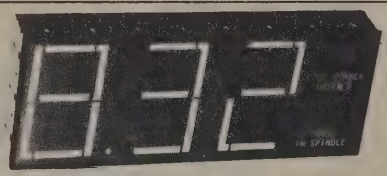
Indoor/Outdoor — Viewing to 150 Ft.



### Series 68032

**5 DIGIT MEGAWATT DISPLAY SHOWN**

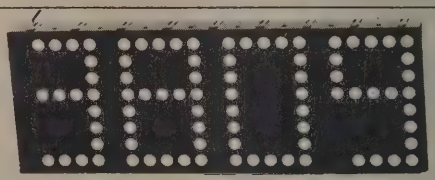
2.0" Characters — Viewing to 60 Ft.



### Series 68033

**3 DIGIT N. C. TOOL DISPLAY SHOWN**

2.7" Characters — Viewing to 80 Ft.



FOR OUTDOOR VIEWING

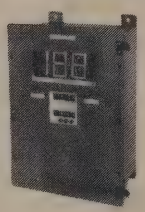
**4 DIGIT UNIT SHOWN**

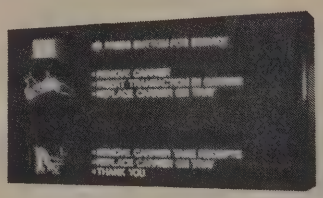
### Series OD68032/33

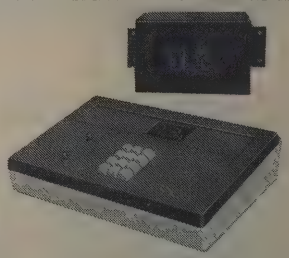
2.1"/2.9" Characters — Viewing to 60/80 Ft.

## SPECIAL SYSTEMS

We have supplied various hardware designed to meet special customer needs, including keyboard entry displays, up/down counters, hi-threshold interfaces, pre-determining counters, display/control systems and special enclosures. Call us to discuss your requirements.







## LIGHTED INDICATORS
## STATUS DISPLAYS
## BACK-LIGHTED/DEAD FRONT PANELS
## ANNUNCIATORS

### SERIES 68011, 68012, 68013 AND 68014

Any group of messages/symbols can be displayed in any combination of colors • Front panel graphics are back lighted using Std. MFB T 1¾" lamps • Basic message module sizes: 3/8" Sq, 3/8" x 3/4", 3/8" x 1-1/8", 3/8" x 1-1/2" or multiples of these • Units are supplied in an attractive package with bezel and "Black-Out" front panel, ready to snap into rectangular panel cutout • Common ground reduces installation time • Servicing can be done from the front • Lamp drivers and special logic available.

**74000 SERIES BACKLIGHTED/DEAD FRONT PANEL ASSEMBLIES** are available to meet a wide variety of medium to large size display applications. These are supplied to meet customer specifications.

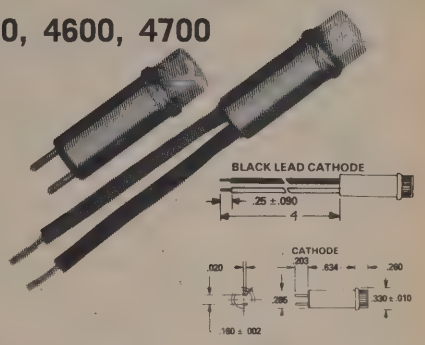
# LED, INCANDESCENT AND NEON INDICATOR LIGHTS

## CUSTOMIZED IN SEVEN DAYS

**LED'S** • Solid state reliability • Decorative panel mounting • Available in red, green and amber • DC voltage range 2 volts to 28 volts at 10 mA (utilizing internal resistor) • 4″ color coded stranded insulated leads or polarized BiPins standard — custom lead lengths available

## FRONT MOUNTING — 9/32″ HOLE CLEARANCE — SERIES 4400, 4600, 4700

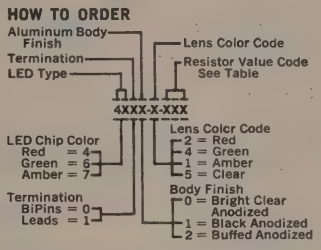
- Aluminum body in 3 anodized finishes: bright clear, black, and buff
- Stainless steel polarized BiPins available




### OPERATING PARAMETERS

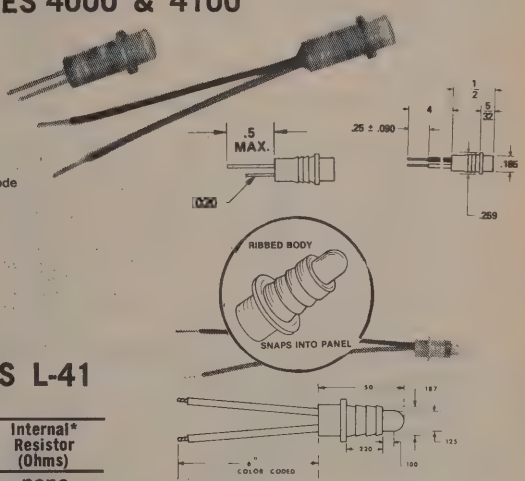
| Part No. XXXX-X- | Voltage | Current (mA) | Internal Resistor (Ohms) |
|---|---|---|---|
| 001 | 2 | 10 | none |
| 002 | 5 | 10 | 330 |
| 003 | 6 | 10 | 390 |
| 004 | 10 | 10 | 820 |
| 005 | 12 | 10 | 1000 |
| 006 | 15 | 10 | 1300 |
| 007 | 28 | 10 | 2700 |

### HOW TO ORDER




## FRONT MOUNTING — 3/16″ HOLE CLEARANCE — SERIES 4000 & 4100

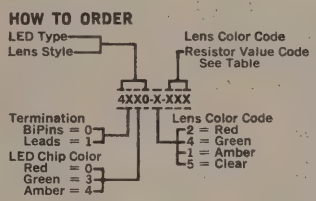
- Ultra miniature size
- One piece construction
- No hardware required — ribbed body snaps into panel
- Available in smooth body — hardware supplied upon request




### OPERATING PARAMETERS

| Part No. XXXX-X- | Voltage | Current (mA) | Internal Resistor (Ohms) |
|---|---|---|---|
| 001 | 2 | 10 | none |
| 002 | 5 | 10 | 330 |
| 003 | 6 | 10 | 390 |
| 004 | 10 | 10 | 820 |
| 005 | 12 | 10 | 1000 |
| 006 | 15 | 10 | 1300 |
| 007 | 28 | 05 | 5100 |

### HOW TO ORDER




## REAR MOUNTING — 3/16″ HOLE CLEARANCE — SERIES L-41

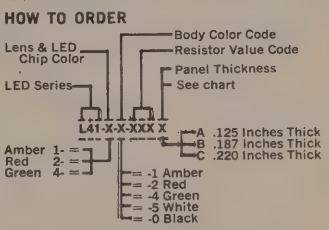
- Eliminates additional final assembly — component included in circuitry
- Available for panel thicknesses 1/8″, 3/16″, 7/32″
- Allows convenient circuitry location
- 22 AWG 6″ leads standard — custom lead lengths available
- TTL and MOS compatible
- Vibration and shock resistant
- No mounting hardware required — ribbed body snaps into panel

Note: Other resistor values for different current requirements are available on request.

### OPERATING SPECIFICATIONS

| Part No. L41-X-X-X | Voltage | Current (mA) | Internal* Resistor (Ohms) |
|---|---|---|---|
| 000 | 2 | 10 | none |
| 330 | 5 | 10 | 330 |
| 390 | 6 | 10 | 390 |
| 820 | 10 | 10 | 820 |
| 1000 | 12 | 10 | 1000 |
| 1300 | 15 | 10 | 1300 |
| 5100 | 28 | 05 | 5100 |
| 2700 | 28 | 10 | —— |

* Externally mounted to one lead due to physical size of resistor.




### HOW TO ORDER




### OPTO-ELECTRIC CHARACTERISTICS AT 25°C

| Characteristics | Minimum | | | Typical | | | Maximum | | | Units | | | Conditions | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Red | Green | Amber | Red | Green | Amber | Red | Green | Amber | Red | Green | Amber | Red | Green | Amber |
| Luminous Intensity | 1.0 | 0.8 | 1.0 | 2.5 | 2.0 | 2.5 | | | | mcd | mcd | mcd | $I_F$ = 10mA | $I_F$ = 20mA | $I_F$ = 10mA |
| Wavelength | | | | 635 | 565 | 583 | | | | nm | nm | nm | Measurement at Peak | | |
| Speed of Response | | | | 90 | 200 | 90 | | | | ns | ns | ns | — | — | — |
| Capacitance | | | | 20 | 8 | 15 | | | | pF | pF | pF | $V_F$ = 0, f = 1MHz | | |
| Thermal Resistance | | | | 95 | 95 | 95 | | | | °C/W | °C/W | °C/W | Junction to Cathode Lead at Seating Plane | | |
| Forward Voltage | | | | 2.2 | 2.4 | 2.2 | 3.0 | 3.0 | 3.0 | V | V | V | $I_F$ = 10mA | $I_F$ = 20mA | $I_F$ = 10mA |
| Reverse Breakdown Voltage | 5 | 5 | 5 | | | | | | | V | V | V | $I_R$ = 100μA | $I_R$ = 100μA | $I_R$ = 100μA |

### ABSOLUTE MAXIMUM RATINGS AT 25°C

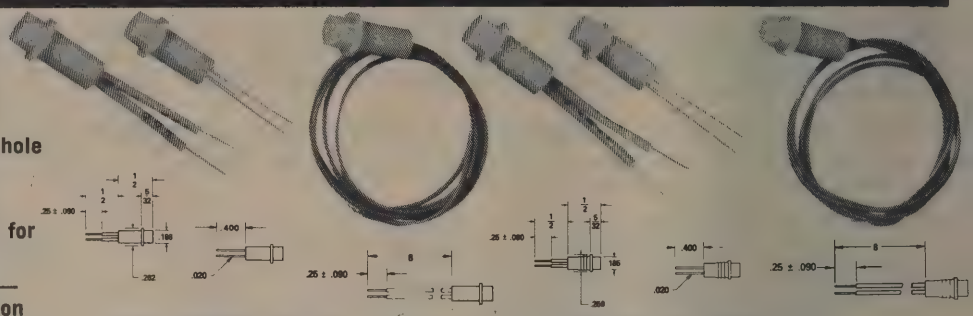
| Absolute Maximum Ratings at 25°C | Red | Green | Amber |
|---|---|---|---|
| Power Dissipation | 120mW | 120mW | 120mW |
| Derate Linearly from 50°C | 1.6mW/°C | 1.6mW/°C | 1.6mW/°C |
| Storage and Operating Temperature | −55°C to +100°C | −55°C to +100°C | −55°C to +100°C |
| Maximum Continuous Forward Current | 20mA | 30mA | 20mA |
| Peak Pulse Current, 1μs Pulse 1% Duty Cycle | 1A | 1A | 1A |

**LEDCO** ™ Div.
A DIVISION OF **WILBRECHT ELECTRONICS**
240 Plato Blvd. / St. Paul, MN 55107 / (612) 222-2791 TWX 910-563-3679

# LED, INCANDESCENT AND NEON INDICATOR LIGHTS

## CUSTOMIZED IN SEVEN DAYS

## ULTRA-MINIATURE INCANDESCENT



- Front mounting—3/16" clearance hole
- Available in 5 transparent and 5 translucent colors
- 400 series features ribbed body for snap in panel mounting
- Smooth body on the 300 series—mounting hardware supplied upon request
- Center-to-center mounting space 3/8" Series 300, 5/16" Series 400
- Standard 1/2" solid or 8" stranded insulated wire leads
- Custom lead lengths available
- Built-in T1 bulb
- 180° visibility
- Environmentally sealed
- Explosion proof
- High impact butyrate plastic—custom materials available
- Hot stamping legends available: Two 6 pt. (5/64") or one 8 pt. (3/32") characters in black or white
- 350 and 450 series available with nickel or gold finish BiPins

### BULB SPECIFICATIONS

| INCANDESCENT (Use Bulb Type Numbers) | | | |
|---|---|---|---|
| Bulb Type | Operating Voltage | Current Amperes | Hours Life |
| High Brightness | | | |
| HM609 | 5.0 | .115 | 40,000 |
| HM619 | 6.0 | .066 | 18,000 |
| HM619 | 6.3 | .067 | 10,000 |
| HM628 | 12.0 | .060 | 16,000 |
| HM630 | 14.0 | .065 | 16,000 |
| HM631 | 18.0 | .026 | 16,000 |
| HM642 | 28.0 | .024 | 16,000 |
| Standard Brightness | | | |
| HM605 | 5.0 | .020 | 5,000 |
| HM619 | 5.0 | .060 | 200,000 |
| HM628 | 10.0 | .055 | 160,000 |
| HM631 | 14.0 | .023 | 200,000 |
| HM642 | 24.0 | .022 | 110,000 |

Note: Other bulb types available upon request.

### STANDARD FEATURES

| Series | Wire | Lead Insulation | Temp | Volts |
|---|---|---|---|---|
| 300 & 400 | 30 AWG Solid | PVC .010 | 105°C | 300 |
| 390 & 490 | 28 AWG Stranded | PVC .010 | 105°C | 300 |

### LENS COLOR CODE

1. Transparent Amber
2. Transparent Red
3. Transparent Blue
4. Transparent Green
5. Transparent Clear
6. Transparent Yellow
7. Translucent Red
8. Translucent Blue
9. Translucent Green
10. Translucent White

### HOW TO ORDER

(See Bulb Chart and Lens Color Code)

Model Number — XXX-X-XXXX — Lens Color Code

Series No.

Termination
Wire Leads = 0
BiPins = 5
Long Leads = 9

Bulb Type (See Chart)

See Lens Code

## INCANDESCENT AND NEON

- Front mounting—5/16" hole clearance
- 1/2" mounting available with steel nickel bezel
- Mounting hardware available upon request
- Center-to-center 1/2" for 5/16", 3/4" for 1/2" mounting
- Built-in T1 3/4 incandescent or T2 neon long life bulb
- Environmentally sealed
- Explosion proof
- 180° visibility
- 5 transparent and 5 translucent colors available
- 2" stranded insulated leads or BiPins standard—custom lead lengths available
- High impact butyrate plastic-polycarbonate available
- 22 AWG PVC 1/32" insulated leads, 105°C 600 volt (7/30)
- BiPins—Brass, 1/2" hard, gold plated
- Hot stamping legends available; four 6 pt. 5/64"; three 8 pt. 3/32" or three 10 pt. 1/8" characters in black or white (not available on 100 series)

### HOW TO ORDER

(See Bulb Chart On Opposite Page)

Model Number — XXX-X-XXXX — Lens Color Code

Series No.

Termination
Wire Leads = 0
BiPins = 5
Long Leads Economy = 9

Mounting
5/16" Hole = 0
1/2" Hole Using Bezel = 2

Bulb Type (See Bulb Chart Opposite Page)

Lens Color Code (See Color Chart)

Note: † Standard colors for 700 Series may vary slightly from standard colors Series 100-200-500-600.

### LENS COLOR CODE

1. Transparent Amber
2. Transparent Red
3. Transparent Blue*
4. Transparent Green*
5. Transparent Clear
6. Translucent Yellow†
7. Translucent Red†
8. Translucent Blue*†
9. Translucent Green*†
10. Translucent White†

Note: * Blue and green lenses not recommended for use with neon bulbs.

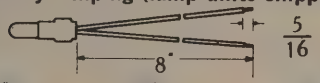
LEDCO™ Div.
A DIVISION OF WILBRECHT ELECTRONICS
240 Plato Blvd. / St. Paul, MN 55107 / (612) 222-2791 TWX 910-563-3679

# LED, INCANDESCENT AND NEON INDICATOR LIGHTS

## CUSTOMIZED IN SEVEN DAYS

## ECONOMY SERIES INCANDESCENT

- T1¾ incandescent bulbs with 28 AWG insulated 8″ stranded leads
- Friction fit for easy lamping (lamp units shipped unassembled)



Series 100 Series 200 Series 500 Series 600

### BULB SPECIFICATIONS

| Incandescent — (Use Bulb Type Numbers) | | | |
|---|---|---|---|
| Bulb Type | Operating Voltage | Current Amperes | Hours Life |
| **High Brightness** | | | |
| H524 | 5.0 | .180 | 50,000 |
| H529 | 6.3 | .200 | 50,000 |
| H533 | 10.0 | .070 | 50,000 |
| H538 | 14.0 | .080 | 50,000 |
| HM550 | 24.0 | .037 | 7,000 |
| HM553 | 28.0 | .040 | 25,000 |
| **Standard Brightness** | | | |
| M522 | 3.0 | .015 | 10,000 |
| M525 | 5.0 | .036 | 90,000 |
| M526 | 5.0 | .066 | 10,000 |
| M525 | 6.0 | .039 | 75,000 |
| M525 | 6.3 | .040 | 50,000 |
| M801 | 10.0 | .014 | 10,000 |
| M540 | 10.0 | .036 | 100,000 |
| M542 | 14.0 | .035 | 20,000 |
| HM550 | 18.0 | .032 | 100,000 |
| HM553 | 24.0 | .037 | 150,000 |
| M555 | 28.0 | .040 | 50,000 |

Note: Other bulb types available upon request.

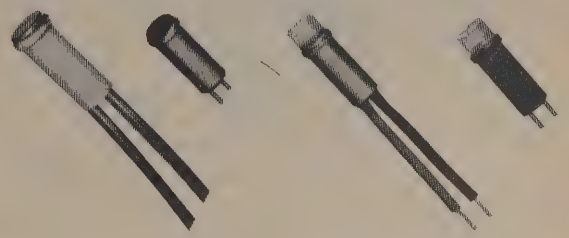
| NEON — (Use Bulb Type Number) | | | | | | |
|---|---|---|---|---|---|---|
| Bulb Type | Circuit Volts AC | Circuit Volts DC | Starting Volts AC | Starting Volts DC | Watts | Resistor Attached |
| **High Brightness — Dark Starting** | | | | | | |
| C2A | 115 | 150 | 95 | 135 | 1/4 | None* |
| RC2X | 115 | 150 | 95 | 135 | 1/4 | 30K ohm |
| **Standard Brightness — Not Recommended with Translucent Lens** | | | | | | |
| A9A | 115 | 115 | 65 | 90 | 1/15 | None* |
| RA9X | 115 | 115 | 65 | 90 | 1/15 | 100K ohm |

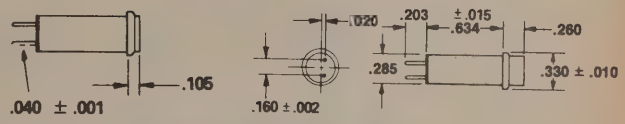
Economy version available — (unit sealed and no insulation on leads). To order place "N" before bulb type.

Note: * Neon assemblies without resistor attached require a current limiting device in the circuit.

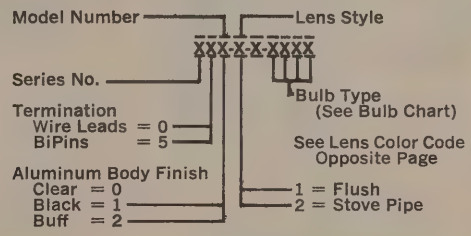
## ALUMINUM BODIED CARTRIDGE LIGHTS

- Anodized aluminum body — internally insulated
- Front mounting in 9/32″ clearance hole
- Stainless steel BiPin terminals (insulated from body) or 2″ stranded insulated leads
- Rapid assembly with optional mounting hardware



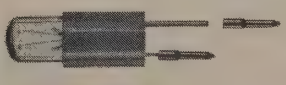


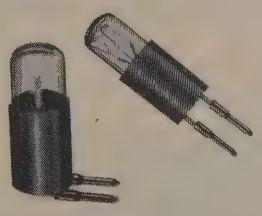

### HOW TO ORDER (700 SERIES ONLY)

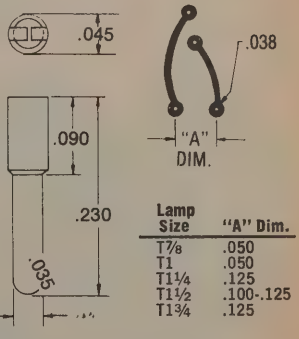



## PC BOARD SOCKET PINS — MODEL SP-210

- Economy socket pins for lamps, LED's or other components
- Solders easily to PC boards — wave, hand, or flow
- Provides component replacement without additional soldering
- Accepts straight or right-angle leads
- Strong internal spring retention
- Accepts male leads to .020 dia and .180 long
- Mounts in .038 hole clearance (#62 drill)
- Base metal — beryllium copper
- Gold plating — 10 m in. 24k



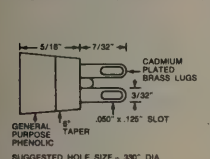




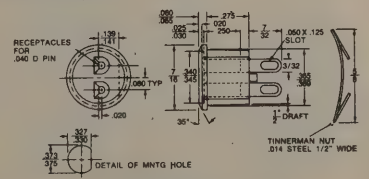

| Lamp Size | "A" Dim. |
|---|---|
| T7/8 | .050 |
| T1 | .050 |
| T1¼ | .125 |
| T1½ | .100-.125 |
| T1¾ | .125 |

For price information call

## SOCKETS AVAILABLE FOR BIPINS ASSEMBLIES




S-101




S-102

**LEDCO** ™ Div.
A DIVISION OF **WILBRECHT ELECTRONICS**
240 Plato Blvd. / St. Paul, MN 55107 / (612) 222-2791 TWX 910-563-3679

# LEECRAFT

## INDICATOR LIGHTS • LAMPHOLDERS • SWITCHES

NEON — INCANDESCENT — LED

**MIDGET GROOVED**
**25-00 SERIES**

Solder Terminals, wire leads, or P/C mounting.

**MIDGET SCREW**
**16-00 Series**

Solder terminals, wire leads, or P/C mounting.

**SUB-MINIATURE**
**WEDGE BASE**
**53-00 Series**
For T1 3/4 Lamps

Solder terminals, wire leads or P/C mounting.

**MINIATURE**
**WEDGE BASE**
**23-00 Series**
For T-3 1/4 Lamps

Solder terminals, wire leads or P/C mounting.

**MINIATURE SCREW**
**5-00 Series**
**CANDELABRA SCREW**
**6-00 Series**

Solder terminals or P/C mounting.

**MINIATURE**
**BAYONET**
**7-00 Series**

Solder terminals or P/C mounting.

**MINIATURE BAYONET**
**2-00 Series**
**3-00 Series**

Wire leads. (2-00-1 Series-grounded)

**CANDELABRA BAYONET**
**DOUBLE CONTACT**
**57 and 12 Series**
**SINGLE CONTACT**
**11 and 10 Series**

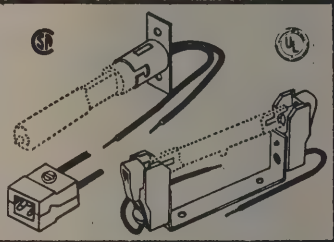
Tab or solder terminals, wire leads.

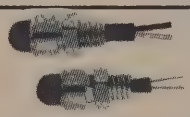
**CANDELABRA**
**SCREW**
**4-00 Series**
Wire leads.
**18-00 Series**
Solder terminals.

**INTERMEDIATE SCREW**
**14-00 Series**
Wire leads.
**8-00 Series**
Solder terminals.

**QUARTZ IODINE**

2600 Series for Double Ended Quartz type lamps. 2200 Series for double contact Quartz lamps. Metal tabs or wire leads.
21 Series for T2 1/4 Quartz Halogen wedge base lamps.



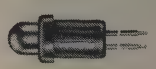


**LED**
**SERIES L58**

High brightness LED's, micro size. Unaffected by shock and vibration. Wide viewing angle. Red, green, yellow. Square Bezel available. Mounting hole .191".

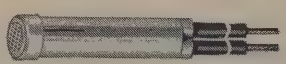
**LED SERIES L45**

High brightness LED's. Available with internal dropping resistor and a variety of lens/Bezels. 5/16" mounting hole.



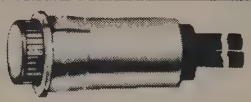
**LED SERIES L59**

Low cost all plastic construction. Black bezel/housing for high contrast. 6" wire leads or wire type terminals.



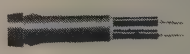
**TINEON SERIES 36**

Long life neon or incandescent lamps. Press fit into 5/16" hole. Built-in resistor. A variety of lens/bezels.



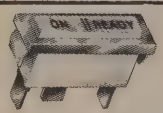
**SNAPLITE SERIES 32**

Available in full range of voltages. Lamps and terminations. Flush, square, High Hat lenses and bezels. Snap fits 1/2" hole.



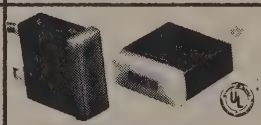
**TINEON SERIES 65**

Ultra compact for minimum back panel projection. Stranded leads or tab terminals. Built in resistor for neon lamp. Mounting ears for snap fit in 5/16" hole.




**RECTANGULAR**
**INDICATOR**
**SERIES 31D**

Dual message indicator with neon or incandescent lamps. All lens colors. Chrome or plastic bezel available. Snap fit in 1.281" x .395" hole.

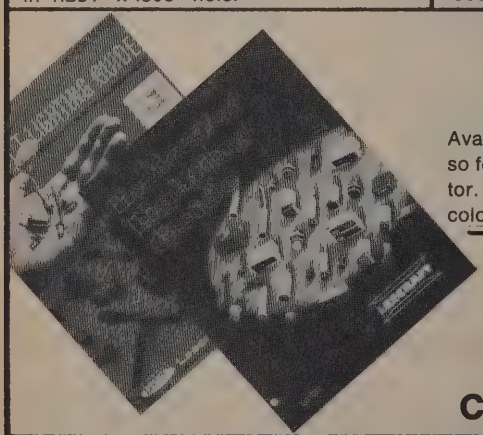


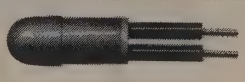
**RECTANGULAR**
**TRIM-LINE**
**SERIES 4800**

Distinctive tapered lens enhances front panel styling. One piece hi-impact plastic construction snaps securely in .325" x .860" hole.

**MIDGET**
**SCREW**
**SERIES 49**

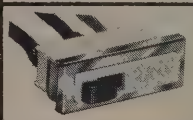
Available with flat or dome lens. Front panel replaceable incandescent lamps. Lens available in all colors with or without hot stamped legend. 7/16" mounting hole.





**WATER PROOF SERIES 56**

Available 6-14-28 Volts incandescent. Also for 115 or 220 Volts with external resistor. One piece Lexan construction in all colors. Mounts [illegible]/16" hole.



**SLIDELITE**
**SERIES 51**

Lighted slide switch and indicator combination. Available in low and line voltages. Contacts rated at 6 Amps., 125V AC. 1.281" x .395" mounting hole.

**WRITE FOR CATALOG**

**LEECRAFT MANUFACTURING CO., INC.**

21-16 44th ROAD, LONG ISLAND CITY, N.Y. 11101
(212) 392-8800 TWX: 710822897

# OPTO-ELECTRONICS

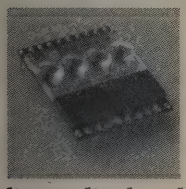
## The broadest selection available anywhere

Now Litronix offers an opto-electronic device for virtually every application. Over 300 LED displays, LED lamps, opto-isolators, IR emitters, photo-detectors and photo-voltaic cells. And more are coming every month.

You will find advanced products not available anywhere else. As well as widely-used standard devices at highly competitive prices.

Some highlights:

### ALPHANUMERIC LED DISPLAYS.

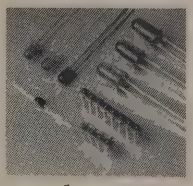


Character sizes from 0.16″ to 0.50″ in end-stackable arrays of 1 to 4 red characters — including an intelligent display that interfaces just like a RAM to μP buses.

### DIGITAL LED DISPLAYS.

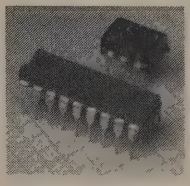
Green, yellow and red digits. Nine sizes from 0.1″ to 1″ high. In DIPs of 1 and 2 digits. On PCBs of 2 to 6 digits with edge connectors. Both light-pipe displays with very wide viewing angle and low-cost reflector displays. 70 different types.

### LED LAMPS.



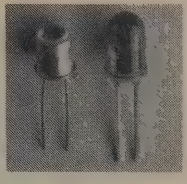
Red, orange, yellow and green lamps. T-1, T-1¾ and axial packages. Arrays of 2 to 10 lamps. With panel mounting clips. Lamps that flash on/off. Constant brightness lamps. Voltage-indicating lamps. 58 different types.

### OPTO-ISOLATORS.



One, two and four-channel opto-isolators. Current transfer ratios up to 320%. Isolation voltages up to 5000v. Transmission rates as high as 4 megabits/sec. 15 JEDEC types. 25 different types in all.

### IR EMITTING DIODES.



From medium to very high power. Beam widths from 6° to 60°. Hermetic and non-hermetic TO-18 size. Miniature with axial or radial leads. 30 different types.

### PHOTO-DETECTORS.

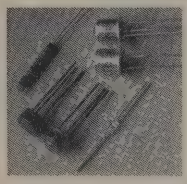
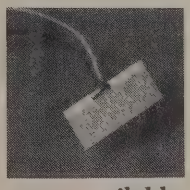


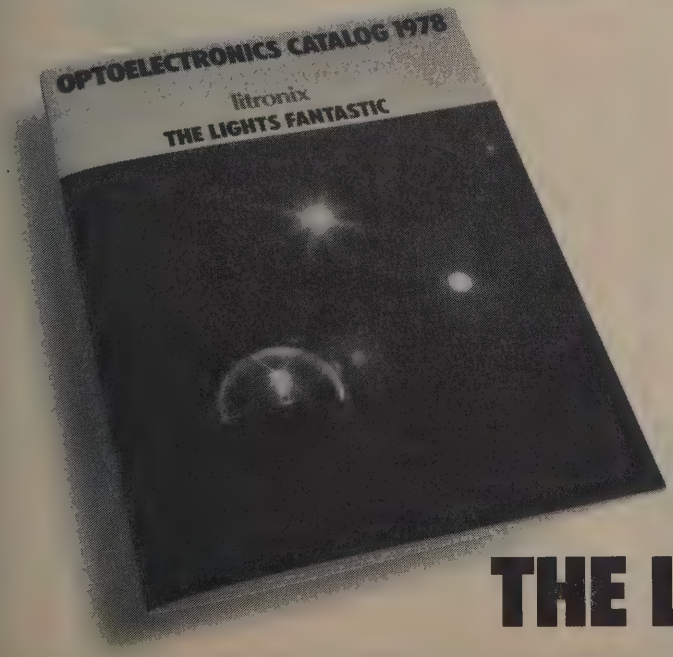
Photo-transistors and photo-diodes with acceptance angles from 6° to 73°. Hermetic high-reliability devices and low-cost non-hermetic devices. TO-18 packages, ceramic packages and miniature radial lead configurations. Arrays of 2 to 10 detectors. 47 different types.

### PHOTO-VOLTAIC CELLS.



Silicon solar cells. Sensitivity from .04 microamperes to 2.8 microamperes. Twelve different types available.

For a well-illustrated 36-page catalog containing data on all devices in the product categories above phone your local distributor. Or contact Litronix at 19000 Homestead Road, Cupertino, CA 95014. Phone (408) 257-7910.




**Send for 36-page catalog**

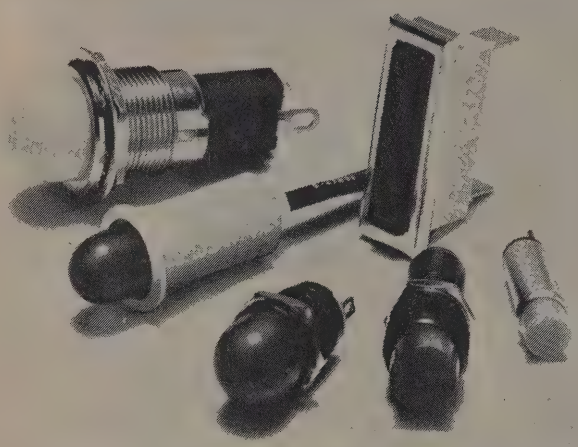
**litronix**

AN AFFILIATE OF SIEMENS

**THE LIGHTS FANTASTIC**

LITTELITES

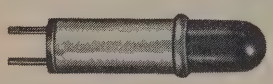
# INDICATOR LIGHTS. . .



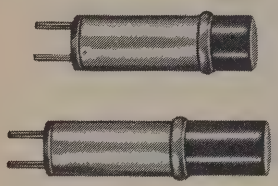
- **Broad line** . . . Littelites include Cartridge Lamps and Lampholders, Subminiature Lampholders, Miniature Lampholders, and Snap-Mount Plastic Lites . . . we offer a wider selection among these four product groups than any other single manufacturer.
- **UL/CSA** . . . All Littelites are UL Recognized or Listed and CSA Certified. New tools and molds assure you of the finest quality lights on the market today.
- **Fast** turn-around on large volume orders.
- **Off-the-shelf** availability from a nationwide network of Littelites distributors.
- **Special** requirements? Just give us a call (312) 824-1188.

## CARTRIDGE LAMPS/LAMPHOLDERS

SEND FOR CATALOG LL-C574

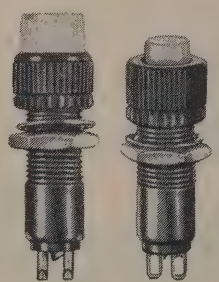


UL RECOGNIZED
CSA CERTIFIED
MEET MIL-L-3661 REQUIREMENTS



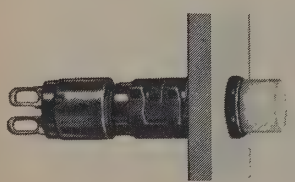
### Cartridge Lamps

Incandescent, neon, or solid state. Solid state units supplied with green, red, yellow, or amber LEDs. All cartridge lamps offer a wide choice of lens styles and colors. Mate with cartridge lampholders shown below.



### Cartridge Lampholders

Designed for rear mounting into 3/8" clearance hole. Turret pin, solder lug, or solder cup terminals. Available with flat for "D" hole mounting. Supplied separately or as complete assembly, which includes lens cap (smooth or fluted) or lens collar (.284" or .230" wide).

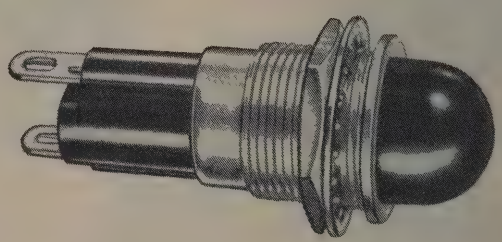


### Clips and Sockets

Provides inexpensive means of mounting cartridge lamps directly to the panel. Solder lug or solder cup terminals. Clip secures cartridge lamp in 9/32" mounting hole.

## MINIATURE LAMPHOLDERS

SEND FOR CATALOG LL-M574



- For front mounting into 11/16" clearance hole.
- Accommodate T3-1/4 or T2 bayonet based incandescent lamps and T3-1/4 bayonet based neon lamps.
- Screw or solder lug terminals
- Drip proof and "D" hole mounting available.
- Neon lampholders feature built-in resistor.
- Six basic lens styles available in wide choice of colors.
- **UL Listed, CSA Certified** (Solder Lug Terminals)
  **UL Recognized, CSA Certified** (Screw Type Terminals)

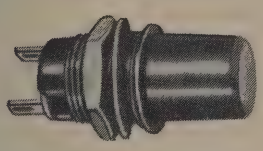
# . . . FROM LITTELFUSE

LITTELFUSE

## SUBMINIATURE LAMPHOLDERS

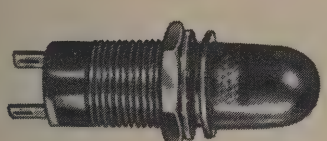
**SEND FOR CATALOG LL-S574**

Subminiature lampholders accommodate T1-3/4 incandescent or T2 neon midget flanged base lamps. All lampholders allow easy installation and replacement of the lamp and lens from the panel front. **UL Recognized. CSA Certified.**



### 920 Series

For front mounting into 15/32" clearance hole. Accept a T1-3/4 incandescent midget flanged base lamp (1.35-28V). Choice of four different lens styles. Meet requirements of MIL-L-3661.



### 921 Series

Front mounting into 15/32" clearance hole. Accommodate replaceable T2 neon midget flanged base lamps (C7A—105-125V AC-DC or C9A—110-125VAC). Built-in resistor limits lamp current. Meet requirements of MIL-L-3661.

### 922 Series

Three different mounting configurations: **922 Series**—front mount—15/32" clearance hole; **923 Series**—front mount—17/32" clearance hole; **924 Series**—front or rear mount—15/32" clearance hole.

Accept a T1-3/4 incandescent midget flanged base lamp (1.35-28V). Choice of four lens styles.

### 925, 926, 927 Series

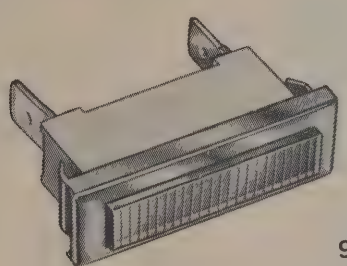
Three different mounting configurations: **925 & 926 Series**—rear mount—3/8" hole; **927 Series**—front mount—15/32" hole.

Accommodate either T1-3/4 incandescent or T2 neon midget flanged base lamps. Three different lens styles in smooth face or fresnel. Lampholders and lenses can be furnished with gaskets for drip proof applications.

## SNAP-MOUNT PLASTIC LITES

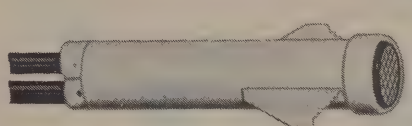
**SEND FOR CATALOG LL-P574**

Designed to snap into mounting hole without the use of auxiliary hardware. The 970 and 980 Series feature a pair of flex arms which ensure positive retention and protection against shock and vibration. **UL Listed. CSA Certified:** All units with wire leads.
**UL Recognized. CSA Certified:** Units with Q.C. Terminals.



### 960 Series

Snap-mount into 1.281" x .395" mounting hole. Available with neon (125-250V) or incandescent (6-28V) lamps. Can be supplied with 6" wire leads, 1/4" or 3/16" Q.C. terminals. Choice of fluted or smooth face lens.



### 970 Series

Snap-mount into .312/.318" diameter hole. Available with neon (125-250V), incandescent (6-28V) or solid state (1.8-28V) lamps. Solid state units supplied with red, yellow, amber, or green LEDs. Terminations include 6" wire leads or .125" Q.C. terminals. Choice of eight lens styles.

### 980 Series

Snap-mount into .500/.510" diameter hole. Available with neon (125-250V) or incandescent (6-28V) lamps. 6" wire leads or .187" Q.C. terminals. Fresnel lenses in six different styles.

**LITTELFUSE**
SUBSIDIARY OF TRACOR

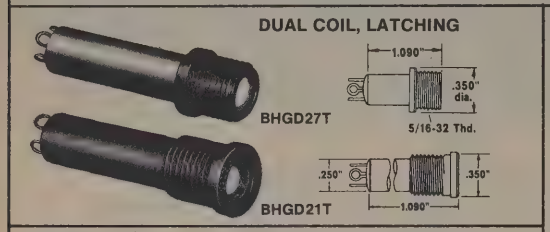
800 EAST N.W. HWY. • DES PLAINES, ILL. 60016
(312) 824-1188

# MINELCO

## BALL AND FLAG INDICATORS*

a **TALLEY INDUSTRIES** Company

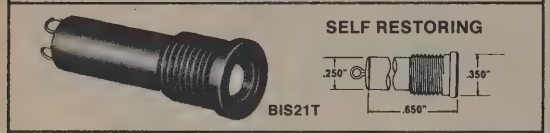
135 South Main Street, Thomaston, CT 06787
Phone 203-283-8261



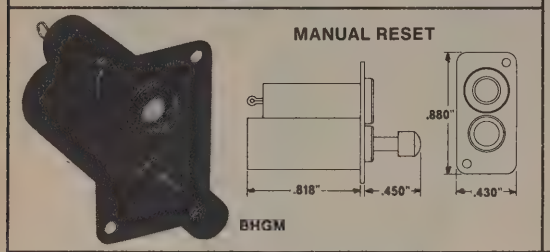

### MAGNETIC BALL INDICATORS
**(Electro-magnetically actuated displays.)**

An electrical pulse to unit rotates a 2-color ball to display the opposite color. No filaments to burn out or fail when used within limits. Power drain is negligible. Mounting configurations (hardware provided) include front or rear panel, sleeve or threaded. Seven standard colors and seven standard voltages 1.5 to 28 VDC. Op. temperature range is −65°C to +125°C. Units withstand over 20 G's vibration and 100 G's shock. Sleeve-mounting and manual reset tools are available. Special modifications include radiused dome lens, edge-lit lens, non-glare glass, O-Ring panel seal, square case, RFI shielding, internal diodes, flatted cases, and insulated lead wire terminations.

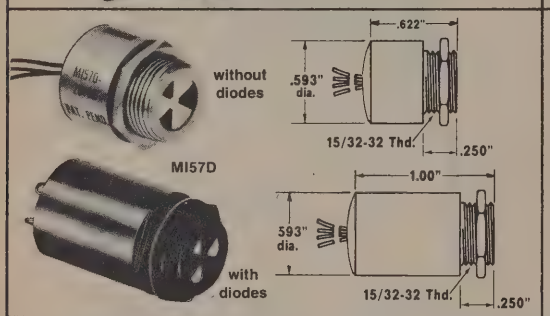
**Dual Coil Latching** Latching models retain fault color after the pulse is removed. Two discreet coils provide for SET and RESET. By far the most popular of Fault Indicators. Units retain reading in either mode magnetically with no power required. May also be reset with RT-22 reset tool. **Single Coil Latching** models are electrically SET by applying a 20 millisecond pulse to coil; electrically RESET by reversing polarity. Both models Qualified to MIL-1-81663/1 and MIL-1-83287/3.
(See Bulletin B-11 for details).



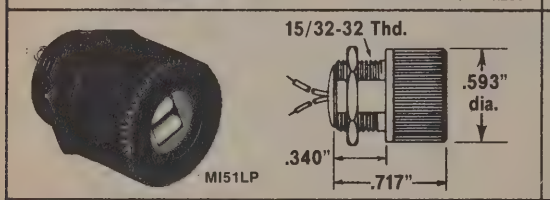

**Self-Restoring** models are ideal for Power-Off indication. Small, reliable, the display ball is magnetically biased to return and magnetically latch to its unenergized color when power fails. (See Bull. B-12 for details).



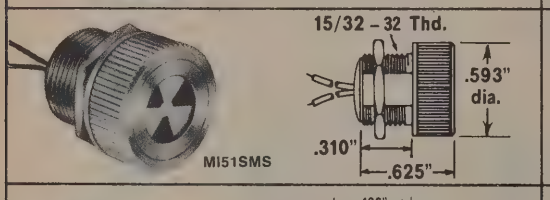

**Manual Reset** single coil model is electrically SET to display fault. No electrical switching or mechanical interlocking is required for RESET. Unit is reset by the magnetic field released by depressing the push button. (See Bull. B-13 for details).



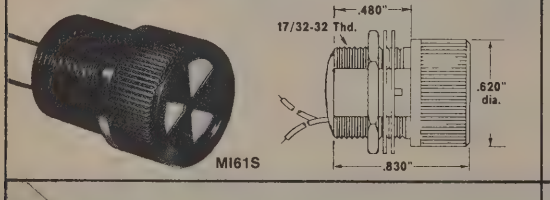

### MI57D (Dual Coil Elec. Reset.)
An internal-flag indicator requiring only pulse power to change color. No-Fault display can be ordered all white or all black. 25 ms pulse changes flag position to show segmented Fault color. Retains display after pulse by magnetically latching in position with no further power requirement. Reset is electrical. Features low power drain, positive indication, excellent visibility, high sensitivity, and fast response. Unit sealed and impervious to humidity, dust and salt spray. Standard display colors: black, white and red. Available in 6 to 28v dc. Operating temperature range: −65°C to +125°C. Available with or without arc suppression and/or steering diodes. Qualified to Mil-1-83287/2. (See Bulletin M-11).



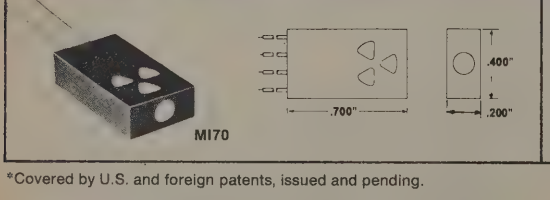

### MI51LP (Low Power Manual Reset.)
A manually resettable magnetic latching indicator requiring only 50 milliwatts pulse power to operate. Ideal for direct interface with TTL logic. Indicator displays red or white color upon application of a pulse width of 25 milliseconds. Display magnetically latches and holds pulse color until knurled knob is rotated 60 degrees clockwise, resetting indicator to all-black display color. Available in 1.5 to 28v dc. Operating temperature range: −65°C to +125°C. Qualified to Mil-1-83287/4. (See Bulletin M12).




### MI51SMS (Flag Indicator. Manual Reset.)
When a fault occurs, an electrical pulse causes the internal flag of this indicator to rotate to a position where it is positively held in a magnetic-locked FAULT position. It can be manually reset to NO FAULT position by rotating knob 60°. Can be special-ordered for both electrical and manual reset. Indicator provides positive indication under shock and vibration, and offers excellent visibility in strong incident light. Available in 6 to 28v dc. Operating temperature range −65°C to +125°C. (See Bulletin M-13).




### MI61S (Flag Indicator. Manual Reset or Elec. Reset.)
This internal flag, magnetic-latching indicator can be manually reset. When a fault occurs, a triggered electrical pulse causes the flag to rotate to a position where it is postively held in a magnetic-locked position. It may be reset by rotating knurled knob clockwise 60 degrees. The knob spring returns to its normal position. Unit is environmentally sealed and offers excellent visibility in strong ambient light. Available in 3 to 28v dc. Operating temperature range: −65°C to +125°C. Qualified to Mil-1-83287/1. (See Bulletin M-17).




### MI70 (Flag Indicator. Internal Switches.)
Designed to fit the latest requirements and concepts of modular packaging, particularly those of modern avionic systems where miniaturization and reliability are the basic criteria. A dual-view, low-profile unit for PC or panel mounting. Internal switching can also be provided to allow either isolated signal switching or internal switching. Arc suppressing diodes can be packaged internally. Available in 6 to 28v dc. Temperature range: −65°C to +105°C. (See Bulletin M-16).

*Covered by U.S. and foreign patents, issued and pending.

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# INDICATOR SELECTION GUIDE

## INCANDESCENT

| SIZE | DESCRIPTION | SERIES | PAGE NO. |
|---|---|---|---|
| T-1 | General Purpose, Sub-Miniature | 99-33180 | 34 |
| | | 99-33081 | 35 |
| | | 99-33080 | 35 |
| | | 99-36980 | 36 |
| | | 99-36981 | 36 |
| | | 99-36982 | 36 |
| | Sub-Miniature, E.M.I. Suppressed | 98-36980 | 36 |
| | | 98-36981 | 36 |
| | | 98-36982 | 36 |
| | Sub-Miniature, Watertight | 95-33180 | 36 |
| T-1¾ | General Purpose, Miniature | 14-33880 | 37 |
| | | 14-33881 | 37 |
| | | 14-33882 | 37 |
| | | 14-34080 | 38 |
| | | 14-35180 | 38 |
| | | 14-36380 | 39 |
| | | 14-30380 | 39 |
| | | 14-30080 | 40 |
| | | 59-52380 | 41 |
| | | 59-52480 | 41 |
| | | 11-33480 | 42 |
| | General Purpose, Miniature, Press-to-Test | 59-52280 | 41 |
| | | 03-90980 | 42 |
| | | 03-91080 | 43 |
| | | 01-91180 | 44 |
| | Watertight | 15-30083 | 44 |
| | | 15-35182 | 45 |
| | | 15-35183 | 45 |
| | | 11-35182 | 45 |
| | Watertight, Press-to-Test | 05-91182 | 46 |
| | | 05-90880 | 46 |
| | | 05-90881 | 46 |
| | E.M.I. Suppressed | 18-36880 | 47 |
| | E.M.I., Press-to-Test | 08-83281 | 47 |
| | E.M.I., Watertight | 18-36680 | 47 |
| | E.M.I., Watertight, Press-to-Test | 08-83283 | 48 |
| T-3¼ | General Purpose | 13-VM305 | 49 |
| | | 13-VM309 | 49 |
| | General Purpose, Press-to-Test | 04-VM905 | 49 |
| | | 04-VM906 | 49 |
| | | 02-91180 | 50 |
| | Watertight, Press-to-Test | 06-91182 | 50 |
| | E.M.I. Suppressed | 18-83680 | 51 |

## NEON

| SIZE | DESCRIPTION | SERIES | PAGE NO. |
|---|---|---|---|
| T-1 | Sub-Miniature | 99-33080 | 35 |
| | | 99-33081 | 35 |
| T-2 | General Purpose, Miniature | 22-35380 | 51 |
| | | 31-36180 | 53 |
| | | 31-36280 | 53 |
| | | 33-36181 | 52 |
| | | 33-36281 | 52 |
| | | 33-30880 | 52 |
| | | 33-30881 | 52 |
| | Watertight | 31-36680 | 53 |
| | | 31-36681 | 53 |
| | E.M.I. Watertight | 38-36680 | 48 |
| | | 38-36681 | 48 |
| | E.M.I. Suppressed | 38-36180 | 54 |
| | | 38-36280 | 54 |
| | | 38-36480 | 54 |
| | | 38-36481 | 54 |
| T-3¼ | E.M.I. Suppressed | 38-83681 | 55 |
| | | 38-83682 | 55 |

## LIGHT EMITTING DIODE (L.E.D.)

| SIZE | DESCRIPTION | SERIES | PAGE NO. |
|---|---|---|---|
| | General Purpose, Miniature | QT/D300 | 55 |
| | | 14-35380 | 55 |

## RECTANGULAR MISSILITES

| DESCRIPTION | PAGES |
|---|---|
| Dual lamp word warning indicators | 56-63 |

▪ UL Recognized
▢ MILITARY APPROVED, See Pages 64 and 65

**OAK Industries Inc.**
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

## Indicators

# INDICATOR LIGHTS

This Indicator Light section of the catalog has been compiled to provide the necessary specification information as concisely as possible, so the design or packaging engineer may readily select the unit which best meets his needs. In particular, the Indicator Selection Guide presents a speedy method of narrowing down the total number of indicators in this catalog to a small group for more detailed consideration.

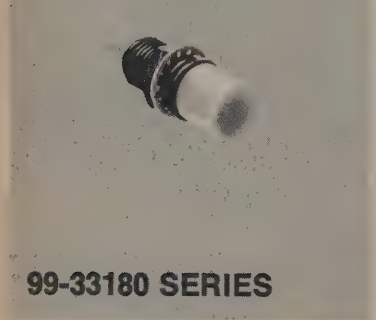
As more and more indicators became available, the old system of requiring the customer to construct his own part number became more and more cumbersome. In this catalog, for the first time, complete assembly part numbers are tabulated for each indicator/cap combination. Very simple substitutions in these numbers allow changes in color, substitution of translucent for transparent lenses, etc. As in the past, the desired lamp number is added as a suffix to the part number. This new method in no way represents a change in the previous numbering system; it is only a faster method for determining the proper number.

These panel indicators embody the best of military and commercial materials and performance features. Materials, finishes, and workmanship, are more than adequate for conformance to Military, Federal, or industry specifications. In particular, pages 64 and 65 present a cross reference listing of Oak indicators which are on the MIL-L-3661B Qualified Products List, and also those which may be ordered against MS (Military Standard) designations.

Because of the wide variety of items in the Oak Switch Division Indicator Light line, it is possible in most cases to select a standard, off-the-shelf unit to meet a precise requirement. Innumerable variations can also be furnished, such as caps in special color combinations, lettered to meet your needs, either hot stamped, or engraved and filled.

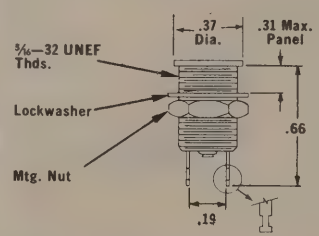
The Oak Switch Division sales staff is always at your service whenever additional information or assistance is required.

## sub-miniature



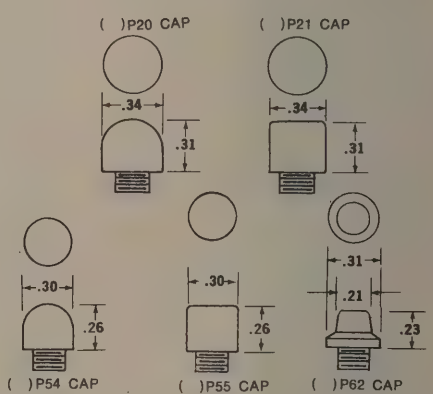
## 99-33180 SERIES

### BASE ASSEMBLY
99-33180




SCHEMATIC

### CAP STYLES




**Notes:**

1. **Material and Finishes:** Mounting tube, black glass filled nylon per MIL-M-19887. Mtg. nut aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a.
3. **Lamp:** T-1 sub-midget flange base. See lamp selection guide. Choose from Group M.
4. **Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended mounting hole .328 + .015 — .000 diameter.
5. **Weight:** Approx. .12 oz less lamp.

| Complete Assembly Part Numbers (Less Lamp) | | | | | |
|---|---|---|---|---|---|
| Transparent Lens Colors | ( )P20 Cap | ( )P21 Cap | ( )P54 Cap | ( )P55 Cap | ( )P62 Cap |
| Clear* | 99-33180-5P20 | 99-33180-5P21 | 99-33180-5P54 | 99-33180-5P55 | 99-33180-5P62 |
| Red | 99-33180-6P20 | 99-33180-6P21 | 99-33180-6P54 | 99-33180-6P55 | 99-33180-6P62 |
| Green | 99-33180-7P20 | 99-33180-7P21 | 99-33180-7P54 | 99-33180-7P55 | 99-33180-7P62 |
| Amber | 99-33180-8P20 | 99-33180-8P21 | 99-33180-8P54 | 99-33180-8P55 | 99-33180-8P62 |
| Blue | 99-33180-11P20 | 99-33180-11P21 | 99-33180-11P54 | 99-33180-11P55 | 99-33180-11P62 |
| Yellow | 99-33180-12P20 | 99-33180-12P21 | 99-33180-12P54 | 99-33180-12P55 | 99-33180-12P62 |
| Orange | 99-33180-16P20 | 99-33180-16P21 | 99-33180-16P54 | 99-33180-16P55 | 99-33180-16P62 |
| Lunar | 99-33180-17P20 | 99-33180-17P21 | 99-33180-17P54 | 99-33180-17P55 | 99-33180-17P62 |

Translucent colors: Add "TL" as suffix to Part No.
( ) Designates color selection.
*White if translucent color specified

## sub-miniature "little QT"

## 99-33080 SERIES
## 99-33081 SERIES

**Notes:**

**1. Materials and Finishes:** Housing and lamp base, gray glass filled nylon. Terminals, beryllium copper, gold flashed. Retainer clip, stainless steel.

**2. Lens Cap:** High impact resistant plastic per L-P-393. (polycarbonate)

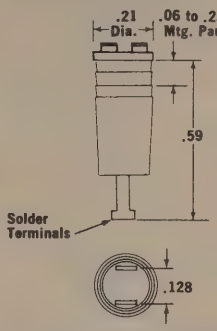
**3. Lamp:** Assembly accepts IPI based T-1 lamp, see lamp selection below. Lamp is replaced by removing snap-on cap.

**4. Mounting:** Two types optional.

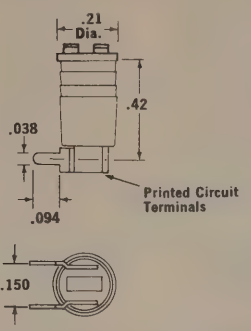
A. Press-in; Assembly press fits into .189 dia. hole. No mounting hardware required.

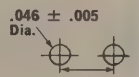
B. Retainer clip; For mounting assembly into .200 ±.005 dia. hole or panels less than .06 thick. Order clip 067003000 separately.

**BASE ASSEMBLY 99-33080**

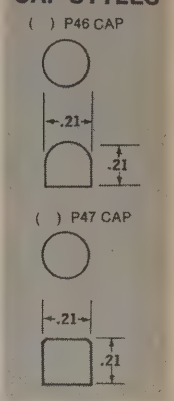



**BASE ASSEMBLY 99-33081**



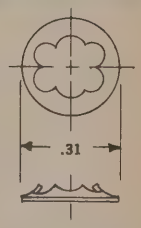

**CAP STYLES**




| Complete Assembly Part Numbers (Less Lamp) ** | | |
|---|---|---|
| Transparent Lens Colors | ( )P46 Cap | ( )P47 Cap |
| Clear* | 99-33080- 5P46 | 99-33080- 5P47 |
| Red | 99-33080- 6P46 | 99-33080- 6P47 |
| Green | 99-33080- 7P46 | 99-33080- 7P47 |
| Amber | 99-33080- 8P46 | 99-33080- 8P47 |
| Blue | 99-33080-11P46 | 99-33080-11P47 |
| Yellow | 99-33080-12P46 | 99-33080-12P47 |
| Orange | 99-33080-16P46 | 99-33080-16P47 |
| Lunar | 99-33080-17P46 | 99-33080-17P47 |

Translucent colors: add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Indicates color designation.
For printed circuit terminals change 99-33080 to 99-33081
**To order with lamp installed, add Lamp Number No. as suffix to Part No.
Example: 99-33080-5P46-001

**SCHEMATIC**



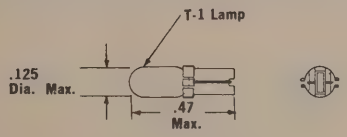

Optional Mtg. Clip 067003000 (Order Separately)

## "little QT" lamps

**Notes:**

**1. Lamp Bases** are color coded for operating voltage as follows:

| | |
|---|---|
| Blue | 1.5 volts |
| Yellow | 3.0 volts |
| Black | 5.0 volts |
| Green | 10.0 volts |
| Gray | 12.0 volts |
| Purple | 14.0 volts |
| White | 18.0 volts |
| Red | 28.0 volts |
| Brown | 115.0 volts AC |




| Little QT™ Lamp Selection | | | | | |
|---|---|---|---|---|---|
| Lamp No. | Volts | Amps | MSCP | Average Life (Hrs.) | ANSI No. (Ref.) |
| 001 | 1.5 | .010 | .002 | 10,000 | 7200 |
| 002 | 1.5 | .015 | .01 | 10,000 | 7201 |
| 003 | 1.5 | .060 | .02 | 50,000+ | 7202 |
| 004 | 1.5 | .075 | .03 | 16,000+ | 7203 |
| 005 | 3.0 | .060 | .03 | 100,000 | 7207 |
| 006 | 3.0 | .120 | .15 | 16,000 | 7208 |
| **007** | **3.0** | **.008** | **.01** | **16,000** | **7204** |
| **008** | **5.0** | **.015** | **.02** | **10,000** | **7209** |
| **009** | **5.0** | **.060** | **.05** | **100,000** | **683** |
| 010 | 5.0 | .075 | .09 | 25,000 | 713 |
| 012 | 5.0 | .115 | .20 | 5,000 | 7213 |
| **013** | **5.0** | **.060** | **.03** | **100,000** | **680** |
| 014 | 5.0 | .115 | .19 | 10,000 | 7215 |
| 015 | 5.0 | .125 | .25 | 5,000 | 7216 |
| **024** | **5.0** | **.115** | **.15** | **40,000** | **715** |
| 025 | 5.0 | .060 | .15 | 6,500 | 6150 |
| **016** | **10.0** | **.027** | **.10** | **10,000** | **7218** |
| **017** | **12.0** | **.060** | **.15** | **16,000+** | **7219** |
| 027 | 14.0 | .040 | .15 | 16,000 | 23 |
| **018** | **18.0** | **.026** | **.15** | **10,000** | **7220** |
| **022** | **28.0** | **.024** | **.15** | **16,000+** | **6838** |

Bold face type indicates most popular lamps generally available directly from stock.

To Order Lamps Separately Specify 100057 ( )
Lamp No. From Tabulation
Example: 100057001

**OAK Industries Inc.**
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# Indicators

## sub-miniature, optional E.M.I. suppression

**98-36980 SERIES**
**99-36980 SERIES**

**Notes:**

**1. Materials and Finishes:** Mounting tube and nut are stainless steel, passivated per MIL-S-5002. Wire leads #26 GA silver coated, stranded copper with TFE-flurocarbon insulation.

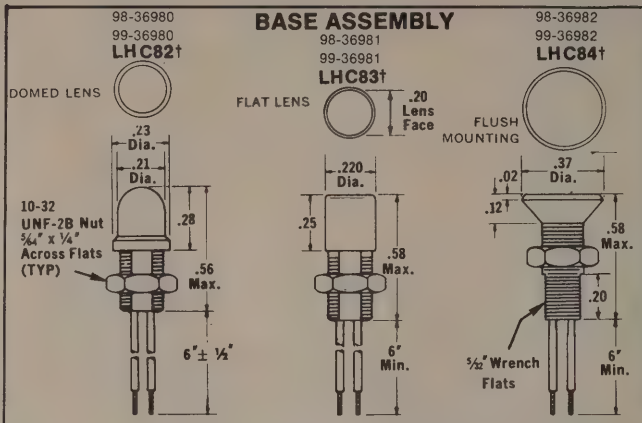
**2. Lens Assembly:** Lens is high impact-resistant plastic per L-P-393 (polycarbonate).

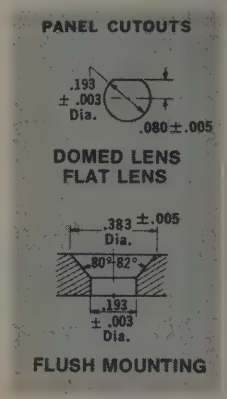
**3. Lamp:** (non-replaceable) MS 24367-683 subminiature T-1 with 5.0V @ .060 AMP rating.

**4. Weight:** Approx. 0.005 lbs. maximum.

**5. Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. E.M.I. suppressed assemblies require paint free area on back side of mounting hole for E.M.I. conductivity.

### BASE ASSEMBLY




| Complete Assembly Part Numbers (Includes Lamp) | | | | | | |
|---|---|---|---|---|---|---|
| | E.M.I. Suppressed | | | Not E.M.I. Suppressed | | |
| Transparent Lens Colors | Domed Lens | Flat Lens | Flush Mounting | Domed Lens | Flat Lens | Flush Mounting |
| Clear* | 98-36980-5 | 98-36981-5 | 98-36982-5 | 99-36980-5 | 99-36981-5 | 99-36982-5 |
| Red | 98-36980-6 | 98-36981-6 | 98-36982-6 | 99-36980-6 | 99-36981-6 | 99-36982-6 |
| Green | 98-36980-7 | 98-36981-7 | 98-36982-7 | 99-36980-7 | 99-36981-7 | 99-36982-7 |
| Amber | 98-36980-8 | 98-36981-8 | 98-36982-8 | 99-36980-8 | 99-36981-8 | 99-36982-8 |
| Blue | 98-36980-11 | 98-36981-11 | 98-36982-11 | 99-36980-11 | 99-36981-11 | 99-36982-11 |
| Yellow | 98-36980-12 | 98-36981-12 | 98-36982-12 | 99-36980-12 | 99-36981-12 | 99-36982-12 |
| Orange | 98-36980-16 | 98-36981-16 | 98-36982-16 | 99-36980-16 | 99-36981-16 | 99-36982-16 |
| Lunar | 98-36980-17 | 98-36981-17 | 98-36982-17 | 99-36980-17 | 99-36981-17 | 99-36982-17 |

Translucent colors: Add "TL" as suffix to Part No.
† Assembly conforms to requirements of MIL-L-3661.
See pages 62 & 63 for complete listing of military type designations.
*White if translucent color specified.

## sub-miniature, watertight

**95-33180 SERIES**

**NOTES:**

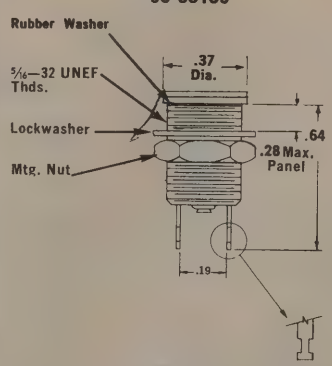
**1. Material and Finishes:** Mounting tube, black glass filled nylon per MIL-M-19887. Mtg. nut, aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Standard colors are transparent.

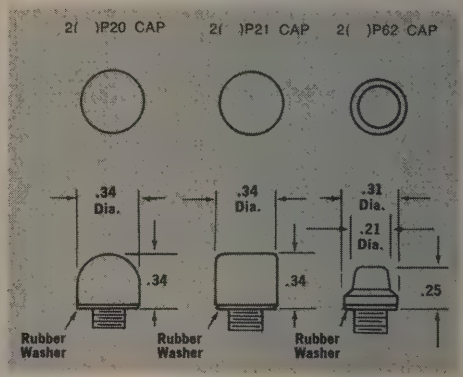
**3. Lamp:** T-1 sub-midget flange base. See lamp selection guide. Choose from Group M.

**4. Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended mounting hole .328 + .015 —.000 diameter.

### BASE ASSEMBLY
**95-33180**




### CAP STYLES




| Complete Assembly Part Number (Less Lamp) | | | |
|---|---|---|---|
| Transparent Lens Colors | 2( )P20 Cap | 2( )P21 Cap | 2( )P62 Cap |
| Clear* | 95-33180- 25P20 | 95-33180- 25P21 | 95-33180- 25P62 |
| Red | 95-33180- 26P20 | 95-33180- 26P21 | 95-33180- 26P62 |
| Green | 95-33180- 27P20 | 95-33180- 27P21 | 95-33180- 27P62 |
| Amber | 95-33180- 28P20 | 95-33180- 28P21 | 95-33180- 28P62 |
| Blue | 95-33180-211P20 | 95-33180-211P21 | 95-33180-211P62 |
| Yellow | 95-33180-212P20 | 95-33180-212P21 | 95-33180-212P62 |
| Orange | 95-33180-216P20 | 95-33180-216P21 | 95-33180-216P62 |
| Lunar | 95-33180-217P20 | 95-33180-217P21 | 95-33180-217P62 |

Translucent colors: Add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

**SCHEMATIC**

## miniature "big QT"

## 14-33880 SERIES
## 14-33881 SERIES
## 14-33882 SERIES

**Notes:**

**1. Materials and Finishes:** Housing and lamp base, gray glass filled nylon. Terminals, beryllium copper, gold flashed. Retainer clip, spring steel.

**2. Lens Cap:** High impact resistant plastic per L-P-393. (polycarbonate)

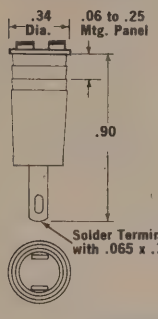
**3. Lamp:** Assembly accepts IPI based T-1¾ lamp, see lamp selection below. Lamp is replaced by removing snap-on cap.

**4. Mounting:** Two types optional.

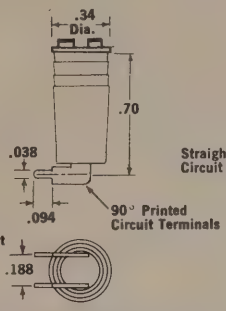
A. Press-in; Assembly press fits into .281 dia. hole. No mounting hardware required.

B. Retainer clip; For mounting assembly into .200 ±.005 dia. hole or panels less than .06 thick. Order clip 067003000 separately.

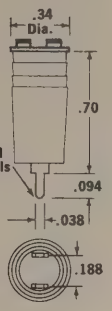
### BASE ASSEMBLY 14-33880



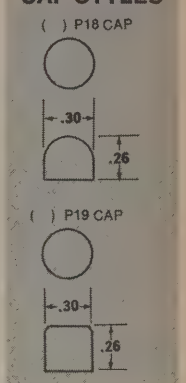

### BASE ASSEMBLY 14-33881




### BASE ASSEMBLY 14-33882

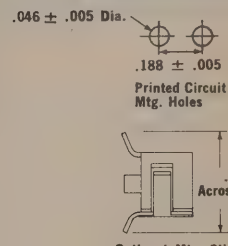



### CAP STYLES

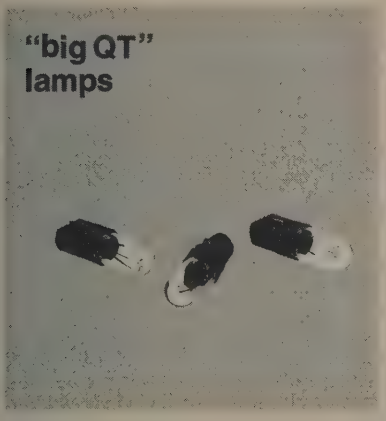



| Complete Assembly Part Numbers (Less Lamp)** | | |
|---|---|---|
| Transparent Lens Colors | ( )P18 Cap | ( )P19 Cap |
| Clear° | 14-33880- 5P18 | 14-33880- 5P19 |
| Red | 14-33880- 6P18 | 14-33880- 6P19 |
| Green | 14-33880- 7P18 | 14-33880- 7P19 |
| Amber | 14-33880- 8P18 | 14-33880- 8P19 |
| Blue | 14-33880-11P18 | 14-33880-11P19 |
| Yellow | 14-33880-12P18 | 14-33880-12P19 |
| Orange | 14-33880-16P18 | 14-33880-16P19 |
| Lunar | 14-33880-17P18 | 14-33880-17P19 |

Translucent colors: add "TL" as suffix to Part No.
°White if translucent colors specified.
( ) Indicates color designation.
For printed circuit terminals change 14-33880 to 14-33881 or 14-33882
**To order with lamp installed, add Lamp No. as suffix to Part No. Example: 14-33880-5P18-101




## "big QT" lamps



**Notes:**

**1. Lamp Bases** are color coded for operating voltage as follows:

| | |
|---|---|
| 5.0 volts | Black |
| 6.0 volts | Orange |
| 6.3 volts | Dark Green |
| 10.0 volts | Green |
| 14.0 volts | Purple |
| 28.0 volts | Red |

To Order Lamps Separately Specify 100057 ( )

Lamp No. From Tabulation

| Big QT™ Lamp Selection | | | | | |
|---|---|---|---|---|---|
| Lamp No. | Volts | Amps | MSCP | Average Life (Hrs.) | ANSI No. (Ref.) |
| 101 | 5.0 | .066 | .11 | 7,000 | 1739 |
| 102 | 6.0 | .040 | .032 | 10,000 | 1730 |
| 103 | 6.0 | .200 | .60 | 3,000 | 1784 |
| 104 | 6.3 | .075 | .230 | 500 | 1739 |
| 105 | 6.3 | .200 | .570 | 5,000 | 2112 |
| 106 | 10.0 | .014 | .004 | 10,000 | 1869 |
| 107 | 14.0 | .080 | .520 | 2,500 | 1705 |
| 108 | 14.0 | .080 | .300 | 50,000 | 2182 |
| 109 | 28.0 | .040 | .340 | 5,000 | 1764 |
| 110 | 28.0 | .040 | .300 | 25,000 | 2187 |

A neon lamp version of this indicator is also available. See 22-35380 series on page 51.

**Example: 100057101**

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

## Indicators

### miniature

**14-34080 SERIES**

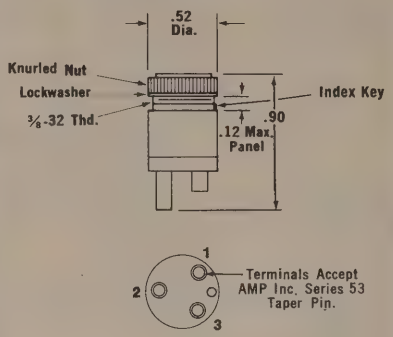
**Notes:**

**1. Materials and Finishes:** Mounting tube, molded glass filled nylon, knurled nut, aluminum, black anodized. Terminals, brass, gold plated per MIL-G-54204. Caps, high impact resistant plastic per L-P-349a.

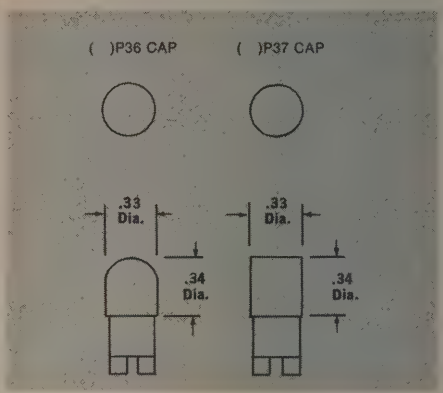
**2. Lamp:** T-1¾ Midget flange base. See Lamp selection guide. Choose from Group A.

**3. Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Knurled nut fits No. 20 Gulmite wrench (Bergander Mfg. Co., Skokie, Illinois).

**BASE ASSEMBLY**
**14-34080**



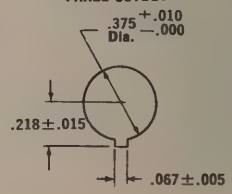

**CAP STYLES**




| Complete Assembly Part Numbers (Less Lamp) | | |
|---|---|---|
| Transparent Lens Colors | ( )P36 Cap | ( )P37 Cap |
| Clear* | 14-34080-5P36 | 14-34080-5P37 |
| Red | 14-34080-6P36 | 14-34080-6P37 |
| Green | 14-34080-7P36 | 14-34080-7P37 |
| Amber | 14-34080-8P36 | 14-34080-8P37 |
| Blue | 14-34080-11P36 | 14-34080-11P37 |
| Yellow | 14-34080-12P36 | 14-34080-12P37 |
| Orange | 14-34080-16P36 | 14-34080-16P37 |
| Lunar | 14-34080-17P36 | 14-34080-17P37 |

Translucent colors: add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

**PANEL CUTOUT**




**SCHEMATIC**

### miniature

**14-35180 SERIES**

**Notes:**

**1. Materials and Finishes:** Mounting tube and nut are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel. Terminals, brass, tin plated per MIL-T-10727A.

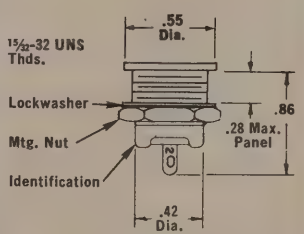
**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a.

**3. Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

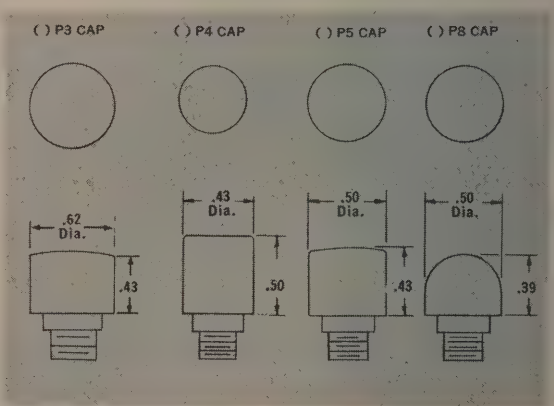
**4. Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.

**5. Weight:** Approx. .2 oz. less lamp.

**BASE ASSEMBLY**
**14-35180**




**CAP STYLES**




| Complete Assembly Part Numbers (Less Lamp) | | | | |
|---|---|---|---|---|
| Transparent Lens Colors | ( )P3 Cap | ( )P4 Cap | ( )P5 Cap | ( )P8 Cap |
| Clear* | 14-35180-5P3 | 14-35180-5P4 | 14-35180-5P5 | 14-35180-5P8 |
| Red | 14-35180-6P3 | 14-35180-6P4 | 14-35180-6P5 | 14-35180-6P8 |
| Green | 14-35180-7P3 | 14-35180-7P4 | 14-35180-7P5 | 14-35180-7P8 |
| Amber | 14-35180-8P3 | 14-35180-8P4 | 14-35180-8P5 | 14-35180-8P8 |
| Blue | 14-35180-11P3 | 14-35180-11P4 | 14-35180-11P5 | 14-35180-11P8 |
| Yellow | 14-35180-12P3 | 14-35180-12P4 | 14-35180-12P5 | 14-35180-12P8 |
| Orange | 14-35180-16P3 | 14-35180-16P4 | 14-35180-16P5 | 14-35180-16P8 |
| Lunar | 14-35180-17P3 | 14-35180-17P4 | 14-35180-17P5 | 14-35180-17P8 |

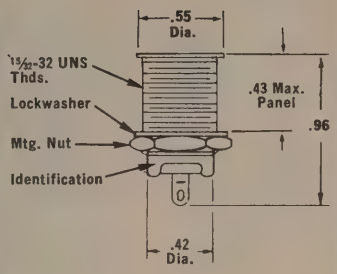
Translucent colors: Add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

**SCHEMATIC**

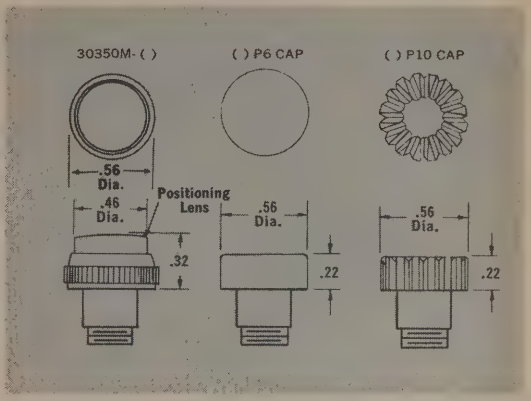
## miniature

## 14-36380 SERIES

### BASE ASSEMBLY
14-36380




### CAP STYLES




**Notes:**

**1. Material and Finishes:** Mounting tube and nut are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holder is brass, bright nickel plate.

**3. Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

**4. Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.

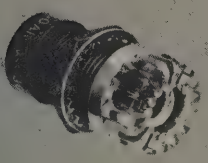
**5. Weight:** Approx. .2 oz. less lamp.

| Complete Assembly Part Numbers (Less Lamp) | | | |
|---|---|---|---|
| Transparent Lens Colors | 30350M-( ) Cap | ( )P6 Cap | ( )P10 Cap |
| Clear* | 14-36380-5 | 14-36380-5P6 | 14-36380-5P10 |
| Red | 14-36380-6 | 14-36380-6P6 | 14-36380-6P10 |
| Green | 14-36380-7 | 14-36380-7P6 | 14-36380-7P10 |
| Amber | 14-36380-8 | 14-36380-8P6 | 14-36380-8P10 |
| Blue | 14-36380-11 | 14-36380-11P6 | 14-36380-11P10 |
| Yellow | 14-36380-12 | 14-36380-12P6 | 14-36380-12P10 |
| Orange | 14-36380-16 | 14-36380-16P6 | 14-36380-16P10 |
| Lunar | 14-36380-17 | 14-36380-17P6 | 14-36380-17P10 |

Translucent colors: Add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

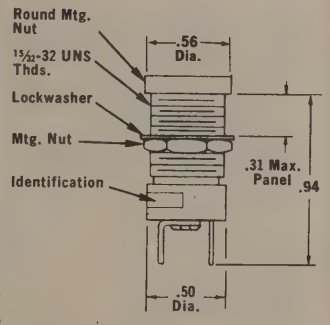
**SCHEMATIC**

## miniature

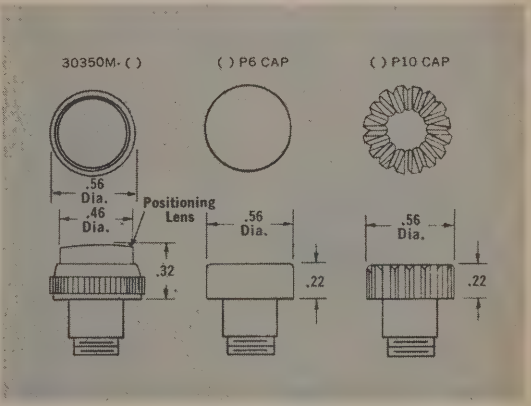


## 14-30380 SERIES

### BASE ASSEMBLY
14-30380




### CAP STYLES




**Notes:**

**1. Material and Finishes:** Mounting tube and rear nut, aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A. Round front mtg. nut, brass, bright nickel plate.

**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holder is brass, bright nickel finish.

**3. Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

**4. Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.

**5. Weight:**
Approx. .4 oz less lamp with 30350M-( ) cap.
.3 oz less lamp with P6 or P10 cap.

| Complete Assembly Part Numbers (Less Lamp) | | | |
|---|---|---|---|
| Transparent Lens Colors | 30350M-( ) Cap | ( )P6 Cap | ( )P10 Cap |
| Clear* | 14-30380-5 | 14-30380-5P6 | 14-30380-5P10 |
| Red | 14-30380-6 | 14-30380-6P6 | 14-30380-6P10 |
| Green | 14-30380-7 | 14-30380-7P6 | 14-30380-7P10 |
| Amber | 14-30380-8 | 14-30380-8P6 | 14-30380-8P10 |
| Blue | 14-30380-11 | 14-30380-11P6 | 14-30380-11P10 |
| Yellow | 14-30380-12 | 14-30380-12P6 | 14-30380-12P10 |
| Orange | 14-30380-16 | 14-30380-16P6 | 14-30380-16P10 |
| Lunar | 14-30380-17 | 14-30380-17P6 | 14-30380-17P10 |

Translucent colors: Add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

**SCHEMATIC**

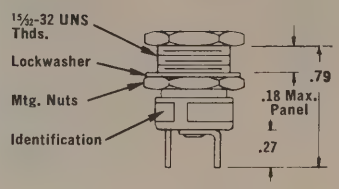
**OAK Industries Inc.**
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# Indicators

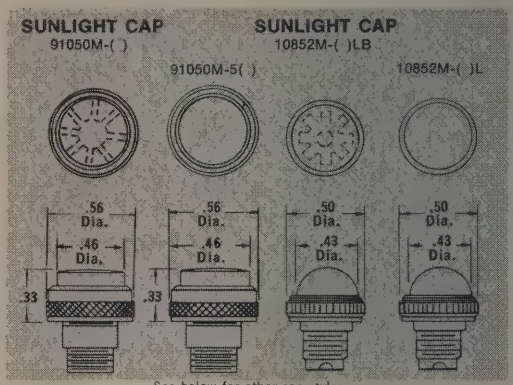
## miniature

## 14-30080 SERIES

### BASE ASSEMBLY
14-30080




### CAP STYLES




See below for other cap styles.

**Notes:**

**1. Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.

**3. Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

**4. Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.

**5. Weight:** Approx. .27 oz less lamp.

| Complete Assembly Part Numbers (Less Lamp) | | | | |
|---|---|---|---|---|
| Transparent Lens Colors | 91050M-( ) Sunlight Cap | 91050M-5( ) Cap | 10852M-( )LB Sunlight Cap | 10852M-( )L Cap |
| Clear° | 14-30080-55LB | 14-30080-55L | 14-30080-5LB | 14-30080-5L |
| Red | 14-30080-56LB | 14-30080-56L | 14-30080-6LB | 14-30080-6L |
| Green | 14-30080-57LB | 14-30080-57L | 14-30080-7LB | 14-30080-7L |
| Amber | 14-30080-58LB | 14-30080-58L | 14-30080-8LB | 14-30080-8L |
| Blue | 14-30080-511LB | 14-30080-511L | 14-30080-11LB | 14-30080-11L |
| Yellow | 14-30080-512LB | 14-30080-512L | 14-30080-12LB | 14-30080-12L |
| Lunar | 14-30080-517LB | 14-30080-517L | 14-30080-17LB | 14-30080-17L |

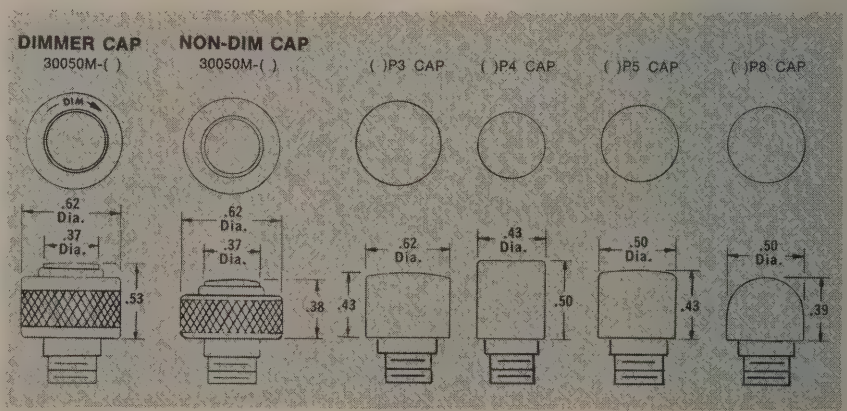
Translucent colors: Add "TL" as suffix to Part No., not recommended for sunlight caps.
Frosted lens: For 10852M caps only — add "EF" (externally frosted) or "IF" (internally frosted) as suffix to Part No.
°White if translucent color specified.
( ) Designates color selection.

### SCHEMATIC

## miniature

## 14-30080 SERIES

### CAP STYLES




**Notes:**

**1. Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.

**3. Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

**4. Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.

**5. Weight:** Approx. .45 oz. less lamp (Dim type)
.25 oz. less lamp (Non-dim)

| Complete Assembly Part Numbers (Less Lamp) | | | | | | |
|---|---|---|---|---|---|---|
| Transparent Lens Colors | 30050M-( ) Dimmer Cap | 30050M-( ) Non-Dim Cap | ( )P3 Cap | ( )P4 Cap | ( )P5 Cap | ( )P8 Cap |
| Clear° | 14-30080-1 | 14-30080-5 | 14-30080-5P3 | 14-30080-5P4 | 14-30080-5P5 | 14-30080-5P8 |
| Red | 14-30080-2 | 14-30080-6 | 14-30080-6P3 | 14-30080-6P4 | 14-30080-6P5 | 14-30080-6P8 |
| Green | 14-30080-3 | 14-30080-7 | 14-30080-7P3 | 14-30080-7P4 | 14-30080-7P5 | 14-30080-7P8 |
| Amber | 14-30080-4 | 14-30080-8 | 14-30080-8P3 | 14-30080-8P4 | 14-30080-8P5 | 14-30080-8P8 |
| Blue | 14-30080-10 | 14-30080-11 | 14-30080-11P3 | 14-30080-11P4 | 14-30080-11P5 | 14-30080-11P8 |
| Yellow | 14-30080-14 | 14-30080-12 | 14-30080-12P3 | 14-30080-12P4 | 14-30080-12P5 | 14-30080-12P8 |
| Orange | —— | 14-30080-16 | 14-30080-16P3 | 14-30080-16P4 | 14-30080-16P5 | 14-30080-16P8 |
| Lunar | —— | 14-30080-17 | 14-30080-17P3 | 14-30080-17P4 | 14-30080-17P5 | 14-30080-17P8 |

Translucent colors: Add "TL" as suffix to Part No.
°White if translucent color specified.
( ) Designates color selection.

*A Subsidiary of Oak Industries Inc.*



## miniature, optional press-to-test

## 59-52280 SERIES
## 59-52380 SERIES

**Notes:**

**1. Material and Finishes:** Mounting tube and knurled nut, clear anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A. Mfg. nut and key washer, brass, nickel plate.

**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Friction fit lens caps are rotatable or keyed.

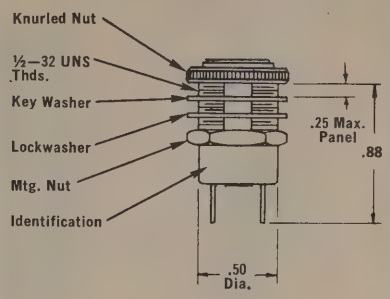
**3. Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

**4. Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole, see drawing to right.

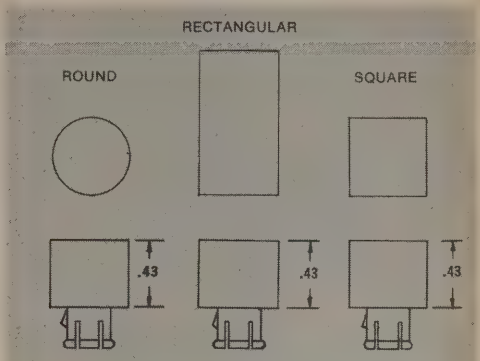
**5. Weight:** Approx. .5 oz, less lamp.

### BASE ASSEMBLY

**59-52280 (Press-to-test)**
**59-52380**



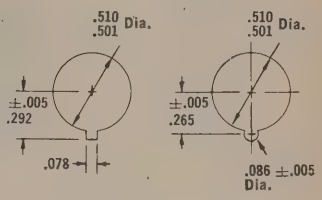

### CAP STYLES




See pages 12 and 13 for cap size, styles

### SCHEMATICS

### PANEL CUTOUTS

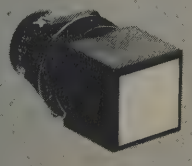



**Complete Assembly Part Numbers**

To order complete assembly specify:

59-52380 - ( ) - ( )
- Lamp (See page 66)
- Cap assy P/N (See page 12 & 13)
- Base assy: P/N 59-52280 (Press-to-Test) P/N 59-52380

## miniature



## 59-52480 SERIES

**Notes:**

**1. Materials and Finishes:** Mounting tube and hex nut, aluminum, black anodized per MIL-A-8625. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Friction fit lens caps are rotatable or keyed.

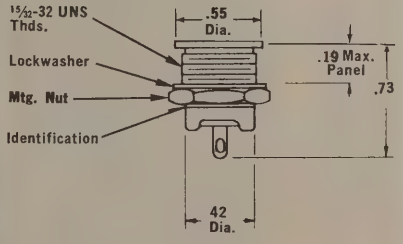
**3. Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

**4. Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.

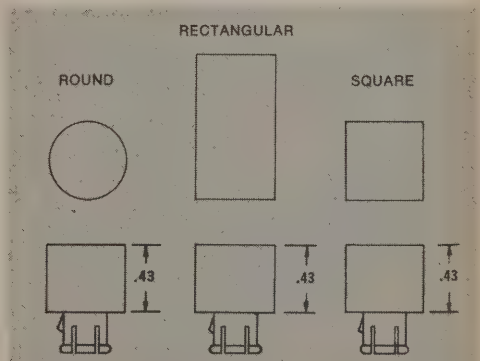
**5. Weight:** Approx. .2 oz. less lamp.

### BASE ASSEMBLY

**59-52480**




### CAP STYLES




See pages 12 and 13 for cap size

### SCHEMATIC

**Complete Assembly Part Numbers**

To Order Complete Assembly Specify:

59-52480-( ) - ( )
- Lamp (See page 66)
- Cap Assembly (See Page 12 & 13)
- Base Assembly

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

## Indicators

### miniature

### 11-33480 SERIES (MS25256)

**NOTES:**

**1. Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

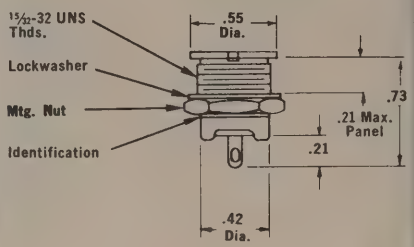
**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a.

**3. Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

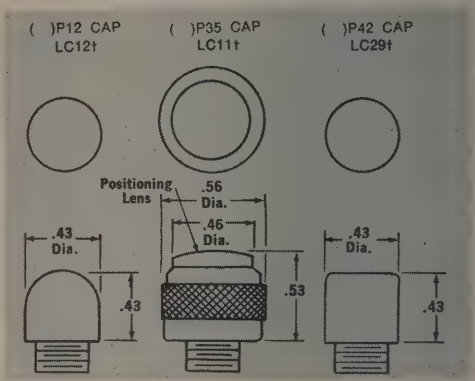
**4. Mounting:** Assembly mounts from front of panel. All mounting hardware supplied.

**5. Weight:** Approx. .20 oz. less lamp.

**BASE ASSEMBLY**
**11-33480**
**LH73/1†**



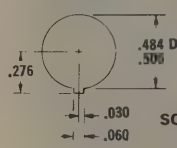

**CAP STYLES**




| Complete Assembly Part Numbers (Less Lamp) | | | |
|---|---|---|---|
| Transparent Lens Colors | ( )P12 Cap | ( )P35 Cap | ( )P42 Cap |
| Clear° | 11-33480- 5P12 | 11-33480- 5P35 | 11-33480- 5P42 |
| Red | 11-33480- 6P12 | 11-33480- 6P35 | 11-33480- 6P42 |
| Green | 11-33480- 7P12 | 11-33480- 7P35 | 11-33480- 7P42 |
| Amber | 11-33480- 8P12 | 11-33480- 8P35 | 11-33480- 8P42 |
| Blue | 11-33480-11P12 | 11-33480-11P35 | 11-33480-11P42 |
| Yellow | 11-33480-12P12 | 11-33480-12P35 | 11-33480-16P42 |
| Orange | 11-33480-16P12 | 11-33480-16P35 | 11-33480-12P42 |
| Lunar | 11-33480-17P12 | 11-33480-17P35 | 11-33480-17P42 |

Translucent colors: Add "TL" as suffix to Part No.
†Assembly conforms to requirements of MIL-L-3661 and MS25256. See pages 64 & 65 for complete listing of MS Part Numbers and Type Designations.
°White if translucent color specified.
( ) Designates color selection.

**PANEL CUTOUT**




**SCHEMATIC**

### miniature, press-to-test

### 03-90980 SERIES

**Notes:**

**1. Material and Finishes:** Moulded glass filled nylon mounting tube. Mtg. nut aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel. Terminals, brass, tin plated per MIL-T-10727A.

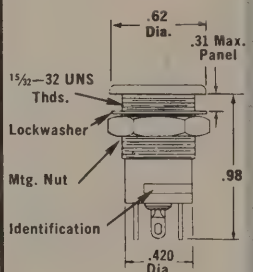
**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.

**3. Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

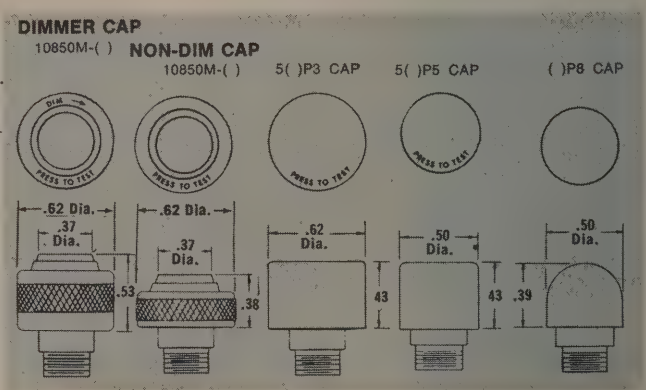
**4. Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.

**5. Weight:** Approx. .9 oz. less lamp.

**BASE ASSEMBLY**
**03-90980**




**CAP STYLES**

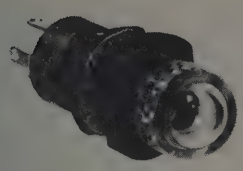



| Complete Assembly Part Numbers (Less Lamp) | | | | | |
|---|---|---|---|---|---|
| Transparent Lens Colors | 10850M-( ) Dimmer Cap | 10850M-( ) Non-Dim Cap | 5( )P3 Cap | 5( )P5 Cap | ( )P8 Cap |
| Clear: | 03-90980-1 | 03-90980-5 | 03-90980-55P3 | 03-90980-55P5 | 03-90980-5P8 |
| Red | 03-90980-2 | 03-90980-6 | 03-90980-56P3 | 03-90980-56P5 | 03-90980-6P8 |
| Green | 03-90980-3 | 03-90980-7 | 03-90980-57P3 | 03-90980-57P5 | 03-90980-7P8 |
| Amber | 03-90980-4 | 03-90980-8 | 03-90980-58P3 | 03-90980-58P5 | 03-90980-8P8 |
| Blue | 03-90980-10 | 03-90980-11 | 03-90980-511P3 | 03-90980-511P5 | 03-90980-11P8 |
| Yellow | 03-90980-14 | 03-90980-12 | 03-90980-512P3 | 03-90980-512P5 | 03-90980-12P8 |
| Orange | —— | 03-90980-16 | 03-90980-516P3 | 03-90980-516P5 | 03-90980-16P8 |
| Lunar | —— | 03-90980-17 | 03-90980-517P3 | 03-90980-517P5 | 03-90980-17P8 |

Translucent colors: Add "TL" as suffix to Part No.
°White if translucent color specified.
( ) Designates color selection.

**SCHEMATIC**

## miniature, press-to-test



## 03-91080 SERIES

**Notes:**

**1. Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel. Terminals, brass, tin plated per MIL-T-10727A.

**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a.

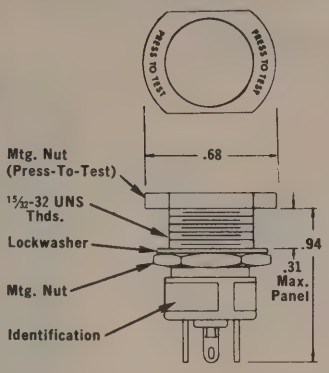
**3. Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

**4. Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.

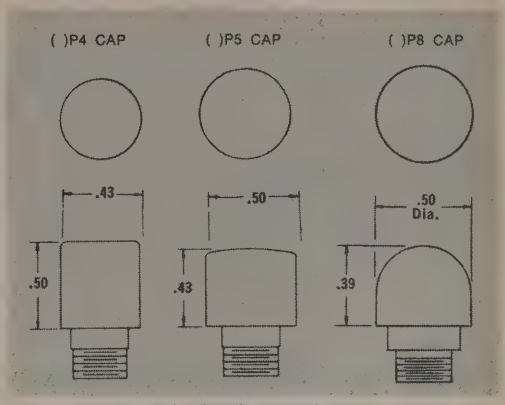
**5. Weight:** Approx. .4 oz less lamp.

### BASE ASSEMBLY

**03-91080**




### CAP STYLES



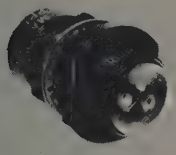

See below for other cap styles

| Complete Assembly Part Number (Less Lamp) | | | |
|---|---|---|---|
| Transparent Lens Colors | ( )P4 Cap | ( )P5 Cap | ( )P8 Cap |
| Clear° | 03-91080-5P4 | 03-91080-5P5 | 03-91080-5P8 |
| Red | 03-91080-6P4 | 03-91080-6P5 | 03-91080-6P8 |
| Green | 03-91080-7P4 | 03-91080-7P5 | 03-91080-7P8 |
| Amber | 03-91080-8P4 | 03-91080-8P5 | 03-91080-8P8 |
| Blue | 03-91080-11P4 | 03-91080-11P5 | 03-91080-11P8 |
| Yellow | 03-91080-12P4 | 03-91080-12P5 | 03-91080-12P8 |
| Orange | 03-91080-16P4 | 03-91080-16P5 | 03-91080-16P8 |
| Lunar | 03-91080-17P4 | 03-91080-17P5 | 03-91080-17P8 |

Translucent colors: Add "TL" as suffix to Part No.
°White if translucent color specified.
( ) Designates color selection.

### SCHEMATIC

## miniature, press-to-test



## 03-91080 SERIES

**Notes:**

**1. Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel. Terminals, brass, tin plated per MIL-T-10727A.

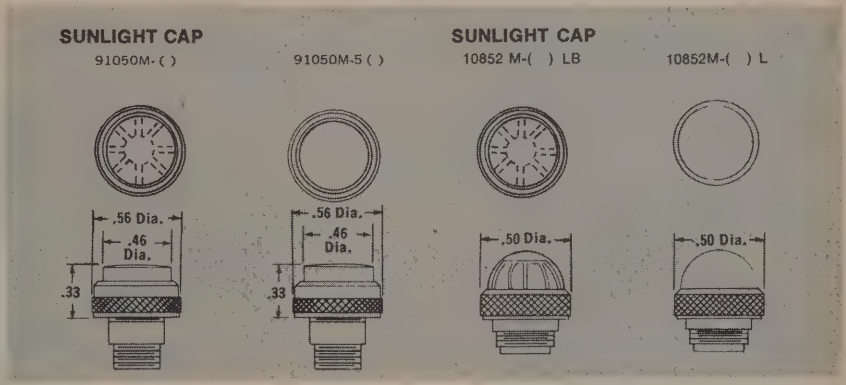
**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.

**3. Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

**4. Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.

**5. Weight:** Approx. .4 oz less lamp.

### CAP STYLES




| Complete Assembly Part Number (Less Lamp) | | | | |
|---|---|---|---|---|
| Transparent Lens Colors | 91050M-( ) Sunlight Cap | 91050M-5( ) Cap | 10852M-( )LB Sunlight Cap | 10852M-( )L Cap |
| Clear° | 03-91080-5 | 03-91080-55 | 03-91080-5LB | 03-91080-5L |
| Red | 03-91080-6 | 03-91080-56 | 03-91080-6LB | 03-91080-6L |
| Green | 03-91080-7 | 03-91080-57 | 03-91080-7LB | 03-91080-7L |
| Amber | 03-91080-8 | 03-91080-58 | 03-91080-8LB | 03-91080-8L |
| Blue | 03-91080-11 | 03-91080-511 | 03-91080-11LB | 03-91080-11L |
| Yellow | 03-91080-12 | 03-91080-512 | 03-91080-12LB | 03-91080-12L |
| Lunar | 03-91080-17 | 03-91080-517 | 03-91080-17LB | 03-91080-17L |

Translucent Colors: Add "TL" as suffix to Part No., not recommended for sunlight caps
Frosted Lens: For 10852M caps only—Add "EF" (externally frosted) or "IF" (internally frosted) as suffix to Part No.
( ) Designates color selection.
°White if translucent color specified

**OAK Industries Inc.**
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# Indicators

## miniature, press-to-test

**01-91180 SERIES (MS25041)**

**Notes:**

**1. Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel. Terminals, brass, tin plated per MIL-T-10727A.

**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.

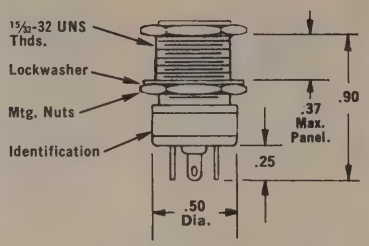
**3. Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

**4. Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.

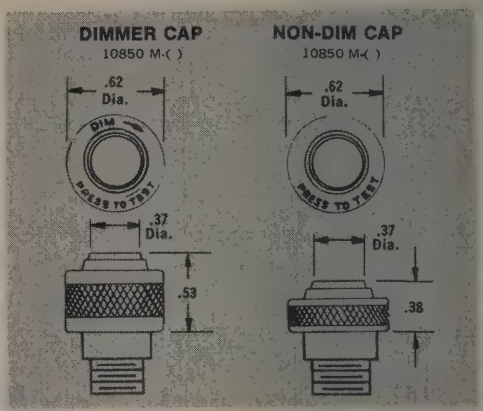
**5. Identification:** The part will be identified with MS P/N and base assembly number.

**6. Weight:** Approx. .5 oz less lamp.

### BASE ASSEMBLY
01-91180




### CAP STYLES

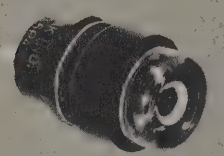



| Complete Assembly Part Numbers (Less Lamp) | | | | |
|---|---|---|---|---|
| Transparent Lens Colors | 10850M-( ) Dimmer Cap | | 10850M-( ) Non Dim Cap | |
| | Part No. | MS Part No. | Part No. | MS Part No. |
| Clear* | 01-91180-1 | MS25041-1 | 01-91180-5 | MS25041-5 |
| Red | 01-91180-2 | MS25041-2 | 01-91180-6 | MS25041-6 |
| Green | 01-91180-3 | MS25041-3 | 01-91180-7 | MS25041-7 |
| Amber | 01-91180-4 | MS25041-4 | 01-91180-8 | MS25041-8 |
| Blue | 01-91180-10 | MS25041-10 | 01-91180-11 | MS25041-11 |
| Yellow | 01-91180-14 | — | 01-91180-12 | — |
| Lunar | — | — | 01-91180-17 | — |

Translucent colors: Add "TL" as suffix to Part No.
( ) Designates color selection.
*White if translucent color specified

**SCHEMATIC**

## miniature, watertight



**15-30083 SERIES**

**Notes:**

**1. Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel, Terminals, brass, tin plated per MIL-T-10727A. Rubber boot and washer, silicone rubber.

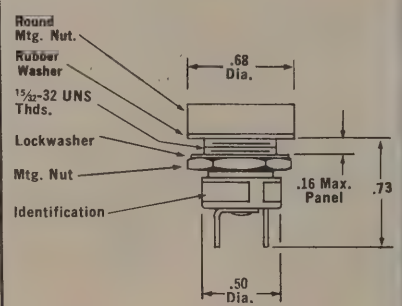
**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.

**3. Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

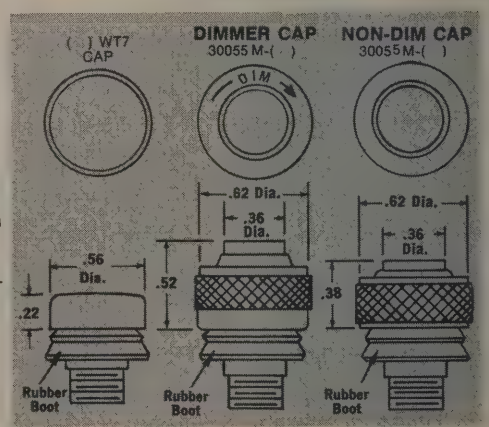
**4. Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.

**5. Weight:** Approx. .3 oz. less lamp.

### BASE ASSEMBLY
15-30083




### CAP STYLES




| Complete Assembly Part Numbers (Less Lamp) | | | |
|---|---|---|---|
| Transparent Lens Colors | ( )WT7 Cap | 30055M-( ) Dimmer Cap | 30055M-( ) Non-Dim Cap |
| Clear* | 15-30083-5WT7 | 15-30083-1 | 15-30083-5 |
| Red | 15-30083-6WT7 | 15-30083-2 | 15-30083-6 |
| Green | 15-30083-7WT7 | 15-30083-3 | 15-30083-7 |
| Amber | 15-30083-8WT7 | 15-30083-4 | 15-30083-8 |
| Blue | 15-30083-11WT7 | 15-30083-10 | 15-30083-11 |
| Yellow | 15-30083-12WT7 | 15-30083-14 | 15-30083-12 |
| Orange | 15-30083-16WT7 | —— | 15-30083-16 |
| Lunar | 15-30083-17WT7 | —— | 15-30083-17 |

Translucent colors: Add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

**SCHEMATIC**

## miniature, watertight and oiltight

**15-35182 SERIES**
**15-35183 SERIES**

**Notes:**

**1. Material and Finishes:** Mounting tubes are aluminum, black anodized per MIL-A-8625A or brass, bright nickel finish per QQ-N-290. Mtg. nut, aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plated. Terminals, brass, tin plated per MIL-T-10727A. "O" ring, and rubber washers, neoprene.

**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a.

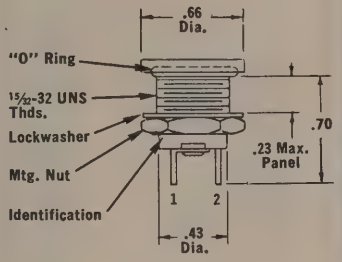
**3. Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

**4. Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter. "O" ring supplied with base assembly.

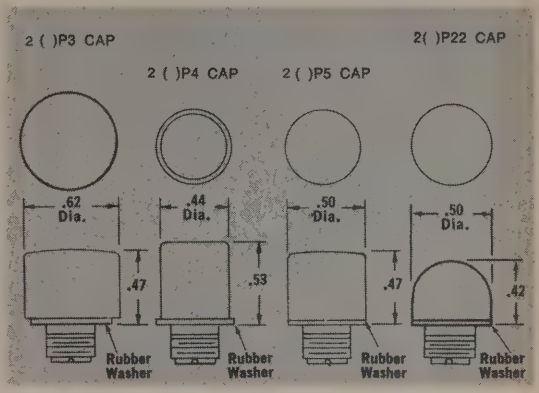
**5. Weight:** Approx. .3 oz. less lamp.

### BASE ASSEMBLY

**15-35182 Black Anodized Finish**
**15-35183 Bright Nickel Finish**




### CAP STYLES

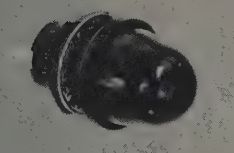



| Complete Assembly Part Numbers (Less Lamp) | | | | |
|---|---|---|---|---|
| Transparent Lens Colors | 2( )P3 Cap | 2( )P4 Cap | 2( )P5 Cap | 2( )P22 Cap |
| Clear° | 15-35182-25P3 | 15-35182-25P4 | 15-35182-25P5 | 15-35182-25P22 |
| Red | 15-35182-26P3 | 15-35182-26P4 | 15-35182-26P5 | 15-35182-26P22 |
| Green | 15-35182-27P3 | 15-35182-27P4 | 15-35182-27P5 | 15-35182-27P22 |
| Amber | 15-35182-28P3 | 15-35182-28P4 | 15-35182-28P5 | 15-35182-28P22 |
| Blue | 15-35182-211P3 | 15-35182-211P4 | 15-35182-211P5 | 15-35182-211P22 |
| Yellow | 15-35182-212P3 | 15-35182-212P4 | 15-35182-212P5 | 15-35182-212P22 |
| Orange | 15-35182-216P3 | 15-35182-216P4 | 15-35182-216P5 | 15-35182-216P22 |
| Lunar | 15-35182-217P3 | 15-35182-217P4 | 15-35182-217P5 | 15-35182-217P22 |

**SCHEMATIC**

To order assembly with bright nickel finish change 15-35182 to 15-35183.
Translucent Colors: Add "TL" as suffix to Part No.
°White if translucent color specified.
( ) Designates color selection.

## miniature, watertight



**11-35182 SERIES**

**Notes:**

**1. Material and Finishes:** Mounting tube aluminum, black anodized per MIL-A-8625A. Mounting nut, steel cad plate per QQ-P-416. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass tin plated per MIL-T-1072A. "O"-ring silicone rubber.

**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a.

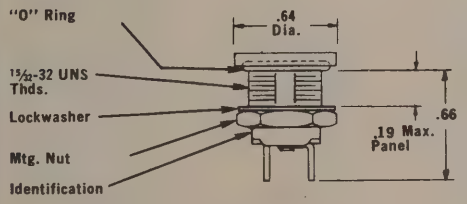
**3. Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

**4. Mounting:** Assembly mounts from front of panel. All mounting hardware supplied.

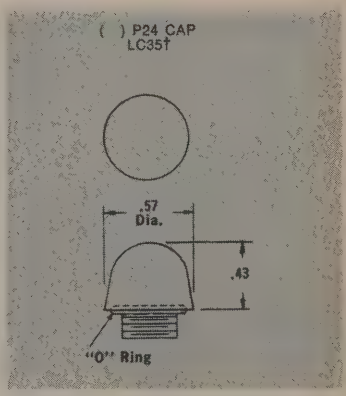
**5. Weight:** Approx. .3 oz. less lamp.

### BASE ASSEMBLY

**11-35182**
**LH 89/1†**




### CAP STYLES




| Complete Assembly Part Numbers (Less Lamp) | |
|---|---|
| Transparent Lens Colors | ( )P24 Cap |
| Clear* | 11-35182-5P24 |
| Red | 11-35182-6P24 |
| Green | 11-35182-7P24 |
| Amber | 11-35182-8P24 |
| Blue | 11-35182-11P24 |
| Yellow | 11-35182-12P24 |
| Orange | 11-35182-16P24 |
| Lunar | 11-35182-17P24 |

**PANEL CUTOUT**

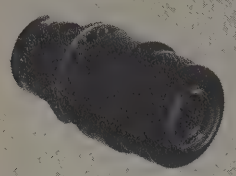
**SCHEMATIC**

Translucent colors: Add "TL" as suffix to Part No.
† Assembly conforms to requirements of MIL-L-3661. See pages 64 & 65 for complete listing of military type designations.
°White if translucent color specified.
( ) Designates color selection.

**OAK Industries Inc.**
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

## Indicators

### miniature, watertight, press-to-test



### 05-91182 SERIES

**Notes:**

**1. Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass. Tin plated per MIL-T-10727A. Rubber boot and washer, silicone rubber.

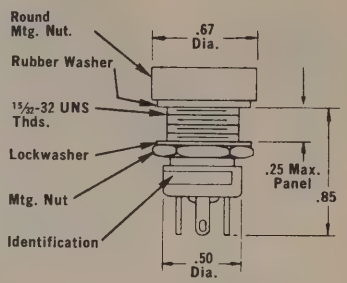
**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.

**3. Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

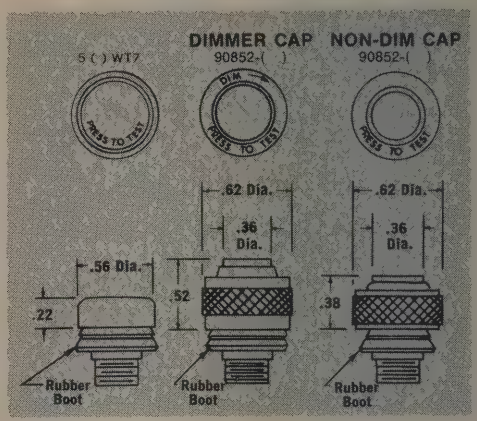
**4. Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.

**5. Weight:** Approx. .44 oz. less lamp.

**BASE ASSEMBLY**
**05-91182**




**CAP STYLES**




| Complete Assembly Part Numbers (Less Lamp) | | | |
|---|---|---|---|
| Transparent Lens Colors | 5( )WT7 Cap | 90852-( ) Dimmer Cap | 90852-( ) Non-Dim Cap |
| Clear° | 05-91182-55WT7 | 05-91182-1 | 05-91182-5 |
| Red | 05-91182-56WT7 | 05-91182-2 | 05-91182-6 |
| Green | 05-91182-57WT7 | 05-91182-3 | 05-91182-7 |
| Amber | 05-91182-58WT7 | 05-91182-4 | 05-91182-8 |
| Blue | 05-91182-511WT7 | 05-91182-10 | 05-91198-11 |
| Yellow | 05-91182-512WT7 | 05-91182-14 | 05-91182-12 |
| Orange | 05-91182-516WT7 | —— | 05-91182-16 |
| Lunar | 05-91182-517WT7 | —— | 05-91182-17 |

Translucent colors: Add "TL" as suffix to Part No.
°White if translucent color specified.
( ) Designates color selection.

**SCHEMATIC**

### miniature, watertight, press-to-test

### 05-90880 SERIES
### 05-90881 SERIES

**Notes:**

**1. Material and Finishes:** Molded glass filled nylon mounting tube. Nut is aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A. Rubber boot and washer, silicone rubber.

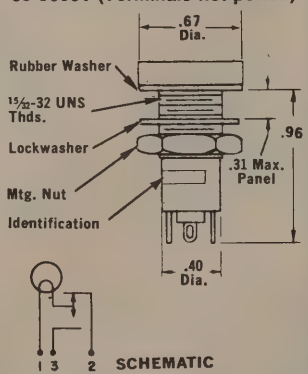
**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.

**3. Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

**4. Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended hole .500 ± .015 diameter.

**5. Weight:** Approx. .3 oz less lamp.

**BASE ASSEMBLY**
**05-90880 (Terminals potted)**
**05-90881 (Terminals not potted)**

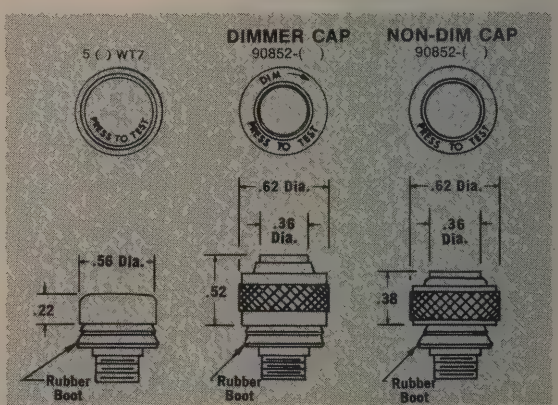






**SCHEMATIC**

**CAP STYLES**




| Complete Assembly Part Numbers (Less Lamp) | | | | | | |
|---|---|---|---|---|---|---|
| Transparent Lens Colors | 05-90880 (Terminals Potted) | | | 05-90881 (Terminals Not Potted) | | |
| | 5( )WT7 Cap | 90852-( ) Dimmer Cap | 90852-( ) Non-Dim Cap | 5( )WT7 Cap | 90852-( ) Dimmer Cap | 90852-( ) Non-Dim Cap |
| Clear° | 05-90880-55WT7 | 05-90880-1 | 05-90880-5 | 05-90881-55WT7 | 05-90881-1 | 05-90881-5 |
| Red | 05-90880-56WT7 | 05-90880-2 | 05-90880-6 | 05-90881-56WT7 | 05-90881-2 | 05-90881-6 |
| Green | 05-90880-57WT7 | 05-90880-3 | 05-90880-7 | 05-90881-57WT7 | 05-90881-3 | 05-90881-7 |
| Amber | 05-90880-58WT7 | 05-90880-4 | 05-90880-8 | 05-90881-58WT7 | 05-90881-4 | 05-90881-8 |
| Blue | 05-90880-511WT7 | 05-90880-10 | 05-90880-11 | 05-90881-511WT7 | 05-90881-10 | 05-90881-11 |
| Yellow | 05-90880-512WT7 | 05-90880-14 | 05-90880-12 | 05-90881-512WT7 | 05-90881-14 | 05-90881-12 |
| Orange | 05-90880-516WT7 | —— | 05-90880-16 | 05-90881-516WT7 | —— | 05-90881-16 |
| Lunar | 05-90880-517WT7 | —— | 05-90880-17 | 05-90881-517WT7 | —— | 05-90881-17 |

Translucent colors: Add "TL" suffix to Part No.
°White if translucent color specified.
( ) Designates color selection.

## miniature, E. M. I. suppressed press-to-test

## 08-83281 SERIES

**Notes:**

**1. Material and Finishes:** Lens holder and front mounting nut is black anodized per MIL-A-8625A. Mounting tube & rear Mtg. nut, is bright nickel plated per QQ-N-290. Lockwasher is stainless steel. Terminals brass, gold plated per MIL-G-45204.

**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.

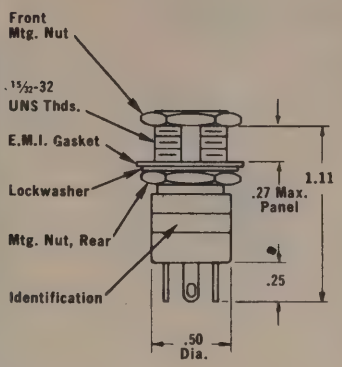
**3. Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

**4. Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Flat on Mtg. tube provides for keyed installation.

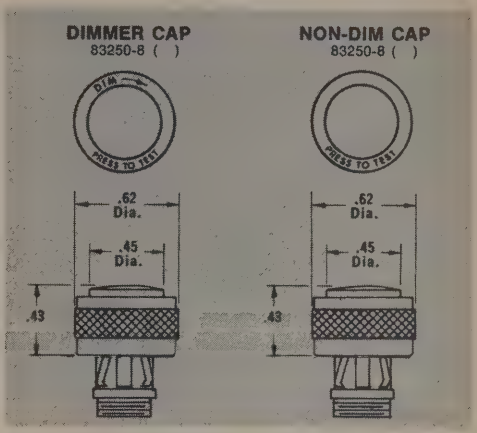
**5. Weight:** Approx. .5 oz less lamp.

### BASE ASSEMBLY

**08-83281**




### CAP STYLES

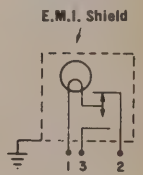



| Complete Assembly Part Numbers (Less Lamp) | | |
|---|---|---|
| Transparent Lens Colors | 83250-8( ) Dimmer Cap | 83250-8( ) Non-Dim Cap |
| Clear° | 08-83281-81 | 08-83281-85 |
| Red | 08-83281-82 | 08-83281-86 |
| Green | 08-83281-83 | 08-83281-87 |
| Amber | 08-83281-84 | 08-83281-88 |
| Blue | 08-83281-810 | 08-83281-811 |
| Yellow | 08-83281-814 | 08-83281-812 |
| Orange | — | 08-83281-816 |
| Lunar | — | 08-83281-817 |

Translucent Colors: Add "TL" as suffix to Part No.
°White if translucent color specified.
( ) Designates color selection.

**PANEL CUTOUT**

**SCHEMATIC**




## miniature, E. M. I. suppressed

## 18-36880 SERIES

**Notes:**

**1. Material and Finishes:** Mounting tube and exposed hardware, brass, bright nickel plate per QQ-N-290. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a.

**3. Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

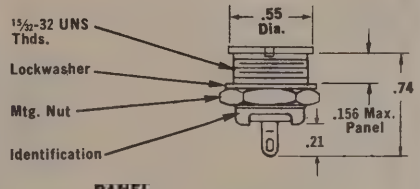
**4. Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. E.M.I. suppressed assemblies require paint free area on back side of mounting hole for E.M.I. conductivity.

**5. Weight:** Approx. .35 oz less lamp.

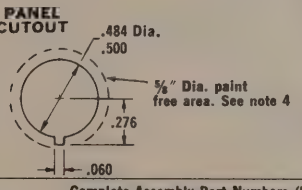
### BASE ASSEMBLY

**18-36880**

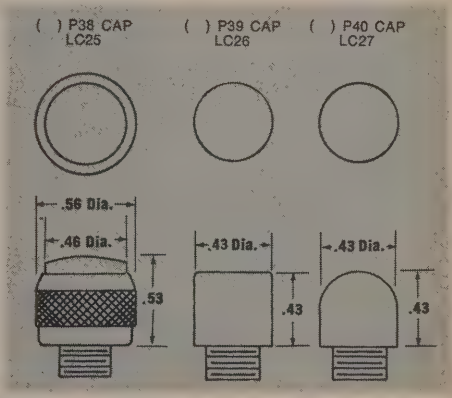
**LH73/2†**




**PANEL CUTOUT**



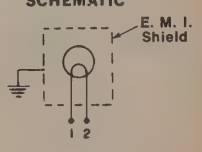

### CAP STYLES




| Complete Assembly Part Numbers (Less Lamp) | | | |
|---|---|---|---|
| Transparent Lens Colors | ( )P38 Cap | ( )P39 Cap | ( )P40 Cap |
| Clear° | 18-36880-5P38 | 18-36880-5P39 | 18-36880-5P40 |
| Red | 18-36880-6P38 | 18-36880-6P39 | 18-36880-6P40 |
| Green | 18-36880-7P38 | 18-36880-7P39 | 18-36880-7P40 |
| Amber | 18-36880-8P38 | 18-36880-8P39 | 18-36880-8P40 |
| Blue | 18-36880-11P38 | 18-36880-11P39 | 18-36880-11P40 |
| Yellow | 18-36880-12P38 | 18-36880-12P39 | 18-36880-12P40 |
| Orange | 18-36880-16P38 | 18-36880-16P39 | 18-36880-16P40 |
| Lunar | 18-36880-17P38 | 18-36880-17P39 | 18-36880-17P40 |

Translucent colors: Add "TL" as suffix to Part No.
† Assembly conforms to requirements of MIL-L-3661. See pages 64 & 65 for complete listing of military type designations.
°White if translucent colors specified.
( ) Designates color selection.

**SCHEMATIC**



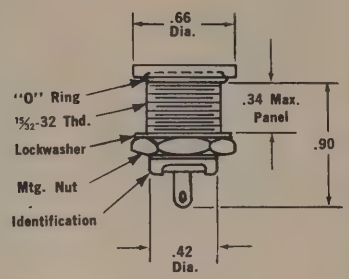
**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

## Indicators

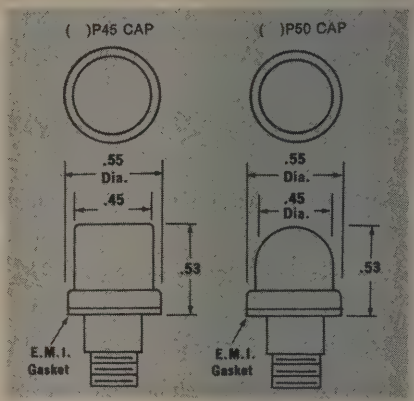
### miniature, E.M.I. suppressed, watertight

**18-36680 SERIES**
Neon version available†

**BASE ASSEMBLY**
**18-36680**




**CAP STYLES**




| Complete Assembly Part Numbers (Less Lamp) | | |
|---|---|---|
| Transparent Lens Colors | ( )P45 Cap | ( )P50 Cap |
| Clear* | 18-36680-5P45 | 18-36680-5P50 |
| Red | 18-36680-6P45 | 18-36680-6P50 |
| Green | 18-36680-7P45 | 18-36680-7P50 |
| Amber | 18-36680-8P45 | 18-36680-8P50 |
| Blue | 18-36680-11P45 | 18-36680-11P50 |
| Yellow | 18-36680-12P45 | 18-36680-12P50 |
| Orange | 18-36680-16P45 | 18-36680-16P50 |
| Lunar | 18-36680-17P45 | 18-36680-17P50 |

*White if translucent color specified.
Translucent colors: add "TL" as suffix to Part No.
( ) Designates color selection.

**SCHEMATIC**

**Notes:**

**1. Material and Finishes:** Mounting tube and mtg. nut brass, bright nickel finish. Lockwasher stainless steel or steel nickel plate. Terminals, brass, tin plated per MIL-T-10727A. "O"-ring, silicone rubber.

**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders, brass, bright nickel plated.

**3. Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

**4. Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended Mounting Hole 500 ± .015 diameter. Paint free area around back side of hole required for E.M.I. conductivity.

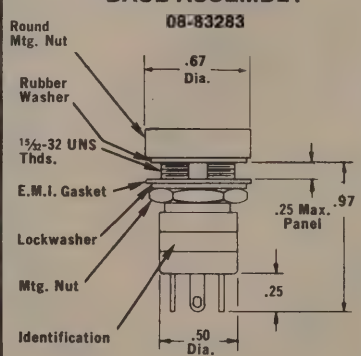
**5. Weight:** Approx. .35 oz. less lamp.

† Specify 38-36681—( ) for 27 KΩ internal resistor (C9A neon lamp) or 38-36680-( ) for 68 KΩ internal resistor (C7A neon lamp).
Neon Lamp (C7A or C9A) must be specified when ordering.

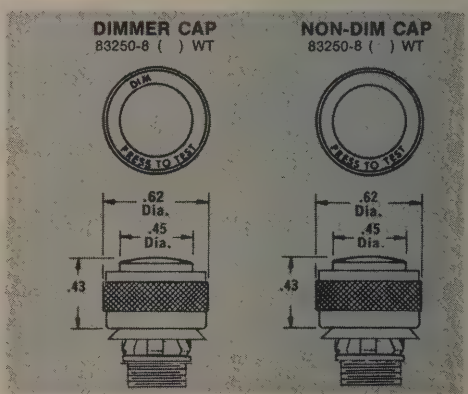
### miniature, E. M. I. suppressed, watertight press-to-test

**08-83283 SERIES**

**BASE ASSEMBLY**
**08-83283**



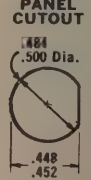

**CAP STYLES**



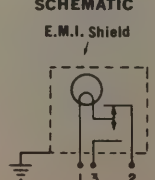

| Complete Assembly Part Numbers (Less Lamp) | | |
|---|---|---|
| Transparent Lens Colors | 83250-8( )WT Dimmer Cap | 83250-8( )WT Non-Dim Cap |
| Clear* | 08-83283-81 | 08-83283-85 |
| Red | 08-83283-82 | 08-83283-86 |
| Green | 08-83283-83 | 08-83283-87 |
| Amber | 08-83283-84 | 08-83283-88 |
| Blue | 08-83283-810 | 08-83283-811 |
| Yellow | 08-83283-814 | 08-83283-812 |
| Orange | — | 08-83283-816 |
| Lunar | — | 08-83283-817 |

Translucent colors: Add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

**PANEL CUTOUT**




**SCHEMATIC**




**Notes:**

**1. Material and Finishes:** Round mtg. nut is aluminum, black anodized per MIL-A-8625A. Mtg. tube and Mtg. nut, bright nickel plated per QQ-N-290. Lockwasher is steel, nickel plated. Rubber boot and washer, silicone rubber. Terminals, brass, gold plated per MIL-G-45204.

**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.

**3. Lamp:** T-1¾ midget flange base. See lamp selection guide. Choose from Group A.

**4. Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Flat on Mtg. tube provides for keyed installation.

**5. Weight:** Approx. .6 oz. less lamp.

## general purpose

## 13-VM 305 SERIES
## 13-VM 309 SERIES

**NOTES:**

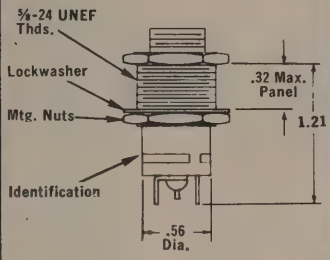
**1. Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

**2. Cap Assembly:** Lens is high impact-resistant plastic (nylon). Standard colors are semi-diffusing.

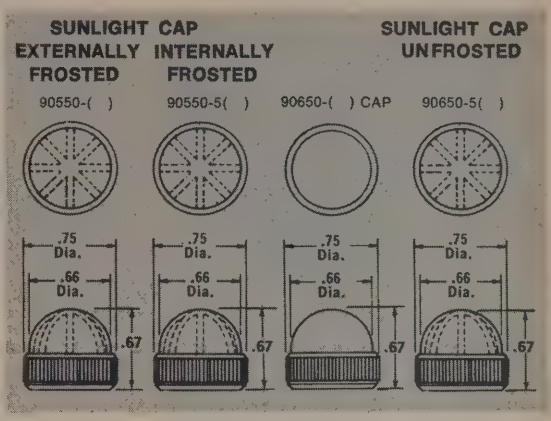
**3. Lamp:** T-3¼ miniature bayonet base. See lamp selection guide. Choose from Group B.

**4. Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .640 ± .015 diameter.

### BASE ASSEMBLY
**13-30080S**




### CAP STYLES




| Complete Assembly Part Number (Less Lamp) | | | | |
|---|---|---|---|---|
| Semi-Diffusing Lens Colors | 90550 - ( ) Sunlight Cap | 90550 - 5( ) Sunlight Cap | 90650 - ( ) Cap | 90650 - 5( ) Sunlight Cap |
| Lunar | 13-VM309- 5 | 13-VM309- 55 | 13-VM305- 5 | 13-VM305- 55 |
| Red | 13-VM309- 6 | 13-VM309- 56 | 13-VM305- 6 | 13-VM305- 56 |
| Green | 13-VM309- 7 | 13-VM309- 57 | 13-VM305- 7 | 13-VM305- 57 |
| Amber | 13-VM309- 8 | 13-VM309- 58 | 13-VM305- 8 | 13-VM305- 58 |
| Blue | 13-VM309-11 | 13-VM309-511 | 13-VM305-11 | 13-VM305-511 |

( ) Designates color selection.

**SCHEMATIC**

## general purpose, press-to-test

## 04-VM905 SERIES
## 04-VM906 SERIES

**NOTES:**

**1. Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

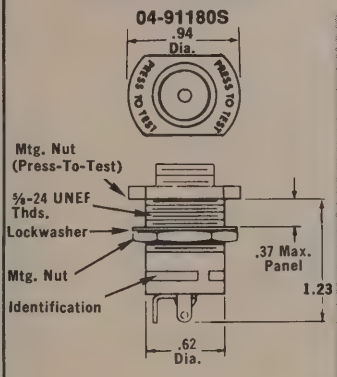
**2. Cap Assembly:** Lens is high impact-resistant plastic (nylon). Standard colors are semi-diffusing.

**3. Lamp:** T-3¼ miniature bayonet base. See lamp selection guide. Choose from Group B.

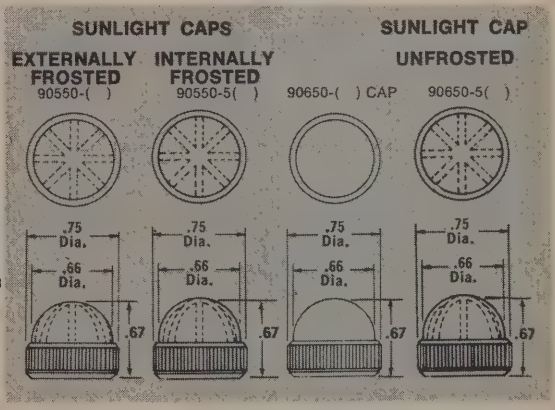
**4. Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .640 ± .015 diameter.

**5. Weight:** Approx. .55 oz. less lamp.

### BASE ASSEMBLY
**04-91180S**



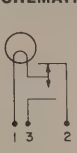

### CAP STYLES




| Complete Assembly Part Number (Less Lamp) | | | | |
|---|---|---|---|---|
| Semi-Diffusing Lens Colors | 90550 - ( ) Sunlight Cap | 90550 - 5( ) Sunlight Cap | 90650 - ( ) Cap | 90650 - 5( ) Sunlight Cap |
| Lunar | 04-VM905- 5 | 04-VM905- 55 | 04-VM906- 5 | 04-VM906- 55 |
| Red | 04-VM905- 6 | 04-VM905- 56 | 04-VM906- 6 | 04-VM906- 56 |
| Green | 04-VM905- 7 | 04-VM905- 57 | 04-VM906- 7 | 04-VM906- 57 |
| Amber | 04-VM905- 8 | 04-VM905- 58 | 04-VM906- 8 | 04-VM906- 58 |
| Blue | 04-VM905-11 | 04-VM905-511 | 04-VM906-11 | 04-VM906-511 |

( ) Designates color selection.

**SCHEMATIC**



**OAK Industries Inc.**
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# Indicators

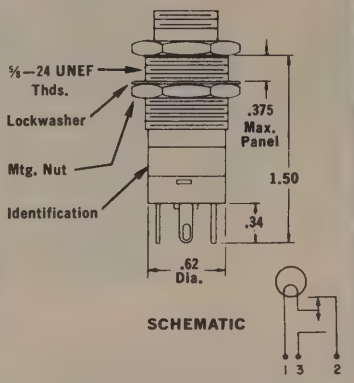
## press-to-test

**02-91180 SERIES (MS25331)**

**Notes:**

1. **Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel. Terminals, brass, tin plated per MIL-T-10727A.
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.
3. **Lamp:** T-3¼ miniature bayonet base. See lamp selection guide. Choose from Group B.
4. **Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .640 ± .015 diameter.
5. **Identification:** The part will be identified with MS P/N and base assembly number.
6. **Weight:** Approx. .8 oz less lamp.

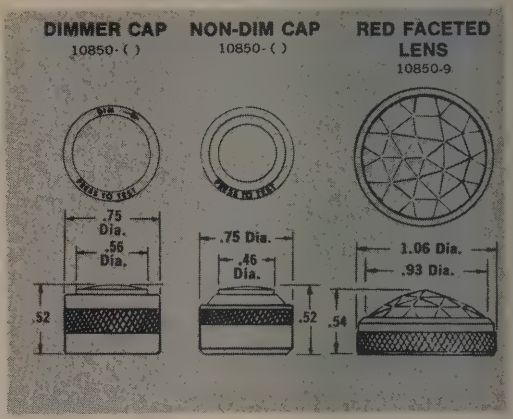
### BASE ASSEMBLY
02-91180




SCHEMATIC




### CAP STYLES




| Complete Assembly Part Numbers (Less Lamp) | | | | | | |
|---|---|---|---|---|---|---|
| Transparent Lens Colors | 10850-( ) Dimmer Cap | | 10850-( ) Non-Dim Cap | | 10850-9 Faceted Lens | |
| | Part No. | MS Part No. | Part No. | MS Part No. | Part No. | MS Part No. |
| Clear* | 02-91180-1 | MS25331-1 | 02-91180-5 | MS25331-5 | — | — |
| Red | 02-91180-2 | MS25331-2 | 02-91180-6 | MS25331-6 | 02-91180-9 | MS25331-9 |
| Green | 02-91180-3 | MS25331-3 | 02-91180-7 | MS25331-7 | — | — |
| Amber | 02-91180-4 | MS25331-4 | 02-91180-8 | MS25331-8 | — | — |
| Blue | 02-91180-10 | — | 02-91180-11 | — | — | — |
| Yellow | 02-91180-14 | — | 02-91180-12 | — | — | — |
| Lunar | — | — | 02-91180-17 | — | — | — |

Translucent colors: Add "TL" as suffix to Part No.
( ) Designates color selection.
*White if translucent color specified

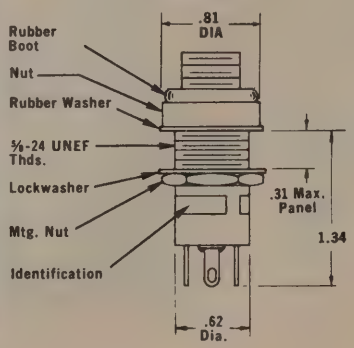
## watertight, press-to-test

**06-91182 SERIES**

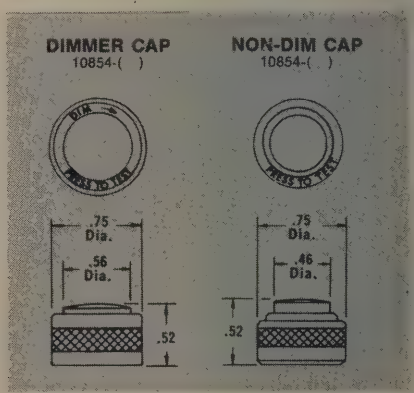
**Notes:**

1. **Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals brass, tin plated per MIL-T-10727A. Rubber boot and washer, silicone rubber.
2. **Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holders are aluminum, black anodized.
3. **Lamp:** T-3¼ miniature bayonet base. See lamp selection guide. Choose from Group B.
4. **Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .640 ± .015 diameter.
5. **Weight:** Approx. .85 oz less lamp.

### BASE ASSEMBLY
06-91182




### CAP STYLES




| Complete Assembly Part Numbers (Less Lamp) | | |
|---|---|---|
| Transparent Lens Colors | 10854-( ) Dimmer Cap | 10854-( ) Non-Dim Cap |
| Clear* | 06-91182-1 | 06-91182-5 |
| Red | 06-91182-2 | 06-91182-6 |
| Green | 06-91182-3 | 06-91182-7 |
| Amber | 06-91182-4 | 06-91182-8 |
| Blue | 06-91182-10 | 06-91182-11 |
| Yellow | 06-91182-14 | 06-91182-12 |
| Orange | —— | 06-91182-16 |
| Lunar | —— | 06-91182-17 |

Translucent colors: Add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

SCHEMATIC

## E.M.I. suppressed

## 18-83680 SERIES

**Notes:**

**1. Materials and Finishes:** Mounting tube and nut, bright nickel finish per QQ-N-290. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

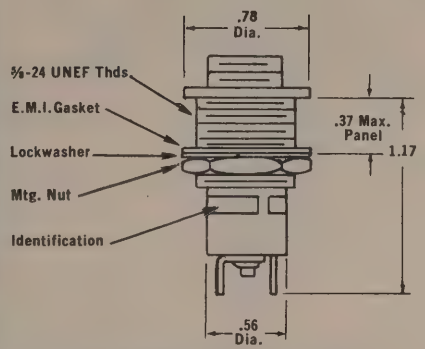
**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Lens holder brass, bright nickel finish.

**3. Lamp:** T-3¼ miniature bayonet base. See lamp selection guide. Choose from Group B.

**4. Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended mounting hole .640 ± .015 diameter with paint free area around back side of hole for E.M.I. conductivity.

**5. Weight:** Approx. 1 oz. less lamp.

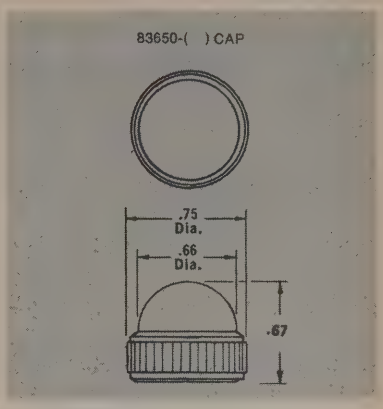
### BASE ASSEMBLY
18-83680



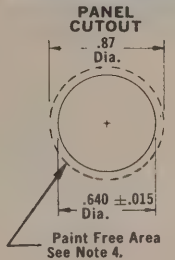

| Complete Assembly Part Numbers (Less Lamp) | |
|---|---|
| Transparent Lens Colors | 83650-( ) Cap |
| Clear* | 18-83680-5 |
| Red | 18-83680-6 |
| Green | 18-83680-7 |
| Amber | 18-83680-8 |
| Blue | 18-83680-11 |
| Yellow | 18-83680-12 |
| Orange | 18-83680-16 |
| Lunar | 18-83680-17 |

Translucent colors: Add "TL" as suffix to Part No.
*White if translucent color specified.
( ) Designates color selection.

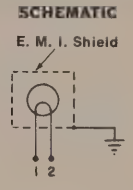
### CAP STYLES




### PANEL CUTOUT




### SCHEMATIC




## miniature, neon

## 22-35380 SERIES

**Notes:**

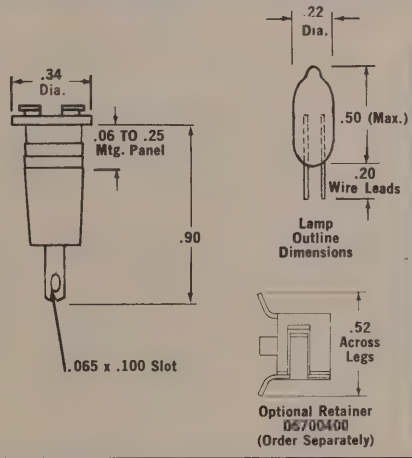
**1. Materials and Finishes:** Housing is black glass filled nylon. Terminals, beryllium copper, plated for solderability. Retainer clip, spring steel.

**2. Lens Cap:** High impact resistant plastic per L-P-393 (polycarbonate). Standard colors are transparent. 6( )P58 cap designed with internal micro grooves to optimize neon illumination.

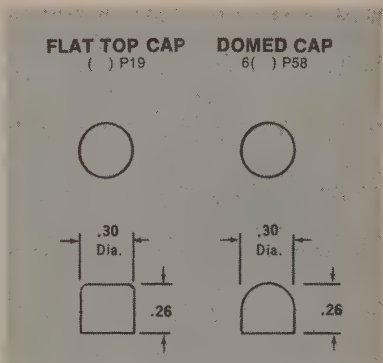
**3. Lamp:** 211 (std.) or 212 (high brightness) T-2 neon lamp furnished with each assembly. Lamp is replaceable from front of panel.

**4. Mounting:** Two types optional
A) Press-in; assembly press fits into .281 diameter hole. No mounting hardware required.
B) Retainer clip; for mounting into .296 ±.015 hole or panels less than .06 thick. Order retainer clip separately.

**5. Solder Terminals:** Terminals accept AMP FASTON receptacle #60415 or equiv.




### CAP STYLES




| Complete Assembly Part Numbers (Includes Lamp) | | | |
|---|---|---|---|
| Lamp | Transparent Lens Colors | ( )P19 Cap | 6( )P58 Cap |
| 211 | Clear | 22-35380-5P19-211 | 22-35380-65P58-211 |
| | Red | 22-35380-6P19-211 | 22-35380-66P58-211 |
| | Amber | 22-35380-8P19-211 | 22-35380-68P58-211 |
| | Lunar | 22-35380-17P19-211 | 22-35380-617P58-211 |
| 212 | Clear | 22-35380-5P19-212 | 22-35380-65P58-212 |
| | Red | 22-35380-6P19-212 | 22-35380-66P58-212 |
| | Amber | 22-35380-8P19-212 | 22-35380-68P58-212 |
| | Lunar | 22-35380-17P19-212 | 22-35380-617P58-212 |

Translucent colors not recommended.
( ) Designates color selection.

SCHEMATIC

| Lamp Selection Guide | | | |
|---|---|---|---|
| Lamp | ANSI No. | Starting Voltage | *Recommended Series Resistor |
| 211 | A1B | 65 VAC<br>95 VDC | 68KΩ |
| 212 | A1C | 95 VAC | 27KΩ |

*Series Resistor not supplied, must be connected externally.

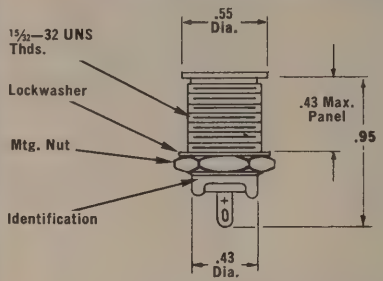
**OAK Industries Inc.**
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

## Indicators

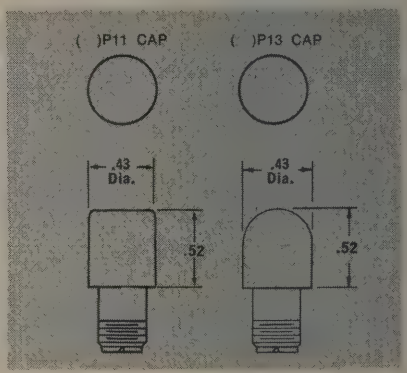
### miniature, neon

**33-36181 SERIES**
**33-36281 SERIES**

**BASE ASSEMBLY**
**33-36181 (Internal Resistor 68KΩ)**
**33-36281 (Internal Resistor 27KΩ)**




**CAP STYLES**




**NOTES:**

**1. Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Standard colors are transparent.

**3. Lamp:** C7A (std.) or C9A (high brightness) T2 neon lamp supplied with each assembly. See lamp guide for electrical characteristics.

**4. Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.

**5. Weight:** Approx. .3 oz. less lamp.

| Complete Assembly Part Number (Includes Lamp) | | | |
|---|---|---|---|
| **LAMP** | **Transparent Lens Colors** | **( )P11 Cap** | **( )P13 Cap** |
| C7A | Clear | 33-36181- 5P11-C7A | 33-36181- 5P13-C7A |
| | Red | 33-36181- 6P11-C7A | 33-36181- 6P13-C7A |
| | Amber | 33-36181- 8P11-C7A | 33-36181- 8P13-C7A |
| | Lunar | 33-36181-17P11-C7A | 33-36181-17P13-C7A |
| C9A | Clear | 33-36281- 5P11-C9A | 33-36281- 5P13-C9A |
| | Red | 33-36281- 6P11-C9A | 33-36281- 6P13-C9A |
| | Amber | 33-36281- 8P11-C9A | 33-36281- 8P13-C9A |
| | Lunar | 33-36281-17P11-C9A | 33-36281-17P13-C9A |

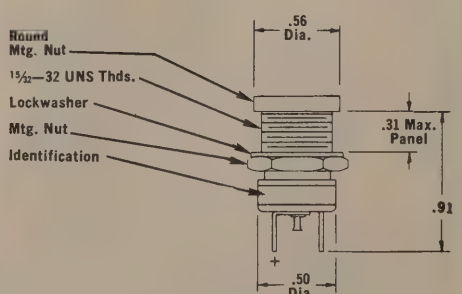
Translucent colors: Not recommended.
( ) Designates color selection.

**SCHEMATIC**

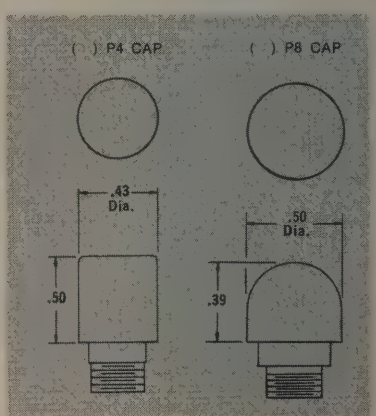
### miniature, neon

**33-30880 SERIES**
**33-30881 SERIES**

**BASE ASSEMBLY**
**33-30880 (27KΩ Internal Resistor)**
**33-30881 (68KΩ Internal Resistor)**




**CAP STYLES**




**Notes:**

**1. Material and Finishes:** Mounting tube gold anodized, rear mtg. nut aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A. Round front mtg. nut, bright nickel plate.

**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Standard colors are transparent.

**3. Lamp:** A1G (std.) or A1H (high brightness) T2 neon is furnished with each assembly.
See lamp guide for electrical characteristics.

**4. Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied. Recommended mounting hole .500 ± .015 diameter.

**5. Weight:** Approx. .35 oz. less lamp.

| Complete Assembly Part Numbers (Includes Lamp) | | | |
|---|---|---|---|
| **Lamp** | **Transparent Lens Color** | **( )P4 Cap** | **( )P8 Cap** |
| A1H | Clear | 33-30880-5P4-A1H | 33-30880-5P8-A1H |
| | Red | 33-30880-6P4-A1H | 33-30880-6P8-A1H |
| | Amber | 33-30880-8P4-A1H | 33-30880-8P8-A1H |
| | Lunar | 33-30880-17P4-A1H | 33-30880-17P8-A1H |
| A1G | Clear | 33-30881-5P4-A1G | 33-30881-5P8-A1G |
| | Red | 33-30881-6P4-A1G | 33-30881-6P8-A1G |
| | Amber | 33-30881-8P4-A1G | 33-30881-8P8-A1G |
| | Lunar | 33-30881-17P4-A1G | 33-30881-17P8-A1G |

Translucent colors: Not recommended.
( ) Designates color selection.

**SCHEMATIC**

## miniature, neon

**31-36180 SERIES**
**31-36280 SERIES**
**(MS 25257)**

**Notes:**

**1. Material, and Finishes:** Mounting tube and nut are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Standard colors are transparent.

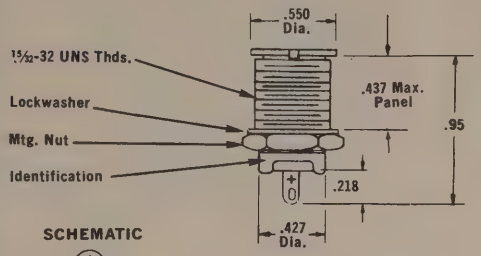
**3. Lamp:** C7A (STD.) or C9A (high brightness) T2 neon lamp furnished with each assembly. See lamp guide for electrical characteristics.

**4. Mounting:** Assembly mounts from rear of panel. All mounting hardware supplied.

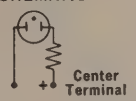
**5. Weight:** Approx. .3 oz. less lamp.

### BASE ASSEMBLY

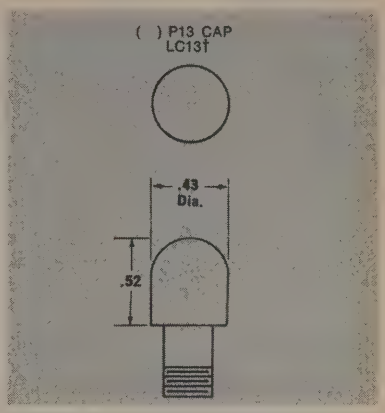
**31-36180 (62KΩ Internal Resistor) LH74/1†**
**31-36280 (27KΩ Internal Resistor) LH 74/2†**




SCHEMATIC

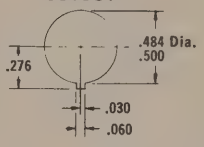



### CAP STYLES




| Complete Assembly Part Number (Includes Lamp) | | |
|---|---|---|
| **Lamp** | **Transparent Lens Colors** | **( )P13 Cap** |
| C7A | Clear | 31-36180-5P13-C7A |
| | Red | 31-36180-6P13-C7A |
| | Amber | 31-36180-8P13-C7A |
| | Lunar | 31-36180-17P13-C7A |
| C9A | Clear | 31-36280-5P13-C9A |
| | Red | 31-36280-6P13-C9A |
| | Amber | 31-36280-8P13-C9A |
| | Lunar | 31-36280-17P13-C9A |

PANEL CUTOUT




Translucent colors: Not recommended.
† Assembly conforms to requirements of MS25257 and MIL-L-3661. See pages 64 & 65 for complete listing of military Part Numbers and type designations.
( ) Designates color selection.

## miniature, neon watertight

**31-36680 SERIES**
**31-36681 SERIES**

**Notes:**

**1. Material and Finishes:** Mounting tube and nuts are aluminum, black anodized per MIL-A-8625A. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A, "O"-ring, silicone rubber.

**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Standard colors are transparent.

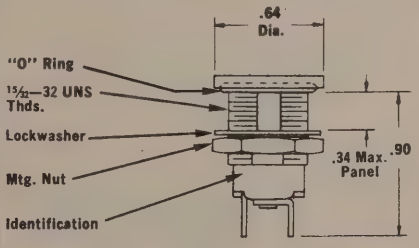
**3. Lamp:** C7A (STD.) or C9A (high brightness) T2 neon lamp furnished with each assembly. See lamp guide for electrical characteristics.

**4. Mounting:** Assembly mounts from front of panel. All mounting hardware supplied.

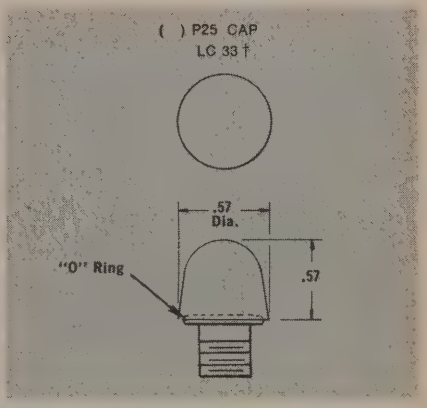
**5. Weight:** Approx. .3 oz less lamp.

### BASE ASSEMBLY

**31-36680 (62KΩ) LH88/1†**
**31-36681 (27KΩ) LH88/2†**

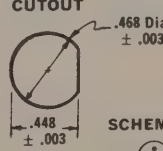



### CAP STYLES

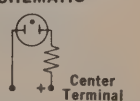



| Complete Assembly Part Numbers (Includes Lamp) | | |
|---|---|---|
| **Lamp** | **Transparent Lens Colors** | **( )P25 Cap** |
| C7A | Clear | 31-36680-5P25-C7A |
| | Red | 31-36680-6P25-C7A |
| | Amber | 31-36680-8P25-C7A |
| | Lunar | 31-36680-17P25-C7A |
| C9A | Clear | 31-36681-5P25-C9A |
| | Red | 31-36681-6P25-C9A |
| | Amber | 31-36681-8P25-C9A |
| | Lunar | 31-36681-17P25-C9A |

PANEL CUTOUT




SCHEMATIC




Translucent colors: Not recommended.
† Assembly conforms to requirements of MIL-L-3661. See pages 64 & 65 for complete listing of military type designations.
( ) Designates color selection.

**OAK Industries Inc.**
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

## Indicators

### miniature, neon, E.M.I. suppressed

**38-36480 SERIES**
**38-36481 SERIES**

**Notes:**

**1. Material and Finishes:** Mounting tube and exposed hardware, bright nickel finish. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Standard colors are transparent. Lens holder bright nickel plated.

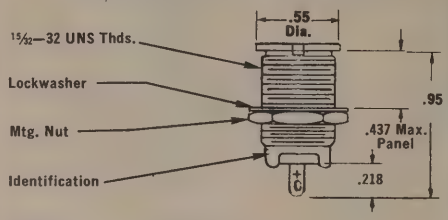
**3. Lamp:** C7A (Std.) or C9A (High brightness) T2 neon lamp furnished with each assembly.
See lamp guide for electrical characteristics.

**4. Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Paint free area around back side of hole required for E.M.I. conductivity.

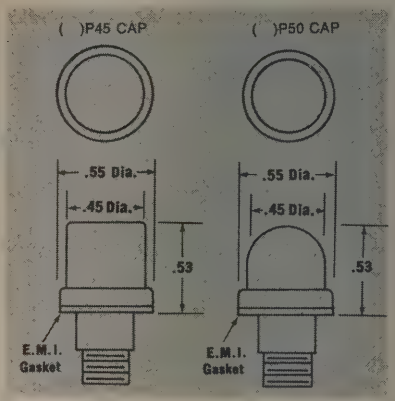
**5. Weight:** Approx. .5 oz. less lamp.

### BASE ASSEMBLY

**38-36480 (62 K Ω Internal Resistor)**
**38-36481 (27 K Ω Internal Resistor)**



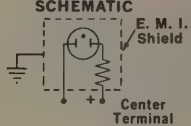
### CAP STYLES



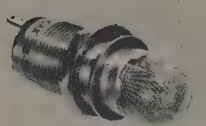

| Complete Assembly Part Numbers (Includes Lamp) | | | |
|---|---|---|---|
| Lamp | Transparent Lens Colors | ( )P45 Cap | ( )P50 Cap |
| C7A | Clear | 38-36480-5P45-C7A | 38-36480-5P50-C7A |
| | Red | 38-36480-6P45-C7A | 38-36480-6P50-C7A |
| | Amber | 38-36480-8P45-C7A | 38-36480-8P50-C7A |
| | Lunar | 38-36480-17P45-C7A | 38-36480-17P50-C7A |
| C9A | Clear | 38-36481-5P45-C9A | 38-36481-5P50-C9A |
| | Red | 38-36481-6P45-C9A | 38-36481-6P50-C9A |
| | Amber | 38-36481-8P45-C9A | 38-36481-8P50-C9A |
| | Lunar | 38-36481-17P45-C9A | 38-36481-17P50-C9A |

Translucent colors: Not recommended.
( ) Designates color selection.

**SCHEMATIC**




### miniature, neon E.M.I. suppressed



**38-36180 SERIES**
**38-36280 SERIES**

**NOTES:**

**1. Material and Finishes:** Mounting tube and nuts are brass, nickel plated per QQ-N-290. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

**2. Cap Assembly:** Lens is high impact-resistant plastic per L-P-349a. Standard colors are transparent.

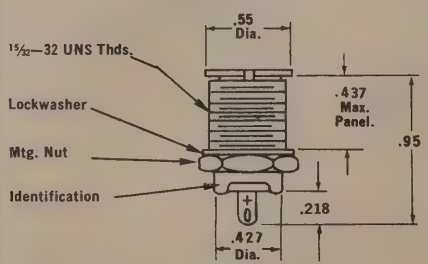
**3. Lamp:** C7A (std.) or C9A (high brightness) T2 neon lamp supplied with each assembly. See lamp guide for electrical characteristics.

**4. Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended Mounting Hole 500 ± .015 diameter. Paint free area around back side of hole required for E.M.I. conductivity.

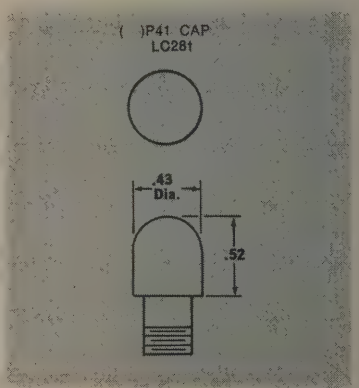
**5. Weight:** .30 oz. less lamp.

### BASE ASSEMBLY

**38-36180 (62KΩ Internal Resistor)**
**LH74/3†**
**38-36280 (27KΩ Internal Resistor)**
**LH74/4†**



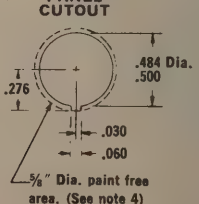

### CAP STYLES



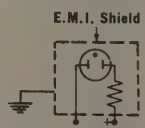

| Complete Assembly Part Number (Includes Lamp) | | |
|---|---|---|
| LAMP | Transparent Lens Colors | ( )P41 Cap |
| C7A | Clear | 38-36180- 5P41-C7A |
| | Red | 38-36180- 6P41-C7A |
| | Amber | 38-36180- 8P41-C7A |
| | Lunar | 38-36180-17P41-C7A |
| C9A | Clear | 38-36280- 5P41-C9A |
| | Red | 38-36280- 6P41-C9A |
| | Amber | 38-36280- 8P41-C9A |
| | Lunar | 38-36280-17P41-C9A |

Translucent colors: Not Recommended.
†Assembly conforms to requirements of MIL-L-3661
See pages 64 & 65 for complete listing of military type designations.
( ) Designates color selection.

**PANEL CUTOUT**




**SCHEMATIC**



## neon, E.M.I. suppressed

## 38-83681 SERIES
## 38-83682 SERIES

**Notes:**

**1. Material and Finishes:** Mounting tube and nut, bright nickel finish per QQ-N-290. Lockwasher, stainless steel or steel, nickel plate. Terminals, brass, tin plated per MIL-T-10727A.

**2. Cap Assembly:** Lens is high impact resistant plastic per L-P-349a. Standard colors are transparent. Lens holder, bright nickel finish per QQ-N-290

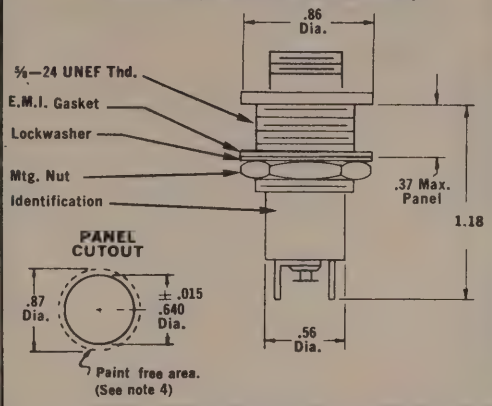
**3. Lamp:** NE51 (standard) or NE51H (high brightness) T-3¼ neon is furnished with each assembly. See lamp guide for electrical characteristics.

**4. Mounting:** Assembly mounts from front of panel. All mounting hardware supplied. Recommended mounting hole .640 ± .015 diameter, with paint free area around back side of hole for E.M.I. conductivity.

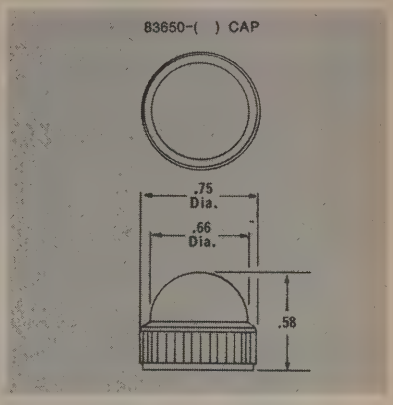
**5. Weight:** Approx. 1 oz.

### BASE ASSEMBLY

**38-83681 (27K Ω Internal Resistor)**
**38-83682 (100KΩ Internal Resistor)**




### CAP STYLES




| Complete Assembly Part Numbers (Includes Lamp) | | |
|---|---|---|
| **Lamp** | **Transparent Lens Colors** | **83650-( ) Cap** |
| NE51H | Clear | 38-83681-5-NE51H |
| | Red | 38-83681-6-NE51H |
| | Amber | 38-83681-8-NE51H |
| | Lunar | 38-83681-17-NE51H |
| NE51 | Clear | 38-83682-5-NE51 |
| | Red | 38-83682-6-NE51 |
| | Amber | 38-83682-8-NE51 |
| | Lunar | 38-83682-17-NE51 |

Translucent colors: Not recommended.
( ) Designates color selection.

**SCHEMATIC**

## miniature, L.E.D. indicator

## QT/D300
## 14-35380 SERIES

**Notes:**

**1. Materials and Finishes:** Housing, molded glass filled nylon. (Black). Terminals, beryllium copper. Retainer clip, spring steel.

**2. Lens Cap:** High impact resistant plastic per L-P-393, (polycarbonate).

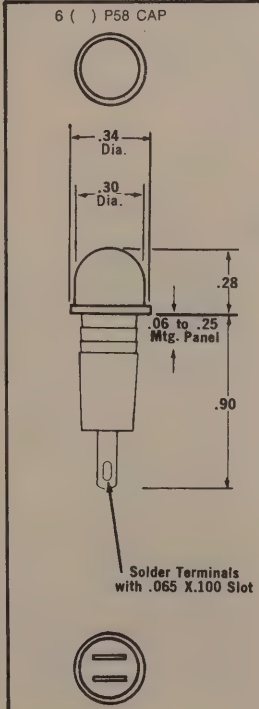
**3. Mounting:** Two types optional:

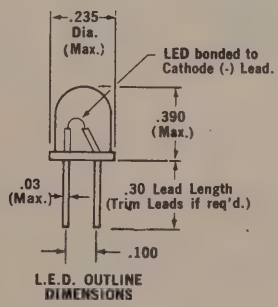
A. Press-In: Assembly press fits into .281 diameter hole. No mounting hardware required.

B. Retainer Clip: For mounting assembly into .296 ± .015 dia. hole or panels less than .06 thick. Order clip 067004000 separately.

**4. Solder Terminals:** Terminals accept AMP FASTON receptacle #60415 or equiv.

**5. Lamp:**
A. QT/D300 assembly supplied with L.E.D. as described.
B. 14-35380 assembly does not include L.E.D. Assembly will accept any L.E.D. conforming to outline shown.



Optional Mtg. Clip 067004000

**SCHEMATIC**

(+) Anode Terminal, Gold Plated
(—) Cathode Terminal, Tin Plated

**QT/D300**
Light Source: Gallium arsenide phosphide light emitting diode. (L.E.D.)

Characteristics: Forward current; 50 milliamps maximum.
Forward voltage; 1.6 to 2.0 at 20 milliamps.
Reverse breakdown; 3 volts minimum.
Wavelength; 655 ±15 nanometers. (Red)

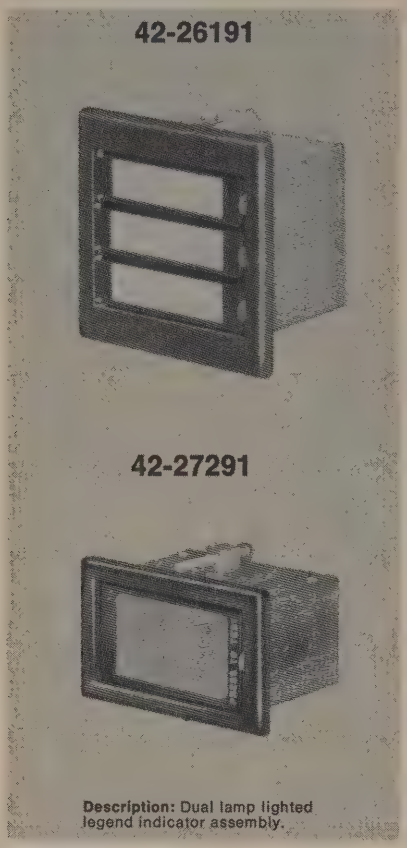
Appearance: Lens cap design optimized to provide high legibility under all indoor lighting conditions, over 170° viewing angle.

| Complete Assembly Part Numbers | | |
|---|---|---|
| **Transparent Lens Colors** | **Includes L.E.D.** | **Less L.E.D.** |
| Clear | ———— | 14-35380-65P58 |
| Red | QT/D300* | 14-35380-66P58 |
| Green | ———— | 14-35380-67P58 |
| Amber | ———— | 14-35380-68P58 |

( ) Designates color selection.
*Also available with flat, red translucent cap as QT/D301.

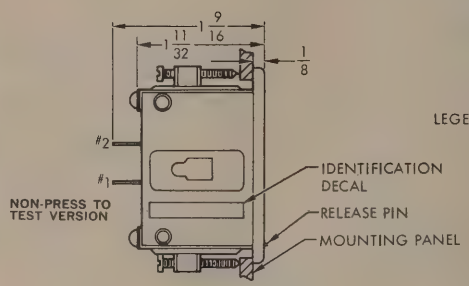
**OAK Industries Inc.**
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

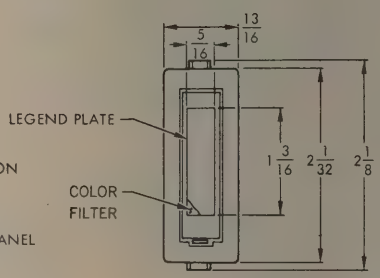
# MISSILITE Assembly

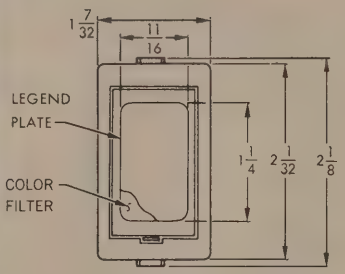


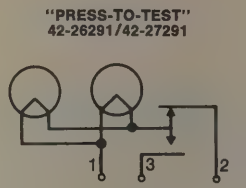

**Description:** Dual lamp lighted legend indicator assembly.

**42-26191** **42-26291** **42-27191** **42-27291**






## SPECIFICATIONS

**LEGEND:** Legend plate is replaceable from front of panel. Legend area may be imprinted with any letter or numeral combination, space permitting. For style and color, refer to page 66.

**LAMPS:** Two lamps are required per assembly and are replaceable from front of panel. Lamps are not included in part number shown. For lamp selection, refer to page 66, and ordering instructions.

**OPTIONS:** If vertical stacking is desirable, a second dash number is added. This number indicates the number of units required. Example: 42-26291-6-8 designates 8 units with red, Style A legend plates or 42-26291-66-4, designates 4 units with red, Style B legend plates. Example 2: 42-27291-6-3, designates 3 units with red, Style A legend plates; or 42-27291-66-4, designates 4 units with red, Style B legend plates. Refer to page 61 for dimensions of single or stacked assemblies. For horizontal or combined horizontal and vertical arrangements, please contact our sales department for part numbers, part dimensions, and cutout dimensions.
Note: If a second dash number does not appear on the part number, a single unit will be furnished.

**MOUNTING:** Single units are furnished with universal mounting brackets which enables the assembly to be secured at either top and bottom or at each side. Unless otherwise specified, multiple units will be supplied with mounting brackets at top and bottom only.

**PANEL CUTOUTS:** For panel cutout dimensions refer to page 61.

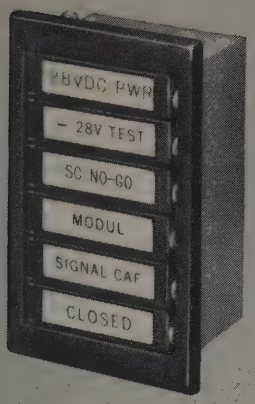
**WEIGHT:** Approximately 1.7 oz., less lamps per single unit.

| Color | Legend Plate Style A | | Legend Plate Style A "Press to Test" | |
|---|---|---|---|---|
| White | 42-26191-5 | 42-27191-5 | 42-26291-5 | 42-27291-5 |
| Red | 42-26191-6 | 42-27191-6 | 42-26291-6 | 42-27291-6 |
| Green | 42-26191-7 | 42-27191-7 | 42-26291-7 | 42-27291-7 |
| Amber | 42-26191-8 | 42-27191-8 | 42-26291-8 | 42-27291-8 |
| Blue | 42-26191-11 | 42-27191-11 | 42-26291-11 | 42-27291-11 |
| Yellow | 42-26191-12 | 42-27191-12 | 42-26291-12 | 42-27291-12 |

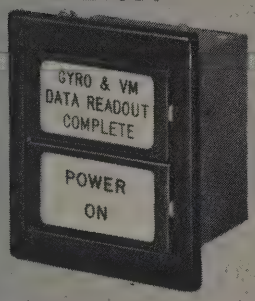
| Color | Legend Plate Style B | | Legend Plate Style B "Press to Test" | |
|---|---|---|---|---|
| Red | 42-26191-66 | 42-27191-66 | 42-26291-66 | 42-27291-66 |
| Green | 42-26191-67 | 42-27191-67 | 42-26291-67 | 42-27291-67 |
| Amber | 42-26191-68 | 42-27191-68 | 42-26291-68 | 42-27291-68 |
| Blue | 42-26191-69 | 42-27191-69 | 42-26291-69 | 42-27291-69 |

# MISSILITE Assembly

## 42-29191



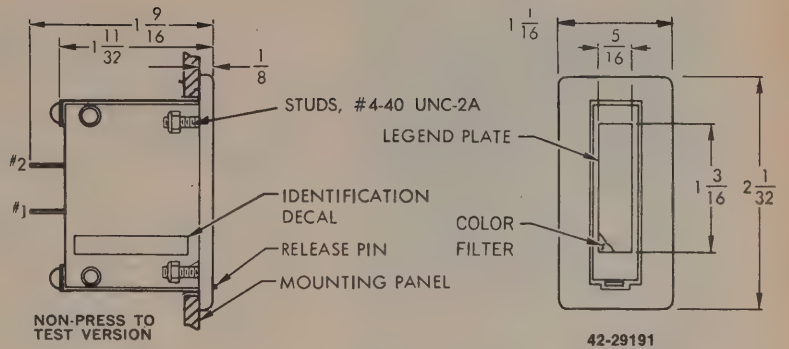

## 42-29391

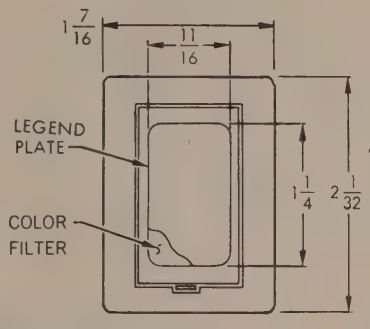



Listed and Qualified under MIL-I-3661B as 41-29193 (LHC81/1 thru /10) and 41-29293 (LHC81/11 thru /20). — difference, legend plates not furnished.
See pages 64 & 65 for complete listing of military type designations.

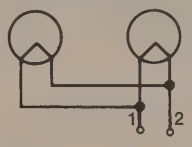
**Description:** Dual lamp lighted legend indicator assembly secured to panel by integral threaded studs and elastic stop nuts.

## 42-29191 42-29291 42-29391 42-29491

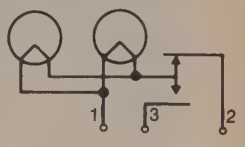



**NON PRESS-TO-TEST**
**41-29193/42-29191/42-29391**
**SCHEMATIC**




**"PRESS-TO-TEST"**
**41-29293/42-29291/42-29491**
**SCHEMATIC**




### SPECIFICATIONS:

**LEGEND:** Legend Plate is replaceable from front of panel. Legend area may be imprinted with any letter or numeral combination, space permitting. For style and color, refer to page 63.

**LAMPS:** Two lamps are required per assembly and are replaceable from front of panel. Lamps are not included in part number shown. For lamp selection, refer to page 66, and ordering instructions.

**OPTIONS:** If vertical stacking is desired, a second dash number is added. This number indicates the number of units required. Example: 41-29191-6-8, designates 8 units with Red, style A Legend Plates: or 42-29191-56-4, designates 4 units with Red, style B Legend Plates. Refer to page 61 for dimensions of single or stacked assemblies. 42-29391 and 42-29491 available with up to 5 units in vertical array.

**NOTE:** If a second dash number does not appear on the part number, a single unit will be furnished.

**MOUNTING:** Units are stud mounted top and bottom.

**PANEL CUTOUTS:** For panel cutout dimensions refer to page 61.

**WEIGHT:** Approximately 1.2 oz. less lamps per single unit.

| Color | Legend Plate Style "A" | | Legend Plate Style "A" Press to Test | |
|---|---|---|---|---|
| White | 42-29191-5 | 42-29391-5 | 42-29291-5 | 42-29491-5 |
| Red | 42-29191-6 | 42-29391-6 | 42-29291-6 | 42-29491-6 |
| Green | 42-29191-7 | 42-29391-7 | 42-29291-7 | 42-29491-7 |
| Amber | 42-29191-8 | 42-29391-8 | 42-29291-8 | 42-29491-8 |
| Blue | 42-29191-11 | 42-29391-11 | 42-29291-11 | 42-29491-11 |
| Yellow | 42-29191-12 | 42-29391-12 | 42-29291-12 | 42-29491-12 |

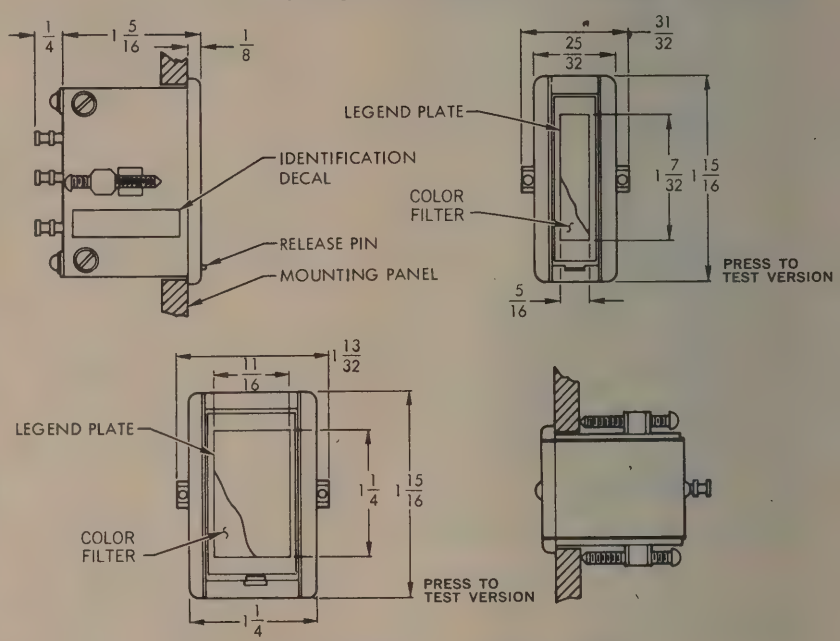
| Color | Legend Plate Style "B" | | Legend Plate Style "B" Press to Test | |
|---|---|---|---|---|
| Red | 42-29191-56 | 42-29391-56 | 42-29291-56 | 42-29491-56 |
| Green | 42-29191-57 | 42-29391-57 | 42-29291-57 | 42-29491-57 |
| Amber | 42-29191-58 | 42-29391-58 | 42-29291-58 | 42-29491-58 |
| Blue | 42-29191-59 | 42-29391-59 | 42-29291-59 | 42-29491-59 |
| White | 42-29191-60 | 42-29391-60 | 42-29291-60 | 42-29491-60 |

**OAK Industries Inc.**
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

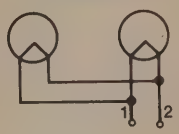
# MISSILITE Assembly

**Description:** Modular dual lamp lighted legend indicator: permits the buildup of multiple assemblies in vertical, horizontal or combination arrays, from standard components.

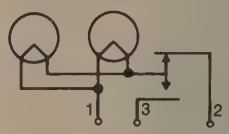
## 42-46191 42-46291 42-47191 42-47291




**NON PRESS-TO-TEST**
**42-46191/42-47191 SCHEMATIC**




**"PRESS-TO-TEST"**
**42-46291/42-47291 SCHEMATIC**




### SPECIFICATIONS

**LEGEND:** Legend plate is replaceable from front of panel. Legend area may be imprinted with any letter or numeral combination, space permitting. For style and color, refer to page 63.

**LAMPS:** Two lamps are required per assembly and are replaceable from front of panel. Lamps are not included in part number shown. For lamp selection, refer to page 66, and ordering instructions.

**OPTIONS:** If vertical stacking is desired, a second dash number is added. This number indicates the number of units required. Example: 42-47291-6-3, designates 3 units with red, Style A legend plates or 42-47291-66-4, designates 4 units with red, style B Legend Plates. Refer to page 61 for dimensions of single or stacked assemblies. For horizontal or combined horizontal and vertical arrangements, please contact our sales department for part numbers, part dimensions, and cut out dimensions.
Note: If a second dash number does not appear on the part number, a single unit will be furnished.

**MOUNTING:** Single and multiple units are furnished with mounting brackets at top and bottom.

**PANEL CUTOUTS:** For panel cutout dimensions refer to page 61.

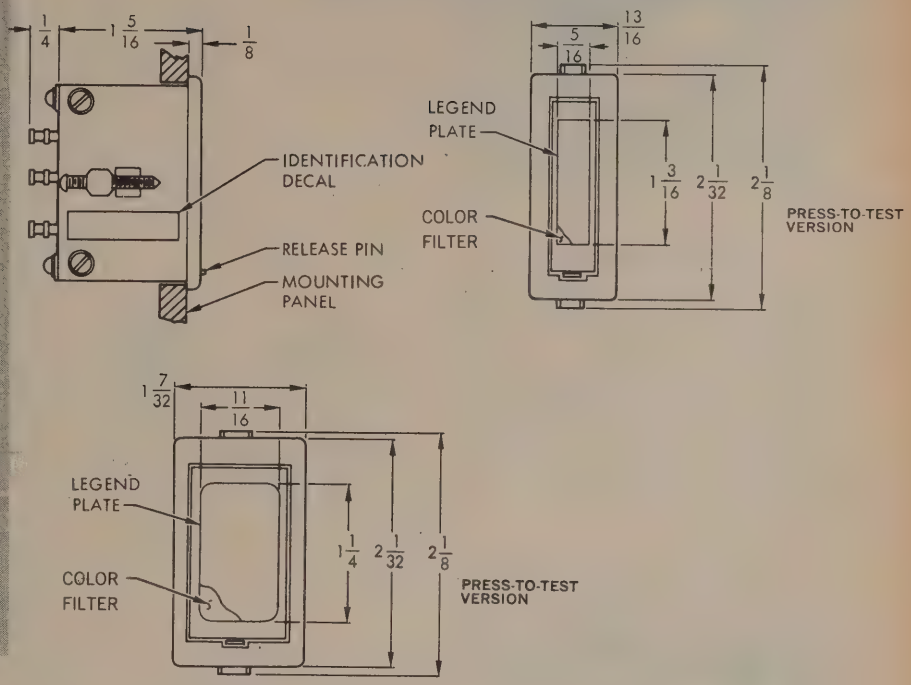
**WEIGHT:** Approximately 1.6 oz., less lamps per single unit.

| Color | Legend Plate Style A | | Legend Plate Style A "Press to Test" | |
|---|---|---|---|---|
| White | 42-46191-5 | 42-47191-5 | 42-46291-5 | 42-47291-5 |
| Red | 42-46191-6 | 42-47191-6 | 42-46291-6 | 42-47291-6 |
| Green | 42-46191-7 | 42-47191-7 | 42-46291-7 | 42-47291-7 |
| Amber | 42-46191-8 | 42-47191-8 | 42-46291-8 | 42-47291-8 |
| Blue | 42-46191-11 | 42-47191-11 | 42-46291-11 | 42-47291-11 |
| Yellow | 42-46191-12 | 42-47191-12 | 42-46291-12 | 42-47291-12 |

| Color | Legend Plate Style B | | Legend Plate Style B "Press to Test" | |
|---|---|---|---|---|
| Red | 42-46191-66 | 42-47191-66 | 42-46291-66 | 42-47291-66 |
| Green | 42-46191-67 | 42-47191-67 | 42-46291-67 | 42-47291-67 |
| Amber | 42-46191-68 | 42-47191-68 | 42-46291-68 | 42-47291-68 |
| Blue | 42-46191-69 | 42-47191-69 | 42-46291-69 | 42-47291-69 |

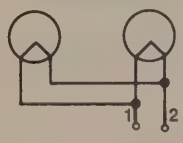
# MISSILITE Assembly R.F.I. SHIELDED

**48-47691 48-47891 48-47791 48-47991**

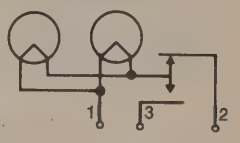



**Description:** Recommended for use where it is desired to exclude extraneous radio frequency radiations from the system or where internally generated RFI must be confined to the originating apparatus.

**NON PRESS-TO-TEST 48-47691/48-47791 SCHEMATIC**




**"PRESS-TO-TEST" 48-47891/48-47991 SCHEMATIC**




## SPECIFICATIONS

**LEGEND:** Legend plate is replaceable from front of panel. Legend area may be imprinted with any letter or numeral combination, space permitting. For style and color refer to page 63.

**LAMPS:** Two lamps are required per assembly and are replaceable from front of panel. Lamps are not included in part number shown. For lamp selection, refer to page 66, and ordering instructions.

**OPTIONS:** If vertical stacking is desired, a second dash number is added. This number indicates the number of units required. Example: 48-47691-6-3, designates 3 units with red, Style A legend plates; or 48-47691-66-4, designates 4 units with red, Style B Legend Plates. Refer to page 61 for dimen- of single or stacked assemblies. For horizontal or combined horizontal and vertical arrangements, please contact our sales department for part numbers, part dimensions, and cutout dimensions.
Note: If a second dash number does not appear on the part number, a single unit will be furnished.

**MOUNTING:** Single units are furnished with universal mounting brackets which enables the assembly to be secured at either top and bottom or at each side. Unless otherwise specified, multiple units will be supplied with mounting brackets at top and bottom only.

**PANEL CUTOUTS:** For panel cutout dimensions refer to page 61.

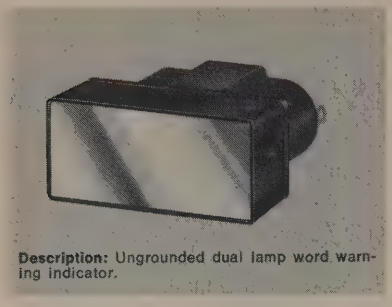
**WEIGHT:** Approximately 1.8 oz., less lamps per single unit.

| Color | Legend Plate Style A | | Legend Plate Style A "Press to Test" | |
|---|---|---|---|---|
| White | 48-47691-5 | 48-47791-5 | 48-47891-5 | 48-47991-5 |
| Red | 48-47691-6 | 48-47791-6 | 48-47891-6 | 48-47991-6 |
| Green | 48-47691-7 | 48-47791-7 | 48-47891-7 | 48-47991-7 |
| Amber | 48-47691-8 | 48-47791-8 | 48-47891-8 | 48-47991-8 |
| Blue | 48-47691-11 | 48-47791-11 | 48-47891-11 | 48-47991-11 |
| Yellow | 48-47691-12 | 48-47791-12 | 48-47891-12 | 48-47991-12 |

| Color | Legend Plate Style B | | Legend Plate Style B "Press to Test" | |
|---|---|---|---|---|
| Red | 48-47691-66 | 48-47791-66 | 48-47891-66 | 48-47991-66 |
| Green | 48-47691-67 | 48-47791-67 | 48-47891-67 | 48-47991-67 |
| Amber | 48-47691-68 | 48-47791-68 | 48-47891-68 | 48-47991-68 |
| Blue | 48-47691-69 | 48-47791-69 | 48-47891-69 | 48-47991-69 |

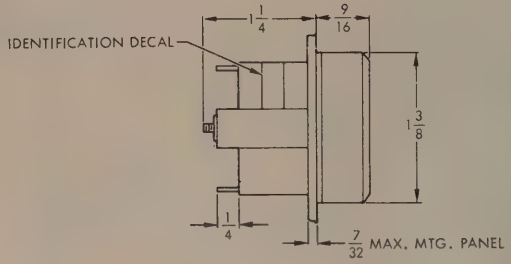
**OAK Industries Inc.**
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

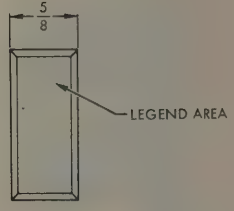
# MISSILITE Assembly



**Description:** Ungrounded dual lamp word warning indicator.

## 43-20580




### SPECIFICATIONS:

**LEGEND:** Legend area may be imprinted with any letter or numeral combination, space permitting. When necessary, special part numbers will be assigned for customer identification. For legend plate style and color refer to page 63.

**LAMPS:** Not supplied with assembly. Specify when ordering if desired. Two lamps required per unit. Consult lamp selection guide page 66. Unit is relampable from front of panel. For independent lamp illumination, specify 43-20880 Missilite.

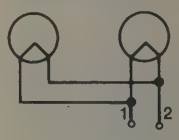
**MOUNTING:** See below for mounting panel cut-out information. Mounting hardware supplied with assembly.

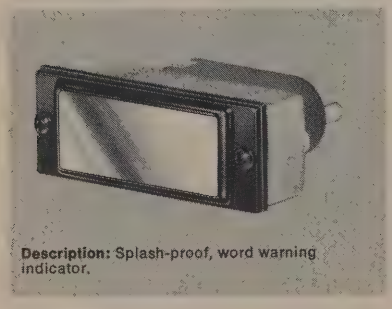
**WEIGHT:** Approximately 1.0 less lamp.

| Color | Legend Plate Style A | Legend Plate Style B |
|---|---|---|
| White | 43-20580-5 | None |
| Red | 43-20580-6 | 43-20580-56 |
| Green | 43-20580-7 | 43-20580-57 |
| Amber | 43-20580-8 | 43-20580-58 |
| Blue | 43-20580-11 | 43-20580-59 |

**NOTE:** To prevent accidental interchange of legends in multiple installations, lens caps will be indexed to proper base when this feature is specified by customer.

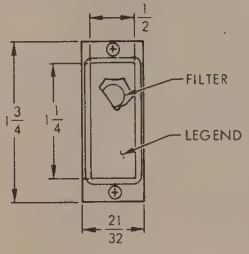
**43-20580 SCHEMATIC**

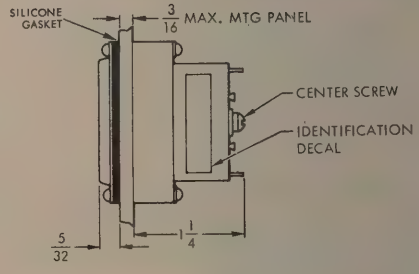


**Description:** Splash-proof, word warning indicator.

## 45-21090




### SPECIFICATIONS:

**LEGEND:** Legend area may be imprinted with any letter or numeral combination, space permitting. When necessary, special part numbers will be assigned for customer identification. For legend plate style and color refer to page 63.

**LAMPS:** Not supplied with assembly. Specify when ordering if desired. Two lamps required per unit. Consult lamp selection guide page 66. Relamping screw at bottom of base. For independent lamp illumination, specify 45-20990 Missilite.

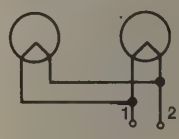
**MOUNTING:** See below for mounting panel cut-out information. Mounting hardware supplied with assembly.

**WEIGHT:** Approximately .8 oz., less lamps.

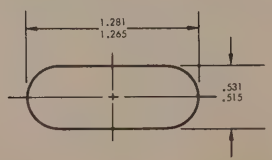
**SPECIAL APPLICATIONS:** Unit is splash-proof when installed in panel and is designed to meet most military and commercial applications.

| Color | Legend Plate Style A | Legend Plate Style B |
|---|---|---|
| White | 45-21090-5 | None |
| Red | 45-21090-6 | 45-21090-56 |
| Green | 45-21090-7 | 45-21090-57 |
| Amber | 45-21090-8 | 45-21090-58 |
| Blue | 45-21090-11 | 45-21090-59 |
| Yellow | 45-21090-12 | None |

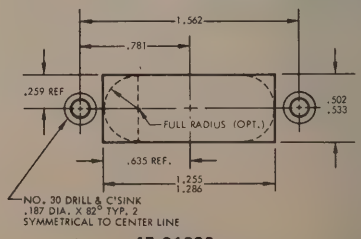
**43-21090 SCHEMATIC**




## MOUNTING PANEL CUT-OUT DIMENSIONS



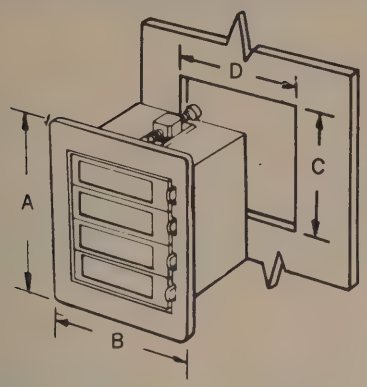

**43-20580**



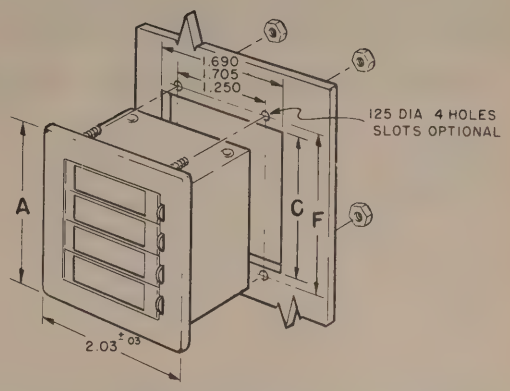

**45-21090**

# MISSILITE Assembly

## MOUNTING PANEL CUT-OUT DIMENSIONS




KEY-BLOCK MOUNT




STUD MOUNT

For other information on configurations not illustrated, contact our Sales Department and appropriate ordering data will be furnished. Our Engineering Department will prepare and maintain a specification control drawing describing your exact requirement. Drawings will be submitted for approval prior to production of parts.

| No. of Units In Vertical Array | | 1 Unit | 2 Unit | 3 Unit | 4 Unit | 5 Unit | 6 Unit | 7 Unit | 8 Unit | 9 Unit | 10 Unit | Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 42-26191 | Dim. A | .812 | 1.218 | 1.937 | 2.390 | X | 3.265 | X | 4.140 | X | 5.031 | ±.03 |
| 42-26291 | Dim. B | 2.031 | 2.031 | 2.031 | 2.031 | X | 2.031 | X | 2.031 | X | 2.031 | ±.03 |
| | Dim. C | .618 | 1.061 | 1.499 | 1.940 | X | 2.820 | X | 3.700 | X | 4.580 | ±.015 |
| | Dim. D | 1.795 | 1.705 | 1.705 | 1.705 | X | 1.705 | X | 1.705 | X | 1.705 | ±.015 |
| 42-27191 | Dim. A | 1.218 | 2.390 | 3.265 | 4.140 | 5.031 | X | X | X | X | X | ±.03 |
| 42-27291 | Dim. B | 2.031 | 2.031 | 2.031 | 2.031 | 2.031 | X | X | X | X | X | ±.03 |
| | Dim. C | 1.061 | 1.940 | 2.820 | 3.700 | 4.580 | X | X | X | X | X | ±.015 |
| | Dim. D | 1.795 | 1.705 | 1.705 | 1.705 | 1.705 | X | X | X | X | X | ±.015 |
| 42-29191 | Dim. A | 1.063 | 1.504 | 1.944 | 2.384 | 2.824 | 3.264 | 3.704 | 4.144 | 5.584 | 5.024 | ±.010 |
| 42-29291 | Dim. C | .540 | .970 | 1.410 | 1.850 | 2.296 | 2.733 | 3.174 | 3.617 | 4.060 | 4.500 | ±.010 |
| | Dim. F | .796 | 1.226 | 1.666 | 2.106 | 2.554 | 2.989 | 3.430 | 3.873 | 4.316 | 4.758 | ±.010 |
| 42-29391 | Dim. A | 1.504 | 2.384 | 3.264 | 4.144 | 5.024 | X | X | X | X | X | ±.010 |
| 42-29491 | Dim. C | .970 | 1.850 | 2.733 | 3.617 | 4.500 | X | X | X | X | X | ±.010 |
| | Dim. F | 1.226 | 2.106 | 2.989 | 3.873 | 4.758 | X | X | X | X | X | ±.010 |
| 42-46191 | Dim. A | .789 | 1.232 | 1.672 | 2.112 | 2.552 | 2.992 | 3.432 | 3.875 | 4.312 | 4.752 | ±.015 |
| 42-46291 | Dim. B | 1.950 | 1.950 | 1.950 | 1.950 | 1.950 | 1.950 | 1.950 | 1.950 | 1.950 | 1.950 | ±.015 |
| 48-47691 | Dim. C | .650 | 1.093 | 1.531 | 1.972 | 2.412 | 2.852 | 3.292 | 3.732 | 4.172 | 4.612 | ±.015 |
| 48-47891 | Dim. D | 1.795 | 1.795 | 1.795 | 1.795 | 1.795 | 1.795 | 1.795 | 1.795 | 1.795 | 1.795 | ±.015 |
| 42-47191 | Dim. A | 1.232 | 2.112 | 2.992 | 3.875 | 4.752 | X | X | X | X | X | ±.015 |
| 42-47291 | Dim. B | 1.950 | 1.950 | 1.950 | 1.950 | 1.950 | X | X | X | X | X | ±.015 |
| 48-47791 | Dim. C | 1.092 | 1.972 | 2.852 | 3.732 | 4.612 | X | X | X | X | X | ±.015 |
| 48-47991 | Dim. D | 1.795 | 1.795 | 1.795 | 1.795 | 1.795 | X | X | X | X | X | ±.015 |

## BASIC DATA

(MISSILITE MATERIAL STANDARDS)

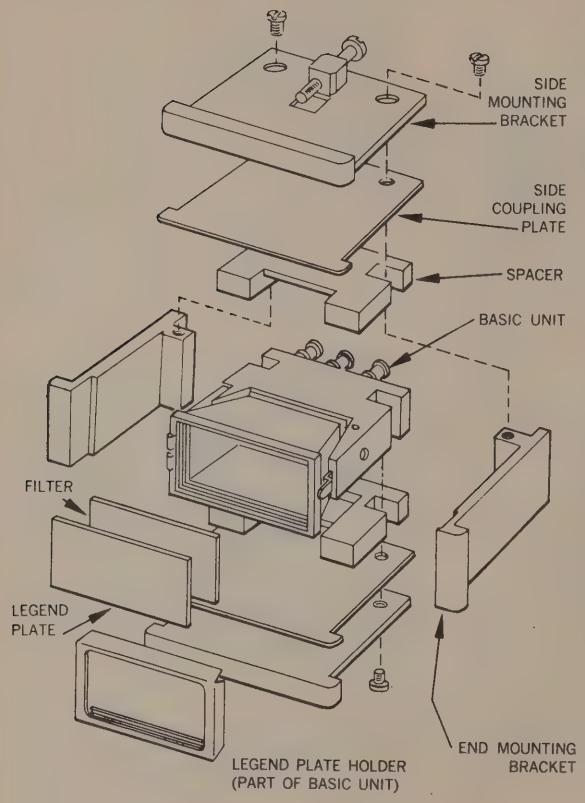
| PART | MATERIAL | FINISH OR MATERIAL SPECIFICATIONS | |
|---|---|---|---|
| Base Shell | Phenolic Resin | Black | MIL-M-14F |
| Lamp Housing | Phenolic Resin | Black | MIL-M-14F |
| Mounting Brackets | Aluminum | Black Anodized | MIL-A-8625 |
| Mounting Plates | Aluminum | Black Anodized | MIL-A-8625 |
| Escutcheon Plates | Aluminum | Black Anodized | MIL-A-8625 |
| Legend Holders | Aluminum | Black Anodized | MIL-A-8625 |
| Legend Plates | Butyrate Plastic | — | L-P-349 |
| Filters | Silicone Rubber | — | MIL-R-5847 |
| | Butyrate Plastic | — | L-P-349 |
| R.F.I. Screen | Monel Wire | — | QQ-N-281 |
| Gaskets | Silicone Rubber | — | MIL-R-5847 |
| Key-block Assemblies | Brass | Cadmium Plated | QQ-P-416 |
| Terminal (Solder) | Brass | Tin Plated | MIL-T-10727 |
| Terminal (Screw) | Brass | Nickel Plated | QQ-N-290 |
| Terminal (Turret) | Brass | Tin Plated | MIL-T-10727 |
| Lamp Contacts | Brass | Nickel Plated | QQ-N-290 |

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# MISSILITE PARTS BREAKDOWN

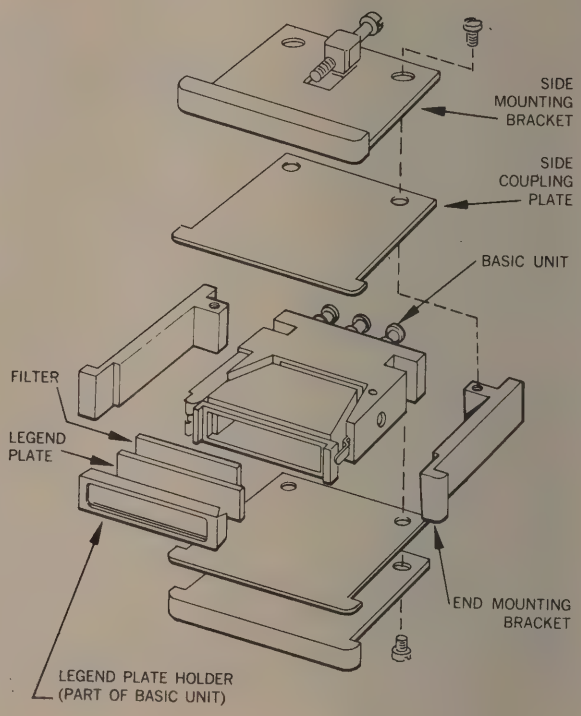
## 42-46191 42-46291 42-47191 42-47291

### 42-47191
### 42-47291




Side Mounting Bracket—042005003
Side Coupling Plate—048016011
Spacer—050007001
Basic Unit—42-47190 or 42-47290
Filter—27203
Legend Plate—27201
Keyblock Assembly—100056001
Legend Plate Holder
(Part of Basic Unit)

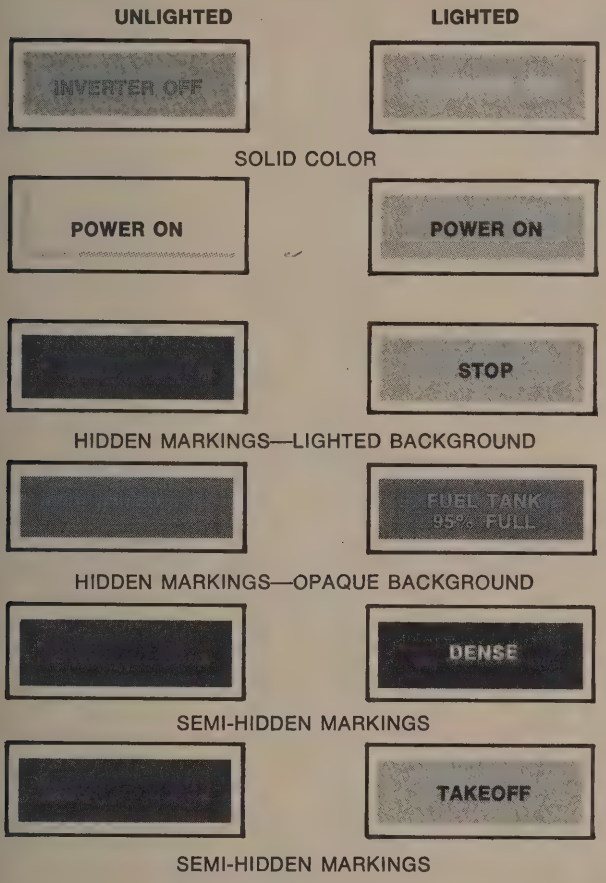
### 42-46191
### 42-46291




Side Mounting Bracket—042005003
Side Coupling Plate—048016011
Basic Unit—42-46190 or 42-46290
Filter—46103
Legend Plate—46101
Legend Plate Holder
(Part of Basic Unit)
Key Block Assembly—100056002

## LEGEND PLATE STYLE SELECTION GUIDE

Part numbers are included for specific assemblies having legend plate Styles A & B. Part numbers are available upon request for assemblies requiring legend styles and colors other than those listed on Missilite catalog pages.




**LEGEND PLATE STYLE A** — Visible opaque markings on translucent background. Standard markings will be black characters on white and yellow backgrounds, and white characters on backgrounds of all other colors.

**LEGEND PLATE STYLE B** — Visible black opaque markings on white translucent background. When lighted, the background changes to desired color.

**LEGEND PLATE STYLE C** — When unlighted, markings are obscured for minimum visibility. When lighted, the markings appear black against a lighted background of desired color.

**LEGEND PLATE STYLE D** — When unlighted, markings are obscured for minimum visibility. When lighted, the markings appear in the desired color, the background remains opaque.

**LEGEND PLATE STYLE E** — When unlighted, the markings are semi-visible on an opaque background. When lighted, the characters are clearly visible in desired color, background remains opaque.

**LEGEND PLATE STYLE F** — Semi-visible markings on background of color specified. When lighted opaque markings are sharply outlined.

## HOW TO ORDER IPI MISSILITES

Simply write or call the Oak representative in your area or the factory.

The following information must be included on the purchase order:

Specify the Oak part number with appropriate dash number (see individual pages).

Specify color and style of legend if requirements are for other than those parts listed herein.

Specify the desired legend plate markings. THE LEGEND PLATE WILL BE MARKED EXACTLY THE WAY IT APPEARS ON THE CUSTOMER'S DRAWING OR PURCHASE ORDER.

Specify lamp number in accordance with the lamp selection guide on page 66. Use lamp number as a suffix dash number to unit reference. Example: 42-26291-6-327.

Specify any requirements that deviate from standard i.e., side mounting for 42-46191 series, horizontal stacks of 42-47291, etc.

Oak will prepare individual customer specification control drawings for special configurations not covered by catalog part number.

These will be distinguished by a three digit dash number affixed to basic part number. Example: 42-26291-147.

**OAK Industries Inc.**
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

## CROSS REFERENCE TO MILITARY TYPE DESIGNATIONS

| SPECIFICATION | TYPE DESIGNATION | IPI PART NUMBER | PG. |
|---|---|---|---|
| MIL-L-3661/5 | LH 73/1 | 11-33480 | 40 |
| | LH 73/2 | 18-36880 | 45 |
| MIL-3661/6 | LH 74/1 | 31-36180 | 51 |
| | LH 74/2 | 31-36280 | 51 |
| | LH 74/3 | 38-36180 | 52 |
| | LH 74/4 | 38-36280 | 52 |
| MIL-L-3661/11 | LC 11 RN 2 | 6 P 35 | 40 |
| | GN 2 | 7 P 35 | |
| | YN 2 | 8 P 35 | |
| | CN 2 | 5 P 35 | |
| | RT 2 | 6 P 35 TL | |
| | GT 2 | 7 P 35 TL | |
| | YT 2 | 12 P 35 TL | |
| | WT 2 | 5 P 35 TL | |
| | GD 2 | 7 P 35 IF | |
| | RD 2 | 6 P 35 IF | |
| | RB 2 | 46 P 35 | |
| | GB 2 | 47 P 35 | |
| | YB 2 | 412 P 35 | |
| | LC 11 WB 2 | 45 P 35 | |
| MIL-L-3661/12 | LC 12 RN 2 | 6 P 12 | 40 |
| | GN 2 | 7 P 12 | |
| | YN 2 | 8 P 12 | |
| | CN 2 | 5 P 12 | |
| | RT 2 | 6 P 12 TL | |
| | GT 2 | 7 P 12 TL | |
| | WT 2 | 5 P 12 TL | |
| | LC 12 YT 2 | 12 P 12 TL | |
| MIL-L-3661/13 | LC 13 RN 2 | 6 P 13 | 51 |
| | YN 2 | 8 P 13 | |
| | WT 2 | 17 P 13 | |
| | CN 2 | 5 P 13 | |
| | LC 13 GT 2 | 7 P 13 TL | |

## CROSS REFERENCE TO MILITARY TYPE DESIGNATIONS

| SPECIFICATION | TYPE DESIGNATION | IPI PART NUMBER | PG. |
|---|---|---|---|
| MIL-L-3661/25 | LC 25 RN 2 | 6 P 38 | 45 |
| | GN 2 | 7 P 38 | |
| | YN 2 | 8 P 38 | |
| | CN 2 | 5 P 38 | |
| | RT 2 | 6 P 38 TL | |
| | GT 2 | 7 P 38 TL | |
| | YT 2 | 12 P 38 TL | |
| | LC 25 WT 2 | 5 P 38 TL | |
| MIL-L-3661/26 | LC 26 GN 2 | 7 P 39 | 45 |
| | GT 2 | 7 P 39 TL | |
| | RN 2 | 6 P 39 | |
| | RT 2 | 6 P 39 TL | |
| | WT 2 | 5 P 39 TL | |
| | YN 2 | 8 P 39 | |
| | YT 2 | 12 P 39 TL | |
| | LC 26 CN 2 | 5 P 39 | |
| MIL-L-3661/27 | LC 27 RN 2 | 6 P 40 | 45 |
| | YN 2 | 8 P 40 | |
| | CN 2 | 5 P 40 | |
| | RT 2 | 6 P 40 TL | |
| | GT 2 | 7 P 40 TL | |
| | YT 2 | 12 P 40 TL | |
| | WT 2 | 5 P 40 TL | |
| | LC 27 GN 2 | 7 P 40 | |
| MIL-L-3661/28 | LC 28 RN 2 | 6 P 41 | 52 |
| | YN 2 | 8 P 41 | |
| | WT 2 | 17 P 41 | |
| | LC 28 CN 2 | 5 P 41 | |
| MIL-L-3661/29 | LC 29 CN 2 | 5 P 42 | 40 |
| | GN 2 | 7 P 42 | |
| | GT 2 | 7 P 42 TL | |
| | RN 2 | 6 P 42 | |
| | RT 2 | 6 P 42 TL | |
| | WT 2 | 5 P 42 TL | |
| | YN 2 | 8 P 42 | |
| | LC 29 YT 2 | 12 P 42 TL | |
| MIL-L-3661/33 | LC 33 RN 2 | 6 P 25 | 51 |
| | YN 2 | 8 P 25 | |
| | WT 2 | 17 P 25 | |
| | LC 33 CN 2 | 5 P 25 | |
| MIL-L-3661/34 | LC 34 EN 2/DO 2 | 80250-11 | * |
| | CN 2/DO 2 | -12 | |
| | EN 2/EN 2 | -13 | |
| | CN 2/EN 2 | -14 | |
| | EN 2/S02 | -15 | |
| | LC 34 CN 2/S02 | 80250-16 | |
| MIL-L-3661/35 | LC 35 RN 2 | 6 P 24 | 43 |
| | GN 2 | 7 P 24 | |
| | YN 2 | 8 P 24 | |
| | CN 2 | 5 P 24 | |
| | GT 2 | 7 P 24 TL | |
| | YT 2 | 12 P 24 TL | |
| | RT 2 | 6 P 24 TL | |
| | LC 35 WT 2 | 5 P 24 TL | |

* Not shown in this catalog. Please contact Oak Switch Division for details.

## CROSS REFERENCE TO MILITARY TYPE DESIGNATIONS

| SPECIFICATION | TYPE DESIGNATION | IPI PART NUMBER | PG. |
|---|---|---|---|
| MIL-L-3661/39 | LHC 81/1 | 41-29193-1 | * |
| | /2 | -2 | |
| | /3 | -3 | |
| | /4 | -4 | |
| | /5 | -5 | |
| | /6 | -6 | |
| | /7 | -7 | |
| | /8 | -8 | |
| | /9 | -9 | |
| | LHC 81/10 | 41-29193-10 | |
| | LHC 81/11 | 41-29293-1 | * |
| | /12 | -2 | |
| | /13 | -3 | |
| | /14 | -4 | |
| | /15 | -5 | |
| | /16 | -6 | |
| | /17 | -7 | |
| | /18 | -8 | |
| | /19 | -9 | |
| | LHC 81/20 | 41-29293-10 | |
| MIL-L-3661/40 | LHC 82/1 WT 2 | 99-36980- 5 TL | 34 |
| | /1 RT 2 | - 6 TL | |
| | /1 GT 2 | - 7 TL | |
| | LHC 82/1 YT 2 | 99-36980-12 TL | |
| | LHC 82/2 YT 2 | 98-36980-12 TL | 34 |
| | /2 WT 2 | - 5 TL | |
| | /2 RT 2 | - 6 TL | |
| | LHC 82/2 GT 2 | 98-36980- 7 TL | |
| MIL-3661/41 | LHC 83/1 WT 2 | 99-36981- 5 TL | 34 |
| | /1 RT 2 | - 6 TL | |
| | /1 GT 2 | - 7 TL | |
| | LHC 83/1 YT 2 | 99-36981-12 TL | |
| | LHC 83/2 WT 2 | 98-36981- 5 TL | 34 |
| | /2 RT 2 | - 6 TL | |
| | /2 GT 2 | - 7 TL | |
| | LHC 83/2 YT 2 | 98-36981-12 TL | |
| MIL-L-3661/42 | LHC 84/1 WT 2 | 99-36982- 5 TL | 34 |
| | /1 RT 2 | - 6 TL | |
| | /1 GT 2 | - 7 TL | |
| | LHC 84/1 YT 2 | 99-36982-12 TL | |
| | LHC 84/2 YT 2 | 98-36982-12 TL | 34 |
| | /2 WT 2 | - 5 TL | |
| | /2 RT 2 | - 6 TL | |
| | LHC 84/2 GT 2 | 98-36982- 7 TL | |
| MIL-L-3661/46 | LH 88/1 | 31-36680 | 51 |
| | LH 88/2 | 31-36681 | 51 |
| MIL-L-3661/47 | LH 89/1 | 11-35182 | 43 |
| MIL-L-3661/51 | LH 92/1 | 91-80280 | * |

## CROSS REFERENCE TO "MS" NUMBERS

| MILITARY STANDARD | IPI PART NUMBER | PG. |
|---|---|---|
| MS 25010 A 11 A | 91-80080-11 | * |
| 12 A | -12 | |
| 13 A | -13 | |
| 14 A | -14 | |
| 15 A | -15 | |
| MS 25010 A 16 A | 91-80080-16 | |
| MS 25010 B* 11 A | 91-80180-11 | * |
| 12 A | -12 | |
| 13 A | -13 | |
| 14 A | -14 | |
| 15 A | -15 | |
| MS 25010 B 16 A | 91-80180-16 | |
| MS 25010 C* 11 B | 91-80280-11 | * |
| 12 B | -12 | |
| 13 B | -13 | |
| 14 B | -14 | |
| 15 B | -15 | |
| MS 25010 C 16 B | 91-80280-16 | |
| Canceled after 5 Feb. 1971. Superseded by LH 92/1 LC 34. | | |
| MS 25041- 1 | 01-91180- 1 | 42 |
| - 2 | - 2 | |
| - 3 | - 3 | |
| - 4 | - 4 | |
| - 5 | - 5 | |
| - 6 | - 6 | |
| - 7 | - 7 | |
| - 8 | - 8 | |
| -10 | -10 | |
| MS 25041-11 | 01-91180-11 | |
| MS 25256- 2 | 11-33480- 8 P 12 | 40 |
| - 4 | - 7 P 12 | |
| - 6 | - 6 P 12 | |
| - 8 | - 5 P 12 | |
| -10 | - 5 P 12 TL | |
| MS 25256-12 | 11-33480-11 P 12 | |
| Canceled after 26 May 1969. Superseded by LH 73/1 LC 12. | | |
| MS 25257- 1 | 31-36180-8 P 13-NE 2 D | 51 |
| - 2 | -8 P 13 | |
| - 3 | -6 P 13-NE 2 D | |
| - 4 | -6 P 13 | |
| - 5 | -5 P 13-NE 2 D | |
| MS 25257- 6 | 31-36180-5 P 13 | |
| Canceled after 4 June 1970. Superseded by LH 74/1 LC 13. | | |
| MS 25331- 1 | 02-91180-1 | 48 |
| - 2 | -2 | |
| - 3 | -3 | |
| - 4 | -4 | |
| - 5 | -5 | |
| - 6 | -6 | |
| - 7 | -7 | |
| - 8 | -8 | |
| MS 25331- 9 | 02-91180-9 | |

* Not shown in this catalog. Please contact Oak Switch Division for details.

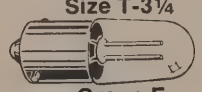
**OAK Industries Inc.**
SWITCH DIVISION / CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# LAMP SELECTION GUIDE

## INCANDESCENT TYPE

| | LAMP NO. | RATED VOLTAGE | AMPERAGE | APPROX. CANDLEPOWER | AVERAGE LIFE (Hrs.) | NOTES |
|---|---|---|---|---|---|---|
| **Size T-1** Sub-midget Flange Base **Group M** | 682 | 5.0 | .060 | .03 | 100,000 | MS24515-682 |
| | 685 | 5.0 | .060 | .05 | 100,000 | MS24515-685 |
| | 718 | 5.0 | .115 | .15 | 40,000 | MS24515-718 |
| | 6839 | 28.0 | .024 | .13 | 16,000 | MS3338-6839 |
| **Size T-1¾** Midget Flange Base **Group A** | 331 | 1.35 | .06 | .01 | 500 | |
| | 268 | 2.5 | .35 | .21 | 10,000 | |
| | 338 | 2.7 | .06 | .04 | 6,000 | MS25237-338 |
| | 345 | 6.0 | .04 | .03 | 10,000 | |
| | 328 | 6.0 | .20 | .34 @ 5 V | 1,000 | MS25237-328 |
| | 380 | 6.3 | .04 | .02 | 50,000 | |
| | 350 | 6.3 | .15 | .45 | 3,000 | |
| | 349 | 6.3 | .20 | .55 | 3,000 | |
| | 381 | 6.3 | .20 | .40 | 50,000 | |
| | 344 | 10.0 | .014 | .004 | 10,000 | |
| | 367X | 10.0 | .04 | .08 | 5,000 | |
| | 330 | 14.0 | .08 | .50 | 750 | MS25237-330 |
| | 370 | 18.0 | .04 | .15 | 1,000 | |
| | 327 | 28.0 | .04 | .34 | 1,000 | MS25237-327 |
| | 387 | 28.0 | .04 | .30 | 25,000 | MS18209-387 |
| **Size T-3¼** Miniature Bayonet Base Single Contact **Group B** | 316 | 6.0 | .70 | 3.4 | 500 | MS25231-316 |
| | 44 | 6.3 | .25 | .9 | 3,000 | |
| | 47 | 6.3 | .15 | .52 | 3,000 | |
| | 1816 | 13.0 | .33 | 3.0 | 1,000 | |
| | 1815 | 14.0 | .20 | 1.4 | 3,000 | |
| | 313 | 28.0 | .17 | 3.0 | 500 | MS25231-313 |
| | 1819 | 28.0 | .04 | .34 | 1,000 | MS25231-1819 |
| | 1829 | 28.0 | .075 | 1.0 | 1,000 | MS25231-1829 |
| | 1835 | 55.0 | .05 | 1.1 | 10,000 | |

## NEON GLOW TYPE

| | LAMP NO. | RATED VOLTAGE | STARTING VOLTAGE | RECOMMENDED SERIES RESISTOR | NOTES |
|---|---|---|---|---|---|
| **Size T-2** **Group C** | A1G | 105-125 AC OR DC | 65 VAC 95 VDC | 68KΩ | |
| | A1H (High Brightness) | 105-120 VAC 150 VDC | 95 VAC | 27KΩ | |
| **Size T-2** **Group D** | C7A | 105-125 AC OR DC | 65 VAC 90 VDC | 68KΩ | MS25252-C7A |
| | C9A (High Brightness) | 105-125 AC OR DC | 105 VAC | 27KΩ | MS25252-C9A |
| **Size T-3¼**  **Group E** | NE51 | 105-125 AC OR DC | 65 VAC 90 VDC | 100KΩ | |
| | NE51H (High Brightness) | 105-125 AC OR DC | 105 VAC | 27KΩ | |

**Notes:**
1. Candlepower values indicated are approximate initial mean spherical candlepower at rated voltage.
2. Service conditions such as voltage surges, temperature, shock, and vibration may contribute to a shorter average life.

# CROSS REFERENCE INDEX

## Oak Lamp Numbers to Industry Lamp Numbers

| Oak No. | Ind. No. | Oak No. | Ind. No. | Oak No. | Ind. No. | Oak No. | Ind. No. | Oak No. | Ind. No. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 7100 | 81 | 7202 | 228 | – | 330 | – | 466 | – |
| 2 | 7200 | 83 | – | 229 | 6150 | 331 | 2128 | 467 | 7248 |
| 3 | 7101 | 84 | 7231 | 230 | 6180 | 332 | 7259 | 468 | – |
| 4 | 7201 | 85 | 7240 | 238 | – | 333 | 3229 | 472 | – |
| 8 | 7209 | 86 | 7241 | 239 | 8587 | 334 | – | 473 | – |
| 9 | 6833 | 87 | 7228 | 240 | 8913 | 335 | 7260 | 474 | – |
| 11 | 683 | 88 | 7227 | 241 | 8828 | 336 | 7261 | 475 | – |
| 12 | 7133 | 96 | 7105 | 242 | 8270 | 339 | – | 476 | – |
| 14 | 713 | 97 | 7107 | 243 | – | 340 | 7022 | 477 | – |
| 16 | 715 | 98 | 7108 | 244 | – | 341 | 7263 | 478 | – |
| 16-39 | – | 99 | 7223 | 245 | – | 342 | – | 556 | – |
| 17 | 7153 | 100 | 7224 | 246 | – | 343 | 7680 | 557 | – |
| 18 | 7102 | 105 | 7104 | 247 | – | 344 | 7683 | 558 | – |
| 20 | 7213 | 108 | 7106 | 248 | – | 345 | 7265 | 559 | – |
| 21 | 7225 | 110 | 7206 | 253 | 253 | 346 | – | 560 | – |
| 22 | 7226 | 111 | 7092 | 253X | 253X | 347 | 7714 | 563 | – |
| 24 | 7233 | 116 | 7211 | 253-1 | 261 | 348 | 7266 | 693 | – |
| 25 | 685 | 117 | 7235 | 255 | – | 349 | 7715 | 694 | – |
| 26 | 714 | 138 | 7205 | 256 | – | 352 | – | 695 | – |
| 27 | 718 | 139 | 7210 | 262 | 7122 | 355 | – | 697 | 6152 |
| 28 | 7237 | 140 | 7109 | 263 | 8022 | 356 | 7267 | 700 | 6212 |
| 29 | 682 | 147 | 7229 | 266 | – | 358 | – | 701 | 8175 |
| 30 | 6803 | 155 | – | 267 | – | 359 | 7268 | 729 | 2140 |
| 32 | 680 | 156 | 7093 | 273 | 679 | 360 | – | 730 | 2124 |
| 33 | 7152 | 157 | 7097 | 279 | – | 361 | – | 731 | 2136 |
| 34 | 8666 | 160 | 7234 | 282 | 3810 | 362 | 8095 | 732 | 252 |
| 39 | 7215 | 161 | 7230 | 283 | 7810 | 366 | – | 733 | – |
| 40 | – | 172 | – | 285 | 3811 | 367 | 8111 | 734 | – |
| 44 | 7238 | 173 | 7090 | 286 | 7811 | 368 | 8112 | 739 | – |
| 45 | 7216 | 174 | 7094 | 288 | – | 369 | 8098 | 770 | – |
| 46 | 7239 | 175 | – | 289 | – | 371 | – | 771 | – |
| 57 | 6802 | 176 | 7096 | 290 | – | 382 | – | 772 | – |
| 58 | 6832 | 186 | – | 292 | – | 383 | – | 773 | – |
| 59 | 7132 | 189 | 2 | 293 | – | 384 | 8097 | 774 | – |
| 60 | 7212 | 201 | – | 296 | – | 385 | – | 775 | – |
| 62 | 6838 | 203 | 8711 | 297 | – | 386 | – | 776 | – |
| 63 | 7232 | 209 | – | 299 | 7113 | 388 | – | 803 | – |
| 64 | 6839 | 210 | 6022 | 303 | 7116 | 389 | 8099 | 804 | – |
| 66 | 7219 | 211 | – | 305 | 8383 | 390 | – | 819 | – |
| 70 | 7214 | 213 | – | 310 | 7123 | 391 | – | 821 | – |
| 71 | 32 | 218 | – | 315 | 3225 | 393 | 7839 | 822 | – |
| 72 | 7207 | 219 | – | 316 | 7254 | 405 | 7118 | 823 | – |
| 73 | 7203 | 220 | – | 319 | – | 450 | – | 824 | – |
| 74 | 7218 | 224 | – | 320 | 8102 | 455 | 7112 | 869 | – |
| 75 | 7220 | 225 | – | 321 | 7255 | 456 | 7114 | 870 | – |
| 76 | 7208 | 226 | – | 326 | – | 457 | 7117 | 871 | – |
| 80 | 7204 | 227 | – | 329 | 7257 | 458 | 7119 | 872 | – |

## Industry Lamp Numbers to Oak Lamp Numbers

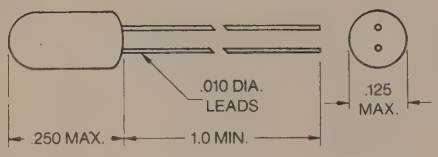
| Industry No. | Oak No. | Industry No. | Oak No. | Industry No. | Oak No. | Industry No. | Oak No. | Industry No. | Oak No. | Industry No. | Oak No. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 189 | 6022 | 210 | 7106 | 108 | 7206 | 110 | 7232 | 63 | 7714 | 347 |
| 32 | 71 | 6150 | 229 | 7107 | 97 | 7207 | 72 | 7233 | 24 | 7715 | 349 |
| 252 | 732 | 6152 | 697 | 7108 | 98 | 7208 | 76 | 7234 | 160 | 7810 | 283 |
| 253 | 253 | 6180 | 230 | 7109 | 140 | 7209 | 8 | 7235 | 117 | 7811 | 286 |
| 253X | 253X | 6212 | 700 | 7112 | 455 | 7210 | 139 | 7237 | 28 | 7839 | 393 |
| 261 | 253-1 | 6802 | 57 | 7113 | 299 | 7211 | 116 | 7238 | 44 | 8022 | 263 |
| 679 | 273 | 6803 | 30 | 7114 | 456 | 7212 | 60 | 7239 | 46 | 8095 | 362 |
| 680 | 32 | 6832 | 58 | 7116 | 303 | 7213 | 20 | 7240 | 85 | 8097 | 384 |
| 682 | 29 | 6833 | 9 | 7117 | 457 | 7214 | 70 | 7241 | 86 | 8098 | 369 |
| 683 | 11 | 6838 | 62 | 7118 | 405 | 7215 | 39 | 7248 | 467 | 8099 | 389 |
| 685 | 25 | 6839 | 64 | 7119 | 458 | 7216 | 45 | 7254 | 316 | 8102 | 320 |
| 713 | 14 | 7022 | 340 | 7122 | 262 | 7218 | 74 | 7255 | 321 | 8111 | 367 |
| 714 | 26 | 7090 | 173 | 7123 | 310 | 7219 | 66 | 7257 | 329 | 8112 | 368 |
| 715 | 16 | 7092 | 111 | 7132 | 59 | 7220 | 75 | 7259 | 332 | 8175 | 701 |
| 718 | 27 | 7093 | 156 | 7133 | 12 | 7223 | 99 | 7260 | 335 | 8270 | 242 |
| 2124 | 730 | 7094 | 174 | 7152 | 33 | 7224 | 100 | 7261 | 336 | 8383 | 305 |
| 2128 | 331 | 7096 | 176 | 7153 | 17 | 7225 | 21 | 7263 | 341 | 8587 | 239 |
| 2136 | 731 | 7097 | 157 | 7200 | 2 | 7226 | 22 | 7265 | 345 | 8666 | 34 |
| 2140 | 729 | 7100 | 1 | 7201 | 4 | 7227 | 88 | 7266 | 348 | 8711 | 203 |
| 3225 | 315 | 7101 | 3 | 7202 | 81 | 7228 | 87 | 7267 | 356 | 8828 | 241 |
| 3229 | 333 | 7102 | 18 | 7203 | 73 | 7229 | 147 | 7268 | 359 | 8913 | 240 |
| 3810 | 282 | 7104 | 105 | 7204 | 80 | 7230 | 161 | 7680 | 343 | | |
| 3811 | 285 | 7105 | 96 | 7205 | 138 | 7231 | 84 | 7683 | 344 | | |

Note: Consult factory for lamps listed but not shown in catalog.

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# INCANDESCENT LAMPS

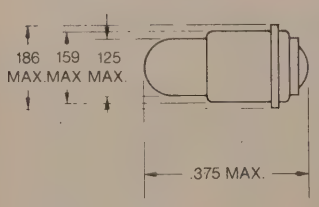
## T-1 Unsupported Unbased




| Part Numbers | | | | | |
|---|---|---|---|---|---|
| Oak No. | Industry No. | Volts | Amps (±10%) | MSCP | Life (hrs.) |
| 2 | 7200 | 1.5 | 0.010** | 0.002 | 10,000 |
| 4 | 7201 | 1.5 | 0.015 | 0.003 | 10,000 |
| 203 | 8711 | 2.5 | 0.320 | 0.210 | 10,000 |
| 331 | 2128 | 3.0 | 0.125*** | 0.005 | 10,000 |
| 138 | 7205 | 3.0 | 0.015 | 0.010 | 5,000 |
| 110 | 7206 | 3.0 | 0.225 | 0.015 | 10,000 |
| 83 | — | 3.0 | 0.040 | 0.027 | 10,000 |
| 72 | 7207 | 3.0 | 0.060 | 0.030 | 100,000 |
| 76 | 7208 | 3.0 | 0.120 | 0.150 | 16,000 |
| 472 | — | 5.0 | 0.020 | 0.020 | 50,000 |
| 210 | 6022 | 5.0 | 0.020 | 0.034 | 10,000 |
| 225 | — | 5.0 | 0.040 | 0.100 | 2,500 |
| 32* | 680 | 5.0 | 0.060 | 0.030 | 100,000 |
| 11* | 683 | 5.0 | 0.060 | 0.050 | 100,000 |
| 229 | 6150 | 5.0 | 0.060 | 0.150 | 6,500 |
| 246 | — | 5.0 | 0.060 | 0.150 | 6,500 |
| 14* | 713 | 5.0 | 0.075 | 0.090 | 25,000 |
| 116 | 7211 | 5.0 | 0.080 | 0.150 | 5,000 |
| 16* | 715 | 5.0 | 0.115 | 0.150 | 40,000 |
| 16-39 | — | 5.0 | 0.115 | 0.170 | 40,000 |
| 39 | 7215 | 5.0 | 0.115 | 0.190 | 10,000 |
| 20 | 7213 | 5.0 | 0.115 | 0.200 | 5,000 |
| 70 | 7214 | 5.0 | 0.115 | 0.220 | 5,000 |
| 244 | — | 5.0 | 0.115 | 0.250 | 5,000 |
| 45 | 7216 | 5.0 | 0.125 | 0.250 | 5,000 |

*MS-24367 **±15% ***±20%

## T-1 Unsupported Flange Base



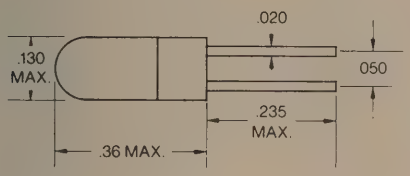

| Part Numbers | | | | | |
|---|---|---|---|---|---|
| Oak No. | Industry No. | Volts | Amps (±10%) | MSCP | Life (hrs.) |
| 320 | 8102 | 1.5 | 0.075 | 0.027 | 16,000 |
| 147 | 7229 | 3.0 | 0.015 | 0.009 | 5,000 |
| 84 | 7231 | 3.0 | 0.060 | 0.030 | 100,000 |
| 473 | — | 5.0 | 0.020 | 0.018 | 50,000 |
| 263 | 8022 | 5.0 | 0.020 | 0.034 | 10,000 |
| 226 | — | 5.0 | 0.040 | 0.090 | 10,000 |
| 29* | 682 | 5.0 | 0.060 | 0.030 | 100,000 |
| 25* | 685 | 5.0 | 0.060 | 0.050 | 100,000 |
| 247 | — | 5.0 | 0.060 | 0.130 | 6,500 |
| 26* | 714 | 5.0 | 0.075 | 0.090 | 25,000 |
| 27* | 718 | 5.0 | 0.115 | 0.150 | 40,000 |
| 28 | 7237 | 5.0 | 0.115 | 0.180 | 5,000 |
| 245 | — | 5.0 | 0.115 | 0.230 | 5,000 |
| 46 | 7239 | 5.0 | 0.125 | 0.220 | 5,000 |

*MS-24515

**Note:** To order lamps, prefix the Oak part number with LA — (example LA330)

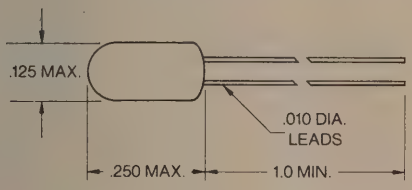
# INCANDESCENT LAMPS

## T-1 Unsupported Bi-Pin




| Part Number Oak No. | Industry No. | Volts | Amps (±10%) | MSCP | Life (hrs.) |
|---|---|---|---|---|---|
| 319 | — | 1.5 | 0.060 | 0.015 | 100,000 |
| 334 | — | 3.0 | 0.0225 | 0.015 | 10,000 |
| 366 | — | 3.0 | 0.040 | 0.027 | 10,000 |
| 336 | 7261 | 3.0 | 0.120 | 0.150 | 16,000 |
| 693 | — | 5.0 | 0.020 | 0.020 | 50,000 |
| 342 | — | 5.0 | 0.040 | 0.100 | 10,000 |
| 346 | — | 5.0 | 0.060 | 0.150 | 6,500 |
| 347 | 7714 | 5.0 | 0.075 | 0.090 | 25,000 |
| 349 | 7715 | 5.0 | 0.115 | 0.150 | 40,000 |
| 352 | — | 5.0 | 0.115 | 0.190 | 10,000 |
| 358 | — | 5.0 | 0.115 | 0.220 | 5,000 |

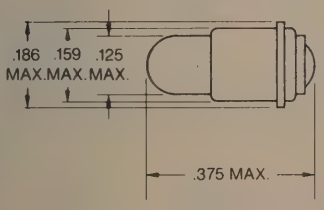
## T-1 Supported Unbased




| Part Numbers Oak No. | Industry No. | Volts | Amps (±10%) | MSCP | Life (hrs.) |
|---|---|---|---|---|---|
| 80 | 7204 | 3.0 | 0.008* | 0.001 | 16,000 |
| 8 | 7209 | 5.0 | 0.015 | 0.015 | 10,000 |
| 139 | 7210 | 5.0 | 0.030 | 0.030 | 16,000 |
| 255 | — | 10.0 | 0.015 | 0.020 | 16,000 |
| 74 | 7218 | 10.0 | 0.027 | 0.100 | 10,000 |
| 209 | — | 12.0 | 0.030 | 0.100 | 25,000 |
| 227 | — | 12.0 | 0.040 | 0.150 | 16,000 |
| 66 | 7219 | 12.0 | 0.060 | 0.150 | 16,000 |
| 266 | — | 13.0 | 0.040 | 0.190 | 16,000 |
| 248 | — | 14.0 | 0.040 | 0.150 | 16,000 |
| 367 | 8111 | 14.0 | 0.065 | 0.150 | 16,000 |
| 75 | 7220 | 18.0 | 0.026 | 0.150 | 10,000 |
| 62 | 6838 | 28.0 | 0.024 | 0.150 | 16,000 |
| 267 | — | 28.0 | 0.024 | 0.200 | 16,000 |

*±18.75%

## T-1 Supported Flange Base




| Part Numbers Oak No. | Industry No. | Volts | Amps (±10%) | MSCP | Life (hrs.) |
|---|---|---|---|---|---|
| 24 | 7233 | 5.0 | 0.015 | 0.013 | 10,000 |
| 160 | 7234 | 5.0 | 0.030 | 0.030 | 16,000 |
| 85 | 7240 | 10.0 | 0.027 | 0.100 | 10,000 |
| 243 | — | 12.0 | 0.030 | 0.090 | 25,000 |
| 71 | 32 | 12.0 | 0.060 | 0.130 | 16,000 |
| 368 | 8112 | 14.0 | 0.065 | 0.150 | 16,000 |
| 86 | 7241 | 18.0 | 0.026 | 0.150 | 10,000 |
| 64* | 6839 | 28.0 | 0.024 | 0.130 | 16,000 |

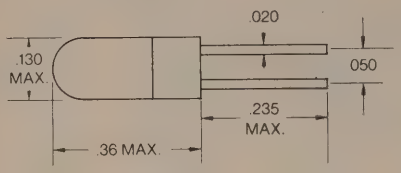
*MS-3338

**Note:** To order lamps, prefix the Oak part number with LA — (example LA330)

**OAK Industries Inc.**
SWITCH DIVISION / CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# INCANDESCENT LAMPS

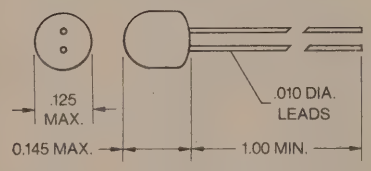
## T-1 Supported Bi-Pin




| Part Numbers | | | | | |
|---|---|---|---|---|---|
| Oak No. | Industry No. | Volts | Amps (±10%) | MSCP | Life (hrs.) |
| 330 | — | 3.0 | 0.008* | 0.001 | 16,000 |
| 361 | — | 10.0 | 0.015 | 0.020 | 16,000 |
| 382 | — | 12.0 | 0.030 | 0.100 | 25,000 |
| 383 | — | 12.0 | 0.040 | 0.150 | 16,000 |
| 388 | — | 14.0 | 0.040 | 0.150 | 16,000 |
| 389 | 8099 | 18.0 | 0.026 | 0.150 | 10,000 |
| 393 | 7839 | 28.0 | 0.024 | 0.150 | 16,000 |
| 391 | — | 28.0 | 0.024 | 0.200 | 16,000 |

*±18.75%

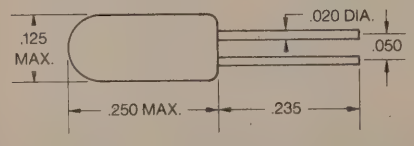
## T-1 Reduced Length 0.145" MOL Unbased




| Part Numbers | | | | | |
|---|---|---|---|---|---|
| Oak No. | Industry No. | Volts | Amps (±10%) | MSCP | Life (hrs.) |
| 57** | 6802 | 5.0 | 0.060 | 0.03 | 100,000 |
| 58** | 6832 | 5.0 | 0.060 | 0.05 | 100,000 |
| 697 | 6152 | 5.0 | 0.060 | 0.15 | 6,500 |
| 59** | 7132 | 5.0 | 0.075 | 0.09 | 25,000 |
| 700 | 6212 | 5.0 | 0.080 | 0.15 | 5,000 |
| 33** | 7152 | 5.0 | 0.115 | 0.15 | 40,000 |
| 60 | 7212 | 5.0 | 0.115 | 0.20 | 5,000 |
| 701 | 8175 | 5.0 | 0.125 | 0.25 | 5,000 |

**MS-90451

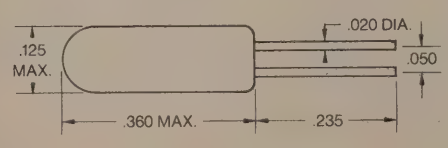
## T-1 Integral Bi-Pin Short Length




| Part Numbers | | | | | |
|---|---|---|---|---|---|
| Oak No. | Industry No. | Volts | Amps (±10%) | MSCP | Life (hrs.) |
| 773 | — | 5.0 | 0.02 | 0.020 | 50,000 |
| 774 | — | 5.0 | 0.02 | 0.034 | 10,000 |
| 775 | — | 5.0 | 0.06 | 0.050 | 100,000 |
| 776 | — | 5.0 | 0.06 | 0.100 | 20,000 |
| 824 | — | 5.0 | 0.115 | 0.150 | 40,000 |

*Special IPI design for minimum space applications

## T-1 Integral Bi-Pin Standard Length



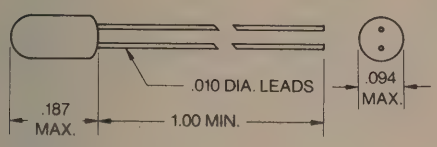

| Part Numbers | | | | | |
|---|---|---|---|---|---|
| Oak No. | Industry No. | Volts | Amps (±10%) | MSCP | Life (hrs.) |
| 871 | — | 5.0 | 0.020 | 0.020 | 50,000 |
| 872 | — | 5.0 | 0.020 | 0.034 | 10,000 |
| 869 | — | 5.0 | 0.060 | 0.050 | 100,000 |
| 870 | — | 5.0 | 0.115 | 0.150 | 40,000 |

*Interchangeable with conventional bi-pin lamps

**Note:** To order lamps, prefix the Oak part number with LA — (example LA330)

# INCANDESCENT LAMPS

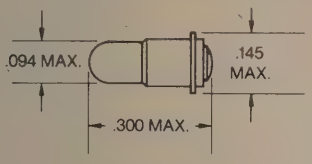
## T-3/4 Unbased




| Part Numbers Oak No. | Industry No. | Volts | Amps (±10%) | MSCP | Life (hrs.) |
|---|---|---|---|---|---|
| 1 | 7100 | 1.5 | 0.010** | 0.002 | 10,000 |
| 3 | 7101 | 1.5 | 0.015 | 0.003 | 10,000 |
| 201 | — | 1.5 | 0.060 | 0.015 | 100,000 |
| 739 | — | 2.0 | 0.040 | 0.020 | 10,000 |
| 213 | — | 5.0 | 0.020 | 0.020 | 50,000 |
| 189 | 2 | 5.0 | 0.020 | 0.034 | 10,000 |
| 803† | — | 5.0 | 0.025 | 0.030 | 5,000 |
| 30* | 6803 | 5.0 | 0.060 | 0.030 | 100,000 |
| 9* | 6833 | 5.0 | 0.060 | 0.050 | 100,000 |
| 12* | 7133 | 5.0 | 0.075 | 0.090 | 25,000 |
| 34 | 8666 | 5.0 | 0.080 | 0.150 | 6,000 |
| 17* | 7153 | 5.0 | 0.115 | 0.150 | 40,000 |
| 18 | 7102 | 5.0 | 0.115 | 0.200 | 5,000 |

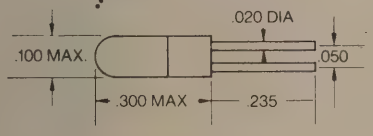
*MS-90452 (AS) **±15% †Rated for DC operation

## T-3/4 Flange Base



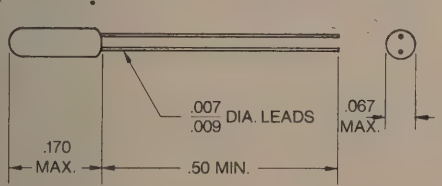

| Part Numbers Oak No. | Industry No. | Volts | Amps (±10%) | MSCP | Life (hrs.) |
|---|---|---|---|---|---|
| 733 | — | 2.0 | 0.040 | 0.018 | 10,000 |
| 292 | — | 5.0 | 0.020 | 0.018 | 50,000 |
| 239 | 8587 | 5.0 | 0.060 | 0.027 | 100,000 |
| 241 | 8828 | 5.0 | 0.075 | 0.080 | 25,000 |
| 242 | 8270 | 5.0 | 0.115 | 0.130 | 40,000 |

## T-3/4 Bi-Pin




| Part Numbers Oak No. | Industry No. | Volts | Amps (±10%) | MSCP | Life (hrs.) |
|---|---|---|---|---|---|
| 290 | — | 1.5 | 0.060 | 0.015 | 50,000 |
| 293 | — | 5.0 | 0.020 | 0.018 | 50,000 |
| 455 | 7112 | 5.0 | 0.020 | 0.032 | 6,000 |
| 297 | — | 5.0 | 0.024 | 0.039 | 1,000 |
| 804 | — | 5.0 | 0.025 | 0.029 | 5,000 |
| 456 | 7114 | 5.0 | 0.060 | 0.049 | 100,000 |
| 457 | 7117 | 5.0 | 0.080 | 0.150 | 6,000 |
| 405 | 7118 | 5.0 | 0.115 | 0.150 | 40,000 |

## T-1/2 Unbased



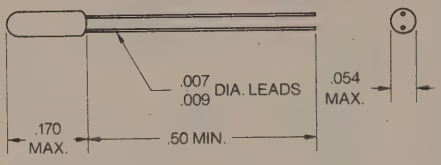

| Part Numbers Oak No. | Industry No. | Volts | Amps (±10%) | MSCP | Life (hrs.) |
|---|---|---|---|---|---|
| 174 | 7094 | 1.5 | 0.015 | 0.002 | 10,000 |
| 175 | — | 1.5 | 0.051 | 0.020 | 5,000 |
| 186 | — | 2.5 | 0.045 | 0.050 | 1,000 |
| 176 | 7096 | 3.0 | 0.029 | 0.030 | 5,000 |
| 157 | 7097 | 5.0 | 0.020 | 0.034 | 5,000 |

**Note:** To order lamps, prefix the Oak part number with LA — (example LA330)

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447
F OAK INDUSTRIES INC.
/ TEL: (714) 540-9471 / TWX: 910-595-1504

# INCANDESCENT LAMPS

## T-3/8 Unbased




| Part Numbers | | | | | |
|---|---|---|---|---|---|
| Oak No. | Industry No. | Volts | Amps (±10%) | MSCP | Life (hrs.) |
| 173 | 7090 | 1.5 | 0.015 | 0.002 | 10,000 |
| 155 | — | 1.5 | 0.051 | 0.020 | 1,000 |
| 156 | 7093 | 3.0 | 0.029 | 0.030 | 5,000 |

## TL Lensed Assemblies

FIG. 1

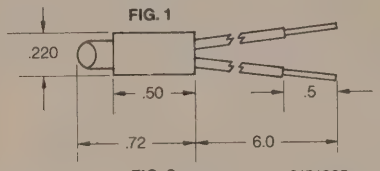
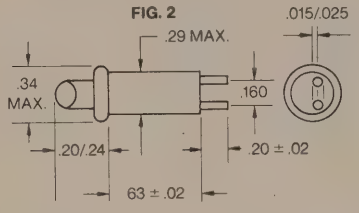



FIG. 2



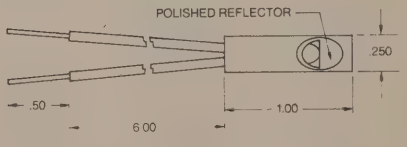

| Part Numbers | | | | | |
|---|---|---|---|---|---|
| Oak No. | Fig. No. | Volts | Amps (±10%) | Life (hrs.) | Spot Intensity ** |
| 474*** | 1 | 2 | 0.180 | 12,000 | 220 |
| 474 | 1 | 2.5 | 0.200 | 1,000 | 500 |
| 477 | 1 | 2.5 | 0.350 | 10,000 | 1,000† |
| 478 | 2 | 2.5 | 0.350 | 10,000 | 800 |
| 475*** | 1 | 5 | 0.180 | 10,000 | 500 |
| 475 | 1 | 6 | 0.200 | 1,000 | 1,000 |

**Foot-Candles ***Derated

Note; Min. spot dia. is .12 measured at .6 in. from tip of lamp.

†0.006" Min. Dia. Spot

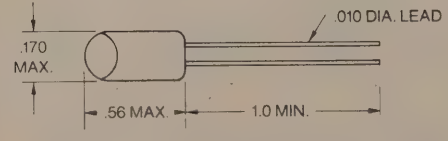
## RL Projection Lensed Assemblies




| Oak No. | Volts | Amps (±10%) | Life (hrs.) | Spot Intensity ** | Spot Dia. (in., min.) |
|---|---|---|---|---|---|
| 556*** | 2 | 0.180 | 12,000 | 180 | 0.12 |
| 556 | 2.5 | 0.200 | 1,000 | 400 | 0.12 |
| 560 | 2.5 | 0.350 | 10,000 | 800 | 0.08 |
| 557*** | 5 | 0.180 | 10,000 | 350 | 0.12 |
| 557 | 6 | 0.200 | 1,000 | 800 | 0.12 |

**Foot-Candles ***Derated

## TL Lensed Unbased

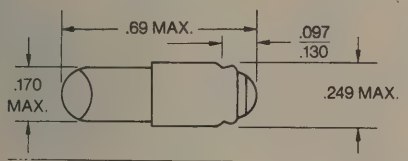



| Part Numbers | | | | |
|---|---|---|---|---|
| Oak No. | Industry No. | Volts | Amps (±10%) | Life (hrs.) |
| 729 | 2140 | 2.5 | 0.350 | 10,000 |
| 731 | 2136 | 2.5 | 0.350 | 10,000 |
| 730 | 2124 | 2.5 | 0.350 | 10,000 |

**Note:** To order lamps, prefix the Oak part number with LA — (example LA330)

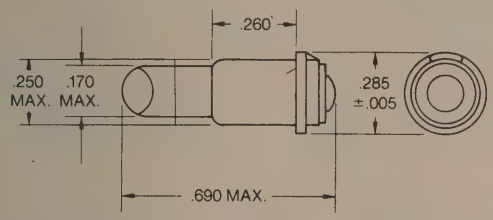
# INCANDESCENT LAMPS

## TL... Lensed Groove Base




| Part Numbers | | | | |
|---|---|---|---|---|
| Oak No. | Industry No. | Volts | Amps (±10%) | Life (hrs.) |
| 253 | 253 | 2.5 | 0.350 | 10,000 |
| 253-X | 253-X | 2.5 | 0.350 | 10,000 |
| 253-1 | 261 | 2.5 | 0.350 | 10,000 |

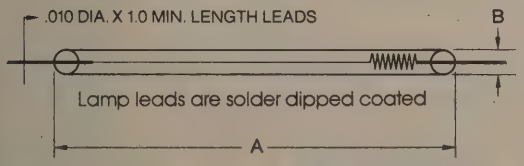
## TL... Lensed Flange Base

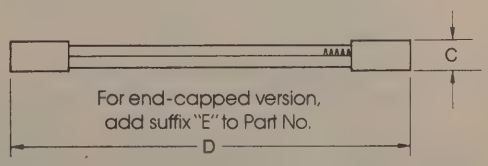



| Part Numbers | | | | |
|---|---|---|---|---|
| Oak No. | Industry No. | Volts | Amps (±10%) | Life (hrs.) |
| 732 | 252 | 2.5 | 0.350 | 10,000 |

## ····· Line Filament

| Part Numbers | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Oak No. | Industry No. | Volts | Amps (±10%) | Filam. Temp. (°K) | Life (hrs.) | Min. Hot Igth. | A | B | C | D |
| 111 | 7092 | 2.5 | 0.045 | 2150 | 1,000 | .37 | .88 | .052 | — | — |
| 218 | — | 3.0 | 0.400 | 1910 | 25,000 | 1.00 | 2.00 | .160 | .190 | 2.20 |
| 219 | — | 3.7 | 0.120 | 2380 | 1,000 | .62 | 1.30 | .094 | .125 | 1.40 |
| 468 | — | 5.0 | 0.480 | 2100 | 20,000 | 1.50 | 2.25 | .160 | .190 | 2.40 |
| 563 | — | 6.0 | 0.110 | 1980 | 25,000 | 1.40 | 2.00 | .094 | .125 | 2.10 |
| 105 | 7104 | 6.0 | 0.120 | 2160 | 5,000 | 1.00 | 1.70 | .094 | .125 | 1.80 |
| 140 | 7109 | 6.0 | 0.400 | 2320 | 2,000 | 1.25 | 2.15 | .160 | .190 | 2.30 |
| 220 | — | 11.0 | 0.400 | 2080 | 20,000 | 3.00 | 4.50 | .160 | .190 | 4.70 |
| 288 | — | 12.0 | 0.140 | 1910 | 25,000 | 3.70 | 4.44 | .094 | .125 | 4.56 |
| 211 | — | 14.0 | 0.500 | 2240 | 5,000 | 3.30 | 4.50 | .160 | .190 | 4.70 |
| 97 | 7107 | 18.0 | 0.120 | 1990 | 25,000 | 3.50 | 4.50 | .094 | .125 | 4.60 |
| 108 | 7106 | 20.0 | 0.120 | 1990 | 25,000 | 4.00 | 5.00 | .094 | .125 | 5.10 |
| 450 | — | 29.0 | 0.120 | 1990 | 25,000 | 6.50 | 7.50 | .094 | .125 | 7.60 |
| 40 | — | 30.0 | 0.335 | 2100 | 20,000 | 9.00 | 10.40 | .160 | .190 | 10.60 |
| 279 | — | 32.0 | 0.180 | 2380 | 1,000 | 6.50 | 7.70 | .160 | .190 | 8.00 |
| 98 | 7108 | 36.0 | 0.120 | 1990 | 25,000 | 7.50 | 8.80 | .094 | .125 | 8.90 |
| 99 | 7223 | 38.0 | 0.200 | 2160 | 5,000 | 9.00 | 10.50 | .125 | .160 | 10.65 |
| 100 | 7224 | 48.0 | 0.200 | 2130 | 5,000 | 11.50 | 12.90 | .125 | .160 | 13.10 |




**Note:** To order lamps, prefix the Oak part number with LA — (example LA330)

# CATALOGUE DE L'ELECTRONIQUE POUR LES INGENIEURS
# DER PRODUKTKATALOG FÜR ELEKTRONIKER
# ELECTRONIC ENGINEERS CATALOGUE

## The 1978 edition is out...and the response is in...
## IMMEDIATE AND OVERWHELMING

# ACCEPTANCE

The ELECTRONIC ENGINEERS CATALOGUE is the only comprehensive, trilingual catalogue/source-directory of electronic products available to—and from—Western Europe.

It is divided into three distinct sections: 1. **The Product Index and Directory,** which lists more than 3,000 product headings & cross-references alphabetically in English with their French and German equivalents. 2. **The Manufacturers' Catalogue Section,** which is a compilation of Manufacturers' Catalogues in alphabetical order. 3. **The Manufacturers' Sales Offices and Trade Marks Directory,** which alphabetically includes country, address, telex or TWX numbers of the Manufacturers' main and local sales offices and/or agents.

The ELECTRONIC ENGINEERS CATALOGUE offers U.S. manufacturers the most cost-efficient method of distributing their catalogue data to **25,000** electronic engineers and buyers throughout Western Europe. It represents the carefully conceived application of the time-proven **eem** "cataloging" concept to the elusive European marketplace.

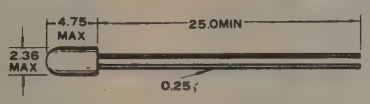
United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Avenue, Garden City, New York 11530 / 516 222-2500

# OSHINO

unit in m/m

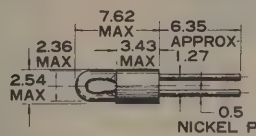
# SUBMINIATURE LAMP BULBS

**1. T-3/4 Wire Terminals** — US Mil. Std MS90452



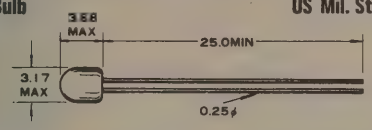

1.5-5V

**2. T-3/4 Bi-Pin**



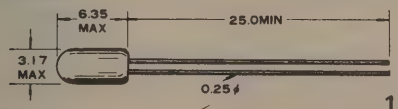

1.5-5V

**3. T-T-1 Short Bulb** — US Mil. Std. MS90451



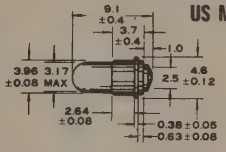

1.5-5V

**4. T-1 Wire Terminals** — US Mil. Std. MS24367



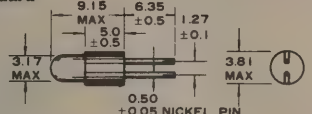

1.5-28V

**5. T-1 Sub-Midget Flanged Base (SM4s/4)** — US Mil. Std. MS24515 MS3338



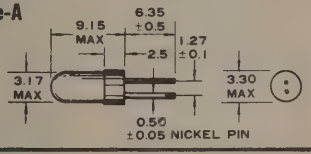

1.5-28V

**6. T-1 Bi-Pin Standard**



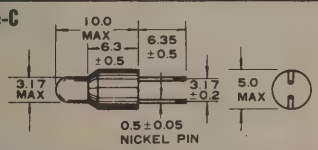

1.5-28V

**7. T-1 Bi-Pin Type-A**



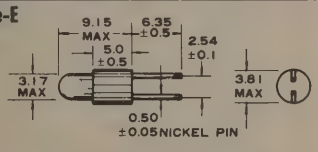

1.5-28V

**8. T-1 Bi-Pin Type-C**



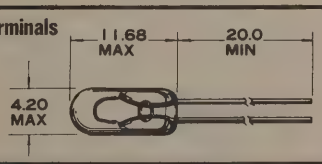

1.5-28V

**9. T-1 Bi-Pin Type-E**



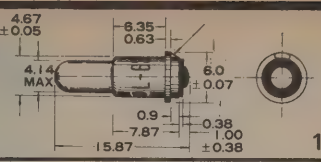

1.5-28V

**10. T-1 1/4 Wire Terminals**



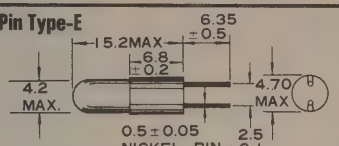

1.5-60V

**11. T-1 1/4 Special Flarged**



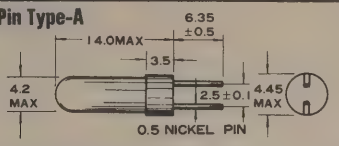

1.5-60V

**12. T-1 1/4 Bi-Pin Type-E**



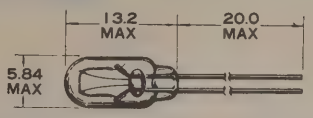

1.5-60V

**13. T-1 1/4 Bi-Pin Type-A**



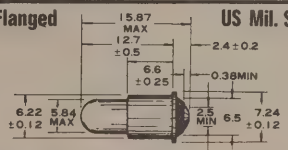

1.5-60V

**14. T-T-1 3/4 Wire Terminals**



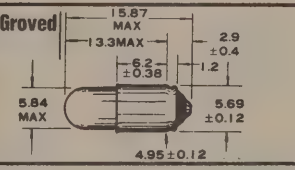

1.5-60V

**15. T-1 3/4 Midget Flanged (MF6s/8)** — US Mil. Std. MS25237 JIS C7522



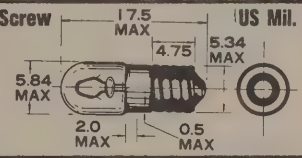

1.5-60V

**16. T-1 3/4 Midget Groved (MG6s/9)**



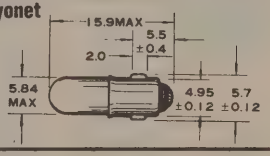

1.5-60V

**17. T-1 3/4 Midget Screw (E-5)** — US Mil. Std. MS15612



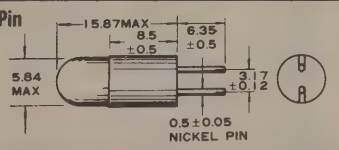

1.5-60V

**18. T-1 3/4 Midget Bayonet (BA5s)**



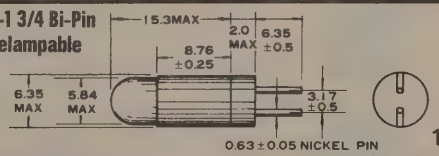

1.5-60V

**19. T-1 3/4 Bi-Pin**



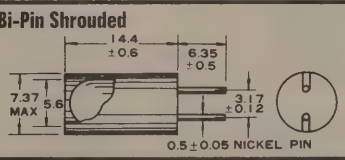

1.5-60V

**20. T-1 3/4 Bi-Pin Relampable**




1.5-60V

**21. T-1 3/4 Bi-Pin Shrouded**

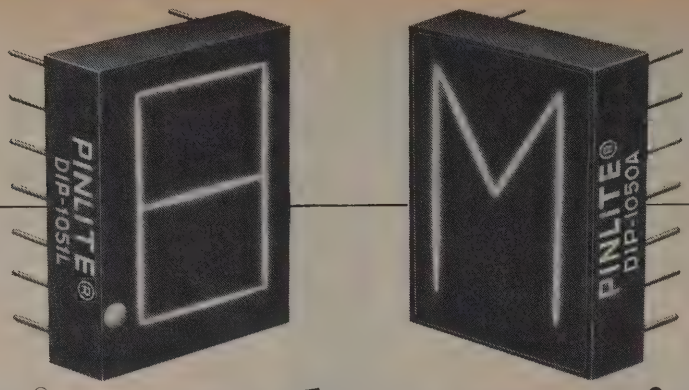



1.5-28V

**OSHINO ELECTRIC LAMP WORKS, LTD.**
Shinagawa, Tokyo, Japan.

• Ask informations to:

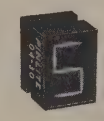
**WAMCO TECHNICAL SALES, INC.**
705 W. 16th Street, Costa Mesa, California 92627
TEL: (714) 833-9361 TELEX: 678459



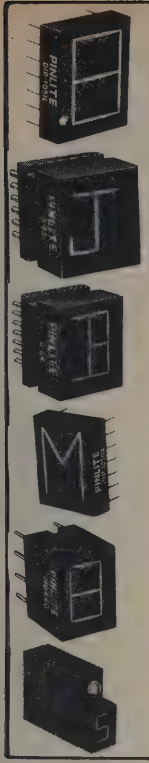

# Pinlite® Incandescent Displays

- Directly-viewed incandescent design makes Pinlite displays ideal for high ambient light situations.
- Simple voltage reduction allows dimming for night use.
- High contrast ratio insures clear character definitions in a 10,000 ft.-candle incident light condition.
- 120° viewing angle.
- Patented cross-over filament arrangement eliminates "open corners" characteristic of other display types.
- Directly compatible with standard TTL driving networks.
- Easily multiplexed.
- "White" light allows filtering to a wide range of colors.

Pinlite displays are particularly desirable for applications requiring brightness and high reliability over a wide range of environmental conditions. Popular uses include aircraft cockpits, marine navigation, computer peripheral equipment, taxi meters and gas pump readouts.



| Part No. | Description | Character Height | Dimensions H (Inches) | Dimensions W (Inches) | Dimensions D (Inches) | Voltage | Current per Segment (mA) | Average Brightness (Ft.-Lmbrts.) | Avg. Life per Segment (Hours) | Mating Connector | Decoder Driver | List Price |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 03-15 | Digit | 3/16" | .305 | .225 | .312 | 1.5 | 8±1 | 700 | 50,000 | CF-9H | DD-20 | $22.32 |
| 03-15PM | Plus/Minus | 3/16" | .305 | .225 | .312 | 1.5 | 8±1 | 700 | 50,000 | CF-9H | Discrete | 22.32 |
| 03-15DP | Decimal Point | N.A. | .305 | .075 | .312 | 1.5 | 7.5 | 700 | 50,000 | CF-3H | Discrete | 14.24 |
| 03-30 | Digit | 3/16" | .305 | .225 | .312 | 3 | 14±2 | 7000 | 50,000 | CF-9H | DD-20 | 22.32 |
| 04-30 | Digit | 1/4" | .375 | .275 | .312 | 3 | 8±1 | 1400 | 100,000 | CF-9H | DD-20 | 17.52 |
| 04-30PM | Plus/Minus | 5/32" | .375 | .275 | .312 | 3 | 8±1 | 1400 | 100,000 | CF-9H | Discrete | 17.52 |
| 04-30DP | Decimal Point | N.A. | .375 | .075 | .312 | 3 | 9±1 | 1400 | 100,000 | CF-3H | Discrete | 11.28 |
| 04-40 | Digit | 1/4" | .375 | .275 | .312 | 4 | 12±2 | 9000 | 100,000 | CF-9H | DD-20 | 17.52 |
| 04-40PM | Plus/Minus | 5/32" | .375 | .275 | .312 | 4 | 12±2 | 9000 | 100,000 | CF-9H | Discrete | 17.52 |
| 04-40DP | Decimal Point | N.A. | .375 | .075 | .312 | 4 | 10.5±1 | 9000 | 100,000 | CF-3H | Discrete | 11.28 |
| 04-50 | Digit | 1/4" | .375 | .275 | .312 | 5 | 12±2 | 9000 | 100,000 | CF-9H | DD-20 | 17.52 |
| 04-H50 | Hexadecimal 9 Segment | 1/4" | .375 | .465 | .312 | 5 | 18±2 | 9000 | 100,000 | CF-10H CF-10D | N.A. | 17.25 |
| 04-N50 | 1½ Digit 9 Segment | 1/4" | .375 | .465 | .312 | 5 | 18±2 | 9000 | 100,000 | CF-10H CF-10D | N.A. | 17.25 |
| 06-30 | Digit | 5/16" | .468 | .306 | .312 | 3 | 8±1 | 1400 | 100,000 | CF-9H | DD-20 | 15.60 |
| 06-40 | Digit | 5/16" | .468 | .306 | .312 | 4 | 17±2 | 9000 | 100,000 | CF-9H | DD-20 | 15.60 |
| 06-50 | Digit | 5/16" | .468 | .306 | .312 | 5 | 18±2 | 9000 | 100,000 | CF-9H | DD-20 | 15.60 |
| 06-50PM | Plus/Minus | 5/32" | .468 | .306 | .312 | 5 | 18±2 | 9000 | 100,000 | CF-9H | Discrete | 15.60 |
| 06-50DP | Decimal Point | N.A. | .465 | .100 | .312 | 5 | 17±2 | 9000 | 100,000 | CF-3H | Discrete | 10.72 |
| 06-50NS | North/South | 5/16" | .468 | .306 | .312 | 5 | 18±2 | 9000 | 100,000 | CF-9H | Discrete | 17.52 |
| 06-50EW | East/West | 5/16" | .468 | .306 | .312 | 5 | 18±2 | 9000 | 100,000 | CF-9H | Discrete | 17.52 |
| 08-50 | Digit | 23/64" | .625 | .425 | .312 | 5 | 17±2 | 7000 | 100,000 | CF-9H | DD-20 | 18.88 |
| 08-50PM | Plus/Minus | 1/4" | .625 | .425 | .312 | 5 | 17±2 | 7000 | 100,000 | CF-9H | Discrete | 18.88 |
| 08-50DP | Decimal Point | N.A. | .625 | .100 | .312 | 5 | 17±2 | 7000 | 10,000 | CF-3H | Discrete | 13.68 |
| DR-650 | Digit | 5/16" | .468 | .306 | .302 | 5 | 18±2 | 9000 | 100,000 | CM5-11 | 5447 | 12.00 |
| DR-650NS | North/South | 5/16" | .468 | .306 | .302 | 5 | 18±2 | 9000 | 100,000 | CM5-11 | Discrete | 18.00 |
| DR-650EW | East/West | 5/16" | .468 | .306 | .302 | 5 | 18±2 | 9000 | 100,000 | CM5-11 | Discrete | 18.00 |
| DIP-640 | Digit | 5/16" | .740 | .400 | .270 | 4 | 17±2 | 9000 | 100,000 | 14 Pin DIP | 5447 | 9.68 |
| DIP-641L | Digit L. dec. pt. | 5/16" | .740 | .400 | .270 | 4 | 17±2 | 9000 | 100,000 | 14 Pin DIP | 5447 | 12.40 |
| DIP-641R | Digit R. dec. pt. | 5/16" | .740 | .400 | .270 | 4 | 17±2 | 9000 | 100,000 | 14 Pin DIP | 5447 | 12.40 |
| DIP-642 | Digit with colon | 5/16" | .740 | .400 | .270 | 4 | 17±2 | 9000 | 100,000 | 14 Pin DIP | 5447 | 15.12 |
| DIP-640PM | Plus/Minus | 5/32" | .740 | .400 | .270 | 4 | 17±2 | 9000 | 100,000 | 14 Pin DIP | 5447 | 9.68 |
| DIP-650 | Digit | 5/16" | .740 | .400 | .270 | 5 | 18±2 | 9000 | 100,000 | 14 Pin DIP | 5447 | 9.68 |
| DIP-651L | Digit L. dec. pt. | 5/16" | .740 | .400 | .270 | 5 | 18±2 | 9000 | 100,000 | 14 Pin DIP | 5447 | 12.40 |
| DIP-651R | Digit R. dec. pt. | 5/16" | .740 | .400 | .270 | 5 | 18±2 | 9000 | 100,000 | 14 Pin DIP | 5447 | 12.40 |
| DIP-652 | Digit with colon | 5/16" | .740 | .400 | .270 | 5 | 18±2 | 9000 | 100,000 | 14 Pin DIP | 5447 | 15.12 |
| DIP-650PM | Plus/Minus | 5/32" | .740 | .400 | .270 | 5 | 18±2 | 9000 | 100,000 | 14 Pin DIP | 5447 | 9.68 |
| DIP-850 | Digit | 29/64" | .700 | .500 | .270 | 5 | 17±2 | 7000 | 100,000 | 14 Pin DIP | 5447 | 9.84 |
| DIP-851L | Digit L. dec. pt | 29/64" | .700 | .500 | .270 | 5 | 17±2 | 7000 | 100,000 | 14 Pin DIP | 5447 | 12.56 |
| DIP-851R | Digit R. dec. pt. | 29/64" | .700 | .500 | .270 | 5 | 17±2 | 7000 | 100,000 | 14 Pin DIP | 5447 | 12.56 |
| DIP-852 | Digit, colon | 29/64" | .700 | .500 | .270 | 5 | 17±2 | 7000 | 100,000 | 14 Pin DIP | 5447 | 15.28 |
| DIP-850PM | Plus/Minus | 1/4" | .700 | .500 | .270 | 5 | 17±2 | 7000 | 100,000 | 14 Pin DIP | 5447 | 9.84 |
| DIP-1050 | Digit | 5/8" | .970 | .760 | .320 | 5 | 17±2 | 6000 | 100,000 | 14 Pin DIP | 5447 | 10.00 |
| DIP-1051L | Digit L. dec. pt. | 5/8" | .970 | .760 | .320 | 5 | 17±2 | 6000 | 100,000 | 14 Pin DIP | 5447 | 12.72 |
| DIP-1051R | Digit R. dec. pt. | 5/8" | .970 | .760 | .320 | 5 | 17±2 | 6000 | 100,000 | 14 Pin DIP | 5447 | 12.72 |
| DIP-1052 | Digit, colon | 5/8" | .970 | .760 | .320 | 5 | 17±2 | 6000 | 100,000 | 14 Pin DIP | 5447 | 15.44 |
| DIP-1050PM-1 | Plus/Minus "1" | 5/16"/ 5/8" | .970 | .760 | .320 | 5 | 17±2 | 6000 | 100,000 | 14 Pin DIP | Discrete | 10.00 |



| Part No. | Description | Character Height | Dimensions H (Inches) | Dimensions W (Inches) | Dimensions D (Inches) | Voltage | Current per Segment (mA) | Average Brightness (Ft.-Lmbrts.) | Avg. Life per Segment (Hours) | Mating Connector | Decoder Driver | List Price |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0-43 | 16 Segment | 1/4" | .375 | .335 | .312 | 3 | 8±1 | 1400 | 100,000 | CF-20H | PLAND-76 | 36.64 |
| 0-44 | 16 Segment | 1/4" | .375 | .335 | .312 | 4 | 12±2 | 9000 | 100,000 | CF-20H | PLAND-76 | 36.64 |
| 0-45 | 16 Segment | 1/4" | .375 | .335 | .312 | 5 | 12±2 | 9000 | 100,000 | CF-20H | PLAND-76 | 36.64 |
| 0-63 | 16 Segment | 5/16" | .465 | .375 | .312 | 3 | 8±1 | 1400 | 100,000 | CF-20H | PLAND-76 | 34.24 |
| 0-64 | 16 Segment | 5/16" | .465 | .375 | .312 | 4 | 17±2 | 9000 | 100,000 | CF-20H | PLAND-76 | 34.24 |
| 0-65 | 16 Segment | 5/16" | .465 | .375 | .312 | 5 | 18±2 | 9000 | 100,000 | CF-20H | PLAND-76 | 34.24 |
| DIP-1050A | 16 Segment | 5/8" | .970 | .760 | .320 | 5 | 17±2 | 6000 | 100,000 | 24 Pin DIP | PLAND-76 | 26.24 |
| MD-440 | Digit | 1/4" | .375 | .275 | .312 | 4 | 12±2 | 9000 | 100,000 | MDC-4 | 5447 | 12.64 |
| MD-440DP | Decimal Point | N.A. | .375 | .075 | .312 | 4 | 10.5±1 | 9000 | 100,000 | MDC-4 | Discrete | 8.72 |
| MD-440PM | Plus/Minus | 5/32" | .375 | .275 | .312 | 4 | 12±2 | 9000 | 100,000 | MDC-4 | Discrete | 12.64 |
| MD-450 | Digit | 1/4" | .375 | .275 | .312 | 5 | 12±2 | 9000 | 100,000 | MDC-4 | 5447 | 12.64 |
| MD-450PM | Plus/Minus | 5/16" | .375 | .275 | .312 | 5 | 12±2 | 9000 | 100,000 | MDC-4 | Discrete | 12.64 |
| MD-4H50 | Hexadecimal | 1/4" | .375 | .465 | .312 | 5 | 18±2 | 9000 | 100,000 | N.A. | N.A. | 20.70 |
| MD-4N50 | 1½ Digit | 1/4" | .375 | .465 | .312 | 5 | 18±2 | 9000 | 100,000 | N.A. | N.A. | 20.70 |
| MD-640 | Digit | 5/16" | .468 | .306 | .312 | 4 | 17±2 | 9000 | 100,000 | MDC-4 | 5447 | 11.04 |
| MD-640PM | Plus/Minus | 5/32" | .468 | .306 | .312 | 4 | 17±2 | 9000 | 100,000 | MDC-4 | Discrete | 11.04 |
| MD-640DP | Decimal Point | N.A. | .465 | .100 | .312 | 4 | 14±2 | 9000 | 100,000 | MDC-4 | 5447 | 8.08 |
| MD-650 | Digit | 5/16" | .468 | .306 | .312 | 5 | 18±2 | 9000 | 100,000 | MDC-4 | 5447 | 11.04 |
| MD-650PM | Plus/Minus | 5/32" | .468 | .306 | .312 | 5 | 18±2 | 9000 | 100,000 | MDC-4 | Discrete | 11.04 |
| MD-650DP | Decimal Point | N.A. | .465 | .100 | .312 | 5 | 17±2 | 9000 | 100,000 | MDC-4 | Discrete | 8.08 |
| MD-640XY | "X" "Y" | 5/16" | .468 | .306 | .312 | 4 | 17±2 | 9000 | 100,000 | MDC-4 | Discrete | 14.16 |
| MD-640LR | Left/Right | 5/16" | .468 | .306 | .312 | 4 | 17±2 | 9000 | 100,000 | MDC-4 | Discrete | 14.16 |
| MDD-640 | Digit | 5/16" | .765 | .306 | .900 | 4 | 17±2 | 9000 | 100,000 | N.A. | 5447 | 20.45 |
| MDD-650 | Digit | 5/16" | .765 | .306 | .900 | 5 | 18±2 | 9000 | 100,000 | N.A. | 5447 | 20.45 |
| MDD-63 | 16 Segment | 5/16" | .765 | .375 | .900 | 3 | 8±1 | 1400 | 100,000 | N.A. | PLAND-76 | 43.20 |
| MDD-64 | 16 Segment | 5/16" | .765 | .375 | .900 | 4 | 17±2 | 9000 | 100,000 | N.A. | PLAND-76 | 43.20 |
| MDD-65 | 16 Segment | 5/16" | .765 | .375 | .900 | 5 | 18±2 | 9000 | 100,000 | N.A. | PLAND-76 | 43.20 |
| MDD-450 | Digit | 1/4" | .665 | .275 | .900 | 5 | 12±2 | 9000 | 100,000 | N.A. | 5447 | 21.95 |

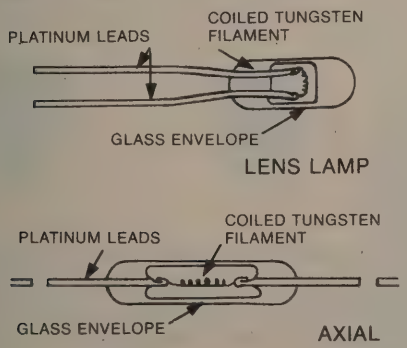
## CONNECTORS

| Part Number | Description | Dimensions H (Inches) | Dimensions W (Inches) | Dimensions D (Inches) | List Price |
|---|---|---|---|---|---|
| CF-3H | For all "0" series decimal points, colons. | .700 | .094 | .385 | $ 4.25 |
| CF-9D | Connector with multiplex isolation diodes for "0" series 7-segment displays. | .562 | .208 | 1.000 | 10.55 |
| CF-9H | For all "0" series 7-segment, PM, EW, NS | .780 | .208 | .385 | 4.30 |
| CF-10D | Connector with multiplex isolation diodes for 1½ digit and hexadecimal displays. | .625 | .440 | 1.000 | 10.80 |
| CF-10H | Connector for 04N series 1½ digit displays and 04H series hexadecimal displays. | .875 | .390 | .385 | 8.95 |
| CF-20H | For 0-43, 0-44, 0-45, 0-63, 0-64, and 0-65 displays. | .875 | .334 | .385 | 12.15 |
| CF-204D | Connector with multiplex isolation diodes for 0-43, 0-44, and 0-45 displays. | .625 | .334 | 1.000 | 17.55 |
| CF-206D | Connector with multiplex isolation diodes for 0-63, 0-64, and 0-65 displays. | .625 | .334 | 1.000 | 17.55 |
| MDC-4 | For all Mini/DIP styles except decimal point. | .525 | .295 | .155 | .90 |

## DECODER/DRIVERS

| | | | | | |
|---|---|---|---|---|---|
| DD-20 | BCD to 7-segment decoder/driver and connector for "0" series. | .875 | .225 | 1.000 | $39.85 |
| DDL-20 | BCD to 7-segment decoder/driver and connector with memory for "0" series. | .875 | .225 | 1.500 | 63.20 |
| PLAND-76 | ASCII to 16-segment decoder/driver. | 1.360 | .960 | .450 | 59.00 |

## MICRO MINIATURE LAMPS




## PINLITE® LAMP SPECIFICATIONS

L = Lens  Axial = No Prefix

| Model | Voltage | Current mA | Dimensions L (Inches) | Dimensions Dia. (Inches) | Light Output in Millilumens | Resistance Cold | Resistance Hot | Life Hours | List Price |
|---|---|---|---|---|---|---|---|---|---|
| L12-12 | 1.25 | 12±2 | .080 (2.03) | .030 (0.76) | 45 | 13 | 104 | 1000 | $5.50 |
| L15-30 | 1.5 | 30±4 | .080 (2.03) | .030 (0.76) | 160 | 5.5 | 50 | 1000 | 5.50 |
| L15-45 | 1.5 | 45±5 | .080 (2.03) | .030 (0.76) | 220 | 4 | 33 | 1000 | 5.50 |
| 15-15 | 1.5 | 15±2 | .070 (1.78) | .015 (0.38) | 60 | 11 | 100 | 800 | 5.50 |
| 30-30 | 3 | 30±3 | .125 (3.18) | .030 (0.76) | 250 | 10 | 100 | 1000 | 5.50 |
| 60-20 | 6 | 20±3 | .250 (6.36) | .040 (1.02) | 400 | 30 | 300 | 2000 | 5.50 |

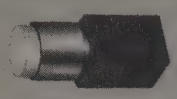
REFAC electronics corporation
DEPT. EM, P.O. BOX 809, WINSTED, CT 06098 (203) 379-2731

# THE SLOAN COMPANY

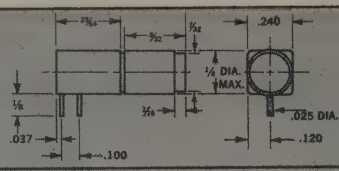
7704 SAN FERNANDO ROAD BOX 367

## SERIES

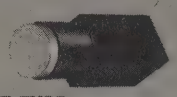
### 101



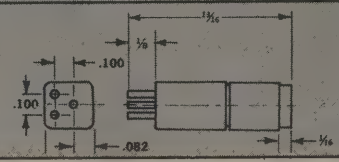
LENS BAYONET TYPE
LENS STYLES AVAIL. — DS, DSC, Q, QB




### 111

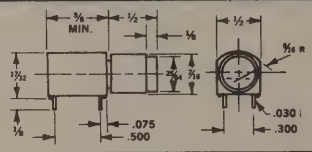


LENS BAYONET TYPE
SAME AS 101



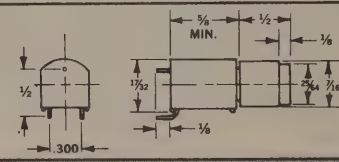

### 864

LENS
BAYONET TYPE
LENS STYLES AVAIL. — DS7, DSC7, Q7, QB7
THE SUFFIX (7) IS PERTINENT TO 864 OR 874 SERIES ONLY

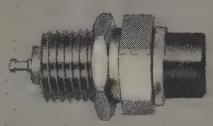



### 874

LENS
BAYONET TYPE
SAME AS 864

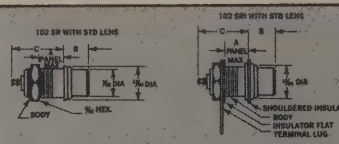



### 102



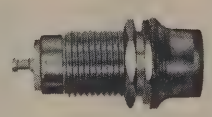
AVAILABLE IN
ALL BODY STYLES

LENS STYLES AVAIL. — STD, DSC, QB, DS, Q



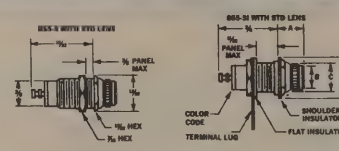

| BODY | A | B | C |
|---|---|---|---|
| S | 13/64 | 3/32 | 13/32 |
| SI | 5/32 | 5/16 | 3/8 |
| SS | 1/4 | 15/64 | 7/16 |
| SSI | 13/64 | 17/64 | 13/32 |
| SK | 17/64 | 15/64 | 15/32 |
| SKI | 3/32 | 1/4 | 7/16 |
| SR | 9/32 | 13/64 | 15/32 |
| SRI | 15/64 | 15/64 | 29/64 |

### 855



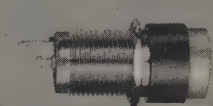
BODY STYLES
AVAILABLE S OR SI

LENS STYLES AVAIL. — STD, DS, DSC, Q, QB, D, M, SE



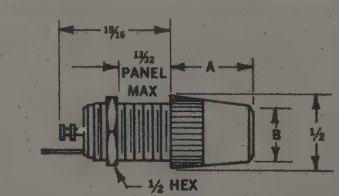

| LENS STLYE | A S | A SI | B | C |
|---|---|---|---|---|
| STD | 19/64 | 21/64 | 17/64 | 3/8 |
| D | 5/16 | 11/32 | 3/8 | 1/2 |
| DS,DSC,Q,QB | 21/64 | 23/64 | 3/8 | 7/16 |
| M | 21/32 | 11/16 | 3/8 | 1/2 |
| SE | 3/16 | 3/16 | | 1/2 |

### 856



AVAILABLE IN BODY
STYLE S ONLY
(2 TERMINAL BODY ONLY)

LENS STYLES AVAIL. — M, Q, DS, MB, QB, DSC




| LENS STYLE | A | B |
|---|---|---|
| M,MB | 5/8 | 3/8 |
| DS,DSC,Q,QB | 3/8 | 15/32 |

## DRAWINGS

## LENS STYLE

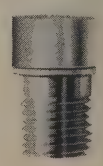
### DS

Matte black anodized bezel prevents sidelight emission. Blends with dark colored panels; contrasts with light colored panels. BI-COLOR has the added feature, white when unlighted and colored lighted.

### Q

Aluminum anodized bezel (matte silver appearing) allows 180° visibility, blends with light colored panels; contrasts with dark colored panels. BI-COLOR has the added feature, white when unlighted and colored when lighted.

### DSC



Aluminum anodized bezel (matte silver appearing) prevents sidelight emission. Blends with light colored panels, contrasts with dark colored panels. BI-COLOR has the added feature, white when unlighted and colored when lighted.

### STD

Flat, slightly projected lens gives 180° visibility.
Lens differs on 855 — see drawing.

### SE

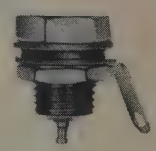
Edgelight for plastic panels. Small diameter light gasket minimizes wasted panel space. Can be relamped with gloved hands.

## BODY TYPES

### S

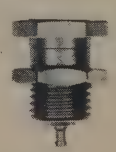
Presents bright metal Hex extending in front of the panel or in front of the shoulder washer on the SI model.

### SI



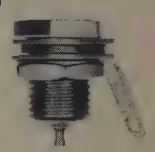
Presents bright metal Hex extending in front of the panel or in front of the shoulder washer.

### SS



Presents 5/16" bright metal Hex extends very little in front of the panel or in front of the shoulder washer on the SSI model.

### SSI



Presents 5/16" bright metal Hex extends very little in front of the panel or in front of the shoulder washer.

SUN VALLEY, CALIFORNIA 91353 PHONE: (213) 875-1123 TWX: 910-498-2250

| LENS STYLE | LENS COLOR | LAMP TYPE | HOW TO ORDER |
|---|---|---|---|
| **QB** Matte black anodized bezel. Allows 180° visibility. Blends with dark colored panels; contrasts with light colored panels. BI-COLOR has the added feature, white when unlighted and colored when lighted. | **TRANSPARENT** RL — Red, *BL — Blue, *GL — Green, AL — Amber, CL — Clear<br>**TRANSLUCENT** RLUC — Red, WLUC — White, BLUC — Blue, GLUC — Green, ALUC — Amber<br>*Not recommended for use with neon lamps. | T-1 INCANDESCENT OR T-1 BASED LED | EXAMPLE: 101 (Model No.) RL (Lens Color); DSC (Lens Style) T-1 Based Lamp (Lamp Type) |
| **D** Skirted lens covers metal parts for neat panel appearance. Large lighted surface assures positive indication. BI-COLOR has the added feature, white when unlighted and colored when lighted. | **TRANSPARENT** RL — Red, *BL — Blue, *GL — Green, AL — Amber, CL — Clear<br>**TRANSLUCENT** RLUC — Red, WLUC — White, BLUC — Blue, GLUC — Green, ALUC — Amber<br>*Not recommended for use with neon lamps. | T-1¾ OR T-2 INCANDESCENT OR T-1¾ BASED LED | EXAMPLE: 864 (Model No.) RL (Lens Color); DSC (Lens Style) T-1¾ Based Lamp (Lamp Type) |
| **MB** Offers the same features as Type M. Black metal trim. Both accommodate T-1¾ based lamp or T-2 based neon lamp (NE2J or AIH types). | **GENERAL PURPOSE LENS MATERIAL** (Translucent except M lens): R — Red, W — White, B — Blue, G — Green, A — Amber, *C — Clear<br>**LEXAN LENS MATERIAL** (Transparent): RL — Red, BL — Blue, GL — Green, AL — Amber, CL — Clear<br>(Translucent): RLUC — Red, WLUC — White, BLUC — Blue, GLUC — Green, ALUC — Amber | T-1 INCANDESCENT OR T-1 BASED LED | EXAMPLE: 102SI (Body Type) AL (Lens Color); DSC (Lens Style) T-1 BASED LAMP (Lamp Type) |
| **M** Large lens for maximum visibility from all angles. Engineered to offer the most uniform light distribution. Full 180° visibility. | **GENERAL PURPOSE** (Translucent): R — Red, W — White, B — Blue, G — Green, A — Amber<br>**LEXAN LENS MATERIAL** (Transparent): RL — Red, BL — Blue, GL — Green, AL — Amber, CL — Clear<br>(Translucent): RLUC — Red, WLUC — White, BLUC — Blue, GLUC — Green, ALUC — Amber | T-1¾ INCANDESCENT OR T-1¾ BASED LED | EXAMPLE: 855SI (Body Type) G (Lens Color) 5 (Color Coding); D BI-COLOR BASED LAMP (Lamp Type) |
| | **M and MB LENS**<br>**TRANSPARENT EXCEPT FOR WHITE**: R — Red, W — White, *B — Blue, *G — Green, A — Amber, C — Clear<br>**ALL LENSES EXCEPT M AND MB**<br>**TRANSPARENT**: RL — Red, *BL — Blue, *GL — Green, AL — Amber, CL — Clear<br>**TRANSLUCENT**: RLUC — Red, WLUC — White, *BLUC — Blue, *GLUC — Green, ALUC — Amber<br>*Not recommended for use with neon lamps | T1¾ AND T2 INCANDESCENT OR T-1¾ BASED LED | EXAMPLE: 856 (MODEL NO.) RLUC (LENS COLOR); T-1¾ or T-2 BASED LAMP (LAMP TYPE) |

## BODY TYPES

**SK**

Presents small knurled flange in front of the panel or in front of the shoulder washer on the SKI model.

**SKI**

Presents small knurled flange in front of the panel or in front of the shoulder washer.

**SR**

Presents a small flange in front of the panel or in front of the shoulder washer on the SRI model.

**SRI**

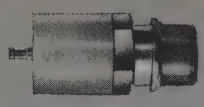
Presents a small flange in front of the panel or in front of the shoulder washer.

# THE SLOAN COMPANY

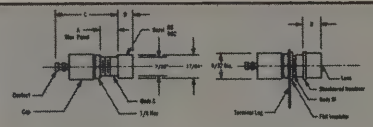
7704 SAN FERNANDO ROAD BOX 367

## SERIES

### 107

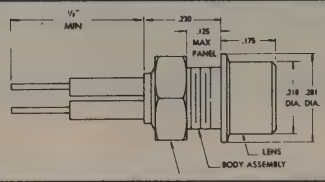


REAR RELAMPABLE
LENS STYLES AVAILABLE —
STD DS DSC Q QB

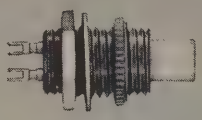


### 105

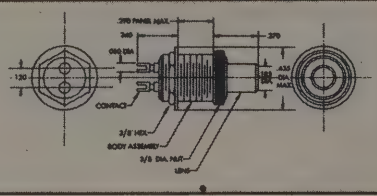
FIXED
LENS STYLES AVAILABLE —
STD DS DSC Q QB



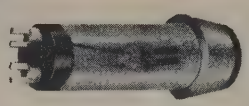

### 106



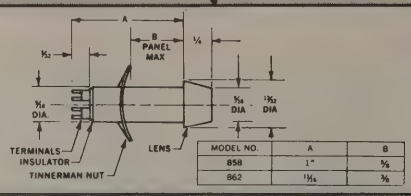
FIXED




### 858
### 862



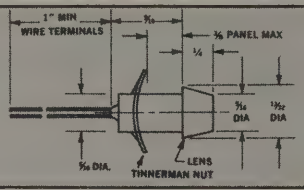
FIXED




| MODEL NO. | A | B |
|---|---|---|
| 858 | 1" | 5/8 |
| 862 | 13/16 | 3/8 |

### 859

FIXED




## DRAWINGS

## LENS STYLE

### DS

Matte black anodized bezel prevents sidelight emission. Blends with dark colored panels; contrasts with light colored panels. BI-COLOR has the added feature, white when unlighted and colored lighted.

### Q

Aluminum anodized bezel (matte silver appearing) allows 180° visibility, blends with light colored panels; contrasts with dark colored panels. BI-COLOR has the added feature, white when unlighted and colored when lighted.

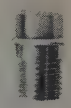
### DSC

Aluminum anodized bezel (matte silver appearing) prevents sidelight emission. Blends with light colored panels, contrasts with dark colored panels. BI-COLOR has the added feature, white when unlighted and colored when lighted.

### QB

Matte black anodized bezel. Allows 180° visibility. Blends with dark colored panels; contrasts with light colored panels. BI-COLOR has the added feature, white when unlighted and colored when lighted.

### STD



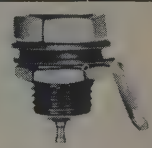
Flat, slightly projected lens gives 180° visibility.

## BODY STYLES

### S

Presents bright metal Hex extending in front of the panel or in front of the shoulder washer on the SI model.

### SI

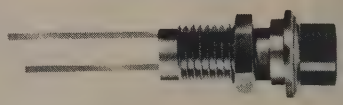


Presents bright metal Hex extending in front of the panel or in front of the shoulder washer.

## FIXED (NON-RELAMPABLE) LED SERIES
## LED: T-1 SIZE

- Lens Shape: Domed or Flat.
- Lens Colors: Red, Green, Amber, White and Clear in either transparent or translucent material.
  All lenses available with or without Fresnel rings.
- Mounting Hole — ¼" — Round or "D" hole. Center to Center Mtg. 5/16"
- Wire Wrap Terminals (will accept standard connector) and solderable.
- Available up to 18 VDC with built-in resistor.

2L5 (RED)
2G5 (GREEN)
2A5 (AMBER)



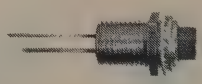
LENS STYLE

DOME FLAT

## FIXED (NON-RELAMPABLE) LED SERIES
## LED: T-1¾ SIZE

- LED Shape: Domed of Flat.
- Lens Colors: LED: Red, Green, Amber, White and Clear.
  Incandescent: Red, Green, Amber, White, Clear or Blue.
  All lenses available with or without Fresnel rings in either transparent or translucent material.
- Mounting Hole — 5/16" — Round or "D" hole. Center to Center Mtg. 7/16".
- Wire Wrap Terminals (will accept standard connector) and solderable.
- Available up to 50 VDC with built-in resistor.
- AC available up to 120 Volt with built-in resistor and diode.
- Standard indicators furnished with Hi-Brite LEDs **(up to 50 Mcd).**
  Other LEDs can be furnished upon request.

3R5 (RED)
3G5 (GREEN)
3A5 (AMBER)

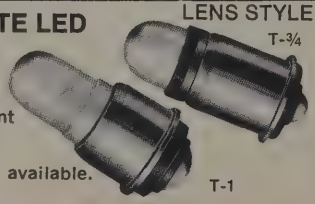


LENS STYLE

DOME FLAT

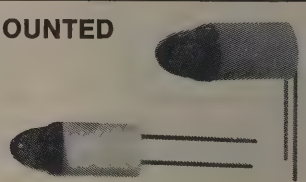
## T-1 FLANGED BASED HI-BRITE LED AND T-1¾ FLANGED BASED HI-BRITE LED

- Used as a replacement for incandescent lamps.
  Available in Red, Green and Amber.
- Various voltages and operating current available.
  **Light intensities up to 50 Mcd.**




## BI-PIN OR P/C MOUNTED HIGH BRITE LED T-1¾ SIZE

VOLTAGES UP TO
28 VOLTS

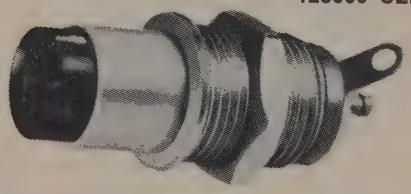


SUN VALLEY, CALIFORNIA 91353 PHONE: (213) 875-1123 TWX: 910-498-2250

| LENS COLOR | LAMP TYPE | HOW TO ORDER |
|---|---|---|
| General Purpose Lens Materials (Translucent): R — Red, W — White, B — Blue, G — Green, A — Amber. Lexan Lens Materials (Transparent): RL — Red, BL — Blue, GL — Green, AL — Amber, CL — Clear. (Translucent): RLUC — Red, WLUC — White, BLUC — Blue, GLUC — Green, ALUC — Amber | **T-1 BASED LAMP INCANDESCENT OR T-1 BASED LED** | EXAMPLE: 107 (Body Type) - RLUC (Lens Color) - DS (Lens Style) - Based Lamp (Lamp Type) |
| General Purpose Lens Materials (Translucent): R — Red, W — White, B — Blue, G — Green, A — Amber. Lexan Lens Materials (Transparent): RL — Red, BL — Blue, GL — Green, AL — Amber, CL — Clear. (Translucent): RLUC — Red, WLUC — White, BLUC — Blue, GLUC — Green, ALUC — Amber | **T-1 UNBASED LAMP MIL SPEC OR COMM.** | 105S - R - MIL. or COMM. (Model No. - Lens Color - Mil. Spec. or Commercial Bulbs) |
| R — Red, W — White, *B — Blue, *G — Green, A — Amber. *Not recommended for use with neon lamps. | **T-1 UNBASED LAMP MIL SPEC OR COMM.** | 106S - R - MIL. or COMM. (Model No. - Lens Color - Mil. Spec. or Commercial Bulbs) |
| R — Red, W — White, *B — Blue, *G — Green, A — Amber, C — Clear. *Not recommended for use with neon lamps. | **T-1, T-1¾ OR T-2 UNBASED INCANDESCENT OR NEON LAMP** | 858 (Model No.) - C (Lens Color) - AIB (Lamp Type) - 220K (*Resistor) |
| R — Red, W — White, *B — Blue, *G — Green, A — Amber, C — Clear. *Not recommended for use with neon lamps. | **T-1, T-1¾ OR T-2 UNBASED INCANDESCENT OR NEON LAMP** | 859 (Model No.) - C (Lens Color) - AIB (Lamp Type) - 220K (*Resistor) |

## SERIES 121000 AND 123000 TWO TERMINAL, FRONT RELAMPABLE

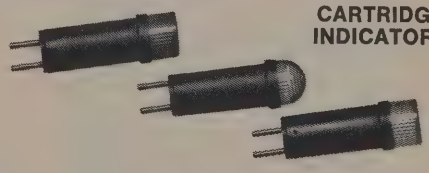
121000 SERIES
123000 SERIES



- Designed to use T-1 size flange based incandescent or LED light sources.
- 9/32" Diam. Mtg. Hole (Series 121000). Center to Center spacing 3/8".
- 5/16" Diam. Mtg. Hole (Series 123000). Center to Center spacing 1/2".
- Three lens styles available for either series in translucent or transparent material, plain or with fresnel rings.
- A variety of lens colors available.
- Terminals accept two (2) #22 AWG wires each and are isolated from case and panel.
- Body and lens bezels can be furnished in black or clear anodized finish.
- Hot stamping of lenses can be furnished upon request.
- Both Series are available in waterproof versions.
- RFI shielding can be provided on both Series.

## SLOAN CARTRIDGE INDICATORS

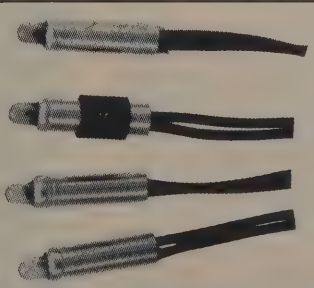
CARTRIDGE INDICATORS



- Designed to provide low cost, front panel light indication with a variety of light sources and multi-optional mounting features.
- Extremely rugged in construction, Sloan Cartridge units consist of an aluminum body incorporating Solid State, Incandescent or Neon light sources. Termination is by .040 diam. stainless steel pins.
- Lens styles are flat or domed in transparent or translucent material. All lenses incorporate Fresnel rings for maximum distribution of light output. A wide variety of lens colors are available.

**New**

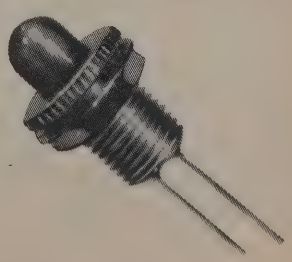
## 5L3 SERIES (T-1 LED)



- Red, Green or Amber
- 1/8" body diameter
- No lens required
- Non relampable
- Termination by color coded wire leads
- Voltages up to 14 VDC

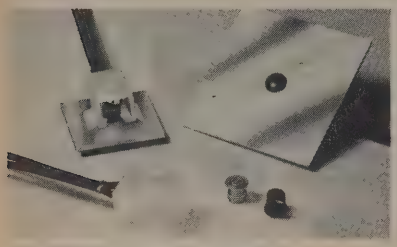
**New**

## 1L3 SERIES (T-1¾ HI-BRITE LED)



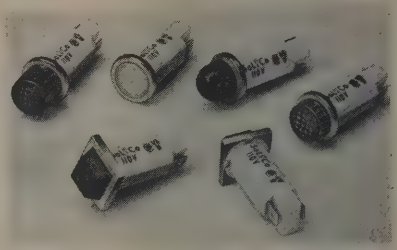
- Red, Green or Amber
- ¼"diam threaded metal body
- No lens required
- Non-relampable
- Voltages up to 14 VDC

# SoLiCo PILOT AND INDICATOR LIGHTS



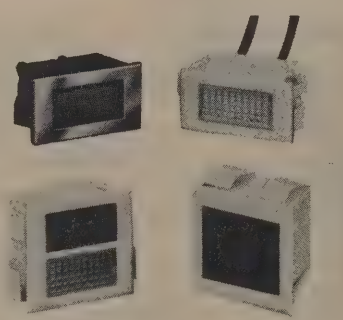
**1K14 SERIES**
Rear mounts in panel not more than .085" thick. Mounting hole .310" — .320"
**LAMP:** High brightness neon is standard with complete range of attached resistors available. Miniature incandescent in T-1¾ size available in range of 1.3 volt thru 28 volt.
**COLORS:** Lens colors are available in complete spectrum both in transparent and translucent material.
Recognized under the component program of U/L and CSA approved.

## A COMPLETE RANGE OF MULTI-FUNCTION INDICATOR LIGHTS

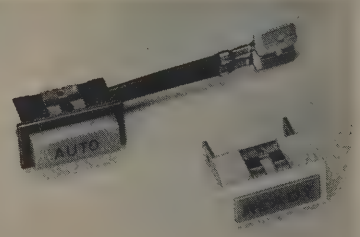


**5T SERIES**
**HOUSING:** Zytel 101, White is standard. However, Black, Red and other colors are available. Fits in ½" mounting hole (snap fit).
**RATING:** Same as 5S — 5L SERIES
**LAMP:** High brightness neon is standard with complete range of attached resistors available. Miniature incandescent in T-1¾ size available in range of 1.3 volt thru 28 volt.
**LENS:** Various styles with internal facets for maximum light refraction. Available in Lexan and Nylon.
**COLORS:** Lens colors are available in complete spectrum both in transparent and translucent material.
**BEZEL:** Optional, available in chrome or other finishes. Square or round depending on lens style.

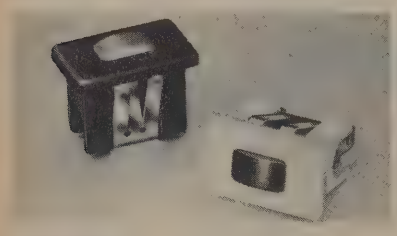
**3L SERIES** (with built-in resistor)
**3S SERIES** (resistor in lead)
These compact lights snapfit in a 5/16" hole. No additional hardware is necessary. Extended portion is .350 diameter by .110 inch high, while body length below shoulder is 1.420" long on 3L and .940" long on 3S.
Recognized under the component program of U/L and CSA approved. High brightness neon lamps with appropriate resistors to assure long life while achieving desired brightness. Complete range of incandescent lamps also available.
**LENS:** F4 and F5* lens is offered in a variety of colors and available in nylon or lexan. Decorative bezel with various finishes upon request. Chrome is standard.
**BODY COLORS:** White is standard although body can be molded in any color.
**LEADS:** Same as 5S.



**"R" SERIES**
These rectangular lights snap in securely (without additional hardware) into 1.312 or 1.280 by .375 inch opening. Material thickness range .030/.080 inch. 2R requires 1.280" by .812 inch mounting hole.
Recognized under the component program of U/L and CSA approved. High brightness neon lamps with appropriate built-in resistors to assure long life while achieving desired brightness. Complete range of incandescent lamps also available.
**LENS:** Ideal for vertical or horizontal hot stamp legends. These 1.150 by .250 inch lenses are offered in a variety of colors (nylon or lexan). Split lens variations also available (2R and 4R Series).
**BEZEL:** Decorative bezel in various finishes available (black, bright brass, etc.) Chrome plate is standard.
**LEADS:** Same as M SERIES.




**"M" SERIES**
These compact units snap securely without additional hardware into .940 by .440 inch opening. Material thickness .031" — .093".
**LENS:** M Series with "H" lens features a .855 by .315 inch lens face — .170" high offering excellent raised lighting characteristics with a choice of colors. (Imprinting available).
M Series with "F" lens affords a full .860 by .315 inch lighting face ideal for hot stamping legends, even two lines if desired.
**BODY COLORS:** white or black available.
**LEADS:** Black plastic 105°C leads 6" long ends stripped ½" and tinned are standard. Any desired length and colored leads can be readily supplied. In addition, these leads can be provided with a variety of terminations — ring, female flag, etc. M series can be supplied with .250" or .187" male spades.

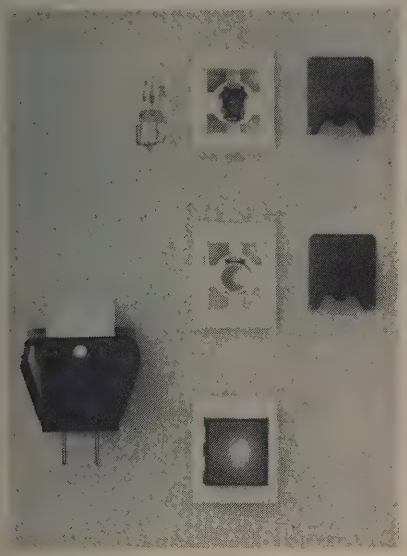


**S222 SERIES**
These lights snap securely without additional hardware into a rectangular opening 1.200 by .640 inch. Material thickness .045 to .065 inch.
**LENS:** Choice of colors available (nylon and acrylic). Red, white, amber, clear.
**LEADS:** S222 Series provided with screw terminals, S222-A with wire leads. S222-B provided with .250 male spade terminals.



**"L" SERIES**
Molded from DuPont Zytel 101. Standard colors are black or white, custom colors available upon request.
**Optional:** When ordering metal bezel, stainless steel is standard. Consult factory for other finishes.
Recognized under the component program of U/L and CSA approved.

# SoLiCo PILOT AND INDICATOR LIGHTS



### 1000 SERIES FEATURES REPLACEABLE LAMP

Snap-out lens and wedge base lamp (6-28 volt range) permits relamping from front of panel without tools.

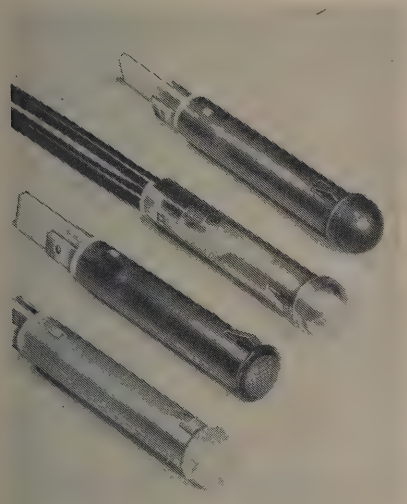
**MOUNTING INFORMATION:** Unit has self-locking ears; snaps into conventional .515″ x .625″ hole in panel .02″ to .156″ thick. Measures .750″ behind panel.

**RATING:** 6-28 volt and 125-250 volt. Recognized under the component program of Underwriters Laboratories, Inc. and CSA approved.

**LENS:** Full range of colors. .430″ x .460″ x .300″ high.

**HOUSING:** DuPont Zytel 101 available in white, red or black.

**TERMINATION:** Solder Lugs.



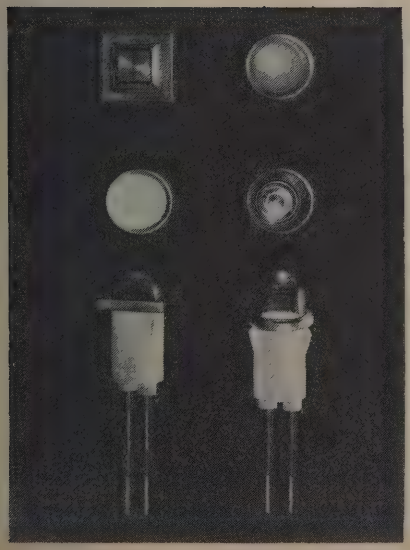
### 3W AND 3T SERIES

**MOUNTING INFORMATION:** Snap-in feature with self-locking ears. Fast assembly, no additional hardware necessary.

**BODY COLORS:** Lens and body one piece design. Available in all colors.

**TERMINATION:** 6″ wire leads standard on 3W, .187″ male tabs on 3T.

**LENS:** 3 configurations: dome, semi-dome, cylindrical flat top.



### 5S AND 5L SERIES

These stylish round body lights with chrome plated bezel mount into ½″ hole and are secured by self-locking "barbs." The overall body length below the bezel is .900″ on the 5S and 1.120″ on the 5L.

Recognized under the component program of U/L and CSA approved. High brightness neon lamps with appropriate resistors to assure long life while achieving desired brightness. Complete range of incandescent lamps also available.

**LENS:** A choice of lens styles and colors available. Nylon or Lexan material.

**BEZEL:** Decorative bezels in various finishes available (chrome plated is standard).

**LEADS:** Black plastic 105°C leads 6″ long, ends stripped ½″ and tinned are standard. Any desired length and color leads can readily be supplied. In addition, these leads can be provided with a variety of terminals, ring, female quick connect, male spade, etc.

### RT SERIES

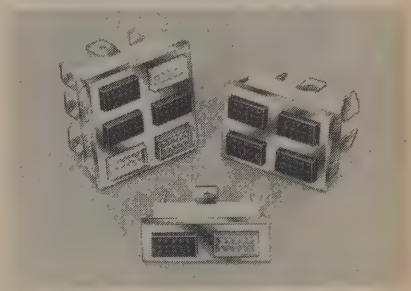
**MOUNTING INFORMATION:** These multiple function lights snap-fit into a 1.28″ x 1.234″ mounting hole in panels from .09″ to .30″ thick. No additional hardware is necessary.

**RATING:** Recognized under the component program of Underwriters Laboratories, Inc. and CSA approved at 125-250 volts.

**LENS:** Ideal for vertical or horizontal hot stamp legends. These 1.150″ x .250″ lenses are offered in a variety of colors (nylon or lexan).

**BEZEL:** Decorative bezel in various finishes available (black, bright brass, etc.). Chrome plate is standard.

**LEADS:** Black plastic 105°C leads 6″ long, ends stripped ½″ and tinned are standard. Any desired length and colored leads can be readily supplied. In addition, these leads can be supplied with a variety of terminations — ring, female quick connect, female flag, etc., or with .250″ male spades attached to the body.



### SR, 4R AND 6R SERIES

**MOUNTING INFORMATION:** These multiple function lights snap-fit into panels from .09″ to .30″ thick. No additional hardware is necessary.

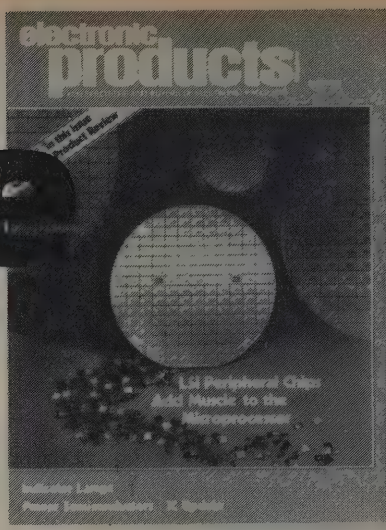
**RATING:** Recognized under the component program of Underwriters Laboratories, Inc. and CSA approved at 125-250 volts.

**LENS:** Ideal for vertical or horizontal hot stamp legends. .485″ x .250″ lenses are offered in a variety of colors (nylon or lexan).

**BEZEL:** Decorative bezel in various finishes available (black, bright brass, etc.). Chrome plate is standard.

**LEADS:** Black plastic 105°C leads 6″ long, ends stripped ½″ and tinned are standard. Any desired length and colored leads can be readily supplied. In addition, these leads can be supplied with a variety of terminations — ring, female quick connect, female flag, etc., or with .250″ male spades attached to the body.

# stay up to date



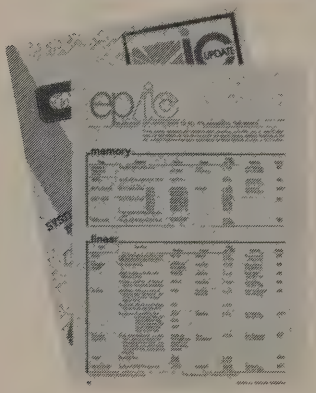

**SUBSCRIBE TO ELECTRONIC PRODUCTS MAGAZINE. IT'S YOUR *COMPLETE* GUIDE TO EVERYTHING THAT'S NEW IN THE FAST-CHANGING WORLD OF ELECTRONIC PRODUCTS AND SYSTEMS.**

**FEATURE STORIES** every month on electronic products, applications and availability.

**FORUMS**—Reports on meetings of manufacturers, users and distributors. Get the very latest news on a wide variety of products.

**NEW PRODUCT NEWS**—Hundreds of new products are introduced each month. You'll get the facts on not only what the new product is, but also where to get it, basic prices and current delivery.

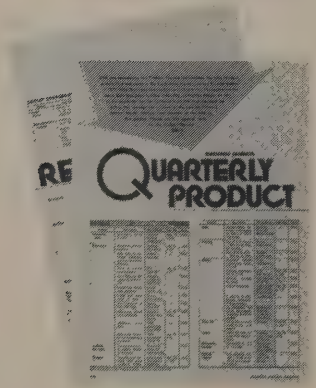
**EP/IC UPDATE**—Exclusive in ELECTRONIC PRODUCTS. A monthly report on *everything* that's new in the fast-moving world of integrated circuits.



**QUARTERLY PRODUCT REVIEW**—Another exclusive in ELECTRONIC PRODUCTS. A complete report of *every* new electronic product introduced in the previous quarter. This feature is in the January, April, July and October issues.

**QUARTERLY PRODUCT PLANNING DIRECTORY**—A compilation of the latest catalogs of a wide variety of electronic products and systems.

**OUTLOOK**—Important industry news affecting electronic products and systems.




**COMPONENT CAPERS**—A humorous look at the strange and wonderful world of electronics.

**MINI-GLOSSARIES,** Quizzes and more—Each and every month for over twenty years the readers of ELECTRONIC PRODUCTS learn something new about the products they work with and specify.

***If you are not now a subscriber, write to:***
***Dorothy Renoud, ELECTRONIC PRODUCTS MAGAZINE, 645 Stewart Avenue, Garden City, NY 11530.***
***Ask for a free qualification card.***

United Technical Publications, Inc., Div. of Cox Broadcasting Corp., 645 Stewart Ave., Garden City, NY 11530/(516) 222-2500

# Signalex™ EMD's*

# Numeric Alphanumeric Displays

**• 1½" to 24" size range • Inherent memory • Conserves energy • Highest contrast ratios • Long-lasting • Virtually maintenance free • TTL/MOS compatible • Standard circuits**

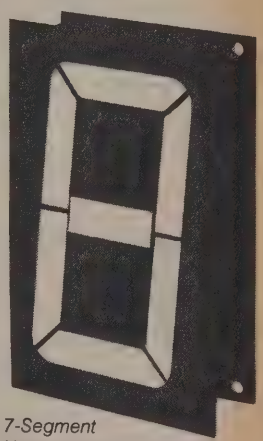
**Applications:** *gas pumps, scoreboards, message boards, electronic scales, traffic controls, teaching aids, time & temp. signs, price signs.*

## NUMERIC MODELS

| DISPLAY SIZES | 1½" | 4" | 6" | 9" | 12" | 18" | 24" |
|---|---|---|---|---|---|---|---|
| *SIGNALEX MODEL* | 152L | 402L | 602L | 900L | 1200L | 1800L | 2400L |
| *Character Size H x W* | 1-9/16" x 15/16" (40 x 24 mm) | 4-1/16" x 2-5/16" (103 x 59 mm) | 6-1/16" x 3-9/16" (154 x 91 mm) | 9" x 6" (228 x 152 mm) | 12"x 8" (305 x 204 mm) | 18" x 12" (46 x 30 cm) | 24" x 16" (61 x 41 cm) |
| *Vane Width* | 5/32" (4 mm) | 7/16" (11 mm) | 11/16" (17 mm) | 1-1/8" (29 mm) | 1-1/2" (38 mm) | 2-1/4" (5.7 cm) | 3" (7.6 cm) |
| *Frame Size H x W* | 1-7/8" x 1-5/16" (49 x 33 mm) | 5" x 3-1/4" (127 x 83 mm) | 7-1/4" x 5-1/4" (184 x 133 mm) | 11" x 8-1/4" (280 x 210 mm) | 14" x 11" (355 x 280 mm) | 21" x 16-1/2" (53 x 42 cm) | 28" x 22" (71 x 56 cm) |
| *Pulse Length, min.* | 30 ms | 50 ms | 90 ms | 150 ms | 200 ms | 500 ms | 500 ms |
| *Pulse Power, Each Vane* | 0.35 W | 0.93 W | 1.1 W | 2.0 W | 2.5 W | 8.0 W | 13.0 W |
| *Viewing Dist., max.* | 75 Feet (22 Meters) | 200 Feet (60 Meters) | 300 Feet (90 Meters) | 450 Feet (135 Meters) | 600 Feet (180 Meters) | 900 Feet (275 Meters) | 1200 Feet (365 Meters) |
| *Weight* | 2-1/4 oz. 65 gm. | 8-1/2 oz. 240 gm. | 12 oz. 340 gm. | 1-1/2 lbs. 680 gm. | 2-1/4 lbs. 1020 gm. | 9-1/4 lbs. 4.2 kg | 12-1/4 lbs. 5.6 kg |

*EMD = Electro-Magnetic Displays

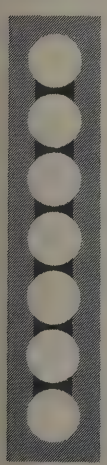
U.S. Patent No. 3,886,545; other patents pending



*7-Segment Numerical Digit Display*

All sizes are 7-segment displays with bi-stable electromagnetic operation that draws no power except during moment of change. (12 VDC standard.) Regular colors of vanes are white on black; other colors, including fluorescents, available. Angular visibility: 75° either side of the perpendicular.

*NOTE: Model 152L is UL Recognized (No. MH10471)*



*Dot Strip System*

## ALPHA-NUMERIC DISPLAY SYSTEMS

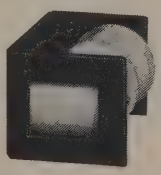
***SIGNALEX® DS (Dot Strip) System*** Dots are supplied in strips of seven. These strips may then be mounted side-by-side or stacked vertically to form any size character field desired. Bi-stable magnetic operation draws no power except at moment of change.

| *DS SIGNALEX MODEL* | *7-Dot Char. Height* | *Dot Diam.* | *Dot-to-Dot Spacing* | *Nom. V.* | *Pulse Current* | *Min. Pulse Length* |
|---|---|---|---|---|---|---|
| 470L | 4-1/16" | 1/2" | 19/32" | 12. | .031a. | 40 ms |
| 670L | 6" | 3/4" | 7/8" | 12. | .031a | 45 ms |

***SIGNALEX® CD (Channel Dot) System*** Individual dots are supplied for assembling in channels. Channels may be mounted side-by-side or directly on top of each other to create large screen effects or dots may be used individually by those who wish to create their own mounting structures. Bi-stable magnetic operation draws no power except at moment of change.

| *CD SIGNALEX MODEL* | *7-Dot Char. Height* | *Dot Diam.* | *Dot-to-Dot Spacing* | *Nom. V.* | *Pulse Current* | *Min. Pulse Length* |
|---|---|---|---|---|---|---|
| 1270L | 12" | 1-1/2" | 1-3/4" | 12. | 0.2a | 90 ms |
| 1670L | 16-1/16" | 2" | 2-11/32" | 12. | 0.2a | 110 ms |

*2-State Indicator*



## SIGNALEX TWO-STATE INDICATORS

3/8" x 1/2" window has two alternating display faces, with each position snapping into view with a 12 v DC pulse. Bi-stable operation. Units available with single windows or in strips with as many windows as required.

U.S. Patent No. 3,936,818

*Channel Dot System*

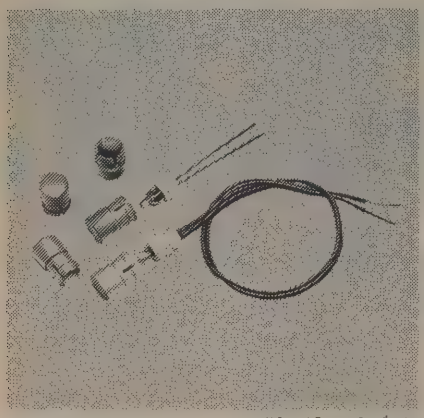
The Staver Company, Inc.
47 N. Saxon Ave., Bay Shore, N.Y. 11706
(516) 666-8000 TWX: 510-227-6142

SIGNALEX

VCC MINIATURE INDICATORS

# CLIPLITE®

## SUBMINIATURE INCANDESCENT & NEON INDICATOR



U.S. and Foreign Pat. Pend

***VISIBILITY*** The CLIPLITE permits up to 180 degrees of viewing angle using either the incandescent or neon lamp.

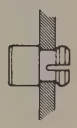
***COMPATIBILITY*** The CLIPLITE when used with the 5 volt 20 milliamp lamp is IC compatible. Application of this lamp and the CLIPLITE will provide full range of color and high light intensity.

***AESTHETICS*** The CLIPLITE gives any display or control panel the finished appearance equal to that of the most expensive indicator light assembly.

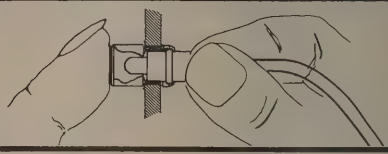
***DESIGN*** The CLIPLITE design and color have been optimized through the use of selected red, amber, green, yellow, clear, white and blue plastics to provide exceptionally high contrast and visibility.

***INSTALLATION*** The CLIPLITE requires no tools; just snap it into a ¼" hole and insert the lamp. Installation is completed in 6 seconds.

## *SIMPLE TWO-STEP INSTALLATION*

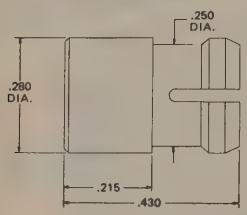


1 Snap the CLIPLITE into a ¼" panel hole.

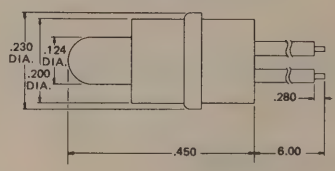


2 While holding the CLIPLITE tight to the panel with your finger, insert the lamp into the CLIPLITE from the back.

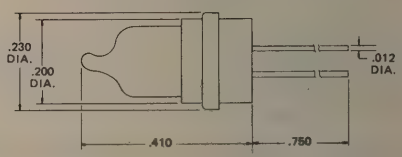
### OUTLINE DRAWING




### T1 INCANDESCENT




### T1¼ NEON LAMP




### ORDERING CODES

CIF 280 RTP 05 020

MODEL
CIF INCANDESCENT
CNF NEON

COLOR

LAMP

| | INCANDESCENT LAMP NUMBER VOLTAGE | CURRENT | LIFE HRS. |
|---|---|---|---|
| RTL Red Translucent | | | |
| ATL Amber Translucent | | | |
| * GTL Green Translucent | 05 | 020 | 25,000 |
| * BTL Blue Translucent | 05 | 060 | 100,000 |
| WTL White Translucent | 14 | 040 | 16,000 |
| RTP Red Transparent | 28 | 024 | 16,000 |
| ATP Amber Transparent | | | |
| * GTP Green Transparent | NEON LAMP NUMBER | | |
| YTP Yellow Transparent | HB | High Brightness | 15,000 |
| CTP Clear Transparent | | | |

* Not recommended for use with neon lamps.

Other lamps and resistors available on request.

### SPECIFICATIONS

CLIPLITE

| | |
|---|---|
| MATERIAL | Cellulose acetate butyrate. |
| LENS | Flat top design using Fresnel rings and Straited lines. |
| MOUNTING | Mounts from the front of the panel in a .250 ± .002 (6.35mm) hole on 3/8" centers. Panel thickness from 1/16" to 1/8". Holes should be deburred but not chamfered. |
| LAMPS | Aged and selected. |
| LEADS | INCANDESCENT: 6 inch 28 AWG stranded. UL Approved. |
| BASE | Snap fit, plastic. |

| INCANDESCENT ASSEMBLY | 1/24 | 25/99 | 100/249 | 250/499 | 500/999 | 1000/2499 |
|---|---|---|---|---|---|---|
| 05 020 | 1.14 | 1.06 | 1.00 | .97 | .82 | .69 |
| 05 060 | 1.06 | .98 | .93 | .90 | .76 | .64 |
| 14 040 | 1.33 | 1.23 | 1.16 | 1.12 | .96 | .81 |
| 28 024 | 1.96 | 1.80 | 1.68 | 1.62 | 1.42 | 1.22 |
| NEON ASSEMBLY | | | | | | |
| HB or SB | .55 | .53 | .51 | .50 | .39 | .31 |

Lens colors can be combined for price advantage per line item only.

Prices Subject To Change Without Notice.

**VISUAL COMMUNICATIONS COMPANY**
P.O. BOX 986 EL SEGUNDO, CALIFORNIA 90245 (213) 822-4727

VCC MINIATURE INDICATORS

# CLIPLITE®

## LED MOUNTING SYSTEM

U.S. and Foreign Pat. Pend

***VISIBILITY*** The CLIPLITE permits up to 180 degrees of viewing angle using any standard T 1¾ LED.

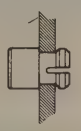
***BRIGHTNESS*** The CLIPLITE allows the use of the much brighter narrow beam LED. Example: HP 5082-4657, 12 mcd @ 10ma vs. current popular wide beam LED HP 5082-4650, 2 mcd @ 10ma. Correspondingly, the amber and green narrow beam LEDS typically increase brightness by a factor of 4 over the commonly used wide beam LEDS.

***AESTHETICS*** The CLIPLITE gives any display or control panel the finished appearance equal to that of the most expensive indicator light assembly.

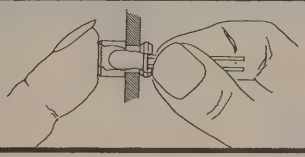
***DESIGN*** The CLIPLITE design and color have been optimized through the use of selected red, yellow, clear, green and amber plastics to provide exceptionally high contrast and visibility.

***INSTALLATION*** The CLIPLITE requires no tools; just snap it into a ¼" hole and insert the LED. Installation is completed in 6 seconds.

## *SIMPLE TWO-STEP INSTALLATION*

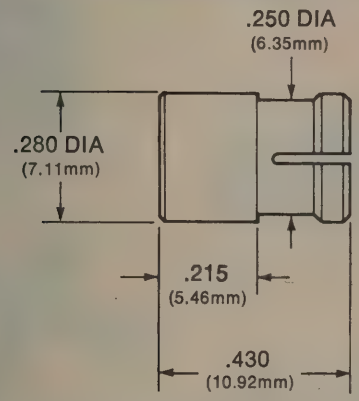


1 Snap the CLIPLITE into a 1/4" panel hole.



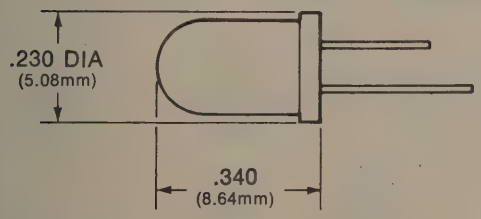
2 While holding the CLIPLITE tight to the panel with your finger, insert the LED into the CLIPLITE from the back.

### OUTLINE DRAWING




### RECOMMENDED LED

STANDARD T1 3/4 SIZE




### SPECIFICATIONS

| | |
|---|---|
| **MATERIAL** | Cellulose acetate butyrate. |
| **LENS** | Flat top design using Fresnel rings and Striated lines. |
| **MOUNTING** | Mounts from the front of the panel in a .250 ± (6.35mm) hole on 3/8" centers. Panel thickness from 1/16" to 1/8". Holes should be deburred but not chamfered. |

### ORDERING CODES

**CLF 280 RTP**

**MODEL**

**COLOR**

RTP Red Transparent
ATP Amber Transparent
GTP Green Transparent
YTP Yellow Transparent
CTP Clear Transparent

| QUANTITY | 100 | 500 | 1000 |
|---|---|---|---|
| PRICE | 18.00/C | 15.00/C | 12.00/C |

All colors can be combined for price advantage.

Prices Subject To Change Without Notice.

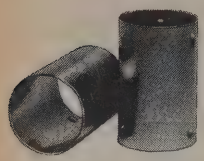
**VISUAL COMMUNICATIONS COMPANY**
P.O. BOX 986 EL SEGUNDO, CALIFORNIA 90245 (213) 822-4727

# MAGNETIC SHIELDS—ANY SIZE OR SHAPE

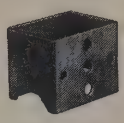
AD-MU AD-VANCE MAGNETICS SHIELDING

## From Ad-Vance Magnetics, Inc., The Problem Solving Magnetic Shielding Specialists

Pictured are typical examples of magnetic shielding problems solved by Ad-Vance Magnetics. Tell us your problem. Let our Problem-Solving Engineering Department help you solve your shielding problem. Complete facilities in 2 large modern plants.



Small Transformer Shields



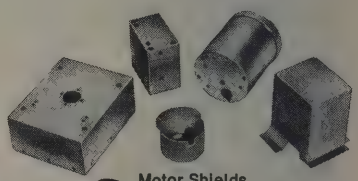
Small Transformer Shield

Scan Converter Shield

Radar Display Tube Shield

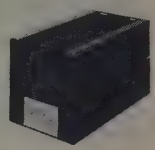
Special 5-Layer PM Shield

CRT Shield

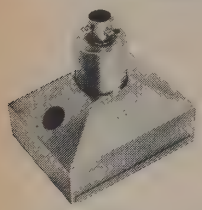


Motor Shields

CRT Deflection Yoke & Neck Shield ("L" locking)

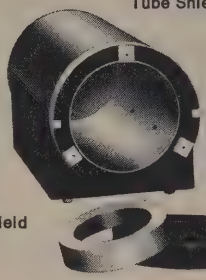


Magnetic Shield/Dust Cover For Small Aircraft Radar Tube



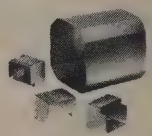
Specialized CRT Shield

Hydroformed CRT Shield

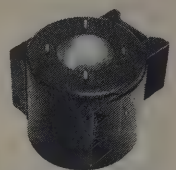


Magnetic Isolation Chamber

Geo-Magnetic Investigation Chamber



Foil Motor Shields

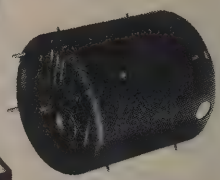


Hydroformed Storage Tube Shield

Movable Multi-Layer Controlled Magnetic Environment Chamber

CRT Shield For Complex Radar Base System

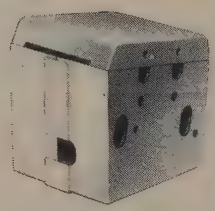
Cassette Tape Data Protector



Storage Tube Shield

Presidential Model Tape Data Protector

Electron Microscope Shield



Video Recorder Head Assembly Shield

Foolproof Snaptwist Fastener Lock Tape Data Protector

Loaded Single Reel Tape Data Protector Drops 4 Feet to Concrete Surface Without Tape Damage

AD-MU Foils Cut, Wrap Easily & Quickly

Ask for NEW 48-PAGE Time-Saving Reference Data/Catalog on Magnetic Shielding Techniques & Problem-Solving

### Typical DC Magnetic Properties For AD-MU Shielding Alloys

| | MATERIAL | INITIAL PERMEABILITY at 40 gauss | PERMEABILITY at 100-200 gauss | MAXIMUM PERMEABILITY | SATURATION INDUCTION gauss | COERCIVE FORCE oersteds |
|---|---|---|---|---|---|---|
| **High Permeability** | AD-MU-80 | 35,000 | 45,000 | 350,000 | 8,200 | 0.015 |
| | AD-MU-78 | 20,000 | 30,000 | 300,000 | 7,500 | 0.015 |
| **Med. Permeability** | AD-MU-48 | 11,000 | 27,000 | 100,000 | 15,200 | 0.03 |
| **Low Permeability** | AD-MU-00 | 300 | 500 | 3,000 | 22,000 | 1.0 |

**Our 3rd Decade of Magnetic Shielding Leadership**

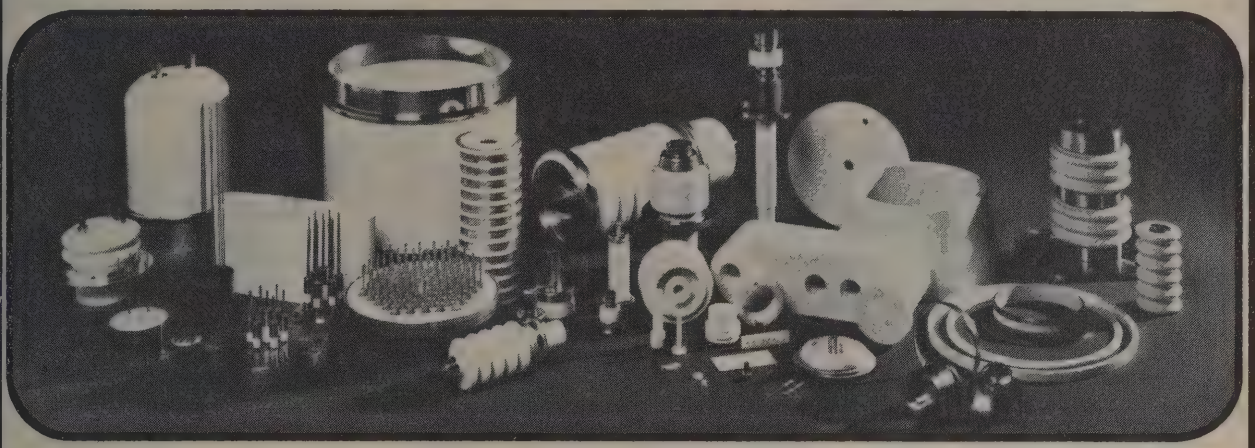
**AD-VANCE MAGNETICS, INC.,** 226 SEVENTH STREET / ROCHESTER, IND. 46975 / (219) 223-3158 / TWX 810-290-0294

# ALBEROX ... *For outstanding performance in high temperature, hermetic terminals.*

We're SPECIALISTS in brazing METAL parts to high alumina CERAMICS for demanding HIGH TEMPERATURE, HERMETIC applications.

***CUSTOM HERMETIC CONNECTORS*** Multipin hermetic connectors for demanding vacuum and space applications requiring 400°C. bakeout — conditions where glass connectors won't stand up — are being produced in a variety of configurations. To save cost, Alberox can also provide connector sub-assemblies such as pin decks to be brazed or welded into shells or flanges by the customer.

***MINIATURE TUBE AND PIN SEALS*** Many high temperature applications require insulated pin or tube feedthrus. These are available with weldable or brazeable metal parts, and can be added to covers or flanges, etc. All Alberox feedthrus are suitable for cryogenic environments.



Since 1961, we have designed and produced a wide variety of seals for custom applications in diverse components such as . . .

- VACUUM FEEDTHRU TERMINALS
- CERAMIC ELECTRON TUBE AND VACUUM SWITCH ENVELOPES
- NUCLEAR REACTOR PENETRATOR FEEDTHRU TERMINALS and INSULATORS
- SQUIBB and DETONATOR CONNECTORS
- POWER SEMICONDUCTOR HOUSINGS
- SPACE FLIGHT HERMETIC CONNECTORS
- JET ENGINE THERMOCOUPLE COMPONENTS
- HIGH PRESSURE OIL WELL LOGGING FEEDTHRUS
- CAPACITORS and TRANSFORMER TERMINALS

In addition to the above, Alberox has designed and produced state-of-the-art components for critical nuclear devices.

The Alberox plant was designed and built specifically for the efficient production of ceramic-to-metal seals. We manufacture our own A-950 high alumina ceramic, which enables us to optimize on the best metalizing process for this ceramic; thus we can provide superior seals. By making our own ceramic, our customers benefit by fast delivery on custom designs.

*Another important feature of Alberox is that all of the plating requirements are met "in-house", including nickel, gold, copper, silver, bright tin and solder plating!*

We have several types of BRAZING FURNACES for brazing ceramic-to-metal and metal-to-metal parts in HIGH VACUUM, or HYDROGEN, ARGON or any other specified atmosphere! The standard operating procedure is to custom program the brazing cycle, taking into account the ceramic, the types of metals, braze materials and the atmosphere.

Alberox exercises complete control, from the design stage right through all manufacturing operations — to meet or exceed the highest quality standards and maintain the fastest delivery in the industry. Products made by Alberox are assured to outperform all design parameters set for them!

***HIGH PRESSURE FEEDTHRUS*** *Alberox A-950 Alumina* has extraordinarily high compressive strength (350,000 psi). By using this strength to its best advantage, ceramic-to-metal seals can be produced to withstand high static or dynamic pressures. Thousands of these seals have been manufactured by Alberox.

***MULTITERMINAL FEEDTHRUS*** Multiterminal feedthrus differ from multipin connectors in that individual feedthru terminals are brazed or welded into a metal deck or flange. These feedthrus are generally used for higher voltage applications than can be accommodated by a regular ceramic pin deck or connector. Alberox has an extensive line of catalog tubular terminal bushings which are often used for the individual feedthrus. In this way, custom multiterminal feedthrus can be delivered quickly.

***POWER FEEDTHRUS*** Copper, or just about any other type of metal, from ⅛ inch to over 1 inch in diameter can be provided in power feedthrus. Modifications of our standard catalog tubular and fluted terminal bushings are often perfectly suited, and custom ceramic-to-metal seal designs can be easily accommodated. Weldable or brazeable flanges also can be added to the feedthrus to allow easy installation on existing flanges or bulkheads.

***INSULATORS AND STANDOFFS*** Insulators and standoffs can be supplied in tubular or fluted shapes, bare or glazed, with or without metal adapters or studs. Alberox manufactures plain ceramic parts for use as spacers, insulators, supports, isolators, decks, or washers. Metalized and glazed cylinders are also available for envelopes of high power electron tubes such as Thyratrons or for vacuum switches.

***CATALOG HIGH VOLTAGE BUSHINGS*** Alberox stocks the largest variety of high voltage tubular and fluted high alumina terminal bushings in the industry. Modifications to these catalog items are easily made. Typical modifications are: special studs, brazed-in-center conductors, different metal parts, finishes and ceramic dimensional changes. Fast delivery at reasonable prices can still be maintained. Ask for Catalog #472 which illustrates details of these parts.

Alberox is ready to assist you with your ceramic-to-metal seal design requirements. When you need FAST DELIVERY of SUPERB ceramic-to-metal seals, at realistic prices — contact ALBEROX.

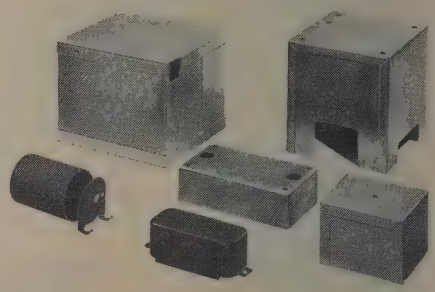
**ALBEROX CORPORATION**
Industrial Park
New Bedford, Massachusetts 02745
Phone 617-995-1725

# Big shielding problem?

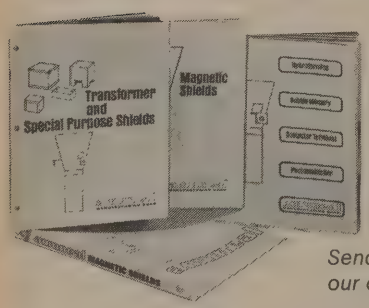
## How's this for size?

This magnetic shield was built by Amuneal for a critical military radar application. Even though the shield is pretty large, it's the size of the *problem* that we're talking about. The specifications called for extremely tight dimensional tolerances and the most stringent electrical performance characteristics we have ever encountered. All this, plus the fact that we had only six weeks to design it, determine the best method of fabrication, tool up, build it, perform complete analytical testing, and deliver. This is just one example of Amuneal's performance in designing and manufacturing magnetic shields to meet all kinds of tough specifications. If you have a shielding problem, big or little, talk it over with us. A phone call is all it takes.

**Cathode Ray Tube Shields**
**Photomultiplier Tube Shields**
**Printed Circuit Shields**
**Transformer Shields**
**Computer Terminal Shields**
**Power Supply Shields**
**Bubble Memory Shields**
**Motor Shields**
**Shielded Test Chambers**
**Storage Tube Shields**
**Special Application Shields**
**Wrap-around Foil Shielding**



**In-house Hydroforming and Hydrogen Annealing**
**Design & Prototype Assistance**
**Complete Tool & Die Making**




*Send for your free copy of our complete facilities catalog.*

**Shields for Magnetic-Sensitive Tubes and Components**

amuneal
MANUFACTURING CORP.
4737 Darrah St., Philadelphia, PA 19124 ■ 215-535-3000

# Magnetic Shieldlng by Eagle

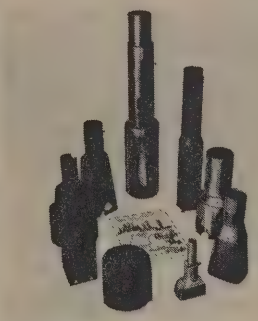
## Ecrans Magnétiques d'Eagle/Magnetische Abschirmung von Eagle

Custom Shields • Standard Shields • Sheet • Foil • Design Engineering • Fabrication • Heat Treating • Testing • Finishing

Ecrans sur Mesure • Ecrans Standard • Plaque • Feuille • Réalisation d'engineering • Fabrication • Traitement Thermique • Finissage

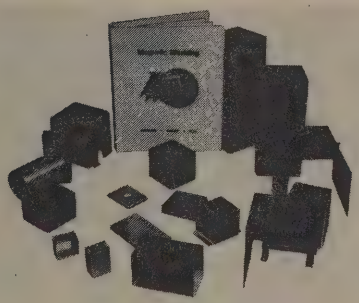
Auf Bestellung hergestellte Schirme • Standardschirme • Blech • Folie • Konstruktionstechnik • Fabrikation • Wärmebehandlung • Prüfung • Nachbearbeitung

PHOTOMULTIPLIER TUBE SHIELDS
ECRANS DE TUBE DE PHOTO-MULTIPLICATEUR
PHOTOVERVIELFACHUNGSROHREN-SCHIRME



CATHODE RAY TUBE SHIELDS
ECRANS DE TUBE A RAYONS CATHODIQUES
KATHODENSTRAHLROHRENSCHIRME

SHIELDS FOR MEDICAL INSTRUMENTS
ECRANS POUR INSTRUMENTS MEDICAUX
SCHIRME FUR MEDIZINISCHE INSTRUMENTE



TRANSFORMER SHIELDS
ECRANS DE TRANSFORMATEUR
TRANSFORMATORSCHIRME

### Sheet and Foil for Every Need

Eagle "AAA" High permeability against low level fields
Eagle "A" Low permeability against high level fields

### Plaque et Feuille pour Tous Besoins

Eagle "AAA" — haute perméabilité contre champs de faible nivea
Eagle "A" — faible perméabilité contre champs de faible niveau

### Blech und Folie für jeden Bedarf

Eagle "AAA" hohe Permeabilität gegenüber kleinen Feldstärken
Eagle "A" niedrige Permeabilität gegenüber großen Feldstärken

### SHEET / PLAQUE / BLECH

For forming, bending, drawing/Pour formage, cintrage, étirage/Zum Formen, Biegen, Ziehen

Eagle "AAA"
Dimensions / Dimensions / Maße
30″ x 120″ (0,762 m x 3,048 m)

Thickness / Epaisseur / Dicke

| Inches: | .014 | .020 | .025 | .030 | .040 | .050 | .062 |
|---|---|---|---|---|---|---|---|
| mm: | 0,356 | 0,508 | 0,635 | 0,762 | 1,016 | 1,27 | 1,575 |

Eagle "A"
Dimensions / Dimensions / Maße
36″ x 96″ (0,914 m x 2,438 m)

Thickness / Epaisseur / Dicke

| Inches: | .014 | .020 | .025 | .030 | .050 | .062 |
|---|---|---|---|---|---|---|
| mm: | 0,356 | 0,508 | 0,635 | 0,762 | 1,27 | 1,575 |

### FOIL / FEUILLE / FOLIE

Plain or with adhesive backing
Naturelle ou avec revêtement adhésif au dos
Einfach oder mit anhaftendem Rücken

Eagle "AAA"
Any width to 15″ (0,381 m)
Toutes laguers jusqu'à* 15″ (0,381 m)
Jede Breit bis zu 15″ (0,381 m)

Thickness / Epaisseur / Dicke

| Inches: | .004 | .006 | .010 |
|---|---|---|---|
| m: | 0,1016 | 0,1524 | 0,254 |

EAGLE MAGNETIC COMPANY INC.
INDIANAPOLIS INDIANA

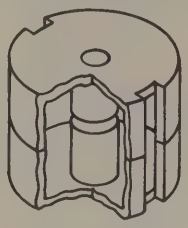
Write for catalog
Ecrivez pour obtenir le catalogue
Wenden Sie sich zwecks Zusendung des Katalogs an:

**P.O. BOX 24283**
**INDIANAPOLIS, INDIANA 46224**
**PHONE (317) 297-1030**

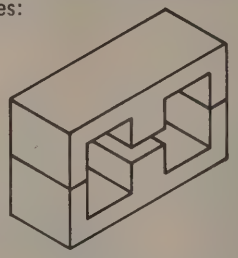
# Four ways to build better Power Chokes...

## with ferrite cores from Fair-Rite

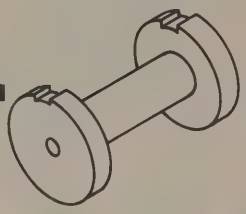
When designing switch mode power supplies, you can provide more stable inductance for the filters in the presence of DC load currents, by using these types of ferrite cores:

**1.** 

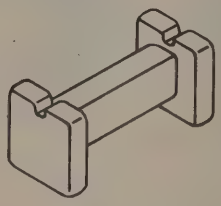
Gapped pot cores for exceptional shielding qualities.

**2.** 

Gapped E-cores, giving moderate shielding at lower cost.

**3.** 

Round bobbins; priced lower yet; some shielding qualities, and highly stable.

**4.** 

Square bobbins; most economical; some shielding properties, and least affected by DC.

To absorb or convert electro-magnetic energy with the right ferrite core...

# Get the JOULE BOX

## from Fair-Rite

When you use EMI suppression devices to absorb energy, or design transformer circuits to convert it, take advantage of Fair-Rite's new SHIELD BEAD, BALUN AND BROADBAND KIT: an unprecedented 34 different ferrite cores in 7 materials to help you quickly optimize circuits or approximate final designs. Includes "beads on leads" taped and reeled to EIA RS-296C, for automatic insertion. "Joule Box" comes with impedance vs frequency curves, attenuation curves, plus wide band transformer design data.

To get your Kit, send check or money order for $10, with your name and address, including Organization where applicable, and we'll ship the Kit postpaid from stock, with technical information.

If you prefer, order on your Organization PO or letterhead; we'll ship the Kit and bill you $10 plus shipping.

Or, send for Free technical information only; please specify.

**Also available: Free Application Notes "A Hanna Curve for Ferrite Cores" and "Use of Ferrites for Wide Band Transformers".**

F R

## FAIR-RITE PRODUCTS CORP.

**Dept. M8, Wallkill, New York 12589**
**Phone 914-895-2055 TWX: 510-249-4819**
**FERRITE CORES FOR THE ELECTRONICS INDUSTRY**

# The INTER-TECHNICAL Group, Inc.

UNITED STATES AGENCY OF THE TELCON METALS GROUP OF COMPANIES

P. O. BOX 23
IRVINGTON, N. Y. 10533
TEL: 914-591-8822
TWX: 710-564-0802

**TELCON METALS LTD.** is one of the largest manufacturers of nickel-iron and cobalt alloys for magnetic applications. Their fully integrated facilities provide raw materials and fabricated components covering the whole range of commonly used soft magnetic materials.

## SOFT MAGNETIC ALLOYS SUPPLIED IN STRIP—ROD—BAR—WIRE—FOIL

| NICKEL-IRON | COBALT-IRON |
|---|---|
| 76% Nickel | PERMENDUR 49 |
| 50% Nickel | PERMENDUR 24 |
| 36% Nickel | SUPERMENDUR |

### THERMOSTATIC BIMETALS

We offer a complete selection of Telcon thermostatic bimetals for various temperature ranges and environments. Their varied mechanical properties, hardnesses, thermal activities, and thermal and electrical conductivities make it easy for the user to select the right one for his particular requirements. Available in thicknesses from .004" to .125" and widths as small as 1/16" in coils and flat lengths.

### MAGNETIC SHIELDS UP TO 30" DIAMETER FOR CATHODE RAY TUBES & TRANSFORMERS by Telcon Metals Ltd.

### MELTING, ROLLING, FABRICATING, ANNEALING FROM START TO FINISH IN ONE FACILITY

Telcon Metals, Ltd., has its own in-plant facilities to handle every phase of the magnetic shield manufacturing process from start to finish. This means 100% Telcon supervision all the way — from the melting and rolling of the raw material to the fabrication and annealing of the magnetic shield. Telcon's total production method is based on a century of experience in the manufacture of alloys. All these factors are your assurance that you get a sensibly priced, high quality product.

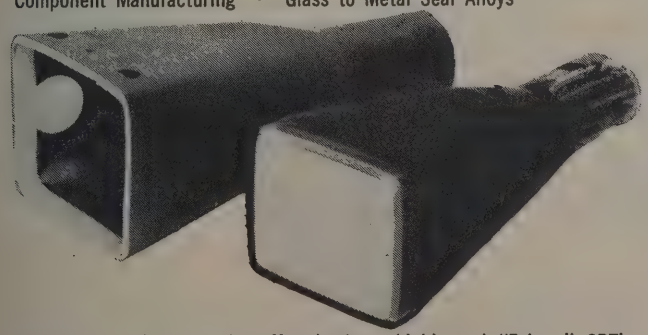
### A NEW CONCEPT IN MAGNETIC SHIELD CONSTRUCTION

Specially developed for quantity production of high efficiency complex shields, new TELFORM construction utilizes precision drawn segments to drastically reduce welded seams. The result is extra close fitting shields with improved shielding characteristics. This new technique is applicable for CRT tubes up to approximately 20" long. No premium charge even though dimensions, finish and appearance are far more uniform throughout batches than conventionally fabricated shields. Rapid delivery after initial tooling. Available in 80%, 50% and 36% nickel-iron alloys.

**Extremely Competitive Prices on Custom Shields.**
**Send for Illustrated Catalog and Ask for a Quotation.**

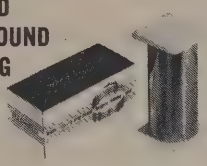
**OTHER TELCON PRODUCTS**

- Thermostatic Bimetals
- High Permeability Strip, Rod & Wire for Component Manufacturing
- Glass to Metal Seal Alloys



Substantial savings can be offered when shields and "Brimar" CRT's are purchased as assemblies.

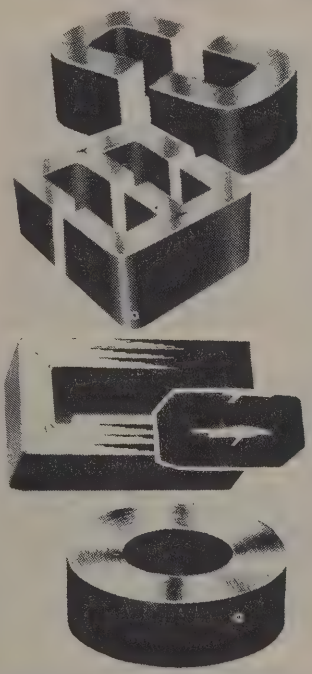
### TELSHIELD WRAP-AROUND SHIELDING FOIL



Shield components efficiently, simply, from unwanted signals with easy-to-use Telshield. Available in 0.001 in.-0.010 in. thickness tape, in widths of 3/32 in-6 in. Special handy packs for laboratory and R & D use.

**ALL ALLOYS AVAILABLE AS COMPONENTS FABRICATED IN HOUSE.**

### E, C AND TOROIDAL TAPE WOUND CORES BY TELCON MAGNETIC CORES, LTD.



- Grain oriented Silicon Steel Cores.
- Made to EIA Spec. RS217 and trade specifications by our British associate TELCON MAGNETIC CORES LTD. . . . one of the largest manufacturers of grain oriented silicon steel components.
- Available in all American standard or special sizes to American core numbers. Popular types available from New York warehouse for immediate delivery.
- Sold at prices that help you solve your constantly rising cost level problem.
- Produced by one of the largest manufacturing facilities in the world.
- Now, also available, LL distributed gap cores for small transformers where temperature and/or gap VA may be problems. Can replace 4 to 6 mil cut cores, 6 mil laminations, and sometimes Ni-Fe laminations.
- Toroidal cores available in 2, 4, 6 and 12/13 mil tape thickness. Cores can be supplied impregnated or edge bonded for improved rigidity. Also available gapped or cut.

### "C" CORE COMPRESSED AIR BANDING TOOL by TELMAG

Manufacturing rejects caused by variations in banding of "C" transformer cores can now be eliminated. The new "C" core Compressed Air Banding Tool provides consistent banding stresses in assembly-line operation. By making cores useful which were formerly rejected, the tool soon pays for itself.

# BERYLLIUM COPPER PRECISION SPRINGS

**Highest quality beryllium copper springs, *micro-processed* from 100% laboratory-certified stock for superior performance. All standard products available from stock!**

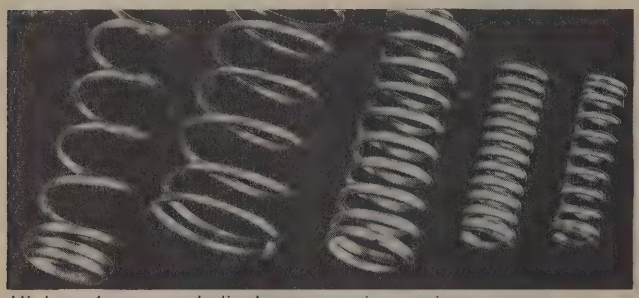
Instrument Specialties precision springs are made from extra quality beryllium copper made to our specifications.* Every lot is tested to be sure that each lot meets these stringent specifications. The exact lot appropriate for the design and application of a particular spring is then selected to meet individual requirements.

Springs are hardened in accordance with the individual requirements of each particular application to develop a *balanced* combination of precise tolerances, high yield strength, ductility, conductivity, stability and long life. Every step in the manufacturing process is controlled by experienced craftsmen using specially designed equipment and relying on over 30 years of experience in the production of the highest quality beryllium copper precision springs.

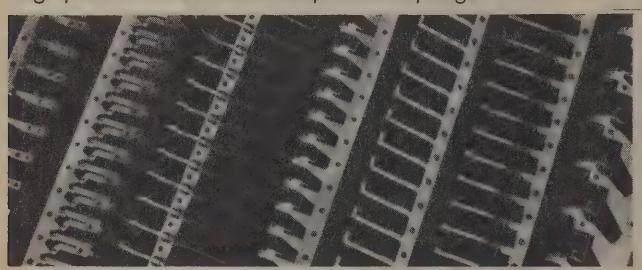
*Beryllium copper used is Alloy No. 25, conforming to ASTM-B194 and Federal QQ-C-533a Alloy 172.

**COMPLETE ENGINEERING AND DESIGN SERVICE**

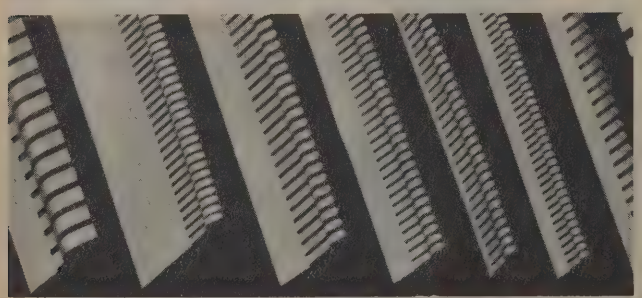
Instrument Specialties is recognized as the leader in the industry; our engineers are available at all times to assist you in solving your problems in the application of beryllium copper springs. Our extensive knowledge and long experience enable us to recommend better parts at lower costs. Prototype quantities can be produced quickly and economically. Just call or write today, or contact any of our representatives.



*High-performance helical compression springs*



*Micro-processed strip springs for automated assembly*



*Micro-processed finger contact strip springs*

### Micro-Processed Coil Springs

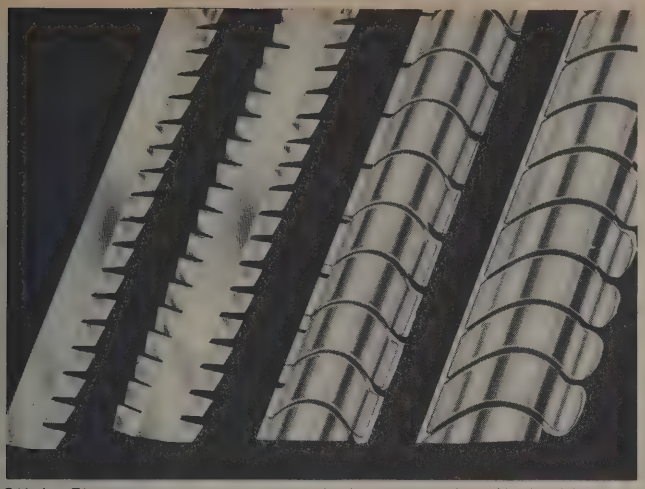
Micro-processed helical compression springs for use as balance weights, brush springs, clutch springs and many other applications. Fabricated from high-strength, heat-treatable beryllium copper and formed on specially designed coiling machines, I/S coil springs offer long life, uniformity and high stability. Two to ten times closer tolerances reduce adjusting and testing after assembly. Pitch, length and number of coils are accurately controlled to meet exacting requirements, and are subjected to exacting load tests.

### Strip Springs

Micro-processed flat springs in easy-to-handle strip form are available for automated production, such as rapid positioning in plastic molds or other assemblies. Each length is handled and positioned only once. Individual springs can be separated with finger pressure with no trace of burr. Soldering, welding, plating, tinning, riveting can be performed while the entire strip is intact. Tangling is eliminated. (Also available with CONTIPS® precious metal contacts and Selective Plating.)

### Finger contact shielding strips

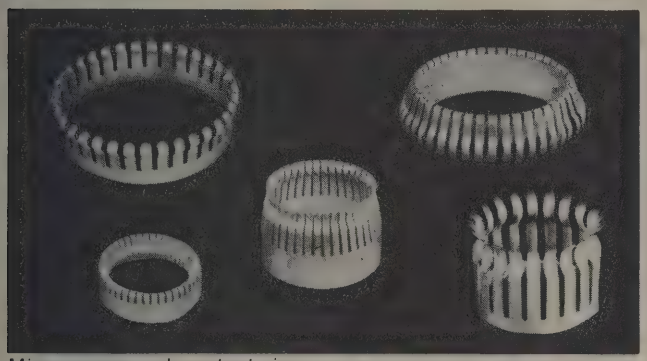
Micro-processed finger contact strip springs for grounding and shielding in high-frequency equipment and for forming large-diameter contact rings are offered in a wide variety of configurations. Various lengths to 16"; widths, contours and hole locations can be specified for many catalog items. Standard finish is "bright finished" (tarnish resistant). A wide variety of electroplated finishes can be specified, depending on surface conditions. Finger contact strips are also available with CONTIPS® precious metal contacts.



*Sticky-Fingers—a new concept in instant RFI/EMI shielding*

### Sticky-Fingers® Self-Adhesive Shielding

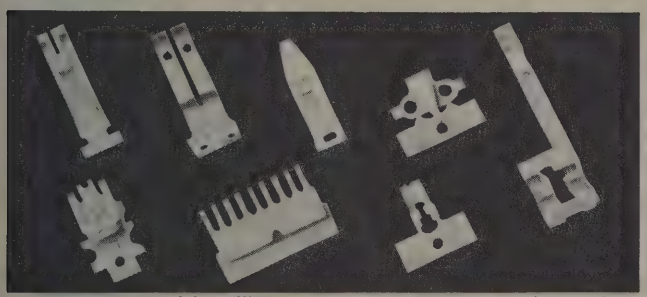
Sticky-Fingers®, a high-performance finger contact strip with its own self-adhesive, provides an extremely tight, instant bond to shield against RFI/EMI in all types of metal cabinets and electronic enclosures. Installed by simply peeling off protective paper backing and placing strip in position, Sticky-Fingers adhere instantly; bond permanently. Soldering or mechanical fastenings are completely eliminated. Sticky-Fingers' adhesive meets MIL Specs for salt spray, shock and humidity cycle tests, and is unaffected in temperature ranges from −65 F to 160 F. Shielding effectiveness is greater than 108 dB at 10 GHz, and 70 dB at 200 kHz magnetic.



*Micro-processed contact rings*

### Micro-processed contact rings

Precision micro-processed contact rings are offered in a wide variety of sizes and shapes and in standard finishes for tube cavities, tuning and shielding applications. Contact rings are supplied in diameters from 0.160"up, in male or female configurations. Almost any number of fingers can be specified. Micro-processing assures precise uniformity to unusually close tolerances. Contact rings are supplied in "bright finished" (tarnish resistant). A wide variety of electroplated finishes can be specified, depending on surface conditions. Contact rings can also be supplied with CONTIPS® precious metal contacts which do not affect spring qualities.

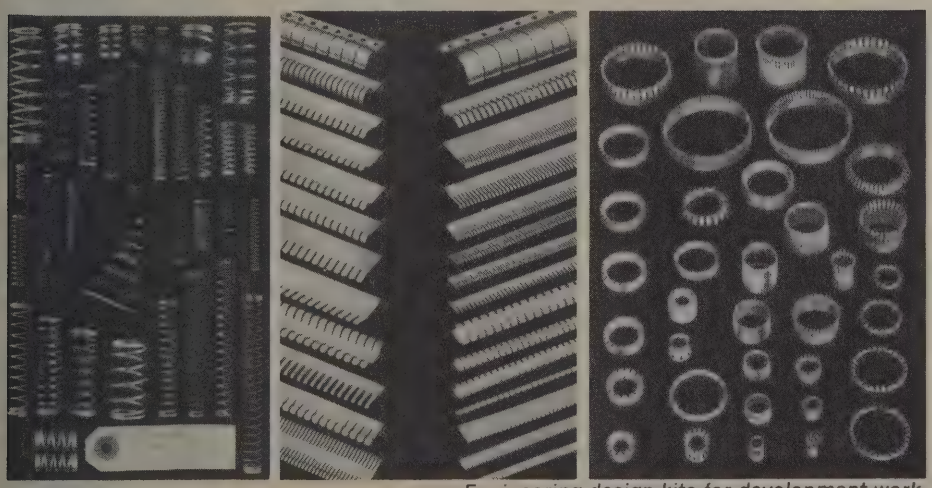


*A wide variety of beryllium copper stampings can be custom-designed and produced to meet most any specific requirement*

### Custom Flat Springs and Stampings

Instrument Specialties is equipped to supply custom machining and heat treating to meet specialized customer requirements.

Included are welded spring assemblies, riveted contact springs, inlaid or overlaid strip precision metal springs and other stampings, whether of a spring nature or not.



*Engineering design kits for development work*

### Engineering design kits

Instrument Specialties can supply design engineers with engineering design kits of selected beryllium copper spring samples for use in development work. Each kit contains a comprehensive assortment of beryllium copper springs. Each sample is selected and tagged for proper identification. Each design in the kit can be readily duplicated for prototype or production requirements.

**Kits are available as follows:**

Coil springs, 50 samples
CAT. No. 97-44 $25.00

Finger contact strips, 34 samples
CAT. NO. 97-272 $30.00

Contact rings, 36 samples
CAT. NO. 97-273 $25.00

***Write for Free Catalog Today!***

**INSTRUMENT SPECIALTIES COMPANY, INC.**

276 Bergen Boulevard, Little Falls, N.J. 07424
Phone: 201-256-3500 TWX: 710-988-5732

# Full Coverage

## ITT Thermotech Surrounds You with Service And Quality

At ITT Thermotech you can expect complete company involvement with your custom molded plastic job from start to finish. Each department is staffed with individuals who, in total, account for many years of experience in precision plastic molding. These people cover your job completely through estimating, mold design, raw material selection and control, manufacturing, quality control, to on-time delivery.

In addition to its ability to mold high tolerance, intricate parts, ITT Thermotech is capable of offering an Engineering service. And, even though we don't literally serve your order on a silver platter, we place a high degree of emphasis on giving you the excellent service you expect from ITT Thermotech.

Call us for an estimate. And find out what we mean by "full coverage".

**ITT THERMOTECH**

1202 South Fifth St., Hopkins, Minnesota 55343, 612-933-9400 • 3200 Tyrone Blvd., St. Petersburg, Florida 33710, 813-347-2191

# Precision makes the big difference at ITT THERMOTECH

**Coils and Bobbins**—Our many years of experience brings you superior technical know-how in the design and manufacturing of coil forms and bobbins. ITT Thermotech maintains an unusually wide selection of standard sizes and in addition can custom produce them to your specifications, whether simple or intricate shapes.

**Two-Color Keytops** — ITT Thermotech maintains an extensive stock of two-color keytops in both semi-matte and gloss finish. Requests for two-color single, 1½, 2, and 3 position keytops and one-color space bars are filled from a large stock of off-the-shelf sizes, colors, and inscriptions. We also welcome the opportunity to quote on special requirements.

**Intricate Parts & Materials** — ITT Thermotech's design and production personnel like the challenges of intricate configurations in a wide variety of materials. No shape is too intricate . . . no material too difficult to mold. We have even designed special equipment to handle the tougher ones.

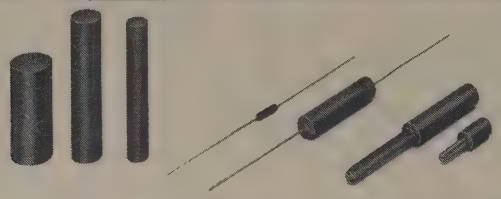
**Custom Products** — Our skilled mold designers want to work with you to help you design and produce your plastic parts. For years, we have done intricate design engineering, helped design complex parts and even done complete product changes from metal to plastics.

**Find the difference at . . .**

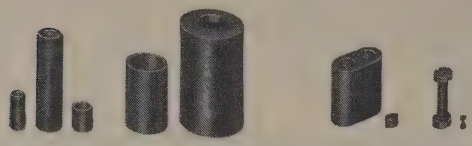
## ITT THERMOTECH

1202 South Fifth Street, Hopkins, Minnesota 55343, (612) 933-9400
3200 Tyrone Boulevard, St. Petersburg, FL 33710, (813) 347-2191

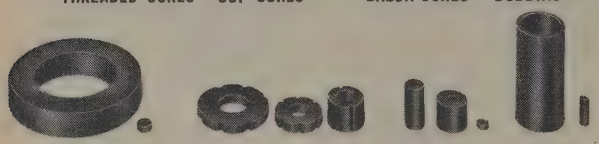
# KRYSTINEL FERRITE CORES



SLUGS COIL FORMS INSERT TUNING CORES



THREADED CORES CUP CORES BALUN CORES BOBBINS



TOROIDS WASHERS SHIELD BEADS SLEEVES

## LINEAR FERRITE CORES

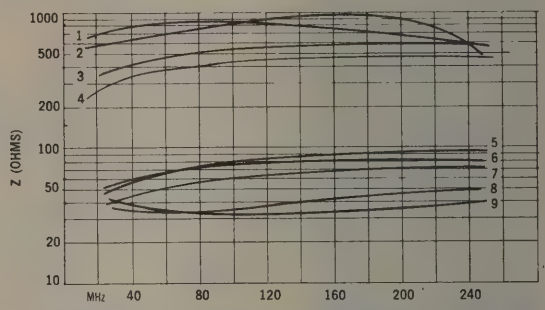
Krystinel manufactures a complete line of standard and custom made ferrites. We maintain a large inventory of standard sizes and shapes as detailed in our catalog. Additionally, special ferrites can be made to your electrical and mechanical specifications if our standard parts do not satisfy your requirements.

Copies of our catalog, as well as samples and technical information, may be obtained by contacting us at our Port Chester office.

Please write to request information on our newly developed K-82 Series of ferrite materials which have been designed especially for pulse applications.

**SHIELD BEADS (Partial Listing)**

| Dimensions (Inches) | | | | Material | K-51 | K-41 | K-14 | K-52 | K-71 |
|---|---|---|---|---|---|---|---|---|---|
| | | | ADD PREFIX HERE | Prefix | E-51 | E-41 | E-14 | E-52 | E-71 |
| HT. | O.D. | I.D. | | Base No. | $A_L$ (NH/N²) ±20% | | | | |
| .050 | .138 | .051 | | 1F3Y-1G0 | 101 | 93 | 202 | 214 | 682 |
| .128 | .138 | .051 | | 3N3Y-1G0 | 258 | 239 | 517 | 550 | 1748 |
| .128 | .138 | .062 | | 3N3Y-1S0 | 208 | 192 | 416 | 442 | 1405 |
| .125 | .163 | .062 | | 3K4N-1S0 | 245 | 227 | 491 | 521 | 1657 |
| .250 | .163 | .062 | | 754N-1S0 | 491 | 454 | 982 | 1043 | 3315 |
| .125 | .190 | .090 | | 3K5F-2K0 | 190 | 175 | 379 | 403 | 1282 |
| .250 | .190 | .090 | | 755F-2K0 | 379 | 351 | 759 | 806 | 2562 |
| .250 | .200 | .062 | | 755Q-1S0 | 595 | 550 | 1190 | 1264 | 4017 |




**1:** WC52-B96R-25. **2:** WC51-B96R-25. **3:** WC52-B96R-15. **4:** WC51-B96R-15. **5:** E41-755SQ-1S0, 1 turn. **6:** E52-755Q-1S0, 1 turn. **7:** E51-755Q-1S0, 1 turn. **8:** E14-755Q-1S0, 1 turn. **9:** E71-755Q-1S0, 1 turn.

**WOUND CHOKE (6 HOLE BEAD)**

| Part Number | Dimensions L | Dimensions O.D. | Dimensions Lead | No. of Turns | No. of Windings | Impedance @ Freq. Min.Ω | Impedance @ Freq. MHz |
|---|---|---|---|---|---|---|---|
| WC52-B96R-15 | .394 | .236 | 1.562 | 1½ | 1 | 300 | 120 |
| WC51-B96R-15 | .394 | .236 | 1.562 | 1½ | 1 | 400 | 240 |
| WC52-B96R-25 | .394 | .236 | 1.562 | 2½ | 1 | 600 | 50 |
| WC51-B96R-25 | .394 | .236 | 1.562 | 2½ | 1 | 700 | 180 |

**KRYSTINEL FERRITE MAGNETIC CHARACTERISTICS — MATERIALS**

| Characteristic | Unit | Symbol | K-31 | K-21 | K-01 | K-M1 | K-51 | K-41 | K-11 | K-14 | K-52 | K-N1 | K-61 | K-71 | K-81 | K-83 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Initial Permeability | | $\mu i$ | 15 | 40 | 120 | 200 | 400 | 370 | 250 | 800 | 850 | 1500 | 1500 | 2700 | 4400 | 6000 |
| Maximum Permeability | | $\mu$Max. | 40 | 100 | 300 | 750 | 1500 | 1200 | 700 | 1900 | 2500 | 2600 | 2500 | 4000 | 6300 | 7500 |
| Coercive Force | Oersted | Hc | 23 | 5.0 | 2.5 | 1.5 | 0.5 | 0.6 | 0.8 | 0.3 | 0.35 | 0.3 | 0.4 | 0.17 | 0.11 | 0.10 |
| Saturation Flux Density | Gauss | Bsat | 2200 | 2000 | 2800 | 2200 | 2100 | 3100 | 2700 | 3200 | 2800 | 4200 | 4750 | 4000 | 4000 | 3900 |
| (@ H Oersted) | | (H) | (20) | (20) | (20) | (12) | (8) | (15) | (10) | (5) | (4) | (6) | (7) | (5) | (2.5) | (2) |
| Residual Flux Density | Gauss | Br | 1350 | 700 | 1600 | 1250 | 1200 | 2100 | 1100 | 1200 | 1400 | 1600 | 1750 | 950 | 920 | 750 |
| Curie Temperature | °C | Tc | 500 | 450 | 400 | 275 | 150 | 325 | 200 | 175 | 140 | 180 | 220 | 150 | 150 | 150 |
| Volume Resistivity | Ohm-Cm | $\rho$ | $2x10^4$ | $1x10^6$ | $1x10^7$ | $1x10^6$ | $1x10^7$ | $1x10^8$ | $3x10^3$ | $4x10^1$ | $1x10^5$ | $5x10^1$ | $1x10^2$ | 2x10 | $2x10^1$ | $2x10^1$ |
| Temperature Change of Initial Permeability (0°C to 60°C) | % | $\triangle$Lx100 | ±5 | ±5 | ±6 | ±3 | ±12 | ±20 | ±8 | ±8 | ±10 | ±10 | ±10 | ±15 | ±15 | ±25 |
| Loss Factor X10⁻⁶ | | L @ 25°C Tan. $\delta$ / $\mu i$ | 325 | 60 | 20 | 50 | 20 | 30 | 12.5 | 27.0 | 25.0 | 6.0 | 4.0 | 10.0 | 10.0 | 9.0 |
| @ Frequency | MHz | | 100 | 10 | 1 | 1 | .1 | .1 | .1 | .1 | .1 | .1 | .1 | .1 | .1 | .1 |

**NOTES:** 1. Normal tolerance of $\mu i$ is ±20%. Permeability values vary with size of toroids used. $A_L$ values listed in the toroid section (Group L) reflect this variation. 2. For extended temperature ranges or tighter temperature coefficients of permeability, contact Krystinel Engineering Dept. 3. Loss data include both coil and core losses as read on a one inch dia. toroid for K-31, K-21, K-01, K-41 and K-11; and one half inch dia. toroid for K-14, K-61, K-81 and K-83. 4. Hysteresis loop data were taken using a D.C. balistic galvanometer @ 25°C.

## BELOW IS A PARTIAL LISTING OF OUR TOROID LINE

**MATERIALS**

| Dimensions (Inches) | | | | Part No. | K-31 | K-21 | K-01 | K-41 | K-14 | K-61 | K-71 | K-81 | K-83 | Cross Sectional Area | Magnetic Path Length |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Add Prefix Here | Prefix | L-31 | L-21 | L-01 | L-41 | L-14 | L-61 | L-71 | L-81 | L-83 | | |
| O.D. | I.D. | HT. | | Base No. | $A_L$ (NH/N²) ±20% | | | | | | | | | $Cm^2$ | Cm |
| .100 | .070 | .050 | | 2V20-1F | 1.3 | 3.6 | 10.9 | 33 | 72 | 135 | 244 | 398 | 543 | .0048 | .678 |
| .138 | .070 | .050 | | 3Y20-1F | 2.5 | 6.8 | 20.7 | 63 | 137 | 258 | 465 | 758 | 1035 | .0109 | .829 |
| .155 | .087 | .050 | | 4F2H-1F | 2.2 | 5.8 | 17.6 | 54 | 117 | 220 | 396 | 645 | 880 | .0109 | .965 |
| .190 | .090 | .050 | | 5F2K-1F | 2.8 | 7.5 | 22.7 | 70 | 151 | 284 | 512 | 835 | 1139 | .0161 | 1.116 |
| .230 | .120 | .060 | | 6K3F-1Q | 2.9 | 7.9 | 23.8 | 73 | 158 | 297 | 535 | 872 | 1190 | .0213 | 1.396 |
| .300 | .125 | .125 | | 8K3K-3K | 8.3 | 22.2 | 66.7 | 205 | 444 | 834 | 1501 | 2446 | — | .0705 | 1.695 |
| .375 | .187 | .125 | | AQ5C-3K | 6.6 | 17.6 | 53.0 | 163 | 353 | 663 | 1193 | 1944 | — | .0758 | 2.241 |
| .500 | .287 | .250 | | EA87-75 | 10.5 | 28.2 | 84.6 | 260 | 564 | 1057 | 1903 | 3102 | — | .1717 | 3.138 |
| .820 | .500 | .250 | | NFEA-75 | 8.9 | 23.8 | 71.6 | 220 | 477 | 895 | 1611 | 2626 | — | .258 | 5.264 |

**EXAMPLE:** For K-21 toroid (.155 OD x .087 ID x .050 Ht.,) part number is L21-4F2H-1F

KRYSTINEL

**KRYSTINEL CORPORATION**
FOX ISLAND ROAD / PORT CHESTER, NEW YORK 10573
(914) 937-5252 / TWX 710-569-1604

# CO-NETIC & NETIC
# EMI shielding material

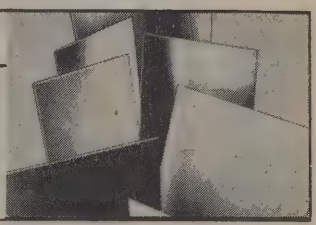
A complete stock of CO-NETIC (high permeability) and NETIC (high saturation) shielding alloys is available in foil and sheet form. Our engineering department will gladly assist you in the development of shield designs to meet your prototype or production requirements.

MAGNETIC SHIELD DIVISION

Perfection Mica Company
750 North Thomas Drive
Bensenville, Illinois 60106
(312) 766-7800 TWX (910) 256-4815

## sheet stock: (standard—30" x 120") Shipped immediately from stock.

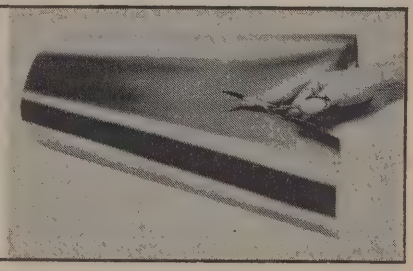
| STD. THK. (Inch) | NETIC S3-6 ALLOY SHEET | CO-NETIC AA STRESS ANNEALED | CO-NETIC AA PERFECTION ANNEALED |
|---|---|---|---|
| .014<br>.020<br>.025<br>.030<br>.040<br>.050<br>.062 | High saturation capability.<br>.040 NETIC not stocked.<br>Also stock .095" | High permeability characteristics. Stress annealed for ease of fabrication. Must be final annealed for maximum attenuation characteristics. Also stocked in .100". | High permeability characteristics. Perfection Annealed material has been fully hydrogen annealed for optimum magnetic properties. No further annealing after fabrication is necessary if severe forming is avoided. |



## foil stock: (standard coils—50 and 100 linear ft.)

| STD. THK. (Inch) | NETIC PERFECTION ANNEALED WIDTH (Inch) | CO-NETIC PERFECTION ANNEALED WIDTH (Inch) |
|---|---|---|
| .002 | — | 4 |
| .004 | 4 | 4 |
| .004 | 15 | 15 |
| .006 | — | 4 |
| .006 | — | 15 |
| .010 | — | 4 |
| .010 | — | 15 |

Standard foils shipped immediately from stock. All sizes available with double-faced pressure sensitive tape and release coated liner. Foils can be slit to a minimum width of ¼", with or without backing. Width tolerance ±.010. Backed and slit foils shipped one week after receipt of order. All foil is Perfection Annealed for maximum attenuation.



## physical & magnetic data:

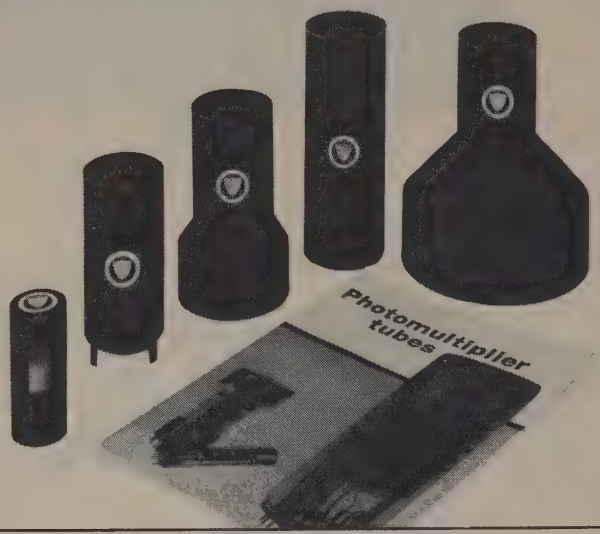
| | CO-NETIC AA PERFECTION ANNEALED | CO-NETIC AA STRESS ANNEALED | NETIC S3-6 |
|---|---|---|---|
| Specific Gravity | 8.58 | 8.58 | 7.85 |
| Coefficient of expansion per °C x $10^{-6}$ | 12.5 | 12.5 | 11.7 |
| Tensile strength in PSI x $10^3$ | 64 | 90 | 50 |
| Yield strength PSI x $10^3$ | 18.5 | 38 | 38 |
| Hardness, Rockwell B | 50±5 | 70±5 | 50±5 |
| Elongation in 2 inches, percent | 27 | 35 | 30 |
| Melting point (°F) | 2680 | 2680 | 2760 |
| Thermal conductivity (cal/sec/cm²/cm/°C) at 20°C | .138 | .138 | .118 |
| Curie Temp. | 750°F | 750°F* | 770°F |

| | CO-NETIC AA PERFECTION ANNEALED | CO-NETIC AA STRESS ANNEALED | NETIC S3-6 |
|---|---|---|---|
| Electrical Resistivity ohms/cir mil foot | 337 | 337 | 60 |
| Microhm centimeters | 56 | 56 | 10 |
| Thickness tolerance | ±10% | ±10% | ±10% |
| Saturation Induction (Gauss) | 7500 | 7500* | 21,400 |
| Initial Permeability | 25,000 | 25,000* | 200 |
| Permeability at 200 gauss | 135,000 | 135,000* | 800 |
| Maximum Permeability | 500,000 | 500,000* | 5000 |
| Induction at $\mu$max. | 3000 | 3000* | 8000 |
| Coercive force, $H_c$, oersteds | .004-.01 | .004-.01* | 1.0 |

* Magnetic Properties after Hydrogen Anneal.

# photomultiplier tube shields...

**Precision shields shipped from stock for 90% of photomultiplier tubes.**




## MAGNETIC SHIELD DIVISION

MAGNETIC SHIELD DIV. CO-NETIC NETIC PERFECTION MICA CO.

Perfection Mica Company
750 North Thomas Drive
Bensenville, Illinois 60106
(312) 766-7800 TWX (910) 256-4815

CO-NETIC magnetic shields improve the amplification characteristics of photomultiplier tubes by providing significant attenuation of magnetic fields. Effective shielding is ensured over a wide range of field intensities. When grounded, the shields provide protection against electrostatic interference.

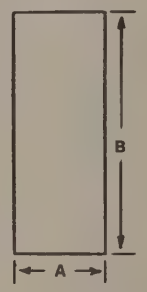
CO-NETIC shields are highly resistant to shock and vibration. The shields have minimal retentivity and do not require periodic re-annealing.

Custom engineered shields are available in any quantity. Call for design assistance or send print for prompt quotation.

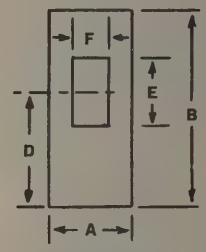
## SHIELDED DIMENSIONS

| Part No. | Drawing | A | B | C | D | E | F | G | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 06P25 | 1 | 5/8 | 2 1/2 | | | | | | |
| 07P13V1 | 2 | 3/4 | 1 3/8 | | 13/16 | 1/2 | 1/4 | | a |
| 10P25 | 1 | 1 | 2 1/2 | | | | | | |
| 10P40 | 1 | 1 | 4 | | | | | | |
| 11P42X18 | 5 | 1 1/8 | 4 1/4 | 1 7/8 | 2 15/16 | 1 5/16 | 1/4 | | d |
| 12P31V1 | 2 | 1 1/4 | 3 1/8 | | 1 11/16 | 1 1/8 | 5/8 | | a |
| 12P35 | 1 | 1 1/4 | 3 1/2 | | | | | | |
| 12P45 | 1 | 1 1/4 | 4 1/2 | | | | | | |
| 13P23V1 | 2 | 1 3/8 | 2 3/8 | | 1 1/4 | 1 1/8 | 5/8 | | a |
| 13P28V1 | 2 | 1 3/8 | 2 13/16 | | 1 5/16 | 1 1/8 | 5/8 | | a |
| 13P32V1 | 2 | 1 3/8 | 3 1/4 | | 1 15/16 | 1 1/8 | 5/8 | | a |
| 13P52V1 | 2 | 1 3/8 | 5 1/4 | | 3 15/16 | 1 1/8 | 5/8 | | a |
| 15P27 | 1 | 1 1/2 | 2 3/4 | | | | | | |
| 15P40 | 1 | 1 1/2 | 4 | | | | | | |
| 15P50 | 1 | 1 1/2 | 5 | | | | | | |
| 17P30 | 1 | 1 3/4 | 3 | | | | | | |
| 17P33V1 | 2 | 1 3/4 | 3 3/8 | | 2 11/16 | 7/8 | 3/4 | | a |
| 17P45 | 1 | 1 3/4 | 4 1/2 | | | | | | |
| 17P53V1 | 4 | 1 3/4 | 5 3/8 | | 2 3/4 | 2 5/8 | 1/4 | 2 1/16 | b |
| 20P50 | 1 | 2 | 5 | | | | | | |
| 21P45V1 | 3 | 2 3/16 | 4 1/2 | | 1/2 | 1/2 | 1/4 | | c |
| 21P55V1 | 3 | 2 3/16 | 5 1/2 | | 1/2 | 1/2 | 1/4 | | c |
| 22P40 | 1 | 2 1/4 | 4 | | | | | | |
| 22P50 | 1 | 2 1/4 | 5 | | | | | | |
| 22P60 | 1 | 2 1/4 | 6 | | | | | | |
| 22P70 | 1 | 2 1/4 | 7 | | | | | | |
| 23P55X32 | 6 | 2 3/8 | 5 5/16 | | 3 3/8 | 1 1/16 | | 1 1/2 | |
| 23P61X37 | 6 | 2 3/8 | 6 1/8 | 3 3/4 | 1/4 | 3 3/4 | | 2 1/8 | |
| 23P68X57 | 6 | 2 3/8 | 6 7/8 | 5 3/4 | 3 | 1 7/8 | | 2 | |
| 23P101X57 | 6 | 2 3/8 | 10 1/8 | 5 3/4 | 1/2 | 2 3/4 | | 6 7/8 | |
| 25P40 | 1 | 2 1/2 | 4 | | | | | | |
| 25P50 | 1 | 2 1/2 | 5 | | | | | | |
| 25P60 | 1 | 2 1/2 | 6 | | | | | | |
| 25P70 | 1 | 2 1/2 | 7 | | | | | | |
| 27P73V1 | 2 | 2 3/4 | 7 3/8 | | 3 5/8 | 4 3/8 | 3 | | a |
| 30P67X57 | 6 | 3 | 6 3/4 | 5 3/4 | 3 1/4 | 1 1/2 | | 2 | |
| 32P80 | 1 | 3 1/4 | 8 | | | | | | |
| 32P100X55 | 6 | 3 1/4 | 10 | 5 1/2 | 3 1/2 | 1 | | 5 1/2 | |
| 35P70 | 1 | 3 1/2 | 7 | | | | | | |

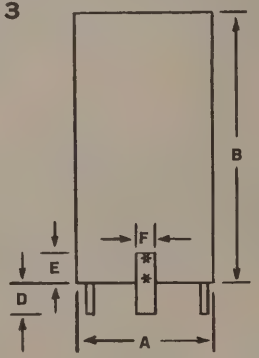
1



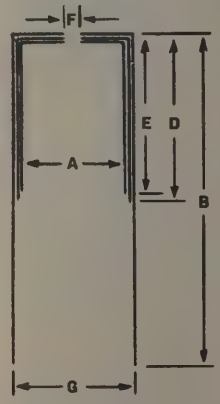

2




3

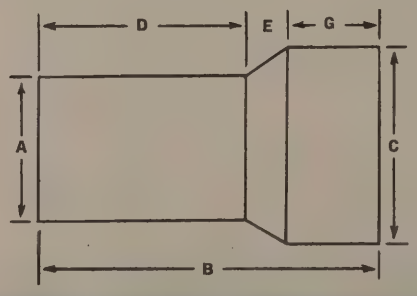



4

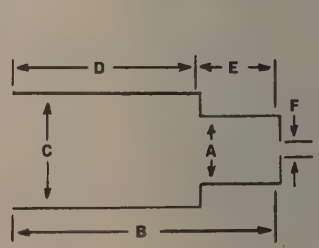



**NOTES:**
Unless otherwise noted:
**Dimensions** — All ID
**Material** — .040" Thick Co-Netic AA
**Finish** — Black baked enamel; texture outside, flat inside.
**a** — Upper end closed.
**b** — Dimensions D & E are measured from the outside of the outer shell. Dimension G is the maximum OD. Material — Three layers, separable; outer .049 Netic S3-6, two inner .031 Co-Netic AA Finish — Netic S3-6, black oxide; Co-Netic AA, none.
**c** — Has three tabs, spaced 120° apart, to grip the metal collar of the PM tube.
**d** — Material — .031" Co-Netic AA.

6



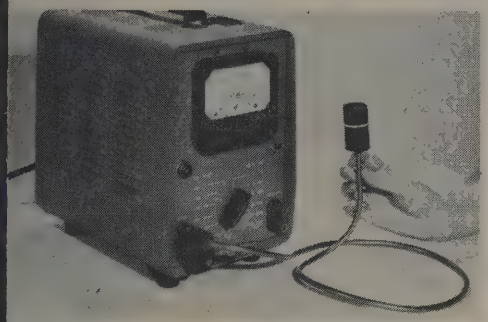

5



# complete magnetic shielding accessories & mica

MAGNETIC SHIELD DIVISION

Perfection Mica Company
750 North Thomas Drive
Bensenville, Illinois 60106
(312) 766-7800 TWX (910) 256-4815

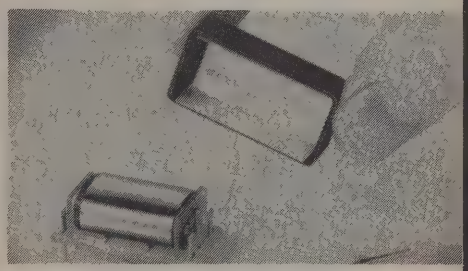


## LAB KITS & PROBES

Lab Kit contains assorted CO-NETIC and NETIC shielding materials, double-faced pressure sensitive tape for shield construction and 20 millivolts/gauss A.C. magnetic pickup probe ..... all for $99.50
Probe only, 20 mV/gauss ..... $49.50
Ultra sensitive probe only, 60 mV/gauss ..... $79.50

## COMPONENT SHIELDS

Standard enclosures for transformers, CRT's, small motors, relays and reed switches are available from stock. Magnetic Shield Division is also the preferred source for custom shields to your specifications. Extensive standard and special tooling provide fast shipment. Call for design assistance or send print for prompt quotation.

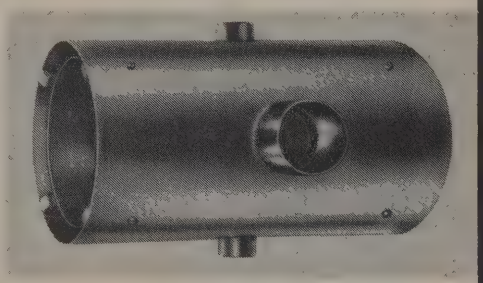


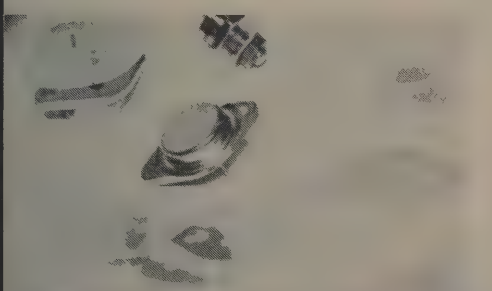
## INTER-8 WEAVE CABLE

Our patented, woven configuration of four signal leads provides superior attenuation over a twisted pair. Attenuation improvement of unshielded INTER-8 WEAVE cable is −20 db for radiation and −12 db for pickup. An additional −20 db is obtained with our braided CO-NETIC jacket. Available in solid/plain or multiple/tinned AWG 24 wire.

## ZERO GAUSS CHAMBERS

Zero gauss chambers provide the ultimate in magnetic shielding. Magnetic Shield Division's general-purpose zero gauss chamber offers a significant reduction in both static and time varying fields found in laboratory and research environments. Degaussing coils can be furnished, and a Helmholtz coil system can be incorporated to generate known fields. Three concentrically spaced CO-NETIC chambers with closed ends and removable covers are provided. Placement of openings is optional. Attenuation in excess of −60 db is typical.

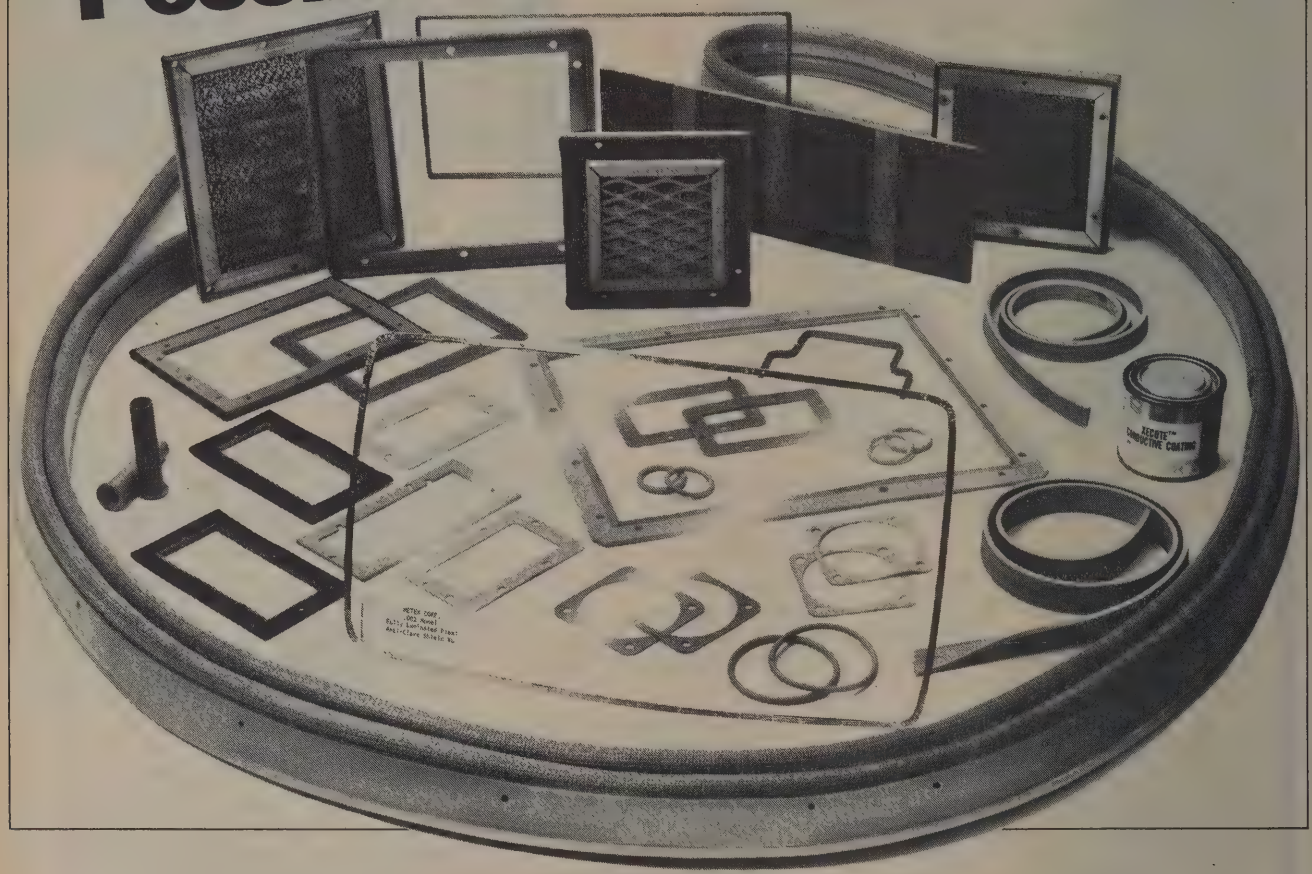




## MICA INSULATORS

Available in sheet, wafer, flakes and ground form. Clear, natural and built-up sheet stock thicknesses from .002″ to .062″. Save tooling expense on a wide variety of fabricated parts, including semi-conductor insulators in .002″ to .003″ thickness with .002″ hole tolerances. Excellent heat resistance and high dielectric strength provide improved breakdown protection and increased efficiency of electronic components.

# Infinite EMI/RFI Shielding Possibilities from Metex



Metex EMI/RFI shielding comes in an infinite assortment of shapes and sizes for every conceivable electronics application, from sophisticated mobile communications and radar systems to fluorescent lighting fixtures. Fact is, we're the most experienced company in the business, worldwide.

That's why, when you get hung up on an interference problem, call your Metex representative. No matter what kind of shielding your application requires, the chances are Metex has a design for it. If not, we'll create one, just for you.

Part of our problem-solution technology is the use of knitted metal. Another is our Xecon® Conductive Elastomer. When we combine the two, the result is Metex Armored Xecon® Gasketing. The most advanced EMI/RFI shielding available. Anywhere.

Metex Shield Vu™ Windows allow you to see clearly (98% visibility) into any cabinet, chamber or digital display without EMI/RFI leakage. Again, we use knitted metal – between panes of acrylic or glass.

Omni Cell® Panels, with our transverse-oriented honeycomb configuration for ventilation shielding, are opaque to all electrostatic polarization vectors.

Metex Combo® Gaskets can be designed to accommodate any pressure differential application regardless of joint unevenness. They're available in combinations of six different standard elastomers and two different knitted metals. The knitted metal strip comes with or without an elastomer core.

Metalex® Shielded Frames are a combination of knitted metal gasketing mounted within an extruded aluminum cross section.

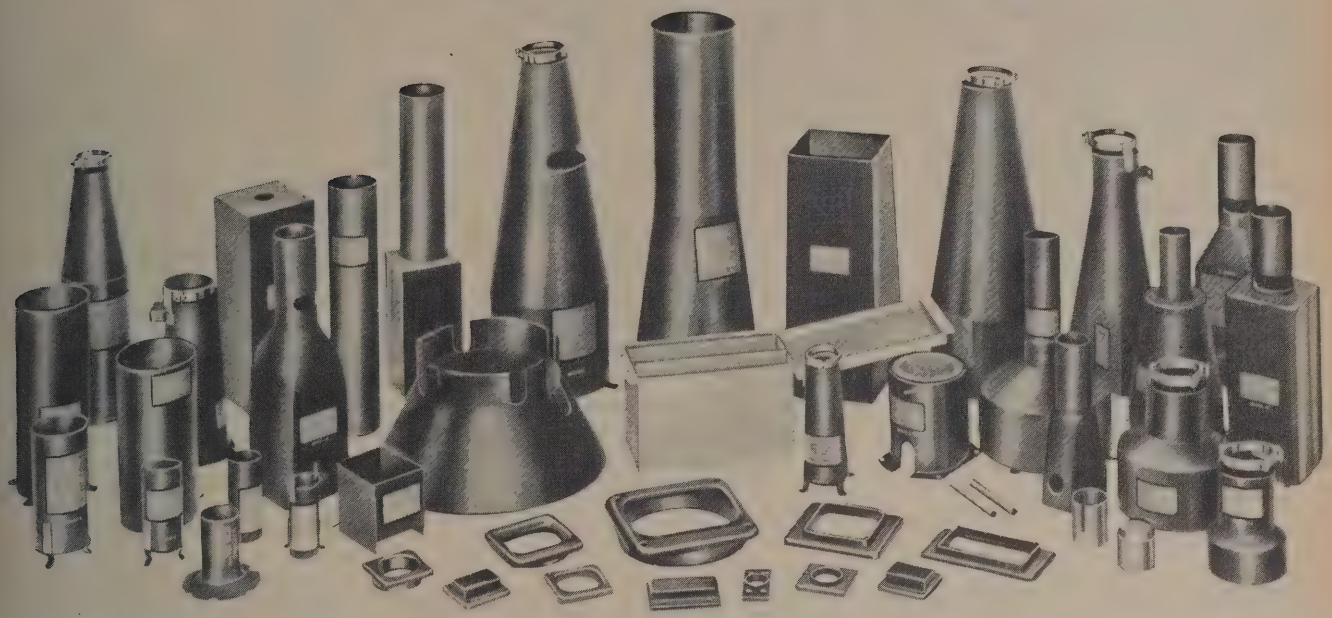
So, whether you can best use custom designed Combo® or Pola® Shielding Gaskets in sheets, rings or strips, or conductive coatings, Metex should be your first thought when it comes to EMI/RFI shielding.

And, to help you realize the infinite possibilities of Metex shielding, we want you to have, free of charge, our 124 page EMI/RFI Shielding Handbook, acclaimed the world over as the "textbook" of the field. Write to us on your company letterhead, at 970 New Durham Road, Edison, N.J. 08817, or on the west coast, 20437 S. Western Ave., Torrance, Ca. 90501.

Or, if you need an answer right away, talk to one of our applications engineers in N.J. at 201•287-0800, or in California on 213•320-8910. Also ask about samples and our free video seminars, offered periodically.

METEX
ELECTRONIC SHIELDING GROUP
A Unit of Metex Corporation

# The utmost in Magnetic Shielding



**Worlds most complete line of off-the-shelf magnetic shielding for side-window and end-on PM tubes, cathode ray and storage tubes.**

With over 35 years experience in the design, fabrication and production of magnetic shielding, backed by the metal forming expertise of its parent company, Bomco, Inc., MuShield's listing of a guaranteed field reduction on all material and every shield is your assurance that MuShield's quality is unsurpassed.

### Magnetic Shielding for Research and Industry

MuShield offers a complete line of off-the-shelf magnetic shielding as well as providing design and engineering support for the production of custom shields. MuShield's personnel are published authorities on the design and production of magnetic shielding and are ready to help in the design of new shields.

### Raw Materials and Heat-Treating Capability

MuShield provides three basic types of shielding material: MuShield High Saturation Material, which has permeability ranging from 200 to as high as 50,000 and a saturation point between 18,000 and 20,000 gauss; MuShield Medium Permeability Material, normally used as a buffer, with a saturation point of approximately 15,500 gauss and permeabilities from 12,500 to 150,000; and MuShield High Permeability Material, which has a minimum permeability of 80,000, at B-40, a maximum permeability of 350,000, and a saturation point of approximately 7,500 gauss.

MuShield offers a Special Heat Treating and Processing Service that gives magnetic shielding material optimum permeability and low-shock characteristics. All MuShield products are heat treated by this special process as a standard manufacturing procedure.

Shielding fabricated of MuShield material may be processed with our Special Heat Treating and Processing Service. Permeability of fabricated parts that receive the Special Heat Treating and Processing Service is guaranteed.

### Seamless Magnetic Shielding Tubing

MuShield offers seamless magnetic shielding tubing in sizes .050" to 1-1/4" in diameter. Like all MuShield products, the permeability of MuShield seamless tubing is guaranteed.

### Magnetic Tape Preserver Cases

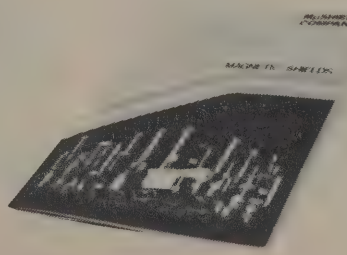
MuShield manufactures a variety of tape preserver cases for the protection of magnetic tapes from degradation caused by proximity to magnetic or electrical fields. MuShield will also manufacture cases to customer specifications.

### Send for Free Catalog

The MuShield catalog is a "must have" reference piece for the engineer concerned with magnetic shielding. All MuShield magnetic shields are listed according to the actual CRT, photomultiplier, and storage tubes they are designed to shield. Design aids, a description of MuShield Material, and the Special Heat Treating and Processing Service are also included. The MuShield catalog is a reference piece that will prove invaluable to the design engineer and buyer.

Write or call: Owen "Hap" Haszard

MuShield Company
121 Madison Street, Malden, MA 02148
Tel.: (617) 321-4410



## MμSHIELD COMPANY

DIVISION OF BOMCO, INC.
121 MADISON STREET, MALDEN, MA 02148 TEL.: (617) 321-4410

# Stackpole CERAMAG® Ferrites:

Stackpole has pioneered since 1947 in the large-scale production of soft ferrite components—products that have set the standard for uniformity and dependability in the electronics industry.

CERAMAG is Stackpole's trademark for its family of soft spinel ferrite compositions. Each material is usable over a portion of the frequency range of 1 kHz to over 200 MHz.

The large selection of CERAMAG materials and tooling that Stackpole offers makes possible new designs heretofore impractical or impossible.

As each CERAMAG material has a unique set of characteristics, the design engineer should carefully choose the precise ferrite needed to achieve an optimum system design.

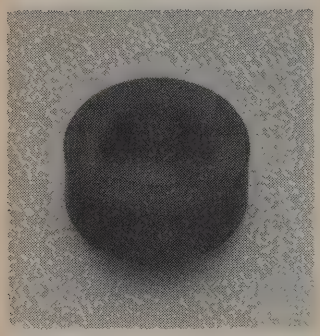
Our expertise lies in designing the best core material and providing it in a usable configuration at the most reasonable cost. We will work with your design engineer and support him with our expertise.

For information on The Right Ferrites, write for Bulletin 59-103, to: Stackpole Carbon Company, Electronic Components Division, St. Marys, Pa. 15857. Telephone: (814) 781-1234. TWX: 510-693-4511.

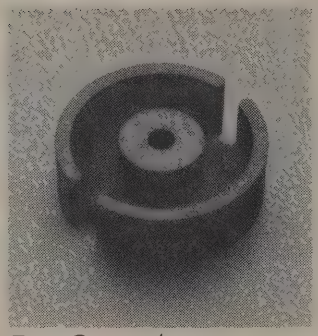
| CHARACTERISTICS | MATERIAL GENERIC TYPE |
|---|---|
| | Initial Permeability ($\mu_o$) |
| | Saturation Flux Density ($B_s$) |
| | (@ H oersteds) |
| | Residual Flux Density ($B_r$) |
| | Coercive Force (H ) |
| | Temperature Coefficient of $\mu_o$ (25°C to 100°C) (T.C.) |
| | Curie Temperature ($T_c$) |
| | Volume Resistivity @ 25°C ($\rho$) |
| | Max. Usable Frequency (F) |

**Saturation Induction, $B_s$—**
Maximum possible induction in a material; value is approached asymptotically (with increasing H) by the normal magnetization curve and the hysteresis loop.

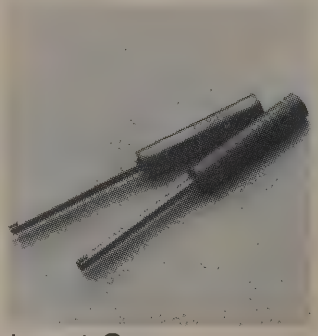
**Coercive Force, $H_c$—**
The demagnetizing force necessary to reduce the Residual Induction to zero.



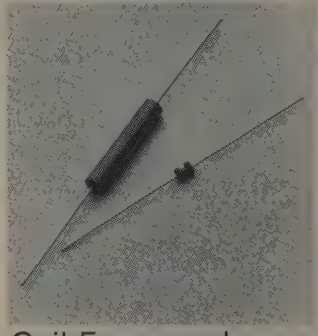
Toroids



Pot Cores/
Cup Cores

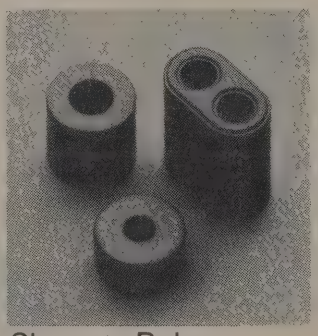


Insert Cores

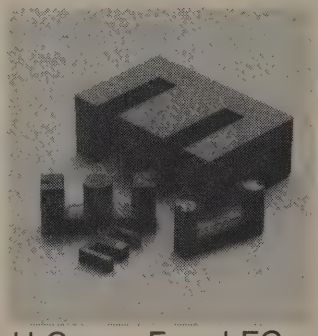


Coil Forms and
Bobbins

Thread Cores



Sleeves, Baluns,
and Beads



U Cores, E and EC
Cores, and I Bars

Deflection-Yoke
Cores

# The Right Ferrites

| C/5N NiZn | C/7B NiZn | C/7D NiZn | C/9 NiZn | C/11 NiZn | C/12 NiZn | C/14 NiZn | C/14A NiZn | C/24 MnZn | C/24B MnZn | C/25 Series MnZn | C/26 MnZn | C/27A MnZn | C/28 MnZn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 500 | 450 | 850 | 190 | 125 | 35 | 12.5 | 7.5 | 2500 | 2000 | 500 to 1250 | 2000 | 1000 | 1500 |
| 2500 | 2600 | 3200 | 3000 | 2550 | 2400 | 2100 | | 4500 | 5100 | NA | 3800 | 4200 | 3900 |
| (9.0) | (9.0) | (9.0) | (18.0) | (18.0) | (9.0) | (100.0) | | (9.0) | (9.0) | | (9.0) | (9.0) | (4.0) |
| 1400 | 1650 | 1800 | 1980 | 1420 | 750 | 1600 | | 1700 | 2500 | NA | 1200 | 1700 | 1700 |
| 0.85 | 0.48 | 0.25 | 2.0 | 2.8 | 4.7 | 21.0 | | 0.25 | 0.25 | NA | 0.25 | 0.40 | 0.36 |
| +0.2 | +0.9 | +0.9 | +0.22 | +0.02 | +0.08 | +0.36 | | −0.18 | NA | | +0.15 | +0.15 | |
| 200 | 160 | 140 | 210 | 385 | 450 | 510 | | 205 | 230 | 195 to 290 | 170 | 200 | 170 |
| $1.0\times10^{3}$ | $1.0\times10^{6}$ | $1.4\times10^{5}$ | $1.0\times10^{11}$ | $2.0\times10^{7}$ | $3.0\times10^{7}$ | $5.0\times10^{9}$ | | $1.0\times10^{2}$ | $5.0\times10^{1}$ | $1.0\times10^{1}$ | $2.0\times10^{2}$ | $2.0\times10^{3}$ | $1.0\times10^{3}$ |
| 1.0 | 1.0 | 1.0 | 2.0 | 5.0 | 50.0 | 100.0 | 400.0 | 0.5 | 0.5 | 2.0 | 0.5 | 1.0 | 0.5 |

**Residual Induction, $B_r$—**
The magnetic induction corresponding to zero magnetizing force in a magnetic material which is in a symmetrically, cyclically magnetized condition.

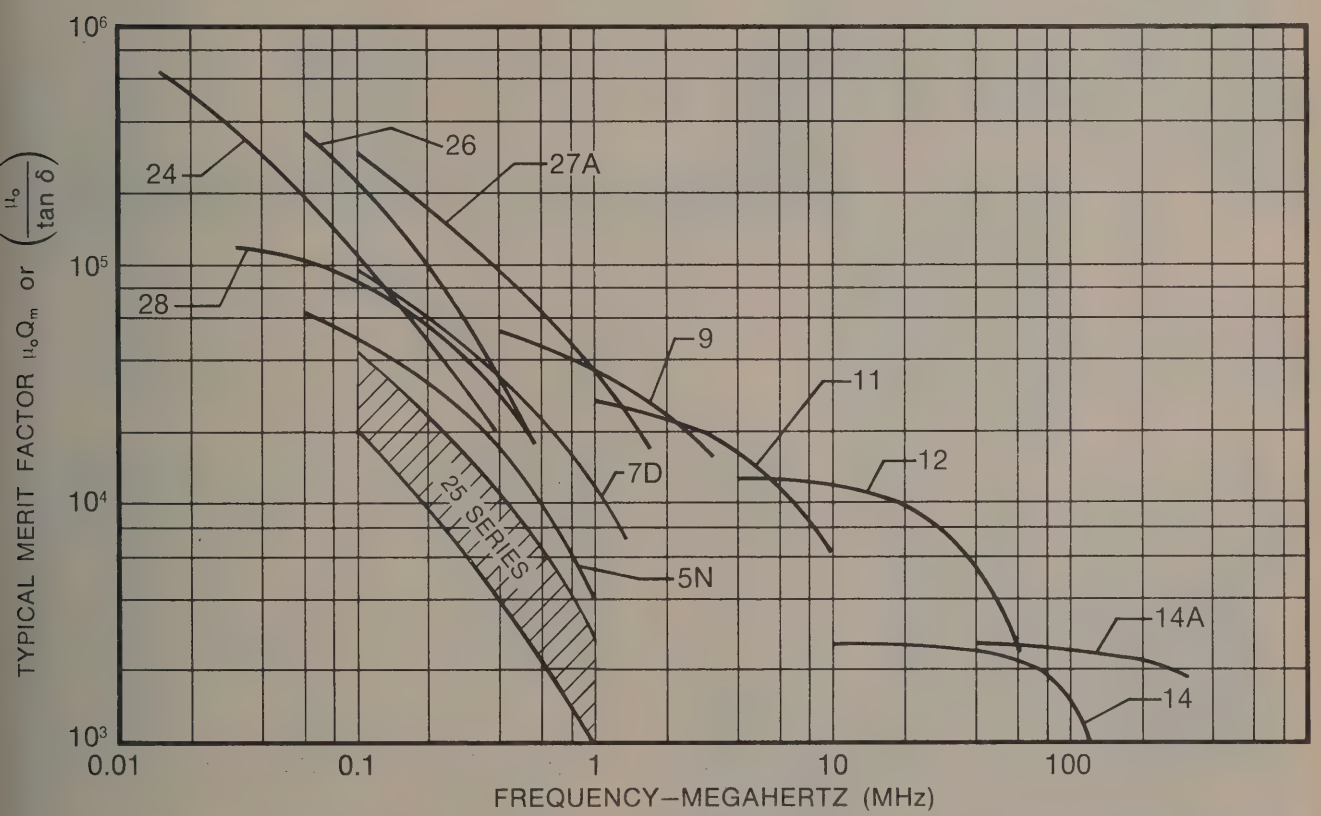
**Temperature Coefficient of Initial Permeability, T.C.—**
The relative change of initial permeability per degree centigrade, in percent.

**Curie Temperature, $T_c$—**
Stackpole Carbon Company defines Curie Temperature as that temperature, in degrees centigrade, at which the $\mu_o$ of a material becomes 1/10 the maximum value of $\mu_o$.

**Volume Resistivity, $\rho$—**
The resistance of a one-cm cube of material.

**General Tolerances on Characteristics**
These will vary depending upon configuration and application.

| | |
|---|---|
| $\mu_o$ | ±20% |
| $\mu_m$, $B_s$, $B_r$, $H_c$ | ±25% |
| T.C. | ±50% |
| $T_c$, $\rho$, D.F., K | Typical |
| $B_u$ | +15% |



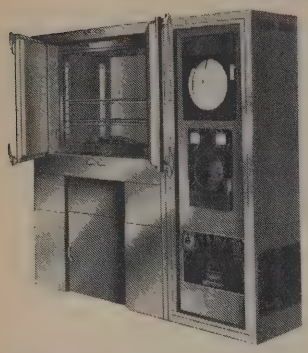

CERAMAG is a family of materials capable of operating over the frequency range of 1k Hz to over 200 MHz.

The $\mu_o Q_m$ product may be regarded as a figure of merit for a given ferrite, since it provides a measure of the useful frequency response. $Q_m$ is the material quality factor, and $\mu_o$ is the toroidal initial permeability.

The section of the $\mu_o Q_m$ curve shown indicates the most suitable area of operation for each material in the ungapped (toroid) configuration.

STACKPOLE

# BLUE M TEMPERATURE CONTROLLED EQUIPMENT FOR CRITICAL RESEARCH/PRODUCTION WORK



## FULL-RANGE TEMP./HUMIDITY CHAMBERS

Maximum capability cabinets to perform all current MIL humidity tests. Dual wet and dry bulb POWER-O-MATIC 60® Proportioning Control Systems assure absolute stability and reliability. Horizontal mechanical convection units feature programming, separate monitoring recorder, and built-in overtemperature protection. Range: −18°C. to +93°C. (±½°C.). Meets MIL-202D, Method 106C, Step 7A; automatically performs −10°C. dip without changing cams. Maintains R.H. ±½%. Chamber sizes: 5.8, 11, 27 and 64 cu. ft.

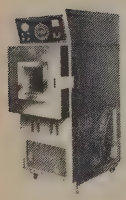
## ALSO . . .

Full-Range Single Steady State Chambers

HUMID-FLOW™ Air-Cooled Chambers

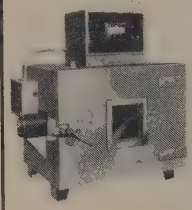
New −40°C. Extended Range Cabinets

New +150°C. Steady State Cabinets



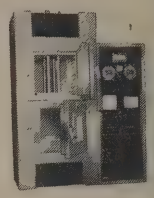
### VERSA-RANGE® REFRIGERATED TEST CHAMBERS

Two versatile ranges: −100°F. to +400°F. and −40°F. to +200°F. Five chamber sizes — 3 to 64 cu. ft. Patented POWER-O-MATIC 60 Control for incomparably reliable performance. Also −40°F., −120°F. chest type units. Overtemperature protection.



### STABIL-THERM® $LN_2$ CHAMBERS

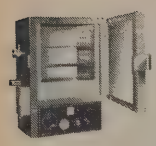
Front or top opening models. −185°C. to +200°C. with solid-state instrumentation. Similar units with $CO_2$ as coolant have −73°C. to +300°C. range. Quality construction throughout, including overtemperature protection.



### THERMAL SHOCK TEST CHAMBERS

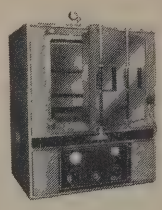
Dual Cabinets for MIL-STD-202 and 883; Versa-Whirl Baths for MIL-STD. 883, Method 1011, Conditions A to F. Latter available as an integrated, automated facility.

## *TYPICAL EXAMPLES OF AMERICA'S FINEST, MOST COMPLETE LINES OF OVENS AND FURNACES*



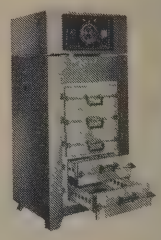
### LIFE-TEST OVENS

Variety of types, sizes and ranges. POWER-O-MATIC 60 Control for unequalled reliability. Also Batch Ovens to 96 cu. ft. including new Class A units meeting recommendations of NFPA Bulletin 86A and Wattage Dissipation Chambers.



### INERT GAS OVENS

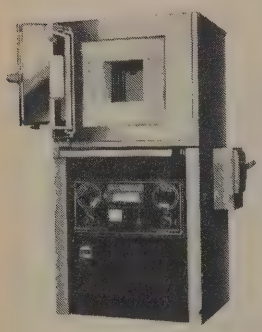
Complete line includes units with manual gas control on up to fully automated chambers with programming. Temperatures to 1100°F. Most have POWER-O-MATIC 60 Control; all have built-in overtemperature protection.



### DRAWER OVENS

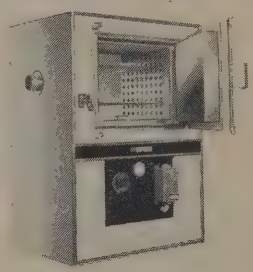
Models include 3 and 5 drawer chambers and 5 door, 5 shelf units. Temperatures to +600°F. Enable different batches of small parts to be processed separately and independently. POWER-O-MATIC 60 Control.

## HIGH TEMPERATURE CHAMBERS — OVENS TO +1300°F. (+704°C.) . . . FURNACES TO +2950°F. (+1620°C.)



Ultra-Temp Ovens, gravity and mechanical, with ranges to +1300°F. Completely redesigned for improved efficiency and safety. Feature new patented POWER-O-MATIC 80™ Solid-State Proportioning Control for true straight-line performance. Available with a variety of accessories including programming. Complete line of Furnaces includes new models with POWER-O-MATIC 80 Control for proportional performance at temperatures to +2950°F. Many models available with new microprocessing control.

## FRICTION-AIRE™ — THE PATENTED ELECTRIC OVENS WITH NO HEATING ELEMENTS . . . NOW WITH 3 MODELS U.L. LISTED FOR CLASS 1, GROUP D SERVICE!



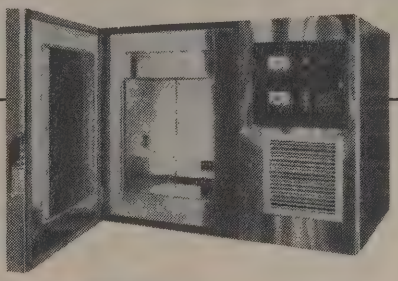
Air turbulence is the only source of heat . . . non-electric POWER-O-MATIC 90™ Control provides superb ±0.5°C. proportional performance. U.L. Listed models have 15°C. above ambient to +150°C. (+302°F.) range — remain well under +215°C. under any operating conditions. Other models built to N.E. Code recommended practices for Class 1, Group D locations . . . others engineered for general-purpose applications of a critical nature. Also Batch types. Various sizes . . . temperatures to +260°C. (+500°F.). You can't buy a safer chamber!

***FOR FULL DETAILS ON THESE PRODUCTS AND FOR INFORMATION ON OUR COMPLETE CONTROLLED TEMPERATURE CAPABILITY INCLUDING MICROPROCESSING CONTROL WRITE:***

**BLUE M** **BLUE M EQUIPMENT,** A Sales & Service Branch of Blue M Electric Company
Corporate Headquarters: BLUE ISLAND, ILLINOIS 60406

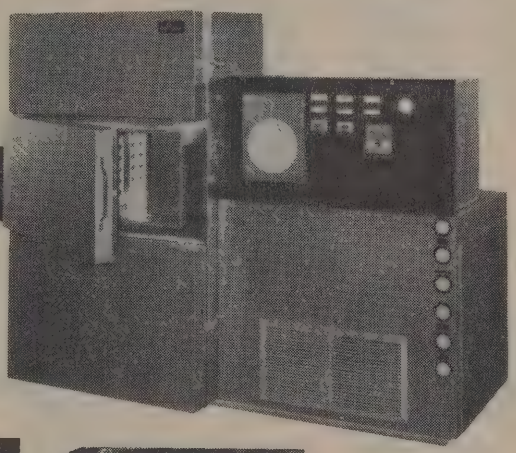
CINCINNATI SUB•ZERO PRODUCTS INC.
2612 N. GILBERT AVE./CINCINNATI, OHIO 45206
(513) 751-8810

*Serving the electronics industry with environmental simulation and test equipment*



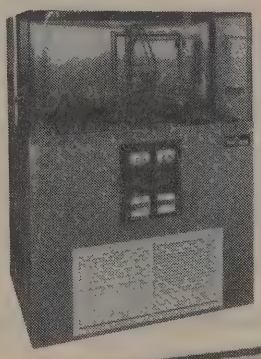
## ENVIRONMENTAL TESTING

19 standard sizes of chambers in 3 temperature ranges, all mechanically refrigerated, for high/low temperature or temperature/humidity. Microprocessor programming available on all models for automation of test sequences.



## TEMPERATURE CYCLING

Air to air temperature cycling. Illustrated model ATS-3HC achieves the extremes of 150°C and -65°C in less than 2 minutes and is completely mechanically refrigerated. Test load remains stationary permitting temperature cycling under power.

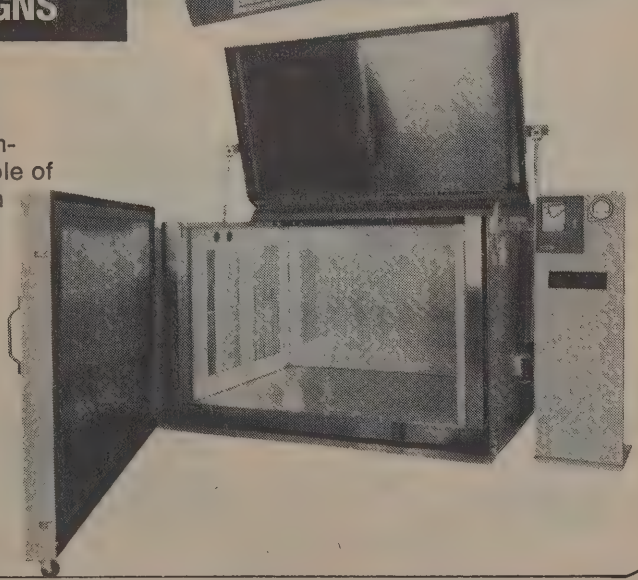


## THERMAL SHOCK

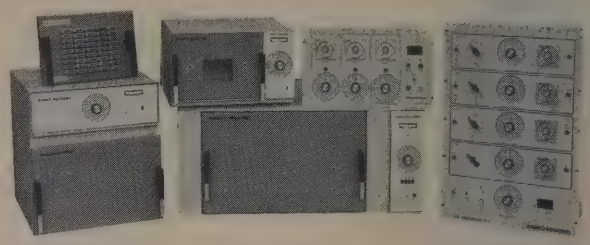
Liquid to liquid thermal shock baths for conducting Mil. Std. 883A available in incoming inspection and production Q.C. versions. Models are completely automatic in operation and designed for minimized fluid evaporation losses.

## STANDARDS AND SPECIAL DESIGNS

Chambers for requirements as simple as the storage of epoxy (illus. at left) to one of a kind. Illustrated at right is a 120 cu. ft. unit with a temperature range from 150°C to -54°C. It is capable of cycling a 500 pound, heat dissipating load from extreme to extreme in less than 30 minutes.

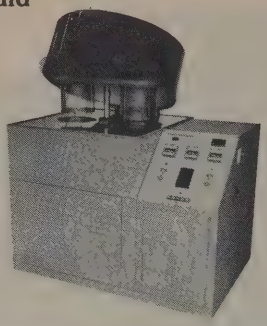


# ENVIRONMENTAL SIMULATION EQUIPMENT

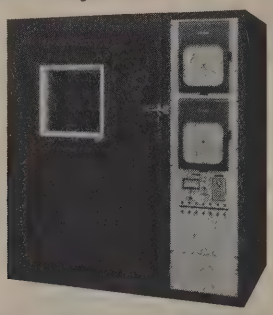


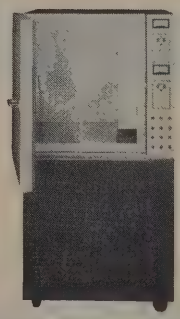
## BENCH TEMPERATURE CHAMBERS
**9 Models • Programmers • Fixtures**

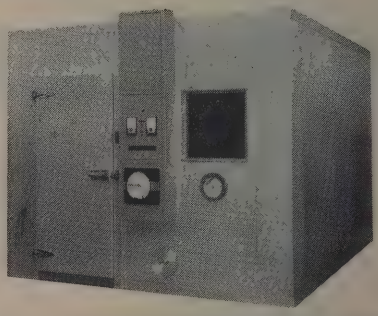
## THERMAL SHOCK - TEMPERATURE CYCLING
**Liquid to Liquid**
**Air to Air**
**Vertical**
**Rotary**



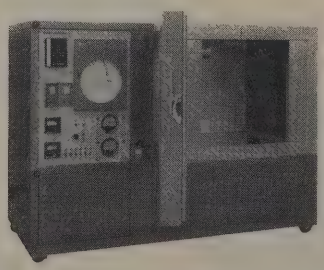
## ENVIRONMENTAL SIMULATION CHAMBERS AND ROOMS
**Temperature-Humidity**
**Temperature**

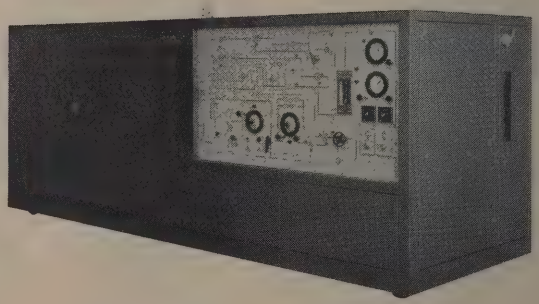






## CUSTOM DESIGN
**Air or Fluid Conditioners**
**Temperature Processing**
**Product Testing**
**Vibration**
**Altitude**





- Temperature: −300° to +1000°F
- Humidity: 5% RH to 95% RH
- Altitude: Ambient to 300,000 Ft.
- Sizes: 0.4 Cu. Ft. to 5000 Cu. Ft.

Main Office:
2221 Statham Blvd.
Oxnard, California 93030
(805) 487-7777 Telex 6-59235

Eastern Regional Sales Office:
P.O. Box 886
Valley Forge, PA 19481
(215) 948-0300

**RANSCO INDUSTRIES**

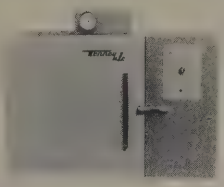
# Tenney ENGINEERING, INC. ENVIRONMENTAL TEST EQUIPMENT

*Oldest and largest manufacturer of Environmental Equipment*

109 Springfield Rd., Union, New Jersey 07083 • (201) 686-7870 • (212) 962-0332

## BENCH TOP TEMPERATURE CHAMBERS

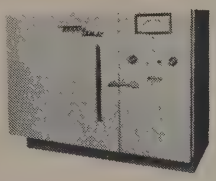
Work space:
1½ & 5 cubic feet.
Temperatures:
−112°F to +350°F
±¼°F
(−80°C to +177°C)



**Bulletins 108 and 123.**

## BENCH MODEL TEMPERATURE-HUMIDITY CHAMBERS

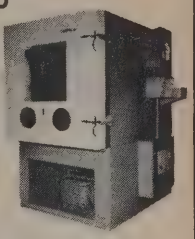
Work space:
3 & 5 cubic feet.
Temperatures:
−100°F to +350°F
(−73°C to +93°C)
Humidity capabilities:
20% RH to 98% RH.



**Bulletins 101 and 123.**

## TENNEY SERIES HIGH-LOW TEMPERATURE AND TEMPERATURE HUMIDITY TEST CHAMBERS

Work Space:
5 cubic feet to
64 cubic feet.
Temperatures:
−112°F to +350°F,
(−80°C to +177°C)



**Bulletins 103, 104, 106, 126 and 127.**

## TH & T SERIES MODERATE RANGE TEMPERATURE-HUMIDITY CHAMBERS

10 cubic feet thru
65 cubic feet.
Temperatures:
Low to 0°F (−17°C)
High to 200°F (+93°C)
Humidity:
optional

**Bulletins 109 and 111.**

## MIL-STD-781 AGREE TEMPERATURE-VIBRATION CHAMBERS

Sizes:
Available in sizes for mating with vibrator units having table tops from 2 square feet to 40 square feet.

**Bulletin 105.**

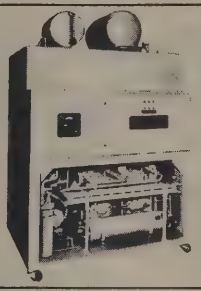
## TENNEYZPHERE ALTITUDE-TEMPERATURE CHAMBERS

Work space: 5 cubic feet thru 64 cubic feet.
Temperatures:
−100°F to +350°F
(−73°C to +177°C)
Altitude: To 200,000 feet.
Humidity: Optional

**Bulletins 117 and 118.**

## KOLD-PAK PACKAGED REFRIGERATION SYSTEMS

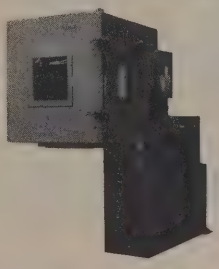
Temperatures:
Low to −100°F
(−73°C)
High to +250°F
(+121°C)



**Bulletin 114.**

## VIBRATION TEMPERATURE CHAMBERS

Sizes: Standard from 5 cubic feet to 64 cubic feet.
Temperatures:
−100°F to +350°F
(−73°C to +177°C)
Humidity: Optional



**Bulletin 102.**

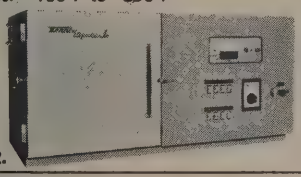
## MULTI-RANGE PRECISION TEMPERATURE BATHS

Work space:
One gallon &
9 gallon.
Temperatures:
−100°F to +248°F
(−73°C to +120°C)

**Bulletins 107 and 125.**

## SPACE JR. THERMAL VACUUM SPACE SIMULATORS

Work space: 14" diameter x 12" deep
Vacuum: To 7.5 x $10^{-8}$ torr.
Temperatures: −100°F to +350°F
(−73°C to +177°C)



**Bulletin 112.**

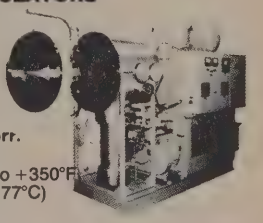
## WALK-IN ENVIRONMENTAL CHAMBERS AND ROOMS

Used for controlled environmental parameters of altitude, temperature, rain, humidity and other conditions. Available as single piece unitized or semi-unitized packages. Also, in modular panels for field construction.

**Bulletins 113**

## THERMAL VACUUM SPACE SIMULATORS

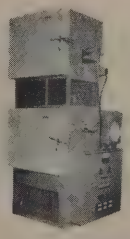
Sizes:
Standard,
1½ feet to
6 feet
diameters.
Vacuum capability:
To 1 x $10^{-9}$ torr.
Temperatures:
From −320°F to +350°F
(−196°C to +177°C)



**Bulletin 120.**

## MECHANICALLY REFRIGERATED THERMAL SHOCK CHAMBERS

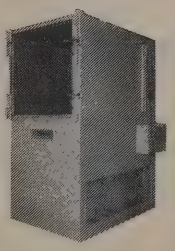
Work Space:
3, 5 & 8 cubic feet
Temperatures:
Top compartment
to +350°F (+177°C)
Lower compartment
to −100°F (−73°C)
Center compartment
ambient optional.



**Bulletin 121.**

## VACUUM CHAMBERS AND VACUUM OVENS

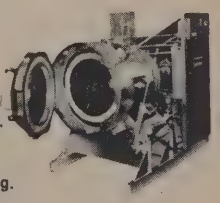
Work space:
4 thru 27 cubic feet.
Temperatures:
To +300°F (+150°C)
Vacuum:
To 148 microns
(200,000 feet)



**Bulletin 110.**

## AUTOCLAVE SYSTEMS

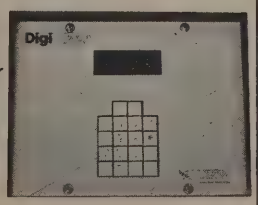
Sizes:
Small laboratory models to large production units.
Temperatures:
+500°F (260°C)
Pressure: to 1000 psig.
Vacuum : Optional



**Bulletin 122.**

## DIGITENN

Microprocessor based programmer for new and existing chambers.




**Bulletin 131**

## TENNEY SUB-ARCTIC INDUSTRIAL CABINETS AND COLD STORAGE CHESTS

Work space:
6 thru
12 cubic feet.
Temperature ranges:
Low to −120°F)
(−84°C)
High to +350°F (+177°C)

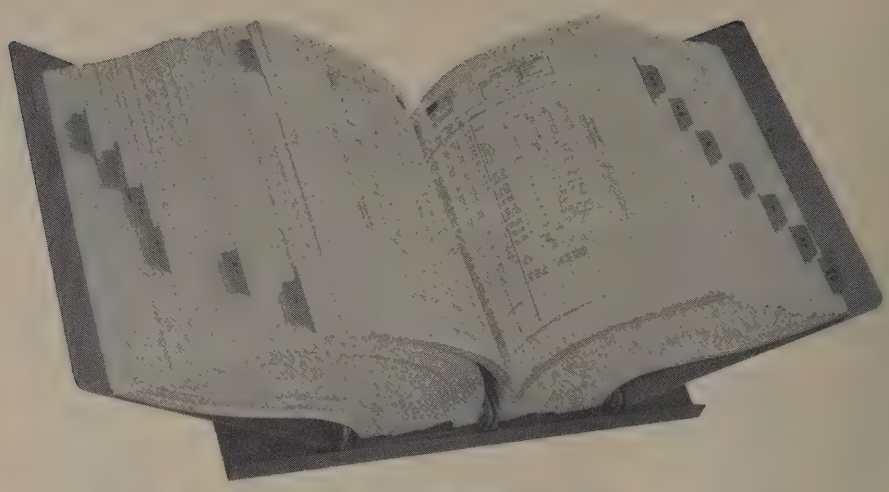
**Bulletin 115.**

## BURN-IN CHAMBER

Size and number of doors may be specified to meet any burn-in requirement.

Typical temperature range: +32° F (0° C) to +140° F (+60° C)

**Bulletin 133**



# UNITED PRICING REPORTS

## the single source that speeds up invoicing, pricing, quoting, purchasing and estimating

Electronic component prices change so fast, you'd need a team of people just to keep up.

United Pricing Reports is the better way. When you subscribe to Pricing Reports you receive 1500 pricing sheets (3000 pages) of the latest prices, as of the date we ship them to you.

This gives you, in a single source, up-to-the minute selling prices on more than 500,000 electronic components.

United Pricing Reports gives you accurate resale prices at the exact moment you need them. Not hours or days later. So it helps you eliminate frantic phone calls, letter writing and catalog scanning to check on prices when you write an invoice or type a purchase order.

## Twice weekly price updates.

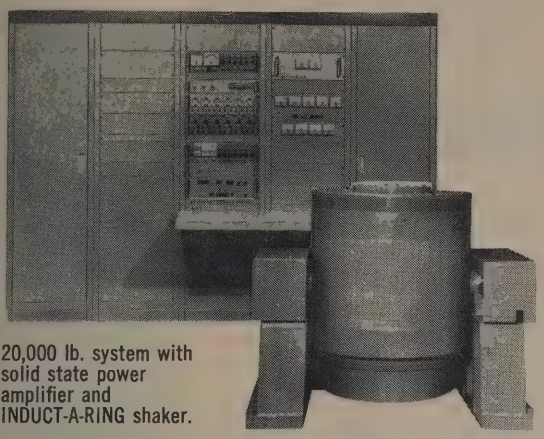
One week after you receive your Pricing Reports source book (1500 pricing sheets) you begin receiving twice weekly price updates. You simply take these new price pages and replace the now obsolete pages with them.

The whole process is simple. All information is organized alphabetically by manufacturer. And each manufacturer's price schedule is listed by part number in numerical/alphabetical sequence.

One more thing. When we promise twice weekly updates, we deliver. 52 weeks a year, consistently. Not monthly or every other month. We have a tradition of delivery on our promises, and we're certainly not going to stop now.

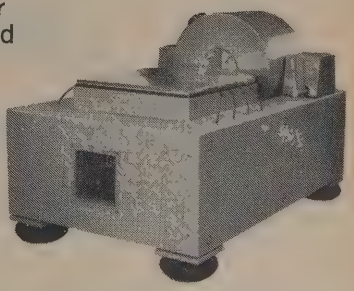
*UNITED TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500 TWX-510/222-*

# ELECTRODYNAMIC VIBRATION TEST SYSTEMS



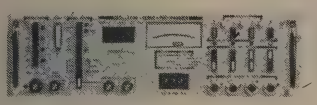
20,000 lb. system with solid state power amplifier and INDUCT-A-RING shaker.

- 50 to 40,000 lb. force systems for sine and random vibration
- Systems powered by solid state amplifiers to 256 kVA
- INDUCT-A-RING shakers for unmatched performance and reliability
- Control instruments for MIL-STD-781C, 810C and 202E testing
- 6 inch stroke electrodynamic force generators
- PERMALINE Slip Table on combined seismic base



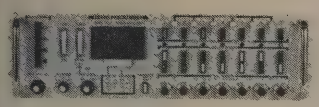
Shaker and slip table on PERMALINE combined seismic base.

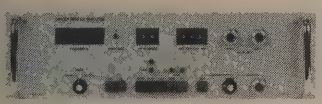
## CONTROL INSTRUMENTATION



**BASIC SINE CONTROL**

The OSP-4 is our most economical, compact sine control system. Provides sine sweep and servo control for test programs of up to four levels. Input charge amplifier is standard.



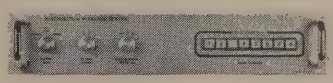


**DELUXE SINE CONTROL**

The OSC-1S and SPA-7 comprise our most comprehensive sine control system. Sine sweep and programmable servo control are provided for tests of up to seven levels. Both frequency and vibration level are digitally displayed. Sweep rate and test duration may be preselected to provide automatic shutdown. Automatic or manual modes for selecting crossover frequencies are provided. Input charge amplifier is standard.

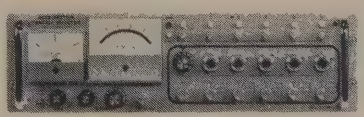
**TRACKING FILTER**

Model TF22 Tracking Filter features fixed or constant 10% bandwidth which varies between 2 and 200 Hz. Log DC output is standard. Modular construction allows six channels per 19″ rack.



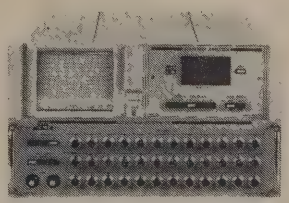
**SIGNAL AVERAGER**

Model MAC-8 Averaging Control features eight individually selectable data channels for control to the average signal level. Can be used for sine or random testing.



**SIGNAL SELECTOR**

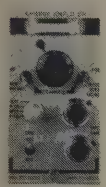
Model ACS-6 automatically selects the highest (or lowest) acceleration input. Accepts six sine acceleration signals, and gates to the output whichever signal reaches its preset limit.



**LOW COST RANDOM CONTROLS**

Model SG-36 Spectrum Generator and Model A-36 Spectrum Analyzer provide simplified manual equalization and real time analysis for random vibration testing as required by MIL-STD-781C, 810C, and 202E.

## SIGNAL CONDITIONERS



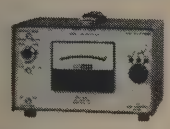
**Model D22PM** Basic Charge Amp

**Model D22PMH** Differential Charge Input Switchable Filters

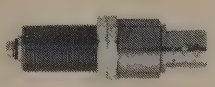
**Model D22PMR** Charge/ Strain Gage Amp

**Model D22PMB** Bridge Conditioner

The D22 Series Signal Conditioners are offered for use with piezoelectric and strain gage transducers. Integrated circuit design provides superior low noise characteristics in a rugged modular construction. Units shown here are only a few examples of a complete family of signal conditioners that permit a wide variety of dynamic and static measurements.

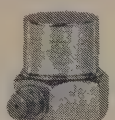


**Model 1610M** Vibration Monitor provides readout of acceleration, velocity or displacement on 1% log scale meter.



**Model 22CA-2** Two Wire Remote Charge Preamp. Operates with any Model 22 instrument.

**Model 11PA-2** Two Wire Remote Voltage Preamp. Operates with any Model 22 instrument.



A full line of piezoelectric accelerometers are offered for general purpose vibration testing and for many special applications.

**INDUSTRIAL VIBRATION MONITORS**

The Series 800 Vibration Alarm Module is used with the Series 8800 Industrial Accelerometer to monitor Displacement, Velocity, and Acceleration. Adjustable alarm and time delay circuits are provided, permitting low cost, comprehensive machinery health monitoring. Multichannel systems available.

**INDUSTRIAL ACCELEROMETERS**

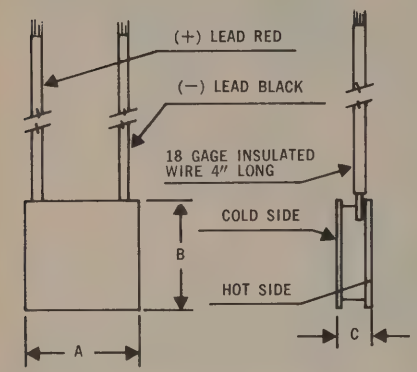
The Series 8800 Industrial Accelerometer features integral electronics giving low output impedance, and rugged cable. Bearing cap or frame mounted accelerometer technique utilizes the total vibration spectrum, compared to limited response of proximity probes or velocity pickups.

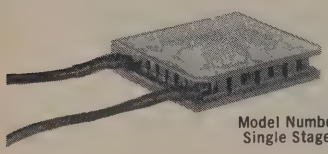
**UNHOLTZ-DICKIE CORPORATION**
DEPT. EM, 3000 WHITNEY AVE. / HAMDEN, CONN. 06518
(203) 288-3358

Borg-Warner Thermoelectrics
BORG-WARNER CORPORATION
WOLF AND ALGONQUIN ROADS, DES PLAINES, ILLINOIS 60018
(312) 827-3131

# THERMOELECTRIC MODULES

## SINGLE STAGE MODULE SPECIFICATION CHART — $T_H$ 27°C IN VACUUM

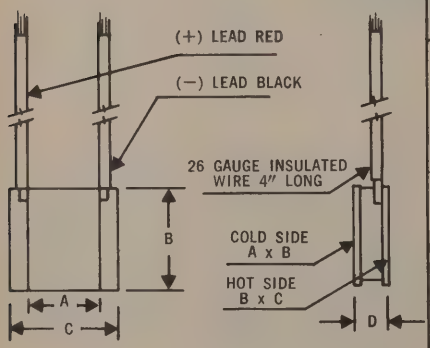


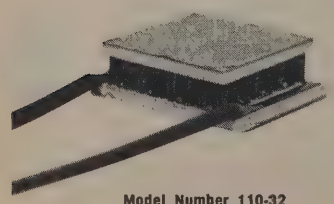
Model Number 920-31
Single Stage Module

| MODULE NUMBER | MAX ΔT $Q_C = 0$ ΔT - °C | MAX $Q_C$ ΔT = 0 $Q_C$ - WATTS | MAX CURRENT AMPS | MAX VOLTAGE VOLTS | DIM. A | DIM. B | DIM. C |
|---|---|---|---|---|---|---|---|
| 920-3 | 66 | 1.8 | 8.5 | 0.34 | 0.29 | 0.57 | 0.22 |
| 920-7 | 66 | 4.3 | 8.5 | 0.80 | 0.57 | 0.57 | 0.22 |
| 920-11 | 66 | 6.7 | 8.5 | 1.24 | 0.57 | 0.85 | 0.22 |
| 920-15 | 66 | 9.2 | 8.5 | 1.70 | 0.57 | 1.20 | 0.22 |
| 920-31 | 66 | 19.0 | 8.5 | 3.50 | 1.20 | 1.20 | 0.22 |
| 930-3 | 66 | 0.8 | 3.7 | 0.36 | 0.20 | 0.38 | 0.21 |
| 930-7 | 66 | 1.8 | 3.7 | 0.84 | 0.38 | 0.38 | 0.21 |
| 930-11 | 66 | 2.9 | 3.7 | 1.30 | 0.38 | 0.57 | 0.21 |
| 930-17 | 66 | 4.5 | 3.7 | 2.00 | 0.57 | 0.57 | 0.21 |
| 930-35 | 66 | 9.4 | 3.7 | 4.20 | 0.57 | 1.20 | 0.21 |
| 930-71 | 66 | 19.0 | 3.7 | 8.50 | 1.20 | 1.20 | 0.21 |
| 940-3 | 66 | 2.9 | 14.0 | 0.34 | 0.29 | 0.57 | 0.18 |
| 940-7 | 66 | 6.8 | 14.0 | 0.80 | 0.57 | 0.57 | 0.18 |
| 940-11 | 66 | 10.6 | 14.0 | 1.24 | 0.57 | 0.85 | 0.18 |
| 940-15 | 66 | 14.5 | 14.0 | 1.70 | 0.57 | 1.20 | 0.18 |
| 940-31 | 66 | 30.0 | 14.0 | 3.50 | 1.20 | 1.20 | 0.18 |
| 950-3 | 66 | 1.3 | 6.0 | 0.36 | 0.20 | 0.38 | 0.17 |
| 950-7 | 66 | 3.0 | 6.0 | 0.84 | 0.38 | 0.38 | 0.17 |
| 950-11 | 66 | 4.6 | 6.0 | 1.30 | 0.38 | 0.57 | 0.17 |
| 950-17 | 66 | 7.2 | 6.0 | 2.00 | 0.57 | 0.57 | 0.17 |
| 950-35 | 66 | 14.8 | 6.0 | 4.20 | 0.57 | 1.20 | 0.17 |
| 950-71 | 66 | 30.0 | 6.0 | 8.50 | 1.20 | 1.20 | 0.17 |

## MINI MODULE SPECIFICATION CHART — $T_H$ 27°C IN VACUUM




| MINI MODULE NUMBER | MAX ΔT $Q_C = 0$ ΔT - °C | MAX $Q_C$ ΔT = 0 $Q_C$ - WATTS | MAX CURRENT AMPS | MAX VOLTAGE VOLTS | DIM. A | DIM. B | DIM C | DIM. D |
|---|---|---|---|---|---|---|---|---|
| 110-4 | 64 | 0.24 | 1.1 | 0.5 | 0.08 | 0.16 | 0.14 | 0.13 |
| 110-8 | 64 | 0.49 | 1.1 | 1.0 | 0.16 | 0.16 | 0.22 | 0.13 |
| 110-12 | 64 | 0.73 | 1.1 | 1.5 | 0.16 | 0.24 | 0.22 | 0.13 |
| 110-18 | 64 | 1.10 | 1.1 | 2.2 | 0.24 | 0.24 | 0.30 | 0.13 |
| 110-32 | 64 | 1.95 | 1.1 | 4.0 | 0.32 | 0.32 | 0.38 | 0.13 |
| 120-4 | 64 | 0.30 | 1.4 | 0.5 | 0.08 | 0.16 | 0.14 | 0.12 |
| 120-8 | 64 | 0.61 | 1.4 | 1.0 | 0.16 | 0.16 | 0.22 | 0.12 |
| 120-12 | 64 | 0.92 | 1.4 | 1.5 | 0.16 | 0.24 | 0.22 | 0.12 |
| 120-18 | 64 | 1.35 | 1.4 | 2.2 | 0.24 | 0.24 | 0.30 | 0.12 |
| 120-32 | 64 | 2.40 | 1.4 | 4.0 | 0.32 | 0.32 | 0.38 | 0.12 |
| 130-4 | 64 | 0.42 | 1.9 | 0.5 | 0.09 | 0.18 | 0.15 | 0.12 |
| 130-8 | 64 | 0.84 | 1.9 | 1.0 | 0.18 | 0.18 | 0.24 | 0.12 |
| 130-12 | 64 | 1.25 | 1.9 | 1.5 | 0.18 | 0.27 | 0.24 | 0.12 |
| 130-18 | 64 | 1.90 | 1.9 | 2.2 | 0.27 | 0.27 | 0.33 | 0.12 |
| 130-32 | 64 | 3.35 | 1.9 | 4.0 | 0.36 | 0.36 | 0.42 | 0.12 |



Model Number 110-32
Mini Module

Standard coolers will withstand ambient temperatures of 110°C. Special coolers are available at premium prices that will withstand ambient temperatures of 160°C. For high temperature applications consult the factory.

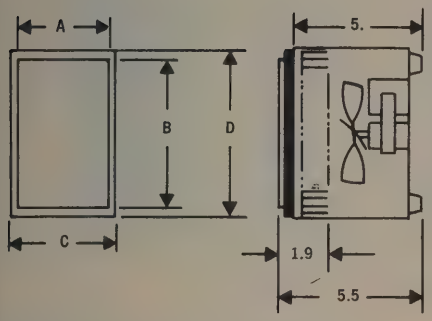
Borg-Warner Thermoelectrics

**Borg-Warner Thermoelectrics**
BORG-WARNER CORPORATION
WOLF AND ALGONQUIN ROADS, DES PLAINES, ILLINOIS 60018
(312) 827-3131

BORG WARNER
Borg-Warner Thermoelectrics

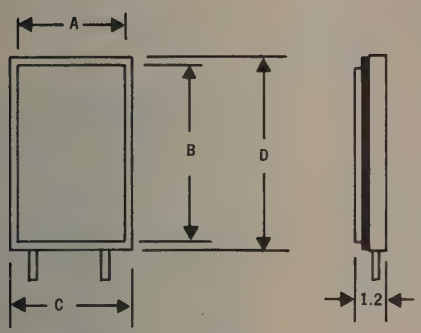
# THERMOELECTRIC HEAT PUMPS

## HEAT PUMP SPECIFICATION CHART $T_H$ 77°F IN DRY AIR — AIR COOLED HEAT SINK




| HEAT PUMP NUMBER | 930AHP-1 | 920AHP-2 | 920AHP-4 | 930AHP-6 | 930AHP-9 |
|---|---|---|---|---|---|
| MAX HEAT PUMPING WITH COLD PLATE SUPPRESSED TO 77°F AMBIENT (WATTS)) | 15 | 30 | 50 | 80 | 120 |
| MIN. COLD PLATE TEMPERATURE OPERATING IN 77°F AMBIENT (°F) | −10 | −10 | −10 | −10 | −10 |
| INPUT POWER AMPS | 3.6 | 8.3 | 8.4 | 6.4 | 9.7 |
| INPUT POWER VOLTS | 9 | 7 | 14 | 24 | 24 |
| DIMENSION A | 1.5 | 1.5 | 3.8 | 3.8 | 6.0 |
| DIMENSION B | 2.0 | 3.8 | 3.8 | 6.0 | 6.0 |
| DIMENSION C | 4.1 | 4.1 | 4.1 | 4.1 | 6.6 |
| DIMENSION D | 4.1 | 4.1 | 4.1 | 6.6 | 6.6 |
| POWER SUPPLY REQUIRED | PS-101 | PS-102 | PS-103 | PS-104 | PS-104 |

## HEAT PUMP SPECIFICATION CHART $T_H$ 77°F IN DRY AIR — LIQUID COOLED HEAT SINK




| HEAT PUMP NUMBER | 950LHP-1 | 940LHP-2 | 940LHP-4 | 950LHP-6 | 950LHP-9 |
|---|---|---|---|---|---|
| MAX HEAT PUMPING WITH COLD PLATE SUPPRESSED TO 77°F AMBIENT (WATTS)) | 20 | 50 | 90 | 125 | 190 |
| MIN. COLD PLATE TEMPERATURE OPERATING IN 77°F AMBIENT (°F) | −20 | −20 | −20 | −20 | −20 |
| INPUT POWER AMPS | 6 | 14 | 12 | 10 | 15 |
| INPUT POWER VOLTS | 9 | 7 | 14 | 24 | 24 |
| DIMENSION A | 1.5 | 1.5 | 3.8 | 3.8 | 6.0 |
| DIMENSION B | 2.0 | 3.8 | 3.8 | 6.0 | 6.0 |
| DIMENSION C | 4.1 | 4.1 | 4.1 | 4.1 | 6.6 |
| DIMENSION D | 4.1 | 4.1 | 4.1 | 6.6 | 6.6 |
| POWER SUPPLY REQUIRED | PS-101 | PS-102 | PS-103 | PS-104 | PS-104 |

### POWER SUPPLIES

| MODEL | VAC | VDC | MAX AMPS |
|---|---|---|---|
| PS 101 | 115 | 12.5 | 7.0 |
| PS 102 | 115 | 9.0 | 20.0 |
| PS 103 | 115 | 16.5 | 12.5 |
| PS 104 | 115 | 24.6 | 24.6 |

### TEMPERATURE CONTROLLERS FOR POWER SUPPLIES

| | | |
|---|---|---|
| TC-101 | Set Point Relay Controlled Accuracy ±3°C | Heat and Cool |
| TC-102 | Set Point Proportional Accuracy ±1°C | Cool only |
| TC-104 | Set Point Proportional Accuracy ±1°C | Heat and Cool |

Other Borg-Warner Thermoelectric Heat Pumps are available that will operate with larger or smaller heat pumping capacities, current, and voltage. Power supplies, on/off temperature controllers with set point, and proportional reverse controllers are available to fit these pumps. Please contact factory for further information.

BORG WARNER
**Borg-Warner Thermoelectrics**
DEPARTMENT OF BORG-WARNER CORPORATION WOLF AND ALGONQUIN ROADS, DES PLAINES, ILLINOIS 60018 • PHONE (312) 827-3131

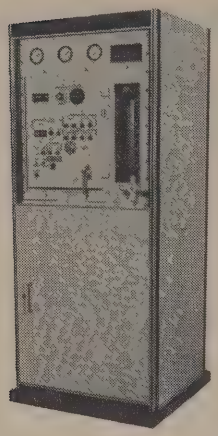
MANUFACTURERS OF QUALITY PRODUCTS FOR INDUSTRY AND THE MILITARY

Electro IMPULSE, INC.

EXCELLENCE IN ENGINEERING SINCE 1949

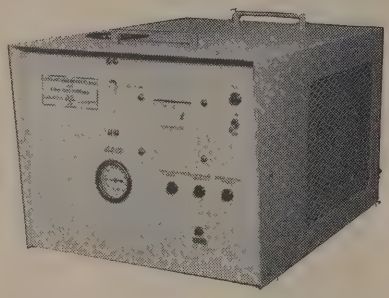
# CLOSED LOOP COOLING SYSTEMS
# OIL PURIFICATION SYSTEMS
# COMPRESSED AIR DEHYDRATORS

We are happy to quote on Standard or Special Units in any quantity



This unit, built for Hughes, circulates coolanol for testing of TWT's.

## CLOSED LOOP COOLING SYSTEMS



This unit provides the cooling for a CAT X-Ray System.

This Heat Exchanger is ground support Test Equipt. for the Air Force.

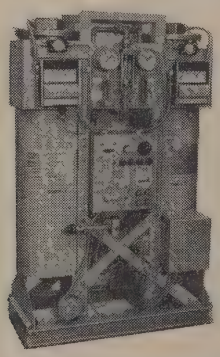
- Units are completely self-contained including Pump, Reservoir, Heat Exchanger, and Interlocks
- Wide variety of Flow Rates, Controls, and Instrumentation available
- Standard or special units available

• TYPES OF COOLING INCLUDE-

Liquid-to-Air. Liquid-to-Air Refrigerated.
Liquid-to-Water. Liquid-to-Liquid Refrigerated.

(Liquid may be water or any exotic coolant)

## COMPRESSED AIR DEHYDRATORS



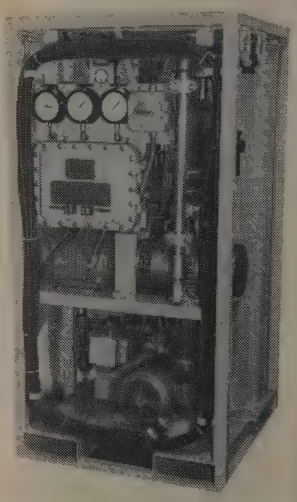
Dual Tower Desiccant Dehydrator Qualified for Naval Use

- Refrigerated (Dew Pt. 35°F) or Dual Tower electrically reactivated (Dew Pt. -65°F)
- Designed for Marine or Industrial Use
- Qualified for severe environments, including shipboard shock & vibration

## FLUID PURIFICATION SYSTEMS

RECLAIMS EXPENSIVE OILS TO BETTER THAN NEW CONDITION WITHOUT HEAT

**REMOVES** — Moisture to 25 PPM, Particulates to .45 microns, Dissolved Gas to 2%, Salt Water to trace levels.
**FROM FLUIDS** — Hydraulic, Lubricating, Insulating, Transformer, X-Ray Oils.
**APPLICATIONS** — Automotive Plants & other machining operations, Ships, Submarines, Aircraft Ground Support Facilities, Transformer Mfrs., Capacitor Mfrs., or wherever clean or high dielectric strength oil is required.
**MOISTURE REMOVAL** — 20 Gallons per day based on hydraulic oil at 120° F. Initial water content 10,000 PPM, final water content 50 PPM.
**SPECIFICATIONS** — Horsepower 8. Size 36x36x70. Weight 1200 lbs. Flow Rate 6-18 GPM

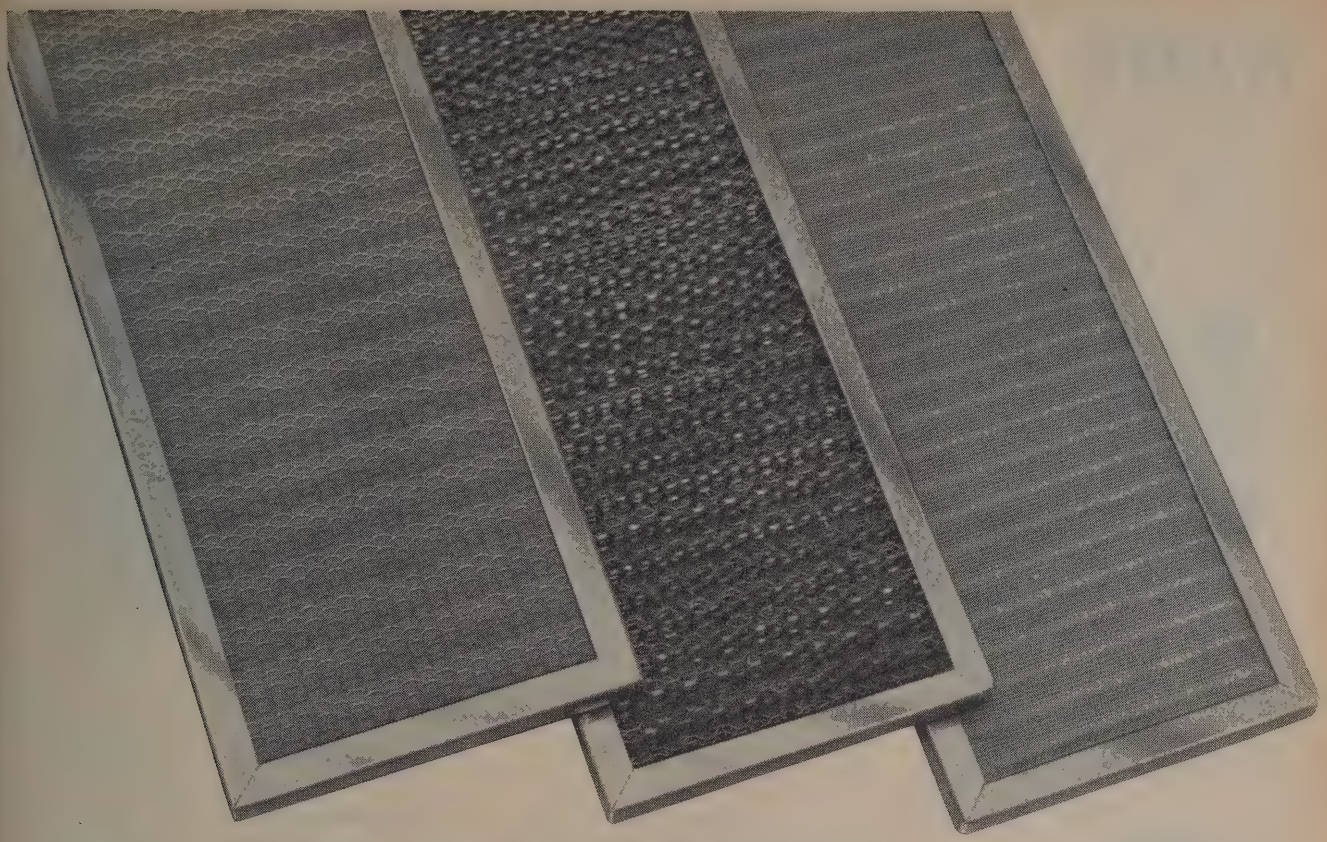


Electro IMPULSE, INC.

REQUEST FREE APPLICATION BULLETIN NO. 696
"CLOSED LOOP COOLING SYSTEMS"

116 CHESTNUT STREET, P.O. BOX 870, RED BANK, N.J. 07701
TELEPHONE: 201-741-0404

SEE OUR OTHER PRODUCTS ON PAGE 2720

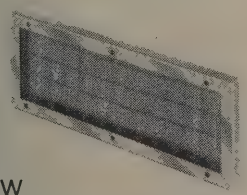


# EVANS air filters

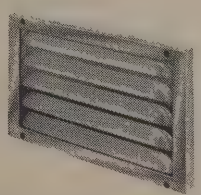
## for Electronic Cabinet Application

. . . used on Computers . . . Card Readers . . . Tape Transports . . . Transceivers . . . Power Supply Units . . . both large and small cabinetry. Evans Air filters are permanent. Rigid. Aluminum. Made to withstand the brutal abuse of military field conditions. Frames have mitered corners for smooth, close tolerance fit. Die cut, expanded aluminum grids are criss crossed and precision fitted into each filter. Patented Brillo Lock design gives more air delivery with positive cleaning results.

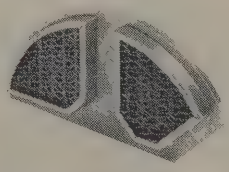
| | |
|---|---|
| Tolerance: | ± 1/32″ |
| Velocity: | 200 to 900 FPM |
| Efficiency: | 75% AFI Test |
| Finishes: | Available in chemical film finish to meet requirements of MIL-C-5541 . . . MIL-F-14072 . . . MIL-A-8625 |
| Sizes: | Filter of 1/2″ or 3/4″ dimension. Made to a maximum area 400 sq. inches . . . with maximum length 25″ on one side without special bracing. For complete information write or call. |



LOW RESISTANCE FILTER
Special serts permit fastening solidly to blower unit. Made for air drop equipment.



LOUVERED FILTERS
For outside application. Louvers protect filter media from water, ice, snow.



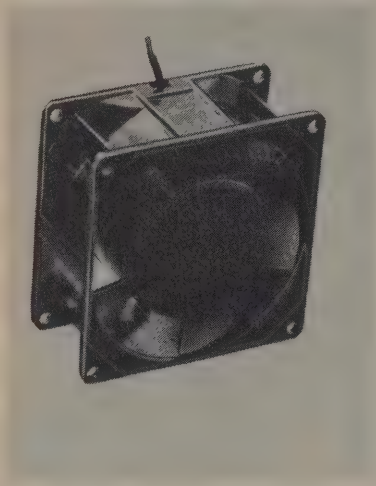
HEAVY DUTY UNIT
For rugged military use. Extra rigid frame made from .063 aluminum.

**The George Evans Corporation** 121-37th Street, Moline, Illinois 61265
Phone 309/762-9456

**ETRI**

Dept. EM, 8002 SOUTH MADISON STREET
BURR RIDGE, ILLINOIS 60521
Telephone (312) 325-9380 / TWX 910-226-0424

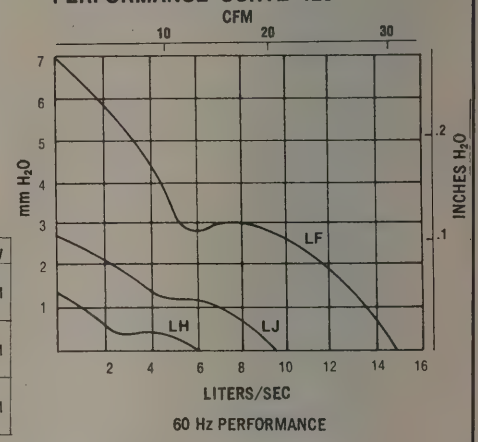
## AXIAL FAN MODEL 126



- Popular 3⅛ x 1½ inch size
- 2 13/16 inch mounting centers
- 22 CFM at .1 inch of water, 32 CFM at Free Flow
- 50% quieter than competitive fans
- U.L. recognized file 64887
- Reduced flow versions for very quiet applications
- Sleeve or ball bearing

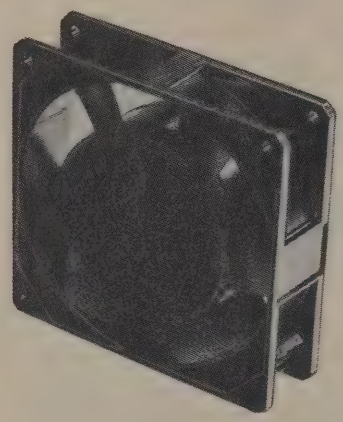
| Part Number | Volt | Current | Delivery |
|---|---|---|---|
| 760-126LH- 2182-11115 | 115 | 45 ma | 13 CFM |
| 760-126LH- 2181-11220 | 220 | 32 ma | 13 CFM |
| 760-126LJ- 2182-11115 | 115 | 50 ma | 20 CFM |
| 760-126LJ- 2181-11220 | 220 | 35 ma | 20 CFM |
| 760-126LF- 2182-11115 | 115 | 100 ma | 30 CFM |
| 760-126LF- 2181-11220 | 220 | 50 ma | 30 CFM |

**PERFORMANCE CURVE 126**




60 Hz PERFORMANCE

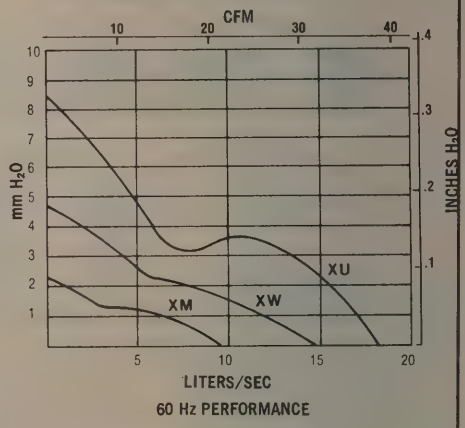
## AXIAL FAN MODEL 99



- 3⅝ x 1 inch thin size
- 3¼ inch mounting centers
- 31 CFM at .1 inch of water, 41 CFM at Free Flow
- U.L. recognized File 64887
- Reduced flow versions for very quiet applications

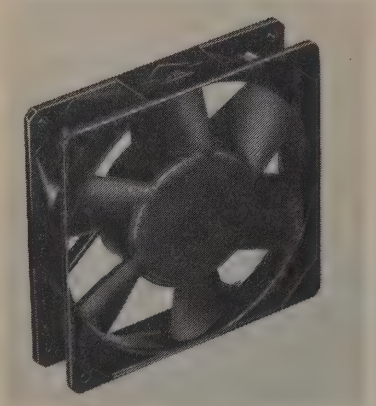
| Part Number | Volt | Current | Delivery |
|---|---|---|---|
| 760-99XM- 182-11115 | 115 | 60 ma | 21 CFM |
| 760-99XM- 181-11220 | 220 | 35 ma | 21 CFM |
| 760-99XW- 182-11115 | 115 | 65 ma | 32 CFM |
| 760-99XW- 181-11220 | 220 | 40 ma | 32 CFM |
| 760-99XU- 182-11115 | 115 | 105 ma | 41 CFM |
| 760-99XU- 181-11220 | 220 | 60 ma | 41 CFM |

**PERFORMANCE CURVE 99**




60 Hz PERFORMANCE

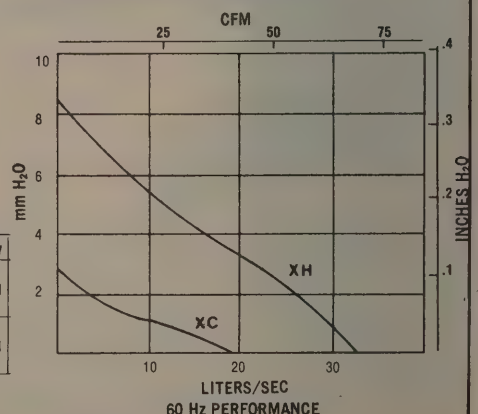
## AXIAL FAN MODEL 98



- 4⅝ x 1 inch thin size
- 4⅛ inch mounting centers
- 50 CFM at .1 inch of water, 73 CFM Free Flow
- Fits where 1½ inch thick fans won't
- U.L. recognized 64887
- Reduced flow version for very quiet applications

| Part Number | Volt | Current | Delivery |
|---|---|---|---|
| 760-98XC- 182-11115 | 115 | 100 ma | 38 CFM |
| 760-98XC- 181-11220 | 220 | 60 ma | 38 CFM |
| 760-98XH- 182-11115 | 115 | 110 ma | 73 CFM |
| 760-98XH- 181-11220 | 220 | 60 ma | 73 CFM |

**PERFORMANCE CURVE 98**

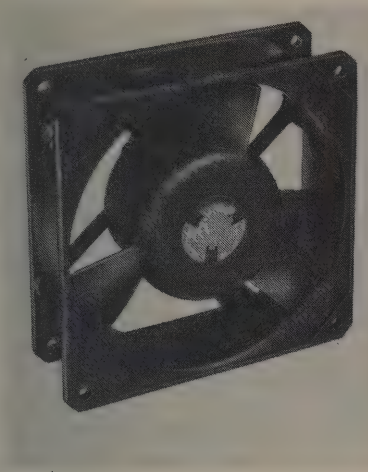



60 Hz PERFORMANCE

**ETRI**

Dept. EM, 8002 SOUTH MADISON STREET
BURR RIDGE, ILLINOIS 60521
Telephone (312) 325-9380 / TWX 910-226-0424

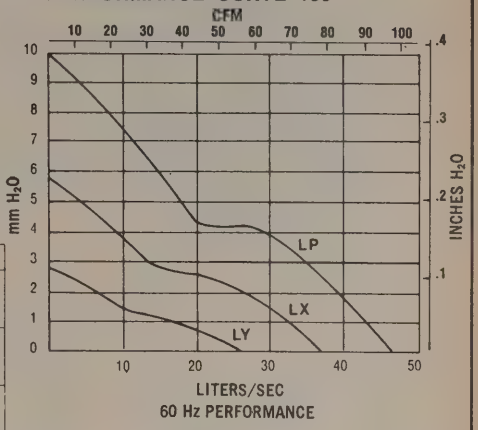
## AXIAL FAN MODEL 133



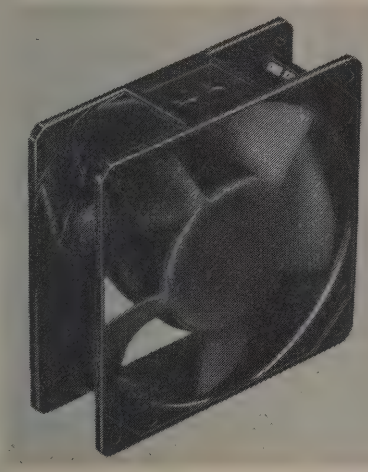
- Popular 4⅝ x 1½ inch size
- 4⅛ inch mounting centers
- 60 CFM at .15 inch of water, 100 CFM Free Flow
- 50% more air at typical working pressures
- At least 5 decibels quieter at typical working pressures
- U.L. recognized file 64887
- Reduced flow versions for very quiet applications
- Sleeve or ball bearing

| Part Number | Volt | Current | Delivery |
|---|---|---|---|
| 133LY-2182 | 115 | 125 ma | 52 CFM |
| 133LY-2181 | 220 | 65 ma | |
| 133LX-2182 | 115 | 140 ma | 77 CFM |
| 133LX-2181 | 220 | 75 ma | |
| 133LP-2182 | 115 | 150 ma | 100 CFM |
| 133LP-2181 | 220 | 80 ma | |

**PERFORMANCE CURVE 133**



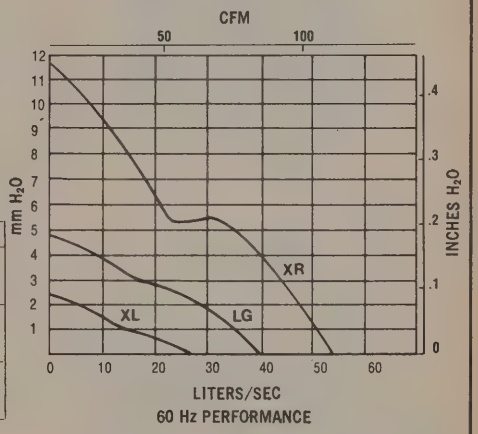

## AXIAL FAN MODEL 125



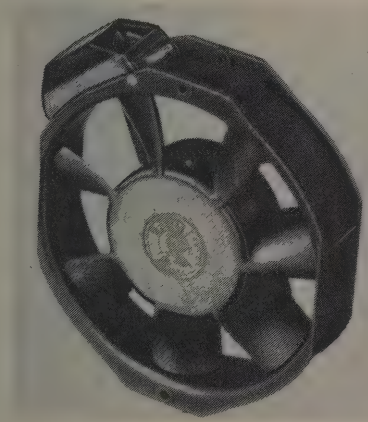
- 4⅝ x 1½ inch size
- 4⅛ inch mounting centers
- 85 CFM at .15 inch of water, 115 CFM Free Flow
- Industry's most powerful 4⅝ inch fan
- U.L. recognized file 64887
- Reduced flow version for quiet applications
- Sleeve or ball bearing

| Part Number | Volt | Current | Delivery |
|---|---|---|---|
| 760-125XL-182-11115 | 115 | 115 ma | 57 CFM |
| 760-125XL-181-11220 | 220 | 60 ma | |
| 760-125LG-182-11115 | 115 | 160 ma | 83 CFM |
| 760-125LG-181-11220 | 220 | 85 ma | |
| 760-125XR-2182-11115 | 115 | 180 ma | 115 CFM |
| 760-125XR-2181-11220 | 220 | 100 ma | |

**PERFORMANCE CURVE 125**



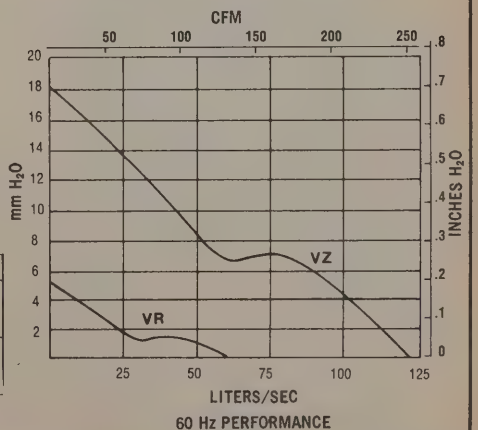

## AXIAL FAN MODEL 120



- 6¾ x 6 x 1½ inch thin size
- 6⅜ inch mounting centers
- 163 CFM at .25 inch of water, 260 CFM Free Flow
- Can replace up to four 4⅝ inch fans
- Quieter than competitive 2 inch thick fans
- U.L. recognized file 64887
- Reduced flow version for even quieter operation

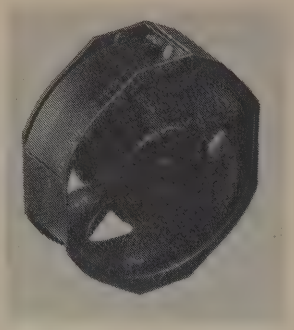
| Part Number | Volt | Current | Delivery |
|---|---|---|---|
| 760-120VR-282-11115 | 115 | 150 ma | 127 CFM |
| 760-120VR-281-11220 | 220 | 70 ma | |
| 760-120VZ-282-11115 | 115 | 350 ma | 260 CFM |
| 760-120VZ-281-11220 | 220 | 195 ma | |

**PERFORMANCE CURVE 120**



**ETRI**
Dept. EM, 8002 SOUTH MADISON STREET
BURR RIDGE, ILLINOIS 60521
Telephone (312) 325-9380 / TWX 910-226-0424

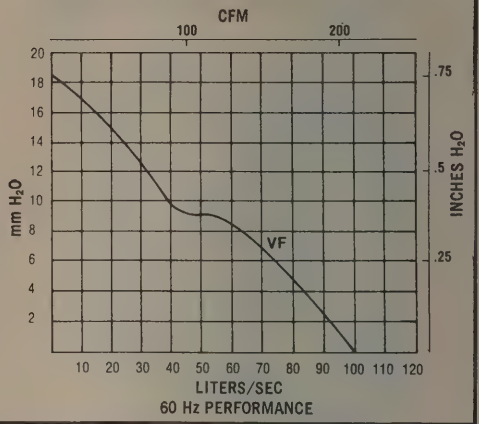
## AXIAL FAN MODEL 122



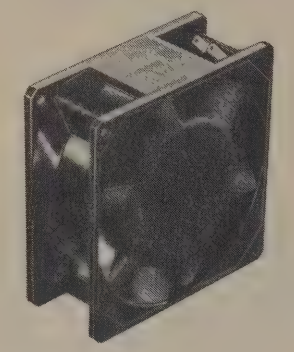
- 6¾ x 6 x 2 inch size
- 6⅜ inch mounting centers
- 150 CFM at .25 inch of water, 215 CFM Free Flow
- Quieter than competitive fans
- U.L. recognized file 64887

| Part Number | Volt | Current | Delivery |
|---|---|---|---|
| 582-11115 | 115 | 500 ma | 215 CFM |
| 760-122VF- | | | |
| 581-11220 | 220 | 260 ma | |

**PERFORMANCE CURVE 122**



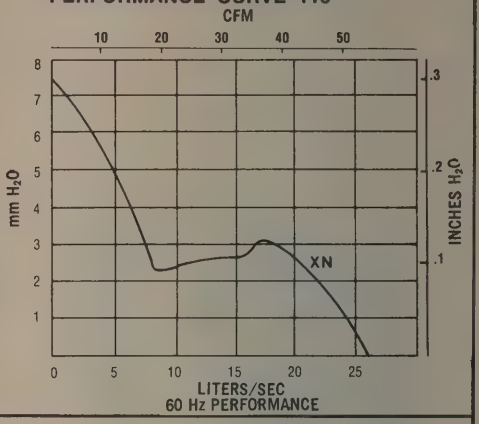

## AXIAL FAN MODEL 113



- 3⅝ x 1½ inch size
- 3.248 inch mounting centers
- 40 CFM at .1 inch of water, 53 CFM Free Flow
- Convenient intermediate size
- U.L. recognized file 64887
- Sleeve or ball bearing

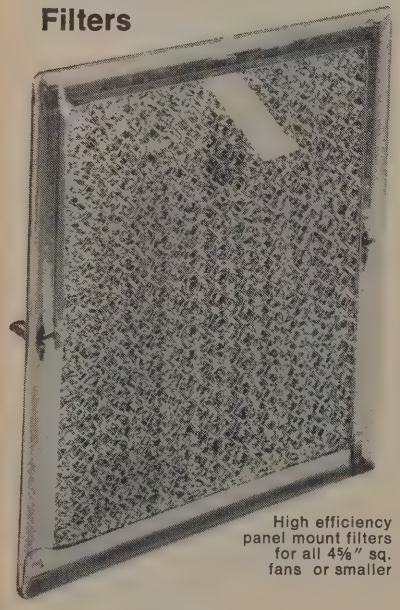
| Part Number | Volt | Current | Delivery |
|---|---|---|---|
| 2182-11115 | 115 | 135 ma | 53 CFM |
| 760-113XN- | | | |
| 2181-11220 | 220 | 70 ma | |

**PERFORMANCE CURVE 113**



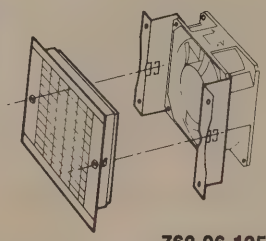

## AXIAL FAN ACCESSORIES

### Filters



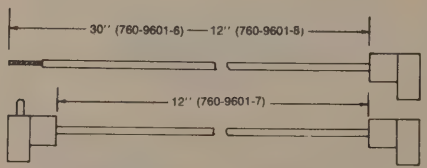
High efficiency panel mount filters for all 4⅝" sq. fans or smaller

| Filter P/N | Size | Mounting Hole Centers |
|---|---|---|
| 760-100-45 | 5 11/16 x 5 11/16 x ¼ | 5 3/16 ±1/16 |



**760-96-125**

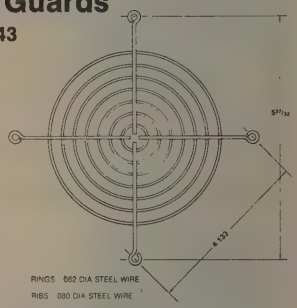
For all 4½ inch square fans; prevents coarse materials from entering unit. Filter mounts easily to the body of the fan by use of attached spring clips. Wire mesh screen is held in place by a pair of quick-release screws.




UL approved #18GA wire molded terminal ⅜ inch end stripped.
760-9601-6 — 30" long
760-9601-7 — 12" jumper for multiple connection
760-9601-8 — 12" long

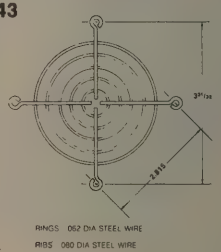
### Finger Guards

**760-9601-43**




Fits all 4½ inch square fans. Meets UL spacing requirements.
Bright zinc finish over steel wire.

**760-12601-43**

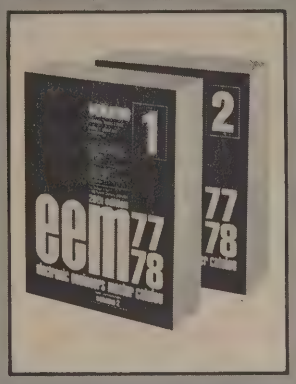



Fits all 3⅛ inch square fans. Meets UL spacing requirements.
Bright zinc finish over steel wire.

# WE KNOW OUR STUFF

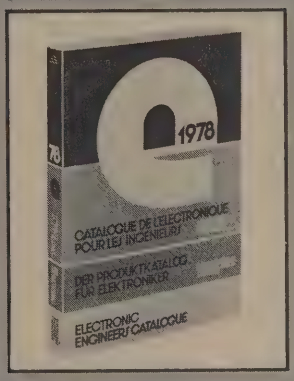
## 41 YEARS OF EXPERIENCE IN CATALOGING, 21 EDITIONS OF eem

### eem/ELECTRONIC ENGINEERS MASTER CATALOG —



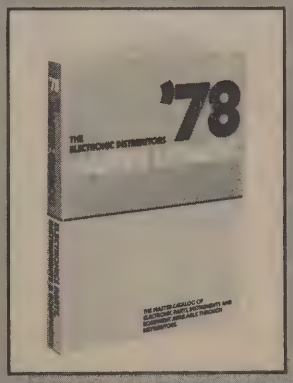

The "blue-ribbon" catalog/directory that has become "the standard of the industry" for electronic engineers, buyers and specifiers.

### ELECTRONIC ENGINEERS CATALOGUE



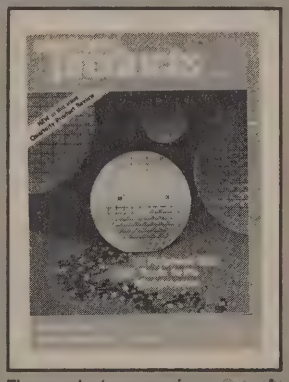

The new catalogue/directory of electronic products available to and from Western Europe and the United Kingdom. Designed especially for the European electronics engineer.

### ELECTRONIC DISTRIBUTORS MASTER CATALOG —



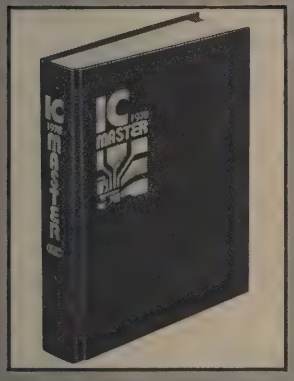

The only national catalog designed exclusively for distributors and their customers featuring electronic parts, instruments and equipment.

### ELECTRONIC PRODUCTS MAGAZINE —



The products magazine . . . A 100% product-oriented magazine including hundreds of new products and special features every month.

### IC MASTER AND THE UPDATES —




The only complete single-source directory including all IC devices manufactured in the United States. Updated three times yearly with accumulative supplements.

### eem FILE SYSTEM —

The only filing system designed especially for the electronics engineer. Instant retrieval and organization of data sheets and catalogs.

### UTP CUSTOM CATALOGS —

The Cadillac of individualized catalogs for the electronic parts distributor, featuring solely his lines and services.

### UNITED COST AND PRICING SERVICES —

The electronic distributors' proven method of being up to the minute on his cost and selling prices.

*United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Ave., Garden City, N.Y. 11530 / (516) 222-2500 TWX 510-222-1673*

# OFF-THE-SHELF MODELS

## Our well-built airmovers are rugged and reliable

Standard **Boxer** fans, rugged ball and new **Grand Prix** sleeve bearing types, both rated at more than 10 years operating life. **Super Boxer** for exceptional output at high back pressure. Versatile **DC Boxer** accepts DC and converts it to drive the unit's AC motor, eliminates brush wear, RF noise and other common DC motor problems. Miniature **PeWee Boxer,** delivering the highest cooling punch of any fan its size.

These reliable performers feature Boxer's sturdy all-metal construction, compact design for ease and flexibility of installation, and patented long-life bearing systems, as do **MiniBoxers, Tandem Boxers, Hi-Fi Boxers** and the new **Fulmar** fans. There's also the slim-profile **Condor** (3½″ thin by 10″ dia.) with air delivery to 575 cfm, and quality proven **IMCair** fans and centrifugal blowers. They are all distributor stocked for immediate availability.

If you'd like complete specifications and performance parameters for our full line of airmovers, send for 20 page catalog #ND7. It's available from **IMC Magnetics Corp., New Hampshire Division. Tel. (603) 332-5300.**

| Bearing (m/n prefix) | | Model No. | Air Delivery (cfm) | Volts (VAC) | Figure No. | Dimensions A | B | C |
|---|---|---|---|---|---|---|---|---|
| BOXER FANS – BALL(BS), SLEEVE(WS) BEARING MODELS | | | | | | | | |
| BS | WS | 2107FL | 115 | 115 | A | 1½ | 4 11/16 | 4 11/16 |
| X | X | 2107FL-2 | 70 | 115 | A | 1½ | 4 11/16 | 4 11/16 |
| X | X | 2107FL-3 | 115 | 220 | A | 1½ | 4 11/16 | 4 11/16 |
| X | X | 2107FL-6 | 115 | 220/240 | A | 1½ | 4 11/16 | 4 11/16 |
| X | X | 2107FL-7 | 115 | 115/230 | A | 1½ | 4 11/16 | 4 11/16 |
| MIL-TYPE BOXER FANS | | | | | | | | |
| X | | 2107F-0-1 | 115 | 115 | A | 1½ | 4 11/16 | 4 11/16 |
| X | | 2107F-2-1 | 70 | 115 | A | 1½ | 4 11/16 | 4 11/16 |
| X | | 2107F-6-1 | 115 | 230 | A | 1½ | 4 11/16 | 4 11/16 |
| SUPER BOXER FANS | | | | | | | | |
| X | X | 2107F-110 | 117 | 115 | A | 1½ | 4 11/16 | 4 11/16 |
| X | X | 2107FL-310 | 117 | 220/240 | A | 1½ | 4 11/16 | 4 11/16 |
| HI-FI BOXER FANS (low noise) | | | | | | | | |
| | X | 2107FL-9 | 50 | 115 | A | 1½ | 4 11/16 | 4 11/16 |
| | X | 2107FL-10 | 50 | 220/240 | A | 1½ | 4 11/16 | 4 11/16 |
| DC BOXER FANS | | | | | | | | |
| X | X | 2107F-12 | 95-118 | 12-16† | B | 1½ | 5 11/16 | 4 11/16 |
| X | X | 2107F-24 | 97-110 | 22-26† | B | 1½ | 5 11/16 | 4 11/16 |
| X | X | 2107F-30 | 110-120 | 28-32† | B | 1½ | 5 11/16 | 4 11/16 |
| X | X | 2107F-36 | 100-114 | 34-38† | B | 1½ | 5 11/16 | 4 11/16 |
| TANDEM BOXER FANS | | | | | | | | |
| TBS | | 2107FL | 125 | 105/125 | A | 3 | 4 11/16 | 4 11/16 |
| X | | 2107FL-6 | 125 | 220/240 | A | 3 | 4 11/16 | 4 11/16 |
| MINIBOXER FANS | | | | | | | | |
| MBS | MWS | * | ** | * | C | 1½ | 3⅝ | 3⅝ |
| PEWEE BOXER FANS | | | | | | | | |
| PBS | PWS | 2107F | 36 | 115 | C | 1.665 | 3.125 | 3.125 |
| CONDOR FANS (Ball bearing – only) | | | | | | | | |
| | | 00, 01, 02 | 450 | 115 | D | 3½ | 10 | – |
| | | 10, 11, 12 | 575 | 115 | D | 3½ | 10 | – |
| | | 20, 21,22 | 575 | 230 | D | 3½ | 10 | – |
| IMCair FANS | | | | | | | | |
| Sleeve | | FE6, FI6 | 225 | 115 | E | 4⅝ | 8⅛ | – |
| Ball | | FE8, FI8 | 485 | 115 | E | 5 29/32 | 10 | – |
| IMCair BLOWERS (Sleeve bearing – only) | | | | | | | | |
| | | B2 | 24 | 115 | F | 4 21/32 | 3 7/16 | 3 15/16 |
| | | B3 | 87 | 115 | F | 5 15/16 | 5 13/16 | 5½ |
| FULMAR FANS | | | | | | | | |
| | | 10, 11, 12 | 240 | 115 | G | 2 | 5 29/32 | 6¾ |
| | | 20, 21, 22 | 240 | 230 | G | 2 | 5 29/32 | 6¾ |

†DC voltage ratings (VDC).

*Identical to standard Boxer and Mil-Type models.

**MBS/MWS2107F-2 rated at 31 cfm, all other models rated at 46 cfm.

U.L. approved models. All Boxer and MiniBoxer (except Mil-Types), Super Boxer (BS/WS2107F-310), Tandem Boxer (TBS2107F), DC Boxer (WS2107F-9), Condor and IMCair (FE6, FI6) fans are optionally available in Underwriters Laboratories, Inc. approved versions. Yellow card component recognition #E36707.

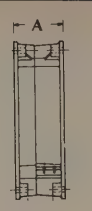



Figure A

Figure B

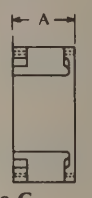



Figure C

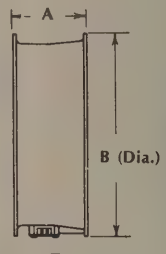



Figure D

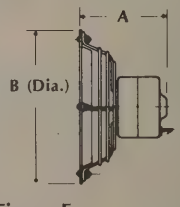



Figure E

Figure F

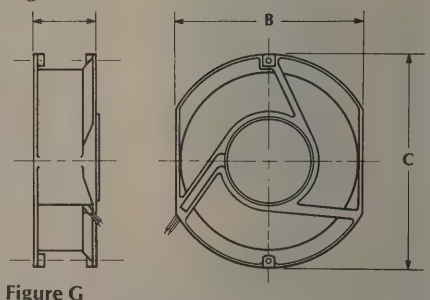



Figure G

imc

**IMC MAGNETICS CORP.**

NEW HAMPSHIRE DIVISION

ROUTE 16B, ROCHESTER, NEW HAMPSHIRE 03867

# CUSTOM DESIGNED MODELS

## We make centrifugal blowers, propeller fans, vaneaxial and tubeaxial airmovers...

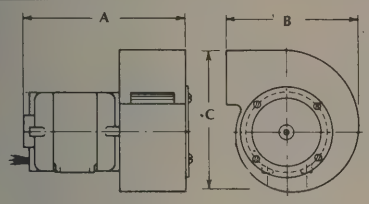


Figure A

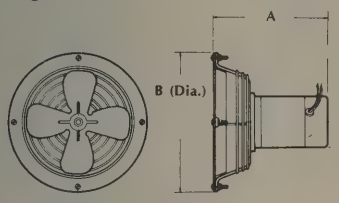


Figure B

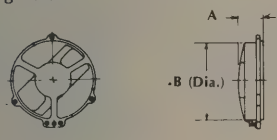


Figure C

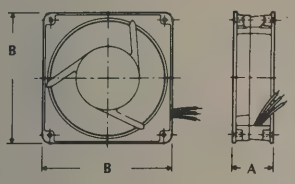


Figure D

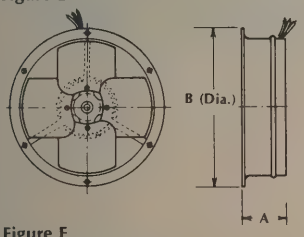


Figure E

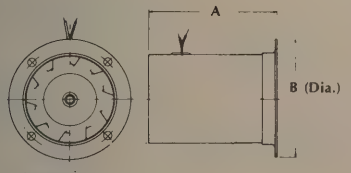


Figure F

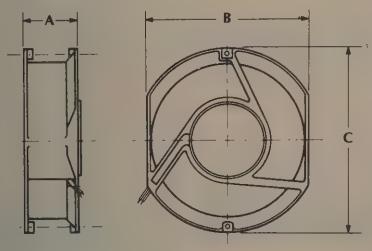


Figure G

to meet your most demanding cooling requirements. Slim-profile IMCool tubeaxials, compact (4-11/16" to a side) Boxers and MiniBoxers in Mil-Spec, 400 Hz and variable frequency versions, propeller fans and centrifugal blowers for intake or exhaust, against back pressure, and in harsh environments. Also, high performance vaneaxials from miniature IMCube (1" cube) to 14.5-inch diameter sizes, automatic air density/speed compensating "Hi-Slip" models for high altitude applications. Air deliveries from 6.5 to 3500 cfm.

Select from the thousand or more catalog designs, a sampling of which appear below, or we will custom design to your exact specifications . . . new systems, evolving systems, exasperating parameters, it's all in a days work for our Applications Engineering Section.

### CENTRIFUGAL BLOWERS

| Model No. | Air Delivery (cfm) | Voltage (VAC) | Frequency (Hz) | Speed (rpm) | Figure No. | Dimensions (inches) A | B | C |
|---|---|---|---|---|---|---|---|---|
| 1696 | 6.3 | 115 | 400 | 10,500 | A | 2 51/64 | 1 59/64 | 1 61/64 |
| 1836 | 20.0 | 200 | 400 | 11,000 | A | 2 3/8 | 2 53/64 | 2 25/32 |
| 1736 | 48.0 | 12 | DC | 10,000 | A | 4 3/16 | 5 17/32 | 5 7/16 |
| 1311 | 215.0 | 208 | 60 | 3300 | A | 7 17/32 | 7 1/4 | 7 7/8 |
| 2142 | 160.0 | 28 | DC | 6500 | A | 6 15/16 | 5 3/4 | 5 1/2 |
| 1598 | 600.0 | 200 | 400 | 3100 | A | 11 3/16 | 9 9/32 | 10 3/8 |
| 2133-2 | 650.0 | 115 | 60 | 3100 | A | 11 3/16 | 9 9/32 | 10 3/8 |
| 1796 | 1750.0 | 220 | 60 | 3200 | A | 12 1/2 | 13 17/64 | 14 21/32 |

### PROPELLER FANS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 804 | 18.0 | 115 | 400 | 18,000 | B | 1 3/4 | 1 1/2 | — |
| 2315 | 32.0 | 115 | 60 | 3400 | B | 2 13/16 | 4 1/4 | — |
| 5-2 | 78.0 | 115 | 60 | 3400 | B | 3 3/8 | 5 3/8 | — |
| 6 | 160.0 | 200 | 400 | 7000 | B | 3 5/8 | 5 3/8 | — |
| 2304 | 360.0 | 115 | 400 | 10,000 | B | 4 53/64 | 6 3/16 | — |
| 1164 | 730.0 | 115 | 60 | 3350 | B | 6 3/16 | 10 | — |
| 2255 | 980.0 | 115 | DC | 4000 | B | 7 1/2 | 10 | — |
| 1999 | 1300.0 | 115 | 60 | 3200 | B | 9 1/2 | 12 | — |
| 2523 | 240.0 | 208 | 400 | 3400 | G | 2 | 5 29/32 | 6 3/4 |
| 2516 | 240.0 | 115 | 400 | 3400 | G | 2 | 5 29/32 | 6 3/4 |

### VANEAXIAL FANS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BC703V | 6.5 | 26 | 400 | 23,000 | F | 1 | 1 | — |
| BC1307V-13 | 50.0 | 115 | 400 | 17,000 | F | 2 1/8 | 2 | — |
| BT1610V-5 | 128.0 | 200 | 400 | 21,500 | F | 4 1/2 | 4 1/2 | — |
| BT1615V-1 | 260.0 | 200 | 400 | 22,500 | F | 4 1/4 | 4 3/4 | — |
| BT2220V | 280.0 | 200 | 400 | 23,000 | F | 4 53/64 | 5 | — |
| BT2922V-3 | 375.0 | 200 | 400 | 21,000 | F | 6 | 5 1/2 | — |
| BT3815V-1 | 700.0 | 115 | 400 | 5500 | F | 7 | 8 | — |
| BT3830V-1 | 2250.0 | 200 | 60 | 3300 | F | 10 | 12 1/2 | — |

### TUBEAXIAL FANS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1840 | 50 | 115 | 400 | 12,500 | C | 7/8 | 3 25/32 | — |
| 1873 | 73 | 115 | 400 | 5600 | D | 1 1/2 | 3 5/8 | — |
| 1554 | 130 | 115 | 400 | 3400 | D | 1 1/2 | 4 11/16 | — |
| 1908 | 265 | 115 | 400 | 7000 | D | 1 1/2 | 4 11/16 | — |
| 1602 | 270 | 208 | 60 | 3300 | E | 2 13/32 | 7 3/4 | — |
| 2311 | 625 | 208 | 60 | 3400 | E | 3 11/16 | 11 | — |
| 2034 | 710 | 200 | 400 | 2000 | E | 3 1/2 | 10 | — |
| 2290 | 1600 | 208 | 60 | 2700 | E | 3 3/4 | 12 1/4 | — |

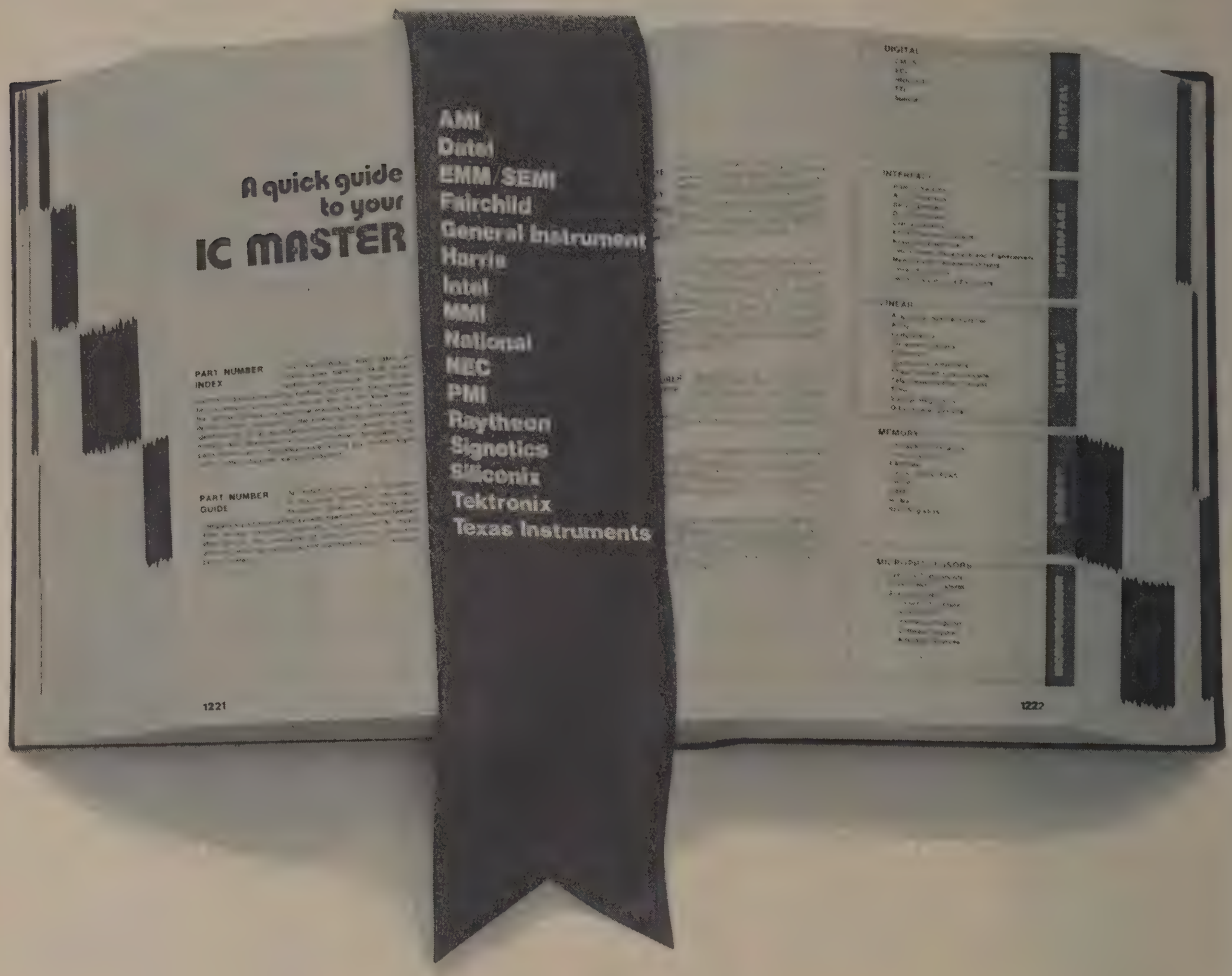
**Tel. (516) 334-7070, TWX 510-222-4469.**

**FREE**

Want more data on our airmover lines? Request the handbook to fit your needs. There's our Centrifugal Blower Catalog #EB2, Vaneaxial Catalog #EV2, and The Fan Catalog featuring propeller and tubeaxial designs, it's #EF2. Each manual contains comprehensive theory and applications information as well.

**IMC MAGNETICS CORP.**
EASTERN DIVISION
570 MAIN STREET, WESTBURY, NEW YORK 11590

# A GOOD BOOK IS KNOWN BY THE COMPANIES IT KEEPS.




These manufacturers have invested in the IC MASTER to bring you the most complete information on their newest standard products.

WHEN USING THE IC MASTER, REFER TO THESE MANUFACTURERS' COMPLETE DATA SHEETS TO HELP YOU IN YOUR IC SELECTION . . .

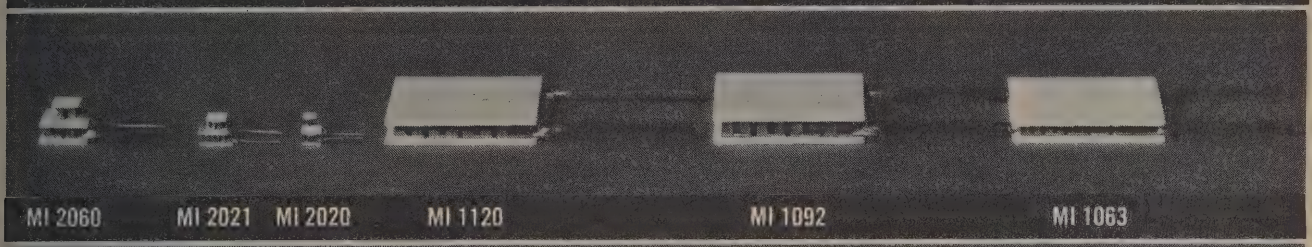
## THE WHOLE WORLD FOLLOWS THE MASTER.

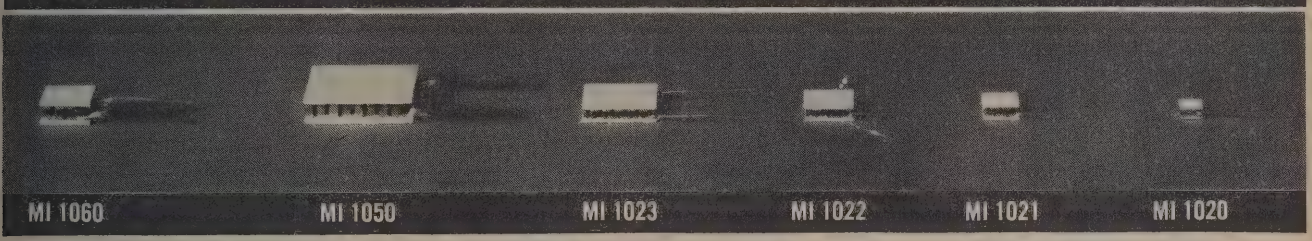
**IC Master**
**1333 Lawrence Expressway, Suite 420**
**Santa Clara, CA 95051**
**(408) 248-8044**

***It's Faster With the Master***

**marlow industries**
incorporated
1021 S. JUPITER ROAD • GARLAND, TEXAS 75042

# THERMOELECTRIC HEAT PUMPS




## STANDARD THERMOELECTRIC HEAT PUMPS

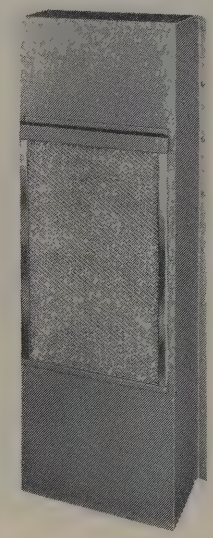
| MODEL | $I_{max}$ (amps) | $V_c$ @ $I_{max}$ (volts) | TOP CERAMIC L (inches) | TOP CERAMIC W (inches) | BOTTOM CERAMIC L (inches) | BOTTOM CERAMIC W (inches) | HEIGHT H (inches) | $T_{c\ max}$ VACUUM ($10^{-6}$ Torr) | $T_{c\ max}$ DRY NITROGEN (14.7 psia) | HEAT PUMP CAPACITY (mw/°C) |
|---|---|---|---|---|---|---|---|---|---|---|
| MI 1020 | 2.0 | 0.8 | .156 | .156 | .156 | .156 | .113 | −40 | −33 | 17 |
| MI 1021 | 2.0 | 2.0 | .260 | .260 | .260 | .260 | .113 | −41 | −35 | 39 |
| MI 1022 | 2.0 | 3.6 | .346 | .346 | .346 | .346 | .113 | −41 | −35 | 73 |
| MI 1023 | 2.0 | 8.2 | .518 | .518 | .518 | .518 | .113 | −41 | −35 | 164 |
| MI 1050 | 5.0 | 3.7 | .750 | .750 | .750 | .750 | .178 | −41 | −34 | 218 |
| MI 1060 | 6.0 | 0.7 | .380 | .380 | .380 | .380 | .165 | −41 | −33 | 55 |
| MI 1063 | 6.0 | 7.5 | 1.167 | 1.167 | 1.167 | 1.167 | .165 | −41 | −34 | 546 |
| MI 1092 | 9.0 | 3.4 | 1.167 | 1.167 | 1.167 | 1.167 | .212 | −40 | −33 | 350 |
| MI 1120 | 12.0 | 3.4 | 1.167 | 1.167 | 1.167 | 1.167 | .195 | −41 | −34 | 450 |
| MI 2020 | 1.7 | 0.9 | .100 | .100 | .156 | .156 | .200 | −70 | −56 | 4 |
| MI 2021 | 1.5 | 2.0 | .156 | .156 | .260 | .260 | .200 | −64 | −55 | 11 |
| MI 2060 | 5.5 | 0.8 | .207 | .207 | .380 | .380 | .294 | −70 | −54 | 12 |
| MI 3026 | 1.2 | 2.9 | .174 | .160 | .346 | .346 | .285 | −84 | −62 | 6 |
| MI 3040 | 4.0 | 6.5 | .511 | .339 | 1.113 | .855 | .421 | −80 | −68 | 54 |
| MI 4000 | 0.5 | 6.0 | .314 | .160 | .678 | .522 | .405 | −85 | −50 | 4 |
| MI 4012 | 1.0 | 6.0 | .314 | .160 | .678 | .522 | .405 | −88 | −60 | 8 |
| MI 6020 | 1.7 | 6.0 | .200 | .200 | 1.113 | .855 | 1.012 | −100 | −33 | 3 |
| MI 6030 | 3.7 | 6.0 | .200 | .200 | 1.113 | .855 | .802 | −105 | −56 | 5 |

Thermoelectric heat pumps are now being used in industrial and military equipment that requires small, efficient, vibration free, cooling systems. Marlow Industries Standard heat pumps are available from stock for off-the-shelf delivery. The smaller heat pumps can be mounted on TO-37 or TO-8 headers. The larger modules can be mounted to a Flat Plate for ease of installation into a system. Related products such as temperature controllers/power supplies, and heat sinks are also available.

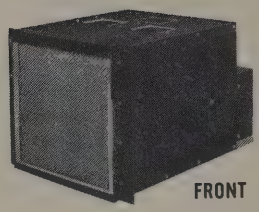
To assist you in selecting a thermoelectric heat pump for your next requirement, write for our "Guide To Thermoelectric Heat Pumps."

**marlow industries**
**incorporated** 1021 S. Jupiter Road • Garland, Texas 75042 • (214) 494-2521 • TWX 910-860-5161

# AIR CONDITIONERS • HEAT EXCHANGERS • HEAT PIPES

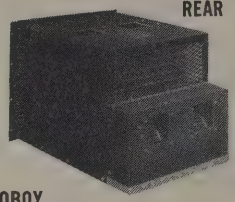


SLIMBOY



FRONT

REAR



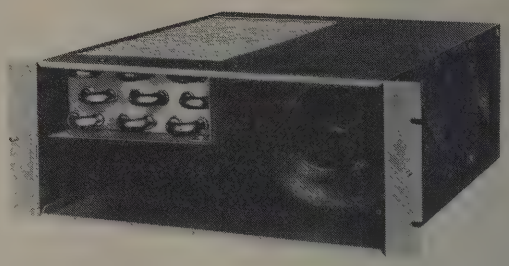
LOBOY

## AIR CONDITIONERS

- FOR COMPUTER-CONTROLLED MACHINE TOOL SYSTEMS
- ELECTRONICS • COMPUTERS
- 5000 TO 10,000 BTU

**SLIMBOY** — For longer life and greater reliability for solid state components and controls packaged door-mounted or rack-mounted units in 115 or 220 volts. Easy to install. Dimensions 19″ wide x 52 1/16″ high x 9½″ deep. Sealed to prevent induction of ambient or polluted air. Centrifugal blowers deliver cool air at high velocity to heat producing components. Pressure-sensing by-pass valve prevents freezing of coil. 20,000 hours continuous duty assured.

**LOBOY** — All the performance characteristics of the SLIMBOY in a compact 6000 BTU package, 19″ x 15 23/32″ high x 25 1/16″ deep. Operates on 115 volts, 60 Hz; 135 lbs; draws 12 amps.

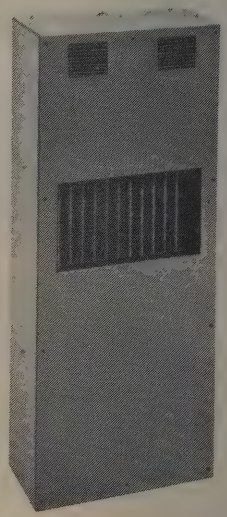


## HEAT EXCHANGERS

These water-cooled heat exchangers are designed for mounting in the front panel of a 19″ electronic cabinet and for removing the heat from the air being recirculated within the cabinet. The system does not use room ambient air nor does it exhaust warm inside cabinet air into the atmosphere. An interior cabinet temperature of 80°F (max.) with a 1 KW heat dissipation can be maintained. The unit employs 66°F to 70°F chilled inlet water.

Substantially more cooling may be obtained by using refrigerated water or direct expansion of a refrigerant.

## HEAT PIPE HEAT EXCHANGERS



The business end of these McLean cooling systems consists of a bank of heat pipes and two dual centrifugal blowers. A highly efficient method of cooling and recirculating electronic cabinet air without introducing ambient, contaminated, or polluted air into the enclosure.

Hot cabinet air is drawn through the bottom half of the heat pipe bank, thus cooling it, and discharging this cool air into the cabinet at 350 CFM at 0″ SP. A blower draws ambient air through the top half of the heat pipe bank, cooling the heat pipes and discharging heated air into the atmosphere.

A stable interior temperature 16°F above ambient is maintained. The unit mounts on the door or mounting rails of the rack and does not take up interior space.

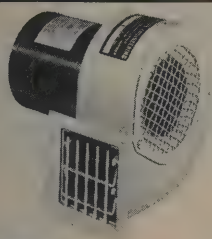
**Send for Catalog**

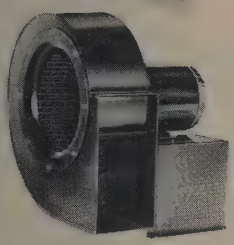
Complete engineering specs on a broad line of cooling equipment for electronics.

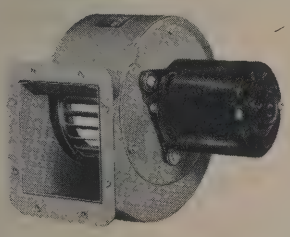
**McLEAN ENGINEERING LABORATORIES**
Dept. EM, Princeton Junction, NJ 08550
(609) 799-0100 • TWX 510-685-2543

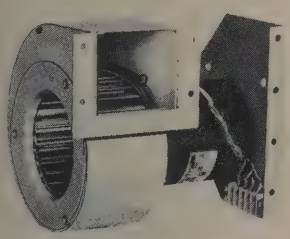
**McLEAN ENGINEERING MIDWEST**
Dept. EM, 9560 Eighty-Fifth Ave. N.
Maple Grove, MN 55369 • (612) 425-4747

# SINGLE & DUAL CENTRIFUGAL BLOWERS FILTER GRILLE PANELS







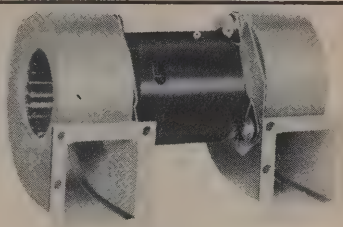


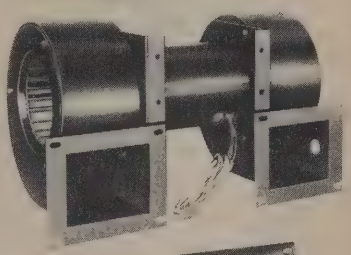
**SINGLE CENTRIFUGAL BLOWERS**—McLean does have a large selection of single centrifugal blowers engineered to meet a wide variety of CFM output and pressure characteristics. Inlet duct flanges, exhaust outlet flanges and protective screens are available. CW and CCW rotations can be supplied. Each motor has been specifically designed for the application, bearings are properly loaded, double shielded and permanently lubricated. Motor and wheels are balanced to precision tolerances assuring vibration-free operation. All motors are UL approved. These blowers may be operated in any shaft position.

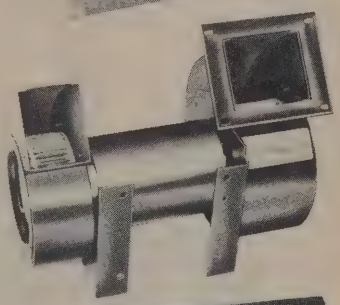
CFM output ranges from 50 to 2000 CFM with static pressures from 0" to 3.0" SP. Motors can be supplied for any AC frequency or power.

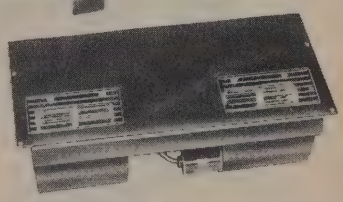
**DUAL CENTRIFUGAL BLOWERS**—There is an extensive variety of McLean Dual Centrifugal Blowers offering a wide choice of static pressure and output characteristics. Wheel diameters range from 3" to 12". Motors can be supplied for any AC frequency or power, single or three phase. Each motor has been specifically designed for the application, bearings are properly loaded, double shielded and permanently lubricated. Motors and wheels are balanced to precision tolerances assuring vibration-free operation. All motors are UL approved.

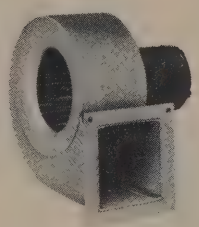
Exhaust outlet flanges, inlet duct flanges, protective screens and various types of mounting flanges and supports are available.

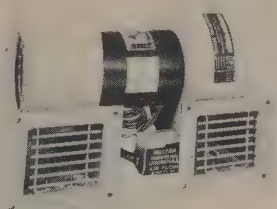






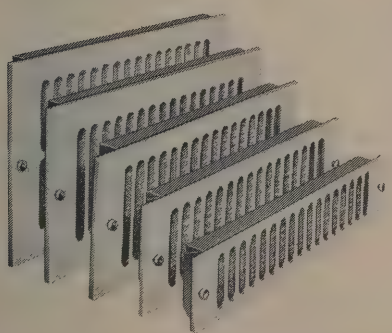


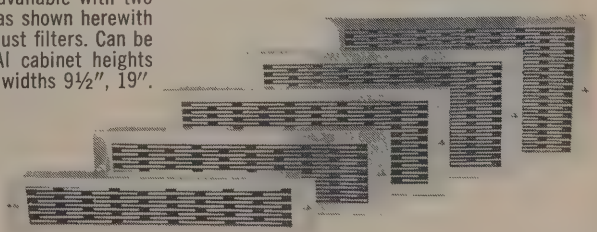




## FILTER GRILLE PANELS

Filter Grille Panels are for use in electronic cabinets where louvered area is needed to permit adequate ventilation. These panels may be used as an air inlet or air outlet. They are available with two different grille designs as shown herewith and are complete with dust filters. Can be supplied in standard EAI cabinet heights from 3½" x 10½" and widths 9½", 19". 24" and 30".





**Send for Catalog**

Complete engineering specs on a broad line of cooling equipment for electronics.

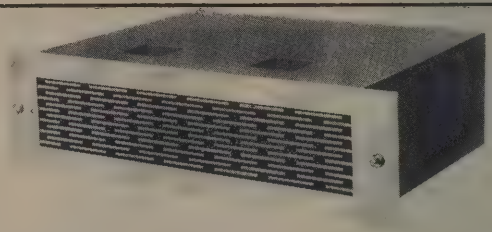
**McLEAN ENGINEERING LABORATORIES**
Dept. EM, Princeton Junction, NJ 08550
(609) 799-0100 • TWX 510-685-2543

**McLEAN ENGINEERING MIDWEST**
Dept. EM, 9560 Eighty-Fifth Ave. N.
Maple Grove, MN 55369 • (612) 425-4747

# PACKAGED COOLING EQUIPMENT

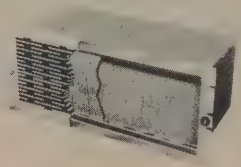
### RACK–MOUNTED BLOWERS

Over 100 models available in any panel width. Heights from 3½" to 12¼". Airflows to 1000 CFM. Pressurize systems with cool, filtered air. Prevent dust from entering systems. Standard EIA notching. Quick, easy mounting. No cutting. No filing. Also Packaged Fans for pressurizing or evacuating. Four sizes. Airflows from 275 to 120 CFM. All units available to Commercial, Military or EMI Shielded Specifications.



| MODEL | CAT. PAGE | CFM | PANEL* HEIGHTS | MOTOR** RPM | MOTOR** AMPS OR WATTS | REMARKS |
|---|---|---|---|---|---|---|
| 2EB300 | 20 | 150 | 3½ & 5¼ | 2900 | 70W | FOR LIMITED SPACE |
| 2EB3500 | 20 | 290 | 3½ & 5¼ | 3200 | 175W | HIGH PRESSURE-LIMITED SPACE |
| 2EB408 | 20 | 300 | 5¼ & 7 | 1500 | 60W | QUIET OPERATION |
| 2EB412 | 20 | 350 | 5¼ & 7 | 3000 | 200W | HIGH PRESSURE & VELOCITY |
| 2EB512 | 20 | 500 | 7 & 8¾ | 1700 | 130W | LARGE VOL. HIGH VELOCITY |
| 2EB612 | 20 | 800 | 8¾ & 10½ | 1650 | 220W | HIGH VOLUME-HIGH VELOCITY |
| 2EB412 | 20 | 500 & 700 | 5¼-7-8¾ | 3000 | 200W | SIDE DISCHARGE DUCT BLOWER |
| 1EB800G | 22 | 1000 | 10½ | 1100 | 240W | LOW NOISE-HIGH CFM |
| 1EB920 | 25 | 200/350 | 3½-5¼ | 1135 | 412W | SIDEWINDER |
| 1EB980 | 25 | 345/550 | 5¼-7 | 1350 | 580W | SIDEWINDER |
| 4EB300 | 26 | 250 | 5¼ x 14⅝D | Two 3100 | 80W | MULTI-EXHAUST BLOWER |
| 4EB424 | 26 | 450 | 7 x 19½D | Two 1700 | 70W | MULTI-EXHAUST BLOWER |
| ID300B | 29 | 75 | 5¼ | 3000 | 40W | HALF PANEL WIDTH |
| IE2200 | 27 | 150 | 3½ | 3150 | 80W | SLOT BLOWER |
| IEB710 | 25 | 140/185 | 1¾-3½ | 1500 | 136W | SIDEWINDER |

* ALL MODELS ARE 19" WIDTH EXCEPT ID300B (HALF PANEL) ** ALL MOTORS ARE 115V 50/60 HZ UL APPROVED
UNITS ALSO AVAILABLE TO OTHER RACK WIDTHS AND FOR RECESSED INSTALLATION

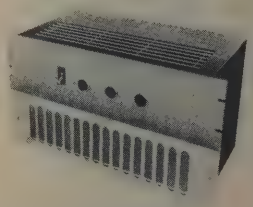


### EMI—SHIELDED UNITS

All packaged blowers available with an EMI shield and wave guide media built into the airstream. Cuts signal leakage inward or outward.

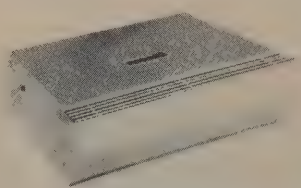
### HEAT EXCHANGERS

Maintain cabinet temperature at 80°F maximum with 1 KW heat dissipation. Air recirculates in rack and is cooled by exchanger in blower case.



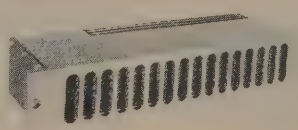
### HEATER—COOLERS

For unheated field installations. Maintains an even 65°F with surrounding air as low as 10°F.



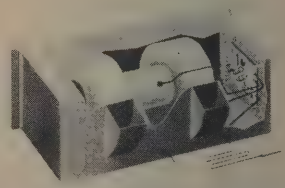
### SIDEWINDER BLOWERS

More air. More pressure. Less space. Delivers 180, 350 or 515 CFM in a 17" wide airstream.



### SLOT BLOWERS

Ideal for jam-packed circuitry. Delivers 150 CFM from a 3½" panel. Quiet.



### SOLID STATE TEMPERATURE CONTROLLERS

Cuts noise level. Modulates blower speed. Keeps operating between 80-90°F. Costs less than air conditioning.

*Also a broad line of accessory equipment including grilles, controls, etc.*

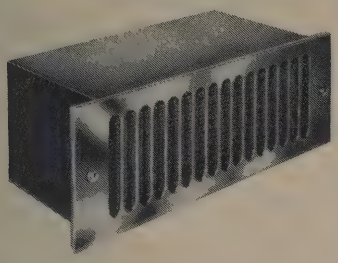
## Send for Catalog

Complete engineering specs on a broad line of cooling equipment for electronics.

**McLEAN ENGINEERING LABORATORIES**
Dept. EM, Princeton Junction, NJ 08550
(609) 799-0100 • TWX 510-685-2543

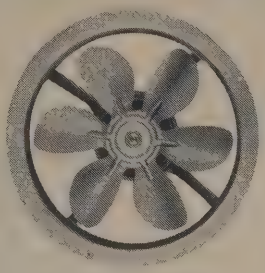
**McLEAN ENGINEERING MIDWEST**
Dept. EM, 9560 Eighty-Fifth Ave. N.
Maple Grove, MN 55369 • (612) 425-4747

# FANS—Venturi, Orifice, Panel, Reversible



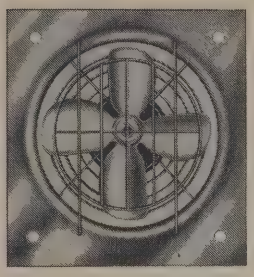
## PACKAGED PROPELLER FANS

McLean Packaged Propeller Fans are for applications where static pressure requirements are low and where low cost is a consideration. Three models available in 5¼", 7", and 8¾" panel heights. Units operate at 115V/50 Hz. Life-lubricated bearings. Permanent washable filter supplied as standard equipment.



## ORIFICE-MOUNTED

**SERIES 1NB65-80** Push or pull airflow. 275,300, or 395 cfm. Dimensions 4" x 8½" or 4¾" x 10¼". Strong, light axial flow aluminum for maximum pressure. Mounts top, bottom, or side. Quiet, vibrationless. 115 volts, 50/60 Hz, 1600 rpm or 3000 rpm.



## PANEL-MOUNTED

**SERIES 1PB65** Low cost, long life, ready-to-mount, shaft in any position: Easy to install. Propeller side and motor side protected with heavy wire guards. 280 cfm, 3100 rpm, 70 watt, 115 volt, 50/60 Hz, permanent lube. 10" square panel on 9" centers, 4$^{23}/_{32}$" deep.

## REVERSIBLE FILTER BOX PROPELLER FANS

Mechanically reversible. Wide range of airflows. Flexible mounting. Efficient, versatile, compact.

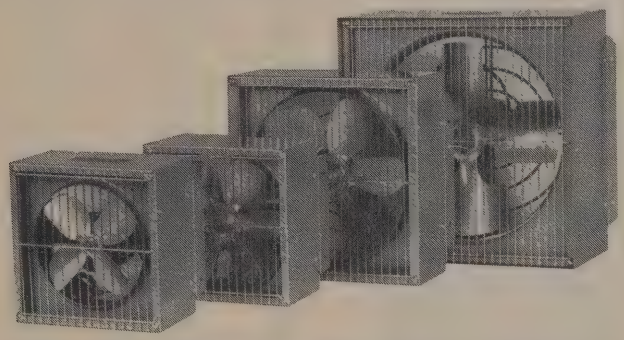
**Model 1RB65** delivers 275 cfm, 3100 rpm 4½" deep x 8⅞" square

**Model 1RB80** delivers 450 cfm, 1650 rpm 4½" deep x 8⅞" square

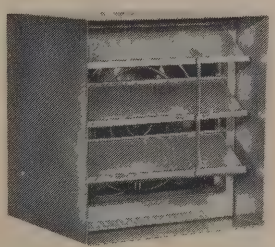
**Model 1RB100** delivers 725 cfm, 1600 rpm 4½" deep x 12⅛" square

**Model 1RB120** delivers 1200 cfm, 1450 rpm 4½" deep x 15⅛" square

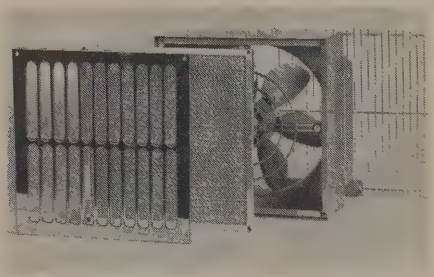
**Model LA120** Back Draft Damper is used in conjunction with Model 1RB120. Louvers automatically open when power is applied and close when power is off. May be used in horizontal or vertical positions.



MODEL 1RB65 MODEL 1RB80 MODEL 1RB100 MODEL 1RB120



MODEL LA120



EXTRA EQUIPMENT: STAINLESS STEEL GRILLE, PERMANENT WASHABLE FILTER, HEAVY GAUGE PROPELLER GUARD

## Send for Catalog

Complete engineering specs on a broad line of cooling equipment for electronics.

**McLEAN ENGINEERING LABORATORIES**
Dept. EM, Princeton Junction, NJ 08550
(609) 799-0100 • TWX 510-685-2543

**McLEAN ENGINEERING MIDWEST**
Dept. EM, 9560 Eighty-Fifth Ave. N.
Maple Grove, MN 55369 • (612) 425-4747

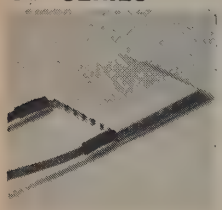
MELCOR
MATERIALS ELECTRONIC PRODUCTS CORP.
990 SPRUCE STREET
TRENTON, NEW JERSEY 08648 U.S.A.
TELEPHONE (609) 393-4178 / TELEX 843314

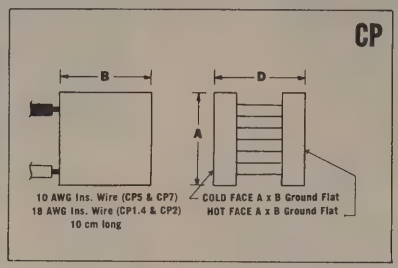
# SOLID STATE COOLING WITH THERMOELECTRICS

## THERMOELECTRIC (PELTIER) HEAT PUMP MODULE SPECIFICATIONS

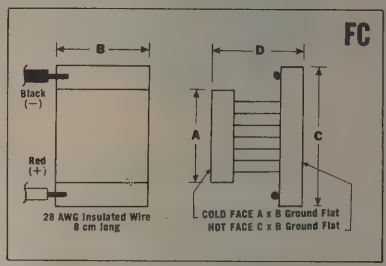
Thermocouples constructed of N & P elements of highest grade bismuth telluride in form of oriented polycrystalline ingots. Ingot ends soldered to copper bus bars interfaced with ceramic plates, affording good mechanical integrity, high dielectric strength and thermal conduction. Ceramic faces lapped flat (designated Type L) for mechanical interfacing (compression) with heat exchangers. Solderable hot face available on special order, specify Type TL. Temperature Range, −150°C to +110°C. Solid state construction.

### CP SERIES






### FC SERIES




| CATALOG NUMBER | I MAX. AMPS | Q MAX. WATTS | V MAX. VOLTS | △T MAX. °C | MULTIPLIER Q & V | DIMENSIONS MM A | B | C | D | WEIGHT GMS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | HOT FACE Th = 27°C | | | | | | | | |
| **CP SERIES** | | | | | | | | | | |
| CP 1.4- 3-10L | 3,6 | 0,8 | 0,36 | 70,0 | 0,04 | 5,0 | 10,0 | | 4,8 | 0,6 |
| CP 1.4- 7-10L | 3,6 | 1,9 | 0,85 | 70,0 | 0,10 | 10,0 | 10,0 | | 4,8 | 1,4 |
| CP 1.4-11-10L | 3,6 | 2,9 | 1,33 | 70,0 | 0,15 | 10,0 | 15,0 | | 4,8 | 2,2 |
| CP 1.4-17-10L | 3,6 | 4,6 | 2,06 | 70,0 | 0,24 | 15,0 | 15,0 | | 4,8 | 3,4 |
| CP 1.4-35-10L | 3,6 | 9,4 | 4,24 | 70,0 | 0,49 | 15,0 | 30,0 | | 4,8 | 7,0 |
| CP 1.4-71-10L | 3,6 | 19,0 | 8,60 | 70,0 | 1,00 | 30,0 | 30,0 | | 4,8 | 14.2 |
| CP 1.4- 3-06L | 6,0 | 1,3 | 0,36 | 67,5 | 0,04 | 5,0 | 10,0 | | 3,8 | 0,5 |
| CP 1.4- 7-06L | 6,0 | 3,0 | 0,85 | 67,5 | 0,10 | 10,0 | 10,0 | | 3,8 | 1,2 |
| CP 1.4-11-06L | 6,0 | 4,6 | 1,33 | 67,5 | 0,15 | 10,0 | 15,0 | | 3,8 | 1,8 |
| CP 1.4-17-06L | 6,0 | 7,2 | 2,06 | 67,5 | 0,24 | 15,0 | 15,0 | | 3,8 | 2,9 |
| CP 1.4-35-06L | 6,0 | 14,8 | 4,24 | 67,5 | 0,49 | 15,0 | 30,0 | | 3,8 | 6,0 |
| CP 1.4-71-06L | 6,0 | 30,0 | 8,60 | 67,5 | 1,00 | 30,0 | 30,0 | | 3,8 | 12,2 |
| CP 2 - 3-10L | 8,5 | 1,8 | 0,36 | 70,0 | 0.10 | 8,0 | 15,0 | | 5,7 | 1,9 |
| CP 2 - 7-10L | 8,5 | 4,3 | 0,85 | 70,0 | 0,23 | 15,0 | 15,0 | | 5,7 | 4,3 |
| CP 2 -11-10L | 8,5 | 7,7 | 1,33 | 70,0 | 0,35 | 15,0 | 23,0 | | 5,7 | 6,5 |
| CP 2 -15-10L | 8,5 | 9,2 | 1,81 | 70,0 | 0,48 | 15,0 | 30,0 | | 5,7 | 8,9 |
| CP 2 -31-10L | 8,5 | 19,0 | 3,75 | 70,0 | 1,00 | 30,0 | 30,0 | | 5,7 | 18,5 |
| CP 2 - 3-06L | 14,0 | 2,9 | 0,36 | 67,5 | 0,10 | 8,0 | 15,0 | | 4,7 | 1,6 |
| CP 2 - 7-06L | 14,0 | 6,8 | 0,85 | 67,5 | 0,23 | 15,0 | 15,0 | | 4,7 | 3,6 |
| CP 2 -11-06L | 14,0 | 10,6 | 1,33 | 67,5 | 0,35 | 15,0 | 23,0 | | 4,7 | 5,5 |
| CP 2 -15-06L | 14,0 | 14,5 | 1,81 | 67,5 | 0,48 | 15,0 | 30,0 | | 4,7 | 7,5 |
| CP 2 -31-06L | 14,0 | 30,0 | 3,75 | 67,5 | 1,00 | 30,0 | 30,0 | | 4,7 | 15,7 |
| CP 5 -31-10L | 36,0 | 81,0 | 3,75 | 70,0 | 1,00 | 55,0 | 55,0 | | 7,1 | 107,0 |
| CP 5 -31-06L | 60,0 | 130,0 | 3,75 | 67,5 | 1,00 | 55,0 | 55,0 | | 6,1 | 93,5 |
| CP 7 -17-10L | 70,0 | 87,0 | 2,06 | 70,0 | 1,00 | 55,5 | 55,5 | | 7,1 | 104,0 |
| CP 7 -17-06L | 115,0 | 135,0 | 2,06 | 67,5 | 1,00 | 55,0 | 55,0 | | 6,1 | 91,5 |
| **FC SERIES** | | | | | | | | | | |
| FC 0.6- 4-06L | 1,1 | 0,30 | 0,48 | 67,5 | 0,125 | 2,1 | 4,1 | 4,1 | 2,7 | All weights below 0.7 g |
| FC 0.6- 8-06L | 1,1 | 0,60 | 0,97 | 67,5 | 0,250 | 4,1 | 4,1 | 6,2 | 2,7 | |
| FC 0.6-12-06L | 1,1 | 0,90 | 1,46 | 67,5 | 0,375 | 4,1 | 6,2 | 6,2 | 2,7 | |
| FC 0.6-18-06L | 1,1 | 1,35 | 2,18 | 67,5 | 0,562 | 6,2 | 6,2 | 8,2 | 2,7 | |
| FC 0.6-32-06L | 1,1 | 2,40 | 3,88 | 67,5 | 1.000 | 8,2 | 8,2 | 10,3 | 2,7 | |
| FC 06-66-06L | 1,1 | 5,00 | 8,00 | 67,5 | 2,060 | 11,2 | 11,2 | 14,2 | 2,7 | |
| FC 0.6- 4-05L | 1,4 | 0,38 | 0,48 | 67,5 | 0,125 | 2,1 | 4,1 | 4,1 | 2,4 | All weights below 0.7 g |
| FC 0.6- 8-05L | 1,4 | 0,75 | 0,97 | 67,5 | 0,250 | 4,1 | 4,1 | 6,2 | 2,4 | |
| FC 0.6-12-05L | 1,4 | 1,13 | 1,46 | 67,5 | 0,375 | 4,1 | 6,2 | 6,2 | 2,4 | |
| FC 0.6-18-05L | 1,4 | 1,69 | 2,18 | 67,5 | 0,562 | 6,2 | 6,2 | 8,2 | 2,4 | |
| FC 0.6-32-05L | 1,4 | 3,00 | 3,88 | 67,5 | 1,000 | 8,2 | 8,2 | 10,3 | 2,4 | |
| FC 06-66-05L | 1,4 | 6,20 | 8,00 | 67,5 | 2,060 | 11,2 | 11,2 | 14,2 | 2,5 | |
| FC 0.7- 4-05L | 1,9 | 0,52 | 0,48 | 67,5 | 0,125 | 2,3 | 4,6 | 4,6 | 2,4 | All weights below 0.7 g |
| FC 0.7- 8-05L | 1,9 | 1,04 | 0,97 | 67,5 | 0,250 | 4,6 | 4,6 | 6,9 | 2,4 | |
| FC 0.7-12-05L | 1,9 | 1,56 | 1,46 | 67,5 | 0,375 | 4,6 | 6,9 | 6,9 | 2,4 | |
| FC 0.7-18-05L | 1,9 | 2,34 | 2,18 | 67,5 | 0,562 | 6,9 | 6,9 | 9,2 | 2,4 | |
| FC 0.7-32-05L | 1,9 | 4,16 | 3,88 | 67,5 | 1,000 | 9,2 | 9,2 | 11,5 | 2,4 | |
| FC 0.7-66-05L | 1,9 | 8,60 | 8,00 | 67,5 | 2,060 | 12,7 | 12,7 | 15,8 | 2,5 | |

FC 0.6 - 4 - 06 = 0.6 mm x 0.6 mm element cross section — 4 thermocouples — .060" element height



Add Dept. EM to address to tell them you saw it in eem

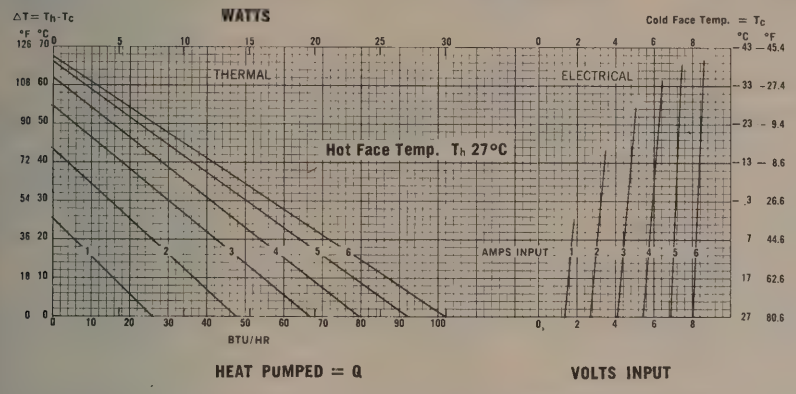
# SOLID STATE COOLING WITH THERMOELECTRICS

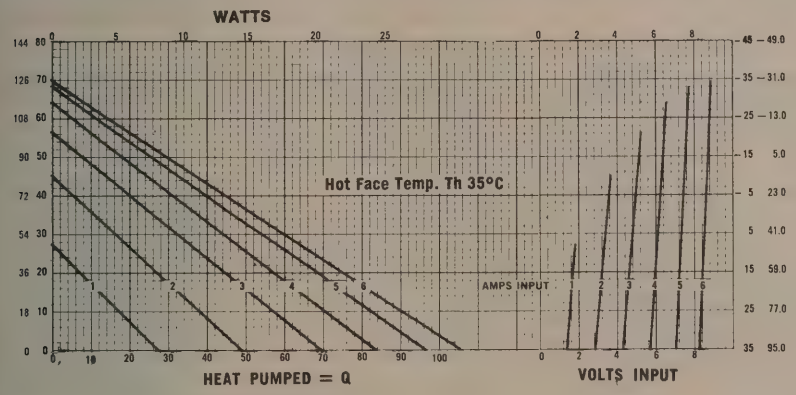
MELCOR
MATERIALS ELECTRONIC PRODUCTS CORP.
990 SPRUCE STREET
TRENTON, NEW JERSEY 08648 U.S.A.
TELEPHONE (609) 393-4178 / TELEX 843314

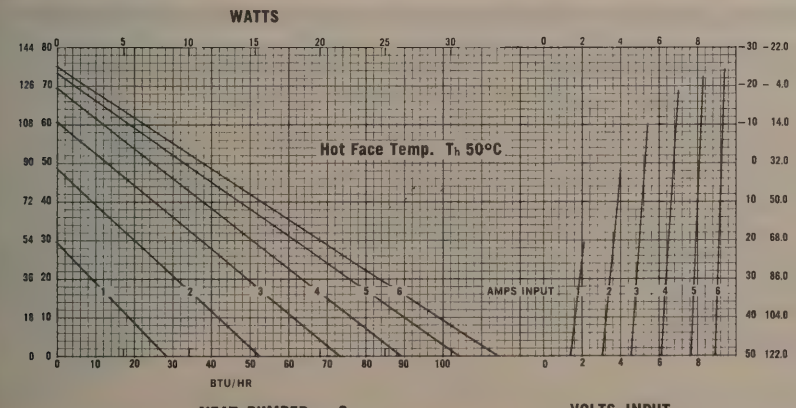
## MODULE PERFORMANCE CHARTS

### HOW TO USE PERFORMANCE CHARTS

1. CP1.4-71-06L — Use charts below. Interpolate for values of Th between 27°C to 35°C, and 35°C to 50°C. Extrapolate for values below 27°C or above 50°C (limits −10°C to +80°C) using linear (straight line) relationship.
2. Conversion To Other Full Modules — Convert I, Q, and V values from CP1.4-71-06L charts using parameter multipliers tabulated at right. Tc, Th and △T values apply universally to all modules.
3. Conversion To Partial (Fractional) Modules — Follow Step #2. Next, convert from full to partial module by applying Q and V multiplier listed in Module Specifications Tables, shown on opposite page. Example: See partial module number CP1.4-35-06L listed in Module Specification Table, also listed in Parameter Multipliers Table): Q and V MULTIPLIER = 35 thermocouples ÷ 71 thermocouples = 0.49 ≈ ½.

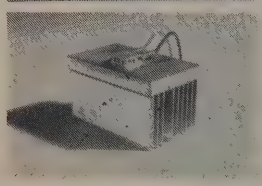


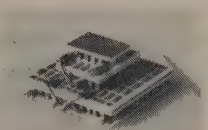



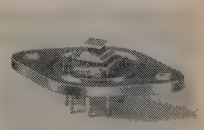




| MODULE NUMBER | MODULE TYPE | PARAMETER MULTIPLIERS (BASED ON CP 1.4-71-06L Graphs) I AMPS | Q WATTS | V VOLTS |
|---|---|---|---|---|
| CP 1.4-71-06L | FULL | 6/6= | 30/30= | 71/71= |
| | | 1,00 | 1,00 | 1.00 |
| CP 2-31-06L | FULL | 14/6= | 30/30= | 31/71= |
| | | 2,33 | 1,00 | 0,44 |
| CP 1.4-71-10L | FULL | 3,6/6= | 19/30= | 71/71= |
| | | 0,60 | 0,63 | 1,00 |
| CP 2-31-10L | FULL | 8,5/6= | 19/30= | 31/71= |
| | | 1,42 | 0,63 | 0,44 |
| CP 5-31-06L | FULL | 60/6= | 130/30= | 31/71= |
| | | 10,00 | 4,33 | 0,44 |
| CP 5-31-10L | FULL | 36/6= | 81/30= | 31/71= |
| | | 6,00 | 2,70 | 0,44 |
| CP 7-17-06L | FULL | 115/6= | 135/30= | 17/71= |
| | | 19,17 | 4,50 | 0,24 |
| CP 7-17-10L | FULL | 70/6= | 87/30= | 17/71= |
| | | 11,67 | 2,90 | 0,24 |
| FC 0.6-32-06L | FULL | 1,1/6= | 2,4/30= | 32/71= |
| | | 0,18 | 0,08 | 0,45 |
| FC 0.6-32-05L | FULL | 1,4/6= | 3,0/30= | 32/71= |
| | | 0,23 | 0,10 | 0,45 |
| FC 0.7-32-05L | FULL | 1,9/6= | 4,2/30= | 32/71= |
| | | 0,32 | 0,14 | 0,45 |
| CP 1.4-35-06L | PARTIAL | 6/6= | 35/71= | 35/71= |
| | | 1,00 | 0,49 | 0,49 |

## SPECIAL HEAT PUMP ASSEMBLIES







Special assemblies are available in O.E.M. quantities, designed to customer requirements, using heat exchangers furnished by customer or by Melcor. Multi-stage cascades also available in standard and custom configuration, with temperature differentials to 105°C (4 stage). Beryllia ceramic construction with solder interfacing between stages.

# Fans & Blowers

PAMOTOR
ONE OF THE PURDY GROUP OF COMPANIES

770 AIRPORT BOULEVARD, BURLINGAME, CALIFORNIA 94010 • TEL (415) 347-1203 • TWX 910-374-2353

## Pamotor Fans

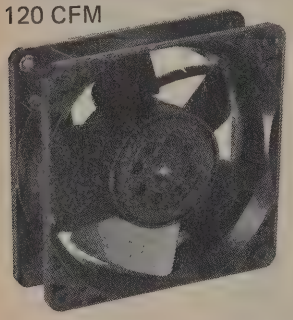
PAMOTOR offers a wide selection of cooling devices each designed to give you a maximum performance at minimum cost. As a result of many years of engineering excellence, PAMOTOR fans have earned a reputation for reliability, high quality and low noise operation. The unique PAMOTOR design, awarded numerous patents, is ounce-for-ounce the best investment for your cooling dollar.

All PAMOTOR fans are warranted to be free of defects in materials and workmanship for a period of one year. The PAMOTOR PENTAFLOW ™ premium grade series are warranted for five years.

Every model in the premium PENTAFLOW ™ series incorporates the seven basic points of superiority that are designed into all standard PAMOTOR fans: lightweight, durable all-metal construction .... high reliability .... low noise level .... low operation temperature .... optimized shape factor .... minimum electromagnetic field .... low true cost.

## 4600XP Pentaflow™ Premium Fan

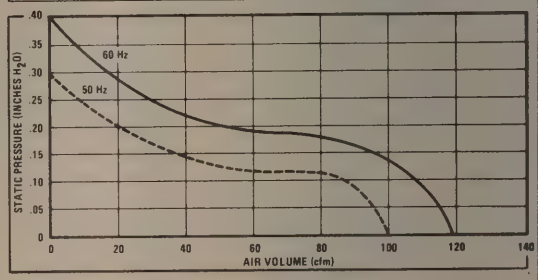
120 CFM



**Size:** 4½" Square x 1½" Deep
**Advantages:** Extra high airflow at maximum back pressure.
**Construction:** All-metal, shaded-pole motor, terminal block.
**Life:** 100,000 hours continuous at 25° C without maintenance.
**Max. Operating Temp.:** +55° C.
**Safety Codes:** UL recognized, Yellow Card E41168. CSA certified. Also conforms to IEC and VDE standards.

Fan accessories are available.

| Model Number | Sintered Iron Sleeve | Ball Bearing | Voltage (ac) | Frequency (Hz) | Input Power | Airflow (cfm) | Speed (rpm) | Weight (ounces) | Noise Level dB (A) | Noise Level dB (SIL) |
|---|---|---|---|---|---|---|---|---|---|---|
| 4600XP | X | | 115 | 50/60 | 18 W | 120 | 3100 | 18 | 46 | 34 |



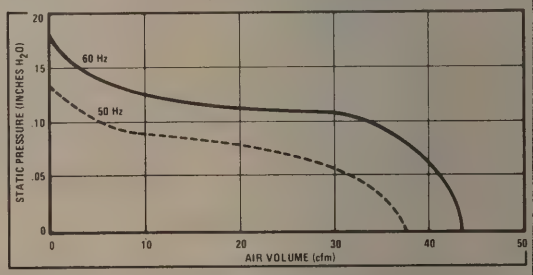

## 8500P Pentaflow™ Premium Fan

43 CFM

**Size:** 3-1/8" Square x 1½" Deep
**Advantages:** Compact high airflow, low noise.
**Construction:** All-metal, shaded-pole motor, 12" leads.
**Life:** 100,000 hours continuous at 25° C without maintenance.
**Max. Operating Temp.:** +55° C.
**Safety Codes:** UL recognized, Yellow Card E41168. CSA certified. Also conforms to IEC and VDE standards.

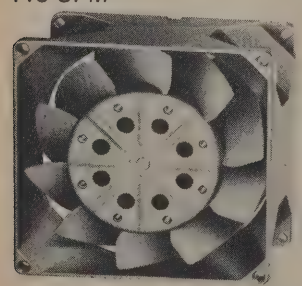
Fan accessories are available.

| Model Number | Sintered Iron Sleeve | Ball Bearing | Voltage (ac) | Frequency (Hz) | Input Power | Airflow (cfm) | Speed (rpm) | Weight (ounces) | Noise Level dB (A) | Noise Level dB (SIL) |
|---|---|---|---|---|---|---|---|---|---|---|
| 8500P | X | | 115 | 50/60 | 13 W | 43 | 3200 | 18 | 38 | 22.3 |




## 2500S Series Shaded Pole Fans

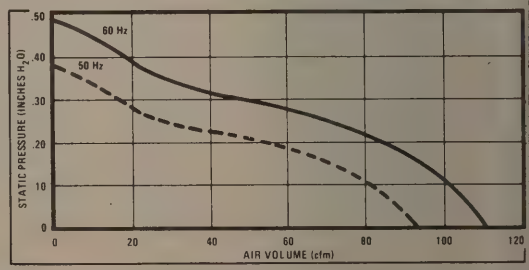
115 CFM



**Size:** 4½" Square x 2" Deep
**Advantages:** Powerful, concentrated air stream, high cooling capacity.
**Construction:** All-metal, shaded-pole motor, 12" leads.
**Life:** 100,000 hours continuous at 25° C without maintenance.
**Max. Operating Temp.:** +55° C.
**Safety Codes:** UL recognized, Yellow Card E41168. CSA certified. Also conforms to IEC and VDE standards.

Fan accessories are available.

| Model Number | Sintered Iron Sleeve | Ball Bearing | Voltage (ac) | Frequency (Hz) | Input Power | Airflow (cfm) | Speed (rpm) | Weight (ounces) | Noise Level dB (A) | Noise Level dB (SIL) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2500S | X | | 115 | 50/60 | 27 W | 115 | 3300 | 32 | 53 | 37.5 |
| 2550S | X | | 230 | 50/60 | 27 W | 115 | 3300 | 32 | 53 | 37.5 |



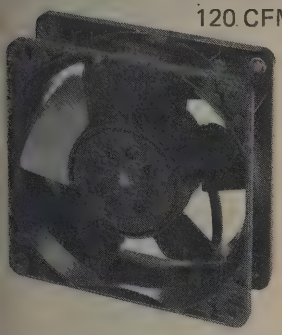
# Fans & Blowers

PAMOTOR
ONE OF THE PURDY GROUP OF COMPANIES

770 AIRPORT BOULEVARD, BURLINGAME, CALIFORNIA 94010 • TEL (415) 347-1203 • TWX 910-374-2353

## 4600X Series Shaded Pole Fans

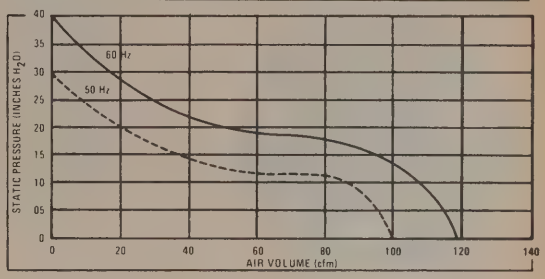
120 CFM



**Size:** 4½" Square x 1½" Deep
**Advantages:** Extra high airflow at maximum back pressures.
**Construction:** All-metal, shaded-pole motor, terminal block.
**Life:** 100,000 hours continuous at 25° C without maintenance.
**Max. Operating Temp.:** +55° C (*+85° C).
**Safety Codes:** UL recognized, Yellow Card E41168. CSA certified and VDE approved. Also conforms to IEC standards.

Fan accessories are available.

| Model Number | Sintered Iron Sleeve | Ball Bearing | Voltage (ac) | Frequency (Hz) | Input Power | Airflow (cfm) | Speed (rpm) | Weight (ounces) | Noise Level dB (A) | Noise Level dB (SIL) |
|---|---|---|---|---|---|---|---|---|---|---|
| 4600X | X | | 115 | 50/60 | 18 W | 120 | 3100 | 18 | 46 | 34 |
| 4606X* | | X | 115 | 50/60 | 18 W | 120 | 3100 | 18 | 47 | 35 |
| 4650X | X | | 230 | 50/60 | 18 W | 120 | 3100 | 18 | 46 | 34 |
| 4656X* | | X | 230 | 50/60 | 18 W | 120 | 3100 | 18 | 47 | 35 |



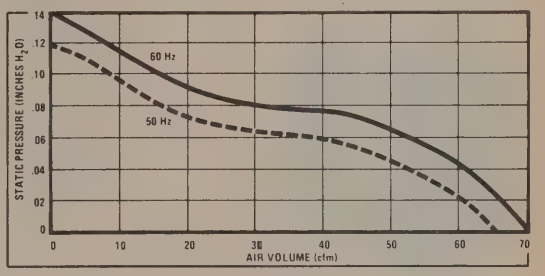

## 4800X Series Shaded Pole Fans

70 CFM

**Size:** 4½" Square x 1½" Deep
**Advantages:** The quietest of fans in this size.
**Construction:** All-metal, shaded-pole motor, terminal block.
**Life:** 100,000 hours continuous at 25° C without maintenance.
**Max. Operating Temp.:** +55° C.
**Safety Codes:** UL recognized, Yellow Card E41168. CSA certified and VDE approved. Also conforms to IEC standards.

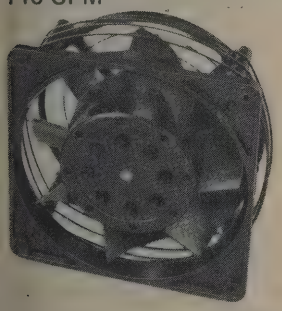
Fan accessories are available.

| Model Number | Sintered Iron Sleeve | Ball Bearing | Voltage (ac) | Frequency (Hz) | Input Power | Airflow (cfm) | Speed (rpm) | Weight (ounces) | Noise Level dB (A) | Noise Level dB (SIL) |
|---|---|---|---|---|---|---|---|---|---|---|
| 4800X | X | | 115 | 50/60 | 10 W | 70 | 1900 | 18 | 32 | 21 |
| 4850X | X | | 230 | 50/60 | 10 W | 70 | 1900 | 18 | 32 | 21 |




## 5500S Series Shaded Pole Fans

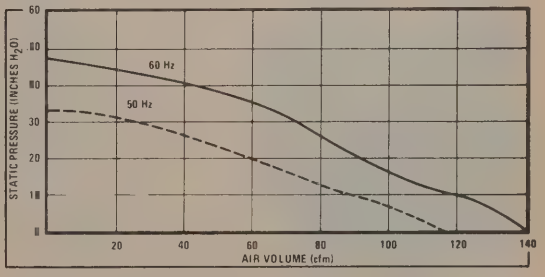
140 CFM



**Size:** 4½" Square x 2" Deep
**Advantages:** Axial and radial air entry for use in high density cooling applications, built-in finger guard.
**Construction:** All-metal, shaded-pole motor, 12" leads.
**Life:** 100,000 hours continuous at 25° C without maintenance.
**Max. Operating Temp.:** +55° C.
**Safety Codes:** UL recognized, Yellow Card E41168. CSA certified. Also conforms to IEC and VDE standards.

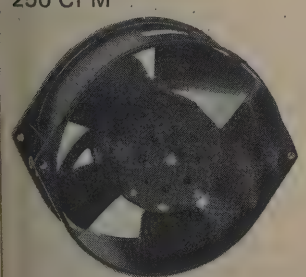
Fan accessories are available.

| Model Number | Sintered Iron Sleeve | Ball Bearing | Voltage (ac) | Frequency (Hz) | Input Power | Airflow (cfm) | Speed (rpm) | Weight (ounces) | Noise Level dB (A) | Noise Level dB (SIL) |
|---|---|---|---|---|---|---|---|---|---|---|
| 5500S | X | | 115 | 50/60 | 40 W | 140 | 3300 | 35 | 50 | 37 |
| 5550S | X | | 230 | 50/60 | 38 W | 140 | 3300 | 35 | 50 | 37 |




## 7600S Series Shaded Pole Fans

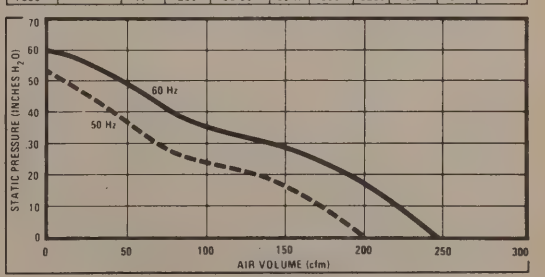
250 CFM



**Size:** 6" Diameter x 2" Deep
**Advantages:** High airflow, excellent back pressures.
**Construction:** All-metal, shaded-pole motor, 12" leads.
**Life:** 100,000 hours continuous at 25° C without maintenance.
**Max. Operating Temp.:** +55° C (*+85° C).
**Safety Codes:** UL recognized, Yellow Card E41168. CSA certified. Also conforms to IEC and VDE standards.

Fan accessories are available.

| Model Number | Sintered Iron Sleeve | Ball Bearing | Voltage (ac) | Frequency (Hz) | Input Power | Airflow (cfm) | Speed (rpm) | Weight (ounces) | Noise Level dB (A) | Noise Level dB (SIL) |
|---|---|---|---|---|---|---|---|---|---|---|
| 7600S | X | | 115 | 50/60 | 38 W | 250 | 3200 | 38 | 54 | 40 |
| 7606* | | X | 115 | 50/60 | 38 W | 250 | 3200 | 38 | 54 | 41 |
| 7650S | X | | 230 | 50/60 | 38 W | 250 | 3200 | 38 | 54 | 40 |
| 7656* | | X | 230 | 50/60 | 38 W | 250 | 3200 | 38 | 54 | 41 |



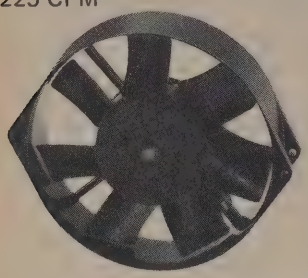
# Fans & Blowers

PAMOTOR
ONE OF THE PURDY GROUP OF COMPANIES

770 AIRPORT BOULEVARD, BURLINGAME, CALIFORNIA 94010 • TEL (415) 347-1203 • TWX 910-374-2353

## 7900S Series Shaded Pole Fans

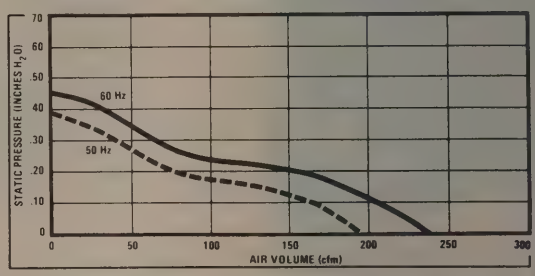
225 CFM



**Size:** 6" Diameter x 1½" Deep
**Advantages:** Minimum depth, high airflow, low noise in operating modes.
**Construction:** All-metal, shaded-pole motor, 12" leads.
**Life:** 100,000 hours continuous at 25° C without maintenance.
**Max. Operating Temp.:** +55° C.
**Safety Codes:** UL recognized, Yellow Card E41168. CSA certified. Also conforms to IEC and VDE standards.

Fan Accessories are available.

| Model Number | Sintered Iron Sleeve | Ball Bearing | Voltage (ac) | Frequency (Hz) | Input Power | Airflow (cfm) | Speed (rpm) | Weight (ounces) | Noise Level dB (A) | Noise Level dB (SIL) |
|---|---|---|---|---|---|---|---|---|---|---|
| 7900S | X | | 115 | 50/60 | 41 W | 225 | 2900 | 27 | 58 | 47 |
| 7950S | X | | 230 | 50/60 | 40.5 W | 225 | 2900 | 27 | 58 | 47 |



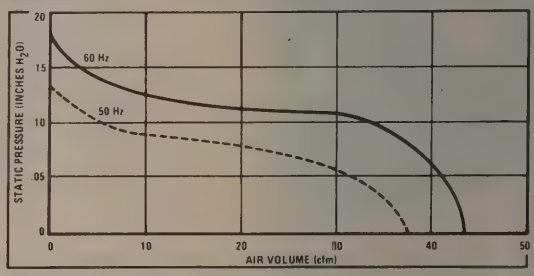

## 8500C Series Shaded Pole Fans

43 CFM

**Size:** 3-1/8" Square x 1½" Deep
**Advantages:** Compact, high airflow, low noise.
**Construction:** All-metal, shaded-pole motor, 12" leads.
**Life:** 100,000 hours continuous at 25° C without maintenance.
**Max. Operating Temp.:** +55° C (*+85° C).
**Safety Codes:** UL recognized, Yellow Card E41168. CSA certified and VDE approved. Also conforms to IEC standards.

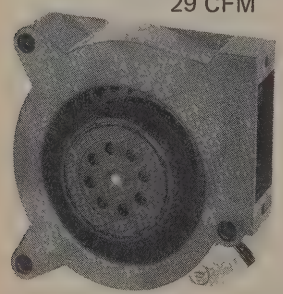
Fan accessories are available.

| Model Number | Sintered Iron Sleeve | Ball Bearing | Voltage (ac) | Frequency (Hz) | Input Power | Airflow (cfm) | Speed (rpm) | Weight (ounces) | Noise Level dB (A) | Noise Level dB (SIL) |
|---|---|---|---|---|---|---|---|---|---|---|
| 8500C | X | | 115 | 50/60 | 13 W | 43 | 3200 | 18 | 38 | 22.3 |
| 8506* | | X | 115 | 50/60 | 13 W | 43 | 3200 | 18 | 39 | 23 |
| 8550C | X | | 230 | 50/60 | 13 W | 43 | 3200 | 18 | 38 | 22.3 |
| 8556* | | X | 230 | 50/60 | 13 W | 43 | 3200 | 18 | 39 | 23 |



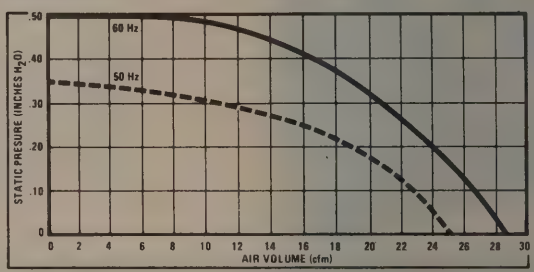

## RL90-18 Series Radial Blowers

29 CFM



**Size:** 4-3/4" Square x 1½" Deep
**Advantages:** High concentrated airflow at maximum pressures, low acoustical disturbance, perfect for spot cooling.
**Construction:** Makrolon housing, ultramid wheel, shaded-pole motor, 12" leads.
**Life:** 100,000 hours continuous at 25° C without maintenance.
**Max. Operating Temp.:** +55° C.
**Safety Codes:** UL recognized, Yellow Card E41168. Also conforms to CSA, IEC and VDE standards.

| Model Number | Sintered Iron Sleeve | Ball Bearing | Voltage (ac) | Frequency (Hz) | Input Power | Airflow (cfm) | Speed (rpm) | Weight (ounces) | Noise Level dB (A) | Noise Level dB (SIL) |
|---|---|---|---|---|---|---|---|---|---|---|
| RL90-18/00 | X | | 115 | 50/60 | 21 W | 29 | 2700 | 23 | 57 | 42.7 |
| RL90-18/50 | X | | 230 | 50/60 | 19 W | 29 | 2600 | 23 | 57 | 42.7 |




The PAMOTOR solid state brushless DC Fans have been engineered to tackle those specialized applications which require highly reliable DC performance. Especially efficient, they out-perform similar sized fans at normal operating back pressure and offer greater air volume (CFM) as well as reduced noise levels and power drain. (The power drain at maximum back pressure is approximately 20% of that required in conventional AC units.) These fans also achieve a new low in magnetic radiation and RF noise, thereby assuring the pure signals necessary for critical airborne and shipboard use.

These fans do not require an external voltage inverter. This means that you save valuable mounting space and weight because the only consideration in mounting is the fan itself.

The brushless DC motor is polarity protected to avoid accidental damage and costly down time.

Available voltage ranges include: 9.5 to 14 VDC (12 VDC nominal); 19 to 28 VDC (24 VDC nominal); and 38 to 56 VDC (48 VDC nominal).

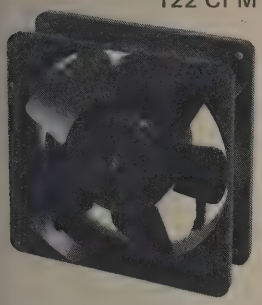
# Fans & Blowers

PAMOTOR
ONE OF THE PURDY GROUP OF COMPANIES

770 AIRPORT BOULEVARD, BURLINGAME, CALIFORNIA 94010 • TEL (415) 347-1203 • TWX 910-374-2353

## Model 4112X DC Fan

122 CFM (variable)

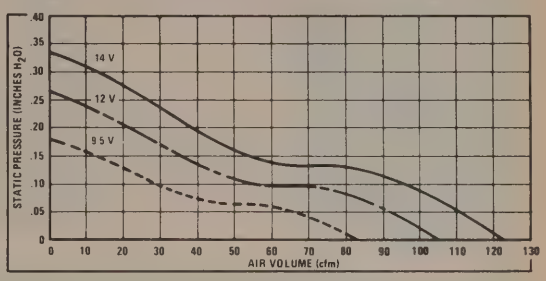


**Size:** 4½" Square x 1½" Deep
**Advantages:** Solid state integral electronics, no external inverter required, low input power, high variable airflow, locked rotor and polarity protected.
**Construction:** All-metal, brushless electronic motor, terminal block.
**Life:** 100,000 hours continuous at 25° C without maintenance.
**Max. Operating Temp.:** +80° C.
**Safety Codes:** Conforms to UL, CSA, IEC and VDE standards.

Fan accessories are available.

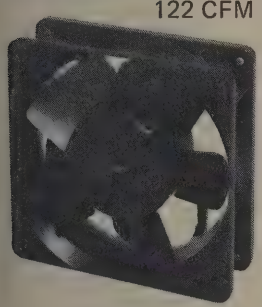
Patent No. 3-873-897

| Model Number | Sintered Iron Sleeve | Ball Bearing | Voltage (dc) | Input Current | Input Power | Airflow (cfm) | Speed (rpm) | Weight (ounces) | Noise Level dB (A) | Noise Level dB (SIL) |
|---|---|---|---|---|---|---|---|---|---|---|
| 4112X | | X | 9.5 - 14 12 Nominal | 330 mA | 4 W | 106 | 2775 | 21 | 44 | 32.9 |




## Model 4124X DC Fan

122 CFM (variable)

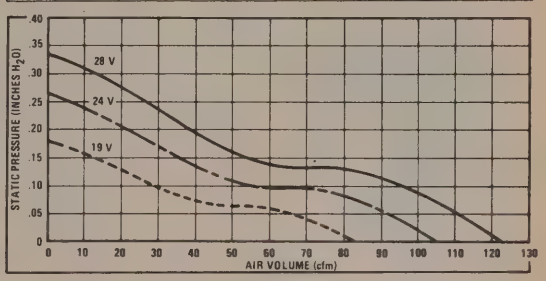


**Size:** 4½" Square x 1½" Deep
**Advantages:** Solid state integral electronics, no external inverter required, low input power, high variable airflow, locked rotor and polarity protected.
**Construction:** All-metal, brushless electronic motor, terminal block.
**Life:** 100,000 hours continuous at 25° C without maintenance.
**Max. Operating Temp.:** +80° C.
**Safety Codes:** UL recognized, Yellow Card E41168. Also conforms to CSA, IEC and VDE standards.

Fan accessories are available.

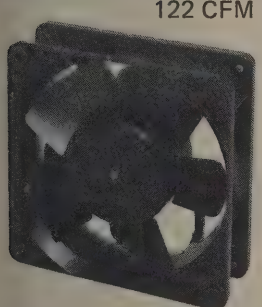
Patent No. 3-873-897

| Model Number | Sintered Iron Sleeve | Ball Bearing | Voltage (dc) | Input Current | Input Power | Airflow (cfm) | Speed (rpm) | Weight (ounces) | Noise Level dB (A) | Noise Level dB (SIL) |
|---|---|---|---|---|---|---|---|---|---|---|
| 4124X | | X | 19 - 28 24 Nominal | 170 mA | 4.1 W | 106 | 2775 | 21 | 44 | 32.9 |




## Model 4148X DC Fan

122 CFM (variable)

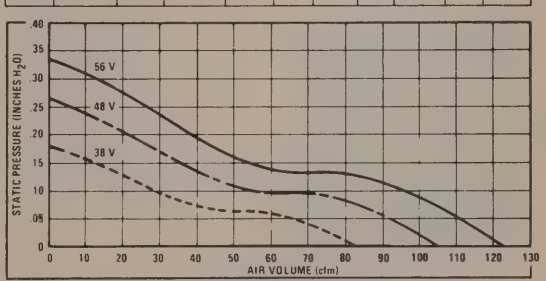


**Size:** 4½" Square x 1½" Deep
**Advantages:** Solid state integral electronics, no external inverter required. low input power, high variable airflow, locked rotor and polarity protected.
**Construction:** All-metal, brushless electronic motor, terminal block.
**Life:** 100,000 hours continuous at 25° C without maintenance.
**Max. Operating Temp.:** +80° C.
**Safety Codes:** Conforms to UL, CSA, IEC and VDE standards.

Fan accessories are available.

Patent No. 3-873-897

| Model Number | Sintered Iron Sleeve | Ball Bearing | Voltage (dc) | Input Current | Input Power | Airflow (cfm) | Speed (rpm) | Weight (ounces) | Noise Level dB (A) | Noise Level dB (SIL) |
|---|---|---|---|---|---|---|---|---|---|---|
| 4148X | | X | 38 56 48 Nominal | 85 mA | 4.1 W | 106 | 2775 | 21 | 44 | 32.9 |




## Models 8112 & 8124 DC Fans

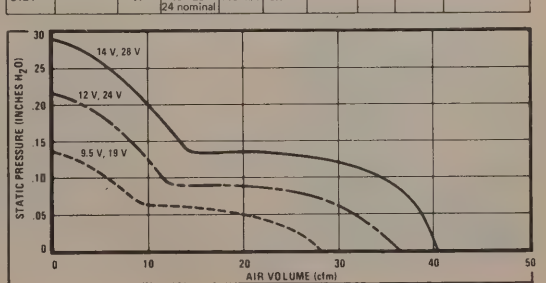
41 CFM (variable)

**Size:** 3-1/8" Square x 1½" Deep
**Advantages:** Solid state integral electronics, no external inverter required, low input power, high variable airflow, locked rotor and polarity protected.
**Construction:** All-metal brushless electronic motor, 12" leads.
**Life:** 100,000 hours continuous at 25° C without maintenance.
**Max. Operating Temp.:** +80° C.
**Safety Codes, Model 8112:** Conforms to UL, CSA, IEC and VDE standards. **Model 8124:** UL recognized, Yellow Card E41168. Also conforms to CSA, IEC and VDE standards.

Fan accessories are available.

Patent No. 3-873-897

| Model Number | Sintered Iron Sleeve | Ball Bearing | Voltage (dc) | Input Current | Input Power | Airflow (cfm) | Speed (rpm) | Weight (ounces) | Noise Level dB (A) | Noise Level dB (SIL) |
|---|---|---|---|---|---|---|---|---|---|---|
| 8112 | | X | 9.5 - 14 12 nominal | 230 mA | 4 W | 37 | 3225 | 19 | 37 | 27.9 |
| 8124 | | X | 19 - 28 24 nominal | 115 mA | 2.8 W | 37 | 3225 | 19 | 37 | 27.9 |



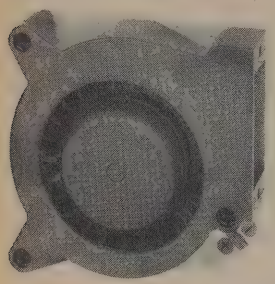
# Fans & Blowers

PAMOTOR
ONE OF THE PURDY GROUP OF COMPANIES

770 AIRPORT BOULEVARD, BURLINGAME, CALIFORNIA 94010 • TEL (415) 347-1203 • TWX 910-374-2353

## RL90-18/24 DC Radial Blower

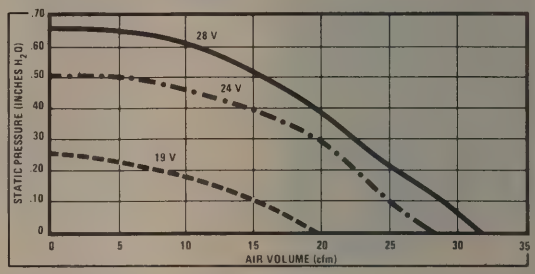
31 CFM (variable)



**Size:** 4-3/4" Square x 1½" Deep
**Advantages:** Solid state integral electronics, no external inverter required, low input power, high concentrated variable airflow, locked rotor and polarity protected.
**Construction:** Makrolon housing, ultramid wheel, brushless electronic motor, 12" leads.
**Life:** 100,000 hours continuous at 25° C without maintenance.
**Max. Operating Temp.:** +80° C.
**Safety Codes:** UL recognized, Yellow Card E41168. Also conforms to CSA, IEC and VDE standards.

Patent No. 3-873-897

| Model Number | Sintered Iron Sleeve | Ball Bearing | Voltage (dc) | Input Current | Input Power | Airflow (cfm) | Speed (rpm) | Weight (ounces) | Noise Level dB (A) | Noise Level dB (SIL) |
|---|---|---|---|---|---|---|---|---|---|---|
| RL90-18/24 | | X | 19 - 28 24 Nominal | 235 mA | 5 W | 28 | 2500 | 22 | 56 | 44.9 |

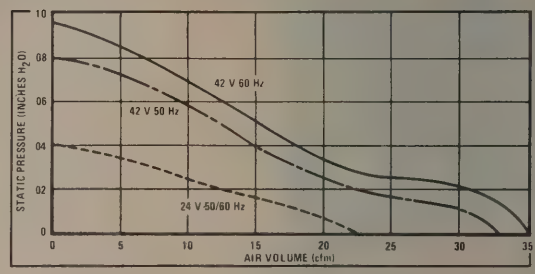



## Model 900 Induction Fan

34 CFM (variable)

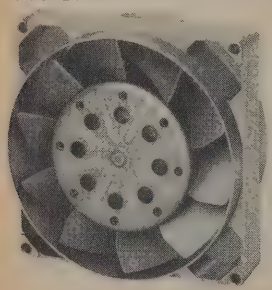
**Size:** 3-1/8" Diameter x 1½" Deep
**Advantages:** Ultra compact - little mounting space required, very quiet, variable airflow, extremely low stray field, axial and radial air entry.
**Construction:** Special polyamid, induction motor, 6" leads.
**Life:** 100,000 hours continuous at 25° C without maintenance.
**Max. Operating Temp.:** +55° C.
**Safety Codes:** UL recognized, Yellow Card E41168. Also conforms to CSA, IEC and VDE standards.
**Capacitor Required:** 5.6 mfd.

| Model Number | Sintered Iron Sleeve | Ball Bearing | Voltage (ac) | Frequency (Hz) | Input Power | Airflow (cfm) | Speed (rpm) | Weight (ounces) | Noise Level dB (A) | Noise Level dB (SIL) |
|---|---|---|---|---|---|---|---|---|---|---|
| 900 | X | | 24 - 42 | 50/60 | 2 3 W | 34 | 1700 | 4 | 22 | 16.8 |




## Model 1300 Induction Fan

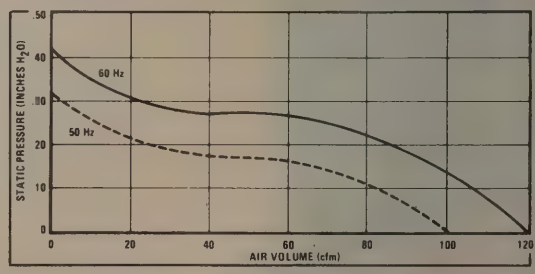
120 CFM



**Size:** 4½" Square x 2" Deep
**Advantages:** Compact, stable airflow and back pressures, ideal for tube mounting.
**Construction:** All-metal, induction motor, 3" leads.
**Life:** 100,000 hours continuous at 25° C without maintenance.
**Max. Operating Temp.:** +55° C.
**Safety Codes:** Conforms to UL, CSA, IEC and VDE standards.
**Capacitor Required:** 2 mfd.

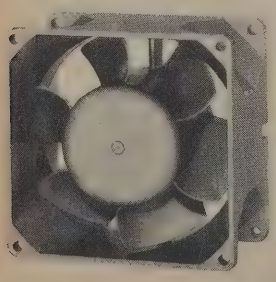
Fan accessories are available.

| Model Number | Sintered Iron Sleeve | Ball Bearing | Voltage (ac) | Frequency (Hz) | Input Power | Airflow (cfm) | Speed (rpm) | Weight (ounces) | Noise Level dB (A) | Noise Level dB (SIL) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1300 | X | | 230 | 50/60 | 25 W | 120 | 3400 | 42 | 52 | 37 6 |



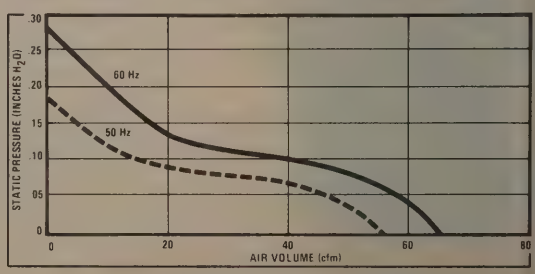

## 3000 Series Induction Fans

65 CFM



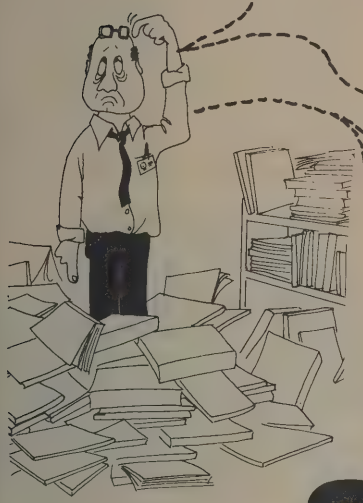
**Size:** 3½" Square x 2" Deep
**Advantages:** Highest airflow for size, low noise.
**Construction:** All-metal, induction motor, 6" leads.
**Life:** 100,000 hours continuous at 25° C without maintenance.
**Max. Operating Temp.:** +55° C.
**Safety Codes:** UL recognized, Yellow Card E41168. CSA Certified. Also conforms to IEC and VDE standards.
**Capacitor Required:** 4 mfd.

| Model Number | Sintered Iron Sleeve | Ball Bearing | Voltage (ac) | Frequency (Hz) | Input Power | Airflow (cfm) | Speed (rpm) | Weight (ounces) | Noise Level dB (A) | Noise Level dB (SIL) |
|---|---|---|---|---|---|---|---|---|---|---|
| 3000 | X | | 115 | 50/60 | 15 W | 65 | 3180 | 19 | 46 | 29.3 |
| 3050U | X | | 230 | 50/60 | 15 W | 65 | 3150 | 19 | 46 | 29.3 |



***What can I use to keep all the manufacturers' product data I receive in order?***

***What system makes filing or retrieving manufacturers' catalogs fast and easy?***



***Which file system have thousands of engineers purchased because they know it works?***

# eem FILE SYSTEM

## THE ONLY FILE SYSTEM DESIGNED SPECIALLY FOR THE ELECTRONIC ENGINEER!

The publishers of **eem** have put together a unique filing system for electronic product information. The complete system includes: a product index booklet which classifies electronic products into 3,000 listings both alphabetically and by product group, and 45 file folders imprinted with the **eem** product sections (extra gummed labels included for expanding the system.)

As you receive manufacturers' catalog data sheets, technical bulletins, or clip magazine articles, jot down the proper Product Section Numbers from the **eem** PRODUCT-TO-SECTION INDEX. Then simply file in order. When you require information on a specific product, refer to PRODUCT-TO-SECTION INDEX again to locate the correct file folder. It's simple, and you'll always have the necessary data to compare, specify and buy, right at your fingertips.

**Here's how to order your eem FILE SYSTEM:**

For the complete system send $10 (plus tax; N.Y., 8%, CA, 6½%) in check or money order to:

United Technical Publications, Inc.,
645 Stewart Avenue, Garden City, N.Y. 11530
Att: Circulation dept.

For an **eem FILE SYSTEM** without file folders send $7.50 (plus tax; N.Y. 8%; CA, 6½%).

*UNITED TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500*

# Rotron Fans and Blowers

ROTRON INC. Woodstock, N. Y. 12498 ☐ 914 • 679-2401 ☐ TWX 510-247-9033

## Muffin® Fan

**The dependable, low cost, largest selling fan for commercial cooling applications.**

- 105 cfm (49.6 L/Sec) free air delivery
- 4.71″ sq. x 1.50″ depth (119.6 mm x 38.1 mm)
- weight: 17.2 oz. (0.49 kg)
- acoustical rating as low as NC-43
- more than 10 years continuous duty at 20°C
- impedance protected
- for ambients to 70°C
- UL yellow card recognized and CSA certified

Catalog Sheet COM 040

## Whisper® Fan

**The quiet one-for efficient cooling where low acoustical disturbance is a must.**

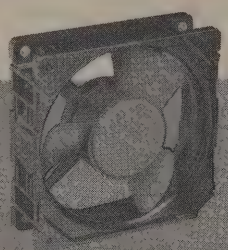
- 52 to 75 cfm (24.5 to 35.4 L/Sec) free air delivery
- 4.71″ sq. x 1.50″ depth (119.6 mm x 38.1 mm)
- weight: 17.2 oz. (0.49 kg)
- acoustical rating as low as NC-26
- 10 years continuous duty at 20°C
- impedance protected
- for ambients to 70°C
- UL yellow card recognized and CSA certified

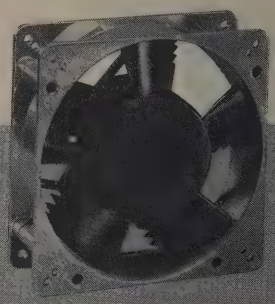
Catalog Sheet COM 050

## Mohawk™ Fan

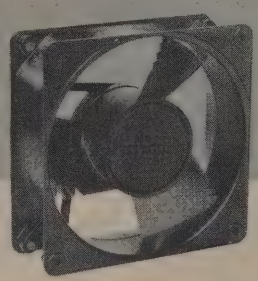
**Highest air flow, quietest performance for 5¼″ (133.3 mm) rack mounted equipment.**

- 127 cfm (59.9 L/Sec)
- 5.06″ sq. x 1.53″ depth (128.5 mm x 38.8 mm)
- weight: 22 oz. (0.73 kg)
- all metal housing
- exclusive Feathered Edge™ blade for low noise level operation, as low as NC-45
- slow speed 100 cfm (47.2 L/Sec) model for noise levels as low as NC-42
- noise attenuator accessory provides even further noise reduction of 5 dB
- impedance protected
- for ambients to 70°C
- UL component recognition and CSA certification applied for





FOR COMMERCIAL APPLICATIONS



### Commercial Products Safety Agency Acceptances

1. UL component recognition file no. E 31293
2. CSA Certification file no. LR 20495
3. Plug & Cord accessories listed under UL file no. E 42397
4. All models 100% tested to meet 1500 VAC dielectric strength for one minute (production line equivalent 1800 VAC for 1 second)

## Muffin® XL Fan

**Sturdy one-piece metal venturi provides popular mounting and terminal configurations of Centaur fan. High performance and low noise level, with Muffin reliability.**

- 115 cfm (54.3 L/Sec) free air delivery
- 4.69″ sq. x 1.54″ depth (119.1 mm x 39.1 mm)
- weight: 21 oz. (0.61 kg.)
- convenient ground lug bosses
- Feathered Edge™ airfoil blades for quietest operation
- available in two flow directions, air over struts or air over blades first
- impedance protected
- for ambients to 70°C
- UL yellow card recognized

Catalog Sheet COM 043

# Rotron Fans and Blowers

ROTRON INC. Woodstock, N. Y. 12498 ☐ 914 • 679-2401 ☐ TWX 510-247-9033

## Lyric® Fan

**Thinness and low noise level are features that make this small fan the ideal choice for computer terminals.**

- 31 cfm (14.63 L/Sec) free air delivery
- 3.14″ sq. x 1.38″ depth (79.75 mm x 35.05 mm)
- weight: 15 oz. (0.43 kg)
- rugged die cast zinc housing
- acoustical rating as low as NC-35
- leadwire and terminal models
- impedance protected
- for ambients to 70°C
- UL yellow card recognized

## Sprite® Fan

**A smaller size fan that delivers relatively high pressures at close-to-maximum air delivery.**

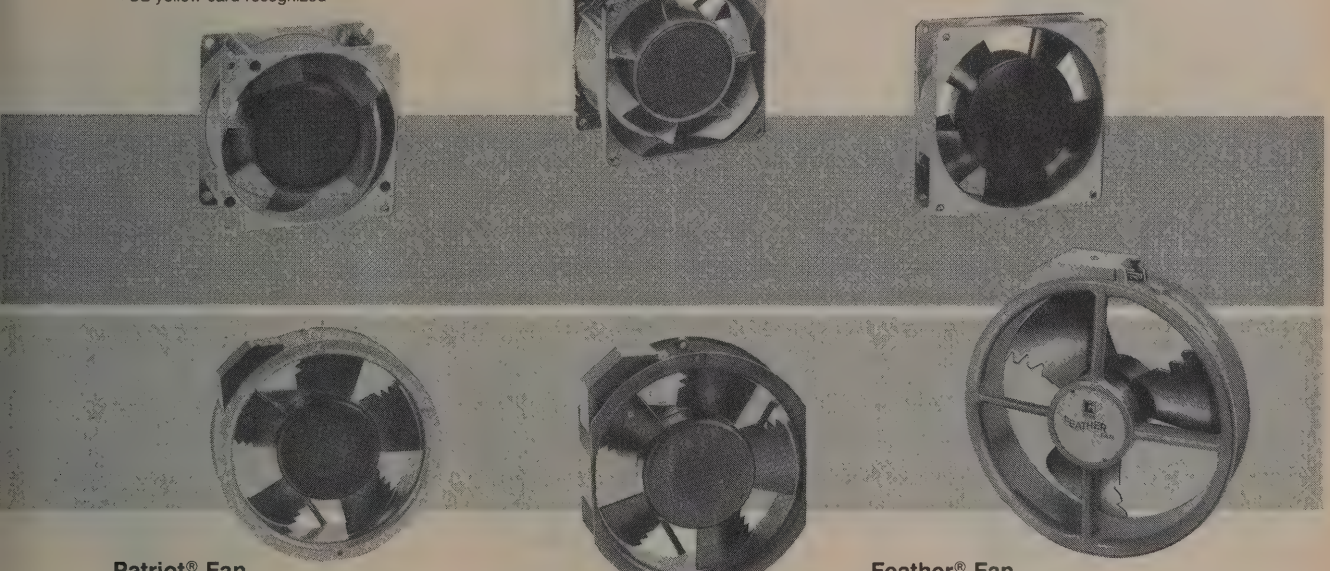
- 35 cfm (16.5 L/Sec) free air delivery
- 3.14″ sq. x 1.64″ depth (79.2 mm x 41.7 mm)
- weight: 18 oz. (.51 kg)
- famous Muffin motor reliability
- acoustical rating as low as NC-28
- rugged die-cast zinc housing
- impedance protected
- for ambients to 70°C
- UL yellow card recognized and CSA certified
- Lead wire and terminal models

Catalog Sheet COM 030

## Wafer Fan

**1″ (25.4 mm) thickness and low noise level for cooling applications in tight spots in equipment used near operators.**

- 37 cfm (17.5 L/Sec) free air delivery
- 3.63″ sq. x 1″ depth (92.2 mm x 25.4 mm)
- weight: 10 oz. (0.28 kg)
- acoustical rating as low as NC-41
- one-piece die-cast zinc housing
- impedance protected
- for ambients to 55°C
- UL yellow card recognized



## Patriot® Fan

**Quiet high pressure performance in a compact rugged fan.**

- 240 cfm (113.3 L/Sec) free air delivery
- 6.75″ dia. x 2″ depth (171.5 mm x 50.8 mm)
- weight: 1.84 lbs. (0.84 kg)
- acoustical rating as low as NC-47
- one-piece die-cast aluminum housing
- long life ball bearings
- permanent split capacitor motor, capacitor provided
- for ambients to 70°C
- UL yellow card recognized

Catalog Sheet COM 083

## Major® Fan

**For low cost, low noise, high pressure/volume cooling in the tightest of spaces.**

- 240 cfm (113.3 L/Sec) free air delivery
- 6.75″ x 5.92″ x 2.00″ depth (171.5 mm x 150.4 mm x 50.8 mm)
- weight: 1.84 lbs. (0.84 kg)
- acoustical rating as low as NC-53
- one-piece die-cast aluminum housing
- long life ball bearings
- thermally protected
- for ambients to 70°C
- permanent split capacitor motor, capacitor provided
- UL yellow card recognized

Catalog Sheet COM 080

## Feather® Fan

**High volume air performance where space is severely limited, particularly in depth.**

- 270 cfm (127.4 L/Sec) free air delivery
- 7″ dia. x 2.47″ depth (177.8 mm x 62.7 mm)
- weight: 1.5 lbs. (0.68 kg)
- exclusive new Feathered Edge™ blade is extra quiet at free delivery, NC-48
- permanently lubricated ball bearings
- permanent split capacitor motor, capacitor provided
- for ambients to 65°C
- UL yellow card recognized

Catalog Sheet COM 090

# Rotron Fans and Blowers

ROTRON INCORPORATED

**ROTRON INC.** Woodstock, N. Y. 12498 ☐ 914 • 679-2401 ☐ TWX 510-247-9033

## Scout™ Fan

**Versatile, compact line of fans for applications demanding packaging in the tightest spots. Available with 3 impeller options, for use with customer designed air passages.**

- 25 to 105 (11.8 to 49.6 L/Sec) free air delivery
- 1.6″ (40.64 mm) depth, impeller dia. 2.93″ to 4.19″ (74.42 to 106.4 mm)
- weight: 12 oz. (0.34 kg)
- acoustical rating dependent on application, maximum NC-45
- famous Muffin motor reliability
- impedance protected
- for ambients to 70°C
- UL yellow card recognized

## Biscuit® Blower

**The only air moving device that fits inside a 1¾″ rack panel mounted instrument.**

- 25 cfm (11.8 L/Sec) free air delivery
- high pressure capability
- built around famous Muffin fan features
- 4.75″ sq. x 1.56″ depth (120.65 mm x 39.7 mm)
- weight: 19 oz. (.54 kg)
- acoustical rating as low as NC-42
- for ambients to 70°C
- UL yellow card recognized

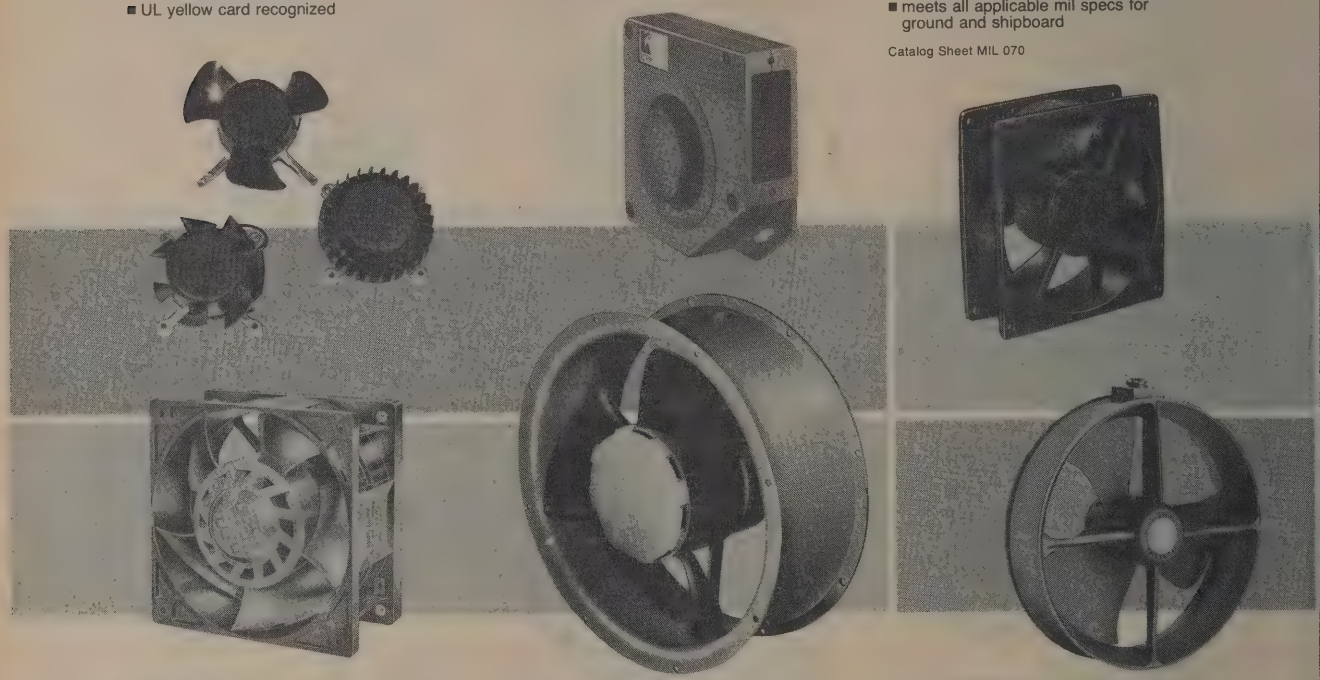
Catalog Sheet COM 130

## Spartan Fan

**The MIL SPEC version of the famous Muffin.**

- 113 cfm (53.3 L/Sec) free air delivery. 132 cfm (62.30 L/Sec) for 400 Hz model
- unusually high pressure characteristics (up to 6.85″ [174 mm] $H_2O$)
- dimensionally interchangeable with the Muffin fan (4.71″ sq. x 1.50″ [119.6 mm x 38 1 mm])
- double shielded stainless steel ball bearings
- lubricated for life
- highly efficient multi-slot motor
- withstands ambients from −60°F (−54°C) to +212°F (+100°C)
- venturi, spiders, and hub are single aluminum casting for shock and vibration resistance
- meets all applicable mil specs for ground and shipboard

Catalog Sheet MIL 070



## Tarzan® Fan

**High air volume and pressure combined, for tightly packed cabinets and chassis.**

- 340 cfm (160.5 L/Sec) free air delivery
- 6.91″ sq. x 4.34″ depth (175.5 mm x 110.2 mm)
- weight: 5 lbs. (2.26 kg)
- acoustical rating as low as NC-57
- ball bearing thermally protected motor
- for ambients to 55°C
- centrifugal blower performance in a compact axial flow fan
- UL yellow card recognized and CSA certified

Catalog Sheet COM 120

## Caravel® Fan

**Maximum air volume, from a narrow fan, for flushing large racks and cabinets.**

- 590 cfm (278.5 L/Sec) free air delivery
- 10″ dia. x 3.5″ depth (254 mm x 88.9 mm)
- weight: 4.4 lbs. (1.99 kg)
- ball bearing thermally protected slow speed motor
- exclusive new Feathered Edge™ (pat. pend.) blade for low noise level operation
- acoustical rating as low as NC-45
- for ambients to 60°C
- UL yellow card recognized and CSA certified

Catalog Sheet COM 110

## Saucer® Fan

**High volume and high pressure both, from a minimum of fan space.**

- 275 cfm (129.8 L/Sec) free air delivery
- generates pressures up to .5″ (12.7 mm) $H_2O$
- driving motor entirely within hub for minimum depth 2.50″ (63.5 mm), dia. 7″ (177.8 mm)
- pre-lubricated stainless steel ball bearings
- for ambients from −60°F (−54°C) to +257°F (+125°C)
- clamping rings at venturi ends for easy mounting
- meets all applicable military specifications

Catalog Sheet MIL 080

# Rotron Fans and Blowers

ROTRON INC. Woodstock, N. Y. 12498 ☐ 914 • 679-2401 ☐ TWX 510-247-9033

## Aximax® 1, 2 & 3

**Family of miniature, high performance air movers for airborne and other critical space/weight/performance applications.**

- free air delivery from 11 cfm to 157 cfm (5.2 to 74.1 L/Sec)
- optional Altivar® motors automatically increase speed with altitude
- life expectancies from 10,000 hours at 72°C, at 22,000 RPM
- withstands ambients up to 257°F (125°C)
- sizes: 1½″ x 1½″ (38.1 mm x 38.1 mm), 2″ x 1½″ (50.8 mm x 38.1 mm), and 3″ x 2⅝″ (76.2 mm x 58.7 mm)
- weight: 4 oz. (113 grams), 4-1/2 oz. (128 grams) and 14 oz. (.4 kg) respectively
- meet all applicable military specifications

Models for 115 VAC, 1 phase, 400 Hz; 200 VAC, 3 phase, 400 Hz; and 115 VAC, 1 phase, 60 Hz

Catalog Sheets MIL 020, 030, 040

## Propimax® 2, 3 & 3B

**Large-volume and high pressure air movers for airborne equipment.**

- free air delivery from 22 to 225 cfm (10.3 to 106.2 L/Sec)
- offer pressures as high as 7″ (177.8 mm) $H_2O$ at cut-off
- optional Altivar® motors automatically increase speed with altitude
- life expectancies of 10,000 hours at 72°C, at 22,000 RPM
- withstand ambients up to 257°F (125°C)
- size/weight: 3¼″ x 1½″ (82.5 mm x 38.1 mm) and 6.5 oz (184.3 g) for Propimax 2, 3¾″ x 2″ (95.3 mm x 50.8 mm) and 15.2 oz. (431 g) for Propimax 3 & 3B
- meet all applicable military specifications

Models for 115 VAC, 1 phase, 400 Hz; 200 VAC, 3 phase, 400 Hz; 115 VAC, 1 phase, 60 Hz

Catalog Sheets MIL 050, 060

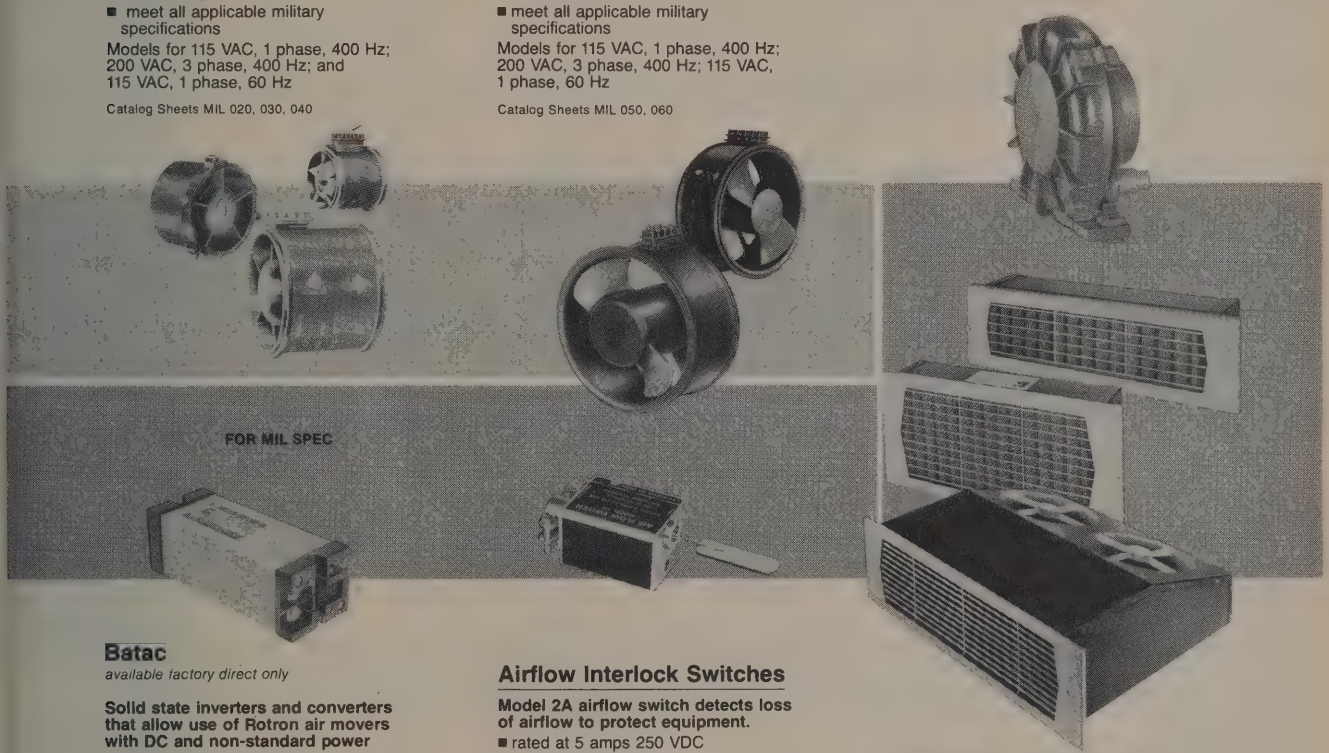
## Mini-Spiral

*available factory direct only*

**A compact, high pressure, low flow air mover**

- pressure/suction over 3 inches of $H_2O$
- up to 3.8 cfm (1.8 L/Sec) free air delivery
- 4.15″ dia. x 1.81″ depth (105.4 mm x 45.7 mm)
- weight: 17 oz. (0.47 kg)
- acoustical rating as low as NC-39
- impedance protected
- long life ball bearings
- minimal power consumption (10 watts)
- two pole, shaded pole motor
- UL yellow card recognized

Catalog Sheet COM 140




## Batac

*available factory direct only*

**Solid state inverters and converters that allow use of Rotron air movers with DC and non-standard power sources.**

- enclosed in solder sealed or resin-filled cases
- compact sizes: from 1.29″ x .97″ x 1.09″ (32.7 mm x 24.6 mm x 27.68 mm) to 2½″ x 3½″ x 5⅛″ (63.5 mm x 88.9 mm x 128.58 mm)
- for ambients −40°C to +71°C
- allows Rotron fan reliability from DC power sources
- available with protection for accidental reversal of input voltage
- every design tailored to a specific fan load

## Airflow Interlock Switches

**Model 2A airflow switch detects loss of airflow to protect equipment.**

- rated at 5 amps 250 VDC
- SPDT actuation
- interchangeable vanes available for sensitivity ranges
- mounts to round or flat duct with single screw

Determinator Kit available with complete set of 8 vanes and model 2A switch in plastic box

Catalog Sheet MIS 010

## Modulair® Cabinet Blowers

**Special air moving packages incorporate proven Rotron fans and blowers to maximize airflow and simplify installation.**

- fit standard 19″ (483 mm) relay racks and cabinets
- incorporate washable filters, and grilles for attractive appearance.

| MODEL | HEIGHT | FLOW | AIRMOVERS |
|---|---|---|---|
| MB 5100 | 5¼″ (133 mm) | 400 CFM (189 L/Sec) | 2 Feather Fans |
| MB 7400 | 7″ (178 mm) | 300 CFM (140 L/Sec) | 1 Duplex |
| MB 7500 | 7″ (178 mm) | 240 CFM (113 L/Sec) | Centrifugal |
| MB 8400 | 8¾″ (222 mm) | 500 CFM (236 L/Sec) | Blower |
| MB 9100 | 5¼″ (133 mm) | 240 CFM (113 L/Sec) | 3 Muffin Fans |
| MB 9200 | 8¾″ (222 mm) | 400 CFM (189 L/Sec) | 2 Feather Fans |
| MB 9300 | 7″ (178 mm) | 400 CFM (189 L/Sec) | 2 Major Fans |

Cabinet blowers requiring other flows and dimensions available on request.

Catalog Sheets CAB 020, 030, 040, 050

ROTRON INCORPORATED

# Rotron Fans and Blowers

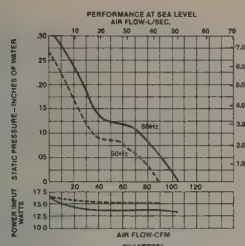
**ROTRON INC.** Woodstock, N. Y. 12498 ☐ 914 • 679-2401 ☐ TWX 510-247-9033

| FAN | MODEL NO. | PART NO. | BEARING | VOLTS | HZ | WATTS | LINE AMPS | LOCKED ROTOR AMPS | CAP MFD. | PH | RPM | CFM | L/SEC | MAX. AMB. °C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MUFFIN | MU2A1 | 028021 | sleeve | 115 | 50/60 | 15/14 | .19/.16 | .26/.24 | — | 1 | 2700/3200 | 88/105 | 41.5/49.6 | 70 |
| | MU2B1 | 028027 | ball | 115 | 50/60 | 15/14 | .19/.16 | .26/.24 | — | 1 | 2700/3200 | 88/105 | 41.5/49.6 | 70 |
| | MU3A1 | 028023 | sleeve | 220/230 | 50/60 | 15/14 | .10/.08 | .14/.12 | — | 1 | 2700/3200 | 88/105 | 41.5/49.6 | 70 |
| | MU3B1 | 028029 | ball | 220/230 | 50/60 | 15/14 | .10/.08 | .14/.12 | — | 1 | 2700/3200 | 88/105 | 41.5/49.6 | 70 |
| MUFFIN XL | MX2A3 | 028316 | sleeve | 115 | 50/60 | 18/15 | .20/.18 | .26/.24 | — | 1 | 2700/3100 | 98/115 | 46.3/54 | 70 |
| | MX3A3 | 028324 | sleeve | 220/230 | 50/60 | 16/15 | .10/.09 | .14/.12 | — | 1 | 2700/3100 | 98/115 | 46.3/54 | 70 |
| | MX2B3 | 028422 | ball | 115 | 50/60 | 18/15 | .20/.18 | .26/.24 | — | 1 | 2700/3100 | 98/115 | 46.3/54 | 70 |
| | MX3B3 | 028423 | ball | 220/230 | 50/60 | 16/15 | .10/.09 | .14/.12 | — | 1 | 2700/3100 | 98/115 | 46.3.54 | 70 |
| WHISPER | WR2A1 | 027117 | sleeve | 115 | 50/60 | 7/7 | .07/.07 | .08/.07 | — | 1 | 1600/1650 | 51/52 | 24.1/24.5 | 70 |
| | WR3A1 | 028171 | sleeve | 220/230 | 50/60 | 11/11 | .07/.07 | .08/.08 | — | 1 | 1750/2000 | 56/65 | 26.4/30.7 | 70 |
| | WR2H1 | 028119 | sleeve | 115 | 50/60 | 8/7 | .09/.08 | .11/.10 | — | 1 | 2250/2350 | 64/75 | 30.2/35.4 | 70 |
| MOHAWK | MW2A1 | 028178 | sleeve | 115 | 50/60 | 18/16 | 30/.24 | .39/.34 | — | 1 | 2650/3100 | 108/127 | 51/60 | 70 |
| | MW3A1 | 028179 | sleeve | 220/230 | 50/60 | 18/16 | 15/.12 | .19/.17 | — | 1 | 2650/3100 | 108/127 | 51/60 | 70 |
| | MW2C1 | 028180 | sleeve | 115 | 50/60 | 18/16 | 31/.23 | 35/.28 | — | 1 | 2100/2600 | 82/100 | 38.7/47.2 | 70 |
| | MW3C1 | 028181 | sleeve | 220/230 | 50/60 | 18/16 | .14/.12 | .16/.14 | — | 1 | 2100/2600 | 82/100 | 38.7/47.2 | 70 |
| SENTINEL | S747 | 020138 | ball | 115 | 50/60 | 15/14 | .18/.16 | .26/.24 | — | 1 | 2800/3300 | 88/105 | 41.5/49.6 | 100 |
| | S756 | 020146 | ball | 220/230 | 50/60 | 15/14 | .10/.08 | .13/.11 | — | 1 | 2800/3300 | 88/105 | 41.5/49.6 | 100 |
| LYRIC | LY2A1 (L) | 028172 | sleeve | 115 | 50/60 | 10/10 | .12/.10 | .15/.15 | — | 1 | 2750/3100 | 25/30 | 11.8 14.2 | 70 |
| | LY2A3 (T) | 028174 | sleeve | 115 | 50/60 | 10/10 | .12/.10 | .15/.15 | — | 1 | 2750/3100 | 25/30 | 11.8/14.2 | 70 |
| | LY3A1 (L) | 028173 | sleeve | 220/230 | 50/60 | 10/10 | .06/.05 | .07/.07 | — | 1 | 2750/3100 | 25/30 | 11.8/14.2 | 70 |
| | LY3A3 (T) | 028175 | sleeve | 220/230 | 50/60 | 10/10 | .06/.05 | .07/.07 | — | 1 | 2750/3100 | 25/30 | 11.8/14.2 | 70 |
| | LY2E1 (L) | 028176 | sleeve | 115 | 50/60 | 11/8 | .12/.10 | .12/.12 | — | 1 | 2000/2650 | 16/21 | 7.5/9.9 | 70 |
| | * LY2E3 (T) | 028390 | sleeve | 115 | 50/60 | 11/8 | .12/.10 | .12/.12 | — | 1 | 2000/2650 | 16/21 | 7.6/9.9 | 70 |
| | LY3E1 (L) | 028177 | sleeve | 220/230 | 50/60 | 10/9 | .06/.05 | .06/.06 | — | 1 | 2000/2650 | 16/21 | 7.6/9.9 | 70 |
| | * LY3E3 (T) | 028391 | sleeve | 220/230 | 50/60 | 10/9 | .06/.05 | .06/.06 | — | 1 | 2000/2650 | 16/21 | 7.6/9.9 | 70 |
| PATRIOT | PT2B3 | 028154 | ball | 115 | 50 | 40 | .40 | .52 | — | 1 | 2850 | 200 | 94.4 | 70 |
| | | | | | 60 | 39 | .36 | .52 | — | 1 | 3350 | 240 | 113 | 70 |
| | | | | 220/240 | 50 | 33 | .18 | .24 | — | 1 | 2850 | 200 | 94.4 | 70 |
| | PT77B3 | 028250 | ball | 208-230 | 60 | 35 | .16 | .25 | — | 1 | 3350 | 240 | 113 | 70 |
| SPRITE | SU2A1 (L) | 028267 | sleeve | 115 | 50/60 | 13/11 | .17/.14 | .23/.21 | — | 1 | 2750/3300 | 29/35 | 13.7/16.5 | 70 |
| | SU2A5 (T) | 028279 | sleeve | 115 | 50/60 | 13/11 | .17/.14 | .23/.21 | — | 1 | 2750/3300 | 29/35 | 13.7/16.5 | 70 |
| | SU3A1 (L) | 028269 | sleeve | 220/230 | 50/60 | 13/11 | .09/.08 | .11/.10 | — | 1 | 2750/3300 | 29/35 | 10.8/12.7 | 70 |
| | SU3A5 (T) | 028280 | sleeve | 220/230 | 50/60 | 13/11 | .09/.08 | .11/.10 | — | 1 | 2750/3300 | 29/35 | 10.8/12.7 | 70 |
| | SU2E1 (L) | 028275 | sleeve | 115 | 50/60 | 7/6 | .08/.07 | .09/.08 | — | 1 | 2200/2500 | 23/27 | 10.8/12.7 | 70 |
| | SU2E5 (T) | 028282 | sleeve | 115 | 50/60 | 7/6 | .08/.07 | .09/.08 | — | 1 | 2200/2500 | 23/27 | 10.8/12.7 | 70 |
| | SU3E1 (L) | 028276 | sleeve | 220/230 | 50/60 | 11/10 | .07/.06 | .08/.07 | — | 1 | 2100/2500 | 22/27 | 10.4/12.7 | 70 |
| | SU3E5 (T) | 028283 | sleeve | 220/230 | 50/60 | 11/10 | .07/.06 | .08/.07 | — | 1 | 2100/2500 | 22/27 | 10.4/12.7 | 70 |
| | SU2C1 (L) | 028270 | sleeve | 115 | 50/60 | 5/5 | .06/.06 | .07/.07 | — | 1 | 1800/1950 | 19/21 | 9.0/9.9 | 70 |
| | SU2C5 (T) | 028281 | sleeve | 115 | 50/60 | 5/5 | .06/.06 | .07/.07 | — | 1 | 1800/1950 | 19/21 | 9.0/9.9 | 70 |
| MAJOR | MR2B3 | 028245 | ball | 115 | 50 | 40 | .40 | .52 | — | 1 | 2850 | 200 | 94.4 | 70 |
| | | | | | 60 | 39 | .36 | .52 | — | 1 | 3350 | 240 | 113.3 | 70 |
| | | | | 220/240 | 50 | 33 | .18 | .24 | — | 1 | 2850 | 200 | 94.4 | 70 |
| | MR77B3 | 028309 | ball | 208/230 | 60 | 35 | .16 | .25 | — | 1 | 3350 | 240 | 113.3 | 70 |
| WAFER | WA2E79 | 028196 | ball | 115 | 50/60 | 14/12 | .075/.065 | .080/.070 | — | 1 | 2750/3300 | 30/37 | 14.1/17.5 | 55 |
| | WA2F79 | 028334 | sleeve | 115 | 50/60 | 14/12 | .075/.065 | .080/.070 | — | 1 | 2750/3300 | 30/37 | 14.1/17.5 | 55 |
| | WA2E77 | 028200 | ball | 208/240 | 50/60 | 13/11 | .15/.13 | .16/.15 | — | 1 | 2750/3300 | 30/37 | 14.1/17.5 | 55 |
| | WA2F77 | 028392 | sleeve | 208/240 | 50/60 | 13/11 | .15/.13 | .16/.15 | — | 1 | 2750/3300 | 30/37 | 14.1/17.5 | 55 |
| FEATHER | FF103 | 026161 | ball | 115 | 50/60 | 21/20 | .19/.18 | .29/.28 | — | 1 | 2800/3350 | 215/270 | 101/127 | 65 |
| | FF113 | 026165 | ball | 115 | 50/60 | 21/20 | .19/.18 | .29/.28 | — | 1 | 2800/3350 | 215/270 | 101/127 | 65 |
| | FF203 | 026162 | ball | 220/230 | 50/60 | 21/20 | .09/.09 | .14/.14 | — | 1 | 2800/3350 | 215/270 | 101/127 | 65 |
| | FF213 | 026166 | ball | 220/230 | 50/60 | 21/20 | .09/.09 | .14/.14 | — | 1 | 2800/3350 | 215/270 | 101/127 | 65 |
| SCOUT | KM2AF | 028118 | sleeve | 115 | 50/60 | 14 | 20 17 | 26/.24 | — | 1 | 2700/3100 | 88/105 | 41.5/49.6 | 70 |
| | KM3AF | 028121 | sleeve | 220/230 | 50 60 | 14 | 10/.09 | .14/.12 | — | 1 | 2700/3100 | 88.105 | 41.5/49.6 | 70 |
| | KM2CF | 028122 | sleeve | 115 | 50/60 | 6 | 07/.06 | .07/.07 | — | 1 | 1600/1650 | 51/52 | 24.1/24.5 | 70 |
| | KS2AC | 028129 | sleeve | 115 | 50/60 | 11 | 17/.14 | .23/.21 | — | 1 | 2750/3300 | 29/35 | 10.4/12.7 | 70 |
| | KS3AC | 028130 | sleeve | 220/230 | 50/60 | 11 | 09/.08 | 11/.10 | — | 1 | 2750/3300 | 29b-35 | 10.4/12.7 | 70 |
| | KS2CC | 028194 | sleeve | 115 | 50/60 | 5 | 06/.06 | .07/.07 | — | 1 | 1800/1950 | 19/21 | 9.0/9.9 | 70 |
| | KB2AC | 028131 | sleeve | 115 | 50/60 | 16 | 19/.19 | .27/.27 | — | 1 | 2550/2900 | 22/25 | 10.4/11.8 | 70 |
| | KB3AC | 028132 | sleeve | 220/230 | 50 60 | 17 | 09/.09 | 13/.12 | — | 1 | 2550/2900 | 22/25 | 10.4/11.8 | 70 |
| TARZAN | TN3A2 (T) | 020174 | ball | 115 | 50/60 | 87/85 | 1.3/1.1 | 2.4/2.0 | — | 1 | 2800/3350 | 285/340 | 135/161 | 55 |
| | TN3C2 (L) | 020169 | ball | 115 | 50/60 | 87/85 | 1.3/1.1 | 2.4/2.0 | — | 1 | 2800/3350 | 285/340 | 135/161 | 55 |
| | TN3A3 (T) | 020172 | ball | 220/230 | 50/60 | 87/85 | .61/.56 | 1.2/1.0 | — | 1 | 2800/3350 | 285/340 | 135/161 | 55 |
| | TN3C3 (L) | 020177 | ball | 220/230 | 50/60 | 87/85 | .61/.56 | 1.2/1.0 | — | 1 | 2800/3350 | 285/340 | 135/161 | 55 |
| BISCUIT | BT2A1 | 025447 | sleeve | 115 | 50 60 | 18.16 | 19/.19 | .27/.27 | — | 1 | 2550/2900 | 22/25 | 10.4/11.8 | 70 |
| | BT3A1 | 025449 | sleeve | 220 230 | 50 60 | 17.17 | 13/.12 | 13/.12 | — | 1 | 2550/2900 | 22/25 | 10.4/11.8 | 70 |
| CARAVEL | CL2L2 (L) | 020188 | ball | 115 | 50/60 | 65/61 | 1.0/.87 | 1.6/1.4 | — | 1 | 1400/1650 | 500/590 | 236/279 | 60 |
| | CL2T2 (T) | 020189 | ball | 115 | 50/60 | 65/61 | 1.0/.87 | 1.6/1.4 | — | 1 | 1400/1650 | 500/590 | 236/279 | 60 |
| | CL3L2 (L) | 020190 | ball | 220/230 | 50/60 | 61/61 | .47/.44 | .75/.69 | — | 1 | 1400/1650 | 500/590 | 236/279 | 60 |
| | CL3T2 (T) | 020191 | ball | 220/230 | 50/60 | 61/61 | .47/.44 | .75/.69 | — | 1 | 1400/1650 | 500/590 | 236/279 | 60 |
| SPARTAN | 682YF | 020027 (L) | ball | 115 | 50/60 | 13.0 | 0.12 | 0.15 | 1.0 | 1 | 3250 | 113 | 53.3 | 100 |
| | | 020028 (T) | | | | | | | | | | | | |
| | 810DF | 026985 (L) | ball | 115 | 400 | 13.0 | 0.12 | 0.13 | 0.39 | 1 | 3750 | 132 | 62.3 | 100 |
| | | 026984 (T) | | | | | | | | | | | | |
| | * 778YF | 026983 (L) | ball | 115 | 50/60 | 13.0 | 0.12 | 0.13 | 0.25 | 1 | 2250 | 75 | 35.4 | 100 |
| | | 026982 (T) | | | 400 | | | | | | | | | |
| | * 942WF | 026987 (L) | ball | 200 | 400 | 37.0 | 0.14 | 0.22 | — | 3 | 5300 | 185 | 87.3 | 100 |
| | | 026986 (T) | | | | | | | | | | | | |
| | * 1395YF | 026989 (L) | ball | 115 | 400 | 41.0 | 0.36 | 0.40 | 0.50 | 1 | 5400 | 188 | 88.7 | 85 |
| | | 026988 (T) | | | | | | | | | | | | |
| SAUCER | 340ZH | 026990 | ball | 115 | 50/60 | 24.0 | 0.21 | 0.31 | 2.0 | 1 | 3300 | 280 | 132.2 | 125 |
| | * 650JH | 026991 | ball | 200 | 400 | 25.0 | 0.13 | 0.18 | — | 3 | 3500 | 300 | 141.6 | 125 |
| | * 656JH | 026992 | ball | 115 | 400 | 27.0 | 0.23 | 0.33 | — | 3 | 3600 | 310 | 146.3 | 125 |
| | * 654DH | 026993 | ball | 115 | 400 | 30.0 | 0.28 | 0.32 | 1.0 | 1 | 3600 | 310 | 146.3 | 125 |
| AXIMAX 1 | 623YH | 026942 | ball | 115 | 400 | 18.0 | 16 | 40 | 0.25 | 1 | 22,000 | 21.0 | 9.9 | 125 |
| | 367JH | 026943 | ball | 200 | 400 | 18.0 | 10 | 30 | — | 3 | 22,500 | 21 | 9.9 | 125 |
| | 464YH | 026944 | ball | 115 | 400 | 9.0 | 10 | 17 | 0.15 | 1 | 11,100 | 10.0 | 4.72 | 125 |
| | 5294H | 033143 | ball | 115 | 400 | 10 | 0.09 | 0.09 | — | 1 | 10,800 | 10 | 4.7 | 125 |
| | 606NH | 026958 | ball | 115 | 50/60 | 7.0 | 0.06 | 0.06 | 1.0 | 1 | 3000 | 7 | 3.3 | 100 |
| AXIMAX 2 | | | | | 400 | 10.0 | 0.09 | 0.09 | 1.0 | 1 | 4800 | 12 | 5.66 | 100 |
| | 464YH | 026952 | ball | 115 | 400 | 11.0 | 0.11 | 0.16 | 0.15 | 1 | 10,200 | 28 | 13.22 | 125 |
| | 368YH | 026948 | ball | 115 | 400 | 38.0 | 0.33 | 0.45 | 0.5 | 1 | 20,000 | 57 | 26.9 | 125 |
| | 367JH | 026950 | ball | 200 | 400 | 34.0 | 0.13 | 0.31 | — | 3 | 20,500 | 57 | 26.9 | 125 |
| | ** 415YH | 026954 | ball | 115 | 400 | 18.0 | 0.18 | 0.19 | 0.15 | 1 | 11,000 | 32 | 15.1 | 100 |
| | ** 395JH | 026956 | ball | 200 | 400 | 22.0 | 0.11 | 0.13 | — | 3 | 12,000 | 34 | 16.0 | 100 |
| | * 606NH | 026959 | ball | 115 | 50 60 | 7 0 | 0 06 | 0 06 | 1 0 | 1 | 3000 | 7 | 3 3 | 100 |
| AXIMAX 2H | | | | | 400 | 10.0 | 0 09 | 0 09 | 1 0 | 1 | 4800 | 12 | 5 66 | 100 |
| | * 464YH | 026953 | ball | 115 | 400 | 11 0 | 0 11 | 0 16 | 0 15 | 1 | 10,200 | 28 | 13 22 | 125 |
| | * 368YH | 026949 | ball | 115 | 400 | 38.0 | 0 33 | 0 45 | 0.5 | 1 | 20,000 | 57 | 26.9 | 125 |
| | * 367JH | 026951 | ball | 200 | 400 | 34 0 | 0 13 | 0 31 | — | 3 | 20,500 | 57 | 26.9 | 125 |
| | * 415YH | 026955 | ball | 115 | 400 | 18.0 | 0 18 | 0.19 | 0.15 | 1 | 11,000 | 32 | 15 1 | 100 |
| | * 395JH | 026957 | ball | 200 | 400 | 22 0 | 0 11 | 0 13 | — | 3 | 12 000 | 34 | 16 0 | 100 |
| AXIMAX 3 | 528YH | 026963 | ball | 115 | 400 | 135.0 | 1.20 | 2.1 | 2.0 | 1 | 22,200 | 185 | 73.2 | 100 |
| | 422DH | 026964 | ball | 115 | 400 | 26.0 | 0.31 | 0.71 | 1.0 | 1 | 11,200 | 76 | 35.9 | 125 |
| | 341JH | 026372 | ball | 200 | 400 | 125.0 | 0.43 | 1.73 | — | 3 | 22,300 | 160 | 75.5 | 125 |
| | * 473JH | 026960 | ball | 200 | 400 | 30.0 | 0.21 | 0.73 | — | 3 | 11,600 | 80 | 37.8 | 125 |
| | 599NF | 026965 | ball | 115 | 50/60 | 3.0 | 0.04 | 0.05 | 0.5 | 1 | 3300 | 21 | 9.9 | 125 |
| | ** 400YH | 026961 | ball | 115 | 400 | 38.0 | 0.33 | 0.36 | 0.5 | 1 | 10,700 | 75 | 35.4 | 100 |
| | ** 387JH | 026962 | ball | 200 | 400 | 58.0 | 0.26 | 0.37 | — | 3 | 13,700 | 97 | 45.8 | 100 |
| | ** * 500JH | 020297 | ball | 200 | 400 | 70.0 | 0.24 | 0.46 | — | 3 | 16,200 | 114 | 53.8 | 100 |
| PROPIMAX 2 | 366ZH | 026966 | ball | 115 | 400 | 41.0 | 0.40 | 0.51 | 0.75 | 1 | 21,000 | 120 | 56.6 | 100 |
| | 464ZH | 026967 | ball | 115 | 400 | 11.0 | 0.11 | 0.16 | 0.15 | 1 | 10,500 | 58 | 27.4 | 125 |
| | 367JH | 026968 | ball | 200 | 400 | 34 0 | 0.13 | 0 29 | — | 3 | 20,400 | 118 | 55.7 | 125 |
| | * 704WH | 026969 | ball | 200 | 400 | 22.0 | 0 12 | 0.20 | — | 3 | 10,500 | 92 | 43.4 | 125 |
| | 606NH | 026970 | ball | 115 | 50/60/400 | 6.5 | 0.06 | 0.06 | 1 0 | 1 | 3200 | 17 | 8 | 125 |
| | ** 415ZH | 026971 | ball | 115 | 400 | 18.0 | 0 17 | 0.18 | 0 15 | 1 | 11,600 | 65 | 30 7 | 100 |
| | ** 395JH | 026972 | ball | 200 | 400 | 18.0 | 0 09 | 0 11 | — | 3 | 12,100 | 64 | 30.2 | 125 |
| PROPIMAX 3 | 341JH | 026974 | ball | 200 | 400 | 80.0 | 0.32 | 1.70 | — | 3 | 22,800 | 220 | 103.8 | 125 |
| | 409ZH | 026973 | ball | 115 | 400 | 105.0 | 1.00 | 2.00 | 2.5 | 1 | 21,900 | 220 | 103.8 | 100 |
| | 473JH | 026976 | ball | 200 | 400 | 62 0 | 0 28 | 0 75 | — | 3 | 10,900 | 190 | 89 7 | 100 |
| PROPIMAX 3B | * 718ZH | 026977 | ball | 115 | 400 | 27 0 | 0 31 | 0 48 | 0 25 | 1 | 12,000 | 120 | 56.6 | 125 |
| | 754DH | 026975 | ball | 115 | 400 | 63.0 | 0 61 | 1.25 | 2 0 | 1 | 11,100 | 190 | 89.7 | 125 |
| | 763ZH | 026978 | ball | 115 | 60 | 13 0 | 0.13 | 0 18 | 0.5 | 1 | 3450 | 56 | 26.4 | 125 |
| | * 805ZH | 026979 | ball | 115 | 50/60/400 | 23.0 | 0.24 | 0.28 | 0.25 | 1 | 3300 | 52 | 24.5 | 125 |
| | 387JH | 026981 | ball | 200 | 400 | 69.0 | 0.30 | 0.36 | — | 3 | 8200 | 140 | 66.1 | 80 |
| | 400ZH | 026980 | ball | 115 | 400 | 37.0 | 0 33 | 0.34 | 0.5 | 1 | 5900 | 100 | 47.2 | 125 |
| PROPIMAX 3BM | * 473JH | 021086 | ball | 200 | 400 | 62.0 | 0.28 | 0.75 | — | 3 | 10,900 | 190 | 89.7 | 100 |
| MINI SPIRAL | SE2A1 | 024100 | ball | 115 | 50/60 | 10.0 | 0.12 | 0 19 | — | 1 | 3400 | 3 5 | 1.65 | 72 |
| | SE2A14 | 027055 | ball | 115 | 50/60 | 9.7 | 0.12 | 0 19 | — | 1 | 3400 | 3.8 | 1.79 | 72 |

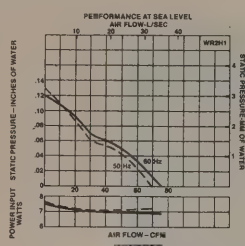
*Available factory direct only **Altivar (high altitude motor) (L) = leadwire models (T) = terminal models

# Rotron Fans and Blowers

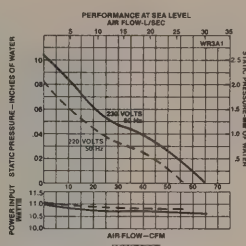
ROTRON INC. Woodstock, N. Y. 12498 ☐ 914 • 679-2401 ☐ TWX 510-247-9033



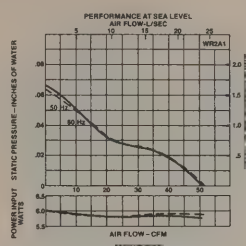

MUFFIN



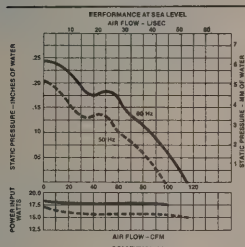

WHISPER



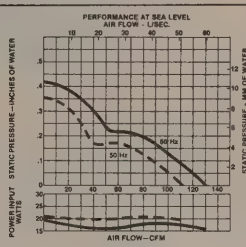

WHISPER



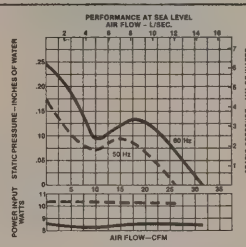

WHISPER



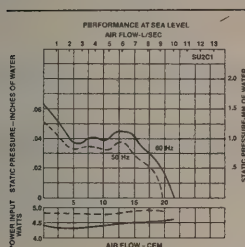

MUFFIN XL



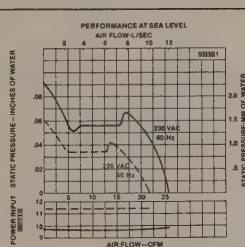

MOHAWK



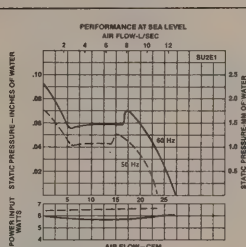

LYRIC



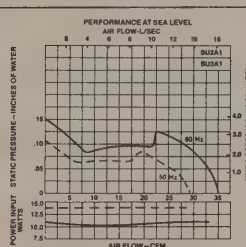

SPRITE



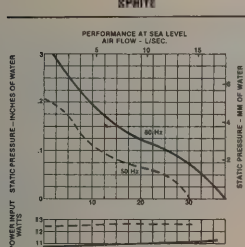

SPRITE



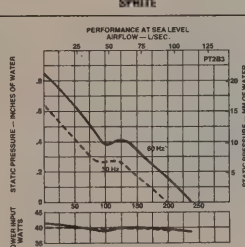

SPRITE



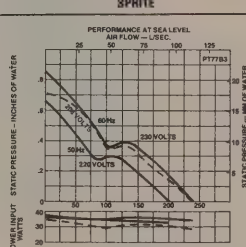

SPRITE



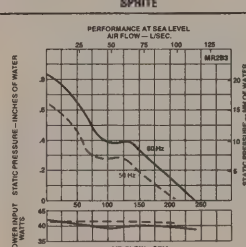

WAFER



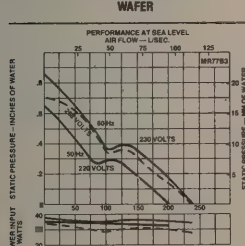

PATRIOT



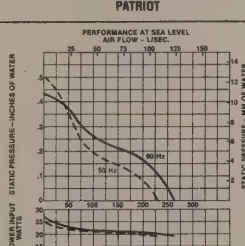

PATRIOT



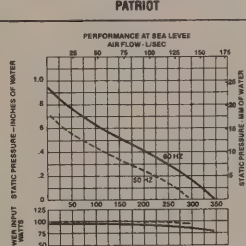

MAJOR



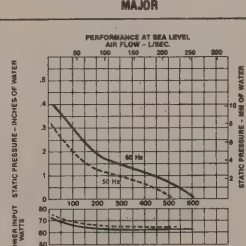

MAJOR



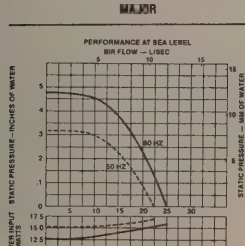

FEATHER



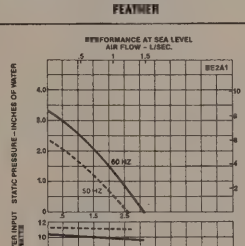

TARZAN




CARAVEL



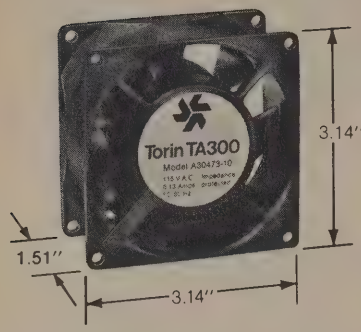

BISCUIT




MINI SPIRAL

# These are Torin thumbnails–

## TA300

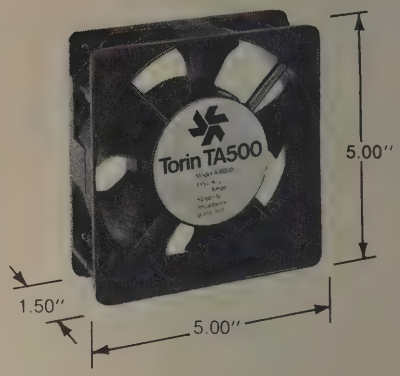



TA300 offers strong performance with lower noise levels and less power input than other fans of a comparable size. A specially designed motor and improved aerodynamics of the impeller combine to make this a most efficient package. Air delivery 36 CFM at 0″ SP. Available with 115 or 230 volt motor, 50/60 Hz.

## TA450

Available in two versions, a standard high performance series, and an "S" series featuring low sound, as low as PSIL 32. Performance makes this fan a natural for a wide range of applications. Air delivery 105 CFM at 0″ SP. Available with 115 or 230 volt motors, 50/60 Hz.

## TA500



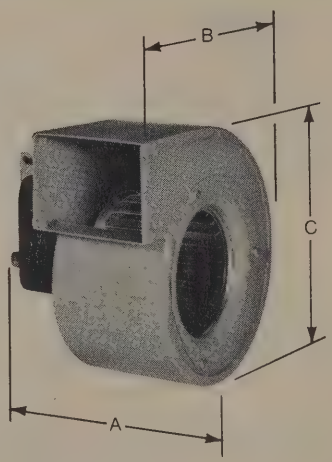

TA500 delivers up to 20% more air than 4½″ units, at a lower sound level, down to PSIL 40, yet it is completely interchangeable with matching mounting holes with any 4½″ unit. Air delivery 130 CFM at 0″ SP. Available with 115 or 230 volt motor, 50/60 Hz.

## Single Centrifugal

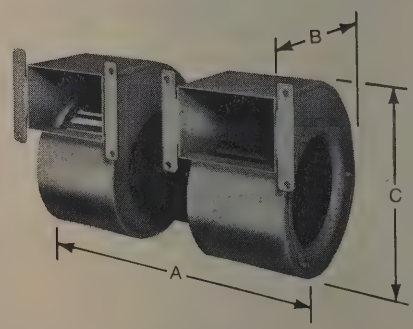
Largest selection of any maker. All motors have Class A insulation, ball bearings, thermal overload protection.

**Specifications**

| Unit | A | B | C | CFM at 0″ SP |
|---|---|---|---|---|
| SC 216-28316-1 | 3.40 | 5.20 | 5.39 | 29 |
| SC 216-28316-2 | 4.34 | 5.20 | 5.39 | 44.5 |
| SC 300-28316-3 | 3.88 | 5.20 | 5.39 | 41.5 |
| SC 300-28316-4 | 4.39 | 5.20 | 5.39 | 61 |
| SC 300-28316-5 | 4.84 | 5.20 | 5.39 | 64 |
| SC 326-28317-1 | 4.21 | 6.40 | 6.79 | 68.5 |
| SC 326-28317-2 | 5.21 | 6.40 | 6.79 | 102.5 |
| SC 326-28962 | 6.33 | 6.44 | 6.85 | 120 |
| SC 400-28963 | 8.31 | 6.44 | 6.85 | 235 |
| SC 400-28964 | 8.81 | 7.17 | 7.68 | 239 |
| SC 416-28965 | 7.82 | 7.17 | 7.68 | 159 |
| SC 424-28966 | 8.35 | 7.17 | 7.68 | 285 |
| SC 424-28967 | 8.32 | 7.83 | 8.52 | 190 |
| Small snap lock housing style | | | | |
| SC 116-28323-1 | 2.87 | 3.58 | 3.73 | 5.6 |
| SC 200-29373-2 | 2.87 | 3.58 | 3.73 | 12.6 |
| Plastic housing & wheel | | | | |
| SC 306-28361 | 6.00 | 5.44 | 5.83 | 98 |




## Dual Centrifugal



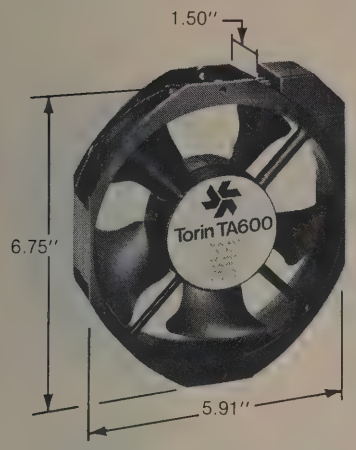

Heavy duty construction.

**Specifications**

| Unit | A | B | C | CFM at 0″ SP |
|---|---|---|---|---|
| SC 326-29039 | 10.50 | 6.40 | 6.78 | 296 |
| SC 400-29042 | 11.06 | 6.40 | 6.78 | 415 |
| SC 408-29040 | 14.00 | 7.13 | 7.61 | 582 |
| SC 408-29041 | 11.25 | 7.13 | 7.61 | 270 |
| SC 416-29044 | 11.69 | 7.13 | 7.61 | 475 |
| SC 500-29045 | 12.12 | 7.13 | 7.61 | 385 |
| SC 508-29046 | 13.78 | 7.79 | 8.45 | 460 |
| SC 610-29047 | 14.75 | 9.76 | 10.64 | 655 |

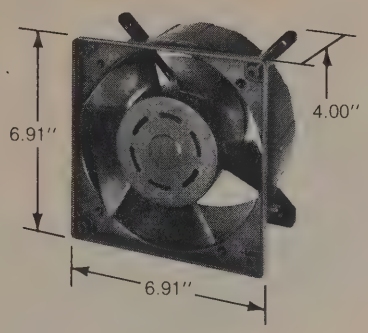
# we'd like to send you complete data.

## TA600



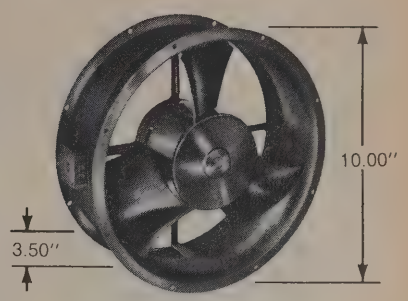

TA600 is only 1½ inches thick, making it the thinnest fan of its size produced in the United States. Its CFM per watt is high relative to other units of these dimensions. Air delivery up to 251 CFM at 0″ SP. Available with 115 or 230 volt motor, 50/60 Hz.

## TA700



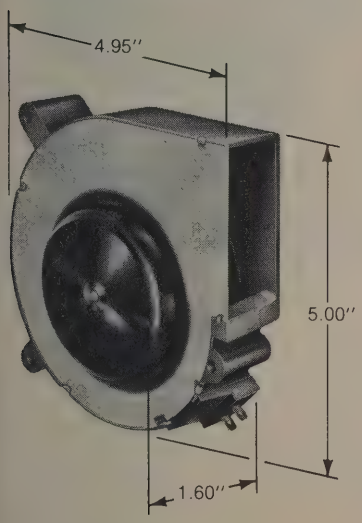

The TA700 is a tube-axial unit developed to produce greater air delivery than any other blower of its size and type. It was designed specifically for applications that demand a large volume of air working against moderate static pressure. It outperforms competitive units in air flow, power consumption and quietness of operation. Air delivery up to 380 CFM at 0″ SP. Available with 115 or 230 volt motor, 50/60 Hz.

## TA1000




TA1000 tube axial has the lowest power and noise for equivalent air delivery of any unit of its type. TA1000 is especially effective in applications where a large volume of air is required, and where moderate system resistance exists. Examples would be cabinet flushing of relay rack and communications packages and printed circuit card chassis in computers. Air delivery up to 530 CFM at 0″ SP. Available with 115 or 230 volt motor, 50/60 Hz.

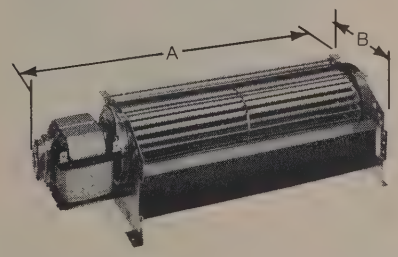
## SC382—Pancake Centrifugal




SC382-29666 features an extremely thin profile, 1⅝″ deep. Its housing is all metal in construction, and the impeller is plastic. The integral motor has proven bearing design presently in use on most sleeve bearing motors.

The SC382 produces high velocity air at good static pressure Air delivery 26 CFM at 0″ SP. 115 volt motor, 50/60 Hz.

## Transverse Flow

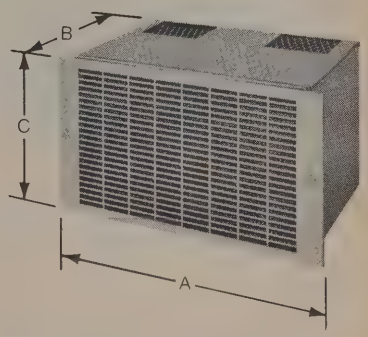



Transverse Flow Blowers utilize the entire width of the impeller blades, they take air in across the entire width of impeller and discharge it at that width.

**Specifications**

| Unit | A | B | CFM at 0″ SP |
|---|---|---|---|
| SEL 236-28206 | 7.29 | 4.33 | 53 |
| SEL 236-28207 | 10.15 | 4.33 | 68 |
| SEL 236-28208 | 10.35 | 4.33 | 73 |
| SEL 236-28309 | 12.87 | 4.33 | 82.5 |
| SEL 236-28310 | 12.97 | 4.33 | 111 |
| SEL 236-28211 | 23.62 | 4.57 | 171 |
| SEL 236-28213 | 10.12 | 3.78 | 81 |
| SEL 236-28214 | 10.12 | 3.78 | 74 |
| Double unit, motor in center | | | |
| SEL 236-2812 | 24.00 | 4.57 | 165 |

## Cabinet Blower




**Specifications**

| Unit | A | B | C | CFM at 0″ SP |
|---|---|---|---|---|
| CB 700-29416-1 | 19.00 | 9.00 | 7.00 | 218 |
| CB 700-29416-2 | 19.00 | 9.00 | 7.00 | 315 |
| CB 875-29471-1 | 19.00 | 10.25 | 8.75 | 360 |
| CB 875-29471-2 | 19.00 | 10.25 | 8.75 | 180 |
| CB 875-29471-3 | 19.00 | 10.25 | 8.75 | 325 |
| CB 875-29471-4 | 19.00 | 10.25 | 8.75 | 250 |
| CB 875-29471-5 | 19.00 | 10.25 | 8.75 | 290 |
| CB 1050-24472-2 | 19.00 | 12.00 | 10.50 | 500 |

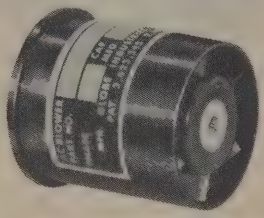
**Torin Corporation** Torrington, Connecticut 06790 (203) 482-4422

**Torin Corporation** **United States:** Torrington, Connecticut, Van Nuys, California; **Canada:** Oakville, Ontario; **England:** Swindon, Wiltshire; **Belgium:** Nivelles; **Australia:** Sydney; **Spain:** Alcalá de Henares; **Brazil:** São José dos Campos.

# TRW GLOBE MOTORS

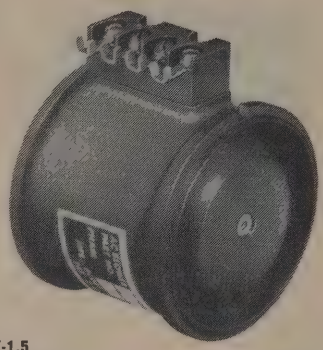
## FANS AND BLOWERS

TRW Globe offers a wide range of a.c. and d.c. fans and blowers for every cooling need. Many standard models are stocked for 48 hour delivery. And because Globe is the largest precision motor source, we can move fast to provide engineered specials in prototype or production quantities. Check your needs below. Hundreds of other units are available.



**VAX-1**

1⅛" VANEAXIAL A.C. or D.C. VAX-1-AC delivers 10 cfm @ .6" $H_2O$. 26 v.a.c., single phase, 400 Hz. 1.5 oz. VAX-1-DC delivers 8.5 cfm @ .5" $H_2O$. 26 v.d.c. 1.4 oz.



**VAX-1.5**

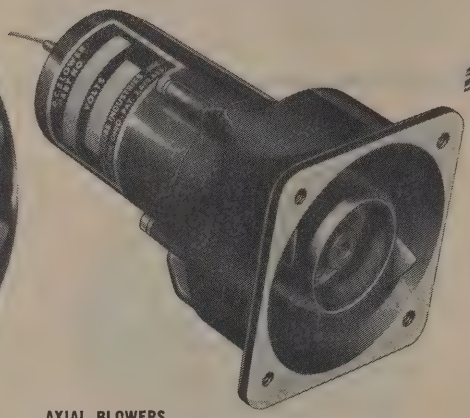
1¾" VANEAXIAL A.C. or D.C. VAX-1.5-AC delivers 12.0 cfm @ 1.9" $H_2O$. 115 v.a.c., single phase, 400 Hz. 4.0 oz. VAX-1.5-DC delivers 15 cfm @ 1.3" $H_2O$. 27 or 50 v.d.c. 5.0 oz.

**VAX-3**

3" VANEAXIAL. Four types A.C. and D.C. deliver 85 to 165 cfm at 0" $H_2O$. 115 and 200 v.a.c.; 12 and 28 v.d.c. 14 to 17 oz.

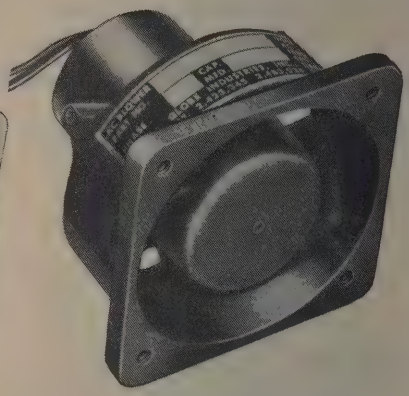
**VAX-4-FC**

4" HIGH ALTITUDE VANEAXIAL A.C. delivers 170 cfm @ 0" $H_2O$, 140 cfm @ 2.1" $H_2O$ at 25,000 ft. or 95 cfm @ 2.5" $H_2O$ at sea level. 200 v.a.c., 3-phase, 400 Hz. 2 lbs.



**AXIAL BLOWERS**

Axial blowers deliver up to 62 cfm free air, available in a.c. or d.c. 27 to 200 v.a.c. 1, 2 or 3-phase, 60 and 400 Hz. 4 to 70 v.d.c. 5 to 9½ oz.



**VARIABLE FREQUENCY FANS & BLOWERS**

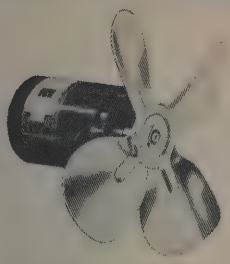
Consist of Type MC or SC variable frequency motors powering a wide range of axial or centrifugal blowers and fans. Max. output 85 cfm @ 0" $H_2O$. 27 to 200 v.a.c., 1, 2 and 3-phase, 320 to 1,200 Hz. 2.7 to 10 oz.

**VAX-4.5-GR**

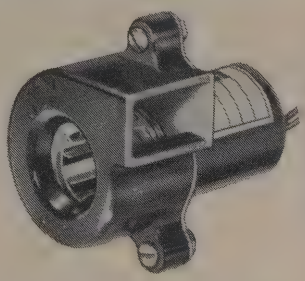
4½" VANEAXIAL A.C./D.C. delivers 315 cfm @ 0" $H_2O$ or 220 cfm @ 1.75" $H_2O$. UNIVERSAL 115 v.a.c., single phase, 60 Hz. or 115 v.d.c. 4½ lbs.

# TRW GLOBE MOTORS

## FANS AND BLOWERS



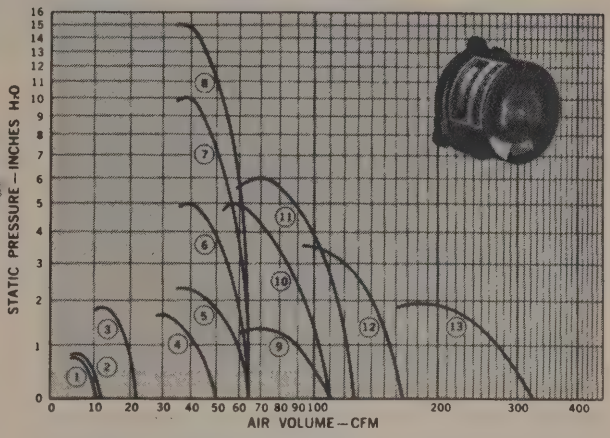
**OPEN FANS**
Fans deliver up to 195 cfm @ 0″ $H_2O$, a.c., d.c. or a.c./d.c. 4 to 120 v.d.c. 200 v.a.c., 1, 2 or 3-phase, 60 and 400 Hz. 2.3 oz. min.



**CENTRIFUGAL BLOWERS**
1″ to 2½″ RH or LH scroll models, a.c. or d.c., round or rectangular outlet, produce up to 50 cfm free air. 115 to 200 v.a.c., 60 and 400 Hz. D.C. versions 27 v.d.c. 4 to 18 oz.

**PAX-3**
3¼″ PROPAXIAL A.C. delivers 120 cfm @ 0″ $H_2O$ with Type MCS 2 pole motor, and 62 cfm @ 0″ $H_2O$ with Type MCS 4 pole motor. 200 v.a.c., 3-phase, 400 Hz, D.C. versions available.

### A.C. AND D.C. VANEAXIAL BLOWERS

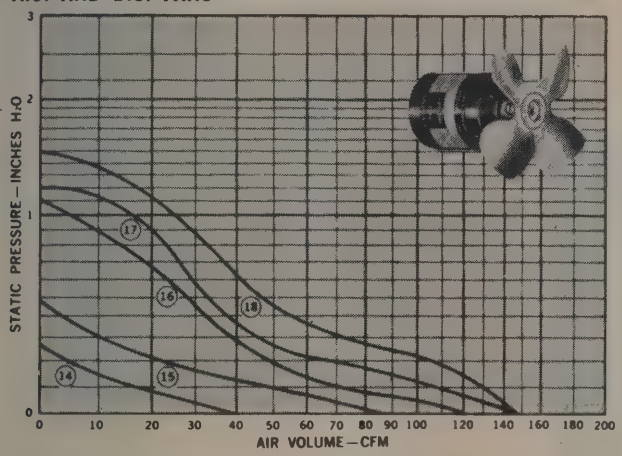



### A.C. AND D.C. VANEAXIAL BLOWERS

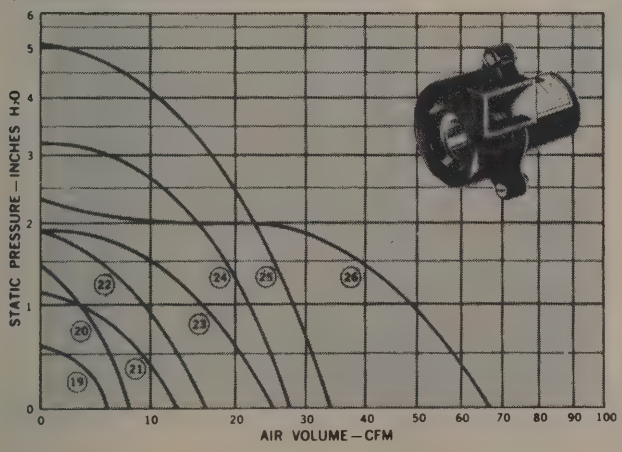
| Curve No. | Type | Dia. | Weight | Power Source | Phase | Part No. |
|---|---|---|---|---|---|---|
| 1 | VAX-1-DC | 1⅛″ | 1.4 oz. | 26 v.d.c. | | 19A1040 |
| 2 | VAX-1-AC | 1⅛″ | 1.5 oz. | 26 v.a.c., 400 Hz | 1 | 19A1173 |
| 3 | VAX-1.5-AC | 1¾″ | 4.2 oz. | 115 v.a.c., 400 Hz | 1 | 19A1233 |
| 4 | VAX-2-MM* | 2″ | 5 oz. | 26 v.d.c. | | 19A1771 |
| 5 | VAX-2-MC* | 2″ | 5 oz. | 200 v.a.c., 400 Hz | 3 | 19A774 |
| 6 | STAX-3-FC | 3″, 1 stage | 48 oz. | 200 v.a.c., 400 Hz | 3 | 19A920 |
| 7 | STAX-3-FC | 3″, 2 stage | 28.6 oz. | 200 v.a.c., 400 Hz | 3 | 19A921 |
| 8 | STAX-3-FC | 3″, 3 stage | 29 oz. | 200 v.a.c., 400 Hz | 3 | 19A922 |
| 9 | VAX-3-BD | 3″ | 16 oz. | 28 v.d.c. | | 19A827 |
| | VAX-3-GN | 3″ | 16 oz. | 115 v.d.c., or 115 v.a.c., 60 Hz | 1 | 19A908 |
| 10 | VAX-4-FC | 4″ | 2 lbs. | 200 v.a.c., 400 Hz | 3 | 19A1348 |
| 11 | VAX-4.5-LC | 4 11/16″ | 5½ lbs. | 200 v.a.c., 400 Hz | 3 | 19A1350 |
| 12 | VAX-3-FC | 3″ | 14 oz. | 115 v.a.c., 400 Hz | 3 | 19A798 |
| 13 | VAX-4.5-GR | 4¾″ | 4½ lbs. | 115 v.d.c., or 115 v.a.c., 60 Hz | 1 | 19A832 |

*Pictured in above chart.

### A.C. AND D.C. FANS




### A.C. AND D.C. CENTRIFUGAL BLOWERS




### A.C., D.C. FANS AND CENTRIFUGAL BLOWERS

| Curve No. | Type | Dia. | Power Source | Phase | Part No. |
|---|---|---|---|---|---|
| 14 | FC | 3″ fan | 115 v.a.c., 60 Hz | 1 | 19A643 |
| 15 | MC | 4″ fan | 115 v.a.c., 60 Hz | 1 | 19A552 |
| 15 | FC | 4″ fan | 115 v.a.c., 60 Hz | 1 | 19A644 |
| 16 | FC | 4½″ fan | 115 v.a.c., 60 Hz | 1 | 19A645 |
| 17 | FC | 5½″ fan | 115 v.a.c., 60 Hz | 1 | 19A647 |
| 18 | FC | 5″ fan | 115 v.a.c., 60 Hz | 1 | 19A646 |
| 19 | SS | 1″ blower | 27 v.d.c. | | 19A566 |
| 20 | SC | 1″ blower | 115 v.a.c., 400 Hz | 1 | 19A565 |
| 21 | MM | 1½″ blower | 27 v.d.c. | | 19A1860 |
| 22 | MC | 2″ blower | 115 v.a.c., 400 Hz | 1 | 19A518 |
| 23 | LL | 2″ blower | 27 v.d.c. | | 19A1852 |
| 24 | MC | 2½″ blower | 115 v.a.c., 400 Hz | 1 | 19A532 |
| 25 | FC | 2″ blower | 115 v.a.c., 400 Hz | 3 | 19A725 |
| 26 | YC | 1½″ blower | 115 v.a.c., 60 Hz | 1 | 19A1185 |

Air volume varies with direction of air flow and type of enclosure.

# ALLEN AVIONICS, INC.

224 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • PHONES: 516-248-8080 OR 516-747-5450

SEE OUR PAGES UNDER
DELAY LINES
SECTION 2350
WRITE FOR CATALOG

## Call/Write for Most Comprehensive L-C Filters Catalog in Industry

Allen Avionics is staffed and organized to provide precision L-C Filters and Delay Lines with fast delivery. Your most difficult engineering problems are solved by our high level engineering staff in conjunction with sophisticated computer programs, enabling rapid filter design determination.

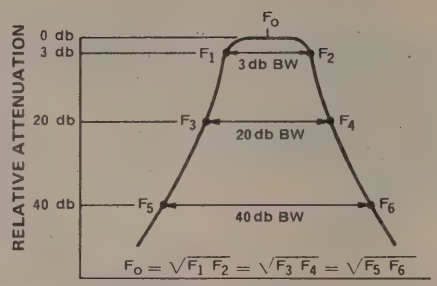
Allen Avionics computer designs are generated for the four basic filter types: Lowpass, Highpass, Bandpass, and Bandstop. These are built-in Butterworth, Tchebycheff, Elliptical, Gaussian, and Bessel functions. All Allen Avionics products are manufactured in the U.S.A.

## BANDPASS

**PROTOTYPES OFTEN DELIVERED IN LESS THAN 3 DAYS**

**Types:** Butterworth, Tchebycheff, and Elliptic Function.
**Frequency Range:** 400 Hz to 30 MHz.
**Impedance Range:** 50 ohms to 10K ohms.
**Construction:** Epoxy encapsulated or sealed in metal can.
Order any center frequency required. Interpolation between frequencies listed below is valid.

| Shape Factor | 20 db BW / 3 db BW | 40 db BW / 3 db BW |
|---|---|---|
| Ao | 3.65 | 7.85 |
| B | 1.60 | 2.50 |
| C | 1.45 | 1.85 |
| E | 1.20 | 1.45 |




1 db MAXIMUM RIPPLE

**SIZE (INCHES)**

**Sealed in Metal Can. Printed Circuit Terminals, End Terminals or Connectors available where applicable:**

M — 3.00 x 1.625 x 1.125
N — 4.00 x 1.500 x 1.250
O — 5.00 x 1.500 x 1.250
P — 6.00 x 1.500 x 1.250
Q — 7.00 x 1.500 x 1.250
NN — 4.00 x 4.000 x 1.250
OO — 5.00 x 4.000 x 1.250

**Encapsulated in Epoxy Container:**

V — 1.75 x 1.750 x .875
W — 2.50 x 1.125 x .750
X — 3.00 x 1.500 x 1.000
Y — 4.00 x 1.500 x 1.125
$Y_1$ — 4.00 x 2.000 x 1.250
Z — 4.50 x 2.500 x 1.375

| Center Frequency (Fo) | Q Range Fo / 3 db BW | Impedance Range (Ohms) | Shape Factor | Insertion Loss | Size |
|---|---|---|---|---|---|
| 400 Hz | 1-10 | 1K-10K | Ao | 2-8 db | $Y_1$ |
| 1 kHz | 1-20 | 1K-10K | Ao | 2-8 db | Y, $Y_1$ |
| | 1-8 | 1K-10K | B | 4-8 db | Z |
| 5 kHz | 1-25 | 500-10K | Ao | 1-8 db | X, Y, $Y_1$ |
| | 1-10 | 500-10K | B | 2-8 db | $Y_1$, Z |
| | 1-5 | 1K | C | 3-8 db | Z |
| 10 kHz | 1-50 | 100-1K | Ao | 1-8 db | X, Y, $Y_1$ |
| | 1-25 | 100-10K | B | 2-8 db | Y, $Y_1$, Z |
| | 1-20 | 100-500 | C | 3-8 db | $Y_1$, Z |
| | 1-5 | 500 | E | 4-8 db | Z |
| 25 kHz | 1-50 | 100-10K | Ao | 1-8 db | W, X, Y |
| | 1-40 | 100-5K | B | 2-8 db | X, Y, $Y_1$ |
| | 1-25 | 100-500 | C | 3-8 db | $Y_1$, Z |
| | 1-5 | 100-500 | E | 4-8 db | Z |
| 50 kHz | 1-50 | 100-5K | Ao | 1-8 db | W, X, Y |
| | 1-40 | 100-500 | B | 2-8 db | X, Y, $Y_1$ |
| | 1-25 | 100-250 | C | 3-8 db | $Y_1$, Z |
| | 1-5 | 100-500 | E | 4-8 db | Z |
| 75 kHz | 1-50 | 100-5K | Ao | 1-8 db | W, X, Y |
| | 1-30 | 100-500 | B | 2-8 db | X, Y, $Y_1$ |
| | 1-25 | 100-250 | C | 3-8 db | $Y_1$, Z |
| | 1-6 | 50-200 | E | 4-8 db | Z |
| 100 kHz | 1-50 | 100-5K | Ao | 1-8 db | W, X, Y |
| | 1-35 | 50-150 | B | 2-8 db | X, Y, $Y_1$ |
| | 1-25 | 50-100 | C | 3-8 db | $Y_1$, Z |
| | 1-8 | 50-100 | E | 4-8 db | Z |
| 200 kHz | 1-50 | 50-5K | Ao | 1-7 db | V, W, X |
| | 1-25 | 50-50K | B | 2-7 db | W, X, Y |
| | 1-25 | 50-100 | C | 3-7 db | X, Y, $Y_1$ |
| | 1-8 | 50-100 | E | 4-7 db | $Y_1$, Z |
| 300 kHz | 1-50 | 50-5K | Ao | 1-7 db | V, W, X |
| | 1-25 | 50-5K | B | 2-7 db | W, X, Y |
| | 1-15 | 50-100 | C | 3-7 db | Y, $Y_1$ |
| | 1-6 | 50-100 | E | 4-7 db | Z |
| 400 kHz | 1-50 | 50-5K | Ao | 1-8 db | V, W, X |
| | 1-25 | 50-5K | B | 2-8 db | W, X, Y |
| | 1-12 | 50-100 | C | 3-8 db | $Y_1$, Z |
| | 1-6 | 50-100 | E | 4-8 db | Z |
| 500 kHz | 1-50 | 50-5K | Ao | 1-8 db | V, W, X |
| | 10-25 | 50-5K | B | 2-8 db | W, X, Y |
| | 1-12 | 50-100 | C | 3-8 db | X, Y, $Y_1$ |
| | 1-5 | 50-100 | E | 4-8 db | Y, Z |
| 750 kHz | 1-50 | 50-2K | Ao | 1-10 db | W, X, Y |
| | 1-25 | 50-5K | B | 2-8 db | X, Y, $Y_1$ |
| | 1-10 | 50-2K | C | 3-8 db | Y, $Y_1$ |
| | 1-3 | 50-100 | E | 4-8 db | $Y_1$, Z |

**OUR COMPLETE CATALOG INCLUDES LINEAR PHASE, FLAT DELAY BANDPASS FILTERS. REQUEST CATALOG**

| Center Frequency (Fo) | Q Range Fo / 3 db BW | Impedance Range (Ohms) | Shape Factor | Insertion Loss | Size |
|---|---|---|---|---|---|
| 1 MHz | 1-50 | 50-100 | Ao | 1-10 db | W, X, Y |
| | 1-25 | 50-100 | B | 2-8 db | X, Y, N |
| | 1-10 | 50-100 | C | 3-8 db | M, N. O |
| | 1-5 | 50 | E | 3-8 db | NN |
| 2 MHz | 1-50 | 50-100 | Ao | 1-10 db | M, N, O |
| | 1-25 | 50-100 | B | 2-8 db | N, O, P |
| | 1-10 | 50-100 | C | 3-8 db | N, O, P |
| | 1-5 | 50 | E | 3-8 db | P, NN |
| 3 MHz | 1-50 | 50-100 | Ao | 1-10 db | M, N, O |
| | 1-20 | 50-100 | B | 2-8 db | N, O, P |
| | 1-10 | 50-100 | C | 3-8 db | N, O, P |
| | 1-5 | 50 | E | 3-8 db | P, NN |
| 4 MHz | 1-50 | 50 | Ao | 1-10 db | M, N, O |
| | 1-20 | 50 | B | 2-8 db | N, O, P |
| | 1-10 | 50 | C | 3-8 db | N, O, P |
| | 1-3 | 50 | E | 3-8 db | P, NN |
| 5 MHz | 1-50 | 50 | Ao | 1-10 db | M, N, O |
| | 1-20 | 50 | B | 2-8 db | N, O, P |
| | 1-10 | 50 | C | 3-8 db | N, O, P |
| | 1-3 | 50 | E | 3-8 db | P, NN |
| 7.5 MHz | 1-50 | 50 | Ao | 1-10 db | M, N, O |
| | 1-15 | 50 | B | 2-8 db | N, O, P |
| | 1-10 | 50 | C | 3-8 db | N, O, P |
| | 1-3 | 50 | E | 3-8 db | P, NN |
| 10 MHz | 1-50 | 50 | Ao | 1-10 db | M, N, O |
| | 1-20 | 50 | B | 2-8 db | N, O, P |
| | 1-12 | 50 | C | 3-8 db | O, P, Q |
| | 1-6 | 50 | E | 3-8 db | Q, NN, OO |
| 15 MHz | 1-50 | 50 | Ao | 1-10 db | M, N, O |
| | 1-15 | 50 | B | 2-8 db | N, O, P |
| | 1-10 | 50 | C | 2-6 db | O, P, Q |
| | 1-3 | 50 | E | 3-7 db | Q, NN, OO |
| 20 MHz | 1-50 | 50 | Ao | 1-10 db | M, N, O |
| | 1-15 | 50 | B | 2-6 db | N, O, P |
| | 1-10 | 50 | C | 2-6 db | O, P, Q |
| | 1-5 | 50 | E | 3-7 db | Q, NN, OO |
| 25 MHz | 1-50 | 50 | Ao | 1-10 db | M, N, O |
| | 1-15 | 50 | B | 2-6 db | N, O, P |
| | 1-10 | 50 | C | 2-6 db | Q, NN |
| | 1-3 | 50 | E | 3-7 db | Q, NN, OO |
| 30 MHz | 1-50 | 50 | Ao | 1-10 db | M, N, O |
| | 1-12 | 50 | B | 2-6 db | N, O, P |
| | 1-6 | 50 | C | 3-7 db | P, Q, NN |
| | 1-3 | 50 | E | 3-7 db | Q, NN, OO |

ALLEN AVIONICS, INC.
224 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • PHONES: 516-248-8080 OR 516-747-5450

SEE OUR PAGES UNDER
DELAY LINES
SECTION 2350
WRITE FOR CATALOG

# CUSTOM-BUILT L-C FILTERS LINEAR PHASE LOWPASS

## LINEAR PHASE LOWPASS FILTERS

**Types:**
Bessel, Gaussian, Equal Phase Ripple and Transitional (Gaussian to 6 db).

**Frequency Range:**
400Hz to 50MHz.

**Impedance Range:**
50 ohms to 20K ohms.

**Low Delay and Phase Distortion in Passband.**

**Very Low Pulse Distortion (Low Overshoot).**

**Construction:**
Epoxy encapsulated or sealed in metal can.

## DELIVERY: PROTOTYPES CAN OFTEN BE DELIVERED IN LESS THAN 3 DAYS

**The lowpass filters listed below are typical units that we build. We do manufacture linear phase lowpass filters with any cut-off frequency between 1KHz and 50MHz.**

## SIZE (INCHES)

**Sealed in Metal Can. Printed Circuit Terminals, End Terminals or Connectors available where applicable:**

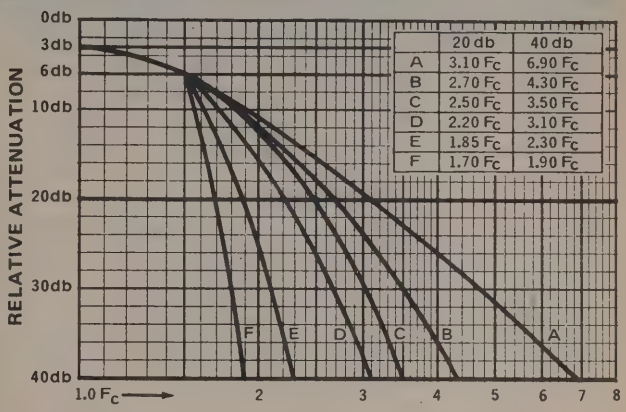
K — 1.50 x 1.000 x .800
L — 2.00 x 1.625 x 1.125
M — 3.00 x 1.625 x 1.125
N — 4.00 x 1.500 x 1.250

**Encapsulated in Epoxy Container:**

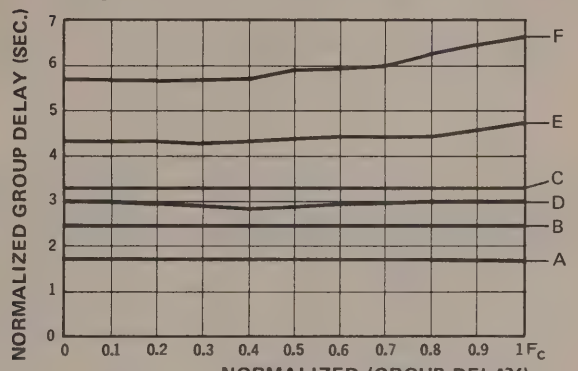
U — 2.00 x 1.125 x .750
W — 2.50 x 1.125 x .750
X — 3.00 x 1.500 x 1.000
Y — 4.00 x 1.500 x 1.125
Z — 4.50 x 2.500 x 1.375

The graph at right illustrates ideal delay characteristics.
Consult table below for typical realizable values.

| Shape Factor | Max. Phase Distortion | Maximum Overshoot | Typical Delay Variation |
|---|---|---|---|
| A | ±2° | 1.5% | 3% |
| B | ±2° | 1.5% | 3% |
| C | ±2° | 1.5% | 3% |
| D | ±3° | 3% | 8% |
| E | ±7° | 6% | 13% |
| F | ±12° | 9% | 17% |




| | 20 db | 40 db |
|---|---|---|
| A | 3.10 $F_c$ | 6.90 $F_c$ |
| B | 2.70 $F_c$ | 4.30 $F_c$ |
| C | 2.50 $F_c$ | 3.50 $F_c$ |
| D | 2.20 $F_c$ | 3.10 $F_c$ |
| E | 1.85 $F_c$ | 2.30 $F_c$ |
| F | 1.70 $F_c$ | 1.90 $F_c$ |




$$\text{GROUP DELAY} = \frac{\text{NORMALIZED (GROUP DELAY)}}{2\pi F_c \text{ (Hz)}}$$

## ½ db MAXIMUM RIPPLE — 1 db MAXIMUM INSERTION LOSS

| Cut-Off ($F_c$) Frequency 3 db Max. | Impedance Range (Ohms) | Shape Factor (See Graph) | Size Range |
|---|---|---|---|
| 1KHz | 500-10K | A | X |
| | 500-10K | B | Y, Z |
| | 500-10K | C | Z |
| | 500-10K | D | Y |
| | 500-10K | E | Y, Z |
| | 500-10K | F | Z |
| 5KHz | 50-20K | A | X |
| | 50-20K | B | Y, Z |
| | 50-15K | C | Y, Z |
| | 50-20K | D | Y |
| | 50-20K | E | Y, Z |
| | 50-10K | F | Z |
| 10KHz | 50-10K | A | W, X |
| | 50-10K | B | X, Y |
| | 50-10K | C | X, Y |
| | 50-10K | D | W, X |
| | 50-10K | E | X, Y |
| | 50-10K | F | Y, Z |
| 50KHz | 50-10K | A | W, X |
| | 50-10K | B | X |
| | 50-5K | C | X, Y |
| | 50-10K | D | W, X |
| | 50-10K | E | X, Y |
| | 50-10K | F | X, Y |
| 100KHz | 50-10K | A | U, W |
| | 50-5K | B | W, X |
| | 50-5K | C | X, Y |
| | 50-10K | D | W, X |
| | 50-10K | E | X |
| | 50-10K | F | X, Y |

| Cut-Off ($F_c$) Frequency 3 db Max. | Impedance Range (Ohms) | Shape Factor (See Graph) | Size Range |
|---|---|---|---|
| 500KHz | 50-3K | A | U, W |
| | 50-3K | B | W |
| | 50-1K | C | W, X |
| | 50-5K | D | W |
| | 50-5K | E | W, X |
| | 50-5K | F | X, Y |
| 750KHz | 50-2.5K | A | U, W |
| | 50-2.5K | B | W, X |
| | 50-1K | C | X, Y |
| | 50-5K | D | U, W |
| | 50-5K | E | W, X |
| | 50-5K | F | X |
| 1MHz | 50-500 | A | L |
| | 50-500 | B | M |
| | 50-500 | C | M |
| | 50-500 | D | W |
| | 50-500 | E | W, X |
| | 50-500 | F | X |
| 2MHz | 50-500 | A | L |
| | 50-500 | B | M |
| | 50-500 | C | M |
| | 50-500 | D | W |
| | 50-500 | E | W, X |
| | 50-500 | F | W, X |
| 5MHz | 50-500 | A | L |
| | 50-500 | B | M |
| | 50-200 | C | M |
| | 50-500 | D | L |
| | 50-500 | E | M |
| | 50-500 | F | M |

| Cut-Off ($F_c$) Frequency 3 db Max. | Impedance Range (Ohms) | Shape Factor (See Graph) | Size Range |
|---|---|---|---|
| 7.5MHz | 50-500 | A | K |
| | 50-250 | B | L |
| | 50-100 | C | M |
| | 50-500 | D | L |
| | 50-500 | E | M |
| | 50-500 | F | M |
| 10MHz | 50-100 | A | K |
| | 50-100 | B | L |
| | 50-100 | C | M |
| | 50-100 | D | L |
| | 50-100 | E | M |
| | 50-100 | F | M |
| 20MHz | 50-100 | A | K |
| | 50-100 | B | L |
| | 50-100 | D | L |
| | 50-100 | E | M |
| | 50-100 | F | N |
| 30MHz | 50-100 | A | K |
| | 50-100 | B | L |
| | 50-100 | D | L |
| | 50-100 | E | M |
| | 50-100 | F | N |
| 40MHz | 50 | A | K |
| | 50 | B | L |
| | 50 | D | L |
| | 50 | E | M |
| | 50 | F | M |
| 50MHz | 50 | A | K |
| | 50 | D | L |
| | 50 | E | M |
| | 50 | F | M |

## SHARP DELAY EQUALIZED LOWPASS FILTERS

By the utilization of delay equalization techniques, Allen Avionics now designs and manufactures a complete line of sharper cut-off, flat delay lowpass filters than shown above. We offer these with 40db to 3db ratios as small as 1.22 and delay distortion of less than 10%.

# ALLEN AVIONICS, INC.

224 EAST SECOND STREET • MINEOLA, NEW YORK 11501 • PHONES: (516) 248-8080 OR (516) 747-5450

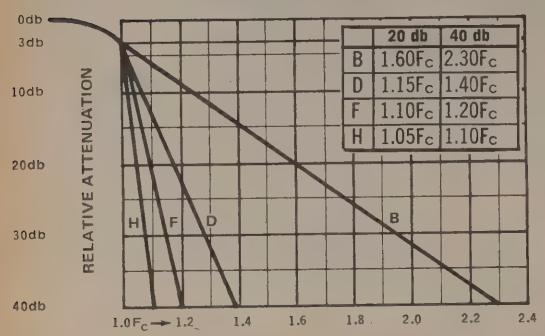
SEE OUR PAGES UNDER
DELAY LINES
SECTION 2350
WRITE FOR CATALOG

## CUSTOM-BUILT LOWPASS & HIGHPASS L-C FILTERS

**PROTOTYPES CAN OFTEN BE DELIVERED IN LESS THAN 3 DAYS**

**Types:** Butterworth, Tchebycheff, Gaussian, Bessel and Elliptic Function.
**Frequency Range:** 200 Hz to 200 MHz.
**Construction:** Epoxy encapsulated or sealed in metal can.
The Lowpass and Highpass Filters listed below are typical units that we build. We do manufacture units with shape factors and cut-off frequencies in-between those listed.

### LOW PASS FILTERS




| | 20 db | 40 db |
|---|---|---|
| B | 1.60Fc | 2.30Fc |
| D | 1.15Fc | 1.40Fc |
| F | 1.10Fc | 1.20Fc |
| H | 1.05Fc | 1.10Fc |

### SIZE (INCHES)

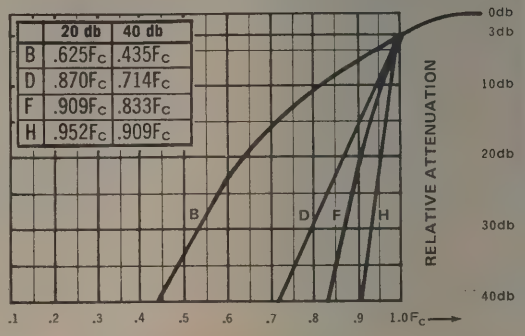
**Sealed in Metal Can with B.N.C. Connectors:**

L — 2.00 x 1.625 x 1.125
M — 3.00 x 1.625 x 1.125
N — 4.00 x 1.500 x 1.250
O — 5.00 x 1.500 x 1.250

**Encapsulated in Epoxy Container:**

S — 1.25 x .875 x .625
U — 2.00 x 1.125 x .750
W — 2.50 x 1.125 x .750
X — 3.00 x 1.500 x 1.000
Y — 4.00 x 1.500 x 1.125
Z — 4.50 x 2.500 x 1.375

### HIGH PASS FILTERS




| | 20 db | 40 db |
|---|---|---|
| B | .625Fc | .435Fc |
| D | .870Fc | .714Fc |
| F | .909Fc | .833Fc |
| H | .952Fc | .909Fc |

**1 db MAXIMUM RIPPLE — 2 db MAXIMUM INSERTION LOSS**

| Cut-Off (Fc) Frequency 3 db Max. | Impedance Range (Ohms) | Shape Factor (See Graph) | Size |
|---|---|---|---|
| 200 Hz | 500-1500 | B | Z |
| | | D | Z |
| 400 Hz | 500-3K | B | Y |
| | | D | Z |
| 1 kHz | 500-10K | B | Y |
| | | D | Z |
| | | F | Z |
| 2.5 kHz | 500-20K | B | Y |
| | | D | Z |
| | | F | Z |
| 5 kHz | 50-20K | B | Y |
| | | D | Z |
| | 150-20K | F | Z |
| 7.5 kHz | 50-20K | B | Y |
| | | D | Z |
| | 150-20K | F | Z |
| 10 kHz | 50-10K | B | X |
| | | D | Z |
| | 150-10K | F | Z |
| 25 kHz | 50-10K | B | X |
| | | D | Z |
| | 150-10K | F | Z |
| 50 kHz | 50-10K | B | X |
| | | D | Z |
| | 150-10K | F | Y |
| | | H | Z |
| 75 kHz | 50-10K | B | W |
| | | D | Y |
| | 150-10K | F | Y |
| | | H | Z |
| 100 kHz | 50-10K | B | W |
| | | D | Y |
| | | F | Y |
| | | H | Z |
| 200 kHz | 50-10K | B | U |
| | | D | W |
| | 50-5K | F | Y |
| | | H | Z |
| 300 kHz | 50-5K | B | U |
| | | D | W |
| | 50-5K | F | Y |
| | | H | Z |

| Cut-Off (Fc) Frequency 3 db Max. | Impedance Range (Ohms) | Shape Factor (See Graph) | Size |
|---|---|---|---|
| 400 kHz | 50-5K | B | U |
| | | D | W |
| | | F | Y |
| | | H | Z |
| 500 kHz | 50-5K | B | U |
| | | D | W |
| | | F | Y |
| | | H | Z |
| 600 kHz | 50-2.5K | B | U |
| | | D | W |
| | 50-2K | F | Y |
| | | H | Z |
| 700 kHz | 50-2.5K | B | U |
| | | D | W |
| | 50-2.0K | F | Y |
| | | H | Z |
| 800 kHz | 50-1.5K | B | U |
| | | D | W |
| | 50-1.0K | F | X |
| | | H | Z |
| 900 kHz | 50-1.5K | B | U |
| | | D | W |
| | 50-1.0K | F | X |
| | | H | Y |
| 1 MHz | 50-1.5K | B | U |
| | | D | W |
| | 50-1.0K | F | X |
| | | H | O |
| 2 MHz | 50-250 | B | U |
| | | D | W |
| | 50-200 | F | X |
| | | H | O |
| 3 MHz | 50-250 | B | U |
| | | D | W |
| | 50-200 | F | X |
| | | H | O |
| 4 MHz | 50-250 | B | U |
| | | D | W |
| | 50-200 | F | X |
| | | H | O |
| 5 MHz | 50-250 | B | S |
| | | D | W |
| | 50-100 | F | X |
| | | H | O |
| 6 MHz | 50-100 | B | S |
| | | D | U |
| | | F | X |
| | | H | O |

| Cut-Off (Fc) Frequency 3 db Max. | Impedance Range (Ohms) | Shape Factor (See Graph) | Size |
|---|---|---|---|
| 7 MHz | 50-100 | B | S |
| | | D | U |
| | | F | M |
| | | H | O |
| 8 MHz | 50-100 | B | S |
| | | D | U |
| | | F | M |
| | | H | O |
| 9 MHz | 50-100 | B | S |
| | | D | U |
| | | F | M |
| | | H | N |
| 10 MHz | 50-100 | B | S |
| | | D | S |
| | | F | M |
| | | H | N |
| 15 MHz | 50-100 | B | S |
| | | D | S |
| | | F | M |
| | | H | N |
| 20 MHz | 50-100 | B | S |
| | | D | S |
| | 50 | F | M |
| | | H | N |
| 25 MHz | 50 | B | S |
| | | D | S |
| | | F | M |
| | | H | N |
| 30 MHz | 50 | B | S |
| | | D | S |
| | | F | M |
| 35 MHz | 50 | B | L |
| | | D | M |
| | | F | M |
| 40 MHz | 50 | B | L |
| | | D | M |
| | | F | M |
| 50 MHz | 50 | B | L |
| | | D | M |
| | | F | N |
| 75 MHz | 50 | B | M |
| | | D | N |
| * 100 MHz to 400 MHz | 50 | B | M |

* Lowpass only.

## REQUEST THE MOST COMPREHENSIVE L-C FILTERS CATALOG

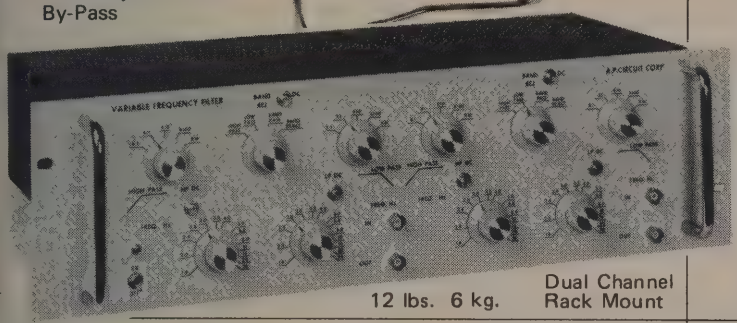
# Active Electronic Filters

**Analyze your requirements with our variable frequency instruments and select our low cost fixed frequency modules accordingly.**

**Applications: Communication, Data Transmission, Control, Vibration Testing, Biomedicine, Military Engineering**

High-Pass
Low-Pass
Band-Pass
Band-Reject
By-Pass

AP 200L SERIES
with linearized scale
5.5 lbs. 3 kg.



12 lbs. 6 kg. Dual Channel Rack Mount

## VARIABLE FREQUENCY INSTRUMENTS FEATURE:

- Low Noise (50 microvolt R.M.S.)
- High Input, Low Output impedance
- O Db insertion Loss
- 24 Db/Octave slope
- Frequency range 0.01 Hz-5 MHz
- Dual channel Rack mount Fig. C

| Partial List of Models | FUNCTION Low Pass | High Pass | Band Pass | Band Reject | Tuning Range |
|---|---|---|---|---|---|
| APVL-43-5 | ✓ | | | | 0.02Hz–2KHz |
| APVL-44-5 | ✓ | | | | 0.2Hz–20KHz |
| APVL-45-5 | ✓ | | | | 2.0Hz–200KHz |
| APVH-43-5 | | ✓ | | | 0.02Hz–2KHz |
| APVH-44-5 | | ✓ | | | 0.2Hz–20KHz |
| AP255-5 | ✓ | ✓ | ✓ | ✓ | 0.2Hz–20KHz |
| AP260-5 | ✓ | ✓ | ✓ | ✓ | 0.1Hz–10KHz |
| AP265-5 | ✓ | ✓ | ✓ | ✓ | 0.02Hz–2KHz |
| AP280-5 | ✓ | ✓ | ✓ | ✓ | 2.0Hz–200KHz |
| AP220-5 | ✓ | ✓ | ✓ | ✓ | 20Hz–2MHz |
| AP 301 | | | ✓ | | 0.1–10KHz |
| AP 401 | | | ✓ | ✓ | 0.1–10KHz |

## FILTER MODULES

**FIXED FREQUENCIES · EXTERNALLY TUNEABLE**
**DUAL IN LINE CONSTRUCTION**

Feature Low Noise, High Input, Low Output impedance. O insertion Loss.

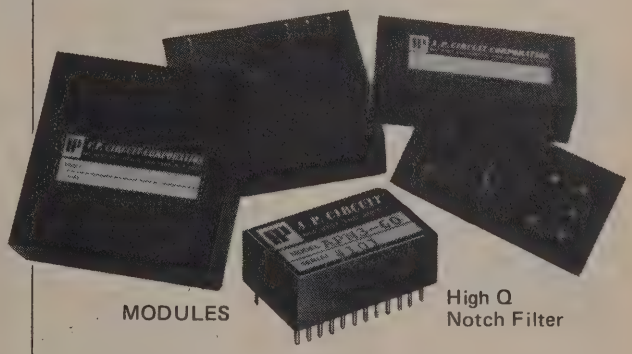
- Low-Pass
- High-Pass
- Band-Pass
- Ellyptic

STD. FREQUENCIES:
0.01 Hz–200,000 Hz
4 pole 24 Db/Octave or
8 pole 48 Db/Octave

**High Q Band reject including 60 Hz noise elimination filter**

Signal Conditioning Units assembled to customer specifications.

For a complete catalog and additional information write to Dept. P.



MODULES

High Q Notch Filter

## NEW:
## VOLTAGE TUNEABLE FILTERS

Both our instruments and modules are now available with voltage controlable tuning.

# A.P. CIRCUIT CORPORATION

865 WEST END AVENUE, NEW YORK, N. Y. 10025 • TEL. 212 · 222-0876

ALL-TRONICS

# RADIO INTERFERENCE FILTERS

## PLF-H series • PLF-R series

**ATTENUATION:**

**PLF-H SERIES:**
100 Db: 14 KHz-10 GHz
MIL-STD-220A,
Load Condition

**ALSO**

100 Db: 14 KHz-20 MHz
Full Load Condition with
Extended Range Buffer
Networks

**PLF-R SERIES:**
100 Db: 14 KHz-10 GHz
MIL-STD-220A,
Load Condition

**FEATURES:**

- **EXTREME RELIABILITY:** Special features specifically developed for secure communications areas, shielded rooms, etc., in continuous service for years without failure.
- **FIELD REPLACEABILITY:** Each individual phase filter is easily replaceable in field without the use of any special tools.
- **LEAKPROOF:** Each individual phase filter, completely hermetically sealed and leakproof.
- **INDESTRUCTIBLE TERMINALS:** Terminal assemblies are made of indestructible alumina ceramic.
- **FLEXIBLE LEADS:** Flexible leads to the electrical connection preventing possibility of damage to terminals.
- **NO FIRE OR EXPLOSIVE HAZARD:** Non-flammable impregnant used wherever applicable.
- **MAXIMUM VOLTAGE DROP:** 2 volts.
- **MAXIMUM OPERATING TEMP.:** 85°C.
- **OVERLOAD SAFETY:** 140% of rated current for 15 minutes in compliance with MIL-F-15733E. Short term current capability in excess of 10 times rating without damage.

For Architects' & Engineers' Specifications, Request Catalog AR-73

## PLF-2300 series • PLF-2100 series • PLF-1900 series

**RFI / EMI FILTERS** FOR 25 • 30 • 50 • 100 • 150 • 200 AMP CIRCUITS

At 277 VAC Line-to-Ground or 480 VAC Line-to-Line • 0-60 Hz
(0-400Hz Available in 1900 & 2100 Series)

SINGLE PHASE FILTER WITH WIRING CHAMBERS FOR DIRECT INSTALLATION

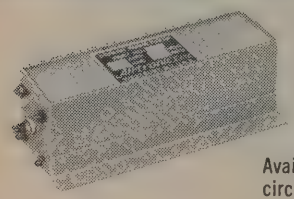
INSERTION LOSS:

PLF-2300 Series — 100 db from 14 KHz to 10 GHz in accordance with MIL-STD-220A, load condition.
PLF-2100 Series — 100 db from 100 KHz to 10 GHz in accordance with MIL-STD-220A.
PLF-1900 Series — Effective range from 100 KHz to 1 GHz.

For Architects' & Engineers' Specifications, Request Catalog AR-73

## PLF-1700 series • PLF-1500 series

## RFI / EMI FILTERS

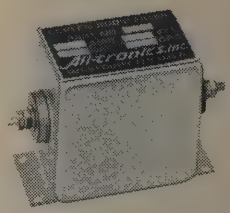


**5-10-15 AMP CIRCUITS**
**At 130 VAC Line-to-Ground**
**0-400 Hz**

Available in single, dual and/or triple circuits in each current rating. Insertion loss when measured in accordance with MIL-STD-220A provides 50 db at 14 KHz and 100 db at 90 KHz out to 1 GHz.

**5 • 10 • 15 • 25 • 50 • 75 • 100 • 200 • 300 AMP CIRCUITS at 250 VAC Line-to-Ground IN BOTH 0-60 Hz & 0-400 Hz Series**
(0-400Hz Series to 100 AMPS only)

Reliable, low-cost, hermetically sealed filters providing insertion loss with effective range from 150 KHz to 150 MHz.



## RFI/EMI TESTING LABORATORY • FCC • MILITARY • RTCA

All-Tronics also maintains a complete RFI/EMI Testing Laboratory. The combination of large modern RFI shielded rooms, the latest in interference testing instrumentation, and top level know-how provide a complete testing service that is capable of covering all of the latest requirements of FCC, Military, Commercial and foreign interference specifications. The laboratory is an approved FCC testing lab specializing in Part 15 and Part 18 compliance testing and consulting. The military interference testing capabilities include testing to specifications such as MIL-STD-220A, MIL-STD-461A, MIL-STD-6181D, MIL-STD-826A and MIL-I-16910C.

In addition to RFI/EMI interference levels caused by your equipment, All-Tronics can also perform susceptibility testing to determine the effects of RFI/EMI emissions on your product. Along with FCC and Military interference testing, All-Tronics also performs interference tests specifically prepared by the Radio Technical Commission for Aeronautics for the commercial aviation industry. In the commercial power field, All-Tronics has and is capable of performing site surveys on power lines, power stations and sub-stations. Test plans per MIL-STD-831 and consultation on test methods for your products are also available.

All-tronics, inc.

47 BOND STREET, WESTBURY, L.I., N.Y. • 516-333-3090

**AXEL ELECTRONICS, INC.**
A UNIT OF GENERAL SIGNAL CORPORATION
134-20 Jamaica Avenue, Jamaica, NY 11418
(212) AX 1-3900

# Must You Meet MIL-STD 461?

## Here's where EXPERIENCE counts!

With the introduction of MIL-STD-461, the previously employed fixed 50-ohm test system, as defined by MIL-F-15733 and MIL-STD-220A, is becoming inadequate to describe true interference noise conditions. Filters are now tested dynamically — that is, from a low impedance source into a finite load simulating true operating conditions. With the new developments of solid state devices which have made inverters practical, direct rectification of the AC power has become prevalent. However, this rectification and these inverters produce large amounts of narrowband and broadband noise from relatively low impedances in the form of current rather than voltage. In addition this noise occurs at much lower frequencies than the previously used test minimum of 14 kHz. As a matter of fact, the first current spike of interest will be at the third harmonic of the power frequency and there will be substantial spikes at the chopper (inverter) frequency and its harmonics. Axel Electronics has the capability of simulating the noise spectrum to be filtered. This is accomplished by the use of a 3 phase full wave bridge (in a three phase system) with a load connected. The bridge diodes used are identical to those in the actual system as one element determining the raw noise (before filtering).

Alternately, Axel Electronics can also use the current injection method of simulation whereby a single frequency interference is injected and, with the use of current probes, the attenuation at that frequency is measured.

Axel Electronics also has the capability to simulate your system and determine the degree of filtering required by the use of its extensive library of computer programs specifically developed for the above application.

Each filter can be supplied with complete documentation of the filtered response, either in the form of a photograph from a swept frequency technique, or tabular form from finite frequency measurements.

Axel has shipped thousands of filters over the years to help our customers meet the requirements of MIL-STD-461 Notice 1, Notice 2, Notice 3 and Notice 4. Our expertise in designing filters for current attenuation and for testing under operating conditions has made this possible. Another feature of these filters is the ability to meet the magnetic radiation requirements of MIL-STD-461 by the use of magnetic liners within the filter itself.

A typical example of a requirement is demonstrated in the photographs below. Figure 1 indicates the raw noise before filtering. Figure 2 is the specified limit of MIL-STD-461, Notice 3, and Figure 3 indicates the results using Axel filter 10B625-1, shown.

The engineering staff of Axel Electronics is always available for consultation regarding your requirements, and can recommend solutions to your specific MIL-STD-461 filtering problems. We are uniquely qualified to solve them efficiently, economically, and expeditiously.

**AXEL Filter 10B625-1**

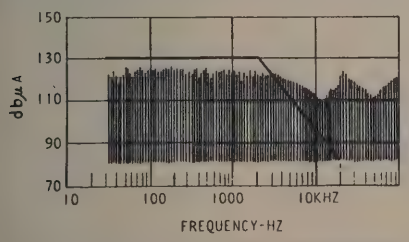



**Figure 1. Narrowband Noise Before Filtering**

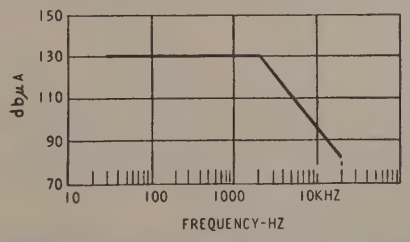



**Figure 2. Limit for CE-01, CE-02 Narrowband Emissions**

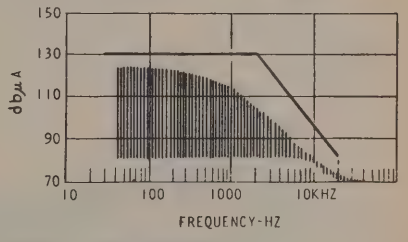



**Figure 3. After Filtering**

**Ask for our complete catalog and Look to the Leader in Filter Technology...**

**AXEL ELECTRONICS, INC.**
A UNIT OF GENERAL SIGNAL CORPORATION
134-20 Jamaica Avenue, Jamaica, NY 11418
(212) AX 1-3900

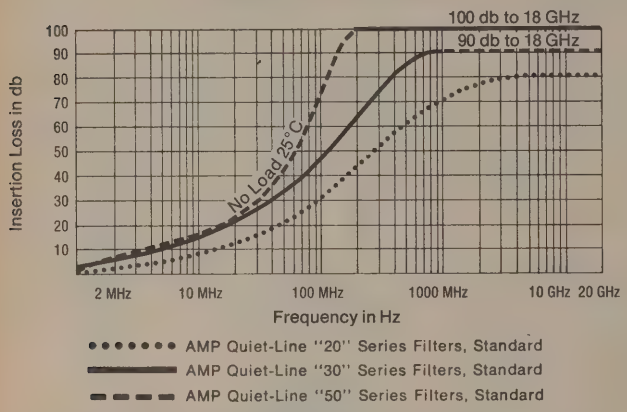
Our complete service includes applications engineering and fast prototype delivery. Send us your specifications and/or applications and we'll do the rest.

# The noise stops here.

## Introducing Quiet-Line. The new name in filters from the filter specialists—AMP.

Win the battle against systems noise and static discharge, with our new Quiet-Line series of miniature and sub-miniature feed-through filters.

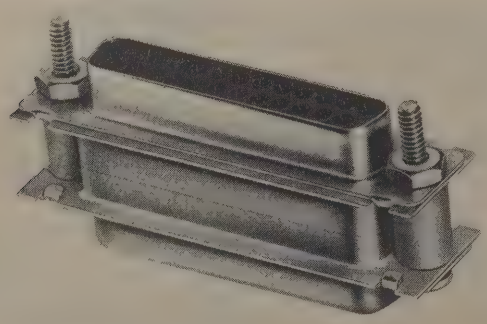
**Insertion Loss vs. Frequency**




An advanced absorptive filtering concept, combined with a unique manufacturing process, gives these filters the highest insertion loss specifications in the industry.

With two basic space-saving filter lines—the standard "20," "30" and "50" series, and the matching premium(P)-performance series—you get across-the-board design coverage. Also available are .025² post filters, an industry first from AMP. Applications range from commercial mobile radios and computer peripherals to military microwave systems and avionics.

No internal resonances—rugged, one-piece construction distributes inductance and capacitance over the filter. You also get high power capability—ratings to 15 amperes load current—and great versatility in mechanical configurations. Assemblies are available with filters mounted on a common ground plate, or as a cable interface, ready for termination.



### Specifications—AMP Quiet Line filters.

**Electrical specifications.**

| | Series 20, 30, 50 | Series 20P, 30P, 50P |
|---|---|---|
| Voltage | 100 VDC | 125 VDC |
| Current | 15A | 15A |
| Insulation resistance | 500 megohms | 1000 megohms |
| Dielectric withstanding voltage | 250 VDC | 375 VDC |
| Capacitance | 20 Series—1000pf min.<br>30 Series—2000pf min.<br>50 Series—3000pf min. | 20P Series—1500pf min.<br>30P Series—3000pf min.<br>50P Series—4000pf min. |

**Insertion loss (per MIL-STD-220 @ +25°C).**

| 20 Series | | 30 Series | | 50 Series | |
|---|---|---|---|---|---|
| 5 MHz | 3 db | 3 MHz | 3 db | 2 MHz | 3 db |
| 25 MHz | 10 db | 25 MHz | 15 db | 25 MHz | 20 db |
| 50 MHz | 15 db | 50 MHz | 20 db | 50 MHz | 30 db |
| 100 MHz | 20 db | 100 MHz | 30 db | 100 MHz | 50 db |
| 300 MHz | 40 db | 300 MHz | 65 db | 300 MHz | 90 db |
| 500 MHz | 50 db | 500 MHz | 80 db | 500 MHz to 18 GHz | 100 db |
| 1 GHz to 18 GHz | 55 db | 1 GHz to 18 GHz | 90 db | — | — |

| 20P Series | | 30P Series | | 50P Series | |
|---|---|---|---|---|---|
| 5 MHz | 3 db | 3 MHz | 3 db | 2 MHz | 3 db |
| 25 MHz | 10 db | 25 MHz | 15 db | 25 MHz | 20 db |
| 50 MHz | 15 db | 50 MHz | 25 db | 50 MHz | 35 db |
| 100 MHz | 20 db | 100 MHz | 35 db | 100 MHz | 55 db |
| 300 MHz | 45 db | 300 MHz | 70 db | 300 MHz to 18 GHz | 100 db |
| 500 MHz | 55 db | 500 MHz | 90 db | — | — |
| 1 GHz to 18 GHZ | 60 db | 1 GHz to 18 GHz | 100 db | — | — |

**Environmental specifications; Series 20P, 30P, 50P. (Not applicable for Standard Series.)**

Salt Spray: MIL-STD-202, Method 101, Cond. A; 96 hrs. (5% salt solution).
Thermal Shock: MIL-STD-202, Method 107, Cond. A; except −55°C to +125°C.
Barometric Pressure: MIL-STD-202, Method 105, Cond. C.
Vibration: MIL-STD-202, Method 204, Cond. D.
Resistance to Soldering Heat: MIL-STD-202, Method 210, Cond. B.
Shock: MIL-STD-202, Method 213, Cond. C.
Terminal Strength: MIL-STD-202, Method 211, Cond. A; 5 lb. pull test.
Operating Temperature Range (with no voltage derating): −55°C to +125°C.

## Mechanical specifications.

| Series 20 Part No. | Series 20P Part No. | Configuration | Thread Size | Suggested Mounting Hole Diameter |
|---|---|---|---|---|
| 859619-1 | 859631-1 | | 8-32 | |
| | -2 | Bolt | 8-32 | 8-32 UNC-2A |
| | -3 | | 8-32 | Threaded |
| | 859640-1 | | 8-32 | |
| 859616-1 | 859628-1 | | | |
| | -2 | Eyelet | — | .117" ±.002 |
| | -3 | | | |
| | 859638-1 | | | |
| 859613-1 | 859625-1 | | | |
| | -2 | Pin/Sleeve | — | .095" ±.002 |
| | -3 | | | |
| | 859636-1 | | | |
| — | 859634-1 | Eyelet/Sleeve | — | .117" ±.002 |

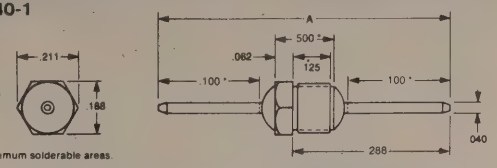
| Series 30 Part No. | Series 30P Part No. | Configuration | Thread Size | Suggested Mounting Hole Diameter |
|---|---|---|---|---|
| 859618-1 | 859630-1 | | 8-32 | |
| | -2 | Bolt | 8-32 | .177" ±.002 |
| | -3 | | 8-32 | |
| | 859639-1 | | 8-32 | |
| 859645-1 | 859647-1 | | 12-32 | |
| | -2 | Bolt | 12-32 | .228" ±.002 |
| | -3 | | 12-32 | |
| 859615-1 | 859627-1 | | | |
| | -2 | Eyelet | — | .117" ±.002 |
| | -3 | | | |
| | 859637-1 | | | |
| 859612-1 | 859624-1 | | | |
| | -2 | Pin/Sleeve | — | .095" ±.002 |
| | -3 | | | |
| | 859635-1 | | | |
| — | 859633-1 | Eyelet/Sleeve | — | .117" ±.002 |

| Series 50 Part No. | Series 50P Part No. | Configuration | Thread Size | Suggested Mounting Hole Diameter |
|---|---|---|---|---|
| 859617-1 | 859629-1 | | 8-32 | |
| | -2 | Bolt | 8-32 | .117" ±.002 |
| | -3 | | 8-32 | |
| 859646-1 | 859648-1 | | 12-32 | |
| | -2 | Bolt | 12-32 | .228" ±.002 |
| | -3 | | 12-32 | |
| 859614-1 | 859626-1 | | | |
| | -2 | Eyelet | — | .117" ±.002 |
| | -3 | | | |
| 859611-1 | 859623-1 | | | |
| | -2 | Pin/Sleeve | — | .095" ±.002 |
| | -3 | | | |
| — | 859632-1 | Eyelet/Sleeve | — | .117" ±.002 |

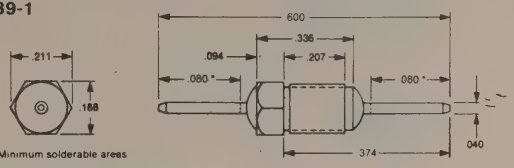
Contact AMP Capitron Division for additional information on mounting specifications.

## Mechanical configurations.

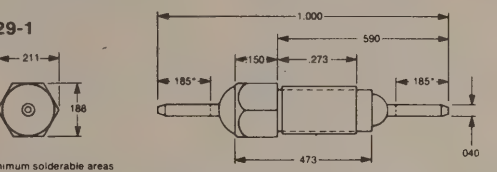
**Bolt Style (8-32 Thread Size)**
**859640-1**



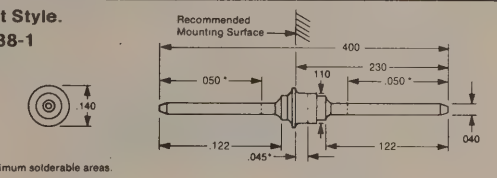

**Bolt Style (8-32 Thread Size), with Nut and Lockwasher**
**859639-1**



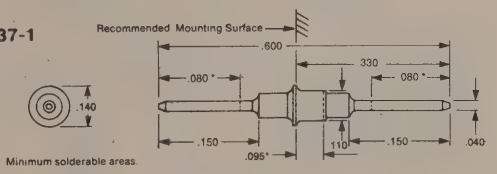

**859629-1**



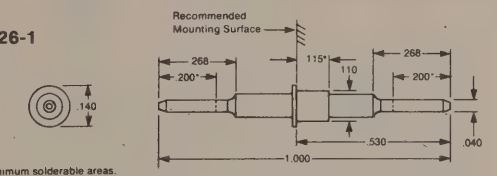

**Eyelet Style.**
**859638-1**



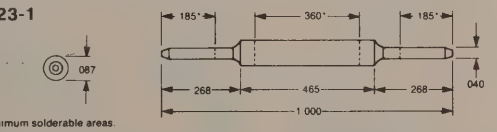

**859637-1**




**859626-1**




**Pin/Sleeve Style.**
**859623-1**




NOTES: Other styles and configurations of Quiet Line filters are available upon request. Contact AMP Capitron Division.
Data subject to change without notice.

For more performance for the money, specify Quiet-Line EMI filters. Write for data on these products, and for information on other AMP Capitron products, including card readers, power supplies and high-voltage lead assemblies and receptacles.
AMP Capitron Division, Elizabethtown, PA 17022.
Or call (717) 367-1105 • TWX: 510-657-4561.

AMP has a better way.

AMP INCORPORATED

AMP is a trademark of AMP Incorporated

## SAW BANDPASS FILTERS . . . . . For Satellite Communications, CATV/TV, Microwave Communications, Radar, ECM. Featuring linear phrase, high rejection, low shape factor, compact size, stability, low cost.

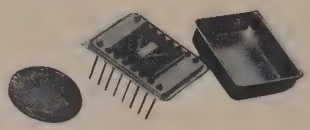
Andersen's engineering staff provides quick turn around on custom designs in the 10 to 400 MHz range. Andersen's production staff is facilitated for high volume manufacture.

### Representative Filters in Production

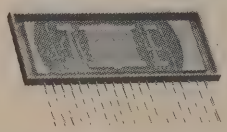
| Model | Center Frequency MHz | Bandwidth 1 db min KHz | Bandwidth 3 db max KHz | Rejection Bandwidth max -MHz @ -db | Insertion Loss max. db |
|---|---|---|---|---|---|
| BP22-400-40** | 21 9 | 400 | 600 | 1 @ 30 | 18 |
| VSB-1-79* | 43 91 | 5.250 | 6.000 | 8.5 @ 45 | 25 |
| BP60-5500 | 60 | 5.000 | 6.400 | 8 5 @ 45 | 25 |
| BP66-400-40** | 65 75 | 400 | 600 | 1 2 @ 40 | 20 |
| BP70-100-119** | 70 | 100 | 180 | 0.44 @ 25 | 22 |
| BP70-400-107** | 70 | 400 | 550 | 1 5 @ 40 | 20 |
| BP70-10000-28* | 70 | 10.000 | 12.000 | 14 5 @ 40 | 25 |
| BP148-300-57** | 148 3 | 330 | 600 | 1 5 @ 40 | 20 |
| BP150-2250-69A** | 150 | 700 | 1.300 | 4 @ 40 | 20 |
| BP160-330-95** | 160 | 330 | 600 | 1 5 @ 40 | 22 |

Typical Insertion Loss 20db Mil Spec Versions Available
Temperature Coefficient, *90ppm/C° *.03ppm/C°² Ref. 25°C

## MATCHED FILTERS . . . . . Dispersive Delay Lines and Phase Coded Devices for Radar, ECM and Communications Signal Processing.



### PHASE CODES DEVICES



Center frequency to 200 MHz
Bandwidth to 50 MHz
Number of chips to 127
Any specified biphase or quadriphase code

### DISPERSIVE DELAY LINES IN CURRENT PRODUCTION

| Model | Type | Center Frequency $f_o$ MHz | Bandwidth $\Delta f$ MHz | Dispersion $\Delta\tau$ µs | Time Bandwidth Product N | Sidelobe Level db (note 1) |
|---|---|---|---|---|---|---|
| DI 7.5-1388 | IMCON | 7.5 | 2.5 | 555 | 1.388 | 40 |
| DI 7.5-25000* | IMCON | 7 5 | 2.5 | 10.000 | 25.000 | 27 |
| DI 10-56 | IMCON | 10.0 | .56 | 100 | 56 | 30 |
| DI 15-600 | IMCON | 15.0 | 6.0 | 100 | 600 | 35 |
| DI 22-2200 | IMCON | 22.0 | 11.0 | 200 | 2.200 | 35 |
| DS 30-250 | SAW-ID | 30 0 | 5.0 | 50 | 250 | 27 |
| DS 35-16 | SAW-ID | 35.0 | 1.0 | 16 | 16 | 25 |
| DS 57-125 | SAW-RAC | 57 5 | 5.0 | 25 | 125 | 27 |
| DS 60-500 | SAW-RAC | 60 0 | 10.0 | 50 | 500 | 27 |
| DS 60-8 | SAW-ID | 60.0 | 4.0 | 2 | 8 | 18 |
| DS 91-650 | SAW-ID | 91 0 | 19.0 | 34 | 650 | 27 |
| DS 240-80 | SAW-ID | 240 0 | 67 0 | 1.2 | 80 | 27 |
| DS 250-256 | SAW-ID | 250 | 80.0 | 3.2 | 256 | 27 |

*Cascaded

## DELAY LINES . . . . . For Commercial and Military Applications.

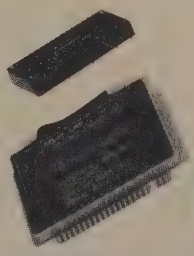
**MINIATURE DIP**

Pins 14 to 16
Delay/rise time 4 to 7
Delay 5 to 1000ns
Taps 10% of total delay

**DISTRIBUTED**

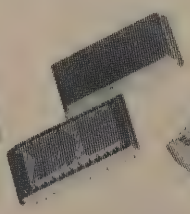
Bandwidth to 50 MHz
Delay 10ns to 1000ns
Taps Available

**LUMPED CONSTANT**



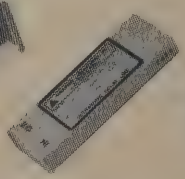
Bandwidths to 50 MHz
Delay 10ns to 3us
Taps available
Electrically variable delay available

**SAW**



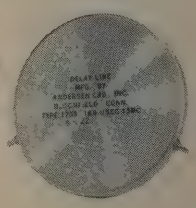
Frequency 10 MHz to 500 MHz
Bandwidth to 200 MHz
Delay 100ns to 50 us
Up to 60 taps

**GLASS**



Frequency 5 to 60 MHz
Bandwidth to 30 MHz
Delay 2 to 250us

**QUARTZ**

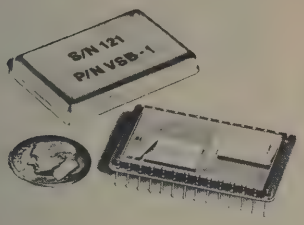


Frequency 5 to 100 MHz
Bandwidth to 50 MHz
Delay 1us to 4.8 ms

**ANDERSEN LABORATORIES, INC.**
Advanced Systems Division
1280 Blue Hills Avenue • Bloomfield, Conn. 06002 • 203-242-0761 • TWX 710-425-2390

## VIDEO PRODUCTS ..... Luminance and Chrominance Delay Lines, Lowpass and Bandpass Filters, SAW Vestigial Sideband Filters and 1H glass delay lines for receivers, VTR's, video disc systems, cameras, exciters, and modulators.

### SAW VESTIGIAL SIDEBAND FILTER




| | |
|---|---|
| Video Carrier | 45.75 MHz |
| 1 db Bandwidth | 41.2 MHz to 46.5 MHz |
| 45 db Bandwidth | 39.8 MHz to 47.2 MHz |
| K-Factor (2T) | 2% |
| Envelope Delay | 25ns Max. (12.5T) |

Filters for other TV standards available.

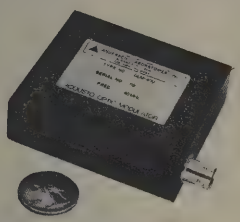
**Luminance Distributed and LC Delay Lines**
Delay 0.5 to 0.8us
Bandwidths to 4.5 MHz
Risetime 0.2 to 0.3usec

### 1H-DELAY LINES IN CURRENT PRODUCTION

| Part No. | PDL 631 B, D, E | PDL 631F | PDL 631M | PDL 641 B, D, E | PDL 641F | *VD-1 |
|---|---|---|---|---|---|---|
| Center frequency, MHz | 3.579545 | 3.579545 | 3.575611 | 4.433619 | 4.433619 | 27 |
| Delay, usec (±.005) | 63.556 | 63.556 | 63.485 | 63.943 | 63.943 | 63.555 ±10ns |
| -3 db min. Bandpass, MHz | 2.83-4.33 | 2.83-4.33 | 2.7-4.4 | 3.4-5.2 | 3.4-5.2 | 14 |
| Insertion loss, db (±3) | 8 | 12 | 8 | 8 | 12 | 30 |
| Max. delay drift, nsec (+20°C to +50°C) | 5 | 5 | 5 | 5 | 5 | 15 |
| Triple travel, db | ≥22 | ≥26 | ≥22 | ≥22 | ≥26 | ≥50 |
| Other spurious, db | ≥30 | ≥26 | ≥26 | ≥30 | ≥26 | ≥50 |
| Operating temperature range | -20°C to +70°C | -20°C to +70°C | -20°C to +70°C | -20°C to +70°C | -20°C to +70°C | 0 to 50°C |

*Available ½H, 1H or 2H

## ACOUSTO-OPTIC DEVICES ..... Modulators, beam deflectors, Q-Switches, Modelockers for laser recording, facsimile, non-impact printing, communications, and industrial application.



DLM-40V
ACOUSTO-OPTIC ELEMENT

D-40 DRIVER

**Beam Deflectors** wave length 325 to 1064 nm resolvable spots 1 to 300 acess times 300ns to 10 usec.

**Q-Switches and Mode Locks** for most commercial YAG lasers

### ACOUSTO-OPTIC MODULATORS IN CURRENT PRODUCTION

| | DLM-40V | DLM-40-IR | DLM-80V | DLM-80-UV |
|---|---|---|---|---|
| Operating wave-length range | 440-700nm | 1060-1150nm | 440-700nm | 300-400nm |
| Optical trans-mission min. | 96% | 95% | 96% | 97% |
| Laser Polarization | random | random | random | linear-vertical |
| Active aperture height | 2mm | 1mm | .5mm | 1.5mm |
| Acoustic center frequency | 40MHz | 40MHz | 80MHz | 80MHz |
| Rise time (10%-90%) | 50ns | 50ns | 25ns | 25ns |
| Modulation bandwidth (—3db point) | 7MHz | 7MHz | 14MHz | 14MHz |
| 1st order deflection efficiency min. | 85% | 85% | 85% | 85% |
| Contrast ratio min. | 1000 to 1 | 1000 to 1 | 1000 to 1 | 1000 to 1 |
| RF drive power max. | 2 watts | 3.5 watts | 2 watts | 2 watts |
| Driver | D-40 | D-40 | D-80 | D-80 |

## SIGNAL PROCESSING SUB-SYSTEMS .....For radar, ECM, communications, and laser recording.

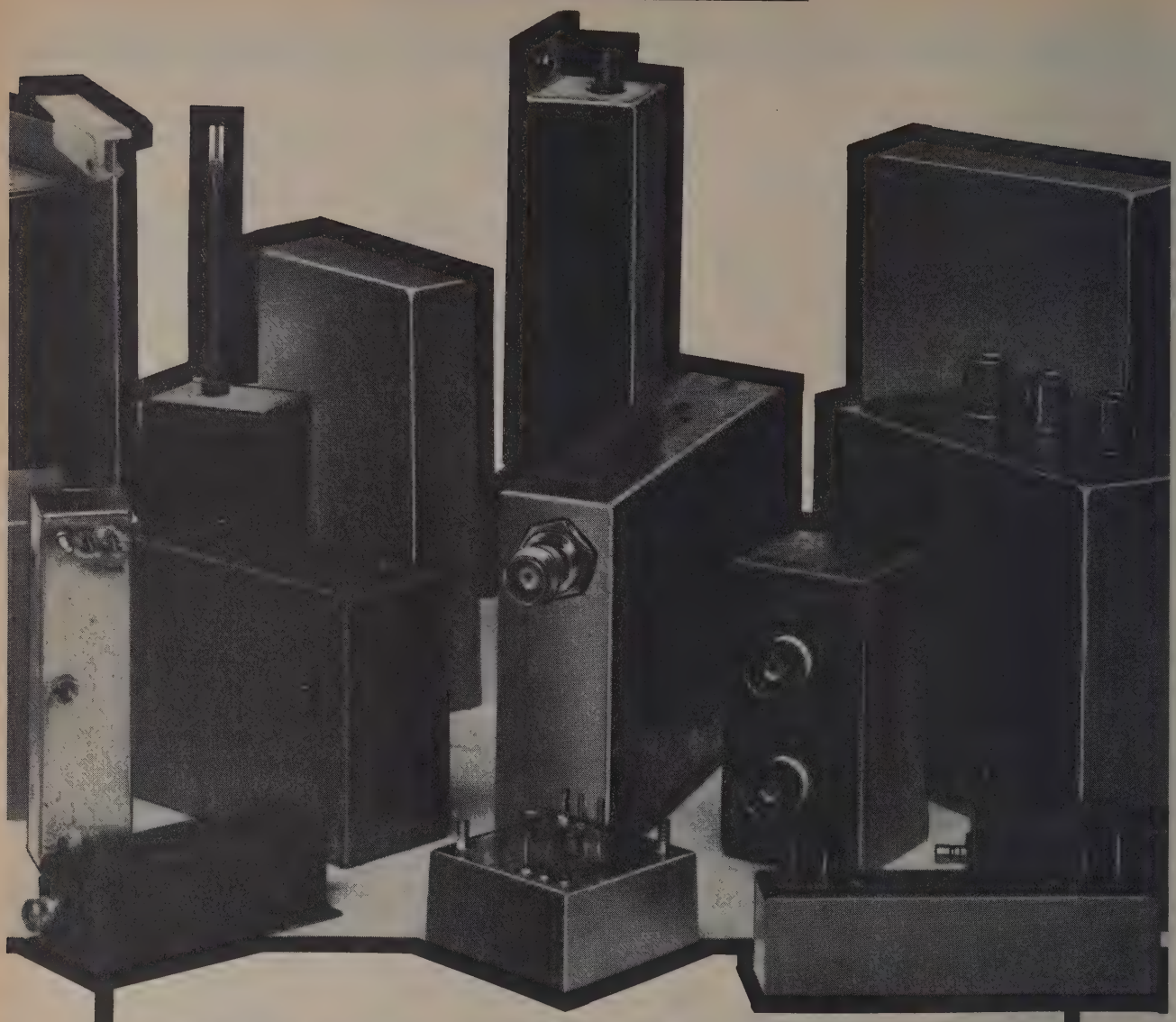
PULSE COMPRESSION RECEIVERS

PULSE EXPANSION—COMPRESSION EQUIPMENT: complete sub-systems including dispersive delay lines and all necessary electronics to perform pulse expansion, pulse compression, and sidelobe suppression.

UNITY GAIN DELAY CHANNELS: complete sub-systems containing dispersive or non-dispersive delay lines with electronics needed to satisfy specified gain, amplitude and phase requirements.

UNITY GAIN VIDEO DELAY MODULES: containing the modulation drive and recovery circuitry necessary to pass base-band NTSC, SCAM and PAL video with outstanding fidelity. Available in 1H, 2H, 1/2H or custom delay time configurations. For dropout compensators, verticle aperture correctors, comb filters, video disc systems.

**ANDERSEN LABORATORIES, INC.**
Advanced Systems Division
1280 Blue Hills Avenue • Bloomfield, Conn. 06002 • 203-242-0761 • TWX 710-425-2390



# FOR ANY TYPE OF LC FILTER
## *CALL THE LEADER*

Low pass, high pass, band pass,
band stop, equalizers, weighting, roofing,
C-notch, C-message and junction filters

From 1.0 Hz to 1000 MHz, designed to commercial or Mil Specs. Our competent staff of filter engineers has made us a top rated supplier in the Instrumentation, Communications, Telemetering, Telephony and Computer industries.

No order too small. If you need one or one thousand, **we will be happy to quote.**

**ANY QUANTITY, FAST QUOTATIONS, FAST DELIVERY, LOW PRICES**
**For further information — call or write today!**

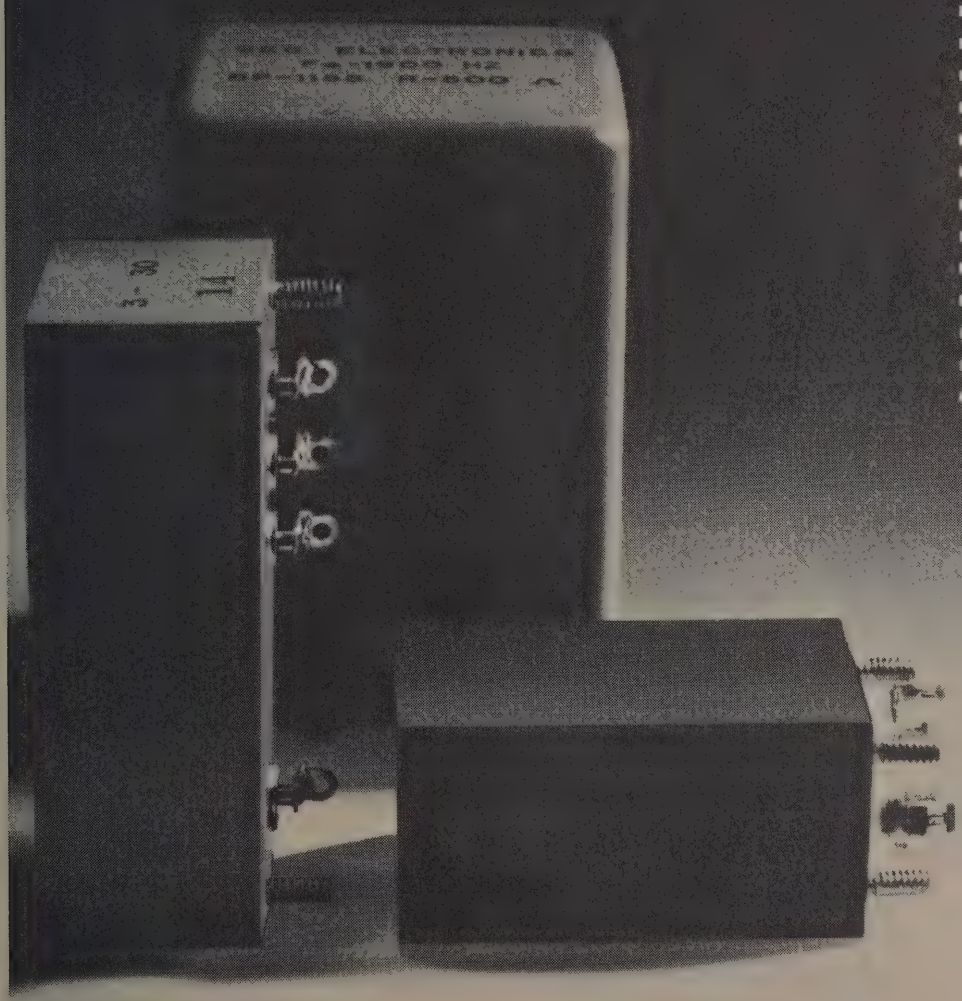
**Dept. E8, 511 Victor Street, Saddle Brook, NJ 07662 • 201/843-6886**

CP Chesterfield Products/inc.

# COMSTRON·SEG

## for all your LC and CRYSTAL filter needs

- Datacom
- Telecom
- Eye Pattern
- Hilbert Transform
- Linear Phase
- High Pass
- Low Pass
- Band Pass
- Band Reject
- Matched
- Delay Equalized
- Amplitude Equalized
- Time Domain
- FDM
- Optimum
- Thompson
- Butterworth
- Chebyschev
- Cauer
- Bessel
- Elliptic
- Legendre
- Channel Simulation



COMSTRON·SEG's on-time delivery of "impossible" filters from engineering conception to mathematical synthesis, through quality oriented production, satisfies our most demanding customers.

Whatever your needs . . . from spectral shaping and phase correction to time-domain synthesis . . . you can rely on the filter experts at COMSTRON·SEG. Computer-optimized custom designs from DC to 120MHz with sharp roll offs or phase correction or narrow bandwidths, all in production quantities with competitive pricing. NAME IT AND COMSTRON·SEG WILL DELIVER IT ON SCHEDULE!

Comstron·Seg

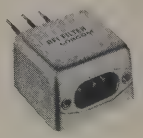
200 East Sunrise Highway, Freeport, New York 11520 (516)546-9700 ■ TWX 510-225-3699

# Corcom RFI Power Line Filters

Case Style
B1, K1, H1

Case Style
B3, K3

Case Style
B4, K4


Case Style
B5, K5

Case Style
B6, K6

Case Style
E1, H4

Case Style
E2, H9

Case Style
R1, S1, V1, W1

Case Style
R3

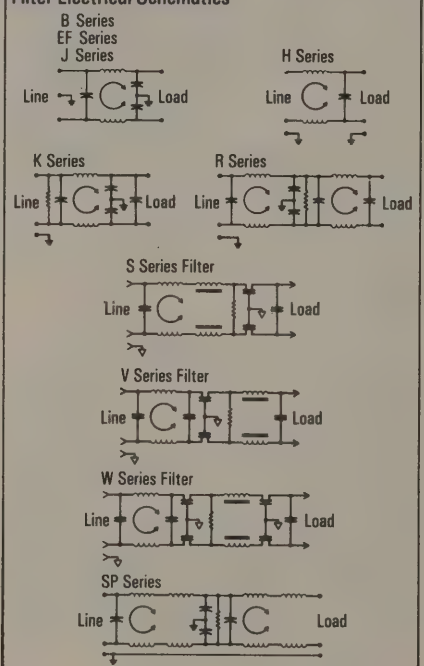
Case Style
R6

Case Style
SP1

Minimum Insertion Loss Values

| Current Rating | Frequency—MHz .15 | .2 | .5 | 10 | 20 |
|---|---|---|---|---|---|
| B Series | | | | | |
| 1A, 3A | 15db | 20db | 30db | 50db | 50db |
| 2A, 5A, 10A, 20A, 30A | 10 | 15 | 25 | 50 | 50 |
| K Series | | | | | |
| 1A, 3A | 15 | 20 | 30 | 50 | 50 |
| 2A, 5A, 10A, 20A, 30A | 8 | 10 | 25 | 50 | 50 |
| EF Series | | | | | |
| 1A | 15 | 20 | 30 | 45 | 45 |
| 3A | 10 | 15 | 25 | 45 | 45 |
| 6A | 8 | 10 | 20 | 45 | 45 |
| H Series | | | | | |
| 6A | 8 | 10 | 20 | 20 | 20 |
| S Series | | | | | |
| 3A, 6A, 10A, 20A | 5 | 10 | 15 | 45 | 45 |
| V Series | | | | | |
| 3A, 6A, 10A, 20A | 5 | 10 | 15 | 45 | 45 |
| W Series | | | | | |
| 3A, 6A, 10A, 20A | 5 | 10 | 15 | 45 | 45 |
| R Series | | | | | |
| 1A, 3A | 40 | 45 | 65 | 65 | 65 |
| 2A, 5A, 10A, 20A | 15 | 25 | 55 | 65 | 65 |
| J Series | | | | | |
| 6A | 8 | 10 | 18 | 40 | 40 |
| SP Series | | | | | |
| 3A, 6A, 10A | 60 | 60 | 60 | 60 | 60 |

**Filter Electrical Schematics**




**B Series*** These filters are general purpose types—effectively providing RFI control of line to ground noise in a small size at lowest cost. They are available in a broad selection of current ratings and termination styles.

**EF Series*** Now VDE approved. These filters incorporate the special IEC (International Electrotechnical Commission) power line connector. This connector has 4 mm minimum pin spacing and complies with all current and proposed requirements for use with industrial and test equipment in the European market where a detachable power cord is part of the equipment design. The EF series features extremely low leakage current; meets IEC, VDE, CSA and ASA requirements for data processing equipment.

**H Series*** These filters are designed for use in health care equipment and are recognized under UL 544 specification. Model 6H1 is suited for patient care equipment. Models 6H4 & 6H9 are suited for non-patient equipment (equipment that is intended for use where contact with the patient is unlikely).

**K Series*** These filters are similar to the B Series but have the added feature of being extremely effective in the control of line to line as well as line to ground RFI interference. The K Series is particularly suited where pulsed, continuous and/or intermittent RFI interference is present and should be used where line to line interference protection is required.

**R Series*** These filters are dual T section RFI power line filters and provide premium performance at moderate cost. They are well suited for low impedance loads where noisy RFI environments are present. At frequencies as low as 150 KHz, the R Series has an insertion loss as high as 40 DB. They control pulsed, continuous and/or intermittent interference. The R Series provides extremely low leakage current without deterioration of insertion loss characteristics.

**SP Series*** These filters have been developed to reduce the RFI noise which is generated in switching type power supplies. Specifically it is suited for equipment that must comply with the requirements of VDE 0875 in West Germany and the proposed FCC specifications in the USA. These filters provide high insertion losses for both line-to-ground and line-to-line emissions throughout the frequency range. This is accomplished without any degradation of performance due to the large peak currents drawn by switching type power supplies.

**S, V & W Series*** These filters combine line-to-ground RFI filters with additional circuitry to reduce low frequency line-to-line noise. They are designed to protect equipment from malfunctions due to conducted line interference coming into the equipment from the line (susceptibility). They are particularly effective when applied in equipment using switching type power supplies, SCR and $T_2L$ circuits.

***THESE FILTERS ARE RECOGNIZED UNDER THE COMPONENTS PROGRAM OF UNDERWRITERS LABORATORIES INC.**

| Specifications | B, K Series | EF, J Series | R Series | H Series | S, V, W Series | SP Series |
|---|---|---|---|---|---|---|
| Rated Voltage | 115/250 VAC | 115/250 VAC | 115/250 VAC | 115/250 VAC | 115/250 VAC | 115/250 VAC |
| Maximum Leakage Current, Each Line to Ground @ 250 VAC 50 Hz | 1.25 mA | .50 mA | 1.25 mA | 5 uA | Less than 1.25 mA | 3.0 mA |
| Operating Frequency | 50-400 Hz | 50-400 Hz | 50-400 Hz | 50-400 Hz | 50-60 Hz | 50-60 Hz |
| High Pot Test | 2250 VDC | 2250 VDC | 2250 VDC | 1500 VAC | 2250 VDC | 2250 VDC |

corcom
Dept. EM
2635 North Kildare Avenue
Chicago, Illinois 60639
(312) 384-7400
TWX 910-221-5308

# Corcom RFI Power Line Filters

**Series B Filters***
General Purpose Type With Two "L" Sections

| Model No. | Case Style | Size L × W × H (Inches) | Current Rated (Amps) | Unit Price |
|---|---|---|---|---|
| 1B1 | B1 | 2.50 × 2.02 × .63 | 1 | $7.60 |
| 1B3 | B3 | 2.50 × .94 × .63 | 1 | 8.06 |
| 1B4 | B4 | 2.00 × 2.42 × .75 | 1 | 8.75 |
| 1B5 | B5 | 2.00 × 1.88 × .75 | 1 | 8.94 |
| 2B1 | B1 | 2.50 × 2.02 × .63 | 2 | 6.86 |
| 2B3 | B3 | 2.50 × .94 × .63 | 2 | 7.32 |
| 2B4 | B4 | 2.00 × 2.42 × .75 | 2 | 8.02 |
| 2B5 | B5 | 2.00 × 1.88 × .75 | 2 | 8.20 |
| 3B1 | B1 | 2.50 × 2.39 × .75 | 3 | 7.88 |
| 3B3 | B3 | 2.50 × 1.31 × .75 | 3 | 8.34 |
| 3B4 | B4 | 2.00 × 2.67 × .75 | 3 | 9.03 |
| 3B5 | B5 | 2.00 × 2.13 × .75 | 3 | 9.22 |
| 5B1 | B1 | 2.50 × 2.39 × .75 | 5 | 7.02 |
| 5B3 | B3 | 2.50 × 1.31 × .75 | 5 | 7.48 |
| 5B4 | B4 | 2.00 × 2.67 × .75 | 5 | 8.18 |
| 5B5 | B5 | 2.00 × 2.13 × .75 | 5 | 8.36 |
| 10B1 | B1 | 2.50 × 2.39 × 1.13 | 10 | 7.72 |
| 10B3 | B3 | 2.50 × 1.31 × 1.13 | 10 | 8.18 |
| 10B4 | B4 | 2.00 × 2.67 × 1.13 | 10 | 8.87 |
| 10B5 | B5 | 2.00 × 2.13 × 1.13 | 10 | 9.06 |
| 10B6 | B6 | 2.50 × 2.63 × 1.13 | 10 | 9.45 |

**Series EF Filters***
International Type With IEC Connector — VDE Approved

| Model No. | Case Style | Size L × W × H (Inches) | Current Rated (Amps) | Unit Price |
|---|---|---|---|---|
| 1EF1 | E1 | 1.97 × 1.97 × .79 | 1 | $9.79 |
| 3EF1 | E1 | 1.97 × 1.97 × .79 | 3 | 9.79 |
| 6EF1 | E1 | 1.97 × 1.97 × .79 | 60 | 9.24 |
| 1EF2 | E2 | 1.97 × 1.55 × 1.31 | 1 | 9.24 |
| 3EF2 | E2 | 1.97 × 1.55 × 1.31 | 3 | 8.69 |
| 6EF2 | E2 | 1.97 × 1.55 × 1.31 | 6 | 8.69 |

**Series H Filters***
Low Leakage Current Filters For Health Care Equipment—UL 544

| Model No. | Case Style | Size L × W × H (Inches) | Current Rated (Amps) | Unit Price |
|---|---|---|---|---|
| 6H1 | H1 | 2.50 × 2.01 × .62 | 6 | $ 7.83 |
| 6H4 | H4 | 1.97 × 1.97 × .79 | 6 | 9.56 |
| 6H9 | H9 | 1.97 × 1.55 × 1.31 | 6 | 9.56 |

**Series K Filters***
For Line To Line & Line To Ground Noise Suppression

| Model No. | Case Style | Size L × W × H (Inches) | Current Rated (Amps) | Unit Price |
|---|---|---|---|---|
| 1K1 | K1 | 2.78 × 2.89 × .88 | 1 | $8.96 |
| 1K3 | K3 | 2.78 × 1.81 × .88 | 1 | 9.40 |
| 1K4 | K4 | 2.00 × 2.67 × .88 | 1 | 10.05 |
| 1K5 | K5 | 2.00 × 2.13 × .88 | 1 | 10.22 |
| 2K1 | K1 | 2.78 × 2.89 × .88 | 2 | 8.26 |
| 2K3 | K3 | 2.78 × 1.81 × .88 | 2 | 8.70 |
| 2K4 | K4 | 2.00 × 2.67 × .88 | 2 | 9.35 |
| 2K5 | K5 | 2.00 × 2.13 × .88 | 2 | 9.53 |
| 3K1 | K1 | 2.78 × 2.89 × 1.13 | 3 | 9.18 |
| 3K3 | K3 | 2.78 × 1.81 × 1.13 | 3 | 9.61 |
| 3K4 | K4 | 2.00 × 2.67 × 1.13 | 3 | 10.27 |
| 3K5 | K5 | 2.00 × 2.13 × 1.13 | 3 | 10.44 |
| 5K1 | K1 | 2.78 × 2.89 × 1.13 | 5 | 8.37 |
| 5K3 | K3 | 2.78 × 1.81 × 1.13 | 5 | 8.92 |
| 5K4 | K4 | 2.00 × 2.67 × 1.13 | 5 | 9.57 |
| 5K5 | K5 | 2.00 × 2.13 × 1.13 | 5 | 9.74 |
| 10K1 | K1 | 2.78 × 3.14 × 1.13 | 10 | 9.03 |
| 10K3 | K3 | 2.78 × 2.06 × 1.13 | 10 | 9.46 |
| 10K6 | K6 | 2.75 × 3.38 × 1.13 | 10 | 10.66 |
| 20K1 | K1 | 2.50 × 3.14 × 1.50 | 20 | 13.10 |
| 20K6 | K6 | 3.32 × 3.38 × 1.50 | 20 | 15.28 |
| 30K6 | K6 | 4.12 × 5.26 × 1.50 | 30 | 26.31 |

**Series R Filters***
For Premium Performance With Two "T" Sections

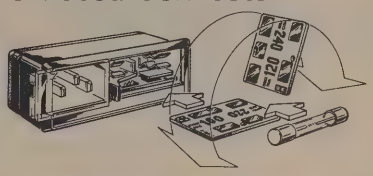
| Model No. | Case Style | Size L × W × H (Inches) | Current Rated (Amps) | Unit Price |
|---|---|---|---|---|
| 1R1 | R1 | 3.14 × 1.75 × 1.13 | 1 | $14.12 |
| 1R3 | R3 | 2.06 × 1.75 × 1.13 | 1 | 14.60 |
| 2R1 | R1 | 3.14 × 1.75 × 1.13 | 2 | 13.35 |
| 2R3 | R3 | 2.06 × 1.75 × 1.13 | 2 | 14.15 |
| 3R1 | R1 | 3.64 × 2.00 × 1.13 | 3 | 14.36 |
| 3R3 | R3 | 2.56 × 2.00 × 1.13 | 3 | 14.85 |
| 5R1 | R1 | 3.64 × 2.00 × 1.13 | 5 | 13.47 |
| 5R3 | R3 | 2.56 × 2.00 × 1.13 | 5 | 13.95 |
| 10R1 | R1 | 3.64 × 2.00 × 1.50 | 10 | 14.19 |
| 10R3 | R3 | 2.56 × 2.00 × 1.50 | 10 | 14.67 |
| 10R6 | R0 | 3.82 × 2.00 × 1.50 | 10 | 16.00 |
| 20R1 | R1 | 5.01 × 3.32 × 1.50 | 20 | 28.19 |
| 20R6 | R6 | 5.25 × 3.32 × 1.50 | 20 | 30.20 |

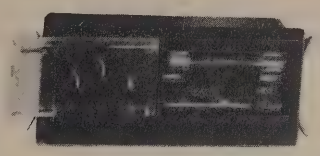
**Series SP***
For Switching Power Supply Noise Suppression

| Model No. | Case Style | Size L × W × H (Inches) | Current Rated (Amps) | Unit Price |
|---|---|---|---|---|
| 3SP1 | SP1 | 6.37 × 2.00 × 1.75 | 3 | $20.00 |
| 6SP1 | SP1 | 6.37 × 2.00 × 2.25 | 6 | 26.75 |
| 10SP1 | SP1 | 6.37 × 2.00 × 2.75 | 10 | 33.35 |

***THESE FILTERS ARE RECOGNIZED UNDER THE COMPONENTS PROGRAM OF UNDERWRITERS LABORATORIES INC.**

## The VS & F Voltage Selecting & Fused Connector





Available to the industry for the first time in one unit a voltage selector switch, a connector and a fuse. The VS & F allows equipment to operate anywhere in the world. **Four operating voltages** — The VS & F and a simple transformer modification allows the equipment to operate at 100, 120, 220 or 240 volts 50-400 Hz. Voltage selection is made with a unique voltage selector card. **Easy installation** — Only one rectangular cut-out is required for easy snap in mounting. **Built-in safety** — The fuse and voltage selector card are enclosed behind a see-thru cover which cannot be moved until the power cord is removed from the equipment. **UL & IEC** — The VS & F has an IEC approved connector. UL SE-01 fire retardant polyester housing and complies with UL and IEC requirements. **RFI Filter** — Available with RFI filter. Minimum insertion loss at .5 MHz is 18 DB, at 2.0 MHz to 5.0 MHz 40 DB.

Model 6J1 (unfiltered style).... **$ 5.95** List Price
Model 6J4 (filtered style)..... **$10.95** List Price

**Series S, V & W Filters***
For Equipment Using Switching Type Power Supplies

| Model No. | Case Style | Size L × W × H (Inches) | Current Rated (Amps) | Unit Price |
|---|---|---|---|---|
| 3S1 | S1 | 3.13 × 1.75 × 1.13 | 3 | $13.21 |
| 6S1 | S1 | 3.62 × 2.00 × 1.50 | 6 | 12.32 |
| 10S1 | S1 | 3.62 × 2.00 × 1.50 | 10 | 13.07 |
| 20S1 | S1 | 5.01 × 3.31 × 1.50 | 20 | 29.54 |
| 3V1 | V1 | 3.13 × 1.75 × 1.13 | 3 | 14.47 |
| 6V1 | V1 | 3.62 × 2.00 × 1.50 | 6 | 13.58 |
| 10V1 | V1 | 3.62 × 2.00 × 1.50 | 10 | 14.33 |
| 20V1 | V1 | 5.01 × 3.31 × 1.50 | 20 | 30.77 |
| 3W1 | W1 | 3.13 × 1.75 × 1.13 | 3 | 15.70 |
| 6W1 | W1 | 3.62 × 2.00 × 1.50 | 6 | 14.82 |
| 10W1 | W1 | 3.62 × 2.00 × 1.50 | 10 | 15.35 |
| 20W1 | W1 | 5.01 × 3.31 × 1.50 | 20 | 32.03 |

corcom

Dept. EM
2635 North Kildare Avenue
Chicago, Illinois 60639
(312) 384-7400
TWX 910-221-5308

# EMI Filters

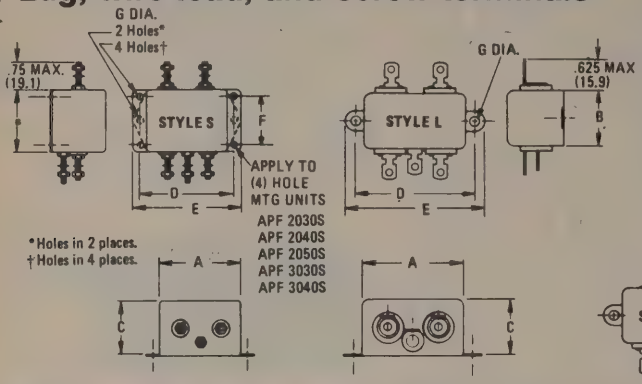
CDE CORNELL-DUBILIER

Class 220.55

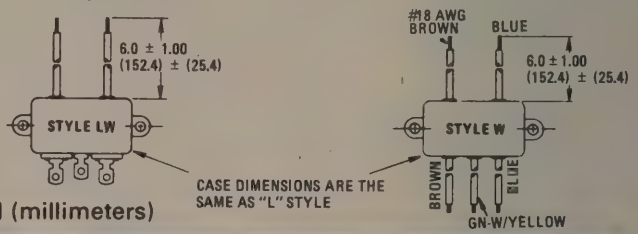
Type APF

## LINE-TO-LINE AND LINE-TO-GROUND INTERFERENCE FILTERS

### Lug, wire lead, and screw terminals




A list of stock filters for most electro-magnetic interference (EMI) applications. For line-to-line and line-to-ground uses. **Rated Voltage:** 115-250VAC, 50-60 Hz **Tested Dielectric Strength:** 2100 VDC. **Leakage Current:** 0.5 ma at 115 VAC; 1.0 ma at 250 VAC. **Insertion Loss Curves** — Measured in 50 ohm system per MIL-STD-220. UL recognition for data processing. **Applications include:** business machines, office machines, copy machines, computer systems, calculators, disc drives, printers, tape drives, microwave ovens plus other major uses.




**Standard Stock Ratings** — Dimensions in inches and (millimeters)

| Current Rating (Amps) | Part ** No. | Terminal Style | A ± .031 (.79) | B ± .031 (.79) | C ± .031 (.79) | D ± .016 (.40) | E ± .031 (.79) | F ± .016 (.40) | G ± .005 (.13) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | APF110 | L,LW,W | 1.81 (46.0) | 1.00 (25.4) | 1.00 (25.4) | 2.12 (54.0) | 2.50 (63.5) | – | .187 (4.76) |
| | APF120 | L,LW,W | 1.81 (46.0) | 1.00 (25.4) | 1.00 (25.4) | 2.12 (54.0) | 2.50 (63.5) | – | .187 (4.76) |
| | APF130 | L,LW,W | 2.00 (50.8) | 2.00 (50.8) | 1.12 (28.6) | 2.38 (60.3) | 2.75 (69.9) | – | .187 (4.76) |
| | APF140 | L,LW,W | 2.00 (50.8) | 2.00 (50.8) | 1.12 (28.6) | 2.38 (60.3) | 2.75 (69.9) | – | .187 (4.76) |
| | APF150 | L,LW,W | 2.00 (50.8) | 2.00 (50.8) | 1.12 (28.6) | 2.38 (60.3) | 2.75 (69.9) | – | .187 (4.76) |
| 2 | APF210 | L,LW,W | 1.81 (46.0) | 1.00 (25.4) | 1.00 (25.4) | 2.12 (54.0) | 2.50 (63.5) | – | .187 (4.76) |
| | APF220 | L,LW,W | 1.81 (46.0) | 1.00 (25.4) | 1.00 (25.4) | 2.12 (54.0) | 2.50 (63.5) | – | .187 (4.76) |
| | APF230 | L,LW,W | 2.00 (50.8) | 2.00 (50.8) | 1.12 (28.5) | 2.38 (60.3) | 2.75 (69.9) | – | .187 (4.76) |
| | APF240 | L,LW,W | 2.00 (50.8) | 2.00 (50.8) | 1.12 (28.5) | 2.38 (60.3) | 2.75 (69.9) | – | .187 (4.76) |
| | APF250 | L,LW,W | 2.00 (50.8) | 2.00 (50.8) | 1.12 (28.5) | 2.38 (60.3) | 2.75 (69.9) | – | .187 (4.76) |
| 3 | APF310 | L,LW,W | 1.75 (44.5) | 1.25 (31.8) | 1.12 (28.5) | 2.12 (54.0) | 2.50 (63.5) | – | .187 (4.76) |
| | APF320 | L,LW,W | 1.75 (44.5) | 1.25 (31.8) | 1.12 (28.5) | 2.12 (54.0) | 2.50 (63.5) | – | .187 (4.76) |
| | APF330 | L,LW,W | 2.00 (50.8) | 2.00 (50.8) | 1.12 (28.5) | 2.38 (60.3) | 2.75 (69.9) | – | .187 (4.76) |
| | APF340 | L,LW,W | 2.00 (50.8) | 2.00 (50.8) | 1.12 (28.5) | 2.38 (60.3) | 2.75 (69.9) | – | .187 (4.76) |
| | APF350 | L,LW,W | 2.00 (50.8) | 2.00 (50.8) | 1.50 (38.1) | 2.38 (60.3) | 2.75 (69.9) | – | .187 (4.76) |
| 5 | APF510 | L,LW,W | 1.75 (44.5) | 1.25 (31.8) | 1.12 (28.5) | 2.12 (54.0) | 2 50 (63.5) | – | .187 (4.76) |
| | APF520 | L,LW,W | 1.75 (44.5) | 1.25 (31.8) | 1.12 (28.5) | 2.12 (54.0) | 2.50 (63.5) | – | .187 (4.76) |
| | APF530 | L,LW,W | 2.00 (50.8) | 2.00 (50.8) | 1.12 (28.5) | 2.38 (60.3) | 2.75 (69.9) | – | .187 (4.76) |
| | APF540 | L,LW,W | 2.00 (50.8) | 2.00 (50.8) | 1.12 (28.5) | 2.38 (60.3) | 2.75 (69.9) | – | .187 (4.76) |
| | APF550 | L,LW,W | 2.00 (50.8) | 2.00 (50.8) | 1.50 (38.1) | 2.38 (60.3) | 2.75 (69.9) | – | .187 (4.76) |
| 10 | APF1010 | L,LW,W | 1.75 (44.5) | 1.25 (31.8) | 1.12 (28.5) | 2.12 (54.0) | 2.50 (63.5) | – | .187 (4.76) |
| | APF1020 | L,LW,W | 1.75 (44.5) | 1.25 (31.8) | 1.12 (28.5) | 2.12 (54.0) | 2.50 (63.5) | – | .187 (4.76) |
| | APF1030 | L,LW,W | 2.00 (50.8) | 2.00 (50.8) | 1.50 (38.1) | 2.38 (60.3) | 2.78 (70.6) | – | .187 (4.76) |
| | APF1040 | L,LW,W | 2.00 (50.8) | 2.00 (50.8) | 1.50 (38.1) | 2.38 (60.3) | 2.78 (70.6) | – | .187 (4.76) |
| | APF1050 | L,LW,W | 2.00 (50.8) | 2.00 (50.8) | 1.50 (38.1) | 2.38 (60.3) | 2.78 (70.6) | – | .187 (4.76) |
| 20 | APF2010 | S | 2.50 (63.5) | 2.00 (50.8) | 1.75 (44.5) | 2.94 (74.7) | 3.31 (84.1) | – | .187 (4.76)* |
| | APF2020 | S | 2.50 (63.5) | 2.00 (50.8) | 1.75 (44.5) | 2.94 (74.7) | 3.31 (84.1) | – | .187 (4.76)* |
| | APF2030 | S | 2.88 (73.2) | 2.25 (57.2) | 2.00 (50.8) | 3.38 (85.9) | 3.88 (98.6) | 1.75 (44.5) | .203 (5.16)† |
| | APF2040 | S | 2.88 (73.2) | 2.25 (57.2) | 2.00 (50.8) | 3.38 (85.9) | 3.88 (98.6) | 1.75 (44.5) | .203 (5.16)† |
| | APF2050 | S | 2.88 (73.2) | 2.25 (57.2) | 2.00 (50.8) | 3.38 (85.9) | 3.88 (98.6) | 1.75 (44.5) | .203 (5.16)† |
| 30 | APF3010 | S | 2.50 (63.5) | 2.00 (50.8) | 1.75 (44.5) | 2.94 (74.7) | 3.31 (84.1) | – | .187 (4.76)* |
| | APF3020 | S | 2.50 (63.5) | 2.00 (50.8) | 1.75 (44.5) | 2.94 (74.7) | 3.31 (84.1) | – | .187 (4.76)* |
| | APF3030 | S | 2.88 (73.2) | 2.25 (57.2) | 2.00 (50.8) | 3.38 (85.9) | 3.88 (98.6) | 1.75 (44.5) | .203 (5.16)† |
| | APF3040 | S | 2.88 (73.2) | 2.25 (57.2) | 2.00 (50.8) | 3.38 (85.9) | 3.88 (98.6) | 1.75 (44.5) | .203 (5.16)† |

**To complete part number, select terminal style above.
Example: Terminal required style L, 3 amps = APF310L.

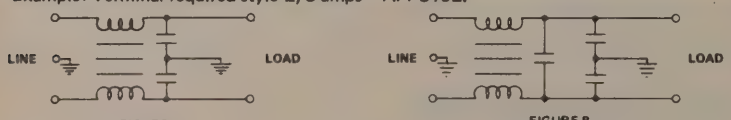
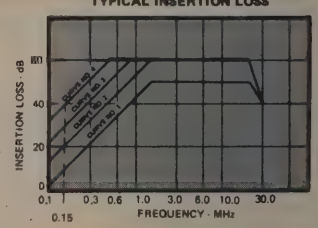



FIGURE A
10 dB = CURVE 1

FIGURE B
20 dB = CURVE 2
30 dB = CURVE 3
40 dB = CURVE 4
50 dB = ☆

☆50 db series is designed for low frequency applications.

TYPICAL INSERTION LOSS




### TO SELECT ALL PURPOSE FILTERS

Typical Ordering Information **APF**

**Determine Current Rating Desired**

**1**

CURRENT RATING

| | |
|---|---|
| 1 = 1 amp | 10 = 10 amp |
| 2 = 2 amp | 20 = 20 amp |
| 3 = 3 amp | 30 = 30 amp |
| 5 = 5 amp | |

**Select Insertion Loss From Curve**

**10**

TYPICAL INSERTION LOSS

| MHz @ 0.15 | |
|---|---|
| 10 = 10 dB—Curve 1 | 40 = 40 dB—Curve 4 |
| 20 = 20 dB—Curve 2 | 50 = 50dB—☆ |
| 30 = 30 dB—Curve 3 | |

☆50 dB series is designed for low frequency applications

**Select Style Terminal Required**

**L**

TERMINALS

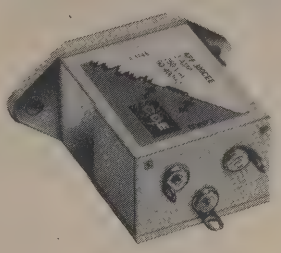
| | |
|---|---|
| L = Lugs | W = Wire |
| LW = Wire on load side lug on line side. (Not applicable over 10 amp rating) | |
| S = 8-32 screw (All 20 and 30 amp only) | |

CDE CORNELL-DUBILIER

# EMI Filters

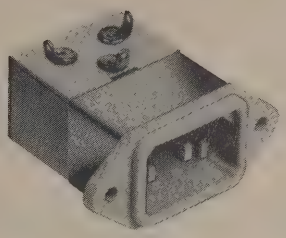


## CONNECTOR SERIES

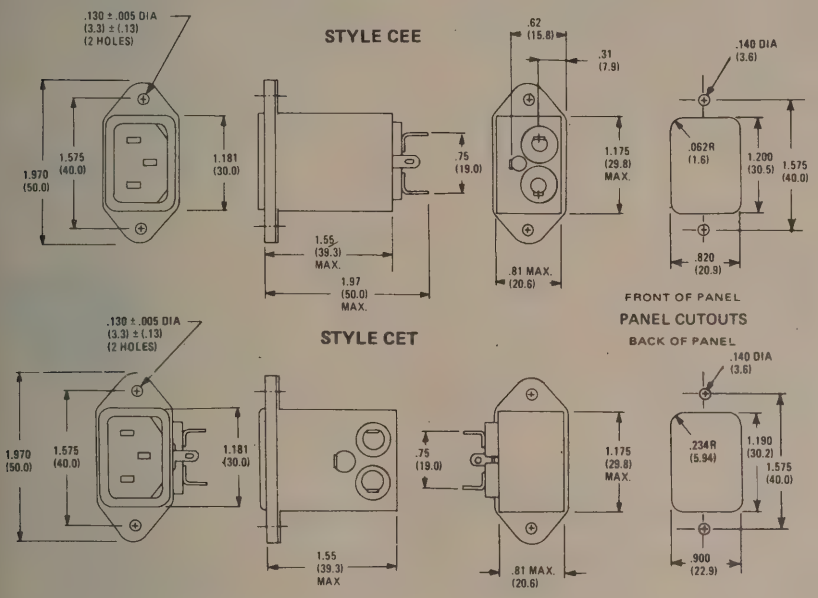


**STYLE CEE, CET:**
These APF filters incorporate the use of an AC power line connector designed to meet IEC standards for use with detachable three-conductor line cord. These cases are molded Celanex®

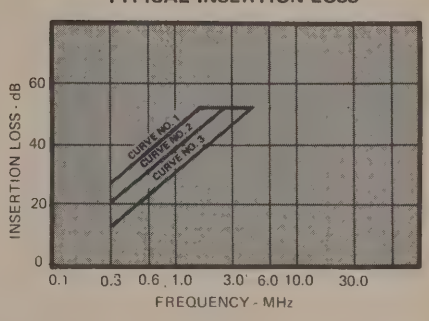
CEE = Connector/End Lug
CET = Connector/Top Lug



**Dimensions in inches and (millimeters)**




**TYPICAL INSERTION LOSS**




## Standard Stock Ratings

| Current Rating (Amps) | Part No.** | Terminal Style | Insertion Loss |
|---|---|---|---|
| 1 | APF100 | CEE,CET | Curve 1 |
| 3 | APF300 | CEE,CET | Curve 2 |
| 6 | APF600 | CEE,CET | Curve 3 |

**To complete part number, select terminal style above. Example, end terminal style "CEE", 3 amps = APF300CEE.

## UL544 MEDICAL AND DENTAL EQUIPMENT PATIENT CONNECTED

UL Recognized under component program of UL544. Low leakage current designs.

### SPECIFICATIONS

— Maximum leakage current, line to ground.
@ 115 VAC, 60 Hz 2 μa
@ 250 VAC, 60 Hz 5 μa
— Rated Voltage 250 VAC
— Operating Frequency 50/400 Hz
— Dielectric Strength
line to ground 2100 VDC (1500 VAC)
line to line 1450 VDC
— Typical Insertion Loss in 50 ohm System.

| .15MHz | .2MHz | .5MHz | 10MHz | 20MHz |
|---|---|---|---|---|
| 12 db | 15 db | 25 db | 28 db | 28 db |

| PART NUMBER | CURRENT RATING |
|---|---|
| APFM100CEE | 1 AMP |
| APFM100CET | 1 AMP |
| APFM300CEE | 3 AMP |
| APFM300CET | 3 AMP |
| APFM600CEE | 6 AMP |
| APFM600CET | 6 AMP |

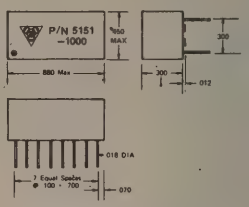
DATA DELAY DEVICES
385 LAKEVIEW AVE., CLIFTON, N. J. 07011 Tel. (201) 772-1105
SHORT FORM CATALOG

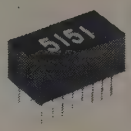
# DIP-ACTIVE FILTERS

**SERIES 5151-5353**

## SPECIFICATIONS

- **Transfer characteristics** – Butterworth
- **Gain in pass-band** – 0 db ± .2 db.
- **Cut-off frequency accuracy** – ± 2% @ –3 db.
- **Maximum input voltage** – 10 volts peak.
- **Skirt Attenuation** – 24 db / octave.
- **DC drift** – 20uV / ℃ typical.
- **Supply Voltage** – ±15V typical (±9V to ±18V operational).
- **Temperature range** – 0℃ to +70℃ (standard); –55℃ to +125℃ (on request).
- **Temperature Coefficient** – .03% / ℃. Better on request.
- **Power Consumption** – 200MW Maximum.




| LOW-PASS FILTERS | | | | HIGH-PASS FILTERS | | | |
|---|---|---|---|---|---|---|---|
| PART NO. | 3 db – FREQUENCY (HZ) | PART NO. | 3 db – FREQUENCY (HZ) | PART NO | 3 db – FREQUENCY (HZ) | PART NO. | 3 db – FREQUENCY (HZ) |
| 5151-1 | 1 | 5151-400 | 400 | 5353-10 | 10 | 5353-2,500 | 2,500 |
| 5151-10 | 10 | 5151-1,000 | 1,000 | 5353-100 | 100 | 5353-3,250 | 3,250 |
| 5151-20 | 20 | 5151-1,200 | 1,200 | 5353-160 | 160 | 5353-4,000 | 4,000 |
| 5151-40 | 40 | 5151-2,500 | 2,500 | 5353-400 | 400 | 5353-13,000 | 13,000 |
| 5151-50 | 50 | 5151-4,000 | 4,000 | 5353-500 | 500 | 5353-16,000 | 16,000 |
| 5151-100 | 100 | 5151-5,000 | 5,000 | 5353-1,000 | 1,000 | 5353-20,000 | 20,000 |
| 5151-200 | 200 | 5151-20,000 | 20,000 | 5353-1,800 | 1,800 | | |

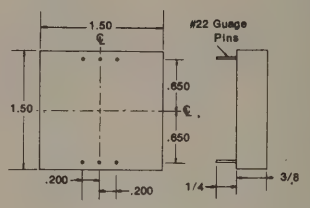
| FUNCTION | PIN # |
|---|---|
| INPUT | 1 |
| OUTPUT | 11 |
| GND | 15 |
| V+ | 12 |
| V– | 8 |

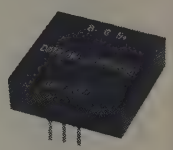
NOTE: The above table gives only a small number of designs available. Many other designs are available on request. Any frequency from 1HZ to 25KHZ can be selected.

# TONE ACTIVE FILTERS

**SERIES TAF-24**

| PART NO. | fc(Hz) | PART NO. | fc(Hz) | PART NO. | fc(Hz) |
|---|---|---|---|---|---|
| TAF24-360 | 360 | TAF24-1260 | 1260 | TAF24-2280 | 2280 |
| TAF24-420 | 420 | TAF24-1320 | 1320 | TAF24-2340 | 2340 |
| TAF24-480 | 480 | TAF24-1336 | 1336 | TAF24-2400 | 2400 |
| TAF24-540 | 540 | TAF24-1380 | 1380 | TAF24-2460 | 2460 |
| TAF24-600 | 600 | TAF24-1440 | 1440 | TAF24-2520 | 2520 |
| TAF24-660 | 660 | TAF24-1477 | 1477 | TAF24-2580 | 2580 |
| TAF24-697 | 697 | TAF24-1500 | 1500 | TAF24-2640 | 2640 |
| TAF24-720 | 720 | TAF24-1560 | 1560 | TAF24-2700 | 2700 |
| TAF24 770 | 770 | TAF24-1620 | 1620 | TAF24-2760 | 2760 |
| TAF24-780 | 780 | TAF24-1633 | 1633 | TAF24-2820 | 2820 |
| TAF24-840 | 840 | TAF24-1680 | 1680 | TAF24-2880 | 2880 |
| TAF24-852 | 852 | TAF24-1740 | 1740 | TAF24-2940 | 2940 |
| TAF24-900 | 900 | TAF24-1800 | 1800 | TAF24-3000 | 3000 |
| TAF24-941 | 941 | TAF24-1860 | 1860 | TAF24-3060 | 3060 |
| TAF24-960 | 960 | TAF24-1920 | 1920 | TAF24-3120 | 3120 |
| TAF24-1020 | 1020 | TAF24-1980 | 1980 | TAF24-3180 | 3180 |
| TAF24-1080 | 1080 | TAF24-2040 | 2040 | TAF24-3240 | 3240 |
| TAF24-1140 | 1140 | TAF24-2100 | 2100 | TAF24-3300 | 3300 |
| TAF24-1200 | 1200 | TAF24-2160 | 2160 | TAF24-3360 | 3360 |
| TAF24-1209 | 1209 | TAF24-2220 | 2220 | | |



## SPECIFICATIONS

- **Center frequency** – See table below (others on request).
- **Bandwidth (3db)** – ±1.5% to ±3% of fc.
- **Bandwidth (20db)** – ±10.5% of fc.
- **Gain** – 10db ±1db.
- **Gain variation** – ±.4db from 0°c. to 70°c.
- **Input impedance** – 10 K (Ω)
- **Output load** – ≥600 (Ω).
- **Temperature range** – -0°c to 70°c.
- **Power supply** – ±15 Vdc.

# LOW PROFILE FILTERS

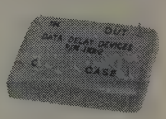
**SERIES 1100**

**CASE** Metal flat case to reduce hum pick-up.

**PINS** Straight pins for PC mounting.

**MIL SPECS** These filters meet MIL-F-18327C specs. Grade 6, Class R, Life X.

**NOTE** Filters with other requirements than shown can be supplied. Our technical staff is ready to give you prompt service.




**LOW-PASS**

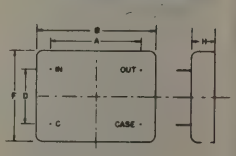
| PART NO. | Imp. IN/OUT | PASS-BAND (1db) | PASS-BAND (3db) | STOP-BAND | CASE NO. |
|---|---|---|---|---|---|
| 1101-1 | 10K | DC to 460Hz | 600Hz | 40db above 750Hz | 1 |
| 1101-2 | 600 | DC to 3KHz | 3.4KHz | 40db above 4.2KHz | 1 |
| 1101-3 | 10K | DC to 4.4KHz | 5KHz | 43db above 6.3KHz | 2 |
| 1101-4 | 1K | DC to 9KHz | 10KHz | 43db above 12.8KHz | 1 |
| 1101-5 | 600 | DC to 15KHz | 18KHz | 43db above 23KHz | 1 |
| 1101-6 | 600 | DC to 43KHz | 50KHz | 43db above 64KHz | 2 |

**HIGH-PASS**

| PART NO. | Imp. IN/OUT | PASS-BAND (1db) | PASS-BAND (3db) | STOP-BAND | CASE NO. |
|---|---|---|---|---|---|
| 1102-1 | 10K | 300Hz & above | 200Hz | 40db below 140Hz | 1 |
| 1102-2 | 10K | 600Hz & above | 400Hz | 40db below 280Hz | 1 |
| 1102-3 | 10K | 1.2KHz & above | 800Hz | 40db below 560Hz | 1 |
| 1102-4 | 10K | 3KHz & above | 2KHz | 40db below 1.4KHz | 2 |
| 1102-5 | 10K | 6KHz & above | 4KHz | 40db below 2.8KHz | 2 |

**BROAD BAND-PASS**

| PART NO. | Imp. IN/OUT | PASS-BAND | STOP-BAND (36db) BELOW | STOP-BAND (36db) ABOVE | CASE NO. |
|---|---|---|---|---|---|
| 1103-1 | 10K | 1KHz to 2KHz | 0.5KHz | 4KHz | 3 |
| 1103-2 | 10K | 2KHz to 4KHz | 1KHz | 8KHz | 3 |
| 1103-3 | 10K | 4KHz to 8KHz | 2KHz | 16KHz | 3 |
| 1103-4 | 10K | 10KHz to 20KHz | 5KHz | 40KHz | 4 |




**CASE DIMENSIONS**

| CASE NO. | A IN. | A M.M. | B IN. | B M.M. | D IN. | D M.M. | F IN. | F M.M. | H IN. | H M.M. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.4 | 35.56 | 1.875 | 47.63 | 1.4 | 35.56 | 2.0 | 50.8 | 0.5 | 12.70 |
| 2 | 1.4 | 35.56 | 2.0 | 50.8 | 0.8 | 20.32 | 1.5 | 38.1 | 0.375 | 9.53 |
| 3 | 1.4 | 35.56 | 2.0 | 50.8 | 0.8 | 20.32 | 1.5 | 38.1 | 0.5 | 12.70 |
| 4 | 0.8 | 20.32 | 1.25 | 31.75 | 1.0 | 25.4 | 1.75 | 44.45 | 0.375 | 9.53 |

DATA DELAY DEVICES
385 LAKEVIEW AVE., CLIFTON, N. J. 07011 Tel. (201) 772-1105
SHORT FORM CATALOG

# DOUGLAS RANDALL

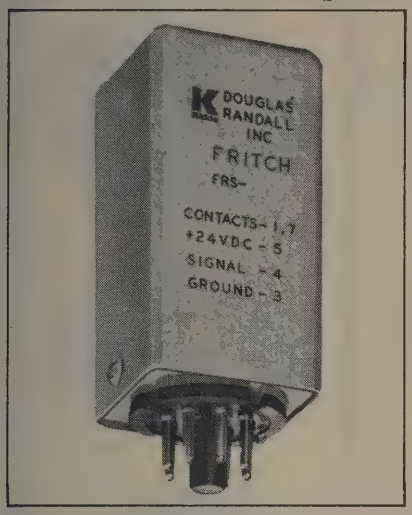
Division of Walter Kidde & Company, Inc.

KIDDE

# TONE CONTROLS

6 PAWCATUCK AVENUE / PAWCATUCK, CONNECTICUT 02891 / (203) 599-1750 / TELEX: 966427 / CABLE: DORANIC

## FRITCH® — Frequency Responsive Switch



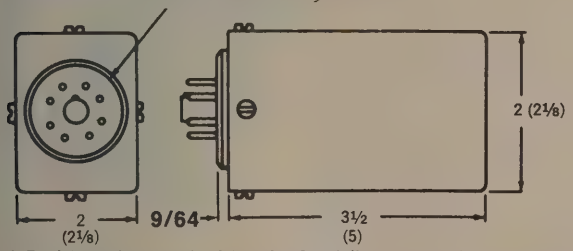

**The FRITCH® is a sensitive, rapid tone detector combining solid state circuitry with a Reed Relay output. Two basic types are made:**

**Type I — Used where only one frequency is present.**

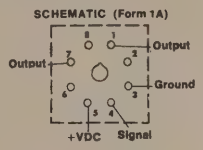
**Type II — Used where several frequencies are present.**

**DOUBLE TONE FRITCHes detect two frequencies. They are prefiltered to operate in the presence of several frequencies and can incorporate optional time delays to minimize the effect of spurious signals. They are ideal for detecting touch tone pairs over telephone lines.**

STANDARD OCTAL TUBE BASE




SCHEMATIC (Form 1A)




DIMENSIONS IN PARENTHESIS ( ) ARE FOR DOUBLE TONE FRITCH

® Registered trademark of Douglas Randall Frequency Responsive switch. (Patent 3584275)

### Specifications

**FREQUENCY RANGE:** 7 Hz to 100 KHz.

**BANDWIDTH:** Must Operate: ±2% fo. May Operate ±5% fo.

**NORMAL CHANNEL SPACING:** 11%.

**INPUT SIGNAL LEVEL:** 5 VRMS, 1 VRMS or 0.7 VRMS (odbm). Special to .050 V.

**INPUT IMPEDANCE:** 25,000 ohms typical.

**RESPONSE TIME:** To 75 pulses per second depending on frequency.

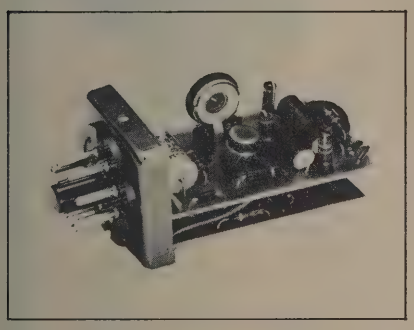
**DC POWER INPUT:** 12 V or 24 VDC ±10% (other voltages available).

**OUTPUT CONTACTS:** Form 1A, 2A, 1B, 2B, 1C or 1A1B. Solid state output optional.

**CONTACT RATING:** Form A or B — 10 W, 0.5 A or 250 VDC Max. Form C — 3 W, 0.25 A or 28 VDC Max.

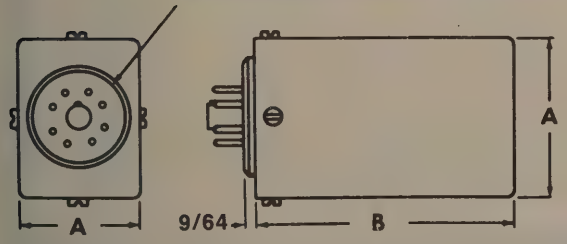
**ENVIRONMENTAL LIMITS:** Shock: 50 g; Vibration: 35 g; Temperature: −0°C to +50°C.

## Oscillators



**Douglas Randall Oscillators are solid state RC devices. The oscillator circuit operates continuously. The output stage is gated to a low impedance driver circuit, insuring extremely rapid signal response and freedom from frequency shift due to keying. Keying is accomplished by connecting the proper terminal to the power supply common (see schematic). The oscillators have reverse polarity protection incorporated in the unit to protect them if improperly connected. Single, double and triple tone versions are available in standard octal plug housings. They are also available for P.C. Mounting.**

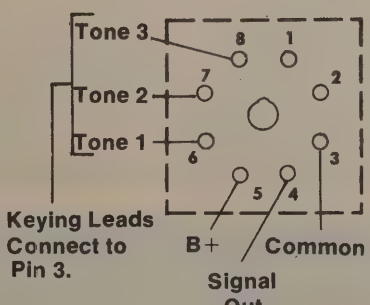
STANDARD OCTAL TUBE BASE




**Dimension**
**Single Tone**
**A — 1½**
**B — 2¾**

**Double or Triple Tone**
**A — 2**
**B — 3½**

SCHEMATIC




### Specifications

**DC POWER INPUT:** 12 V or 24 VDC ±10% (other voltages available).

**LOAD IMPEDANCE:** 600 ohms.

**OUTPUT SIGNAL:** Standard, 1 V RMS.

**DISTORTION:** 1%.

**RESPONSE TIME:** 50 Microseconds.

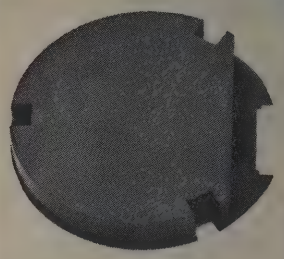
**DECAY TIME:** 50 Microseconds.

**FREQUENCY RANGE:** ±1%: 0°C to 40°C. ±1.5%: −20° to +65°.

# ESC LC FILTERS

## DC to 100 Mhz

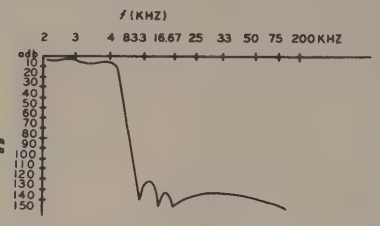
- Low Pass
- Band Reject
- RC
- Phase Matched
- High Rel
- High Pass
- Wideband
- Linear Phase
- Attenuation Matched
- Comb
- Band Pass
- Audio
- Constant Group Delay
- Low Transient Response
- Attenuation Equalizers



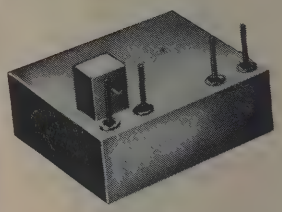
**SONAR FILTERS IN PHASE AND AMPLITUDE MATCHED SETS**

Linear phase bandpass and lowpass filters, with phase and amplitude matched passbands. Matching can be accomplished for any number of channels; generally three filters made a set, but as many as 900 have been phase and amplitude matched. ESC produces filters for Sonobuoys and audio comb analyzers.

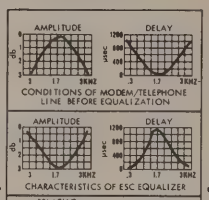
**HIGH ATTENUATION 140 db AIRCRAFT RADIO LOW PASS FILTERS**




ESC is the leading manufacturer of high attenuation filters. These filters provide more than 140 db attenuation of harmonic frequencies in the audio band and have controlled minimum phase shift. Size is only 1.2 x 1.0 x .58.

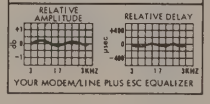


**ESC EQUALIZERS**




ESC produces custom designed equalizers for group delay and amplitude distortion. In particular, ESC produces custom designed compromise equalizers for modem manufacturers to correct for transmission line and modem produced amplitude and phase (delay) distortion. Equalization allows modem sets to be used at highest possible rates with minimum distortion. Contact ESC for your specific requirement.

**ESC TELEPHONE LINE SIMULATORS**




They provide voice-band data systems users with nominal worst case conditions of amplitude and envelope delay of Bell Telephone voice bandwidth data channel 3002 and C1, C2 and C4 conditioning.

**FILTERS FOR THE TELEPHONE INDUSTRY**

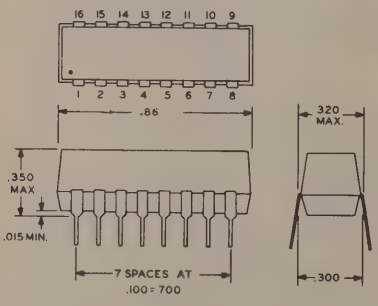
ESC has a full line of 1010 Hz Band reject filters. Low profile versions for standard telephone testing production equipment. Available in 600 Ω and 900 Ω balanced and unbalanced versions to "Western Electric" specifications.

2600 Hz Band reject filters available to standard "Bell" specifications or in miniaturized version with height approximately ½". Low cost for standard "SF" Signalling equipment.

**ULTRA SHARP HIGH SPEED DATA MODEM FILTERS**

ESC produces a series of lowpass, bandpass and band suppression filters in 60 Khz to 108 Khz range for use in high speed (150 Kbps) data modems. Filters have very sharp attenuation characteristics, low group delay distortion and more than 60 db intermodulation distortion and are made in compact sizes for PC board capability.

**DIP LOW PASS FILTER SERIES**



**SPECIFICATIONS:**

- Insertion Loss: less than .5 db at .1 Fc
- Ripple: less than 1 db in Passband to Fc
- Attenuation: less than 3 db to Fc; greater than 50 db at 3 Fc
- Operating Temp: – 55°C to + 125°C
- Built to conform to applicable portions of MIL-F-18327
- Mounting: Standard 16 Pin configuration
- For other filter types in DIP configuration contact plant

| CUT-OFF FREQUENCY Fc | IMPEDANCE Z IN/OUT → 75 Ω | 100 Ω | 200 Ω | 250 Ω | 500 Ω | 1000 Ω |
|---|---|---|---|---|---|---|
| 200 KHz | | | 2 DIP-200 | 2 DIP-250 | 2 DIP-500 | 2 DIP-1000 |
| 400 KHz | | 4 DIP-100 | 4 DIP-200 | 4 DIP-250 | 4 DIP-500 | 4 DIP-1000 |
| 500 KHz | | 5 DIP-100 | 5 DIP-200 | 5 DIP-250 | 5 DIP-500 | 5 DIP-1000 |
| 800 KHz | 8 DIP-75 | 8 DIP-100 | 8 DIP-200 | 8 DIP-250 | 8 DIP-500 | 8 DIP-1000 |
| 1 MHz | 10 DIP-75 | 10 DIP-100 | 10 DIP-200 | 10 DIP-250 | 10 DIP-500 | 10 DIP-1000 |

*Request Bulletin — DIP-F*

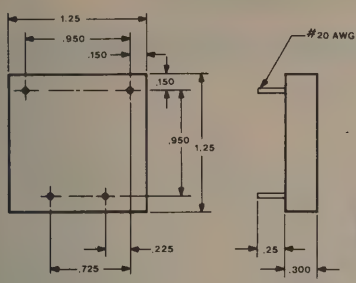
**ESC ELECTRONICS CORPORATION**
534 BERGEN BOULEVARD • PALISADES PARK, N.J. 07650
PHONE: (201) 947-0400 • TWX 710-991-9780
TOLL FREE 800-631-0853 (except N.J.)

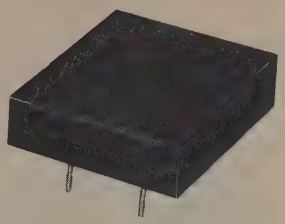
# LC FILTERS

## DC to 100 Mhz

ESC

### 130 DB/OCTAVE MINIATURIZED
### FL LOW PASS FILTERS



**SPECIFICATIONS:**

- Insertion Loss: ..... Less than 1 db at .1 $f_c$
- Ripple: ..... Less than 1 db in Pass Band
- Roll-off: ..... 130 db per octave or better
- Minimum stop band attenuation: .. 45 db
- Operating Temp. Range: ..... -55°C to + 125°C
- Construction: ..... Epoxy - DAP molded construction
- Built to conform to applicable portions of MIL-F-18327

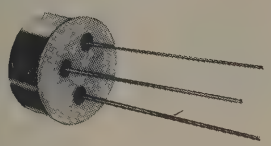
*Request Bulletin — FL*

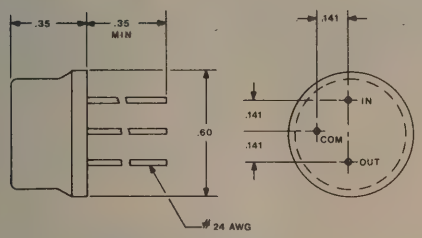
STANDARD TYPES:

| Cut-off Frequency (Khz) | Impedance (ohms) | | | | |
|---|---|---|---|---|---|
| | 600 | 1000 | 2000 | 3000 | 5000 |
| 3.0 | FL3-6 | FL3-10 | FL3-20 | FL3-30 | |
| 4.0 | FL4-6 | FL4-10 | FL4-20 | FL4-30 | |
| 5.0 | FL5-6 | FL5-10 | FL5-20 | FL5-30 | FL5-50 |
| 8.0 | FL8-6 | FL8-10 | FL8-20 | FL8-30 | FL8-50 |
| 10.0 | FL10-6 | FL10-10 | FL10-20 | FL10-30 | FL10-50 |

Other designs available upon request

### TO-8 LOW PASS FILTERS






*Request Bulletin-TO-8*

**SPECIFICATIONS:**

- Insertion Loss: ..... Less than .5 db at .1 $f_c$
- Ripple: ..... Less than .5 db Peak to Peak in pass-band.
- Attenuation: ..... Series M: 12 db/octave roll-off from 3 db point.
  Series P: 18 db/octave roll-off from 3 db point.
- Operating Temp. Range: ..... Military: -55°C to + 125°C. Conforms to applicable portions of MIL-F-18327.
  Commercial: 0° to + 70°C.
- Mounting: ..... Standard TO-8 -- see diagram.

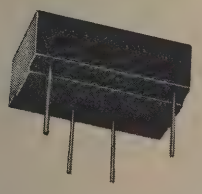
STANDARD TYPES:

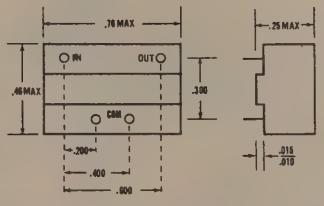
| SERIES M (12 db/octave) Impedance (ohms) | | | | | Cut-off Frequency (Khz) | SERIES P (18 db/octave) Impedance (ohms) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 600 | 1000 | 2000 | 3000 | 5000 | | 600 | 1000 | 2000 | 3000 | 5000 |
| | M2-10* | M2-20 | | | 2.0 | | P2-10* | P2-20* | | |
| M3-6* | M3-10 | M3-20 | | | 3.0 | P3-6* | P3-10* | P3-20 | | |
| M5-6 | M5-10 | M5-20 | M5-30 | | 5.0 | P5-6* | P5-10 | P5-20 | P5-30 | |
| M8-6 | M8-10 | M8-20 | M8-30 | M8-50 | 8.0 | P8-6 | P8-10 | P8-20 | P8-30 | |
| M10-6 | M10-10 | M10-20 | M10-30 | M10-50 | 10.0 | P10-6 | P10-10 | P10-20 | P10-30 | P10-50 |

Other designs available upon request

* Not available to MIL specs.

### ESC DUAL-IN-LINE DIF® FILTERS






Five series of filters, three lowpass and two highpass. As example DIF-L39 lowpass series is listed below. Also available is linear phase series DIF-LP, lowpass series DIF-L20, highpass series DIF-H20 and DIF-H39. Full specifications for attenuation and typical characteristics such as phase shift, group delay and pulse response are presented in catalog. A bandpass filter can be formed by tandem connection of a lowpass and highpass (minimum bandwidth is one octave).

**SPECIFICATIONS:**

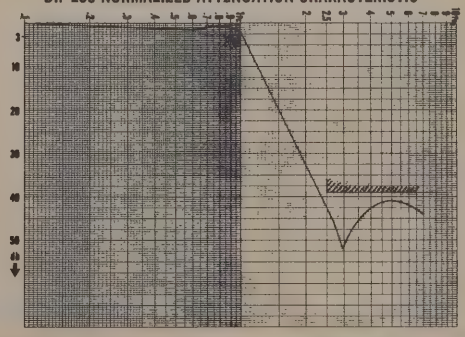
| | |
|---|---|
| INSERTION LOSS | <.5 db at .1Fc |
| RIPPLE | <±1 db in Passband (to Fc) |
| ATTENUATION | <3 db to Fc |
| | >39 db at 2.5 Fc & higher frequencies |

**DIF-L39 SERIES STANDARD PART NUMBERS**

| CUTOFF FREQUENCY Fc / IMPEDANCE, Z IN/OUT | 50Ω | 100Ω | 200Ω | 500Ω | 1000Ω | 2000Ω | 5000Ω |
|---|---|---|---|---|---|---|---|
| 1KH, | | | | DIF-L39-31 | DIF L39-41 | | |
| 2 | | | | DIF-L39-32 | | | |
| 2.5 | | | DIF-L39-21 | | DIF-L39-42 | DIF-L39-50 | |
| 5 | | DIF-L39-11 | DIF-L39-22 | DIF-L39-33 | DIF-L39-43 | DIF-L39-51 | DIF-L39-57 |
| 10KH, | DIF-L39-1 | DIF-L39-12 | | DIF-L39-34 | DIF-L39-44 | | DIF L39-58 |
| 12.5 | | | DIF-L39-23 | | | DIF-L39-52 | |
| 20 | DIF-L39-2 | | | DIF-L39-35 | | | DIF-L39-59 |
| 25 | | DIF-L39-13 | DIF-L39-24 | | DIF-L39-45 | DIF-L39-53 | |
| 50 | DIF-L39-3 | DIF-L39-14 | DIF-L39-25 | DIF-L39-36 | DIF-L39-46 | DIF-L39-54 | DIF-L39-60 |
| 100KH, | DIF-L39-4 | DIF-L39-15 | | DIF-L39-37 | DIF-L39-47 | | DIF-L39-61 |
| 125 | | | DIF-L39-26 | | | DIF-L39-55 | |
| 200 | DIF-L39-5 | | | DIF-L39-38 | | | |
| 250 | | DIF-L39-16 | DIF-L39-27 | | DIF-L39-48 | DIF-L39-56 | |
| 500 | DIF-L39-6 | DIF-L39-17 | DIF-L39-28 | DIF-L39-39 | DIF-L39-49 | | |
| 1MH, | DIF-L39-7 | DIF-L39-18 | | DIF-L39-40 | | | |

*Request Bulletin — DIF*

**DIF-L39 NORMALIZED ATTENUATION CHARACTERISTIC**



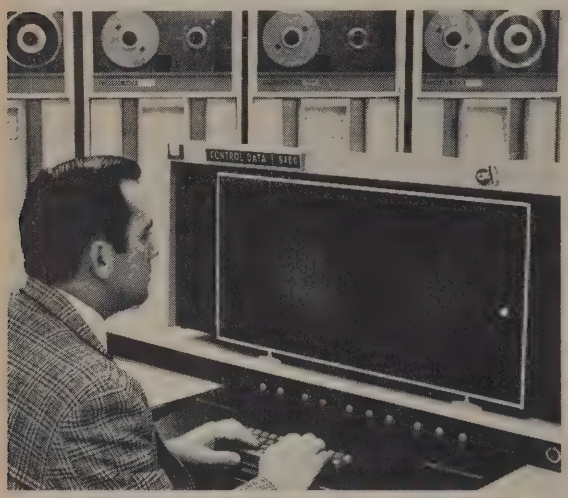

ESC ELECTRONICS CORPORATION
534 BERGEN BOULEVARD • PALISADES PARK, N.J. 07650
PHONE: (201) 947-0400 • TWX 710-991-9780
TOLL FREE
800-631-0853
(except N.J.)

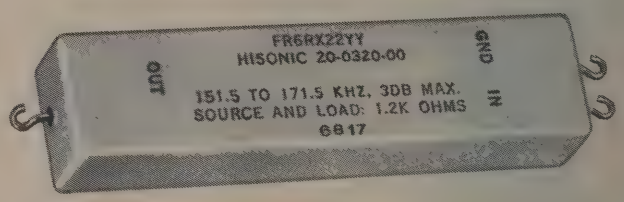
hisonic inc.

249 N. TROOST • OLATHE, KANSAS 66061
PHONE: 913-782-0012
TELEX: 4-2562

# CUSTOM FILTERS

Low, band or high pass and band stop filters with optimum amplitude and/or delay characteristics can be supplied to your special requirements and MIL-F-18327 Construction utilizes precision inductors and high quality capacitors of special films or silvered mica, according to frequency and space requirements. Operating frequencies range to 100 MHZ. Temperature stabilization for both amplitude and frequency can be effected. Mechanical styles may be epoxy encapsulated or hermetically sealed metal in sizes from 0.2 to 200 cu. in.






To keep pace with the most sophisticated technologies of network design, Hisonic engineers have direct in-plant access to the tremendous capabilities of large late-generation computers. The Hisonic staff includes specialists with up to 25 years experience in precision inductor and filter network design. It also includes advanced mathematicians with backgrounds of program development, who are able to achieve design excellence not otherwise attainable.

## EXAMPLE CUSTOM FILTERS

**BAND PASS**

| P/N | | Pass Band db ¤ BW | Stop Band db ¤ BW | Impedance | Size |
|---|---|---|---|---|---|
| 20-0340-xx | Series: $f_0$ .8-7 5KHZ | .15@ 1.0 $f_0$ | 25@ 1.75f | 2.7K/2 7K | 1.3x3 0x1.OH |
| 20-0450-xx | Series: $f_0$ 4 5-7.1KHZ | 4.0@98HZ | 26¤ 258HZ | 600/600 | 1 5x3 6x1 0H |
| 20-0521-12 | $f_0$ 9960HZ.IL 4db | 1.0@ 1460HZ | 35¤ 4000HZ | 2K/500 | 2 5x2 5x.7H |
| 20-0501-10 | $f_0$ 30KHZ:IL .5db | .25@ 20KHZ | 40@ ¤ +30KHZ - 24 7KHZ | 4.7K/4 7K | 1 4x2 0x 6H |
| 20-0481-11 | $f_0$ 40KHZ:IL .5db | 3.0@ 24KHZ | 30¤ + 50KHZ - 27KHZ | 4.7K/4.7K | 1.1x1.9x.6H |
| 20-0177-10 | $f_0$ 142KHZ:IL 20db | 3.0@ 3.0KHZ | 70@ 20KHZ | 5K/470 | 1.8x2.0x.9H |
| 20-0299-10 | $f_0$ 155KHZ:IL 3db | 1.2@ 56.6KHZ | 40 ¤ + 120KHZ - 80KHZ | 1K/1K | 1.3x1 4x 8H |
| 20-0410-xx | Series. $f_0$ 200-500KHZ | 3.0@ 10f | 60@ 85f | 1K/1K | 1.3x2 8x1.1H |
| 20-0466-10 | $f_0$ 5.5MHZ:IL 4db | .5@ 40KHZ | 40@ 980KHZ 65¤ 1980KHZ | 600/600 | 1.0x2 3x 7H |
| 20-0527-10 | $f_0$ 10MHZ:IL 5db | .3@ 320KHZ | 45¤ 4 0MHZ | 600/600 | 1.3x1.8x 9H |
| 20-0459-10 | $f_0$ 11.8MHZ:IL 4db | 2.0@ 1 0MHZ | 50@ ¤ + 1 0MHZ - 1 6MHZ | 50/50 | 6x3 2x1 0H |
| 20-0539-10 | $f_0$ 30MHZ:IL 8db | .3@ .64MHZ | 20@ 3.2MHZ 30¤ 6 2MHZ | 500/500 | 1.4x2.0x.6H |

**LOW & HIGH-PASS & BAND SUPPRESSION**

| P/N | Description | db ¤ Abs.Freq. | | | Size |
|---|---|---|---|---|---|
| 20-0212-10 | 200HZ Low Pass | 3¤ 185HZ | 60 ¤ 430HZ | 1K/1K | 1 0x1 7x1 5H |
| 20-0388-xx | IRIG TELEM VCO LP f Range 4-70KHZ | 1 ¤ 1 07f | 20 ¤ 1 8f 36 ¤ 2 8f | Source 18K Load 47K | 5x 8x.8H |
| 20-0350-10 | High Atten LP | 3¤ 500HZ | 105 ¤ 1000HZ | 1K/100K | 6x3 5x1 0H |
| 20-0519-10 | Voice Low Pass | 5 ¤ 2500HZ | 40 ¤ 4000HZ | 600/600 | 1 3x1 8x 9H |
| 20-0342-10 | Voice Low Pass | 1 ¤ 3000HZ | 40 ¤ 3400HZ | 600/600 | 1 5x4 0x1 1H |
| 20-0475-10 | Voice Low Pass | 3 ¤ 3500HZ | 40 ¤ 4500HZ | 600/600 | 2 0x2 0x 5H |
| 20-0414-10 | Low Pass | 4 ¤ 24 5KHZ | 61 ¤ 40KHZ | 1K/1K | 1 0x2 0x 5H |
| 20-0399-10 | Low Pass | .25 ¤ 25KHZ | 65 ¤ 50KHZ | 10K/10K | 1.0x1 0x1 1H |
| 20-0280-01 -02 | Instrumentation LP W/BNC Connectors | 3¤ 500KHZ 3 ¤ 1 2MHZ | 18/Octave 18/Octave | 75/75 75/75 | 1 3x1 3x1 0H 1 3x1 3x1 0H |
| 20-0529-10 | Video Range LP | 1¤ 4MHZ | 40 ¤ 5 5MHZ | 200/200 | 1 3x2 0x 5H |
| 20-0489-10 | 300HZ High Pass | 3 ¤ 300HZ | 20 ¤ 250HZ | 200/6K | 1 0x1 5x 5H |
| 20-0473-00 | Balanced High Pass | .5 ¤ 1400HZ | 50 ¤ 750HZ | 600/600 | Field Test Case |
| 20-0325-10 | Speech + Tone Suppress | 3 ¤ 1 0&1 6KHZ | 40 ¤ 1 2 1 3KHZ | 600/600 | 2 8x3 0x1 0H |
| 20-0460-10 | Band Suppression | .3¤ 552&667KHZ | 50 ¤ 605 609KHZ | 75/75 | 1 4x2 0x2 0H |
| 20-0159-11 | Band Suppression | 3¤ 7 4&9 8MHZ | 50 ¤ 8 47 8 56MHZ | 75/75 | 1 4x2 0x2 0H |

**DUAL FUNCTION FILTERS & SPECIAL NETWORKS**

| P/N | Description | Characteristics | Impedance | Size |
|---|---|---|---|---|
| 20-0488-13 | Isolated LPF &Video range XFMR | .6db¤ 1 5MHZ.14db ¤ 2 5MHZ 3db 1 to 5 MHZ | 200/200 200/200 | 8x.8x 4H |
| 20-0343-10 | Common input voice LP & Signal BP Filter | 1db¤ 3KHZ.35db ¤ 3 4KHZ f 3.4KHZ.6db ¤ 150HZ BW | 600/600 Com/50K | 2 5x4 0x1 1H |
| 20-0232-10 | Common input Voice LP & Signal BP Filter | 1db ¤ 3 4KHZ.35db ¤ 3 8KHZ f 3 8KHZ.2db ¤ 20HZ BW | 600/600 Com/50K | 2 5x4 0x1 1H |
| 20-0486-10 | 90/150HZ Glide/Slope Dual BP Filter | 25db ¤ 85 -95HZ.20DB ¤ 50&150HZ 25db ¤ 142 -158HZ.20DB ¤ 90&250HZ | 1K/10K Com/10K | 2 3x2 4x1 7H |
| 20-0405-10 | Isolated Dual Dissymetrical BP Filter | 3db2 1 - 2 5KHZ.30db ¤ 3 7KHZ 3db3 7 - 4 1KHZ.30db ¤ 2 8KHZ | 1K/10K 1K/10K | 1 6x1.9x 8H |
| 20-0217-10 | Common Input, Dual Narrow BP Filter | f 269KHZ.55db ¤ 63KHZ BW f 331KHZ.55db ¤ 75KHZ BW | 1K/10K Com/10K | 2 0x4 0x 7H |
| 20-0463-11 | Twin Tee RC Network | 56db min ¤ 130 HZ | 82/5M | 1 6x1 6x 6H |
| 20-0463-12 | Twin Tee RC Network | 56db min ¤ 140 HZ | 82/5M | 1 6x1 6x 6H |
| 20-0412-11 | Audio Delay Equalizer | 90 us correction ¤ 2KHZ.Bal Imp | 600/600 | 9x1 3x1 0H |
| 20-0478-10 | Phase Shift Network | 160 ± 5 degrees 3 - 90KHZ | 50/2K/2K | 1.4x2.3x1 4H |

hisonic inc.

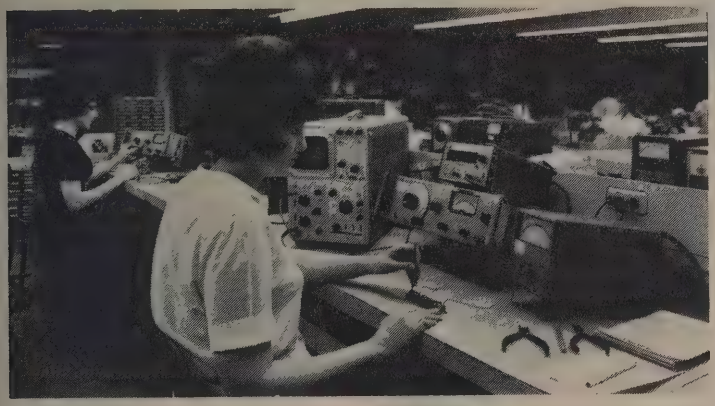
OTHER PRODUCTS: Precision Inductors • Transformers & Reactors • Tuned Circuits • Amp/Phase Equalizers • Lumped Constant Delay Lines

hisonic inc.
249 N. TROOST • OLATHE, KANSAS 66061
PHONE: 913-782-0012
TELEX: 4-2562

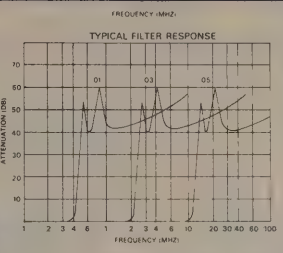
# STANDARD FILTERS

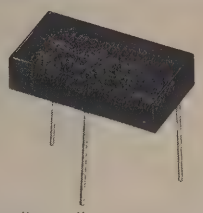
## FOR HIGHEST SELECTIVITY

Standard filters are computer designed by modern network methods for minimum stop to pass band ratios. Applications are those requiring optimum utilization of frequency spectrum.



Technicians adjust critical response of special band pass filters utilizing adjustable ferrite core inductors. Modern precision test equipment is employed in association with MIL I 45208 Quality Control procedures.



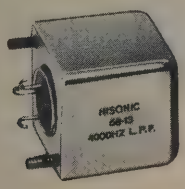
.72" x .40" x .23 encapsulated.

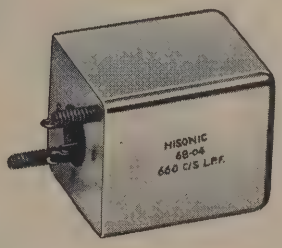
### MINIATURE SERIES 550 LOW PASS

**ELECTRICAL SPECIFICATIONS**

- IMPEDANCE: 100 ohms standard.
- INSERTION LOSS: .5db max. at .1Fc.
- RESPONSE:
  3DB max. at Fc
  40DB min. at 1.5 Fc
- SIGNAL LEVEL: Max. power in mw = 10
- OTHER IMPEDANCES AND FREQUENCIES: Write for data sheet.
- TEMPERATURE RANGE: −55 to +105°C
- STANDARD CUTOFF FREQUENCIES:

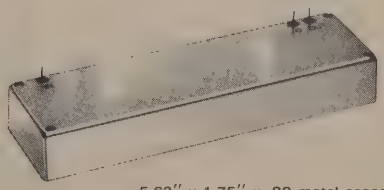
| Fc (MHZ) | HISONIC PART NUMBER |
|---|---|
| .40 | 20-0550-01 |
| 1.0 | 20-0550-02 |
| 2.0 | 20-0550-03 |
| 5.0 | 20-0550-04 |
| 10.0 | 20-0550-05 |
| 20.0 | 20-0550-06 |




### SERIES 68 LOW PASS

| SPECIFICATIONS: Relative Attenuation 3 db ± .5 @ fc | fc cps | Part No. |
|---|---|---|
| 20 db min @ 1.3 fc | 330 | 68-01 |
| 40 db min @ 1.5 fc | 450 | 68-02 |
| | 600 | 68-03 |
| Insertion loss—1 db max | 660 | 68-04 |
| | 790 | 68-05 |
| Terminations | 900 | 68-06 |
| Input—10K ohms | 1050 | 68-07 |
| Output—10K ohms | 1200 | 68-08 |
| | 1600 | 68-09 |
| Physical Specifications | 2100 | 68-10 |
| Case Hermetically Sealed Steel | 3000 | 68-11 |
| Size (330 to 900 cps) | 3300 | 68-12 |
| 1.26"x1.26"x1.5" High | 4000 | 68-13 |
| Mounting: two 6-32 studs | 4500 | 68-14 |
| spaced 1.25" | 5250 | 68-15 |
| Size (1050 to 13000 cps) | 6000 | 68-16 |
| 1"x1"x1" High | 8000 | 68-17 |
| Mounting: two 4-40 studs | 10500 | 68-18 |
| spaced 1" | 11500 | 68-19 |
| Terminals—3 solder type | 13000 | 68-20 |



5.62" x 1.75" x .80 metal cased.

### SERIES 430 FSK TONE CHANNEL BAND PASS

(170HZ spacing)

| SPECIFICATIONS: Relative Attenuation | Freq. | Receiver No. | Trans. No. |
|---|---|---|---|
| (Receive Filters) | 425 | 430-01 | 430-21 |
| 3 db max at ± 42.5 cps | 595 | 430-02 | 430-22 |
| 20 db min at ± 85 cps | 765 | 430-03 | 430-23 |
| 38 db min at ± 128 cps | 935 | 430-04 | 430-24 |
| (Transmit Filters) | 1105 | 430-05 | 430-25 |
| 3 db max at ± 42.5 cps | 1275 | 430-06 | 430-26 |
| 15 db min at ± 85 cps | 1445 | 430-07 | 430-27 |
| 30 db min at ± 128 cps | 1615 | 430-08 | 430-28 |
| | 1785 | 430-09 | 430-29 |
| Insertion Loss—6 db max | 1955 | 430-10 | 430-30 |
| | 2125 | 430-11 | 430-31 |
| Terminations | 2295 | 430-12 | 430-32 |
| Input: 600 ohms | 2465 | 430-13 | 430-33 |
| (inputs all channels may | 2635 | 430-14 | 430-34 |
| be operated in parallel) | 2805 | 430-15 | 430-35 |
| Output: Receive 50K ohms | 2975 | 430-16 | 430-36 |
| Transmit 600 ohms | 3145 | 430-17 | 430-37 |
| | 3315 | 430-18 | 430-38 |

In addition to series listed, other tone channel series with spacings from 85 to 500 c/s are available.

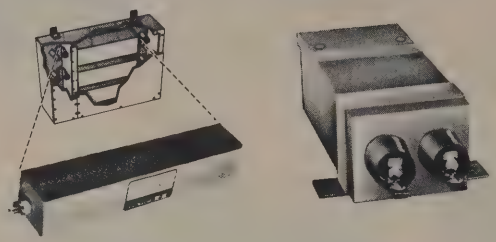
hisonic inc.
OTHER PRODUCTS: Precision Inductors • Transformers & Reactors • Tuned Circuits • Amp/Phase Equalizers • Lumped Constant Delay Lines

# HOPKINS ENGINEERING CO.

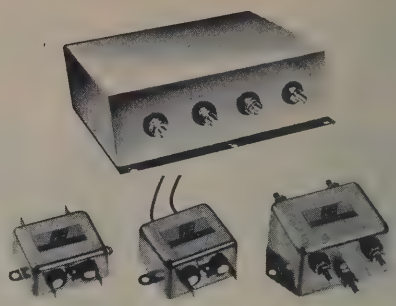
## WORLD'S LEADER IN EMI/RFI FILTERS

12900 Foothill Blvd., San Fernando, California 91342 • Phone: (213) 361-8691 • TWX: 910-496-1531

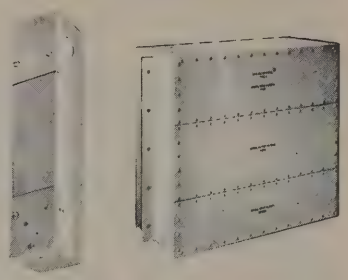
### HEAVY DUTY POWER LINE FILTERS



### DATA PROCESSING FILTERS



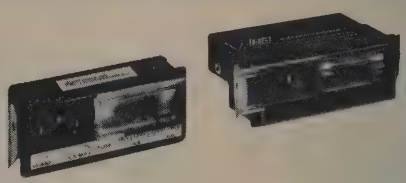
### COMMUNICATION FILTERS



### UNIVERSAL RFI/EMI FILTER

### CUSTOM FILTERS

### FILTERED FUSE CONNECTOR MODULE



ENGINEERING CATALOGUE AVAILABLE UPON REQUEST

### FACILITIES CAPABILITY

Hopkins' Engineering Company is a leading manufacturer of RFI/EMI filters. It was founded in 1945 and offers engineering design and manufacturing expertise in solving electromagnetic interference problems.

### MANUFACTURING

A wide variety of filter designs are manufactured in our modern fully equipped 30,000 square foot factory. Quality is built into every Hopkins filter by skilled production personnel and an efficient prototype department offers prompt delivery of new designs. Hopkins has manufactured products to the most exacting military programs for over 25 years.

### ENGINEERING

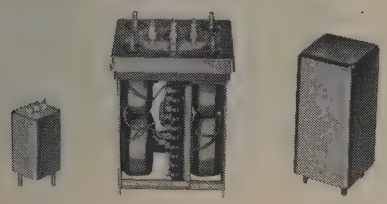
Hopkins' engineers have developed thousands of filter designs to meet a variety of military and industrial RFI/EMI suppression requirements. This versatility coupled with the latest filter design techniques and use of computer assisted design programs allows our engineers to develop filters of optimized circuitry, performance, reliability, and cost.

### QUALITY ASSURANCE

A policy of rigid quality control practices are employed. Quality materials and high workmanship standards insures a product that meets or exceeds specification requirements. Our quality assurance department maintains established procedures to control the quality and reliability objectives of the customer and Hopkins Engineering Company.

# HERTZ FILTERS

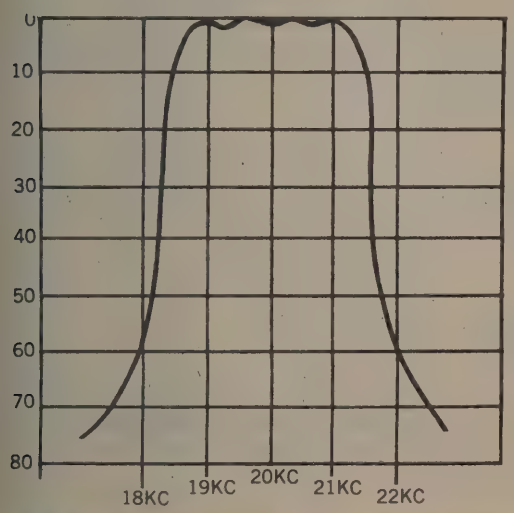
## BAND PASS FILTERS CUSTOM DESIGNED TO FILL YOUR NEEDS



Hertz Filter Corporations' engineering department is made up entirely of specialists in the field of custom design of band pass filters. They are all fully experienced and prepared to help you solve your filter problems. Call or write Hertz for reliable service and prompt delivery.

### FEATURES

1. Filters, Band Pass, Passive
2. Center Frequencies — 50 Hz to 50 Meg Hz
3. Shape factors — better than 2.0 for ratios of 60 db to 3 db
4. Bandwidth to center frequency ratio — up to 10%
5. Phase linearity — within 10° through passband
6. Low passband insertion loss
7. Better than 80 db attenuation 50% above and below center frequency
8. Input and output impedances as required
9. Low input and output impedances in stop band
10. Low passband ripple
11. L, C, and R elements only




### PARTIAL LIST OF HERTZ FILTERS
(all filters in accordance with MIL-F-18327)

| BAND PASS PART NO. | PASS BAND | STOP BAND | $Z_o$ | I.L.@CF | SIZE |
|---|---|---|---|---|---|
| BP-7907-1 | 3db(150-300)Hz | 60db(50-850)Hz | 600 | 1db | 2 x 2¼ x 4 |
| BP-7907-2 | 3db(300-600)Hz | 60db(110-1700)Hz | 600 | 1db | 2 x 2¼ x 4 |
| BP-7907-3 | 3db(600-1200)Hz | 60db(210-3400)Hz | 600 | 1db | 2 x 2¼ x 4 |
| BP-7907-4 | 3db(1.2-2.4)KHz | 60db(.43-6.8)KHz | 600 | 1db | 2 x 2¼ x 4 |
| BP-7907-5 | 3db(2.4-4.8)KHz | 60db(.85-13.5)KHz | 600 | 1db | 2 x 2¼ x 4 |
| BP-7907-6 | 3db(4.8-9.6)KHz | 60db(1.7-27)KHz | 600 | 1db | 2 x 2¼ x 4 |
| BP-7907-7 | 3db(8.9-11.2)KHz | 60db(3.1-32)KHz | 600 | 1db | 2 x 2 x 3 |
| BP-7996-1 | 3db(825-1,175)Hz | 40db(650-1,350)Hz | 30K | 3db | 1 x 2¼ x 4½ |
| BP-8004-10 | 3db(8-26)KHz | 30db(4-30)KHz | 10K/2K | 2db | 1⅜ x 1⅝ x 2¾ |
| BP-8004-11 | 3db(19.5-33.5)KHz | 30db(16.5-36.5)KHz | 10K/2K | 2db | 1⅜ x 1⅝ x 2¾ |
| BP-8004-12 | 3db(26.25-40.25)KHz | 30db(23.25-43.25)KHz | 10K/2K | 2db | 1⅜ x 1⅝ x 2¾ |
| BP-8004-13 | 3db(32.6-52.6)KHz | 30db(27.6-57.6)KHz | 10K/2K | 2db | 1⅜ x 1⅝ x 2¾ |
| BP-7897-1 | 3db(37.5-40.5)KHz | 30db(34.5-43.5)KHz | 10K/1K | 4db | 1¼ x 1¼ x 2 |
| BP-7897-2 | 3db(40.5-43.5)KHz | 30db(37.5-46.5)KHz | 10K/1K | 4db | 1¼ x 1¼ x 2 |
| BP-7897-3 | 3db(43.5-46.5)KHz | 30db(40.5-49.5)KHz | 10K/1K | 4db | 1¼ x 1¼ x 2 |
| BP-7897-4 | 3db(46.5-49.5)KHz | 30db(43.5-52.5)KHz | 10K/1K | 4db | 1¼ x 1¼ x 2 |
| BP-7897-5 | 3db(49.5-52.5)KHz | 30db(46.5-55.5)KHz | 10K/1K | 4db | 1¼ x 1¼ x 2 |
| BP-7897-6 | 3db(52.5-55.5)KHz | 30db(49.5-58.5)KHz | 10K/1K | 4db | 1¼ x 1¼ x 2 |
| BP-7897-7 | 3db(55.5-58.5)KHz | 30db(52.5-61.5)KHz | 10K/1K | 4db | 1¼ x 1¼ x 2 |
| BP-7897-8 | 3db(58.5-61.5)KHz | 30db(55.5-64.5)KHz | 10K/1K | 4db | 1¼ x 1¼ x 2 |
| BP-7897-9 | 3db(61.5-64.5)KHz | 30db(58.5-67.5)KHz | 10K/1K | 4db | 1¼ x 1¼ x 2 |
| BP-7897-10 | 3db(64.5-67.5)KHz | 30db(61.5-70.5)KHz | 10K/1K | 4db | 1¼ x 1¼ x 2 |
| BP-7897-11 | 3db(67.5-70.5)KHz | 30db(64.5-73.5)KHz | 10K/1K | 4db | 1¼ x 1¼ x 2 |
| BP-7897-12 | 3db(70.5-73.5)KHz | 30db(67.5-76.5)KHz | 10K/1K | 4db | 1¼ x 1¼ x 2 |
| BP-7897-13 | 3db(73.5-76.5)KHz | 30db(70.5-79.5)KHz | 10K/1K | 4db | 1¼ x 1¼ x 2 |
| BP-7897-14 | 3db(76.5-79.5)KHz | 30db(73.5-82.5)KHz | 10K/1K | 4db | 1¼ x 1¼ x 2 |
| BP-7897-15 | 3db(79.5-82.5)KHz | 30db(76.5-85.5)KHz | 10K/1K | 4db | 1¼ x 1¼ x 2 |

| LOW PASS PART NO. | PASS BAND | STOP BAND | $Z_o$ | SIZE |
|---|---|---|---|---|
| LP-7907-1 | 4db@300Hz, 1db@225Hz | 60db@850Hz | 600 | 2 x 2 x 3 |
| LP-7907-2 | 4db@600Hz, 1db@450Hz | 60db@1700Hz | 600 | 2 x 2 x 3 |
| LP-7907-3 | 4db@1.2KHz, 1db@.9KHz | 60db@3.4KHz | 600 | 2 x 2 x 3 |
| LP-7907-4 | 4db@2.4KHz, 1db@1.8KHz | 60db@6.8KHz | 600 | 2 x 2 x 3 |
| LP-7907-5 | 4db@4.8KHz, 1db@3.6KHz | 60db@13.5KHz | 600 | 2 x 2 x 3 |
| LP-7907-6 | 4db@9.6KHz, 1db@7.2KHz | 60db@27KHz | 600 | 2 x 2 x 3 |
| LP-7907-7 | 4db@11.2Hz, 1db@10KHz | 60db@32KHz | 600 | 1⅜ x 1⅝ x 2¾ |
| LP-7996-1 | 5db@1,175Hz, 2db@1,000Hz | 40db@650Hz | 30K | 1⅜ x 1⅝ x 2¾ |
| LP-8004 10 | 5db@26KHz, 1db@17KHz | 30db@30KHz | 10K/2K | 1¼ x 1¼ x 2 |
| LP-8004-11 | 5db@33.5KHz, 1db@26.5KHz | 30db@36.5KHz | 10K/2K | 1¼ x 1¼ x 2 |
| LP-8004-12 | 5db@40.25KHz, 1db@33.25KHz | 30db@43.25KHz | 10K/2K | 1¼ x 1¼ x 2 |
| LP-8004-13 | 5db@52.6KHz, 1db@42.6KHz | 30db@57.6KHz | 10K/2K | 1¼ x 1¼ x 2 |

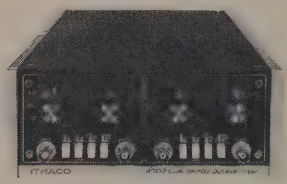
| PART NO. HIGH PASS | PASS BAND | STOP BAND | $Z_o$ | SIZE |
|---|---|---|---|---|
| HP-7907-1 | 4db@150Hz, 1db@225Hz | 60db@50Hz | 600 | 2 x 2 x 3 |
| HP-7907-2 | 4db@300Hz, 1db@450Hz | 60db@110Hz | 600 | 2 x 2 x 3 |
| HP-7907-3 | 4db@600Hz, 1db@900Hz | 60db@210Hz | 600 | 2 x 2 x 3 |
| HP-7907-4 | 4db@1.2KHz, 1db@1.8KHz | 60db@.43KHz | 600 | 2 x 2 x 3 |
| HP-7907-5 | 4db@2.4Hz, 1db@3.6KHz | 60db@.85KHz | 600 | 2 x 2 x 3 |
| HP-7907-6 | 4db@4.8Hz, 1db@7.2KHz | 60db@1.7KHz | 600 | 2 x 2 x 3 |
| HP-7907-7 | 4db@8.9KHz, 1db@10KHz | 60db@3.1KHz | 600 | 1⅜ x 1⅝ x 2¾ |
| HP-7996-1 | 5db@825Hz, 2db@1,000Hz | 40db@1,350Hz | 30K | 1⅜ x 1⅝ x 2¾ |
| HP-8004-10 | 5db@8KHz, 1db@17KHz | 30db@4KHz | 10K/2K | 1¼ x 1¼ x 2 |
| HP-8004-11 | 5db@19.5KHz, 1db@26.5KHz | 30db@16.5KHz | 10K/2K | 1¼ x 1¼ x 2 |
| HP-8004-12 | 5db@26.25KHz, 1db@33.25KHz | 30db@23.25KHz | 10K/2K | 1¼ x 1¼ x 2 |
| HP-8004-13 | 5db@32.6KHz, 1db@42.6KHz | 30db@27.6KHz | 10K/2K | 1¼ x 1¼ x 2 |

HERTZ FILTER CORPORATION
3 AERIAL WAY • SYOSSET, NEW YORK 11791
TELEPHONE (516) 822-4770

# ITHACO

## THE PREDICTABLE FILTERS

### MODEL 4302 LABORATORY DUAL FILTER



ACCURACY/PHASE MATCH: ±3% of setting / ±6°

FREQUENCY RANGE: 10 Hz – 1 MHz

ATTENUATION: 24 dB/octave all modes; 48 dB/octave series hi- or lo-pass, > 100 dB max attenuation

CHARACTERISTICS: selectable Butterworth or Bessel

HUM AND NOISE: <75μV rms X1 gain; <10μV rms X10 gain

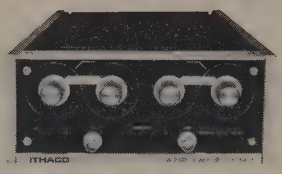
COUPLING: selectable AC or DC

GAIN: selectable X1 or X10 for each section

LOW DISTORTION: <.005% at 1kHz X10 gain

LOW COST: $688

### 4210 SERIES CALIBRATED LAB FILTERS



ACCURACY/PHASE MATCH: ±1% of setting / ±2°

FREQUENCY RANGE: .01 Hz – 1MHz in 3 models

ATTENUATION: 24 dB/octave all modes; >100 dB max.

CHARACTERISTICS: selectable Butterworth or Bessel

HUM AND NOISE: <70μV rms

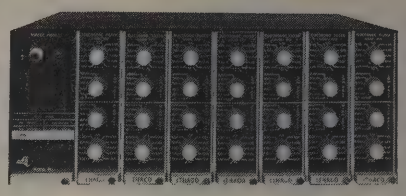
COUPLING: DC in lo-pass; AC all other modes

GAIN: optional selectable 0/10/20/30/40 dB

BATTERY POWER: available as option

THREE MODELS TO CHOOSE FROM AT $995

### 4110 SERIES MULTI-CHANNEL FILTERS



ACCURACY/PHASE MATCH: ±1% of setting / ±2°

FREQUENCY RANGE: ±.01 Hz – 1MHz in 3 models

ATTENUATION: 24 dB/octave all modes; >90 dB max.

CHARACTERISTICS: Butterworth only

HUM AND NOISE: <70μV rms

COUPLING: DC in lo-pass; AC all other modes

BANDPASS: characteristics completely predictable and repeatable ±1% / ±0.1 dB all settings

THREE MODELS TO CHOOSE FROM, $861 to $914

# ITHACO

735 W CLINTON ST ITHACA NEW YORK 14850

PHONE 607-272-7640 TWX 510-255-9307

KR ELECTRONICS, INC. 91 Avenel Street, Avenel, New Jersey 07001 • (201) 636-1900

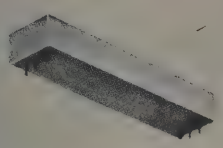
### LOW PASS FILTERS

**Frequency Range:** DC to 50MHz
**Impedance Range:** 1 ohm to ∞
**Stop Bands:** 10 to 80db

### BAND PASS FILTERS

**Frequency Range:** DC to 50MHz
**Band Width:** 1% to >100%
**Stopband:** 10 to 80db
**Impedance Range:** 1 ohm to ∞

### HIGH PASS FILTERS



**Frequency Range:** DC to 50MHz
**Impedance Range:** 1 ohm to ∞
**Stop Bands:** 10 to 80db

### BAND REJECT FILTERS

**Frequency Range:** DC to 50MHz
**Band Width:** 1% to >100%
**Stop Band:** 10 to 80db
**Impedance Range:** 1 to ∞

# Custom LC Filters

### COMPUTER-AIDED SERVICE

The following examples of KR's LC filter design capabilities are but a small representation of the broad range of our experience. Through our use of an IBM 360, level 60 computer, output data plotted against frequency including impedance, attenuation, phase, group delay and phase delay can be evaluated to supply an immediate quotation.

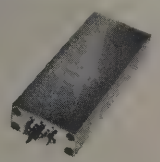
### BROAD EXPERIENCE IN DESIGN OF THESE FILTER TYPES

Low Pass • High Pass • Band Pass • Band Reject • Linear Phase • Constant Group Delay • Phase Matched • Attenuation Matched • Phase Equalizers • Delay Equalizers • Attenuation Equalizers • Low Transient Response •

# DIP Filters

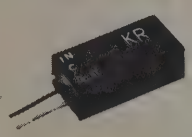
For information on our complete line of DIP filters, send for our new catalog.

### MATCHED PHASE & ATTENUATION



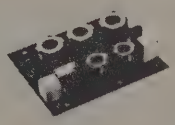
**Typical Specifications:**
Phase Matched ± 2½° In Pass Band
Attenuation Matched ±.25db In Pass Band for use in Sonar & other multi channel systems.

### MAXIMUM FLAT DELAY (BESSEL) FILTER




**Size (Typical):** .75" x .75" x 1.5"
**Frequency Range:** 1.5KHz to 1MHz
**Z Range:** 50 to 10 K
**Overshoot:** <1%
**Delay Flat:** <2% to Fc

### LINEAR GROUP DELAY VIDEO FILTER



**Typical Specifications:**
**L.P. Cutoff:** 4.5 MHz
**I.L.:** <1db
**Passband Ripple:** <±.1db
**Pass Band Delay Distortion:** <25 nsec.
**Stopband:** >25db

### GROUP DELAY & ATTENUATION EQUALIZER NETWORK

To correct system introduced delay distortion & attenuation roll off.

# Constant Group Delay Filters

Computer-designed and checked to give equal ripple delay over the pass band insuring exact delay and attenuation characteristics.

**Frequency Range:** DC to 50 MHz
**Impedance Range:** 1 ohm to ∞
**Temperature Range:** —55°C to +125°C.
Complete Encapsulation
Hermetic Seal
P.C. Board Construction
**Case Configuration:**
Stock or Custom Designed
P.C. Card
Dual In-Line
Standard Hardware Program

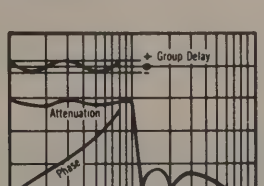
**All filters conform to applicable mil specifications.**

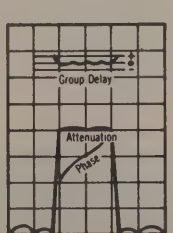
### Phase & Attenuation Matching

Differential phase and attenuation matched to eliminate the need for adjustments in multi-channeled systems.

### Linear Phase Filters

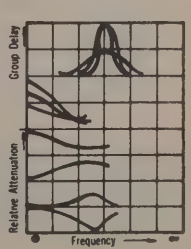
To reduce distortions and lower transient response in modulated systems.



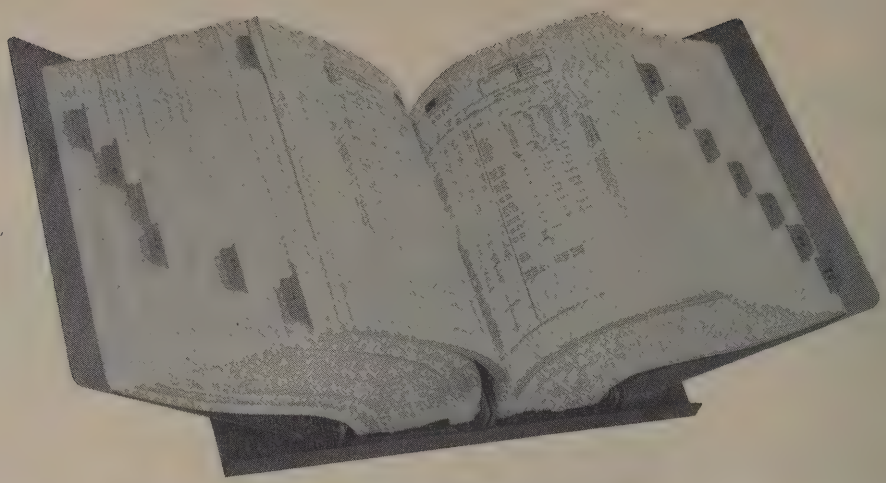




### Equalizers

**Phase/Delay/Attenuation**
Computer-designed correction networks derived from system error curves.




Printed in USA



# UNITED PRICING REPORTS

## the single source that speeds up invoicing, pricing, quoting, purchasing and estimating

Electronic component prices change so fast, you'd need a team of people just to keep up.

United Pricing Reports is the better way. When you subscribe to Pricing Reports you receive 1500 pricing sheets (3000 pages) of the latest prices, as of the date we ship them to you.

This gives you, in a single source, up-to-the minute selling prices on more than 500,000 electronic components.

United Pricing Reports gives you accurate resale prices at the exact moment you need them. Not hours or days later. So it helps you eliminate frantic phone calls, letter writing and catalog scanning to check on prices when you write an invoice or type a purchase order.

## Twice weekly price updates.

One week after you receive your Pricing Reports source book (1500 pricing sheets) you begin receiving twice weekly price updates. You simply take these new price pages and replace the now obsolete pages with them.

The whole process is simple. All information is organized alphabetically by manufacturer. And each manufacturer's price schedule is listed by part number in numerical/alphabetical sequence.

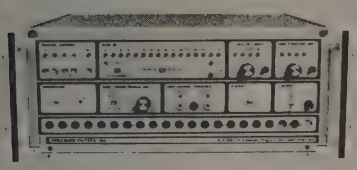
One more thing. When we promise twice weekly updates, we deliver. 52 weeks a year, consistently. Not monthly or every other month. We have a tradition of delivery on our promises, and we're certainly not going to stop now.

*UNITED TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500 TWX-510/222-16*

# PRECISION FILTERS, Inc.

## SYSTEM 216
### PROGRAMMABLE AMPLIFIERS AC - DC - AUTO-RANGING

16 channel amplifier systems with automatic gain ranging or programmable gain only. A system consists of a main-frame, a plug-in control module and up to 16 plug-in amplifiers. In the automatic gain ranging systems the output level is maintained at a level suitable for recording on tape while the gain status of all channels is recorded on a separate track.



- AUTOMATIC GAIN RANGING
- PROGRAMMABLE GAIN, LFRO, MODE, & TC
- GAIN: -12dB to +78dB
- LOW-NOISE DIFF. INPUT
- OVERLOAD DETECTORS
- PLUG-IN LOW-PASS FILTERS
- COMPUTER INTERFACES
- BANDWIDTH 1 Hz-500kHz
- 1° PHASE ACCURACY

**PLUG-IN CONTROL MODULES**

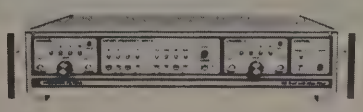
| | |
|---|---|
| 216-XX-C-01 | IEEE Bus (488) |
| 216-XX-C-02 | Interface for TTY |
| 216-XX-C-03 | Interface for Mini |
| 216-XX-C-04 | Manual Control Only |
| 216-XX-C-05 | Ampl. Status MUX/ DEMUX |

**AMPLIFIER SYSTEMS**

| | |
|---|---|
| 216-01 | Automatic Gain-Ranging/ Programmable AC Amplifier |
| 216-02 | Automatic Gain-Ranging/ Programmable DC Amplifier |
| 216-03 | Programmable AC Amplifier Gain: -12dB to +78dB |
| 216-04 | Programmable DC Amplifier Gain: 0dB to +60dB |

## MODEL 602
### DUAL-CHANNEL FILTER HP-LP-BP-BR

This two-channel filter has programmable gain & cutoff frequency and direct readout of channel overload. It is housed in a 3½" high rack-mounting cabinet and contains a control card to interface a mini-computer. Precisely controlled low-pass, high-pass or time-delay (linear-phase) filters are available which cover four decades of cutoff frequencies in the range .01 Hz to 150 kHz.



- 1° PHASE ACCURACY
- HP-LP-BP-BR
- -80 dB at 2 $F_c$
- ELLIPTIC FILTERS
- LINEAR-PHASE FILTERS
- PROGRAMMABLE GAIN & CUTOFF FREQUENCY
- OVERLOAD DETECTORS
- COMPUTER INTERFACES: IEEE, TTY, BUFFERED I/O

**CONTROL OPTIONS**

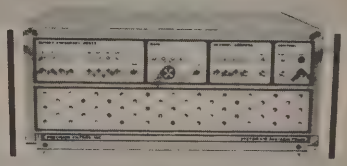
| | |
|---|---|
| 602-C-01 | IEEE Bus (HP-IB) |
| 602-C-02 | Interface for TTY |
| 602-C-03 | Interface for Mini-computer's Buffered I/O |
| 602-C-04 | Manual Only |

**FILTERS**

| | |
|---|---|
| 602-01-XXX | 10 Hz - 150 kHz |
| 602-02-XXX | 1 Hz - 15 kHz |
| 602-03-XXX | .1 Hz - 1.5 kHz |
| 602-04-XXX | .01 Hz - 150 Hz |
| 602-XX-LP1 | 6 pole, 6 zero LP |
| 602-XX-HP1 | 6 pole, 6 zero HP |
| 602-XX-TD1 | 6 pole, 4 zero TD |

## SYSTEM 616
### MULTI-CHANNEL PROGRAMMABLE FILTERS

This 16-channel filter system with programmable gain and cutoff frequency consists of a 7" high rack-mounting main frame with power, connections, and controls for all channels; a plug-in control module for interfacing a minicomputer; and up to 16 plug-in filters. Precisely controlled low-pass, high-pass and time-delay (linear-phase) filters are available which cover four decades of cutoff frequencies in the range .01 Hz - 150 kHz.



- 1° PHASE ACCURACY
- HP-LP-BP-BR
- -80 dB at 2 $F_c$
- -90 dB at 1.56 $F_c$
- ELLIPTIC FILTERS
- LINEAR-PHASE FILTERS
- PROGRAMMABLE GAIN & CUTOFF FREQUENCIES
- COMPUTER INTERFACES: IEEE, TTY, BUFFERED I/O

**PLUG-IN CONTROL MODULES**

| | |
|---|---|
| 616-C-01 | IEEE Bus (HP-IB) |
| 616-C-02 | Interface for TTY |
| 616-C-03 | Interface for Mini-computer's Buffered I/O |
| 616-C-04 | Manual Only |

**PLUG-IN FILTER MODULES**

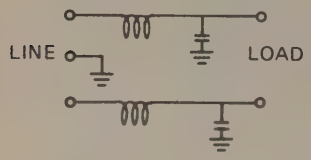
| | |
|---|---|
| 616-01-XXX | 10 Hz - 150 kHz |
| 616-02-XXX | 1 Hz - 15 kHz |
| 616-03-XXX | .1 Hz - 1.5 kHz |
| 616-04-XXX | .01 Hz - 150 Hz |
| 616-XX-LP1 | 6 pole, 6 zero LP |
| 616-XX-LP2 | 12 pole, 12 zero LP |
| 616-XX-HP1 | 6 pole, 6 zero HP |
| 616-XX-TD1 | 6 pole, 4 zero TD |

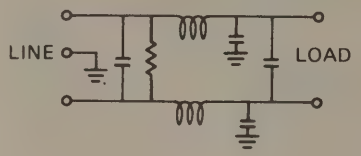
**PRECISION FILTERS, Inc.**
303 West Lincoln Street, Ithaca, New York 14850 (607) 277-3550

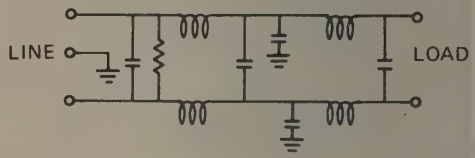
# RtroN RFI/EMI FILTERS

For Data Processing, Industrial Controls, and Instrumentation Applications. Meets U.L. and C.S.A. requirements. Low Leakage without sacrificing Insertion Loss. Excellent Quality at Low Cost.

VOLTAGE RATING 115/250




## RNF L SERIES

### 1 AMP FILTERS

| Part No. | STYLE | A | B | C | D | E | F |
|---|---|---|---|---|---|---|---|
| RNF-1L1 | 1 | 1.750 | .875 | .625 | 2.125 | 2.500 | .625 |
| RNF-1L2 | 2 | 1.750 | .875 | .625 | 2.125 | 2.500 | .625 |
| RNF-1L3 | 3 | 1.750 | .875 | .625 | 2.125 | 2.500 | – |
| RNF-1L4 | 4 | 1.750 | .875 | .625 | 2.125 | 2.500 | .500 |
| RNF-1L5 | 5 | 1.750 | .875 | .625 | 2.125 | 2.500 | .500 |
| RNF-1L6 | 6 | 2.000 | 1.750 | .750 | 1.500 | – | .625 |
| RNF-1L7 | 7 | 2.000 | 1.750 | .750 | 1.500 | – | – |

### 2 AMP FILTERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| RNF-2L1 | 1 | 1.750 | .875 | .625 | 2.125 | 2.500 | .625 |
| RNF-2L2 | 2 | 1.750 | .875 | .625 | 2.125 | 2.500 | .625 |
| RNF-2L3 | 3 | 1.750 | .875 | .625 | 2.125 | 2.500 | – |
| RNF-2L4 | 4 | 1.750 | .875 | .625 | 2.125 | 2.500 | .500 |
| RNF-2L5 | 5 | 1.750 | .875 | .625 | 2.125 | 2.500 | .500 |
| RNF-2L6 | 6 | 2.000 | 1.750 | .750 | 1.500 | – | .625 |
| RNF-2L7 | 7 | 2.000 | 1.750 | .750 | 1.500 | – | – |

### 3 AMP FILTERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| RNF-3L1 | 1 | 1.750 | 1.250 | .750 | 2.125 | 2.500 | .625 |
| RNF-3L2 | 2 | 1.750 | 1.250 | .750 | 2.125 | 2.500 | .625 |
| RNF-3L3 | 3 | 1.750 | 1.250 | .750 | 2.125 | 2.500 | – |
| RNF-3L4 | 4 | 1.750 | 1.250 | .750 | 2.125 | 2.500 | .500 |
| RNF-3L5 | 5 | 1.750 | 1.250 | .750 | 2.125 | 2.500 | .500 |
| RNF-3L6 | 6 | 2.000 | 2.000 | .750 | 1.500 | – | .625 |
| RNF-3L7 | 7 | 2.000 | 2.000 | .750 | 1.500 | – | – |

### 5 AMP FILTERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| RNF-5L1 | 1 | 1.750 | 1.250 | .750 | 2.125 | 2.500 | .625 |
| RNF-5L2 | 2 | 1.750 | 1.250 | .750 | 2.125 | 2.500 | .625 |
| RNF-5L3 | 3 | 1.750 | 1.250 | .750 | 2.125 | 2.500 | – |
| RNF-5L4 | 4 | 1.750 | 1.250 | .750 | 2.125 | 2.500 | .500 |
| RNF-5L5 | 5 | 1.750 | 1.250 | .750 | 2.125 | 2.500 | .500 |
| RNF-5L6 | 6 | 2.000 | 2.000 | .750 | 1.500 | – | .625 |
| RNF-5L7 | 7 | 2.000 | 2.000 | .750 | 1.500 | – | – |

### 10 AMP FILTERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| RNF-10L1 | 1 | 1.750 | 1.250 | 1.125 | 2.125 | 2.500 | .625 |
| RNF-10L2 | 2 | 1.750 | 1.250 | 1.125 | 2.125 | 2.500 | .625 |
| RNF-10L3 | 3 | 1.750 | 1.250 | 1.125 | 2.125 | 2.500 | – |
| RNF-10L4 | 4 | 1.750 | 1.250 | 1.125 | 2.125 | 2.500 | .500 |
| RNF-10L5 | 5 | 1.750 | 1.250 | 1.125 | 2.125 | 2.500 | .500 |
| RNF-10L6 | 6 | 2.000 | 2.000 | 1.125 | 1.500 | – | .625 |
| RNF-10L7 | 7 | 2.000 | 2.000 | 1.125 | 1.500 | | – |
| RNF-10L8 | 8 | 1.750 | 1.250 | 1.125 | 2.125 | 2.500 | .625 |

### 20 AMP FILTERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| RNF-20L8 | 8 | 2.000 | 2.000 | 1.125 | 2.375 | 2.781 | .625 |

### 30 AMP FILTERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| RNF-30L10 | 10 | 3.875 | 3.312 | 1.500 | 3.750 | 4.125 | .625 |

## RNF P SERIES

### 1 AMP FILTERS

| Part No. | STYLE | A | B | C | D | E | F |
|---|---|---|---|---|---|---|---|
| RNF-1P1 | 1 | 2.000 | 1.750 | .875 | 2.375 | 2.781 | .625 |
| RNF-1P2 | 2 | 2.000 | 1.750 | .875 | 2.375 | 2.781 | .625 |
| RNF-1P3 | 3 | 2.000 | 1.750 | .875 | 2.375 | 2.781 | – |
| RNF-1P4 | 4 | 2.000 | 1.750 | .875 | 2.375 | 2.781 | .500 |
| RNF-1P5 | 5 | 2.000 | 1.750 | .875 | 2.375 | 2.781 | .500 |
| RNF-1P6 | 6 | 2.000 | 2.000 | .875 | 1.500 | – | .625 |
| RNF-1P7 | 7 | 2.000 | 2.000 | .875 | 1.500 | – | – |

### 2 AMP FILTERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| RNF-2P1 | 1 | 2.000 | 1.750 | .875 | 2.375 | 2.781 | .625 |
| RNF-2P2 | 2 | 2.000 | 1.750 | .875 | 2.375 | 2.781 | .625 |
| RNF-2P3 | 3 | 2.000 | 1.750 | .875 | 2.375 | 2.781 | – |
| RNF-2P4 | 4 | 2.000 | 1.750 | .875 | 2.375 | 2.781 | .500 |
| RNF-2P5 | 5 | 2.000 | 1.750 | .875 | 2.375 | 2.781 | .500 |
| RNF-2P6 | 6 | 2.000 | 2.000 | .875 | 1.500 | – | .625 |
| RNF-2P7 | 7 | 2.000 | 2.000 | .875 | 1.500 | – | – |

### 3 AMP FILTERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| RNF-3P1 | 1 | 2.000 | 1.750 | 1.125 | 2.375 | 2.781 | .625 |
| RNF-3P2 | 2 | 2.000 | 1.750 | 1.125 | 2.375 | 2.781 | .625 |
| RNF-3P3 | 3 | 2.000 | 1.750 | 1.125 | 2.375 | 2.781 | – |
| RNF-3P4 | 4 | 2.000 | 1.750 | 1.125 | 2.375 | 2.781 | .500 |
| RNF-3P5 | 5 | 2.000 | 1.750 | 1.125 | 2.375 | 2.781 | .500 |
| RNF-3P6 | 6 | 2.000 | 2.000 | 1.125 | 1.500 | – | .625 |
| RNF-3P7 | 7 | 2.000 | 2.000 | 1.125 | 1.500 | – | – |

### 5 AMP FILTERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| RNF-5P1 | 1 | 2.000 | 1.750 | 1.125 | 2.375 | 2.781 | .625 |
| RNF-5P2 | 2 | 2.000 | 1.750 | 1.125 | 2.375 | 2.781 | .625 |
| RNF-5P3 | 3 | 2.000 | 1.750 | 1.125 | 2.375 | 2.781 | – |
| RNF-5P4 | 4 | 2.000 | 1.750 | 1.125 | 2.375 | 2.781 | .500 |
| RNF-5P5 | 5 | 2.000 | 1.750 | 1.125 | 2.375 | 2.781 | .500 |
| RNF-5P6 | 6 | 2.000 | 2.000 | 1.125 | 1.500 | – | .625 |
| RNF-5P7 | 7 | 2.000 | 2.000 | 1.125 | 1.500 | – | – |

### 10 AMP FILTERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| RNF-10P1 | 1 | 2.000 | 2.000 | 1.125 | 2.375 | 2.781 | .625 |
| RNF-10P2 | 2 | 2.000 | 2.000 | 1.125 | 2.375 | 2.781 | .625 |
| RNF-10P3 | 3 | 2.000 | 2.000 | 1.125 | 2.375 | 2.781 | – |
| RNF-10P4 | 4 | 2.000 | 2.000 | 1.125 | 2.375 | 2.781 | .500 |
| RNF-10P5 | 5 | 2.000 | 2.000 | 1.125 | 2.375 | 2.781 | .500 |
| RNF-10P8 | 8 | 2.000 | 2.000 | 1.125 | 2.375 | 2.781 | .625 |

### 20 AMP FILTERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| RNF-20P9 | 9 | 2.500 | 2.000 | 1.500 | 2.940 | 3.312 | .625 |

### 30 AMP FILTERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| RNF-30P10 | 10 | 3.875 | 3.312 | 1.500 | 3.750 | 4.125 | .625 |

## RNF T SERIES

### 1 AMP FILTERS

| Part No. | STYLE | A | B | C | D | E | F |
|---|---|---|---|---|---|---|---|
| RNF-1T11 | 11 | 2.000 | 1.750 | 1.125 | 2.375 | 2.781 | .625 |
| RNF-1T12 | 12 | 2.000 | 1.750 | 1.125 | 2.375 | 2.781 | .625 |
| RNF-1T13 | 13 | 2.000 | 1.750 | 1.125 | 2.375 | 2.781 | |
| RNF-1T14 | 14 | 2.000 | 1.750 | 1.125 | 2.375 | 2.781 | .500 |
| RNF-1T15 | 15 | 2.000 | 1.750 | 1.125 | 2.375 | 2.781 | .500 |

### 2 AMP FILTERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| RNF-2T11 | 11 | 2.000 | 1.750 | 1.125 | 2.375 | 2.781 | .625 |
| RNF-2T12 | 12 | 2.000 | 1.750 | 1.125 | 2.375 | 2.781 | .625 |
| RNF-2T13 | 13 | 2.000 | 1.750 | 1.125 | 2.375 | 2.781 | |
| RNF-2T14 | 14 | 2.000 | 1.750 | 1.125 | 2.375 | 2.781 | .500 |
| RNF-2T15 | 15 | 2.000 | 1.750 | 1.125 | 2.375 | 2.781 | .500 |

### 3 AMP FILTERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| RNF-3T11 | 11 | 2.500 | 2.000 | 1.125 | 2.940 | 3.312 | .625 |
| RNF-3T12 | 12 | 2.500 | 2.000 | 1.125 | 2.940 | 3.312 | .625 |
| RNF-3T13 | 13 | 2.500 | 2.000 | 1.125 | 2.940 | 3.312 | – |
| RNF-3T14 | 14 | 2.500 | 2.000 | 1.125 | 2.940 | 3.312 | .500 |
| RNF-3T15 | 15 | 2.500 | 2.000 | 1.125 | 2.940 | 3.312 | .500 |

### 5 AMP FILTERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| RNF-5T11 | 11 | 2.500 | 2.000 | 1.125 | 2.940 | 3.312 | .625 |
| RNF-5T12 | 12 | 2.500 | 2.000 | 1.125 | 2.940 | 3.312 | .625 |
| RNF-5T13 | 13 | 2.500 | 2.000 | 1.125 | 2.940 | 3.312 | – |
| RNF-5T14 | 14 | 2.500 | 2.000 | 1.125 | 2.940 | 3.312 | .500 |
| RNF-5T15 | 15 | 2.500 | 2.000 | 1.125 | 2.940 | 3.312 | .500 |

### 10 AMP FILTERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| RNF-10T11 | 11 | 2.500 | 2.000 | 1.500 | 2.940 | 3.312 | .625 |
| RNF-10T12 | 12 | 2.500 | 2.000 | 1.500 | 2.940 | 3.312 | .625 |
| RNF-10T13 | 13 | 2.500 | 2.000 | 1.500 | 2.940 | 3.312 | – |
| RNF-10T14 | 14 | 2.500 | 2.000 | 1.500 | 2.940 | 3.312 | .500 |
| RNF-10T15 | 15 | 2.500 | 2.000 | 1.500 | 2.940 | 3.312 | .500 |
| RNF-10T16 | 16 | 2.500 | 2.000 | 1.500 | 2.940 | 3.312 | .625 |

### 20 AMP FILTERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| RNF-20T10 | 10 | 3.875 | 3.312 | 1.500 | 3.750 | 4.125 | .625 |

### 30 AMP FILTERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| RNF-30T10 | 10 | 5.500 | 3.312 | 1.750 | 3.750 | 4.125 | .625 |

## ELECTRICAL SPECIFICATIONS

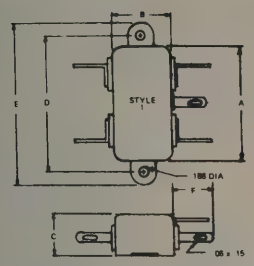
Maximum leakage current, each,
line to ground. @ 115 VAC-60Hz ..... 0.5 MA
@ 250 VAC-60Hz ..... 1.0 MA
Test Voltage ..... 2100 VDC
Frequency ..... 50 - 400 Hz
Voltage ..... 115/250 VAC

TYPICAL INSERTION LOSS
Mil. STD. 220

RtroN corporation P.O. Box 743 Skokie, Illinois 60076 312 • 679-7180

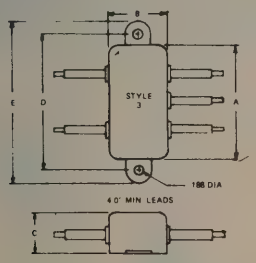
# Rtron RFI/EMI FILTERS

### Case Style 1 & 2

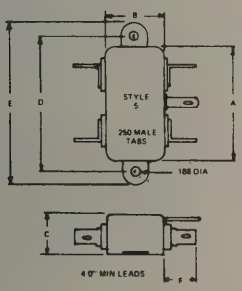



Style 2 same as 1 except load side has lead wires instead of solder lugs.

### Case Style 3

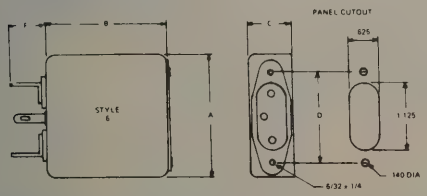



### Case Style 4 & 5



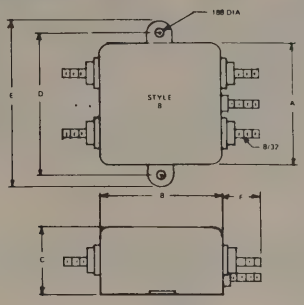

Style 4 same as 5 except load side has lead wires instead of quick disconnects.

### Case Style 6 & 7



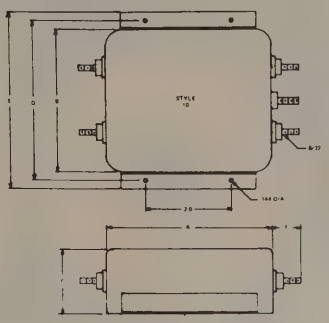

Style 7 same as 6 except load side has lead wires instead of solder lugs.

### Case Style 8 & 9

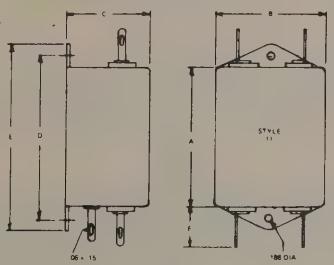



Style 9 same as 8 except has triangular mounting tabs.

### Case Style 10

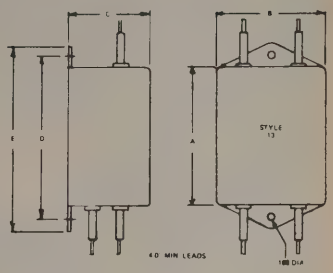



### Case Style 11 & 12

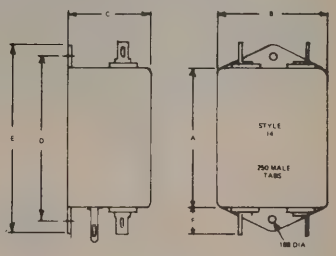



Style 12 same as 11 except has lead wires instead of solder lugs.

### Case Style 13

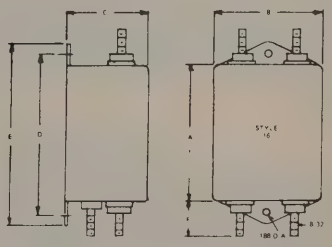



### Case Style 14 & 15




Style 15 same as 14 except has lead wires on load side instead of quick disconnects.

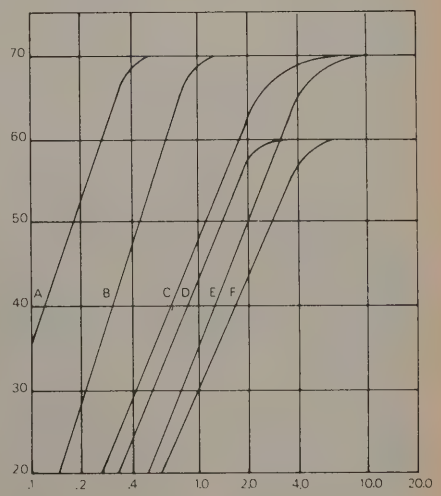
### Case Style 16




**TYPICAL INSERTION LOSS**
**Mil. STD. 220**

| Curve | Filter |
|---|---|
| A | 1T, 3T* |
| B | 2T, 5T, 10T, 20T, 30T |
| C | 1P, 3P |
| D | 1L, 3L |
| E | 2P, 5P, 10P |
| F | 2L, 5L, 10L, 20L, 30L, 20P, 30P |

Example
1T . . . 1 represents "current," T represents "series"



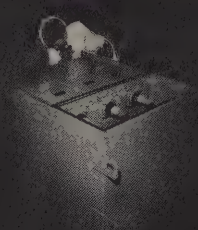

Rtron corporation P.O. Box 743 Skokie, Illinois 60076 312 • 679-7180

# Manufacturers of over 10,000 RFI/EMC filter types.

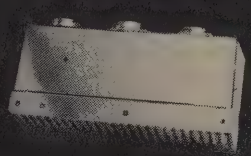
RFI, the nation's leading filter supplier, offers the most complete range of products in the industry. Sophisticated, complex, multi-circuit filter assemblies, or simple feedthru capacitors - we make them all.

These are just a few of the more than 10,000 different filter designs by RF INTERONICS for specific customer requirements. For detailed information concerning standard and custom-engineered parts, contact our sales department.

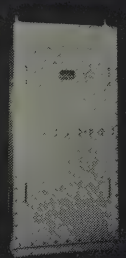
Subminiature "MICRO-FILTER"® for use in power and signal lines rated up to 230 VAC.



Much bigger ones, too. Ratings from 1 milliamp to 2,000 amps; 0.1 volt to 20,000 volts; fractions of an ounce to more than 1,000 lbs.



156 circuit, hermetically sealed high-reliability filter assembly – for use in aircraft data-link equipment.



1100 circuit filter cabinet for red/black secure communications.

RF INTERONICS, INC.

100-E PINE AIRE DRIVE, BAY SHORE, LONG ISLAND, N.Y. 11706 (516) 231-6400 TWX 510-227-6233

STERLING TRANSFORMER

# STANDARD INTERSTAGE AND LINE TRANSISTOR AND TUBE APPLICATIONS *filters*

Hermetically Sealed — Manufactured to MIL-F-18327B Available in Other Frequencies

## LOW PASS

### INTERSTAGE

LI units have a loss of approximately 3 db at cutoff frequency, and an attenuation of 35 db at 1.5 cutoff frequency. Input and output 10,000 ohms. LI units are MIL type FR4RX11YY.

| Part No. | Frequency | Case Size | Net Price |
|---|---|---|---|
| LI-60 | 60 cps | A | $87.12 |
| LI-100 | 100 cps | A | 87.12 |
| LI-200 | 200 cps | B | 87.12 |
| LI-400 | 400 cps | B | 87.12 |
| LI-500 | 500 cps | B | 87.12 |
| LI-800 | 800 cps | B | 87.12 |
| LI-1,000 | 1,000 cps | B | 87.12 |
| LI-1,500 | 1,500 cps | B | 87.12 |
| LI-2,000 | 2,000 cps | B | 87.12 |
| LI-2,500 | 2,500 cps | B | 87.12 |
| LI-3,000 | 3,000 cps | B | 87.12 |
| LI-4,000 | 4,000 cps | B | 87.12 |
| LI-5,000 | 5,000 cps | B | 87.12 |
| LI-10,000 | 10,000 cps | B | 87.12 |

### LINE

LL units have a loss of approximately 3 db at cutoff frequency, and an attenuation of 35 db at 1.5 cutoff frequency. Input and output 500/600 ohms. LL units are MIL type FR4RX11YY.

| Part No. | Frequency | Case Size | Net Price |
|---|---|---|---|
| LL-600 | 600 cps | A | $87.12 |
| LL-1,000 | 1,000 cps | A | 87.12 |
| LL-1,500 | 1,500 cps | A | 87.12 |
| LL-2,000 | 2,000 cps | A | 87.12 |
| LL-2,500 | 2,500 cps | A | 87.12 |
| LL-4,000 | 4,000 cps | A | 87.12 |
| LL-8,000 | 8,000 cps | A | 87.12 |
| LL-10,000 | 10,000 cps | A | 87.12 |
| LL-12,000 | 12,000 cps | A | 87.12 |

## HIGH PASS

### INTERSTAGE

HI units have a loss of less than 6 db at cutoff frequency, and an attenuation of 35 db at .67 cutoff frequency. Input and output 10,000 ohms. HI units are MIL type FR4RX33YY.

| Part No. | Frequency | Case Size | Net Price |
|---|---|---|---|
| HI-100 | 100 cps | A | $87.12 |
| HI-200 | 200 cps | A | 87.12 |
| HI-300 | 300 cps | A | 87.12 |
| HI-400 | 400 cps | A | 87.12 |
| HI-500 | 500 cps | A | 87.12 |
| HI-800 | 800 cps | A | 87.12 |
| HI-1,000 | 1,000 cps | A | 87.12 |
| HI-2,000 | 2,000 cps | A | 87.12 |
| HI-3,000 | 3,000 cps | A | 87.12 |

### LINE

HL units have a loss of less than 6 db at cutoff frequency, and an attenuation of 35 db at .67 cutoff frequency. Input and output 500/600 ohms. HL units are MIL type FR4RX33YY.

| Part No. | Frequency | Case Size | Net Price |
|---|---|---|---|
| HL-200 | 200 cps | A | $96.80 |
| HL-300 | 300 cps | A | 96.80 |
| HL-500 | 500 cps | A | 96.80 |
| HL-1,000 | 1,000 cps | A | 96.80 |

FOR WIDE BAND PASS FILTERS THE LI & HI OR LL & HL MAY BE CONNECTED IN SERIES.

## BAND PASS

### INTERSTAGE

BI units have 2:1 voltage gain. They are sharply peaked, having approximately 2 db attenuation at plus or minus 3% from center frequency and attenuation greater than 40 db at 1/2 and twice center frequency. Input 10,000 ohms, output to grid. BI units are MIL type FR4RX22YY.

| Part No. | Frequency | Case Size | Net Price |
|---|---|---|---|
| BI-50 | 50 cps | A | $87.12 |
| BI-60 | 60 cps | A | 87.12 |
| BI-100 | 100 cps | A | 87.12 |
| BI-120 | 120 cps | B | 87.12 |
| BI-200 | 200 cps | B | 87.12 |
| BI-240 | 240 cps | B | 87.12 |
| BI-400 | 400 cps | B | 87.12 |
| BI-500 | 500 cps | B | 87.12 |
| BI-750 | 750 cps | B | 87.12 |
| BI-800 | 800 cps | B | 87.12 |
| BI-1,000 | 1,000 cps | B | 87.12 |
| BI-1,500 | 1,500 cps | B | 87.12 |
| BI-2,000 | 2,000 cps | B | 87.12 |
| BI-3,000 | 3,000 cps | B | 87.12 |
| BI-4,000 | 4,000 cps | B | 87.12 |
| BI-5,000 | 5,000 cps | B | 87.12 |
| BI-10,000 | 10,000 cps | B | 87.12 |

### LINE

BL units have 9:1 voltage gain. They are sharply peaked, having approximately 2 db attenuation at plus or minus 3% from center frequency and attenuation greater than 40 db at 1/2 and twice center frequency. Input 500/600 ohms, output to grid. BL units are MIL type FR4RX22YY.

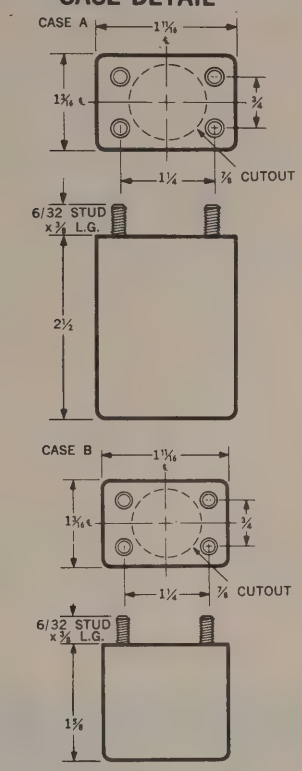
| Part No. | Frequency | Case Size | Net Price |
|---|---|---|---|
| BL-400 | 400 cps | B | $87.12 |
| BL-1,000 | 1,000 cps | B | 87.12 |

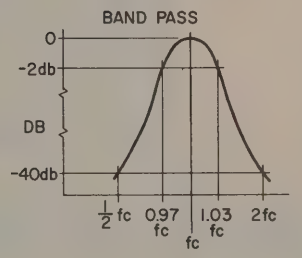
### TRANSISTOR INTERSTAGE

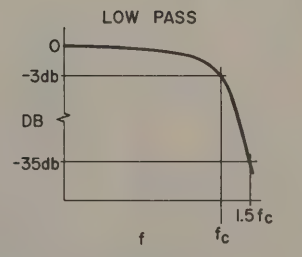
They are sharply peaked, having approximately 2 db attenuation at plus or minus 3% from center frequency and attenuation greater than 40 db at 1/2 and twice center frequency. Input 10,000 ohms, output 10,000 ohms. BIT units are MIL type FR4RX22YY.

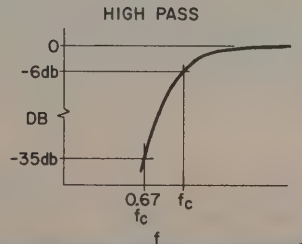
| Part No. | Frequency | Case Size | Net Price |
|---|---|---|---|
| BIT-60 | 60 cps | A | $96.80 |
| BIT-100 | 100 cps | A | 96.80 |
| BIT-120 | 120 cps | B | 96.80 |

## CASE DETAIL




STERLING TRANSFORMER CORP.
DEPT. EM, 510 DRIGGS AVENUE • BROOKLYN, NEW YORK 11211 • TELEPHONE: (212) 782-4200

# SPECTRUM CONTROL INC.

**SPECTRUM CONTROL . . .** The company was founded upon the basic philosophy of encompassing literally the spectrum of services in the EMI/EMC technology . . . services offered within reasonable cost structures.

Today, Spectrum Control facilities must rate among the most efficient in the industry. Advanced test equipment, shielded test rooms and a fully experienced engineering staff combined with a broad range of electronic components qualifies Spectrum as a unique source for total program management of electromagnetic interference.

Your EMI/EMC problem in electronic or electromechanical equipment can be assumed in total by Spectrum engineers . . . including testing, planning and control, from the initial stages to final resolution of the problem. At the outset an EMC control plan is formulated. This involves in-depth analysis of engineering drawings, circuitry, specifications and the equipment. Next, Spectrum provides consulting service to assist compliance with the control plan. EMI testing to the latest applicable specifications are conducted at your plant site by a team of experienced Spectrum engineers; or, if more convenient, specific equipment and apparatus can be brought directly to our test facilities.

As the problem is pinpointed, Spectrum Control has the total facilities to affect satisfactory, economical solution. Corrective action may involve circuit changes, packaging changes . . . or require EMI Filters, gaskets, metal shields or other types of hardware. Whatever is required, Spectrum Control is equipped with qualified personnel, plant facilities and a broad range of reasonably priced components to help resolve your EMI/EMC problems.

## INDUSTRIAL CONSUMER APPLICATIONS

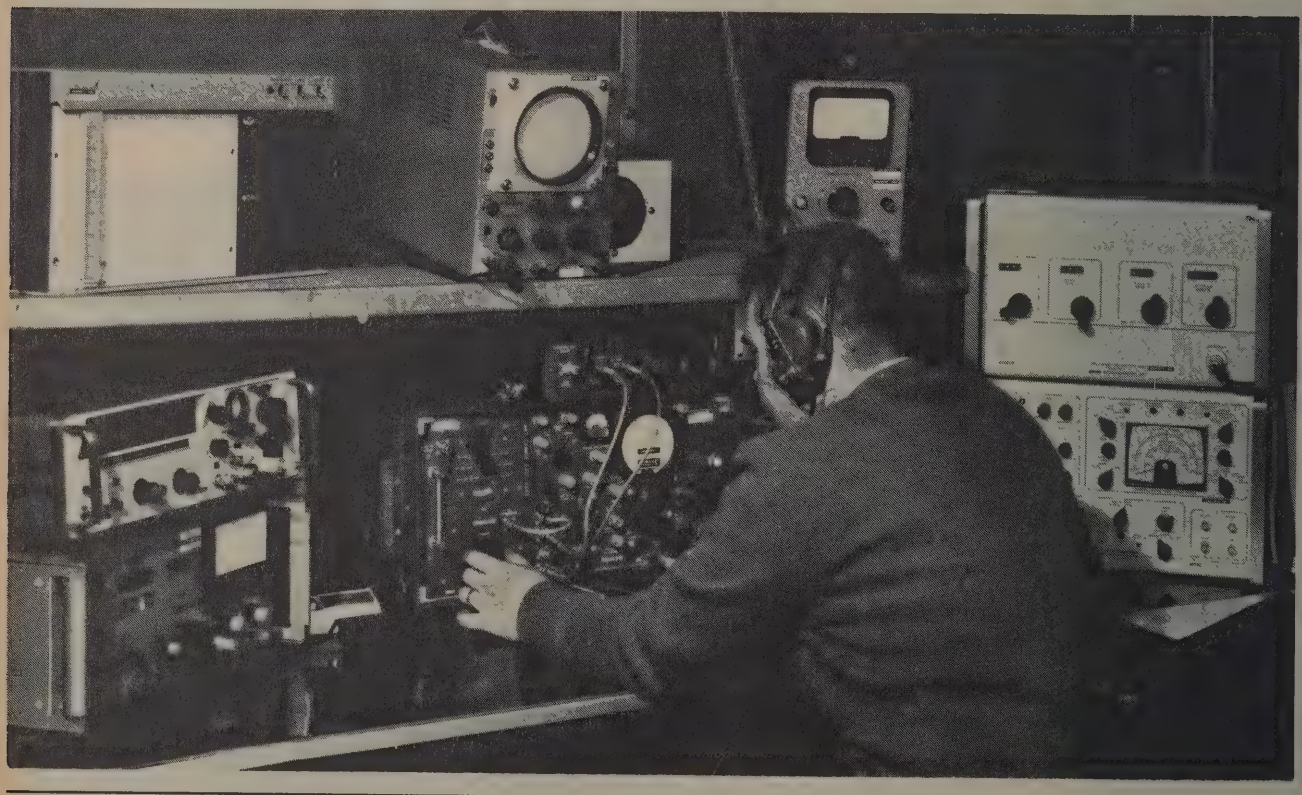
A rapidly increasing number of industrial and consumer products, equipment and systems are potential sources of electromagnetic interference. Spectrum Control specializes in air navigation and avionics, microwave ovens, control circuits, power supplies, electrical instruments, electric motor noise suppression . . . just about any application where EMI impairs optimum performance.

## MILITARY APPLICATIONS

Today's powerful communications systems, radar systems and other high performance systems demand the ultimate in electromagnetic compatibility. Spectrum Control offers one of the best equipped, independent test facilities in the United States. Spectrum is capable of performing to the following applicable specifications:

MIL-STD-461/462
MIL-STD-826
MIL-I-6181
MIL-I-26600
MIL-I-16910
FCC-Part 15
FCC-Part 18

**EMC Planning, Control and Testing . . . a total approach to electromagnetic compatibility!**



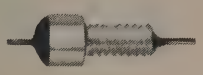
| | |
|---|---|
| HALL-MARK ELECTRONICS | (215) 355-7300 |
| METUCHEN CAPACITOR | (201) 442-0500 |
| ROSE ELECTRONICS | (415) 697-0224 |
| MOLTRONICS | (213) 773-6521 |

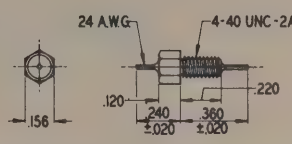
**SPECTRUM CONTROL INC.**
152 EAST MAIN ST., FAIRVIEW, PENNSYLVANIA 16415
PH. (814) 474-5593 TWX 510-699-6848

# EMI/RFI SUPPRESSION FILTERS

**THREAD BUSHING**
**RESIN SEAL**

SPECTRUM CONTROL

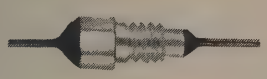


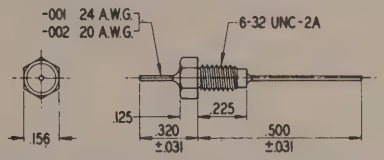



## Pi CIRCUITS
## *L SECTION

### TEST SPECIFICATION: SCI 51000

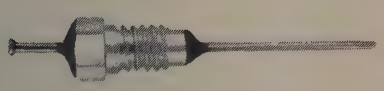
| Spectrum Control N° | Rated $I_{DC}$ | Working Volts +85°C | Working Volts +125°C | DCR Max. | Refer Cap - - - - | Insertion Loss DB 1 MHz | 10 MHz | 100 MHz | 200 MHz | 1 GHz | 10 GHz |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 51-729-303 | 10 amps | 200 VDC | 100 VDC | .01 | .0015 MFD | — | 5 | 42 | 50 | 65 | 65 |
| *51-729-304 | 10 amps | 200 VDC | 100 VDC | .01 | .022 MFD | 7 | 27 | 43 | 45 | 55 | 55 |
| 51-729-305 | 10 amps | 200 VDC | 200 VDC | .01 | .0045 MFD | — | 14 | 55 | 60 | 60 | 60 |

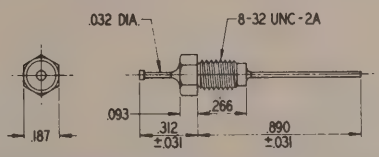





### TEST SPECIFICATION: SCI 51000

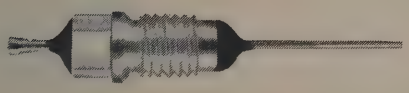
| Spectrum Control N° | Rated $I_{DC}$ | Working Volts +85°C | Working Volts +125°C | DCR Max. | Refer Cap - - - - | Insertion Loss DB 1 MHz | 10 MHz | 100 MHz | 200 MHz | 1 GHz | 10 GHz |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 51-726-001 | 3 amps | 200 VDC | 100 VDC | .01 | .001 MFD | — | 3 | 40 | 50 | 70 | 70 |
| * 51-726-002 | 10 amps | 200 VDC | 100 VDC | .01 | .022 MFD | 7 | 27 | 43 | 45 | 55 | 55 |
| 51-726-008 | 10 amps | 100 VDC | 50 VDC | .01 | .0055 MFD | — | 16 | 60 | 70 | 70 | 70 |

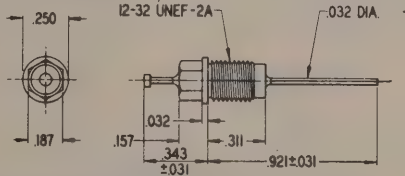





### TEST SPECIFICATION: SCI 51000

| Spectrum Control N° | Rated $I_{DC}$ | Working Volts +85°C | Working Volts +125°C | DCR Max. | Refer Cap - - - - | Insertion Loss DB 1 MHz | 10 MHz | 100 MHz | 200 MHz | 1 GHz | 10 GHz |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 51-712-001 | 10 amps | 200 VDC | 100 VDC | .01 | .0015 MFD | — | 5 | 42 | 50 | 70 | 70 |
| *51-712-003 | 10 amps | 200 VDC | 100 VDC | .01 | .022 MFD | 7 | 27 | 43 | 45 | 70 | 70 |
| 51-712-017 | 10 amps | 200 VDC | 100 VDC | .01 | .0055 MFD | — | 11 | 50 | 55 | 70 | 70 |






### TEST SPECIFICATION: SCI 51000

| Spectrum Control N° | Rated $I_{DC}$ | Working Volts +85°C | Working Volts +125°C | DCR Max. | Refer Cap - - - - | Insertion Loss DB 100 KHz | 1 MHz | 10 MHz | 100 MHz | 200 MHz | 1 GHz | 10 GHz |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 51-714-001 | 10 amps | 350 VDC | 200 VDC | .01 | .0015 | — | — | 5 | 45 | 50 | 70 | 70 |
| 51-714-002 | 10 amps | 200 VDC | 100 VDC | .01 | .0050 | — | 5 | 20 | 60 | 60 | 70 | 70 |
| * 51-714-007 | 10 amps | 200 VDC | 100 VDC | .01 | .05 | — | 10 | 30 | 50 | 60 | 70 | 70 |

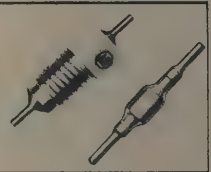

## SPECTRUM CONTROL INC.

152 EAST MAIN STREET, FAIRVIEW, PA. 16415 PHONE (814) 474-5593

# EMI/RFI SUPPRESSION FILTERS

**RESIN SEAL THREAD BUSHING**

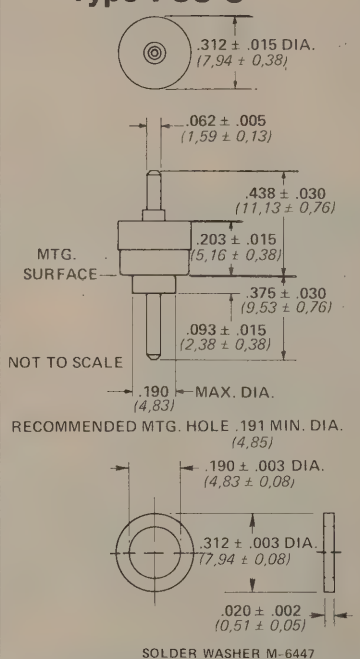
SPECTRUM CONTROL



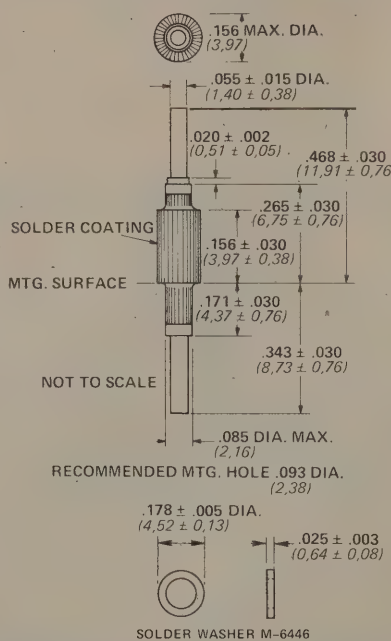
| Specifications | Type FCS-C | Type SMFB-A4 | Type SMFO-1 / Type SMFB-A1 | Type SMFB-A2 / Type SMFO-2 |
|---|---|---|---|---|
| **Attenuation** See explanation below table. | 25 dB @ 25°C<br>20 dB @ 85°C | 50 dB @ 25°C<br>45 dB @ 125°C | 35 dB @ 25°C<br>35 dB @ 125°C | 60 dB @ 25°C<br>50 dB @ 85°C |
| **Operating Temperature Range** | −55°C to +85°C | −55°C to +125°C | −55°C to +125°C | −55°C to +85°C |
| **DC Working Voltage** Includes summation of the DC and lower level AC peak voltages. | 500 Volts | 500 Volts | 200 Volts | 200 Volts |
| **Feed-Thru Current** DC and/or low frequency AC RMS. | 25 Amperes | 10 Amperes | 10 Amperes | 10 Amperes |
| **Capacitance (pF)** Minimum values at 25°C, 0.5 to 2.5 volts RMS, at 1 KHz. | 1000 | 2500 | 1300 | 5500 |
| **Feed-Thru Terminal Resistance** | 0.01 Ohm Maximum | | | |

**Attenuation:** Minimum attenuation values from 100 MHz to 10 GHz, when measured with an input 50 ohm series resistor (except FCS-C which is determined without 50 ohm series resistor), and at 0 volts DC and 0 amperes DC.

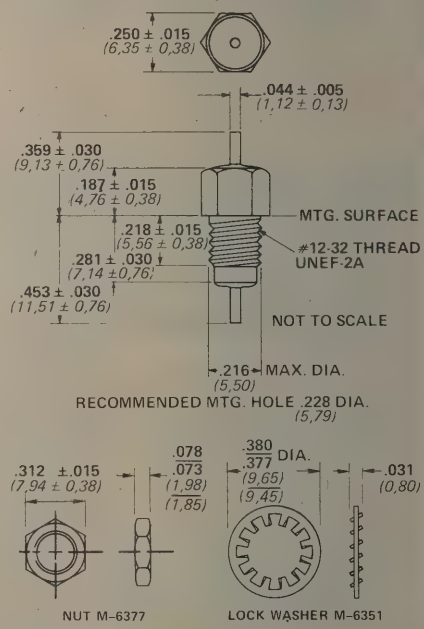
## Type FCS-C




## Types SMFO-1, SMFO-2




## Types SMFB-A1, SMFB-A2, SMFB-A4




| Allen Bradley Type Number | Spectrum Control Inventory Code Number |
|---|---|
| FCS-C | 51-722-001<br>51-722-022 with solder mounting washer |
| SMFB-A1 | 51-719-022 with nut and lockwasher |
| SMFB-A2 | 51-719-021 with nut and lockwasher |
| SMFB-A4 | 51-719-011 with nut and lockwasher |
| SMFO-1 | 51-723-303<br>51-723-304 with solder mounting washer |
| SMFO-2 | 51-723-301<br>51-723-302 with solder mounting washer |

## SPECTRUM ACQUIRES ALLEN BRADLEY LINE

In May of 1973, Spectrum Control, Inc. and Allen Bradley Company entered into a long term agreement whereby Spectrum Control acquired all patents, technology and machinery to manufacture the Allen Bradley line of filters and capacitors. These devices can be ordered by the Allen Bradley part number or by the Spectrum Control inventory code number.

**SPECTRUM CONTROL INC.**

152 EAST MAIN STREET, FAIRVIEW, PA. 16415 PHONE (814) 474-5593

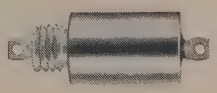
# EMI/RFI SUPPRESSION FILTERS

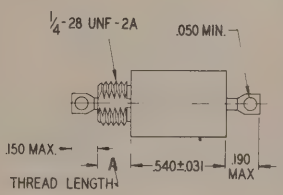
HERMETIC SEAL

SPECTRUM CONTROL

## 50VDC +85°C L SECTION 28VDC +125°C

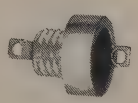
| Spectrum Control N° | A Thread Length | Inductor Location | Rated Current | DCR Max. | Insertion Loss DB 30 KHz | 150 KHz | 300 KHz | 1 MHz | 10 MHz | 1 GHz |
|---|---|---|---|---|---|---|---|---|---|---|
| 51-353-007 | .187 | THREAD | 60 ma. | 70 | 44 | 70 | 70 | 70 | 70 | 70 |
| 51-353-086 | .312 | END | | | | | | | | |
| 51-353-094 | .187 | TOP | | | | | | | | |
| 51-353-102 | .312 | END | | | | | | | | |
| 51-353-006 | .187 | THREAD | 150 ma. | 12 | 24 | 52 | 64 | 70 | 70 | 70 |
| 51-353-087 | .312 | END | | | | | | | | |
| 51-353-095 | .187 | TOP | | | | | | | | |
| 51-353-103 | .312 | END | | | | | | | | |
| 51-353-005 | .187 | THREAD | 250 ma. | 4 | 18 | 42 | 56 | 70 | 70 | 70 |
| 51-353-088 | .312 | END | | | | | | | | |
| 51-353-096 | .187 | TOP | | | | | | | | |
| 51-353-104 | .312 | END | | | | | | | | |
| 51-353-004 | .187 | THREAD | 300 ma. | 2.3 | 16 | 35 | 44 | 62 | 70 | 70 |
| 51-353-089 | .312 | END | | | | | | | | |
| 51-353-097 | .187 | TOP | | | | | | | | |
| 51-353-105 | .312 | END | | | | | | | | |
| 51-353-003 | .187 | THREAD | 450 ma. | 1.2 | 15 | 31 | 37 | 55 | 70 | 70 |
| 51-353-090 | .312 | END | | | | | | | | |
| 51-353-098 | .187 | TOP | | | | | | | | |
| 51-353-106 | .312 | END | | | | | | | | |
| 51-353-276 | .187 | THREAD | 1 amp. | .25 | 15 | 33 | 44 | 70 | 70 | 70 |
| 51-353-091 | .312 | END | | | | | | | | |
| 51-353-099 | .187 | TOP | | | | | | | | |
| 51-353-107 | .312 | END | | | | | | | | |
| 51-353-277 | .187 | THREAD | 5 amps | .015 | 15 | 28 | 33 | 46 | 70 | 70 |
| 51-353-092 | .312 | END | | | | | | | | |
| 51-353-100 | .187 | TOP | | | | | | | | |
| 51-353-108 | .312 | END | | | | | | | | |
| 51-353-001 | .187 | THREAD | 10 amps | .01 | 15 | 28 | 33 | 44 | 64 | 70 |
| 51-353-093 | .312 | END | | | | | | | | |
| 51-353-101 | .187 | TOP | | | | | | | | |
| 51-353-109 | .312 | END | | | | | | | | |



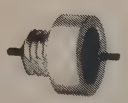



## 100VDC +85°C L SECTIONS 125VAC +125°C

51-717 Style
See Fig. 1



51-359 Style
See Fig. 2



51-344 Style
See Fig. 3

| Spectrum Control N° | Rated $I_{DC}$ | Working Volts +85°C | Working Volts +125°C | DCR Max. | Refer Cap - - - - | Insertion Loss DB 30 KHz | 150 KHz | 300 KHz | 1 MHz | 10 MHz | 1 GHz |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 51-717-001 | 15 amps | 100 VDC | 50 VDC | .01 | 1.4 MFD | 15 | 28 | 33 | 44 | 60 | 70 |
| 51-717-007 | 15 amps | 125 VAC | 125 VAC | .01 | .015 ±20% | — | — | — | 10 | 30 | 70 |
| 51-359-001 | 15 amps | 100 VDC | 50 VDC | .01 | 1.2 MFD | 15 | 28 | 33 | 44 | 60 | 70 |
| 51-359-007 | 15 amps | 125 VAC | 125 VAC | .01 | .015 ±20% | — | — | — | 10 | 30 | 70 |
| 51-344-006 | 15 amps | 100 VDC | 50 VDC | .01 | 1.4 MFD | 15 | 28 | 33 | 44 | 60 | 70 |

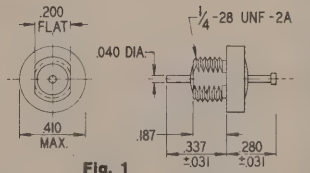


Fig. 1

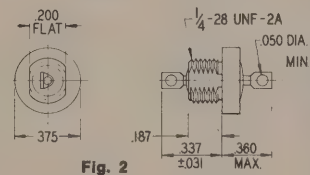


Fig. 2

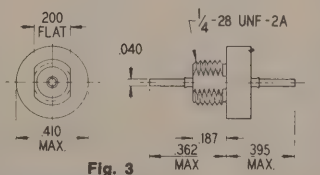


Fig. 3

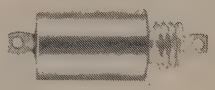

## SPECTRUM CONTROL INC.

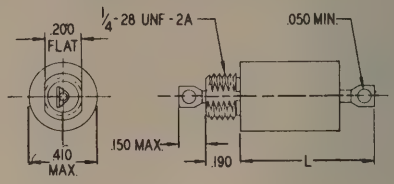
152 EAST MAIN STREET, FAIRVIEW, PA. 16415 PHONE (814) 474-5593

# EMI/RFI SUPPRESSION FILTERS

SPECTRUM CONTROL

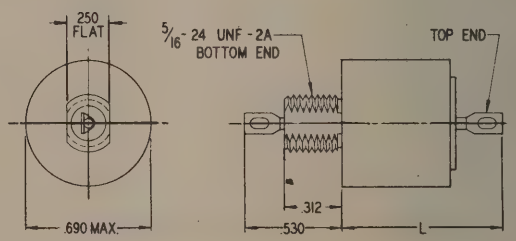
## 125VAC +125°C L, Pi, T 0-400 HERTZ






| Spectrum Control N° | Rated $I_{DC}$ | Filter Circuit and Inductor | Length L +.015 −.090 | DCR Max. | Insertion Loss DB 75 KHz | 150 KHz | 300 KHz | 1 MHz | 10 MHz | 1 GHz |
|---|---|---|---|---|---|---|---|---|---|---|
| 51-353-110 | 1 amp L | Inductor Top | .728 | .25 | 8 | 17 | 29 | 50 | 70 | 70 |
| 51-353-111 | | Inductor Bottom | | | | | | | | |
| 51-353-112 | 3 amp L | Inductor Top | .728 | .05 | 8 | 13 | 20 | 35 | 70 | 70 |
| 51-353-113 | | Inductor Bottom | | | | | | | | |
| 51-353-114 | 5 amp L | Inductor Top | .728 | .015 | 8 | 12 | 20 | 30 | 62 | 70 |
| 51-353-115 | | Inductor Bottom | | | | | | | | |
| 51-311-315 | .5 amp | Pi | .778 | .6 | 15 | 33 | 50 | 80 | 80 | 80 |
| 51-311-316 | 1 amp | Pi | .778 | .25 | — | 20 | 40 | 70 | 80 | 80 |
| 51-311-317 | 3 amp | Pi | .778 | .05 | — | — | 20 | 55 | 80 | 80 |
| 51-351-601 | 2 amp | T | 1.164 | — | 5 | 11 | 18 | 33 | 70 | 70 |

## 240VAC +125°C L, Pi, T 0-400 HERTZ




| Spectrum Control N° | Rated $I_{DC}$ | Filter Circuit and Inductor | Length "L" | DCR Max. | Insertion Loss DB 50 KHz | 100 KHz | 150 KHz | 1 MHz | 10 MHz | 1 GHz |
|---|---|---|---|---|---|---|---|---|---|---|
| 51-320-023 | 1 amp | Inductor Bottom | 1.006 | .21 | 13 | 24 | 30 | 60 | 70 | 70 |
| 51-320-024 | | Inductor Top | | | | | | | | |
| 51-320-025 | 3 amp | Inductor Bottom | 1.006 | .03 | 9 | 14 | 19 | 45 | 70 | 70 |
| 51-320-026 | | Inductor Top | | | | | | | | |
| 51-320-027 | 5 amp | Inductor Bottom | 1.006 | .007 | 9 | 14 | 19 | 37 | 70 | 70 |
| 51-320-028 | | Inductor Top | | | | | | | | |
| 51-323-005 | 10 amp | Inductor Bottom | 1.006 | .0075 | 5 | 10 | 14 | 30 | 53 | 70 |
| 51-323-001 | | Inductor Top | | | | | | | | |
| 51-322-012 | 20 amp | Inductor Bottom | 1.738 | .0075 | 4 | 6 | 19 | 35 | 55 | 70 |
| 51-322-013 | | Inductor Top | | | | | | | | |
| 51-321-317 | 1 amp | Pi | 1.170 | .21 | 23 | 43 | 53 | 80 | 80 | 80 |
| 51-321-318 | 3 amp | Pi | 1.170 | .03 | — | 15 | 31 | 80 | 80 | 80 |
| 51-321-319 | 5 amp | Pi | 1.170 | .02 | — | — | 17 | 75 | 80 | 80 |
| 51-321-612 | 4 amp | T | 1.170 | .0013 | 8 | 14 | 18 | 40 | 70 | 70 |

**SPECTRUM CONTROL INC.**

152 EAST MAIN STREET, FAIRVIEW, PA. 16415 PHONE (814) 474-5593

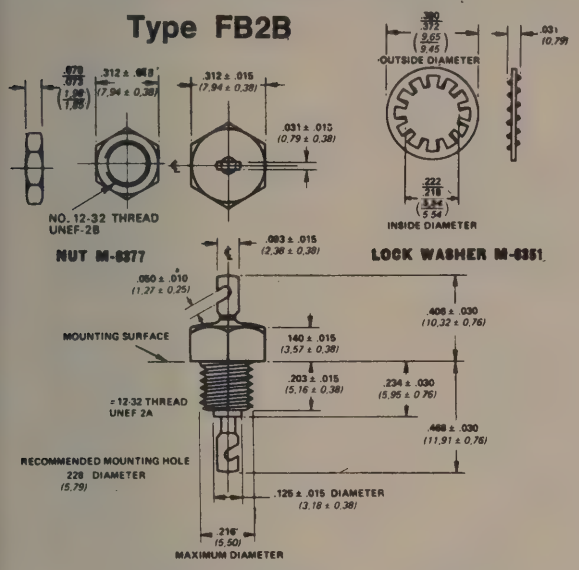
# FEED-THRU CERAMIC CAPACITORS

500VDC −55°C to +85°C

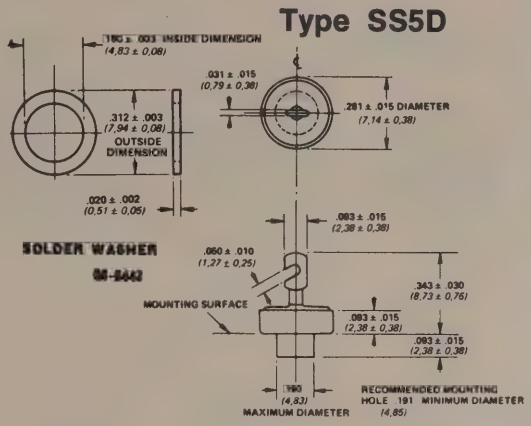
## SPECTRUM ACQUIRES ALLEN BRADLEY LINE

In May of 1973, Spectrum Control, Inc. and Allen Bradley Company entered into a long term agreement whereby Spectrum Control acquired all patents, technology and machinery to manufacture the Allen Bradley line of filters and capacitors. These devices can be ordered by the Allen Bradley part number or by the Spectrum Control inventory code number.

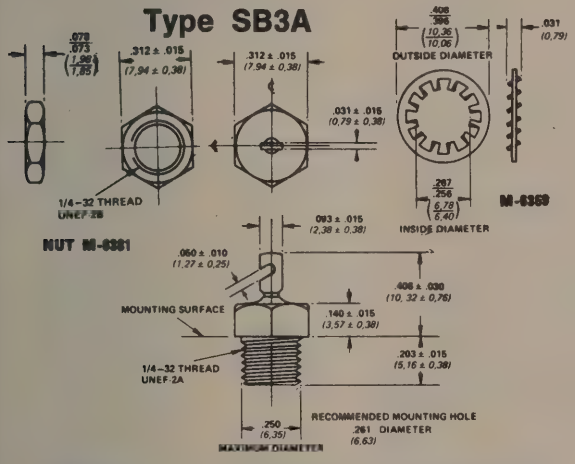
### Type FB2B



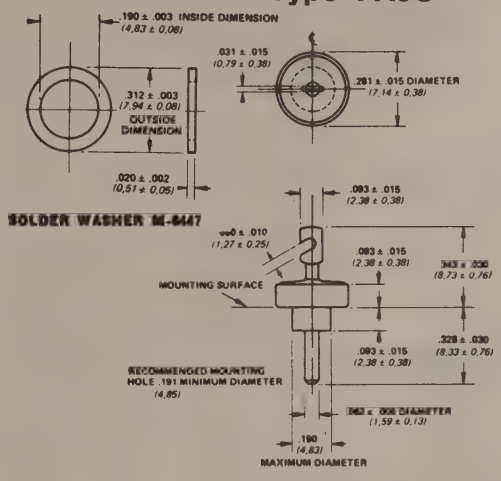

### Type SS5D



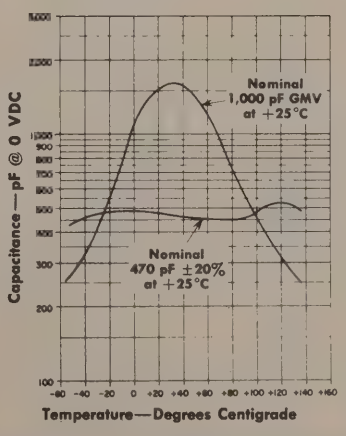

### Type SB3A


.312 ± .015 (7,94 ± 0,38)
.031 ± .015 (0,79 ± 0,38)
1/4-32 THREAD UNEF 2B
OUTSIDE DIAMETER
INSIDE DIAMETER
M-6359
NUT M-6381
.093 ± .015 (2,38 ± 0,38)
.050 ± .010 (1,27 ± 0,25)
.406 ± .030 (10,32 ± 0,76)
MOUNTING SURFACE
.140 ± .015 (3,57 ± 0,38)
.203 ± .015 (5,16 ± 0,38)
1/4-32 THREAD UNEF-2A
.250 (6,35) MAXIMUM DIAMETER
RECOMMENDED MOUNTING HOLE .261 DIAMETER (6,63)

### Type FA5C




| Spectrum Control P/N | Allen Bradley P/N | Tolerance % | Capacitance pf | Hardware Supplied |
|---|---|---|---|---|
| 54-794-002-101M | FA5C-1012 | 20 | 100 | M6447 Solder Preform |
| 54-794-002-471M | FA5C-4712 | 20 | 470 | |
| 54-794-002-102P | FA5C-102W | GMV | 1000 | |
| 54-804-002-101M | FB2B-1012 | 20 | 100 | Nut M6377 Washer M6351 |
| 54-804-002-471M | FB2B-4712 | 20 | 470 | |
| 54-804-002-102P | FB2B-102W | GMV | 1000 | |
| 54-803-004-101M | SS5D-1012 | 20 | 100 | M6474 Solder Preform |
| 54-803-004-471M | SS5D-4712 | 20 | 470 | |
| 54-803-004-102P | SS5D-102W | GMV | 1000 | |
| 54-807-002-101M | SB3A-1012 | 20 | 100 | Nut M6381 Washer M6359 |
| 54-807-002-471M | SB3A-4712 | 20 | 470 | |
| 54-807-002-102P | SB3A-102W | GMV | 1000 | |


Capacitance — pF @ 0 VDC
Nominal 1,000 pF GMV at +25°C
Nominal 470 pF ±20% at +25°C
-80 -40 -20 0 +20 +40 +60 +80 +100 +120 +140 +160
Temperature — Degrees Centigrade

SPECTRUM CONTROL


## SPECTRUM CONTROL INC.

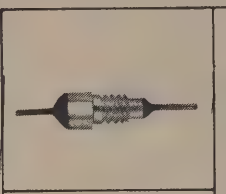
152 EAST MAIN STREET, FAIRVIEW, PA. 16415 PHONE (814) 474-5593

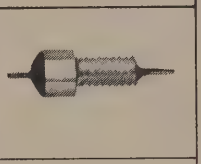
# FEED-THRU CERAMIC CAPACITORS

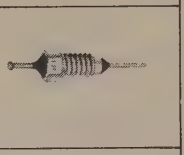
**RESIN SEAL**

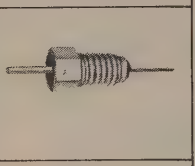
SPECTRUM CONTROL

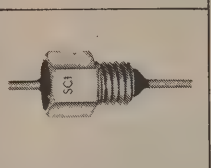
**SPECTRUM ACQUIRES ALLEN BRADLEY LINE** In May of 1973, Spectrum Control, Inc. and Allen Bradley Company entered into a long term agreement whereby Spectrum Control acquired all patents, technology and machinery to manufacture the Allen Bradley line of filters and capacitors. These devices can be ordered by the Allen Bradley part number or by the Spectrum Control inventory code number.

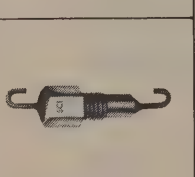


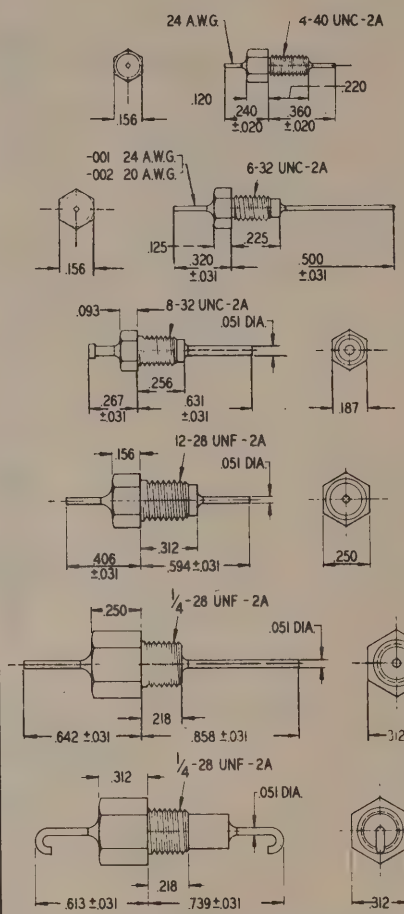






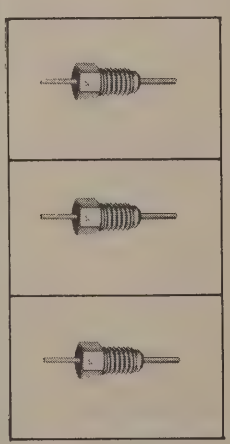


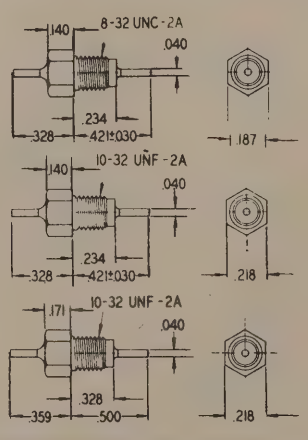





| Working Voltage +85°C | Working Voltage +125°C | Catalog Values Picofarad | Ordering Number |
|---|---|---|---|
| 200 | 100 | 10 | 54-790-001-100M |
| 200 | 100 | 100 | 54-790-001-101M |
| 200 | 100 | 500 | 54-790-001-501Z |
| 200 | 100 | 22000 | 54-790-001-223Z |
| 200 | 100 | 10 | 54-779-001-100M |
| 200 | 100 | 100 | 54-779-001-101M |
| 200 | 100 | 500 | 54-779-001-501P |
| 200 | 100 | 1000 | 54-779-001-102P |
| 200 | 100 | 22000 | 54-779-001-223Z |
| 200 | 100 | 10 | 54-713-001-100M |
| 200 | 100 | 100 | 54-713-001-101M |
| 200 | 100 | 1000 | 54-713-001-102Z |
| 200 | 100 | 3000 | 54-713-001-302Z |
| 500 | 250 | 500 | 54-743-001-501M |
| 500 | 250 | 1000 | 54-743-001-102Z |
| 500 | 250 | 39000 | 54-743-001-393Z |
| 500 | 250 | 1000 | 54-721-001-102Z |
| 500 | 250 | 1500 | 54-721-001-152Z |
| 500 | 250 | 3000 | 54-721-001-302Z |
| 500 | 250 | 1000 | 54-752-001-102Z |
| 500 | 250 | 1500 | 54-752-001-152Z |
| 500 | 250 | 10000 | 54-752-001-103Z |

## MULTI-LAYER FEED-THRU CAPACITORS






| Working Voltage +85°C | Working Voltage +125°C | Catalog Values Picofarad | Ordering Number |
|---|---|---|---|
| 100 | 100 | 50000 | 54-785-005-503P |
| 50 | 50 | .3 MFD | 54-786-013-304Z |
| 50 | 50 | .5 MFD | 54-786-021-504Z |
| 50 | 50 | 1.0 MFD | 54-786-014-105Z |


## SPECTRUM CONTROL INC.

**152 EAST MAIN STREET, FAIRVIEW, PA. 16415** **PHONE (814) 474-5593**

# EMI/RFI SUPPRESSION FILTERS

Listed below are the decodings from Mil-F-15733 to Spectrum part number. These filters can be ordered by the Spectrum or Mil number. A copy of this Mil specification and the slash sheets are available through normal channels at Naval Publications, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120. Spectrum Control is QPL'd on all dash numbers under slash sheets shown and will become qualified under all new slash sheets.

**MIL-F-15733**

| Military Designation | Spectrum Part Number |
|---|---|
| M15733/23-0001 | 51-390-001 |
| M15733/23-0002 | 51-390-002 |
| M15733/23-0003 | 51-390-003 |
| M15733/23-0004 | 51-390-004 |
| M15733/23-0005 | 51-353-316 |
| M15733/23-0006 | 51-353-317 |
| M15733/23-0007 | 51-390-005 |
| M15733/23-0008 | 51-390-006 |
| M15733/23-0009 | 51-390-007 |
| M15733/23-0010 | 51-390-008 |
| M15733/23-0011 | 51-353-318 |
| M15733/23-0012 | 51-353-319 |
| M15733/23-0013 | 51-390-009 |
| M15733/23-0014 | 51-390-010 |
| M15733/23-0015 | 51-390-011 |
| M15733/23-0016 | 51-390-012 |
| M15733/23-0017 | 51-353-320 |
| M15733/23-0018 | 51-353-321 |
| M15733/23-0019 | 51-390-013 |
| M15733/23-0020 | 51-390-014 |
| M15733/23-0021 | 51-390-015 |
| M15733/23-0022 | 51-390-016 |
| M15733/23-0023 | 51-353-322 |
| M15733/23-0024 | 51-353-323 |
| M15733/23-0025 | 51-390-017 |
| M15733/23-0026 | 51-390-018 |
| M15733/23-0027 | 51-390-019 |
| M15733/23-0028 | 51-390-020 |
| M15733/23-0029 | 51-353-324 |
| M15733/23-0030 | 51-353-325 |
| M15733/23-0031 | 51-390-021 |
| M15733/23-0032 | 51-390-022 |
| M15733/23-0033 | 51-390-023 |
| M15733/23-0034 | 51-390-024 |
| M15733/23-0035 | 51-353-326 |
| M15733/23-0036 | 51-353-327 |
| M15733/23-0037 | 51-390-025 |
| M15733/23-0038 | 51-390-026 |
| M15733/23-0039 | 51-390-027 |
| M15733/23-0040 | 51-390-028 |
| M15733/23-0041 | 51-353-328 |
| M15733/23-0042 | 51-353-329 |
| M15733/23-0043 | 51-390-029 |
| M15733/23-0044 | 51-390-030 |
| M15733/23-0045 | 51-390-031 |
| M15733/23-0046 | 51-390-032 |
| M15733/23-0047 | 51-353-330 |
| M15733/23-0048 | 51-353-331 |
| M15733/23-0049 | 51-390-033 |
| M15733/23-0050 | 51-390-034 |
| M15733/23-0051 | 51-390-035 |
| M15733/23-0052 | 51-390-036 |
| M15733/23-0053 | 51-353-332 |
| M15733/23-0054 | 51-353-333 |
| M15733/23-0055 | 51-390-037 |
| M15733/23-0056 | 51-390-038 |
| M15733/23-0057 | 51-390-039 |
| M15733/23-0058 | 51-390-040 |
| M15733/23-0059 | 51-353-334 |
| M15733/23-0060 | 51-353-335 |
| M15733/24-0001 | 51-353-064 |
| M15733/24-0002 | 51-353-065 |
| M15733/24-0003 | 51-385-025 |
| M15733/24-0004 | 51-385-026 |
| M15733/24-0005 | 51-353-066 |
| M15733/24-0006 | 51-353-067 |
| M15733/24-0007 | 51-385-027 |
| M15733/24-0008 | 51-385-028 |

| Military Designation | Spectrum Part Number |
|---|---|
| M15733/24-0009 | 51-353-068 |
| M15733/24-0010 | 51-353-069 |
| M15733/24-0011 | 51-353-070 |
| M15733/24-0012 | 51-353-071 |
| M15733/24-0013 | 51-353-072 |
| M15733/24-0014 | 51-353-073 |
| M15733/24-0015 | 51-353-074 |
| M15733/24-0016 | 51-353-075 |
| M15733/24-0017 | 51-385-029 |
| M15733/24-0018 | 51-385-030 |
| M15733/24-0019 | 51-385-031 |
| M15733/24-0020 | 51-385-032 |
| M15733/24-0021 | 51-385-033 |
| M15733/24-0022 | 51-385-034 |
| M15733/24-0023 | 51-385-035 |
| M15733/24-0024 | 51-385-036 |
| M15733/25-0001 | 51-353-052 |
| M15733/25-0002 | 51-311-308 |
| M15733/25-0003 | 51-353-053 |
| M15733/25-0004 | 51-311-309 |
| M15733/25-0005 | 51-353-054 |
| M15733/25-0006 | 51-311-310 |
| M15733/25-0007 | 51-382-603 |
| M15733/25-0008 | 51-353-055 |
| M15733/25-0009 | 51-353-056 |
| M15733/25-0010 | 51-311-311 |
| M15733/25-0011 | 51-353-057 |
| M15733/25-0012 | 51-382-604 |
| M15733/26-0001 | 51-353-076 |
| M15733/26-0002 | 51-353-336 |
| M15733/26-0003 | 51-353-077 |
| M15733/26-0004 | 51-353-078 |
| M15733/26-0005 | 51-311-312 |
| M15733/26-0006 | 51-353-079 |
| M15733/26-0007 | 51-353-080 |
| M15733/26-0008 | 51-351-603 |
| M15733/26-0009 | 51-311-313 |
| M15733/26-0010 | 51-353-081 |
| M15733/26-0011 | 51-311-314 |
| M15733/26-0012 | 51-351-604 |
| M15733/27-0001 | 51-320-013 |
| M15733/27-0002 | 51-320-014 |
| M15733/27-0003 | 51-323-313 |
| M15733/27-0004 | 51-321-312 |
| M15733/27-0005 | 51-320-015 |
| M15733/27-0006 | 51-320-016 |
| M15733/27-0007 | 51-323-314 |
| M15733/27-0008 | 51-320-017 |
| M15733/27-0009 | 51-320-018 |
| M15733/27-0010 | 51-321-313 |
| M15733/27-0011 | 51-323-003 |
| M15733/27-0012 | 51-323-004 |
| M15733/27-0013 | 51-321-314 |
| M15733/27-0014 | 51-322-009 |
| M15733/27-0015 | 51-322-010 |
| M15733/27-0016 | 51-321-606 |
| M15733/27-0017 | 51-321-607 |
| M15733/27-0018 | 51-321-608 |
| M15733/27-0019 | 51-320-019 |
| M15733/27-0020 | 51-320-020 |
| M15733/27-0021 | 51-323-315 |
| M15733/27-0022 | 51-321-315 |
| M15733/27-0023 | 51-321-609 |
| M15733/28B-0001 | 51-712-014 |
| M15733/28B-0002 | 51-712-028 |
| M15733/32-0001 | 52-304-006 |
| M15733/33-0001 | 51-707-006 |
| M15733/33-0002 | 51-707-007 |
| M15733/34B-0001 | 51-322-016 |

| Military Designation | Spectrum Part Number |
|---|---|
| M15733/34B-0002 | 51-322-017 |
| M15733/34B-0003 | 51-311-327 |
| M15733/34B-0004 | 51-321-328 |
| M15733/34B-0005 | 51-321-329 |
| M15733/34B-0006 | 51-321-330 |
| M15733/34B-0007 | 51-353-207 |
| M15733/34B-0008 | 51-353-208 |
| M15733/34B-0009 | 51-321-334 |
| M15733/35-0001 | 51-719-017 |
| M15733/35-0002 | 51-719-018 |
| M15733/36-0001 | 51-702-012 |
| M15733/36-0002 | 51-702-013 |
| M15733/37-0001 | 51-703-004 |
| M15733/38A-0001 | 51-343-018 |
| M15733/38A-0002 | 51-343-028 |
| M15733/39B-0001 | 51-353-148 |
| M15733/39B-0002 | 51-353-149 |
| M15733/39B-0003 | 51-353-150 |
| M15733/39B-0004 | 51-353-151 |
| M15733/39B-0005 | 51-353-152 |
| M15733/39B-0006 | 51-353-153 |
| M15733/39B-0007 | 51-353-154 |
| M15733/39B-0008 | 51-353-155 |
| M15733/39B-0009 | 51-353-156 |
| M15733/39B-0010 | 51-353-157 |
| M15733/39B-0011 | 51-353-344 |
| M15733/39B-0012 | 51-353-345 |
| M15733/39B-0013 | 51-353-223 |
| M15733/40-0001 | 51-704-002 |
| M15733/43A-0001 | 51-719-023 |
| M15733/43A-0002 | 51-712-055 |
| M15733/44B-0001 | 51-744-003 |
| M15733/44B-0003 | 51-744-006 |
| M15733/46-0001 | 51-709-004 |
| M15733/47B-0001 | 51-714-023 |
| M15733/47B-0002 | 51-714-024 |
| M15733/47B-0003 | 51-714-032 |
| M15733/47B-0004 | 51-712-038 |
| M15733/48A-0001 | 51-385-038 |
| M15733/48A-0002 | 51-385-040 |
| M15733/49-0001 | 51-344-011 |
| M15733/50B-0001 | 51-707-007 |
| M15733/50B-0002 | 51-703-009 |
| M15733/51-0001 | 51-703-007 |
| M15733/52A-0001 | 51-714-039 |
| M15733/52A-0002 | 51-714-040 |
| M15733/52A-0003 | 51-714-041 |
| M15733/52A-0004 | 51-712-039 |
| M15733/54B-0001 | 51-353-347 |
| M15733/54B-0002 | 51-353-348 |
| M15733/54B-0003 | 51-353-349 |
| M15733/54B-0004 | 51-353-350 |
| M15733/54B-0005 | 51-353-351 |
| M15733/54B-0006 | 51-353-352 |
| M15733/54B-0007 | 51-353-353 |
| M15733/54B-0008 | 51-353-354 |
| M15733/54B-0009 | 51-353-355 |
| M15733/54B-0010 | 51-353-356 |
| M15733/54B-0011 | 51-353-357 |
| M15733/54B-0012 | 51-353-358 |
| M15733/54B-0013 | 51-353-359 |
| M15733/54B-0014 | 51-353-360 |
| M15733/54B-0015 | 51-353-227 |
| M15733/54B-0016 | 51-353-228 |
| M15733/56-0001 | 51-431-804 |
| M15733/56-0002 | 51-431-805 |
| M15733/57-0001 | 51-353-226 |

SPECTRUM CONTROL

**SPECTRUM CONTROL INC.**

**152 EAST MAIN STREET, FAIRVIEW, PA. 16415** **PHONE (814) 474-5593**

# TRW UTC TRANSFORMERS — INDUCTORS

## ULTRAMINIATURE HIGH Q INDUCTORS
## MINIDUCTOR SERIES

**PACKAGING** Hermetically sealed. MS, MM, MH, MW, epoxy molded symmetrical toroids. ML, hipermalloy shield cased, hum reducing laminated inductor. MO, epoxy molded hum reducing laminated inductor. All have straight pin terminals for printed circuit applications.

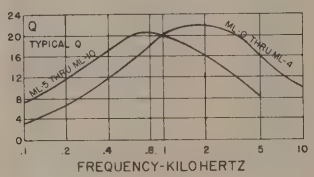
**TERMINALS** Per MIL-STD-1276.
**MIL SPECS** To complete MIL-T-27D Specs. Mil Type TF5R20ZZ.

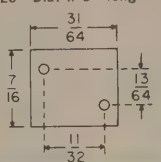
| Type No. | Tolerance Inductance at 25°C | Test Frequency | Test Level RMS V | Max. L Variation −55°C to +105°C |
|---|---|---|---|---|
| ML-0 thru 4 | ±3% | 1 kHz | 1.0 | Within 2% |
| ML-5 thru 10 | ±3% | 400 Hz | 1.0 | ±2% |
| MO-.1 thru 1 | ±2% | 1 kHz | 1.0 | +1% −2% |
| MO-2 thru 100 | ±2% | 400 Hz | 1.0 | +1% −3% |
| MS | ±2% | 1 kHz | 0.1 | ±2% |
| MM | ±2% | 1 kHz | 0.1 | ±2% |
| MH | ±2% | 1 kHz | 0.1 | ±1% |
| MW | ±1% | 1 kHz | 1.0 | ±1% |

## LAMINATED TYPES ML SERIES

**ML CASE**
7/16" x 31/64" x 7/16" high
Weight .2 oz.

**TERM.** Type D
gold-plated Dumet
.025" Dia. x 1" long



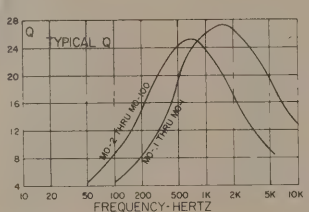

TERM. LAYOUT

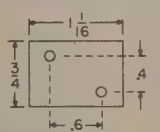
| Type No. | Ind. Hy (0 DC) | ma DC Max. | DCRΩ ±20% | Type No. | Ind. Hy (0 DC) | ma DC Max. | DCRΩ ±20% |
|---|---|---|---|---|---|---|---|
| ML-0 | .15 | 12 | 33 | ML-6 | 4.0 | .7 | 340 |
| ML-1 | .25 | 9 | 55 | ML-7 | 6.0 | .6 | 530 |
| ML-2 | .4 | 7 | 90 | ML-8 | 10 | .5 | 850 |
| ML-3 | .7 | 5 | 135 | ML-9 | 25 | .3 | 2300 |
| ML-4 | 1.4 | 3 | 210 | ML-10 | 60 | .2 | 5160 |
| ML-5 | 2.5 | 1 | 210 | | | | |

## MO SERIES

**MO CASE**
3/4" x 1 1/16" x 13/16" high Weight 1 oz.

**TERM.** Tinned Dumet
.040" Dia. x 3/32" long




TERM. LAYOUT

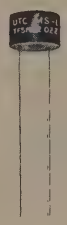
| Type No. | Ind. Hy (0 DC) | ma DC Max. | DCRΩ ±20% | Type No. | Ind. Hy (0 DC) | ma DC Max. | DCRΩ ±20% |
|---|---|---|---|---|---|---|---|
| MO-.1 | .1 | 55 | 14 | MO-5 | 5 | 5 | 340 |
| MO-.15 | .15 | 45 | 22 | MO-7.5 | 7.5 | 4.5 | 517 |
| MO-.3 | .3 | 28 | 34 | MO-20 | 20 | 2.7 | 1310 |
| MO-.5 | .5 | 23 | 54 | MO-50 | 50 | 1.4 | 3180 |
| MO-1 | 1 | 16 | 130 | MO-100 | 100 | 1.1 | 8550 |
| MO-2 | 2 | 8 | 130 | | | | |

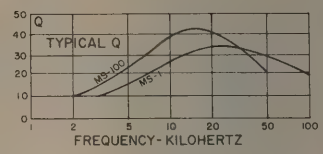
## TOROIDAL TYPES

## MS SERIES

**MS CASE**
.35" Dia. x .23 high
Weight 1.3 Gm.

**TERM.** Type D
gold-plated Dumet
.025" Dia. x 1 1/4" long



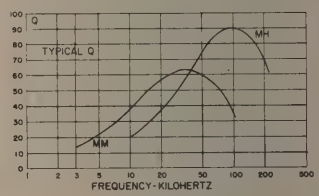



| Type No. | Ind. mHy (0 DC) | ma DC Max. | DCRΩ Max. | Type No. | Ind. mHy (0 DC) | ma DC Max. | DCRΩ Max. |
|---|---|---|---|---|---|---|---|
| MS-1 | 1 | 60 | 1.4 | MS-25 | 25 | 13 | 38 |
| MS-5 | 5 | 28 | 7 | MS-50 | 50 | 9 | 75 |
| MS-10 | 10 | 20 | 11 | MS-100 | 100 | 6 | 132 |

## MM SERIES / MH SERIES

**MM / MH CASE**
7/16" Dia. x 1/4" high
Weight .07 oz.

**TERM.** Type D
gold-plated Dumet
.025" Dia. x 1 1/4" long




**MM SERIES**

| Type No. | Ind. mHy (0 DC) | ma DC Max. | DCRΩ Max. |
|---|---|---|---|
| MM1 | 3 | 50 | 4.8 |
| MM-2 | 5 | 40 | 8.0 |
| MM-3 | 8 | 30 | 13 |
| MM-4 | 12.5 | 25 | 19 |
| MM-5 | 20 | 20 | 31 |
| MM-6 | 30 | 16 | 47 |
| MM-7 | 60 | 11 | 94 |
| MM-8 | 120 | 8 | 186 |

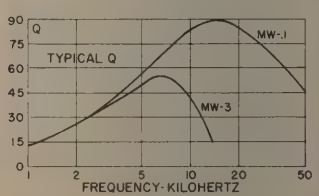
**MH SERIES**

| Type No. | Ind. mHy (0 DC) | ma DC Max. | DCRΩ Max. |
|---|---|---|---|
| MH-1 | .6 | 90 | 1.9 |
| MH-2 | 1.5 | 57 | 4.9 |
| MH-3 | 2.5 | 44 | 8.2 |
| MH-4 | 6 | 28 | 19 |
| MH-5 | 10 | 22 | 32 |
| MH-6 | 15 | 18 | 49 |
| MH-7 | 25 | 14 | 82 |
| MH-8 | 40 | 11 | 130 |

## MW SERIES

**MW CASE**
23/32" Dia. x 13/32" high
Weight .25 oz.

**TERM.** Type N-2
gold-plated nickel
.040" Dia. x 3/8" long




| Type No. | Ind. Hy (0 DC) | ma DC Max. | DCRΩ ±20% | Type No. | Ind. Hy (0 DC) | ma DC Max. | DCRΩ ±20% |
|---|---|---|---|---|---|---|---|
| MW-.05 | .05 | 25 | 27 | MW-1 | 1.0 | 6 | 500 |
| MW-.10 | .10 | 18 | 51 | MW-1.2 | 1.2 | 5 | 560 |
| MW-.25 | .25 | 11 | 136 | MW-2 | 2 | 4 | 870 |
| MW-.5 | .5 | 8 | 243 | MW-3 | 3 | 3.5 | 1340 |
| MW-.75 | .75 | 7 | 355 | MW-5 | 5 | 3 | 2500 |

# TRW UTC TRANSFORMERS

# FILTERS

## UTC "FLATS"* ELECTRIC WAVE FILTERS

**DESIGNED, MANUFACTURED AND SUCCESSFULLY TESTED TO COMPLETE MIL-F-18327 SPECIFICATIONS**

These filters meet today's need for flat component configurations, have excellent attenuation characteristics and are ruggedized to Grade 6, MIL-F-18327. Straight pin terminals and flat construction make these units ideally suited for printed circuit applications. These filters are hermetically sealed in flat metal cases shielded to reduce hum pickup. FP-A Case: 2" x 2" x ½" h., 2.5 oz. FP-B Case: 2" x 1½" x ⅜" h., 2 oz. FP-C Case: 2" x 1½" x ½" h., 2.2 oz.

**FHH-200:** Flat package high pass filter, source and load 10K ohms. Units are within 1 db up to 300 Hz 3 db ±1 db at 200 Hz, and have an attenuation of at least 40 db at frequencies below 140 Hz. FP-A Case. Mil Type: FR6RX33YY1.

**FLH-600:** Flat package low pass filter, source and load 10K ohms. Units are within 1 db from DC to 450 Hz, 3 db ±1 db at 600 Hz, and have an attenuation of at least 40 db at frequencies above 800 Hz. FP-A Case. Mil Type: FR6RX11YY1.

**FLH-5000:** Flat package low pass filter, source and load 10K ohms. Units are within 1 db from DC to 4.2 kHz, 3 db ±1 db at 5 kHz, and have an attenuation of at least 43 db at frequencies above 6400 Hz. FP-B Case. Mil Type: FR6RX11YY1.

**FLL-3500:** Flat package low pass filter, source and load 600 ohms. Units are within 1 db from DC to 3 kHz, 3 db ±1 db at 3500 Hz, and have an attenuation of at least 40 db at frequencies above 4500 Hz. FP-A Case. Mil Type: FR6RX33YY1.

**FLL-18000:** Flat package low pass filter, source and load 600 ohms. Units are within 1 db from DC to 15 kHz, 3 db ±1 db at 18 kHz, and have an attenuation of at least 43 db at frequencies above 23 kHz. FP-A Case. Mil Type: FR6RX11YY1.

**FLL-50000:** Flat package low pass filter, source and load 600 ohms. Units are within 1 db from DC to 42 kHz, 3 db ±1 db at 50 kHz, and have an attenuation of at least 43 db above 64 kHz. FP-B Case. Mil Type: FR6RX11YY1.

**FBH-1:** Flat package Broad Band Pass Filter has a source and load of 10K ohms. Units are within 3 db from 1 kHz to 2 kHz, and have an attenuation of at least 36 db at frequencies below 500 cps and above 4 kHz. FP-C Case. Mil Type FR6RX22YY1.

**FBH-10:** Same as FBH-1, except less than 3 db from 10 kHz to 20 kHz, attenuation of at least 36 db below 5 kHz and above 40 kHz.

## INTERSTAGE AND LINE FILTERS

Available in stock frequencies listed below (numerical part of type — number is center frequency in Hz on band pass or cutoff frequency in Hz on low and high pass filters). Compact shielded cases hermetically sealed to MIL-F-18327 specs. BMI, LMI, BML Cases: 1⅜" x 1 1⁄16" x 1⅝" h.; wt., 6 oz. HMI, HML, LML Cases: 1⅜" x 1 1⁄16" x 2½" h.; wt., 9 oz. The BMI filters are band pass interstage units designed to operate between 10,000 ohms and a grid. They provide a gain of 2 at center frequency. BTI units are same as BMI, but 10,000 ohms output. BML band pass filters, similarly, work into a grid, but have an input impedance of 500/600 ohms. They provide a gain of 9.

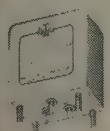
HMI filters are high pass interstage units.

LMI filters are low pass interstage units.

HML filters are high pass with input and output impedance of 500/600 ohms.

LML filters are low pass filters with input and output impedance of 500/600 ohms.

BM & LM Series



HM Series

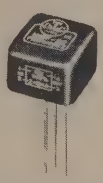
| UTC Type | UTC Type | UTC Type | UTC Type | UTC Type |
|---|---|---|---|---|
| BMI-30 | BMI-1000 | HMI-100 | LMI-50 | LMI-5000 |
| BMI-50 | | HMI-200 | LMI-100 | LMI-10000 |
| BMI-60 | | HMI-300 | LMI-150 | |
| BMI-90 | | HMI-400 | LMI-200 | LML-500 |
| BMI-100 | | HMI-500 | LMI-400 | LML-1000 |
| BMI-120 | | HMI-800 | LMI-500 | LML-1500 |
| BMI-150 | | HMI-1000 | LMI-800 | LML-2000 |
| BMI-200 | BML-400 | HMI-2000 | LMI-1000 | LML-2500 |
| BMI-240 | BML-1000 | HMI-3000 | LMI-1500 | LML-3000 |
| BMI-300 | | HML-40 | LMI-2000 | LML-4000 |
| BMI-400 | BTI-60 | HML-200 | LMI-2500 | LML-8000 |
| BMI-500 | BTI-100 | HML-300 | LMI-3000 | LML-10000 |
| BMI-750 | BTI-120 | HML-500 | LMI-4000 | LML-12000 |
| BMI-800 | HMI-50 | HML-1000 | | |

## MNF/MWF BAND PASS TELE-MINIFILTER

Both MNF and MWF types are designed for 10K source and load impedance. Low profile and pin terminals make these filters ideally suited for printed circuit applications. Mil-F-18327 Type FR7RX22ZZ1

MNF filters are down less than:
3 db. at ±7.5% of Center Frequency.
15 db. min at ±25% of Center Frequency.
Attenuation is greater than 40 db. beyond 1.75 x Center Frequency and .58 x Center Frequency.

MWF filters are down less than:
3 db. at ±15% of Center Frequency.
15 db. min. at ±50% of Center Frequency.
Attenuation is greater than 40 db. beyond 2.5 x Center Frequency and .4 x Center Frequency.



**MNF-.4 thru MNF-5.4**
1⅜" sq. x ½" high
Weight 1 oz.

**MNF-7.35 thru MWF-70**
2⅜2" sq. x ½" high
Weight ⅓ oz.

| UTC Type | Center Frequency kHz | Band Width± (%) |
|---|---|---|
| MNF-.4 | .4 | 7½ |
| MNF-.56 | .56 | 7½ |
| MNF-.73 | .73 | 7½ |
| MNF-.96 | .96 | 7½ |
| MNF-1.3 | 1.3 | 7½ |
| MNF-1.7 | 1.7 | 7½ |
| MNF-2.3 | 2.3 | 7½ |
| MNF-3.0 | 3.0 | 7½ |
| MNF-3.9 | 3.9 | 7½ |
| MNF-5.4 | 5.4 | 7½ |
| MNF-7.35 | 7.35 | 7½ |
| MNF-10.5 | 10.5 | 7½ |
| MNF-14.5 | 14.5 | 7½ |
| MNF-22 | 22 | 7½ |
| MNF-30 | 30 | 7½ |
| MNF-40 | 40 | 7½ |
| MNF-52.5 | 52.5 | 7½ |
| MNF-70 | 70 | 7½ |
| MWF-22 | 22 | 15 |
| MWF-30 | 30 | 15 |
| MWF-40 | 40 | 15 |
| MWF-52.5 | 52.5 | 15 |
| MWF-70 | 70 | 15 |

## MINIFILTERS*

These units provide almost the same characteristics as the standard interstage units listed at the bottom left, although extremely miniaturized. Hermetically sealed to MIL-F-18327 specs. B Type Case: ¾" x ¾" x 1⅛" h.; wt., 1 oz. H and L Cases: 1" x 1" x 1⅜"h; wt., 2¼ oz. Center frequency in Hz on band pass or cutoff frequency in Hz on low and high pass filters is indicated by type numbers."

BPM units (BAND PASS) have 2:1 gain. Attenuation is approximately 2 db ±3% from center frequency, and 35 db per octave as shown. source 10,000 ohms, output to grid, tapped for 10,000 ohms.

BPM units (band pass) have a 2:1 gain grid output. Attenuation is less than 2 db ±3% from center frequency and 35 db per octave. Source 10,000 ohms, output to grid, tapped for 10,000 ohms. Can be connected for band reject response."
Source and load 10,000 ohms.
LPM units (LOW PASS) are down less than 6 db at cutoff frequency, and more than 30 db at 1.5 cutoff frequency, 40 db at 1.65 cutoff frequency. Source and load 10,000 ohms.

BPM

HPM & LPM

| UTC Type | UTC Type | UTC Type |
|---|---|---|
| BPH-50000 | BPM-2500 | HPM-4000 |
| BPH-100000 | BPM-3000 | LPM-200 |
| BPM-400 | BPM-3200 | LPM-300 |
| BPM-440 | BPM-4000 | LPM-500 |
| BPM-500 | BPM-4800 | LPM-1000 |
| BPM-600 | BPM-5000 | LPM-1500 |
| | BPM-6000 | LPM-2000 |
| BPM-800 | | LPM-3000 |
| BPM-1000 | BPM-8000 | LPM-5000 |
| BPM-1200 | BPM-10000 | LPM-6000 |
| BPM-1500 | BPM-20000 | LPM-8000 |
| BPM-1600 | HPM-500 | LPM-10000 |
| | HPM-1000 | LPM-15000 |
| BPM-2000 | HPM-1500 | |

# TRW UTC TRANSFORMERS FILTERS & INDUCTORS

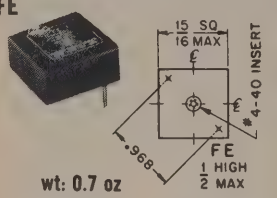
## FE, FI MINIATURE INDUCTORS

**DESIGNED, MANUFACTURED AND TESTED TO COMPLETE MIL-T-27**

**SPECIFICATIONS**

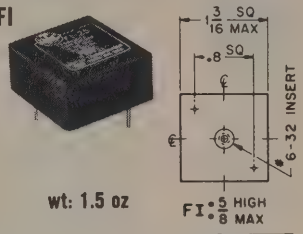
FE, FI miniature inductors are ideal for transistor and printed circuit applications, having both pin terminals and a molded flat construction. These units are symmetrical toroids providing maximum Q in minimum size. The FE and FI inductors are adjusted at 1V, 1 kHz. All units are adjusted to a tolerance of ±1%. The maDC max. shown is for approximately 5% drop in inductance. The temperature stability is unequalled from −55°C to +100°C. For AC level limitations, a general rule of thumb would be to consider the maximum AC current approximately equal to the maximum DC current rating. All units Mil Type: TF5R20ZZ.

FE

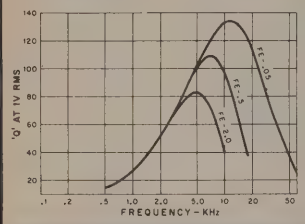


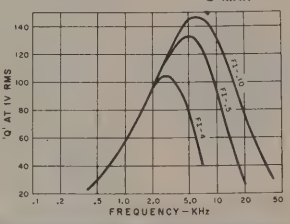

wt: 0.7 oz

FI




wt: 1.5 oz



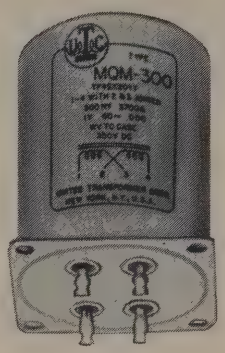



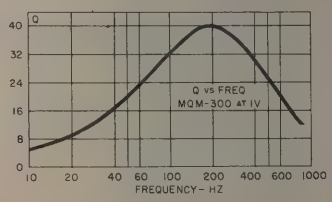

| Type No. | Ind. Hy (0 DC) | maDC Max. | DCRΩ Max. |
|---|---|---|---|
| FE-.01 | .0100 | 70 | 2.5 |
| FE-.02 | .0200 | 50 | 5.1 |
| FE-.05 | .0500 | 30 | 12 |
| FE-.1 | .100 | 22 | 22 |
| FE-.5 | .500 | 10 | 122 |
| FE-1 | 1.00 | 7 | 250 |
| FE-2 | 2.00 | 5 | 500 |

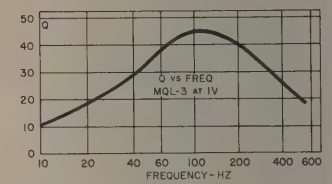
| Type No. | Ind. Hy (0 DC) | maDC Max. | DCRΩ Max. |
|---|---|---|---|
| FI-.04 | .0400 | 50 | 4.3 |
| FI-.1 | .100 | 30 | 11 |
| FI-.25 | .250 | 20 | 27 |
| FI-.5 | .500 | 14 | 60 |
| FI-1 | 1.00 | 10 | 110 |
| FI-4 | 4.00 | 5 | 430 |

## LOW FREQUENCY HIGH Q COILS
## MQM — MQL

Designed for High Q at low frequencies, structure provides excellent stability. Inductance values to 2% tolerance at 1V, 60 Hz Inductance Variation MQM −55°C to +130°C less than ±2%, MQL −55°C to 105°C less than 3%. Transformer, parallel, series or center tapped connections are permitted due to dual windings to 4 terminals. MQM Mil Type TF4S0YY 1⅝ diam., 1⅝ h, Mounting 1⅛ sq., cutout 1 diam., wt. 5 oz. MQL Mil Type TF4R20YY 1 13/16 dia., 2½ h, Mounting 1½ sq., cutout 1½ diam., wt. 1 lb.




| Type No. | Series Henries (0 DC) | Parallel Henries (0 DC) | Series DCRΩ ±20% |
|---|---|---|---|
| MQM-2 | 2 | .5 | 21 |
| MQM-16 | 16 | 4 | 143 |
| MQM-40 | 40 | 10 | 368 |
| MQM-300 | 300 | 75 | 3700 |
| MQM-600 | 600 | 150 | 5720 |

| Type No. | Series Henries (0 DC) | Parallel Henries (0 DC) | Series DCRΩ ±20% |
|---|---|---|---|
| MQL-0 | 1 | .25 | 5 |
| MQL-1 | 10 | 2.5 | 50 |
| MQL-2 | 20 | 5 | 82 |
| MQL-3 | 200 | 50 | 820 |
| MQL-4 | 400 | 100 | 2100 |
| MQL-5 (For 60 Hz and lower) | 2500 | 625 | 13K |

## VARIDUCTORS

These variable inductors are ideal for use in tuned circuits, equalizers, oscillators, etc.

## HVC, TVC VARIABLE INDUCTORS

**PACKAGING** — Hermetically sealed. Metal encased. Inductance variation controlled by adjustment screw on top of case. Range is covered in 900° rotation. Setting is positive. TVC is tapped version of HVC, with taps at 30% and 50% of total turns.

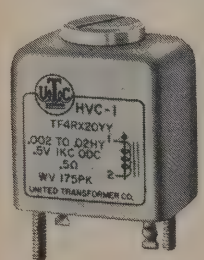
**RANGE** — HVC, TVC +200% −70% of nominal value.

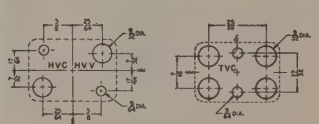
**TEMPERATURE STABILITY** — At mean inductance, from −55°C to +105°C. HVC & TVC: ±1.5%.

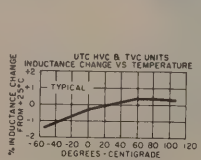
**MIL TYPE TF4R20YY Size** — 1⅛ x 25/32 x 1 3/32 h, Wt. 2 oz.

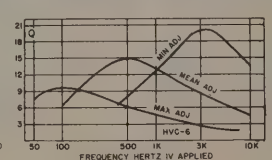
| Type No. | Tapped Type No. | Min. Hys. | Mean Hys. | Max. Hys. | maDC | DCRΩ +20% |
|---|---|---|---|---|---|---|
| HVC-1 | TVC-1 | .002 | .006 | .02 | 100 | .5 |
| HVC-2 | TVC-2 | .005 | .015 | .05 | 60 | 1.4 |
| HVC-3 | TVC-3 | .011 | .040 | .11 | 40 | 3.6 |
| HVC-4 | TVC-4 | .03 | .1 | .3 | 30 | 8.6 |
| HVC-5 | TVC-5 | .07 | .25 | .7 | 20 | 22 |
| HVC-6 | TVC-6 | .2 | 6 | 2 | 15 | 55 |
| HVC-7 | TVC-7 | .5 | 1.5 | 5 | 10 | 141 |
| HVC-8 | TVC-8 | 1.1 | 4 | 11 | 7 | 360 |
| HVC-9 | TVC-9 | 3 | 10 | 30 | 5 | 950 |
| HVC-10 | TVC-10 | 7 | 25 | 70 | 3.5 | 2220 |
| HVC-11 | TVC-11 | 20 | 60 | 200 | 2 | 5550 |
| HVC-12 | TVC-12 | 50 | 150 | 500 | 1.5 | 15.6K |

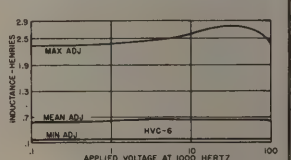
**Choosing Type No.:** If frequency is above 100 Hz, use type providing required inductance between mean and min. values.



# TRW UTC TRANSFORMERS — INDUCTORS

## SR POWER INDUCTORS

SR power inductors are a new development, optimizing saturation characteristics with temperature rise. By special design, TRW/UTC has achieved higher LI² capability with lower DCR for a given size. Another way to see this improvement is to realize that these units produce less drop in inductance with DC for their size than comparable available units. See the curves below for typical capability in each size.

These inductors have low losses in the 3 to 100 kHz frequency range, making them ideal for switching regulator and AC filter choke applications.

The type numbers correspond to their inductance values in microhenries, which are measured at 1 V, 10 kHz, 0 DC with an inductance tolerance of +15%, −5%. Current listings $I_1$ are for approximately 10% drop in inductance with a typical 20°C temperature rise, and listings $I_2$ are for a 20% drop in inductance with a typical 40°C temperature rise.

Values of inductance other than listed in an existing size are available. Part number would be:

SR (A, B, or C)—(inductance in microhy at 0 DC)

Single-winding construction is assumed unless otherwise specified.

## USE OF CURVES

**EXAMPLE 1** Select an inductor to meet a requirement of 200 μhy at 3 amps with a maximum temperature rise of 20°C.

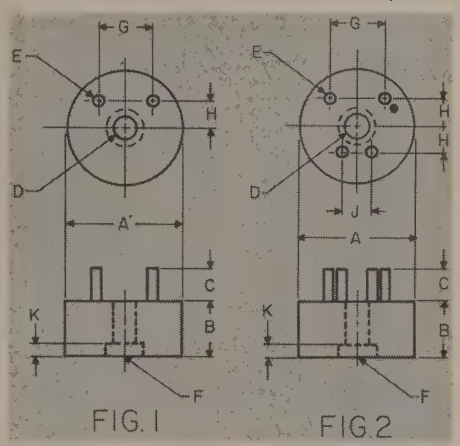
First, calculate LI², where L is in microhenries and I is in amperes. LI² = 200 × 3 × 3 = 1800.

Study the curves below to find the smallest coil that has a temperature rise less than 25°C. For LI² = 1800, SRA ≈ 30°C, which is too high for this requirement. However, the SRB curve shows an acceptable heat rise of 15°C and 92% of initial inductance at LI² = 1800. To meet the requirement of 200 μhy at 3 amps, inductance at 0 DC ≈ $\frac{200}{.92}$ = 217. Look in the itemized listing for an appropriate coil. Select SRB-220. Recalculate LI² = 220 × 3 × 3 = 1950. Check the curve to verify that the heat rise is still under 20°C for the new value of LI².

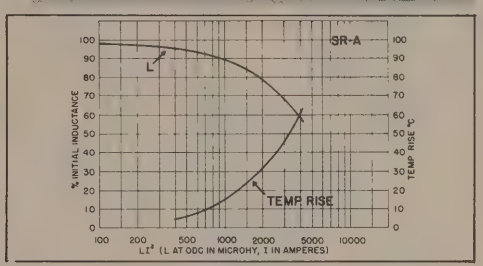
**EXAMPLE 2** Select an inductor to meet a requirement of 750μhy minimum at 0 DC, with a maximum range in inductance of 15% at 1 amp and 25% at 1.5 amp. Looking at the itemized listing, select SRA-800. Calculate LI² as in Example 1. For 1 amp, LI² = 800; for 1.5 amp, LI² = 1800.

Check the SRA curve for the drop in inductance. It is less than 10% at 1 amp, and less than 20% at 1.5 amp, which is acceptable.

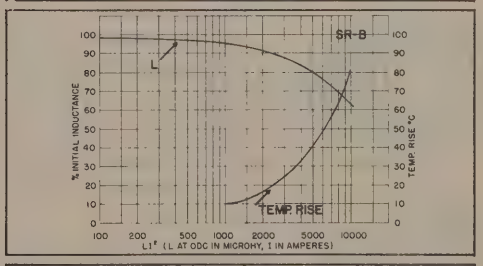
| FIG. | TYPE | DIA. A | B | C | DIA. D | DIA. E | DIA. F | ±.010 G | ±.010 H | ±.010 J | C'BORE K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SRA | 7/8 | 7/16 | 1/4 | 5/32 | .073 | 9/32 | .400 | .200 | — | .082 |
| 2 | SRA | 7/8 | 7/16 | 1/4 | 5/32 | .073 | 9/32 | .400 | .200 | .200 | .082 |
| 1 | SRB | 13/16 | 9/16 | 1/4 | 5/32 | .073 | 9/32 | .600 | .300 | — | .082 |
| 2 | SRB | 13/16 | 9/16 | 1/4 | 5/32 | .073 | 9/32 | .600 | .300 | .400 | .082 |
| 1 | SRC | 13/8 | 3/4 | 1/4 | 5/32 | .073 | 9/32 | .800 | .300 | — | .082 |
| 2 | SRC | 13/8 | 3/4 | 1/4 | 5/32 | .073 | 9/32 | .800 | .300 | .400 | .082 |



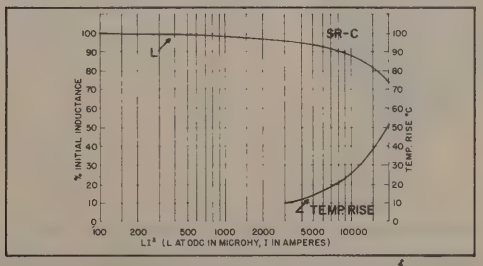

| Type No. | Microhy (0 DC) L | Amps $I_1$ | Amps $I_2$ | Ohms Max DCR | No. of Windings | Case |
|---|---|---|---|---|---|---|
| SRA-1250 | 1250 | .8 | 1.2 | .7 | 1 | Fig. 1 |
| SRA-800 | 800 | 1 | 1.5 | .45 | 1 | Fig. 1 |
| SRA-500 | 500 | 1.2 | 1.8 | .3 | 1 | Fig. 1 |
| SRA-350 | 350 | 1.5 | 2.2 | .2 | 1 | Fig. 1 |
| *SRA-200 | 200 | 2 | 3 | .12 | 2 | Fig. 2 |
| | 50 | 4 | 6 | .03 | | |
| *SRA-88 | 88 | 3 | 4.5 | .052 | 2 | Fig. 2 |
| | 22 | 6 | 9 | .013 | | |
| *SRA-32 | 32 | 5 | 7.5 | .02 | 2 | Fig. 2 |
| | 8 | 10 | 15 | .005 | | |




| Type No. | Microhy (0 DC) L | Amps $I_1$ | Amps $I_2$ | Ohms Max DCR | No. of Windings | Case |
|---|---|---|---|---|---|---|
| SRB-3000 | 3000 | .8 | 1.2 | 1.2 | 1 | Fig. 1 |
| SRB-2000 | 2000 | 1 | 1.5 | .8 | 1 | Fig. 1 |
| SRB-1200 | 1200 | 1.25 | 1.88 | .5 | 1 | Fig. 1 |
| SRB-780 | 780 | 1.6 | 2.4 | .3 | 1 | Fig. 1 |
| SRB-520 | 520 | 2 | 3 | .2 | 1 | Fig. 1 |
| SRB-320 | 320 | 2.5 | 3.75 | .13 | 1 | Fig. 1 |
| *SRB-220 | 220 | 3 | 4.5 | .08 | 2 | Fig. 2 |
| | 55 | 6 | 9 | .02 | | |
| *SRB-120 | 120 | 4 | 6 | .05 | 2 | Fig. 2 |
| | 30 | 8 | 12 | .013 | | |
| *SRB-80 | 80 | 5 | 7.5 | .032 | 2 | Fig. 2 |
| | 20 | 10 | 15 | .008 | | |




| Type No. | Microhy (0 DC) L | Amps $I_1$ | Amps $I_2$ | Ohms Max DCR | No. of Windings | Case |
|---|---|---|---|---|---|---|
| SRC-10000 | 10000 | .84 | 1.1 | 2.1 | 1 | Fig. 1 |
| SRC-6400 | 6400 | 1 | 1.35 | 1.4 | 1 | Fig. 1 |
| SRC-2500 | 2500 | 1.6 | 2.2 | .55 | 1 | Fig. 1 |
| SRC-1600 | 1600 | 2.1 | 2.8 | .34 | 1 | Fig. 1 |
| SRC-1000 | 1000 | 2.6 | 3.5 | .21 | 1 | Fig. 1 |
| *SRC-640 | 640 | 3.3 | 4.5 | .13 | 2 | Fig. 2 |
| | 160 | 6.6 | 9 | .033 | | |
| *SRC-400 | 400 | 4 | 5.4 | .088 | 2 | Fig. 2 |
| | 100 | 8 | 10.8 | .022 | | |
| *SRC-240 | 240 | 5 | 6.8 | .056 | 2 | Fig. 2 |
| | 60 | 10 | 13.6 | .014 | | |




*Two identical windings brought out to four terminals permit series, parallel, center tapped or transformer connections.

# TTE *miniature* FILTERS

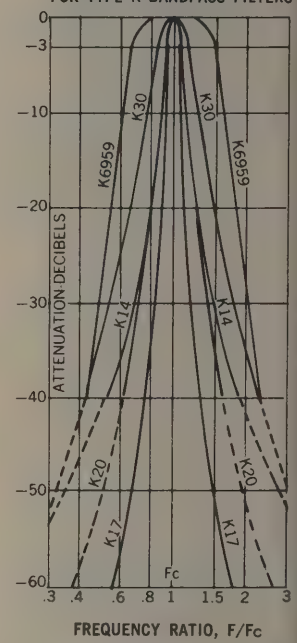
## THESE PAGES CATALOG OVER 1,000,000 STANDARD FILTER TYPES— SPECIFY ANY COMBINATION OF FREQUENCY, SOURCE AND LOAD OHMS WITHIN THE MIN-MAX RANGES. ONE WEEK PROTOTYPE SHIPMENTS ARE AVAILABLE.

## BANDPASS FILTERS FOR ANY CENTER FREQUENCY FROM 30Hz (SPECIALS FROM 10Hz UPWARD)

| Series | Fc Center Freq. Range Min. | Max. | Bandwidth @ −3db | Stopband Attenuation | Source, Ohms Min. | Max. | Load, Ohms Min. | Max. | Case No. |
|---|---|---|---|---|---|---|---|---|---|
| K10 | 500Hz | 9.9KHz | ±1%Fc | 30db at .92Fc & 1.1Fc & | 1K | 500K | 1K | 500K | 4 |
| K10A | 10KHz | 100MHz | ±1%Fc | 40db at .86Fc & 1.2Fc | 50 | 10K | 50 | 10K | 3 or 11 |
| K11B | 500Hz | 9.9KHz | ±1%Fc | | 1K | 500K | 1K | 500K | 4 |
| K11E | 10KHz | 99KHz | ±1%Fc | 30db at .94Fc & 1.06Fc & | 1K | 10K | 1K | 10K | 3 or 13 |
| K11G | 100KHz | 100MHz | ±1%Fc | 40db at .93Fc & 1.1Fc | 50 | 1K | 50 | 1K | 12 |
| K12A | 500Hz | 9.9KHz | ±2%Fc | 30db at .92Fc & 1.1Fc | 1K | 10K | 1K | 10K | 4 |
| K12C | 10KHz | 100MHz | ±2%Fc | 30db at .92Fc & 1.1Fc | 50 | 10K | 50 | 10K | 3 or 12 |
| K13 | 30Hz | 99Hz | ±5%Fc | 60db at .5Fc & 2Fc | 1K | 500K | 1K | 500K | 5 |
| K14A | 100Hz | 100KHz | ±5%Fc | 40db at .5Fc & 2Fc | 500 | 10K | 100 | 1 meg | 3 |
| K14B | 300Hz | 999Hz | ±5%Fc | 35db at .5Fc & 2Fc | 700 | 15K | 700 | 15K | 11 |
| K14E | 1KHz | 99KHz | ±5%Fc | 40db at .5Fc & 2Fc | 1K | 1K | 1K | 10K | 10 |
| K14D | 100KHz | 100MHz | ±5%Fc | 43db at .5Fc & 2Fc | 50 | 100 | 50 | 100 | 10 |
| K17 | 100Hz | 10KHz | ±5%Fc | 60db at .5Fc & 2Fc | 500 | 10K | 100 | 1 Meg | 4 |
| K17D | 300Hz | 3KHz | ±5%Fc | 50db at .5Fc & 2Fc | 500 | 15K | 500 | 30K | 12 |
| K17E | 3KHz | 99KHz | ±5%Fc | 50db at .5Fc & 2Fc | 100 | 50K | 100 | 100K | 11 |
| K17C | 100KHz | 100MHz | ±5%Fc | 60db at .5Fc & 2Fc | 50 | 300 | 50 | 300 | 11 |
| K18 | 10KHz | 100KHz | ±5%Fc | 60db at .5Fc & 2Fc | 100 | 100K | 100 | 500K | 3 |
| K20 | 100Hz | 3.9KHz | ±7.5%Fc | 40db at .57Fc & 1.75Fc | 500 | 10K | 500 | 10K | 4 |
| K20C | 250Hz | 99KHz | ±7.5%Fc | 35db at .5Fc & 2Fc | 1K | 10K | 1K | 10K | 11 |
| K20D | 100KHz | 100MHz | ±7.5%Fc | 40db at .67Fc & 1.5Fc | 50 | 300 | 50 | 300 | 11 |
| K21B | 1KHz | 100KHz | ±7.5%Fc | 40db at .6Fc & 1.67Fc | 500 | 10K | 500 | 10K | 3 |
| Q20 | 10KHz | 99KHz | ±7.5%Fc | 40db at .7Fc & 1.4Fc | 600 | 10K | 600 | 10K | 4 or 13 |
| Q21 | 10KHz | 99KHz | ±7.5%Fc | 60db at .75Fc & 1.3Fc | 600 | 10K | 600 | 10K | 5 or 16 |
| Q20A | 100KHz | 999KHz | ±7.5%Fc | 40db at .7Fc & 1.4Fc | 50 | 1K | 50 | 1K | 13 |
| Q21A | 100KHz | 999KHz | ±7.5%Fc | 60db at .75Fc & 1.3Fc | 50 | 1K | 50 | 1K | 15 |
| Q20B | 1MHz | 50MHz | ±7.5%Fc | 40db at .7Fc & 1.4Fc | 50 | 75 | 50 | 75 | 12 |
| Q21B | 1MHz | 50MHz | ±7.5%Fc | 60db at .75Fc & 1.3Fc | 50 | 75 | 50 | 75 | 15 |
| K30 | 100Hz | 3.9KHz | ±15%Fc | 40db at .4Fc & 2.5Fc | 500 | 10K | 500 | 10K | 4 |
| K30C | 150Hz | 99KHz | ±15%Fc | 25db at .45Fc & 2.2Fc | 1K | 10K | 1K | 10K | 11 |
| K30D | 100KHz | 100MHz | ±15%Fc | 40db at .5Fc & 2Fc | 50 | 300 | 50 | 300 | 11 |
| K31B | 1KHz | 100KHz | ±15%Fc | 40db at .45Fc & 2.2Fc | 500 | 10K | 500 | 10K | 3 |
| Q30 | 10KHz | 99KHz | ±15%Fc | 30db at .67Fc & 1.37Fc | 600 | 10K | 600 | 10K | 4 or 13 |
| Q31 | 10KHz | 99KHz | ±15%Fc | 50db at .73Fc & 1.31Fc | 600 | 10K | 600 | 10K | 5 or 16 |
| Q30A | 100KHz | 999KHz | ±15%Fc | 30db at .67Fc & 1.37Fc | 50 | 1K | 50 | 1K | 13 |
| Q31A | 100KHz | 999KHz | ±15%Fc | 50db at .73Fc & 1.31Fc | 50 | 1K | 50 | 1K | 15 |
| Q30B | 1MHz | 50MHz | ±15%Fc | 30db at .67Fc & 1.37Fc | 50 | 75 | 50 | 75 | 12 |
| Q31B | 1MHz | 50MHz | ±15%Fc | 50db at .73Fc & 1.31Fc | 50 | 75 | 50 | 75 | 15 |

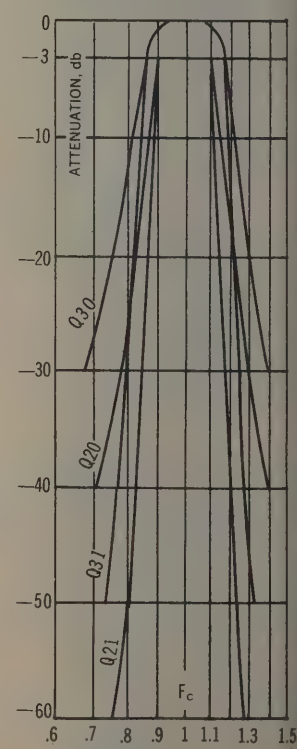
***The bandwidth for any of the above filters can be increased or decreased to specification.***

TYPICAL RESPONSE CURVES FOR TYPE K BANDPASS FILTERS

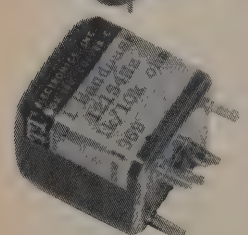



FREQUENCY RATIO, F/Fc

TYPICAL RESPONSE CURVES FOR TYPE Q BANDPASS FILTERS




FREQUENCY RATIO, F/Fc



**WIDE BAND FILTERS:** Bandwidths of ±16% or greater can be obtained by ordering TTE standard High pass and Low pass filter sections as a composite network. Select numbers from the Series H and J listings on the next page which give the desired attenuation slopes and combine these numbers. For example to obtain a slope of 40db at 0.65 of the lower frequency cut-off, $F_{c1}$, (High pass section) and 40db at 1.6 of the upper frequency cut-off, $F_{c2}$, (Low pass section) use H6959. **THE HIGH PASS SERIES NUMBER IS FIRST, FOLLOWED BY THE LOW PASS NUMBER.** Types with dissymmetrical attenuation slopes can be combined. Also specify the 3db down cut-off frequencies $F_{c1}$ and $F_{c2}$ and impedance. The price is the sum of the HP and LP section prices.

**INSERTION LOSSES** for bandpass types between equal terminations are from 0.5 to 6db depending upon bandwidth, frequency and size. K10 and K11 types have about 10db, and K12 types about 5db flat loss. **SPECIALS** are available for center frequencies from 10Hz upward and 60db to 3db bandwidth ratios as sharp as 2.0:1. **TO ORDER** Specials, also specify (5) bandwidth and (6) stop band attenuation required.

**TO ORDER BANDPASS FILTERS** — Specify (1) TTE Series No., (2) minus 3db frequencies, (3) source impedance, (4) load impedance. **PRICES** $39 to $160 each.

**TELEMETERING:** Refer to Series K20, K21B, K30, K31B, Q20, Q21, Q30 or Q31.
**TO ORDER** specify IRIG Channel number, source and load impedances.

**TT ELECTRONICS** 2214 SO. BARRY AVE.
LOS ANGELES, CA 90064
(213) 478-8224

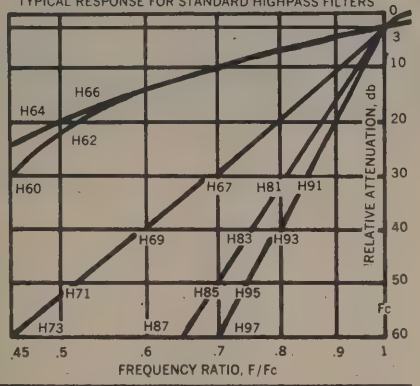
# TTE *miniature* FILTERS

## HIGH PASS

**STANDARD FILTERS FOR ANY CUT-OFF FREQ. FROM 75Hz TO 100MHz**

| Series | Min. Attn. db | Cut-off Ratio F/Fc |
|---|---|---|
| H60E | 30 | .45 |
| H62E | 40 | .35 |
| H64E | 50 | .25 |
| H66E | 60 | .15 |
| H67E | 30 | .70 |
| H69E | 40 | .60 |
| H71E | 50 | .52 |
| H73E | 60 | .45 |
| H81E | 30 | .81 |
| H83E | 40 | .75 |
| H85E | 50 | .70 |
| H87E | 60 | .65 |
| H91E | 30 | .85 |
| H93E | 40 | .80 |
| H95E | 50 | .75 |
| H97E | 60 | .70 |

TYPICAL RESPONSE CURVE



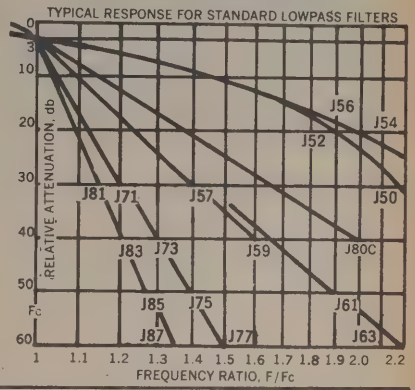

**TO ORDER** specify (1) TTE Series No., (2) minus 3db freq., (3) impedance. (4) Case No. **SPECIALS** are available for cut-off frequencies down to 40Hz and above 100MHz. **PRICES** $29 to $80.

## LOW PASS

**STANDARD FILTERS FOR ANY CUT-OFF FREQ. FROM 75Hz TO 100MHz (*And from 10Hz to 74Hz)**

| Series | Min. Attn. db | Cut-off Ratio F/Fc |
|---|---|---|
| J50E | 30 | 2.2 |
| J52E | 40 | 3.0 |
| J54E | 50 | 4.0 |
| J56E | 60 | 5.5 |
| J57E | 30 | 1.4 |
| J59E | 40 | 1.6 |
| J61E | 50 | 1.9 |
| J63E | 60 | 2.2 |
| J71E | 30 | 1.2 |
| J73E | 40 | 1.3 |
| J75E | 50 | 1.4 |
| J77E | 60 | 1.5 |
| J81E | 30 | 1.15 |
| J83E | 40 | 1.20 |
| J85E | 50 | 1.27 |
| J87E | 60 | 1.35 |
| *J80E | 40 | 2.0 |

TYPICAL RESPONSE CURVE




**TO ORDER** specify (1) TTE Series No., (2) minus 3db freq., (3) impedance. (4) Case No. **SPECIALS** are available for cut-off frequencies down to 3Hz and above 100MHz. **PRICES** $29 to $80.

### IMPEDANCE GUIDE
### HIGHPASS AND LOWPASS TYPES

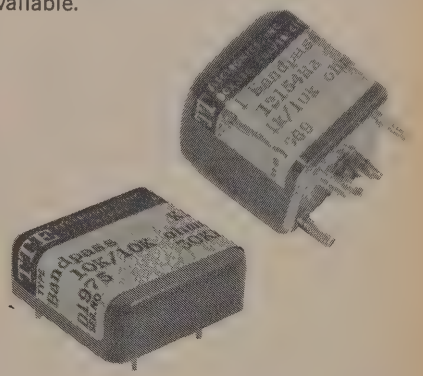
**IMPEDANCE GUIDE — HIGH PASS AND LOW PASS TYPES**

| Fc −3db | | 10Hz | 50Hz | 100Hz | 500Hz | 5KHz | 10KHz | 100KHz | 500KHz | 1MHz | 5MHz | 100MHz |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Z MIN | Ω | 10K | 10K | 5K | 1K | 500 | 100 | 50 | 50 | 50 | 50 | |
| Z MAX | Ω | 15K | 39K | 39K | 39K | 20K | 3K | 3K | 1K | 300 | 75 | |

**SOURCE AND LOAD** impedances are equal and resistive for standard HP and LP filters. The insertion loss is less than 0.5db for ±10% matching. Typical Passband flatness within ±0.2db. **SPECIALS** for other impedance and unequal terminations are available. Units with cut-off ratios as sharp as 1.06 (0.94 Highpass) are available.

**CASE SIZES FOR HIGHPASS AND LOWPASS FILTERS**

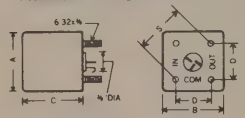
| | STANDARD CHASSIS TYPE | | | | FLAT PC BOARD TYPE | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Series No. | 2 | 3 | 4 | 5 | 9 | 10 | 11 | 12 | 13 | 15 | 16 | 17 |
| H60E-H66E J50E-J56E | 500Hz to 100KHz | 100Hz to 200KHz | 75Hz to 100Hz | | 200Hz to 500Hz | 500Hz to 100MHz | | | | | | |
| H67E-H73E J57E-J63E | 50KHz to 100KHz | 1KHz to 50KHz | 75Hz to 1KHz | | | | 2KHz to 100MHz | 200Hz to 2KHz | 100Hz to 200Hz | | | |
| H81E-H87E J71E-J77E | | 5KHz to 100KHz | 1KHz to 5KHz | 100Hz to 1KHz | | | 2.5KHz to 100MHz | 500Hz to 2.5KHz | | | 200Hz to 500Hz | 100Hz to 200Hz |
| H91E-H97E J81E-J87E | | 5KHz to 100KHz | 1KHz to 5KHz | 100Hz to 1KHz | | | | 2.5KHz to 100MHz | | 500Hz to 2.5KHz | | 200Hz to 500Hz |
| J80E | | | | 10Hz to 74Hz | | | | | | | | |



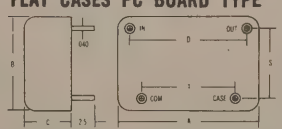
## CASE DIMENSIONS & MOUNTING INFORMATION FOR ALL FILTERS

| | STANDARD CHASSIS TYPE | | | | FLAT PC BOARD TYPE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Case | 2 | 3 | 4 | 5 | 9 | 10 | 11 | 12 | 13 | 15 | 16 | 17 | Case |
| A | 1.19 | 1.31 | 1.63 | 1.94 | 1.27 | 1.27 | 1.88 | 2.0 | 2.0 | 2.96 | 2.96 | 2.96 | A |
| B | 1.19 | 1.31 | 1.63 | 1.81 | 1.27 | 1.27 | 1.44 | 2.0 | 2.0 | 1.93 | 1.93 | 1.93 | B |
| C | 1.25 | 1.75 | 2.38 | 2.44 | 1.0 | .5 | .5 | .5 | .75 | .5 | .75 | 1.25 | C |
| D | .75 | — | 1.19 | 1.38/ 1.25 | .9 | .9 | 1.5 | 1.5 | 1.5 | 2.4 | 2.4 | 2.4 | D |
| S | — | 1.25 | — | — | .9 | .9 | 1.0 | 1.5 | 1.5 | 1.4 | 1.4 | 1.4 | S |
| Mtg. | (4) | (2) | (4) | (4) | .6 | .6 | 1.0 | 1.0 | 1.0 | 2.0 | 2.0 | 2.0 | T |
| | 6-32 x 3/8" STUDS | | | | PRINTED CIRCUIT BOARD PINS | | | | | | | | Mtg. |

**CHASSIS MOUNT TYPE**




**FLAT CASES PC BOARD TYPE**




FROM 500KHz UPWARD FLAT CASE "COM" IS CONNECTED TO CASE.

**BNC AND SMA CONNECTIONS ARE AVAILABLE**

**NOTES:** TTE Filters are epoxy encased within hermetically sealed steel cases. The case finish is copper plate per MIL-C-14550 under fused tin per MIL-T-10727A. The maximum power output without de-tuning is 10 to 20 milliwatts for most low frequency types. K10 and K12 types are tested at 100mV and B83 types at .77V output for all imped. levels. Terminations are regarded as resistive unless otherwise specified.

TTE COVERS THE RANGE —
**VLF-LF-MF-HF-VHF-UHF**
LC — CRYSTAL — POWER NETWORKS

**TT ELECTRONICS**
INC. 2214 SO. BARRY AVE. / LOS ANGELES, CA 90064 / (213) 478-8224

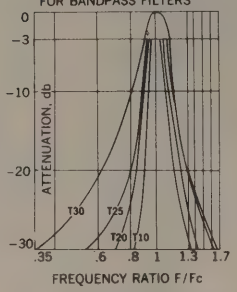
# TTE *miniature* FILTERS

## VHF-UHF

### BANDPASS — ANY FREQUENCY FROM 100MHz TO 300MHz

| Series | $F_c$ Center Freq. Range Min. | Max. | Bandwidth @ 3db | Stopband Attenuation | Source & Load Ohms | Case No. |
|---|---|---|---|---|---|---|
| T10 | 100MHz | 299MHz | $\pm 1\% F_c$ | 30db at $.8F_c$ & $1.35F_c$ | 50 | 36 |
| T14 | 100MHz | 299MHz | $\pm 2\% F_c$ | 30db at $.79F_c$ & $1.36F_c$ | 50 | 36 |
| T20 | 100MHz | 300MHz | $\pm 5\% F_c$ | 30db at $.71F_c$ & $1.47F_c$ | 50 | 33 |
| T25 | 100MHz | 300MHz | $\pm 7.5\% F_c$ | 30db at $.45F_c$ & $1.62F_c$ | 50 | 33 |
| T30 | 100MHz | 300MHz | $\pm 10\% F_c$ | 30db at $.35F_c$ & $1.65F_c$ | 50 | 33 |

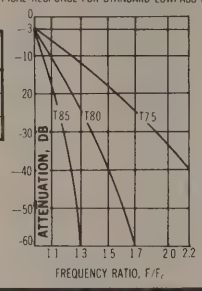
TYPICAL RESPONSE CURVES FOR BANDPASS FILTERS

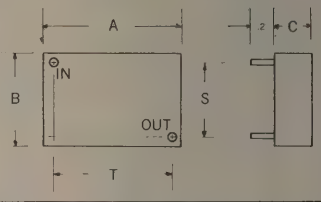


### LOWPASS — ANY FREQUENCY FROM 10MHz TO 500MHz

| Series | Attenuation, db | Cut-off Ratio | Source & Load Ohms | Case No. |
|---|---|---|---|---|
| T75 | 40 | 2.2 | 50 | 33 |
| T80 | 60 | 1.7 | 50 | 42 |
| T85 | 60 | 1.3 | 50 | 44 |

TYPICAL RESPONSE FOR STANDARD LOWPASS FILTERS




| Case | A | B | C | S | T |
|---|---|---|---|---|---|
| 33 | 1.16 | .66 | .38 | .38 | .8 |
| 36 | 1.6 | 1.0 | .5 | .65 | 1.3 |
| 42 | 2.2 | .74 | .38 | .44 | 1.9 |
| 44 | 3.0 | .75 | .38 | .44 | 2.7 |

**TO ORDER BANDPASS** Specify (1) TTE Series Number, (2) Center Frequency, (3) Minus 3db frequencies. The approximate price is $65. Other Bandwidths may be specified.

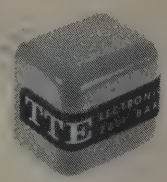
**TO ORDER LOWPASS** Specify (1) TTE Series Number, (2) Cutoff frequency.

**PRICES** $47 to $110.

## SUBMINIATURE

### BANDPASS FILTERS FOR ANY FREQUENCY FROM 300Hz TO 100MHz

| Series | $F_c$ Center Freq. Range Min. | Max. | Bandwidth @ −3db Max. | Stopband Attenuation | Source Ohms Min. | Source Ohms Max. | Load Ohms Min. | Load Ohms Max. | Case No. |
|---|---|---|---|---|---|---|---|---|---|
| S10 | 300Hz | 1KHz | $\pm 7.5\% F_c$ | 40db at $.55F_c$ & $1.8F_c$ | 10k | 10k | 10k | 10k | 31 |
| S11 | 1KHz | 5KHz | $\pm 7.5\% F_c$ | 40db at $.55F_c$ & $1.8F_c$ | 1k | 10k | 1k | 10k | 31 |
| S12 | 5KHz | 50KHz | $\pm 7.5\% F_c$ | 40db at $.58F_c$ & $1.75F_c$ | 1k | 1k | 1k | 1k | 30 or 31 |
| S13B | 50KHz | 999KHz | $\pm 7.5\% F_c$ | 40db at $.58F_c$ & $1.75F_c$ | 500 | 1k | 500 | 1k | 30 or 31 |
| S14B | 1MHz | 100MHz | $\pm 7.5\% F_c$ | 40db at $.58F_c$ & $1.75F_c$ | 50 | 500 | 50 | 500 | 31 |
| S20 | 300Hz | 1KHz | $\pm 15\% F_c$ | 40db at $.4F_c$ & $2.5F_c$ | 10k | 10k | 10k | 10k | 31 |
| S21 | 1KHz | 5KHz | $\pm 15\% F_c$ | 40db at $.4F_c$ & $2.5F_c$ | 1k | 10k | 1k | 10k | 31 |
| S22A | 5KHz | 50KHz | $\pm 15\% F_c$ | 40db at $.4F_c$ & $2.5F_c$ | 1k | 10k | 1k | 10k | 30 or 31 |
| S23B | 50KHz | 999KHz | $\pm 15\% F_c$ | 40db at $.4F_c$ & $2.5F_c$ | 500 | 1k | 500 | 1k | 30 or 31 |
| S24A | 1MHz | 100MHz | $\pm 15\% F_c$ | 40db at $.4F_c$ & $2.5F_c$ | 50 | 500 | 50 | 500 | 31 |




**TO ORDER BANDPASS** specify (1) TTE series number, (2) center frequency, (3) source and load impedance. The approximate price is $78 each.

**TO ORDER HP** and **LP** specify (1) TTE series number, (2) cut-off frequency, (3) source and load impedance. The approximate price is $70 each.

**IMPEDANCE GUIDE:** standard impedances for HP and LP types are 10K (1KHz to 5KHz) 1K to 10K (5KHz to 10KHz) 300 ohms to 1K (10KHz to 100KHz) 50 ohms to 1K (100KHz to 500KHz) 50 ohms to 300 ohms (0.5MHz to 1MHz) 50 to 75 ohms (1MHz to 10MHz) 50 ohms (from 10MHz to 100MHz).

**CASE GUIDE:** the standard cases for HP and LP types are case 29 (1KHz to 5KHz) case 30 (5KHz to 1MHz) case 31 (1MHz to 100MHz).

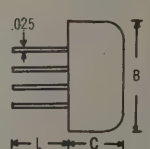
### HIGHPASS
FROM 1KHz to 100MHz

| Series | Min. Attn. db | Cut-off Ratio F/FC |
|---|---|---|
| S60 | 30 | 1.41 |
| S61 | 40 | 1.67 |
| S62 | 50 | 1.96 |
| S63 | 60 | 2.45 |

### LOWPASS
FROM 1KHz to 100MHz

| Series | Min. Attn. db | Cut-off Ratio F/FC |
|---|---|---|
| S40 | 30 | .7 |
| S41 | 40 | .59 |
| S42 | 50 | .51 |
| S43 | 60 | .4 |

| Case | A | B | C | T | L |
|---|---|---|---|---|---|
| 29 | .75 | .75 | .75 | .1 | 1.0 |
| 30 | .75 | .75 | .5 | .1 | 1.0 |
| 31 | 1.19 | 1.19 | .5 | .2 | 1.0 |

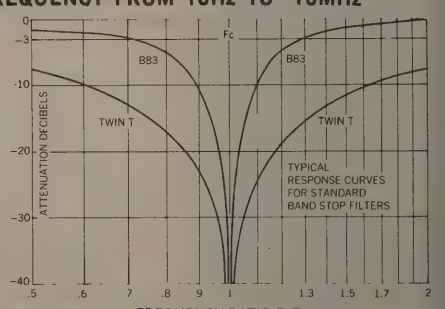



**BNC AND SMA CONNECTORS ARE AVAILABLE**

## BAND REJECT

### STANDARD FILTERS FOR ANY CENTER FREQUENCY FROM 10Hz TO 10MHz

| Series | $F_c$ Center Freq. Range Min. | Max. | Bandwidth −3db | Attenuation | Impedance Ohms Min. | Impedance Ohms Max. | Circuit | Case No. |
|---|---|---|---|---|---|---|---|---|
| B83 | 10Hz | 1MHz | $.77F_c$ & $1.3F_c$ | 50db Notch | 50 | 1 Meg. | L-C | 4 |
| D | 10Hz | 100KHz | $.25F_c$ & 4 $F_c$ | 50db Notch | SEE ORDERING INSTRUCTIONS BELOW | | Twin-T | 2 |
| F | 10Hz | 100KHz | $.25F_c$ & 4 $F_c$ | 60db Notch | | | Twin-T | 2 |
| R20 | 100Hz | 3999Hz | $BW_{3db}/BW_{40db} \leq 5$ | | 10K | 50K | L-C | 4 or 13 |
| R30 | 4KHz | 10MHz | For $BW_{40db} \geq 10\% F_c$ | | 50 | 10K | L-C | 4 or 13 |




**TO ORDER BAND REJECT FILTERS** — Specify (1) TTE Series No. or Letter, (2) center frequency, (3) source impedance, (4) load impedance. For Series R20 and R30 specify 40db bandwidth. Twin-T prices and cases apply to all filters using capacitor values from 0.1 MFD to 500 pF. $C = 1/8.85FHz\ (R_{source}R_{load})^{1/2}$. C is in farads. Filters with null frequencies as low as 1Hz are available. Terminations are regarded as resistive unless otherwise specified.

**PRICES** $19 to $64.

**TT ELECTRONICS INC.** 2214 SO. BARRY AVE. / LOS ANGELES, CA 90064 / (213) 478-8224

# for prompt service and "off-the-shelf" availability, call... DIPLOMAT

FOR OUR COMPLETE COMPREHENSIVE INVENTORY SELECTION

## SEMICONDUCTORS AND IC's
Alpha (Microwave)
AmPower
Carter Semiconductor
CDI Compensated Devices
Computer Diode
Crystalonics/Teledyne
Delco
EDI
Exar
General Instrument
General Semiconductor
ITT
Intersil
Kertron Semiconductor
Microsemiconductor Corp.
Microwave Associates
Monolithic Memories
Mostek
NAE North American Electronics
NEC Microcomputer Inc.
Optron
Semicon
Semtech
Sensitron
Signetics
Silicon General
Silicon Transistor Corp.
Solid Power Corp.
Solid State Devices
Solid State Scientific
Solitron Devices
SMC Microsystems Corp.
Syntron
Teledyne
Texas Instruments
Western Digital
Xciton

## CAPACITORS AND FILTERS
ARCO
Capar
CAL-R
Cornel Dubilier
ITT
Johanson
Mallory
NCI
San Fernando/Westcap
Sangamo

## CONNECTORS AND SOCKETS
Amphenol
Cinch
Robinson Nugent
Sullins
Texas Instruments

## CONTROLS AND SWITCHES
Alco Switch
Cherry
CTS
Hamlin
Mallory
Omron

## FANS & BLOWERS
Howard Industries

## FUSES AND HOLDERS
Bussman
Littelfuse

## HARDWARE AND CABINETS
Bud Radio
Hammond
H.H. Smith
Hollingsworth
Ungar

## METERS OF TEST EQUIPMENT
Simpson
Triplett

## OPTOELECTRONICS
Chicago Miniature
General Electric
Monsanto
Optron
Xciton

## POTENTIOMETERS AND TRIMMERS
Clarostat
CTS
Spectrol
Weston/Sangamo
VRN (IRC)

## RELAYS
Allied Controls
Deltrol
Electrol
Guardian
Hamlin
IDEC
Potter & Brumfield
Omron

## RESISTORS
American Corp.
CAL-R
Capar
Clarostat
Mallory
Memcor
RCL
Shallcross
Stackpole
Ward-Leonard

## R.F. CHOKES
J.W. Miller

## THERMISTORS AND RF FILTERS
CORCOM
Fenwal
Gulton Industries

## TRANSFORMERS AND POWERSTATS
Chicago Stancor

## TUBES
Amperex

## WIRE, CABLE, INSULATION PRODUCTS
Alpha
Belden
Cable-Tech
Cimco
Coleflex
Columbia
Dearborn
DeWire
Electronized Chemical Corp.
Harbor Industries
Hi Temp
Insultab
ITT
Manhattan
Norflex
Rainbow

**Each of the Above Listed Lines are Franchised at one or more of the Following Locations.**

DIPLOMAT

**DIPLOMAT ELECTRONICS, INC.**
Woodbury, N.Y.
(516) 921-9373

**DIPLOMAT ELECTRONICS, INC.**
Farmington, Mich.
(313) 477-3200

**DIPLOMAT ELECTRONICS, INC.**
Totowa, N.J.
(201) 785-1830

**DIPLOMAT ELECTRONICS, INC.**
Elk Grove Village, Ill.
(312) 595-1000

**DIPLOMAT ELECTRONICS, INC.**
Chicopee Falls, Mass.
(413) 592-9441

**DIPLOMAT ELECTRONICS, INC.**
Minneapolis, Minn.
(612) 788-8601

**DIPLOMAT ELECTRONICS, INC.**
Mt. Laurel, N.J.
(609) 234-8080

**DIPLOMAT ELECTRONICS, INC.**
Salt Lake City, Utah
(801) 486-4134

**DIPLOMAT ELECTRONICS, INC.**
St. Louis, Mo.
(314) 645-8550

**DIPLOMAT ELECTRONICS, INC.**
Holliston, Mass.
(617) 429-4120

**DIPLOMAT ELECTRONICS, INC.**
Sunnyvale, Calif.
(408) 734-1900

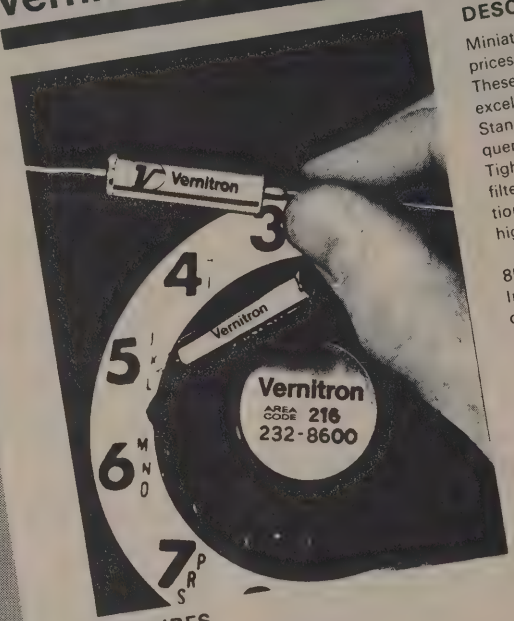
**DIPLOMAT ELECTRONICS, INC.**
Clearwater, Fla.
(813) 443-4514

**DIPLOMAT ELECTRONICS, INC.**
Ft. Lauderdale, Fla.
(305) 771-0440

**DIPLOMAT ELECTRONICS, INC.**
Woodbury, N.Y.
(516) 921-7920

# from **Vernitron** (the ceramic filters people)

## Vernitron CERAMIC LADDER FILTERS — 9, 11 and 17-disc




### DESCRIPTION

Miniature ceramic i-f filters are available at reasonable prices for use in Military and commercial equipment. These rugged, light weight, fixed-tuned devices offer excellent selectivity and stability in less than 0.1 cu. in. Standard stop band rejection to 80 dB and center frequency tolerance varies between ± 2 and ± 3 kHz. Tighter tolerances available on special order. These filters are designed for communications circuit applications where precise center frequency tolerance and high stop band rejection are required.

Standard models in 6 dB bandwidths from 2 kHz to 85 kHz are available at 455• kHz center frequency. Input and output impedence is between 1000 and 2000 ohms.

•Also available in 500 kHz center frequency.

### APPLICATIONS

These Ladder Filters are ideal for transistorized i-f amplifier circuitry as well as IC's in AM and FM sets. Their small size, ruggedness and high stopband rejection make them particularly suitable for airborne and hand-held transceivers.

### FEATURES

- Stopband Rejections to 80 dB
- Small Size
- Lightweight
- Shape Factor ≤ 2:1
- Hermetically Sealed
- Vibration and Shock Resistant
- Excellent Stability
- Fixed-Tuned

**100-700 kHz**

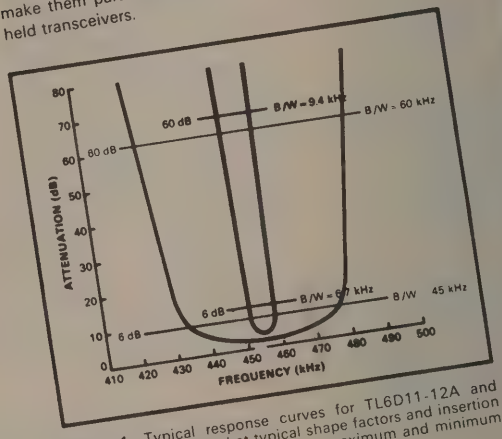



Figure 1. Typical response curves for TL6D11-12A and TL40D11-72A. Note that typical shape factors and insertion losses are considerably better than maximum and minimum values shown in table below.

**Vernitron Piezoelectric Division**
Ohio 44146 / (216) 232-8600

| GENERAL SPECIFICATIONS | | 9-DISC — 50 dB STOPBAND | | | 11-DISC — 60 dB STOPBAND | | | 17-DISC — 80 dB STOPBAND | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | TYPICAL MODELS | TL-10D9 20A | TL-16D9 32A | TL-20D9 38A | TL-6D11 12A | TL-16D11 32A | TL-30D11 57A | TL-2D 5A | TL-16D 25A | TL-30D 45A |
| **Center Frequency** 455 or 500 kHz (capability from 100-700 kHz) | BANDWIDTH/6dB @27°C /60dB | 10<br>20 | 16<br>32 | 20<br>38 | 6<br>12 | 16<br>32 | 30<br>57 | 5<br>5 | 16<br>25 | 30<br>45 |
| **Stopband Rejection** 9-disc — 50 dB; 11-disc — 60 dB; 17-disc — 80 dB | SHAPE FACTOR | 2.0:1 | 2.0:1 | 1.9:1 | 2.0:1 | 2.0:1 | 1.9:1 | 2.5:1 | 1.6:1 | 1.5:1 |
| **Stability** +0.2%/5 yrs; within ±0.2%/ −40° to +85° C. | INSERTION LOSS (dB) | 4 | 5 | 5 | 6 | 5 | 5 | 10 | 5 | 5 |
| **Ripple** Bandwidth Dependent, 1 to 3dB | | | | | | | | | | |
| **Operating Range** −40° to +85° C. | | | | | | | | | | |
| **Environmental** Meets MIL Std. 202B | IN/OUT IMPEDANCE (OHMS) | 2000 | 1000 | 1000 | 2000 | 1000 | 1000 | 2500 | 1500 | 1200 |

**Vernitron Piezoelectric Division**
232 Forbes Road / Bedford, Ohio 44146 / (216) 232-8600

# from **Vernitron** (the ceramic filters people)

## LADDER FILTERS

Series LTL

100 to 270 kHz

*Bandpass capabilities 1 to 10%*

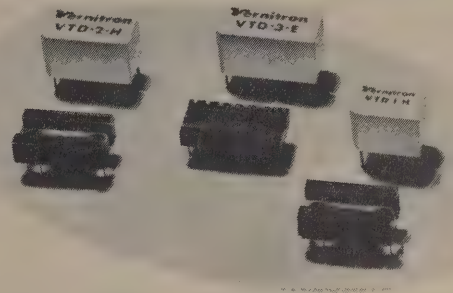
For the medium-frequency range, these rugged ceramic bandpass filters offer advantages in price and size over LC filters. Typical shape factors of 2.0 to 1 are achieved in this unique ladder design.

Ideal for navigation and instrumentation applications.

**Any Operating Frequency Between 100 kHz and 270 kHz.**

*SEND FOR BULLETIN 94043*

## 455 kHz LOW-COST MINIATURES




*For today's compact COMM receivers*

Vernitron has designed the new "VTD" Series of Ceramic Ladder Filters in 3 model groups. VTD-1 models offer 40 dB Bandwidth and stopband of 25 dB to 27 dB. VTD-2 offers 50 dB Bandwidth and stopband of 30 dB to 40dB, and VTD-3 offers 60 dB Bandwidth and stopband of 40 dB to 45 dB. VTD-4 offers 55 dB stopband and VTD-5 offers 70 dB Bandwidth and 60 dB stopband.

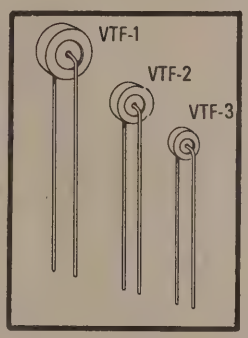
*Bulletin 940 VTD 1-2-3-4-5*

New Miniature Flat Pack Available Summer 1978

## RESONATORS FOR OSCILLATOR CONTROL

Series VTF

175 to 1006 kHz




Series VTF-1/175-249 kHz

Series VTF-2/250-346 kHz

Series VTF-3/347-1006 kHz

**Applications:** Digital clock generators, oscillator elements, frequency-selective bypass elements, coupling elements, bandpass filters, notch filters, data transmission.

**GENERAL SPECIFICATIONS**

| | |
|---|---|
| Resonant Frequency Tolerance | 1.0% to 2.0% dependent on frequency |
| Temperature Stability | 0.2% of resonant frequency |
| Operating Range | —20°C to +60°C. |
| Resonant Impedance | Less than 30 ohms |

*Bulletin 940 VTF*

## $f_o$–7.5 to 50 kHz

*Designed for Omega Applications*

**LOW FREQUENCY FILTERS (LF)**

Single Resonator
2, 3 or 4 Resonator
Cascades

High-performance miniature for LF communications or Omega systems—featuring selection of any $f_o$ from 7.5 to 50 kHz. Single-resonator units have rejection to greater than 40 dB; cascaded units to above 90 dB. Standard Omega models at 10.2, 11.33 and 13.0 kHz, available in commercial or hermetically-sealed militarized versions.

**FEATURES**

- **Any $f_o$ Between 7.5 and 50 kHz**
- **Phase Stability <1.5° Over 60 dB Range**
- **Temp. Stability Within 0.2%**
- **Low Insertion Loss**
- **Passive—No External Power Req'd**
- **Fixed-tuned**

**APPLICATIONS**

Low frequency receivers, specifically Omega series; selective calling, underwater sound, command-destruct; air or maritime navigation receivers.

**Write for Data Sheet 94037**

**Vernitron Piezoelectric Division**
232 Forbes Road / Bedford, Ohio 44146 / (216) 232-8600

RAYTHEON

# CAPTIVE HARDWARE

See other Raytheon Products in EEM

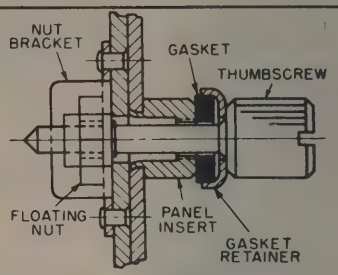
Opto-electronics—Section 3700
Switches—Section 5100
Knobs—Section 2400
Test Jacks—Section 2100

## CAPTIVE HARDWARE

Raytheon captive hardware was designed to fill the need for a standard line of stainless steel fastening hardware which would meet government specifications. MIL-E-16400 (ships) and when painted or dull—MIL-E-5400 and MIL-P-11268 (sig C).

Available in a variety of sizes to handle almost any requirement, the complete captive assembly consists of a slotted-head thumb screw, an insert bushing for securing the thumb screw to the panel, a captive floating nut assembly which is fastened to the chassis member or rack, and a gasket retainer and rubber gasket for use when a dust proof, splash proof seal is required.

The panel insert is secured in a hole of suitable dimensions by flaring the end on an arbor press. The nut assembly is fastened to the chassis member or rack with either rivets or mounting hardware.




### MATERIALS

**Screw**—303 stainless steel per QQ-S-763, Class 303, Cond. A passivated per MIL-F-14072
**Insert**—302 stainless steel per QQ-S-763, Class 302, Cond. A
**Gasket**—Rubber per MIL-R-3065, RN500B
**Gasket Retainfer**—302 stainless steel per QQ-S-766, Class 302
**Nut Bracket Assembly**—Cold rolled steel bracket per QQ-S-692, MIL-B-12128A. Cadmium plated per QQ-P-416, Type II, Class I with iridescent chromate film.

### SELECTION GUIDE (Select thread size and read across)

| THREAD SIZE | CAPTIVE SCREW | | | | | | | | | | PANEL INSERT | | | | | NUT/RETAINER/GASKET | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SCREW LENGTH, INCHES | | | | | | | | | | NOMINAL MATL. THICKNESS RANGE, INCHES | | | | | | | |
| | 5/8 | 3/4 | 7/8 | 1 | 1-1/8 | 1-1/4 | 1-3/8 | 1-1/2 | 1-3/4 | 2 | .048-.072 | .074-.109 | .119-.156 | .188 | .250 | | | |
| | CATALOG NUMBER | | | | | | | | | | CATALOG NUMBER | | | | | CATALOG NUMBER | | |
| | PREFIX CS— | | | | | | | | | | PREFIX PIN— | | | | | NUT ASSY | RETAINER | GASKET |
| 8-32NC-2 | 100 | 101 | 102 | 103 | | | | | | | 100 | 101 | 102 | 103 | | NB100 | GSR118 | GS103 |
| 10-24NC-2<br>10-32NF-2 | | 120 | 111<br>121 | 112<br>122 | | | | | | | 110<br>120 | 111<br>121 | 112<br>122 | 113<br>123 | 114<br>124 | NB101<br>NB102 | GSR115 | GS100 |
| 1/4-20NC-2 | | | 130 | 131 | 132 | 133 | 134 | 135 | | | 130 | 131 | 132 | 133 | 134 | NB103 | GSR116 | GS101 |
| 5/16-18NC-2 | | | | | | | | 142 | 143 | 144 | 140 | 141 | 142 | 143 | 144 | NB104 | GSR117 | GS102 |

### DIMENSIONAL DATA

#### CAPTIVE SCREW

| Catalog No. CS— | Thread Size | A | B | C | D | E | F | G NOM | KNURL PITCH |
|---|---|---|---|---|---|---|---|---|---|
| 100/103 | 8-32NC | 5/16 | 3/64 | 5/64 | 1/4 | 3/32 | .125<br>.115 | 5/16 | 40 |
| 110/112<br>120/122 | 10-24NC-2<br>10-32NF-2 | 7/16 | 1/16 | 3/32 | 1/14 | 5/32 | .135<br>.125 | 3/8 | 30 |
| 130/136 | 1/4-20NC-2 | 9/16 | 5/64 | 3/32 | 5/16 | 3/16 | .180 | 1/2 | 30 |
| 140/144 | 5/16-18NC-2 | 11/16 | 3/32 | 1/8 | 3/8 | 1/4 | .235<br>.225 | 5/8 | 20 |

#### GASKET

| CATALOG NUMBER | A ±1/32 | B ±1/32 | C ±1/32 |
|---|---|---|---|
| GS103 | 5/32 | 11/32 | 1/8 |
| GS100 | 3/16 | 7/16 | 3/16 |
| GS101 | 1/4 | 9/16 | 3/16 |
| GS102 | 5/16 | 11/16 | 3/16 |

#### CAPTIVE NUT ASSEMBLY

| Nut Assy. Cat. No. | Thread Size | +0 −1/64 A | ±.002 B | ±.008 C | REF MAX D | ±.008 E | ±1/64 F | +.003 −.000 G | +.015 −.000 H | +1/64 −0 J | +1/64 −0 K | ±.005 L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NB100 | 8-32NC-2 | 1-3/32 | .796 | .312 | .263 | .209 | 15/32 | .128 | .199 | 9/32 | 1/4 | .030 |
| NB101 | 10-24NC-2 | 1-1/4 | .937 | .312 | .305 | .254 | 5/8 | .128 | .223 | 19/64 | 17/64 | .048 |
| NB102 | 10-32NF-2 | 1-1/4 | .937 | .312 | .305 | .254 | 5/8 | .128 | .223 | 19/64 | 17/64 | .048 |
| NB103 | 1/4-20NC-2 | 1-3/8 | 1.062 | .375 | .350 | .279 | 3/4 | .128 | .343 | 27/64 | 5/16 | .060 |
| NB104 | 5/16-18NC-2 | 1-9/16 | 1.250 | .500 | .437 | .329 | 7/8 | .161 | .361 | 7/16 | 7/16 | .060 |

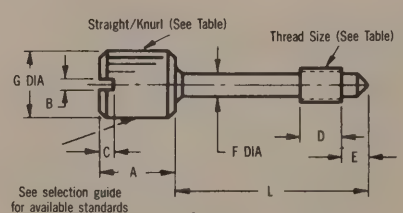
Nut entirely captive. Bracket and nut supplied as one unit.

#### RETAINER

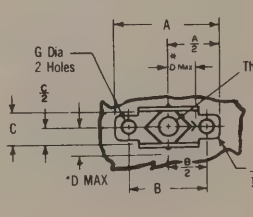
| CATALOG NUMBER | A +1/64 −0 | B ±1/64 |
|---|---|---|
| GSR118 | 11/32 | 11/64 |
| GSR115 | 7/16 | 7/32 |
| GSR116 | 9/16 | 9/32 |
| GSR117 | 11/16 | 11/32 |

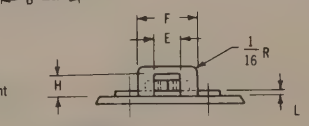
#### INSERT

| Cat. No. PIN— | A NOM | B MIN | C ±.020 | Thread Size |
|---|---|---|---|---|
| 100<br>101<br>102<br>103 | 5/16 | 3/16 | .262<br>.232<br>.187<br>.124 | 8-32NC-2 |
| 110<br>111<br>112<br>113<br>114 | 3/8 | 7/32 | .325<br>.295<br>.250<br>.187<br>.125 | 10-24NC-2 |
| 120<br>121<br>122<br>123<br>124 | 3/8 | 7/32 | .325<br>.295<br>.250<br>.187<br>.125 | 10-32NF-2 |
| 130<br>131<br>132<br>133<br>134 | 1/2 | 9/32 | .387<br>.357<br>.312<br>.249<br>.187 | 1/4-20NC-2 |
| 140<br>141<br>142 | 5/8 | 11/32 | .450<br>.420<br>.375 | 5/16-18NC-2 |

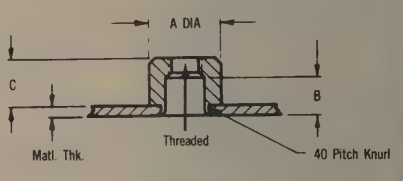


Screw

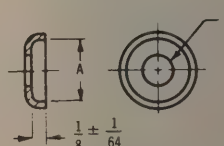


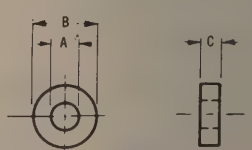
Nut Assembly



Insert



Gasket Retainer



Gasket

RAYTHEON COMPANY / DISTRIBUTOR PRODUCTS OPERATION
DEPT. EM / FOURTH AVE. / BURLINGTON, MA 01803 / TEL: (617) 272-6400 / TWX: 710-332-7641


Add Dept. EM to address to tell them you saw it in eem

# A. D. DATA SYSTEMS, INC

DEPT. EM, 200 COMMERCE DR. • ROCHESTER, N.Y. 14623 • PHONE 716-334-9649 • TWX 510-253-3246


## DATA ACQUISITION SYSTEMS

**A.D. Data Systems offers a low cost approach to datalogging thru a series of loggers with output in computer compatible format. Units are available with RS 232 output or magnetic tape cassette, so that the data can be processed by any RS 232 compatible equipment.**

ML-1
MINILOGGER

### SERIES ML MINILOGGERS

Portable, battery operated loggers with magnetic tape cassette output. Ideal for use in remote locations for collecting data to be processed in a central location.

#### ML-1 SINGLE CHANNEL

Displays and records analog data at selected time intervals, with elapsed time recorded after each block of data. Options include inputs from A.C. signals, thermocouples, current transmitters and similar instruments.

#### ML-10 TEN CHANNEL

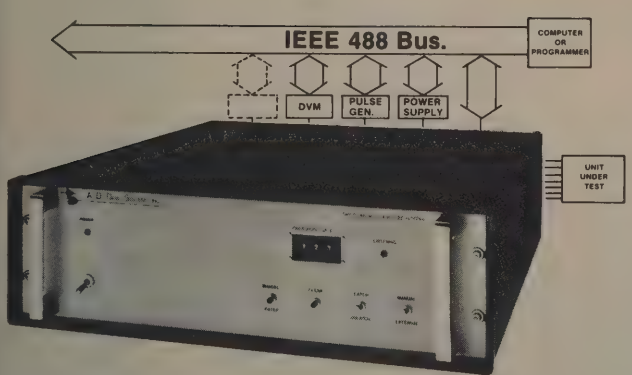
Records up to 10 analog inputs, 32 digital inputs and real time clock with scan interval selection. Clock, digital inputs, and analog data are displayed on the front panel. Options are available for measuring different signal inputs such as thermocouples and for outputs in RS 232 compatible format.

### SERIES 14 DATALOGGERS

Multiple analog inputs, expandable in 10 channel modules, with autoranging thru ±.1999V, ±1.999V, and 19.99V. Real time digital clock and digital inputs with scan interval select. Output in RS 232 compatible format at either 110, 300, 1200, or 2400 baud to drive terminals, printers, or datacassettes. Also available with options for thermocouple measurements.

## AUTOMATIC TEST EQUIPMENT

### SWITCHING MATRIX




MODEL 56
SWITCHING MATRIX

**SERIES 56 SWITCHING MATRICES** are offered as the most versatile method of switching available for automatic test equipment and similar applications.

The mainframe is available with the following features:

- IEEE compatibility
- 16 bit computer I/O control
- Microprocessor control

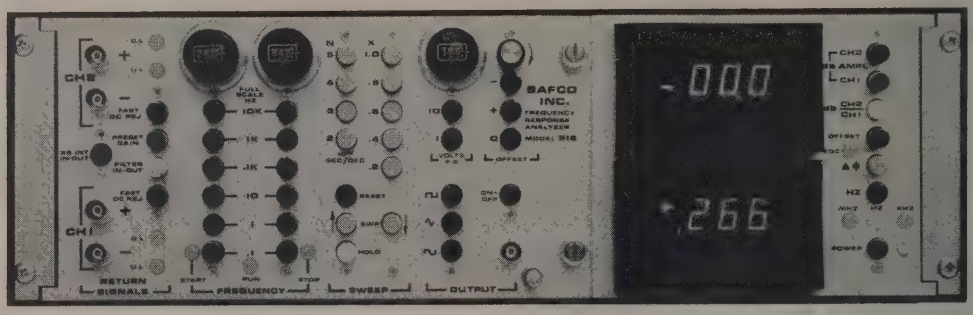
Modules are available with the following features:

- Flexibility in matrix configuration
- High frequency signal switching
- Power level signal switching
- Power switching

# A COMPLETE LINE OF FREQUENCY RESPONSE ANALYZERS

WITH

High Noise & Harmonic Rejection (Fourier Analysis). Direct Readout of Amplitude, Phase Shift, Frequency, AMP. Ratio (db). Fast, Simple Operation. Low Cost, Portable. Calibrated, Low Distortion Test Signal with D.C. Offset.

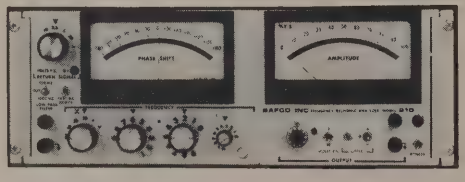



## MODEL 916
## UNIVERSAL TWO CHANNEL SWEEP F.R.A.

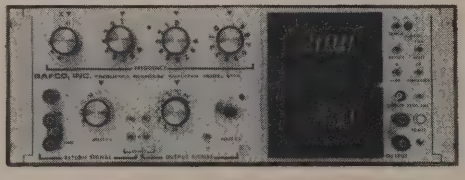
916 - .005 Hz to 10,000 Hz • 916M - .01 Hz to 20,000 Hz • 916H - .025 Hz to 50,000 Hz

- DISPLAYS & PLOTS AMP. RATIO (db) & PHASE SHIFT VS. LOG FREQUENCY
- OPEN LOOP RESULTS FROM CLOSED LOOP TESTS
- AUTOMATIC GAIN CONTROL – 80 db DYNAMIC RANGE IN EACH CHANNEL
- CONTINUOUS SWEEP OVER ANY PORTION OF 6½ DECADE FREQUENCY RANGE
- DIRECT OPERATOR CONTROL OF ALL FUNCTIONS – SWEEP SPEED, SWEEP SENSE, INTEGRATE TIME
- HIGH NOISE & HARMONIC REJECTION – FOURIER INTEGRAL ANALYSIS
- OPTIONS: CARRIER, AMPLITUDE SERVO, MECHANICAL IMPEDANCE

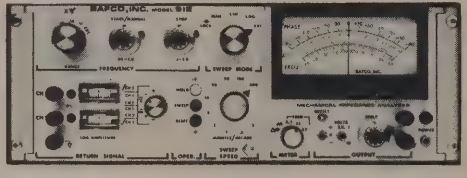
● REMOTE PROGRAMMING – MODEL 920 ●




**MODEL 910-B**
SINGLE CHANNEL – 0.1-20,000 Hz
LOW COST – DUAL METER – CONTINUOUS READING



**MODEL 911A-2D**
SINGLE CHANNEL – .01 -10,000 Hz
DUAL DIGITAL READOUTS – AMPLITUDE RATIO (DB) & PHASE SHIFT



**MODEL 912**
MECHANICAL IMPEDANCE ANALYZER – TWO CHANNEL 1.-20,000 Hz. A.G.C. OVER 60 DB IN EACH CHANNEL. DIRECT PLOT OF AMPLITUDE RATIO (DB) AND PHASE SHIFT VS. LOG FREQUENCY. ARTIFICIAL INTEGRATION.

BAFCO, INC. welcomes your inquiry, and is pleased to assist you in selecting the model analyzer best suited to your frequency response measurement needs. Send for complete catalog of all models.

**BAFCO**
INCORPORATED

717 MEARNS ROAD
WARMINSTER, PENNSYLVANIA 18974
TEL.: (215) 674-1700 • TWX No. 510-665-6860

# Ballantine Instruments and Measuring Equipment

## AC VOLTMETERS and MULTIMETERS

Model 3630A

■ **AC Voltmeters Digital and Analog.** True RMS, Average and Peak Responding. Sensitivities from 100 μV to 1 kV full scale. Bandwidths from 0.1 Hz to 1 GHz. 19,999 counts. AC/DC coupled models. Resolution to 1 μV; Accuracy to 0.01%. Linear and log voltage and dB indication. Floating inputs/battery and line powered. IEEE 488 Adaptable Models.

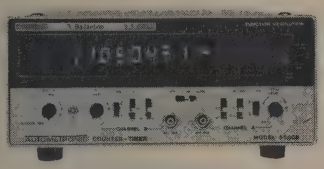
**REQUEST CATALOG V78**

■ **Portable Digital Multimeters, RMS Responding.** 1999 counts. 6 functions. 35 ranges from 10 μV to 1200 V ac and dc; 10 nA to 1.999 A ac and dc; 10 milliohms to 19.99 megohms. Accuracy to 0.05%.

Model 3028B

Over 25 Commercial, Industrial and Military Models to Fit Your Application.

## FREQUENCY COUNTERS and COUNTER-TIMERS



Model 5500B-08

■ **Intelligent Universal Counter Timers.** Model 5500B: DC to 110 MHz, 8 digits, automatic resolution, ATE oriented. IEEE 488 Adapter.

Model 5500B-Opt. 35: to 1 GHz.

**REQUEST CATALOG C78**

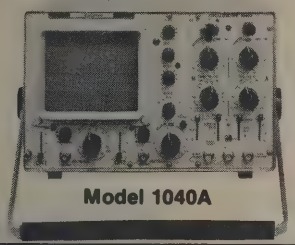
■ **Communications Counters.** Sensitivities to 15 mV.

Model 5720A: Low cost, 8 digit, 80 MHz. 0.01 Hz resolution in 1 sec.

Model 5725B: Low cost, 6 digit, 225 MHz for field, CB, and general usage.

Model 5760A: 600 MHz, 8 digit, line/battery, operated. TCXO and proportional oven clock positions.

## PORTABLE OSCILLOSCOPES/DUAL CHANNEL



Model 1040A

■ **15MHz/20MHz/40MHz Models.** Sensitivities to 50 μV/cm; mixed and delayed sweeps to 20 ns/cm. Field/bench capability. Rugged. Reliable.

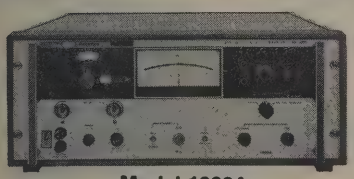
■ **10MHz Miniscope Models Tool Kit Size.** Dual trace.

**Other Instruments:**

- **Oscilloscope Calibrators**
- **Time Mark Generators**
- **Transient Recorders**

**REQUEST CATALOG O78**

## AC CALIBRATION STANDARDS and THERMAL TRANSFER DEVICES



Model 1600A

■ **Automatic AC/DC Transfer Standard.** DC to 100 MHz. 0.25 V to 1200 V/100 MHz.

■ **Coaxial Thermal Converters to 1 GHz.** 0.1 V to 135 V.

■ **Micropotentiometers to 900 MHz.** 17 μV to 1.4 V.

■ **RF Voltage Comparators.** 10 mV to 10 V/1 GHz.

■ **AC/DC Voltage Calibrators.** Accuracy to 100 ppm . . . Resolution and repeatability to 20 ppm. Ranges from 17 μV to 1 kV.

**REQUEST CATALOG S78**

All fully NBS traceable and certifiable. Complete capability for traceable voltage and current and power metrology measurements.

## DIGITAL PANEL METERS

Model 8300B

**39 Voltage and Current Models. 4½, 3½, 2½ digits.** Superior long time stability. Accuracies to ± (0.01% rdg + 0.01% fs).

**Longtime reliability — 3 years LCD display warranty.**

**0.5" and 0.7" high characters.** High contrast illuminated white on black displays and daylight-viewing power-saving reflective displays.

**8300B Series** — 20 mV to 1000 V; 2 μA to 2A; less than 1 W power consumption.

**8300E Series Engineering Units** — Readout in actual units of measurement as specified.

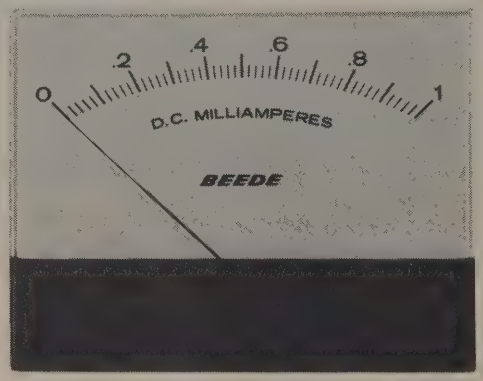
**REQUEST CATALOG M78**

**FOR A COMPLETE SET OF BALLANTINE LITERATURE REQUEST CATALOG A78.**

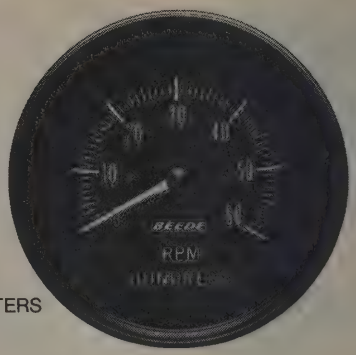
Ballantine Laboratories, Inc.
P.O. Box 97, Boonton, New Jersey 07005, U.S.A.
Telephone: 201-335-0900 TWX: 710-987-8380

# Beede Custom Panel Meters

Beede, world's largest manufacturer of custom meters for monitoring and control of variables, maintains large inventories of meter components to provide customers with low-cost customizing capabilities. Beede products are available in the U.S., Canada and Europe through company representatives, meter modification centers and from the manufacturer.

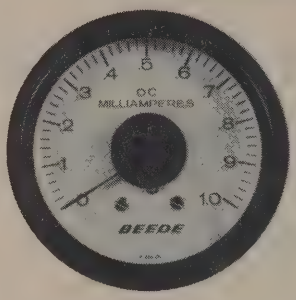


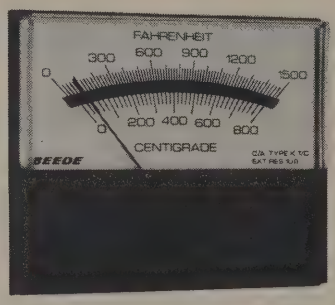

PANEL METERS



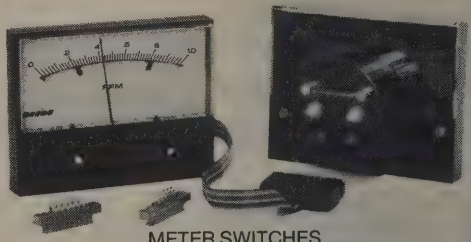

TACHOMETERS

**Panel Meters.** Wide variety of styles and features to meet your needs. Tracking accuracies to 1% or ½% available.
**250° Meters.** Variety of case styles and sizes.
**Meter Relays.** Precision optical controller with output indication and wide choice of unique functional options.
**Meter Switch.** Optoelectronic switching device combining analog display with digital control in one compact unit.
**Pyrometers.** Six stocked ranges available from 0-300°F to 0-2500°F with custom ranges readily available.
**Tachometers.** For a broad range of high shock and vibration applications.
**Meter Movements.** Six types of D'Arsonval movements in selection of Beede case styles or customer's case.

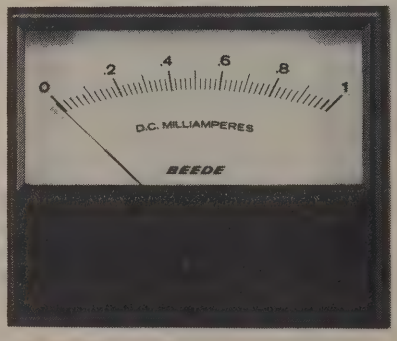


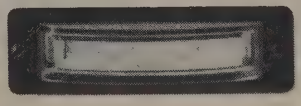



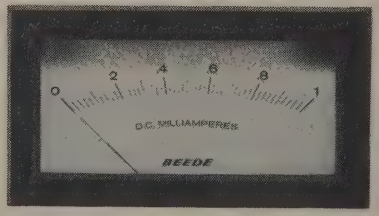

PYROMETERS

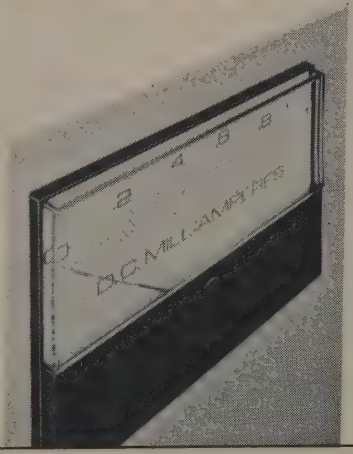


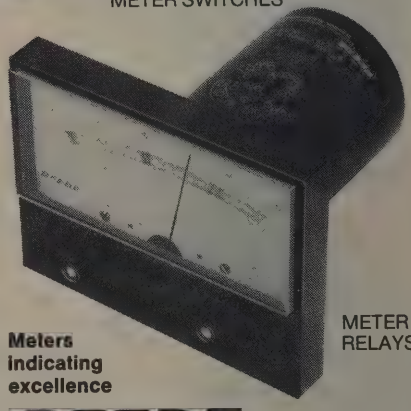

METER SWITCHES







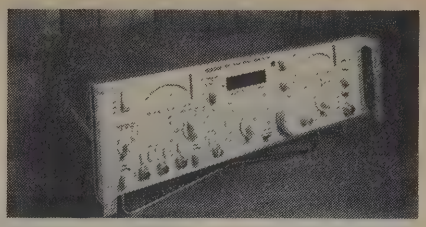
METER RELAYS

**Meters indicating excellence**

**BEEDE**

Beede Electrical Instrument Co., Inc.
Penacook, New Hampshire 03301
(603) 753-6362 TWX 710-364-6977

## Consider BOONTON when your applications require accuracy, precision, and stability in...



## METERS

| TYPE | MODEL | FS RANGES | FREQUENCY | READOUT | REMOTE RANGING | BCD OUTPUTS | AVAILABLE OPTIONS: IEEE-488 BUS INTERFACE | AVAILABLE OPTIONS: AUTO-RANGE | AVAILABLE OPTIONS: dB DISPLAY | AVAILABLE OPTIONS: BATTERY OPERATION |
|---|---|---|---|---|---|---|---|---|---|---|
| RF Microwatt-meters | 42B | 10 nW-10 mW | 200 kHz-18 GHz | Analog | Std. | | | | | X |
| | 42BD | 10 nW-10 mW | 200 kHz-18 GHz | Digital | Std. | Std. | X | X | X | |
| | 42C | 100 nW-100 mW | 200 kHz-18 GHz | Analog | Std. | | | | | X |
| | 42CD | 100 nW-100 mW | 200 kHz-18 GHz | Digital | Std. | Std. | X | X | X | |
| Inductance Meters | 62A | 1 $\mu$H-3000 $\mu$H | 1 MHz | Analog | Std. | | | | | |
| | 62AD | 2 $\mu$H-2000 $\mu$H | 1 MHz | Digital | Std. | Std. | X | Std. | | |
| Capacitance Meters | 72B | 1 pF-3000 pF | 1 MHz | Analog | Std. | | | | | |
| | 72BD | 2 pF-2000 pF | 1 MHz | Digital | Std. | Std. | X | Std. | | |
| RF Millivolt-meters | 92B | 1 mV-3 V | 10 kHz-1.2 GHz | Analog | Std. | | | | | X |
| | 92BD | 1 mV-3 V | 10 kHz-1.2 GHz | Digital | Std. | Std. | X | X | X | |
| | 92C | 3 mV-3 V | 10 kHz-1.2 GHz | Analog | | | | | | |
| RMS Voltmeters | 93A | 1 mV-300 V | 10 Hz-20 MHz | Analog | Std. | | | | | |
| | 93AD | 1 mV-300 V | 10 Hz-20 MHz | Digital | Std. | Std. | X | X | X | |

## BRIDGES

| TYPE | MODEL | RANGE | FREQUENCY | FEATURES |
|---|---|---|---|---|
| RF Admittance | 33A/1 | 0-150 pF, 0-25 mS | 1, 5, 10, 20, 30, 50, 100 MHz | Excellent resolution of high-Q samples with low test voltages |
| | 33B/1 | 0-150 pF, 0-5 mS | 1, 5, 10, 20, 30, 50, 100 MHz | |
| | 33C/1 | 0-15 pF, 0-25 mS | 1, 5, 10, 20, 30, 50, 100 MHz | |
| | 33D/1 | 0-15 pF, 0-5 mS | 1, 5, 10, 20, 30, 50, 100 MHz | |
| Inductance | 63H | 0.2 nH-110 mH, 0-11 k$\Omega$ | 5-500 kHz | High test frequencies for each range of inductance |
| | 63L | 20 nH-11 H, 0-110 k$\Omega$ | 0.4-40 kHz | |
| | 63M | 2 nH-1.1 H, 0-110 k$\Omega$ | 1-100 kHz | |
| Capacitance | 75D | 0-1000 pF, 0-1000 $\mu$S | 1 MHz | Industry standard |
| | 76A | 0-2000 pF, 0-2000 $\mu$S | 1 MHz | Auto-Balance, Digital, 488 Bus Interface |

## SIGNAL GENERATORS

| TYPE | MODEL | RF OUTPUT | FREQUENCY | READOUT | FEATURES |
|---|---|---|---|---|---|
| FM-AM | 102C | −130 to +13 dBm | 450 kHz-520 MHz | Digital | Low cost |
| | 102D | −130 to +13 dBm | 450 kHz-520 MHz | Digital, Phase-Lock | 0.05 ppm/hr. Stability |
| | 103A | −130 to +23 dBm | 125 kHz-175 MHz | Digital | 5 Sweep Ranges |
| | 103B | −130 to +23 dBm | 125 kHz-175 MHz | Digital, Phase-Lock | Sweep + High Stability |

## MODULATION METERS

| TYPE | MODEL | FS RANGES | FREQUENCY | FEATURES |
|---|---|---|---|---|
| FM-AM | 82AD | 10, 100, 300 kHz dev.; 10, 100% AM | 10 MHz-1.2 GHz | Auto-tuned, Auto-leveled, Digital Display, IEEE 488 Bus Interface Available. |

**For full catalog information or a demonstration, contact your BOONTON representative, or write or call Boonton Electronics Corporation, Route 287 at Smith Road, Parsippany, N.J. 07054—(201) 887-5110.**

# BOONTON

BOONTON ELECTRONICS CORP. ■ PARSIPPANY, N.J. 07054 U.S.A. ■ (201) 887-5110 TWX: 710-986-8241

## CLAMP-ON CURRENT-MEASURING PROBE — F. W. BELL, Inc.

# F. W. BELL CURRENT GUN™ PROBE

## DESCRIPTION

The Model CG-100A Current Gun Probe lets you measure currents from dc to 1 kHz and from 0 to 200 amps accurately, quickly and safely on your voltmeter or scope.

No need to break the circuit or disturb insulation. Merely squeeze the trigger and slip the probe over any conductor up to ¾-inch in diameter. This Hall effect device is the end result of technology developed and perfected over the years by F. W. Bell and proven in the 1776 Current Meter.

## SPECIFICATIONS

| | |
|---|---|
| ACCURACY: | 2.0% of rated output |
| RANGES: | ±10 A (dc or Peak ac)<br>±100 A (dc or Peak ac)<br>100% overrange capability* |
| OUTPUT: | ±1 V/10 A<br>±1 V/100 A |
| FREQUENCY RESPONSE: | dc to 1.0 kHz<br>operable to 5.0 kHz* |
| OUTPUT IMPEDANCE: | approximately 125 Ω |
| RECOMMENDED LOAD: | ≥100 kΩ |
| OPERATING TEMPERATURE RANGE: | −10°C to +65°C |
| BATTERY LIFE:<br>(4 AA SIZE REQUIRED) | Mercury—60 hours continuous<br>Alkaline—30 hours continuous<br>Nicad—8 hours continuous |
| PROBE ISOLATION CAPABILITY: | 600 V dc or Peak ac |
| APERTURE SIZE: | 0.75" (19 mm) diameter |
| WEIGHT: | approximately 2 lbs. (0.9 kg) |
| | *with slightly reduced accuracy |

## ORDERING INFORMATION

Contact F. W. Bell, Inc. for application assistance. Product assistance and technical literature are availale.

*A subsidiary of*
*The Arnold Engineering Company*

4949 Freeway Drive E.
Columbus, Ohio 43229

Phone: (614) 888-7501
TWX: 810-337-2851

BELL INC.®

# CURRENT MEASURING AND SENSING EQUIPMENT — F. W. BELL, Inc.

## DIGITAL CURRENT METER

Model 1776

### DESCRIPTION

The Bell model 1776 digital current meter provides a revolution in metrology via its ability to accurately measure ac, dc, (and ac on dc) current with non-contact, clamp-on probes. No longer is it necessary to break the circuit to make a current measurement. This time-saving feature is extremely helpful in the troubleshooting, repair and design fields. Now it's possible to obtain current measurements more easily and safely than voltage measurements with complete isolation from the bus.

The Bell model 1776 digital current meter introduces virtually no resistance on dc readings and extremely small impedance on ac readings. In this way, measurements can be made with a minimum of disturbance in the measured circuit.

The unique circuit design, coupled with the digital readout, provides a wide dynamic range of measurements with excellent resolution. Peak read and hold capability is standard. This function permits you to read and hold the reading of the peak current appearing on the measured conductor. The 1776 is designed for portable operation with internal rechargeable batteries and for 115/230 Vac, 50-60 Hz line operation.

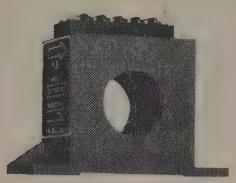
### PROBES

There are three clamp-on probes available for the Bell 1776 digital current meter. Each probe is designed for a distinct full scale range. These ranges are 1000 amperes, 100 amperes, and 10 amperes. The probes are self-calibrating and are interchangeable on any 1776 digital current meter. The probes have a 100% overrange capability with reduced accuracy.

### SPECIFICATIONS

| | |
|---|---|
| Current Ranges (with applicable probe) | 1000 amperes. F.S.<br>100 amperes. F.S.<br>10 amperes. F.S. |
| Accuracy | |
| dc | ±1.0%. F.S. |
| ac (Sinusoidal) | ±1.0%. F.S. |
| Peak Detection (dc accuracy) | ±2.0%. F.S. |
| Frequency Response | dc to 5 kHz |
| Power Requirements | 115/230 Vac 50/60Hz and internal rechargeable Nicad batteries, with built-in trickle charge circuitry. |

## DC AND AC CURRENT SENSORS



### FEATURES

- Fast-responding
- Non-contact operation
- Output voltage isolated from input
- Very low insertion impedance
- Minimal distortion from adjacent conductors
- Amplified and non-amplified models available

### DESCRIPTION

F. W. Bell current sensors are designed to meet the challenging requirements of many different current measurement applications. The sensors are compact, non-contact, Hall effect devices.

The Bell current sensors function by sensing the magnetic field surrounding a current-carrying conductor.

### SPECIFICATIONS

| model | rated current | rated output | accuracy |
|---|---|---|---|
| ID-5001M | 350 A ac/dc | 0.5 to 1.1 mV/A | ±2% RO |
| ID-5011M | 350 A ac/dc | 0.5 mV/A | ±2% RO |
| ID-5021M | 350 A ac/dc | 0.5 mV/A | ±2% RO |
| ID-5031M | 350 A ac/dc | 0.5 mV/A | ±2% RO |
| IA-5023P | 250 A dc | 10 V dc | ±0.5% RO |
| IA-5022P | 500 A dc | 10 V dc | ±0.5% RO |
| IA-5021P | 1000 A dc | 10 V dc | ±0.5% RO |
| IA-5020P | 2000 A dc | 10 V dc | ±0.5% RO |
| IF-5002M | 500 A ac/dc | 0.15 to 0.30 mV/A | ±0.5% RO |
| IF-5001M | 1000 A ac/dc | 0.15 to 0.30 mV/A | ±0.5% RO |
| IF-5000M | 2000 A ac/dc | 0.15 to 0.30 mV/A | ±0.5% RO |

### ORDERING INFORMATION

Contact F. W. Bell, Inc. for application assistance. Product assistance and technical literature are available. If standard models are not suitable, F. W. Bell, Inc. can design one for your special electrical and physical requirements.

FW BELL INC.®
A Subsidiary of
The Arnold Engineering Company

4949 Freeway Drive E.
Columbus, Ohio 43229

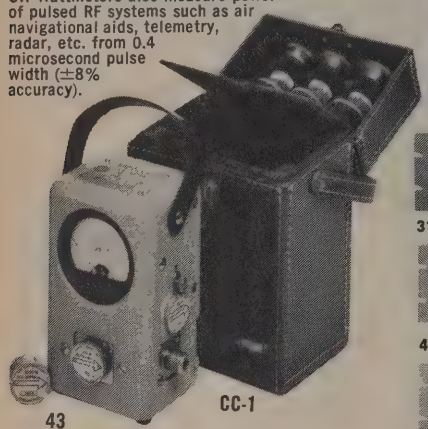
Phone: (614) 888-7501
TWX: 810-337-2851

# BIRD

## Quality Instruments For RF Power Measurement

50 ohms nominal

Insertion instruments for measuring and monitoring incident and reflected power in coaxial transmission lines with ±5% of full scale accuracy. Insertion VSWR is less than 1.05. Net power under any load condition is the difference between incident and reflected power readings, which also yield load VSWR from a nomograph. 4311 and 4314 THRULINE Peak and CW Wattmeters also measure power of pulsed RF systems such as air navigational aids, telemetry, radar, etc. from 0.4 microsecond pulse width (±8% accuracy).

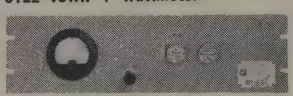


43 CC-1

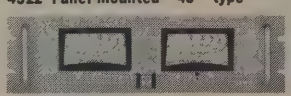
4111-18

460

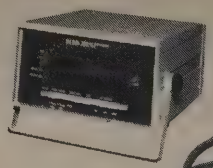
3122 VSWR + Wattmeter



4522 Panel-mounted "43" type



3127 | 3128

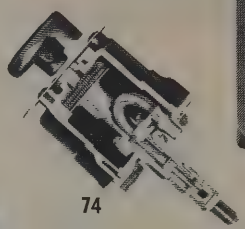


4371 Digital Multirange Broadband Wattmeter, self-contained elements. (Analog Version: Model 4370)

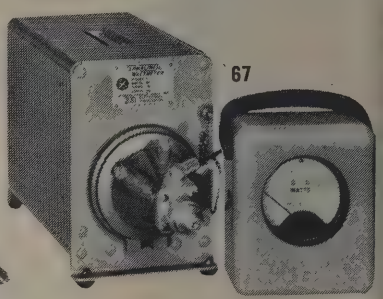
6254

6154

Direct reading instruments for absorbing and measuring RF power. The load section of the TERMALINE Wattmeter serves as a dummy load. The indicating meter is calibrated to read RF power directly in watts with ±5% of full scale accuracy (to 500MHz).



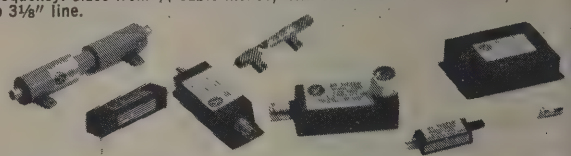
74



67

### COAXIAL RF FILTERS

Custom engineered or field-proven designs. High rejection attenuation filters available with Low-pass cut-off from 16 to 2700MHz (about fifty designs of 400MHz). Hi-pass cut-off frequencies from 30 to 1000MHz, Band-pass as narrow as 5% of center frequency. Sizes from ¼ cubic inches, with subminiature connectors, to 3⅛" line.



## THRULINE® RF Directional Wattmeters

| Model | Connectors | Frequency (MHz) | Power Ranges (Watts) | U.S. Price |
|---|---|---|---|---|
| | | PLUG-IN ELEMENTS | | |
| 43 | QC (1) | For CW, FM, and TV (black level) | | $120 |
| 4311 (Battery) | QC (1) | For Peak, Pulse, SSB, AM, TV, CW, and FM | | 395 |
| 4314 (AC/DC) | QC (1) | For Peak, Pulse, SSB, AM, TV, CW, and FM | | 450 |
| Order one or more elements with your Thruline Wattmeter to suit your frequency and power ranges. | | 2-30 | 50, 100, 250, 500 1000, 2500, 5000 | 42 each |
| | | 25-60, 50-125, 100-250, 200-500, 400-1000 | 5, 10, 25, 50, 100, 250, 500, 1000 | 36 each |
| | | Elements, Milliwatt (100, 250, 500) narrow band | | $75 |
| | | Elements, low power (1, 2.5W) narrow band | | 50 |
| | | Elements, 950-1260MHz (1, 2.5, 5, 10, 25, etc. to 5000W) | | 75 |
| | | Elements, high frequency to 2300MHz (1, 2.5, 5, 10, 25W) | | 75 |
| | | Elements, peak only to 10kW, 25-1000MHz in five bands | | 75 |
| | | CC-1 Cowhide Carrying Case for 43, 4311 | | 25 |
| | | EC-1 Element Case for 12 spares | | 16 |
| 4274 | | Directional Coupler Elements, BNC/F RF Output: | | |
| | | —40dB 50-100MHz, 1000W max. | | 55 |
| | | —40dB 75-150MHz, 1000W max. | | 55 |
| | | —40dB 125-250MHz, 1000W max. | | 55 |
| | | —40dB 225-450MHz, 1000W max. | | 55 |
| | | —35dB 400-800MHz, 500W max. | | 55 |
| | | —30dB 750-1250MHZ, 100W max. | | 55 |
| 4274-025 | | Non-directional RF Sampler 25-1000MHz: —50dB, 500W max. | | 36 |
| 4275 | | Variable (—35 to —80dB) stand-alone RF Sampler 2-1000MHz, 1000W max. | | 42 |
| 4330 | QC (1) | Milliwatt version of Model 43 (200/800mW) Elements (4330) 60-2300MHz in narrow bands, 60-950/950-2300 | | 150 60/80 |
| 4370 | QC (1) | 25-520MHz | 1-500W | 595 |
| 4371 | QC (1) | 25-520MHz | 1-1000W | 995 |
| 4111 | UHF, N, BNC | 25-175MHz | 150/15W | 149 |
| 4112 | N, UHF, BNC | 2- 30MHz Mini- | 200/20W | 149 |
| 4113 | N, UHF, BNC | 2- 30MHz Monitor® | 1000/100W | 149 |
| 4114 | N, UHF, BNC | 400-512MHz Pocket | 50/5W | 149 |
| 4115 | N, UHF, BNC | 100-225MHz Meter | 50/5W | 149 |
| 4118 | N, UHF, BNC | 400-512MHz | 150/15W | 149 |
| 4712 | 1⅝ EIA Fl. | Rigid Line Wattmeter Elements (4712) Choices from 25W-25kW 2-1000MHz | | 225 50 |
| 460 | 3⅛ EIA Fl. | Rigid Line Wattmeter | | $260 |
| 4805 | 3⅛ Unfl. | Rigid Line Wattmeter Elements (460, 4805) Choices from 1-100kW, 2-1000MHz | | 185 50 |

## THRULINE RF Directional Wattmeters (Cont'd)

| | | | |
|---|---|---|---|
| 4902 | 6⅛ EIA Fl. | Rigid Line Wattmeter Elements (4902) Choices from 2.5-250kW, 2-1000MHz | $630 50 |
| 4521 | QC (1) | Panel-mounted, one meter — one socket | 125 |
| 4522 | QC (1) | Panel-mounted, one meter — two sockets | 185 |
| 4526 | QC (1) | Panel-mounted, two meters — two sockets | 235 |
| 3122 | QC (1) | Special meter: simultaneous forward: reflected power and VSWR, panel mtd. two sockets | 350 |
| 4342 | QC (1) | Portable version of 3122 | 350 |
| | | These five models use Elements listed for Model 43 | |
| 4320/21 | | Amplifiers for adding PEAK READ to CW Thrulines | 285 |

## WATTCHER® RF Power Monitor/Alarm

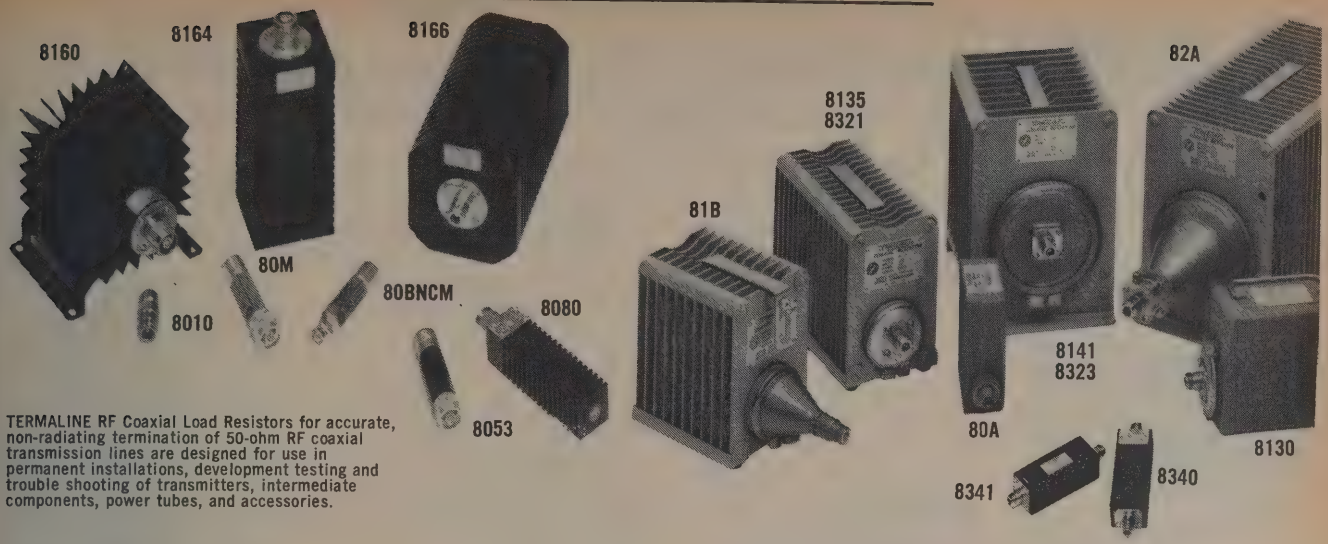
| Model | | U.S. Price |
|---|---|---|
| 3127/28 | Fwd./refl. Wattmeter. Has alarm or Xmitter shut-off with high VSWR. Requires Line Section, Elements, etc. Choices from 0.45 to 2300 MHz, 1W to 250kW. | $525 |
| 3170 | HighSpeed RF Monitoring System for cables | 750 |
| 3171 | HighSpeed RF Monitoring System for rigid lines | 750 |

## TERMALINE® RF Absorption Wattmeters

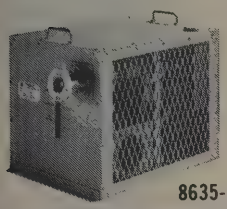
| Model | Power Scales | Freq. (MHz) | Connector | U.S. Price |
|---|---|---|---|---|
| 6254 | 25, 50, 100, 250, 500mW, 1 or 2W | 30-500 | BNC/F | $190 |
| †611 | 0-15/60W also see 6156 | 30-500 | N/F | 250 |
| 6104 | 0-2/6/20/60W | 25-112 | N/F | 249 |
| 6154 | 0-5/15/50/150W | 25-1000 | N/F | 275 |
| 6156 | 0-5/15/50/150W | 25-512 | N/F | 249 |
| †67 | 0-25/100/500W | 30-500 | QC (1) | 410 |
| 694 | 0-1000W | 2-30 | QC (1) | 525 |
| 6835 | 0-120/600/1200W | 30-500 | QC (1) | 650 |
| **Water-cooled:** | | | | |
| †67C | 0-100/500/2500W | 30-500 | QC (1) | 525 |
| †Special calibration 500-1000 MHz available at time of order. | | | | 25 |

## COAXWITCH® Coaxial Selector Switches

| Model | Function | U.S. Price | Model | Function | U.S. Price |
|---|---|---|---|---|---|
| 7422 | 1P2T | $125 | 718 | 1P8T | $150 |
| 7441 | 1P3T | 125 | 7181 | 1P10T | 160 |
| 7431 | 1P4T | 125 | 72-2 | 2P2T | 125 |
| 74 | 1P6T | 140 | 72-R | 2P-Rev. | 125 |




TERMALINE RF Coaxial Load Resistors for accurate, non-radiating termination of 50-ohm RF coaxial transmission lines are designed for use in permanent installations, development testing and trouble shooting of transmitters, intermediate components, power tubes, and accessories.



8635-115

No external water supply is needed for the new 10kW Self-Cooling MODULOAD® RF Load Resistor Module. In a scant three cubic feet of space, the integral heat-exchanger permits continuous 10kW dissipation in 5° to 45° ambients (−20°C to +20°C with anti-freeze).

**QC-TYPE CONNECTORS (Quick Change):** Adaptable to particular TERMALINE, THRULINE, and TENULINE units, these connectors may be quickly changed in the field. Connector types available are: Female or male BNC, TNC, N, C, SC, HN, LC, UHF, LT, 7/8", and 1 5/8" EIA Flanged.

Normally supplied: (1) Female N, (2) Female LC, (3) Male N.

**OTHER BIRD INSTRUMENTS:** THRULINE® RF DIRECTIONAL POWER SENSORS • SENTRILINE® FILTER-COUPLERS • COAXIAL RF FILTERS • NEW: VSWR/WATTMETERS.

Prices are subject to changes without notice. F.O.B. Cleveland, Ohio.

**Standard Units: Stock to 12 weeks delivery**

## TERMALINE® RF Coaxial Load Resistors

### Air Cooled, Dry Dielectric

| Model | Power | Freq. | VSWR @ 1GHz | Connector | U.S. Price |
|---|---|---|---|---|---|
| 8010, 8011 | 2W | 0-4GHz | 1.04 | N/F, N/M | $29 |
| 8015, 8016 | 2W | 0-4GHz | 1.04 | TNC/M, TNC/F | 29 |
| 80F, 80M | 5W | 0-4GHz | 1.1 | N/F, N/M | 32 |
| 80CF, 80CM | 5W | 0-4GHz | 1.1 | C/F, C/M | 35 |
| 80 BNC/F, -/M | 5W | 0-4GHz | 1.1 | BNC/F, BNC/M | 35 |
| 8052, 8053 | 10W | 0-4GHz | 1.1 | N/F, N/M | 38 |
| 8080 | 25W | 0-3.5GHz | 1.1 | QC (3) | 47 |
| 8085 | 50W | 0-3.5GHz | 1.1 | QC (3) | 75 |
| 8071 Miniload® | 100W* | 0-2GHz | 1.1 | SMA/F | 125 |
| 8160 | 100W | 0-2.5GHz | 1.1 | QC (3) | 150 |
| 8164 | 100W | 0-2.5GHz | 1.1 | QC (1) | 125 |
| 8166 | 150W | 0-2.5GHz | 1.1 | QC (1) | 150 |
| 8072 Miniload® | 300W* | 0-2.5GHz | 1.1 | SQC (1) | 140 |

*When bolted to heat sink.

### Air Cooled, Liquid Dielectric

| | | | | | |
|---|---|---|---|---|---|
| 80A | 20W | 0-3.5GHz | 1.1 | N/F | 50 |
| 8130 | 50W | 0-4GHz | 1.1 | QC (1) | 60 |
| 81B | 80W | 0-4GHz | 1.1 | N/F | 100 |
| 8135 | 150W | 0-4GHz | 1.1 | QC (1) | 85 |
| 8141 | 250W | 0-2.5GHz | 1.1 | QC (1) | 125 |
| 8201 | 500W | 0-2.5GHz | 1.1 | QC (1) | 175 |
| 82A | 500W | 0-3.5GHz | 1.1 | QC (1) | 200 |
| 8401 | 600W | 0-3GHz | 1.1 | QC (1) | 195 |
| 8251 | 1000W | 0-2.5GHz | 1.1 | QC (2) | 325 |
| 8833 | 1000W | 0-2.5GHz | 1.1 | QC (2) | 400 |
| 8890** | 2500W | 0-1.5GHz | 1.1 | QC (2) | 545 |
| 8891** | 2500W | 0-1.5GHz | 1.1 | 3 1/8 EIA Fl. | 545 |
| 8892** | 2500W | 0-1.5GHz | 1.1 | 1 5/8 EIA Fl. | 545 |
| 8897-510 | 7500W | dc-1000MHz | 1.1 | 3 1/8 Unfl. | 1025 |
| 8921 | 5000W | dc-1000MHz | 1.1 | QC (1) | 1595 |
| 8926 | 5000W | dc-1000MHz | 1.1 | 3 1/8 EIA Fl. | 1595 |
| 8932-115 | 10kW | dc-1000MHz | 1.1 | 1 5/8 EIA Fl. | 2150 |
| **BA-88 Blower for doubling power (intermittent duty). | | | | | 300 |
| **Overtemperature Thermoswitch. | | | | | 38.50 |

### MODULOAD® Self-Cooled Load Systems

| | | | | | |
|---|---|---|---|---|---|
| 8635-115 | 10kW | 1kHz-1000MHz | 1.1 | 1 5/8 EIA Fl. | 2150 |
| 8645-115 | 25kW | 1kHz-900MHz | 1.1 | 3 1/8 Unfl. | 3300 |
| 8656-115 | 40kW | 1kHz-900MHz | 1.1 | 3 1/8 Unfl. | 4850 |

## TERMALINE® RF Coaxial Load Resistors (Cont'd)

### Water Cooled, Air Dielectric

| | | | | | |
|---|---|---|---|---|---|
| 8710 | 1kW | 0-3.5GHz | 1.1 | N/M or F | $210 |
| 8720 | 5kW | 0-2GHz | 1.1 | 1 5/8 EIA Fl. | 350 |
| 8730 | 10kW | 1kHz-1000MHz | 1.1 | 1 5/8 EIA Fl. | 475 |
| 8745 | 20kW | 1kHz-900MHz | 1.1 | 3 1/8 EIA Fl. | 620 |
| 8755 | 30kW | 1kHz-900MHz | 1.1 | 3 1/8 EIA Fl. | 935 |
| 8766 | 40kW | 1kHz-900MHz | 1.1 | 3 1/8 Unfl. | 1150 |
| 8762/8562 | 50kW | 0-1.5GHz | 1.1 | 3 1/8 EIA Fl. | 2600 |
| 6770 Series Dolly for mounting 10kW to 50kW loads | | | | | 225 |

## TENULINE® Attenuators

| Model | Power | Freq. | VSWR | Atten. | Connector | U.S. Price |
|---|---|---|---|---|---|---|
| 8340-060, -100, -200 | 25W | 0-500MHz to 1000MHz | 1.1 1.15 | 6dB 10, 20 dB | QC (1) in, (1) out | $125 |
| 8341-060, -100, -200 | 40W* | 0-500MHz to 1000MHz | 1.1 1.15 | 6dB 10, 20dB | QC (1) in, (1) out | 140 |
| 8343-060, -100, -200 | 100W | 0-500MHz to 1000MHz | 1.1 1.15 | 6dB 10, 20dB | QC (1) in, (1) out | 250 |
| 8321 | 50W | 0-500MHz | 1.1 | 30dB | QC (1) in, (1) out | 200 |
| 8323 | 100W | 0-500MHz | 1.1 | 30dB | QC (1) in, (1) out | 250 |
| 8322 | 200W | 0-500MHz | 1.1 | 30dB | QC (1) in, (1) out | 300 |
| 8325 | 500W | 0-500MHz | 1.1 | 30dB | QC (1) in, (1) out | 450 |
| 8327** | 1000W | 0-500MHz | 1.1 | 30dB | QC (2) in, (1) out | 575 |
| 8329** | 2000W | 0-500MHz | 1.1 | 30dB | QC (2) in, (1) out | 675 |
| BA-88 Blower for 4000W int. duty (8329). | | | | | — | 300 |

*When bolted to heat sink. **Overtemperature Thermoswitch. 38.50

**EASTERN REGION**
802B OLDE HICKORY RD.
LANCASTER, PENN. 17601
PHONE (717) 569-0467

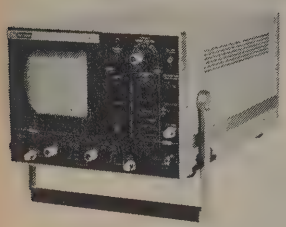
**WESTERN REGION**
1188 EAST OJAI AVE.
OJAI, CALIF. 93023
PHONE (805) 646-7255

**Electronic Corporation**
30303 Aurora Road, Cleveland (Solon) Ohio 44139
Phone: (216) 248-1200 • TWX: 810-427-2687
Cable: BIRDELEC

# B+K PRECISION DYNASCAN CORPORATION / DUAL-TRACE SCOPES

Dept. EM, 6460 West Cortland Avenue, Chicago, Illinois 60635 • (312) 889-9087

## DUAL-TRACE 5" 30 MHz TRIGGERED SWEEP SCOPE . . . LOWEST PRICE 30 MHz SCOPE WITH SIGNAL DELAY



**Model 1474 / $999.00**
INCLUDING PROBES

### FEATURES

• Rise time 11.7 nS or less • Built-in signal delay line permits view of high frequency pulse rise time • Triggers on signals up to 50 MHz • Mode automatically shifts between CHOP and ALTERNATE as you change sweep time • Checks most digital logic circuitry, including ECL • High accuracy ten position vertical input attenuator • Flat response with smooth rolloff past 30 MHz • Built-in high and low pass filters • Maintains calibration accuracy over 105-130 VAC range • 20 calibrated sweeps — 0.2 μS/cm-0.5 S/cm.

### APPLICATIONS

Microprocessors system development . . . Analysis and troubleshooting of mini-computer and microprocessors . . . Computer terminals . . . Video character generators . . . Video games . . . Broadcast studio application.

Logic and digital design work and troubleshooting, including electronic organs, counters, calculators, phase-locked-loops, DMM's and synthesizers . . . Check the divider network of any system using TTL, DTL, RTL and most ECL logic . . . Measure propagation delays and phase shifts . . . Troubleshoot and maintain video recording systems and equipment . . . Set sync, video and color burst levels in video systems with extreme accuracy . . . Use A-B mode to compare amplifier input output waveforms and display algebraic difference as distortion curve.

### SPECIFICATIONS

VERTICAL AMPLIFIER (Channel A and Channel B.)

Deflection Factor: 5 mV/cm to 5 V/cm, ±3% in 10 ranges, each with fine adjustment.

Freq. Response: DC, DC-30 MHz (−3 dB); AC, 10 Hz-30 MHz (−3 dB).

Rise Time: 11.7 nS or less.

Overshoot: 3% or less.

Input Impedance: 1 MΩ ±2%, 22 pF (±3;F).

Tilt: Less than 5%.

Maximum Input Voltage: 300 V DC + AC peak or 600 V p-p.

Operating Modes: CH-A, CH-B, Dual, Add.

ALT 0.2 μS/cm-0.5 mS/cm.

CHOP 1 mS/cm-0.5 S/cm.

Chop Frequency: 200 kHz ±20%.

Signal Delay: Fixed.

CH B Polarity: NORM; INV.

SWEEP SYSTEM (Common to Channel A and Channel B.)

Type: Automatic and triggered

(NORM) Mode (X-Y operation) CH A = Y, CH B = X.

Sweep Time: 0.2μS/cm-0.5 S/cm ±3% in 20 calibrated steps in a 1-2-5 sequence with vernier adjustment.

Horizontal Position Control: Pull for 5X magnification.

Sweep Magnification: x5 (five times) ±5%.

Linearity: 3% or better.

TRIGGERING

Source: INT CH A, CH B and EXT; X1 and X.1.

Slope: Positive or negative, continuously variable level control; pull for AUTO.

Range: INT DC-5 MHz, .3 cm or less. 5 MHz-30 MHz, 1 cm or less.

EXT. DC-10 MHz, 100 mV p-p or better. DC-30 MHz, 500 mV p-p or better.

Coupling: AC, DC, LF reject, HF reject. (AC) 30 Hz — 30 MHz (LF reject) signals below 10 kHz are attenuated. (HF reject) signals higher than 30 kHz are attenuated.

Non-Distorted Maximum Amplitude: More than 40 mm at 30 MHz: more than 80 mm at 10 MHz.

HORIZONTAL AMPLIFIER (Input through Channel B vertical input).

Deflection Factor: 5 mV/cm to 5 V/cm, ±5%, in ten ranges, each with fine adjustment.

Freq. Response: DC-1 MHz (−3 dB).

Input Impedance: 1 megohm (nominal), shunted by 22 pF (±3 pF).

Input Protection: 300 V DC + AC peak, or 600 V p-p.

X-Y Operation: With SWEEP TIME CM switch in CH.B position, the CH.B input becomes the X input (horizontal) and the CH.B position control becomes the horizontal position control.

OTHER SPECIFICATIONS

Calibration: 0.5 V p-p ±1% square wave at kHz ±10%).

Intensity Modulation: More than ±5V. DC-5 MHz.

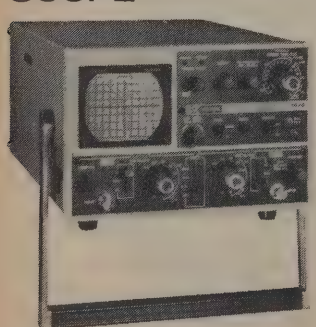
Probes: Two PR-36 probes supplied.

Power Requirements: 115/230 VAC. 50/60 Hz, 25 W.

Size (HxWxD): 18.4 x 25.3 x 36.9 cm (7⅜ x 10⅛ x 14¾").

Weight: 8.8 kg. (19.6 lbs.).

## NEW 15 MHz BATTERY PORTABLE DUAL-TRACE SCOPE



**Model 1432 / $750.00**

### FEATURES

• 15 MHz bandwidth with smooth roll-off; usable response extends beyond 30 MHz • mV/DIV. vertical sensitivity • Operates on 117 VAC, 234 VAC, 12 VDC or optional internal battery pack • Fully regulated high- and low-voltage supplies • Algebraic addition and subtraction of Channel A and B input signals • Nineteen calibrated sweep ranges cover 0.5 microsecond to 0.5 second • TTL Compatible Z-axis input • Compact size; measures only 5.5 x 8.25 x 14.3" • Includes two slim-body 10:1/direct probes and accessory tips • Built-in sync separators.

### SPECIFICATIONS

VERTICAL AMPLIFIER

Deflection Factor: 2mV/div. to 10V/div., ±5%, in 12 ranges, each with fine adjustment.

Frequency Response: DC, 15MHz (−3 dB); AC, 10 Hz-15 MHz (−3 dB).

Rise Time: 24nSec or less. Overshoot: 3% or less.

Input Impedance: 1 megohm shunted by 22 pF (±3 pF).

Non-Distorted Maximum Amplitude: More than 4 div. at 15 MHz.

Maximum Input Voltage: 300 V, DC + AC peak or 600 V p-p.

Operating Modes: Channel A only; Channel B only; A & B (dual); A + B (add); A − B (obtained by inverting CH B when in ADD mode).

Dual-Trace: Trace automatically chopped at all sweep times of 1 mSec/div. and slower; alternate mode automatically selected for all faster sweep times.

Chop Frequency: 200 kHz ±20%.

CH B Polarity: NORM; INV. Selected by mode switch.

Channel Separation: Better than 60 dB at 1 kHz.

SWEEP SYSTEM
(Common to Channel A and Channel B).

Type: Automatic and triggered (NORM).

Sweep Magnification: x5 (5 times) ±10%. Extends maximum sweep rate to 0.1 μS/div.

Sweep Time: 0.5 μS/div.-0.5 S/div. ±5% in 19 calibrated steps in a 1-2-5 sequence with vernier adjustment.

Linearity: 3% or better. 5% or better for 1 μS/div. and 0.5 μS/div. ranges.

TRIGGERING

Source: CH A, CH B, and EXT.

Automatic: Sweep is obtained without an input signal.

Normal: Sweep is obtained with a displayed signal of one division or more.

Slope: Sweep can be set to trigger on the positive- or negative-going slope of the trigger waveform.

TV Sync: Vertical and horizontal sync separator circuitry allows any portion of complex TV video waveform to be synchronized and expanded for viewing. TV-H (line) and TV-V (frame) sync switched automatically by SWEEP TIME/DIV switch. TV-V, 0.5 SEC/div. to 0.1 mSEC/div.; TV-H, 50 μSEC/div. to 0.5 μSEC/div.

Coupling: AC, 20 Hz-20 MHz.

Level: Continuously variable.

Tigger Sensitivity:
INT. NOR: 20 Hz-10 MHz/0.5 div. 20 Hz-15 MHz/1 div.
AUTO: 50 Hz-15 MHz/1 div.
EXT. NOR: 20 Hz-10 MHz/0.5 V pp 20 Hz-15 MHz/1 V pp
AUTO: 50 Hz-15 MHz/1 V pp

External Trigger Specs.: Max. Input Voltage, 50 V p-p or 25 V, DC + AC peak. Input Impedance, 100k (nominal). Input Capacitance, 35 pF (nominal).

HORIZONTAL AMPLIFIER

Input through Channel B vertical input.

Deflection Factor: 2 mV/div., to 10 mV/div., ±5%, in 12 ranges, each with fine adjustment.

Frequency Response: DC to 1 MHz (−3 dB); AC, 10 Hz to 1 MHz.

Input Impedance: 1 megohm (±5%), shunted by 22 pF (±3 pF).

Input Protection: 300 VDC + AC peak, or 600 V p-p.

X-Y Operation: With SWEEP TIME/DIV switch in CH B position, the CH B input becomes the X input (horizontal) and the CH B position control becomes the horizontal position control. Mode (X-Y operation) CH A = Y, CH B = X.

Z-AXIS INPUT

Sensitivity: TTL compatible.

Usable Frequency Range: DC to 1 MHz.

Input Impedance: 10k ohm ±20%.

Maximum Input Voltage: 30 V (DC + AC peak).

OTHER SPECIFICATIONS:

Operating Environment: +0° to +50°C.

Calibration: Internal 1 V p-p ±3% (square wave at 1 kHz ±5%).

CRT: 3" (approx. 1.5 KV) with P31 phosphor; full Mumetal shield.

Power Requirements: 117/234 50/60 Hz AC (selectable to 105-130 V and 210-260 V) or 11 to 15.5 VDC. Power consumption is 30 watts (AC). Optional battery pack available. (Minimum of 2 hours operation per charge.)

Size (Without Handle): (HxWxD) 14 x 21 x 36 cm (8.26 x 5.5 x 4.3").

Weight: 8.3 kg (18.3 lbs) with batteries.

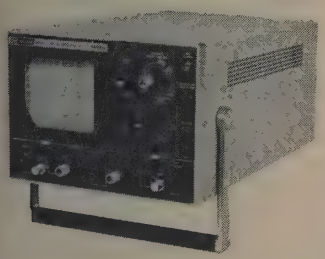
Probes: Two PR-37 10:1/direct probes and accessory tips included.

Options: LC-132 protective carrying case **$25.00, BP-32 battery pack $50.00.**

# B&K PRECISION DYNASCAN CORPORATION / OSCILLOSCOPES

Dept. EM, 6460 West Cortland Avenue, Chicago, Illinois 60635 • (312) 889-9087

## DUAL-TRACE 5" 15 MHz TRIGGERED SWEEP SCOPE . . . USABLE RESPONSE THROUGH 27 MHz



**Model 1472C/$750.00**
INCLUDING PROBES

### FEATURES

• Mode automatically shifts between CHOP and ALTERNATE as you change sweep time for fast set up • Bright Blue P31 phosphor • Flat in-band response with smooth rolloff past 15 MHz • Maintains calibration accuracy over 105-130 VAC range • Check most digital logic circuitry, including CMOS • Front-panel X-Y operation using matched vertical amps • Algebraic addition and subtraction • Differential input capability • 19 calibrated sweeps — .5 μsec/cm to .5 sec/cm • Sweep to .1 μsec/cm with 5x; 1.5 sec/cm with uncalibrated vernier • Monitor CB AM and SSB • Adjust color video to close tolerances in TV broadcast studies • TV sync separators.

### SPECIFICATIONS

VERTICAL AMPLIFIER

Deflection Factor: 0.01 V/cm to 20 V/cm, ±5%, in 11 ranges, each with fine adjustment.

Frequency Response: DC, DC-15 MHz (−3 dB); AC, 2 Hz-15 MHz (−3 dB).

Risetime: 24 nsec.

Input Impedance: 1 megohm (approx.) shunted by 27 pF (±3 pF).

Maximum Input Voltage: 300 V, DC + AC peak or 600 V p-p.

Operating Modes: Channel A only; Channel B only; Dual Trace (A and B) — trace automatically chopped at all sweep times of 1 msec/cm and slower, alternate mode automatically selected for all faster sweep times; A + B (single-trace algebraic sum of Channels A and B); A-B (single-trace algebraic difference of Channels A-B).

SWEEP

Auto and triggered. 0.5 μsec/cm to 0.5 sec/cm in 19 overlapping ranges.

Sweep Magnification: 5x at all speeds.

TRIGGERING

Source: CH A and CH B, 1 cm deflection minimum. EXT, 1 V p-p sensitivity.

Slope: Positive and negative, continuously variable level control; pull for AUTO.

Range: 20 Hz guaranteed (minimum 1 cm deflection as measured on CRT); 20 Hz-27 MHz typical.

TV Sync: Vertical and horizontal sync separator.

Low Pass Filters: TV sync separators function as 100 Hz-3 kHz (TV-V) and 100 Hz-1 MHz (TV-H) filters.

HORIZONTAL AMPLIFIER

(Input through Channel B vertical input).

Deflection Factor: 0.01 V/cm to 20 V/cm, ±5%, in 11 ranges, each with fine adjustment.

Frequency Response: DC-1 MHz (−3 dB).

Input Protection: 300 V, DC + AC peak, or 600 V p-p.

OTHER SPECIFICATIONS

Calibration Voltage: 1 kHz square wave.

Intensity (Z-Axis) Modulation: 30 V p-p minimum.

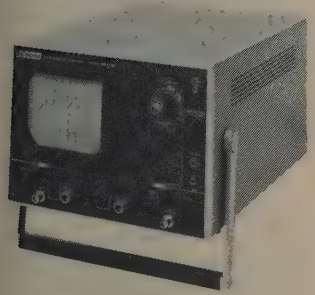
Probes: Two PR-34's supplied.

Power Required: 115/230 VAC, 50/60 Hz, 23 W; CSA-approved three-wire line cord.

Size (HxWxD): 18.4 x 25.3 x 36.9 cm (7⅜ x 10⅛ x 14¾").

Weight: 8.8 kg. (19.6 lbs.).

## DUAL-TRACE 5" 10 MHz TRIGGERED SWEEP SCOPE WITH TTL COMPATIBLE Z AXIS



**Model 1471B/$599.00**
INCLUDING PROBES

### FEATURES

• Mode automatically shifts between CHOP and ALTERNATE as you change sweep time for fast set-up • Bright blue P31 phosphor • 18 calibrated sweeps —1 μsec/cm to .5 sec/cm • Sweep to 200 nsec/cm with 5x magnification • Maintains calibration accuracy over 105-130 VAC range • Front panel X-Y operation using matched vertical amps • Input grounding switches • TV sync separators • Check most digital logic circuitry including CMOS • Character display applications using TTL Z-axis intensity modulation.

### SPECIFICATIONS

VERTICAL AMPLIFIER

Deflection Factor: 0.01 V/cm to 20 V/cm, ±5%, in 11 ranges.

Frequency Response: DC, DC-10 MHz (−3 dB); AC, 10 Hz-10 MHz (−3 dB).

Risetime: 35 nsec.

Overshoot: 3% or less at 100 kHz.

Input Impedance: 1 megohm (approx.) shunted by 25 pF (±3 pF).

Tilt: Less than 5%.

Maximum Input Voltage: 300 V, DC + AC peak or 600 V p-p.

Operating Modes: Channel A only; Channel B only; Channels A and B (dual).

Dual Trace: Trace automatically chopped at all sweep times of 1 msec/cm and slower, alternate mode automatically selected for all faster sweep times.

Chop Frequency: 200 kHz approx.

Channel Separation: Better than 60 dB at 1 kHz.

SWEEP SYSTEM

(Common to Chan. A and Chan. B.)

Type: Automatic and triggered; in automatic mode, sweep is obtained without input signal.

Sweep Time: 1 μsec/cm to 0.5 sec/cm (±5%) in 18 ranges, in 1-2-5 sequence.

Sweep Magnification: 5x at all speeds for maximum sweep speed of 200 nsec/cm.

Linearity: 3% or less.

TRIGGERING

Source: CH A and CH B; triggers at or less than 1 cm deflection. EXT 1 V p-p sensitivity.

Slope: Positive and negative, continuously variable level control; pull for AUTO.

Range: 20 Hz to 10 MHz min. (at or less than 1 cm deflection); triggers to 15 MHz.

TV Sync: Vertical and horizontal sync separator circuitry allows any portion of complex TV video waveform to be synchronized and expanded for viewing. TV-H (line) and TV-V (frame) sync switched automatically by SWEEP TIME/CM switch. TV-V, 0.5 sec/cm to 0.1 msec/cm. TV-H, 50 μsec/cm 1 μsec/cm.

Low Pass Filters: The TV sync separator circuits also function as 100 Hz-3 kHz (TV-V) and 100 Hz-1 MHz (TV-H) filters.

HORIZONTAL AMPLIFIER
(Input through Chan. B vertical input.)

Deflection Factor: 0.01 V/cm to 20 V/cm, ±5%, 11 ranges.

Frequency Response: DC-1 MHz (−3 dB).

Input Impedance: 1 megohm (nom.) shunted by 25 pF (±3 pF).

Input Protection: 300 V, DC + AC peak, or 600 V p-p.

X-Y Operation: With SWEEP TIME/CM switch in CH B position, the CH B input becomes the X input (horizontal) and the CH B position control becomes the horizontal position control.

OTHER SPECIFICATIONS

Calibration Voltage: Line frequency square wave, 1 V p-p (±5%).

Intensity (Z-Axis) Modulation: 5 V p-p nominal; 470 K nominal input resistance.

Probes: Two PR-31's supplied.

Power Required: 115/230 V, 50/60 Hz, 20 W; CSA-approved three-wire line cord.

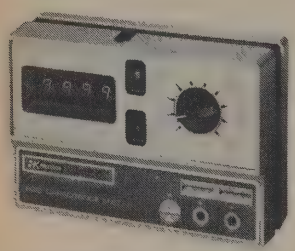
Size (HxWxD): 18.4 x 25.3 x 36.9 cm (7⅜ x 10⅛ x 14¾").

Weight: 8.8 kg. (19.6 lbs.).

# B&K PRECISION DYNASCAN CORPORATION / CAPACITANCE METER / OSCILLOSCOPES

Dept. EM, 6460 West Cortland Avenue, Chicago, Illinois 60635 • (312) 889-9087

## NEW PORTABLE DIGITAL CAPACITANCE METER



**Model 820 / $120.00**

### FEATURES

• Measures capacitance from 0.1 pF to 999,900 μF • Resolves to 0.1 pF • 10 ranges for accuracy and resolution • 4 digit easy-to-read LED display • 0.5% accuracy • Special lead insertion jacks or banana jacks • Fuse protected • Uses either rechargeable or disposable batteries • Overrange indication.

### APPLICATIONS

For capacitance measurement in lab or field, B&K-PRECISION introduces the new Model 820 Digital Capacitance Meter. The 820 is an economical multi-range capacitance meter that features digital accuracy and full portability.

Ten ranges cover from 0.1 pF to 999,900 μF with resolution to 0.1 pF. The capacitance of virtually any capacitor can be measured quickly and accurately with the 820. Because the accuracy of this unit greatly exceeds the tolerance of most capacitors, required values can be "hand selected." Matched capacitors can also be singled out for use in bridge circuits and other critical applications.

For production line applications, the 820 is an excellent means of pre-testing critical capacitors. It's so easy to use that untrained workers can be quickly instructed on proper operation. For incoming component sorting and selection, the front-panel lead insertion jacks offer fast in-out testing.

### SPECIFICATIONS

CAPACITANCE

Range: 10 selectable ranges with full scale value from 999.9 picofarads to 999.9 millifarads (reads from 0.1 pF to 999.9 millifarads).

Accuracy: 0.5% of full scale, ±1 digit to 100 μF; 1% of full scale, ±1 digit from 1 millifarad to 1 Farad.

Resolution: 0.1 pF.

Reading Time: 0.3 SEC up to 1000 μF increasing to 35 SEC max. at 1 Farad.

Overrange Indicator: (All Ranges) All bottom segments of the digits are "ON" when the capacitor value exceeds the value of the range selected.

GENERAL

Display: 4 digits LED display.

Front Panel Controls: 10-position range switch, zero adjust, ON-OFF switch.

Power Source: 4 standard "C" size cells operating from 4-6 volts, nicad, alkaline or zinc carbon, with provision for charger (Note: batteries and charger are not supplied).

Battery Life: 8 hours minimum.

Operating Temperature: 0°C to 50°C (32° to 100°F).

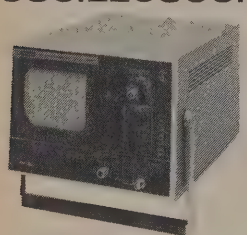
Dimension: 16 x 11 x 6 cm (6.4 x 4.4 x 2⅜").

Weight: 675 g. (1.51 lbs.) with batteries.

Accessories Included: Tilt stand, manual, spare fuse.

**Accessories Optional: BC-28 charger $9.00, BP-28 battery pack $20.00, LC-28 carrying case $7.50.**

## 10 MHz TRIGGERED SWEEP 5" OSCILLOSCOPE



**Model 1461 / $499.00**
INCLUDING PROBE

### FEATURES

• 18 sweep range selections • DC-10 mV/cm sensitivity • Fully regulated . . . Calibration is accurate from 105-130 V line • Automatic selection of horizontal or vertical TV signals • Built-in calibration signal • Triggered and automatic sweep • Built-in TV vertical and horizontal sync separation circuits.

This is one scope that's equally at home in an R&D lab or on a technician's bench. Top styling and performance form a blend uncommon in this price category.

The Model 1461 offers all the advantages of triggered sweep with automatic sync plus very high 10 mV/cm sensitivity. The eleven-position vertical attenuator is conveniently calibrated in 1-2-5 step sequence.

### SPECIFICATIONS

VERTICAL AMPLIFIER

Sensitivity: 10 mV/cm-20 V•cm ±5%, divided into 11 calibrated ranges, each with fine adjustment.

Frequency Response: DC, DC-10 MHz (3 dB); AC, 2 Hz-10 MHz (−3 dB).

Risetime: 35 nsec.

Overshoot and Ringing: 3% or less at 100 kHz square wave display.

Input Impedance: 1 megohm shunted by 22 pF (±3 pF).

Maximum Input Voltage: 300 VDC plus AC peak, or 600 V p-p.

SWEEP

Sweep System: Automatic and triggered.

Sweep Time: 1 μsec/cm-.5 sec/cm, ±5%, divided into 18 calibrated ranges (1-2-5 step sequence), each with fine adjustment.

Magnification: 5x at all speeds; increase maximum sweep to .2 μsec/cm.

Linearity: 5 sec/cm-2 μsec/cm ranges 3% or less; 1 μsec/cm 5% or less.

TRIGGERING

Source: Internal and external.

Slope: Positive or negative, continuously variable level control (pull for automatic triggering).

Range: 20 Hz-10 MHz (minimum 1.0 cm deflection on CRT screen).

TV SYNC: Vertical and horizontal sync separator circuit provided so that any portion of complex TV waveform can be syncrhonized and expanded for viewing. TV sync polarity is selected by Sync switch. TVH (line) and TVV (frame) sync switched automatically by SWEEP TIME/CM switch.

TVV (FRAME) = 0.5 sec/cm to 0.1 msec/cm, logic-increases brightness; low 1 μsec/cm.

HORIZONTAL AMPLIFIER

Sensitivity: 100 mV/cm.

Response: DC-800 kHz (−3 dB) 100.

Input Impedance: 100k ohms (nominal), shunted by 40 pF.

Maximum Input Voltage: 300 V (DC + AC Peak) or 600 V p-p.

X-Y Operation: Y (vertical) signal supplied to scope INPUT jack; X (horizontal) signal supplied to H INPUT jack.

1 V p-p square wave (±5%) at line frequency.

Intensity Modulation: 0-5 V p-p (TTL logic-compatible). High logic-increases brightness; low logic-decreases brightness. Input Resistance: 10 kΩ (nominal).

Power Requirements: 117 or 230 VAC, ±10%, 50/60 Hz, 20 watts. (3-wire line cord, CSA approved for oscilloscopes.) Calibration accuracy applies over full input voltage range.

Size (HxWxD): 18.4 x 25.3 x 36.9 cm (7⅜ x 10⅛ x 14¾").

Net Weight: 8 kg (17.3 lbs.).

PROBE (included)

Model No.: PR-31.

Attenuation: Combination 10:1 and direct.

Input Impedances: 10:1-10 megohms, 18 pF.

Connector: BNC.

Tip: Spring-loaded, hook-on tip.

## 3" SOLID STATE PORTABLE OSCILLOSCOPE

**Model 1403A / $228.00**

### FEATURES

DC to 5 MHz bandwidth, with direct-deflection input for waveforms to 450 MHz • Sharp, bright trace • DC amplifiers on both axes • New high-brightness CRT • All solid state • Weighs only 8.4 lbs.

### APPLICATIONS

The 1403A is ideal for many monitoring applications, freeing more expensive scopes from "menial" monitoring tasks. Just set the controls for the waveform being monitored and leave the rest to your tester. She'll appreciate the 1403A's sharp trace and stability. The 1403A takes up very little space on production line, classroom lab table or bench; its sturdy construction, bright display and portability make it ideal for use anywhere. This rugged "miniscope" has DC to 5 MHz bandwidth, DC amplifiers on both vertical and horizontal axes and direct-deflection terminals for waveforms up to 450 MHz. Model 1403A is completely solid state (except CRT), weighs just 8.4 lbs. and has a three-wire grounded AC cord. With test leads. Use optional PR-21 probe; all other probes with UHF to double-banana connector adapter.

### SPECIFICATIONS

VERTICAL AMPLIFIER

Sensitivity: 10 mV•div or better.

Response: DC, DC 5 MHz (−3 dB); AC, 2 Hz-5 MHz −3 dB).

Overshoot: 5% or less.

Maximum Input: 600 V peak-to-peak.

Input Impedance: 1 meg shunted by 30 pF.

Attenuator: 1, 1/10, 1/100 multiplier, ±5%.

Gain Control Range: Continuously variable range greater than 22 dB.

HORIZONTAL AMPLIFIER

Sensitivity: 300 mV/div or better.

Response: DC-250 kHz.

Input Impedance: 1 meg shunted by 30 pF.

SWEEP SYSTEM

Type: Recurrent.

Time Base Rangers: 10-100 Hz, 100-1000 Hz, 1-10 kHz, 10-100 kHz; continuously variable between ranges.

Sweep Linearity: ±5%.

Synchronization: Internal, negative.

Signal Required for Sync: (Internal) More than 1 division deflection on screen of CRT. (External) More than 2 V p-p.

GENERAL

Intensity Modulation: 25 V peak-to-peak.

Power Requirements: 117/234 VAC, 50-60 Hz, 15 W; three-wire grounded line cord.

Accessories Included: Leads, spare fuse, instructions.

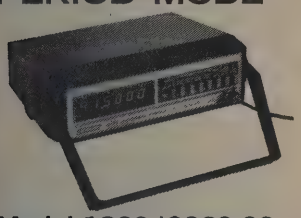
Size (HxWxD): 15 x 19 x 30 cm (6 x 7.25 x 12").

Net Weight: 3.8 kg. (8.4 lbs.).

# B+K PRECISION DYNASCAN CORPORATION / FREQUENCY COUNTERS / POWER SUPPLIES

Dept. EM, 6460 West Cortland Avenue, Chicago, Illinois 60635 • (312) 889-9087

## 80 MHz COUNTER WITH PERIOD MODE



**Model 1820/$260.00**

### FEATURES

• 5 Hz to 80 MHz reading guaranteed — 100 MHz typical • Period measurements from 5 Hz to 1 MHz • Period average, auto and manual positions • One PPM resolution • Totalizes to 999999 plus overflow • Elapsed time measurements from .01 to 9999.99 seconds plus overflow • One-megohm input resistance • Bright .43″ high LED readouts.

For frequency measurements, the 1820 reads to a typical top frequency of 100 MHz and reads signals as low as 5 Hz. By the using the period mode, accurate resolution of a 5 Hz signal is to 1 Hz. The 1820 is fully autoranging, with automatic decimal point position and MHz/kHz readout.

In the accumulate mode, "event counts" are displayed by totalizing pulses counted, up to 999.999. The 1820 also counts from .01 to 9999.99 seconds (2.777 hours) plus overrange.

### SPECIFICATIONS

FREQUENCY CHARACTERISTICS
Range: 5 Hz to 80 MHz.
Gate Time Auto: 10 ms (MHz reading) and 100 ms and 1 sec. (kHz reading).
Gate Time Manual: 1 sec. (kHz reading — 1 Hz resolution).
Accuracy: ±t.b. accuracy ±1 count.
Resolution: ±0.0001% (i.e. 1 PPM of a 6 digit scale).

PERIOD CHARACTERISTICS
Range: 5 Hz to 1 MHz.
Period Average Auto: 1 period average (ms), 10 and 100 period average (μs).
Period Average Manual: 100 period average (μs reading with 1 ns resolution).

TOTALIZE CHARACTERISTICS
Range: 5 Hz to 80 MHz.
Capacity: 0 to 999999 plus overflow.

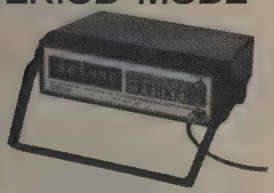
ELAPSED TIME
Range: .01 to 9999.99 sec. plus overrange.

INPUT CHARACTERISTICS
Impedance: 1 Megohm, 25 pF.
Sensitivity: 30 mV RMS, 5 Hz to 40 MHz; 50 mV maximum at 80 MHz.
Max. Input: 200 V (peak AC + DC) DC to 500 Hz, derate linearly to 30 V (peak AC + DC) at 80 MHz.
Attenuator: X10 switch selectable.

INTERNAL TIME BASE (25°C)
Type: 10 MHz Crystal Oscillator.
Setability: ±1 PPM (±1 Hz).
Stability: Less than ±0.001% (i.e. ±10 PPM) from 0°C to 50°C ambient.
Display: 6 digits .43″ high with overflow, kHz/μs, MHz/ms indicator, and leading zero blanking.

GENERAL
Power: 105 V to 130 V and 212 to 258 V, 50-60 Hz.
Size (HxWxD): 8.1 x 29 x 19 cm. (3.25 x 11.6 x 7.50″).
Weight: 2.55 kg (5 lbs.).

## 520 MHz COUNTER WITH PERIOD MODE



**Model 1850/$450.00**

### FEATURES

• 5 Hz to 520 MHz reading guaranteed • Gate time from 10 ms to 10 seconds • Full period measurement capability • 50 mV input sensitivity at 520 MHz • Operates from 115 or 230 VAC, or 12 VDC • Well protected input circuitry • Temperature compensated crystal oscillator (TCXO).

For engineers and technicians requiring accurate frequency measurement extending into the UHF range, the new Model 1850 will seem "made to order." The prescaled range covers 10 to 520 MHz while the normal range is from 5 Hz to 60 MHz. Autoranging is featured on both. Gate times from 10 ms to 10 seconds are automatically selected in the prescale mode, and 10 ms to 1 second in normal. For manual gate time selection, 1 second operation in normal and 10 seconds in prescale are selectable.

A high-accuracy TCXO (temperature compensated crystal oscillator) time base is standard.

For accurate very low-frequency measurements, the 1850 has period measurement capability, covering 5 Hz to 1 MHz.

### SPECIFICATIONS

FREQUENCY CHARACTERISTICS
Range: Normal — 5 Hz to 60 MHz.
Prescale: 10 MHz to 520 MHz; Function switch selects kHz or AUTO display reading.
Gate Time Auto: Normal — 10 ms, 100 ms and 1 sec.
Prescale: 10 ms and 100 ms, 10 sec.
Gate Time Manual: Normal — 1 sec.
Prescale: 10 sec.
Accuracy: ±0.0001% (i.e. 1 PPM of a 6 digit scale).

PERIOD CHARACTERISTICS
(Normal input only).
Range: 5 Hz to 1 MHz.
Period Average Auto: 1 period average (ms), 10 and 100 period average (μs).
Period Average Manual: 100 period average (μS reading with 1 ns resolution).

INPUT CHARACTERISTICS
Impedance: Normal — 1 Megohm, 25 pF.
Prescale: 50Ω with less than 2 V RMS input.

SENSITIVITY
Normal: 30 mV, 5 Hz to 40 MHz; 50 mV maximum at 60 MHz (5 Hz to 1 MHz in period).
Prescale: 50 mV RMS, 10 MHz to 520 MHz with 50Ω.

MAX. INPUT
Normal: 200 V (peak AC + DC) DC to 500 Hz, derating linearly to 30 V (peak AC + DC) at 60 MHz.
Prescale: 5 V RMS, 10 MHz to 520 MHz*

INTERNAL TIME BASE (25°C)
Type: TCXO (Temperature Compensated Crystal Oscillator) 10 MHz.
Stability: ±1 PPM max. 0°C to 50°C ambient.
Output: 10 MHz TTL level (rear panel BNC jack).
Display: 6 digits .43″ high with overflow kHz/μS, MHz/ms indicator and leading zero blanking.

GENERAL
Power: 105 to 130 V, and 212 to 258 V, 50-60 Hz, 11 to 16 VDC Automotive battery with accessory power cable (provided with unit).
Size (HxWxD): 8.1 x 29 x 19 cm. (3.25 x 11.6 x 7.50″).
Weight: 2.55 kg (5 lbs.).

## 30 MHz PORTABLE FREQUENCY COUNTER

**Model 1827 $120.00**

### FEATURES

• 30 MHz reading guaranteed, 50 MHz typical — COVERS ALL 40 CB CHANNELS • Full 6-digit display with range switch allows 8-digit accuracy • 1 Hz resolution — even at 30 MHz and beyond • Completely portable for use anywhere • Exclusive battery saver features auto-shutoff of display to reduce battery drain • Operates on AA size batteries, AC with optional charger/adapter or 12 VDC with optional power cord/adapter • Complete range of optional accessories for unequaled versatility • Easy to use.

Full autoranging provides direct frequency readout of the six most significant digits, or switch to the "1 second" position for 1 Hz resolution. Decimal point position and MHz/kHz indication are both automatic.

Battery saver feature electronically shuts off power to the LED display after 15 seconds of operation. DISPLAY button instantly restores the display for another 15 seconds. When on external power, DC or AC, the display remains on continuously. The 1827 can be powered from either an external 6.7 to 9.7 volts, 12 volts DC (for mobile operation) or 115 VAC with appropriate accessories.

### SPECIFICATIONS

FREQUENCY CHARACTERISTICS
Range: 100 Hz to 30 Hz (guaranteed); 50 MHz typical. Function switch selects kHz or AUTO display reading.
Gate Time: (Auto) 10 ms, 100 ms or 1 sec. (kHz reading). (Manual) 1 sec. (kHz reading, 1 Hz resol).
Accuracy: ±1 count.
Resolution: 1 PPM of a 6 digit scale.

INPUT CHARACTERISTICS
Impedance: 10kΩ min.
Sensitivity: 100 mV RMS: 200 kHz — 30 MHz 200 mV RMS: 100 Hz — 200 kHz.
Max. Input: 200 V (peak AC + DC) to 500 Hz; derate linearly to 25 V (peak AC + DC) at 30 MHz.

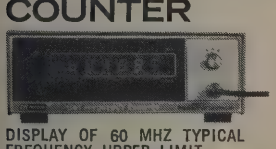
TIME BASE (25°C)
Type: 4.0 MHz Crystal Oscillator.
Setability: ±0.25 PPM (±1 Hz).
Temp. Stability: Better than ±0.001% (i.e. ±10 PPM) from 0-50°C ambient.
Display: Six .3″ high LED digits with overflow, LED kHz and MHz lights.

GENERAL
Power: 6 to 9 V ("AA" battery operation) or 6.7 to 9.7 VDC at external power jack.
Battery Life: Eight hours min. for normal usage pattern.
Battery Charging Time: 14-16 hours. Batteries are not required when operated on external power.
Size (HxWxD): 4 x 9.5 x 17 cm (1.75 x 3.75 x 6.6″).
Weight: Less than 0.45 kg (1 lb.) with batteries.

### ACCESSORIES

Model BP-27: Battery Pack, **$18.00,**
OC-52 Cable. Allows operation on external 6.7 to 9.7 volts DC, **$5.00.**
Model BP-27: Rechargeable Battery Pack, **$18.00.**
Model BC-27: Charger/AC Adapter, **$15.00.**
Model SA-10: R-F Signal Tap. Rated at 100 watts, **$12.00.**
Model LC-18: Carrying Case, **$7.50.**
Model MB-27: Mounting Bracket, **$4.50.**
Model SA-27: Pick-Up Antenna, **$6.00.**

## 40 MHz AUTORANGING COUNTER



DISPLAY OF 60 MHZ TYPICAL FREQUENCY UPPER LIMIT

**Model 1801/$200.00**

### FEATURES

• Automatic ranging 20 Hz-40 MHz guaranteed • Hz resolution • Six-digit solid-state readout with discrete reliable TTL logic • Suppression of leading digit for extra resolution above 1 MHz on 1 sec gate time • 10 MHz crystal time base for stability • User-convertible to external time base • Three automatic decimal point positions • Accepts wide input range with no level adjustment normally needed • Autoranging 20 Hz-40 MHz (typically 10 Hz-60 MHz, but may require larger input signal) • 10, 100 or 1000 msec gate times automatically selected for best accuracy and fastest reading •

### MODEL PR-25 PROBE

10:1 and 1:1 compensated counter probe (optional). **$20.00.**

### SPECIFICATIONS

FREQUENCY
Range: 20 Hz-40 MHz guaranteed; 10 Hz to over 60 MHz typical.
Auto Gate Time: 10 msec or 100 msec (MHz reading) or 1 sec (kHz reading), chosen automatically.

Manual Gate Time: 1 sec (kHz reading, 1 Hz resolution).

Accuracy: ± time base accuracy, ±1 count.

INPUT CHARACTERISTICS
Impedance: 1 meg/25 pF.
Sine Wave Sensitivity: 30 mV RMS (guaranteed); 15 mV RMS (typical).

Max. Input (peak AC + DC): 200 V to 500 Hz; linearity derated to 100 V at 1 kHz; 100 V, 1 kHz-5 MHz; linearly derated to 50 V at 40 MHz.

INTERNAL TIME BASE
(Ref. 25°C after 30 min. warmup)
Type: 10 MHz. Xtal oscillator.
Setability: ±0.1 PPM (±1 Hz).
Line Voltage Stability: Better than 1 PPM for ±10% line variation.
Temperature Stability: Better than ±0.001% (i.e., ±10 PPM), 0-50°C.
Max. Aging Rate: 10 PPM/year.

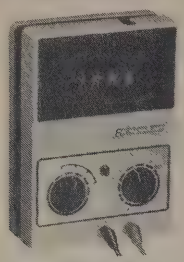
DISPLAY CHARACTERISTICS
Visual: 6 digits with overflow, kHz and MHz indicators.
Overflow: Flashing light.

GENERAL
Power Requirements: 105-130 V, 60 Hz, 25 W max.
Size (HxWxD): 8.3 x 22 x 26 cm (3.3 x 8.7 x 10.5″).
Weight: 2.5 kg (5.5 lbs.).

# B&K PRECISION DYNASCAN CORPORATION / DIGITAL MULTIMETERS

Dept. EM, 6460 West Cortland Avenue, Chicago, Illinois 60635 • (312) 889-9087

## 3½ DIGIT DMM WITH .5% ACCURACY



**Model 2810/$119.95**

### FEATURES

• 3½ digit easy to read LED display • 0.5% DC accuracy with autozeroing • 100 mV, .01Ω resolution • 10 ohm range and control to zero lead resistance • Selectable High-Low-power ohms on four ranges • Completely overload protected on all 29 ranges • 100% overrange reading to 2000 counts full scale • Protected against RF interference • Completely portable.

### THE MOST VERSATILE PORTABLE DMM WE'VE EVER OFFERED

While retaining the convenience of our popular user-oriented panel layout, we've designed into the B&K-PRECISION Model 2810 a combination of features uncommon in a portable digital VOM. Typical DC accuracy is 0.5% with a 3½ digit display. Autozeroing on all but the 10Ω range minimizes set-up time, while the 100% overranging capability reduces the need for frequent range changes.

The 10Ω range, with its .01Ω resolution, is ideal for locating a shorted winding in a transformer, motor or coil.

The high-/low-power ohms switch permits resistance measurements in solid-state circuitry without biasing semiconductor junctions. Unlike many electronic voltmeters, the 2810 can also be used in R-F energy fields. This includes use near business band, CB and amateur radio transmitters.

Like other B&K-PRECISION instruments, the 2810 is well protected against overloads.

### SPECIFICATIONS

AC-DC VOLTAGE
Ranges: ±100.0 mV, 1 V, 10 V, 100 V, 1000 V.
Input Impedance: 10 megohms.
Circuit Protection: ±1500 VDC or AC peak, all ranges.

Frequency Response: 50-1000 Hz; 50-400 Hz, 1000 V range.
Protection: ±1500 VDC or AC peak, all ranges (50 Hz-1 kHz).

DC AND AC CURRENT
Ranges: 1 mA, 10 mA, 100 mA, 1000 mA.
Circuit Protection: Diodes and externally accessible fuse, all ranges.
Nominal Voltage Drop (full scale): 200 mV; 750 mV on 1 amp range.
AC Frequency Response: 50-400 Hz.
Overrange: 100% to 1999.

RESISTANCE
Ranges: 10Ω, 100Ω, 1kΩ, 100kΩ, 10MΩ.
Protection: No component failure other than a fuse will result with application of +1000 VDC or −450 DC or 300 VAC RMS to input.

ACCURACY
Note: For all ranges add ±1 L.S.D.
DC Volts: ±0.5% of reading, ±0.1% of f.s., 1 V, 10 V, 100 V ranges; ±1.0% of reading, ±0.2% of f.s., 100 mV, 1000 V ranges.
DC Current: ±1% of reading, ±0.5% of f.s., 1 mA, 10 mA, 100 mA ranges; 1.5% of reading, ±0.5% of f.s., 1000 mA range.
AC Volts: ±1.0% of reading, ±0.25% of f.s., 1 V, 10 V, 100 V ranges; ±1.0% of readings, ±0.5% of f.s., 100 mV range; ±2.0% of reading, ±0.5% of f.s., 1000 V range.
AC Current: ±1.5% of reading, ±0.5% of f.s., 1 mA, 10 mA, 100 mA ranges: ±2.0% of reading, ±0.5% of f.s., 1000 mA range.
Resistance: ±1.0% of reading, ±0.25% of f.s., 1kΩ, 10kΩ, 100kΩ, and 1000kΩ ranges in High-Ω; ±1.5% of reading, ±0.5% of f.s., 10Ω, 100Ω, 1kΩ, 10kΩ, 1000kΩ ranges in low-Ω 1.5% of reading, ±0.5% of f.s., 10MΩ range.

GENERAL
Readout: 3½ digits, .3″ LED.
Overrange Indication: Display flashes 1999.
Polarity Indication: Automatic.
Operating Temperature Range: +15°C to +35°C; usable range at reduced accuracy: 0°C to 50°C.
Power: Four "C" size batteries — NiCad, alkaline or carbon-zinc, with provision for AC charger (Batteries and charger not supplied).
Battery Life: Better than 40 hours with alkaline batteries.
Size (HxWxD): 16 x 11 x 5 cm (6.4 x 4.4 x 2″).
Weight: 907 g. (2 lbs.).

## 3½ DIGIT PORTABLE DMM

**Model 2800/$99.95**

### FEATURES

• Reliable — fully overload protected • 3½ digit easy to read LED display • Completely portable — use it anywhere! • Auto zeroing • High/Low-power ohms for in-circuit accuracy • 1 mV, 1 μA, 0.1 ohm resolution • 10 meg input impedance, industry standard • Excellent temperature coefficient • Typical DC accuracy 1%.

Combines the features of our most popular DMM with a new 3½ digit readout capability. Other new features include an auto-zero circuit and improved overload protection. The 2800 features 22 scales that range as high as 1000 volts, DC or AC. Resolution is to 1 mV, 1 μA or 0.1 ohm. Input impedance is 10 megohms.

The 2800 has 100% overrange reading capability. This allows you to read 1999 on a scale normally limited to a maximum reading of 1000.

Alternating high-/low-power ohms ranges permit analysis of solid-state circuitry without biasing semiconductor junctions. Typical accuracy is ±19° on DC and ±1.5% AC.

### 2800, 2810 ACCESSORIES

Model BC-28: **$9.00.** AC adapter/battery charger; Model BP-28: **$20.** Rechargeable batteries; Model ES-28: 10 amp current shunt; Model LC-28: **$7.50.** Carrying Case: Model MS-28: **$3.00.** Wire tilt stand; Model PR-21: **$15.00.** Isolation/direct probe; Model PR-23: **$20.00.** RF demodulator probe; Model PR-28 High-voltage probe: **$25.00.** Model TP-28 Temperature probe **$60.00.**

### SPECIFICATIONS

AC-DC VOLTAGE
Ranges: ±0-1 V, 100 V, 1000 V.
Input Impedance: 10 megohms.
Circuit Protection: ±1000 VDC or AC RMS, all ranges.

Response: 50-400 Hz.

DC AND AC CURRENT
Ranges: 0-1 mA, 10 mA, 100 mA, 1000 mA.
Circuit Protection: Diodes and externally accessible fuse.

RESISTANCE
Ranges: 0-100Ω, 1kΩ, 10kΩ, 10MΩ. Alternate ranges are Hi and Lo power.
Protection: +1000 VDC, −450 VDC or 300 VAC RMS to input.

ACCURACY
Note: For all ranges add ±1 L.S.D.
DC Volts: ±1% of reading, ±0.25% of f.s. three lowest ranges; ±1.5% of reading, ±0.25% of f.s. 1000 V range.
DC Current: ±2.0% of reading, ±.5% of f.s. range, 1 mA, 10 mA, 100 mA ranges, ±2.5% of f.s., ±.5% of f.s., 1 A range.
AC Volts: ±1.5% of reading, ±.5% of f.s., 1 V, 10 V, 100 V ranges. ±2.5% of reading, ±.5% of f.s., 1000 V ranges.
AC Current: ±2.0% of reading, ±.5% of f.s., 1 mA, 10 mA, 100 mA ranges. ±3.0% of reading, ±.5% of f.s., 1 A range.
Resistance: ±1.5% of reading, ±.5% of f.s., ±1 LSD, 1000Ω, 1kΩ 10kΩ, 100kΩ and 1MΩ ranges. ±2% of reading, ±.5% of f.s., ±1 LSD, 10MΩ range.

GENERAL
Same as Model 2810 above.

## NEW 3½ DIGIT LAB DMM

**Model 2830 / $235.00**

### FEATURES

• Bright 3½ digit high-efficiency LED display • 0.5% DC accuracy • 100 μV, 100 nA, .01 ohm resolution • 100 mV AC and DC ranges • All ranges and functions are pushbutton selectable • Selectable high-/low-power ohms • Autozeroing • Completely overload protected • AC operation standard with DC power pack option • Easily installed optional battery pack • Built-in 10 amp current shunt • Protected against RF interference.

The new Model 2830 is well suited for all types of lab or bench operation. The bright 0.43″ high LED display is visible under virtually all types of lighting conditions and allows for fast, easy reading. With a basic DC accuracy of 0.5% and autozeroing on all ranges, the 2830 is accurate enough for most lab or servicing applications. For added efficiency, 100% overranging reduces the need for frequent range changes.

### OPTIONAL ACCESSORIES

**Model BP-30 rechargeable battery** pack. Installs in minutes with a screwdriver. Permits 8 hours of continuous use on one overnight recharging. Recharging does not interfere with the use of the 2830. **$50.00.**
**PR-21** direct/isolation probe. Has switchable 100k resistor to prevent capacitive loading when measuring DC in RF circuits. **$15.00.**
**PR-23** demodulator probe. 10 kHz-125 MHz ±2 db. **$20.00.**
**PR-28** high-voltage multiplier probe. Increases voltmeter range to 40,000 VDC. **$25.00.**
**LC-50** leatherette carrying case for protection of Model 2830 in field service or storage. Provides for storing manual and test leads. **$20.00.**
Model TP-28 Temperature probe **$60.00.**

### SPECIFICATIONS

AC-DC VOLTAGE
Ranges: ±100.0 mV, 1 V, 10 V, 100 V.
Input Impedance: 10 megohms.
Polarity Indication: Automatic, minus sign shown with plus sign implied.
Note: Average-responding circuitry calibrated to read RMS value of pure sine wave.
AC Frequency Response: 50-1000 Hz; 50-400 Hz, 1000 V range.
Protection: ±1000 VDC or AC peak, all ranges (50 Hz-1 kHz).
Overrange: 100% to 1999, except 1000 V range.

DC AND AC CURRENT
Ranges: 100μA, 1 mA, 10 mA, 100 mA, 10 A.
Circuit Protection: Diodes and externally accessible fuse, all ranges, except 10 A.
Nominal Voltage Drop (full scale): 200 mV, on 100 μA, 1 mA, 10 mA; 300 mV on 100 mA range; 1.9 V on 1 A and 10 A ranges.
AC Frequency Response: 50-1000 Hz.
Overrange: 100% to 1999.

RESISTANCE
Ranges: 10Ω, 100Ω, 1kΩ, 100kΩ, 1000kΩ, 10MΩ. High or low-power ohms selectable on 1kΩ, 10kΩ, 100kΩ, 1000kΩ, ranges.
Circuit Protection: No component failure other than a fuse will result with application of +1000 V DC or −450 V DC or 300 V AC RMS to input with ohms function selected. All ranges are protected against accidental direct connection to AC line (117 V nom.).
Polarity: Plus (+) jack is positive fo all ranges.
Overrange: 100% to 1999.

ACCURACY
Same as Model 2810 above.

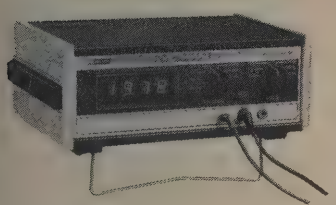
±0.5% of full scale, 100 mV range; ±2.0% of reading; ±0.5% of full scale, 1000 V range.
AC Current: ±1.5% of reading, ±0.5% of full scale, 1 mA, 10 mA, 100 mA ranges; ±2.0% of reading, ±0.5% of full scale, 100 mA, 1000 mA, 10 A, ranges.
Resistance: ±1.0% of reading, ±0.25% of full scale, 1kΩ, 10kΩ, 100kΩ, and 1000kΩ ranges in High-Ω; ±1.5% of reading, ±0.5% of full scale, 10Ω, 100Ω, 1kΩ, 10kΩ, 100kΩ, 1000kΩ ranges in low-Ω. 1.5% of reading, ±0.5% of full scale, 10MΩ range.

GENERAL
Readout: 3½ digits .43″ LED.
Overrange Indication: Display flashes 1999.
Polarity Indication: Automatic.
Operating Temperature Range: +15°C to +35°C; usable range at reduced accuracy; 0°C to 50°.
Settling Time: Typically 0.5 seconds.
Includes: 2 test leads, detachable line cord, 3 spare fuses, operating manual.
Power Requirements: 105-130 VAC, 230 VAC, 50/60 Hz. With three-wire detachable line cord. CSA listed. Optional BP-30 battery pack provides 8 hours (minimum) portable use on overnight recharging. **$50.00.**
Size (HxWxD): 8.1 x 29 x 19 cm (3.25 x 11.6 x 7.5″) including handle at rest position.
Weight: 1.5 kg (3 lbs.).

# B+K PRECISION DYNASCAN CORPORATION / VTVM MULTIMETERS

Dept. EM, 6460 West Cortland Avenue, Chicago, Illinois 60635 • (312) 889-9087

## 3½ DIGIT PORTABLE MULTIMETER



Model 283/$185.00

### FEATURES

• High intensity, reliability 3½ digit LED display for maximum readability • Selectable HI/LO ohms function allows in-circuit resistance measurement without forward biasing semiconductor junctions • Universal AC power supply • Easily installed optional battery pack • Large, bright non-blinking 7-segment digits • DC accuracy, 0.5% • Automatic polarity • Full overload protection on all ranges • 1 mV resolution.

### OPTIONAL ACCESSORIES

**Model BP-83: $50.00.** Rechargeable Battery Pack: Permits 8 hours of continuous use on one overnight recharging. **Model PR-21: $15.00.** Isolation/Direct Probe. **Model LC-83: $15.00.** Handsome leatherette case. **Model PR-23: $20.00.** Demodulator Probe. **Model PR-28: $25.00.** High Voltage Multiplier Probe (increases the voltmeter range to 40,000 VDC).

### SPECIFICATIONS

DC VOLTAGE (Auto Polarity)
Ranges: ±1.000, 10.00, 100.0 1000 V.
Maximum DC Input: 1500 VDC or DC plus AC peak.
Accuracy: 1, 10, 100 V range ±.5% of reading ±1 LSD, 1000 V ranges, ±1% of reading, ±1 LSD.
Polarity: Automatic.

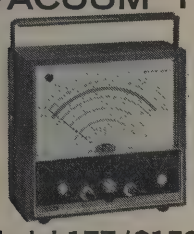
AC VOLTAGE
Ranges: ±0-1.000, 10.00, 100.0, 1000 RMS.
Maximum AC Input: 1500 V peak or 1500 VDC plus AC peak.
Accuracy and Response: 1 V, 10 V, 100 V range, ±1% of reading, ±1 LSD, 40-400 Hz; 1000 V range, ±1.5% of reading, ±1 LSD, 40-400 Hz.

AC-DC CURRENT
Ranges: 0-1.000, 10.00, 100.0, 1000 mA.
DC Accuracy: 1, 10, 100 mA ranges, ±1% of reading; ±1 LSD. 1000 mA range, ±1.5% of reading, ±1 LSD.
AC Accuracy: 1, 10, 100 mA ranges, ±1.5% of reading, ±1 LSD. 1000 mA range, ±2% of reading, ±1 LSD.
Frequency Response: 40-400 Hz.

RESISTANCE
Ranges: 0-100.0Ω; 1.000k, 10.00k, 100.0kΩ; 1.000, 10.0MΩ.
Accuracy: 1k to 1000k ranges in Hi ohms, ±1% of reading, ±1 LSD. 10MΩ range, and five lowest ranges in low ohms, ±2% of reading, ±1 LSD.

GENERAL
Display: 3½ digit, .41″ LED.
Accuracy Temperature Coefficient (15°C to 35°C): ±.25% of reading °C on DCV ranges; ±.05% °C, all other ranges.
Input Impedance: 10MΩ.
Overrange: 100%.
Overload Protection: Protected up to 1000 V on ohms ranges; to 3 A on current shunts; to 1500 V on voltage ranges.
Power: 105-125 VAC, 50-60 Hz; 230 VAC, 50-60 Hz, with 3-wire grounded detachable AC line cord and test leads.
Size (WxDxH): 23 x 18 x 19 cm (9 x 7 x 3.5″).
Weight: 2.7 kg. (3 lbs.).

## VACUUM TUBE VOLTMETER



Model 177/$150.00

### FEATURES

• Internal DC power supply for ohms ranges — no battery needed • 37 ranges, including dB and zero center scales.

The 177 includes the PR-43 DC/AC/Ohms probe with switch and ground lead. Low AC ranges have special calibrations. Features easy-to-read 7″ mirrored scale, DC polarity switch and 1% precision resistors in all critical circuits. See other meter probes on page 1497.

### SPECIFICATIONS

DC Volts: 0-.5, 1.5, 5, 15, 50, 150, 500, 1500.
AC Volts: RMS, 0-1.5, 5, 15, 50, 150, 500, 1500; peak-to-peak, 4, 14, 40, 140, 400, 1400, 4000; frequency response, ±1 dB, 40 Hz-3 MHz 600 ohm source, 5 V range).
Resistance: 0-1 K, 10 K, 100 K; 0-1, 10, 100, 1000 meg; 10 ohms center scale.
Input Resistance: 11 megs (1 meg in probe).
Accuracy: DC, ±3% f.s.; AC, ±5% f.s.
Power Required: 105-125 VAC, 50-60 Hz.
Size (HxWxD): 18 x 18 x 9 cm (7.1 x 7.25 x 3.6%).
Net Weight: 2.7 kg (6 lbs.).

## SOLID STATE ELECTRONIC MULTIMETER WITH HIGH-LOW POWER OHMS

FET Meter
Model 277/$130.00

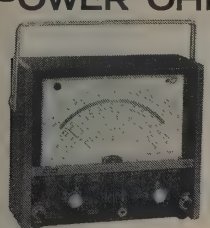
### FEATURES

• High and lower-power ohms ranges for transistor circuit test • 1 μA full scale current range for semiconductor leakage test • 15 meg input impedance • FET input • 25 ranges; overload protected • Checks its own batteries.

### SPECIFICATIONS

Multipliers: 1% precision type, frequency-compensated.
Meter: 4.5″; 50 μA movement, mirrored scale.
Protection: Meter and FET input fully overload protected; current and resistance circuits overload protected by fuse.
DC Volts: 0-.1, 3, 1, 3, 10, 30, 100, 300, 1000; zero-center capability on all ranges; accuracy, ±2% f.s.; input resistance, 15 megs.
AC Volts: RMS, 0-.1, .3, 1, 3, 10, 30, 100, 300, 1000; peak-to-peak, 0-.28, .88, 2.8, 8.8, 28, 88, 280, 880, 2800; accuracy, ±3% f.s.; input impedance, 10 megs shunted by 100 pF; frequency response, flat, 50 Hz-150 kHz.
DC Current: 0-1, 10, 100 μA; 0-1, 10, 30, 100, 300, 1000 mA; accuracy, ±3% f.s.
Resistance: Rx1, x10, x100, x1K, x1, meg, switch-selectable for 00K, x1 either .068 or 1.5 test volts; 10 ohms center-scale.
Decibles: 9 ranges from −20 to +60 dB; accuracy, ±3% f.s. (0 dB = 1 mW into 600 ohms).
Power Required: One 9 V type 2 V 6 battery and one 1.5 V "D" cell.
Size (HxWxD): 18 x 14.5 x 9.1 cm (7.25 x 5.8 x 3.6″).
(600 ohm source, 5 V range).
Net Weight: 907 g. (2 lbs.).

## SOLID STATE ELECTRONIC MULTIMETER WITH HIGH-LOW POWER OHMS



FET Meter
Model 290/$190.00

### FEATURES

• 75 ranges; ±1.5% VDC accuracy • High and low-power ohms ranges • 15 meg FET input • Fully overload protected • 50 μA full scale current range • Rx0.1 ohm range with 1 ohm scale.

### SPECIFICATIONS

DC VOLTS
10 Ranges: 0-50, 150, 500 mV; 1.5, 5, 15, 50, 150, 500, 1500 V.
Accuracy: ±1.5% f.s.
Input Resistance: 15 megs, including 100 K in PR-21 probe.
AC Rejection: Greater than 46 dB at 60 Hz.

AC VOLTS
10 RMS Ranges: 0-50, 150, 500 mV; 1.5, 5, 15, 50, 150, 500, 1500 V.
Peak-to-Peak Ranges: 0-140, 440 mV; 1.4, 4.4, 14, 140, 440, 1400, 4400 V.
Accuracy: ±3% f.s. at 60 Hz; ±5% on 500 V and 1500 V ranges.
Input Impedance: 15 megs shunted by 41 pF at input jacks.
Frequency Response: 50 mV-150 V ranges, ±0.5 dB, 20 Hz-500 kHz; ±3 dB, 5 Hz-750 kHz.

DC CURRENT
10 Ranges: 0-50, 150, 500 μA; 1.5, 5, 15, 50, 150, 500 mA; 1.5 A.
Accuracy: ±3% f.s., except ±4% on 1.5 A range.
Internal Voltage Drop: At input terminals, 50 mV on 50 mA range.

AC CURRENT
10 Ranges: 0-50, 150, 500 μA; 1.5, 5, 15, 50, 150, 500 mA; 1.5 A.
Accuracy: ±4% f.s. at 60 Hz; ±5% on 50 μA and 1.5 A ranges.
Frequency Response: ±0.5 dB, 20 Hz-5 kHz; ±3 dB, 7 Hz-16 kHz.
Internal Voltage Drop: At input terminals, 50 mV to 50 mA range.

RESISTANCE
8 Low-Power Ranges (33 mV source): Rx0.1, Rx1, Rx10, Rx100, Rx1 K, Rx10 K, Rx100 K, Rx1 meg.
Center Scale Reading: 1 ohm, Rx0.1; 10 ohms, Rx1 range.
Accuracy: ±3° of arc.

DECIBELS
10 Ranges: −40 to +66 dB.
Accuracy: ±3% f.s. (0 dB = 1 mW across 600 ohms).

GENERAL
Meter: 7″, with 6.63″ scale arc length; 100 μA movement, ±2%, 100°; mirrored scale.
Protection: Meter and FET input protected against overloads. Circuit overload protection by diodes and fuse; spark gaps for high voltage protection.
Power Required: 105-124 VAC, 50-60 Hz; also available for 240 VAC, 50-60 Hz. 3.9 W; three-wire grounded cord.
Size (HxWxD): 18 x 20 x 9 cm (7.25 x 8 x 3.6″).
Net Weight: 1:96 kg. (4.25 lbs.).

# B+K PRECISION DYNASCAN CORPORATION / COMPACT VOMS / POWER SUPPLIES

Dept. EM, 6460 West Cortland Avenue, Chicago, Illinois 60635 • (312) 889-9087

## COMPACT VOMS

### Model 115/$44.95

#### FEATURES

Unusual features include a 5 ohm mid-scale range for checking windings; and four DC current ranges to allow checks of thermocouples and oil burner controls. DC and AC voltage measurement extends to 1200 volts.

Test leads, and instructions are included; carrying case is optional. HV-12 high-voltage probe adapter is also optional and extends the 115 to 12k VDC.

#### SPECIFICATIONS

DC Volts: 0-60, 300, 1200 mV; 0-3, 12, 60, 300, 1200 V.
DC Current: 0-0.03, 0.06; 60, 600 mA.
DC Accuracy: ±3% full scale.
AC Volts: 0-6, 30, 60, 300, 600, 1200, ±4% full scale.
Resistance: 0-500, 50k, 500k, 5MΩ.
Meter: 30,000Ω VDC; 15,000Ω VAC.
Battery: 1.5 V "AA" battery; 15 V W-10 battery.
Size (HxWxD): 10.2 x 15 x 4.4 cm (6 x 4 x 1.75").
Weight: .45 kg. (.5 lb.).

### Model 110/$28.95

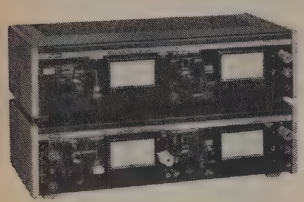
#### FEATURES

The 110's 10Ω mid-scale range allows accurate testing of coil and motor windings. Leakage resistances up to one megohm can also be measured. Test leads and detailed instructions included; LC-10 case is optional.

#### SPECIFICATIONS

DC Volts: 0-2.5, 10, 50, 250, 1000 V.
DC Current: 0.05, (250 mV), 25, 250 mA.
DC Accuracy: ±3% full scale.
AC Volts: 0-10, 50, 250, 500, 1000.
AC Accuracy: ±4% full scale.
Resistance: 0-1k, 100k, 1 M.
Meter: 20,000 VDC; 10,000 VAC.
Battery: 1.5 V "AA" battery.
Size (HxWxD): (5 x 3.5 x 1.5").
Weight: 35 kg. (.4 lb.).

## LABORATORY POWER SUPPLIES



### Model 1601/$240.00

#### FEATURES

• Isolated 0-50 VDC, continuously variable; 02 A in four ranges • Fully automatic shutdown, adjustable current limit • Perfect for solid state servicing.

#### SPECIFICATIONS

Input Voltage: 105-125 VAC, 60 Hz.
Output Voltage: 0-50 VDC, continuously variable; two ranges, 0-25 and 0-50 VDC.
Output Current: 02 A in four ranges — 0-50 mA, 0-0.2 A, 0-0.5 A, 0-2 A.
Load Regulation: Minimum, 0.05%; maximum, 0.1%; typical, 0.07%.
Line Regulation: 0.02% typical from 105 to 125 VAC with output of 50 VDC and 2 A.
Ripple: 5 mV peak-to-peak.
Temperature Coefficient: .012% of output voltage per °C.
Size (HxWxD): 9.8 x 35 x 25 cm (3.8 x 14.13 x 10").
Net Weight: 5 kg. (11 lbs.). Complete with leads and instruction manual.

### Model 1602/$260.00

#### FEATURES

• 0-400 VDC, 0-200 mA, continuously variable • 0 to — 100 VDC, 0-2 mA and 12.6/6.3 VAC at 3.5A • Fully automatic shutdown, adjustable current limit.

#### SPECIFICATIONS

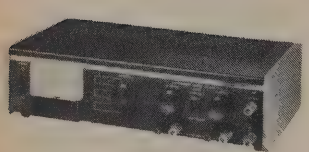
Input Voltage: 105-125 VAC, 60 Hz.

400 VDC SUPPLY
Output Voltage: 0-400 VDC, continuously variable.
Output Current: 0-200 mA.
Load Regulation: 0.1%.
Line Regulation: 0.1% for 105-125 VAC line.
Noise and Ripple: Less than 10 mV peak-to-peak.
Protection: 0-200 mA adjustable shutdown.

BIAS SUPPLY (100 VDC)
Output Voltage: 0 to —100 VDC continuously variable, floating.
Output Current: 0-2 mA.
Load Regulation: 1%.
Line Regulation: 1%.
Noise and Ripple: Less than 10 mV peak-to-peak.
Protection: Current-limiting resistance.

12.6 AND 6.3 VAC (NON-ADJUSTABLE)
Output Voltage: 12.6 or 6.3 VAC ±5% no-load, floating.
Output Current: 3.5 A continuous.
Protection: Thermal circuit breaker on front panel.
Size (HxWxD): 9.8 x 35 x 25 cm (3.88 x 14.13 x 10").
Net Weight: 5 kg. (11 lbs.).

## NEW TRI-OUTPUT POWER SUPPLY



### Model 1650 / $250.00

#### FEATURES

• Functions as three separate power supplies • 5 VDC, 5 A fixed output • Two separate 0 to 25 VDC outputs at 0.5 A • Fully automatic, current-limited overload protection • Unique tracking circuit allows automatic tracking of variable DC outputs • + and — terminals of each output are fully isolated, even when in automatic tracking mode • All three outputs may be connected in series or parallel for higher voltage or current requirements.

Our new Model 1650 tri-output power supply was designed for modern solid-state applications where both linear and digital circuits are encountered. In one package, this unit combines the features of a separate 5 VDC fixed-output supply and two 0-25 VDC variable supplies. The 5 volt output is rated at 5 amps, to satisfy power requirements of complex digital devices.

#### SPECIFICATIONS

Input Voltage: 105-125 VAC, 60 Hz.

OUTPUT VOLTAGES
5 Volt Supply: 5 Volts DC ±5%.
A Supply: 0 to 25 VDC.
B Supply: 0 to 25 VDC.

OUTPUT CURRENT
5 Volt Supply: 5 A max; A & B Supplies: 0.5 A current lim.

REGULATION
Load: 0.1% (25 mV) variation to full-load on 25 V supplies. 3% (150 mV) variation from 10 m.A. to 5 A change in load current on 5-volt supply.
Line: 0.2% (50 mV) for a line voltage change of 20-volts on 25 V supplies. 0.4% (20 mV) for a line voltage change of 20 volts on 5 V supply.

NOISE RIPPLE
All supplies: 5 mV RMS. (not applicable to "A" in track mode).

GENERAL
Current limiting: Limiting for each 0-25 V supply fixed slightly above rated current for short-circuit protection. The 0-5 V supply has automatic fold-back to 2.5 A short-circuit.

TRACKING
(0-25 V Supplies): "A" Supply Tracks "B" supply at a fixed or selected ratio. Applies whether the supplies are connected in series, back-to-back or are completely isolated.
Tracking Error: ±1% of rated voltage (±250 mV).
Size (HxWxD): 3.9 x 14.1 x 10 cm (3.88 x 14.13 x 10").
Weight: 22 lbs. CSA listed.

## MOBILE EQUIPMENT POWER SUPPLY

### Model 1640/$100.00

#### FEATURES

• Regulated adjustable output from 11-15 VDC, 0-3 A • Fully automatic overload protection, manual reset, 5 A surge limit • Perfect for servicing CB radios and all other 12 volt mobile equipment.

#### APPLICATIONS

Citizens Band transceivers . . . Auto tape decks . . . Auto radios . . . FM converters . . . Electronic ignitions.

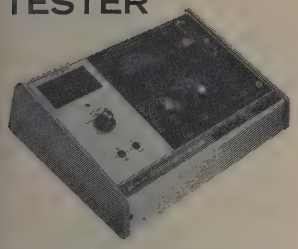
#### SPECIFICATIONS

Input Voltage: 117 VAC, 60 Hz.
Output Voltage: 11-15 VDC, continuously variable.
Output Current: 0-3 A continuous, 5 A surge limited.
Meter: Voltmeter-ammeter, pivot and jewel movement (illuminated). Metering function selected by switch.
Overload Indicator: LED glows after overload; turns off when overload is cleared.
Ripple: Less than 8 mV RMS; 0-3 A.
Load Regulation: Less than 0.8% voltage change from 0-3 A, 11 V to 15 V.
Line Regulation: Less than 0.8% voltage change at 3 A output ±10% line variation.
Short Circuit Protection: Voltage shutdown, manual reset. Surge current limited to 5 A maximum.
Size: (HxWxD): 7.8 x 25 x 22 cm (3⅛ x 10 x 8½").
Weight: 3.6 kg. (8 lbs.).

# B+K PRECISION / DYNASCAN CORPORATION / TRANSISTOR TESTERS

Dept. EM, 6460 West Cortland Avenue, Chicago, Illinois 60635 • (312) 889-9087

## LAB QUALITY SEMI-CONDUCTOR TESTER



**Model 530/$310.00**

### FEATURES

• Measures transistor beta or FET gm • Measures transistors cut-off frequency up to 1500 MHz • Non-destructive testing of transistor and diode breakdown voltages • Measures $I_{CES}$ and $I_{DSS}$ • Fast testing of transistors, FET's, and SCR's — in or out-of-circuit • Base diagrams are not required • No biasing information required • Identifies all leads of transistors and SCR's • Automatic identification of PNP/NPN types and N or P channel FET's.

### SPECIFICATIONS

IN-CIRCUIT TESTS

Good/Bad Test: For bipolar transistors, FET's and SCR's.

Identifies: All leads of bipolar transistors and SCR's, and gate lead of FET's. Also identifies device polarity by automatically indicating PNP, NPN, and P or N channel FET's.

OUT-OF-CIRCUIT TESTS

Measures: Transistor beta, gm, $f_t$, $I_{CES}$, $I_{DSS}$, $BV_{CES}$, and PIV.

Transistor Beta: Two Ic ranges (low power, 20-600; high power, 20-200).

gm: OF FET's

$f_t$: Three ranges (1-100 MHz; 50-750 MHz; 750-1500 MHz). $I_{CES}$ and $I_{DSS}$: From .5 μA to 5 mA. $BV_{CES}$ of transistors and PIV of diodes at 10 V (5 mA max.) or variable 10-100 V (100 μA max.).

Accuracy: Within 10% for β, gm, and $f_t$ tests.

INDICATORS

Audible tone for GOOD indication. Front panel switch provides tone defeat. LED Lamps identify device polarity, including NPN, PNP, or N or P channel FET's. Panel Indicator and Test Switch identifies all leads of transistors and SCR's and base lead of FET's.

Jacks and test leads are color coded.

Meters indicate other device parameters.

APPLIED TEST CURRENTS

Collector: 125 mA at 4% duty cycle.

Base: 250 mA at 4% duty cycle (HI drive); 1 mA at 4% duty cycle (low drive).

Test Repetition Rate: 10 per second.

Voltage for Leakage Test: Variable from 10-100 VDC.

High-power beta and gm Tests: Special 300 μS, 1% duty cycle current pulses enable testing at 2 amps without over-dissipation of device under test. Maximum beta (200) and maximum gm (400 millimhos) correspond to test current of 2 amps.

LIMITING IN-CIRCUIT SHUNT VALUES FOR IN-CIRCUIT GOOD/BAD TEST

Resistance: Down to 10Ω (HI drive). Down to 1.5kΩ (LO drive).

Capacitance: Up to 15 μF (HI drive). Up to 0.3 μF (LO drive).

GENERAL

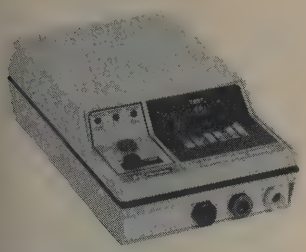
Color-coded Mini-lock clips for hands-free operation. Detailed instruction manual. Optional FP-5 Dynaflex three-lead, one-hand probe for easy in-circuit testing.

Power Required: 105-125 VAC, 60 Hz, 10 watts.

Size (HxWxD): 18 x 33 x 9 cm (7 x 13 x 3½″).

Net Weight: 2.3 kg. (5 lbs.).

## PORTABLE INDUSTRIAL TESTER



**Model 510/$97.00**

### FEATURES

• Fast GO/NO-GO in-circuit transistor testing • Fast and thorough GOOD/BAD out-of-circuit testing • Tests FET's and SCR's in-circuit or out-of-circuit • Connect any test clip to any component lead • Gives positive emitter-base-collector identification in LO drive — positive base identification in HI drive • Light-Emitting Diodes indicate NPN-OK or PNP-OK • Pocket-size — over 100 hours of testing from single set of "AA" cells • Digital stability — no adjustments; nothing to go out of calibration.

### SPECIFICATIONS

IN/OUT-OF-CIRCUIT TESTS

GOOD/BAD test for transistors, FET's and SCR's.

Identifies transistors as NPN or PNP.

FET as N-channel or P-channel.

Identifies FET gate lead.

Identifies all leads of transistors in LO drive; base lead in HI drive.

Identifies all leads of SCR.

APPLIED TEST CURRENTS

Base Drive: 250 mA (HI) or 1 mA (LO) at 2% duty cycle.

Collector Drive: 125 mA at 2% duty cycle.

Test Repetition Rate: 5 Hz.

IN-CIRCUIT SHUNT LIMITS FOR VALID GOOD/BAD TEST:

Resistance: Down to 10 ohms with HI drive; down to 1.5 K ohms with LO drive.

Capacitance: Up to 25 μF with HI drive; up to .3 μF with LO drive.

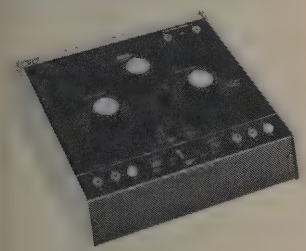
Power Requirements: 6 VDC from four "AA" cells, not supplied. Standby current, 4 mA; average testing current, 12 mA.

Accessories: Carrying Case and test leads supplied. Model FP-5 Dynaflex Probe (optional) may be used in place of test leads.

Size (HxWxD): 4.4 x 9.5 x 6.6 cm (1.75 x 3.75 x 6.6″).

Weight: 450 g. (1 lb.).

## SEMICONDUCTOR CURVE TRACER



**Model 501A/$198.00**

### FEATURES

• Display characteristic curves for all semiconductor devices on your scope • Built-in current limiting protects devices under test • Pinpoint bad devices in-circuit • Measure breakdown voltage non-destructively • Identify unknown devices.

### SPECIFICATIONS

COLLECTOR SWEEP

Range: 0-100 VDC peak at 100 mA maximum.

Polarity: NPN (N-Channel) or PNP (P-Channel).

Current Limiting: Automatic at approximately 130% of full scale for each vertical attenuator range.

STEP GENERATOR

11 Current Rangers: 1, 2, 5, 10, 20, 50 μA per step; .1, .2, .5, 1, 2 mA per step; ±3% constant-current steps.

5 Voltage Ranges: .05, .1, .2, .5, 1 V per step, ±4%; source resistance, 1 K.

Number of Steps: Six, continuous display.

Step Polarity: Same as Collector Sweep (NPN); inverted in VOLTS/STEP positions.

CALIBRATION

Source: ±.05 to 5 V p-p, ±3% accuracy.

Attenuator Range: 1, 2, 5, 10, mA per division vertically, ±3%.

GENERAL

Sockets: Two TO-5 type transistor sockets (right and left) with each pin (three per socket) paralleled by a banana jack or external cables. Slide switch selects right or left socket.

Output Terminals: Banana jacks for vertical, horizontal and ground outputs to oscilloscope.

Accessories Included: Cables to scope, mylar 10 x 10-division graticule, detailed instruction manual and FP-5 probe.

Power Requirements: 105-125 VAC, 50-60 Hz; also available for 230 VAC, 60 Hz. With three-wire cord.

Size (HxWxD): 10.2 x 25 x 24 cm (4 x 10 x 9.5″).

Net Weight: 1.35 kg. (3 lbs.).

## INDUSTRIAL TRANSISTOR TESTER

**Model 520B $175.00**

### FEATURES

• Now with HI/LO drive • Works in-circuit when others won't • Identifies all three transistor leads • Random lead connection • Audibly and visually indicates GOOD transistor • Automatic NPN/PNP determination • Positive Si/Ge identification • Tests diodes, SCR's, FET's, and Darlingtons.

### SPECIFICATIONS

IN-CIRCUIT TESTS

Good/Bad Test: For PNP and NPN transistors. FET's and SCR's.

Identifies: NPN or PNP.

OUT-OF-CIRCUIT TESTS

Good/Bad Test: For PNP and NPN transistors. FET's, SCR's, leakage and loss.

Identifies: NPN or PNP; silicon or germanium transistors.

Measures: Reverse leakage from 0.1 μA to 5 mA.

AUTOMATIC INDICATORS

Audible Tone for GOOD indication. LED Lamps identify NPN or PNP devices and Ge or Si types. Test Switch automatically identifies base or gate lead for good transistors or FET's.

Meter Scales: Readable from 0.1 μA to 5 mA for Ice leakage; calibrated for silicon and germanium power and signal transistor leakage limits.

APPLIED TEST CURRENTS

Collector: 250 mA at 5% duty cycle.

Base: 125 mA at 5% duty cycle.

Test Repetition Rate: 10 per second.

Leakage Test Reverse Voltage: 2.0 V.

LIMITING IN-CIRCUIT BASE-EMITTER SHUNT VALUES FOR VALID TESTS

Resistance: Greater than 10 ohms.

Capacitance: Less than 15 μF.

GENERAL

Accessories: Color-coded test leads with Mini-Lock clips; detailed instruction manual; optional FP-5 Dynaflex™ three-lead, one-hand probe for easy in-circuit testing available.

Power Required: 105-125 VAC, 50-60 Hz; also available for 230 VAC, 50-60 Hz.

Size (HxWxD): 20 x 17 x 8.9 cm (8 x 7 x 3.5″).

Net Weight: 2.27 kg. (5 lbs.).

# B&K PRECISION DYNASCAN CORPORATION / FUNCTION GENERATORS / SIGNAL GENERATORS

Dept. EM, 6460 West Cortland Avenue, Chicago, Illinois 60635 • (312) 889-9087

## NEW SWEEP / FUNCTION GENERATOR

**Model 3020 / $325.00**

### FEATURES

• Four instruments in one package — sweep generator, function generator, pulse generator, tone-burst generator • Covers 0.02 Hz-2 MHz • 1000:1 tuning range • Low-distortion high-accuracy outputs • Three-step attenuator plus vernier control • Internal linear and log sweeps • Tone-burst output is front-panel or externally programmable.

The new Model 3020 is the most versatile signal source ever offered by B&K-PRECISION. This one instrument can actually replace a function generator, sweep generator, pulse generator and tone-burst generator. Frequency coverage spans 0.02 Hz to 2 MHz in seven ranges, with each range providing linear 1000:1 frequency control. Operating frequency can be varied on each range by the front panel frequency control or the VCO external input.

### SPECIFICATIONS

FREQUENCY CHARACTERISTICS
Range: .02 Hz to 2 MHz in 7 ranges. (Each range provides 1000:1 frequency control.)
External Control (rear panel input): VCO range greater than 1000:1 (linear).
Accuracy: ±5%.
Stability: .05% (after 15 min.)
Functions: Sine, Triangle, Square, TTL Square Wave, Pulse, Tone Burst.
Square Wave: Variable amplitude and fixed TTL output.
Symmetry: 99% to 100 kHz.
Rise/Fall Time: <100 ns at maximum output.
TTL Square Wave Response: <25 ns rise/fall time (logic 0<0.4; logic 1>2.4 V).
Sine Wave: Variable amplitude.
Distortion: <1% 0.2 Hz to 100 kHz, <0.5% typical.
Amplitude Flatness. Better than ±0.3 dB to 2 MHz at maximum output amplitude.
Triangle Wave: Variable amplitude.
Linearity: 99% at 100 kHz.
Variable Symmetry: 40:1 range, independent of frequency or output waveform.
AM Modulation: 0-1.5 V p-p external signal provides 100% modulation; continuously variable. Capable of suppressed carrier operation.

SWEEP CHARACTERISTICS
Internal: Linear or log.
Sweep Rate: 0.5 Hz (2 SEC period) to 50 Hz (20 ms period).
Sweep Width: Variable from 10:1 to 1000:1.
Sweep Voltage Output: Proportional to sweep; at rear GCV connector.
External Sweep: Rear panel VCO input provided.

TONE-BURST CHARACTERISTICS
Burst Width: Adjustable from 5-90% of period of internal gating frequency. External gating, burst width determined by TTL gating pulse.
Repetition Rate: 0.5 Hz (2 SEC period), to 50 Hz (20 ms period) set by SWEEP RATE control.

OUTPUT
Amplitude: 20 V p-p open circuit; 10 V p-p into 50Ω.
Control: Continuously variable, >20 dB. Fixed attenuation, 0-40 dB in 3 steps. This, together with 30 dB variable, provides 60 dB total attenuation.
Impedance: 50Ω ±5%.
D.C. Offset: Continuously variable, maximum of ±10 V open circuit or ±5 V into 50Ω. (Maximum AC peak + VDC offset without clipping is ±20 V open circuit; ±10 V into Ω).

GENERAL
Rear Panel Jacks: (All phono) VCO (sweep) input, GCV voltage out (proportional to frequency), AM input, TTL output, tone-burst control external input.
Operating Environment: 0-50°C (Accuracy specified at 25°C ±5°C.)
Power Requirements: 105-130 VAC, 60 Hz, 22 W. Three-wire cord.
Size (HxWxD): 8.1 x 29 x 20 cm (3.2 x 11.3 x 5″) including handle at rest position.
Weight: 1.35 kg. (3.1 lbs.) CSA listed.

## NEW LOW DISTORTION FUNCTION GENERATOR

**Model 3010 / $175.00**

### FEATURES

• Generates sine, square and triangle waveforms • Variable amplitude and fixed TTL square-wave outputs • 0.1 Hz to 1 MHz in six ranges • Push button range and function selection • Typical sine wave distortion under 0.5% from 0.1 Hz to 100 kHz • Variable DC offset for engineering applications • VCO external input sweep-frequency tests.

B&K-PRECISION's new model 3010 function generator offers convenience and excellent waveform accuracy at an affordable price. Frequency coverage is unusually wide, spanning 0.1 Hz to 1 MHz in six ranges, with each range providing linear 100:1 frequency control.

The 3010 features a variable DC offset control which provides up ±5 VDC (into 600Ω) combined with the selected audio output frequency. Engineering applications for this feature are many and varied. For square-wave operation, the 3010 offers a fixed TTL output level and a variable amplitude output. Variable output square wave rise or fall time is 100 nanoseconds or less; TTL square wave rise/fall time is 25 nanoseconds or less. Square-wave symmetry at 100 kHz is a near-perfect 99%. The 3010 generates a near-perfect triangle-wave output by providing 99% linearity at 100 kHz. As a sine-wave generator, the 3010 is conservatively rated at less than 1% distortion from 0.1 Hz to 100 kHz; less than 0.5% is typical.

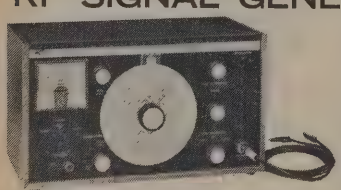
### SPECIFICATIONS

FREQUENCY CHARACTERISTICS
Range: 0.1 Hz to 1 MHz in six ranges. (Each range provides >100:1 frequency control.)
External Control (rear panel input): VCO ≥100:1 (linear) on any frequency range. (With dial setting at .1, a 0 to 5.5 V input ramp produces a frequency change of 100:1).
Accuracy: 5% of full scale on all ranges. (Calibrated at full scale).
Stability: 05% (after 15 min.).
Functions: Sine, Triangle, Square, TTL Square Wave.
Square Wave: Variable amplitude or fixed TTL output.
Symmetry: 99% to 100 kHz.
Rise/Fall Time: <100 ns at maximum output.
TTL Square-Wave Response: <25 ns rise/fall time (0 <.4 V: 1> 2.4 V).
Sine-Wave: Variable amplitude.
Distortion: <1% 0.1 Hz to 100 kHz; <0.5% typical.
Amplitude Flatness: <.3 dB to 1 MHz at maximum output amplitude.
Triangle Wave: Variable amplitude.
Linearity: 99% at 100 kHz.

OUTPUT
Amplitude: 20 V p-p open circuit 10 V p-p into 600Ω.
Control: Continuously variable, >30 dB range.
Impedance: 600Ω ±5%.
D.C. Offset: Continuously variable, maximum of ±10 V open circuit or ±5 V into 600Ω. (Maximum VAC + VDC offset without clipping is ±10 V open circuit; ±5 V into 600Ω).

GENERAL
Operating Environment: 0-50°C (accuracy specified at 25°C ±5°C).
Power Requirements: 105-130 VAC, 60 Hz, 8 W. Three-wire cord.
Size (HxWxD): 8.1 x 29 x 20 cm (3.2 x 11.3 x .5″) including handle at rest position.
Weight: 1.3 kg. (2.9 lbs.). CSA listed.

## SOLID STATE RF SIGNAL GENERATOR



**Model E200D / $275.00**

### FEATURES

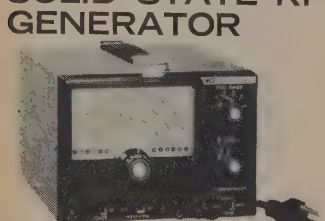
• 100 kHz to 216 MHz in 5 bands • Completely shieldeed RF output w/ modulation percent metering and variable monitored attenuation usable to less than 1 μV • Bult-in 100 kHz and 1 MHz crystal calibration system • Easy-setting 2-color 5″ anti-backlash vernier dial.

Features 100% silicon transistor circiutry and zener-regulated power supply for accuracy, stability and long life. Double shielding eliminates spurious radiation even at outputs of 1 μV. Internal crystal calibrator has accuracy of better than 0.1%. Has 200 μA d'Arsonval meter for accurate monitoring and setting of RF carrier and modulation levels.

### SPECIFICATIONS

Frequency Range: 100 kHz-54 MHz in 5 bands; 54-216 MHz on harmonics.
Accuracy: ±1.5% of highest frequency on any range used; better than 0.1% obtainable with crystal calibrator.
Output (calibrated into 50Ω load): 100,000 μV maximum.
Output Level Calibration Accuracy: ±1 dB to 54 MHz.
Attenuation: 6 individually shielded step attenuators with total attenuation capability of −96 dB. Outputs as low as 106 dB below 100,000 μV can be obtained with fine output level control and calibrated meter, which provides variable −10 dB to +2 dB output level indication (0 dB = 100,000 μV into 50Ω).
Modulation: 400 Hz, nominal. External sensitivity; 1 VRMS for 50% modulation.
Crystal Calibrator: 1 MHz ±.05% crystal oscillator. Bulit-in detector, amplifier and speaker provided for calibration.
Power Requirements: 110-130 VAC, 50-60 Hz; 6 W. Also available for 234 VAC, 50-60 Hz. Three-wire grounded line cord.
Size (HxWxD): 18 x 32 x 20 cm (7.25 x 12.75 x 8″).
Net Weight: 4.5 kg. (10 lbs.).

## SOLID STATE RF SIGNAL GENERATOR



**Model 2050 / $125.00**

### FEATURES

• 100 kHz to 30 MHz in 6 bands, with 1.5% accuracy • 3 Outputs: RF, modulated RF (400 Hz) and externally modulated RF • Positive anti-backlash dial drive • Zener-regulated power supply • 100% solid state • FET's for stability.

Rugged versatile, accurate RF signal generator is built to withstand the rigors of continuous industrial use, yet it's compact and light-weight — weighs only 5 lbs. Zener-regulated power supply is internally fuse-protected. Isolated RF output gives maximum protection against external voltage sources.

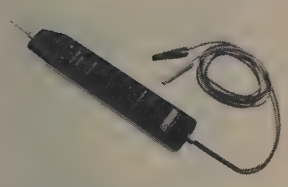
### SPECIFICATIONS

Frequency Ranges: 100 kHz to 30 MHz on 6 fundamental bands.
Accuracy: 1.5% of dial setting.
Output: 0.1 VRMS or better (20°C).
Attenuator: Combination HIGH-LOW switch, plus continuously variable RF OUTPUT control for approximately 20 dB change.
Modulation, Internal: 400 Hz; 40%, ±5%.
Modulation, External: 40 Hz to 10 kHz; modulating voltage input, 1.5 VRMS for 40% or better modulation.
Operating Temp. Range: 0-50°C.
Power Requirements: 117 VAC (also available for 230 VAC) 50-60 Hz; 2.8 W. three-wire grounded line cord.
Size (HxWxD): 15 x 19 x 25 cm (6.1 x 7.5 x 9.75″).
Net Weight: 2.2 kg. (5 lbs.).
Accessories: Supplied with shielded leads with insulated clip and banana plug; detailed instruction manual.

# B&K PRECISION DYNASCAN CORPORATION / PROBES / CABLES

Dept. EM, 6460 West Cortland Avenue, Chicago, Illinois 60635 • (312) 889-9087

## NEW 50 MHz DIGITAL PROBE



**Model DP-50 / $50.00**

### FEATURES

• Multi-family, compatible with TTL, DTL, RTL, HTL, CMOS, MOS and HiNIL • Displays DC to 50 MHz • Displays pulse presence and logic states • Memory mode to "freeze" pulse display • Pulse mode "stretches" short pulses • **2 megohm input impedance** • Input overload protected • Typically detects pulses to 10 ns.

### APPLICATIONS

Simplify and speed de-bugging of digital circuits . . . Analyze digital circuits for design changes . . . Trace a pulse throughout a circuit . . . Demonstrate logic state changes and digital circuit operation for classroom use . . . Microprocessor troubleshooting . . . Digital control circuit troubleshooting . . . MRO applications.

The new B&K-PRECISION DP-50 50 MHz digital probe simplifies the troubleshooting and analysis of digital circuits by clearly displaying in-circuit logic activity. The DP-50 is a multi-family device that is compatible with TTL, DTL, RTL, HTL, CMOS, MOS and high-noise immunity logic (HiNIL).

This compact instrument is easy to handle in tight spaces yet includes every important logic probe feature. Three bright LED indicators display pulse presence and high- and low-logic states. Unlike many logic probes, the DP-50 digital probe will continue to indicate pulse presence through its maximum frequency of 50 MHz. For high-speed or intermittent pulses, the DP-50 offers a MEMORY mode to "freeze" and store the pulse display.

### SPECIFICATIONS

INPUT CHARACTERISTICS
Maximum Input Frequency Displayed: 50 MHz.
Minimum Detectable Input Pulse Width: 20 ns (10 ns typical).
Duty Cycle: LED intensity is directly proportional to duty cycle observed, up to 50 MHz (and a 10 to 1 ratio).
Pulse Standard Mode: Will detect and stretch any input pulse.
Memory Mode: Will detect and latch any input pulse.

LOGIC THRESHOLDS
TTL-DTL: Logic One: 2.4 V; Logic Zero: 0.8 V.
CMOS: Logic One: 70% of supply voltage; Logic Zero: 30% of supply voltage.
Input Overload Protection: ±50 VDC.
**Input Impedance: 2 megohms in all modes.**

GENERAL
Power Requirements: 5 to 15 VDC (30 ma @ 5 VDC; 90 ma @ 15 VDC) protected to +20 VDC.
Reverse Polarity Protection: −50 VDC.
Operating Temperature: 0 −50°C.
Size (HxWxD): 16.25 x 3.12 x 1.9 cm.
Lead Length: 75 cm.
Weight: 98 g.

## HIGH-VOLTAGE MULTIPLIER PROBE

**Model PR-28 / $25.00**

### FEATURES

• Extends voltmeter range to rated 40,000 VDC • Accurate to ±2% • Safe one-hand testing • Use with any high-impedance voltmeter (10 megohm input or greater).

The PR-28 can be used with B&K-PRECISION Models 277, 280, 281, 282, 283, 290, 2800, 2810 and 2830 or with any other constant-impedance voltmeter to extend its range to 40k VDC.

### SPECIFICATIONS

Voltage Range: Usable to 40 kVDC and 20 kVAC (60 Hz); multiplies instrument range by 1000 (e.g., 40 V becomes 40,000 V); may be used with any instrument having a constant impedance of 10 megohms or greater.
Impedance: 600 ohms nominal.
Accuracy: ±2%, plus instrument accuracy.
Calibration: Internal; factory calibrated at 25 kV.
Frequency Range: DC-80 Hz; 20 kVAC max. at 60 Hz.
Size: (HxDia.xCord) 35.56 x 5.72 x 76.2 cm (14 x 2.25 x 30").
Weight: 199 g. (7 oz.).

### Carrying Case Model LC-32 / $6.00

Use this optional vinyl case to carry your PR-28 or HV-40 safely to any job.

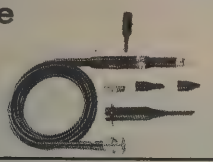
## HIGH-VOLTAGE 40 kVDC PROBES DIRECT-READING

**Model HV-44 / $35.00**

The HV-44 high-voltage probe meter offers extreme reliability and user safety. Voltage measurements up to 40,000 volts are performed accurately and quickly. The HV-44 is factory calibrated at 25 kV and should never need recalibration. Accuracy at 25 kV is ±2% and ±3% at full scale. The core magnet type meter is unaffected by common outside magnet fields and is highly shock resistant. The probe body is molded of high-impact ABS plastic for maximum insulation and lightest weight. The HV-44 will hold-up under the most active field service conditions, preventing down time and possible lost business. Supplied with two interchangeable tips: one conventional round needle type and one specially designed flat spring type for easy access to CRT anode. Model LC-32 vinyl carrying case is optional.

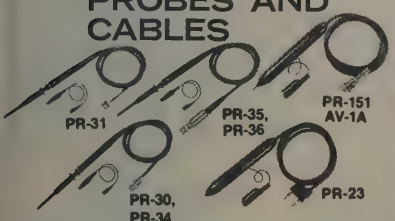
## Deluxe 10:1 / Direct Probe

### Model PR-37 / $38.50



The B&K-PRECISION Model PR-37 deluxe probe is designed for use with wideband oscilloscopes to 100 MHz. The PR-37 is a slimbody probe of precision lightweight construction. A three-position switch selects 10:1 or direct modes, or a reference position that grounds the tip through a 9M resistor. The 52" coaxial cable is extremely flexible. Accessories include with the PR-37 are a spring-loaded retractable tip cover, insulating tip, BNC tip adapter, IC tip and an insulated compensation capacitor adjustment tool. The PR-37 is available in both grey and red colors for instant identification of which channel a probe is connected. Order model PR-37G (grey) or PR-37R (red).

## PROBES AND CABLES




**Model PR-23 RF Detector/Demodulator Probe: $20.00.** An all purpose detector/demodulator probe usable with any electronic voltmeter (both analog and digital) or oscilloscope Models 1403, 1431, 1400, 1460, 1465, 1470, and 1472. Typical Freq. Res. ±2 dB 15 kHz to 125 MHz, within 6 dB at 250 MHz. With UHF connector; banana plug adap- and 1403 A.

**Model PR-30 Combination 10:1/Direct Probe: $26.00.** Input Z: Low-capacity, 10:1, 10 megohms/12 pF; direct, 1 megohm/120 pF. With spring-loaded clip-tip and UHF connector.

**Model PR-31 Combination 10:1/Direct Probe: $26.00.** Input Z: Low-capacity, 10:1, 10 megohms/12 pF; direct 1 megohm/120 pF. With spring-loaded clip-on probe tip and BNC connector.

**Model PR-34 10:1/Direct Low-Capacitance Probe: $31.00.** Designed to prevent ringing when used with extended bandwidth scopes such as the B&K-PRECISION Model 1472. Input Z: 10:1 10 megohms/18 pF; 1:1, 1 megohm, 120 pF. Max. Input: 500 Vp-p. With spring-loaded clip-on tip and UHF connector.

**Model PR-35 10:1/Direct Low-Capacitance Probe: $31.00.** Designed for use with 15 MHz scopes. Input Z: 10:1, 10 megohms/18 pF; 1:1, 1 megohm, 120 pF. Max. Input: 500 Vp-p. With spring-loaded clip-on tip and BNC connector.

**Model PR-36 10:1/Direct Low Capacitance Probe: $36.50.** Designed for scopes with bandwidth extending beyond 30 MHz. Input Z: 10:1, 10 megohms/18 pF; 1:1, 1 megohm, 120 pF. Input Voltage: 500 Vp-p. With spring-loaded clip-on tip and BNC connector.

**Model AV-1A RF Probe: $22.50.** Extends frequency range to 250 MHz. For use with Model 177 VTVM.

**Model AV-2B High-Voltage Probe: $25.00.** Extends DC voltage range to 50,000 VDC. For use with Model 177 VTVM.

**Model PR-21 Isolation/Direct Probe: $15.00.** Prevents capacitive loading and RF interference when measuring DC in RF circuits. Has switchable 100 K ohm isolating resistor. Termination in molded double banana plug.

**Model PR-25 10:1 and 1:1 Compensated Counter Probe: $20.00.** Reduce possibility of double counts when measuring square waves or digital steps, with Model 1801. Direct impedance 1 meg, shunted by 110pF; 10:1 impedance 10 meg, shunted by 10 pF. Frequency Response: 20 Hz to 60 MHz. BNC connector.

**Model PR-43 DC/AC/Ohms Probe: $17.00.** Exact replacement for probe supplied with Model 177 VTVM's.

**Model PR-151 Demodulator Probe: $17.00.** Use for viewing RF and IF modulation waveforms on scopes, and exact replacement for probe furnished with Model 415 Alignment Generator.

**Model TP-41 Terminated RF Cable: $15.00.** Exact replacement for cable furnished with B&K-PRECISION Model 415 Alignment Generator. With selectable terminations of 75 or 300 ohms.

**Model FP-5 "Dynaflex" Probe. $18.00.** Positive contact is assured by spring-loaded needle-sharp tips. Spacing of 3 tips, adjustable with one hand, from 1/32" to 5/8". Each tip is colored-coded. For Model 501A, Model 520B, Model 530 or Model 162 or with any VTVM, or VOM having banana jacks.

## INSTRUMENT CONNECTING CABLES

**Model CC-41: $7.50.** 36" RG/58 U with a BNC connector on each end.

**Model CC-42: $7.50.** 36" RG/58 U with BNC connector and UHF connector (PL-259).

**Model CC-43: $9.00.** 36" RG/58 U with BNC connector and banana plugs.

**Model CC-44: $8.00.** 36" RG/58 U with BNC connector and coaxial microphone connector.

**Model CC-45: $9.50.** 36" RG/58 U with BNC connector and Type N connector.

**Model CC-46: $7.50.** 36" RG/58 U with UHF connector (PL 259) on each end.

**Model CC-47: 06.00.** 36" zip cord with spade lugs and cigarette lighter plug.

**Model CC-48: $9.00.** 36" audio coax with 1/4" phone plug and dual banana plug.

**Model CC-49: $7.00.** 36" audio coax with phono plug to dual banana plugs.

**Model CC-50: $7.00.** 36" audio coax with 3.5 mm mini-phone plug to dual banana plug.

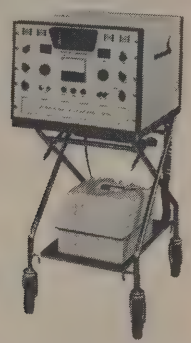
**Model CC-51: $7.00.** 36" audio coax with RCA phono plug to alligator clips.

# CABLEMASTER DIVISION
(213) 341-9200

## AUTOMATIC CABLE HARNESS AND CONNECTOR TESTERS

### CABLEMASTER 400-C

**A field proven 400 circuit tester for in-plant use.**



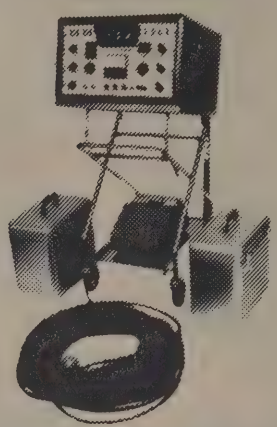
The Cablemaster Model 400-C is a 400 point sequential tester which measures continuity, insulation resistance and dielectric strength (hipot) quickly — accurately — enoconmically. It is ideal for use in receiving inspection, production, quality control, laboratories, field maintenance, operational sites and in a wide range of applications where complete and reliable cable or connector testing is desired with one compact unit. It is equipped with a removable mobile carrier. The 400-C sequences thru the 400 points at a rate of up to 120 steps per minute checking each point for the parameter under test.

**CHECK THESE OUTSTANDING FEATURES**

- Continuity to 59 ohms, and to 3 amps
- Insulation resistance to 5K meg variable voltage
- Dielectric strength (hipot) AC and DC to 3000 volt
- Simplified multiple circuit testing. (More than 2 ends to each wire)

### CABLEMASTER 400S

**For shipboard and aircraft checkout of installed cables**



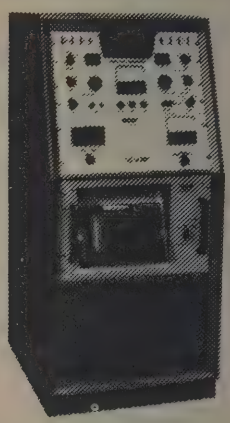
The Model 400-S Cablemaster is a modified Model 400-C, designed to test long, installed cables in ships, aircraft, launch facilities and nuclear plants where test points may be hundreds of feet apart. It contains a scanning feature for finding crossed wires which is used in making retrofits and troubleshooting new systems.

**OPTIONS**

- Printed record
- AC current monitor for actual current readings
- AC capacitance compensation
- Megohmmeter panel for exact resistance measurements
- Digital printout of measurement values

### CABLEMASTER 5000M

**A 5000 point programmable tester**



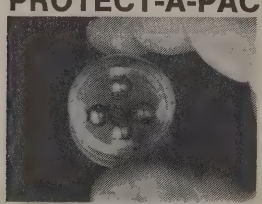
The Model 5000M is a Random Access 5000 Point Tester that is completely programmable for points, parameters, limits and accessories with a maximum test voltage of 1500 VAC/VDC. In hipot, it can perform any of the functions of the 400-C, including all the options. It can be reduced or increased in a number of points to meet needs of any type of testing.

- Low ohms analyzer for discrete low resistance values
- Digital readout of discrete values for each of the above accessories
- Rise time control for application of high voltage 220 volt units available

# IMPACT-O-GRAPH DIVISION
(213) 341-3000

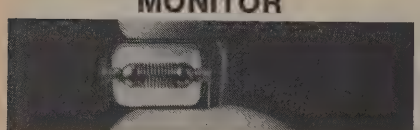
## SHOCK & VIBRATION INDICATORS ACCELEROMETERS & RECORDERS

### PROTECT-A-PAC



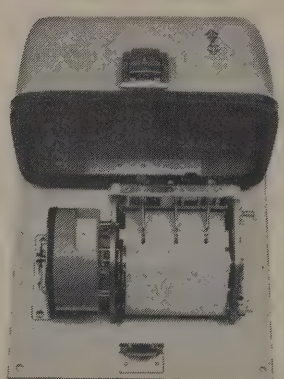
Miniature non-resettable accelerometer monitors shocks from all directions. Tells at a glance if excessive shock has been encountered. Available in ratings from 5g to 300g.

### INERTIAL THRESHOLD MONITOR



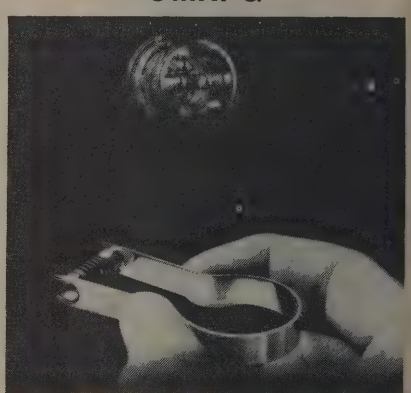
Shock-Fuse™ is a subminiature stick-on jolt indicator designed for OEM monitoring of products. Any impact above factory-set value permanently trips the unit to give visual proof of excessive shock exposure. Available in any shock level from 5g to 500g.

### IMPACT-O-GRAPH RECORDER



IMPACT-O-GRAPH recorders are available in sensitivities of 2g to 300g full scale deflection. Recording period of various models is from (1) one minute to (1) one year. Independent style record time, direction and magnitude of shocks in three separate axis. Self contained — no outside power source necessary. For sale or lease. Lightweight and compact.

### OMNI-G



**THE ONLY RESETTABLE ALL-DIRECTIONAL SHOCK INDICATOR**

- Low cost, compact accelerometer
- Easy to reset
- Monitors shocks from all directions
- Available in ratings from 2g to 500g
- Repeatable accuracy within 40% of rated value
- Can be recalibrated at nominal cost

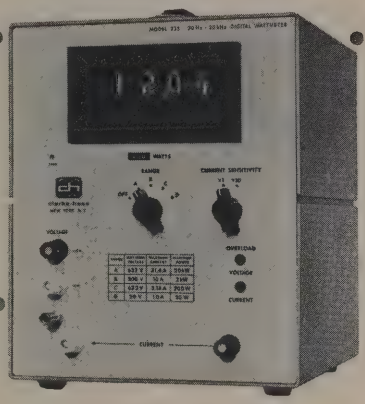
# CHATSWORTH DATA CORPORATION

DEPT. EM, 20710 LASSEN STREET / CHATSWORTH, CALIFORNIA 91311 / (213) 341-9200
CABLEMASTER DIVISION (213) 341-9200 / IMPACT-O-GRAPH DIVISION (213) 341-3000

NEW

# unique instrumentation

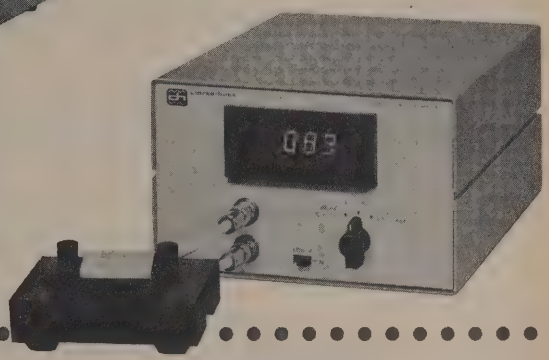
## Model 255
**VOLT-AMPERE-WATT METER**
**True RMS/d-c to 300 kHz/Waveshape Independent**
Accuracy: 0.6% in mid frequency range.
5.000A/500.0mA/50.00mA/5.000mA and 20.00V/200.0V/1000V
Twenty-four power combinations between 10.00 mW and 5000 W.
Power factor for "sinusoidal-like" waveshapes. (BCD outputs and/or remote programming of functions available as options.)
Price: $985.00



## Model 235
**WIDEBAND WATTMETER**
20Hz — 20 kHz; 2W — 20kW. Full scale up to 31 A/630 V. down to 100 mA/20 V. Accuracy 1%, any connection. Power Factors 0-1. Easy to connect and to read. BCD output available. Various range combinations available: 6 to 600 V, 10 mA to 31 Amperes.
Price: $2,495.00

## Model 273A
**DIGITAL ESR METER**
The industry standard for 100 kHz ESR measurements. The Model 273A measures Equivalent Series Resistance values from 0.1 milliohm to 20 ohms. Handles any type of capacitance with values from 5,000 pF up to 1 farad. In use by the world's leading capacitor users. The Model 273A allows production line monitoring in capacitor manufacture and 100% incoming inspection for capacitor users with critical loss requirements. BCD outputs standard.
Price: $875.00

Model 273A also measures internal impedance of *Batteries*, contact resistance of *Relays*, and the effective loss term in *Networks*.



# function generators

All function generators with sine, square, and triangular waveshapes, Tone Burst, Phase Lock Synchronization, Wide Range low distortion VCF and/or FM. All extend down to 1 mHz with "Low Frequency Expand Switch". All generators have sine wave distortions below 46 dB and extremely flat sine wave amplitude vs frequency characteristics. Most units sweep to twice the upper dial frequency. All generators have 50 ohm output, 60 dB of output range.

## Model 743
**TONE BURST, PHASE LOCK SYNC.**
Dial Controlled 1 Hz to 2 MHz. Low distortion FM or VCG. Price: $395.00

## Model 748
**DIAL CONTROLLED 1 Hz to 2 MHz.**
High quality, low distortion AM or suppressed carrier modulation or detection.
Price: $535.00

## Model 744
**TONE BURST, PHASE LOCK SYNC.**
Dial Controlled 3 Hz to 3 MHz. Balanced 600 ohm output. Price: $445.00

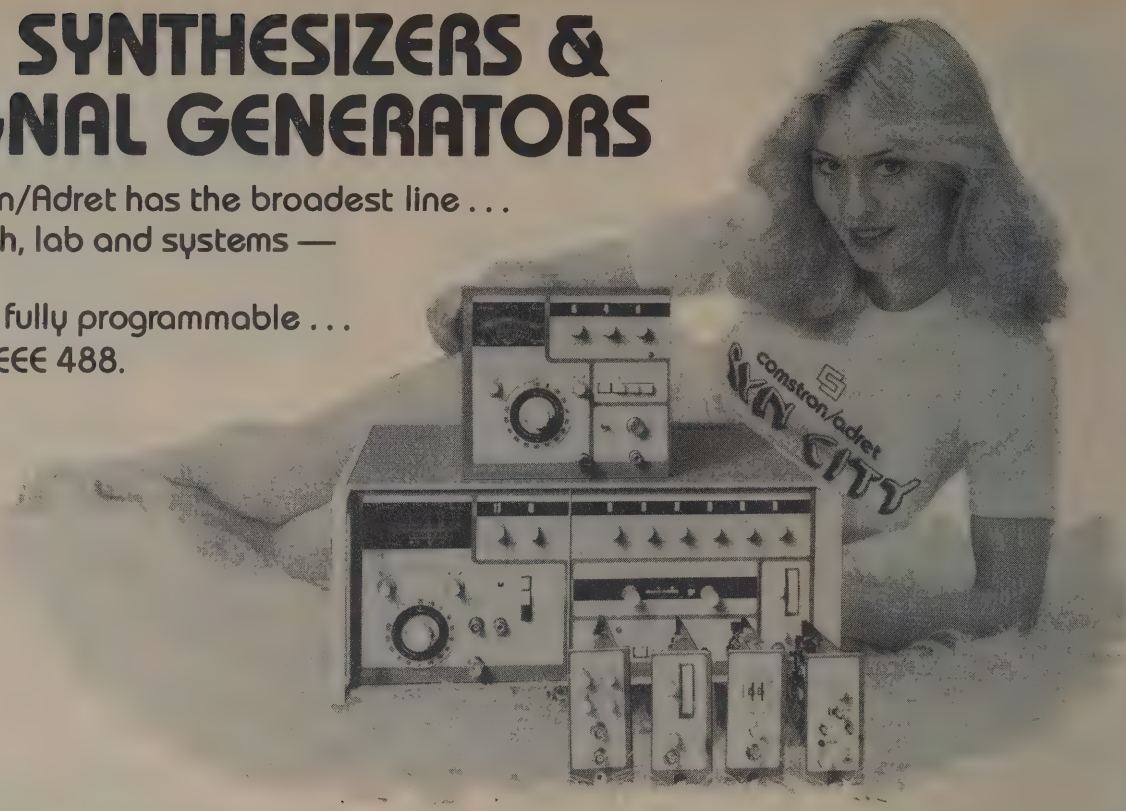
## Model 750
**DIAL CONTROLLED 1 Hz to 2 MHz.**
Internal ramp generator with sweep times from 1 msec to 200 seconds.
Price: $495.00

**clarke·hess** COMMUNICATION RESEARCH CORP.
156 FIFTH AVENUE • NEW YORK, N.Y. 10010 • (212) 255–2940

# SYNTHESIZERS & SIGNAL GENERATORS

Comstron/Adret has the broadest line . . .
for bench, lab and systems —

All units fully programmable . . .
BCD or IEEE 488.




**MODEL 6300 (with 6100 main frame)**
**FREQUENCY SYNTHESIZER • SIGNAL GENERATOR**
**300 Hz- 110 MHz**
Resolution: 1 Hz (0.01 Hz with plug-in 6504)
• Continuous frequency adjustment • Sweep with markers (with plug-in 6501A) • Output level: +20 dBm /50Ω
• Programmable attenuator: 150 dB dynamic range, 1 dB steps and verniers • AM/FM capability (with plug-in 6506)

**MODEL 6315 (with 6100 mainframe)**
**GENERATOR SYNTHESIZER**
**400 kHz - 600 MHz**
Resolution: 1 Hz (0.01 Hz with plug-in 6504)
• Continuous frequency adjustment • Sweep with markers (with plug-in 6501A) • Output level: +13 dBm /50Ω
• Programmable attenuator: 140 dB dynamic range, 0.1 dB steps and verniers
• AM, FM and PM capability (with plug-in 6506)

**MODEL 6316 (with 6100 mainframe)**
**GENERATOR SYNTHESIZER**
**400 kHz - 1.2 GHz**
Resolution: 2 Hz (.02 Hz with 6504 plug-in)
• Continuous frequency adjustment • Sweep with markers (with plug-in 6501A) • Output level: +3 dBm /50Ω
• Programmable attenuator: 140 dB dynamic range, 0.1 dB steps and verniers
• AM,|FM and PM capability (with 6506 plug-in)

**MODEL 6303 (with 6100 main frame)**
**PROGRAMMABLE SYNTHESIZED**
**SPECTRUM ANALYZER**
**DC - 110 MHz**
Resolution: 1 Hz • Impedance: 50Ω, 75Ω, 150Ω, 600Ω,
• Analysis bandwidth: 10 Hz/100 Hz
• Dynamic range: up to 120 dB
• Residual noise: 0.1 μV to 3μV

**MODEL 6301**
**LEVEL GENERATOR**
**FREQUENCY SYNTHESIZER**
**100 Hz - 120 MHz**
Resolution: 1 Hz • Two output channels (774 mVrms/75Ω)
• Output level flatness: ±0.025dB

Auxiliary Plug-ins (for 6100 main frame)

**6501A** Sweep with Markers
Provides internal and external sweep capabilities as well as markers.

**6502** Frequency Comparator
Measures the frequency difference between the synthesizer and an external frequency.

**6504** Resolution Extension
Provides extended resolution to 0.01 Hz (.02 Hz with 6316 RF plug-in) with full programmability.

**6506** Internal AM, FM and PM
Provides internal fixed frequency generators for sine or square wave modulation. Amplitude, frequency, and phase modulation can be selected.

**MODEL 3300**
**GENERATOR SYNTHESIZER/**
**FREQUENCY SYNTHESIZER**
**300 Hz - 60 MHz**
Resolution: 1 Hz • Continuous frequency adjustment
• Output level: + 20 dBm/50Ω (75Ω with option 020)
• Attenuator: 150 dB dynamic range, 10 dB steps and verniers
• AM/FM capability

**MODEL 3310**
**GENERATOR SYNTHESIZER/**
**FREQUENCY SYNTHESIZER**
**300 Hz - 60 MHz**
Resolution: 0.1 Hz • Output level: + 20 dBm/50Ω
(75Ω with option 020)
• Programmable attenuator: 100 dB dynamic range, 0.1 dB resolution

### MODEL 3100
### GENERATOR WITH WIRED OPTIONS
### 0.01 Hz - 200 kHz

Resolution: 0.01 Hz • Two 90° phase-shifted outputs • Waveforms: ~ and ⊓⊔ • Output level: 10 V peak • Impedance: 5Ω – 50Ω Options: • Programmable attenuator: 80 dB dynamic range, 0.1 dB resolution • Programmable phase-shifter: 0° to 359.9° with 0.1° resolution • Search function/Sweep with markers.

### Model 2230
### GENERATOR SYNTHESIZER for Telecommunications Applications
### 10 Hz - 1 MHz

Resolution: 1 Hz • Output level: +20 dBm • Programmable attenuator: dynamic range 90 dB, Resolution 0.01 dB; • Impedance: 5Ω, 50Ω, 75Ω, 600Ω • Balanced Output • Tracking frequency with 4 MHz offset • Level flatness ±.05 dB; • IEEE 488.

### MODEL 2430
### GENERATOR SYNTHESIZER for Telecommunications Applications
### 300 Hz - 18.6 MHz

Resolution: 1 Hz • Output level: +20 dBm • Programmable attenuator: 100 dB dynamic range, 0.1 dB resolution • Impedance: 5Ω, 75Ω, 150Ω, 600Ω • Level flatness: ±0.05 dB • Balanced Output • Tracking frequency with 24 MHz offset.

### MODEL 201
### GENERATOR SYNTHESIZER
### 0.1 Hz - 2 MHz

Resolution: 0.1 Hz • Continuous frequency adjustment • Output level: + 13 dBm /50Ω • Attenuator: 100 dB dynamic range, 1 dB resolution • AM/FM capability

### MODEL 201 SB
### FREQUENCY SYNTHESIZER
### 0.1 Hz - 2 MHz

Resolution: 0.1 Hz • Output level: 3 Vrms • Impedance: 1Ω, 50Ω, 75Ω, 600Ω • Output level flatness: ±0.02 dB • Attenuator: 50 dB dynamic range, 10 dB steps and verniers • Tracking frequency with 2 MHz offset.

### MODEL 1010
### FREQUENCY SYNTHESIZER
### Spin Wheeled Tuned
### 1.0 Hz - 10 MHz in 2 ranges

Resolution: 1Hz (to 100 kHz) 100 Hz (to 10 MHz) 5 digit synthesizer at the price of an ordinary oscillator . . . clean signals - leveled, displayed, high output power with crystal accuracy in a precision user oriented instrument. (Not programmable)

### MODEL 1013
### FREQUENCY SYNTHESIZER
### 0.1 Hz - 13 MHz in 5 ranges

Programmable, BCD or IEEE 488 5 digit synthesizer at the price of an ordinary oscillator . . . clean signals - leveled, displayed, high output power with crystal accuracy in a precision user oriented instrument.

### MODEL 1013A
### FREQUENCY SYNTHESIZER
### 0.1 Hz - 13 MHz in 5 ranges

This unit is the same as the Model 1013, but has the added feature of programmable attenuation: 90 dB dynamic range, 0.1 dB Resolution.

## Synthesized Metrology Instruments

### MODEL 4101
### SYNTHESIZED FREQUENCY STANDARD RECEIVER

Maintains time-standard accuracy on loss of power or signal for approximately 24 hours. Tuning frequency: 15 kHz to 200 kHz • Resolution: 20 Hz • Sensitivity: 5 μVrms • Standard frequencies: 1 MHz/5 MHz/10 MHz • Accuracy: $5 \times 10^{-10}$

### MODEL 4110
### FREQUENCY ERROR MULTIPLIER

Input frequencies: 10 MHz and submultiples (down to 1 MHz) • Multiplication rate up to 10,000 • Acquisition time: < 0.2 s Error Measurement: Resolution: $10^{-8}$ to $10^{-12}$

## OEM SYNTHESIZER

### MODEL 5104
### Programmable Compact OEM Synthesizer for Phase-Locked Sources
### 90 to 120 MHz

Resolution: 10 Hz; Phase Noise: −120 dB/Hz at 10 kHz from carrier.

### Synthesized Master Oscillators

4500 & 507: Master Oscillator for television transmitters
5130 : Master Oscillator for medium-wave transmitters
5104 : Master Oscillator for microwave sources
5102 : Master Oscillator for SSB Transmitters

The name to remember in synthesizers.

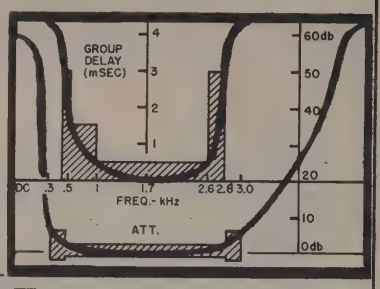
# comstron/adret

200 East Sunrise Highway, Freeport, New York 11520 • (516) 546-9700 TWX 510-225-3699

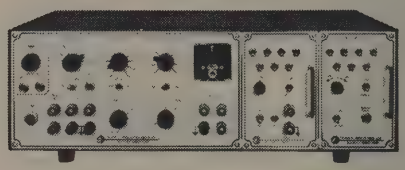
# COMSTRON·SEG TELEPHONE CHANNEL TEST AND SIMULATION EQUIPMENT

## STANDARD TELEPHONE DATA LINE SIMULATORS

- Simulates nominal worst case attenuation and delay per Bell, CCITT, and DCS Schedules.
- Simulates 3002, C1, C2, C4, and DCS-S1, S2, S3.
- Also available; C-Message Weighting, A Weighting, 3kHz Flat, and Tone Notches.



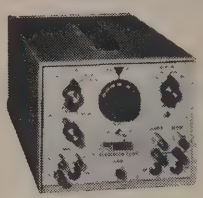

## PHASE JITTER SIMULATOR



FA-1564A

- Simulates normally encountered active telephone channel impairments such as phase jitter, phase hits, harmonic distortion, broadband and impulse noise and frequency translation
- Simulates phase jitter; 0 to 45° peak-to-peak; jitter frequencies, 20 to 300Hz
- Use for developing, testing and evaluating data-com equipment

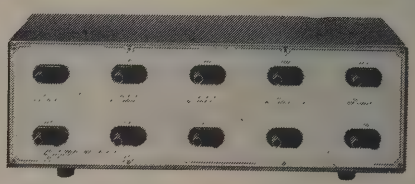
## TUNABLE BAND PASS AND BAND REJECT FILTER



AF-850A

- Telephone channel filter tunable from 35Hz to 3500Hz
- Use for notched noise measurements and waveform analysis; 3.5Hz and 35Hz bandwidth
- Fully compatible with telephone channel transmission measuring techniques and equipment
- 0dB, 10dB, 20dB, 30dB gain and by-pass functions
- Generates reference signal at Fc of notch and bandpass

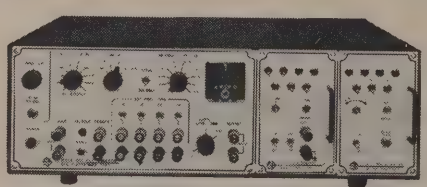
## TELEPHONE DATA LINE SIMULATOR



Model LSCC-( )

- Contains up to 5 data line simulators
- Industry standard telephone line simulator
- Simulates nominal worst case attenuation and delay, per Bell, CCITT, and DCS schedules
- Simulates 3002, C1, C2, C4 and DCS-S3
- Controlled out-of-band characteristics
- Also available: C-Message Weighting, F1A Weighting, Telephoto 1 and 2, etc.

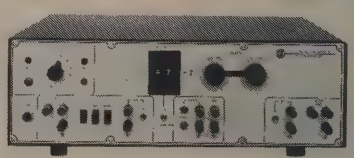
## DROPOUT SIMULATOR



FA-1955A

- Simulates data-channel dropout; adjustable duration from 1 ms to 10 seconds and depth from −3dB to greater than −50dB
- Simulates additive broadband and impulse noise, SFI tones and out-of-band signals
- Operates in band limited mode, with SEG Telephone Data Line Simulators, or in broadband metallic mode

## DIGITAL DELAY (ECHO) GENERATOR



FA-1755

- Simulates data channel delay and/or echo
- Delay to 100 ms* in 1 ms steps
- Stores 99 ms* of transient input data and continuously regenerates it for analysis or utilization as additional channel impairment
- Bandwidth 200Hz to 3.4kHz delay-corrected to 50usec
- Echo adjustable to 49dB in 1dB steps

*Up to 2 seconds available

FOR APPLICATIONS ENGINEERING ASSISTANCE CALL 516-546-9700

Comstron-Seg

200 East Sunrise Highway, Freeport, New York 11520 (516)546-9700 ■ TWX 510-225-3699

Why buy?

# Rent or lease ...and save!

**Continental can deliver the right instrument at the right price — now!**

We have rental, lease and purchase plans to suit your needs: **Standard Rental Plan** — The standard rental term is for one month. After the first month, rentals are pro-rated daily for partial months. **Rental/Purchase Plan** — Continental offers a rental plan with an option to purchase the equipment. A substantial portion of your rental payment is credited towards the purchase of the equipment. **40 Month Scope Lease Program** — This plan is available for Tektronix Model 465, 475 and other oscilloscopes. Reasonable quantities of Tektronix scopes are available for immediate delivery. Check our local office for a current price. **Special Annual Agreements** — These agreements are based on either volume or long-term requirements and they provide for discounts that make renting even more attractive.

**PLUS**

**LATEST EQUIPMENT.** Your choice of hundreds of electronic instruments. All the latest models. From virtually every leading manufacturer.

**IMMEDIATE PRE-PAID DELIVERY.** Usually 24-48 hours, from any of our 10 regional centers located across the country. Pre-paid to 48 contiguous states.

**RELIABLE EQUIPMENT.** Continental's four complete calibration, repair, and maintenance laboratories assure you of receiving only fully tested, guaranteed instruments.

**GUARANTEED PERFORMANCE.** Should any Continental instrument ever fail, we'll immediately ship you a backup. And we'll pay the shipping charges.

## FOR IMMEDIATE RESPONSE CALL:

**New England:** (617) 275-0850
**N.J., N.Y. (except L.I.):** (201) 654-6900
**Long Island, N.Y.:** (516) 752-1622
**Philadelphia area:** (609) 234-5100
**Washington, D.C. area:** (301) 948-4310
**Florida & Southeast:** (800) 638-4050
**Illinois & Midwest:** (312) 439-4700
**Texas & South Central:** (800) 323-9656
**California:**
Santa Clara: (408) 249-9870
Costa Mesa: (714) 540-6566
Carson: (213) 638-0454

Send for free catalog today!

**CONTINENTAL RESOURCES, INC.**
175 Middlesex Turnpike • Bedford, Mass. 01730 • (617) 275-0850

# CURTIS

## ANALOG ELAPSED TIME INDICATORS

... Smallest size, lowest cost, AC or DC, any voltage

**How they work** — The patented Curtis Ampere Hour Meter is basically a mercury microcoulometer fabricated from precision bore, glass capillary tubing filled with two columns of mercury separated by a small electrolyte gap. Application of pure or pulsed DC signals to electrodes inserted in the mercury causes mercury at the anode to be electrochemically transferred across the gap to the cathode at a time rate proportional to the current. The gap moves along the tube length as a function of the current-time integral. A constant-current supply provides a precision timing device.

### TYPICAL APPLICATIONS

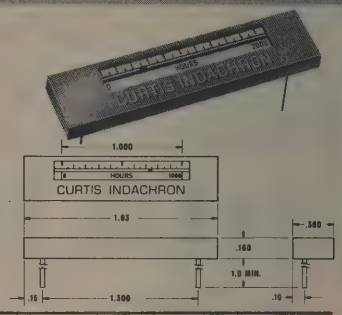
**Warranty** — Low-cost meters for warranty of equipment based on both actual usage, and calendar period.

**Reliability Engineering** — Provides mean-time-to-failure or sub-system replacement time without costly, unreliable logging.

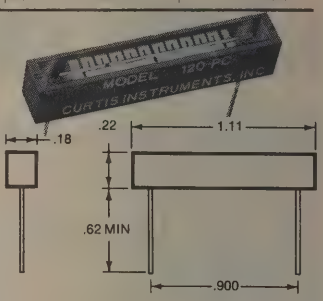
**Test Equipment Utilization & Calibration** — Provides calibration on actual hours of use with savings up to 50% compared to calendar-basis programs. Substantial savings in capital investments can be realized with accurate utilization data on test instruments, tools and equipment.

CURTIS INSTRUMENTS, INC.
200 Kisco Ave., Mt. Kisco, N.Y. 10549
(914) 666-2971 • TWX 710-571-2163

**L Series Curtis Indachron™**
Used on OEM equipment as a very low-cost means of validating warranties and for P.M. scheduling. Under $2.00 each in production quantities. AC and DC Models. Various time scales and electrical ratings. Can be mounted on printed circuit cards or direct to chassis with adhesive strips.




**120-PC Series**
Radial leads for installation directly on printed circuit cards for "mean-time-to-failure" or preventative maintenance scheduling. Can be instrumented from available DC voltages for any time scale by use of series resistor. Full scale of .65 inches = 4.16 milliamp-hours.

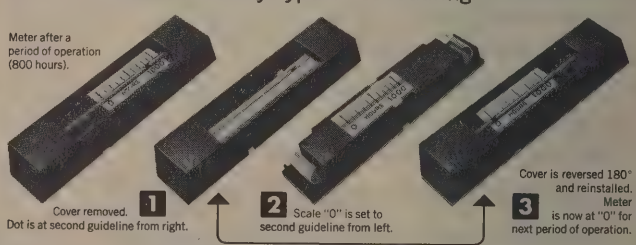



**620 PC, 620N Series, MIL Type**

The Curtis MIL type analog timers are made in two configurations. The 620N Series meet MS90386, and are now available in 5V and 15V, as well as 28V DC and 115V AC models. The 5V and 15V units directly answer the long felt need for an elapsed time meter than can be powered **directly** from voltages available within the box, precluding the necessity of special wiring for the ETI. The units also provide dramatic economies over the older electromechanical types. The 28V DC version provides for internal regulation over the complete aircraft power range, and the 115V AC device is truly insensitive to variation in line frequency.

The 620 PC Series meets the MS-3311 (AS) and was specifically designed for repairable modules and subassemblies, is very low cost and installs directly on PC boards.

**CP-3 Series**
New low cost monitor for P/M scheduling and other applications requiring a simple means of reset to zero in the field. AC or DC. Scales for any type of scheduling.

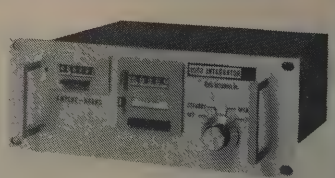

Meter after a period of operation (800 hours).
Cover removed. Dot is at second guideline from right.
1
2
Scale "0" is set to second guideline from left.
3
Cover is reversed 180° and reinstalled. Meter is now at "0" for next period of operation.

**ANALOG COUNTERS**
When operated by well defined pulses such as digital logic signals, any Curtis INDACHRON™ can be calibrated to provide direct indication of accumulated number of pulses with virtually any full scale reading. They can be used to count the number of lines, copies, characters, or other operating functions of computer peripherals, office or communication equipment.

# 1002 D.C. INTEGRATOR

The Curtis Model 1002 Integrator is a highly reliable, precision integration and control system for ampere hour applications in battery, solar energy and process control including the plating processes involving precious metals such as gold and silver. The 1002 maintains a guaranteed accuracy of ±1.0% over the full specified current or voltage range. Available in A.C. and D.C. powered models.

The Model 1002 can be configured with any of four counter options, consisting of six digit counters and a five digit predetermined counter. Single channel models are available in a half rack or full rack package and dual channel models are enclosed in a full rack package.
A related Integrator, the Model 1003, is available for bipolar D.C. integration.
Write for full specifications.



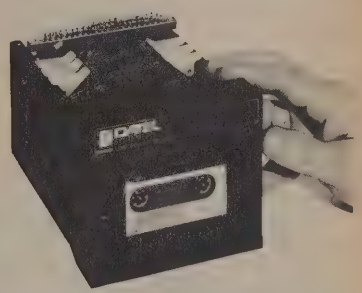
# DATEL

## INSTRUMENTS AND SYSTEMS

This section covers Datel's unique instrument and subsystem products. These products are innovative applications of Datel's A/D-D/A Data Converters. These products keep Datel in close touch with users needs and the high performance systems (DAS-256, SineTrac, etc.) are a natural outgrowth of Datel's application experience. Datel has specialized in the following instruments and systems: Micropowered analog data loggers using incremental digital cassette recorders, thermal and alphanumeric printers, digital panel meters and, in Section 2000 of EEM, computer A/D-D/A analog peripherals and high performance A/D-D/A analog data systems.

**Cassette and Printing Data Loggers**

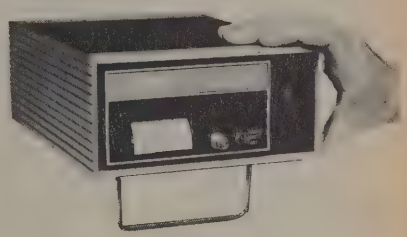
Micropowered stepping motor digital cassette transports offer battery operated portable recorders for field and remoted unattended applications. Straight digital recorders (ICT Series) and mixed digital/16 channel analog recorders (LPS-16 Series) may be played back directly to computers and TTY/CRT terminals. A weatherproof, 64-channel logger (Model DL-2) and companion reader (DL-2R) records unattended one year or more using internal batteries. ICT, LPS and DL-2 systems record 120,000 to 220,000 analog or digital samples per cassette. A 10-channel laboratory data logger (Model PDL-10) uses Datel's thermal printer and a 4½ digit DVM display in a 16 pound, one-hand portable housing.



**Digital Printers**

Datel pioneered the complete Digital Panel Printer, Model DPP-7, in 1975. Thermal printing eliminates messy ink ribbons and the DPP-7 prints highly readable 7-segment digits. The miniature panel mount DPP-7 is complete with an internal BCD full parallel interface and choice of internal power supply. The DPP-7 directly accepts data output from most Digital Panel Meters and BCD counters.

Answering the demand for very inexpensive (from $425) alphanumeric printers, Datel offers the 40-column AIP-40 with choice of parallel or serial interfaces. The AIP-40 is a complete stand-alone table-top printer which directly connects to serial interface mini- and microcomputers. It is an ideal program development printer, industrial data logger output, or point-of-sale printer.



**Digital Panel Meters and Voltage Calibrator**

Datel's leadership in Digital Panel Meters (DPM's) has resulted in today's product line of very low cost (from $29 in 100's) 3½ and 4½ digit DPM's. These display-only models operate from +5 Vdc or 115/230 VAC power and the Liquid-Crystal Display models need only 3 mA from a 9V transistor battery! Half-inch LED displays are used and all models are autozeroed. The 3½ digit models offer many input features for a wide range of applications. These include balanced differential inputs, 5 pA bias currents, and ratiometric operation for scaling. PC board pads have been left for voltage dividers, current shunts and offset pots for milliammeter and ohmmeter applications.

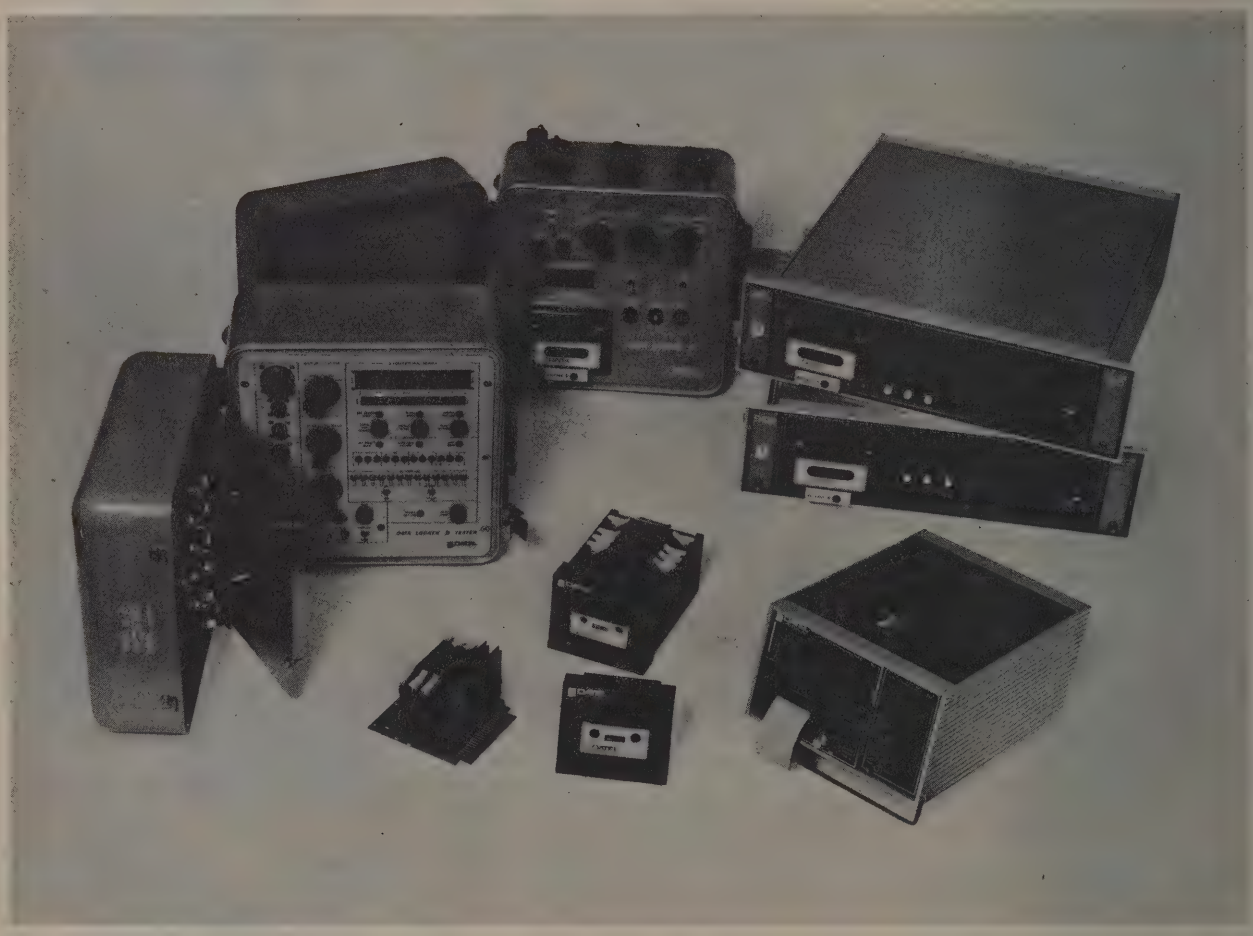
Datel also offers a very compact Digital Voltage Calibrator, model DVC-8500. This ±19.999 Volt dc calibrator is ideal for A/D-D/A and V/F converters, DPM's, op amps and data acquisition systems.

DATEL SYSTEMS, INC.

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
**TELEPHONE:** (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET, CANTON, MASS. 02021
TEL. (617) 828-8000 / TWX: 710-348-0135

# Data Loggers



DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
**TELEPHONE:** (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

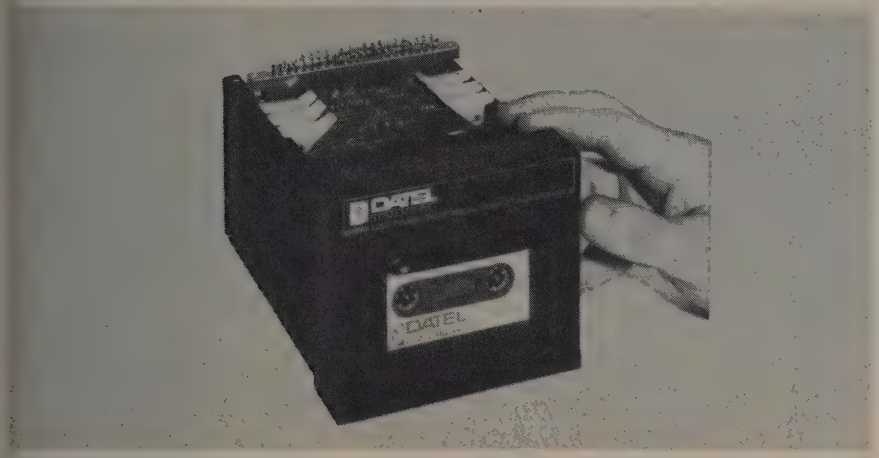


**Add Dept. EM to address to tell them you saw it in eem**

DATEL SYSTEMS, INC.



# MODEL LPS-16 DATA LOGGER
# LOW POWER CASSETTE DATA ACQUISITION AND LOGGING SYSTEM



## FEATURES

- Sixteen Channel Analog Input
- Digital Input for Timing Information
- 12 Bit A/D Resolution
- 12VDC Battery Operated
- 900 Milliwatts Maximum Power Consumption
- C/MOS Logic Throughout
- True Incremental Recording
- Certified Phillips Cassette
- 2.2 Million Bit Capacity
- Total Weight 2 Lbs.
- Cassette Reader for Computer Entry

Datel Systems announces a new approach to the Data Logging system, a complete *Data Logging system in a Module*, occupying only 134 cubic inches weighing less than 2 lbs. and operating from a single 12VDC source requiring only 900 milliwatts when recording and microwatts during standby.

In incremental recording, the cassette tape moves only when information is presented. This conserves power in portable operation, and no tape is wasted because data is uniformly recorded in precise tape increments. Further, the length of time a cassette can be left unattended can be accurately predicted from the data rate, the number of bits, and the tape length.

Applications include oceanography, pollution monitoring, meteorology, seismology, or other remote data logging requirements. It is also ideal for other scientific and technical data acquisition uses both in the laboratory and in the field.

A cassette reader is available which allows the user to transcribe the digital data on the cassette to computer compatible media. These readers may be interfaced to produce IBM ½" tape or to teletype, data terminals, acoustic coupler, or directly into a digital computer.

## ORDERING INFORMATION

**LPS-16**

**NUMBER OF BITS & CODING**
- 8B = 8 Binary Bits
- 10B = 10 Binary Bits
- 12B = 12 Binary Bits

**FULL SCALE ANALOG INPUT**
- 1 = 0V to −5V
- 2 = ±5V, inverted analog
- 3 = 0 to +5V
- 4 = ±5V, conventional

**A/D OUTPUT FORMAT**
- A = Straight Binary, Unipolar Input
- B = Offset Binary, Bipolar Input
- C = 2's Complement, Bipolar Input

**FILE LENGTH**
- 00 = None
- 01 = 1 Word
- 02 = 2 Words
- 04 = 4 Words
- 08 = 8 Words
- 16 = 16 Words
- 32 = 32 Words
- 64 = 64 Words
- 99 = Externally controlled file length

**EXAMPLE:**

LPS-16- 12B 4 B 32
- 12B: 12 Binary Bits
- 4: ±5V Conventional
- B: Offset Binary
- 32: 32 Words

| MODEL | PRICE (1-9) |
|---|---|
| LPS-16-8B | $1195. |
| LPS-16-10B | $1245. |
| LPS-16-12B | $1295. |

Tape Cassette Model 12123-1 $ 9.95
Prerecorded Cassette Model 37-6077-1 $35.00

GSA Contracted: Datel's products are available both direct and through the General Services Administration (GSA). If you are connected with a military or federal agency or receive federal funds, you may be entitled to purchase Datel's data loggers and other products through GSA to expedite requisitioning and order processing. Datel's data loggers are covered under FSC Group 66-56, Part II, Section K, Contract GS-00S-29002

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

DATEL SYSTEMS, INC.

## DATA LOGGERS/LPR-16

# LPR-16 CASSETTE TAPE READER/INTERFACE FOR MODEL LPS-16 DATA LOGGER

### FEATURES

- Digital Tape Cassette Reader for the 16-channel battery-powered LPS-16 Data Logger
- Full parallel interface to minicomputer or mainframe processor
- Teletypewriter/RS-232-C serial I/O interface
- Selectable I/O loading and logic coding for complete data buss compatibility
- Complete "handshaking" computer controls and flags for "on-line" external control
- Tape-to-Tape Interface for ½" 7/9 track tape transports
- Open collector parallel interface can be multiplexed with order I/O devices sharing common data buss

### ORDERING GUIDE

**LPR-16**

**INTERFACE OPTIONS**
1 = Full Parallel TTL Computer Interface
2 = Teletypewriter/RS-232C serial Interface
3 = Options 1 and 2
4 = Incremental ½" 7/9 Track Tape Interface
5 = Options 1 and 4

**POWER SUPPLY**
A = 115VAC*
E = 230VAC*
J = 100VAC*
*47 to 63 Hz

**INPUT LOADING**
0 = Parallel Interface not supplied
1 = 1 TTL Load
2 = 1KΩ pullup to +5V
3 = 330Ω pullup to +5V and 470Ω pulldown to gnd.
(Input loading applies to parallel interface only).

**OUTPUT LOADING**
0 = Parallel Interface not supplied
1 = Open collector 7406
2 = 1KΩ pullup to +5V
3 = 330Ω pullup to +5V and 470Ω pulldown to gnd.
(Output loading applies to parallel interface only)
+5 Volts must be supplied from the external device.

**SERIAL INTERFACE TYPE**
**(For Serial Interface only)**
R = RS-232-C
T = Teletypewriter
(This selects an internal jumper which floats the TTY power supply)
B = Both TTY and RS-232-C Interfaces. Power supply will be grounded for both versions.
X = Serial Interface not supplied

**NUMBER OF A/D WORDS PER FILE**
**(For Serial Interface only)**
01 = 1 16 = 16
02 = 2 32 = 32
04 = 4 64 = 64
08 = 8 99 = Serial Interface not supplied.
(Programmed by PC jumpers)

**BAUD RATE**
**(For Serial Interface only)**
A = 75 F = 1200
B = 110 G = 2400
C = 150 H = 4800
D = 300 J = 9600
E = 600 X = Serial Interface not supplied
(Programmed via PC jumpers)

**PRICES (Single Quantity)**

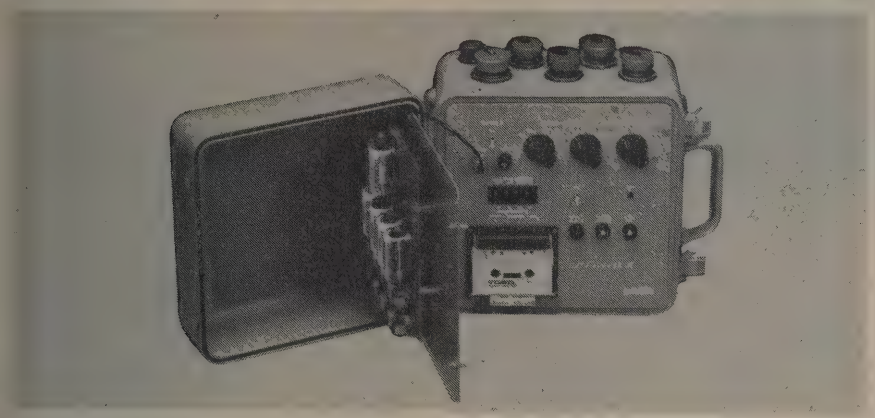
LPR-16-1 Full Parallel Interface .....$1995
LPR-16-2 TTY/RS-232-C Interface ...$2295
LPR-16-3 Interfaces 1 and 2 .....$2395
LPR-16-4 Incremental ½" Tape Interface .....$2295*
LPR-16-5 Interfaces 1 and 4 .....$2395
*Interface only to a user-supplied Kennedy 1600/360 off-line transport.

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

DATEL SYSTEMS, INC.

# DATA LOGGERS/DATA LOGGER 2

## DATA LOGGER 2: A NEW INSTRUMENT FOR FIELD DATA LOGGING



Scientists and industrial researchers have long required a battery-powered, portable multichannel analog recording system for long term unattended data logging of slowly varying signals. The power and long-term requirements have been particularly difficult to achieve in a portable commercial instrument. Many applications in meteorology, pollution monitoring, oceanography, biomedicine, geophysics and natural resource exploration require an instrument which can literally be left in the field to run on its own batteries, recording slowly changing data unattended for up to a year.

### SYSTEM DESCRIPTION

Datel System's new Data Logger 2 provides the missing link needed for a remote analog recorder with an output system compatible with most computer systems. Using this system, up to 64 analog inputs derived from physical variables can be displayed or printed out on a computer with the date and time of each measurement. Up to 120,000 separate measurements or samples can be recorded using a single digital magnetic tape cassette. By using a suitable computer program, each input can be displayed—identifying the physical quantity being measured—and properly offset and scaled to the correct engineering units.

In this way the Data Logger 2 system and computer will print out the day, hours, minutes and seconds, and then the actual measurement (i.e. temperature in degrees F, wind speed in miles per hour, etc.). Connected to a set of sensors, the sealed Data Logger 2 makes an ideal weather station, geophysical monitor, or oceanographic buoy data acquisition and recording system.

The complete Data Logger 2 system consists of three separate instruments: the Data Logger, the Tester, and the Reader/Interface. The Logger is the data acquisition and write-only digital cassette recording system. It runs from its own internal battery and makes scans of up to 64 channels at preselected intervals from 1 second to 30 hours. The Logger is housed in a rugged weatherproof metal case and weighs 20 pounds (9,1 Kg). Analog inputs are connected through sealed I/O connectors on the case. A typical data recording system consists of one Tester, one Reader/Interface, and several Loggers deployed for data collection at different locations. The tester is taken to the field to test and calibrate each Logger during set-up; completed digital cassettes are taken back to the laboratory for playback on the Reader/Interface.

### DATA LOGGER 2 TESTER

The Tester is used to calibrate the Logger and to test all its functions before it is committed to long-term unattended recording. The tester checks all controls of the Logger, the battery status (voltage and current), Logger power drain, and tape heads. Simulated data generated on the Tester can be recorded on the Logger. The Tester will also display actual data or the simulated data on the Tester's LED readouts. In addition the Tester performs a complete self-check of all its own switches, displays, and batteries. The Tester is housed in a portable weatherproof case identical to that of the Logger.

### READER/INTERFACE AND INTERFACE OPTIONS

The Reader/Interface for the Data Logger 2 system is a complete computer front end for playing back the digital cassettes recorded on the Logger. The Reader can be operated from front panel controls or can be remotely controlled on-line by a minicomputer, mainframe processor or other I/O device. Front panel displays allow the operator to manually step through a recording to find a sample on a particular date and time. Front panel binary and decimal LED's will display this date and time in addition to the raw binary data for that sample on a selected channel.

### FEATURES

- 64 channel cassette digital tape data acquisition system in a sealed weatherproof, high reliability ruggedized metal case
- One year lithium battery supply
- −10°C to +60°C operating temperature range
- +10mV, ±5mV or ±5V, 0 to +5V Volt input ranges, 100 megohm impedance, 100dB CMR differential configuration
- 6mW standby power CMOS design, 1 watt power while scanning, +12VDC power
- 1 second to 30 hour selectable scan rates
- From $4999.

### KEY SPECS: DATA LOGGER 2

| | |
|---|---|
| No. Channels | Up to 64 |
| Analog Inputs, HI Level | 0 to +5V or −5V to +5V (Single Ended) |
| Analog Inputs, LO Level | 0 to +10mV or −5mV to +5mV (Differential) |
| Input Impedance | 100 Megohms |
| Common Mode Voltage Range | ±5V |
| Common Mode Rejection | 110dB |
| Resolution | 12 Bits, Hi Level<br>8 Bits, Lo Level |
| Accuracy, HI Level | .04%FS±½ LSB |
| Temperature Coefficient | ±12 ppm/°C |
| Data Capacity | 120,000 samples/300' Cassette (2000 64 Channel Scans) |
| Scan Intervals | 1 Second to 30 hours |
| Throughput Rate | 5 samples/second |
| Power Requirement | 12VDC (5 Lithium D-Cells) (100mA Recording, 1mA standby) |
| Operating Temperature Range | −10°C to +60°C |
| Weight | 20 lbs. (9,1 Kg) |

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

DATEL SYSTEMS, INC.

# DATA LOGGERS/DATA LOGGER 2

## DATA LOGGER 2 READER

By suitable computer programming an automatic search for a particular sample can be conducted.

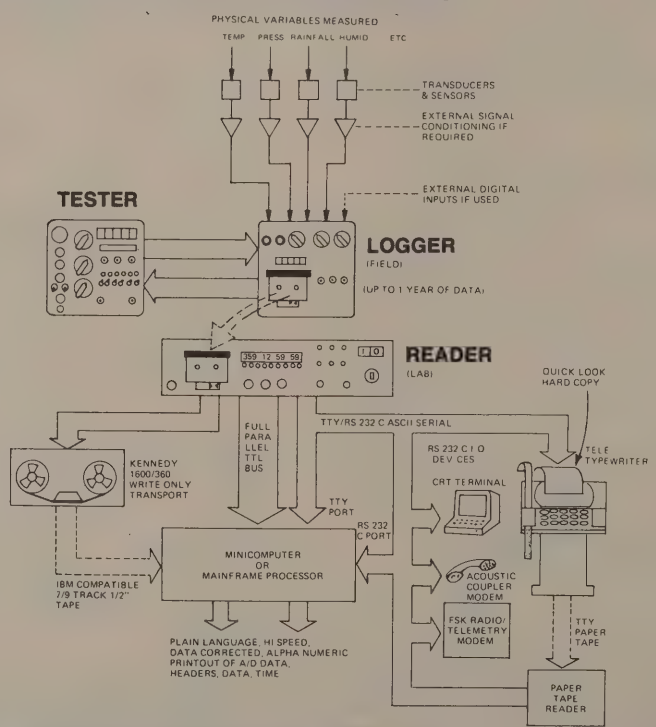
The Reader is available with one of these interface types. A full parallel interface provides buffered TTL binary data at ranges up to 100 samples per second with the cassette tape moving continuously. This interface provides the highest output rate and may be used to load a computer memory in interrupt mode or block transfer (direct memory access).

The second interface is full serial (2 wire) to connect to teletypewriters and RS-232-C I/O devices such as CRT terminals and high speed printers in ASCII format. The teletypewriter (TTY) output provides a simple way to connect to a computer which has a TTY port. The teletypewriter can be used off-line to prepare paper tapes of the raw data and to get a "quick look" at the data. Feeding the paper tape back to the computer on-line will then produce a plain language print out with suitable programming. The RS-232-C outputs may also operate an acoustic coupler modem for telephone transmission or frequency-shift keying of a radio link. The TTY/RS-232-C serial interfaces are programmable from 75 to 9600 baud rates to accommodate different output devices and transmission lines.

The third Reader interface connects to a Kennedy 1600 incremental ½" magnetic tape transport. Tapes prepared using this transport may be played back at high speed on any 7/9-track mainframe processor tape deck. This tape-to-tape interface provides simplified no-wiring data entry to a computer and user retention of the data on a high speed tape medium.

Various user configurations of the Data Logger 2 system are shown in the "Data Logger 2 System Configurations" diagram.

## DATA LOGGER 2 SYSTEM CONFIGURATIONS




## LOGGER OPERATION

The Logger and Reader both employ Datel Systems' low power stepper-motor incremental cassette tape transport. This transport features very fast power turn-on permitting the transport to be normally off except during actual recording. Extensive use of fast turn-on circuits using MOS devices allows the Logger to operate for a year or longer (depending on sample rate) using only 5 D cell Lithium batteries mounted inside the front cover. While recording, the tape transport and data acquisition electronics are powered up for only 11 seconds maximum to record all 64 channels. The system then turns off except for a CMOS crystal-controlled clock circuit which initiates the next scan at the time determined by the manually selected scan rate. During each scan the data and time are automatically recorded on the cassette tape. A battery monitor will record if the battery voltage falls too low.

The Logger is rated for a year or more of operation at moderate sample rates over an operating temperature range of −10°C to +60°C. External inputs may be used to record 36 bit parallel digital data on command or to make an analog scan on external command.

Both high and low level analog inputs are accepted with unipolar, bipolar, or two's complement coding on the 12 bit A/D converter. The high level ranges are −5V to +5V or 0 to +5V; low level ranges are 0 to +10mV or −5mV to +5mV with 8 bit accuracy. The low level inputs are differential with 100 megohm input impedance, ±5V common mode range, and 100dB common mode rejection out to 100 Hz. Basic high level accuracy is ±.04% of full scale ±½ LSB with a temperature coefficient of ±12ppm/°C.

During recording the Logger draws a maximum 100mA of current from its 12V Lithium batteries; between scans only the crystal clock is running, drawing just 1mA maximum. A variety of power options may be used with Data Logger 2 including external AC, or +12VDC. In addition the internal battery holders may be rewired to accept rechargeable D cell nickel cadmium batteries or other types of D cells.

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

DATEL SYSTEMS, INC.

# DATA LOGGERS/DATA LOGGER 2

## DATA LOGGER 2 ORDERING GUIDE

AVAILABLE UNDER GSA CONTRACT
NO. GS-00S-29002

**DL-2**

**Channel Configuration**

A = 32 High Level
B = 32 Low Level
C = 32 High Level and 32 Low Level
D = 64 High Level
E = 64 Low Level

**Input Ranges & Coding**

Note:
High Level (HL) Inputs are single-ended
Low Level (LL) Inputs are differential

1 = Bipolar (offset binary) (not useable if TTY, RS-232-C output is used)
LL: −5mV to +5mV and/or
HL: −5V to +5V
2 = Bipolar (2's complement)
LL: −5mV to +5mV and/or
HL: −5V to +5V
3 = Unipolar (straight binary)
LL: 0 to +10mV and/or
HL: 0 to +5V
4 = Special Low Level Range (contact factory)

Notes: 1 Coding types 1, 2, & 3 *cannot* be intermixed.
2 Coding must be specified at time of order.
3 High level and low level channels may be ordered in the same unit, but all coding must be the same.
4 Low level 0 to +5mV is not offered.

**Internal Power Supplies**

A* = (10) internal D-cell battery holders installed and internal 115VAC/60Hz supply
E* = (10) internal D-cell battery holders installed and internal 220 VAC/50Hz supply
J* = (10) internal D-cell battery holders installed and internal 100VAC/60Hz supply
} Add $175. for AC supply
X = External battery connector and (10) internal D-cell holders installed. No internal AC power supply furnished.

**HOUSING, CONNECTORS, & BATTERY TRAY**

Leave Blank = Included
1 = Not Included

**DATA LOGGER 2 PRICES (SINGLE QUANTITY)**

| | | WITH HOUSING | WITHOUT HOUSING |
|---|---|---|---|
| DL-2A | (32HL) | $4999. | $3999. |
| DL-2B | (32LL) | $5295. | $4295. |
| DL-2C | (32HL & 32LL) | $6199. | $5199. |
| DL-2D | (64HL) | $5999. | $4999. |
| DL-2E | (64LL) | $6495. | $5495. |

**DL-2T1** Tester with 13-bit D/A calibrator . . . . . $4995.00
**DL-2T2** Tester less D/A calibrator . . . . . $4495.00

*Batteries are not included, please order separately below.

Low temperature operation (−40°C to +60°C) available on special order, contact Datel.

## DATA LOGGER 2 READER ORDERING GUIDE

**DL-2R**

**Interface Options**

1 = Full parallel computer interface
2 = TTY/RS-232C serial interface
4 = 7 or 9 track ½" incremental mag tape interface

**Power Supply**

A = 115VAC, 60Hz
E = 230VAC, 50Hz
J = 100VAC, 60Hz
(Power consumption, 65 watts max., either version)

**Input Loading**
**(For full parallel interface)**

0 = No parallel interface
1 = 1 TTL load
2 = 1K ohm pullup to +5V
3 = 330 ohm pullup to +5V and 470 ohm pulldown to ground

**Output Loading**
**(For full parallel interface)**

0 = No parallel interface
1 = Open collector 7406
2 = 1K ohm pullup to +5V
3 = 330 ohm pullup to +5V and 470 ohm pulldown to ground
*+5V must be supplied from external device

**Baud Rate**
**(TTY/RS-232 interface)**

A = 75
B = 110
C = 150
D = 300
E = 600
F = 1200
G = 2400
H = 4800
J = 9600
X = No serial interface

(Programmable via PC jumpers)

PRICES FOR THE DL-2R CASSETTE READER/DISPLAY/INTERFACE ARE AS FOLLOWS:

DL-2R-1 with full parallel computer interface . . . . . $3495.00
DL-2R-2 with TTY/RS232C serial interface . . . . . $3895.00
DL-2R-4 with 7 or 9-track ½" tape interface . . . . . $3895.00

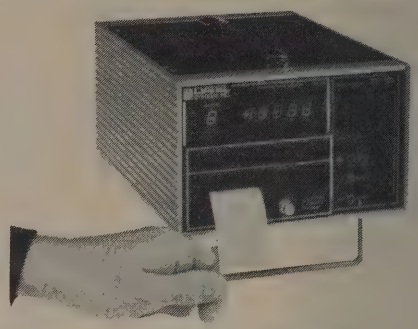
NOTES:
1. Both interfaces supplied with option 3 but can be used only one at a time. Can be swapped by removing DL-2R top cover.
2. ½" Mag tape interface wired for Kennedy 1600/360 incremental, off-line write-only transport. Other transports require customer modification. Playback is 7/9 track, high speed ½" IBM compatible.

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

DATEL SYSTEMS, INC.

# DATA LOGGERS/PDL-10

Meeting the demand for a high performance laboratory-grade printing data recorder, Datel's model PDL-10 Printing Data Logger accepts up to 10 floating analog input voltages and automatically prints them out at preselected intervals. The PDL-10 digitizes all selected inputs to 4½ digit accuracy, displays and prints them out as decimal voltages on a very compact inkless thermal printer. Analog inputs are accepted over ±199.99mV, ±1.9999V and ±19.999 Volt front-panel selected voltage ranges and are printed out every second with the channel number at preselected scan intervals.



## SPECIFICATIONS

### ANALOG INPUT

**Number of Channels** ..... 10

**Configuration**
3-Wire differential inputs, transformer-isolated using a mechanical relay multiplexer.

**Input Voltage Ranges**
Choice of 3 DC ranges:
±.19999V; ±1.9999V; ±19.999V
preselected by ten front panel slide switches for each channel.

**Overvoltage**
Input is diode-protected for up to ±100V maximum continuous.

**Common Mode rejection**
108dB, DC to 60Hz with 1000Ω maximum input unbalance.

**Common Mode Voltage Range**
±20 volts maximum to signal guard. ±300 volts maximum to AC power ground.

**Input Impedance** (±20V input max)
(Differential) ..... 500 Megohms minimum.
(To Signal Guard) ..... 100 Megohms minimum.

**Input Bias Current**
500pA typ., 8nA maximum

### PERFORMANCE

**Accuracy @ +25°C**
Within ±0.01% when calibrated due to all effects except temperature drift.

**Temperature Drift**
ZERO: ±1μV/°C GAIN: 20ppm/°C

**Operating Temperature Range**
0°C to +45°C

**Storage Temperature Range**
−25°C to +85°C

**Sampling Rate**
Pre-selected channels are advanced, displayed and printed one channel per second.

**Scan Intervals**
Intervals from 00 to 99 seconds or minutes

### DISPLAYS

**Input**
A digital panel meter (DPM) displays the analog input voltage.

**Channel**
A single 0.43" (11 mm) red LED digit indicates channel 0 through 9.

**Printing Method**
Seven segment digits are formed on thermal paper using a thick-film resistor matrix printhead requiring no ink, hammers or ribbons.

**Printer Digits**
7-segment 0 to 9 digits 0.155" (4 mm) high. Spacing between printed lines: 0.2 inch (5 mm).

**Line Capacity**
Approximately 9000 lines.

**Printout Format**
Printout format is 9± .1.9.9.9.9 with the leading digit indicating channel number. Three lines are skipped between scans.

**Printing Paper**
Using heat sensitive thermal printing paper, 1.75"W (44,5 mm) and supplied in rolls 150 feet (45 mm) long.

### FRONT PANEL CONTROLS

**Channel Select and Input Range**
(Ten 4-position slide switches) ".2V, 2V, 20V and SKIP".

**Scan Interval**
(Two decade thumbwheel switch) Sets the time interval between scan starts from 00 to 99 seconds or minutes.

**Minutes/Seconds**
(2 position toggle switch) Determines whether the Scan is set for minutes or seconds.

**No Print/Run/Reset & Start**
(Three position toggle switch) In NO PRINT, the instrument scans and displays but does not print. In RUN the instrument scans, displays and prints out.

In RESET & START, the scan timer is reset and starts timing. One scan is printed out one second from switch release.

**One Channel/Scan**
(Two position toggle switch) The ONE CHANNEL position prevents the multiplexer relay for the selected channel from disconnecting with each scan. In the SCAN position, normal relay cycling, display and printout occur. Channel 0 (="10") cannot be skipped in "scan".

**Paper quantity**
A lever indicates relative quantity of paper remaining.

### REAR PANEL INPUT CONNECTIONS

Analog input voltages are connected using screwdriver barrier terminal strips. (30 terminals).

### POWER SUPPLY

Choice of 115 or 230 VAC ±5, 10, 15 or 20 volts at 50 or 60 Hz only. Power consumption (all models) 30 watts, typical.

### PHYSICAL DIMENSIONS

**Mounting**
Bench-top mounting with tilt-up stand and mar-proof plastic feet. Users can remove the feet and stand for optional ½-rack mounting.

**Outline Dimensions**
5.25"H × 8.5"W × 12"D (133 × 216 × 305 mm)

**Weight**
16.5 pounds (7,5 Kg)

## ORDERING GUIDE

**MODEL NUMBER PDL—10**

| POWER SUPPLY VOLTAGE | POWER SUPPLY FREQUENCY |
|---|---|
| A* = 115VAC<br>E* = 230VAC<br>J* = 100VAC<br>*±10%, May be user-rewired to other voltages, see specs. | 5 = 50Hz<br>6 = 60Hz<br>May be user-rewired to either frequency. |

## PRICES (single quantity)

PDL—10 ..... $1795.00

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

DATEL SYSTEMS, INC.

## MICROPOWER CASSETTE TRANSPORTS

## ICT-WZ Series Micro-Powered Digital Cassette Recorder

### FEATURES

- ▶ **Simple, reliable capstan/pinch roller stepping motor drive**
- ▶ **Ultra-low power (700 milliwatts while writing) using CMOS electronics**
- ▶ **High data capacity: Up to 2.2 million bits per 300 foot cassette**
- ▶ **Ideal for +12VDC battery portable digital data recorders**
- ▶ **Reader Systems available to interface most computer terminals, RS-232-C CRT displays, modems and teleprinters (TTY)**

### DESCRIPTION

These unique data recorders and reader systems offer a new concept to the instrument designer—miniature, removable ultra-low power, digital data storage. Using a Philips data tape cassette, low power incremental stepping motor and CMOS electronics, these recorders are ideal for portable-battery-powered data collection instruments.

Reader/interface systems which are separate from the data recorder provide several output forms (full parallel, TTY/RS-232-C ASCII, 1/2" mag. tape) to adapt to different computers and printout devices.

With very fast power turn-on, the tape moves only when actually recording data or creating a gap. At all other times when not recording data, the transport and power-multiplexed electronics remain turned off to save tape and batteries.

Complete Cassette Data Logging Systems from Datel are available to record up to 16 or 64 analog channels (refer to Datel Models LPS-16 and DL-2). Applications include oceanographic buoys and submersible probes, portable air and water quality environmental monitors, traffic and noise loggers, natural resources exploration, vehicular testing, seismic and geophysical measurements, RF field strength and transmission loggers, unmanned weather stations and biomedical loggers.

A dual-track complementary NRZ (CNRZ) method is used for high noise immunity and self-clocking on playback. Using separate 1's and 0's tracks and very small gaps, one cassette can hold up to 2.2 million bits, or 120,000 A/D samples.

All electronics for the ICT systems are mounted in an optional PC card cage which attaches to the rear of the transport.

Optional +5V power version available (ICT-W5Z)

### SIMPLIFIED ICT-WZ COMPLEMENTARY NRZ MODEL SELECTION

Four systems should be selected ranging from transport to full system.

| Model Number | Description | Input Type | Price |
|---|---|---|---|
| **ICT-WZ1 (Transport System)** | Transport Mechanism Only | Direct input to Write-head windings and 4-phase stepper motor windings. | **$359.00** |
| **ICT—WZ1B2A (Unformatted Serial System)** | Transport, Card Cage, Write Step Card | CMOS logic inputs, unformatted full serial Write Step requires external write clock timing but codes write-head signals to complementary NRZ coding. | **$695.00** |
| **ICT-WZ1B2A-3942**<br>**ICT-WZ2B2A-3950** | Transport less Cage, with Write Step mounted to transport by standoffs. | Same as above | **$595.00 (less EOT/BOT)**<br>**$625.00 (with EOT/BOT)** |
| **ICT-WZ1B2B (16-Bit Parallel System)** | Transport, Card Cage, Write Step and Formatter Cards. | Accepts full parallel or serial 8 to 16 bits CMOS data and formats in files of selectable word length. Parallel inputs are stored. Files are jumper-selected to any length. | **$900.00** |

Contact Datel for optional analog input (A/D Converter) to the ICT-WZ system.
Prices and specifications subject to change without notice.
Use Models LPR-16 or ICT-RZ2 as readers.

### DIGITAL CASSETTE TRANSPORT SPECIFICATIONS
**(Typical over −10°C to +60°C unless noted)**

| | MODEL ICT-WZ COMPLEMENTARY NRZ FORMAT |
|---|---|
| **GENERAL** | |
| **Recording Medium** | Philips tape cassette, certified for digital operation |
| **Number of Tracks** | Two half-width tracks, recorded simultaneously |
| **Recording Direction** | One direction only |
| **TAPE MOTION** | |
| **Nominal Tape Speed** | 0.163 in./sec. (4, 13mm/sec) at 100 steps/sec |
| **Bit Density** | 615 bit per inch (615 FRPI) 24 bits per mm |
| **Bit Writing Rate and Motor Step Rate** | 100 bits/second, asynchronous |
| **DATA CHARACTERISTICS USING DATEL'S ELECTRONICS** | |
| **Recording Format** | 2-track serial complementary NRZ. 1's on Track 1. 0's on Track 2 |
| **Character Record Length** | 8, 10, 12, 14 or 16 bit characters or words |
| **File or Block Length** | Files consisting of 1, 2, 4, 8, 16, 32 or 64 characters or words per block or any length |
| **Gaps** | 3-bit intercharacter, or inter-word gaps added before each character. 12-bit end-of-file gap written after each file |
| **Gap Stepping Rate** | 100 steps/sec |
| **Time to Generate Full Gap Length** | 0.12 sec |
| **DATA CAPACITY** | |
| | (Assuming 64 8-bit characters per file, and 282 feet (86 m) usable recording area) |
| **Block or Files per Cassette** | 3200 files |
| **Time per File (not including gaps)** | 6.4 seconds |
| **Time to Fill a Cassette (continuous running at max. step rate)** | 5.8 hours |
| **Playback Speed, typical** | 1700 bits/sec (LPR-16 Reader, 2.75 ips) |
| **PHYSICAL** | |
| **Weight** | 1.25 pounds (0.567 kilogram) |
| **Dimensions (Transport alone)** | 3.91" High x 4.5" Wide x 3.36" Deep (99,3 x 114,3 x 106,7 mm) |
| **Maximum Depth Behind Mounting Panel** | 1.94" (49,3 mm) from panel front surface |
| **Temperature Range (Operating and Storage)** | −10°C to +60°C standard |
| **Power Consumption (Auxiliary Cards and EOT/BOT Detector)** | 120 microwatts each (+12VDC @ 10 microamps). The EOT/BOT Lamp and detector consume 900 mW (+12VDC @ 75 mA) |
| **Power Consumption** (Transport & Tapehead only) | 700 mW typ @ 100 steps/sec (+12VDC @ 60 mA) |

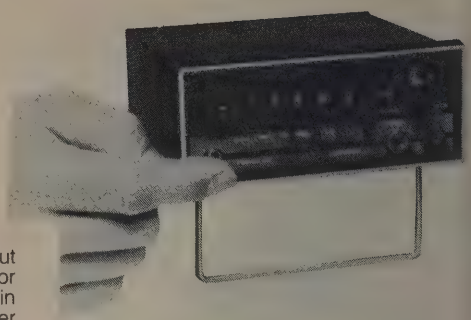
DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

DATEL SYSTEMS, INC.

# 0.005% MINIATURE DIGITAL VOLTAGE CALIBRATOR

## FEATURES

- ±19.999 Volts Isolated Bipolar Output @ 25mA
- 1mV Settability With ±1.5mV Continuous Vernier, 100μV Graduations
- Accuracy ±1mV of Setting With Low ±20μV/°C Drift
- Miniature Aluminum Case Includes Bench-Top Stand or Can Be Panel-Mounted
- Low Cost $450.00



## GENERAL DESCRIPTION

A digital voltage calibrator small enough for bench-top use or panel-mounting is available from Datel Systems and fulfills many laboratory and portable applications. Datel's model DVC-8500 Calibrator offers full 4½ digit resolution (1mV steps) with a +19.999 Volt bipolar output. Up to 25mA output current may be drawn at the +1mV rated accuracy. This short-circuit proof output may be continuously varied within +1.5mV for precise vernier control. The ±20μV/°C drift specification applies over the 0°C to +50°C operating temperature range.

The DVC-8500 uses easy-to-operate digital lever switches to set the output voltage. Front panel banana jacks simplify the connection to calibration circuits while rear panel sense feedback inputs insure output accuracy.

An overload LED lamp is lit when output loading exceeds 25mA. The rear connector accommodates either standard dual 36-pin gold-plated PC board connectors or solder or crimp lugs using 4-40 hardware. The +10V reference is derived from an oven-stabilized zener diode and is brought out at the rear connector for voltage-tracing of external circuits.

The DVC-8500 is powered by a choice of 100, 115, or 230 VAC +10%, 47 to 440 Hz at 5 watts typical. The black-anodized extruded aluminum housing provides excellent shielding to electrical noise and a regulated power supply provides excellent stability and performance.

## MODEL NUMBER DVC-8500

| AC POWER SUPPLY |
|---|
| A = 115VAC |
| E = 230VAC |
| J = 100VAC |
| *±10%, 47 to 440Hz |

## PRICE (1-9)

DVC-8500 ..... $450.00

Panel-Mounting Kit,
P/N 38-A-3022-1 ..... $ 10.00
(Consists of (2) U-Straps, rear PC-board connector, and hardware. Rubber feet and tilt-stand bale supplied for bench-top use are screwed to case bottom and must be removed before panel mounting).

## SPECIFICATIONS:

**(Typical between +20°C to +30°C at steady ambient temperature after 5 minute warm-up)**

### VOLTAGE OUTPUT

Output Voltage Range . 0 to +19.999 Volts DC or 0 to −19.999 Volts DC, lever switch selected.
Output Current Range . 0 to ±25mA to rated voltage output accuracy.
Output Overload ..... Greater than ±25mA will illuminate front panel LED overload lamp. Output is current limited (continuous short-circuit proof) to ±70mA at any voltage up to ±20VDC.
Output Impedance: .... Less than 10 milliohms.

### PERFORMANCE

Accuracy @ +25°C ... Within ±1mV of setting when calibrated (equivalent to ±0.0005% of Full Scale) Due to all effects except temperature drift.
Resolution ..... ±1mV increments and ±1.5mV Vernier with 100-V graduations.
Temperature Drift ..... Within ±20μV/°C
Operating Temperature Range ..... 0°C to +50°C
Output Noise ..... 25μV p-p, wideband
Reference Source ..... 6.4V oven-stabilized zener diode

### FRONT PANEL

Output Selector Switches ..... Six lever-operated, detented switches
Output Vernier ..... Rotary potentiometer, range ±1.5mV of selected output. Graduated in 100μV divisions.

### INPUT/OUTPUT CONNECTIONS

Front Panel ..... Voltage output and output common available from two (2) gold plated brass deep banana jacks.
Rear Panel ..... PCB Connectors sense in VOUT.

### POWER SUPPLY

Power Required ..... Choice of 100, 115, or 230 VAC, ±10% 47 to 440 Hz, 10 watts. 3-prong U.S. captive line cord installed. Ground wire connected to case, but transformer isolated ±300VDC from output common.

### MECHANICAL DIMENSIONS

Case ..... 5.56″W × 2.11″H × 5.78″D(141,2 × 53, 6 × 146, 8mm)
Bezel ..... 5.86″W × 2.25″H × 0.50″THK (148,7 × 57.0 × 12,7 mm)
Weight ..... 2.25 pounds (1,0 Kg)

**MOUNTING** ..... Choice of bench-top mounting or panel mounting through a cutout measuring 2.16″H × 5.59″W (54,8 × 142,1 mm) and secured by 2 U-Straps. See ordering guide for optional panel-mount kit.

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

DATEL SYSTEMS, INC.

# DIGITAL PANEL PRINTER/DPP-7

## 7-COLUMN THERMAL PANEL PRINTER

### FEATURES

- 3 Lines/Second OEM-Reliable Thermal Printer using only 2 moving parts.
- Includes All Electronics for BCD Inputs with Input Storage Register
- 6 Numeric Columns and Sign
- Selectable Leading Zero Blanking
- Positive or Negative True TTL/DTL Inputs
- +5VDC Power (2.3 lbs) or AC (4.2 lbs)
- $475.00 Single Quantity
- Last Line Visible Immediately After Printing
- 2.3 Lb. Panel-Mounting Featherweight

Imagine a low cost 7-column panel-mounting printer just slightly larger than most digital panel meters. Imagine this lightweight, high-reliability digital panel printer installed in your instrument or system front panel. And imagine an ink-less, non-impact thermal printing method with only two moving parts which will last for years.

This is Datel's miniature 3 line per second DPP-7 thermal panel printer. A no-nonsense, simple to apply, OEM-designed digital output device that weighs in at only 2.3 pounds (1,1 Kg). OEM features are designed in to the DPP-7 such as selectable leading zero blanking, selectable positive or negative true coding inputs and choice of ±5VDC or AC line power. Full parallel TTL input BCD electronics are included as standard.

Other OEM design features include a selection of printout formats, manual print and advance front panel switch, and a low-paper switch output. A unique mounting technique uses an aluminum housing which attaches directly through a front panel cutout. This housing permanently holds the electronics, although the mechanical assembly can be completely removed for paper replacement using a single front panel thumbscrew. As the mechanical assembly is removed, it disconnects from the internal electronics PC board connectors, so that no lethal power voltages are exposed during paper reloading. However, the external PC board connectors at the rear of the case remain connected to the internal electronics.

The housing supports the weight of the mechanical assembly and is mounted on a front panel through a 4.50″ × 2.72″ cutout and secured by four screws. Three DPP-7 panel printers can conveniently be mounted across a 19″ × 3½″ high rack mount panel.

OEM pricing makes the DPP-7 ideal for instrument products. Comparable impact parallel printers with BCD decoding and drive electronics usually list for more than the DDP-7.

Standard 1¾″ wide thermographic papers are used in handy 150 foot rolls giving about 9,000 lines per roll with 5 lines per inch. The 7-segment digits are .155″ high with left-of-digit decimal points selectable at each digit. Seven column printing formats include sign and six digits or 2-channel (ident) digits, sign and 4 data digits. Other 7 column decimal formats are also available.

The DPP-7 Digital Panel Printer extends back 6.2″ from the front surface of the mounting panel (8.62″ for the AC powered versions), including space allowance for the two 30-conductor PC board connectors or AC fuses.

Three universal AC line voltages (100, 115, and 230 VAC) will power the DPP-7 Printer as well as +5VDC at 20 watts average (8 Amps peak).

The DPP-7 is ruggedly built, using a simple, but sophisticated mechanical design which is optimized for heavy duty OEM applications. A proprietary printhead character coating allows the head to be conservatively rated at 3 million lines.

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

DATEL SYSTEMS, INC.

# DIGITAL PANEL PRINTER/DPP-7

## SPECIFICATIONS (Typical @ +25°C unless noted)

### GENERAL

**Number of columns: 7**
Formats Available.

Type 1: ±.9.9.9.9.9.9
Type 2: .9.9±.9.9.9.9
Type 3: .9±.9.9.9.9.9

(See other formats in ordering guide. Hexadecimal printout is available but will not allow blanked columns)

**Decimal digit format:**
7-segment 0 to 9 digits .155" (4 mm) high with 10° slant and selectable left decimal point.

**Printing method:**
Thick film thermal print head, black characters on white paper (using 3M Type 161 paper)

**Printer paper:**
1.75" wide × 150 feet long, (44,5 mm × 45 m), 3M-type 161 thermal paper roll with the thermal surface facing away from the center of the roll.

**Paper advance:**
Via linear solenoid and one-direction rotary clutch. Paper tears off cleanly by lifting against the paper slot top edge.

### PERFORMANCE:

Max. printing rate: 3 lines per second
Print and paper advance cycle: 330 milliseconds
Line spacing: 0.2 inch (5 mm)
Line density: 5 lines per inch
Line capacity per paper roll: approx. 9,000 lines
Minimum print head life: 3 million lines
Average print pulse on-time 25 mSec. (height varied by temperature feedback)

### INPUTS

DTL/TTL compatible, selectable positive or negative true, level sensitive. TTLLS low power Schottky logic used on all inputs.

**Logic Levels:**

| | | |
|---|---|---|
| Positive true: | +2.0V≤"1"≤+5.0V | |
| | 0V≤"0"≤+0.5V | Note TTLLS |
| Negative true: | 0V≤"1"≤+0.5V | logic levels |
| | +2.0V≤"0"≤+5.0V | |

Note:Pullup resistors to +5V may be optionally removed on all inputs and outputs.

**Data: (24 lines)**
Full parallel BCD (1-2-4-8), selectable positive or negative true, 1 TTLLS load plus 10 K ohm pullup to +5V. May be used with Form A (normally open) or Form B (normally closed) switch closure inputs. Level sensitive (rise-time non-critical). Data is stored

**Change Data Polarity: (Pin C1-B11)**
Selects input polarity of data, decimal points and ±sign simultaneously.
LOW = positive true coding
HIGH = negative true coding
6 TTLLS loads, pus 1 K ohm pullup to +5V, level sensitive

**Print and Advance Command: (Pin C1-B14)**
Level sensitive for Form A or Form B contact closure, selectable positive or negative true.
1 TTLLS load plus 10K ohm pullup to +5V.

Pulse Width: 1 microsecond to 200 mSec (data must be valid 1 μsec. after leading edge and 500 nSec. before the print command).

Maximum print command rate: 3 per second.

Paper advance automatically occurs after digit printing. Holding print command TRUE longer than the busy output is true (200 to 330 mSec, typ) causes continuous 3 lines/sec. printing.

**Change Print Polarity: (Pin C1-B7)**
HIGH = negative true coding
LOW = positive true coding
1 TTLLS load, plus 10K ohm pullup to +5V, level sensitive

**Leading Zero Suppress: (Pin C1-B4)** blanks all leading zero's to the left of decimal point except a zero just left of the decimal point
HIGH = Leading 0's blanked
LOW = full print (no suppression)
2 Low Power TTL loads, plus 10K ohm pullup to +5V, level sensitive.
Note: Will not suppress if any characters are blanks.

**Minus Sign: (Pin C1-B1)**
Selectable positive or negative true using data level select input.
1 TTLLS load, plus 10K ohm pullup to +5V, level sensitive.

**Plus Sign: (Pin C1-A5)**
(Selectable positive or negative true using change data polarity input). (Minus sign must also be printed since it is used as the horizontal portion of the plus sign).
1 TTLLS load, plus 10K ohm pullup to +5V, level sensitive.
Note: Printing "plus" sign only results in vertical portion of plus sign. See above. Usable as 100% overrange digit.

**Blanked Character:**
Created by loading 1-1-1-1 in a given column. Can be hard-wired. Not available for hexadecimal models.

**Decimal Points: (6 lines)**
1 TTLLS load, plus 10K ohm pullup to +5V, level sensitive
(Selectable positive or negative true using change data polarity inputs).

**No-Print Paper Advance: (Pin C1-A3)**
Ground this line 70±5 mSec. to advance one line. Hold to ground for continuous advance at 6.7 lines per second.
1 TTLLS load plus 10K ohm pullup to +5V.

**No Print Paper Advance:**
May also be created by loading the illegal BCD character 1-1-1-1 in all decimal locations, and disabling all decimal points and ± signs, then initiating a print/advance command.

**Test: (Pin C2-B6)** (Not available on hexadecimal models)
LOW = ±.8.8.8.8.8.8 printout when print/advance command is given.
1 TTLLS load, plus 10K ohm pullup to +5V, level sensitive.

**Change Busy Polarity: (Pin C1-A2)**
HIGH = positive true busy out
LOW = negative true busy out
1 TTLLS load, plus 10K ohm pullup to +5V, level sensitive.

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

DATEL SYSTEMS, INC.

# DIGITAL PANEL PRINTER/DPP-7

## SPECIFICATIONS (CONTINUED)

### OUTPUTS

**DTL/TTL compatible**

Positive true: 0V≤"0"≤+0.4V
+2.4V≤"1"≤+5.0V

Negative true: +2.4V≤"0"≤+5.0V
0V≤"1"≤+0.4V

**Busy: (Pin C2-B12)** (Open collector TTL 7438 with 1K ohm pullup to +5V)

Remains TRUE during print and advance cycle (approximately 200 to 330 milliseconds). Data inputs may be changed 500 nSec. after transition to TRUE. Next print command can be enabled when busy goes FALSE. Selectable positive or negative true. 10 TTL loads.

**Out of Paper: (Pin C2-B4)**
Switch opening via mechanical pawl when approx. 6′ (2m) of paper are left on roll.

### TEMPERATURE RANGES

**Operating:** 0 to +40°C (to +50°C at derated speed)

**Storage:** −25°C to +85°C (Paper darkens above +60°C)

Active printhead temperature sensor is employed to maintain proper print head temperature at all ambient temperatures and during warmup.

### POWER SUPPLY—DC VERSION

**Model DPP-7D (+5V):**
**Voltage:**
+5 ±.5VDC Printhead Section 10 Amps peak @ 10% to 100% duty cycle depending on line rate and printout. 5 to 20 mS 10 Amp pulses occur several times per second in standby. A regulated power supply is recommended, using 16 gauge wire or larger not to exceed 10 ft. (3m.)

**Voltage:**
+5 ±.25 VDC Logic Section 300 mA typical, logic spikes 50 mV max. Separate PC board connection.

**Connections:** Two recessed ¼″ spade terminals.

**Fuses:** ¼″ dia. × 1¼″ long, SLO-BLO (+5V) 10A, (+12V) 4A, (+28V) 2A

### POWER SUPPLY—AC VERSION:

105-125 VAC, 47-440Hz @ 40 watts max (10 watts, typ standby)

**Optional:**
205-240 VAC, 47-440Hz @ 40 watts max (10 watts, typ standby)

**Optional:**
90-110 VAC, 47-440Hz @ 40 watts max (10 watts, typ standby)

**AC Fuse:** ¼″ × 1¼″ Buss MDL or equivalent ½ A, SLO-BLO, 115VAC, ¼A, SLO-BLO, 230VAC.

*Note:* Case is isolated from 5V ground and AC line. A separate spade terminal is included to ground case.

+5V, 200mA max. logic power out available with AC version.

Optional dual-winding 115/230 VAC model available (see ordering)

### WEIGHT (WITH HOUSING AND FULL PAPER ROLL)

| | | |
|---|---|---|
| 5 Volt Version: | 2.3 lbs. | (1,1Kg) |
| AC Version: | 4.2 lbs. | (1,9Kg) |

### DIMENSIONS

Front panel mounting cutout:
4.50″ WIDE × 2.72″ HIGH (115 mm × 69 mm)

Front panel Bezel dimensions:
5.25″ WIDE × 2.82″ HIGH (134 mm × 72 mm)

Depth behind front surface of mounting panel including clearance for rear PC connectors and fuses:

| | |
|---|---|
| 5V Version: | 6.2″ (158 mm) |
| AC 12V, 28V Version: | 8.7″ (221 mm) |

## ORDERING INFORMATION

**MODEL NUMBER**

**DPP-7** ____ ____ ____

**POWER SUPPLY**
A = 115VAC
E = 230VAC
J = 100VAC
B* = Both 115/230VAC
Dual-winding transformer, shipped as 230VAC. Rewired by user to 115VAC
D = + 5VDC
Y = +12VDC
Z = +28VDC

*Add $15 for the 115/230 VAC version.

**PRINTOUT FORMAT**
1 = ±.9.9.9.9.9.9
2 = .9.9±.9.9.9.9
3 = .9±.9.9.9.9.9
4 = .9.9.9 .9.9.9
5 = .9.9.9.9 .9.9
6 = .9.9.9.9.9 .9

**CHARACTERS**
Leave Blank = Decimal Digits
H** = Hexadecimal Digits

**Add $15 for Hexadecimal printout.

## PRICES (1-9)

DPP-7 Printer with decimal printout . . . . . $475.00
(Includes 2 connectors, roll of paper, and a line cord if an AC model)
Add for dual-power transformer, 115/230 VAC . . . . . $15.00
Add for hexadecimal printout . . . . $15.00
Model 9114, Box of 10 paper rolls, 150 ft. per roll . . . . . $19.95

## ORDERING EXAMPLE:

DPP-7B3H Printer with dual-power 115/230 VAC transformer, and hexadecimal .F±.F.F.F.F.F printout . . . $505.00

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

DATEL SYSTEMS, INC.

# MODEL AIP-40 Alphanumeric Impact Printer

## FEATURES

- ▶ 40-column, 5 x 7 dot matrix printer prints 64 ASCII characters
- ▶ Printing rate up to 50 characters per second or 1.25 lines per second
- ▶ Choice of 8-bit parallel or optional serial TTY/RS-232-C interfaces
- ▶ Parallel Printer is directly compatible with 8080 or 6800 microprocessor Peripheral Interface Devices
- ▶ Serial Printers include choice of speeds (110 to 9600 Baud), 20 mA TTY loop or EIA RS-232-C signals, 10 or 11 bit formats, self test, parity detection
- ▶ Serial Printers include 120 or 200 character Buffers
- ▶ Choice of 100, 115 or 230 VAC, 50/60 Hz power input

## GENERAL DESCRIPTION

Datel's model AIP-40 is a complete stand-alone Alphanumeric Impact Printer for teleprinter use with mini- and microcomputers and as a print-only 40-column teletypewriter. It includes a printhead, paper feed mechanism, choice of electronics and power supply.

The AIP-40 prints the standard 64-character ASCII set consisting of upper case letters, numerals, punctuation and spaces. Lower case letters from the computer are printed as upper case. Characters are formed within a 5 x 7 35-dot matrix area with logic controlled optional printing of 10 x 7 double-width characters corresponding to a 20-column line. The double-width characters offer greater emphasis to printed output and may be used like a color ribbon control

Both 8-bit parallel and full serial interfaces are offered on the AIP-40. The 8-bit parallel interface is asynchronous and offers the lowest cost. It may be connected by the user to many microprocessor systems and to most mini-computers. The serial interfaces have somewhat higher cost but offer simpler wiring to the teletypewriter (TTY) or EIA RS-232-C peripheral module offered by most computer manufacturers.

## PERFORMANCE

The AIP-40 features excellent speed and reliable, low maintenance operation for terminal and development applications. Average printing rate is 50 characters per second corresponding to 1.25 lines per second. Serial interfaces type 2 and 3 can sustain a continuous 300 BAUD printing rate. An impact mechanism is used for printing on the AIP-40. Characters are formed using a vertical column of seven print wires and solenoids which are rapidly impacted through a ribbon onto conventional adding machine paper. A single AC synchronous motor controls printhead motion, paper advance, ribbon feed and automatic ribbon reversing. The mechanism life is rated at 400 million characters (10 million lines).

Each AIP-40 is a complete stand-alone printer for table-top or bench-top mounting and includes a choice of interface electronics. A triple-voltage power transformer accepts 100, 115 or 230 VAC, ±10% at 50 or 60 Hz. Users may rewire the transformer in the field to any of these voltages. Recalibration of the character rate clock will also be needed. Systems manufacturers may order a distribution of AIP-40 Printers with complete confidence that field changes can be made quickly at any time.

## INPUT INTERFACES

The AIP-40 Printer is available with an 8-bit parallel input interface or several full serial interfaces The 8-bit parallel asynchronous input is ideal for simple connection to microprocessor data sources such as 8080 and 6800 based microcomputers. The parallel interface may also be used with parallel I/O ports offered by most minicomputer manufacturers. The parallel input offers the lowest cost model, but may require some simple wiring and controller electronics fabricated by the user, depending on the computer used. The AIP-40 is directly compatible to the Intel 8255 and Motorola 6820 Peripheral Interface devices.

The full serial interfaces offer the simplest method of interconnection to computers at slightly higher cost. The serial interfaces require a serial peripheral driver (teletypewriter port) in the computer using ASCII data coding and RS-232-C or teletypewriter (TTY) 20mA current loop electrical characteristics. Such serial peripheral drivers are offered as standard card modules by most computer manufacturers and are included in complete microcomputer boards such as Intel's SBC-80/10/20. All serial AIP-40 printers may be jumper-programmed to accept standard data rates from 110 to 9600 BAUD. For users requiring a remote slave printer, the 20mA TTY loop may be operated hundreds of feet away from the computer over voice-grade telephone wires.

The first serial interface (type 2) includes TTY-RS-232-C input and a 120-character serial buffer which can store 3 full lines of printout. This interface requires that the computer not exceed the average printing rate. The second serial interface (type 3) includes a 5-line, 200-character input buffer and prints single and double width characters by program control of each character. This interface also supplies the RS-232-C handshake signals, "Request to Send" and "Data Terminal Ready". These two signals prevent the computer from supplying data faster than the printer can accept it. These signals also free the CPU and serial peripheral from excessive duty cycle devoted only to the printer. This is done by allowing bursts of data up to 9600 BAUD rate triggered by an interrupt generated from the "Request to Send" line.

The third serial interface (type 4) contains the features of type 2 and 3 serial interfaces and offers fast paper feed plus automatic detection of ASCII carriage return (CR) and line feed (LF) characters to initiate printing.
This option also adds a separate line feed motor offering line advance without printing at a 5 line/per second rate for fast separation of printed records.

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

## INPUT INTERFACES

The AIP-40 Printer is available with an 8-bit parallel input interface or several full serial interfaces. The 8-bit parallel asynchronous input is ideal for simple connection to microprocessor data sources such as 8080 and 6800 based microcomputers. The parallel interface may also be used with parallel I/O ports offered by most minicomputer manufacturers. The parallel input offers the lowest cost model, but may require some simple wiring and controller electronics fabricated by the user, depending on the computer used. The AIP-40 is directly compatible to the Intel 8255 and Motorola 6820 Peripheral Interface devices.

The full serial interfaces offer the simplest method of interconnection to computers at slightly higher cost. The serial interfaces require a serial peripheral driver (teletypewriter port) in the computer using ASCII data coding and RS-232-C or teletypewriter (TTY) 20mA current loop electrical characteristics. Such serial peripheral drivers are offered as standard card modules by most computer manufacturers and are included in complete microcomputer boards such as Intel's SBC-80/10/20. All serial AIP-40 printers may be jumper-programmed to accept standard data rates from 110 to 9600 BAUD. For users requiring a remote slave printer, the 20mA TTY loop may be operated hundreds of feet away from the computer over voice-grade telephone wires.

The first serial interface (type 2) includes TTY-RS-232-C input and a 120-character serial buffer which can store 3 full lines of printout. This interface requires that the computer not exceed the average printing rate. The second serial interface (type 3) includes a 5-line, 200-character input buffer and prints single and double width characters by program control of each character. This interface also supplies the RS-232-C handshake signals, "Request to Send" and "Data Terminal Ready". These two signals prevent the computer from supplying data faster than the printer can accept it. These signals also free the CPU and serial peripheral from excessive duty cycle devoted only to the printer. This is done by allowing bursts of data up to 9600 BAUD rate triggered by an interrupt generated from the "Request to Send" line.

The third serial interface (type 4) contains the features of type 2 and 3 serial interfaces and offers fast paper feed plus automatic detection of ASCII carriage return (CR) and line feed (LF) characters to initiate printing. This option also adds a separate line feed motor offering line advance without printing at a 5 line/per second rate for fast separation of printed records.

## QUICK SPECIFICATIONS

**Characters Printed** ..... 64-character upper case subset of the ASCII code
**Printing Method** ..... Impact ink-ribbon 5 x 7 dot matrix.
**Number of Columns** ..... 40 characters (40 columns) per line. This reduces to 20 characters for double-width printing
**Printout Sizes** ..... Line length: 3.33 inches (84,6 mm)
Character size: .077 in. wide x .112 in. high
**Printer Paper** ..... Roll paper adding machine type
Width: 3.875 inches (98,5mm). Contains 170 feet (51,8 m) Capacity: Approx. 12,240 lines

**PERFORMANCE**
**Average Throughput Rate** ..... 1.25 lines per second (800 milliseconds per line) @ 60 Hz power (50 characters/second)

**PARALLEL INTERFACE INPUTS**
**Data** .....
**Data Ground** .....
**Character Width** .....
**Last Character** .....
**Ready / Ready**

**OUTPUTS**
**Acknowledge** .....

**SERIAL INTERFACE**
**Data Format** ..... 10 or 11 bits transmit one character.
**Data Rates** ..... Crystal-controlled Baud rates:
110 1200
150 2400
300 4800
600 9600

**PHYSICAL-ENVIRONMENTAL**
**Outline Dimensions** ..... 13.50 inches wide x 13.25 inches deep x 7.12 inches high

### Model Number

AIP-40

| Power Supply |
|---|
| A = 115VAC, 60 Hz |
| E = 230VAC, 50 Hz |
| J = 100VAC, 60 Hz |

| Interface Type |
|---|
| 1 = Parallel 8-Bit ASCII |
| 2 = Serial TTY/RS-232-C ASCII with 120-character buffer |
| 3 = Option 2 plus 200-character buffer, 1X/2X widths, RS-232-C handshakes, parity detect, test and select. data formats |
| 4 = Options 2 and 3 plus fast paper feed and ASCII CR, LF detection |

## SELECTION GUIDE AND PRICES

| Interface Type | Models | Number of Wires | Print Command | Double Width Chars. | Parity Error | Line Feed | Buffer | Price (singles) |
|---|---|---|---|---|---|---|---|---|
| Parallel, Character Synchronous | AIP-40A1<br>AIP-40E1<br>AIP-40J1 | 8 Data<br>3 Control<br>8 Ground | Ready line goes true | One line control | Not detected | Automatic mechanical | One character, 6 bits | **$425.00** |
| Serial Type 2 | AIP-40A2<br>AIP-40E2<br>AIP-40J2 | 3 Data*<br>2 Ground | 40 chars. (full line) or CR char. | Not detected | Not detected | Automatic mechanical | 120 chars. (3 full lines) | **$625.00** |
| Serial Type 3 | AIP-40A3<br>AIP-40E3<br>AIP-40J3 | 3 Data*<br>2 RS-232-C control<br>2 Ground<br>1 Self Test | 40 chars. (full line) or CR char. | SO/SI ASCII chars. | Detected, selectable reverse field printed | Automatic mechanical | 200 chars. (5 full lines) | **$675.00** |
| Serial Type 4 | AIP-40A4<br>AIP-40E4<br>AIP-40J4 | 3 Data*<br>2 RS-232-C Control<br>2 Ground<br>1 Self Test | 40 chars. (full line) or CR or LF chars. | SO/SI ASCII chars. | Detected, selectable reverse field printed | 2nd LF motor cycled by ASCII LF, CR or 40 char. count | 200 Chars. (5 full lines) | **$695.00** |

*3 Data lines: 2 TTY 20mA loop / 1 RS-232-C

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

# ULTRA-LOW COST DIGITAL PANEL METERS
## DM-3100/DM-4100 SERIES

For higher accuracy and resolution the DM-4100's will measure 100 microvolt increments in their 4½ digit displays. They are ideal for low cost, dedicated DVM applications. They too are auto zeroed and can be operated ratiometrically.

**DM-3100L**
Lowest Cost: From $29 in 100's
Large 0.5" LED displays
Short Depth, front access case
Autozeroing, Ratiometric (opt.)
Differential Balanced Inputs

**DM-3100N**
Lowest Cost: From $29 in 100's
Large 0.5" LED displays
Low Profile, minimum panel area case
Autozeroing, Ratiometric
User-wired offset and scaling
Differential, Balanced Inputs

**DM-3100X**
Ultra low power: 9VDC @ 3mA or 5VDC @ 6mA
Power voltage range 4 to 15 Volts DC
Short Depth, Front Access case
Autozeroing, Ratiometric
Differential, Balanced inputs

**DM-4100L**
Lowest Cost for dedicated DVM applications: $59 in 100's
Large 0.5" LED displays
Short Depth front access case
System Controls for automatic test equipment
Autozeroing

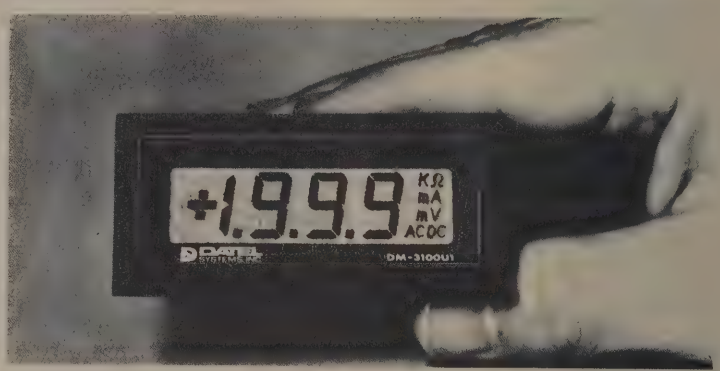
**DM-4100N**
Lowest Cost for dedicated DVM applications: $59 in 100's
Low profile, minimum panel area case
Autozeroing

**DM-3100U1**
Ultra-low power: 9VDC @ 3mA
Power Voltage Range: 4V to 15V
Low Profile, minimum panel area case
Autozeroing, Ratiometric
Differential, Balanced Inputs
Descriptor Labels: mA, mV, Ω, AC, DC

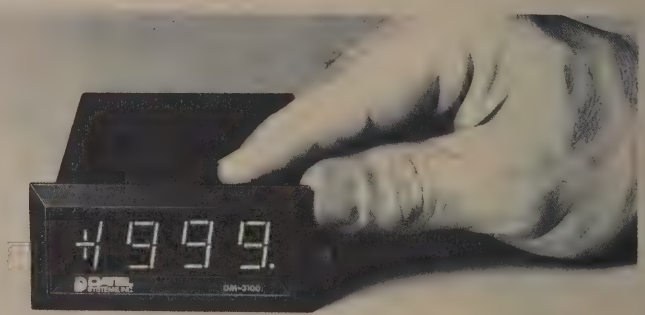
**DM-3100U2, U3**
AC or DC powered
DC Power Range: 9V to 15V
Autozeroing, Ratiometric
Differential, Balanced Inputs
Descriptor Labels: mA, mV, KΩ, AC, DC

**DM-4100N**

**DM-3100X**




**DM-3100U1**




**DM-3100N**

**CONTACT DATEL FOR A COMPLETE DPM BROCHURE**
**Note: DPM's are normally supplied without Bezel Labels or Logos.**



DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

## QUICK SELECTION GUIDE

| Datel Model | Number of Digits | Input Type | Input Range | Auto-Zero | Ratio-metric | Display | Power Req'd. | Case | Notes | Price (Quantity) |
|---|---|---|---|---|---|---|---|---|---|---|
| DM-3100L | 3½ | Bal. Diff. | ±2V | Yes | Yes | .5" LED | 5V @ .19A | short depth | front access | $45 (1-9) $29 (100+) |
| DM-3100N | 3½ | Bal. Diff. | ±2V (.2V opt.)* | Yes | Yes | .5" LED | 5V @ .19A | low profile | fits other mfgr's cutouts | $45 (1-9) $29 (100+) |
| DM-3100X | 3½ | Bal. Diff. | ±2V | Yes | Yes | .5" LCD | 5V @ 6mA or 9V @ 3mA | short depth | Batt. power | $59 (1-9) $41 (100+) |
| DM-4100L | 4½ | Sing. End. | ±2V | Yes | Yes | .5" LED | 5V @ .35A | short depth | front access | $79 (1-9) $59 (100+) |
| DM-4100N | 4½ | Sing. End. | ±2V | Yes | Opt. | .3" LED | 5V @ .35A | low profile | fits other mfgr's cutouts | $79 (1-9) $59 (100+) |
| DM-3100UI | 3½ | Bal. Diff. | ±2V (.2V opt.)* | Yes | Yes | .5" LCD | 5V @ 6mA or 9V @ 3mA | low profile | Descriptors: mA, mV, kΩ, AC, DC | $69 (1-9) $49 (100+) |
| DM-3100U2 DM-3100U3 | 3½ | Bal. Diff. | ±2V (.2V opt.)* | Yes | Yes | .5" LCD | 9Vdc or AC | low profile | Descriptors: mA, mV, kΩ, AC, DC | $69 (1-9) $49 (100+) |

*Requires components selected and installed by the user
NOTE: Because of continuing product enhancement, prices and specifications are subject to change without notice.

## SPECIAL FEATURES CHART*

| Model | 9Vdc Power | Ratio-metric (Ext. Ref.) | Offset Pot.* | Current Shunt* | Volt.* Divider | 200mV Range* | Ohm-meter* |
|---|---|---|---|---|---|---|---|
| **DM-3100L** | NO | YES | NO | YES | YES | YES | YES |
| **DM-3100X** | YES | YES | NO | YES | YES | YES | YES |
| **DM-3100N** | NO | YES | YES | YES | YES | YES | YES |
| **DM-3100U1** | YES | YES | YES | YES | YES | YES | YES |
| **DM-3100U2** | YES | YES | YES | YES | YES | YES | YES |
| **DM-3100U3** | YES | YES | YES | YES | YES | YES | YES |
| **DM-4100L** | NO | YES | NO | YES | YES | NO | NO |
| **DM-4100N** | NO | SOLDER GAPS | NO | YES | YES | NO | NO |

*Features with an asterisk require internal or external component selection and installation by the user.

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

# SPECIFICATIONS

(Typical @ +25°C unless noted)

## ANALOG INPUT

**Configuration**
True, balanced differential bipolar (3½ digit models) or single-ended bipolar (4½ digit models).

**Full Scale Input Range**
−1.999Vdc to +1.999Vdc (3½ digit models)
−1.9999Vdc to +1.9999Vdc (4½ digit models)

**Optional Ranges***
±199.9mVdc to ±1000Vdc

**Ammeter Ranges (optional*)**
±19.99 microamps to ±1.999 Amps

**Ohmmeter Ranges (optional*)**
0 to 199.9 ohms up to 0 to 19.99 megohms

**Input Offset (optional*)**
+1.9Vdc to −5Vdc referred to 5V ground

***NOTE:** The optional ranges require installation of extra components by the user inside the DPM. This is also available on special order in OEM quantities from Datel.

**Input Bias Current**
5pA typical, 50pA maximum

**Displayed Accuracy @ +25°C**
Adjustable to ±0.02% of Reading, ±2 count (4½ digit models)
Adjustable to ±0.1% of Reading, ±1 count (3½ digit models)

**Resolution**
1mV (3½ digit models)
100μV (4½ digit models)

**Temperature Drift of Gain**
Within ±50ppm of Reading/°C typ.
Within ±100ppm of Reading/°C max.

**Temperature Drift of Zero**
Autozeroed, ±1 count over 0 to +50°C

**Input Impedance**
100 Megohms, minimum

**Input Overvoltage**
±250 Volts dc, 155 VRMS continuous max.
±300 Volts intermittent max.
(Resistor and diode clamp protected)

**Common Mode Rejection**
80dB, DC to 60Hz, 1 Kilohm unbalance (3½ digit models)

**Common Mode Voltage Range**
(3½ digit models)
Within +Vs −.5V and −Vs +1V
Where +Vs is the positive rail (A/D or +5V PWR. IN) and −Vs is the negative rail (EXT. REF. LO or 9V PWR. COM.)

**Warm-up Time (LED Models)**
Within 10 minutes

**Reference**
**(DM-3100 Models)**
Internal, referred to the negative rail (−Vs). External user-supplied Reference optional for ratiometric operation.

**External Ref. Range**
Must be within the common mode range.

**Ramp-up Time**
**(Integration Period)**
83.3mS

## DISPLAY

**Number of Digits**
3 decimal digits and most significant "1" digit (3½ digit models).
4 decimal digits and most significant "1" digit (4½ digit models).

**Decimal Points**
Selectable decimal points are included for scale multipliers

**Display Type**
Red, light-emitting diode (LED) self-illuminated. (Models DM-3100L, -3100N, -4100L, -4100N) Field effect, sealed liquid crystal displays (LCD) requiring external illumination. Black digits against a light background. (Models DM-3100X, DM-3100U1, DM-3100U2, U3)

**Display Height**
0.5 inches (12,7 mm) All models except: 0.3 inches (7,6 mm): DM-4100N models.

**Overscale**
Inputs exceeding the full scale range cause the display to blink (4½ digit models). On 3½ digit models, the display blanks, leaving a "1" MSD and sign.

**Autopolarity**
A polarity sign is automatically displayed for bipolar inputs, and may also be blanked.

**Sampling Rate**
Factory set at 3 conversions per second. May be rewired up to 20 conversions/second.

**Electrical Unit Descriptors**
**(Model DM-3100U1, U2, U3 only)**
kΩ
mA
mV
ACDC
This field of function labels is positioned to the right of the decimal digits. Individual unit descriptors may be selected for display (see I/O connections, below).

## I/O CONNECTIONS

**ANALOG HI INPUT**
**ANALOG LO INPUT**
**Models: All**
For 3½ digit models, differential input voltages are connected between these inputs. A bias current path to POWER COMMON or ANALOG RETURN from both these inputs must be externally provided. External circuits must constrain these inputs to be within the common mode voltage range.
For DM-4100N, Analog LO IN is connected internally to POWER COMMON. 4100L must conn. to PWR. COM externallv.

**ANALOG RETURN**
**Models: All 3½ digit models**
This pin may be used as a low-noise bias current return for some floating inputs. If not possible, inputs may be referenced to POWER COMMON (except in 9V power configuration). Analog Return is approx. −2.8Vdc below plus Vs. and can sink 30mA to −Vs.

DO NOT connect Analog Return to +5V or +9V power. Analog Return may be connected to 5V PWR. COM. (NOT −Vs!) For single-ended input.

**REFERENCE IN/OUT**
**Models: All DM-3100's**
Normally, REF. IN and REF. OUT should be jumpered together. An external floating source referred to EXT. REF. "LO" may be substituted for ratiometric operation, 3½ digits. Model DM-4100L, N: An ext. ref. returned to Power Common may be used ratiometrically. See pg. 20.

**BUSY/$\overline{\text{DONE}}$ OUT**
**Model DM-4100L**
**Model DM-4100N**
This output is logic "HI" during A/D conversion and logic "LO" when conversion is complete. It may be used in automatic equipment to prevent changing the input voltage during conversion.

**OVERSCALE OUT**
**UNDERSCALE OUT**
**Model DM-4100L**
**Model DM-4100N**
A logic "HI" on either output indicates an out of range input for autoranging applications.

**DECIMAL POINTS**
**Model DM-3100N**
**Model DM-4100N**
On these models only, connect selected pin to DECIMAL POINT COMMON.

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

**DECIMAL POINT COMMON**
**Model DM-3100L**
**Model DM-3100X**
**Model DM-3100U1, U2, U3**
**Model DM-4100L**
On these models, connect this pin to the selected decimal point pin.

**DISPLAY ENABLE**
**Model DM-3100L**
**Model DM-3100N**
**Model DM-4100N**
**Model DM-4100L**
Connect to +5Vdc power to illuminate display. Disconnect to blank display, but keep A/D converter cycling.

**RUN/$\overline{\text{HOLD}}$ IN**
**Model DM-4100L**
**Model DM-4100N**
A TTL "HI" or open pin enables continuous sampling. TTL "LO" or ground will hold and display the last sample for temporary single sample storage or to copy down a reading.

**DISPLAY TEST**
**Model DM-3100L**
**Model DM-3100N**
**Model DM-3100X**
**Model DM-4100L,N**
On DM-3100's, connect this input to +5Vdc to light all display segments. On DM-4100's, ground this input.

**$\overline{\text{POLARITY ENABLE}}$**
**Model DM-3100L**
**Model DM-3100N**
**Model DM-4100N**
**Model DM-4100L**
Ground this input to automatically display a minus sign for negative inputs.

**HORIZ. POLARITY IN**
**HORIZ. POLARITY OUT**
**Model DM-3100X**
**Model DM-3100U1**
**Model DM-3100U2, U3**
Normally these inputs are jumpered together to continuously illuminate the horizontal portion of the polarity sign. Omit the jumper for applications not requiring sign display.

**VERT. POLARITY IN**
**VERT. POLARITY OUT**
**Model DM-3100X**
**Model DM-3100U1**
**Model DM-3100U2, U3**
Jumper these inputs when HORIZ. POL. is jumpered for automatic sign display with bipolar inputs. For reverse sensing applications, VERT. POL. OUT may be jumpered to HORIZ. POL. IN (no other connections). This will display a minus sign with positive inputs and no sign (implied positive) with negative inputs.

**OHMS LO**
**All 3½ digit models**
This connection is used in the ohmmeter configuration, otherwise do not use. See applications.

**BACKPLANE OUT**
**Model DM-3100X**
**Model DM-3100U1**
**Model DM-3100U2, U3**
Connect all unused Polarity, Decimal Points and Descriptors to Backplane Out.

**DESCRIPTORS**
**Model DM-3100U1**
**Model DM-3100U2, U3**
Electrical units are displayed by connecting to the Descriptor Common. Descriptors displayed are as follows:

| | | |
|---|---|---|
| "mA" | (pin A3) - "m" | portion only |
| "kΩ" | (pin A4) - "k" | portion only |
| "KΩ" | (pin A5) - "Ω" | portion only |
| "mA" | (pin A6) - "A" | portion only |
| "mV" | (pin A7) - "V" | portion only |
| "DC" | (pin A8) | |
| "AC" | (pin A9) | |
| "mV" | (pin A10 - "m" | portion only |

**IMPORTANT NOTE:** The descriptors display labels only. They do not select functions. The DM-3100U1 and DM-3100U2 do not directly measure ohms, mA, AC, etc. without first adding user-installed internal or external components.

**POWER CONNECTIONS**
**A/D POWER IN**
**Model DM-3100X**
**Model DM-3100U1, U2, U3**
Connect this pin to the positive leg of the power supply voltage.

**5V DC/DC POWER IN**
**Model DM-3100X**
**Model DM-3100U1**
Connect this pin to +5V if a single 5 Volt supply is used. This will generate negative voltage for analog circuits. Do not use this pin for 9V power.

**5V POWER COMMON**
**MODELS: ALL**
Use only for 5V power configuration. This pin may be used as a bias current return path for some inputs, if it is connected to an external power source.

**9V POWER COMMON**
**Model DM-3100X**
**Model DM-3100U1, U2, U3**
This pin is connected to the internal negative supply rail. Use only as the negative supply leg for 9V power configuration.

**AC POWER (DM-3100U2, U3)**
**115V (U2), 230V (U3) ±10%,**
**47 to 440 Hz, Isolation 300 Vrms**

**POWER REQUIREMENTS**
**MODELS DM-3100X and DM-3100U1**
**5V Single Supply Configuration:**
**Input Pins:** +5V to A/D PWR IN and to 5V DC/DC PWR IN. Ground 5V DC/DC GND.
**Supply Range:** +4Vdc to +8Vdc
**Current @ 5V:** 6mA typ., 10mA max.
**Regulation:** Use a bypass capacitor to attenuate external noise.

**9V Single Supply Configuration U1,2,3:**
**Input Pins:** +9V to A/D PWR IN No Conn. to DC/DC PWR IN. Gnd to 9V PWR. COM.
**NOTE:** 33μF bypass caps internally supplied.
**Supply Range:** +9Vdc to +15Vdc (A 9V alkaline battery is recommended)
**Current @ 9V:** 3mA typ. 6mA max.
**Current @ 15V:** 7mA typ., 12mA max.
**Regulation:** Use a bypass capacitor to attenuate external noise.

**POWER REQUIREMENTS**
**MODELS DM-3100L, DM-3100N, DM-4100L, DM-4100N**
External +5 ±0.25Vdc regulated required at 190mA typical, 250mA max. (3½ digits) or 350mA typical, 400mA max. (4½ digits). Logic spikes must not exceed 50mV. Power current varies rapidly so that unregulated supplies cannot be used.

**Calibration**
A multiturn screwdriver pot adjusts the full scale reading (gain). Zero is automatic (autozeroing). Suggested recalibration in stable conditions is 90 days.

**PHYSICAL-ENVIRONMENTAL**
**Low Profile Case**
**Outline Dimensions**
2.53"W x 3.25"D x 0.94"H (64,3 x 82,5 x 23,8 mm)
**Cutout Dimensions**
2.562"W x 0.97"H min. (65,1 x 24,6 mm)
**Mounting Method**
Through a front panel cutout secured by brackets and two removable side case screws. Panel thickness up to 0.62" (15,9 mm). See mounting diagram.

**Short-Depth Case**
(Interchangeable with other Datel cases)
**Outline Dimensions**
3.00"W x 2.15"D x 1.76"H (76,2 x 54,6 x 44,7 mm)
**Cutout Dimensions**
1.812"H x 3.062"W (46,0 x 77,8 mm)
**Mounting Method**
Through a front panel cutout secured by (4) 4-40 front access screws which are concealed by the bezel. See mounting diagram.

**Weight**
Approx. 5 ounces (142g)
**Connector**
Double-sided, edgeboard PC type, solder tab, gold-plated fingers.
**Mounting Position**
Any
**Operating Temperature Range**
0 to +50°C
**Storage Temperature Range**
−25°C to +85°C
**Altitude**
0 to 15,000 feet (4900m)
**Relative Humidity**
20% to 80% non-condensing

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

# Data Precision...

## The Best Choice in Portable, Bench and Systems Multimeters.

**Here is our outstanding selection of multimeters—each model optimized for a particular class of applications. These quality instruments are developed by Data Precision, the company that led the industry with pioneering advances that reduced the size, circuit complexity and cost of digital instruments—and improved performance and reliability.**

**Your work demands performance. And our selection of quality DMMs includes the model or models to match your requirements.**

### MODEL 175
### Portable, 3½ Digit DMM
### $189.00

With a basic DC accuracy of ±0.1% input ±1 l.s.d., guaranteed for a full year, and 100μV resolution, the Model 175 is unsurpassed for accuracy and sensitivity.

Battery and line operated and truly portable, it measures: DC Volts from ±100μV to ±1000V... AC Volts from 100μV to 500V (30Hz to 50kHz)... DC Current from ±0.1μA to ±2A... AC Current from 0.1μA to 2A (30Hz to 50kHz)... Resistance from 100mΩ to 20MΩ in two modes (Hi excitation 2.5V and Lo excitation 300mV).

The Model 175 also features autopolarity, automatic zero, 100% overrange, big, bright 0.43" LED display. It comes equipped with both rechargeable NiCd battery module and battery charger/line adaptor.

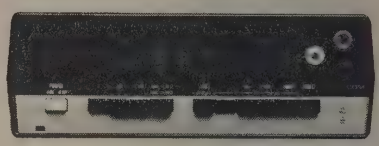
Size: 5½"W x 1¾"H x 3½"D
13.97 x 4.45 x 8.89 cm

### MODEL 1750
### 3½ Digit Bench/Portable DMM with Extra Functions & Ranges, dBm, True RMS, Hi/Lo Ohms, ±0.1% Accuracy
### $279.00

Our new Model 1750 is a 3½-digit, extra-function multimeter featuring dBm, True RMS, and Hi/Lo Resistance measurement.

Designed for high-precision applications, it offers 36 extra ranges and 6 extra functions, with 0.1% basic DC accuracy, as well as 100μV sensitivity, 10A measuring range, full overload protection, 100% overrange, and automatic zero. And the 1750 is readily converted to complete portability.

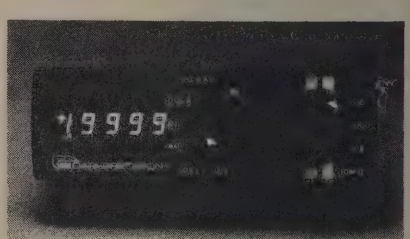
It measures DCV from ±100μV to ±1000V... ACV from 100μV to 1000V True RMS (frequency response: 20Hz to 20kHz)... DC Current from ±100 nanoAmps to ±10A True RMS... AC Current from 100 nanoAmps to 2A (frequency response: 20Hz to 20kHz) ...10A range, 20Hz to 1kHz... Hi/Lo excitation Resistance, 100 milliohms to 20 megohms... and dBm direct reading, −60dBm to +20dBm.



### MODEL 1350
### 3½ Digit DMM
### 0.1% Accuracy
### $169.00

This new bench-operated 3½-digit multimeter is a full-function instrument with a 0.1% basic accuracy. It measures DC Volts from ±100μV to ±1200V... AC Volts from 100μV to a full 1000V RMS... Resistance independently in both high (2.3V) and low (300mV) excitation, from 100mΩ to 20MΩ... and both DC and AC Current from 0.1μA to 2A.

The Model 1350 is fully protected in all modes, and features an extra-bright 0.43" LED display. It makes use of Data Precision's patented Tri-Phasic™ technology and Isopolar™ and Ratiohmic™ measurement techniques. The 1350 comes with built-in carrying case and tilt stand, test leads, and spare fuse.

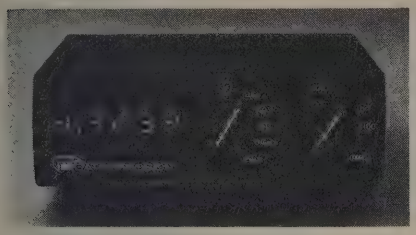



### MODEL 245
### Portable, 4½ Digit DMM
### $295.00

Ideal for field use, the Model 245 is a rugged, truly miniature, lab-quality, 5-function instrument featuring a basic DC accuracy of ±0.05% of input ±1 l.s.d., .005% resolution, 100% overranging. It comes equipped with both rechargeable battery pack and charger/line adaptor.

Model 245 measures ACV 100μV to 500V RMS, DCV ±100μV to 1000V, Resistance 100 milliohms to 20 Megohms, AC and DC Current 1 microamp to 2 Amps. AC voltage/current frequency response, 30Hz to 50kHz.

Size: 5½"W x 1¾"H x 3½"D
13.97 x 4.45 x 8.89 cm

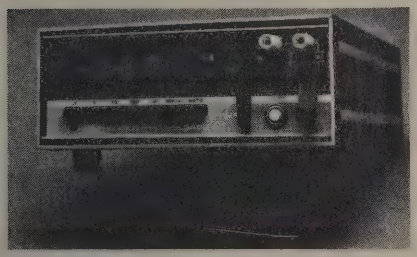


## MODEL 248
## Portable, 4½ Digit DMM With 10μV Resolution and True RMS
## $295.00

This high-resolution instrument measures Resistance from 100mΩ to 20MΩ, DC Volts from ±10μV to ±1KV, True RMS AC Volts from 10μV to 500V, both DC Current and True RMS AC Current from 10 nanoAmps to 2A.

The Model 248 features sensitivity of 10μV. Basic DC accuracy is ±0.05% of input, ±1 l.s.d., guaranteed for a full year, 100% overrange, overload protection, large LED display. It comes complete with both rechargeable NiCd battery module and battery charger/line adaptor, with 6 hours of in-spec operation before requiring recharge.

Size: 5½"W x 1¾"H x 3½"D
13.97 x 4.45 x 8.89 cm



## MODEL 3400
## System/Lab 4½ Digit Multimeter
## $795.00

The Model 3400 is the world's most accurate systems/lab 4½-digit multimeter. It is a fully programmable system multimeter, as well as a highly versatile stand-alone, autoranging instrument. Remote triggering will allow 12 conversions per second.

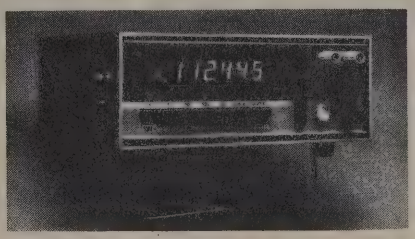
The 3400 offers 100% overranging and a basic DCV accuracy of ±0.007% of input ±1 l.s.d. for 6 months. It measures from ±10 microvolts to ±1000 VDC, ACV from 10 microvolts to 750V, Resistance from 10 milliohms to 20 Megohms, and AC/DC and DC/DC voltage ratio.

Also available with IEEE STD 488 interface unit Model 3410.

## MODEL 3400R
## With True RMS
## $895.00

**The same specifications and features as Model 3400, but with TRUE RMS AC Volts. $895.00.**

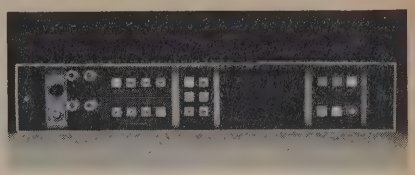
Also available with IEEE STD 488 interface unit Model 3410.



## MODEL 3500
## 5½ Digit Precision DMM
## $995.00

The Model 3500 is a full function, auto-ranging DMM with 6 month basic accuracy of ±0.007% of input, ±0.001% f.s. ±1 l.s.d. Remote ranging and trigger, 20% overrange and ½-inch planar display.

- DCV ±1μV to ±1000 volts. AC 1 μV to 700 volts. 30Hz to 100kHz.
- Resistance 1 milliohm to 12 Megohms.
- 1000 MΩ Input Impedance through 10 VDC. 2 and 4 wire Ratiohmic™ Resistance Measurement.
- DC/DC and AC/DC Ratio.
- BCD output and voltage ratio included at no extra cost.



## MODEL 7500
## 5½ Digit Programmable Systems Multimeter
## From $2995.00

Model 7500 is a 5½ digit multi-speed instrument that will perform a full conversion *1000 times per second!* It's completely programmable in function, range, mode, timing, and conversion speeds. DCV accuracy is ±0.007% of input ±0.001% range ±1 l.s.d. for 6 months. Sensitivity is 1μV DC and AC and 1mΩ. DCV and ACV measurement is from 1μV to 1000V. A true universal ratiometer, Model 7500 enables the user to choose both the numerator and denominator independently, and every measurement—DC Volts, AC Volts, and Resistance—can be made on a ratio basis to any other, if desired.

Model 7500 provides for full incorporation into any computer-based, high-speed, multi-channel automatic test or data acquisition system. In addition, a broad range of standard options, including built-in microprocessor-controlled IEEE 488 BUS or RS232/TTY Output is available.

**For complete information on these and other Data Precision instruments, or a demonstration, contact your local Data Precision representative or Data Precision Corporation, Audubon Road, Wakefield, MA. 01880 USA (617) 246-1600. TELEX (0650) 949341.**

DATA PRECISION®
...years ahead

### DATA PRECISION U.S. REPRESENTATIVES

| | | | | | |
|---|---|---|---|---|---|
| **AL** | (205) 533-5896 | **MA** | (617) 245-5940 | **NY** (S) | (212) 895-7177 |
| **AZ** | (602) 253-6104 | **MD** | (301) 384-8500 | **OH** (N) | (216) 331-0900 |
| **CA** (N) | (408) 733-8690 | **MI** | (313) 459-1670 | **OH** (S) | (513) 433-8171 |
| **CA** (S) | (714) 540-7160 | **MN** | (612) 781-1611 | **OK** | (918) 743-6892 |
| **CO** | (800) 528-4512 | **MO** | (816) 358-7272 | **OR** | (503) 653-1750 |
| **CT** | (203) 693-0710 | **NC** | (919) 787-5818 | **TX** (N) | (214) 234-4137 |
| **FL** (N) | (813) 294-5815 | **NJ** (S) | (215) 674-9600 | **TX** (S) | (713) 461-4487 |
| **FL** (S) | (305) 491-7220 | **NJ** (N) | (800) 645-8016 | **TX** (W) | (512) 837-3881 |
| **GA** | (404) 945-4222 | **NM** | (800) 528-4512 | **UT** | (800) 528-4512 |
| **IL** | (312) 593-0282 | **NY** (N) | (315) 446-0220 | **VA** | (800) 638-2720 |
| **IN** | (317) 293-9827 | **NY** (S) | (516) 482-3500 | **WA** | (206) 883-6336 |

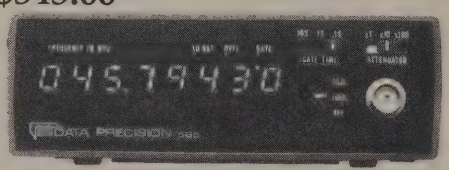
# Data Precision:

# The Best Choice in Portable and Bench Counters.

**Our counters are the result of meticulous product planning, progressive engineering, and detail-conscious quality control. We've anticipated your needs and built the instruments to meet them, optimizing each model for a particular class of applications. The end product is quality you can count on at cost-effective prices.**

**Check these specifications for the quality counter that meets your requirements best.**

## MODEL 585
## Portable, 250 MHz, 8 Digit Frequency Counter
## $345.00




A completely portable—battery and line operated—8 digit frequency counter, it will measure frequency from 10Hz to 250MHz, always reading directly in MHz, with correctly positioned decimal point. Resolution 0.1Hz. It also has excellent sinewave sensitivity (10mVRMS to 50MHz, 50mVRMS to 250MHz). Other features: dual Input Impedance (50Ω/1MΩ), a 3-position Attenuator, 3 gate times, 0.1, 1, 10 sec. and bright 0.3" LED display for optimum reliability. Includes NiCd Module, Charger, and Carrying Case. Optional antenna and other accessories.

Size: 5½"W x 1¾"H x 3½"D
13.97 x 4.45 x 8.89 cm.

## MODEL 5740
## 100MHz, 7 Digit Multifunction Counter
## $295.00

The Model 5740 measures Frequency, Period, Period Average, Total Events and Elapsed Time.

The Model 5740 measures: Sinewaves, Square Waves, Pulses, Pulse Pairs, Complex Waves • Frequency: 5 Hz to 100 MHz; 10 ms/100 ms/1 sec./10 sec. gate times, resolution to 0.1 Hz • Period: ½ microsecond to 0.2 sec. • Period Average: 10, 100 and 1000 periods • Total Events: 0 to 9,999,999 (unlimited with "overflow" indicator) • Elapsed Time: 0 to 99,999.99 sec. (27.8 hrs) • Sensitivity to 10mV.

**For complete information on these and other Data Precision instruments or a demonstration, contact your local Data Precision representative or Data Precision Corporation, Audubon Road, Wakefield, MA. 01880 USA (617) 246-1600. TELEX (0650) 949341.**

**DATA PRECISION U.S. REPRESENTATIVES**

| | |
|---|---|
| AL | (205) 533-5896 |
| AZ | (602) 253-6104 |
| CA (N) | (408) 733-8690 |
| CA (S) | (714) 540-7160 |
| CO | (800) 528-4512 |
| CT | (203) 693-0710 |
| FL (N) | (813) 294-5815 |
| FL (S) | (305) 491-7220 |
| GA | (404) 945-4222 |
| IL | (312) 593-0282 |
| IN | (317) 293-9827 |
| MA | (617) 245-5940 |
| MD | (301) 384-8500 |
| MI | (313) 459-1670 |
| MN | (612) 781-1611 |
| MO | (816) 358-7272 |
| NC | (919) 787-5818 |
| NJ (S) | (215) 674-9600 |
| NJ (N) | (800) 645-8016 |
| NM | (800) 528-4512 |
| NY (N) | (315) 446-0220 |
| NY (S) | (516) 482-3500 |
| NY (S) | (212) 895-7177 |
| OH (N) | (216) 331-0900 |
| OH (S) | (513) 433-8171 |
| OK | (918) 743-6892 |
| OR | (503) 653-1750 |
| TX (N) | (214) 234-4137 |
| TX (S) | (713) 461-4487 |
| TX (W) | (512) 837-3881 |
| UT | (800) 528-4512 |
| VA | (800) 638-2720 |
| WA | (206) 883-6336 |

DATA PRECISION®
...years ahead

DRANETZ
ENGINEERING LABORATORIES INCORPORATED
DEPT. EM, SOUTH PLAINFIELD, NEW JERSEY 07080 • TEL: (201) 755-7080 • TWX: 710-997-9553

# SERIES 305
## SUPER PERFORMANCE PHASEMETERS AND GAIN/PHASE METERS*

**305 Series Phasemeters** provide the highest available accuracy, along with many operational features. Designed for the calibration laboratory, the design engineer's bench, the production line and automatic test systems, the 305 is the most widely accepted phasemeter in industrial, and governmental organizations. **

### FEATURES
- No hands 86 dB dynamic range
- Automatic or programmable operation and calibration
- Highest accuracy — to 0.03°
- Repeatability better than 0.01°
- Rejects harmonics and noise
- Wide frequency range — 1 Hz to 11 MHz
- IEEE 488 Bus Compatibility

### FLEXIBILITY THROUGH PLUG-IN CONCEPT
The plug-in concept of the 305 offers a wide selection of characteristics. Three standard mainframes and nine plug-ins are complemented by a variety of options, such as programmability, high speed and autocalibration. Special modifications are also available. In addition, modular construction throughout provides maintainability at both component and P.C. card levels for ease and speed of servicing.

### WIDE FREQUENCY RANGE
The basic mainframe provides a direct frequency coverage of 2 Hz to 700 kHz with high accuracy. By the use of frequency converting plug-ins such as the 305-PA-3005, standard units can handle frequencies up to 11 MHz. Special units can be provided for higher frequency.

### NO HANDS OPERATION
The Series 305 Phasemeters require no controls or adjustments by the operator. These units are also equipped with several significant automatic features. These include automatic selection of angle range, automatic sensing of leading or lagging angle, automatic selection of the output time constants, and automatic setting of AC gains.

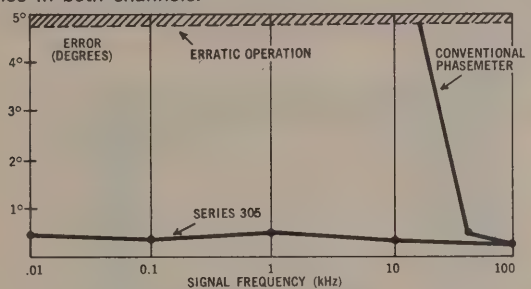
### HIGHEST ACCURACY
Accuracy to better than ±0.03° is attained with precision mainframes and carefully designed plug-ins. Mainframes exhibit precise zero crossing detection, angle-to-DC conversion linearity to approximately ±0.01° and outstanding DC stability. Plug-ins are designed for accurate conversion of sine wave (also square wave) inputs to square waves through carefully controlled amplifier circuitry, use of gain autoranging, and harmonic filters where necessary.

### INSENSITIVITY TO INPUT LEVEL
Series 305 plug-ins are available with a guaranteed accuracy of better than ±0.05° even with independent input level variations of 60 dB. Typical accuracy can approach ±0.03° as shown on the following page.

### NON-AMBIGUOUS ANGLE READINGS
Two phase angle ranges in the 305 eliminate the ambiguity or "dead zone" error inherent in all other phasemeters (usually at 0°/360° or −180°/+180°). An automatic system switches to the 0°/360° range for angles near 180° and to the −180°/+180° range for angles near 0°. Unique guard bands prevent dead zones near switching points.

### REPEATABILITY, STABILITY, AUTOCALIBRATE
Repeatability of the 305 is better than ±0.005°; temperature coefficient is ±0.001°/°C; and DC output drift is better than ±0.05° over any 30 day period. The autocalibrate feature eliminates virtually all DC errors in digital panel readout and BCD rear panel outputs.

### NOISE IMMUNITY
Unique patented circuitry minimizes noise errors and makes possible accurate phase measurements under noise levels where other phasemeters become completely useless. The accompanying curve compares the phase error of the model 305 with that of a conventional phasemeter with broad band noise in both channels.



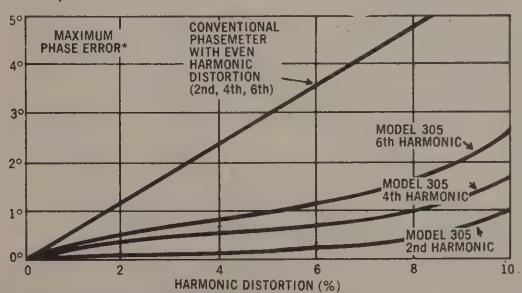

PHASE READING ERROR VS SIGNAL FREQ. FOR GAUSSIAN NOISE (FLAT TO 5 MHz) IN BOTH CHANNELS FOR S/N = 10

### PROGRAMMABLE OPERATION
Standard mainframes are provided with rear connections for overriding the automatic time constant and angle range selectors by relay contact closures. Options are available for full compatibility with IEEE 488 Interface Bus and for control by DTL and TTL logic.

### DIGITAL READOUT
In addition to analog DC output, standard mainframes are available with up to 5 digit panel readouts (i.e., 0.00° to ±180.00° and 0.00° to +360.00°) and BCD outputs for each digit. Autocalibrate feature eliminates virtually all meter drift and scaling errors.

### RAPID PHASE NULLING
For production testing of filters and other networks, an additional analog deviation-panel meter (305D) provides an easy means of adjusting a test angle to any accurate value. Presetting can be done in seconds without any other equipment. The precision digital panel meter monitors actual test angle continuously.

### ABILITY TO REDUCE HARMONICS
The 305 is designed to reduce significantly the errors due to even harmonic distortion without the use of filters. The accompanying curve compares the error due to even harmonic distortion (maximized for worst case harmonic angle) on conventional phasemeters and on the model 305. (Odd harmonics in-phase with fundamental contribute no error.)




COMPARISON OF ERRORS DUE TO EVEN HARMONIC DISTORTION
(* For worst case phase relationship between harmonic and fundamental)

*Manufactured under U.S. Pat. No. 3,725,781
**For extensive application information, write for availability of "Applications Handbook of Precision Phase Measurement."

SEE PAGE 2713 FOR LIST OF AVAILABLE TECHNICAL ARTICLES

SEE PAGE 2713 FOR LIST OF AVAILABLE TECHNICAL ARTICLES

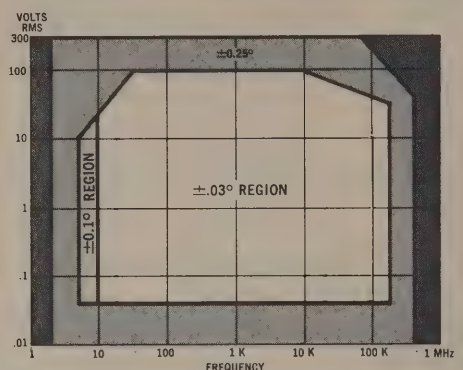
DRANETZ
ENGINEERING LABORATORIES INCORPORATED
DEPT. EM, SOUTH PLAINFIELD, NEW JERSEY 07080 • TEL: (201) 755-7080 • TWX: 710-997-9553

# SERIES 305
## SUPER PERFORMANCE PLUG-INS

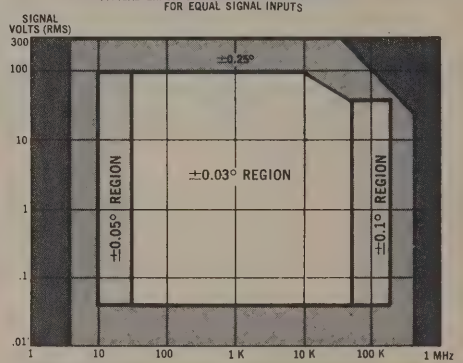
The variety of plug-ins available provides unlimited flexibility for the Series 305 Phasemeters in meeting many phase measurement problems. In addition to an expanding line of standard plug-ins, custom units can be designed for special needs.

### 305-PA-3001 AUTORANGING PLUG-IN

This plug-in features high accuracy over a broad range of input levels and frequencies. Autoranging of gain in each channel assures high accuracy (±0.05° guaranteed) over a dynamic range of 60 dB (50 mV to 50 V rms) for independent levels of inputs, with a useful range of 90 dB (10 mV to 300 V rms). This plug-in covers the range from 2 Hz to 700 kHz, with its highest accuracy in the 50 Hz to 50 kHz range. The curves shown illustrate typical accuracies as a function of level and frequency. The 305-PA-3001 also features compatibility with Tektronix probes and includes front panel lamps to indicate when either input signal is below 50 mV or above 50 V rms.




TYPICAL ERROR CONTOURS FOR 305 w/305-PA-3001 FOR EQUAL SIGNAL INPUTS




TYPICAL ERROR CONTOURS FOR 305 w/305-PA-3001 FOR UNEQUAL INPUTS — REF. 0.3 VOLTS RMS

While the above accuracies apply to sine wave inputs, this instrument can also be used for square wave and amplitude modulated signals.

### 305-PA-3002 SINGLE RANGE PLUG-IN

The 305-PA-3002 is similar to the model 305-PA-3001 except that it does not include autoranging or limit indicator lamps. For sine wave inputs the standard unit is designed for guaranteed ±0.05° accuracy (typically ±0.03°) over independent signal levels of 50 mV to 500 mV rms, with a slight reduction in accuracy from 10 mV to 3 V rms. Other level ranges can be supplied on special order; Tektronix probes can be used for high input levels. This plug-in is useful for sine wave, square wave and amplitude modulated signals.

### 305-PA-3005 HIGH FREQUENCY PLUG-IN

This high frequency plug-in is designed for high accuracy to 11 MHz. Using a self tracking oscillator, the input signals are converted to 40 kHz for precision measurement by the mainframe. Input attenuators (50 ohms) are provided with 10 dB steps, to cover a range of 1 mV to 3 V rms in either channel. Front panel lamps indicate when input levels are out of range or when level controls are improperly set. The self tracking oscillator can be controlled by channel A signal or by a third independent signal.

### 305-PA-3007 PROGRAMMABLE AND AUTORANGING PLUG-IN

This programmable plug-in features all of the characteristics of the model 305-PA-3001. In addition it includes increased input gain to achieve operation down to 1 mV rms. The unit can be operated either in an automatic or programmable mode. Without rear connections, the plug-in operates automatically as a 305-PA-3001; however, by utilizing rear connectors, the internal autoranging can be overridden and additional internal gain can also be inserted. Programming is available by DTL and TTL logic.

### 305-PA-3008 SINGLE FREQUENCY PLUG-IN

The 305-PA-3008 is a special purpose plug-in designed for precision calibration of 50 Hz, 60 Hz and 400 Hz power line equipment such as wattmeters, phase detectors and watt hour meters. This instrument can measure phase difference between two voltages, two currents or between a voltage and a current. The unit covers a voltage range of 25 V to 250 V rms and a current range of 0.1 to 5 A rms. The basic plug-in covers the frequency range of 50 Hz to 500 Hz. Plug-in filters, available for 50 Hz, 60 Hz and 400 Hz, assure reduction of second harmonic by at least 40 dB and higher harmonics by at least 50 dB. A front panel zero control provides adjustment for high accuracy (±0.1°) at any single frequency.

### 305-PA-3009 WIDE BAND NETWORK ANALYZER PLUG-IN (GAIN/PHASE/AMPLITUDE)

This plug-in measures the voltage amplitude of each signal input (in volts or dBV, selectable by operator), the phase difference between inputs, and the amplitude ratio of inputs. Featuring autoranging of gain in both channels, it requires no manual setting of gains for any measurement. Simultaneous DC outputs on mainframe are proportional to all four fuctions. A front panel switch selects the measuring mode for digital panel readout — channel A voltage, channel B voltage, phase difference, or amplitude ratio. Lamps on the front panel of the plug-in indicate the proper decade multiplier. The 305-PA-3009A is designed for extending the low frequency range.

### 305-PA-3010 SPECIAL PURPOSE PLUG-IN

This plug-in is typical of special purpose plug-ins which can be supplied to meet unique problems. Having high input impedance, it is equipped with closely matched low pass filters to pass 125 Hz signals while rejecting 400 Hz signals, solving problems in many types of servo control systems. Similar units can be readily designed for other special voltage and frequency applications.

### 305-PA-3015 PROGRAMMABLE PLUG-IN

Intended for use in automatic test systems, this plug-in has two selectable filters for harmonic rejection and selectable gains to handle inputs from 50 mV to 50 V rms. Filter (or filter out) selection as well as gain switching is accomplished by contact closures across terminals on the rear of the main frame.

## PRECISION TRANSFORMER ISOLATION NETWORKS

Dranetz TR 3100 series networks are available for input voltage isolation with minimum phase error and flat gain response. For use with balanced or signal ended sources, these units are equipped with internal preamplifiers to produce outputs in the 30 mV to 3 V rms range (for use with 305 Series Phasemeters) for input levels from 50 mV to 500 V rms. These transformer units are packaged for direct plug-in into the input BNC's of the phasemeter, and draw B+ power from the front panel accessory connector of the phasemeter plug-in. Size: 2¾" x 2¾" x 2". Input: banana jack. Output: BNC.

| Model TR— | Zin | Com. Mode Rej: >60 dB for frequency | Range for ±0.1° typical shift | Range for ±0.3° typical shift | Gain ±2% |
|---|---|---|---|---|---|
| 3101 | 1 megΩ 70 pF | Below 1 kHz | 20-400 V rms 50 Hz-20 kHz | 5-400 V rms 10 Hz-25 kHz | x 0.01 |
| 3102 | 100 kΩ 70 pF | Below 10 kHz | 2-40 V rms 50 Hz-20 kHz | 0.5-40 V rms 10 Hz-25 kHz | x 0.1 |
| 3103 | 10 kΩ 70 pF | Below 25 kHz | 0.2-4 V rms 50 Hz-20 kHz | 0.05-4 V rms 10 Hz-25 kHz | x 1.0 |

DRANETZ
ENGINEERING LABORATORIES INCORPORATED
DEPT. EM, SOUTH PLAINFIELD, NEW JERSEY 07080 • TEL: (201) 755-7080 • TWX: 710-997-9553

# SERIES 305

## SUPER PERFORMANCE PHASEMETERS

## MAINFRAME SPECIFICATIONS

**Frequency Range:** 2 Hz to 11 MHz (see plug-in data)

**Angle Ranges:** 0.00° to ±180.00° or 0.00° to +360.00° manually or automatically selected. End-of-range measurement errors are prevented by 15° automatic guard zones.

**Analog Output**
**Range:** −1.8000 to +3.6000 Vdc corresponding to measured angle; 10.0 mVdc per degree
**Accuracy:** See plug-in specifications
**Output Impedance:** 100 ohms
**DC Resolution:** Infinite
**Linearity:** Approx. ±0.01°
**Repeatability:** Better than ±0.005°
**Time Constants:** Automatically selected; 10 ms for frequency >5 kHz, 50 ms >500 Hz, 350 ms >50 Hz, 700 ms >2 Hz (Note: 4.6 time constants to respond to better than 99% of step change).
**Warm-up Drift:** Approx. 0.05° after first minute.
**Long Term Drift:** Typically less than ±0.05° per month
**Temp. Coefficient:** Approx. ±0.001°/°C
**Recommended Output Devices:** Recorders, DVM's, A-D Converters, Printers
**Self Check:** Front panel switches; dc outputs correspond to −180.00°, 0.00°, +180.00° and +360.00°
**Error Rejection:** False triggers due to high frequency noise are locked out for signal to noise ratios better than 10:1. Errors and fluctuations due to waveform dissymmetry or low frequency noise reduced by at least 10 to 1.
**Harmonic Rejection:** Worst case errors due to even harmonic distortion reduced by approximately 5:1 without filters. Odd harmonics in-phase with fundamental contribute no error.
**Operator Adjustments:** None.

**Operating Temp. Range:** 0° to +50°C
**Grounding:** Independent grounds for signal, chassis, and power line. (For safety, chassis and power line grounds connected at factory.)
**Remote Programmability (standard on all mainframes):** By rear connector pins. Override by contact closure of automatic time constant selection and angle range. Factory installed wiring from rear connector to plug-in for use with programmable plug-ins.
**Modular Construction:** Circuits on removable plug-in cards, extenders supplied for ease in servicing.
**Size:** 3½" high, 16" deep, 19" rack/portable package; shipping 22½" x 22½" x 6½".
**Weight:** 20 lbs. (9 kg.); shipping 30 lbs. (14 kg.).
**Power:** 115/230 V, 50-400 Hz, <0.75 A (specify voltage and frequency when ordering).
**Plug-In Accommodation:** Accepts 305-PA-( ) plug-ins. Mainframes and plug-ins are interchangeable.

### ANGLE PRESENTATION

| | Model 305 | Model 305B | Model 305C | Model 305D |
|---|---|---|---|---|
| **DIGITAL** | | | | |
| Display | None | 4 digit plus sign | 5 digit plus sign | |
| Angle Ranges | Not Applicable | 0.0° to ±180.0° and 0.0° to +360.0° | 0.00° to ±180.00° and 0.00° to +360.00° | |
| Resolution | NA | 0.1° | 0.01° | |
| BCD Output | None | BCD coded (1248), 4 lines per digit plus polarity line; TTL/DTL compatible (<0.8 V to > +2.4 V dc). Read and hold on command, and data ready features available on rear connector. | | |
| Warm-up Time | NA | 30 minutes (1 minute with option 107) | | |
| Zero & FS Controls | NA | Front panel for FS & 0 (no adjustments with option 107) | | |
| **ANALOG** | | | | |
| DC Output | 10.0 mV/°; 0.0000 V to 3.6000 V and −1.8000 V to +1.8000 V corresponding to 0.00° to 360.00° and −180.00° to +180.00°; infinite resolution. | | | |
| DC Offset | None | | Continuously adjustable angle offset. Analog panel meter and DC output indicate deviation from offset. | |

### OPTIONS

#101 Rear connectors for signal and reference inputs, BNC[4]
#102 Full mainframe programmability; includes self check, angle range and time constant selection, DTL and TTL compatible.
#103 High speed analog output response. Time to respond to within 99% of step change: 1 ms for frequency >5 kHz, 10 ms >500 Hz, 100 ms >50 Hz, 1 second >5 Hz. (Temp. stability ±0.01°/°C)
(Opt. 103 not available with Opt. 107 or Mod. 14 below.)
#105 Remote zero control.
#107 Automatic calibration checks and automatically readjusts digital readout and BCD output circuits to reduce readout errors to ±0.02°. This option available only on 305C.
#110 Full compatibility with IEEE 488 Interface Bus. (Requires options 102 and 305-PA-3007 Plug-In.) This option available only on 305C.
Mod. 14 Higher accuracy below 12 Hz. Available only on 305B, 305C, and 305D.

## COMBINED PLUG-IN AND MAINFRAME SPECIFICATIONS

| MODEL | FREQUENCY RANGE | INPUT LEVELS (independent) | INPUT Z | ACCURACY[2] WITH INDEPENDENT LEVELS UNLESS OTHERWISE INDICATED<br>Analog output accuracy: As specified below.<br>Digital phase accuracy: For model 305C, same as analog accuracy. For model 305B, add ±0.15° digital readout error to analog accuracy specified. |
|---|---|---|---|---|
| 305-PA-3001 Auto Ranging Plug-in | 2 Hz to 700 kHz | 10 mV to 300 V rms up to 10 kHz and to 50 V rms up to 700 kHz; can be extended to 40 kV rms with Tektronix probes. Each channel has automatic gain ranging, and lamps which indicate when level is below 50 mV and above 50 V rms. | 1 megohm shunted with 40 pF | ±0.05°, 50 mV to 50 V rms from 50 Hz to 50 kHz; typically ±0.03°, 50 mV to 50 V rms from 50 Hz to 50 kHz, ±0.05° to 10 Hz, ±0.1° to 250 kHz, and ±0.25° at other levels to 500 kHz. |
| 305-PA-3002 Single Range Plug-in | 2 Hz to 700 kHz | 10 mV to 3 V rms[1]; can be extended to 3 kV rms with Tektronix probes. Other ranges available on request. | 1 megohm shunted with 40 pF | ±0.05°, 50 mV to 500 mV rms from 50 Hz to 50 kHz; typically ±0.03°, 50 mV to 500 mV rms from 50 Hz to 50 kHz, ±0.05° to 10 Hz, ±0.1° to 250 kHz, and ±0.25° at other levels to 500 kHz. |
| 305-PA-3005 High Frequency Plug-in | 200 kHz to 11 MHz | 1 mV to 3 V rms; manual level controls in 10 dB steps. Lamps indicate when inputs are out of range or when level controls are improperly set. | 50 ohms | Broadband with equal inputs above 10 mV rms: ±0.4° from 200 kHz to 4 MHz; ±1° from 4 MHz to 11 MHz.<br>With independent levels above 10 mV rms: ±1° up to 4 MHz and ±2° up to 11 MHz.<br>Single frequency — above 10 mV rms: ±0.3° at any frequency from 200 kHz to 11 MHz at any fixed levels. |
| 305-PA-3007 Programmable and Auto-Ranging Plug-in | 2 Hz to 700 kHz | Autoranging: similar to levels of 305-PA-3001. Programmable: overrides autoranging; extends low levels to 1 mV rms; DTL, TTL logic; program connector in rear of mainframe. | 1 megohm shunted with 40 pF | Same as 305-PA-3001 for levels above 10 mV rms; typically ±0.35° from 50 Hz to 50 kHz for levels below 10 mV rms. |
| 305-PA-3008 Power Freq. Plug-in | 50-500 Hz without filters. 50 Hz, 60 Hz and 400 Hz L.P. filters available[3] | 25 V to 250 V rms; 0.1 A to 5 A rms. Inputs are transformer isolated. | 100 k ohm (voltage) 0.02 Ω max. (current) | At any single frequency, with filter set: ±0.1°, 25 V to 250 V rms, or 0.1 A to 5 A rms. |
| 305-PA-3009 Network Analyzer (Gain/Phase/ Amplitude) | 5 Hz to 700 kHz (Note: 305-PA-3009A operates to 1 Hz with 305 mod. 14) | 10 mV to 40 V rms. Each channel has automatic gain ranging. Direct reading of phase angle, amplitude ratio and level of each input. Compatible with Tektronix probes. | 1 megohm shunted with 40 pF | Phase: ±0.1° from 40 mV to 40 V rms from 50 Hz to 50 kHz; typically ±0.25° at all other levels from 5 Hz to 500 kHz.<br>Voltage Amplitude: above 40 mV (channel A or B): ±2% reading ±0.03% FS, 50 Hz to 50 kHz; ±5% reading ±0.03% FS, 100 kHz to 500 kHz.[5]<br>Ratio: ±0.5 dB, 50 Hz to 50 kHz; ±1 dB, 50 kHz to 500 kHz.[5] |
| 305-PA-3010 Special Purpose Plug-in (with filter) | For use at 125 ±10 Hz; matched filters in both channels reject higher frequencies | 500 mV to 5 V rms. Other ranges available on request. | 1 megohm shunted with 40 pF | ±0.1°, 500 mV to 5V rms; ±0.25°, 100 mV to 500 mV rms. |
| 305-PA-3015 Selectable Filter Plug-in | 5 Hz to 500 kHz without filters; uses 2 of type 305-PA-3008-( ) filters[3]; filter selection programmable | Ranges of 50-500 mV rms, 0.5 to 5 V rms, and 5-50 V rms selectable by remote contact closures. | 1 megohm shunted with 40 pF | With filters, ±0.1° at fixed frequencies over all levels; without filters ±0.1° from 50 Hz to 50 kHz at all levels (typically ±0.03°), typically ±.25°, 5 Hz to 500 kHz. |

[1] Can be provided for other voltage levels.
[2] For sinusoidal signal; can be used for square wave inputs over limited frequency range; can be used for amplitude modulated signals up to 97% modulation, depending upon model, level and frequency.
[3] 50 Hz filter, P/N 305-PA-3008-50; 60 Hz filter, P/N 305-PA-3008-60; 400 Hz filter, P/N 305-PA-3008-400. (Other frequencies available on request.)
[4] Available for use with 305-PA-3001, -3002, -3007 and -3010. Specify when ordering plug-in.
[5] For higher accuracy below 50 Hz, specify Model 305-PA-3009A.

SEE PAGE 2713 FOR LIST OF AVAILABLE TECHNICAL ARTICLES

SEE PAGE 2713 FOR LIST OF AVAILABLE TECHNICAL ARTICLES

DRANETZ
ENGINEERING LABORATORIES INCORPORATED
DEPT. EM, SOUTH PLAINFIELD, NEW JERSEY 07080 • TEL: (201) 755-7080 • TWX: 710-997-9553

# SERIES 606

## POWER LINE DISTURBANCE ANALYZER/RECORDER

- For 115/230/460 V rms, 1 and 3 phase systems.
- Monitors, classifies, times and prints out line disturbances.
- Immediate and day-end printouts.
- Operates on command or disturbance — no wasted paper.
- For portable or permanent installation.
- 4 hour internal carry over power.

The 606 is designed specifically for monitoring power lines connected to computers, process control systems, hospital equipment and data communications devices, which are particularly susceptible to line transients, level changes or other disturbances. Using a digital microprocessor, the 606 classifies each disturbance into IMPULSE, CYCLE-TO-CYCLE CHANGE or SLOW RMS CHANGE. When preset thresholds are exceeded, the instrument prints out time, classification, magnitude, duration and channel designation. Data is also accumulated for overflow and day-end printout. The instrument is designed for unattended monitoring in a permanent installation or for temporary use at more than one site.

### SPECIFICATIONS

**Input Voltage Ranges:** 115, 230, 460 V rms ±50%, all transformer isolated, Zin > 100 kΩ

**Number of Inputs:** Model 606-1, 1 input; Model 606-3, 3 inputs (3φ or separate circuits)

**Test Modes:**

**AVG+ or AVG−:** Increase or decrease in steady state rms, averaged over 10 sec

**SURGE or SAG:** Increase or decrease in cycle-to-cycle rms value

**IMPULSE:** 0-peak value of impulse (excluding line voltage waveform) having duration 0.5-800 μsec. Optional Adaptors (see below) measure strength, polarity and direction.

**ACCUMULATED COUNT:** Summation of disturbance data in memory (includes time, HI AVERAGE, LO AVERAGE, HI SURGE and number of HITS, LO SAG and number of HITS, HI IMPULSE and number of HITS)

**Printing Modes:**

**AVG+ or AVG−:** Prints time, AVG+ or AVG−, rms VALUE, CHAN., when exceeding threshold of 3, 5, 10, 15 V rms*

**SURGE or SAG:** Prints time, SURGE or SAG, rms VALUE, CHAN. and duration (cycles) when exceeding threshold of 3, 5, 10, 15 V rms*

**IMPULSE:** Prints time, IMPULSE, 0-pk VALUE (excluding line voltage) and CHAN, when exceeding 0-pk threshold of 50, 100, 200, 400 V. See below for additional information printed when Impulse Analysis Adaptors are used.

**SUPPLY DOWN or UP:** Prints POWER OFF or POWER ON and TIME

**STORED DISTURBANCES:** Stores data on disturbances during printing. Prints out when printer clears

**ACCUMULATED COUNT** (Short Term): Overflow of data entering printer. Prints out automatically

**DAILY ACCUMULATED COUNT:** End-of-day print out. Prints number of day and ACCUMULATED COUNT

**TEST:** Prints time and ACCUMULATED COUNT

**RESET:** Prints time and ACCUMULATED COUNT, resets memory

**PRINT OFF:** Prints PRINT OFF and TIME, disables printer, all data goes into accumulator for delayed summary printout

**Accuracy:**

**AVG+ or AVG−:** At 60 Hz (sine wave signal), ±1% of reading ±1% of nominal input

**SURGE or SAG:** At 60 Hz (sine wave signal), ±1% of reading ±1% of nominal input

**IMPULSE:** ±5% of reading ±1% of maximum impulse calibrated with a positive going, 10 μsec, half sinewave impulse. 6 dB bandwidth with half sinewave impulses: 800 μsec to 0.5 μsec

**Clock:** Indicates real time in hours, minutes, seconds, crystal controlled. During power off, operates on internal batteries (4 hours). Clock resets from front panel buttons

**Printer:** 18 character, alpha-numeric, thermal, paper 2¼" wide, prints 1 line/sec

**Supply Power:** 90 to 140 V rms, 45-450 Hz, 1φ, 1.0 A maximum (also DC operation 120-170 V maximum).

**Case:** Portable, removable cover with carrying handle.

**Size (with cover):** 11" H x 7" W x 9½" D; shipping 11" x 14" x 18".

**Weight:** 16 lbs. (7 kg.); shipping 24 lbs. (11 kg.).

**Options:** Opt. 101 (606-3 only), freq. disturbances; Opt. 102, 115/230 V supply power (switch selectable), 45-65 Hz; Opt. 103 (606-3, Opt. 101 only), monitors 400 Hz power lines; Opt. 104, external event indication; Opt. 105, enables use of Impulse Analysis Adaptors; MR15 Rack Mount Series, 19" rack plate and dust cover.

**Model K103 Test Kit:** Includes disturbance generator designed to verify operation of Series 606. Also includes a card puller, an extender card, and a set of programmed memories for assisting in calibration and troubleshooting.

**Model 910 Uninterruptible Power Supply:** For complete operation of 606 during power shutdown up to 2 hours. Fully protected from impulses to 1600 Volts, sags and surges of 50%, and total power interruptions.

**Input (under normal conditions):** 115/230 V rms nominal (switch selectable), 45-65 Hz, 1φ, 1.0 A maximum.

**Output:** 120 to 170 Volts, DC, 1.0 A.

**Recharging Time:** 18 hours.

**Size:** Portable carrying case same size as 606.

**Weight:** 35 pounds (16 kg.).

*These values for 115 V input; multiply by x2 or x4 for 230 V rms or 460 V rms.

# SERIES 606-PA-( )

## IMPULSE ANALYSIS ADAPTORS FOR SERIES 606

Impulse Analysis Adaptors supplement the analytical capabilities of the Series 606 Power Line Disturbance Analyzers by providing recorded measurements of **impulse strength,** i.e., the integral of impulse voltage with respect to time. The **strength** indicates the potential of the disturbance to damage or interfere with **sensitive** electronic equipment. Two of the four models in the Series also provide indication of the Polarity and Direction, i.e., from source to load or vice versa. These data are conveyed to the associated Model 606 (equipped with Option 105), for printing in conjunction with the information provided by the Model 606 itself.

### SPECIFICATIONS

**Function**

**606-PA-6001** Single-phase, 50/60 Hz; measures Strength only.

**606-PA-6002** Three-phase, 50/60 Hz; measures Strength only.

**606-PA-6003** Single-phase, 50/60 Hz; measures Strength, Polarity and Direction. Includes one current probe.

**606-PA-6004** Three-phase, 50/60 Hz; measures Strength, Polarity and Direction. Includes three current probes.

**Printed Information**

**Strength:** Separates IMPULSE disturbances into six ranges of Strength. Prints appropriate range, i.e., >.001 V-SEC.

**Polarity:** Prints + or −.

**Direction:** Prints SRCE or LOAD.

**Input Voltage Ranges:** Same as Series 606.

**Input Current Ranges:** (Only applies to -6003 and -6004).

Max. at power-line frequency (47-63 Hz): 100 A. rms

Max. Impulse: 1000 A. Peak at 1 msec

Min. for Direction determination: 1 A. for at least 0.2 μsec

**Current Probe Insertion Impedance:** 0.4 mΩ at 50 Hz.

**Steady State Power Requirements:** Single-phase Adaptors operate from power supply of associated Model 606. Three-phase Adaptors contain a separate power supply which requires 90 to 140 Vrms, 45 to 65 Hz, 1φ, at 0.25 A. nominal.

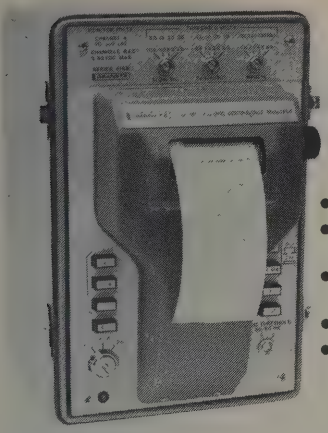
**Option 102:** Available on -6002 and -6004 to permit operation from 180 to 280 Vrms, or 90 to 140 Vrms (switch-selectable), 45-65 Hz, 1φ.

**FOR FULL INFORMATION WRITE FOR BULLETIN 606**

DRANETZ
ENGINEERING LABORATORIES INCORPORATED
SOUTH PLAINFIELD, NEW JERSEY 07080 • TEL: (201) 755-7080 • TWX: 710-997-9553

# SERIES 616

## DC/AC VOLTAGE DISTURBANCE ANALYZER



- Field troubleshooting
- Power supply analysis and testing
- Testing power conditioning equipment
- Monitoring battery voltages
- Simultaneous monitoring of AC and DC voltages

The Series 616 is a highly portable easy-to-connect analyzer for recording voltage disturbances on three channels: one AC and two DC. The Series 616 combines the outstanding features and operating techniques of the Series 606 (described on previous page) to record IMPULSES, SAGS and SURGES, and SLOW AVERAGE variations, when they occur, in an easy-to-interpret alphanumeric printout. The instrument is ideal for pinpointing the effects of AC input line disturbances on the DC outputs of power supplies in computers, communication equipment, and medical apparatus. Two models, the Model 616A for 4 to 25 VDC and the Model 616B for 8 to 50 VDC, are available.

### SPECIFICATIONS

**Input Voltage Ranges:*** Channel A, 40 to 250 Vrms, 45 to 65 Hz; Channels B&C, ±4 to 25 VDC.

**Test Modes**

**Impulse:** Peak voltage of impulse after removing steady-state AC or DC voltage level. Impulse durations range from 0.5 to 800 μsec.

**Sag/Surge:** Sudden changes in steady-state voltage. Measurement interval equals one cycle of Channel A signal.

**Slow Average:** Slow changes in steady-state voltage. Measurement time constant is approximately 5 seconds.

**Accumulated Count:** Summation of disturbance data in memory (includes the number and worst case values of each type of disturbance on each channel since the beginning of the day).

**Printing Modes**

**Impulse:** Prints time, IMPULSE, 0-pk. value (excluding steady-state) and channel, when exceeding 0-pk. thresholds of 0.5, 1.0, 2.0 and 4.0 V* for DC channels, and thresholds of 50, 100, 200, 400 V* for AC channel.

**Sag/Surge:** Prints time, SURGE or SAG, voltage, duration (cycles) and channel when exceeding thresholds of 0.3, 0.5, 1.0, 1.5 V* for DC channels, and thresholds of 3, 5, 10, 15 Vrms* for AC channels.

**Slow Average:** Prints time, AVG+ or AVG−, voltage, and channel when exceeding thresholds of 0.3, 0.5, 1.0, 1.5 V* for DC channels, and thresholds of 3, 5, 10, 15 Vrms* for AC channel.

**Supply Power:** 90 to 140 Vrms, 45 to 65 Hz, 1φ, 1.0 A. maximum (also DC operation from 120 to 170 V).

**Options:** Opt. 101, frequency disturbances on channel A; Opt. 102, 115/230 V supply power (switch-selectable), 45 to 65 Hz; Opt. 104, external event indication; MR15 Rack Mount Series, 19″ rack plate and dust cover.

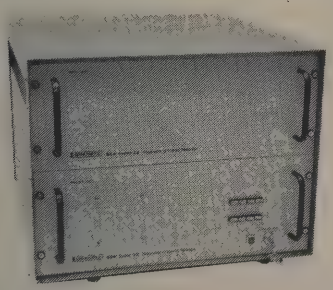
**Model 604A-PA-1001:** Adapts the Model K103 (described on previous page) for troubleshooting and calibration of the Series 616.

*These values are for Model 616A. Multiply by 2 for Model 616B.

**FOR FULL INFORMATION WRITE FOR BULLETIN 616**

# SER SYSTEM 22

## SEQUENCE OF EVENTS RECORDER



### FEATURES

- One millisecond resolution
- Alphanumeric input descriptions
- Ongoing self-diagnostics
- Freestanding printer and panel-mounted printer/keyboard/display packages available
- Portable or permanent installation
- Field expandable to 1024 inputs

### APPLICATIONS

- Document plant start up sequences
- Plant performance analysis
- Test sequence controllers
- Protective relay event recording
- Interface into computer or supervisory control system
- Test solid state relay systems

**FOR FULL INFORMATION WRITE FOR SYSTEM 22 BULLETIN**

# TECHNICAL ARTICLES

Prepared by the Engineering Department of Dranetz Engineering Laboratories

**TM-102,081** Measurement of Power Factor in Single-Phase and Three-Phase Systems Using Phasementer Techniques (17-page technical paper).

**TP-102,980** Phasemeter Specs Can Fool You (6-page reprint from **Electronic Design**, November 22, 1975).

**TP-102,984** Applications Handbook of Precision Phase Measurement (28-page publication).

**TP-102,985** Advantages of Phase-Angle Measurement by Digital Techniques (7-page technical paper).

**TP-102,986** Power Line Monitoring & Transient Analysis (19-page technical paper presented at Powercon 2, October 17, 1975).

**TP-102,987** Power Monitoring — It Can Help Cure Your Repair/Replacement Problems (2-page reprint from **Maintenance Engineering**, January, 1976).

**TP-102,988** Tracking Down & Identifying Power Line Aberrations (4-page reprint from **Mini-Micro Systems**, July, 1976).

**TP-102,989** Incoming Inspection for AC Power (6-page reprint from **Design News**, December 20, 1976).

**TP-102,991** When & How to Automate Phase Instrumentation (12-page technical paper).

**TP-102,992** Trip-Point Testing of Overcurrent, Overvoltage & Impedance Relays (4-page technical paper).

**TP-102,993** Use of Digital Instrumentation in Substation Activation Procedures (3-page technical paper).

**TP-102,994** Laboratory Calibration of Single-Phase Power Meters by Digital Voltage, Current and Phase-Angle Instrumentation (4-page technical paper).

**TP-102,998** Input-Output Disturbance Analysis — A New Technique for Power-Supply Performance Evaluation (6-page technical paper presented at Powercon 4, May 13, 1977).

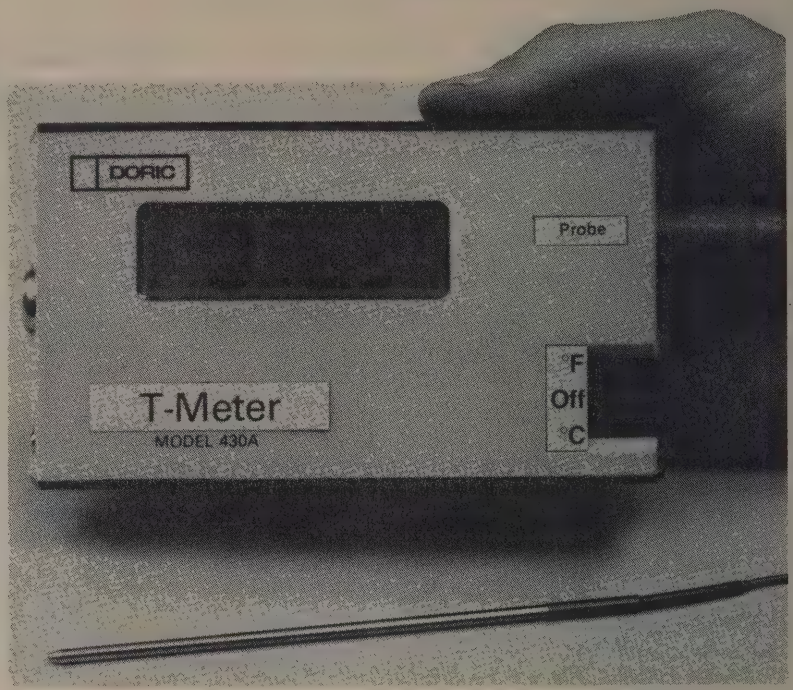
**THESE ARTICLES ARE AVAILABLE UPON REQUEST**

DORIC

# HAND-HELD DIGITAL TEMPERATURE AND CAPACITANCE METERS

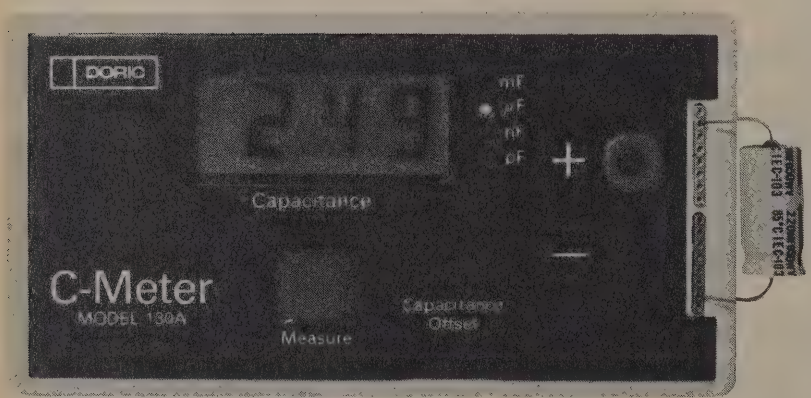
Hand-held and portable—

## The Model 130A C-meter and Model 430A T-meter



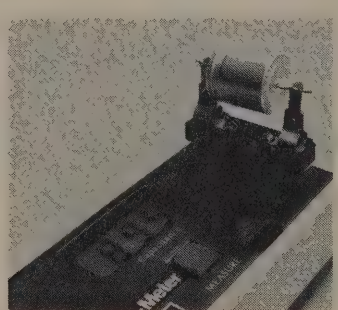

## T-Meter

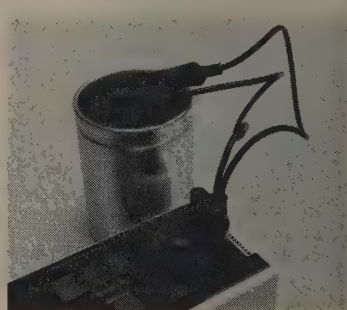
Hand-held, rugged and portable, the Model 430A T-Meter measures temperatures from −100°C to 200°C with 0.5°C accuracy over the range of −55°C to 125°C. Using a 0.6 inch liquid crystal display, it reads either Celsius or Fahrenheit at the flip of a switch. The display includes low battery and faulty probe indicators. The T-Meter uses four size "N" cells which will last more than 1500 hours. Probes are available for the T-Meter with standard accuracy (0.5°C) or high accuracy (0.1°C). The T-Meter can be operated in −20°C to 50°C environments.




## C-Meter

Handy, precise, and highly versatile, just insert or connect the capacitor, press the button and the 130A C-Meter automatically displays the capacitance in 10 ranges to 200,000 microfarads, with a maximum resolution of 0.1 picofarads. Small and portable, the C-Meter operates on four AA batteries, for over a year of normal use. A large 3½ digit liquid crystal display with variable decimal points makes the C-Meter easy to read, as the capacitance range is indicated by a high brightness LED. The C-Meter comes complete with accessory clips for all capacitor sizes.



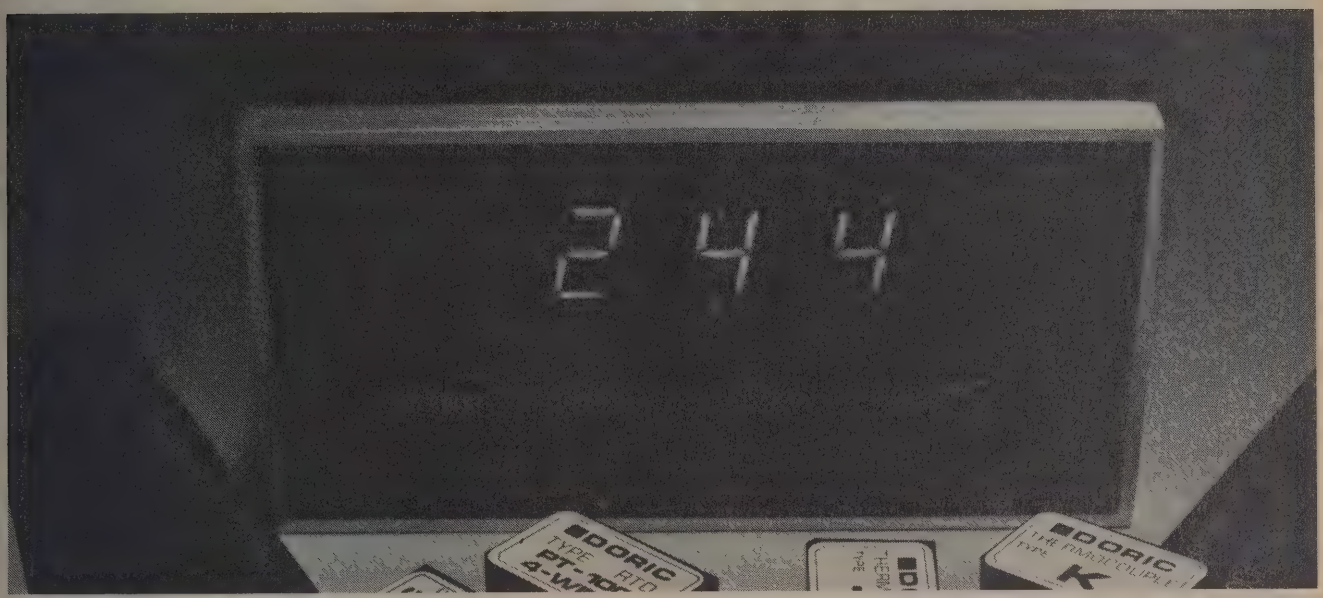


Doric Scientific
Division of Emerson Electric
3883 Ruffin Rd., San Diego, CA 92123
Toll Free (800) 854-2708, Telex 695001
In CA call (714) 565-4415 COLLECT

DIGITAL INDICATORS FOR TEMPERATURE
VOLTAGE AND CURRENT

DORIC

## Low cost, accurate, modular — The 400A Series Trendicators for temperature, voltage and current measurement.




The 400A series measures any of nine thermocouple types and temperature ranges, four voltage ranges, two RTD ranges or two current transmitter ranges. And offers you the most change ever in the history of digital indicators.

By changing plug-in modules you are able to change the basic 400A from one thermocouple range to another. Or from a thermocouple indicator to a current, RTD, or voltage indicator. And it can give you temperature resolution to ±0.1° current to ±0.01%, and voltage readings to ±1μV to make any process more efficient.

The 400A works in the toughest, noisiest environments without the downtime common to other indicators. With over 20,000 in the field, it has a failure rate of less than 1%. A record unmatched by any other indicators.

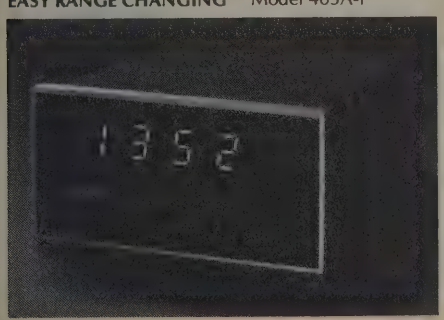
A portable model with battery pack and carrying case is available. With an optional calibration potentiometer it can be used as a transfer standard for calibrating other indicators.

The 400A offers a choice of panel mounting or rack mounting with optional adapter plate. Or a bench model with tilt stand. Field installable BCD is also available as an option.

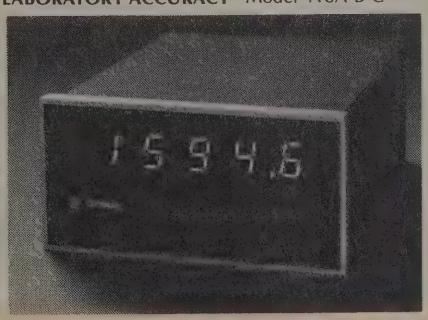
**SUMMARY OF AVAILABLE MODELS**

400A: Single function, 1° (0.1%, 10μV) resolution
402A: Same as 400A with built-in 5-point selector
403A: Switchable J, K, T, R, S, B thermocouple inputs, 1° resolution
405A: 10-input pushbutton selector for Trendicators
408A: Switchable FeCon(DIN), CuCon(DIN), K(NBS), E(NBS) thermocouples; platinum RTD and 1000 mV ranges; 1° (1 mV) resolution
409A: 10-input RTD selector for Trendicators
410A: 0.1° (0.01%, 1μV) resolution version of 400A
412A: 0.1° resolution version of 403A
418A: 0.1° (100 μV) resolution version of 408A

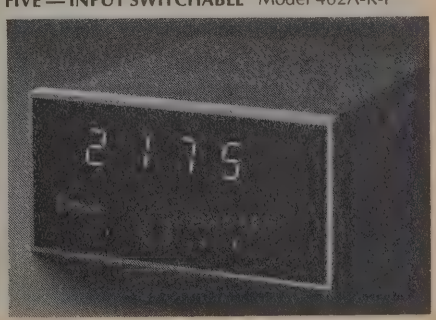
**EASY RANGE CHANGING** Model 403A-F




**LABORATORY ACCURACY** Model 410A-B-C




**FIVE — INPUT SWITCHABLE** Model 402A-K-F



DORIC

# DIGITAL PRESSURE INDICATORS TEMPERATURE STANDARDS AND DATA LOGGERS

**For measuring pressure, load, torque or any strain —**

## The Series 420 Digital Transducer Indicators

The 420 Digital Transducer indicator is a precision instrument for displaying output signals from strain gauges. The Model 420 can be used to monitor thrust, torque, pressure, force, weight and other physical phenomena, directly in engineering units.

The Model 420P comes complete with a built in strain gauge type pressure transducer, for measuring pressure in seven ranges up to 5000 psig. Just connect the pressure source to the 420P, plug it in and read the pressure indication.

## For Digital Temperature Standards

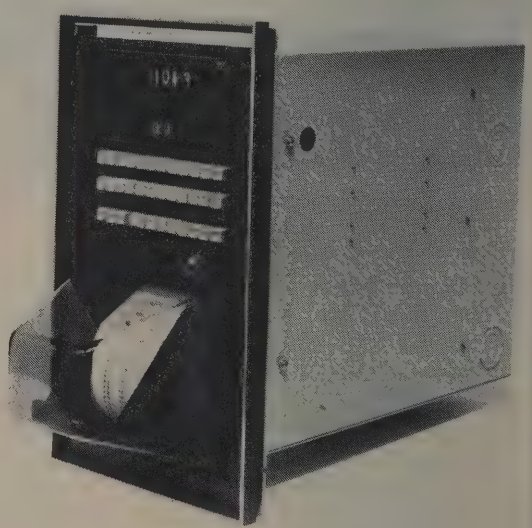
Doric offers three complete temperature measurement calibration systems. Each system includes the indicator, sensor, interconnection and system calibration. Their importance is growing with the demands for greater process efficiency, product quality and lower pollution.

DS-100-T5A

**For the ultimate in data acquisition —**

## Digitrend 200, 220, and 240 data loggers and process monitors.

Doric has years of experience in the designing and manufacturing of data loggers. With over 2000 of them at work around the world, Doric multi-point monitoring systems have become the recognized standards of the industry.



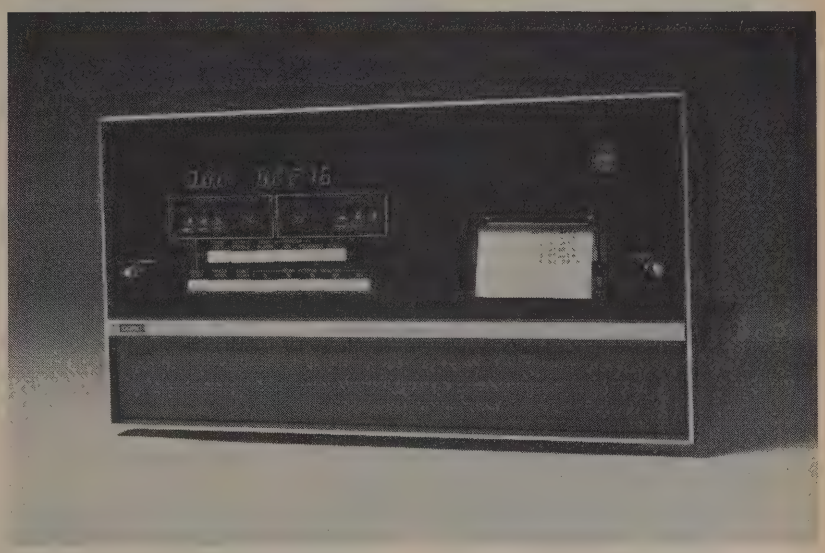
**Rugged and durable —**

## The Digitrend 200 Data Logger

The 200 is a digital multipoint, single-function data logger. It scans, logs and alarms low-level outputs from the thermocouples, millivolts, volts, current transmitters and RTDs. With digital display and output on strip printer. Guarded differential inputs, filtering, dual slope integration, auto-zero and optical coupler isolation allow the rugged 200 to operate in virtually any industrial environment. Options include digital clock and multiple selective alarms.

**More sophisticated with micro processor power —**

# The Digitrend 220 Data Logger



The Digitrend 220 was designed simply to uncomplicate your life. It measures inputs from all thermocouple types, current transmitters, RTDs, millivolts or volts. It can be used as a single-function unit or a multi-function scan-alarm-data logger. A simple pushbutton keyboard that allows you to program alarm limits and functions, point by point or randomly, is tucked away behind a front panel swing-down door. The 220 makes a perfect computer front end, and can give 1$\mu$V or 0.1° resolution at up to 20 points/sec. It can be randomly accessed by calculator or computer with output on strip printer, mag tape, teleprinter or modem.

Other features like autorange, remote digitizing and remote data access are available.

**Total command performance —**

# The Digitrend 240 Process Monitor.

It helps you monitor your process in the most exceptional way. Because it's a lot more than a simple data logger, we call it a process monitor. It gives you big computerized performance — without the need of a computer — on-line the day you receive it. Without months of software program de-bugging.

Built around a proven microprocessor, the Digitrend 240 continuously scans your process for you. When it detects and double checks a point that has gone off-limits it activates an alarm. Only then need you become involved. That's what monitoring by exception is all about.

All it takes to operate a 240 system is a few simple commands (about 30 minutes of operator training). For anything from the basic 20 point/80 alarm setpoint system to the full 1000 channel/4000 setpoint maximum.

You can mix up to 32 factory-programmed and custom functions — including thermocouples, RTDs, millivolts, current transmitters and volts — to fit your own specific requirements. And when you add the wide choice of outputs and options available with the 240, you have the most exceptional cost/performance process monitor available today.

Doric Scientific
Division of Emerson Electric
3883 Ruffin Rd., San Diego, CA 92123
Toll Free (800) 854-2708, Telex 695001
In CA call (714) 565-4415 COLLECT

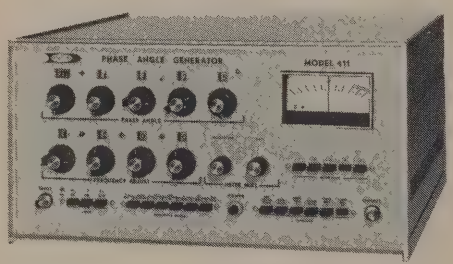
DYTRONICS

## The first authentic Primary Phase Angle Standard for industry

# MODEL 311/RT-1/717S PRIMARY PHASE ANGLE STANDARD

- 0.015° Accuracy
- Self-Calibrating
- Maximum 125 Volt Output
- Shift or Measure Phase Angle
- Frequency Range 30Hz to 10,000Hz
- 12 Microdegrees Resolution

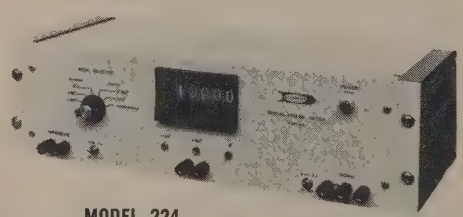
Dytronics offers an array of instrumentation for the measurement and generation of phase angle. This successful and advanced measurement technique pioneered by Dytronics is recognized as the finest throughout the world. See our catalog for complete information or contact Dytronics Company Inc. 4800 Evanswood Drive, Columbus, Ohio 43229, Telephone (614) 885-3303.




MODEL 411
PHASE SHIFTER/GENERATOR

| Model Number | Frequency Range | Accuracy | Measure Phase? | Shift Phase? | 0° to 360° Coverage without Ambiguity? |
|---|---|---|---|---|---|
| 302 | 1 Hz-100 kHz | ±0.5° | Yes | Yes | Yes |
| 311/Rt-1/717S | 30 Hz-10 kHz | ±0.015° | Yes | Yes | Yes |
| 312 | 4 kHz-500 kHz | ±0.02° | Yes | Yes | Yes |
| 342 | 400 Hz | ±0.1° | Yes | Yes | Yes |
| 402 | 400 Hz | ±0.01° | No | Yes | No |
| 411 | 1 Hz-100 kHz | ±0.1° | No | Yes | Yes |
| 412 | .01 Hz-1 kHz | ±0.1° | No | Yes | Yes |

SEE OUR CATALOG FOR A COMPLETE LIST OF MODELS AND SPECIFICATIONS.



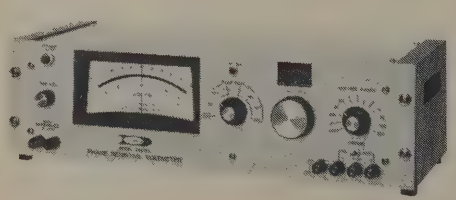
MODEL 224

## Model 224 "hands-off" Digital Phase Meter

Hands-Off Phase Angle Measurements using new **"Linear Mode Concept"** 0.1° Accuracy 0.01° Resolution

| Model Number | Frequency Range | Accuracy | Internal Filters | Outputs | 0° to 360° Coverage without Ambiguity? |
|---|---|---|---|---|---|
| 222 | 20 Hz-100 kHz | ±0.1° | No | DC | Yes |
| 224 | 20 Hz-100 kHz | ±0.1° | No | DC-BCD | Yes |
| 244/RS | 400 Hz | ±1.0° | Yes | DC | Yes |
| 250B | 4 Frequency | ±1.0° | Yes | DC | Yes |

SEE OUR CATALOG FOR A COMPLETE LIST OF MODELS AND SPECIFICATIONS



MODEL 244/RS
PHASE SENSITIVE VOLTMETER

DYTRONICS COMPANY, INC.
4800 EVANSWOOD DRIVE, COLUMBUS, OHIO 43229
Telephone (614) 885-3303

# Ectron CORPORATION

- Differential DC Amplifiers
- Strain Gage Signal Conditioners
- Thermocouple Signal Conditioners
- Signal Conditioning Systems
- Data Acquisition Systems
- Thermocouple/MV Calibrators

## MODEL 314

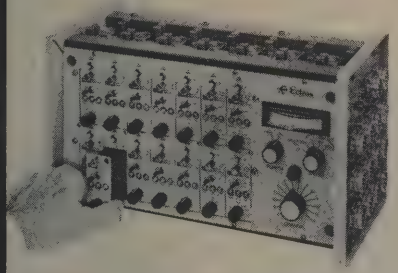
Miniature airborne amplifier occupies less than one cubic inch. Contains differential amplifier, strain gage excitation and power supply to operate from 28V dc. 20 kHz Bandwidth. Price $450. (Bulletin 2007)

## 400 ENVIRONMENTAL SERIES

- 100G Shock
- −25 to +71°C
- 0.5 μV/°C Stability
- Small Size 1"w X 2"h X 3"d
- Bridge Excitation and Balance
- Thermocouple Conditioning
- RFI protection
- 120 db CMR • 100V CMV
- Rack or Stud Mounting
- 12 or 28 V dc Power • 8 oz's.
- From $430 (Bulletin 2001)

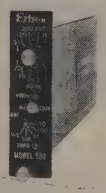
## 4000 SERIES, SIGNAL CONDITIONING SYSTEMS

The typical 4000 series system shown below is designed for Airborne or Vehicular service involving moderately high G forces. It includes 14 stable 400 series amplifiers, a monitor meter and monitor selection switch, individual CAL switches, bridge excitation, bridge balance and conditioning.



Other 4000 series systems are designed for operation during shocks up to 100 G's. Features available in these systems include integral VCO's, FET Calibration, Channel ID signals, Rechargeable Battery Pack and others. (See Bulletin 2010)

## 500 ECONOMY SERIES



- 1μV/°C
- 114 dB CMR
- Gains X.01 to X2500
- 16 Amps per 3.5" high rack
- 80 kHz bandwidth
- Filtered output
- 10 ma, 100 ma, dual outputs
- Bridge Bal., Completion, CAL
- From $180 (Bulletin 2004)

MODEL 540 — Four-channel amplifier for multi-channel data systems such as Model 6000 at right. From $500 (Bulletin 2004)

## 600 INDUSTRIAL SERIES

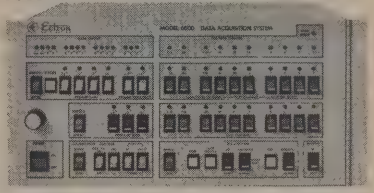
- Strain Gage Conditioning
- Thermocouple Conditioning
- Thermocouple Linearization
- Reference Junctions
- Multifunction Amplifiers
- Bridge Excitation and Bipolar Cal.
- Expanded Scale Operation
- .5 μV/°C Zero Stability
- 120 dB CMR and 300V CMV
- 12V dc, 28V dc or 115V ac power
- From $370 (Bulletin 2005)

## 700 WIDEBAND SERIES

- 100 kHz Bandwidth
- Manual or Programmable Gain
- Digital Storage
- Local Readout
- 1μV/°C Zero Stability
- .003%/°C Gain T.C.
- .01% Gain Accuracy
- 300V CMV • 126 dB CMR
- 3-pole filters • Dual outputs
- From $405 manual gain
- From $805 programmable gain (Bulletin 2003)

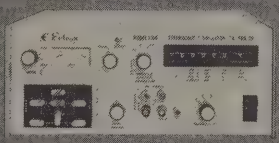
## 6000 SERIES HIGH SPEED DATA ACQUISITION SYSTEM

All 6000 Series Systems combine per channel low level amplifiers/signal conditioners with a high level multiplexer, a programmable post amplifier and a 14 bit A-D converter to provide complete multichannel high speed signal processing. Outstanding performance is provided by the chopper stabilized design and anti-aliasing filters. The systems are capable of scan rates to 100,000 channels per second.



- CMV 300V (higher on special order)
- CMR 120 dB with 1K unbalanced
- 0.5 μV zero stability
- 0.01% gain stability
- 3rd order filter, each channel, plug in
- Sequential or random access
- 100kHz throughput rate
- 64 channels per 8.75" high enclosure (Bulletin 2008)

## MODEL 1100 THERMOCOUPLE SIMULATOR CALIBRATOR



### CALIBRATES . . .

- Digital Thermometers
- Temperature Recorders
- Thermocouple Transmitters

**SIMPLE**
Just dial the temperature (C or F) (or program remotely)

**ACCURATE**
Voltage output conforms to NBS 125 within 0.1°

**UNIQUE**
Outputs on thermocouple alloys or copper

**VERSATILE**
It's a DC Voltage Standard and a Differential Voltmeter, too!

8159 Engineer Road, San Diego, California 92111
Phone (714) 278-0600/TWX 910-335-1259

*Specialists in Airborne, Marine and Industrial Instrumentation*

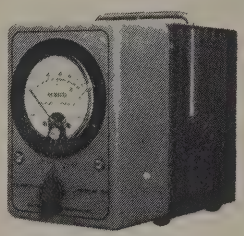
Ectron CORPORATION

Electro IMPULSE, INC.

# PRODUCTS FOR BROADCAST COMMUNICATIONS

DUMMY LOADS • POWER METERS • ATTENUATORS • BALUNS • COOLING UNITS

PM SERIES
## POWER METERS

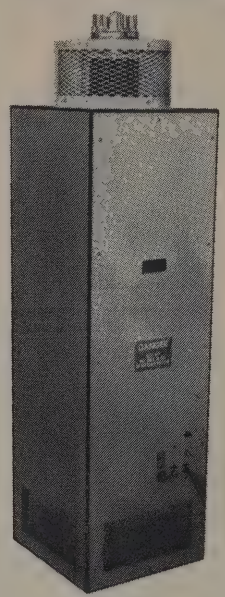


- 1.5 — 150 Watts
- Termination-Type
- AC Calibration

AX SERIES
## ATTENUATORS

DC — 500 MHz
100-10,000 Watts
Many Standard Values

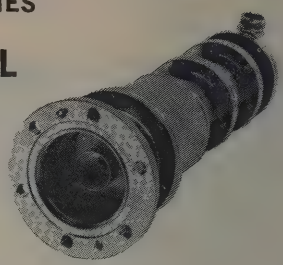
DPTC-FM SERIES



## FM DRY FORCED AIR COOLED LOADS

10,000-75,000 Watts
VSWR 1.15:1

CLW SERIES
## COAXIAL WATER LOADS



5000-80,000 Watts
Field Replaceable Resistor

CPTC SERIES
## SELF-COOLED LOAD PACKAGE

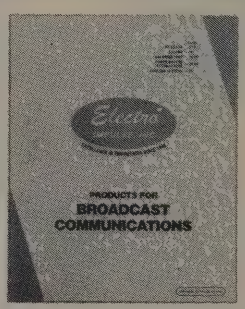
VSWR: 1.05:1
For FM/TV

Up to 75,000 Watts
DC — GHz

DPTU SERIES

## AM BROADCAST LOADS

Dry, Forced Air Cooled up to 400,000 Watts




## NEW GENERAL CATALOG No. 890

AVAILABLE FREE UPON REQUEST

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

EXCELLENCE IN ENGINEERING SINCE 1949

Electro IMPULSE, INC.

DEPT. EM • 116 CHESTNUT ST. • RED BANK, NJ 07701
TELEPHONE: (201) 741-0404

SEE OUR OTHER PRODUCTS ON PAGE 2578

# Electro Industries

## SOLID-STATE DIGITAL POWER LINE MONITOR

**SPECIFICATIONS COMMON TO ALL UNITS**

**OPERATING RANGE:**
Voltage: 85-145V (When power input is parallel
Suffix A - 170-270V with the measurement input)
Measurement input is 0-300V (When applying a fixed power input voltage)

**VOLTAGE ACCURACY:** Voltage — ±.5% f.s. ±1 Digit
**SAMPLE RATE:** Voltage — 30m sec. - 600m sec.
**DIGITAL DISPLAYS:** LED — .43" high
**SIZE:** 4.75" W x 3.25" H x 3.50" L
Panel cut out required 4.125" x 3.125"

The Power Line Monitor is a solid-state digital meter that was designed to satisfy the requirements for a digital readout device combining the functions normally provided by two distinct conventional line monitoring panel meters.

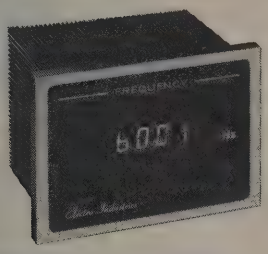
This digital meter has the unique two-fold capability of monitoring line voltage and line frequency fluctuations through visual presentation as well as by optional digital digit outputs for remote interface.

The unit was designed and built for ruggedness and durability, the LED's Display and the solid-state component will assume a long life operation.

The Power Line Monitor is suited ideally for use with power generation equipment, computerized measuring systems, control panel installations, and in instrumentation laboratories where power sources must be monitored for measuring test equipment accuracies.

| MODELS | FREQUENCY RANGE | FREQUENCY ACCURACY | | SAMPLE RATE FREQUENCY |
|---|---|---|---|---|
| LM 150 | —— | — | | — |
| LM 160 | 42 - 999 Hz. | ± 1 Hz. | | 1 sec. |
| LM 1400 | 42 - 999 Hz. | ± 1 Hz. | | 1 sec. |
| LM 1600 | 42.0 - 99.9 Hz. | ±.1 Hz. | | 10 sec. |
| LM 1600-1 | 42.0 - 99.9 Hz. or 42 - 999 Hz. | ±.1 Hz. or ± 1 Hz. | Crystal Con-trolled | 10 sec. or 1 sec. |
| LM 1600-10 | 42.0 - 99.9 Hz. | ±.1 Hz. | | 1 sec. |

## SOLID-STATE DIGITAL FREQUENCY MONITOR



**SPECIFICATIONS COMMON TO ALL UNITS**
**INPUT VOLTAGE RANGE:** 2 - 300V.
**FREQUENCY ACCURACY:** ±1 Digit over operating temperature range
**SAMPLE RATE:** 1 second
**DIGITAL DISPLAY:** LED — .43" high
**SIZE:** 4.75" W x 3.25" H x 3.50" L

The Solid State Digital Frequency Monitor was designed to satisfy the requirements for high resolution and fast updating when measuring low frequency.

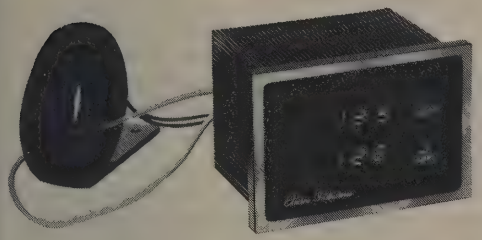
The fast updating feature is achieved through a unique phase lock loop scheme. In addition, this technique allows the unit to reject noise on the incoming signal. The accuracy of this unit is controlled by a crystal with maximum aging factor of 20 PPM.

This feature enables the unit to be free from calibration requirements.

The Frequency Monitor is ideally suited for use in monitoring Power Line frequencies and for general low frequency monitoring.

| MODELS | FREQUENCY RANGE | FREQUENCY RESOLUTION |
|---|---|---|
| LF 60 | 5.00 - 99.99 Hz. | .01 Hz. |
| LF 400 | 50.0 - 999.9 Hz. | .1 Hz. |
| LF 1000 | 5 - 9999 Hz. | 1. Hz. |

## SOLID-STATE DIGITAL VOLTS AMPERES MONITOR



Electro Industries Solid State Digital Volts/Amps Monitor is designed to satisfy the requirements for digital readout devices, combining the functions normally provided by two distinct conventional panel meters.

The unit features a better visual presentation, as well as an optional digital-digit output for remote interfacing. Combining both functions on a single meter provides a space saving panel.

The unit is built for ruggedness and durability. It is a 100% solid state unit with no moving parts to wear or break which makes it extremely resistant to shock and vibration. The LED's and LSI components will assure a long life operation.

The current sensor that is supplied with each unit is a highly accurate device that was designed to meet the total accuracy of the current measurements.

The Digital Volts/Amps Monitor is ideally suited for use with power generation equipment. Together with our Digital Frequency Monitor, the LF series provides a complete monitoring system for generators and control panels.

**SPECIFICATI NS COMMON TO ALL MODELS**

**VOLTAGE RANGE:** 0 - 300V
Suffix G — 0 - 600V
**ACCURACY:** Voltage: ±.5% F.S. ±1 digit
Current: ± 1% F.S. ±1 digit
(total accuracy when using Electro Ind. current transformer)
**AMBIENT TEMPERATURE:** Operating: 0 - 50°C
Storage: −55°C - +85°C

**FREQUENCY RANGE:** 47 - 440 Hz.
**SAMPLE RATE:** 100 - 600m sec.
**POWER REQUIREMENTS:** 115V ±25% 5VA max.
Suffix A — 230V ±25% 5VA max.
**SIZE:** 4.75" W x 3.25 " H x 3.50" L. Panel cut out required 4.125" x 3.125"
**TEMPERATURE ACCURACY:** 100 ppm/°C
**DIGITAL DISPLAYS:** LED .43" high

**CURRENT**

| Model | VA-100* | VA-100-1* | VA-1000 |
|---|---|---|---|
| Range: | 0-99.9A | 0-99.99A | 0-999A |
| Resolution: | 0.1A | 0.01A | 1A |
| Accuracy: | ±1% of F.S. ±1 digit | same | same |

* Includes C.T.

**OPTIONS:** a. Multiplexed BCD Output (add Suffix N to the model Number)

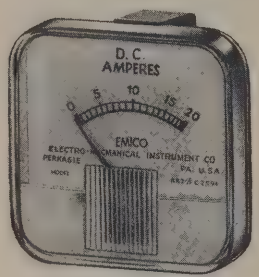
**ELECTRO INDUSTRIES / PANEL METER DIVISION / DEPT. EM, 109 NASSAU DRIVE / ALBERTSON, NEW YORK 11507 / TEL: (516) 621-6652**

# EMICO HIGH TORK PRECISION METERS

## PRODUCED IN VOLUME AT COMPETITIVE PRICES

EMICO is your dependable VOLUME source for 100% American-made AC and DC meters for a wide range of applications in the electronics, automotive, appliance, test equipment and process industries. Select any standard model or have EMICO design and engineer a meter to your exact requirements, including a custom dial face with special scale, trademark, name or colors. Send for a complete catalog of standard models or mail drawings and specifications for a prompt quotation on a custom meter.

- Voltmeters
- Ammeters
- Millivoltmeters
- Milliameters
- Microammeters
- DB meters
- VU meters
- Circuit indicators
- Voltage testers
- Induction meters

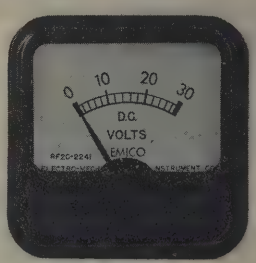



### PANEL METERS WITH METAL OR PLASTIC BEZELS

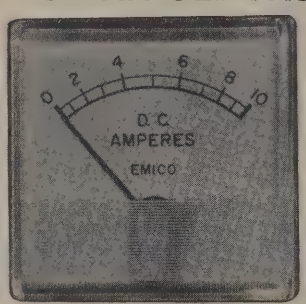
**Plastic Bezel Meter**
Model 42—2 5/16" square
Model 44—2 13/16" square

**Metal Bezel Meter**
Model 72—2 1/4" square
Model 74—2 3/4" square

Featuring the unique EMICO High-Tork movement, these versatile meters are available as AC or DC ammeters, voltmeters and milliammeters. All AC meters have 5% accuracy; DC meters available with 3% or 5% accuracy. These meters can be mounted into a 2 1-16" diameter panel hole.




## THE CHARGE INDICATOR WITH A MODERN LOOK BUT AN OLD-FASHIONED PRICE




**Plastic Face Meters**

**50 Series all approximately 2 3/8" square**

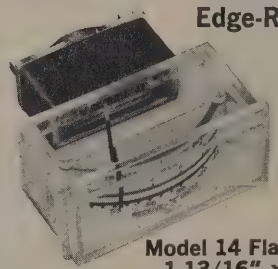
The eye-catching appearance, durability, and low price tag have made these meters especially popular. The one shown above (Model 53) is ideal for battery charger applications. Features attractive, clear molded plastic bezel and easy-to-read scale that can be customized. Specific models available as DC ammeters, voltmeters and milliammeters with 3% or 5% accuracy. AC model accurate to 5% of full scale.

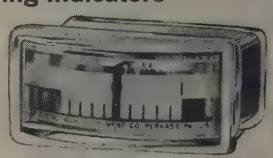
**Send for detailed product data sheets, today.**

**SHELLER-GLOBE CORPORATION**
ELECTRO-MECHANICAL INSTRUMENT DIVISION
P. O. Box 368 Dublin, Pa. 18917
Phone: (215) 249-9330 TWX: 510-665-9583

## THE LOW-COST EMICO EDGE ...ON SALES APPEAL

**Edge-Reading Indicators**





**Model 12 Curved Front 1 1/4" x 9/16"**

**Model 14 Flat Front 1-13/16" x 3/4"**

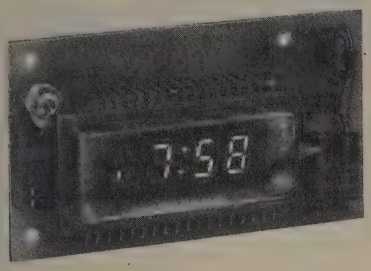
You can design added sales appeal into your product with the EMICO edge—either curved-front Model 12 or flat-front Model 14. Both compact edge-reading indicators have clear molded plastic cases for easy readability. Primarily current indicators, they are available in virtually any range up to a sweep of 100 milliamperes DC. Basic DC milliammeter movement easily converts to voltmeter with eternal resistor and to AC with external rectifier. Includes zero adjustment. Specify preference for zero-left, zero-center, or zero-right. Dial face can be customized for vertical or horizontal installation.

**Send for detailed product data sheets, today.**

**SHELLER-GLOBE CORPORATION**
ELECTRO-MECHANICAL INSTRUMENT DIVISION
P. O. Box 368 Dublin, Pa. 18917
Phone: (215) 249-9330 TWX: 510-665-9583

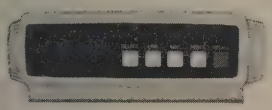
# CLOCKS & MONITORS new from EMICO

PRECISION-PLUS



**CLOCK MODULE**—Displays time and activates alarm circuit at pre-set moment.

Supplied with or without case, this highly accurate 24-hour digital clock can be a timer/controller or an alarm clock (10 ma. maximum drive current). It can also be set to display time in minutes and seconds. Includes "fast set" and "slow set." Has capability for snooze alarm. DC or AC operation. Low cost in OEM quantities.

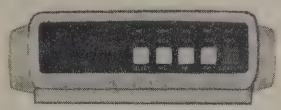


**TIME MONITOR**
Digital clock that also measures elapsed time independently

Operates on DC. Time elapsed counter reads in minutes and seconds to 59:59, then in hours and minutes to 99:59. Display and indicator lights change in intensity depending upon environment.

**TACH/EVENT COUNTER**
Measures RPM or events and signals when an adjustable pre-set standard is exceeded.

Continuously, accurately shows RPM's to nearest hundred. Includes memory for preset standard that can be reset at the push of two buttons.

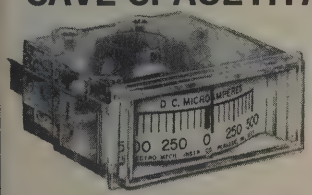


**FOUR-FUNCTION COMPUTER**
Determines relationship between two variables.

Keeps totals of both variables. Also computes accumulated average and displays total usage of both variables. Operates on DC. Example: miles per gallon computer.

For complete information on any or all of these products, send for detailed product bulletins, today.

# ACCURATE EASY-READ METERS SAVE SPACE... AND COSTS




Model 13-F Flat-Front

Model 13 Curved-Front

## Edge-Reading Meters

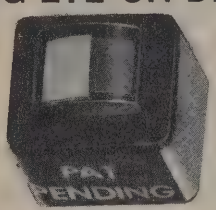
Two attractively designed meters that offer excellent readability. You have the choice of either the curved-front Model 13, or the flat-front Model 13-F. Both are 1-13/16" x ¾" and have clear molded plastic cases for easy illumination. Available as 0-500 microampes DC meter, as well as DC or AC ammeter, milliammeter and voltmeter. Either 3% or 5% accuracy depending on range. AC meters have 5% accuracy rating. Standard quick disconnect-type terminal fits ¼" x .032" connector . . . screw-type also available. Can be supplied with zero-left, zero-center, or zero-right. Vertical or horizontal installation. Dial face can be customized.

**Send for detailed product data sheets, today.**

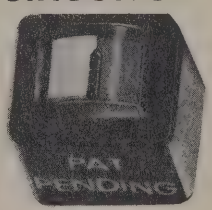
SG **SHELLER-GLOBE CORPORATION**
ELECTRO-MECHANICAL INSTRUMENT DIVISION
P. O. Box 368 Dublin, Pa. 18917
Phone: (215) 249-9330 TWX: 510-665-9583

EMICO PRECISION-PLUS

# TINY INDICATORS KEEP A BIG EYE ON D.C. CIRCUITS




Flag




Pointer

## Model 802—approx. ½" square

Rugged, dependable, and extra low in cost, these micro-miniature circuit indicators:

- **Monitor on-off conditions**
- **Indicate battery-charge conditions**
- **Indicate circuit-operating conditions**

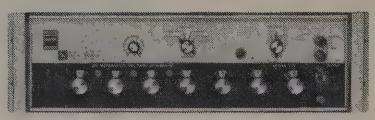
Less than 2 milliwatts required to move flag or pointer. Overload capacity is 15 times current rating without burn-out or calibration shift. All models are packaged in a high-impact, clear plastic case and are available either with wire leads or plug-in jacks for ease of installation.

**Send for detailed product bulletin, today.**

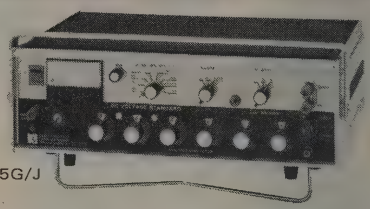
SG **SHELLER-GLOBE CORPORATION**
ELECTRO-MECHANICAL INSTRUMENT DIVISION
P. O. Box 368 Dublin, Pa. 18917
Phone: (215) 249-9330 TWX: 510-665-9583

EMICO PRECISION-PLUS

# AC & DC voltage and current calibrators
## General purpose and special purpose standard, sources and references



1030A



MV105G/J

## DC VOLTAGE STANDARDS

Applications for Production Line QC, Field Service Calibration Laboratories. Ideal as a Reference/Source/Supply for design and development labs. Simulator for thermocouples and transducers.

| MODELS | E 100E | MV 100/J | MV 105/J | MV 106/J | MV 116/J | 330J | 1030A |
|---|---|---|---|---|---|---|---|
| Bulletin | (#23) | (#25) | (#25) | (#25) | (#25) | (#20) | (#22) |
| DC Volts (ranges) | ± 11 V<br>±100 mV | ± 11 V<br>±100 mV | ± 11 V<br>±100 mV | ± 11 V<br>±100 mV<br>± 10 mV | ± 11 V<br>± 1 V<br>±100 mV | ±311 V<br>± 31 V<br>± 3 V<br>±300 mV | ±1111V<br>111V<br>11V<br>100mV |
| Resolution (1 ppm) | 100 μV<br>1 μV | 10 μV<br>0.1 μV | 10 μV<br>0.1 μV | 10 μV<br>100 nV<br>10 nV | 10 μV<br>1 μV<br>100 nV | 100 μV<br>10 μV<br>1 μV<br>0.1 μV | 100 μV<br>10 μV<br>1 μV<br>0.1 μV |
| $I_{out}$ | 75 mA | 50 mA | 50 mA | 50 mA | 50 mA | 100 mA | 50 mA |
| Accuracy | ±0.005%<br>of setting | ±0.003%<br>of setting | ±0.003%<br>of setting | ±0.003%<br>of setting | ±0.003%<br>of setting | ±0.002%<br>of setting | ±0.003%<br>of setting |
| Price | $725 | $1050 | $1095 | $1195 | $1195 | $1595 | $2095 |

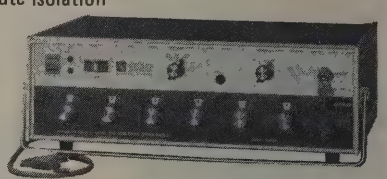
### Option: DIFFERENTIAL VOLTMETER (ΔVM) OPTION "G" (Bulletin 26)

Available in all "MV" models. (Not available in 330 or E100)
**For potentiometric and differential measurements:** from 0.5μV to 1000 V dc. **Optional:** Recorder output. **Price:** $395
**Accuracies:** from ±0.005% to ±0.002%. Factory installed. **Price:** $295

---

## BATTERY/EXTERNAL POWERED DC VOLTAGE STANDARD/SOURCE – MODEL MV 216 A (Bulletin 24)

Internal, re-chargeable battery operation and 117 Vac, 12 Vdc and 24 Vdc external power. Absolute isolation from line. High voltage accuracy and stability. Compliance current. Very low source impedance.

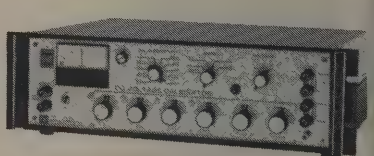


| | | | | | | |
|---|---|---|---|---|---|---|
| Ranges (dc) | 10V | 1V | 100mV | $Z_{out}$ | 0.01Ω | 0.001Ω 20Ω |
| Resolution (1ppm) | 10μV | 1μV | 100NV | Power | Internal re-chargeable Batteries also 117 Vac, 12V and 24 Vdc | |
| I out | 10mA | | | | | |
| Accuracy | 0.003% of setting | | | Price | $1495 | |

---

## DIFFERENTIAL VOLTMETER (ΔVM) AND CALIBRATOR – MODEL 2902 (Bulletin 21)

The model 2902 is a high accuracy ΔVM for potentiometric and differential DC voltage measurements. Also, it is a highly stable and accurate reference/source/standard.

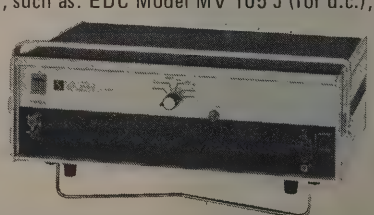


| | MEASURE MODE | | OUTPUT MODE |
|---|---|---|---|
| Ranges | 1000V, 100V, 10V, 1V, 100mVdc | Ranges | 100V, 10V, 1V, 100mVdc |
| Sensitivity | 1000V, 100V, 10V, 1V, 100mV, 10mV, 1mV, 100μV, 10μV | Resolution | 100μV, 10μV, 1μV, 100NV |
| | | Stability | ±0.0005% |
| Maximum sensitivity | 0.5μV/division | Current | 50 to 100mA |
| $Z_{in}$ | ∞ At null; 10 MΩ off null. | Accuracy | 0.002% of setting |
| Accuracy | ±0.002% of setting. | Price | $1795 |

---

## 10 AMP CURRENT CALIBRATOR (Source) AC and DC Amperes, Auxiliary Instrument, Model 3200 (See Bulletin 27)

This auxiliary instrument operates from the output of a stable, accurate AC or DC Voltage Calibrator, such as: EDC Model MV 105 J (for d.c.), and EDC Model AC 1000 D/B (for a.c.).

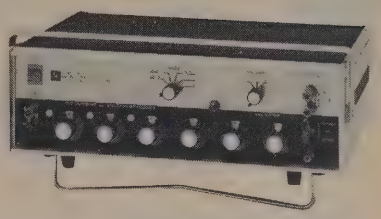


| | |
|---|---|
| Ranges (ac & dc) | 10 A, 1 A, 100 mA, 10 mA, and 1 mA |
| Accuracy: (dc) | ±(0.025% of setting + 0.0025% of range) |
| (ac) | ±(0.035% of setting + 0.0035% of range) |
| Voltage Compliance | 2V (min) to 5V (max). |
| Price | $1350.00 |

## DC CURRENT AND VOLTAGE STANDARD — MODEL CR 103 J (Bulletin 31)

Short-circuit and open-circuit protected. 30 second warm-up. Automatic zero.

| | Current Mode | Voltage Mode |
|---|---|---|
| **DC Ranges** | ±110 mA<br>± 11 mA | ±11 V<br>±1V<br>±110 mV |
| **Resolution (1 ppm)** | 100 nA<br>10 nA | 10 μV<br>1 μV<br>0.1 μV |
| **Compliance** | 100 V | 50 mA |
| **Accuracy** | ±0.005% of setting | ±0.003% of setting |



Price $1595

## AC VOLTAGE STANDARD — MODEL AC 1000 D/B (Bulletin 41)

Completely solid state. Highly stable. 60 second warm-up. Low output impedance.

| | |
|---|---|
| **Vac rms ranges** | 1000 V, 1 V, 100 mV, 10 mV |
| **Accuracy** | 0.025% |
| **Burden** | 50 VA (2A max.) |
| **Frequency Range** | 50 Hz to 5 kHz |

5 internal frequencies 50 Hz, 60 Hz, 400 Hz, 1 kHz plus optional frequency and unlimited number of frequencies attained by use of external oscillator via front panel terminals.

| | |
|---|---|
| **Distortion** | .5% |
| **Weight** | 45 lbs. |
| **Price** | $3795 |

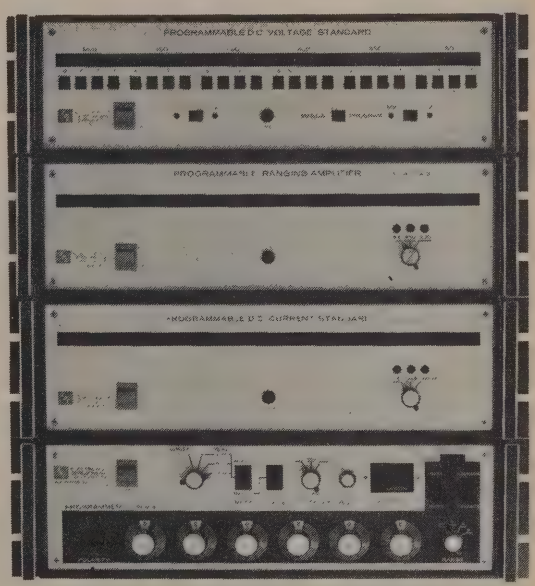
**Option** Model IC-15 — Meter increment calibration — Bulletin 42

## DIGITALLY PROGRAMMABLE STANDARD MODEL 501 J (Bulletins 51 through 55)

**Switching and settling time:** 50 μs
**Formats:** BCD, ASCII, BINARY, or IEEE 488
Certification N B S traceability

**Complete specifications:** Bulletins 51, 52, 53, 54, 55
**Complete Prices:** Bulletin 6

| | MAIN FRAME Model (501 J) See Bulletin 51 | 100 mV RANGE Option: D See Bulletin 51 | AMPLIFIER RA-3 See Bulletin 54 | DC CURRENT PCS-1 See Bulletin 53 |
|---|---|---|---|---|
| **Output d.c.** | 10.0000 Vdc | 100.000 mV | 100 & 200 V | 10 & 100 mA |
| **Resolution** | 100μV (10ppm) | 1μV(10ppm) | 1 & 2mV(10ppm) | 0.1 & 100 mA |
| **w/Opt. B** | 10μV(1ppm) | 0.1μV(1ppm) | 100 & 200μV | 0.01 & 0.1μA |
| **Accuracy** | ±0.005% | ±0.005% | ±0.01% | 0.01% |
| **Noise** | 0.0005% | 0.0005% | 0.0005% | 0.0005% |
| **Compliance** | 50mA | in to 400Ω load | 15mA | 100V |
| **Prices** | $1675 | $185 | $985 | $1395 |




### OPTIONS (Factory installed) (See Bulletin 51).

**B— Additional Resolution** — (see "Resolution, w/Opt. B" above).
**C— Ready Signal** — output signal indicating "ready" state.
**D— 100mV Range** — (See "100mV Range" above) (See Opt. D, above).
**J— Bipolar Operation** — Programmable polarity control.
**L— Binary format** — Accepts straight binary program.

### ACCESSORIES (May be field installed) (See Bulletin 51).

**MR-1** Memory register or buffer storage.
**MR-2** Serial-to-parallel converter, w/storage.
**AK-1** Negative programming logic.
**AM-1** Front panel display and control (for BCD).
**AM-2** Front panel display and control (for BINARY).
**IS-40** Opto-Isolation.
**KT-488** IEEE 488 interface (Kit) See Bulletins 51 & 55.)

### AUXILIARY INSTRUMENTS

Separate chassis, plug-in to main frame. No modifications

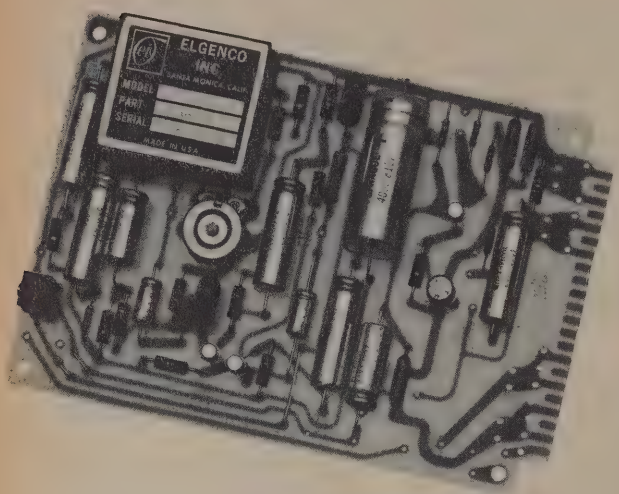
**RCM-4 Programmer.** (See Bulletin 52) Manually programmed. Automatically sequenced. Up to 40 addresses. Selectable triggering: Manual, automatic or external. Price:
**PCS-1 Programmable DC Current.** (See above) (See Bulletin 53)
**RA-3 Programmable Amplifier.** (See above) (See Bulletin 54)

**Electronic Development Corp.** 11 Hamlin Street, Boston, MA 02127 (617) 268-9696

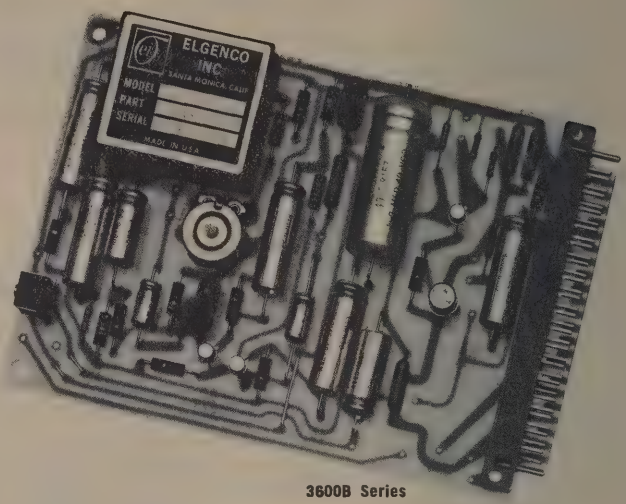
All EDC instruments are traceable to the U.S. National Bureau of Standards. Certification supplied with each instrument / All instruments are available under GSA Contract / Export prices slightly higher / Line (Mains) power: 115 Vac, 60 or 400 Hz, or 220 Vac, 50 Hz / Instruments available for no-charge evaluation. Contact your local sales representative or the main plant.

**ELGENCO INCORPORATED**
*statistical instruments for industry*
DEPT. EM • HURRICANE, UTAH 84737 • (801) 635-4954

# SERIES 3600 FIXED RANGE • NOISE GENERATOR CARDS




3600A Series




3600B Series

## SPECIFICATIONS

**FREQUENCY RANGE:** The frequency band may be any combination of the listed low and high frequencies.

**Lower Frequency:** 10, 20, 50, or 200 Hz, 5 kHz.

**Upper Frequency:** 20, 50, 100, 200, or 500 kHz; 1, 2, 3, or 5 mHz.

**SPECTRAL UNIFORMITY:** Spectral uniformities are available as:

| Upper Frequency | Spectral Uniformity |
|---|---|
| 20 kHz to 500 kHz | ±0.5, ±1.0, ±2.0 or ±3.0db |
| 1 mHz to 3 mHz | ±1.0, ±2.0, or ±3.0db |
| 5 mHz | ±2.0 or ±3.0db |

As a rule of thumb, the roll off above the specified upper frequency gives a 3db point about twice the specified upper frequency. Roll off above 3db point approaches 12db per octave.

**OUTPUT IMPEDANCE:**

20 kHz to 500 kHz units .....600 ohms
1 to 5 mHz units .....200 ohms

**POWER REQUIREMENTS:**

| | 3600A Series or 3600B Series | Low Current Option 3600A or 3600B | 3600C Series |
|---|---|---|---|
| Power supply voltage required ..... | −30 VDC ±1% | −30 VDC ±1% | −24 VDC ±1% |
| Approximate current.. | 50 ma | 30 ma | 37 ma |
| Open ckt. output level | 0 to 3.0 VRMS | 0 to 1.5 VRMS | 0 to 2.2 VRMS |

**Note:** The 3600B series units are the same as the 3600A series except the 3600B series have a test point and Elco 00-7023-035-000-001 connector mounted on the PCB.

The 3600A and 3600C units mate with a Cinch 250-22-30-170, Elco 00-6007-022-940-022 connector or equivalent.

**SPECIFICATIONS COMMON TO ALL UNITS:**

**Amplitude Probability Distribution:** Gaussian.

**Peak to RMS Capability:** Minimum dynamic ranges 3.5 to 1 at specified maximum level. Increases with lower output levels.

**Maximum Load:** 900 ohms minus output impedance.

**Operating Temperature Range:** 0 to 50°C.

**Size:** 4½ x 6½ x ⅞ inches.

**Weight:** 7 oz.

**PRICING:** (See price list on facing page)

**Base Price:** 3600A, 3600C and 3600A or C with reduced current option (specify on order).

**Base price plus $20.00:** 3600B or 3600B with reduced current option (specify on order).

**OPTIONS:**

Other than specified frequency; add $10.00 each per frequency per board.

Steel shield plate, ¼-inch off conductor side of PCB; add $12.50 each.

Other than specified output impedance, add $10.00 each.

To operate on other power supply voltages, voltage difference must be 30-volts for 3600A or 3600B and 24-volts for 3600C. Specify on order; "Decoupled option for operation on_____power supply," and add to price as:

| Quantity Per Order | Add Each | Quantity Per Order | Add Each |
|---|---|---|---|
| 1 | $17.00 | 25-49 | $3.00 |
| 2 | 12.00 | 50-99 | 2.50 |
| 3 | 9.00 | 100-249 | 2.30 |
| 4 | 7.50 | 250-499 | 2.10 |
| 5-9 | 6.00 | 500 up | 2.00 |

**DISCOUNT:** Quantity discounts apply as:

| Quantity | Discount | Quality | Discount |
|---|---|---|---|
| 1-4 | List | 20-49 | 13% |
| 5-9 | 5% | 50-99 | 17% |
| 10-19 | 10% | 100 | 20% |

# MODEL 3609A POWER SUPPLY CARD

**Size:** 4½" x 6½" x 2 1/16".

**Input:** 115/230 volts ± 10/20 volts, 50 to 1000 Hz.

Supplies power for up to 2 noise generator cards or up to 4 noise generator cards with reduced current option. Price: **$105.00**

**MATING CONNECTOR:** Mating Elco Connector; Elgenco, Inc. part numbers 7521-1122, for 3600A, 3600C and 3609A is available at $7.85 each.

ELGENCO INCORPORATED
*statistical instruments for industry*
DEPT. EM • HURRICANE, UTAH 84737 • (801) 635-4954

# SERIES 1600 • ENCAPSULATED NOISE SOURCE MODULES • 10Hz TO 5MHz

## SPECIFICATIONS IN RECOMMENDED CIRCUIT:

The 1600 series provide a low level wide band output. A portion of this wide band is specified to a certain flatness; uniformity. The 3 or 5 millivolt output is for the whole band extending to 5 mHz. Specifications are for 25°C unless specified otherwise.

**SPECTRAL DENSITY UNIFORMITY:** Available with uniformity to ±½db, ±1db, ±2db, or ±3db and many frequency ranges within 10 Hz to 5 mHz. See price list for complete list of standards.

**SPECTRAL DENSITY:** Approximately 2 $\mu v/\sqrt{\text{Hz}}$ .

**RMS OUTPUT LEVEL:** 1602A series 3 mv; 1603A, 1606A, and 1607A series 5 mv.

**OUTPUT IMPEDANCE:** Approx 20 ohms.

**AMPLITUDE PROBABILITY DISTRIBUTION:** Gaussian.

**OPERATING TEMPERATURE RANGE:** 0 to 50°C.

**POWER REQUIREMENTS:** −30 volts dc ±1% at approximately 3.5 ma. **Note:** external passive components are required to properly install unit.

**MOUNTING:** .032" Printed Circuit Leads.

**Size:** 11/16" H x 1 51/64" W x 1 37/64" D.

**WEIGHT:** Approx 1.5 oz.

## SERIES 3600/1600 PRICES

| Frequency Band | Flatness | SERIES 3600 CARDS Model No. | SERIES 3600 CARDS Price | SERIES 1600 MODULES Model No. | SERIES 1600 MODULES Price | Frequency Band | Flatness | SERIES 3600 CARDS Model No. | SERIES 3600 CARDS Price | SERIES 1600 MODULES Model No. | SERIES 1600 MODULES Price |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 200 Hz to 20 kHz | ±½db | 3606A-52224 | $369.00 | 1606A-52224 | $310.00 | 200 Hz to 500 kHz | ±1db | 3603A-12255 | $319.00 | 1603A-12255 | $260.00 |
| 50 Hz to 20 kHz | ±½db | -55124 | $379.00 | -55124 | $320.00 | 50 Hz to 500 kHz | ±1db | -15155 | $339.00 | -15155 | $270.00 |
| 20 Hz to 20 kHz | ±½db | -52124 | $399.00 | -52124 | $340.00 | 20 Hz to 500 kHz | ±1db | -12155 | $349.00 | -12155 | $290.00 |
| 10 Hz to 20 kHz | ±½db | -51124 | $434.00 | -51124 | $360.00 | 10 Hz to 500 kHz | ±1db | -11155 | $384.00 | -11155 | $315.00 |
| 200 Hz to 50 kHz | ±½db | 3606A-52254 | $389.00 | 1606A-52254 | $330.00 | 200 Hz to 50 kHz | ±2db | 3602A-22254 | $244.00 | 1602A-22254 | $185.00 |
| 50 Hz to 50 kHz | ±½db | 55154 | $399.00 | -55154 | $350.00 | 50 Hz to 50 kHz | ±2db | -25154 | $354.00 | -25154 | $195.00 |
| 20 Hz to 50 kHz | ±½db | -52154 | $419.00 | -52154 | $360.00 | 20 Hz to 50 kHz | ±2db | -22154 | $274.00 | -22154 | $215.00 |
| 10 Hz to 50 kHz | ±½db | -51154 | $454.00 | -51154 | $385.00 | 10 Hz to 50 kHz | ±2db | -21154 | $309.00 | -21154 | $240.00 |
| 200 Hz to 100 kHz | ±½db | 3606A-52215 | $409.00 | 1606A-52215 | $350.00 | 200 Hz to 100 kHz | ±2db | 3602A-22215 | $249.00 | 1602A-22215 | $190.00 |
| 50 Hz to 100 kHz | ±½db | -55115 | $434.00 | -55115 | $375.00 | 50 Hz to 100 kHz | ±2db | -25115 | $279.00 | -25115 | $220.00 |
| 20 Hz to 100 kHz | ±½db | -52115 | $439.00 | -52115 | $380.00 | 20 Hz to 100 kHz | ±2db | -22115 | $279.00 | -22115 | $220.00 |
| 10 Hz to 100 kHz | ±½db | -51115 | $474.00 | -51115 | $405.00 | 10 Hz to 100 kHz | ±2db | -21115 | $314.00 | 21115 | $245.00 |
| 200 Hz to 200 kHz | ±½db | 3606A-52225 | $424.00 | 1606A-52225 | $365.00 | 200 Hz to 200 kHz | ±2db | 3602A-22225 | $269.00 | 1602A-22225 | $210.00 |
| 50 Hz to 200 kHz | ±½db | -55125 | $424.00 | -55125 | $375.00 | 50 Hz to 200 kHz | ±2db | -25125 | $279.00 | -25125 | $220.00 |
| 20 Hz to 200 kHz | ±½db | -52125 | $454.00 | -52125 | $395.00 | 20 Hz to 200 kHz | ±2db | -22125 | $299.00 | -22125 | $240.00 |
| 10 Hz to 200 kHz | ±½db | -51125 | $489.00 | -51125 | $415.00 | 10 Hz to 200 kHz | ±2db | -21125 | $334.00 | -21125 | $265.00 |
| 200 Hz to 500 kHz | ±½db | 3606A-52255 | $444.00 | 1606A-52255 | $385.00 | 200 Hz to 500 kHz | ±2db | 3602A-22255 | $284.00 | 1602A-22255 | $225.00 |
| 50 Hz to 500 kHz | ±½db | -55155 | $454.00 | -55155 | $395.00 | 50 Hz to 500 kHz | ±2db | -25155 | $294.00 | -25155 | $235.00 |
| 20 Hz to 500 kHz | ±½db | -52155 | $474.00 | -52155 | $415.00 | 20 Hz to 500 kHz | ±2db | -22155 | $314.00 | -22155 | $255.00 |
| 10 Hz to 500 kHz | ±½db | -51155 | $509.00 | -51155 | $440.00 | 10 Hz to 500 kHz | ±2db | -21155 | $354.00 | -21155 | $280.00 |
| 200 Hz to 20 kHz | ±1db | 3602A-12224 | $244.00 | 1602A-12224 | $185.00 | 200 Hz to 500 kHz | ±3db | 3602A-32255 | $244.00 | 1602A-32255 | $185.00 |
| 50 Hz to 20 kHz | ±1db | -15124 | $254.00 | -15124 | $195.00 | 50 Hz to 500 kHz | ±3db | -35155 | $254.00 | -35155 | $195.00 |
| 20 Hz to 20 kHz | ±1db | -12124 | $274.00 | -12124 | $215.00 | 20 Hz to 500 kHz | ±3db | -32155 | $284.00 | -32155 | $215.00 |
| 10 Hz to 20 kHz | ±1db | -11124 | $309.00 | -11124 | $240.00 | 10 Hz to 500 kHz | ±3db | -31155 | $309.00 | -31155 | $240.00 |
| 200 Hz to 50 kHz | ±1db | 3602A-12254 | $264.00 | 1602A-12254 | $205.00 | 5 kHz to 1 mHz | ±1db | 3607A-15316 | $435.00 | 1607A-15316 | $366.00 |
| 50 Hz to 50 kHz | ±1db | -15154 | $274.00 | -15154 | $215.00 | 5 kHz to 2 mHz | ±1db | -15326 | $525.00 | -15326 | $456.00 |
| 20 Hz to 50 kHz | ±1db | -12154 | $294.00 | -12154 | $235.00 | 5 kHz to 3 mHz | ±1db | -15336 | $625.00 | -15336 | $556.00 |
| 10 Hz to 50 kHz | ±1db | -11154 | $329.00 | -11154 | $260.00 | | | | | | |
| 200 Hz to 100 kHz | ±1db | 3603A-12215 | $289.00 | 1603A-12215 | $215.00 | 5 kHz to 1 mHz | ±2db | 3607A-25316 | $345.00 | 1607A-25316 | $276.00 |
| 50 Hz to 100 kHz | ±1db | -15115 | $294.00 | -15115 | $225.00 | 5 kHz to 2 mHz | ±2db | -25326 | $420.00 | -25326 | $351.00 |
| 20 Hz to 100 kHz | ±1db | -12115 | $304.00 | -12115 | $255.00 | 5 kHz to 3 mHz | ±2db | -25336 | $500.00 | -25336 | $431.00 |
| 10 Hz to 100 kHz | ±1db | -11115 | $349.00 | -11115 | $280.00 | 5 kHz to 5 mHz | ±2db | -25356 | $660.00 | -25356 | $591.00 |
| 200 Hz to 200 kHz | ±1db | 3603A-12225 | $299.00 | 1603A-12225 | $240.00 | 5 kHz to 1 mHz | ±3db | 3607A-35316 | $285.00 | 1607A-35316 | $216.00 |
| 50 Hz to 200 kHz | ±1db | -15125 | $309.00 | -15125 | $250.00 | 5 kHz to 2 mHz | ±3db | -35326 | $345.00 | -35326 | $270.00 |
| 20 Hz to 200 kHz | ±1db | -12125 | $319.00 | -12125 | $270.00 | 5 kHz to 3 mHz | ±3db | -35336 | $415.00 | -35336 | $346.00 |
| 10 Hz to 200 kHz | ±1db | -11125 | $364.00 | -11125 | $295.00 | 5 kHz to 5 mHz | ±3db | -35356 | $550.00 | -35356 | $481.00 |

**NOTE:** A SERIES TO OPERATE ON −30VDC
C SERIES TO OPERATE ON −24VDC, PRICE SAME AS (A) SERIES

TO EXTEND 3607A LOW FREQUENCY ADD AS FOLLOWS:

200 Hz add $30.00 — 20 Hz add $60.00
50 Hz add $40.00 — 10 Hz add $95.00

ELGENCO INCORPORATED
*statistical instruments for industry*
DEPT. EM • HURRICANE, UTAH 84737 • (801) 635-4954

# MODELS 602A-200/602A-1390/603A • ALL SOLID STATE NOISE GENERATORS 5 Hz TO 5 MHz

## SPECIFICATIONS:

**These specs are unique to the Series 602A-200, 602A-1390, 603A introduced on this page.**

**FREQUENCY RANGES:** 5 Hz to 20 kHz, 5 Hz to 500 kHz, 5 Hz to 5 mHz.

**AMPLITUDE PROBABILITY DISTRIBUTION:** Gaussian.

**OUTPUT SPECTRUM:**

| Accuracy | 602A-1390 | 602A-200 | 603A |
|---|---|---|---|
| 20 Hz to 20 kHz | ±1 db | ±1 db | — |
| 20 Hz to 500 kHz | ±3 db | ±2.5 db | — |
| 500 kHz to 5 mHz | ±8 db | ±5 db | — |
| 10 Hz to 500 kHz | — | — | ±1 db |
| 500 kHz to 5 mHz | — | — | ±3 db |

**RMS OUTPUT LEVEL:** (Minimum value of maximum open circuit output).

| | | | |
|---|---|---|---|
| 20 kHz range | 3 volts | 3 volts | 3 volts |
| 500 kHz range | 2 volts | 2.5 volts | 3 volts |
| 5 mHz range | 1 volt | 2.0 volts | 3 volts |

**OUTPUT IMPEDANCE:**

| | | | |
|---|---|---|---|
| | 900 ohms ±10% | 200 ohms ±10% | 200 ohms ±10% |

**MAXIMUM LOAD:** (on direct output)

| | | | |
|---|---|---|---|
| | no limit | 700 ohms | 700 ohms |

**OUTPUT STEP ATTENUATOR:** Five positions: X1.0, X0.1, X.01, X.001, and X.0001; calibrated to work into open circuit. Accuracy:

| | | | |
|---|---|---|---|
| to 100 kHz | ±3% | ±3% | — |
| to 500 kHz | — | — | ±3% |
| to 5 mHz | ±10% | ±10% | ±5% |
| Output Impedance | 200 ohms | 200 ohms | 200 ohms |
| | — | ±1% | ±1% |

**SPECTRAL DENSITY:** Approximate spectral density (mv $\sqrt{}$ Hz ) for 1 volt RMS output.

| | | | |
|---|---|---|---|
| 20 kHz band | 5.0 | 5.0 | 5.0 |
| 500 kHz band | 1.2 | 1.2 | 1.2 |
| 5 mHz band | 0.6 | 0.4 | 0.4 |

**PRICE**

| | | | |
|---|---|---|---|
| | $735.00 | $840.00 | $995.00 |

## SPECIFICATIONS • ALSO COMMON TO SERIES 624A

**These specs are common to the Series 602A-200, 602A-1390, 603A introduced on this page and the Series 624A on facing page.**

**DYNAMIC RANGE:** 3.5 to 1 peak to RMS at 3 volts RMS open circuit; 5 to 1 at 2.1 volts RMS. Dynamic range is inversly proportional to output level as set by front panel amplitude control.

**OUTPUT METER:** Rectifier type meter circuit reads proportional to average value, calibrated to read RMS value of Gaussian Noise; 0-5 volts RMS scale.

**OPERATING TEMPERATURE RANGE:** 0 to 50°C.

**POWER SUPPLY:** Built-in highly regulated dc supply.

**POWER REQUIREMENTS:** 115/230 volts ±10/20 volts, 50 to 1,000 Hertz ac; approximately 5 watts. A rechargeable battery option is available. Battery is recharged by operating unit on ac line.

**DIMENSIONS:** 5¼" high x 8⅝" wide x 11" deep.

**RACK MOUNT:** A rack mounting adapter kit is available for rack mounting two units side by side. Also available is a rack mounting adapter kit for rack mounting one unit. One or two units use 5¼" x 19" of rack panel space with adapter kit. Full rack width cabinet option for one unit is available. Size of unit with this option is 5¼" high x 17" wide x 11" deep and comes with rack mounting hardware.

**SHIPPING WEIGHT:** Approximately 12 lbs.

**OPTIONS AVAILABLE:** Full rack width cabinet with mounting hardware option; rechargeable battery option; BNC output terminal on rear panel option.

**ACCESSORIES AVAILABLE:** Dual adapter kit and rack mounting hardware; single unit adapter kit with rack mounting hardware and front and rear dummy panels; rechargeable battery adapter kit.

# OPTIONS & ACCESSORIES FOR MODELS 602A/603A/610A & SERIES 624A

Adapter kit, single unit rack mounting (mounts one unit in rack, includes blank panel to make dual unit) Part No. 8804-0002 ..... $130.00

Adapter kit, dual unit and rack mounting hardware (mounts two units side by side) Part No. 8804-0001 ..... $25.00

Full rack width cabinet and rack mounting hardware option....add $100.00

Pink filters, Part No. 8890-0015 ..... $105.00

Rechargeable battery option .....add $350.00

Rechargeable battery kit ..... $360.00

ELGENCO INCORPORATED
*statistical instruments for industry*
DEPT. EM • HURRICANE, UTAH 84737 • (801) 635-4954

# SERIES 624A FIXED RANGE • ALL SOLID STATE NOISE GENERATORS

## SPECIFICATIONS • ALSO SEE FACING PAGE

**FREQUENCY RANGES:** See price list for a partial list of frequency ranges available.

**RMS OUTPUT LEVEL:** (Minimum value of maximum open circuit output) 3 volts.

**OUTPUT IMPEDANCE:** 200 ohms ±10%.

**MAXIMUM LOAD:** (on direct output) 700 ohms.

**OUTPUT STEP ATTENUATOR:** Five positions: X1.0, X0.1, X.01, X.001, and X.0001; calibrated to work into open circuit.

**Accuracy:** ±3%
**Output Impedance:** 200 ohms

**SPECTRAL DENSITY:** Approximate spectral density (mv$\sqrt{\text{Hz}}$) for 1 volt RMS output.

| Accuracy | mv | Accuracy | mv |
|---|---|---|---|
| 20 kHz band | 5.0 | 200 kHz band | 1.6 |
| 50 kHz band | 3.1 | 500 kHz band | 1.0 |
| 100 kHz band | 2.2 | | |

**AMPLITUDE PROBABILITY DISTRIBUTION:** Gaussian.

## SPECIFICATIONS FOR SERIES 624A

| | | |
|---|---|---|
| 624A-11124 | 10 Hz to 20 kHz, ±1db | $730.00 |
| -12124 | 20 Hz to 20 kHz, ±1db | $685.00 |
| -15124 | 50 Hz to 20 kHz, ±1db | $675.00 |
| -12224 | 200 Hz to 20 kHz, ±1db | $665.00 |
| 624A-11154 | 10 Hz to 50 kHz, ±1db | $750.00 |
| -12154 | 20 Hz to 50 kHz, ±1db | $715.00 |
| -15154 | 50 Hz to 50 kHz, ±1db | $695.00 |
| -12254 | 200 Hz to 50 kHz, ±1db | $685.00 |
| 624A-11115 | 10 Hz to 100 kHz, ±1db | $770.00 |
| -12115 | 20 Hz to 100 kHz, ±1db | $735.00 |
| -15115 | 50 Hz to 100 kHz, ±1db | $715.00 |
| -12215 | 200 Hz to 100 kHz, ±1db | $705.00 |
| 624A-11125 | 10 Hz to 200 kHz, ±1db | $820.00 |
| -12125 | 20 Hz to 200 kHz, ±1db | $785.00 |
| -15125 | 50 Hz to 200 kHz, ±1db | $765.00 |
| -12225 | 200 Hz to 200 kHz, ±1db | $755.00 |

## SPECIFICATIONS FOR SERIES 624A (Cont'd)

| | | |
|---|---|---|
| 624A-11155 | 10 Hz to 500 kHz, ±1db | $840.00 |
| -12155 | 20 Hz to 500 kHz, ±1db | $805.00 |
| -15155 | 50 Hz to 500 kHz, ±1db | $785.00 |
| -12255 | 200 Hz to 500 kHz, ±1db | $775.00 |
| 624A-21154 | 10 Hz to 50 kHz, ±2db | $730.00 |
| -22154 | 20 Hz to 50 kHz, ±2db | $695.00 |
| -25154 | 50 Hz to 50 kHz, ±2db | $675.00 |
| -22254 | 200 Hz to 50 kHz, ±2db | $765.00 |
| 624A-21115 | 10 Hz to 100 kHz, ±2db | $735.00 |
| -22115 | 20 Hz to 100 kHz, ±2db | $700.00 |
| -25115 | 50 Hz to 100 kHz, ±2db | $680.00 |
| -22215 | 200 Hz to 100 kHz, ±2db | $670.00 |
| 624A-21125 | 10 Hz to 200 kHz, ±2db | $750.00 |
| -22125 | 20 Hz to 200 kHz, ±2db | $720.00 |
| -25125 | 50 Hz to 200 kHz, ±2db | $700.00 |
| -22225 | 200 Hz to 200 kHz, ±2db | $690.00 |
| 624A-21155 | 10 Hz to 500 kHz, ±2db | $770.00 |
| -22155 | 20 Hz to 500 kHz, ±2db | $735.00 |
| -25155 | 50 Hz to 500 kHz, ±2db | $715.00 |
| -22255 | 200 Hz to 500 kHz, ±2db | $705.00 |
| 624A-31155 | 10 Hz to 500 kHz, ±3db | $730.00 |
| -32155 | 20 Hz to 500 kHz, ±3db | $695.00 |
| -35155 | 50 Hz to 500 kHz, ±3db | $675.00 |
| -32255 | 200 Hz to 500 kHz, ±3db | $665.00 |
| 624A-51124 | 10 Hz to 20 kHz, ±½db | $855.00 |
| -52124 | 20 Hz to 20 kHz, ±½db | $820.00 |
| -55124 | 50 Hz to 20 kHz, ±½db | $800.00 |
| -52224 | 200 Hz to 20 kHz, ±½db | $790.00 |
| 624A-51154 | 10 Hz to 50 kHz, ±½db | $870.00 |
| -52154 | 20 Hz to 50 kHz, ±½db | $820.00 |
| -55154 | 50 Hz to 50 kHz, ±½db | $800.00 |
| -52254 | 200 Hz to 50 kHz, ±½db | $790.00 |
| 624A-51115 | 10 Hz to 100 kHz, ±½db | $895.00 |
| -52115 | 20 Hz to 100 kHz, ±½db | $860.00 |
| -55115 | 50 Hz to 100 kHz, ±½db | $840.00 |
| -52215 | 200 Hz to 100 kHz, ±½db | $830.00 |
| 624A-51125 | 10 Hz to 200 kHz, ±½db | $945.00 |
| -52125 | 20 Hz to 200 kHz, ±½db | $910.00 |
| -55125 | 50 Hz to 200 kHz, ±½db | $890.00 |
| -52225 | 200 Hz to 200 kHz, ±½db | $880.00 |
| 624A-51155 | 10 Hz to 500 kHz, ±½db | $965.00 |
| -52155 | 20 Hz to 500 kHz, ±½db | $930.00 |
| -55155 | 50 Hz to 500 kHz, ±½db | $910.00 |
| -52255 | 200 Hz to 500 kHz, ±½db | $900.00 |

**Model 602A** with full rack width mounting option

**Models 602A** and **610A** combined by dual unit adapter kit.

ELGENCO INCORPORATED
*statistical instruments for industry*
DEPT. EM • HURRICANE, UTAH 84737 • (801) 635-4954

# MODEL 610A • ALL SOLID STATE NOISE GENERATOR • 5Hz TO 5MHz

## SPECIFICATIONS

**FREQUENCY RANGES:** Eight ranges selectably by front panel switch; 5 Hz to 2 kHz, 5 Hz to 5 kHz, 5 Hz to 20 kHz, 5 Hz to 50 kHz, 5 Hz to 200 kHz, 5 Hz to 500 kHz, 5 Hz to 2 mHz, and 5 Hz to 5 mHz.

**OUTPUT SPECTRUM:** Uniform to ±0.5 db from 10 Hz to 500 kHz and ±2.0 db from 500 kHz to 5 mHz.

**OUTPUT LEVEL:** 0 to 1 volt RMS, adjustable by front panel amplitude control. A dynamic range of 5 to 1 peak to RMS value is provided.

**OUTPUT STEP ATTENUATOR:** Five positions; X1.0, X0.1, X.01, X.001, X.0001. Accuracy ±0.1 db to 500 kHz; ±0.25 db to 5 mHz.

**SPECTRAL DENSITY:** Approximate spectral density for 1 volt RMS output.

| Band | volts/√ Hz | Band | volts/√ Hz |
|---|---|---|---|
| 2 kHz | $1.75 \times 10^{-2}$ | 200 kHz | $1.75 \times 10^{-3}$ |
| 5 kHz | $1.1 \times 10^{-2}$ | 500 kHz | $1.1 \times 10^{-3}$ |
| 20 kHz | $5.5 \times 10^{-3}$ | 2 mHz | $5.5 \times 10^{-4}$ |
| 50 kHz | $3.5 \times 10^{-3}$ | 5 mHz | $3 \times 10^{-4}$ |

**AMPLITUDE PROBABILITY DISTRIBUTION:** Symmetrical Gaussian Distribution all ranges.

**OUTPUT METER:** Meter reads 0 to 1 volt RMS. Accuracy ±2% of full scale to 2 mHz; ±5% to 5 mHz.

**MAXIMUM LOAD:** 500 ohms on direct output.

**OUTPUT IMPEDANCE:** Approximately 50 ohms direct output. Step attenuated output 50 ohms ±1%.

**POWER SUPPLY:** Built-in highly regulated dc supply.

**POWER REQUIREMENTS:** 115/230 volts ±10/20 volts, 50 to 1,000 Hertz ac; approximately 7 watts. A rechargeable power option is available. Battery is recharged by operating unit on ac line.

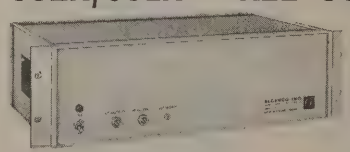
**DIMENSIONS:** 5¼" high x 8⅝" wide x 11" deep.

**RACK MOUNT:** A rack mounting adapter kit is available for rack mounting two units side by side. Also available is a rack mounting adapter kit for rack mounting one unit. One or two units use 5¼" x 19" of rack panel space with adapter kit. Full rack width cabinet option for one unit is available. Size of unit with this option is 5¼" high x 17" wide x 11" deep and comes with rack mounting hardware.

**SHIPPING WEIGHT:** Approximately 14 lbs.

**PRICE: $1935.00**

# MODELS 632A/631A • ALL SOLID STATE NOISE GENERATOR



**Model 632A** Dual Output DC to 400 Hz and 5 Hz to 40 kHz ..... **$3,955**

## LOW FREQUENCY OUTPUT

**AMPLITUDE PROBABILITY DISTRIBUTION:** Gaussian ±1.0%.
**OUTPUT SPECTRUM:** Uniform ±0.1 db from DC to 350 Hz.

**MAXIMUM OUTPUT:** 1.0 volts rms. A dynamic range of 5 to 1 peak to rms value is provided.

**MAXIMUM SPECTRAL DENSITY:** Approx. $1.5 \times 10^{-3}$ volts²/Hz.

**OUTPUT MEAN:** Less than 5 mv.

**OUTPUT IMPEDANCE:** Approximately 1,000 ohms.

## HIGH FREQUENCY OUTPUT

**AMPLITUDE PROBABILITY DISTRIBUTION:** Gaussian ±2%.

**OUTPUT SPECTRUM:** Uniform ±0.5 db from 10 to 35,000 Hz.

**MAXIMUM OUTPUT:** 1.0 volts rms. A dynamic range of 5 to 1 peak to rms values is provided.

**MAXIMUM SPECTRAL DENSITY:** Approx. $2 \times 10^{-5}$ volts²/Hz.

**OUTPUT MEAN:** Less than 1 mv.

**OUTPUT IMPEDANCE:** Approximately 100 ohms.

**NOISE REGULATOR:** rms output level continuously stabilized against a reference voltage.

**OVERLOAD INDICATOR:** Panel overload indicator lights when input noise level to regulator is out of regulation range.

**POWER:** 115/230 volts ±10/20 volts, 50 to 1,000 Hertz ac.

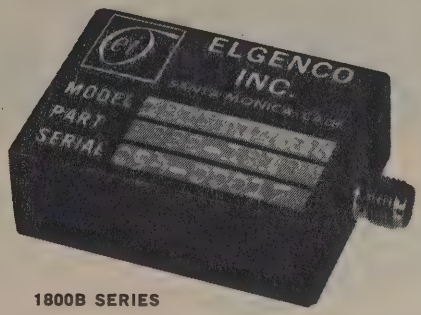
**DIMENSIONS:** 5¼" high x 17" wide x 11" deep. 19" wide with rack mounting flanges mounted (supplied).

**Model 631A** 5 Hz to 40 kHz ..... **$2,525**

ELGENCO INCORPORATED
*statistical instruments for industry*
DEPT. EM • HURRICANE, UTAH 84737 • (801) 635-4954

# SERIES 1800 • NOISE SOURCE MODULES • 10KHz TO 100MHz

1800A SERIES




1800B SERIES

## SPECIFICATIONS

The 1800 Series provides a low level wide band output. A portion of this band is specified to a certain flatness; uniformity. The approximate 6 mv open circuit output is for the whole band. The 1800B Series modules are the same as the 1800A series except the output is via a SMA connector. Specifications are for 25°C unless specified otherwise.

**SPECTRAL DENSITY UNIFORMITY:** Available with uniformity of ±0.5 db, ±1 db, ±2 db, ±3 db and ±4 db for many frequency ranges between lower frequencies of 10 kHz and 2 mHz and upper frequencies of 20 mHz, 30 mHz, 45 mHz, 50 mHz, 70 mHz, 80 mHz and 100 mHz.

**SPECTRAL DENSITY:** Approximately 0.3 $\mu$V per root Hz into 50 ohms.

**RMS OUTPUT LEVEL:** Approximately 3 mv rms into 50 ohms; 6 mv rms open circuit.

**OUTPUT IMPEDANCE:** Approximately 50 ohms.

**AMPLITUDE PROBABILITY DISTRIBUTION:** Gaussian.

**OPERATING TEMPERATURE RANGE:** 0 to 50°C.

**POWER REQUIREMENTS:** Model 1815, −15 VDC; Model 1818, −18 VDC; Model 1820, −20 VDC; Model 1822, −22 VDC; Model 1824, −24 VDC (well regulated power is required); current approximately 25 ma. Note: No external components are needed to properly install unit.

**MOUNTING:** .032" printed circuit leads.

**SIZE:** 1.60 x 1.30 x 0.65 inches.

**WEIGHT:** Approximately 1 oz.

**PRICING:**
**Base Price:** 1818A.
**Base Price plus $15.00:** 1818B.
**Base Price plus $20.00:** 1815A, 1820A, 1822A and 1824A.
**Base Price plus $35.00:** 1815B, 1820B, 1822B and 1824B.

## SERIES 1800 PRICES

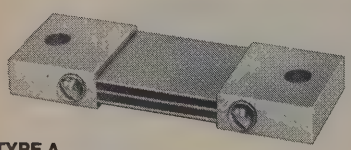
| Model No. | Frequency Band | Price |
|---|---|---|
| 1818A-31427 | 10 kHz to 20 mHz, ±3 db | $229.00 |
| -21427 | 10 kHz to 20 mHz, ±2 db | $259.00 |
| -11427 | 10 kHz to 20 mHz, ±1 db | $369.00 |
| -51427 | 10 kHz to 20 mHz, ±0.5 db | $489.00 |
| 1818A-31437 | 10 kHz to 30 mHz, ±3 db | $239.00 |
| -21437 | 10 kHz to 30 mHz, ±2 db | $269.00 |
| -11437 | 10 kHz to 30 mHz, ±1 db | $389.00 |
| -51437 | 10 kHz to 30 mHz, ±0.5 db | $529.00 |
| 1818A-31447 | 10 kHz to 45 mHz, ±3 db | $269.00 |
| -21447 | 10 kHz to 45 mHz, ±2 db | $319.00 |
| -11447 | 10 kHz to 45 mHz, ±1 db | $489.00 |
| -51447 | 10 kHz to 45 mHz, ±0.5 db | $669.00 |
| 1818A-31457 | 10 kHz to 50 mHz, ±3 db | $319.00 |
| -21457 | 10 kHz to 50 mHz, ±2 db | $389.00 |
| -11457 | 10 kHz to 50 mHz, ±1 db | $539.00 |
| -51457 | 10 kHz to 50 mHz, ±0.5 db | $789.00 |
| 1818A-41477 | 10 kHz to 70 mHz, ±4 db | $319.00 |
| -31477 | 10 kHz to 70 mHz, ±3 db | $339.00 |
| -21477 | 10 kHz to 70 mHz, ±2 db | $409.00 |
| -11477 | 10 kHz to 70 mHz, ±1 db | $589.00 |
| 1818A-41487 | 10 kHz to 80 mHz, ±4 db | $339.00 |
| -31487 | 10 kHz to 80 mHz, ±3 db | $359.00 |
| -21487 | 10 kHz to 80 mHz, ±2 db | $439.00 |
| -11487 | 10 kHz to 80 mHz, ±1 db | $639.00 |
| 1818A-41418 | 10 kHz to 100 mHz, ±4 db | $369.00 |
| -31418 | 10 kHz to 100 mHz, ±3 db | $389.00 |
| -21418 | 10 kHz to 100 mHz, ±2 db | $489.00 |
| -11418 | 10 kHz to 100 mHz, ±1 db* | $779.00 |

Note: 1815 Series not available in 80 mHz and 100 mHz units.

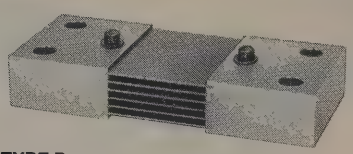
| Model No. | Frequency Band | Price |
|---|---|---|
| 1818A-32627 | 2 mHz to 20 mHz, ±3 db | $179.00 |
| -22627 | 2 mHz to 20 mHz, ±2 db | $209.00 |
| -12627 | 2 mHz to 20 mHz, ±1 db | $319.00 |
| -52627 | 2 mHz to 20 mHz, ±0.5 db | $389.00 |
| 1818A-32637 | 2 mHz to 30 mHz, ±3 db | $189.00 |
| -22637 | 2 mHz to 30 mHz, ±2 db | $219.00 |
| -12637 | 2 mHz to 30 mHz, ±1 db | $339.00 |
| -52637 | 2 mHz to 30 mHz, ±0.5 db | $439.00 |
| 1818A-32647 | 2 mHz to 45 mHz, ±3 db | $219.00 |
| -22647 | 2 mHz to 45 mHz, ±2 db | $269.00 |
| -12647 | 2 mHz to 45 mHz, ±1 db | $439.00 |
| -52647 | 2 mHz to 45 mHz, ±0.5 db | $569.00 |
| 1818A-32657 | 2 mHz to 50 mHz, ±3 db | $269.00 |
| -22657 | 2 mHz to 50 mHz, ±2 db | $339.00 |
| -12657 | 2 mHz to 50 mHz, ±1 db | $489.00 |
| -52657 | 2 mHz to 50 mHz, ±0.5 db | $689.00 |
| 1818A-42677 | 2 mHz to 70 mHz, ±4 db | $269.00 |
| -32677 | 2 mHz to 70 mHz, ±3 db | $289.00 |
| -22677 | 2 mHz to 70 mHz, ±2 db | $359.00 |
| -12677 | 2 mHz to 70 mHz, ±1 db | $539.00 |
| 1818A-42687 | 2 mHz to 80 mHz, ±4 db | $289.00 |
| -32687 | 2 mHz to 80 mHz, ±3 db | $309.00 |
| -22687 | 2 mHz to 80 mHz, ±2 db | $389.00 |
| -12687 | 2 mHz to 80 mHz, ±1 db | $589.00 |
| 1818A-42618 | 2 mHz to 100 mHz, ±4 db | $319.00 |
| -32618 | 2 mHz to 100 mHz, ±3 db | $339.00 |
| -22618 | 2 mHz to 100 mHz, ±2 db | $439.00 |
| -12618 | 2 mHz to 100 mHz, ±1 db* | $729.00 |

*Available 1800B Series only.

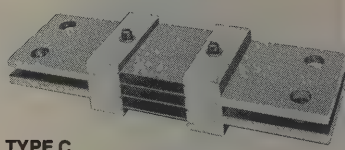
# Empro gives you the world's widest selection of DC ammeter shunts



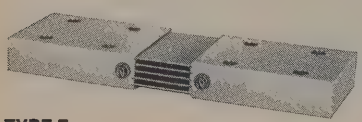
**TYPE A**
50 MV 15 through 600 amperes
100 MV 50 through 600 amperes



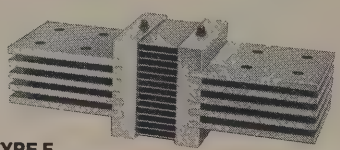
**TYPE B**
50 MV 300 through 1200 amperes
100 MV 300 through 1200 amperes



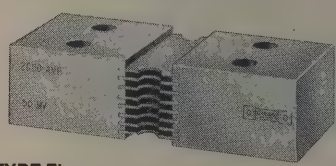
**TYPE C**
50 MV 1000 through 2000 amperes
100 MV 1000 through 2000 amperes



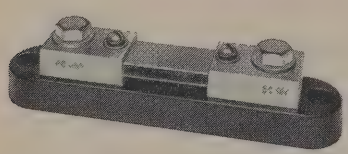
**TYPE E**
50 MV 1500 through 2000 amperes
100 MV 1500 through 2000 amperes



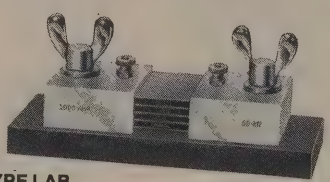
**TYPE F**
50 MV 2500 through 30000 amperes
100 MV 2500 through 10000 amperes



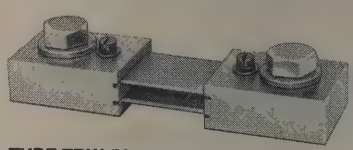
**TYPE FL**
50 MV 1000 through 3000 amperes



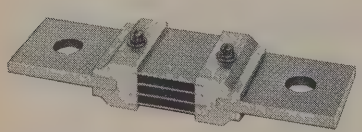
**TYPE HA**
50 MV 1 through 500 amperes
100 MV 1 through 500 amperes



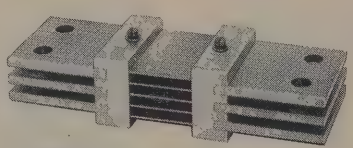
**TYPE LAB**
50 MV 15 through 1000 amperes
100 MV 15 through 1000 amperes



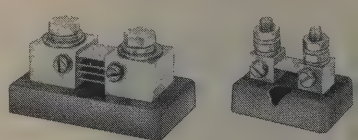
**TYPE TRW-50**
50 MV 100 through 600 amperes



**TYPE W**
50 MV 300 through 1000 amperes
100 MV 120 through 500 amperes



**TYPE WT**
50 MV 1000 through 10000 amperes
100 MV 600 through 6000 amperes



**LIGHTWEIGHT**
50 MV 5 through 1200 amperes

All types are also available in 25 MV • Accuracy is ¼%

**For details, call us or one of our representatives . . .**

**CALIFORNIA**
Lew Brooks Co.
5067 Fallhaven Lane
LaCanada, Cal. 91011
Phone (213) 790-8358

**CALIFORNIA**
Lew Brooks Co.
13952 Winthrope St.
Santa Ana, Cal. 92705
Phone (714) 544-8900

**GEORGIA**
Brownell Electro
3020 Commerce Way
Atlanta, Ga. 30354
Phone (404) 762-5181

**ILLINOIS**
PVA Company
521 S. LaGrange Rd.
LaGrange, Ill. 60525
Phone (312) 352-1037

**MASSACHUSETTS**
The Mancib Co.
"A" St. at Middlesex Tpk.
Burlington, Mass. 01803
Phone (617) 272-9450

**NEW JERSEY**
D. F. Tobias & Co., Inc.
433 Pompton Ave.
Cedar Grove N.J. 07009
Phone (201) 239-8585

**OHIO**
Weschler Electric Corp.
4250 West 130th St.
Cleveland, Ohio 44135
Phone (216) 251-4609

**PENNSYLVANIA**
Sunshine Scientific Instruments, Inc.
1810 Grant Ave.
Philadelphia, Pa. 19115
Phone (215) 673-5600

Empro SHUNTS ®

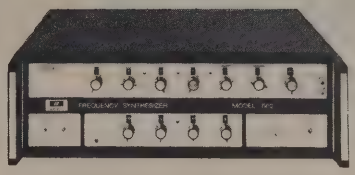
*World's Largest Shunt Manufacturer*

**EMPRO MANUFACTURING COMPANY, INC.**

P. O. Box 26064 • Indianapolis, Indiana 46226 • (317) 823-4478

# SIGNAL SOURCES FROM EXACT

From periods as low as 11.4 years to frequencies as high as 20 MHz, Exact supplies a complete line of analog and digitally synthesized function generators and frequency synthesizers.



## FUNCTION GENERATORS

**SERIES 500 and 510**
5 MHz and 11 MHz Function Generators featuring gate, trigger, sweep.
Model 508 – 5 decade log sweep.
Model 519 – AM/FM

**SERIES 7200**
20 MHz Function Generators Provides features necessary for precision laboratory use. Pulse modes, sweep, gate, burst. 30 V P-P output.

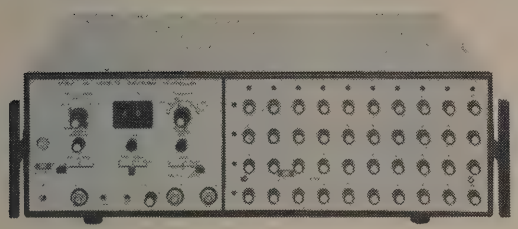
**SERIES 117/119/121**
Sine, square, triangle, ramp, pulse and sweep.
02 Hz to 2.2 MHz 20 Volts P-P.

**MODEL 605**
Programmable Waveform Generator. Remote programming of frequency, amplitude, waveform and mode. IEEE 488 option.

## SYNTHESIZERS

**SERIES 800**
20 MHz Frequency Synthesizers featuring 10 PPM stability, constant dial resolution, optional BCD or ASCII programming and all plug-in card construction. Output up to +26 dBm into 50 Ohms.

## DEDICATED SPECIAL PURPOSE GENERATORS



**COMPLEX WAVEFORM SYNTHESIZER**
**MODEL 202/20**
Build your own waveform from 40 descrete steps.

**MATERIALS TESTING GENERATORS**
**MODEL 340**
Periods from 1 mSec. to 99,900 Hrs. Plug-in expandable for dual rate and variable phase waveforms. Remote programmable.

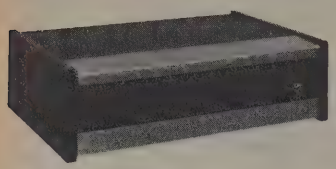
**VARIABLE PHASE GENERATOR**
**MODEL 337**
Set phase lead angle with .2° resolution from 0° to 360°.

**MODEL 336**
Dual rate, adjustable breakpoint, adjustable hold time.

® Box 160 Hillsboro, Oregon
97123 Tel. (503) 648-6661
TWX 910-460-8811
EXACT electronics, inc.

505½ Centinela Ave.
Inglewood, CA 90302
(213) 674-3021

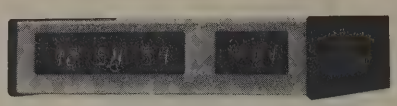
# ESE DIGITALS



## DIGITAL CLOCK ES 112/124 ($139)

ES 112 (12 hr.) and ES 124 (24 hr.) are solid state, six digit clocks. Three simple controls make setting to the precise second easy: Fast Advance, Slow Advance, Hold. Can drive Jumbo Slaves.
**Dimensions:** 2½" High x 8" Wide x 5-5/8" Deep
**Case:** Etched Aluminum
**Electrical:** 117V AC 50/60 Hz 10W max.
**Options:** B C D J K L P Q R S W

Do you need a contact closure one or more times during the hour? Many ESE clocks can be equipped to generate a time pulse. Contact factory for pricing.



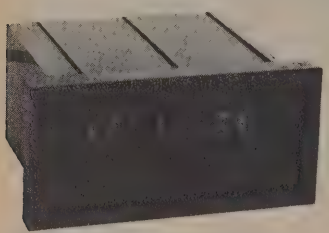
## DIGITAL CLOCK THERMOMETER ES 142/144 ($241)

ES 142 (12 hr.) and ES 144 (24 hr.) are MOS, solid state digital clock/thermometers. Displays 6 digits of time (hours, minutes, seconds) and 3 digits of temperature (-50°F to +150°F or -45°C to +66°C) in planar, gas discharge displays .55" high. Temperature sensor on 25 ft. cable included; attaches to rear-mounted connector.

ES 240 Digital thermometer is available as separate unit, calibrated for °F or °C.
**Dimensions:** 2½" High x 10" Wide x 6" Deep
**Electrical:** 12W max. 117V AC 60 Hz
**Options:** B C D J K P R S W

## SIX DIGIT CLOCK TIMER ES 500 ($160)

ES 500 is a 12 hour clock or timer with 5 front-mounted controls: Start, Stop, Reset, Fast Advance, Slow Advance. Will run continuously to 12:59:59. Advances to 1:00:00 and continues as clock unless stopped or advanced. After use as a timer, time of day must be re-established. Can drive Jumbo Slaves.
**Dimensions:** 2½" High x 8" Wide x 5-5/8" Deep
**Case:** Etched Aluminum
**Electrical:** 117V AC 60 Hz 12W max.
**Options:** B C D J K P Q R S W



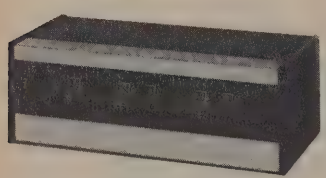
## CONSOLE MOUNT CLOCKS AND TIMERS, 70 SERIES

All units have access to control inputs on rear-mounted connector. Displays are .3" red LED's.

**ES 172 Six Digit, 12 Hour Clock ($134.00):** Three setting controls—Fast Advance, Slow Advance, and Hold. Four line multiplexed BCD's present on the rear connector. Options are C, D, J, M and V.
**ES 174 Six Digit, 24 Hour Clock** ($134.00): Otherwise identical to the ES 172.
**ES 370 Four-Digit, One Hundred Minute Up/Down Timer** ($171.00): Six controls—Count Up, Count Down, Stop, Minutes Advance, Seconds Advance, Reset. Options are B, C, D, J, M and V.
**ES 371 Up/Down Timer** ($267.00): Similar to the ES 370 except with Leverwheel Preset capability for faster setting of the desired time. Option D is an ingegral, separately mounted part of this unit. Options are C, J, and V.

**ES 570 Four Digit, Sixty or 100 Minute Timer** ($134.00): Select 60 or 100 minute mode on rear connector. Start, Stop and Reset controls. Runs continuously unless stopped. Reset will return all displays to zero. Unit will run if reset while running or will stay at zero if reset when stopped. Options are B, C, D, J, M and V.
**ES 572 Six Digit, 12 Hour Clock or Timer** ($160.00): Five controls—Start, Stop, Reset, Fast Advance, Slow Advance. Will run continuously to 12:59:59. Advances to 1:00:00 and continues as clock unless stopped or advanced. After use as a timer, time of day must be re-established using Fast Advance, Slow Advance and Stop Controls. Options are C, D, J, M and V.
**ES 574** ($160.00): A 24 hour version of ES 572.

**Dimensions:** 2.16" High x 4.5" Wide x 4.13" Deep
**Electrical:** 117V AC, 60 Hz



## JUMBO CLOCKS AND TIMERS, 80 SERIES

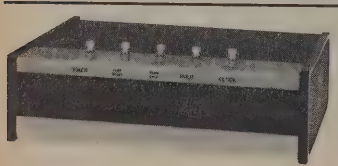
Displays are 1" planar gas discharge.

**ES 182 Six Digit, 12 Hour Clock** ($230.00): Three rear-mounted setting controls—Fast Advance, Slow Advance and Hold. Options are B, C, D, J, P, Q, R, S, and W. When option Q, panel mount, is specified digits will be separated by colons.
**ES 184 Six Digit, 24 Hour Clock** ($230.00): Otherwise identical to the ES 182.
**ES 380 Four Digit, 100 Minute Up/Down Timer** ($267.00): Displays minutes and seconds, with rear-mounted connector to allow remote wiring of six momentary SPST controls—Count Up, Count Down, Stop, Minutes Advance, Seconds Advance and Reset. Other features similar to ES 300. Options are B, C, D, J, N, P, Q, S, T, W, Y, and Z.
**ES 381 Up/Down Timer** :$353.00): Similar to ES 380, except that leverwheel preset is used instead of pushbutton preset. Option D is supplied as part of this unit. Options are B, C, J, N, P, Q, S, T, W Y, and Z.

**ES 580 Four Digit, 60 Minute Timer** ($193.00): Displays minutes and seconds. Rear connector allows remote wiring of three momentary SPST controls—Start, Stop and Reset. Runs continuously unless stopped. Reset returns all displays to zero; and timer will continue to run from zero if reset while running. Options are B, C, D, J, P, Q, S, T, and W.
**ES 582 Six Digit, 12 Hour Clock or Timer** ($267.00): Five control inputs (SPST momentary) brought to rear connector—Start, Stop, Reset, Fast Advance and Slow Advance. After use as a timer, time of day must be re-established using Fast Advance, Slow Advance and Stop controls. Options are B, C, D, J, P, Q, S, and W.

80 Series slaves are also compatible with other ESE clocks and timers: ES 112/124, 300, 301, 302, 400, 510, and 500.

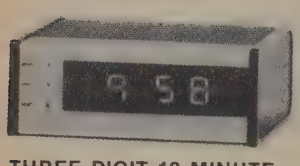
**Dimensions:** 4.45" High x 10.38" Wide x 6.58" Deep
**Electrical:** 117V AC, 60 Hz



## ES 512/524 FOUR DIGIT CLOCK TIMER WITH MEMORY ($200)

Combination four digit 12 or 24 hour clock and 60 minute timer with memory, allowing the user to set the clock to the correct time of day, switch to timer mode, then switch back to time of day by pushing one button; time of day will be correctly displayed, in hours and minutes.

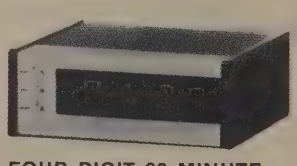
**Electrical:** 117V AC, 60 Hz, 8 watts Max.
**Mechanical:** 8" Wide x 2-3/4" High x 5-5/8" Deep.
**Case:** Etched Aluminum.
**Display:** Four digits of .55" Planar Gas Discharge Display.
**Options:** B, C, D, J, P, Q, R & W.



## THREE DIGIT 10 MINUTE TIMER ES 400 ($105)

The ES 400 has three controls—Start, Stop, Reset. Runs continuously unless stopped. Reset returns display to all zeros. Can be reset while running or stopped. If reset while running, timer will continue to run. Can drive Jumbo Slaves.

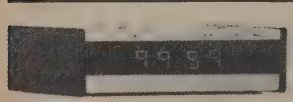
**Dimensions:** 2½" High x 6" Wide x 5-5/8" Deep
**Case:** Etched Aluminum
**Electrical:** 117V AC 60 Hz 8W max.
**Options:** B D J K P Q R S T W



## FOUR DIGIT 60 MINUTE TIMER ES 510 ($134)

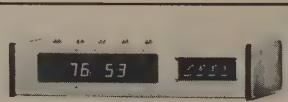
ES 510 is a four digit, sixty minute timer (59:59) with Start, Stop and Reset controls (Single pole, momentary, push-button). Runs continuously unless stopped. Reset returns display to all zeros. Can reset while running or stopped. Can drive Jumbo Slaves.

**Dimensions:** 2½" High x 6" Wide x 5-5/8" Deep
**Case:** Etched Aluminum
**Electrical:** 117V AC 60 Hz 10W max.
**Options:** B D J K P Q R S T W



## ES 300 ($180)

## ES 301 ($198)



## ES 302 ($254)

## 100 MINUTE UP/DOWN TIMERS

ES 300 is a four digit, one hundred minute timer (99:59) with six controls: Count Up, Count Down, Stop, Minutes Advance, Seconds Advance, Reset. Controls are single pole, momentary, push-button switches. When "Stop" control is pressed the four digit display is held. Counting direction (up or down) can be changed or time can be reset for zero without stopping the count. It will continue to register elapsed time beyond the zero setting unless stopped. The ES 300 can drive Jumbo Slaves.

**Dimensions:** 2½" High x 8" Wide x 5-5/8" Deep
**Electrical:** 117V AC 60 Hz 10W max.
**Options:** B D J K P Q R S W Y Z

The ES-302 is similar to the ES 300, except that planar gas discharge displays are used in the ES 301-302. Display height is .55".
All the ES 300 features are included in the ES 301. Additionally, with the ES 302, the user can preset times much faster than with the ES 300 or ES 301, because lever-wheel type switches are used for the preset feature. The ES 301-302 can drive Jumbo Slaves.

**Dimensions:** ES 301: 2½" High x 8" Wide x 6" Deep
ES 302: 2½" High x 10" Wide x 6" Deep
**Electrical:** 117V AC 60 Hz, 7 W max.
**Options:** 301—B D J K N P Q R S T W Y Z
302—B D J K N P R S T W Y Z

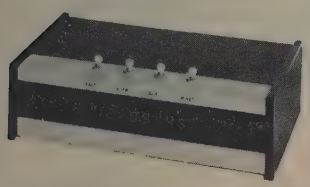
# Perfect Timing

## PROGRAMMER/ COMPARATORS 750 SERIES

For flexibility and economy with up to ten events ESE has designed the 750 Series of Programmer/Comparators. Rugged thumbwheel programmers coupled with an ESE clock or timer to provide single pole form A contact closure (1 Amp contact rating) for the length of time program matches display. All this on a 3½" high 19" relay rack mounting panel. Power required: 117V AC 60 Hz; 220V AC 50 Hz may be specified.

If required control function involves a count other than timing, these products can be adapted to your needs.

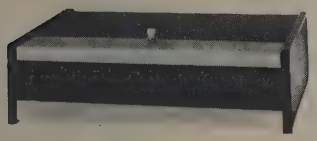
**Thumbwheel Comparator Systems:**
**ES 750**—ES 112 and one 6 Digit Program
**ES 751**—ES 124 and one 6 Digit Program
**ES 752**—ES 500 and one 6 Digit Program
**ES 753**—ES 112 and two 4 Digit Programs
**ES 754**—ES 124 and two 4 Digit Programs
**ES 755**—ES 500 and two 4 Digit Programs
**ES 756**—ES 510 and one 4 Digit Program
**ES 757**— ES 300 and one 4 Digit Program
**ES 758**—ES 510 and two 4 Digit Programs
**ES 759**—ES 300 and two 4 Digit Programs



## ES 1296 ($150)

For Off-Air taping, or operating tape recorders when nobody is there, ESE has created **ES 1296**. Presets up to 96 hrs. ahead.
**ES 1296** is a six digit, twelve hour clock with LED displays and a programmable, 300 watt, 117V AC outlet on the rear.
Once the rear outlet is activated, it will remain on for 66 minutes, unless manually terminated, or an optional Record Duration switch is set to a different time interval. This Record Duration option allows the user to select one of four time intervals for recording. These four time intervals are either 16, 33, 66 and 138 minutes, or 33, 66, 138 and 250 minutes. Price $25.00.

An additional option is Sequential Turn-on, for those machines that require Power, Play, Record in sequence, for proper operation. This option costs $25.00.



## ES-251 ($250)

**ES 251 SMPTE Time Code Reader** ES 251 is a six digit SMPTE Time Code Reader displaying Hours, Minutes and Seconds. Receives the standard SMPTE Time Code through rear mounted BNC connector, converts it into six digits of clock time. Source of the code is normally a SMPTE time code generator but the unit will read the time code directly from a tape machine running at playback speed. This unit produces an extremely accurate time of day display when driven from a time code generator which is locked to a color sub-carrier frequency. The momentary hold switch allows holding of time on display. Releasing hold switch updates display to correct time.

The input code is AC coupled to two stages of amplification and level shifting to obtain a ground reference. The input circuit requires between 1 and 20 volts peak to peak of input signal and presents an input impedance of 50 Kohm. **ES 251** is a CMOS design which operates from a single power supply.
**Dimensions:** Aluminum Case 2¾" High x 8" Wide x 5-5/8" Deep.
**Electrical:** 117V AC 50/60 Hz 6W Max.
**Options:** BJPQW

**ES 252 SMPTE Time Code Reader:** Exactly like **ES 251**, but displays Minutes, Seconds and Frames.

## MASTER CLOCKS

**ES 160** ($750.00): Mounted in a 5¼" relay rack panel and chassis, displays six digits of time information on large, easy to read .3" LED displays, in 12 or 24 hour format, as specified. **ES 160** has its own internal timebase, with three second per month accuracy. Its standard output is serial BCD, CMOS compatible, and can drive 20 **ES 161, 166, 168** or **171** Remote Displays without buffering. All inputs and outputs are through rear-mounted connectors.
**Dimensions:** 5¼" High x 19" Wide x 15" Deep
**Electrical:** 117V AC 50/60 Hz.
**Options:** B (CMOS Compatible), J, One PPS Output, Relay Closure on hour and half hour, Battery/Charger (ES 163) Impulse Driver (ES 162), External Timebase-1, 5 or 10 MHz.
**ES 160/1** ($900.00): One second per month version of **ES 160**
**ES 190** ($900.00): The ultimate in accuracy! A digital clock, similar to **ES 160**, with special circuits for receiving and decoding a 1000 Hz tone at the start of each minute. The decoder output resets the seconds' counters in the clock each minute except the first minute of every hour, when a 1500 Hz tone occurs. These tones are transmitted by Radio Station WWV, with an oscillator accuracy of $\pm 1$ part in $10^{11}$ **ES 190** has an antenna and internal WWV receiver with audio-output. Its crystal timebase is accurate to $\pm 1.7$ seconds per day, used when WWV is not received. A battery and charger (ES 163) is available to protect against power interruptions. Displays are .3" red LED's. Serial output drives **ES 161, 166, 168** or **171** Slaves.
**Dimensions:** 5¼" High x 19" Wide x 15" Deep
**Electrical:** 117V AC 50/60 Hz
**Options:** B (CMOS compatible), J, One PPS Output, Relay Closure on hour and ½ hour, Battery/Charger (ES 163)
**ES192/194** ($275.00): The most economical Masters, **ES 192** (12 Hr) and **ES 194** (24 Hr) are constructed using **ES 112** or **ES 124** digital clocks and adding the **ES 167** Serial Time Code Generator to provide the output needed to drive Remote Serial Displays **ES 161, ES 166, ES 168** and **ES 171**. 60 Hz timebase is derived from the power line. Displays are .6" incandescent type.
**Dimensions:** 2½" High x 8" Wide x 5-5/8" Deep.
**Electrical:** 117V AC 60 Hz
**Options:** BCDJLPQR, Time Pulse Outputs, Battery and Charger, Impulse Driver. Unit mounted on a 3½" High panel when certain options are specified.
**ES 196** ($650.00): Time and Temperature Master—Basically the same as **ES 192**, with gas discharge displays, panel mounting and separate serial BCD outputs for time and temperature. Displays either 12 or 24 hours and °F or °C, as specified.
**Dimensions:** 3½" High x 19" Wide x 8" Deep
**Electrical:** 117V AC 60 Hz
**Options:** BCDJR, Time Pulse Outputs, Battery/Charger.

## ACCESSORIES

**ES 161 Remote Digital Display** ($140.00): Designed to function with any ESE Master Clock, decodes serial time data and displays six digits of clock time on large .55" Gas Discharge Displays, in either 12 or 24 hour format as specified.
**Dimensions:** 8" Wide x 2½" High x 6" Deep.
**Electrical:** 117V AC 50/60 Hz.
**Options:** JPQW.
**ES 162 Impulse Driver** ($170.00): Plugs into the **ES 160** chassis, can drive 20 Impulse Clocks. Designed so that, if power fails, impulse always comes on with the same polarity when power is restored. Drives minute or second clocks as specified.
**ES 163 Battery and Charger** ($140.00): Plugs into the **ES 160** or **ES** 190 chassis. Fast charge, 12 hours continuous use. When operating on battery, displays are automatically blanked and may be viewed by actuating Display button on the front panel.
**ES 164 Remote Digital Impulse Display** ($170.00): Similar to the **ES 161** except that the **ES 164** derives its count command from the **ES 162** Impulse Driver, or any impulse clock drive circuits already installed. Choice of 12 or 24 hour display and available either as desk top unit or panel mounted.
**Dimensions:** 8" Wide x 2½" High x 6" Deep.
**Electrical:** 117V AC 50/60 Hz.
**Options:** BJPQW.
**ES 166 Jumbo 1" Clock Display** ($215.00): Features six digits of one inch high planar gas discharge displays in 12 or 24 hour format as specified. Receives serial time code input from any ESE Master Clock or serial time code generator.
**Dimensions:** 10½" Wide x 4½" High x 6½" Deep.
**Electrical:** 117V AC 50/60 Hz.
**Options:** JPQW. If Q is ordered digits are separated by colons.
**ES 167 Serial Time Code Generator** ($125.00): Offers a low cost answer to a master timing system. An integral part of **ES 160, 190, 192/194** and **196** Master Clocks, this unit can be added to many other ESE products, including **ES 112, 124, 182, 184, 500, 582, 750, 751, 752, 753, 754, 755,** and all **780** Series Time Programmers. The **ES 167** fits inside the case so that no extra space is needed. Drives 20 **ES 161, 166, 168** or **171** Remote Displays. **ES 167** provides CMOS compatible serial BCD output and operates from the logic supply voltage.
**ES 168 Remote Electromagnetic Display** ($388.00): 4" HEIGHT! Used wherever large size at low cost is essential. Receives the serial time code from any ESE Master Clock, displays the time on four bright, yellow-green digits in 12 or 24 hour format as specified. Designed to mount on wall or ceiling. When time changes, audible "click" is heard
**Dimensions:** 6" High x 16½" Wide x 6" Deep.
**Electrical:** 117V AC 50/60 Hz.
**Options:** JW
**ES 169 Temperature Slave** ($125.00): Receives serial BCD temperature code from **ES 196**, displays it on .55" Gas Discharge Displays.
**Dimensions:** 8" Wide x 2½" High x 6" Deep.
**Electrical:** 117V AC 50/60 Hz.
**Options:** JPQW.
**ES 171 Console Mount Display** ($134.00): Newest of the 70 series console mount clocks and timers, **ES 171** receives the serial time code generated by any ESE Master Clock, or any ESE product containing the **ES 167** serial time code generator, and displays it on bright red .3" LED's.
**Dimensions:** 2¼" High x 4½" Wide x 4" Deep.
**Case:** High Impact Black Plastic.
**Electrical:** 117V AC 50/60 Hz.
**Options:** JW.

## RAM TIME PROGRAMMERS 780 SERIES

The ES 780 Series Programmers provide 32 events (expandable to 96) in 5¼ inches of rack space. Ten minutes is all that is required to install, set the clock and program 32 events. Bright .3" LED displays and all controls are on the front panel, outputs and battery test are on the rear. ES 167 Serial Time Code Outputs can be specified as an option. Line frequency time base with backup crystal time base, 72 hour battery/battery charger are standard. External time base can be used. 60 Hz is preferred, others may require additional internal circuitry.

**Eight Digits of Programming Capability:**
**ES 780**—10 Days, 10 Outputs, Hours, Minutes, Seconds
**ES 781**—100 Days, Hours, Minutes, Seconds
**ES 782**—16 Outputs, Hours, Minutes, Seconds
**Six Digits of Programming Capability:**
**ES 783**—Hours, Minutes, Seconds
**ES 784**—100 Days, Hours, Minutes
**ES 785**—100 Days, Minutes, Seconds
**ES 786**—16 Outputs, Hours, Minutes
**ES 787**—16 Outputs, Minutes, Seconds
**Four Digits of Programming Capability:**
**ES 788**—Hours, Minutes
**ES 789**—Minutes, Seconds

ES 782, 786, and 787 have 16 isolated outputs. Any of the 32 events can be programmed to activate any of the 16 outputs. ES 780 has 10 outputs. The other units have a single output.
ES 784, 786, and 788 have a one minute contact closure. The others have a one second contact closure.
**Displays:**
REAL TIME: An eight digit display when day selection is required as on the ES 781, 784, 785, seven digits for ES 780, and six digits for the others.
NEXT EVENT: A two digit display of next event number.
NEXT EVENT TIME: An eight digit display when ES 780, 781, or 782 is specified, a six digit display when ES 783, 784, 785, 786, or 787 is specified, and a four digit display when ES 788 or 789 is specified.
**Dimensions:** 5¼" high x 19" wide x 10" deep.
**Weight:** Approx. 20 lbs. varying with model number.
**Front Panel:** Brushed, etched, anodized aluminum.

## OPTIONS

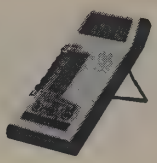
**Please Note: Some combinations of options are not compatible. Consult factory if in doubt.**

**B BCD Output**
**C Crystal Timebase:** A $\pm .002\%$ crystal is employed in an oscillator for those applications requiring independence from the power line frequency. Trimmer included for greater accuracy.
**D Remote Connector, 6' Cable and Control Switch Set:** This option consists of a rear-mounted connector wired for all control functions, a mating connector, wired to six feet of cable, the other end of which is connected to control switches which are mounted on a 1/8" anodized satin finish aluminum plate suitable for mounting on most surfaces.
**L .55" Planar Gas Discharge Display**
**M Front-mounted pushbutton controls:** available on 70 Series except for ES 371.
**N Available on ES 301, 302, 380, 381.** Provides a change in count direction from down to up at zero when the unit has been counting down from a preset time.
**P 19" Front Panel,** 3½" high.
**Q 9" Front Panel,** 3½" high.
**R Remote Connector**
**S Slave/Remote Display:** User must specify option B (BCD Output) on master when ordering a slave.
**T Tenths of Seconds**
**V DC Operation** (Includes crystal timebase)
**W Three Wire Cord**
**Y Relay Closure at Zero:** Available on ES 300, 301, 302, 380 and 381 only.
**Z Relay Contact Closure and Stop at Zero:** Available on ES 300, 301, 302, 380 and 381 only.

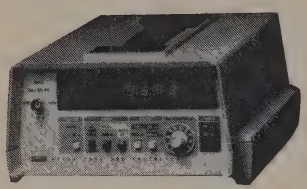
ESE
505-1/2 Centinela Ave.
Inglewood, CA 90302
(213) 674-3021

FLUKE

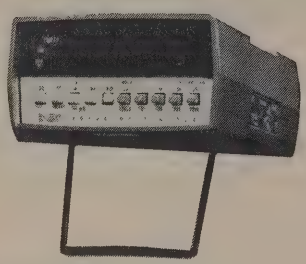
# DIGITAL VOLTMETERS AND MULTIMETERS



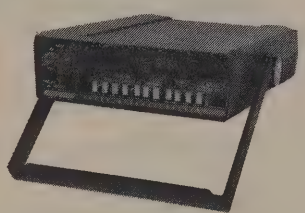
8020A



8920A



8030A



8000A

8000-05

8000-06

## 3½ DIGIT VOLTMETERS

### 8020A

- 26 ranges, 7 functions
- New conductance function
- Extensive overload protection
- LCD readout, 200-hour battery life
- Complete with 9V battery and leads

Many features set the new 8020A apart as a truly exceptional DMM. Twenty-six ranges and 7 functions include measuring capability up to 1000V dc, 750V ac, 2A ac/dc, 20 MΩ, and hi/lo ohms for in-circuit resistance and diode test capability. Unique conductance function allows resistance and leakage measurements up to 10,000 MΩ, a must for circuit board and component testing. Readout is in Siemens (S).

### 8920A, 8921A

These broadband True RMS DVM's read the True RMS values of non-sinusoidal inputs. AC and AC+DC are measured over a frequency range of 10 Hz to 20 MHz with 0.5% mid-band accuracy. Ranging is fully automatic or manual, spanning 7 decades for voltages from 180 μV to 700V. Readout is in voltage or dB. In dB mode, any input voltage may be selected as a reference for future readings in dB.

Twelve user-selectable impedances are referenced to 0 dBm, 1 mW: 50Ω, 75Ω, 93Ω, 110Ω, 124Ω, 135Ω, 150Ω, 300Ω, 600Ω, 900Ω, 1000Ω and 1200Ω. BNC input, Model 8920A; banana jack input, Model 8921A. Logarithmic analog output is optional on the 8920A. Frequency counter output is optional on both the 8920A and 8921A.

### 8000A

- 26 ranges of ac/dc voltage, current and resistance in basic DMM
- Calibrate X-Ray Tubes with mAs option
- Full scale 2Ω and 20Ω ranges with Lo Ohms option
- Optional current to 20A
- Analog meter option for peaking/dipping measurements

Versatile 8000A family of DMM's offers a wide range of measurement capability. Basic 8000A is 5 functions and 26 ranges for ac/dc volts, current, and resistance. Model 8000A-05 extends current capability to 20A. Lo Ohms option 8000A-06 features added resolution to 0.001Ω in two added low-end ranges. Model 8000A/MAS adds a mA-sec function for direct calibration of x-ray tubes in 5 ranges to 200 μA sec. Analog DMM 8000A/MTR includes a front panel meter for peaking and dipping measurements. Rechargeable NiCad batteries and digital output are available for most models.

### 8030A

- Measures ac/dc volts, ac/dc current, resistance
- True RMS on all ac functions
- Diode test, in-circuit resistance measurements
- Overload protection on all functions

Handheld 8030A features True RMS conversion technique for high accuracy in the presence of noise or when measuring distorted waveforms. One range for diode test and 5 ranges for each of the other functions. Field-durable, shock-resistant mechanical design incorporates disposable alkaline batteries with choice of 100V, 115V, or 230V ac battery eliminator/charger. Optional rechargeable NiCad battery pack.

## SPECIFICATIONS AND OPTIONS

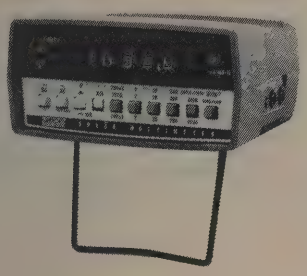
| Model | 8020A | 8030A | 8000A | 8920A | 8921A |
|---|---|---|---|---|---|
| Basic Accuracy (1 Yr) dc Volts Sensitivity | 0.25% dc 100 μV | 0.1% dc 100 μV | 0.1% dc 100 μV | 0.5% ac (90 days) | 0.5% ac (90 days) |
| No. Ranges — dc Volts | 5 - 200 mV to 1000V | 5 - 200 mV to 1100V | 5 - 200 mV to 1200V | | |
| No Ranges — ac Volts | 5 - 200 mV to 750V | 5 - 200 mV to 750V | 5 - 200 mV to 1200V | 7 - 2 mV to 700V | 7 - 2 mV to 700V |
| No. Ranges — ac and dc Current | 4 - 2 mA to 2A | 5 - 200 μA to 2A | 5 - 200 μA to 2A[1] | | |
| No. Ranges — Resistance | 6 - 200Ω to 20 MΩ | 5 - 200Ω to 2 MΩ | 6 - 200Ω to 20 MΩ[2] | | |
| No. Ranges — Conductance | 2 - 200 nS to 2 mS | | | | |
| No. Ranges — Milliamp-Seconds | | | 5 - 200 μAs to 2000 mAs[3] | | |
| No. Ranges — dB | | | | 7 - 0 to 132 dB | 7 - 0 to 132 dB |
| Disposable Batteries | Std | Std[5] | | | |
| Rechargeable Battery Option | | -01 | -01[4] | | |
| Data Output Option | | | -02 | | |
| Logarithmic Analog Output Option | | | | -04 | |
| Frequency Counter Output Option | | | | -03 | -03 |

(1) 200 μA to 20A with Model 8000A-05. (2) 7 ranges, 2Ω to 2000 KΩ with Model 8000A-06.
(3) Model 8000A/MAS. (4) Standard on 8000A/MAS, optional on 8000A-05, -06 and /MTR.
(5) Includes battery eliminator.

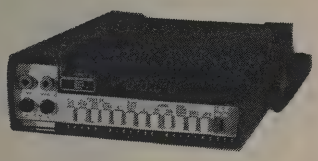
Call toll-free 800-426-0361, John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, WA 98043. In Washington, call (206) 774-2481.

FLUKE

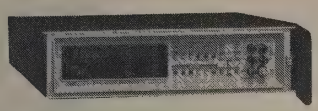
# DIGITAL VOLTMETERS AND MULTIMETERS



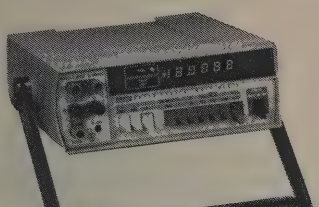
8040A



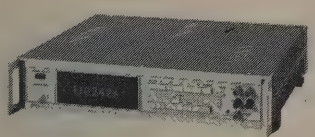
8600A



8502A



8810A



8375A

## 4½-DIGIT VOLTMETERS

### 8040A

The 8040A 5-function DMM features the capabilities of more sophisticated bench multimeters while retaining the size of a handheld VOM. A total of 26 ranges provides 5 each for ac/dc volts and ac/dc current and 6 for resistance. For optimum accuracy on ac measurements, True RMS conversion is used. Ranging is switch selectable as well as automatic. The 8040A uses disposable alkaline batteries and includes a battery eliminator for ac line operation.

### 8600A

The 8600A includes a 4½-digit LED readout featuring five ranges of dc volts, five ranges of ac volts, five ranges of dc current, five ranges of ac current, and six ranges of resistance. Autorange and autozero are standard. Options include rechargeable batteries and isolated data output.

### 8200A

The 8200A four range dc DVM easily expands into a 400 readings per second systems multimeter by installing a family of plug-in options. Standard features of the basic instrument include 60% overrange, switched filter for assured broadband noise rejection, all push button selection, autoranging, polarity selection and display, and full guarding.

### 8125A

The Model 8125A is a compact, militarized 4½-digit DMM designed to meet MIL-T-28800B, Type II, Class 2, Style A requirements for rugged field applications, where reliability and long-term accuracy are essential.

### SPECIFICATIONS AND OPTIONS

| Model | 8040A | 8600A | 8200A | 8125A |
|---|---|---|---|---|
| Basic dc Accuracy (6 mo.) dc Volts Sensitivity | 0.05% 10 μV | 0.02% 10 μV | 0.01% (90 day) 1 μV | 0.01% 100 μV |
| No. Ranges — dc Volts | 5 - 200 mV to 1100V | 5 - 200 mV to 1200V | 6 - 10 mV to 1000V[1] | 4 - 1V to 1000V |
| No. Ranges — ac Volts | 5 - 200 mV to 750V | 5 - 200 mV to 1200V | 4 - 1V to 1000V[2] | 4 - 1V to 1000V |
| No. Ranges — ac and dc Current | 5 - 200 μA to 2A | 5 - 200 μA to 2A | - | |
| No. Ranges — Resistance | 6 - 200Ω to 20 MΩ | 6 - 200Ω to 20 MΩ | 6 - 100Ω to 10 MΩ[2] | 5 - 1 kΩ to 10 MΩ |
| True RMS Option | Std. | | -09 | |
| Remote Control Option | | | -08 | |
| Data Output Option | | -02 | -07 | |
| Battery Pack Option | -01[3] | -01 | | -01 |

(1) 10 mV and 100 mV optional. (2) Optional. (3) Disposable battery with battery eliminator standard.

## 5½-DIGIT VOLTMETERS

### 8502A, 8500A

The bus-structured 8502A DMM provides equal benefits to the systems designer and to the bench top user. Measurement performance is the same for bench use as well as when programmed as part of a sophisticated measurement system.

The 8502A offers five ranges of dc with a resolution of ±1 μV and ±1200V maximum. Mid-range basic dc accuracy is 6 ppm for 30 days at 23°C ±5°C. The DMM includes autoranging, dc/dc ratio, pushbutton dc and ohms zero, and a unique offset feature which allows measurement of deviations from any stored value. Measured values may be scaled by a prestored factor or may be both scaled and offset at the same time. High/low limits may be stored for pass-fail operation. Peak memories save minimum and maximum readout values. Calibration memory option allows recalibration of the DMM from the front panel in about 10 minutes.

The 8500A is similar to the 8502A except it does not have as extensive front panel control. All other 8502A capabilities apply to the 8500A when controlled remotely. The 8500A should be considered when needs are primarily for systems applications.

### 8810A, 8800A

The 8810A is a configurable, precision, 5½-digit DMM based upon a lab quality dc voltage mainframe. It is similar to the popular 8800A DMM with the addition of a new plug-in True RMS ac option plus plug-in convenience for average-responding ac, resistance, and data output options which can be specified at time of purchase or added in the field at any time.

The 8810A and 8800A feature 15 ranges including five dc, four ac, and six resistance. Isolated 4-terminal ohms measurements are provided on all ranges. Dual-slope integration, full guarding, and complete power line isolation assure superior noise rejection without sacrificing measurement speed. All functions and ranges are fully protected against accidental overloads. These compact DMM's measure just 3.5 by 9 by 12 inches.

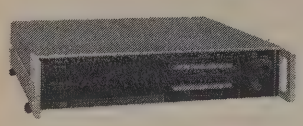
### 8375A

The 8375A 5½-digit multimeter combines highly accurate measurement of dc volts, True RMS ac volts, and resistance with a unique self-test feature that permits a rapid check of all measurement functions. A powerful set of field-installable systems options include data output, remote control, and external dc reference.

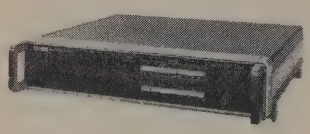
Call toll-free 800-426-0361, John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, WA 98043. In Washington, call (206) 774-2481.

FLUKE

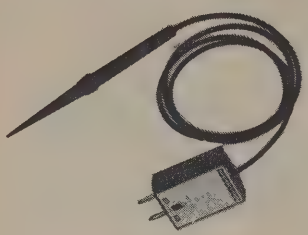
# DIGITAL VOLTMETERS AND MULTIMETERS VOLTMETER ACCESSORIES



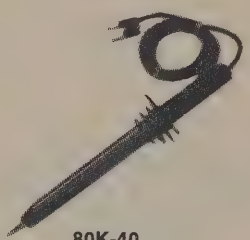
8400A



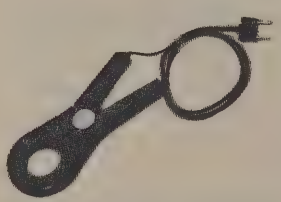
8300A



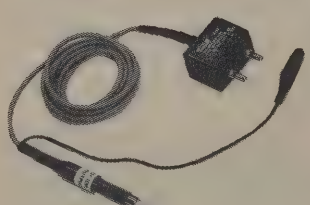
80T-150



80K-40



80I-600



82RF

## 8400A

The 8400A's outstanding accuracy is complemented by versatile functional capabilities. DC voltages are measured on five ranges with resolution to 1 microvolt. Overrange is 20% on all ranges except on the ±1000V range. 1100V can be applied to any voltage range without damaging the unit.

The basic DVM accepts a family of rugged plug-in option cards for ac volts, resistance, dc/dc ratio, True RMS volts, data output and remote control.

## 8300A

The 8300A offers five full decades of digits plus a 6th digit for 20% overrange. Its mainframe will accept options in any sequence for expansion from a bench DVM into a bench or systems multimeter.

The basic instrument offers 3 ranges of dc voltage measuring capability including autorange, autopolarity, and switchable active filtering.

## SPECIFICATIONS AND OPTIONS

| Model | 8502A/8500A | 8810A/8800A | 8375A | 8400A | 8300A |
|---|---|---|---|---|---|
| Basic dc Accuracy (90 Days) dc Volts Sensitivity | 0.001% 1 μV | 0.01% 1 μV | 0.005% 1 μV | 0.004% 1 μV | 0.01% 1 μV |
| No. Ranges — dc Volts | 5 - 312 mV to 1280V | 5 - 200 mV to 1200V | 5 - 100 mV to 1000V | 5 - 100 mV to 1000V | 5 - 100 mV to 1000V |
| No. Ranges ac Volts | 4 - 2.5V to 1200V[1] | 4 - 2V to 1200V[2] | 4 - 1V to 1000V | 4 - 1V to 1000V[1] | 4 - 1V to 1000V[1] |
| No. Ranges — ac/dc Current | 5 - 312 μA to 1.28A[1] | | | | |
| No. Ranges — Resistance | 8 - 31.2Ω to 260 MΩ[1] | 6 - 200Ω to 20 MΩ[2] | 7 - 10Ω to 10 MΩ | 7 - 10Ω to 10 MΩ[1] | 5 - 1 kΩ to 10 MΩ[1] |
| True RMS Option | -09 | -09 | Std | -09 | |
| Remote Control Option | | | -04 | -04 | -04 |
| Data Output Option | | -02 -02 | -03 | -03 | -03 |
| IEEE Interface Option | -05 | | | | |
| RS-232 Interface Option | -06 | | | | |
| Parallel Interface Option | -07 | | | | |
| Calibration Memory Option | -04 | | | | |

(1) Optional. (2) Optional on 8810A.

## 80T-150 TEMPERATURE PROBE

- Converts dc voltmeters and stripchart recorders to thermometers
- Wide temperature range — 50°C to +150°C or −58°F to +302°F
- Reads out directly in degrees, (1 mV dc/°)
- 350V standoff allows measurement in live electrical circuits
- Fast responding, low thermal mass

**Accuracy** (including 0.25% DMM error): ±1°C (1.8°F) 0°C to 100°C.
**Input R** ≤ 1 MΩ preferred, to 100 kΩ with additional error.
**Power** Internal disposable battery, 1000 hours continuous.

## 80K-40 GENERAL PURPOSE HIGH VOLTAGE PROBE

The 80K-40 is a handheld probe for general purpose HV measurements up to 40 kV. Accuracy and stability of the 1000:1 division ratio is ensured by special metal film resistors having matched temperature coefficients. This unique probe offers an unusually high input impedance to minimize loading of the circuit under test.

**(80 K-40) Voltage Range** 1 kV to 40 kV
**Input Resistance** 1000 MΩ
**Division Ratio** 1000:1
**Overall Accuracy** 20 kV to 30 kV ±2% (Calibrated 1% at 25 kV).
**Upper Limit** Changes Linearly from 2% at 30 kV to 4% at 40 kV.

## 80J-10 CURRENT SHUNT

The 80J-10 is for use with any sensitive ac or dc voltmeter having ¾-inch spaced banana jack input connectors. Up to 10A may be measured continuously, 20A for up to 1 minute.

**Output** 100 mV at 10A.
**Accuracy** (18°C to 28°C) ±0.25% from dc to 10 kHz, rising typically to 1 dB at 100 kHz.

## 80I-600 AC CLAMP-ON CURRENT TRANSFORMER

The 80I-600 is designed to extend the ac current measuring capabilities of DMM's up to 600 amperes by use of a 1000:1 division ratio. A clamp-on transformer design allows measurements to be made without breaking the circuit under test.

**Range** 2A - 600A.
**Frequency Response** 30 Hz - 1 kHz.
**Accuracy** ±3%.
**Division Ratio** 1000:1.

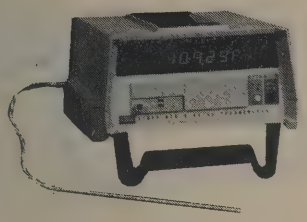
## 81RF, 82RF RF PROBES

| | 81RF | 82RF |
|---|---|---|
| Frequency Response | 100 kHz to 100 MHz; ±1 dB | 100 kHz to 200 MHz; ±1 dB 200 MHz to 500 MHz; ±3 dB |
| Extended Response (Useful for relative readings) | 20 kHz to 250 MHz | 200 kHz to 700 MHz |
| Voltage Range | 0.25V to 30V RMS 350 VDC Max. | 0.25V to 30V RMS 200 VDC Max. |

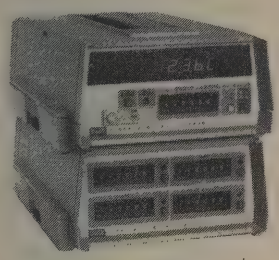
Call toll-free 800-426-0361, John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, WA 98043. In Washington, call (206) 774-2481.

FLUKE

# DIGITAL THERMOMETERS

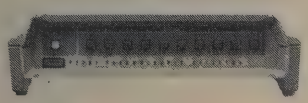


2180A

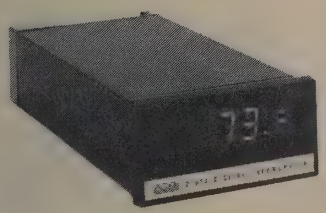


2190A

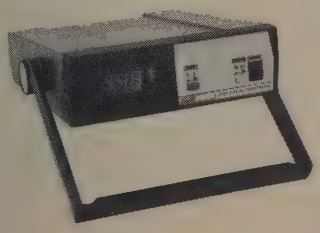
Y2002



Y2001



2160A



2175A

## TemPak TEMPERATURE MEASUREMENT SYSTEM

Configurable to suit your needs, TemPak monitors thermocouple inputs on the 2190A and RTD inputs on the 2180A. Microprocessor-aided control lets you read plus or minus temperature differences from preset nominal value and store maximum and minimum readings for later recall. Optional analog and data output drives recorder and printer, respectively. Modular units stack and latch for ease in transporting, and convenient operation.

### 2190A

Two versions of the 2190A cover seven thermocouple types. Internal switch selects desired type. Bright LED display. Power consumption 8W.

### 2180A

Selects and measures the temperature from any one of six types of RTD's via internal switch.

### SPECIFICATIONS

| MODEL | 2190A | 2180A |
|---|---|---|
| Type of Temperature Sensor | Thermocouple | RTD |
| Temperature Range (Dependent on Sensor Type) | −422°F to +4480°F<br>−202°C to +2457°C | −380°F to +1424°F |
| Thermocouple/RTD Types | J, K, T, C, R or<br>J, K, E, S, R | 385 Pt-DIN, 390 Pt, 3902 Pt, 392 Pt, 100Ω DIN NI, 120Ω Ni, resistance (0-1000Ω) |
| Number of Thermocouple/RTD Types | 7 total (5 each version of 2190A) | 6 |
| Accuracy[1] (Max. Error Including Conformity Due to Resolution and Computational Errors) | <0.19 to <0.60°C depending on type | <0.061 to <0.249°C depending on type and range |

(1) 90 days

### OPTIONS

**21X0A-002**
Isolated analog voltage output proportional to temperature plus RS-232C and parallel ASCII digital output.

**21X0A-006**
Enables thermometer to read plus and minus temperature differences, store maximums and minimums. Provides out-of-limit alarm indications and outputs.

### ACCESSORIES

**Y2002**
Alarms output module with 4 independent comparators for signaling up to 4 stages of out-of-limit conditions. Includes output relays.

**Y2001**
Thermocouple selector lets you choose any one of up to 10 thermocouples to be read on the 2190A, 5 of one type and 5 of another.

**Y2009**
Rechargeable battery pack supplies ±12V dc to 2180A and 2190A for up to 5 hours continuous operation.

**Y2000**
RTD selector operates with the 2180A to select 10 RTD's. Similar to Y2001.

**Y2003**
Calibrator and battery pack provides stable low voltage source for calibration of less accurate thermocouple thermometers, analog and digital.

## 2160A/2170A SERIES

The 2160A and 2170A series thermometers complement a broad temperature measurement capability offering unique performance and features to the user. Temperature resolution of 1° and 0.2° is available in either panel mount or portable bench models. Panel mounted versions conform to DIN standards for harsh industrial environments.

### 2160A/2170A

Panel mounted 4-digit 1°F/C or 0.2°F/C, respectively, thermocouple thermometers capable of resolving over the temperature span of any of eight thermocouple types.

### 2165A/2175A

Portable single-point instruments housed in rugged bench mount cases. Can be equipped with rechargeable batteries for complete portability.

### 2166A/2176A

Bench type instruments with the capability of monitoring up to ten thermocouples of the same type. Ten-position front panel rotary switch selects thermocouple channel. Powered from line or external 12 volts dc.

### 2168A

A portable, single-point instrument capable of accepting any one of eight thermocouple types as an input.

### SPECIFICATIONS

| MODEL | 2160A SERIES | 2170A SERIES |
|---|---|---|
| Type of Temperature Sensor | Thermocouple | Thermocouple |
| Temperature Range (Dependent on Thermocouple Type) | −328° to 3999°F<br>−200° to 2328°C | −99.8° to 999.8°F<br>−99.8° to 999.8°C |
| Resolution and Repeatability | 1°F or C | 0.2°F or C |
| Thermocouple Types | J, K, T, E, R, S, B, C | J, K, T, E |

### OPTIONS AND ACCESSORIES

**2161A**
Panel mount, multipoint switch unit for use with 2160A and 2170A.

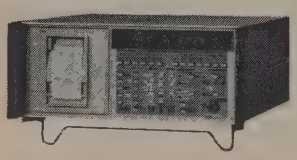
**2162A**
Panel mount digital comparator, compatible with 2160A and 2170A. Selects limits or on/off control.

**-01** Rechargeable battery pack for 2165A and 2175A.
**-02** Field installable BCD output for 2160A and 2170A.
**-04** Field installable analog output for 2160A and 2170A.
**Y2004** Rechargeable battery pack for 2166A, 2168A, 2178A.

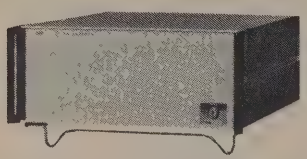
Call toll-free 800-426-0361, John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, WA 98043. In Washington, call (206) 774-2481.

FLUKE

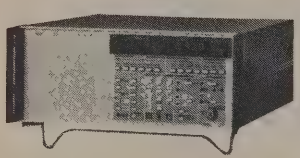
# DATA LOGGERS



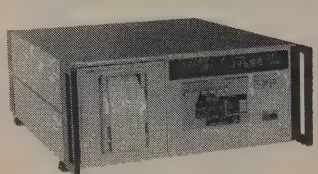
2240B



2242B



2241B



2200A

There are four basic models of Fluke data loggers: the 2240B, 2241B, 2242B, and 2200A. They are complete modular systems ready to operate when delivered. All you do is connect your sensors and select the front panel operating parameters. All physical quantities can be measured and logged that can be represented by a proportional voltage or current. Signal inputs can be from thermocouples, RTD's, thermistors, and current transmitters. Digital inputs can also be accommodated. The data loggers are configured to your particular application using standard data logger mainframes and plug-in modules.

## FEATURES

- Complete interactive keyboard programming of range, function, skip and limits
- Resolution to 1 μV and 0.1°
- Scan 1 to 1000 points, up to 60 in one mainframe
- Mix voltages, thermocouples, and thermocouple types on adjacent channels
- Multiple scan modes: continuous limits monitoring, dual interval scan, delayed interval scan, and monitoring selected channels
- Keyboard-selectable scan interval 1 sec to 24 hours
- Displays date, time, data, polarity, channel number, and function
- Selectable scanning rates (3 or 15 channels per second)
- Thermocouple conditioning
- Complete program list printout
- Alarms output
- Six digits "fixed" data
- Digital inputs
- Field expandable
- Reference voltages for self-check
- Switch-selectable output formats
- Clock: days, hours, minutes, seconds
- Most popular data communications and data terminal equipment are compatible

## 2240B

The 2240B provides full programming capability and utilization of all data logger options. The 2240B has a capacity of 60 channels in the mainframe and the ability to monitor up to 1000 channels using additional scanner chassis. An on-board printer and front panel display are standard. Remote programming is accessible through Option -17.

## 2241B

The 2241B offers the same capabilities as the 2240B except the on-board printer is not included in the instrument.

## 2242B

The 2242B is identical to the 2240B in capability, but is intended solely for remote programming applications. It has an entirely blank front panel with all connections to the remote programming point made via the rear panel. Option -17 is required for remote operation.

## 2200A

The 2200A provides control and basic front panel programming for systems not requiring maximum flexibility or frequent reprogramming. System cost is minimum with capability to log up to 60 channels in the mainframe or up to 100 channels using a separate scanner chassis. Range, function, and channel skip can be programmed for 10 individual channels or in blocks of 10 to 100 channels.

## DATA LOGGER INPUT OPTIONS

| Inputs | Ranges | Input Options[1] |
|---|---|---|
| DC Voltage | 40V, 4V, 0.4V, 0.04V | -07 Solder pin connector |
| Current Transmitters | 1 to 5 mA<br>4 to 20 mA<br>10 to 50 mA | -28 Current transmitter connector<br>-29 Current transmitter connector<br>-30 Current transmitter connector |
| Thermocouples | Thermocouple types J, K, E, T, R, S, B, C, D (W3) or G | -08 Isothermal connector |
| RTD's | 385 Pt, 390 Pt, 3902 Pt, 392 Pt, 100Ω Ni, 120Ω Ni, resistance | -03 RTD connector[2] |

(1) In addition to options listed, one scanner and one a/d converter (not listed) are required to establish a functioning data logger system. Ask for the Data Logger data sheet for complete details.

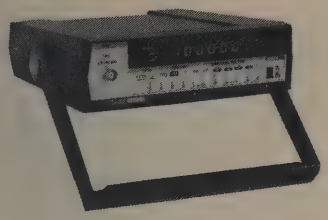
(2) Requires RTD Scanner Chassis.

NOTE: Output interface options are available that are compatible with TTY, RS-232-C, most calculators Facit tape perforators, Kennedy magnetic tape, and other equipment.

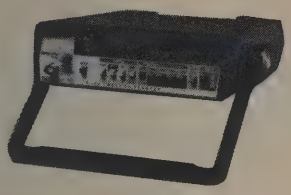
Call toll-free 800-426-0361, John Fluke Mfg. Co., Inc.,
P.O. Box 43210, Mountlake Terrace, WA 98043.
In Washington, call (206) 774-2481.

FLUKE

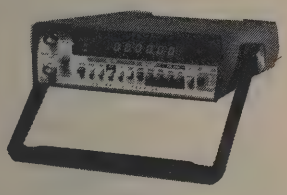
# COUNTERS



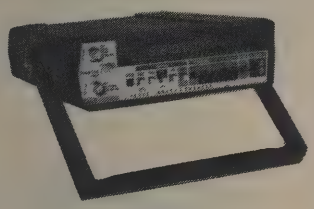
1900A



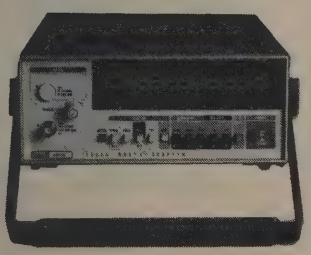
1910A



1911A



1912A



1925A

1920A

## MULTICOUNTERS

The 1910A, 1911A, 1912A, and 1900A comprise a family of distinctive counters offering precise, rapid measurement of frequency, period, and total number of events.

Full autoranging is supplemented by selectable 4-range manual operation. Autoreset resets the counter every time you select a new range or function so you do not have to wait for a second reading. The first one is always correct. Automatic clean dropout on the 1911A and 1912A channel B input gives you instant indication in the form of zero readout whenever the signal level falls below the sensitivity threshold of the counter so that you do not get erroneous readings. Wide choice of timebases include standard 0.5 ppm per month standard, optional timebases with improved aging rates and temperature stabilities, and external input for your own 10.00 MHz standard.

Input signal conditioning on the 1910 series include trigger level and attenuator controls for full control over the dynamic signal input range and more accurate readings in the presence of noise.

All four counters employ optional rechargeable batteries for field service or any off-line operation with up to 4 hours minimum operating time between charges.

### 1900A

The 1900A is the lowest cost multicounter in the Fluke counter family, but with performance to match the more expensive units. A selectable 1 MHz low-pass filter provides input signal conditioning for accurate low frequency measurements in noisy environments. A selectable 10:1 attenuator is included in the input controls.

### 1910A

This single-channel counter features operation to 125 MHz for frequency measurements and 2 MHz for period. Basic sensitivity is 15 mV rms.

### 1911A, 1912A

These dual-channel counters offer channel A frequency coverage to 125 MHz and channel B prescaled coverage to 250 MHz, 1911A, and 520 MHz, 1912A. The 1911A and 1912A include 50-ohm input from 50 MHz to 250 MHz and 50 MHz to 520 MHz, respectively, for proper matching in your rf application.

### 1925A

The 1925A is a ruggedized, portable counter intended for operation under severe RFI/EMI conditions. Special features include 9-digit readout, shielded power supply, optional ovenized timebase, clock inputs and outputs, standard data output, and sturdy metal case.

### 1920A

Frequency measurement from 5 Hz to 520 MHz with optional prescaling to 1000 and 1250 MHz make the 1920A ideal for bench or field measurements in the VHF television, 900 MHz telecommunications, and beacon bands. Frequency measurement of rf bursts permit rapid checks of transmitter operating frequencies. Resolution Multiplier option provides high resolution measurement of audio and low frequency signals from 10 Hz to 10 kHz.

## UNIVERSAL COUNTER-TIMERS

### 1953A

The 1953 is designed for bench or systems with a wide array of options that let you select exactly the capability you need to solve your specific measurement problems.

The basic instrument features frequency, frequency ratio, period, period averaging, time interval, and totalize. There are six choices of gate times, period averages, and time interval resolution. Trigger-level controls for channels A and B allow user to select a preset trigger level (0V dc) or to vary the level at which the input signal triggers the counter. Signal conditioning controls for each channel permit selection of positive or negative slope triggering, ac or dc coupling, and X1 or X10 attentuation. Dual input channels are direct coupled with 30 mV sensitivity.

Optional 50-ohm prescalers extend frequency measurement capability from 0 to 125 MHz (std.) to 520, 1000, or 1250 MHz. Systems users can choose from three remote programming options, two of the fast parallel controlled type and one using the IEEE-488 interface.

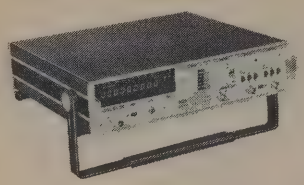
### 1952B

The 1952B is similar to the 1953A. It features the same measurement functions, and trigger level and input signal conditioning controls. Frequency measurement range is 0 to 80 MHz with basic 50 mV sensitivity. A highly stable temperature-compensated crystal oscillator (TCXO) with 8-digit display is available as an option.

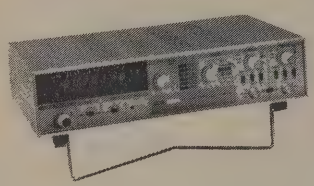
**Call toll-free 800-426-0361, John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, WA 98043. In Washington, call (206) 774-2481.**

FLUKE

# COUNTERS AND SIGNAL SOURCES

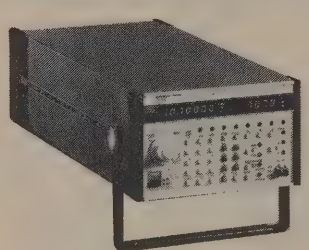


1953A

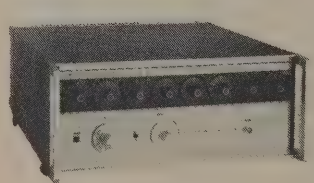


1952B

6010A



6011A



6160B

## COUNTERS

### SPECIFICATIONS AND OPTIONS

| Model | 1900A | 1910A | 1911A | 1912A | 1920A | 1925A | 1952B | 1953A |
|---|---|---|---|---|---|---|---|---|
| Number of Digits | 6 | 7 | 7 | 7 | 9 | 9 | 7/8 | 9 |
| Frequency (MHz) Basic Unit | 80 | 125 | 250 | 520 | 520 | 125 | 80 | 125 |
| Frequency (MHz) Options | | | | | 1250 | 520 | | 1250 |
| Period | ● | ● | ● | ● | | ● | ● | ● |
| Totalize | ● | ● | ● | ● | | ● | ● | ● |
| Time Interval | | | | | | | ● | ● |
| Ratio | | * | * | * | * | * | ● | ● |
| A gated by B | | | | | | | ● | ● |
| Sensitivity (mV) | 25 | 15 | 15 | 15 | 15 | 15 | 50 | 30 |
| Trigger Level Control | | ● | ● | ● | | ● | ● | ● |
| External Timebase Input | | ● | ● | ● | ● | ● | ● | ● |
| Battery Option | ● | ● | ● | ● | ● | | | |
| TCXO Option | | ● | ● | ● | ● | ● | ● | ● |
| Ovenized Timebase Option | | | | | | ● | | ● |
| Data Output Option | ● | ● | ● | ● | ● | Std | | ● |
| Autoreset | ● | ● | ● | ● | ● | ● | | |
| Autorange | ● | ● | ● | ● | | ● | | |
| Remote Control Option | | | | | | | | ● |
| IEEE Bus Option | | | | | | | | ● |

* Using external timebase input

## SIGNAL SOURCES

Fluke signal generators incorporate advanced microprocessor techniques which greatly reduce their size while increasing their overall capability, flexibility, and range of application. Cumbersome front panel knobs have been replaced by a universal calculator keyboard enabling free-form entry of volts, millivolts, dBm, Hz, kHz, and MHz. Frequencies and levels can be stored and recalled for repetitive testing. Ranges are set automatically for best resolution and programmable limits prevent damage to unit under test.

Fluke synthesizers employ the indirect approach to frequency synthesis and exhibit exceptional accuracy, stability, spectral purity, and resolution.

### SPECIFICATIONS AND OPTIONS

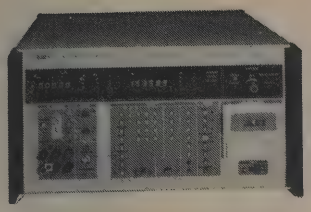
| Model | 6010A | 6011A | 6039A | 6160B |
|---|---|---|---|---|
| Frequency Range | 10 Hz to 11 MHz | 10 Hz to 11 MHz | 1 MHz to 40 MHz | 1 MHz to 160 MHz |
| Frequency Resolution | 0.1 Hz steps to 110 kHz<br>10 Hz steps to 11 MHz | 0.1 Hz steps to 110 kHz<br>10 Hz steps to 11 MHz | 0.1 Hz steps to 4 MHz<br>1 Hz steps to 40 MHz | 0.1 Hz steps to 12 MHz<br>1 Hz steps to 160 MHz |
| Non-Harmonic Spurs | >60 dB | >60 dB | >80 to 100 dB | >83 to 100 dB |
| Harmonics | >35 to 50 dB | >35 to 50 dB | >25 dB | >25 dB |
| Residual Phase Noise (Excluding Int. Std.) | >50 dB | >50 dB | >74 dB | >74 dB |
| Amplitude Range (into 50 ohms) | 0.25 mV to 5V rms | 0.39 mV to 5V rms | +3 to +13 dBm (+21 dBm optional) | +3 to +13 dBm |
| Frequency Response (Amplitude Flatness) | ±0.5 dB within each band | ±0.2 dB 10-100 Hz<br>±0.025 dB 100 Hz - 10 MHz | ±1 dB | ±1 dB |
| Freq. Switching Speed | 2 ms | 2 ms | 800 μs[1] | 800 μs[1] |
| Remote Control | Std | Std | Std | Std |
| Oven Timebase Option | | | ● | ● |
| AM & FM Option | ● | ● | | |
| RS-232-C Option | ● | ● | | |
| IEEE Bus Option | ● | ● | (2) | (2) |

(1) Switching speed improves at lower frequencies.
(2) IEEE Bus operation available using Fairchild 4880 instrument coupler.

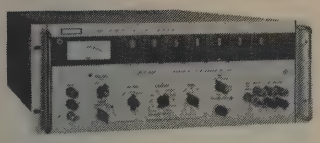
Call toll-free 800-426-0361, John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, WA 98043. In Washington, call (206) 774-2481.

FLUKE

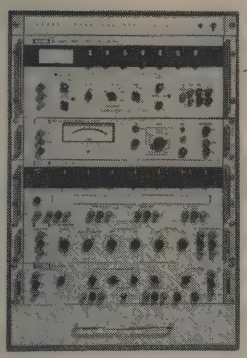
# CALIBRATORS AND STANDARDS



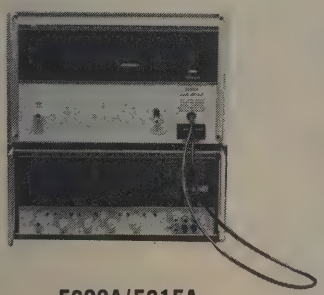
5101A



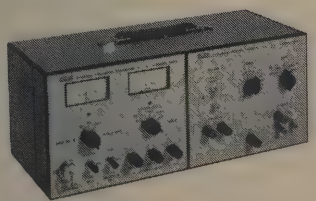
335A



7105A



5200A/5215A



540B

## MULTIFUNCTION CALIBRATORS

### 5100A, 5101A

The 5100 Series microprocessor-based calibrators have built-in computational power designed to increase the accuracy and throughput for any calibration operation. DC volts, ac volts, current, and resistance functions permit a wide range of meter calibration — from single-function panel meters to autoranging DMM's with up to 4½-digits of resolution.

You enter data via a calculator-type keyboard in the same format encountered in the manufacturer's cal procedure. The calibrator computes the error of the unit under test in % or dB. Then it indicates whether the unit passed or failed and amount of error.

The 5101A employs a built-in cassette tape deck to store calibration or test programs and perform them under microprocessor control. The recorded procedures are those you write yourself.

You can choose either IEEE or RS-232 interfaces for full systems applications. Printer accessories Y8005 (IEEE interface) and Y8006 (RS232C interface) provide a hardcopy printout of the programmed test procedure.

### 515A

This precision calibrator is ideal for on-site calibrations requiring dc voltage, ac voltage, and resistance standards in a compact portable unit. Weighs just 13 lbs. including rechargeable battery pack. Checks many voltmeter functions including zero offset, a-d linearity, absolute accuracy, frequency response, residual noise, and linearity.

### 760A

The 760A Meter Calibrator combines direct percent-error readout with single range operation for each function including ac/dc volts, ac/dc current, and resistance. Accuracy figures are % of setting so that they apply over the entire voltage or current range. The unit is guaranteed to remain within specifications for 1 year.

## DC VOLTAGE CALIBRATORS

### 335A, 335D

The 335 Series DC Voltage Standard/Null Detectors combine the functions of a precision dc voltage standard with those of a differential voltmeter and high-impedance null detector. Output voltage to 1111V is available in three ranges with 1 $\mu$V, 10 $\mu$V, and 100 $\mu$V resolution.

### 332B, 332D

The 332 Series are precision dc voltage calibrators with output in seven decades to 1111V at 50 mA. Outstanding regulation, and adjustable overcurrent and overvoltage protection make these instruments well suited for day-to-day use on the production line or in the laboratory.

### 341A, 343A

The 341A, 343A DC Voltage Calibrators offer 6-digit (10 $\mu$V) resolution with 50 ppm accuracy (341A) and 7-digit (1 $\mu$V) resolution with 20 ppm accuracy (343A). Combined ripple and noise is $<$ 50 $\mu$V for the 343A. Calibrators include adjustable overcurrent protection and remote sense terminals.

### 7105A

The 7105A comprises a self-contained dc calibration system consisting of those Fluke dc standards-type instruments that are normally required to set up a laboratory. The system is self calibrating and achieves accuracies equal to those found in standards laboratories. A typical system includes the Fluke 335A, 845AR, 750A, 720A, and 721A.

## DC VOLTAGE/CURRENT CALIBRATORS

### 3330B

The 3330B combines high dc accuracy with the programmability required by automated test systems. The unit can be operated manually or remotely programmed for voltage outputs to ±1111V and current outputs to 111 mA.

### 382A

The 382A provides 2-range voltage outputs to 50V and 4 ranges of current to 2A. Output voltage and current limits may be preset. Remote control is standard.

## AC CALIBRATORS

### 5200A/5215A

The 5200A/5215A comprise a precision ac source suitable for the calibration laboratory or production line. Frequencies to 1.2 MHz and voltages to 1000V are available. Output current limit can be preset. Calibration error is read directly from the unit when calibrating voltmeters.

### 5205A

The 5205A is a dc coupled, programmable, inverting power amplifier with a fixed gain of 100. It extends the range of the 5200A to 1200V or can be used independently for a wide range of waveforms from dc to 120 kHz.

## STANDARDS

### 540B

The 540B Thermal Transfer Standard is designed for precise measurement and calibration of ac voltage and current. Voltage range is 0.25 to 1000V rms ac, 5 Hz to 1 MHz. Basic accuracy is ±0.01% without calibration curves or correction tables.

### 731B

The 731B DC Reference Standard provides a variety of precision voltages with standard cell accuracy. Ideal as a working transfer standard from standard cells. Optional rechargeable battery.

### 510A

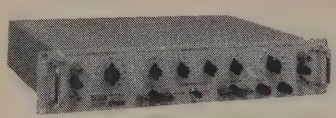
The 510A AC Reference Standard is a precision ac voltage source which provides an accurate 10V ac reference. Choose any one of eight standard frequencies from 50 Hz to 100 kHz.

Call toll-free 800-426-0361, John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, WA 98043. In Washington, call (206) 774-2481.

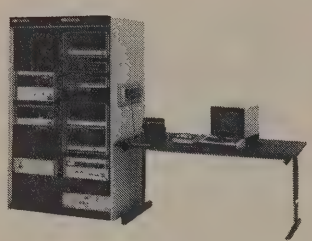
FLUKE

# CALIBRATORS & STANDARDS, AUTOMATED CALIBRATION SYSTEMS, PROGRAMMABLE POWER SUPPLIES

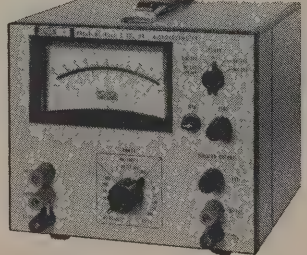
720A



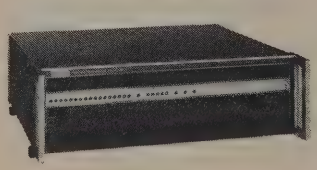
750A



7505C



845AB



4250A

## CALIBRATORS AND STANDARDS

### SPECIFICATIONS

| Model | Function | Basic Accuracy | Range | Stability |
|---|---|---|---|---|
| 332B | dc volts | 0.002% | 0 to 1100V | 0.001%/mo |
| 332D | dc volts | 0.001% | 0 to 1100V | 5 ppm/mo |
| 335A | dc volts(1) | 0.002% | 0 to 1100V | 0.001%/mo |
| 335D | dc volts(1) | 0.001% | 0 to 1100V | 5 ppm/mo |
| 341A | dc volts | 0.005% | 0 to 1100V | 0.003%/mo |
| 343A | dc volts | 0.002% | 0 to 1100V | 0.0015%/mo |
| 7105A(4) | dc volts | 0.0004% | 0 to 1100V | 10 ppm/year |
| 3330B | dc volts<br>dc current | 0.003% voltage<br>0.006% current | 0 to 1100V<br>0 to 100 mA | 15 ppm/mo (voltage)<br>30 ppm/mo (current) |
| 382A | dc volts<br>dc current | 0.01% | 0 to 50V<br>0 to 2A | 0.005%/mo |
| 5200A | ac volts | 0.02%<br>30 Hz - 20 kHz(2) | 0 to 100V(3) | 0.005%/24 hours (amplitude)<br>0.05%/24 hours (freq.) |
| 5100A/<br>5101A | ac/dc volts, current, resistance | 50 ppm dc volts<br>0.05% ac volts<br>0.025% dc current<br>0.07% ac current<br>0.02 to 0.005% resistance | 0 to 1100V dc<br>1 mV to 1100V ac<br>10 μA to 2A<br>1Ω to 10 MΩ<br>(in decade steps) | 10 ppm dc volts (short term)<br>Within performance specs for 6 months |
| 760A | ac/dc volts, current, resistance | 0.05% dc volts<br>0.2% ac volts<br>0.1% dc current<br>0.25% ac current<br>0.1% ohms | 1 mV to 1000V<br>1 μA to 10A<br>1Ω to 10 MΩ | Within performance specs for 12 months |
| 515A | ac/dc volts, resistance | 0.003% dc volts<br>0.04% at 10V ac<br>0.015% 1 KΩ - 1 MΩ | 4 ranges dc<br>3 ranges ac<br>10Ω to 10 MΩ | Within performance Specs for 12 months |
| 731B | dc voltage standard | 10 ppm/30 days<br>30 ppm/year<br>2 ppm transfer | 1.018V, 1.019V, 1V, 10V | 30 ppm/year |
| 510A | ac voltage standard | Midband<br>0.015%/30 days<br>0.02%/year | 10V rms | 0.005%/30 days |

(1) Includes 0.002% differential voltmeter and high Z null detector in same unit.
(2) Reduced accuracy at higher frequencies
(3) Operation to 1200V using companion model 5215A power amp.
(4) Calibrates voltmeters and dc calibrators (self-calibrating).

## VOLTAGE DIVIDERS, NULL DETECTOR

### 720A, 750A

The 720A Kelvin-Varley Divider is a high-resolution primary ratio standard with absolute linearity of 0.1 ppm and self calibration capability. Ratio range is 0 to 1.1 in 7 decades, 0.1 ppm resolution. The 750A Reference Divider is a precision stable voltage divider for calibration of precision dc voltmeters, dc calibrators, etc. Accuracy is 10 ppm for 1 year. Has switched input taps from 1100V to 1.1V, switched output from 1100V to 0.1V. Output voltages are directly transferred from the standard cell.

### 845AB, 721A

The 845AB Null Detector is designed for extremely high input impedance and isolation, 100 MΩ and $10^{12}$Ω, respectively. It is operable from the line or rechargeable batteries (standard). The 721A Lead Compensator equalizes the voltage drop across two resistive dividers connected in parallel for calibration to eliminate the effects of contact and lead resistance.

## AUTOMATED CALIBRATION SYSTEMS

Fluke Terminal/10 Automated Calibration Systems satisfy the need for increased volume in precision measurements in a cost-effective manner. Time-share concept permits a main computer to control a number of satellite meter and oscilloscope stations plus other time-shared terminals.

Operator follows step-wise procedures displayed on a CRT. Blinking messages, LED prompters, and audio signals complement basic instructions. Complete software covers operation and maintenance at the system and calibration station levels.

The 7505C Meter Calibration Station provides stimulus and measurement capability for calibration of VOM's, VTVM's, DMM's, precision DVM's, sources, calibrators, and passive devices.

The 7510B Oscilloscope Calibration Station is optimized for calibration of oscilloscopes and plug-ins plus related instruments such as electronic counters.

## PROGRAMMABLE POWER SOURCES

Designed specifically for automatic test systems, the 4200 series offers speed, accuracy, low programming noise, true current limiting, isolated control logic, ac or dc external reference, and full digital control.

### OPTIONS

**4200A-03** External Reference
**4210A-07** 100 μV Resolution (4210A only)
**4210A-09** Multistrobe Logic
**4250A-06** Programmable Current Limit

### SPECIFICATIONS

| | 4210A | 4250A | 4270A | 4216A | 4265A | 4275A |
|---|---|---|---|---|---|---|
| Output | 0 to ±9.999V, 100 mA | 0 to ±9.999V, 1A.<br>0 to ±65V, 1A. | 0 to ±9.999V, 0.5A.<br>0 to ±99.99V, 0.5A. | 0 to ±16.383V, 100 mA | 0 to ±16.383V, 1A.<br>0 to ±65.532V, 1A. | 0 to ±32.767V, 0.5A.<br>0 to ±110V, 0.5A. |
| Code | BCD | BCD | BCD | Binary | Binary | Binary |
| Accuracy ±(% output + μV) | 0.01 +100 | 0.01 +100<br>0.01 +700(1) | 0.01 +100<br>0.01 +700(1) | 0.01 +100 | 0.01 +100<br>0.01 +700(1) | 0.01 +160<br>0.01 +530(1) |

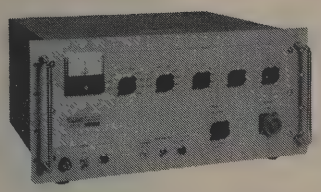
(1) High range

Call toll-free 800-426-0361, John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, WA 98043. In Washington, call (206) 774-2481.

FLUKE

# LOGIC TESTERS, DIFFERENTIAL VOLTMETERS, HV POWER SUPPLIES

893A



410B

## DIFFERENTIAL VOLTMETERS

| Model | 895A | 887AB | 893A | 931B |
|---|---|---|---|---|
| Function | dc | ac/dc | ac/dc | ac[2] |
| Basic Accuracy | 0.0025% | 0.0025% dc<br>0.05% ac | 0.01% dc<br>0.05% ac | 0.05% |
| Range | 0 - 1100V | 0 - 1100V | 0 - 1100V | 10 mV - 1100V |
| Frequency Range — ac | — | 20 Hz - 100 kHz | 5 Hz - 100 kHz | 2 Hz - 2 MHz Bandwidth |
| Dc Input Resistance | Infinite | 10 MΩ above 11V[1] | Infinite[2] | — |
| Ac Input Impedance | — | 1 MΩ, 40 pF | 1 MΩ, 20 pF | 1 MΩ, 8 pF |
| Resolution | 1 μV max. | 1 μV max. | 10 μV max. | — |
| Stability of Reference Supply | 5 ppm/hour | 5 ppm/hour | 10 ppm/hour | 50 ppm/hour |

(1) Infinite at null from 0-11V (2) True RMS

## HV POWER SUPPLIES

| Model | | 410B | 415B |
|---|---|---|---|
| Output Voltage | | 0 to ±10,000V | 0 to ±3100V |
| Calibration Accuracy 90 days, 25°C ±5°C | | ±0.25% of setting or 250 mV, whichever is greater | ±0.25% of setting or 100 mV whichever is greater |
| Output Current, Max. | | 10 mA | 30 mA |
| Regulation | Line (±10% line change) | ±0.001% or 2 mV, whichever is greater | ±0.005% or 2 mV, whichever is greater |
| | Load (Full load change) | ±0.001% or 5 mV, whichever is greater | ±0.005% or 5 mV, whichever is greater |
| Stability | Hour | ±0.005% | ±0.002% |
| | Day | ±0.02% | ±0.01% |
| Ripple | RMS | 1 mV | 0.1 mV |
| | Peak-to-Peak | 5 mV | 1 mV |

## LOGIC TESTERS

Fluke Logic Testers provide the highest performance at reasonable cost. Hundreds of our testers are presently in service throughout the world.

The 3000 Series has made notable contributions to the field. They have established a new price/performance class. They cost significantly less to program and they yield superior diagnostic speed and test confidence. They incorporate notable improvements in the key areas of tester technology: programmability, programming means, interfacing, drive/receive electronics, diagnostic tools, and even power supplies.

### FIRST PROGRAMMING

Most testers require a difficult and time consuming approach to creating input stimuli, requiring the programmer to painstakingly develop each test word, bit-by-bit. The 3000 Series simplify programming by providing a large array of stimulus signals with various duty cycles and relative frequencies to exercise all but the most complex circuits. Where specific test words are required, the 3040A provides this capability also.

### PROGRAMMING MEANS

Programming and editing are done on-line by pushbutton. Assemblers, compilers, and tapes are eliminated.

### INTERFACING

A standard test adapter interfaces a card family connector to the tester's zero insertion force mating connector.

### DRIVE/RECEIVE ELECTRONICS

They are level programmable and tri-state for handling bidirectional buses.

### AUTOMATED DIAGNOSIS

In each 3000 Series tester, all I/O pins are tested and automatic go-no-go results are displayed. Both comparative board-to-board state testing and signature testing are used, plus a dozen other aids.

### POWER SUPPLIES

Board power is provided by multiple fixed and programmable supplies.

### PROGRAM STORAGE

The program and pass/fail signature data are stored on inexpensive magnetic media. The 3040A uses floppy disks, while the 3010A and 3020A use a small magnetic stripped "credit card." Program loading involves simply inserting the card and pressing the ENTER switch.

## 3040A

The 3040A is a general purpose digital logic board tester with advanced high speed functional testing and diagnosis capability . . . unsurpassed in the industry. The tester features new programming capabilities, AUTOTRACK guided clip and probe diagnostics and new built-in features that enable testing of microprocessor boards at full data and clock rates. Programming time, the highest cost associated with most digital testers, is reduced to a minimum by unique system architecture that allows the user to combine specific programmer-defined test vectors with machine-generated algorithms. Circuit board descriptions for AUTOTRACK are entered and stored on floppy disk via the companion 3041A programming station.

## 3020A

The 3020A Logic Tester provides test and diagnosis of all but the most complex digital boards at a fraction of the cost of conventional software-driven systems. Programs are entered through a calculator-like programming panel and stored on 3010-compatible magnetic credit cards. Over a dozen diagnostic aids speed trouble-shooting of complex faults.

## 3010A

Designed for low cost production and field service, the 3010 Logic Tester provides many of the features of the 3020A at a lower cost benchtop/rack mount configuration. It is quite efficient as a programming unit for boards of moderate complexity, even though it does not include the full I/O display, override switches, and stop-on-fail capability which reduces 3020A programming time on complex boards. The unit's test and test length capabilities are identical.

**Call toll-free 800-426-0361, John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, WA 98043. In Washington, call (206) 774-2481.**

FLUKE

# PRICE LIST

| | |
|---|---|
| 1900A | $345 |
| 1910A | 395 |
| 1911A | 495 |
| 1912A | 620 |
| 1920A | 995 |
| 1925A | 750 |
| 1952B | 795 |
| 1953A | 995 |
| 2160A | 299 |
| 2161A | 135 |
| 2162A | 235 |
| 2165A | 375 |
| 2166A | 475 |
| 2168A | 550 |
| 2170A | 375 |
| 2175A | 475 |
| 2176A | 575 |
| **2160A/2170A Series Options** | |
| -01 | 50 |
| -02 | 110 |
| -04 | 150 |
| 2180A | 695 |
| 2190A | 695 |
| 21XO-002 | 195 |
| 21XO-006 | 195 |
| 2200A | 2695* |
| 2240B | 4395* |
| 2241B | 3995* |
| 2242B | 2995* |
| **Data Logger Options** | |
| -03 | 75 |
| -07 | 25 |
| -08 | 100 |
| -28, -29, -30 | 150 ea |
| 3040A | 59,900* |
| 3041A | 16,500* |
| 3020A | 31,900* |
| 3010A | 12,900* |
| 332B | 3595 |
| 332D | 4095 |
| 3330B | 4995 |
| 335A | 4095 |
| 335D | 4595 |
| 341A | 1895 |
| 343A | 2395 |
| 382A | 2695 |
| 410B | 1695 |
| 415B | 995 |

| | |
|---|---|
| 4210A | $1695 |
| 4216A | 1695 |
| 4250A | 2145 |
| 4265A | 2145 |
| 4270A | 2245 |
| 4275A | 2245 |
| **4200 Series Options** | |
| -03 | 200 |
| -06 | 200 |
| -07 | 300 |
| -09 | 125 |
| 510A | 695 |
| 5100A | 6995 |
| 5101A | 8995 |
| 515A | 2295 |
| 5200A/5215A | 9390 |
| 5205A | 4995 |
| 540B | 2095 |
| 6010A | 2695 |
| 6011A | 4195 |
| 6039A | 3995 |
| 6160B | 5995 |
| 7105A | 10,620 |
| 720A | 2495 |
| 721A | 645 |
| 750A | 1995 |
| 731B | 745 |
| 7505C | 77,000* |
| 7510B | 55,000* |
| 760A | 4495 |
| 80I-600 | 70 |
| 80J-10 | 25 |
| 80K-40 | 65 |
| 80T-150C | 99 |
| 80T-150F | 99 |
| 8000A | 325 |
| 8000A-05 | 349 |
| 8000A-06 | 375 |
| 8000A/MAS | 550 |
| 8000A/MTR | 375 |
| **800A Series Options** | |
| -01 | 50 |
| -02 | 100 |
| 8020A | 169 |
| 8030A | 270 |
| 8030A-01 | 295 |
| 8040A | 440 |
| 8040A-01 | 465 |

| | |
|---|---|
| 81RF | $40 |
| 8125A | 2595 |
| 8125A-01 | 2795 |
| 82RF | 75 |
| 8200A | 1495 |
| -07 | 445 |
| -08 | 250 |
| -09 | 645 |
| 8300A | 2095 |
| -03 | 545 |
| -04 | 300 |
| 8375A | 2495 |
| -03 | 500 |
| -04 | 200 |
| 8400A | 2695 |
| -03 | 500 |
| -04 | 200 |
| -09 | 745 |
| 845AB | 995 |
| 8500A | 2495 |
| 8502A | 2595 |
| **8500 Series Options** | |
| -04 | 425 |
| -05 | 250 |
| -06 | 275 |
| -07 | 275 |
| -09 | 350 |
| 8600A | 549 |
| -01 | 50 |
| -02 | 150 |
| 8800A | 985 |
| -02 | 150 |
| 8810A | 695 |
| -02 | 150 |
| -09 | 275 |
| 887AB | 2295 |
| 8920A | 995 |
| 8920A-03 | 95 |
| 8920A-04 | 95 |
| 8921A | 995 |
| 8921A-03 | 95 |
| 893A | 1795 |
| 895A | 2195 |
| 931B | 2095 |
| Y2000 | 295 |
| Y2001 | 295 |
| Y2002 | 395 |
| Y2003 | 395 |
| Y2004 | 99 |
| Y2009 | 195 |

* Contact factory for details.

*Prices subject to change without notice.*

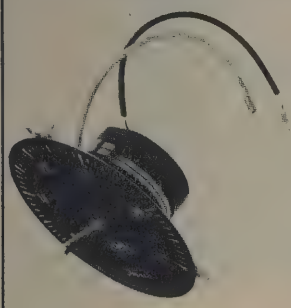
**Call toll-free 800-426-0361, John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, WA 98043. In Washington, call (206) 774-2481.**

# Faria Meter Corporation

19 FARIA LANE, UNCASVILLE, CONNECTICUT 06382
(203) 848-9271

## THE COUNTRY'S LARGEST MANUFACTURER OF AMMETERS & 250 METERS

## GREATER READABILITY & QUALITY



WITH THE LOWEST PRICED 250° MOVEMENT MADE IN THE COUNTRY!

. . . 40% More Magnetic Strength
. . . Friction Free Taut Band
. . . Greater Torque
. . . Custom Dials
. . . Available As Bare Movements Or As Panel Meters Shown Below

### AUTOMOTIVE STYLED PANEL METERS

. . . Internal Lighting
. . . Hermetically Sealed
. . . Blank Internal Circuit Boards Available
. . . In Panel or Top Of Panel Mounting

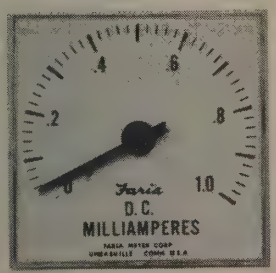
3" METER

4" METER

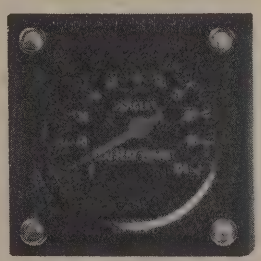
ALSO 2" & 5" (NOT SHOWN)

### COMMERCIAL PANEL METERS

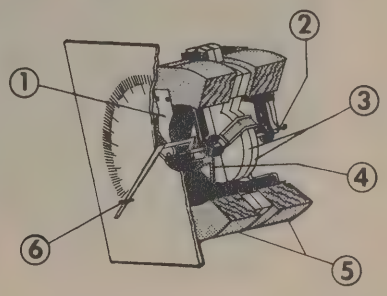
. . . 2½ TIMES the Scale Length of Ordinary Meters
. . . Priced in the Same Range as 90° Instructions
. . . Features Contemporary Styling




ASA 2½" METER



MILITARY-AIRCRAFT METER




1. Tension member assures constant band tension while absorbing shock and vibration to prevent band breakage.

2. Strong taut-band eliminates friction and will withstand heavy shock and vibration without damage.

3. Pole piece design assures uniform flux density from 0 to 250° deflection for better tracking.

4. Unique balance weight design assures proper balance even after heavy shock and vibration. No weight wires to shift as on other meters.

5. Large berrium ferrite magnet provides 40% more flux density than other "core magnet" designs for better torque.

6. Movement is suppressed slightly against stop peg to eliminate zero adjust. Pointer is always at zero in any position.

Field proven in the most rugged automotive and snowmobile OEM applications, this high performance 250° meter movement is featured in all the case styles shown at left. Write or call for data sheets and prices today!

**ALSO 2 INCH MOVING MAGNET METERS, AMMETERS AND GAUGES**

ALL RANGES AVAILABLE AT LOW PRICES!

# FREED TRANSFORMER CO., INC.

2030-A-B-C-D

1620-A-B-D

## MEGOHMMETERS

1020-C

Freed can supply a complete range of insulation resistance measuring equipment with fixed and variable d.c. test voltages from 5 to 2500 volts. Insulation and leakage measurements can be made on transformers, motors, cables, electronic assemblies and components, dielectric materials, electrical appliances and tools, capacitors and resistors.

| Type | Resistance Range | Test Voltage | Accuracy | Power Requirements | Size and Weight | Price |
|---|---|---|---|---|---|---|
| 1620-A | 0.01 to 4,000,000 megohms<br>0.1 to 200,000 megohms @ 50 volts<br>1 to 2,000,000 megohms @ 500 volts | Variable<br>5-100 volts d.c.<br>100-1000 volts d.c. | ±5% at full scale | 105-125 volts<br>50-60 cycles | 15″ x 9″ x 7½″<br>24 lbs.<br>* | $465.00 |
| 1620-B | 1 to 2,000,000 megohms<br>10 to 2,000,000 megohms @ 2500 volts | Variable<br>250-2500 volts d.c. | ±5% at full scale | 105-125 volts<br>50-60 cycles | 15″ x 9″ x 7½″<br>24 lbs.<br>* | 490.00 |
| 1620-D | 0.01 to 40,000,000 megohms<br>0.1 to 2,000,000 megohms @ 50 volts<br>1 to 20,000,000 megohms @ 500 volts | Variable<br>5-100 volts d.c.<br>100-1000 volts d.c. | ±5% at full scale<br>except highest<br>range ±10% | 105-125 volts<br>50-60 cycles | 15″ x 9″ x 7½″<br>25 lbs.<br>* | 500.00 |
| 1020-C | 0.1 to 2,000,000 megohms<br>0.1 to 200,000 megohms<br>@ 50 or 100 volts d.c.<br>1 to 2,000,000 megohms @ 500 volts d.c. | Fixed<br>50, 100, 500 volts<br>Regulated | ±3% all ranges<br>except highest<br>range ±5% | 105-125 volts<br>50-60 cycles | 9½″ x 10½″ x 8″<br>18 lbs.<br>* | 355.00 |
| 2030-A | 10 to 2,000,000 megohms | Fixed 500 volts d.c. | ±5% at full scale | battery operated<br>transistor supply | 6″ x 8″ x 4″<br>8 lbs. | 240.00 |
| 2030-B | 1 to 20,000,000 megohms | Fixed 500 volts d.c. | ±5% at full scale | battery operated<br>transistor supply | 6″ x 8″ x 4″<br>8 lbs. | 280.00 |
| 2030-C | 1 to 2,000,000 megohms | Fixed 50 volts d.c. | ±5% at full scale | battery operated<br>transistor supply | 6″ x 8″ x 4″<br>8 lbs. | 250.00 |
| 2030-D | 1 to 2,000,000 megohms | Fixed 100 volts d.c. | ±5% at full scale | battery operated<br>transistor supply | 6″ x 8″ x 4″<br>8 lbs. | 250.00 |

Rack type available — 1620 series 19″ x 10½″ x 9½″
1020 series 19″ x 7″ x 9½″

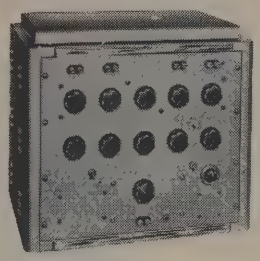
**Prices quoted are subject to change without notice**

FREED TRANSFORMER COMPANY, INC. 1795 WEIRFIELD ST. (Ridgewood) Brooklyn, N.Y. 11227

# FREED TRANSFORMER CO., INC.

## INCREMENTAL INDUCTANCE BRIDGES

Direct in-line readings of inductance and conductance of iron core component at audio frequencies with or without super-imposed direct current. The bridge uses the Owens circuit with provisions for measuring the series or parallel inductance and conductance of the unknown inductor; five precision resistance and capacitance decades are provided to indicate these values. "Q" or storage factor can be measured as the product of the inductive reactance and the conductance.



1110-C

| Type | Inductance Range | Conductance Range | Frequency Range | D.C. Current | Accuracy | Dimensions and Weight | Price |
|---|---|---|---|---|---|---|---|
| 1110-C | 1111.1 h to 1 mh 5 decades<br>1.1 h to 1 μh 2 decades | 0.015 μmho—100 mho<br>"Q" = 600 max @ 100 cycles | 20 cycles to 10KC | up to 2 amperes | ±0.5% to 5 KC<br>±2% to 10 KC | 21¾" x 17½" x 15¼"<br>50 lbs. | 765.00 |
| 1115 | 111.1 h to 100 μh 5 decades<br>0.11 h to 0.1 μh 2 decades | 0.15 μmho—1000 mho<br>"Q" = 600 max @ 100 cycles | 20 cycles to 10 KC | up to 15 amperes | ±1% to 5 KC<br>±3% to 10 KC | 21¾" x 28" x 15¼"<br>80 lbs. | 1095.00 |
| 1185 | 111.1 h to 100 μh 5 decades<br>0.11 h to 0.1 μh 2 decades | 0.15 μmho—1000 mho<br>"Q" = 600 max @ 100 cycles | 20 cycles to 10 KC | up to 30 amperes | ±1% to 5 KC<br>±3% to 10 KC | 21¾" x 33¼" x 15¼"<br>100 lbs. | 1535.00 |

## NULL DETECTOR

Sensitive null detector for bridge measurements, with self contained selective filters to limit the amplifier characteristics at various bridge measuring frequencies.

1140-B

| Type | Sensitivity | Frequency Range | Filter | Power Requirements | Dimensions and Weight | Price |
|---|---|---|---|---|---|---|
| 1140-B | 10μ volts @ 1 KC<br>for 15% meter deflection<br>filter in | 20 to 20,000 cycles | Fixed<br>60, 400, 1000 cycles<br>Adjustable ±5% of center<br>Other frequencies available | 105-125 volts<br>50-60 cycles | Cabinet<br>12" x 8½" x 10"—18 lbs.<br>Rack—19" x 6" x 10" | 305.00 |

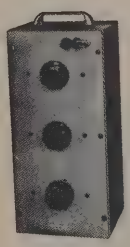
## D.C. SUPPLY

A constant voltage transformer regulated current source designed for use with the Freed Incremental Inductance Bridges. Solid state bridge rectification, L-C filters and low internal impedance provides good current regulation with a minimum of circuit complexity.

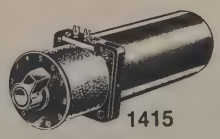
| Type | Current Ranges | Voltage Ranges | Regulation | Power Requirement | Dimensions and Weight | Price |
|---|---|---|---|---|---|---|
| 1170-A | 4 ranges, 0-5, 25, 100 and 1000 milliamperes | Maximum no load voltage<br>1000 Ma, 270V, 100 Ma, 270V<br>25 Ma, 85 V, 5 Ma, 48 V | ± 1% for line variation<br>105-125 V | 105-125 volts<br>60 cycles | 19" x 10½" x 13½"<br>66 lbs. | 410.00 |

## DECADE CAPACITORS

The Freed series of Decade Capacitors cover a wide range of values and can be supplied as individual decades from 0.0001 PF. per step to 1 mf. per step or in various combinations of assembled decade boxes. All capacitors are non-inductively wound and heat treated for stability.



1250



1415

| Type | Total Capacity | Dielectric | Dissipation Factor | Accuracy | Dimensions and Weight | | Price |
|---|---|---|---|---|---|---|---|
| 1415 | 10 μf in steps of 1 μf | Mylar | <0.005 | ±1% | 3" x 3" x 7" | 2 lbs. | 70.00 |
| 1416 | 1 μf in steps of 0.1 μf | Polystyrene | <0.0002 | ±1% | 3" x 3" x 7" | 2 lbs. | 85.00 |
| 1417 | 0.1 μf in steps of 0.01 μf | Polystyrene | <0.0002 | ±1% | 3" x 3" x 7" | 2 lbs. | 70.00 |
| 1418 | 0.01 μf in steps of 0.001 μf | Polystyrene | <0.0002 | ±1% | 3" x 3" x 7" | 2 lbs. | 70.00 |
| 1419 | 0.001 μf in steps of 0.0001 μf | Polystyrene | <0.0002 | ±1% | 3" x 3" x 7" | 2 lbs. | 80.00 |
| 1250 | 1.110 μf in steps of 0.001 μf | Polystyrene | <0.0002 | ±1% | 13¾" x 6" x 4½" | 8 lbs. | 295.00 |
| 1352 | 1.111 μf in steps of 0.0001 μf | Polystyrene | <0.0002 | ±1% | 19" x 5¼" x 10" | 13 lbs. | 350.00 |
| 1353 | 11.111 μf in steps of 0.0001 μf | Mylar Polystyrene | <0.005 | ±1% | 19" x 5¼" x 10" | 14 lbs. | 425.00 |

Maximum operating voltage, 500 VDC or peak. Capacitors can be supplied to better than ±1%, write for complete information.
In addtion to listed equipment, Freed manufactures a complete series of decade inductors, AC and DC regulated power supplies, comparison and limit bridges.
Write for complete catalog.

# DIGITAL PANEL METERS

## MODEL 36-4

**NEW IMPROVED VERSION OF OUR FAMOUS SYSTEM DPM**

- Instrumentation input
- Adjustable conversion rate
- External trigger
- Gas discharge display
- Compact case

### SPECIFICATIONS

| | |
|---|---|
| **INPUTS** | |
| FULL SCALE RANGES | IMPEDANCE |
| ±199.9 mV, differential | 1000 megohms |
| ±1.999 V, differential | 1000 megohms |
| ±19.99 V, single ended | 10 megohms |
| BIAS CURRENT | 10 pA max. at 25°C |
| COMMON MODE VOLTAGE | ±2.0 V DC |
| COMMON MODE REJECTION | > 70 dB, 50 to 60 Hz |
| NORMAL MODE REJECTION | 30 dB at 60 Hz |
| **PERFORMANCE** | |
| ACCURACY | ±0.05% rdg ±1 digit |
| STABILITY | 80 ppm/°C rdg, typ. |
| ZERO DRIFT | Auto zero (1 μV/°C) |
| CONVERSION RATE | 3 per second (internal control)<br>0 to 16 per second, ext. trigger |
| **DISPLAY** | |
| TYPE | Seven segment gas discharge, .55 in. |
| OVERRANGE INDICATION | 3 LSD's blank |
| DECIMAL POINTS | Programmable |
| POLARITY | Automatic + and − indication |
| **DIGITAL OUTPUTS** | |
| DATA FORMAT | 8421 BCD, parallel, latched |
| FANOUT | 1 std TTL load |
| POLARITY | Logical 1 = positive input |
| OVERRANGE | Logical 1 = overload |
| DATA READY | Logical 1 = converter busy |
| **CONTROLS AND INTERFACE** | |
| HOLD | Ground or logical 0 freezes data |
| EXTERNAL TRIGGER | Logical 0 pulse initates update |
| **POWER** | 100, 117, 220 or 237 V ±10% 50 to 440 Hz at 3.5 watts nom. |
| **PHYSICAL** | |
| OPERATING TEMPERATURE | 0 to 60°C |
| STORAGE TEMPERATURE | −25 to 70°C |
| RELATIVE HUMIDITY | To 95%, non-condensing |
| SIZE | 2.25H x 3.75W x 2.82D |

## MODEL 37

**3½ AND 3¾ DIGITS**

- Gas discharge or LED display
- Isolated BCD output option
- Floating input
- 4-20 mA transducer option
- Event counter/voltmeter option

### SPECIFICATIONS

| | |
|---|---|
| **INPUTS** | |
| FULL SCALE RANGES | IMPEDANCE |
| ±199.9 mV, ±399.9 mV | 100 megohms |
| ±1.999 V, ±3.999 V | 100 megohms |
| ±19.99 V, ±39.99 V | 1 megohm |
| BIAS CURRENT | 10 nA max. |
| COMMON MODE VOLTAGE | ±300 V DC |
| COMMON MODE REJECTION | > 60 dB to 60 Hz |
| NORMAL MODE REJECTION | > 24 dB to 60 Hz |
| **PERFORMANCE** | |
| ACCURACY | ±0.1% rdg ±1 digit |
| STABILITY | 80 ppm rdg/°C |
| ZERO DRIFT | 25 ppm fsr/°C ±5 μV/°C |
| CONVERSION RATE | 6 per second |
| **DISPLAY** | |
| TYPE | Gas discharge, .55 in. or LED, .5 in. |
| OVERRANGE INDICATION | Dashes |
| DECIMAL POINTS | Programmable |
| POLARITY | Automatic — |
| **DIGITAL OUTPUTS OPTION (ISOLATED)** | |
| DATA FORMAT | 8421 BCD, latched, parallel or serial |
| FANOUT | 2 std TTL loads |
| POLARITY | Logical 1 = positive input |
| OVERRANGE | Logical 0 = overload |
| DATA READY | Logical 1 = converter busy |
| **CONTROLS AND INTERFACE** | |
| HOLD | Grounding inhibits update |
| DISPLAY BLANK | Logical 0 blanks display |
| **POWER** | 100, 117, 220 or 237 V ±10% 50 to 440 Hz at 4 watts max. |
| **PHYSICAL** | |
| OPERATING TEMPERATURE | 0 to 60°C |
| STORAGE TEMPERATURE | −25 to 70°C |
| RELATIVE HUMIDITY | To 95%, non-condensing |
| SIZE | 1.76H x 4.00W x 4.04D (NEMA case) |

**NEW!!**

# DIGITAL MAS METER

## INTEGRATING VOLTMETER

- X-ray dosage (MAS)
- Flow totalizer
- Volt seconds, minutes, hours

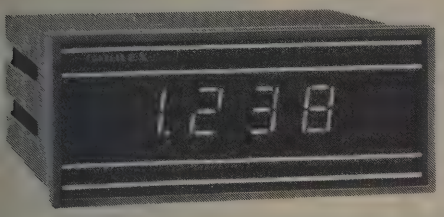
### SPECIFICATIONS

| | |
|---|---|
| **INPUTS** | |
| RANGES | 0-600 millivolt seconds (x-ray dosage)<br>0-9999 volt seconds, minutes or hours |
| VOLTAGE | 0-2 V |
| TIME GATE | Variable, 0.1 sec. to 3600 sec.<br>CMOS compatible |
| **DISPLAY** | |
| NUMBER OF DIGITS | 3 or 4 |
| TYPE | Seven segment gas discharge, .55 in. |
| **POWER** | 100, 117, 220 or 237 V ±10% 50 to 440 Hz at 4 watts. |
| **SIZE** | 1.76H x 4.00W x 4.04D |

GRALEX INDUSTRIES
DIVISION OF GENERAL MICROWAVE CORP.
DEPT. EM, 155 MARINE ST., FARMINGDALE, NY 11735
(516) 694-3607 TWX: 510-224-6406

# DIGITAL PANEL METERS

## MODEL 38-2




**NEW!!**

- Floating differential input
- Economical BCD output option
- High intensity LED display
- LSI reliability
- NEMA case

### SPECIFICATIONS

| | |
|---|---|
| **INPUTS** | |
| FULL SCALE RANGES | IMPEDANCE |
| ±199.9 mV, differential | 1000 megohms |
| ±1.999 V, differential | 1000 megohms |
| ±19.99 V, single ended | 10 megohms |
| BIAS CURRENT | 10 pA max. at 25°C |
| COMMON MODE VOLTAGE | ±2.0 V DC |
| COMMON MODE REJECTION | > 70 dB (DC to 60 Hz) |
| NORMAL MODE REJECTION | > 30 dB at 60 Hz |
| **PERFORMANCE** | |
| ACCURACY | ±0.05% rdg ±1 digit |
| STABILITY | 80 ppm rdg/°C max. |
| ZERO DRIFT | Auto zero (1 μV/°C) |
| CONVERSION RATE | 6 per second |
| **DISPLAY** | |
| TYPE | High intensity LED, .43 in. |
| OVERRANGE INDICATION | 3 LSD's blank |
| DECIMAL POINTS | Programmable |
| POLARITY | Automatic — |
| **DIGITAL OUTPUTS OPTION** | |
| DATA FORMAT | 8421 BCD, parallel, latched |
| FANOUT | 1 std TTL load |
| POLARITY | Logical 1 = positive input |
| OVERRANGE | Logical 1 = overload |
| DATA READY | Logical 1 = converter busy |
| **CONTROLS AND INTERFACE** | |
| HOLD | Grounding inhibits update |
| **POWER** | 100, 117, 220 or 237 V ±10% 50 to 440 Hz at 3 watts max. |
| **PHYSICAL** | |
| OPERATING TEMPERATURE | 0 to 60°C |
| STORAGE TEMPERATURE | −25 to 70°C |
| RELATIVE HUMIDITY | To 95%, non-condensing |
| SIZE | 1.76H x 4.00W x 4.04D (NEMA case) |

## MODEL 39

**NEW!!**

**WESTON REPLACEMENT**

- Replaces Weston Model 1230 and Analog Devices Model 2009
- Differential input
- BCD output standard
- Gas discharge display

### SPECIFICATIONS

| | |
|---|---|
| **INPUTS** | |
| FULL SCALE RANGES | IMPEDANCE |
| ±199.9 mV, differential | 1000 megohms |
| ±1.999 V, differential | 1000 megohms |
| ±19.99 V, single ended | 10 megohms |
| BIAS CURRENT | 10 pA max. at 25°C |
| COMMON MODE VOLTAGE | ±2.0 V DC |
| COMMON MODE REJECTION | > 70 dB, DC to 60 Hz |
| NORMAL MODE REJECTION | > 30 dB at 60 Hz |
| **PERFORMANCE** | |
| ACCURACY | ±0.05% rdg ±1 digit |
| STABILITY | 80 ppm rdg/°C max. |
| ZERO DRIFT | Auto zero (1 μV/°C) |
| CONVERSION RATE | 6 per second |
| **DISPLAY** | |
| TYPE | Seven segment gas discharge, .55 in. |
| OVERRANGE INDICATION | 3 LSD's blanked |
| DECIMAL POINTS | Programmable |
| POLARITY | Automatic + and − indication |
| **DIGITAL OUTPUTS** | |
| DATA FORMATS | 8421 BCD, parallel, latched |
| FANOUT | 1 std TTL load |
| POLARITY | Logical 1 = positive input |
| OVERRANGE | Logical 1 = overload |
| DATA READY | Logical 1 = converter busy |
| **CONTROLS AND INTERFACE** | Grounding or logical 0 inhibits |
| HOLD | update |
| **POWER** | 100, 117, 220 or 237 V ±10% 50 to 440 Hz at 3.5 watts |
| **PHYSICAL** | |
| OPERATING TEMPERATURE | 0 to 60°C |
| STORAGE TEMPERATURE | −25 to 70°C |
| RELATIVE HUMIDITY | To 95%, non-condensing |
| SIZE | 1.76H x 4.00W x 4.04D (NEMA case) |

# DIGITAL AC LINE MONITOR

### SPECIFICATIONS

| | |
|---|---|
| **INPUT** | |
| FULL SCALE RANGES | IMPEDANCE |
| 0 - 199.9 V rms | 1 megohm |
| 0 - 399.9 V rms | 1 megohm |
| 0 - 600 V rms | 1 megohm |
| **PERFORMANCE** | |
| ACCURACY | ±0.5% rdg ±1 digit 45 Hz to 2 kHz<br>±1.0% rdg ±1 digit 2 kHz to 20 kHz |
| STABILITY | ±0.01% fs/°C |
| ZERO DRIFT | ±0.003% fs/°C |
| **DISPLAY** | Seven segment gas discharge, .55 in. |
| **POWER** | 100, 117, 220 or 237 V ±10% 50 to 440 Hz at 3 watts |
| **PHYSICAL** | |
| OPERATING TEMPERATURE | 0 to 60°C |
| STORAGE TEMPERATURE | −25 to 70°C |
| HUMIDITY | To 95%, non-condensing |
| SIZE | 1.76H x 4.00W x 4.04D |

**THE MODERN WAY TO READ AC POWER LINE VOLTAGES**

**GRALEX INDUSTRIES**

DIVISION OF GENERAL MICROWAVE CORP.
DEPT. EM, 155 MARINE ST., FARMINGDALE, NY 11735
(516) 694-3607 TWX: 510-224-6406

# THE BEST VALUE IN OSCILLOSCOPES COMES IN MANY MODELS.

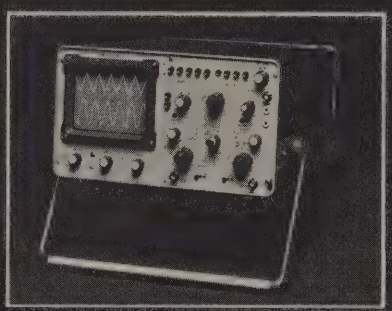
When you choose a Gould oscilloscope—regardless of the model—you get reliability, versatile performance and a modest price tag. All of which adds up to true value. Over the years, Gould has earned a well-deserved reputation for building reliable instruments. Prompt, efficient service is available through a worldwide network of service centers. And all Gould oscilloscopes carry a full two-year warranty covering all parts and labor exclusive of fuses, calibration and minor maintenance. Look to Gould for your best value in oscilloscopes.

For more information contact Gould, Instruments Division, 3631 Perkins Ave., Cleveland, OH 44114. In Europe contact Gould Advance Ltd., Roebuck Rd., Hainault, Essex, CB10 1EJ England.

For brochure call toll-free (800) 325-6400, Ext. 77. In Missouri: (800) 342-6600.

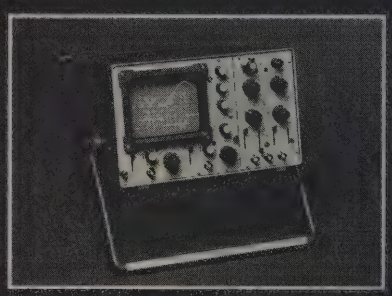
**Gould OS 245A**

- DC to 10 MHz
- Dual trace
- 4 inch CRT
- 5 mV/div sensitivity
- Only 11 pounds



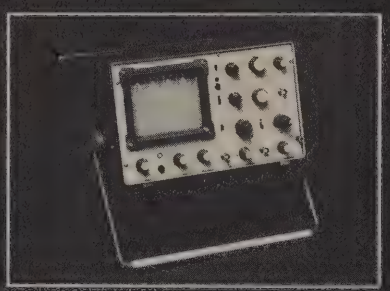
**Gould OS 1100**

- DC to 30 MHz
- Dual trace
- 1 mV/div sensitivity
- Delayed timebase
- Channel Sum and Difference



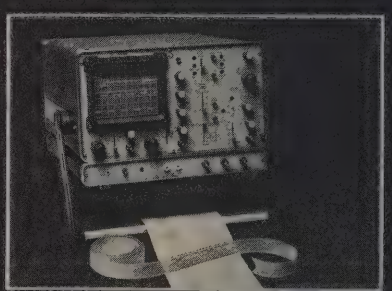
**Gould OS 3300 B**

- DC to 50 MHz
- Dual trace
- Two independent timebases
- Mixed sweep
- 1 mV/div sensitivity
- Channel Sum and Difference



**Gould OS 260**

- DC to 15 MHz
- True dual beam
- High brightness CRT
- 2 mV/div sensitivity
- Single Sweep
- Switched X—YY



**Gould OS 4000**

- DC to 10 MHz—dual trace—digital storage (RAM)—no deterioration of stored trace—pre-trigger viewing—output to analog and digital recorders—simultaneous stored and real time viewing.

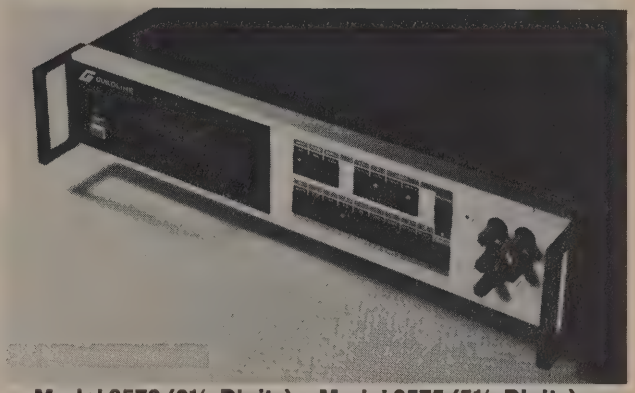
GOULD

# MODERN ELECTRONIC METROLOGY FROM GUILDLINE

## The "INTELLIGENT" DVM

| MEASUREMENT | *PLUS* |
|---|---|
| dc voltage | offset |
| ac voltage | multiplication |
| resistance | ratio |
| 1μV sensitivity | limits |
| auto and manual ranging | percentage deviation |
| scale length, 3½ digits to 6½ digits | max, min, peak-to-peak |
| hidden decades | temperature |
| 396 readings/s at 3½ digits | statistics |
| 51 readings/s at 5½ digits | *all* under time control |

*with* 4 systems interfaces: bcd, binary, RS 232, IEEE/IEC



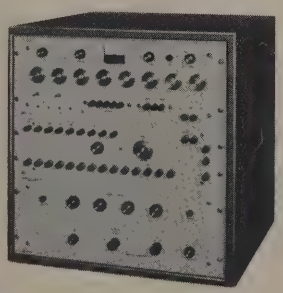
**Model 9576 (6½ Digits) Model 9575 (5½ Digits)** With these microprocessor voltmeters, instruments that process their measurements to give a wealth of useful data, there's a button to solve your problem—at your fingertips.

**Model 9577 7½ Digit Precision Digital Voltmeter**—For bench and system use via programmable BCD or IEEE 488-Interface

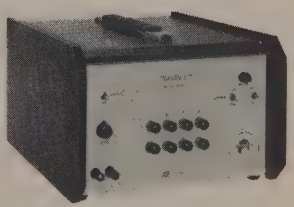
**SPECIFICATIONS:**

| | |
|---|---|
| **DC VOLTAGE:** | 1 μv to 1000 volts (for systems use 0.01 μv to 1000 volts)<br>accuracy: 10 volt range, 24 hours, 23°C±1°C to <4ppm |
| **RESISTANCE** | 1mΩ to 14 megohms<br>Accuracy: 10Ω range, 24 hours, 23°C±1°C to <25ppm |
| **AC VOLTAGE TRUE RMS** | 1 μv to 750 volts (1.1kv peak)<br>accuracy: 10 volt range, 24 hours 23°C±1°C,<br>40Hz to 10kHz to <0.06% |
| **RATIO** | DC/DC AC/DC<br>Reference 1 to 11 volts |

**Model 9936 Potentiometer System**—a complete voltage measuring system to 1500 volts, the 9936 comprises a two range DCC Potentiometer for measurements to 2 volts, an electronic null detector, a constant current source, and a volt ratio box to extend the range to 1500 volts. This compact, integrated package offers accuracies previously achievable only by the best standards laboratories employing a cumbersome array of equipment.



**Model 9154D Transvolt®** A self-powered inter-laboratory traveling standard which is usable almost immediately after arrival at destination. The re-chargeable batteries will power the Transvolt off-line for up to one full week at an ambient temperature of 20°C. A single panel meter serves to indicate heater cycle, battery state-of-charge and over-temperature control activation. A rugged fiberglass Transit Case —Model 91541—is available for unattended shipment by common carrier.



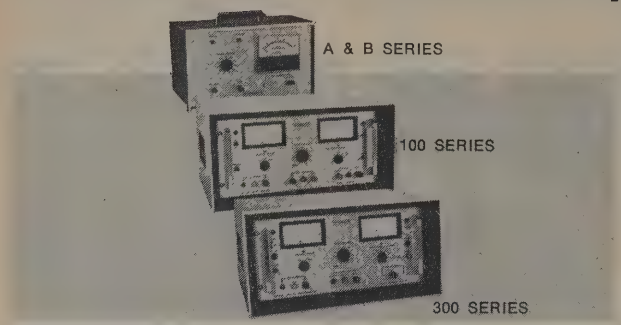
Guildline Instruments

2 Westchester Plaza, Elmsford, NY 10523, (914) 592-9101

Canada: Churchill Road, Smith Falls, Ontario, Canada K7A4S9 • Telephone: (613) 283-3000 • Telex: 058-3028

HIPOTRONICS

# AC/DC Hipot & Insulation Testers




**Non-destructive units for production or laboratory use. . . . In ranges up to 10 kV AC and to 25 kV DC.**

- Reset button and failure indicator
- Recalibration facilities
- Guard circuit for grounded and ungrounded operation
- Front panel re-entrant test lead connections
- AC/DC function indicator lights
- Zero start interlock compels operator to start tests at zero volts
- Gravity operated shorting solenoid with discharge resistor
- Audible failure signal

## AC/DC Hipot Testers & Megohmmeters (300 Series)

Six versatile models are designed in A and B versions to meet the requirements of AC Hipot Testing, DC Hipot Testing and Resistance Measurement. The range capability for current and resistance reading varies according to the model number and selected version.

Every unit contains an overload circuit with continuously adjustable sensitivity from 50 μA to 5 mA allowing non-destructive testing of insulation and dielectrics.

### Features

- Dual range output connected kV meter with calibrated set point for megohmmeter readings clearly marked

### Specifications

**Input:** 115 V AC, 60 Hz, 1 Amp max. **Size & Weight:** 21″Wx19″Dx10″H; approx. 50 lbs. **Meters:** 2% full scale accuracy, 4½″ meter. **Current Meter Ranges: A Series** — Ranges of 0-50/500/5000 μA, dc, 0-5 mA AC, 1 to 1000 megohms in 2 ranges. **B Series** — Ranges of 0-0.5/5/50/500/5000 μA, 0-5 mA AC, 1 to 100,000 megohms in 4 ranges.

| Model | Output Voltage (kV) AC | Output Voltage (kV) DC | Current Meter Range AC | Current Meter Range DC | Megohm Ranges |
|---|---|---|---|---|---|
| H301A | 1.0 | 1.5 | 0-5 mA | 0-50/500/5000 μA | 2 |
| H301B | 1.0 | 1.5 | 0-5 mA | 0-0.5/5/50/500/5000 μA | 4 |
| H303A | 2.5 | 3.0 | 0-5 mA | 0-50/500/5000 μA | 2 |
| H303B | 2.5 | 3.0 | 0-5 mA | 0-0.5/5/50/500/5000 μA | 4 |
| H306A | 5.0 | 6.0 | 0-5 mA | 0-50/500/5000 μA | 2 |
| H306B | 5.0 | 6.0 | 0-5 mA | 0-0.5/5/50/500/5000 μA | 4 |

## AC/DC Hipot Testers (100 Series)

The H100 Series consists of eight models subdivided into four subseries — H103, H106, H115, H125 — based on output voltage range. Each subseries is available in two versions, standard (H) or deluxe (HD) based on the number of ranges provided for current readings.

All units are constructed with a standard 19″ panel and enclosed in an attractive bench top cabinet. A ground lead and a shielded test lead is included with each unit.

### Features

- Overload circuit with continuously adjustable overload sensitivity from 50 μA to 5 mA permitting safe, non-destructive testing
- kV meter recalibration facility
- Output control continuously adjustable from zero to max.
- Front panel re-entrant test lead connections
- AC/DC function indicator lights
- Gravity operated output shorting solenoid with discharge resistor
- Audible failure signal

### Specifications

**Input:** 115 V AC, 60 Hz, 5 Amps max. **Size & Weight:** 21″Wx19″Dx10″H; approx. 60 lbs. **Meter:** 2% full scale accuracy. 4½″ meter.

| Model | Output Voltage (kV) AC | Output Voltage (kV) DC | Output Current Meter DC | Output Current Meter AC | kV Meter Ranges |
|---|---|---|---|---|---|
| H103 | 2.5 | 3.0 | 0-5 mA | 0-5 mA | 0-3 kV |
| HD103 | 2.5 | 3.0 | 0-50/500/5000 μA | 0-5 mA | 0-0.6/1.2/3 kV |
| H106 | 5.0 | 6.0 | 0-5 mA | 0.5 mA | 0-6 kV |
| HD106 | 5.0 | 6.0 | 0-50/500/5000 μA | 0-5 mA | 0-1.2/3/6 kV |
| H115 | 12.0 | 15.0 | 0-5 mA | 0-5 mA | 0-15 kV |
| HD115 | 12.0 | 15.0 | 0-50/500/5000 μA | 0-5 mA | 0-3.75/7.5/15 kV |
| H125 | 10.0 | 25.0 | 0-5 mA | 0-5 mA | 0-25 kV |
| HD125 | 10.0 | 25.0 | 0-50/500/5000 μA | 0-5 mA | 0-5/10/25 kV |

## AC & DC Production Hipot Testers (A & B Series)

The A and B Series of Hipot Testers is designed for simple and reliable production line testing. Each model has continuously variable output voltage and an output connected kV meter providing optimum test accuracy. Non-destructive testing is ensured with a sensitive leakage and arc detection system.

### Features

- An AC power on switch, an internal fuse and pilot light
- A continuously adjustable output voltage control
- Corona network arc detector and indicator
- A shielded output lead with an alligator clip termination
- Adjustable overload system

| AC Models | Output Voltage | kV Meter |
|---|---|---|
| HDA3 | 3 kV AC | 0-3 |
| HDA5 | 5 kV AC | 0-5 |
| HDA10 | 10 kV AC | 0-10 |
| **DC Models** | **Output Voltage** | **kV Meter** |
| HDB4 | 4 kV DC | 0-4 |
| HDB6 | 6 kV DC | 0-6 |
| HDB12 | 12 kV DC | 0-12 |

### Specifications

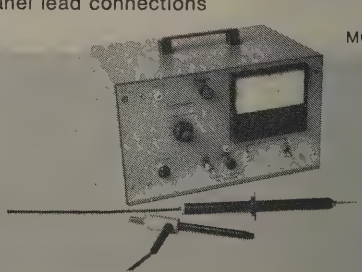
**Input:** 115 V AC, 60 Hz, 3 Amps max. **Size & Weight:** 7″Hx12″Wx 8″D; approx. 20 lbs. **Meter:** 3% full scale accuracy, 4″ meter.

## AT Series of UL Testers

Reliable and simple to operate, the AT Series is designed for continuous assembly line testing of electrical appliances and instruments to meet UL standards of dielectric withstand. Visible and audible indicators of component leakage or internal arcing provide safe, non-destructive testing. Direct and accurate output voltage readings will result, independent of the load.

### Features

- AC outputs: 1200 volts A1 Series, 0-3,000 volts HA3 Series
- Overload circuit with manual reset and overload pilot light
- Voltmeter connected at output for maximum accuracy (except the model A1-AT which has a 500 VA transformer)
- Visible and audible failure indicators
- Input switch, pilot light and high voltage fuse
- Front panel lead connections



MODEL HA3-AT

Prices and specifications subject to change without notice.

# Megohmmeters/ Insulation Testers

The HM Series consists of six high voltage megohmmeters for precision measurement of resistance in a variety of components and insulations.

The output voltage is double-regulated with a ferro-resonant line and solid state electronic regulators eliminating the need for meter averaging even in the larger capacitive loads.

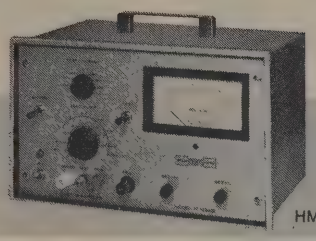
A complete short circuit protection system permits continuous shorting without injury to the operator or the component.

## Features

- A meter multiplier with multiple positions for range selection
- Ferro-resonant line and solid state electronically regulated test voltage
- Dual color meter scale
- Four terminal output network for grounded or ungrounded testing
- Self-contained precision calibrating resistors

**Specifications**

**Input:** ..... 115 volts, 60 Hz.
**Weight:** ..... 20 lbs. (approx.)
**Size:** ..... 7″Hx12″Wx8″D



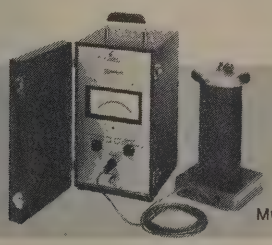
HM3AS

| Model No. | Output Voltage | Megohm Ranges | Megohm Ranges |
|---|---|---|---|
| HM1 | 500 | 1 to 1,000 megohms | 2 |
| HM3A | 50 | 0.1 to 1,000,000 megohms | 6 |
| | 100 | 0.2 to 2,000,000 megohms | 6 |
| | 500 | 1 to 10,000,000 megohms | 6 |
| | 1000 | 2 to 20,000,000 megohms | 6 |
| HM3AS | | Same as HM3A, but with mandatory 2 hand operation | |
| HM6B | 50 | 0.1 to 1,000,000 megohms | 6 |
| | 250 | 0.5 to 5,000,000 megohms | 6 |
| | 500 | 1 to 10,000,000 megohms | 6 |
| HM6S | | Same as HM6B, but with mandatory 2 hand operation | |
| M6C | 250 | 0.1 to 1,000,000 megohms | 6 |

# AC/DC Kilovoltmeters

Our AC/DC kilovoltmeters offer laboratory precision combined with rugged design and packaging for field use. Separate dividers for AC and DC are enclosed in one oil filled phenolic cylinder for safe storage.

All models are triple range and have a shorting position for transport. Every unit is calibrated with our standard traceable to the National Bureau of Standards which has better than 0.1% accuracy on DC and better than 0.5% accuracy on AC. Surge devices prevent injury to the operator and the component even when short circuits occur at full voltage.



MODEL KV50A

**Specifications**

| | Model KV25A | Model KV50A | Model KV100A | Model KV200A |
|---|---|---|---|---|
| Accuracy: | | | | |
| DC | 1.0% | 1.0% | 1.0% | 1.0% |
| AC | 1.0% | 1.0% | 1.0% | 1.0% |
| Tracking | 0.5% | 0.5% | 0.5% | 0.5% |
| Temp. Coef. | | | | |
| DC | 0.025%/C° | 0.025%/C° | 0.025%/C° | 0.025%/C° |
| AC | 0.1%/C° | 0.1%/C° | 0.1%/C° | 0.1%/C° |
| Freq. Response | DC and 40 to 1000 Hz | DC and 40 to 1000 Hz | DC and 40 to 1000 Hz | DC and 40 to 1000 Hz |
| Meters (kV) | 0-5/10/25 | 0-10/25/50 | 0-20/50/100 | 0-40/100/200 |
| Volts Div. | 50/100/250 | 100/250/500 | 200/500/1000 | 400/1000/2000 |
| Imped. | 90 megΩ @ 200 pfd | 190 megΩ @ 200 pfd | 380 megΩ @ 100 pfd | 760 megΩ @ 50 pfd |
| Size | 8½Wx10½D x15½″H | 8½Wx10½D x15½″H | 8½Wx10½D x15½″H | 9½Wx10½D x40″H |
| Weight | 18 lbs. | 20 lbs. | 21 lbs. | 40 lbs. |

# Liquid Dielectric Testers

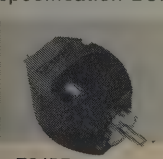
The portable OC Series of liquid dielectric testers is designed to test the breakdown voltage of insulating liquids in accordance with ASTM and various international specifications. The fully automatic models, OC-50A, OC-60A and OC-90A feature automatic rate of rise with manual dwell at any voltage. The fourth model, OC-51M has manually operated variable output with a range of 0-50 kV.

The memory meter, included on all the units, provides accuracy and repeatability of readings, allowing truly comparative readings of different dielectrics and periodic comparative readings of the same dielectric. A variety of test cells (oil cups) are available for use with the units.

## Test Cells

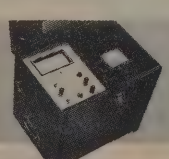
TC/DE ASTM test cell with disc electrodes for testing to ASTM specification D877. (left)

TC/VDE ASTM test cell with VDE electrodes for testing to ASTM specification D1816. (right)



TC/DE

TC/VDE



OC-60A

**Specifications**

| Model No. | Output Voltage | Current | Dimension | Wgt. |
|---|---|---|---|---|
| OC-50A | 0-50 kV rms | 2 kVA | 15½Wx14½Hx11½″D | 60 |
| OC-60A | 0-60 kV rms | 2 kVA | 15½Wx14½Hx11½″D | 65 |
| OC-90A | 0-90 kV rms | 2 kVA | 16½Wx18½Hx20¾″D | 90 |
| OC-51M | 0-50 kV rms | 2 kVA | 15½Wx14½Hx11½″D | 60 |

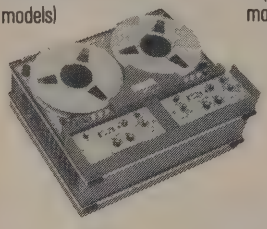
**Input:** 115 volts, 50/60 Hz, 2 Amps, Single phase.

HIPOTRONICS®
HIPOTRONICS, INC.
Brewster, N. Y. 10509 / (914) 279-8031
TELEX: 710-574-2420

Call or write our sales department for more data and descriptive literature. See other Hipotronics' listings under Power Supplies.

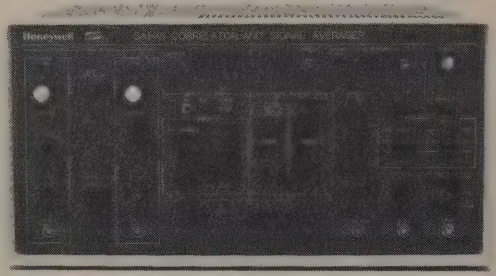
Prices and specifications subject to change without notice.

# Honeywell High-Performance Magnetic Tape Systems

| Model | No. of Record And Reproduce Channels | Reel Size | Tape Speeds | Direct Record/ Reproduce Bandwidth | FM Record/ Reproduce Bandwidth | Special Features |
|---|---|---|---|---|---|---|
| 101 | Up to 16 or 32, depending on model. | 10-1/2″ to 15″ NAB | 15/16 to 120 ips | 600 kHz, 2 MHz | IRIG 40% systems to 80 kHz at 120 ips. IRIG 30% Wideband Group II systems to 500 kHz at 120 ips. | Microcomputer control, automatic self-test, self-contained calibration gear, programmable shuttle; 3000 hr ferrite heads. |
| 5600 Series (Includes intermediateband models)  | Up to 16 or 32, depending on model. | 7″ plastic (1/4″) to 10-1/2″ NAB | 15/16 to 60 ips | 300 kHz 1 MHz | IRIG 40% systems to 40 kHz at 60 ips. IRIG 30% Wideband Group II systems to 250 kHz at 60 ips. | High-performance capstan servosystem and tricapstan drive; outstanding flutter performance, built-in monitor meters for input and output monitoring of any channel. |
| Ninety-Six | Up to 42, depending on model. | 7″ plastic (1/4″) to 16″ NAB | 15/16 to 240 ips | 600 kHz, 2 MHz | IRIG 40% systems to 80 kHz at 120 ips. IRIG 30% Wideband Group II systems to 500 kHz at 120 ips. | High-density digital electronics, selective track recording, 3000 hr ferrite wideband heads. |

All Honeywell recorders feature adjustment-free tape path designs and carry a full 12-month warranty.

## Now, A Powerful New Signal Analyzer For On-Line Processing



With the all-digital, high speed SAI-48, you can now compute:

- Auto correlation
- Signal enhancement
- Cross correlation
- Probability density
- Probability distribution

To further speed and simplify your data analysis, the SAI-48 offers full 400-point sampling capability, sampling rates to 20 MHz, 800 points of precomputation delay, digital exponential averaging and binary digital outputs. And all your computed values are shown on a large 6-digit display.

Call us for full details concerning the SAI-48 and our other correlators and Fourier transform analyzer that can provide complete two-channel frequency domain analysis.

**WE'LL SHOW YOU A BETTER WAY.**

**Honeywell**

Test Instruments Division, Box 5227, Denver, Colorado, 80217. (303) 771-4700

# HOYT
# PANEL METERS

- AMMETERS
- MILLIAMMETERS
- VOLTMETERS
- MILLIVOLTMETERS
- VU METERS

## HOYT PANEL METERS

The Hoyt line of ammeters, milliammeters, voltmeters, millivoltmeters and VU meters is available in a wide range of sizes (1½″ to 8″) and accuracy ranges (1% to 5%).

## EDGEWISE SERIES (2½″)

Excellent readability with a long narrow scale.

## PROJECTED FRONT SERIES

The newest in meter design. Projected front allows window type mounting. Completely shadow free illumination due to translucent case back.

## CUSTOM SERIES

Our standard custom series rectangular meter is available in sizes from 1½″ to 8″. Special case paint, dial colors and layouts are available for unique applications.

## BEZEL MOUNT SERIES

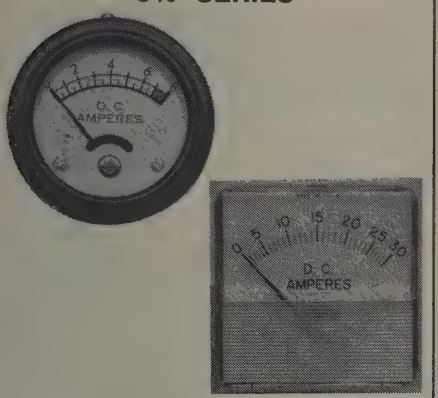
Rugged die cast metal bezels are available for the custom meter sizes 1½″, 2½″, 3½″ and 4½″.

## METER MOVEMENTS

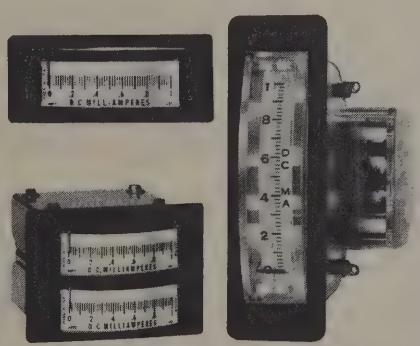
One of the most complete selections of meter movements in the industry.

- Self-shielded
- External Magnet
- A.C. Repulsion
- A.C. Rectified

### 5% SERIES

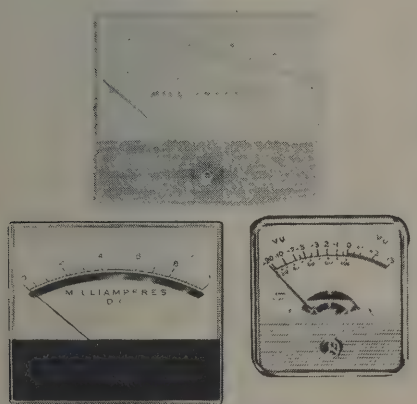



### EDGEWISE SERIES

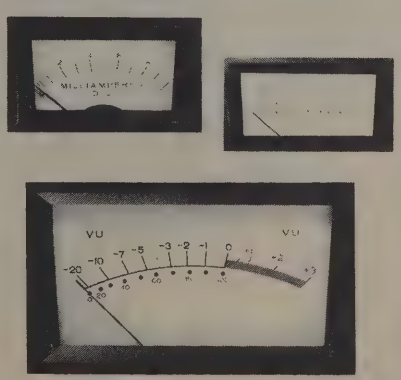



### PROJECTED FRONT SERIES

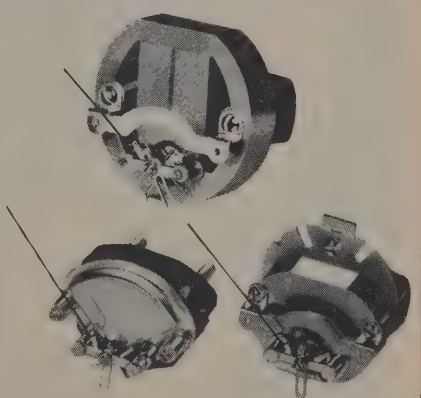
### CUSTOM SERIES




### BEZEL MOUNT SERIES




### METER MOVEMENTS



HOYT

**HOYT ELECTRICAL INSTRUMENT WORKS, INC.**
**19 Linden Street / Penacook, New Hampshire 03301 / (603) 753-6321**

# Now—Valid testing of up to 20,000 complex wired circuits a minute. Economically.

## That's a FACT.®

Our newest FACT (Flexible Automatic Circuit Tester) system, called FACT®-PC, is controlled by a programmable digital processor and specially designed modular software for performing all wiring-analysis functions.

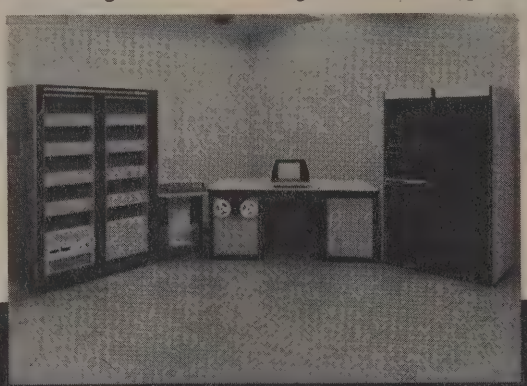
Very high testing rates of complex wiring, computer backplanes, and multilayer PCs are achieved: 10K-20K continuity tests/minute and 4K-10K leakage (at up to 1500 VDC) tests/minute—more than double those previously possible.

FACT-PC complements existing FACT-II systems. Programming, output connectors and fixturing are common between the FACT-PC and FACT-II.

And these FACT interconnection devices help optimize system productivity:
FACT-AID (Automatic Interconnection Device) permits rapid electrical hookup of multilayer boards and backplanes under fully automatic control.

FACT-LIFT (Low Insertion Force Technique) achieves multipin electrical contact to hook up thousands of backplane contacts positively in seconds.
FACT-QUIC (Quick Universal Interface Connector)is for rapid interconnection to FACT switching modules.
FACT SPRING PROBE ADAPTERS are fixtures that feature Quick Interchangeable Test Heads with contact densities of up to 400 probes/sq. in.

The FACT systems and associated interconnection devices offer you the most efficient, economical solution to exacting, large-volume wiring analysis. Two brochures, "FACT-PC" and "The FACT System," explain in detail. Ask for them at Industrial Products Division, FACT Systems, Hughes Aircraft Company, PO Box 92904, Los Angeles, CA 90009; (213) 670-9040.



**HUGHES**
HUGHES AIRCRAFT COMPANY
INDUSTRIAL PRODUCTS DIVISION
FACT SYSTEMS

# Lab automation made simple

Now you can quickly and economically hook up most analytical instruments and test equipment to most computers. The IBM 7406 Device Coupler can be connected in hours. By taking advantage of high-level languages and interactive computing, the Device Coupler reduces clerical effort and improves the precision of data acquisition. It also permits the user to take greater advantage of the performance already built into existing equipment. At prices that start at only $3050, the Device Coupler can be configured with special combinations of analog and digital input and output modules to fit most application needs.

Find out how the Device Coupler can be put to work for you. Write or call Henderson Cole (Collect) at (914) 696-4575.

**IBM 7406**
**Device Coupler**
Permits the attachment of user analog or digital equipment to local or remote computer systems via dial-up or hard-wire lines and controls the two-way flow of data between user equipment and a computer or a terminal or both.

**Highlights**
- Ease of use
  - No new programming skills required
  - No hardware/software changes required with in-line configuration
  - Operable under existing interactive languages, e.g. APL, FORTRAN, PL/1, BASIC
- Modular and economical
- Easily adaptable to a variety of environments
- Access to interactive computing permits selection of appropriate
  - File management/data storage capabilities
  - High level language and graphics support
  - Computer power required for user's application.
- Off-line capability with IBM 7407 Tape Drive Unit (or equivalent)
  - Provides local data storage of up to 60,000 characters of information.
  - Permits recording, transmission and/or retransmission at up to 400 characters per second.
- Terminal/Communications Compatibility
  - IBM 2741, 3767, Communicating Magnetic Card Selectric Typewriter (or equivalent)
  - IBM 5100 (or equivalent)
  - Teletype 33/35 (or equivalent)
  - Tektronix 4013 (or equivalent)
  - Standard line speeds from 110 to 9600 bps

**Available Modules**
- Systems Communication Module (SCM)
- Digital Input Module (DIM)
- Digital Output Module (DOM)
- Analog Input Module (AIM)
- Analog Output Module (AOM)
- Data Logging Module (DLM)

**Application Examples**
- Liquid Chromatograph Automation
- X-Ray Spectroscopy
- General Experiment Automation
- Production Line Monitoring
- Process Unit Monitoring
- Scale Monitoring
- Numerical Machine Tool Control
- Electric Motor Testing
- Circuit Design and Testing

**Physical Characteristics**

| | |
|---|---|
| Height | 27.3 cm (10-3/4") |
| Width | 43.5 cm (17-1/8") |
| Depth | 54.6 cm (21-1/2") |
| Weight | 43.2 Kg (95 lbs) |
| Current | 4.0 amps |
| Voltage | 115 VAC |
| Frequency | 60 Hz |
| Phase | 1 |

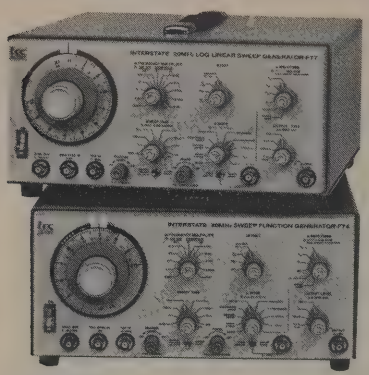
**Environment**
- IBM Class "C" building environment (non airconditioned with normal winter heating and ventilation)
- Temperature range: 10-40°C (50-105°F)
- Relative Humidity: 8-80%
- Maximum Wet Bulb or Dew Point: 26°C (80°F)

IBM® INSTRUMENT SYSTEMS
1000 Westchester Avenue, White Plains, New York 10604

INTERSTATE ELECTRONICS CORPORATION
SUBSIDIARY OF ATO

# Bench and Programmable Instruments for laboratory, production, and service.

## Function Generators: sine, triangle, square wave, 0.00002 Hz to 20 MHz.



### Series 70
**Broad Range With Plenty of Power**

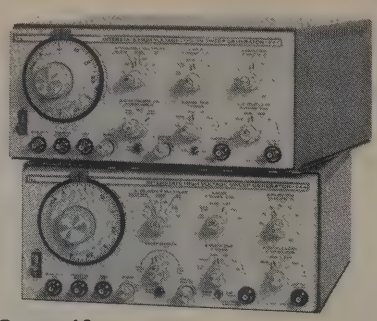
SERIES 70, a universal signal-source line, offers the ultimate blend of function, pulse, and sweep generator capabilities. Four SERIES 70 models to choose from, all producing sine, square, triangle and dc-level waveforms with 5/95% waveform variable symmetry control, fixed and variable offset, and calibrated coarse/fine frequency tuning. Model F72 combines the capabilities of "true pulse" and function generators into one versatile unit. Models F74 and F77 add sweep capabilities to the "true pulse" and function generator combination. Top-of-the-line F77 also offers selectable log/lin sweep, sweep sync, and analog power amplifier capabilities.

**F71**
- 0.00002 Hz to 20 MHz range
- 15 V p-p into 50 ohms
- constant duty cycle pulses
- 1000:1 VCF
- waveform inversion
- high/low output, 30-dB separation

**F72**
- adjustable rise/fall pulses to 15 ns
- 3 ns to 1000 ms adjustable pulse width
- trigger & gate with variable start-stop phase
- external synchronization
- plus all other F71 features

**F74**
- fixed rise/fall pulses — 15 ns
- 3 ns to 10 ms adjustable pulse width
- 60-db step attenuator with vernier
- continuous & triggered sweep, sweep-and-hold & burst modes
- sweep up/sweep down
- direct-reading sweep limit control
- sweep ramp/frequency analog outputs
- trigger & gate with variable start-stop phase
- external synchronization
- plus all other F71 features

**F77**
- selectable logarithmic/linear sweep characteristics
- sweep synchronization
- analog power amplifier
- plus all other F74 features



### Series 40
**High Performance in the Medium Price Range!**

This new high voltage (40 V p-p output) line offers five models, some including frequency marker and calibrator. These units also feature bipolar and unipolar positive and negative variable width pulses down to 120 nsec with rep rates to 4 MHz. F44 features true sweep generator characteristics such as 1000:1 linear sweep capabilities, sweep ramp output, continuous and triggered sweep and direct-reading sweep limit. F47 combines the features of the F44 with 10,000:1 logarithmic sweep and 11-point step frequency calibration between main dial settings. F46 gives the user AM/FM function generator capabilities with sinewave to 8 MHz, internal 400 Hz modulation and a 40-dB dynamic range.

**F41**
- continuously variable vernier
- 0.0004 Hz to 4 MHz range
- 20 V p-p into 50-ohms
- analog of frequency out
- 1000:1 VCF (FM)
- 11-point calibrator
- variable offset
- sine, square, triangle, dc waveforms & variable width pulse

**F43**
- external synchronization
- trigger & gate modes with variable start-stop phase
- variable symmetry
- plus all other F41 features

**F44**
- sweep ramp output
- frequency marker
- direct-reading sweep limit
- continuous & triggered sweep
- plus all other F41 features except calibrator

**F46**
- sinewave to 8 MHz
- internal 400 Hz modulation
- AM 40-dB dynamic range
- plus all other F41 features except calibrator

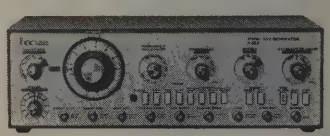
**F47**
- selection of linear or logarithmic sweep characteristics
- 11-point calibrator
- plus all other F44 features

### Series 30
**Interstate's Best Selling Economy Line!**

The most popular models in the SERIES 30 line are F31 and F34 — thousands of satisfied users agree that the price/performance value of this line is excellent. F31 provides clean sine, square, triangle, and adjustable dc. F34 adds trigger and gate, variable width pulse and sweep waveforms — continuous, triggered and burst — plus Interstate's exclusive direct-reading sweep limit control and calibrated coarse/fine frequency vernier.

**F31**
- 0.03 Hz to 3 MHz
- 10 V p-p into 50 ohms
- 2-step, 40-dB attenuator
- 1000:1 VCF
- ±5V offset into 50 ohms

**F34**
- continuous & triggered sweep & burst modes
- direct-reading sweep limit control
- analog of frequency out
- 5-step, 60-dB attenuator
- trigger & gate modes
- variable width pulse
- plus all other F31 features



**F55A**
**The Sophisticated Generator with Phase-Lock and Phase-Shift**

Phase-lock output is phase-coherent and adjustable in phase through 360° with respect to a reference signal. F55A's special phase-lock capability permits input signal to be frequency-multiplied or divided, as well as changed to any other form. Comprehensive pulse and waveform generation, multiple operating modes, and a host of superior performance features enable this precision instrument to fulfill critical instrumentation parameters for exacting laboratory situations.

- 0.00001 Hz to 11 MHz range
- 3 mV to 15 V p-p into 50 ohms
- sine, square, triangle, ramps
- fixed & variable offset
- 1000:1 VCF
- fixed & variable width pulses & ramps
- pulse width modulation
- trigger & gate modes
- continuous & triggered sweep, sweep-and-hold modes
- burst — single or multiple cycles
- direct-reading sweep limit control
- variable start-stop phase
- waveform inversion
- phase-lock

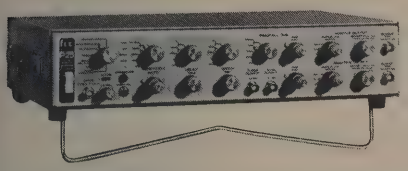
## INTERSTATE ELECTRONICS CORPORATION

Dept. 7000, P.O. Box 3117, Anaheim, California 92803 • 714-772-2811 • TWX 910-591-1197 • TELEX 655443 & 655419

# Programmable and Bench Instruments for production, laboratory, and service.

INTERSTATE ELECTRONICS CORPORATION
SUBSIDIARY OF ATO

## Pulse Generators: constant duty cycle, variable rise/fall, pulse rates to 50 MHz, and more.



### Series 20
**Engineered to Perform All Your Pulse Requirements**

Constant duty cycle mode and pulse amplifier mode, in addition to standard pulses, make SERIES 20 pulse generators tremendously versatile instruments, outstanding for their price. Pulse width delay from 10 nsec to 1 second, full range offset, normal and double pulse, trigger and gate modes with slope and level adjustments are standard on all models. P22 and P24 offer selectable positive or negative output. P24 and P25 have variable rise/fall times from 5 nsec to 0.5 sec. P23 and P25 feature simultaneous positive and negative outputs.

### P22
- 1 Hz to 50 MHz range
- 10 V p-p output into 50 ohms
- single output, selectable positive or negative pulses
- fixed rise/fall times less than 3.5 ns

### P23
- dual outputs, simultaneous positive & negative pulses
- fixed rise/fall times less than 3.5 ns for each output
- plus all other P22 specifications & features

### P24
- single output, selectable positive or negative pulses
- adjustable rise/fall times from 5 ns to 0.5 sec
- independent rise & fall controls
- plus all other P22 specifications & features

### P25
- dual outputs, simultaneous positive & negative pulses
- adjustable rise/fall times from 5 ns to 0.5 sec for each output
- independent rise & fall controls
- plus all other P22 specifications & features

## Programmable Generator: plug-in features, 0.01 Hz to 14 MHz, IEEE 488 bus, and more.

### SPG-800
**Programmable Generator combines all these instruments in one:**

- **Synthesizer**
- **Pulse Generator**
- **Function Generator**
- **Voltage Source**

This exciting product from INTERSTATE gives Automatic Test Equipment system designers a truly universal signal source. SPG-800 not only has all the top performance specifications of each of these four plug-in programmable instruments individually, but several unique extra capabilities from the synergistic effect of their interaction.

### Interface Options
- IEEE 488, RS-232-C and 20 mA loop, BCD. (ASCII is standard)
- opto isolation available
- manual front panel with double entry keyboard and display
- data output bus available

### Programmable Function Generator
- sine, square, triangle, ramp, pulse and more
- continuous, trigger, gate, AM and FM modes and more
- 0.1 Hz to 14 MHz, 10 mV p-p into 50-ohm load

### Programmable Synthesizer
- frequency accuracy to 0.0001%
- tracking signal output (31-43 MHz)
- 1 MHz crystal reference output
- 1 MHz external precision reference input
- 0.1 Hz to 14 MHz, 10 mV p-p into 50-ohm load

### Programmable Pulse Generator
- true pulse generator with variable rise/fall to less than 20 ns
- width and delay from 40 ns
- single or double pulse modes
- unipolar or bipolar pulses
- 0.1 Hz to 14 MHz, 10 mV p-p into 50-ohm load

### Programmable Voltage Source
- three-digit resolution to ±9.99 V
- 0.1 Hz to 14 MHz, 10 mV p-p into 50-ohm load

### Counted Burst
- counts any waveform, up to 19,999 counts or double pulse to 39,998
- computer or manually initiated

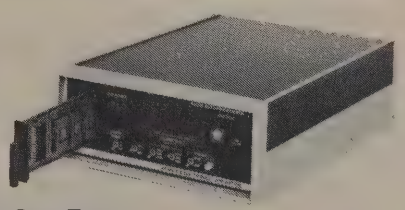
## Programmable Controller: 2048 bytes of plug-in memory, EPROM or PROM, 8-byte control outputs.

### A-1000
**For control of small systems in production, quality control, and the laboratory.**

Low-cost A-1000 programmable controller operates the SPG-800 programmable generator or other devices capable of accepting commands from either an ASCII bus or an auxiliary 8-byte (TTL level) latched output. A-1000 brings the power and convenience of computer-driven ATE to smaller, less-demanding jobs.

### Programming
Available with EPROM, fusible-link PROM, or sockets only. Front-panel, plug-in memory card contains 2048 bytes. Accommodates programs up to 99 steps each.

### Operation
Front-panel pushbutton or external control of each test sequence. Also, end-of-program sequence and stop. High-volume repetition. High and low sequence limits set on front-panel switches.



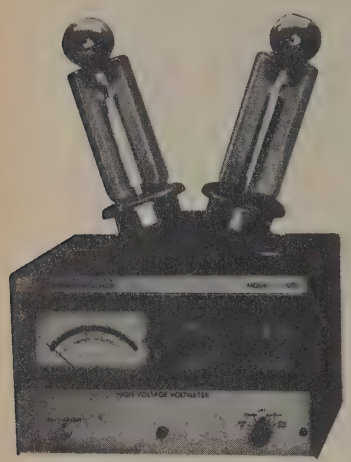
### Step Rate
Front-panel, variable, step-rate control and program-selectable delays of 25 msec. Front-panel controls for delays of 1-10 sec. Manual or remote 1-bit trigger signal.

Also providing systems, products, and services to the world of

## Information Processing and Display

# high voltage test and measuring equipment

## SOLID STATE AC VOLTMETER



MODEL J-1005

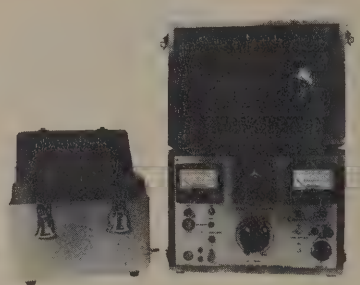
A compact, portable instrument for the accurate, direct reading of very high voltages at rf, audio and power frequencies . . . determination of the amplitude of pulses with oscilloscope connections for viewing wave shapes . . . removable high voltage input circuit for remote panel mounting of the meter . . . internal battery and ac line operation.

| Specifications | Model J-1005 |
|---|---|
| Voltage Ranges | Peak Kilovolts (single-ended) 0-2.5, 0-5, 0-10, 0-25, 0-50<br>Peak Kilovolts (double-ended) 0-2.5, 0-5, 0-10, 0-25, 0-50, 0-100 |
| Frequency Response | Flat from 10 Hz to 20 MHz at full rated voltage. |
| Accuracy | ±3% of full scale on all voltage ranges. |
| Oscilloscope Connection | 600 to 1 division ratio (approx.). |
| Meter Calibration | The meter is calibrated in peak kilovolts with linear voltage scales of 0-2.5, 0-5, 0-10, 0-25, 0-50. |
| Input Impedance | Greater than 2 x $10^{12}$ ohms and approx. 4 pf single-ended to ground, 2 pf double-ended. |
| Power Supply | 117/230 volts ±10%, 50/60 Hz, 5 watts, or rechargeable battery. |
| Dimensions | Height, 16″; width, 10¾″; depth, 8″. |
| Net Weight | 12 pounds (approx.). |

## PORTABLE AC HIGH VOLTAGE TESTER

MODEL JHP-70A

The smallest and lightest instrument available at its power level the JHP70A will generate and measure 70,000 volts peak for on-site testing of high voltage components such as capacitors, switches, transformers, bushings, vacuum tubes, etc.



**Maximum Output Voltage ..... 70 KV Peak**
**Maximum Continuous Current ..... 21 MA RMS**
**Short Circuit Current (Est.) ....100 MA RMS**
**Power Requirements .....105-125 Volts RMS**
**Frequency .....50-60 Hz**
**Current .....15 Amps**
**Surge Current .....10 Amps**
**Weight:**
**Control Cabinet .....28 lbs.**
**Transformer .....43 lbs.**

## HIGH VOLTAGE AC DIVIDER

MODEL 13200

These dividers can be used with an oscilloscope to measure and observe voltages up to 50 kv at frequencies up to 20 MHz. Their low circuit loading design and shielded construction make them particularly suitable for rf measurement applications including tank circuit and transmission line voltages, pulse parameters, modulation voltages, and transient wave characteristics.

| Specifications | Model 13200 |
|---|---|
| Voltage | 50 kv peak |
| Current | 12.5 amperes RMS maximum through the voltage divider. |
| Input Impedance | Above $10^{12}$ ohms, 4 pfd. |
| High Frequency Response | Flat to 20 MHz at 50 kv peak; maximum frequency 50 MHz at 20 kv peak. |
| Division Ratio | 325:1 to termination of 3 ft. of RG-58A/U cable. |
| Low Frequency Response When operated into shunt resistance of 1 megohm<br>10 megohms | 1000 Hz<br>100 Hz |
| Weight | 2 lbs. 4 oz. |

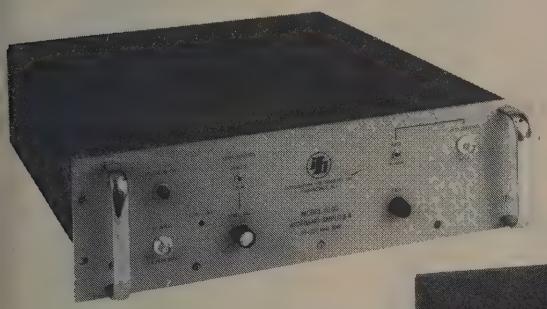
ITT JENNINGS Dept. EM, 970 McLaughlin Ave. • San Jose, CA 95122 • (408) 292-4025
DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

# BROADBAND POWER GENERATING AND MEASURING SYSTEMS

From milliwatts to kilowatts, Hertz to megahertz—IFI offers a complete line of high gain, high power, wideband amplifiers and associated measuring equipment. The IFI catalog lists more than 25 standard models. Frequency and outputs can be tailored to your specific requirements. A few products are shown below. Call for information about your requirements.

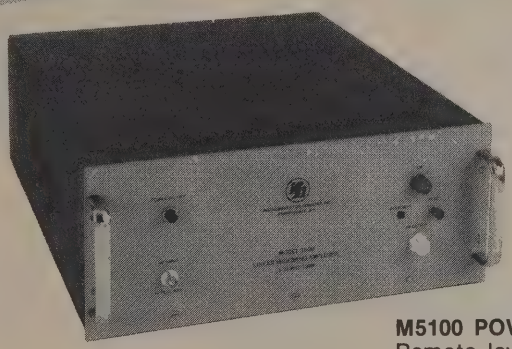
**FEATURES**

- ☐ **High quality, rugged commercial construction**
- ☐ **Thermionic and solid state units**
- ☐ **High power gain: drive with signal generator**
- ☐ **No tuning, no bandswitching**
- ☐ **Fully protected, metered**
- ☐ **System compatible, modular**
- ☐ **Drive mismatched loads**

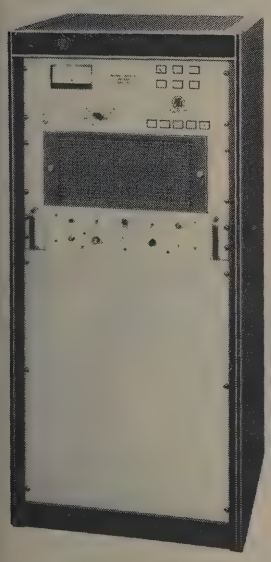


**M1600 POWER AMPLIFIER**
Solid state. 130 watts linear output (300 W saturated). Operates into any load impedance from open to short. 0.5 to 50 MHz, 55 dB gain. Other models 5 to 1000 watts.

**M2600 POWER AMPLIFIER**
Special control features for scientific and biological use. Supplies constant voltage or power to load regardless of impedance changes. Rated 130 watts, 0.5 to 35 MHz.

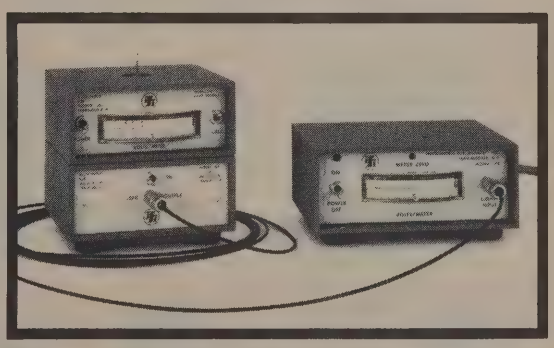


**M5100 POWER AMPLIFIER**
Remote leveling capability. Works into any load impedance. Rated 10 watts; 10 kHz to 250 MHz; 40 dB gain.



**M406 POWER AMPLIFIER**
High power (1 kW), high gain (60 dB), broad range (10 kHz to 220 MHz) make the M406 the most versatile off-the-shelf wideband amplifier available today.

**EFS-1 FIELD SENSOR**
Measures E-fields from 10 kHz to 300 MHz. No tuning or bandswitching...**NEW:** Model EFS-2 offers CW/pulse capability; EFS-3, CW/pulse/monopulse. Accessories for remote operation, including fiber optic data link.



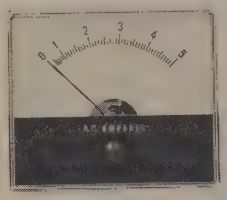
**INSTRUMENTS FOR INDUSTRY, INC.**
151 TOLEDO STREET/FARMINGDALE/N.Y. 11735/516-694-1414 ■ Cable: Electronic Hallandale, Fla.
TELEX: 51-43-32

# Jewell
ELECTRICAL INSTRUMENTS, INC.

# PANEL METERS
# AVIONIC PRODUCTS

KATY INDUSTRIES, INC.
SUBSIDIARY

## Series MS Series

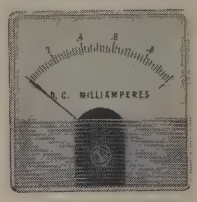


Three sizes available, 1½" (Model MS1), 2½" (Model MS2), 3½" (Model MS3) . . . painted cover section can be color styled . . . the modern meter for the modern look.

## VU Meters

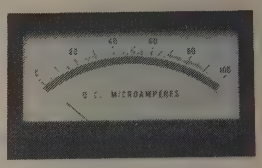
Used for monitoring volume levels in broadcast, recording and communication applications . . . meter is essentially a rectifier-type AC voltmeter of high sensitivity . . . built in some of the conventional meter case designs.

## Series 70 Meters




Available in 5 sizes, 1½" (Model 71), 2½" (Model 72), 3½" (Model 73), 4½" (Model 75) and 6" (Model 76). All meters front panel mounted . . . behind the panel mounting with black bezel on 2½, 3½ and 4½" models. Available with taut band, pivot and jewel and iron vane movements.

## Model 65 Meters

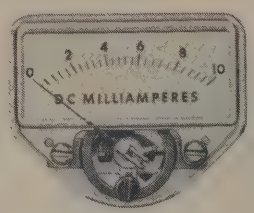



A rectangular styled meter with zero adjustment screw located on front face . . . dial is mounted flush with panel . . . Available with pivot and jewel and taut band.

## Series MM Meters

Medallion styled panel meters available in three sizes (1½, 2½ and 3½"). Painted portion of cover can be color styled. Available with taut band, pivot and jewel and iron vane movement.

## Series 80 Meters




Series 80 Taut Band meters affords functional design that provides maximum visibility in minimum space. Available in three sizes (1½, 2½ and 3½").

## Series HS Meters

These meters are noted for their resistance to shock and vibration . . . mechanisms are mounted on rubber at three points . . . special pivots, hair-springs and fastening techniques reduce effects of hard usage. 1½, 2½ and 3½" models.

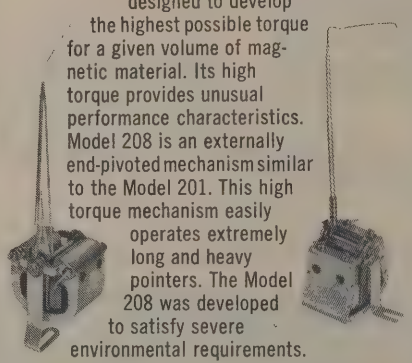
## Model 45 Meters

Modern industrial styling on a 4½" meter with bakelite cover and glass window. Available with taut band, pivot and jewel and iron vane movements.

# AVIONIC PRODUCTS

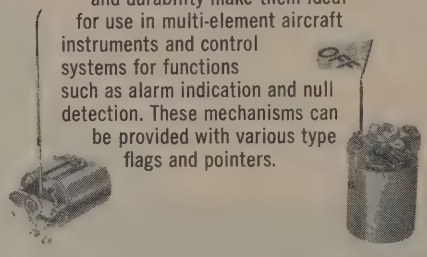
## Mechanisms 201/208

The Model 201 was designed to develop the highest possible torque for a given volume of magnetic material. Its high torque provides unusual performance characteristics. Model 208 is an externally end-pivoted mechanism similar to the Model 201. This high torque mechanism easily operates extremely long and heavy pointers. The Model 208 was developed to satisfy severe environmental requirements.



## Mechanisms 202/215

The Model 202 and the Model 215 are center pivoted coaxial flag mechanisms. Lightweight, compact size, and durability make them ideal for use in multi-element aircraft instruments and control systems for functions such as alarm indication and null detection. These mechanisms can be provided with various type flags and pointers.



## Mini Indicators

The Model 240 Mini Indicator features a compact moving-coil mechanism which is available in a range of easy to read pointer configurations. This versatile mechanism is also utilized in the Model 241 flag indicators. These compact units provide a confusion-proof display of on-off information such as alarm, position, or malfunction.

Jewell ELECTRICAL INSTRUMENTS, INC. DEPT. EM GRENIER FIELD, MANCHESTER, NH 03108 (603) 669-6400 TELEX 94-3435

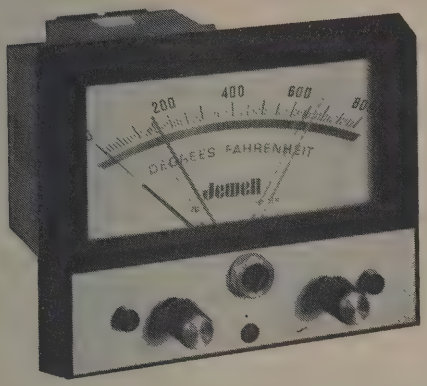
# Jewell
ELECTRICAL INSTRUMENTS, INC.

# INDICATING CONTROLLER PANEL METERS AVIONIC PRODUCTS

KATY INDUSTRIES, INC.
SUBSIDIARY

## INDICATING CONTROLLER

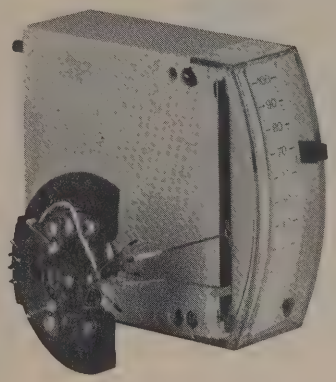
**A Versatile Solid-State Meter Relay for AC, DC and Temperature Ranges**




### FEATURING

- ☐ PLUG-IN POWER SUPPLY
- ☐ ON-OFF OR TIME PROPORTIONING
- ☐ HORIZONTAL OR VERTICAL MOUNTING
- ☐ RECORDER OUTPUT
- ☐ 4″ MIRROR BAKED SCALE
- ☐ PUSH-TO-SET KNOB
- ☐ PLUG-IN DPDT RELAY
- ☐ ¼″ DIN HOUSING
- ☐ SINGLE OR DOUBLE SET POINT
- ☐ THERMOCOUPLE BREAK PROTECTION
- ☐ LATCHING WITH MANUAL RESET
- ☐ FIXED SET POINT
- ☐ SLAVE SET POINT
- ☐ TRIAC OUTPUT
- ☐ SCREWDRIVER SET POINT ADJUST

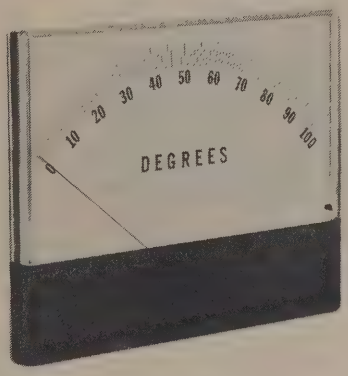
## EDGEWIZE METERS AND MECHANISIMS FOR THE OEM



### FEATURING

- ☐ SINGLES AND DUALS
- ☐ MAGNETICALLY SHIELDED
- ☐ LEXAN™ CASE AND COVER
- ☐ 1% TRACKING
- ☐ SPRING SET SAPPHIRE JEWELS

## 8″ PANEL METER

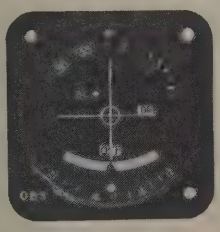



### FEATURING

- ☐ PIVOT AND JEWEL
- ☐ TAUT BAND
- ☐ IRON VANE
- ☐ UL APPROVED CASE
- ☐ CUSTOM DIALS

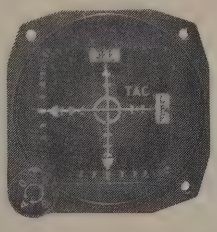
## AVIONIC PRODUCTS

### 308, 309 Indicators



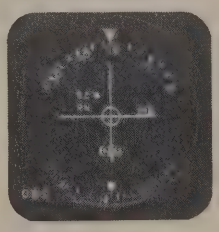
A course Indicator illustrates the degree of deviation from a selected flight path. The basic course indicator contains a Localizer Pointer, a To-From-Off flag and servo course selector. The 309 ILS Indicator is a modified 308 to contain a Glide Slope pointer and associated power failure flag which indicates aircraft deviation from the glide slope path.

### Hover Indicator



The Hover Indicator was designed to provide doppler or cable drift information to the helicopter pilot. This instrument is a flight director and is capable of being operated in four models: (1) Automatic Flight Control System (A.F.C.S.), (2) Ground Velocity Reference (G.V.R.), (3) Tactical Air Navigation Beacon Systems (TAC/TACAN), (4) Visual Omni Range (On-On/VOR).

### 328, 329 Indicators



These course Indicators are highly sophisticated versions of the 308 and 309 models utilizing resolvers, synchros and control transformers which yield greater accuracy required in the more advanced navigation systems such as Area Navigation (R/NAV).

Jewell ELECTRICAL INSTRUMENTS, INC. DEPT. EM GRENIER FIELD, MANCHESTER, NH 03108 (603) 669-6400 TELEX 94-3435

# JULIE RESEARCH LABORATORIES INCORPORATED

# LOCOST 106

**• LEASING A LOCOST SAVES THE AVERAGE CALIBRATION LAB A MIN. OF $4000/MONTH.**

## FEATURES

- High-reliability multi-station capability without limitations of central-processor time sharing.
- Requires zero software design by the user.
- Multi-function/Multi-instrument/Multi-parameter automation of short run test routines.
- Completely modular, endlessly field-expandable and totally non-dedicated.
- Based on NBS-traceable, state-of-the-art, ratiometric measurement technology.
- Dated, unconditionally guaranteed fully functional turnkey on-site performance . . . on-line, in your facility, from 84-114 days ARO.
- Provides economical solutions to all requirements from 2½-digit production ATE to 7½-digit standards-laboratory automation.

## APPLICATIONS

- Completely automated production batch-testing of electrical and electronic components at accuracy levels from ±1% to ±0.00001%.
- Versatile short-run multi-point/multi-parameter testing of active and passive networks, circuits, subsystems, and systems.
- Automatically programmed data-logging of physical parameters into electrical qualities.
- Comprehensive life-test measurement and categorization of components, circuits and equipment by quality.
- Automated stimulus/response testing of circuit modules, subsystems and complete equipment.

## SUPPORT COMPONENTS

- Master Program Cassettes.
- Disc memories for mass program storage.
- Fundamental standards of EMF, resistance, ratio and AC/DC transfer.
- Data-link Modems.
- Programmable Resistance (Standard Model PRS-106).
- Power amplifiers providing up to 1200 V and 200 W AC output.
- Programmable resistive dividers providing up to 1 million precise ratios.
- Graphic Displays.
- Computer-compatible D/A & A/D converters.
- Function, Signal, Pulse, Word and Sweep Generators.

System can include pulse/function generators, frequency synthesizers, distortion analyzers, vector voltmeters, phasemeters. Peripherals available for complete oscilloscope testing.

## DESCRIPTION

From the leading manufacturer of precision standards and measuring instrumentation, Julie Research, a new computer controlled test system is available at a low cost to fit into the budgets of even small calibration and testing laboratories.

LOCOST* features a combination of computer, data terminal, high speed thermal printer, programming cassette memory and a programming calculator which can be operated by lab technicians with little or no computer and programming experience. It uses BASIC language, has an alphanumeric keyboard and an interactive 32-character display, as well as a built-in 15Kbyte main-line memory. Cassette memory is 32,000 words. Capability of the calculator is equivalent to a 10K or 12K minicomputer. A unique, labor saving feature of LOCOST* is its unique programmed software which makes it possible to generate, store, and carry-out test programs for new instruments efficiently. Simple questions concerning the specifications of the instrument under test are asked by the calculator and the operator answers these questions by typing specifications such as full-scale accuracy, etc. When completed, these specifications are then stored on cassette memory for future reference and use by the system's preprogrammed meter test routine. Programming costs are 80 to 90% lower than for conventional computer controlled systems.

A complete array of programmable DC and AC test instrumentation is available to satisfy even the most demanding testing and calibration applications. LOCOST* is a highly flexible user oriented system and is expandable in both hardware and software. Extended range instruments for both stimulus and measurement may be integrated into these systems at the time of purchase or at a later date as new requirements arise. Typical systems that are available include:

## POPULAR LOCOST 106 MODELS

LOCOST 106 MINI (ON SITE) SYSTEM ..... From **$18,250/year**
Gives the user all the capabilities necessary for full-range precision measurement and limited range precision DC stimulus: calibrates and prints out complete data for potentiometers, decade boxes, meter functions, dividers, bridges, dc power supplies, DC voltage and current calibrators, standard cells, standard resistors, meter shunts, load cells, strain gauges, temperature, resistors, networks, and others. Does double duty as an automated on-site test system. (1)

LOCOST 106 DC/LF SYSTEM ..... From **$40,000/year**
Adds full-range precision AC and DC stimulus to the MINI system: in addition to the capabilities listed above gives full range precision calibration of all meters (AC and DC, digital and panel), volt boxes, high current shunts, AC voltage and current calibrators, etc. (2)

LOCOST 106 OSCILLOSCOPE/PLUG-IN SYSTEM ..... From **$26,500/year**
A complete stand alone automated system to provide fully automated calibration of oscilloscopes and plug-ins. (2)

LOCOST 106 STANDARD SYSTEM ..... From **$57,350/year**
Combines the LOCOST 106 DC/LF AND OSCILLOSCOPE/PLUG-IN systems in a single system. (3)

LOCOST 106/2 DUAL STATION UNIVERSAL SYSTEM ..... From **$70,000/year**
A complete two station automated system, as in the STANDARD system, with the addition of a second, fully independent work station and added capability for calibration of pulse and function generators, oscillators and counters. (4)

(1) This system produces savings of over $20,000/yr in a plant with $75,000 total present Standard/Calibration/Repair payroll

(2) This system produces savings of $30,000 to $55,000/yr in a plant with $150,000 to $250,000 total present S/C/R payroll

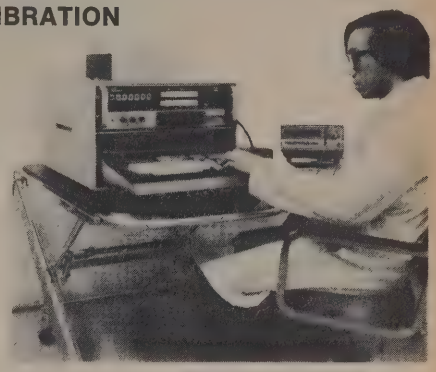
(3) This system produces savings of $55,000/yr (one shift) to $110,000/yr (two shift) in a plant with $150,000 to $300,000 total present S/C/R payroll

(4) This system produces $120,000/yr savings (one shift) in a plant with $400,000 total present S/C/R payroll

**JULIE RESEARCH LABORATORIES, INC.** • 211 W. 61 ST., NEW YORK, N.Y. 10023 • (212) 245-2727 • TWX: 710-581-5138

# JULIE RESEARCH INCORPORATED LABORATORIES

## LOCOST 106 MINI SYSTEM PRECISE, MOBILE ON-SITE CALIBRATION



**DESCRIPTION AND APPLICATIONS**

The Mini-System features high accuracy and resolution for a wide range of electrical and transducer test and measurement parameters. Utilizes the JRL Model DM-1060 1 PPM ACCURACY DIGITAL MULTIMETER LOCOST 106 ATE System interfaces and software and a modified HP computer calculated to provide a compact flexible data measuring, data processing, data formatting and recording system. Also functions as a computer (tape cassette) programmed tester, supplying voltage and current stimuli for calibrating measuring or recording devices.

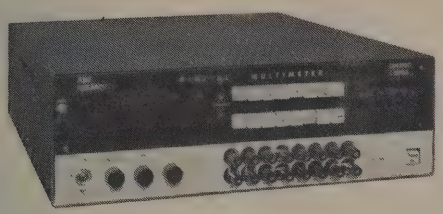
**System Features:**

- High Accuracy DM-1060 Measuring System
- Universal Data Logging, Processing and Formatting
- Programmed Testing and V/C Source
- Master Program Software (No Computer Expertise Required)
- Computer Coupling Directly to Many Peripheral Devices
- Simplified Editing and Debugging

Computers with JRL master program cassette controls measurement sequence selects modes of operation and ranges and then records, formats and processes data with results stored on tape cassettes or optionally displayed on peripheral devices.

**HIGH-RELIABILITY MULTIPLE-STATION SYSTEM 106N.** Up to 4 dedicated LOCOST 106 workstation complements may be interconnected so as to share a 2.4 megaword mass memory, and provide an order of magnitude higher reliability to the test line.

## PROGRAMMABLE AC/DC MULTIMETERS AND PRODUCTION CALIBRATORS DM-1000 SERIES DIGITAL MULTIMETERS TO 1 PPM ACCURACY/RESOLUTION/ STABILITY

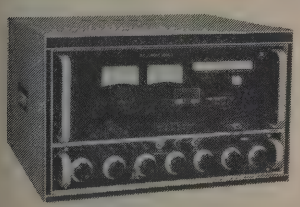


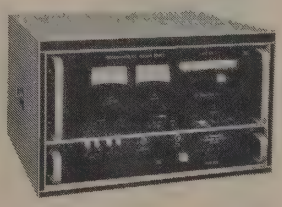
JULIE RESEARCH, for 15 years the pioneer in the manufacture of Precision Standards, now leads the way in providing Multimodel automatic precision calibrators. The new approach to production measurements with three sigma certainty reduces test equipment costs and testing time. The DM-1000 Multimeter doubles as a Ratiometer and Voltage Source in addition to measuring Voltage, Resistance and Current to 1 ppm. Just a few of this amazing instrument's uses are:

- **CALIBRATING DVM's AND DMM's** — 2½ digits to 5½ digits, with full confidence.
- **CALIBRATING A/D AND D/A CONVERTERS** — 8-bit to 20-bit binary resolution.
- **CALIBRATING ANALOG TRANSDUCERS** — to unprecedented orders of precision.
- **MEASURING ZENER DIODES AND STANDARD CELLS** — 1% to 0.0001%, automatically.
- **MEASURING RESISTORS AND NETWORKS** — both absolute resistance and ratios.
- **CALIBRATING POTENTIOMETERS AND ATTENUATORS** — both linear and nonlinear.
- **MEASURING POWER-SUPPLY CHARACTERISTICS** — absolute output, regulation, tracking, stability.
- **CALIBRATING AC SIGNALS AND GAINS** — over 30 Hz-5 kHz, with excellent linearity.
- **STANDARDIZING CURRENT SOURCES** — over wide ranges, to unprecedented accuracy.
- **MONITORING PROCESS VARIABLES** — electrical parameters, temperature, strain, pressure, etc.

These new calibrators are the ultimate in accurate DC measurements, offering numerous benefits which yield the most reliable and flexible operation ever. Some of the more obvious benefits are low parts count for reliability, ease of programmable application for quality measurements with isolated data output with BCD input, and output options.

## DC VOLTAGE AND CURRENT SOURCES, MANUAL AND PROGRAMMABLE



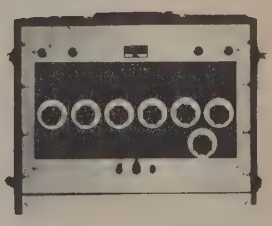


| Model | Outputs |
|---|---|
| *AVS-106 | 0 to ±12, 120, 1200V, 6 digits |
| DVS-106 | 0 to ±12, 120, 1200V at 35 ma, 7 digits |
| *ACS-106 | 0 to ±1.2, 12, 120 ma; 1.2, 12 Amps |
| DCS-105 | 0 to ±1.2, 12, 120 ma; 1.2, 12 Amps |
| DCS-106 | 0 to ±1.2, 12, 120 ma; 1.2, 120 Amps |
| *ACV-106 | 0 to ±1.2, 12 ma; 0-12V, 120 Volts |

| Accuracy | Stability | Linearity |
|---|---|---|
| To 2 ppm | To 5 ppm/30 days | To 1 ppm |

* Compliance Programmable

## VOLTAGE DIVIDERS



| Model | Accu. (ppm) | Lin. Resol. (ppm) | Stability (ppm/yr.) | Resistance (Kohms) | Max. Volts | Mode of Operation |
|---|---|---|---|---|---|---|
| VDR-106/7H | 1 (5 yr.) | 1 | 1 | 100 | 700 | Manual |
| VDR-106/7 | 1 (5 yr.) | .1 | .2 | 100 | 300 | Manual |
| VDR-307 | 1 (5 yr.) | .1 | 1 | 100 | 700 | Manual |
| VDR-307J | 1 | .1 | 1 | 100/110/120 | 700 | Manual |
| *RVD-106 | 1 | 1 | .5 | 100 | 200 | Prog./Manual |
| *RVD-126 | 1 | 1 | .5 | 100/110/120 | 200 | Prog./Manual |

* All RVD Programmable Dividers are standard with BCD input/output.

**JULIE RESEARCH LABORATORIES, INC.** • 211 W. 61 ST., NEW YORK, N.Y. 10023 • (212) 245-2727 • TWX: 710-581-5138

# JULIE RESEARCH LABORATORIES INCORPORATED — PRECISION MEASURING & REFERENCE EQUIPMENT

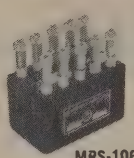
## HIGH VOLTAGE DIVIDERS/VOLT BOXES

The Julie High Voltage Dividers and Volt Boxes on the table below are used to "drop" high voltages to a level that traditional precision potentiometers and high impedance electronic voltmeters can safely measure (such as the Julie models PVP-1000S and PVP-1000C).

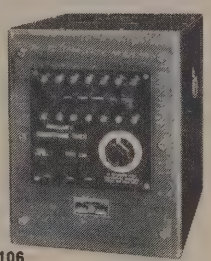
| Model | No. | Input Ranges Lowest | Input Ranges Highest | Input Imped. | Output Taps | Acc. (%) | 1 Year Stab. (%) |
|---|---|---|---|---|---|---|---|
| DV-1500 | 11 | 1 v | 1500 v | 1 Kohm/v | 1/1.5 v | .001 | .001 |
| DV-1000 | 7 | 1 v | 1000 v | 1 Kohm/v | 1/1.5 v | .001 | .001 |
| DV-1000B | 7 | 1 v | 1000 v | 1 Kohm/v | 1 v | .001 | .001 |
| HV-100/w | 1 | 100 Kv | 100 Kv | 1 Kohm/v | 1 v | .05 | .0015 |
| HV-100 | 1 | 100 Kv | 100 Kv | 4 Kohm/v | 1 v | .05 | .1 |
| KV-50/.01 | 1 | 50 Kv | 50 Kv | 1 Kohm/v | 1/10 v | .01 | .0015 |
| KV-25/.01 | 1 | 25 Kv | 25 Kv | 1 Kohm/v | 1/10 v | .01 | .0015 |
| KV-10/.01 | 1 | 10 Kv | 10 Kv | 1 Kohm/v | 1/10 v | .01 | .0015 |
| KV-10R | 1 | 10 Kv | 10 Kv | 1 Kohm/v | 1/10 v | .01 | .0015 |
| KV-VB/10 | 1 | 10 Kv | 10 Kv | 2 Kohm/v | 10 v | .05 | .005 |

## RESISTANCE REFERENCE

DMR



MRS-106

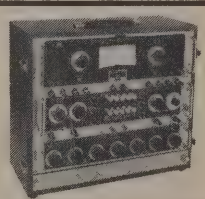


PRO-106

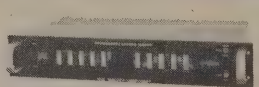
| Model | Absolute Resistance Values | Accuracy (ppm) | Room Temp. Eff. (ppm/°C) | Approximate Size (inches) |
|---|---|---|---|---|
| PRO-106 | 10 ohms to 1 Meg. | 8 | .1(0-28°C) | 10 x 14 x 15 |
| PRO-106L | .001 ohms to 10 ohms | 50-100 | .1(0-28°C) | 10 x 14 x 15 |
| MRS-106 | 100 ohms to 1 Meg. | 15 | 2.5/°C | 4 x 2 x 4 |
| MRS-105 | .1 ohms to 100 ohms | 30-100 | 2.5/°C | 4 x 2 x 4 |
| DMR Series | 10 ohms to 1 Meg. | 15 | 2.5/°C | 5 x 4 x 3 |
| BMR Series | 29,996,131,071 ohms | 15-50 | 5/°C | 5 x 4 x 3 |
| BDR Series | 100,000 ohms Max. | 15 | 5/°C | 5 x 4 x 3 |

## PRECISION RESISTANCE MEASURING SYSTEMS

| PRB-205C PLUG IN | |
|---|---|
| 0-1000 | ±1 ppm Setting ±1 ppm f.s. |
| 0-10K | ±1 ppm Setting ±1 ppm f.s. |
| 0-100K | ±1 ppm Setting ±1 ppm f.s. |
| 0-1 Meg. | ±2 ppm Setting ±1 ppm f.s. |
| 0-10 Meg. | ±3 ppm Setting ±1 ppm f.s. |



## AUTOMATIC RANDOM ACCESS SCANNER

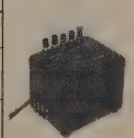


Features: Random bussing capabilities, will not degrade 1 ppm measurements, up to 10 individually Addressable Decades, 2-Pole 100-Position and most combinations in-between. Programmable, sequential, or manual modes. Thermal EMF of 0.2 μV max. Please call us for custom applications.

## SOLID STATE REFERENCES — ZENERS

**Line Regulation:** 1 ppm for 10% line charge for all models.
**Output:** +1.018, +1.0 and −5.0 volts all models except ZVR-500 Series.
**Room Temp. Efficiency:** 0.3 ppm/°C (20°C to 30°C) for ZVR-106 Series and 0.2 ppm/°C (20°C to 30°C) for ZVR-500 Series.

| Model | Size |
|---|---|
| ZVR-106B<br>ZVR-106MV (10V, 1V,.1V, .01V) | 6″ x 6″ x 4″<br>6″ x 6″ x 4″ |
| ZVR-506 (6.3V)<br>ZVR-512 (12.6V)<br>ZVR-518 (18.9V) | .84″ x .84″ x .75″<br>—<br>— |
| ZTS-106 | 1.000, 1.018 + Delta,1.019 + Delta VDC 0 to 1000 μV (Delta); ±2 ppm Accur.; 1 μV Resol.; ±3 ppm/Mo. Stable |



## AC-DC THERMAL VOLTAGE TRANSFER STANDARDS

**TNB-102 Series**

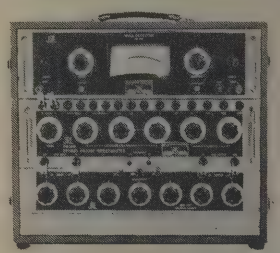
This set of two Thermoelement Modules (2.5 ma and 5 ma) and six Resistor Modules provide highest available transfer accuracy from 0.5 v to 1000 v up to 50 kHz.

Model TNB-102 Series Coaxial AC/DC Transfer Standards

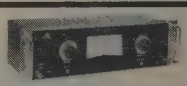
## POTENTIOMETERS

Through the use of POTENTIOMETER Plug-ins, the Multivider system is made into various precision voltage measuring systems. (Systems listed in the table below include null detector and voltage divider.)

| Range Volts | PVP-1000S Accuracy (w/self cal.) |
|---|---|
| 1000 | 8 ppm +1 ppm f.s. |
| 300 | 8 ppm +1 ppm f.s. |
| 100 | 8 ppm +1 ppm f.s. |
| 30 | 8 ppm +1 ppm f.s. |
| 12 | — |
| 10 | 5 ppm +1 ppm f.s. |
| 3 | 5 ppm +1 ppm f.s. |
| 1.2 | — |
| 1.1 | +1 μv (cell compar.) |
| 1.0 | 2 ppm +1 ppm f.s. |
| .12 | — |
| .012 | — |
| .0012 | — |



## NULL DETECTORS



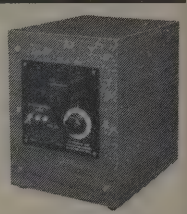
| Model | Ranges | Sensitivity | Dimensions |
|---|---|---|---|
| ND-106 | (9) 3 μv to 30 mv | .1 μv | 19 x 5¼ x 8 |

## VOLTAGE REFERENCES

**SATURATED STANDARD CELL OVENS**

The best voltage reference possible must meet two basic critical requirements —

1. Time performance; the three saturated cells used must have minimum output voltage change with time.
2. The enclosure must maintain its nominal temperature with time.

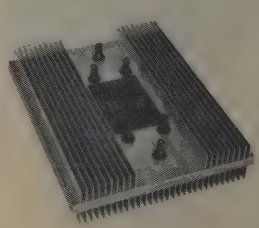


| Stability Specs | | Temperature | Time |
|---|---|---|---|
| SCO-106 | cells | .64 ppm/.01°C | 1 ppm/yr. max. |
| | oven | .01°C/day max. | .05°C/yr. max. |

## DIALABLE PRECISION DCV SOURCES

The GTX-300 Series is a high quality, compact, portable voltage source. Output settings on this 1 ppm resolution instrument range from 1 microvolt to 10 volts DC and can be made simply by dialing the desired value. Accuracies of from 0.001% to 0.005% can be ordered. Loads requiring up to 25 mA can be tolerated without accuracy deterioration. An output stability of ±3 ppm/24 hours is standard on all units.

## CURRENT SHUNTS



High quality shunts are high quality 4-terminal resistors especially designed to operate at relatively higher current levels without suffering appreciable resistance change. Most high ranges (50 A for example) are the finned heat-sink type. Most lower ranges are available in single and multiple-range (oil-filled) units. Accuracies up to .0025% are available although .05% or .01% are most typical. Yearly stabilities of .01% are typical and temperature coefficients are 5 ppm/°C or better. Ask for a data sheet.

**JULIE RESEARCH LABORATORIES, INC.** • 211 W. 61 ST., NEW YORK, N.Y. 10023 • (212) 245-2727 • TWX: 710-581-5138

# JULIE RESEARCH INCORPORATED LABORATORIES — OPTIMATION Division

**PRECISION OSCILLATORS**

| Model | Frequency Range | Frequency Accuracy | Output Voltage | Output Current | Frequency Response | Features |
|---|---|---|---|---|---|---|
| RCD-900 | 10 Hz-100 kHz | 1.0% | 0-5 | | | Digital Frequency Selection |
| RCD-901 | 10 Hz-100 kHz | 0.1% | 0-5 | | | Accurate Frequency |
| RCD-902 | 10 Hz-1 MHz | 1.0% | 0-5 | | | Wide Band |
| RCD-903 | 10 Hz-100 kHz | 1.0% | 0-11.11 absolute | 100 MA | ±.05% | Remote Sensing |
| RCD-904 | 10 Hz-1 MHz | 0.1% | 0-11.11 absolute | 100 MA | ±.05% | Remote Sensing |

**POWER OSCILLATORS**

| Model | Power VA | Frequency Range | Voltage | Features |
|---|---|---|---|---|
| AC-50 | 50 | 0.1 Hz to 100 kHz | 15 | Precision High Power |

**PRECISION POLYPHASE OSCILLATORS/POWER OSCILLATORS**

| Model | Phases Power/$\phi$ | Output V/$\phi$ | 1/$\phi$ | Regulation | Frequency Range | Amplitude Stability | Distortion | Features |
|---|---|---|---|---|---|---|---|---|
| AC-153 | 2/3 45 | 150 | 2a | adj. to Zero | 10 Hz to 10 kHz | 100 ppm | .05% | Switchable 2 or 3$\phi$ |
| RCD-2038 | 2 | 7.07 | | | .01 Hz to 10 kHz | 100 ppm | .02% | General Purpose Oscillator |
| RCD-11 | 2/3 | 5 | | | .01 Hz to 10 kHz | 100 ppm | .02% | General Purpose Oscillator |

* Options are available to extend V+1 ranges of all power oscillators and amplifiers.

**DISTORTION ANALYZER**

| Model | Frequency Range | Distortion Resolution | Input Level | Features |
|---|---|---|---|---|
| ADS-104 | 10 Hz to 100 kHz | .001% | 1 to 300 VRMS | Fully Automatic, Auto-set-level, Auto-nulling, Auto-ranging, Digital Read-out. |

## PRECISION POLYPHASE OSCILLATORS/POWER OSCILLATORS

- High Power — to 50 VA per phase
- Low Distortion — to less than 0.02%
- Fixed or Variable Stable Frequency
- Adjustable Load Regulation
- Perfectly Suited for Gyro Testing

## POWER OSCILLATORS

- Accurate Digital Frequency Selection
- Stable Amplitude — less than 0.01% variation
- Stable Frequency — 10 ppm available
- Low Distortion — less than 0.05%
- Wide Frequency Range — up to 110 kHz
- Absolute Stability Regardless of Load
- Up to 50 VA Output

## POWER AMPLIFIERS

- Low Distortion — under 0.05%
- Stable Voltage Gain — to 1 ppm
- Wide Frequency Ranges — DC to 2 Mhz
- Adjustable Output Impedance
- Absolute Stability Regardless of Load
- Voltage or Current Regulation

## PRECISION SOURCES

- Stable Amplitude — less than 20 ppm variation
- Low Distortion — under 0.05%
- High Power Output — up to 200 VA
- Stable Frequency — less than 0.01% variation
- Wide Frequency Range — to 100 kHz at 1000 V
- Constant Voltage/Current—to 1500 V: to 40 Amps

## PRECISION OSCILLATORS

- Absolute Amplitude Accuracy — ±0.05%
- Amplitude Stability — ±0.01% month
- Output — from 11 Volts to 100 Milli-amperes
- Remote Sensing Available
- Quadrature Phase Accuracy — 0.05°
- Frequency Range — 10 Hz to 1 MHz
- Frequency Accuracy — to 0.1%

## ABSOLUTE CALIBRATORS FOR:

**Ammeters - Voltmeters - Wattmeters - Phasemeters - Digital Multimeters**

- Programmable Models
- Highest Accuracy Available
- 10 Hz to 1 MHz
- Compact and Lightweight
- Complete Systems Available

**ABSOLUTE CALIBRATORS**

| Model | Output Range | Accuracy DC | AC* | Frequency Range | Features |
|---|---|---|---|---|---|
| AC125/PA225 | 10 NV to 1211.11V | | 0.02% | 10 Hz to 1.1 MHz | Fixed Amplitude Quadrature Output |
| AC127 | 10 NV to 121.111V | | 0.02% | 10 Hz to 1.1 MHz | 120V to 1 MHz |
| AC128 | 10 NV to 121.111V | | 0.02% | 10 Hz to 1.1 MHz | Fully Programmable 120V to 1 MHz |
| AC129 | 10 NV to 121.111V | | 0.02% | 10 Hz to 1.1 MHz | Fully Programmable |
| AC150 | 0-600V | | 0.05% | 25 Hz to 10 kHz | Calibrates Volt, Amp and Watt Meters — Variable Phase |
| | 0-10 Amps | | 0.05% | | Absolute Power Factor |
| CS112 | 1 $\mu$a to 2.2 Amp | .005% | 0.02% | 10 Hz to 100 kHz | Bi-polar DC |
| CS129 | 1 $\mu$a to 1.1 Amp | | 0.02% | 10 Hz to 100 kHz | Programmable |
| QCS110 | 1 $\mu$a to 1.1 Amp | | 0.02% | 10 Hz to 100 kHz | Phase Calibrated From 0-360° ±0.05° |
| PA270 | 1 Amp to 110 Amp | | 0.02% | 10 Hz to 100 kHz | High Current—Self Calibrating |
| RCD709 | 0 to 5V RMS | | | 10 Hz to 100 kHz | Absolute Phase Standard ±.05° |

* Typical Midband

**PRECISION SOURCES**

| Model | Voltage | Current | Resolution | Frequency Range | Distortion | Stability | Features |
|---|---|---|---|---|---|---|---|
| AC50CAL | 500V | 10A | 10 ppm | 10 Hz to 100 kHz | <.05% | ±20 ppm | High Performance at Low Cost |
| AC104 | 1500V | 20A | 10 ppm | 10 Hz to 100 kHz | <.05% | ±20 ppm | Full Power Output From 45 Hz to 100 kHz |
| AC105 | 1500V | 20A | 10 ppm | 10 Hz to 100 kHz | <.05% | ±20 ppm | Full Power Output From 25 Hz to 30 kHz |

**POWER AMPS**

| Model | Power (VA) | Voltage | Current | Band Width | | Distortion | Features |
|---|---|---|---|---|---|---|---|
| | | | | Full Power | Extended | | |
| PA25 | 25 | 150 | | DC - 1 MHz | DC - 2 MHz | <.02% | Sine/Pulse—1500V $\mu$S |
| PA50 | 50 | 15 | | DC - 20 kHz | DC - 100 kHz | <.05% | Wide band |
| PA50T | 45 | 150 | | 45 Hz - 20 kHz | 10 Hz - 100 kHz | <.05% | Voltage Regulated |
| PA50T/10A | 45 | | 10 Amps | 45 Hz - 2 kHz | 10 Hz - 100 kHz | <.05% | Current Regulated |
| PA50T/500 | 45 | 500 | 10 Amps | 55 Hz - 10 kHz | 10 Hz - 100 kHz | <.05% | High Voltage |
| PA250L | 250 | 150 | 10 Amps | 25 Hz - 20 kHz | 15 Hz - 40 kHz | <.05% | Adjust. Output Imped. |
| PA250M | 250 | 300 | 5 Amps | 20 Hz - 10 kHz | 20 Hz - 100 kHz | <.05% | Absolute Load Stability |
| PA260 | 200 | 1200 | 200 MA | DC - 100 kHz | DC - 200 kHz | <.03% | .15% resp. — 1 ppm linearity — 300V $\mu$S |

*Half Power

OPTIMATION

JULIE RESEARCH LABORATORIES, INC.

211 W. 61 ST., NEW YORK, N.Y. 10023 • (212) 245-2727 • TWX: 710-581-5138

# ATTENUATORS

## IN-LINE ATTENUATORS

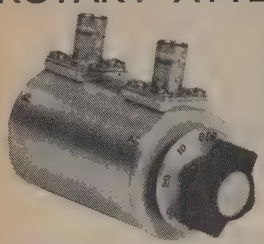
STANDARD 9 STEP: 9¾"Lx2$\frac{1}{32}$"Hx1¼"W
MINIATURE 9 STEP: 6"Lx1$\frac{3}{32}$"Hx⅞"W
CONNECTORS: BNC, N, SMA, F
TEFLON SWITCHES, GOLD CONTACTS
9 STEP AND 6 STEP MODELS

FREQUENCY DC: 1000MHz, 1 WATT
HIGH ACCURACY, LOW INSERTION LOSS
IMPEDANCE: 50, 75 AND 90 OHMS

TYPICAL SPECIFICATIONS, OTHER MODELS AVAILABLE

| Model | Size | Range dB | Steps dB | Z Ohms | Insertion Loss dB |
|---|---|---|---|---|---|
| 432<br>439 | STD<br>MIN | 0-101 | 1 | 50 | .7 1 GHz<br>.5 1 GHz |
| 1/432<br>1/439 | STD<br>MIN | 0-22.1 | 0.1 | 50 | .2 .5 GHz<br>.5 1 GHz |
| 460 | MIN | 0-132 | 1 | 50 | .7 1 GHz |
| 447 | MIN | 0-102 | 0.5 | 75 | .4 1 GHz |

## ROTARY ATTENUATORS



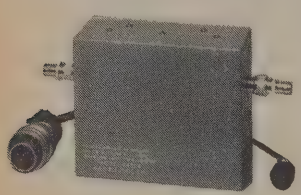
DIA.: 1½"
LENGTH: 1¾" AND 2¼"
WEIGHT: 8 OZ.

### HIGH ACCURACY, LONGLIFE, MINIATURE

FREQUENCY: 2 GHz
ATTENUATION RANGE: 0-70 dB 10 dB STEPS
0-10 dB 1 dB STEPS
0-1 dB .1 dB STEPS
IMPEDANCE: 50 AND 75 OHMS
POWER: 0-70 dB .5 WATTS, OTHERS 1 WATT

## PROGRAMMABLE STEP ATTENUATORS 0-1.3 GHz

**MODEL 4430 —**
**9 STEP 0-135 dB IN 1 dB STEPS**
**(Other Attenuation Ranges Available)**



SWITCHING SPEED:
20 ms — 117V POWERED
RF POWER: 1 WATT
INSERTION LOSS:
2 dB TO .5 GHz
.5 dB TO 1 GHz
DIMENSIONS:
5¼" x 2⅛" x 4¼"
WEIGHT: 3.5 LBS.

MODEL 4490 — LOGIC ADAPTER
PROVIDES TTD LOGIC LEVEL CONTROL FOR 4430

## SLIDING BLOCK ATTENUATORS

**MODEL 461B**

FREQUENCY RANGE: DC TO 4 GHz
ATTENUATION STEPS: 9 STEPS
(dB): 1, 2, 3, 6, 10, 20, 30, 30, 30
CONTROLS: SLIDE SWITCHES
DIMENSIONS: 8⅜" x 2⅜" x 1⅞", PLUS CONNECTORS
WEIGHT: 2.5 LBS.

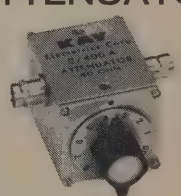
## 2000 AND 2100 ATTENUATORS

**PROGRAMMABLE CONTINUOUSLY VARIABLE ATTENUATOR**

SOLID STATE, FAST ACTING, 2-500 MHz
OVER 76 dB RANGE, INSERTION LOSS 6 dB MAX.
CONTROL VOLTAGE:
0-12V DC TO 30 KHz
SUPPLY VOLTAGE: 12V
USABLE AS AN RF SWITCH OR AM MODULATOR

MODEL 2000 — 75 OHMS
MODEL 2100 — 50 OHMS
DIMENSIONS: 4⅛" x 2⅛" x 1½"
WEIGHT: 1 LB.

## CONTINUOUSLY VARIABLE ATTENUATORS



ATTENUATION RANGE: 12 dB
CONTROL:
ROTARY CONTINUOUSLY VARIABLE
ACCURACY: 0.3 dB
FLATNESS: 0.2 dB
DIMENSIONS: 1½" x 2" x 2$\frac{5}{16}$"

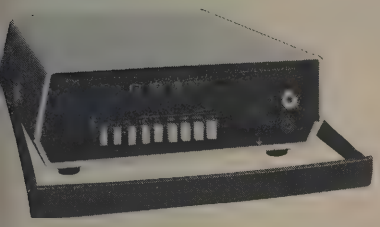
| Model | Frequency Range | Insertion Loss | Maximum VSWR | Impedance |
|---|---|---|---|---|
| 0/400 | DC-500 MHz | 1 dB | 1.3:1 | 50 ohms |
| 0/410 | DC-400 MHz | 1 dB | 1.35:1 | 75 ohms |

**KAY** ELEMETRICS CORP.
MAPLE AVE. / PINE BROOK, NEW JERSEY 07058 / TWX: 710-734-4347 / TEL: (201) 227-2000

# KEITHLEY

# MULTIMETERS AND SYSTEMS

## Digital Multimeters



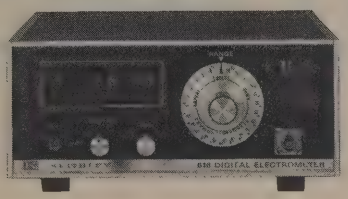
- ☐ **10 Models.**
- ☐ Choice of 3½, 4½, 5½ and 6½ digits.
- ☐ **Low cost.** Prices start at $199 for 4½ digits.
- ☐ Bench style with extra-large, easy-to-read displays.
- ☐ **Accuracy** to 10 ppm.
- ☐ Exceptional reliability.
- ☐ **IEEE 488** compatibility with optional interface.
- ☐ Analog and digital outputs.
- ☐ **Automatic,** manual and programmable ranging.
- ☐ Line operation standard, battery optional.
- ☐ **TRMS,** Hi-Lo Ohms and other features.

**For more right-now information, call our DMM hotline**

**(800) 321-0560.**

In Ohio call (216) 248-0400.

## Scientific Instruments



In addition to the standard DMM line, Keithley makes a broad line of highly sensitive measuring instruments.

If you measure dc

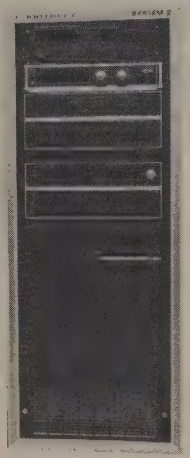
- ☐ **picoamperes**
- ☐ **nanovolts**
- ☐ **micro-ohms**
- ☐ **gigaohms**

we have the instruments you need.

## Scanners (Multiplexers)

- ☐ **Thermocouple,** low-current, low voltage, and general-purpose relay scanner cards.
- ☐ 100-channel and 10-channel mainframes.
- ☐ **Priced low** as $38 per channel—complete.
- ☐ Ideal for scanning, controlling, matrixing.
- ☐ **IEEE 488** compatibility with optional interface.

## Test Systems



Automated systems for high-sensitivity dc and low-frequency ac test and measurement.

**System 1** is a low-cost, versatile, programmable calculator-controlled measuring system for data acquisition and reduction, and control of experiment or process. Plug-to-plug component compatibility. IEEE-488 interface availability. Several peripherals available. Prices start at $8300 for complete systems.

**System 2** is a computer-based system designed for fast, accurate, economical automated testing. A typical turnkey implementation is System 2/LPT, a linear parametric test system for semiconductor testing at wafer, discrete or packaged levels. A complete range of measuring instruments, sources, and peripherals is available. Prices start under $40,000, including complete software package.

If you'd like detailed product data and ordering information, send for these brochures and our complete catalog:

**"HOW TO GET MORE FROM YOUR DMM"**
(Measurement Guide for Digital Multimeters)
**"KEITHLEY SCANNERS"**
**"KEITHLEY SYSTEM 2/LPT"**

# KEITHLEY

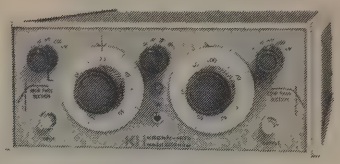
**The measurement engineers.**

**Keithley Instruments, Inc., 28775 Aurora Road, Cleveland, Ohio 44139. (216) 248-0400**

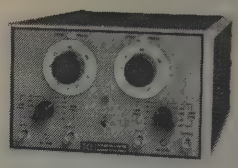
KROHN-HITE CORPORATION
Avon Industrial Park,
Avon, Massachusetts 02322
(617) 580-1660
TWX 710-345-0831

# Variable Filters

Model 3343



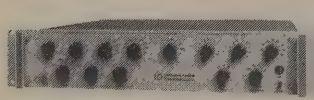
Model 3550



Model 3202

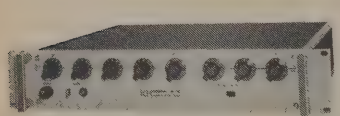
| Frequency Range | Filter Model | BAND PASS | BAND REJECT | HIGH PASS | LOW PASS | Battery Kits No./Price | Freq. Acc. % | Attenuation Slope dB/Octave | Hum and Noise (RMS) | Max. Attenuation | Output Volt/Amps (RMS) | 3dB Points | Rack Mounting Kit — $35 | Base Price |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .001Hz - 99.9kHz | 3320 | | | X | X | BK332/$100 | 2 | 24 | 0.5mv | 80dB | 5v/50mA | DC - 1MHz | RK-58 | $ 800 |
| .001Hz - 99.9kHz | 3322 | X | X | X | X | BK334/$200 | 2 | 24/48 | 0.5mv | 80dB | 5v/50mA | DC - 1MHz | RK-519 | $1550 |
| .001Hz - 99.9kHz | 3340 | | | X | X | BK332/$100 | 2 | 48 | 0.5mv | 80dB | 5v/50mA | DC - 1MHz | RK-58 | $1200 |
| .001Hz - 99.9kHz | 3342 | X | X | X | X | BK334/$200 | 2 | 48/96 | 0.5mv | 80dB | 5v/50mA | DC - 1MHz | RK-519 | $2200 |
| .01Hz - 99.9kHz | 3321 | | | X | X | BK332/$100 | 2 | 24 | 0.5mv | 80dB | 5v/50mA | DC - 1MHz | RK-58 | $ 700 |
| .01Hz - 99.9kHz | 3323 | X | X | X | X | BK334/$200 | 2 | 24/48 | 0.5mv | 80dB | 5v/50mA | DC - 1MHz | RK-519 | $1350 |
| .01Hz - 99.9kHz | 3341 | | | X | X | BK332/$100 | 2 | 48 | 0.5mv | 80dB | 5v/50mA | DC - 1MHz | RK-58 | $1100 |
| .01Hz - 99.9kHz | 3343 | X | X | X | X | BK334/$200 | 2 | 48/96 | 0.5mv | 80dB | 5v/50mA | DC - 1MHz | RK-519 | $2000 |
| .02Hz - 20kHz | 3750 | X | X | X | X | BK375/$200 | 5 | 6, 12, 18, 24 | 0.5mv | 80dB | 10v/2mA | DC - 1MHz | RK-519 | $1100 |
| .2Hz - 20kHz | 3700 | X | | | | BK370/$100 | 5 | 24 | 0.2mv | 80dB | 5v/1mA | N/A | RK-38 | $ 675 |
| 2Hz - 200kHz | 3550 | X | X | X | X | N/A | 5 | 24 | 0.2mv | 60dB | 5v/10mA | .2Hz - 3MHz | RK-38 | $ 775 |
| 10Hz - 1MHz | 3100 | X | | | | N/A | 5 | 24 | 0.1mv | 80dB | 3v/10mA | N/A | RK-38 | $ 725 |
| 10Hz - 3MHz | 3103 | X | | | | N/A | 5 | 24 | 0.15mv | 80dB | 3v/10mA | N/A | RK-38 | $ 755 |
| 10Hz - 3MHz | 3103-4 | X | | | | N/A | 5 | 18 | 0.15mv | 80dB | 3v/10mA | N/A | RK-38 | $ 755 |
| 20Hz - 200kHz | 3500 | X | | | | N/A | 10 | 24 | 0.2mv | 60dB | 5v/3.5mA | N/A | RK-38 | $ 625 |
| 20Hz - 2MHz | 3200* | | | X | X | N/A | 5 | 24 | 0.1mv | 80dB | 3v/10mA | DC - 10MHz | Suffix R | $ 525 |
| 20Hz - 2MHz | 3202* | X | X | X | X | N/A | 5 | 24/48 | 0.1mv | 80dB | 3v/10mA | DC - 10MHz | Suffix R | $ 950 |

# Programmable Signal Sources



Model 5500AR

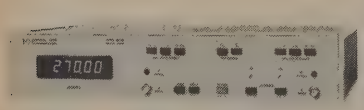
| Frequency Range | Model | Operating Modes | Output Waveforms | Max. Output | Output Imped. (Ohms) | Aux. Outputs | DC Offset | Ext. VC | Additional Features | Price |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0001 Hz to 5MHz | 5500AR | CONT, TRIG, GATE | ∿⊓∿⩘⩙⎍⊔ | 30V p-p | 50 | 5V ⊓ | ±7.5V | 1000:1 | PROGRAMMABLE | $2195 |



Model 4141R

| Frequency Range | Osc. Model | Freq. Acc. % | Max. Volts | Output Impedance | Dist. % | Square Wave | Prog. Amp. | Base Price |
|---|---|---|---|---|---|---|---|---|
| 0.1 Hz to 100 kHz | 4030R | 0.5 | 10 RMS | 200/600 | 0.01 | optional | optional | $1700 |
| 0.1 Hz to 100 kHz | 4031R | 0.1 | 10 RMS | 200/600 | 0.01 | optional | optional | $2300 |
| 1 Hz to 1 MHz | 4140R | 0.5 | 10 RMS | 50 | 0.02 | yes | yes | $1495 |
| 1 Hz to 1 MHz | 4141R | 0.1 | 10 RMS | 50 | 0.02 | yes | yes | $1795 |

# Phasemeters

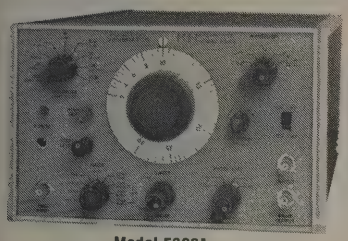


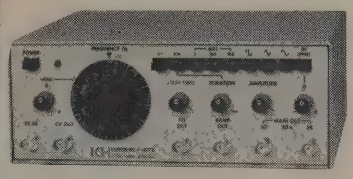
Model 6500

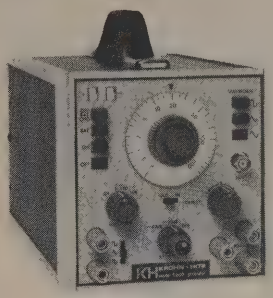
| Model | Phase Accuracy | Frequency Range | Resolution | Input Waveforms | Input Voltage Range | Display | Rack Mounting Kit — $35 | Base Price |
|---|---|---|---|---|---|---|---|---|
| 6500 | 0.05° | 3Hz - 5MHz | .01° | ∿⩘⎍ | 0.01V-120V RMS | 5 digit readout | RK-319 | $1995 |
| 6400 | 0.1° | 3Hz - 5MHz | 0.1° | ∿⩘⎍ | 0.01V-120V RMS | 4 digit readout | RK-319 | $1500 |
| 6200A | 0.5° | 10Hz - 1MHz | 0.1° | ∿⊓ | 0.1V-120V RMS | 3½ digit readout | RK-38 | $ 795 |

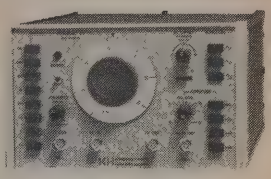
KROHN-HITE CORPORATION
Avon Industrial Park
Avon, Massachusetts 02322
(617) 580-1660
TWX 710-345-0831

# Function Generators


Model 5300A


Model 1200


Model 5600


Model 2000

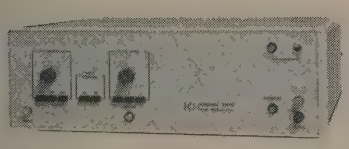
| Frequency Range | Model | Output Waveforms | Max. Output | Output Impedance (Ohms) | Aux. Outputs | D.C. Offset | Ext. V.C. | Additional Features | Rack Mounting Kit—$35. | Base Price |
|---|---|---|---|---|---|---|---|---|---|---|
| .2Hz - 3MHz | 1000 | ∿⊓∿ | 20V p-p | 50 | TTL ⊓ | – | 1500:1 | 1500:1 Tuning | RK-39 | $ 245 |
| .2Hz - 3MHz | 1200 | ∿⊓∿ | 20V p-p | 50 | TTL ⊓ | ±10V | 1500:1 | Int. Lin. Swp. V.C. Output | RK-39 | $ 295 |
| .2Hz - 3MHz | 1400 | ∿⊓∿⊓⊔⋀⋀ | 20V p-p | 50 | ⊓⋀ MKR. | ±10V | 1500:1 | Int. Lin. Swp. Int. MKR., Sym. Cont. | RK-314 | $ 595 |
| .2Hz - 3MHz | 1600 | ∿⊓∿⊓⊔⋀⋀ | 20V p-p | 50 | ⊓⋀⋀ MKR. | ±10V | 1500:1 | Int. Lin/Log Swp. Int. MKR., Sym. Cont. | RK-314 | $ 695 |
| .003Hz - 30MHz | 2000 | ∿⊓∿⊓⊔⋀⋀ | 30V p-p | 50 | ⊓, CVO, | ±15V | 1000:1 | P.B. Attenuator Sym. Control | RK-58 | $ 895 |
| .003Hz - 30MHz | 2200 | ∿⊓∿⊓⊔⋀⋀ | 30V p-p | 50 | ⊓, CVO, | ±15V | 1000:1 | Int. Lin/Log Swp. Int. MKR., Sym. Cont. | RK-519 | $1195 |
| .002Hz - 3MHz | 5100B | ∿⊓∿⌁⊓⊔⋀⋀ | 20V p-p | 50 | 5V⊓ | ±5V | 1000:1 | Sym. Control Output Protect Cir. | RK-58 | $ 550 |
| .002Hz - 3MHz | 5200A | ∿⊓∿⌁⊓ | 20V p-p | 50 | ⊓⋀ | ±5V | 1000:1 | Int. Lin. Swp. Output Protect Cir. | RK-58 | $ 650 |
| .002Hz - 3MHz | 5300A | ∿⊓∿⌁⊓ | 20V p-p | 50 | ⊓⋀⋀ | ±5V | 1000:1 | Int. Lin/Log Swp. Output Protect Cir. | RK-58 | $ 750 |
| .002Hz - 5MHz | 5400B | ∿⊓∿⌁⊓⊔⋀⋀ | 30V p-p | 50 | 5V⊓ | ±10V | 1000:1 | Sym. Control Output Protect Cir. | RK-58 | $ 650 |
| .002Hz - 2MHz | 5600 | ∿⊓∿ | 15V p-p | 50/600 Bal. | 1V∿⊓∿ | ±5V | – | Battery Operated | N/A | $ 395* |
| .002Hz - 2MHz | 5700 | ∿⊓∿ | 15V p-p | 50/600 Bal. | 1V⊓ | ±5V | – | 1000:1 Tuning | N/A | $ 350 |

*Battery Kit. Part No. BK-560; Price $100.

# RC Oscillators

| Frequency Range | Model | Freq. Acc. % | Output Each Phase | | | Quad. Output | Output Waveforms | Freq. Resp. (dB) | Dist. % | Rack Mounting Kit — $35 | Base Price |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Power (mw) | Impedance (Ohms) | Max. Volts | | | | | | |
| 0.001Hz - 100kHz | 4024A | 0.5 | 125 | 200/600 | 10 | Yes | ∿⊓⎍ | 0.01 | 0.01 | Suffix R | $1600 |
| 0.001Hz - 100kHz | 4025A | 0.1 | 125 | 200/600 | 10 | Yes | ∿⊓⎍ | 0.01 | 0.01 | Suffix R | $1995 |
| .01Hz - 1MHz | 4100A | 0.5 | 500 | 50 | 10 | | ∿⊓ | 0.05 | 0.02 | Suffix R | $ 795 |
| 0.1Hz - 100kHz | 4000A | 0.5 | 125 | 200/600 | 10 | Yes | ∿ | 0.01 | 0.01 | Suffix R | $1200 |
| 0.1Hz - 100kHz | 4001A | 0.1 | 125 | 200/600 | 10 | Yes | ∿ | 0.01 | 0.01 | Suffix R | $1500 |
| 10Hz - 10MHz | 4200A | 2.0 | 500 | 50 | 10 | | ∿∿ | 0.025 | 0.1 | RK-58 | $ 550 |
| 10Hz - 10MHz | 4300A | 2.0 | 500 | 50 | 10/20 | | ∿⊓∿ | 0.025 | 0.1 | RK-58 | $ 600 |

# Laboratory Power Amplifiers


Model 7500

| Frequency Range | Model | Output Power (watts) | Dist. % | Freq. Resp. (dB) | Input Volts (RMS) | Max. Voltage Gain | Matched Load (Ohms) | Max. Output Volts (RMS) | Max. Output Current | Rack Mounting Kit - $35. | Base Price |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DC - 1MHz | DCA-10 | 10 | 0.1 | ±1.0 | 10 | 10 | 600-1000 | 105 | 130mA | Suffix R | $995 |
| DC - 1MHz | 7500 | 75 | 0.1 | ±0.1 | 1.25 | 100 | 200 | 125 | 625mA | RK519 | $1500 |
| 30Hz - 1MHz | MT-56‡ | 75 | — | — | 125 | — | 2-1000 | 100 | 6.5A | N/A | $295 |

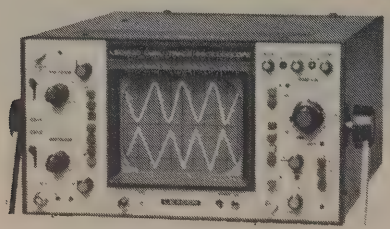
‡Accessory matching transformer

# LEADER
## Test Instruments

*More Than 50 Fine Quality Test Instruments for Industry, Education and Service*

# OSCILLOSCOPES

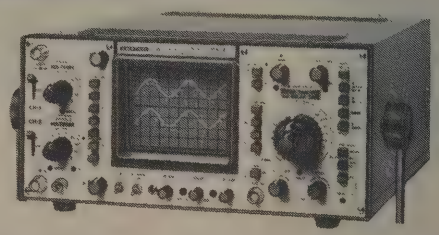
*A Broad Range of Applications . . . for Accuracy, Dependability and Cost Effective Economy*



MODEL LBO-520

### The 30MHz Dual Trace Oscilloscope With Delay

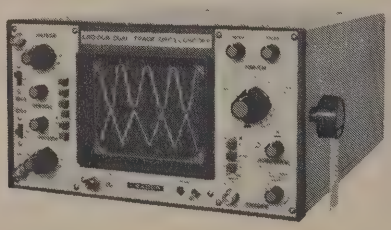
- 5mV sensitivity facilitates accurate signal viewing from video cameras and other low level sources.
- Built-in delay line makes it easy to view pulse leading edge.
- Single shot trigger (CH-1, CH-2) captures transient phenomena — no guesswork, no "double-takes".
- 5" P-D-A CRT assures brighter, sharper trace at all sweep speeds.
- 20nS/cm sweep capability plus 11.7nSec rise time lets you observe the fastest signals.



MODEL LBO-515

### 25MHz Dual Trace/Dual Time Base Oscilloscope, Variable Delay

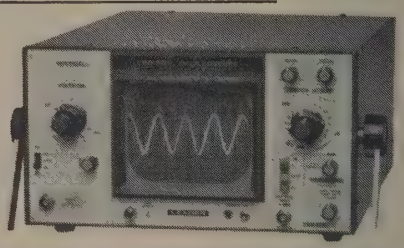
- Built-in delay circuitry, continuously variable, from 1μSec to 5Sec . . . plus 5mV/Div. Vertical Sensitivity with ±3% acc.
- Rectangular 8x10Div. CRT in a horizontal format, with internal graticule.
- Selectable synchronization — automatic, normal, single trace and reset modes with H-F rejection.
- 14nSec. rise time; plus X10 sweep magnification.
- CH-1 or 2 trigger; HF filter; and TV sync — all emphasize a broader range of capabilities, for the best in a cost payout ratio.



MODEL LBO-508

### The 20MHz Dual Trace Oscilloscope

- Add & subtract modes (with CH-2 invert) permits quick analysis of signals, amplitude, etc.
- Front panel X-Y operation makes it ideal for phase-shift, analysis, sweep alignment and vectorscope service.
- 17.5 nanosec rise time for easy viewing of high speed pulses and wave forms.
- Automatic trigger from either channel, including TV sync, extends convenience and versatility.



MODEL LBO-507

### The Multi-Purpose 20MHz Triggered Oscilloscope

- Automatic triggered circuitry guarantees maximum display stability, with minimum adjustments.
- Outstanding trigger sensitivity over entire operational range.
- 10mV vertical sensitivity and 17.4nSec rise time helps achieve lab grade performance.
- X5 magnification (±5%) delivers 100nS/cm maximum speed for easy, precise readings.

# MULTIMETERS

*Accuracy, Reliability & Portability for Use Everywhere*

MODEL LT-70B

### Extra Versatile V-O-M

- Protected against overload and polarity reversal.
- Reads as low as 0.25V and 50μA, full scale.
- Measures up to 2.5A, DC and AC.
- Measures up to 50 Megμ, 5 ranges.
- Measures 8 DC voltage ranges, 20,000Ω/VDC and 8,000Ω/VAC.
- Battery operated, two "AA" 1.5V cells.

MODEL LV-71

### Solid State, FET V-O-M

- VTVM accuracy with battery operated, portable convenience.
- Dual FET differential amplifier circuitry
- Diode overload meter protection.
- Instant-on operation, polarity reversal switch; battery checkout.
- 12 Voltage 4 Current and 4 Resistance ranges.
- 10MegΩ impedance.

# When Quality Counts . . .

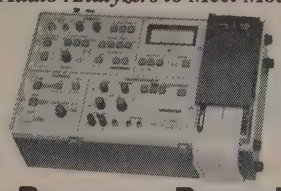
# SYSTEMS ANALYZERS

*Advanced Design Audio Analyzers to Meet Modern Demands*

MODEL LAS-5500

## 7-IN-1 Audio Analyzer

- ***Oscilloscope*** . . . 5MHz b/width; 10mV/Div. defl sensitivity.
- ***Oscillator*** . . . 10Hz — 1MHz, 5 ranges, less than 0.05% dist.
- ***Attenuator*** . . . 0 to 110dB range in 0.1dB steps.
- ***AC Meter*** . . . from 30$\mu$V to 100V, 12 steps; ±3% accuracy.
- ***Wow & Flutter*** . . . 3KHz & 3.15KHz; 15mV to 10Vrms input range calibrated for CCIR, DIN and JIS standards.
- ***Driftmeter*** . . . 3KHz, ±0.1% test frequency source, 0.3Vrms signal output; 3.15KHz, ±10% measurement range; ±5% drift measurement tests.
- ***Dummy Load*** . . . 8Ω resistance; 30W, 50W, 100W power.



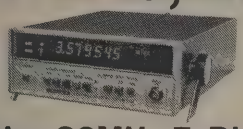
MODEL LFR-5600

## Frequency Response Recorder

- Standard signal freq's of 1KHz to 333Hz for automatic start, stop & response plotting.
- Selectable 25dB, 50dB or linear scales.
- Sweep oscillator output has 20dB and 40dB attenuation for high sensitivity testing.
- Use external signals to check response.
- Use meter as sweep frequency or voltage indicator for calibration.
- Use chart section as a direct current recorder (10mV/cm).
- Oscilloscope output for scope display.

# COUNTERS, BRIDGES, TESTERS

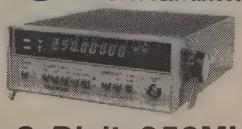
*State-of-the-Art Design to Meet Advanced Requirements*



MODEL LDC-822

## The Sensitive 80MHz 7-Digit Counter

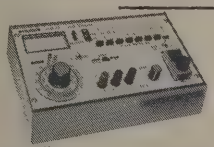
- 80MHz capability for a variety of uses — laboratory, production and service.
- Period Function determines precise pulse width, increases resolution.
- Bright 1/2" numbers asure easy readability.
- Pushbutton Gate Time 20mVRMS sensitivity — variable.
- 10MHz Time Base assures high 5ppm accuracy.
- High reliability LSI Circuitry.
- Overrange and Gate Time indicators.



MODEL LDC-823

## The Precise 8-Digit, 250MHz Counter

- 250MHz capability for variety of applications.
- 20mVRMS sensitivity variable with pushbutton gate time.
- Period Function increases resolution.
- 5ppm accuracy; 10MHz time base.
- 1MΩ or 50Ω impedance.
- Easy to read, bright 1/2" numbers.
- Overrange and gate time indicators.



MODEL LCR-740

## Transistorized LCR Bridge

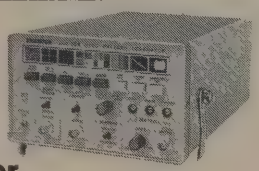
- Highly accurate 3 digit readout.
- Measure Inductance (L), Capacitance (C) and Resistance (R), within –0.5% accuracy.
- Range expandable — built-in 10% overrange.
- Loss Factor scale (D).
- Battery, or AC adapter operation.

MODEL LDM-851

## One-Button Ranging Digital Multimeter

- Bright 1/2" LED display for high visibility 3 1/2 digit readout.
- Single pushbutton range selection covers 16 ranges; makes "knob twisting" obsolete.
- Total, self-contained portability with 4 "C" cells, AC line flexibility — AC adapter included.
- Overload protection for reliable, long term performance.
- 0.5% accuracy for many applications, e.g., design, development, q.c. and service.

# COLOR BAR GENERATORS

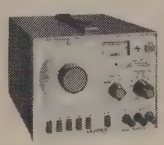


MODEL LCG-396

## The Video Problem Solver.

- Provides all signals to precisely time, test, evaluate all MATV, CATV, color and B&W video systems.
- Chroma & Luminance variable by 20%; set up by 10%.
- Full-field or IQW insertion; on-off for chroma and luminance.
- Better checking and adjusting of purity and white balance via red, blue, green, white rasters.
- Adjustable scanning control for interlaced or progressive scan — eliminates flicker.
- 75Ω Video (1 V fixed) and RF output for all TV and VTR units. Equalizing pulse phase locked to color subcarrier.

# GENERATORS



MODEL LAG-125

## Low Distortion Audio Generator

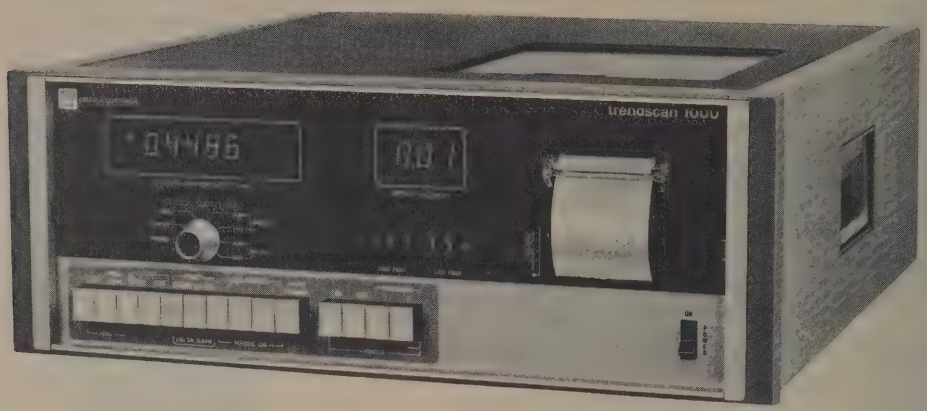
- Clean square waves test transient response.
- Low distortion sine wave output — less than .03%.
- Burst signals for loudspeaker tests.
- Pushbutton frequency ranges switching, 5 steps.
- 0 to 50dB calibrated attenuator.
- Frequency synchronization from external source.

# LEADER Instruments Corp.

***FREE CATALOG! Ask for Data on the Complete Leader Quality Line.***

151 Dupont Street, Plainview, N.Y. 11803 (516) 822-9300
West Coast: 9721 Lurline Ave., Chatsworth, Ca. 91311 (213) 882-4335
Midwest: 221 Higgins Road, Park Ridge, Ill. 60068 Tel: (312) 825-3300

# Leeds & Northrup's Trendscan 1000 Data Acquisition System




## ...lets you speed read your data with logging, trending and alarming up to 1000 points

### Features

- **Scanning, alarming, logging up to 1000 points.**
- **3+ or 4+ digit measurements . . . Single or Multi-range.**
- **Linear and non-linear inputs . . . TC, RTD, V, mV, mA and contact closure.**
- **Easy programming . . . range selection, point skip, alarm commutation.**
- **Integral printer . . . ribbonless, non-impact, 21 alphanumeric columns.**
- **Unique Trend Mode . . . prints bar graphs (Trendbars) for trending or profiling.**
- **Full alphanumeric printing of legends, status and static data.**
- **Built-in clock.**
- **Six internal digit alarms . . . or 128 with external Trendscan Alarm Processor.**
- **Remote location of input switching assemblies . . . up to 3200 feet (1000 meters).**
- **Low thermal input switching relays . . . convenient isothermal input connectors.**
- **Self-test of each range . . . independent of inputs.**
- **Flexible input/output peripheral interface.**

The Trendscan 1000 Data Acquisition System provides a highly flexible means of scanning, alarming, trending and/or logging up to 1000 inputs—thermocouples, RTDs, transmitters, EMF signals, current signals and/or contact closures. Single ranges or multi-ranges (3) are available with 3+ or 4+ digit resolution. Multi-range units may include any combination of linear or non-linear signals including TC, RTD, mV, V, mA or contact closure.

A complete 20 point system can be provided in a single compact (7″ × 19″ × 22½″) chassis for bench use or rack mount. This includes two 10 point input switching relay cards with isothermal connectors (5 inputs per card for RTD)—basic point selection and scanning controls with point display—signal conditioning, A/D conversion, linearization and measurement display—an integral printer for data logging and a clock which provides system or real time with controls to initiate a periodic data log at intervals up to 8 hours.

**INPUT SWITCHING** When more than 20 inputs are needed, input switching relays and input connectors are supplied in Model 2701 Trendscan Input Frames which accommodate up to 10 input cards (100 inputs) per frame. Up to 10 frames can be supplied for 1000 inputs. These frames may be located up to 3200 feet (1000 meters) away from the Trendscan 1000 for convenient and economical installation near the input elements.

Point selection signals are supplied to each of the 2701 Input Frames through a 42 conductor matrix cable from the Trendscan 1000 where the point selection and scanning controls are located. A set of input signal leads for each range are connected between the 2701 Input Frame(s) and the 2700 Trendscan. No power connections are required for the Input Frames.

**ALARMS** Up to 6 bipolar digital alarms and a per point alarm programming feature are available. The Trendscan 1000 can be specified with 1, 2 or 3 internally mounted alarm modules, each with two independent alarms. A module has two sets of digital switches to set a 4 digit limit corresponding to the 4 most significant digits of the measurement. Each alarm limit has a separate sense switch for HI or LO limit, and a polarity select switch. One reset switch is provided on each module common to both alarms. Each alarm has an LED indicator and a SPDT output relay connected to screw terminals at the rear of the Trendscan.

When more than 6 alarms are required, the 2783 Trendscan Alarm Processor is available in place of the internal alarms for up to 128 different dual level alarms.

**PROGRAMMING** Following a very simple sequence, any one of up to 250 input points may be addressed and assigned to any one of three available ranges (except RTD ranges which are assigned in groups of 5 inputs). Any point may be skipped or assigned to any one, none or all of the 6 internal alarms. Points programmed for point skip do not cause a loss of time during the scan cycle.

Systems with more than 250 input points are programmed in a similar manner except that range, point skip and alarm assignments are made in groups of 5 points rather than on a per-point basis. All programming is stored in solid state memory (RAM) with a continuously charged battery back-up for 1000 hour program retention without line power.

LEEDS & NORTHRUP

North Wales, Pa. 19454
(215) 643-2000
Attn: MD 337-K

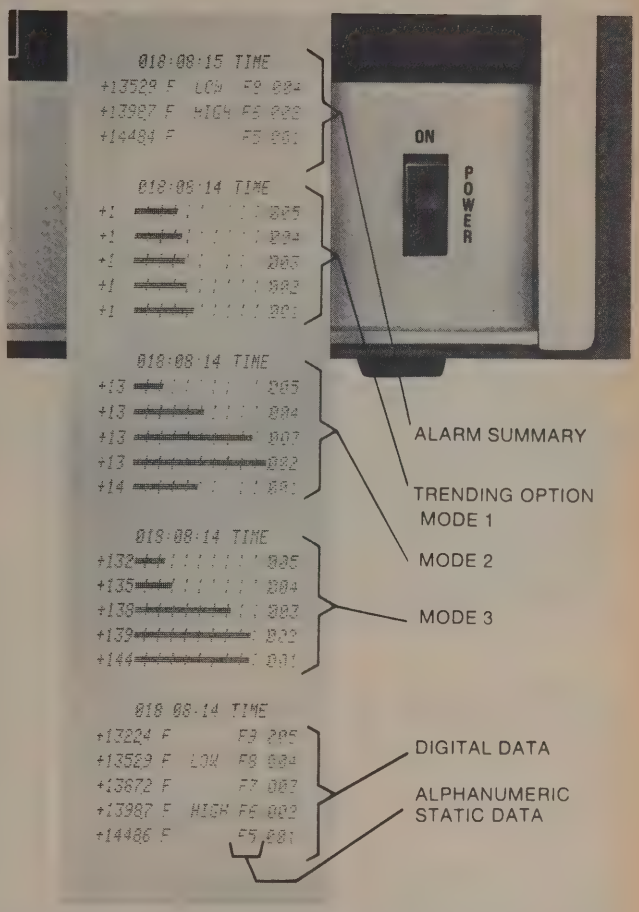
**PRINTOUT** Trendscan 1000 systems offer unique capabilities for data presentation. An integral ribbonless printer prints out point identification, optional 4 character static data, status reports on inputs (e.g. OPEN or OVLD) and alarms (e.g. HIGH or LOW), four or five digit presentation of measured variable with polarity and legend plus an independent line stating time of printout, all arranged in an orderly format. In addition, an exclusive Trend Mode feature is available which graphically presents the least significant digits in the measurement as a bar graph (Trendbar) preceded by a numeric printout of the most significant digit(s). Three modes of increasing resolution are available for the Trendbar graph in which 1, 2 or 3 of the most significant features are suppressed and printed out, and the next two digits are presented in the Trendbar format.

The three modes of digital suppression allow successively higher resolution with the Trendbar for critical analysis in analog form. Best resolution is achieved in Mode 3 which can be as high as 1 part in 40,000 on a 4+ digit instrument or 1 part in 4,000 on a 3+ digit instrument, depending on the total range selected.

Printout of any single point, group of points or all points, may be initiated either manually, in response to an alarm, or on a preset time interval in any one of the formats desired. In addition, detection of alarms can initiate a printout. A summary of printout of all points in alarm can be manually initiated.

**INPUT/OUTPUT INTERFACE OPTIONS** Where data records other than the integral printer are needed, interface options are available for: Paper tape punch, 7 Track Magnetic Tape, 9 Track Magnetic Tape, Teletype Writers, Line Printers, CRTs, Programmable Calculators, and RS-232-C/TTY interface for full bidirectional control.

Where the measurement data presented on the integral printer is the only record desired, a limit interface to other equipment can be provided. This option permits remote signals to control start of scan and scan-rate. Ouput from the Trendscan 1000 interface to external equipment is TTL compatible, serial by character, and includes measurement data with the following point status information: high or low alarm, open input or overload, last point indication, scan point and next scan point advance indication. Provision is also made for 4 digits of static data entry from external BCD switches.




# EXPANDED TRENDSCAN SYSTEMS

The Trendscan 1000 can be combined with a Trendscan Alarm Processor to create a Data Acquisition System with extensive and flexible alarm capability. The Trendscan Alarm Processor is conveniently packaged in a 7″ × 19″ rack chassis and can be mounted with the Trendscan 1000 and related Input Frames in a variety of cabinets to provide a compact totally integrated system with broad data measurement and surveillance capacity.

The Trendscan Alarm Processor provides 64 or 128 programmable single or dual level alarms. Any one or more of the inputs from the Trendscan 1000 can be assigned at random to any one of these alarms.

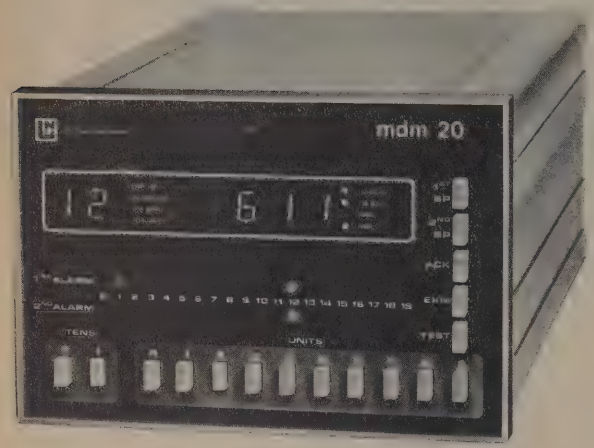
Responses to alarms can take the form of illuminated LED indicators on the front panel, relay contact closures (made through screw type terminals on the rear of the chassis), and a serial BCD output.

Input and alarm assignments are programmed through an array of programming switches on the front panel into a solid state memory in the Alarm Processor—a memory which has a 1000 hour program retention time in the event of power loss. A locking switch with a removable key prevents tampering after the alarms have been programmed.

LEEDS & NORTHRUP

North Wales, Pa. 19454
(215) 643-2000
Attn: MD 337-K

# Leeds & Northrup's MDM20 Multipoint Digital Monitor




## ...lets you scan up to 20 points for alarms at 15 points a second

- **15 points-per-second measurement, digital output and alarm scanning. Analog output available.**
- **Simultaneous alarm scanning of all 20 sensor inputs and display of measured value of one input in engineering units.**
- **Low power CMOS circuitry.**
- **Solid-state or reed-relay switching.**
- **TC, mV, Volt, mA, or RTD inputs.**
- **Noise frequency locked analog-to-digital conversion for high noise immunity.**
- **All digital reference junction compensation — optional field mountable remote RJ sensor.**
- **Field programmable point skip & alarm skip.**
- **CMOS microprocessor based supervision, scanning and linearization.**
- **Up to 40 field-programmable discrete alarm levels, two levels per point.**
- **Exclusive optional examination function — sequences display through input values or alarm set-points at slow speed (programmable) with simultaneous high-speed alarm scan.**

The MDM 20 multipoint digital monitor scans up to 20 points of measurement for alarm conditions at the rate of 15 points a second while simultaneously monitoring the value of the most critical point, or any other point in the system. Recall buttons on the face of the instrument allow the alarm set-point value to be called up for display in place of the measured value.

LED alarm displays include 2 common alarm indicators and up to 40 indicators of alarm status, plus LED indication of over-range, open circuit, set-point skip, point skip and range. Each point is individually assigned up to two alarm values. These alarm values as well as any desired point skips or alarm skips are programmable in the field. The MDM 20 is available in single-range and dual-range versions. The range assignment for each point on the dual-range models is also field programmable.

Front panel controls include point selection pushbuttons, a display "test" button and an "acknowledge" button for resetting the common alarm relay. An optional "examine" pushbutton permits scanning through all inputs on a sequential basis at any of three rates of speed. This allows observation or logging of either the value of each input or its alarm set-point. With this operation, as well as all others, the background alarm scan continues uninterrupted at the same rate of speed. If an alarm occurs, the point going into alarm is immediately accessed and displayed. The value at the time of alarm is locked in the display window interrupting any previous display mode. Pressing the "acknowledge" button clears the display and allows the previous display mode to resume.

The circuit design of the MDM 20 Monitor incorporates low power CMOS logic. The measurement technique uses a noise-frequency locked, dual-slope integrating analog-to-digital converter which provides high noise immunity. All supervision, scanning, reference junction compensation, and linearization functions are CMOS microprocessor based. Inputs to the instrument can be TC, mV, V, mA, or RTD signals, and switching can be either solid-state CMOS switches or reed relays.

### MDM 20 SPECIFICATIONS

**Display —**

Large seven-segment LED displays.
3+ digits of measured value or alarm set-point.
2 digits of point position.
Up to 40 LED indicators of alarm status.
2 common alarm LED indicators.
LED indication of over range, open circuit, set-point skip, point skip, and range.

**Alarms** — 1, 2, or 4 sets of bipolar 3+ digit setting switches or 40 diode-pin programmed set-points which can be programmed H, HH, L, or LL. Each point can be programmed for up to 2 alarms.

**Common Alarm Relays** — 2 common alarm relays, one manually reset and one automatically reset, both SPDT, max. ratings 10 VA, 220 V a-c (RMS), or 120 V d-c, 500 mA (resistive load).

**Ranges** — Single or dual.

**Number of Inputs** — 20

**Input Types** — Linear and non-linear including TC, RTD, V, mV, and mA.

**Input Fault Detection** — Each point checked prior to each measurement.

**Calibration Accuracy** — (25 ±1 C, 24 Hours) Typical overall ±0.05% of range ±1 digit.

**Temperature Coefficient** — (±0.005% of reading+0.002% of range) per degree C.

**Scan Rate** — 15 pps @ 60 Hz (12.5 pps @ 50 Hz).

**Common Mode Rejection** — 120 dB @ 50/60 Hz with 100-ohm line unbalance.

**Normal Mode Rejection** — 60 dB @ 50/60 Hz (±5% nominal).

**Ambient Temperature Range** — +5 to +45 C after 10 minute warmup.

**Humidity** — 5 to 90% RH, 45 C non-condensing.

**Input Power** — 40 Watts maximum.
100, 120, 220, 240 V a-c ±10%, 50 or 60 Hz.

**Dimensions** — DIN standard 144 mm. (5.67") high × 216 mm. (8.50") wide × 473 mm. (18.62") deep; weight approximately 8 kg. (17.6 lbs.)

# CATALOGUE DE L'ELECTRONIQUE POUR LES INGENIEURS
# DER PRODUKTKATALOG FÜR ELEKTRONIKER
# ELECTRONIC ENGINEERS CATALOGUE

## The 1978 edition is out...and the response is in...
## IMMEDIATE AND OVERWHELMING

## ACCEPTANCE

The ELECTRONIC ENGINEERS CATALOGUE is the only comprehensive, trilingual catalogue/source-directory of electronic products available to—and from—Western Europe.

It is divided into three distinct sections: 1. **The Product Index and Directory,** which lists more than 3,000 product headings & cross-references alphabetically in English with their French and German equivalents. 2. **The Manufacturers' Catalogue Section,** which is a compilation of Manufacturers' Catalogues in alphabetical order. 3. **The Manufacturers' Sales Offices and Trade Marks Directory,** which alphabetically includes country, address, telex or TWX numbers of the Manufacturers' main and local sales offices and/or agents.

The ELECTRONIC ENGINEERS CATALOGUE offers U.S. manufacturers the most cost-efficient method of distributing their catalogue data to **25,000** electronic engineers and buyers throughout Western Europe. It represents the carefully conceived application of the time-proven **eem** "cataloging" concept to the elusive European marketplace.

United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Avenue, Garden City, New York 11530 / 516 222-2500

# NEW

**mi 2016**

**10kHz to 120MHz low cost Signal Generator**

**mi 2015/2**

**Transistorized replacement for Model 1066B/6.**

## mi FM/AM SIGNAL GENERATORS

| DESCRIPTION | FREQUENCY | FEATURES |
|---|---|---|
| FM/AM SIGNAL GENERATOR<br>Model 2016 Series | 10kHz to 120MHz | Covers 10kHz to 120MHz in 12 fundamentally generated frequency bands for spurious free output. AM to 100%, FM to 75kHz deviation. Total level accuracy ±1dB, max. output 2V into 50Ω. Low leakage permits accurate sensitivity measurements down to 0.1μV. Special versions available with preset 150Hz pilot tones. |
| FM/AM SIGNAL GENERATOR<br>Model 2002B | 10kHz to 88MHz | 0.1μV to 1V ±dB, fully solid state, AM variable to 100%, FM deviation ±1kHz to ±50kHz max. dependent upon range. Incremental frequency controls with discrimination of 0.025% and direct readout in kHz. Xtal calibrator. External frequency shift permits phase mod. or phase locking. Digital Synchronizer available. |
| AM/FM SIGNAL GENERATOR<br>AND SWEEP GENERATOR<br>Model 2008 | 10kHz to 510MHz | This unique combination Generator/Sweeper provides both facilities without sacrifice to the precision quality of either function. Eleven bands with 1:1.5 cover span from VLF thru UHF. Output 0.1μV to 100mV into 50Ω. Stability 5 p.p.m. Comprehensive FM, AM and sweep facilities provided on all bands. Full modulation facilities may be retained in the sweep mode. |
| SYNTHESIZED AM/FM<br>SIGNAL GENERATOR<br>Model 2020 | 50kHz to 520MHz | **NEW: (Illustration on Cover)** Provides comprehensive CW, AM and FM facilities. All operating functions including carrier frequency, output level, modulation can be controlled from front panel or by remote programming. Exceptional sideband noise of −130dBC/Hz at 20kHz from carrier make unit ideal for automatic test systems for receivers. |
| FM/AM SIGNAL GENERATOR<br>(6625-00-913-7223)<br>Model 995B/Series | 200kHz to 220MHz | 0.1μV to 100mV. Calibrated ΔF. Step attenuator, Crystal standardized; extremely stable. Deviation ±600kHz on top bands. Has simultaneous FM & AM. Also available for narrow band working FM spurious less than 25Hz Model 995B/5. |
| FM/AM SIGNAL GENERATOR<br>Model 2015<br>Model 2015/1 | 10MHz to 520MHz | Covers 10MHz to 520MHz in 11 bands with discrimination permitting tuning to narrow band receivers. FM deviation 10kHz and 100kHz. AM to 80%. Precision ALC eliminates need for external set carrier control. Fundamental signal with low spurious content. Can operate from 24VDC. Portable. 5½" high 11" wide. Special narrow deviation. Model 2015/1 features deviation ranges 2.5, 5 and 25kHz peak deviation. |
| FM/AM SIGNAL GENERATOR<br>Model 2015/2 | 10MHz to 520MHz | Transistorized replacement for Model 1066B/6. Automatically leveled output 0.1μV to 100 mV; internal modulation at 1 kHz and 5 kHz, FM deviation to 400 kHz, AM to 80%; No non harmonic spurious; Stability .002% 5 min. |
| LOW NOISE VHF/UHF<br>FM SIGNAL GENERATORS<br>Models 2011-2012-2013 | 130MHz to 180MHz<br>400MHz to 520MHz<br>800MHz to 960MHz | Highly stable low noise units for testing narrow band mobile receivers. Velvet vernier tuning. Infinitesimal leakage. Noise less than −140dB/Hz, VHF/UHF; −125dB/Hz, 800 to 960MHz, 20kHz from carrier. Output level 0.01μV to 100mV into 50Ω FM deviation to ±30kHz $f_m$ 300Hz to 3kHz. |

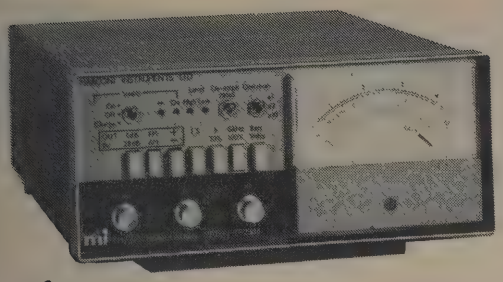
## mi AM/FM MODULATION METERS

| | | |
|---|---|---|
| FM DEVIATION/<br>AM MODULATION METER<br>Model 2300A (USA)<br>(6625-00-480-8706) | 4MHz to 1000MHz<br>to 2500MHz using ext.<br>oscillator | Wide range, mod. freq. up to 200kHz; deviation ranges ±1.5, ±5, ±15, ±50, ±150, ±500kHz. Local oscillator can be xtal locked, external oscillator can be used. De-emphasis 50μsec. 75μsec. switch selected. FM accuracy ±3% for deviation up to ±500kHz $f_m$ 30Hz to 200kHz. AM modulation two ranges 30% and 100% modulation frequencies 30Hz to 50kHz (carrier 4 to 350MHz). |
| FM DEVIATION/<br>AM MODULATION METER<br>Model 2300B | 4MHz to 1200MHz | Measures FM deviation to 500kHz, AM depth to 95% at carriers up to 400MHz. Very low internal noise allows narrow deviation measurements. Filter for noise measurement. De-emphasis 50μS, 75μS and 750μS. Distortion and channel separation on FM stereo meets FCC testing requirements. |
| AM/FM MODULATION METER<br>Model 2304<br>(6625-01-033-5835) | 25MHz to 1000MHz | Completely automatic tuning and level setting. Measures FM on ranges 1.5 kHz to 150 kHz, AM 30% and 100% for modulating frequency 50 Hz to 9 kHz. Accuracy 3%. Optional internal rechargeable battery. |
| PROGRAMMABLE FM/AM<br>MODULATION METER<br>Model 2301A | 4MHz to 1000MHz | FM deviation in six ranges from ±1.5kHz to ±500kHz $f_m$ 30Hz to 200kHz demodulated output distortion 0.25%. AM 30% and 100%. Automatic internal carrier level setting. |

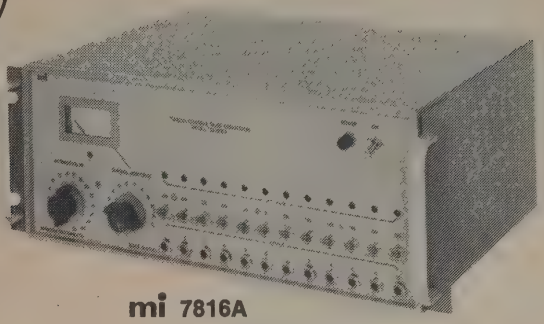
**mi MARCONI INSTRUMENTS**
DIVISION OF MARCONI ELECTRONICS INC.

100 STONEHURST COURT, NORTHVALE, NEW JERSEY 07647 • 201/767-7250 • TWX: 710-991-9752

*NEW*



**mi 2304**
**Automatic Modulation Meter for Mobile Radio**



**mi 7816A**
**Twelve Channel Noise Generator**

## mi MOBILE RADIO TEST GEAR

| DESCRIPTION | FREQUENCY | FEATURES |
|---|---|---|
| PORTABLE AUTOMATIC MODULATION METER Model 2304 | 25 MHz to 1000 MHz | Completely automatic tuning and level setting. Measures FM on ranges 1.5 kHz to 150 kHz, AM 30% and 100% for modulating frequency 50 Hz to 9 kHz. Accuracy 3%. Optional internal rechargeable battery. |
| MOBILE RADIO SIGNAL GENERATORS | All Mobile Bands | Special low noise and general purpose signal generator series for all bands. 10kHz thru 960 MHz. See Signal Generator Section. |
| AUTOMATIC DISTORTION METER Model 2337A | 20Hz to 20 kHz | Measures distortion down to 0.01% at signal level down to 100mV simultaneously with level with no tuning adjustments. Ideal for all audio testing including SINAD. |

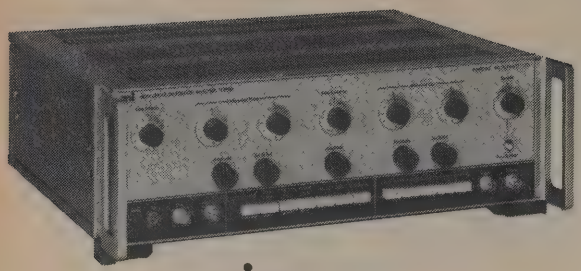
## mi DIGITAL COMMUNICATIONS — P.C.M. TEST GEAR

| | | |
|---|---|---|
| MULTIPLEX TEST SET Model 2807A | Voice Channel | Both sinewave and pseudo random noise stimuli available to measure channel gain, frequency response, idle channel noise, gain linearity, quantization distortion and interchannel crosstalk. National and International models available. |
| CABLE SIMULATOR Model 2825 | 1.5 to 2 M Bits/s | Provides close approximation to loss and phase characteristics of cable for performance testing digital regenerators. Comprises 16 switched passive networks to simulate various cable spans. |
| DIGITAL TRANSMISSION TEST SETS | 1.5 to 274 M Bits/s | Full range of test instruments to meet European CEPT 30 channel PCM Transmission systems. Includes Digital Error Detector, Pattern Generator and SLMS, P-R Generators and Error Rate Test Sets and Complete Regenerator Test Systems. |
| DATA LINE ANALYZER Model 2809 | 300Hz to 3400Hz | Used for testing data transmission lines and links; measures peak-to-average rating (PAR), frequency response and system noise level. Has correction for phase-intercept distortion. |

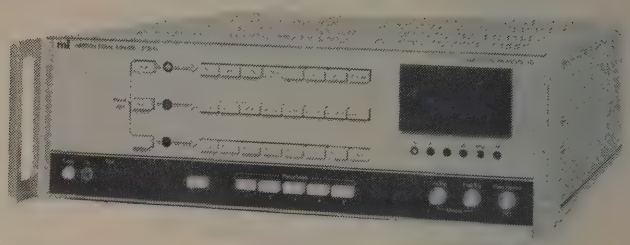
## mi INTERMODULATION AND BASEBAND TEST GEAR

| | | |
|---|---|---|
| NOISE LOADING TEST SET (6625-00-965-8625) (AN/GSM 161A) Model 2090A | 12 kHz to 12.388MHz (i.e. up to 2700 channels) | Solid state unit has built-in standardizing noise source in receiver for gain setting, out-of-band testing, etc. Includes noise generator, receiver and a choice of many different filters. NPR measurements can be made up to 75 dB. |
| NOISE LOADING TEST SET (6625-00-591-8383) Model 2090B | 12 kHz to 12.388MHz | Designed to meet latest CCIR and CCITT accuracy requirements (Recommendation 399-1 Oslo 1966). Includes ALC on generator; suitable for use with A or B series filters. |
| FILTER EXTENSION UNIT Model 2099AB | | This filter extension box can be added to any 2090A or 2090B system to provide accommodation for up to nine extra high, low or band stop filters and six extra band pass filters with oscillators. Minor modification required to existing generators and receivers to provide access. Simple field modification kits available. |
| AUTOMATIC WHITE NOISE TEST SET Model 2090C | 6 kHz to 12.360 MHz | The automatic alternative to Model 2090B. Provides digital readout in all commonly used measurement units. In programmable mode all control transfers to auxiliary computer or optional Remote Control unit TK2085. Ideal for design, manufacturing, commissioning and maintenance of FDM systems, particularly when rapid testing is critical. Suitable for A or B series filters. |
| HF SPECTRUM ANALYZER Model 2370 (50Ω) Model 2370/1 (75 Ω) | 30Hz to 110MHz | Comprehensive spectrum analyzer system with dispersion from 20Hz/div to 100MHz full width, resolution 0.1 dB, filter bandwidths from 5Hz to 50KHz, displayed dynamic range 100dB, 10 x 12 cm flicker-free digitally stored display, frequency measurement to counter accuracy. Built in tracking generator for Network Analysis. |
| TWELVE CHANNEL NOISE GENERATOR (6625-00-948-4724) Model 7816A | 300Hz to 3400Hz | Generates twelve non-coherent channels of Gaussian noise from twelve separate solid state sources. Output: each channel 1mW in 600Ω balanced, 300Hz to 3400Hz. Attenuation to —32 dBm in 2 dB steps. Spurious noise in OFF channel (all other channels ON) is less than 15 dBrnC. |
| TWO TONE TEST SET (6625-00-190-1311) Model 2005R | 20Hz to 20kHz | Generates low distortion two tone signal for the measurement of intermodulation caused by non-linearity of audio transmission systems. |
| TV AUTOMATIC MONITORING SYSTEM Models 2914A, 2915, 2917 | | See television section overleaf. |

# *NEW*



**mi 2910 series**
**Non Linear Distortion Analyzer with Sampler**



**mi 2914A**
**Automatic TV Quality Analyzer**

## mi TV TRANSMISSION TEST EQUIPMENT

| DESCRIPTION | FEATURES |
|---|---|
| TV AUTOMATIC QUALITY MONITORING SYSTEM Models 2914A, 2915, 2917 | Automatically analyzes and displays all essential parameters including: amplitudes of bar, sync, various T pulses, and noise; luminance linearity, chrominance gain, chrominance/luminance crosstalk, differential gain and phase, etc., all measured in the most suitable units of measure and presented digitally when under manual control (see illustration above). Data Selector Model 2917 enables both local and remote print out of results. Versions to meet International, F.C.C. and NTC recommendations, 525/625 lines. |
| TV SWEEPER Model 2361 | Main sweep unit has internal rep. rate 0.01Hz to 100Hz with linear, semi log, CW, single shot and manual modes. TV field lock, blanking and phase shift controls and alternate trace separation. Produces ultra flat, low distortion sweep. Plug-ins available: Video 25kHz to 30MHz. VHF 1 to 300MHz, UHF 220MHz to 1000MHz. |
| TV SWEEP ANALYZER Model 2900 | Comprehensive frequency sweep analyzer combines Model 2361 Sweeper and video unit, Blanking and Sync Mixer Model 2908 and Differntial Probes unit, Model 2907. Measures response of active or passive transmission networks. Differential measurements on composite signal to an accuracy of 0.01dB. Also measures termination impedance and return loss. |
| LUMINANCE/CHROMINANCE GAIN & DELAY TEST SET Model 2904/1 | Measures gain and delay inequality with gain discrimination 0.5dB, delay discrimination 2 nanoseconds, visible display of misalignment with waveform monitor. |
| NON-LINEAR DISTORTION ANALYZER with SAMPLER Model 2910 | Makes accurate, simultaneous measurements from Vertical Internal Test Signal or Full Field Signal of differential gain, differential phase and luminance non-linearity, even in the presence of noise. Gain and phase can be directly measured against a calibrated pulse which can be varied over the ranges of 0 to 11% in .1% steps and 0 to 11° in .1° steps respectively, with the luminance non-linearity being resolvable down to 0.1% using an external scope display. Available for 625 line systems. |
| TV TESTLINE GENERATOR AND INSERTER Model 2913 | Erases and inserts Vertical Interval Test Signals on selected lines, Generates full field test signals. Can be remote programmed. Ideal for use with TV Automatic Quality Monitoring System. SECAM and PAL versions available. |

## EDDYSTONE COMMUNICATIONS RECEIVERS

| | | |
|---|---|---|
| Model 958 | 10kHz to 30MHz | A unique series of communications receivers covering 10KHz thru 470MHz. All feature superb construction and top performance Low frequency models provide AM/CW/SSB, high frequency offer AM/FM. Xtal locking facility optional on all models to enhance stability. Optional Panoramic Display Units available. |
| Model 1830 | 120kHz to 30MHz | |
| Model 990R | 27MHz to 240MHz | |
| Model 1990R | 25MHz to 470MHz | |

## mi BRIDGES AND Q METERS

| | | |
|---|---|---|
| UNIVERSAL BRIDGE Model 1313A | 1kHz and 10kHz 20Hz to 20kHz External | 0.1μH to 110H, 0.1pF to 100μF, 0.003Ω to 110MΩ. Accuracy 0.1%. Built-in osc. and det. Direct reading; simplest possible operation Uses adapter TM6113 for biasing inductors to 200mA. |
| PORTABLE UNIVERSAL BRIDGE Model 2700 | 1kHz internal 20Hz to 20kHz External | 0.2μH to 110H, 0.5pF to 1100μF, 0.01Ω to 11MΩ. Accuracy 1%. Transistorized, simple. Measures incremental L, electrolytics & non-linear resistance using external bias supplies. |
| Q METER Model 1245A | 1kHz to 300MHz | Q ranges 5 to 1000, △Q 25-0-25. Accuracy 5% to 100MHz, 20% to 300MHz. Calibrated capacitor 7.5 to 500pF, △C ranges ±1 and ±5pF. Extremely stable and easy to operate. Uses separate oscillators. |

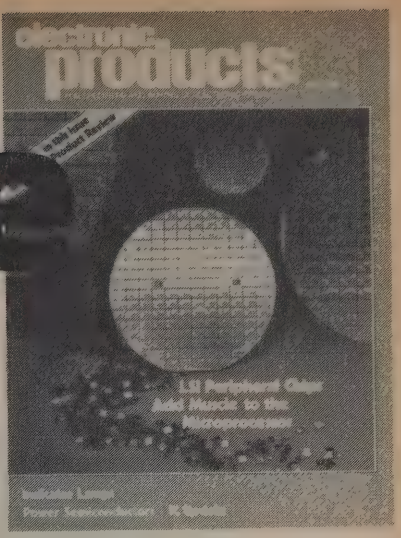
## mi MICROWAVE SIGNAL SOURCES

| | | |
|---|---|---|
| Model 6055 | 0.85 to 2.15GHz | A unique series of transistor and gunn diode microwave signal sources covering 400MHz to 18.0GHz. Digital display of frequency, accuracy typically ±1%. Variable output levels typically 10mW on gunn diode sources. Up to 150mW on transistor models, Gunn Diode Models are 6057, 6058 and 6059. Special frequency coverages on request. |
| Model 6056 | 2.0 to 4.0GHz | |
| Model 6057 | 4.5 to 8.5GHz | |
| Model 6058 | 8.0 to 12.5GHz | |
| Model 6059 | 12.0 to 18.0GHz | |
| Model 6070 | 0.4 to 1.2GHz | |

**MARCONI INSTRUMENTS**
DIVISION OF MARCONI ELECTRONICS INC.

100 STONEHURST COURT, NORTHVALE, NEW JERSEY 07647 • 201/767-7250 • TWX: 710-991-9752

# stay up to date



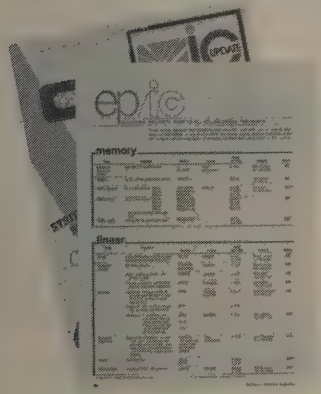

**SUBSCRIBE TO ELECTRONIC PRODUCTS MAGAZINE. IT'S YOUR *COMPLETE* GUIDE TO EVERYTHING THAT'S NEW IN THE FAST-CHANGING WORLD OF ELECTRONIC PRODUCTS AND SYSTEMS.**

**FEATURE STORIES** every month on electronic products, applications and availability.

**FORUMS**—Reports on meetings of manufacturers, users and distributors. Get the very latest news on a wide variety of products.

**NEW PRODUCT NEWS**—Hundreds of new products are introduced each month. You'll get the facts on not only what the new product is, but also where to get it, basic prices and current delivery.

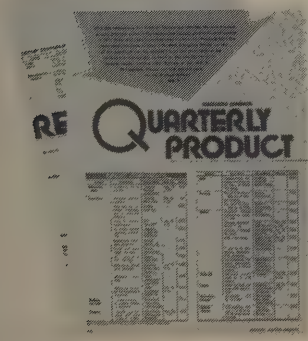
**EP/IC UPDATE**—Exclusive in ELECTRONIC PRODUCTS. A monthly report on *everything* that's new in the fast-moving world of integrated circuits.



**QUARTERLY PRODUCT REVIEW**—Another exclusive in ELECTRONIC PRODUCTS. A complete report of *every* new electronic product introduced in the previous quarter. This feature is in the January, April, July and October issues.

**QUARTERLY PRODUCT PLANNING DIRECTORY**—A compilation of the latest catalogs of a wide variety of electronic products and systems.

**OUTLOOK**—Important industry news affecting electronic products and systems.



**COMPONENT CAPERS**—A humorous look at the strange and wonderful world of electronics.

**MINI-GLOSSARIES,** Quizzes and more—Each and every month for over twenty years the readers of ELECTRONIC PRODUCTS learn something new about the products they work with and specify.

***If you are not now a subscriber, write to:***
***Dorothy Renoud, ELECTRONIC PRODUCTS MAGAZINE, 645 Stewart Avenue, Garden City, NY 11530.***
***Ask for a free qualification card.***

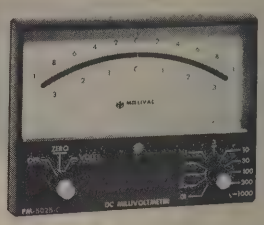
United Technical Publications, Inc., Div. of Cox Broadcasting Corp., 645 Stewart Ave., Garden City, NY 11530/(516) 222-2500

## DC VOLTMETERS

| MODEL | PRICE | LOWEST RANGE | HIGHEST RANGE | NO. OF RANGES | INPUT IMPEDANCE | BASIC ACCURACY | DC OUTPUT | POWER FREQUENCY | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| PM-403B | $600.00 | 0-1mV | 0-1KV | 7 | 10 meg | .1% ±1 Digit | 0-1Volt @ 1mAmp or ±.5Volt for center zero models | 45-65 Hz | 3-1/2 Digit readout Panel Mounting 1μV/Digit sensitivity |
| PM-502B | $425.00 | 0-10mV | | 11 | | ±2% | | | All analog Panel Mounting voltmeters also available with center-zero meter movements PM-502B-C PM-503B-C PM-504B-C |
| PM-503B | $450.00 | 0-1mV | | 13 | | | | | |
| PM-504B | $475.00 | 0-.1mV | | 15 | | | | | |

PM-403B

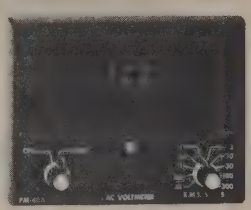
PM-502B-C



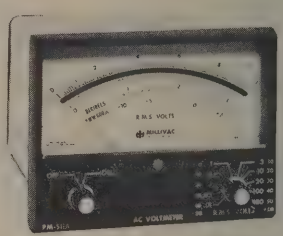
## AC VOLTMETERS

| MODEL | PRICE | LOWEST RANGE | HIGHEST RANGE | NO. OF RANGES | INPUT IMPEDANCE | FREQUENCY RESPONSE | BASIC ACC'Y | POWER FREQUENCY | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| PM-411A | $500.00 | 0-10mV RMS | 0-300V RMS | 10 | 10meg 20pF | 20Hz to 1MHz | ±2% | 45-450 Hz | 3 Digit readout Panel Mounting |
| PM-511A | $350.00 | | | | | | | | Analog readout Panel Mounting |

PM-411A



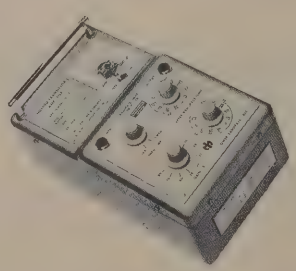
PM-511A



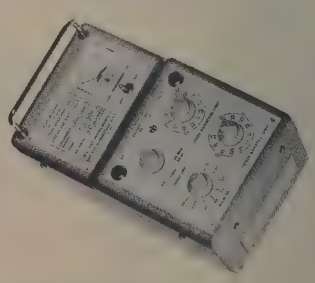
## LOW-NOISE, AC AMPLIFIERS

| MODEL | PRICE | GAIN | FREQUENCY RANGE | INPUT IMPEDANCE | FEATURES | REMARKS |
|---|---|---|---|---|---|---|
| VS-64A | $550.00 | 10-80 DB | 2Hz-180KHz | 10K & 100K | Upper and lower bandpass limit selector switches | Original hushed transistor amplifier, internal batteries. |
| VS-68B | $700.00 | | | 10K, 100K & 50 meg | | Hi-impedance amplifier, all solid-state, internal batteries |

VS-64A



VS-68B



MILLIVAC INSTRUMENTS

2818 CURRY ROAD SCHENECTADY, N.Y. 12303

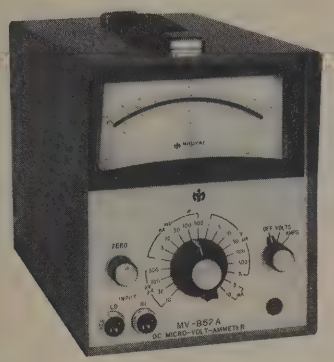
P.O. BOX 997 SCHENECTADY, N.Y. 12301

PHONE: (518) 355-8300

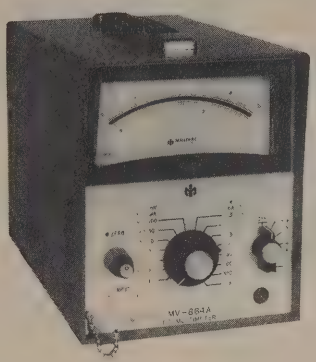
## DC MULTIMETERS

| MODEL | PRICE | LOWEST RANGE | HIGHEST RANGE | NO. OF RANGES | INPUT IMPEDANCE | BASIC ACCURACY | DC OUTPUT | POWER FREQUENCY | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| MV-852A | $750.00 | 0-10μV 0-10pA | 0-1Kv 0-10mA | 17 19 | Voltmeter: 10meg on lowest range to 100meg on highest range | ±2% | 1-0-1Volt @1mAmp. | 40-1000 Hz | Solid-state DC Micro-Volt-Ammeter Center-zero meter Line operated |
| MV-952A | $875.00 | | | | | | | | Same as above Line or battery operated |
| MV-864A | $650.00 | 0-100μV 0-100nA X1Ω mid scale | 0-1Kv 0-1A X100mΩ | 15 15 9 | Voltmeter: 10meg on lowest range to 200meg on highest range | ±1% ±2% ±5% | 0-±1Volt @ 1mAmp | | Solid-state DC Volt-Ampere-Ohmmeter Left-zero meter Line operated |
| MV-964A | $775.00 | | | | | | | | Same as above Line or battery operated |

MV-852A




MV-864A



## RF VOLTMETERS

| MODEL | PRICE | LOWEST RANGE | HIGHEST RANGE | NO. OF RANGES | FREQUENCY RESPONSE | BASIC ACCURACY | DC OUTPUT | POWER FREQUENCY | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| PM-422B | $875.00 | 0-3mV | 0-10V | 8 | 10KHz to 1.2GHz | ±3% | 0-1Volt @1mAmp. 0-3Volt @1mAmp. | 45-65 Hz | All solid-state 4 digit readout Panel Mounting |
| PM-522B | $675.00 | | | | | | | | Analog readout Panel Mounting |
| MV-723B | $1200.00 | 0-1mV | 0-10V | 9 | | | | 40-1000 Hz | 4 Digit readout Line operated — Latest design True linear scale Many options available |
| MV-823B | $1000.00 | | | | | | | | Analog readout Line operated |
| MV-923B | $1125.00 | | | | | | | | Analog readout Line or battery |
| MV-828A | $875.00 | | 0-3V | 8 | | | 0-1Volt @1mAmp. | | Line operated |
| MV-928A | $1000.00 | | | | | | | | Line or battery operated |

MV-828A

MV-723B

MILLIVAC INSTRUMENTS

For further information on any of the above instruments, accessories, and options, please contact the representative in your area or the factory

Prices and specifications subject to change without notice

# MODUTEC

## #1 IN TAUT BAND PANEL METERS

See overleaf for ranges & prices

## TAUT BAND PANEL METERS

**2% F.S. accuracy in ranges for all applications**

## MOVING MAGNET PANEL METERS

**5% F.S. accuracy, high quality & style, low cost**

**Available in Taut Band & Moving Magnet Versions**

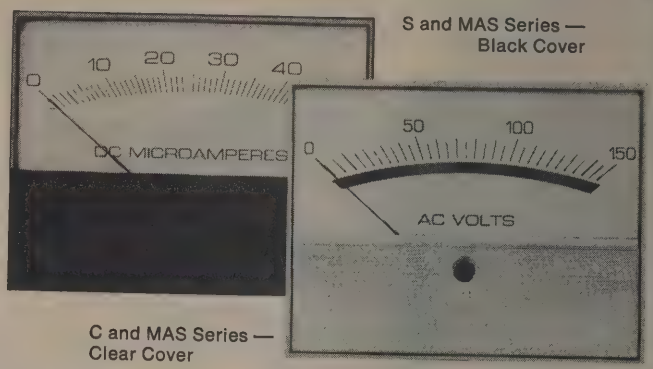
### SURFACE MOUNT

**S and MAS Series — Black Cover**

Handsome aspect ratio and clean-cut detailing add distinction to any panel. Optional colors available.

**C and MAS Series — Clear Cover**

Clear acrylic case front reduces contrast between the meter and adjacent panel for a pleasing overall effect.




S and MAS Series — Black Cover

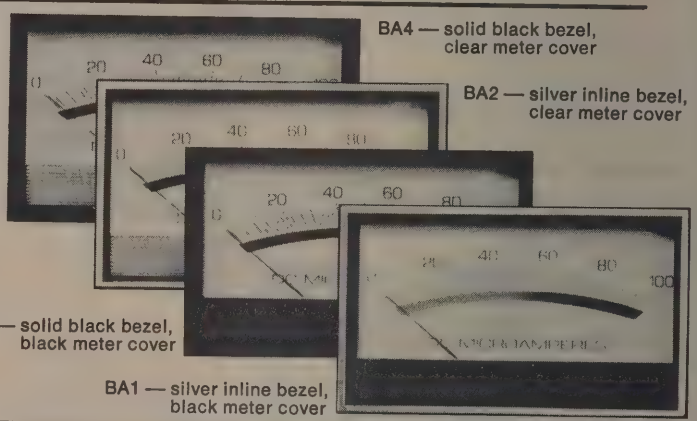
C and MAS Series — Clear Cover

**Available in Taut Band**

### BEZEL MOUNT

**BA Series**

Actually a package comprising a surface mount meter and a slender, graceful bezel in the combination shown. Mounting hardware and instructions are included. Bezels are available in optional colors; all meter options apply.



BA4 — solid black bezel, clear meter cover

BA2 — silver inline bezel, clear meter cover

BA3 — solid black bezel, black meter cover

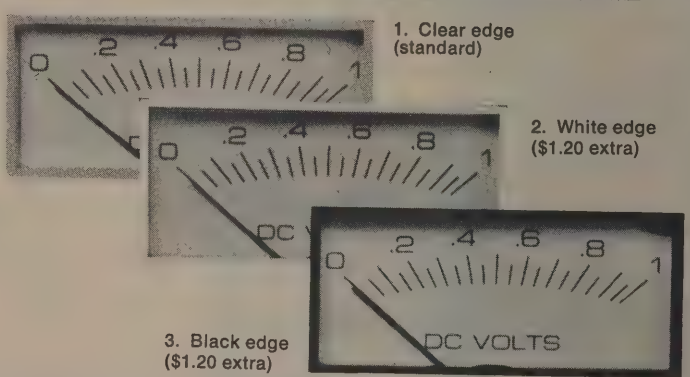
BA1 — silver inline bezel, black meter cover

**Available in Taut Band & Moving Magnet**

### WINDO-MOUNT™

**W Series**

A sophisticated and original design that has been widely imitated, these original Windo-mount meters are easily installed without special adapters, and do not sink the meter dial deep behind the panel. Uniquely attractive edge options are available, as shown at right.



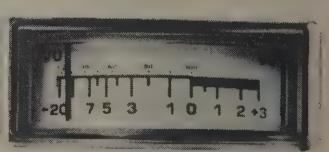

1. Clear edge (standard)

2. White edge ($1.20 extra)

3. Black edge ($1.20 extra)

**Available in Moving Magnet Version**

**SQUARE** An attractive and useful shape, in 1½″ (OMS) and 2½″ (MSQ) sizes, and all ranges including VU. Available for surface mount or Windo-mount (above), but not bezel mount.




**EDGE READING** meter comes in all ranges, including VU, 3 sizes (1¼″, 2″, 2½″), and installs without modification as either surface mount or flush mount.

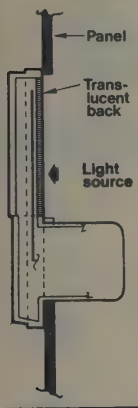
**24 OR LESS CATALOG METERS SHIPPED IN 1 WEEK OR YOU PAY ½ PRICE**
**FAST DELIVERY OF OPTIONS AND SPECIALS FROM FACTORY MODIFICATION CENTERS**

***TAUT BAND METER SIZES***-*1½" • 2½" • 3½" • 4½" • 5½" & 8"*

***MOVING MAGNET METER SIZES***-*1" • 1½" • 2" • 2½" • 3½"*
*& EDGE READING 1¼", 2", 2½"*

**See next page for ranges & prices**

**Available in taut band and moving magnet**



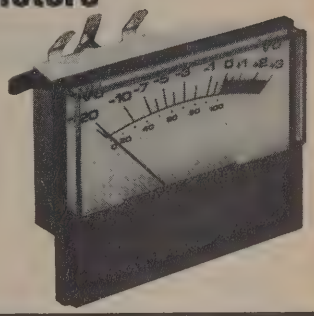

## L SERIES
### Trans-Lit™ Panel Meters

- Dial printed on translucent back for illumination through the meter dial — highest quality lighting of any meter.
- Optional smoke-grey covers enable "meter blackout" technology.
- Save money in installation and illumination accommodations.
- Available in Surface Mount, Bezel Mount, and Windo-Mount styles.

**Available in taut band**

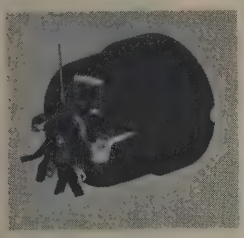
## LL SERIES
### Lite/Box Panel Meters

- Integral light box provides finest, glare-free illumination.
- Ready-to-use package — no installation problems. Lamp replacement is quick and easy.
- Optional smoke-grey covers enable "meter blackout" technology.
- Available in Surface Mount, Bezel Mount, and Windo-Mount styles.

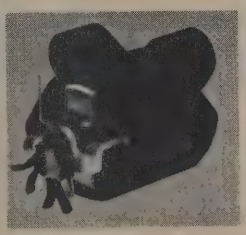


## HIGH TORQUE METER MOVEMENTS

***Unpointered • Pointered • Dial Mounted***



MP4



MP5

MP3

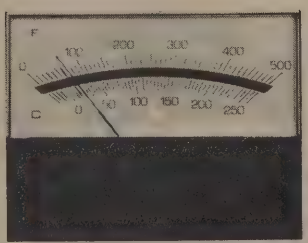
Modutec furnishes large numbers of uncased and dial mounted mechanisms to a variety of users. Units are available to fit standard cutouts and also are manufactured to meet individual requirements for performance, size, and shape.

The high torque and other desirable features of Modutec meter movements make them very useful in applications such as torque motors, recorder pen motors, flag indicators, etc.

High precision taut band movements, or ultra-economical moving magnet movements, will provide ideal answers to your needs, with benefits in cost, appearance, and space utilization.

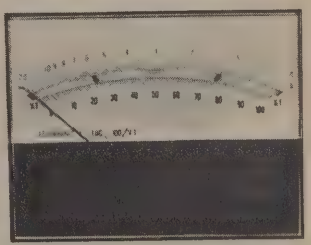
Phone or write for full information.

## PYROMETERS & THERMOCOUPLES



Utilizing precise and reliable Modutec taut band movements, in all panel meter styles, sizes 1½" through 5½", Modutec pyrometers have thermistor copper error compensation, and are supplied in 19 ranges from −150°F to +3000°F. Many useful options can be incorporated. Thermocouples are stocked in useful variety, in types E, J, K, R, and T. Wire, connectors, and hardware are also available.
For details request Catalog PYR-1105.

## CONTROL METERS



A new approach to actuating and monitoring IC control circuits. Modutec Control Meters have precise taut band movements with low and/or high set potentiometers incorporated into the meter, the setting being indicated by pointers visible through the mirror-scale slot. They are available in 3½", 4½", and 5½" sizes.
For information, including detailed typical applications, request Catalog CM-1012.

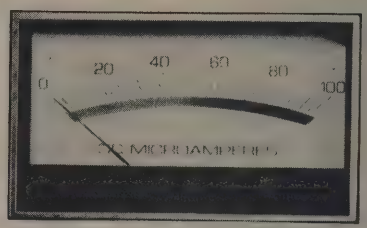
**MODUTEC, INC.**
18 Marshall St., Norwalk, CT 06854 (203) 853-3636 TWX: 710-468-2039

# MODUTEC

(see preceding spread for description)

## TAUT BAND PANEL METERS

**Modutec 100° Taut Band Panel Meters are Number 1 nationally in sales — for many good reasons! Meet or exceed the performance requirements of USA STD C-39.1. Full-scale accuracy 2% (AC 3%), tracking 1.5% (AC 2%), repeatability 0.5%. Trend-setting styling, high torque, high precision, low friction movements. Numerous options available for immediate incorporation in any catalog meter. Plus fast service!**




### Ranges, Sizes, Prices (Request Modutec Catalog 78-79 for detailed information)

Note: Prices are approximately median for range groups; catalog price for any specific range may differ slightly.

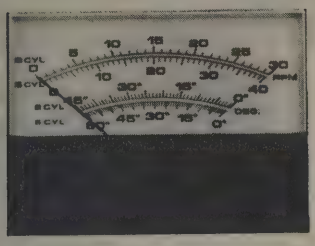
| SIZE: | 1½" | 2½" | 3½" | 4½" | 5½" | 8" |
|---|---|---|---|---|---|---|
| **DC MICROAMMETERS (Available in all series)** | | | | | | |
| Zero left — 5 ranges: 0-20μA to 0-500μA | $30.40 | $28.90 | $30.40 | $32.25 | $38.65 | — |
| Zero center — 5 ranges: 10-0-10μA to 500-0-500μA | 31.50 | 30.40 | 31.50 | 33.65 | 40.05 | — |
| Logarithmic, zero left — 4 ranges: 0-100μA to 0-1000μA | — | — | 46.80 | 49.00 | 59.35 | $80.60 |
| Logarithmic, suppressed zero — 4 ranges: 10-100μA to 100-1000μA | — | — | 51.35 | 53.80 | 65.15 | 89.25 |
| **DC MILLIAMMETERS (Available in all series)** | | | | | | |
| Zero left — 15 ranges: 0-1mA to 0-750mA | 28.20 | 26.85 | 28.20 | 29.90 | 35.70 | 45.00 |
| Zero center — 8 ranges: 1-0-1mA to 500-0-500mA | 28.90 | 27.60 | 28.90 | 30.50 | 36.50 | 46.30 |
| **DC AMMETERS (Available in all series)** | | | | | | |
| Zero left — 22 ranges: 0-1A to 0-2000A | 26.00 | 25.85 | 27.00 | 28.80 | 34.35 | 43.05 |
| Zero center — 13 ranges: 1-0-1A to 500-0-500A | 28.30 | 27.15 | 28.30 | 30.15 | 36.05 | 45.65 |
| **DC MILLIVOLTMETERS (Available in all series)** | | | | | | |
| Zero left — 2 ranges: 0-50mV and 0-100mV | 27.00 | 25.85 | 27.00 | 28.80 | 34.45 | 43.05 |
| Zero center — 2 ranges: 50-0-50mV and 100-0-100mV | 27.65 | 26.60 | 27.65 | 29.55 | 35.30 | 44.50 |
| **DC VOLTMETERS (Available in all series)** | | | | | | |
| Zero left — 23 ranges: 0-1V to 0-1000V | 27.00 | 25.85 | 27.00 | 28.80 | 34.35 | 43.05 |
| Zero center — 10 ranges: 5-0-5V to 600-0-600V | 27.65 | 26.60 | 27.65 | 29.45 | 35.20 | 44.40 |
| Expanded scale, volts — 8 ranges: 5V to 300V±10%, ±.05% acc. | — | 93.30 | 97.90 | 102.55 | 107.10 | — |
| Exp. scale, % deviation — 3 ranges: 12,28,120V±10%, ±.05% acc. | — | 93.30 | 97.90 | 102.55 | 107.10 | — |
| **AC MILLIAMMETERS (Available in all series)** | | | | | | |
| 8 ranges: 0-1mA to 0-500mA | 34.70 | 32.50 | 34.70 | 38.15 | 43.65 | — |
| **AC AMMETERS (Available in all series)** | | | | | | |
| 24 ranges: 0-1A to 0-2000A | 34.70 | 32.50 | 34.70 | 38.15 | 43.65 | 57.70 |
| **AC VOLTMETERS (Available in all series)** | | | | | | |
| 11 ranges: 0-3V to 0-600V | 32.25 | 30.80 | 32.25 | 34.10 | 41.30 | 54.10 |
| Expanded scale, volts: 105-125V or 210-250V at ±0.5% acc. | — | 90.25 | 94.65 | 98.85 | 103.05 | — |
| Expanded scale, volts: 95-135V or 190-270V at ±1.0% acc. | — | 90.25 | 94.65 | 98.85 | 103.05 | — |
| **NULL METERS (Available in all series)** | | | | | | |
| 35Ω, 640Ω, or 2550Ω resistance | 38.05 | 37.00 | 38.05 | — | — | — |
| **ELAPSED TIME METERS (Series S, C, BA, W)** | | | | | | |
| AC, non-resettable; 0-99,999.9 mins. or hrs. | — | 34.70 | 43.70 | — | — | — |
| AC, front-resettable; 0-99,999.9 mins. or hrs. | — | — | 57.50 | — | — | — |
| DC, non-resettable; 0-9,999.9 hrs.; 4-10, 10-20, 104-120VDC | — | — | 60.60 | — | — | — |
| **RF AMMETERS (Series S, C, BA, W)** | | | | | | |
| 6 ranges: 0-1A to 0-10A | — | — | 36.75 | 41.85 | 49.80 | — |
| **FREQUENCY METERS (Series S, C, BA, W)** | | | | | | |
| Vibrating reed type — 7 ranges: 47-53Hz to 380-420Hz | — | — | 58.30 | — | — | — |
| Pointer type, electronic, 6 ranges: 45-55Hz to 380-420Hz | — | — | 75.00 | 78.50 | — | — |
| **VU METERS (Available in all series)** | | | | | | |
| Per USA Std. C-16.5-1954 | 38.05 | 36.60 | 38.05 | 39.35 | — | — |
| VU type DC Microammeters | 28.45 | 27.80 | 28.45 | 30.20 | — | — |
| S, C, and W Series — Prices are listed above. | | | | | | |
| BA Series — Add to the prices listed above: | 3.35 | 3.35 | 3.35 | 3.60 | 3.85 | — |
| K Series (MIL Spec.) — Add to the prices listed above: (plus bezel mount adder if desired) | 10.15 | 9.25 | 10.15 | 11.80 | 13.50 | — |
| R Series (interchangeable dial) — Add to the prices listed above: | — | — | 4.60 | 5.35 | 6.15 | 10.75 |
| L & V Series — Add to the prices above (bezel mount extra): | — | — | 3.05 | 3.85 | 3.85 | 4.60 |
| LL Series, less lamps (bezel mount extra)—Add: | — | 8.85 | 8.85 | 9.55 | — | — |

**DISCOUNT SCHEDULE: 1-9 NET; 10-24 15%; 25-49 35%; 50-99 45% on total order for one shipment.**

(see preceding spread for description)

# MODUTEC

## MOVING MAGNET PANEL METERS & INDICATORS



**M-Series Panel Meters are for those users — high volume in particular — who do not require the rigorous performance characteristics of Modutec Taut Band Meters. Featuring sales-making appearance and advanced engineering, M-Series Meters are rugged and dependable, with 5% f.s. accuracy, improvable to 3%, as one of many catalog-listed options available in this unique line of low-cost meters.**

### M SERIES — Ranges, Sizes, Prices (Request Catalog 78-79 for detailed information)

Note: Prices are approximately median; catalog prices for specific ranges may differ slightly.

| SIZE: | 1″ | 1½″ | 2″ | 2½″ | 3½″ | Edge Reading 1¼″ | Edge Reading 2″ | Edge Reading 2½″ |
|---|---|---|---|---|---|---|---|---|
| **DC MICROAMMETERS & LEVEL (BALANCE) INDICATORS** | | | | | | | | |
| Zero Left — 2 ranges: 0-200$\mu$A and 0-500$\mu$A | $6.80 | — | — | — | — | $6.64 | — | — |
| Zero Center — 3 ranges: 150-0-150$\mu$A to 500-0-500$\mu$A | 5.91 | $6.57 | $7.22 | $7.52 | $7.82 | 6.76 | $6.74 | $7.59 |
| **DC MILLIAMMETERS** | | | | | | | | |
| Zero Left — 14 ranges: 0-1mA to 0-500mA | 5.58 | 6.19 | 6.80 | 7.16 | 7.28 | 5.36 | 5.47 | 7.05 |
| Zero Center — 8 ranges: 1-0-1mA to 500-0-500mA | 5.72 | 6.36 | 6.98 | 7.33 | 7.28 | 5.53 | 5.65 | 7.05 |
| **DC AMMETERS (Battery & Circuit Condition Indicators)** | | | | | | | | |
| Zero Left — 9 ranges: 0-1A to 0-30A | 5.77 | 6.41 | 7.05 | 7.39 | 7.63 | 5.73 | 5.90 | 7.40 |
| Ammeters with ext. shunts can be supplied to 125A | | | | | | | | |
| Zero Center — 6 ranges: 1-0-1A to 25-0-25A | 5.87 | 6.51 | 7.16 | 7.46 | 7.76 | 5.84 | 6.02 | 7.53 |
| **DC MILLIVOLTMETERS** | | | | | | | | |
| Zero Left — 0-50mV, 0-100mV | 5.82 | 6.47 | 7.10 | 7.43 | 7.76 | 5.49 | 5.60 | 7.53 |
| Zero Center — 50-0-50mV, 100-0-100mV | 6.03 | 6.69 | 7.35 | 7.67 | 8.00 | 5.79 | 5.96 | 7.71 |
| **DC VOLTMETERS (Battery & Circuit Condition Indicators)** | | | | | | | | |
| **Standard Sensitivity** | | | | | | | | |
| Zero Left — 15 ranges: 0-1V to 0-500V | 5.82 | 6.47 | 7.10 | 7.43 | 7.76 | 5.43 | 5.60 | 7.53 |
| (Multiplier resistor furnished externally above 15V) | | | | | | | | |
| Zero Center — 8 ranges: 5-0-5V to 500-0-500V | 6.03 | 6.69 | 7.35 | 7.67 | 8.00 | 5.79 | 5.96 | 7.71 |
| **High Sensitivity** | 6.32 | 6.97 | 7.60 | 7.93 | 8.26 | 5.93 | 6.10 | 8.03 |
| Zero Left — 15 ranges: 0-1V to 0-500V | | | | | | | | |
| Zero Center — 8 ranges: 5-0-5V to 500-0-500V | 6.53 | 7.19 | 7.85 | 8.17 | 8.50 | 6.29 | 6.46 | 8.21 |
| **AC MILLIAMMETERS** | | | | | | | | |
| Zero Left — 3 ranges: 0-10mA to 0-500mA | 5.82 | 6.47 | 7.10 | 7.43 | 7.76 | 5.60 | 5.78 | 7.53 |
| **AC AMMETERS** | | | | | | | | |
| Zero Left — 4 ranges: 0-1A to 0-10A | 6.54 | 7.25 | 7.97 | 8.26 | 8.55 | 6.41 | 6.58 | 8.26 |
| **AC VOLTMETERS** | | | | | | | | |
| (Multiplier resistor furnished externally above 25V) | | | | | | | | |
| Zero Left — 6 ranges: 0-10V to 0-300V | 6.12 | 6.73 | 7.46 | 7.67 | 7.88 | 5.84 | 6.02 | 7.65 |
| **VU METERS** | | | | | | | | |
| Supplied with either recording or broadcasting type scales, printed in black and red on white background. Designed to read zero VU (100%) with 1.23V applied to meter with the circuit supplied. DC Type are the same indicators, but the resistor/rectifier package is not supplied. | | | | | | | | |
| **AC TYPE** — supplied with resistor/rectifier package **Standard Sensitivity** (4 mA basic) | 7.89 | 8.75 | 6.92 | 9.89 | 9.98 | 8.07 | 8.30 | 9.87 |
| **DC TYPE** — resistor/rectifier package not supplied **Standard Sensitivity** (4 mA basic — 300 ohms) | 6.41 | 7.11 | 7.82 | 8.08 | 8.36 | 6.39 | 6.56 | 8.07 |

**DISCOUNT SCHEDULE (per type): 1-9 list; 10-24 10%; 25-99 20%; 100-249 30%; 250-499 40%; 500+ inquire.**

**MODUTEC, INC.** 18 Marshall St., Norwalk, CT 06854 (203) 853-3636 TWX: 710-468-2039

# NATIONWIDE ELECTRONIC SYSTEMS, Inc.

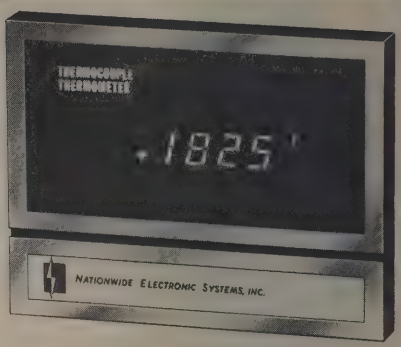
*First in Electronics through Innovation*

# SLIMLINES . . . the METERS that GROW

## the BROADEST and MOST POWERFUL line of digital meters . . . IN THE WORLD

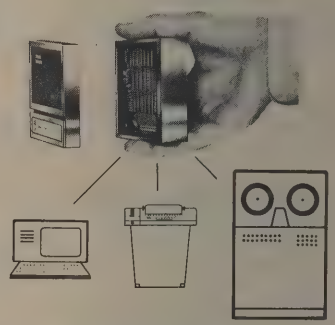
**METERS . . . what an inadequate word to describe these compact workhorses! Most meters on the market are designed to be looked at. Slimlines work for a living.**

**They combine high-performance measurement circuitry with all of the control inputs and data outputs needed for fast, efficient systems interface. And their quality is backed up by an unheard-of 5-year warranty!**




## SOLVE MEASUREMENT PROBLEMS!

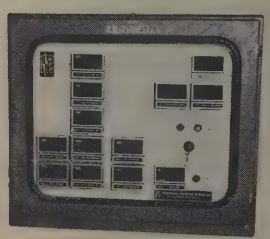
The widest selection of meters on the market, with a model to fit your need. **VOLTMETERS** from $76, **AMMETERS** from $185, **OHMMETERS** from $255, **WATTMETERS** from $416, **TRI-SCALE METERS** from $580, **CUSTOM METERS** with special scaling from $300, **TRANSDUCER READOUTS** from $88, **FREQUENCY METERS** and **TACHOMETERS** from $300, **CLOCKS** from $76, **CALENDARS** from $199, **STOPWATCHES** from $200, **RTD THERMOMETERS** from $380, **THERMISTOR THERMOMETERS** from $280, **THERMOCOUPLE THERMOMETERS** from $280, **COUNTERS** from $175, **TENSION & COMPRESSION METERS** from $560, **VACUUM & PRESSURE METERS** from $550, **REMOTE DISPLAYS** from $145, **POWER FACTOR METERS** from $415. NEW PRODUCTS: **PRODUCTION RATE METERS** from $240, **PRODUCTION YIELD** from $240, **WATT-HOUR METERS,** $600, **VARS METERS** from $500, **RELATIVE HUMIDITY METERS** from $455.



## TRANSMIT & RECORD DATA!

**A NES EXCLUSIVE!** Plug-on **ASCII BUSTLES** (from $180) give Slimlines incredible power: connect 100 Slimlines to a single pair of wires . . . meters transmit readings in serial ASCII to teletypewriters or printers for logging, CRT terminals for real-time dislay, computers or microprocessors for on-line processing. Address meters at random or program for automatic self-scan. Build a complete system one step at a time. **RECEIVING BUSTLES** . . . control equipment from a teletypewriter. **BCD BUS BUSTLES** from $160: up to 100 Slimlines on a parallel BCD data bus . . . use with printers, microprocessors, minicomputers, etc. **ISOLATOR/DRIVER INTERFACES** (from $150): isolating buffers and interface to high-level logic.

## AUTOMATE!

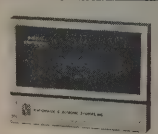


Monitor the reading of **any Slimline** and control, alarm, or automate! **COMPARATOR/CONTROLLERS** (from $196) do it automatically, providing outputs for solid-state relays, indicators, motor controls, solenoid actuators, etc. **PRELOADERS** from $124 and **SCANNERS** from $175, too.

## COMPLETE SYSTEMS!

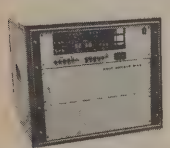
We will design and build instrumentation and control systems to solve specific problems . . . large or small, at reasonable cost. Call our applications engineering department.

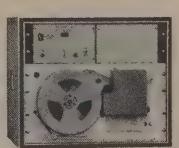
## READ-ONLY MODELS = LOW COST!

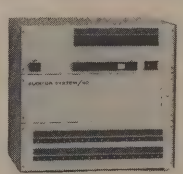


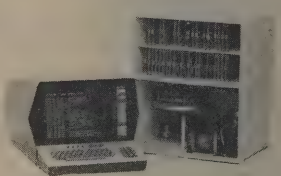
Same high quality, appearance, and **5-year warranty** as the other Slimlines . . . only the data outputs and control inputs have been left off to substantially lower the cost! **CLOCKS, VOLTMETERS, TRANSDUCER READOUTS, STOPWATCHES & COUNTERS** with more units due for release shortly!

## OTHER PRODUCTS FROM NES:









**MEASUREMENT**
**METERS, CIRCUIT CARDS,** and complete Systems for all types of Measurement Applications.

**PROCESS CONTROL**
**AUTOMATIC TESTING, PROCESS ALARMS, BATCHING, SORTING** . . . small & large Systems to fit any need.

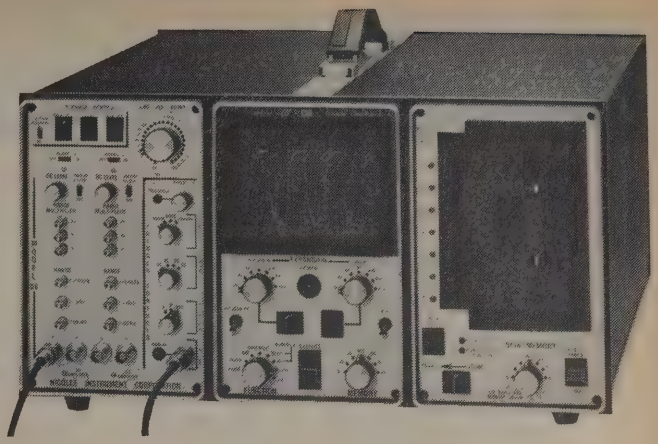
**DATA ACQUISITION**
**DATA LOGGERS, RECORDERS,** and **CUSTOMIZED SYSTEMS,** for Transmitting, Printing, and storing Data.

**COMMUNICATIONS**
**TRAFFIC LOGGERS, CODE CONVERTERS, TRANSMITTER LOGGERS, BROADCAST AUTOMATION, TELETYPE SYSTEMS,** etc.

**NATIONWIDE ELECTRONIC SYSTEMS, Inc.**

*1536 Brandy Parkway, Streamwood, IL 60103 • TEL: (312) 289-8820 • TWX: 910-651-3190 • USA*

NICOLET INSTRUMENT CORPORATION
OSCILLOSCOPE DIVISION
5225 Verona Road, Madison, Wisconsin 53711
Telephone: 608/271-3333



# The Explorer Series of Digital Storage Oscilloscopes

For low frequency, high precision measurements, no other storage oscilloscope even approaches the performance, efficiency and ease of operation of the Nicolet EXPLORER Series. When you choose the Explorer II or Explorer III, you're selecting an oscilloscope that's backed by the unmatched experience of Nicolet in digital instrumentation. We introduced the first digital oscilloscope over six years ago. These new scopes are third generation digital scopes that you'll use for exactly the same applications as analog oscilloscopes. The difference is that they let you do so much more. Check our specs, then call us for a demonstration and you'll see what it means to go the digital way with Nicolet.

## Mainframe Specifications

**MEMORY** — 4096 12 bit or 8 bit words. All 4096 words can be used for one waveform, or two 2048 point waveforms can be stored, or four 1024 point waveforms.

**VARIABLE PERSISTENCE** — Each waveform is shown, as it occurs. The trace remains until the next signal is received, however long the interval.

**OUT OF SIGHT STORAGE** — One or more waveforms can be placed in memory out of sight for later recall.

**SUPERIMPOSITION OF WAVEFORMS** — Two or more stored waveforms can be viewed superimposed for comparison. A stored and live waveform may also be superimposed, or two live waveforms. Zoom-in scale magnification may be used to observe very small difference in all three cases. (Up to x64 magnification.)

**DISPLAY** — Either YT or XY display may be used.

**NUMERICS** — These show true time and voltage for any selected point, with respect to zero or with respect to any other selected point.

**PEN RECORDER OUTPUT** — Microprocessor controlled pen recorder drive voltages cause external XY recorders to plot waveform information.

**WAVEFORM SUBTRACTION** — Two stored waveforms may be subtracted, to produce the difference waveform.

**STATUS STORAGE** — The oscilloscope operating control settings are recorded with the waveform information to insure that waveforms recalled later will indicate true time and voltages independent of intervening control setting changes.

**POWER** — 85 watts, 115 v ± 10% or 230 v ± 10%, 48-60 Hz. Specify voltage when ordering.

**WEIGHT** — (Explorer II) 32 lbs.
(Explorer III) 42 lbs.

**SIZE** — (Explorer II) Bench top cabinet 18" long x 11½" wide x 8¾" high.
(Explorer III) Rack mount cabinet 18" long x 17" wide x 8¾" high (not including rack mount hardware).

## Explorer III Additional Spec's

(mainframe)

**DISK RECORDER** — Capacity 32 k 12 bit bytes. Manual or automatic recording sequence. Eight individually protectable tracks. Disks removable for filing.

**I/O BUSS** — IEEE 488, RS 232 or 12 line binary.

**INTERCHANGEABILITY** — Explorer II may be converted at the factory to an Explorer III.

## Plug-in Unit Descriptions

**MODEL 206-1 and 206-2** are one and two channel plug-ins which have 12 bit ADC's. These contain buffer memories which allow observation of pre-trigger signal information. Bandwidths are 1 mHz, with signal measurement rate of 2 mHz (for both signal channels in the case of Model 206-2).

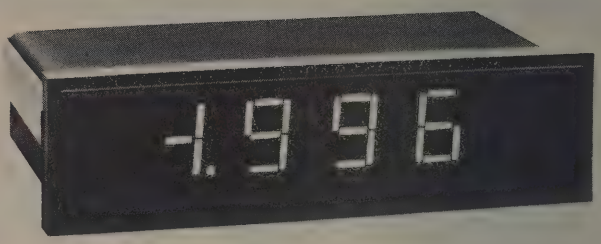
**MODEL 204-1 and 204-2** are 10 mHz bandwidth plug-ins, one and two channel which have 8 bit ADCs. They include buffer memories for observing pre-trigger information. Sweep speed ranges from 50 ns per data point to 20 seconds per point. Amplifiers are single ended rather than differential.

**MODEL 201-2** is a low bandwidth, high sensitivity unit for measuring slowly changing variables. It has high input impedance, drift stabilized dc amplifiers with 5 μv maximum sensitivity (± 10 millivolts full scale, with 0.025% resolution and essentially no dc drift with time and temperature).

# NEWPORT

# VOLTAGE, CURRENT & RATIO DIGITAL PANEL METERS

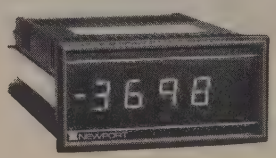
- DIFFERENTIAL INPUT
- 13mm (½ IN.) LED DISPLAY
- AUTOMATIC ZERO AND POLARITY
- DUAL SLOPE, AVERAGE VALUE
- 10μV RESOLUTION (OPTION ON 216)
- 60dB CMR DC TO 60Hz
- VOLTAGE AND RATIO MEASUREMENT
- BCD OUTPUTS (OPTION ON 216)
- DIN STANDARD CASES
  96mm(W) X 71mm(D) X 24 OR 48mm(H)
- LOW POWER CONSUMPTION (1 WATT)
- 5VDC POWER



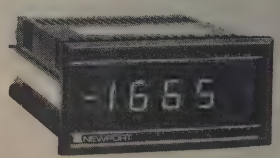

**DIGITAL EDGEWISE METER**

| MODEL 214 | MODEL 216 |
|---|---|
| 2000 COUNTS | 6000 COUNTS |
| $32.50/100's | $73.70/100's |

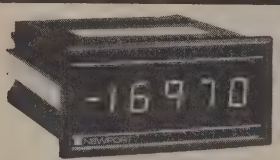
**SERIES 200AS** • 10 ranges voltage and current • Differential input • Beckman display • BCD outputs • 1000 megohm input impedance • Up to 60 readings per second • Optional extra zeros for weight applications (shown above) • From $159



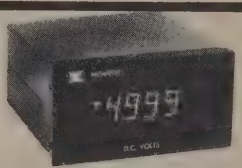

**MODEL 204** • Monitors current or voltage transmitter loops • Displays in engineering units — watts, volts, amps, flow, pressure, volume, temperature, etc. • Replaces pointer-type meters • 3999 counts • 13mm LED display • From $145




**MODEL 203A** • 3½ Digit • ½" LED display • Auto. zero and polarity • Dual slope, average value • 100μV resolution • 120dB CMR up to 500V • Voltage and ratio measurement • Parallel BCD outputs • Available in DIN or NEMA case • Orange LED display (option) • $71/100's

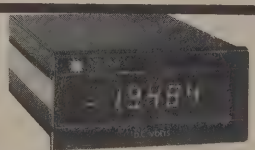



**MODEL 2003A** • 4½ Digit • 13mm (½") LED display • Automatic zero and polarity • Dual slope, average value • 10μV resolution • 120dB CMR up to 500V • Voltage and ratio measurement • Parallel BCD outputs • Available in DIN or NEMA case • Orange LED disp. (option) • $132/100's

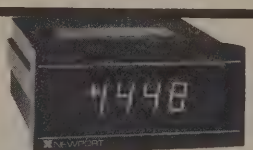



**SERIES 400AS** • Auto polarity, to ±4999 counts • DC voltage and current • Gated, buffered BCD outputs • 0.1% reading error • Up to 60 readings/second • Display blanking • Extruded aluminum case • Isolation of inputs from digital ground • Beckman display • From $189

**SERIES 2000AS** • Voltage, current, ratio models • ±39,999 counts full scale • 20 readings per second • High accuracy, ±.01%R ±.005%FS • Isolated, gated and buffered BCD outputs • Beckman display • 300VCM between analog and digital • From $385




**SERIES 2000BS** • DC voltage, current and ratio models • To ±39,999 counts optional • Buffered, isolated, gated outputs • .02% reading error • Up to 30 readings/second • Differential input • Beckman display • From $280




**MODEL 258** • Voltage, current, ratio models • 1999 counts • Beckman gas discharge display • AC powered • NEMA style case • Parallel BCD output standard • 100μV resolution • Automatic zero and polarity • From $137

**MODEL 6152/6153** • Remote display • Displays up to 5 digits • Parallel BCD, Hexadecimal or octal inputs • Display blanking • Optional annunciator display • Integral AC supply or 5VDC powered • 13mm LED display • DIN standard case • From $72

**CORPORATE OFFICE:**
630 East Young St.
**Santa Ana, CA 92705**
Telephone: (714) 540-4914
TWX: 910-595-1787
Cable: Newlab, Santa Ana, CA 92705

**NEWPORT BV**
P.O. Box 7759, Schiphol East
**The Netherlands**
Telephone: (20) 45-20-52
Telex: 844-16347

**NEWPORT LABORATORIES GmbH**
D-6072 Dreieich
Max-Planck-Strasse 13
Postfach 102163
**German Federal Republic**
Telephone: (06103) 3741 Telex: 04 17908 (NEWPT D)

# DIGITAL TEMPERATURE METERS NEWPORT

**MODEL 267B**
**7800 COUNTS**
**from $250**

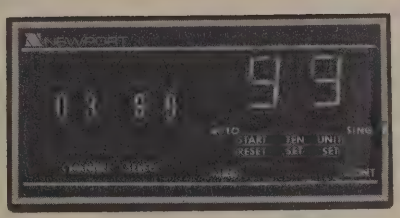
**MODEL 268**
**2000 COUNTS**
**from $185**

- BIPOLAR OPERATION
- J, K, T, E, B, R, S & W THERMOCOUPLE MODELS WITH 0.1° CONFORMITY AND 0.1° RESOLUTION
- OPEN THERMOCOUPLE INDICATION
- RTD MODEL WITH 0.01° RESOLUTION
- PRECALIBRATED PLUG-IN SENSOR MODULES
- DUAL SLOPE, AVERAGE VALUE
- 13mm (½ INCH) LED DISPLAY
- ORANGE LED DISPLAY (OPTION)
- PARALLEL BCD OUTPUT STANDARD
- AUTOMATIC ZERO & POLARITY
- DIN CASE WITH SCREW TERMINAL INPUTS
- 350V ANALOG TO DIGITAL ISOLATION
- DIGITAL SET POINT ALARM (OPTION)
- 0-1V LINEARIZED ANALOG OUTPUT (OPTION)
- BENCH STYLE METAL CASE (OPTION)
- PORTABLE BATTERY OPERATED UNIT

## SYSTEM COMPONENTS

**MODEL 810** • Digital printer • 9 columns, std.; expandable to 18 • Small size 4½" H. X 8½" W. • Programmable two-color printing • Reliable rotating drum printer • Fixed or floating decimal point • Uses standard adding machine paper • Last line visible without advancing paper • From $495

**SERIES 870** • Dual or single limit comparators • Capacity to ±39999 • Hi, Lo, Go lamps on dual comparator • DIN case, 96mm W. X 48mm H. X 130mm D. • Relay output • Compares parallel BCD or binary input data with numbers preset on front panel thumbwheel switches • From $115



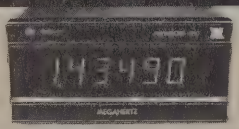
**LOW LEVEL SCANNERS**

**MODEL 850** • Controller for up to 100 channels • Thumbwheel selection of first and last point • Manual, single, and continuous scan modes • Adjustable scan rate up to 10 ch./sec. • 13mm (½ in.) LED ch. I.D. • DIN case (96 W. X 48 H. X 130 D.) mm • From $235

**MODEL 851** • 10 channel 2 pole Reed relay card • Low thermal EMF for TC signals • Low pass filter per channel • From $145

**MODEL 852** • Low pass filter per channel • 10 channel reed relay card for switching 3-wire RTD's • High level switching up to 200 volts • From $250

## TIME & EVENT METERS




**MODEL 6110, 6130** • Direct readout of RPM, frequency, time interval, period, period average, totalize and ratio • High noise immunity • Optically-coupled, isolated input with anti-contact bounce circuit • High input sensitivity • Buffered and gated BCD outputs • Beckman or 13mm (½ in.) LED display • From $250

**MODEL 6700S** • 12, 24 or 100 hour display • 100 day display optional • Selectable timing pulses • Front panel preset/reset • Power-line time base • Power failure indicator • Crystal time base, optional • Beckman display • From $275

**Corporate Office:**
630 East Young St.
**Santa Ana, CA 92705**
Telephone: (714) 540-4914
TWX: 910-595-1787
Cable: Newlab, Santa Ana, CA 92705

**Newport BV**
P.O. Box 7759, Schiphol East
**The Netherlands**
Telephone: (20) 45-20-52
Telex: 844-16347

**Newport Laboratories GmbH**
D-6072 Dreieich
Max-Planck-Strasse 13
Postfach 102163
**German Federal Republic**
Telephone: (06103) 3741 Telex: 04 17908 (NEWPT D)

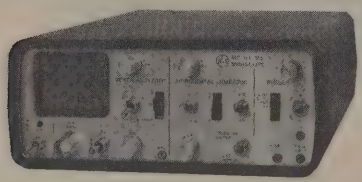
# SOMETHING FOR EVERYONE!!!

## The Modern, High Quality, Broad-based, Portable Test Equipment and Digital Panel Meter Line

For service dealers, MRO's field service, OEM's, educators, hobbyists and professionals.

For OEM's, MRO's and test equipment designers.

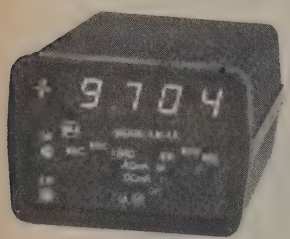
### OSCILLOSCOPES



The NLS MS-15 Miniscope is a battery or line operated 15-megahertz cathode-ray oscilloscope that weighs only three pounds and sells for $289.

### DIGITAL PANEL METERS

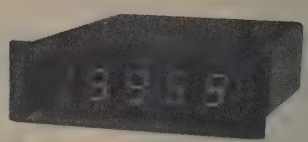
The world's smallest, lowest priced and lowest powered DPM's. NLS' panel meters offer top quality in a wide variety of AC and DC models in 3, 3½ and 4 digits. Prices range from $59 to $170.



### DIGITAL MULTIMETERS

NLS offers four digital multimeters in 3-, 3½- and 4-digit versions. Prices range from $125 for the LM-3A, a 3-digit meter, to $227 for the 4-digit LM-4A with ±0.03% accuracy. All are complete with NiCad batteries and charger unit.

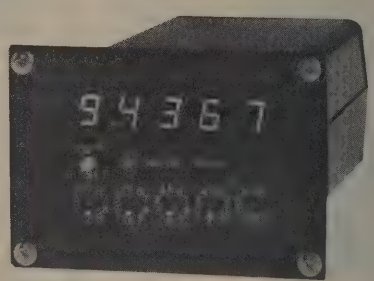
### DIGITAL COUNTERS



The PC-4 Event Counter is a low cost ($54.50), high speed alternative to electromechanical counters.

### DIGITAL FREQUENCY COUNTERS

The FM-7 is a 7-digit frequency counter with a full scale range of 60 megahertz; it sells for $195. Using the NLS SC-5 Prescaler, an additional $89, the range of the FM-7 is increased to 512 MHz.



The PR-5 is a preset counter of five digits which has a system interface capability—an outstanding value at $149.

NLS products are available for immediate delivery from leading local distributors.

**Non-Linear Systems, Inc.**

*Originator of the digital voltmeter.*

Box N, Del Mar, California 92014 Telephone (714) 755-1134 TWX 910-322-1132

# AC and Synchro Instrumentation

If you're into AC Instrumentation or ATE, then you've probably worked with our high-accuracy, high-reliability instrumentation . . . or wanted to! We are the innovators of equipment and modules based on an industry-first usage of LSI that resulted in performance parameters unmatched by competitive products.

All North Atlantic equipment reflects the highest state-of-the-art technology. Each product we produce goes through extensive testing including burn-in at a 100% level.

## Now! LSI in Synchro Converter modules!

Founded on our leadership in AC Instrumentation is our innovative line of data conversion modules. Making use of advanced LSI technology, all receive the same, intensive quality-control tests as our instruments including burn-in. If you're into data conversion, your logical next step should be to learn about our LSI-enhanced modules.

**S/D & D/S CONVERTER MODULES**
- LSI/85 Single Speed S/D
- LSI/36 2 Speed S/D
- 785 1.25VA D/S

**ANGLE POSITION INDICATORS**
- 8300 0.01 Resolution
- 8800 0.001 Resolution

**SYNCHRO SIMULATOR**
- 530 0.0001 Resolution
- 532 DPM Style
- 538 Digital Interface

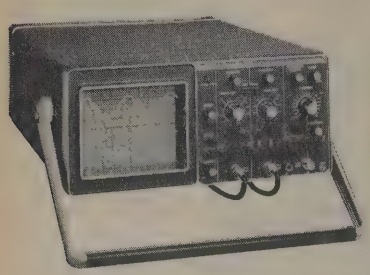
**SYNCHRO BRIDGES**
- 540/10 0.0001° Resolution
- 540/11 Wideband

**PHASE ANGLE VOLTMETERS**
- 213C Manual, Low Cost
- 225 Digital 4 Freq.
- 321 Wideband

NORTH ATLANTIC
*industries,inc*

200 Terminal Drive, Plainview, New York 11803 • (516) 681-8600

# PHILIPS.. the USER-ORIENTED instrument company

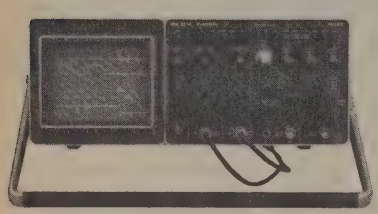


**PM 3211-New, compact Dual Trace 15 Mhz/2mV Oscilloscope**

- **Lightweight, compact**
- **Big 8 x 10 screen**
- **Double insulated power supply**
- **Comprehensive triggering and display facilities not available in competitively priced scopes**

The PM 3211 is designed for multiple applications ranging from general purpose use in laboratories to shop floor production and testing, as well as field service. Power supply is double insulated. No grounding is needed and measurements can be made without ground loops, thus eliminating hum and spurious signals which often influence results.

Triggering on the PM 3211 can be in "Auto" or level-set modes and multi-sourced, thus eliminating the need to change probes. Channel B can be used as an X input to facilitate X-Y displays with calibrated attenuation of both X and Y in inputs. Channel B can be inverted and with the ADD function can display A & B. Thus, maximum advantage can be taken of the high 2 mV sensitivity. The oscilloscope's 18-speed time base also has a vernier control for simplified phase and timing measurements.
PM 3211—$875.00 (including probes)

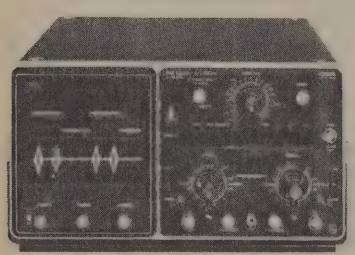


**PM 3214 25 MHz Dual Trace Osilloscope with Delayed Time Base**

- **Complete triggering on both time bases**
- **25 MHz at 2 mV**
- **Double insulation**
- **8 x 10 cm sharp 10 kV display**
- **Alternate time base display**
- **Battery option (internal)**

The PM 3214 with its complete triggering facilities and delayed time base is the ideal digital service oscilloscope. Alternate time base display allows full viewing of the main time base with intensified zone and complete delayed time base expansion simultaneously for both channels. "User-oriented" front panel design allows quick and efficient measurements to be made without error. Compeltely separate delayed time base controls allow use of full capability without confusion.
PM 3214—$1425.00 (including probes)

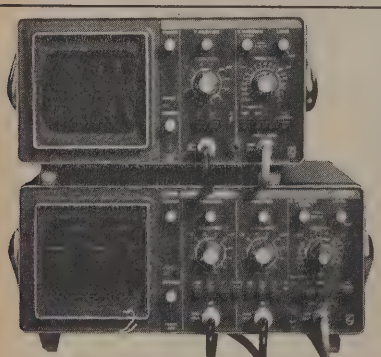
PM 3212-25 MHz Dual Trace Oscilloscope without Delayed Time Base—$1115.00 (including probes)



**PM 3232 and PM 3233 Dual Beam 10 MHz Oscilloscopes**

- **Dual beam operation — no alternate or chopped displays**
- **10 kV 8 x 10 cm display**
- **10 MHz at 2 mV**
- **Comprehensive triggering facilities**

The PM 3232 and PM 3233 dual beam oscilloscopes provide measuring capability with no phase errors as in time shared displays. Complete triggering capability including an auto mode where trigger is derived from peak to peak value of the signal, provides stable displays of all measurements. Front panel layout provides efficient operation, ideal for laboratory and school use.
PM 3232 dual beam 10 MHz oscilloscope - $1,160.00
PM 3233 dual beam 10 MHz oscilloscope with delay lines
with delay lines - $1,230.00



**PM 3225 and PM 3226 Single and Dual Trace Oscilloscopes**

- **15 MHz at 2 mV**
- **Lightweight, compact portable**
- **Complete triggering facilities**

The PM 3225 and PM 3226 15 MHz oscilloscopes are truly lightweight portables which are designed for use in servicing, production and education. Automatic triggering provides stable displays under almost any signal conditions. A minimum of controlled use, a maximum of functional capability that is efficient to use due to the functional front panel design. Sturdy, rugged construction leads to reliability under the most demanding conditions.
PM 3225 - 15 MHz single trace oscilloscope - $ 625.00
PM 3226 - dual trace 15 MHz oscilloscope - $ 820.00
PM 3226P - dual trace with A-B capability — $ 960.00

For technical information, additional data or a complete test and measuring instruments catalog, utilize our toll-free Hotline 800 631-7172 (New Jersey residents call (201) 529-3800 collect) or contact:

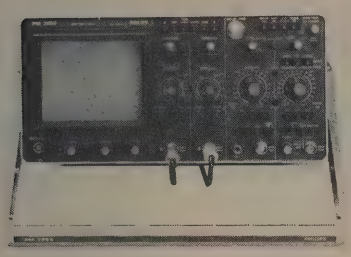
In the U.S.:
85 Mc Kee Drive
Mahwah, N.J. 07430

In Canada:
6 Leswyn Road
Toronto, Ontario, Canada M6A 1K2
Tel. (416) 789-7188

PHILIPS Test & Measuring Instruments

**PHILIPS**

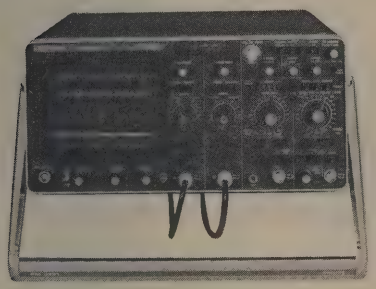
# PHILIPS.. the USER-ORIENTED instrument company



**PM 3262-100 MHz Dual Trace Universal Oscilloscope with Delayed Time Base**

- **Third channel for simultaneous viewing of trigger signal**
- **Alternate time base display**
- **100 MHz at 5 mV**
- **New CRT gives bright display, high writing speeds**
- **Composite trigger capability**
- **Compact, lightweight**

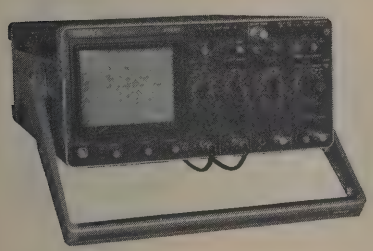
Alternate time base display allows simultaneous viewing of main time base display with intensified zone and full screen delayed time base. Eliminates constant switching to find out where delayed time base measurements are taken. Third channel allows simultaneous display of external trigger signal for timing comparison. Complete trigger facilities on both main and delayed time bases in addition to extended X-Y display capability. This lightweight portable oscilloscope is ideal for high frequency analog and digital measurements in the field and the laboratory.
PM 3262—$2,345.00 (including probes)



**PM 3261 120 MHz Portable Oscilloscope for Digital Testing**

- **Digital delay mode**
- **Special TTL trigger circuits**

5Mv sensitivity; complete triggering facilities for both time bases; X-Y operation via A or B channels. 20 kV CRT for bright displays. Delayed time base can be set to start at any preset Nth after main base starts. Trigger selection includes TTL threshold window to insure positive triggering on TTL transitions and not on spurious pulses or noise. The oscilliscope provides a TTL pulse output simultaneous with the delayed time base. This output can be used along with main time base trigger to measure time from start to end pulse. 120 MHz dual trace portable oscilloscope digital delay counter on delayed time base that can be preset from 1 to 9,999 to start the delayed time base.
PM 3261—$2,795.00 (including probes)



**PM 3265E 150 MHz Portable Oscilloscope**

- **Alternate time base display**
- **Cold switching controls**
- **2.3 nS risetime**

The PM 3265E is a dual trace 150 MHz portable oscilloscope with separate delayed time base control section. Alternate time base display capability allows viewing of time base with intensified zone and full screen delayed time base of both channels simultaneously. "User-oriented" front panel design, enabled by cold switching technique, provides a most efficient use of the instrument. Switching regulated supply provides power input capability from 100 - 250 V AC (40 440 Hz) or DC at total of 45 watts.
PM 3265E - $3,095.00 (including probes)

**PM 3265 150 MHz Multiplier Oscilloscope**

- **150 MHz dual trace**
- **100 MHz multiplier (A X B)**
- **Alternate time base display**

The PM 3265 is a 150 MHz dual trace oscilloscope with delayed time base and also features a 100 MHz multiplication capability, Real time power can be displayed for circuit and device analysis. A X B output provided for average instrument with cold switched controls and logical front panel layout. Alternate time base display allows main and delayed time base to be presented simultaneously for both channels. B Channel display is provided in addition to A X B display for reference.
PM 3265 - $3,850.00 (including probes)

For technical information, additional data or a complete test and measuring instruments catalog, utilize our toll-free Hotline 800 631-7172 (New Jersey residents call (201) 529-3800 collect) or contact:

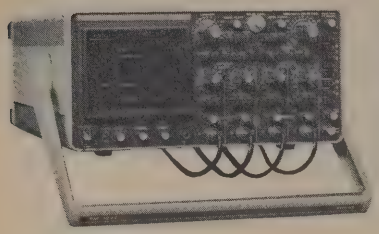
In the U.S.:
85 Mc Kee Drive
Mahwah, N.J. 07430

In Canada:
6 Leswyn Road
Toronto, Ontario, Canada M6A 1K2
Tel. (416) 789-7188

PHILIPS Test & Measuring Instruments

**PHILIPS**

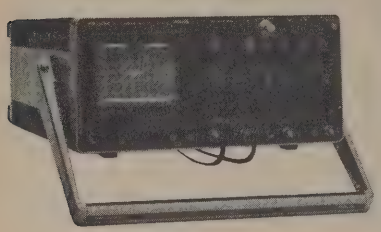
# PHILIPS.. the USER-ORIENTED instrument company



**PM 3244 4 Trace Portable Oscilloscope**

- **50 MHz, delayed time base**
- **Complete triggering facilities**
- **Up to 6 traces with A + B and C + D**

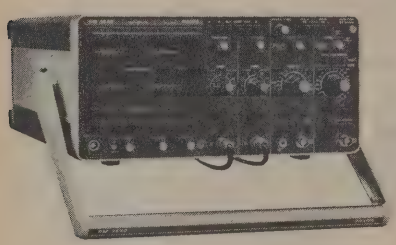
The PM 3244 is a 50 MHz 4 trace portable scope with delayed time base at 5 mV per cm. Displays any combination of channels A, B, C and D in chopped or alternate mode with A ± B and C ± D possibilities. X deflection possible using any selected channel or external input for X —Ya, Yb, Yc, Yd display. Complete triggering facilities including composite trigger, with AC or DC coupling. 8 x 10 cm 10 kV CRT. Cold switching allows all the controls necessary for a 4 trace scope in a portable instrument.
PM 3244 - $2,995.00 (including 4 probes)



**PM 3243 50 MHz Multiplier/Storage Oscilloscope**

- **A X B capability to 40 MHz**
- **Variable persistence and complete storage**
- **Delayed time base**

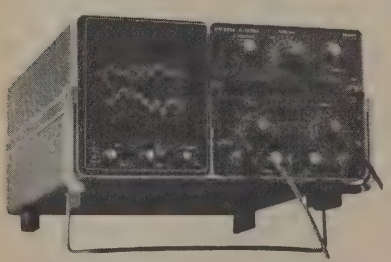
The PM 3243 50 MHz delayed time base oscilloscope has a 40 MHZ multiplication capability. Real time power can be displayed as well as stored in the variable persistence and full storage mode. A fully comprehensive storage scope with delayed time base and complete triggering facilities makes for a versatile laboratory and field instrument. A X B output provided for additional laboratory measurements. PM 3243 has all the features of the other Philips high frequency portables.
PM 3243 - $3,995.00 (including probes)



**PM 3240, PM 3240X 50 MHz Portable Oscilloscope and TV version**

- **Seperate delayed time base control section**
- **18.5 lbs./ 23 watts**
- **Complete triggering facilities**
- **TV line and frame sync**

PM 3240 is an ultra lightweight dual time base instrument with a bright 8 x 10 cm display. Ideal for service, production and laboratory use, the PM 3240 has all the features needed for analog and digital measurements. A bright CRT coupled with an efficient front panel design, incorporating comprehensive triggering and display controls make the PM 3240 an ideal field service portable. For television applications, the PM 3240 includes odd/even frame selection as well as line frame synchronization and line/sync and delayed time base.
PM 3240 - 50 MHz dual trace oscilloscope - $1,795.00 (including probes)
PM 3240X 50 MHz dual trace TV oscilloscope - $1,920.00 (including probes)



**PM 3234 10 MHz Dual Beam Storage Scope**

- **Dual beam operation**
- **Variable persistence and full storage**
- **Bright displays with 8.5 kV CRT**
- **Complete triggering including one shot**
- **10 MHz at 2 mV**

The PM 3234 is a dual beam operation storage and variable persistence oscilloscope. Dual beam display, combined with the storage facilities, insures true displays and recording including single shot phenomena. Use of variable persistence allows the storage of multiple traces for comparison. No chopping and no alternate display provides total signal storage of both channels even with fast one shot signals. AC, DC and Auto triggering are provided, with Auto position triggering derived from the incoming signal peak to peak value. 24V DC operation is possible as well as AC line voltages, Maximum writing speed is 1 div/mS.
PM 3234 - $2,710.00

For technical information, additional data or a complete test and measuring instruments catalog, utilize our toll-free Hotline 800 631-7172 (New Jersey residents call (201) 529-3800 collect) or contact:

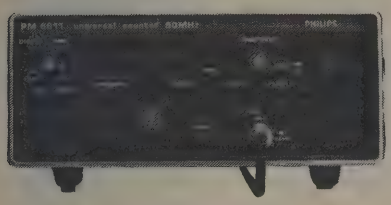
In the U.S.:
85 Mc Kee Drive
Mahwah, N.J. 07430

In Canada:
6 Leswyn Road
Toronto, Ontario, Canada M6A 1K2
Tel. (416) 789-7188

PHILIPS Test & Measuring Instruments

**PHILIPS**

# PHILIPS.. the USER-ORIENTED instrument company



**PM 6610 Universal counters**

- 5 models to choose from
- Measure frequency, period, ratio, totalize and time interval
- Comprehensive triggering
- Bright, 9-digit gas discharge display

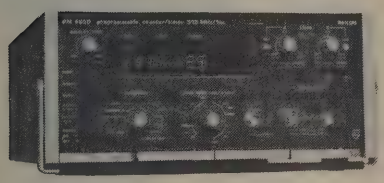
The PM 6610 series is a family of universal frequency counters and a counter/timer designed to fulfill a broad range of measurement applications. The PM 6613, PM 6614, PM 6615 and PM 6616 universal counters provide for frequency, ratio, period, period average and totalizing measurements with frequency of 250, 520, 1000 and 1300 MHz, respectively. The PM 6612, 80 MHz counter/timer also permits time interval measurements. Options available include internal rechargeable battery pack, BCD, D/A output and IEEE 488 Buss compatibility, rack mounting and either for five time base oscillators.

PM 6612—80 MHz—$740.00
PM 6613—250 MHz—$795.00
PM 6614—520 MHz—$875.00
PM 6615—1000 MHz—$1075.00
PM 6616—1300 MHz—$1395.00

**PM 6620 Series Universal Timer/Counters**

- Comprehensive Time and Frequency Measurements
- Two 80 MHz Channels with Complete Triggering Controls
- Models Available with Trigger Hold-Off, 520 or 1000 MHz Frequency Range

The PM 6620 series comprises three compact instruments offering time and frequency measurement capabilities. All models provide for measuring (single shot and averaging), time interval, period, frequency, ratio and pulse counting. Two identical 80 MHz input channels are equipped with comprehensive triggering controls and monitoring facilities. The PM 6622 also includes a trigger hold-off control which permits masking unwanted stop pulses such as those generated by contact bounce or ringing. The PM 6624 and PM 6625 extend the range of frequency measurements to 520 or 1,000 MHz respectively.
All of the options available for the PM 6610 series above are also compatible with the PM 6620 series.
PM 6622 - 80 MHz - $965.00
PM 6625 - 1000 MHz - $1495.00
PM 6624 - 520 MHz - $1365.00



**PM 6650 Programmable Timer/Counter**

- Complete Time and Frequency Measurement System
- 10 nS Single Shot T.I. Resolution
- Direct Counting to 520 MHz
- GPIB Option
- 1 and 12.6 GHz Sub-Units Available

The PM 6650 is a complete time and frequency measurement system for the lab or systems use. The instrument's basic architecture includes a 100 MHz clock; a 512 MHz RF channel with 62 dB dynamic range; two very fast (1 nS), equalized 160 MHz channels with comprehensive triggering facilities; and a nine-digit gas discharge display. This architecture provides for: frequency measurements to 512 Mhz with 1 Hz resolution in 1 sec.; single shot T.I. measurments with 10 nS resolution; average T.I. measurments with 1 pS resolution; and accurate monitoring of trigger levels for easy pulse parameter measurements. The PM 6650 is available with a plug-in IEEE Bus module which provides for complete control of all instrument functions including trigger level adjustments.
PM 6650B - $ 3,855.00

**PM 6661 80 MHz,**
**PM 6664 520 MHz**
**Automatic Frequency Counters**

- Fully Automatic Frequency Measurements
- Automatic PIN Diode Attenuator with 50:1 Range
- 8—digit LED display with leading zero blanking and grouped digits for easy reading.
- Compact, rugged steel housing.
- 98% AM Tolerance

These compact instruments have been designed to provide accurate, easy to read frequency measurements with an absolute minimum of operation attention. Fully automatic operation has been achieved by replacing the usual sensitivity control or attenuator switch by a high effective automatic Pin diode attenuator.
Both models provide 1 Hz resolution up to 80 MHz and the PM 6661 provides 10 Hz resolution between 10 and 520 MHz.
The PM 6661 time base ageing rate is 2 ppm/yr. and temperature stability is 15 ppm, 0-50°C. The PM 6664-01 ageing rate is 2 ppm/yr. and stability is 15 ppm, 0-50°C. The PM 6664-02 ageing rate is 0.1 ppm/mo. and stability is 1 ppm, 0-50°C.
PM 6661—80 MHz—$275.00
PM 6664-01—520 MHz—$545.00
PM 6664-02—520 MHz—$645.00

For technical information, additional data or a complete test and measuring instruments catalog, utilize our toll-free Hotline 800 631-7172 (New Jersey residents call (201) 529-3800 collect) or contact:

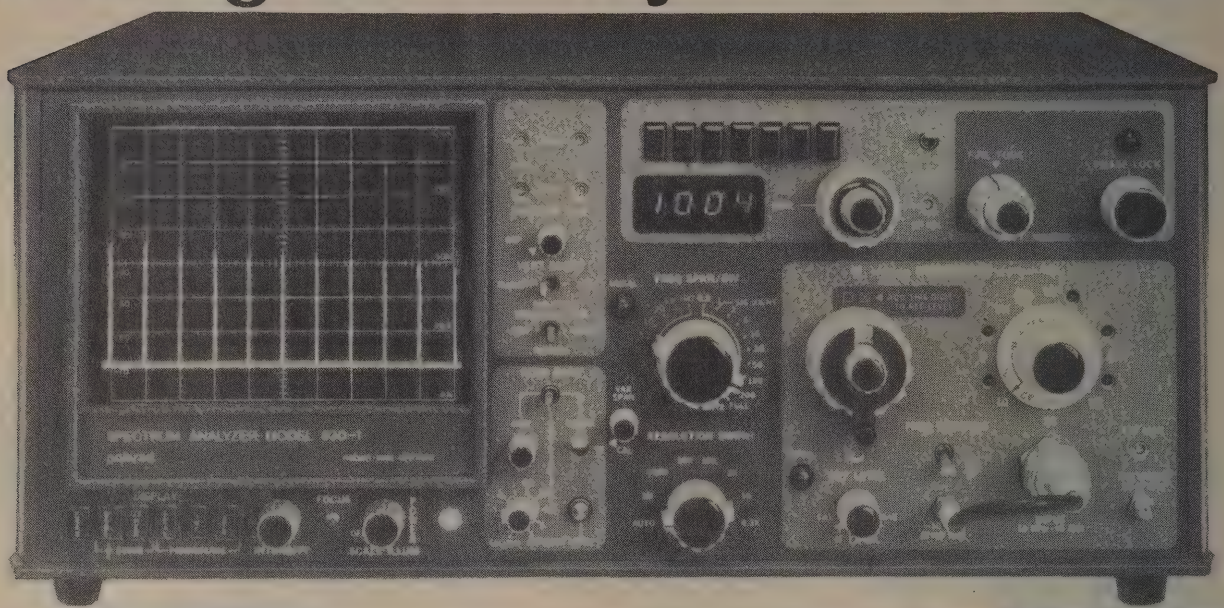
In the U.S.:
85 Mc Kee Drive
Mahwah, N.J. 07430

In Canada:
6 Leswyn Road
Toronto, Ontario, Canada M6A 1K2
Tel. (416) 789-7188

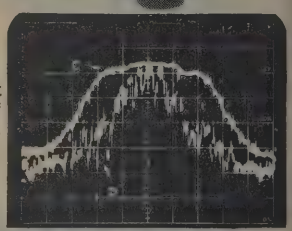
PHILIPS
Test & Measuring Instruments

**PHILIPS**

# 5 RF/Microwave Spectrum Analyzers with Digital Memory & I/O Interface



Model 630-1 includes digital memory.
Display: Frequency markers. Internal marker oscillator generates 100 MHz (±5 kHz) and harmonics.



SPLIT MEMORY: Comparison of envelope vs. instantaneous levels of FM broadcast. 20 kHz/Div. Span. 10 dB/Div. Scale

"C" is stored max. envelope vs. frequency.
"D" is flicker-free updated incoming signal

## The Digital Memory and Data Interface of the 600 Series make other analyzer displays obsolescent. Here's Why!

- **Flicker-free updated displays, even with slowest scans.**
- **Precise comparisons of stored vs. incoming signals.**
- **Single line envelopes of noisy and pulsed signals.**
- **Data Interface "Talker" and "Listener" functions. Adaptable to IEEE 488 BUS.**
- **Internal battery retains memory contents.**

### N-R 600 Series Summary

| MODEL | | U.S.A. Prices Without Memory | U.S.A. Prices Including Memory |
|---|---|---|---|
| **632** | 100 kHz to 2 GHz | $ 6,275 | $ 7,625 |
| **630** | 10 MHz to 40 GHz, 7 Bands | 8,550 | 9,900 |
| **640** | 630 plus Internal Preselector | 11,250 | 12,600 |
| **631** | 10 MHz to 40 GHz, 6 Bands | 7,900 | 9,250 |
| **641** | 631 Plus Internal Preselector | 10,600 | 11,950 |

*Get complete specifications. Call or write for immediate reply or check Reader Service Number.*

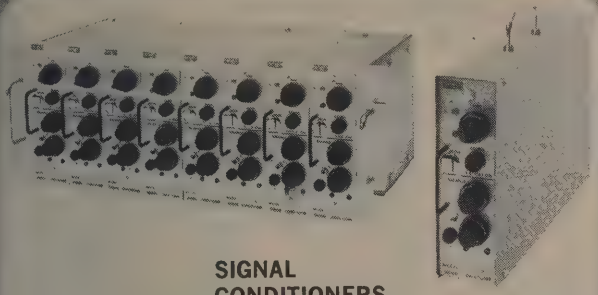
### Other Features of the 600 Series:

- LED frequency readout. Absolutely level calibration.
- Internal tracked preselector. (Models 640 and 641)
- Calibrated 0-2 GHz frequency spans. Also Full Span Mode.
- 300 Hz (phase-locked) to 1 MHz Resolution Bandwidths. Auto-tracked or manually selectable.
- −115 dBm sensitivity, Model 632. To −110 dBm for others. Sensitivity conservatively rated at 1 kHz bandwidth. Sensitivity = Average noise level +6 dB.
- 70 dB Log Scale (10 dB/Div.). Also 2 dB/Div. and Linear.
- Precise frequency markers, 100 MHz (±5 kHz) and harmonics.
- Level reference checks abs. level calibration.
- Parallax-free internal CRT graticule. Scale illumination. Standard mount for Scope cameras.
- Interface for Tracking Generator (Option 2).
- Compact, portable, all solid-state construction. Models 630, 631 and 632 are 7" high; approx. 40 lbs.
- Low cost.

## polarad electronics corp.

5 Delaware Drive • Lake Success, New York 11040 • 516-328-1100 • TWX 510-223-0414

# PPM, INC.



## SIGNAL CONDITIONERS

**THE SG-11 IS A PLUG-IN MODULE** with power supply, balance calibration and monitoring circuits. The power supply circuit offers high temperature and time stability, providing line and load regulation of 0.01%; excitation voltage is adjustable from 0 to 16 volts at 0 to 150 mA. Featured is a self-restoring current limit circuit. All units may be wired for constant-current operation.

THE SG-11 has very high isolation to line—under 0.03 pF coupling capacitance from power line to DC output—SG-11 performance approximates battery operation.

All controls are 10 turn potentiometers of very high resolution. Calibration is bipolar single shunt.

Two types of enclosures are available: A 19" relay rack that permits the mounting of eight units side-by-side and a portable enclosure accepting a single plug-in unit. A plug-in power supply is also available.

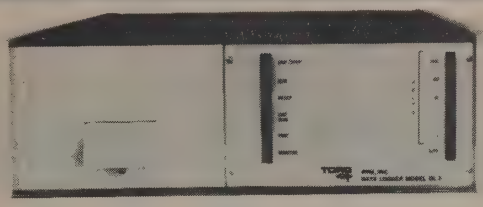
**MODEL SG-11 PLUG-IN UNIT (eight shown in rack)** . . . . . **$187.50**

**PORTABLE ENCLOSURE (MODEL SG-11-P as shown)** . . . . . **$ 39.50**

**RELAY-RACK MOUNTING ENCLOSURE (MODEL SG-11-R as shown) with solder terminals only** . . . . . **$129.00**

**RELAY-RACK MOUNTING ENCLOSURE (MODEL SG-11-RC as shown) with MS connectors (mating connectors included)** . . . . . **$395.00**

**THE MODEL SG-16 series** (not illustrated) provides lowest-cost strain-gage conditioning. A 20 channel system with common power supply occupies only 5¼ inches of vertical panel space at a total cost of $75 per channel. Amplifier options range from $10 per channel for 10ma galvo drive amplifiers to $100 per channel for low-drift differential amplifiers. Write for Bulletin SG-11.



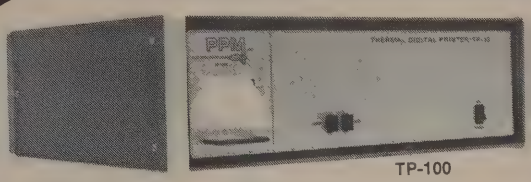
## DATA LOGGER

**THE MODEL DL-2 IS A COMPLETE DATA ACQUISITION SYSTEM** in a compact, portable package. It scans up to 100 differential signals, digitizes them and a thermal printer records their values. Options include floating decimals, internal digital clock, conditioning for thermocouple or strain-gage transducers and punched paper or magnetic tape recording.

Input signals include DC voltage, resistance and frequency. Write for Bulletin DL-2.

**Data Logger with 10 Channels** . . . . . **$2320.00**

**Data Logger with 100 Channels** . . . . . **$3220.00**



TP-100

## SILENT THERMAL PRINTER

**THE TP-100 IS A SILENT, ALPHA-NUMERIC THERMAL PRINTER.** It prints up to 20 columns at speeds to 5 lines/second from BCD or ASCII inputs.

This high-performance instrument is simple and compact, with only one moving part. Quiet and reliable operation, long life as well as low cost, result from the use of a simple mechanism whose only function is to advance paper.

A choice of input interface options is available, as well as an internal digital clock or voltmeter. The Model TP-100M is available for O.E.M. applications; it is a plug-in unit with all electronics, but less cabinet and power supply.

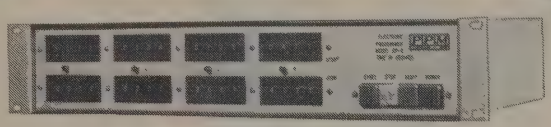
**Model TP-100, 12 columns, as shown. Unit price.** . . . . . **$595.00**
**Model TP-100M, 12 columns. 100 each.** . . . . . **200.00**

**Write for Bulletin TP-100, or call collect today.**

## THERMOCOUPLE MONITOR

**THE TM 100A SCANS UP TO 100 THERMOCOUPLES,** displaying temperature in digital form. A high-low limit circuit compares temperature with preset thumbwheel switches; a lamp matrix displays all out-of-limit channels. Interface provides for auxiliary printout or computer entry of data.

**Write for Bulletin TM-100**



## DIGITAL TIMERS-PROGRAMMERS

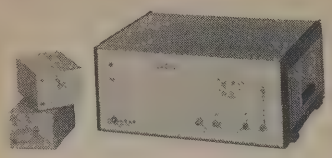
The EP series of solid-state digital electronic programmers provide relay or solid-state switch operation at digitally-preset start and stop times. Each channel operates independently of all others. Units available from 1 to 1000 channels, with timing from microseconds to hours.

**Write for Bulletin EP.**

Bulletin PE-2-7

Prices subject to change without notice.

**PPM, INC.** 7575 Bond Street • Cleveland, Ohio 44139 • 216/232-4140



## ANVIL L SYSTEM Electrical Isolation in a Precision Pulse Generator

**$3,080 - $11,600**

**(1-8 channels) Fiber Optic Coupled • 1 nS Risetime into 50 Ohms**

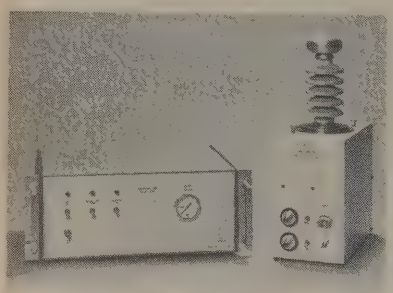
### Key Performance Specifications

**Remote Output Pulser (ANVIL-160)**

| | |
|---|---|
| **Peak volts** | +140 to +220 V., unit-to-unit variation |
| **Peak current** | 3.2 Amps |
| **Output impedance** | 50 ohms |
| **Risetime** | ≤2 nS |
| **Fall-time** | 55 nS |
| **Single shot jitter** | ± 0.25 nS |
| **External Dimensions** | 4" wide, 3" tall and 6" deep |

**Master Control Module**

| | |
|---|---|
| **Input Power** | 115 VAC, 60 Hz at 2 Amps |
| **Trigger Requirements** | 2-10 volts, >40 nS wide pulse, 50 ohms |
| **External dimensions/weight** | 17" wide, 7" tall and 13" deep, 20 lbs. |

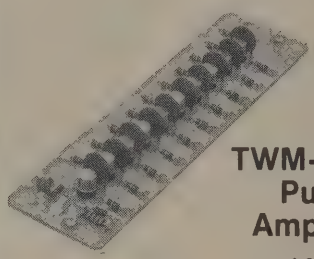


### The VPR 60-30 Fiber-Optic Coupled High Voltage Probe

**$7500.00**

### Specifications

**Frequency Response:** 50 Hz to 25 MHz
**Dynamic Range:** 40 dB
**Peak Input Voltage:** ± 50 kV
**Input Impedance:** capacitive, 5 pF
Probe is battery powered;
30 meter optical cable length;
remote (pneumatic) on/off and calibration functions.



### TWM-1000N Pulse Amplifier

**$235**

**Less than 1 nS Command Jitter**
**Compact • Versatile**

### Specifications

Input trigger 1-10 volts
Output pulse (standard is negative)

| | 50 Ohm Load | 1000 Ohm Load |
|---|---|---|
| **Peak voltage** | ~ 400 V | ~ 1000 V |
| **Risetime** | ~ 10 nS | ~ 5 nS |
| **Decay time** | ~ 60 nS | ~ 1 μS |

**Supply voltage** +125 VDC, 1.5 mA

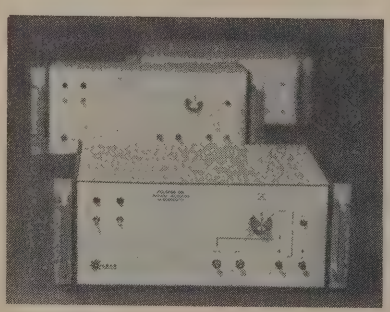
### SW-50K High Precision Switch

**±1 nS Jitter • Compact**

**$209 (Quantity Discounts Available)**

### Specifications

**Operating range:** 10 kV to 50 kV
**Jitter:** ± 1 nS (when used with PULSPAK 10A)
**Lifetime:** 10 k shots at 250 millicoulomb/shot and peak current of 50 kA
**Gas:** Synthetic air (Hydrocarbon free dry air)
**Trigger:** Pulse risetime<50 nS at 50% charge voltage
**Switch Inductance:** Depends on circuit application; typically in 100 to 200 nH range



Output pulse

### PULSPAK 10A Precision High Voltage Pulse Generator

**1 nS Command Jitter • Trigger Input: 2-10 volts**

**Pulse Output: 10 kV**

**$2,250**

### Key Performance Specifications

| | |
|---|---|
| **Peak volts** | +10 kV |
| **Peak Current** | 200 Amps |
| **Output Impedance** | 50 Ohms |
| **Risetime (10-90%)** | < 10 nS |
| **Fall-time** | 150 nS |
| **Throughput Delay** | 70 nS or less |
| **Internal Repetition Rates** | 1, 5, 10 Hz |

**External power requirements**
115/230 VAC, 50/60 Hz, .3/.15 amps
**External dimensions/weight**
17" wide, 7" tall and 13" deep, 24 lbs.

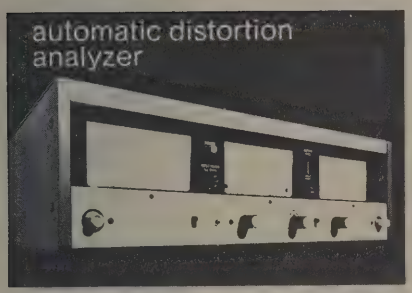
## pulsar associates, inc.

**high voltage electronics....**

11491 Sorrento Valley Road, San Diego, CA 92121 • (714) 455-5933

# RADIOMETER ELECTRONICS TEST INSTRUMENTS

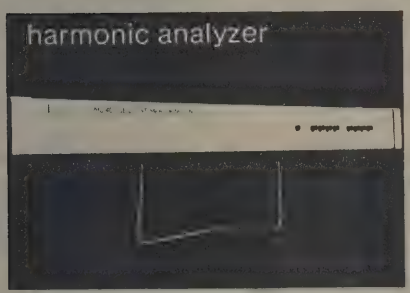
## Audio/Component/Communications



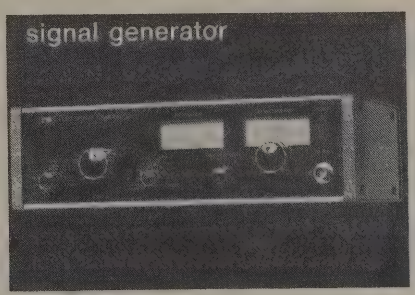

**Automatic Distortion Analyzer — BFK-10**
Swept measurements of total harmonic distortion.

**Stereo Modulator — SMG 40**
Advanced design signal source . . . superior flexibility.

**AM/FM Modulation Meters — AFM2, AFM3**
Wide band and narrow band models cover 5 to 1002 MHz.

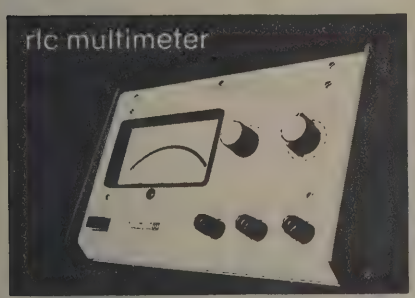



**Harmonic Analyzer — SMU 401**
Automatic sweep measurements of selected individual harmonics, second through fifth.




**Signal Generator — RE 101**
A compact signal generator covering the frequency ranges of 0.15 MHz.

**Picoammeter/Megohmeter — IM6**
Unusually versatile low current and high resistance measurements.

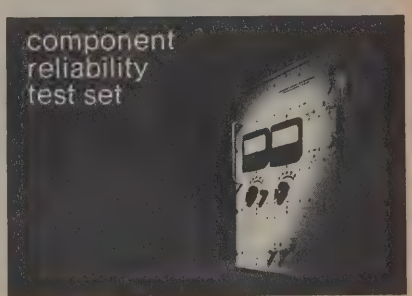



**R, L, C Multimeter — MM2**
Fast measurements at appropriate frequencies.

For over 40 years Radiometer has been manufacturing and marketing the most reliable, advanced state-of-the-art electronic test and measuring equipment . . . primarily for the audio, radio and component fields.

You will find eight of our best sellers on this page. There are many more. Please write for our complete catalog.

**The London Company**
U. S. Representatives for
Radiometer-Copenhagen
811 Sharon Drive, Cleveland, Ohio 44145
Telephone (216) 871-8900




**Component Reliability Test Set — CLT 1**
Fast, constructive test method.

re Radiometer Electronics a/s

These precision analog filters enjoy a worldwide reputation for accuracy, stability, and wide-range flexibility. Highly price-competitive, they have become the first choice of the electronics industry for a broad spectrum of applications, including: anti-aliasing; band limiting in data-acquisition systems; signal-to-noise enhancement in low-level measurements and communications; signal reconstruction (smoothing) in A/D/A and digital-communications systems; and hundreds of test and development-laboratory uses.

### Models 432 and 442 Budget Variable Analog Filters

- Two Independent Channels usable in Series, in Parallel, or Separately
- 24dB Rolloff/Octave/Channel
- Cutoff Frequency Ranges: 1Hz-110KHz (Model 432), 10Hz-1.1MHz (Model 442)
- Cutoff Frequency Accuracy: ±5%
- Resolutions: 1Hz to 10KHz (2 digits)
- High Pass, Low Pass, Band Pass, and Band Reject Functions
- 0dB/20dB Gain
- Flat Amplitude (Butterworth) and Flat Delay (Linear Phase) Responses
- Impedances: 1 Megohm Input, 50 Ohms Output
- 80dB Dynamic Range

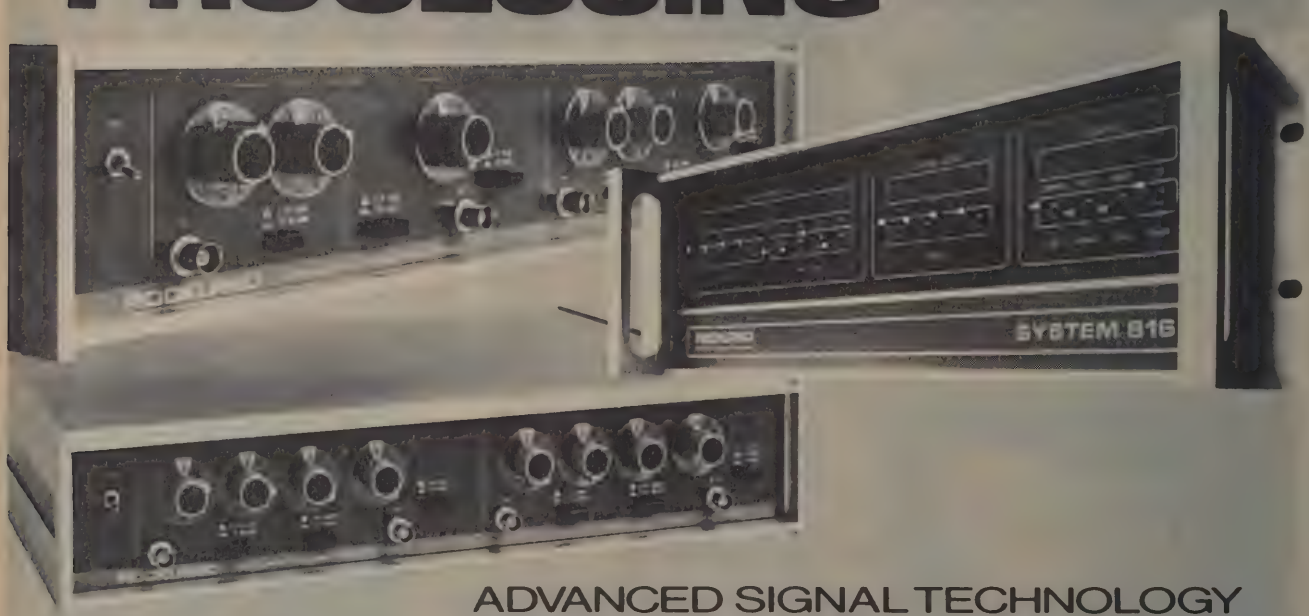
### Models 452 and 852 Dual Hi/Lo Variable Analog Filters

- Two Independent Channels usable in Series, in Parallel, or Separately
- Rolloff: 24dB/Octave (Model 452) or 48dB/Octave (Model 852)
- Cutoff Frequency Ranges: 0.1Hz to 111KHz; Option -01: 0.01Hz to 111KHz
- Cutoff Frequency Accuracy: ±2%
- Resolution: 0.01 to 100Hz (3 digits)
- High Pass, Low Pass, Band Pass, and Band Reject Functions
- Near-Ideal Flat Amplitude (Butterworth) and Flat Delay (Linear Phase) Responses
- 0dB/20dB Gain
- Impedances: Input 1 Megohm, Output 50 Ohms
- Dynamic Range: 90dB
- Negligible Noise and Drift.

### System 816 Computer-Compatible Multi-channel Filter System

- Up to 16 Independent Channels
- Local, Remote, and On-card Programming, High Pass, Low Pass, Band Pass, and Band Reject Functions
- Cutoff Frequency Range: 0.1Hz to 150KHz
- Cutoff Frequency Accuracy: ±2%
- Butterworth and Bessel Responses
- 60 Cutoff Frequencies per 4-decade plug-in card
- 48dB/Octave Rolloff (96dB/Octave with 2 channels cascaded)
- Impedances: 1 Megohm Input, 50 Ohms Output
- Programming Delay 3msec (plus filter settling time)
- Negligible Insertion Loss
- Dynamic Range: 80dB

# FILTERS for SIGNAL PROCESSING




ADVANCED SIGNAL TECHNOLOGY

# ROCKLAND

SYNTHESIS • PROCESSING • ANALYSIS

Our Second Decade of Leadership

Rockland Systems Corporation, 230 W. Nyack Road, West Nyack, N.Y. 10994, (914) 623-6666, TWX 710-575-2631

These state-of-the-art designs all employ some form of *direct* synthesis . . . widely acknowledged to be the most advanced technique in frequency synthesis. By eliminating all of the limitations of the phase-locked-loop technique, Rockland synthesizer designs offer greatly superior performance at very reasonable prices. The newest Rockland synthesizer, the Model 5600, is remarkable in that it provides the superiority of direct synthesis at a price significantly *lower* than phase-locked designs in the same frequency range.

### NEW! Model 5600 Programmable Frequency Synthesizer

- Direct Digital Synthesis — No Heterodyning or Phase-Locking
- 0.1 to 160MHz — without Multipliers
- Constant 1Hz Resolution throughout range
- High-Speed Switching — 20μsec
- High Spectral Purity: —70dB Spurious, —35dB Harmonic
- Low Phase Noise: —70dB typical
- Remote-Digital and Front-Panel Programming
- Excellent Temperature Stability: $\pm 1 \times 10^{-8}/^{\circ}C$ (or $\pm 1 \times 10^{-6}/^{\circ}C$ optionally) from $0^{\circ}C$ to $50^{\circ}C$ . . . or use external reference.

### Models 5100 and 5110 Frequency Synthesizers

- Direct Digital Synthesis — No Heterodyning, no Phase-Locking
- DC — 2MHz Range. To 3MHz (Option 13)
- 0.001Hz Resolution over entire range
- High Spectral Purity: —70dB Spurious, —55dB Harmonic
- Low Phase Noise: —50dB
- High-Speed Switching: 1.5μsec Programming Delay, 625nsec Update
- No Switching Transients
- Excellent Temperature Stability: $\pm 1 \times 10^{-8}/^{\circ}C$ (or $\pm 1 \times 10^{-6}/^{\circ}C$ optionally) from $0^{\circ}C$ to $50^{\circ}C$ . . . or use external reference.
- Remote and Local Frequency and Amplitude Programming (Model 5110 remote only — for OEM Systems)

### System 51 Programmable Multichannel Frequency Synthesizer System

- Direct Digital Synthesis — No Heterodyning or Phase-Locking
- DC to 3MHz Range — Constant 1Hz Resolution throughout range
- Up to 48 Channels
- Very Fast Switching: 2μsec Programming Delay, 1μsec Update
- Sine and Squarewave Outputs
- No Switching Transients — Amplitude and Phase Continuity Maintained
- High Spectral Purity: —50dB Spurious, —40dB Harmonic
- Low Phase Noise: —50dB
- Excellent Temperature Stability: $\pm 1 \times 10^{-6}/^{\circ}C$, from $0^{\circ}C$ to $50^{\circ}C$
- Manual/Automatic Programming

# FREQUENCY SYNTHESIZERS

ADVANCED SIGNAL TECHNOLOGY

# ROCKLAND

SYNTHESIS • PROCESSING • ANALYSIS

Our Second Decade of Leadership

Rockland Systems Corporation, 230 W. Nyack Road, West Nyack, N.Y. 10994, (914) 623-6666, TWX 710-575-2631

The Rockland Model FFT 512/S provides state-of-the-art performance, unparalleled ease and simplicity of operation . . . *plus unprecedented functional versatility*, by accepting *dozens* of different combinations of built-in standard options.

Despite its exceptional functional capability, the FFT 512/S represents the *greatest performance/price value* in its class. Function for function, spec for spec, it is also the *most advanced* instrument in its class . . . the *logical choice* for the great majority of applications in the 0 to 100 KHz range.

# REAL-TIME SPECTRUM ANALYZERS

## DESIGN HIGHLIGHTS

**Select 400 to 51,200 Lines of Resolution.** With all digital range translator option, resolves 0.4 mHz on 0 to 20 Hz range, 2 Hz on 0 to 100 KHz range!

**Four in One Capability.** With standard options, a state-of-the-art narrowband spectrum analyzer, plus a 1/3-octave and octave analyzer and of an extremely flexible *tunable* RMS voltmeter/power meter.

**Highest Performance Standards.** Accuracy, linearity, dynamic range, sensitivity, and all-digital stability surpass all other instruments in its frequency range.

**Most Advanced Signal Processing.** Circuit architecture inherently superior to conventional analyzers.

**Full Computer/Calculator Programmability.** *Two* standard digital I/O interfaces for use with large scale scientific computers, and with minicomputer, microprocessor, and calculator-based systems.

**Display.** Built-in 8 x 10cm CRT with bright flicker-less display featuring *full* graticule.

**Data Displayed.** Input time function (continuous or captured), instantaneous power spectrum, averaged power spectrum, two averaged power spectra (dual display), difference spectrum, ratio spectrum, magnified analysis range – range translator zoom, (Option -20), 1/3-Octave spectrum, (Option -12), octave spectrum, (Option -12).

**ADVANCED READOUT SYSTEM** — Combines a multi-format cursor system with direct-reading multi-parameter alphanumeric displays – everything about a spectrum can be measured, displayed and recorded. Provides engineering unit readout by either entering sensitivity of the transducer – or by measuring a known reference and defining its amplitude or power in *engineering units*.

## STANDARD OPTIONS

**Option 12 – 1/3 Octave and Octave Bandwidths, plus Power Readout in Both Bands.** Presents spectra as generated by banks of precise, wide-dynamic-range digital filters covering six selectable ranges from 2.5 Hz to 100 KHz. Also provides power measurement and direct-reading display of power.

**Option 14 – Digital I/O Interface.** Provides direct access to the FFT 512/S memory and control circuitry for an external minicomputer, controller, or data terminal.

**Option 15 – IEEE-STD 488/1975 Instrumentation Interface.** Provides analyzer compatibility with any external controller designed around IEEE Std. 488.

**Option 17 – Narrow-Band Power Readout.** Measures power over the entire analysis range or any selected portion. Readout display in V RMS, $(V\ RMS)^2$ or dBV 0 dBV = 1 $(V\ RMS)^2$ or in equivalent engineering units.

**Option 18 – Ultra Low Frequency Analysis Ranges.** Provides analysis ranges of 2.5, and 10 Hz in place of the standard 20, 50, and 100 KHz. Compatible with all other listed options.

**Option 20 – All Digital Range Translator.** Select from 400 to 51,200 lines resolution across each of 12 analysis ranges on single *and* dual displays. **Analysis anywhere from 0 Hz to 100 KHz.**

ADVANCED SIGNAL TECHNOLOGY

# ROCKLAND

SYNTHESIS • PROCESSING • ANALYSIS

Our Second Decade of Leadership

Rockland Systems Corporation, 230 W. Nyack Road, West Nyack, N.Y. 10994, (914) 623-6666, TWX 710-575-2631

# INSTRUMENTATION DIVISION

Since 1922

## AC/DC Calibration Standard

| Model 829G | Measure & Deliver |
|---|---|
| Full-scale ranges | AC/DC Volts 0.01—1400 V<br>AC/DC Current 10 μA-14A<br>Ohms 0.1-10 meg. |
| Accuracies of reading | ±0.05% DC<br>±0.08% AC<br>±0.06% Ohms |
| AC Frequencies | 50, 60, 400, 1000 Hz |

**Model 5058A**

Model 5058A Wattmeter Calibration Module for use with two Model 829G's. For calibration of wattmeters ranging from 0.05 watt to 14,000 watts.

**Model 85**

Converts a precision input voltage to a proportional output current for meter testing, calibration and generation of a precise stable current. Ranges from 100 μA full scale to 10 amperes full scale.
DC accuracy is ±0.02% of range, ±0.01% of output.
AC accuracy is ±0.05% of range, ±0.05% of output.
Can be used with Model 82 Precision Standard and most voltage sources.

**Model 87**

Model 87 Voltage Amplifier/Calibration with 1 volt input, achieve 1000 volt output.

## Magnet Chargers and Treaters

**Model 747**

High energy magnet charger covers full range of charging applications, from the lowest to the highest coercive forces, in all configurations
Available in five separate energy-storage capacity levels from 2,000 to 10,000 watt-seconds.

**Model 1500**

Produces 225 watt-seconds for large Alnico meter magnets plus cobalt platinum and barium ferrite materials. Wire-wound fixtures plug into front panel through safety interlocks.

**Model 440**

Variable output voltage with energies up to 440 watt-seconds for saturating up to 4 lbs. of Alnico V using wire-wound fixture. Bench or rack mounting available. Accessory Booster available for doubling output.

**Model 2470-700R**

With variable voltage outputs and energies up to 880 watt-seconds. Will saturate Alnico V up to 5½ pounds, as well as many core-type indicating meters completely assembled and encased. Rack mounting only.

**Model 942A**

Saturate Alnico magnets to 34 lbs. and high coercive force barium ferrite compounds of any shape or number of poles. Outputs to 3,600 watt-seconds. Safety interlocked.

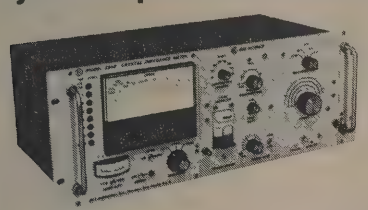
**Magnetreater® Model 990**

Completely solid-state demagnetizer for stabilization of permanent magnets. Power continuously variable from less than 1 VA to in excess of 80,000 VA. Resolution 0.1%. Can be programmed for automatic or semi-automatic operation.

**Magnetreater®/Charger Model 580**

Combination Magnet Charger and Magnetreater capable of charging and stabilizing permanent magnet materials and assemblies. Completely solid-state, providing high reliability. Energy storage for the charging mode is 105 watt-seconds. Magnetreater mode is 54 watt-seconds. Can be combined with RFL Gaussmeter for automatic or semi-automatic operation.

## Crystal Impedance Meters



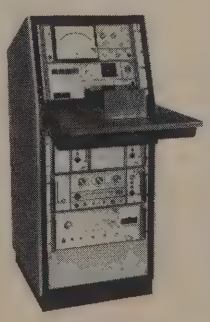
**New Model 5950A** completely solid-state CIM measures semi-automatically. Consists of a main-frame and two interchangeable RF modules covering a frequency range of 2.5kHz to 60MHz.

| Model | Module | Frequency Range | Impedance Range |
|---|---|---|---|
| 5950A | 254A | 2.5kHz - 4MHz | 10 ohms - 400 K ohms |
| 5950A | 460A | 4MHz - 60MHz | 2 - 75 ohms |
| 1207 | n/a | 55 - 200MHz | 10 - 125 ohms |

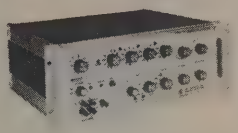
Model 5950A-254/460 replaces discontinued RFL Models 459B, 531 and 541C.

Reference standards for measuring resonance and anti-resonance of quartz crystals in determination of capacitance, inductance and performance index. Meet U.S. MIL-C-3098E/Amd. 1 and U.K. Defense DEF-5271 A.

## Automagnetic® Systems



A combination of RFL standard magnetizing, measuring and demagnetizing equipment permits interconnection for semi-automatic and completely automatic systems designed for individual requirements. Processing includes TWT, BAR and C shaped magnets, DC meters, Torque motors, accelerometers and other designs embodying permanent magnets.



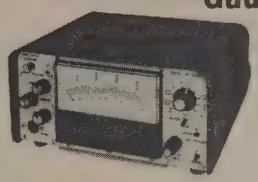
## Precision Standard

**for AC/DC Voltage and Current**

**Model 82**

Tests a wide range of analog and digital meters. AC and Bipolar DC voltage ranges of 100mV, 1V and 10V.
AC and Bipolar DC current ranges of 100uA, 1mA, 10mA and 100mA. Nominal accuracies of 0.01% DC and 0.05% AC. Percent error deviation dial. Frequency variable from 40Hz to 1kHz. Four fractional scale division ranges.

## Gaussmeters



**Model 750A**

**Model 750A,** sensitive wide-range device for analog measurement of 0.10 gauss to 50 kilogauss in 18 full-scale ranges. Measures permanent magnetic fields, DC and AC, to 400 Hz. Polarity sensitive, self-calibrating. Nominal accuracy ±1%.

**Model 750D**, sensitive high-range device for digital measurement of 10 gauss to 100 kilogauss in five full-scale ranges. Measures permanent magnetic fields, DC and AC, to 400 Hz. 3½-digit panel meter. Polarity sensitive. Self-calibrating. Nominal accuracy ±0.2%.

**Model 505**, a low cost unit ranging from 5 gauss to 50 kilogauss in 7 full-scale ranges. Measures permanent magnet, DC and AC fields to 20kHz. Built in probe calibration and zero center mode for determining polarity. Accuracy ±3%.

**Probes**—Are InAs elements for temperature stability. Choice of flat, axial or tangential in various sizes to fit most gaps. Flat ranges from .015" thick × .080" wide × .309" long.

**Reference Magnets**—Traceable to NBS with 50 gauss to 20K gauss fields and gaps from .040" to .343" are standards for probe calibration.

## Magnetometer

**Model 101**

Solid-state low level magnetic flux density measurements from 1 gamma to 100,000 gamma (1 oersted). Temperature compensation is provided to enable virtual drift-free operation.

## Fluxmeter

**Model 803**

Measures total flux and flux density - both AC and DC from 100 Maxwell-turns to 200 × $10^7$ Maxwell-turns. Solid-state with digital readout.
Four modes of operation, normal DC, peak DC no polarity, peak DC with polarity indication, AC average indication.

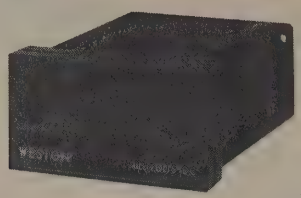
**RFL Industries, Inc.**
Instrumentation Div., Boonton, N.J. 07005
Tel: 201-334-3100 / TWX: 710-987-8352 / CABLE: RADAIRCO, N.J.

SANGAMO WESTON
Schlumberger

**WESTON INSTRUMENTS**
a DIVISION of SANGAMO WESTON, INC.
614 Frelinghuysen Avenue, Newark, New Jersey 07114
Tel: (201) 242-2600 TWX: (710) 995-4616

# Digital Panel Meters

## MODEL 1220 (BIPOLAR)



### Features

- All digital logic circuitry contained on a single MOS LSI plug-in chip — added reliability
- LED plug-in readout — added reliability
- Instant accuracy — requires no warm-up time
- Requires only 4 sq. in. space
- Complete instrument uses approximately ¾ watt power — conservatively rated to operate in 60°C ambient — added reliability
- Fixed or remote programmed decimal points
- Range change easily accomplished—simplifying stocking requirements
- Input vs readout "slope" changes easily accomplished
- Ruggedized — engineered to meet Military shock and vibration specs. — exceeds requirements of ACA C39.1 specifications for analog panel meters
- Model 1220 weighs less than 4 oz.

## MODEL 1230

Available in 2½ Digit as Model 1232

### Features

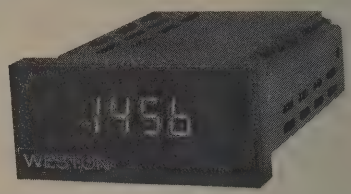
- Dual Slope Integration* A/D Converter
- Automatic bipolar operation
- Automatic zeroing
- Reliable TTL Logic and C-MOS analog gates
- 100% overrange (except 1 KV range)
- 2 nA maximum input bias current
- 7.5 conversions per second
- 0.55″ Sperry displays
- 80 dB CMRR
- 25 dB NMRR (10 dB on 1 volt range)
- Signal and control terminals:
  - Hold • Print Command • Outrange • Polarity

## MODEL 1234

### Features

- Dual Slope Integration* A/D Converter
- Automatic bipolar operation
- Reliable TTL Logic
- 3 nA maximum input bias current
- 7.5 conversions per second
- 0.55″ Sperry displays
- 80 dB CMRR
- 40 dB NMRR
- Signal and control terminals:
  - Hold • Print Command • Outrange • Polarity

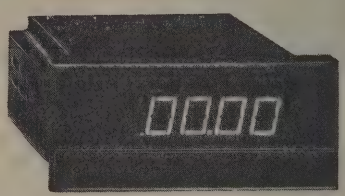
## 2460 SERIES



### Features

- LSI Solid-state reliability
- 0.6″ High Brightness LED Display
- Noise-immune Dual Slope Integration*
- Floating signal input section
- Choice of single-ended or differential inputs
- Isolated, interactive systems interface
- Latched, parallel BCD outputs
- Industry-standard 1.75″ by 4.0″ DPM case

## 2470 SERIES



### Features

- **"True bipolar" integration eliminates dead band**

No dead band around zero. High noise rejection. No skewing at zero. These hallmarks of "Tru bipolar" integration give precise reading near zero for both positive and negative signals.

- **3 Output voltages available** (±12V +5V)

Onboard voltage regulators provide 3 different output voltages to drive external circuits.

- **Automatic zero calibration**

Automatic zero and polarity eliminate zero calibration adjustments and allow direct readings of + and − input signals.

- **Temperature-controlled voltage reference for fast warm-up**

Temperature-controlled zener voltage references eliminate temperature shifts. No long waiting time for the unit to settle. The unit is "within spec" less than 10 minutes after turn-on.

- **High brightness 0.6″ LED display**

Crisp, clear, bright display with semicoductor reliability.

- **3.5W. power consumption**

Special low power circuit design coupled with large bright high efficiency LEDs provide cool running operation in industrial environments.

- **Dual Slope Integration rejects noise**

Universally accepted and patented Weston Dual Slope Integration (U.S. Patent 3,051,939) provides excellent noise rejection.

- **Worldwide Service**

Facilities assure strong, local support throughout the world to satisfy application and service needs.

### Options

- **Current loop ranges**

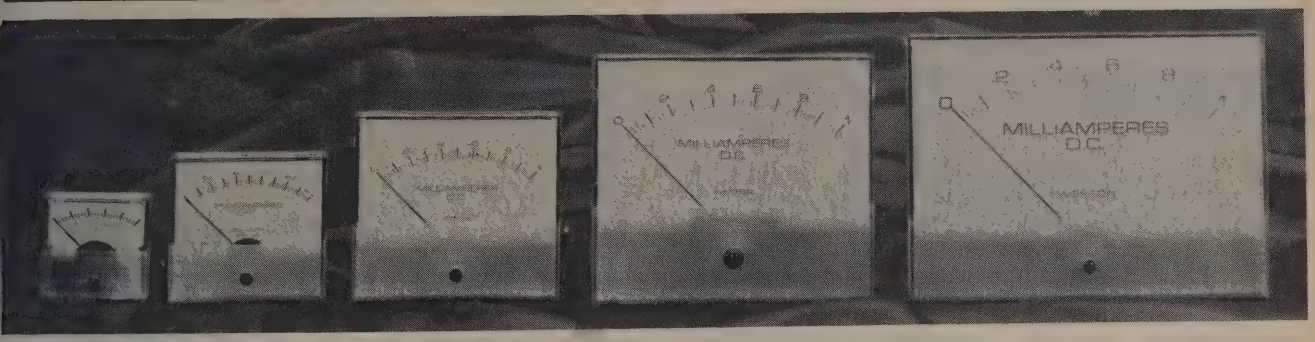
4 current loop ranges from 200μA to 200mA.

- **Isolated parallel BCD Output** (Model 2472)
- **Ratiometric operation** (standard)
- **Engineering units** (offset and full scale calibrated for pH, psi, C°, F°)

SANGAMO WESTON
Schlumberger

**WESTON INSTRUMENTS**
a DIVISION of SANGAMO WESTON, INC.
614 Frelinghuysen Avenue, Newark, New Jersey 07114
Tel: (201) 242-2600 TWX: (710) 995-4616

# MUSTANG
## Panel Meters




# MUSTANG

MUSTANG is a new line of precision panel meters by Weston, manufacturers of panel instruments since 1888. MUSTANG answers your need for true economy combined with style, ruggedness and reliability. You'll be glad to know abut the:

- Versatile appearance options—panel, bezel or window mounting
- Taut-band and pivot-and-jewel mechanisms
- Tough plastic pointer—ignores handling and electrical overloads
- White plastic scale, molded-in color which can't chip or yellow
- Ring-Lock mounting option—makes installation a real snap
- Backlighting feature—bright, uniform scale illumination when you need it.

The MUSTANG panel meter contains fewer parts than any other analog panel meter made today. That's why it offers unsurpassed reliability and economy. For top value in new applications or replacement. MUSTANG is your best choice.

The MUSTANG mechanism is a self-shielding CORMAG™ design, exhaustively tested in the lab and in the field to provide day-after-day accuracy and reliability. Welded electrical connections are used throughout. A unique caging design is used in taut band meters for added protection from environmental shock and vibration.

Small in overall size, The MUSTANG mechanism permits rear illumination without shadowing the lower part of the scale. Despite this small size, enough torque is available for crisp, low-overshoot response in VU applications.

# PERFORMANCE SPECIFICATIONS

**Taut Band or Pivot & Jewel**

| | DC | AC |
|---|---|---|
| Accuracy F.S. (5.2)† | ±2% | ±3% |
| Tracking (5.34) | 2% | |
| Repeatability (5.34) | 1% (DC$\mu$A>200$\mu$A)<br>2% (DC$\mu$A≤200$\mu$A) | 2% |
| Balance (5.3) | ±2% | |
| Overshoot (5.33) | 20% max for 1½ and 2½"<br>25% max for 3½ and 4½"<br>30% max for 6"* | |
| Response time (5.36)* | 2 Sec. Typical* | |
| Effect of overload<br>Momentary (5.8)<br>Sustained (5.11)<br>Short time (5.10) | <br>2%<br>1% | <br><br>1.5%<br>1% |

| | | |
|---|---|---|
| Operating temperature (5.6.3) | −4°F to +122°F<br>−20°C to +50°C | |
| Storage temperature (5.6) | −4°F to +150°F<br>−20°C to +65°C | |
| Shock (5.9), 50G<br>Vibration (5.13) | 2%<br>2% | |
| Dielectric (5.5) | 2600 Vrms<br>(1500 Vrms for 1½" size) | |
| Pointer type | Knife edge<br>Black, Red or White | |
| Housing materials—UL<br>Flammability classes | Case Cycoloy® KHP<br>Lexan® Optional<br>Cover NAS polystyrene<br>Lexan® Optional | 94 V-O<br>94 V-O<br>94 H-B<br>94 V-O |

*See ANSI C39.1, 1972 for further details
†Note: Numbers in parenthesis refer to pertinent paragraphs of ANSI C39.1-1972 performance spetifications
Cycoloy® is a registered trademark of Borg-Warner Corp.
Lexan® is a registered trademark of General Electric Co.

# HOW TO ORDER

Standard ranges and options are conveniently specified by constructing a catalog number by the guide below. Please consult your local representative, distributor, or service center for features not included in this description.

**CATALOG NUMBER**

7 5 ☐ ☐ ☐ ☐ 4 ☐ ☐ ☐ ☐

**Mustang**
Series 7500

**Size**
1—1½"
2—2½"
3—3½"
4—4½"
6—6½"

1—AC
2—DC

**Range**
Volts—1
amps—2
VU—3
mA—4
μA—5
mV—8

**Style**
1—P&J Rear Mounting
2—TB Rear Mounting
5—P&J Front Mount, Black Front
6—P&J Front Mount
7—TB Front Mount, Black Front
8—TB Front Mount

**Mounting**
1—Ring Lock
3—None (rear mount)
4—4 Stud
9—2 Stud

**Range**
001—0 to 1
002—0 to 2
005—0 to 5
010—0 to 10
020—0 to 20
050—0 to 50
100—0 to 100
200—0 to 200
300—0 to 300
500—0 to 500
For AC, VU use 600

*These options are not available: 1½ and 6½" Bezel mount; 6" window mount; 6" Ring-Lock; 1½" Translucent case.*

SANGAMO WESTON
Schlumberger

**WESTON INSTRUMENTS**
a DIVISION of SANGAMO WESTON, INC.
614 Frelinghuysen Avenue, Newark, New Jersey 07114
Tel: (201) 242-2600 TWX: (710) 995-4616

# MUSTANG Panel Meters

## RANGES

All ranges listed below are stocked both at Weston in Newark and at distributor locations throughout the United States, except as noted. T=Taut Band only. P=Pivot and Jewel only. •=Both.

**MODEL NUMBERS**
1½" MODEL 7511
2½" MODEL 7521
3½" MODEL 7531
4½" MODEL 7541
6" MODEL 7561

| Range | Resistance/Sensitivity Taut Band Ohms ± 20% | Resistance/Sensitivity Pivot & Jewel Ohms ± 20% | Scale Div. 1½" | Scale Div. 2½"-6" | 1½" | 2½" | 3½" | 4½" | 6" |
|---|---|---|---|---|---|---|---|---|---|
| **Microamperes DC** | | | | | | | | | |
| 0-50 | 1100 | — | 25 | 50 | T | T | T | T | T |
| 0-100 | 650 | 2265 | 20 | 50 | • | • | • | • | • |
| 0-200 | 208 | 570* | 20 | 40 | • | • | • | • | • |
| 0-500 | 45 | 180 | 25 | 50 | T | T | T | T | T |
| **Milliamperes DC** | | | | | | | | | |
| 0-1 | 15 | 57 | 20 | 50 | • | • | • | • | • |
| 0-2 | 10 | 15 | 20 | 40 | — | — | T | T | T |
| 0-5 | 10 | 6.3 | 25 | 50 | T | T | T | T | T |
| 0-10 | 5 | 5 | 20 | 50 | T | T | T | • | T |
| 0-20 | 2.5 | 2.5 | 20 | 40 | • | T | T | T | — |
| 0-50 | 1 | 1 | 25 | 50 | T | T | T | T | T |
| 0-100 | .5 | .5 | 20 | 50 | T | T | T | T | T |
| 0-200 | .25 | .25 | 20 | 40 | T | T | T | T | T |
| 0-500 | .1 | .1 | 25 | 50 | T | T | T | T | T |
| **Amperes DC** | | | | | | | | | |
| 0-1 | 50mV | 50mV | 20 | 50 | T | T | T | T | T |
| 0-2 | 50mV | 50mV | 20 | 40 | — | — | — | T | P |
| **Volts DC** | | | | | | | | | |
| 0-1 | 1000Ω/v | 1000Ω/v | 20 | 50 | — | T | — | T | — |
| 0-2 | | | 20 | 40 | T | — | T | T | — |
| 0-5 | | | 25 | 50 | T | T | T | T | T |
| 0-10 | | | 20 | 50 | — | — | — | T | — |
| 0-15 | | | 15 | 60 | — | T | — | T | T |
| 0-30 | | | 30 | 60 | T | T | T | T | T |
| 0-50 | | | 25 | 50 | T | T | — | T | T |
| 0-100 | | | 20 | 50 | — | — | — | — | — |
| 0-150 | | | 15 | 60 | T | T | T | T | T |
| 0-200 | 10,000Ω/v | 10,000Ω/v | 20 | 40 | T | — | T | T | — |
| 0-300 | | | 30 | 60 | T | T | — | T | T |
| 0-500 | | | 25 | 50 | — | — | — | — | — |
| **Volts AC** | | | | | | | | | |
| 0-150 | 870Ω/v | 870Ω/v | 15 | 60 | T | T | T | T | T |
| 0-300 | 870Ω/v | 870Ω/v | 30 | 60 | • | T | T | T | • |
| **vu or Modulation** | | | | | | | | | |
| "A" Scale | | | | | | | | | |
| 0-200μADC | 208 | — | Log/lin | | — | T | T | T | — |
| 0-1mADC | 15 | — | | | — | T | T | T | — |
| 0-1.73VAC | 3900 | — | Log/lin | | — | T | T | T | — |
| "B" Scale | | | | | | | | | |
| 0-200μADC | 208 | — | Log/lin | | — | — | T | T | — |
| 0-1mADC | 15 | — | | | — | — | T | T | — |
| 0-1.73VAC | 3900 | — | Log/lin | | — | — | T | T | — |

*6" Model only—1140Ω ±20%.
*DC and AC ballistic response is very close to ANSI C16.5 specification for vu meters. For detailed technical information, please contact your local representative.*

SANGAMO WESTON
Schlumberger

# WESTON INSTRUMENTS

a DIVISION of SANGAMO WESTON, INC.
614 Frelinghuysen Avenue, Newark, New Jersey 07114
Tel: (201) 242-2600 TWX: (710) 995-4616

# MUSTANG
## Panel Meters

## AC MICROAMMETERS, RECTIFIER TYPE

**2½" MODEL 2022**

| Range | Scale Div. | Pivot & Jewel Resistance Ohms (Approx.) | Catalog No. †△ | Taut Band Resistance Ohms (Approx.) | Catalog No. †△ |
|---|---|---|---|---|---|
| 100 | 50 | 5500 | 5841100 | 5500 | 5842100 |
| 200 | 40 | 2600 | 5841200 | 2400 | 5842200 |
| 500 | 50 | 1000 | 5841500 | 1000 | 5842500 |

**3½" MODEL 2032**

| Range | Scale Div. | Pivot & Jewel Resistance Ohms (Approx.) | Catalog No. †△ | Taut Band Resistance Ohms (Approx.) | Catalog No. †△ |
|---|---|---|---|---|---|
| 100 | 50 | 5500 | 5841100 | 5500 | 5842100 |
| 200 | 40 | 2600 | 5841200 | 2400 | 5842200 |
| 500 | 50 | 1000 | 5841500 | 1000 | 5842500 |

**4½" MODEL 2042**

| Range | Scale Div. | Pivot & Jewel Resistance Ohms (Approx.) | Catalog No. †△ | Taut Band Resistance Ohms (Approx.) | Catalog No. †△ |
|---|---|---|---|---|---|
| 100 | 50 | 5500 | 5841100 | 5500 | 5842100 |
| 200 | 40 | 2600 | 5841200 | 2400 | 5842200 |
| 500 | 50 | 1000 | 5841500 | 1000 | 5842500 |

**5½" MODEL 2052**

| Range | Scale Div. | Pivot & Jewel Resistance Ohms (Approx.) | Catalog No. †△ | Taut Band Resistance Ohms (Approx.) | Catalog No. †△ |
|---|---|---|---|---|---|
| 100 | 50 | 5500 | 5841100 | 5500 | 5842100 |
| 200 | 40 | 2600 | 5841200 | 2400 | 5842200 |
| 500 | 50 | 1000 | 5841500 | 1000 | 5842500 |

## AC MILLIAMMETERS, RECTIFIER TYPE

**2½" MODEL 2022**

| Range | Scale Div. | Pivot & Jewel Resistance Ohms (Approx.) | Catalog No. †△ | Taut Band Resistance Ohms (Approx.) | Catalog No. †△ |
|---|---|---|---|---|---|
| 1 | 50 | 530 | 4841001 | 500 | 4842001 |
| 2 | 40 | 280 | 4841002 | 270 | 4842002 |
| 5 | 50 | 115 | 4841005 | 115 | 4842005 |

**3½" MODEL 2032**

| Range | Scale Div. | Pivot & Jewel Resistance Ohms (Approx.) | Catalog No. †△ | Taut Band Resistance Ohms (Approx.) | Catalog No. †△ |
|---|---|---|---|---|---|
| 1 | 50 | 530 | 4841001 | 500 | 4842001 |
| 2 | 40 | 280 | 4841002 | 270 | 4842002 |
| 5 | 50 | 115 | 4841005 | 115 | 4842005 |

**4½" MODEL 2042**

| Range | Scale Div. | Pivot & Jewel Resistance Ohms (Approx.) | Catalog No. †△ | Taut Band Resistance Ohms (Approx.) | Catalog No. †△ |
|---|---|---|---|---|---|
| 1 | 50 | 530 | 4841001 | 500 | 4842001 |
| 2 | 40 | 280 | 4841002 | 270 | 4842002 |
| 5 | 50 | 115 | 4841005 | 115 | 4842005 |

**5½" MODEL 2052**

| Range | Scale Div. | Pivot & Jewel Resistance Ohms (Approx.) | Catalog No. †△ | Taut Band Resistance Ohms (Approx.) | Catalog No. †△ |
|---|---|---|---|---|---|
| 1 | 50 | 530 | 4841001 | 500 | 4842001 |
| 2 | 40 | 280 | 4841002 | 270 | 4842002 |
| 5 | 50 | 115 | 4841005 | 115 | 4842005 |

* *Stock item.*
† *When ordering meters, model number must precede catalog number.*
△ *When ordering meter with optional black painted front change second digit of catalog number "8" to "7."*

## AC IRON VANE

### AC VOLTMETERS Iron Vane (Pivot & Jewel Only) Frequency: 25-125 Hz△

| Range | 2½"MODEL 2024 Scale Div. | 2½"MODEL 2024 Nominal Resistance | 3½" MODEL 2034 Scale Div. | 3½" MODEL 2034 Nominal Resistance | 4½" MODEL 2044 Scale Div. | 4½" MODEL 2044 Nominal Resistance | CATALOG NO. |
|---|---|---|---|---|---|---|---|
| 7.5 | 75 | 37.5 | 75 | 37.5 | 75 | 37.5 | 1841975 |
| 10 | 50 | 66.5 | 50 | 66.5 | 50 | 66.5 | 1841010*** |
| 15 | 75 | 150 | 75 | 150 | 75 | 150 | 1841015** |
| 25 | 50 | 500 | 50 | 500 | 50 | 500 | 1841025 |
| 30 | 60 | 600 | 60 | 600 | 60 | 600 | 1841030 |
| 50 | 50 | 1665 | 50 | 1665 | 50 | 1665 | 1841050* |
| 100 | 50 | 6700 | 50 | 6700 | 50 | 6700 | 1841100 |
| 150 | 75 | 15,000 | 75 | 15,000 | 75 | 15,000 | 1841150* |
| 300 | 60 | 60,000 | 60 | 60,000 | 60 | 60,000 | 1841300* |
| 500 | 50 | 100,000 | 50 | 100,000 | 50 | 100,000 | 1841500** |

△ Can be adjusted for 400 (± 10%) Hz
NOTE: Power Consumption: 150 Volt Range at 115 Volts, 1.15 Watts, at 60 Hz, 1.15 Volt-Amperes

### AC AMMETERS Iron Vane (Pivot & Jewel Only) Frequency: 25-500 Hz

| Range | 2½" MODEL 2024 Scale Div. | 2½" MODEL 2024 Nominal Resistance | 3½" MODEL 2034 Scale Div. | 3½" MODEL 2034 Nominal Resistance | 4½" MODEL 2044 Scale Div. | 4½" MODEL 2044 Nominal Resistance | CATALOG NO. |
|---|---|---|---|---|---|---|---|
| 1 | 50 | .25 | 50 | .25 | 50 | .25 | 2841001* |
| 2 | 40 | .06 | 40 | .062 | 40 | 062 | 2841002 |
| 3 | 60 | 025 | 60 | 025 | 60 | 025 | 2841003 |
| 5 | 50 | 016 | 50 | 016 | 50 | 016 | 2841005* |
| 10 | 50 | 0045 | 50 | 0045 | 50 | 0045 | 2841010* |
| 15 | 75 | 0015 | 75 | 0025 | 75 | 0025 | 2841015 |
| 20 | 40 | 0011 | 40 | 0011 | 40 | 0011 | 2841020* |
| 25 | 50 | 0011 | 50 | .0011 | 50 | 0011 | 2841025** |
| 30 | 60 | 00056 | 60 | 00056 | 60 | 00056 | 2841030* |
| 50 | 50 | 00027 | 50 | .00027 | 50 | 00027 | 2841050* |

NOTE: Power Consumption: 5 Ampere Range at 5 Amperes, 0 45 Watts, 0.45 Watts: at 60 Hz, 0 45 Volt-Amperes

### AC MILLIAMMETERS Iron Vane (Pivot & Jewel Only) Frequency: 25-500 Hz

*Denotes Stock Item
**Model 2044 In Stock Only
***Models 2034, 2044 In Stock Only

| Range | 2½"MODEL 2024 Scale Div. | 2½"MODEL 2024 Nominal Resistance | 3½" MODEL 2034 Scale Div. | 3½" MODEL 2034 Nominal Resistance | 4½" MODEL 2044 Scale Div. | 4½" MODEL 2044 Nominal Resistance | CATALOG NO. |
|---|---|---|---|---|---|---|---|
| 10 | 20 | 2550 | 50 | 2550 | 50 | 2550 | 4841010 |
| 50 | 25 | 100 | 50 | 100 | 50 | 100 | 4841050* |
| 100 | 20 | 25 | 50 | 25 | 50 | 25 | 4841100* |
| 200 | 40 | 6 3 | 40 | 6 33 | 40 | 6 33 | 4841200 |
| 250 | 25 | 6 3 | 50 | 4 0 | 50 | 4 0 | 4841250 |
| 500 | 25 | 1 0 | 50 | 1 0 | 50 | 1 0 | 4841500* |

## 2000 SERIES VU METERS

| Model | Catalog No. | Scale Type |
|---|---|---|
| 2022 | 3841001 * | Type 30 A scale |
| | 3841002 | Type 30 B scale |
| 2032 | 3841001 * | Type 30 A scale |
| | 3841002 | Type 30 B scale |

Weston VU Meters are available with Type A or Type B scales. The Type A scale stresses the level in VU units for monitoring wire lines. The Type B scale emphasizes percent use of transmitter output and is the standard for broadcast service. The VU meter is designed to read zero VU, or 100%, with 1.228 volts AC applied to the meter and a 3600 ohm series resistor. This represents 4dB above 1 MW in 600 ohms.

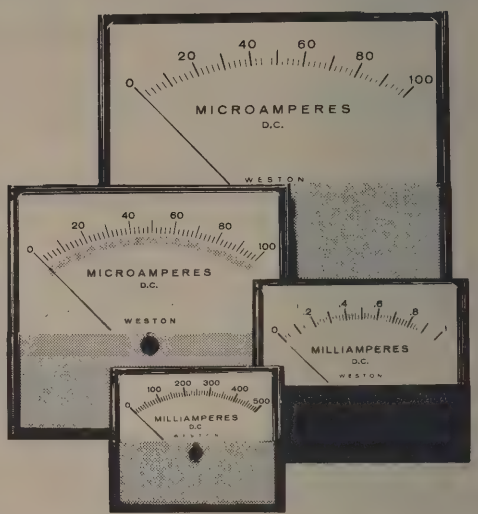
* *Stock item.*
† *When ordering meters, model number must precede catalog number.*
△ *When ordering meter with optional black painted front change second digit of catalog number "8" to "7."*

**External Illumination Kits Available**

SANGAMO WESTON
Schlumberger

**WESTON INSTRUMENTS**
a DIVISION of SANGAMO WESTON, INC.
614 Frelinghuysen Avenue, Newark, New Jersey 07114
Tel: (201) 242-2600 TWX: (710) 995-4616

# 2000 Series Panel Meters




## Specifications

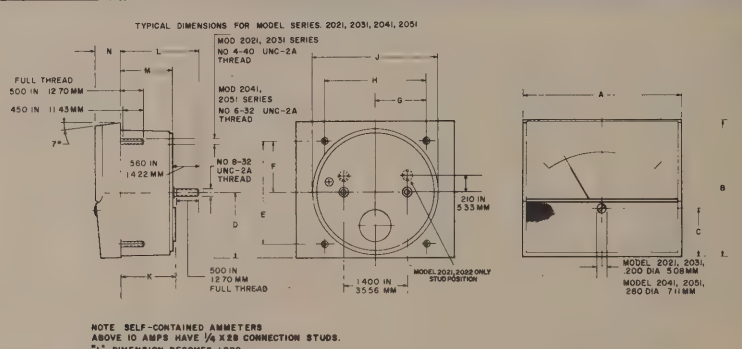
| Size | Model | Function & Mechanism | Accuracy (% Full Scale) | Scale Length | Pointer | Type*** Scale |
|---|---|---|---|---|---|---|
| 2½" | 2021<br>2022 | DC—CORMAG®<br>AC RECT.—CORMAG® | 2%<br>3%* | 2.13"<br>2.13" | Knife-Edge<br>Knife-Edge | Plain<br>Plain |
| 3½" | 2031<br>2032 | DC—CORMAG®<br>AC RECT.—CORMAG® | 2%**<br>3%* | 2.7"<br>2.7" | Knife-Edge<br>Knife-Edge | Plain<br>Plain |
| 4½" | 2041<br>2042 | DC—CORMAG®<br>AC RECT.—CORMAG® | 2%**<br>3%* | 3.7"<br>3.7" | Knife-Edge<br>Knife-Edge | Plain<br>Plain |
| 5½" | 2051<br>2052 | DC—CORMAG®<br>AC RECT.—CORMAG® | 2%**<br>3%* | 4.5"<br>4.5" | Knife-Edge<br>Knife-Edge | Plain<br>Plain |

*On Sinewave. 25-20,000 Hz for current meters. 25-1500 Hz voltmeters.
**Available with increased accuracy and tracking on special order.
***Mirror scale available on special order.
(Higher frequency available on special order.)

## Dimensions

| Model | A | B | C | D | E | F | G | H | J | K | L | M | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2021<br>2022 | 2.810<br>71.37mm | 2.400 in.<br>60.96 mm | .985 in.<br>25.02 mm | 1.160 in.<br>29.46 mm | 1.880 in.<br>47.75 mm | .940 in.<br>23.88 mm | .940 in.<br>23.88 mm | 1.880 in.<br>47.75 mm | 2.200 in.<br>55.88 mm | 1.220 in.<br>30.99 mm | 1.725 in.<br>43.82 mm | 1.140 in.<br>28.96 mm | .560 in.<br>14.22 mm |
| 2031<br>2032 | 3.500 in.<br>88.90 mm | 2.980 in.<br>75.69 mm | 1.060 in.<br>26.92 mm | 1.440 in.<br>36.58 mm | 2.250 in.<br>57.15 mm | 1.125 in.<br>28.58 mm | 1.125 in.<br>28.58 mm | 2.250 in.<br>57.15 mm | 2.750 in.<br>69.85 mm | 1.200 in.<br>30.48 mm | 1.725 in.<br>43.82 mm | 1.140 in.<br>28.96 mm | .560 in.<br>14.22 mm |
| 2041<br>2042 | 4.530 in.<br>115.06 mm | 4.050 in.<br>102.87 mm | 1.480 in.<br>37.59 mm | 1.780 in.<br>45.21 mm | 3.560 in.<br>90.42 mm | 2.020 in.<br>51.31 mm | 2.000 in.<br>50.80 mm | 4.000 in.<br>101.60 mm | 2.750 in.<br>69.85 mm | 1.200 in.<br>30.48 mm | 1.725 in.<br>43.82 mm | 1.140 in.<br>28.96 mm | .600 in.<br>15.24 mm |
| 2051<br>2052 | 5.630 in.<br>143.00 mm | 4.490 in.<br>114.45 mm | 1.460 in.<br>37.08 mm | 1.590 in.<br>40.39 mm | 3.000 in.<br>76.20 mm | 2.150 in.<br>54.61 mm | 2.625 in.<br>66.68 mm | 5.250 in.<br>133.35 mm | 2.750 in.<br>69.85 mm | 1.200 in.<br>30.48 mm | 1.725 in.<br>43.82 mm | 1.140 in.<br>28.96 mm | .600 in.<br>15.24 mm |

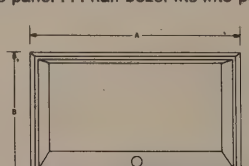
*See diagram for dimensions*


TYPICAL DIMENSIONS FOR MODEL SERIES 2021, 2031, 2041, 2051
MOD 2021, 2031 SERIES NO 4-40 UNC-2A THREAD
MOD 2041, 2051 SERIES NO 6-32 UNC-2A THREAD
NO 8-32 UNC-2A THREAD
FULL THREAD
500 IN 12 70 MM
450 IN 11 43MM
560 IN 14 22 MM
210 IN 5 33 MM
500 IN 12 70 MM FULL THREAD
1400 IN 35 56 MM
MODEL 2021, 2022 ONLY STUD POSITION
MODEL 2021, 2031, .200 DIA 5 08MM
MODEL 2041, 2051, 280 DIA 7 11MM

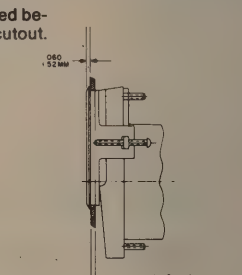
NOTE SELF-CONTAINED AMMETERS ABOVE 10 AMPS HAVE ¼ X 28 CONNECTION STUDS.
"L" DIMENSION BECOMES 1.990

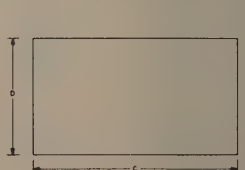
**RECESS** ***(Bezel mounting)***

Only the scale is visible since meter is mounted behind the panel . . . half bezel fits into panel cutout.




*Note: Half bezel mounting easily adaptable to external illumination.*




| Model | A | B | C | D | Catalog No. |
|---|---|---|---|---|---|
| 2021/22/24 | 3.120 in.<br>79.25 mm | 1.720 in.<br>43.69 mm | 3.000 in.<br>76.20 mm | 1-19/32 (1.609) in.<br>40.87 mm | 020090271495 |
| 2031/32/34 | 3.860 in.<br>98.04 mm | 2.265 in.<br>57.54 mm | 3-23/32 (3.718) in.<br>94.43 mm | 2-5/32 (2.156) in.<br>54.74 mm | 020090271922 |
| 2041/42/44 | 4.960 in.<br>125.98 mm | 2.900 in.<br>73.66 mm | 4-13/16 (4.812) in.<br>122.22 mm | 2-3/4 (2.750) in.<br>69.85 mm | 020090271923 |
| 2051/52 | 6.060 in.<br>153.92 mm | 3.300 in.<br>83.82 mm | 5-7/8 (5.875) in.<br>149.22 mm | 3-5/32 (3.156) in.<br>80.16 mm | 020090271924 |

SANGAMO WESTON
Schlumberger

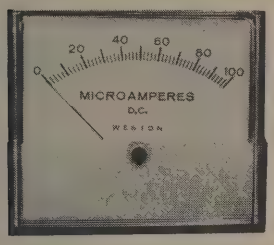
# WESTON INSTRUMENTS

a DIVISION of SANGAMO WESTON, INC.
614 Frelinghuysen Avenue, Newark, New Jersey 07114
Tel: (201) 242-2600 TWX: (710) 995-4616

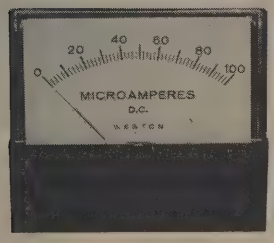
# 2000 Series Panel Meters

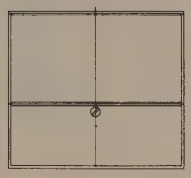
**CONVENTIONAL**

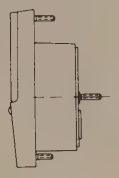
Use same dimensions, whether you choose a meter with taut band or pivot and jewel movement.

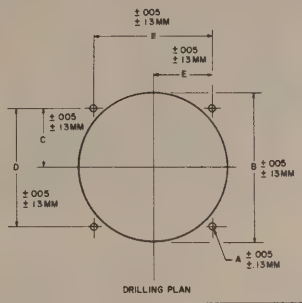



| Model | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 2021 | .125 in.<br>3.17 mm | 2.200 in.<br>55.88 mm | .940 in.<br>23.88 mm | 1.880 in.<br>47.75 mm | .940 in.<br>23.88 mm | 1.880 in.<br>47.75 mm |
| 2031 | .125 in.<br>3.17 mm | 2.820 in.<br>71.63 mm | 1.125 in.<br>28.57 mm | 2.250 in.<br>57.15 mm | 1.125 in.<br>28.57 mm | 2.250 in.<br>57.15 mm |
| 2041 | .166 in.<br>4.21 mm | 2.820 in.<br>71.63 mm | 2.020 in.<br>51.31 mm | 3.562 in.<br>90.47 mm | 2.000 in.<br>50.80 mm | 4.000 in.<br>101.60 mm |
| 2051 | .166 in.<br>4.21 mm | 2.820 in.<br>71.63 mm | 2.150 in.<br>54.61 mm | 3.000 in.<br>76.20 mm | 2.625 in.<br>66.67 mm | 5.250 in.<br>133.35 mm |








## DC MICROAMMETERS

### 2½" MODEL 2021

| Range | Scale Div. | Pivot & Jewel Resistance (Ohms) | Catalog No. † △ | Taut Band Resistance (Ohms) | Catalog No. † △ |
|---|---|---|---|---|---|
| 50 | 50 | 2500 | 5841050 • | 950 | 5842050* |
| 100 | 50 | 2300 | 5841100 • | 845 | 5842100* |
| 200 | 40 | 850 | 5841200 | 275 | 5842200* |
| 500 | 50 | 230 | 5841500 | 60 | 5842500* |
| 50-0-50 | 40 | 2300 | 8888001 | 845 | 8888004 • |
| 100-0-100 | 40 | 850 | 8888002 | 275 | 8888005 • |
| 500-0-500 | 50 | 85 | 8888003 | 16.5 | 8888006 |

### 3½" MODEL 2031

| Range | Scale Div. | Pivot & Jewel Resistance (Ohms) | Catalog No. † △ | Taut Band Resistance (Ohms) | Catalog No. † △ |
|---|---|---|---|---|---|
| 50 | 50 | 2500 | 5841050 • | 950 | 5842050* |
| 100 | 50 | 2300 | 5841100 • | 845 | 5842100* |
| 200 | 40 | 850 | 5841200 | 275 | 5842200* |
| 500 | 50 | 230 | 5841500 | 60 | 5842500 |
| 50-0-50 | 40 | 2300 | 8888001 • | 845 | 8888004* |
| 100-0-100 | 40 | 850 | 8888002 | 275 | 8888005 |
| 500-0-500 | 50 | 85 | 8888003 | 16.5 | 8888006 |

### 4½" MODEL 2041

| Range | Scale Div. | Pivot & Jewel Resistance (Ohms) | Catalog No. † △ | Taut Band Resistance (Ohms) | Catalog No. † △ |
|---|---|---|---|---|---|
| 50 | 50 | 2500 | 5841050 • | 950 | 5842050* |
| 100 | 50 | 2300 | 5841100 • | 845 | 5842100* |
| 200 | 40 | 850 | 5841200 • | 275 | 5842200* |
| 500 | 50 | 230 | 5841500 | 60 | 5842500* |
| 50-0-50 | 40 | 2300 | 8888001 • | 845 | 8888004 |
| 100-0-100 | 40 | 850 | 8888002 | 275 | 8888005 |
| 500-0-500 | 50 | 85 | 8888003 | 16.5 | 8888006 |

### 5½" MODEL 2051

| Range | Scale Div. | Pivot & Jewel Resistance (Ohms) | Catalog No. † △ | Taut Band Resistance (Ohms) | Catalog No. † △ |
|---|---|---|---|---|---|
| 50 | 50 | 2500 | 5841050 • | 950 | 5842050 |
| 100 | 50 | 2300 | 5841100 | 845 | 5842100 |
| 200 | 40 | 850 | 5841200 • | 275 | 5842200 |
| 500 | 50 | 230 | 5841500 | 60 | 5842500 |
| 50-0-50 | 40 | 2300 | 8888001 • | 845 | 8888004 |
| 100-0-100 | 40 | 850 | 8888002 | 275 | 8888005 |
| 500-0-500 | 50 | 85 | 8888003 | 16.5 | 8888006 |

## DC MILLIAMMETERS

### 2½" MODEL 2021

| Range | Scale Div. | Pivot & Jewel Res. Ohms ±20% | Catalog No. † △ | Taut Band Res. Ohms ±20% | Catalog No. † △ |
|---|---|---|---|---|---|
| 1 | 50 | 85 | 4841001* | 16.5 | 4842001 • |
| 2 | 40 | 16 | 4841002 | 8.2 | 4842002 |
| 5 | 50 | 9 | 4841005 | 4.7 | 4842005 |
| 10 | 50 | 2.2 | 4841010* | 2.2 | 4842010 |
| 20 | 40 | 1.6 | 4841020 | 2.0 | 4842020 |
| 50 | 50 | 2.0 | 4841050* | 2.0 | 4842050 |
| 100 | 50 | 1.0 | 4841100* | 1.0 | 4842100 |
| 200 | 40 | 0.5 | 4841200* | 0.5 | 4842200 |
| 300 | 60 | 0.33 | 4841300* | 0.33 | 4842300 |
| 500 | 50 | 0.2 | 4841500 | 0.2 | 4842500 |

### 3½" MODEL 2031

| Range | Scale Div. | Pivot & Jewel Res. Ohms ±20% | Catalog No. † △ | Taut Band Res. Ohms ±20% | Catalog No. † △ |
|---|---|---|---|---|---|
| 1 | 50 | 85 | 4841001* | 16.5 | 4842001 • |
| 2 | 40 | 16 | 4841002 | 8.2 | 4842002 |
| 5 | 50 | 9 | 4841005 | 4.7 | 4842005 |
| 10 | 50 | 2.2 | 4841010* | 2.2 | 4842010 |
| 20 | 40 | 1.6 | 4841020 | 2.0 | 4842020 |
| 50 | 50 | 2.0 | 4841050* | 2.0 | 4842050 |
| 100 | 50 | 1.0 | 4841100* | 1.0 | 4842100 |
| 200 | 40 | 0.5 | 4841200 | 0.5 | 4842200 |
| 300 | 60 | 0.33 | 4841300 | 0.33 | 4842300 |
| 500 | 50 | 0.2 | 4841500* | 0.2 | 4842500 |

### 4½" MODEL 2041

| Range | Scale Div. | Pivot & Jewel Res. Ohms ±20% | Catalog No. † △ | Taut Band Res. Ohms ±20% | Catalog No. † △ |
|---|---|---|---|---|---|
| 1 | 50 | 85 | 4841001* | 16.5 | 4842001 • |
| 2 | 40 | 16 | 4841002 | 8.2 | 4842002 |
| 5 | 50 | 9 | 4841005* | 4.7 | 4842005 |
| 10 | 50 | 2.2 | 4841010 | 2.2 | 4842010 |
| 20 | 40 | 1.6 | 4841020 | 2.0 | 4842020 |
| 50 | 50 | 2.0 | 4841050* | 2.0 | 4842050 |
| 100 | 50 | 1.0 | 4841100 | 1.0 | 4842100 |
| 200 | 40 | 0.5 | 4841200 | 0.5 | 4842200 |
| 300 | 60 | 0.33 | 4841300* | 0.33 | 4842300 |
| 500 | 50 | 0.2 | 4841500 | 0.2 | 4842500 |

### 5½" MODEL 2051

| Range | Scale Div. | Pivot & Jewel Res. Ohms ± 20% | Catalog No. † △ | Taut Band Res. Ohms ± 20% | Catalog No. † △ |
|---|---|---|---|---|---|
| 1 | 50 | 85 | 4841001 • | 16.5 | 4842001 • |
| 2 | 40 | 16 | 4841002 | 8.2 | 4842002 |
| 5 | 50 | 9 | 4841005 | 4.7 | 4842005 |
| 10 | 50 | 2.2 | 4841010 | 2.2 | 4842010 |
| 20 | 40 | 1.6 | 4841020 | 2.0 | 4842020 |
| 50 | 50 | 2.0 | 4841050 | 2.0 | 4842050 |
| 100 | 50 | 1.0 | 4841100 | 1.0 | 4842100 |
| 200 | 40 | 0.5 | 4841200 | 0.5 | 4842200 |
| 300 | 60 | 0.33 | 4841300 | 0.33 | 4842300 |
| 500 | 50 | 0.2 | 4841500 | 0.2 | 4842500 |

* *Stock item.*
† *When ordering meters, model number must precede catalog number.*
△ *When ordering meter with optional black painted front change second digit of catalog number "8" to "7."*

SANGAMO WESTON
Schlumberger

**WESTON INSTRUMENTS**
a DIVISION of SANGAMO WESTON, INC.
614 Frelinghuysen Avenue, Newark, New Jersey 07114
Tel: (201) 242-2600 TWX: (710) 995-4616

# 2000 Series Panel Meters

## DC AMMETERS

### 2½" MODEL 2021

| Range | Scale Div. | Pivot & Jewel | Catalog No. † △ | Taut Band | Catalog No. † △ |
|---|---|---|---|---|---|
| 1 | 50 | ↑ Approx. 50MV Drop ↓ | 2841001* | ↑ Approx. 50MV Drop ↓ | 2842001 |
| 2 | 40 | | 2841002 | | 2842002 |
| 5 | 50 | | 2841005* | | 2842005 |
| 10 | 50 | | 2841010 | | 2842010 |
| 20 | 40 | | 2841020 | | 2842020 |
| 25 | 50 | | 2841025* | | 2842025 |
| 30 | 60 | | 2841030 | | 2842030 |
| 50 | 50 | | 2841050* | | 2842050 |

### 3½" MODEL 2031

| Range | Scale Div. | Pivot & Jewel | Catalog No. † △ | Taut Band | Catalog No. † △ |
|---|---|---|---|---|---|
| 1 | 50 | ↑ Approx. 50MV Drop ↓ | 2841001* | ↑ Approx. 50MV Drop ↓ | 2842001 |
| 2 | 40 | | 2841002 | | 2842002 |
| 5 | 50 | | 2841005* | | 2842005 |
| 10 | 50 | | 2841010* | | 2842010 |
| 20 | 40 | | 2841020 | | 2842020 |
| 25 | 50 | | 2841025 | | 2842025 |
| 30 | 60 | | 2841030 | | 2842030 |
| 50 | 50 | | 2841050* | | 2842050 |

### 4½" MODEL 2041

| Range | Scale Div. | Pivot & Jewel | Catalog No. † △ | Taut Band | Catalog No. † △ |
|---|---|---|---|---|---|
| 1 | 50 | ↑ Approx 50MV Drop ↓ | 2841001* | ↑ Approx. 50MV Drop ↓ | 2842001 |
| 2 | 40 | | 2841002* | | 2842002 |
| 5 | 50 | | 2841005* | | 2842005 |
| 10 | 50 | | 2841010 | | 2842010 |
| 20 | 40 | | 2841020 | | 2842020 |
| 25 | 50 | | 2841025* | | 2842025 |
| 30 | 60 | | 2841030 | | 2842030 |
| 50 | 50 | | 2841050* | | 2842050 |

### 5½" MODEL 2051

| Range | Scale Div. | Pivot & Jewel | Catalog No. † △ | Taut Band | Catalog No. † △ |
|---|---|---|---|---|---|
| 1 | 50 | ▲ Approx. 50MV Drop ▼ | 2841001* | ▲ Approx. 50MV Drop ▼ | 2842001 |
| 2 | 40 | | 2841002 | | 2842002 |
| 5 | 50 | | 2841005* | | 2842005 |
| 10 | 50 | | 2841010* | | 2842010 |

## DC VOLTMETERS

### 2½" MODEL 2021

| Range | Scale Div. | OHMS PER VOLT | | | |
|---|---|---|---|---|---|
| | | Pivot & Jewel | Catalog No. † △ | Taut Band | Catalog No. † △ |
| 2 | 40 | 1000 ↓ | 1841002 | 1000 ↓ | 1842002 |
| 5 | 50 | | 1841005* | | 1842005 |
| 10 | 50 | | 1841010* | | 1842010 |
| 15 | 30 | | 1841015 | | 1842015 |
| 25 | 50 | | 1841025 | | 1842025 |
| 30 | 60 | | 1841030 | | 1842030 |
| 50 | 50 | | 1841050* | | 1842050 |
| 100 | 50 | | 1841100 | | 1842100 |
| 150 | 30 | | 1841150* | | 1842150 |
| 200 | 40 | | 1841200* | | 1842200 |
| 300 | 60 | | 1841300* | | 1842300 |
| 500 | 50 | | 1841500 | | 1842500 |

### 3½" MODEL 2031

| Range | Scale Div. | OHMS PER VOLT | | | |
|---|---|---|---|---|---|
| | | Pivot & Jewel | Catalog No. † △ | Taut Band | Catalog No. † △ |
| 2 | 40 | 1000 ↓ | 1841002 | 1000 ↓ | 1842002 |
| 5 | 50 | | 1841005 | | 1842005 |
| 10 | 50 | | 1841010* | | 1842010 |
| 15 | 75 | | 1841015 | | 1842015 |
| 25 | 50 | | 1841025* | | 1842025 |
| 30 | 60 | | 1841030 | | 1842030 |
| 50 | 50 | | 1841050* | | 1842050 |
| 100 | 50 | | 1841100 | | 1842100 |
| 150 | 75 | | 1841150* | | 1842150 |
| 200 | 40 | | 1841200 | | 1842200 |
| 300 | 60 | | 1841300* | | 1842300 |
| 500 | 50 | | 1841500 | | 1842500 |

### 4½" MODEL 2041

| Range | Scale Div. | OHMS PER VOLT | | | |
|---|---|---|---|---|---|
| | | Pivot & Jewel | Catalog No. † △ | Taut Band | Catalog No. † △ |
| 2 | 40 | 1000 ↓ | 1841002 | 1000 ↓ | 1842002 |
| 5 | 50 | | 1841005 | | 1842005 |
| 10 | 50 | | 1841010* | | 1842010 |
| 15 | 75 | | 1841015 | | 1842015 |
| 25 | 50 | | 1841025 | | 1842025 |
| 30 | 60 | | 1841030 | | 1842030 |
| 50 | 50 | | 1841050* | | 1842050 |
| 100 | 50 | | 1841100 | | 1842100 |
| 150 | 75 | | 1841150* | | 1842150 |
| 200 | 40 | | 1841200 | | 1842200 |
| 300 | 60 | | 1841300* | | 1842300 |
| 500 | 50 | | 1841500 | | 1842500 |

### 5½" MODEL 2051

| Range | Scale Div. | OHMS PER VOLT | | | |
|---|---|---|---|---|---|
| | | Pivot & Jewel | Catalog No. † △ | Taut Band | Catalog No. † △ |
| 2 | 40 | 1000 ↓ | 1841002 | 1000 ↓ | 1842002 |
| 5 | 50 | | 1841005 | | 1842005 |
| 10 | 50 | | 1841010 | | 1842010 |
| 15 | 75 | | 1841015 | | 1842015 |
| 30 | 60 | | 1841030 | | 1842030 |
| 50 | 50 | | 1841050 | | 1842050 |
| 100 | 50 | | 1841100 | | 1842100 |
| 150 | 75 | | 1841150 | | 1842150 |
| 200 | 40 | | 1841200 | | 1842200 |
| 300 | 60 | | 1841300 | | 1842300 |
| 500 | 50 | | 1841500 | | 1842500 |

## AC VOLTMETERS, RECTIFIER TYPE

### 2½" MODEL 2022

| Range | Scale Div. | OHMS PER VOLT | | | |
|---|---|---|---|---|---|
| | | Pivot & Jewel | Catalog No. † △ | Taut Band | Catalog No. † △ |
| 15 | 30 | 1000 ↓ | 1841015 | 1000 ↓ | 1842015 |
| 30 | 60 | | 1841030 | | 1842030 |
| 75 | 75 | | 1841075 | | 1842075 |
| 150 | 75 | | 1841150 | | 1842150 |
| 300 | 60 | | 1841300 | | 1842300 |

### 3½" MODEL 2032

| Range | Scale Div. | OHMS PER VOLT | | | |
|---|---|---|---|---|---|
| | | Pivot & Jewel | Catalog No. † △ | Taut Band | Catalog No. † △ |
| 15 | 30 | 1000 ↓ | 1841015 | 1000 ↓ | 1842015 |
| 30 | 60 | | 1841030 | | 1842030 |
| 75 | 75 | | 1841075 | | 1842075 |
| 150 | 75 | | 1841150* | | 1842150 |
| 300 | 60 | | 1841300 | | 1842300 |

### 4½" MODEL 2042

| Range | Scale Div. | OHMS PER VOLT | | | |
|---|---|---|---|---|---|
| | | Pivot & Jewel | Catalog No. † △ | Taut Band | Catalog No. † △ |
| 15 | 30 | 1000 ↓ | 1841015 | 1000 ↓ | 1842015 |
| 30 | 60 | | 1841030 | | 1842030 |
| 75 | 75 | | 1841075 | | 1842075 |
| 150 | 75 | | 1841150 | | 1842150 |
| 300 | 60 | | 1841300 | | 1842300 |

### 5½" MODEL 2052

| Range | Scale Div. | OHMS PER VOLT | | | |
|---|---|---|---|---|---|
| | | Pivot & Jewel | Catalog No. † △ | Taut Band | Catalog No. † △ |
| 15 | 75 | 1000 ↓ | 1841015 | 1000 ↓ | 1842015 |
| 30 | 60 | | 1841030 | | 1842030 |
| 75 | 75 | | 1841075 | | 1842075 |
| 150 | 75 | | 1841150 | | 1842150 |
| 300 | 60 | | 1841300 | | 1842300 |

* *Stock item.*
† *When ordering meters, model number must precede catalog number.*
△ *When ordering meter with optional black painted front change second digit of catalog number "8" to "7."*

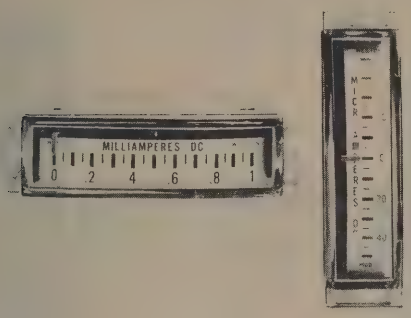
SANGAMO WESTON
Schlumberger

**WESTON INSTRUMENTS**
a DIVISION of SANGAMO WESTON, INC.
614 Frelinghuysen Avenue, Newark, New Jersey 07114
Tel: (201) 242-2600 TWX: (710) 995-4616

# Edgewise Panel Meters

## WESTON Model 111

- Completely flat—can be stacked side-by-side
- Flat self-shielded Cormag ® mechanism
- Saves panel space




MODEL 111

### SPECIFICATIONS

**Accuracy:** 2% of full scale value for DC (**Model 111**).
3% of full scale value for AC Rectifier Type (**Model 112**)

**Scale Length:** 1.24 inches

**Pointer:** Red Lance Type

**Movement:** Self shielded thin line CORMAG® mechanism. Shock mounted jewel arrangement.

**Ranges:** Voltage: 50 mv minimum
300 volts maximum
self-contained

Current: 50 ua minimum
2 amps maximum
self-contained

**Mounting:** Meter is designed to be mounted on a vertical panel with the scale being either horizontally (zero on left) or vertically (zero on bottom) oriented. Most ranges stocked for horizontally oriented scales. Meters can be supplied for a horizontal panel mounting on special order.

Mounting clips fasten to meter behind panel—no screws show on front of panel. For "stacking," thru-holes are provided so stack can be bolted together.

Zero corrector not used on ammeters, milliammeters above 10 Ma, rectifier meters and suppressed zero meters.

All resistances are approximate

### RANGES

| DC VOLTMETERS (Model 111) | RESISTANCE |
|---|---|
| 0-10 | 5000 Ω /v |
| 0-25 | 5000 Ω /v |
| 0-50 | 5000 Ω /v |
| 0-100 | 5000 Ω /v |
| 0-150 | 5000 Ω /v |
| 0-300 | 5000 Ω /v |

| DC MILLIAMMETERS (Model 111) | RESISTANCE |
|---|---|
| 0-1 | 39 Ohms |
| 0-5 | 5.2 Ohms |
| 0-10 | 2.3 Ohms |
| 0-25 | 2.0 Ohms |
| 0-100 | 0.5 Ohm |
| 0-150 | 0.33 Ohm |
| 0-250 | 0.2 Ohm |
| 0-500 | 0.1 Ohm |

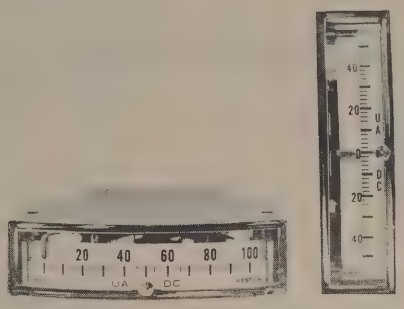
| DC MICROAMMETERS (Model 111) | RESISTANCE |
|---|---|
| 0-50 | 2300 Ohms |
| 0-100 | 900 Ohms |
| 0-200 | 600 Ohms |
| 0-500 | 134 Ohms |
| 50-0-50 | 900 Ohms |

| DC AMMETERS (Model 111) | RESISTANCE |
|---|---|
| 0-1 | 0.05 Ohm |

| AC VOLTMETERS (Rectifier-Type) (Model 112) | RESISTANCE |
|---|---|
| 0-150 | 2000 Ω /v |
| 0-300 | 2000 Ω /v |

## WESTON Model 121

- Completely flat—can be stacked side-by-side
- Parallax eliminated—in-line pointer and scale
- Flat self-shielded Cormag ® mechanism
- Saves panel space
- Optional self-contained illumination feature
- Front mounted zero corrector




MODEL 121

### SPECIFICATIONS

**Accuracy:** 2% of full scale value for DC (**Model 121**).
3% of full scale value for AC Rectifier Type (**Model 122**)

**Scale Length:** 1.875 inches; Anti-parallax in-line scale

**Pointer:** Red Lance Type

**Movement:** New shelf shielded thin line CORMAG® mechanism. Shock mounted jewel arrangement.

**Ranges:** Voltage: 50 mv minimum
300 volts maximum
self-contained

Current: 50 ua minimum
2 amps maximum
self-contained

**Mounting:** Meter is designed to be mounted on a vertical panel with the scale being either horizontally (zero on left) or vertically (zero on bottom) oriented. Most ranges stocked for horizontally oriented scales. Meters can be supplied for a horizontal panel mounting on special order.

Mounting clips fasten to meter behind panel—no screws show on front of panel. (Bezel furnished for single meter mounting.) For "stacking" thru holes are provided so stack can be bolted together.

**Illumination:** Two G.E. 328 lamps are used. Recommended operating voltage—5 volts (less than 200 ma per bulb). Expected life greater than 5,000 hours.

**Dielectric:** 1500 volts RMS

### RANGES

| DC VOLTMETERS | RESISTANCE |
|---|---|
| 0-10 | 5000 Ω /v |
| 0-25 | 5000 Ω /v |
| 0-50 | 5000 Ω /v |
| 0-100 | 5000 Ω /v |
| 0-150 | 5000 Ω /v |
| 0-300 | 5000 Ω /v |

| DC MILLIAMETERS | RESISTANCE |
|---|---|
| 0-1 | 39 Ohms |
| 0-5 | 5.2 Ohms |
| 0-10 | 2.3 Ohms |
| 0-25 | 2.0 Ohms |
| 0-100 | 0.5 Ohms |
| 0-150 | 0.33 Ohms |
| 0-250 | 0.2 Ohms |
| 0-500 | 0.1 Ohms |

| DC MICROAMMETERS | RESISTANCE |
|---|---|
| 0-50 | 2300 Ohms |
| 0-100 | 900 Ohms |
| 0-200 | 600 Ohms |
| 0-500 | 134 Ohms |
| 50-0-50 | 900 Ohms |

| DC AMMETERS | RESISTANCE |
|---|---|
| 0-1 | 0.05 Ohm |

| AC VOLTMETERS (Rectifier-Type) | RESISTANCE |
|---|---|
| 0-150 | 2000 Ω /v |
| 0-300 | 2000 Ω /v |

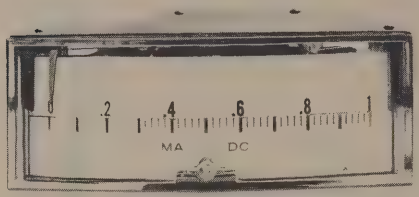
SANGAMO WESTON
Schlumberger

**WESTON INSTRUMENTS**
a DIVISION of SANGAMO WESTON, INC.
614 Frelinghuysen Avenue, Newark, New Jersey 07114
Tel: (201) 242-2600 TWX: (710) 995-4616

# Edgewise Panel Meters

## WESTON Model 231

**Scale Length:** 2.75" Anti-parallax in-line scale
**Zero Corrector:** Front only
**Illumination:** Optional—2 #328 lamps, 5V @ 200mA each 5000 hr. life
**Mounting:** Vertical Panel Standard; Horizontal scale (zero left) standard or Vertical scale (zero bottom) standard. Screw-clamps are standard. For stacking, through holes are provided so stack can be bolted together.



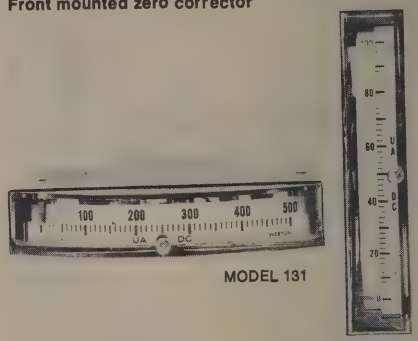

### SPECIFICATIONS

| | |
|---|---|
| **Accuracy** | ±2% of full scale, DC ranges<br>±3% of full scale, AC rectifier-input ranges |
| **Range Capability** | Voltage: 50 mV minimum span, 300V maximum self contained<br>Current: 50 μA minimum span, 2A maximum self contained |
| **Mechanical Suppression** | 25% with zero adjuster<br>50% without zero adjuster |
| **Dielectric** | 2600 Vrms maximum |
| **Shock, Vibration** | Per ANSI C39.1-1972 |
| **Pointer** | Dragon tooth (Model 231)<br>Lance type all others |
| **Mechanism** | Modular CORMAG thin-line type, pivot & jewel (Spring loaded jewels) |
| **Response Time** | 2 Sec. |
| **Magnetic Shielding** | Self-shielded mechanism, steel external cover |
| **Terminals** | †8-32 threaded posts |

| Range | |
|---|---|
| **D.C. Microamperes** | |
| 0-50 | 2300 |
| 50-0-50 | 900 |
| 0-100 | 900 |
| 100-0-100 | 600 |
| 0-200 | 600 |
| 0-500 | 134 |
| 500-0-500 | 38 |
| **D.C. Milliamperes** | |
| 0-1 | 38 |
| 1-0-1 | — |
| 0-5 | 5.2 |
| 0-10 | 2.3 |
| 0-25 | 2.0 |
| 0-100 | .5 |
| 0-250 | .2 |
| 0-500 | .1 |
| **D.C. Amperes** | |
| 0-1 | .05 |
| **D.C. Volts** | |
| 0-10 | |
| 0-25 | |
| 0-50 | 5000 Ω/V |
| 0-100 | |
| 0-150 | |
| 0-300 | |
| **A.C. Volts** | |
| 0-150 | 2000 Ω/V |
| 0-300 | |

## WESTON Model 131

- **Completely flat—can be stacked side-by-side**
- **Parallax eliminated—in-line pointer and scale**
- **Flat self-shielded Cormag® mechanism**
- **Saves panel space**
- **Optional self-contained illumination feature**
- **Front mounted zero corrector**




MODEL 131

### SPECIFICATIONS

**Accuracy:** 2% of full scale value for DC
3% of full scale value for AC Rectifier Type

**Scale Length:** 2.75 in.; Anti-parallax in-line scale

**Pointer:** Red Lance Type

**Movement:** New self-shielded thin line CORMAG® mechanism. Shock mounted jewel arrangement.

**Ranges:** Voltage: 50 mv minimum
300 volts maximum
self-contained

Current: 50 ua minimum
2 amps maximum
self-contained

**Mounting:** Meter is designed to be mounted on a vertical panel with the scale being either horizontally (zero on left) or vertically (zero on bottom) oriented. Most ranges stocked for horizontally oriented scales. Meters can be supplied for a horizontal panel mounting on special order.

Mounting clips fasten to meter behind panel—no screws show on front of panel. For "stacking", thru holes are provided so stack can be bolted together.

**Illumination:** Two readily accessible G.E. 328 lamps are used. Recommended operating voltage—5 volts (less than 200 ma per bulb). Expected life greater than 5,000 hours.

**Dielectric:** 1500 volts RMS

### RANGES

| **DC VOLTMETERS** | **RESISTANCE** |
|---|---|
| 0-10 | 5000 Ω/v |
| 0-25 | 5000 Ω/v |
| 0-50 | 5000 Ω/v |
| 0-100 | 5000 Ω/v |
| 0-150 | 5000 Ω/v |
| 0-300 | 5000 Ω/v |
| **DC MILLIAMMETERS** | **RESISTANCE** |
| 0-1 | 38 Ohms |
| 0-5 | 5.2 Ohms |
| 0-10 | 2.3 Ohms |
| 0-25 | 2.0 Ohms |
| 0-100 | 0.5 Ohm |
| 0-150 | 0.33 Ohm |
| 0-250 | 0.2 Ohm |
| 0-500 | 0.1 Ohm |
| **DC MICROAMMETERS** | **RESISTANCE** |
| 0-50 | 2300 Ohms |
| 0-100 | 900 Ohms |
| 0-200 | 600 Ohms |
| 0-500 | 134 Ohms |
| 50-0-50 | 900 Ohms |
| **DC AMMETERS** | **RESISTANCE** |
| 0-1 | 0.05 Ohm |
| **AC VOLTMETERS (Rectifier-Type)** | **RESISTANCE** |
| **M-1[illegible]** | |
| 0-150 | 2000 Ω/v |
| 0-300 | 2000 Ω/v |

SANGAMO WESTON
Schlumberger

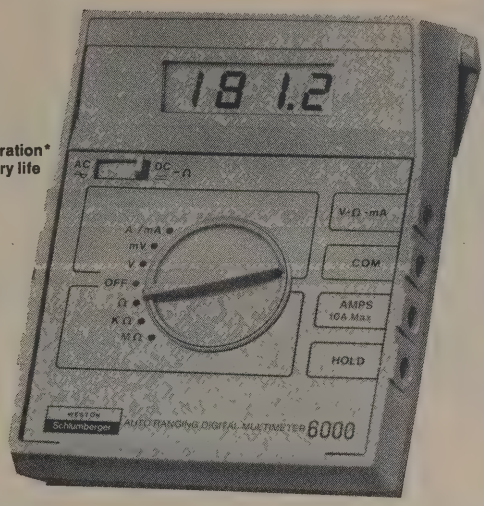
**WESTON INSTRUMENTS**
a DIVISION of SANGAMO WESTON, INC.
614 Frelinghuysen Avenue, Newark, New Jersey 07114
Tel: (201) 242-2600 TWX: (710) 995-4616

# AC/DC Multimeters

## Model 6000 *Autoranging* Digital Multimeter

### Features

- Autoranging
- Long life Liquid Crystal Display
- Portable
- LSI microcircuitry
- Patented Dual Slope Integration*
- More than 200 hours battery life




### Specifications

| | |
|---|---|
| **Polarity** | Automatic bipolar |
| **NMRR (DC only)** | 66 dB at 50 Hz (20 dB near zero) |
| **Display** | 1999 with polarity (0.5"/12.7 mm LCD) |
| **Display Hold** | SPST contact closure (HOLD to COM) retains reading |
| **Operating Power** | Two 9V "transistor" batteries (NEDA 1604, PP3 or RR3) |
| **Battery Life** | 200 operating hours (350 hours with alkaline batteries) |
| **Low Battery Warning** | Valid reading blinks during final 10 hours |
| **Outrange Indication** | Blinking "1888" display ("1" and "888" alternate) |
| **Operating Ambient** | 5°-50°C, 10-85% R.H. |
| **Storage Temperature** | −10 to +55°C |
| **A.C. Frequency Influence:** | |
| 0-2/20/200 V | Less than 0.25 dB to 16 kHz |
| 0-200 mV, 0-1000 V and current | Less than 0.5 dB to 1000 Hz |
| **Weight** | 22 oz (625 g) incl. batteries |
| **Size** | 7" x 5.75" x 2.25" (178 x 146 x 58 mm) overall |

### Accessories extend DMM 6000 applications

**Hold Probe/Cat. No. 9740-279407**
Permits finger-tip control of HOLD input of DMM 6000. Probe tip is signal input. 2-position slide switch allows normal or HOLD operating modes.

**Light Meter Attachment/Cat. No. 856-0280851**
This attachment used with the Model 6000 provides direct reading of light levels in foot-candles. The standard range is 0-125 fc (accuracy of ±7% of full scale).

**RF Voltage Probe/Cat. No. 9740-279627**
Passive diode probe for measurement of 1-30 volt, 10 kHz-50 MHz voltages (usable over 1-90 volt, 1 kHz-100 MHz range). Scaled for RMS of sinewave signal, 10 Megohm instrument input. Use with DC ranges of any DMM.

**VHF RF Probe/Cat. No. 9970-271961**
For use with 10 Megohm DMM's. Permits voltage measurements from 0.25 to 30 volts up to 520 MHz. Molded dual banana plug output, ground lead at probe. Complete with storage pouch and adapter for direct mating to BNC receptacle.

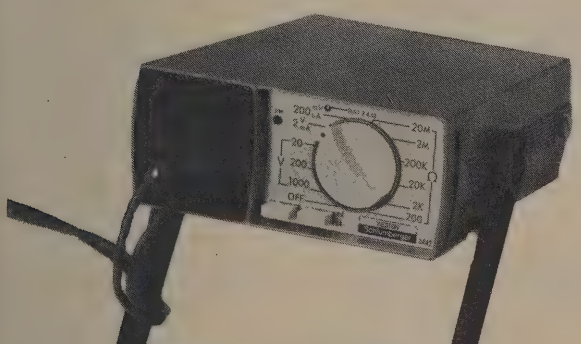
**High Voltage Probe/Cat. No. 9740-279395**
Provides 0-50,000 VDC measurements with 10 Megohm DMM or FET VOM. Includes replaceable 990 Megohm resistor for 100:1 division of input voltage; resistors are also available for use with 20,000 ohm/volt meters.

**A.C. Clamp-on Probe/Cat. No. 9740-275768**
Scales any of 3 switch-selectable A.C. current ranges (0-2/20/200A.) for readout on 0-200 mV range of DMM. Split-jaw construction for fast, easy measurements. Use on 50-400 Hz currents, conductor diameters to 1" (25mm). Accuracy 2% (200A), 3% (20A), and 4% (2A).

| Specifications[1] | D.C. Voltage | A.C. Voltage | D.C. Current | A.C. Current | Resistance |
|---|---|---|---|---|---|
| Accuracy | 0.35% Rdg ± 2d | 0.5% Rdg ± 5d[3] | 0.75% Rdg ± 3d | 1.5% Rdg ± 5d[3] | 0.5% Rdg ± 1d[3] |
| Input Impedance | 10 Megohms | 9 Megohms//39 pF | 10Ω[4] | 10Ω[4] | — |
| Resolution | 100 uV | 100 uV | 1 uA | 1 uA | 0.1 ohm |
| Maximum Reading | 1000 V | 1000 V | 10 A | 10 A | 20 Megohm |
| Overload Rating | 1500 V peak | 1000 V (1500 V peak) | 1/4A/250 V fuse[4] | 1/4A/250 V fuse[4] | 250 V (350 V peak) |
| Temperature Coefficient[5] | 250 ppm/°C[6] | 600 ppm/°C | 300 ppm/°C | 750 ppm/°C | 600 ppm/°C[3] |

**Notes:** *(1) Specifications guaranteed for 90 days and when operated at 23°C ±5°C*
*(2) 40 to 400 Hz; ±2% Rdg ±5d for 0 to 1000 VAC range*
*(3) ±1% Rdg ±2d and 2000 ppm/°C for 200 ohm range (4) Except 0-2A/10A ranges: 0.01 ohm input, 15A maximum*
*(5) Offset Tempco 1d/5°C beyond the 23°C ±5°C range (6) Tempco for 1000 V range is 350 ppm/°C max.*

## MODEL 4442 DIGITAL MULTIMETER



### General Specifications

**DISPLAY**
1999, —1999 (non-blinking) 0.19" character size.
Leading zero blanking—Least significant digit never blanked.
Overrange indication—blinking 1 in thousands place with a polarity and decimal indication. Balance of digits blanked.
Moving decimal point.

**BATTERIES**
Four "C" size nickel cadmium supplied with meter

**CONVERSION RATE**
Approximately 4 per second

**POLARITY**
Automatic

**CMRR**
80 dB (Approaches ∞ on battery)

**NMRR**
38 dB

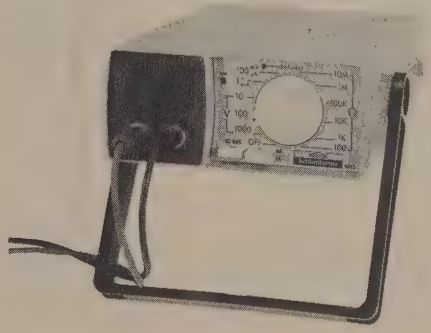
**INPUT POWER**
Battery operation
Line operation—115 V, 50-400 Hz (All Models)

**TEMPERATURE**
25°C ± 3°C with guaranteed accuracy (Operable from 0 C to 50 C – derate accuracy)

**SIZE**
2.25" H x 5.45" W x 7" D

**WEIGHT**
Less than 2½ pounds

## MODEL 4445 RMS DMM AC/DC MULTIMETER



### Features:

- True RMS AC measurements.
- 3½ Digit non-blinking LED readout.
- All solid state MOS LSI circuitry.
- Dual Slope conversion for accuracy and long term stability.
- Self-contained battery pack provides up to 10 hours of continuous use.
- 117 Volt battery charger supplied as standard equipment.
- Automatic blanking of digits not in use to conserve battery life.
- Fully-overload protected-fuses externally replaceable.
- Shock-proofed, high impact plastic case.
- Weighs less than 2½ pounds.

### GENERAL SPECIFICATIONS

**DISPLAY**
1999, —1999 (non-blinking) 0.19" character size
Leading zero blanking—Least significant digit never blanked
Outrange indication—blinking 1 in thousands place with a polarity and decimal indication. Balance of digits blanked
Moving decimal point

**BATTERIES**
Four "C" size nickel cadmium supplied with meter

**CONVERSION RATE**
Approximately 4 per second

**POLARITY**
Automatic

**CREST FACTOR**
4:1 at full scale (except where limited by maximum input), inversely proportional to input valve (IE, 8:1 at half scale, 40:1 at tenth scale, 2:1 at 100% overrange)

**OVERRANGE**
100% (Reads 1999) except on 1000 V range

**CMRR**
80 dB (Approaches ∞ on battery)

**NMRR**
38 dB

**INPUT POWER**
Battery operation
Line operation—115 V, 50-400 Hz

**TEMPERATURE**
25°C ± 3°C with guaranteed accuracy (Operable from 0°C to 50°C—derate accuracy)

**SIZE**
2.25" H x 5.45" W x 7" D

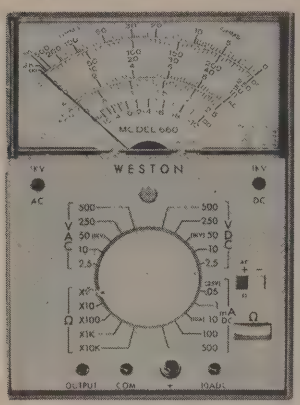
**WEIGHT**
Less than 2½ pounds

SANGAMO WESTON
Schlumberger

**WESTON INSTRUMENTS**
a DIVISION of SANGAMO WESTON, INC.
614 Frelinghuysen Avenue, Newark, New Jersey 07114
Tel: (201) 242-2600 TWX: (710) 995-4616

# TEST EQUIPMENT

## WESTON® Model 660 Drop-Proofed VOM




### SPECIFICATIONS

| | |
|---|---|
| **Accuracy** | 2% DC (1.5% on 50 *ua* range) 3% AC |
| **Sensitivity** | 20,000 ohms/volt DC 5,000 ohms/volt AC |
| **Dimensions** | 7"H X 5"W X 2¼"D |
| **Weight** | Less than 2 lbs. (Batteries included) |
| **Ranges** | |
| **DC Millivolts** | 0-250 |
| **DC Volts** | 0-2.5/0-10/0-50/0-250/0-500/0-1000 |
| **AC Volts** | 0-2.5/0-10/0-50/0-250/0-500/0-1000 |
| **VAC Output** | 0-2.5/0-10/0-50/0-250 |
| **DC Microamps** | 0-50 |
| **DC Milliamps** | 0-1/0-10/0-100/0-500 |
| **DC Amps** | 0-10 |
| **Ohms** | R×1(0-2K)20Ωcenter/R×10(0-20K)200Ωcenter/R×100(0-200K)2000Ω center/R×1000(0-2Meg)20KΩcenter/R×10K(0-20Meg)200KΩcenter |
| **dB Scales** | (1 mw on 600 ohm line) −10 to +10/+2 to +22/+16 to +36/+30 to +50/+36 to +56 |

**Also available: Model 661 High Accuracy VOM • Model 662 Fully Overload-Protected VOM Model 666 Solid State Circuit Tester • Model 663 High Accuracy Fully Overload Protected VOM**

## WESTON® Model 633 A-C Clamp Ammeter and Volt Ammeter

**Accurate within 3%**
**Scale Length: 2.36"**
**Size: 13⅝" x 4⅜" x 2½"—346 x 111 x 64 mm**
**Weight: 3¾ lbs.**

### Outstanding Features:

- Non-Shatterable Glass
- Adjustable Pointer Stop (Model 633 VA-1 only)
- Safety Type Trigger
- Insulated For 750 Volt Service
- Can Be Hung On A Conductor, Leaving Operator's Hands Free
- Accepts Conductors Up to 2" In Diameter

### Ranges:

**Model 633 Type VA-1** Cat. No. 633-9901001 (Incl. Potential Leads) 1000/250/100/25/10 amperes a-c 700/350/175 volts a-c

**Model 633 Type A-1** Cat. No. 633-2901001 500/250/100/50/25/10 amperes a-c

**Model 633 Type A-2** Cat. No. 633-2901002 1000/500/250/100/25/10 amperes a-c

**Model 633 Type A-3** Cat. No. 633-2901003 2000/1000/500/250/100/50 amperes a-c

**Leather carrying case** for types VA2, A1, A2, A3 Model 9959 - P/N 90856

## WESTON Model 749 A-C Clamp Volt Ammeter

**Accurate with 3%**
**Scale Length: 2.36"**
**Size: 7½" x 3" x 1¼"—191 x 77 x 32 mm**
**Weight: 14 oz.**

### Outstanding Features:

- Pocket Size
- Precision Ground Faces Provide Positive Jaw Contact
- Shatterproof Wrap-around Plastic Window
- Uses Shock-mounted Core Magnet Mechanism
- Fully Insulated for 750 Volt Services

Plug-in adapter, Model 9886, designed for use with Model 749, facilitates current measurements of double conductor leads without breaking the circuit. Used on direct reading or as a 10-to-1 divider for low current measurements. Simplifies voltage testing during current checks.

**Model 749** (Ind. case, leads, battery, clips, probes) Cat. No. 749-2901001
300/150/60/30/15/6 amperes a-c
600/300/150 volts a-c

Model 9886 Plug-in adapter—P/N 159983

**All meters are stock items. Any other practical range can be supplied.**

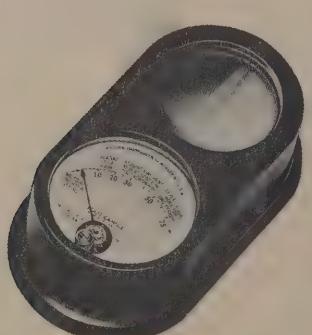
## WESTON®

### Model 615 Broad Range Light Meter

### Features

- Ranges 0-1.2/3/12/30/120/300/1200 Foot Candles
- Viscor and Cosine correction supplied
- More than one year of operation from one 9 volt transistor battery
- Portable—7"x3½"x2½" 2 lbs.
- Light level guidelines in cover

## WESTON® Model 703 Illumination Meters



**Model 703-0275190,** Illumination Meter 0-60 foot-candles (with Viscor and cosine correction filters)

**Model 703-996007,** Illumination Meter 0-100 foot-candles (with Viscor and cosine correction filters)

**Model 703-0275191,** Illumination Meter 0-200 foot-candles (with Viscor and cosine correction filters)

**Model 703-0275192,** Illumination Meter 0-600 foot-candles (with Viscor and cosine correction filters)

**Model 703-9960009,** Illumination Meter 0-30 foot-candles (with Viscor filter)

**Model 703-9960011,** Illumination Meter 0-75 foot-candles (with Viscor filter)

**Model 703-9960010,** Illumination Meter 0-75 foot-candles (with Glass Filter)

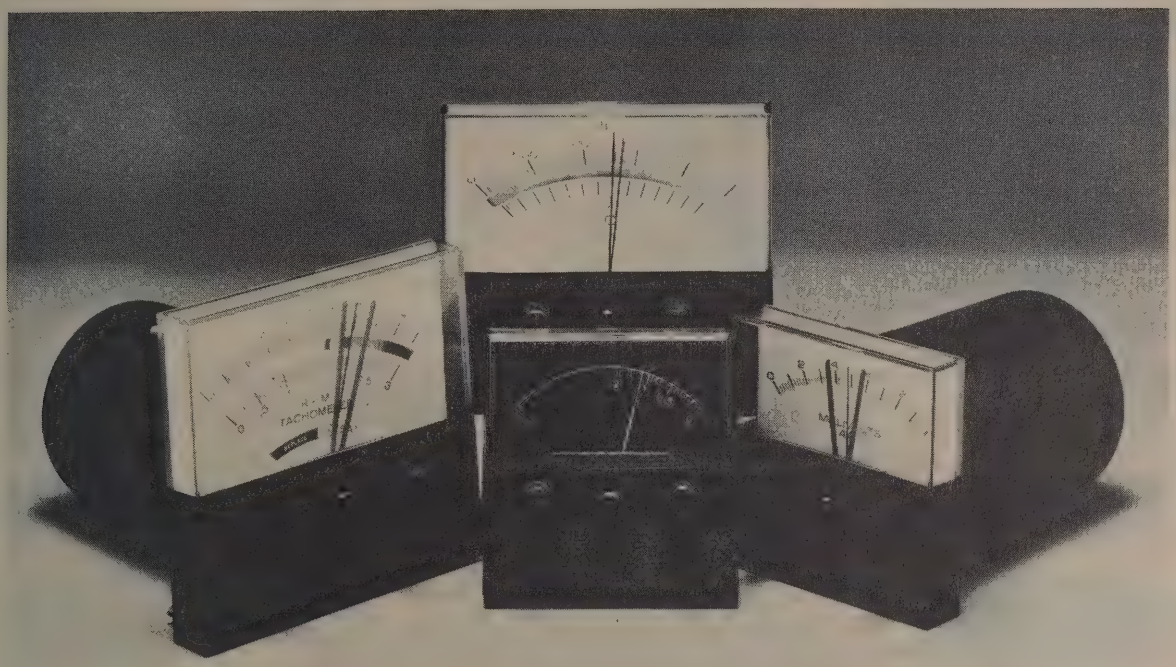
**Model 703-9960051,** Illumination Meter 0-150 foot-candles (with Quartz Filter) for Ultra violet use. Fluorescent characters and pointer on black background scale.

**Model 9959-0074472,** Leather Carrying Case

**Model 9924-0092108,** Multiplier Disc (X10) (Not usable with cosine corrected instruments.)

SANGAMO WESTON
Schlumberger

# WESTON® Meter-Relays, Meter-Switches & Meter-Controllers



Weston now offers the most comprehensive, versatile and economical family of meter-based controls available—any where! Add the clean, modern appearance and traditional Weston reliability to your applications in: Analytical Instrumentation, Furnace and Oven Shutdown, Go/No Go Testing, Machine Tool Control, Medical Monitoring Plating Control, Microprocessor Data Input, Motor Overload Alarms, Petrochemical Processing, Power Monitoring, Speed Control, Temperature Control, Vacuum Equipment. The New 7600/7700 Family brings 60 years of Weston meter-relay experience to you—with valuable features such as:

- **Wrap-around window for shadow-free, wide-angle viewing.**
- **Space-saving shallow barrel.**
- **3½" and 4½" sizes with standardized panel cutouts and terminals.**
- **All taut band suspensions for superior accuracy and ruggedness.**
- **Optical and solid-state types for any application.**
- **Plastic pointer resists electrical on mechanical overload.**

## Optical-7600 Series

- Front-replaceable lamp
- Meter-switch for compact, solid state control
- Optional input buffer for high impedance
- Infinite line noise rejection

## Solid-State-7700 Series

- High input impedance
- Immune to shock and vibration
- Meter-relay provides IK pot output for OEM controls
- Quick delivery on non-standard ranges

## Ranges

DC-10$\mu$A to 10A, self-contained: 10mV to 500V
AC-50$\mu$A to 10A, self-contained : 50mV to 500V
Temperature—300°F span

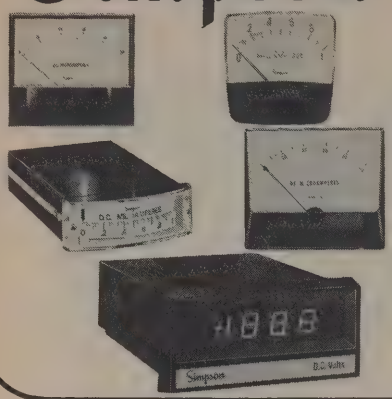
## Options

Relay indicator lamp ● relay latching ● reset push-button ● dial illumination DC operation ● red or white pointer ● non-standard ranges, impedances, response times.

Over 1,000,000 combinations of ranges, types and options are available—guaranteeing you the right answer to your application problems. Look to WESTON for Meter-Relays, Meter-Switches, & Meter-Controllers.

# Simpson® PANEL METERS

## If it's a meter — stock or special — analog, digital, Ana-Led® or meter relay, Simpson makes it



### STANDARD ANALOG PANEL METERS Industry's Widest Source

**Century Series,** modern styling in 1½, 2½, 3½ and 4½″ sizes, wide choice of ranges. **Wide-Vue®,** popular style, in 1½, 2½, 3½, 4½ and 8″ sizes, many stock ranges to select from. **Edgewise meters** save precious panel space, available in barrel and stackable models with vertical or horizontal scales, in all standard ranges plus specials. Other panel meter types also available include Bold-Vue®, Designer series, round and rectangular, metal cased. 250° long scale meters provide double the length of standard scales. The famous Simpson self-shielded meter movement provides calibration that is not affected by stray magnetic fields or magnetic mounting. A wide variety of stock DC, AC, RF, DB, wattmeters, percent load, elapsed time, frequency, and segmental ranges are available through worldwide electronics distributors.

### DIGITAL PANEL METERS

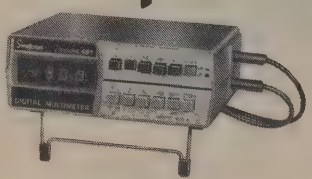
Highly reliable 3½ digit instruments utilize state-of-the-art LSI circuitry and provide 0.1% of reading accuracy. Designed to fit 1.682″ x 3.622″ cutouts. Adapters are available for other popular domestic and IEC/DIN cutout sizes. Automatic zero and polarity indication. Choice of 120/240 V AC, 50-400 Hz or 5 V DC operation. Input/output edge connector is included.

**Low Cost Series 2860 DPM** has 0.43″ LED readout.
Available in 9 stock DC ranges ..... **$74.10**

**Deluxe Series 2850 DPM.** Choice of 0.43″ LED or 0.55″ planar gas discharge display. BCD output for computer or recorder interfacing.
Available in 9 stock DC ranges plus specials including AC ranges ..... **$138.00**

# Simpson® DIGITAL MULTIMETERS

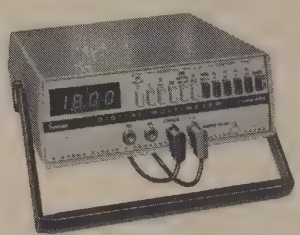
### NEW MODEL 461 — DIGITAL MULTIMETER



Compact 2″ x 5.6″ x 4.6″ instrument weighs only 1 lb. 3 oz. 3½ digit, 0.33″ LED readout. ±0.5% accuracy on all DC V ranges. High impact, shock-resistant case with tilt-view adjustable handle. 26 ranges, pushbutton selection: 5 AC and 5 DC current ranges to 2 amps, 6 resistance ranges to 20 M, 5 AC voltage ranges to 600 V, 5 DC voltage ranges to 1000 V. Conforms to ANSI C39.5 requirements. With nickel-cadmium batteries and recharger/adapter.

**Model 461,** for 120 V AC (50-400 Hz) line and battery operation.
Catalog No. 12136 ..... **$142.50**
**Model 461,** for 230 V AC (50-400 Hz) line and battery operation.
Catalog No. 12137 ..... **$142.50**
**40 KV High Voltage Probe,**
Catalog No. 00749 ..... **$39.35**
**Carrying Case,** Catalog No. 00747 ..... **$20.86**
**RF Probe,** Catalog No. 00748 ..... **$28.10**
**Model 153 AC Amp-Clamp Adapter,**
Catalog No. 12138 ..... **$31.60**

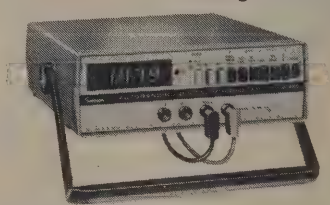
### MODEL 464 PRICE/PERFORMANCE BREAKTHROUGH



For field or factory, production line, lab or R & D testing and for general electronic/electrical servicing. 3½ digit, 0.43″ LED readout ±0.1% accuracy on DC ranges. High impact, shock-resistant case with tilt-view, adjustable handle. 28 ranges, pushbutton selection: 6 AC and 6 DC current ranges to 10 amps, 6 resistance ranges to 20 MΩ, 5 AC voltages to 600 V, 5 DC voltages to 1000 V. Conforms to ANSI C39.5 requirements.

**464A for AC line operation.**
**For 120 V.** Catalog No. 12583 ..... **$225.00**
**For 220 V.** Catalog No. 12597 ..... **$225.00**
**For 240 V.** Catalog No. 12595 ..... **$225.00**
**464D for AC line or rechargeable battery operation.** Batteries not incl.
**For 120 V.** Catalog No. 12584 ..... **$265.00**
**For 220 V.** Catalog No. 12598 ..... **$265.00**
**For 240 V.** Catalog No. 12596 ..... **$265.00**

### MODEL 465 AUTORANGING DMM



Automatically selects and displays the proper measuring range. Has bright 3½ digit 0.43″ LED readout. Custom MOS/LSI circuitry provides high 0.1% DC V accuracy. Measures DC voltage to 1000 volts, AC voltage to 600 volts, resistance to 20 megohms, plus low-power ohms ranges, AC/DC current to 10 amps. High-impact shock-resistant case with tilt-view adjustable handle.

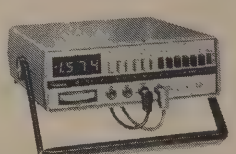
**465A for AC line operation.**
**For 120 V.** Catalog No. 12561 ..... **$315.00**
**For 220 V.** Catalog No. 12562 ..... **$315.00**
**For 240 V.** Catalog No. 12563 ..... **$315.00**
**465D for AC line or rechargeable battery operation.** Batteries not incl.
**For 120 V.** Catalog No. 12564 ..... **$355.00**
**For 220 V.** Catalog No. 12565 ..... **$355.00**
**For 240 V.** Catalog No. 12566 ..... **$355.00**

### MODEL 360-2 DIGITAL VOLT-OHM-MILLIAMMETER

Choice of nickel-cadmium rechargeable battery operation or AC line operation. Large bright 3½ digit 0.43″ LED readout, plus calibrated zero center analog meter for nulling, peaking, scanning trends. Exclusive MOS/LSI circuitry provides compactness with high reliability and low power dissipation. 29 ranges: 7 AC and 7 DC current ranges to 10 amps, 5 DC voltage ranges to 1000 V, 5 AC voltage ranges to 600 V, 6 resistance ranges including 2 low ohms ranges.

**360-2,** line and battery operation, 120 V AC (50-400 Hz), Catalog No. 12286 .... **$275.00**
**360-2,** line and battery operation, 220 V AC (50-400 Hz), Catalog No. 12287 .... **$275.00**
**Carrying Case,** Catalog No. 00816 .. **$28.10**

### 460-3 DIGITAL MULTIMETER



32 ranges with separate low-power ohms ranges for most measurement application. 3½ digit 0.54″ LED readout. Custom MOS/LSI circuitry gives 0.1% DC V accuracy. Calibrated auxiliary analog display. Measures AC/DC current to 10 amps, AC voltage to 600 V, DC voltage to 1000 V, resistance to 20 megohms. High impact case with tilt-view adjustable handle.

**460-3A. for AC line operation.**
**For 120 V.** Catalog No. 12541 ..... **$299.00**
**For 220 V.** Catalog No. 12546 ..... **$338.00**
**For 240 V.** Catalog No. 12542 ..... **$299.00**
**460-3D for AC line or rechargeable bat. operation.** Batteries not incl.
**For 120 V.** Catalog No. 12543 ..... **$338.00**
**For 220 V.** Catalog No. 12545 ..... **$299.00**
**For 240 V.** Catalog No. 12544 ..... **$338.00**

### ACCESSORIES FOR 464, 465, 460-3, 360-2

**40 KV High Voltage Probe,** Catalog No. 00432 ..... **$35.00**
**Carrying Case,** (not for 360-2), Catalog No. 01617 ..... **$28.10**
**RF Probe,** Catalog No. 00433 ..... **$28.10**
**Model 154, AC Amp-Clamp Adapter,** Catalog No. 12222 ..... **$31.60**

# Simpson® 260 FAMILY OF VOMS

## 260-6® VOLT-OHM-MILLIAMMETER

Fast, accurate measurements of 27 popular ranges. Direct-dial reading of Amp-Clamp ranges. Rugged taut band movement, varistor protected. External access battery and fuse compartment. Multi-purpose test leads with combination probe and alligator clips. Two batteries supplied — 9 V (NEDA 1604) and 1.5 V "D" size (NEDA 13F). Complete with batteries, test leads and manual, Catalog No. 12167 ..... **$83.50**

**260-6P.** Circuit overload protected. Reset pushbutton releases when overload exists. Will not reset until overload is eliminated. With batteries, test leads and manual, Catalog No. 12171 ..... **$124.95**

**260-6M,** with Mirror Scale, Catalog No. 12168 ..... **$86.60**

**260-6RT,** in Roll Top Case, Catalog No. 12169 ..... **$94.00**

**260-6MRT,** with Mirror Scale and in Roll Top Case, Catalog No. 12170 ..... **$97.15**

**260-6PM,** Protected with Mirror Scale, Catalog No. 12175 .... **$128.10**

**260-6PRT,** Protected in Roll Top Case, Catalog No. 12172 .... **$135.45**

**Low-Power Ohms Probe,** Catalog No. 00735 ..... **$34.80**

**Vinyl Ever-Redy Case,** Catalog No. 00805 ..... **$24.25**

## 260-6XL VOLT-OHM-MILLIAMMETER

For the special needs of solid-state electronics. 33 ranges with extra voltage, current, resistance and low-power ohms functions. Extra shock and drop resistant construction. High impact, custom-molded panel and case. Extra large viewing area with color-keyed scales. Plus, all the features of the 260 Series 6. Complete with batteries, test leads and manual, Catalog No. 12177 ..... **$97.50**

**260-6XLM,** with Mirror Scale, Catalog No. 12186 ..... **$101.00**

**260-6XLP** Circuit overload protected — same as 260-6XL. With batteries, test leads and manual, Catalog No. 12176 ..... **$134.50**

**260-6XLPM,** Protected with Mirror Scale, Catalog No. 12187 ..... **$137.50**

**40 KV Probe,** Catalog No. 00033 ..... **$27.45**

**Vinyl Ever-Redy Case,** Catalog No. 00805 ..... **$24.25**

# Simpson® MODEL 452

## DUAL TRACE TRIGGERED SWEEP SCOPE

For design, development and service of digital circuitry, communications, audio, TV. Uses reliable integrated circuitry and solid state components. Differential vertical amplifier stages provide DC to 15 MHz bandwidth with smooth rolloff to beyond 27 MHz. Triggering is internal and external with 3 TV sync positions (TVV, TVH, VITS). Trace automatically shifts from Chop to Alternate as you change sweep times. Also 24 nsec rise time, front panel X-Y displays CHA, CHB, A&B, A+B or A−B. 0.5 V P-P 1 KHz square wave calibrator. Voltage calibrated 11-step vertical and horizontal inputs, X5 magnification.

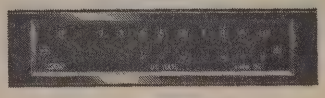
**Model 452,** for 120 V AC, Catalog No. 12513 ..... **$675.00**

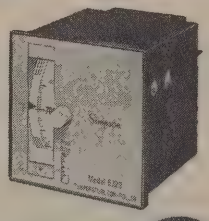
**Model 452,** for 220-240 V AC, Catalog No. 12514 ..... **$675.00**

**Low-Cap. 10-1 Probe,** Catalog No. 00791 ..... **$20.65**

# Simpson® ANA-LED

## MODEL 7527 SOLID-STATE PANEL METER/CONTROLLER

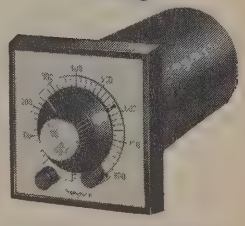




The best of analog and digital techniques for unique advantages. Choice of "bar" or dot display, through or front panel mounting. Instant response, no moving parts. Extreme resistance to shock and vibration. 5″ direct-reading horizontal linear LED scale. Vertical scale available. No pointers, no blinking digits. 15 msec max. response, no overshoot. Set-point modules for on/off limit control and output devices available.

Many variations available ..... **$99.50**

## CONTROLLERS • RECORDERS



**Model 5850 Solid State, Non-Indicating Controller** provides precision control of voltage, current or temperature. Single or double set-points. Rugged sealed, all metal housing. Solid state circuitry with 10-amp relay output. Wide selection of ranges.

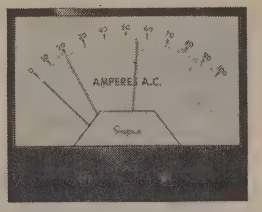
**Single Set-Point Models** ..... **$102.75**

**Double Set-Point Models** ..... **$176.55**

**Model 3623XA Edgewise Controllers.** 3½″ size, single or double setpoint with removable knobs. Wide variety of ranges. **Model 3323XA Rugged Seal Controllers.** 3½, 4½ and 4 x 6″ sizes. Variety of ranges.

**Model 2750-Miniature Strip Chart Recorders.** Panel mount or portable. 3¾″ square. Versatile models for electrical value, event or temperature recording. Wide complete selection of ranges and accessories.

**Quantity OEM prices available on request.**




**MANY OTHER INSTRUMENTS IN STOCK AT YOUR LOCAL ELECTRONICS DISTRIBUTOR — WRITE FOR FULL LINE CATALOG**

Simpson®

**SIMPSON ELECTRIC COMPANY**
Dept. EM, 953 Dundee Avenue, Elgin, Illinois 60120
(312) 697-2260 • Telex 72-2416 • Cable SIMELCO

# Insulation Testers

WRITE FOR DATA SHEETS ON THE INSTRUMENTS SHOWN...ALL ARE STANDARD PRODUCTION MODELS, AVAILABLE FOR IMMEDIATE DELIVERY FROM STOCK... LET US QUOTE ON YOUR REQUIREMENTS FOR MODIFIED UNITS OR SPECIAL TEST EQUIPMENT.

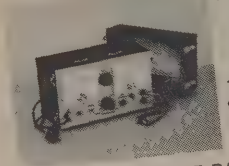
## SLAUGHTER CO.

MOORE & HAILEY STREETS
ARDMORE, OKLAHOMA 73401

TELEPHONE: 405-223-4773 TWX 910-830-6972

### High-voltage Leakage Tester

checks insulation for ...leakage
...grounds
...arcing



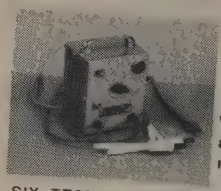
MODEL **122**

16 lb. Portable for lab and field work

VARIABLE VOLTAGE RATINGS TO 2.5 KV AC & DC. DUAL RANGE LEAKAGE METER 0/100/1000 Ma...CAPACITY COMPENSATION...MEASURES INSULATION RESISTANCE, CAPACITY, POWER FACTOR.

### High-voltage Insulation Tester

with buzzer signal on breakdowns
....grounds
.....shorts



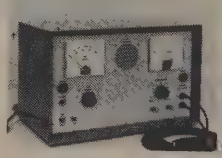
MODEL **101**

Watch what you are doing... not the tester

SIX TEST VOLTAGES...500 to 2500 V. A. C. PRICED SO YOU CAN AFFORD TO SPOT A FEW ALONG YOUR ASSEMBLY LINES.

### High-voltage Leakage Tester

audibly signals excess leakage
....grounds
....arching



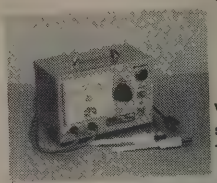
MODEL **103**

Measures Leakage... not capacity current

TEST VOLTAGE CONTINUOUSLY VARIABLE ADJUSTABLE LEAKAGE LIMIT ...CAPACITY COMPENSATION ON AC TESTS...RATINGS TO 10,000 VOLTS AC & DC....LIMITED ENERGY...NON-DESTRUCTIVE...FOR LAB AND PRODUCTION LINE SERVICE...

### Adjustable High-voltage Tester

with buzzer signal on breakdowns
....grounds
.....shorts



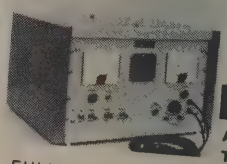
MODEL **106**

Voltmeter shows actual Test Voltage

CONTINUOUSLY VARIABLE TEST VOLTAGE RATINGS TO 10,000 VOLTS AC & DC...RECOMMENDED FOR BREAKDOWN TESTING AT FINAL ASSEMBLY AND INSPECTION.

### Automatic H-V Insulation Tester

for precision checking
breakdowns
.....leakage
.....grounds



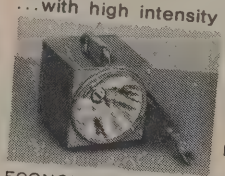
MODEL **103-MP**

Automatic Test Cycle

FULLY AUTOMATIC TEST CYCLE... CONTROLLED RATE-OF-RISE... ADJUSTABLE TEST VOLTAGE, DWELL, TIME, & LEAKAGE LIMIT...CAPACITY COMPENSATION ON AC TEST...FOR PRECISION TEST OF CRITICAL PARTS & ASSEMBLIES...

### General Utility Stroboscope

...with high intensity daylight lamp



MODEL **168**

200/5,000 Flashes per Minute

ECONOMY UNIT FOR MOTION STUDY AND INSPECTION APPLICATIONS... HIGH INTENSITY WHITE LIGHT...INSTANT STARTING...OPERATES FROM INTERNAL OSCILLATOR OR EXTERNAL TRIGGER.

### Midget Stoboscope Flash Head

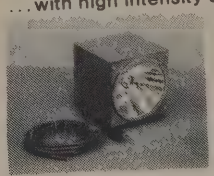
MODEL **166**

0/10,000 Flashes per Minute

FOR WORK ON MINIATURIZED EQUIPMENT...FOR PRINTING TRADES ...FOR BIO-MEDICAL WORK... ADAPTS TO ANY SLAUGHTER STROBOSCOPE...

### Inspection Stroboscope

...with high intensity daylight lamp



MODEL **161**

0/2,000 Flashes per Minute

LIGHT WEIGHT INEXPENSIVE TRIGGERED FLASH UNIT...PUSH-TO-SEE SWITCH...INTENSE WHITE LIGHT FOR INSPECTION ON-THE-GO.

### Precision digital Stroboscope

...with high intensity daylight lamp

MODEL **169**

110/25,000 Flashes per Minute

PRECISION STROBOSCOPIC TACHOMETER WITH 5 DIGIT READOUT—INSTANT STARTING—HIGH INTENSITY WHITE LIGHT—INTERNAL OSCILLATOR CONTROL OR LINE SYNCHRONIZED OPERATION—CAN BE TRIGGERED FROM EXTERNAL TTL LOGIC.

# Stroboscopes

WRITE FOR DATA SHEETS ON THE INSTRUMENTS SHOWN...ALL ARE STANDARD PRODUCTION MODELS, AVAILABLE FOR IMMEDIATE DELIVERY FROM STOCK...LET US QUOTE ON YOUR REQUIREMENTS FOR MODIFIED UNITS OR SPECIAL TEST EQUIPMENT.

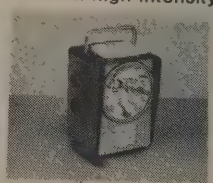
## SLAUGHTER CO.

MOORE & HAILEY STREETS
ARDMORE, OKLAHOMA 73401

TELEPHONE: 405-223-4773 TWX 910-830-6972

### Metered Precision Stroboscope

...with high intensity daylight lamp

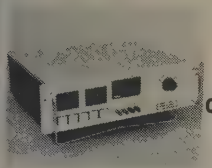


MODEL **165**

110/25,000 Flashes per Minute

PRECISION STROBOSCOPE TACHOMETER INSTANT STARTING ..HIGH INTENSITY WHITE LIGHT...OPERATES FROM EXTERNAL CONTACTS OR INTERNAL OSCILLATOR...EASILY SYNCHRONIZED...OUTPUT JACKS TO COUPLE SCOPE, ETC....

### Precision Digital Ohmmeter
... for accurate resistance testing

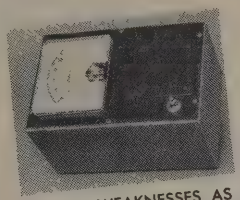


SERIES 203

0.001 — 19.99K Ohms Range

CONSTANT CURRENT 4 WIRE SYSTEM . . . SELF PROTECTING . . . GO/NO-GO LIMIT STYLE WITH BUZZER REJECTION SIGNAL . . . 3½ DIGIT READOUT.

### High Energy Coil Tester
surge test coils for . . . shorts . . . grounds . . . opens



SERIES 640

High Level Tester

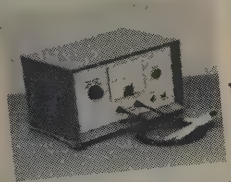
DETECTS WEAKNESSES AS WELL AS DEFECTS . . . USE WITH CORE OR SOLENOID TYPE COILS . . . REQUIRES NO OPERATOR SKILL.

## Coil & Winding Testers

WRITE FOR DATA SHEETS ON THE UNITS SHOWN ALL ARE STANDARD PRODUCTION ITEMS, AVAILABLE FOR EARLY DELIVERY . . . LET US QUOTE ON YOUR REQUIREMENTS FOR MODIFIED UNITS OR SPECIAL TEST EQUIPMENT.

**SLAUGHTER CO.**
MOORE & HAILEY STREETS
ARDMORE, OKLA. 73401
TELEPHONE: 405-223-4773 TWX: 910-830-6972

### Adjustable Limit Megohmmeter
... with buzzer signal on rejections

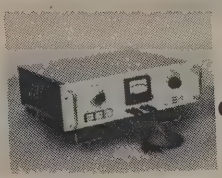


SERIES 205

1 to 20,000 Megohms

DRIFT FREE . . . NO WARM-UP . . . RUGGED TAUT BAND MOVEMENT . . . ADJUSTABLE REJECTION LIMIT WITH BUZZER SIGNAL.

### Resistance Deviation Bridge
... for precision high speed testing

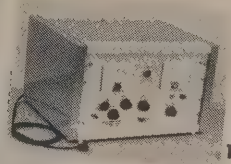


SERIES 223

0.01/10,000 Ohms

LESS THAN 0.2 SEC. RESPONSE . . . SOLID STATE . . . SELF CALIBRATING INDICATES PERCENT DEVIATION . . . ADJUSTABLE HIGH/LOW LIMITS WITH BUZZER SIGNAL FOR GO/NO-GO TESTING.

### Adjustable HI Voltage Surge Tester
... tests coils and windings for shorts ... grounds ... opens



SERIES 648

Ratings to 10,000 Volts

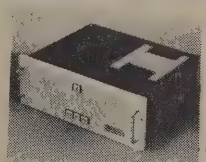
DIRECT READING PULSE-SURGE TESTER . . . REQUIRES NO ACTIVE MASTER . . . PRECISE ENERGY CONTROL . . . GO/NO-GO OPERATION FOR UNSKILLED PERSONNEL.

## Automatic Test Equipment

WRITE FOR DETAILS ON THE EQUIPMENT SHOWN THESE ARE FULLY ENGINEERED, PROVEN, STANDARD DESIGNS AVAILABLE ON A REASONABLE DELIVERY SCHEDULE . . . LET US QUOTE ON YOUR REQUIREMENTS . . .

**SLAUGHTER CO.**
MOORE & HAILEY STREETS
ARDMORE, OKLA. 73401
TELEPHONE: 405-223-4773 TWX: 910-830-6972

### Micro-Processor Control Panel

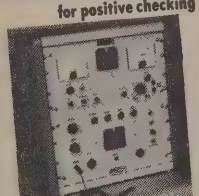


SERIES 720

Brain Package

HANDLES MULTIPLE TEST PANELS AND SINGLE OR DUAL TEST FIXTURES PLUS PERIPHERAL EQUIPMENT . . . SOLID STATE ...PLUG-IN P-C BOARD CONSTRUCTION... COMPATIBLE STANDARD LOGIC . . . FULLY PROGRAMMABLE.

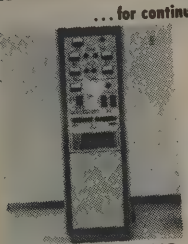
### Automatic Final Test Station
for positive checking . . . ground lead . . . dielectric . . . run test



SERIES 950

COMPLETE PACKAGE FINAL TEST STATION . . . STEP OR RAMP FUNCTION DIELECTRIC TEST . . . FULLY AUTOMATIC CYCLE INCLUDING TEST RUN . . . ACCESSORY RUN TEST INSTRUMENTATION AVAILABLE.

### Automatic Cable & Harness Tester
... for continuity . . . breakdowns . . . megohms



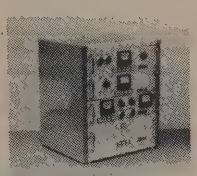
SERIES 727

Expandable to 9,999 Circuits

Micro-Processor Controlled

SELF PROGRAMMING WITH MAGNETIC TAPE CASSETTE STORAGE AND RECOVERY OF PROGRAMS . . . MODULAR CONSTRUCTION . . . TESTING RATES TO 3000 CIRCUITS PER MINUTE . . . GO/NO-GO OPERATION . . . DIGITAL READOUT.

### Automatic Coil & Winding Test Station
micro-processor controlled . . . coils . . . armatures . . . stators . . . fields

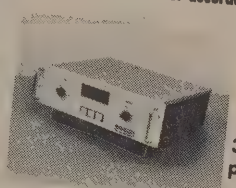


SERIES 720

Test Rates to 1000 Parts per Hour

READY-TO-GO PACKAGE HANDLES 90% OF COIL WINDING TEST APPLICATIONS . . . QUICK CHANGE TEST FIXTURES . . . FULLY AUTOMATIC GO/NO-GO CYCLE.

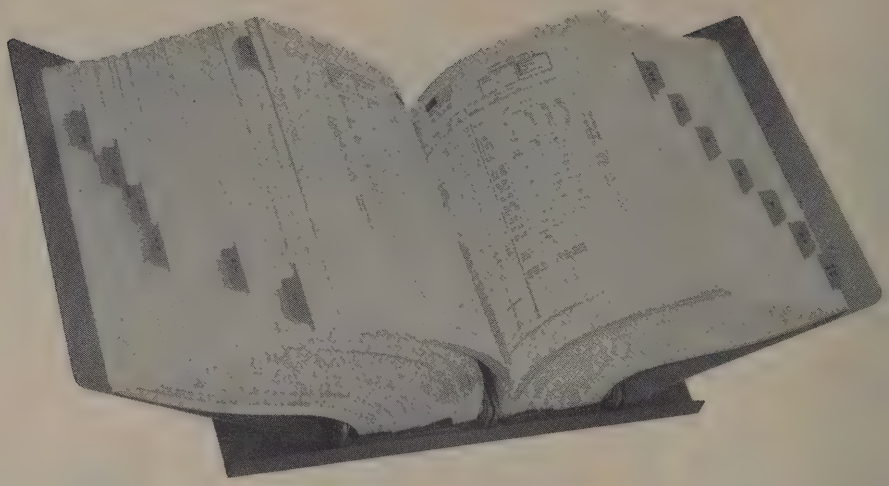
### High Speed Circuit Tester
... for accuracy and integrity



SERIES 703

3000 Tests per Minute

SELF PROGRAMMING FOR TESTING UP TO 500 POINTS . . . MICRO PROCESSOR CONTROLLED . . . GO/NO-GO OPERATION DIGITAL READOUT OF FAULT AND LOCATION.



# UNITED PRICING REPORTS

## the single source that speeds up invoicing, pricing, quoting, purchasing and estimating

Electronic component prices change so fast, you'd need a team of people just to keep up.

United Pricing Reports is the better way. When you subscribe to Pricing Reports you receive 1500 pricing sheets (3000 pages) of the latest prices, as of the date we ship them to you.

This gives you, in a single source, up-to-the minute selling prices on more than 500,000 electronic components.

United Pricing Reports gives you accurate resale prices at the exact moment you need them. Not hours or days later. So it helps you eliminate frantic phone calls, letter writing and catalog scanning to check on prices when you write an invoice or type a purchase order.

## Twice weekly price updates.

One week after you receive your Pricing Reports source book (1500 pricing sheets) you begin receiving twice weekly price updates. You simply take these new price pages and replace the now obsolete pages with them.

The whole process is simple. All information is organized alphabetically by manufacturer. And each manufacturer's price schedule is listed by part number in numerical/alphabetical sequence.

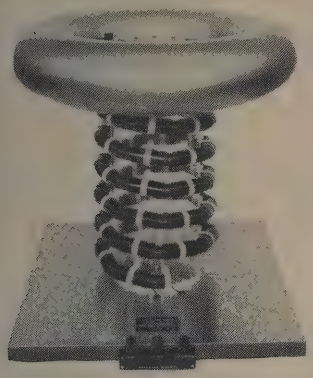
One more thing. When we promise twice weekly updates, we deliver. 52 weeks a year, consistently. Not monthly or every other month. We have a tradition of delivery on our promises, and we're certainly not going to stop now.

*UNITED TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500 TWX-510/222*

**Sensitive Research***

*A TRADEMARK OF EIS

# HIGH VOLTAGE MEASUREMENT



PARK

## High Voltage Divider

Model PARK Voltage Divider is constructed to a design by J. H. Park. (Ref: "Journal of Research" of National Bureau of Standards, Engineering and Instrumentation Vol. 66C, No. 1, Jan.—Mar., 1962. Reprints available upon request.) It is similar to the NBS standard employed in their calibration of high voltage instruments. Each 100 kv divider consists of 100 individually shielded one-megohm resistors, matched to each other to achieve an approximate temperature coefficient of less than 1 ppm/°C, and connected in series to form a vertical helix between a ground plate and a high voltage electrode. Uniquely shielded, testing indicates that corona, heating and leakage errors are less than 10 ppm at less than 10 ppm at 50 kv and 50 ppm at 100 kv.

The divider's special "hat" is designed to give uniform gradients from the high voltage electrode to ground and allows stacking of additional 100 kv units for higher voltage measurements. Each unit is only 22¼" high! DC Ratio Accuracy: ±.05%, 100 kv to 1 v; ±.5%, 100 kv to 1 kv. AC Ratio Accuracy: ±.5%, 50 kv (max.) to 500 v. (60 cps only). Recommended readout instrument at 1 v output tap is a precision DC potentiometer, at 1 kv tap (.5 kv on AC) recommended instrument is a ±.5% accurate electrostatic voltmeter (**Sensitive Research** Model ESD described below).

DCHI

## Special High Voltage Dividers

Based on experience with the many Park Dividers already manufactured and their proved reliability, special designs have been constructed and proposed. These special dividers are essentially the same as the Park except for such criteria as sensitivity and size. Designs up to 600 KV DC at ±1% accuracy have been constructed and successfully used by our customers. Dividers for use up to 1,000,000 volts are under consideration. Although most designs considered so far have been for single ranges, there is no particular objection to building a divider with several ranges. Present certification by NBS is limited to 100 KV but higher ranges can be calibrated by "bootstrapping" methods.

## DC Kilovoltmeter (multirange)

Model DCHI is a multirange permanent magnet moving coil, DC kilovoltmeter. Available at 50,000 ohms/v, ±1% fs accuracy, ranges of 1.5/3/7.5/15 kv or 3/7.5/15/30 kv, and at 75,000 ohms/v, ±.5% fs accuracy, ranges of 2/5/10/20 kv. The indicator is a University Model ±.5% accurate microammeter with a 4" scale length. It is self-contained in a moulded bakelite case and internally bracketed to the instrument panel. Size: 13¾" x 7½" x 8" h.

ESH

## Electrostatic Voltmeter (high voltage)

Model ESH AC/DC electrostatic voltmeter is available as a single range instrument up to 100 kv fs (140 kv DC only), or with as many as 4 switch-controlled ranges from 5 to 50 kv fs. DC input resistances to 5 x $10^{13}$ ohms. Capacitance varies from approx. 30 mmfd on 5 kv range to 10 mmfd on 50-100 kv ranges. Reads true RMS. Accuracy is ±1% fs (±.5% up to 30 kv on special order). 6" scale length. Transit lock and brackets for panel mounting available. Maximum frequency usage is expressed as follows: f = 2 fCE, where f = max. allowable operating frequency, C = capacitance of instrument in farads, E = voltage in volts.

ESD

## Electrostatic Voltmeter (portable)

Model ESD portable AC/DC electrostatic voltmeter is available as a single or multirange instrument to measure from 120 to 6 kv fs. Insulation resistance is 1 x $10^{13}$ ohms. Capacitance varies from approx. 225 mmfd for a 120 v range to 20 mmfd for a 6 kv range. Multirange instruments are designed for AC/DC measurements on first range, AC only on higher ranges. ±.5% to 1% fs accuracy (±1.5% for ranges of 150 v and less). 5.2" scale length. Size: 7¾" x 7½" x 6⅛". Available as edgewise panel instrument with the same performance characteristics except insulation resistance approx. 1 x $10^{13}$ ohms.

## Electrostatic Voltmeter (small portable)

University Model is a smaller, more economical version of the portable Model ESD. Single and multirange instruments available from 300 v to 5 kv fs. ±1% fs accuracy. 4" scale length. Moulded bakelite case. Size 5¼" x 5" x 4⅜".

**ELECTRICAL INSTRUMENT SERVICE, INC.** 25 DOCK STREET, MT. VERNON, N.Y. 10550

# TRIPLETT® PANEL

## *Custom tooled . . . custom specifications or standard off-the-shelf . . . Triplett can supply your panel instruments or requirements.*

Even though Triplett offers a wide selection of different styles, sizes and types of standard panel instruments, a large proportion of our customers require custom designed instruments. Many have a specific requirement for custom packaging to enhance the appearance or function of their product.

Triplett's versatile GL-GL/B Series provides a flexibility that may enable you to save considerable tooling expense by utilizing a standard back with a custom designed front panel. This flexibility can save you up to 50% on tooling costs.

If your requirements do not demand special packaging, but do demand custom instrument movements, Triplett engineering can also design to your accuracy, tracking, resistance or damping requirements.

Panel Instrument parameters and standard case styles are shown below to assist you in determining your instrument requirements.

## METER SPECIFICATIONS

Instruments can be DC or AC, Taut-Band (Suspension) or Pivot and Jewel and designed to your accuracy, tracking, resistance, sensitivity or damping requirements. They can be zero left or right, up-scale zero, zero center (null meter) or with a suppressed zero.

**DC Instruments** are the d'Arsonval type with linear scales, extra light moving coil, rugged construction, Bar-Ring Magnet and one piece diecast frames.

**AC Instruments** are either the moving iron vane type with viscous damping and light moving parts or the rectifier type.

**Coil Support System**—Both the taut band and pivot and jewel systems are available. All pivot and jewel movements have selected spring back jewel bearings with highly polished and specially treated pivots.

**Resistance**—Instruments can normally be designed to meet your internal resistance requirements. For best results, current instruments should be low resistance and voltmeters should be high resistance.

**Accuracy**—Instruments can be designed to within ½% (standard ±2%) with mirror scales and knife-edge pointers.

## RANGES

**DC Ammeters**—From 5μA to 50A with internal construction and up to 5,000A using an external shunt.

**DC Voltmeters**—from 5mV to 1000V with internal construction and up to 5,000V using an external multiplier box.

**AC (Iron Vane Type) Ammeters**—from 5mA to 50A with internal construction and up to 1,000A using external current transformer.

**AC (Iron Vane Type) Voltmeters**—from 1.5V to 600V with internal construction and up to 1,000V using external multiplier box.

**AC (Rectifier Type) Ammeters**—from 0.5mA to 10mA.

**AC (Rectifier Type) Voltmeters**—from 1V to 1000V with internal construction and up to 5,000V using external multiplier box.

**RF Thermocouple Ammeters**—from 2mA to 10A.

Watt Meters, VU Meters, db Meters (power level indicators) and Pyrometers are also available in many sizes and styles.

## SCALES

**Dials** can be custom designed to conform with the overall appearance of the end product. Company logos, different ink colors and custom dials reading in such units as pH, roentgens, mm, Hg, rpm, %, heartrate and inches can be designed.

**Pointers** are also available in many styles.

**Mirror Scales** can be added for greater reading accuracy.

**Divisions**—For standard ranges, each division is in multiples or decimal multiples of 1, 2 or 5 of the units measured, determined by size, readability accuracy, etc.

If the standard case designs do not fulfill your design requirements contact the factory for custom machining or molding.

## INFORMATION FOR ORDERING

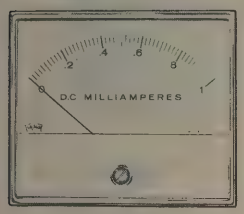
What custom panel instrument specifications do you need to make your product more reliable, more accurate, more rugged and—in the long run—less expensive? For quick, dependable delivery of small quantities of Triplett's "designed-for-you" panel instruments, contact your Triplett Sales/Service/Modification Center. For prototypes or production quantities, contact your Triplett representative. He'll put you in touch with our Instrument Designers/Engineers who'll help you analyze the problem and suggest the optimum cost/result solution.

# INSTRUMENTS

TEL: (419) 358-5015 TWX 810-490-2400
TRIPLETT CORPORATION, BLUFFTON, OHIO 45817

## STANDARD CASE STYLES

### G SERIES: Models 120-G, 220-G, 320-G, 420-G, 520-G.




**Sizes available:** 1½"; 2½", 3½", 4½", 5½".

**Case and Composition:** Thermoplastic front and back, four stud mounting.

**Options Available:** Half-Bezel for behind panel mounting, illumination kit, and shallow barrel.

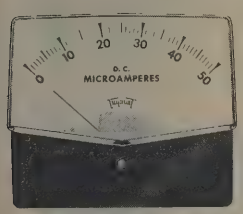
### GL SERIES: Models 320-GL, 420-GL, 520-GL, 820-GL.

**Sizes available:** 3½", 4½", 5½", 8".

**Case and composition:** Glass window, flat black thermosetting plastic case, two stud mounting except 820-GL with four stud mounting, contains contoured base with sealed meter movement permitting utilization of lower part of front for mounting controls, switches, etc.

**Options available:** Three and four stud mounting for 320-GL, four stud mounting for 420-GL 520-GL.

### M SERIES: Model 820-M.




**Sizes available:** 8½".

**Case and Composition:** Thermoplastic front and back.

**Options available:** A thermosetting plastic accessory case 3¾" d (with handle) is available allowing instrument to be utilized in special test equipment requirements. Contact factory for additional data.

### R SERIES: Models 320-R, 420-R.

**Sizes available:** 3½", 4½".

**Case and composition:** Thermoplastic front and thermosetting plastic back with flat scale arc.

### RUGGEDIZED SERIES: Models 127-HR, 221-HR, 321-HR.

Models 221-HR and 321-HR meet MIL-M-10304-D.

**Sizes available:** 1½", 2½", 3½".

**Case and composition:** Thermoplastic front and steel back.

### GL/B SERIES: Models 320-GL/B, 420-GL/B, 520-GL/B.

**Sizes available:** 3½", 4½", 5½".

**Case and composition:** Glass window, flat black thermosetting plastic case, integral bezel provides behind the panel mounting, minimum panel space requirement permits fuller utilization of panel area.

### EDGEWISE SERIES: Models .5-E, 120, 220-E, 320-E, 320-EG, 420-E.

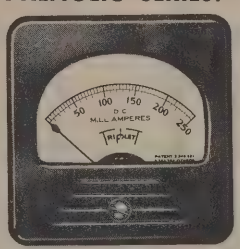
**Sizes available:** ½", 1½", 2½", 3½", 4½".

**Case and composition:** .5-E thermoplastic front, steel back; all others thermoplastic front (320-EG sealed glass window), thermo-setting plastic back. 320-EG constructed to withstand rough environmental and high vibration industrial applications.*

**Options available:** Bezels available for 320-E, 420-E. Models 320-E, 320-EG and 420-E can be mounted from front or rear of panel. Also available for vertical mounting.

*Includes steel mounting brackets.

### PHENOLIC SERIES:

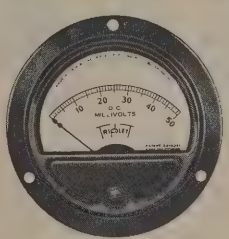



**Models: 227-T, 327-T.**

**Sizes available:** 2½", 3½".

**Case and composition:** Glass window, thermosetting plastic case, four stud mounting.

**Options available:** Illumination available for certain models—contact factory.

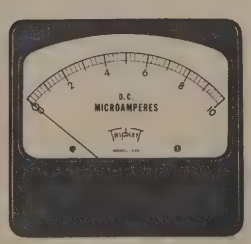



**Models: 221-T, 321-T.**

**Sizes available:** 2½", 3½".

**Case and composition:** Glass window, thermosetting plastic case, three stud mounting.

**Options available:** Illumination available for certain models—contact factory.




**Models: 420, 626, 726.**

**Sizes available:** 4½", 6½", 7½".

**Case and composition:** Glass window, thermosetting plastic case, four stud mounting.

**Options available:** Illumination available for certain models—contact factory.

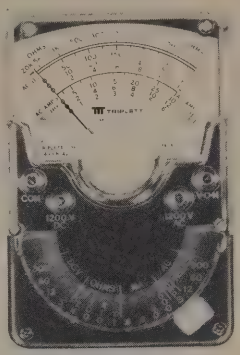
TRIPLETT

## MODEL 310 V-O-M TYPE 3

**1. Drop-resistant, hand-size V-O-M with high-impact thermoplastic case.**
**2. 20,000 Ohms per Volt DC and 5,000 Ohms per volt AC; diode overload protection with fused Rx1 Ohms range.**
**3. Single range switch; direct reading AC Amp range to facilitate clamp-on AC Ammeter usage.**

**RANGES**

**DC Volts:** 0-3-12-60-300-1,200 (20,000 Ohms per Volt).
**AC Volts:** 0-3-12-60-300-1,200 (5,000 Ohms per Volt).
**Ohms:** 0-20k-200k-2MΩ-20MΩ (200 Ohm center scale on low range).
**DC Microamperes:** 0-600 at 250 mV.
**DC Milliamperes:** 0-6-60-600 at 250 mV.
**Accuracy:** ±3% DC; ±4% AC; (full scale).
**Scale Length:** 2⅛".
**Meter:** Self-shielded; diode overload protected; spring backed jewels.
**Case:** Molded, black, high impact thermoplastic with slide latch cover for access to batteries and fuse, 2¾"w x 1 5/16"d x 4¼" h.
**Batteries:** NEDA 15V 220 (1), 1½V 910F (1): Complete with 42" leads, alligator clips, batteries and instruction manual. Shpg. Wt. 2 lbs.
**Model 310**
Cat. No. 3018 .....**$55.00**



**ACCESSORIES FOR 310's**

**Model 10 Clamp-on AC Ammeter**—For 310, 310-FET & 310T. Ranges, 0-6-12-30-60-120-300.
Cat. No. 60-211 .....**$26.30**
**Model 101 Line Separator**—Divides two conductor cords direct or increases Model 10 sensitivity 10x and 20x.
Cat. No. 60-218 .....**$11.60**
**Model 311 Lead**—42" long lead to separate Model 10 from 310 unit for easy reading in awkward spots.
Cat. No. 79-161 .....**$5.20**
**Model 369 Carrying Case**—For Model 310's.
Cat. No. 10-1258 .....**$6.70**
**Model 79-153 Needle Tip Replacement Lead**—For Model 310 series.
Cat. No. 79-153 .....**$5.20**

## MODEL 310-C V-O-M TYPE 3

**1. Hand-size V-O-M with diode overload-protected suspension movement.**

**2. 20,000 Ohms per volt DC and 15,000 Ohms per volt AC.**

**3. Single, enclosed range switch minimizes error; DC polarity-reversing switch.**

**RANGES**

**DC Volts:** 0-3-12-60-300-600 (20,000 Ohms per Volt).
**AC Volts:** 0-3-12-60-300-600 (15,000 Ohms per Volt).
**Ohms:** 0-20k-200k-2MΩ-20MΩ (200 Ohm center scale on low range).
**DC Microamperes:** 0-600 at 250 mV.
**DC Milliamperes:** 0-6-60-600 at 250 mV.
**Accuracy:** ±3% DC; ±4% AC; (full scale).
**Scale Length:** 2⅛".
**Meter:** Self-shielded, diode overload protected suspension movement; DC polarity-reversing switch; single, enclosed range switch.
**Case:** Molded black, 2¾"w X 1-5/16"d x 4¼"h.
**Batteries:** NEDA 15V 220 (1), 1½V 910F (1).
Complete with 42" leads, alligator clips, batteries and instruction manual. Shpg. Wt. 2 lbs.
**Model 310-C**
Cat. No. 3022 ..... **$70.00**

**ACCESSORIES FOR 310's**

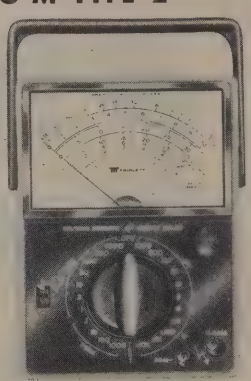
**Model 10-C Clamp-on AC Ammeter**—For 310-C. Ranges, 0-6-12-30-60-120-300.
Cat. No. 60-335 .....**$26.30**
**Model 101 Line Separator**—Divides two conductor cords direct or increases Model 10 sensitivity 10x and 20x.
Cat. No. 60-218 .....**$11.60**
**Model 311 Lead**—42" long lead to separate Model 10 from 310 unit for easy reading in awkward spots.
Cat. No. 79-161 .....**$5.20**
**Model 369 Carrying Case**—For Model 310's.
Cat. No. 10-1258 .....**$6.70**
**Model 79-153 Needle Tip Replacement Lead**—For Model 310 series.
Cat. No. 79-153 ..... **$5.20**

## MODEL 60 V-O-M TYPE 2

**1. X'TRA Rugged—Will withstand an accidental drop up to a five foot height.**
**2. Overload Protected—All ranges protected by diode and unusual three fuse arrangement, including ⅛ amp, 1 amp and 2 amp/1000V fuses.**
**3. Safety Designed For You—Designed to most rigid safety standards; completely insulated unit including newly designed safety leads.**

**RANGES**

**DC Volts:** 0-0.3-1-3-10-30-100-300-1000 (Approx. 20,000 Ohms per Volt).
**AC Volts:** 0-3-10-30-100-300-1000 (Approx. 5,000 Ohms per Volt).
**Ohms:** 0-1k-10k-100k-1MΩ-10-MΩ (12 Ohms center scale on low range).
**DC Microamperes:** 0-100 at approx. 320 mV.
**DC Milliammeters:** 0-10-100-1000 at approx. 320 mV.
**Decibels:** —20 to +52 ("0"-db at 1mW on 600 Ohm line).
**Accuracy:** ±2% DC; ±3% AC; (full scale).
**Scale Length:** 4½".
**X'TRA Rugged:** will withstand an accidental drop up to a five foot height with deviation from stated accuracy not exceeding ±4%.
**Overload Protected:** All ranges protected by diodes and unusual three fuse arrangement, including ⅛ amp, 1 amp and 2 amp/1000V fuses.
**Safety Designed** to most rigid safety standards to prevent explosive arcs in high energy circuits, up to the 2 amp/1000V (20kW) fuse capacity.
**Meter:** Diode overload protected ruggedized suspension meter movement module, DC polarity reversing switch.
**Confidence test:** Reassurance check of instrument meter.
**Case:** Molded, orange, high impact thermoplastic; easy external access sealed battery and fuse compartment; handle holds tester at 30° angle; 5¼"W X 7¼"H X 3¼"D.
**Batteries:** NEDA 9V 1604 (1), 1½V 13F (1).
Complete with 48" safety test leads, insulated alligator clips, batteries, spare 1/8A and 1A fuses and instruction manual. Shpg. [illegible] 4 lbs.
**Model 6[illegible]**
Cat. No. 3145 .....**$102.00**



## MODEL 60-NA V-O-M

**1. X'TRA Rugged—50 ranges with mirror scale and ±1½% DC accuracy—will withstand an accidental drop up to a five foot height.**
**2. Overload Protected—All ranges protected by diode and unusual three fuse arrangement, including ⅛ amp, 1 amp and 2 amp/1000V fuses.**
**3. Safety Designed For You—Designed to most rigid safety standards; completely insulated unit including newly designed safety leads.**

**RANGES**

**DC Volts:** 0-0.15-0.5-1.5-5-15-50-150-500 (20,000 Ohms/Volt).
**X2:** 0-0.3-1-3-10-30-100-300-1000 (10,000 Ohms/ Volt).
**AC Volts:** 0-3-15-50-150-500 (Approx. 10,000 Ohms/Volt).
**X2:** 0-6-30-100-300-1000 (Approx. 5,000 Ohms/Volt).
**Ohms:** 0-1k-10k-100k-1MΩ 100MΩ (6 Ohm center scale).
**DC Microamperes:** 0-50-500 at approx. 150mV.
**X2:** 0-100 at approx. 300mV.
**DC Milliammeters:** 0-5-50-500 at approx. 150mV.
**X2:** 0-1-10-100-1000 at approx. 300mV.
**Decibels:** —20 to +52 ("0" dB at 1mW on 600 Ohm line).
**Accuracy:** ± 1½% DC; ±3% AC; (full scale).
**Frequency Compensated.**
**Scale Length:** 4½".
**X'TRA Rugged.** See Model 60.
**Overload Protected.** See Model 60.

**Safety Designed** to most rigid safety standards to prevent explosive arcs in high energy circuits, up to the 2 amp/1000V (20kW) fuse capacity.
**Meter:** Diode overload protected ruggedized suspension meter movement, ½% resistors.
**Confidence Test:** See Model 60.
**Case:** Molded, gray, high impact thermoplastic; external access sealed battery and fuse compartment; handle holds tester at 30° angle; 5¼"W X 7½"H X 3¼"D.
**Batteries:** NEDA 30V 210 (1), 1½V 13F (1).
Complete with 48" safety test leads, insulated alligator clips, batteries, spare ⅛A and 1A fuses and instruction manual. Shpg. Wt. 4 lbs.
**Model 60-NA**
Cat. No. 3151 .....**$140.00**

TRIPLETT
BLUFFTON, OHIO 45817
TEL. (419) 358-5015 TWX 810-490-2400

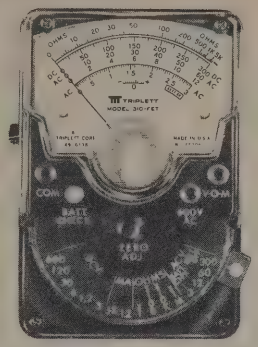
THE MARK OF QUALITY

## MODEL 310-FET—TYPE 1

**1. Hand-size FET V-O-M with 10 megohm DC input resistance and diode overload-protected suspension movement.**

**2. Low voltage range of 300 mV DC; X1 megohm range.**

**3. Single range switch; DC polarity-reversing switch.**



**RANGES**

**DC Volts:** 0-0.3-1.2-6-30-120-600. Input resistance 10 megohms.

**AC Volts:** 0-3-12-60-300-600 (5,000 Ohms per Volt).

**Ohms:** 0-5k-500k-50MΩ-5,000-MΩ (50 Ohm center scale on low range).

**DC Milliamperes:** 0-0.12-1.2 at 300 mV.

**Accuracy:** ±3% DC; ±4% AC; (full scale).

**Scale Length:** 2⅛".

**Meter:** Self-shielded, diode overload protected suspension movement; DC polarity-reversing switch.

**Case:** Molded, black, 2¾"w X 1-5/16"d X 4¼"h.

**Batteries:** NEDA 7V 1501M (1), 1½V 910A (1).
Complete with 42" leads, alligator clips, batteries and instruction manual. Shpg. Wt. 2 lbs.

**Model 310-FET**
Cat. No. 3027 ..... **$92.00**

**ACCESSORIES FOR 310's**

**Model 10 Clamp-on AC Ammeter**—For 310, 310-FET & 310-T. Ranges, 0-6-12-30-60-120-300.
Cat. No. 60-211 ..... **$26.30**

**Model 101 Line Separator**—Divides two conductor cords direct or increases Model 10 sensitivity 10x and 20x.
Cat. No. 60-218 ..... **$11.60**

**Model 311 Lead**—42" long lead to separate Model 10 from 310 unit for easy reading in awkward spots.
Cat. No. 79-161 ..... **$5.20**

**Model 369 Carrying Case**—For Model 310's.
Cat. No. 10-1258 ..... **$6.70**

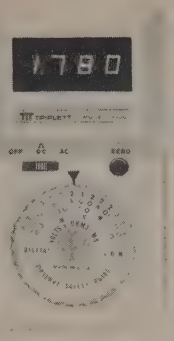
**Model 79-153 Needle Tip Replacement Lead**—For Model 310 series.
Cat. No. 79-153 ..... **$5.20**

## MODEL 3300 D-V-O-M

**1. HAND-SIZE, 3½ DIGIT—Easy operation, 22 ranges with Hi and Low Power Ohms. Auto-polarity.**

**2. OVERLOAD PROTECTION—Protected up to 600 volts on all ranges with special 2A/600V fuse arrangement.**

**3. BATTERY PAC™—Easily removed, snap-in Battery Pac™ provides convenient field exchange for fully charged Pac. Battery Pac™ rechargeable in tester or externally.**



**RANGES**

**DC Volts:** 0-.2-2-20-200-600, ±5% Rdg. ±1 Digit. Input resistance all ranges: 10 Meg. Full scale step response: 1 sec. typical.

**AC Volts:** 0-.2-2-20-200, 60Hz ±1% Rdg. ±2 Digits. 0-600, 60Hz ±1.5% Rdg. ±2 Digits. Input impedance all ranges. 10 Meg., Cap. 100 pF. Full scale step response: 3 sec. typical.

**Ohms**—Low Power Ranges: 0-200-20k-2M, ±.5% Rdg. ±1 Digit, FS voltage 200 mV. Full scale step response: 2 sec. typical all ranges.

**Ohms**—Hi Power Ranges: 0-2k-200k, ±.5% Rdg. ±1 Digit, FS voltage 2V. 0-20M, ±1% Rdg. ±1 Digit, FS voltage 2V. Full scale step response: 2 sec. typical all ranges except 20M range 8 sec. typical.

**DC Milliammeters:** 0-2-20-200, ±1.25% Rdg. ±1 Digit, .2 volt burden FS. Full scale step response: 1 sec. typical.

**AC Milliammeter:** 0-2-20-200, 50-kHz ±1.5% Rdg. ±2 Digits, .2 volt burden FS. Full scale step response: 3 sec. typical.
Overload Protection: 0-600 volts on all ranges.
Out of Range Indication: blinks.
.3" LED with Polarity Indication.
DC Polarity: automatic.
ZERO: Offset zero adjustment.
Fuses: 1A/250V; 2A/600V.
Probe: Red/Gray houses fuses.
Case: Molded, gray high impact thermoplastic with non-slip "finger-tread" surface finish; easy access Battery Pac™; dimensions approx. 3"W X 5⅜"L X 1⅜"D.
Batteries: NEDA 1½V 15NC (4), Ni. Cad. type AA.
Complete with one year warranty, 42" test leads, insulated alligator clips, rechargeable Ni. Cad. batteries, AC Adapter Charger and instruction manual. Shpg. Wt. Approx. 10 oz.

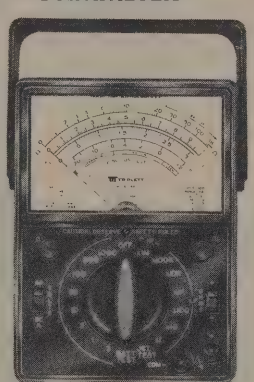
**Model 3300**
Cat. No. 3300 ..... **$175.00**

## MODEL 64 VOLT-OHMMETER

**1. X'TRA Rugged/Overload Protected (all ranges)/Safety Designed solid state Volt-Ohmmeter.**

**2. Low-Power Ohms—LPΩ™—6 ranges with 90mV power source for in-circuit measurements plus junction test circuit.**

**3. Exclusive Triplett Micro Power — TMP™ — permits continuous operation with carbon battery life in excess of a year.**



**RANGES**

**DC Volts:** 0-0.3-1-3-10-30-100-300-1000. Input res. 11.12 MΩ.

**AC Volts:** 0-0.3-1-3-10-30-100-300-1000. Input imp. 10 MΩ. Frequency range 20Hz to 20kHz, except 300 and 1000V.

**Ohms-Low Power:** 0-1k-10k-100k-1MΩ-10mΩ-100MΩ. (Max. voltage 90mV, max. power 0.08mW, 10 Ohm center scale).

**Ohms-Conventional:** 1000MΩ. (Max. voltage 0.9V, max. power 0.08μW, 10M ohm center scale).

**Junction Test:** checks diodes and transistor junctions (silicon-germanium-open or shorted); forward and reverse conduction. (Max. V. 0.9V, max. power 0.8mW).

**Decibels:** −40dB to +62dB.

**Accuracy:** ±3% F.S., all ranges.

**Scale Length:** 4½".

**X'TRA Rugged:** Will withstand an accidental drop up to a five foot height with deviation from stated accuracy not exceeding ±4%.

**Overload Protected:** All ranges protected by diodes and unusual two fuse arrangement, including 1 amp and 2 amp/1000V fuses.

**Safety Designed** to most rigid safety standards to prevent explosive arcs in high energy circuits, up to the 2 amp/1000V (20kW) fuse capacity.

**Meter:** Diode overload protected suspension movement module.

**Case:** Molded, green, high impact thermoplastic; external access sealed battery and fuse compartment; 5¼"W X 7½"H X 3¼"D.

**Batteries:** NEDA 9V 1604 (2), 1½V 13F (1).
Complete with 48" safety test leads, insulated alligator clips, batteries, spare 1A fuse and instruction manual. Shpg. Wt. 4 lbs.

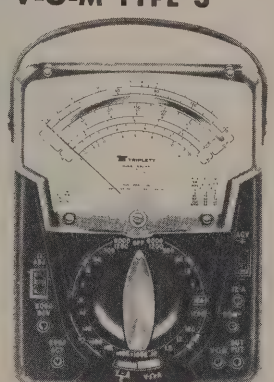
**Model 64**
Cat. No. 3152 ..... **$140.00**

## MODEL 630-NA V-O-M TYPE 3

**1. 70-range V-O-M with single range switch and DC polarity-reversing switch.**

**2. Accuracy 1½% DC and 3% AC; mirrored scale.**

**3. Diode overload-protected suspension movement; temperature compensation.**



**RANGES**

**DC Volts:** 0-0.6-3-12-60-300-1,200-6,000 (10,000 Ohms per Volt). 0-0.3-1.5-6-30-150-600-3,000 (20,000 Ohms per Volt). 0-0.120 at 60 microamperes. 0-0.240 at 120 microamperes.

**AC Volts:** 0-3-12-60-300-1,200-6,000 (5,000 Ohms per Volt). 0-1.5-6-30-150-600-3,000 (10,000 Ohms per Volt). Frequency range 35 Hz to 20 kHz.

**Ohms:** 0-1k-10k-100k-1MΩ-10MΩ-100MΩ (4.4 Ohm center scale on low range).

**DC Microamperes:** 0-60-600 at 120 mV; 0-120 at 240 mV.

**DC Milliamperes:** 0-6-60-600 at 120 mV; 0-1.2-12-120-1,200 at 240 mV.

**DC Amperes:** 0-6 at 120 mV; 0-12 at 240 mV.

**Decibels:** −26 +51 ("0" dB at 1 mW on 600 Ohm line).

**Output Volts (AC):** 0-3-12-60-300 (5,000 Ohms per Volt).

**Accuracy:** ±1½% DC; ±3% AC; (full scale).

**Scale Length:** 4½".

**Meter:** Diode overload protected suspension movement, DC polarity reversing switch, mirror scale, ½% resistors, switch for doubling range selection.

**Case:** Molded, black, 5½"w X 3-11/32"d X 7½"h.

**Batteries:** NEDA 30V 210 (1), 1½V 13F (1).
Complete with 48" leads, alligator clips, batteries and instruction manual. Shpg. Wt. 5 lbs.

**Model 630-NA**
Cat. No. 3042 ..... **$126.00**

**Model 630-NS:** Similar to Model 630-NA with 200,000 Ohms per Volt DC and 20,000 Ohms per Volt AC. Maximum AC/DC voltage range, 1200 Volts.
Cat. No. 3102 ..... **$156.00**

**Model 639-OS Leather Case:** Flaps open to permit use of tester in case. Accessory compartment, built in stand on back.
Cat. No. 10-1793 ..... **$23.30**

TRIPLETT

For Comprehensive Catalog Contact:

TRIPLETT®
BLUFFTON, OHIO 45817
TEL. (419) 358-5015 TWX 810-490-2400

THE MARK OF QUALITY

# Sweep Generators, Spectrum Analyzers, Oscillators, Attenuators, Filters and R.F. Components

## INSTRUMENTS

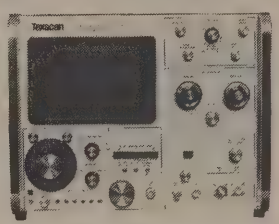
### VS SERIES - SWEEP/SIGNAL GENERATORS

The VS series sweep/signal generators are completely solid state, low distortion, wide sweep instruments containing sufficient features for wide application in the industry. These include variable sweep rate capability, excellent linearity, with attenuated outputs and have extensive marker capability.

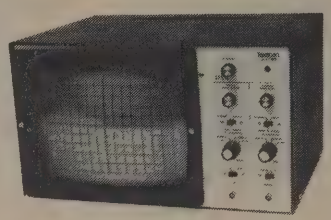
| Model | Frequency Range |
|---|---|
| VS-20 | 500 Hz to 25 MHz |
| VS-30A | 300 kHz to 100 MHz |
| VS-40A | 1 MHz to 300 MHz |
| VS-50A | 5 MHz to 500 MHz |
| VS-60B | 2 MHz to 1000 MHz |
| VS-80 | 1 MHz to 1200 MHz |
| VS-90B | 3 MHz to 2350 MHz |

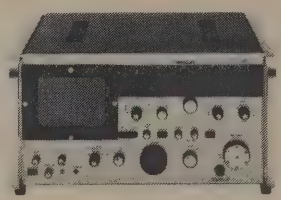
### DU SERIES OSCILLOSCOPES

Texscan oscilloscopes are sensitive, large screen, solid state, X-Y display units designed to satisfy the particular needs of a production or laboratory testing system using sweep generator techniques. These display units are complete with cathode ray tube, vertical and horizontal deflection amplifiers, video (Z axis) amplifier, and high and low voltage supplies.



The Model 9650 tracking sweep spectrum analyzer makes possible dynamic measurements of over 100 dB. This technique provides rapid observation of many band pass—band reject responses previously available only on a point-to point basis. This unique instrument combines the features of a sweep generator, spectrum analyzer, display section, reflection bridge and associated 1 dB step attenuators.



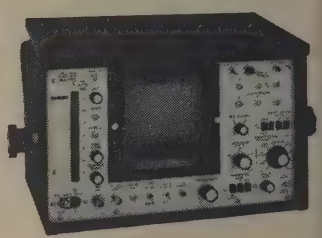


### SPECTRUM ANALYZER AL-60

1 MHz to 3 GHz, solid state, −110 to +30 dBm. Texscan's line of lab spectrum analyzers consists of the AL-60, 1 MHz to 3 GHz. Designed for maximum reliability and maintainability, accurate frequency and amplitude identification.

### PORTABLE SPECTRUM ANALYZERS

The AL-50 family of portable spectrum analyzers provides the user with a rugged instrument for making RF measurements both in the lab and in the field. There are three units in the series — the AL-50, single resolution 4-300 MHz, AL-51 selectable resolution and phase lock, 4-1000 MHz, and the AL-55, 4-350 MHz, with crystal markers and special hum modulation measurement circuitry. These units will operate from an internal 12V rechargeable battery, an AC power converter, or 12V vehicular systems. Weighing less than 25 lbs., they are provided with a protective cover and rugged field carrying case with handle.



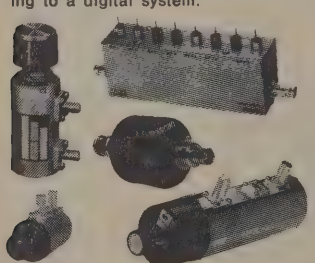
## ATTENUATORS

**New High Performance Attenuators**—New HFP Series are 10 watt CW fixed attenuators and FP are subminiature with an exacting range from DC—18 GHz. With a conservative 2 watt rating at room temperature these attenuators are ideal for environmental protection, ruggedness and low cost. The attenuators are also packaged in convenient laboratory protective cases.

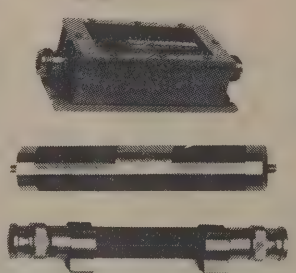
**Attenuators** — RA Series—Rotary —DC—4000 MHz, direct reading in dB, 8 attenuation ranges up to 120 dB, 50 to 75 ohm. Texscan offers a complete range of attenuators with steps of 0.1, 1.0 and 10.0 dB, covering attenuation ranges of 1.0, 10.0 and 120.0 dB. Wide selection of connector choices available.

**FP Series**—Fixed Coaxial—DC—18 GHz, 2 watt average power, values up to 50 dB.

**PA Series** — Digitally Programmable—DC—1250 MHz, 6 millisecond switching speed. Three different units cover 0—127 dB in 1.0 dB steps. Each pad represents a single binary digit for easy mating to a digital system.



## FILTERS



**Filters** — Tunable Bandpass — 48 MHz to 4 GHz, 3 dB BW, 1% to 10%, 3 and 5 sections. Any single model covers more than an octave.

**Bandpass/Lowpass**—10 MHz to 13 GHz. Five different types available, each with its own unique characteristics. Choice of connector style as well as special mechanical designs to fit your packaging requirements, 48 hour delivery.

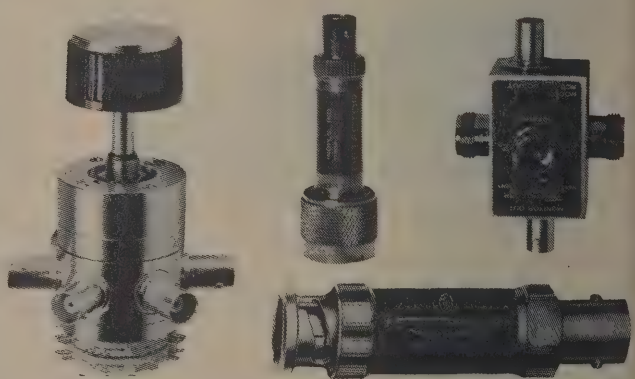
**Lumped Component**—5 MHz to 100 MHz, 3 to 8 sections. Miniature size provides freedom in circuit layout, reducing overall package volume. Available in bandpass and lowpass designs.

**Cavity Bandpass**—30 MHz to 3000 MHz, 2 to 6 sections, 0.2 to 3%, 3 db BW. Designed to provide low insertion loss at narrow bandwidths.

**Waveguide** — 4 GHz to 18 GHz Bandpass. Custom designs from 0.25 to 10% bandwidths.

## COMPONENTS

Texscan line of RF components consist of RF detectors, coaxial switches, reflection coefficient bridges, mis-matches, terminations and impedance matching pads.



**Solid State Oscillators**—Texscan's seven lines of solid state RF sources span between 2.5 MHz to 20 GHz and supply RF power up to one watt. Both electronically and mechanically tuned devices are available.

**BITE Oscillators**—Texscan's PMO series operate with TTL logic pulses at a .001 duty. They require a 20 mW input for a 200 mW peak RF output making them ideal for battery operation. The PMO series is also available with a direct pulse drive input.

• 2446 North Shadeland Avenue, Indianapolis, Indiana 46219, PH: 317-357-8781, TWX: 810-341-3184, Telex: 272110

**Texscan**

• 1, Northbridge Road, Berkhamsted, Hertfordshire, England UK, PH: 04427-71138, Telex: 82258

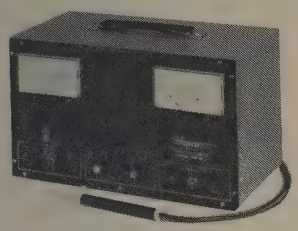
• 8 Munchen 90, Schlierseestrasse 31A, West Germany, PH: 0811/69 5421, Telex: 522915

TOROTRON CORP. DEPT. EM, 255 WASHINGTON ST., MT. VERNON, NY 10553, (914) 664-2050

# AC/DC Hipot Insulation Tester

**Application:** • Production testing for insulation resistance, Dielectric withstand, etc. • High Voltage Capacitor • Motors • Wire & Cable • Dielectric Materials • Transformers & Coils • Bushing & Insulators • High Voltage Rectifiers • **UL Listed Electrical Hi Pot Tests.**

## RHP HiPot Series DC DIELECTRIC WITHSTANDING TESTER



**PERMITS MONITORING OF LEAKAGE CURRENT AS LOW AS 2 MICRO AMPS**

**The RHP Series Test Sets are reliable, sensitive power sources for laboratory or production testing. These sets having fully zero start interlock with HV on and off switches — compel operator to start test at zero volts. Sensitive multirange current meter circuit for accurate leakage measurement, built-in current-limiting adjustable from 5 Micro Amps to 4 Milli Amps. A timer is incorporated with a range of 2 to 120 seconds to limit the test duration to a preset time.**

**FEATURES:**

- **High Voltage Output Control:** Continuously variable from 0 to full voltage.
- **Voltage Monitoring:** 4½" Taut Band Mirror Scale Ruggedized Kilovoltmeter with an accuracy of 2% monitors actual output voltage.
- **Current Monitor:** Multirange Micro Amp meter from 0 to 5 MA in three ranges 0 to 50 Micro Amp, 0 to 500 Micro Amp, and 0 to 5 MA. With adjustable current set from 10% to 80% of full scale to shut off high voltage and activate visual and audible alarms when preset leakage current exceeds set limit, permitting GO/NO-GO testing.
- **Output Probe:** Special high voltage silicone cable is internally connected to a shorting relay that shorts the output when unit shuts off or not operating, permitting the safe removal of tested components, and discharges any residual charge.
- **Test Duration Timer:** A timer covering the range from 2 seconds to 120 seconds that permits limiting the time during which the component is tested. An override switch permits the bypassing of timer.

**SPECIFICATIONS:**

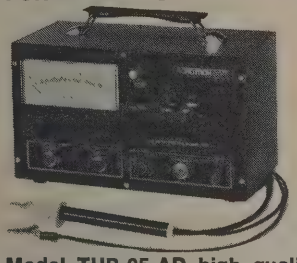
| | |
|---|---|
| **Input** | 115 VAC, 60 Hz, 3 Amp. |
| **Size and Weight** | 9½" H x 17" W x 11" D. Approx. 22 lbs. |
| **Timer Range** | 2-120 seconds. |

| DC Model | Output Voltage | Current Meter Range | Price 1-5 |
|---|---|---|---|
| RPH-02 | 2 KVDC | 50μA | $480 |
| RPH-04 | 4 KVDC | 500μA | 520 |
| RPH-07 | 7 KVDC | 500μA | 580 |
| RPH-12 | 12 KVDC | 5MA | 680 |

## THP-AD Hipot Series

### AC DIELECTRIC WITHSTANDING TESTER

**FOR MAKING U.L. LISTED ELECTRICAL HIPOT TESTS**



| AC Model | Output Voltage | Price 1-5 |
|---|---|---|
| THP-02-AD | 2 KVAC | $220 |
| THP-03-AD | 3 KVAC | 250 |
| THP-05-AD | 5 KVAC | 270 |
| THP-10-AD | 10 KVAC | 410 |
| **DC Model** | **Output Voltage** | **Price 1-5** |
| THP-03D-AD | 3 KVDC | $ 245 |
| THP-04D-AD | 4 KVDC | 275 |
| THP-07D-AD | 7 KVDC | 300 |
| THP-12D-AD | 12 KVDC | 420 |

**Model THP-05-AD high quality low cost AC high voltage insulation tester. Makes fast accurate dielectric withstanding tests of appliances, Motors, Coils, Transformers, Electronic components, Insulation Materials, etc.**

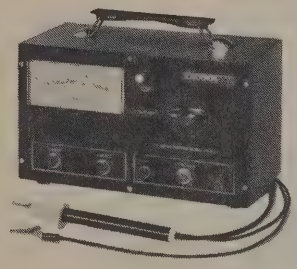
**FEATURES:**

- **High Voltage Output Control:** Continuously variable from 0 to 5 KVAC.
- **Leakage Detector:** Continuously adjustable from 1 MA to 4 MA permitting non-destructive testing of insulation.
- **Arcing Detector:** Visual Indicators illuminated in front panel when component Leakage or Arcing is detected.
- **Solid State Audible Alarm:** Adjustable from 1 MA to 4 MA breakdown current.
- **Latching Relay:** Shuts power off, when breakdown current exceeds limits, keeps Audible Alarm On, Until main Power 'ON' Switch is turned off, faulty component removed, and tester restarted.
- **Voltage Monitoring:** 4½" Taut Band Mirror Scale Ruggedized Kilovoltmeter with an Accuracy of 2% monitors actual output voltage.
- **Shielded Output Cable:** To high voltage probe.

**SPECIFICATIONS:**

| | |
|---|---|
| **Input** | 115 VAC, 60 Hz, 3 Amp Max. |
| **Size & Weight** | 7" H x 12" W x 6" D Approx. 18 Lbs. |
| **Meter** | 2% full scale accuracy 4½" ruggedized meter. |
| **Output Voltage** | 0 to Full Voltage, 60 Hz, Shielded Hi Voltage Probe. |
| **Short Circuit Current** | 18 MA. |

## THP Hipot Series



| AC Model | Output Voltage | Price 1-5 |
|---|---|---|
| THP-02 | 2 KVAC | $180 |
| THP-03 | 3 KVAC | 200 |
| THP-05 | 5 KVAC | 220 |
| **DC Model** | **Output Voltage** | **Price 1-5** |
| THP-03D | 3 KVDC | $200 |
| THP-04D | 4 KVDC | 230 |
| THP-07D | 7 KVDC | 250 |
| THP-12D | 12 KVDC | 365 |

**High Quality Low Cost AC Hi Voltage Insulation Tester Designed for use by unskilled personnel.**

**FEATURES:**

- **High Voltage Output Control:** Continuously Variable from 0 to 5 KVAC.
- **Leakage Detector:** Continuously adjustable from 1 MA to 4 MA permitting non-destructive testing of insulation.
- **Arcing Detector:** Visual Indicators illuminated in front panel when component Leakage or Arcing is detected.
- **Voltage Monitoring:** 4½" Taut Band Mirror Scale Ruggedized Kilovoltmeter with an Accuracy of 2% monitors actual output voltage.
- **Shielded Output Cable:** To high voltage probe.

**SPECIFICATIONS:**

| | |
|---|---|
| **Input** | 115 VAC, 60 Hz, 3 Amp Max. |
| **Size & Weight** | 7" H x 12" W x 6" D Approx. 18 Lbs. |
| **Meter** | 2% full scale accuracy 4½" ruggedized meter. |
| **Output Voltage** | 0 to Full Voltage, 60 Hz, Shielded Hi Voltage Probe. |
| **Short Circuit Current** | 18 MA. |

**NOTES:** • HiPot Testers available in many other voltage ratings and features. Consult factory for modifications. • All output voltage referenced to ground. Floating output available on request.

**ADDITIONAL FEATURES:** • Zero Start Interlock • Audible Failure Signal.

Specifications and price subejct to change without notice.

# SYSTEMS INSTRUMENTATION

DigiTec designs with quality and reliability in mind. Quality is assured by thorough testing during production and backed by a full year warranty.

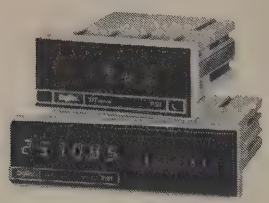
Easy maintainability is a by-product of our construction technique. This, coupled with our 30 worldwide and 18 domestic service centers give you the edge in minimum downtime.

In addition to panel meters and printers, we manufacture the finest multimeters, thermometers, counters and data acquisition systems.

For complete details of our product line, please contact us or our representative in your area.

*DigiTec: precision measurements to count on!*

## PANEL MOUNT INSTRUMENTATION



### Process Monitors

- Use with any current or voltage transducer/transmitter
- Direct readout in desired engineering units
- 3½ or 4½ digit display
- Field adjustable or fixed scaled and/or offset

### Panel Meters

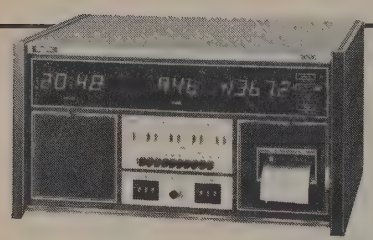
- AC Voltage & Current • AC true rms
- DC Voltage & Current • DC Autoranging

### Panel Thermometers

- Thermocouple, Thermistor, RTD Sensors
- Resolution & Repeatability to 0.01°
- Readout in °C or °F

### Factoring Counter/Timers

- Counters, Totalizers, Timers
- Thumbwheel or rear connector programmable
- Direct readout in Rate, Flow, Ratio, Total or Time
- Full 6 digit display



## DATALOGGERS

- Wide selection of ranges & functions (field interchangeable)
- Single or multiple parameters
- Unlimited alarm capability • Low cost
- Resolution to 1μV dc, 10μV ac or 0.01°
- Continuous visual display of time, channel and measured data
- Hard copy printout of all data
- Isolated BCD or RS-232-C output

## PRINTERS

- Numeric & Alpha-numeric • 10 to 26 Columns
- Integral clock & events counter
- System interface TTL & RTL
- Microprocessor controlled
- RS-232-C 20mA current loop & 8-bit parallel inputs
- Selectable baud rates

## LABORATORY INSTRUMENTATION

### DMM'S, COUNTER/TIMERS, THERMOMETERS

### Portable, Bench & Systems Digital Multimeters

- Six functions • 100 μV resolution
- 4½ digit display • 0.02% basic accuracy
- Autoranging-BCD output

### Counter/Timers

- 7 models, full scale readings from 150MHz to 1GHz
- Full 9 digit display TCXO

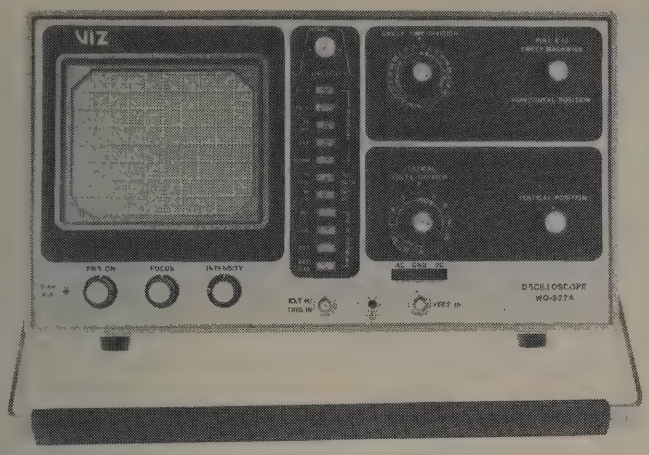
### Thermometers-Portable, Bench & Systems

- Thermocouple, Thermistor, RTD Sensors
- Resolution & Repeatability to 0.01°
- Readout in °C or °F or both

**DigiTec UNITED SYSTEMS CORPORATION**

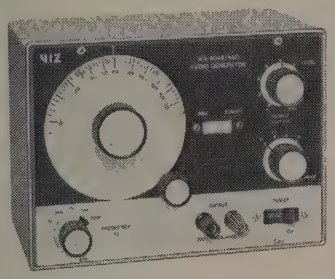
918 Woodley Road, Dayton, Ohio 45403
(513) 254-6251. TWX (810) 459-1728

## WO-527A 15 MHz. Trigger Sweep Scope — $525.00



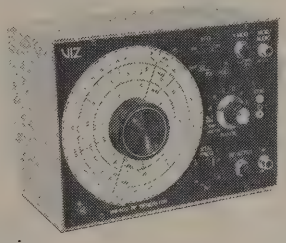
- Freq. resp. DC to 15 MHz (−3 dB) sensitivity 10 mV/cm. to 20V in 11 ranges. Rise time 24 n. sec. Horz. Osc. Freq. DC to 1MHz.
- Trigger mode normal or auto freq. resp. DC to 30 MHz.
- Calibrated time base 0.5$\mu$ sec. to 0.5 sec., 19 ranges.
- Preset TVV and TVH plus special TV line selector to display single line of TV video frame.
- Times 10 sweep Mag. advanced I.C. circuitry thru-out full shield CRT with P-31 Phos.
- Unique simplified trig. level adj. system with LED indicators show trig. polarity at a glance.

## WA-504B/44D Audio Sine/Sq.-Wave Generator — $129.00



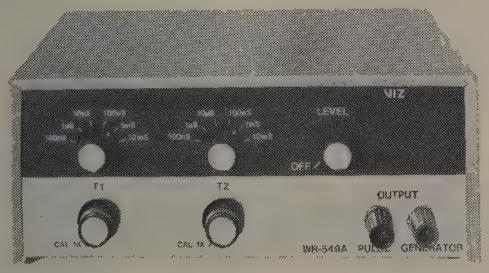
- Output 20 Hz to 200 kHz in 4 ranges, stability ± 0.5% and ± 5% dial cal.
- Voltage output 4 ranges 0.01 to 10V at 600Ω.
- Sine wave harmonic distortion 0.15% sq. wave rise and fall 150 ns., tilt 2%.
- All solid-state, throughout, 3 wire AC cord.

## WR-50C RF Signal Generator — $120.00



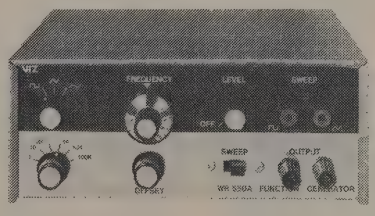
- Tunable on fundamental 6 ranges 85 kHz to 40 MHz ± 2% with sweep output at 455 kHz and 10.7 MHz plus External xtal.
- RF output 0.05V rms, 2 step 10 to 1 plus fine adj. attenuator.
- Internal Modulating freq. 600 Hz adj. to 80%.
- Audio output 6V rms across 15 kΩ load.
- FET amplifier for rugged stability, 3 wire AC cord.

## WR-549A Pulse Generator — $119.00



- Freq. range 5 Hz to 5 MHz ±5% output adj. 0-15V into 600Ω, 0-6V into 50Ω.
- Pulse width adj. 100 ns. to 0.1 sec. rise and fall time 20 ns.
- TTL and CMOS compatible, on and off time independently adj.
- Ideal for logic design or digital circuit troubleshooting
- 3 wire AC cord.

## WR-550A Function Generator — $139.00



- Sine, sawtooth and sq. wave output 1 Hz to 1MHz.
- Peak to peak output 0-20V at 600Ω plus 10V adj. offset.
- 10 to 1 freq. sweep with ext. sweep voltage of any wave form.
- Freq. stability 200 PPM/°C, accuracy to 100 kHz ± 5% of dial above 100 kHz ± 8%.
- TTL and CMOS compatible with sq. and sawtooth fix output 4 VDC.
- 3 wire AC cord.

VIZ

Test Instruments Group
of VIZ Mfg. Co.
335 E. Price St. Philadelphia, Pa. 19144 (215) 844-2626

**These instruments are available through local VIZ distributors**

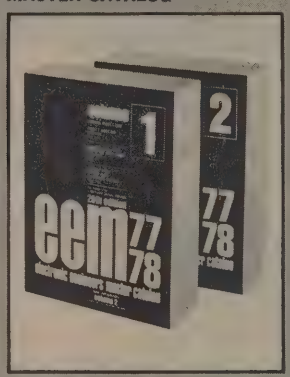
formerly RCA Instruments

6865A

# WE KNOW OUR STUFF.

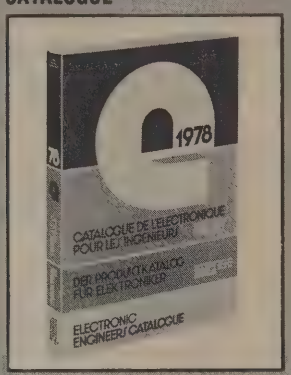
## 41 YEARS OF EXPERIENCE IN CATALOGING, 21 EDITIONS OF eem

### eem/ELECTRONIC ENGINEERS MASTER CATALOG —



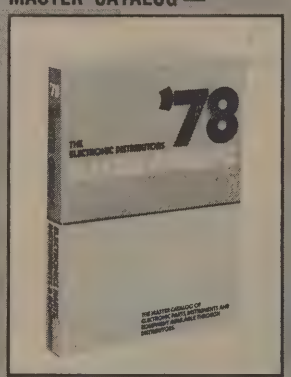

The "blue-ribbon" catalog/directory that has become "the standard of the industry" for electronic engineers, buyers and specifiers.

### ELECTRONIC ENGINEERS CATALOGUE



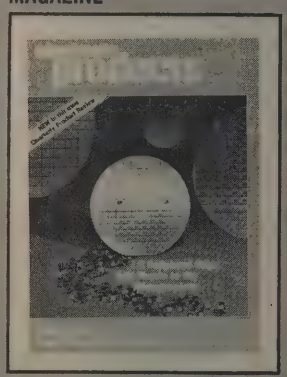

The new catalogue/directory of electronic products available to and from Western Europe and the United Kingdom. Designed especially for the European electronics engineer.

### ELECTRONIC DISTRIBUTORS MASTER CATALOG —



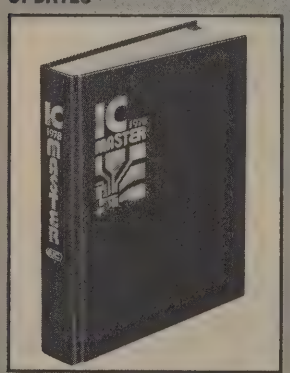

The only national catalog designed exclusively for distributors and their customers featuring electronic parts, instruments and equipment.

### ELECTRONIC PRODUCTS MAGAZINE —



The products magazine . . . A 100% product-oriented magazine including hundreds of new products and special features every month.

### IC MASTER AND THE UPDATES —




The only complete single-source directory including all IC devices manufactured in the United States. Updated three times yearly with accumulative supplements.

### eem FILE SYSTEM —

The only filing system designed especially for the electronics engineer. Instant retrieval and organization of data sheets and catalogs.

### UTP CUSTOM CATALOGS —

The Cadillac of individualized catalogs for the electronic parts distributor, featuring solely his lines and services.

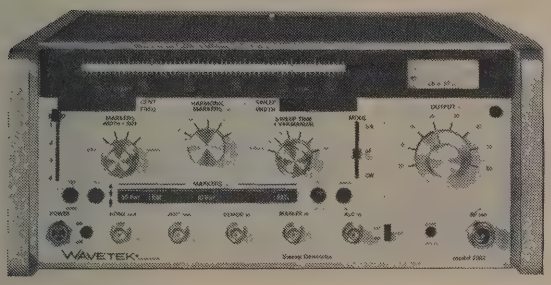
### UNITED COST AND PRICING SERVICES —

The electronic distributors' proven method of being up to the minute on his cost and selling prices.

*United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Ave., Garden City, N.Y. 11530 / (516) 222-2500 TWX 510-222-1673*

WAVETEK®
INDIANA INCORPORATED

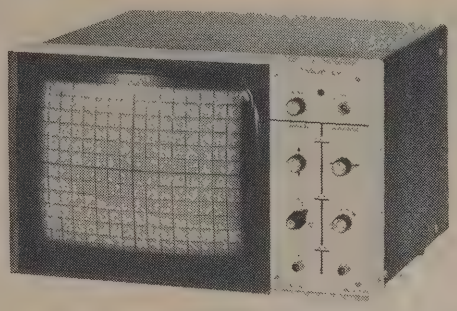
## MODEL 2002
## SWEEP SIGNAL GENERATOR



- **1 MHz to 2500 MHz in one unit.**
- **Band stacking option for sweeping full range.**
- **Calibrated RF output system.**
- **Manual, triggered, or recurring sweep mode.**
- **Excellent flatness and display linearity.**

**SPECIFICATIONS**
Frequency Range: 1 to 2500 MHz.
RF Output: Continuously adjustable from +13 dBm to –77 dBm.
Output Flatness: ±0.5 dB.
Display Linearity: 1%.
Spurious Signals: –30 dB.
Marker Accuracy: 0.005%.
**Price: $2,700.**

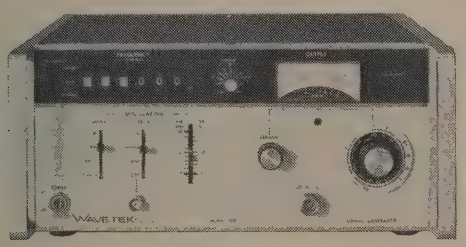
## MODEL 1901C
## DISPLAY OSCILLOSCOPE



- **Large 12-inch diagonal CRT.**
- **1 mV/ division sensitivity.**
- **Bright, well-focused trace.**
- **Ideal for production test applications.**

**SPECIFICATIONS**
CRT Display: 12-inch diagonal.
Deflection: Magnetic.
Acceleration Voltage: 9 kV nominal.
Phosphor:
P1 (medium persistence); P4 and P7 available as options.
Vertical Bandwidth: DC to 15 kHz.
Horizontal Linearity: 3%.
**Price: $545.**

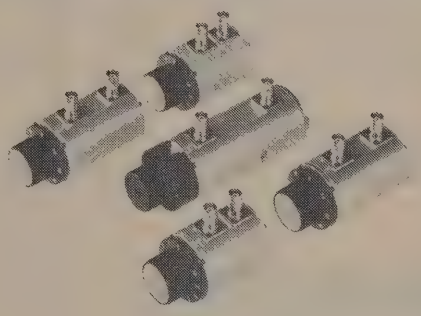
## MODEL 3001 SIGNAL GENERATOR



- **1 MHz to 520 MHz with 1 kHz resolution.**
- **Over-all frequency accuracy of 0.001%.**
- **Phase-lock stability.**
- **External and internal frequency standard options.**
- **Built-in frequency programmability.**
- **Calibrated output from +13 dBm to –137 dBm.**
- **Internal and external AM/FM capability.**

**SPECIFICATIONS**
Frequency Range: 1 MHz to 520 MHz.
Resolution: 1 kHz.
Accuracy: CW, FM, and AM modes: 0.001%.
Stability: CW, AM, and FM modes: 0.2 ppm/hour. (optional to 0.005 ppm/day.)
Power Level: +13 dBm to –137 dBm.
Residual FM: Typically 200 Hz.
AM/FM Modulation: Internal—400 Hz and 1 kHz.
Programmability: Frequency is digitally programmable (programmable output level available as an option).
**Price: $2,750.**

## SERIES 5000 ATTENUATORS



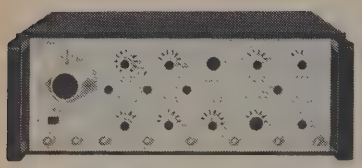
- **Broadband operation.**
- **Low VSWR.**
- **High repeatable accuracy.**
- **Ideal for systems manufacturers, plant and field use.**

**SPECIFICATIONS**
Frequency Range: DC to 2,000 MHz.
Impedance: 50 ohms (75-ohm units also available).
Attenuation:
Model 5001: 0–1 in 0.1 dB steps.
Model 5010: 0–10 in 1 dB steps.
Model 5070: 0–70 in 10 dB steps.
Model 5080: 0–80 in 1 dB steps.
**Prices: Models 5001, 5010, and 5070: $95.**
**Model 5080: $195.**

WAVETEK®
**Indiana Incorporated**
**66 North First Avenue, P.O. Box 190**
**Beech Grove, Indiana 46107 (317) 783-3221**

WAVETEK® P.O. Box 651, San Diego, CA 92112 Phone (714) 279-2200. TWX 910-335-2007

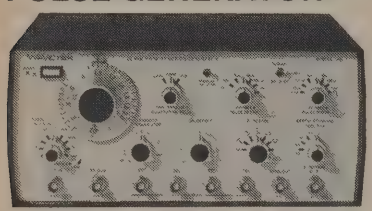
## 50 MHz PULSE/ FUNCTION GENERATOR



Model 166

**Pulse and Functions**
The Model 166 Pulse/Function Generator fills your requirement for a truly versatile laboratory instrument. It is a swept sine, square and triangle function generator for your analog applications, and a pulse generator with time, width, and transition control for your digital testing requirements.
**0.0001 Hz to 50 MHz Range**
The full frequency range of 0.0001 Hz to 50 MHz gives you the frequency and repetition rates in greater ranges than normally found in function or pulse generators alone. The sine, triangle, square, haverwave and ramp waveforms and the pulses can be output in a variety of modes.
**AM and FM**
To round out the versatility of the Model 166, the output pulse as well as the functions can be amplitude and frequency modulated with an ac signal or amplitude and frequency controlled with a remote dc signal. Amplitude modulation can be to 200% for a suppressed carrier operation.
**PRICE** (FOB San Diego) **$1695**

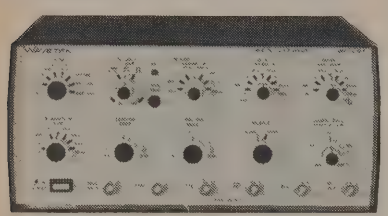
## 20 MHz FUNCTION/ PULSE GENERATOR



Model 145

The Model 145 offers both the versatility of a function generator and the precise requirements of a pulse generator—both at a cost much lower than that of separate instruments. It operates over a frequency range of 0.001 Hz to 20 MHz, providing sine, square and triangle functions, plus pulse and inverted pulse. With a simple turn of the mode switch, the instrument can be a precision waveform generator with versatile function generator features or a precision pulse generator with controllable period, delay and width. The output of the generator is variable to a full 30 volts peak to peak with simultaneous ECL, $\overline{\text{ECL}}$, TTL and $\overline{\text{TTL}}$ outputs, and an output sync signal. Features used in either mode include triggering and gating with manual pushbutton or external signals; external voltage control of frequency/period; signal baseline offset; 0 to 60 dB attenuation; and a 0 to +2V signal output proportional to the generator frequency/ period.
**PRICE** (FOB San Diego) **$995**

## PULSE GENERATOR



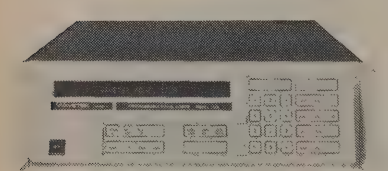
Model 801

The Model 801 is a 50 MHz pulse generator with full pulse shaping and triggering control. Its versatile output system lets you have a variable output and fixed ECL, $\overline{\text{ECL}}$ and TTL outputs simultaneously. You can complement the outputs, independently adjust both levels of the variable output from −20 to +20 volts (20V p-p max) and adjust the rise and fall from <5 ns to 250 ns. All pulses can be fully shaped with independent width, rate and delay controls.

Not only do you get full pulse capability, but also format versatility. Operating modes include continuous, triggered and gated for both single and double pulses. A burst mode gives you an exact number of pulses with each triggering. Another mode allows you to reconstruct or reshape pulses.

Triggering is by a front-panel switch or an external signal. A front-panel LED indicates trigger acceptance. You can trigger and gate on the rising or falling edge of the trigger signal and a particular trigger signal level.
**PRICE** (FOB San Diego) **$995**

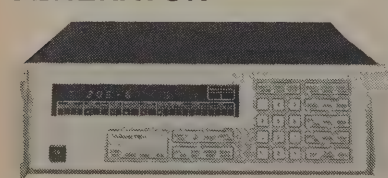
## PROGRAMMABLE SIGNAL SOURCE



Model 172A

The Model 172A provides top system performance in its standard configuration and offers a versatile package of options that allows it to perform multiple tasks in systems applications.
**Microprocessor Control**
The instrument features a microprocessor-controlled interface and preprocessor to simplify programming and application of the instrument. The microprocessor numeric capability relieves the system controller from formatting responsibility.
**Multiple Waveforms**
The 172A generates sine, square, triangle, ramp, pulse, haversine, and havertriangle waveforms. A no-waveform or dc mode can also be programmed which expands the versatility of the unit to a dc supply with a 50 ohm source impedance. All waveforms may be phase-locked to your external frequency for system frequency coherence.
**GPIB Compatibility and Programming Versatility**
The standard Model 172A accepts synchronous, bit parallel, byte serial ASCII programming. For greater versatility, an option is available which fully conforms to the requirements of IEEE 488-1975, the General Purpose Interface Bus (GPIB).
**Other Features**
As standard features, the Model 172A also offers sweep and FM capability, trigger and tone burst, and variable symmetry.
**PRICE** (FOB San Diego) **$4300**

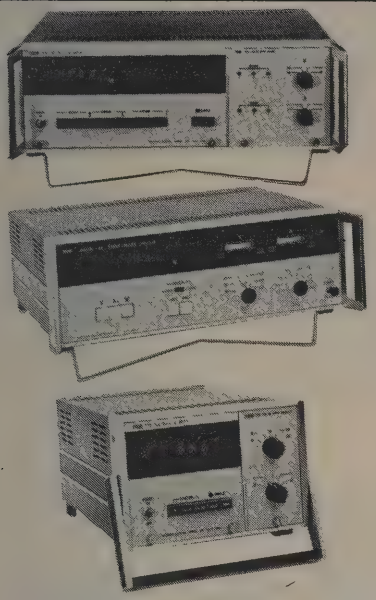
## ARBITRARY WAVEFORM GENERATOR



Model 175

**Generate Custom Waveforms**
Not only does this Arbitrary Waveform Generator give you sine, square, triangle and ramp waveforms, it lets you generate any waveform that can be expressed as a function of time. The working Random Access Memory (RAM) has 4 sets of 256 addresses and each address accepts an 8-bit word. This corresponds to a 1024 (time) by 255 (amplitude) matrix in which to draw waveforms. These storage addresses can be manually loaded by front panel controls or remotely loaded via the GPIB interface. The stored waveform, or any portion thereof, then can be generated at selectable clock rates and amplitudes.
**Fixed and Variable Waveform Storage**
In addition to four working RAMs, provisions are made for storage of up to four waveforms in Programmable Read Only Memory (PROM). Waveforms that are used repetitively may be stored in the PROMs, then called up without reloading. This permits storing your normal waveforms in the PROMs and saving the RAM for unusual requirements.
**PRICE** (FOB San Diego) **$3995**

# YEW Precision Electrical Measurement Instrumentation



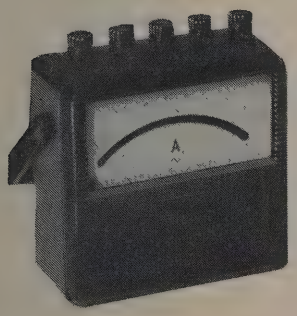
## PRECISION DIGITAL AC POWER INSTRUMENTATION

**YEW's offers a complete line of digital precision low frequency instrumentation for True RMS Volts/Amps and Watts to ±0.01% accuracy.**

| Model | Accuracy | Range * V | Range * A | Frequency Range | Approx. Price |
|---|---|---|---|---|---|
| APR-2 | ±0.01% | 120 | 5 | DC & 60 Hz | $18,000 |
| 2885-16 1φ, 2W | ±0.03% | 75/100/ 150/300 | 0.5/1/2 5/10/20 | 20 Hz - 10 kHz | $ 5,995 |
| 2503-01 1φ, 2W | ±0.1% | 3/10/30/100/ 300/600 | 0.1/0.3/1/ 3/6/10/30 | Watts 40 Hz to 1.2 kHz V & A 25 Hz to 2 kHz | $ 5,170 |
| 2503-03 3φ, 3W | ±0.1% | 3/10/30/100/ 300/600 | 0.1/0.5/1/ 3/6/10/30 | | $ 7,705 |
| 2504 1φ, 2W | ±0.25% | 30/60/100/ 150/300 | 0.5/1/2/ 5/10 | | $ 2,948 |
| 2505 3φ, 4W | ±0.25% | 100/150/ 300/600 | 2/5/10/20 | | $ 7,950 |
| 2509 1φ, 2W | ±0.5% | 70/250 | 1/2/5/10 | 40 Hz to 400 Hz | $ 1,250 |

* Watt Range — VA at unity power factor.
**NOTE:** Above instruments useable from 0.0 P.F. to 1.0 (unity) P.F.

## Taut-band Precision Portables



**YEW is the world's largest and most respected manufacturer of precision, tautband, 0.5% portable instruments.**

### FEATURES:

- **Full One Year Warranty**
- **Fast and Complete Service Facilities Manned by Factory Personnel**
- **Lowest Prices in the Field**
- **Guaranteed 0.5% Accuracy Traceable to N.B.S.**
- **Tautband Friction-Free Meter Movements**

## AMMETERS AND VOLTMETERS

Specifications: DC: Moving Coil, AC: Iron Vane, Accuracy: ±0.5%, Scale Length: 130 mm

| Model | Range |
|---|---|
| 2011-01 | DC 3/10/30/100uA |
| 2011-02 | DC 10/30/100/300uA |
| 2011-03 | DC 0.1/0.3/1/3mA |
| 2011-04 | DC 1/3/10/30mA |
| 2011-05 | DC 10/30/100/300mA |
| 2011-06 | DC 0.1/0.3/1/3A |
| 2011-07 | DC 1/3/10/30A |
| 2011-08 | DC 0.3/1/3/10V |
| 2011-09 | DC 3/10/30/100V |
| 2011-10 | DC 30/100/300/1000V |
| 2013-01 | AC 20/100mA |
| 2013-02 | AC 50/250mA |
| 2013-03 | AC 100/500mA |
| 2013-04 | AC 0.2/.1A |
| 2013-05 | AC 0.5/2.5A |
| 2013-06 | AC 1/5A |
| 2013-07 | AC 2/10A |
| 2013-08 | AC 5/25A |
| 2013-09 | AC 10/50A |
| 2013-10 | AC 20/50/100/200mA |
| 2013-11 | AC 0.1/0.2/0.5/1A |
| 2013-12 | AC 0.5/1/2/5A |
| 2013-13 | AC 2/5/10/20A |
| 2013-14 | AC 10/20/50/100A |
| 2013-15 | AC 15/30V |
| 2013-16 | AC 30/75V |
| 2013-17 | AC 75/150V |
| 2013-18 | AC 150/300V |
| 2013-19 | AC 300/750V |
| 2013-28 | AC 150/300/600V |
| 2013-99 | AC 150/300/750V |

**Price: $161.00 to $176.00**

## MULTI-RANGE AC AND DC METERS

Specifications — Same as 2011 and 2013

| Model | Range |
|---|---|
| 2012-00 | DC 17 Range, Voltage: up to 1000V. Current: up to 30A **Price: $332.00** |
| 2014-00 | AC 13 Range, Voltage: up to 750V, Current: up to 30A **Price: $309.00** |

## WATTMETER

Specifications — Electrodynamometer, Accuracy: ±0.5%, Scale Length: 130 mm, Frequency: DC, 25 Hz to 1 kHz

| Model | Range |
|---|---|
| 2041-01 | 0.2/1A 120/240V |
| 2041-02 | 1/5A 120/240V |
| 2041-03 | 5/25A 120/240V |
| 2041-11 | 0.2/1A 120/240V PF 0.2 |
| 2041-12 | 1/5A 120/240V PF 0.2 |
| 2041-13 | 5/25A 120/240V PF 0.2 |
| 2041-21 | 0.2/1A 30/60V PF 0.2 |
| 2041-22 | 1/5A 30/60V PF 0.2 |
| 2042-01 | 0.2/1A 120/240V (3 phases) |
| 2042-02 | 1/5A 120/240V (3 phases) |
| 2042-03 | 5/25A 120/240V (3 phases) |

**Price: $365.00 to $524.00**

## HIGH FREQUENCY METERS

Specifications — Thermocouple, Accuracy: ±0.5% (60 Hz) for Voltmeter, ±1.0% (60 Hz) for Ammeter, Frequency: up to 100 kHz for Voltmeter, Maximum: up to 5 MHz for Ammeter, Scale Length: 130 mm

| Model | Range |
|---|---|
| 2016-01 | 5/10/20/50mA |
| 2016-02 | 20/50/100/200mA |
| 2016-03 | 100/200/500/1000mA |
| 2016-04 | 15/30/75/150V |

**Price: $434.00**

YEW® YOKOGAWA CORPORATION OF AMERICA
Dept. EM, 5 Westchester Plaza
Elmsford, New York 10523
Phone: (914) 592-6767
TWX: 710-567-1256

*60 Years of Measuring and Recording Instrumentation*

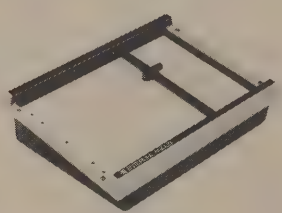
# Instruments for Data Acquisition, Analysis, Recording, and Controlling

High performance recorders—here now to help you track processes, power, experiments, tests, and pollution. The line includes servo, direct writing and event recorders; miniature recorders; two of the lowest-cost programmable data acquisition systems available; and high performance X-Y recorders. Gas analysis systems and components available for continuous stack, ambient air monitoring, and process control.

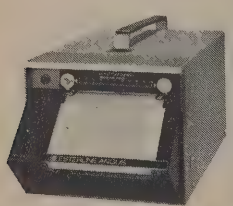
ESTERLINE ANGUS
AN ESTERLINE COMPANY

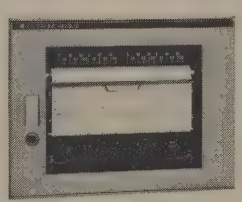
**Key-Programmable Data System (PD-2064):** Gathers analog and digital data in the field, lab, and plant on up to 248 channels, pushbutton-controlled through an 11-function keyboard and microprocessor setup. Functions in the self-contained system include signal conditioning, crystal controlled clocking, measurement as fast as 25 channels/second, optional high/low alarms, two outputs plus LED display, integration. Special ROM programs and Program Bank available. Remote programming too. **Write for Bulletin B110.** Base price $4350.

**Count/Time Data Systems (C/TDS):** Appears similar to the PD-2064, the C/TDS models DE2100 and DE2101 gather production, research, and traffic study data on up to 248 channels. On each channel they record number of switch operations or totalize On-time duration with printed tape and computer-compatible outputs listing performance by channel for the last minute, hour, 8 hours, or month. Key programming through microprocessor makes C/TDS extremely versatile. Optional alarms. Highly protected against the worst electrical environments. **Write for Bulletin B130.** Base price $3800.

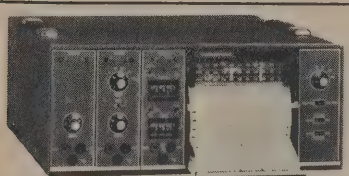


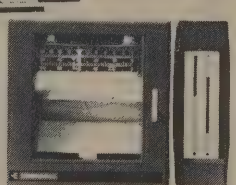
**X-Y recorders for every need:** Model 530 is for general lab use, with a sensitivity of 1 mV/in to 10 V/in. Model 540 is a two-pen crossover ideal for analytical readout, plotting dependent vs. independent voltages, or statistical plotting. Model 575 is stripped down for OEM applications, or order with add-on multirange module. Slew speed 45 ips both axes. Pen drop repeat rate of 45 cycles/sec. **Write for Bulletin E500.** Prices begin $1085.



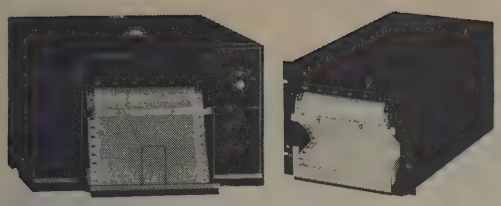


**Direct writing recorders:** Widest range of direct writing instruments—from 4½″ single channel curvilinear to four 2³⁄₁₆″ channel Rectigraph recorders. Electrodynamometer or permanent magnet moving coil types. To record (generally) mA, A, V, W, Vars, KVA, frequency, pressure, vacuum, speed, position. Electric or spring drives with hr., min., and sec. chart speeds. From $620. **Bulletin C200.**



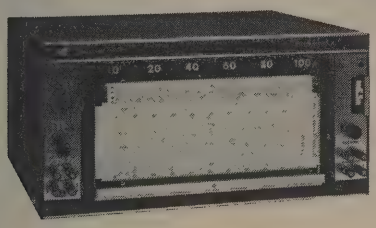


**Miniservo® III recorders for lab or industry:** 1, 2 or 3 pens per servo recorder with independent amplifier per channel. Lab model features flexible building block concept with a selection of five interchangeable plug-in amplifiers from 1MVDC, AZAS and four chart drives. Bench case, 10 cm chart width. Base price $895. **Bulletin F610.** Industrial Miniservo III has built-in transmitter loop power supply ideal for process industry. Seismic approved. 7″ x 7″ panel mounted. **Bulletin F620.** Base price $550.



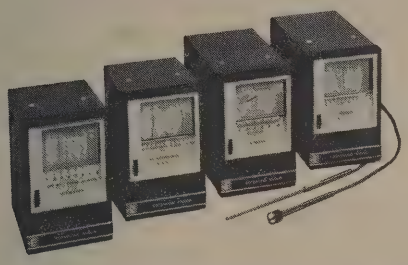
**Miniservo® recorders:** Basic OEM unit (right) starts at $335. **Bulletin F611.** Stock benchmount model (left) includes selectable chart speeds, multi-span—1MVDC to 100V with ± full scale zero adjust or Adjustable Zero, Adjustable Span (AZAS)—span from 1 MV to 100 VDC full scale, adjustable zero of ±100 VDC. Models: AC, battery-powered DC with AC rectifier/charger. Prices begin at $595. **Bulletins F612 through F615.**

---



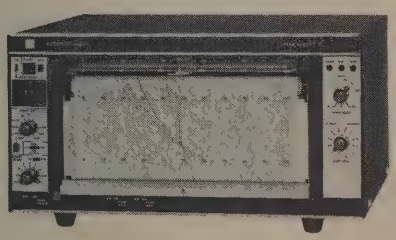
**Speed Servo® II recorders:** Single pen, two-pen crossover, two-pen side-by-side. 0.3 sec. response, 10″ recorder available fully equipped for versatile lab use or stripped for OEM use. All feature linear servo motor, wireless feedback potentiometer, and disposable writing system or inkless writing system. 2, 5, or 10 chart speed drives; accessible front controls 0.5 mV-100 VDC input spans; E, J, K, R, S and T thermocouple compatible. Alarms. Bench, rack mount or panel mount styles. Prices from $1150.

---



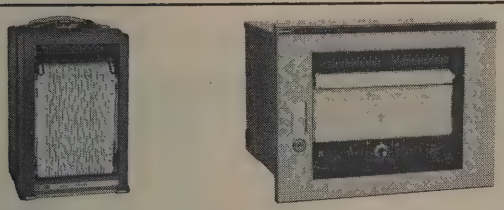
**Minigraph recorders:** Small low cost analog single channel, two-channel, time share and temperature inkless recorders available in 70 chart speeds. For lab, industry, education. Priced from $122. **Hook-on current transformer:** 50 or 60 Hz, indoor rated (to 750 V), 5-250 amp range dialset. $219. **Event Minigraphs:** for 4 or 8 channel on/off or yes/no applications. From $139. **Request Bulletins C230, C231, and D330.**

---



**Ink and inkless multipoint:** A 24- or 48-point 10″ rotary servo recorder with ink system with 1½ sec. print rate. Slide switch selects points to be deleted or printed. 1 mV minimum span. From $1850. Inkless multipoint recorder thermally brands analog data on up to 24 channels at 1 second print rate on 10″ heat-sensitive chart. Universal input panel accepts millivolt/volt or thermocouple inputs. Options include channel print/skip switches, dual range control, alarms, and time/I.D. recording. From $1725. **Ink Bulletin F600. Inkless Bulletin F720.**

---



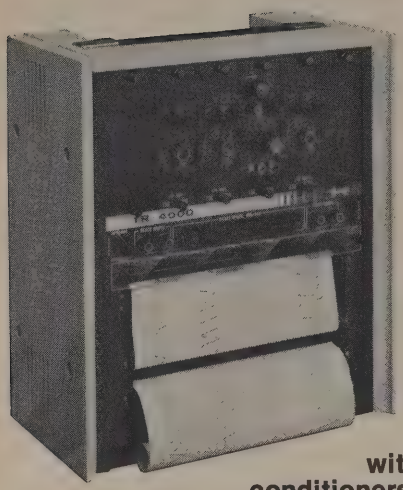
**Event recorders:** 5, 10, 15, 20 or 40 channels ink or inkless for yes-no, on-off recording of events. 8″ x 8″ flush cases, front switch board or wall mounted cases, too. Electric or spring chart drives with hour, minute and second speeds. Hundreds of varieties possible in A, E, or S Series. Prices from $610.

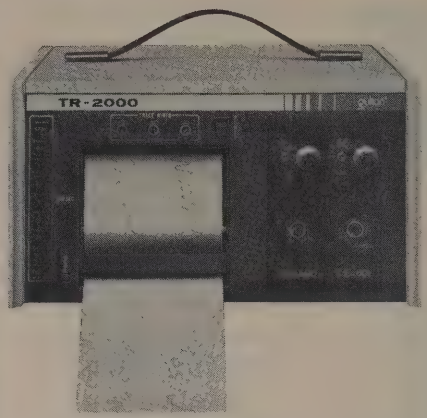
---

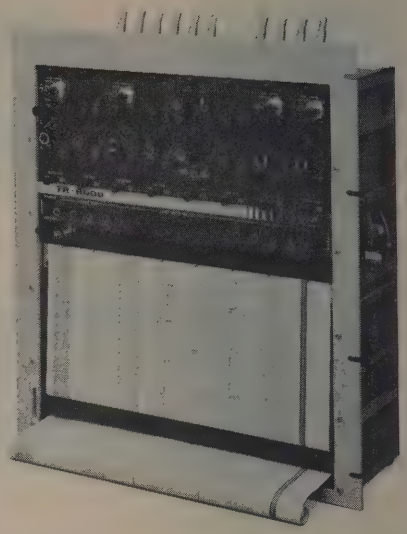
**Gas analysis systems and opacity monitors:** Includes visible emission monitor for stacks to meet EPA and local codes. Automatic continuous process monitoring and control, and ambient air monitoring of parameters such as CO, $CO_2$, HC, $NO_x$ and many others. Closed loop components —controllers, transmitters, transducers—available. **Write for Bulletin G1300 and application questionnaire for gas analysis, and Bulletin G1305 for opacity monitor.**

**Esterline Angus Instrument Corporation**
**Box 24000**
**Indianapolis, Indiana 46224**
**Tel. (317) 244-7611**

# oscillographic recorders





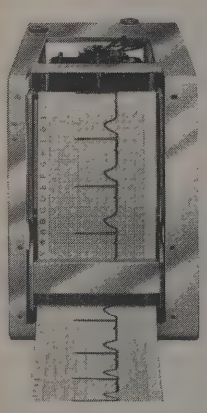
**2, 4, 6 and 8-channel recorders with interchangeable plug-in signal conditioners . . . the smallest, lightest, most versatile portable multichannel recorders available.**

**Compare these features with any other recorder's:**

**True portability:** for example, our 8-channel recorder weighs only 65 lbs. and measures 17½″ x 19″ x 6″. Our two channel is only 30 lbs.
**Frequency response:** 140 Hz (−3dB)
**Thirty interchangeable signal conditioners:** provide recording of volts, millivolts, microvolts (down to 15 uV/division), temperature (thermocouple and thermistor), ac and dc strain, frequency to dc, EKG, log to dc, watts and more (see below).
**Chart speeds:** 8-speed pushbutton chart drive (0.5 to 100 mm/sec.) is standard on all models.
**Writing:** Coaxial or nearly indestructible ceramic tip heated stylus on rectilinear chart paper produces high trace quality.
**Delivery:** two weeks delivery in many cases.
**Available on GSA.**

## PLUG-IN SIGNAL CONDITIONERS FOR GULTON PORTABLE MULTICHANNELS

- ☐ TSC-800 LOW GAIN—Low cost. Single span. 10 mV/div. sensitivity.
- ☐ TSC-801 MEDIUM GAIN—1 mV/div. sensitivity.
- ☐ TSC-810 LOW GAIN—10 mV/div. sensitivity.
- ☐ TSC-820 HIGH GAIN—10 uV/div. sensitivity. For use with strain gage transducers.
- ☐ TSC-510 AC STRAIN—5 uV RMS/div. For use with strain gages, LVDT's, and variable reluctance transducers. Toggle switch permits bypass of signal conditioning circuitry.
- ☐ TSC-500 J, T, K or E—Preamps with thermocouple compensation.
- ☐ TSC-811 CURRENT TO DC—Monitor currents from 1 to 20 mA. Four ranges.
- ☐ TSC-815 DIAL PULSING & TONE BURST MONITOR—For monitoring telephone communications.
- ☐ TSC-822 HIGH GAIN—Same as TSC-820, except without DC excitation.
- ☐ TSC-823 HIGH/LOW GAIN—Two ranges: 5 uV/div. to 500 uV/div. and 5 mV/div. to 500 mV/div. Zero suppression.
- ☐ TSC-830 FREQUENCY TO DC CONVERTER—Input frequency range 10 Hz to 20 KHz.
- ☐ TSC-831 FREQUENCY TO DC CONVERTER—Same as TSC-830, but with f.s. range suppression and 10X scale expansion.
- ☐ TSC-840 AC TO DC CONVERTER—50 Hz to 100 kHz range. Inputs to 250 VRMS.
- ☐ TSC-840A AC TO DC CONVERTER—50 Hz to 100 kHz range. Inputs to 1000 VRMS.
- ☐ TSC-841 AC TO DC CONVERTER—100A to 1000A. Use with clamp-on current transformer.
- ☐ TSC-843 COMMUNICATIONS PREAMP—Converts AC to log. Records DC signals up to 100 Hz.
- ☐ TSC-850 EKG SIGNAL CONDITIONER—For research and laboratory diagnostic use.
- ☐ TSC-870 MEDICAL THERMISTOR PROBE—Temperature range 50° to 113°F.
- ☐ TSC-871 INDUSTRIAL THERMISTOR PROBE—Temperature range 0° to 100°C.
- ☐ TSC-880 LOG TO DC—Range −80 dB to +40 dB over 50 Hz to 100 kHz.

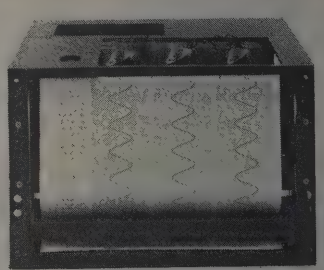


## OEM Recorders

**Standard or custom recorders • complete systems designed for your application**

- ☐ 1, 2, 3, 3½, 4, 5, 6 and 8 channel recorders with two year warranty on recorder body.
- ☐ Select position feedback or velocity galvanometer models.
- ☐ Alphanumeric thermal printing available; either single line or up to 12 lines.
- ☐ Three types of styli available: 1) strut type, 2) coaxial with six month warranty or 3) long life ceramic tip with two year warranty.
- ☐ Frequency response up to 140 Hz.
- ☐ Low power consumption miniature dc models available with multi-speed option.
- ☐ UL listed units.
- ☐ Models designed to satisfy AHA requirements.
- ☐ 90 Days delivery on most recorders.
- ☐ Special requirements easily met.

Call or write for application questionnaire and catalog!



gulton®

**Measurement & Control Systems Division**
Gulton Industries Inc., East Greenwich, Rhode Island 02818
401-884-6800 • TWX 710-387-1500

# Rustrak chart recorders

## Standard miniature recorders

Rustrak miniature chart recorders generally measure 5⅝″ h x 3⅝″ w x 4⅛″ d, and offer a wide range of sensitivities, writing and chart speeds. Accuracy is typically ±2% of full scale and response time is 0.8 to 1.0 seconds. The recorders operate in both chart rewind and tear-off modes. Chart width of single channel recorders is 2⁵⁄₁₆″, dual channels 1″ each. Multichannel recorders are available containing either two or three full width channels.

**Single Channel DC Recorders**
Ranges from 0-10 uA to 0-5 A; 0-10 mV to 0-500 V. Voltage and current ranges available. Chart speeds from 1/32″/hr. to 480″/hr. AC models also available.

**Dual Channel DC Recorders**
Two channels with dual galvanometer. Available in various combinations of current, voltage and temperature. AC models also available.

**Temperature Recorders**
Thermocouple, thermistor or RTD recorders available. Ranges from −100°F to +2400°F. Custom spans as narrow as 25°F. Also available in °C and in single, two or three channels.

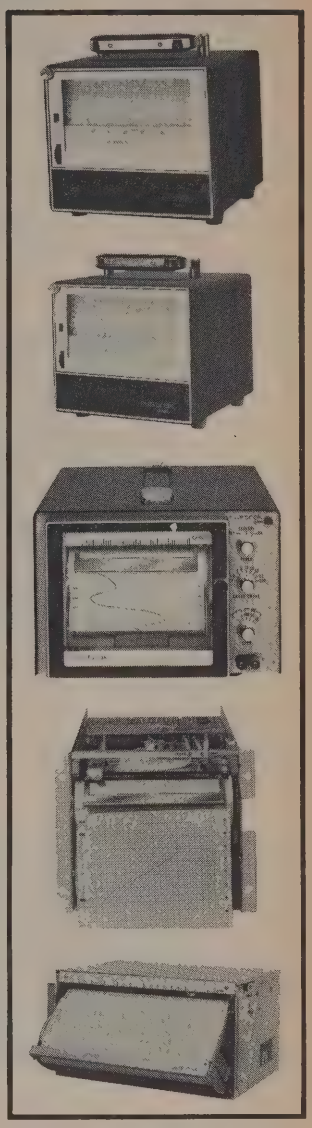
**Power Recorders**
Select full scale ranges from 500 watts to more than two megawatts. For single or three phase systems. Full month's recording on one roll of chart paper.

**Event Recorders**
4, 8, 16, 24 channels. Chart speeds to 50″/min. with definition of up to 16 events/sec.

**RH/Temperature Recorder**
Electronically monitors relative humidity from 10% to 90% and temperature from 60°F to 90°F on a single chart. Two months of operation on a single roll of chart paper.

**Continuous Writing Recorder**
100 mV direct writing recorder offers 1 MΩ input impedance and solid state amplifiers. Series of plug-ins available for current, voltage, temperature measurement.

## New wide chart recorders



**4″ Galvanometric Recorders — Series 7000**—Record volts, amps, temperature, many other variables. 4″ Calibrated chart width. One to four traces (time shared). Up to three events. Reliable inkless pressure writing, 1 sec. response. 30 day operation unattended. AC or DC operation. Dual width models available.

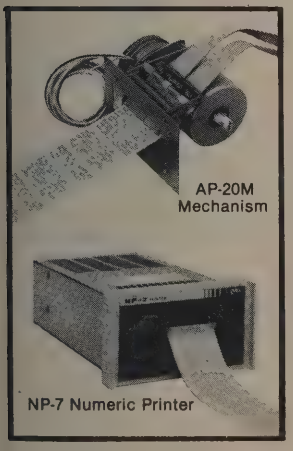
**4″ Continuous Writing Potentiometric Recorder With Plug-In Signal Conditioners — Series 6400**—Record current, voltage, temperature, up to three events. Inkless pressure writing. AC or DC operation. Dual width models available.

**4″ Continuous Writing Potentiometric Laboratory Recorder With Plug-In Range Cards — Series 500.**—Record current, voltage, temperature. Reroll, tearoff or Z-fold chart styles. Single or multiple spans. Single or multiple chart speeds. Event marker and low and high alarm contact options. Half second full scale response. Convenient disposable ink cartridge.

**4″ Continuous Writing Potentiometric OEM Recorder — Model 505**—Case depth only 7¼″. Fixed span. Record voltage, current, temperature. Reroll, tearoff or Z-fold chart styles. Half second full scale response. Disposable fiber-tip ink cartridge.

**10″ Continuous Writing Recorder With Plug-In Range Cards — Model 1025**—10″ Calibrated chart. Disposable fiber tip ink cartridge. OEM rack mount. Record voltage, current, temperature. Full scale response is 0.25 second. One or two event markers are optional. Accuracy is ±0.25%. Reroll or tearoff chart operation.

# Fixed head digital thermal printers and mechanisms




Gulton's fixed head approach to thermal printing takes advantage of the quietness and reliability of solid state switching. Compare: only one moving part — the paper drive; independence from ink supplies and ribbon mechanisms, high character quality versus any other printing technique such as moving head, print solenoids, wire matrix, decade or electrosensitive (RFI problems).

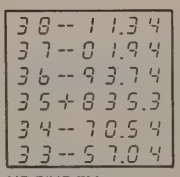
☐ AP-20 alphanumeric dot matrix printer accepts a character serial bit parallel interface in 64 character ASCII code. Provides 20 columns of 5x7 characters at up to 2.5 lines/sec (RS232C, 20 mA current loop and IEEE STD 488 bus interfaces optional.)

☐ NP-7 accepts parallel BCD inputs. Provides 7 columns of exceptional quality 7 segment numerals. Up to 4 lines/sec.

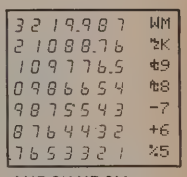
☐ ANP-9 accepts parallel BCD inputs. Similar to NP-7 but has 2 additional alphanumeric dot matrix I.D. columns. Up to 2.5 lines/sec.

☐ Mechanisms AP-20M, NP-7M and ANP-9M are available.

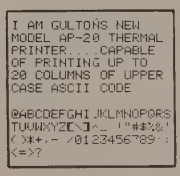
☐ NEW mechanism GAP-101M for simultaneous analog, alphanumeric (10 col. 7x9 or 16 col. 5x7) and grid printing.



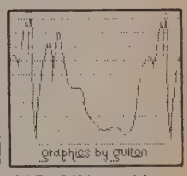
NP-7/NP-7M printout



ANP-9/ANP-9M printout




AP-20/AP-20M printout




GAP-101M graphic printout

gulton®

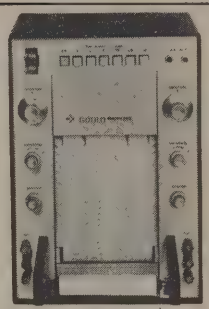
**Measurement & Control Systems Division** Gulton Industries Inc., East Greenwich, Rhode Island 02818 401-884-6800 • TWX 710-387-1500

# Gould Brush Analog Recording Systems. The Most complete Line.

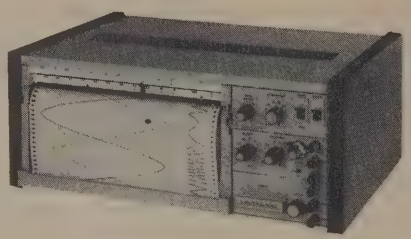
Gould Brush direct writing recorders produce written records of highest accuracy, trace clarity, crispness and uniformity.

Gould offers a complete selection of general purpose, high performance direct writing and strip chart recorders with many exclusive features.

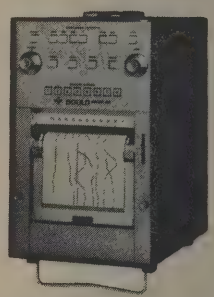
Most models are available in both portable and rack mounted versions. These quality recorders are ideally suited for industrial and scientific applications that require the highest precision, sensitivity and accuracy.



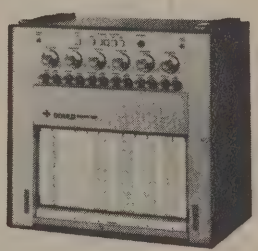
Gould Brush 222•2-CHANNEL. Portable battery operated version of Brush 220 recorder. Internal recharger. 30Hz frequency response. Sensitivity 1mV/div. to 500Vf.s.



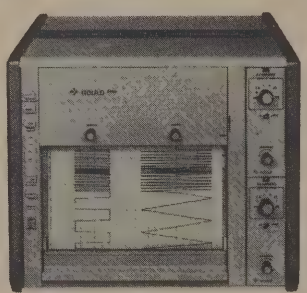
Gould Brush 110 STRIP CHART. Most versatile 10-inch recorder. One or two channels; integrator optional. Lifetime thermal pen guarantee. 0.25 sec. f.s. response.



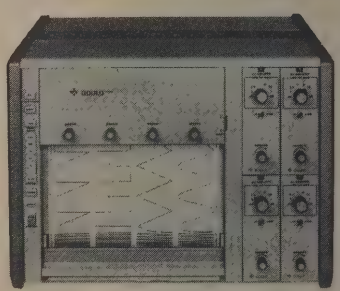
Gould Brush 816•8-CHANNEL HI-SPEED MULTIPOINT. Data is recorded at a rate 2 sec. / point to 16 points / sec.



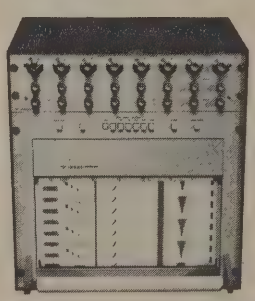
Gould Brush 260•6-CHANNEL. High precision and operator conveniences. Built-in preamps. 1mV/div. to 500Vf.s. sensitivity.



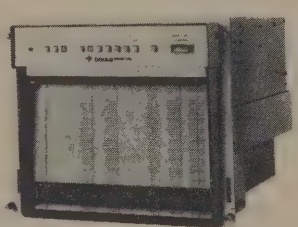
Gould Brush 2400 • 2-CHANNEL. Channels are a true 100mm wide. Plug-in preamps. 30Hz frequency response.



Gould Brush 2400 • 4-CHANNEL. 50mm channels, 50Hz frequency response, 99.65% linearity.



Gould Brush 481 • 8-CHANNEL. 1mV/div. to 500 V f.s. sensitity. Model 480 available without preamps.



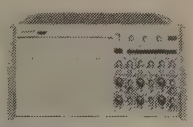
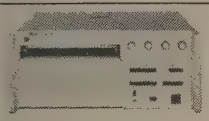
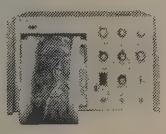
Gould Brush 200 • 8-CHANNEL. The world's standard for high performance recorders. Tailored to your specific requirements.

For more information contact, Gould Inc., Instruments Division, 3631 Perkins Ave., Cleveland, Ohio, 44114. Or Gould Alco S.A., 57 rue St. Sauveur, 91160, Ballainvilliers, France.

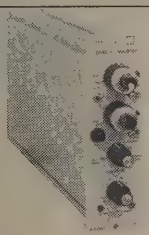
**For brochure, call toll free (800) 325-6400, Ext. 77.** (in Missouri: (800) 342-6600)

GOULD

# Honeywell High-Performance Oscillographic Recorders

| Model | Type/Response | No. of Channels | Comments |
|---|---|---|---|
| 1858 Visicorder  | Direct writing fiber-optic CRT. DC to 5 kHz sine wave, DC to 15 kHz square wave, 0.1 to 120 inch/sec record speed. | Up to 18; expandable to 32 with auxiliary housing. | Complete, self-contained oscillographic data acquisition system supported by eight different plug-in signal conditioning modules. Eight-inch paper. |
| 1508B Visicorder  | Direct writing galvanometer. DC to 25 kHz. | Up to 24, plus 4 for event recording. | Combines high-linearity optical system with sensitive galvanometers to produce extremely accurate recordings. Eight-inch paper. |
| 1508C Visicorder | | Up to 12, plus 2 for event recording. | |
| 1912 Visicorder | | Up to 36, plus 6 for event recording. | Versatile recorder accommodating 12-inch wide paper. Paper speeds from .005 to 200 inch/ sec. |
| 1856A Visicorder  | Linescan fiber-optic CRT. DC to 8 MHz, Z axis, DC to 75 kHz, Y axis, Scan rates to18000/sec, X axis. | Separate inputs for X, Y, and Z axes, variable chart speeds. | Particularly suitable for facsimile, spectrum analyzer readout, IR mapping and echocardiography since records have high resolution and wide gray scale. Record width 70 mm to 6 inches. Accessories for film records. OEM versions available. |
| 1806A Visicorder | Direct writing fiber-optic CRT. DC to 1 MHz, Y axis, DC to 10 MHz, Z axis, DC to 1 MHz, X axis, greater than 1,000,000 inch/sec writing speed. | | Capable of recording high-frequency signals that would otherwise require magnetic tape or oscilloscope camera techniques. Record width 70 mm to 6 inches. Accessories for film records. |

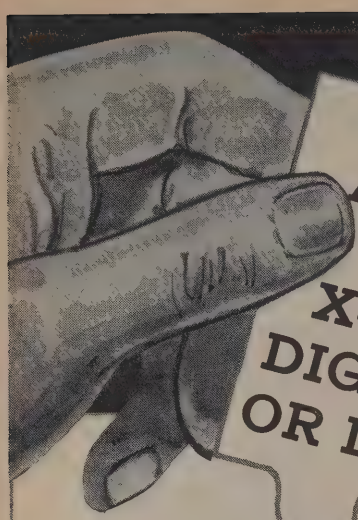
# Honeywell High-Performance Signal Conditioning Modules

| Model | Description |
|---|---|
| Accudata 218 Gage Control/Bridge Amplifier  | Controls excitation, balance and calibration of strain-gage transducers and provides signal amplification for almost any strain-gage application. Has optional automatic bridge balance. Accessory plug-in circuit cards provide for bridge-completion resistors and a choice of local, or local and remote, bipolar, two-step shunt calibration. This module also features three independent outputs for galvanometers, tape recorders and other recording or indicating devices. |
| Accudata 117 Multichannel DC Amplifier/ Attenuator | Direct-coupled, single-ended floating wideband amplifier of moderate gain for systems that use amplifiers to drive oscillograph galvanometers or magnetic tape recorders. Available in 4-, 6-, or 7-channel versions. |
| Accudata 118 Gage Control/Amplifier | Controls excitation, balance and calibration of strain-gage transducers used to measure force, pressure, acceleration, displacements, etc. Constant current or constant voltage excitation. Amplifier optional. |
| Accudata 122 and 123 Differential Wide Gain Range Amplifiers | May be used as differential, single-ended inverting or single-ended noninverting amplifier. Especially suitable for amplifying low-level signals where relatively high common mode voltages are encountered. Input sensitivity is from ±2 mV to ±300V. |
| Accudata 124 High Voltage Amplifier/Attenuator | Wide input range, ±50 mV to ±1000V, common mode voltage max ±1200V, excellent common mode rejection, four channels per housing. Also has three independent outputs for galvanometers, tape recorders or other indicating devices. |

**WE'LL SHOW YOU A BETTER WAY.**

**Honeywell**

Test Instruments Division, Box 5227, Denver, Colorado, 80217. (303) 771-4700



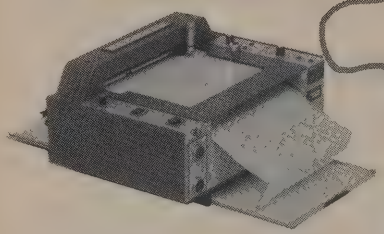
LOOKING FOR A STRIP CHART RECORDER, X-Y RECORDER, DIGITAL PLOTTER OR LINE PRINTER?

# Get the WHOLE PICTURE from HOUSTON INSTRUMENT

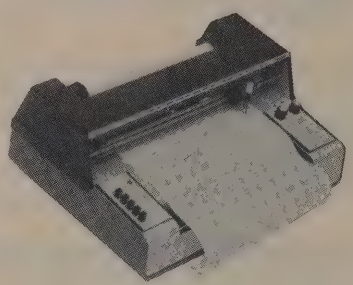
*"The recorder company"*

## CØMPLØT®
**Digital Plotters and Plotting Systems**

On line, offline and remote starting at $3550.*



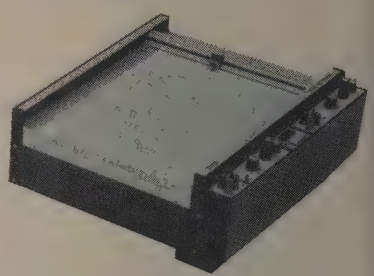
## OmniScribe®
**Strip Chart Recorders**



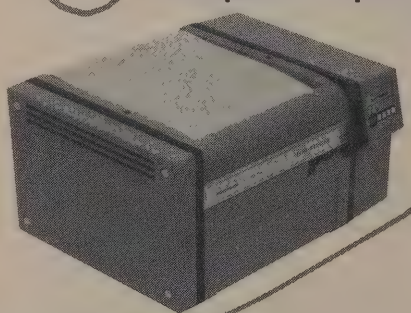
One or two pen 10" Strip Chart Recorders starting at $395.*

## Omnigraphic®
**X-Y Recorders**

General purpose or OEM. Scores of plug-in modules available starting at $950*



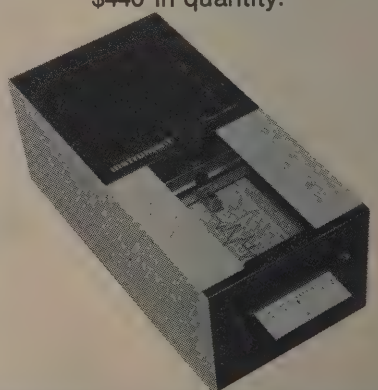
## Computer Peripheral Line Printers



2400 LPM — 80 column.
1400 LPM — 132 column.
Starting at $3000.*

## Standard 80 Column Computer Card Recorder

X-Y, T-Y, Incremental. For OEM's $440* in quantity.



**houston instrument** | **THE RECORDER COMPANY** | DIVISION OF BAUSCH & LOMB

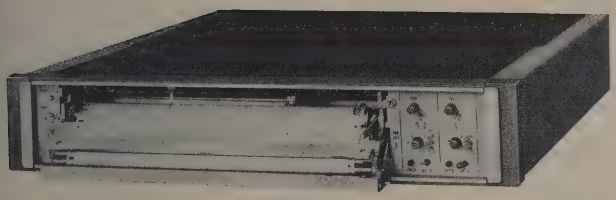
ONE HOUSTON SQUARE (at 8500 Cameron Road) AUSTIN, TEXAS 78753
(512) 837-2820 TWX 910-874-2022 cable HOINCO
TELECOPIER
EUROPEAN OFFICE Rochesterlaan 6 8240 Gistel Belgium
Phone 059/277445 Telex Bausch 81399

*U.S. Domestic Price Only ®Registered Trademark of Houston Instruments

LEEDS & NORTHRUP

North Wales, Pa. 19454
(215) 643-2000
Attn: MD 337-K

# Leeds & Northrup's Speedomax XL630 Lab/Test Recorder



## ...provides one or two pen 10″ wide recording in only 3½″ of vertical panel space

- **Unique Maxi-View™ chart drive feature provides "instant replay" of previous records**
- **10″ wide recording in only 3½″ of vertical panel space**
- **Disposable markers standard . . . thermal marking system optional**
- **One or two full scale, cross-over pens . . . English or metric calibration**
- **Lever-operated manual chart advance**
- **Single, dual or adjustable-zero, adjustable spans**
- **Wide selection of ranges**
- **Mechanical pen lifters standard . . . electrical lifters optional**
- **Meets ANSI C39.4-1966 Performance Standard and ANSI C39.5 (Proposed Safety Standard)**
- **Bench, rack or panel mount**
- **Electronic Off-Scale limit protection**

## Specifications

Recorder meets or exceeds specifications listed in ANSI Standard Specifications for Automatic Null-Balancing Electrical Measuring Instruments C39.4-1966 and ANSI C39.5-1974.

**Measuring Circuit**—D-c potentiometer.

**Record**—One or two channels with independent disposable markers. Thermal marking system optionally available for single-channel recorder.

**Range Spans**—Emf spans provided by interchangeable plug-in modules.

**Fixed Spans**—1 mV to 100 V d-c.

**Adjustable Spans**—(1) Low-Level AZAR (Adjustable Zero, Adjustable Range) Circuit provides selection of 1, 2, 5, 10, 20, 50 mV and 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, and 100 V d-c. (2) High-Level AZAR Circuit provides selection of 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, and 100 V d-c. Both AZAR circuits contain a continuously adjustable uncalibrated vernier between fixed span steps to provide a 2.5:1 span turndown. All spans are provided with an uncalibrated ±100% zero adjustment.

**Accuracy**—±0.25% of span.

**Dead Band**—≤0.1% of span.

**Span Step-Response-Time**—0.5 second for full scale response.

**Source Impedance**—≤25,000 ohms.

**Off-Balance Input Impedance**—Spans up to 100 mV: from 3.5 megohms at 1 Hz to 0.2 megohm at 40 Hz and above; Span 0.1 to 5 V: 3.5 megohms; Spans over 5 V: 2.5 megohms.

**Balance Input Impedance**—Spans up to 5 V: 30 megohms; Spans over 5 V: 2.5 megohms.

**Common Mode Rejection**—Greater than 80 dB at full source impedance.

**Normal Mode Rejection**—Greater than 40 dB at line frequency.

**Power Requirements**—Operates on 120 volts, 60 Hz or on 120, 220, or 240 volts, 50 Hz as specified.

**Power Consumption**—One Channel: 20 volt-amperes
Two Channels: 35 volt-amperes

**Chart**—9⅞ inches (250 millimeters) in calibrated width and 30 yards (about 27 meters) long.

**Chart Speeds**—Single or switch selection of two speeds (1 to 720 in/hr or 3 to 1800 cm/hr). Mechanical ten-speed changer (0.5 to 3600 in/hr or 1 to 7200 cm/hr). Electronic ten-speed changer (1 to 360 in/hr or 6 to 720 cm/hr).

**Pen Lifters**—Mechanical type. Solenoid operated type optionally available.

**Event Marker**—Optionally available for X1 channel only; equipped with disposable marker or thermal marking system.

**Scale**—An optional scale with pointers can be supplied.

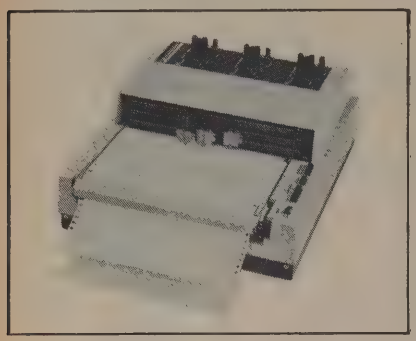
**Case**—Designed for panel, cabinet-type relay rack, telephone-type relay rack, or bench mounting. Chassis of panel, cabinet-type relay rack, or telephone-type relay rack recorder supported on drawer-type slides; bench-type recorder supported on four feet.

**Dimensions**—Panel, cabinet-type relay rack, or telephone-type relay rack recorders: 3½″ high by 19″ wide by 19½″ deep behind panel (89 mm × 483 mm × 495 mm). Bench type recorders: 4″ high by 19″ wide by 21¾″ deep (102 mm × 483 mm × 552 mm).

**Weight**—One-pen models, 27 lb (12.3 kg) and two-pen models, 37 lb (16.8 kg).

**SIMPLE RECORD REVIEW** Push a lever and unroll your chart for an "instant replay" review of previous record . . . then push and automatically rewind . . . all without stopping the regular chart drive. This unique feature gives you the chart visibility of "free fall" operation even when the chart is operated in the reroll mode.

# YEW Oscillographs & Recorders



## 3066 SERIES FLAT BED RECORDERS

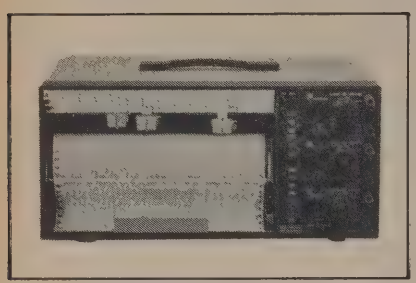
The 3066 Series of flat bed recorders are offered in one, two and three pen models covering a wide range of voltages — 19 ranges from 5μV/cm to 5V/cm in the high sensitivity model and 13 ranges from 0.5mV/cm to 5V/cm in the standard model. A long life conductive plastic potentiometer/DC servo system combined with a highly reliable pulse chart drive/tuning fork oscillator system results in unexcelled accuracy and dependability under the most adverse conditions.

Recorder flexibility is greatly enhanced through such options as remote control of chart drive, event markers, pen lift, chart reroll and take-up. Ease of operation results from the use of disportable felt tip pen assemblies.

**SPECIFICATIONS**
Channels: 1, 2 or 3
Accuracy: ±0.25% of span
Chart Width: 250mm
Ranges: 19 ranges, 5μV/cm to 5V/cm or 13 ranges, 5mV/cm to 5V/cm
Chart: Z-fold or roll chart
Chart Speeds: 2cm/hr to 60cm/min.
Pen Speed: 800mm/sec nominal
Common Mode Rej.: Greater than 140dB,AC or DC

**PRICE**

| Model | Channels | Sensitivity | Prices From |
|---|---|---|---|
| 3066-11 | 1 | Standard | $1175.00 |
| 3066-12 | 1 | High Sensitivity | 1368.00 |
| 3066-21 | 2 | Standard | 1675.00 |
| 3066-22 | 2 | High Sensitivity | 1995.00 |
| 3066-31 | 3 | Standard | 2358.00 |
| 3066-32 | 3 | High Sensitivity | 2924.00 |



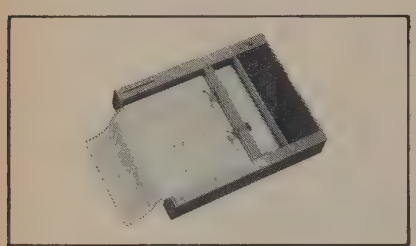
## 3056 SERIES LABORATORY RECORDERS

The 3066 Series of vertical pen laboratory recorders are self balancing potentiometric, 250mm full span units offered in 1, 2 and 3 pen models. Maximum sensitivity is 5μV/cm while overall accuracy for each channel is ±0.25% of effective recording span. A variety of remote control options provide maximum recorder flexibility while felt-tipped pens offer high definition and fast, easy replacement.

**SPECIFICATIONS**
Channels: 1, 2 or 3
Accuracy: ±0.25%
Chart Width: 250mm
Ranges: 19 ranges, 5μV/cm to 5V/cm or 13 ranges, 5mV/cm to 5V/cm
Chart: Z-fold
Chart Speeds: 2cm/hr to 60cm/min
Pen Speed: 800mm/sec nominal
Common Mode Rej.: Greater than 140dB, AC or DC

**PRICE**

| Model | Channels | Sensitivity | Prices From |
|---|---|---|---|
| 3056-11 | 1 | Standard | $1230.00 |
| 3056-12 | 1 | High | 1440.00 |
| 3056-21 | 2 | Standard | 1870.00 |
| 3056-22 | 2 | High | 2280.00 |
| 3056-31 | 3 | Standard | 2514.00 |
| 3056-32 | 3 | High | 3130.00 |



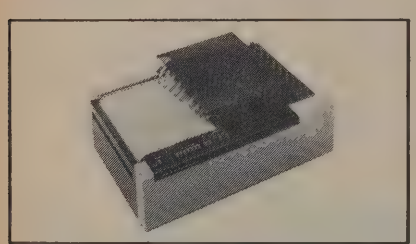
## 3036 SERIES X-Y RECORDER

The 3036 Series of X-Y recorder features 1 or 2 pen models with X-Y and X, $Y_1$ and $Y_2$ inputs on a full 250mm x 250mm chart. Overall accuracy is ±0.25% of effective recording span with a maximum pen speed of 50cm/sec on both X and Y channels. Disposable felt tip pens produce crisp and easily read traces.

**SPECIFICATIONS**
Channels: 1 or 2 Pen
Chart: 250mm x 250mm
Ranges: 19 ranges 5μV/cm to 5V/cm or 13 ranges, 5mV/cm to 5V/cm
Accuracy: ±0.25% of span
Writing: Disposable felt-tipped pens
Pen Speed: Approx. 0.7 seconds for 200mm

**PRICE**

| Model | Y Channels | Sensitivity | Prices From |
|---|---|---|---|
| 3036-11 | 1 | Standard | $2260.00 |
| 3036-12 | 1 | High | 2500.00 |
| 3036-21 | 2 | Standard | 3400.00 |
| 3036-22 | 2 | High | 3850.00 |

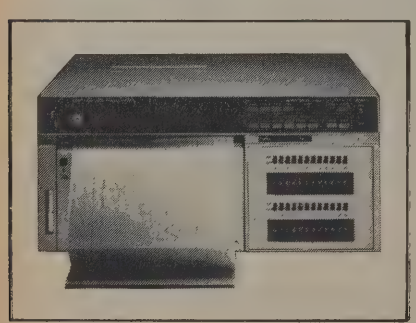


## 3061 SERIES 6 AND 9 PEN FULL SPAN RECORDERS

The 3061 Series of flat bed recorders simultaneously utilizes the full 240mm chart span for each of the 6 and 9 channels providing an exceptionally high degree of readability and flexibility for laboratory applications. Each channel utilizes an independent amplifier providing 13 voltage ranges from 0.5mV/cm to 5V/cm. Long life conductive plastic feedback potentiometers are used for long life and maximum reliability. A wide selection of options including remote control of chart speed, pen lift, chart reroll and event markers additionally increase overall flexibility.

**SPECIFICATIONS**
Channels: 6 or 9
Accuracy: ±0.25% of span
Chart Width: 250mm (240mm calibrated)
Ranges: 13 ranges from 0.5mV/cm to 5V/cm
Chart: Z-fold or roll chart
Chart Speed: 2cm/hr to 60cm/min

**PRICE**
6 pen models from $5192.00
9 pen models from 7169.00



## 2900 SERIES LIGHT BEAM OSCILLIGRAPH

The 2900 Series consists of 6, 9, 18 and 24 channel photographic recorders which use light sensitive paper for the recording medium. Since these units respond to very high frequencies, they are most suitable for recording waveforms which change at high speeds and contain high frequency components. The units also feature a high chart speed capability (to 4 meters per sec.) to enhance their high frequency capabilities. A long optical arm common to all models increases accuracy while providing minimum arc distortion.

**SPECIFICATIONS**
Model: 2901-00, 6 channels
Model: 2932-10, 9 channels
Model: 2932-20, 18 channels
Model: 2932-30, 24 channels
Frequency: DC to 3500Hz depending on galvo used
Sensitivity: Approx. 3.3μA/mm to 2.8μA/mm depending on galvo used
Recording Width: 5, 6, 7, or 8 inches
Light Source: High tension mercury arc lamp
Paper Speed: Up to 4 meters per second

**PRICE**
2901-00, $2485.00
2932-10, 3175.00
2932-20, 3745.00
2932-30, 4255.00
Galvanometers, From $99.00

YEW® YOKOGAWA CORPORATION OF AMERICA
Dept. EM, 5 Westchester Plaza
Elmsford, New York 10523
Phone: (914) 592-6767
TWX: 710-567-1256

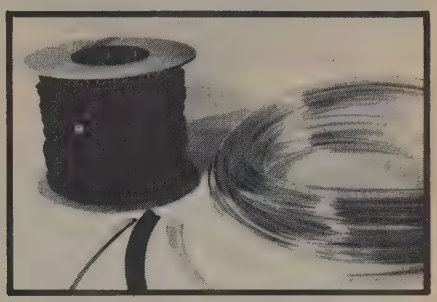
*60 Years of Measuring and Recording Instrumentation*

# MARKEL CORPORATION

## Insulating Tubings and Sleevings — High Temperature Wire and Cable

FLEXITE

### ELECTRICAL GRADE PLASTIC TUBINGS



**FLEXITE Shrinkdown HT-105** is a flexible vinyl material made in expanded sizes to shrink 50% with 135°C heating; has outstanding electrical and mechanical properties. (UL FR-1)

**FLEXITE Shrinkdown PO-135** is a thermally-stable Class B (—55° to 130°C) crosslinked material that when heated shrinks 50% in diameter, forming a tough, smooth insulating covering with excellent chemical, electrical and oil resistant properties. (UL FR-1, CSA)

**FLEXITE Teflon* TFE and FEP** extruded tubings are fluorocarbon materials that combine long-term reliability with chemical inertness, flexibility, and superb electrical characteristics. Useful continuous operating temperatures range from —70°C to 200°C for FEP and 260°C for TFE.

**FLEXITE HT—105C** extruded Vinyl tubing is UL recognized for continuous use at 105°C. It is strong, very flexible tubing for many applications. (UL FR-1, CSA)

**FLEXITE SR-200** Silicone Rubber extruded tubing is made of an extremely elastic compound, and is excellent for high voltage applications at Class H temperatures to —70°C.

**FLEXITE E** extruded Vinyl tubing is an extremely flexible tubing designed primarily for low temperature applications (to —68°C) as in aeronautical instrumentation.

FLEXTECH

### FLUID AND MECHANICAL® GRADE PLASTIC TUBINGS

**FLEXTECH AR-400** tough, abrasion-resistant tubing is extruded from a Markel patented composition of reinforced Teflon and exhibits abrasion resistance many times greater than conventional Teflon tubings.

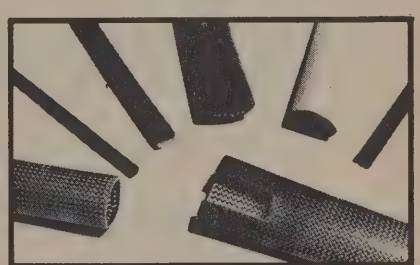
**FLEXTECH FN** Nylon and HP Nylon tubings are extruded from polyamides specially compounded to provide flexibility, heat stability and ultraviolet resistance and the conveyance of air gases and liquids under high pressures.

**FLEXTECH LP-80** Polyethylene is a specially compounded flexible tubing designed for the conveyance of air, gases and liquids under low pressure conditions.

**FLEXTECH U-585** Polyurethane is one of the most versatile of materials, combining long life with high working-pressure ratings, superb resistance to fuels and solvents, excellent flexibility, high resistance to abrasion, and low moisture absorption.

HYGRADE

### ELECTRICAL INSULATING SLEEVINGS



**HYGRADE Polytube 463** Class F Flexible Fiberglass Sleeving is an acrylic-coated material especially compatible with the wire enamels used in motors and transformers.

**HYGRADE Thermoflex 1200** Class C Flexible Fiberglass Sleeving is made of 100% tightly braided fiberglass. For use at continuous temperatures as high as 1200°F. (UL FR-1)

**HYGRADE Thermoflex 500** Class C Flexible Fiberglass Sleeving is made of tightly braided and pigmented fiberglass. For continuous operating temperatures to 500°F. (UL FR-1)

**HYGRADE SR-398** Silicone Rubber Coated Fiberglass Sleeving is a Class H material made of closely-woven glass braid, coated with highly abrasion-resistant silicone rubber. (UL FR-1)

**HYGRADE VF** Flexible Vinyl Fiberglass Sleeving is a tough, Class B insulation of plastic-covered fiberglass with excellent electrical resistance, flexibility, and heat stability. (UL-FR-1)

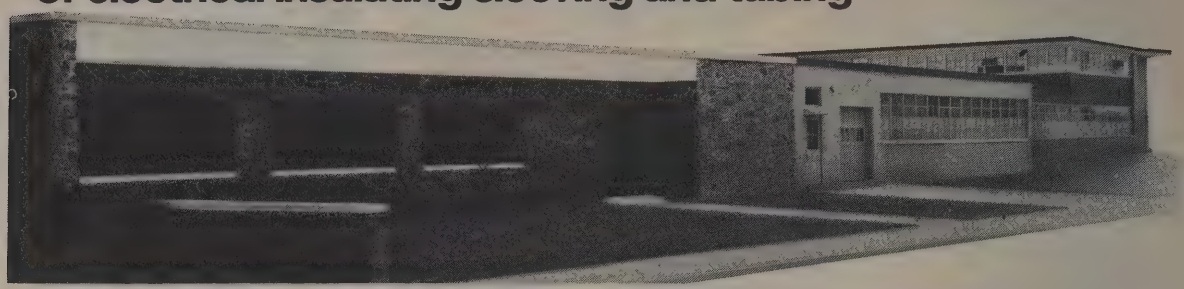
MARKEL CORPORATION
P.O. Box 752, NORRISTOWN, PENNSYLVANIA 19401
Telephone: (215) 272-8960 ■ TWX: 510-660-0929

*DuPont Trademark

# reliable products delivered on time

# VARFLEX

## the complete line of electrical insulating sleeving and tubing



Whatever your problem, heat, cold, flexibility miniaturization, high insulating or dielectric strength—Varflex can supply the required reliability and delivery. Our rapidly expanding plant is fully equipped to supply sleeving for any combination of characteristics you may need. In addition to maintaining large stock for off-the-shelf delivery, Varflex has the productive capacity to provide prompt delivery (often 48 hours) on special orders. As insulation specialists, we are ready to work with you on unusual specifications or applications.

### Here is a brief description of Varflex products

**VARGLAS SILICONE RUBBER ES-4400 SLEEVING.** Passes U/L FR-1 flammability test. The ultimate in flexibility, yet dielectric protection to 8000 volts. Class H-A-1 certified to meet Government Specification MIL-I-3190/6 (formerly MIL-I-18057A) Class H-B-1 (4000 volts) available, also. Continuous exposure from —70° to 400°F. does not affect coating or Fiberglas braid. Class H-C-1 (2500 volts), Class H-C-2 (1500 volts) and Class H-C-3 also available.

**VARGLAS SILICONE RESIN SLEEVING.** Class H-A-1 is recommended for applications requiring extremes of heat endurance and high dielectric strength (7000 volts). Class H-B-1 is identical except for dielectric guarantee (4000 volts). Good abrasion resistance. Class H-A-1 meets the requirements of MIL-I-3190/5. Four other standard grades available where 7000 volt test not important.

**SILFLEX SLEEVING.** A light coating of Silicone resin on Fiberglas braid. Extremely flexible within a temperature range from minus 85°F. to 500°F.

**VARGLAS SILICONE LEAD WIRE.** Made from solid or stranded wire covered with one or more walls of Fiberglas braid and impregnated with Silicone. Built to your specifications.

**VARGLAS SILICONE TYING CORDS.** Continuous filament Fiberglas cords impregnated with Silicone resin, ¼" to ⅛" diameter. Specify Type 46 for dry cure, Type 48 for tacky cure.

**VARGLAS S1600 SLEEVING.** Newest development in Fiberglas yarn. Will retain "life" at temperatures up to 1600°F. (400 degrees higher than E glass).

**VARGLAS POLYURETHANE CLASS F SLEEVING.** Made with Polyurethane resins on Fiberglas braid. Offers better than Class B heat resistance (up to 155°C continuously). Available in F-A-1, F-B-1 and F-C-1 grades.

**VARGLAS ACRYLIC CLASS F SLEEVING.** Highly resistant to acids, organic solvents, oils and water and exhibits fair resistance to alkalies. It is compatible with polyester, acrylic, epoxy, phenolic and formvar wire enamels. Designed to perform for long periods in the 155°C range without loss of any electrical or physical properties. Available in five grades. Class F-A-1 (7000 volts) meets the requirements of MIL-I-3190/3.

**VARFIL SLEEVING.** Fiberglas braids impregnated with polyester resin. Four grades available in coils as well as 36" lengths in most sizes. In a class by itself because of its toughness, flexibility, high temperature resistance and ability to withstand bending and twisting without dielectric loss. Compatible with varnish. Over 1000 hours at 125°C., with intermittent operation at 150°C.

**VARFLO SLEEVING.** Class B insulation. Good flexibility, solvent, oil and moisture resistance. The A grade passes 90° Navy bend test after 2000 hours at 300°F. with 3500 volt end point. Varflo has good shelf life and will not lose dielectric strength when subjected to severe twisting. Classes B-A-1, B-B-1 and B-C-1 are available. Flame and fungus resistant if specified. B-A-1 approved under MIL-I-3190/2 (formerly MIL-I-21557B).

**VARGLAS VARNISHED SLEEVINGS.** Flexible continuous coatings of flame resistant oleoresinous varnish built up over fine Fiberglas braids in several carefully controlled operations. Operate at temperatures up to 130°C continuously. Available in five grades.

**VARGLAS LECTON SLEEVING.** Specifically designed for hermetic motors. Non-contamination of Freon and other refrigerants in Class B motors. B-A-1, B-B-1, and B-C-1 grades.

**VARGLAS NON-FRAY SLEEVINGS.** Type H: The normalizing treatment given the Fiberglas braid removes the organic impurities and tends to hold the individual filaments together. The lack of any bonding agent means it may be subjected to temperatures as high as 1200°F. Recommended for applications where dielectric requirements are not of prime importance. Resists fungus and is noncorrosive. Type HP: Similar to Type H, but dyed various colors for coding purposes. Ideal as secondary insulation where primary covering might disintegrate due to high temperature or continual flexing. Colors may fade at 300°F. Type HO: A very light treatment of resin added after the braid has been normalized — just enough to hold the sleeving round for accurate cutting. Will distend to cover soldered joints or terminals. Avaliable in eight colors. Colors fade at 300°F., but sleeving unaffected up to 1200°F. Best of the three from a non-fray standpoint.

**VARGLAS LITEWALL SLEEVINGS.** Wall thickness of Type A is .008" and of Type B, .006". These extremely flexible, finer braids are supplied untreated, heat treated and/or dyed. Produced in fractional sizes. Because of the construction, one size can be used to cover several different wire sizes. Specify Type HA or HB if heat treated braids preferred.

**SYNTHOLVAR EXTRUDED TUBING.** Made from vinyl polymers. High dielectric and tensile strength. Will not support combustion nor absorb moisture. Smooth surface, thin wall and flexibility all make for ease in assembling operations. Type SHH recognized by U/L for 105°C applications. Type LT will function at temperatures down to —50°C. Specify fungus resistant tubing where needed. Special formulations for high and low temperature environment. Made to meet applicable Government Specifications MIL-I-631 and MIL-I-7444.

**NYLON UNTREATED SLEEVING.** This product has outstanding abrasion resistance and is the ultimate in flexibility. It is intended for use over insulated wire and cable, not as primary insulation.

**U.L. Recognized Sleevings: File Numbers E-53690, E-63450.**

**FREE**

Write for our folder containing 25 test samples.

## VARFLEX CORPORATION

514 W. Court Street, Rome, N.Y. 13440
Telephone (315) 336-4400

Varflex CORPORATION *Makers of Electrical Insulating Tubing and Sleeving*

Varflex products meet or exceed applicable government specifications including: **MIL-I-18057A, MIL-I-3190C, MIL-I-7444B, MIL-I-631D, MIL-I-21557** Many recognized by U/L, our No. E53690.

# ZEUS

# HIGH PERFORMANCE FLUOROPLASTIC EXTRUSIONS

## TUBING • BEADING • SHAPES • UNIQUE WIRE INSULATIONS

A high-quality line of fluoroplastic resins with unique properties that lend themselves to the most exotic applications in the aerospace, electronics, medical, automotive, nuclear, chemical, industrial, and electrical fields. Zeus Tubings and other products are manufactured from the following and other fluoroplastic resins:

**PTFE Teflon* • PTFE Fluon** • PTFE Hostaflon*** • FEP Teflon* • PFA Teflon* • ETFE Tefzel***

*Reg. TM duPont **Reg. TM I.C.I., U.S. ***Reg. TM Hoechst AG

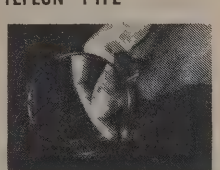
**TEFLON* PTFE TUBING** the ultimate in heat resistance, continuous use at 500°F, chemical stability, and dielectric properties. Commercial and Mil Spec. Inert to all solvents, acids, alkalies and salt. Unique concentricity and close tolerance assured. Three different wall thicknesses. Available in AWG and fractional inch sizes, and industrial grades. U.L. listed. File No. E-64007

**TEFLON* FEP TUBING** Chemically inert, excellent dielectric properties. Continuous use at 400°F. Non-aging, anti-stick. Great tensile strength. U.L. listed. File No. E-64007

**TEFLON* PFA TUBING** Tough, flexible. Continuous use near 500°F. Features clarity, chemical inertness and excellent flex-life. Ideal for chemical flow. Exceptional stress-crack resistance combined with exceptional dielectric properties. For extended service in environments demanding high levels of chemical, electrical, thermal and mechanical performance.

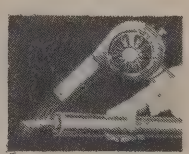
**TEFLON* ETFE TUBING** Mechanically superior, tough material of medium stiffness with excellent flex-life, impact resistance, cut-through resistance and low water absorption. Weather-resistant, and inert to most solvents and chemicals. Excellent resistance to high energy radiation. Low-loss dielectric. Continuous use at temperature ranges around 300°F.

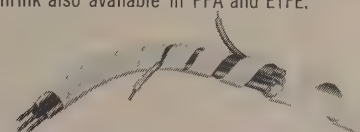
**SUB-LITE WALL TUBING OF TEFLON* PTFE**



Unprecedented miniaturization! Rivals nature's own capillaries. Walls as thin as 0.001" in I.D. dimensions of 0.022" and larger. Also available with an I.D. as small as 0.001" with wall thicknesses of 0.007" or greater. (NOTE: Average dimension of a human hair is 0.003".) Superior lubricity! Impervious to virtually all solvents and chemicals. Operating temperatures from −420°F to +500°F. Zero water absorption. I.D.'s and wall thicknesses absolutely uniform.

**TEFLON* PTFE HEAT-SHRINK TUBING 2 to 1 and 4 to 1** Radial shrink ratios of 2 to 1 (30% to 50% reduction) and 4 to 1 (approx. 75% reduction) available in a wide range of AWG, fractional inch and industrial sizes. Standard wall, thin wall and lightweight wall. Outstanding electrical and mechanical properties. Heat shrink also available in PFA and ETFE.

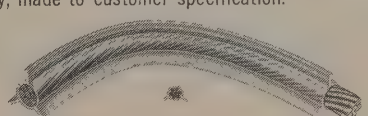




**SPIRAL-CUT CABLE WRAPS OF TEFLON* PTFE, FEP, PFA, & ETFE** Expandable, abrasion-resistant wraps for harnessing and insulating wires, cables, and bundles. Installed over wire bundles they provide openings allowing individual leads to be broken out at any point while also creating a rugged homogeneous harness assembly which can be channeled, bent or flexed.

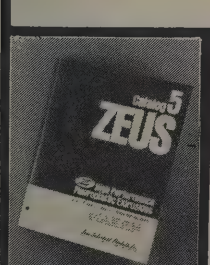
**ROUND BEADING OR MINIATURE ROD.** Available in TEFLON*, PTFE, FEP, PFA ,and ETFE in a range of diameters and tolerances to meet most requirements. PTFE beading is fully cured.

**SHAPES OF TEFLON* PTFE** Unlimited capability and variety, made to customer specification.



**SPLINES OF TEFLON* PTFE** for the coaxial cable manufacturer requiring the ultimate in PTFE/AIR primary dielectric over a primary conductor of coaxial cable or tube. Unsurpassed concentricity and tolerance.

ALSO SPECIALTY WIRES, CABLES, COAXIAL CORES AND ETCHING ON TEFLON* PTFE




**FREE**—24 page catalog with complete details and specs. Includes helpful data on heat-shrink tubing; a summary of properties of extruded fluoroplastic resins; mechanical, electrical, chemical and medical applications; and ordering information.

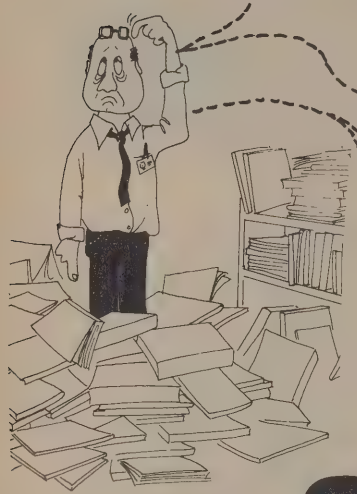
*Zeus Industrial Products, Inc.*

FOOT OF THOMPSON ST., RARITAN, N.J., 08869 • 201-526-0800

TWX 710-480-9346 — OR VIA TELEX TO TWX

*What can I use to keep all the manufacturers' product data I receive in order?*

*What system makes filing or retrieving manufacturers' catalogs fast and easy?*



*Which file system have thousands of engineers purchased because they know it works?*

# eem FILE SYSTEM

## THE ONLY FILE SYSTEM DESIGNED SPECIALLY FOR THE ELECTRONIC ENGINEER!

The publishers of **eem** have put together a unique filing system for electronic product information. The complete system includes: a product index booklet which classifies electronic products into 3,000 listings both alphabetically and by product group, and 45 file folders imprinted with the **eem** product sections (extra gummed labels included for expanding the system.)

As you receive manufacturers' catalog data sheets, technical bulletins, or clip magazine articles, jot down the proper Product Section Numbers from the **eem** PRODUCT-TO-SECTION INDEX. Then simply file in order. When you require information on a specific product, refer to PRODUCT-TO-SECTION INDEX again to locate the correct file folder. It's simple, and you'll always have the necessary data to compare, specify and buy, right at your fingertips.

**Here's how to order your eem FILE SYSTEM:**

For the complete system send $10 (plus tax; N.Y., 8%, CA, 6½%) in check or money order to:

United Technical Publications, Inc.,
645 Stewart Avenue, Garden City, N.Y. 11530
Att: Circulation dept.

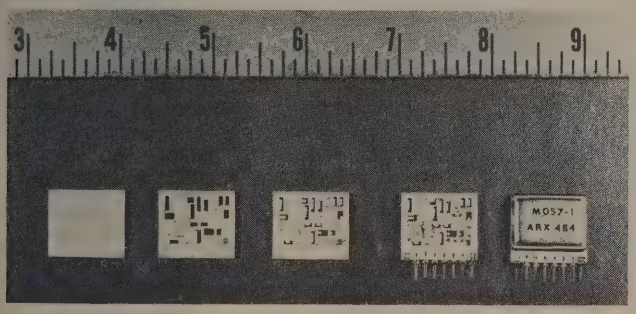
For an **eem FILE SYSTEM** without file folders send $7.50 (plus tax; N.Y. 8%; CA, 6½%).

*UNITED TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500*

# Hybrid Microcircuits for Airborne and Ground Systems — Military and Industrial

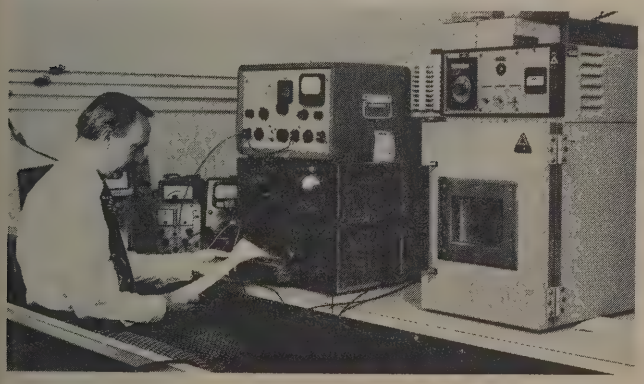
Aeroflex Laboratories Inc. has been a leading designer/producer of high technology products. More recently the company has been expanding its electronic component capability. With the acquisition of Integrated Microsystems Incorporated, Aeroflex added a modern Thick-Film Hybrid Facility on the West Coast. In turn it established a similar capability within the company's Eastern Headquarters' Plant.

Both facilities are now engaged in the design, development and high volume manufacture of custom hybrids for both military and industrial customers. The hybrids are qualified for use on B1, B52, B747, L1011, F15 and F16, plus numerous other ground and airborne systems and mobile communications equipment.



**THICK FILM HYBRIDS** — The Hybrid Integrated Circuit provides a link between traditional printed circuit discrete assemblies and the true monolithic integrated circuit. The hybrid technology provides the flexibility required to combine the advantages of the quick response, printed circuit fabrication technique with the small-size, low-cost and high reliability of the monolithic integrated circuit. To determine the advisability of converting a known discrete circuit to either a monolithic or a hybrid, careful consideration must be given to the technical limitations of the monolithic technology, manufacturing lead time and cost effectiveness.

IMI is fully equipped to provide the technical and manufacturing support required to satisfy your most demanding requirements. With an extensive staff of electronic circuit designers, IMI is fully prepared to translate a customer's black box parameters into a cost effective circuit consistent with small size and minimal weight. We excel in the original design of active filters, sample and hold networks, low noise pre-amps, voltage regulators, drivers and receivers, and interface circuits to meet MIL-STD-1553A.



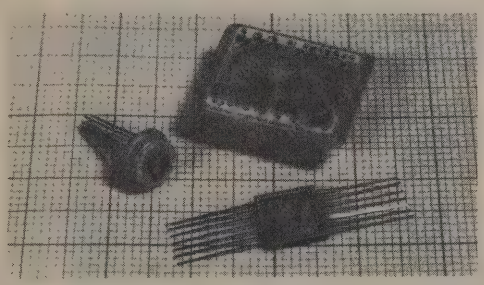
**PROCESS TECHNOLOGY** — Each requirement is carefully considered in arriving at an optimum process. Thick film desposition is extremely flexible and is generally employed. However, thin film discrete components may, on occasion, be utilized in conjunction with thick film resistors and conductors. Gold conductors or various silver alloys are employed depending upon requirements. A variety of resistor inks are utilized to cover the full range of resistor values. Both laser and air brasive trimming systems are utilized.

IMI uses two basic techniques for the attachment of discrete active chips and elements. The most flexible method is commonly referred to as chip and wire bonding. Semiconductor and capacitor chips are usually bonded to alumina substrates using a precision epoxy die bonder. This method puts minimum stress on components resulting in high yields. For applications requiring high power dissipation, this method is supplemented by eutectic die attach, brazing and soldering.

Wire bonding is performed by a semi-automatic tailless ultrasonic ball bonder. A hydrogen torch melts a small ball on the end of a fine gold wire. The ball is placed on a pad with the aid of a spot light locator and ultrasonically attached to a mounting pad. A second bond is made to a substrate pad and the wire is then cut by the capillary. The use of ultrasonic bonding puts minimum stress on the die resulting in maximum yields with no sacrifice in bond strength. Chip and wire bonding is very flexible because of the wide availability of semiconductors in die form.

The second technique used by IMI is referred to as flip-chip die attach. In this method, the die has solder-bumps deposited in place of mounting pads on the active side of the chip. The substrate is solder tinned by either dipping in a solder bath or by a solder paste screening process. The chip is placed face down on the substrate with the solder-bumps in contact with mounting pads. Capacitor chips as well as semiconductors are mounted during the same operation. When all the chips have been mounted on the substrate, the substrate is placed in a belt furnace and reflow soldered. All connections are made in one soldering operation. This technique requires substantially less labor than chip and wire bonding and results in connections that are an order of magnitude stronger than any wire bonding process. In addition yields are significantly higher. This cost effective approach is used mainly in industrial applications.

Packaging capability ranges from epoxy sealed ceramic packages and fluidized bed for industrial applications to welded, hermetically sealed, all metal cases including flat packs, dips, platforms and "TO" cans for military requirements.



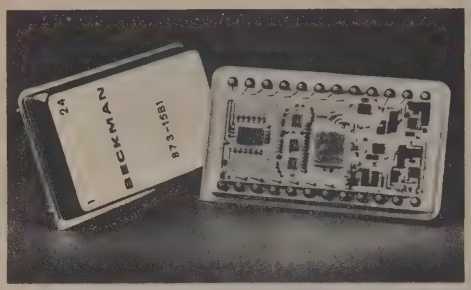
**PRODUCT ASSURANCE** — IMI maintains a Product Assurance Department in accordance with the requirements of MIL-Q-9858A. Quality Assurance, Quality Control, Qualification Testing and Equipment Calibration are the responsibility of Product Assurance.

Incoming Inspection is performed on semiconductors in accordance with MIL-STD-883 Method 2010.1 Level B. Similar criteria are applied to hybrid inspection. Screening and qualification testing to MIL-STD-883B, Method 5008 and MIL-M-38510D are also available.

**integrated microsystems**
**Division of Aeroflex Laboratories Inc.**
**Eastern Operations:** 35 South Service Road
Plainview, New York 11803
Tel. 516-694-6710 TWX 510-224-6417
**Western Operations:** 1215 Terra Bella Avenue
Mountain View, California 94043
Tel. 415-965-3900 TWX 910-379-6585

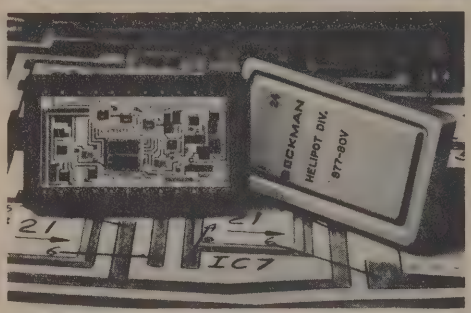
BECKMAN

# A/D and D/A Converters



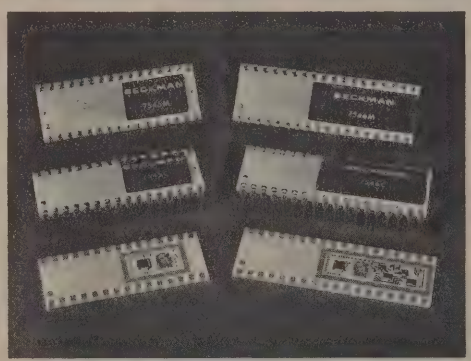

**12-Bit, TTL A/D Converters**
Beckman 12-bit, TTL successive approximation A/D converters are available in three performance and packaging options. Series 873-78 is a low-priced unit packaged in a glass, 24-pin DIP for operation over 0° to +70° C. Series 873-88 is a higher performance unit operating over −25°C to +85°C. Series 873-15 operates over full −55°C to +125°C temp. range and is screened to MIL-STD-883A. Both 873-88 and 873-15 are hermetically sealed in a 24-pin, metal DIP. All are available with full scale voltages of 10 volts unipolar and 5 & 10 volts bipolar. Features include:

- 12-bit resolution
- ±½ LSB in 12 (±½ LSB quantizing error)
- Internal reference




**12-Bit TTL D/A Converters**
Beckman offers a complete range of 12-bit, TTL D/A converters for commercial, industrial and military applications. The economy 877-80 is packaged in a glass, 24-pin DIP and operates over 0° to +70°C. Series 877-85 is a higher performance converter specified over −25°C to +85°C. Series 877-15 operates over full −55°C to +125°C temp. range and is screened to MIL-STD-883. Both 877-85 & 877-15 are hermetically sealed in a 24-pin, metal DIP. All are available in voltage and current output models. Features include:

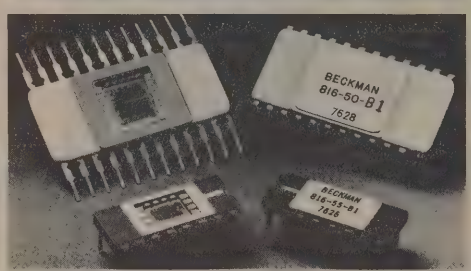
- 12-bit resolution
- ±½ LSB (877-80, 877-85) or ±1 LSB (877-15) in 12 linearity
- 300 nsec conversion settling time (current output models)
- Internal reference



**12-Bit Microprocessor Compatible CMOS D/A Converters**
Beckman Series 7545 and 7546 are 12-bit precision digital-to-analog converters designed specifically for 8-bit microprocessor compatibility. The input registers can accommodate 12-bit words in 4-bit and 8-bit bytes. Series 7546 is a complete internally referenced and output buffered 12-bit converter. Series 7545 is an externally referenced 4-quadrant multiplying converter. The input and control lines of both series can be driven by TTL or CMOS logic.

- ±½ LSB in 12 linearity over specified operating temperature
- Low power dissipation
- Low cost
- Commercial, industrial, military temperature range and performance options

For complete technical information on Beckman's full line of standard A/D and D/A converters contact your local Beckman sales representative.




**Thin Film Ladder Networks**
Series 816-50 and Series 816-55 Thin Film Ladder Networks are low-cost, 12-bit current summing (R-2R-4R-8R) and voltage summing (R-2R) building blocks for unique A/D and D/A converter applications. Both offer 0 to +70°C and −55°C to +125°C temperature range options. Series 816-50 and 816-55 feature:

- 12-bit resolution
- ±½LSB in 12-bit accuracy over full temp. range
- High stability — low noise characteristics

Beckman also stocks a complete line of standard, thick film ladders. Consult your local Beckman sales representative for complete technical information.

**Series 840 Precision Voltage Reference**
Series 840 Precision Voltage Reference provides the user with a self-contained, ready to use hybrid reference functionally laser trimmed to deliver +10Vdc output at ±0.1% max. absolute accuracy with low ±5 ppm/°C temperature coefficient. Series 840-T1 operates over the −55°C to +125°C temperature range; 840-T2 operates over the −25°C to +85°C range. Features include:

- ±0.1% max. output voltage accuracy (840-T1)
- ±5 ppm/°C output voltage TC
- Hermetically sealed, 8-pin to -5 package

For detailed product information, call, TWX, or write Beckman or your nearest Beckman/Helipot sales representative today.

BECKMAN INSTRUMENTS, INC. HELIPOT DIVISION
2500 Harbor Boulevard, Fullerton, California 92634
(714) 871-4848 · TWX No. 910-592-1260

BECKMAN®

# Amplifiers, Regulators and Custom Microcircuits

**Standard Electronic Module (SEM) Program**

Beckman is a fully qualified supplier of Navy Standard Electronic Module Program modules. Cost effective, low profile, hermetic, ceramic hybrid packaging allows high density and high performance electrical functions to be packaged in the standard 1-A SEM configuration. One hybrid on each side allows 40 pin-outs of high density packaging. Precision active filters, digital-to-analog and analog-to-digital converters and other complex functions can cost effectively utilize the functional trimming and density capabilities of hybrid technology. Thin or thick film can be combined with most semiconductor technologies to provide the optimum in integration. Functionally specified standard or specials are available. Consult the factory for complete details.

**Power Amplifiers**

Beckman Series 833-21 are general purpose operational amplifiers capable of providing output currents in excess of 1 ampere at ±12V. Available off-the-shelf in an 8-pin, TO-3 package, Series 833-21 features:

- Wide full power bandwidth (15kHz)
- Low quiescent power (100mW @ ±15V)
- High slew rate (3V/μs)

Beckman stocks a complete line of standard power amplifiers to meet industrial and military application requirements. Consult your local Beckman sales representative for complete technical information.

**DC Voltage Regulators**

Beckman hybrid circuit voltage regulators are available in high performance military or low-cost industrial models, and cover the entire voltage range of requirements for most semiconductor circuitry (from 3 to 120 volts) with either positive or negative outputs. Both preset output and adjustable output models are available with regulation to ±0.005% (line and load). All offer maximum flexibility of performance parameters so that modifications can be made to satisfy individual system requirements. Consult your local Beckman sales representative for complete technical information.

**Custom Hybrid Microcircuits**

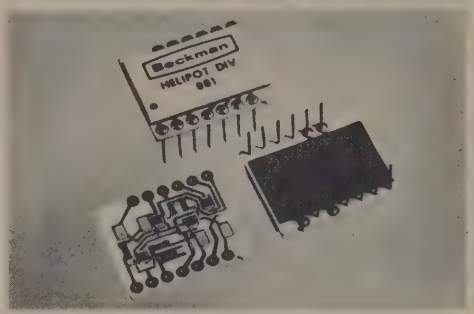
Beckman custom microcircuit ability is based upon thick and thin film material technologies with an integrated circuit chip handling capability. With these combinations, Beckman can supply a wide variety of linear and digital circuits including: active filters for telephone tone filter products, DACs and ADCs from commercial to military standards, power linears from amplifiers to voltage regulators, passive substrate to multilayer digital hybrids, dual logarithmic amplifiers, hammer driver circuits, decoder driver circuits, signal conditioning circuits, oscillator circuits, and massive resistors for use as infrared heating sources.

For detailed product information, call, TWX, or write Beckman or your nearest Beckman/Helipot sales representative today.

BECKMAN INSTRUMENTS, INC. HELIPOT DIVISION
2500 Harbor Boulevard, Fullerton, California 92634
(714) 871-4848 • TWX No. 910-592-1260

BECKMAN

# Telecommunication/Filter Products




**Model 881 Universal Active Filters**

Model 881 is a two-pole, audio-frequency filter that can be used as a basic building block to generate virtually any complex filter function. Model 881 features:

- Simultaneous high-pass, low-pass, and band-pass outputs
- Inverting, non-inverting or differential operation
- 10kHz maximum operating frequency
- 0.5 to 50 adjustable Q range

**Series 883 Telecommunication Products**

Beckman Series 883 are standard tone-decoding building blocks for high-performance central office, PBX, accounting system or industrial control telecommunication applications.

Series 883 are pretuned to meet Bell System performance requirements, and are available off-the-shelf as individual modules or in preassembled, standard rack-mountable PC cards.

**Model 883-1 Dial-Tone Filter**

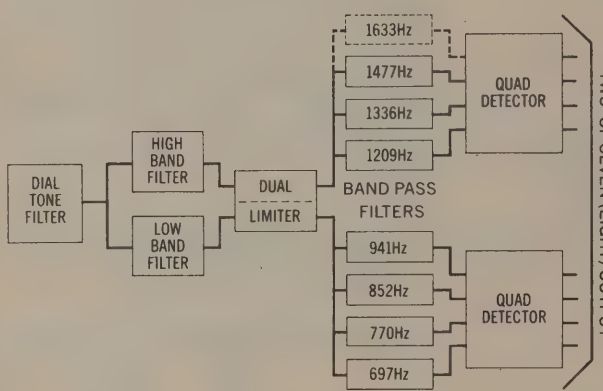
- Modified dual-notch active filter
- 50dB notch attenuation
- ±12V power supply operation

**Model 883-2 Low-Band Filter**

- Modified Cauer low-pass filter
- 941Hz upper cutoff frequency
- >20dB attenuation above 1190Hz

**Model 883-3 High-Band Filter**

- Modified Cauer high-pass filter
- 1209Hz lower cutoff frequency
- >dB attenuation below 995Hz

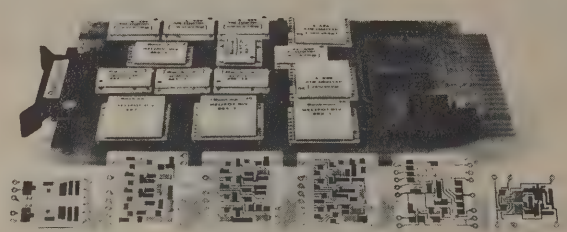



**Model 883-4 Dual Limiter**

- Two-section signal amplitude compression
- ±300mV input threshold
- 11V p-p square wave output

**Model 883-5 Quad Tone Detector**

- Four preset threshold detectors
- Preset time delay/invalid tone rejection
- TTL complementary output logic



**Models 883-6 to 883-16 Band-Pass Filters**

- Eight standard telephone frequency filters: 697, 770, 852, 941, 1209, 1336, 1477 and 1633Hz
- ±0.5% $f_0$ accuracy/high $f_0$ stability
- High input impedance/low output impedance

**Models 883-107 and 883-108 Tone Receiver Cards**

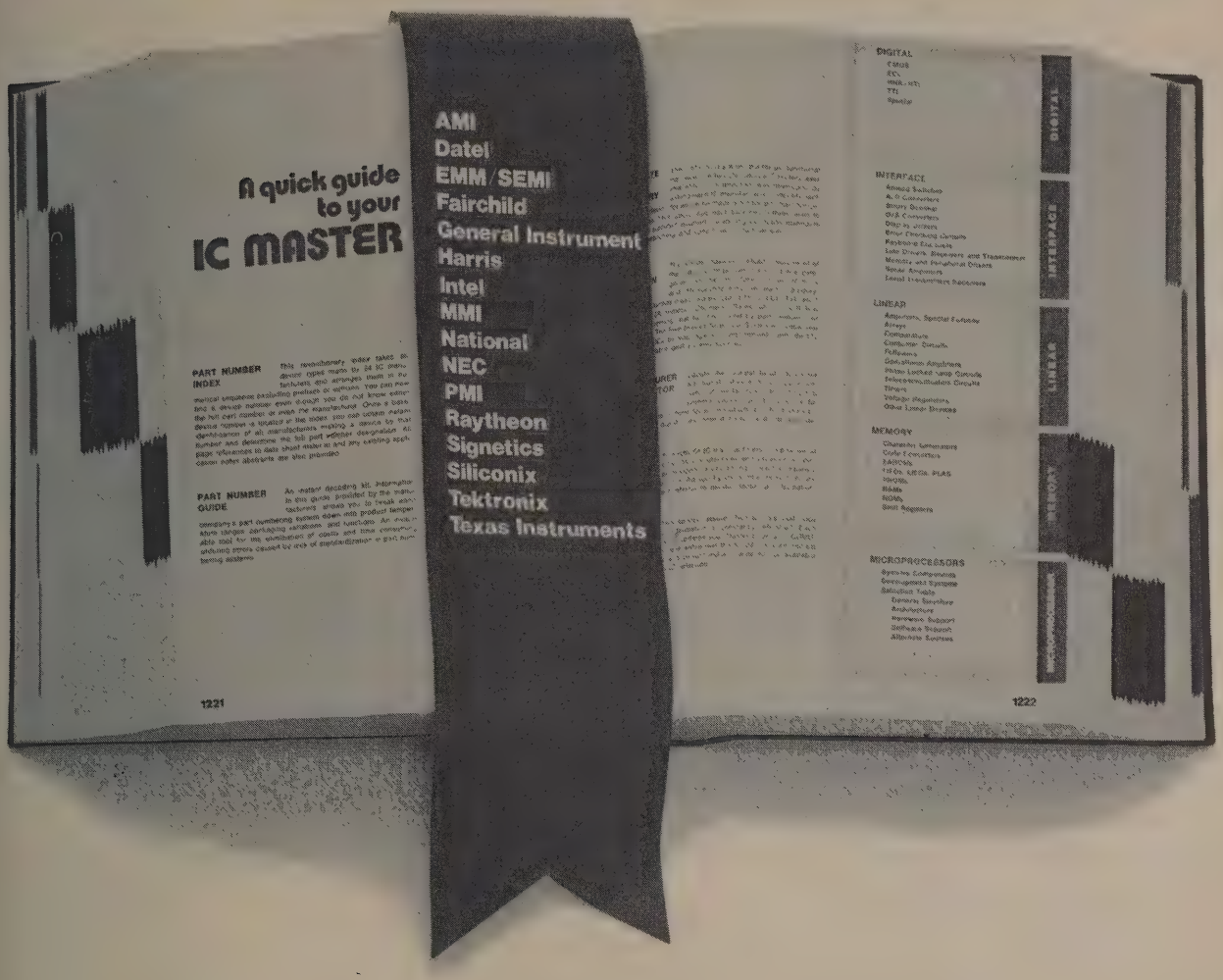
- Complete hybrid set and necessary system components
- Preassembled and test standard PC board
- Standard 22-pin, 0.156" (3,962mm) spacing, edge plug
- 4 X 3 tone matrix with 2 of 7 output (883-107)
- 4 X 4 tone matrix with 2 of 8 output (883-108)

For custom versions of these products or application assistance, call Microcircuit Application Engineering (714) 871-4848, Ext. 3235.

For detailed product information, call, TWX, or write Beckman or your nearest Beckman/Helipot sales representative today.

BECKMAN INSTRUMENTS, INC. HELIPOT DIVISION
2500 Harbor Boulevard, Fullerton, California 92634
(714) 871-4848 · TWX No. 910-592-1260

# A GOOD BOOK IS KNOWN BY THE COMPANIES IT KEEPS.




These manufacturers have invested in the IC MASTER to bring you the most complete information on their newest standard products.

HEN USING THE IC MASTER, REFER TO THESE MANUFACTURERS' COMPLETE DATA SHEETS TO HELP YOU IN YOUR IC SELECTION . . .

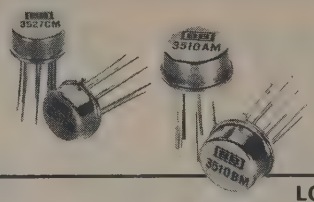
## THE WHOLE WORLD FOLLOWS THE MASTER.

**IC Master**
**1333 Lawrence Expressway, Suite 420**
**Santa Clara, CA 95051**
**(408) 248-8044**

***It's Faster With the Master***

# BURR-BROWN OPERATIONAL AMPLIFIERS

BURR-BROWN
TUCSON, ARIZONA 85734

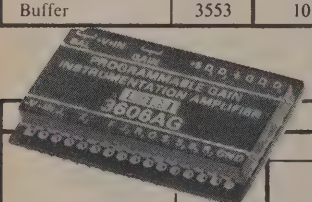


## LOW DRIFT

| | | RANGE OF SPECIFICATIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Rated Output | | Offset Voltage at 25°C | Offset Voltage Temp. Drift | Bias Current at 25°C | Frequency Response Unity Gain | Frequency Response Slew Rate | Package | Price (100's) |
| | Model | ±V | ±mA | mV | µV/°C | pA | MHz | V/µsec | | |
| Chopper-Stabilized | 3291 | 10 | 5 | .02 - .10 | .10 - 1 | ±50 to ±100 | 3 | 6 | Module | $39.50 - $66.50 |
| | 3354 | 10 | 5 | .03 - .10 | .10 - 1 | ±20 to ±50 | 6 | 6 | Module | $75.00 - $125.00 |
| | 3271 | 50 - 110 | 20 | .05 | 1 | ±80 | 1 | 20 | Module | $150.00 |
| Bipolar | 3510 | 10 | 10 | .06 - .15 | 0.5 - 2 | ±15 to ±35nA | 0.4 | 0.5 | TO-99 | $4.95 - $10.00 |
| | 3500 | 10 | 10 | 1 - 5 | 3 - 20 | ±15 to ±30nA | 1.5 | 0.6 - 1 | TO-99 | $5.15 - $28.00 |
| | 3501 | 10 | 5 | 2 - 5 | 5 - 20 | ±3 to ±15nA | 0.5 | 0.1 | TO-99 | $3.20 - $14.20 |
| FET | 3521 | 10 | 10 | .25 - .50 | 1 - 10 | -10 to -20 | 1 | 0.6 | TO-99 | $12.50 - $41.00 |
| | 3527 | 10 | 10 | .25 - .50 | 2 - 10 | -2 to -5 | 1 | 0.6 | TO-99 | $7.95 - $19.40 |
| **LOW BIAS CURRENT** | | | | | | | | | | |
| Varactor | 3430 | 10 | 5 | Adj to 0 | 10 - 30 | ±0.01 | 2kHz | .4V/msec | Module | $47.00 |
| | 3431 | 10 | 5 | Adj to 0 | 10 - 30 | ±0.01 | 2kHz | .4V/msec | Module | $47.00 |
| FET | 3523 | 10 | 10 | 0.5 - 1 | 25 - 50 | -0.1 - 0.5 | 1 | 0.6 | TO-99 | $17.80 - $23.10 |
| | 3522 | 10 | 10 | 0.5 - 1 | 10 - 50 | -1 to -10 | 1 | 0.6 | TO-99 | $8.80 - $20.50 |
| | 3527 | 10 | 10 | .25 - .50 | 2 - 10 | -2 to -5 | 1 | 0.6 | TO-99 | $7.95 - $19.40 |
| | 3521 | 10 | 10 | .25 - .50 | 1 - 10 | -10 to -20 | 1 | 0.6 | TO-99 | $12.50 - $41.00 |
| | 3542 | 10 | 10 | 20 | 50 | -25 | 1 | 0.5 | TO-99 | $5.40 - $9.30 |
| | 3528 | 10 | 5 | .1 - .2 | 5 - 10 | ±0.075 to -.30 | 0.7 | 0.3 | TO-99 | $9.90 - $17.50 |
| **HIGH VOLTAGE** | | | | | | | | | | |
| FET | 3584 | 65 - 145 | 15 | 3 | 25 | -20 | 20 | 150 | TO-3 | $65.00 |
| | 3583 | 40 - 140 | 75 | 3 | 25 | -20 | 5 | 30 | TO-3 | $61.00 - $63.00 |
| | 3580 | 10 - 145 | 15 - 60 | 3 - 10 | 25 - 30 | -20 to -50 | 5 | 15 - 20 | TO-3 | $33.00 - $58.25 |
| **HIGH CURRENT** | | | | | | | | | | |
| FET | 3571 | 30 | 1A | 2 | 40 | -100 | 0.5 | 3 | TO-3 | $38.50 |
| | 3572 | 30 | 2A | 2 | 40 | -100 | 0.5 | 3 | TO-3 | $43.50 |
| | 3573 | 23 | 2A | 5 | 10 | 15nA | 1 | 2.6 | TO-3 | $19.80 |
| Buffer | 3553 | 10 | 200 | 50 | 300 | -200 | 32 | 2000 | TO-3 | $18.65 |
| | 3329 | 10 | 100 | 50 | - | bipolar | 1 | - | DIL | $19.50 |

## WIDEBAND

| | | Rated Output | | Offset Voltage at 25°C | Offset Voltage Temp. Drift | Frequency Response A = BW | Frequency Response Slew Rate | $t_s$ ±0.1% | Compensation | Package | Price (100's) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Model | ±V | ±mA | mV | µV/°C | MHz | V/µsec | nsec | | | |
| Differential | 3554 | 10 | 100 | 1 - 2 | 15 - 50 | 1000, A=1000 | 1000 | 120 | ext | TO-3 | $39.60 - $49.50 |
| | 3551 | 10 | 10 | 1 | 50 | 50, A = 10 | 250 | 400 | ext | TO-99 | $17.10 - $29.65 |
| | 3550 | 10 | 10 | 1 | 50 | 10 - 20, A = 1 | 65 - 100 | 400 | int | TO-99 | $17.10 - $29.65 |
| | 3508 | 10 | 10 | 5 | 30 | 100, A = 100 | 20 | - | ext | TO-99 | $6.75 |
| | 3507 | 10 | 10 | 10 | 30 | 20, A = 10 | 80 | 200 | ext | TO-99 | $8.40 |
| Buffer | 3553 | 10 | 200 | 50 | 300 | 32 | 2000 | - | - | TO-3 | $18.65 |



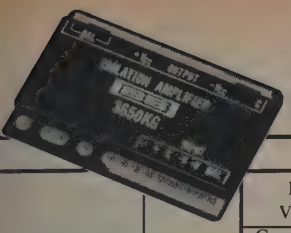

# INSTRUMENTATION AMPLIFIERS

## LOW DRIFT

| | | Gain | | | Input Parameters | | Dynamic Response | | |
|---|---|---|---|---|---|---|---|---|---|
| | Model | Range (V/V) | Non-Linearity G = 100, max | Rated Output V/mA | CMR, DC to 60Hz, G = 10 1kΩ, Unbal | Offset Voltage vs Temp max (µV/°C) | G = 100 ±3dB, BW | Package | Price (100's) |
| Lowest Drift | 3620 | 0.1 - 10,000 | ±0.01% | ±10/±10 | 74dB | ±(10 + .25 G) | 10kHz | Module | $74.00 - $155.00 |
| Low Drift, Low Cost | 3626 | 5 - 1000 | ±0.01% | ±10/±5 | 80dB, min | ±(1 + 5 G) | 14kHz | DIP | $13.00 - $19.50 |
| | 3629 | 5 - 1000 | ±0.004% | ±10/±10 | 90dB, min | ±(0.75 + 5/G) | 30kHz | DIP | $15.25 - $23.75 |
| General Purpose, Low Cost | 3660 | 1 - 1000 | ±0.1% | ±10/±10 | 76dB, min | ±(10 + 1000/G) | 72kHz | TO-100 | $7.10 - $25.00 |
| | 3662 | 1 - 1000 | ±0.05% | ±10/±10 | 84dB | ±(2 + 400/G) | 72kHz | DIP | $10.00 - $15.95 |
| Buffer, Unity Gain, Differential | 3627 | 1 (fixed) | ±0.001% G = 1 | ±10/±5 | 100dB | 20 | 800kHz G = 1 | TO-99 | $6.90 - $8.25 |
| Very-high Accuracy | 3630 | 1 - 1000 | ±0.003% | ±10/±5 | 96dB, min | ±(.25 + 10/G) | 25kHz | DIP | * |
| **PROGRAMMABLE GAIN** | | | | | | | | | |
| Digitally Controlled | 3606 | 1 - 1024 | 0.003% | ±10/±5 | 94dB | 10µV/°C, typ ±(1 + 50/G) | 50kHz | DIP | * |

*Contact factory for current price.

**FOR ADDITIONAL DETAILS REFER TO THE BURR-BROWN GENERAL CATALOG OR CONTACT YOUR NEAREST BURR-BROWN REPRESENTATIVE**



# ISOLATION AMPLIFIERS

BURR-BROWN
TUCSON, ARIZONA 85734

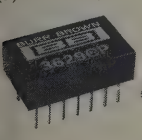
## TRANSFORMER COUPLED

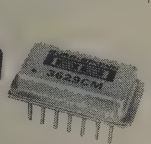
| Model | Input Voltage Common Mode (V) | Input Voltage Differential (V) | Input Impedance Common Mode (Ω) | Input Impedance Differential (Ω) | Isolation Voltage Continuous (V)Peak | Isolation Voltage Pulse/Test (V)Peak | Isolation Mode Rejection, min DC (dB) | Isolation Mode Rejection, min 60Hz (dB) | Leakage Current at Test Voltage (μA) | Gain Nonlinearity max (%) | Gain Nonlinearity typ (%) | ±3dB Freq. (kHz) | External Isolation Power Required | Package | Price (100's) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Low Drift, Bipolar 3450 | ±10 | ±15 | $5 \times 10^9$ | $10^7$ | ±500 | ±2000 | 160 | 120 | 1 | ±0.01 | ±0.003 | 1.5 | No | Module | $135 |
| Low Bias, FET 3451 | ±10 | ±15 | $10^{11}$ | $10^{11}$ | ±500 | ±2000 | 160 | 120 | 1 | ±0.05 | ±0.01 | 2.5 | No | Module | $82 |
| 3452 | ±10 | ±15 | $10^{11}$ | $10^{11}$ | ±2000 | ±5000 | 160 | 120 | 1 | ±0.05 | ±0.01 | 2.5 | No(1) | Module | $107 |
| 3455 | ±10 | ±15 | $10^{11}$ | $10^{11}$ | (2) | (2) | 160 | 120 | (2) | ±0.05 | ±0.01 | 2.5 | No(1) | Module | $110 |
| True 3-wire Inst. Amp. 3456A | ±10 | ±15 | $5 \times 10^9$ | $10^7$ | ±2000 | ±5000 | 160 | 130 | 25 | ±0.01 | ±0.02 | 2.5 | No | Module | $109 |
| 3456B | ±10 | ±15 | $5 \times 10^9$ | $10^7$ | ±2000 | ±5000 | 160 | 130 | 25 | ±0.01 | ±0.02 | 2.5 | No | Module | $124 |

## OPTICALLY COUPLED

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Balanced Current Input | 3650HG | ±10 | ±15 | $10^9$ | 25(3) | ±2000 | ±5000 | 140 | 120 | .25(4) | ±0.02 | ±0.05 | 15 | Yes(5) | DIP | $26.50 |
| | 3650JG | ±10 | ±15 | $10^9$ | 25(3) | ±2000 | ±5000 | 140 | 120 | .25(4) | ±0.02 | ±0.05 | 15 | Yes(5) | DIP | $36.00 |
| | 3650KG | ±10 | ±15 | $10^9$ | 25(3) | ±2000 | ±5000 | 140 | 120 | .25(4) | ±0.02 | ±0.05 | 15 | Yes(5) | DIP | $47.50 |
| Balanced FET Input | 3652HG | ±10 | (6) | $10^{11}$ | $10^{11}$ | ±2000 | ±5000 | 140 | 120 | .25(4) | ±0.05 | ±0.1 | 15 | Yes(5) | DIP | $37.00 |
| | 3652JG | ±10 | (6) | $10^{11}$ | $10^{11}$ | ±2000 | ±5000 | 140 | 120 | .25(4) | ±0.05 | ±0.1 | 15 | Yes(5) | DIP | $45.00 |

(1) ±15V at ±10mA isolated power available to power external circuitry. (2) Isolation voltage tested at both ±5000Vp pulse test and 2500V, rms, 60Hz; leakage current tested for 2μA max, at 240V, rms, 60Hz. (3) 3650 is a current input device; to reduce input errors, very low input impedance is desirable. (4) At 240V/60Hz. (5) Models 700 or 710 isolated DC/DC converters may be used to provide isolated power. (6) Protected up to ±6000V.





# ANALOG CIRCUIT FUNCTIONS

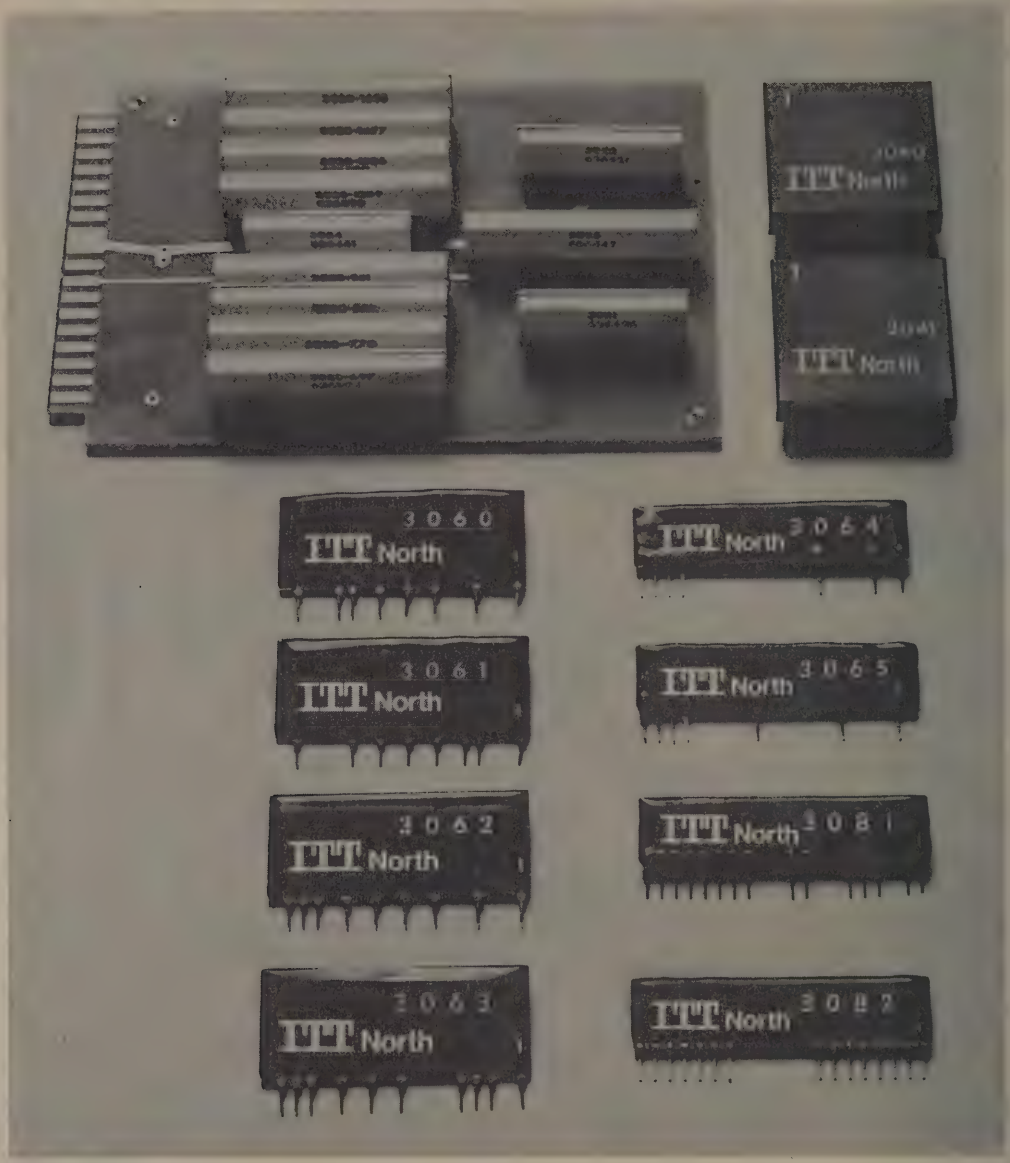
## MULTIPLIER/DIVIDERS

| Model | RANGE OF SPECIFICATIONS: Accuracy at 25°C, max No Trimming Required | RANGE OF SPECIFICATIONS: Specification Temp. Range (°C) | Package | Price (100's) |
|---|---|---|---|---|
| 4203 | 1 - 2% | -55 to +150 | TO-100 | $16.00 - $32.50 |
| 4204 | 0.25 - 0.50% | -55 to +125 | DIP | $38.00 - $65.00 |
| 4205 | 1 - 2% | -55 to +125 | TO-100 | $16.00 - $32.50 |
| 4206 | 0.25% - 0.50% | 0 to +70 | DIP | $24.00 |
| 4213 | 0.50 - 1% | -55 to +125 | TO-100 | $15.50 - $31.00 |
| 4214 | 0.50 - 1% | -55 to +125 | DIP | $14.00 - $30.00 |

## SPECIAL FUNCTIONS

| | Model | Comments | Package | Price (100') |
|---|---|---|---|---|
| Logarithmic Amplifier | 4127 | 0.50 - 1% accuracy; 2 current input signals or 2 voltage input signals | DIP | $36.00 - $33.00 |
| Divider | 4291 | ±0.25 to 1% untrimmed accuracy | DIP | $27.00 - $45.00 |
| Multifunction Converter (Multiply, divide, square root, etc.) | 4301 | Hermetically sealed metal package; compatible with 4302 | DIP | $51.00 |
| | 4302 | $E_o = V_Y (V_Z/V_X)^m$; plastic package. | DIP | $25.00 |
| Peak Detector | 4085 | Read-out of DC voltage equal to peak value of complex wave form | DIP | $36.00/$59.00 |
| RMS-to-DC Converter | 4340 | Laser-trimmed, no external trimming; metal package | DIP | $53.00 |
| | 4341 | Externally trimmed; low cost in plastic package | DIP | $16.50 |
| Oscillators | 4023/25 | Fixed-frequency (10Hz to 20kHz) | Module | $120.00 |
| | 4423 | Very-low cost, RC programmable, 0 to 20kHz | DIP | $9.85 |
| Comparators | 4115/04 | Provides window or dual limit for comparison | Module | $39.00 |
| | 4082/03 | Drives lamps, relays or logic loads | Module | $25.00 |
| Fixed-Frequency Active Filters | ATF76 Series | Pre-tuned, multiple pole bandpass, low-pass, and notch filters | DIP | $37.00 - $114.00 |
| Universal Active Filters | UAF41 UAF31 UAF21 UAF11 | Variable type, 4-resistor, programmable, 2-pole filters; Q and $f_c$ can be programmed; 3 outputs provide low-pass, high-pass and bandpass transfer functions; complex filter response by cascading. | DIP | $8.00 - $39.00 |

# Hybrid Microcircuits? Go North, young man.




ITT North Electric Company, Microsystems Division. That's the name to remember when it comes to specifying:

- PCM filters
- Tone receivers
  - DTMF
  - MFR1
  - No. 5
  - MFR2 (a bandsplit filter for 2-wire operations is available)
- DTMF group filters
- Subscriber line interface circuits
- Custom hybrid circuitry

We have the capability. The experience. The facilities.

We can satisfy your volume requirements for top quality thick-film hybrids.

ITT North specializes in telecommunications applications, but furnishes products to many segments of the electronics industry. Custom circuit inquiries are invited.

Write to us, or call. 700 Hillsboro Plaza, Deerfield Beach, Florida 33441. Phone: (305) 421-8450. TELEX & TWX 510-953-7523.

**ITT North**

Microsystems Division

# HERE ARE 9 COMPELLING REASONS FOR HAVING US PRODUCE A CUSTOM LSI CIRCUIT FOR YOU:

The first reason for using a custom chip at all is the money you'll save. Your production costs will be lower, since you'll only be wiring in one chip instead of many. And you'll save money on quality control, inventory, and in-plant handling.

The second reason is the improved reliability of your finished product.

The third is proprietary protection: a custom circuit is almost impossible to copy, as opposed to a number of standard IC's on a PC board.

And fourth, enhanced marketability: extra functions not included in your original chip concept can be loaded on the chip—usually at no extra cost—enabling the product to do things it could never do before.

The first reason to have your custom chip produced by LSI Computer Systems, Inc., specifically, is that it will receive full-time attention by experts, whatever the size of your order.

The second is that it will be produced on the finest, most advanced processing equipment, and with the MOS technique best suited to your requirements.

Third, each chip will receive 100% functional testing.

Fourth, the "prototypes" you receive for your verification are actually random samples from an actual production run, and not the products of a special engineering prototype line.

And fifth, LSI Computer Systems has been helping companies large and small, in all fields, realize the full benefits of MOS/LSI circuits for over eight years. All of its engineers have been involved with MOS since its infancy.

# AND HERE ARE 9 HOTSHOT STANDARD CIRCUITS FOR YOU TO USE RIGHT NOW:

## COUNTERS

**For DC to 5MHz counting applications.**

LS7030: DC to 5MHz eight decade MOS up counter with 8 decade latch and multiplexer.

Multiplexed BCD and 7 segment outputs. Single power supply +4.75 to +15 VDC (full frequency range over full voltage range). Compatible with CMOS logic. Counter output latches. Leading zero blanking. 40 pin DIP.

**For 5MHz to 500MHz counting applications.**

LS7031: DC to 5MHz six decade MOS up counter with 8 decade latch and multiplexer.

Multiplexed BCD outputs. Access to LSD latches allows attachment of prescalers for counting to 500 MHz. Leading zero blanking. Single power supply operation +4.75 to +15VDC (full frequency range over full voltage range). Compatible with CMOS logic. 40 pin DIP.

**For multi-comparison applications where parallel outputs are required.**

LS7040: Dual 3 decade up/down counter with parallel BCD outputs.

Selectable as 6 decade or dual 3 decade up/down counter. DC to 350KHz count frequency at +5 volts. Fully synchronous operation. Inputs CMOS, TTL, and DTL compatible at +5V operation. Reset. Count enable. Power-on-reset. 40 pin DIP.

## NUMERIC DISPLAY DRIVER

**For liquid crystal or gas discharge displays requiring up to 60V**

LS7100: BCD to 7 segment latch/decoder/driver.

Ion-implanted P Channel MOS circuit compatible with CMOS and TTL systems. Drive voltages up to 60V. 16 pin DIP.

## MULTIPLEXER/ALPHA-NUMERIC DISPLAY DRIVER

**For switching applications and alpha-numeric display applications requiring up to 60V.**

LS7110: Binary addressable latched 8-channel multiplexer/demultiplexer/driver.

Ion-implanted P Channel MOS circuit compatible with CMOS and TTL systems. Drive voltages up to 60V. 16 pin DIP.

## CLOCK CIRCUIT

**For direct drive of large liquid crystal and gas discharge display clocks from 50/60Hz.**

C1200: MOS digital clock circuit.

Directly drives liquid crystal and gas discharge displays (80V P-P across LCD), 50/60Hz AC input. 12 hour clock format (hours and minutes). Independent minute and hour set at 2Hz rate. Flashing 1 second indicator. 28 pin DIP.

## DIVIDERS

**For applications requiring 10 pulses per second from 50/60Hz input.**

RED 5/6: CMOS divider.

Input shaping network. Resettable. Division select input 50/60Hz. Clock enable input. 8 pin* mini-DIP.

**For applications requiring 1 pulse per second from 50/60Hz input.**

RED 50/60: CMOS divider.

Input shaping network. Resettable. Division select input 50/60Hz. Clock enable input. 8 pin* mini-DIP.

**For applications requiring 1 pulse per minute from 50/60Hz input.**

RED 3000/3600: CMOS divider.

Input shaping network. Resettable. Division select input 50/60Hz. Clock enable input. 8 pin* mini-DIP.

* Inputs so arranged that circuit cannot be damaged if plugged in backwards.

**LSI COMPUTER SYSTEMS INC.**

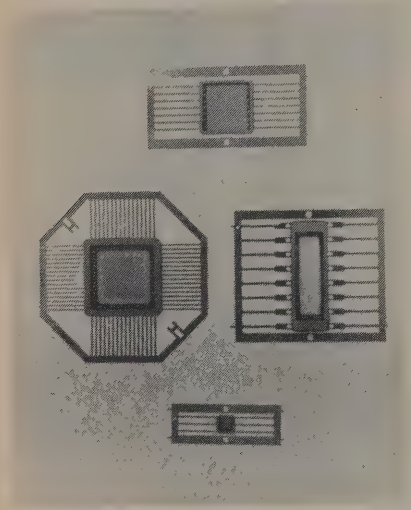
1235 Walt Whitman Road, Melville, New York 11746.
(516) 271-0400. TWX: 510 226 7833.
Argentina Tel. 46-9549. Germany Tel. 089/69 65 66/67.
Italy Tel. (02) 688.38.06 Japan Tel. (03) 449-7141/2
U.K. Tel. 01 995-8495, Mr. Glyn Hall.

MINI-SYSTEMS, INC.
20 David Road, North Attleboro, MA 02761
TELEPHONE: (617) 695-0206 • TWX NO. 710-348-0564

# HERMETIC MICROELECTRONIC FLAT-PAKS

## DESIGN FEATURES

- Designed to meet MIL-STD-883, MIL-STD-750, and MIL-STD-208 requirements.
- Seal Rings lapped flat for best sealing.
- Packages can be ordered with metal or ceramic bases and can be selectively plated.
- .030" lead centers available for greater packaging density.
- Most packages available in extra deep versions.



MINI-SYSTEMS' packages can be custom designed to fit your specific requirements

## PACKAGE GUIDE

| PACKAGE DIMENSIONS | NUMBER OF LEADS | GLASS FREE AREA (MIN.) | INSIDE HEIGHT | PACKAGE PART NO. |
|---|---|---|---|---|
| **STANDARD HERMETIC FLAT-PAKS WITH .050" LEAD CENTERS** | | | | |
| .125 x .125 | 6 | .040 x .070 | .038 | 5A6(M)/(C) |
| .175 x .175 | 8 | .070 x .090 | .032 | 5C8(M)/(C) |
| .250 x .250 | 10 | .150 x .180 | .040 | 5H10(M)/(C)-2 |
| *.250 x .250 | 10 | .130 x .170 | .080 | 5H10(M)/(C)-1 |
| .250 x .250 | 14 | .150 x .180 | .040 | 5H14(M)/(C)-2 |
| *.250 x .250 | 14 | .130 x .170 | .080 | 5H14(M)/(C)-1 |
| .250 x .375 | 14 | .140 x .290 | .040 | 5J14(M)/(C) |
| .250 x .375 | 16 | .135 x .290 | .035 | 5J16(M)/(C)-2 |
| .266 x .375 | 10 | .190 x .245 | .035 | 5K10(M)/(C)-2 |
| .266 x .375 | 10 | .155 x .285 | .040 | 5K10(M)/(C) |
| .266 x .375 | 14 | .155 x .285 | .040 | 5K14(M)/(C) |
| .375 x .375 | 14 | .260 x .290 | .040 | 5L14(M)/(C) |
| *.375 x .375 | 14 | .250 x .280 | .080 | 5L14(M)/(C)-1 |
| .375 x .375 | 14 | .280 x .290 | .045 | 5L14(M)/(C)-2 |
| .375 x .375 | 16 | .260 x .290 | .040 | 5L16(M)/(C) |
| *.375 x .375 | 16 | .250 x .280 | .080 | 5L16(M)/(C)-1 |
| *.375 x .625 | 16 | .285 x .485 | .090 | 5R16(M)/(C)-1 |
| *.375 x .625 | 22 | .240 x .530 | .090 | 5R22(M)/(C)-1 |
| *.375 x .625 | 24 | .240 x .530 | .090 | 5R24(M)/(C)-1 |
| .625 x .625 | 20 | .470 x .500 | .050 | 5U20(M)/(C)-2 |
| *.625 x .625 | 20 | .465 x .495 | .095 | 5U20(M)/(C)-1 |
| *.940 x .873 | 30 | .760 x .760 | .117 | 5X30(M)/(C)-1 |
| *1.0 x 9.40 | 30 | .810 x .810 | .105 | 5X30(M)/(C)-51 |
| *1.290 x 1.290 | 44 | 1.020 x 1.020 | .120 | 5Y44(M)/(C)-1 |
| **SPACE SAVING FLAT-PAKS WITH .030" LEAD CENTERS** | | | | |
| .175 x .175 | 12 | .070 x .090 | .032 | 3C12(M)/(C) |
| .250 x .250 | 16 | .150 x .180 | .040 | 3H16(M)/(C) |
| *.250 x .250 | 16 | .130 x .170 | .080 | 3H16(M)/(C)-1 |
| .250 x .375 | 16 | .160 x .255 | .040 | 3J16(M)/(C) |
| *.250 x .375 | 16 | .150 x .245 | .080 | 3J16(M)/(C)-1 |
| .250 x .375 | 24 | .135 x .290 | .040 | 3J24(M)/(C) |
| *.250 x .375 | 24 | .125 x .285 | .080 | 3J24(M)/(C)-1 |
| .375 x .375 | 24 | .260 x .290 | .040 | 3L24(M)/(C) |
| *.375 x .375 | 24 | .250 x .280 | .080 | 3L24(M)/(C)-1 |
| *.375 x .625 | 24 | .285 x .485 | .090 | 3R24(M)/(C)-1 |
| *.375 x .625 | 44 | .240 x .530 | .090 | 3R44(M)/(C)-1 |
| .375 x .625 | 48 | .210 x .290 | .065 | 3R48(M)/(C) |
| *.545 x .545 | 64 | .330 x .330 | .090 | 3T64(M)/(C)-1 |
| **"DIP" (DUAL INLINE PACKAGE)** | | | | |
| *.250 x .750 | 14 | .135 x .540 | .075 | 10F14(M)/(C)-1 |
| *.250 x .750 | 16 | .135 x .540 | .075 | 10F16(M)/(C)-1 |

*Deep Version

(M) Metal Base
(C) Ceramic Base

MINI-SYSTEMS PAYS CONSISTENT ATTENTION TO

QUALITY
CUSTOMER SERVICE
DELIVERY

# HIGH POWER MICROWAVE SIGNAL GENERATION

## CW or PULSE 150-25,000 MHz

**Epsco** offers you off-the-shelf capability encompassing the vast majority of user requirements. Should you need a special design, however, our engineers can provide state-of-the-art expertise that can save you time and money. Call us. We'll be happy to discuss it.

### PEAK POWER CALIBRATION SYSTEM

**(Mil spec. AN/USM-397)**

A secondary standard for calibrating TACAN, DME, DABS, ATC, IFF and other accuracy-demanding systems in the 925 to 1225 MHz frequency range. Power accuracy of ±0.3 dB is directly traceable to the National Bureau of Standards. Peak power of 5kW. Direct readout of pulse power, pulse width, PRF, and operating frequency. Pulse duration from 0.35 to 5 microseconds. Automatic sequencing. Sync output. Accepts internal/external trigger.

### PULSE SIGNAL SOURCES

**Model PH40K**

*The highest pulse power available in a single generator.*

Covering the range from 150 to 6100 MHz, tuneable plug-in oscillator heads provide guaranteed minimum powers as high as 40kW. Magnetron plug-ins further extend the upper limit to 16,500 MHz. Pulses are continuously variable in width from 0.4 to 25$\mu$s and in repetition rate from 10 to 10,000 pps. Available also in pulse modulator configuration (MH250).

**Model PG5KB**

*Wide range, medium power unit.*

With guaranteed minimum powers as high as 5kW, the Model PG5KB covers 150 to 6100 MHz with plug-in heads. Magnetron plug-ins further extend the upper limit to 16,500 MHz. Pulses are continuously variable in width from 0.3 to 50$\mu$s and in repetition rate from 20 to 25,000 pps.

### CW SIGNAL SOURCE

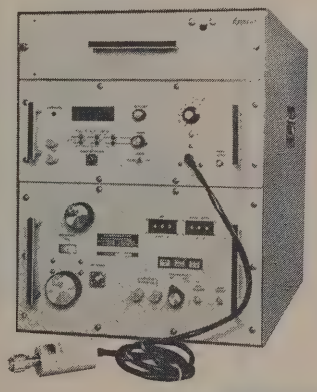
**Model C203**

*The highest CW power available in a single instrument.*

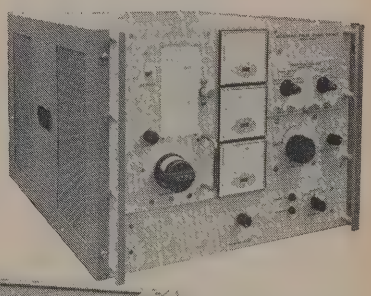
Covering the range from 200 to 6100 MHz with plug-in heads, the Model C203 provides full power modulation at 0.5 duty cycle with internal 1000 Hz square wave generator or from an external pulse source. Power levels of oscillator heads are from 0.5W to 100W.

### CAVITY OSCILLATORS AND AMPLIFIERS

Standard oscillator models for CW or pulse applications in a variety of configurations cover selected frequency bands from 150 to 6100 MHz. Cavity amplifiers from 150 to 3000 MHz, CW and pulse, for applications in TACAN, DME, and similar requirements. These cavities cover the power output range from 0.5W to 40kW.



PH40K



PG5KB

C203

Epsco INCORPORATED

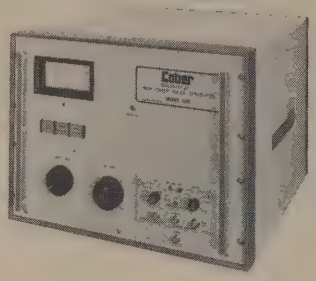
APPLIED MICROWAVE DIVISION

411 Providence Highway • Westwood, MA 02090

(617) 329-1500 • TWX (710) 348-0484

# HIGH POWER-AMPLIFIERS, PULSE GENERATORS, D.C. POWER SUPPLIES, MICROWAVE SYSTEMS

## HIGH POWER PULSE GENERATORS



**Model 606** generates 31KW pulses, 2500 volts at 12.5 amps. Pulse width is 50 nanoseconds to 10 milliseconds, rep rate 1 shot to 1MHz with rise time of 20 nanoseconds. Drives grids of tubes and guns, use it for gas discharge and plasma studies as well as component testing, laser applications and more.

Cober's pulse generators are versatile lab instruments and provide high power kilowatt pulses in nanoseconds. A broad line is available from stock with pulse widths out to D.C., both positive and negative polarities or alternating polarities and outputs floating to 50 KV. Plug-in accessories provide an extensive range of voltage and current combinations.

## LABORATORY MICROWAVE SIGNAL GENERATORS AND AMPLIFIERS

Model 2251 is broadband, TWTA providing 250 watts CW or 1KW pulsed from 1.0-1.5GHz. Pulse width is variable from 0.5-20 microseconds and is used for CW and pulse jamming studies on countermeasures programs.

Cober's high power R.F. signal generators and amplifiers provide microwave frequency energy for use in antenna-pattern studies, EMI susceptibility measurements, and in testing microwave components such as TR limiters, filters and circulators. In ground support equipment stations, Cober units are the basic source of high power microwave test frequencies.

Cober's sources use magnetrons or amplifiers such as klystrons and TWT's working in conjunction with suitable oscillators and drivers. The choice of the final tube is dependent on the required power output, frequency, bandwidth and, of course, the intended application. Units are available from L-Band to millimeter frequencies, for CW or pulse operation and at power levels from several hundred watts to the megawatt region.

## MICROWAVE COMMUNICATIONS TRANSMIT SUBSYSTEMS

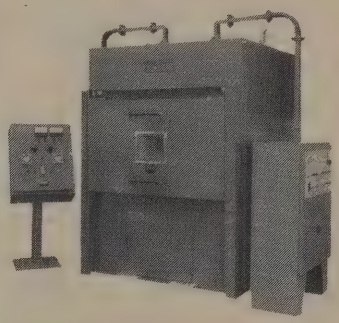
**Model 1400-KK12, 14-14.5GHz,** 1.25KW Klystron PA is uplink HPA for satellite communications. Handles data, voice and TV signals and can be supplied with preset channel tuning and for local or remote operation.

Cober HPA's and transmitters are the heart of satellite and troposcatter communications systems. All circuitry is fully solid state except for the final amplifier tube. Features include complete equipment and personnel safety, flexible controls and status indicators and a full complement of accessories for the greatest possible system versatility. Careful design assures low distortion, spurious and harmonic content.

Cober HPA's and transmitters are available at power levels of several hundred watts to many kilowatts at microwave frequencies. Cober has standard units for the "L," "S" and "C" band tropo frequencies and for the 5.9-6.4GHz, 7.9-8.4GHz and 14.0-14.5GHz satellite communications frequencies.

Frequency upconverters to translate a 70MHz modulated IF to the microwave carrier frequency are also available for integral mounting in HPA's. Model 1400-UP70 converts 70MHz to any selected carrier frequency in the 14.0-14.5GHz range.

## MICROWAVE HEATING SYSTEMS

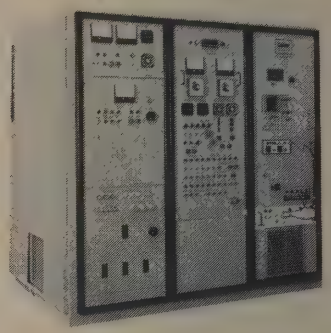


**Model BPH 18A, 6 to 18KW, 2450MHz** industrial microwave oven provides rapid and efficient processing. System includes auxiliary high temperature hot air heating. Cavity size is 4′ x 4′ x 3′ and has remote control, automatic processing cycling and forward and reflected power meters to monitor process and maximize efficiency."

For industrial applications. Full range of power packs from 1 to 50KW at both 2450MHz and 915MHz. Complete systems for laboratories, food, chemical, rubber, foundry and factory applications. Ovens, components, waveguide and instrumentation for users to assemble their own systems and complete applications assistance to adopt microwaves to new processes for efficient, energy conscious, smoke free, high quality electronic processing.

## PULSE MODULATORS AND D.C. POWER SUPPLY SYSTEMS

Cober's line of pulse modulators include units to drive high powered pulsed microwave tubes, high power lasers, plasma tubes, and ultra-violet sources. Power levels range from a few kilowatts to over 100 megawatts. In addition to standard modulators, we specialize in the generation of state of the art nanosecond rise times and high rep rates. Full MIL Spec solid state modulators are supplied for systems use, and soft tube and hard tube units are furnished for laboratories and particle accelerator facilities.



**Model 2048** is 35KV TWT Test Set. Includes highly regulated D.C. power supplies and Cober developed grid modulator. Unique feature is oscilloscope "floating" at 35KV with all controls at ground potential that allows precise display of TWT pulses.

Cober's unique pulse capability is combined with its power supply "know-how" to provide special pulsed systems for fusion research programs. This pulse and D.C. capability has made Cober the leading supplier of high power microwave tube test equipment.

Cober Laboratory and MIL Spec DC supplies operate over 5KW and at voltages between 5KV and 1000KV. Standard electro-mechanical or electronic regulator modules can be incorporated to furnish regulation and ripple to 0.001%. Our Systems Engineering Group designs full MIL Spec units and provides all integration and software to satisfy Government requirements.

The products shown on this page are representative of Cober's very broad line. They have in common a concept of standard packaged modules and designs which make it as easy and as economical for our customers to buy units to their own specifications as it is for them to buy our standard products. If your need is in the area of high power electronics won't you please call us.

**Cober**
electronics, inc.

**"THE HIGH POWER PEOPLE"**

**DEPT. EM, 7 GLEASON AVE., STAMFORD, CT 06902**
**PHONE: (203) 327-0003 TWX: 710-474-3371**

MCL INC LA GRANGE ILL

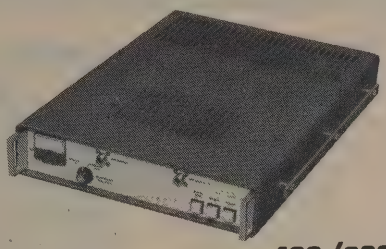
# MICROWAVE AMPLIFIERS AND GENERATORS

## TWT AMPLIFIERS

Four models cover your power requirements: 10, 20, 100 and 200 watts. All provide stable microwave power to meet testing, measurement, and calibration requirements.

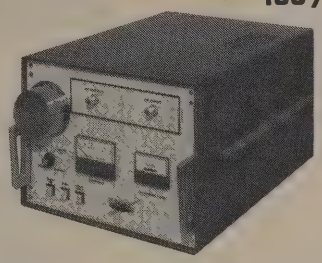
Modular construction and plug-in boards accommodate a wide variety of standard and special traveling wave tubes.

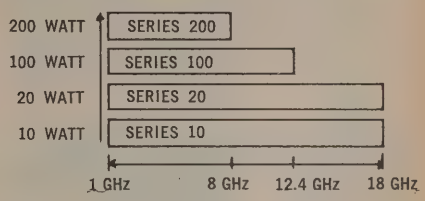
Solid state components and protective circuitry. Beam and helix current metering. Options include VSWR protection, harmonic filtering, and power monitoring.



**10/20 WATT SERIES**

**100/200 WATT SERIES**






## 65 WATT SIGNAL GENERATOR

10 to 2500 MHz with six plug-in heads. Highest stability and reliability for laboratory calibration, testing, and measurement.

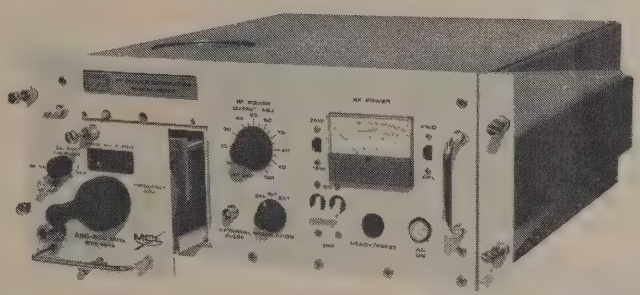
**Frequency Stability:** ±0.003%/10 minutes.

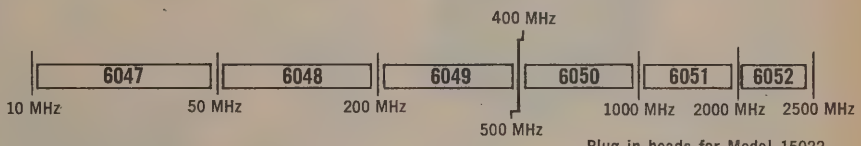
**Power Stability:** ±0.2 db/hour.

Internal and external modulation. Single control tuning to 1% of actual frequency. Front panel power indication.

All solid state components (except osc. tube), regulated power supplies, and conservative design provide laboratory quality in a compact unit.

**MODEL 15122 SIGNAL GENERATOR**



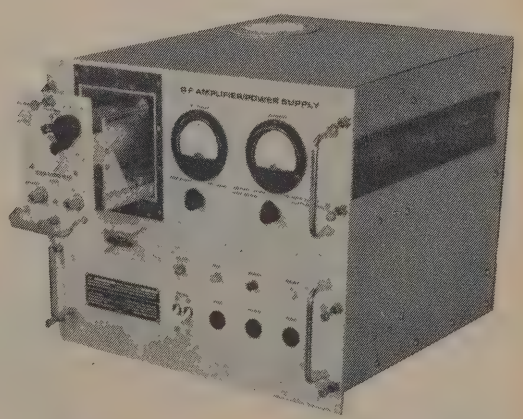


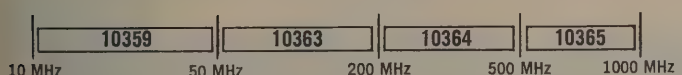

Plug in heads for Model 15022

## 200 WATT CW AMPLIFIER

10 to 1000 MHz with four plug-in heads. The amplifier can be used to drive higher power amplifiers or as a final amplifier driven by a lower power source.

**MODEL 10358**



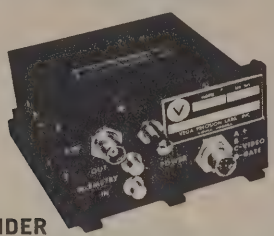



# VEGA PRECISION LABORATORIES, INC.

VEGA MAJOR PRODUCTS: Portable Radar Tracking Systems • Command and Data Systems • Target Control Systems • Radar Transponders • Radar Beacons • Transmitters • Receivers • Location and Navigation Systems • Radar Augmentation Devices • Special Test Equipment • R-NAV Devices • Antennas and Microwave Devices • Ranging Systems

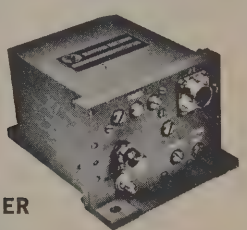
## X BAND RACON TRANSPONDER
**(MODEL 361X)**

This Vega RACON is a navigation aid suitable for positioning offshore drilling equipment, buoy moorings, and defining most sea and landmark locations. **Transmitter:** ±3 MHz, 300 watts minimum, 2 pulse reply. **Receiver:** −65 dbm sensitivity. **Environmental:** Watertight, temp. −40°C to +70°C. **Power:** 24 to 30 VDC (no internal ground). **Size:** Overall height 15 in. Diameter: 8½ in. **Weight:** Approximately 9 lbs.



## C-BAND RADAR TRANSPONDER
**MODEL 302C-2**

**Freq:** 5.4-5.9 GHz; **Receiver Type:** Superhet with sensitivity of −70 dbm; **Transmitter Type:** Magnetron with 400 w min. peak power output; **Input Power:** 22 to 32 VDC; **Size:** 43 cu. in.; **Weight:** 43 oz.; **Temp:** −35°C to +75°C; **Altitude:** 230,000 ft.; **Humidity:** 100%; **Shock:** 125 g in any direction, 3 shocks in opposite directions along each axis for 6 μsec. each; **Acceleration:** 125 g applied along any axis for 3 minutes; **RFI:** Per MIL-1-26600. **Vibration:** Sinusoidal, 5 to 25 Hz 0.4 in. DA and 15 g 15 to 2500 Hz.



## C-BAND RADAR TRANSPONDER
**MODEL 321C**

**Freq:** 5400-5900 MHz; **Receiver Type:** Superhet with sensitivity of −70 dbm, 100% firing; **Transmitter Type:** Triode Cavity with 300 w min. peak power output; **Input Power:** 24 to 32 VDC, 45 w; **Size:** 38 cu. in.; **Weight:** 44 oz.; **Temp:** −37°C to +75°C; **Altitude:** 230,000 ft.; **Acceleration:** 125 g; **Shock:** 125 g; **Vibration:** Sinusoidal, 5 to 25 Hz, 0.4 DA. 25 to 2500 Hz, 15 g **RFI:** Per MIL-1-26600.

## CAVITY BACKED HELIX ANTENNAS
**MODELS 815S, 820C and 830X — C, S, and X BAND**

An optical quartz-loaded, cavity backed helix radiator which produces a circularly polarized radiation pattern. The use of quartz material provides for high and low temperature stability with no degradation in electrical performance. Flush mounting is normally used on reentry vehicles with no performance deterioration as a result of reentry heat.

## X-BAND RADAR TRANSPONDER
**VEGA'S MODEL 229X**

Miniature all solid-state radar transponder is smaller than a king size pack of cigarettes; weighs only 10 oz. This X-Band (9.1-9.6 GHz) unit employs the latest state-of-the-art solid-state devices and construction techniques, and features high sensitivity (−40 dBm full-firing) with average power output of 4 watts peak. It operates with an input voltage from 24 to 32 VDC and draws only 60 milliamperes quiescent or 80 milliamperes at a PRF of 2500 PPS. Uses single or double pulse codes and operates with practically all X-Band airborne, ship and ground radars in use today without any change to the radar. A circularly polarized antenna is attached to the top of the unit. Optional battery pack available. Also available in C-Band (5.4-5.9 GHz).

## C, S AND X-BAND STUB ANTENNAS
**MODELS 832S, 845CX**

A vertically polarized omnidirectional antenna enclosed within a radome, it is compact and extremely lightweight while maintaining the electrical and environmental characteristics of this type antenna. Height of the radome is approximately ¾″; diameter is approximately 1″. The skin of the vehicle serves as the ground plane for the antenna due to the simplified mounting technique. Mounting is accomplished via a "D" hole (.505 dia. x .480 flat) through the vehicle skin. It is then secured to the vehicle with a locking nut.

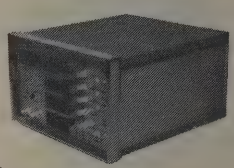
## RADAR SIMULATORS
**C-BAND**
**X-BAND**
**S-BAND**

The 616C, 617X, and 627S Series are designed to interrogate and measure parameters of radar transponders or beacons during final checkout on a launch pad or flight line. They are particularly useful when tracking radars are located at great distances from launch sites. Transmitters and receivers are calibrated and controllable from the front panel in tuned frequency, output power, code spacing and sensitivity. Built-in oscilloscopes are hooded for daylight viewing. A resonant stubhorn antenna is standard. The internal battery supply includes a self-contained charging circuit. Telescoping legs are optional.

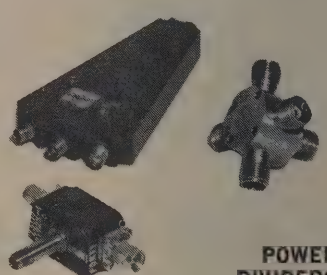
## HORN ANTENNA TYPES

The Model 844X-2 Flared Horn Antenna was developed for use in target drone applications. Radiation coverage is controlled to the desired beamwidths by the flared aperture. A colinear type feed is employed to couple energy from the TNC input connector into the waveguide. Construction utilizes standard aluminum waveguide parts dip-brazed together. The radome is epoxied in position over the aperture. Flared horn antennae of this type are available in other frequency bands utilizing the same design.

## DIGITAL CODE GENERATOR
**MODEL 766**



Generates extremely accurate pulse stream for pulse position code simulation. Pulse stream starts with a sync pulse followed by five data pulses. Each data pulse is independently adjustable for both delay from the sync pulse and for pulse width. Delay adjustable from 0.0 to 999.9 microseconds in 0.1 microsecond steps. Width is continuously adjustable from 0.1 to 1.0 microseconds. Operates from 115 VAC, 50 to 400 Hz. Outputs are TTL positive logic terminated in 50 ohms.



## POWER DIVIDERS

Vega produces an assortment of power dividers with two, three or four-way division in addition to a variable power divider. Choice of connectors (TNC or SMA) is offered in most models. All designs are well engineered and provide low VSWR, low insertion loss, and balanced power division with high power capabilities. Some designs are qualified for missile and satellite use. Frequency ranges extend through X-Band with stripline and coaxial devices.

Vega's antenna and microwave engineering staff specialize in the design and development of aircraft, space and missile components. Among our designs are units intended for RPV control. A single basic system can be used to control virtually any vehicle. Our laboratory utilizes the latest in equipment and suitable antenna test ranges are maintained. Some of the more popular available components are shown above.

**VEGA PRECISION LABORATORIES, INC.**

800 Follin Lane, S.E. • Vienna, Va. 22180 • (703) 938-6300 • Telex: 89-2521

ARRA INC.
ANTENNA & RADOME RESEARCH ASSOCIATES

Coaxial • Waveguide • Solid State
microwave
Components • Assemblies • Sub-Systems

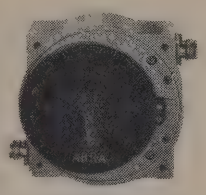
# VARIABLE ATTENUATORS DC THRU 18000 MHz

## Direct Reading

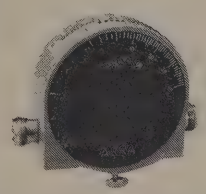
**Low Ins. Loss • 1.5 Max. VSWR • 10 Watts Aver. Power**

| Freq. Range (GHz) | Atten. Range (dB) | Atten. vs. Freq. (±dB) | Form Type | Model No. |
|---|---|---|---|---|
| DC-0.3 | 50 | 2.0 | 0-760 | 7684-50* |
| DC-1.0 | 20 | 1.5 | 0-760 | 7684-20* |
| 0.5-1.0 | 60 | 1.0 | 0-214 | 2952-60 |
| 0.5-1.0 | 100 | 1.5 | 0-214 | 2952-100 |
| 0.9-1.3 | 60 | 1.0 | 0-660 | 2-3952-60 |
| 0.9-1.3 | 100 | 1.5 | 0-660 | 2-3952-100 |
| 1.0-2.0 | 10 | 1.0 | 0-1014 | 3617-10F |
| 1.0-2.0 | 60 | 1.0 | 0-660 | 3952-60X |
| 1.0-2.0 | 100 | 1.5 | 0-660 | 3952-100X |
| 1.4-2.4 | 80 | 1.25 | 0-660 | 3-4952-80 |
| 2.0-4.0 | 10 | 1.0 | 0-51 | 4674-10F |
| 2.0-4.0 | 20 | 1.5 | 0-51 | 4674-20F |
| 2.0-4.0 | 30 | 2.0 | 0-51 | 4674-30F |
| 2.0-4.0 | 60 | 1.0 | 0-660 | 4952-60X |
| 2.0-4.0 | 100 | 1.5 | 0-660 | 4952-100X |
| 2.5-4.0 | 10 | 0.75 | 0-51 | 4674-10G |
| 2.5-4.0 | 20 | 1.0 | 0-51 | 4674-20G |
| 4.0-8.0 | 10 | 0.6 | 0-39 | 5684-10F |
| 4.0-8.0 | 20 | 1.0 | 0-39 | 5684-20F |
| 4.0-8.0** | 60 | 1.0 | 0-660 | 5952-60X |
| 4.0-8.0** | 100 | 1.5 | 0-660 | 5952-100X |
| 5.4-11.0 | 10 | 1.0 | 0-39-2 | 5-6684-10F |
| 5.4-11.0 | 20 | 1.5 | 0-39-2 | 5-6684-20F |
| 7.0-11.0 | 10 | 0.5 | 0-39-2 | 6684-10F |
| 7.0-11.0 | 20 | 1.0 | 0-39-2 | 6684-20F |
| 8.0-12.4 | 10 | 0.5 | 0-39-2 | 6684-10X |
| 8.0-12.4 | 20 | 1.0 | 0-39-2 | 6684-20X |
| 12.4-18.0 | 10 | 0.5 | 0-39-2 | 9684-10F |
| 12.4-18.0 | 20 | 1.0 | 0-39-2 | 9684-20F |
| 12.4-18.0 | 30 | 1.0 | 0-39-2 | 9684-30F |

*See catalog for VSWR, Ins. Loss and Power.
**Only less than octave — consult factory.



Form 0-660: 5″ Dia.
Form 0-214: 6″ Dia.



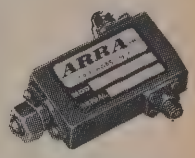
Form 0-39 & 0-39-2: 3″ Dia.
Form 0-51: 5″ Dia.

## Miniature

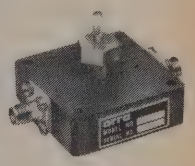
**0.5 dB Max. Ins. Loss • 5 Watts Aver. 3 KW Peak • 2 Ounces**

| Freq. Range (GHz) | Atten. Range (dB) | Atten. vs. Freq. (±dB) | Max. VSWR | Form Type | Model No. |
|---|---|---|---|---|---|
| 1.0-2.0 | 10 | | 1.8 | 3651 | 3814-10 |
| 1.5-2.0 | 15 | | 1.7 | 3651 | 3814-15 |
| 2.0-4.0 | 10 | | 1.8 | 2191 | 4804-10 |
| 2.0-4.0 | 20 | | 1.5 | 3651 | 4814-20 |
| 2.5-4.0 | 10 | | 1.5 | 2191 | 4804-10X |
| 3.0-4.0 | 10 | 1.5 | 1.5 | 3347 | 4603-10 |
| 4.0-8.0 | 10 | | 1.5 | 2191 | 5804-10 |
| 4.0-8.0 | 20 | | 1.5 | 2191 | 5804-20 |
| 4.0-8.0 | 30 | | 1.5 | 3651 | 5814-30 |
| 4.0-8.0 | 10 | 1.5 | 1.5 | 3347 | 5603-10 |
| 6.0-11.0 | 10 | | 1.5 | 2191 | 5-6804-10 |
| 6.0-11.0 | 20 | | 1.5 | 2191 | 5-6804-20 |
| 6.0-11.0 | 30 | | 1.5 | 2191 | 5-6804-30 |
| 6.0-11.0 | 40 | | 1.5 | 3651 | 5-6814-40 |
| 8.0-18.0 | 10 | 1.5 | 1.5* | 2191 | 9803-10 |
| 8.0-12.4 | 10 | | 1.5* | 2191 | 6804-10 |
| 8.0-12.4 | 20 | | 1.5* | 2191 | 6804-20 |
| 8.0-12.4 | 30 | | 1.5* | 2191 | 6804-30 |
| 8.0-12.4 | 40 | | 1.5* | 3651 | 6814-40 |
| 8.0-12.4 | 10 | 1.5 | 1.5 | 3347 | 6603-10 |
| 8.5-10.5 | 10 | 0.5 | 1.5 | 2191 | 6803-10A |
| 8.5-10.5 | 20 | 0.5 | 1.5 | 2191 | 6803-20A |
| 10.5-12.4 | 10 | 0.5 | 1.6 | 2191 | 6803-10B |
| 10.5-12.4 | 20 | 0.5 | 1.6 | 2191 | 6803-20B |
| 12.0-18.0 | 10 | | 1.5 | 2191 | 9804-10X |
| 12.0-18.0 | 20 | | 1.5 | 2191 | 9804-20X |
| 12.0-18.0 | 30 | | 1.7 | 2191 | 9804-30X |
| 12.0-18.0 | 40 | | 1.7 | 2191 | 9804-40X |
| 12.0-18.0 | 10 | 1.0 | 1.5 | 2191 | 9803-10A |
| 12.0-18.0 | 15 | 1.0 | 1.7 | 2191 | 9803-15A |

*1.7 VSWR above 11.0 GHz.



Form 2191: 1¾x1x½″
Form 3651: 2x1¼x½″



Form 3347: 1½x1½x½″

# BROADBAND DIODE DEVICES

SP4T

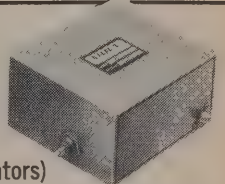
## SPST & SPNT Switches

- High Isolation
- Low Insertion Loss
- Integrated Drivers Available

| Configuration | Freq. Range (MHz) | Switching Time (nsec) | Average Power (Watts) | Model Number With Driver | Model Number Without Driver |
|---|---|---|---|---|---|
| SPST | 100-18000 | 20 | 2 | F8753-80D | F8753-80 |
| SPST | 200-18000 | 50 | 5 | 8753-80D | 8753-80 |
| SPST | 500-18000 | 10 | 2 | H8753-80D | H8753-80 |
| SPDT | 200-18000 | 500 | 2 | 2-8753D | 2-8753 |
| SP3T | 200-18000 | 500 | 2 | 3-8753D | 3-8753 |
| SP4T | 200-18000 | 500 | 2 | 4-8753D | 4-8753 |
| SP5T | 200-18000 | 500 | 2 | 5-8753D | 5-8753 |

## Attenuators & Modulators

- Absorptive for all Values
- Each Model 200-18000 MHz
- Low Insertion Loss
- Integrated Linearized Driver (Attenuators)
- TTL Compatible Driver (Modulators)



Model 8752-30D

| Configuration | Attenuation (dB) | Switching Time | Model No. |
|---|---|---|---|
| Cont. Variable | 35 | 50 μsec | 8752-35D |
| Cont. Variable | 65 | 50 μsec | 8752-65D |
| On/Off | 30 | 20 nsec | 8752-30M |
| On/Off | 65 | 20 nsec | 8752-65M |

# COAXIAL COMPONENTS

**Phase Shifters**

DC-18GHz Model

**Microwave Filters**

.03-18GHz Bandpass & Reject

**Broadband Fixed Attenuators**

DC-18GHz High Power

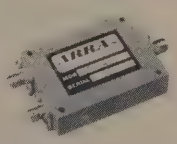
**Broadband Terminations**

DC-18GHz High Power

**Couplers & Hybrids**

Bands from .5-18GHz

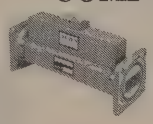
**Power Dividers**



Bands from .25-18GHz

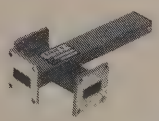
**Motorized Variable Attenuators**
**500 Watt Variable Attenuators . . . Lots More**

# WAVEGUIDE COMPONENTS & ASSEMBLIES

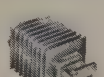


Broadband Diode Switches

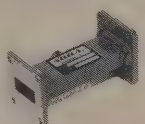
Variable Attenuators



Cross Guide Couplers



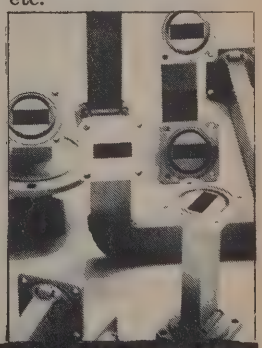
Dummy Loads



Fixed Attenuators

Filters

ARRA will fabricate your special waveguide assemblies in any material and finish . . . from the simplest straight section and single bend to complex combinations of bends, miters, twists, etc.



**Send for Complete New Catalog**

15 Harold Court • Bay Shore, L.I., N.Y. 11706 • Phone: (516) 231-8400 • TWX: 510-227-6231

# RF Filters, Converters, Switches, Amplifiers, Multipliers, Signal Sources, Multicouplers

*Applied Research*
IS THE SOURCE FOR

## FREQUENCY SOURCES

- VCO Oscillators
- Phase Lock Oscillators
- Frequency Multipliers
- Synthesizers
- Spectrum Generators

Applied Research has a complete line of frequency sources from HF to the microwave region up to and including 16 GHz. These sources incorporate one or more of the above drivers from either a free running stabilized source or crystal controlled reference, and can optionally incorporate modulation capabilities.

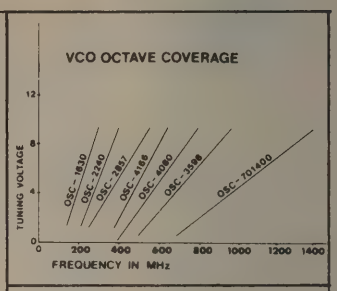
***Power Output Capabilities***

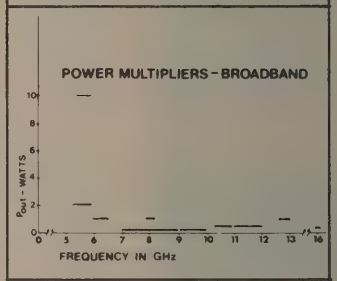
From mW to Watts. Where power amplifiers are not available from 2 to 16 GHz, we can supply 10 watts at 2 GHz to 1 watt at 12 GHz instantaneous broadband. A typical unit at 5.9 to 6.4 GHz will deliver 5 to 10 watts within ±1 dB over the bandpass.

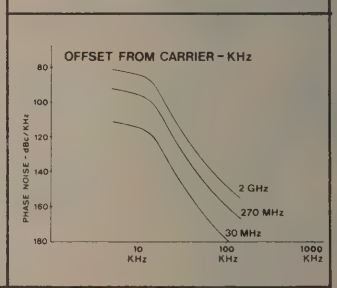
***Spurious Response***

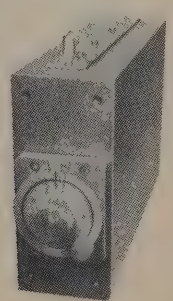
Through the use of bandpass and band reject filters, spurious responses can be held to any degree desired. Standard specifications are 60 dB below carrier level.

So if you have a frequency source requirement, call the source today. Applied Research.



### BAND REJECT FILTER (225 to 400 MHz)

Single knob control band reject filters reject unwanted signals, with extreme selectivity through L-band. Tune ranges of nearly an octave can be obtained. Units are tunable over the range 225 to 400 MHz. The bandwidth is >1 MHz at the 60 dB points. Total notch depth is 60 dB. Use of helical resonators provides for high rejection and low insertion loss in the passband of <1 dB. The phase linearity in the passband is achieved by utilizing quarterwave coaxial lines.

**PERFORMANCE SPECIFICATIONS**

Insertion Loss (out of notch region): 1 dB
Notch Range: 225 to 400 MHz
Typical Notch Specs: Frequency 225.2 MHz; 1 dB bandwidth 11.1 MHz; Depth 68 dB
Impedance (I & O): 50 ohms
VSWR (I & O) (out of notch region): < 1.3:1
Group Delay (out of notch region): < 20 ns

### CONVERTERS

State of the art converters available for military or commercial application throughout the frequency range. All units are constructed to meet mil applications.

**TELEMETRY CONVERTERS**

These units permit the ready adapting of existing UHF telemetry receiving equipment for use in the 1435 to 1540 and 2200 to 2300 MHz telemetry band with high conversion gain.

General characteristics:

| | |
|---|---|
| Long term stability: | better than ±.1 PPM over temperature range |
| Image rejection: | >than 50 dB |
| Noise figure: | better than 5 dB for 100 mc bandwidth (2.2 to 2.3 GHz) |

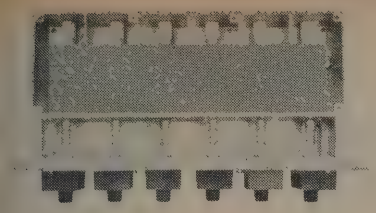
### FIXED PAD ATTENUATORS & TERMINATIONS (DC—2.5 GHz)

**FOR TYPES BNC, TNC C, N & OSM CONNECTORS**

Integrated line of fixed pad attenuators, terminations and impedance-matching transformers provides means for rapid and accurate division of voltages over the frequency range of DC—2.5 GHz, and for the matching of different impedances with minimum loss over a broad frequency band. The unit cost is within the practical price range of the large and small equipment user, as well as the research and experimental user.

General characteristics:

| | |
|---|---|
| Frequency Range: | DC—2.5 GHz |
| VSWR: | 1.25:1 |
| Attenuation Accuracy: | ±0.5 dB |
| Impedances (nominal): | 50, 75, 90 ohms |
| Attenuation values: | 1, 2, 3, 4, 6, 10, 12, 15, 20 dB (standard) |



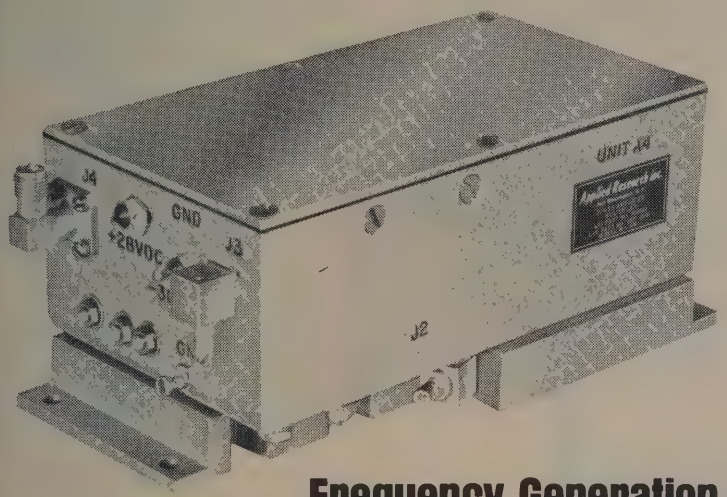
## BAND REJECT FILTER (240 to 365 MHz)

Band reject filters operating from the HF range to K-band exhibit a wide bandpass frequency range without reentrances. Resonant elements are independently tuned or ganged to a single knob control. Operation is over frequency ranges greater than one octave, providing high rejection at one frequency or rejection by greater than 15 to 20 dB to as many as six separate and independent frequencies within the band.

Two or more notches can be aligned to adjacent frequencies to vary the depth and/or bandwidth of the band rejection curve. With all rejection notches tuned to a single frequency, the resultant response is such that an undesired signal approximately one percent away from a desired signal is attenuated by more than 70 to 80 dB while the desired signal is passed with only a 1 dB insertion loss.

**PERFORMANCE SPECIFICATIONS**

Insertion Loss (out of notch region):
<1 dB 100 to 1000 MHz
Bandpass: DC to 1000 MHz
Notch Frequency: 240 to 365 MHz
Typical Rejection below Passband: 240 MHz/23 dB; 325 MHz/19 dB; 365 MHz/17 dB
Impedance (I & O): 5 ohms
VSWR (I & O): < 1.35:1




# Frequency Generation thru Multiplication & Phase-Lock techniques

**VHF to Ku-Band (10 MHz to 1.5 GHz)**

Applied Research offers many proven designs using both techniques. And we're capable of meeting your exact requirements, precisely.

Our Phase-lock loops, comprised of I.C. components, together with RF devices, yield outputs of up to 10 watts at microwave frequencies. And our multipliers are available as passive devices or in combination with amplifiers having multiplication factors of from 2 to 2000. In combination with varactor multiplier devices output in Ku-band can be obtained.

What's more, we can supply crystal oscillators or internal drivers to provide a self-contained source.

**SOME PERFORMANCE SPECIFICATIONS**

**Phase-Lock Signal Source**
Output: 494 MHz @ 10 watts
Stability: .005% from internal crystal oscillator

**Phase-Lock Synthesizer**
Input: 6 MHz & 200 MHz @ 10 dBm each
Output: 218, 224, 230, 236, 242, 248, 254, 260 MHz @ 10 dBm each
Spurious: 60 dBc min.

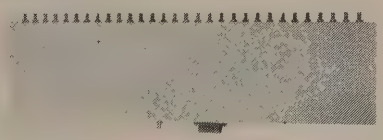
**Ku-Band Multiplier**
Input: 45.5 to 46.1 MHz @ 1 dBw; (other inputs available)
Output: 15.3 to 15.5 GHz @ 100 milliwatts
Spurious: 60 dBc min.

**C-Band Multiplier**
Input: 50.3 to 51.5 MHz @ 1 milliwatt; (other inputs available)
Output: 5030 to 5150 MHz @ 200 milliwatts
Spurious: 60 dBc min.

## TUNABLE BAND REJECT FILTERS (5-2000 MHz)

Tunable multicontrol band reject filters provide high rejection of more than one and up to eight unwanted signals, or, extreme rejection of one. Low insertion loss and sharp skirt selectivity in the band reject region. Eight knobs and counter readout allow continuous tuning.

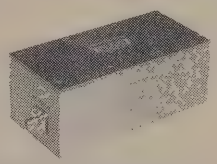
General Characteristics:
- Center Frequency: 5-2000 MHz
- Out-of-Band Insertion Loss: 0.5 dB
- Notch Bandwidth: narrow as ¼% fo
- Notch Depth: 20 dB/section
- VSWR (outside of notch region): 1.5:1
- Size: 24" x 2" x 8"
- Connectors: BNC



## SWITCHES (10-1000 MHz)

A series of computer compatible solid state switches using PIN diodes in a broadband stripline matching structure. Can be directly addressed without interfacing. Units available with equal path lengths to all outputs, providing good phase coherence with phase and amplitude tracking on all ports. Switch matrix configurations are also available.

General Characteristics:
- Frequency Band: 10-1000 MHz
- Switch Configuration: 1x2 to 1x30
- Isolation: 70 dB min. (higher available)
- Insertion Loss: 1.0 dB max.
- VSWR: 1.2:1
- Operation Time: 1.0 μsec.
- Primary Power: ±4.5V, 50ma per crosspoint
- Sizes: 2" to 16"L x 4"W x ½"H



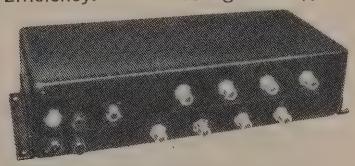
## BROADBAND MULTIPLIERS (5-18,000 MHz)

These units utilize solid state devices.

Using the frequency multiplier as the basic tool, lines of Signal Sources, Frequency Synthesizers and Multiplier Chains are now available.

General characteristics:

| | |
|---|---|
| Frequency Range: | 5-18,000 MHz |
| Bandwidths: | up to 27% |
| Power Output: | up to 5 watts |
| Efficiency: | as high as 50% |



## MULTICOUPLERS

Model HFM Series is designed to meet the needs of most systems.

General features:
- High isolation between outputs
- High dynamic range
- Low noise
- Modular construction
- Solid-state
- Octave bandwidth (if desired)

Model PM Series of passive multicouplers provides the ultimate performance in signal distribution.

*Applied Research* INCORPORATED

76 So. Bayles Ave., Port Washington, N.Y. 11050, (516) 883-5700, TWX #510-223-0822.

# CATALOGUE DE L'ELECTRONIQUE POUR LES INGENIEURS
# DER PRODUKTKATALOG FÜR ELEKTRONIKER
# ELECTRONIC ENGINEERS CATALOGUE

## The 1978 edition is out...and the response is in...
## IMMEDIATE AND OVERWHELMING

ACCEPTANCE

The ELECTRONIC ENGINEERS CATALOGUE is the only comprehensive, trilingual catalogue/source-directory of electronic products available to—and from—Western Europe.

It is divided into three distinct sections: 1. **The Product Index and Directory,** which lists more than 3,000 product headings & cross-references alphabetically in English with their French and German equivalents. 2. **The Manufacturers' Catalogue Section,** which is a compilation of Manufacturers' Catalogues in alphabetical order. 3. **The Manufacturers' Sales Offices and Trade Marks Directory,** which alphabetically includes country, address, telex or TWX numbers of the Manufacturers' main and local sales offices and/or agents.

The ELECTRONIC ENGINEERS CATALOGUE offers U.S. manufacturers the most cost-efficient method of distributing their catalogue data to **25,000** electronic engineers and buyers throughout Western Europe. It represents the carefully conceived application of the time-proven **eem** "cataloging" concept to the elusive European marketplace.

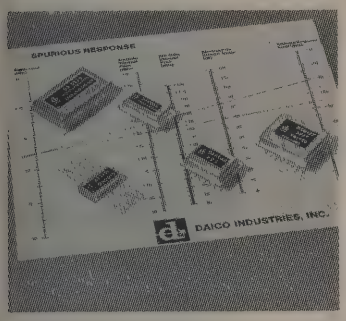
United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Avenue, Garden City, New York 11530 / 516 222-2500

# DAICO INDUSTRIES, INC.

## IF / RF SWITCHES

### Programmable Attenuators and Phase Shifters

Send for our Switch and Microwave Component Catalog.




### THIN-FILM HYBRID INTEGRATED CIRCUITS

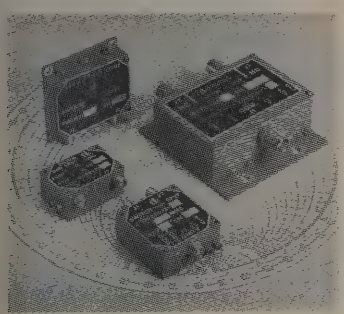
Thin film hybrid packaging techniques have allowed miniaturization of the Daico Industries product line. Switches include drivers compatible with TTL or CMOS logic. Step attenuators are packaged in multi-section units. These wideband devices are available in frequency ranges from 10-50 MHz, 50-500 MHz and 100-800 MHz. They are custom designed and built to your specifications. We can provide prototypes in any of our stock packages. Contact us with your particular requirements.

**SWITCHES**
- HIGH SPEED, LOW TRANSIENT
  $T_{ON}$ = 30 ns; Trans. = 20mV (Typ)
- LOW CURRENT 10-500 MHz; +20dBm; 1-10$\mu$s
- STD: 10-300 MHz; +10dBm; 1.0$\mu$s

**STEP ATTENUATORS**
- Ranges (dB): 0.25-0.50; 0.75-1.5; 1-32; 2-4; 3-6; 8-16; 10-12 & 12-24

**STEP-PHASE SHIFTERS**
- Dual $\pi$ Section Switches

**VC ANALOG ATTENUATORS (0-5V DC Control)**
- Ranges (dB): 15; 20 & 40 • VSWR: 1.15/1



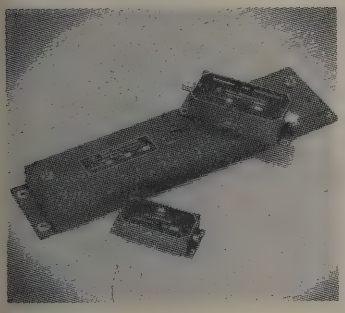
### SOLID-STATE MULTIPOLE SWITCHES

**High Speed, Low Transient Types.** Balanced design allows operation at speeds of 3-5ns RF transition, with transients as low as 15mV over the 1-300 MHz range. Applications include RF blanking, pulse modulation and high speed sampling. **Low Current Types** operate from less than 10mA DC. Internal CMOS circuitry compatible with open collector TTL or CMOS control. **Standard Types.** Operating directly from TTL, these units present a single Schottky low power load to the control line. They provide switching in the 20-700 MHz range, and utilize a single 5V/30mA supply per switch section.

**HIGH SPEED, LOW TRANSIENT TYPES**
- High Isolation: Greater than 60dB
- Insertion Loss: Under 1.0dB
- RF Transition Speed: 3-5ns
- Low Transients: 15mV
- Freq. Range: 1-300 MHz

**LOW CURRENT TYPES**
- Isolation: 85dB • Speed: 5.0$\mu$s
- Insertion Loss: 1.0dB
- Freq. Range: 20-700 MHz
- 3rd Order Intercept Point: +40dBm
- RF Power: +20dBm

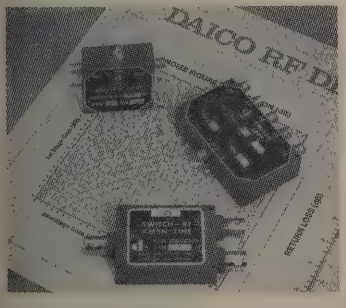
**STANDARD TYPES**
- Isolation: 85dB • Speed: 200ns
- Insertion Loss: 1.0dB
- 3rd Order Intercept Point: +35dBm
- RF Power: +15dBm



### PROGRAMMABLE ATTENUATORS AND PHASE SHIFTERS

Programmable Attenuators and Phase Shifters are comprised of a series of combining elements with either RF relays or solid-state switches to perform an additive function of attenuation or delay. The units either switch pads or closely controlled coaxial line lengths in and out of the series path. Simplicity of design allows the user to specify the desired attenuation sections or delay sections in a standard package alleviating the need for costly non-recurring engineering. Attenuators are available with constant phase-shift over the full attenuation range.

- FREQUENCY RANGES:
  20 to 800 MHz
- MAXIMUM ATTENUATION RANGES:
  127dB through 100 MHz;
  or 63dB through 500 MHz
- SWITCHING SPEEDS:
  High Speed—30 ns
  Standard—1.0$\mu$s
  Relay—2.0ms




### RF RELAYS (DC-500 MHz/50W CW)

Daico Industries RF relays employ hermetically sealed switching elements which provide extreme resistance to the severe environments encountered in military aircraft and communications systems, including 20 g's vibration to 3 KHz, 80 g's shock and altitude in excess of 100,000 ft. A continual test and evaluation program assures switch performance in excess of 20 million operations. These units are operable at extremely low current levels and may be ordered with 6-, 12-, 18- or 24-Volt coils (17mA at 28VDC).

- Available in SPST thru SP24T and TRANSFER Types
- Switching Speed: 5.0ms
- RF Power: 50W CW—500W Pk.
- SMA Connect. Std. (others optional)
- Std. Isolation: 70dB at 100 MHz
- High Isolation: 100dB at 250MHz

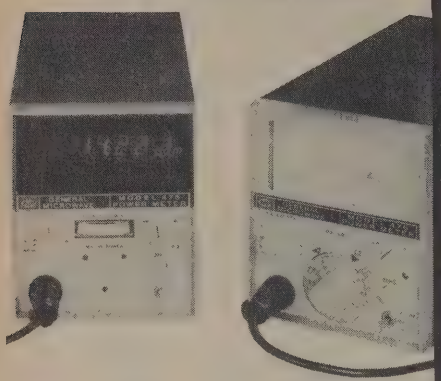
Note: Values are typical

Other products currently being supplied by Daico Industries include high power switches through 1 KW CW, and large IF M x N switch matrices employing both solid-state and RF relay switching elements. All Daico hybrid devices are constructed in accordance with MIL-M-38510 and MIL-STD-883. Full screening is available to Level B.

**DAICO INDUSTRIES, INC.** 2351 E. DEL AMO, COMPTON, CA 90224 • (213) 631-1143 • TWX: 910-346-6741

# Instrumentation from GENERAL MICROWAVE

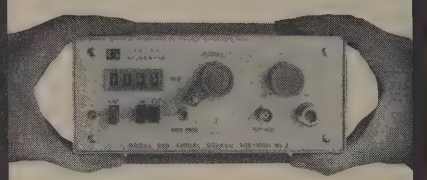
## Power Meters 0.01-40 GHz



**Model 475:** Digital Readout
- Direct reading from: −39.99 to +20.00 dBm in one range
- Accuracy as high as 0.05 dB
- Resolution: 0.01 dB
- Noise and Drift: less than 0.01 W p-p
- Automatic zero set
- Built-in self calibrator

**Model 476:** Analog Readout
- 30 nanowatts to 100 mW power range
- ±1% of full scale accuracy
- less than 1.5% noise and drift on lowest range
- Automatic zero set
- Built-in self calibrator

## Signal Sources

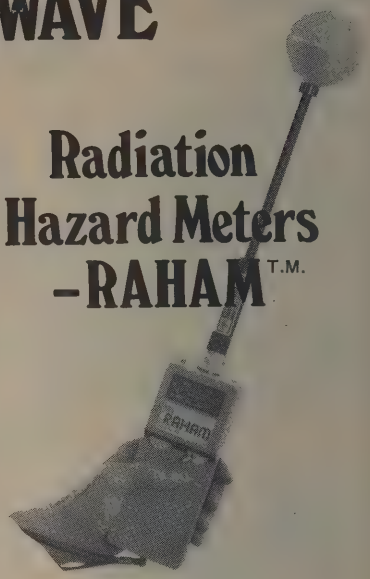


- **EASY TO USE** (Pushbutton Controls)
- **SMALL SIZE** (3⅞" high x 8" wide x 11½" deep)
- **LIGHTWEIGHT** (8 lbs.)
- **0.4 to 18 GHz**

Six solid state models in the Series 520 are smaller, lighter, consume less power and are generally more economical than their vacuum tube counterparts.

| Model No. | Frequency Range, GHz |
|---|---|
| 520 | 0.4 to 1.2 |
| 521 | 0.85 to 2.15 |
| 522 | 2.0 to 4.0 |
| 523 | 4.0 to 8.0 |
| 524 | 8.0 to 12.5 |
| 525 | 12.0 to 18.0 |

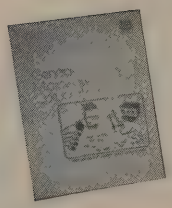
## Radiation Hazard Meters –RAHAM T.M.



General Microwave RAHAM Hazard Meters detect and measure potentially hazardous electromagnetic energy radiating or leaking from rf and microwave sources, e.g. microwave ovens, medical equipment, radar installations, microwave heaters and dryers, mobile communication systems, electronic warfare systems.

- Three 10 dB power ranges with full scale readings of 2, 20 & 200 mW/cm².
- Easy one hand operation
- 1000 hour battery life
- Low Cost

| Model | Polarization | Frequency Range, GHz |
|---|---|---|
| 1 | Bi-directional | 0.3-18 |
| 2 | Bi-directional | 0.01-3 |
| 3 | Isotropic | 0.3-18 |
| 12 | Bi-directional | 0.01-18 (2 probes) |

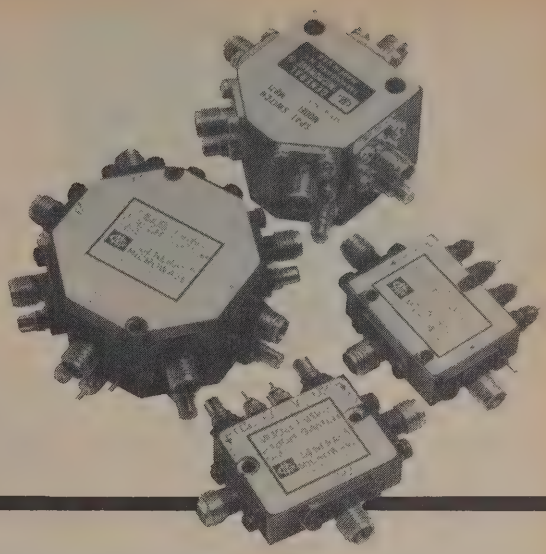


For complete information call or write.

# GENERAL MICROWAVE

GENERAL MICROWAVE CORPORATION 155 Marine Street, Farmingdale, L.I., New York 11735, Tel: 516-694-3600

# PIN Diode Switches



General Microwave's complete line of high performance broadband switches, with and without integral drivers, are available in three basic series.

- **Ultra Broadband Series:** 0.2 to 18 GHz, SPST to SP5T
- **Multi Octave Band — Miniature Series:** 0.2 to 4 GHz (Series 92) 2-18 GHz (Series 91); SPST to SP7T
- **Octave Band — High Speed Series:** 10 nsec switching speed, 2-18 GHz; SP2T

Many models of each type are available to satisfy most requirements. Terminated switches, space qualified units and other special designs are also available.

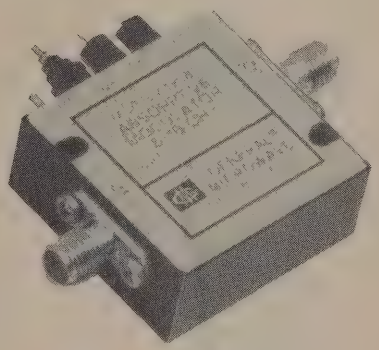
# PIN Diode Modulators/Attenuators

- Integral Drivers
- 0.5 to 18 GHz
- Low VSWR
- Exceptional Linearity
- 60 dB attenuation range
- Low Insertion Loss

The Series D195 family of fast, linear, absorptive modulators with integral drivers are current controlled PIN Diode attenators which provide high performance at low cost. Their characteristics make them ideally suited for a wide range of applications including level setting, amplitude modulation, pulse modulation, and high speed switching.

**0.5 to 18 GHz Frequency Range is provided by eight (8) Models:**

| | |
|---|---|
| D1950 | 0.5-1 GHz |
| D1951 | 1-2 GHz |
| D1952 | 2-4 GHz |
| D1953 | 3-6 GHz |
| D1954 | 4-8 GHz |
| D1955 | 5-10 GHz |
| D1956 | 6-12 GHz |
| D1958 | 8-18 GHz |



Most models are capable of extended bandwidth operation. Typically 3:1, with only moderate degradation in performance at the band edges.

# Digitally Programmable PIN Diode Attenuators

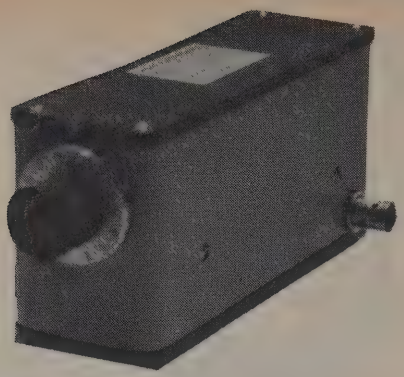
This latest development from General Microwave is Series 329 digitally programmable PIN Diode Attenuators.

- Frequency Range: 0.5-18 GHz
- Attenuation Range: Up to 120 dB
- Attenuation Interval: As low as 0.1 dB
- Accuracy: ± (0.35 + 0.01 dB/dB)
- Fast Switching Speed
- Low VSWR and Insertion Loss
- Exceptional Flatness
- Small Size, Low Power Consumption
- Binary or BCD Programming

**For complete information call or write.**

## GENERAL MICROWAVE

**GENERAL MICROWAVE CORPORATION** 155 Marine Street, Farmingdale, L.I., New York 11735, Tel: 516-694-3600

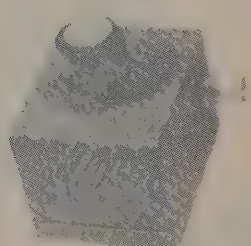


# HOPE ELECTRONICS

# ROTARY ATTENUATORS

| Model | Attenuation Range | Attenuation Steps | Frequency Range | Impedance | Price 1 - 24 |
|---|---|---|---|---|---|
| RT-10-50 | 0 to 10 db | 1 db | DC to 500 MHZ | 50Ω | $95.00 |
| RT-100-50 | 0 to 100 db | 10 db | DC to 500 MHZ | 50Ω | $95.00 |
| RT-10-75 | 0 to 10 db | 1 db | DC to 500 MHZ | 75Ω | $95.00 |
| RT-100-75 | 0 to 100 db | 10 db | DC to 500 MHZ | 75Ω | $95.00 |
| RT-10-600 | 0 to 10 db | 1 db | DC to 1 MHZ | 600Ω | $95.00 |
| RT-100-600 | 0 to 100 db | 10 db | DC to 1 MHZ | 600Ω | $95.00 |

## FIXED ATTENUATORS AND TERMINATIONS



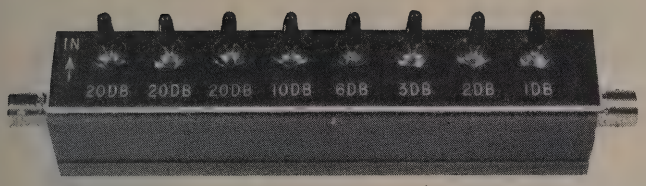
| Model | Attenuation | Frequency Range | Impedance | Price 1 - 24 |
|---|---|---|---|---|
| A50-1 | 1 db | DC to 1 GHZ | 50Ω | $14.00 |
| A50-2 | 2 db | DC to 1 GHZ | 50Ω | $14.00 |
| A50-3 | 3 db | DC to 1 GHZ | 50Ω | $14.00 |
| A50-6 | 6 db | DC to 1 GHZ | 50Ω | $14.00 |
| A50-10 | 10 db | DC to 1 GHZ | 50Ω | $14.00 |
| A50-20 | 20 db | DC to 1 GHZ | 50Ω | $14.00 |
| A75-1 | 1 db | DC to 500 MHZ | 75Ω | $14.00 |
| A75-2 | 2 db | DC to 500 MHZ | 75Ω | $14.00 |
| A75-3 | 3 db | DC to 500 MHZ | 75Ω | $14.00 |
| A75-6 | 6 db | DC to 500 MHZ | 75Ω | $14.00 |
| A75-10 | 10 db | DC to 500 MHZ | 75Ω | $14.00 |
| A75-20 | 20 db | DC to 500 MHZ | 75Ω | $14.00 |
| A600-3 | 3 db | DC to 2 MHZ | 600Ω | $14.00 |
| A600-6 | 6 db | DC to 2 MHZ | 600Ω | $14.00 |
| A600-10 | 10 db | DC to 2 MHZ | 600Ω | $14.00 |
| A600-20 | 20 db | DC to 2 MHZ | 600Ω | $14.00 |
| T50 | Termination | DC to 1 GHZ | 50Ω | $10.00 |
| T60 | Termination | DC to 1 GHZ | 60Ω | $10.00 |
| T65 | Termination | DC to 1 GHZ | 65Ω | $10.00 |
| T75 | Termination | DC to 1 GHZ | 75Ω | $10.00 |
| T93 | Termination | DC to 1 GHZ | 93Ω | $10.00 |
| T600 | Termination | DC to 2 MHZ | 600Ω | $10.00 |

## CONTINUOUSLY VARIABLE ATTENUATORS

| Model | Attenuation Range | Frequency Range | Impedance | Calibration | Price 1 - 24 |
|---|---|---|---|---|---|
| AV-50-20 | 0 to 20 db | DC to 50 MHZ | 50Ω | None | $50.00 |
| AV-50-20C | 0 to 20 db | DC to 50 MHZ | 50Ω | 1 db increments | $70.00 |
| AV-75-20 | 0 to 20 db | DC to 50 MHZ | 75Ω | None | $50.00 |
| AV-75-20C | 0 to 20 db | DC to 50 MHZ | 75Ω | 1 db increments | $70.00 |
| AV-600-20 | 0 to 20 db | DC to 2 MHZ | 600Ω | None | $50.00 |
| AV-600-20C | 0 to 20 db | DC to 2 MHZ | 600Ω | 1 db increments | $70.00 |

**HOPE ELECTRONICS** 20 NEWARK POMPTON TURNPIKE, WAYNE N.J. 07470 (201) 777-3522

# HOPE ELECTRONICS




# ATTENUATORS

| Model | Attenuation Range | Attenuation Steps | Frequency Range | Impedance | Power Rating | Price |
|---|---|---|---|---|---|---|
| ATE-3-50 | 0 to 3 db | 0.1, 0.2, 0.4, 0.5, 0.8, 1 | DC to 50 MHZ | 50Ω | ½ Watt | $75.00 |
| ATE-42-50 | 0 to 42 db | 1, 2, 3, 6, 10, 20 | DC to 50 MHZ | 50Ω | ½ Watt | $75.00 |
| ATE-82-50 | 0 to 82 db | 1, 2, 3, 6, 10, 20, 20, 20 | DC to 50 MHZ | 50Ω | ½ Watt | $89.00 |
| AT-3-50 | 0 to 3 db | 0.1, 0.2, 0.4, 0.5, 0.8, 1 | DC to 300 MHZ | 50Ω | ½ Watt | $85.00 |
| AT-6.3-50 | 0 to 6.3 db | 0.1, 0.2, 0.4, 0.8, 1.6, 3.2 | DC to 300 MHZ | 50Ω | ½ Watt | $85.00 |
| AT-42-50 | 0 to 42 db | 1, 2, 3, 6, 10, 20 | DC to 300 MHZ | 50Ω | ½ Watt | $85.00 |
| AT-82-50 | 0 to 82 db | 1, 2, 3, 6, 10, 20, 20, 20 | DC to 300 MHZ | 50Ω | ½ Watt | $99.00 |
| AT5-3-50 | 0 to 3 db | 0.1, 0.2, 0.4, 0.5, 0.8, 1 | DC to 500 MHZ | 50Ω | ½ Watt | $95.00 |
| AT5-6.3-50 | 0 to 6.3 db | 0.1, 0.2, 0.4, 0.8, 1.6, 3.2 | DC to 500 MHZ | 50Ω | ½ Watt | $95.00 |
| AT5-42-50 | 0 to 42 db | 1, 2, 3, 6, 10, 20 | DC to 500 MHZ | 50Ω | ½ Watt | $95.00 |
| AT5-82-50 | 0 to 82 db | 1, 2, 3, 6, 10, 20, 20, 20 | DC to 500 MHZ | 50Ω | ½ Watt | $110.00 |
| AT10-32-50 | 0 to 32 db | 1, 2, 3, 6, 10, 10 | DC to 1000 MHZ | 50Ω | ½ Watt | $95.00 |
| AT2W-3-50 | 0 to 3 db | 0.1, 0.2, 0.4, 0.5, 0.8, 1 | DC to 300 MHZ | 50Ω | 2 Watts | $110.00 |
| AT2W-42-50 | 0 to 42 db | 1, 2, 3, 6, 10, 20 | DC to 300 MHZ | 50Ω | 2 Watts | $110.00 |
| AT2W-82-50 | 0 to 82 db | 1, 2, 3, 6, 10, 20, 20, 20 | DC to 300 MHZ | 50Ω | 2 Watts | $120.00 |
| AT-3-75 | 0 to 3 db | 0.1, 0.2, 0.4, 0.5, 0.8, 1 | DC to 300 MHZ | 75Ω | ½ Watt | $75.00 |
| AT-6.3-75 | 0 to 6.3 db | 0.1, 0.2, 0.4, 0.8, 1.6, 3.2 | DC to 300 MHZ | 75Ω | ½ Watt | $75.00 |
| AT-42-75 | 0 to 42 db | 1, 2, 3, 6, 10, 20 | DC to 300 MHZ | 75Ω | ½ Watt | $75.00 |
| AT-82-75 | 0 to 82 db | 1, 2, 3, 6, 10, 20, 20, 20 | DC to 300 MHZ | 75Ω | ½ Watt | $89.00 |
| AT2W-3-75 | 0 to 3 db | 0.1, 0.2, 0.4, 0.5, 0.8, 1 | DC to 300 MHZ | 75Ω | 2 Watts | $85.00 |
| AT2W-42-75 | 0 to 42 db | 1, 2, 3, 6, 10, 20 | DC to 300 MHZ | 75Ω | 2 Watts | $85.00 |
| AT2W-82-75 | 0 to 82 db | 1, 2, 3, 6, 10, 20, 20, 20 | DC to 300 MHZ | 75Ω | 2 Watts | $99.00 |
| AT-3-600 | 0 to 3 db | 0.1, 0.2, 0.4, 0.5, 0.8, 1 | DC to 2 MHZ | 600Ω | ½ Watt | $75.00 |
| AT-42-600 | 0 to 42 db | 1, 2, 3, 6, 10, 20 | DC to 2 MHZ | 600Ω | ½ Watt | $75.00 |
| AT-82-600 | 0 to 82 db | 1, 2, 3, 6, 10, 20, 20, 20 | DC to 2 MHZ | 600Ω | ½ Watt | $89.00 |
| AT2W-3-600 | 0 to 3 db | 0.1, 0.2, 0.4, 0.5, 0.8, 1 | DC to 2 MHZ | 600Ω | 2 Watts | $85.00 |
| AT2W-42-600 | 0 to 42 db | 1, 2, 3, 6, 10, 20 | DC to 2 MHZ | 600Ω | 2 Watts | $85.00 |
| AT2W-82-600 | 0 to 82 db | 1, 2, 3, 6, 10, 20, 20, 20 | DC to 2 MHZ | 600Ω | 2 Watts | $99.00 |
| AT-3-600B | 0 to 3 db | 0.1, 0.2, 0.4, 0.5, 0.8, 1 | DC to 20 KHZ | 600Ω Bal. | ½ Watt | $95.00 |
| AT-42-600B | 0 to 42 db | 1, 2, 3, 6, 10, 20 | DC to 20 KHZ | 600Ω Bal. | ½ Watt | $95.00 |
| AT-82-600B | 0 to 82 db | 1, 2, 3, 6, 10, 20, 20, 20 | DC to 20 KHZ | 600Ω Bal. | ½ Watt | $110.00 |
| AT2W-3-600B | 0 to 3 db | 0.1, 0.2, 0.4, 0.5, 0.8, 1 | DC to 20 KHZ | 600Ω Bal. | 2 Watts | $110.00 |
| AT2W-42-600B | 0 to 42 db | 1, 2, 3, 6, 10, 20 | DC to 20 KHZ | 600Ω Bal. | 2 Watts | $110.00 |
| AT2W-82-600B | 0 to 82 db | 1, 2, 3, 6, 10, 20, 20, 20 | DC to 20 KHZ | 600Ω Bal. | 2 Watts | $120.00 |

**HOPE ELECTRONICS** 20 NEWARK POMPTON TURNPIKE, WAYNE N.J. 07470 (201) 777-3522

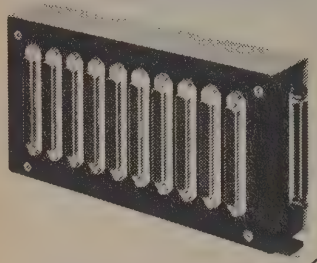
# MATRIX

SYSTEMS CORPORATION
9411 Lurline Avenue • Chatsworth, California 91311
(213) 882-2008

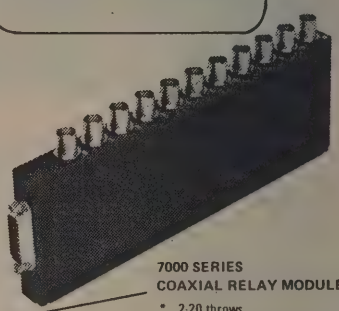
SEE OUR OTHER PRODUCTS IN SECTION 4500 PAGE 3582

## COAXIAL SWITCHING SYSTEMS

### PROGRAMMABLE – COAXIAL RELAY MATRIX

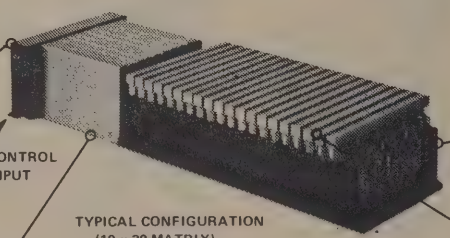


MODULAR ASSEMBLY



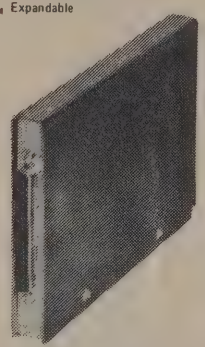
MODEL 6310 DECODE MODULE
- Computer controllable
- 16 bit parallel or ASCII input
- TTL/DTL compatible
- Decodes 200 switchpoints
- Expandable

CONTROL INPUT



TYPICAL CONFIGURATION (10 x 20 MATRIX)

7000 SERIES COAXIAL RELAY MODULE
- 2-20 throws
- 106 dB isolation @ 100 MHz
- 100 watt switching
- DC-300 MHz
- Switched shield
- Self terminating
- 50 or 75 ohm
- Machined housing
- 28 V control

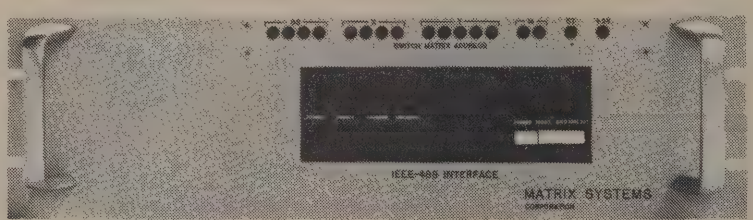


6100 SERIES LOGIC MODULE
- Controls 2-20 switchpoints
- TTL/DTL compatible
- X - Y addressable
- 28 VDC control output
- Latching
- J - K flipflops
- Hex gate drivers

PUSH-ON CROSS STRAP
9100 SERIES
9200 SERIES
9300 SERIES

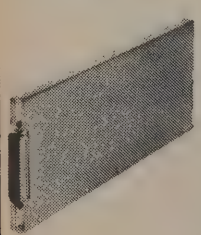
CROSS STRAPS INTERCONNECT COAXIAL RELAYS TO FORM CROSSBAR CONFIGURATION.

### IEEE-488 INTERFACE CHASSIS




**TEXT**
- Interfaces Matrix Switching Systems with IEEE-488 standard interface bus
- Decimal X-Y address format
- Binary address display
- Interfaces programmable calculators
- Operated from 115v AC 60 Hz
- Standard 5¼" × 19" × 18" deep chassis

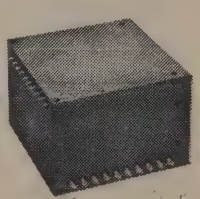
### TWO WIRE AUDIO RELAY MODULE



**FEATURES:**
- Programmable
- Two pole-twenty throw
- Contains four independent two pole, five throw relays
- Dry reed or mercury wetted contacts available
- Independent control
- Compatible with 6100 series latching and drive module
- May be connected in a 2 x 10 or 4 x 5 matrix configuration
- Reed switches easily accessible
- 28 V control

**MODEL 6157**

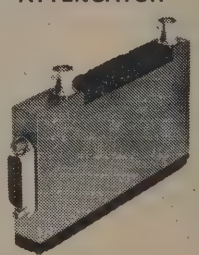
### 10 x 10 VIDEO RELAY MATRIX



**FEATURES:**
- Any of ten inputs may be connected to any of ten outputs
- Computer programmable
- Random addressable
- Low VSWR
- Signal circuits isolated from control circuitry
- Switchpoints individually field replaceable
- Stripline construction
- SMA connectors
- 28 V control

**MODEL 6160**

### PROGRAMMABLE COAXIAL ATTENUATOR



**FEATURES:**
- 0 - 63 dB Range
- One dB steps - .5 dB optional
- Pure six bit binary control
- Low VSWR
- Continuous shield continuity
- Signal circuits isolated from control circuitry
- Attenuator elements field replaceable
- Compatible with 6100 series latching logic
- 28 V control

**MODEL 6152**

Matrix Systems Corporation manufactures a variety of Switching Devices. Whether you are Switching VHF, Video, Pulse or Audio or your control requirements are programmable or manual. Give us a call. We specialize in specials. (213) 882-2008

ATTENUATORS — COUPLERS — HYBRIDS
POWER DIVIDERS — CONNECTORS —
ADAPTERS — TERMINATIONS — SHORTS
— MIXERS — DIODES — SWITCHES —
BENDS—AMPLIFIERS—CABLE ASSEMBLIES

OFF-THE-SHELF
MICROWAVE
COMPONENTS

# WE GOT EM !!!

## THE LARGEST INVENTORY OF PRODUCTS FROM

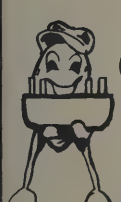
# Solitron/Microwave

**SMA, SMB, SMC, N, TNC, BNC, 7 MM—plus—**
**All the Adapters within and between Series**
**are always in stock at:**

MICROWAVE
Distributors Company

AUTHORIZED DISTRIBUTORS FOR

BUNKER RAMO AMPHENOL
Aertech
MIDISCO
Solitron/Microwave
AEP
MCL Mini-Circuits Laboratory
A Division Scientific Components Corp
KINGS



## Our Guarantee

Microwave Distributors Co. will maintain a substantial inventory of quality RF components and will provide technical assistance to all who desire it. All orders will be shipped the same day. All orders to be picked up will be ready within one hour after the order is called in.

Our failure to deliver as required for any reason within our control costs us a **sack of NUTS (we stock them too).**

REQUEST OUR COMPLETE CATALOG OF OFF-THE-SHELF COMPONENTS
SEE REPRESENTATION LISTING FOR LOCAL SALES OFFICES

## IN STOCK AT:

MICROWAVE
Distributors Company

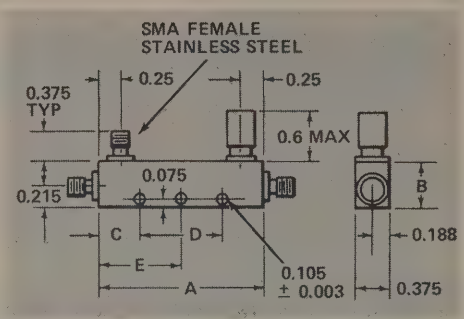
61 Mall Drive
Commack, N.Y. 11725

516-543-4771
Twx 510-226-7839

# midisco directional couplers

## 0.5 to 18 GHz

Many of the couplers shown exceed a frequency bandwidth and exhibit excellent flatness and directivity characteristics in small packages. **They are available from stock. Multi-octave units are available.**




| OUTLINE DRAWING NUMBER | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | 3.10 | 0.50 | 0.80 | 1.50 | — |
| 2 | 3.10 | 0.55 | 0.80 | 1.50 | — |
| 3 | 1.80 | 0.50 | 0.43 | 0.94 | — |
| 4 | 1.80 | 0.55 | 0.43 | 0.94 | — |
| 5 | 1.20 | 0.50 | 0.43 | 0.34 | — |
| 6 | 1.20 | 0.55 | 0.43 | 0.34 | — |
| 7 | 1.00 | 0.50 | — | — | 0.50 |
| 8 | 1.00 | 0.55 | — | — | 0.50 |
| 9 | 1.00 | 0.60 | — | — | 0.50 |

| MODEL NO. | FREQUENCY RANGE (GHz) | COUPLING* (dB) | FREQ. SENS. (dB) | INSERTION LOSS (dB) | | DIRECTIVITY (dB MIN.) | VSWR MAX. | | POWER | | | OUTLINE DWG. NO. | PRICE 1 TO 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | EXCL. CPLD PWR. | TRUE | | PRIMARY LINE | SECONDARY LINE | AVERAGE INCIDENT (W) | AVERAGE REFLD. (W) | PEAK (kW) | | |
| MDC6223-6 | 0.5-1.0 | 6 ±1.00 | ±0.60 | 0.20 | 1.80 | 23 | 1.15 | 1.15 | 50 | 2 | 3 | 1 | $111.00 |
| MDC6223-10 | 0.5-1.0 | 10 ±1.25 | ±0.75 | 0.20 | 0.80 | 25 | 1.15 | 1.15 | 50 | 5 | 3 | 1 | 111.00 |
| MDC6223-20 | 0.5-1.0 | 20 ±1.25 | ±0.75 | 0.20 | 0.20 | 25 | 1.15 | 1.15 | 50 | 50 | 3 | 1 | 111.00 |
| MDC6223-30 | 0.5-1.0 | 30 ±1.25 | ±0.75 | 0.20 | 0.20 | 25 | 1.15 | 1.15 | 50 | 50 | 3 | 2 | 111.00 |
| MDC6224-6 | 1.0-2.0 | 6 ±1.00 | ±0.60 | 0.20 | 1.80 | 25 | 1.15 | 1.15 | 50 | 2 | 3 | 3 | 111.00 |
| MDC6224-10 | 1.0-2.0 | 10 ±1.25 | ±0.75 | 0.20 | 0.80 | 25 | 1.10 | 1.10 | 50 | 5 | 3 | 3 | 111.00 |
| MDC6224-20 | 1.0-2.0 | 20 ±1.25 | ±0.75 | 0.20 | 0.20 | 27 | 1.10 | 1.10 | 50 | 50 | 3 | 3 | 111.00 |
| MDC6224-30 | 1.0-2.0 | 30 ±1.25 | ±0.75 | 0.20 | 0.20 | 27 | 1.10 | 1.10 | 50 | 50 | 3 | 4 | 111.00 |
| MDC6225-6 | 2.0-4.0 | 6 ±1.00 | ±0.60 | 0.20 | 1.80 | 22 | 1.15 | 1.15 | 50 | 2 | 3 | 5 | 111.00 |
| MDC6225-10 | 2.0-4.0 | 10 ±1.25 | ±0.75 | 0.20 | 0.80 | 22 | 1.15 | 1.15 | 50 | 5 | 3 | 5 | 111.00 |
| MDC6225-20 | 2.0-4.0 | 20 ±1.25 | ±0.75 | 0.20 | 0.20 | 22 | 1.15 | 1.15 | 50 | 50 | 3 | 5 | 111.00 |
| MDC6225-30 | 2.0-4.0 | 30 ±1.25 | ±0.75 | 0.20 | 0.20 | 22 | 1.15 | 1.15 | 50 | 50 | 3 | 6 | 111.00 |
| MDC6266-6 | 2.6-5.2 | 6 ±1.00 | ±0.60 | 0.25 | 1.80 | 18 | 1.25 | 1.25 | 50 | 2 | 3 | 7 | 120.00 |
| MDC6266-10 | 2.6-5.2 | 10 ±1.25 | ±0.75 | 0.25 | 0.80 | 20 | 1.25 | 1.25 | 50 | 5 | 3 | 7 | 120.00 |
| MDC6266-20 | 2.6-5.2 | 20 ±1.25 | ±0.75 | 0.25 | 0.25 | 20 | 1.25 | 1.25 | 50 | 50 | 3 | 7 | 120.00 |
| MDC6266-30 | 2.6-5.2 | 30 ±1.25 | ±0.75 | 0.25 | 0.20 | 20 | 1.25 | 1.25 | 50 | 50 | 3 | 8 | 120.00 |
| MDC6226-6 | 4.0-8.0 | 6 ±1.00 | ±0.60 | 0.25 | 2.00 | 18 | 1.25 | 1.25 | 50 | 2 | 3 | 7 | 111.00 |
| MDC6226-10 | 4.0-8.0 | 10 ±1.25 | ±0.75 | 0.25 | 1.00 | 20 | 1.25 | 1.25 | 50 | 5 | 3 | 7 | 111.00 |
| MDC6226-20 | 4.0-8.0 | 20 ±1.25 | ±0.75 | 0.25 | 0.30 | 20 | 1.25 | 1.25 | 50 | 50 | 3 | 7 | 111.00 |
| MDC6226-30 | 4.0-8.0 | 30 ±1.25 | ±0.75 | 0.25 | 0.25 | 20 | 1.25 | 1.25 | 50 | 50 | 3 | 8 | 111.00 |
| MDC6227-6 | 7.0-12.4 | 6 ±1.00 | ±0.50 | 0.40 | 2.00 | 15 | 1.30 | 1.30 | 50 | 2 | 3 | 7 | 120.00 |
| MDC6227-10 | 7.0-12.4 | 10 ±1.25 | ±0.50 | 0.40 | 1.00 | 17 | 1.30 | 1.30 | 50 | 5 | 3 | 7 | 120.00 |
| MDC6227-20 | 7.0-12.4 | 20 ±1.00 | ±0.50 | 0.30 | 0.35 | 17 | 1.25 | 1.25 | 50 | 50 | 3 | 7 | 120.00 |
| MDC6227-30 | 7.0-12.4 | 30 ±1.00 | ±0.50 | 0.30 | 0.30 | 17 | 1.25 | 1.25 | 50 | 50 | 3 | 8 | 120.00 |
| MDC6288-6 | 7.5-16.0 | 6 ±1.10 | ±0.60 | 0.60 | 2.00 | 12 | 1.35 | 1.40 | 50 | 2 | 2 | 7 | 125.00 |
| MDC6288-10 | 7.5-16.0 | 10 ±1.50 | ±0.75 | 0.60 | 1.00 | 12 | 1.35 | 1.40 | 50 | 5 | 2 | 7 | 125.00 |
| MDC6288-20 | 7.5-16.0 | 20 ±1.25 | ±0.75 | 0.50 | 0.50 | 15 | 1.35 | 1.40 | 50 | 50 | 2 | 7 | 125.00 |
| MDC6288-30 | 7.5-16.0 | 30 ±1.25 | ±0.75 | 0.50 | 0.50 | 15 | 1.35 | 1.40 | 50 | 50 | 2 | 8 | 125.00 |
| MDC6228-6 | 12.4-18.0 | 6 ±1.00 | ±0.50 | 0.30 | 2.00 | 15 | 1.35 | 1.40 | 50 | 2 | 1 | 7 | 160.00 |
| MDC6228-10 | 12.4-18.0 | 10 ±1.00 | ±0.50 | 0.30 | 1.10 | 15 | 1.30 | 1.40 | 50 | 5 | 1 | 7 | 160.00 |
| MDC6228-20 | 12.4-18.0 | 20 ±1.00 | ±0.50 | 0.30 | 0.50 | 15 | 1.30 | 1.40 | 50 | 50 | 1 | 9 | 160.00 |
| MDC6228-30 | 12.4-18.0 | 30 ±1.00 | ±0.50 | 0.30 | 0.50 | 15 | 1.30 | 1.40 | 50 | 50 | 1 | 9 | 160.00 |

*Includes Frequency Sensitivity.

MIDISCO
61 Mall Drive / Commack, New York 11725
(516) 543-4774 / TWX 510-226-7839

SPECIFICATIONS AND PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.

ALL MIDISCO PRODUCTS ARE IN STOCK AT MICROWAVE DISTRIBUTORS CO.

# midisco hybrids/power dividers

## hybrids/90° mini

MIDISCO offers this series of 3 dB Miniature Hybrids with excellent electrical performance. These devices are useful as signal and power splitters in both laboratory and system applications. **All Power Dividers are in stock.**

| MODEL | FREQUENCY RANGE (GHz) | COUPLED (dB) NOM. | DEV. FROM NOM. MAX. (dB) | VSWR MAX. | ISOL. (MIN.) (dB) | INPUT PWR. AVG. (W) | INPUT PWR. PEAK (KW) | FIG. NO. | A | B | C | D | E | PRICE 1 TO 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MDC7223 | 0.5-0.1 | $3\ ^{+0.2}_{-0}$ | ±0.5 | 1.25 | 20 | 50 | 5 | 1 | 3.06 | 0.50 | 0.64 | 1.780 | 2.56 | $111.00 |
| MDC7224 | 1.0-2.0 | $3\ ^{+0.2}_{-0}$ | ±0.5 | 1.10 | 30 | 50 | 5 | 1 | 1.78 | 0.50 | 0.64 | 1.500 | 1.28 | 111.00 |
| MDC7225 | 2.0-4.0 | $3\ ^{+0.2}_{-0}$ | ±0.5 | 1.20 | 22 | 50 | 5 | 1 | 1.15 | 0.50 | 0.314 | 0.66 | 0.58 | 111.00 |
| MDC7266 | 2.6-5.2 | $3\ ^{+0.3}_{-0}$ | ±0.5 | 1.25 | 20 | 50 | 5 | 2 | 1.00 | 0.50 | 0.314 | 0.50 | 0.50 | 120.00 |
| MDC7226 | 4.0-8.0 | $3\ ^{+0.3}_{-0}$ | ±0.5 | 1.25 | 20 | 50 | 5 | 2 | 1.00 | 0.50 | 0.314 | 0.50 | 0.50 | 108.00 |
| MDC7227 | 7.0-12.4 | $3\ ^{+0.4}_{-0}$ | ±0.5 | 1.30 | 18 | 50 | 5 | 2 | 1.00 | 0.50 | 0.314 | 0.50 | 0.50 | 120.00 |
| MDC7288 | 7.5-16.0 | $3\ ^{+0.6}_{-0}$ | ±0.6 | 1.35 | 15 | 50 | 5 | 2 | 1.00 | 0.58 | 0.392 | 0.50 | 0.50 | 125.00 |
| MDC7228 | 12.4-18.0 | $3\ ^{+0.6}_{-0}$ | ±0.7 | 1.40 | 15 | 50 | 5 | 2 | 1.00 | 0.58 | 0.392 | 0.50 | 0.50 | 125.00 |
| MDC7267 | 2.0-8.0 | $3\ ^{+0.8}_{-0}$ | ±0.6 | 1.30 | 17 | 50 | 5 | 1 | 2.54 | 0.75 | 0.64 | 1.260 | 2.04 | 135.00 |

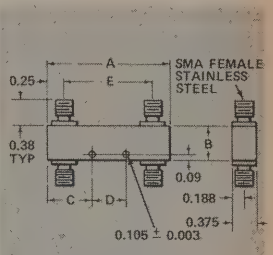


FIGURE 1

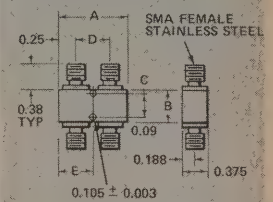


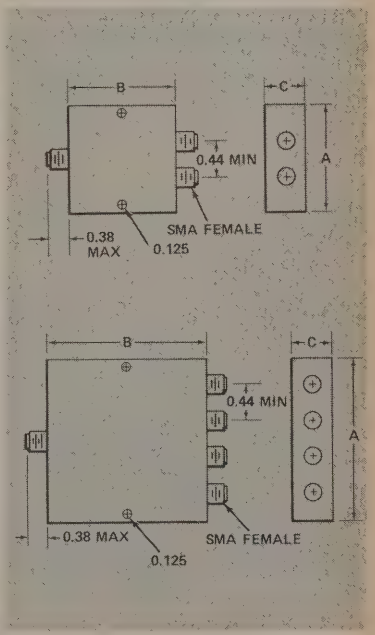
FIGURE 2

## power dividers/isolated

MIDISCO Power Dividers are designed for high isolation with excellent phase and amplitude characteristics in a compact, rugged construction. **They are available from stock.**

| MODEL NO. | FREQ. RANGE (GHz) | VSWR IN | VSWR OUT | ISOLATION (dB MIN.) | LOSS (dB) EXCL. DIV. | DIMENSIONS A | DIMENSIONS B | DIMENSIONS C | PRICE 1 TO 9 |
|---|---|---|---|---|---|---|---|---|---|
| **2-WAY** | | | | | | | | | |
| MDC8204 | 0.8- 2.0 | 1.30 | 1.20 | 20 | 0.4 | 1.40 | 2.50 | 0.57 | $135.00 |
| MDC8205 | 1.0- 2.5 | 1.30 | 1.20 | 20 | 0.4 | 1.40 | 2.50 | 0.57 | 135.00 |
| MDC8206 | 1.5- 3.75 | 1.35 | 1.25 | 20 | 0.4 | 1.40 | 2.00 | 0.57 | 135.00 |
| MDC8207 | 2.0- 5.0 | 1.40 | 1.30 | 20 | 0.5 | 1.40 | 1.50 | 0.57 | 135.00 |
| MDC8208 | 3.0- 7.5 | 1.40 | 1.30 | 18 | 0.5 | 1.40 | 1.50 | 0.57 | 135.00 |
| MDC8209 | 5.0-10.0 | 1.50 | 1.40 | 17 | 0.5 | 1.05 | 1.00 | 0.44 | 135.00 |
| **4-WAY** | | | | | | | | | |
| MDC8404 | 0.8- 2.0 | 1.35 | 1.25 | 20 | 0.75 | 2.25 | 2.25 | 0.57 | $195.00 |
| MDC8405 | 1.0- 2.5 | 1.35 | 1.25 | 20 | 0.75 | 2.25 | 2.25 | 0.57 | 195.00 |
| MDC8406 | 1.5- 3.75 | 1.40 | 1.30 | 20 | 0.8 | 2.25 | 2.25 | 0.57 | 195.00 |
| MDC8407 | 2.0- 5.0 | 1.50 | 1.40 | 20 | 1.0 | 2.25 | 1.50 | 0.57 | 195.00 |
| MDC8408 | 3.0- 7.5 | 1.55 | 1.45 | 18 | 1.0 | 2.25 | 1.50 | 0.57 | 195.00 |
| MDC8409 | 5.0-10.0 | 1.60 | 1.50 | 17 | 1.0 | 1.80 | 1.25 | 0.44 | 195.00 |

RF Input Power, Max. 2-Way: 2W CW with 1.5:1 Max. Load VSWR. 4-Way: 4W CW with 1.5:1 Max. Load VSWR.




**MIDISCO**

61 Mall Drive / Commack, New York 11725
(516) 543-4774 / TWX 510-226-7839

SPECIFICATIONS AND PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.

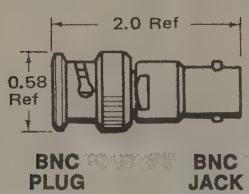
ALL MIDISCO PRODUCTS ARE IN STOCK AT MICROWAVE DISTRIBUTORS CO.

# midisco coaxial attenuators

MIDISCO offers the broadest line of coaxial attenuators, all of which can usually be found in stock. BNC, TNC, N, SMA types are available in 1 dB steps thru 20 dB. The SMA and N Series offer tight specifications from DC to 12.4 or 18.0 GHz and standard specs for DC to 2.5 GHz and 12.4 GHz. All handle 2 watts average input power at 25°C and derate linearly to zero at 150°C. (3 dB units are rated 75% higher; 6 dB units are 25% higher average power). Peak power is 200 watts. Distortion, tested thru L Band, is less than 0.5° relative to a unit with zero dB attenuation. Operating temperature is −55°C to +125°C; temperature stability: $10^{-4}$ dB/dB/°C. Calibration charts are available on some units at a nominal charge. All SMA attenuators are stainless steel, gold-plated and connectors are in accordance with MIL-C-39012.

**All attenuation values in 1 dB steps thru 20 dB are in stock.**

## type bnc/dc to 8.0 GHz — MDC1051



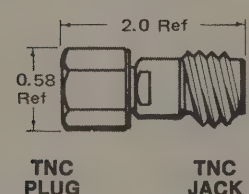

| PART NO. | ATTENUATION VALUE† |
|---|---|
| MDC1051-3 | 3 dB ±0.5 |
| MDC1051-6 | 6 dB ±0.5 |
| MDC1051-10 | 10 dB ±0.7 |
| MDC1051-14 | 14 dB ±0.8 |
| MDC1051-20 | 20 dB ±1.0 |

| | |
|---|---|
| Operating Temp. Range: | −55°C to +125°C |
| Total Input Power: | 2 watts average, 0.5kW peak |
| Impedance: | 50 ohms |
| Material: | Brass |
| Finish: | Bright alloy |
| Weight: | 1.4 ounces (40 grams) |
| VSWR: | 1.10 to 1 GHz, 1.25 to 4 GHz usable to 8 GHz |

†Other attenuation values are in stock or available.

**PRICE 1 TO 9 $29.00**

## type tnc/dc to 12.4 GHz — MDC1084/1088




| PART NO. | ATTENUATION VALUE† |
|---|---|
| MDC1084-3 | 3 dB ±0.5 |
| MDC1088-3 | 3 dB ±0.5 |
| MDC1084-6 | 6 dB ±0.5 |
| MDC1088-6 | 6 dB ±0.5 |
| MDC1084-10 | 10 dB ±0.7 |
| MDC1088-10 | 10 dB ±0.7 |
| MDC1084-14 | 14 dB ±0.9 |
| MDC1088-14 | 14 dB ±0.9 |
| MDC1084-20 | 20 dB ±1.0 |
| MDC1088-20 | 20 dB ±1.0 |

| | |
|---|---|
| Operating Temp. Range: | −55°C to +125°C |
| Total Input Power: | 2 watts average, 0.5kW peak |
| Impedance: | 50 ohms |
| Material: | Brass |
| Finish: | Bright alloy |
| Weight: | 1.4 ounces (40 grams) |
| VSWR **(MDC1084):** | 1.10 max. to 1 GHz, 1.25 max. to 4.5 GHz, 1.50 max. to 11 GHz |
| VSWR **(MDC1088):** | 1.3 max. to 12.4 GHz |

†Other attenuation values are in stock or available.

**PRICE 1 TO 9, MDC1084 $29.00**
**MDC1088 $59.00**

**MIDISCO**

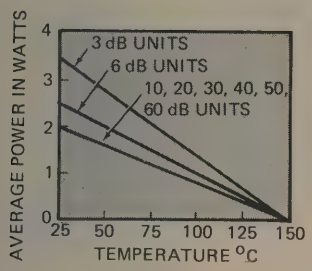
**61 Mall Drive / Commack, New York 11725**
**(516) 543-4774 / TWX 510-226-7839**

**SPECIFICATIONS AND PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.**

**ALL MIDISCO PRODUCTS ARE IN STOCK AT MICROWAVE DISTRIBUTORS CO.**

# midisco coaxial attenuators

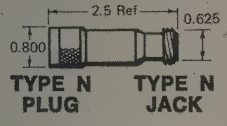
## type n




MIDISCO offers three series of Type N Coaxial Pads for in-line attenuation or isolation from 1 to 60 dB. The three series are all broadband, DC to 12.4 GHz or DC to 18.0 GHz or a slightly reduced spec version for DC to 12.4 GHz, and feature excellent phase response over the entire range. Peak power is 0.5 kW and average power is 2 watts at 25°C, derating linearly to 0 at 150°C; 75% higher for 3 dB units, 25% higher for 6 dB units. Distortion, tested through L-band, was less than 0.5° relative to a unit with zero dB attenuation. Operational temperature from −55°C to +125°C; temperature stability: $10^{-4}$ dB/dB/°C. Calibration chart is available. Material: Brass with bright alloy finish.

OTHER ATTENUATION VALUES ARE IN STOCK.

## type n/dc to 18.0 GHz — MDC1078A

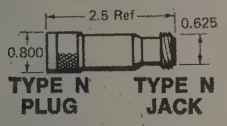



| PART NO. | ATTENUATION | VSWR |
|---|---|---|
| MDC1078A-3 | 3 ±0.3 dB | |
| MDC1078A-6 | 6 ±0.3 dB | |
| MDC1078A-10 | 10 ±0.5 dB | |
| MDC1078A-20 | 20 ±0.6 dB | DC-4 GHz: 1.20 |
| MDC1078A-30 | 30 ±0.9 dB | 4-12.4 GHz: 1.35 |
| MDC1078A-40 | 40 ±1.2 dB | 12.4-18 GHz: 1.50 |
| MDC1078A-50 | 50 ±1.5 dB | |
| MDC1078A-60 | 60 ±1.8 dB | |

**CLOSE ACCURACY**

**PRICE 1 TO 9**
**$69.00 (3, 6, 10, 20 dB)**
**$79.00 all other values**

## type n/dc to 12.4 GHz — MDC1078B

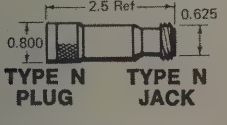



| PART NO. | ATTENUATION | VSWR |
|---|---|---|
| MDC1078B-3 | 3 ±0.3 dB | |
| MDC1078B-6 | 6 ±0.3 dB | |
| MDC1078B-10 | 10 ±0.5 dB | |
| MDC1078B-20 | 20 ±0.6 dB | DC-4 GHz: 1.20 |
| MDC1078B-30 | 30 ±0.9 dB | 4-12.4 GHz: 1.35 |
| MDC1078B-40 | 40 ±1.2 dB | |
| MDC1078B-50 | 50 ±1.5 dB | |
| MDC1078B-60 | 60 ±1.8 dB | |

**CLOSE ACCURACY**

**PRICE 1 TO 9**
**$59.00 (3, 6, 10, 20 dB)**
**$69.00 all other values**

## type n/dc to 12.4 GHz — MDC1078C




| PART NO. | ATTENUATION | VSWR |
|---|---|---|
| MDC1078C-3 | 3 ±0.5 dB | |
| MDC1078C-6 | 6 ±0.5 dB | |
| MDC1078C-10 | 10 ±0.7 dB | |
| MDC1078C-20 | 20 ±1.0 dB | DC-4GHz: 1.25 |
| MDC1078C-30 | 30 ±1.5 dB | 4-12.4 GHz: 1.40 |
| MDC1078C-40 | 40 ±2.0 dB | |
| MDC1078C-50 | 50 ±2.5 dB | |
| MDC1078C-60 | 60 ±3.0 dB | |

**STANDARD ACCURACY**

**PRICE 1 TO 9**
**$39.00 (3, 6, 10, 20 dB)**
**$49.00 all other values**

**MIDISCO**

SPECIFICATIONS AND PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.

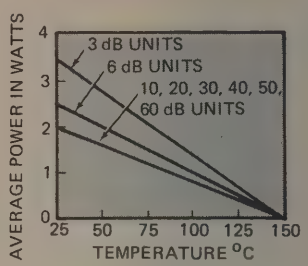
61 Mall Drive / Commack, New York 11725
(516) 543-4774 / TWX 510-226-7839

ALL MIDISCO PRODUCTS ARE IN STOCK AT MICROWAVE DISTRIBUTORS CO.

# midisco coaxial attenuators

## type sma attenuators

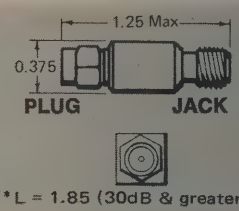
MIDISCO offers SMA Coaxial Pads for in-line attenuation or isolation in four series: Tight specifications from dc to 12.4 or 18.0 GHz and standard specifications for dc to 2.5 GHz and dc to 12.4 GHz. All handle 2W average input power at 25°C and de-rate linearly to zero at 150°C. (3 dB units are rated 75% higher; 6 db units are 25% higher average power.) Peak power is 200 watts. Distortion, tested through L-band, was less than 0.5 degrees relative to a unit with zero dB attenuation. Operating temperature is −55 to +125°C; temperature stability: $10^{-4}$ dB/dB/°C. Weight: ¼ ounce. Calibration chart is available. Material: All units - gold-plated stainless steel. OTHER ATTENUATION VALUES ARE IN STOCK.




## type sma/dc to 12.4 GHz — MDC1030

**STANDARD ACCURACY**
Operating Temp. Range: −55°C to +125°C
Total Input Power: 2 watts average, 0.5kW peak
Impedance: 50 ohms
**PRICE 1 TO 9**
**$39.00 (3, 6, 10, 20 dB)**
**$49.00 all other values**

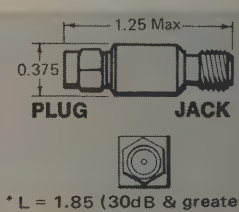
| PART NO. | ATTENUATION | VSWR (ALL UNITS) |
|---|---|---|
| MDC1030-3 | 3 ±0.6 dB | DC-4 GHz: 1.20<br>4-8 GHz: 1.30<br>8-12.4 GHz: 1.40 |
| MDC1030-6 | 6 ±0.6 dB | |
| MDC1030-10 | 10 ±1.0 dB | |
| MDC1030-20 | 20 ±1.25 dB | |
| MDC1030-30 | 30 ±1.50 dB | |




## type sma/dc to 12.4 GHz — MDC1055

**CLOSE ACCURACY**
Operating Temp. Range: −55°C to +125°C
Total Input Power: 2 watts average, 0.5kW peak
Impedance: 50 ohms
**PRICE 1 TO 9**
**$49.00 (3, 6, 10, 20 dB)**
**$59.00 all other values**

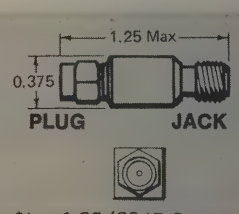
| PART NO. | ATTENUATION | VSWR (ALL UNITS) |
|---|---|---|
| MDC1055-3 | 3 ±0.3 dB | DC-4 GHz: 1.20<br>4-10 GHz: 1.30<br>10-12.4 GHz: 1.35 |
| MDC1055-6 | 6 ±0.3 dB | |
| MDC1055-10 | 10 ±0.5 dB | |
| MDC1055-20 | 20 ±0.75 dB | |
| MDC1055-30 | 30 ±1.00 dB | |




## type sma/dc to 18.0 GHz — MDC1065

**CLOSE ACCURACY**
Operating Temp. Range: −55°C to +125°C
Total Input Power: 2 watts average, 0.5kW peak
Impedance: 50 ohms
**PRICE 1 TO 9**
**$69.00 (3, 6, 10, 20 dB)**
**$79.00 all other values**

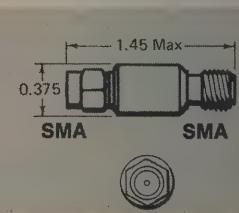
| PART NO. | ATTENUATION | VSWR (ALL UNITS) |
|---|---|---|
| MDC1065-3 | 3 ±0.3 dB | DC-4 GHz: 1.20<br>4-8 GHz: 1.30<br>8-12 GHz: 1.35<br>12.4-18 GHz: 1.50 |
| MDC1065-6 | 6 ±0.3 dB | |
| MDC1065-10 | 10 ±0.5 dB | |
| MDC1065-20 | 20 ±1.0 dB | |
| MDC1065-30 | 30 ±1.5 dB | |




## type sma/dc to 2.5 GHz — MDC1012

Operating Temp. Range: −55°C to +125°C
Total Input Power: 2 watts average, 0.5kW peak
Impedance: 50 ohms
**PRICE 1 TO 9**
**$19.95 (3, 6, 10, 20 dB)**
**$29.95 all other values**

| PART NO. | ATTENUATION | VSWR (ALL UNITS) |
|---|---|---|
| MDC1012-3 | 3 ±0.5 dB | DC-1.0 GHz: 1.20<br>1.0-2.5 GHz: 1.30 |
| MDC1012-6 | 6 ±0.6 dB | |
| MDC1012-10 | 10 ±0.6 dB | |
| MDC1012-20 | 20 ±1.0 dB | |
| MDC1012-30 | 30 ±1.5 dB | |




**MIDISCO**

**61 Mall Drive / Commack, New York 11725**
**(516) 543-4774 / TWX 510-226-7839**

**ALL MIDISCO PRODUCTS ARE IN STOCK AT MICROWAVE DISTRIBUTORS CO.**

**SPECIFICATIONS AND PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.**

# midisco coaxial terminations

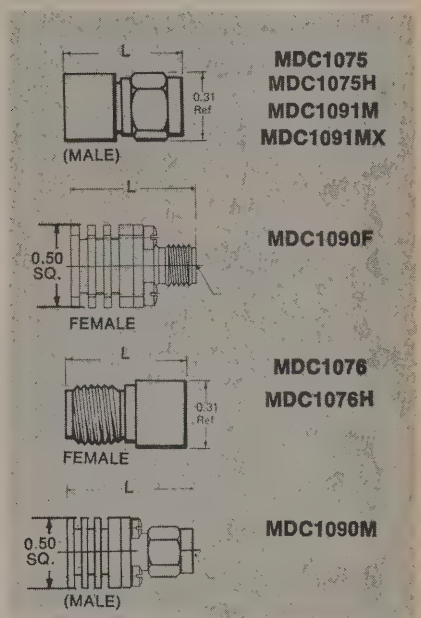
MIDISCO has accumulated the broadcast line of coaxial terminations in SMA, SNB, SNC, N, TNC and BNC. Most units are extremely broadband with low VSWR.
Mechanically, we do not know of the existence of any smaller SMA, M, TNC or BNC terminations with such good electrical characteristics. The Kwik-Slip (quick disconnect) termination provides solid fit with no threads on the coupling nut.
Bead chains are available where specified.
**All models are in stock.**

## type sma terminations (precision)
### 1/2, 2 and 5 watts

All are constructed from stainless steel material, have a temperature range of −50°C to +125°C and have an impedance of 50 ohms.

| Part No. | Finish | Average Power (Watts) | VSWR Max. DC-4 GHz[1] | 4-8 GHz | 8-12 GHz | 12-18 GHz | L | PRICE 1-9 |
|---|---|---|---|---|---|---|---|---|
| MDC1075 Precision | Passivated Coupling Nut, Gold Plated Body | ½ | 1.05 | 1.10 | 1.15 | 1.20 | .55 | $12.00* |
| MDC1075H Precision | Passivated Coupling Nut, Gold Plated Body | 2 | 1.05 | 1.10 | 1.15 | 1.25 | .69 | 25.00* |
| MDC1076 Precision | Passivated Coupling Nut, Gold Plated Body | ½ | 1.05 | 1.10 | 1.15 | 1.20 | .52 | 15.00 |
| MDC1076H Precision | Passivated Coupling Nut, Gold Plated Body | 2 | 1.05 | 1.10 | 1.15 | 1.25 | .63 | 25.00* |
| MDC1090F Precision | Passivated Coupling Nut, Black Anodized Aluminum Body | 5 | 1.05 | 1.30 | 1.50 | — | .755 | 35.00 |
| MDC1090M Precision | Passivated Coupling Nut, Black Anodized Aluminum Body | 5 | 1.05 | 1.30 | 1.50 | — | .895 | 35.00 |
| MDC1091M Ultra Miniature | Passivated | ½ | 1.05 | 1.10 | 1.15 | 1.20 | .32 | 18.00 |
| MDC1091MX Super Precision | Passivated | ½ | 1.03 | 1.04 | 1.08 | 1.12 | .32 | 35.00 |

*These items are also available with a 2.25 inch bead chain; add Suffix (-C).
Add $10 to prices shown. L=Length




## type sma/ kwik-slip termination

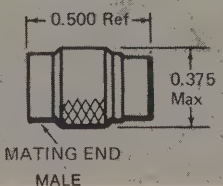
## MDC1075Q

The MIDISCO Kwik-Slip Termination is intended for lab or system use where it is too difficult or time consuming to use the standard (MDC1075) SMA termination. The Q Series snaps onto any SMA female connector and is rated to 18 GHz.

| | |
|---|---|
| Material: | Stainless steel, gold plated |
| Power: | 1 watt average |
| Impedance: | 50 ohms |
| Temp. Range: | −55°C to +125°C |
| VSWR: | 1.05 +0.010F (GHz) |
| Durability: | 500 cycles min. |
| Engagement Force: | 10 lbs. axial |

**MATES WITH SMA**
**PRICE 1 TO 9**
**MDC1075Q $35.00**
**MDC1075QC $45.00**
**(with 2.5" bead chain)**

**MDC1075Q MATES WITH MIL-C-39012/SMA SERIES**




**MIDISCO**

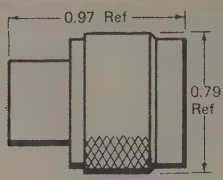
SPECIFICATIONS AND PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.

61 Mall Drive / Commack, New York 11725
(516) 543-4774 / TWX 510-226-7839

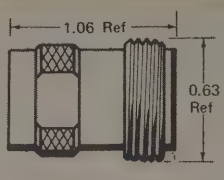
ALL MIDISCO PRODUCTS ARE IN STOCK AT MICROWAVE DISTRIBUTORS CO.

# midisco coaxial terminations

## type n/dc to 12.4 GHz — MDC1042M/1042F




TYPE N MALE
MDC1042M



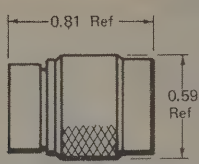

TYPE N FEMALE
MDC1042F

PRECISION/MINIATURE SPECIFICATIONS:

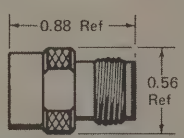
| | |
|---|---|
| Material: | Brass with bright alloy finish |
| Power: | 2 watts average, 1kW pk |
| Impedance: | 50 ohms |
| VSWR: | 1.15 max. thru 12.4 GHz |
| RFI: | −90 dB |

**PRICE 1 TO 9 $25.00**

## type tnc/dc to 12.4 GHz — MDC1044M/1044F




TYPE TNC MALE
MDC1044M



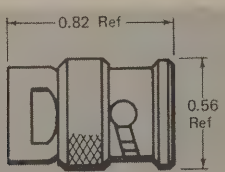

TYPE TNC FEMALE
MDC1044F

PRECISION/MINIATURE SPECIFICATIONS:

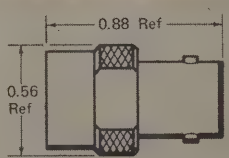
| | |
|---|---|
| Material: | Brass with bright alloy finish |
| Power: | 2 watts average, 1kW pk |
| Impedance: | 50 ohms |
| VSWR: | 1.15 max. thru 12.4 GHz |
| RFI: | −90 dB |

**PRICE 1 TO 9 $25.00**

## type bnc/dc to 8.0 GHz — MDC1043M/1043F




TYPE BNC MALE
MDC1043M



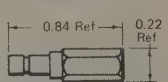
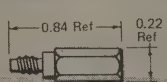
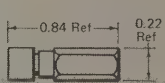
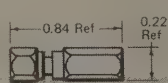

TYPE BNC FEMALE
MDC1043F

PRECISION/MINIATURE SPECIFICATIONS:

| | |
|---|---|
| Material: | Brass with bright alloy finish |
| Power: | 2 watts average, 1kW pk |
| Impedance: | 50 ohms |
| VSWR: | 1.15 max. thru 8.0 GHz |
| RFI: | −90 dB |

**PRICE 1 TO 9 $25.00**

## type smb and smc/dc to 4.0 GHz

| | SMB TYPE | | SMC TYPE | |
|---|---|---|---|---|
| SNAP-ON MDC1001BM |   | 10-32 THREAD MDC1001CM |   | |
| SNAP-ON MDC1001BF |   | 10-32 THREAD MDC1001CF |   | |

| | | |
|---|---|---|
| **SMB** | MALE | **MDC1001BM** |
| **SMB** | FEMALE | **MDC1001BF** |
| **SMC** | MALE | **MDC1001CM** |
| **SMC** | FEMALE | **MDC1001CF** |

SPECIFICATIONS

| | |
|---|---|
| Material: | Gold plated BeCu |
| Power: | ½ watt average |
| Impedance: | 50 ohms |
| VSWR: | 1.20 max. (SMC)<br>1.35 max. (SMB) |

**PRICE 1 TO 9 $18.00**

**MIDISCO**

61 Mall Drive / Commack, New York 11725
(516) 543-4774 / TWX 510-226-7839

SPECIFICATIONS AND PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.

ALL MIDISCO PRODUCTS ARE IN STOCK AT MICROWAVE DISTRIBUTORS CO.

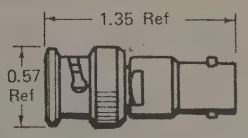
# midisco coaxial components

## type bnc/feed-thru terminations — MDC1079

The MIDISCO Feed-Thru Termination is ideal for terminating pulse microwave or UHF instruments in their characteristic impedance.

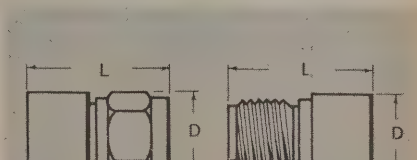
**PRICE 1 TO 9 $12.50 EACH**

| | |
|---|---|
| Impedance: | 50 ±1 ohm |
| Average Power: | 2 watts |
| Connectors: | BNC male/female |
| Finish: | Bright alloy |
| Frequency: | DC-500 MHz |
| VSWR: (Max.) | 1.1 (DC-250 MHz)<br>1.2 (250-500 MHz) |




## coaxial shorts — MDC1025

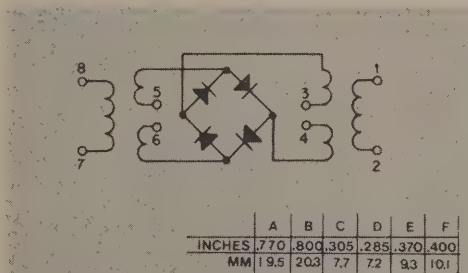
| S/M P/N SHORT | TYPE | D (REF.) | L (REF.) | MATERIAL | |
|---|---|---|---|---|---|
| MDC1025M-S | SMA Male | 0.31 | 0.33 | Stainless Steel | PRICE 1 TO 9 $18.00<br>WITH BEAD CHAIN (SUFFIX -C) $19.75 |
| MDC1025F-S | SMA Female | 0.31 | 0.34 | | |
| MDC1025M-T | TNC Male | 0.59 | 0.70 | Brass with Bright Alloy Finish | |
| MDC1025F-T | TNC Female | 0.50 | 0.58 | | |
| MDC1025M-N | N Male | 0.78 | 0.69 | | |
| MDC1025F-N | N Female | 0.78 | 0.75 | | |
| MDC1025M-B | BNC Male | 0.59 | 0.70 | | |
| MDC1025F-B | BNC Female | 0.50 | 0.58 | | |



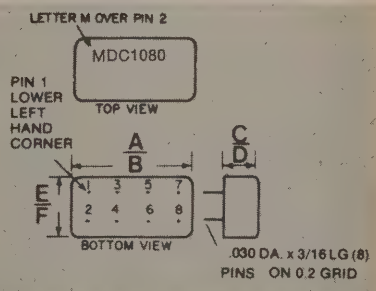

## double-balanced mixers — MDC1080

For demanding industrial and commercial applications, where low-cost and high performance are critical; Model MDC1080 will fill your need. MDC1080 covers the broad frequency range of 1-500 MHz with 6 dB conversion loss and isolation greater than 40 dB. Every MDC1080 is RF tested twice, all transformer leads are double-wrapped, every solder connection is 100% inspected under high power microscopes and all components are rated for more than +85°C operation. The weight is .18 oz. (5.2 grams).

**PRICE 1 TO 9 $5.00 EACH**




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| INCHES | .770 | .800 | .305 | .285 | .370 | .400 |
| MM | 19.5 | 20.3 | 7.7 | 7.2 | 9.3 | 10.1 |

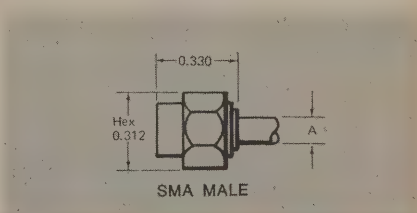



## sma semi-rigid midgets — MDC1141/1085

The MIDISCO Midgets are the smallest SMA Connectors for Semi-Rigid Cable available. The self facing design and the retractable coupling nut make these solder type connectors desirable for quality and ease of assembly. Material: Gold Plated BeCu. Interface dimensions are in accordance with MIL-C-39012.

**MDC1141**
For .141 (RG402/U) Cable
Uses insulator and center conductor of cable.
**PRICE $1.50 EACH**
**(PACKED IN BAGS OF 25)**

**MDC1085**
For .085 (RG405/U) Cable
Supplied with insulator and contact.
**PRICE $2.20 EACH**
**(PACKED IN BAGS OF 25)**




**MIDISCO**

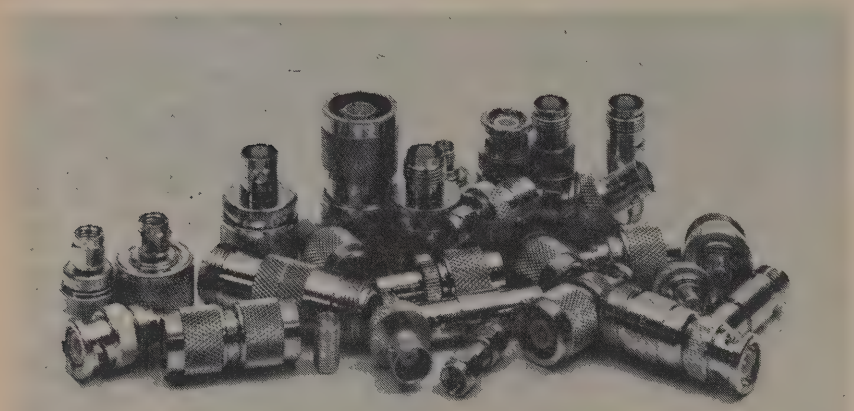
**61 Mall Drive / Commack, New York 11725**
**(516) 543-4774 / TWX 510-226-7839**

**ALL MIDISCO PRODUCTS ARE IN STOCK AT MICROWAVE DISTRIBUTORS CO.**

**SPECIFICATIONS AND PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.**

# midisco adapters within and between series

## simplified adapter part numbers



**SELECT CONNECTOR TYPE**

| | |
|---|---|
| N | = N |
| TNC | = T |
| BNC | = B |
| SMA | = S |
| SMB | = SMB |
| SMC | = SMC |
| MALE | = M |
| FEMALE | = F |
| BULKHEAD | = Prefix with B |
| RT. ANGLE | = Prefix with R |
| PANEL | = Prefix with P |

| **Examples:** | **Part No.** |
|---|---|
| N (male) to SMA (female) | NM-SF |
| TNC (female) to SMA (male) | TF-SM |
| BNC (male) to BNC (female) | BM-BF |
| SMB (male) to SMC (female) | SMBM–SMCF |

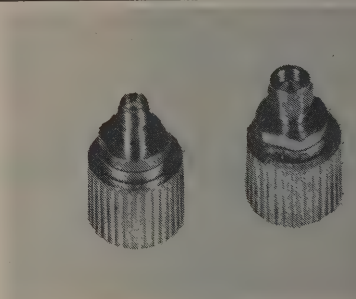
**PRICE 1-9 pcs. $15.00 EACH**

## precision 7mm adapters

| 7mm TO | PART NO. | MAX. SWR |
|---|---|---|
| N female<br>N male | NF-7<br>NM-7 | 1.03 @ 4 GHz<br>1.04 @ 9 GHz<br>1.08 @ 18 GHz |
| BNC female<br>BNC male | BF-7<br>BM-7 | 1.03 @ 4 GHz<br>1.045 @ 9 GHz<br>1.08 @ 12 GHz<br>1.12 @ 18 GHz |

| 7mm TO | PART NO. | MAX. SWR |
|---|---|---|
| TNC female<br>TNC male | TF-7<br>TM-7 | Same as BNC |
| SMA female<br>SMA male | SF-7<br>SM-7 | 1.07 @ 12.4 GHz<br>1.15 @ 18 GHz |

**PRICE 1 TO 4 $125.00 EACH**

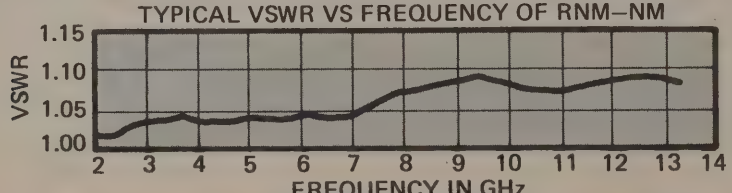


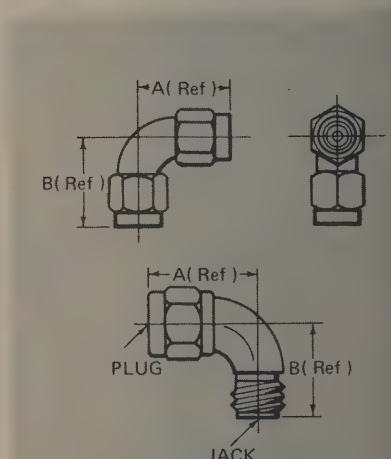
## precision radius adapters

The MIDISCO Radius Adapters consist of a bent section with a one piece center conductor that eliminates the vibration and shock failures that normally would occur at the solder joint. VSWR to 18 GHz is superior to that of mitered right angle adapters.

| TYPE | PART NUMBER | A | B | PRICE 1-9 |
|---|---|---|---|---|
| N Male — N Male | RRNM-NM | 1.094 | 1.084 | $25.00 |
| N Male — N Female | RRNM-NF | 1.109 | 1.000 | 25.00 |
| SMA Male — SMA Male | RRSM-SM | 0.550 | 0.550 | 18.00 |
| SMA Male — SMA Female | RRSM-SF | 0.550 | 0.460 | 16.50 |
| TNC Male — TNC Male | RRTM-TM | 1.060 | 1.060 | 25.00 |
| TNC Male — TNC Female | RRTM-TF | 0.953 | 1.060 | 25.00 |

TYPICAL VSWR VS FREQUENCY OF RNM–NM




**MIDISCO**

**61 Mall Drive / Commack, New York 11725**
**(516) 543-4774 / TWX 510-226-7839**

**ALL MIDISCO PRODUCTS ARE IN STOCK AT MICROWAVE DISTRIBUTORS CO.**

**SPECIFICATIONS AND PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE**

# midisco adapters

## adapto-kits

The MIDISCO Adapto-Kit consists of a hanging display board with spring clips which holds a total of 15 inter and intra Series Adapters. Kits are available in N, TNC, BNC, and SMA Series. This enables the technician to adapt from one series to all of the other series.

**PRICE:**
**AK - SMA — $195.00**
**AK - N — 175.00**
**AK - TNC — 175.00**
**AK - BNC — 175.00**
Replacement adapters are available at **$15.00 ea.**

### FOR COMPLETE SERIES ADAPTATION

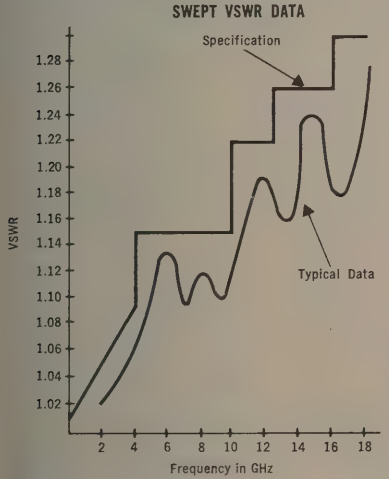
**The SMA Series Adapto-Kit (AK-SMA) consists of 1 each:**

| | | | |
|---|---|---|---|
| SMA Male to SMA Male | (SM-SM) | SMA Male to BNC Female | (BF-SM) |
| SMA Female to SMA Female | (SF-SF) | SMA Female to N Male | (NM-SF) |
| SMA Male to SMA Female | (SM-SF) | SMA Female to N Female | (NF-SF) |
| SMA Male to N Male | (NM-SM) | SMA Female to TNC Male | (TM-SF) |
| SMA Male to N Female | (NF-SM) | SMA Female to TNC Female | (TF-SF) |
| SMA Male to TNC Male | (TM-SM) | SMA Female to BNC Male | (BM-SF) |
| SMA Male to TNC Female | (TF-SM) | SMA Female to BNC Female | (BF-SF) |
| SMA Male to BNC Male | (BM-SM) | | |

# phase adjustable sma connector

### ELECTRICAL SPECIFICATIONS

Nom. Impedance: 50 ohms
Frequency Range: DC — 18 GHz
VSWR: (See chart)
Insertion Loss: dB =
.1 x $\sqrt{F}$ for Adapter version
.08 x $\sqrt{F}$ for Connector version
(F is Frequency in GHz)
Phase Adjustment (Degrees): 10° x F
Phase Change per Revolution of Adjustment Nut: .636° x F
Voltage Rating: 500 Volts RMS




### MECHANICAL SPECIFICATIONS

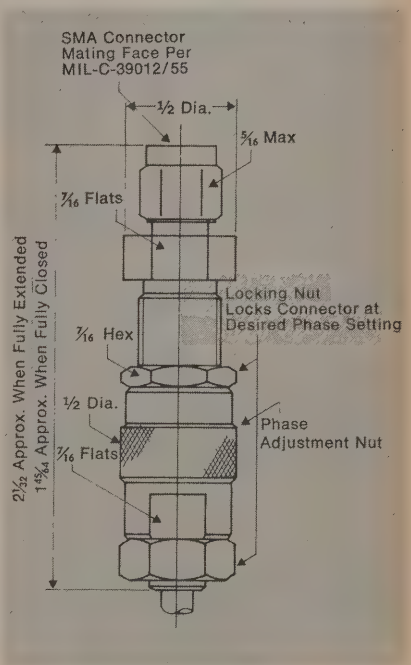
**Mating Characteristics:** Mating face dimensions compatible with the mating requirements of MIL-C39012 (Type SMA).
**Connector Durability:** (SMA Interface) 500 cycles of mating and unmating without deterioration.
**Materials and Finishes:**
Center Conductor —
Beryllium Copper, Gold Plated
Connector Body —
Brass or Beryllium Copper, Gold Plated
Adjusting Nut and Locking Nut —
Brass, with non-tarnish finish.
Connector Coupling Nut —
Stainless Steel, Passivated
Insulation — TFE

### ENVIRONMENTAL SPECIFICATIONS

Corrosion: MIL-STD-202, Method 101, Test Condfition B
Mechanical Shock: MIL-SD-202, Method 213, Test Condition I
Vibration: MIL-STD-202, Method 204, Test Condition D
Thermal Limits: −65°C to +125°C

| P/N | MAX. LENGTH, IN. | DIA., IN. | DESCRIPTION | PRICES 1-9 |
|---|---|---|---|---|
| MDC1089-1 | 2 1/32 | 1/2 | In-Line Adapter | $85.00 |
| MDC1089-2 | 2 1/32 | 1/2 | .141" Cable Conn. | 79.00 |
| MDC1089-3 | 2 1/32 | 1/2 | .085" Cable Conn. | 79.00 |

NOTE: Phase adjustable SMA Connectors are available for other semi-rigid cables. Please consult factory.




**MIDISCO**

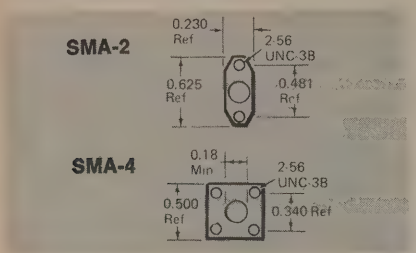
61 Mall Drive / Commack, New York 11725
(516) 543-4774 / TWX 510-226-7839

SPECIFICATIONS AND PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.

ALL MIDISCO PRODUCTS ARE IN STOCK AT MICROWAVE DISTRIBUTORS CO.

# midisco
# fpps (front panel problem solvers)

## multi-nut type sma-2 and sma-4

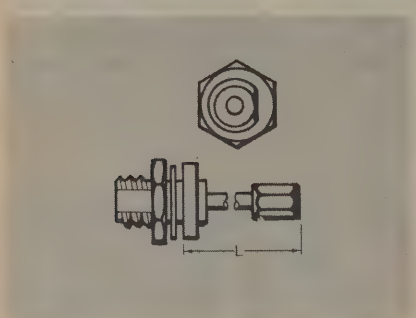



Where an SMA Connector must go through a panel, and assemblers have to use four separate nuts to hold it in place, you will be interested in the MIDISCO Multi-Nut. It cuts down assembly time and eliminates the use of nuts in tight places. They can be purchased in packs of 10.

Material: Aluminum 0.061 thick
Part Number: SMA-4 & SMA-2

**PRICE 75¢ EA. — OVER 500 50¢ EA. (minimum 10 pcs.)**

## bulkhead adapters/semi custom



MIDISCO makes use of their large inventory of connectors and Quick Reaction Cable Assembly Department to bring you a line of Semi-Custom Bulkhead Adapters. These adapters are also available in "Bent" configurations. See the MIDISCO Simplified Adapter Part Number Table on page 2884 and specify as follows:

B = Bulkhead

L = Length from panel face to interface of internal connectors in inches.

**HOW TO SPECIFY:**

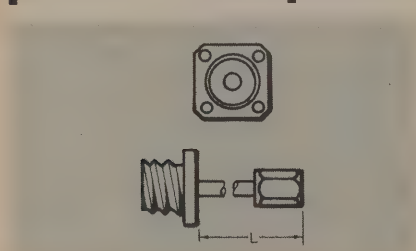
| Outside Conn. | Sex | Inside Conn. | Sex |
|---|---|---|---|
| B ( ) | ( ) | —L—( ) | ( ) |

Example: BNF-4-SM is a Bulkhead N female to SMA male and L = 4.

**PRICE**
**(for Bulkhead or Panel Types)**
**10 PIECES $25.00 EACH***

* These prices are for any combination between N, TNC, BNC, and SMA, SMB and SMC.

## panel adapters/semi custom



These adapters are the same as the Bulkhead adapters above except we make use of a four hole panel mount for the outside connector. L is dimensioned from the back of the flange to the interface of the internal connector. Use the part numbering system as shown.

**HOW TO SPECIFY:**

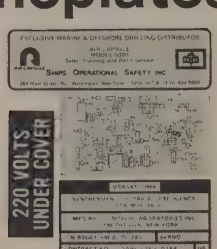
| Outside Conn. | Sex | Inside Conn. | Sex |
|---|---|---|---|
| P ( ) | ( ) | —L—( ) | ( ) |

Example: PNF ie a Panels N female to SMA male and L = 4 inches.

**PRICE**
**(for Bulkhead or Panel Types)**
**10 PIECES $25.00 EACH***

* These prices are for any combination between N, TNC, BNC, and SMA, SMB and SMC.

## nameplates/full mil-spec




QUICK DELIVERY

The ARTPLAK subsidiary is fully equipped to do short and long run nameplates, labels, front panels and overlays.

CONTACT:

ARTPLAK — Designers and Manufacturers of Plaques and Name Plates
61 Mall Drive • Commack, New York 11725 • Telephone (516) 543-3553

# MIDISCO

**61 Mall Drive / Commack, New York 11725**
**(516) 543-4774 / TWX 510-226-7839**

**ALL MIDISCO PRODUCTS ARE IN STOCK AT MICROWAVE DISTRIBUTORS CO.**

**SPECIFICATIONS AND PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE**

# midisco waveguide bends & adapters

## cast waveguide bends & adapters

| WAVEGUIDE SIZE ID, INCHES | TYPE OF BEND | PART NUMBER | STYLE AVAILABLE & PRICE 1-9 ALUMINUM* | | | | DIMENSIONS | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | M1 | M2 | M3 | M4 | A | B | C |
| 6.500 x 3.250 | 90° H | H-6500 | | | | $222.00 | | 5.000 | 5.000 |
| | 90° E | E-6500 | | | | 222.00 | | 4.000 | 4.000 |
| 2.840 x 1.340 | 90° H | H-2840 | $39.00 | $36.00 | | | 1.531 | 3.600 | |
| | 90° E | E-2840 | 39.00 | 36.00 | | | .781 | 1.625 | |
| | 45° H | H-2841 | 33.60 | 31.20 | | | 1.677 | 1.125 | |
| 2.290 x 1.145 | 90° H | H-2290 | 24.00 | 27.60 | $27.60 | | 1.234 | 2.000 | 2.000 |
| | 90° E | E-2290 | 24.00 | 27.60 | 27.60 | | .700 | 1.093 | 1.093 |
| | 45° H | H-2291 | 24.00 | | | | 1.750 | | |
| 1.872 x .872 | 90° H | H-1870 | 14.40 | | | | 1.062 | | |
| | 90° E | E-1870 | 14.40 | | | | .593 | | |
| 1.590 x .795 | 90° H | H-1590 | 12.00 | | 22.20 | | 1.000 | 1.875 | 1.875 |
| | 90° E | E-1590 | 12.00 | | | | .550 | (In development) | |
| 1.372 x .622 | 90° H | H-1370 | 8.40 | | | | .830 | | |
| | 90° E | E-1370 | 8.40 | | | | .438 | | |
| 1.122 x .497 | 90° H | H-1120 | 6.00 | | | | .656 | | |
| | 90° E | E-1120 | 6.00 | | | | .344 | | |
| .900 x .400 | 90° H | H-9000 | 4.80 | 7.20 | 7.20 | | .575 | 1.375 | 1.030 |
| | 90° E | E-9000 | 4.80 | | | | .325 | | |
| | 30° H | H-9001 | 5.11 | | | | .750 | | |
| .750 x .375 | 90° H | H-7500 | 4.51 | | | | .484 | | |
| | 90° E | E-7500 | 4.51 | | | | .325 | | |
| .622 x .311 | 90° H | H-6200 | 4.51 | | | | .368 | | |
| | 90° E | E-6200 | 4.51 | | | | .250 | | |
| | 30° H | H-6201 | 5.11 | | | | .601 | | |
| .510 x .255 | 90° H | H-5110 | 8.50 | | | | .312 | | |
| | 90° E | E-5110 | 8.50 | | | | .187 | | |
| .420 x .170 | 90° H | H-4200 | 5.40 | | 6.00 | | .300 | .350 | .437 |
| | 90° E | E-4200 | 5.40 | | | | .170 | | |
| | 45° E | E-4201 | | 5.71 | | | .179 | .120 | |
| .280 x .140 | 90° H | H-2800 | 5.40 | | 9.00 | | .210 | .620 | .450 |
| | 90° E | E-2800 | 5.40 | | | | .140 | | |
| .224 x .112 | 90° H | H-2200 | 7.80 | | | | .187 | | |
| | 90° E | E-2200 | 7.80 | | | | .125 | | |
| .188 x .094 | 90° H | H-1900 | 8.50 | | | | .193 | | |
| | 90° E | E-1900 | 8.50 | | | | .193 | | |

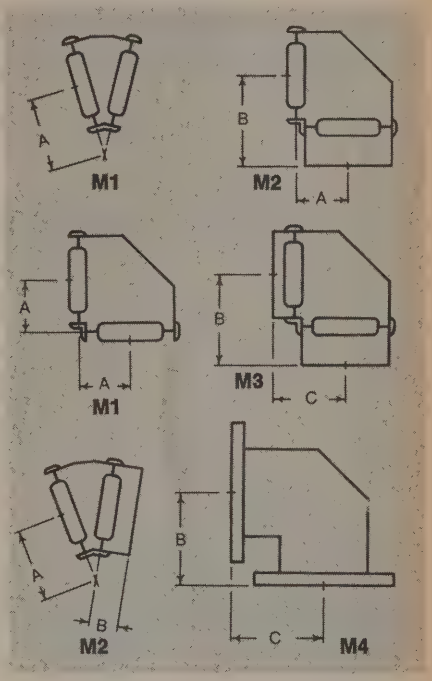
The bends listed in this bulletin are part of an ever growing line of 90° and acute angle E and H castings. Material can be either dip-brazeable aluminum or a beryllium copper alloy suitable for silver brazing or soft soldering. All elbows are frequency compensated and have VSWR generally less than 1.05 over the waveguide band. E bends are designed with a radius on the inside corner to discourage arcing at high power levels. Bends can also be supplied pressure tight. **

A data sheet is available on each model. The data sheet gives complete information, including mechanical tolerances and typical VSWR.

Please specify the catalog number, the style (i.e. M1, M2, etc.) and material. Also advise if casting must be pressure tight.

* Add 20% for Be Cu. ** Add $1.00 or 10%, whichever is greater, for pressure tight bends.

- All Bends and Adapters are available in Dip Brazeable Aluminum or Beryllium Copper Alloy.
- VSWR is typically less than 1.05:1 over the full waveguide band.
- E Bends are designed with a radius on the inside corner to discourage arcing at high power levels.




## coax to waveguide adapters

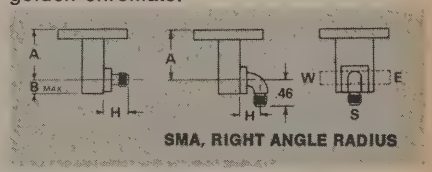
### VSWR SPECIFICATIONS

| CONNECTORS | 1.20 | 1.25 | 1.30 | "H" DIM. |
|---|---|---|---|---|
| SMA, Female (3mm) | WR284 - WR187 | WR137 - WR90 | WR75 - WR51 | .53 |
| SMA, Right Angle | WR284 - WR229 | WR187 - WR137 | WR112 - WR75 | .38 |
| 7mm | WR650 - WR159 | WR137 - WR75 | | .95 |
| Type N Female | WR650 - WR159 | | | .95 |

### GENERAL SPECIFICATIONS

| WAVEGUIDE SIZE | FREQUENCY RANGE, MHz | FLANGE TYPE | DIMENSIONS | | MIDISCO PART NUMBERS | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | B | SMA | Price 1-9 | SMA R/A | Price 1-9 | 7mm | Price 1-9 | N | Price 1-9 |
| WR650 | 1120-1700 | Specify | 3.00 | 1.75 | | | | | 7-650 | $288 | N-650 | $240 |
| WR430 | 1700-2600 | Specify | 2.50 | 1.30 | | | | | 7-430 | 288 | N-430 | 240 |
| WR340 | 2200-3250 | Specify | 2.25 | .95 | SM-340 | $186 | RRSM-340 | $216 | 7-340 | 288 | N-340 | 240 |
| WR284 | 2600-4000 | Specify | 1.90 | .80 | SM-284 | 84 | RRSM-284 | 114 | 7-284 | 144 | N-284 | 72 |
| WR229 | 3300-4700 | Specify | 1.21 | .65 | SM-229 | 84 | RRSM-229 | 114 | 7-229 | 144 | N-229 | 84 |
| WR187 | 4000-6000 | Specify | 1.16 | .55 | SM-187 | 78 | RRSM-187 | 108 | 7-187 | 132 | N-187 | 72 |
| WR159 | 4900-6900 | Specify | 1.08 | .50 | SM-159 | 78 | RRSM-159 | 108 | 7-159 | 132 | N-159 | 72 |
| WR137 | 5400-8200 | Specify | 1.00 | .50 | SM-137 | 72 | RRSM-137 | 102 | 7-137 | 120 | N-137 | 84 |
| WR112 | 7000-10000 | UG138/U | .90 | .50 | SM-112 | 66 | RRSM-112 | 96 | 7-112 | 114 | N-112 | 84 |
| WR102 | 7000-11000 | UG1493/U | .90 | .50 | SM-102 | 66 | RRSM-102 | 96 | 7-102 | 108 | N-102 | 140 |
| WR90 | 8200-12400 | UG135/U | .90 | .50 | SM-900 | 66 | RRSM-900 | 96 | 7-900 | 108 | N-90 | 140 |
| WR75 | 10000-15000 | 1.50 Square | .90 | .50 | SM-750 | 72 | RRSM-750 | 102 | 7-750 | 140 | | |
| WR62 | 12400-18000 | UG419/U | .90 | .50 | SM-620 | 84 | RRSM-620 | 114 | 7-620 | 144 | | |
| WR51 | 15000-18000 | 1.31 Square | .87 | .50 | SM-510 | 96 | RRSM-510 | 126 | 7-510 | 158 | | |

MIDISCO Coax To Waveguide Adapters are available as standard items in fourteen common waveguide sizes and with a choice of four connector styles. Standard material is aluminum and finish is golden chromate.



SMA, RIGHT ANGLE RADIUS

### NOTES ON SPECIALS AND MODIFICATIONS

When inquiring, specify restricted frequency ranges whenever possible for better performance or lower cost.

### WHEN ORDERING

Please specify flange type for sizes WR650 through WR137. CPR, CMR, and UG Series are standard. Right angle connectors will be tested in position "S" if orientation is not specified. All right angle SMA connectors are MIDISCO RRSF.

SPECIFICATIONS AND PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.

MIDISCO
61 Mall Drive / Commack, New York 11725
(516) 543-4774 / TWX 510-226-7839

ALL MIDISCO PRODUCTS ARE IN STOCK AT MICROWAVE DISTRIBUTORS CO.

# midisco cable assemblies

## right angle bent assembly

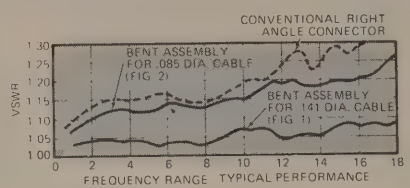
MIDISCO employs newly achieved bending techniques and the MIDISCO MDC1141 and MDC1085 Connectors to eliminate the need for conventional right angle SMA Connectors.

By mounting the MIDISCO connector to the semi-rigid cable and bending (90°) immediately at the plug entry, we obtain the basic dimensions of a right angle plug with performance of a straight connector.

**ORDERING INFORMATION**

| PART NUMBER FOR 0.141 CABLE | PART NUMBER FOR 0.085 CABLE |
|---|---|
| MDC1052-"L" | MDC1053-"L" |

"L" = Length in Inches
Any lengths are available from STOCK




**PRICE 1-9 — LENGTH**
**$12.00 2"-8" / $12.50 10"-16" / $13.00 18"-24"**

**Conventional Method**

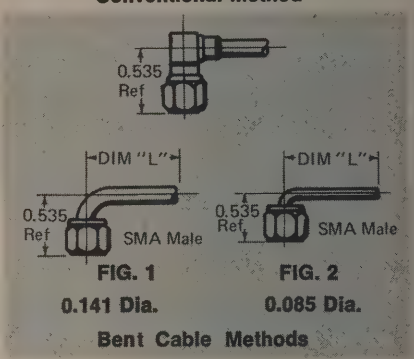


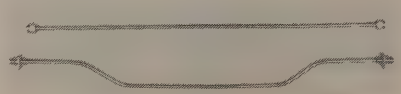

**FIG. 1** **0.141 Dia.**
**FIG. 2** **0.085 Dia.**
**Bent Cable Methods**

# custom assemblies

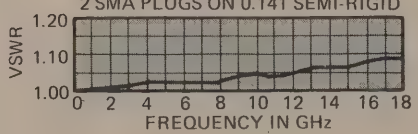
MIDISCO stores large quantities of the types of connectors required to deliver complete cable assemblies to our customers in as little as **three hours.**

One pc prototypes are available to your sketch or bent wire or mock up for $25.

**SEMI-RIGID**



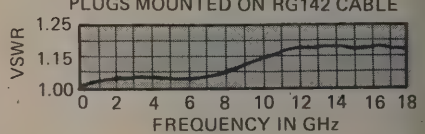
TYPICAL PERFORMANCE
2 SMA PLUGS ON 0.141 SEMI-RIGID




**FLEXIBLE**
**CRIMP, CLAMP OR SOLDER**

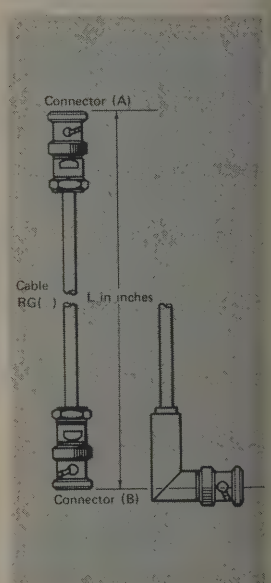
N's, TNC's, BNC's, SMB's, SMC's, SMA's, SSMA's, PTNC's, TM's, etc. Available on various types of flexible cable: RG 55, 58, 141, 142, 223, 8, 9, 213, 215, 174, 179A, 187, 188, etc.

TYPICAL VSWR OF 2 PRECISION TNC PLUGS MOUNTED ON RG142 CABLE




# test cables

Prices with Cable Type: RG58, RG59, RG141, RG142, RG174, RG188, RG214, and RG223 (any connector combination) also 0.085 (RG405) and 0.141 (RG402) Semi-Rigid.




All other RG cable types are available.

| CONN. TYPES = | CONN. P/N | CONN. TYPES = | CONN. P/N | LENGTH | PRICE 1-9 |
|---|---|---|---|---|---|
| N Male | NM | SMA Male | SM | 12" | $11.75 |
| N Female | NF | SMA Female | SF | 18" | 12.25 |
| BNC Male | BM | SMB Male | SMBM | 24" | 12.75 |
| BNC Female | BF | SMB Female | SMBF | 36" | 13.50 |
| TNC Male | TM | SMC Male | SMCM | 48" | 14.25 |
| TNC Female | TF | SMC Female | SMCF | 60" | 15.00 |
| | | UHF Male | UM | 72" | 15.75 |

**MIDISCO Part Numbers = Connector (A) — RG ( ) — Connector (B) — Length in Inches**

**EXAMPLE:**

**RNM - 58 - BF-36** is a 3-foot, RG58 Cable Assembly with a right angle Type N Male and a BNC Female. Price = $13.50 plus $3.00 for one right angle connector.

NOTES:
A. All connectors are (where possible) in accordance with MIL-C-39012.
B. Finish — Type N, TNC, BNC — Non-tarnish — Bright Alloy; SMA — Gold Plated.
C. Other cable and connector types are readily available.
D. Length — L equals overall length of cable assembly in inches.
F. For right angle connector, prefix connector part number with "R" and add $3.00 to cable assembly price for each right angle connector.
G. Bulkhead or Panel connectors available at additional cost.

**MIDISCO**

**61 Mall Drive / Commack, New York 11725**
**(516) 543-4774 / TWX 510-226-7839**

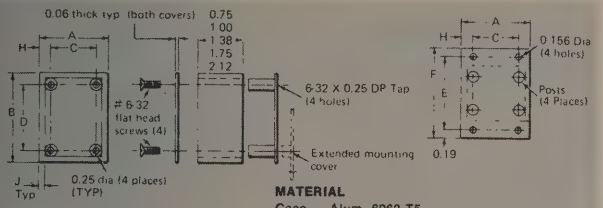
**SPECIFICATIONS AND PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.**

**ALL MIDISCO PRODUCTS ARE IN STOCK AT MICROWAVE DISTRIBUTORS CO.**

# midisco rfi shielded cases

## blank and connectorized boxes/ circuit boards/gaskets

MIDISCO's Blank Series consists of blank cases in 12 standard sizes, with five various heights (0.75, 1.00, 1.38, 1.75, 2.12). All have top and bottom covers mounted in place with four flat head screws. Extended covers are available to give mounting flexibility.




**MATERIAL**
Case Alum. 6063-T5
Covers Alum. 6061-T4
Finish Chemical film per MIL-C-5541, Class 1A

| CASE[1] PART NO. | TABULATION CHART A | B | C | D | E | F | H | J |
|---|---|---|---|---|---|---|---|---|
| MDC11 | 1.50 | 2.00 | 1.000 | 1.500 | 2.375 | 2.75 | 0.25 | 0.12 |
| MDC12 | 1.50 | 2.50 | 1.000 | 2.000 | 2.875 | 3.25 | | |
| MDC13 | 1.50 | 6.00 | 1.000 | 5.500 | 6.375 | 6.75 | | |
| MDC15 | 1.75 | 3.00 | 1.250 | 2.500 | 3.375 | 3.75 | | |
| MDC16 | 2.00 | 2.00 | 1.500 | 1.500 | 2.375 | 2.75 | | |
| MDC17 | 2.00 | 3.00 | 1.500 | 2.500 | 3.375 | 3.75 | | |
| MDC18 | 2.00 | 4.00 | 1.500 | 3.500 | 4.375 | 4.75 | | |
| MDC19 | 2.00 | 5.00 | 1.500 | 4.500 | 5.375 | 5.75 | | |
| MDC20 | 2.00 | 6.00 | 1.500 | 5.500 | 6.375 | 6.75 | | |
| MDC21 | 3.00 | 3.00 | 2.500 | 2.500 | 3.375 | 3.75 | | |
| MDC22 | 3.00 | 5.00 | 2.500 | 4.500 | 5.375 | 5.75 | 0.25 | 0.12 |
| MDC23 | 3.00 | 6.00 | 2.375 | 5.375 | 6.375 | 6.75 | 0.31 | 0.19 |

[1](a) Any case size in the above column includes top and bottom covers, and (4) 6-32 flat head screws.
(b) Other sizes available; contact factory.

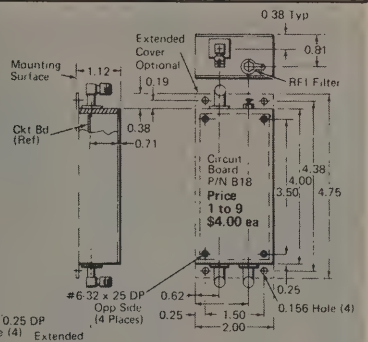
**10 BUCKS A BOX (1-9) ANY SIZE.**

**HOW TO ORDER**
MDC11 — 138 — 0
CASE PART NO.
CASE HEIGHT
075=0.75 100=1.00 138=1.38 175=1.75 212=2.12
COVER TYPE
0=Std. Flush
1=Extended (1); Flush (1)

MIDISCO's Connectorized Series consists of many standard case sizes, each having a top and bottom flush cover mounted in place with four screws (extended covers available), and a selection of three flange mounted "female" connectors (SMA, TNC, BNC). One nut plate is supplied with each connector which secures the connector to the case, and supports the circuit board providing an excellent ground plane. MIDISCO cases offer very easy accessibility to the circuit board. By removing the four screws, the top and bottom covers disengage to allow complete accessibility to both sides of the board.

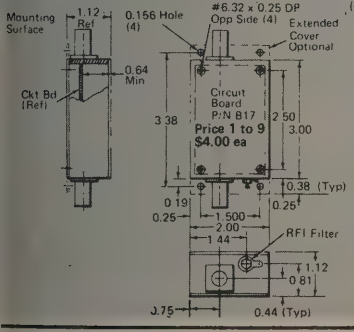
**PRICE 1 TO 9 $24.00 EACH**
**(Add $2.00 for each right angle connector)**

### MDC6318



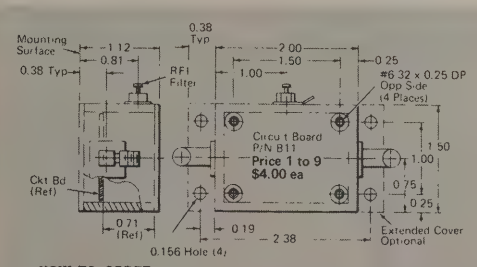

**HOW TO ORDER**
MDC6318 — S — 0
BASIC PART NO.
COVER TYPE
0=Std. Flush
1=Extended (1); Flush (1)
CONNECTOR TYPE
S=SMA Female (Straight)
SR=SMA Female (Right Angle)
**PRICE 1 TO 9 $24.00 EACH**
**Uses Gasket G18**
**PRICE 1 TO 9 $10.50**

### MDC6217



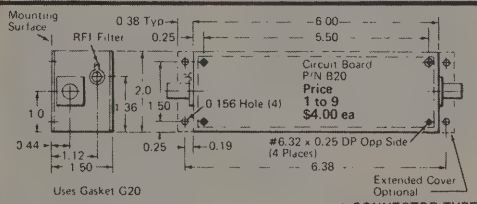

**HOW TO ORDER**
MDC6217 — S — 0
BASIC PART NO.
COVER TYPE
0=Std. Flush
1=Extended (1); Flush (1)
CONNECTOR TYPE
S=SMA Female
B=BNC Female
T=TNC Female
**PRICE 1 TO 9 $24.00 EACH**
**Uses Gasket G17**
**PRICE 1 TO 9 $8.50 EACH**

### MDC6211



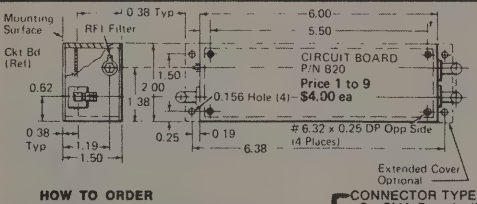

**HOW TO ORDER**
MDC6211 — S — 0
BASIC PART NO.
COVER TYPE
0=Std. Flush
1=Extended (1); Flush (1)
CONNECTOR TYPE
S=SMA Female (Straight)
SR=SMA Female (Right Angle)
**PRICE 1 TO 9 $24.00 EACH**
**Uses Gasket G11**
**PRICE 1 TO 9 $8.00 EACH**

### MDC6220




**HOW TO ORDER**
MDC6220 — S — 0
BASIC PART NO.
COVER TYPE
0=Std. Flush
1=Extended (1); Flush (1)
CONNECTOR TYPE
S=SMA Female
B=BNC Female
T=TNC Female
**PRICE 1 TO 9 $24.00 EACH**
**Uses Gasket G20**
**PRICE 1 TO 9 $13.00 EACH**

### MDC6320




**HOW TO ORDER**
MDC6320 — S — 0
BASIC PART NO.
COVER TYPE
0=Std. Flush
1=Extended (1); Flush (1)
CONNECTOR TYPE
S=SMA Female (Straight)
SR=SMA Female (Right Angle)
**PRICE 1 TO 9 $24.00 EACH**
**Uses Gasket G20**
**PRICE 1 TO 9 $13.00 EACH**

**SPECIFICATIONS AND PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.**

**MIDISCO**

**61 Mail Drive / Commack, New York 11725**
**(516) 543-4774 / TWX 510-226-7839**

**ALL MIDISCO PRODUCTS ARE IN STOCK AT MICROWAVE DISTRIBUTORS CO.**

# RF COMPONENTS DESIGNER'S GUIDE

NEXT 168 PAGES

## TABLE OF CONTENTS


Reliability considerations ..... 3
Environmental specifications ..... 5
Power splitter/combiner selection table ..... 84
Power splitter/combiner frequency chart ..... 85
Power splitter/combiner specifications and curves ..... 86
Electronic attenuator/switch specifications and curves ..... 156
Limiter specifications and curves ..... 169
Frequency doubler specifications and curves ..... 162
Broadband amplifier specifications and curves ..... 168
Directional coupler applications/frequency chart ..... 141
Directional coupler specifications and curves ..... 142
RF transformer specifications and curves ..... 166
Double-balanced mixer selection table ..... 6
Double-balanced mixer frequency chart ..... 7
Double-balanced mixer specifications and curves ..... 8
Cross-index of all models ..... 170
Ordering information and warranty ..... 3



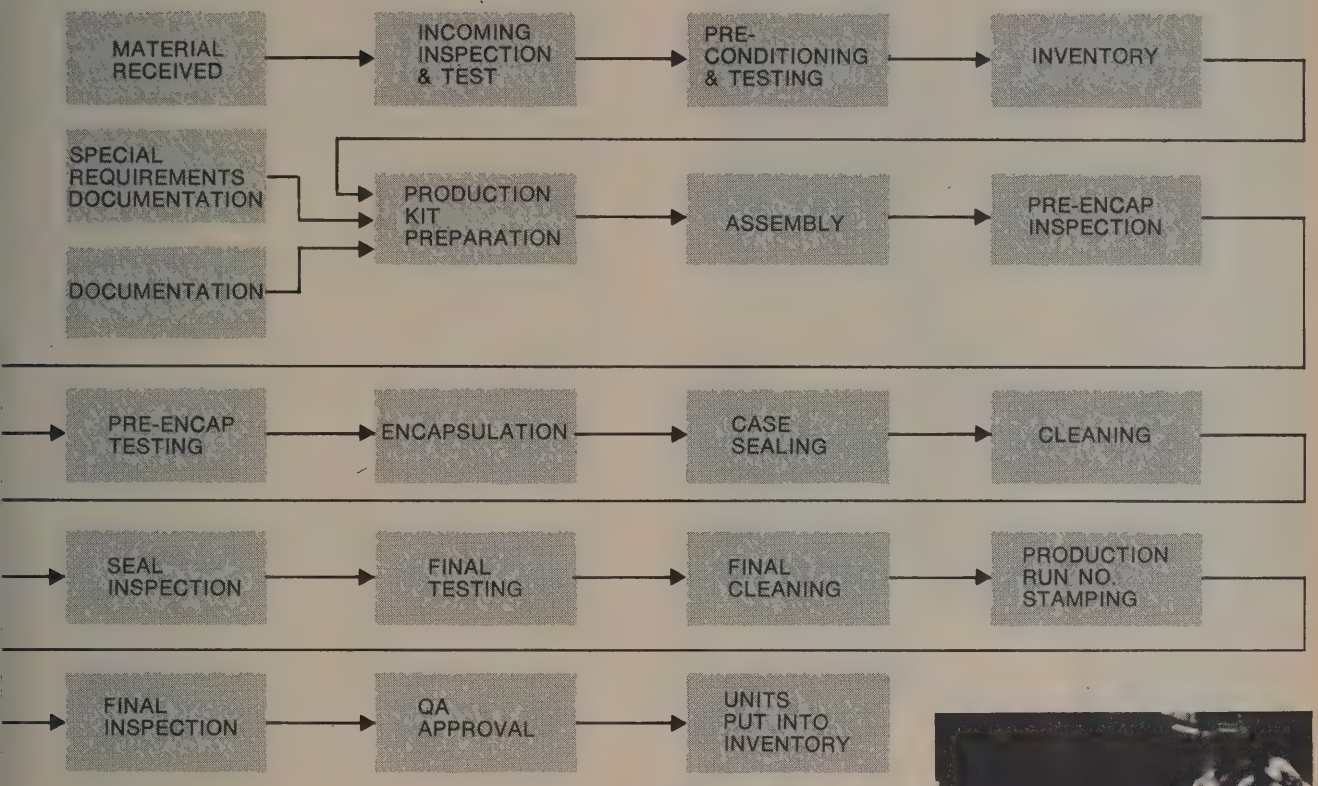
WORLD'S LARGEST MANUFACTURER OF DOUBLE-BALANCED MIXERS

Mini-Circuits Laboratory
*A Division of Scientific Components*

Mini-Circuits 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

Mini-Circuits

# HERE'S HOW MINI-CIRCUITS ACHIEVES HIGH RELIABILITY



## Ordering Information

Your local representative or distributor is the contact for both sales and service assistance for products listed in this catalog. These local offices have the latest price and delivery information on all models. They can also provide details on ordering procedures, service information and application engineering data.

Your order may be sent directly to Mini-Circuits Laboratory or to any of the local sales offices.

Prices listed in this catalog are domestic F.O.B. Brooklyn, New York.

Mini-Circuits Laboratory reserves the right to change specifications, models, prices, or designs without prior notice and without liability for such changes.

## Shipping

Shipments can be made by either air or surface carriers. If specific shipping instructions do not accompany the order, Mini-Circuits Laboratory will specify the carrier to be used.

## Terms

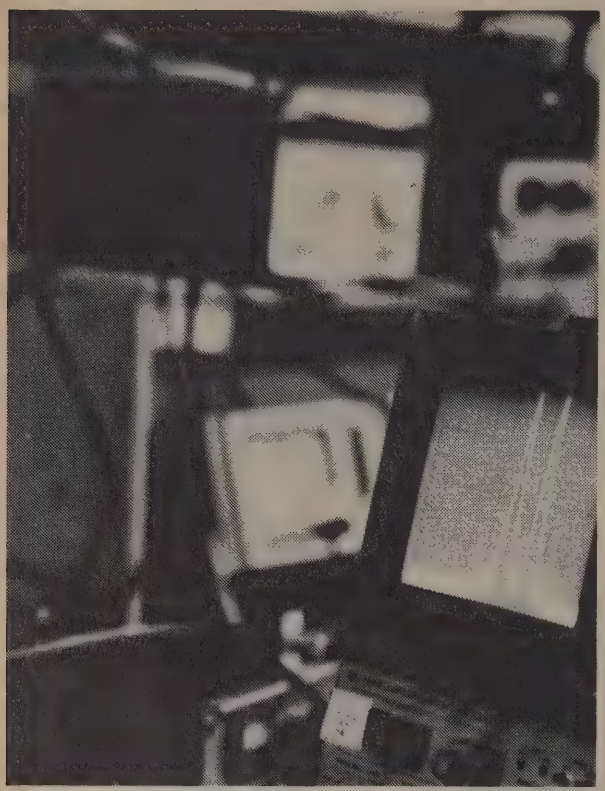
Net 30 days from date of invoice. If credit is not established with Mini-Circuits Laboratory, shipments will be made C.O.D. (cash on delivery) or prepaid. When sending prepayments please include freight.

## Warranty

Scientific Components Corporation, Mini-Circuits Laboratory division, warrants each new device to be free from defects in material and workmanship. The sellers obligation under this warranty is limited to repairing, or at his option, replacing any device or parts except tubes, semiconductors, lamps, fuses, or batteries, for any device returned to the sellers premise, transportation charges prepaid, within one year after delivery to the original purchaser, and which after examinations by the seller shall prove to be defective within the terms of the warranty. This warranty excludes all other warranties expressed or implied. Seller shall not be liable for any special, indirect, or consequential damages. This warranty does not extend to any device or part which in the opinion of the seller has been subjected to use in violation of seller's instructions or to any misuse, negligence, or accident.

PROMPT SERVICE / ONE WEEK DELIVERY Mini-Circuits

# RELIABILITY CONSIDERATIONS



**Performance characteristics are checked** to assure compliance with data-sheet specs.

It is very important that the mixer should provide reliable service under adverse environmental conditions. The user should also expect satisfactory performance after years of operation. Since these two criteria are somewhat subjective, the manufacturer should utilize procedures, techniques, and criterion which will enhance the reliability and quality of the finished product. After manufacturing hundreds of thousands of RF components Mini-Circuits is confident that we are doing the "right thing"

At Mini-Circuits reliability and quality control is one of the most important considerations in the manufacture of our products. Some of the procedures which are incorporated to ensure that every unit shipped has quality built in are as follows:

**A.** 100% testing of each diode.

**B.** 100% testing of each unit.

**C.** 100% inspection of every solder connection.

**D.** All transformers bonded to the header for protection against severe shock and vibration condition.

**Every single solder connection** is closely inspected to detect potential flaws.

**Transformer leads are doubly wrapped** to eliminate potential flaws.

**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# Mini-Circuits

**E.** All diodes, resistors and capacitors bonded to the header for protection against severe shock and vibration conditions.

**F.** Diode and resistor power dissipation derated greater than 50%.

**G.** All Components rated for greater than +125° C operation.

**H.** All transformer leads double wrapped.

**I.** Heavy coated wire insulation for Hi-Pot/ altitude requirements.

**J.** Completely encapsulated for protection against mechanical shock and vibration and temperature shock.

**K.** Permanent case marking of model number, cannot be removed by cleaning agents or ultrasonic baths.

**L.** Cupro-Nickel case for long lasting finish especially under salt atmosphere conditions.

As a consequence of these considerations Mini-Circuits guarantees its products for one full year after shipment and guarantees an SRA-1 high-rel double balanced mixer for 2 years!! In addition Mini-Circuits guarantees its units will meet the following environmental specifications.

**Matched diodes are carefully mounted** to the header assembly for rugged protection against severe shock and vibration.

**Every single solder connection is closely inspected** to detect potential flaws.

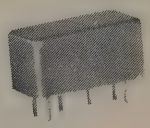
# ENVIRONMENTAL SPECIFICATIONS

All MCL components are manufactured under exacting quality assurance and control standards. They will meet or exceed published specifications over the operating temperature range of −54° to +100° C, and after being subjected to any or all of the following physical or environmental tests of MIL STD 202E which are applicable.

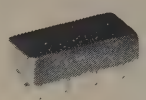
| | | |
|---|---|---|
| Temperature Cycling: | | |
| −65° to +125° C | 102 | C |
| Altitude: 656,000 feet | 105 | G |
| Humidity: 90% RH, 65° C | 106 | |
| Thermal Shock: | | |
| −65° C to +125° C | 107 | B |
| Seal: Less than $10^{-5}$ Atm. cc/sec | 112 | A |
| Drop: Random, 45 min. | 203 | |
| Vibration: | | |
| 2 to 2,000 cps, 20g, 12 hrs. | 204 | D |
| Solder Heat: 260° C, 10 sec. | 210 | B |
| Solderability: 95% coverage | 208 | |
| Terminal Tensile Strength: | | |
| 4½ lbs., 10 sec. | 211 | A |
| Terminal Fatigue: 2 lbs., 3 cycles | 211 | C |
| Mechanical Shock: 100g, 6ms | 213 | I |
| Solvent Resistance: | | |
| Alcohol, Trichloroethan, Freon | 215 | |

# MIXER SELECTION GUIDE

**STEP 1**
*SELECT PACKAGE STYLE*

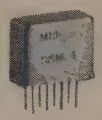


**A.** SRA, SRA-H, RAY

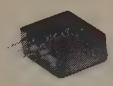


**B.** TAK, TAK-H

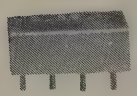
**C.** TSM



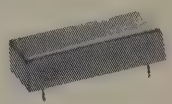
**D.** SAM, SAM-H



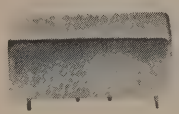
**E.** TFM, TFM-H



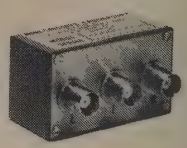
**F.** SBL



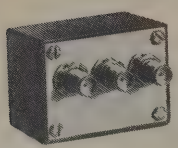
**G.** GRA



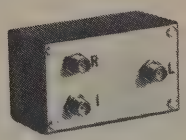
**H.** GRA-H



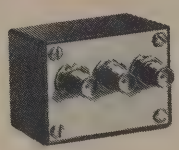
**I.** ZAD, ZAD-H, ZAD-SH, ZAY



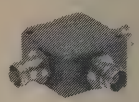
**J.** ZLW, ZLWH, ZLW-SH, ZMY




**K.** MA



**L.** ZMA



**M.** ZFM, ZFM-H

| SERIES | CASE STYLE SEE FIG. | FREQUENCY RANGE | FEATURES | CONNECTORS | SIZE (INCHES) | PRICE FROM (QTY.) | PAGE |
|---|---|---|---|---|---|---|---|
| **STANDARD LEVEL (+7 dBm LO)** | | | | | | | |
| SRA | A | 500 Hz - 2 GHz | Economical, Miniature | 8 Pins | 0.4 x 0.4 x 0.8 | $ 9.95 (1-49) | 8 |
| TAK | B | 10 KHz - 1250 MHz | Low Profile, Miniature | 8 Pins | 0.2 x 0.4 x 0.8 | $17.95 (1-4) | 18 |
| TSM | C | 100 KHz - 500 MHz | Low Profile, Micro-Min. | 8 Pins | 0.25 x 0.2 x 0.5 | $16.95 (5-24) | 24 |
| SAM | D | 100 KHz - 1500 MHz | Economical, Micro-Min. | 8 Pins | 0.4 x 0.2 x 0.5 | $13.95 (6-24) | 26 |
| TFM | E | 40 KHz - 3 GHz | Flat Pack/Plug-In Micro-Min. | 4 Pins | 0.25 x 0.2 x 0.5 | $11.95 (6-49) | 20 |
| GRA | G | 500 Hz - 500 MHz | Replacement Existing Designs | 6 Pins | 0.25 x 0.5 x 1.0 | $10.95 (6-49) | 30 |
| SBL | F | 1 MHz - 1000 MHz | Very Economical | 8 Pins | 0.3 x 0.4 x 0.8 | $3.95 (10-49) | 16 |
| ZAD | I | 500 Hz - 2 GHz | Economical, Compact | BNC STD., TNC OPT. | 2.25 x 1.4 x 1.15 | $24.95 (4-24) | 32 |
| ZLW | J | 500 Hz - 2 GHz | Economical, Miniature | SMA | 1.5 x 1.15 x 0.88 | $34.95 (4-24) | 42 |
| ZFM | M | 40 KHz - 3 GHz | 3 Mtg. Opt. Miniature, Rugged | BNC STD., TNC, SMA, N OPT. | 1.25 x 0.75 x 1.25 | $41.95 (4-24) | 38 |
| **HIGH LEVEL (+17 dBm LO)** | | | | | | | |
| SRA-H | A | 50 KHz - 3 GHz | +10 dBm Input, Miniature | 8 Pins | 0.4 x 0.4 x 0.8 | $15.95 (5-24) | 48 |
| SAM-H | D | 100 KHz - 1 GHz | +7 dBm Input, Micro-Min. | 8 Pins | 0.4 x 0.2 x 0.5 | $19.95 (5-24) | 52 |
| GRA-H | H | 50 KHz - 500 MHz | Replacement Existing Designs | 6 Pins | 0.4 x 0.5 x 1.0 | $16.95 (5-24) | 54 |
| TAK-H | B | 50 KHz - 750 MHz | +15 dBm Input, Low Profile, Min. | 8 Pins | 0.25 x 0.4 x 0.8 | $19.95 (5-24) | 58 |
| TFM-H | E | 0.1 MHz - 1000 MHz | +15 dBm Input, Flatpack Plug-In, Micro-Min. | 4 Pins | 0.25 x 0.2 x 0.5 | $23.95 (5-24) | 56 |
| ZAD-H | I | 50 KHz - 3 GHz | +10 dBm Input, Compact | BNC STD., TNC OPT. | 2.25 x 1.4 x 1.15 | $30.95 (4-24) | 60 |
| ZLW-H | J | 50 KHz - 3 GHz | +10 dBm Input, Miniature | SMA | 1.5 x 1.15 x 0.88 | $40.95 (4-24) | 64 |
| ZAD-SH | I | 50 KHz - 750 MHz | +15 dBm Input, Compact | BNC STD., TNC OPT. | 2.25 x 1.4 x 1.15 | $40.95 (4-24) | 70 |
| ZFM-H | M | 0.1 MHz - 1000 MHz | +15 dBm Input, Miniature, Rugged | BNC STD., TNC, SMA, N OPT. | 1.25 x 0.75 x 1.25 | $53.95 (1-24) | 68 |
| ZLW-SH | J | 50 KHz - 750 MHz | +15 dBm Input, Miniature | SMA | 1.5 x 1.15 x 0.88 | $50.95 (4-24) | 72 |
| **VERY HIGH LEVEL (+23 dBm LO)** | | | | | | | |
| RAY | A | 70 KHz - 1 GHz | +15 dBm Input, Miniature | 8 Pins | 0.4 x 0.4 x 0.8 | $31.95 (4-9) | 74 |
| ZAY | I | 70 KHz - 1 GHz | +15 dBm Input, Compact | BNC STD., TNC OPT. | 2.25 x 1.4 x 1.15 | $41.95 (4-9) | 76 |
| ZMY | J | 70 KHz - 1 GHz | +15 dBm Input, Miniature | SMA | 1.5 x 1.5 x 0.88 | $51.95 (4-9) | 78 |
| **MICROWAVE** | | | | | | | |
| MA | K | 1 MHz - 2.5 GHz | Double-Balanced, Compact | SMA | 2.25 x 1.4 x 1.15 | $99.95 (1-9) | 80 |
| ZMA | L | 1.0 GHz - 3.0 GHz | Balanced, Economical | SMA | 2.25 x 1.4 x 1.15 | $49.95 (1-9) | 82 |

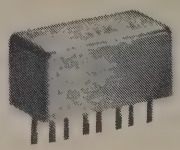
# Model Number vs Frequency Range

**STEP 2**
*SELECT MODEL NUMBER BY FREQUENCY RANGE*

**PROMPT SERVICE / ONE WEEK DELIVERY** **Mini-Circuits**

# Standard Level (+7 dBm LO)
# DOUBLE-BALANCED MIXERS

## SRA SERIES



| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| * SRA-1 | 0.5 MHz-500 MHz | 50 | $ 9.95 (1-49) |
| SRA-1W | 1 MHz-750 MHz | 50 | $12.95 (6-49) |
| SRA-1-1 | 0.1 MHz-500 MHz | 50 | $11.95 (6-49) |
| SRA-2 | 1 MHz-1000 MHz | 50 | $14.95 (5-24) |
| SRA-3 | 25 KHz-200 MHz | 50 | $12.95 (6-49) |
| SRA-4 | 5 MHz-1250 MHz | 50 | $16.95 (5-24) |
| SRA-5 | 5 MHz-1500 MHz | 50 | $24.95 (1-24) |
| SRA-6 | 3 KHz -100 MHz | 50 | $19.95 (5-24) |
| SRA-8 | 500 Hz -10 MHz | 50 | $24.95 (5-24) |
| SRA-11 | 5 MHz-2000 MHz | 50 | $29.95 (1-24) |
| SRA-12 | 800 MHz-1250 MHz | 50 | $29.95 (1-24) |
| NATIONAL STANDARD NUMBER | SRA-1 | NSN-6625-00-008-8272 | |

**DESCRIPTION** — Having a volume of only .128 cu. inches, the SRA series covers a very broad frequency range from 500 Hz to 2000 MHz. Offered at the lowest prices available in the industry, these rugged units provide low conversion loss, 6 dB, high isolation, 40 dB, and exceptional unit to unit matched performance.

Packaged within an RFI shielded metal enclosure and hermetically sealed header, these high performance units have their pins oriented on a 0.2 inch grid. Unit weight is .18 ounces (5.2 grams).

Only well matched hot carrier diodes and ruggedly constructed transmission line transformers are used. Internally, every component is bonded to the header and case with silicone rubber to provide super reliable protection against shock, vibration and acceleration.

## FEATURES

**Broadband:** 500 Hz to 2000 MHz
**Low Conversion Loss:** typically less than 6 dB
**High Isolation:** typically greater than 40 dB
**Miniature:** 0.128 in.$^3$, 0.4″ x 0.8″ PC area, 0.4″ high
**High Reliability:** 100% tested, 2 year guarantee SRA-1, 1 year guarantee all other models
**Low Cost:** as low as $9.95 in small quantity

## APPLICATIONS

- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Bi-phase modulation

## ABSOLUTE MAXIMUM RATINGS

- **Input Power:** 50 mW
- **Peak IF Input Current:** 40 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Pin Temperature:** (10 sec.) 510°F
- **Environmental Specifications:** See Index Page

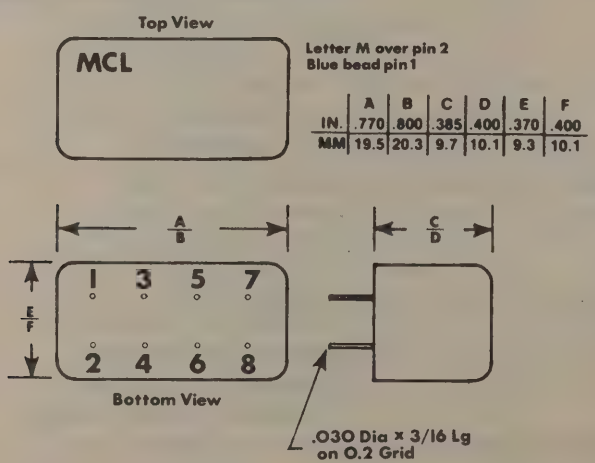
## * WHAT IS HTRB TESTING?

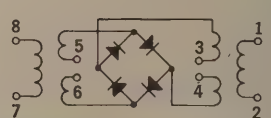
The model SRA-1 has become an industry standard through the world and is used by all branches of the Department of Defense, NASA, FAA, and every major communications company. In over 500 different military contracts, over a period of years, the SRA-1 has proven to be one of the most reliable mixers obtainable, even when considering high priced models.

Schottky-diodes selected for high-reliability mixer service are deliberately stressed to accelerate aging and thus force temperature related failure modes to take their toll. In the HTRB (High Temperature Reverse Bias) technique, the diode is operated at 168 hours at 150°C with 1-V reverse bias applied.

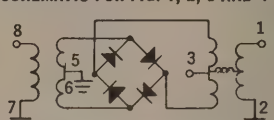
In conventional testing, or "baking", the diode does not experience anywhere near the stress encountered with the HTRB program. Thus, the HTRB process screens out potentially unreliable diodes before they are assembled into completed Hi-rel mixers.

## DIMENSIONS AND CONNECTIONS




SCHEMATIC FOR FIG. 1, 2, 3 AND 4




SCHEMATIC FOR FIG. 5

PIN LAYOUTS

| | Fig. 1 | Fig. 2 | Fig. 3 | Fig. 4 | Fig. 5 |
|---|---|---|---|---|---|
| Model No. | -1<br>-1-1<br>-3 | -2<br>-4 | -6<br>-8 | -1W | -5<br>-11<br>-12 |
| LO | 8 | 8 | 8 | 8 | 8 |
| RF | 1 | 3,4 | 1 | 1 | 1 |
| IF | 3,4 | 1 | 3,4 | 3,4 | 3 |
| Ground | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 |
| Case Ground | 2 | 2,5,6,7 | — | 2,5,6,7 | 2,5,6,7 |

NOTE: PINS 3 AND 4 MUST BE CONNECTED TOGETHER EXCEPT FOR FIG. 5 IN WHICH PIN 4 IS PRESENT, BUT UNUSED.

**WEIGHT** 5.2 grams .18 ounces

**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# SRA Series
# 500 Hz to 2000 MHz

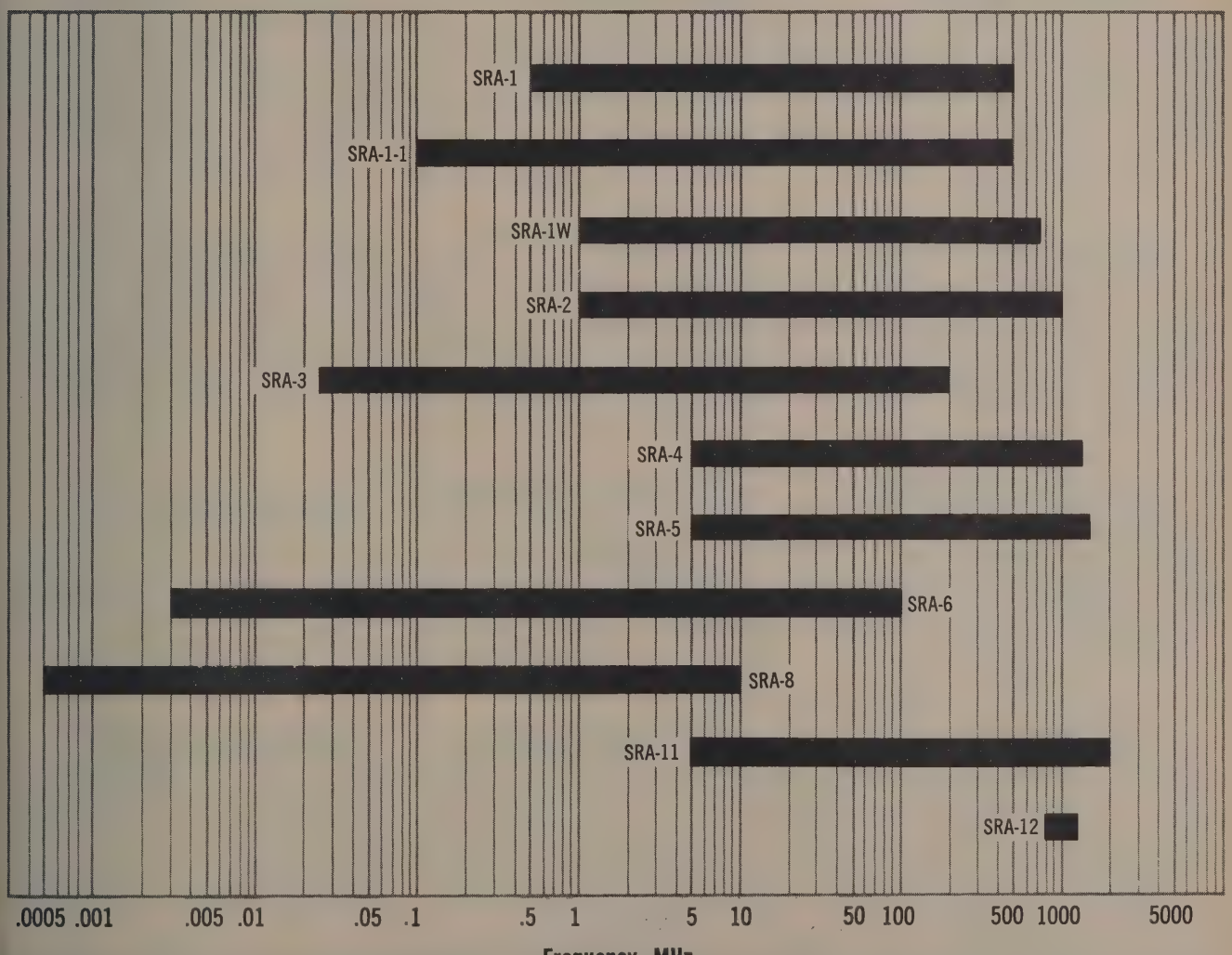
Mini-Circuits

## SPECIFICATIONS

| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Pin Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| SRA-1 | .5-500 | .5-500 | DC-500 | 5.5 | 7.0 | 6.5 | 8.5 | 50 | 45 | 45 | 35 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. 1 |
| SRA-1W | 1-750 | 1-750 | DC-750 | 5.5 | 7.5 | 6.5 | 8.5 | 50 | 45 | 45 | 30 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. 4 |
| SRA-1-1 | .1-500 | .1-500 | DC-500 | 5.5 | 7.5 | 6.5 | 8.5 | 50 | 45 | 45 | 30 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. 1 |
| SRA-2 | 1-1000 | 1-1000 | .5-500 | 5.5 | 7.5 | 6.5 | 8.5 | 45 | 30 | 45 | 30 | 35 | 20 | 35 | 20 | 30 | 20 | 30 | 20 | Fig. 2 |
| SRA-3 | .025-200 | .025-200 | DC-200 | 5.5 | 7.5 | 6.5 | 8.5 | 60 | 50 | 45 | 35 | 45 | 35 | 40 | 30 | 35 | 25 | 30 | 20 | Fig. 1 |
| SRA-4 | 5-1250 | 5-1250 | .5-500 | 5.5 | 7.5 | 6.5 | 8.5 | 50 | 40 | 50 | 40 | 40 | 20 | 40 | 20 | 30 | 20 | 30 | 20 | Fig. 2 |
| SRA-5 | 5-1500 | 5-1500 | 10-600 | 7.0 | 8.0 | 7.5 | 8.5 | 50 | 45 | 45 | 40 | 35 | 30 | 30 | 25 | 30 | 20 | 25 | 15 | Fig. 5 |
| SRA-6 | .003-100 | .003-100 | DC-100 | 5.5 | 7.5 | 6.5 | 8.5 | 60 | 50 | 60 | 45 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. 3 |
| SRA-8 | .0005-10 | .0005-10 | DC-10 | 6.5 | 7.5 | 7.0 | 8.5 | 60 | 50 | 60 | 50 | 50 | 40 | 50 | 40 | 45 | 35 | 45 | 35 | Fig. 3 |
| SRA-11 | 5-2000 | 5-2000 | 10-600 | 7.0 | 8.5 | 7.5 | 9.0 | 50 | 45 | 45 | 40 | 35 | 25 | 30 | 20 | 30 | 20 | 25 | 15 | Fig. 5 |
| SRA-12 | 800-1250 | 800-1250 | 50-90 | — | — | 6.0 | 7.5 | Over full range — LO-IF: 30 typ. 20 min./LO-RF: 35 typ. 25 min. | | | | | | | | | | | | Fig. 5 |

**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +1 dBm. Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -1, 3 dB Model -1W, 3.5 dB Model -1-1, 2.5 dB Model -3, 1.5 dB Model -6, 1 dB Model -8, 1 dB.

## FREQUENCY SELECTION GUIDE




PROMPT SERVICE / ONE WEEK DELIVERY Mini-Circuits

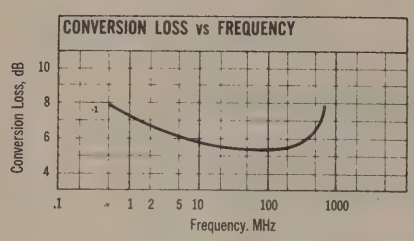
# Standard Level (+7 dBm LO) DOUBLE-BALANCED MIXERS

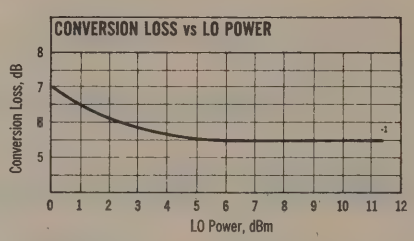
## SPECIFICATIONS

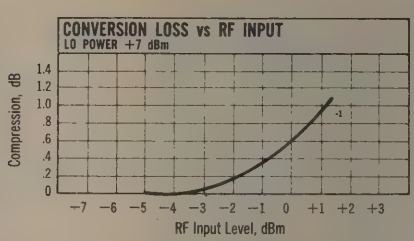
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Pin Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| SRA-1 | .5-500 | .5-500 | DC-500 | 5.5 | 7.0 | 6.5 | 8.5 | 50 | 45 | 45 | 35 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. 1 |

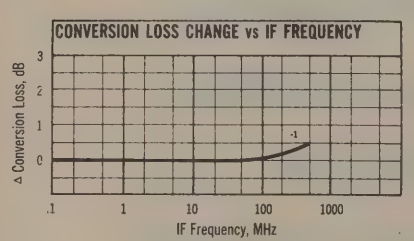
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +1 dBm. Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -1, 3 dB.

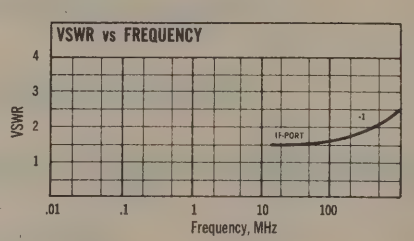
## MODEL SRA-1

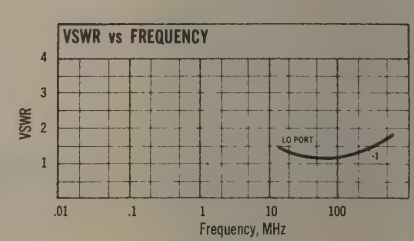


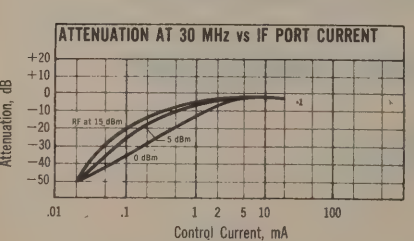



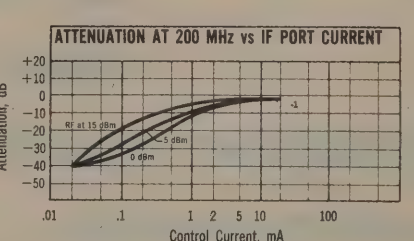



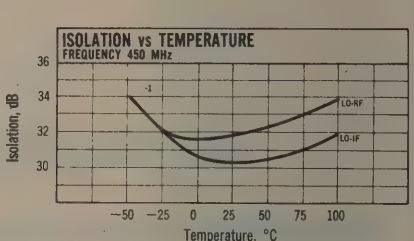



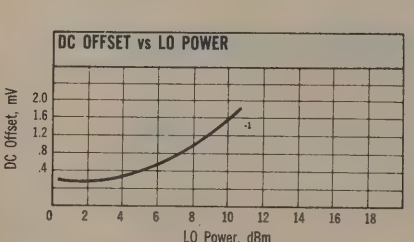



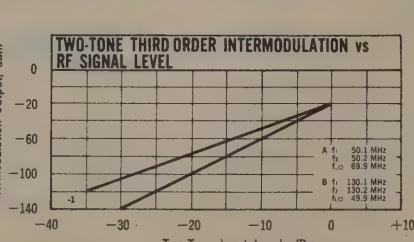



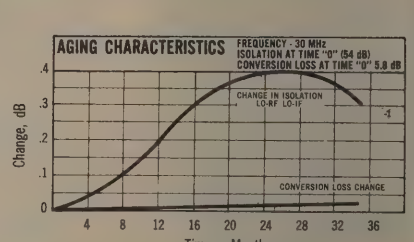



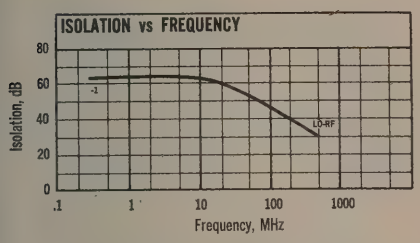


AGING CHARACTERISTICS
FREQUENCY - 30 MHz
ISOLATION AT TIME "0" (54 dB)
CONVERSION LOSS AT TIME "0" 5.8 dB
CHANGE IN ISOLATION LO-RF LO-IF
CONVERSION LOSS CHANGE
Change, dB
Time — Months

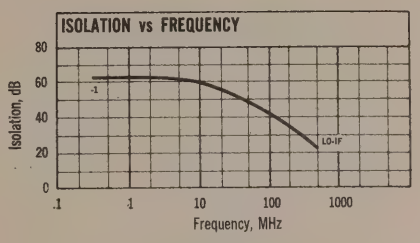
# SRA Series
# 500 Hz to 2000 MHz

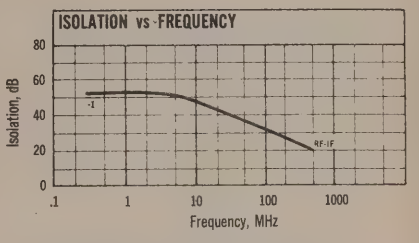
**Mini-Circuits**

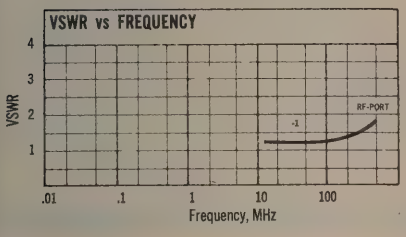
HTRB Tested
(High Temperature Reverse Bias)

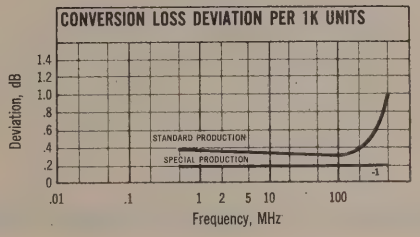
## MODEL SRA-1

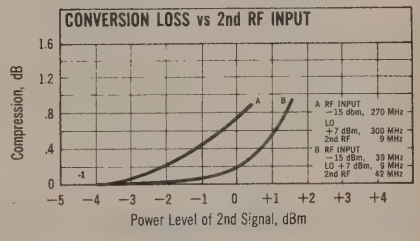


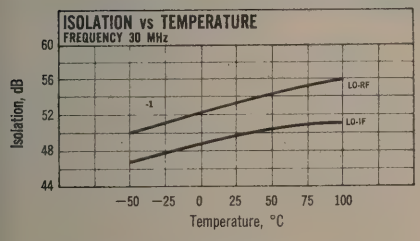



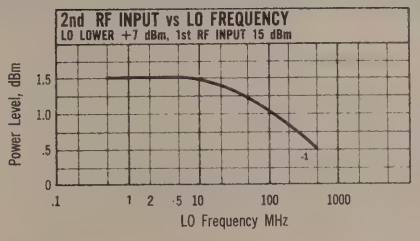



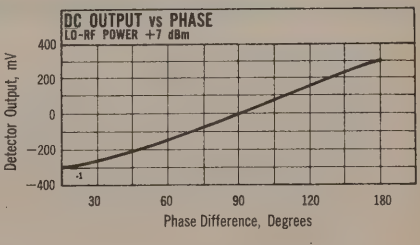



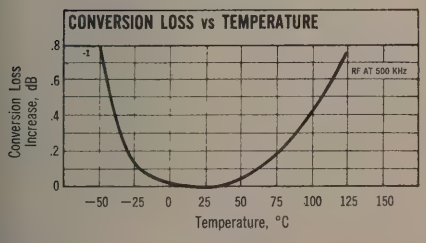



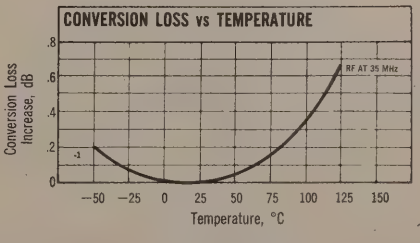



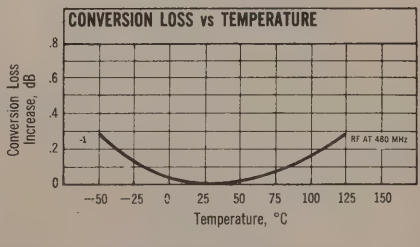



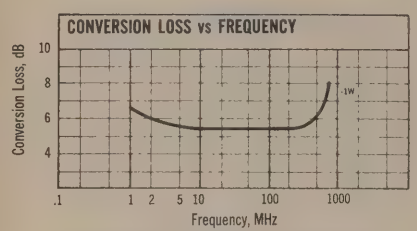
# Standard Level (+7 dBm LO)
# DOUBLE-BALANCED MIXERS

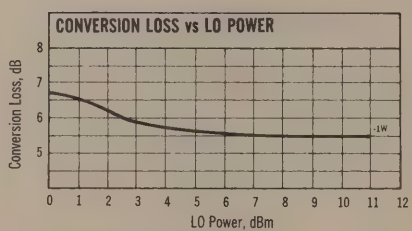
## SPECIFICATIONS

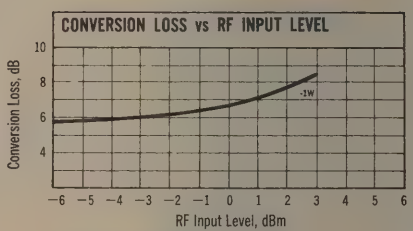
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Pin Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| SRA-1W | 1-750 | 1-750 | DC-750 | 5.5 | 7.5 | 6.5 | 8.5 | 50 | 45 | 45 | 30 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. 4 |
| SRA-1-1 | .1-500 | .1-500 | DC-500 | 5.5 | 7.5 | 6.5 | 8.5 | 50 | 45 | 45 | 30 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. 1 |
| SRA-2 | 1-1000 | 1-1000 | .5-500 | 5.5 | 7.5 | 6.5 | 8.5 | 45 | 30 | 45 | 30 | 35 | 20 | 35 | 20 | 30 | 20 | 30 | 20 | Fig. 2 |
| SRA-3 | .025-200 | .025-200 | DC-200 | 5.5 | 7.5 | 6.5 | 8.5 | 60 | 50 | 45 | 35 | 45 | 35 | 40 | 30 | 35 | 25 | 30 | 20 | Fig. 1 |
| SRA-4 | 5-1250 | 5-1250 | .5-500 | 5.5 | 7.5 | 6.5 | 8.5 | 50 | 40 | 50 | 40 | 40 | 20 | 40 | 20 | 30 | 20 | 30 | 20 | Fig. 2 |

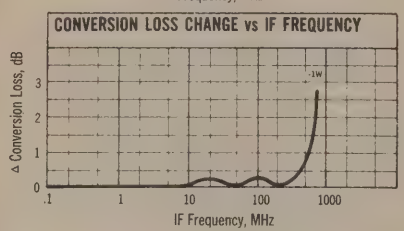
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +1 dBm. Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -1W, 3.5 dB Model -1-1, 2.5 dB Model -3, 1.5 dB.

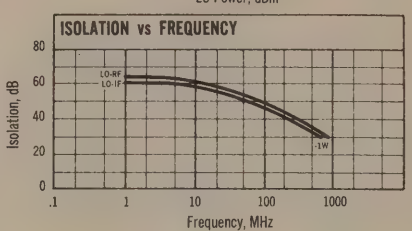
## MODEL SRA-1W

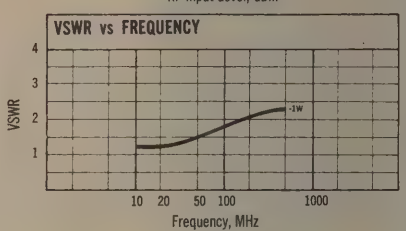


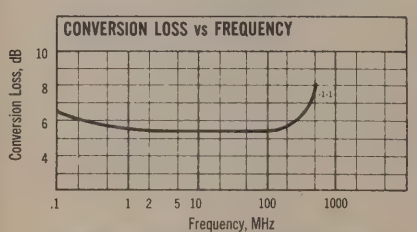



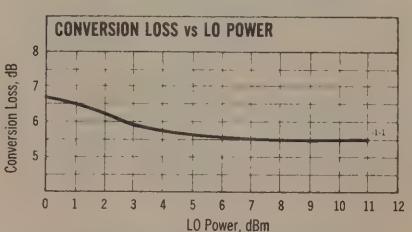



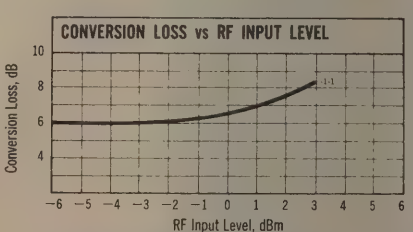



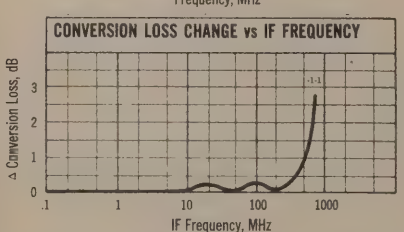



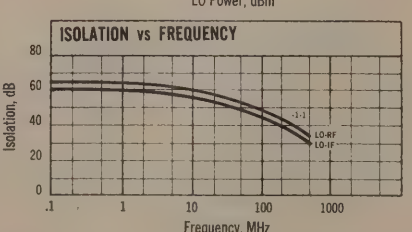

## MODEL SRA-1-1

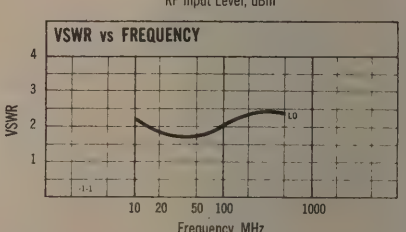


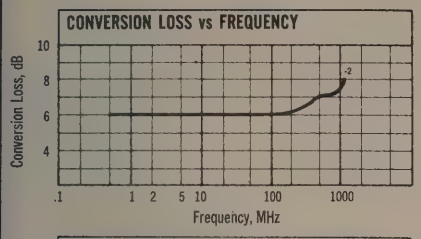



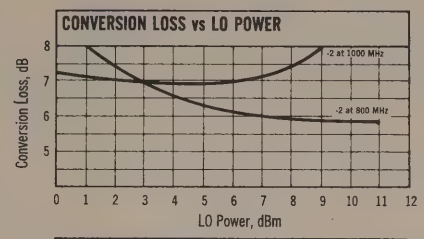

Mini-Circuits 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

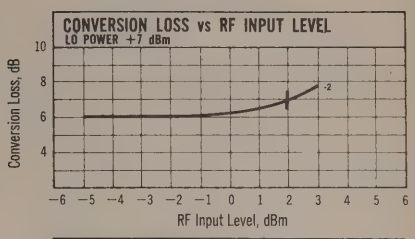
# SRA Series
# 500 Hz to 2000 MHz

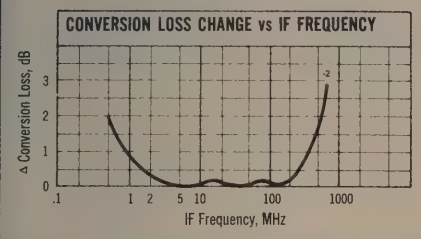
Mini-Circuits

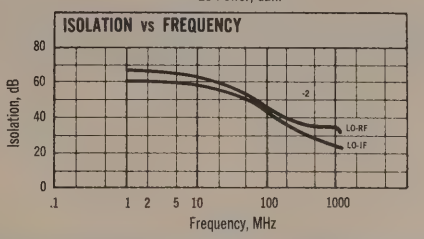
## MODEL SRA-2

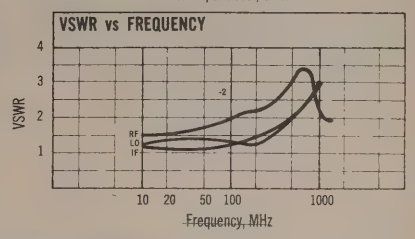


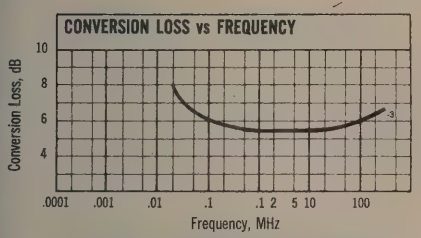



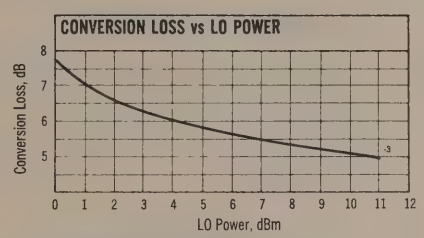



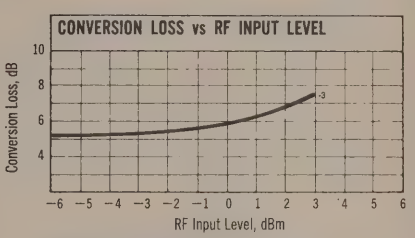



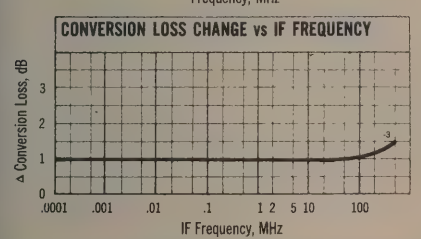



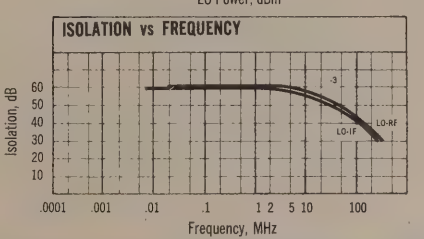

## MODEL SRA-3

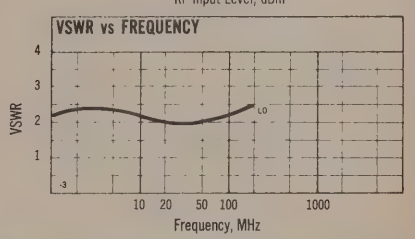


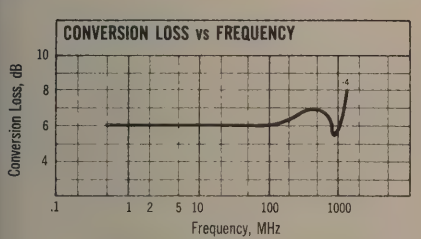



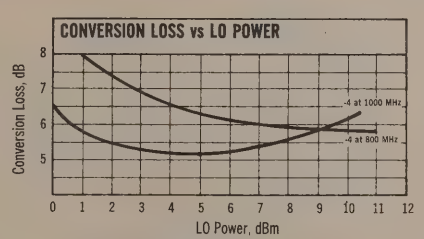



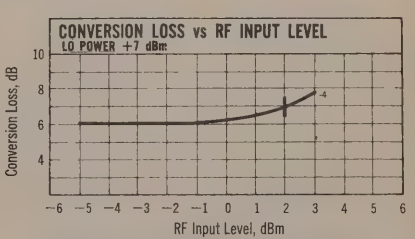



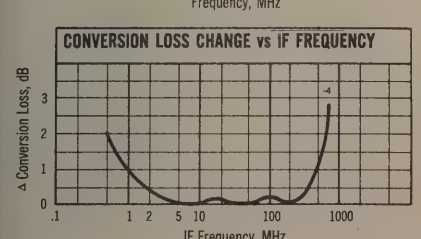



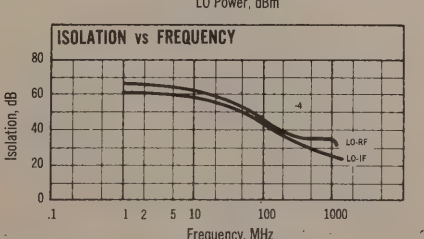

## MODEL SRA-4

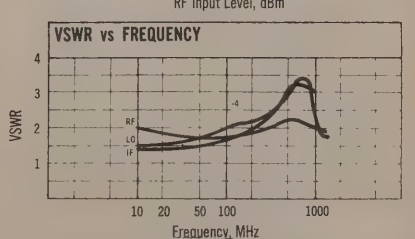


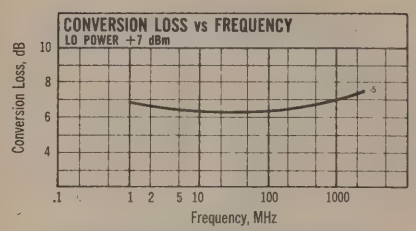
# Standard Level (+7 dBm LO) DOUBLE-BALANCED MIXERS

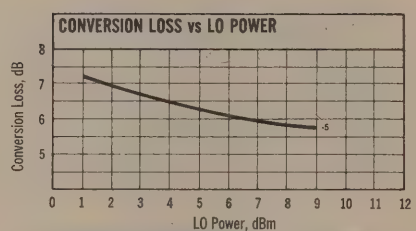
## SPECIFICATIONS

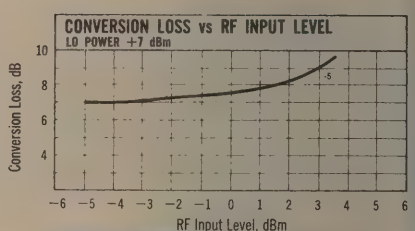
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Pin Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| SRA-5 | 5-1500 | 5-1500 | 10-600 | 7.0 | 8.0 | 7.5 | 8.5 | 50 | 45 | 45 | 40 | 35 | 30 | 30 | 25 | 30 | 20 | 25 | 15 | Fig. 5 |
| SRA-6 | .003-100 | .003-100 | DC-100 | 5.5 | 7.5 | 6.5 | 8.5 | 60 | 50 | 60 | 45 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. 3 |
| SRA-8 | .0005-10 | .0005-10 | DC-10 | 6.5 | 7.5 | 7.0 | 8.5 | 60 | 50 | 60 | 50 | 50 | 40 | 50 | 40 | 45 | 35 | 45 | 35 | Fig. 3 |
| SRA-11 | 5-2000 | 5-2000 | 10-600 | 7.0 | 8.5 | 7.5 | 9.0 | 50 | 45 | 45 | 40 | 35 | 25 | 30 | 20 | 30 | 20 | 25 | 15 | Fig. 5 |
| SRA-12 | 800-1250 | 800-1250 | 50-90 | — | — | 6.0 | 7.5 | Over full range — LO-IF: 30 typ. 20 min./LO-RF: 35 typ. 25 min. | | | | | | | | | | | | Fig. 5 |

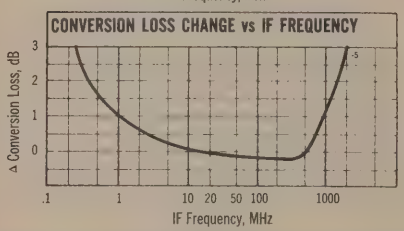
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +1 dBm. Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -6, 1 dB Model -8, 1 dB.

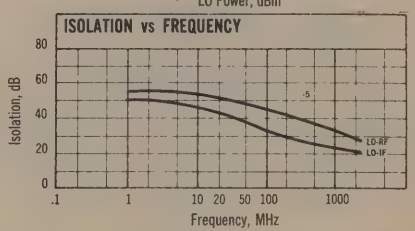
## MODEL SRA-5

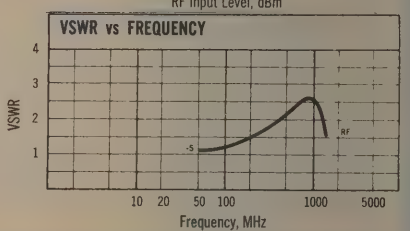


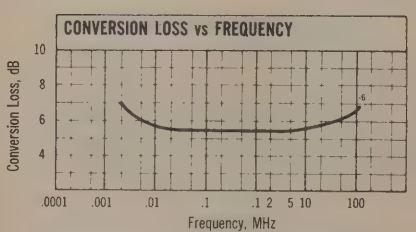



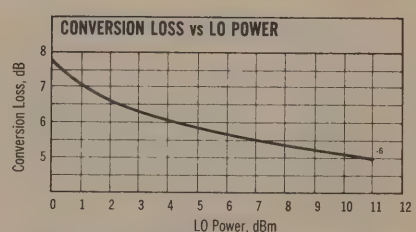



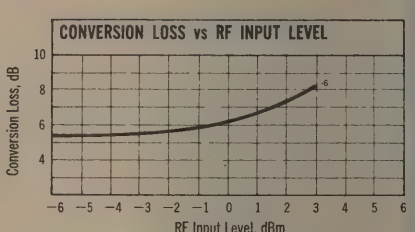



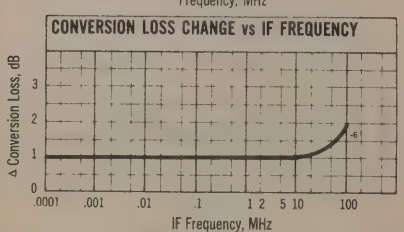



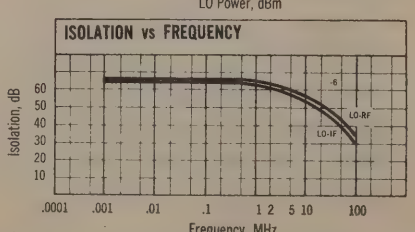

## MODEL SRA-6

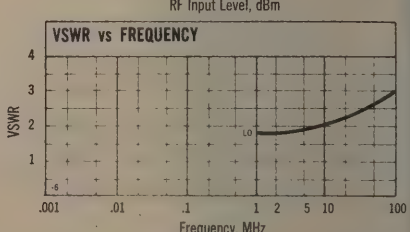


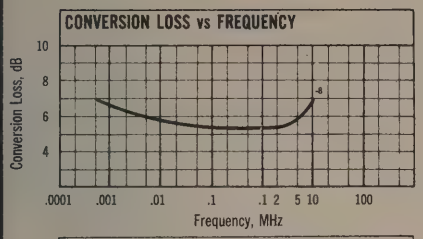



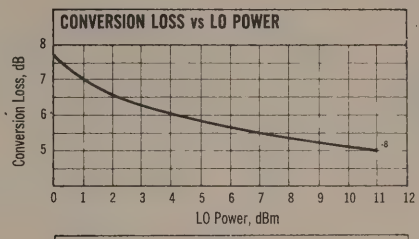



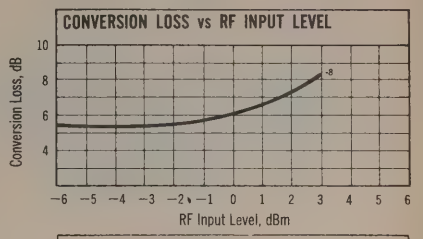
# SRA Series
# 500 Hz to 2000 MHz

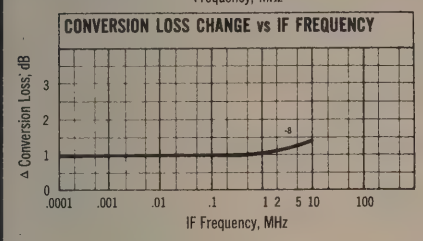
Mini-Circuits

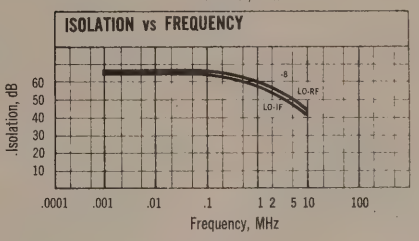
## MODEL SRA-8

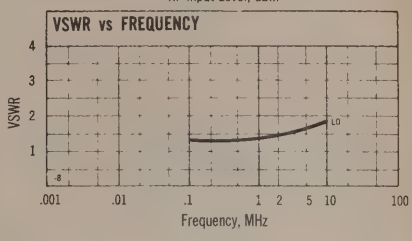


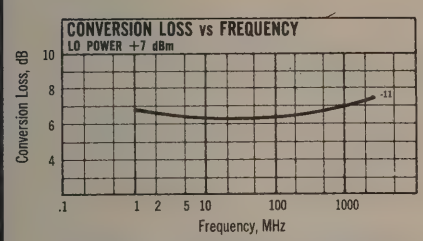



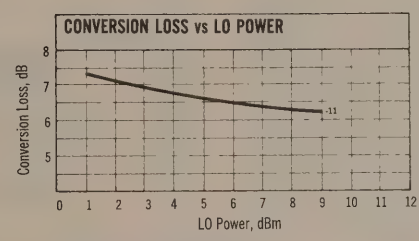



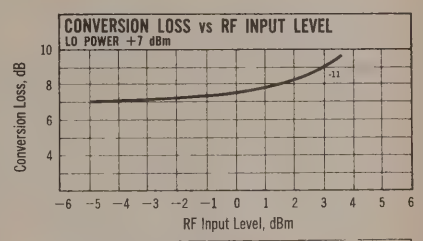



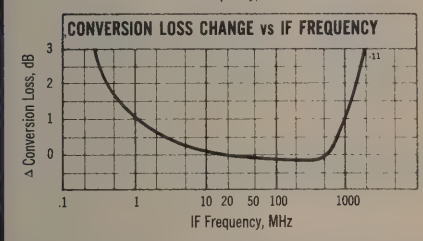



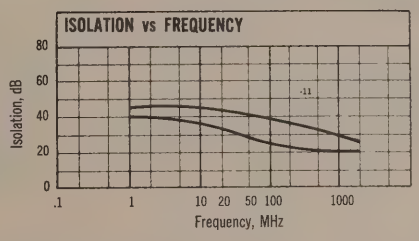

## MODEL SRA-11

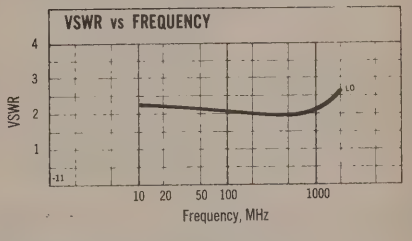


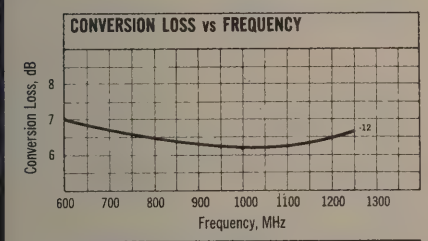



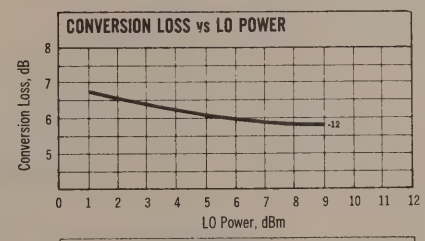



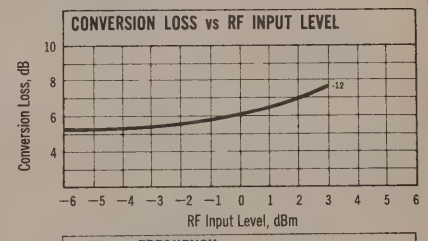



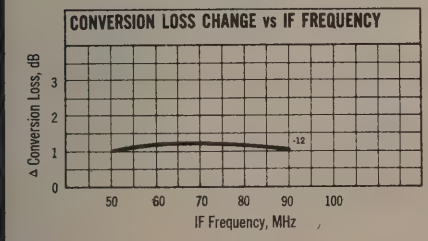



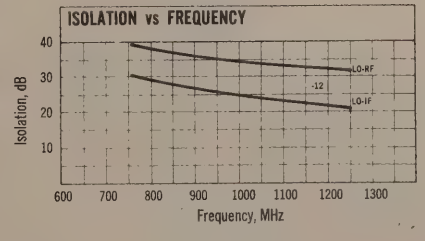

## MODEL SRA-12

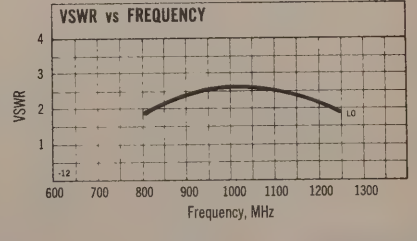


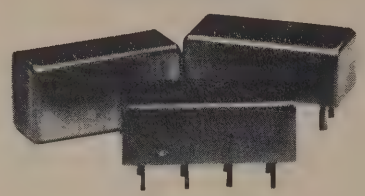




**PROMPT SERVICE / ONE WEEK DELIVERY** Mini-Circuits

# Standard Level (+7 dBm LO) DOUBLE-BALANCED MIXERS

## SBL SERIES



| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| SBL-1 | 1 MHz-500 MHz | 50 | $3.95 (10-49) |
| SBL-1X | 10 MHz-1000 MHz | 50 | $4.95 (10-49) |

### FEATURES

**Broadband:** 1 MHz to 1000 MHz
**Low Conversion Loss:** typically less than 6 dB
**High Isolation:** typically greater than 40 dB
**Miniature:** 0.096 in.$^3$, 0.4″ x 0.8″ PC area, 0.3″ high
**High Reliability:** 100% tested, 1 year guarantee
**Low Cost:** as low as $3.95 in small quantity

### APPLICATIONS

- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Bi-phase modulation

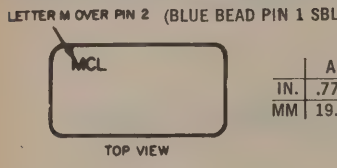
### ABSOLUTE MAXIMUM RATINGS

- **Input Power:** 50 mW
- **Peak IF Input Current:** 40 mA
- **Operating and Storage Temp.:** −20°C to +85°C
- **Pin Temperature:** (10 sec.) 510°F
- **Environmental Specifications:** See Index Page

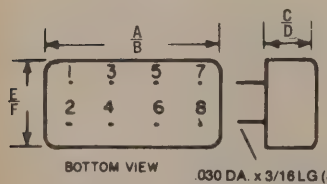
**DESCRIPTION** — For demanding industrial and commercial applications, where low-cost and high-performance are critical; Series SBL will fill your need. Don't let the low price mislead you. As the world's number one manufacturer of double-balanced mixers, Mini-Circuits' has accumulated extensive experience in high-volume production and testing, a key factor in achieving a successful low-cost/high-performance line of products. The tough SBL covers the broad frequency range of 1-1000 MHz with 6 dB conversion loss and isolation greater than 40 dB. Only well-matched hot-carrier diodes and ruggedly constructed transmission-line transformers are used. Internally, every component is bonded to the header for excellent protection against shock, vibration and acceleration. Weight is .18 oz. (5.2 grams).

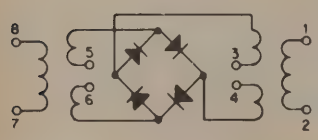
Here are some of the steps taken to ensure quality: Every SBL is RF tested two times, every solder connection is 100 per cent inspected under high power microscopes, all transformer leads are double-wrapped, and all components are rated for more than +85°C operation. Of course, our one-year guarantee applies to these units.

### DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| IN. | .770 | .800 | .305 | .285 | .370 | .400 |
| MM | 19.5 | 2.03 | 7.7 | 7.2 | 9.3 | 10.1 |




PIN LAYOUTS

| | Fig. 1 | Fig. 2 |
|---|---|---|
| Model No. | -1 | -1X |
| LO | 8 | 3,4 |
| RF | 1 | 1 |
| IF | 3,4 | 2,5,6,7 |
| Ground | 2,5,6,7 | 2,5,6,7 |

NOTE: PINS 3 AND 4 MUST BE CONNECTED TOGETHER

**WEIGHT** 5.2 grams .18 ounces


**NOW AVAILABLE!**
**the lowest priced unit in the world covering 10-1000 MHz**

**SBL-1X**

**at only**

**$4.95**

*Now you can be price competitive in a tough market situation*

ACT NOW *and purchase these super money-savers!*


**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# SBL Series
# 1 MHz to 1000 MHz

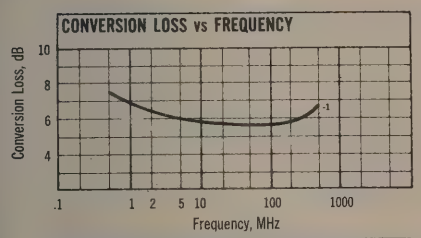
Mini-Circuits

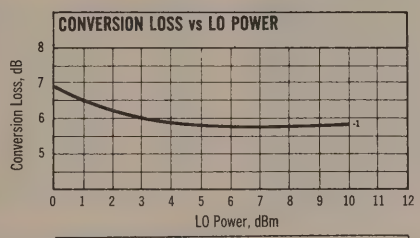
## SPECIFICATIONS

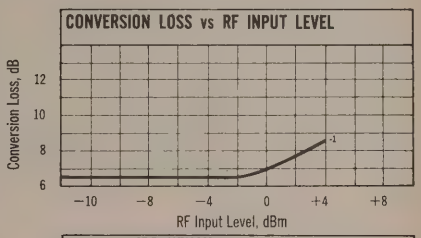
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Pin Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| SBL-1 | 1-500 | 1-500 | DC-500 | 5.5 | 7.5 | 6.5 | 8.5 | 50 | 35 | 45 | 30 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. 1 |
| SBL-1X | 10-1000 | 10-1000 | 5-500 | 6 | 7.5 | 7 | 9 | 50 | 35 | 45 | 30 | 40 | 25 | 35 | 20 | 30 | 20 | 25 | 20 | Fig. 2 |

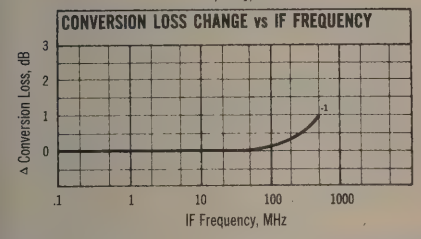
**COMMON SPECIFICATIONS:** DC offset, 1 mV typ. DC polarity, negative. Impedance (all ports), 50 ohms. Electronic attenuation, 3 dB.
**ELECTRONIC ATTENUATION:** Model -1, 3 dB

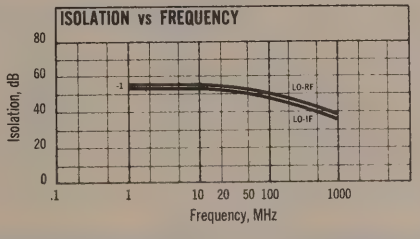
## MODEL SBL-1

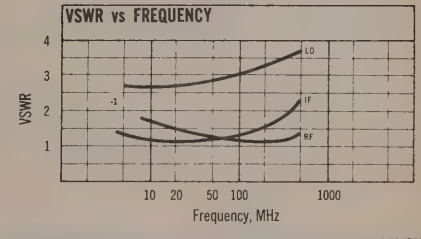


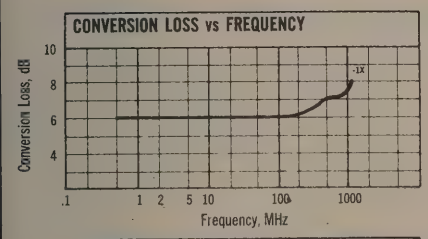



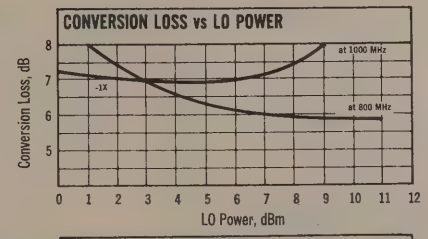



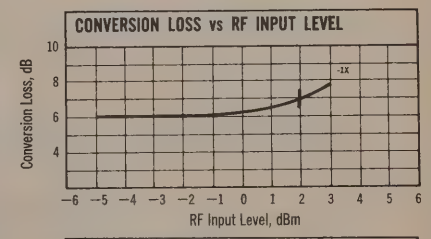



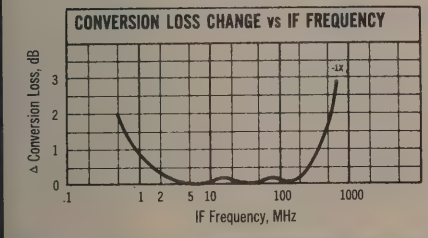



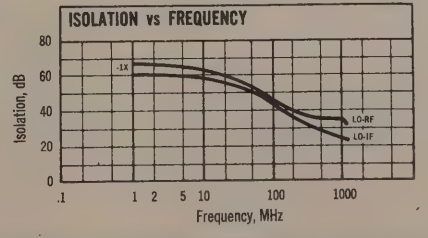

## MODEL SBL-1X

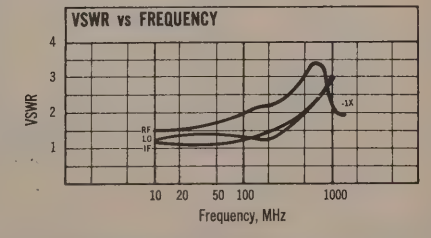


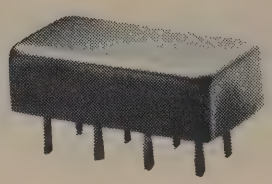



# Standard Level (+7 dBm LO) DOUBLE-BALANCED MIXERS

## TAK SERIES



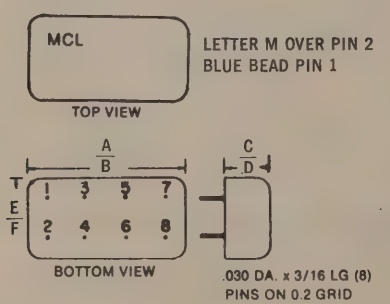
| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| TAK-5 | 10 KHz -250 MHz | 50 | $17.95 (1-4) |
| TAK-6 | 0.5 MHz-600 MHz | 50 | $17.95 (1-4) |
| TAK-7 | 2 MHz-1000 MHz | 50 | $19.95 (1-4) |
| TAK-9 | 5 MHz-1250 MHz | 50 | $21.95 (1-4) |

**DESCRIPTION** — Only 0.2 inches high, the low profile TAK series of double balanced mixers cover a very broad frequency range from 10 KHz to 1250 MHz. Exhibiting a flat conversion loss, these low profile units have a conversion loss typically 5.5 dB and isolation typically greater than 40 dB.

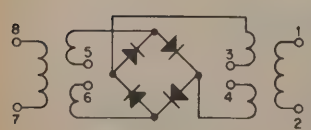
Packaged within an RFI shielded metal enclosure and hermetically sealed header, this low profile unit is only .064 cubic inches. The TAK series has its 8 pins located on a 0.2 inch grid. Unit weight is .13 ounces (3.7 grams).

Internal components include well matched hot-carrier diodes and extra wideband transmission line transformers supported with silicone rubber for vibration and shock requirements.

## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| IN. | .8 | .77 | .21 | .2 | .4 | .37 |
| MM | 20.3 | 19.5 | 5.3 | 5.0 | 10.1 | 9.3 |




**PIN LAYOUTS**

| | Fig. 1 | Fig. 2 |
|---|---|---|
| Model No. | -5<br>-6 | -7<br>-8 |
| LO | 8 | 8 |
| RF | 1 | 3,4 |
| IF | 3,4 | 1 |
| Ground | 2,5,6,7 | 2,5,6,7 |
| Case Ground | 2 | 2,5,6,7 |

**NOTE: PINS 3 AND 4 MUST BE CONNECTED TOGETHER**

**WEIGHT** 3.7 grams .13 ounces

### FEATURES

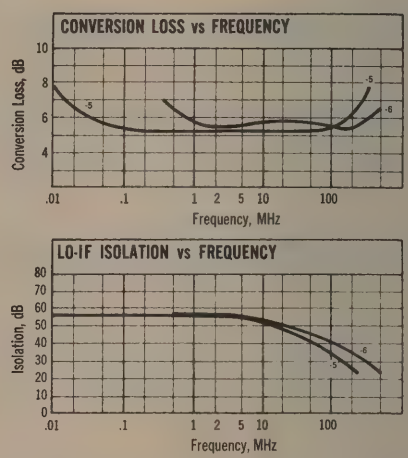
**Broadband:** 10 KHz to 1250 MHz
**Low Conversion Loss:** typically less than 5.5 dB
**High Isolation:** typically greater than 40 dB
**Low Profile:** 0.067 in.$^3$, 0.4″ x 0.8″ PC area, 0.2″ high
**High Reliability:** 100% tested, 1 year guarantee
**Low Cost:** as low as $17.95 in small quantity

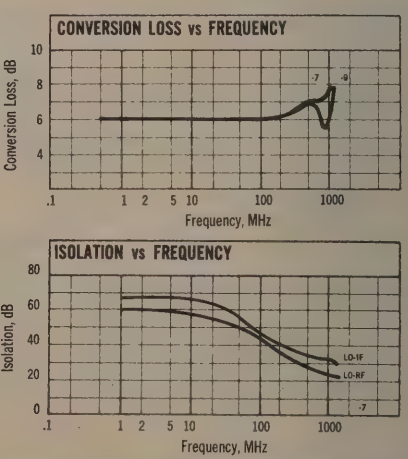
### APPLICATIONS

- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Bi-phase modulation

### ABSOLUTE MAXIMUM RATINGS

- **Input Power:** 50 mW
- **Peak IF Input Current:** 40 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Pin Temperature:** (10 sec.) 510°F
- **Environmental Specifications:** See Index Page



# TAK Series
# 10 KHz to 1250 MHz

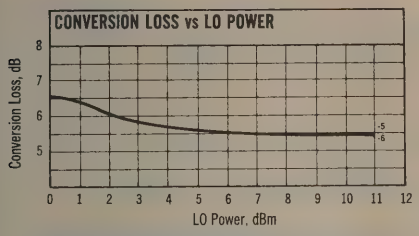
Mini-Circuits

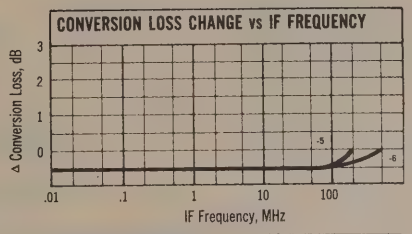
## SPECIFICATIONS

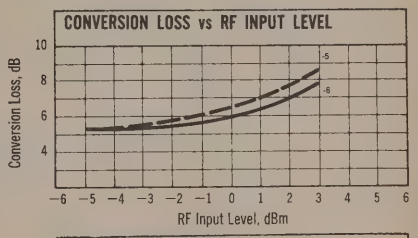
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Pin Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| TAK-5 | .01-250 | .01-250 | DC-250 | 5.5 | 7.0 | 6.5 | 8.5 | 60 | 50 | 55 | 45 | 50 | 35 | 45 | 30 | 40 | 30 | 35 | 25 | Fig. 1 |
| TAK-6 | .5-600 | .5-600 | DC-600 | 5.5 | 7.5 | 6.5 | 8.5 | 60 | 50 | 55 | 45 | 50 | 30 | 45 | 30 | 40 | 25 | 30 | 20 | Fig. 1 |
| TAK-7 | 2-1000 | 2-1000 | .5-500 | 5.5 | 7.5 | 6.5 | 8.5 | 45 | 30 | 45 | 30 | 35 | 20 | 35 | 20 | 30 | 20 | 30 | 20 | Fig. 2 |
| TAK-9 | 5-1250 | 5-1250 | .5-500 | 5.5 | 7.5 | 6.5 | 8.5 | 50 | 40 | 50 | 40 | 40 | 20 | 40 | 20 | 30 | 20 | 30 | 20 | Fig. 2 |

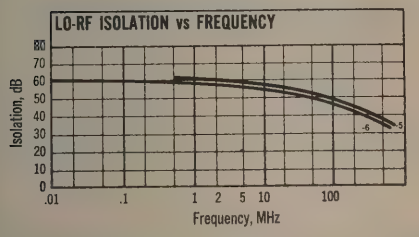
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +1 dBm. Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -5, 1.5 dB Model -6, 3.5 dB.

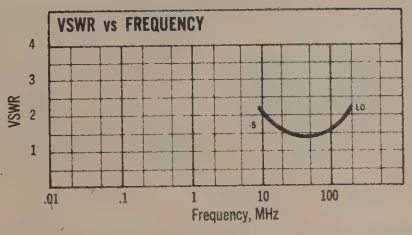
## MODELS TAK-5, TAK-6

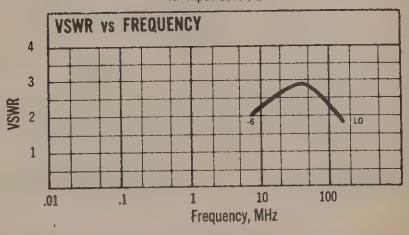


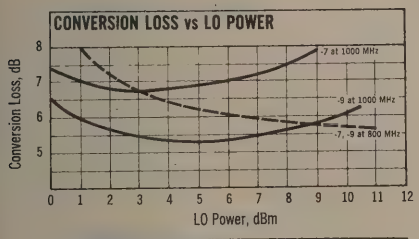



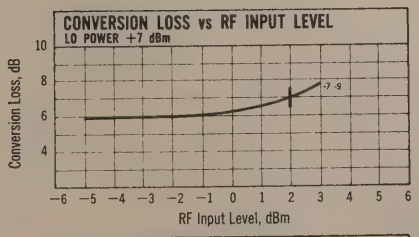



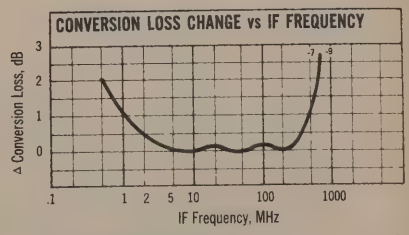



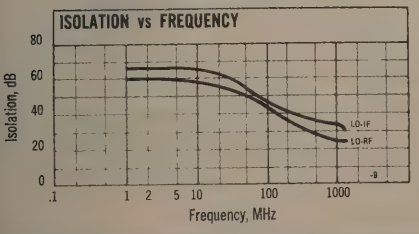



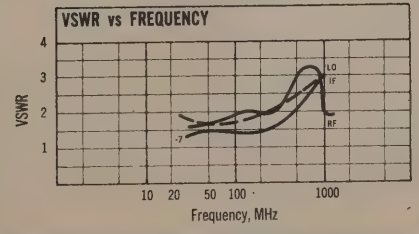

## MODELS TAK-7, TAK-9

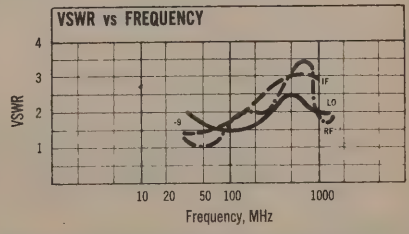


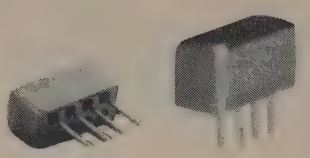



# Standard Level (+7 dBm LO) DOUBLE-BALANCED MIXERS

## TFM SERIES



| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| TFM-2 | 1 MHz-1000 MHz | 50 | $11.95 (6-49) |
| TFM-3 | 40 KHz -400 MHz | 50 | $19.95 (5-49) |
| TFM-4 | 5 MHz-1250 MHz | 50 | $19.95 (5-49) |
| TFM-11 | 1 MHz-2000 MHz | 50 | $39.95 (1-24) |
| TFM-12 | 800 MHz-1250 MHz | 50 | $39.95 (1-24) |
| TFM-15 | 10 MHz-3000 MHz | 50 | $49.95 (1-9) |

### FEATURES

**Broadband:** 40 KHz to 3000 MHz
**Low Conversion Loss:** typically less than 6 dB
**High Isolation:** typically greater than 45 dB
**Microminiature Flatpack:** 0.025 in.$^3$, 0.1″ x 0.1″ PC area, 0.25″ high
**High Reliability:** 100% tested, 1 year guarantee
**Low Cost:** as low as $11.95 in small quantity

### APPLICATIONS

- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Bi-phase modulation

### ABSOLUTE MAXIMUM RATINGS

- **Input Power:** 50 mW
- **Peak IF Input Current:** 40 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Pin Temperature:** (10 sec.) 510°F
- **Environmental Specifications:** See Index Page

**DESCRIPTION** — The TFM microminiature series offers a number of significant advantages over other available models: (1) versatility in mounting configuration, (2) simpler PC layout and wiring, (3) smaller size and (4) very low cost. The TFM series covers the 40 KHz-3000 MHz range and features wide bandwidth, isolation greater than 45 dB and conversion loss of 6 dB.

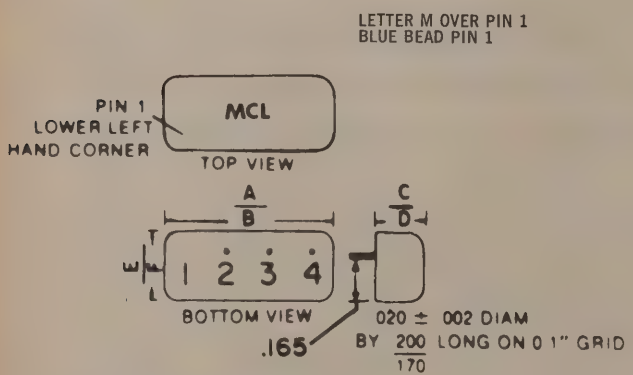
The TFM units require less PC area than a flatpack or TO-5 can. Unit weight is .07 ounces 1.8 grams. Use the TFM series to solve your tight space problems. Take advantage of the mounting versatility — plug it upright on a PC board or mount it sideways as a flatpack. Simplify PC layout and reduce board connections with the TFM series . . . **only four pins have to be wired.**

Packaged within an EMI shielded metal enclosure and hermetically sealed header (enclosure is 0.5 by 0.2 by 0.2 in.) the TFM series exhibits a typical noise figure of just ½ to 1 dB greater than its conversion loss. It's pins are oriented on a 0.1 inch grid for PC board mounting.

## TFM-15

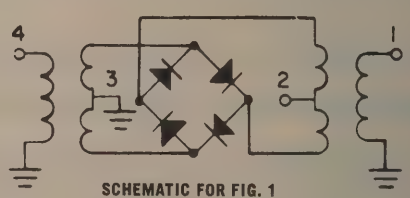
*New Super Mixer*
10-3000 MHz with
6.5 dB Conversion
Loss

### DIMENSIONS AND CONNECTIONS

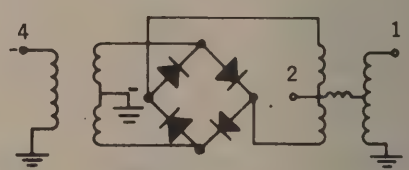



* Note TFM-11, -12, -15
C = 0.385″, D = 0.405″

| | A | B | C* | D* | E | F | G |
|---|---|---|---|---|---|---|---|
| IN. | .500 | .480 | .255 | .240 | .230 | .210 | .165 |
| MM | 12.7 | 12.2 | 6.4 | 6 | 5.8 | 5.3 | 4.1 |




SCHEMATIC FOR FIG. 1




SCHEMATIC FOR FIG. 2

PIN LAYOUT

| | Fig. 1 | Fig. 2 |
|---|---|---|
| Model No. | -2<br>-3<br>-4 | -11<br>-12<br>-15 |
| LO | 4 | 4 |
| RF | 1 | 1 |
| IF | 2 | 2 |
| Case Ground | 3 | 3 |

**WEIGHT** 1.8 grams .07 ounces

**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# TFM Series
# 40 KHz to 3000 MHz

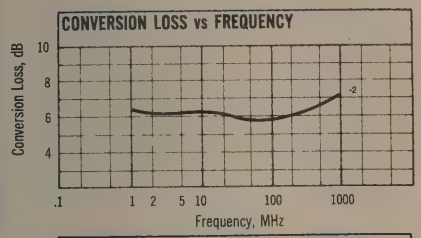
Mini-Circuits

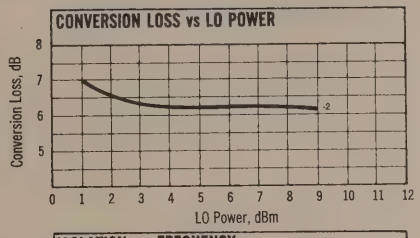
## SPECIFICATIONS

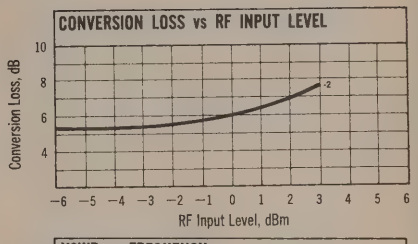
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Pin Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| TFM-2 | 1-1000 | 1-1000 | DC-1000 | 6.0 | 7.5 | 7.0 | 8.5 | 50 | 45 | 45 | 40 | 40 | 25 | 35 | 25 | 30 | 25 | 25 | 20 | Fig. 1 |
| TFM-3 | .04-400 | .04-400 | DC-400 | 5.3 | 7.0 | 6.0 | 8.0 | 60 | 50 | 55 | 40 | 50 | 35 | 45 | 30 | 35 | 25 | 35 | 25 | Fig. 1 |

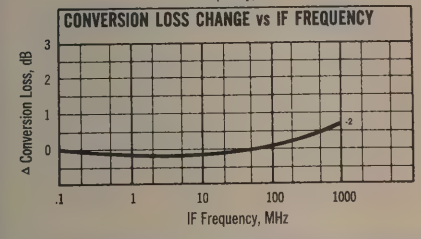
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +1 dBm. Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -2, 3.5 dB Model -3, 3.5 dB

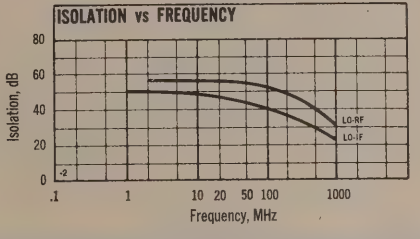
## MODEL TFM-2

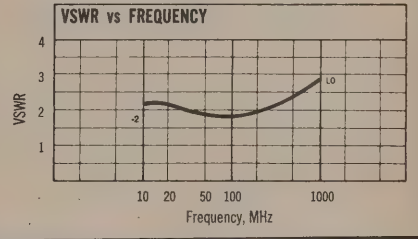


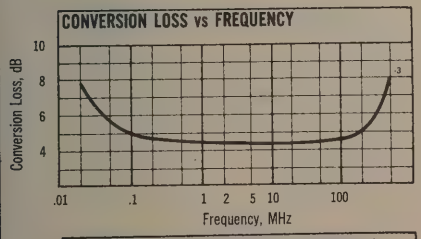



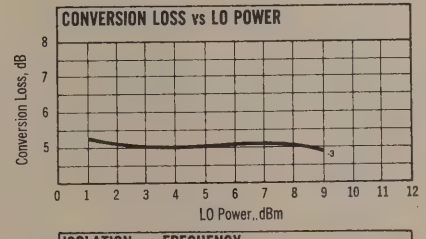



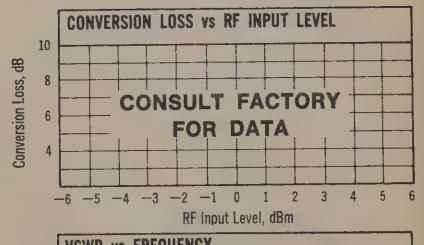



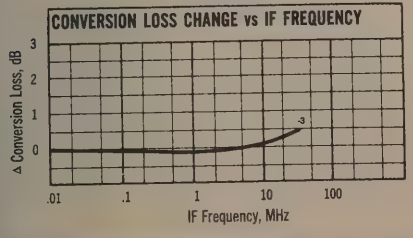



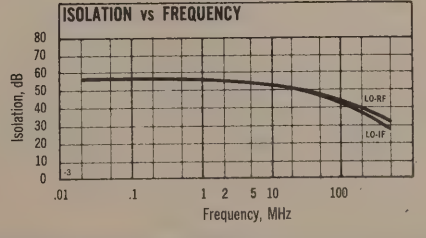

## MODEL TFM-3

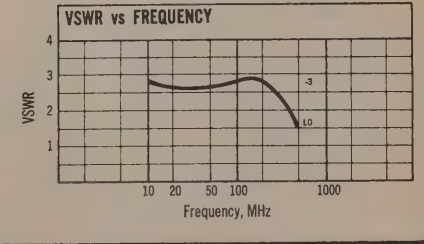



PROMPT SERVICE / ONE WEEK DELIVERY Mini-Circuits

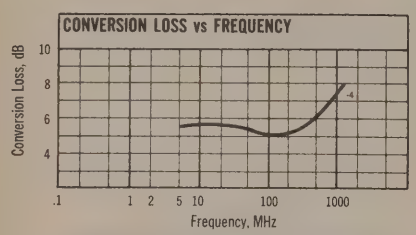
# Standard Level (+7 dBm LO)
# DOUBLE-BALANCED MIXERS

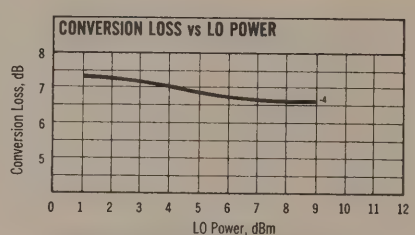
## SPECIFICATIONS

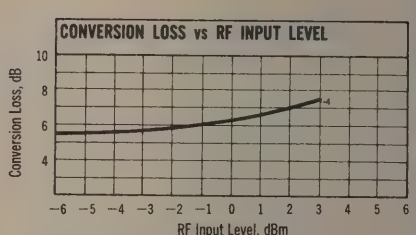
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Pin Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| TFM-4 | 5-1250 | 5-1250 | DC-1250 | 60 | 7.5 | 7.5 | 8.5 | 50 | 45 | 45 | 40 | 40 | 30 | 35 | 25 | 30 | 25 | 25 | 20 | Fig. 1 |
| TFM-11 | 1-2000 | 1-2000 | 5-600 | 7.0 | 8.5 | 7.5 | 9.0 | 50 | 45 | 45 | 40 | 35 | 25 | 27 | 20 | 25 | 20 | 25 | 20 | Fig. 2 |
| TFM-12 | 800-1250 | 800-1250 | 50-90 | — | — | 6.0 | 7.5 | Over Full Range LO-RF: 35 typ., 25 min. LO-IF: 30 typ., 20 min. | | | | | | | | | | | | Fig. 2 |
| TFM-15 | 10-3000 +10 dBm | 10-3000 | 10-800 | 6.3 | 7.5 | 6.5 | 8.5 | Over Full Range LO-RF: 30 typ., 25 min. LO-IF: 30 typ., 20 min. | | | | | | | | | | | | Fig. 2 |

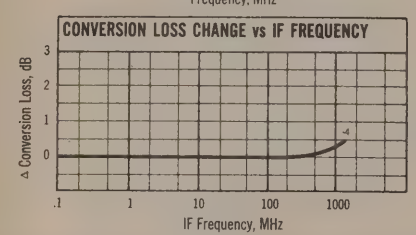
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +1 dBm. Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -4, 2.5 dB

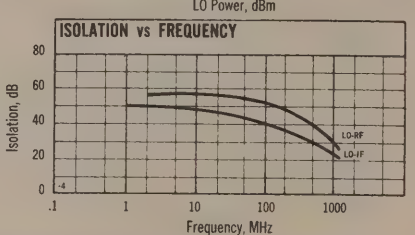
## MODEL TFM-4

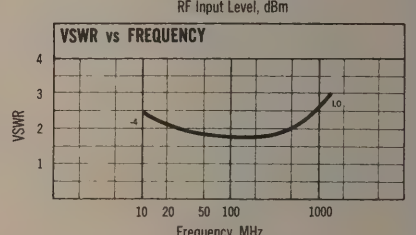


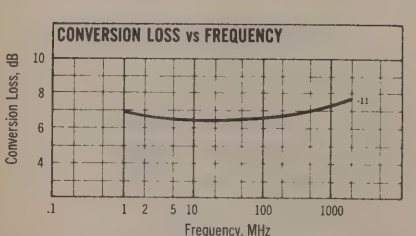



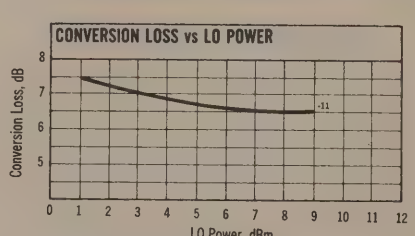



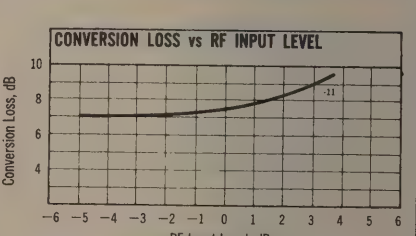



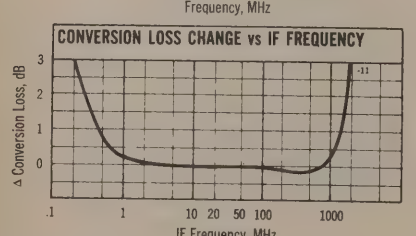



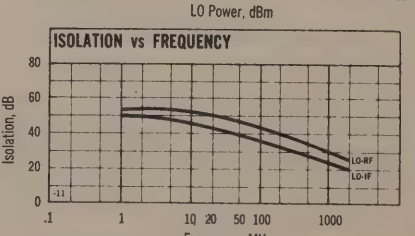

## MODEL TFM-11

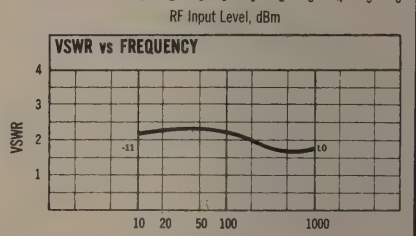


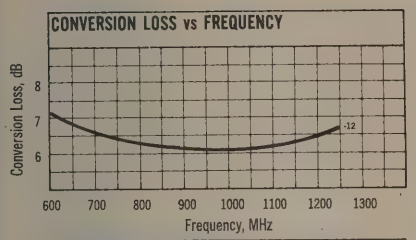



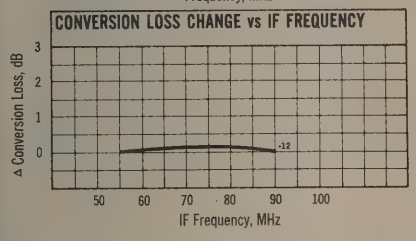

**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

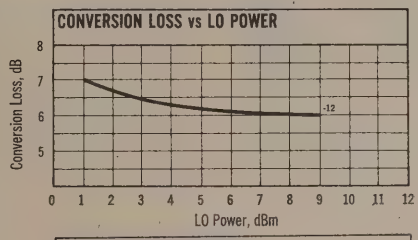
# TFM Series
# 40 KHz to 3000 MHz

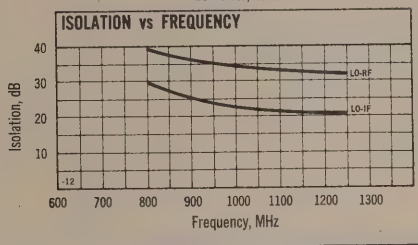
Mini-Circuits

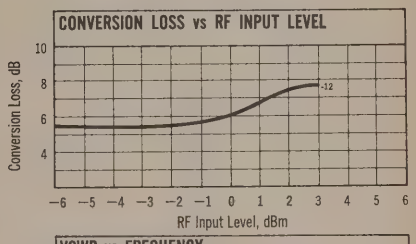
## MODEL TFM-12

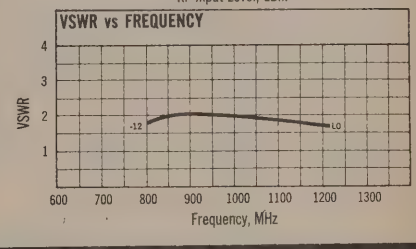


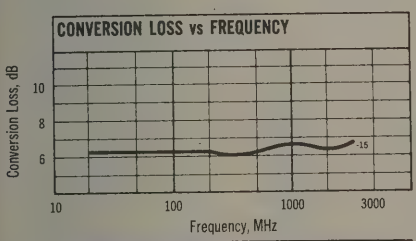



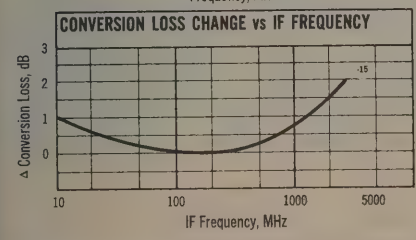



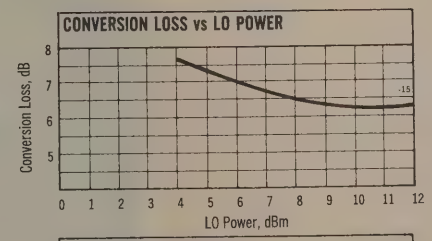



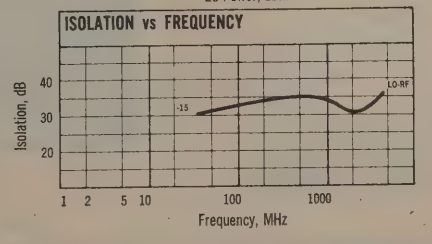



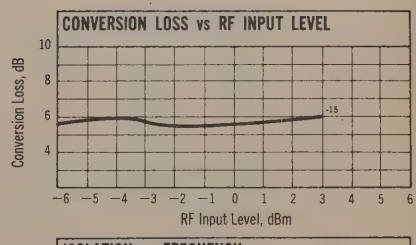

## MODEL TFM-15

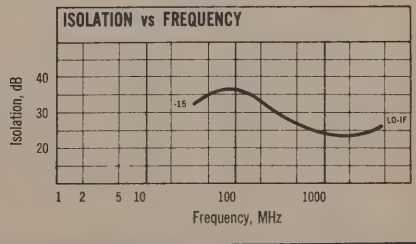


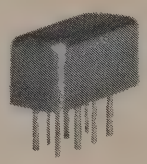



# Standard Level (+7 dBm LO) DOUBLE-BALANCED MIXERS

## TSM SERIES



| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| TSM-1 | 1 MHz-500 MHz | 50 | $16.95 (5-24) |
| TSM-3 | 0.1 MHz-400 MHz | 50 | $18.95 (5-24) |

**DESCRIPTION** —Representing a performance and price breakthrough in microminiature low profile double balanced mixers, the TSM series covers the frequency range 100 KHz to 500 MHz.

Although smaller than mixers presently available, the TSM series offers extra wide bandwidth, low conversion loss, and high isolation. These tiny units have isolation of greater than 55 dB and conversion loss of 5.5 dB. The TSM units require less PC area than a flat-pack or TO-5 can. Unit weight is .07 ounces (1.8 grams).

Packaged within an EMI shielded metal enclosure and hermetically sealed header (enclosure is 0.5 by 0.2 by 0.25 in.) The TSM series exhibits a typical noise figure of just ½ to 1 dB greater than its conversion loss. Its pins are oriented on a 0.1 inch grid for printed circuit board mounting.

Only well matched hot-carrier diodes and rugged transmission line transformers are used. Internally, silicone rubber is incorporated as an insulator against any wire shorts and to provide protection against shock and vibration.

### FEATURES

**Broadband:** .1 MHz to 500 MHz
**Low Conversion Loss:** typically less than 5.5 dB
**High Isolation:** typically greater than 55 dB
**Microminiature:** 0.025 in.$^3$, 0.5″ x 0.23″ PC area, 0.25″ high
**High Reliability:** 100% tested, 1 year guarantee
**Low Cost:** as low as $16.95 in small quantity

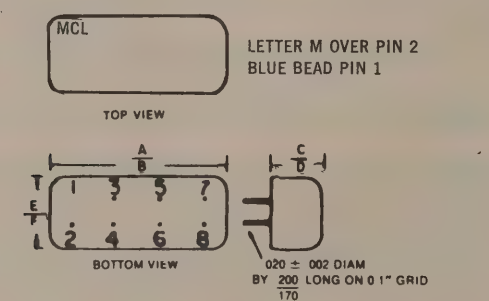
### APPLICATIONS

- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Bi-phase modulation

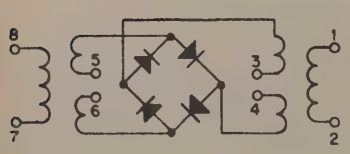
### ABSOLUTE MAXIMUM RATINGS

- **Input Power:** 50 mW
- **Peak IF Input Current:** 40 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Pin Temperature:** (10 sec.) 510°F
- **Environmental Specifications:** See Index Page

### DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| IN. | .500 | .480 | .255 | .240 | .230 | .210 |
| MM | 12.7 | 12.2 | 6.4 | 6 | 5.8 | 5.3 |




**PIN LAYOUTS**

| | Fig. 1 |
|---|---|
| Model No. | -1<br>-3 |
| LO | 8 |
| RF | 1 |
| IF | 3,4 |
| Ground | 2,5,6,7 |
| Case Ground | 2 |

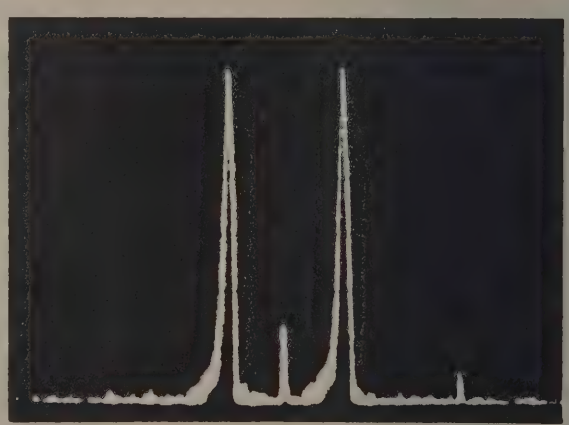
NOTE: PINS 3 AND 4 MUST BE CONNECTED TOGETHER

**WEIGHT** 1.8 grams .07 ounces

## BALANCED MODULATOR

For double-sideband, suppressed-carrier applications, the balanced mixer is used with the carrier, signal $f_c$, applied to the R port and the modulating signal, $f_m$, applied to the IF port. In this balanced modulator configuration, the output signal composed of the $f_m$ signal centered on the suppressed carrier $f_c$, is taken from the L.O. port.

The high isolation of Mini-Circuits mixers enable higher, 40 dB, suppression of the carrier while the undesired higher-order sidebands are almost totally removed.



Vertical: 10 dB/Div. Horizontal: 1 MHz/Div.

Mini-Circuits 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# TSM Series
# .1 MHz to 500 MHz

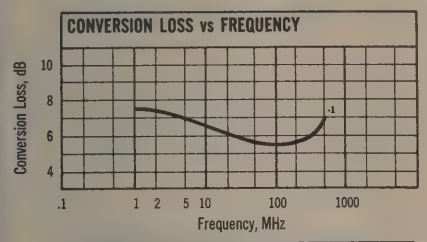
Mini-Circuits

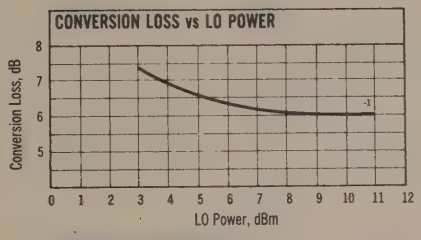
## SPECIFICATIONS

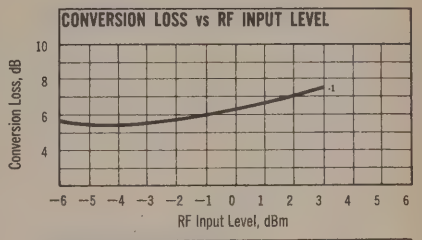
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Pin Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| TSM-1 | 1-500 | 1-500 | DC-500 | 6.0 | 7.5 | 6.5 | 8.5 | 60 | 45 | 55 | 45 | 45 | 35 | 40 | 30 | 35 | 25 | 35 | 25 | Fig. 1 |
| TSM-3 | .1-400 | .1-400 | DC-400 | 5.3 | 7.5 | 6.5 | 8.5 | 60 | 50 | 55 | 45 | 50 | 35 | 45 | 30 | 35 | 25 | 35 | 25 | Fig. 1 |

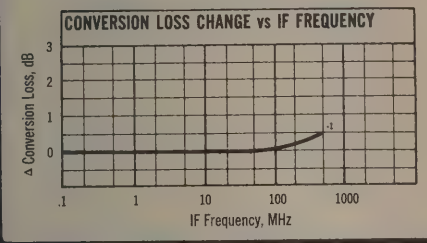
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +1 dBm. Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -1, 3.5 dB Model -3, 2.5 dB.

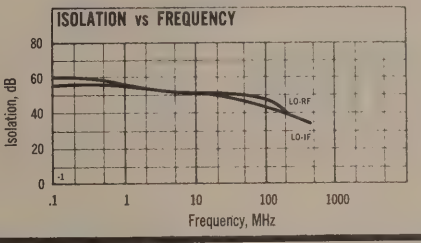
## MODEL TSM-1

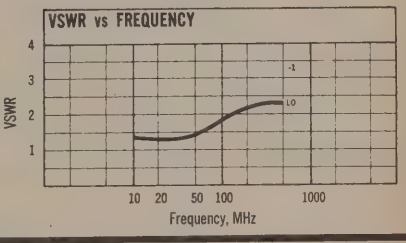


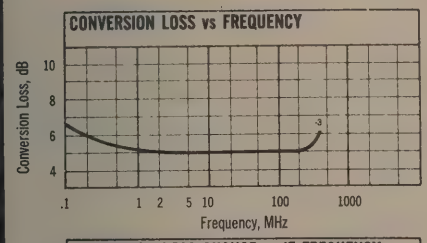



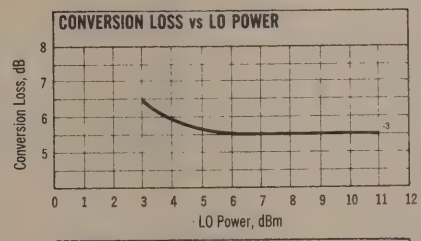



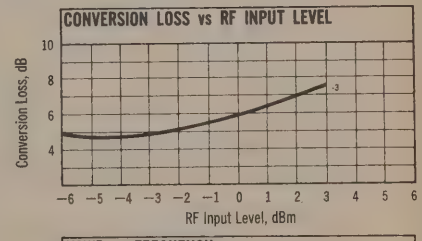



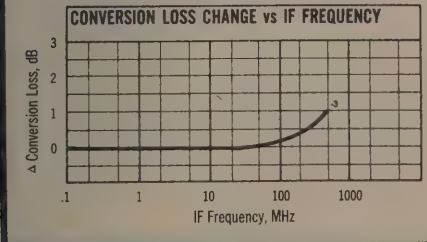



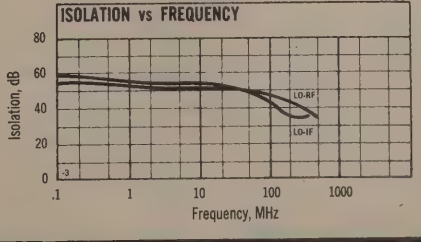

## MODEL TSM-3

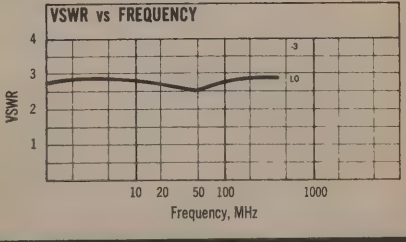


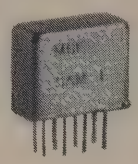



# Standard Level (+7 dBm LO) DOUBLE-BALANCED MIXERS

## SAM SERIES



| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| SAM-1 | 1 MHz-600 MHz | 50 | $13.95 (6-24) |
| SAM-2 | 1 MHz-1000 MHz | 50 | $17.95 (1-24) |
| SAM-3 | 0.1 MHz-500 MHz | 50 | $15.95 (5-24) |
| SAM-4 | 5 MHz-1250 MHz | 50 | $19.95 (1-9) |
| SAM-5 | 5 MHz-1500 MHz | 50 | $24.95 (1-9) |

### FEATURES

**Broadband:** .1 MHz to 1500 MHz
**Low Conversion Loss:** typically less than 5.5 dB
**High Isolation:** typically greater than 55 dB
**Microminiature:** 0.04 in.$^3$, 0.5″ x 0.23″ PC area, 0.4″ high
**High Reliability:** 100% tested, 1 year guarantee
**Low Cost:** as low as $13.95 in small quantity

### APPLICATIONS

- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Bi-phase modulation

### ABSOLUTE MAXIMUM RATINGS

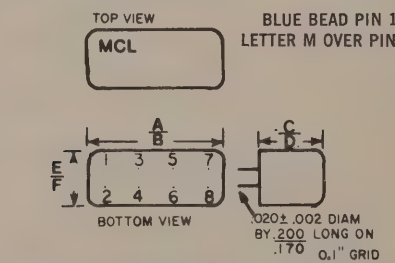
- **Input Power:** 50 mW
- **Peak IF Input Current:** 40 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Pin Temperature:** (10 sec.) 510°F
- **Environmental Specifications:** See Index Page

**DESCRIPTION** —Representing a performance and price breakthrough in microminiature double balanced mixers, the SAM series covers the frequency range 100 KHz to 1500 MHz. Although smaller than mixers presently available, the SAM series offers extra wide bandwidth, low conversion loss, and high isolation. These tiny units have isolation of greater than 55 dB and conversion loss of 5.5 dB. The SAM units require less PC area than a flat-pack on TO-5 can. Unit weight is .07 ounces (1.9 grams).

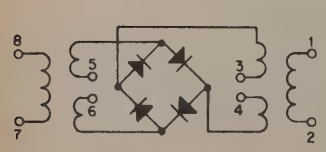
Packaged within an EMI shielded metal enclosure and hermetically sealed header (enclosure is 0.5 by 0.2 by 0.4 in.) the SAM series exhibits a typical noise figure of just ½ to 1 dB greater than its conversion loss. Its pins are oriented on a 0.1 inch grid for printed circuit board mounting.

Only well matched hot-carrier diodes and rugged transmission line transformers are used. Internally, silicone rubber is incorporated as an insulator agaist any wire shorts and to provide protection against shock and vibration.

### DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| IN. | .500 | .480 | .405 | .390 | .230 | .210 |
| MM | 12.7 | 12.2 | 10.3 | 9.9 | 5.8 | 5.3 |




**PIN LAYOUTS**

| | Fig. A | Fig. B |
|---|---|---|
| Model No. | -1<br>-2<br>-3 | -4<br>-5 |
| LO | 8 | 8 |
| RF | 1 | 3,4 |
| IF | 3,4 | 1 |
| Ground | 2,5,6,7 | 2,5,6,7 |
| Case Ground | 2 | 2,5,6,7 |

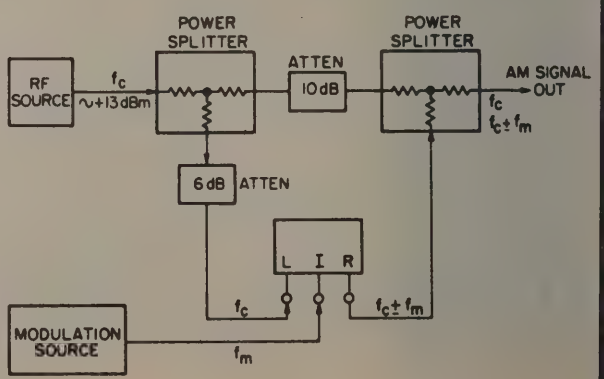
NOTE: PINS 3 AND 4 MUST BE CONNECTED TOGETHER

**WEIGHT** 1.9 grams .07 ounces

## Pulse and Amplitude Modulation

For amplitude modulator applications, the carrier, $f_c$, is applied to the R input while the modulating signal, $f_m$, is routed to the I.F. port. A dc current is also fed to the I.F. port and its setting determines the quiescent point on the amplitude vs control current curve. The modulated output is taken from the L.O. port.

Another approach involves the use of a balanced modulator arrangement with the carrier reinserted at the mixer output, as shown. Improved control of modulation index as well as lower distortion is offered by this technique versus the variable bias approach.



# SAM Series
# .1 MHz to 1500 MHz

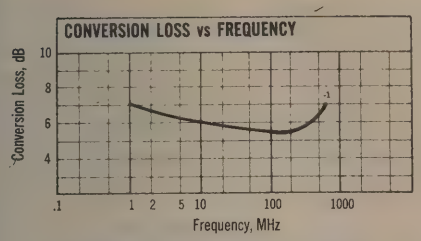
Mini-Circuits

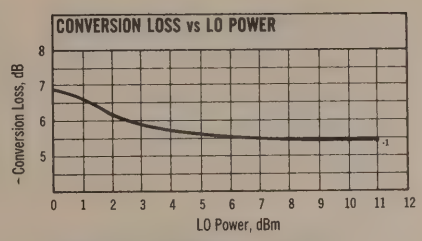
## SPECIFICATIONS

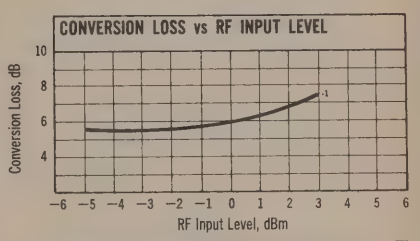
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Pin Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| SAM-1 | 1-600 | 1-600 | DC-600 | 5.5 | 7.0 | 6.5 | 8.5 | 55 | 45 | 50 | 40 | 45 | 30 | 40 | 25 | 35 | 20 | 30 | 20 | Fig. 1 |
| SAM-2 | 1-1000 | 1-1000 | DC-1000 | 6.0 | 7.5 | 7.0 | 9.5 | 55 | 45 | 50 | 40 | 40 | 25 | 40 | 25 | 35 | 20 | 30 | 20 | Fig. 1 |

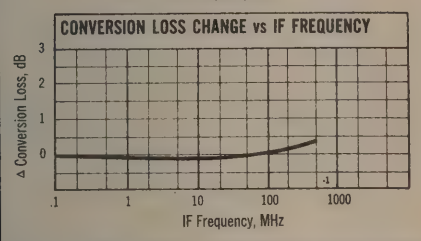
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +1 dBm. Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -1, 3.5 dB Model -2, 3.5 dB.

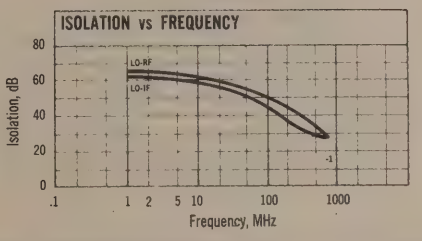
## MODEL SAM-1

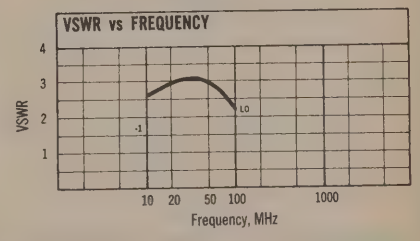


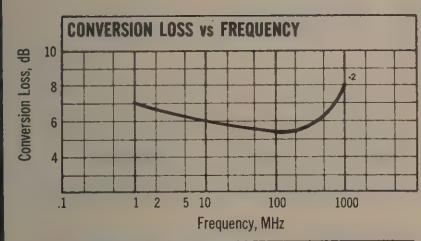



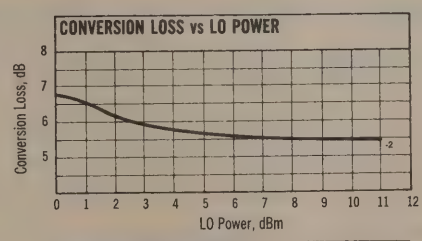



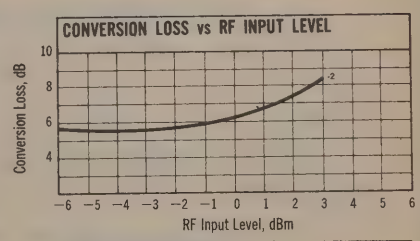



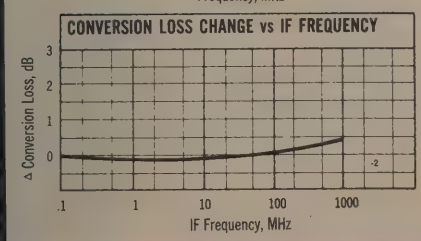



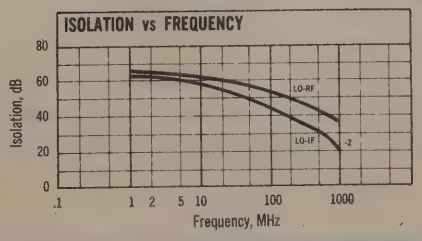

## MODEL SAM-2

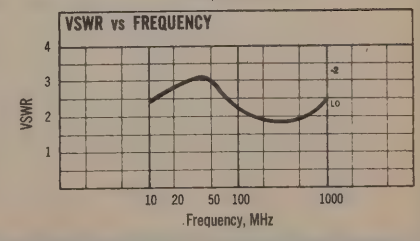


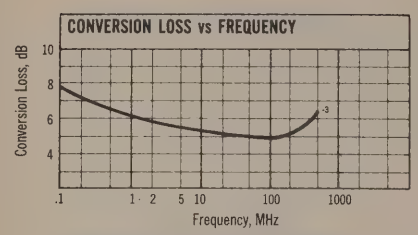
# Standard Level (+7 dBm LO)
# DOUBLE-BALANCED MIXERS

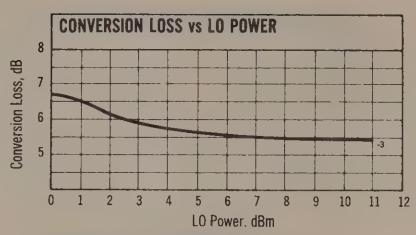
## SPECIFICATIONS

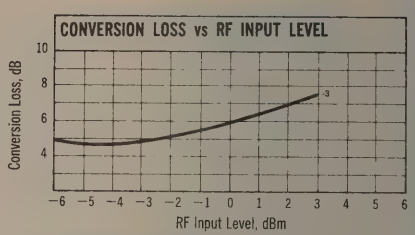
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Pin Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| SAM-3 | .1-500 | .1-500 | DC-500 | 5.5 | 7.0 | 6.5 | 8.5 | 60 | 50 | 50 | 40 | 50 | 35 | 45 | 30 | 35 | 30 | 30 | 20 | Fig. 1 |
| SAM-4 | 5-1250 | 5-1250 | .5-1000 | 6.5 | 8.5 | 6.5 | 8.5 | 55 | 40 | 50 | 40 | 35 | 25 | 35 | 25 | 30 | 20 | 30 | 20 | Fig. 2 |
| SAM-5 | 5-1500 | 5-1500 | .5-1000 | 6.5 | 7.5 | 6.5 | 8.5 | 55 | 40 | 50 | 40 | 35 | 25 | 35 | 25 | 30 | 20 | 30 | 20 | Fig. 2 |

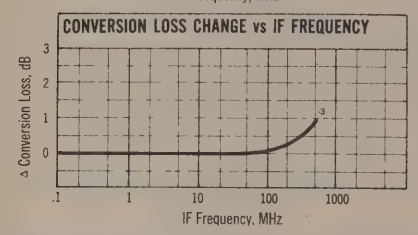
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +1 dBm. Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -3, 2.5 dB.

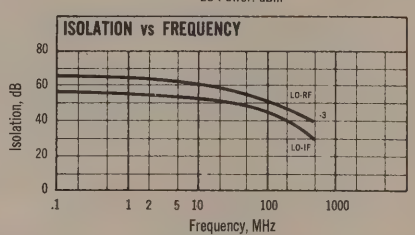
## MODEL SAM-3

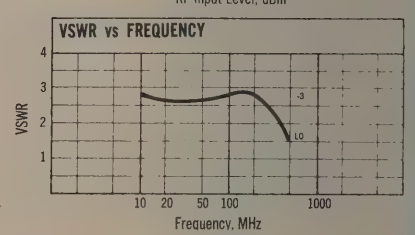




## COMPONENTS FOR ALL YOUR NEEDS – FROM MINI-CIRCUITS

Mini-Circuits offers a complete range of RF Components. By specifying all Mini-Circuits units you can be assured that they will work well together in a system, and that all will have been built to the same exacting quality standards.

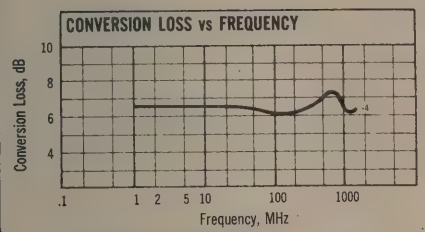
- ☐ *Double-Balanced Mixers*
- ☐ *Microwave Mixers*
- ☐ *Power Splitter/Combiners*
- ☐ *Frequency Doublers*
- ☐ *Directional Couplers*
- ☐ *Amplifiers*
- ☐ *Limiters*
- ☐ *Attenuator/Switches*
- ☐ *RF Transformers*

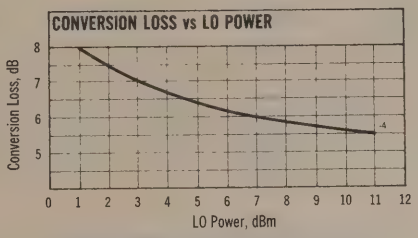
**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

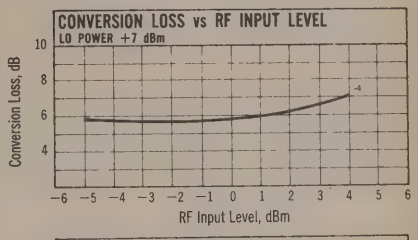
# SAM Series
# .1 MHz to 1500 MHz

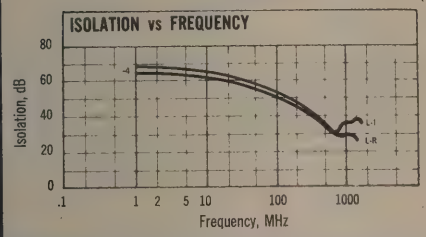
Mini-Circuits

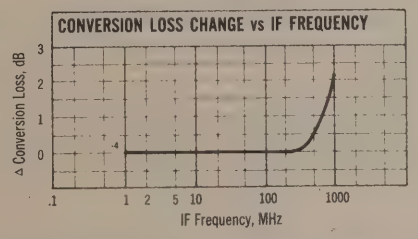
## MODEL SAM-4

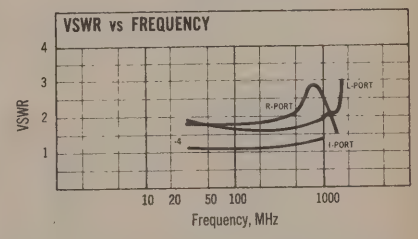


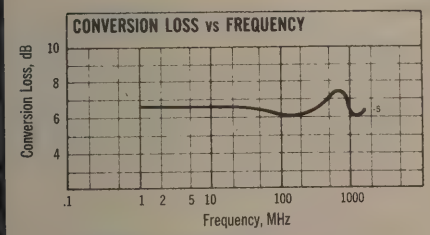



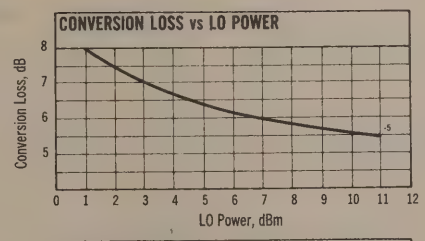



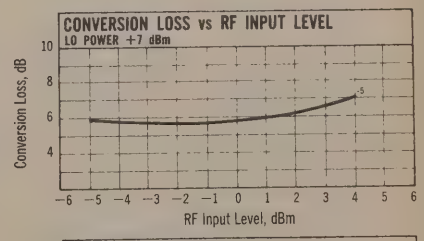



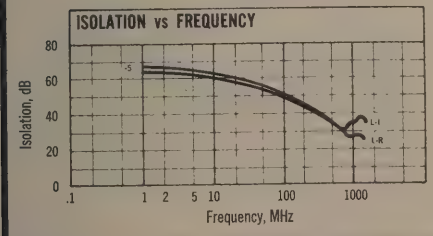



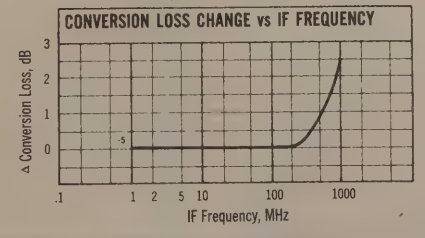

## MODEL SAM-5

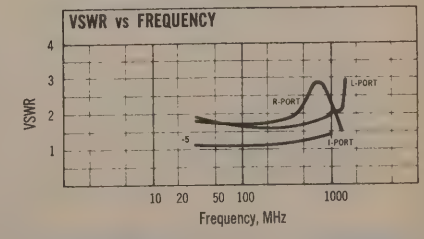


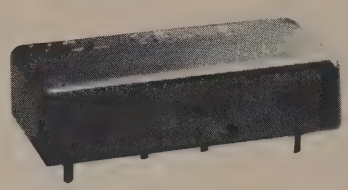




**PROMPT SERVICE / ONE WEEK DELIVERY** Mini-Circuits

# Standard Level (+7 dBm LO)
# DOUBLE-BALANCED MIXERS

## GRA SERIES



| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| GRA-1 | 0.5 MHz-500 MHz | 50 | $10.95 (6-49) |
| GRA-3 | 0.25 MHz-200 MHz | 50 | $13.95 (6-49) |
| GRA-6 | 3 KHz -100 MHz | 50 | $20.95 (5-24) |
| GRA-8 | 500 Hz -10 MHz | 50 | $25.95 (5-24) |

**DESCRIPTION** — These double-balanced mixers are exact mechanical and electrical replacements for existing designs, see table. Offered at the lowest price available in the industry these rugged units provide low conversion loss, 6 dB, high isolation 40 dB and exceptional unit to unit matched performance. The units are packaged within an RFI shielded metal enclosure and hermetically sealed header.

Ruggedness and durability are built into the GRA series. Only well matched hot-carrier diodes and ruggedly constructed transmission line transformers are used. Internally every component is bonded to the header and case with silicone rubber to provide super reliable protection against shock, vibration and acceleration.

High reliability is associated with every GRA series mixer. Every production run is 100% tested and every unit must pass our rigid inspection and high quality standards. Naturally, our 1 year guarantee applies to these units.

### REPLACEMENT TABLE

| Use Mini-Circuits | To replace |
|---|---|
| GRA-1 | M6K, M6N, M6F, M6KC |
| GRA-3 | M6A, M6Q |
| GRA-8 | M6J |

### FEATURES

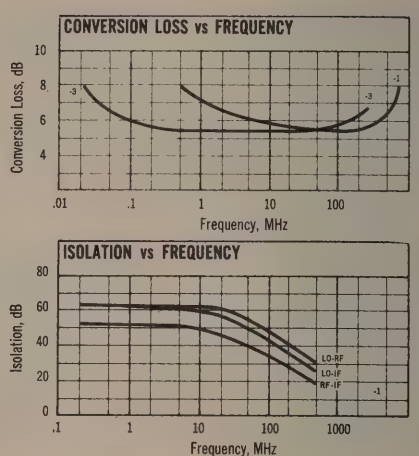
**Broadband:** 500 Hz to 500 MHz
**Low Conversion Loss:** typically less than 6 dB
**High Isolation:** typically greater than 40 dB
**Low Profile:** 0.128 in.³, 1.0″ x 0.5″ PC area, 0.25″ high
**High Reliability:** 100% tested, 1 year guarantee
**Low Cost:** as low as $10.95 in small quantity

### APPLICATIONS

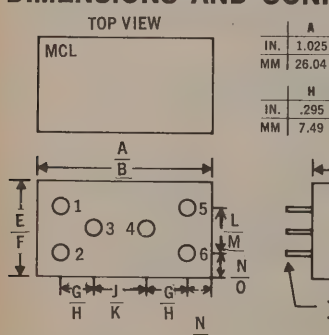
- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Bi-phase modulation

### ABSOLUTE MAXIMUM RATINGS

- **Input Power:** 50 mW
- **Peak IF Input Current:** 40 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Pin Temperature:** (10 sec.) 510°F
- **Environmental Specifications:** See Index Page

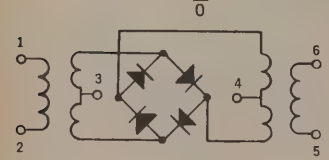



### DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| IN. | 1.025 | 1.00 | .28 | .24 | .525 | .5 | .305 |
| MM | 26.04 | 25.4 | 7.11 | 6.1 | 13.33 | 12.7 | 7.75 |

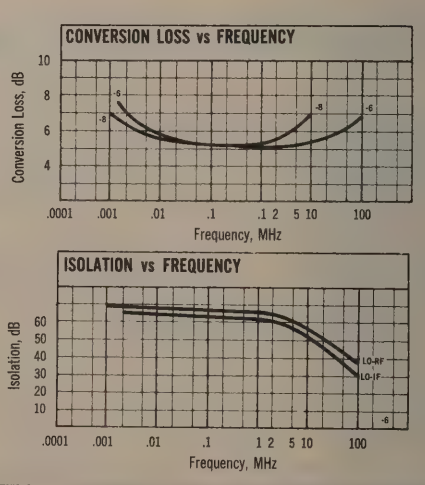
| | H | J | K | L | M | N | O |
|---|---|---|---|---|---|---|---|
| IN. | .295 | .205 | .195 | .305 | .295 | .13 | .090 |
| MM | 7.49 | 5.21 | 4.95 | 7.75 | 7.49 | 3.30 | 2.29 |




**PIN LAYOUT**

| | Fig. 1 |
|---|---|
| Model No. | -1<br>-3<br>-6<br>-8 |
| LO | 1 |
| RF | 6 |
| IF | 4 |
| Ground | 2,3,5 |

**WEIGHT** 7.1 grams .25 ounces




Mini-Circuits 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# GRA Series
# 500 Hz to 500 MHz

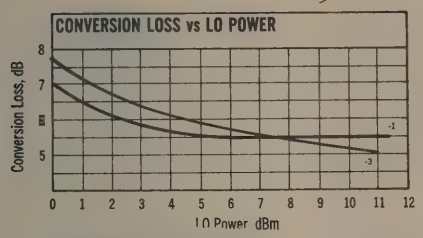
Mini-Circuits

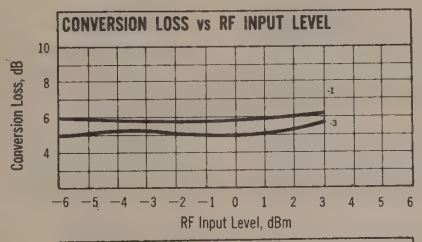
## SPECIFICATIONS

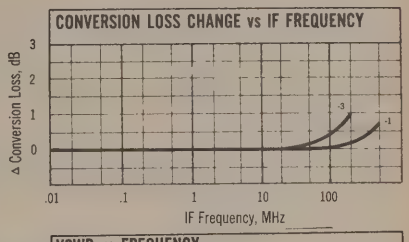
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Pin Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| GRA-1 | .5-500 | .5-500 | DC-500 | 5.5 | 7.0 | 6.5 | 8.5 | 50 | 45 | 45 | 35 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. 1 |
| GRA-3 | .025-200 | .025-200 | DC-200 | 5.5 | 7.5 | 6.5 | 8.5 | 60 | 50 | 45 | 35 | 45 | 35 | 40 | 30 | 35 | 25 | 30 | 20 | Fig. 1 |
| GRA-6 | .003-100 | .003-100 | DC-100 | 5.5 | 7.5 | 6.5 | 8.5 | 60 | 50 | 60 | 45 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. 1 |
| GRA-8 | .5 kHz 10 MHz | .5 kHz 10MHz | DC-10 | 6.5 | 7.5 | 7.0 | 8.5 | 60 | 50 | 60 | 50 | 50 | 40 | 50 | 40 | 45 | 35 | 45 | 35 | Fig. 1 |

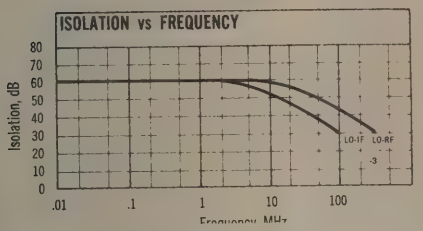
**COMMON SPECIFICATIONS:** Signal, 1 dB compression point +1 dBm. Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, positive.
**ELECTRONIC ATTENUATION:** Model -1, 3 dB Model -3, 1.5 dB Model -6, 1 dB Model -8, 1 dB

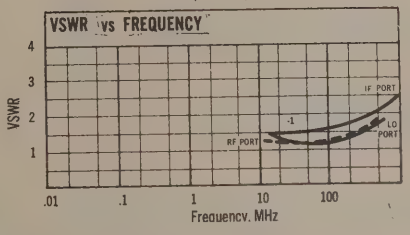
## MODELS GRA-1, GRA-3

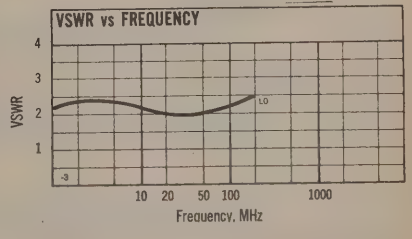


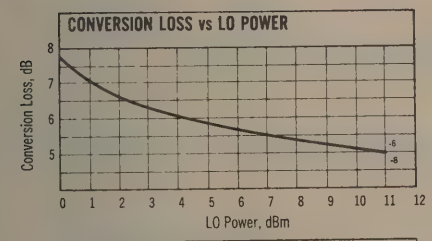



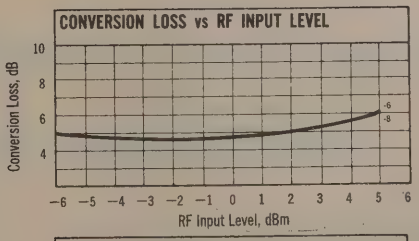



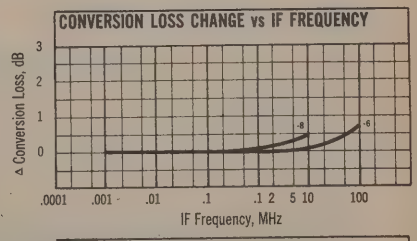



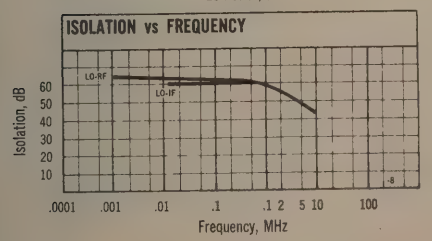



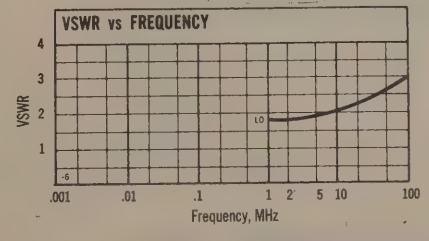

## MODELS GRA-6, GRA-8

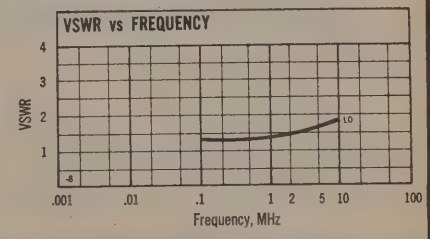


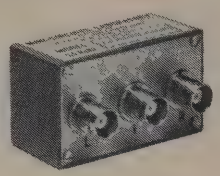



# Standard Level (+7 dBm LO)
# DOUBLE-BALANCED MIXERS

## ZAD SERIES



| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| * ZAD-1 | 0.5 MHz-500 MHz | 50 | $24.95 (4-24) |
| ZAD-1W | 1 MHz-750 MHz | 50 | $29.95 (4-24) |
| ZAD-1-1 | 0.1 MHz-500 MHz | 50 | $26.95 (4-24) |
| ZAD-2 | 1 MHz-1000 MHz | 50 | $34.95 (4-24) |
| ZAD-3 | 25 KHz-200 MHz | 50 | $26.95 (4-24) |
| ZAD-4 | 5 MHz-1250 MHz | 50 | $36.95 (4-24) |
| ZAD-6 | 3 KHz -100 MHz | 50 | $34.95 (4-24) |
| ZAD-8 | 500 Hz -10 MHz | 50 | $39.95 (4-24) |
| ZAD-11 | 5 MHz-2000 MHz | 50 | $49.95 (1-24) |
| ZAD-12 | 800 MHz-1250 MHz | 50 | $49.95 (1-24) |

NATIONAL STANDARD NUMBER ZAD-1B NSN-5985-00-280-7750

**DESCRIPTION** — The ZAD series mixers are economically priced while covering the very broad frequency range from 500 Hz to 2000 MHz. They offer low conversion loss, 6 dB, high isolation, 40 dB, and exceptional unit to unit matched performance.

BNC connectors are standard. TNC connectors are a no-cost option.

These rugged units are double shielded to meet tough RFI requirements. The die-cast aluminum case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 2.6 ounces (74 grams).

Only well matched hot-carrier diodes and ruggedly constructed transmission line transformers are used. Internally, every component is bonded with silicone rubber to provide protection against shock, vibration and acceleration.

## FEATURES

**Broadband:** 500 Hz to 2000 MHz
**Low Conversion Loss:** typically less than 6 dB
**High Isolation:** typically greater than 40 dB
**Compact:** 2.25″ W, 1.15″ D, 1.4″ H
**High Reliability:** 100% tested, 1 year guarantee
**Low Cost:** as low as $24.95 in small quantity

## APPLICATIONS

- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Bi-phase modulation

## ABSOLUTE MAXIMUM RATINGS

- **Input Power:** 50 mW
- **Peak IF Input Current:** 40 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Environmental Specifications:** See Index Page

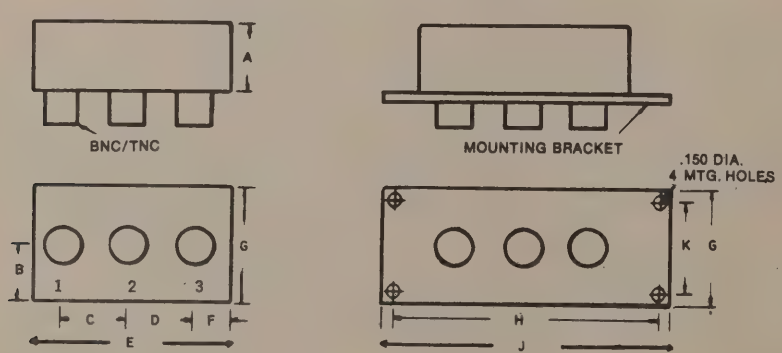
## *WHAT IS HTRB TESTING?

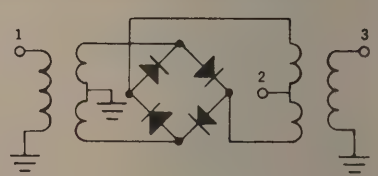
The model ZAD-1 has become an industry standard through the world and is used by all branches of the Department of Defense, NASA, FAA, and every major communications company. In over 500 different military contracts, over a period of years, the ZAD-1 has proven to be one of the most reliable mixers obtainable, even when considering high priced models.

Schottky-diodes selected for high-reliability mixer service are deliberately stressed to accelerate aging and thus force temperature related failure modes to take their toll. In the HTRB (High Temperature Reverse Bias) technique, the diode is operated at 168 hours at 150°C with 1-V reverse bias applied.

In conventional testing, or "baking", the diode does not experience anywhere near the stress encountered with the HTRB program. Thus, the HTRB process screens out potentially unreliable diodes before they are assembled into completed Hi-rel mixers.

## DIMENSIONS AND CONNECTIONS




**CONNECTOR/TERMINAL LAYOUT**

| | Fig. A | Fig. B |
|---|---|---|
| Model No. | -2 -4 | All Models except -2 and -4 |
| LO | 1 | 1 |
| RF | 2 | 3 |
| IF | 3 | 2 |

**NOTE:** For Models ZAD-11 and ZAD-12 connector/terminal 2 is at dc ground through an inductance.

**MOUNTING BRACKET AVAILABLE ON REQUEST.** Add suffix B to part number and $1.50 to unit cost.
**CONNECTORS:** BNC standard. TNC on request (no charge).

| | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| IN. | 1.15 | .63 | .750 | .730 | 2.25 | .385 | 1.40 | 2.95 | 3.25 | 1.10 |
| MM | 29 | 16 | 19 | 18.5 | 57 | 9.7 | 35.5 | 74.9 | 82.5 | 28 |

**WEIGHT** 74 grams 2.6 ounces

Mini-Circuits 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# ZAD Series
# 500 Hz to 2000 MHz

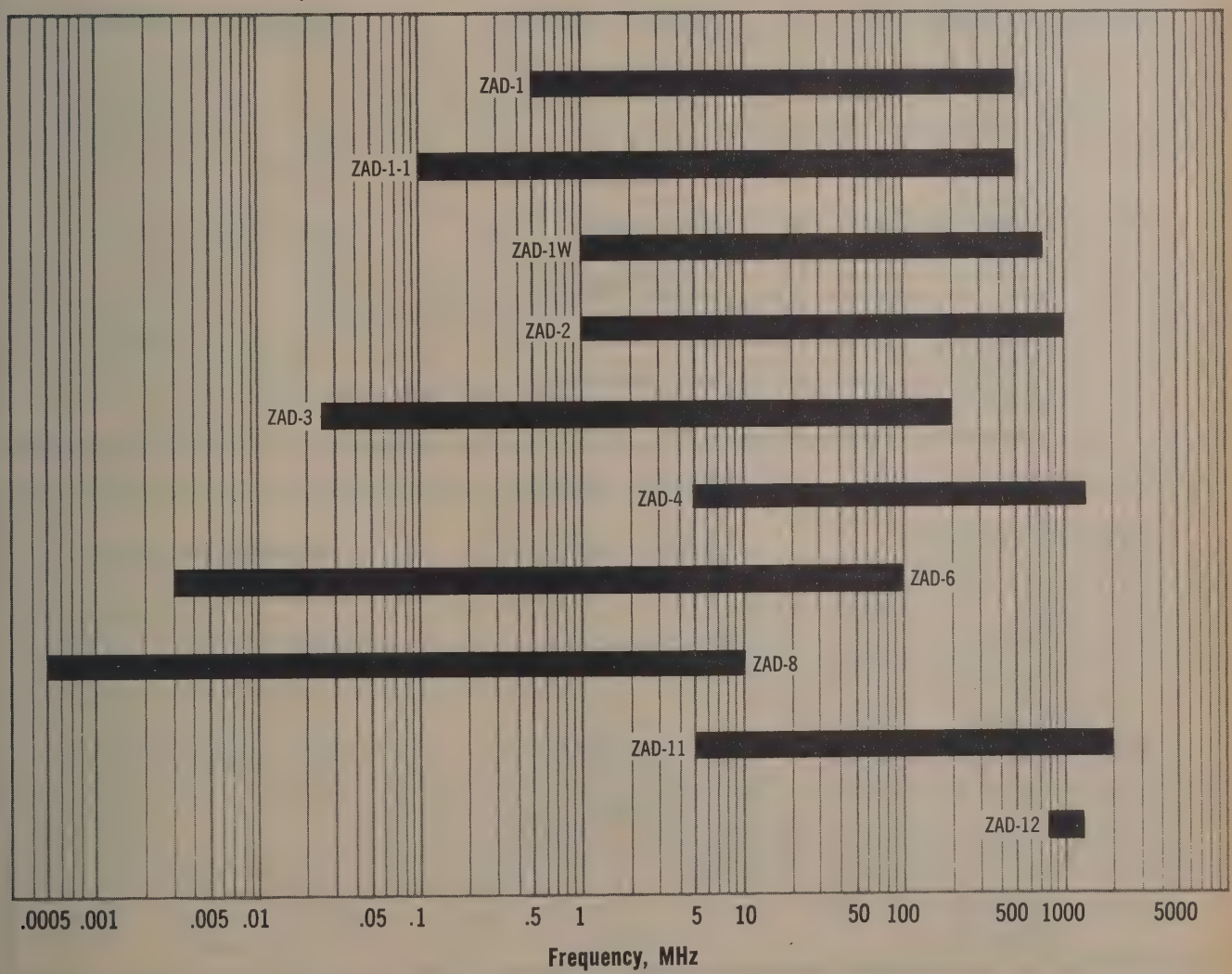
Mini-Circuits

## SPECIFICATIONS

| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Conn Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| ZAD-1 | .5-500 | .5-500 | DC-500 | 5.5 | 7.0 | 6.5 | 8.5 | 50 | 45 | 45 | 35 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. B |
| ZAD-1W | 1-750 | 1-750 | DC-750 | 5.5 | 7.5 | 6.5 | 8.5 | 50 | 45 | 45 | 30 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. B |
| ZAD-1-1 | .1-500 | .1-500 | DC-500 | 5.5 | 7.5 | 6.5 | 8.5 | 50 | 45 | 45 | 30 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. B |
| ZAD-2 | 1-1000 | 1-1000 | .5-500 | 5.5 | 7.5 | 6.5 | 8.5 | 45 | 30 | 45 | 30 | 35 | 20 | 35 | 20 | 30 | 20 | 30 | 20 | Fig. A |
| ZAD-3 | .025-200 | .025-200 | DC-200 | 5.5 | 7.5 | 6.5 | 8.5 | 60 | 50 | 45 | 35 | 45 | 35 | 40 | 30 | 35 | 25 | 30 | 20 | Fig. B |
| ZAD-4 | 5-1250 | 5-1250 | .5-500 | 5.5 | 7.5 | 6.5 | 8.5 | 50 | 40 | 50 | 40 | 40 | 20 | 40 | 20 | 30 | 20 | 30 | 20 | Fig. A |
| ZAD-6 | .003-100 | .003-100 | DC-100 | 5.5 | 7.5 | 6.5 | 8.5 | 60 | 50 | 60 | 45 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. B |
| ZAD-8 | .0005-10 | .0005-10 | DC-10 | 6.5 | 7.5 | 7.0 | 8.5 | 60 | 50 | 60 | 50 | 50 | 40 | 50 | 40 | 45 | 35 | 45 | 35 | Fig. B |
| ZAD-11 | 5-2000 | 5-2000 | 10-600 | 7.0 | 8.5 | 7.5 | 9.0 | 50 | 45 | 45 | 40 | 35 | 25 | 30 | 20 | 30 | 20 | 25 | 15 | Fig. B |
| ZAD-12 | 800-1250 | 800-1250 | 50-90 | 6.0 | 7.5 | 6.0 | 7.5 | Over full range — LO-IF: 30 typ. 20 min./LO-RF: 35 typ. 25 min. | | | | | | | | | | | | Fig. B |

**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +1 dBm. Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -1, 3 dB Model -1W, 3.5 dB Model -1-1, 2.5 dB Model -3, 1.5 dB Model -6, 1 dB Model -8, 1 dB.

## FREQUENCY SELECTION GUIDE




PROMPT SERVICE / ONE WEEK DELIVERY Mini-Circuits

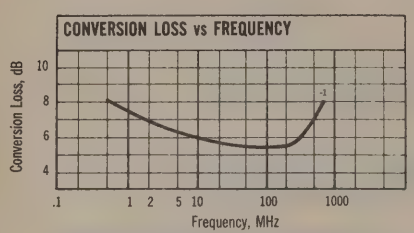
# Standard Level (+7 dBm LO) DOUBLE-BALANCED MIXERS

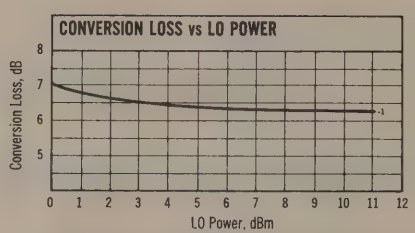
## SPECIFICATIONS

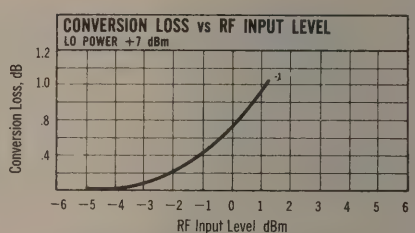
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Conn. Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| ZAD-1 | .5-500 | .5-500 | DC-500 | 5.5 | 7.0 | 6.5 | 8.5 | 50 | 45 | 45 | 35 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. B |
| ZAD-1W | 1-750 | 1-750 | DC-750 | 5.5 | 7.5 | 6.5 | 8.5 | 50 | 45 | 45 | 30 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. B |
| ZAD-1-1 | .1-500 | .1-500 | DC-500 | 5.5 | 7.5 | 6.5 | 8.5 | 50 | 45 | 45 | 30 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. B |
| ZAD-2 | 1-1000 | 1-1000 | .5-500 | 5.5 | 7.5 | 6.5 | 8.5 | 45 | 30 | 45 | 30 | 35 | 20 | 35 | 20 | 30 | 20 | 30 | 20 | Fig. A |
| ZAD-3 | .025-200 | .025-200 | DC-200 | 5.5 | 7.5 | 6.5 | 8.5 | 60 | 50 | 45 | 35 | 45 | 35 | 40 | 30 | 35 | 25 | 30 | 20 | Fig. B |

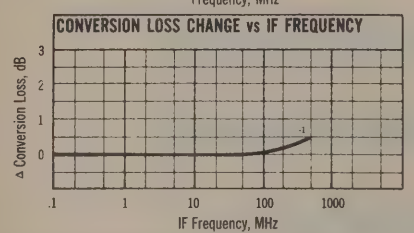
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +1 dBm. Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -1, 3 dB Model -1W, 3.5 dB Model -1-1, 2.5 dB Model -3, 1.5 dB.

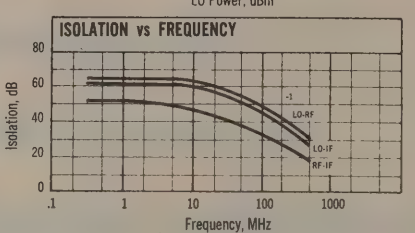
## MODEL ZAD-1

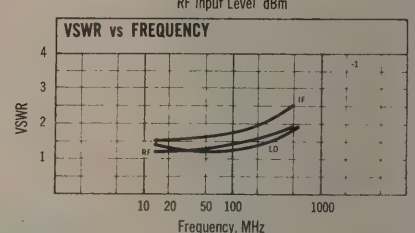


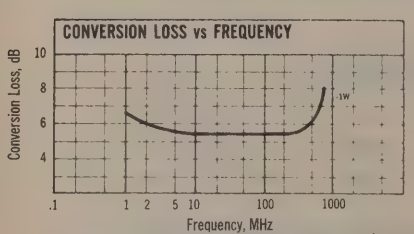



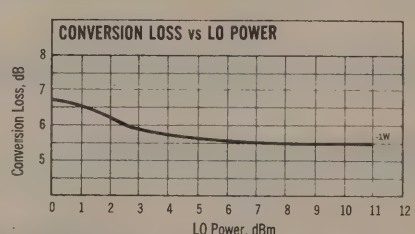



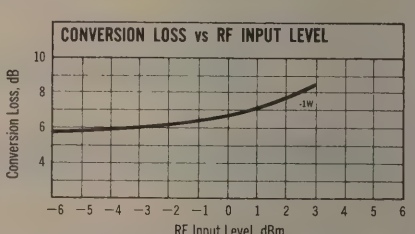



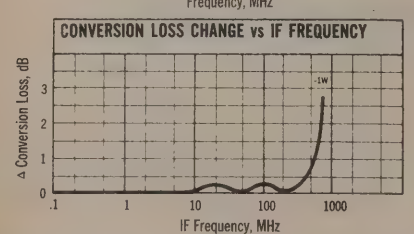



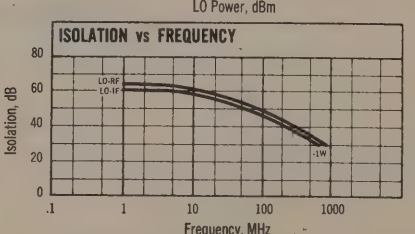

## MODEL ZAD-1W

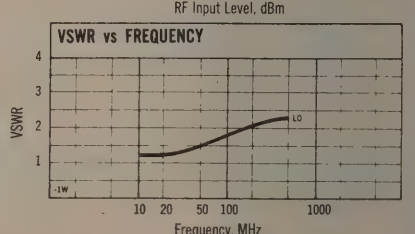


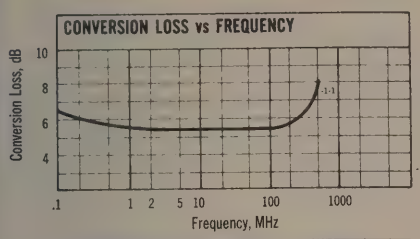



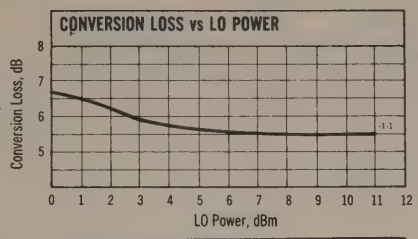

**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

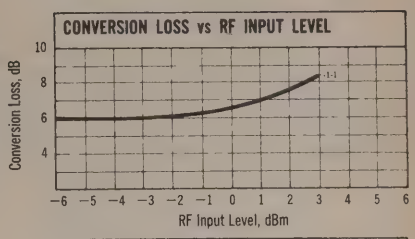
# ZAD Series
# 500 Hz to 2000 MHz

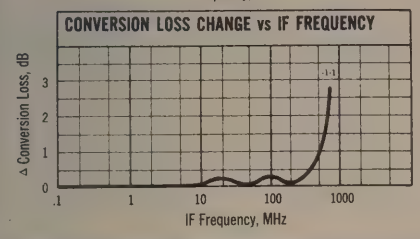
Mini-Circuits

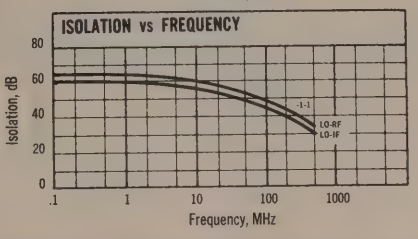
## MODEL ZAD-1-1

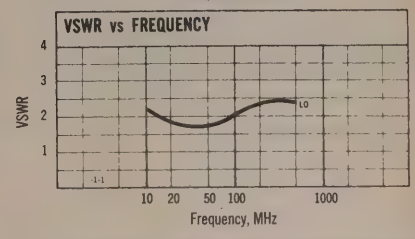


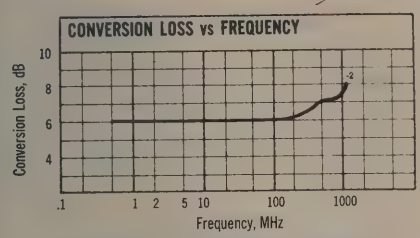



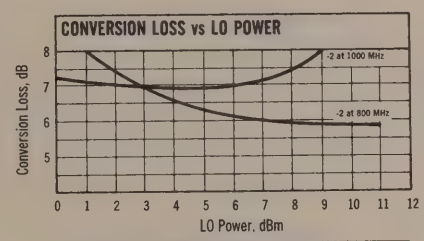



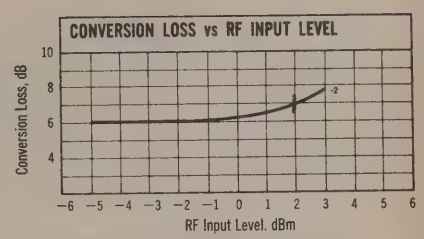



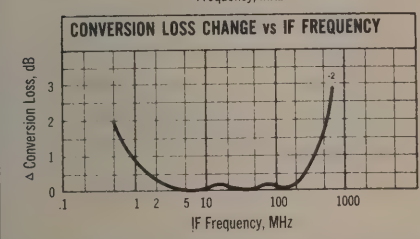



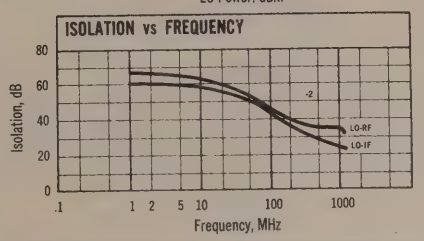

## MODEL ZAD-2

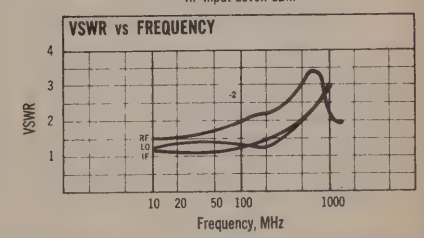


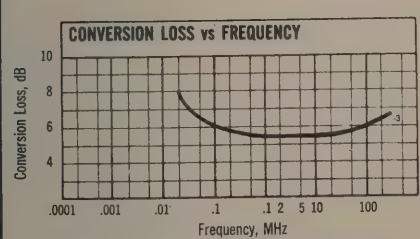



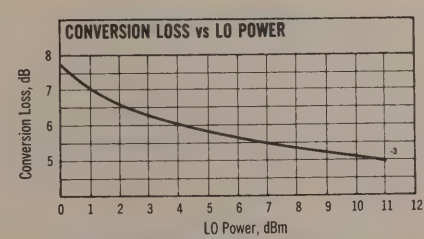



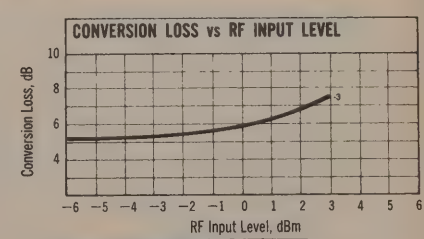



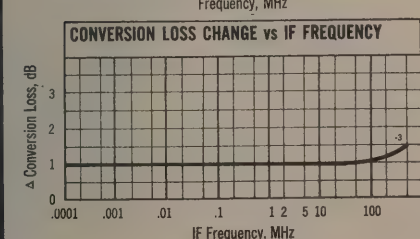



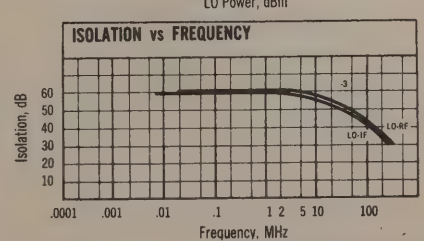

## MODEL ZAD-3

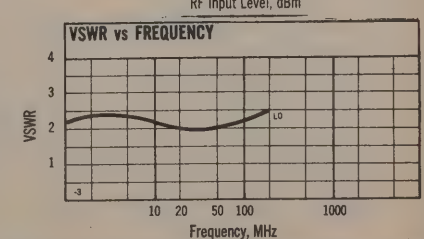



PROMPT SERVICE / ONE WEEK DELIVERY

Mini-Circuits

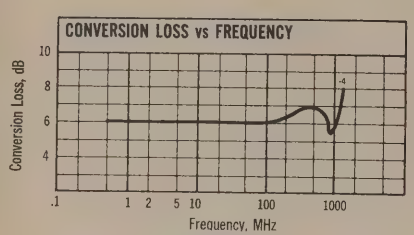
# Standard Level (+7 dBm LO)
# DOUBLE-BALANCED MIXERS

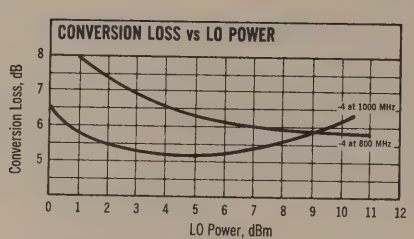
## SPECIFICATIONS

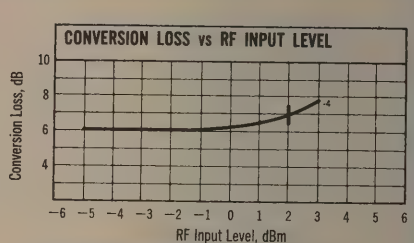
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Conn Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| ZAD-4 | 5-1250 | 5-1250 | .5-500 | 5.5 | 7.5 | 6.5 | 8.5 | 50 | 40 | 50 | 40 | 40 | 20 | 40 | 20 | 30 | 20 | 30 | 20 | Fig. A |
| ZAD-6 | .003-100 | .003-100 | DC-100 | 5.5 | 7.5 | 6.5 | 8.5 | 60 | 50 | 60 | 45 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. B |
| ZAD-8 | .0005-10 | .0005-10 | DC-10 | 6.5 | 7.5 | 7.0 | 8.5 | 60 | 50 | 60 | 50 | 50 | 50 | 50 | 40 | 45 | 35 | 45 | 35 | Fig. B |
| ZAD-11 | 5-2000 | 5-2000 | 10-600 | 7.0 | 8.5 | 7.5 | 9.0 | 50 | 45 | 45 | 40 | 35 | 25 | 30 | 20 | 30 | 20 | 25 | 15 | Fig. B |
| ZAD-12 | 800-1250 | 800-1250 | 50-90 | — | — | 6.0 | 7.5 | Over full range — LO-IF: 30 typ. 20 min./LO-RF: 35 typ. 25 min. | | | | | | | | | | | | Fig. B |

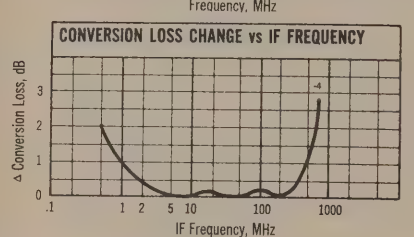
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +1 dBm. Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -6, 1 dB Model -8, 1 dB.

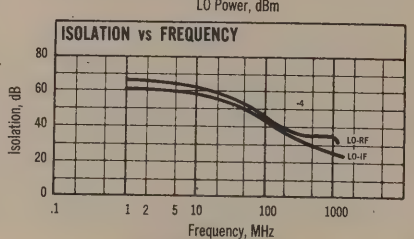
## MODEL ZAD-4

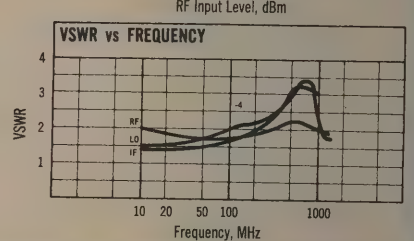


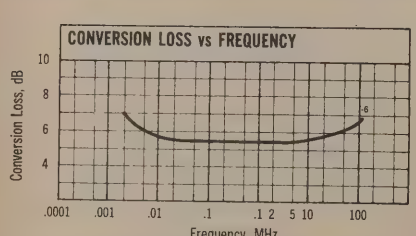



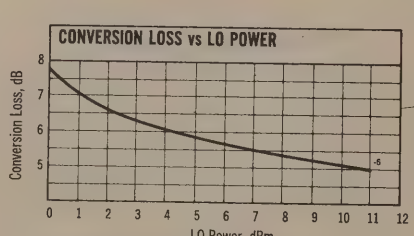



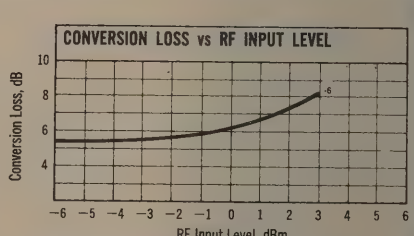



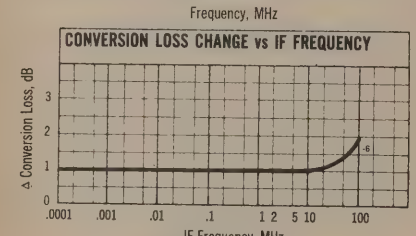



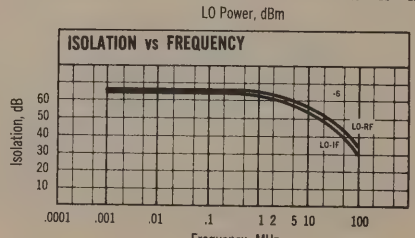

## MODEL ZAD-6

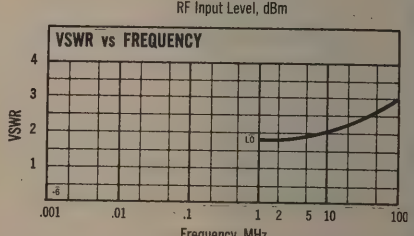


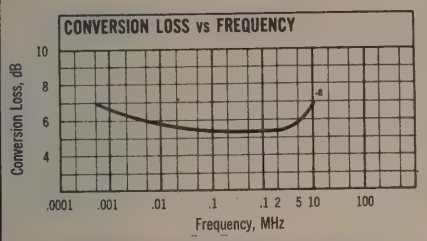



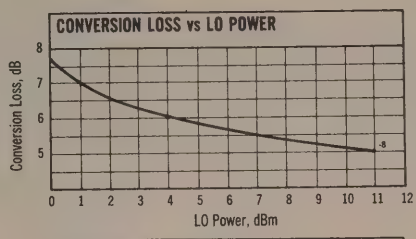



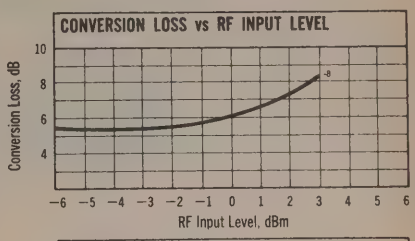
# ZAD Series
# 500 Hz to 2000 MHz

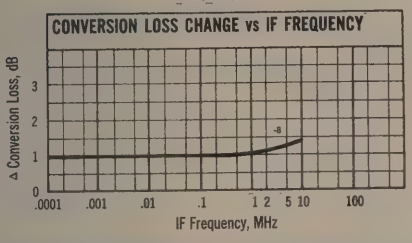
Mini-Circuits

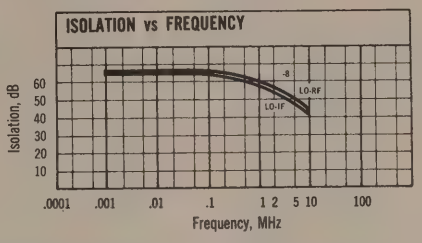
## MODEL ZAD-8

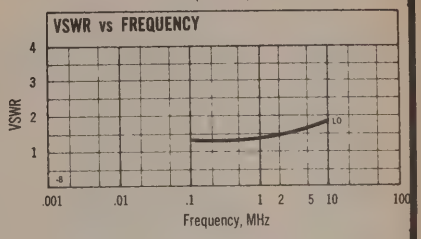


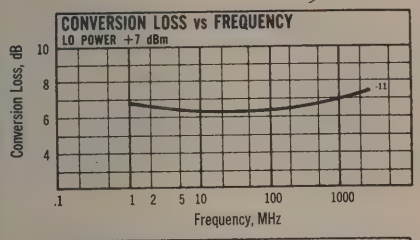



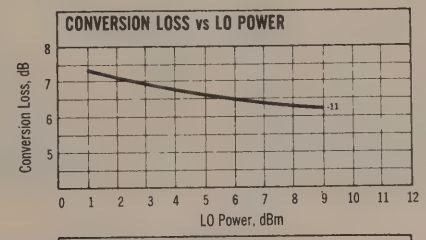



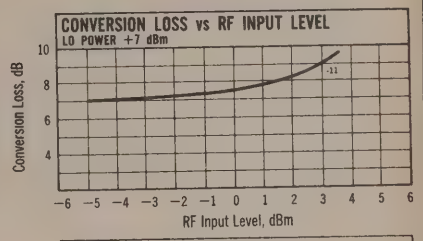



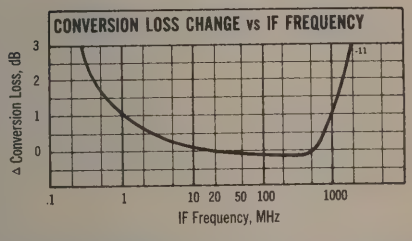



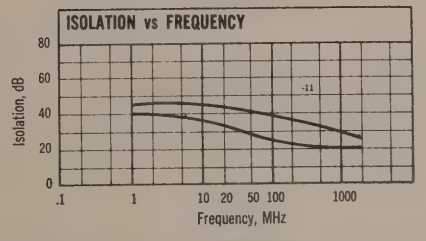

## MODEL ZAD-11

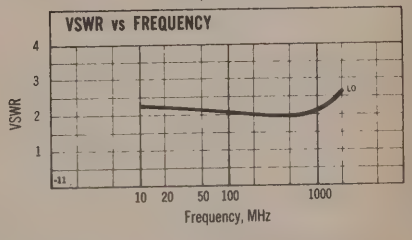


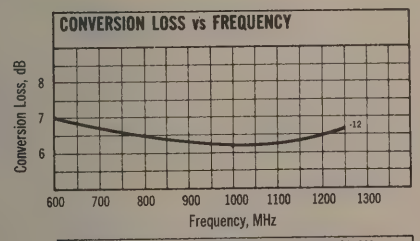



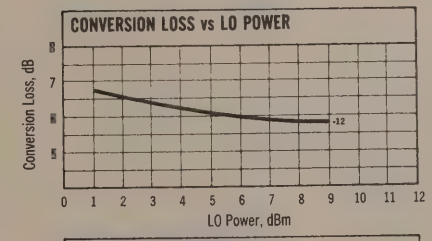



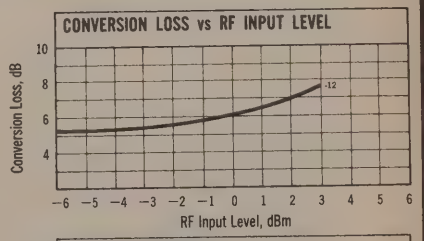



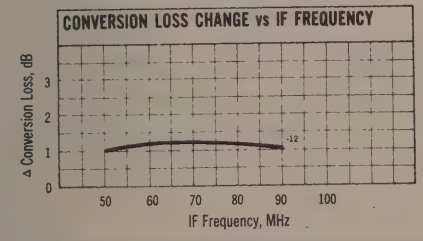



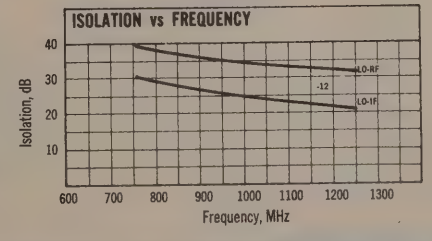

## MODEL ZAD-12

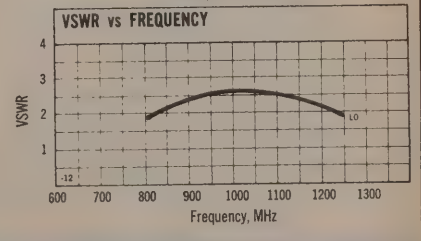



**PROMPT SERVICE / ONE WEEK DELIVERY** Mini-Circuits

# Standard Level (+7 dBm LO)
# DOUBLE-BALANCED MIXERS

## ZFM SERIES

| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| ZFM-2 | 1 MHz-1000 MHz | 50 | $41.95 (4-24) |
| ZFM-3 | 40 KHz -400 MHz | 50 | $49.95 (1-24) |
| ZFM-4 | 5 MHz-1250 MHz | 50 | $49.95 (1-24) |
| ZFM-11 | 1 MHz-2000 MHz | 50 | $79.95 (1-24) |
| ZFM-12 | 800 MHz-1250 MHz | 50 | $69.95 (1-24) |
| ZFM-15 | 10 MHz-3000 MHz | 50 | $79.95 (1-9) |

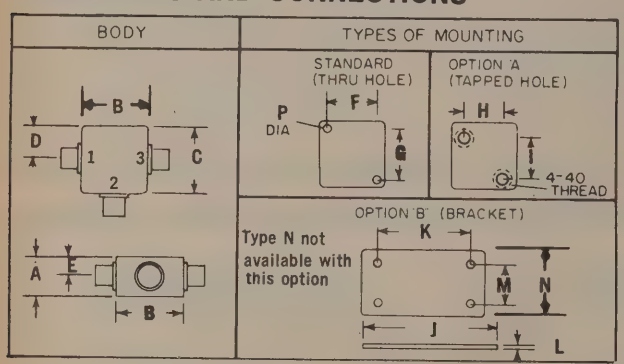
**DESCRIPTION** — The ZFM series mixers are economically priced while covering the very broad frequency range from .04-3000 MHz. They offer low conversion loss 6 dB, high isolation 40 dB, and exceptional unit to unit matched performance.

This series is housed in an extremely rugged 1¼ in. square metal case with one connector on each of three sides.

BNC connectors are standard. TNC connectors a no-cost option, must be specified. Either SMA (3mm) or Type N connectors can be specified at an added cost of $5.00 per unit. Unit weight with BNC connectors is 1.92 ounces (54.5 grams).

Case finish is grey epoxy paint.

## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| IN | .75 | 1.25 | 1.25 | .625 | .375 | 1.00 | 1.00 | 0.8 |
| MM | 19.1 | 31.8 | 31.8 | 15.9 | 9.5 | 25.4 | 25.4 | 20.3 |

| | I | J | K | L | M | N | P |
|---|---|---|---|---|---|---|---|
| IN | 0.8 | 2.188 | 1.688 | .060 | .75 | 1.25 | .125 |
| MM | 20.3 | 55.6 | 42.9 | 1.5 | 19.1 | 31.8 | 3.18 |

**MOUNTING OPTIONS:** Two .125" (31.8mm) thruholes standard. Two 4-40 tapped holes optional at no cost. Add suffix A to part number. Mounting bracket on request. Add suffix B and $1.50 to unit price.

**CONNECTORS:** BNC standard. Specify TNC at no cost if required. Either SMA (3mm) or Type N can be specified at an added cost of $5.00 per unit.

**WEIGHT** 54.5 grams 1.92 ounces

## FEATURES

**Broadband:** 40 KHz to 3000 MHz
**Low Conversion Loss:** typically less than 6 dB
**High Isolation:** typically greater than 40 dB
**Low Profile:** 1.25" W, 1.25" D, 0.75" H
**High Reliability:** 100% tested, 1 year guarantee
**Low Cost:** as low as $41.95 in small quantity

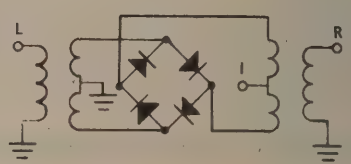
## APPLICATIONS

- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Bi-phase modulation

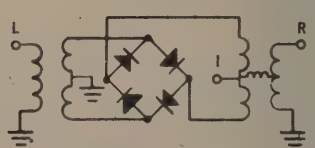
## ABSOLUTE MAXIMUM RATINGS

- **Input Power:** 50 mW
- **Operating and Storage Temp.:** −55°C to +100°C
- **Peak IF Input Current:** 40 mA
- **Environmental Specifications:** See Index Page

## ZFM-15
## *New Super Mixer*
## 10-3000 MHz with 6.5 dB Conversion Loss




SCHEMATIC FOR FIG. A




SCHEMATIC FOR FIG. B

**TERMINAL/CONNECTOR LAYOUTS**

| | Fig. A | Fig. B |
|---|---|---|
| Model No. | -2<br>-3<br>-4 | -11<br>-12<br>-15 |
| LO | 1 | 1 |
| RF | 3 | 3 |
| IF | 2 | 2 |

Mini-Circuits 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# ZFM Series
# 40 KHz to 3000 MHz

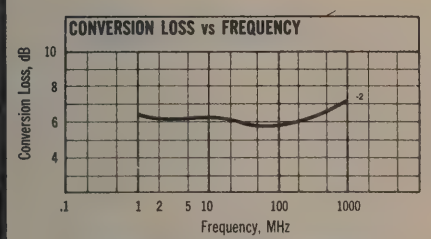
Mini-Circuits

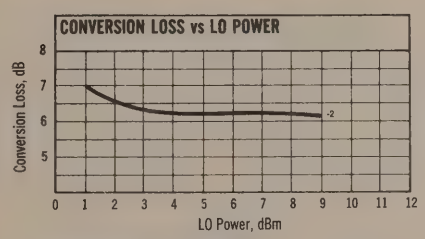
## SPECIFICATIONS

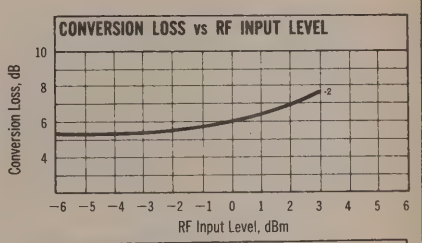
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Conn/ Term Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| ZFM-2 | 1-1000 | 1-1000 | DC-1000 | 6.0 | 7.5 | 7.0 | 8.5 | 50 | 45 | 45 | 40 | 40 | 25 | 35 | 25 | 30 | 25 | 25 | 20 | Fig. A |
| ZFM-3 | .04-400 | .04-400 | DC-400 | 5.3 | 7.0 | 6.0 | 8.0 | 60 | 50 | 55 | 40 | 50 | 35 | 45 | 30 | 35 | 25 | 35 | 25 | Fig. A |

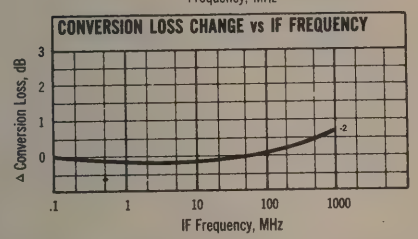
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +1 dBm. Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -2, 3.5 dB Model -3, 3.5 dB

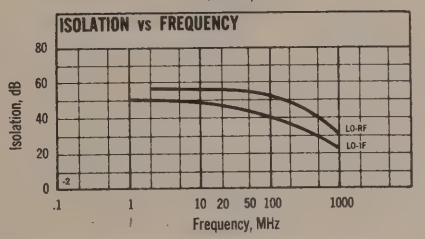
## MODEL ZFM-2

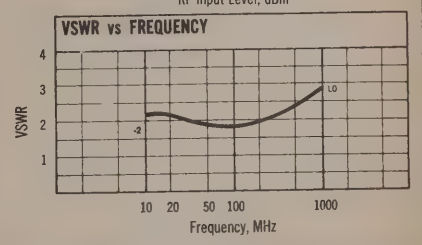


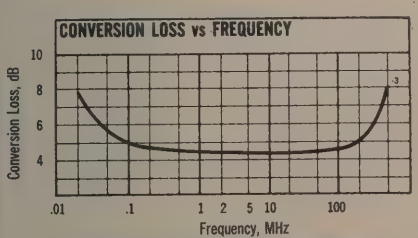



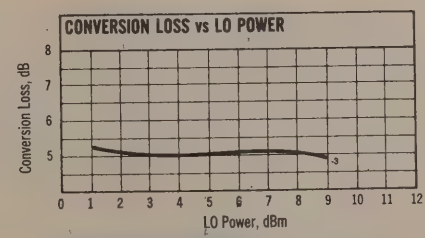



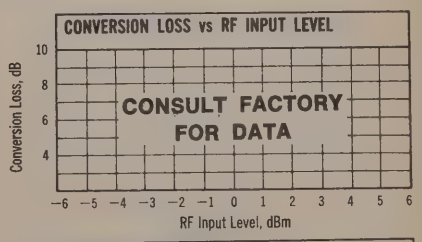



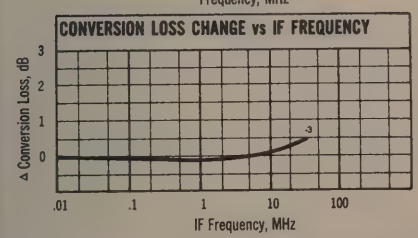



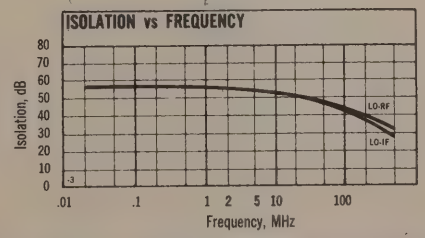

## MODEL ZFM-3

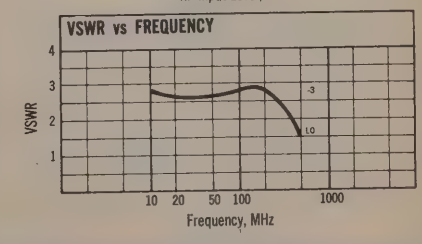



PROMPT SERVICE / ONE WEEK DELIVERY Mini-Circuits

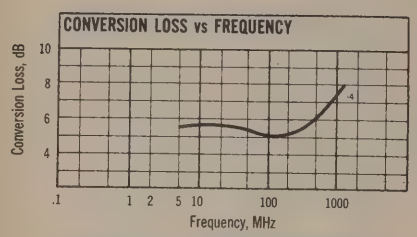
# Standard Level (+7 dBm LO)
# DOUBLE-BALANCED MIXERS

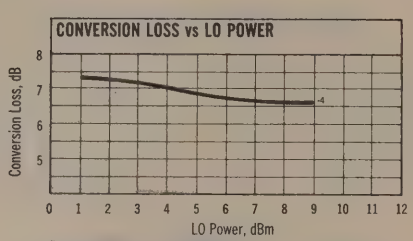
## SPECIFICATIONS

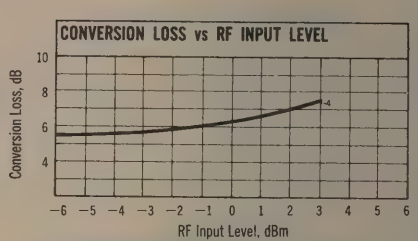
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Conn/ Term Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| ZFM-4 | 5-1250 | 5-1250 | DC-1250 | 60 | 7.5 | 7.5 | 8.5 | 50 | 45 | 45 | 40 | 40 | 30 | 35 | 25 | 30 | 25 | 25 | 20 | Fig. A |
| ZFM-11 | 1-2000 | 1-2000 | 5-600 | 7.0 | 8.5 | 7.5 | 9.0 | 50 | 45 | 45 | 40 | 35 | 25 | 27 | 20 | 25 | 20 | 25 | 20 | Fig. B |
| ZFM-12 | 800-1250 | 800-1250 | 50-90 | — | — | 6.0 | 7.5 | Over Full Range LO-RF: 35 typ., 25 min. LO-IF: 30 typ., 20 min. | | | | | | | | | | | | Fig. B |
| ZFM-15 | 10-3000 +10 dBm | 10-3000 | 10-800 | 6.3 | 7.5 | 6.5 | 8.5 | Over Full Range LO-RF: 30 typ., 25 min. LO-IF: 30 typ., 20 min. | | | | | | | | | | | | Fig. B |

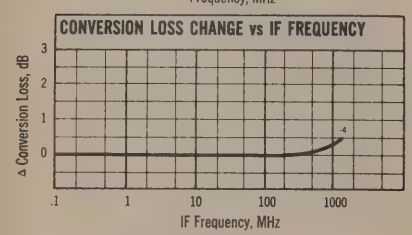
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +1 dBm. Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -4, 2.5 dB

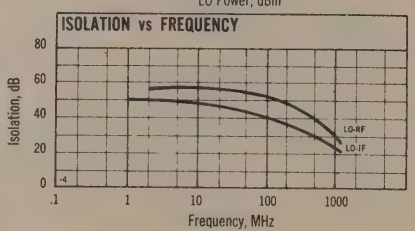
## MODEL ZFM-4

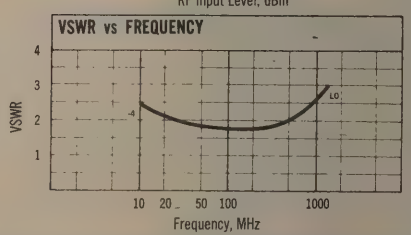


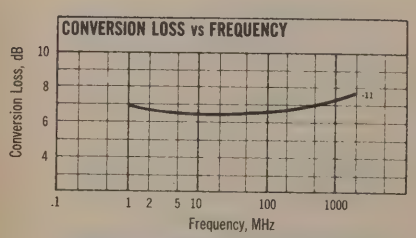



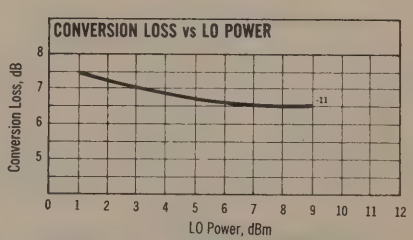



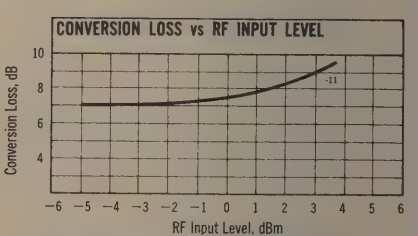



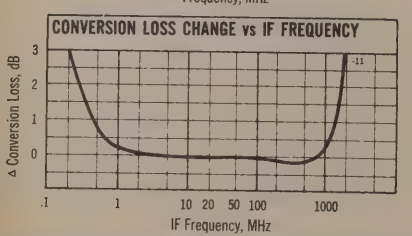



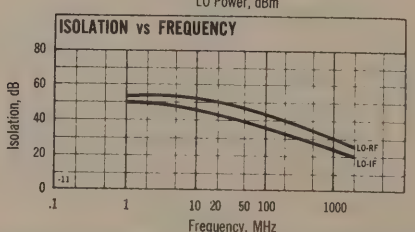

## MODEL ZFM-11

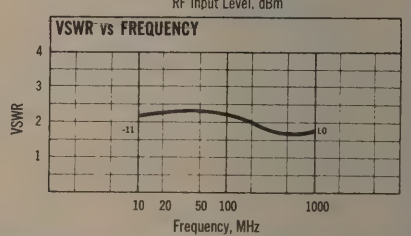


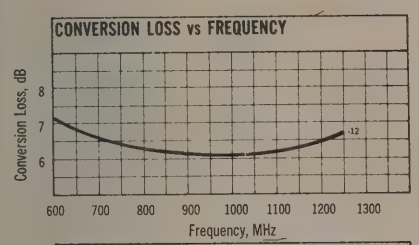



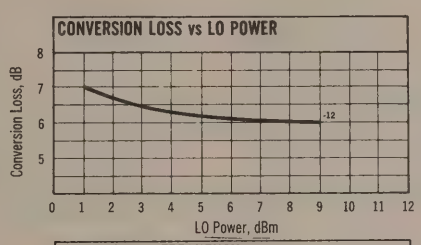



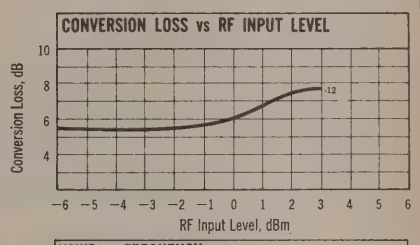
# ZFM Series
# 40 KHz to 3000 MHz

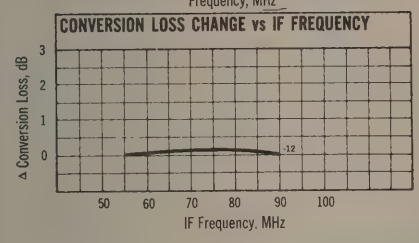
Mini-Circuits

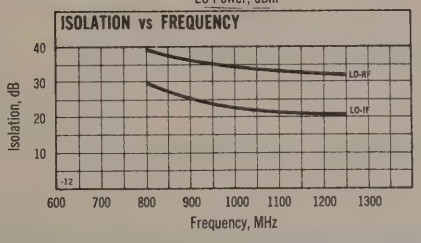
## MODEL ZFM-12

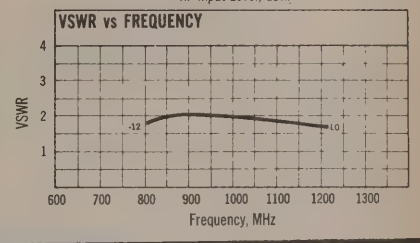


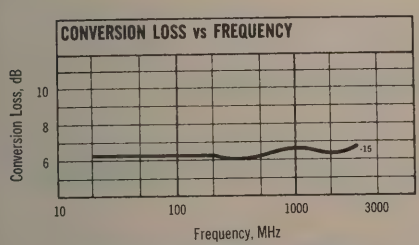



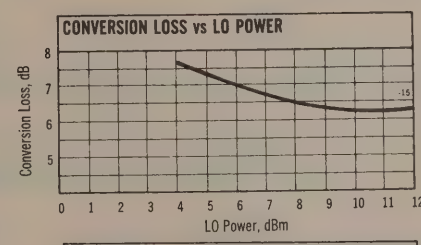



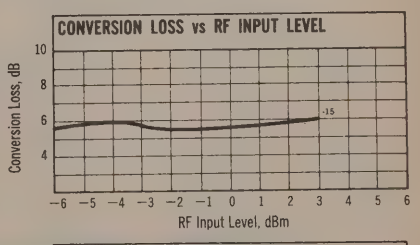



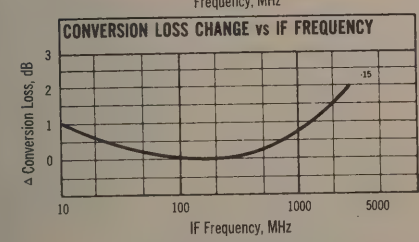



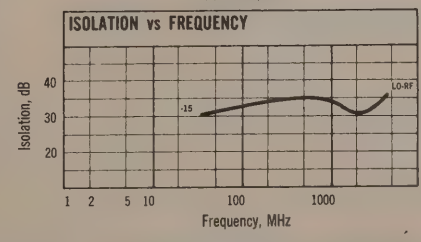

## MODEL ZFM-15

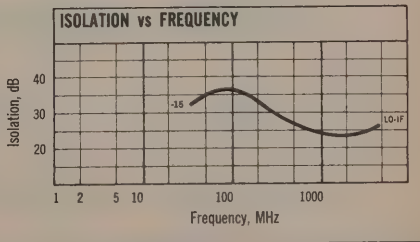


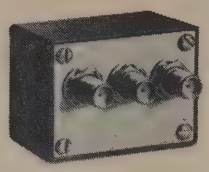




PROMPT SERVICE / ONE WEEK DELIVERY

Mini-Circuits

# Standard Level (+7 dBm LO)
# DOUBLE-BALANCED MIXERS

## ZLW SERIES



| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| * ZLW-1 | 0.5 MHz-500 MHz | 50 | $34.95 (4-24) |
| ZLW-1W | 1 MHz-750 MHz | 50 | $39.95 (4-24) |
| ZLW-1-1 | 0.1 MHz-500 MHz | 50 | $36.95 (4-24) |
| ZLW-2 | 1 MHz-1000 MHz | 50 | $39.95 (1-24) |
| ZLW-3 | 25 KHz -200 MHz | 50 | $36.95 (4-24) |
| ZLW-5 | 5 MHz-1500 MHz | 50 | $49.95 (1-9) |
| ZLW-6 | 3 KHz -100 MHz | 50 | $44.95 (4-24) |
| ZLW-8 | 500 Hz -10 MHz | 50 | $49.95 (4-24) |
| ZLW-11 | 5 MHz-2000 MHz | 50 | $59.95 (1-24) |
| ZLW-12 | 800 MHz-1250 MHz | 50 | $59.95 (1-24) |
| NATIONAL STANDARD NUMBER | ZLW-1W | NSN-5840-00-607-7010 | |

**DESCRIPTION** — The ZLW series mixers are economically priced while covering the very broad frequency range from 500 Hz to 2000 MHz. They offer low conversion loss, 6 dB, high isolation, 40 dB, and exceptional unit to unit matched performance.

Available with SMA (3mm) connectors the ZLW series is housed in a die cast aluminum case. These rugged units are double shielded to meet tough RFI requirements. The case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 1.02 ounces (34 grams).

Only well matched hot-carrier diodes and ruggedly constructed transmission line transformers are used. Internally, every component is bonded with silicone rubber to provide protection against shock, vibration and acceleration.

## FEATURES

**Broadband:** 500 Hz to 3000 MHz
**Low Conversion Loss:** typically less than 6 dB
**High Isolation:** typically greater than 40 dB
**Miniature:** 1.5″ W, 0.88″ D, 1.15″ H
**High Reliability:** 100% tested, 2 year guarantee ZLW-1, 1 year guarantee all other models
**Low Cost:** as low as $34.95 in low quantity

## APPLICATIONS

- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Bi-phase modulation

## ABSOLUTE MAXIMUM RATINGS

- **Input Power:** 50 mW
- **Peak IF Input Current:** 40 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Environmental Specifications:** See Index Page

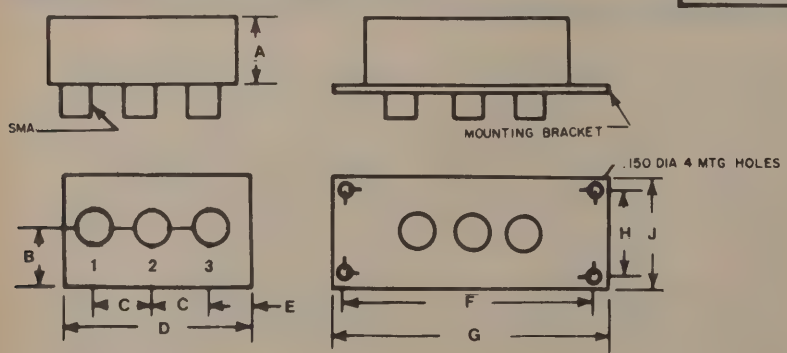
## *WHAT IS HTRB TESTING?

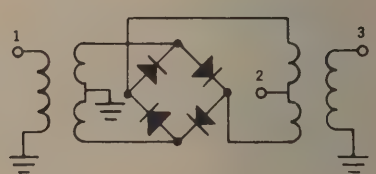
The model ZLW-1 has become an industry standard through the world and is used by all branches of the Department of Defense, NASA, FAA, and every major communications company. In over 500 different military contracts, over a period of years, the ZLW-1 has proven to be one of the most reliable mixers obtainable, even when considering high priced models.

Schottky-diodes selected for high-reliability mixer service are deliberately stressed to accelerate aging and thus force temperature related failure modes to take their toll. In the HTRB (High Temperature Reverse Bias) technique, the diode is operated at 168 hours at 150°C with 1-V reverse bias applied.

In conventional testing, or "baking", the diode does not experience anywhere near the stress encountered with the HTRB program. Thus, the HTRB process screens out potentially unreliable diodes before they are assembled into completed Hi-rel mixers.

## DIMENSIONS AND CONNECTIONS




**MOUNTING BRACKET AVAILABLE ON REQUEST.** Add suffix B to part number and $1.50 to unit cost.
**CONNECTORS:** SMA (3mm) standard.

| | A | B | C | D | E | F | G | H | J |
|---|---|---|---|---|---|---|---|---|---|
| IN. | 0.88 | 0.66 | .438 | 1.50 | .312 | 2.19 | 2.50 | 0.84 | 1.15 |
| MM | 22 | 17 | 11 | 38 | 7.9 | 55.6 | 63.5 | 21 | 29 |

**CONNECTOR/TERMINAL LAYOUT**

| | Fig. A | Fig. B |
|---|---|---|
| Model No. | -2 -5 | All Models except -2 and -5 |
| LO | 1 | 1 |
| RF | 2 | 3 |
| IF | 3 | 2 |

**NOTE:** For Models ZLW-11 and ZLW-12 connector/terminal 2 is at dc ground through an inductance.

**WEIGHT** 34 grams 1.02 ounces

**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# ZLW Series
# 500 Hz to 2000 MHz

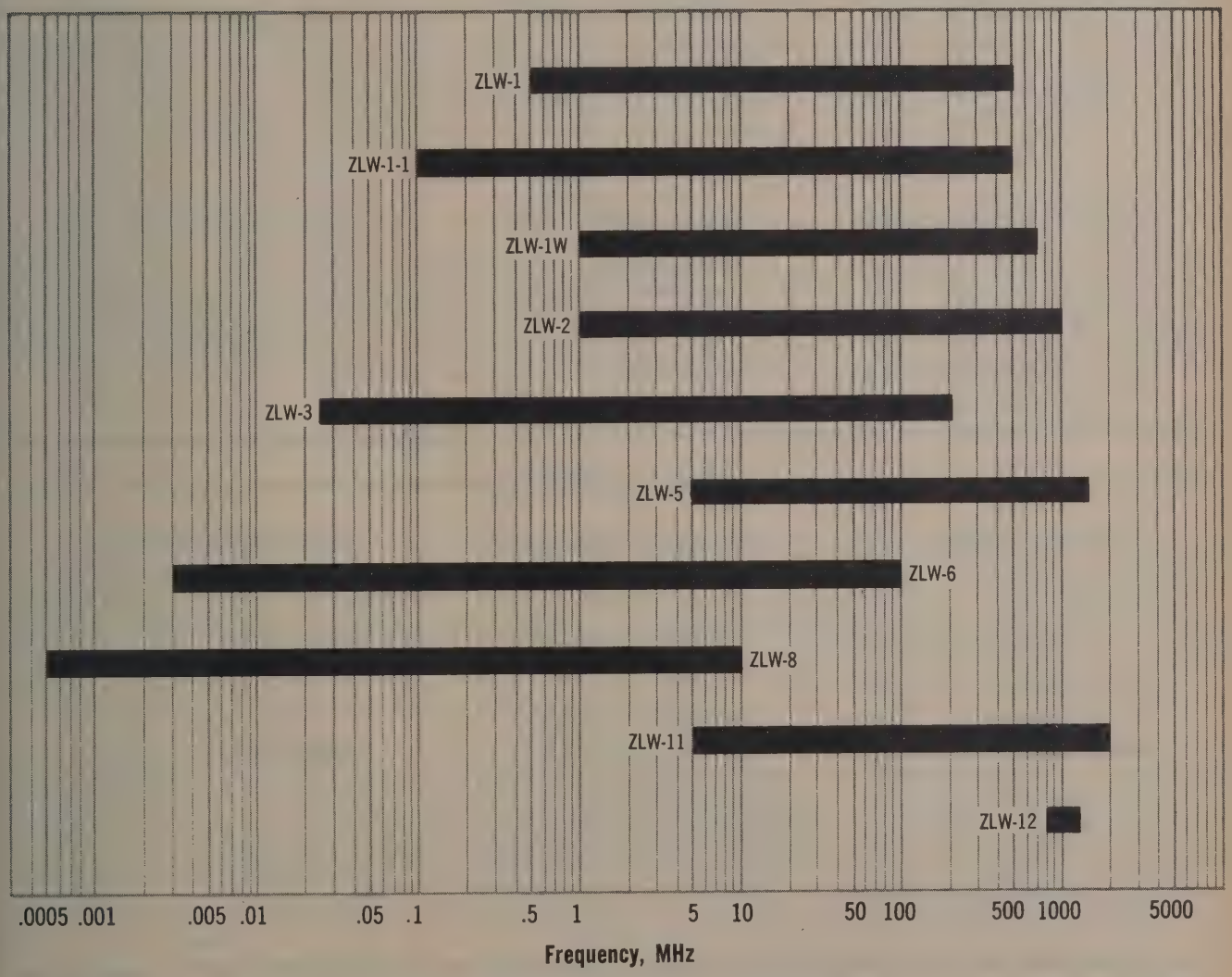
Mini-Circuits

## SPECIFICATIONS

| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Conn Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| ZLW-1 | .5-500 | .5-500 | DC-500 | 5.5 | 7.0 | 6.5 | 8.5 | 50 | 45 | 45 | 35 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. B |
| ZLW-1W | 1-750 | 1-750 | DC-750 | 5.5 | 7.5 | 6.5 | 8.5 | 50 | 45 | 45 | 30 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. B |
| ZLW-1-1 | .1-500 | .1-500 | DC-500 | 5.5 | 7.5 | 6.5 | 8.5 | 50 | 45 | 45 | 30 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. B |
| ZLW-2 | 1-1000 | 1-1000 | DC-1000 | 6.0 | 7.5 | 7.0 | 9.5 | 55 | 45 | 50 | 40 | 40 | 25 | 40 | 25 | 35 | 20 | 30 | 20 | Fig. B |
| ZLW-3 | .025-200 | .025-200 | DC-200 | 5.5 | 7.5 | 6.5 | 8.5 | 60 | 50 | 45 | 35 | 45 | 35 | 40 | 30 | 35 | 25 | 30 | 20 | Fig. B |
| ZLW-5 | 5-1500 | 5-1500 | .5-1000 | 6.5 | 7.5 | 6.5 | 8.5 | 55 | 40 | 50 | 40 | 35 | 25 | 35 | 25 | 30 | 20 | 30 | 20 | Fig. A |
| ZLW-6 | .003-100 | .003-100 | DC-100 | 5.5 | 7.5 | 6.5 | 8.5 | 60 | 50 | 60 | 45 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. B |
| ZLW-8 | .0005-10 | .0005-10 | DC-10 | 6.5 | 7.5 | 7.0 | 8.5 | 60 | 50 | 60 | 50 | 50 | 40 | 50 | 40 | 45 | 35 | 45 | 35 | Fig. B |
| ZLW-11 | 5-2000 | 5-2000 | 10-600 | 7.0 | 8.5 | 7.5 | 9.0 | 50 | 45 | 45 | 40 | 35 | 25 | 30 | 20 | 30 | 20 | 25 | 15 | Fig. B |
| ZLW-12 | 800-1250 | 800-1250 | 50-90 | — | — | 6.0 | 7.5 | Over full range — LO-IF: 30 typ. 20 min./LO-RF: 35 typ. 25 min. | | | | | | | | | | | | Fig. B |

**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +1 dBm. Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -1, 3 dB Model -1W, 3.5 dB Model -1-1, 2.5 dB Model -2, 3.5 dB Model -3, 1.5 dB Model -6, 1 dB Model -8, 1 dB.

## FREQUENCY SELECTION GUIDE




PROMPT SERVICE / ONE WEEK DELIVERY Mini-Circuits

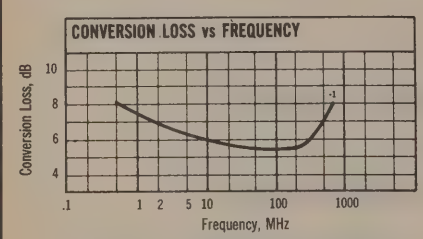
# Standard Level (+7 dBm LO)
# DOUBLE-BALANCED MIXERS

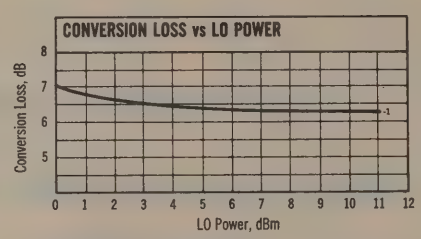
## SPECIFICATIONS

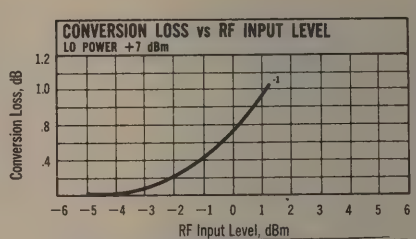
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Conn Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| ZLW-1 | .5-500 | .5-500 | DC-500 | 5.5 | 7.0 | 6.5 | 8.5 | 50 | 45 | 45 | 35 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. B |
| ZLW-1W | 1-750 | 1-750 | DC-750 | 5.5 | 7.5 | 6.5 | 8.5 | 50 | 45 | 45 | 30 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. B |
| ZLW-1-1 | .1-500 | .1-500 | DC-500 | 5.5 | 7.5 | 6.5 | 8.5 | 50 | 45 | 45 | 30 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. B |
| ZLW-2 | 1-1000 | 1-1000 | DC-1000 | 6.0 | 7.5 | 7.0 | 9.5 | 55 | 45 | 50 | 40 | 40 | 25 | 40 | 25 | 35 | 20 | 30 | 20 | Fig. B |
| ZLW-3 | .025-200 | .025-200 | DC-200 | 5.5 | 7.5 | 6.5 | 8.5 | 60 | 50 | 45 | 35 | 45 | 35 | 40 | 30 | 35 | 25 | 30 | 20 | Fig. B |

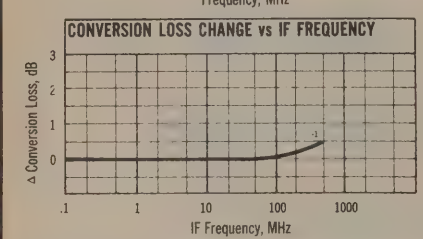
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +1 dBm. Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -1, 3 dB Model -1W, 3.5 dB Model -1-1, 2.5 dB Model -2, 3.5 dB Model -3, 1.5 dB.

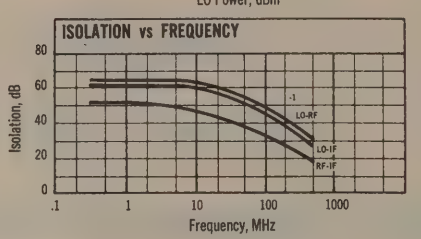
## MODEL ZLW-1

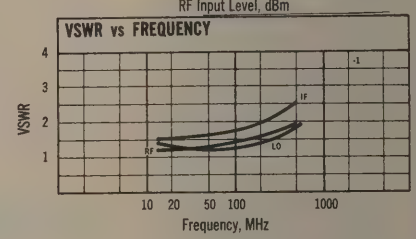


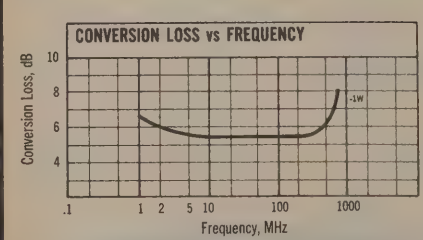



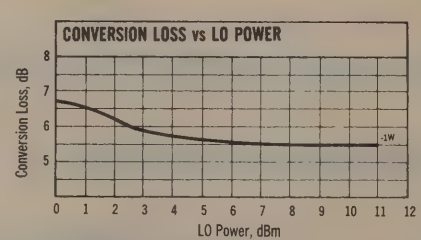



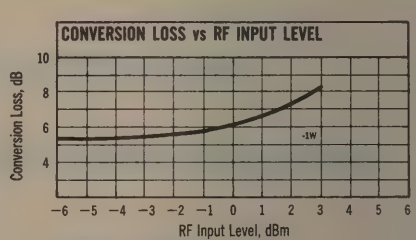



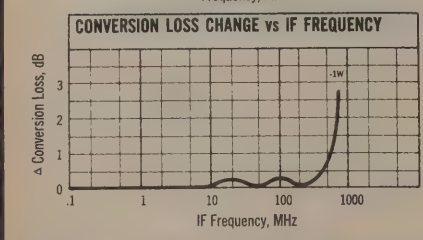



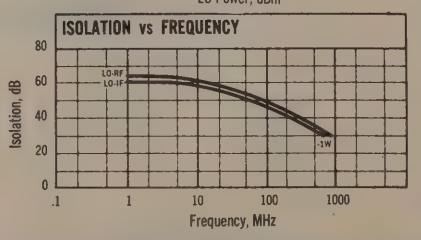

## MODEL ZLW-1W

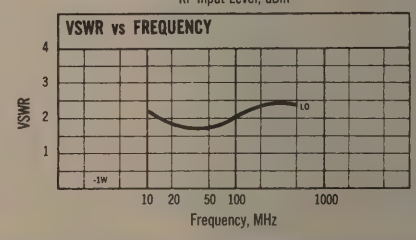


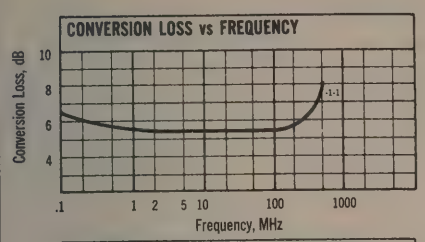



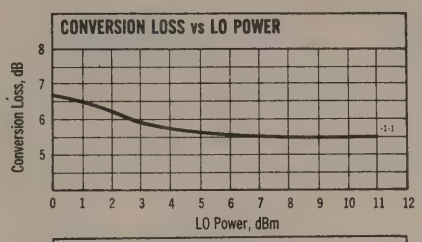

Mini-Circuits 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

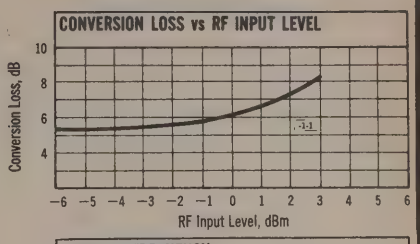
# ZLW Series
# 500 Hz to 2000 MHz

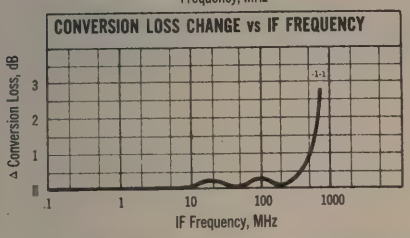
Mini-Circuits

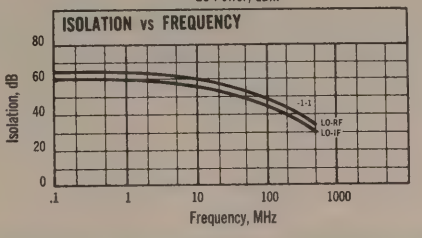
## MODEL ZLW-1-1

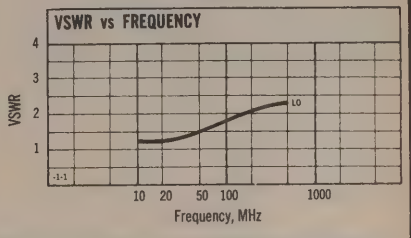


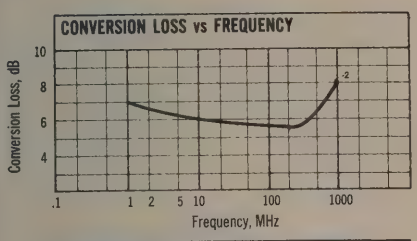



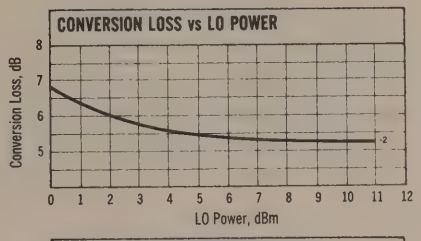



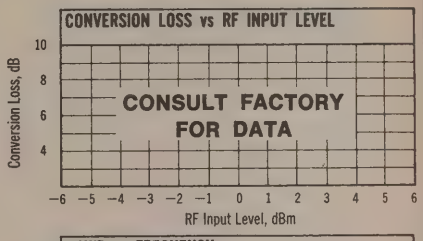



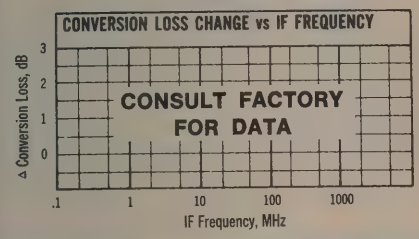



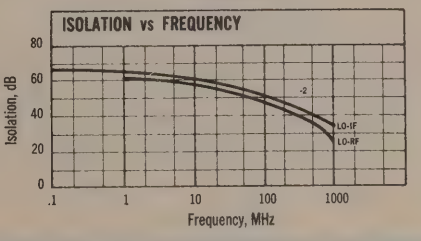

## MODEL ZLW-2

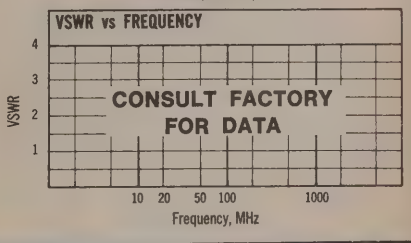


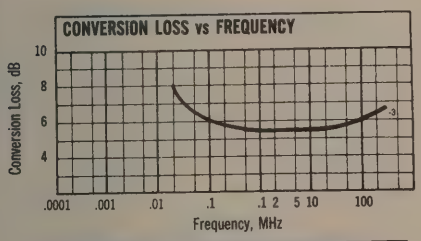



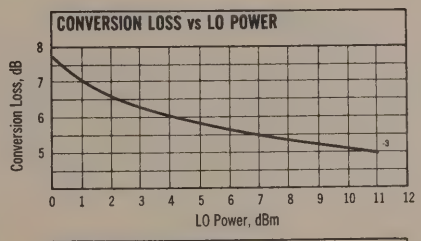



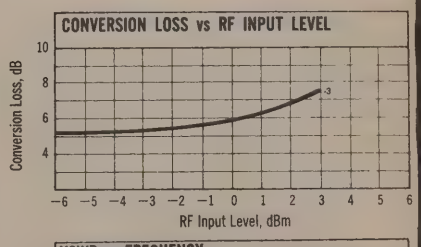



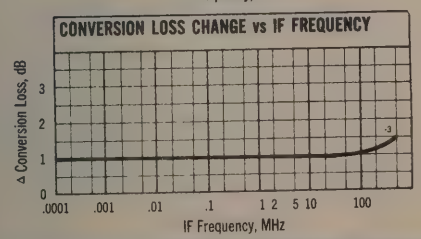



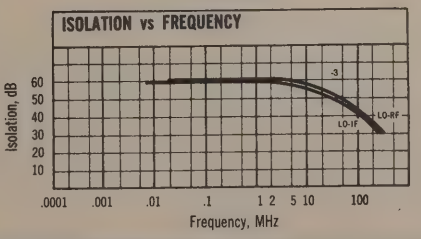

## MODEL ZLW-3

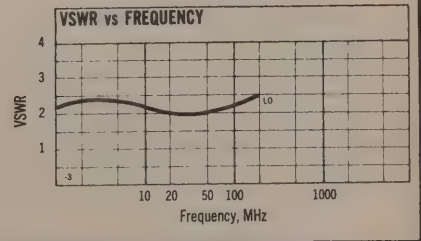



**PROMPT SERVICE / ONE WEEK DELIVERY** Mini-Circuits

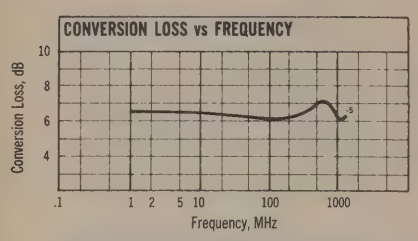
# Standard Level (+7 dBm LO) DOUBLE-BALANCED MIXERS

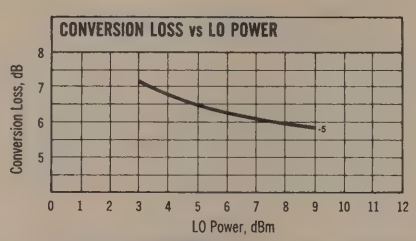
## SPECIFICATIONS

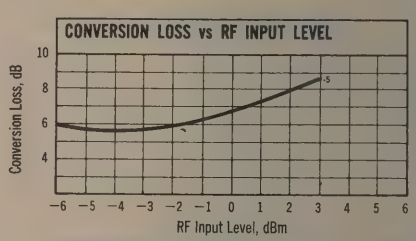
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Conn Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| ZLW-5 | 5-1500 | 5-1500 | .5-1000 | 6.5 | 7.5 | 6.5 | 8.5 | 55 | 40 | 50 | 40 | 35 | 25 | 35 | 25 | 30 | 20 | 30 | 20 | Fig. A |
| ZLW-6 | .003-100 | .003-100 | DC-100 | 5.5 | 7.5 | 6.5 | 8.5 | 60 | 50 | 60 | 45 | 45 | 30 | 40 | 25 | 35 | 25 | 30 | 20 | Fig. B |
| ZLW-8 | .0005-10 | .0005-10 | DC-10 | 6.5 | 7.5 | 7.0 | 8.5 | 60 | 50 | 60 | 50 | 50 | 40 | 50 | 40 | 45 | 35 | 45 | 35 | Fig. B |
| ZLW-11 | 5-2000 | 5-2000 | 10-600 | 7.0 | 8.5 | 7.5 | 9.0 | 50 | 45 | 45 | 40 | 35 | 25 | 30 | 20 | 30 | 20 | 25 | 15 | Fig. B |
| ZLW-12 | 800-1250 | 800-1250 | 50-90 | — | — | 6.0 | 7.5 | Over full range — LO-IF: 30 typ. 20 min./LO-RF: 35 typ. 25 min. | | | | | | | | | | | | Fig. B |

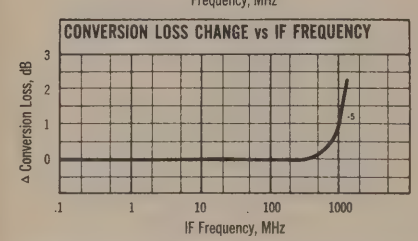
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +1 dBm. Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -6, 1 dB Model -8, 1 dB.

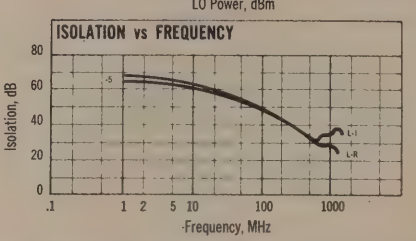
## MODEL ZLW-5

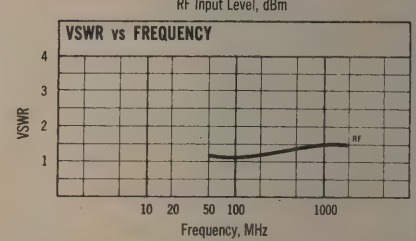


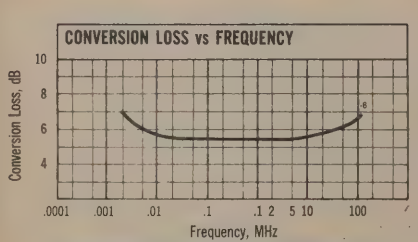



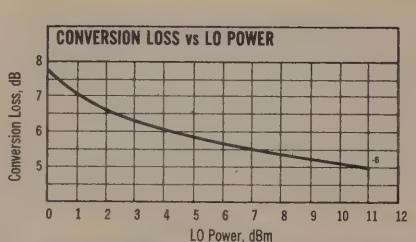



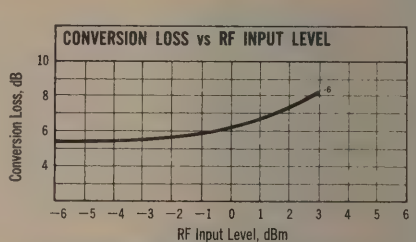



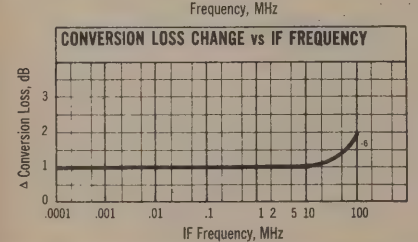



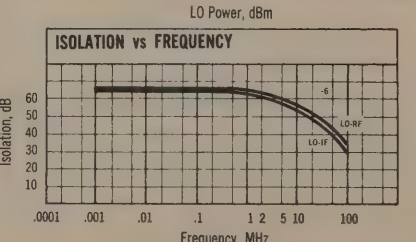

## MODEL ZLW-6

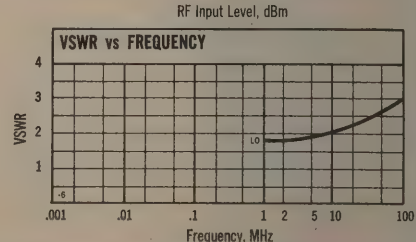


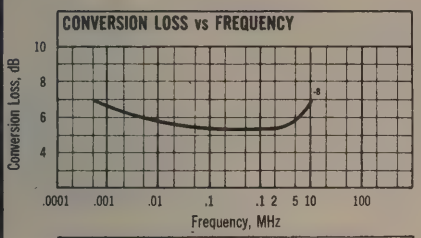



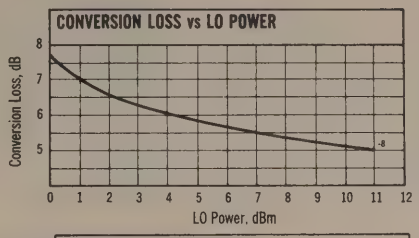

**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

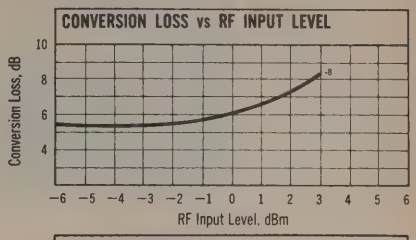
# ZLW Series
# 500 Hz to 2000 MHz

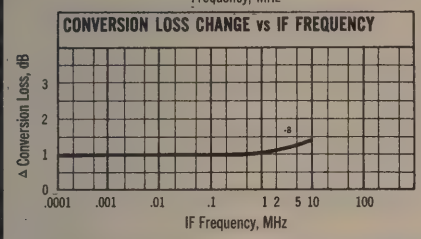
Mini-Circuits

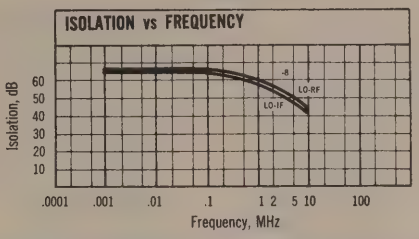
## MODEL ZLW-8

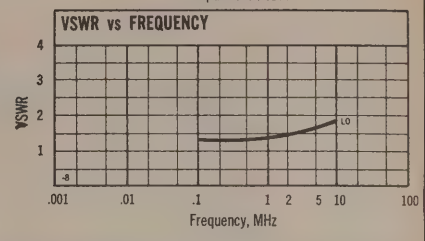


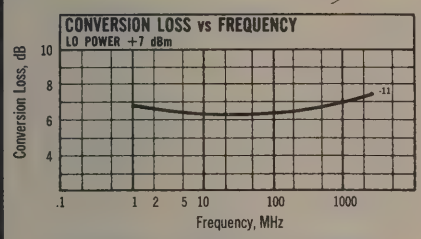



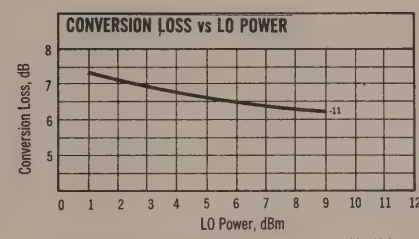



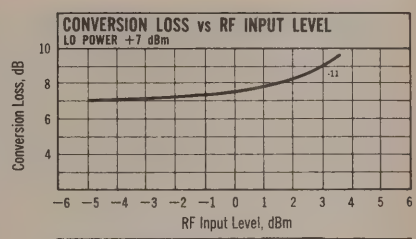



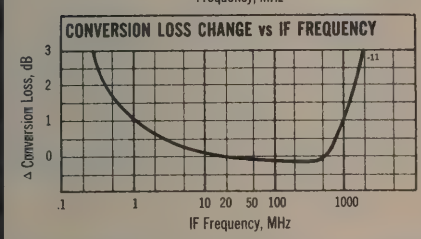



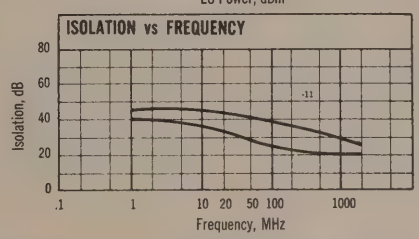

## MODEL ZLW-11

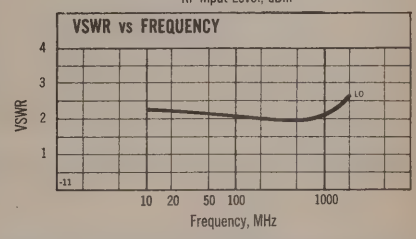


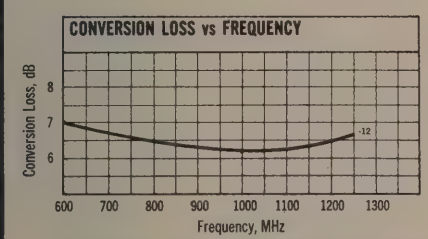



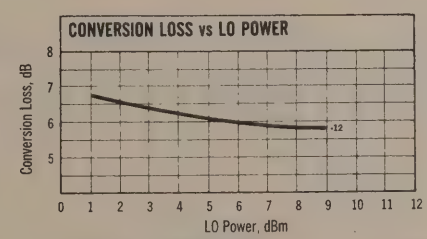



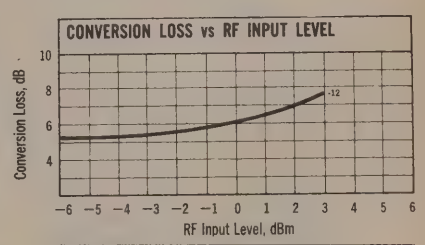



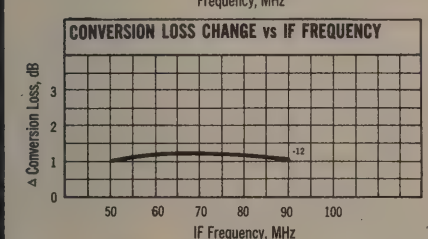



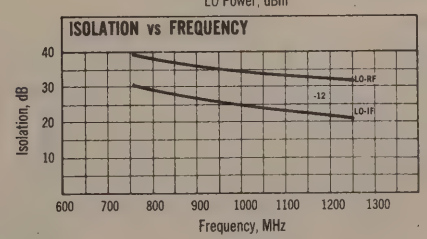

## MODEL ZLW-12

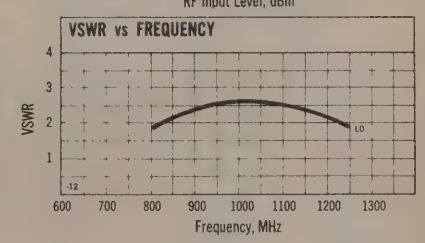


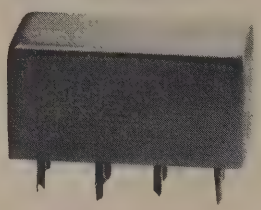




PROMPT SERVICE / ONE WEEK DELIVERY Mini-Circuits

# High Level (+17 dBm LO) DOUBLE-BALANCED MIXERS

## SRA-H SERIES



| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| * SRA-1H | 0.5 MHz-500 MHz | 50 | $15.95 (5-24) |
| * SRA-1WH | 1 MHz-750 MHz | 50 | $19.95 (5-24) |
| SRA-2H | 2 MHz-1000 MHz | 50 | $29.95 (5-24) |
| * SRA-3H | 50 KHz-200 MHz | 50 | $17.95 (5-24) |
| SRA-11H | 10 MHz-3000 MHz | 50 | $49.95 (1-24) |
| NATIONAL STANDARDS NUMBER | SRA-1H | NSN-6625-00-594-0223 | |
| | SRA-1WH | NSN-5840-00-576-0716 | |

**DESCRIPTION** — Having a volume of only 0.1 cu. inches, the SRA-H series covers a broad frequency range from 50 KHz to 3000 MHz. Designed to solve severe intermodulation distortion problems, the SRA-H series offers linear operation up to +10 dBm signal input at only 1 dB of compression. Reducing all higher order signal harmonic IMD, the SRA-H series provides a conversion loss of typically 6 dB and isolation of greater than 40 dB.

Packaged within an RFI shielded metal enclosure and hermetically sealed header, this tiny unit has its 8 pins located on a 0.2 inch grid. Unit weight is .18 ounces (5.2 grams).

Internal components include well matched hot-carrier diodes and very broadband, low distortion transformers. Supported with silicone rubber, the SRA-H series withstands high shock, vibration and acceleration environments.

### FEATURES

**Broadband:** 50 KHz to 3000 MHz
**Low Conversion Loss:** typically less than 6 dB
**High Isolation:** typically greater than 40 dB
**Miniature:** 0.128 in.$^3$, 0.4" x 0.8" PC area, 0.4" high
**High Reliability:** 100% tested, 2 year guarantee SRA-1H, -1WH, -3H, 1 year guarantee all other models
**Low Cost:** as low as $15.95 in small quantity

### APPLICATIONS

- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Bi-phase modulation

### ABSOLUTE MAXIMUM RATINGS

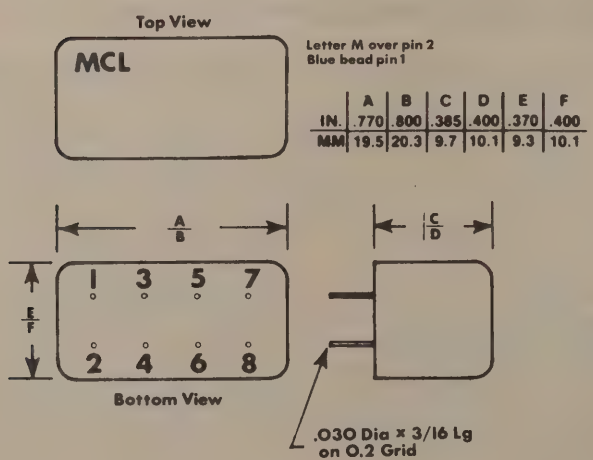
- **Input Power:** 500 mW
- **Peak IF Input Current:** 40 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Pin Temperature:** (10 sec.) 510°F
- **Environmental Specifications:** See Index Page

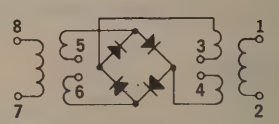
### *HTRB TESTING MODELS SRA-1H, SRA-1WH, SRA-3H

Schottky-diodes selected for high-reliability mixer service are deliberately stressed to accelerate aging and thus force temperature related failure modes to take their toll. In the HTRB (High Temperature Reverse Bias) technique, the diode is operated at 168 hours at 150°C with 1-V reverse bias applied.

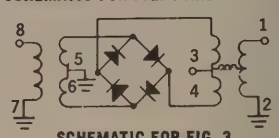
In conventional testing, or "baking", the diode does not experience anywhere near the stress encountered with the HTRB program. Thus, the HTRB process screens out potentially unreliable diodes before they are assembled into completed Hi-rel mixers.

### DIMENSIONS AND CONNECTIONS




SCHEMATIC FOR FIG. 1 AND FIG. 2




SCHEMATIC FOR FIG. 3

PIN LAYOUTS

| | Fig. 1 | Fig. 2 | Fig. 3 |
|---|---|---|---|
| Model No. | -1H -3H | -1WH -2H | -11H |
| LO | 8 | 8 | 8 |
| RF | 1 | 1 | 1 |
| IF | 3,4 | 3,4 | 3 |
| Ground | 2,5,6,7 | 2,5,6,7 | 2,5,6,7 |
| Case Ground | 2 | 2,5,6,7 | 2,5,6,7 |

NOTE: PINS 3 AND 4 MUST BE CONNECTED TOGETHER EXCEPT FOR FIG. 3 IN WHICH PIN 4 IS PRESENT, BUT UNUSED.

**WEIGHT** 5.2 grams .18 ounces

**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# SRA-H Series
# 50 KHz to 3000 MHz

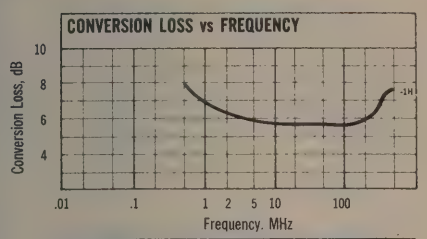
Mini-Circuits

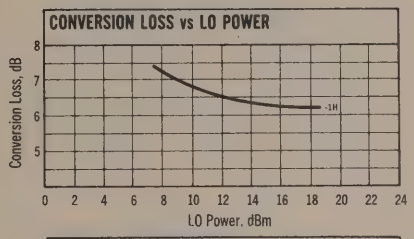
## SPECIFICATIONS

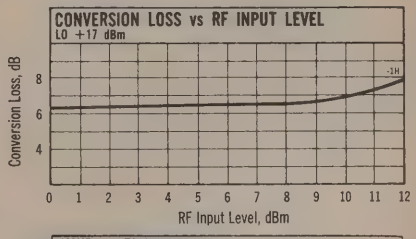
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Pin Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| SRA-1H | .5-500 | .5-500 | DC-500 | 5.5 | 7.5 | 6.5 | 8.5 | 55 | 45 | 45 | 35 | 45 | 30 | 40 | 30 | 35 | 25 | 30 | 20 | Fig. 1 |
| SRA-1WH | 1-750 | 1-750 | DC-750 | 5.5 | 7.5 | 6.5 | 8.5 | 50 | 40 | 45 | 35 | 45 | 25 | 40 | 20 | 35 | 25 | 30 | 20 | Fig. 2 |

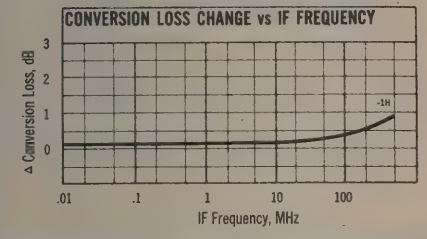
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +10 dBm. Impedance (all ports), 50 ohms. DC offset, 1.5 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -1H, 3.5 dB Model -1WH, 3.5 dB

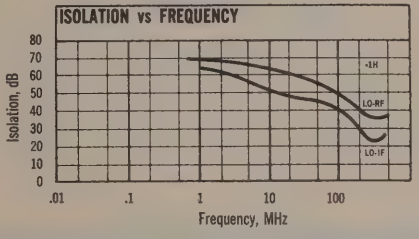
## MODEL SRA-1H

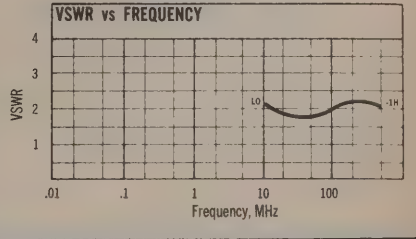


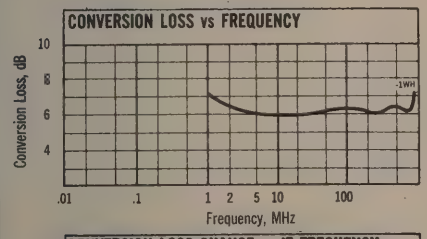



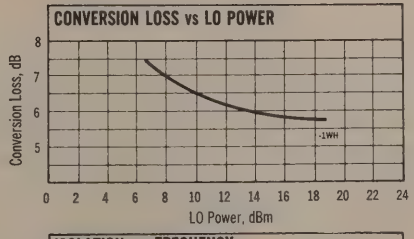



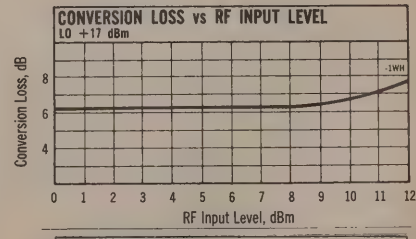



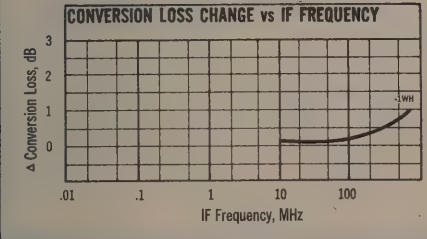



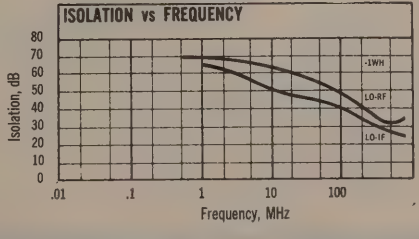

## MODEL SRA-1WH

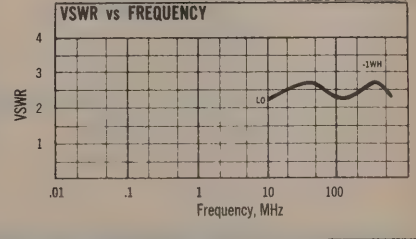


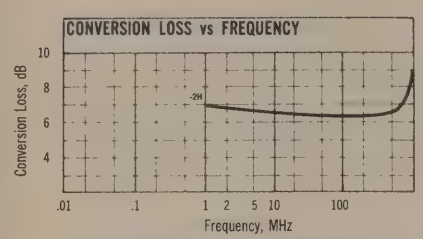
# High Level (+17 dBm LO) DOUBLE-BALANCED MIXERS

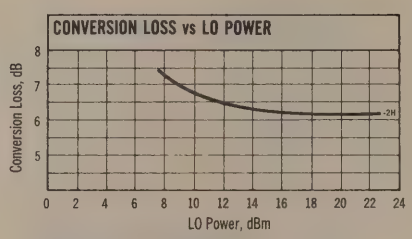
## SPECIFICATIONS

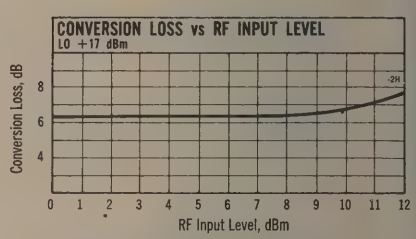
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Pin Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| SRA-2H | 2-1000 | 2-1000 | DC-1000 | 6.0 | 7.5 | 8.5 | 10.0 | 50 | 40 | 45 | 35 | 35 | 25 | 30 | 20 | 35 | 25 | 25 | 20 | Fig. 2 |
| SRA-3H | .05-200 | .05-200 | DC-200 | 5.5 | 7.0 | 5.5 | 7.5 | 55 | 45 | 45 | 35 | 45 | 30 | 40 | 30 | 35 | 25 | 30 | 20 | Fig. 1 |
| SRA-11H | 10-3000 | 10-3000 | 10-1000 | 8 | 10 | 10 | 12 | 27 | 20 | 27 | 20 | 25 | 18 | 25 | 18 | 23 | 16 | 23 | 16 | Fig. 3 |

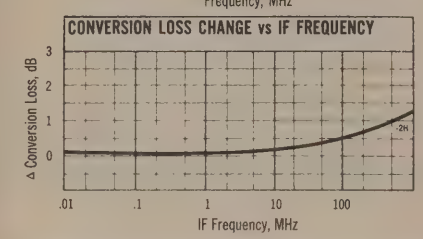
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +10 dBm. Impedance (all ports), 50 ohms. DC offset, 1.5 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -2H, 5 dB Model -3H, 2 dB

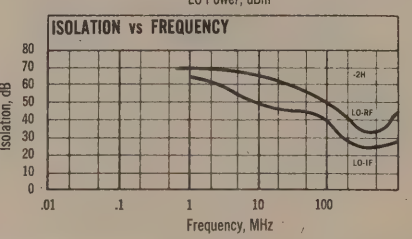
## MODEL SRA-2H

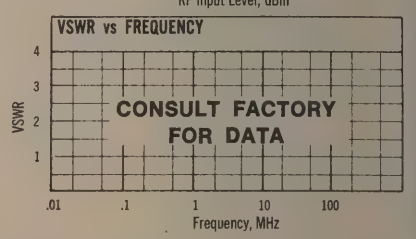



# *SUPER MIXERS*

Be sure to check the specs on the exciting new Super Mixers with

**ULTRA-LOW DISTORTION**

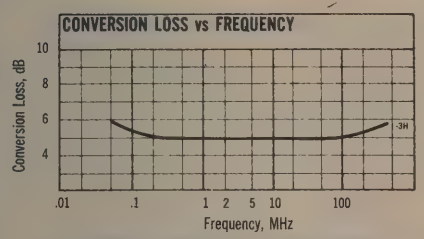
*SERIES TAK-H* ..... *p. 58*
*SERIES TFM-H* ..... *p. 56*
*SERIES ZFM-H* ..... *p. 68*
*SERIES ZAD-SH* ..... *p. 70*
*SERIES ZLW-SH* ..... *p. 72*

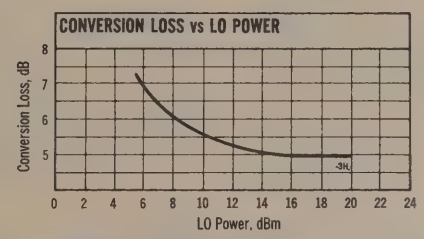
**Offered for the first time in this catalog.**

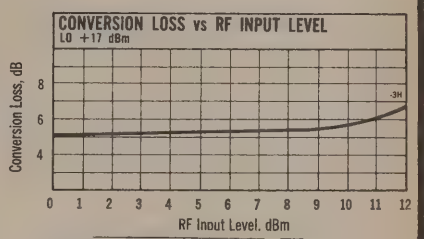
# SRA-H Series
# 50 KHz to 3000 MHz

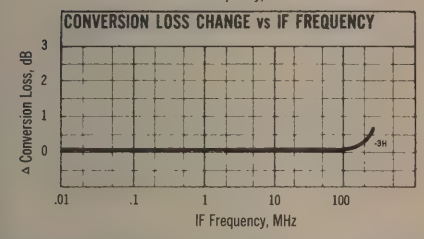
Mini-Circuits

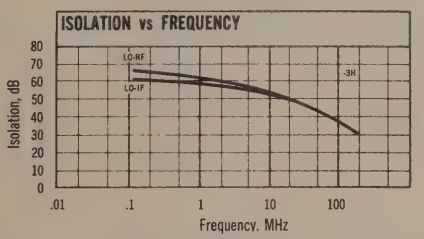
## MODEL SRA-3H

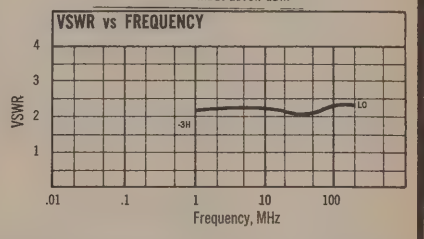


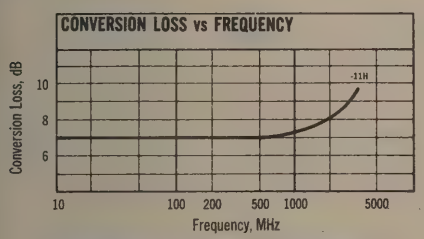



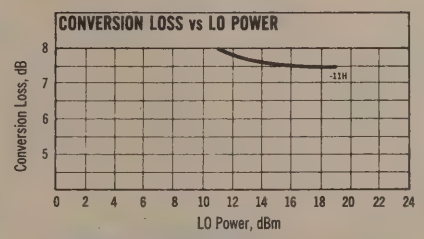



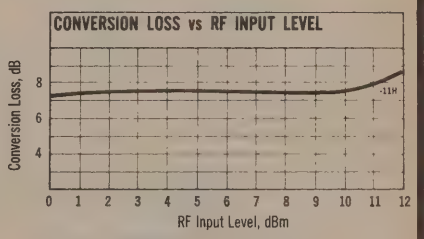



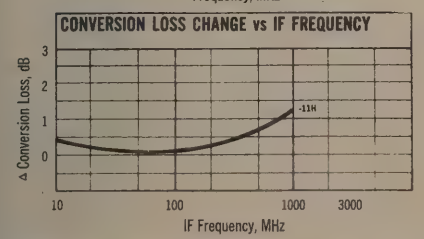



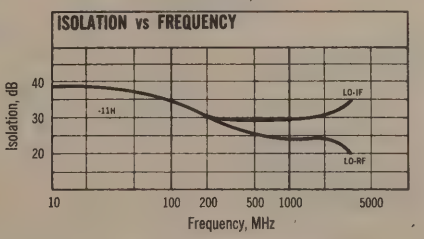

## MODEL SRA-11H

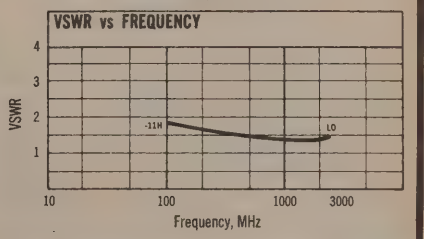


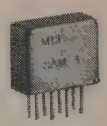




PROMPT SERVICE / ONE WEEK DELIVERY Mini-Circuits

# High Level (+17 dBm LO) DOUBLE-BALANCED MIXERS

## SAM-H SERIES



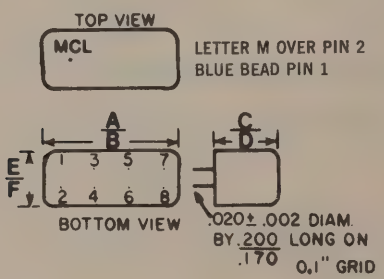
| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| SAM-1H | 1 MHz-600 MHz | 50 | $19.95 (5-24) |
| SAM-2H | 5 MHz-1000 MHz | 50 | $34.95 (1-24) |
| SAM-3H | 0.1 MHz-500 MHz | 50 | $19.95 (5-24) |

**DESCRIPTION** — Representing a performance and price breakthrough in microminiature double balanced mixers, the SAM-H series covers the frequency range 100 KHz to 1000 MHz. Although smaller than mixers presently available, the SAM-H series offers extra wide bandwidth, low conversion loss, and high isolation. These tiny units have isolation of greater than 55 dB and conversion loss of 6.0 dB. The SAM-H units require less PC area than a flatpack or TO-5 can. Unit weight is .07 ounces (1.9 grams).

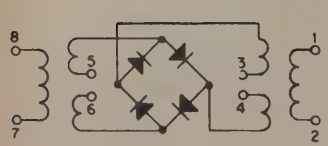
Packaged within an EMI shielded metal enclosure and hermetically sealed header (enclosure is 0.5 by 0.2 by 0.4 in.) the SAM-H series exhibits a typical noise figure of just ½ to 1 dB greater than its conversion loss. Its pins are oriented on a 0.1 inch grid for printed circuit board mounting.

Only well matched hot-carrier diodes and rugged transmission line transformers are used. Internally, silicone rubber is incorporated as an insulator against any wire shorts and to provide protection against shock and vibration.

## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| IN. | .500 | .480 | .405 | .390 | .230 | .210 |
| MM | 12.7 | 12.2 | 10.3 | 9.9 | 5.6 | 5.3 |




**PIN LAYOUTS**

| | Fig. 1 | Fig. 4 |
|---|---|---|
| Model No. | -1H<br>-3H | -2H |
| LO | 8 | 8 |
| RF | 1 | 1 |
| IF | 3,4 | 3,4 |
| Ground | 2,5,6,7 | 2,5,6,7 |
| Case Ground | 2 | 2,5,6,7 |

NOTE: PINS 3 AND 4 MUST BE CONNECTED TOGETHER

**WEIGHT** 1.9 grams .07 ounces

## FEATURES

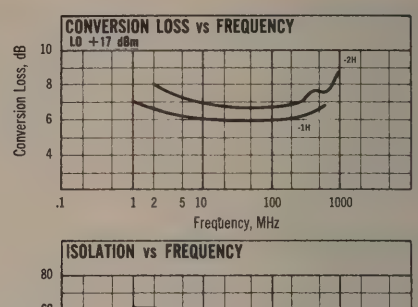
**Broadband:** .1 MHz to 1000 MHz
**Low Conversion Loss:** typically less than 5.5 dB
**High Isolation:** typically greater than 55 dB
**Microminiature:** 0.04 in.³, 0.5″ x 0.23″ PC area, 0.4″ high
**High Reliability:** 100% tested, 1 year guarantee
**Low Cost:** as low as $19.95 in small quantity

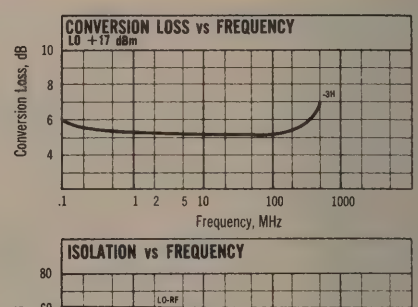
## APPLICATIONS

- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Bi-phase modulation

## ABSOLUTE MAXIMUM RATINGS

- **Input Power:** 100 mW
- **Peak IF Input Current:** 40 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Pin Temperature:** (10 sec.) 510°F
- **Environmental Specifications:** See Index Page




**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# SAM-H Series
# .1 MHz to 1000 MHz

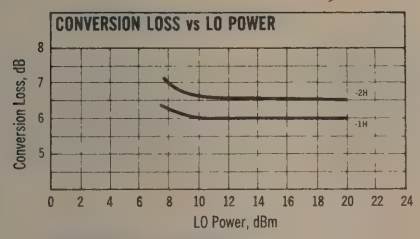
Mini-Circuits

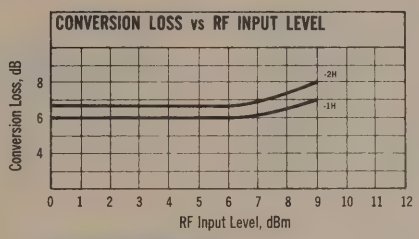
## SPECIFICATIONS

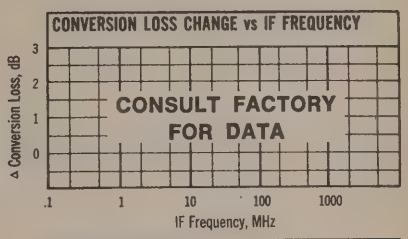
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Pin Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| SAM-1H | 1-600 | 1-600 | DC-600 | 6.0 | 7.5 | 6.5 | 8.5 | 55 | 45 | 50 | 40 | 40 | 25 | 35 | 25 | 35 | 20 | 30 | 20 | Fig. 1 |
| SAM-2H | 5-1000 | 5-1000 | DC-1000 | 6.7 | 8.0 | 7.5 | 9.5 | 55 | 45 | 50 | 40 | 40 | 25 | 35 | 20 | 35 | 20 | 25 | 15 | Fig. 2 |
| SAM-3H | .1-500 | .1-500 | DC-500 | 5.5 | 7.0 | 6.5 | 8.0 | 55 | 45 | 50 | 40 | 40 | 25 | 35 | 20 | 30 | 20 | 20 | 15 | Fig. 1 |

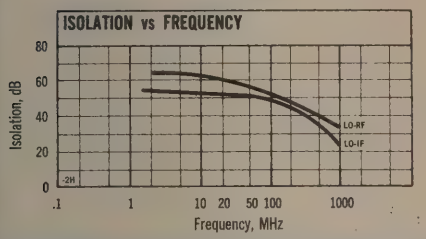
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +7 dBm. Impedance (all ports), 50 ohms. DC offset, 2 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -1H, 3.5 dB Model -2H, 5 dB Model -3H, 2.5 dB

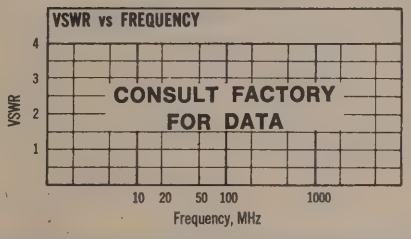
## MODELS SAM-1H, SAM-2H

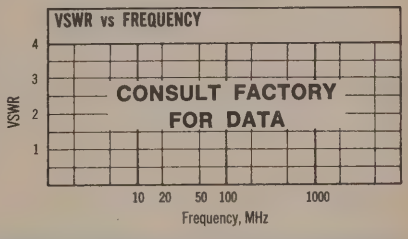


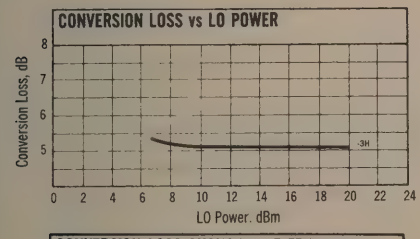



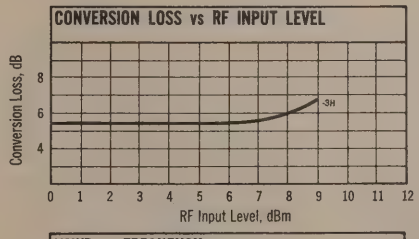



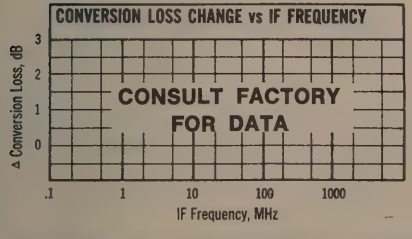



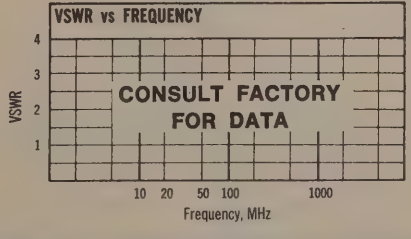




## MODEL SAM-3H



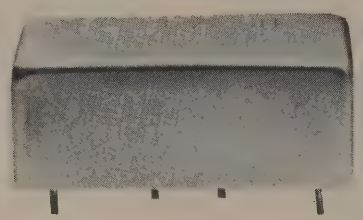




*PROMPT SERVICE / ONE WEEK DELIVERY* Mini-Circuits

# High Level (+17 dBm LO) DOUBLE-BALANCED MIXERS

## GRA-H SERIES



| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| GRA-1H | 0.5 MHz-500 MHz | 50 | $16.95 (5-24) |
| GRA-3H | 50 KHz -200 MHz | 50 | $18.95 (5-24) |

**DESCRIPTION** — The high level GRA-H series covers a broad frequency range from 500 Hz to 500 MHz. Designed to solve severe intermodulation distortion problems, the GRA-H series offers linear operation up to +10 dBm signal input at only 1 dB of compression. Reducing all higher order signal harmonic IMD, the GRA-H series provides a conversion loss of typically 6 dB and isolation of greater than 40 dB.

Packaged within an RFI shielded metal enclosure and hermetically sealed header, this tiny unit has its 6 pins located for exact replacement in existing designs for models shown in table.

Ruggedness and durability are built-in features. Internal components include well matched hot-carrier diodes and very broad band, low distortion transformers. Supported with silicone rubber, the GRA-H series withstands high shock, vibration and acceleration environments.

Naturally our 1 year guarantee applies to these units.

## FEATURES

**Broadband:** 500 Hz to 500 MHz
**Low Conversion Loss:** typically less than 6 dB
**High Isolation:** typically greater than 40 dB
**Low Profile:** 0.128 in.$^3$, 1.0″ x 0.5″ PC area, 0.39″ high
**High Reliability:** 100% tested, 1 year guarantee
**Low Cost:** as low as $16.95 in small quantity

## APPLICATIONS

- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Bi-phase modulation

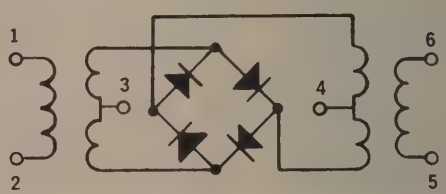
## ABSOLUTE MAXIMUM RATINGS

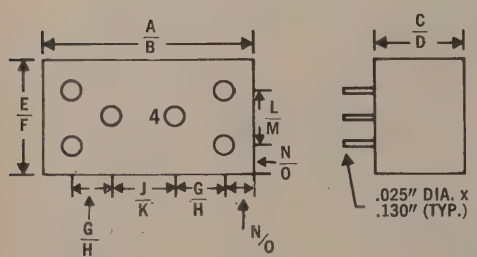
- **Input Power:** 50 mW
- **Peak IF Input Current:** 40 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Pin Temperature:** (10 sec.) 510°F
- **Environmental Specifications:** See Index Page

## REPLACEMENT TABLE

| Use Mini-Circuits Model | To Replace |
|---|---|
| GRA-1H | M9B, M9C |
| GRA-3H | M9A, M9AC |

## DIMENSIONS AND CONNECTIONS




**PIN LAYOUT**

| Model No. | Fig. 1 -1H -3H |
|---|---|
| LO | 1 |
| RF | 6 |
| IF | 4 |
| Ground | 2,3,5 |

| | A | B | C | D | E | F | G | H | J | K | L | M | N | O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IN. | 1.025 | 1.00 | .43 | .39 | .525 | .5 | .305 | .295 | .205 | .195 | .305 | .295 | .13 | .090 |
| MM | 26.04 | 25.4 | 10.9 | 9.9 | 13.33 | 12.7 | 7.75 | 7.49 | 5.21 | 4.95 | 7.75 | 7.49 | 3.30 | 2.29 |

**WEIGHT** 8.6 grams .3 ounces

# GRA-H Series
## 50 KHz to 500 MHz

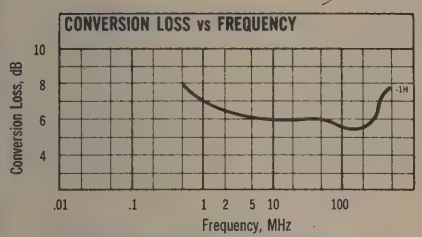
Mini-Circuits

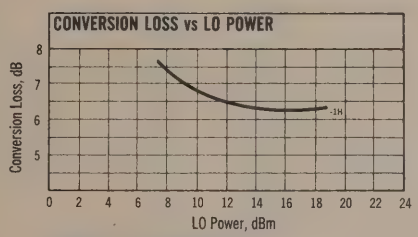
## SPECIFICATIONS

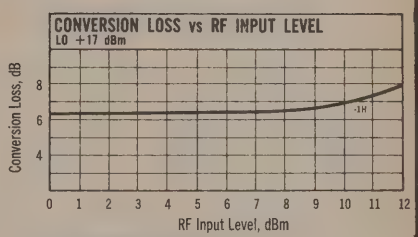
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Pin Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| GRA-1H | .5-500 | .5-500 | DC-500 | 5.5 | 7.5 | 6.5 | 8.5 | 55 | 45 | 45 | 35 | 45 | 30 | 40 | 30 | 35 | 25 | 30 | 20 | Fig. 1 |
| GRA-3H | .05-200 | .05-200 | DC-200 | 5.5 | 7.0 | 5.5 | 7.5 | 55 | 45 | 45 | 35 | 45 | 30 | 40 | 30 | 35 | 25 | 30 | 20 | Fig. 1 |

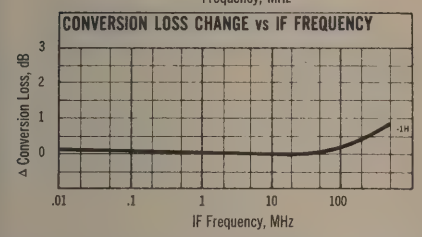
**COMMON SPECIFICATIONS:** Signal, 1 dB compression point, +10 dBm. Impedance (all ports), 50 ohms. DC offset, 1.5 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -1H, 3.5 dB Model -3H, 2 dB

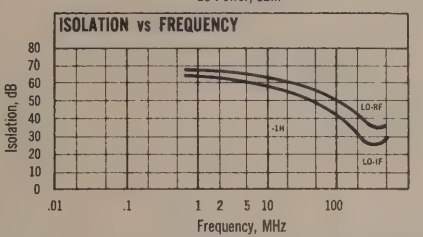
## MODEL GRA-1H

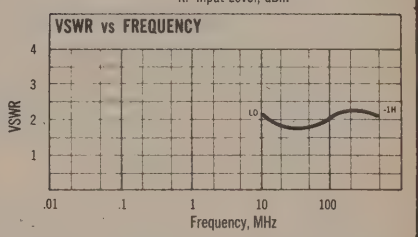


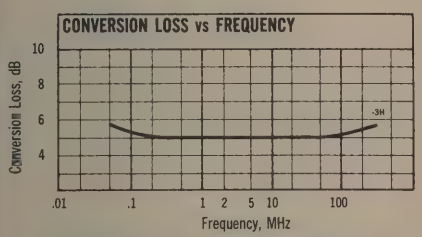



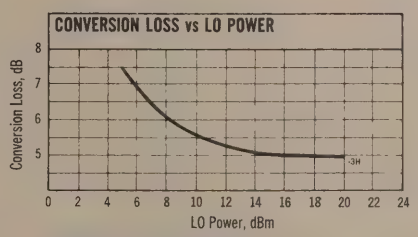



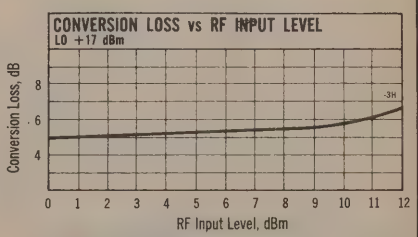



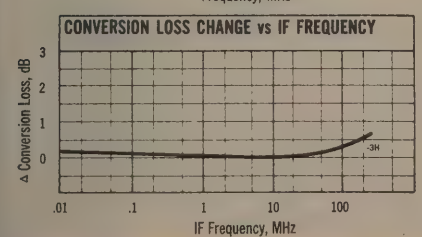



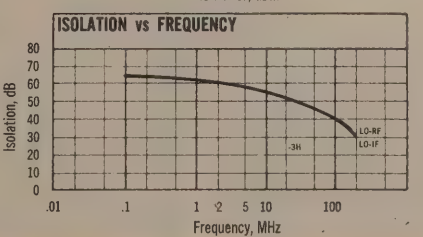

## MODEL GRA-3H

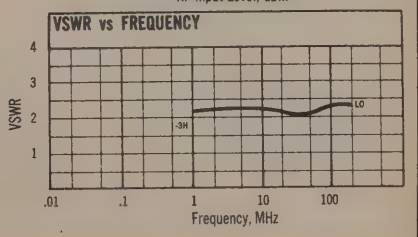


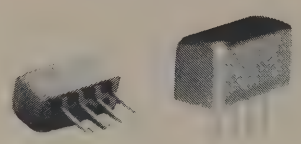



# High Level (+17dBm LO) DOUBLE-BALANCED MIXERS

SUPER LOW DISTORTION

## TFM-H SERIES



| MODEL | FREQUENCY | Z(Ohms) | COST |
|---|---|---|---|
| TFM-1H | 2 - 500 MHz | 50 | $23.95 (5-24) |
| TFM-2H | 5 - 1000 MHz | 50 | $31.95 (5-24) |
| TFM-3H | 0.1 - 250 MHz | 50 | $23.95 (5-24) |

**DESCRIPTION** —These new super low distortion mixers represent the new generation of high performance mixers. The TFM-H series are the only units in the world offering a guaranteed 55 dB intermod. spec. in a microminiature package — at only $23.95.

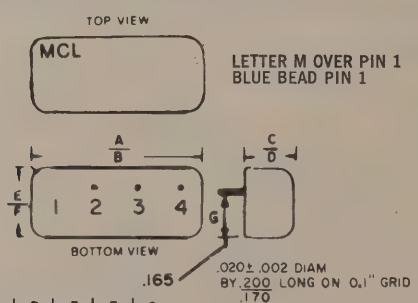
The TFM-H units require less PC area than a flatpack or TO-5 features wide bandwidth, isolation greater than 55 dB and conversion loss of 6 dB.

The TFM units require less PC area than a flatpack or TO-5 can. Take advantage of the mounting versatility — plug it upright on a PC board or mount it sideways as a flatpack. Simplify PC layout and reduce board connections with the TFM-H series . . . **only four pins have to be wired.**

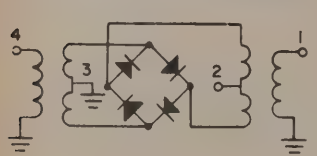
Packaged within an EMI shielded metal enclosure and hermetically sealed header, a typical noise figure is just ½ to 1 dB greater than its conversion loss. Its pins are oriented on a 0.1 inch grid for PC board mounting.

One year guarantee, of course.

## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| IN. | .480 | .500 | .240 | .250 | .210 | .230 | .165 |
| MM | 12.2 | 12.7 | 6.00 | 6.40 | 5.30 | 5.80 | 4.10 |




**PIN LAYOUTS**

| Model No. | Fig. 1 -1H -2H -3H |
|---|---|
| LO | 4 |
| RF | 1 |
| IF | 2 |
| Case Ground | 3 |

**WEIGHT** 1.8 grams 0.07 ounces

**FEATURES**

**Broadband:** 0.1 MHz to 1000 MHz
**Ultra-Low Distortion:** 1 dB compression at +15 dBm
**Low Conversion Loss:** Typically less than 6 dB
**High Isolation:** Typically greater than 55 dB
**Micro-Miniature:** 0.025 in³, 0.5″ x 0.23″ PC area, 0.25″ high
**Low Cost:** As low as $23.95 in small quantity.

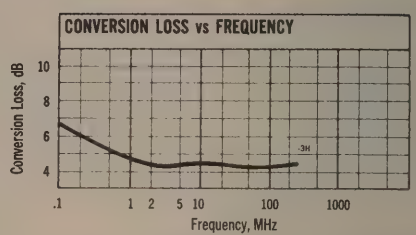
**APPLICATIONS**

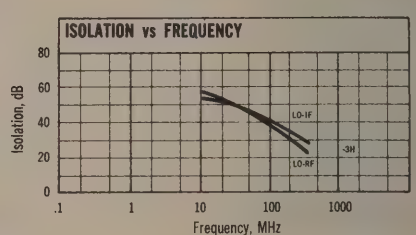
- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Fast switching
- Bi-phase modulation

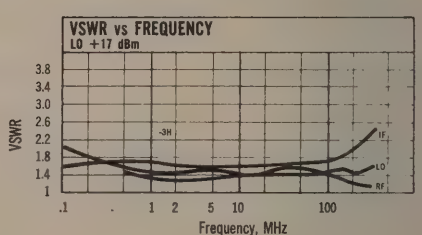
**ABSOLUTE MAXIMUM RATINGS**

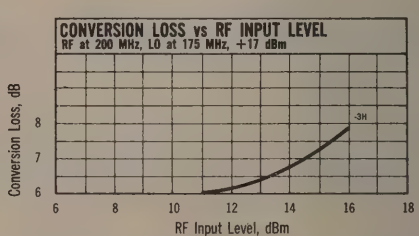
- **Input Power:** 100 mW
- **Peak IF Input Current:** 20 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Pin Temperature:** (10 sec.) 510°F
- **Environmental Specifications:** See Index Page

## MODEL TFM-3H




Mini-Circuits 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# TFM-H Series
# 0.1 to 1000 MHz

Mini-Circuits

## SPECIFICATIONS

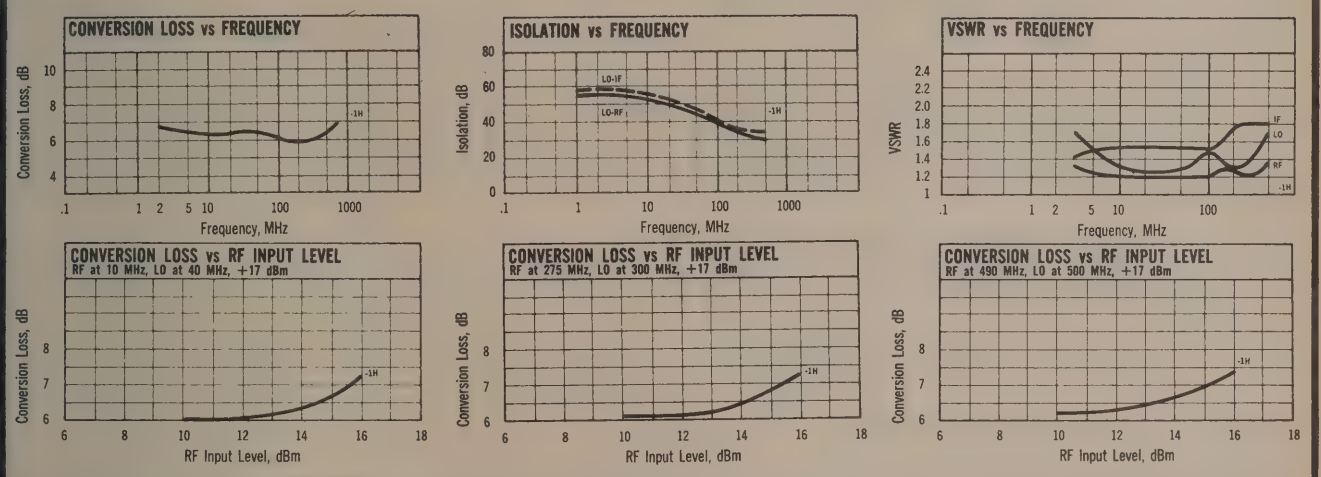
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Pin Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| TFM-1H | 2-500 | 2-500 | DC-500 | 6.0 | 7.5 | 7.0 | 8.5 | 50 | 45 | 45 | 40 | 40 | 30 | 35 | 25 | 30 | 20 | 25 | 20 | Fig. 1 |
| TFM-2H | 5-1000 | 5-1000 | DC-1000 | 6.2 | 7.0 | 7.0 | 10 | 50 | 45 | 45 | 40 | 40 | 30 | 35 | 25 | 30 | 20 | 25 | 17 | Fig. 1 |
| TFM-3H | .1-250 | .1-250 | DC-250 | 5.0 | 7.0 | 6.0 | 8.5 | 50 | 45 | 45 | 40 | 40 | 30 | 35 | 25 | 28 | 23 | 26 | 20 | Fig. 1 |

**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +14 dBm (Models -1H, -2H), +13 dBm (Model -3H). Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, negative.

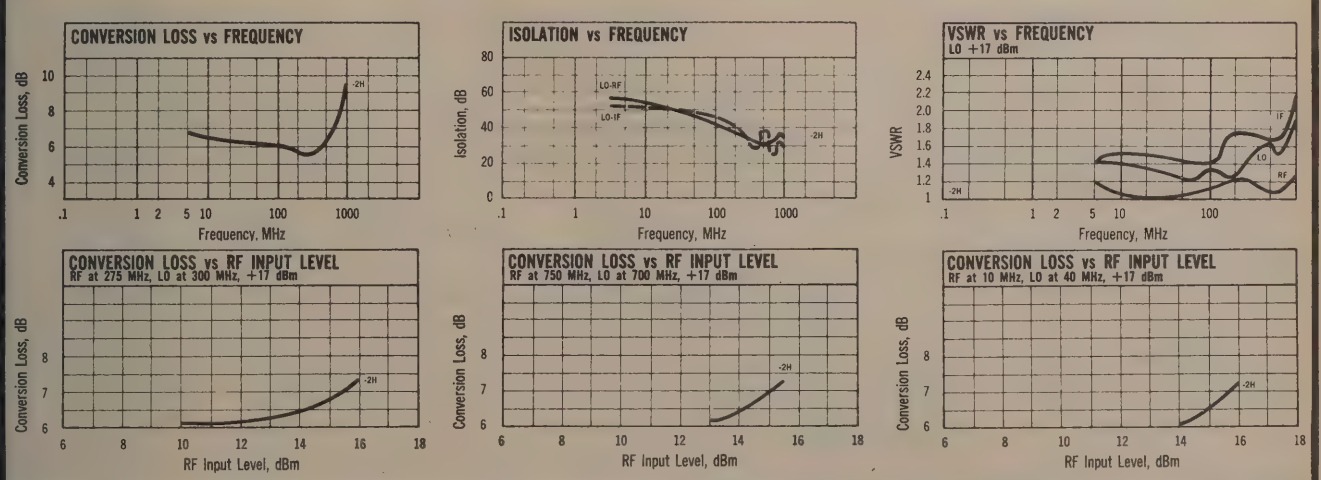
**VSWR:** Models -1H, -2H, LO (1.8 typ) RF (1.3 typ) IF (1.7 typ)
Model -3H, LO (1.5 typ) RF (1.5 typ) IF (1.8 typ)

**Two-tone, 3rd Order IM:** RF input, 2 tones each at 0 dBm, 200 MHz and 202 MHz. LO at +17 dBm, 180 MHz. IM level below desired IF is 60 dB typ, 55 dB min (Models -1H, -2H) and 45 dB min (Model -3H).

## MODEL TFM-1H




## MODEL TFM-2H



# High Level (+17dBm LO) DOUBLE-BALANCED MIXERS

SUPER LOW DISTORTION

## TAK-H SERIES

| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| TAK-1H | 2 - 500 MHz | 50 | $19.95 (5-24) |
| TAK-1WH | 5 - 750 MHz | 50 | $23.95 (5-24) |
| TAK-3H | 50 KHz - 300 MHz | 50 | $21.95 (5-24) |

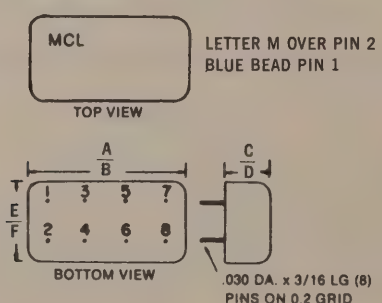
**DESCRIPTION** — These new super low distortion mixers offer state-of-the-art performance while still being economically priced. These are the only units in the world offering a guaranteed 55 dB intermod. spec. in a low profile package — at only $19.95.

Only .25 inches high, the low profile TAK-H series of double balanced mixers covers a very broad frequency range from 50 KHz to 750 MHz. Exhibiting a flat conversion loss, these low profile units are designed to operate with a 50 ohm impedance at all ports. Conversion loss is typ. 6 dB and isolation is typ. greater than 55 dB.

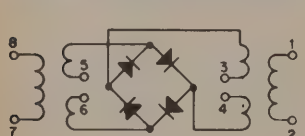
Packaged within a RFI shielded metal enclosure and hermetically sealed header, this low profile unit is only .064 cubic inches. The TAK-H series has its 8 pins located on a 0.2 inch grid.

High reliability is characteristic of the TAK-H series. Each unit carries with it a one year guarantee by Mini-Circuits.

## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| IN. | .770 | .800 | .240 | .250 | .370 | .400 |
| MM | 19.5 | 20.3 | 6.09 | 6.35 | 9.39 | 10.1 |



**PIN LAYOUTS**

| Model | Fig. 1 -1H -3H | Fig. 2 -1WH |
|---|---|---|
| LO | 8 | 8 |
| RF | 1 | 1 |
| IF | 3,4 | 3,4 |
| Ground | 2,5,6,7 | — |
| Case Ground | 2 | 2,5,6,7 |

NOTE: PIN 3 AND 4 MUST BE CONNECTED TOGETHER

**WEIGHT** 3.7 grams 0.13 ounces

## FEATURES

**Broadband:** 50 KHz to 750 MHz
**Ultra-Low Distortion:** 1 dB compression at +15 dBm
**Low Conversion Loss:** Typically less than 6 dB
**High Isolation:** Typically greater than 55 dB
**Low Profile:** .064 in³, 0.8″ x 0.4″ PC area, 0.25″ high
**Low Cost:** As low as $19.95 in small quantity

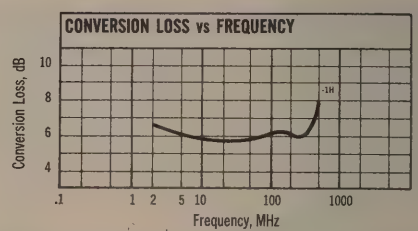
## APPLICATIONS

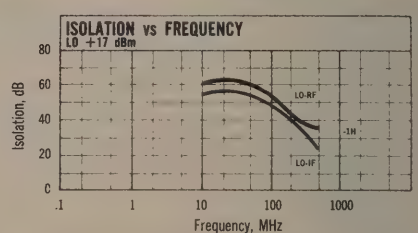
- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Fast switching
- Bi-phase modulation

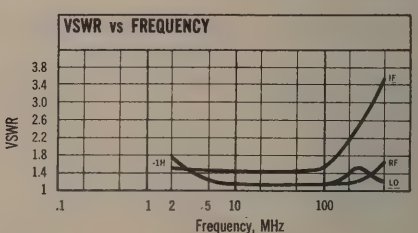
## ABSOLUTE MAXIMUM RATINGS

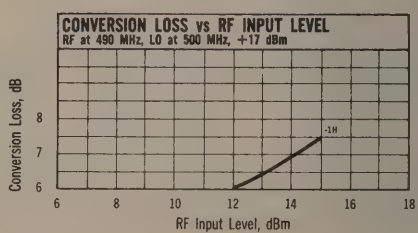
- **Input Power:** 100 mW
- **Peak IF Input Current:** 20 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Pin Temperature:** (10 sec.) 510°F
- **Environmental Specifications:** See Index Page

## MODEL TAK-1H



# TAK-H Series
# 50 KHz to 750 MHz

Mini-Circuits

## SPECIFICATIONS

| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Pin Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| TAK-1H | 2-500 | 2-500 | DC-500 | 6.0 | 7.5 | 7.0 | 8.5 | 50 | 40 | 45 | 35 | 40 | 30 | 35 | 25 | 30 | 25 | 25 | 20 | Fig. 1 |
| TAK-1WH | 5-750 | 5-750 | DC-750 | 6.2 | 7.5 | 7.0 | 9.0 | 50 | 40 | 45 | 35 | 40 | 30 | 35 | 25 | 30 | 25 | 30 | 20 | Fig. 2 |
| TAK-3H | .05-300 | .05-300 | DC-300 | 5.0 | 7.0 | 6.0 | 8.5 | 55 | 45 | 50 | 40 | 40 | 30 | 35 | 25 | 30 | 25 | 25 | 20 | Fig. 1 |

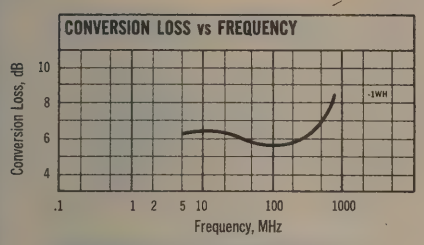
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +14 dBm (Models -1H, -2H), +13 dBm (Model -3H). Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, negative.

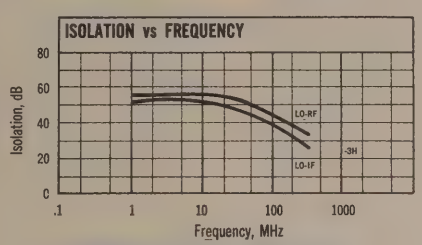
**VSWR:** Models -1H, -1WH, LO (1.6 typ, 2.0 max)
RF (1.25 typ, 1.8 max)
IF (1.6 typ, 3.0 max)

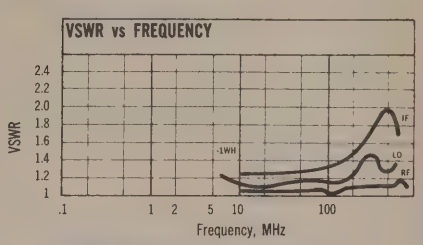
Model -3H, LO (1.5 typ, 2.0 max)
RF (1.4 typ, 2.0 max)
IF (1.8 typ, 2.8 max)

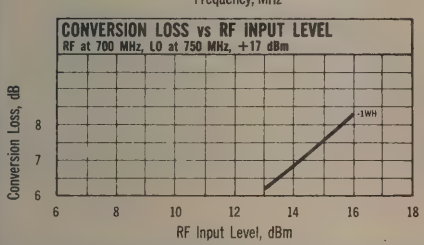
**Two-tone, 3rd Order IM:** RF input, 2 tones each at 0 dBm, 200 MHz and 202 MHz. LO at +17 dBm, 180 MHz. IM level below desired IF is 60 dB typ, 55 dB min (Models -1H, -1WH) and 45 dB min (Model -3H).

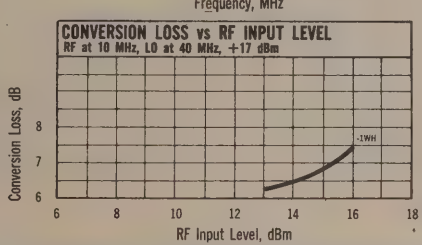
## MODEL TAK-1WH

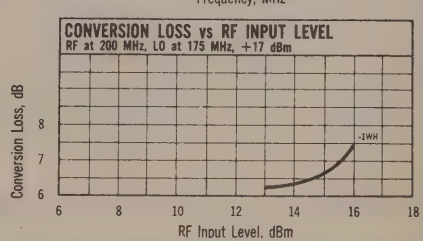


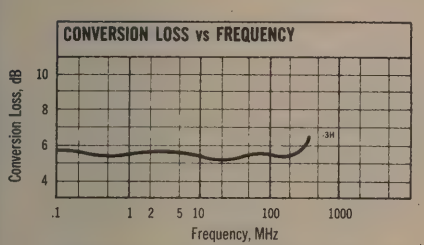



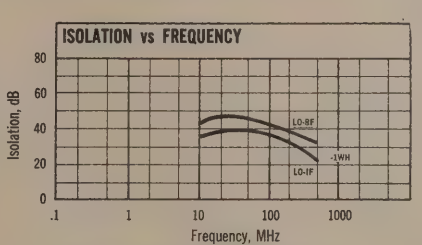



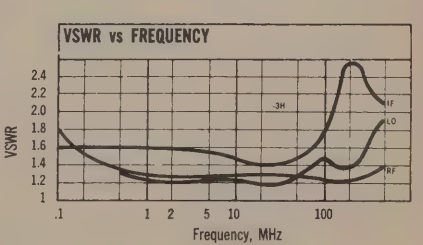



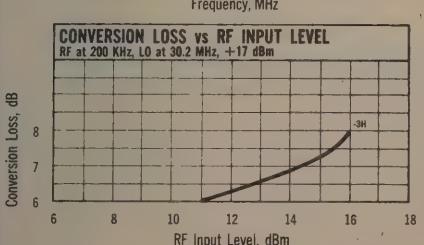



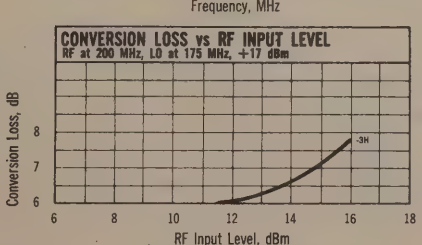

## MODEL TAK-3H



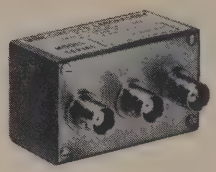




*PROMPT SERVICE / ONE WEEK DELIVERY*

Mini-Circuits

# High Level (+17 dBm LO) DOUBLE-BALANCED MIXERS

## ZAD-H SERIES



| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| * ZAD-1H | 0.5 MHz-500 MHz | 50 | $30.95 (4-24) |
| * ZAD-1WH | 1 MHz-750 MHz | 50 | $34.95 (4-24) |
| ZAD-2H | 2 MHz-1000 MHz | 50 | $44.95 (4-24) |
| * ZAD-3H | 50 KHz -200 MHz | 50 | $32.95 (4-24) |
| ZAD-11H | 10 MHz-3000 MHz | 50 | $79.95 (1-24) |

**DESCRIPTION** — The ZAD-H series mixers cover a broad frequency range from 50 KHz to 3000 MHz. Solving severe intermodulation distortion problems, the ZAD-H series offers linear operation up to +10 dBm signal input at only 1 dB of compression. Reducing all higher order signal harmonic IMD, the ZAD-H series provides a conversion loss of typically 6 dB and isolation of greater than 40 dB.

BNC connectors are standard. TNC connectors are a no-cost option.

The ZAD-H series is housed in a die cast aluminum case. These rugged units are double shielded to meet tough RFI requirements. The case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 2.6 ounces (74 grams).

Only well matched hot-carrier diodes and ruggedly constructed low distortion transformers are used. Internally, every component is bonded with silicone rubber to provide protection against shock, vibration and acceleration.

### FEATURES

**Broadband:** 50 KHz to 3000 MHz
**Low Conversion Loss:** typically less than 6 dB
**High Isolation:** typically greater than 40 dB
**Compact:** 2.25″ W, 1.15″ D, 1.4″ H
**High Reliability:** 100% tested, 1 year guarantee
**Low Cost:** as low as $30.95 in small quantity

### APPLICATIONS

- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Bi-phase modulation

### ABSOLUTE MAXIMUM RATINGS

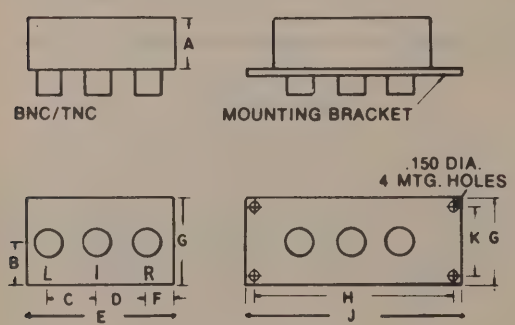
- **Input Power:** 500 mW
- **Peak IF Input Current:** 40 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Environmental Specifications:** See Index Page

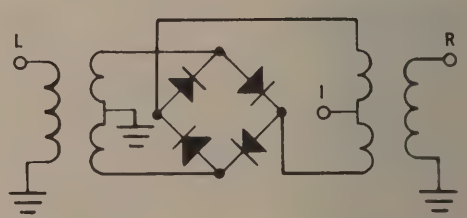
### *HTRB TESTING MODELS ZAD-1H, ZAD-1WH, ZAD-3H

Schottky-diodes selected for high-reliability mixer service are deliberately stressed to accelerate aging and thus force temperature related failure modes to take their toll. In the HTRB (High Temperature Reverse Bias) technique, the diode is operated at 168 hours at 150°C with 1-V reverse bias applied.

In conventional testing, or "baking", the diode does not experience anywhere near the stress encountered with the HTRB program. Thus, the HTRB process screens out potentially unreliable diodes before they are assembled into completed Hi-rel mixers.

### DIMENSIONS AND CONNECTIONS




**NOTE:** For Model -11H connector/terminal I is at DC ground through an inductance.

**MOUNTING BRACKET AVAILABLE ON REQUEST.** Add suffix B to part number and $1.50 to unit cost.
**CONNECTORS:** BNC standard. TNC on request (no charge).

| | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| IN. | 1.15 | .63 | .750 | .730 | 2.25 | .385 | 1.40 | 2.95 | 3.25 | 1.10 |
| MM | 29 | 16 | 19 | 18.5 | 57 | 9.7 | 35.5 | 74.9 | 82.5 | 28 |

**WEIGHT** 74 grams 2.6 ounces

**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# ZAD-H Series
# 50 KHz to 3000 MHz

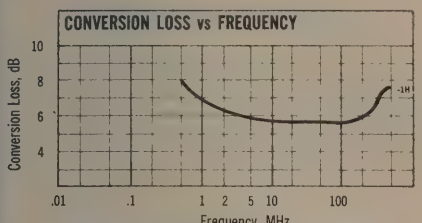
Mini-Circuits

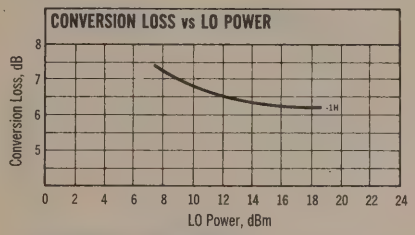
## SPECIFICATIONS

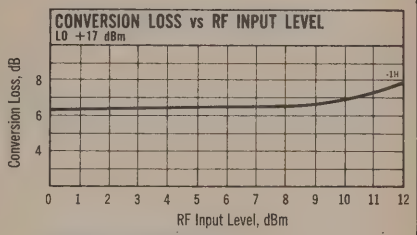
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. |
| ZAD-1H | .5-500 | .5-500 | DC-500 | 5.5 | 7.5 | 6.5 | 8.5 | 55 | 45 | 45 | 35 | 45 | 30 | 40 | 30 | 35 | 25 | 30 | 20 |
| ZAD-1WH | 1-750 | 1-750 | DC-750 | 5.5 | 7.5 | 6.5 | 8.5 | 50 | 40 | 45 | 35 | 45 | 25 | 40 | 25 | 35 | 25 | 30 | 20 |

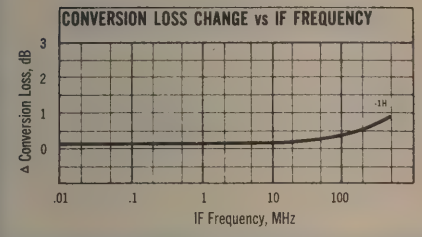
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +10 dBm. Impedance (all ports), 50 ohms. DC offset, 1.5 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -1H, 3.5 dB Model -1WH, 3.5 dB

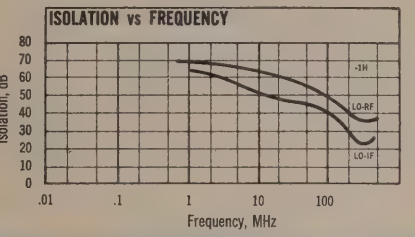
## MODEL ZAD-1H

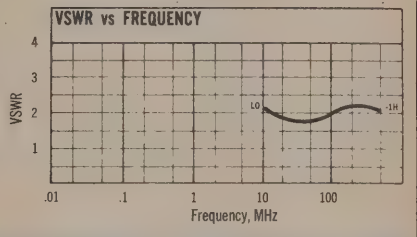


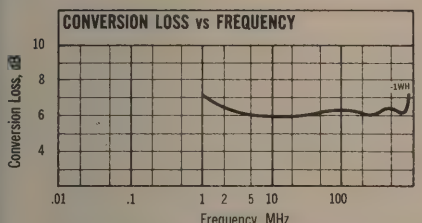



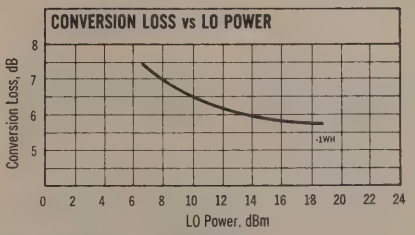



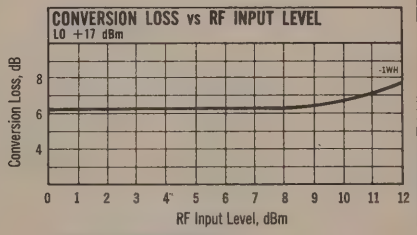



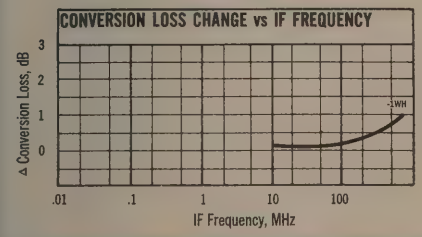



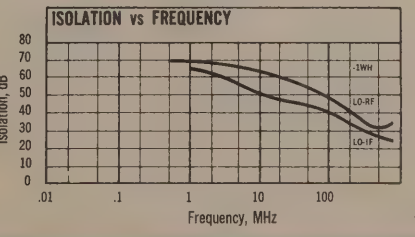

## MODEL ZAD-1WH

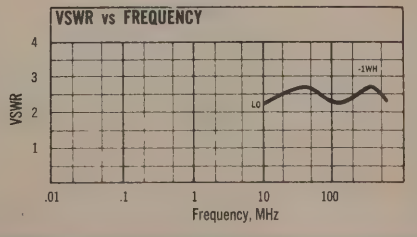


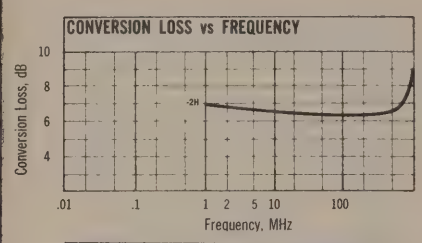
# High Level (+17 dBm LO)
# DOUBLE-BALANCED MIXERS

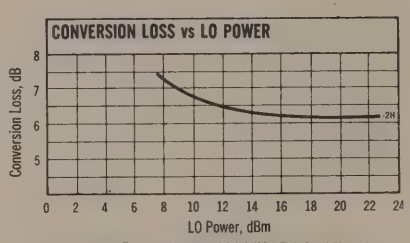
## SPECIFICATIONS

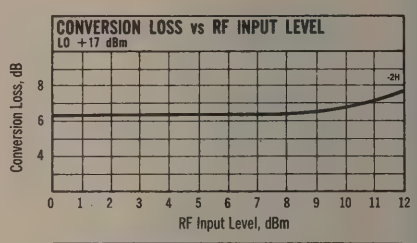
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. |
| ZAD-2H | 2-1000 | 2-1000 | DC-1000 | 6.0 | 7.5 | 8.5 | 10.0 | 50 | 40 | 45 | 35 | 35 | 25 | 30 | 20 | 35 | 25 | 25 | 20 |
| ZAD-3H | .05-200 | .05-200 | DC-200 | 5.5 | 7.0 | 5.5 | 7.5 | 55 | 45 | 45 | 35 | 45 | 30 | 40 | 30 | 35 | 25 | 30 | 20 |
| ZAD-11H | 10-3000 | 10-3000 | 10-1000 | 8 | 10 | 10 | 12 | 27 | 20 | 27 | 20 | 25 | 18 | 25 | 18 | 23 | 16 | 23 | 16 |

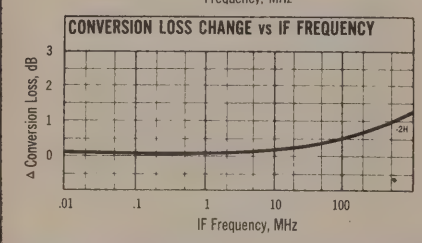
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +10 dBm. Impedance (all ports), 50 ohms. DC offset, 1.5 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -2H, 5 dB Model -3H, 2 dB

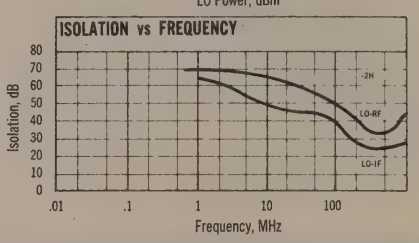
## MODEL ZAD-2H

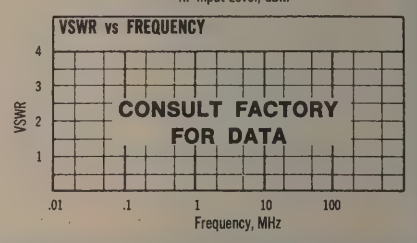



# *SUPER MIXERS*

Be sure to check the specs on the exciting new Super Mixers with

**ULTRA-LOW DISTORTION**

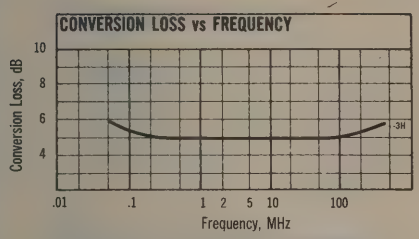
*SERIES TAK-H* ..... *p. 58*
*SERIES TFM-H* ..... *p. 56*
*SERIES ZFM-H* ..... *p. 68*
*SERIES ZAD-SH* ..... *p. 70*
*SERIES ZLW-SH* ..... *p. 72*

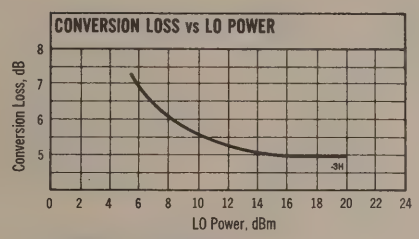
**Offered for the first time in this catalog.**

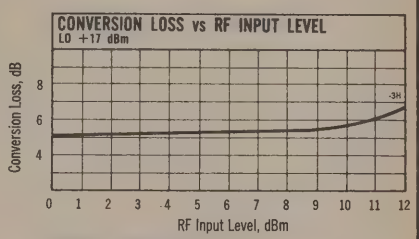
# ZAD-H Series
# 50 KHz to 3000 MHz

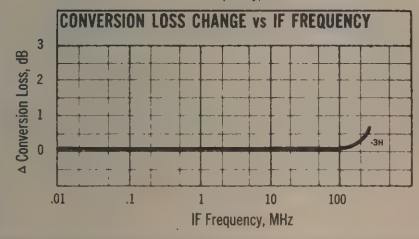
Mini-Circuits

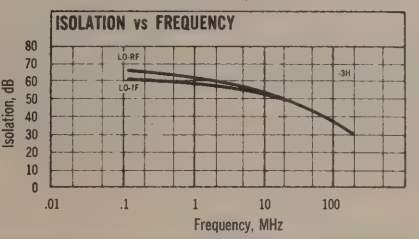
## MODEL ZAD-3H

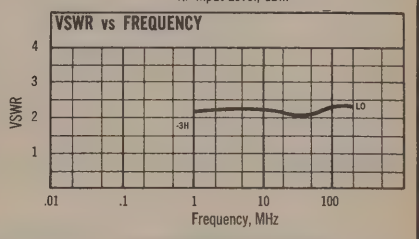


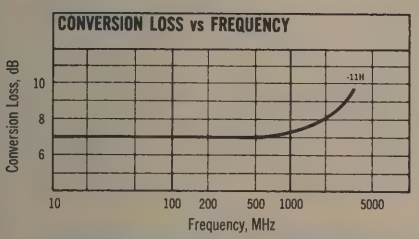



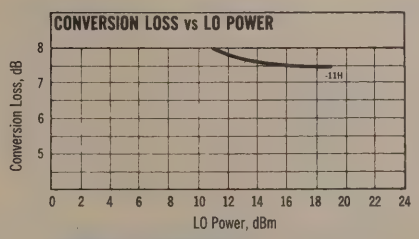



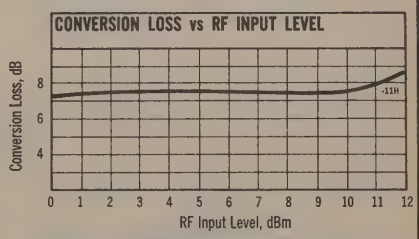



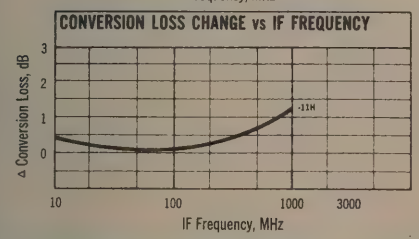



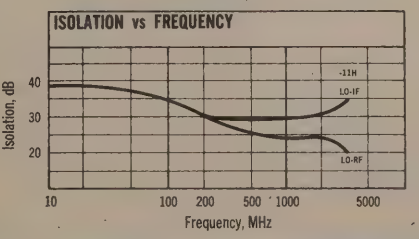

## MODEL ZAD-11H

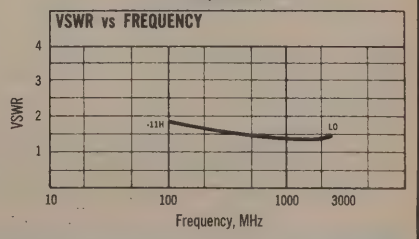


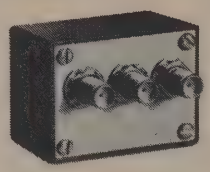




PROMPT SERVICE / ONE WEEK DELIVERY

Mini-Circuits

# High Level (+17 dBm LO) DOUBLE-BALANCED MIXERS

## ZLW-H SERIES



| * MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| * ZLW-1H | 0.5 MHz-500 MHz | 50 | $40.95 (4-24) |
| ZLW-1WH | 1 MHz-750 MHz | 50 | $44.95 (4-24) |
| ZLW-2H | 2 MHz-1000 MHz | 50 | $54.95 (4-24) |
| * ZLW-3H | 50 KHz -200 MHz | 50 | $42.95 (4-24) |
| ZLW-11H | 10 MHz-3000 MHz | 50 | $89.95 (1-24) |

**DESCRIPTION** — The ZLW-H series mixers cover a broad frequency range from 50 KHz to 1000 MHz. Solving severe intermodulation distortion problems, the ZLW-H series offers linear operation up to +10 dBm signal input at only 1 dB of compression. Reducing all higher order signal harmonic IMD, the ZLW-H series provides a conversion loss of typically 6 dB and isolation of greater than 40 dB.

Available with SMA (3mm) connectors, the ZLW-H series is housed in a die cast aluminum case. These rugged units are double shielded to meet tough RFI requirements. The case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 1.02 ounces (34 grams).

Only well matched hot-carrier diodes and ruggedly constructed low distortion transformers are used. Internally, every component is bonded with silicone rubber to provide protection against shock, vibration and acceleration.

## FEATURES

**Broadband:** 50 KHz to 2000 MHz
**Low Conversion Loss:** typically less than 6 dB
**High Isolation:** typically greater than 40 dB
**Miniature:** 1.5″ W, 0.88″ D, 1.15″ H
**High Reliability:** 100% tested, 1 year guarantee
**Low Cost:** as low as $40.95 in low quantity

## APPLICATIONS

- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Bi-phase modulation

## ABSOLUTE MAXIMUM RATINGS

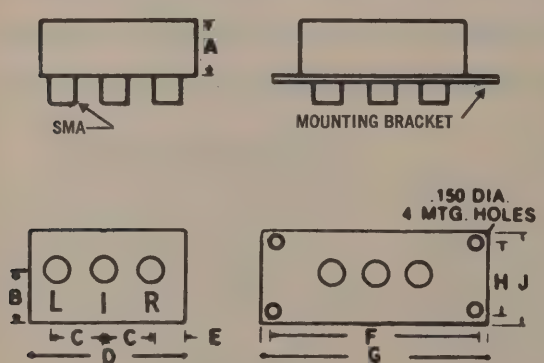
- **Input Power:** 500 mW
- **Peak IF Input Current:** 40 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Environmental Specifications:** See Index Page

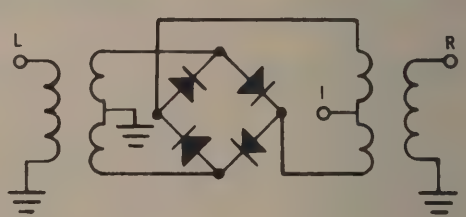
## *HTRB TESTING MODELS ZLW-1H, ZLW-1WH, ZLW-3H

Schottky-diodes selected for high-reliability mixer service are deliberately stressed to accelerate aging and thus force temperature related failure modes to take their toll. In the HTRB (High Temperature Reverse Bias) technique, the diode is operated at 168 hours at 150°C with 1-V reverse bias applied.

In conventional testing, or "baking", the diode does not experience anywhere near the stress encountered with the HTRB program. Thus, the HTRB process screens out potentially unreliable diodes before they are assembled into completed Hi-rel mixers.

## DIMENSIONS AND CONNECTIONS




**NOTE:** For Model -11H connector/terminal I is at DC ground through an inductance.

**MOUNTING BRACKET AVAILABLE ON REQUEST.** Add suffix B to part number and $1.50 to unit cost.
**CONNECTORS:** SMA (3mm) standard.

| | A | B | C | D | E | F | G | H | J |
|---|---|---|---|---|---|---|---|---|---|
| IN. | 0.88 | 0.66 | .438 | 1.50 | .312 | 2.19 | 2.50 | 0.84 | 1.15 |
| MM | 22 | 17 | 11 | 38 | 7.9 | 55.6 | 63.5 | 21 | 29 |

**WEIGHT** 34 grams 1.02 ounces

**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# ZLW-H Series
# 50 KHz to 3000 MHz

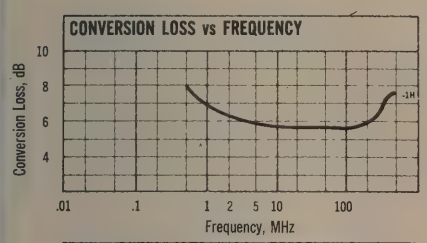
Mini-Circuits

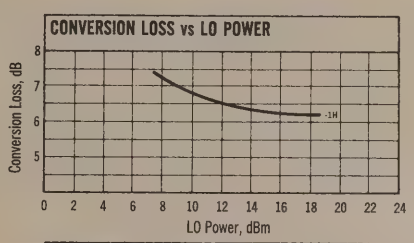
## SPECIFICATIONS

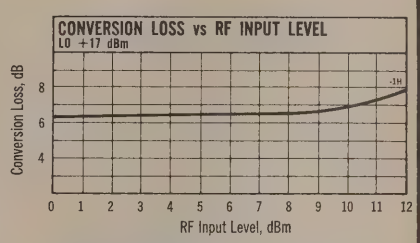
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. |
| ZLW-1H | .5-500 | .5-500 | DC-500 | 5.5 | 7.5 | 6.5 | 8.5 | 55 | 45 | 45 | 35 | 45 | 30 | 40 | 30 | 35 | 25 | 30 | 20 |
| ZLW-1WH | 1-750 | 1-750 | DC-750 | 5.5 | 7.5 | 6.5 | 8.5 | 50 | 40 | 45 | 35 | 45 | 25 | 40 | 25 | 35 | 25 | 30 | 20 |

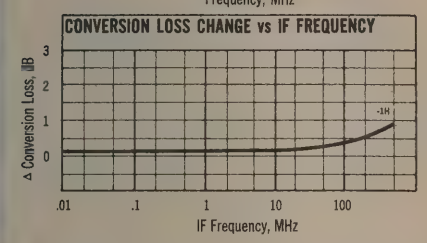
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +10 dBm. Impedance (all ports), 50 ohms. DC offset, 1.5 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -1H, 3.5 dB Model -1WH, 3.5 dB

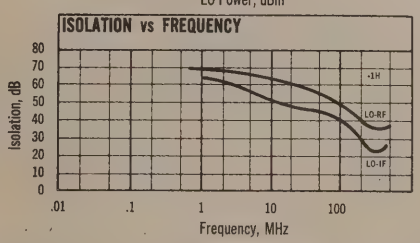
## MODEL ZLW-1H

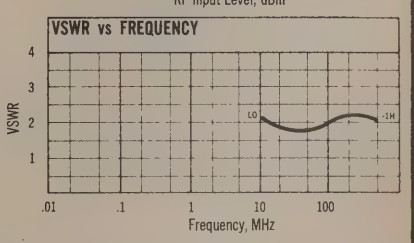


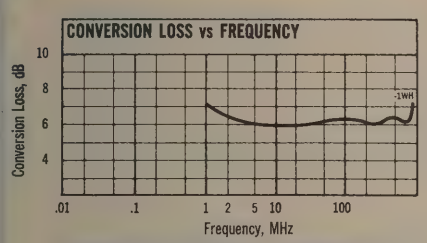



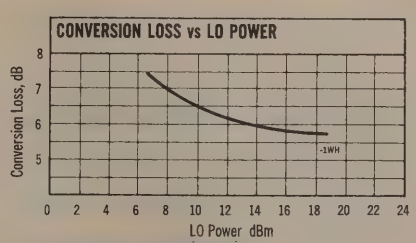



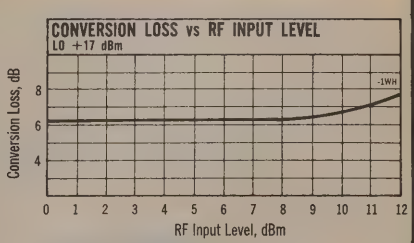



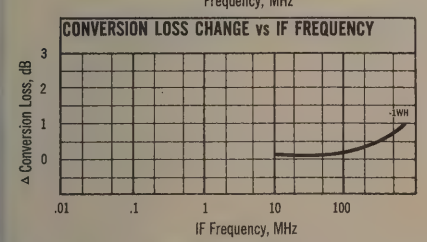



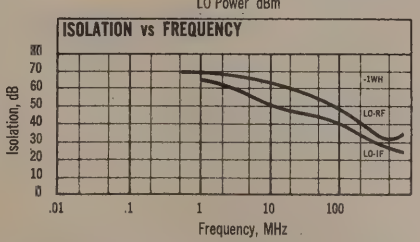

## MODEL ZLW-1WH

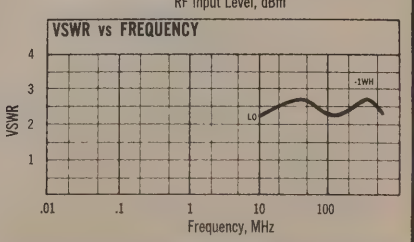


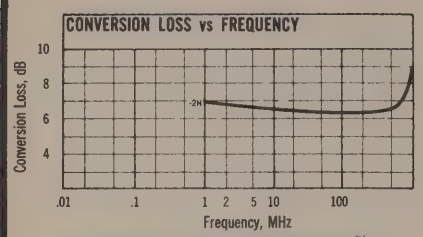
# High Level (+17 dBm LO)
# DOUBLE-BALANCED MIXERS

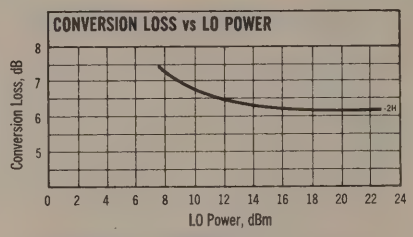
## SPECIFICATIONS

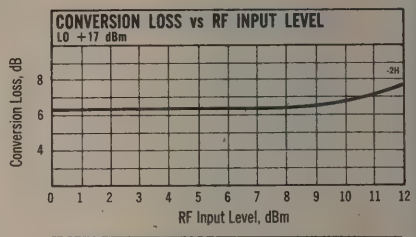
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. |
| ZLW-2H | 2-1000 | 2-1000 | DC-1000 | 6.0 | 7.5 | 8.5 | 10.0 | 50 | 40 | 45 | 35 | 35 | 25 | 30 | 20 | 35 | 25 | 25 | 20 |
| ZLW-3H | .05-200 | .05-200 | DC-200 | 5.5 | 7.0 | 5.5 | 7.5 | 55 | 45 | 45 | 35 | 45 | 30 | 40 | 30 | 35 | 25 | 30 | 20 |
| ZLW-11H | 10-3000 | 10-3000 | 10-1000 | 8 | 10 | 10 | 12 | 27 | 20 | 27 | 20 | 25 | 18 | 25 | 18 | 23 | 16 | 23 | 16 |

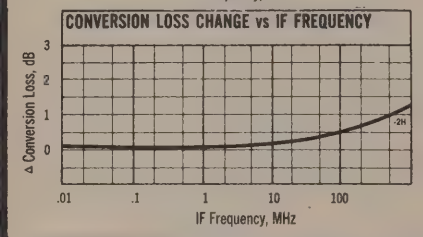
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +10 dBm. Impedance (all ports), 50 ohms. DC offset, 1.5 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -2H, 5 dB Model -3H, 2 dB

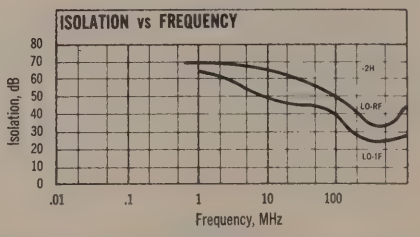
## MODEL ZLW-2H

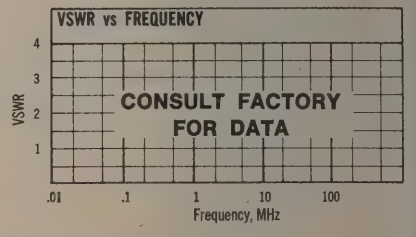



## SUPER MIXERS

Be sure to check the specs on the exciting new Super Mixers with

**ULTRA-LOW DISTORTION**

*SERIES TAK-H* ..... *p. 58*
*SERIES TFM-H* ..... *p. 56*
*SERIES ZFM-H* ..... *p. 68*
*SERIES ZAD-SH* ..... *p. 70*
*SERIES ZLW-SH* ..... *p. 72*

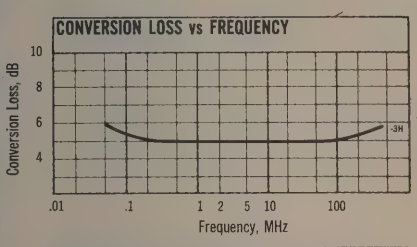
**Offered for the first time in this catalog.**

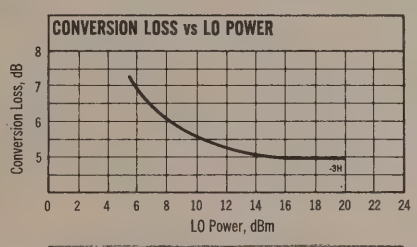
**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

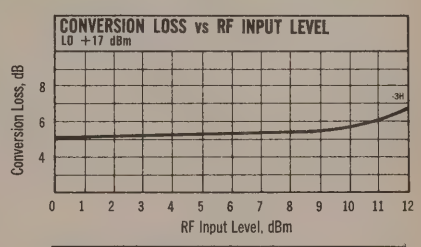
# ZLW-H Series
# 50 KHz to 3000 MHz

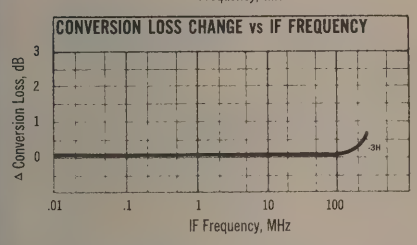
Mini-Circuits

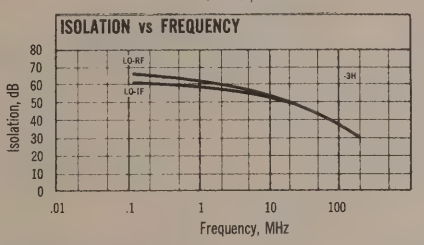
## MODEL ZLW-3H

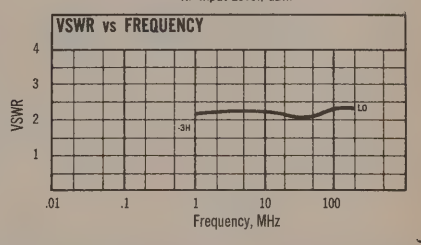


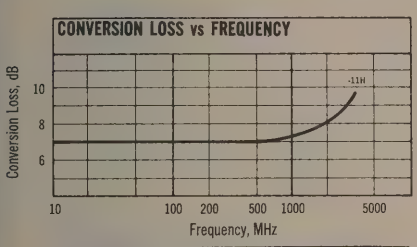



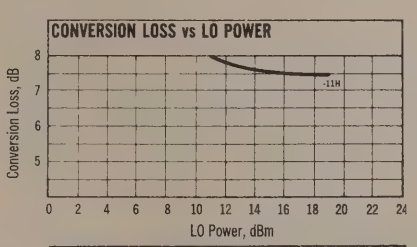



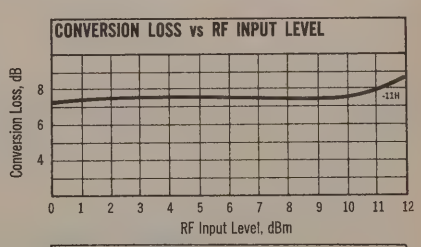



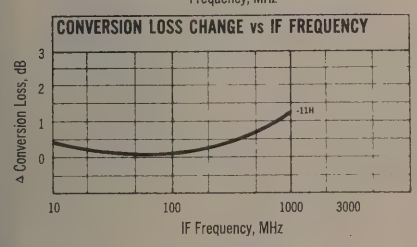



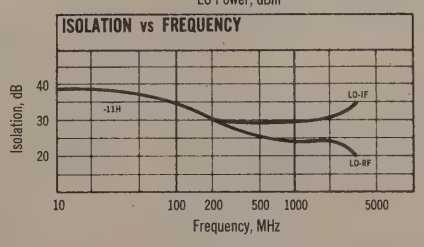



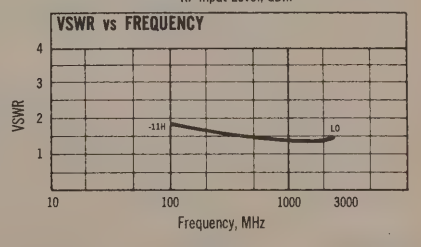




PROMPT SERVICE / ONE WEEK DELIVERY Mini-Circuits

# High Level (+17dBm LO) DOUBLE-BALANCED MIXERS

SUPER LOW DISTORTION

## ZFM-H SERIES

| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| ZFM-1H | 2 - 500 MHz | 50 | $53.95 (1-24) |
| ZFM-2H | 5 - 1000 MHz | 50 | $61.95 (1-24) |
| ZFM-3H | 50 KHz - 300 MHz | 50 | $54.95 (1-24) |

**DESCRIPTION** — The ZFM-H series are state-of-the-art low distortion mixers. Economically priced they cover the very broad frequency range from 0.05 MHz to 1000 MHz. They offer low conversion loss, 6 dB, high isolation 55 dB, and exceptional unit to unit matched performance.

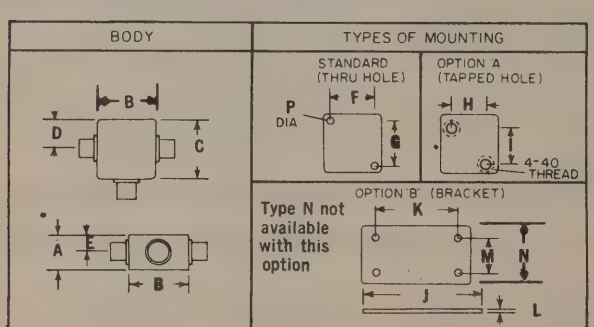
This series is housed in an extremely rugged 1¼ in. square metal case with one connector on each of three sides.

BNC connectors are standard. TNC connectors a no-cost option, must be specified. Either SMA (3mm) or Type N connectors can be specified at an added cost of $5.00 per unit. Unit weight with BNC connectors is 1.92 ounces (54.5 grams).

Case finish is grey epoxy paint.

Every unit is 100% tested and carries a one-year guarantee.

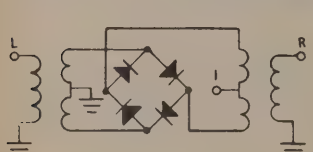
## DIMENSIONS AND CONNECTIONS




**MOUNTING OPTIONS:** Two .125″ (31.8mm) thruholes standard. Two 4-40 tapped holes optional at no cost. Add suffix A to part number. Mounting bracket on request. Add suffix B and $1.50 to unit price.

**CONNECTORS:** BNC standard. Specify TNC at no cost if required. Either SMA (3mm) or Type N can be specified at an added cost of $5.00 per unit.

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IN | .75 | 1.25 | 1.25 | .625 | .375 | 1.00 | 1.00 | 0.8 | 0.8 | 2.188 | 1.688 | .060 | .75 | 1.25 | .125 |
| MM | 19.1 | 31.8 | 31.8 | 15.9 | 9.5 | 25.4 | 25.4 | 20.3 | 20.3 | 55.6 | 42.9 | 1.5 | 19.1 | 31.8 | 3.18 |




**TERMINAL/CONNECTOR LAYOUT**

| Model No. | Fig. A -1H -2H, -3H |
|---|---|
| LO | 1 |
| IF | 2 |
| RF | 3 |

**WEIGHT** 54.5 grams 1.92 ounces

## FEATURES

**Broadband:** 50 KHz to 1000 MHz
**Ultra-Low Distortion:** 1 dB compression at +15 dBm RF
**Low Conversion Loss:** Typically less than 6 dB
**High Isolation:** Typically greater than 55 dB
**Low Profile:** 1.25″ W, 1.25″ D, .75″ H
**Low Cost:** As low as $53.95 in small quantity

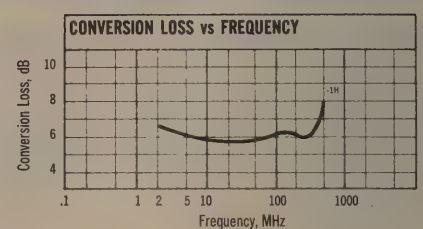
## APPLICATIONS

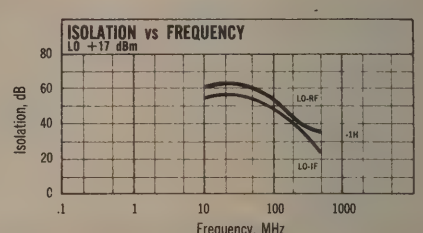
- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Fast switching
- Bi-phase modulation

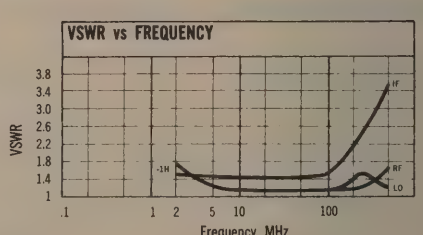
## ABSOLUTE MAXIMUM RATINGS

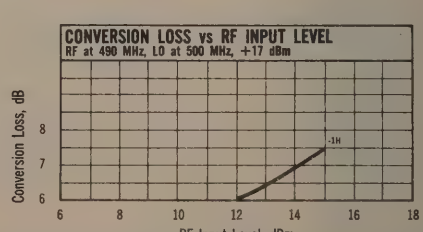
- **Input Power:** 100 mW
- **Peak IF Input Current:** 20 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Environmental Specifications:** See Index Page

## MODEL ZFM-1H



# ZFM-H Series
# 50 KHz to 1000 MHz

Mini-Circuits

## SPECIFICATIONS

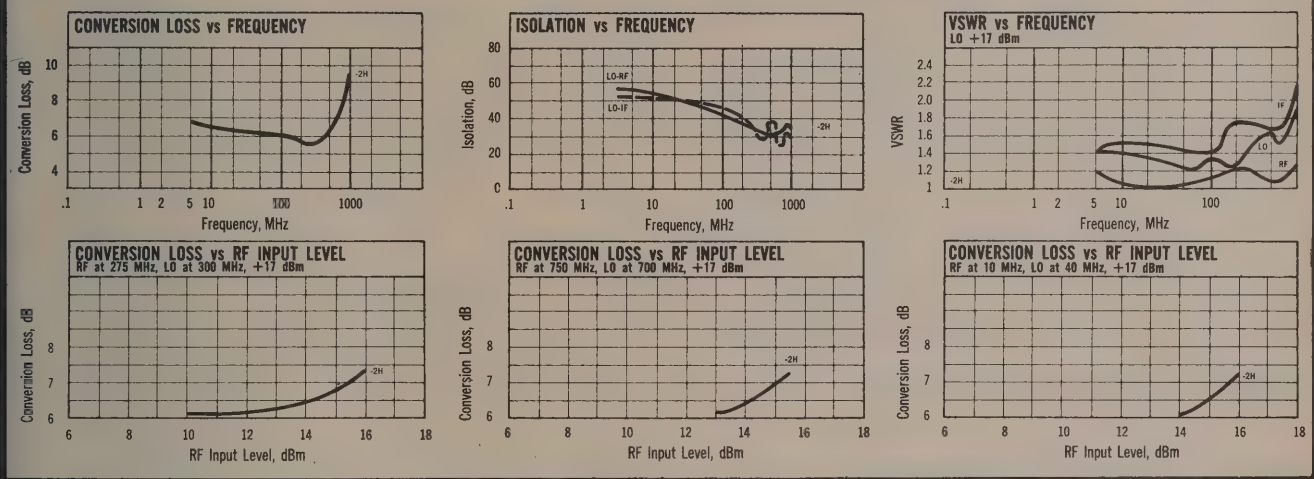
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Conn Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| ZFM-1H | 2-500 | 2-500 | DC-500 | 6.0 | 7.5 | 7.0 | 8.5 | 50 | 40 | 45 | 35 | 40 | 30 | 35 | 25 | 30 | 25 | 25 | 20 | Fig. A |
| ZFM-2H | 5-1000 | 5-1000 | DC-1000 | 6.2 | 7.0 | 7.0 | 10 | 50 | 45 | 45 | 40 | 40 | 30 | 35 | 25 | 30 | 20 | 25 | 17 | Fig. A |
| ZFM-3H | .05-300 | .05-300 | DC-300 | 5.0 | 7.0 | 6.0 | 8.5 | 55 | 45 | 50 | 40 | 40 | 30 | 35 | 25 | 30 | 25 | 25 | 20 | Fig. A |

**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +14 dBm (Models -1H, -2H), +13 dBm (Model -3H). Impedance (all ports), 50 ohms. DC offset, 1 mV typ. DC polarity, negative.

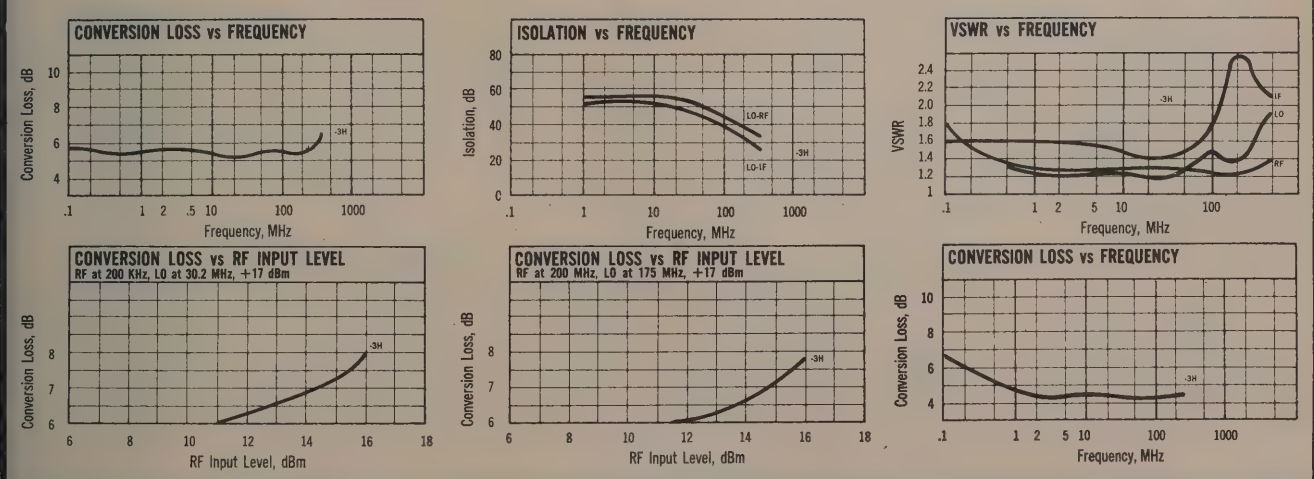
**VSWR:** Model -1H, LO (1.6 typ, 2.0 max) RF (1.25 typ, 1.8 max) IF (1.6 typ, 3.0 max)
Model -2H, LO (1.8 typ, 2.5 max) RF (1.3 typ, 2.0 max) IF (1.7 typ, 3.0 max)
Model -3H, LO (1.5 typ, 2.0 max) RF (1.4 typ, 2.0 max) IF (1.8 typ, 2.8 max)

**Two-tone, 3rd Order IM:** RF input, 2 tones each at 0 dBm, 200 MHz and 202 MHz. LO at +17 dBm, 180 MHz. IM level below desired IF is 60 dB typ, 55 dB min (Models -1H, -2H) and 45 dB min (Model -3H).

## MODEL ZFM-2H




## MODEL ZFM-3H



# High Level (+17dBm LO) DOUBLE-BALANCED MIXERS

SUPER LOW DISTORTION

## ZAD-SH SERIES

| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| ZAD-1SH | 2 - 500 MHz | 50 | $40.95 (4-24) |
| ZAD-1WSH | 5 - 750 MHz | 50 | $44.95 (4-24) |
| ZAD-3SH | 50 KHz - 300 MHz | 50 | $42.95 (4-24) |

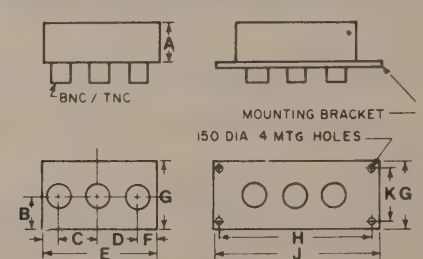
**DESCRIPTION** — The ZAD-SH series are state-of-the-art low distortion mixers. Economically priced they cover the very broad frequency range from 50 KHz to 750 MHz. They offer low conversion loss, 6 dB, high isolation 55 dB, and exceptional unit to unit matched performance.

Available with BNC or TNC connectors the ZAD-SH series is housed in a die cast aluminum case. These rugged units are double shielded to meet tough RFI requirements. The case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A.

Ruggedness and durability are built into the ZAD-SH series. Only well matched hot-carrier diodes and ruggedly constructed transmission line transformers are used. Internally, every component is bonded with silicone rubber to provide protection against shock, vibration, and acceleration.

Every unit is 100% tested and carries a one-year guarantee.

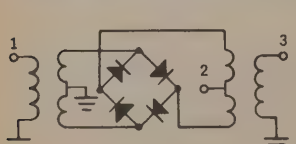
## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| IN. | 1.15 | .630 | .750 | .730 | 2.25 | .385 | 1.40 | 2.95 | 3.25 | 1.10 |
| MM | 29.0 | 16.0 | 19.0 | 18.5 | 57.0 | 9.77 | 35.5 | 74.9 | 82.5 | 28.0 |

**MOUNTING BRACKET AVAILABLE ON REQUEST.** Add suffix B to part number and $1.50 to unit cost.
**CONNECTORS:** BNC standard. TNC on request (no charge).

**CONNECTOR/TERMINAL LAYOUT**




| Model No. | Fig. A |
|---|---|
| | -1SH<br>-1WSH<br>-3SH |
| LO | 1 |
| RF | 3 |
| IF | 2 |

**WEIGHT** 74.0 grams 2.6 ounces

## FEATURES

**Broadband:** 50 KHz to 750 MHz
**Ultra-Low Distortion:** 1 dB compression at +15 dBm RF
**Low Conversion Loss:** Typically less than 6 dB
**High Isolation:** Typically greater than 55 dB
**Compact:** 2.25″ W, 1.15″ D, 1.4″ H
**Low Cost:** As low as $40.95 in small quantity.

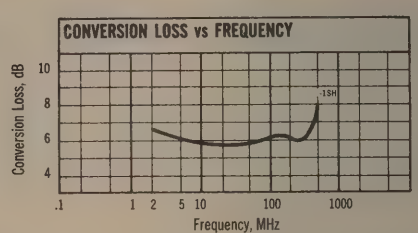
## APPLICATIONS

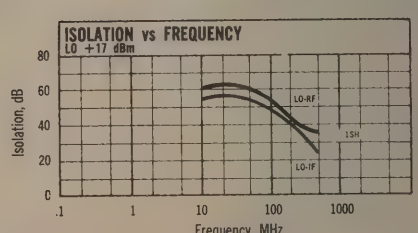
- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Fast switching
- Bi-phase modulation

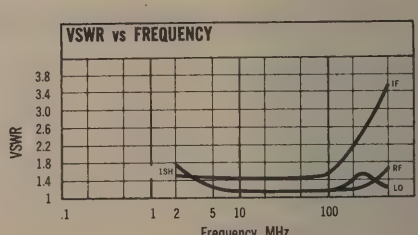
## ABSOLUTE MAXIMUM RATINGS

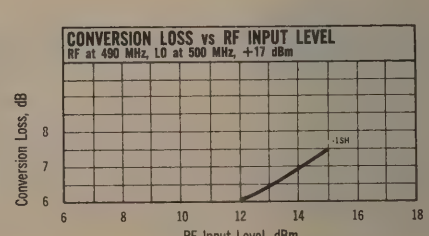
- **Input Power:** 100 mW
- **Peak IF Input Current:** 20 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Environmental Specifications:** See Index Page

## MODEL ZAD-1SH



# ZAD-SH Series
# 50 KHz to 1000 MHz

**Mini-Circuits**

## SPECIFICATIONS

| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Conn Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| ZAD-1SH | 2-500 | 2-500 | DC-500 | 6.0 | 7.5 | 7.0 | 8.5 | 50 | 40 | 45 | 35 | 40 | 30 | 35 | 25 | 30 | 25 | 25 | 20 | Fig. A |
| ZAD-1WSH | 5-750 | 5-750 | DC-750 | 6.2 | 7.5 | 7.0 | 9.0 | 50 | 45 | 45 | 40 | 40 | 30 | 35 | 25 | 30 | 20 | 30 | 20 | Fig. A |
| ZAD-3SH | .05-300 | .05-300 | DC-300 | 5.0 | 7.0 | 6.0 | 8.5 | 55 | 45 | 50 | 40 | 40 | 30 | 35 | 25 | 30 | 25 | 25 | 20 | Fig. A |

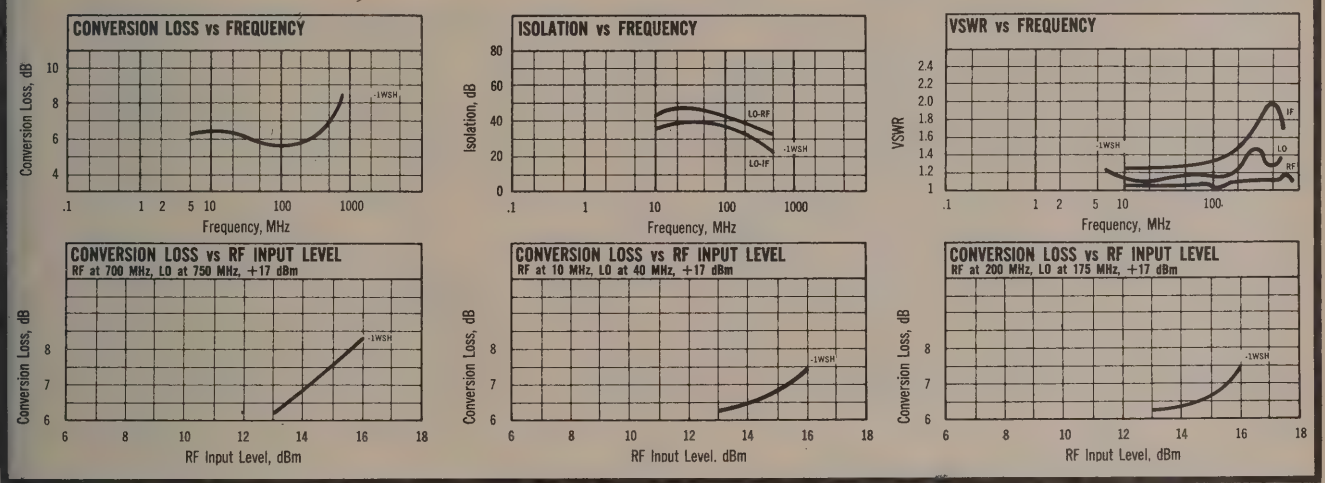
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +14 dBm Min. (Models -1SH, -1WSH), +13 dBm Min. (Model -3SH). Impedance (all ports), 50 ohms.

**VSWR:** Models -1SH, -1WSH, LO (1.6 typ, 2.0 max)
RF (1.25 typ, 1.8 max)
IF (1.6 typ, 3.0 max)

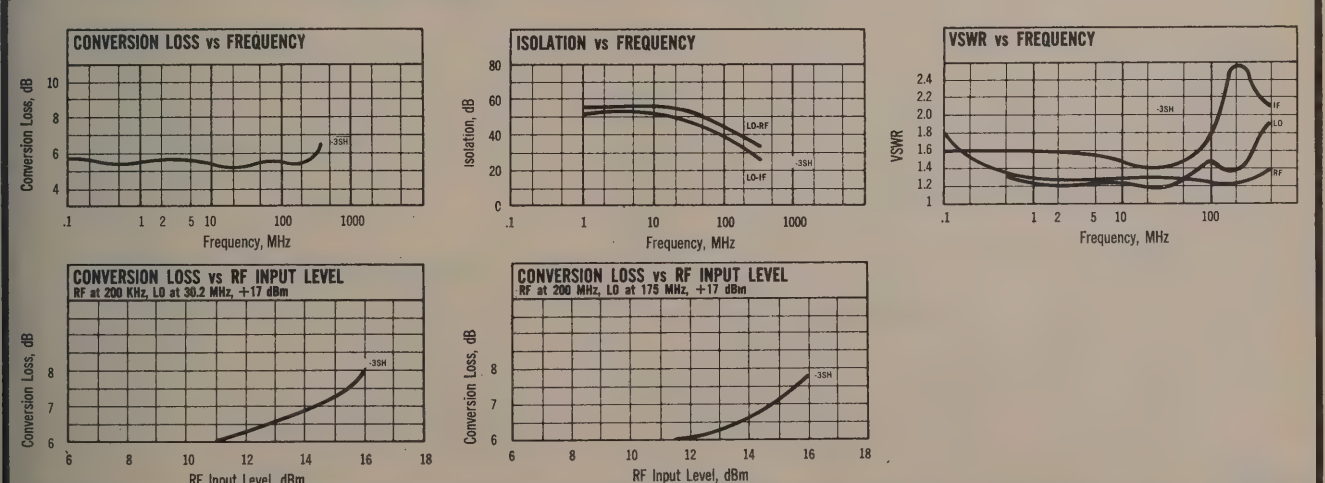
Model -3SH, LO (1.5 typ, 2.0 max)
RF (1.4 typ, 2.0 max)
IF (1.8 typ, 2.8 max)

**Two-tone, 3rd Order IM:** RF input, 2 tones each at 0 dBm, 200 MHz and 202 MHz. LO at +17 dBm, 180 MHz. IM level below desired IF is 60 dB typ, 55 dB min (Models -1SH, -1WSH) and 45 dB min (Model -3SH).

## MODEL ZAD-1WSH



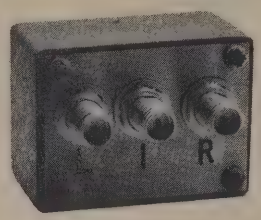

## MODEL ZAD-3SH



# High Level (+17dBm LO) DOUBLE-BALANCED MIXERS

SUPER LOW DISTORTION

## ZLW-SH SERIES




| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| ZLW-1SH | 2 - 500 MHz | 50 | $50.95 (4-24) |
| ZLW-1WSH | 5 - 750 MHz | 50 | $54.95 (4-24) |
| ZLW-3SH | 50 KHz - 300 MHz | 50 | $52.95 (4-24) |

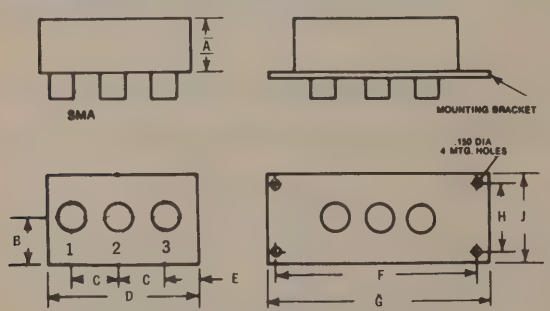
**DESCRIPTION** — The ZLW-SH series are state-of-the-art low distortion mixers. Economically priced they cover the very broad frequecy range from 50 KHz to 750 MHz. They offer low conversion loss, 6 dB, high isolation 55 dB, and exceptional unit to unit matched performance.

Available with SMA (3 mm) connectors the ZLW-SH series is housed in a die cast aluminum case. These rugged units are double shielded to meet your tough RFI requirements. The case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A.

Ruggedness and durability are built into the ZLW-SH series. Only well matched hot-carrier diodes and ruggedly constructed transmission line transformers are used. Internally, every component is bonded with silicone rubber to provide protection against shock, vibration, and acceleration.

Every unit is 100% tested and carries a one-year guarantee.

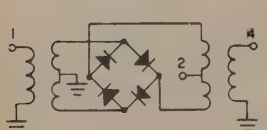
## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F | G | H | J |
|---|---|---|---|---|---|---|---|---|---|
| IN. | 0.88 | 0.66 | .438 | 1.50 | .312 | 2.19 | 2.50 | 0.84 | 1.15 |
| MM | 22.0 | 17.0 | 11.0 | 38.0 | 7.90 | 55.6 | 63.5 | 21.0 | 29.0 |

**Mounting Bracket Available on Request:** Add suffix B to part number and $1.50 to unit cost

**Connectors:** SMA (3 mm)




**CONNECTOR/TERMINAL LAYOUT**

| Model No. | Fig. A -1SH, -1WSH -3SH |
|---|---|
| LO | 1 |
| RF | 3 |
| IF | 2 |

**WEIGHT** 34 grams 1.02 ounces

## FEATURES

**Broadband:** 50 KHz to 750 MHz
**Ultra-Low Distortion:** 1 dB compression at +15 dBm RF
**Low Conversion Loss:** Typically less than 6 dB
**High Isolation:** Typically greater than 55 dB
**Miniature:** 1.5″ W. 0.88″ D. 1.15″ H
**Low Cost:** As low as $50.95 in small quantity

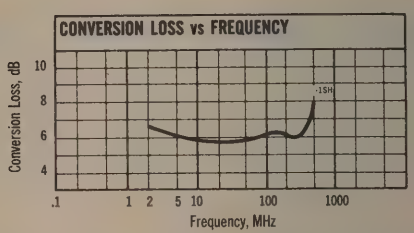
## APPLICATIONS

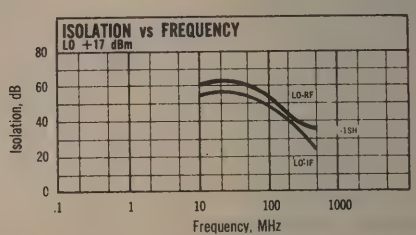
- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Fast switching
- Bi-phase modulation

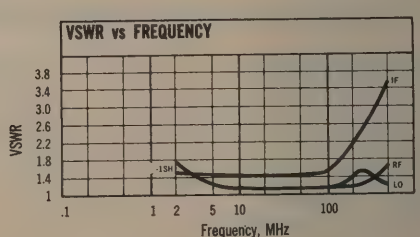
## ABSOLUTE MAXIMUM RATINGS

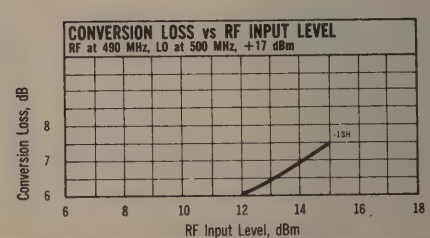
- **Input Power:** 100 mW
- **Peak IF Input Current:** 20 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Environmental Specifications:** See Index Page

## MODEL ZLW-1SH



# ZLW-SH Series
# 50 KHz to 750 MHz

Mini-Circuits

## SPECIFICATIONS

| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Conn Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| ZLW-1SH | 2-500 | 2-500 | DC-500 | 6.0 | 7.5 | 7.0 | 8.5 | 50 | 40 | 45 | 35 | 40 | 30 | 35 | 25 | 30 | 25 | 25 | 20 | Fig. A |
| ZLW-1WSH | 5-750 | 5-750 | DC-750 | 6.2 | 7.5 | 7.0 | 9.0 | 50 | 45 | 45 | 40 | 40 | 30 | 35 | 25 | 30 | 20 | 30 | 20 | Fig. A |
| ZLW-3SH | .05-300 | .05-300 | DC-300 | 5.0 | 7.0 | 6.0 | 8.5 | 55 | 45 | 50 | 40 | 40 | 30 | 35 | 25 | 30 | 25 | 25 | 20 | Fig. A |

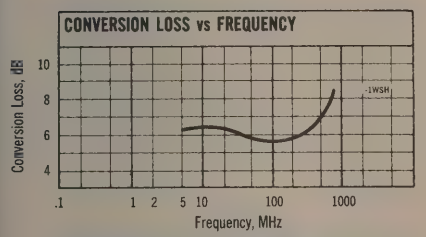
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +14 dBm Min. (Models -1SH, -1WSH), +13 dBm Min. (Model -3SH). Impedance (all ports), 50 ohms.

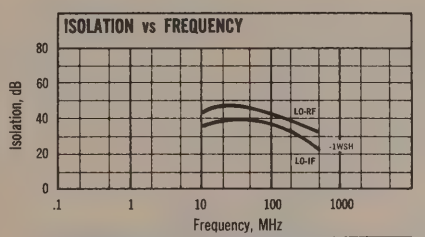
**VSWR:** Models -1SH, -1WSH, LO (1.6 typ, 2.0 max)
RF (1.25 typ, 1.8 max)
IF (1.6 typ, 3.0 max)

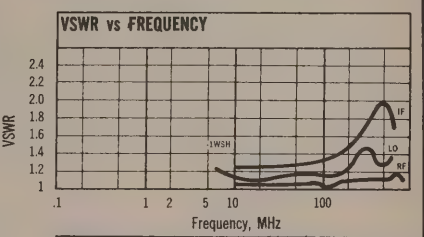
Model -3SH, LO (1.5 typ, 2.0 max)
RF (1.4 typ, 2.0 max)
IF (1.8 typ, 2.8 max)

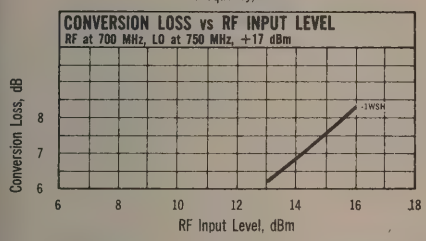
**Two-tone, 3rd Order IM:** RF input, 2 tones each at 0 dBm, 200 MHz and 202 MHz. LO at +17 dBm, 180 MHz. IM level below desired IF is 60 dB typ, 55 dB min (Models -1SH, -1WSH) and 45 dB min (Model -3SH).

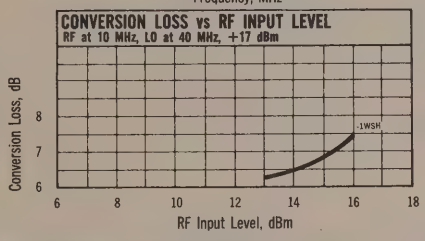
## MODEL ZLW-1WSH

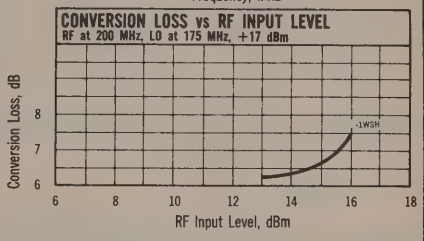


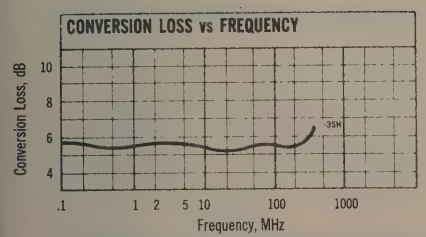



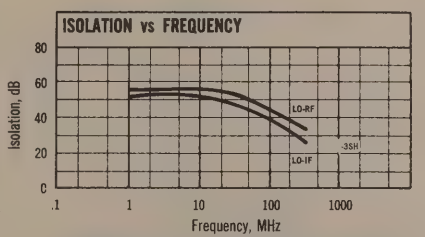



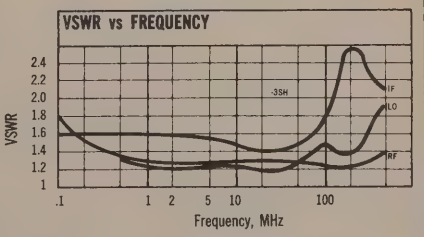



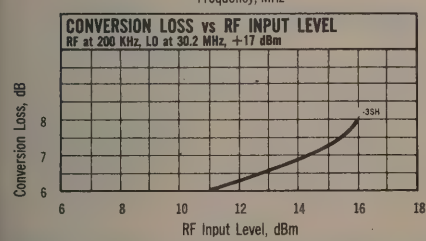



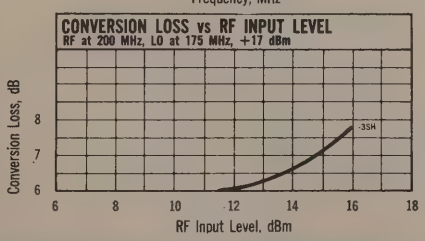

## MODEL ZLW-3SH



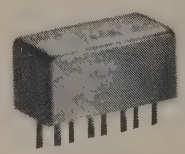



# Very High Level (+23 dBm LO) DOUBLE-BALANCED MIXERS

## RAY SERIES



| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| RAY-1 | 5 MHz-500 MHz | 50 | $31.95 (4-9) |
| RAY-2 | 10 MHz-1000 MHz | 50 | $51.95 (4-9) |
| RAY-3 | 70 KHz -200 MHz | 50 | $31.95 (4-9) |

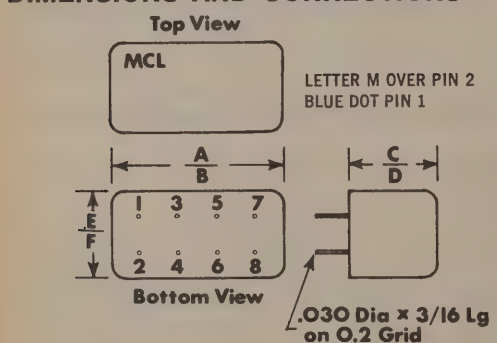
**DESCRIPTION** — Housed in a volume of only 0.1 cu. inches and requiring a PC board area of only .32 sq. inches the RAY series is the smallest packaged mixers for very high level operation. The RAY series covers a broad frequency range from 70 KHz to 1000 MHz.

Designed to solve very severe intermodulation distortion problems, the RAY series offers linear operation up to +15 dBm signal input at only 1 dB of compression. Reducing all higher order IMD, the RAY series provides a conversion loss of typically 6 dB and isolation of greater than 40 dB.

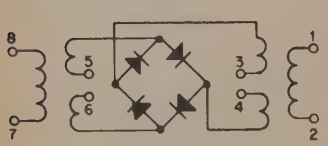
Packaged within an RFI shielded metal enclosure and hermetically sealed header this tiny unit has its 8 pins located on a 0.2 inch grid. Unit weight is .18 ounces (5.2 grams).

Internal components include well matched hot-carrier diodes and very broad band, low distortion transformers. Supported with silicone rubber, the RAY series withstands high shock vibration and acceleration environments.

## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| IN. | .770 | .800 | .385 | .400 | .370 | .400 |
| MM | 19.5 | 20.3 | 9.7 | 10.1 | 9.3 | 10.1 |




**PIN LAYOUTS**

| | Fig. 1 | Fig. 2 |
|---|---|---|
| Model No. | -1<br>-3 | -2 |
| LO | 8 | 8 |
| RF | 1 | 1 |
| IF | 3,4 | 3,4 |
| Ground | 2,5,6,7 | 2,5,6,7 |
| Case Ground | 2 | 2,5,6,7 |

**NOTE: PINS 3 AND 4 MUST BE CONNECTED TOGETHER**

**WEIGHT** 5.2 grams .18 ounces

### FEATURES

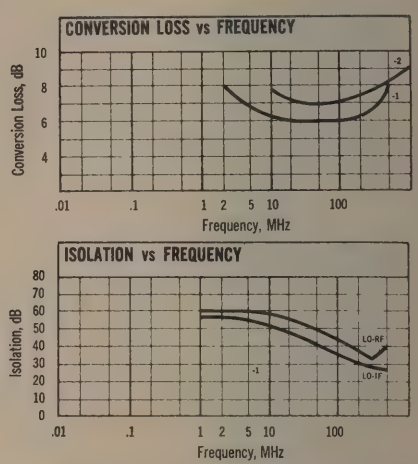
**Broadband:** 70 KHz to 1000 MHz
**Low Conversion Loss:** typically less than 6 dB
**High Isolation:** typically greater than 40 dB
**Miniature:** 0.128 in.³, 0.4″ x 0.8″ PC area, 0.4″ high
**High Reliability:** 100% tested, 1 year guarantee
**Low Cost:** as low as $31.95 in small quantity

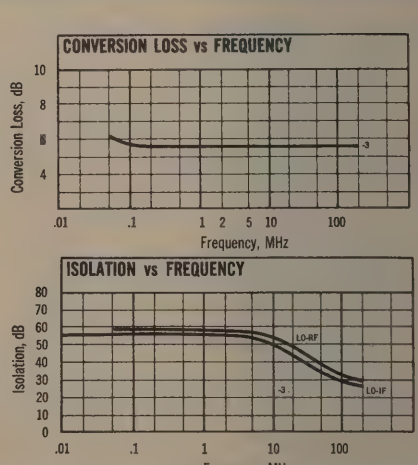
### APPLICATIONS

- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Bi-phase modulation

### ABSOLUTE MAXIMUM RATINGS

- **Input Power:** 50 mW
- **Peak IF Input Current:** 40 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Pin Temperature:** (10 sec.) 510°F
- **Environmental Specifications:** See Index Page




**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# RAY Series
# 70 KHz to 1000 MHz

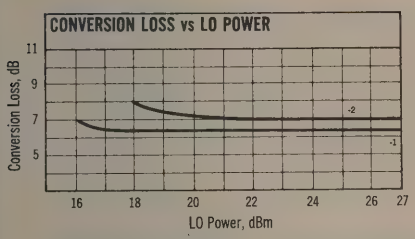
Mini-Circuits

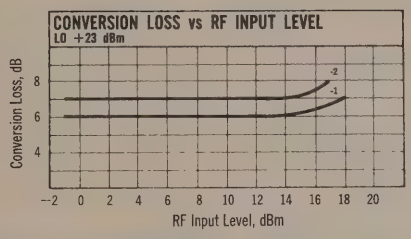
## SPECIFICATIONS

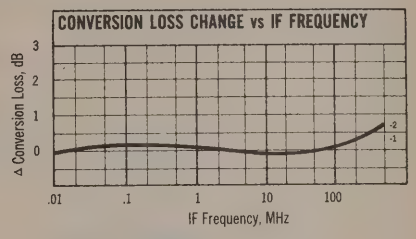
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | | Conn Layout |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | |
| RAY-1 | 5-500 | 5-500 | DC-500 | 6.0 | 7.5 | 7.5 | 8.5 | 55 | 45 | 55 | 45 | 40 | 30 | 40 | 30 | 30 | 25 | 30 | 20 | Fig. 1 |
| RAY-2 | 10-1000 | 10-1000 | DC-1000 | 7.0 | 8.5 | 8.5 | 10.0 | 50 | 35 | 50 | 35 | 40 | 30 | 35 | 25 | 35 | 25 | 25 | 20 | Fig. 2 |
| RAY-3 | .07-200 | .07-200 | DC-200 | 6.0 | 7.5 | 6.5 | 8.0 | 55 | 45 | 55 | 45 | 40 | 30 | 40 | 30 | 30 | 25 | 30 | 20 | Fig. 1 |

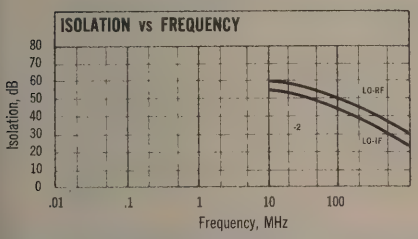
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +15 dBm. Impedance (all ports), 50 ohms, DC offset, 2 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -1, 3.5 dB Model -2, 6 dB Model -3, 2 dB

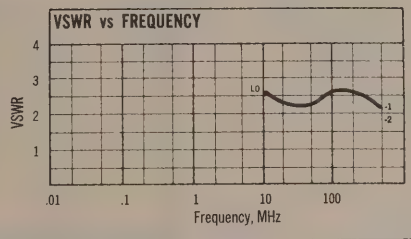
## MODELS RAY-1, RAY-2

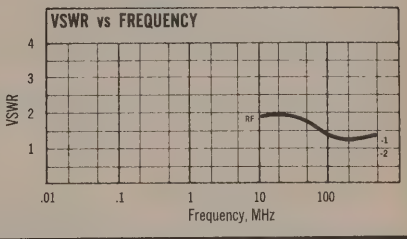


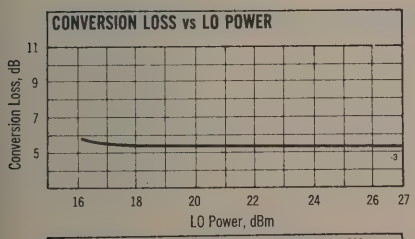



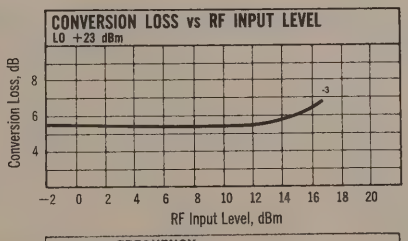



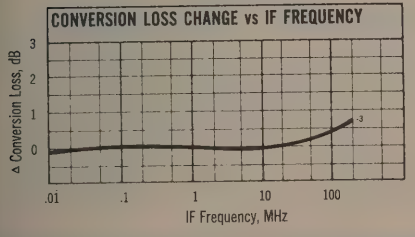



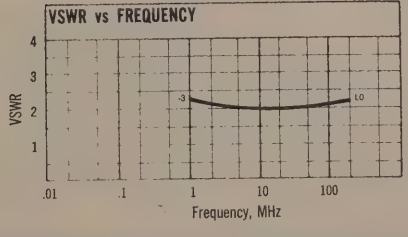




## MODEL RAY-3



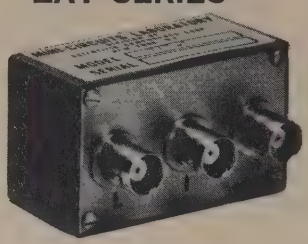



# Very High Level (+23 dBm LO) DOUBLE-BALANCED MIXERS

## ZAY SERIES



| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| ZAY-1 | 5 MHz-500 MHz | 50 | $41.95 (4-9) |
| ZAY-2 | 10 MHz-1000 MHz | 50 | $61.95 (4-9) |
| ZAY-3 | 70 KHz -200 MHz | 50 | $41.95 (4-9) |

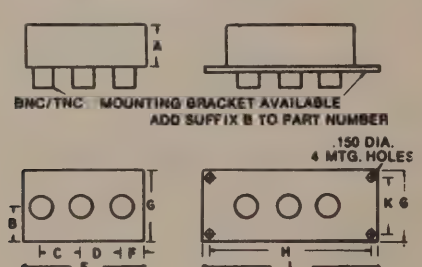
**DESCRIPTION** — The ZAY series of mixers cover a broad frequency range from 70 KHz to 1000 MHz. Solving very severe intermodulation distortion problems, this series offers linear operation up to +15 dBb signal input at only 1 dB of compression. Reducing all higher order IMD, these models provide a conversion loss of typically 6 dB and isolation of greater than 40 dB.

BNC connectors are standard. TNC connectors are a no-cost option.

The ZAY series is housed in a die cast aluminum case. These rugged units are double shielded to meet tough RFI requirements. The case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 2.6 ounces (74 grams).

Only well matched hot-carrier diodes and ruggedly constructed low distortion transformers are used. Internally, every component is bonded with silicone rubber to provide protection against shock, vibration and acceleration.

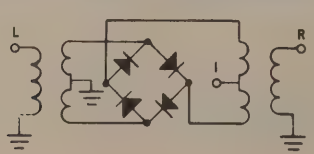
## DIMENSIONS AND CONNECTIONS




**MOUNTING BRACKET AVAILABLE ON REQUEST.** Add suffix B to part number and $1.50 to unit cost.

**CONNECTORS:** BNC standard. TNC on request (no charge).

| | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| IN. | 1.15 | .63 | .750 | .730 | 2.25 | .385 | 1.40 | 2.95 | 3.25 | 1.10 |
| MM | 29 | 16 | 19 | 18.5 | 57 | 9.7 | 35.5 | 74.9 | 82.5 | 28 |




**WEIGHT** 74 grams 2.6 ounces

## FEATURES

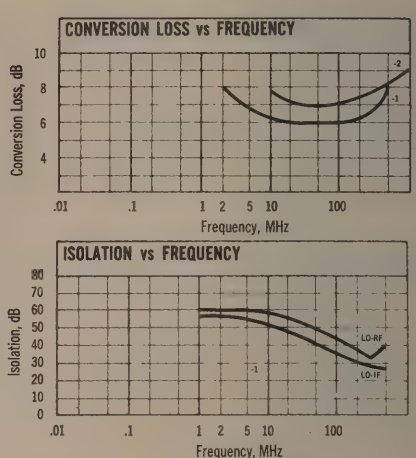
**Broadband:** 70 KHz to 1000 MHz
**Low Conversion Loss:** typically less than 6 dB
**High Isolation:** typically greater than 40 dB
**Compact:** 2.25″ W, 1.15″ D, 1.4″ H
**High Reliability:** 100% tested, 1 year guarantee
**Low Cost:** as low as $41.95 in small quantity

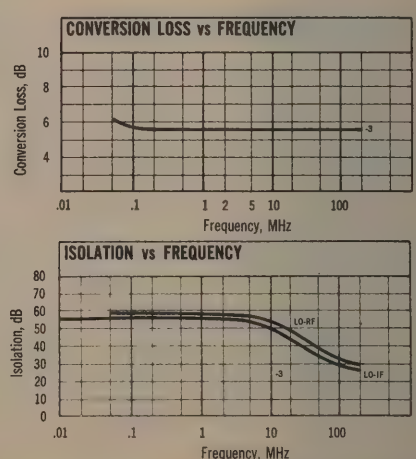
## APPLICATIONS

- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Bi-phase modulation

## ABSOLUTE MAXIMUM RATINGS

- **Input Power:** 1 mW
- **Peak IF Input Current:** 40 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Environmental Specifications:** See Index Page




Mini-Circuits 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# ZAY Series
# 70 KHz to 1000 MHz

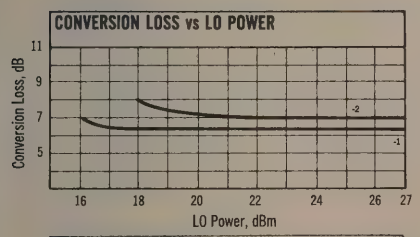
Mini-Circuits

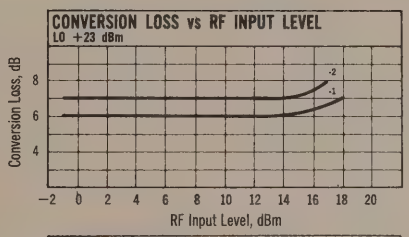
## SPECIFICATIONS

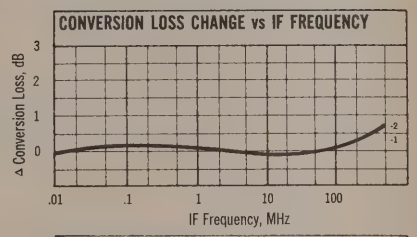
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. |
| ZAY-1 | 5-500 | 5-500 | DC-500 | 6.0 | 7.5 | 7.5 | 8.5 | 55 | 45 | 55 | 45 | 40 | 30 | 40 | 30 | 30 | 25 | 30 | 20 |
| ZAY-2 | 10-1000 | 10-1000 | DC-1000 | 7.0 | 8.5 | 8.5 | 10.0 | 50 | 35 | 50 | 35 | 40 | 30 | 35 | 25 | 35 | 25 | 25 | 20 |
| ZAY-3 | .07-200 | .07-200 | DC-200 | 6.0 | 7.5 | 6.5 | 8.0 | 55 | 45 | 55 | 45 | 40 | 30 | 40 | 30 | 30 | 25 | 30 | 20 |

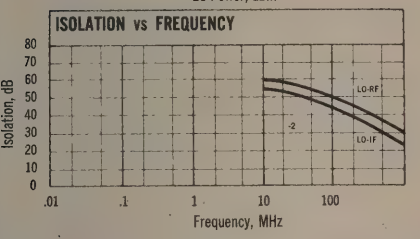
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +15 dBm. Impedance (all ports), 50 ohms, DC offset, 2 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -1, 3.5 dB Model -2, 6 dB Model -3, 2 dB

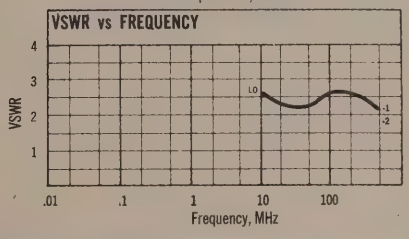
## MODELS ZAY-1, ZAY-2

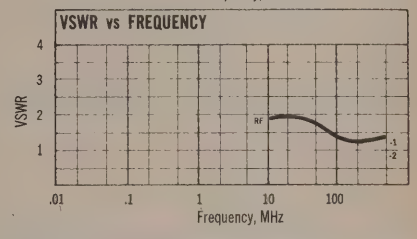


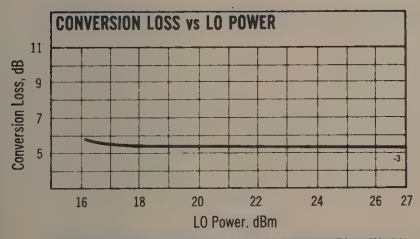



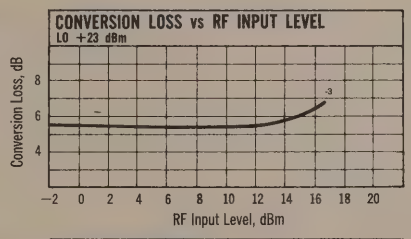



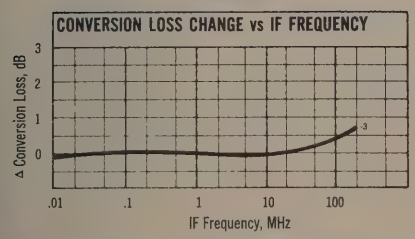



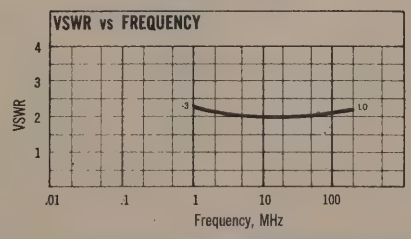




## MODEL ZAY-3



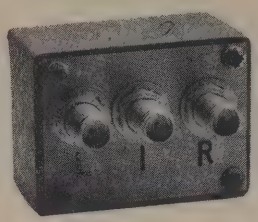




*PROMPT SERVICE / ONE WEEK DELIVERY* Mini-Circuits

# Very High Level (+23 dBm LO) DOUBLE-BALANCED MIXERS

## ZMY SERIES



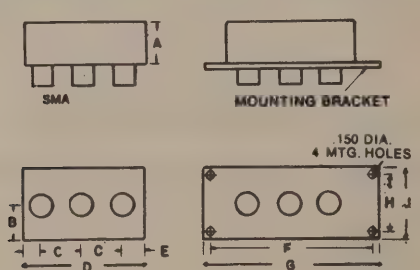

| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| ZMY-1 | 5 MHz-500 MHz | 50 | $51.95 (4-9) |
| ZMY-2 | 10 MHz-1000 MHz | 50 | $71.95 (4-9) |
| ZMY-3 | 70 KHz -200 MHz | 50 | $51.95 (4-9) |

**DESCRIPTION** — The ZMY series of mixers cover a broad frequency range from 70 KHz to 1000 MHz. Solving very severe intermodulation distortion problems, the ZMY series offers linear operation up to +15 dBb signal input at only 1 dB of compression. Reducing all higher order IMD, the ZMY series provides a conversion loss of typically 6 dB and isolation of greater than 40 dB.

Available with SMA (3mm) connectors, the ZMY series is housed in a die cast aluminum case. These rugged units are double shielded to meet tough RFI requirements. The case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 1.02 ounces (34 grams).

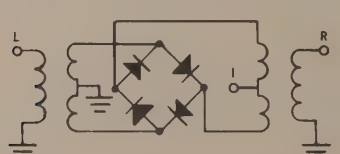
Only well matched hot-carrier diodes and ruggedly constructed low distortion transformers are used. Internally, every component is bonded with silicone rubber to provide protection against shock, vibration and acceleration.

## DIMENSIONS AND CONNECTIONS




**MOUNTING BRACKET AVAILABLE ON REQUEST.** Add suffix B to part number and $1.50 to unit cost.
**CONNECTORS:** SMA (3mm) standard.

| | A | B | C | D | E | F | G | H | J |
|---|---|---|---|---|---|---|---|---|---|
| IN. | 0.88 | 0.66 | .438 | 1.50 | .312 | 2.19 | 2.50 | 0.84 | 1.15 |
| MM | 22 | 17 | 11 | 38 | 7.9 | 55.6 | 63.5 | 21 | 29 |




**WEIGHT** 34 grams 1.02 ounces

## FEATURES

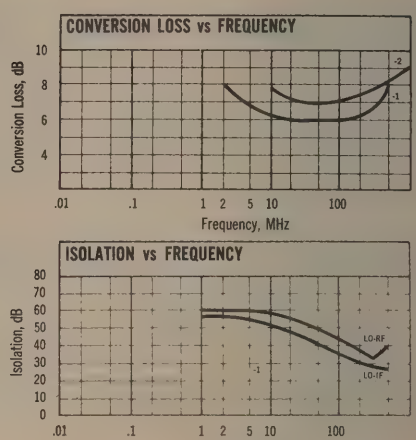
**Broadband:** 70 KHz to 1000 MHz
**Low Conversion Loss:** typically less than 6 dB
**High Isolation:** typically greater than 40 dB
**Miniature:** 1.5″ W, 0.88″ D, 1.15″ H
**High Reliability:** 100% tested, 1 year guarantee
**Low Cost:** as low as $51.95 in small quantity

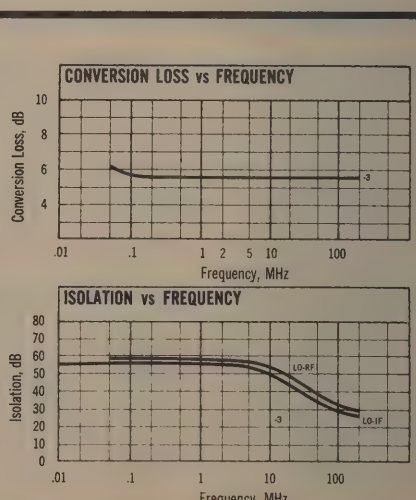
## APPLICATIONS

- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Bi-phase modulation

## ABSOLUTE MAXIMUM RATINGS

- **Input Power:** 1 mW
- **Peak IF Input Current:** 40 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Environmental Specifications:** See Index Page



# ZMY Series
# 70 KHz to 1000 MHz

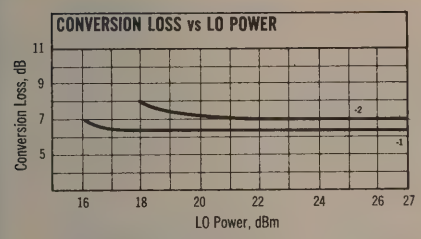
Mini-Circuits

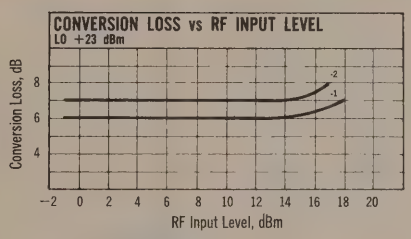
## SPECIFICATIONS

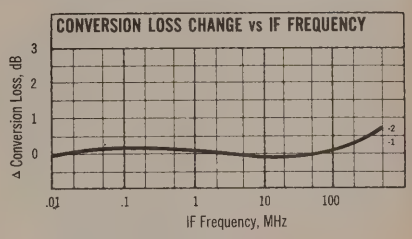
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | | Isolation, dB | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | One Octave From Band Edge | | Total Range | | Lower Band Edge To One Decade Higher | | | | Mid Range | | | | Upper Band Edge To One Octave Lower | | | |
| | | | | | | | | LO-RF | | LO-IF | | LO-RF | | LO-IF | | LO-RF | | LO-IF | |
| | LO | RF | IF | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. |
| ZMY-1 | 5-500 | 5-500 | DC-500 | 6.0 | 7.5 | 7.5 | 8.5 | 55 | 45 | 55 | 45 | 40 | 30 | 40 | 30 | 30 | 25 | 30 | 20 |
| ZMY-2 | 10-1000 | 10-1000 | DC-1000 | 7.0 | 8.5 | 8.5 | 10.0 | 50 | 35 | 50 | 35 | 40 | 30 | 35 | 25 | 35 | 25 | 25 | 20 |
| ZMY-3 | .07-200 | .07-200 | DC-200 | 6.0 | 7.5 | 6.5 | 8.0 | 55 | 45 | 55 | 45 | 40 | 30 | 40 | 30 | 30 | 25 | 30 | 20 |

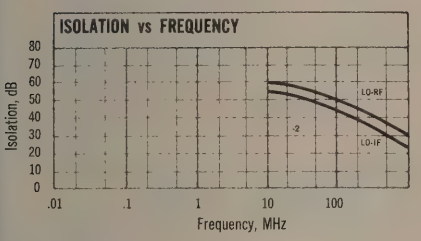
**COMMON SPECIFICATIONS:** Signal, 1 dB compression level +15 dBm. Impedance (all ports), 50 ohms, DC offset, 2 mV typ. DC polarity, negative.
**ELECTRONIC ATTENUATION:** Model -1, 3.5 dB Model -2, 6 dB Model -3, 2 dB

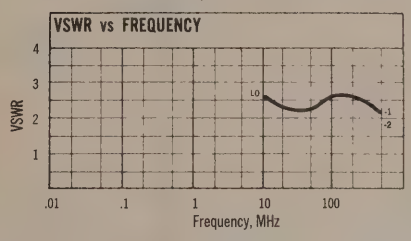
## MODELS ZMY-1, ZMY-2

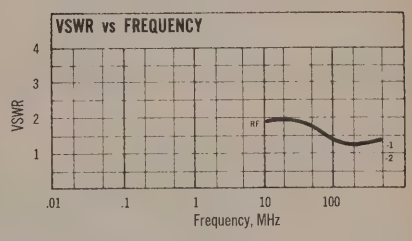


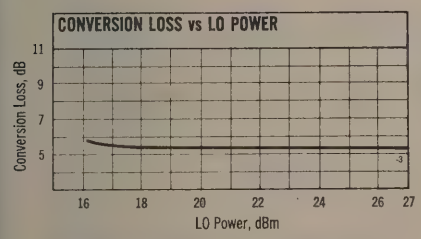



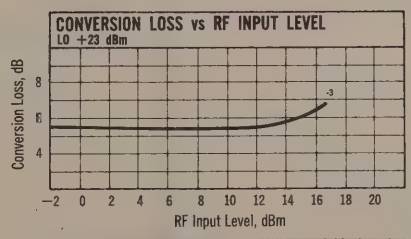



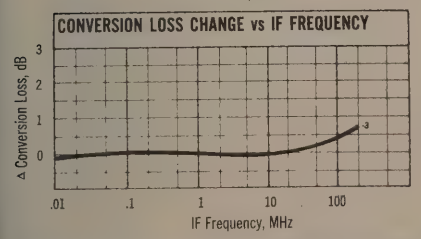



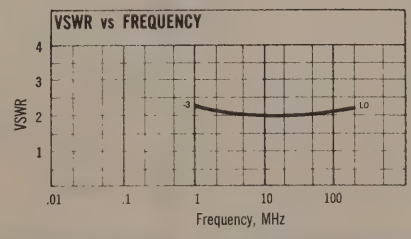




## MODEL ZMY-3



# Microwave (+10 dBm LO) DOUBLE-BALANCED MIXERS

## MA SERIES

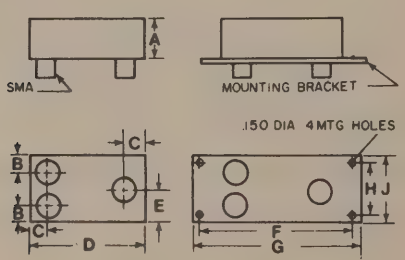
| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| MA-1 | 1 MHz-2.5 GHz | 50 | $99.95 (1-9) |

**DESCRIPTION** — A price/performance breakthrough in microwave double balanced mixers has been achieved with the MA Series. A new 1 to 2500 MHz mixer, the MA Series offers 9.0 dB conversion loss and isolation of 40 dB.

Housed in a die cast aluminum case these rugged units are shielded to meet tough EMI requirements. The case is finished with a blue baked enamel per Federal Standard 596 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 2.6 ounces (74 grams).

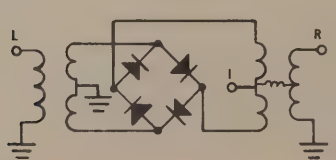
Only well matched hot-carrier diodes and rugged coaxial transmission line transformers are used. Extra special care has been taken to enable these units to be used in environments in severe shock and vibration.

### DIMENSIONS AND CONNECTIONS




**MOUNTING BRACKET AVAILABLE ON REQUEST.** Add suffix B to part number and $1.50 to unit cost.
**CONNECTORS:** SMA (3mm) standard.

| | A | B | C | D | E | F | G | H | J |
|---|---|---|---|---|---|---|---|---|---|
| IN. | 1.15 | .360 | .516 | 2.25 | .690 | 2.95 | 3.25 | 1.10 | 1.40 |
| MM | 29 | 9 | 13 | 57 | 17.5 | 74.9 | 82.5 | 28 | 35.5 |




**WEIGHT** 74 grams 2.6 ounces

### FEATURES

**Broadband:** 1 MHz to 2500 MHz
**Low Conversion Loss:** typically less than 9 dB
**High Isolation:** typically greater than 40 dB
**Compact:** 2.25″ W, 1.15″ D, 1.4″ H
**High Reliability:** 100% tested, 1 year guarantee
**Low Cost:** as low as $99.95 in small quantity

### APPLICATIONS

- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Bi-phase modulation

### ABSOLUTE MAXIMUM RATINGS

- **Input Power:** 50 mW
- **Operating and Storage Temp.:** −55°C to +100°C
- **Environmental Specifications:** See Index Page

FOR PC MOUNTING
SEE
**TFM-15**
*New Super Mixer*
10-3000 MHz with
6.5 dB Conversion
Loss

**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# MA Series
# 1 MHz to 2.5 GHz

Mini-Circuits

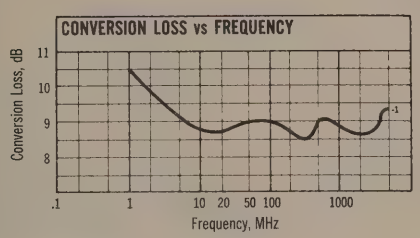
## SPECIFICATIONS

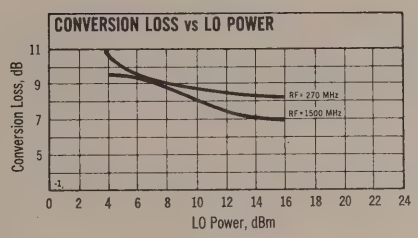
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | Isolation, dB | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | LO | RF | IF | Over Frequency Band | Typ. | Max. | Over Frequency Band | Typ. | Min. | Typ. | Min. |
| MA-1 | .001-2.5 | .001-2.5 | .001-1.0 | 1-5 MHz | 9.5 | 11.0 | Lower Band* | 60 | 50 | 55 | 45 |
| | | | | 5-1000 MHz | 9.0 | 10.5 | Mid Range | 40 | 30 | 40 | 30 |
| | | | | 1000-2500 MHz | 8.0 | 11.0 | Upper Band† | 35 | 25 | 30 | 20 |

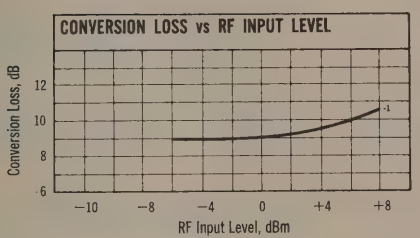
* Lower Band Edge to One Decade Higher  † Upper Band Edge to One Octave Lower

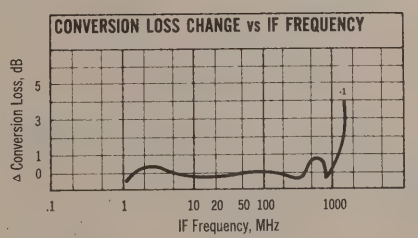
**COMMON SPECIFICATIONS:** Signal, 1 dB compression point +7 dBm. Impedance (all ports), 50 ohms.

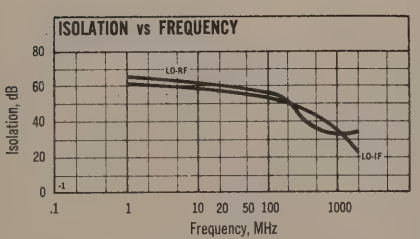
## MODEL MA-1

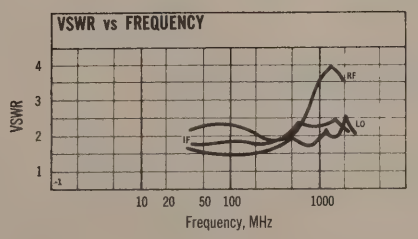


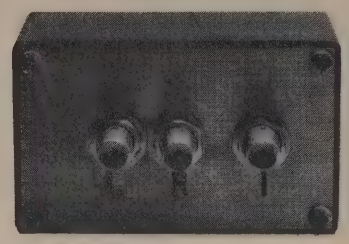



# Microwave (+7 dBm LO) BALANCED MIXERS

## ZMA SERIES



| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| ZMA-2 | 1 GHz-2.5 GHz | 50 | $49.95 (1-9) |
| ZMA-3 | 1.4 GHz-3 GHz | 50 | $54.95 (1-9) |

### FEATURES

**Broadband:** 1000 MHz to 3000 MHz
**Low Conversion Loss:** typically less than 7 dB
**High Isolation:** typically greater than 30 dB
**Compact:** 2.25″ W, 1.15″ D, 1.4″ H
**High Reliability:** 100% tested, 1 year guarantee
**Low Cost:** as low as $49.95 in small quantity

### APPLICATIONS

- Frequency mixing
- Pulse and amplitude modulation
- Phase detection
- Current controlled attenuation
- Bi-phase modulation

### ABSOLUTE MAXIMUM RATINGS

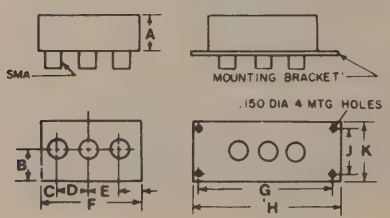
- **Input Power:** 50 mW
- **Operating and Storage Temp.:** −55°C to +100°C
- **Peak IF Input Current:** 40 mA
- **Environmental Specifications:** See Index Page

**DESCRIPTION** — The ZMA series mixers are very economically priced while covering the broad frequency range from 1000 MHz to 3000 MHz. They offer low conversion loss, 7 dB, and high LO-IF isolation, 50 dB, over most of its frequency range.

With SMA (3mm) connectors the ZMA series is housed in a die cast aluminum case. These rugged units are shielded to meet tough RFI requirements. The case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A. Unit weight is 2.6 ounces (74 grams).

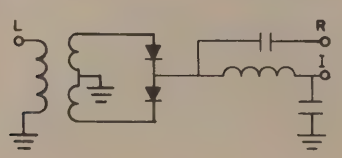
Only well matched hot-carrier diodes and ruggedly constructed transmission line transformers are used, Internally, every component is bonded with silicone rubber to provide protection against shock, vibration and acceleration.

### DIMENSIONS AND CONNECTIONS




**MOUNTING BRACKET AVAILABLE ON REQUEST.** Add suffix B to part number and $1.50 to unit cost.
**CONNECTORS:** SMA (3mm) standard.

| | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| IN. | 1.15 | .690 | .688 | .437 | .562 | 2.25 | 2.95 | 3.25 | 1.10 | 1.40 |
| MM | 29 | 17.5 | 17 | 11 | 14 | 57 | 74.9 | 82.5 | 27.9 | 35.5 |




**WEIGHT** 74 grams 2.6 ounces

FOR PC MOUNTING SEE

**TFM-15**

*New Super Mixer*

10-3000 MHz with 6.5 dB Conversion Loss

Mini-Circuits 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# ZMA Series
# 1 GHz to 3 GHz

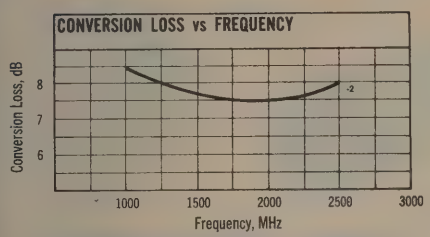
Mini-Circuits

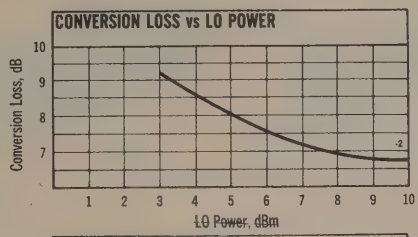
## SPECIFICATIONS

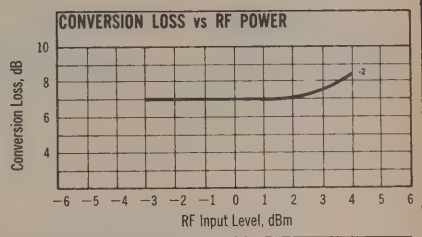
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | Isolation, dB | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | LO-RF | | LO-IF | |
| | LO | RF | IF | Over Frequency Band | Typ. | Max. | Over Frequency Band | Typ. | Min. | Typ. | Min. |
| ZMA-2 | 1-2.5 | 1-2.5 | DC-.15 | 1.4-2 GHz | 7.0 | 8.5 | 1.0-1.5 GHz | 25 | 20 | 50 | 35 |
| | | | | 1.0-2.5 GHz | 8.0 | 9.0 | 1.5-2.0 GHz | 22 | 17 | 40 | 30 |
| | | | | | | | 2.0-2.5 GHz | 20 | 15 | 35 | 25 |
| ZMA-3 | 1.4-3.0 | 1.4-3.0 | DC-.5 | 1.6-2.5 GHz | 6.5 | 8.0 | 1.4-2.0 GHz | 25 | 20 | 50 | 35 |
| | | | | 1.4-3.0 GHz | 7.0 | 9.0 | 2.0-2.5 GHz | 28 | 18 | 50 | 30 |
| | | | | | | | 2.5-3.0 GHz | 23 | 15 | 50 | 30 |

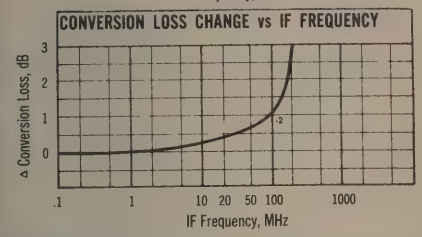
**COMMON SPECIFICATIONS:** Signal, 1 dB compression point. +2 dBm (Model -2) and +3 dBm (Model -3). Impedance (all ports), 50 ohms.

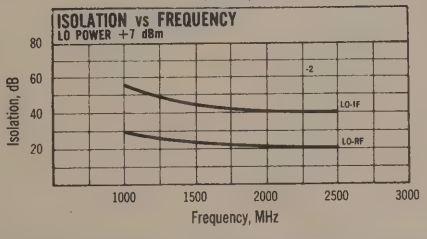
## MODEL ZMA-2

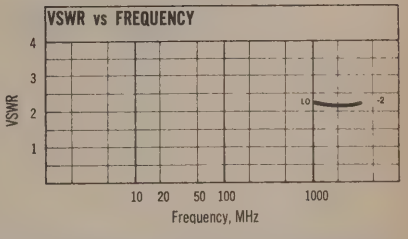


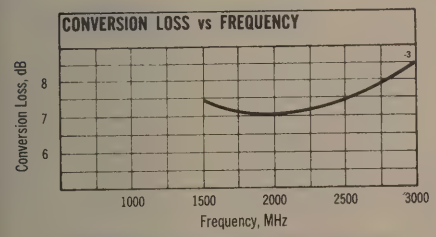



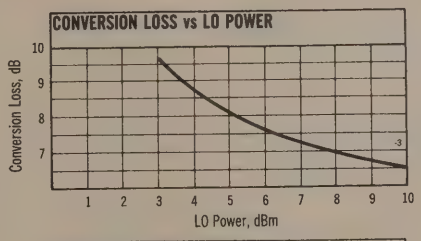



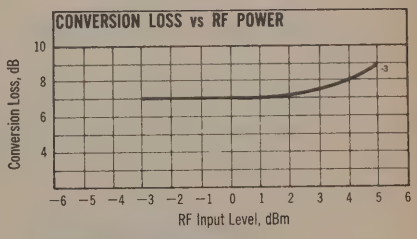



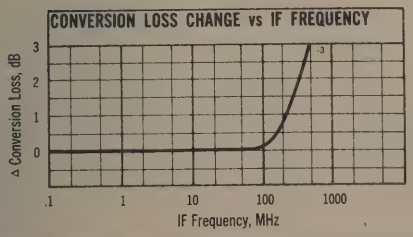



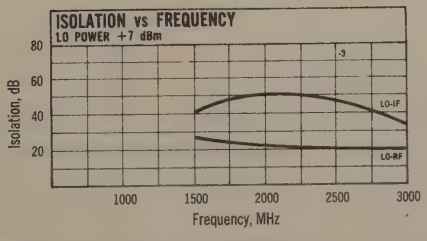

## MODEL ZMA-3

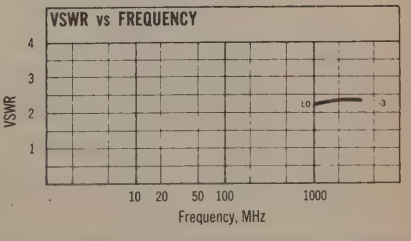


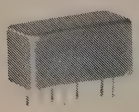



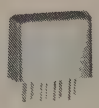

PROMPT SERVICE / ONE WEEK DELIVERY Mini-Circuits

# POWER SPLITTER/COMBINER SELECTION GUIDE

**STEP 1**
*SELECT PACKAGE STYLE*

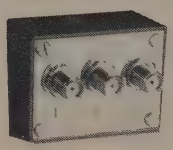


A. PSC-2, PSCQ-2, PSCJ-2 PSC-3, PSC-4

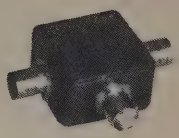


B. MSC-2

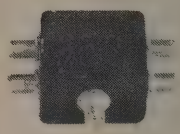
C. ZSC-2, ZSCJ-2, ZSCQ-2



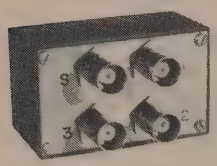
D. ZMSC-2, ZMSCJ-2, ZMSCQ-2



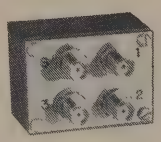
E. ZFSC-2, ZFSCJ-2



F. ZFSC-4

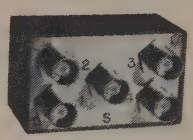


G. ZSC-3



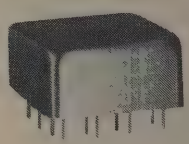
H. ZMSC-3

I. ZFSC-3

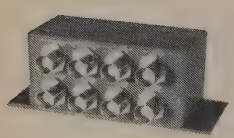


J. ZSC-4

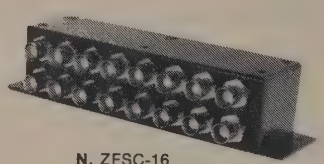
K. ZMSC-4



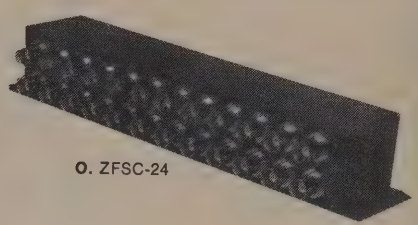
L. PSC-6, PSC-8



M. ZFSC-8



N. ZFSC-16



O. ZFSC-24

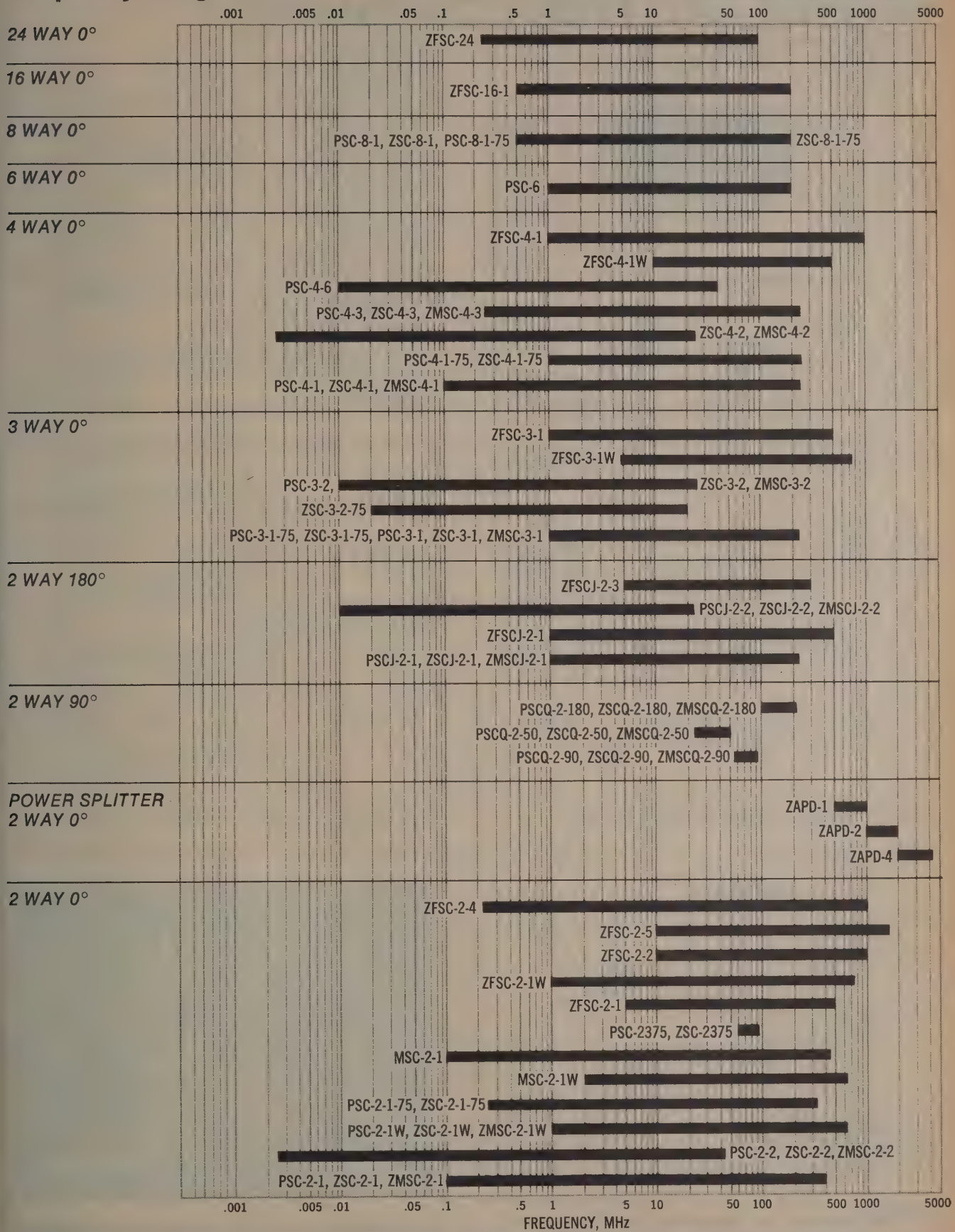
P. ZAPD

| SERIES | CASE STYLE SEE FIG. | OUTPUT PORTS | PHASE DEGREES | FREQUENCY RANGE | CONNECTOR | SIZE (INCHES) | PRICE FROM (QTY.) | PAGE |
|---|---|---|---|---|---|---|---|---|
| PSC-2 | A | 2 | 0 | 2 KHz - 650 MHz | 8 Pin | 0.4 x 0.4 x 0.8 | $ 9.95 (6-49) | 86/96 |
| MSC-2 | B | 2 | 0 | 100 KHz - 650 MHz | 8 Pin | 0.4 x 0.2 x 0.5 | $16.95 (6-24) | 88 |
| ZSC-2 | C | 2 | 0 | 2 KHz - 650 MHz | BNC STD., TNC OPT. | 2.25 x 1.4 x 1.15 | $24.95 (4-24) | 90/96 |
| ZMSC-2 | D | 2 | 0 | 2 KHz - 650 MHz | SMA | 1.5 x 1.15 x 0.88 | $34.95 (4-24) | 92 |
| ZFSC-2 | E | 2 | 0 | 200 KHz - 1500 MHz | BNC STD., TNC, N, SMA OPT. | 1.25 x 0.75 x 1.25 | $31.95 (4-24) | 94 |
| ZAPD | P | 2 | 0 | 0.5 GHz - 4.2 GHz | BNC STD., TNC, SMA, TYPE N | 2 x 2 x 0.75 | $39.95 (1-9) | 98 |
| PSCQ-2 | A | 2 | 90 | 25 MHz - 180 MHz | 8 Pin | 0.4 x 0.4 x 0.8 | $19.95 (5-29) | 100 |
| ZSCQ-2 | C | 2 | 90 | 25 MHz - 180 MHz | BNC STD., TNC OPT. | 2.25 x 1.4 x 1.15 | $34.95 (4-24) | 102 |
| ZMSCQ-2 | D | 2 | 90 | 25 MHz - 180 MHz | SMA | 1.5 x 1.15 x 0.88 | $44.95 (4-24) | 104 |
| PSCJ-2 | A | 2 | 180 | 10 KHz - 200 MHz | 8 Pin | 0.4 x 0.4 x 0.8 | $19.95 (5-49) | 106 |
| ZSCJ-2 | C | 2 | 180 | 10 KHz - 200 MHz | BNC STD., TNC OPT. | 2.25 x 1.4 x 1.15 | $34.95 (4-24) | 108 |
| ZMSCJ-2 | D | 2 | 180 | 10 KHz - 200 MHz | SMA | 1.5 x 1.15 x 0.88 | $44.95 (4-24) | 110 |
| ZFSCJ-2 | E | 2 | 180 | 1 MHz - 500 MHz | BNC STD., TNC, N, SMA OPT. | 1.25 x 0.75 x 1.25 | $49.95 (4-24) | 112 |
| PSC-3 | A | 3 | 0 | 10 KHz - 200 MHz | 8 Pin | 0.4 x 0.4 x 0.8 | $19.95 (5-49) | 114 |
| ZSC-3 | G | 3 | 0 | 10 KHz - 200 MHz | BNC STD., TNC OPT. | 2.25 x 1.4 x 1.15 | $34.95 (4-24) | 116 |
| ZMSC-3 | H | 3 | 0 | 10 KHz - 200 MHz | SMA | 1.5 x 1.15 x 0.88 | $44.95 (4-24) | 118 |
| ZFSC-3 | I | 3 | 0 | 1 MHz - 750 MHz | BNC STD., TNC, SMA, N OPT. | 1.25 x 0.75 x 1.25 | $39.95 (4-24) | 120 |
| PSC-4 | A | 4 | 0 | 10 KHz - 250 MHz | 8 Pin | 0.4 x 0.4 x 0.8 | $23.95 (6-49) | 122 |
| ZSC-4 | J | 4 | 0 | 2 KHz - 250 MHz | BNC STD., TNC OPT. | 2.25 x 1.4 x 1.15 | $38.95 (4-24) | 124 |
| ZMSC-4 | K | 4 | 0 | 2 KHz - 250 MHz | SMA | 1.5 x 1.15 x 0.88 | $48.95 (4-24) | 126 |
| ZFSC-4 | F | 4 | 0 | 1 MHz - 1000 MHz | SMA | 1.25 x 0.75 x 1.25 | $74.95 (1-4) | 128 |
| PSC-6 | L | 6 | 0 | 500 KHz - 175 MHz | 16 Pin | 0.4 x 0.8 x 0.8 | $59.95 (1-5) | 130 |
| PSC-8 | L | 8 | 0 | 500 KHz - 175 MHz | 16 Pin | 0.4 x 0.8 x 0.8 | $59.95 (1-5) | 132 |
| ZFSC-8 | M | 8 | 0 | 500 KHz - 175 MHz | BNC STD., TNC, SMA OPT. | 4.0 x 1.5 x 1.6 | $89.95 (1-4) | 134 |
| ZFSC-16 | N | 16 | 0 | 500 KHz - 125 MHz | BNC STD., TNC, SMA OPT. | 6.75 x 1.5 x 1.6 | $174.95 (1-4) | 136 |
| ZFSC-24 | O | 24 | 0 | 200 KHz - 100 MHz | BNC STD., TNC, SMA OPT. | 9.3 x 1.5 x 1.6 | $264.95 (1-4) | 138 |

**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# Model Number vs Frequency Range

**STEP 2**
*SELECT MODEL NUMBER BY FREQUENCY RANGE*

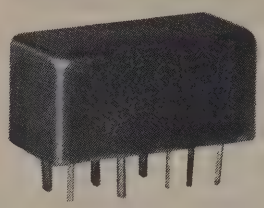




**PROMPT SERVICE / ONE WEEK DELIVERY** Mini-Circuits

# 2-Way 0°
# POWER SPLITTER/COMBINERS

## PSC-2 SERIES



## FEATURES

- **Broadband,** 2 KHz to 650 MHz
- **Excellent Balance,** typically, phase balance within 1°, amplitude balance within 0.05 dB
- **Low Insertion Loss,** typically less than 0.6 dB
- **High Isolation,** typically better than 25 dB
- **Hermetically Sealed & RFI Shielded**
- **Miniature,** 0.128 in.$^3$, 0.4" x 0.8" PC area 0.4" high
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $9.95 in small quantity

## APPLICATIONS

- **Split an input signal into two equal in-phase outputs**
- **Combine signals from two different sources**
- **Add signals vectorially**
- **Provide RF logic capability**

## ABSOLUTE MAXIMUM RATINGS

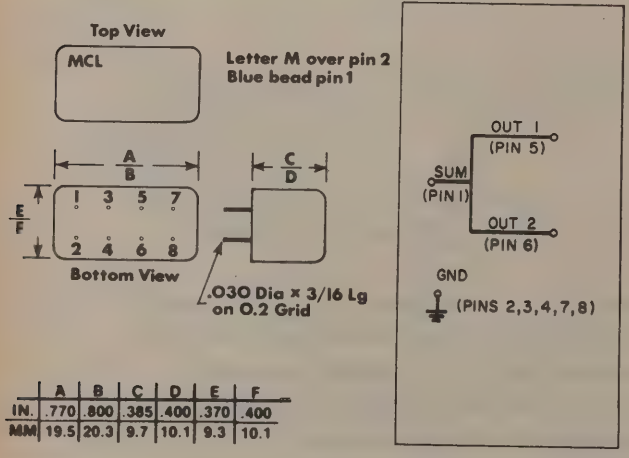
- **Operating and Storage Temp.** −55°C to +100°C
- **Pin Temperature:** (10 sec.) 510°F
- **Environmental Specifications:** See Index Page

| MODEL | FREQUENCY | Z (Ohms) | Cost |
|---|---|---|---|
| PSC-2-1 | 100 KHz - 400 MHz | 50 | $9.95 (6-49) |
| PSC-2-1W | 1 MHz - 650 MHz | 50 | $14.95 (6-49) |
| PSC-2-2 | 2 KHz - 60 MHz | 50 | $19.95 (6-49) |
| NATIONAL STANDARD NUMBERS | | PSC-2-1 | NSN 5820-00-548-0739 |

**DESCRIPTION** — The Series PSC-2 2-way power splitter/combiner is a high performance broad band hybrid junction. Internally, terminations and transformers are provided to ensure a well matched 50 ohm impedance at all ports. Signals fed into the input S port are equally divided, in phase, to the two output (1 and 2) ports. Similarly, signals fed into ports 1 and 2 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within .05 dB.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| IN. | .770 | .800 | .385 | .400 | .370 | .400 |
| MM | 19.5 | 20.3 | 9.7 | 10.1 | 9.3 | 10.1 |

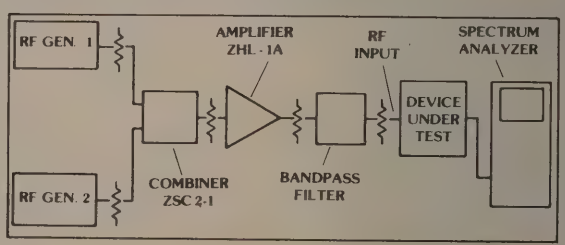
## TWO-TONE INTERMODULATION MEASUREMENT

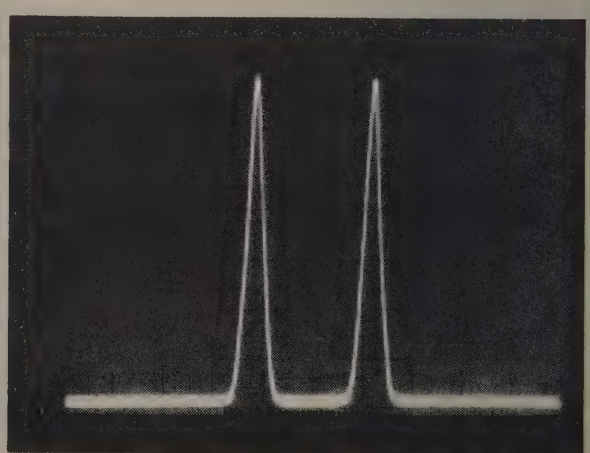
### RF INPUT CONDITIONS

TONE 1 - 10 MHz at +7 dBm INPUT
TONE 2 - 9 MHz at +7dBm INPUT

### SPECTRUM DISPLAY

RESOLUTION - 500 kHz PER DIVISION
VERTICAL - 10 dB PER DIVISION



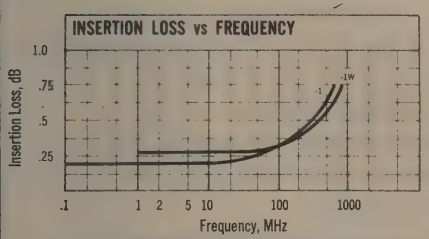
**WEIGHT** 5.2 grams 0.18 ounces

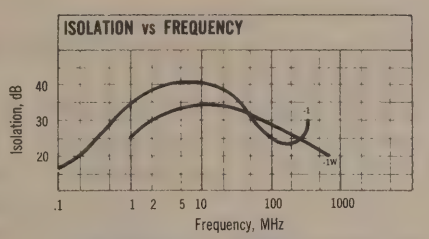
# PSC-2 Series
# 2 KHz to 650 MHz

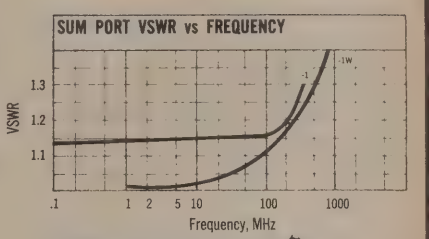
**Mini-Circuits**

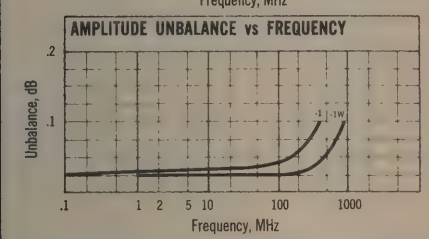
| MODEL | PSC-2-1 | PSC-2-1W | PSC-2-2 |
|---|---|---|---|
| FREQ. RANGE (MHz) | 0.1-400 | 1-650 | 2 KHz-60 MHz |
| NOMINAL PHASE | 0° | 0° | 0° |
| IMPEDANCE, ALL PORTS | 50 ohms | 50 ohms | 50 ohms |
| ISOLATION BETWEEN OUTPUT 1 and 2, dB | Typ. / Min.<br>2-40 MHz 40 30<br>0.4-400 MHz 25 20<br>0.1-0.4 MHz 20 15 | Typ. / Min.<br>10-200 MHz 35 25<br>1-650 25 20 | Typ. / Min.<br>15 KHz-6 MHz 40 30<br>4 KHz-60 MHz 27 20 |
| INSERTION LOSS, dB (above 3dB split) | Typ. / Max.<br>0.1-100 MHz 0.2 0.5<br>100-200 MHz 0.4 0.75<br>200-400 MHz 0.6 1.0 | Typ. / Max.<br>1-200 MHz 0.3 0.6<br>200-500 MHz 0.5 0.9<br>500-650 MHz 0.7 1.0 | Typ. / Max.<br>10 KHz-3 MHz 0.2 0.4<br>2 KHz-20 MHz 0.3 0.6<br>20 MHz-60 MHz 0.6 1.0 |
| PHASE UNBALANCE, DEGREES | Typ. / Max.<br>0.1-100 MHz 0.5 2<br>100-200 MHz 1 3<br>200-400 MHz 2 4 | Typ. / Max.<br>1-100 MHz 0.5 2.0<br>100-400 MHz 1.0 3.0<br>400-650 MHz 2.0 4.0 | Typ. / Max.<br>10 KHz-3 MHz 0.5 2<br>2 KHz-20 MHz 1 3<br>20 MHz-60 MHz 2 4 |
| AMPLITUDE UNBALANCE, dB | Typ. / Max.<br>0.1-100 MHz 0.05 0.15<br>100-200 MHz 0.05 0.2<br>200-400 MHz 0.1 0.3 | Typ. / Max.<br>1-100 0.05 0.15<br>100-400 MHz 0.05 0.20<br>400-650 MHz 0.10 0.30 | Typ. / Max.<br>2 KHz-20 MHz 0.05 0.15<br>20 MHz-60 MHz 0.1 0.3 |
| VSWR | 1.2 typ. | 1.2 typ. | 1.2 typ. |
| MATCHED POWER RATING | 1 watt max. | 1 watt max. | 1 watt max. |
| INTERNAL LOAD DISS. | 0.12 watt | 0.12 watt | 0.12 watt |

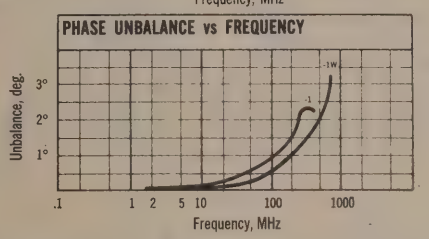
## MODELS PSC-2-1, PSC-2-1W

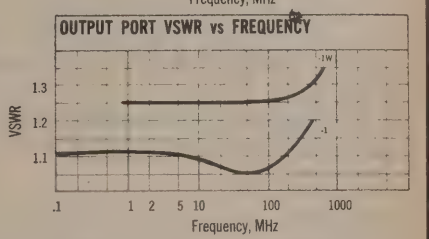


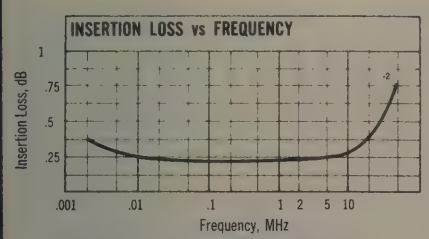



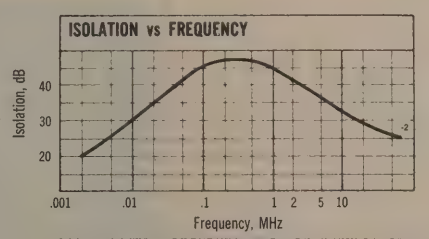



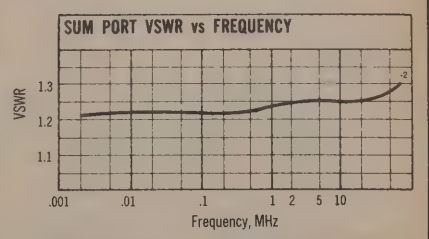



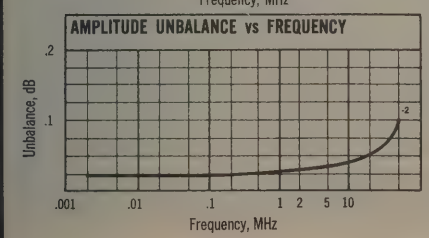



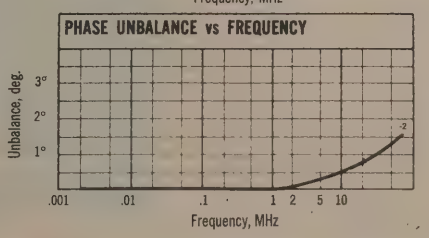

## MODEL PSC-2-2

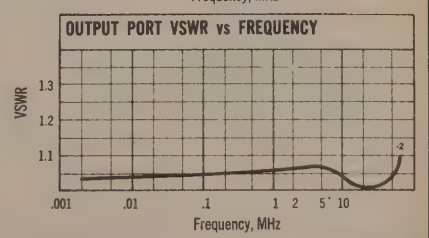


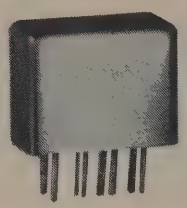




***PROMPT SERVICE / ONE WEEK DELIVERY*** **Mini-Circuits**

# 2-Way 0°
# POWER SPLITTER/COMBINERS

## MSC-2 SERIES



| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| MSC-2-1 | 100 KHz - 450 MHz | 50 | $16.95 (5-24) |
| MSC-2-1W | 2 MHz - 650 MHz | 50 | $17.95 (5-24) |

## FEATURES

- **Broadband,** 100 KHz to 650 MHz
- **Excellent Balance,** typically, phase balance within 1°, amplitude within 0.05 dB
- **Low Insertion Loss,** typically less than 0.6 dB
- **High Isolation,** typically better than 25 dB
- **Hermetically Sealed & RFI Shielded**
- **Micro-Miniature,** 0.05 in.$^3$, 0.2" x 0.5" PC area, 0.4" high
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $16.95 in small quantity

## APPLICATIONS

- **Split an input signal into two equal in-phase outputs**
- **Combine signals from two different sources**
- **Add signals vectorially**
- **Provide RF logic capability**

## ABSOLUTE MAXIMUM RATINGS

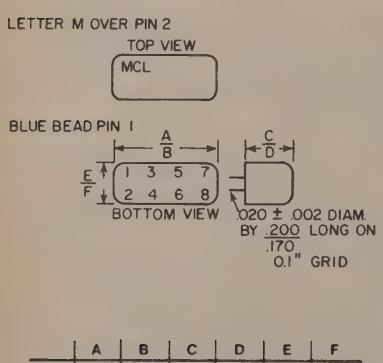
- **Operating and Storage Temp.** −55°C to +100°C
- **Pin Temperature:** (10 sec.) 510°F
- **Environmental Specifications:** See Index Page

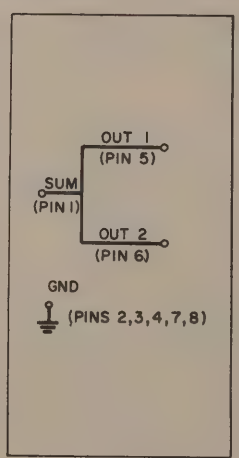
**DESCRIPTION** — The Series MSC-2 2-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, in phase, to the two output ports. Similarly, signals fed into ports 1 and 2 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within .05 dB.

The MSC-2 is ruggedly constructed to provide reliable service under severe environmental conditions. This hermetically sealed unit performs well under high relative humidity conditions and over temperature extremes from −55°C to +100°C.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| IN. | .480 | .500 | .390 | .405 | .210 | .230 |
| MM. | 12.2 | 12.7 | 9.9 | 10.3 | 5.3 | 5.8 |

**WEIGHT** 1.9 grams 0.07 ounces

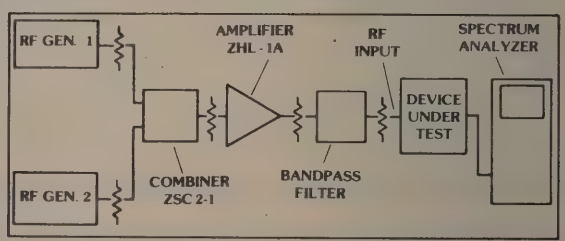
## TWO-TONE INTERMODULATION MEASUREMENT

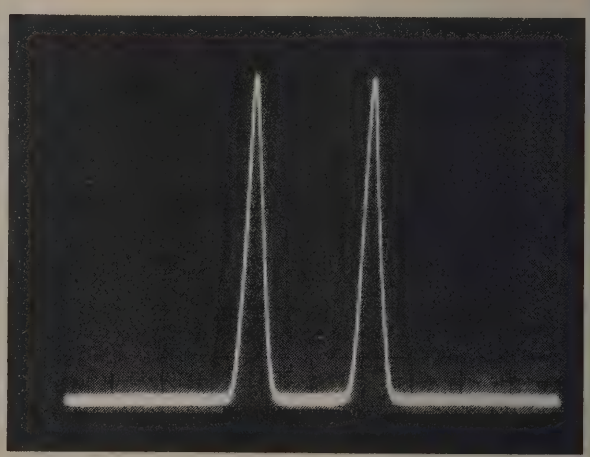
### RF INPUT CONDITIONS

TONE 1 - 10 MHz at +7 dBm INPUT
TONE 2 - 9 MHz at +7dBm INPUT

### SPECTRUM DISPLAY

RESOLUTION - 500 kHz PER DIVISION
VERTICAL - 10 dB PER DIVISION



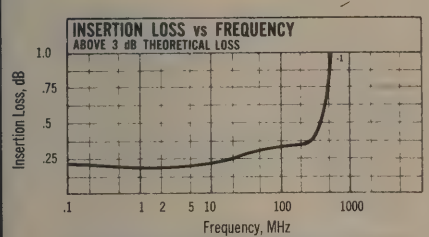
Mini-Circuits 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

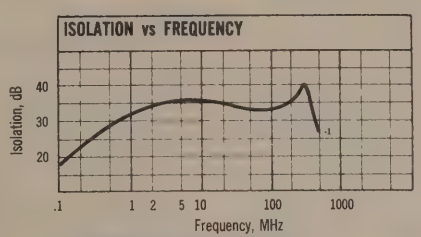
# MSC-2 Series
# 0.1 MHz to 650 MHz

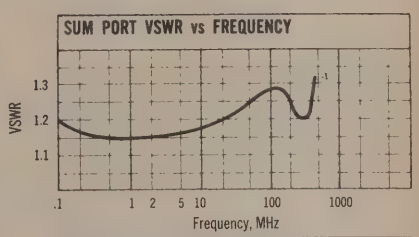
**Mini-Circuits**

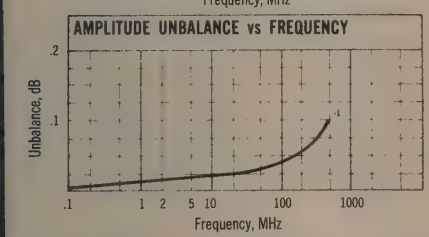
| MODEL | MSC-2-1 | | | MSC-2-1W | | |
|---|---|---|---|---|---|---|
| FREQ. RANGE (MHz) | 0.1-450 | | | 2-650 | | |
| NOMINAL PHASE | 0° | | | 0° | | |
| IMPEDANCE, ALL PORTS | 50 ohms | | | 50 ohms | | |
| ISOLATION (dB) BETWEEN OUTPUT 1 and 2 | | Typ. | Min. | | Typ. | Min. |
| | 2-250 MHz | 35 | 25 | 10-200 MHz | 30 | 25 |
| | 0.4-450 MHz | 30 | 20 | 2-650 MHz | 22 | 18 |
| | 0.1-0.4 MHz | 20 | 15 | | | |
| INSERTION LOSS, dB (ABOVE 3 dB SPLIT) | | Typ. | Max. | | Typ. | Max. |
| | 2-100 MHz | 0.3 | 0.5 | 2-100 MHz | 0.3 | 0.5 |
| | 0.1-250 MHz | 0.4 | 0.75 | 100-400 MHz | 0.5 | 0.8 |
| | 250-450 MHz | 0.6 | 1.0 | 400-650 MHz | 0.8 | 1.2 |
| PHASE UNBALANCE, DEGREES | | Typ. | Max. | | Typ. | Max. |
| | 0.1-100 MHz | 0.5 | 2 | 2-100 MHz | 0.2 | 1.0 |
| | 100-200 MHz | 1 | 3 | 100-400 MHz | 0.4 | 2.0 |
| | 200-450 MHz | 2 | 4 | 400-650 MHz | 0.8 | 4.0 |
| AMPLITUDE UNBALANCE, dB | | Typ. | Max. | | Typ. | Max. |
| | 0.1-100 MHz | 0.05 | 0.15 | 2-100 MHz | 0.05 | 0.15 |
| | 100-200 MHz | 0.05 | 0.2 | 100-400 MHz | 0.05 | 0.2 |
| | 200-450 MHz | 0.1 | 0.3 | 400-650 MHz | 0.1 | 0.3 |
| VSWR | 1.2 typ. | | | 1.3 typ. | | |
| MATCHED POWER RATING | 1 watt max. | | | 1 watt max. | | |
| INTERNAL LOAD DISS. | 0.12 Watt | | | 0.12 Watt | | |

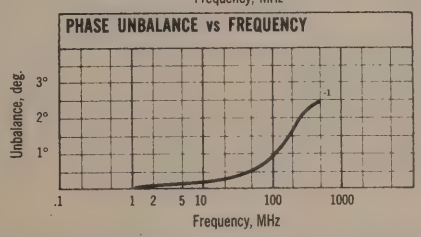
## MODEL MSC-2-1

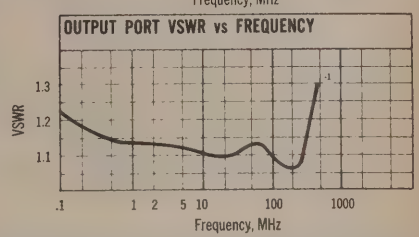


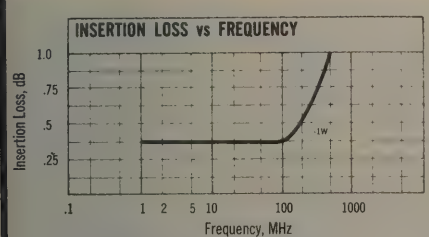



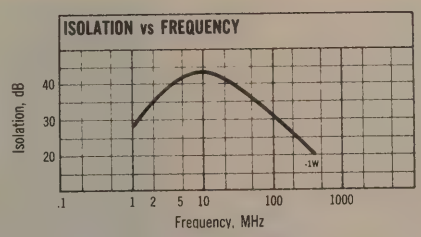



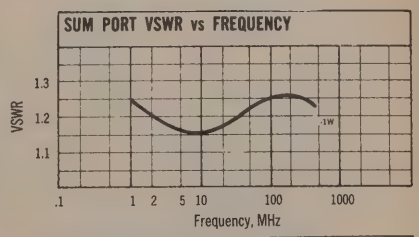



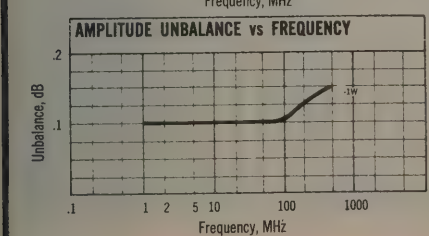



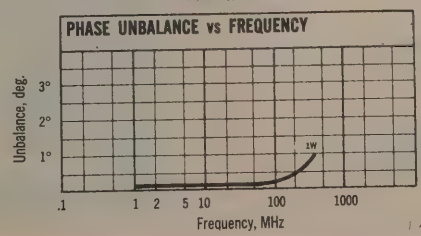

## MODEL MSC-2-1W

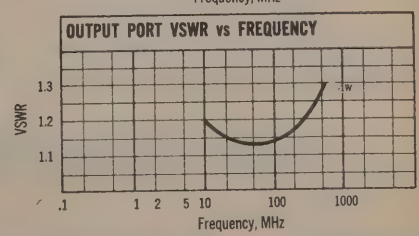


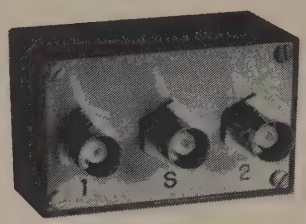



# 2-Way 0°
# POWER SPLITTER/COMBINERS

## ZSC-2 SERIES




| MODEL | FREQUENCY | Z (Ohms) | Cost |
|---|---|---|---|
| ZSC-2-1 | 100 KHz - 400 MHz | 50 | $24.95 (4-24) |
| ZSC-2-1W | 1 MHz - 650 MHz | 50 | $29.95 (4-24) |
| ZSC-2-2 | 2 KHz - 60 MHz | 50 | $34.95 (4-24) |

NATIONAL STANDARD NUMBERS ZSC-2-1B NSN 5820-00-270-3055
ZSC-2-2-75B NSN 5915-01-012-8162

## FEATURES

- **Broadband,** 2 KHz to 650 MHz
- **Excellent Balance,** typically, phase balance within 1°, amplitude balance within 0.05 dB
- **Low Insertion Loss,** typically less than 0.6 dB
- **High Isolation,** typically better than 25 dB
- **Connectors,** available with BNC or TNC
- **Mounting,** available with bracket as option
- **Compact,** 2.25" width, 1.4" height, 1.15" depth
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $24.95 in small quantity

## APPLICATIONS

- **Split an input signal into two equal in-phase outputs**
- **Combine signals from two different sources**
- **Add signals vectorially**
- **Provide RF logic capability**

## ABSOLUTE MAXIMUM RATINGS

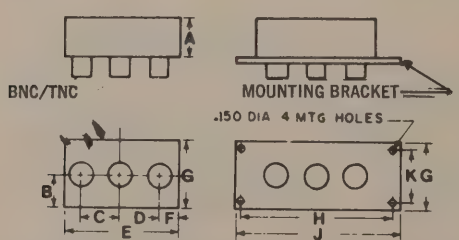
- **Operating and Storage Temp.** −55° C to +100° C
- **Environmental Specifications:** See Index Page

**DESCRIPTION** — The Series ZSC 2-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, in phase, to the two output ports. Similarly, signals fed into ports 1 and 2 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 2 degree and the amplitude balance is within .05 dB.

Housed in a die cast aluminum case, these rugged units are double shielded to meet tough EMI requirements. The case is finished with a blue baked enamel per Federal Standard 595 +25109 over phosphoric etch per MIL-C-15328A.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

## DIMENSIONS AND CONNECTIONS




MOUNTING BRACKET AVAILABLE ON REQUEST. Add suffix B to part number and add $1.50 to unit cost.
CONNECTORS BNC Std., TNC on request

| | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| IN. | 1.15 | .63 | .750 | .730 | 2.25 | .385 | 1.40 | 2.95 | 3.25 | 1.10 |
| MM | 29. | 16. | 19. | 18.5 | 57. | 9.77 | 35.5 | 74.9 | 82.5 | 28. |

**WEIGHT** 74.0 grams 2.60 ounces

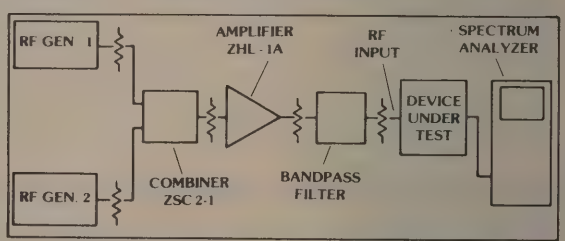
## TWO-TONE INTERMODULATION MEASUREMENT

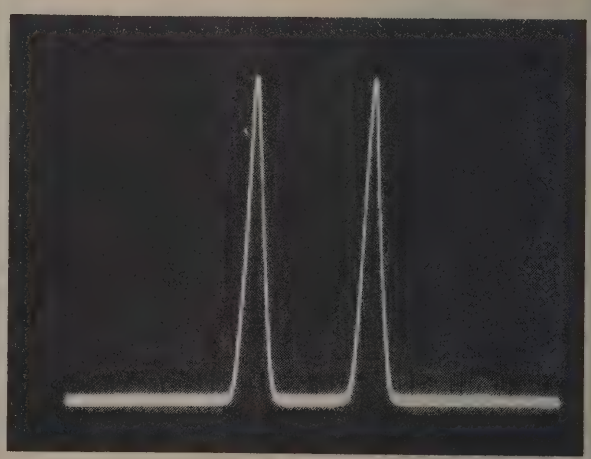
### RF INPUT CONDITIONS

TONE 1 - 10 MHz at +7 dBm INPUT
TONE 2 - 9 MHz at +7dBm INPUT

### SPECTRUM DISPLAY

RESOLUTION - 500 kHz PER DIVISION
VERTICAL - 10 dB PER DIVISION



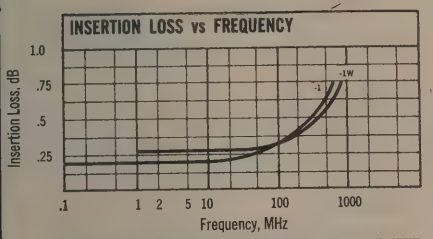
Mini-Circuits 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

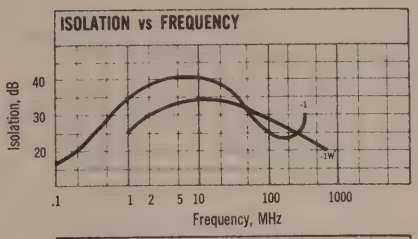
# ZSC-2 Series
# 2 KHz to 650 MHz

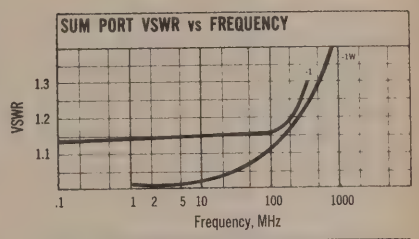
# Mini-Circuits

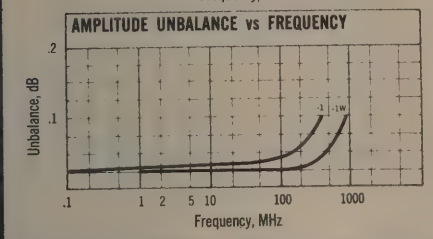
| MODEL | ZSC-2-1 | ZSC-2-1W | ZSC-2-2 |
|---|---|---|---|
| FREQ. RANGE (MHz) | 0.1-400 | 1-650 | 2 KHz-60 MHz |
| NOMINAL PHASE | 0° | 0° | 0° |
| IMPEDANCE. ALL PORTS | 50 ohms | 50 ohms | 50 ohms |
| ISOLATION BETWEEN OUTPUT 1 and 2. dB | Typ. Min.<br>2-40 MHz 40 30<br>0.4-400 MHz 25 20<br>0.1-0.4 MHz 20 15 | Typ. Min.<br>10-200 MHz 35 25<br>1-650 30 20 | Typ. Min.<br>15 KHz-6 MHz 40 30<br>4 KHz-60 MHz 27 20 |
| INSERTION LOSS. dB (above 3dB split) | Typ. Max.<br>0.1-100 MHz 0.2 0.5<br>100-200 MHz 0.4 0.75<br>200-400 MHz 0.6 1.0 | Typ. Max.<br>1-200 MHz 0.2 0.5<br>200-500 MHz 0.5 0.8<br>500-650 MHz 0.7 1.0 | Typ. Max.<br>10 KHz-3 MHz 0.2 0.4<br>2 KHz-20 MHz 0.3 0.6<br>20 MHz-60 MHz 0.5 1.0 |
| PHASE UNBALANCE. DEGREES | Typ. Max.<br>0.1-100 MHz 0.5 2<br>100-200 MHz 1 3<br>200-400 MHz 2 4 | Typ. Max.<br>1-100 MHz 0.5 2.0<br>100-400 MHz 1.0 3.0<br>400-650 MHz 2.0 4.0 | Typ. Max.<br>10 KHz-3 MHz 0.5 2<br>2 KHz-20 MHz 1 3<br>20 MHz-60 MHz 2 4 |
| AMPLITUDE UNBALANCE. dB | Typ. Max.<br>0.1-100 MHz 0.05 0.15<br>100-200 MHz 0.05 0.2<br>200-400 MHz 0.1 0.3 | Typ. Max.<br>1-100 0.05 0.15<br>100-400 MHz 0.05 0.20<br>400-650 MHz 0.10 0.30 | Typ. Max.<br>2 KHz-20 MHz 0.05 0.15<br>20 MHz-60 MHz 0.1 0.3 |
| VSWR | 1.2 typ. | 1.2 typ. | 1.2 typ. |
| MATCHED POWER RATING | 1 watt max. | 1 watt max. | 1 watt max. |
| INTERNAL LOAD DISS. | 0.25 watt | 0.25 watt | 0.25 watt |

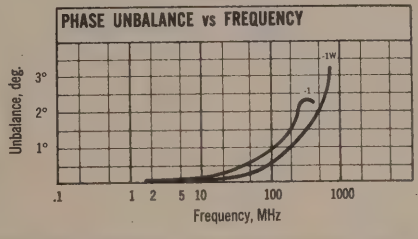
## MODELS ZSC-2-1, ZSC-2-1W

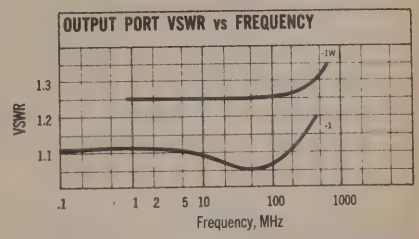


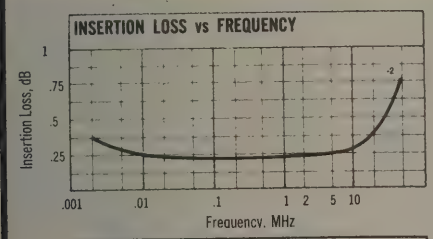



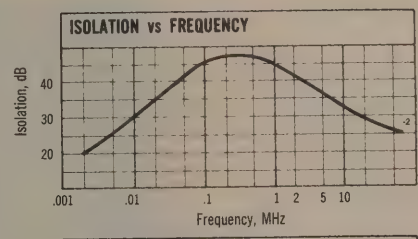



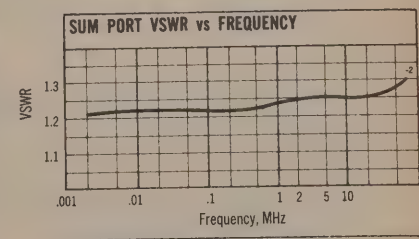



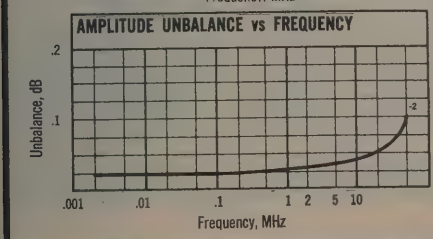



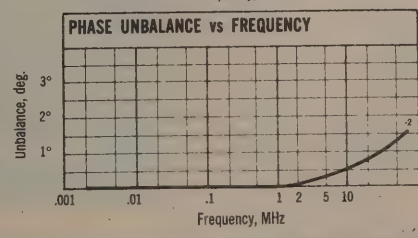

## MODEL ZSC-2-2

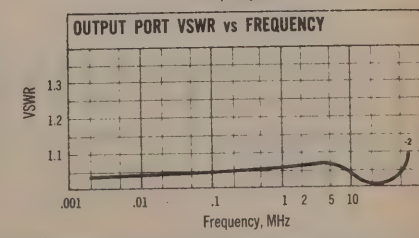


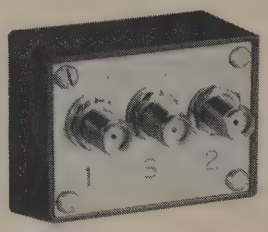




**PROMPT SERVICE / ONE WEEK DELIVERY** Mini-Circuits

# 2-Way 0°
# POWER SPLITTER/COMBINERS

## ZMSC-2 SERIES




| MODEL | FREQUENCY | Z (Ohms) | Cost |
|---|---|---|---|
| ZMSC-2-1 | 100 KHz - 400 MHz | 50 | $34.95 (4-24) |
| ZMSC-2-1W | 1 MHz - 650 MHz | 50 | $39.95 (4-24) |
| ZMSC-2-2 | 2 KHz - 60 MHz | 50 | $44.95 (4-24) |

## FEATURES

- **Broadband,** 2 KHz to 650 MHz
- **Excellent Balance,** typically phase balance within 1°, amplitude balance within 0.05 dB
- **Low Insertion Loss,** typically less than 0.6 dB
- **High Isolation,** typically bettr than 25 dB
- **Connectors,** available with SMA
- **Mounting,** option, available with bracket
- **Miniature,** 1.5′ width, 1.15″ height, 0.88″ depth
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $34.95 in small quantity

## APPLICATIONS

- **Split an input signal into two equal in-phase outputs**
- **Combine signals from two different sources**
- **Add signals vectorially**
- **Provide RF logic capability**

## ABSOLUTE MAXIMUM RATINGS

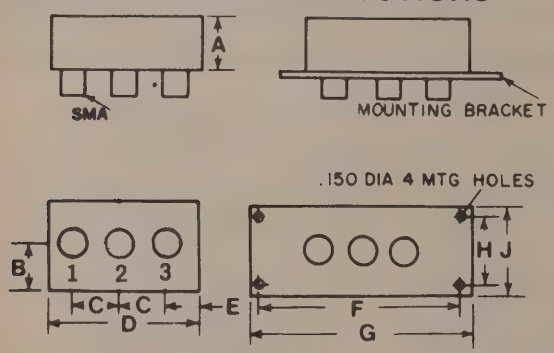
- **Operating and Storage Temp.** −55°C to +100°C
- **Environmental Specifications:** See Index Page

**DESCRIPTION** — The Series ZMSC 2-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, in phase, to the two output ports. Similarly, signals fed into ports 1 and 2 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within .05 dB.

Housed in a die cast aluminum case, these rugged units are double shielded to meet tough EMI requirements. The case is finished with a blue baked enamel per Federal Standard 595 +25109 over phosphoric etch per MIL-C-15328A.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F | G | H | J |
|---|---|---|---|---|---|---|---|---|---|
| IN. | 0.88 | 0.66 | .438 | 1.50 | .312 | 2.19 | 2.50 | 0.84 | 1.15 |
| MM | 22.0 | 17.0 | 11.0 | 38.0 | 7.90 | 55.6 | 63.5 | 21.0 | 29.0 |

MOUNTING BRACKET AVAILABLE ON REQUEST. Add suffix B to part number and add $1.50 to unit cost.
CONNECTORS SMA only.

**WEIGHT** 34.0 grams 1.20 ounces

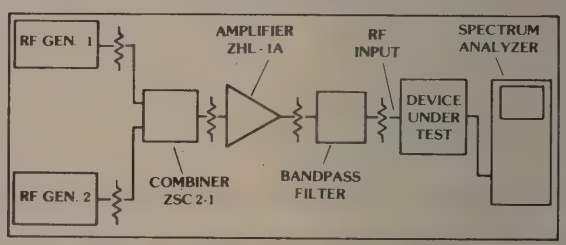
## TWO-TONE INTERMODULATION MEASUREMENT

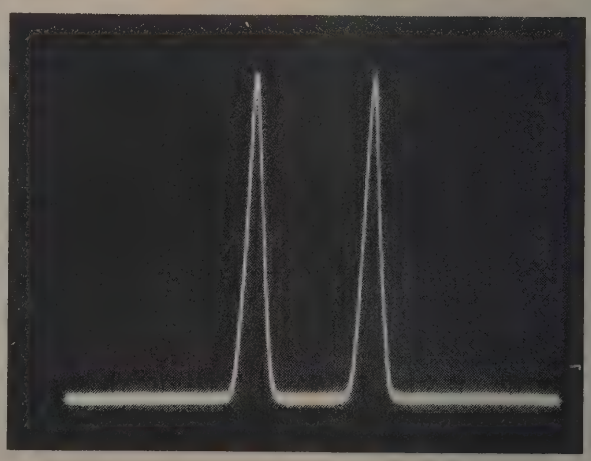
### RF INPUT CONDITIONS

TONE 1 - 10 MHz at +7 dBm INPUT
TONE 2 - 9 MHz at +7dBm INPUT

### SPECTRUM DISPLAY

RESOLUTION - 500 kHz PER DIVISION
VERTICAL - 10 dB PER DIVISION



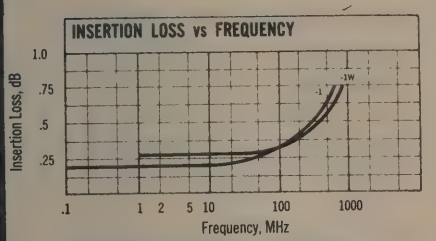



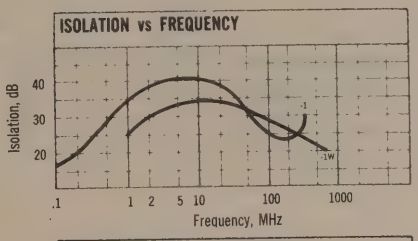
# ZMSC-2 Series
# 2 KHz to 650 MHz

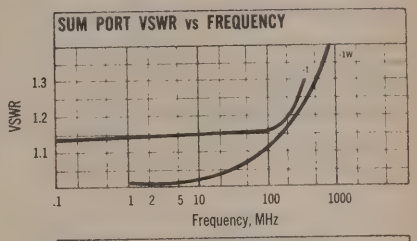
**Mini-Circuits**

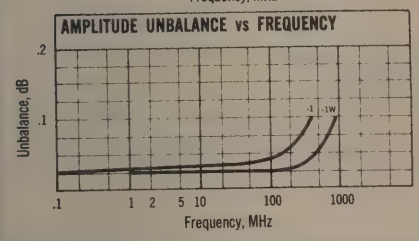
| MODEL | ZMSC-2-1 | ZMSC-2-1W | ZMSC-2-2 |
|---|---|---|---|
| FREQ. RANGE (MHz) | 0.1-400 | 1-650 | 2 KHz-60 MHz |
| NOMINAL PHASE | 0 | 0 | 0 |
| IMPEDANCE. ALL PORTS | 50 ohms | 50 ohms | 50 ohms |
| ISOLATION BETWEEN OUTRUT 1 and 2. dB | Typ. / Min.<br>2-40 MHz 40 30<br>0.4-400 MHz 20 20<br>0.1-0.4 MHz 20 15 | Typ. / Min.<br>100-200 MHz 35 25<br>1-650 MHz 30 20 | Typ. / Min.<br>15 KHz-6 MHz 40 30<br>4 KHz-60 MHz 27 20 |
| INSERTION LOSS. dB (above 3 dB split) | Typ. / Max.<br>0.1-100 MHz 0.2 0.5<br>100-200 MHz 0.4 0.75<br>200-400 MHz 0.6 1.0 | Typ. / Max.<br>1-200 MHz 0.2 0.5<br>200-500 MHz 0.5 0.8<br>500-650 MHz 0.7 1.0 | Typ. / Max.<br>10 KHz-3 MHz 0.2 0.4<br>2 KHz-20 MHz 0.3 0.6<br>20 MHz-60 MHz 0.6 1.0 |
| PHASE UNBALANCE. DEGREES | Typ. / Max.<br>0.1-100 MHz 0.5 2<br>100-200 MHz 1 3<br>200-400 MHz 2 4 | Typ. / Max.<br>1-100 MHz 0.5 2.0<br>100-400 MHz 1.0 3.0<br>400-650 MHz 2.0 4.0 | Typ. / Max.<br>10 KHz-3 MHz 0.5 2<br>2 KHz-20 MHz 1 3<br>20 MHz-60 MHz 2 4 |
| AMPLITUDE UNBALANCE. dB | Typ. / Max.<br>0.1-100 MHz 0.05 0.15<br>100-200 MHz 0.05 0.2<br>200-400 MHz 0.1 0.3 | Typ. / Max.<br>1-100 MHz 0.05 0.15<br>100-400 MHz 0.05 0.20<br>400-650 MHz 0.10 0.30 | Typ. / Max.<br>2 KHz-20 MHz 0.05 0.15<br>20 MHz-60 MHz 0.1 0.3 |
| VSWR | 1.2 typ. | 1.2 typ. | 1.2 typ. |
| MATCHED POWER RATING | 1 watt max. | 1 watt max. | 1 watt max. |
| INTERNAL LOAD DISS. | 0.25 watt | 0.25 watt | 0.25 watt |

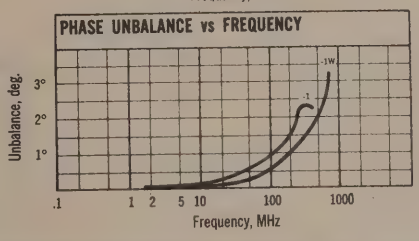
## MODELS ZMSC-2-1, ZMSC-2-1W

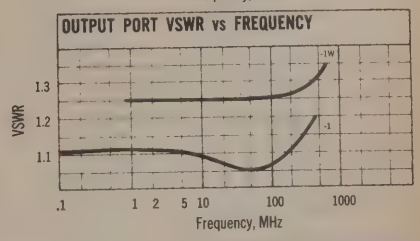


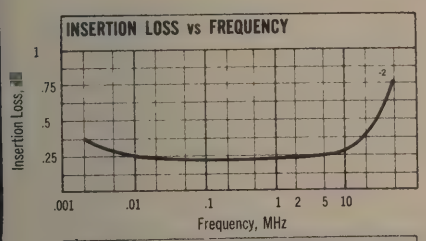



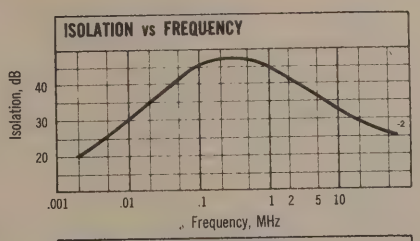



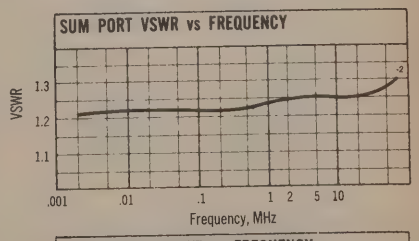



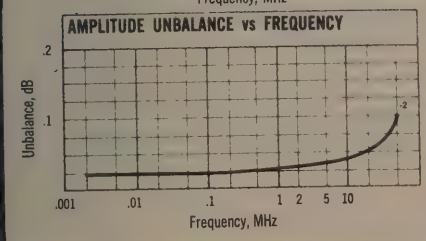



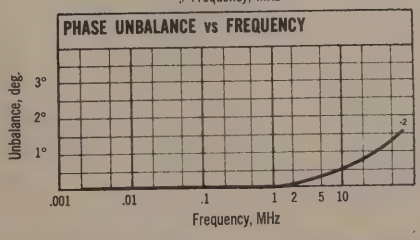

## MODEL ZMSC-2-2

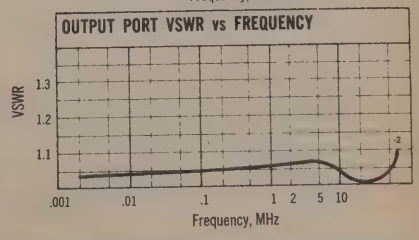


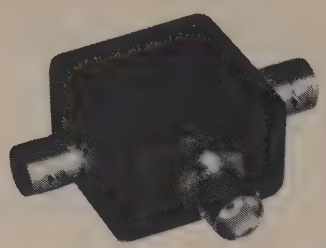




*PROMPT SERVICE / ONE WEEK DELIVERY* **Mini-Circuits**

# 2-Way 0°
# POWER SPLITTER/COMBINERS

## ZFSC-2 SERIES



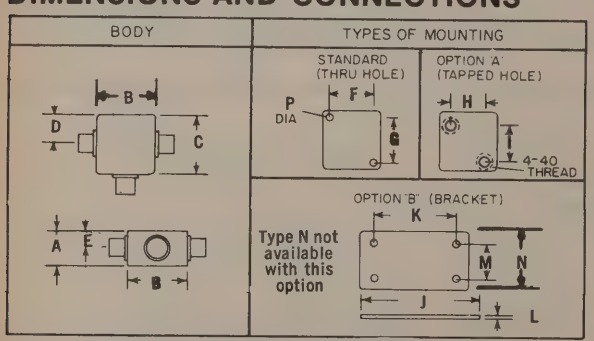
| MODEL | FREQUENCY | Z (Ohms) | Cost |
|---|---|---|---|
| ZFSC-2-1 | 5 MHz - 500 MHz | 50 | $31.95 (4-24) |
| ZFSC-2-1W | 1 MHz - 750 MHz | 50 | $35.95 (4-24) |
| ZFSC-2-2 | 10 MHz - 1000 MHz | 50 | $39.95 (4-24) |
| ZFSC-2-4 | 200 KHz - 1000 MHz | 50 | $44.95 (4-24) |
| ZFSC-2-5 | 10 MHz - 1500 MHz | 50 | $49.95 (4-24) |

**DESCRIPTION** — The Series ZFSC-2 2-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, in phase, to the two output ports. Similarly, signals fed into ports 1 and 2 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within .05 dB.

The ZFSC-2 series is housed in an extremely rugged 1¼ in. square metal case with one connector on each side. BNC, TNC, SMA and Type N connectors are available. Three convenient mounting options are included, (4-40 threaded inserts, 0.125 in. dia. through holes, and flange mounting). Each unit is supplied in a grey epoxy paint finish.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

## DIMENSIONS AND CONNECTIONS




**For mounting option A or B add Letter to P/N**

BNC (std), TNC (on request), SMA (3mm) and TYPE N on request, add $5 to unit cost.

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| IN | .75 | 1.25 | 1.25 | .625 | .375 | 1.00 | 1.00 | 0.8 |
| MM | 19.1 | 31.8 | 31.8 | 15.9 | 9.5 | 25.4 | 25.4 | 20.3 |

| | I | J | K | L | M | N | P |
|---|---|---|---|---|---|---|---|
| IN | 0.8 | 2.188 | 1.688 | .060 | .75 | 1.25 | .125 |
| MM | 20.3 | 55.6 | 42.9 | 1.5 | 19.1 | 31.8 | 3.18 |

**WEIGHT** 67.0 grams 2.36 ounces

## FEATURES

- **Broadband,** 200 KHz to 1500 MHz
- **Excellent Balance,** typically, phase balance within 1°, amplitude balance within 0.05 dB
- **Low Insertion Loss,** typically less than 0.4 dB
- **High Isolation,** typically better than 25 dB
- **Connectors,** available with BNC, TNC, SMA, or N
- **Mounting,** flange, thur holes, or tapped holes
- **Miniature,** width 1.25", height 0.75", depth 1.25"
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $31.95 in small quantity

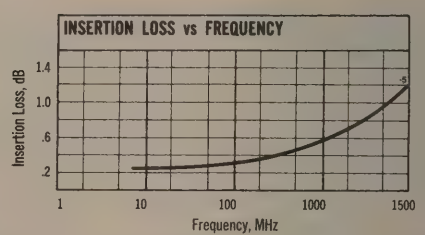
## APPLICATIONS

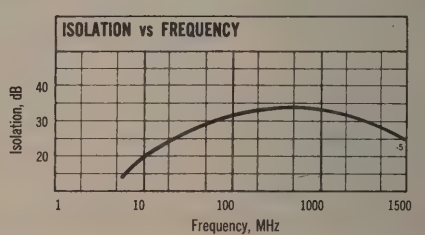
- **Split an input signal into two equal in-phase outputs**
- **Combine signals from two different sources**
- **Add signals vectorially**
- **Provide RF logic capability**

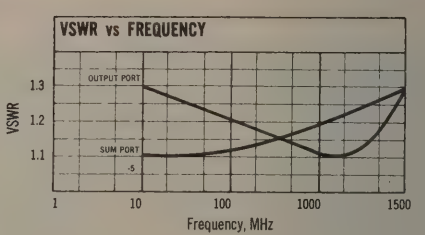
## ABSOLUTE MAXIMUM RATINGS

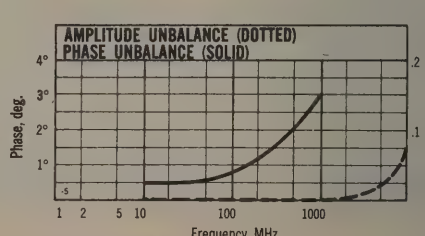
- **Operating and Storage Temp.** −55° C to +100° C
- **Environmental Specifications:** See Index Page

## MODEL ZFSC-2-5



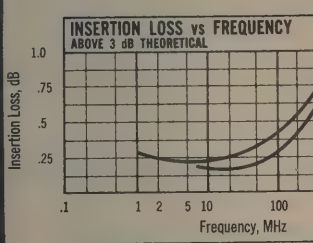



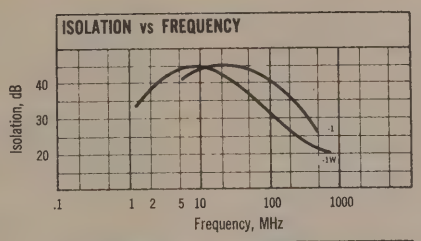
# ZFSC-2 Series
# 0.2 MHz to 1500 MHz

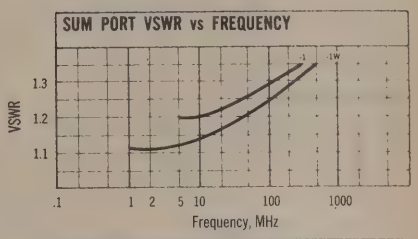
**Mini-Circuits**

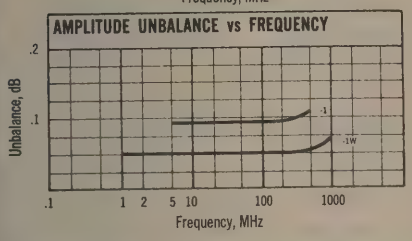
| MODEL | ZFSC-2-1 | ZFSC-2-1W | ZFSC-2-2 | ZFSC-2-4 | ZFSC-2-5 |
|---|---|---|---|---|---|
| FREQ. RANGE (MHz) | 5-500 | 1-750 | 10-1000 | 0.2-1000 | 10-1500 |
| NOMINAL PHASE | 0° | 0° | 0° | 0° | 0° |
| IMPEDANCE, ALL PORTS | 50 ohms | 50 ohms | 50 ohms | 50 ohms | 50 ohms |
| ISOLATION (dB) | Typ. Min. | Typ. Min. | Typ. Min. | Typ. Min. | Typ. Min. |
| Lower band edge to one decade higher | 30 25 | 30 20 | 30 20 | 20 12 | 25 15 |
| Mid Range | 28 20 | 28 20 | 25 20 | 25 20 | 30 20 |
| Upper band edge to one octave lower | 25 20 | 25 20 | 23 18 | 23 18 | 25 18 |
| INSERTION LOSS (dB) above 3 dB split | Typ. Max. | Typ. Max. | Typ. Max. | Typ. Max. | Typ. Max. |
| Lower band edge to one decade higher | 0.2 0.5 | 0.2 0.5 | 0.2 0.5 | 0.2 0.5 | 0.25 0.6 |
| Mid Range | 0.3 0.6 | 0.4 0.8 | 0.5 1.0 | 0.5 1.0 | 0.5 1.0 |
| Upper band edge to one octave lower | 0.6 0.8 | 0.8 1.0 | 0.9 1.2 | 0.9 1.2 | 0.8 1.5 |
| PHASE UNBALANCE, DEGREES | Typ. Max. | Typ. Max. | Typ. Max. | Typ. Max. | Typ. Max. |
| Lower band edge to one octave upper | 0.5 2 | 0.5 2 | 0.5 2 | 0.5 2 | 3 5 |
| Upper band edge to one octave lower | 1 4 | 1 4 | 1 4 | 1 4 | 5 10 |
| AMPLITUDE UNBALANCE (dB) | Typ. Max. | Typ. Max. | Typ. Max. | Typ. Max. | Typ. Max. |
| Lower band edge to one octave upper | 0.05 0.15 | 0.05 0.15 | 0.05 0.15 | 0.05 0.15 | 0.05 0.2 |
| Upper band edge to one octave lower | 0.1 0.3 | 0.1 0.3 | 0.1 0.3 | 0.1 0.3 | 0.1 0.5 |
| VSWR | 1.25 typ. | 1.25 typ. | 1.25 typ. | 1.25 typ. | 1.25 typ. |
| MATCHED POWER RATING | 1 watt max. | 1 watt max. | 1 watt max. | 1 watt max. | 1 watt max. |
| INTERNAL LOAD DISS. | 0.25 watt | 0.25 watt | 0.25 watt | 0.25 watt | 0.25 watt |

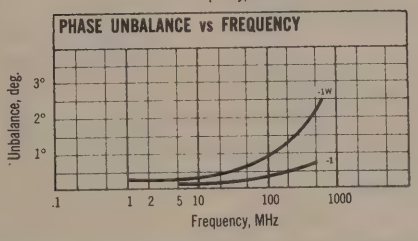
## MODELS ZFSC-2-1, ZFSC-2-1W

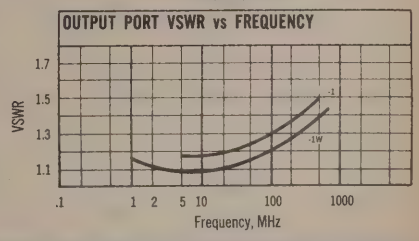


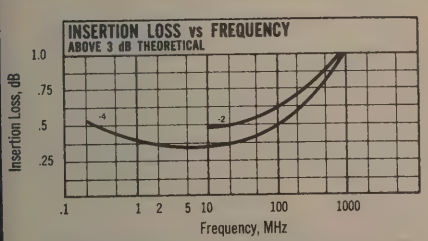



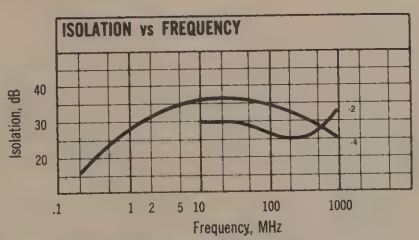



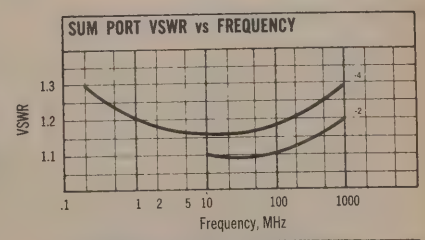



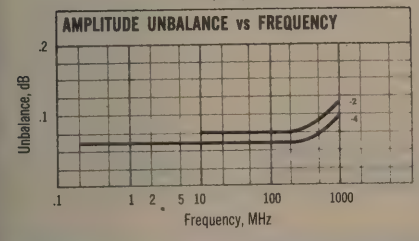



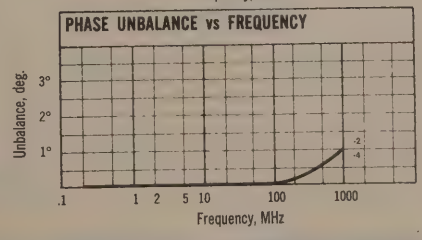

## MODELS ZFSC-2-2, ZFSC-2-4

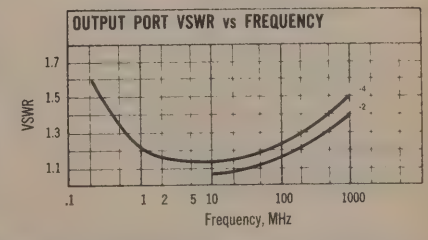


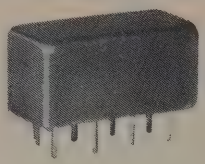



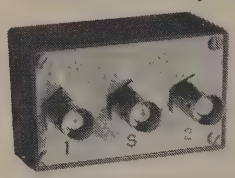

PROMPT SERVICE / ONE WEEK DELIVERY Mini-Circuits

# 2-Way 0° 75Ω
# POWER SPLITTER/COMBINERS

**MODELS PSC-2-1-75, PSC-2375**



**MODELS ZSC-2-1-75, ZSC-2375**



| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| PSC-2375 | 55 MHz- 88 MHz | 75 | $19.95 (6-49) |
| ZSC-2375 | 55 MHz- 88 MHz | 75 | $34.95 (4-24) |
| PSC-2-1-75 | 250 kHz -300 MHz | 75 | $11.95 (6-49) |
| ZSC-2-1-75 | 250 kHz -300 MHz | 75 | $26.95 (4-24) |

**DESCRIPTION** — Series PSC-2 and ZSC-2 2-way power splitter/combines are high performance hybrid junctions. Signals fed into the input S port are equally divided, in phase, to the two output ports. Similarly, signals fed into ports 1 and 2 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 2 degree and the amplitude balance is within .05 dB.

Models PSC-2375 and PSC-2-1-75 are hermetically sealed and RFI shielded. Model ZSC-2-1-75 and Model ZSC-2375 are housed in die cast aluminum cases and are double shielded to meet tough EMI requirements. The case is finished with a blue baked enamel per Federal Standard 595 +25109 over phosphoric etch per MIL-C-15328A.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

## FEATURES

- **Impedance,** 75 ohm
- **Excellent Balance,** typically, phase balance within 1°, amplitude balance within 0.05 dB
- **Low Insertion Loss,** typically less than 0.6 dB
- **High Isolation,** typically better than 25 dB

**PSC-2 Series**

- **Hermetically Sealed & RFI Shielded**
- **Miniature,** 0.128 in.³, 0.4″ x 0.8″ PC area 0.4″ high
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $11.95 in small quantity

**ZSC-2 Series**

- **Connectors,** available with BNC or TNC
- **Mounting,** available with bracket as option
- **Compact,** 2.25″ width, 1.4″ height, 1.15″ depth
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $26.95 in small quantity

## APPLICATIONS

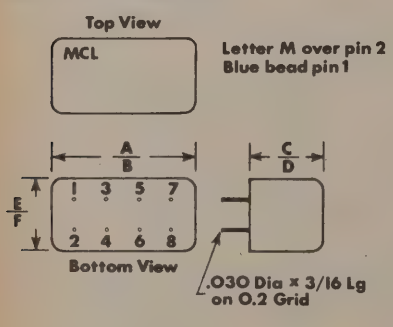
- **Split an input signal into two equal in-phase outputs**
- **Combine signals from two different sources**
- **Add signals vectorially**
- **Provide RF logic capability**

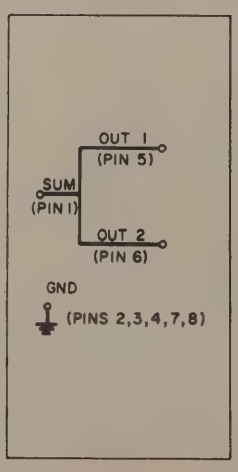
## ABSOLUTE MAXIMUM RATINGS

- **Operating & Storage Temp.** −55°C to +100°C
- **Pin Temperature Series:** (10 sec.) 510°F
- **Environmental Specifications:** See Index Page

## DIMENSIONS AND CONNECTIONS

**MODEL PSC-2-1-75**
**MODEL PSC-2375**



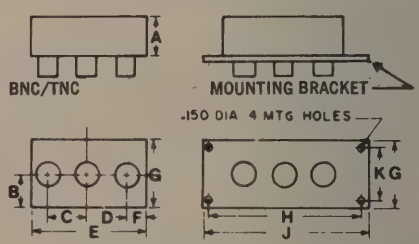




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| IN. | .770 | .800 | .385 | .400 | .370 | .400 |
| MM | 19.5 | 20.3 | 9.7 | 10.1 | 9.3 | 10.1 |

**WEIGHT** 5.2 grams 0.18 ounces

## DIMENSIONS AND CONNECTIONS

**MODEL ZSC-2375, MODEL ZSC-2-1-75**




MOUNTING BRACKET AVAILABLE ON REQUEST. Add suffix B to part number and add $1.50 to unit cost.
CONNECTORS BNC Std., TNC on request

| | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| IN. | 1.15 | .63 | .750 | .730 | 2.25 | .385 | 1.40 | 2.95 | 3.25 | 1.10 |
| MM | 29. | 16. | 19. | 18.5 | 57. | 9.77 | 35.5 | 74.9 | 82.5 | 28. |

**WEIGHT** 74.0 grams 2.60 ounces

**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

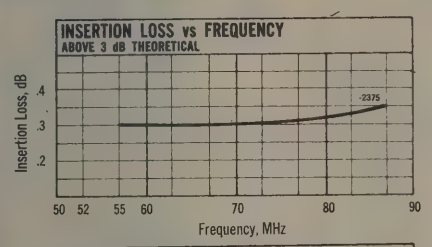
# 75 Ω Series
# .25 MHz to 300 MHz

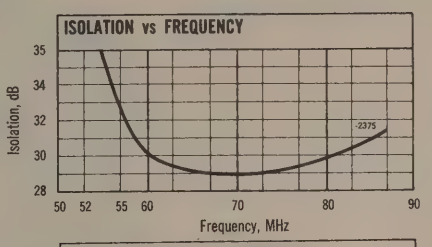
# Mini-Circuits

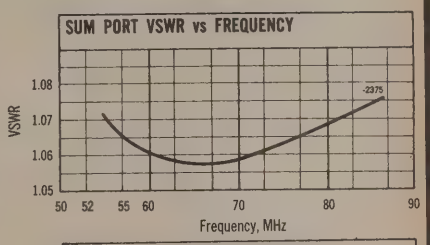
| MODEL | PSC-2-1-75 | PSC-2375 |
|---|---|---|
| FREQ. RANGE (MHz) | 0.25-300 | 55-85 |
| NOMINAL PHASE | 0° | 0° |
| IMPEDANCE, ALL PORTS | 75 ohms | 75 ohms |
| ISOLATION BETWEEN OUTPUT 1 and 2, dB | Typ. Min.<br>10-50 MHz 40 30<br>2-150 MHz 30 20<br>0.25-300 MHz 20 15 | Typ. Min.<br>55-85 MHz 35 25 |
| INSERTION LOSS, dB (above 3 dB split) | Typ. Max.<br>1-50 MHz 0.2 0.5<br>0.25-100 MHz 0.4 0.75<br>100-300 MHz 0.4 1.0 | Typ. Max.<br>55-85 MHz 0.3 0.5 |
| PHASE UNBALANCE, DEGREES | Typ. Max.<br>0.25-50 MHz 0.5 2<br>50-150 MHz 1 3<br>150-300 MHz 2 5 | |
| AMPLITUDE UNBALANCE, dB | Typ. Max.<br>1-50 MHz 0.05 0.15<br>50-150 MHz 0.05 0.2<br>150-300 MHz 0.1 0.3 | Typ. Max.<br>55-85 MHz 0.05 0.1 |
| VSWR | 1.2 typ. | Less than 1.2 |
| MATCHED POWER RATING | 1 watt max. | 1 watt max. |
| INTERNAL LOAD DISS. | 0.12 watt | 0.12 watt |

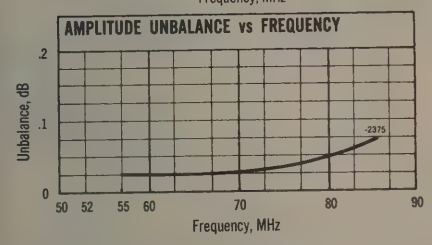
| ZSC-2-1-75 | ZSC-2375 |
|---|---|
| 0.25-300 | 55-85 |
| 0° | 0° |
| 75 ohms | 75 ohms |
| Typ. Min.<br>10-50 MHz 40 30<br>2-150 MHz 30 20<br>0.25-300 MHz 20 15 | Typ. Min.<br>55-85 MHz 35 25 |
| Typ. Max.<br>1-50 MHz 0.2 0.5<br>0.25-100 MHz 0.4 0.75<br>100-300 MHz 0.4 1.0 | Typ. Max.<br>55-85 MHz 0.3 0.5 |
| Typ. Max.<br>0.25-50 MHz 0.5 2<br>50-150 1 3<br>150-300 MHz 2 5 | |
| Typ. Max.<br>1-50 MHz 0.05 0.15<br>50-150 MHz 0.05 0.2<br>150-300 MHz 0.1 0.3 | Typ. Max.<br>55-85 MHz 0.05 0.1 |
| 1.2 typ. | Less than 1.2 |
| 1 watt max. | 1 watt max. |
| 0.12 watt | 0.25 watt |

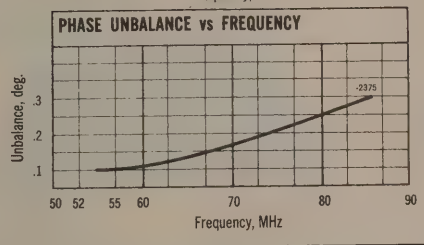
## MODELS PSC-2375, ZSC-2375

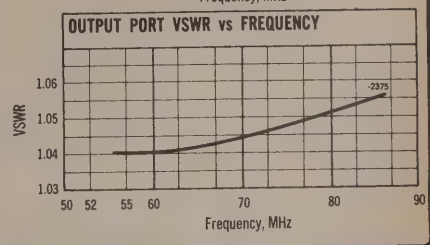


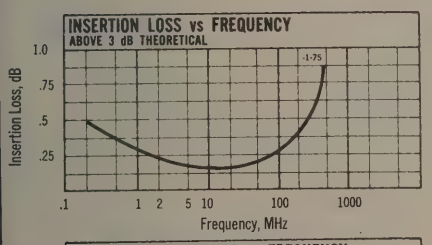



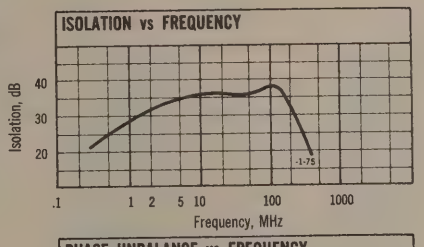



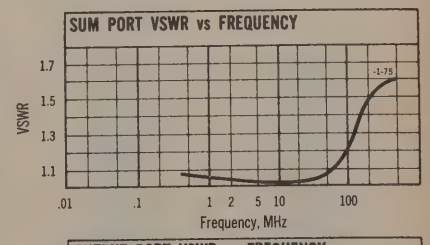



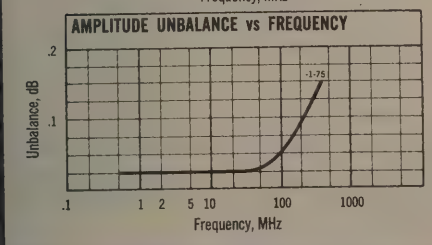



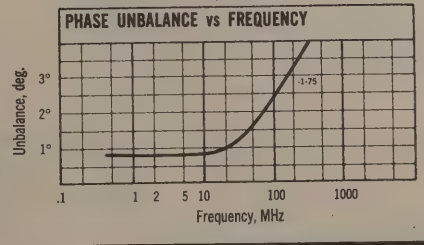

## MODELS PSC-2-1-75, ZSC-2-1-75

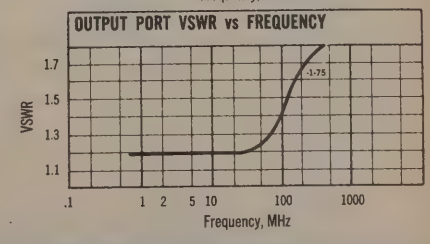



PROMPT SERVICE / ONE WEEK DELIVERY

Mini-Circuits

# POWER DIVIDERS

**Broadband, 0.5 — 4.2 GHz • Only 0.2 dB insertion loss**
**Isolation over 30 dB midband, 25 dB at bandedges • Octave bandwidths**
**Two way • up to 10 W (matched output)**

- **High performance microstrip construction**
- **Housed in rugged RFI-shielded aluminum case**
- **Available with BNC, TNC, SMA and Type N connectors**
- **Meets MIL-202E standards**
- **Also useful as power combiners at signal levels up to +10 dBm**

*Now you can specify and purchase state-of-the-art power dividers at 1/3 to 1/2 the price of competitive units, with immediate off-the-shelf delivery. . . from Mini-Circuits, of course.*

*This breakthrough in price/performance is a natural extension of our extensive experience in high-volume manufacturing, exacting quality-control and thorough testing. This expertise assures you highly reliable power dividers with guaranteed repeatability of performance at lowest cost.*

*So, if you are among the thousands of companies now using Mini-Circuits' signal-processing units in your systems designs, add power dividers to the list of price/performance industry standards available from Mini-Circuits.*

**$39.95** 1-9

| Model | Frequency Range, GHz | Insertion Loss, dB Typ | Insertion Loss, dB Max | Isolation, dB Typ. | Isolation, dB Min. | Amplitude Unbalance, dB | VSWR (All Ports) Typ. | Power Rating-W Divider | Power Rating-W Combiner | Price Qty. |
|---|---|---|---|---|---|---|---|---|---|---|
| ZAPD-1 | 0.5-1.0 | 0.2 | 0.4 | 25 | 19 | ±0.1 | 1.20 | 10 W | 10 mW | $39.95 1-9 |
| ZAPD-2 | 1.0-2.0 | 0.2 | 0.4 | 25 | 19 | ±0.1 | 1.20 | 10 W | 10 mW | $39.95 1-9 |
| ZAPD-4 | 2.0-4.0 | 0.2 | 0.5 | 25 | 19 | ±0.2 | 1.20 | 10 W | 10 mW | $39.95 1-9 |

**Dimensions** 2" × 2" × 0.75" **Connectors Available:** BNC, TNC, available at no additional charge
$5.00 additional for SMA and Type N

*World's largest supplier of Double-Balanced Mixers*

**Mini-Circuits**
MINI-CIRCUITS LABORATORY
*A Division Scientific Components Corp*

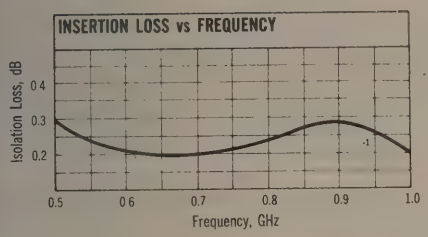
2625 East 14th Street Brooklyn, New York 11235 (212) 769-0200
Domestic and International Telex 125460 International Telex 620156

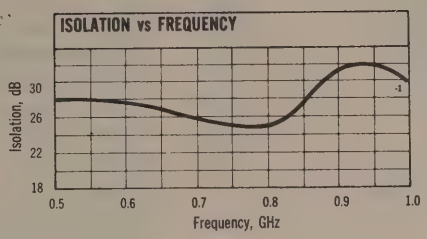
**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

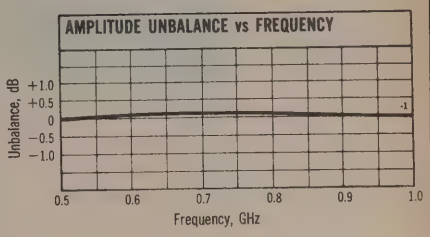
# ZAPD Series
# 0.5 - 4.2 GHz

Mini-Circuits

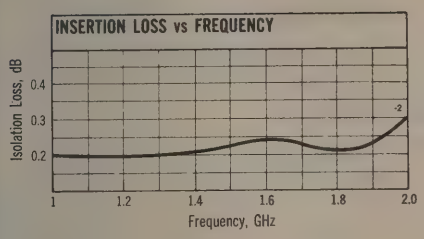
## MODEL ZAPD-1

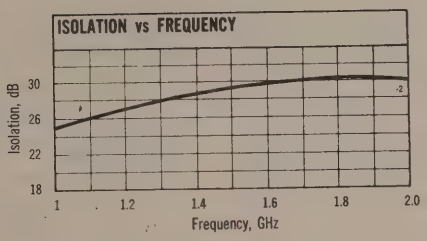


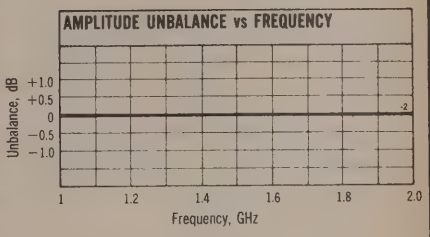



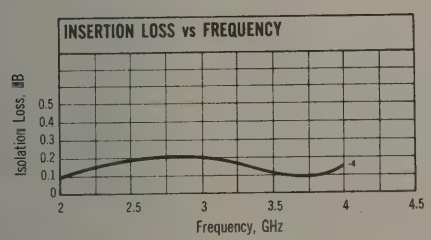

## MODEL ZAPD-2

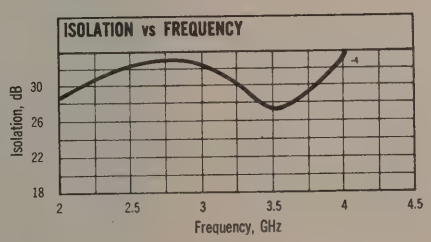


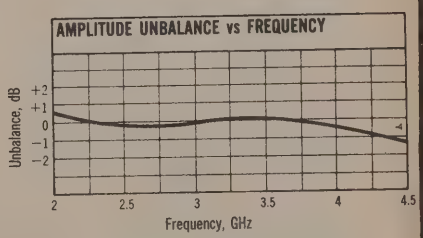




## MODEL ZAPD-4

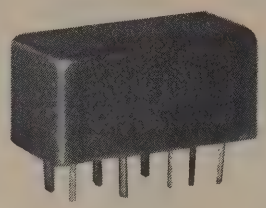


# 2-Way 90° POWER SPLITTER/COMBINERS

## PSCQ-2 SERIES



| MODEL | FREQUENCY | Z (Ohms) | Cost |
|---|---|---|---|
| PSCQ-2-50 | 25 MHz - 50 MHz | 50 | $19.95 (5-49) |
| PSCQ-2-90 | 55 MHz - 95 MHz | 50 | $19.95 (5-49) |
| PSCQ-2-180 | 120 MHz - 180 MHz | 50 | $19.95 (5-49) |

## FEATURES

- **Broadband, 25 MHz to 180 MHz**
- **Excellent Balance,** typically, phase deviation from quadrature less than 1°, amplitude unbalance 0.6 dB
- **Low Insertion Loss,** typically average loss is less than 0.3 dB
- **High Isolation,** typically better than 25 dB
- **Hermetically Sealed & RFI Shielded**
- **Miniature,** 0.128 in.$^3$, 0.4" x 0.8" PC area 0.4" high
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $19.95 in small quantity

## APPLICATIONS

- **Split an input signal into two equal phase quadrature outputs**
- **Add signals vectorially**
- **SSB modulators**
- **Image reject mixers**

## ABSOLUTE MAXIMUM RATINGS

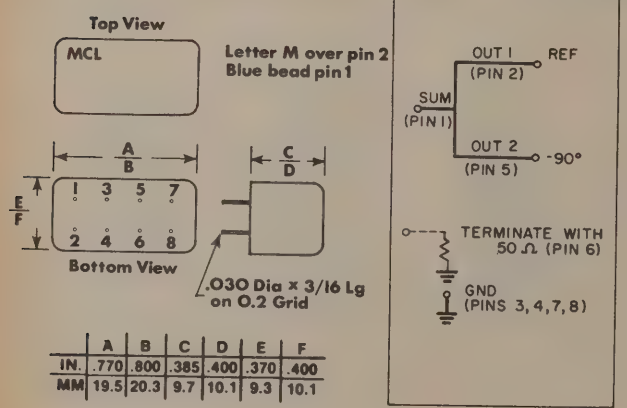
- **Operating and Storage Temp.** −55° C to +100° C
- **Pin Temperature:** (10 sec.) 510° F
- **Environmental Specifications:** See Index Page

**DESCRIPTION** — The Series PSCQ-2 2-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, 90° out of phase to the two output ports. Similarly, signals fed into ports 1 and 2 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within 0.6 dB.

The PSCQ-2 is ruggedly constructed to provide reliable service under severe environmental conditions. This hermetically sealed unit performs well under high relative humidity conditions and over temperature extremes from −55° C to +100° C.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| IN. | .770 | .800 | .385 | .400 | .370 | .400 |
| MM | 19.5 | 20.3 | 9.7 | 10.1 | 9.3 | 10.1 |

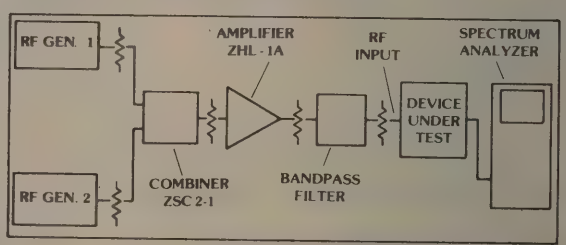
## TWO-TONE INTERMODULATION MEASUREMENT

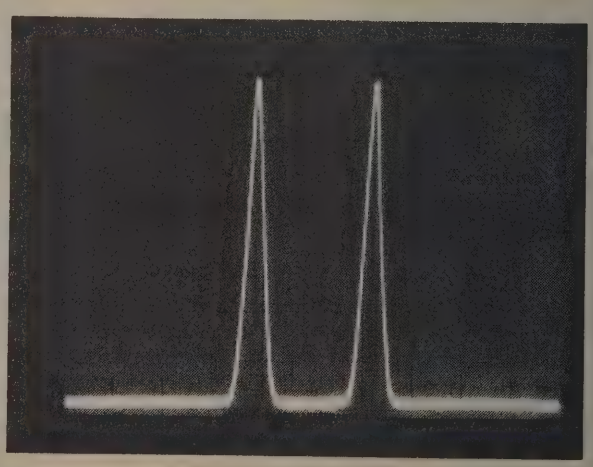
### RF INPUT CONDITIONS

TONE 1 - 50 MHz at +7 dBm INPUT
TONE 2 -51 MHz at +7dBm INPUT

### SPECTRUM DISPLAY

RESOLUTION - 500 kHz PER DIVISION
VERTICAL - 10 dB PER DIVISION



**WEIGHT** 5.2 grams 0.18 ounces

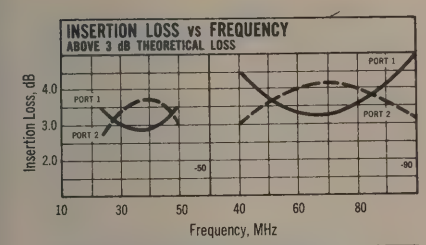
**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

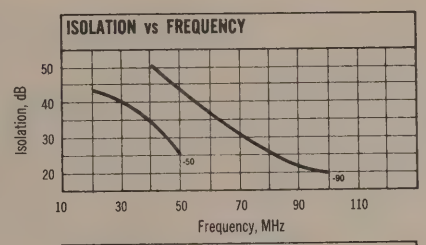
# PSCQ-2 Series
# 25 MHz to 180 MHz

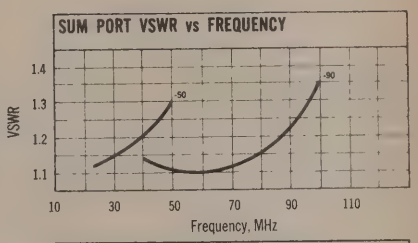
Mini-Circuits

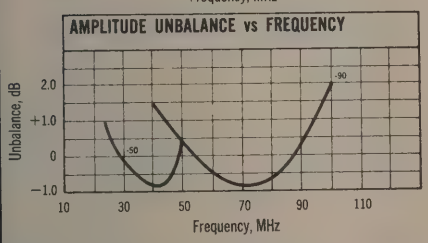
| MODEL | PSCQ-2-50 | | PSCQ-2-90 | | PSCQ-2-180 | |
|---|---|---|---|---|---|---|
| FREQ. RANGE (MHz) | 25-50 | | 55-95 | | 120-180 | |
| NOMINAL PHASE | 90° | | 90° | | 90° | |
| IMPEDANCE, ALL PORTS | 50 ohms | | 50 ohms | | 50 ohms | |
| ISOLATION BETWEEN OUTPUT 1 AND 2, dB | Typ. 30 | Min. 20 | Typ. 30 | Min. 20 | Typ. 23 | Min. 15 |
| INSERTION LOSS, dB (Average of Coupled Outputs Less 3 dB) | Typ. 0.3 | Max. 0.7 | Typ. 0.3 | Max. 0.7 | Typ. 0.3 | Max. 0.7 |
| PHASE DEVIATION FROM QUADRATURE, DEGREES | Typ. 1 | Max. 3 | Typ. 1 | Max. 3 | Typ. 2 | Max. 4 |
| AMPLITUDE UNBALANCE, dB | 0.4 | 1.5 | 0.4 | 1.2 | 0.4 | 1.2 |
| VSWR | 1.2 Typ. | | 1.2 Typ. | | 1.35 Typ. | |
| INPUT POWER RATING | 2 watts max. | | 2 watts max. | | 2 watts max. | |

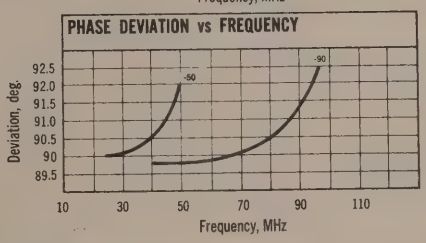
## MODELS PSCQ-2-50, PSCQ-2-90

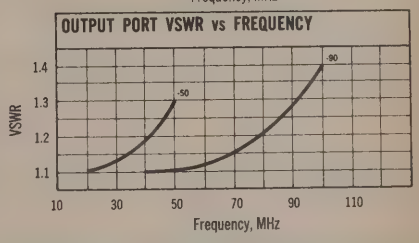


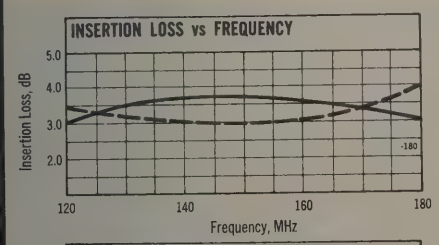



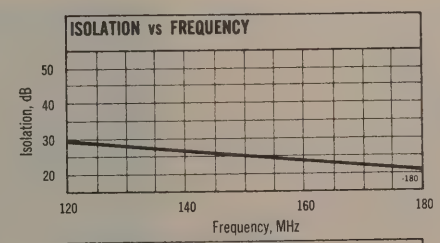



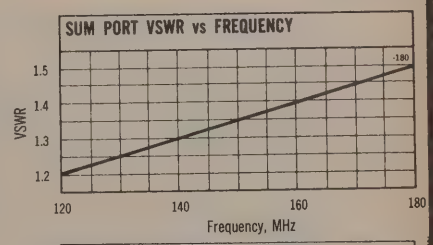



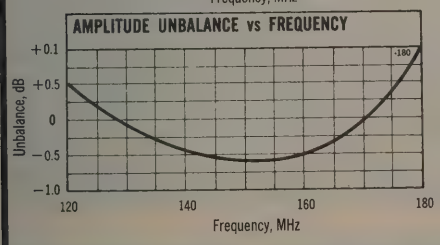



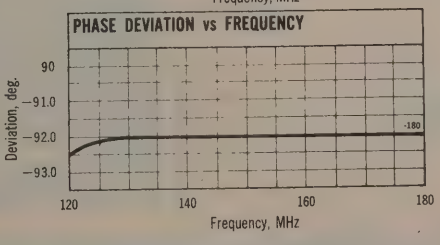

## MODEL PSCQ-2-180

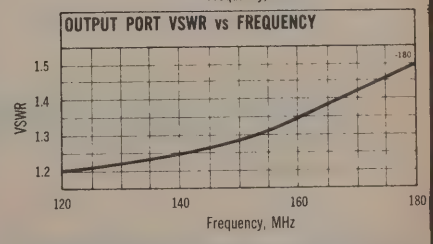



PROMPT SERVICE / ONE WEEK DELIVERY Mini-Circuits

# 2-Way 90°
# POWER SPLITTER/COMBINERS

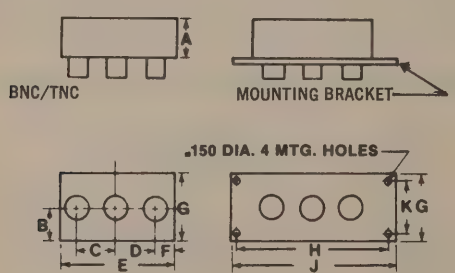
## ZSCQ-2 SERIES

| MODEL | FREQUENCY | Z (Ohms) | Cost |
|---|---|---|---|
| ZSCQ-2-50 | 25 MHz - 50 MHz | 50 | $34.95 (4-24) |
| ZSCQ-2-90 | 55 MHz - 95 MHz | 50 | $34.95 (4-24) |
| ZSCQ-2-180 | 120 MHz - 180 MHz | 50 | $34.95 (4-24) |

**DESCRIPTION** — The Series ZSCQ-2 2-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, 90° out of phase, to the two output (1 and 2) ports. Similarly, signals fed into ports 1 and 2 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within 0.6 dB.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

## DIMENSIONS AND CONNECTIONS




MOUNTING BRACKET AVAILABLE ON REQUEST. Add suffix B to part number and add $1.50 to unit cost

CONNECTORS BNC Std., TNC on request

| | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| IN. | 1.15 | .63 | .750 | .730 | 2.25 | .385 | 1.40 | 2.95 | 3.25 | 1.10 |
| MM | 29. | 16. | 19. | 18.5 | 57. | 9.77 | 35.5 | 74.9 | 82.5 | 28. |

**WEIGHT** 74.0 grams 2.60 ounces

## FEATURES

- **Broadband,** 25 MHz to 180 MHz
- **Excellent Balance,** typically, phase deviation from quadrature less than 1°, amplitude unbalance 0.6 dB
- **Low Insertion Loss,** typically average loss is less than 0.3 dB
- **High Isolation,** typically better than 25 dB
- **Connectors,** available with BNC or TNC
- **Mounting,** available with bracket as option
- **Compact,** 2.25" width, 1.4" height, 1.15" depth
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $34.95 in small quantity

## APPLICATIONS

- **Split an input signal into two equal phase quadrature outputs**
- **Add signals vectorially**
- **SSB modulators**
- **Image reject mixers**

## ABSOLUTE MAXIMUM RATINGS

- **Operating and Storage Temp.** −55° C to +100° C
- **Environmental Specifications:** See Index Page

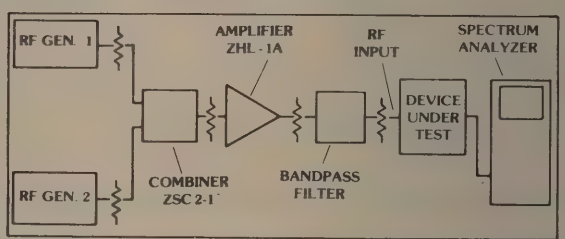
## TWO-TONE INTERMODULATION MEASUREMENT

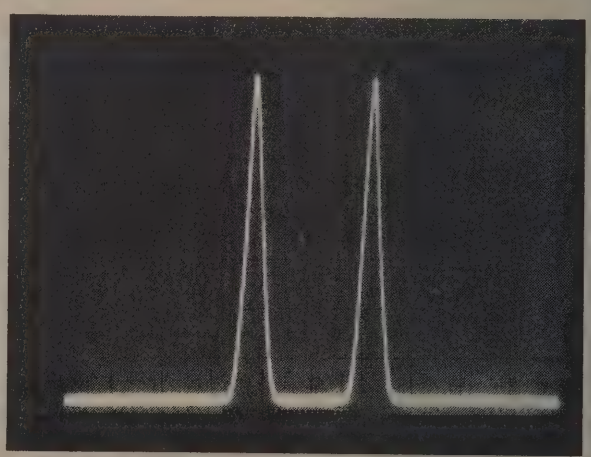
### RF INPUT CONDITIONS

TONE 1 - 50 MHz at +7 dBm INPUT
TONE 2 - 51 MHz at +7 dBm INPUT

### SPECTRUM DISPLAY

RESOLUTION - 500 kHz PER DIVISION
VERTICAL - 10 dB PER DIVISION



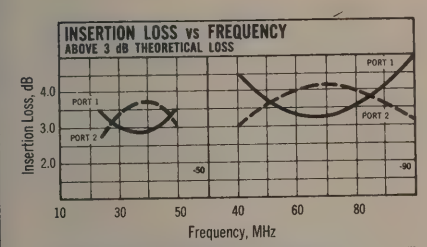



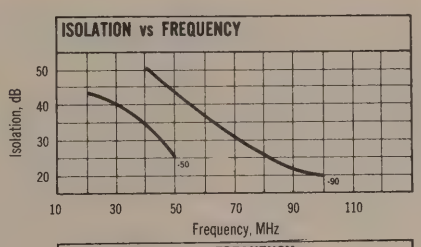
# ZSCQ-2 Series
# 25 MHz to 180 MHz

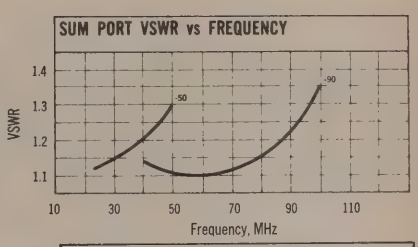
**Mini-Circuits**

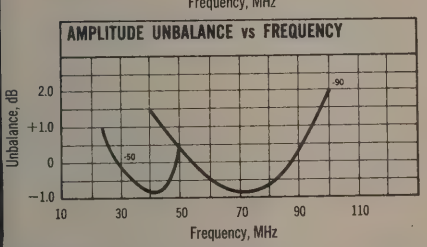
| MODEL | ZSCQ-2-50 | | ZSCQ-2-90 | | ZSCQ-2-180 | |
|---|---|---|---|---|---|---|
| FREQ. RANGE (MHz) | 25-50 | | 55-95 | | 120-180 | |
| NOMINAL PHASE | 90° | | 90° | | 90° | |
| IMPEDANCE, ALL PORTS | 50 ohms | | 50 ohms | | 50 ohms | |
| ISOLATION BETWEEN OUTPUT 1 AND 2, dB | Typ. 30 | Min. 20 | Typ. 30 | Min. 20 | Typ. 23 | Min. 15 |
| INSERTION LOSS, dB (Average of Coupled Outputs Less 3 dB) | Typ. 0.3 | Max. 0.7 | Typ. 0.3 | Max. 0.7 | Typ. 0.3 | Max. 0.7 |
| PHASE DEVIATION FROM QUADRATURE, DEGREES | Typ. 1 | Max. 3 | Typ. 1 | Max. 3 | Typ. 2 | Max. 4 |
| AMPLITUDE UNBALANCE, dB | 0.4 | 1.5 | 0.4 | 1.2 | 0.4 | 1.2 |
| VSWR | 1.2 Typ. | | 1.2 Typ. | | 1.35 Typ. | |
| INPUT POWER RATING | 2 watts max. | | 2 watts max. | | 2 watts max. | |

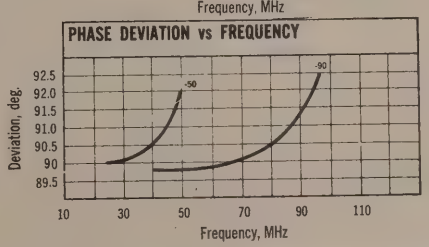
## MODELS ZSCQ-2-50, ZSCQ-2-90

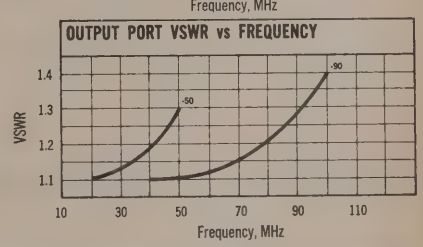


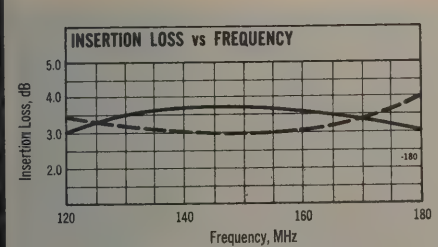



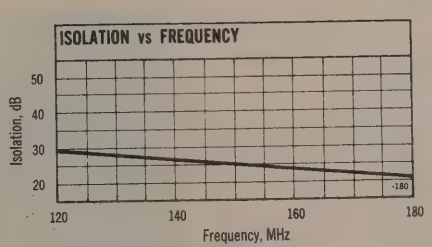



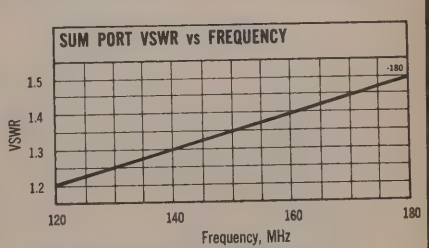



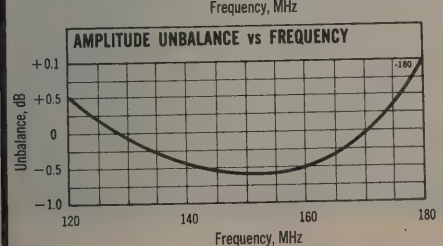



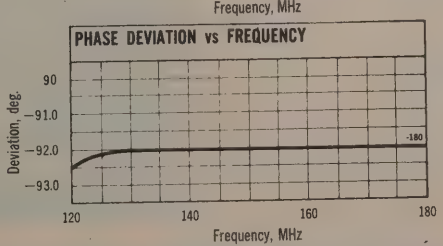

## MODEL ZSCQ-2-180

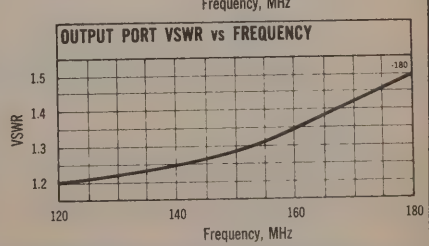


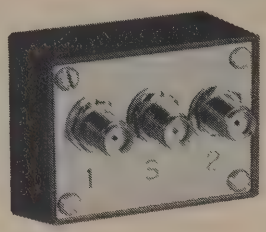



# 2-Way 90°
# POWER SPLITTER/COMBINERS

## ZMSCQ-2 SERIES




| MODEL | FREQUENCY | Z (Ohms) | Cost |
|---|---|---|---|
| ZMSCQ-2-50 | 25 MHz - 50 MHz | 50 | $44.95 (4-24) |
| ZMSCQ-2-90 | 55 MHz - 95 MHz | 50 | $44.95 (4-24) |
| ZMSCQ-2-180 | 120 MHz - 180 MHz | 50 | $44.95 (4-24) |

## FEATURES

- **Broadband,** 25 MHz to 180 MHz
- **Excellent Balance,** typically, phase deviation from quadrature less than 1°, amplitude unbalance 0.6 dB
- **Low Insertion Loss,** typically average loss is less than 0.3 dB
- **High Isolation,** typicaly better than 25 dB
- **Connectors,** available with SMA
- **Mounting,** available with bracket as option
- **Miniature,** 1.5″ width, 1.15″ height, 0.88″ depth
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $44.95 in small quantity

## APPLICATIONS

- **Split an input signal into two equal phase quadrature outputs**
- **Add signals vectorially**
- **SSB modulators**
- **Image reject mixers**

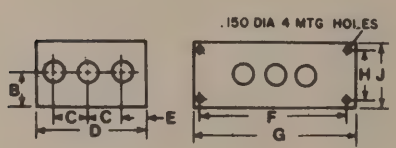
## ABSOLUTE MAXIMUM RATINGS

- **Operating and Storage Temp.** −55°C to +100°C
- **Environmental Specifications:** See Index Page

**DESCRIPTION —** The Series ZMSCQ-2 2-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, 90° out of phase, to the two output (1 and 2) ports. Similarly, signals fed into ports 1 and 2 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within 0.5 dB.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F | G | H | J |
|---|---|---|---|---|---|---|---|---|---|
| IN. | 0.88 | 0.96 | .438 | 1.50 | .312 | 2.19 | 2.50 | 0.94 | 1.15 |
| MM | 22. | 17. | 11. | 38. | 79. | 55.6 | 63.5 | 21. | 29. |

**MOUNTING BRACKET AVAILABLE ON REQUEST.** Add suffix B to part number and $1.50 to unit cost.
**CONNECTORS:** SMA (3mm) standard.

**WEIGHT** 34.0 grams 1.20 ounces

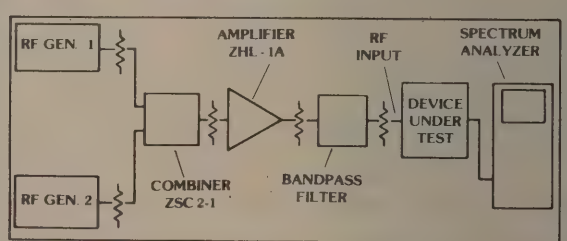
## TWO-TONE INTERMODULATION MEASUREMENT

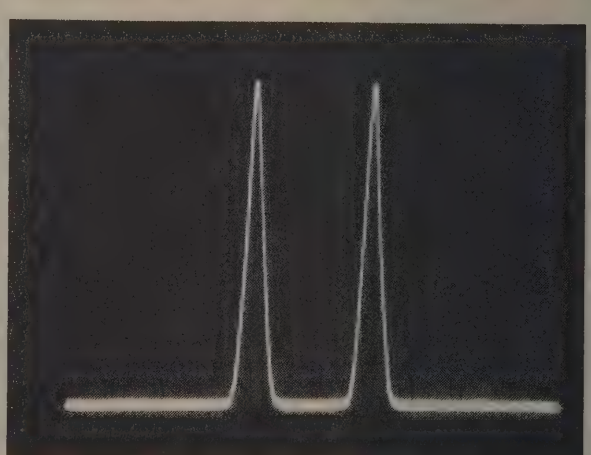
### RF INPUT CONDITIONS

TONE 1 - 50 MHz at +7 dBm INPUT
TONE 2 -51MHz at +7dBm INPUT

### SPECTRUM DISPLAY

RESOLUTION - 500 kHz PER DIVISION
VERTICAL - 10 dB PER DIVISION



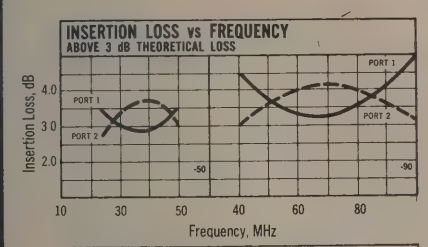
Mini-Circuits 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

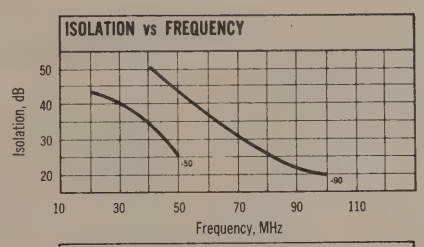
# ZMSCQ-2 Series
# 25 MHz to 180 MHz

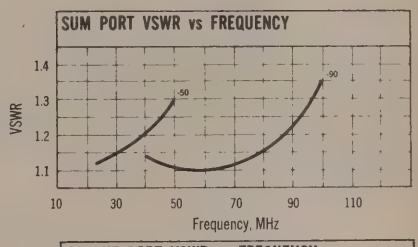
**Mini-Circuits**

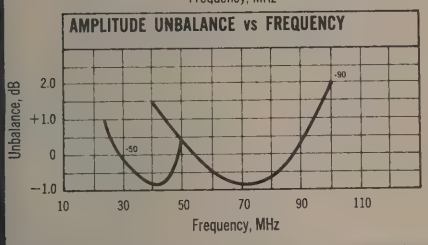
| MODEL | ZMSCQ-2-50 | | ZMSCQ-2-90 | | ZMSCQ-2-180 | |
|---|---|---|---|---|---|---|
| FREQ. RANGE (MHz) | 25-50 | | 55-95 | | 120-180 | |
| NOMINAL PHASE | 90° | | 90° | | 90° | |
| IMPEDANCE, ALL PORTS | 50 ohms | | 50 ohms | | 50 ohms | |
| ISOLATION BETWEEN OUTPUT 1 AND 2, dB | Typ. 30 | Min. 20 | Typ. 30 | Min. 20 | Typ. 23 | Min. 15 |
| INSERTION LOSS, dB (Average of Coupled Outputs Less 3 dB) | Typ. 0.3 | Max. 0.7 | Typ. 0.3 | Max. 0.7 | Typ. 0.3 | Max. 0.7 |
| PHASE DEVIATION FROM QUADRATURE, DEGREES | Typ. 1 | Max. 3 | Typ. 1 | Max. 3 | Typ. 2 | Max. 4 |
| AMPLITUDE UNBALANCE, dB | 0.4 | 1.5 | 0.4 | 1.2 | 0.4 | 1.2 |
| VSWR | 1.2 Typ. | | 1.2 Typ. | | 1.35 Typ. | |
| INPUT POWER RATING | 2 watts max. | | 2 watts max. | | 2 watts max. | |

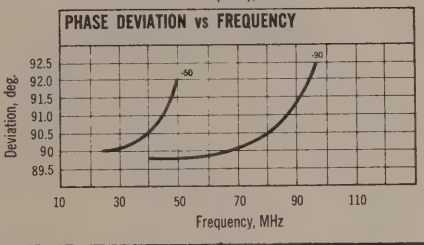
## MODELS ZMSCQ-2-50, ZMSCQ-2-90

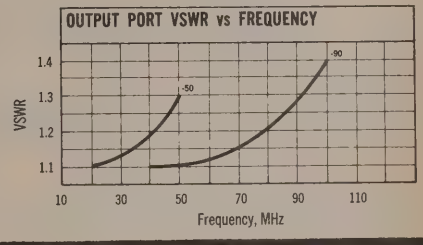


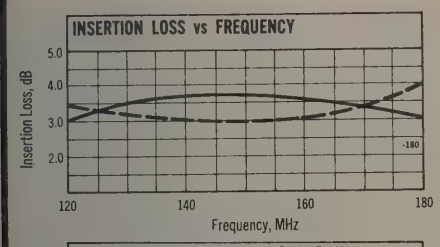



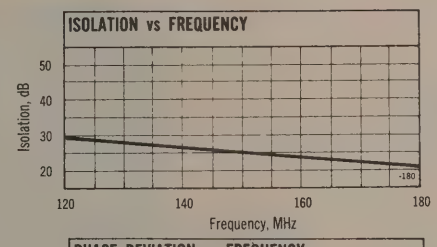



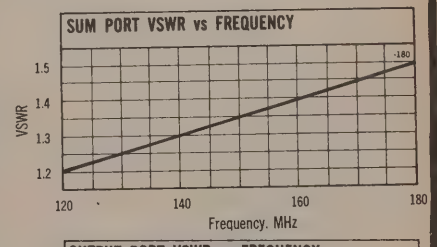



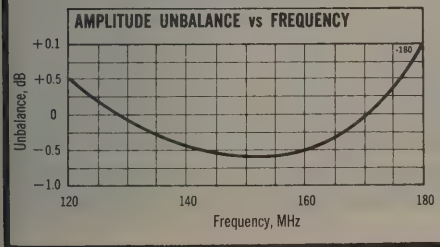



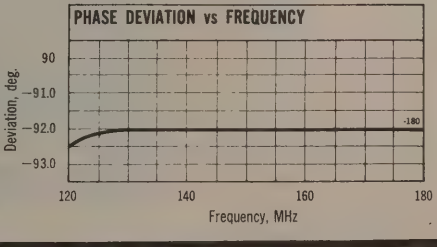

## MODEL ZMSCQ-2-180

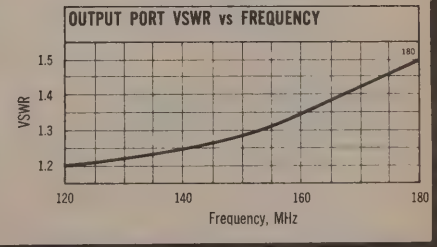


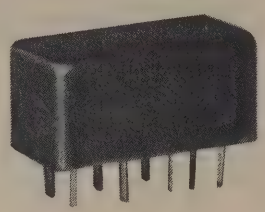




*PROMPT SERVICE / ONE WEEK DELIVERY*

**Mini-Circuits**

# 2-Way 180°
# POWER SPLITTER/COMBINERS

## PSCJ-2 SERIES



| MODEL | FREQUENCY | Z (Ohms) | Cost |
|---|---|---|---|
| PSCJ-2-1 | 1 MHz - 200 MHz | 50 | $19.95 (5-49) |
| PSCJ-2-2 | 0.01 MHz - 20 MHz | 50 | $29.95 (5-49) |

## FEATURES

- **Broadband, 10 KHz to 200 MHz**
- **Excellent Balance,** typically, phase balance less than 2°, amplitude unbalance within 0.1 dB
- **Low Insertion Loss,** typically less than 0.9 dB
- **High Isolation,** typically better than 30 dB
- **Hermetically Sealed & RFI Shielded**
- **Miniature,** 0.128 in.$^3$, 0.4" x 0.8" PC area 0.4" high
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $19.95 in small quantity

## APPLICATIONS

- **Split an input signal into two equal 180° out-of-phase outputs**
- **Add signals vectorially**
- **Combine outputs of push-pull amplifiers**
- **Provide RF logic capability**

## ABSOLUTE MAXIMUM RATINGS

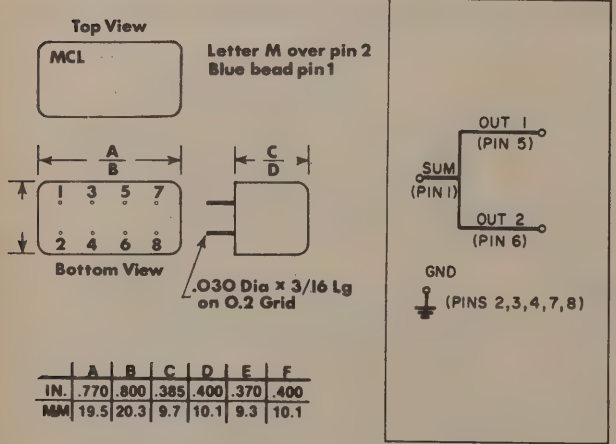
- **Operating and Storage Temp.** −55°C to +100°C
- **Pin Temperature:** (10 sec.) 510°F
- **Environmental Specifications:** See Index Page

**DESCRIPTION** — The Series PSCJ-2 2-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, 180° out of phase to the two output (1 and 2) ports. Similarly, signals fed into ports 1 and 2 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within 0.1 dB.

The PSCJ-2 is ruggedly constructed to provide reliable service under severe environmental conditions. This hermetically sealed unit performs well under high relative humidity conditions and over temperature extremes from −50°C to +100°C.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| IN. | .770 | .800 | .385 | .400 | .370 | .400 |
| MM | 19.5 | 20.3 | 9.7 | 10.1 | 9.3 | 10.1 |

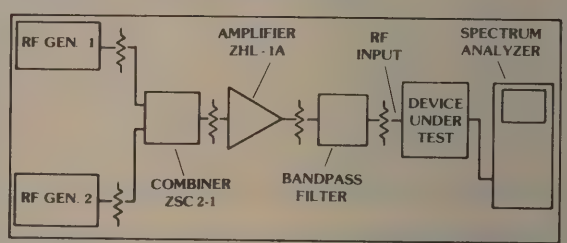
## TWO-TONE INTERMODULATION MEASUREMENT

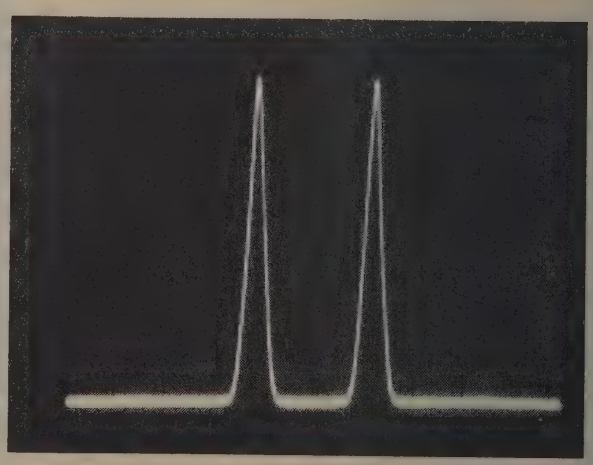
### RF INPUT CONDITIONS

TONE 1 - 10 MHz at +7 dBm INPUT
TONE 2 - 9 MHz at +7dBm INPUT

### SPECTRUM DISPLAY

RESOLUTION - 500 kHz PER DIVISION
VERTICAL - 10 dB PER DIVISION



**WEIGHT** 5.2 grams 0.18 ounces

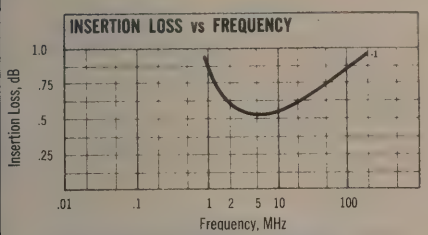
Mini-Circuits 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

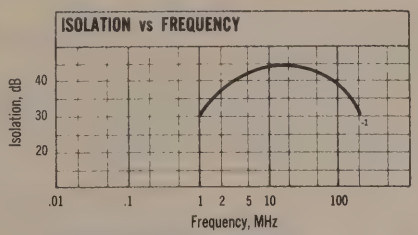
# PSCJ-2 Series
# 10 KHz to 200 MHz

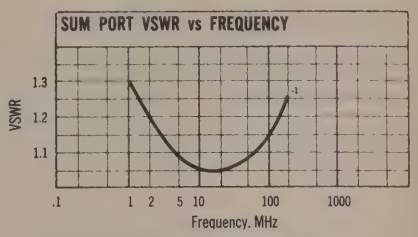
**Mini-Circuits**

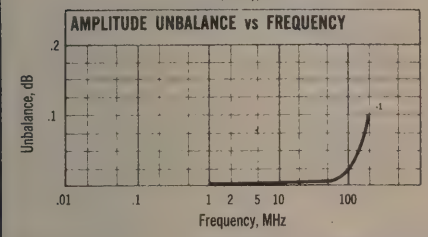
| MODEL | PSCJ-2-1 | | | PSCJ-2-2 | | |
|---|---|---|---|---|---|---|
| FREQ. RANGE, (MHz) | 1-200 | | | 0.01-20 | | |
| NOMINAL PHASE | 180° | | | 180° | | |
| IMPEDANCE, ALL PORTS | 50 ohms | | | 50 ohms | | |
| ISOLATION BETWEEN OUTPUT 1 and 2, dB | | Typ. | Min. | | Typ. | Min. |
| | 1-50 MHz | 35 | 30 | 0.05-2 MHz | 40 | 30 |
| | 50-150 MHz | 35 | 25 | 0.01-5 MHz | 35 | 25 |
| | 150-200 MHz | 30 | 23 | 5-20 MHz | 25 | 18 |
| INSERTION LOSS, dB (ABOVE 3 dB SPLIT) | | Typ. | Max. | | Typ. | Max. |
| | 1-5 MHz | 0.75 | 1.0 | 0.05-10 MHz | 0.2 | 0.5 |
| | 5-50 MHz | 0.6 | 0.8 | 10-20 MHz | 0.3 | 0.6 |
| | 50-200 MHz | 0.75 | 1.2 | 0.01-0.05 MHz | 0.3 | 0.8 |
| PHASE DEVIATION FROM 180°, DEGREES | | Typ. | Max. | | Typ. | Max. |
| | 1-50 MHz | 1.0 | 2.5 | 0.01-10 MHz | 1 | 2.0 |
| | 50-200 MHz | 2.0 | 4.0 | 10-20 MHz | 1 | 2.5 |
| AMPLITUDE UNBALANCE, dB | | Typ. | Max. | | Typ. | Max. |
| | 1-100 MHz | 0.05 | 0.15 | 0.01-10 MHz | 0.05 | 0.1 |
| | 100-200 MHz | 0.05 | 0.3 | 10-20 MHz | 0.05 | 0.2 |
| VSWR | 1.2 typ. | | | 1.2 typ. | | |
| MATCHED POWER RATING | 1 watt max. | | | 1 watt max. | | |
| INTERNAL LOAD DISS. | 0.12 watt | | | 0.12 watt | | |

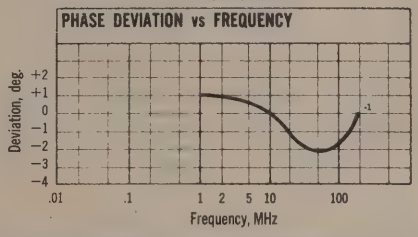
## MODEL PSCJ-2-1

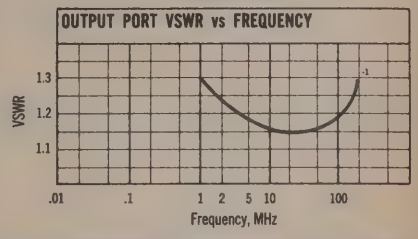


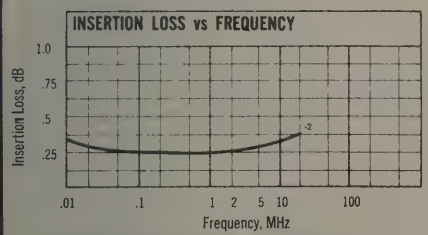



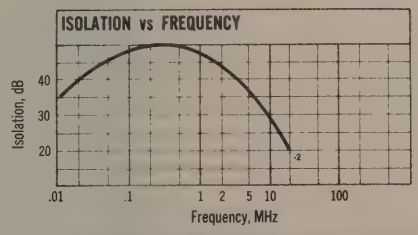



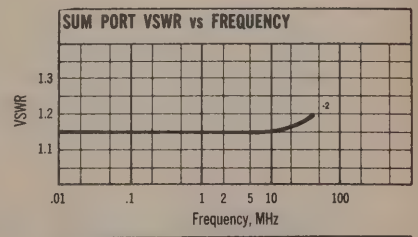



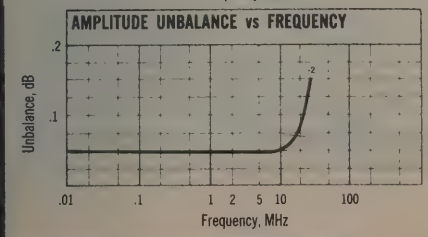



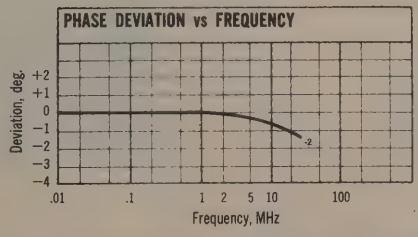

## MODEL PSCJ-2-2

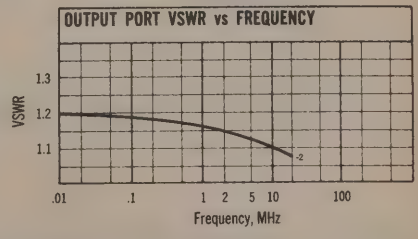


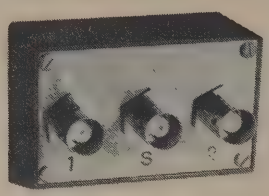




*PROMPT SERVICE / ONE WEEK DELIVERY* **Mini-Circuits**

# 2-Way 180°
# POWER SPLITTER/COMBINERS

## ZSCJ-2 SERIES




| MODEL | FREQUENCY | Z (Ohms) | Cost |
|---|---|---|---|
| ZSCJ-2-1 | 1 MHz - 200 MHz | 50 | $34.95 (4-24) |
| ZSCJ-2-2 | 10 KHz - 20 MHz | 50 | $44.95 (5-49) |

## FEATURES

- **Broadband,** 10 KHz to 200 MHz
- **Excellent Balance,** typically, phase balance within 2°, amplitude balance within 0.1 dB
- **Low Insertion Loss,** typically less than 0.9 dB
- **High Isolation,** typically better than 30 dB
- **Connectors,** available with BNC or TNC
- **Mounting,** option, available with bracket
- **Compact,** 2.25" width, 1.4" height, 1.15" depth
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $34.95 in small quantity

## APPLICATIONS

- **Split an input signal into two equal 180° out-of-phase outputs**
- **Add signals vectorially**
- **Combine outputs of push-pull amplifiers**
- **Provide RF logic capability**

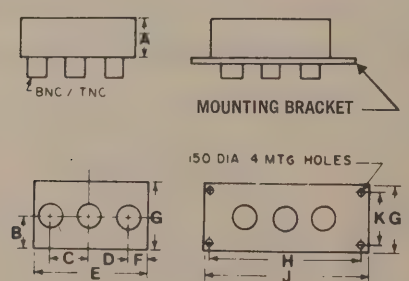
## ABSOLUTE MAXIMUM RATINGS

- **Operating and Storage Temp.** −55°C to +100°C
- **Environmental Specifications:** See Index Page

**DESCRIPTION** — The Series ZSCJ-2 2-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, 180° out of phase to the two output ports. Similarly, signals fed into ports 1 and 2 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within 0.1 dB.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

## DIMENSIONS AND CONNECTIONS




MOUNTING BRACKET AVAILABLE ON REQUEST. Add suffix B to part number and add $1.50 to unit cost.
CONNECTORS BNC Std., TNC on request

| | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| IN. | 1.15 | .63 | .750 | .730 | 2.25 | .385 | 1.40 | 2.95 | 3.25 | 1.10 |
| MM | 29. | 16. | 19. | 18.5 | 57. | 9.77 | 35.5 | 74.9 | 82.5 | 28. |

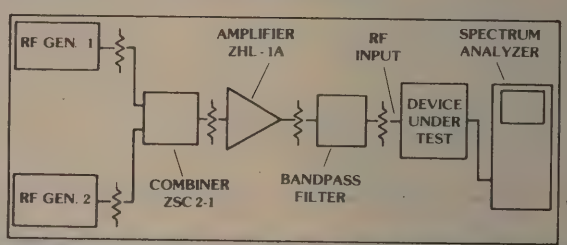
## TWO-TONE INTERMODULATION MEASUREMENT

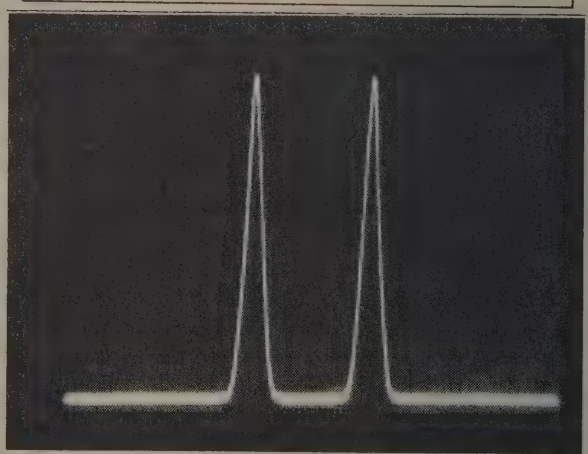
### RF INPUT CONDITIONS

TONE 1 - 10 MHz at +7 dBm INPUT
TONE 2 - 9 MHz at +7dBm INPUT

### SPECTRUM DISPLAY

RESOLUTION - 500 kHz PER DIVISION
VERTICAL - 10 dB PER DIVISION



**WEIGHT** 74.0 grams 2.60 ounces

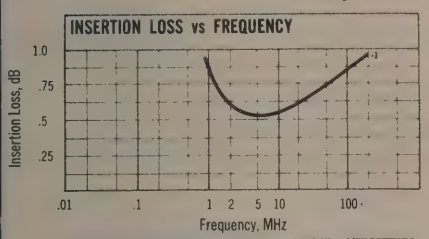
**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

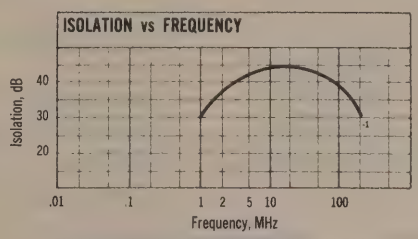
# ZSCJ-2 Series
# 10 KHz to 200 MHz

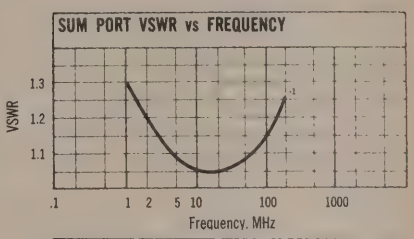
**Mini-Circuits**

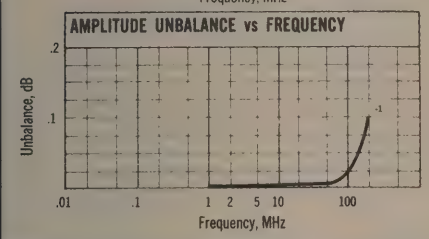
| MODEL | ZSCJ-2-1 | | | ZSCJ-2-2 | | |
|---|---|---|---|---|---|---|
| FREQ. RANGE, (MHz) | 1-200 | | | 0.01-20 | | |
| NOMINAL PHASE | 180° | | | 180° | | |
| IMPEDANCE, ALL PORTS | 50 ohms | | | 50 ohms | | |
| ISOLATION BETWEEN OUTPUT 1 and 2, dB | | Typ. | Min. | | Typ. | Min. |
| | 1-50 MHz | 35 | 30 | 0.05-2 MHz | 40 | 30 |
| | 50-150 MHz | 35 | 25 | 0.01-5 MHz | 35 | 25 |
| | 150-200 MHz | 30 | 23 | 5-20 MHz | 25 | 18 |
| INSERTION LOSS, dB (ABOVE 3 dB SPLIT) | | Typ. | Max. | | Typ. | Max. |
| | 1-5 MHz | 0.75 | 1.0 | 0.05-10 MHz | 0.2 | 0.5 |
| | 5-50 MHz | 0.6 | 0.8 | 10-20 MHz | 0.3 | 0.6 |
| | 50-200 MHz | 0.75 | 1.2 | 0.01-0.05 MHz | 0.3 | 0.8 |
| PHASE DEVIATION FROM 180°, DEGREES | | Typ. | Max. | | Typ. | Max. |
| | 1-50 MHz | 1.0 | 2.5 | 0.01-10 MHz | 1 | 2.0 |
| | 50-200 MHz | 2.0 | 4.0 | 10-20 MHz | 1 | 2.5 |
| AMPLITUDE UNBALANCE, dB | | Typ. | Max. | | Typ. | Max. |
| | 1-100 MHz | 0.05 | 0.15 | 0.01-10 MHz | 0.05 | 0.1 |
| | 100-200 MHz | 0.05 | 0.3 | 10-20 MHz | 0.05 | 0.2 |
| VSWR | 1.2 typ. | | | 1.2 typ. | | |
| MATCHED POWER RATING | 1 watt max. | | | 1 watt max. | | |
| INTERNAL LOAD DISS. | 0.25 watt | | | 0.25 watt | | |

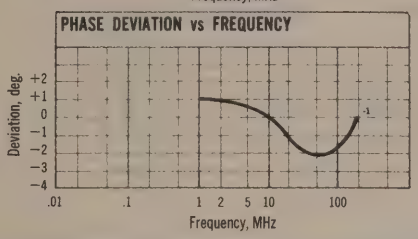
## MODEL ZSCJ-2-1

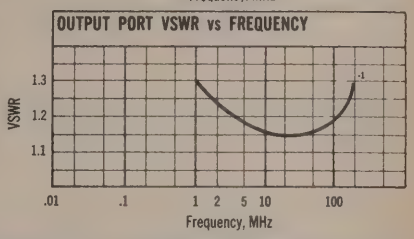


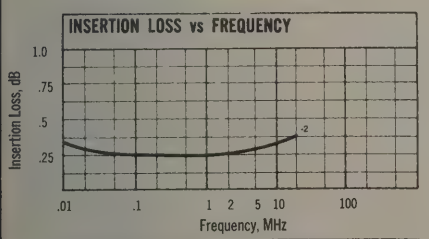



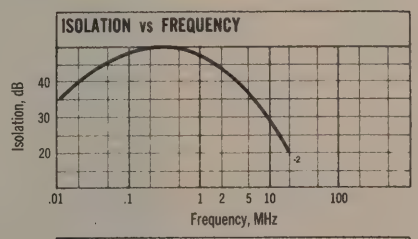



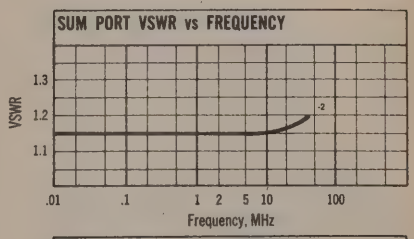



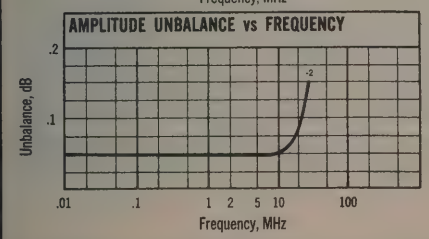



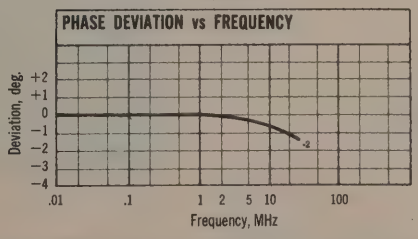

## MODEL ZSCJ-2-2

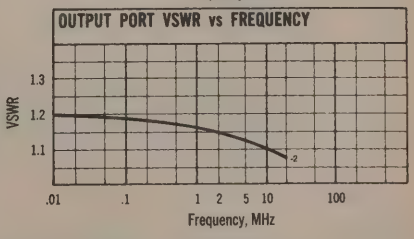


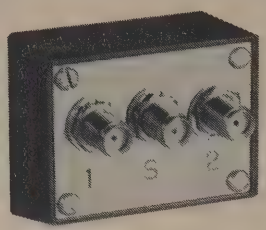



# 2-Way 180°
# POWER SPLITTER/COMBINERS

## ZMSCJ-2 SERIES




| MODEL | FREQUENCY | Z (Ohms) | Cost |
|---|---|---|---|
| ZMSCJ-2-1 | 1 MHz - 200 MHz | 50 | $44.95 (4-24) |
| ZMSCJ-2-2 | 0.01 MHz - 20 MHz | 50 | $54.95 (4-24) |

## FEATURES

- **Broadband,** 10 KHz to 200 MHz
- **Excellent Balance,** typically, phase balance within 2°, amplitude balance within 0.1 dB
- **Low Insertion Loss,** typically less than 0.9 dB
- **High Isolation,** typically better than 30 dB
- **Connectors,** available with SMA
- **Mounting,** option, available with bracket
- **Miniature,** 1.5" width, 1.15" height, 0.88" depth
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $44.95 in small quantity

## APPLICATIONS

- **Split an input signal into two equal 180° out-of-phase outputs**
- **Add signals vectorially**
- **Combine outputs of push-pull amplifiers**
- **Provide RF logic capability**

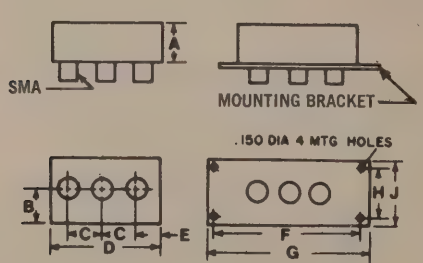
## ABSOLUTE MAXIMUM RATINGS

- **Operating and Storage Temp.** −55° C to +100° C
- **Environmental Specifications:** See Index Page

**DESCRIPTION —** The Series ZMSCJ-2 2-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, 180° out of phase to the two output ports. Similarly, signals fed into ports 1 and 2 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within 0.1 dB.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

## DIMENSIONS AND CONNECTIONS




MOUNTING BRACKET AVAILABLE ON REQUEST. Add suffix B to part number and add $1.50 to unit cost.
CONNECTORS SMA only.

| | A | B | C | D | E | F | G | H | J |
|---|---|---|---|---|---|---|---|---|---|
| IN. | 0.88 | 0.66 | .438 | 1.50 | .312 | 2.19 | 2.50 | 0.84 | 1.15 |
| MM | 22. | 17. | 11. | 38. | 79. | 55.6 | 63.5 | 21. | 29. |

**WEIGHT** 34.0 grams 1.20 ounces

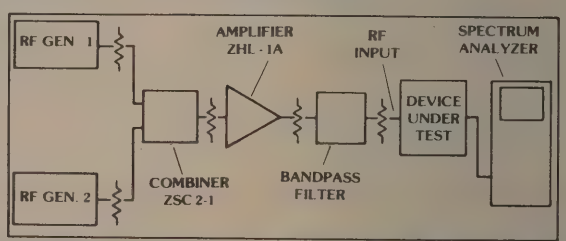
## TWO-TONE INTERMODULATION MEASUREMENT

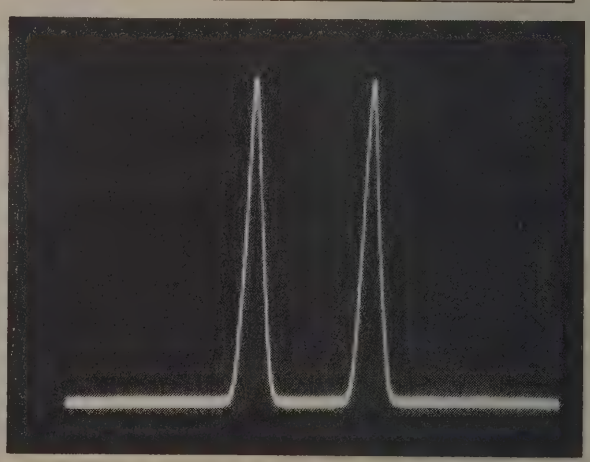
### RF INPUT CONDITIONS

TONE 1 - 10 MHz at +7 dBm INPUT
TONE 2 - 9 MHz at +7dBm INPUT

### SPECTRUM DISPLAY

RESOLUTION - 500 kHz PER DIVISION
VERTICAL - 10 dB PER DIVISION



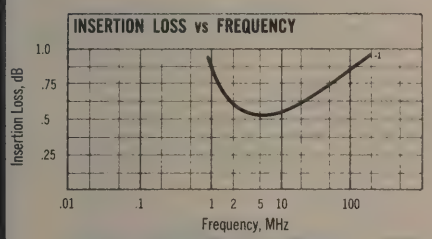
Mini-Circuits 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

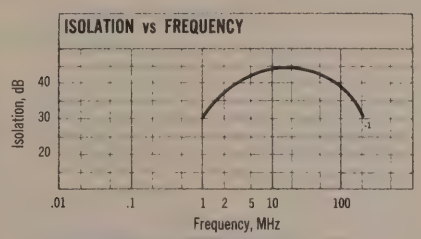
# ZMSCJ-2 Series
# 10 KHz to 200 MHz

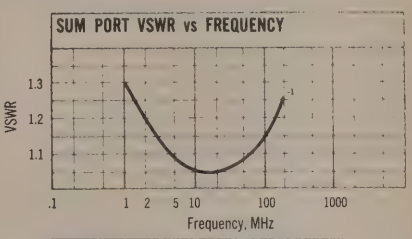
**Mini-Circuits**

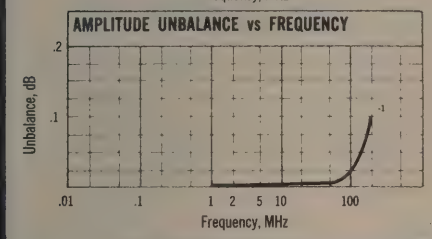
| MODEL | ZMSCJ-2-1 | | | ZMSCJ-2-2 | | |
|---|---|---|---|---|---|---|
| FREQ. RANGE, (MHz) | 1-200 | | | 0.01-20 | | |
| NOMINAL PHASE | 180° | | | 180° | | |
| IMPEDANCE, ALL PORTS | 50 ohms | | | 50 ohms | | |
| ISOLATION BETWEEN OUTPUT 1 and 2, dB | | Typ. | Min. | | Typ. | Min. |
| | 1-50 MHz | 35 | 30 | 0.05-2 MHz | 40 | 30 |
| | 50-150 MHz | 35 | 25 | 0.01-5 MHz | 35 | 25 |
| | 150-200 MHz | 30 | 23 | 5-20 MHz | 25 | 18 |
| INSERTION LOSS, dB (ABOVE 3 dB SPLIT) | | Typ. | Max. | | Typ. | Max. |
| | 1-5 MHz | 0.75 | 1.0 | 0.05-10 MHz | 0.2 | 0.5 |
| | 5-50 MHz | 0.6 | 0.8 | 10-20 MHz | 0.3 | 0.6 |
| | 50-200 MHz | 0.75 | 1.2 | 0.01-0.05 MHz | 0.3 | 0.8 |
| PHASE DEVIATION FROM 180°, DEGREES | | Typ. | Max. | | Typ. | Max. |
| | 1-50 MHz | 1.0 | 2.5 | 0.01-10 MHz | 1 | 2.0 |
| | 50-200 MHz | 2.0 | 4.0 | 10-20 MHz | 1 | 2.5 |
| AMPLITUDE UNBALANCE, dB | | Typ. | Max. | | Typ. | Max. |
| | 1-100 MHz | 0.05 | 0.15 | 0.01-10 MHz | 0.05 | 0.1 |
| | 100-200 MHz | 0.05 | 0.3 | 10-20 MHz | 0.05 | 0.2 |
| VSWR | 1.2 typ. | | | 1.2 typ. | | |
| MATCHED POWER RATING | 1 watt max. | | | 1 watt max. | | |
| INTERNAL LOAD DISS. | 0.25 watt | | | 0.25 watt | | |

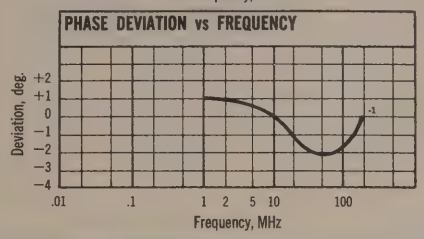
## MODEL ZMSCJ-2-1

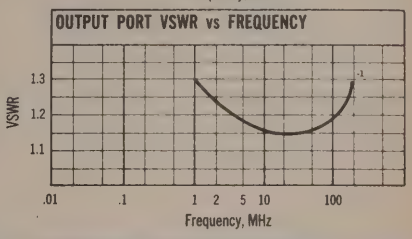


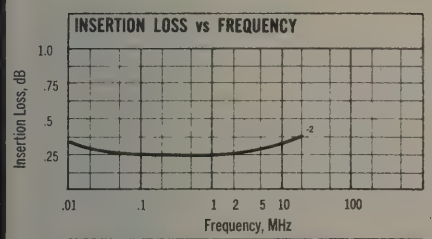



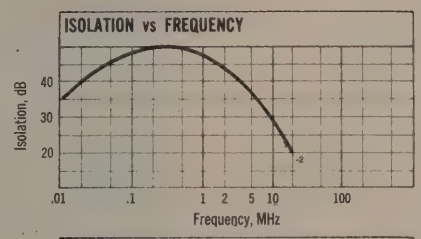



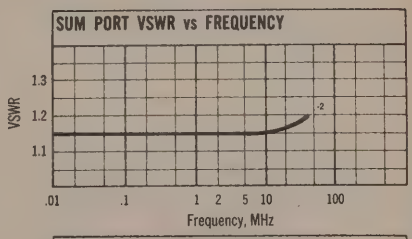



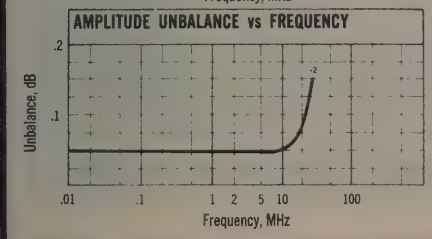



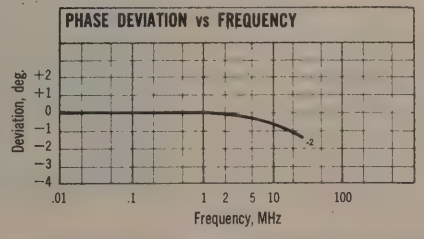

## MODEL ZMSCJ-2-2

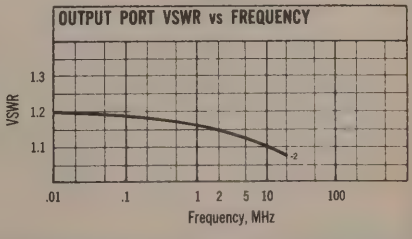


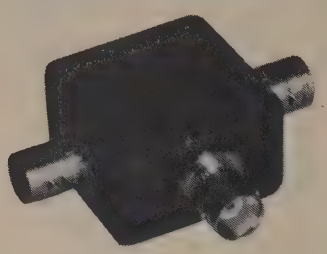




*PROMPT SERVICE / ONE WEEK DELIVERY* **Mini-Circuits**

# 2-Way 180°
# POWER SPLITTER/COMBINERS

## ZFSCJ-2 SERIES



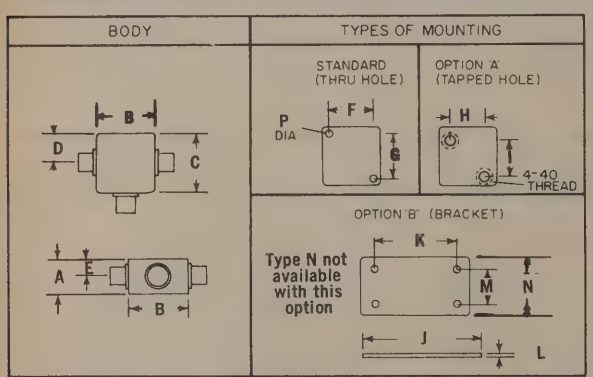
| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| ZFSCJ-2-1 | 1 MHz - 500 MHz | 50 | $49.95 (5-49) |
| ZFSCJ-2-3 | 5 MHz - 300 MHz | 50 | $39.95 (4-24) |

**DESCRIPTION —** The ZFSCJ-2 Series 2-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, 180° out of phase, to the two output ports. Similarly, signals fed into ports 1 and 2 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within 0.1 dB.

The ZFSCJ-2 Series is housed in an extremely rugged 1¼ in. square metal case with one connector on each side. BNC, TNC, SMA and Type N connectors are available. Three convenient mounting options are included, (4-40 threaded inserts, 0.125 in. dia. through holes, and flange mounting. Each unit is supplied in a grey epoxy paint finish.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

## DIMENSIONS AND CONNECTIONS




**For mounting option A or B add Letter to P/N**

BNC (std). TNC (on request). SMA (3mm) and TYPE N on request, add $5 to unit cost.

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| IN | .75 | 1.25 | 1.25 | .625 | .375 | 1.00 | 1.00 | 0.8 |
| MM | 19.1 | 31.8 | 31.8 | 15.9 | 9.5 | 25.4 | 25.4 | 20.3 |

| | I | J | K | L | M | N | P |
|---|---|---|---|---|---|---|---|
| IN | 0.8 | 2.188 | 1.688 | .060 | .75 | 1.25 | .125 |
| MM | 20.3 | 55.6 | 42.9 | 1.5 | 19.1 | 31.8 | 3.18 |

**WEIGHT** 54.5 grams 1.92 ounces

## FEATURES

- **Broadband,** 1 MHz to 500 MHz
- **Excellent Balance,** typically, phase balance within 1°, amplitude balance within 0.1 dB
- **Low Insertion Loss,** typically less than 0.9 dB
- **High Isolation,** typically better than 25 dB
- **Connectors,** available with BNC, TNC, SMA, or N
- **Mounting,** flange, thru holes, or tapped holes
- **Miniature,** width 1.25", height 0.75", depth 1.25"
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $49.95 in small quantity

## APPLICATIONS

- **Split an input signal into two equal 180° out-of-phase outputs**
- **Add signals vectorially**
- **Combine outputs of push-pull amplifiers**
- **Provide RF logic capability**

## ABSOLUTE MAXIMUM RATINGS

- **Operating and Storage Temp.** −55°C to +100°C
- **Environmental Specifications:** See Index Page

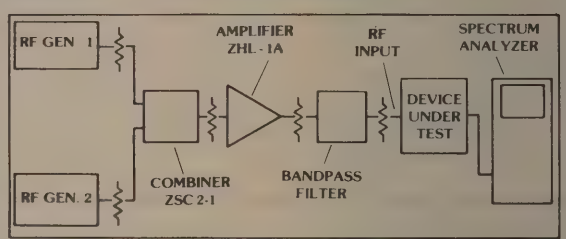
## TWO-TONE INTERMODULATION MEASUREMENT

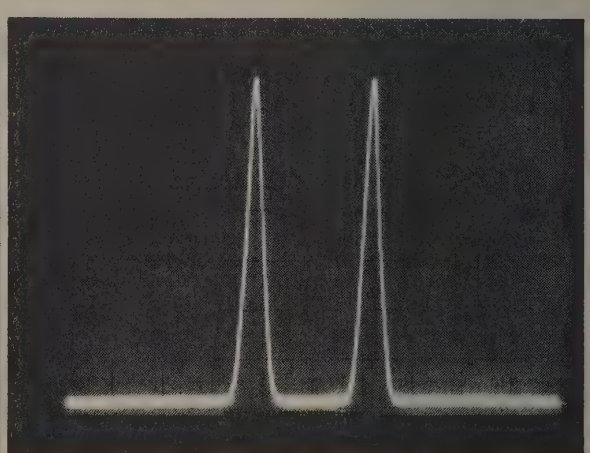
### RF INPUT CONDITIONS

**TONE 1 - 10 MHz at +7 dBm INPUT**
**TONE 2 - 9 MHz at +7dBm INPUT**

### SPECTRUM DISPLAY

**RESOLUTION - 500 kHz PER DIVISION**
**VERTICAL - 10 dB PER DIVISION**



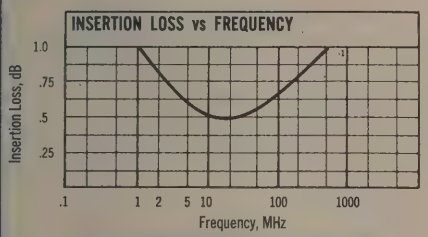
**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

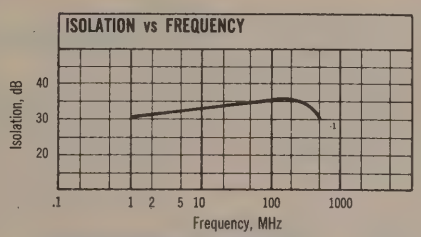
# ZFSCJ-2 Series
# 1 MHz to 500 MHz

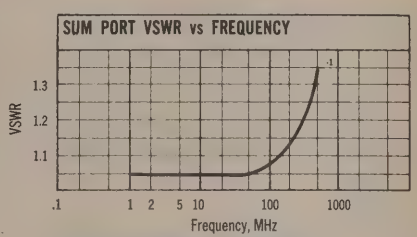
**Mini-Circuits**

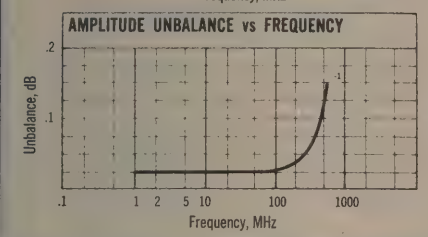
| MODEL | ZFSCJ-2-1 | | | ZFSCJ-2-3 | | |
|---|---|---|---|---|---|---|
| FREQ. RANGE (MHz) | 1-500 | | | 5-300 | | |
| NOMINAL PHASE | 180° | | | 180° | | |
| IMPEDANCE, ALL PORTS | 50 ohms | | | 50 ohms | | |
| ISOLATION BETWEEN OUTPUT 1 and 2, dB<br>Lower-Band Edge To One Decade Higher<br>Mid-Band<br>Upper-Band Edge To One Octave Lower | | Typ.<br>30<br>33<br>30 | Min.<br>20<br>25<br>18 | | Typ.<br>30<br>33<br>30 | Min.<br>20<br>25<br>18 |
| INSERTION LOSS, dB<br>(ABOVE 3 dB SPLIT) | Total Range | Typ.<br>1.0 | Max.<br>1.5 | Total Range | Typ.<br>1.0 | Max.<br>1.5 |
| PHASE DEVIATION FROM 180°, DEGREES | Total Range | Typ.<br>0.5 | Max.<br>6.0 | Total Range | Typ.<br>0.5 | Max.<br>6.0 |
| AMPLITUDE UNBALANCE, dB | Total Range | Typ.<br>0.1 | Max.<br>0.5 | Total Range | Typ.<br>0.1 | Max.<br>0.5 |
| VSWR | 1.2 typ. | | | 1.2 typ. | | |
| MATCHED POWER RATING | 1 watt max. | | | 1 watt max. | | |
| INTERNAL LOAD DISS. | 0.25 watt | | | 0.25 watt | | |

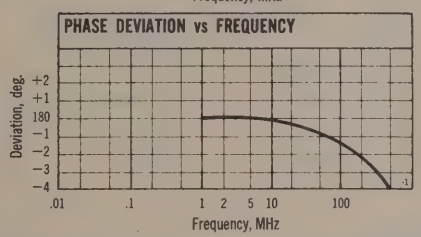
## MODEL ZFSCJ-2-1

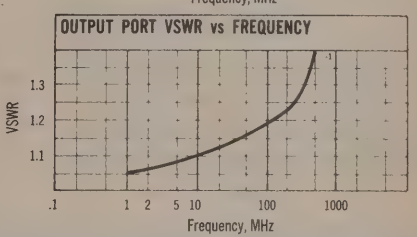


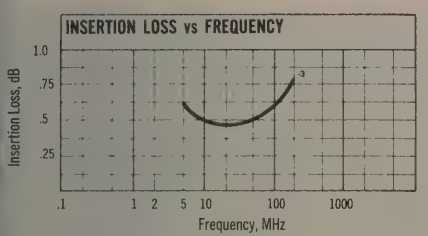



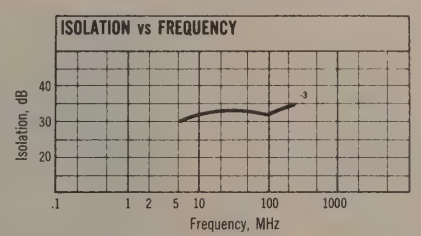



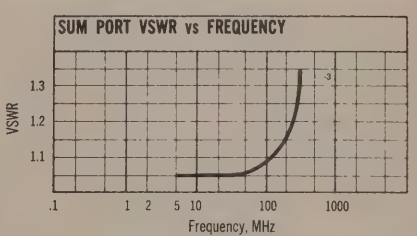



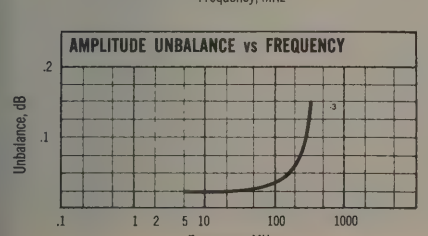



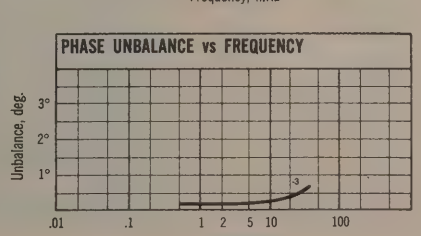

## MODEL ZFSCJ-2-3

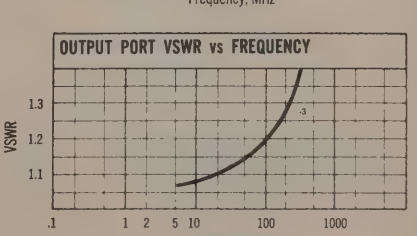


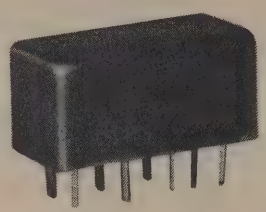




*PROMPT SERVICE / ONE WEEK DELIVERY* **Mini-Circuits**

# 3-Way 0°
# POWER SPLITTER/COMBINERS

## PSC-3 SERIES



| MODEL | FREQUENCY | Z (Ohms) | Cost |
|---|---|---|---|
| PSC-3-1 | 1 MHz - 200 MHz | 50 | $19.95 (6-49) |
| PSC-3-2 | 10 KHz - 30 MHz | 50 | $29.95 (6-49) |
| PSC-3-1-75 | 1 MHz - 200 MHz | 75 | $20.95 (6-49) |

## FEATURES

- **Broadband,** 10 KHz to 200 MHz
- **Excellent Balance,** typically, phase balance less than 1.5°, amplitude unbalance within 0.1 dB
- **Low Insertion Loss,** typically less than 0.6 dB
- **High Isolation,** typically better than 35 dB
- **Hermetically Sealed & RFI Shielded**
- **Miniature,** 0.128 in.$^3$, 0.4" x 0.8" PC area 0.4" high
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $19.95 in small quantity

## APPLICATIONS

- **Split an input signal into three equal in-phase outputs**
- **Combine signals from three different sources**
- **Add signals vectorially**
- **Provide RF logic capability**

## ABSOLUTE MAXIMUM RATINGS

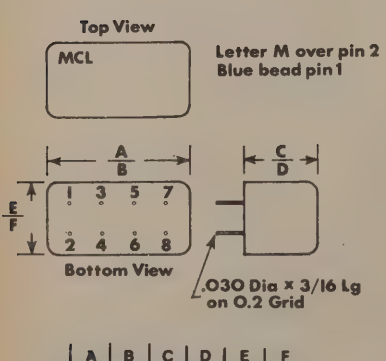
- **Operating and Storage Temp.** −55°C to +100°C
- **Pin Temperature:** (10 sec.) 510°F
- **Environmental Specifications:** See Index Page

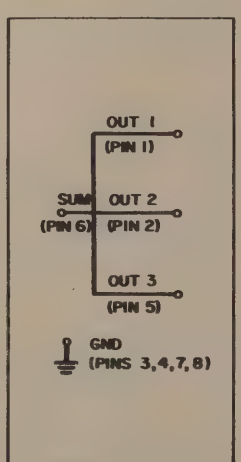
**DESCRIPTION** — The PSC-3 Series 3-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, in phase, to the three output ports. Similarly, signals fed into ports 1, 2 and 3 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within 0.1 dB.

The PSC-3 Series is ruggedly constructed to provide reliable service under severe environmental conditions. This hermetically sealed unit performs well under high relative humidity conditions and over temperature extremes from −55°C to +100°C.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| IN. | .770 | .800 | .385 | .400 | .370 | .400 |
| M/M | 19.5 | 20.3 | 9.7 | 10.1 | 9.3 | 10.1 |

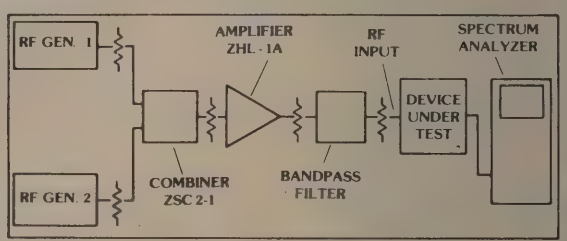
## TWO-TONE INTERMODULATION MEASUREMENT

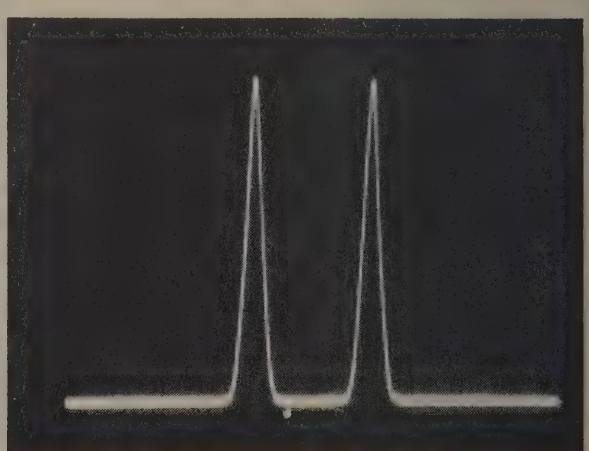
### RF INPUT CONDITIONS

TONE 1 - 10 MHz at +7 dBm INPUT
TONE 2 - 9 MHz at +7dBm INPUT

### SPECTRUM DISPLAY

RESOLUTION - 500 kHz PER DIVISION
VERTICAL - 10 dB PER DIVISION



**WEIGHT** 5.2 grams 0.18 ounces

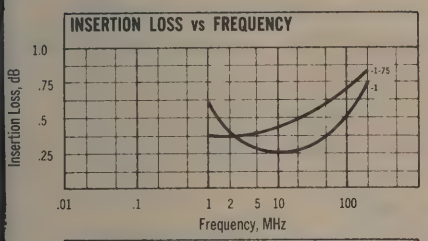
**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

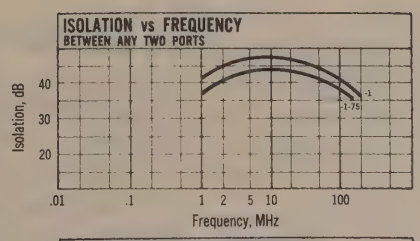
# PSC-3 Series
# 10 KHz to 200 MHz

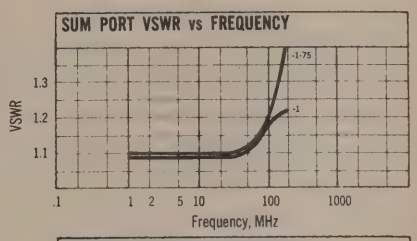
**Mini-Circuits**

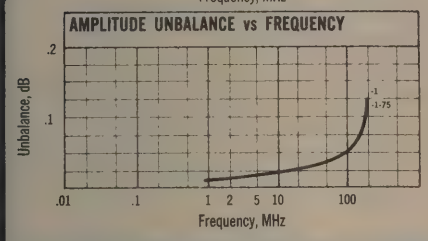
| MODEL | PSC-3-1 | | PSC-3-2 | | PSC-3-1-75 | |
|---|---|---|---|---|---|---|
| FREQ. RANGE (MHz) | 1-200 | | 0.01-30 | | 1-200 | |
| NOMINAL PHASE | 0° | | 0° | | 0° | |
| IMPEDANCE, ALL PORTS | 50 ohms | | 50 ohms | | 75 ohms | |
| ISOLATION (db) BETWEEN OUTPUTS 1, 2, and 3 | Typ. | Min. | Typ. | Min. | Typ. | Min. |
| 1-50 MHz | 45 | 30 | 0.01-5 MHz | 35 | 30 | 1-50 MHz | 40 | 30 |
| 50-200 MHz | 40 | 25 | 5-30 MHz | 30 | 25 | 50-200 MHz | 35 | 20 |
| INSERTION LOSS, dB (ABOVE 4.8 dB SPLIT) | Typ. | Max. | Typ. | Max. | Typ. | Max. |
| 3-30 MHz | 0.3 | 0.5 | 0.05-5 MHz | 0.15 | 0.3 | 3-30 MHz | 0.3 | 0.5 |
| 1.5-100 MHz | 0.4 | 0.7 | 0.01-15 MHz | 0.25 | 0.45 | 1.5-100 MHz | 0.4 | 0.7 |
| 1-200 MHz | 0.6 | 1.0 | 15-30 MHz | 0.45 | 0.75 | 1-200 MHz | 0.6 | 1.0 |
| PHASE UNBALANCE, DEGREES | Typ. | Max. | Typ. | Max. | Typ. | Max. |
| 1-100 MHz | 1 | 2 | 0.01-10 MHz | 1 | 2 | 1-100 MHz | 1 | 2 |
| 100-200 MHz | 2 | 4 | 10-30 MHz | 2 | 4 | 100-200 MHz | 2 | 4 |
| AMPLITUDE UNBALANCE, dB | Typ. | Max. | Typ. | Max. | Typ. | Max. |
| 1-10 MHz | 0.05 | 0.15 | 0.01-10 MHz | 0.05 | 0.2 | 1-10 MHz | 0.05 | 0.15 |
| 10-100 MHz | 0.05 | 0.2 | 10-30 MHz | 0.1 | 0.3 | 10-100 MHz | 0.05 | 0.2 |
| 100-200 MHz | 0.1 | 0.3 | | | | 100-200 MHz | 0.1 | 0.3 |
| VSWR | 1.1 typ. | | 1.1 typ. | | 1.2 typ. | |
| MATCHED POWER RATING | 1 watt max. | | 1 watt max. | | 1 watt max. | |
| INTERNAL LOAD DISS. | 0.37 watt | | 0.37 watt | | 0.37 watt | |

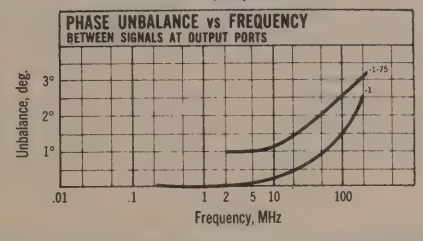
## MODELS PSC-3-1, PSC-3-1-75

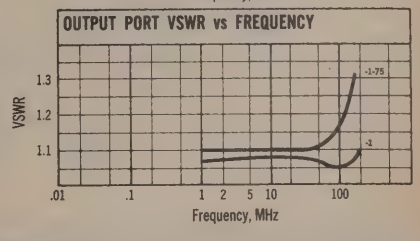


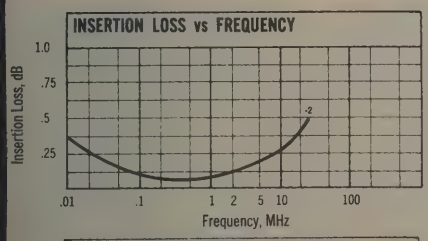



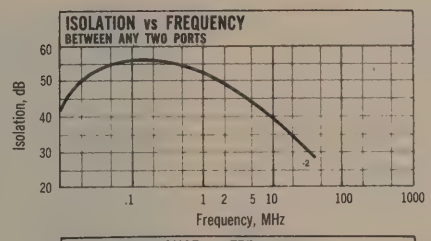



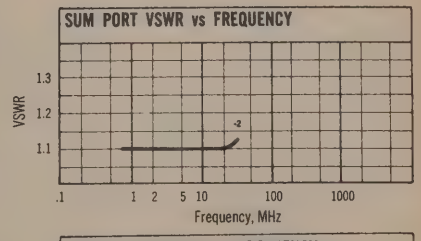



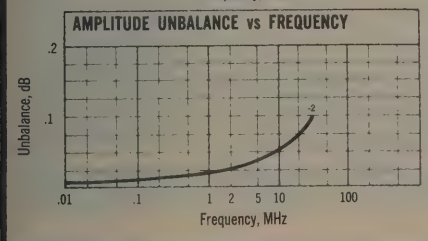



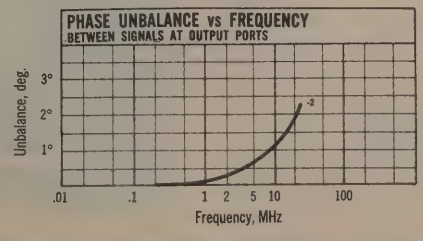

## MODEL PSC-3-2

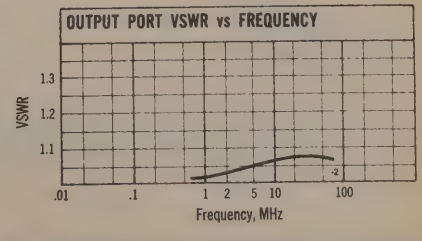


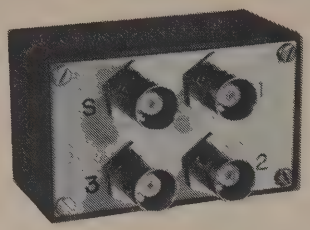




*PROMPT SERVICE / ONE WEEK DELIVERY* **Mini-Circuits**

# 3-Way 0°
# POWER SPLITTER/COMBINERS

## ZSC-3 SERIES




| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| ZSC-3-1 | 1 MHz - 200 MHz | 50 | $34.95 (4-24) |
| ZSC-3-2 | 10 KHz - 30 MHz | 50 | $44.95 (4-24) |
| ZSC-3-1-75 | 1 MHz - 200 MHz | 75 | $35.95 (4-24) |
| ZSC-3-2-75 | .02 MHz - 20 MHz | 75 | $45.95 (4-24) |

## FEATURES

- **Broadband,** 10 KHz to 200 MHz
- **Excellent Balance,** typically, phase balance within 1.5°, amplitude balance within 0.1 dB
- **Low Insertion Loss,** typically less than 0.6 dB
- **High Isolation,** typically better than 35 dB
- **Connectors,** available with BNC or TNC
- **Mounting,** option, available with bracket
- **Compact,** 2.25″ width, 1.4″ height, 1.15″ depth
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $34.95 in small quantity

## APPLICATIONS

- **Split an input signal into three equal in-phase outputs**
- **Combine signals from three different sources**
- **Add signals vectorially**
- **Provide RF logic capability**

## ABSOLUTE MAXIMUM RATINGS

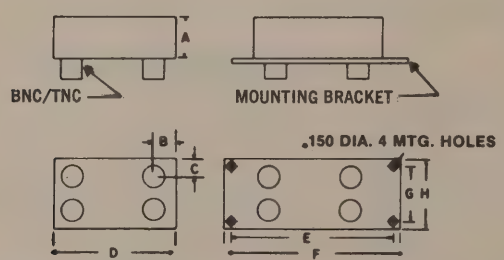
- **Operating and Storage Temp.** −55° C to +100° C
- **Environmental Specifications:** See Index Page

**DESCRIPTION** — The ZSC-3 Series 3-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, in phase, to the three output ports. Similarly, signals fed into ports 1, 2, and 3 are vectorially summed at the output S port. Typically over most of the frequency range, the phase balance is within 2 degree and the amplitude balance is within 0.1 dB.

Ruggedness and durability are built into the ZSC-3 Series. Available with BNC or TNC connectors, the ZSC-3 Series is housed in a die cast aluminum case. The case finish is a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15329A.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

## DIMENSIONS AND CONNECTIONS




MOUNTING BRACKET AVAILABLE ON REQUEST. Add suffix B to part number and add $1.50 to unit cost.
CONNECTORS BNC Std., TNC on request

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| IN. | 1.15 | .781 | .346 | 2.25 | 2.95 | 3.25 | 1.10 | 1.40 |
| MM. | 29. | 19.8 | 8.76 | 57. | 75. | 83. | 27.9 | 35.5 |

**WEIGHT** 81.0 grams 2.90 ounces

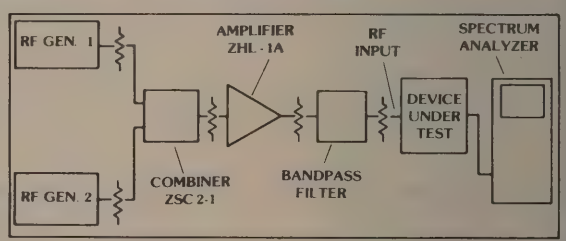
## TWO-TONE INTERMODULATION MEASUREMENT

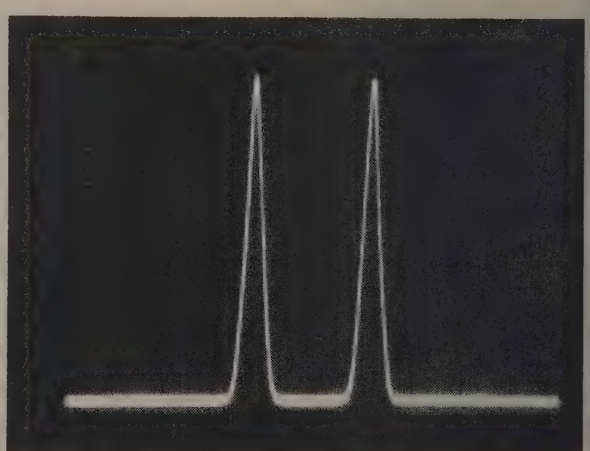
### RF INPUT CONDITIONS

TONE 1 - 10 MHz at +7 dBm INPUT
TONE 2 - 9 MHz at +7dBm INPUT

### SPECTRUM DISPLAY

RESOLUTION - 500 kHz PER DIVISION
VERTICAL - 10 dB PER DIVISION



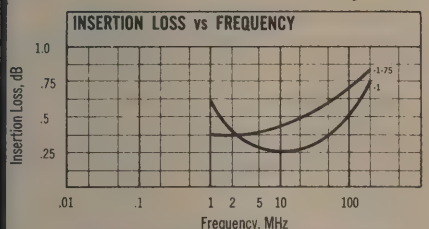



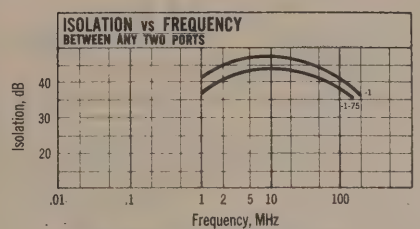
# ZSC-3 Series
# 10 KHz to 200 MHz

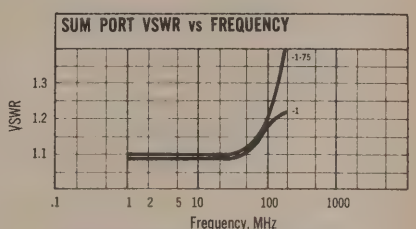
**Mini-Circuits**

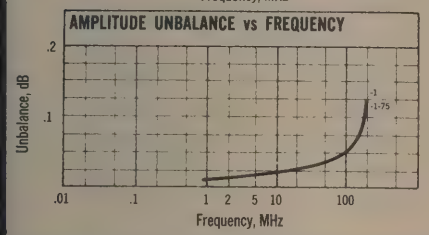
| MODEL | ZSC-3-1 | ZSC-3-2 | ZSC-3-1-75 | ZSC-3-2-75 |
|---|---|---|---|---|
| FREQ. RANGE (MHz) | 1-200 | 0.01-30 | 1-200 | 0.02-20 |
| NOMINAL PHASE | 0° | 0° | 0° | 0° |
| IMPEDANCE, ALL PORTS | 50 ohms | 50 ohms | 75 Ohms | 75 Ohms |
| ISOLATION (dB) BETWEEN OUTPUTS 1, 2, and 3 | Typ. / Min.<br>1-50 MHz 45 30<br>50-200 MHz 40 25 | Typ. / Min.<br>0.01-5 MHz 35 30<br>5-30 MHz 30 25 | Typ. / Min.<br>1-50 MHz 40 30<br>50-200 MHz 35 25 | Typ. / Min.<br>0.05-5 MHz 35 30<br>5-20 MHz 30 20 |
| INSERTION LOSS, dB (ABOVE 4.8 dB SPLIT) | Typ. / Max.<br>3-30 MHz 0.3 0.5<br>1.5-100 MHz 0.4 0.7<br>1-200 MHz 0.6 1.0 | Typ. / Max.<br>0.05-5 MHz 0.15 0.3<br>0-01-15 MHz 0.25 0.45<br>15-30 MHz 0.45 0.75 | Typ. / Max.<br>3-30 MHz 0.3 0.5<br>1.5-100 MHz 0.4 0.7<br>1-200 MHz 0.6 1.0 | Typ. / Max.<br>0.05-5 MHz 0.2 0.5<br>0.02-10 MHz 0.25 0.6<br>10-20 MHz 0.45 0.75 |
| PHASE UNBALANCE, DEGREES | Typ. / Max.<br>1-100 MHz 1 2<br>100-200 MHz 2 4 | Typ. / Max.<br>0.01-10 MHz 1 2<br>10-30 MHz 2 4 | Typ. / Max.<br>1-100 MHz 1 2<br>100-200 MHz 2 4 | Typ. / Max.<br>0.02-10 MHz 1 2<br>10-20 MHz 2 4 |
| AMPLITUDE UNBALANCE, dB | Typ. / Max.<br>1-10 MHz 0.05 0.15<br>10-100 MHz 0.05 0.2<br>100-200 MHz 0.1 0.3 | Typ. / Max.<br>0-01-10 MHz 0.05 0.2<br>10-30 MHz 0.1 0.3 | Typ. / Max.<br>1-10 MHz 0.05 0.15<br>10-100 MHz 0.05 0.2<br>100-200 MHz 0.1 0.3 | Typ. / Max.<br>0.02-10 MHz 0.05 0.2<br>10-20 MHz 0.1 0.3 |
| VSWR | 1.1 typ. | 1.1 typ. | 1.2 typ. | 1.2 typ. |
| MATCHED POWER RATING | 1 watt max. | 1 watt max. | 1 watt max. | 1 watt max. |
| INTERNAL LOAD DISS. | 0.37 watt | 0.37 watt | 0.37 watt | 0.37 watt |

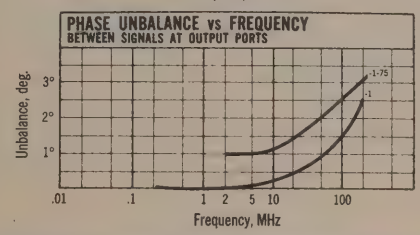
## MODELS ZSC-3-1, ZSC-3-1-75

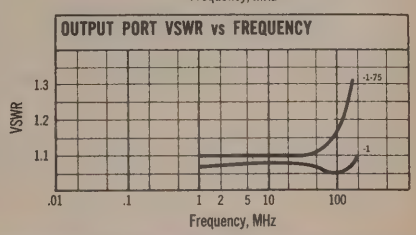


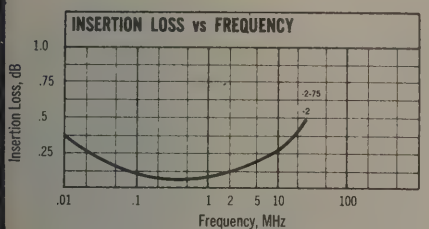



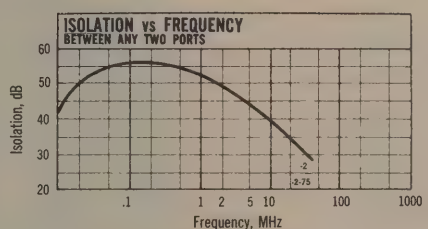



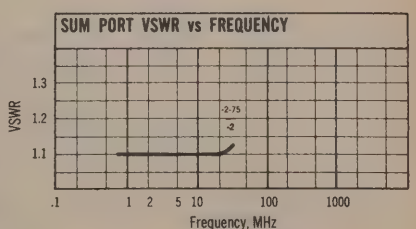



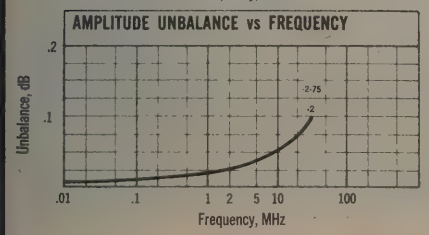



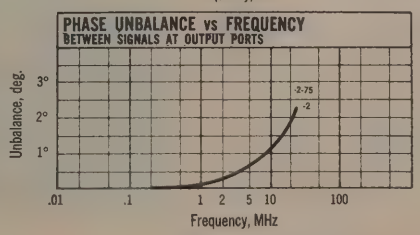

## MODELS ZSC-3-2, ZSC-3-2-75

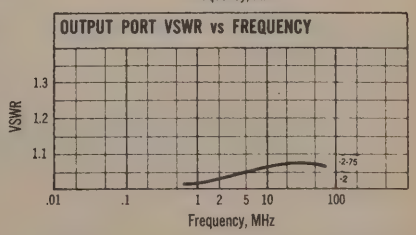


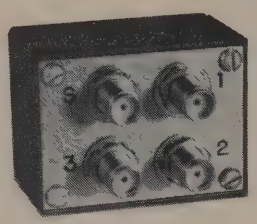




*PROMPT SERVICE / ONE WEEK DELIVERY* **Mini-Circuits**

# 3-Way 0°
# POWER SPLITTER/COMBINERS

## ZMSC-3 SERIES




| MODEL | FREQUENCY | Z (Ohms) | Cost |
|---|---|---|---|
| ZMSC-3-1 | 1 MHz - 200 MHz | 50 | $44.95 (4-24) |
| ZMSC-3-2 | 10 KHz - 30 MHz | 50 | $54.95 (4-24) |

## FEATURES

- **Broadband,** 10 KHz to 200 MHz
- **Excellent Balance,** typically, phase balance within 1.5°, amplitude balance within 0.1 dB
- **Low Insertion Loss,** typically less than 0.6 dB
- **High Isolation,** typically better than 35 dB
- **Connectors,** available with SMA
- **Mounting,** option, available with bracket
- **Miniature,** 1.5″ width, 1.15″ height, 0.88″ depth
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $44.95 in small quantity

## APPLICATIONS

- **Split an input signal into three equal in-phase outputs**
- **Combine signals from three different sources**
- **Add signals vectorially**
- **Provide RF logic capability**

## ABSOLUTE MAXIMUM RATINGS

- **Operating and Storage Temp.** −55°C to +100°C
- **Environmental Specifications:** See Index Page

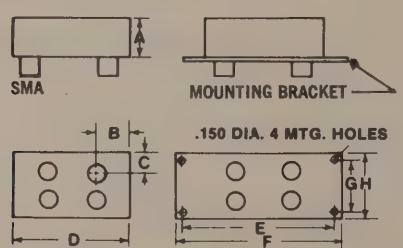
## DESCRIPTION

— The ZMSC-3 Series 3-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, in phase, to the three output ports. Similarly, signals fed into ports 1, 2, and 3 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within 0.1 dB.

Ruggedness and durability are built into the ZMSC-3 Series. Every component is bonded with silicone. Available with SMA (3mm) connectors, the ZMSC-3 Series is housed in a die cast aluminum case. The case finish is a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C15329A.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

## DIMENSIONS AND CONNECTIONS




MOUNTING BRACKET AVAILABLE ON REQUEST. Add suffix B to part number and add $1.50 to unit cost.
CONNECTORS SMA only.

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| IN. | 0.88 | 0.5 | .315 | 1.50 | 2.19 | 2.50 | 0.84 | 1.15 |
| MM. | 22. | 13. | 8. | 38. | 55.6 | 63.5 | 21. | 29. |

**WEIGHT** 40.5 grams 1.4 ounces

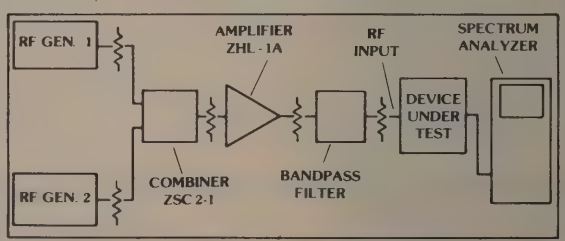
## TWO-TONE INTERMODULATION MEASUREMENT

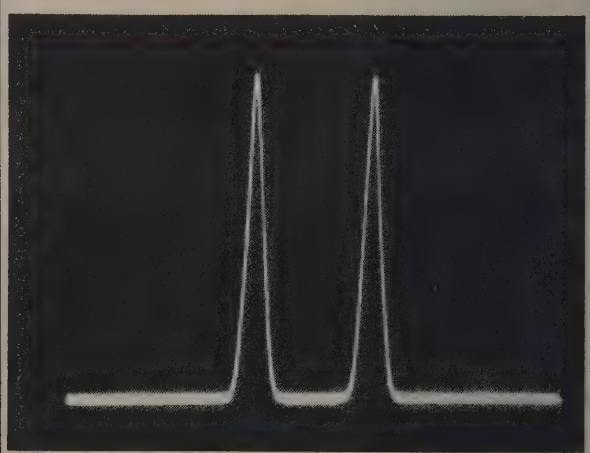
### RF INPUT CONDITIONS

TONE 1 - 10 MHz at +7 dBm INPUT
TONE 2 - 9 MHz at +7dBm INPUT

### SPECTRUM DISPLAY

RESOLUTION - 500 kHz PER DIVISION
VERTICAL - 10 dB PER DIVISION



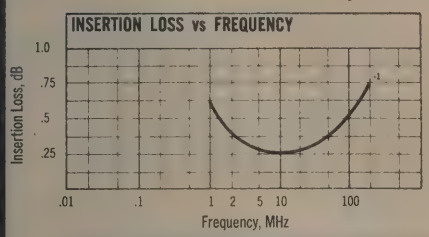
**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

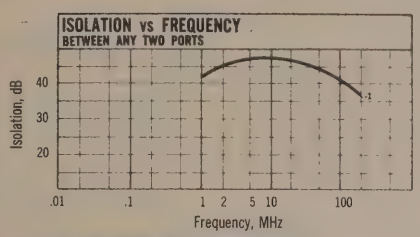
# ZMSC-3 Series
# 10 KHz to 200 MHz

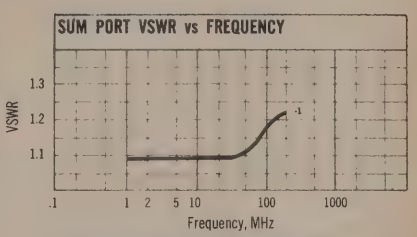
**Mini-Circuits**

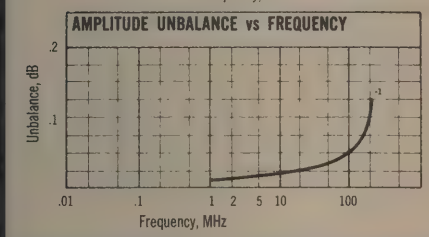
| MODEL | ZMSC-3-1 | ZMSC-3-2 |
|---|---|---|
| FREQ. RANGE (MHz) | 1-200 | 0.01-30 |
| NOMINAL PHASE | 0° | 0° |
| IMPEDANCE, ALL PORTS | 50 ohms | 50 ohms |
| ISOLATION (db) BETWEEN OUTPUTS 1, 2, and 3 | 1-50 MHz Typ. 45 Min. 30<br>50-200 MHz Typ. 40 Min. 25 | 0.01-5 MHz Typ. 35 Min. 30<br>5-30 MHz Typ. 30 Min. 25 |
| INSERTION LOSS, dB (ABOVE 4.8 dB SPLIT) | 3-30 MHz Typ. 0.3 Max. 0.5<br>1.5-100 MHz Typ. 0.4 Max. 0.7<br>1-200 MHz Typ. 0.6 Max. 1.0 | 0.05-5 MHz Typ. 0.15 Max. 0.3<br>0.01-15 MHz Typ. 0.25 Max. 0.45<br>15-30 MHz Typ. 0.45 Max. 0.75 |
| PHASE UNBALANCE, DEGREES | 1-100 MHz Typ. 1 Max. 2<br>100-200 MHz Typ. 2 Max. 4 | 0.01-10 MHz Typ. 1 Max. 2<br>10-30 MHz Typ. 2 Max. 4 |
| AMPLITUDE UNBALANCE, dB | 1-10 MHz Typ. 0.05 Max. 0.15<br>10-100 MHz Typ. 0.05 Max. 0.2<br>100-200 MHz Typ. 0.1 Max. 0.3 | 0.01-10 MHz Typ. 0.05 Max. 0.2<br>10-30 MHz Typ. 0.1 Max. 0.3 |
| VSWR | 1.1 typ. | 1.1 typ. |
| MATCHED POWER RATING | 1 watt max. | 1 watt max. |
| INTERNAL LOAD DISS. | 0.37 watt | 0.37 watt |

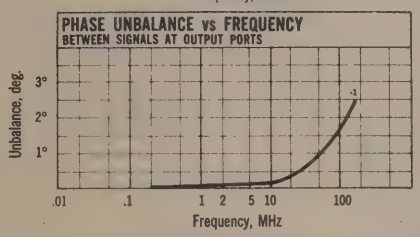
## MODEL ZMSC-3-1

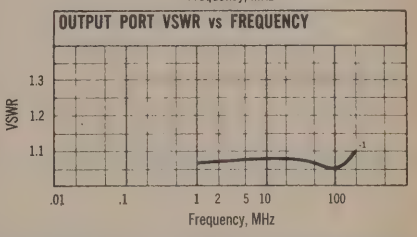


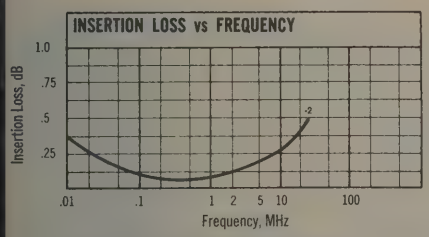



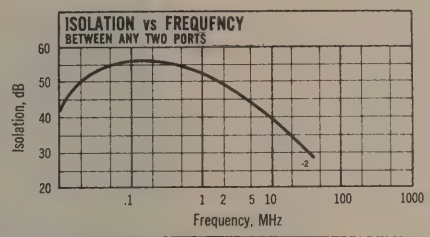



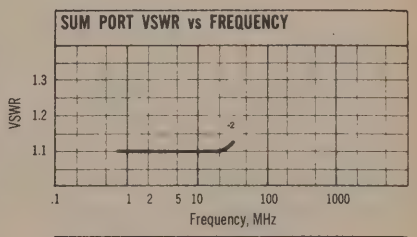



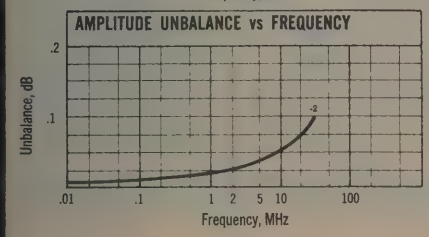



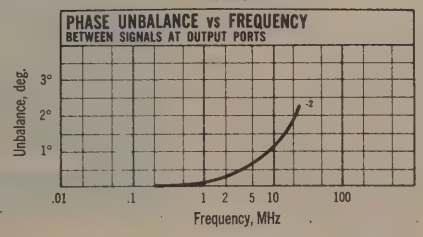

## MODEL ZMSC-3-2

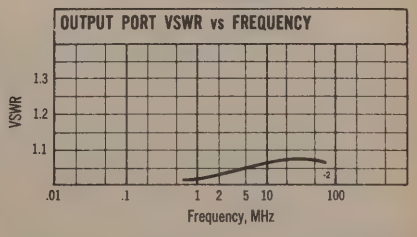


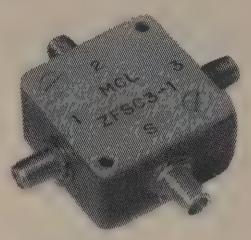




*PROMPT SERVICE / ONE WEEK DELIVERY*

**Mini-Circuits**

# 3-Way 0°
# POWER SPLITTER/COMBINERS

## ZFSC-3 SERIES



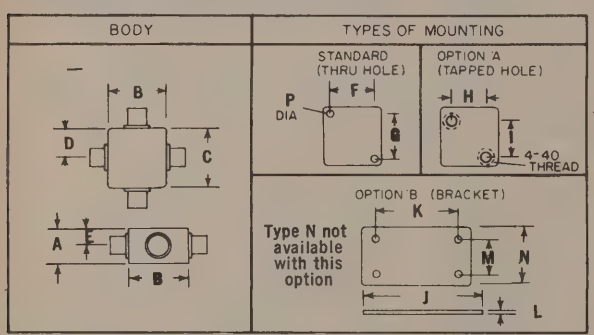

| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| ZFSC-3-1 | 1 MHz - 500 MHz | 50 | $39.95 (4-24) |
| ZFSC-3-1W | 2 MHz - 750 MHz | 50 | $41.95 (4-24) |

**DESCRIPTION** — The Series ZFSC-3 3-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, in phase, to the three output ports. Similarly, signals fed into ports 1, 2, and 3 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within 0.2 dB.

The ZFSC-3 series is housed in an extremely rugged 1¼ in. square metal case with one connector on each side. BNC, TNC, SMA and Type N connectors are available. Three convenient mounting options are included. (4-40 threaded inserts, 0.125 in. dia. through holes, and flange mounting.) Each unit is supplied in a gray epoxy paint finish.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

## DIMENSIONS AND CONNECTIONS




**For mounting option A or B add Letter to P/N**

BNC (std), TNC (on request), SMA (3mm) and TYPE N on request, add $5 to unit cost.

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| IN | .75 | 1.25 | 1.25 | .625 | .375 | 1.00 | 1.00 | 0.8 |
| MM | 19.1 | 31.8 | 31.8 | 15.9 | 9.5 | 25.4 | 25.4 | 20.3 |

| | I | J | K | L | M | N | P |
|---|---|---|---|---|---|---|---|
| IN | 0.8 | 2.188 | 1.688 | .060 | .75 | 1.25 | .125 |
| MM | 20.3 | 55.6 | 42.9 | 1.5 | 19.1 | 31.8 | 3.18 |

**WEIGHT** 58.0 grams 2.04 ounces

## FEATURES:

- **Broadband,** 1 MHz to 750 MHz
- **Excellent Balance,** typically, phase balance within 2°, amplitude balance within 0.2 dB
- **Low Insertion Loss,** typically less than 0.5 dB
- **High Isolation,** typically better than 25 dB
- **Connectors,** available with BNC, TNC, SMA or N
- **Mounting,** flange, thru holes, or tapped holes
- **Miniature,** width 1.25", height 0.75", depth 1.25"
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as low as $39.95 in small quantity

## APPLICATIONS

- **Split an input signal into four equal in-phase outputs**
- **Combine signals from four different sources**
- **Add signals vectorially**
- **Provide RF logic capability**

## ABSOLUTE MAXIMUM RATINGS

- **Operating and Storage Temp.** −55°C to +100°C
- **Environmental Specifications:** See Index Page

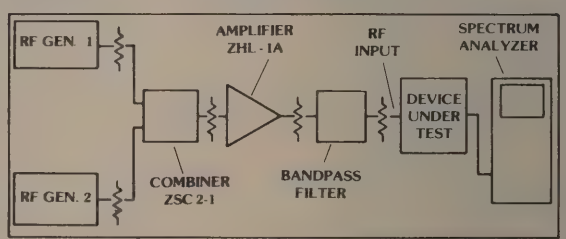
## TWO-TONE INTERMODULATION MEASUREMENT

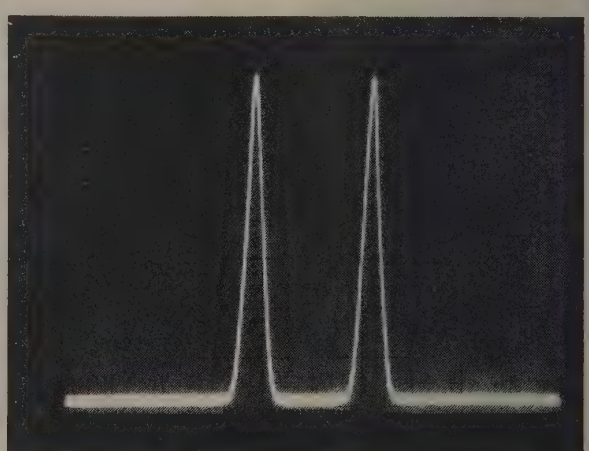
### RF INPUT CONDITIONS

TONE 1 - 10 MHz at +7 dBm INPUT
TONE 2 - 9 MHz at +7dBm INPUT

### SPECTRUM DISPLAY

RESOLUTION - 500 kHz PER DIVISION
VERTICAL - 10 dB PER DIVISION



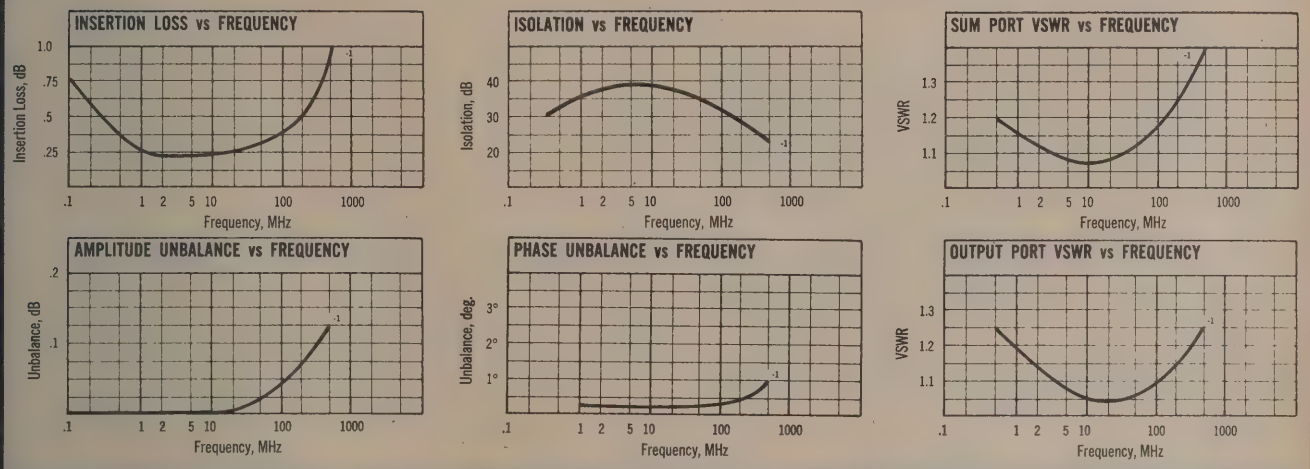



# ZFSC-3 Series
# 1 MHz to 750 MHz

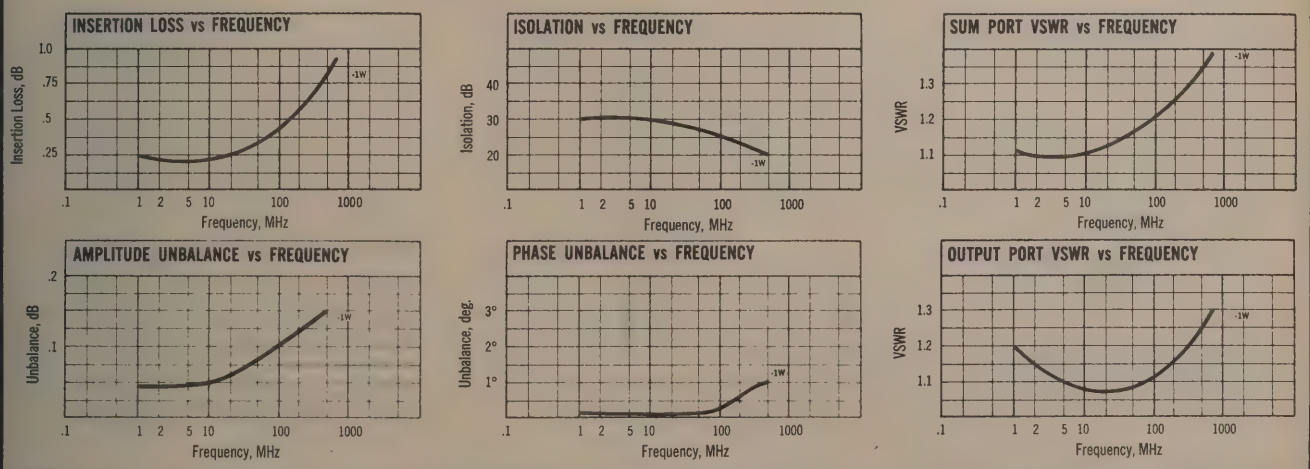
**Mini-Circuits**

| MODEL | ZFSC-3-1 | | | ZFSC-3-1W | | |
|---|---|---|---|---|---|---|
| FREQ. RANGE (MHz) | 1-500 | | | 2-750 | | |
| NOMINAL PHASE | 0° | | | 0° | | |
| IMPEDANCE, ALL PORTS | 50 ohms | | | 50 ohms | | |
| ISOLATION (dB) BETWEEN OUTPUTS 1, 2 and 3 | | Typ. | Min. | | Typ. | Min. |
| | 1-50 MHz | 30 | 20 | 2-100 MHz | 35 | 25 |
| | 50-250 MHz | 30 | 20 | 100-500 MHz | 25 | 20 |
| | 250-500 MHz | 25 | 18 | 500-750 MHz | 21 | 19 |
| INSERTION LOSS, dB (ABOVE 4.8 dB SPLIT) | | Typ. | Max. | | Typ. | Max. |
| | 1-100 MHz | 0.4 | 0.75 | 2-100 MHz | 0.4 | 0.6 |
| | 100-250 MHz | 0.5 | 0.9 | 100-400 MHz | 0.5 | 1.0 |
| | 250-500 MHz | 0.8 | 1.2 | 400-750 MHz | 1 | 1.6 |
| PHASE UNBALANCE, DEGREES | | Typ. | Max. | | Typ. | Max. |
| | 1-500 MHz | 1 | 4 | 2-400 MHz | 2 | 5 |
| | | | | 5-750 | 4 | 7 |
| AMPLITUDE UNBALANCE, dB | | Typ. | Max. | | Typ. | Max. |
| | 1-500 MHz | 0.1 | 0.4 | 2-750 | 0.1 | 0.3 |
| VSWR | 1.2 typ. | | | 1.3 typ. | | |
| MATCHED POWER RATING | 1 watt max. | | | 1 watt max. | | |
| INTERNAL LOAD DISS. | 0.37 watt | | | 0.37 watt | | |

## MODEL ZFSC-3-1



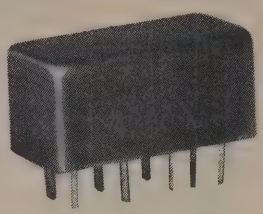

## MODEL ZFSC-3-1W




*PROMPT SERVICE / ONE WEEK DELIVERY* **Mini-Circuits**

# 4-Way 0°
# POWER SPLITTER/COMBINERS

## PSC-4 SERIES



## FEATURES:

- **Broadband,** 10 KHz to 250 MHz
- **Excellent Balance,** typically, phase balance less than 2°, amplitude unbalance within 0.2 dB
- **Low Insertion Loss,** typically less than 0.5 dB
- **High Isolation,** typically better than 25 dB
- **Hermetically Sealed & RFI Shielded**
- **Miniature,** 0.128 in.$^3$, 0.4" x 0.8" PC area, 0.4" high
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $23.95 in small quantity

## APPLICATIONS

- **Split an input signal into four equal in-phase outputs**
- **Combine signals from four different sources**
- **Add signals vectorially**
- **Provide RF logic capability**

## ABSOLUTE MAXIMUM RATINGS

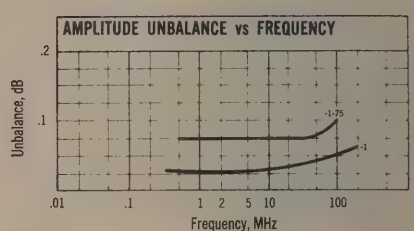
- **Operating and Storage Temp.** −55° C to +100° C
- **Pin Temperature:** (10 sec.) 510° F
- **Environmental Specifications:** See Index Page

| MODEL | FREQUENCY | Z (Ohms) | Cost |
|---|---|---|---|
| PSC-4-1 | 100 KHz - 200 MHz | 50 | $28.95 (6-49) |
| PSC-4-1-75 | 1 MHz - 200 MHz | 75 | $24.95 (6-49) |
| PSC-4-3 | 250 KHz - 250 MHz | 50 | $23.95 (6-49) |
| PSC-4-6 | 10 KHz - 40 MHz | 50 | $29.95 (6-49) |

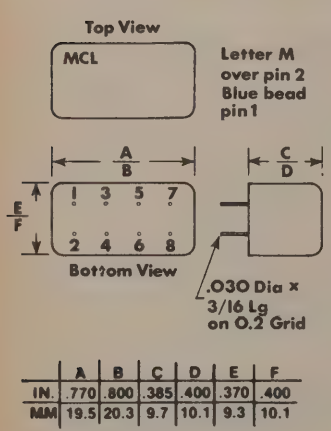
**DESCRIPTION** — The Series PSC-4 4-way power divider/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, in power, to the four output prots. Similarly, signals fed into ports 1, 2, 3 and 4 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within 0.2 dB.

The PSC—4 is ruggedly constructed to provide reliable service under severe environmental conditions. This hermetically sealed unit performs well under high relative humidity conditions and over temperature extremes from −55° C to +100° C.

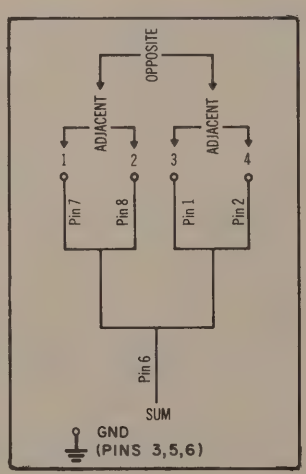
High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

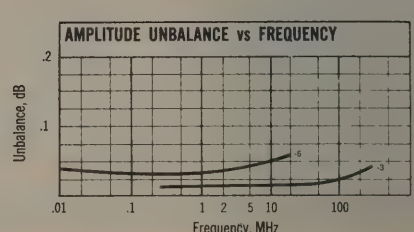



## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| IN. | .770 | .800 | .385 | .400 | .370 | .400 |
| MM | 19.5 | 20.3 | 9.7 | 10.1 | 9.3 | 10.1 |




**WEIGHT** 5.2 grams 0.18 ounces

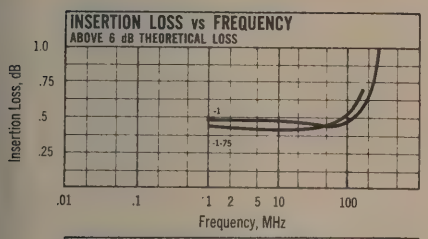
**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

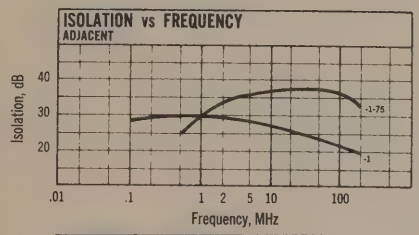
# PSC-4 Series
# 10 KHz to 250 MHz

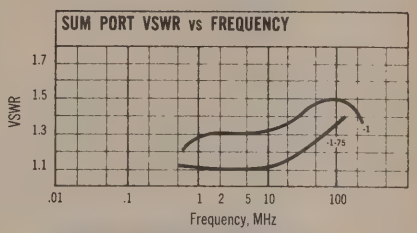
Mini-Circuits

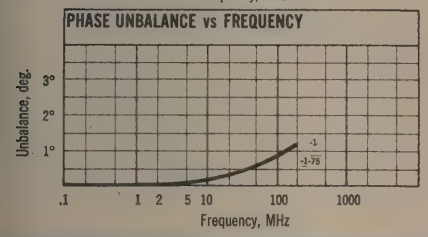
| MODEL | PSC 4-1 | PSC 4-3 | PSC 4-6 | PSC-4-1-75 |
|---|---|---|---|---|
| FREQ. RANGE (MHz) | 0.1-200 | 0.25-250 | 0.01-40 | 1-200 |
| NOMINAL PHASE | 0° | 0° | 0° | 0° |
| IMPEDANCE, ALL PORTS | 50 ohms | 50 ohms | 50 ohms | 75 ohms |
| ISOLATION, dB OPPOSITE PORTS | Typ. Min.<br>0.1-10 MHz 35 20<br>10-100 MHz 40 30<br>100-200 MHz 40 30 | Typ. Min.<br>0.25-10 MHz 35 20<br>10-50 MHz 40 30<br>50-250 MHz 40 20 | Typ. Min.<br>0.01-0.5 MHz 35 28<br>0.5-20 MHz 32 25<br>20-40 MHz 28 22 | Typ. Min.<br>1-10 MHz 30 20<br>10-100 MHz 35 30<br>100-200 MHz 30 20 |
| ISOLATION, dB ADJACENT PORTS | Typ. Min.<br>0.1-10 MHz 33 25<br>10-100 MHz 30 20<br>100-200 MHz 27 20 | Typ. Min.<br>0.25-10 MHz 33 20<br>10-100 MHz 30 20<br>100-250 MHz 27 20 | Typ. Min.<br>0.1-10 MHz 35 30<br>0.02-20 MHz 35 25<br>0.01-40 MHz 25 18 | Typ. Min.<br>1-10 MHz 30 20<br>10-100 MHz 25 20<br>100-200 MHz 25 20 |
| INSERTION LOSS, dB (above 6 dB split) | Typ. Max.<br>0.1-10 MHz 0.4 0.6<br>10-100 MHz 0.5 0.75<br>100-200 MHz 0.7 1.0 | Typ. Max.<br>0.25-10 MHz 0.4 0.7<br>10-100 MHz 0.5 0.75<br>100-250 MHz 0.7 1.2 | Typ. Max.<br>0.01-0.02 MHz 0.4 0.8<br>0.02-20 MHz 0.3 0.5<br>20-40 MHz 0.5 1.0 | Typ. Max.<br>1-10 MHz 0.4 0.7<br>10-100 MHz 0.5 0.9<br>100-200 MHz 0.7 1.2 |
| INSERTION LOSS, UNBALANCE, dB | Typ. Max.<br>0.1-10 MHz 0.05 0.15<br>100-200 MHz 0.1 0.25 | Typ. Max.<br>0.25-100 MHz 0.05 0.15<br>100-250 MHz 0.1 0.25 | Typ. Max.<br>0.01-20 MHz 0.05 0.1<br>20-40 MHz 0.05 0.15 | Typ. Max.<br>1-100 MHz 0.05 0.2<br>100-200 MHz 0.1 0.3 |
| VSWR | 1.2 typ. | 1.1 typ. | 1.2 typ. | 1.2 typ. |
| MATCHED POWER RATING | 1 watt max. | 1 watt max. | 1 watt max. | 1 watt max. |
| INTERNAL LOAD DISS. | 0.37 watt | 0.37 watt | 0.37 watt | 0.37 watt |

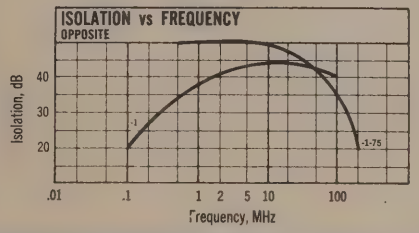
## MODELS PSC-4-1, PSC-4-1-75

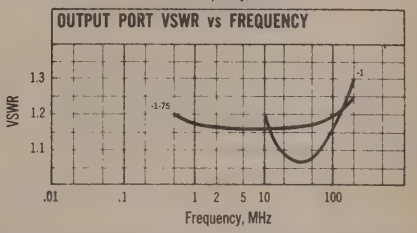


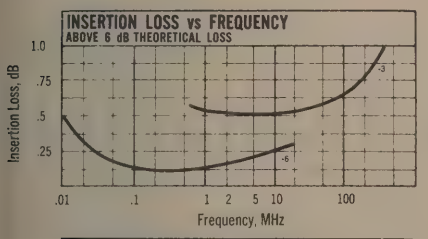



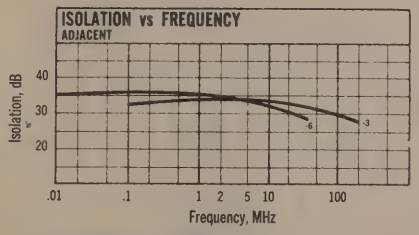



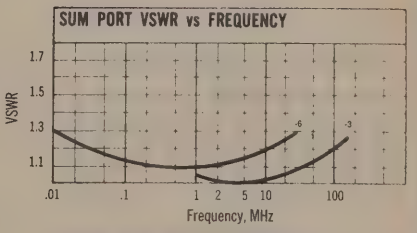



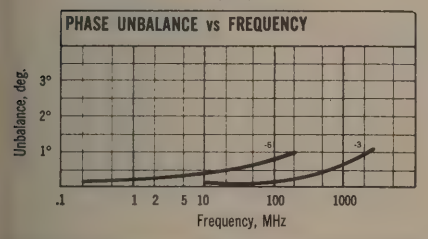



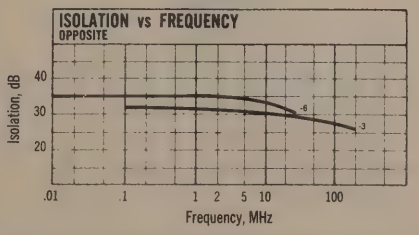

## MODELS PSC-4-3, PSC-4-6

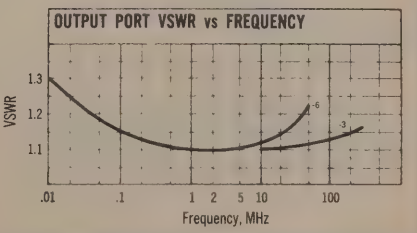


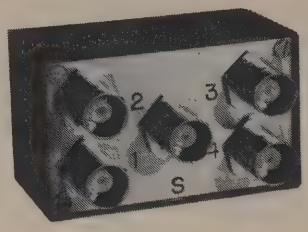



# 4-Way 0°
# POWER SPLITTER/COMBINERS

## ZSC-4 SERIES




| MODEL | FREQUENCY | Z (Ohms) | Cost |
|---|---|---|---|
| ZSC-4-1 | 100 KHz - 200 MHz | 50 | $41.95 (4-24) |
| ZSC-4-2 | 2 KHz - 20 MHz | 50 | $64.95 (4-24) |
| ZSC-4-3 | 250 KHz - 250 MHz | 50 | $38.95 (4-24) |
| ZSC-4-1-75 | 1 MHz - 200 MHz | 75 | $43.45 (4-24) |
| NATIONAL STANDARD NUMBER | | ZSC-4-1B | NSN 5820-00-270-3056 |

## FEATURES:

- **Broadband,** 2 KHz to 250 MHz
- **Excellent Balance,** typically, phase balance within 2°, amplitude balance within 0.2 dB
- **Low Insertion Loss,** typically less than 0.5 dB
- **High Isolation,** typically better than 25 dB
- **Connectors,** available with BNC or TNC
- **Mounting,** option available with bracket
- **Compact,** 2.25" width, 1.4" height, 1.15" depth
- **High Reliability,** 100% tested, one year guaranteed
- **Low Cost,** as little as $38.95 in small quantity

## APPLICATIONS

- **Split an input signal into four equal in-phase outputs**
- **Combine signals from four different sources**
- **Add signals vectorially**
- **Provide RF logic capability**

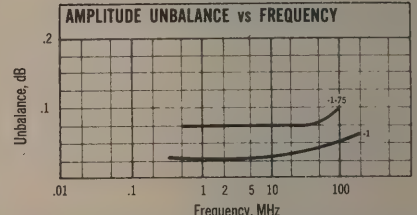
## ABSOLUTE MAXIMUM RATINGS

- **Operating and Storage Temp.** −55° C to +100° C
- **Environmental Specifications:** See Index Page

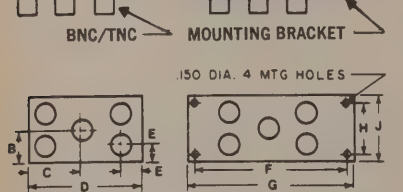
**DESCRIPTION** — The Series ZSC-4 4-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, in phase, to the four output ports. Similarly, signals fed into ports 1, 2,, 3 and 4 are vectorially summed at the S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within 0.2 dB.

Housed in a die cast sluminum case, these rugged units are double shielded to meet your tough EMI requirements. The case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

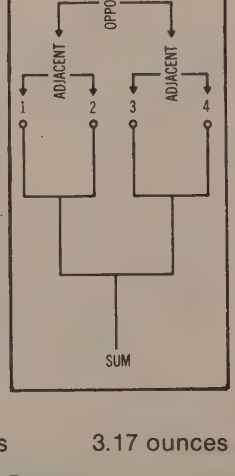


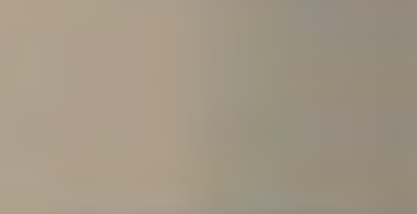

## DIMENSIONS AND CONNECTIONS




MOUNTING BRACKET AVAILABLE ON REQUEST.
Add suffix B to part number and add $1.50 to unit cost.
CONNECTORS BNC Std., TNC on request

| | A | B | C | D | E | F | G | H | J |
|---|---|---|---|---|---|---|---|---|---|
| IN | 1.15 | .70 | 1.125 | 2.25 | .405 | 2.95 | 3.25 | 1.10 | 1.40 |
| MM | 29. | 18. | 28.5 | 57. | 10.3 | 74.9 | 82.5 | 27.9 | 35.5 |



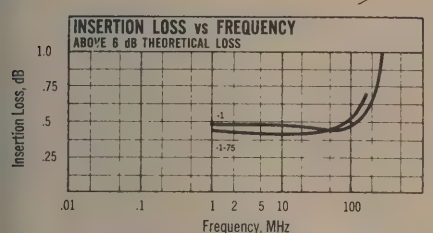

**WEIGHT** 90.0 grams 3.17 ounces

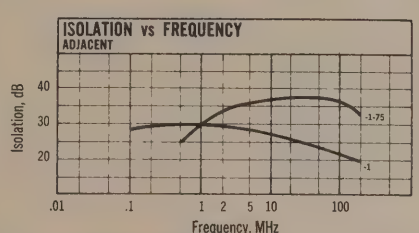
# ZSC-4 Series
# 2 KHz to 250 MHz

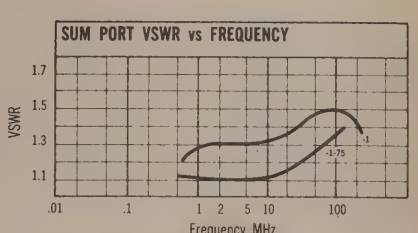
**Mini-Circuits**

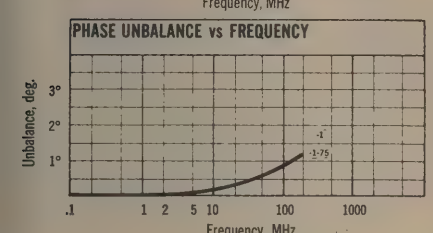
| MODEL | ZSC-4-1 | ZSC-4-2 | ZSC-4-3 | ZSC-4-1-75 |
|---|---|---|---|---|
| FREQ. RANGE (MHz) | 0.1-200 | 2 KHz-20 MHz | 0.250-250 | 1-200 |
| NOMINAL PHASE | 0° | 0° | 0° | 0° |
| IMPEDANCE, ALL PORTS | 50 ohms | 50 ohms | 50 ohms | 75 ohms |
| ISOLATION, dB OPPOSITE PORTS | Typ. Min.<br>0.1-10 MHz 35 20<br>10-100 MHz 40 30<br>100-200 MHz 40 30 | Typ. Min.<br>40 KHz-4 MHz 45 35<br>10 KHz-20 MHz 40 30<br>2 KHz-10 KHz 30 20 | Typ. Min.<br>0.25-10 MHz 35 20<br>10-50 MHz 40 30<br>50-250 MHz 40 20 | Typ. Min.<br>1-10 MHz 30 20<br>10-100 MHz 35 30<br>100-200 MHz 30 20 |
| ISOLATION, dB, ADJACENT PORTS | Typ. Min.<br>0.1-10 MHz 33 25<br>10-100 MHz 30 20<br>100-200 MHz 27 20 | Typ. Min.<br>2 KHz-20 MHz 33 25 | Typ. Min.<br>0.25-10 MHz 33 20<br>10-100 MHz 30 20<br>100-250 MHz 27 20 | Typ. Min.<br>1-10 MHz 30 20<br>10-100 MHz 25 20<br>100-200 MHz 25 20 |
| INSERTION LOSS, dB (above 6 dB split) | Typ. Max.<br>0.1-10 MHz 0.4 0.6<br>10-100 MHz 0.5 0.75<br>100-200 MHz 0.7 1.0 | Typ. Max.<br>5 KHz-1.0 MHz 0.3 0.5<br>2 KHz-5 KHz 0.45 0.75<br>1 MHz-20 MHz 0.7 1.0 | Typ. Max.<br>0.25-10 MHz 0.4 0.7<br>10-100 MHz 0.5 0.75<br>100-250 MHz 0.7 1.2 | Typ. Max.<br>1-10 MHz 0.4 0.7<br>10-100 MHz 0.5 0.8<br>100-200 MHz 0.7 1.2 |
| INSERTION LOSS, UNBALANCE, dB | Typ. Max.<br>0.1-100 MHz 0.05 0.15<br>100-200 MHz 0.1 0.25 | Typ. Max.<br>2 KHz-10 MHz 0.05 0.15<br>10 MHz-20 MHz 0.1 0.25 | Typ. Max.<br>0.25-100 MHz 0.05 0.15<br>100-250 MHz 0.1 0.3 | Typ. Max.<br>1-100 MHz 0.05 0.2<br>100-200 MHz 0.1 0.3 |
| VSWR | 1.2 typ. | 1.2 typ. | 1.1 typ. | 1.2 typ. |
| MATCHED POWER RATING | 1 watt max. | 1 watt max. | 1 watt max. | 1 watt max. |
| INTERNAL LOAD DISS. | 0.37 watt | 0.37 watt | 0.37 watt | 0.37 watt |

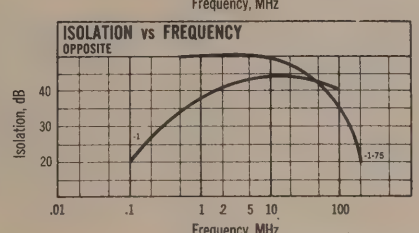
## MODELS ZSC-4-1, ZSC-4-1-75

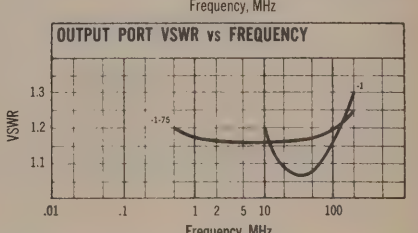


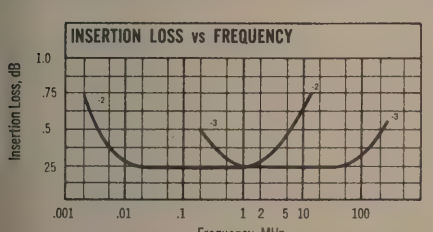



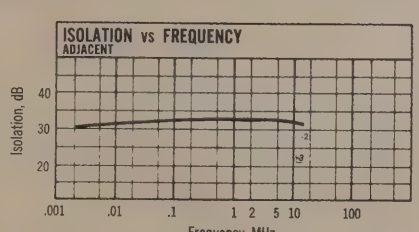



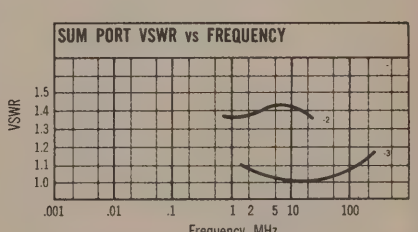



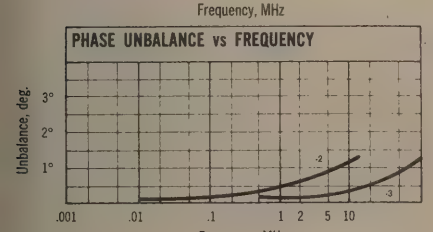



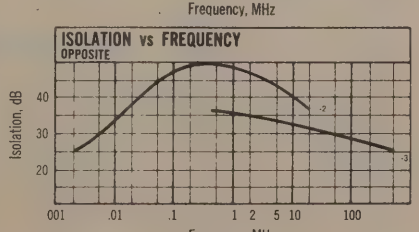

## MODELS ZSC-4-2, ZSC-4-3

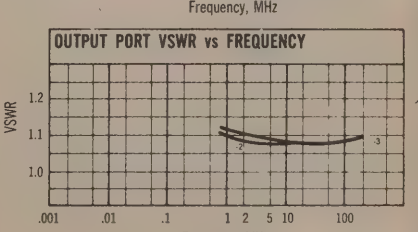


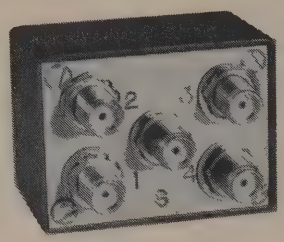



# 4-Way 0°
# POWER SPLITTER/COMBINERS

## ZMSC-4 SERIES



## FEATURES

- **Broadband,** 2 KHz to 250 MHz
- **Excellent Balance,** typically, phase balance within 2°, amplitude balance within 0.2 dB
- **Low Insertion Loss,** typically less than 0.5 dB
- **High Isolation,** typically better than 25 dB
- **Connectors,** available with SMA
- **Mounting,** option, available with bracket
- **Miniature,** 1.5″ width, 1.15″ height, 0.88″ depth
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $48.95 in small quantity

## APPLICATIONS

- **Split an input signal into four equal in-phase outputs**
- **Combine signals from four different sources**
- **Add signals vectorially**
- **Provide RF logic capability**

## ABSOLUTE MAXIMUM RATINGS

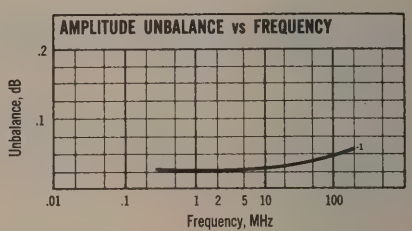
- **Operating and Storage Temp.** −55° C to +100° C
- **Environmental Specifications:** See Index Page

| MODEL | FREQUENCY | Z (Ohms) | Cost |
|---|---|---|---|
| ZMSC-4-1 | 100 KHz - 200 MHz | 50 | $51.95 (4-24) |
| ZMSC-4-2 | 2 KHz - 20 MHz | 50 | $64.95 (4-24) |
| ZMSC-4-3 | 250 KHz - 250 MHz | 50 | $38.95 (4-24) |

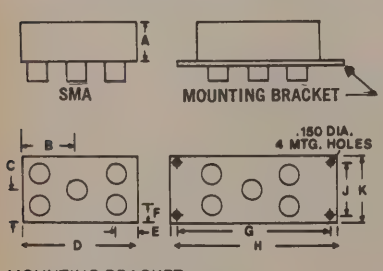
**DESCRIPTION** — The Series ZMSC-4 4-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, in phase, to the four output ports. Similarly, signals fed into ports 1, 2, 3 and 4 are vectorially summed at the S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance s within 0.2 dB.

Housed in a die cast aluminum case, these rugged units are double shielded to meet your tough EMI requirements. The case is finished with a blue baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A.

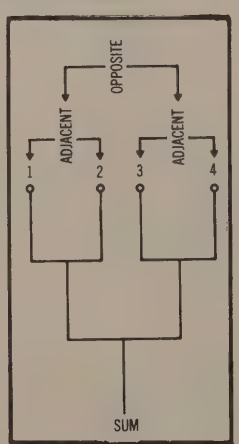
High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.



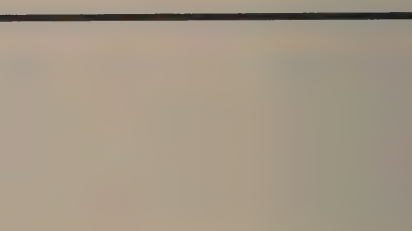

## DIMENSIONS AND CONNECTIONS




MOUNTING BRACKET AVAILABLE ON REQUEST. Add suffix B to part number and add $1.50 to unit cost. CONNECTORS SMA only.




| | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| IN. | .088 | .075 | .575 | 1.50 | .313 | .315 | 2.19 | 2.50 | .84 | 1.15 |
| MM | 2.2. | 19. | 14.6 | 38. | 7.95 | 8.0 | 55.6 | 63.5 | 21. | 29. |



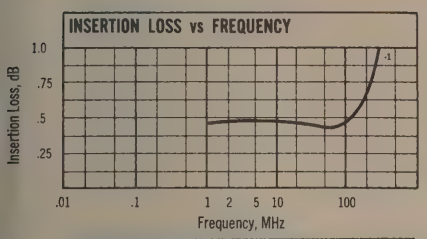

**WEIGHT** 44.0 grams 1.55 ounces

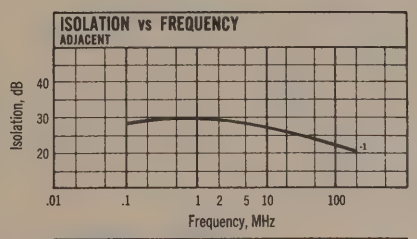
# ZMSC-4 Series
# 2 KHz to 250 MHz

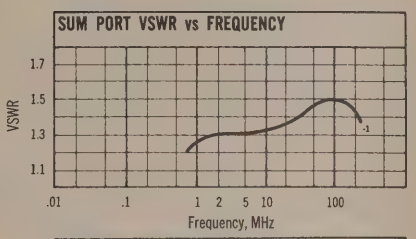
**Mini-Circuits**

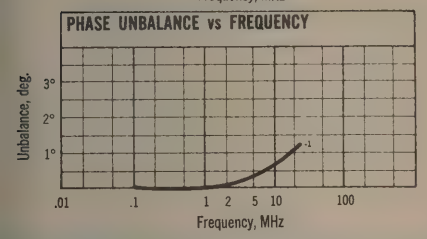
| MODEL | ZMSC-4-1 | | ZMSC-4-2 | | ZMSC-4-3 | |
|---|---|---|---|---|---|---|
| FREQ. RANGE | 0.1-200 | | 2 KHz-20 MHz | | 0.250-250 | |
| NOMINAL PHASE | 0° | | 0° | | 0° | |
| IMPEDANCE. ALL PORTS | 50 ohms | | 50 ohms | | 50 ohms | |
| ISOLATION. dB **OPPOSITE PORTS** | | Typ. Min. | | Typ. Min. | | Typ. Min. |
| | 0.1-10 MHz | 35 20 | 40 KHz-4 MHz | 45 35 | 0.25-10 MHz | 35 20 |
| | 10-100 MHz | 40 30 | 10 KHz-20 MHz | 40 30 | 10-50 MHz | 40 30 |
| | 100-200 MHz | 40 30 | 2 KHz-10 KHz | 30 20 | 50-250 MHz | 40 20 |
| ISOLATION. dB. **ADJACENT PORTS** | | Typ. Min. | | Typ. Min. | | Typ. Min. |
| | 0.1-10 MHz | 33 25 | 2 KHz-20 MHz | 33 25 | 0.25-10 MHz | 33 20 |
| | 10-100 MHz | 30 20 | | | 10-100 MHz | 30 20 |
| | 100-200 MHz | 27 20 | | | 100-250 MHz | 27 20 |
| INSERTION LOSS, dB (above 6 dB split) | | Typ. Max. | | Typ. Max. | | Typ. Max. |
| | 0.1-10 MHz | 0.4 0.6 | 5 KHz-1.0 MHz | 0.3 0.5 | 0.25-10 MHz | 0.4 0.7 |
| | 10-100 MHz | 0.5 0.75 | 2 KHz-5 KHz | 0.45 0.75 | 10-100 MHz | 0.5 0.75 |
| | 100-200 MHz | 0.7 1.0 | 1 MHz-20 MHz | 0.7 1.0 | 100-250 MHz | 0.7 1.2 |
| INSERTION LOSS. UNBALANCE. dB | | Typ. Max. | | Typ. Max. | | Typ. Max. |
| | 0.1-100 MHz | 0.05 0.15 | 2 KHz-10 MHz | 0.05 0.15 | 0.25-100 MHz | 0.05 0.15 |
| | 100-200 MHz | 0.1 0.25 | 10 MHz-20 MHz | 0.1 0.25 | 100-250 MHz | 0.1 0.25 |
| VSWR | 1.2 typ. | | 1.2 typ. | | 1.1 typ. | |
| MATCHED POWER RATING | 1 watt max. | | 1 watt max. | | 1 watt max. | |
| INTERNAL LOAD DISS. | 0.37 watt | | 0.37 watt | | 0.37 watt | |

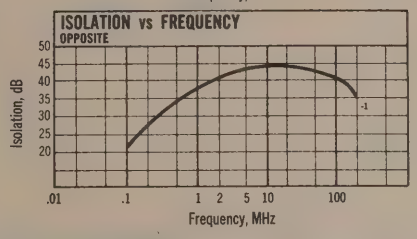
## MODELS ZMSC-4-1

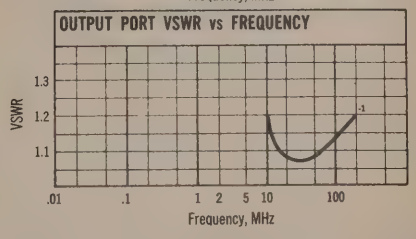


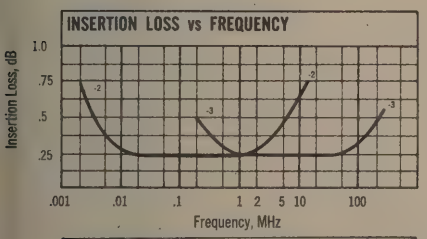



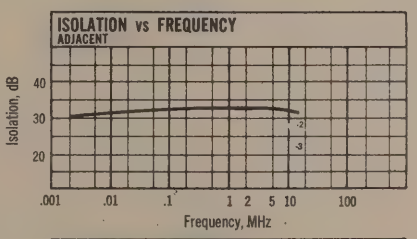



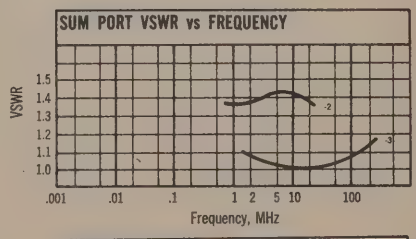



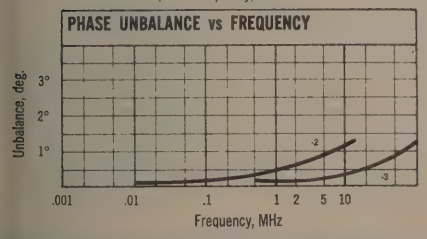



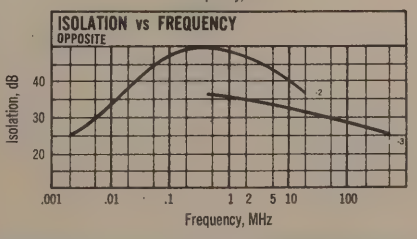

## MODELS ZMSC-4-2, ZMSC-4-3

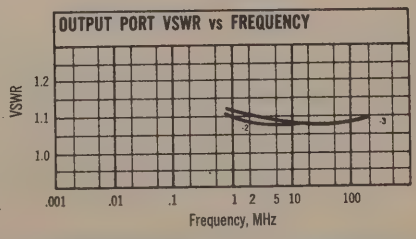


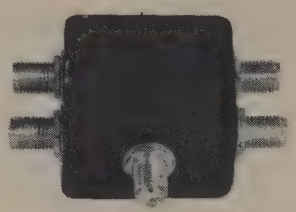



# 4-Way 0°
# POWER SPLITTER/COMBINERS

## ZFSC-4 SERIES



| MODEL | FREQUENCY | Z (Ohms) | Cost |
|---|---|---|---|
| ZFSC-4-1 | 1 MHz - 1000 MHz | 50 | $89.95 (1-4) |
| ZFSC-4-1W | 10 MHz - 500 MHz | 50 | $74.95 (1-4) |

## FEATURES

- **Broadband,** 1 MHz to 1000 MHz
- **Excellent Balance,** typically, phase balance within 3°, amplitude balance within 0.2 dB
- **Low Insertion Loss,** typically less than 0.8 dB
- **High Isolation,** typically better than 25 dB
- **Connectors,** available with SMA, and BNC
- **Mounting,** flange, or tapped holes
- **Miniature,** width 1.25", height 0.75", depth 1.25"
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $74.95 in small quantity

## APPLICATIONS

- **Split an input signal into four equal in-phase outputs**
- **Combine signals from four different sources**
- **Add signals vectorially**
- **Provide RF logic capability**

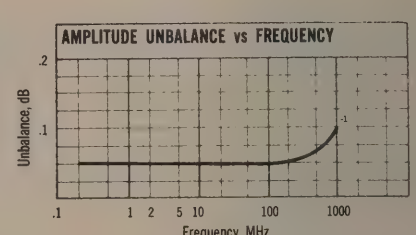
## ABSOLUTE MAXIMUM RATINGS

- **Operating and Storage Temp.** −55° C to +100° C
- **Environmental Specifications:** See Index Page

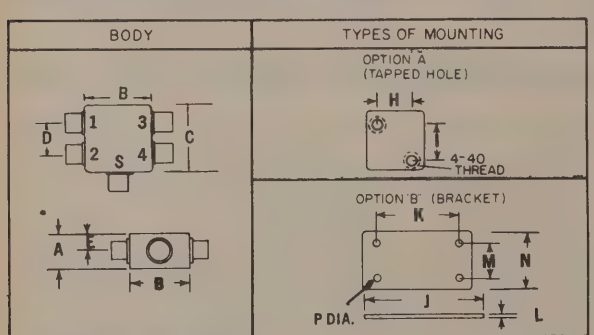
**DESCRIPTION** — The Series ZFSC-4 4-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, in phase, to the four output ports. Similarly, signals fed into ports 1, 2, 3 and 4 are vectorially summed at the S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within 0.2 dB.

The ZFSC-4 Series is housed in an extremely rugged 1¼ in. square metal case with one SMA connector on each side. Two convenient mounting options are included, (4-40 threaded inserts, and flange mounting).

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.



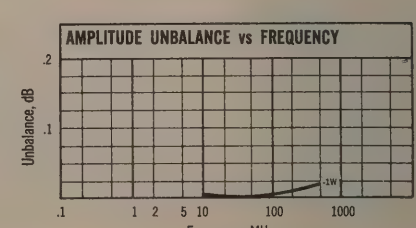

## DIMENSIONS AND CONNECTIONS




CONNECTORS SMA and BNC.

| | A | B | C | D | E | N |
|---|---|---|---|---|---|---|
| IN | .75 | 1.25 | 1.25 | .625 | .375 | 0.8 |
| MM | 19.1 | 31.8 | 31.8 | 15.9 | 9.5 | 20.3 |

| | I | J | K | L | M | N | P |
|---|---|---|---|---|---|---|---|
| IN | 0.8 | 2.188 | 1.688 | .060 | .75 | 1.25 | .125 |
| MM | 20.3 | 55.6 | 42.9 | 1.5 | 19.1 | 31.8 | 3.18 |

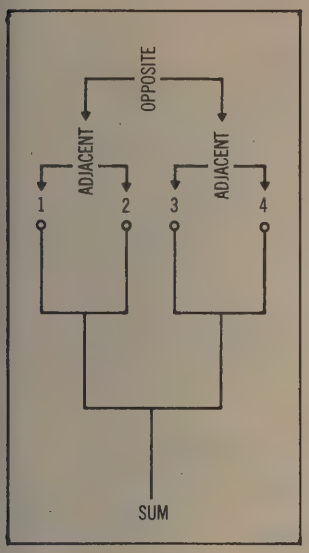



**WEIGHT** 64.0 grams 2.26 ounces

**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

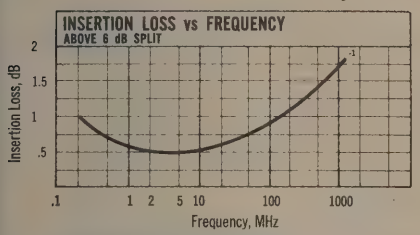
# ZFSC-4 Series
# 1 MHz to 1000 MHz

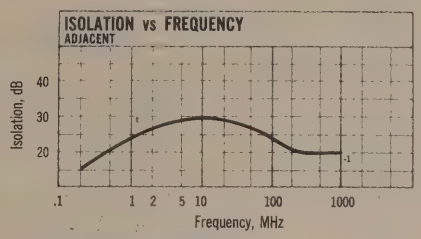
Mini-Circuits

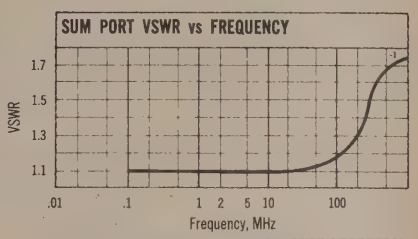


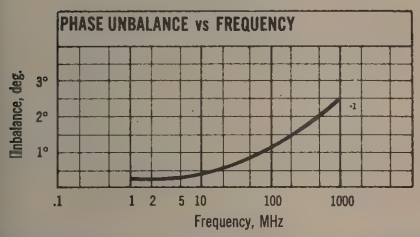

| MODEL | ZFSC-4-1 | | | ZFSC-4-1W | | |
|---|---|---|---|---|---|---|
| FREQ. RANGE (MHz) | 1-1000 | | | 10-500 | | |
| NOMINAL PHASE | 0° | | | 0° | | |
| IMPEDANCE, ALL PORTS | 50 ohms | | | 50 ohms | | |
| ISOLATION, dB OPPOSITE PORTS | | Typ. | Min. | | Typ. | Min. |
| | 1-10 MHz | 40 | 30 | 10-500 MHz | 23 | 20 |
| | 10-500 MHz | 30 | 20 | | | |
| | 500-1000 MHz | 26 | 15 | | | |
| ISOLATION, dB ADJACENT PORTS | | Typ. | Min. | | Typ. | Min. |
| | 1-10 MHz | 25 | 20 | 10-500 MHz | 23 | 20 |
| | 10-500 MHz | 23 | 18 | | | |
| | 500-1000 MHz | 20 | 15 | | | |
| INSERTION LOSS, dB (ABOVE 6 dB SPLIT) | | Typ. | Max. | | Typ. | Max. |
| | 1-10 MHz | 0.4 | 0.8 | 10-500 MHz | 0.6 | 1.5 |
| | 10-500 MHz | 0.6 | 1.5 | | | |
| | 500-1000 MHz | 1.6 | 2.5 | | | |
| AMPLITUDE UNBALANCE, dB | | Typ. | Max. | | Typ. | Max. |
| | 1-500 MHz | 0.05 | 0.2 | 10-500 MHz | 0.05 | 0.2 |
| | 500-1000 MHz | 0.4 | 0.7 | | | |
| VSWR | 1.2 typ. | | | 1.2 typ. | | |
| MATCHED POWER RATING | 1 watt max. | | | 1 watt max. | | |
| INTERNAL LOAD DISS. | 0.37 watt | | | 0.37 watt | | |

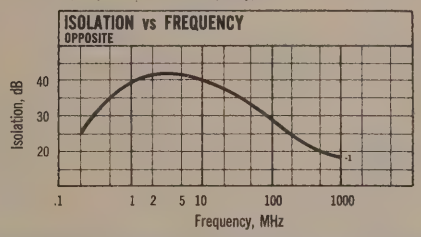
## MODEL ZFSC-4-1

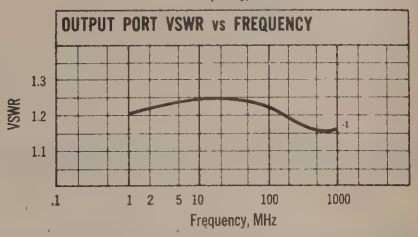


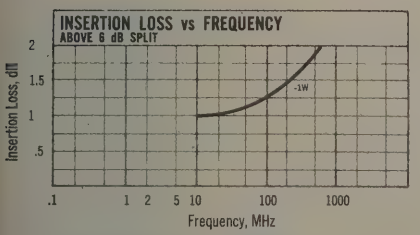



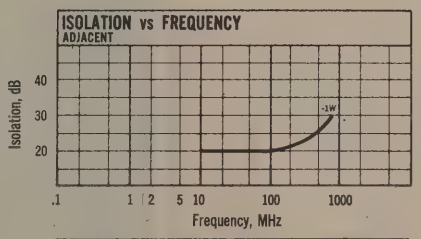



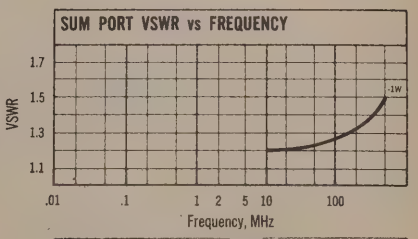



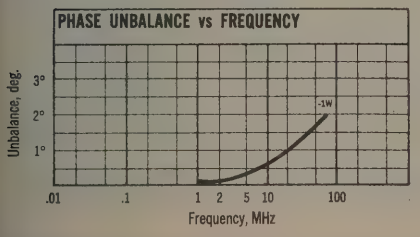



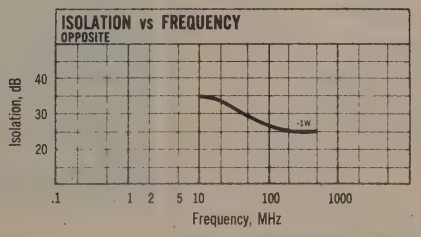

## MODEL ZFSC-4-1W

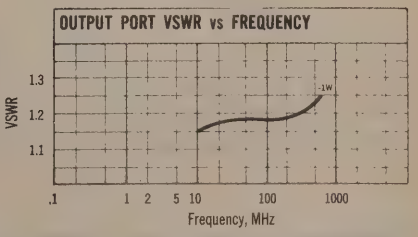


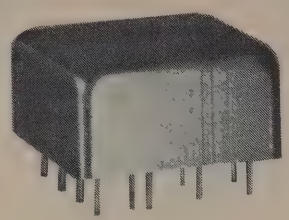




PROMPT SERVICE / ONE WEEK DELIVERY Mini-Circuits

# 6-Way 0°
# POWER SPLITTER/COMBINERS

## PSC-6 SERIES



| MODEL | FREQUENCY | Z (Ohms) | Cost |
|---|---|---|---|
| PSC-6-1 | 1 MHz - 175 MHz | 50 | $59.95 (1-5) |

## FEATURES

- **Broadband,** 1 MHz to 175 MHz
- **Excellent Balance,** typically, phase balance less than 4°, amplitude unbalance within 0.4 dB
- **Low Insertion Loss,** typically less than 0.75 dB
- **High Isolation,** typically better than 20 dB
- **Hermetically Sealed & RFI Shielded**
- **Miniature,** 0.256 in.$^3$, 0.8" x 0.8" PC area, 0.4" high
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $59.95 in small quantity

## APPLICATIONS

- **Split an input signal into six equal in-phase outputs**
- **Combine signals from six different sources**
- **Add signals vectorially**
- **Provide RF logic capability**

## ABSOLUTE MAXIMUM RATINGS

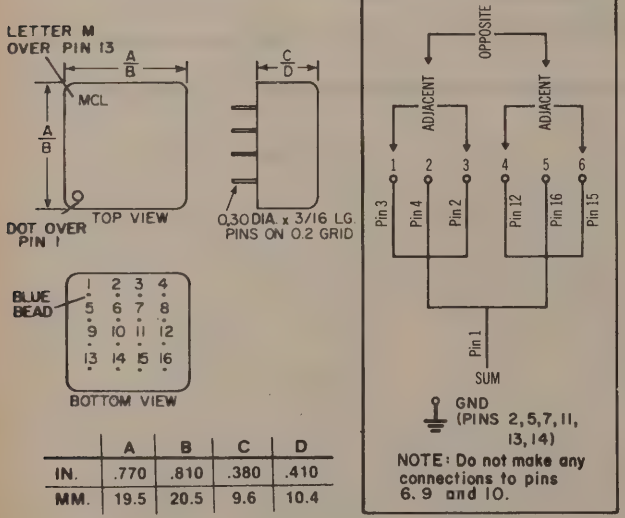
- **Operating and Storage Temp.** −55°C to +100°C
- **Pin Temperature:** (10 sec.) 510°F
- **Environmental Specifications:** See Index Page

**DESCRIPTION** — The PSC-6 Series 6-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, in phase, to the six output ports. Similarly, signals fed into ports 1, 2 thru 6 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within 0.4 dB.

The PSC-6 Series is ruggedly constructed to provide reliable service under severe environmental conditions. This hermetically sealed unit performs well under high relative humidity conditions and over temperature extremes from −55°C to +100°C.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

## DIMENSIONS AND CONNECTIONS




| | A | B | C | D |
|---|---|---|---|---|
| IN. | .770 | .810 | .380 | .410 |
| MM. | 19.5 | 20.5 | 9.6 | 10.4 |

**WEIGHT** 11.0 grams 0.39 ounces

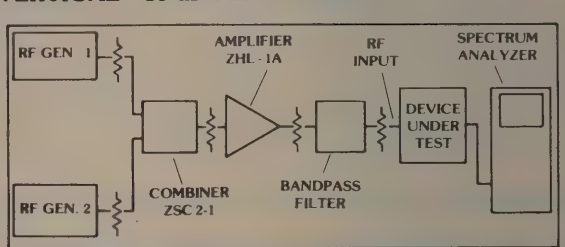
## TWO-TONE INTERMODULATION MEASUREMENT

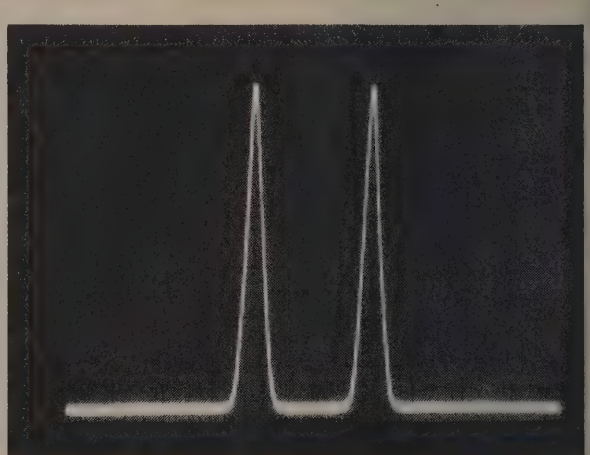
### RF INPUT CONDITIONS

TONE 1 - 10 MHz at +7 dBm INPUT
TONE 2 - 9 MHz at +7dBm INPUT

### SPECTRUM DISPLAY

RESOLUTION - 500 kHz PER DIVISION
VERTICAL - 10 dB PER DIVISION



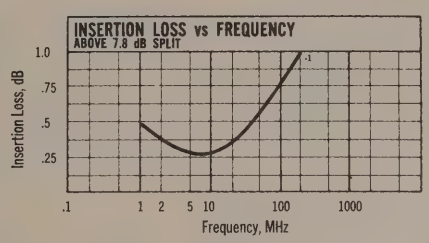



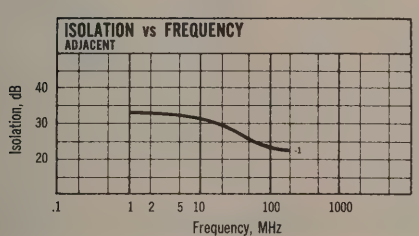
# PSC-6 Series
# 1 MHz to 175 MHz

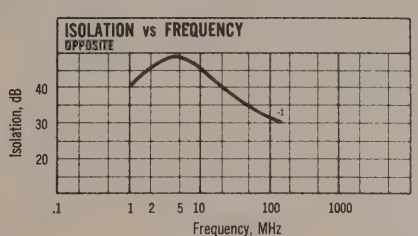
Mini-Circuits

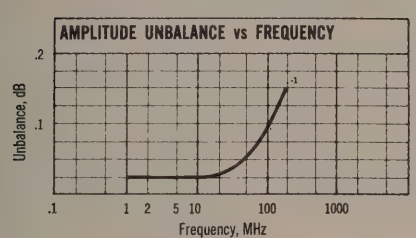
| MODEL | PSC-6-1 | | |
|---|---|---|---|
| FREQ. RANGE (MHz) | 1-175 | | |
| NOMINAL PHASE | 0° | | |
| IMPEDANCE, ALL PORTS | 50 ohms | | |
| ISOLATION BETWEEN ADJACENT PORTS, dB | | Typ. | Min. |
| | 1-50 MHz | 30 | 24 |
| | 50-175 MHz | 26 | 18 |
| INSERTION LOSS, dB (ABOVE 7.8 dB SPLIT) | | Typ. | Max. |
| | 1-50 MHz | 0.5 | 0.8 |
| | 50-150 MHz | 0.75 | 1.2 |
| | 150-175 MHz | 1.0 | 1.5 |
| PHASE UNBALANCE, DEGREES | | Typ. | Max. |
| | 1-50 MHz | 1° | 4° |
| | 50-175 | 4° | 12° |
| AMPLITUDE UNBALANCE, dB | | Typ. | Max. |
| | 1-50 MHz | 0.1 | 0.2 |
| | 50-150 MHz | 0.1 | 0.4 |
| | 150-175 | 0.4 | 0.8 |
| VSWR | 1.2 typ. | | |
| MATCHED POWER RATING | 1 watt max. | | |
| INTERNAL LOAD DISS. | 0.87 watt | | |

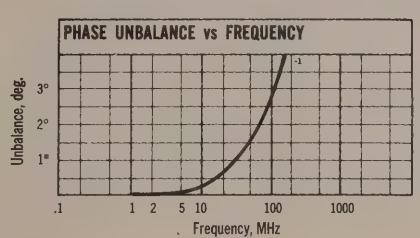
## MODEL PSC-6-1

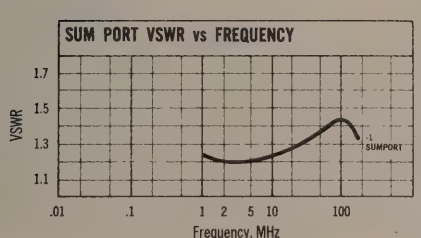


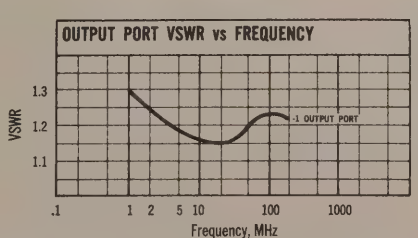



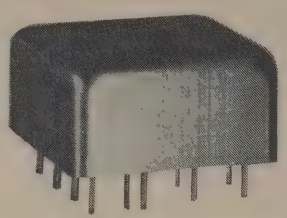



# 8-Way 0°
# POWER SPLITTER/COMBINERS

## PSC-8 SERIES



| MODEL | FREQUENCY | Z (Ohms) | Cost |
|---|---|---|---|
| PSC-8-1 | 500 KHz - 175 MHz | 50 | $59.95 (1-5) |
| PSC-8-1-75 | 500 KHz - 175 MHz | 75 | $60.95 (1-5) |

## FEATURES

- **Broadband,** 500 KHz to 175 MHz
- **Excellent Balance,** typically, phase balance less than 3°, amplitude unbalance within 0.2 dB
- **Low Insertion Loss,** typically less than 1.0 dB
- **High Isolation,** typically better than 20 dB
- **Hermetically Sealed & RFI Shielded**
- **Miniature,** 0.256 in.$^3$, 0.8" x 0.8" PC area,0.4" high
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $59.95 in small quantity

## APPLICATIONS

- **Split an input signal into eight equal in-phase outputs**
- **Combine signals from eight different sources**
- **Add signals vectorially**
- **Provide RF logic capability**

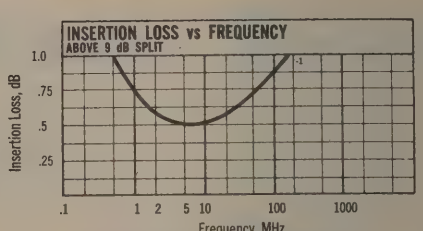
## ABSOLUTE MAXIMUM RATINGS

- **Operating and Storage Temp.** −55°C to +100°C
- **Pin Temperature:** (10 sec.) 510°F
- **Environmental Specifications:** See Index Page

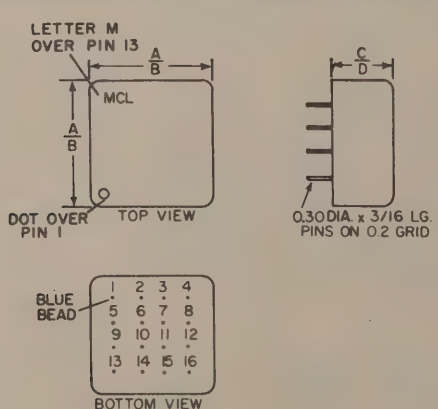
**DESCRIPTION** — The PSC-8 Series 8-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, in phase, to the eight output ports. Similarly, signals fed into ports 1 through 8 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within 0.2 dB.

The PSC-8 Series is ruggedly constructed to provide reliable service under severe environmental conditions. This hermetically sealed unit performs well under high relative humidity conditions and over temperature extremes from −55°C to +100°C.

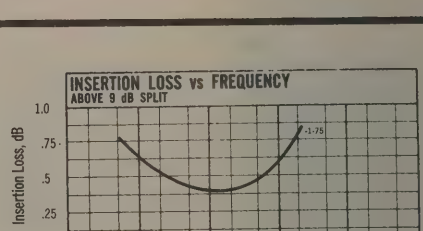
High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.




## DIMENSIONS AND CONNECTIONS



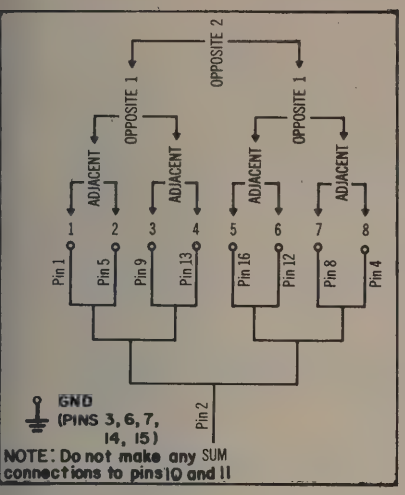

| | A | B | C | D |
|---|---|---|---|---|
| IN. | .770 | .810 | .380 | .410 |
| MM. | 19.5 | 20.5 | 9.6 | 10.4 |




**WEIGHT** 11.0 grams 0.39 ounces

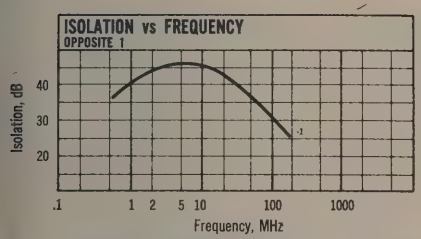
# PSC-8 Series
# 0.5 MHz to 175 MHz

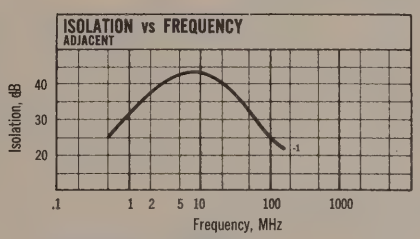
**Mini-Circuits**

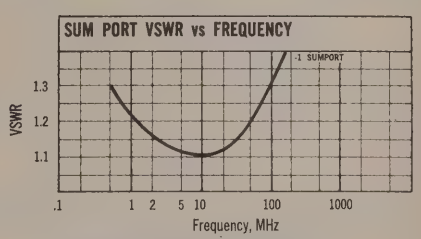


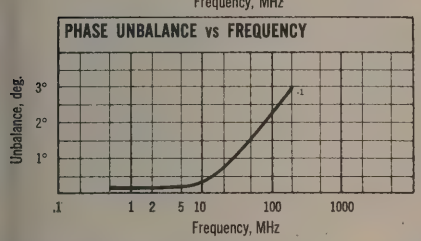

| MODEL | PSC-8-1 | | | PSC-8-1-75 | | |
|---|---|---|---|---|---|---|
| FREQ. RANGE (MHz) | 0.5-175 | | | 0.5-175 | | |
| NOMINAL PHASE | 0° | | | 0° | | |
| IMPEDANCE, ALL PORTS | 50 ohms | | | 75 ohms | | |
| ISOLATION BETWEEN ADJACENT PORTS, dB | | Typ. | Min. | | Typ. | Min. |
| | 0.5-100 MHz | 30 | 20 | 0.5-175 MHz | 25 | 20 |
| | 100-175 MHz | 23 | 18 | | | |
| INSERTION LOSS dB (ABOVE 9 dB SPLIT) | | Typ. | Max. | | Typ. | Max. |
| | 0.5-100 MHz | 0.8 | 1.2 | 0.5-100 MHz | 0.5 | 1.0 |
| | 100-175 MHz | 1.0 | 1.6 | 100-175 MHz | 0.8 | 1.3 |
| PHASE UNBALANCE DEGREES | | Typ. | Max. | | Typ. | Max. |
| | 0.5-50 MHz | 1.0 | 3.0 | 0.5-50 MHz | 1.0 | 2.5 |
| | 50-175 MHz | 3.0 | 6.0 | 50-175 MHz | 1.5 | 5.0 |
| AMPLITUDE UNBALANCE, dB | | Typ. | Max. | | Typ. | Max. |
| | 0.5-100 MHz | 0.05 | 0.2 | 0.5-50 MHz | 0.05 | 0.2 |
| | 100-175 MHz | 0.1 | 0.5 | 50-175 MHz | 0.1 | 0.3 |
| VSWR | 1.25 typ | | | 1.25 typ. | | |
| MATCHED POWER RATING | 1 watt max. | | | 1 watt max. | | |
| INTERNAL LOAD DISS. | 0.62 watt max. | | | 0.62 watt max. | | |

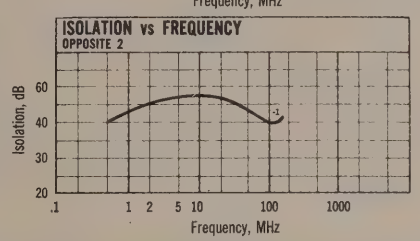
## MODEL PSC-8-1

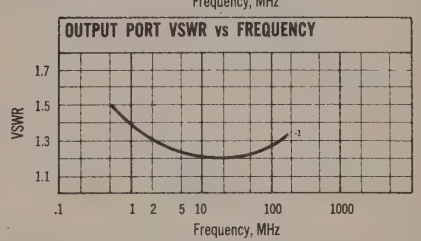


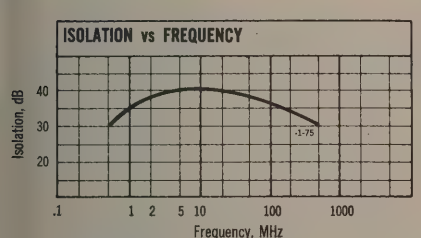



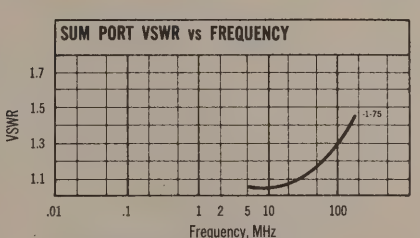



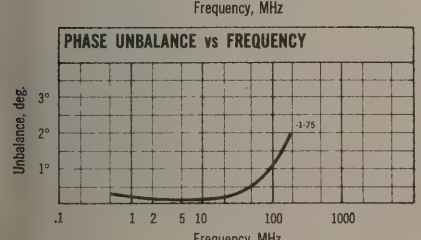



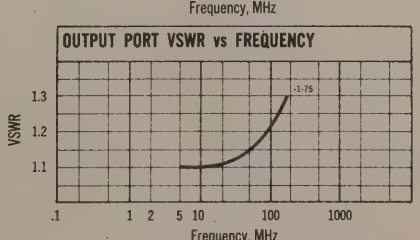




## MODEL PSC-8-1-75



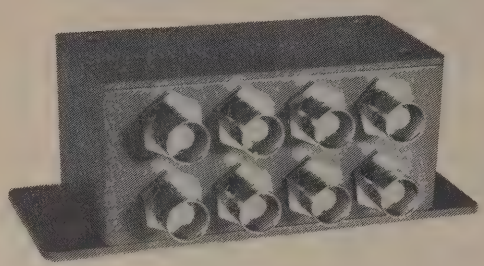




PROMPT SERVICE / ONE WEEK DELIVERY

Mini-Circuits

# 8-Way 0°
# POWER SPLITTER/COMBINERS

## ZFSC-8 SERIES



| MODEL | FREQUENCY | Z (Ohms) | Cost |
|---|---|---|---|
| ZFSC-8-1 | 500 KHz - 175 MHz | 50 | $89.95 (1-4) |
| ZFSC-8-1-75 | 500 KHz - 175 MHz | 75 | $90.95 (1-4) |

## FEATURES

- **Broadband,** 500 KHz to 175 MHz
- **Excellent Balance,** typically, phase balance within 3°, amplitude balance within 0.2 dB
- **Low Insertion Loss,** typically less than 1.0 dB
- **High Isolation,** typically better than 20 dB
- **Connectors,** available with BNC, TNC, or SMA
- **Mounting,** flanges with 4 thru holes
- **Compact,** 4.08" wide, 1.57" high, 1.64" deep
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $89.95 in small quantity

## APPLICATIONS

- **Split an input signal into eight equal in-phase outputs**
- **Combine signals from eight different sources**
- **Add signals vectorially**
- **Provide RF logic capability**

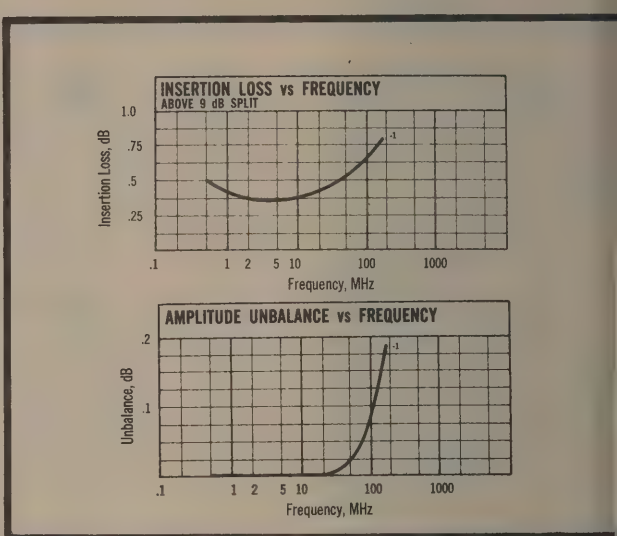
## ABSOLUTE MAXIMUM RATINGS

- **Operating and Storage Temp.** −55° C to +100° C
- **Environmental Specifications:** See Index Page

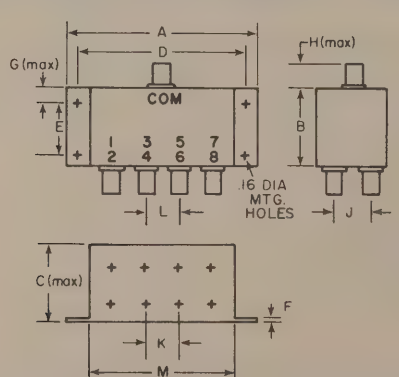
**DESCRIPTION —** The ZFSC-8 Series 8-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, in phase, to the eight output ports. Similarly, signals fed into ports 1 through 8 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within 0.2 dB.

The ZFSC-8 Series is housed in an extremely rugged metal case to withstand severe mechanical stress. BNC, TNC and SMA connectors are available. Mounting is simple and convenient with the flange design. Each unit is supplied in a grey epoxy paint finish.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

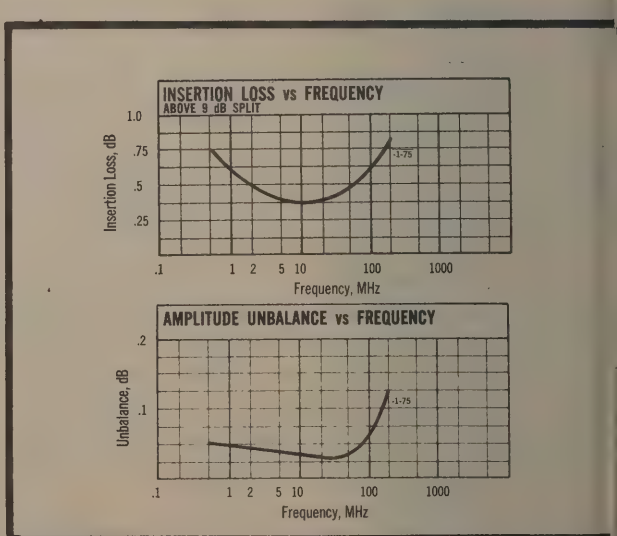



## DIMENSIONS AND CONNECTIONS




BNC (std), TNC (on request), SMA (3mm) on request, add $15 to unit cost.

| | A | B | C | D | E | F | G | H | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IN. | 4.08 | 1.64 | 1.57 | 3.56 | .88 | .06 | .45 | .56 | .69 | .66 | .56 | 3.25 |
| CM. | 10.36 | 4.17 | 3.99 | 9.04 | 2.24 | .15 | 1.14 | 1.42 | 1.74 | 1.67 | 1.42 | 7.93 |

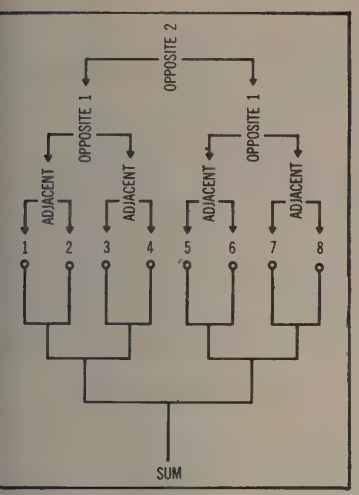



**WEIGHT** 280 grams 9.89 ounces

**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 6201

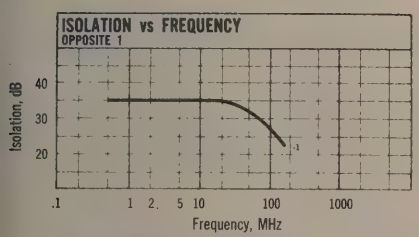
# ZFSC-8 Series
# 0.5 MHz to 175 MHz

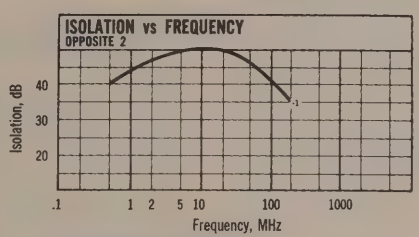
**Mini-Circuits**

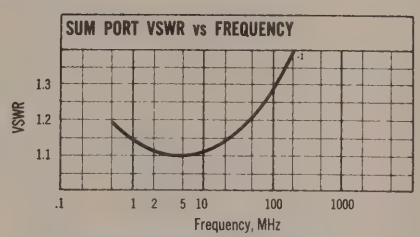


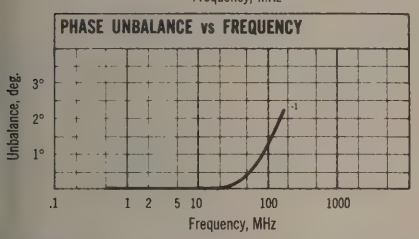

| MODEL | ZFSC-8-1 | | | ZFSC-8-1-75 | | |
|---|---|---|---|---|---|---|
| FREQ. RANGE (MHz) | 0.5-175 | | | 0.5-175 | | |
| NOMINAL PHASE | 0° | | | 0° | | |
| IMPEDANCE, ALL PORTS | 50 ohms | | | 75 ohms | | |
| ISOLATION (dB) BETWEEN ADJACENT PORTS | | Typ. | Min. | | Typ. | Min. |
| | 0.5-100 MHz | 25 | 20 | 0.5-175 MHz | 25 | 20 |
| | 100-175 MHz | 22 | 18 | | | |
| INSERTION LOSS, dB (ABOVE 9 dB SPLIT) | | Typ. | Max. | | Typ. | Max. |
| | 0.5-100 MHz | 0.6 | 1.0 | 0.5-100 MHz | 0.5 | 1.0 |
| | 100-175 MHz | 0.8 | 1.2 | 100-175 MHz | 0.8 | 1.3 |
| PHASE UNBALANCE DEGREES | | Typ. | Max. | | Typ. | Max. |
| | 0.5-50 MHz | 1.0 | 2.5 | 0.5-50 MHz | 1.0 | 2.5 |
| | 50-175 MHz | 2.0 | 5.0 | 50-175 MHz | 1.5 | 5.0 |
| AMPLITUDE UNBALANCE, dB | | Typ. | Max. | | Typ. | Max. |
| | 0.5-100 MHz | 0.05 | 0.2 | 0.5-50 MHz | 0.05 | 0.2 |
| | 100-175 MHz | 0.1 | 0.3 | 50-175 MHz | 0.1 | 0.3 |
| VSWR | 1.25 typ | | | 1.25 typ. | | |
| MATCHED POWER RATING | 1 watt max. | | | 1 watt max. | | |
| INTERNAL LOAD DISS. | 0.62 watt max. | | | 0.62 watt max. | | |

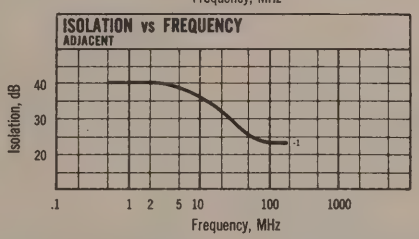
## MODEL ZFSC-8-1

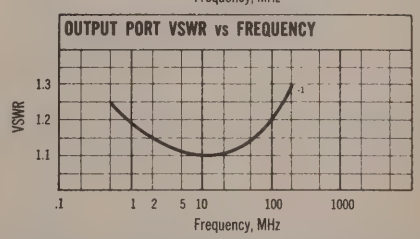


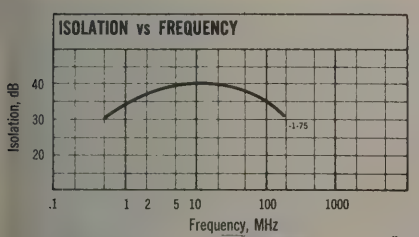



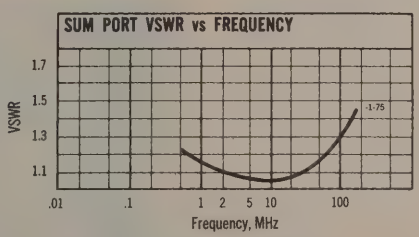



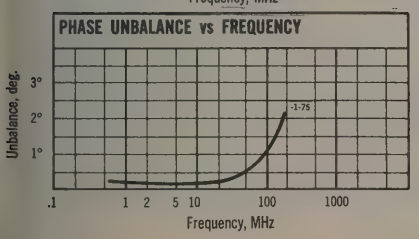



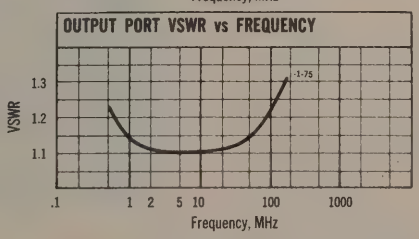




## MODEL ZFSC-8-1-75



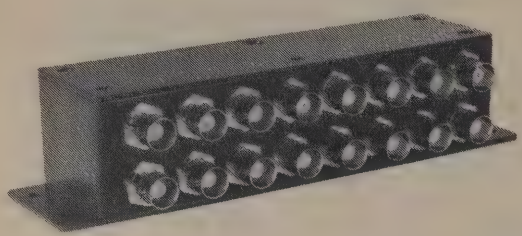




*PROMPT SERVICE / ONE WEEK DELIVERY* **Mini-Circuits**

# 16-Way 0°
# POWER SPLITTER/COMBINERS

## ZFSC-16 SERIES



| MODEL | FREQUENCY | Z (Ohms) | Cost |
|---|---|---|---|
| ZFSC-16-1 | 500 KHz - 125 MHz | 50 | $174.95 (1-4) |

## FEATURES

- **Broadband,** 500 KHz to 125 MHz
- **Excellent Balance,** typically, phase balance within 3°, amplitude balance within 0.1 dB
- **Low Insertion Loss,** typically less than 1.0 dB
- **High Isolation,** typically better than 18 dB
- **Connectors,** available with BNC, TNC, or SMA
- **Mounting,** flanges with 4 thru holes
- **Compact,** 6.7" wide, 1.5" high, 1.6" deep
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $174.95 in small quantity

## APPLICATIONS

- **Split an input signal into sixteen equal in-phase outputs**
- **Combine signals from sixteen different sources**
- **Add signals vectorially**
- **Provide RF logic capability**

## ABSOLUTE MAXIMUM RATINGS

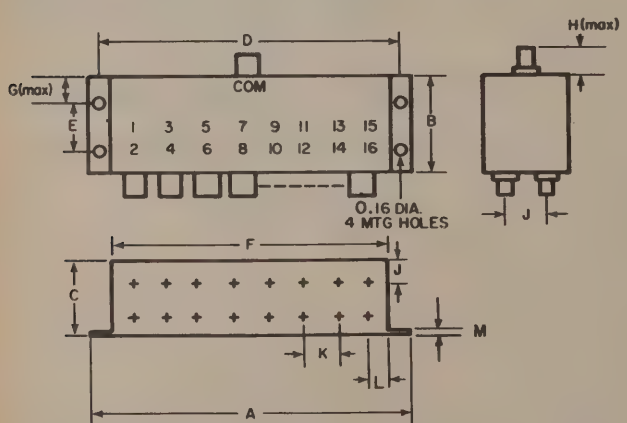
- **Operating and Storage Temp.** −55°C to +100°C
- **Environmental Specifications:** See Index Page

**DESCRIPTION —** The ZFSC-16 Series 16-way power splitter/combiner is a high performance broad-band hybrid junction. Signals fed into the input S port are equally divided in phase, to the sixteen output ports. Similarly, signals fed into ports 1 through 16 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within 0.1 dB.

The ZFSC-16 Series is housed in an extremely rugged metal case to withstand severe mechanical stress. BNC, TNC and SMA connectors are available. Mounting is simple and convenient with the flange design. Each unit is supplied in a grey epoxy paint finish.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

## DIMENSIONS AND CONNECTIONS




BNC (std), TNC (on request), SMA (3mm) on request, add $25 to unit cost.

| | A | B | C | D | E | F | G | H | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IN. | 6.688 | 1.609 | 1.5 | 6.22 | 0.88 | 5.75 | .45 | .56 | .69 | .66 | .56 | .06 |
| CM. | 16.99 | 4.09 | 3.81 | 15.8 | 2.24 | 14.61 | 1.14 | 1.42 | 1.74 | 1.67 | 1.42 | .15 |

**WEIGHT** 475 grams 16.76 ounces

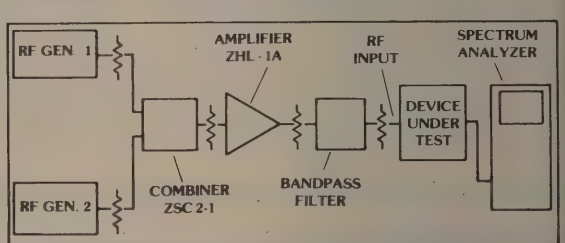
## TWO-TONE INTERMODULATION MEASUREMENT

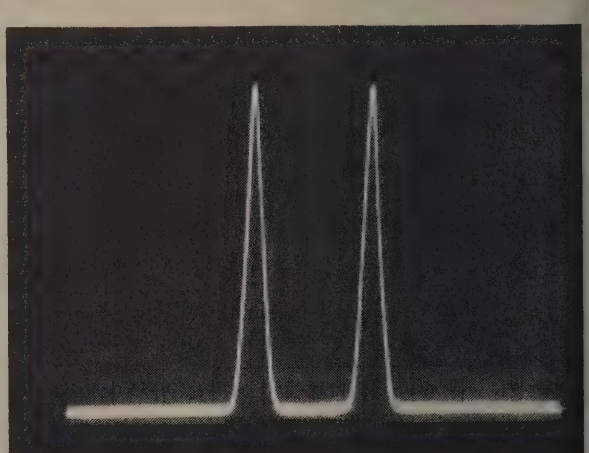
### RF INPUT CONDITIONS

TONE 1 - 10 MHz at +7 dBm INPUT
TONE 2 - 9 MHz at +7dBm INPUT

### SPECTRUM DISPLAY

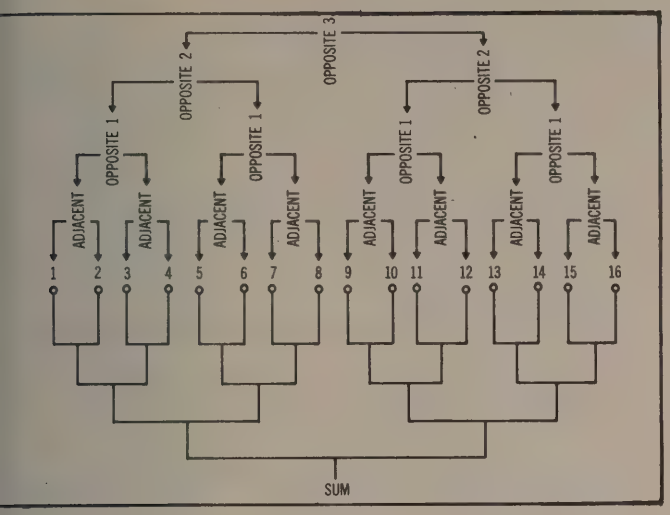
RESOLUTION - 500 kHz PER DIVISION
VERTICAL - 10 dB PER DIVISION



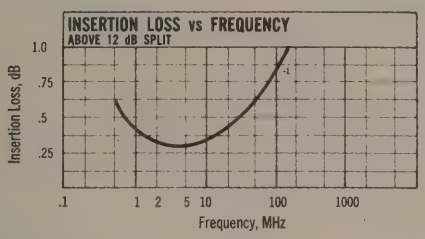
# ZFSC-16 Series
# 0.5 MHz to 125 MHz

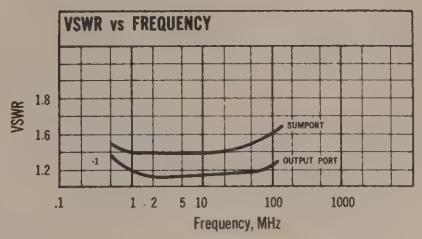
Mini-Circuits

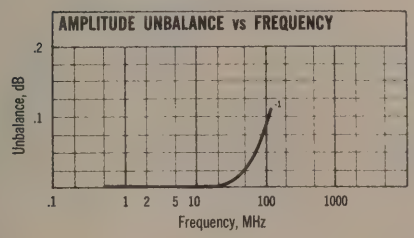


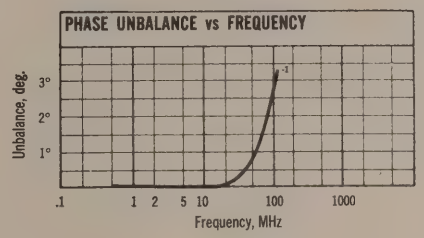

| MODEL | ZFSC-16-1 | | |
|---|---|---|---|
| FREQ. RANGE (MHz) | 0.5-125 | | |
| NOMINAL PHASE | 0° | | |
| IMPEDANCE, ALL PORTS | 50 ohms | | |
| ISOLATION (dB) BETWEEN ADJACENT PORTS | | Typ. | Min. |
| | 0.5-25 MHz | 30 | 24 |
| | 25-75 MHz | 25 | 18 |
| | 100-125 MHz | 20 | 15 |
| INSERTION LOSS, dB (FULL RANGE) | | Typ. | Max. |
| | Above 12 dB | 1.0 | 1.6 |
| PHASE UNBALANCE, DEGREES | | Typ. | Max. |
| | 0.5-50 MHz | 1.0 | 3.0 |
| | 50-125 MHz | 3.0 | 6.0 |
| AMPLITUDE UNBALANCE, dB | | Typ. | Max. |
| | 0.5-50 MHz | 0.05 | 0.2 |
| | 50-125 MHz | 0.1 | 0.5 |
| VSWR Sum Port | 1.5 typ. | | |
| VSWR Output Port | 1.20 Typ. | | |
| MATCHED POWER RATING | 1 watt max. | | |
| INTERNAL LOAD DISS. | 0.87 watt max. | | |

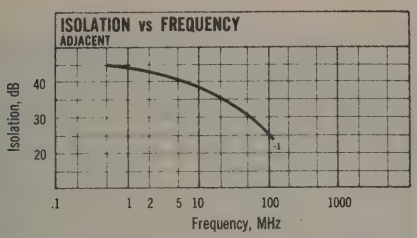
## MODEL ZFSC-16-1

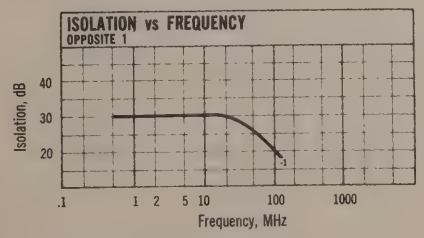


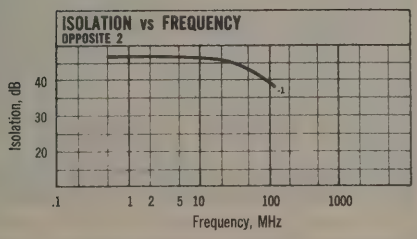



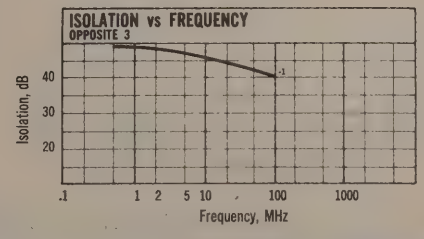



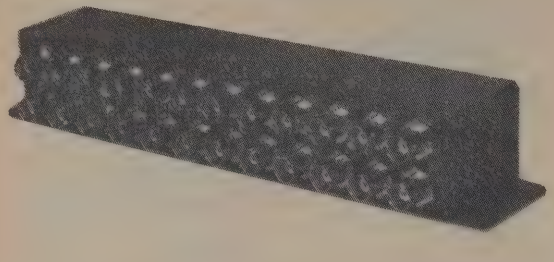



# 24-Way 0° POWER SPLITTER/COMBINERS

## ZFSC-24 SERIES



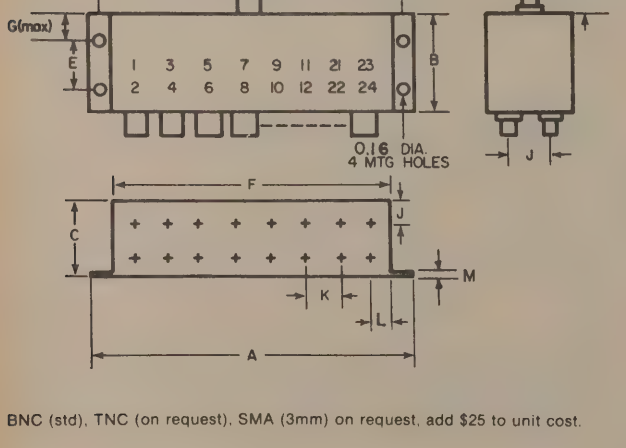
| MODEL | FREQUENCY | Z (Ohms) | Cost |
|---|---|---|---|
| ZFSC-24-1 | 200 KHz - 100 MHz | 50 | $264.95 (1-4) |

**DESCRIPTION —** The ZFSC-24 Series 24-way power splitter/combiner is a high performance broad band hybrid junction. Signals fed into the input S port are equally divided, in phase, to the 24 output ports. Similarly, signals fed into ports 1 through 24 are vectorially summed at the output S port. Typically, over most of the frequency range, the phase balance is within 1 degree and the amplitude balance is within 0.5 dB.

The ZFSC-24 Series, with BNC, TNC or SMA connectors, is housed in an extremely rugged metal case to withstand severe mechanical stress. Mounting is simple and convenient with the flange design. Each unit is supplied in a gray epoxy paint finish.

High reliability is associated with every MCL unit. Every unit is 100% tested and carries a one year guarantee.

## DIMENSIONS AND CONNECTIONS




BNC (std), TNC (on request), SMA (3mm) on request, add $25 to unit cost.

| | A | B | C | D | E | F | G | H | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IN. | 9.32 | 1.61 | 1.5 | 9.22 | 0.88 | 8.38 | .45 | .56 | .69 | .66 | .56 | .06 |
| CM. | 23.7 | 4.09 | 3.81 | 23.4 | 2.24 | 21.29 | 1.14 | 1.42 | 1.75 | 1.68 | 1.42 | .15 |

**WEIGHT** 545 grams 19.22 ounces

## FEATURES

- **Broadband,** 200 KHz to 100 MHz
- **Excellent Balance,** typically, phase balance within 5°, amplitude balance within 0.5 dB
- **Low Insertion Loss,** typically less than 1.0 dB
- **High Isolation,** typically better than 20 dB
- **Connectors,** available with BNC, TNC, or SMA
- **Mounting,** flanges with 4 thru holes
- **Compact,** 9.3" wide, 1.5" wide, 1.6" deep
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $264.95 in small quantity

## APPLICATIONS

- **Split an input signal into twenty-four equal in-phase outputs**
- **Combine signals from twenty-four different sources**
- **Add signals vectorially**
- **Provide RF logic capability**

## ABSOLUTE MAXIMUM RATINGS

- **Operating and Storage Temp.** −55°C to +100°C
- **Environmental Specifications:** See Index Page

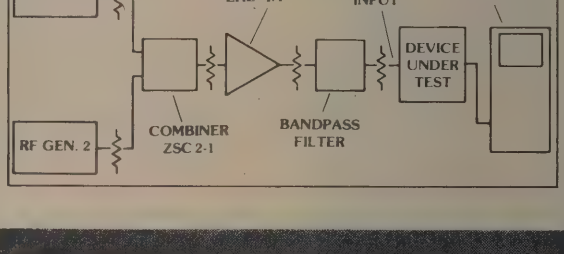
## TWO-TONE INTERMODULATION MEASUREMENT

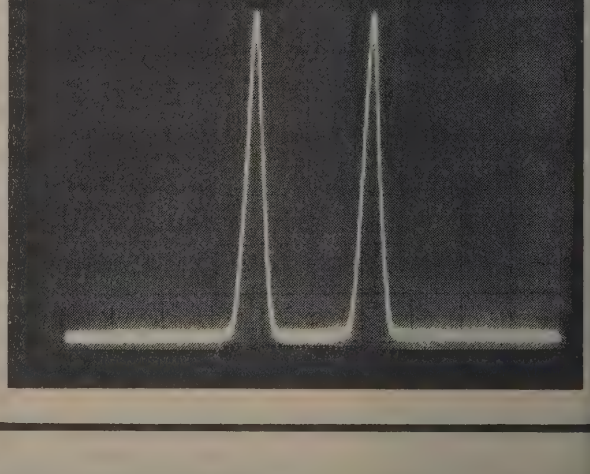
### RF INPUT CONDITIONS

TONE 1 - 10 MHz at +7 dBm INPUT
TONE 2 - 9 MHz at +7dBm INPUT

### SPECTRUM DISPLAY

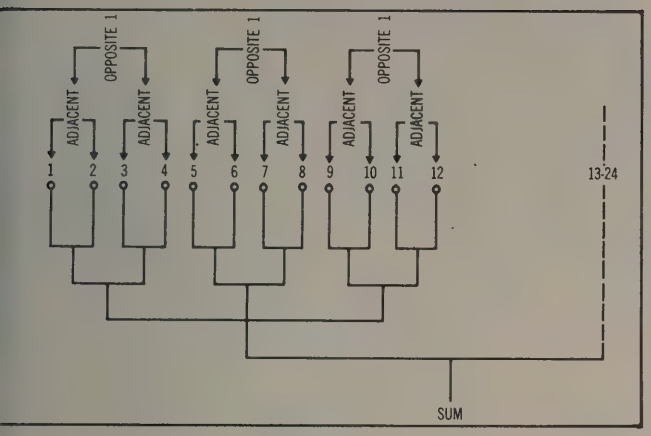
RESOLUTION - 500 kHz PER DIVISION
VERTICAL - 10 dB PER DIVISION



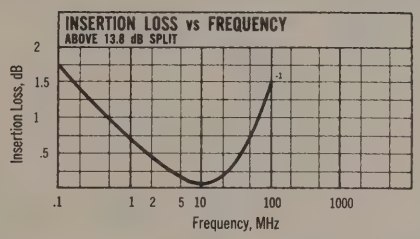
# ZFSC-24 Series
# 0.2 MHz to 100 MHz

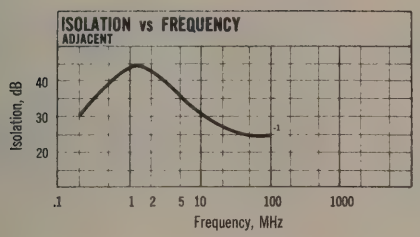
Mini-Circuits

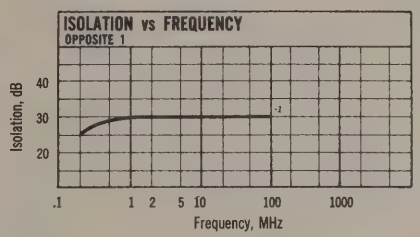


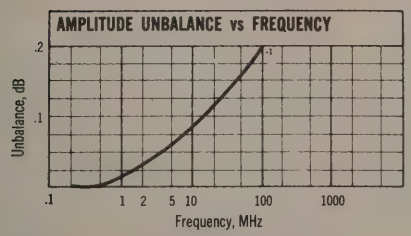

| MODEL | ZFSC-24-1 | | |
|---|---|---|---|
| FREQ. RANGE (MHz) | 0.2-100 | | |
| NOMINAL PHASE | 0° | | |
| IMPEDANCE, ALL PORTS | 50 ohms | | |
| ISOLATION (dB) BETWEEN ADJACENT PORTS | | Typ. 25 | Min. 20 |
| INSERTION LOSS, dB (FULL RANGE) | Above 13.8 dB | Typ. 1 | Max. 2 |
| PHASE UNBALANCE, DEGREES | | Typ. 2.0 | Max. 5.0 |
| AMPLITUDE UNBALANCE, dB | | Typ. 0.2 | Max. 0.5 |
| VSWR | Sum Port<br>Output Port | 1.5 Typ.<br>1.2 Typ. | |
| MATCHED POWER RATING | 1 watt max. | | |
| INTERNAL LOAD DISS. | 1 watt max. | | |

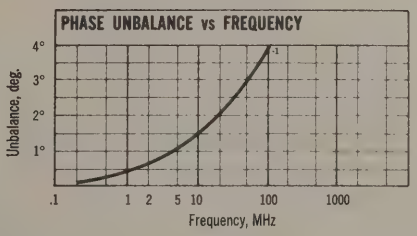
## MODEL ZFSC-24-1

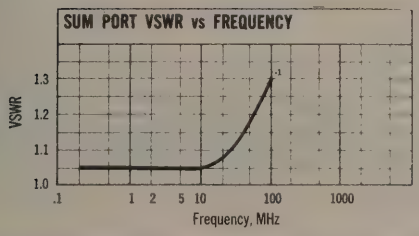


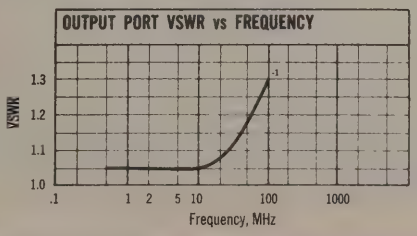



# Surprise!

# 2 KHz-1500 MHz Power Splitter/Combiners

## OFF-THE-SHELF FOR IMMEDIATE DELIVERY...

FROM **$31.95** (4-24)

**Satisfy just about any two-way power-splitter/combiner need with Mini-Circuits ZFSC-2 series. . . covering 2 kHz —1500 MHz, with a choice of BNC, TNC, SMA or Type N connectors. Also, three convenient mounting options are available; threaded inserts, through holes, and flange mounting. Units are available from stock for immediate delivery and prices start at only $31.95. Mini-Circuits extensive experience in high volume manufacturing, coupled with exacting quality control and thorough testing makes this price/performance breakthrough possible.**

**Examine your power splitter/combiner specifications and select a highly reliable, low-cost ZFSC-2 model to meet your systems requirements.**

| Model | Freq. Range (MHz) | Minimum Isolation (Mid-band) | Maximum Insertion Loss (Mid-band) | Price (Quantity) |
|---|---|---|---|---|
| ZFSC-2-1 | 5-500 | 20 dB | 0.6 dB | $31.95 (4-24) |
| ZFSC-2-1W | 1-750 | 20 dB | 0.8 dB | $35.95 (4-24) |
| ZFSC-2-2 | 10-1000 | 20 dB | 1.0 dB | $39.95 (4-24) |
| ZFSC-2-4 | 0.2-1000 | 20 dB | 1.0 dB | $44.95 (4-24) |
| ZFSC-2-5 | 10-1500 | 20 dB | 1.0 dB | $49.95 (4-24) |
| ZFSC-2-6 | 0.02-60 | 20 dB | 0.6 dB | $31.95 (4-24) |

*World's largest manufacturer of Double-Balanced Mixers*

**Mini-Circuits**
**MINI-CIRCUITS LABORATORY**
A Division of Scientific Components Corp.

2625 East 14th Street Brooklyn, New York 11235 (212) 769-0200
Domestic and International Telex 125460 International Telex 620156

# Directional Coupler Application and Operation

Mini-Circuits

Mini-Circuits directional couplers are reactive devices featuring very low insertion loss. The basic operation of the directional coupler is to operate on an input so that two output signals are available. However, when the input is applied to an opposite port, only one output signal is available. The directional coupler has the following theoretical characteristics.

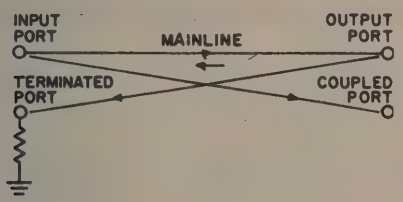
**1)** The output signals are unequal in amplitude. The larger signal is at the main line. The smaller signal is at the coupled line.

**2)** The main line insertion loss depends on the signal level at the coupled line. The relationship is as follows:

| Theoretical Minimum | |
|---|---|
| **Main Line Insertion Loss** | **Coupling** |
| 3 dB | 3 dB |
| 1.2 dB | 6 dB |
| .46 dB | 10 dB |
| .14 dB | 15 dB |
| .04 dB | 20 dB |

**3)** There is high isolation between the coupled line and the ouput of the main line.

A schematic representation of the coupler is as follows:




Key characteristics of a directional coupler include coupling coefficient, coupling flatness, insertion loss, directivity and isolation, defined as follows:

**Coupling coefficient** expresses the ratio, in dB, of the input port power to the coupled port power with all ports properly terminated. Mini-Circuits offers a variety of directional couplers with coupling values ranging from 10 to 21 dB.

**Coupling flatness** indicates the maximum peak-to-peak variation in coupling coefficient over the frequency range covered by the directional coupler.

**Insertion loss** relates to the change in output port power due to the insertion of the directional coupler into a system, considering all ports properly terminated.

**Isolation** reveals the unbalance due to slight variations in device symmetry. If the coupler is perfectly symmetrical, the signal applied to the output port will split between the input port and the terminated port. Any unbalance will allow a leakage signal to develop at the coupled port. The ratio, in dB, of this leakage signal to the output port signal is termed the device's isolation.

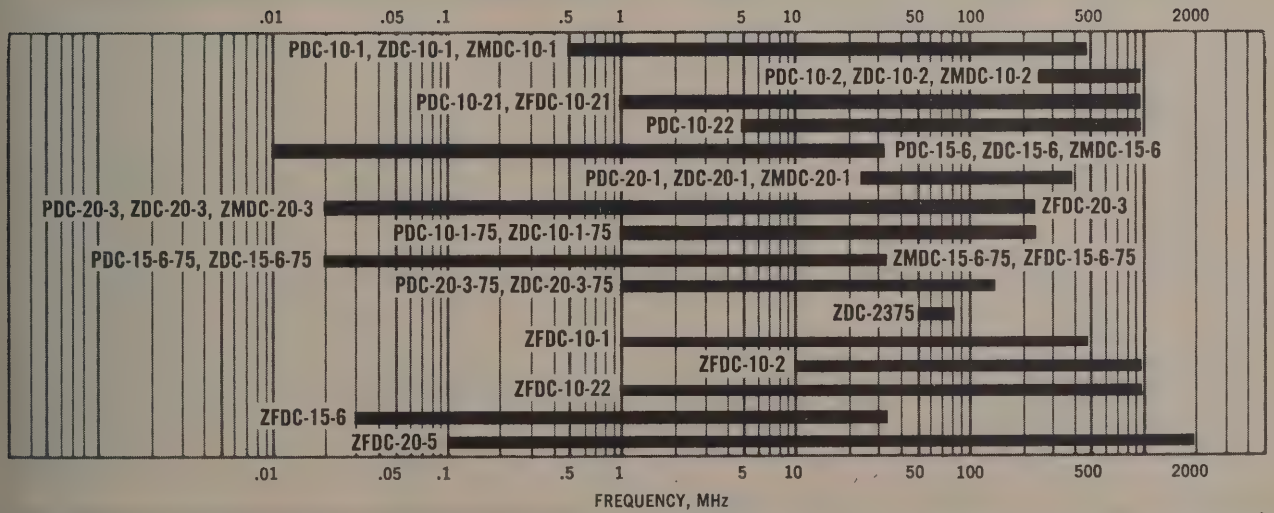
**Directivity** is a significant factor in coupler selection. The output power at the coupled port is measured when input power is transmitted in the desired direction; then output power at the coupled port is measured with the same amount of input power transmitted in the opposite direction. The ratio, in dB, of the two powers at the coupled port expresses the directivity. All ports are considered properly terminated. Directivity is equal to the isolation in dB, minus coupling in dB, and is a measure of the dynamic range at the coupled port.

Mini-Circuit's full line of directional couplers provide excellent performance. They feature 1) **broad bandwidth** 2) **low insertion loss,** as low as 0.1 dB 3) **directivity** as high as 45 dB and 4) **a wide range of coupling values,** from 10 dB to 21 dB.

The high performance characteristics of these units enable the following signal processing functions to be accomplished:

- **Measure Incident and Reflected Power to Determine VSWR**
- **Signal Sampling**
- **Signal Injection**
- **Signal Generator/Oscillator Leveling**
- **Power Flow Monitoring**

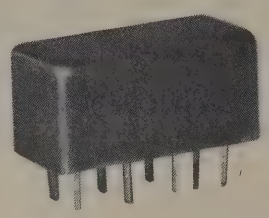
## DIRECTIONAL COUPLER FREQUENCY SELECTION GUIDE




PROMPT SERVICE / ONE WEEK DELIVERY Mini-Circuits

# 10-21 dB DIRECTIONAL COUPLERS

## PDC SERIES



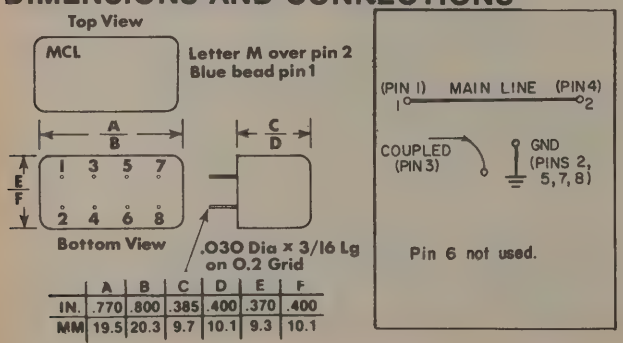
| MODEL | Freq. Range (MHz) | Coupling (dB) | Z (Ω) | COST |
|---|---|---|---|---|
| PDC-10-1 | 0.5 - 500 | 11.5 | 50 | $11.95 (5-49) |
| PDC-10-2 | 250 - 1000 | 10.5 | 50 | $24.95 (5-49) |
| PDC-10-21 | 1 - 1000 | 11.0 | 50 | $24.95 (5-49) |
| PDC-10-22 | 5 - 750 | 11.0 | 50 | $19.95 (5-49) |
| PDC-15-6 | 0.01 - 35 | 15.0 | 50 | $19.95 (5-49) |
| PDC-20-1 | 25 - 400 | 21.0 | 50 | $19.95 (5-49) |
| PDC-20-3 | 0.2 - 250 | 19.5 | 50 | $11.95 (5-49) |
| PDC-10-1-75 | 1 - 250 | 10.5 | 75 | $12.95 (5-49) |
| PDC-15-6-75 | 0.02 - 35 | 14.5 | 75 | $20.95 (5-49) |
| PDC-20-3-75 | 1 - 150 | 19.5 | 75 | $12.95 (5-49) |

**DESCRIPTION** — The PDC series directional couplers are economically priced while covering the frequency range from 10 KHz to 1000 MHz. They offer main-line loss as low as 0.1 dB and high directivity of up to 35 dB. A wide selection of coupling ratios is available and exceptional unit to unit matched performance is standard.

Only well matched and ruggedly constructed transmission line transformers ar used. Internally, every component is bonded to the header and case with silicone rubber to provide wuper reliable protection against shock vibration and acceleration.

High reliability is associated witn every PDC series directional coupler. Every production run is 100% tested and every unit must pass our rigid inspection and high quality standards. Naturally, our one year guarantee applies to these units.

## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| IN. | .770 | .800 | .385 | .400 | .370 | .400 |
| MM | 19.5 | 20.3 | 9.7 | 10.1 | 9.3 | 10.1 |

**WEIGHT** 5.2 grams 0.18 ounces

## FEATURES

- **Broadband,** 10 KHz to 1 GHz
- **Low Insertion Loss,** typically less than 0.5 dB
- **High Directivity,** typically better than 30 dB
- **Hermetically Sealed & RFI Shielded**
- **Miniature,** 0.128 in.$^3$, 0.4" x 0.8" PC area 0.4" high
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $11.95 in small quantity

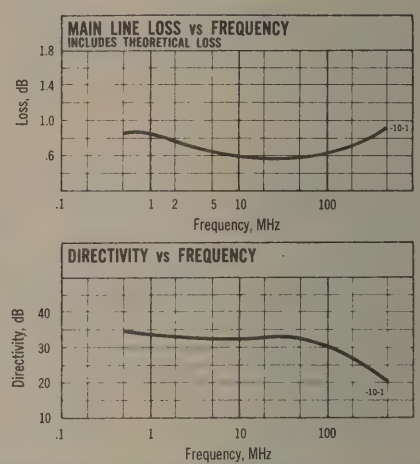
## APPLICATIONS

- **Measure incident and reflected power to determine VSWR**
- **Signal sampling**
- **S parameter measurement**
- **Signal injection**
- **Signal generator/oscillator leveling**
- **Power flow monitoring**

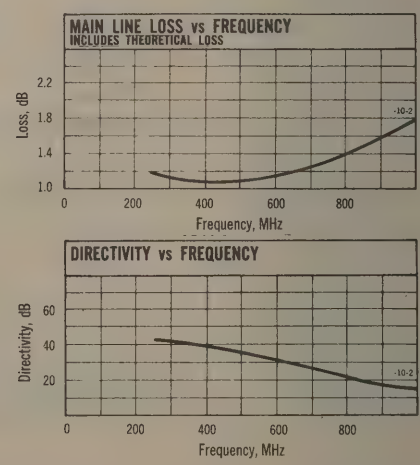
## ABSOLUTE MAXIMUM RATINGS

- **Operating and Storage Temp.** −55° C to +100° C
- **Pin Temperature:** (10 sec.) 510° F
- **Environmental Specifications:** See Index Page

## MODEL PDC-10-1




## MODEL PDC-10-2



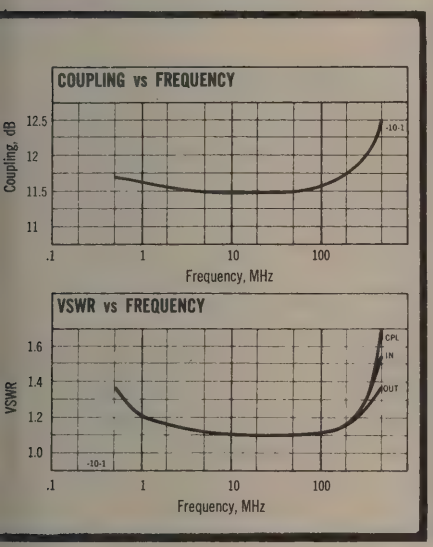

Mini-Circuits 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# PDC Series
## 10 KHz to 1000 MHz

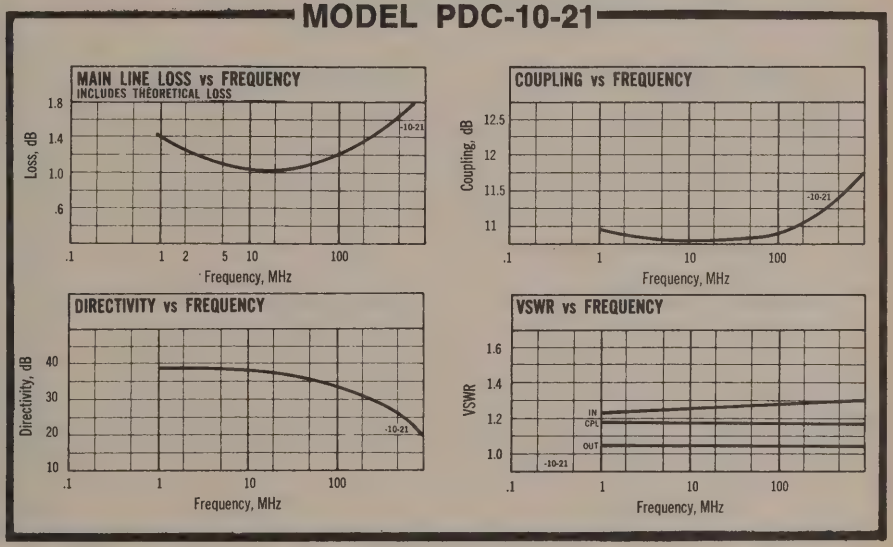
**Mini-Circuits**

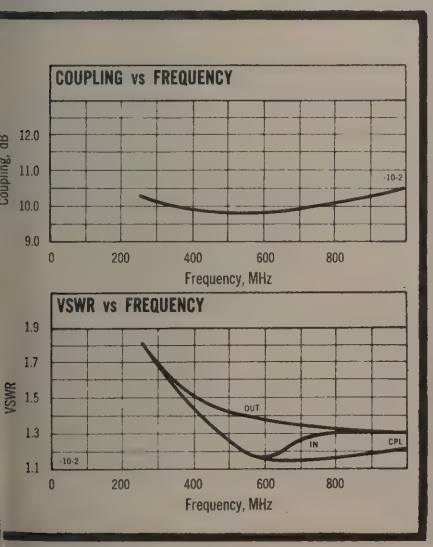
| Model No. | Frequency Range MHz | Coupling, dB (Input to Coupled Port) | Coupling Flatness dB | VSWR (Typ.) | Directivity, dB | | | Main Line Loss, dB (Includes Theoretical Power Split Loss) | | | Input Power, W | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Over Freq. Band | Typ. | Min. | Over Freq. Band | Typ. | Max. | Total Range | Lower Band Edge to One Decade Higher |
| PDC-10-1 | 0.5-500 | 11.5±0.5 | ±0.6 | 1.2 | Lower range†<br>Mid range<br>Upper range† | 32<br>32<br>22 | 25<br>25<br>15 | One Octave from band edge<br>Total range | 0.65<br>0.85 | 1.0<br>1.3 | 3 | 1.5 |
| PDC-10-2 | 250-1000 | 10.5±0.5 | ±1.0 | 1.5 | 250-400 MHz<br>400-800 MHz<br>800-1000 MHz | 40<br>30<br>20 | 30<br>20<br>15 | 250-600 MHz<br>600-1000 MHz | 1.1<br>1.6 | 1.4<br>1.9 | 5 | — |
| PDC-10-21 | 1-1000 | 11±0.5 | ±0.5* | 1.2 | Lower range†<br>Mid range<br>Upper range† | 40<br>25<br>25 | 30<br>20<br>20 | Lower range†<br>Mid range<br>Upper range† | 1.2<br>1.2<br>1.6 | 1.7<br>1.7<br>2 | 2 | 1 |
| PDC-10-22 | 5-750 | 11±0.5 | ±0.5 | 1.25 | Lower range†<br>Mid range<br>Upper range† | 35<br>25<br>25 | 30<br>20<br>20 | Lower range†<br>Mid range<br>Upper range† | 1.1<br>1.2<br>1.4 | 1.6<br>1.7<br>1.9 | 2 | 1 |

* Upper band ±0.75 † Lower band edge to one decade higher. Upper band edge to one octave lower.

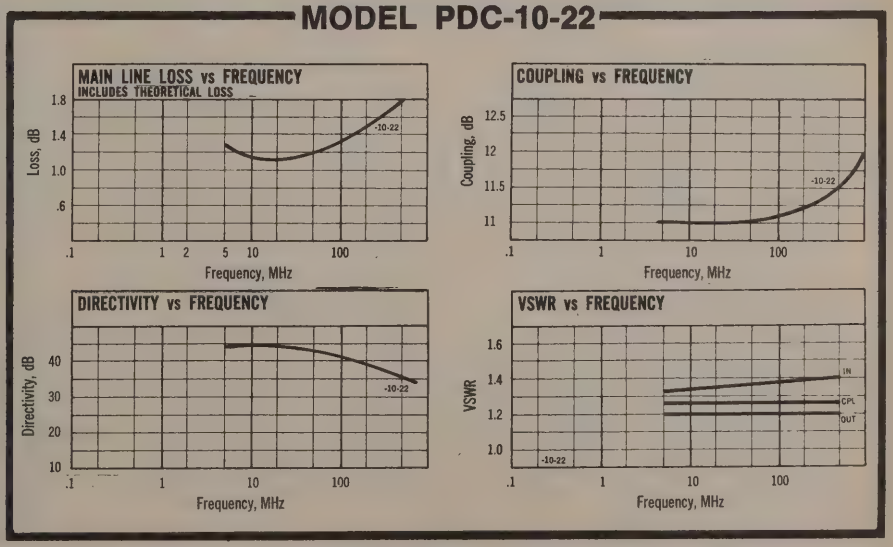



## MODEL PDC-10-21




## MODEL PDC-10-22



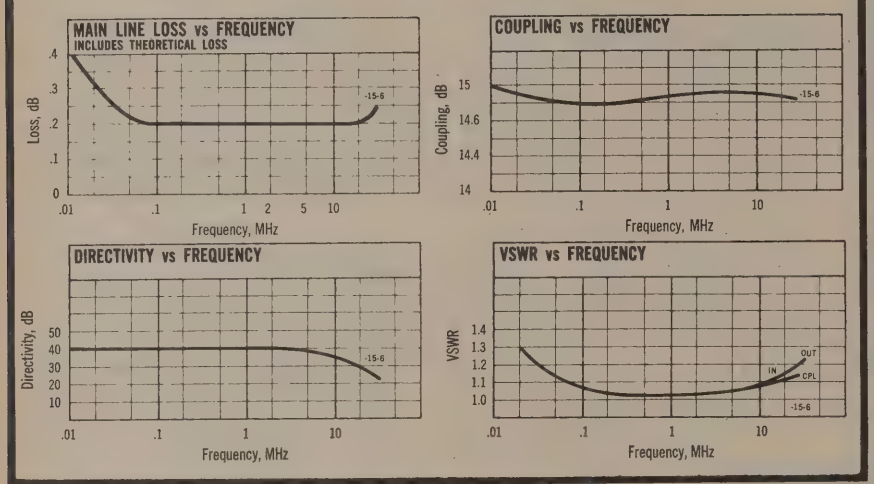

*PROMPT SERVICE / ONE WEEK DELIVERY* **Mini-Circuits**

# 10-21 dB DIRECTIONAL COUPLERS

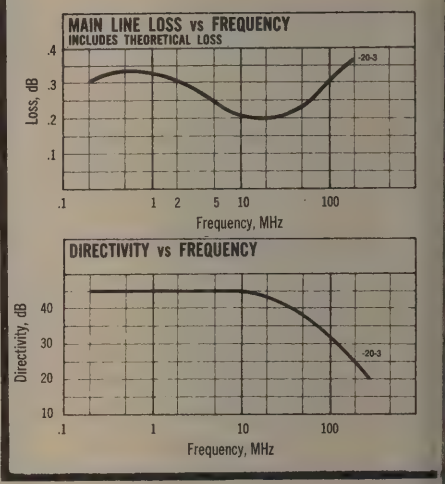
| Model No. | Frequency Range MHz | Coupling, dB (Input to Coupled Port) | Coupling Flatness dB | VSWR (Typ.) | Directivity, dB | | | Main Line Loss, dB (Includes Theoretical Power Split Loss) | | | Input Power, W | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Over Freq. Band | Typ. | Min. | Over Freq. Band | Typ. | Max. | Total Range | Lower Band Edge to One Decade Higher |
| PDC-15-6 | 0.01-35 | 15±0.5 | ±0.5 | 1.15 | Lower range†<br>Mid range<br>Upper range† | 38<br>35<br>28 | 30<br>25<br>20 | One octave from band edge<br>Total range | 0.2<br>0.3 | 0.4<br>0.6 | 4 | 2 |
| PDC-20-1 | 25-400 | 21±0.75 | ±0.5 | 1.25 | 25-150 MHz<br>150-300 MHz<br>300-400 MHz | 25<br>35<br>25 | 20<br>25<br>20 | 25-50 MHz<br>50-300 MHz<br>300-400 MHz | 0.2<br>0.1<br>0.15 | 0.5<br>0.2<br>0.3 | 5 | 3 |
| PDC-20-3 | 0.2-250 | 19.5±0.5 | ±0.5 | 1.2 | Lower range†<br>Mid range<br>Upper range† | 36<br>33<br>25 | 30<br>25<br>20 | One octave from band edge<br>Total range | 0.25<br>0.35 | 0.5<br>0.6 | 4 | 1.5 |
| PDC-10-1-75 | 1-250 | 10.5±0.5 | ±0.75 | 2 | Entire range | 30 | 20 | Entire range | 1.1 | 1.5 | 4 | 2 |
| PDC-15-6-75 | 0.02-35 | 14.5±0.5 | ±0.5 | 1.3 | Entire range | 35 | 20 | Entire range | 0.3 | 0.7 | 4 | 1.5 |
| PDC-20-3-75 | 1-150 | 19.5±0.5 | ±0.75 | 2 | Entire range | 25 | 20 | Entire range | 0.35 | 0.8 | 4 | 2 |

† Lower band edge to one decade higher. Upper band edge to one octave lower.

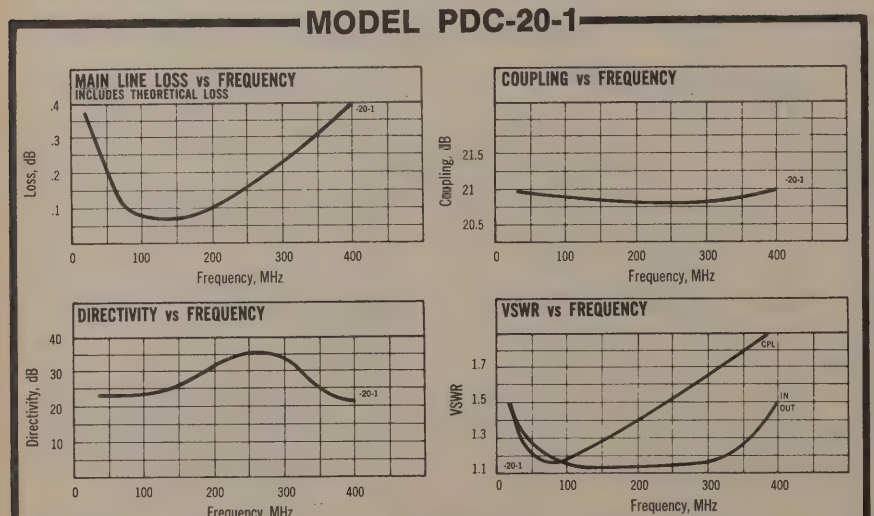
## MODEL PDC-15-6



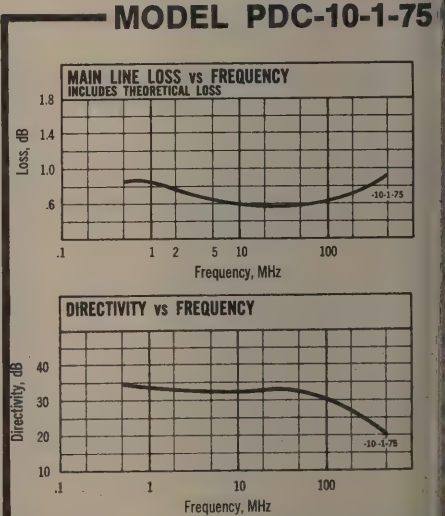

## MODEL PDC-20-3




## MODEL PDC-20-1




## MODEL PDC-10-1-75

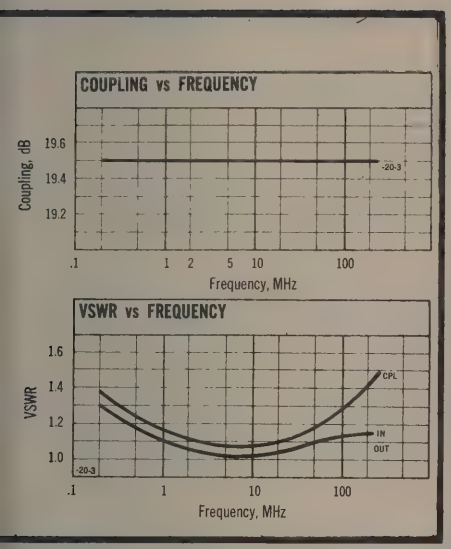


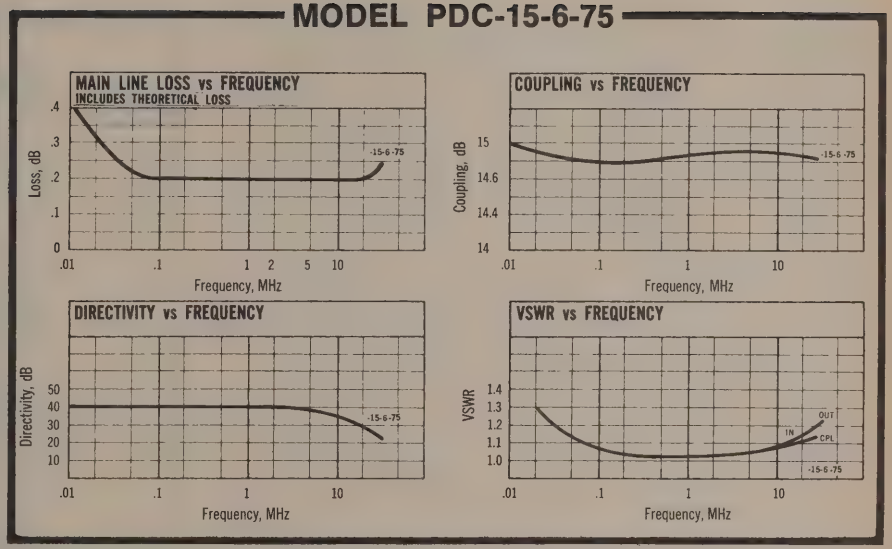

Mini-Circuits 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# PDC Series
## 10 KHz to 1000 MHz

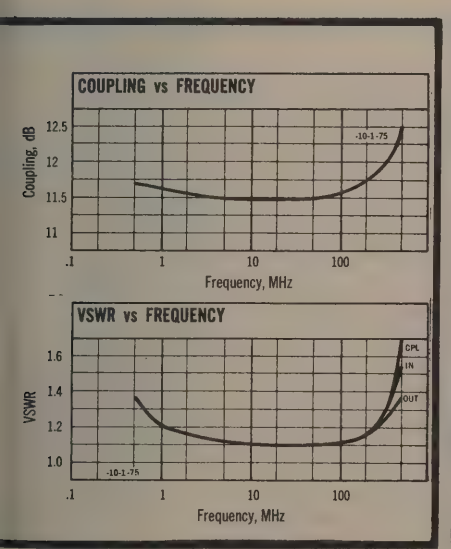
Mini-Circuits

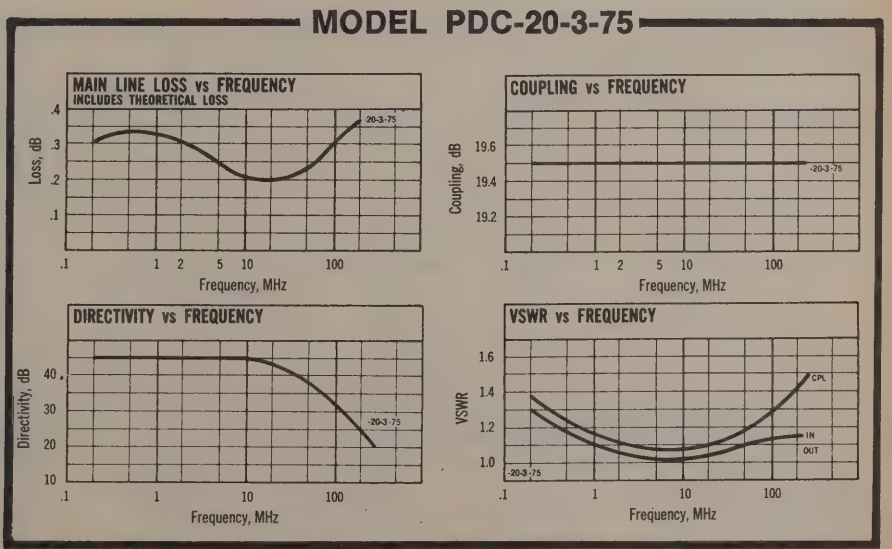
## MODEL PDC-15-6-75




## MODEL PDC-20-3-75




*PROMPT SERVICE / ONE WEEK DELIVERY*

Mini-Circuits

# 10-21 dB DIRECTIONAL COUPLERS

## ZDC SERIES

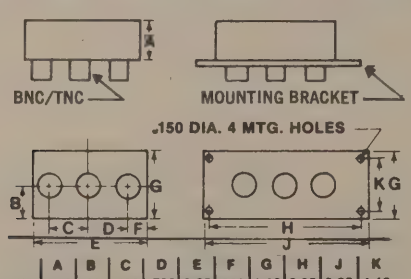
| MODEL | Freq. Range (MHz) | Coupling (dB) | Z (Ω) | COST |
|---|---|---|---|---|
| ZDC-10-1 | 0.5 - 500 | 11.5 | 50 | $26.95 (4-24) |
| ZDC-10-2 | 250 - 1000 | 10.5 | 50 | $34.95 (4-24) |
| ZDC-15-6 | 0.01 - 35 | 15.0 | 50 | $34.95 (4-24) |
| ZDC-20-1 | 25 - 400 | 21.0 | 50 | $34.95 (4-24) |
| ZDC-20-3 | 0.2 - 250 | 19.5 | 50 | $26.95 (4-24) |
| ZDC-10-1-75 | 1 - 250 | 10.5 | 75 | $26.95 (4-24) |
| ZDC-15-6-75 | 0.02 - 35 | 14.5 | 75 | $35.95 (4-24) |
| ZDC-20-3-75 | 1 - 150 | 19.5 | 75 | $27.95 (4-24) |
| ZDC-2375 | 55 - 85 | 11.5 | 75 | $35.95 (4-24) |

**DESCRIPTION —** The ZDC series directional couplers are economically priced while covering the frequency range from 10 kHz to 1000 MHz. They offer main-line loss as low as 0.1 dB and high directivity of up to 35 dB. A wide selection of coupling rations are available and exceptional unit to unit matched performance is standard.

Available with BNC or TNC connectors, the ZDC series is housed in a die-cast aluminum case. The case is finished with a blue-baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A.

High reliability is associated with every MCL unit. Every production run is 100% tested and every unit must pas our production run is 100% tested and every unit must pass our rigid inspection and high quality standards. Naturally, our one year guarantee applies to these units.

## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| IN. | 1.15 | .63 | .750 | .730 | 2.25 | .385 | 1.40 | 2.95 | 3.25 | 1.10 |
| MM | 29. | 16. | 19. | 18.5 | 57. | 9.77 | 35.5 | 74.9 | 82.5 | 28. |

**MOUNTING BRACKET AVAILABLE ON REQUEST.** Add suffix B to part number and $1.50 to unit cost.

**CONNECTORS:** BNC standard. TNC on request (no charge).

**WEIGHT** 4.0 grams 1.02 ounces

## FEATURES

- **Broadband,** 10 KHz to 1 GHz
- **Low Insertion Loss,** typically less than 0.5 dB
- **High Directivity,** typically better than 30 dB
- **Hermetically Sealed & RFI Shielded**
- **Connectors,** available with BNC or TNC
- **Mounting,** option, available with bracket
- **Compact,** 2.25" width, 1.4" height, 1.15" depth
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $26.95 in small quantity

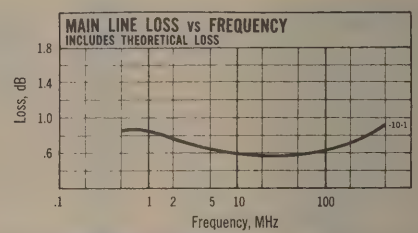
## APPLICATIONS

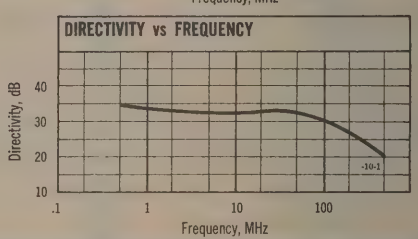
- **Measure incident and reflected power to determine VSWR**
- **Signal sampling**
- **S parameter measurement**
- **Signal injection**
- **Signal generator/oscillator leveling**
- **Power flow monitoring**

## ABSOLUTE MAXIMUM RATINGS

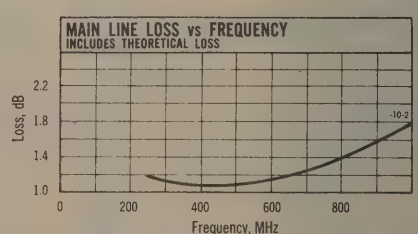
- **Operating and Storage Temp.** −55° C to +100° C
- **Environmental Specifications:** See Index Page

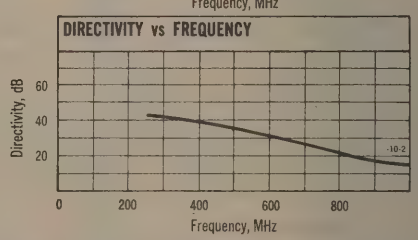
## MODEL ZDC-10-1




## MODEL ZDC-10-2



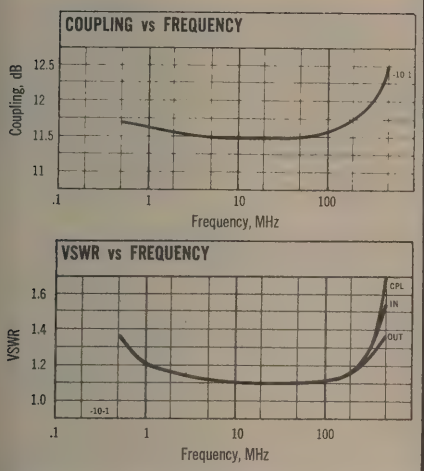



# ZDC Series
## 10 KHz to 1000 MHz

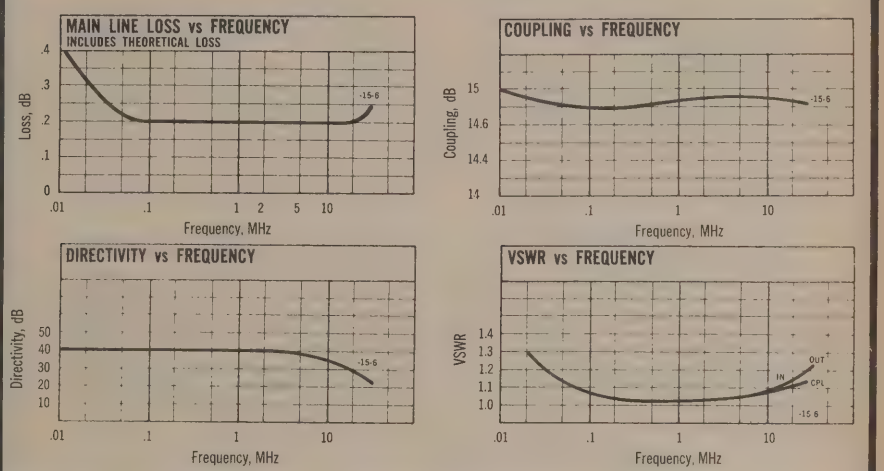
**Mini-Circuits**

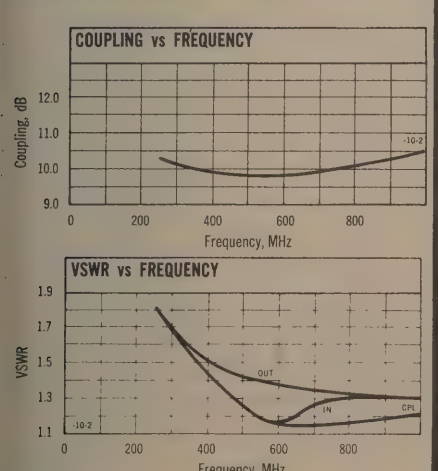
| Model No. | Frequency Range MHz | Coupling, dB (Input to Coupled Port) | Coupling Flatness dB | VSWR (Typ.) | Directivity, dB | | | Main Line Loss, dB (Includes Theoretical Power Split Loss) | | | Input Power, W | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Over Freq. Band | Typ. | Min. | Over Freq. Band | Typ. | Max. | Total Range | Lower Band Edge to One Decade Higher |
| ZDC-10-1 | 0.5-500 | 11.5±0.5 | ±0.6 | 1.2 | Lower range†<br>Mid range<br>Upper range† | 32<br>32<br>22 | 25<br>25<br>15 | One octave from band edge<br>Total range | 0.65<br>0.85 | 1.0<br>1.3 | 3 | 1.5 |
| ZDC-10-2 | 250-1000 | 10.5±0.5 | ±0.5 | 1.5 | 250-400 MHz<br>400-800 MHz<br>800-1000 MHz | 40<br>30<br>20 | 30<br>20<br>15 | 250-600 MHz<br>600-1000 MHz | 1.1<br>1.6 | 1.4<br>1.9 | 5 | — |
| ZDC-15-6 | .01-35 | 15±0.5 | ±0.5 | 1.15 | Lower range†<br>Mid range<br>Upper range† | 38<br>35<br>28 | 30<br>25<br>20 | One octave from band edge<br>Total range | 0.2<br>0.3 | 0.4<br>0.6 | 4 | 2 |
| ZDC-20-1 | 25-400 | 21±0.75 | ±0.5 | 1.25 | 25-150 MHz<br>150-300 MHz<br>300-400 MHz | 25<br>35<br>25 | 20<br>25<br>20 | 25-50 MHz<br>50-300 MHz<br>300-400 MHz | 0.2<br>0.1<br>0.15 | 0.5<br>0.4<br>0.6 | 5 | 3 |

† Lower band edge to one decade higher. Upper band edge to one octave lower.

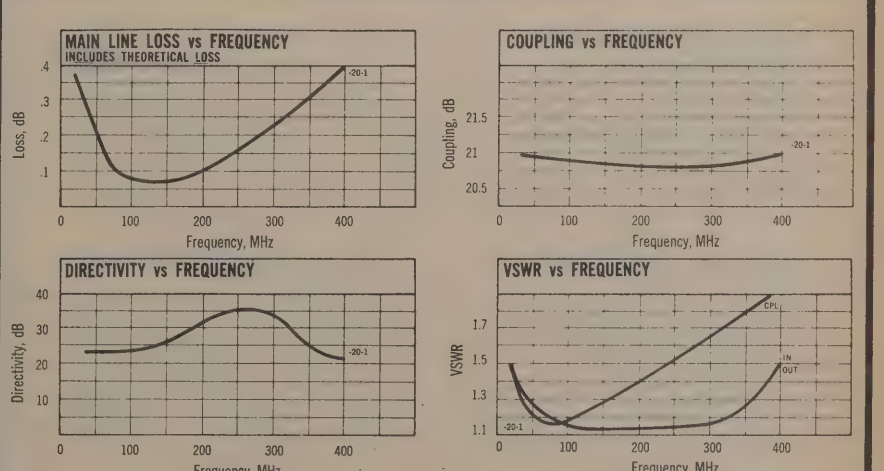



## MODEL ZDC-15-6




## MODEL ZDC-20-1



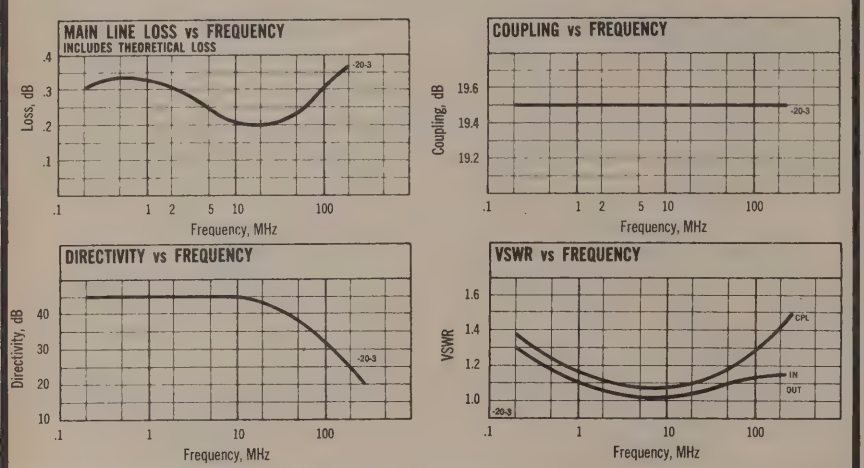

**PROMPT SERVICE / ONE WEEK DELIVERY** **Mini-Circuits**

# 10-21 dB DIRECTIONAL COUPLERS

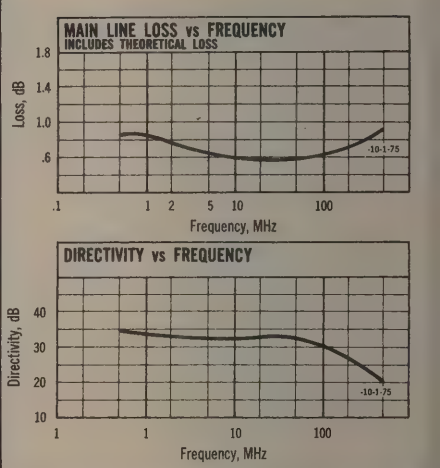
| Model No. | Frequency Range MHz | Coupling, dB (Input to Coupled Port) | Coupling Flatness dB | VSWR (Typ.) | Directivity, dB | | | Main Line Loss, dB (Includes Theoretical Power Split Loss) | | | Input Power, W | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Over Freq. Band | Typ. | Min. | Over Freq. Band | Typ. | Max. | Total Range | Lower Band Edge to One Decade Higher |
| ZDC-20-3 | .2-250 | 19.5±0.5 | ±0.5 | 1.2 | Lower range†<br>Mid Range<br>Upper range† | 36<br>33<br>25 | 30<br>25<br>20 | One octave from band edge<br>Total range | 0.25<br>0.35 | 0.5<br>0.6 | 4 | 1.5 |
| ZDC-10-1-75 | 1-250 | 10.5±0.5 | ±0.75 | 2 | Entire range | 30 | 20 | Entire range | 1.1 | 1.5 | 4 | 2 |
| ZDC-15-6-75 | .02-35 | 14.5±0.5 | ±0.5 | 1.5 | Lower range†<br>Mid range<br>Upper range† | 35<br>35<br>28 | 30<br>25<br>20 | One octave from band edge<br>Total range | 0.2<br>0.3 | 0.4<br>0.6 | 4 | 2 |
| ZDC-20-3-75 | 1-150 | 19.5±0.5 | ±0.75 | 2 | Entire range | 25 | 20 | Entire range | 0.35 | 0.8 | 4 | 2 |
| ZDC-2375 | 55-85 | 11.5±0.5 | ±0.5 | 1.5 | Entire range | 35 | 30 | Entire range | 1.6 | 2.1 | 4 | — |

† Lower band edge to one decade higher. Upper band edge to one octave lower.

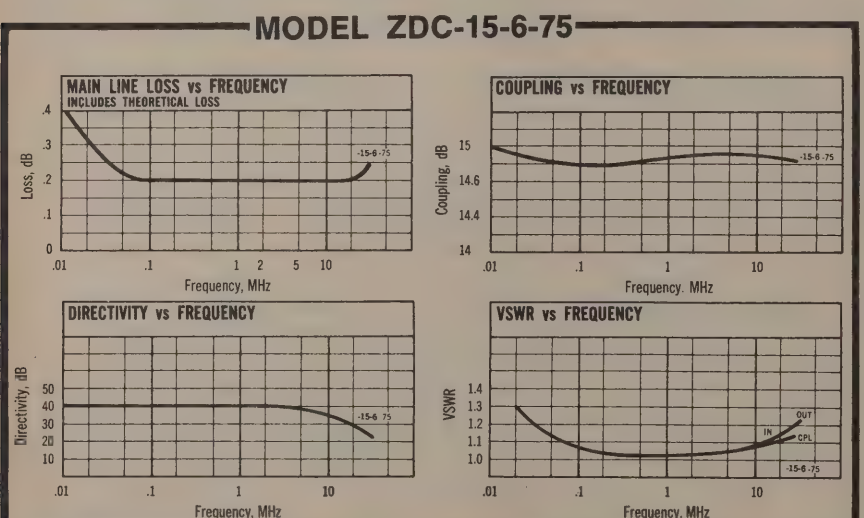
## MODEL ZDC-20-3




## MODEL ZDC-10-1-75



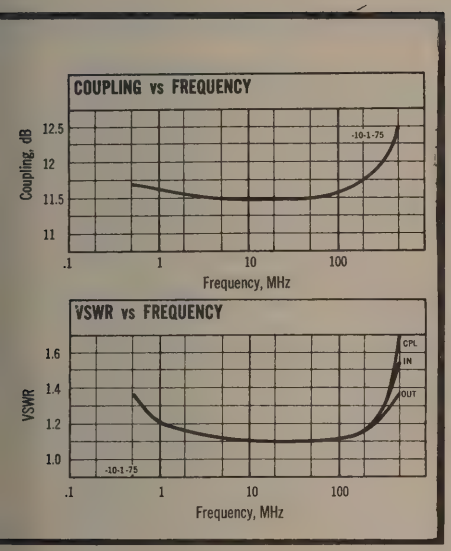

## MODEL ZDC-15-6-75



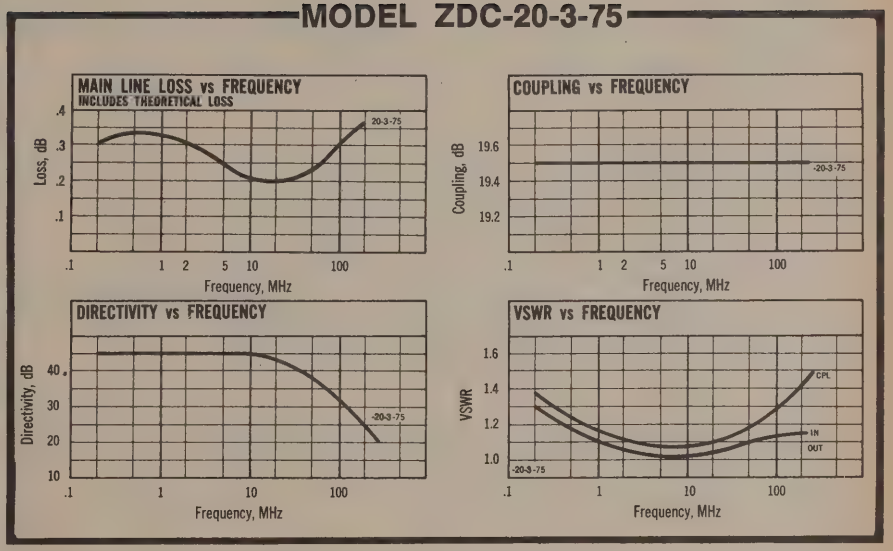

Mini-Circuits 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# ZDC Series
# 10 KHz to 1000 MHz

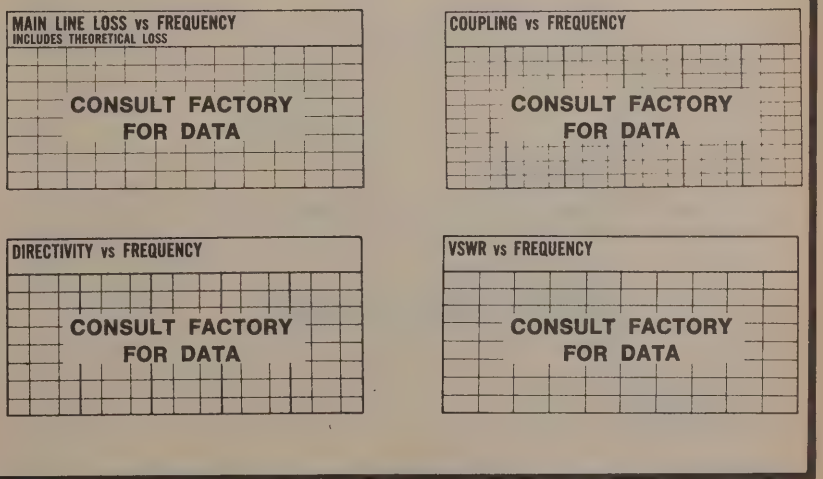
Mini-Circuits




## MODEL ZDC-20-3-75




## MODEL ZDC-2375



# 10-21 dB
# DIRECTIONAL COUPLERS

## ZMDC SERIES

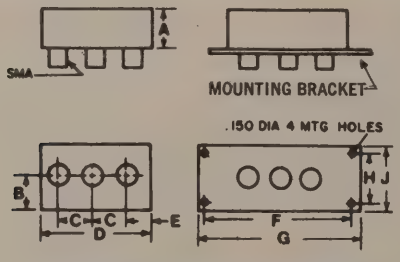
| MODEL | Freq. Range (MHz) | Coupling (dB) | Z (Ω) | COST |
|---|---|---|---|---|
| ZMDC-10-1 | 0.5 - 500 | 11.5 | 50 | $36.95 (4-24) |
| ZMDC-10-2 | 250 - 1000 | 10.5 | 50 | $44.95 (4-24) |
| ZMDC-15-6 | 0.01 - 35 | 15.0 | 50 | $44.95 (4-24) |
| ZMDC-20-1 | 25 - 400 | 21.0 | 50 | $44.95 (4-24) |
| ZMDC-20-3 | 0.2 - 250 | 19.5 | 50 | $36.95 (4-24) |

**DESCRIPTION** — The ZMDC series directional couplers are economically priced while covering the frequency range from 10 kHz to 1000 MHz. They offer main-line loss as low as 0.1 dB and high directivity of up to 35 dB. A wide selection of coupling rations are available and exceptional unit to unit matched performance is standard.

Available with SMA connectors, the ZMDC series is housed in a die-cast aluminum case. The case is finished with a blue-baked enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A.

High reliability is associated with every MCL unit. Every production run is 100% tested and every unit must pass our rigid inspection and high quality standards. Naturally, our one year guarantee applies to these units.

## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F | G | H | J |
|---|---|---|---|---|---|---|---|---|---|
| IN. | 0.88 | 0.66 | .438 | 1.50 | .312 | 2.19 | 2.56 | 0.84 | 1.15 |
| MM | 22. | 17. | 11. | 38. | 79. | 55.6 | 63.5 | 21. | 29. |

MOUNTING BRACKET AVAILABLE ON REQUEST. Add suffix B to part number and add $1 50 to unit cost.
CONNECTORS SMA only.

**WEIGHT** 34.0 grams 1.20 ounces

## FEATURES

- **Broadband,** 10 KHz to 1 GHz
- **Low Insertion Loss,** typically less than 0.5 dB
- **High Directivity,** typically better than 30 dB
- **Connectors,** available with SMA
- **Mounting,** option, available with bracket
- **Miniature,** 1.5" width, 1.15" height, 0.88" depth
- **High Reliability,** 100% tested, one year guarante
- **Low Cost,** as little as $36.95 in small quantity

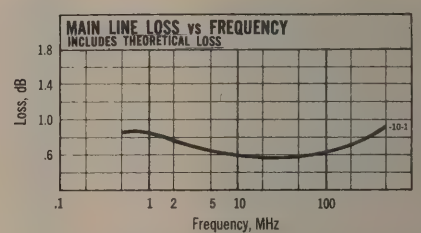
## APPLICATIONS

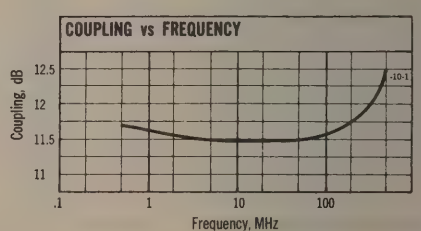
- **Measure incident and reflected power to determi VSWR**
- **Signal sampling**
- **S parameter measurement**
- **Signal injection**
- **Signal generator/oscillator leveling**
- **Power flow monitoring**

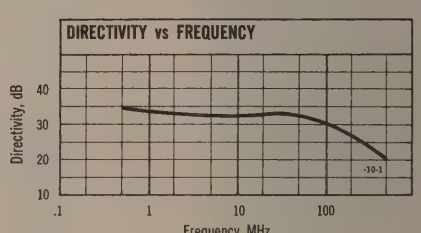
## ABSOLUTE MAXIMUM RATINGS

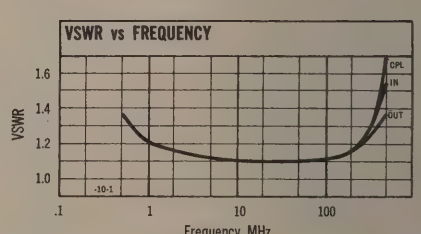
- **Operating and Storage Temp.** −55°C to +100
- **Environmental Specifications:** See Index P

## MODEL ZMDC-10-1




**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 62

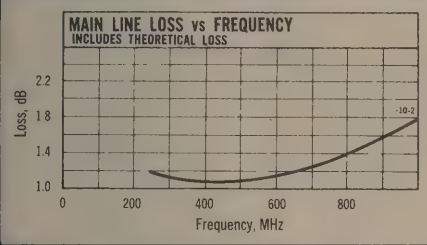
# ZMDC Series
# 10 KHz to 1000 MHz

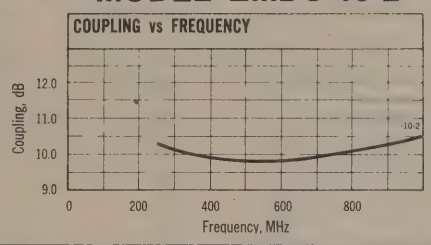
**Mini-Circuits**

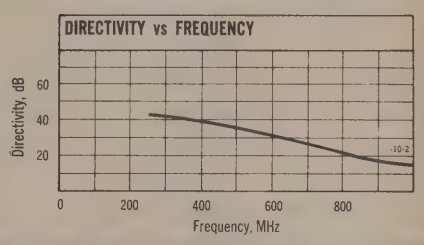
| Model No. | Frequency Range MHz | Coupling, dB (Input to Coupled Port) | Coupling Flatness dB | VSWR (Typ.) | Directivity, dB | | | Main Line Loss, dB (Includes Theoretical Power Split Loss) | | | Input Power, W | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Over Freq. Band | Typ. | Min. | Over Freq. Band | Typ. | Max. | Total Range | Lower Band Edge to One Decade Higher |
| ZMDC-10-1 | 0.5-500 | 11.5±0.5 | ±0.6 | 1.2 | Lower range†<br>Mid range<br>Upper range† | 32<br>32<br>22 | 25<br>25<br>15 | One octave from band edge<br>Total range | 0.65<br>0.85 | 1.0<br>1.3 | 3 | 1.5 |
| ZMDC-10-2 | 250-1000 | 10.5±0.5 | ±0.5 | 1.5 | 250-400 MHz<br>400-800 MHz<br>800-1000 MHz | 40<br>30<br>20 | 30<br>20<br>15 | 250-600 MHz<br>600-1000 MHz | 1.1<br>1.6 | 1.4<br>1.9 | 5 | — |
| ZMDC-15-6 | .01-35 | 15±0.5 | ±0.5 | 1.15 | Lower range†<br>Mid range<br>Upper range | 38<br>35<br>28 | 30<br>25<br>20 | One octave from band edge<br>Total range | 0.2<br>0.4 | 0.4<br>0.6 | 4 | 2 |
| ZMDC-20-1 | 25-400 | 21±0.75 | ±0.5 | 1.25 | 25-150 MHz<br>150-300 MHz<br>300-400 MHz | 25<br>35<br>25 | 20<br>25<br>20 | 25-50 MHz<br>50-300 MHz<br>300-400 MHz | 0.2<br>0.1<br>0.15 | 0.5<br>0.4<br>0.6 | 5 | 3 |
| ZMDC-20-3 | .2-250 | 19.5±0.5 | ±0.5 | 1.2 | Lower range†<br>Mid range<br>Upper range† | 36<br>33<br>25 | 30<br>25<br>20 | One octave from band edge<br>Total range | 0.25<br>0.35 | 0.5<br>0.6 | 4 | 1.5 |

† Lower Band Edge to One Decade Higher. Upper Band Edge to One Octave Lower.

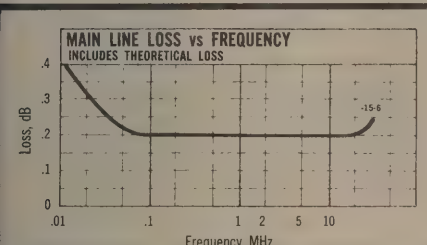
## MODEL ZMDC-10-2

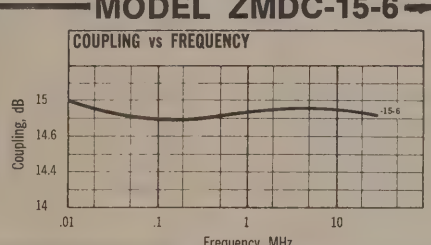


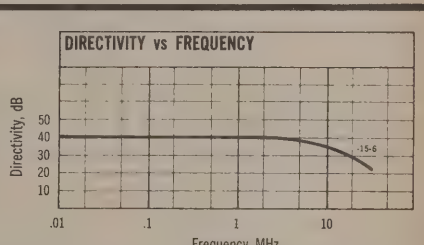



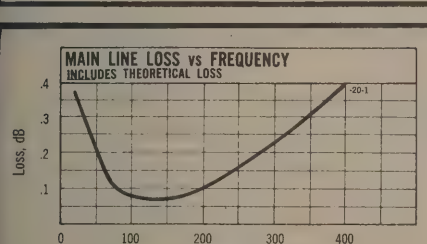

## MODEL ZMDC-15-6

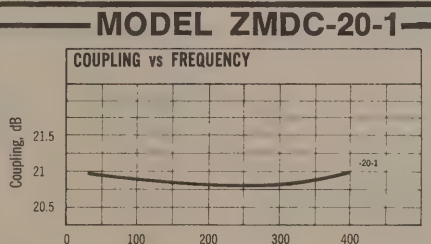


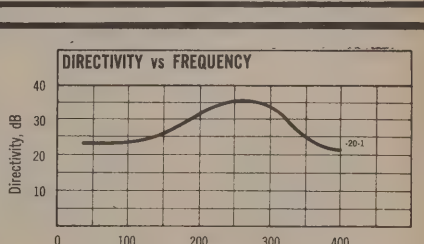



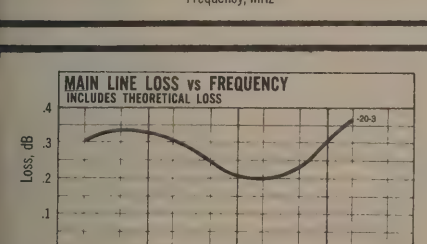

## MODEL ZMDC-20-1

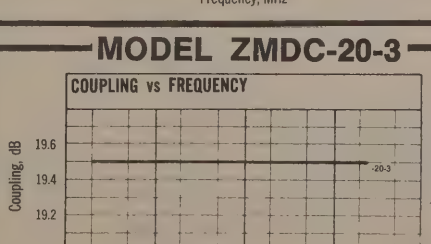


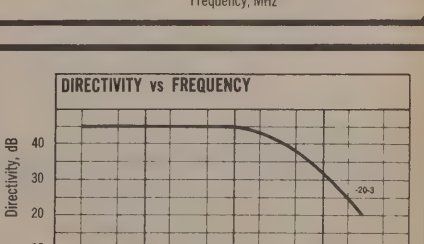




## MODEL ZMDC-20-3

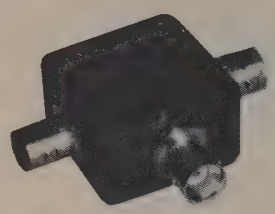


# 10.5-19.5 dB DIRECTIONAL COUPLERS

## ZFDC SERIES



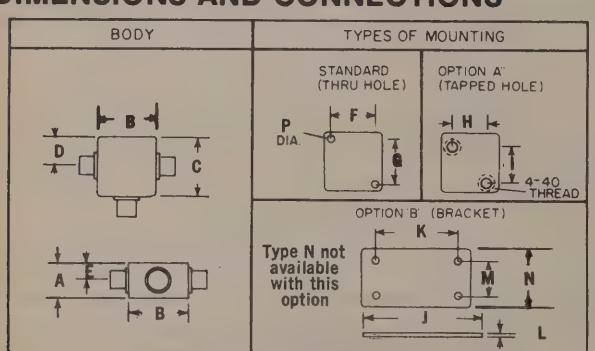
| MODEL | Freq. Range (MHz) | Coupling (dB) | Z (Ω) | COST |
|---|---|---|---|---|
| ZFDC-10-1 | 1 - 500 | 10.5 | 50 | $29.95 (4-24) |
| ZFDC-10-2 | 10 - 1000 | 10.75 | 50 | $39.95 (4-24) |
| ZFDC-10-21 | 1 - 1000 | 11.0 | 50 | $44.95 (4-24) |
| ZFDC-10-22 | 1 - 750 | 11.0 | 50 | $34.95 (4-24) |
| ZFDC-15-6 | 0.03 - 35 | 15.0 | 50 | $34.95 (4-24) |
| ZFDC-20-3 | 0.2 - 250 | 19.5 | 50 | $29.95 (4-24) |
| ZFDC-20-5 | 0.1 - 2000 | 19.5 | 50 | $79.95 (1-4) |
| ZFDC-15-6-75 | 0.02 - 35 | 14.5 | 75 | $35.95 (4-24) |

**DESCRIPTION** — The ZFDC series directional couplers are economically priced while covering the frequency range from 0.01-2000 MHz. They offer main-line loss as low as 0.1 dB and high directivity of up to 35 dB. A wide selection of coupling ratios are available and exceptional unit to unit matched performance is standard.

The ZFDC series is housed in an extremely rugged 1¼ in. square metal case with one connector on each side. Each unit is supplied in a grey baked enamel paint finish.

Every unit is 100% tested and inspected under strict MCL quality-control standards to insure superior electrical performance and reliability and carries a one-year guarantee.

## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IN | .75 | 1.25 | 1.25 | .625 | .375 | 1.00 | 1.00 | 0.8 | 0.8 | 2.188 | 1.688 | .060 | .75 | 1.25 | .125 |
| MM | 19.1 | 31.8 | 31.8 | 15.9 | 9.5 | 25.4 | 25.4 | 20.3 | 20.3 | 55.6 | 42.9 | 1.5 | 19.1 | 31.8 | 3.18 |

For mounting option A or B add Letter to P/N

BNC (std), TNC (on request), SMA (3mm) and TYPE N on request, add $5 to unit cost.

**WEIGHT** 67.0 grams 2.36 ounces

## FEATURES

- **Broadband,** 20 KHz to 2 GHz
- **Low Insertion Loss,** typically less than 0.5 dB
- **High Directivity,** typically better than 30 dB
- **Connectors,** BNC, TNC, SMA, or Type N
- **Mounting,** thru hole, tapped hole, or bracket
- **Miniature,** 1.25" width, 0.75" height, 1.25" depth
- **High Reliability,** 100% tested, one year guarantee
- **Low Cost,** as little as $29.95 in small quantity

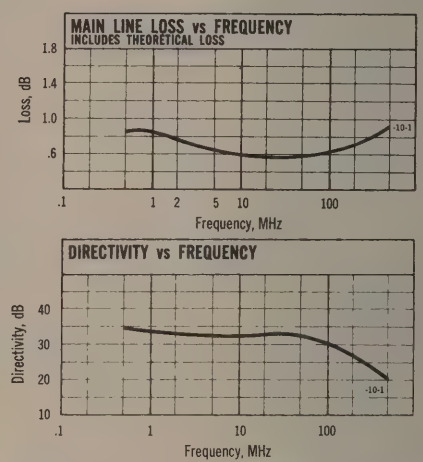
## APPLICATIONS

- **Measure incident and reflected power to determine VSWR**
- **Signal sampling**
- **S parameter measurement**
- **Signal injection**
- **Signal generator/oscillator leveling**
- **Power flow monitoring**

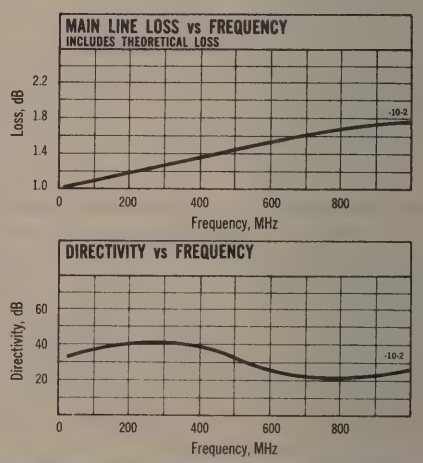
## ABSOLUTE MAXIMUM RATINGS

- **Operating and Storage Temp.** −55° C to +100° C
- **Environmental Specifications:** See Index Page

## MODEL ZFDC-10-1




## MODEL ZFDC-10-2




**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# ZFDC Series
# 20 KHz to 2000 MHz

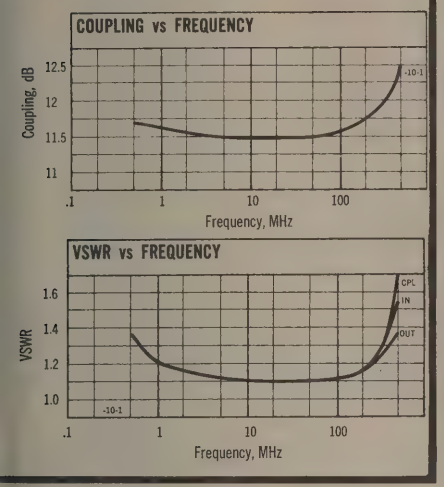
**Mini-Circuits**

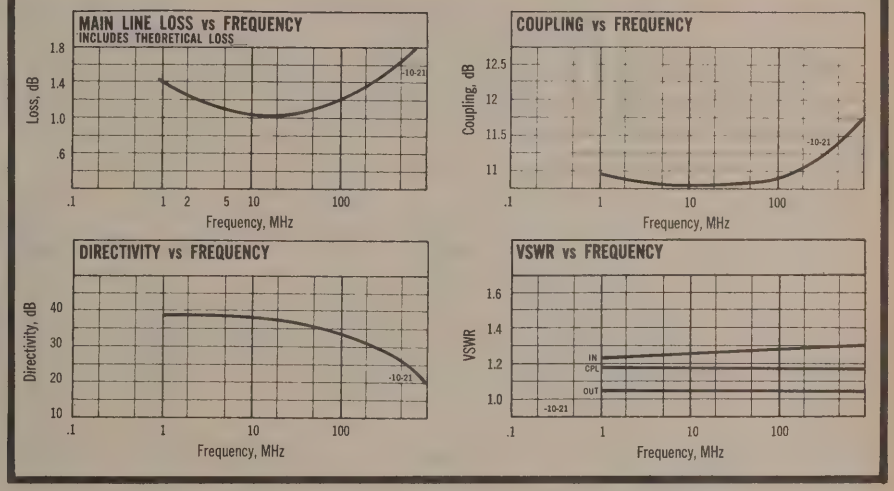
| Model No. | Frequency Range MHz | Coupling, dB (Input to Coupled Port) | Coupling Flatness dB | VSWR (Typ.) | Directivity, dB | | | Main Line Loss, dB (Includes Theoretical Power Split Loss) | | | Input Power, W | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Over Freq. Band | Typ. | Min. | Over Freq. Band | Typ. | Max. | Total Range | Lower Band Edge to One Decade Higher |
| ZFDC-10-1 | 1-500 | 10.5±0.25 | ±0.6 | 1.2 | Lower range†<br>Mid range<br>Upper range† | 32<br>33<br>22 | 25<br>25<br>15 | One octave from band edge<br>Total range | 0.8<br>1.0 | 1.1<br>1.3 | 3 | 1.5 |
| ZFDC-10-2 | 10-1000 | 10.75±0.5 | ±0.75 | 1.5 | Lower range†<br>Mid range<br>Upper range† | 35<br>30<br>27 | 28<br>25<br>20 | One octave from band edge<br>Total range | 1.2<br>1.5 | 1.6<br>2.0 | 3 | 1.5 |
| ZFDC-10-21 | 1-1000 | 11±0.5 | ±0.5* | 1.2 | Lower range†<br>Mid range<br>Upper range† | 40<br>25<br>25 | 30<br>20<br>20 | Lower range†<br>Mid range<br>Upper range† | 1.2<br>1.2<br>1.6 | 1.7<br>1.7<br>2.0 | 2 | 1 |
| ZFDC-10-22 | 1-750 | 11±0.5 | ±.05 | 1.25 | Lower range†<br>Mid range<br>Upper range† | 35<br>25<br>25 | 30<br>20<br>20 | Lower range†<br>Mid range<br>Upper range† | 1.1<br>1.2<br>1.4 | 1.6<br>1.7<br>1.9 | 2 | 1 |

*Upper band ±0.75
# ± 2.0 over 1000 MHz

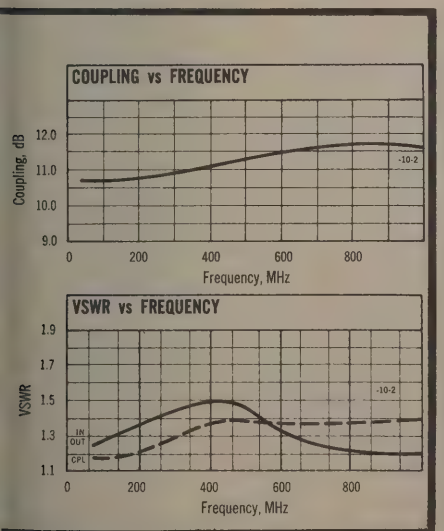
† Lower band edge to one decade higher. Upper band edge to one octave lower.

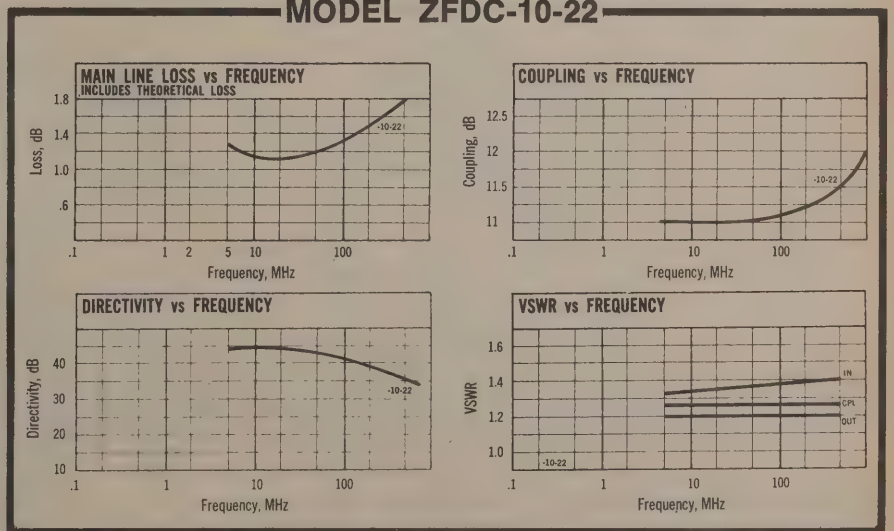
## MODEL ZFDC-10-21




## MODEL ZFDC-10-22



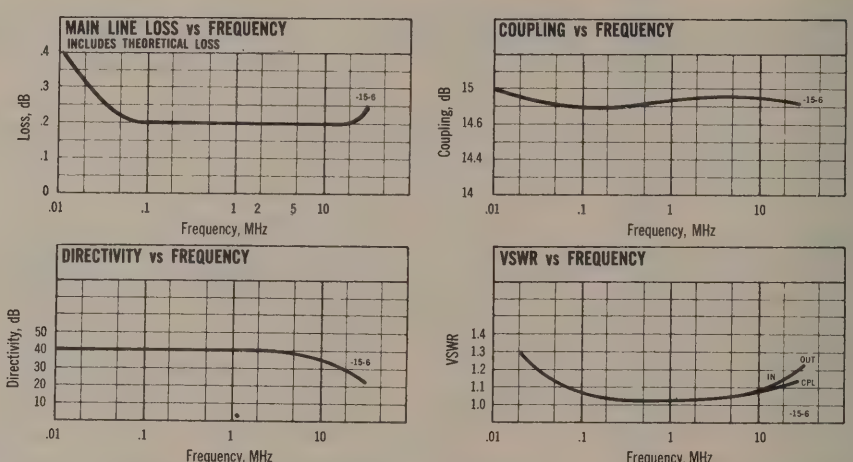
# 10.5-19.5 dB DIRECTIONAL COUPLERS

| Model No. | Frequency Range MHz | Coupling, dB (Input to Coupled Port) | Coupling Flatness dB | VSWR (Typ.) | Directivity, dB | | | Main Line Loss, dB (Includes Theoretical Power Split Loss) | | | Input Power, W | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Over Freq. Band | Typ. | Min. | Over Freq. Band | Typ. | Max. | Total Range | Lower Band Edge to One Decade Higher |
| ZFDC-15-6 | 0.03-35 | 15±0.05 | ±0.5 | 1.15 | Lower range†<br>Mid range<br>Upper range† | 38<br>35<br>28 | 30<br>25<br>20 | One octave from band edge<br>Total range | 0.2<br>0.3 | 0.4<br>0.6 | 4 | 2 |
| ZFDC-20-3 | .2-250 | 19.5±0.5 | ±0.25 | 1.2 | Lower range†<br>Mid range<br>Upper range† | 36<br>33<br>25 | 25<br>25<br>20 | One octave from band edge<br>Total range | 0.25<br>0.35 | 0.5<br>0.6 | 4 | 1.5 |
| ZFDC-20-5 | .1-2000 | 19.5±0.5 | ±0.5# | 1.2 | .1-1 MHz<br>1-100 MHz<br>100-1000 MHz<br>1000-2000 MHz | 30<br>40<br>27<br>22 | 20<br>30<br>20<br>10 | .1-5 MHz<br>0.5-250 MHz<br>250-1000 MHz<br>1000-2000 MHz | 0.3<br>0.2<br>0.7<br>1.5 | 1<br>0.8<br>1.4<br>2.3 | 2 | ½ |
| ZFDC-15-6-75 | 0.02-35 | 14.5±0.5 | ±0.5 | 1.3 | Entire range | 35 | 20 | Entire range | 0.3 | 0.7 | 4 | 1.5 |

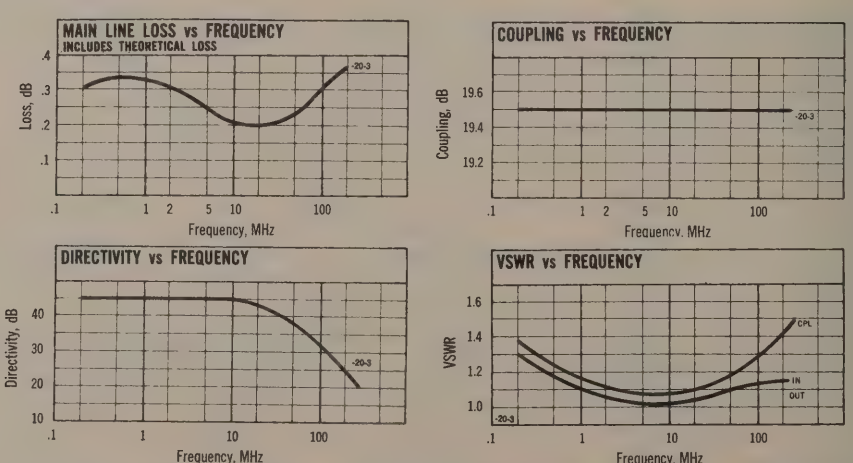
*Upper band ±0.75
# ± 2.0 over 1000 MHz

† Lower band edge to one decade higher. Upper band edge to one octave lower.

## MODEL ZFDC-15-6




## MODEL ZFDC-20-3

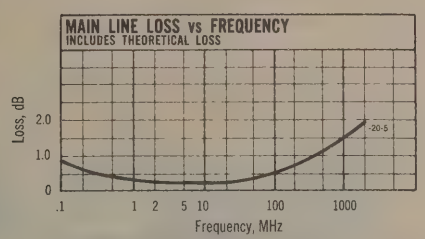


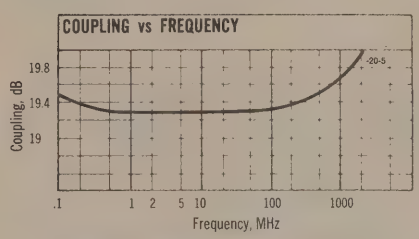

Mini-Circuits 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

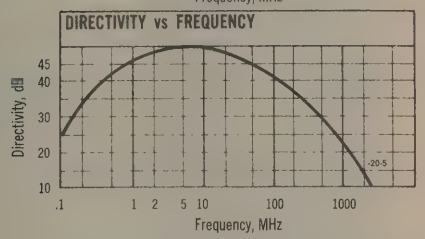
# ZFDC Series
# 30 KHz to 2000 MHz

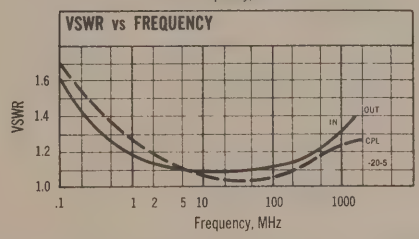
Mini-Circuits

## MODEL ZFDC-20-5

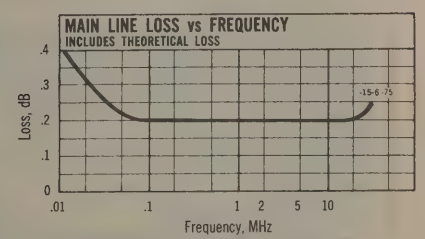


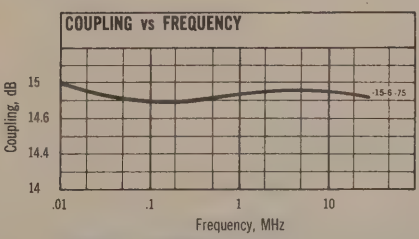



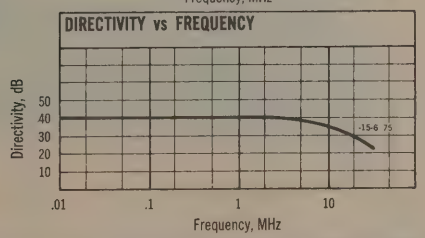



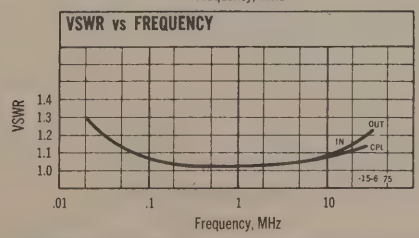




## MODEL ZFDC-15-6-75



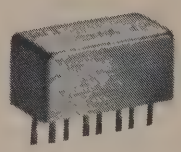



# ELECTRONIC ATTENUATOR/SWITCH

## PAS SERIES



| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| PAS-1 | 5 MHz - 450 MHz | 50 | $27.95 (5-24) |
| PAS-3 | 1 MHz - 200 MHz | 50 | $28.95 (5-24) |

**DESCRIPTION** — The PAS series of electronic attenuator/switches enable attenuation control of RF signals with a maximum of only 20 mA of control current. Due to the specific properties of these attenuators, for a single frequency input all harmonics even and odd order, are virtually eliminated at the output. As a consequence the intercept point is greater than +45 dBm.

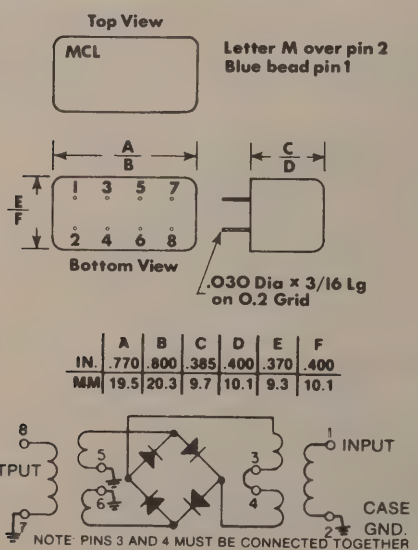
The attenuator/switches are economically priced while covering the very broad frequency range from 1 to 450 MHz. They offer low insertion loss, 1.5 dB, high isolation 50 dB, and exceptional unit to unit matched performance.

Having a volume of only .128 cu. inches, the PAS series is packaged within an RFI shielded metal enclosure and hermetically sealed header. These high performance units have their pins oriented on a 0.2 inch grid.

High reliability is associated with every MCL unit. Every production run is 100% tested and every unit must pass our rigid inspection and high quality standards.

Naturally, our one year guarantee applies to these units.

## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| IN. | .770 | .800 | .385 | .400 | .370 | .400 |
| MM | 19.5 | 20.3 | 9.7 | 10.1 | 9.3 | 10.1 |

**WEIGHT** 5.2 grams .18 ounces

## FEATURES

**Broadband:** 1 MHz to 450 MHz
**High On/Off Ratio:** Typically greater than 50 dB
**Low Insertion Loss:** Typically less than 1.5 dB
**Miniature:** .0128 in³, 0.4″ x 0.8″ PC area, 0.4″ high
**High Reliability:** 100% tested, 1 year guarantee
**Low Cost:** As low as $27.95 in small quantity

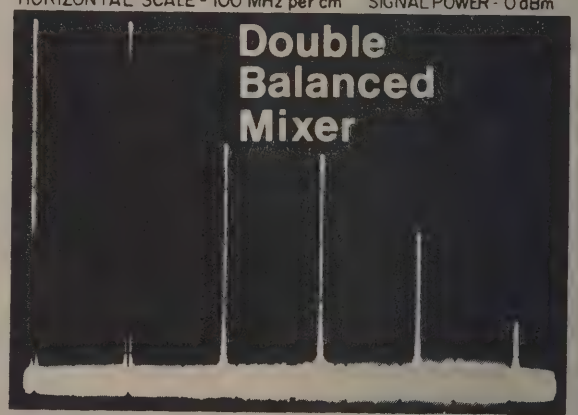
## APPLICATIONS

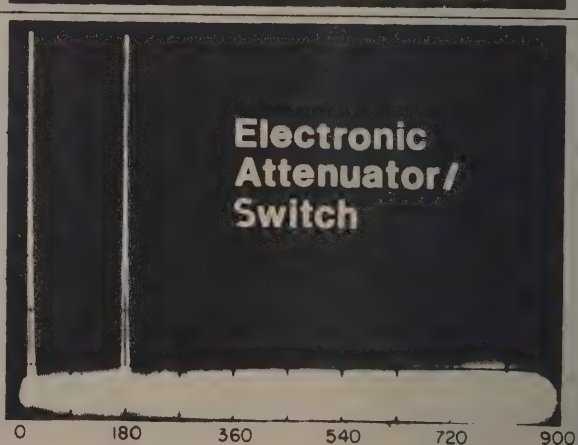
- Electronic Switching
- Current controlled attenuation
- Bi-phase modulation
- Power leveling

## ABSOLUTE MAXIMUM RATINGS

- **Total Input Power:** 1 Watt
- **Total Input Current Peak:** 40 mA
- **Operating and Storage Temp.:** −55°C to +100°C
- **Pin Temperature:** (10 sec.) 510°F

**TYPICAL HARMONIC SPECTRUM COMPARING ATTENUATORS** - CONTROL CURRENT SET FOR 10dB ATTEN.
SIGNAL FREQUENCY - 180 MHz VERTICAL SCALE - 10 dB per cm
HORIZONTAL SCALE - 100 MHz per cm SIGNAL POWER - 0 dBm




Mini-Circuits 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

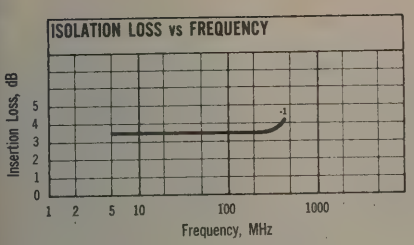
# PAS Series
# 1 MHz to 450 MHz

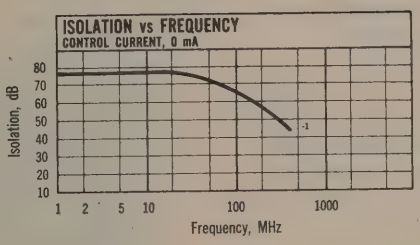
Mini-Circuits

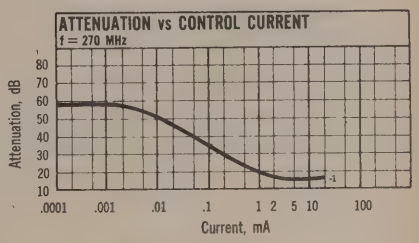
## SPECIFICATIONS

| Model No. | Frequency Range, MHz | | Insertion Loss, dB | | | | Isolation, dB | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | One Octave From Band Edge | | Total Range | | Lower Band Edge to One Decade Higher | | | | Mid Range | | | | Upper Band Edge to One Octave Lower | | | |
| | | | | | | | IN-OUT | | IN-CON | | IN-OUT | | IN-CON | | IN-OUT | | IN-CON | |
| | Input | Control | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. |
| PAS-1 | 5-450 | DC-0.05 | 3.5 | 4.0 | 3.5 | 4.7 | 65 | 50 | 35 | 25 | 45 | 35 | 25 | 15 | 35 | 25 | 20 | 10 |
| PAS-3 | 1-200 | DC-0.05 | 1.4 | 2.0 | 1.6 | 2.5 | 65 | 50 | 35 | 25 | 50 | 40 | 20 | 15 | 50 | 35 | 15 | 10 |

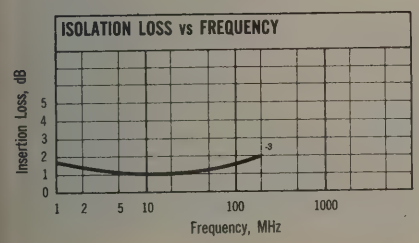
## MODEL PAS-1

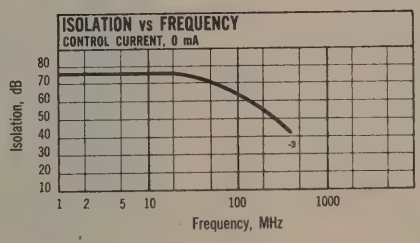


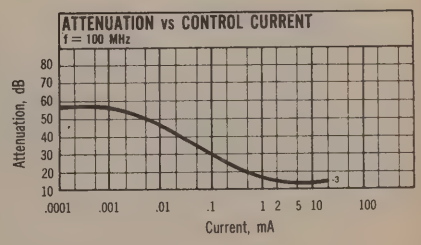




## MODEL PAS-3

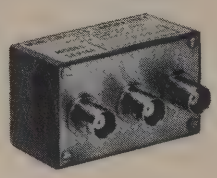


# ELECTRONIC ATTENUATOR/SWITCH

## ZAS SERIES



| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| ZAS-1 | 5 MHz - 450 MHz | 50 | $42.95 (4-24) |
| ZAS-3 | 1 MHz - 200 MHz | 50 | $43.95 (4-24) |

**DESCRIPTION**—The ZAS series of electronic attenuator/switches enable attenuation control of RF signals with a maximum of only 20 mA of control current. Due to the specific properties of these attenuators, for a single frequency input all harmonics even and odd order, are virtually eliminated at the output. As a consequence the intercept point is greater than +45 dBm.

The attenuator/switches are economically priced while covering the very broad frequency range from 1 to 450 MHz. They offer low insertion loss, 1.5 dB, high isolation 50 dB, and exceptional unit to unit matched performance.

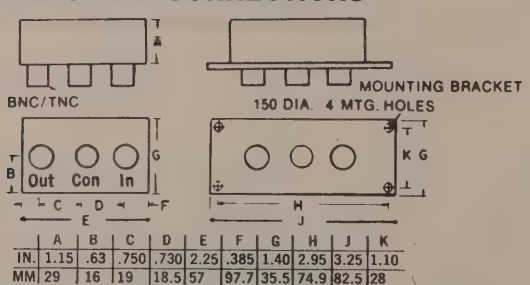
Having BNC connectors as a standard, the ZAS series has as an option TNC connectors at no cost.

The ZAS series is housed in a die cast aluminum case. These rugged units are double shielded to meet tough RFI requirements. The case is finished with a blue baked-enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A.

High reliability is associated with every MCL unit. Every production run is 100% tested and every unit must pass our rigid inspection and high quality standards.

Naturally, our one year guarantee applies to these units.

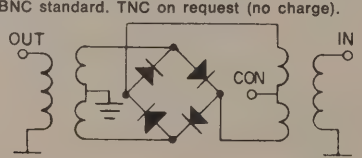
## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| IN. | 1.15 | .63 | .750 | .730 | 2.25 | .385 | 1.40 | 2.95 | 3.25 | 1.10 |
| MM | 29 | 16 | 19 | 18.5 | 57 | 97.7 | 35.5 | 74.9 | 82.5 | 28 |

**MOUNTING BRACKET AVAILABLE ON REQUEST.** Add suffix B to part number and $1.50 to unit cost.

**CONNECTORS:** BNC standard. TNC on request (no charge).




**WEIGHT** 74 grams 2.6 ounces

## FEATURES

**Broadband:** 1 MHz to 450 MHz
**High On/Off Ratio:** Typically greater than 50 dB
**Low Insertion Loss:** Typically less than 1.5 dB
**Compact:** 2.25″ W, 1.15″ D, 1.4″ H
**High Reliability:** 100% tested, 1 year guarantee
**Low Cost:** As low as $43.95 in small quantity

## APPLICATIONS

- Electronic Switching
- Current controlled attenuation
- Bi-phase modulation
- Power leveling

## ABSOLUTE MAXIMUM RATINGS

- **Total Input Power:** 1 Watt
- **Total Input Current Peak:** 40 mA
- **Operating and Storage Temp.:** −55°C to +100°C

**TYPICAL HARMONIC SPECTRUM COMPARING ATTENUATORS** - CONTROL CURRENT SET FOR 10dB ATTEN.
SIGNAL FREQUENCY - 180 MHz VERTICAL SCALE - 10 dB per cm
HORIZONTAL SCALE - 100 MHz per cm SIGNAL POWER - 0 dBm

Mini-Circuits 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

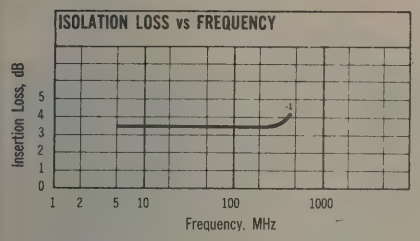
# ZAS Series
# 1 MHz to 450 MHz

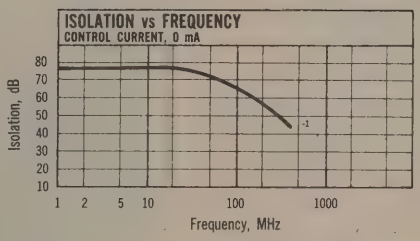
Mini-Circuits

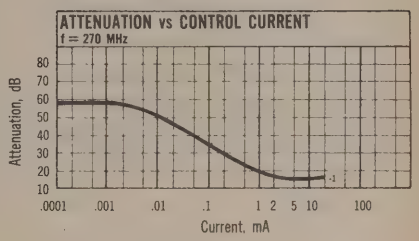
## SPECIFICATIONS

| Model No. | Frequency Range, MHz | | Insertion Loss, dB | | | | Isolation, dB | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | One Octave From Band Edge | | Total Range | | Lower Band Edge to One Decade Higher | | | | Mid Range | | | | Upper Band Edge to One Octave Lower | | | |
| | | | | | | | IN-OUT | | IN-CON | | IN-OUT | | IN-CON | | IN-OUT | | IN-CON | |
| | Input | Control | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. |
| ZAS-1 | 5-450 | DC-0.05 | 3.5 | 4.0 | 3.5 | 4.7 | 65 | 50 | 35 | 25 | 55 | 45 | 25 | 15 | 35 | 25 | 20 | 10 |
| ZAS-3 | 1-200 | DC-0.05 | 1.4 | 2.0 | 1.6 | 2.5 | 65 | 50 | 35 | 25 | 50 | 40 | 20 | 15 | 50 | 35 | 15 | 10 |

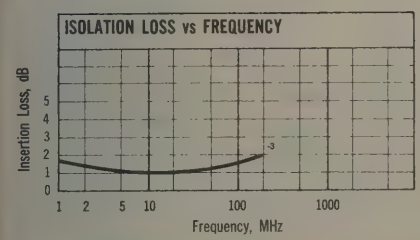
## MODEL ZAS-1

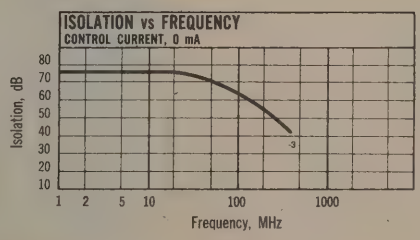


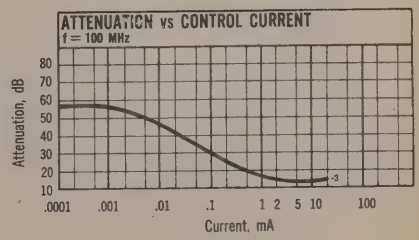




## MODEL ZAS-3

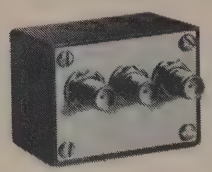


# ELECTRONIC ATTENUATOR/SWITCH

## ZMAS SERIES



| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| ZMAS-1 | 5 MHz - 450 MHz | 50 | $52.95 (4-24) |
| ZMAS-3 | 1 MHz - 200 MHz | 50 | $53.95 (4-24) |

**DESCRIPTION** —The ZMAS series of electronic attenuator/switches enable attenuation control of RF signals with a maximum of only 20 mA of control current. Due to the specific properties of these attenuators, for a single frequency input all harmonics even and odd order, are virtually eliminated at the output. As a consequence the intercept point is greater than +45 dBm.

The attenuator/switches are economically priced while covering the very broad frequency range from 1 to 450 MHz. They offer low insertion loss, 1.5 dB, high isolation 50 dB, and exceptional unit to unit matched performance.

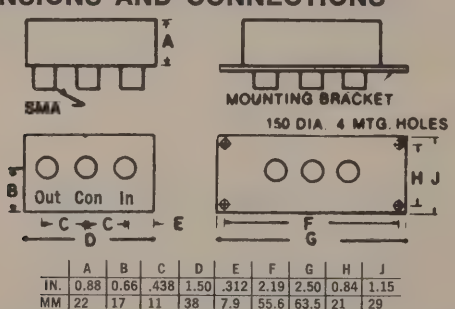
SMA (3mm) connectors are supplied with the Series ZMAS.

The ZMAS series is housed in a die cast aluminum case. These rugged units are double shielded to meet tough RFI requirements. The case is finished with a blue baked-enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A.

High reliability is associated with every MCL unit. Every production run is 100% tested and every unit must pass our rigid inspection and high quality standards.

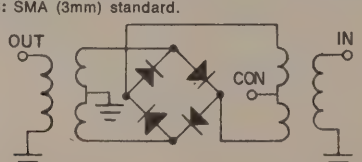
Naturally, our one year guarantee applies to these units.

## DIMENSIONS AND CONNECTIONS




| | A | B | C | D | E | F | G | H | J |
|---|---|---|---|---|---|---|---|---|---|
| IN. | 0.88 | 0.66 | .438 | 1.50 | .312 | 2.19 | 2.50 | 0.84 | 1.15 |
| MM | 22 | 17 | 11 | 38 | 7.9 | 55.6 | 63.5 | 21 | 29 |

**MOUNTING BRACKET AVAILABLE ON REQUEST.** Add suffix B to part number and $1.50 to unit cost.
**CONNECTORS:** SMA (3mm) standard.




**WEIGHT** 34 grams 1.02 ounces

## FEATURES

**Broadband:** 1 MHz to 450 MHz
**High On/Off Ratio:** Typically greater than 50 dB
**Low Insertion Loss:** Typically less than 1.5 dB
**Miniature:** 1.5″ W, .88″ D, 1.15″ H
**High Reliability:** 100% tested, 1 year guarantee
**Low Cost:** As low as $52.95 in small quantity

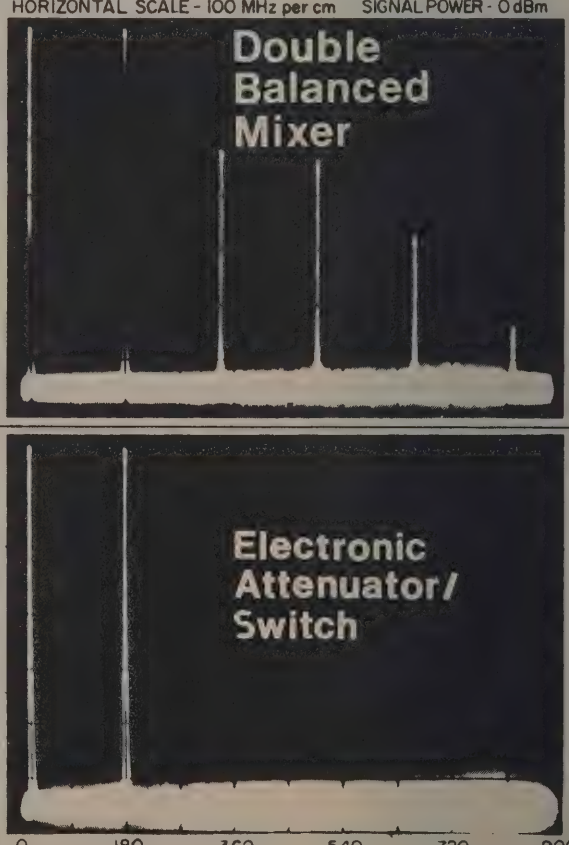
## APPLICATIONS

- Electronic Switching
- Current controlled attenuation
- Bi-phase modulation
- Power leveling

## ABSOLUTE MAXIMUM RATINGS

- **Total Input Power:** 1 Watt
- **Total Input Current Peak:** 40 mA
- **Operating and Storage Temp.:** −55°C to +100°C

**TYPICAL HARMONIC SPECTRUM COMPARING ATTENUATORS** - CONTROL CURRENT SET FOR 10dB ATTEN.
SIGNAL FREQUENCY - 180 MHz VERTICAL SCALE - 10 dB per cm
HORIZONTAL SCALE - 100 MHz per cm SIGNAL POWER - 0 dBm



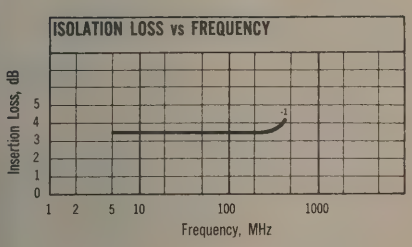
# ZMAS Series
# 1 MHz to 450 MHz

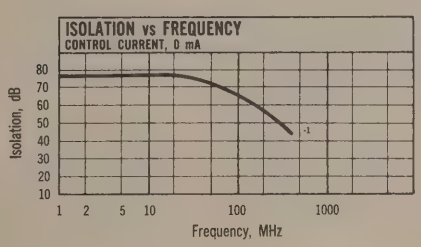
Mini-Circuits

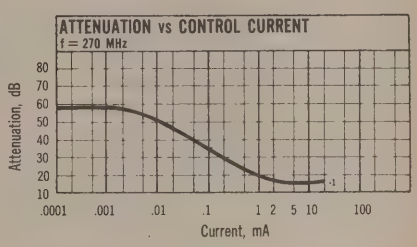
## SPECIFICATIONS

| Model No. | Frequency Range, MHz | | Insertion Loss, dB | | | | Isolation, dB | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | One Octave From Band Edge | | Total Range | | Lower Band Edge to One Decade Higher | | | | Mid Range | | | | Upper Band Edge to One Octave Lower | | | |
| | | | | | | | IN-OUT | | IN-CON | | IN-OUT | | IN-CON | | IN-OUT | | IN-CON | |
| | Input | Control | Typ. | Max. | Typ. | Max. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. | Typ. | Min. |
| ZMAS-1 | 5-450 | DC-0.05 | 3.5 | 4.0 | 3.5 | 4.7 | 65 | 50 | 35 | 25 | 55 | 45 | 25 | 15 | 35 | 25 | 20 | 10 |
| ZMAS-3 | 1-200 | DC-0.05 | 1.4 | 2.0 | 1.6 | 2.5 | 65 | 50 | 35 | 25 | 50 | 40 | 20 | 15 | 50 | 35 | 15 | 10 |

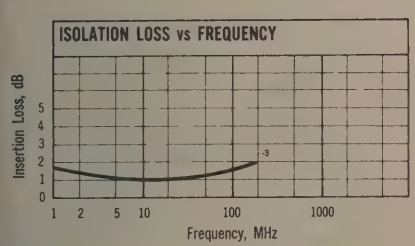
## MODEL ZMAS-1

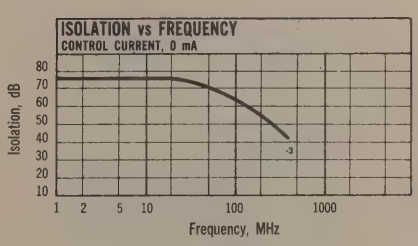


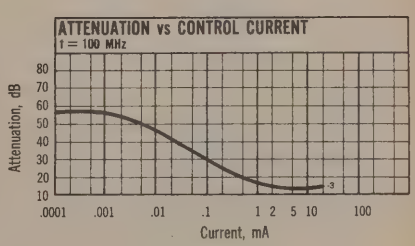




## MODEL ZMAS-3

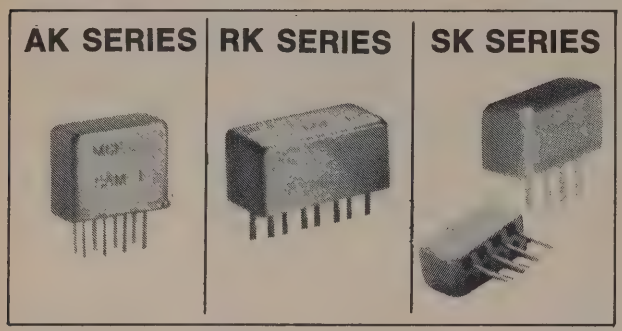



PROMPT SERVICE / ONE WEEK DELIVERY Mini-Circuits

# 0 dBm to +20 dBm
# FREQUENCY DOUBLERS




| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| AK-2 | 1 MHz - 500 MHz | 50 | $19.95 (5-24) |
| RK-2 | 1 MHz - 500 MHz | 50 | $15.95 (5-24) |
| SK-2 | 1 MHz - 500 MHz | 50 | $19.95 (5-24) |
| RK-3 | 50 KHz - 150 MHz | 50 | $14.95 (5-24) |

**DESCRIPTION** — The Mini-Circuits' frequency doublers are economically priced while covering the very broad frequency range from 50 KHz to 1000 MHz. They offer a very low conversion loss, 12.5 dB, and high spurious rejection 40 dB. These doublers give exceptional unit to unit matched performance.

They offer a new degree of freedom in designing frequency multiplier chains. Their many octave band width, and excellent rejection of fundamental and third harmonics enable a significant reduction in filter requirements. In addition, they operate with 50 ohm impedances at input and output ports and are very sensitive to input power. They perform well from 0 dBm to +20 dBm input.

Only well matched hot-carrier diodes and ruggedly constructed transmission line transformers are used. Internally, every component is bonded with silicone rubber to provide protection against shock, vibration and acceleration. Three case styles are available.

## FEATURES

**Broadband:** 50 KHz to 1000 MHz
**Low Conversion Loss:** Typically less than 12.5 dB
**High Spurious Rejection:** Typically greater than 40 dB
**Hermetically Sealed and RFI Shielded**
**High Reliability:** 100% tested, one year guarantee

**AK Series**
**Microminiature:** 0.04 in.³, 0.5″ x 0.23″ PC area, 0.4″ high
**Low Cost:** As low as $19.95 in small quantity

**RK Series**
**Miniature:** 0.128 in.³, 0.4″ x 0.8″ PC area, 0.4″ high
**Low Cost:** As low as $14.95 in small quantity.

**SK Series**
**Micro-min Flatpack:** 0.025 in.³, 0.5″ x 0.23″ PC area, 0.25″ high
**Low Cost:** As low as $19.95 in small quantity

## APPLICATIONS

- Wideband frequency multiplier chains
- Low spurious frequency multiplier chains
- FM, PM modulation chains
- Double frequency range of signal generators

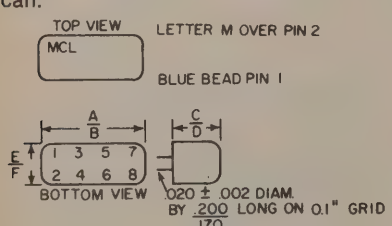
## ABSOLUTE MAXIMUM RATINGS

- **Input Power:** 100 mW
- **Operating and Storage Temperature:** −55°C to +85°C
- **Pin Temperature:** (10 sec.) 510°F
- **Environmental Specifications:** See Index Page

## DIMENSIONS AND CONNECTIONS

### AK Series

The AK units are packaged within an EMI shielded metal enclosure and hermetically sealed header (enclosure is 0.5 by 0.2 by 0.4 in.) Its pins are oriented on a 0.1 inch grid for printed circuit board mounting. The AK units require less PC area than a flat-pack or TO-5 can.




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| IN. | .480 | .500 | .390 | .405 | .210 | .230 |
| MM. | 12.2 | 12.7 | 9.9 | 10.3 | 5.3 | 5.8 |

**PIN LAYOUTS**

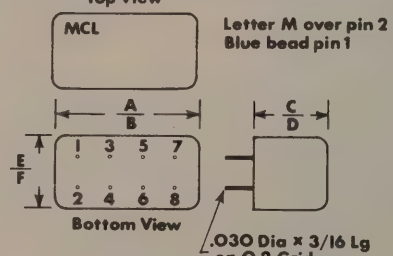
| | Fig. 2 |
|---|---|
| Input | 1,3,4* |
| Output | 8 |
| Ground | 2,5,6,7 |

*Connect all pins together

**WEIGHT** 1.9 grams .07 ounces

### RK Series

Having a volume of only .128 cu. inches, the RK series is packaged within an RFI shielded metal enclosure and hermetically sealed header. These high performance units have their pins oriented on a 0.2 inch grid.




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| IN. | .770 | .800 | .385 | .400 | .370 | .400 |
| MM | 19.5 | 20.3 | 9.7 | 10.1 | 9.3 | 10.1 |

**PIN LAYOUTS**

| | Fig. 2 |
|---|---|
| Input | 1,3,4* |
| Output | 8 |
| Ground | 2,5,6,7 |

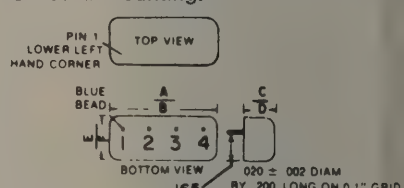
*Connect all pins together

**WEIGHT** 5.2 grams .18 ounces

### SK Series

The SK series units require less PC area than a flatpack or TO-5 can. Use the SK series to solve your tight space problems.

Packaged within an EMI shielded metal enclosure and hermetically sealed header (enclosure is 0.5 by 0.2 in.) the pins are oriented on a 0.1 inch grid for PC board mounting.




| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| IN. | .500 | .480 | .255 | .240 | .230 | .210 | .165 |
| MM | 12.7 | 12.2 | 6.40 | 6.00 | 5.80 | 5.30 | 4.10 |

**PIN LAYOUTS**

| | Fig. 1 |
|---|---|
| Input | 1,2* |
| Output | 4 |
| Ground | 3 |

*Connect all pins together

**WEIGHT** 1.8 grams .07 ounces

**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

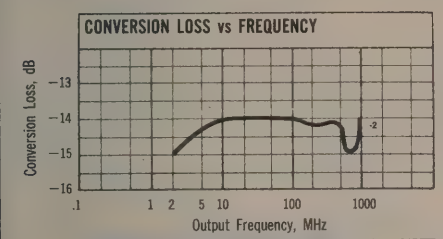
# AK, RK and SK Series
# 50 KHz to 1000 MHz

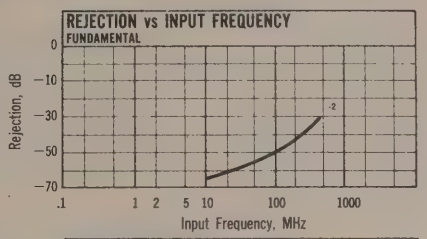
Mini-Circuits

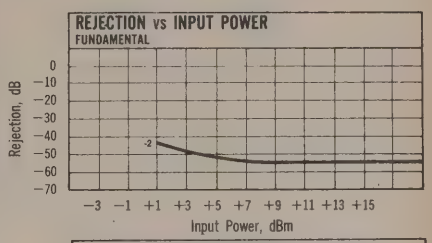
## SPECIFICATIONS

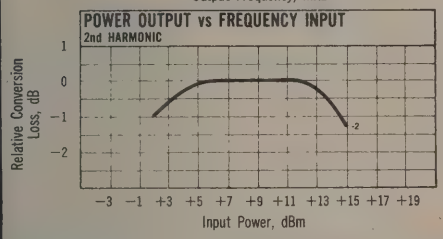
| Model No. | Frequency Range, MHz | | | Conversion Loss, dB | | | Spurious Harmonic Output, dB Relative to F2 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Input | Output | RF Input Power Full Range | Over Freq. Band MHz | Typ. | Max. | Over Freq. Band MHz | F1 Typ. | F1 Max. | F3 Typ. | F3 Max. | F4 Typ. | F4 Max. | Pin Layout |
| AK-2 | 1-500 | 2-1000 | +1 dBm to +15 dBm | 1-100 | 13 | 15 | 2-200 | −40 | −30 | −50 | −40 | −16 | −12 | Fig. 2 |
| RK-2 | | | | 100-300 | 13.5 | 15.5 | 200-600 | −25 | −20 | −40 | −30 | −16 | −12 | Fig. 2 |
| SK-2 | | | | 300-500 | 14.0 | 16.5 | 600-1000 | −20 | −15 | −30 | −25 | −16 | — | Fig. 1 |
| RK-3 | .05-150 | .1-300 | +0 dBm to +13 dBm | .05-50 | 11 | 13 | .1-100 | −40 | −30 | −45 | −30 | −16 | −12 | Fig. 2 |
| | | | | 50-150 | 11.5 | 15 | 100-300 | −35 | −20 | −40 | −20 | −16 | −12 | |

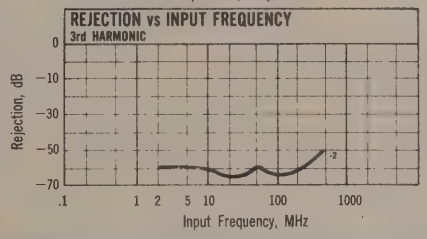
## MODELS AK-2, RK-2, SK-2

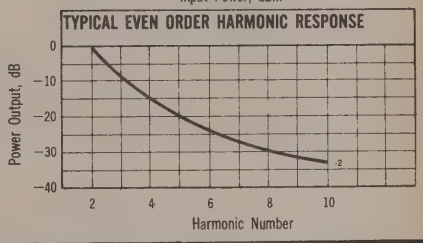


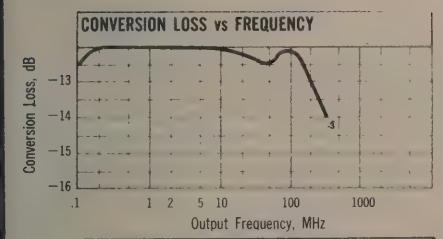



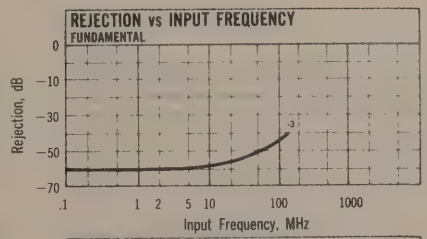



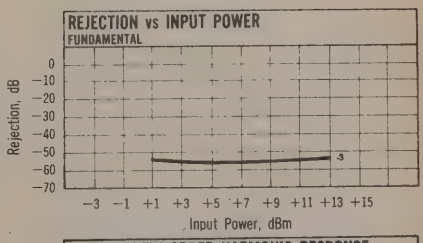



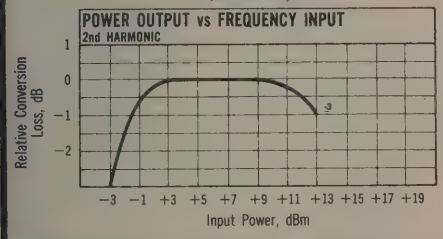



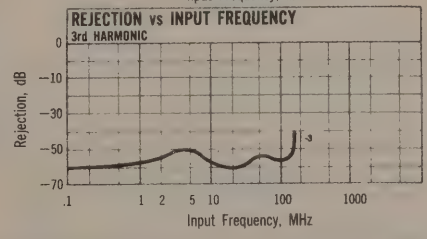

## MODEL RK-3

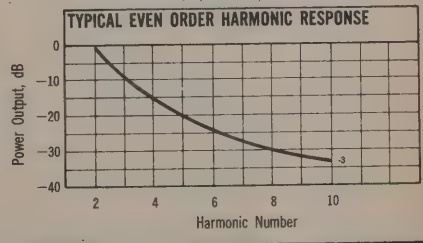


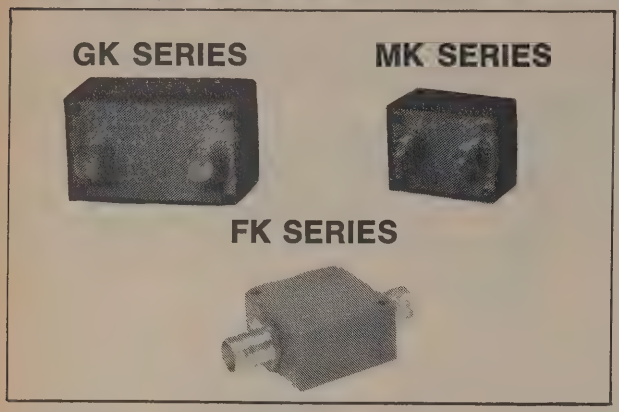



# 0 dBm to +20 dBm
# FREQUENCY DOUBLERS




| MODEL | FREQUENCY | Z (Ohms) | COST |
|---|---|---|---|
| GK-2 | 1 MHz - 500 MHz | 50 | $29.95 (1-4) |
| MK-2 | 1 MHz - 500 MHz | 50 | $39.95 (1-4) |
| GK-3 | 50 KHz - 150 MHz | 50 | $27.95 (1-4) |
| MK-3 | 50 KHz - 150 MHz | 50 | $34.95 (1-4) |
| GK-5 | 10 MHz - 1000 MHz | 50 | $54.95 (1-4) |
| MK-5 | 10 MHz - 1000 MHz | 50 | $64.95 (1-4) |
| FK-5 | 10 MHz - 1000 MHz | 50 | $59.95 (1-4) |

**DESCRIPTION**—These frequency doublers are economically priced while covering the very broad frequency range from 50 KHz to 2000 MHz. They offer a very low conversion loss, 12.5 dB, and high spurious rejection 40 dB. These doublers give exceptional unit to unit matched performance.

They operate with 50 ohm impedances at input and output ports and are not very sensitive to input power, and perform well from 0 dBm to +20 dBm input.

## FEATURES

**Broadband:** 50 KHz to 2000 MHz
**Low Conversion Loss:** Typically less than 12.5 dB
**High Spurious Rejection:** Typically greater than 40 dB
**High Reliability:** 100% tested, one year guarantee

### GK Series

**Connectors:** BNC or TNC
**Compact:** 2.25″ width, 1.4″ height, 1.15″ depth
**Low Cost:** As low as $27.95 in small quantity

### MK Series

**Connectors:** SMA (3mm)
**Miniature:** 1.5″ width, 1.15″ height, 0.88″ depth
**Low Cost:** As low as $34.95 in small quantity

### FK Series

**Connectors:** BNC, TNC, SMA, Type N
**Low Profile:** 1.25″ width, 0.75″ height, 1.25″ depth
**Low Cost:** As low as $59.95 in small quantity

## APPLICATIONS

- Wideband frequency multiplier chains
- Low spurious frequency multiplier chains
- FM, PM modulation chains
- Double frequency range of signal generators

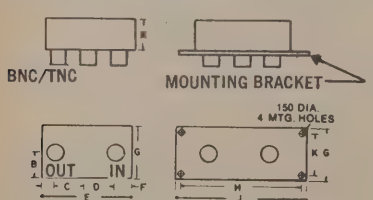
## ABSOLUTE MAXIMUM RATINGS

- **Input Power:** 100 mW
- **Operating and Storage Temperature:** −55°C to +100°C
- **Environmental Specifications:** See Index Page

## DIMENSIONS AND CONNECTIONS

### GK Series

The GK Series packages are rugged double shielded to meet tough RFI requirements. The case is die-cast aluminum finished with a blue baked-enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A.




**Mounting Bracket Available on Request:** Add Suffix B to part number and $1.50 to unit cost.
**Connectors:** BNC standard. TNC on request (no charge).

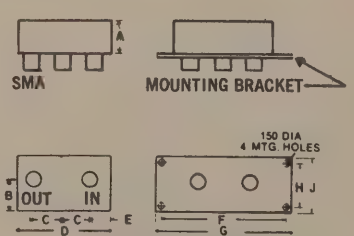
| | A | B | C | D | E |
|---|---|---|---|---|---|
| IN. | 1.15 | .630 | .750 | .730 | 2.25 |
| MM | 29.0 | 16.0 | 19.0 | 18.5 | 57.0 |

| | F | G | H | J | K |
|---|---|---|---|---|---|
| IN. | .385 | 1.40 | 2.95 | 3.25 | 1.10 |
| MM | 9.77 | 35.5 | 74.9 | 82.5 | 28.0 |

**WEIGHT** 74 grams 2.6 ounces

### MK Series

The MK Series packages are rugged double shielded to meet tough RFI requirements. The case is die-cast aluminum finished with a blue baked-enamel per Federal Standard 595 #25109 over phosphoric etch per MIL-C-15328A.



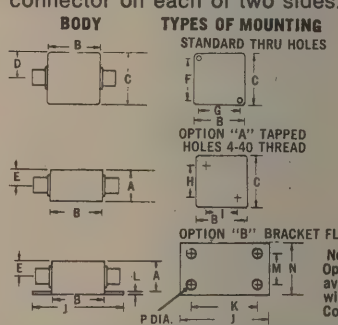

**Mounting Bracket Available on Request:** Add suffix B to part number and $1.50 to unit cost.
**Connectors:** SMA (3mm).

| | A | B | C | D | E | F | G | H | J |
|---|---|---|---|---|---|---|---|---|---|
| IN. | 0.88 | 0.66 | .438 | 1.50 | .312 | 2.19 | 2.50 | 0.84 | 1.15 |
| MM | 22.0 | 17.0 | 11.0 | 38.0 | 7.90 | 55.6 | 63.5 | 21.0 | 29.0 |

**WEIGHT** 34 grams 1.02 ounces

### FK Series

The FK Series is housed in an extremely rugged 1¼″ square metal case with one connector on each of two sides.




Note: Option B not available with Type N Connectors.

**Connectors:** BNC standard. TNC on request (no charge). SMA (3mm) or Type N on request (add $5 to unit cost).
**Mounting Options:** Option "A" tapped holes, no cost. Option "B" mounting bracket, add $1.50 to unit cost. Specify by adding suffix A or B to part no.

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| IN. | 0.75 | 1.25 | 1.25 | .625 | .375 | 1.00 | 1.00 | 0.80 |
| MM | 19.1 | 31.8 | 31.8 | 15.9 | 9.50 | 25.4 | 25.4 | 20.3 |

| | I | J | K | L | M | N | P |
|---|---|---|---|---|---|---|---|
| IN. | 0.80 | 2.188 | 1.688 | .060 | 0.75 | 1.25 | .125 |
| MM | 20.3 | 55.6 | 42.9 | 1.50 | 19.1 | 31.8 | 3.18 |

**WEIGHT** 54.5 grams 1.92 ounces

**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# GK, MK and FK Series
# 50 KHz to 2000 MHz

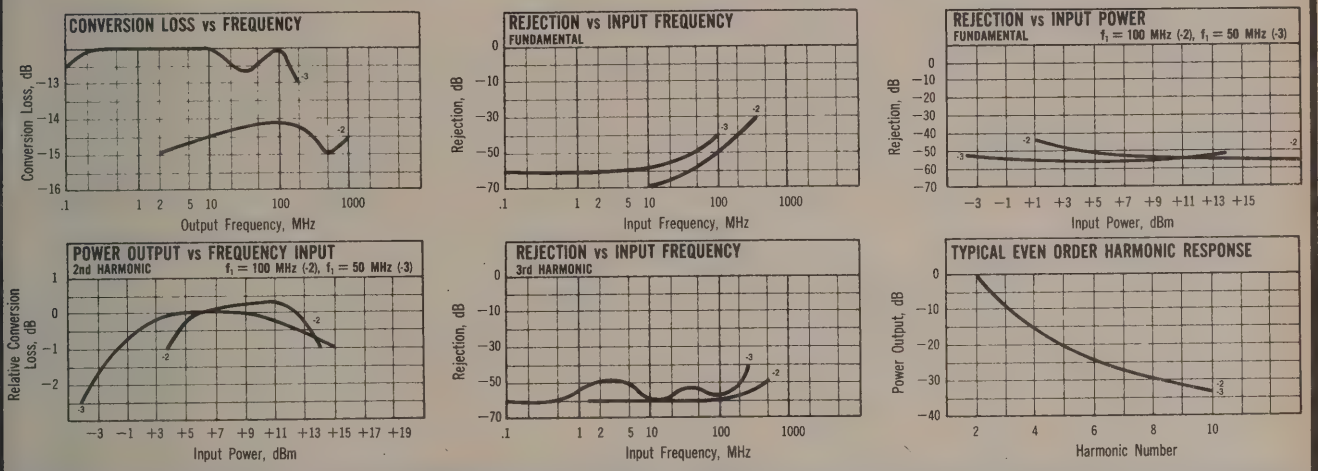
**Mini-Circuits**

## SPECIFICATIONS

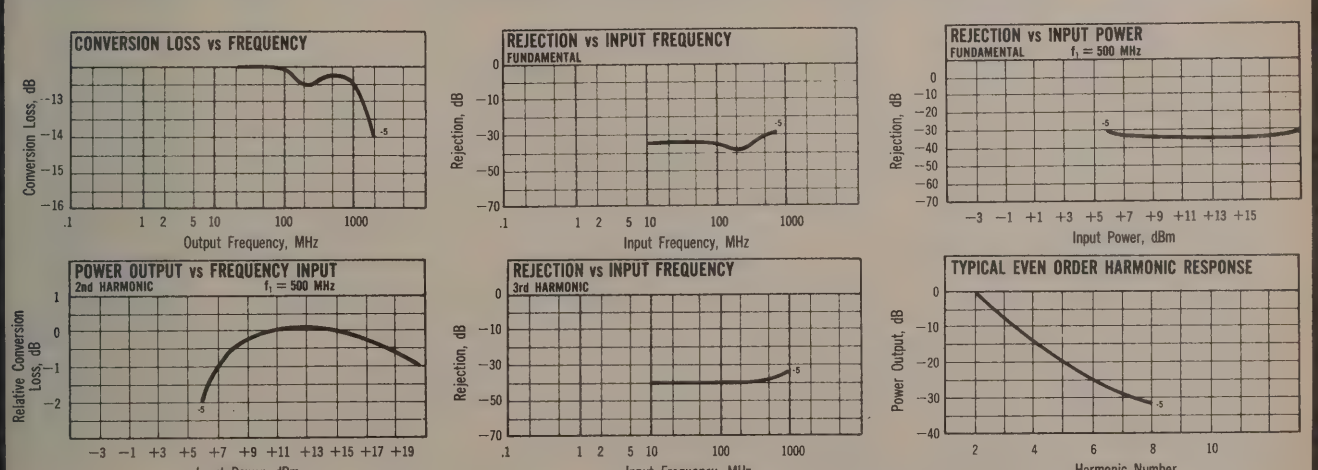
| Model No. | Frequency Range, MHz | | RF Input Power Full Range | Conversion Loss, dB | | | Spurious Harmonic Output, dB Relative to F2 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Input | Output | | Over Freq. Band MHz | Typ. | Max. | Over Freq. Band MHz | F1 Typ. | F1 Max. | F3 Typ. | F3 Max. | F4 Typ. | F4 Max. |
| GK-2<br>MK-2 | 1-500 | 2-1000 | +1 dBm to +15 dBm | 1-100<br>100-300<br>300-500 | 13<br>13.5<br>14.0 | 15<br>15.5<br>16.5 | 2-200<br>200-600<br>600-1000 | −40<br>−25<br>−20 | −30<br>−20<br>−15 | −50<br>−40<br>−30 | −40<br>−30<br>−25 | −16<br>−16<br>−16 | −12<br>−12<br>— |
| GK-3<br>MK-3 | .05-150 | .1-300 | +0 dBm to +13 dBm | .05-50<br>50-150 | 11<br>11.5 | 13<br>15 | .1-100<br>100-300 | −40<br>−35 | −30<br>−20 | −45<br>−40 | −30<br>−20 | −16<br>−16 | −12<br>−12 |
| GK-5<br>MK-5<br>FK-5 | 10-1000 | 20-2000 | +10 dBm to +20 dBm* | 10-600<br>600-1000 | 13<br>14 | 15<br>17 | 10-1000 | −20 | −15 | −25 | −20 | — | — |

* For GK-5/MK-5/FK-5 Full range is +13 dBm to +20 dBm above 700 MHz.

## MODELS GK-2, GK-3, MK-2, MK-3




## MODELS GK-5, MK-5, FK-5



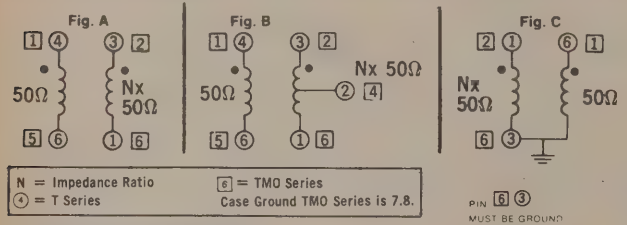

*PROMPT SERVICE / ONE WEEK DELIVERY* **Mini-Circuits**

# Wideband (10 KHz to 800 MHz)
# RF TRANSFORMERS

| SERIES T | SERIES TMO |
|---|---|
| | |

**DESCRIPTION** — These microminiature wideband RF Transformers cover the frequency range from 10 KHz to 800 MHz. They operate with impedance levels from 12.5 ohms to 800 ohms and provide very low insertion loss, typically less than 0.5 dB.

These microminiature series are available in three basic configurations: (1) the primary and secondary windings are DC isolated (2) the primary and secondary windings are DC isolated and the secondary is center-tapped and (3) the primary and secondary windings are unbalanced (i.e. they both have one end grounded).
Although specified for a 50 ohm primary impedance they may be operated with a primary impedance as low as 12.5 ohms. The impedance matching ratio is essentially constant over the primary impedance range. The frequency response may change somewhat.



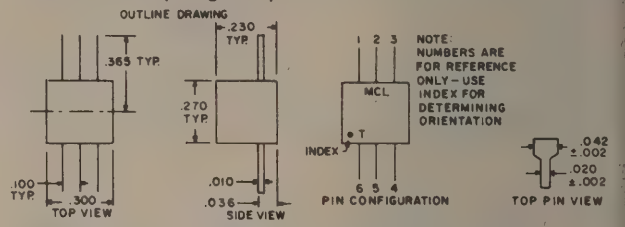

N = Impedance Ratio
④ = T Series
⑥ = TMO Series
Case Ground TMO Series is 7.8.

## DESIGNER'S KITS

(TK-1)—2 transformers of each type T1-1, T2-1, T4-1, T9-1, T16-1 **$32.00**
(TMK-2) — 2 transformers of each type TM01-1, TM02-1, TM04-1, TM09-1, TM016-1 **$49.50**

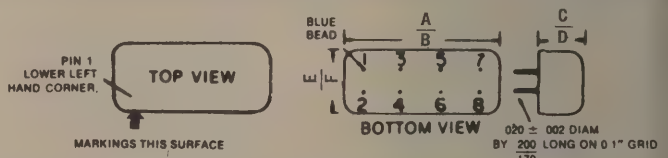
## SERIES T PLASTIC CASE from $2.95

Having a volume of less than .02 cu. inches, these tiny units have their adjacent pins spaced 0.1 inches. Between rows the pin spacing is 0.3 inches. The T-series transformers can be inserted into a standard DIP socket. Unit weight is .01 ounces (.04 grams).




## SERIES TMO METAL CASE from $4.95

The TMO units require less PC area than a flat-pack or TO-5 can. Packaged within an EMI shielded metal enclosure and hermetically sealed header (enclosure is 0.5 by 0.2 by 0.25 in.). Its pins are oriented on a 0.1 inch grid for printed circuit board mounting. Unit weight is 0.7 ounces (1.0 grams).




Note
Numbers are for reference only, use blue bead for determining orientation.

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| INCHES | .500 | .480 | .255 | .240 | .230 | .210 |
| MM | 12.7 | 12.2 | 6.4 | 6.0 | 5.8 | 5.3 |

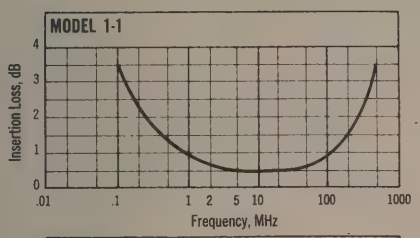
## SPECIFICATIONS

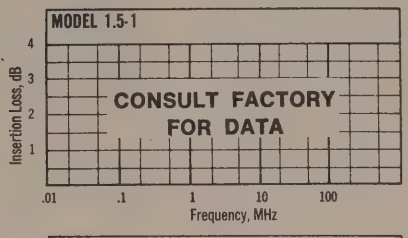
| Impedance Ratio | Primary Impedance Ohms | Insertion Loss 3 dB MHz | Insertion Loss 2 dB MHz | Insertion Loss 1 dB MHz | Maximum Amplitude Unbalance .1 dB MHz | Maximum Amplitude Unbalance .5 dB MHz | Maximum Phase Unbalance Degrees 1° MHz | Maximum Phase Unbalance Degrees 5° MHz | Configuration | Quantity | Price | Model No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 50 | .15-400 | .35-200 | 2-50 | — | — | — | — | Fig. A | 10-49<br>10-49 | $2.95<br>$4.95 | T1-1<br>TM01-1 |
| 1.5 | 50 | .1-300 | .2-150 | .5-80 | — | — | — | — | Fig. A | 10-49<br>10-49 | $3.95<br>$6.25 | T1.5-1<br>TM01.5-1 |
| 2.5 | 50 | .01-100 | .02-50 | .05-20 | — | — | — | — | Fig. A | 10-49<br>10-49 | $3.95<br>$5.95 | T2.5-5<br>TM02.5-6 |
| 4 | 50 | .02-200 | .05-150 | .1-100 | — | — | — | — | Fig. A | 10-49<br>10-49 | $3.95<br>$5.95 | T4-8<br>TM04-6 |
| 9 | 50 | .15-200 | .3-150 | 2-40 | — | — | — | — | Fig. A | 10-49<br>10-49 | $3.45<br>$5.45 | T9-1<br>TM09-1 |
| 16 | 50 | .3-120 | .7-80 | 5-20 | — | — | — | — | Fig. A | 10-49<br>10-49 | $3.95<br>$5.95 | T16-1<br>TM016-1 |
| 1 | 50 | .05-200 | .08-150 | .2-80 | .5-80 | .05-200 | .5-80 | .05-200 | Fig. B | 10-49<br>10-49 | $3.95<br>$5.95 | T1-1T<br>TM01-1T |
| 2 | 50 | .07-200 | .1-100 | .5-50 | 1-50 | .07-200 | 1-50 | .07-200 | Fig. B | 10-49<br>10-49 | $4.25<br>$6.25 | T2-1T<br>TM02-1T |
| 2.5 | 50 | .01-100 | .02-50 | .05-20 | .1-20 | .01-100 | .1-20 | .01-100 | Fig. B | 10-49<br>10-49 | $4.25<br>$6.25 | T2.5-6T<br>TM02.5 |
| 3 | 50 | .05-250 | .1-200 | .5-70 | 1-70 | .05-250 | 1-70 | .05-250 | Fig. B | 10-49<br>10-49 | $3.95<br>$5.95 | T3-1T<br>TM03-1T |
| 4 | 50 | .2-350 | .35-300 | 2-100 | .5-100 | .2-350 | 5-100 | .2-350 | Fig. B | 10-49<br>10-49 | $2.95<br>$4.95 | T4-1<br>TM04-1 |
| 5 | 50 | .3-300 | .6-200 | 5-100 | 10-100 | .3-300 | 10-100 | .3-300 | Fig. B | 10-49<br>10-49 | $4.25<br>$6.25 | T5-1T<br>TM05-1T |
| 15 | 50 | .3-120 | .7-80 | 5-20 | 5-20 | .3-120 | 5-20 | .3-120 | Fig. B | 10-49<br>10-49 | $4.25<br>$6.25 | T13-1T<br>TM013-1T |
| 2 | 50 | .025-600 | .05-400 | .05-200 | — | — | — | — | Fig. C | 10-49<br>10-49 | $3.45<br>$5.45 | T2-1<br>TM02-1 |
| 3 | 50 | .5-800 | 2-400 | — | — | — | — | — | Fig. C | 10-49<br>10-49 | $4.25<br>$6.25 | T3-1<br>TM03-1 |
| 4 | 50 | .2-60 | .5-500 | 2-250 | — | — | — | — | Fig. C | 10-49<br>10-49 | $3.45<br>$5.45 | T4-2<br>TM04-2 |
| 8 | 50 | .15-250 | .25-200 | 2-100 | — | — | — | — | Fig. C | 10-49<br>10-49 | $3.45<br>$5.45 | T8-1<br>TM08-1 |
| 14 | 50 | .2-150 | .5-100 | 2-50 | — | — | — | — | Fig. C | 10-49<br>10-49 | $4.25<br>$6.25 | T14-1<br>TM014-1 |

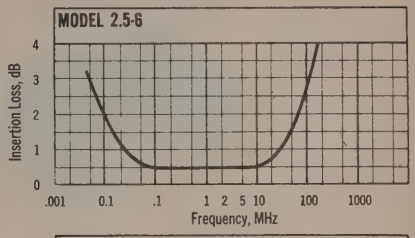
**COMMON SPECIFICATIONS**—Operating and Storage Temperature: T Series −20°C to +85°C, TMO Series −55°C, to +100°C. Total Input Power ¼ watt.

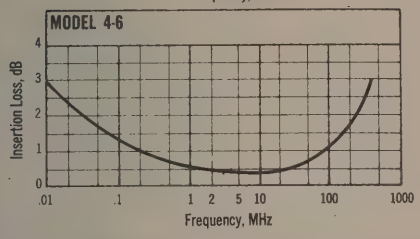
**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

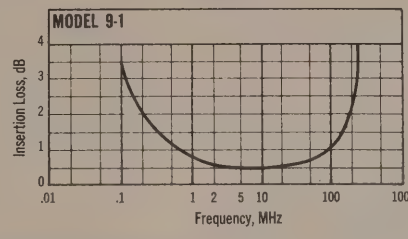
## FIG. A INSERTION LOSS VS FREQUENCY

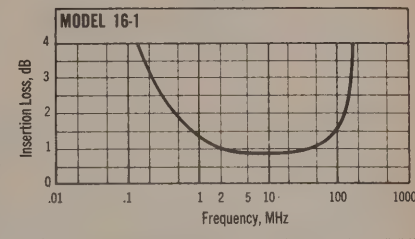


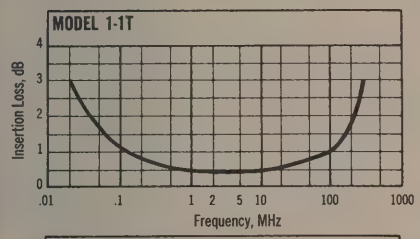



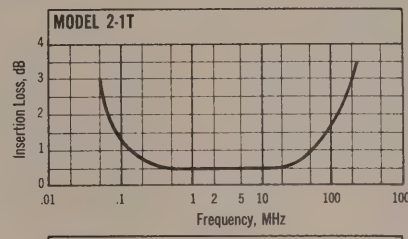



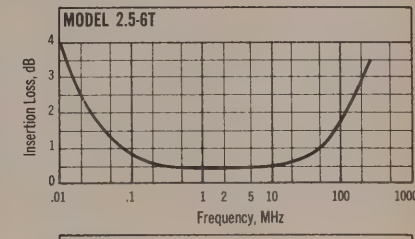



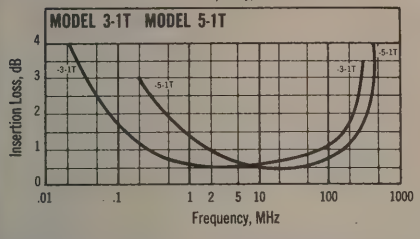



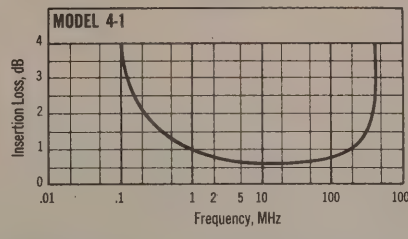

## FIG. B INSERTION LOSS VS FREQUENCY

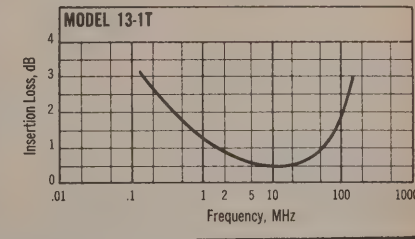


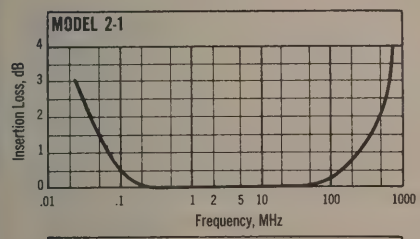



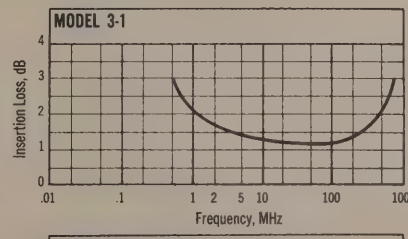



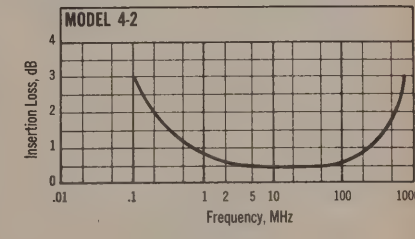



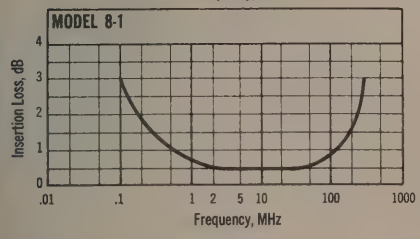



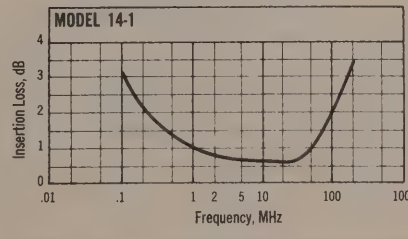

## FIG. C INSERTION LOSS VS FREQUENCY



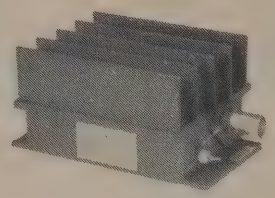



# High Power (+28dBm)
# AMPLIFIERS, BROADBAND

## ZHL SERIES



**FEATURES**

**Frequency Range:** 2 MHz to 500 MHz
**Compact:** 4.13″ x 2.69″ x 2.63″
**Connectors:** BNC
**Price:** $199 (1-9)

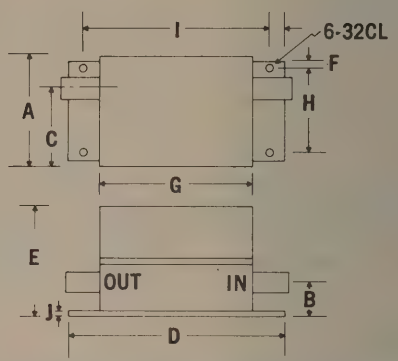
**DESCRIPTION** — The ZHL-1A RF power amplifier is capable of providing approximately 1 watt of power output over a broad frequency range from 2 MHz to 500 MHz. Using an ultra linear Class A design, the ZHL-1A provides a minimum of 16 dB gain over the full frequency range. Gain flatness is typically within ±0.5 dB.

The ZHL-1A is unconditionally stable and can be connected to any load impedance without amplifier damage or oscillation. Having a two stage design, and incorporating a highly reliable power output transistor enables the ZHL-1A to be designed for reliability of performance.

BNC connectors are supplied. Housed in a 3/16 inch aluminum case, the ZHL-1A is constructed to withstand tough environments. This rugged case includes a hefty heat sink as an integral part of the case construction.

The high performance ZHL-1A is offered at a remarkable price of ½ to ⅓ the cost of competitive units.

**DIMENSIONS AND CONNECTIONS**




| | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| IN | 2.60 | .665 | 1.3 | 3.75 | 1.84 | .187 | 3.0 | 1.025 | 3.375 | .090 |
| CM. | 6.60 | 1.69 | 3.30 | 9.33 | 4.67 | .47 | 7.62 | 4.13 | 8 75 | .229 |

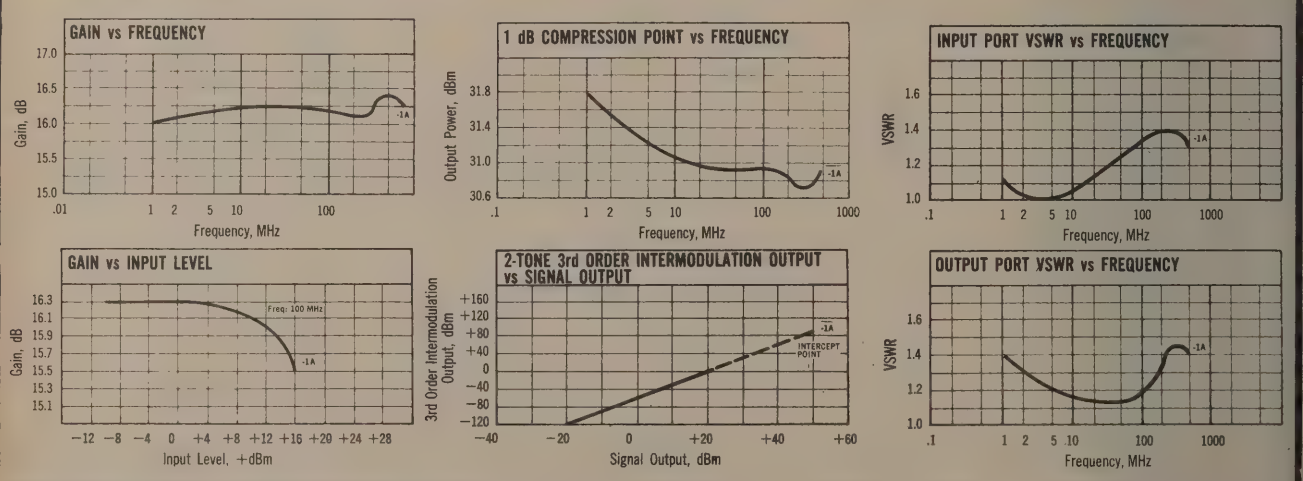
**WEIGHT** 625 grams 1.38 lbs.

## SPECIFICATIONS

| Model No. | Frequency Range MHz | Gain dB | Gain Flatness dB | Maximum Power Output dBm 1-dB Compression | Noise Figure dB | Intercept Point 3rd Order dBm | Impedance Ohms | | VSWR, Max. | | DC Power | | Quantity | Price |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Input | Output | Input | Output | Voltage | Current | | |
| ZHL-1A | 2-500 | 16 Min. | 1.0 dB Max. | +28 Min. | 11 Typ. | +38 Typ. | 50 | 50 | 2:1 | 2:1 | +24V | 0.6A | 1-9 | $199 |

**COMMON SPECIFICATIONS:** Total Input Power: +20 dBm. Operating Temperature: −0°C to +65°C. Storage Temperature: −55°C to +100°C.

## MODEL ZHL-1A

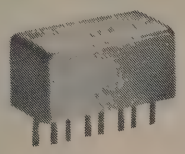



**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# Broadband LIMITERS

Mini-Circuits

## PLS SERIES



**FEATURES**

**Frequency Range:** 100 KHz to 150 MHz
**Miniature:** .8″ x .4″ .4″
**PC Mount:** .2″ Grid
**Price:** $15.95 (5-49)

**DESCRIPTION** —Having a volume of only .128 cu. inches, the PLS series covers a very broad frequency range from 100 KHz to 150 MHz. They have a dynamic range from +6 to +20 dBm and provide exceptionally hard limiting of a .05 dB output change per dB input change.

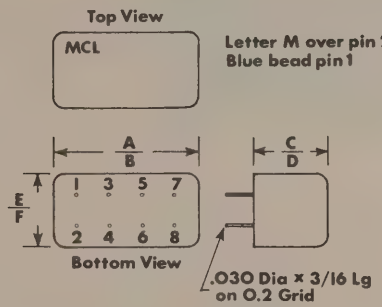
The PLS series has been designed to provide very small phase variations as the input level is changed. A bias current of about 3 mA from a 50 Ω source is required to excite the PLS limiter.

When the PLS series limiter is used with Mini-Circuits ZHL series amplifiers, a constant +15 dBm output can be obtained from 1 to 150 MHz.

Packaged within an RFI shielded metal enclosure and hermetically sealed header, these high performance units have their pins oriented on a 0.2 inch grid.

Only well matched hot-carrier diodes and ruggedly constructed transmission line transformers are used. Internally, every component is bonded to the header and case with silicone rubber to provide super reliable protection against shock, vibration and acceleration.

**DIMENSIONS AND CONNECTIONS**




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| IN. | .770 | .800 | .385 | .400 | .370 | .400 |
| MM | 19.5 | 20.3 | 9.7 | 10.1 | 9.3 | 10.1 |

**PIN CONNECTIONS**

| | Fig. 14 |
|---|---|
| Output | 8 |
| Input | 1 |
| Control | 3,4 |
| Ground | 2,5,6,7 |
| Case Ground | 2 |

**NOTE: PINS 3 & 4 CONNECT TOGETHER**

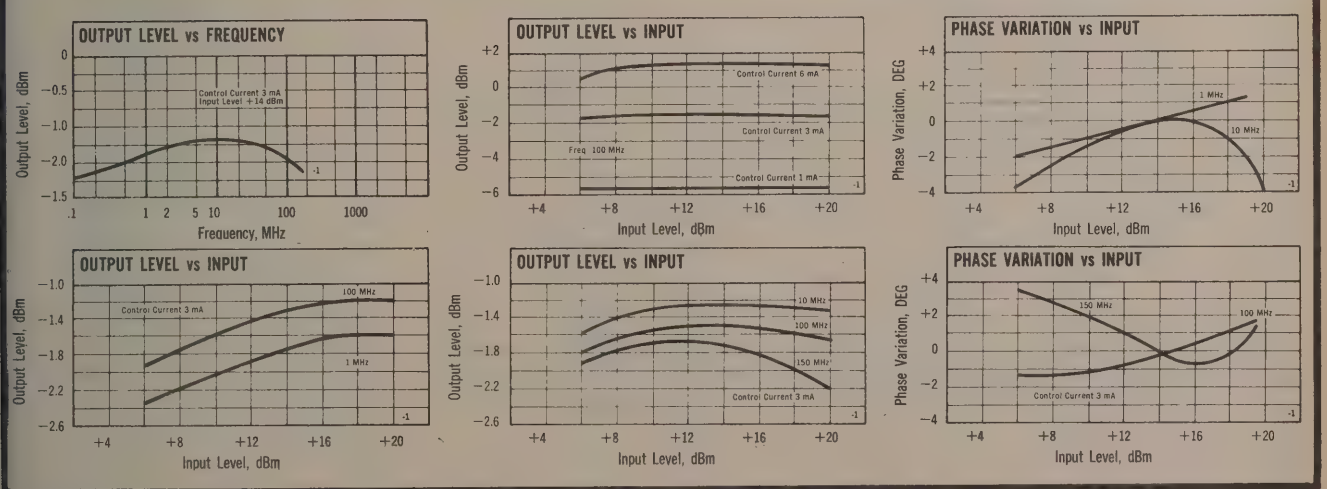
**WEIGHT** 5.2 grams .18 ounces

## SPECIFICATIONS

| Model No. | Frequency Range MHz | Input Level Range dBm | Output Level (Control Current 3 mA) | Control Current Source Impedance | Limiting (△ Output/△ Input dB/dB) Input Level dBm Typ. | | | Relative Phase Variation Input Level Typ. | | | Control Current mA | Pin Layout | Qty. | Price |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | +6-+10 | +10-+16 | +16-+20 | +6-+10 | +10-+16 | +16-+20 | | | | |
| PLS-1 | 0.1-150 | +6-+20 | −1.6 dBm Typ. | 50 ohms | 0.1 | .05 | 0.7 | 0.05 | 0.05 | 1.0 | 3 Typ. | Fig. 14 | 5-49 | $15.95 |

**COMMON SPECIFICATIONS:** Impedance, All Ports: 50 ohms. Operation and Storage Temperature: −55°C to +100°C.

## MODEL PLS-1




PROMPT SERVICE / ONE WEEK DELIVERY Mini-Circuits

# MODEL INDEX


**AMPLIFIERS, BROADBAND**
ZHL-1 A ..... 168

**DIRECTIONAL COUPLERS**
PDC-10-1 ..... 142
PDC-10-1-75 ..... 142
PDC-10-2 ..... 142
PDC-10-21 ..... 142
PDC-10-22 ..... 142
PDC-15-6 ..... 142
PDC-15-6-75 ..... 142
PDC-20-1 ..... 142
PDC-20-3 ..... 142
PDC-20-3-75 ..... 142
ZDC-10-1 ..... 146
ZDC-10-1-75 ..... 146
ZDC-10-2 ..... 146
ZDC-15-6 ..... 146
ZDC-15-6-75 ..... 146
ZDC-20-1 ..... 146
ZDC-20-3 ..... 146
ZDC-20-3-75 ..... 146
ZDC-2375 ..... 146
ZFDC-10-1 ..... 152
ZFDC-10-2 ..... 152
ZFDC-10-21 ..... 152
ZFDC-10-22 ..... 152
ZFDC-15-6 ..... 152
ZFDC-15-6-75 ..... 152
ZFDC-20-3 ..... 152
ZFDC-20-5 ..... 152
ZMDC-10-1 ..... 150
ZMDC-10-2 ..... 150
ZMDC-15-6 ..... 150
ZMDC-20-1 ..... 150
ZMDC-20-3 ..... 150

**ELECTRONIC ATTENUATOR/SWITCH**
PAS-1 ..... 156
PAS-3 ..... 156
ZAS-1 ..... 158
ZAS-3 ..... 158
ZMAS-1 ..... 160
ZMAS-3 ..... 160

**FREQUENCY DOUBLERS**
AK-2 ..... 162
FK-5 ..... 164
GK-2 ..... 164
GK-3 ..... 164
GK-5 ..... 164
MK-2 ..... 164
MK-3 ..... 164
MK-5 ..... 164
RK-2 ..... 162
RK-3 ..... 162

**LIMITERS**
PLS-1 ..... 169

**MIXERS**
GRA-1 ..... 30
GRA-3 ..... 30
GRA-6 ..... 30
GRA-8 ..... 30
GRA-1H ..... 54
GRA-3H ..... 54
MA-1 ..... 80
RAY-1 ..... 74
RAY-2 ..... 74
RAY-3 ..... 74
SAM-1 ..... 26
SAM-2 ..... 26
SAM-3 ..... 26
SAM-4 ..... 26
SAM-5 ..... 26
SAM-1H ..... 60
SAM-2H ..... 60
SAM-3H ..... 60
SBL-1 ..... 16
SBL-1X ..... 16
SRA-1 ..... 8
SRA-1-1 ..... 8
SRA-1W ..... 8
SRA-2 ..... 8
SRA-3 ..... 8
SRA-4 ..... 8
SRA-5 ..... 8
SRA-6 ..... 8
SRA-8 ..... 8
SRA-11 ..... 8
SRA-12 ..... 8
SRA-1H ..... 48
SRA-1WH ..... 48
SRA-2H ..... 48
SRA-3H ..... 48
SRA-11H ..... 48
TAK-5 ..... 18
TAK-6 ..... 18
TAK-7 ..... 18
TAK-9 ..... 18
TAK-1H ..... 58
TAK-1WH ..... 58
TAK-3H ..... 58
TFM-2 ..... 20
TFM-3 ..... 20
TFM-4 ..... 20
TFM-11 ..... 20
TFM-12 ..... 20
TFM-15 ..... 20
TFM-1H ..... 56
TFM-2H ..... 56
TFM-3H ..... 56
TSM-1 ..... 24
TSM-3 ..... 24
ZAD-1 ..... 32
ZAD-1-1 ..... 32
ZAD-1W ..... 32
ZAD-2 ..... 32
ZAD-3 ..... 32
ZAD-4 ..... 32
ZAD-6 ..... 32
ZAD-8 ..... 32
ZAD-11 ..... 32
ZAD-12 ..... 32
ZAD-1H ..... 60
ZAD-1WH ..... 60
ZAD-2H ..... 60
ZAD-3H ..... 60
ZAD-11H ..... 60
ZAD-1SH ..... 70
ZAD-1WSH ..... 70
ZAD-3SH ..... 70
ZAY-1 ..... 76
ZAY-2 ..... 76
ZAY-3 ..... 76
ZFM-2 ..... 38
ZFM-3 ..... 38
ZFM-4 ..... 38
ZFM-11 ..... 38
ZFM-12 ..... 38
ZFM-15 ..... 38
ZFM-1H ..... 68
ZFM-2H ..... 68
ZFM-3H ..... 68
ZLW-1 ..... 42
ZLW-1-1 ..... 42
ZLW-1W ..... 42
ZLW-2 ..... 42
ZLW-3 ..... 42
ZLW-5 ..... 42
ZLW-6 ..... 42
ZLW-8 ..... 42
ZLW-11 ..... 42
ZLW-12 ..... 42
ZLW-1H ..... 64
ZLW-1WH ..... 64
ZLW-2H ..... 64
ZLW-3H ..... 64
ZLW-11H ..... 64
ZLW-1SH ..... 72
ZLW-1WSH ..... 72
ZLW-3SH ..... 72
ZMA-2 ..... 82
ZMA-3 ..... 82
ZMY-1 ..... 78
ZMY-2 ..... 78
ZMY-3 ..... 78

**POWER SPLITTER/ COMBINERS**
MSC-2-1 ..... 88
MSC-2-1W ..... 88
PSC-2-1 ..... 86
PSC-2-1-75 ..... 96
PSC-2-1W ..... 86
PSC-2-2 ..... 86
PSC-2375 ..... 96
PSC-3-1 ..... 114
PSC-3-1-75 ..... 114
PSC-3-2 ..... 114
PSC-4-1 ..... 122
PSC-4-1-75 ..... 122
PSC-4-3 ..... 122
PSC-4-6 ..... 122
PSC-6-1 ..... 130
PSC-8-1 ..... 132
PSC-8-1-75 ..... 132
PSCJ-2-1 ..... 106
PSCJ-2-2 ..... 106
PSCQ-2-50 ..... 100
PSCQ-2-90 ..... 100
PSCQ-2-180 ..... 100
ZAPD-1 ..... 98
ZAPD-2 ..... 98
ZAPD-4 ..... 98
ZFSC-2-1 ..... 96
ZFSC-2-1W ..... 96
ZFSC-2-2 ..... 96
ZFSC-2-4 ..... 96
ZFSC-2-5 ..... 96
ZFSC-3-1 ..... 120
ZFSC-3-1W ..... 120
ZFSC-4-1 ..... 128
ZFSC-4-1W ..... 128
ZFSC-8-1 ..... 134
ZFSC-8-1-75 ..... 134
ZFSC-16-1 ..... 136
ZFSC-24-1 ..... 138
ZFSCJ-2-1 ..... 112
ZFSCJ-2-3 ..... 112
ZMSC-2-1 ..... 90
ZMSC-2-1W ..... 90
ZMSC-2-2 ..... 90
ZMSC-3-1 ..... 118
ZMSC-3-2 ..... 118
ZMSC-4-1 ..... 126
ZMSC-4-2 ..... 126
ZMSC-4-3 ..... 126
ZMSCJ-2-1 ..... 110
ZMSCJ-2-2 ..... 110
ZMSCQ-2-50 ..... 104
ZMSCQ-2-90 ..... 104
ZMSCQ-2-180 ..... 104
ZSC-2-1 ..... 90
ZSC-2-1-75 ..... 96
ZSC-2-1W ..... 90
ZSC-2-2 ..... 90
ZSC-2375 ..... 96
ZSC-3-1 ..... 116
ZSC-3-1-75 ..... 116
ZSC-3-2 ..... 116
ZSC-3-2-75 ..... 116
ZSC-4-1 ..... 124
ZSC-4-1-75 ..... 124
ZSC-4-2 ..... 124
ZSC-4-3 ..... 124
ZSCJ-2-1 ..... 108
ZSCJ-2-2 ..... 108
ZSCQ-2-50 ..... 102
ZSCQ-2-90 ..... 102
ZSCQ-2-180 ..... 102

**TRANSFORMERS, R.F.**
T1-1 ..... 166
T1-1T ..... 166
T1.5-1 ..... 166
T2-1 ..... 166
T2-1T ..... 166
T2.5-6 ..... 166
T2.5-6T ..... 166
T3-1 ..... 166
T3-1T ..... 166
T4-1 ..... 166
T4-2 ..... 166
T4-6 ..... 166
T5-1T ..... 166
T8-1 ..... 166
T9-1 ..... 166
T13-1T ..... 166
T14-1 ..... 166
T16-1 ..... 166
TMO-1-1 ..... 166
TMO1-1T ..... 166
TMO1.5-1 ..... 166
TMO2-1 ..... 166
TMO2-1T ..... 166
TMO2.5-6 ..... 166
TMO2.5-6T ..... 166
TMO3-1 ..... 166
TMO3-1T ..... 166
TMO4-1 ..... 166
TMO4-2 ..... 166
TMO4-6 ..... 166
TMO5-1T ..... 166
TMO8-1 ..... 166
TMO9-1 ..... 166
TMO13-1T ..... 166
TMO14-1 ..... 166
TMO16-1 ..... 166


**Mini-Circuits** 2625 E. 14th St., Brooklyn, NY 11235 (212) 769-0200/Dom. Telex 125460/Int'l. Telex 620156

# stay up to date

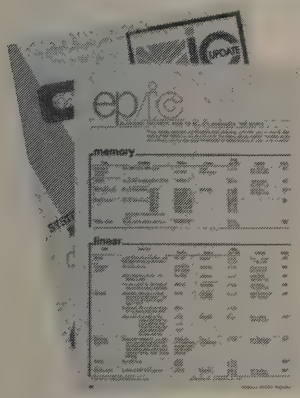
**SUBSCRIBE TO ELECTRONIC PRODUCTS MAGAZINE. IT'S YOUR *COMPLETE* GUIDE TO EVERYTHING THAT'S NEW IN THE FAST-CHANGING WORLD OF ELECTRONIC PRODUCTS AND SYSTEMS.**

**FEATURE STORIES** every month on electronic products, applications and availability.

**FORUMS**—Reports on meetings of manufacturers, users and distributors. Get the very latest news on a wide variety of products.

**NEW PRODUCT NEWS**—Hundreds of new products are introduced each month. You'll get the facts on not only what the new product is, but also where to get it, basic prices and current delivery.

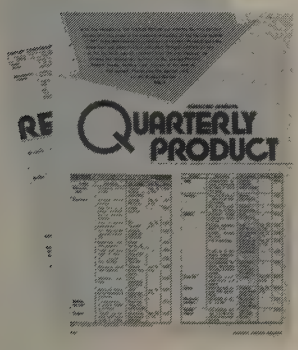
**EP/IC UPDATE**—Exclusive in ELECTRONIC PRODUCTS. A monthly report on *everything* that's new in the fast-moving world of integrated circuits.




**QUARTERLY PRODUCT REVIEW**—Another exclusive in ELECTRONIC PRODUCTS. A complete report of *every* new electronic product introduced in the previous quarter. This feature is in the January, April, July and October issues.

**QUARTERLY PRODUCT PLANNING DIRECTORY**—A compilation of the latest catalogs of a wide variety of electronic products and systems.

**OUTLOOK**—Important industry news affecting electronic products and systems.




**COMPONENT CAPERS**—A humorous look at the strange and wonderful world of electronics.

**MINI-GLOSSARIES,** Quizzes and more—Each and every month for over twenty years the readers of ELECTRONIC PRODUCTS learn something new about the products they work with and specify.

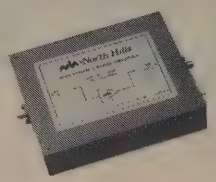
***If you are not now a subscriber, write to:***
***Dorothy Renoud, ELECTRONIC PRODUCTS MAGAZINE, 645 Stewart Avenue, Garden City, NY 11530.***
***Ask for a free qualification card.***

United Technical Publications, Inc., Div. of Cox Broadcasting Corp., 645 Stewart Ave., Garden City, NY 11530/(516) 222-2500

# North Hills

# VIDEO, RF, and MICROWAVE AMPLIFIERS

## WIDE DYNAMIC RANGE AMPLIFIERS — SERIES AS-61

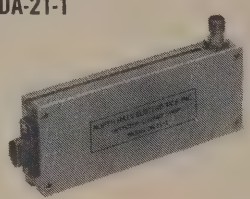


- Low Cross Modulation
- Low Intermodulation Distortion
- Low Cost

| Model | Frequency Range (MHz) | Gain (dB) Min. | Noise Figure (dB) Max. | Power Output (dBm) Min. | Intercept Points (dBm) Typ. 2nd Order | Intercept Points (dBm) Typ. 3rd Order | Power Req. V/mA dc |
|---|---|---|---|---|---|---|---|
| AS61-1310 | 1.5-32 | 9 | 5.0 | +28 | +95 | +50 | 20/200 |
| AS61-1320 | | 14 | 5.5 | | +90 | +49 | /350 |
| AS61-1330 | | 19 | 5.5 | | +90 | +49 | /350 |
| AS61-1350 | | 28 | 5.5 | | +90 | +49 | /500 |
| AS61-1910 | 20-90 | 9 | 4.5 | +27 | +87 | +50 | 20/200 |
| AS61-1920 | | 14 | 5.5 | | +95 | +52 | /350 |
| AS61-1930 | | 19 | 5.5 | | +84 | +48 | /350 |
| AS61-1950 | | 28 | 5.5 | | +84 | +48 | /500 |
| AS61-2110 | 100-160 | 9 | 5.5 | +26 | +84 | +49 | 20/200 |
| AS61-2120 | | 14 | 6.0 | | +85 | +49 | /350 |
| AS61-2130 | | 19 | 5.5 | | +84 | +49 | /350 |
| AS61-2150 | | 28 | 5.5 | | +84 | +47 | /500 |
| AS61-2151 | 30-180 | 27 | 5.0 | +32 | +85 | +52 | 20/700 |
| AS61-2510 | 220-470 | 7 | 9.0 | +28 | +72 | +49 | 20/500 |
| AS61-2520 | | 10 | 6.0 | +26 | +67 | +46 | /250 |
| AS61-2530 | | 17 | 5.0 | +27 | +62 | +40 | /150 |
| AS61-2550 | | 20 | 7.0 | +26 | +70 | +45 | /500 |

## DETECTOR-LOGAMP STRIP — MODEL DA-21-1

0.5 to 18 GHz



**Model DA-21-1 Detector-Logamp Strip** is a unique product for signal processing in pulse-modulated RF receiving systems. In its miniature package, the strip incorporates a highly accurate logarithmic video amplifier, a detector, a limiter and a test oscillator.

The unit accepts RF signals from 0.5 to 18 GHz and provides excellent tangential sensitivity at wide bandwidth without pulse stretching. An internal pulsed RF oscillator enables channel and detector testing by the application of a negative logic pulse to the Test Input pin. It meets the environmental specifications of **MIL-E-5400, Class 2** for airborne electronic equipment.

**SPECIFICATIONS**

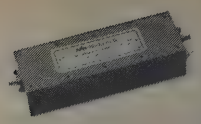
**Input**

| | |
|---|---|
| Dynamic Range: | 50 dB |
| Log Accuracy: (referred to input) | ±1.5 dB |
| TSS (2-18 GHz): Pulse of 1 μsec Width & Repetition Rate of 1000 pps: | −43 dBm |
| Maximum Out-of-Band Level: | +10 dBm |

**Output**

| | |
|---|---|
| Dynamic Range: | 27 dB approx. |
| Voltage: | 2V at 0 dBm input |
| Noise Level: | 100 mV p.t.p. |
| Polarity: | Pos. or neg. |
| Rise & Fall Time: (over dynamic range) | Less than 50 ns |
| stretching: (1 μsec pulse at 50% of amplitude, referred to input) | Less than 50 ns |

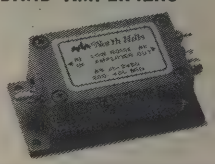
## MICROWAVE AMPLIFIERS — SERIES AS-41



- Low Noise Figure • Rugged Construction • Low Cost

| Model | Gain (dB) Min. | Noise Figure (dB) Max. | Power Output (dBm) Min. | Intercept/ Point (dBm) Typ. | Power Required V/mA DC |
|---|---|---|---|---|---|
| **1.0-2.0 GHz** | | | | | |
| AS41-3250 | 27 | 3.0 | +10 | +20 | 15/60 |
| AS41-3251 | 27 | 4.0 | | | 15/60 |
| AS41-3280 | 40 | 3.0 | +10 | +20 | 15/75 |
| AS41-3281 | 40 | 4.0 | | | 15/75 |
| **2.0-4.0 GHz** | | | | | |
| AS41-3450 | 27 | 4.0 | +10 | +23 | 15/85 |
| AS41-3451 | | 4.5 | | | |
| AS41-3452 | | 5.0 | | | |
| AS41-3453 | | 5.5 | | | |
| AS41-3454 | | 6.0 | | | |
| AS41-3455 | | 6.5 | | | |
| AS41-3470 | 38 | 4.5 | +10 | +25 | 15/100 |
| AS41-3471 | | 5.5 | | | |
| AS41-3472 | | 6.5 | | | |
| AS41-3480 | 42 | 4.5 | +10 | +25 | 15/110 |
| AS41-3481 | | 5.5 | | | |
| AS41-3482 | | 6.5 | | | |
| AS41-3490 | 50 | 4.5 | +10 | +27 | 15/130 |
| AS41-3491 | | 5.5 | | | |
| AS41-3492 | | 6.5 | | | |
| AS41-3460 | 30 | 7.0 | +15 | +25 | 15/140 |
| AS41-3483 | 40 | 7.0 | | | 15/150 |

## LOW NOISE WIDEBAND AMPLIFIERS — SERIES AS-21



- 2.5 dB Noise Figure
- Rugged Construction
- Low Cost

| Model | Frequency Range (MHz) | Gain (dB) Min. | Power Output (dBm) Min. | Intercept Point (dBm) Typ. | Power Req. V/mA DC |
|---|---|---|---|---|---|
| AS21-1860 | 20-80 | 30 | +10 | +20 | 15/50 |
| AS21-1880 | 20-80 | 40 | +4 | +14 | 15/60 |
| AS21-1890 | 20-80 | 50 | +4 | +15 | 15/70 |
| AS21-2260 | 100-200 | 30 | +8 | +18 | 12/30 |
| AS21-2350 | 150-300 | 27 | +8 | +18 | 12/30 |
| AS21-2450 | 200-400 | 27 | +5 | +15 | 12/40 |
| AS21-2550 | 250-500 | 28 | +8 | +18 | 15/40 |
| AS21-2650 | 300-600 | 27 | +10 | +20 | 12/40 |
| AS21-3150 | 500-1000 | 28 | +8 | +18 | 15/50 |
| AS21-3170 | 500-1000 | 38 | +8 | +18 | 15/60 |

# MULTICOUPLERS

## 8 OR 12 CHANNELS — 1.5-4000 MHz

| Model (X = No. of Output Channels 8 or 12) | Frequency Range (MHz) | Gain (dB) Min. | Noise Figure (dB) Max. | Power* Input (dBm) Min. | Intermodulation** Products (dB) Typ. 2nd Order | Intermodulation** Products (dB) Typ. 3rd Order | VSWR*** In/Out Max. |
|---|---|---|---|---|---|---|---|
| AD-X-101 | 1.5-30 | 3.0 | 6.5 | +13 | 80 (a) | 80 (a) | 1.5:1 |
| AD-X-102 | 20-90 | 3.0 | 6.5 | +13 | 80 (a) | 80 (a) | 1.5:1 |
| AD-X-103 | 100-160 | 3.0 | 6.5 | +10 | | 75 (a) | 1.7:1 |
| AD-X-104 | 220-400 | 3.0 | 6.5 | + 4 | | 60 (b) | 1.7:1 |
| AD-X-105 | 220-470 | 3.0 | 6.0 | + 5 | 55 (b) | 65 (b) | 1.7:1 |
| AD-X-106 | 220-470 | 3.0 | 7.5 | + 8 | 65 (b) | 75 (b) | 1.7:1 |
| AD-X-107 | 500-1000 | 10.0 | 8.0 | − 8 | | 45 (c) | 2.0:1 |
| AD-X-108 | 10-1000 | 3.0 | 8.0 | − 8 | 25 (c) | 45 (c) | 2.0:1 |
| AD-X-109 | 1000-2000 | 5.0 | 7.5 | − 8 | 25 (d) | 55 (d) | 2.5:1 |
| AD-X-110 | 2000-4000 | 5.0 | 7.0 | −14 | 20 (d) | 45 (d) | 2.5:1 |

*At 1 dB gain compression point
**2nd Order: $f_1 \pm f_2$
3rd Order: $2f_1 \pm f_2$
***For 50 ohm loads

Letter in brackets indicates the level of the two interfering signals, $f_1$ and $f_2$, at which test was performed: (a) = −5 dBm (b) = −10 dBm (c) = −20 dBm (d) = −20 dBm

Series AD-X is a complete line of VHF and UHF Multicouplers covering a wide frequency range between 1.5 to 4000 MHz.

North Hills multicouplers are used in broadband systems where signals from a single antenna are distributed to as many as 12 receivers.

Specs of the multicoupler such as number of output channels, filter characteristics, and AC/DC power source can be changed in response to customer requirements. A combination of active solid state amplifier stages and passive dividers results in a wide dynamic range and good noise figure. The multicoupler is mechanically designed for mounting in standard 19″ racks.

# FILTERS

## FLAT TIME DELAY BAND-PASS

Wide variety of passive and active filter designs with controlled amplitude, group delay, and return loss characteristics.

## MONOTONIC LOW-PASS

Cut-off Frequencies (Fc): 1 to 100 MHz
Return Loss: >20 dB over pass-band
Group Delay: Flat over pass-band
Stop Band Attenuation: >40 dB at 2.5 Fc
Unit Step Response: <2% overshoot

## COMB AND INTERDIGITAL BAND-PASS FILTERS

## TUBULAR LOW- AND BAND-PASS

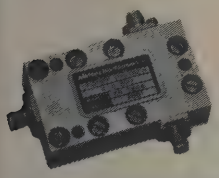
North Hills Electronics, INC. / GLEN COVE, N.Y. 11542 • 516-671-5700

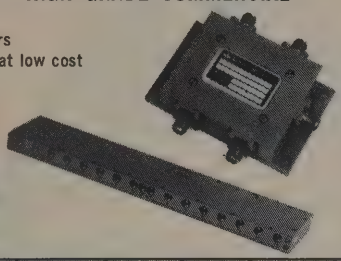
North Hills

# POWER DIVIDERS/COMBINERS

## 50 OHMS - MILITARY — HIGH GRADE COMMERCIAL

- Rugged housings
- Wide choice of connectors
- Superior characteristics at low cost

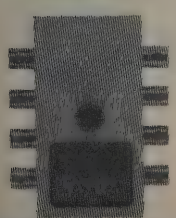




| Model No. | Freq. MHz | Ins. Loss dB Max. | Isol. db Min. | VSWR Max. | Phase Bal. ±° | Ampl. Bal. ±dB |
|---|---|---|---|---|---|---|
| **TWO-WAY** | | | | | | |
| H23-1301 | 2-32 | 0.5 | 35 | 1.3 | 2 | 0.2 |
| H23-2101 | 10-100 | 0.5 | 30 | 1.3 | 2 | 0.2 |
| H23-2102 | 100-200 | 0.8 | 30 | 1.3 | 2 | 0.2 |
| H23-2301 | 30-300 | 0.7 | 30 | 1.3 | 2 | 0.2 |
| H23-2401 | 200-400 | 1.0 | 30 | 1.3 | 2 | 0.2 |
| H23-3101 | 500-1000 | 1.0 | 25 | 1.5 | 2 | 0.2 |
| H23-2302 | 2-300 | 1.2 | 20 | 1.4 | 6 | 0.5 |
| H23-2601 | 60-550 | 1.2 | 20 | 1.5 | 4 | 0.5 |
| H23-3102 | 2-1000 | 1.2 | 20 | 1.5 | 4 | 0.6 |
| H24-3101 | 500-1000 | 0.5 | 20 | 1.3 | 2 | 2 |
| H24-3201 | 800-1600 | 0.5 | 20 | 1.3 | 2 | 2 |
| H24-3202 | 1000-2000 | 0.5 | 20 | 1.3 | 3 | 3 |
| H24-3401 | 2000-4000 | 0.5 | 20 | 1.3 | 3 | 3 |
| H24-3801 | 4000-8000 | 0.6 | 19 | 1.4 | 4 | 4 |
| H24-4101 | 8000-12400 | 0.7 | 19 | 1.5 | 4 | 4 |
| **THREE-WAY** | | | | | | |
| H31-1301 | 2-32 | 0.7 | 28 | 1.3 | 2 | 0.2 |
| H31-2101 | 10-100 | 0.7 | 28 | 1.3 | 2 | 0.2 |
| H31-2201 | 100-200 | 0.7 | 28 | 1.3 | 2 | 0.2 |
| **FOUR-WAY** | | | | | | |
| H43-1301 | 2-32 | 1.0 | 35 | 1.3 | 2 | 0.2 |
| H43-2101 | 10-100 | 1.0 | 30 | 1.3 | 2 | 0.2 |
| H43-2201 | 100-200 | 1.5 | 30 | 1.5 | 2 | 0.2 |
| H43-2301 | 30-300 | 1.0 | 35 | 1.3 | 2 | 0.2 |
| H43-2401 | 200-400 | 1.2 | 35 | 1.3 | 2 | 0.2 |
| H43-3101 | 500-1000 | 2.0 | 30 | 1.5 | 3 | 0.3 |
| H43-2302 | 2-300 | 1.2 | 20 | 1.5 | 4 | 0.4 |
| H43-2501 | 10-550 | 1.2 | 25 | 1.5 | 4 | 0.4 |
| H43-3102 | 2-1000 | 1.5 | 30 | 1.5 | 6 | 0.5 |
| H43-3201 | 10-2000 | 2.0 | 20 | 1.7 | 15 | 0.5 |
| **EIGHT-WAY** | | | | | | |
| H83-2101 | 10-100 | 2.0 | 30 | 1.3 | 2 | 0.2 |
| H83-2201 | 100-200 | 2.0 | 30 | 1.5 | 2 | 0.2 |
| H83-2301 | 30-300 | 1.3 | 35 | 1.3 | 4 | 0.2 |
| H83-2401 | 200-400 | 2.0 | 35 | 1.3 | 2 | 0.2 |
| H83-3101 | 500-1000 | 3.0 | 25 | 1.5 | 4 | 0.5 |
| H83-2701 | 10-700 | 2.0 | 30 | 1.7 | 4 | 0.4 |
| H83-3102 | 2-1000 | 2.0 | 20 | 1.8 | 10 | 1.0 |
| H83-3201 | 2-2000 | 3.0 | 20 | 2.0 | 20 | 1.5 |
| **SIXTEEN-WAY** | | | | | | |
| H161-1301 | 2-32 | 2.0 | 35 | 1.3 | 2 | 0.5 |
| H161-2101 | 10-100 | 2.0 | 30 | 1.3 | 2 | 0.7 |
| H161-2201 | 100-160 | 2.0 | 35 | 1.3 | 2 | 0.4 |
| H161-2401 | 200-400 | 2.0 | 35 | 1.3 | 2 | 0.4 |

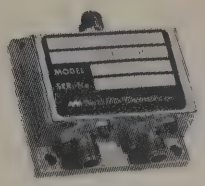
## INDUSTRIAL & INSTRUMENT SERIES

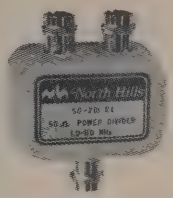
**50 and 75 Ohms, 0.2-225 MHz**
**BNC Connectors (Standard)**



| Model | Impedance (Ω) | Freq. (MHz) | Max. Ins. Loss (dB) | Min. Isolation (dB) | Max. Input VSWR |
|---|---|---|---|---|---|
| **TWO-WAY** | | | | | |
| 50-201 | 50 | .2-110 | 0.25 | 30 | 1.1 |
| 75-201 | 75 | .2-110 | 0.25 | 30 | 1.1 |
| 50-210 | 50 | 3-225 | 0.5 | 30 | 1.25 |
| 75-210 | 75 | 3-225 | 0.5 | 30 | 1.25 |
| **FOUR-WAY** | | | | | |
| 50-401 | 50 | .2-110 | 0.5 | 30 | 1.1 |
| 75-401 | 75 | .2-110 | 0.5 | 30 | 1.1 |
| 50-410 | 50 | 3-225 | 1.0 | 25 | 1.25 |
| 75-410 | 75 | 3-225 | 1.0 | 25 | 1.25 |
| **EIGHT-WAY** | | | | | |
| 50-801 | 50 | .2-110 | 1.0 | 30 | 1.1 |
| 75-801 | 75 | .2-110 | 1.0 | 30 | 1.1 |
| 50-810 | 50 | 3-225 | 1.5 | 25 | 1.25 |
| 75-810 | 75 | 3-225 | 1.5 | 25 | 1.25 |

# DIRECTIONAL COUPLERS





| Model | Frequency | Coupling (dB) | Max. Ins. Loss (dB) | Min. Directivity (dB) |
|---|---|---|---|---|
| **50 OHMS — RF, VHF, UHF** | | | | |
| D4-1310 | 0.5-30 MHz | 10 | 1.0 | 40 |
| D4-1315 | 0.5-30 | 15 | 1.0 | 45 |
| D4-1320 | 0.5-30 | 20 | 1.0 | 50 |
| D4-2110 | 1.0-100 | 10 | 1.5 | 40 |
| D4-2115 | 10-100 | 15 | 1.5 | 45 |
| D4-2120 | 10-100 | 20 | 1.5 | 50 |
| D4-3110 | 100-1000 | 10 | 1.5 | 30 |
| D4-3115 | 100-1000 | 15 | 1.5 | 35 |
| D4-3120 | 100-1000 | 20 | 1.5 | 40 |
| **50 OHMS — MICROWAVE** | | | | |
| D5-3110 | 0.5- 1.0 GHz | 10 | 1.0 | 25 |
| D5-3120 | 0.5- 1.0 | 20 | 0.5 | 35 |
| D5-3130 | 0.5- 1.0 | 30 | 0.5 | 45 |
| D5-3210 | 1.0- 2.0 | 10 | 1.0 | 25 |
| D5-3220 | 1.0- 2.0 | 20 | 0.5 | 35 |
| D5-3230 | 1.0- 2.0 | 30 | 0.5 | 45 |
| D5-3407 | 2.0- 4.0 | 7 | 1.0 | 20 |
| D5-3410 | 2.0- 4.0 | 10 | 1.0 | 23 |
| D5-3420 | 2.0- 4.0 | 20 | 0.5 | 33 |
| D5-3430 | 2.0- 4.0 | 30 | 0.5 | 43 |
| D5-3807 | 4.0- 8.0 | 7 | 1.0 | 20 |
| D5-3810 | 4.0- 8.0 | 10 | 1.0 | 21 |
| D5-3820 | 4.0- 8.0 | 20 | 1.0 | 31 |
| D5-3830 | 4.0- 8.0 | 30 | 1.0 | 41 |
| D5-4107 | 8.0-12.4 | 7 | 1.0 | 18 |
| D5-4110 | 8.0-12.4 | 10 | 1.0 | 20 |
| D5-4120 | 8.0-12.4 | 20 | 1.0 | 30 |
| **75 OHMS — RF, VHF — MATCHED 75Ω CONNECTORS** | | | | |
| D3-2120 | 1-100 MHz | 20 | 0.5 | 30 |
| D3-2130 | 1-100 | 30 | 0.5 | 30 |
| D3-2220 | 25-225 | 20 | 1 | 25 |
| D3-2230 | 25-225 | 30 | 1 | 25 |

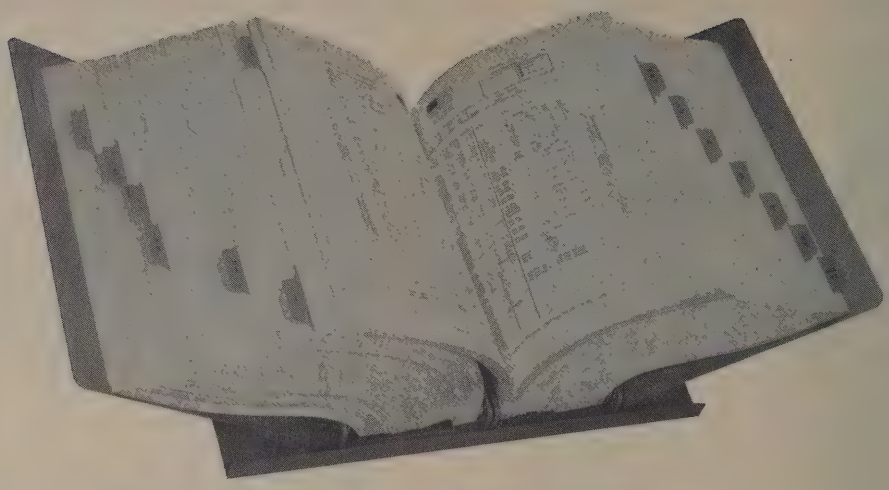
## TO-5 PACKAGING

New series of high quality directional couplers in a TO-5 configuration. The D71 Series gives excellent wide-band characteristics over the HF through VHF frequency range.

**SPECIFICATIONS**

| Parameter / Model | D71-2101 | D71-2201 | D71-2401 |
|---|---|---|---|
| Frequency Range (MHz) | 20-100 | 100-200 | 200-400 |
| Coupling (dB) | 10 ±1 | 10 ±1 | 10 ±1 |
| Frequency Sensitivity max. (dB) | ±0.2 | ±0.25 | ±0.5 |
| Directivity, min. (dB) | 27 | 25 | 20 |
| Insertion Loss, max. (dB) | 0.4 | 0.6 | 0.75 |
| Amplitude Balance, max. (dB) | ±0.2 | ±0.3 | ±0.3 |
| VSWR, max. | 1.2:1 | 1.3:1 | 1.5:1 |
| Impedance | 50 Ohms | 50 Ohms | 50 Ohms |
| Power Handling (Watt) | 2 | 2 | 2 |

North Hills Electronics, INC.
GLEN COVE, N.Y. 11542 • 516-671-5700



# UNITED PRICING REPORTS

## the single source that speeds up invoicing, pricing, quoting, purchasing and estimating

Electronic component prices change so fast, you'd need a team of people just to keep up.

United Pricing Reports is the better way. When you subscribe to Pricing Reports you receive 1500 pricing sheets (3000 pages) of the latest prices, as of the date we ship them to you.

This gives you, in a single source, up-to-the minute selling prices on more than 500,000 electronic components.

United Pricing Reports gives you accurate resale prices at the exact moment you need them. Not hours or days later. So it helps you eliminate frantic phone calls, letter writing and catalog scanning to check on prices when you write an invoice or type a purchase order.

## Twice weekly price updates.

One week after you receive your Pricing Reports source book (1500 pricing sheets) you begin receiving twice weekly price updates. You simply take these new price pages and replace the now obsolete pages with them.

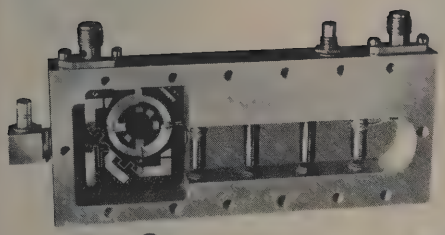
The whole process is simple. All information is organized alphabetically by manufacturer. And each manufacturer's price schedule is listed by part number in numerical/alphabetical sequence.

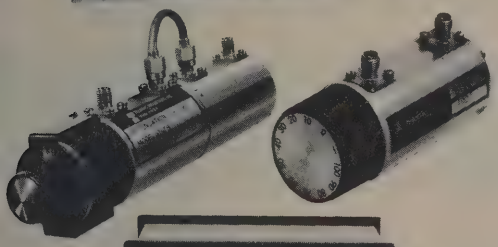
One more thing. When we promise twice weekly updates, we deliver. 52 weeks a year, consistently. Not monthly or every other month. We have a tradition of delivery on our promises, and we're certainly not going to stop now.

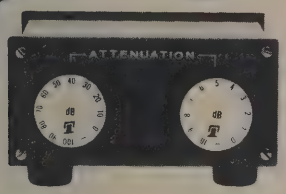
*UNITED TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500 TWX-510/2*

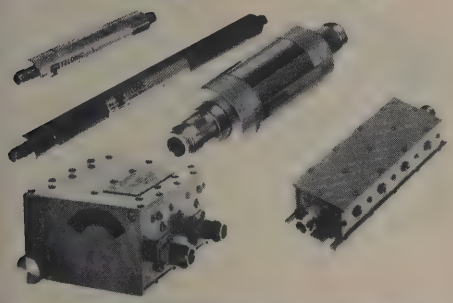
# TELONIC

## Specialists in the world of RF and Microwave







### MICROWAVE SUBASSEMBLIES

Telonic can custom design, manufacture, and integrate microwave components for specific packages and subassemblies. Our in-house capabilities for stripline and microstrip production permit quick turn around and attractive pricing structures.

The following list is representative of the type of components we can design and integrate into subassemblies to meet your requirements.

Preamplifiers • Power Amplifiers • Frequency Multipliers • Comb Generators • Oscillators • PIN Switches • Digital Phase Shifters • Phase & Amplitude Modulators • Detectors • Mixers • Discriminators • Limiters • Voltage Controlled Attenuators • Receiver Front Ends • Filters • Couplers • Multiplexers • Multicouplers • Hybrids • Power Dividers & Combiners • Attenuators • Baluns

### ATTENUATORS

Incorporating thick film, solid state construction, Telonic attenuators can guarantee precise operating parameters, high power handling capabilities and dependable service. Rotary type models may be specified with attenuation steps as low as .1 dB up to 10 dB in ranges from 1 dB to 110 dB, 50 or 75 ohms. Power rating for all units is 3 watts average, 1000 watts peak. Various combinations of rotary types permit tandem and parallel configurations for panel mounting and bench top units. A variety of connectors are also available.

### FILTERS

Telonic produces a range of RF and microwave filters so extensive that most requirements can be filled from standard catalog series. The product line covers 20 MHz to 12 GHz in low pass tubular types and bandpass in tubular, cavity, interdigital, and combline. Several series of tunable bandpass and band reject are also available. Our latest Filter Catalog provides complete specifications, performance curves, and simplified ordering procedures for all models. Special requirements should be directed to our marketing department.

### TEST INSTRUMENTS AND DISPLAYS

Telonic has long been recognized as a leader and innovator in the development of sweep/signal generation equipment. The 1200 series sweep generators encompass 8 instruments with frequency coverage from DC to 1.5 GHz.

Our display oscilloscopes are large screen types (11-inch) in single and dual trace. Both models, 121 and 122, have built-in marker adders for Y and Z pulse markers, are highly stable, and will operate with a wide variety of input instruments and devices.

Telonic's Rho-Tector line of VSWR instrumentation permits low cost, reliable test systems for VSWR determination over a 1.02:1 to 3:1 range. Various detectors, terminations, mismatches, meters, and kits are available.

Inquiries on Telonic equipment in the continental U.S. should be directed to the main office in Laguna Beach, California. Our TOLL FREE no. is 800-854-3813 (except in California). Overseas, Telonic is represented by distributors in 33 countries.

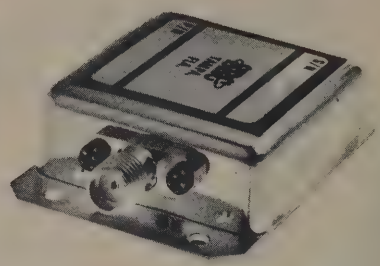
**TELONIC/BERKELEY**

*2700 DuPont Dr., Irvine, CA 92715*
*714-833-3300 or Toll Free 800-854-3813.*

TRAK MICROWAVE CORPORATION

# A Sampling of Microwave Component Capabilities from TRAK Microwave Corporation

## 10 mW to 1 W Crystal Controlled Oscillators



Base plate-mount configuration

PC board-mount configuration

This family of oscillators from Scientific Research Corp. (SRC), Subsidiary of TRAK Microwave Corp., has three power levels; 10 mW, 100 mW and 1 W to provide maximum flexibility for the system designer. These oscillators utilize thin-film hybrid technology to provide the ultimate in miniaturization with proved reliability and top performance, for military or space applications. They are housed in completely shielded enclosures and are available to 1200 MHz with pins for PC board mounting and to 2300 MHz with baseplate mount and coaxial connector output.

### General Specifications
(subject to change without notice)

Frequency Set Accuracy at Room Temp.: ±0.001%
Stability: ±0.003% Power Variation with Temperature: ±2dB
Temperature Range: −54°C to +85°C
(to +125°C with degradation)
Non-harmonically Related Spurious (1MHz BW): ≥60 dBc

| | | 60-1200 MHz | Above 1200 MHz |
|---|---|---|---|
| Output Harmonics: | a. 10 mW series | ≥30 dBc | ≥60 dBc |
| | b. 100 mW series | ≥20 dBc | ≥60 dBc |
| | c. 1 watt series | ≥20 dBc | ≥60 dBc |
| Harmonics of fifth overtone crystal oscillator: | a. 10 mW series | ≥30 dBc | ≥40 dBc |
| | b. 100 mW series | ≥20 dBc | ≥40 dBc |
| | c. 1 watt series | ≥20 dBc | ≥40 dBc |

### Size, Excluding Protrusions, and Frequency:

| | 10 mW[1] | | 100 mW[2] | | 1 W[3] | |
|---|---|---|---|---|---|---|
| Frequency (MHz) | Model Number[4] | Size (Inches) | Model Number[4] | Size | Model Number[4] | Size |
| 60 - 120 | 5040 - 1057 | 1.17x.67x.49 | 5040 - 1087 | 1.17x.67x.49 | 5040 - 1097 | 1.33x1.33x.49 |
| 121 - 240 | 5041 - 1057 | 1.17x.67x.49 | 5041 - 1087 | 1.17x.67x.49 | 5041 - 1097 | 1.33x1.33x.49 |
| 241 - 360 | 5042 - 1057 | 1.17x.67x.49 | 5042 - 1087 | 1.17x.67x.49 | 5042 - 1097 | 1.33x1.33x.49 |
| 361 - 720 | 5043 - 1057 | 1.33x1.33x.49 | 5043 - 1087 | 1.33x1.33x.49 | 5043 - 1097 | 1.33x1.33x.49 |
| 721 - 1200 | 5044 - 1057 | 1.33x1.33x.49 | 5044 - 1087 | 1.33x1.33x.49 | 5044 - 1097 | 1.33x1.33x.49 |
| 1201 - 1700 | 5044 - 1110 | 2.5x1.4x.5 | 5044 - 1120 | 2.5x1.4x.5 | 5044 - 1130 | 3.5x1.4x.5 |
| 1701 - 2000 | 5044 - 1111 | 2.5x1.4x.5 | 5044 - 1121 | 2.5x1.4x.5 | 5044 - 1131 | 3.5x1.4x.5 |
| 2001 - 2300 | 5044 - 1310 | 2.5x1.4x.5 | 5044 - 1320 | 2.5x1.4x.5 | 5044 - 1330 | 3.5x1.4x.5 |

[1]Power supply: +15 VDC @ 50 mA max. (other voltages optional).
[2]Power supply: +15 VDC @ 70 mA max.
[3]Power supply: +15 VDC @ 250 mA max.
[4]Model numbers and dimensions for base plate configuration. Consult factory for comparable data on PCB-mountable models to 1200 MHz. Other models available to 18 GHz.

## Broadband Comb Generators

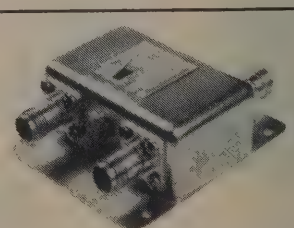
Comb generators from TRAK's SRC Subsidiary are available in any frequency value to 18 GHz, with a wide variety of comb spacings. Typical RF power output is −20 dBm, and typical package size is 1.9" x 1.3" x 0.5".

### General Specifications

| Comb Spacing | Frequency Range | Frequency Stability | RF Power Output (min.) | Power Flatness (Fixed Temp) | Load VSWR (max.) | Part Number |
|---|---|---|---|---|---|---|
| 5 MHz | 5 to 100 MHz | ±0.003% | −20 dBm | ±2 dB typ. | 2:1 | 3901 - 1000 |
| 20 MHz | 20 to 500 MHz | ±0.003% | −20 dBm | ±7.5 dB | 2:1 | 3901 - 1001 |
| 100 MHz | 2.0 to 3.5 GHz | ±0.003% | −20 dBm | ±6 dB | 1.25:1 | 3900 - 1300 |
| 500 MHz | 0.5 to 12 GHz | ±0.003% | +6 dBm, max. −22 dBm, min. | ±10 dB typ. | 1.5:1 | 3900 - 1900 |
| 100 MHz | 0.1 to 18 GHz | ±0.003% | 0 dBm, max. −40 dBm, min. | ±20 dB typ. | 1.25:1 | 3900 - 1200 |

Contact your TRAK representative or call the factory for specific information and quotations.

## IF Amplifier with Linear AGC



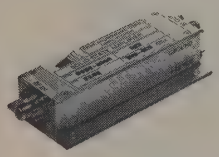
SRC's Model 8410-1010 exhibits exceptionally linear AGC characteristics and very low distortion. Operating at a center frequency of 60 MHz with a 3 dB bandwidth of 18-22 MHz, the device is particularly suited for radar applications.

Gain is 75 ±1.5 dB; AGC accuracy is ±1 dB at any AGC voltage and AGC slope is 11.3-16.3 dB/V. The device offers IF output at +7 dBm nominal and video output at 0.5 V minimum across 500 ohms. Ask TRAK for additional information about the Model 8410-1010 and other advanced IF amplifiers.

TRAK MICROWAVE CORPORATION

# A Sampling of Microwave Component Capabilities from TRAK Microwave Corporation

## Ultra Wideband GaAs FET Amplifiers



| Frequency Range (GHz) | Model Number | Noise Figure (dB max.) | Small Signal Gain (dB min.) | Power Output (dBm min.) | Gain Flatness (dB max.) | Intercept Point for IM Products (dBm) | VSWR In-Out (max.) | Primary Voltage & Current (VDC & mA) |
|---|---|---|---|---|---|---|---|---|
| 1.0-4.0 | 8023-1001 | 5.0 | 18 | + 7 | ±2.0 | +21 | 2.0 | +15 100 |
| 1.5-8.0 | 8042-1005 | 6.0 | 20 | +10 | ±2.0 | +22 | 2.2 | +15 150 |
| 2.0-7.0 | 8042-1006 | 6.0 | 20 | + 7 | ±1.5 | +22 | 2.2 | +15 150 |
| 2.0-6.0 | 8042-1007 | 4.5 | 22 | +10 | ±1.0 | +22 | 2.0 | +15 150 |
| 2.0-6.0 | 8042-1001 | 7.0 | 25 | + 7 | ±1.0 | +20 | 2.0 | +15 150 |
| 8.0-18.0 | 8067-1001* | 8.0 | 20 | + 7 | ±1.5 | +20 | 2.5 | +15 100 |
| 8.0-16.0 | 8066-1003* | 8.0 | 20 | + 7 | ±1.5 | +19 | 2.5 | +15 100 |
| 7.0-17.0 | 8068-1001* | 8.0 | 20 | + 7 | ±1.5 | +19 | 2.5 | +15 100 |
| 6.0-16.0 | 8065-1001* | 8.0 | 20 | + 7 | ±1.5 | +19 | 2.5 | +15 100 |

Standard octave bandwidth and narrow bandwidth amplifiers are also available.
*Under development

## Ferrite Circulators and Isolators

### Coaxial and drop-in types

Miniature circulators and isolators with coaxial connections or tabs for drop-in use, are available with the following specifications: **Frequency range** — 0.5 to 18 GHz. **Bandwidth** — 5% to greater than octave. **Isolation** — 20 dB minimum, narrow band; 17 dB minimum, octave. **Insertion loss** — 0.3 dB typical, 0.5 to 0.8 dB maximum. **VSWR** — 1.17 typical, 1.25 maximum (narrow band). **Operating temperature** — −54 to +95°C (most models). **Size range** — 0.5 x 0.5 x 0.5 inches to 1 x 1 x 0.5 inches (narrow band). **Weight range** — 0.2 to 1.8 ounces (narrow band). **Connectors** — SMA female or solderable tabs. **Isolator termination** — 1 W standard, others optional.

### Waveguide types

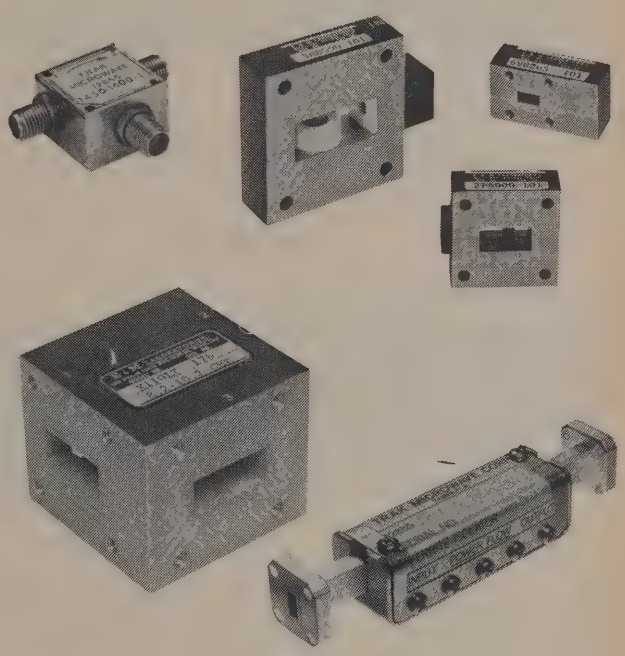
E&M Laboratories Division of TRAK offers a complete line of waveguide devices. General information is below; specific details are available upon request or from local representatives.

**Flange Waveguide Isolators** — Frequency range: 7.05 to 40 GHz. Bandwidth: 1 to 5%. Isolation: 20 dB nominal. Insertion loss: 0.3 to 0.5 dB maximum. VSWR (bilateral): 1.20 typical.

**3-port Waveguide Circulators, full waveguide bandwidth wye type** — Frequency range: 8.2 to 26.5 GHz. Isolation: 17 dB nominal. Insertion loss: 0.5 dB maximum. VSWR: 1.3 maximum.

**Broad bandwidth tee type** — Frequency range: 3.7 to 40 GHz. Isolation: 20 dB nominal. Insertion loss: 1.0 to 1.5 dB maximum. VSWR: 1.3 maximum.

**Full Bandwidth Waveguide Isolators** — Frequency range: 2.6 to 40 GHz. Isolation: 25 dB nominal. Insertion loss: 1.5 dB maximum. VSWR: 1.3 maximum.

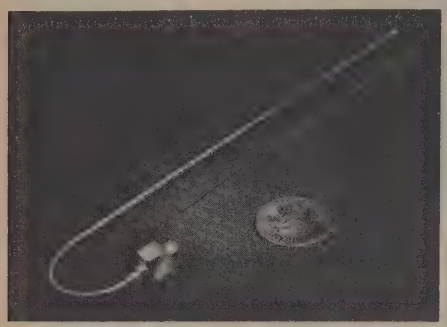


# 96-Page Catalog — FREE

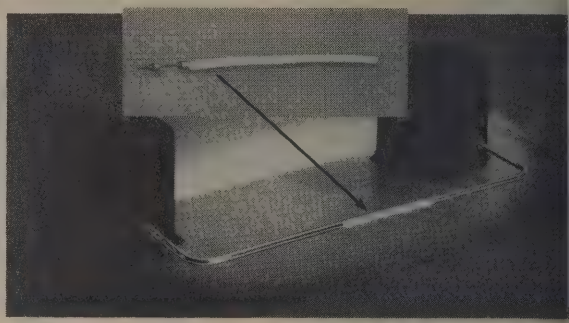
Send today for your TRAK Microwave and RF Components Handbook. This comprehensive free catalog gives complete details on the entire TRAK line, including products of the Company's SRC Subsidiary and E&M Laboratories Division. While you're at it, ask about TRAK's growing capability in supercomponents — it's the coming thing in the microwave industry.

**TRAK MICROWAVE CORPORATION**
**Mail Station E-8**
**4726 Eisenhower Boulevard**
**Tampa, Florida 33614**
**Phone (813) 884-1411**
**Telex 52-827**

# MICRO-COAX The RELIABLE Semi-



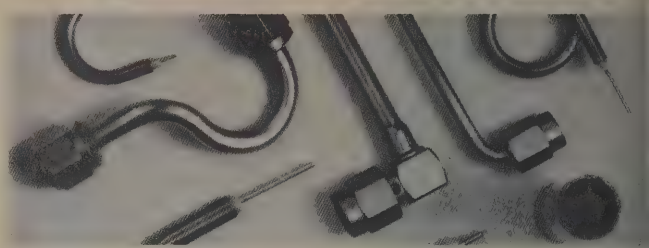
**IMPEDANCE TRANSFORMER IN-A-CABLE** adds reliability and eliminates up to 4 connectors. Designed for use between low impedance solid state sources and standard 50 and 75 ohm interconnections.



**MICROWAVE LOW-PASS FILTER IN-A-CABLE** gives reliability of a monolithic seal and can eliminate up to 4 connectors. Use wherever rigid tubular designs are employed.

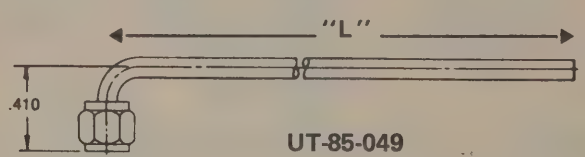
## MICRO-COAX CABLE ASSEMBLIES

**The usefulness of Micro-Coax semi-rigid coaxial cable is increased by its ability to be formed or fabricated into simple or complex geometric assemblies. Coiling, bending, stripping, and soldering, attaching connectors and other secondary operations result in delivery of maximum power in minimum space. The fabrication potential of Micro-Coax Cable is practically limitless, meeting mechanical and environmental requirements in phase matching, attenuation and VSWR optimization, assembly, encapsulating and insulating, and delay calibration. UTI provides finished assemblies, pretested and ready for installation.**

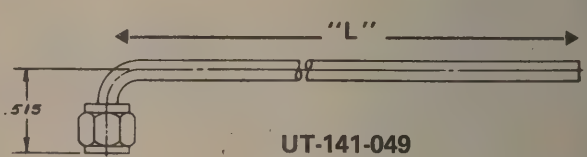


## LOW-PROFILE RIGHT-ANGLE MICRO-COAX CONNECTOR ASSEMBLIES

Reduce space requirements • Economical • Lengths from 2" to 48" • Silver plate is standard • Tin plate on special order




UT-85-049




UT-141-049

## STANDARD GENERAL PURPOSE 50 OHM MICRO-COAX CABLES

Typical applications include: Microwave transmission lines • Amplifier shielding or isolation • Totally shielded interconnections • Microwave delay lines

| Micro-Coax Part Number | Normal Impedance and Tolerance (ohms) | Outer Conductor Diameter ±.001" (1) | Dielectric Diameter ±.001" | Center Conductor Diameter (inches) Nominal | Center Conductor Material | Minimum Inside Bend Radius (inches) | $T_i/T_o$ (5) (°C) | Weight (lbs./100') | Dielectric Strength (VRMS, 60 Hz) | Safe Maximum Voltage Under Normal Usage (VRMS, 60 Hz) | Higher Order Mode (GHz) | Typical Attenuation (dB/100')/Power Kilowatts (CW) at 25°C and Sea Level | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | 0.5 GHz | 1.0 GHz | 5.0 GHz | 10.0 GHz | 20.0 GHz |
| UT- 85 | 50.0±1.5 | .0865 •• | .066 | .0201 | SPCW | .125 | 150/100 | 1.4 | 2500 | 1500 | 60 | 13.0/0.221 | 19.0/0.151 | 44.0/0.065 | 64.5/0.045 | 96.0/0.030 |
| UT- 85C | 50.0±1.5 | .0865 •• | .066 | .0201 | SPC | .125 | 150/100 | 1.4 | 2500 | 1500 | 60 | 13.0/0.221 | 19.0/0.151 | 44.0/0.065 | 64.5/0.045 | 96.0/0.030 |
| UT-141 | 49.0±1.0 | .141 • | .116 | .0359 | SPCW | .250 | 175/100 | 3.2 | 5000 | 1900 | 34 | 7.5/0.742 | 11.0/0.506 | 26.0/0.214 | 39.5/0.140 | 60.5/0.091 |
| UT-141A | 50.0±1.0 | .141 •• | .1175 | .0359 | SPCW | .250 | 175/100 | 3.2 | 5000 | 1900 | 33 | 7.5/0.742 | 11.0/0.506 | 26.0/0.214 | 39.5/0.140 | 60.5/0.091 |
| UT-141AA | 50.0±0.5 | .141 •• | .1175 | .0359 | SPCW | .250 | 175/100 | 3.2 | 5000 | 1900 | 33 | 7.5/0.742 | 11.0/0.506 | 26.0/0.214 | 39.5/0.140 | 60.5/0.091 |
| UT-141B | 50.0±1.0 | .141 • | .1175 | .0359 | SP BeCu | .250 | 175/100 | 3.2 | 5000 | 1900 | 33 | 8.5/0.742 | 12.0/0.506 | 28.0/0.214 | 41.0/0.140 | 62.0/0.091 |
| UT-141C | 50.0±1.0 | .141 •• | .1175 | .0359 | SPC | .250 | 175/100 | 3.2 | 5000 | 1900 | 33 | 7.5/0.742 | 11.0/0.506 | 26.0/0.214 | 39.5/0.140 | 60.5/0.091 |
| UT-141L | 50.0±1.0 | .141 | .1175 | .0359 | Tophet C† | .250 | 175/100 | 3.2 | 5000 | 1900 | 33 | 45.0/0.742 | 57.5/0.506 | 130.0/0.214 | 187.0/0.140 | 268.0/0.091 |
| UT-250A | 50.0±0.5 | .250 • | .209 (2) | .0640 | SPC | .375 | 200/90 | 10.0 | 7000 | 3000 | 19 | 4.3/2.622 | 6.4/1.762 | 16.5/0.683 | 26.0/0.434 | 41.0/0.275 |
| UT-325A | 50.0±1.0 | .325 (2) | .285 (2) | 7x .0312 | SPC | .750 | 200/90 | 14.5 | 7500 | 3000 | 14 | 3.0/4.733 | 5.0/2.840 | 13.0/1.092 | 20.5/0.693 | |
| UT-390 | 50.0±0.5 | .390 (2) | .332 (2) | .102 | SPC | .750 | 200/90 | 25.0 | 12000 | 6000 | 12 | 3.0/5.512 | 4.5/3.675 | 12.0/1.378 | 19.0/0.870 | |

† Trademark W.B. Driver Co.

## ULTRAMINIATURE 50 OHM MICRO-COAX CABLES

Typical applications include: High reliability miniature packages • Miniature delay lines • Printed circuit wiring • High speed computers

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UT- 8 | 50.0±5.0 | .008 | .0045 | .002 | C | .032 | 100/85 | .10 | 250 | 150 | | 141.0/ | 200.0/ | 448.0/ | | |
| UT-13 | 50.0±4.0 | .013 | .010 | .0031 | SPCW | .063 | 100/85 | .10 | 250 | 150 | | 63.0/ | 89.5/ | 202.0/ | 288.0/ | 413.0/ |
| UT-20 | 50.0±3.0 | .023 | .0165 | .005 | SPCW | .063 | 100/85 | .10 | 750 | 500 | 240 | 51.0/0.005 | 72.0/0.004 | 163.0/0.002 | 233.0/0.001 | 334.0/ |
| UT-34 | 50.0±3.0 | .034 •• | .026 | .008 | SPCW | .125 | 125/100 | .19 | 2000 | 750 | 150 | 32.0/0.019 | 45.5/0.013 | 104.0/0.006 | 149.0/0.004 | 215.0/0.003 |
| UT-47 | 50.0±2.5 | .047 •• | .037 | .0113 | SPCW | .125 | 125/100 | .38 | 2000 | 1000 | 109 | 22.0/0.035 | 31.0/0.015 | 71.5/0.011 | 103.0/0.007 | 151.0/0.005 |
| UT-70-50 (Old No. UT 701) | 50.0±2.0 | .070 | .059 | .0179 | SPC | .125 | 150/145 | .79 | 2300 | 1200 | 68 | 14.5/0.163 | 21.0/0.113 | 49.0/0.048 | 71.0/0.033 | 105.0/0.022 |

## ULTRAMALLEABLE 50 OHM MICRO-COAX CABLES

Typical applications are identical to ultraminiature cables above where slight sacrifices can be made in VSWR and impedance matching to attain higher power ratings and easier bends

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UT-20M | 50.0±8.0 | .023 | .013 (5) | .0045 | SPCW | .032 | 200/175 | 10 | 750 | 500 | | 51.0/0.019 | 72.0/0.013 | 163.0/0.006 | 233.0/0.004 | 334.0/ |
| UT-34M | 50.0±6.0 | .0375 | .024 (5) | .008 | SPCW | .063 | 225/200 | .27 | 2000 | 750 | 150 | 32.0/0.072 | 45.5/0.050 | 104.0/0.022 | 149.0/0.015 | 215.0/0.010 |
| UT-47M | 50.0±4.0 | .050 | .037 (5) | .0113 | SPCW | .063 | 250/230 | .45 | 2000 | 1000 | 109 | 22.0/0.132 | 31.0/0.096 | 71.5/0.042 | 103.0/0.029 | 151.0/0.020 |

# Rigid Coaxial Cable MICRO-COAX

## 0, 15, 25, 70, 75, 93 and 95 OHM MICRO-COAX CABLES

Typical applications include: CATV amplifier wiring • Capacitor sections • Low impedance matching for solid state units • Quarter-wave transformer sections

| Micro-Coax Part Number | Nominal Impedance and Tolerance (ohms) | Outer Conductor Diameter ±.001" (1) | Dielectric Diameter ±.001" | Center Conductor Diameter (inches) Nominal | Center Conductor Material | Minimum Inside Bend Radius (inches) | $T_i/T_o$ (6) (°C) | Capacitance (pF/ft) | Dielectric Strength (VRMS, 60 Hz) | Safe Maximum Voltage Under Normal Usage (VRMS, 60 Hz) | Higher Order Mode (GHz) | Typical Attenuation (dB/100')/Power Kilowatts (CW) at 25°C and Sea Level | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | 0.5 GHz | 1.0 GHz | 5.0 GHz | 10.0 GHz | 20.0 GHz |
| UT-34-25 (Old No. UT-25) | 25±3.0 | .034 | .023 | .0126 | SPCW | .125 | 125/100 | 58.5 | 500 | 200 | 143.7 | 47.5/0.013 | 67.5/0.009 | 153.0/0.004 | 218.5/0.003 | 313.5/0.001 |
| UT-34-95 | 95±4.0 | .034 | .027 | .0028 | SPCW | .125 | 125/100 | 15.4 | 2000 | 1000 | 17.5 | 40.5/0.013 | 57.5/0.009 | 131.0/0.004 | 188.0/0.003 | 270.0/0.001 |
| UT-47-70 | 70±3.0 | .047 | .0375 | .0071 | SPCW | .125 | 100/85 | 20.6 | 2000 | 1000 | 11.8 | 23.5/0.150 | 33.5/0.110 | 77.5/0.045 | 112.0/0.030 | 163.0/0.019 |
| UT-43-10 (Old No. UT-10) | 10±3.0 | .043 | .036 | .0285 | C | .250 | 125/100 | 145.0 | 500 | 200 | 81.0 | 61.5/0.013 | 87.0/0.009 | 179.5/0.004 | 281.5/0.003 | 402.5/0.001 |
| UT-90-25 | 25±3.0 | 090 | .073 | .040 | SPC | 125 | 175/100 | 58.5 | 1000 | 750 | 46.0 | 15.5/0.182 | 22.0/0.130 | 51.5/0.056 | 75.0/0.038 | 111.0/0.026 |
| UT-85-70 (Old No. UT-70) | 70±2.0 | .085 • | .060 | .0113 | SPCW | .125 | 175/150 | 20.6 | 2000 | 1200 | 78.0 | 15.0/0.190 | 22.0/0.130 | 50.5/0.057 | 74.0/0.039 | 109.5/0.026 |
| UT-85-75 (Old No. UT-852) | 75±2.0 | .085 | .067 | .0113 | SPCW | .125 | 175/150 | 19.3 | 2500 | 1200 | 67.0 | 14.0/0.205 | 20.0/0.143 | 46.5/0.062 | 68.0/0.042 | 100.5/0.028 |
| UT-85-93 (Old No. UT-851) | 93±1.5 | .085 | .073 | .008 | SPCW | .125 | 150/140 | 15.6 | 2500 | 1200 | 65.0 | 15.0/0.190 | 21.5/0.133 | 50.0/0.057 | 73.0/0.039 | 107.5/0.027 |
| UT-130-93 (Old No. UT-93) | 93±1.5 | 130 | .1055 | 0113 | SPCW | .250 | 175/100 | 15.6 | 3000 | 1500 | 45.0 | 10.5/0.488 | 15.0/0.341 | 36.5/0.140 | 53.5/0.095 | 80.5/0.063 |
| UT-141-15 | 15±3.0 | 141 | .114 | .080 | SPC | .250 | 175/150 | 97.0 | 1000 | 750 | 27.0 | 9.0/0.618 | 13.0/0.428 | 32.0/0.173 | 47.5/0.117 | 71.5/0.077 |
| UT-141-70 | 70±1.0 | .141 | .107 | .0201 | SPCW | .250 | 175/90 | 20.6 | 5000 | 2000 | 41.0 | 8.5/0.655 | 12.5/0.445 | 30.0/0.185 | 44.5/0.125 | 67.5/0.082 |
| UT-141-70C | 70±1.0 | .141 | .107 | .0201 | SPC | .250 | 175/90 | 20.6 | 5000 | 2000 | 41.0 | 8.5/0.655 | 12.5/0.445 | 30.0/0.185 | 44.5/0.125 | 67.5/0.082 |
| UT-141-75 | 75±1.0 | .141 | .1175 | .0201 | SPCW | .250 | 175/90 | 19.3 | 5000 | 2000 | 38.0 | 8.0/0.696 | 11.5/0.484 | 28.0/0.198 | 41.5/0.133 | 63.5/0.087 |
| UT-141-75C | 75±1.0 | .141 | .1175 | .0201 | SPC | .250 | 175/90 | 19.3 | 5000 | 2000 | 38.0 | 8.0/0.696 | 11.5/0.484 | 28.0/0.198 | 41.5/0.133 | 63.5/0.087 |
| UT-250-75 | 75±1.0 | 250(2) | .210(2) | 0359 | SPCW | .500 | 200/90 | 19.3 | 7000 | 3000 | 21.0 | 4.5/2.505 | 6.5/1.735 | 175.0/0.644 | 27.0/0.418 | 42.5/0.265 |

## AIR ARTICULATED (SPLINE) 50 OHM MICRO-COAX CABLES

Typical applications include: Spacecraft interconnections • Antenna feed cables • Liquid level sensing devices • Low loss receivers

| Micro-Coax Part Number | Outer Conductor Diameter ±.002" | Dielectric Diameter ±.002" | Number of TFE Splines | Center Conductor SPCT Outside Diameter ±.001" | Center Conductor Inside Diameter ±.002" | Minimum Inside Bend Radius (inches) | $T_i/T_o$ (6) (°C) | Weight (lbs./100') | Dielectric Strength (VRMS, 60 Hz) | Safe Maximum Voltage Under Normal Usage (VRMS, 60 Hz) | Higher Order Mode (GHz) | Typical Attenuation (dB/100')/Power Kilowatts (CW) at 25°C and Sea Level | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | 0.5 GHz | 1.0 GHz | 5.0 GHz | 10.0 GHz | 12.0 GHz |
| OFHC Copper | | | | | | | | | | | | | | | | |
| UT-S-250-50 | .250 | .221 | 3 | .087 | .066 | 3.0 | 200/150 | 5.6 | 4000 | 1400 | 21.0 | 3.7/0.46 | 5.4/0.32 | 13.8/0.12 | 21.5/0.08 | 25.0/0.07 |
| UT-S-325-50 | .325 | .285 | 5 | .110 | .090 | 5.0 | 200/150 | 9.5 | 5000 | 2000 | 16.4 | 2.8/0.61 | 4.2/0.41 | 11.0/0.15 | 16.5/0.10 | 19.0/0.09 |
| UT-S 375 50 | 375 | .325 | 5 | .126 | 085 | 5.0 | 200/150 | 15.0 | 5000 | 2200 | 14.4 | 2 5/0 68 | 3.7/0.46 | 9.2/0.19 | 14.3/0.12 | 17.0/0.10 |
| UT-S-390-50 | 390 | .340 | 5 | .136 | .096 | 5.0 | 200/150 | 16.3 | 5000 | 2200 | 13.6 | 2.3/0.74 | 3.4/0.50 | 8.0/0.21 | 12.0/0.14 | 15.0/0.11 |
| UT-S-500-50 | .500 | .450 | 5 | .174 | 134 | 6.0 | 200/150 | 21.0 | 7500 | 3000 | 10.4 | 1.8/0.94 | 2.7/0.63 | 6.0/0.28 | 10.0/0.16 | |
| 1100 Aluminum | | | | | | | | | | | | | | | | |
| UT-S-250-50 AL | .250 | .221 | 3 | .087 | .066 | 3.0 | 200/125 | 2.6 | 4000 | 1400 | 21.0 | 4.2/0.37 | 6.5/0.26 | 17.5/0.09 | 24.3/0.06 | 27.5/0.05 |
| UT-S-325-50 AL | .325 | 285 | 5 | .110 | .090 | 5.0 | 200/125 | 4.5 | 5000 | 2000 | 16.4 | 3.4/0.49 | 5.0/0.33 | 13.2/0.12 | 20.8/0.08 | 23.6/0.07 |
| UT-S-390-50 AL | 390 | 340 | 5 | .136 | .096 | 5.0 | 200/125 | 7.5 | 5000 | 2200 | 13.6 | 2.8/0.60 | 4.2/0.40 | 11.4/0.15 | 18.3/0.11 | 21.0/0.08 |
| UT-S-500-50 AL | .500 | 450 | 5 | .174 | .134 | 6.0 | 200/125 | 11.0 | 7500 | 3000 | 10.4 | 2.3/0.76 | 3.4/0.51 | 9.7/0.22 | 15.9/0.13 | |

## SPECIAL ORDER LOW IMPEDANCE AND HIGH IMPEDANCE MICRO-COAX CABLES

Typical applications include: Medical electronics • Computers • Aerospace • Detectors • Test equipment

| Micro-Coax Part Number | Nominal Impedance and Tolerance (ohms) | Outer Conductor Diameter ±.001" | Outer Conductor Material | Dielectric Diameter ±.001" | Dielectric Material | Center Conductor Diameter (inches) Nominal | Center Conductor Material | Capacitance (Pf./Ft.) | Minimum Inside Bend Radius (inches) | Typical Attenuation (dB/100') at 25°C | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 0.5 GHz | 1.0 GHz | 5.0 GHz | 10.0 GHz | 20.0 GHz |
| UT-34-10 | 10.0±4.0 | .034 | Copper | .025 | TFE | .0201 | SPC | 145.0 | 125 | 88.5 | 124.0 | 280.0 | 400.0 | 566.0 |
| UT-34-17 | 17.0±4.0 | .034 | Copper | .024 | TFE | .0159 | SPC | 85.0 | .125 | 58.5 | 83.0 | 188.0 | 270.0 | 392.0 |
| UT-44-5 | 5.0±1.0 | .044 | Copper | .036 | TFE | .032 | SPC | 290.0 | .250 | 117.5 | 166.0 | 374.0 | 531.0 | 755.0 |
| UT-47-35 | 35.0±1.5 | .047 | Copper | .037 | TFE | .016 | SPC | 41.0 | .125 | 25.0 | 25.0 | 36.0 | 119.0 | 173.0 |
| UT-70-25 | 25.0±2.0 | .070 | Copper | .056 | TFE | .032 | SPC | 57.0 | .125 | 19.0 | 33.0 | 64.0 | 93.0 | 136.0 |
| UT-75-10 | 10.0±3.0 | .075 | Copper | .067 | TFE | .0453 | SPC | 145.0 | .250 | 39.0 | 55.0 | 126.0 | 181.0 | 259.0 |
| UT-85-15 | 15.0±2.0 | .0865 | Copper | .066 | TFE | .046 | SPC | 97.0 | .250 | 24.5 | 34.5 | 79.5 | 115.0 | 167.0 |
| UT-90-35 | 35.0±2.0 | .090 | Copper | .074 | TFE | .032 | SPC | 41.0 | .250 | 13.5 | 19.0 | 45.0 | 66.0 | 98.0 |
| UT-141-10 | 10.0±1.5 | .141 | Copper | .118 | TFE | .092 | SPC | 145.0 | .250 | 19.0 | 27.5 | 63.5 | 92.0 | 135.0 |
| UT-141-25 | 25.0±1.0 | .141 | Copper | .116 | TFE | .064 | SPC | 57.0 | .250 | 10.0 | 19.0 | 33.5 | 50.0 | 105.0 |
| UT-141-35 | 35.0±2.0 | .141 | Copper | .117 | TFE | .0508 | SPC | 41.0 | .250 | 8.0 | 12.0 | 29.0 | 43.0 | 65.5 |
| UT-300-25 | 25.0±2.0 | .300(2) | Copper | .261(2) | TFE | .144 | SPC | 57.0 | .500 | 4.5 | 7.0 | 17.0 | 26.5 | 42.5 |
| UT-325-12.5 | 12.5±2.0 | .325(2) | Copper | .285(2) | TFE | .213 | SPCT | 121.0 | .750 | 7.0 | 10.0 | 24.0 | 36.5 | 56.0 |

| Micro-Coax Part Number | Nominal Impedance and Tolerance (ohms) | Outer Conductor Diameter ±.001" | Outer Conductor Material | Dielectric Diameter ±.001" | Dielectric Material | Center Conductor Diameter (inches) Nominal | Center Conductor Material | Minimum Inside Bend Radius (inches) | Typical Attenuation (dB/100') at 25°C | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 0.5 GHz | 1.0 GHz | 5.0 GHz | 10.0 GHz | 20.0 GHz |
| UT-48-75 | 75.0±3.0 | .048 | Copper | .037 | TFE | .0063 | SPCW | .125 | 23.0 | 33.0 | 76.0 | 110.0 | 160.0 |
| UT-85-70-B | 70.0±2.0 | .084 | Copper | .056 | TFE | .0113 | SP BeCu | .125 | 16.0 | 23.0 | 51.0 | 74.5 | 110.0 |
| UT-90-70 | 70.0±2.0 | .090 | Copper | .074 | TFE | .0142 | SPCW | .125 | 12.5 | 18.0 | 42.5 | 62.5 | 93.0 |
| UT-90-100 | 100.0±2.0 | .090(2) | Copper | .075(2) | TFE | .0069 | SPCW | .125 | 16.0 | 23.0 | 54.0 | 78.5 | 115.5 |
| UT-130-93-AL | 93.0±1.5 | .130 | 1100 AL | .1055 | TFE | .0113 | SPCW | .250 | 11.0 | 16.0 | 38.0 | 55.0 | 82.5 |
| UT-130-93-SS | 93.0±1.5 | .130 | 304 SS | .1055 | TFE | .0113 | SPCW | .250 | 15.5 | 22.0 | 55.0 | 75.0 | 110.0 |
| UT-141-100 | 100.0±2.0 | .141 | Copper | .1175 | TFE | .0108 | SPCW | .250 | 10.0 | 14.0 | 33.5 | 50.0 | 75.5 |
| UT-250-110 | 110.0±2.0 | .250(2) | Copper | .210(2) | TFE | .0159 | SPCW | .250 | 8.5 | 12.5 | 30.0 | 45.0 | 68.0 |

SP BeCu: Silver-plated beryllium copper.
SS: Type 304 Stainless steel.
SPCT: Silver-plated copper tube.
AL: Aluminum.

*: Tin-plated (TP)
•: Silver-plated (SP)
SPC: Silver-plated copper.
SPCW: Silver plated, copper-clad steel.

(1) For plated conductor allow additional +.001".
(2) Dimensional tolerance ±.002".
(3) Dimensional tolerance ±.003".
(4) IP: Irradated polyolefin.
(5) Nominal Dielectric Diameter.
(6) $T_i$ – Outer Conductor Integrity Operating Temperature Maximum (MIL-C-17E).
$T_o$ – Recommended Maximum Operating Temperature.

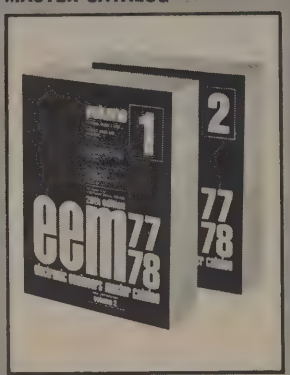
**UNIFORM TUBES, INC.**
...a UTI Company
COLLEGEVILLE, PA. 19426, U.S.A.
Phone 215/539-0700 • TWX 510-660-6107 • Telex 84-6428

***Catalogs on Request***

# WE KNOW OUR STUFF

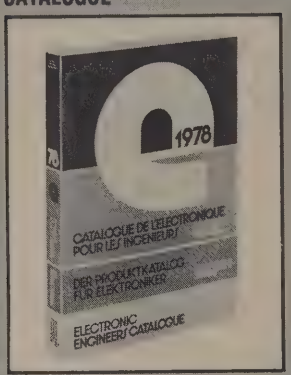
## 41 YEARS OF EXPERIENCE IN CATALOGING, 21 EDITIONS OF eem

### eem/ELECTRONIC ENGINEERS MASTER CATALOG —



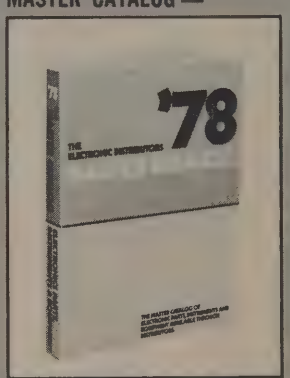

The "blue-ribbon" catalog/directory that has become "the standard of the industry" for electronic engineers, buyers and specifiers.

### ELECTRONIC ENGINEERS CATALOGUE



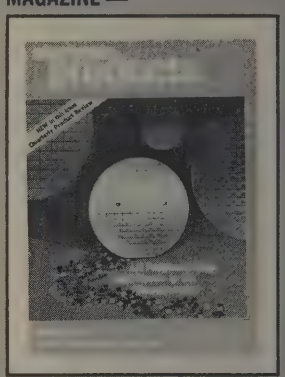

The new catalogue/directory of electronic products available to and from Western Europe and the United Kingdom. Designed especially for the European electronics engineer.

### ELECTRONIC DISTRIBUTORS MASTER CATALOG —




The only national catalog designed exclusively for distributors and their customers featuring electronic parts, instruments and equipment.

### ELECTRONIC PRODUCTS MAGAZINE —



The products magazine . . . A 100% product-oriented magazine including hundreds of new products and special features every month.

### IC MASTER AND THE UPDATES —

The only complete single-source directory including all IC devices manufactured in the United States. Updated three times yearly with accumulative supplements.

### eem FILE SYSTEM —

The only filing system designed especially for the electronics engineer. Instant retrieval and organization of data sheets and catalogs.

### UTP CUSTOM CATALOGS —

The Cadillac of individualized catalogs for the electronic parts distributor, featuring solely his lines and services.

### UNITED COST AND PRICING SERVICES —

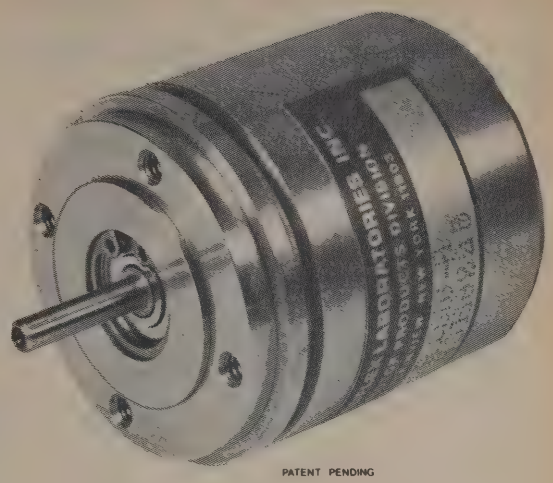
The electronic distributors' proven method of being up to the minute on his cost and selling prices.

*United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Ave., Garden City, N.Y. 11530 / (516) 222-2500 TWX 510-222-1673*

# AEROFLEX

## *brushless DC motors— featuring:*

- **A complete package with fully integrated electronics.**
- **Solid state switching techniques and patented solid state sensing.**
- **High power to weight/size ratio.**
- **Speed independent non-contacting rotor position sensors.**




PATENT PENDING

You no longer have to endure the penalties of brush wear and high power loss. You can have the high starting torque and linear/speed characteristics of conventional, permanent magnet DC motors — plus the brushless advantages of greater reliability, higher efficiency, lower operating temperatures, and a service life limited principally by bearing wear. Also, being brushless, they run without fear of sparking so they can be used in explosive, corrosive and other hostile environments.

The motor's inherent rotor-stator inside-out design provides for easier heat flow and cooler operation. In conventional motors, heat generated in the rotor windings must pass through an airgap to the housing. In the Aeroflex design, heat generated in the stator windings passes directly to the housing (a low resistance thermal path).

The motor can be supplied for operation from a fixed polarity voltage and rotation in either direction, or with the direction of rotation reversing with reverse polarity voltage. The solid-state commutation circuitry is available with integral speed regulation, to meet custom requirements.

High performance fan and blower motor applications can benefit by the higher capability of the Aeroflex brushless DC motors. Greater outputs (pressure and airflow) are achieved since these motors are able to run at much higher RPM than AC motors. This makes their use much more effective in AC blower applications.

In instrumentation and control applications, their reliability and long life can significantly enhance total system performance. Their very high starting torques and shaft power capabilities allow use of smaller motor sizes. They are compatible with pulse modulation and pulsed variable rep-rate types of servo control techniques.

Contact Aeroflex Motor Applications Engineering for assistance.

## TYPICAL PERFORMANCE DATA

| FRAME SIZE | 8 | 11 | 15 | 25 | 33 |
|---|---|---|---|---|---|
| Stall Torque (oz-in) | .2-.8 | 1-1.5 | 1.5-8 | 3-13 | 5-40 |
| Stall Power (watts) | 6 | 8 | 14-22 | 23-35 | 50-110 |
| Rotor Moment of Inertia (gm cm²) | .5 | 1.0 | 5.0 | 140 | 750 |
| Rated Torque (oz-in) | .1-.4 | .5-.75 | 1-5 | 1.75-8 | 3.5-25 |
| Speed at Rated Load (rpm) | 2,500/5,000 | 2,500/5,000 | 150/5,000 | 150/5,000 | 150/5,000 |
| No Load Speed (rpm) | 5,000/10,000 | 5,000/10,000 | 3,000/10,000 | 3,000/10,000 | 3,000/10,000 |
| Weight (oz) | 2.5 | 5.0 | 10 | 25 | 65 |
| Dim. Length | 1.25 | 1.75 | 2.00 | 4.00 | 5.00 |
| Dim. Diameter | .750 | 1.062 | 1.437 | 2.75 | 3.31 |
| Dim. Pilot Diameter | .500 | .825 | .875 | N/A | N/A |
| Dim. Pilot Length | .040 | .062 | .040 | N/A | N/A |

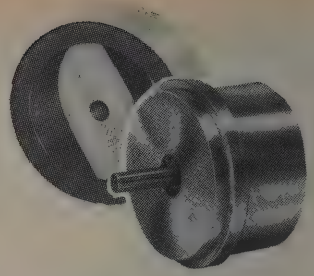
**"MADE TO ORDER" MOTORS— SIZES RANGING UP TO 2 HP**

**NOTES:**

1. Designed to meet military and industrial specifications.
2. Available with speed regulation to ±1% for variations in load torque and supply voltage.
3. Shaft details as requested.
4. Synchro type mounting optional.
5. Excitation voltage - standard ratings available.
6. Peak torque ratings approx. 40% above continuous value.
7. Efficiency up to 75%.
8. Consult our engineering staff for other ratings.

MOTOR PRODUCTS DIVISION
**AEROFLEX LABORATORIES INC.**
SOUTH SERVICE ROAD • PLAINVIEW, LONG ISLAND, N. Y. 11803
DEPT. EM TEL. (516) 694-6700

# AEROFLEX *brushless* D.C. Torquers



**FEATURES:**

- No commutator brush or contact friction
- Unlimited life
- Infinite resolution
- Direct Drive
- No radio noise or explosion hazard
- No motor ripple or "slot lock"

## Wide Angle *brushless* D.C. Torquers (Partial Listing)

| Basic Part Number | Peak Torque (oz. in.) | Peak Power (watts) | Continuous Torque (oz. in.) | Continuous Power at 25°C (watts) | Driving Voltage for Continuous Torque (volts D.C.) | Angular Excursion (degrees) | Torque Sensitivity (oz. in./amp.) | Back EMF (v/rad/sec) | Resistance at 25°C (ohms) | Electrical Time Constant L/R (sec) | Rotor Inertia (oz. in. sec²) | VISCOUS DAMPING Infinite | VISCOUS DAMPING Zero | Weight (oz.) | PANCAKE DIMENSIONS O.D. (inch) | PANCAKE DIMENSIONS Thick. (inch) | PANCAKE DIMENSIONS I.D. (inch) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Source Impedance (oz. in./rad/sec) | | | | | |
| TQ10Y-10 | 1.3 | 21 | .5 | 2.4 | 12 | 120 | 2.5 | .018 | 60 | $3 \times 10^{-4}$ | $1.6 \times 10^{-5}$ | $1.5 \times 10^{-5}$ | $1.1 \times 10^{-3}$ | 1 | 1.000 | .350 | .125 |
| TQ10Y-1 | 6 | 110 | 1.5 | 7 | 34.5 | 120 | 7.6 | .055 | 175 | $2 \times 10^{-4}$ | $4 \times 10^{-5}$ | $4 \times 10^{-5}$ | $2.4 \times 10^{-3}$ | 2 | 1.000 | .700 | .125 |
| TQ10Y-2 | 6 | 103 | 1.5 | 7 | 26 | 120 | 5.8 | .041 | 100 | $2 \times 10^{-4}$ | $4 \times 10^{-5}$ | $4 \times 10^{-5}$ | $3 \times 10^{-3}$ | 2 | 1.000 | .700 | .125 |
| TQ10Y-4 | 6 | 85 | 1.5 | 5 | 5.6 | 120 | 1.6 | .011 | 6 | $2 \times 10^{-4}$ | $4 \times 10^{-5}$ | $4 \times 10^{-5}$ | $3 \times 10^{-3}$ | 2 | 1.000 | .700 | .125 |
| TQ18W-30 | 3 | 25 | 1.8 | 8 | 17 | 120 | 3.9 | .027 | 36 | $5 \times 10^{-4}$ | $2.4 \times 10^{-4}$ | $3 \times 10^{-4}$ | $2 \times 10^{-3}$ | 3 | 1.718 | .350 | .187 |
| TQ18W-37 | 3 | 20 | 1.9 | 8 | 15 | 120 | 3.5 | .025 | 27 | $5 \times 10^{-4}$ | $2.4 \times 10^{-4}$ | $3 \times 10^{-4}$ | $2 \times 10^{-3}$ | 3 | 1.718 | .350 | .187 |
| TQ18W-23 | 8 | 45 | 4 | 11 | 22.5 | 120 | 8.5 | .060 | 48 | $8 \times 10^{-4}$ | $4.8 \times 10^{-4}$ | $3 \times 10^{-4}$ | $1 \times 10^{-2}$ | 4 | 1.718 | .700 | .187 |
| TQ18W-35 | 8 | 35 | 4 | 9 | 4.6 | 120 | 2.2 | .015 | 2.5 | $8 \times 10^{-4}$ | $4.8 \times 10^{-4}$ | $3 \times 10^{-4}$ | $1 \times 10^{-2}$ | 4 | 1.718 | .700 | .187 |
| TQ18-25 | 5.6 | 25 | 3 | 7 | 20 | 50 | 9 | .063 | 60 | $2 \times 10^{-4}$ | $3.2 \times 10^{-4}$ | $2 \times 10^{-4}$ | $1 \times 10^{-3}$ | 3 | 1.718 | .350 | .250 |
| TQ18-26 | 5.6 | 25 | 3 | 7 | 13.4 | 50 | 5.6 | .040 | 25 | $2 \times 10^{-4}$ | $3.2 \times 10^{-4}$ | $2 \times 10^{-4}$ | $1.1 \times 10^{-3}$ | 3 | 1.718 | .350 | .250 |
| TQ18-28 | 10 | 47 | 5 | 12 | 7.6 | 50 | 3.3 | .024 | 5 | $2 \times 10^{-4}$ | $5.8 \times 10^{-4}$ | $4 \times 10^{-4}$ | $1.6 \times 10^{-2}$ | 4 | 1.718 | .600 | .250 |
| TQ18-1 | 18 | 75 | 8 | 14 | 51 | 50 | 30 | .210 | 190 | $2 \times 10^{-4}$ | $6.7 \times 10^{-4}$ | $5 \times 10^{-4}$ | $3.3 \times 10^{-2}$ | 4 | 1.718 | .700 | .250 |
| TQ18-11 | 18 | 75 | 8 | 14 | 12.8 | 50 | 7.5 | .053 | 12 | $2 \times 10^{-4}$ | $6.7 \times 10^{-4}$ | $5 \times 10^{-4}$ | $3.3 \times 10^{-2}$ | 4 | 1.718 | .700 | .250 |
| TQ18-47 | 18 | 80 | 8 | 16 | 20 | 50 | 10 | .071 | 25 | $2 \times 10^{-4}$ | $6.7 \times 10^{-4}$ | $5 \times 10^{-4}$ | $2.9 \times 10^{-2}$ | 4 | 1.718 | .700 | .250 |
| TQ25W-2 | 15 | 60 | 8 | 17 | 32.0 | 120 | 15 | .106 | 60 | $2 \times 10^{-3}$ | $9 \times 10^{-4}$ | $1 \times 10^{-4}$ | $2.6 \times 10^{-2}$ | 4 | 2.500 | .500 | .250 |
| TQ25W-4 | 15 | 60 | 8 | 17 | 52.8 | 120 | 25 | .175 | 165 | $2 \times 10^{-3}$ | $9 \times 10^{-4}$ | $1 \times 10^{-4}$ | $2.6 \times 10^{-2}$ | 4 | 2.500 | .500 | .250 |
| TQ25W-1 | 33 | 130 | 16 | 30 | 33.8 | 120 | 18 | .130 | 38 | $3 \times 10^{-3}$ | $2.1 \times 10^{-3}$ | $2 \times 10^{-4}$ | $6 \times 10^{-2}$ | 7 | 2.500 | 1.000 | .250 |
| TQ25-6 | 30 | 63 | 10 | 7 | 8.3 | 50 | 12 | .085 | 10 | $3 \times 10^{-3}$ | $1.5 \times 10^{-3}$ | $2 \times 10^{-3}$ | $1.6 \times 10^{-1}$ | 6 | 2.500 | .500 | .250 |
| TQ25-9 | 30 | 70 | 15 | 17 | 9.5 | 50 | 8.5 | .060 | 5.4 | $2 \times 10^{-3}$ | $1.5 \times 10^{-3}$ | $2 \times 10^{-3}$ | $9.4 \times 10^{-2}$ | 6 | 2.500 | .500 | .250 |
| TQ25-2 | 80 | 150 | 25 | 14 | 14.8 | 50 | 27 | .190 | 16 | $5 \times 10^{-3}$ | $4.4 \times 10^{-3}$ | $5 \times 10^{-3}$ | $3.2 \times 10^{-1}$ | 12 | 2.500 | 1.000 | .250 |
| TQ34W-1 | 40 | 90 | 30 | 37 | 25.7 | 120 | 21 | .150 | 18 | $3 \times 10^{-3}$ | $4.2 \times 10^{-3}$ | $5 \times 10^{-3}$ | $1.8 \times 10^{-1}$ | 13 | 3.313 | .625 | .375 |
| TQ34W-10 | 40 | 90 | 30 | 36 | 40 | 120 | 33 | .240 | 44 | $3 \times 10^{-3}$ | $4.2 \times 10^{-3}$ | $5 \times 10^{-3}$ | $1.8 \times 10^{-1}$ | 13 | 3.313 | .625 | .375 |
| TQ34W-12 | 80 | 180 | 60 | 83 | 38.6 | 120 | 28 | .200 | 18 | $4 \times 10^{-3}$ | $8.4 \times 10^{-4}$ | $1 \times 10^{-2}$ | $3 \times 10^{-1}$ | 21 | 3.313 | 1.125 | .375 |
| TQ34-14 | 80 | 150 | 28 | 17 | 47.3 | 50 | 80 | .570 | 135 | $1 \times 10^{-3}$ | $9.1 \times 10^{-3}$ | $1.5 \times 10^{-2}$ | $3.4 \times 10^{-1}$ | 16 | 3.375 | .600 | .250 |
| TQ34-4 | 130 | 220 | 40 | 20 | 22.2 | 50 | 45 | .310 | 25 | $1 \times 10^{-3}$ | $9.1 \times 10^{-3}$ | $1 \times 10^{-2}$ | $5.6 \times 10^{-1}$ | 16 | 3.375 | .725 | .250 |
| TQ40W-4 | 150 | 270 | 60 | 45 | 8.5 | 120 | 12 | .090 | 1.7 | $2 \times 10^{-3}$ | $2 \times 10^{-2}$ | $1 \times 10^{-2}$ | $6.3 \times 10^{-1}$ | 30 | 4.000 | .850 | .375 |
| TQ40W-11 | 150 | 250 | 60 | 40 | 14.5 | 120 | 22 | .160 | 5.2 | $2 \times 10^{-3}$ | $2 \times 10^{-2}$ | $1 \times 10^{-2}$ | $6.8 \times 10^{-1}$ | 30 | 4.000 | .850 | .375 |
| TQ40W-1 | 260 | 250 | 120 | 50 | 14.1 | 120 | 34 | .250 | 4.0 | $3 \times 10^{-3}$ | $4 \times 10^{-2}$ | $2 \times 10^{-2}$ | 1.9 | 51 | 4.000 | 1.500 | .375 |
| | Lb. Ft. | | Lb. Ft. | | | Lb. Ft./Amp. | | | | | Lb. In. Sec² | Lb. In./Rad./Sec. | | Lb. | | | |
| TQ52W-1 | 1.5 | 152 | 1.1 | 75 | 21.3 | 90 | .31 | .42 | 6.2 | $6.5 \times 10^{-3}$ | $6.9 \times 10^{-3}$ | $6.3 \times 10^{-4}$ | $2.6 \times 10^{-1}$ | 5 | 5.125 | 1.500 | .750 |
| TQ52-2 | 2.6 | 250 | 1.0 | 40 | 21.9 | 20 | .57 | .79 | 12 | $3 \times 10^{-3}$ | $8.8 \times 10^{-3}$ | $1.2 \times 10^{-3}$ | $4.5 \times 10^{-1}$ | 5 | 5.187 | 1.250 | .984 |
| TQ56-1 | 4.2 | 270 | 1.5 | 36 | 16.2 | 20 | .70 | .95 | 7.3 | $6 \times 10^{-3}$ | $1.8 \times 10^{-2}$ | $4.4 \times 10^{-2}$ | 1.06 | 10 | 5.625 | 2.000 | 1.000 |
| TQ64W-5 | 4.2 | 230 | 2.4 | 91 | 14.5 | 90 | .39 | .53 | 2.3 | $6 \times 10^{-3}$ | $3 \times 10^{-2}$ | $2.5 \times 10^{2}$ | 1.06 | 16 | 6.235 | 2.300 | 1.187 |
| TQ64-1 | 4.5 | 230 | 3.3 | 127 | 14.7 | 30 | .39 | .53 | 1.7 | $7 \times 10^{-3}$ | $5 \times 10^{-2}$ | $5.6 \times 10^{-2}$ | 1.25 | 16 | 6.375 | 2.300 | 1.187 |
| TQ74W-5 | 4.2 | 300 | 1.5 | 39 | 24.2 | 110 | .96 | 1.2 | 15 | $8 \times 10^{-3}$ | $5 \times 10^{-2}$ | $1.2 \times 10^{-2}$ | $5.8 \times 10^{-1}$ | 10 | 7.310 | 1.440 | 1.000 |
| TQ74W-6 | 7.8 | 350 | 5.1 | 150 | 18.2 | 110 | .62 | .86 | 2.2 | $7 \times 10^{-3}$ | $1.5 \times 10^{-1}$ | $6 \times 10^{-3}$ | $2.4 \times 10^{-1}$ | 27 | 7.310 | 3.440 | 1.000 |
| TQ74-4 | 3.3 | 170 | 1.6 | 43 | 15.1 | 30 | .33 | .46 | 1.7 | $4 \times 10^{-3}$ | $2.6 \times 10^{-2}$ | $4.4 \times 10^{-2}$ | 1.25 | 8 | 7.375 | 1.160 | .812 |
| TQ74-2 | 7.0 | 350 | 4.5 | 150 | 20.1 | 30 | .66 | .89 | 2.95 | $6 \times 10^{-3}$ | $5 \times 10^{-2}$ | $6 \times 10^{-2}$ | 2.4 | 19 | 7.380 | 2.290 | .812 |
| TQ82W-1 | 4.0 | 450 | 2.5 | 174 | 31.3 | 120 | .48 | .7 | 6.4 | $2.8 \times 10^{-2}$ | $3 \times 10^{-2}$ | $2 \times 10^{-2}$ | 1.2 | 12 | 8.190 | 1.380 | .820 |
| TQ120-2 | 22 | 375 | 18 | 178 | 20.2 | 40 | 2.05 | 2.1 | 2.3 | $1.5 \times 10^{-2}$ | $3.2 \times 10^{-1}$ | $2 \times 10^{-1}$ | $2.2 \times 10^{1}$ | 49 | 12.500 | 2.250 | 1.380 |
| TQ140W-1 | 18 | 580 | 17 | 500 | 51 | 120 | 1.70 | 2.3 | 5.2 | $4 \times 10^{-2}$ | $6 \times 10^{-1}$ | 1.5 | $1.2 \times 10^{1}$ | 60 | 14.000 | 3.000 | 1.500 |

## Full Rotation *brushless* D.C. Torque Motors

A torque delivery system designed to achieve maximum power efficiency within a minimum of space, weight and power. It consists of a permanent magnet brushless DC torquer mechanically coupled with a brushless resolver.

### (Partial Listing)

| Characteristics | TFR47-5P | TFR47-3P | TFR47-4P | TFR90-1P | TFR120-2P |
|---|---|---|---|---|---|
| Peak Torque | 1.2 lb. ft. | 4.1 lb. ft. | 7.8 lb. ft. | 16 lb. ft. | 45 lb. ft. |
| Power | 180 watts | 240 watts | 350 watts | 180 watts | 450 watts |
| Resistance | 16 ohms | 13 ohms | 13 ohms | 0.3 ohms | 5.6 ohms |
| Size | 4.625 in. O.D. x .62 in. Thick | 4.625 in. O.D. x 1.75 in. Thick | 4.625 in. O.D. x 2.25 in. Thick | 9.00 in. O.D. x 2.50 in. Thick | 12.00 in. O.D. x 3.25 in. Thick |

## Wide Angle *brushless* Tachometers

| Basic Part Number | Output Sensitivity (v/rad/sec) | Resistance at 25°C (Ohms) | Rotor Inertia (oz. in. sec²) | Pancake Dimensions O.D. (inch) | Pancake Dimensions Thick. (inch) | Pancake Dimensions I.D. (inch) |
|---|---|---|---|---|---|---|
| TG10Y-58 | .03 | 210 | $1.6 \times 10^{-5}$ | 1.000 | .350 | .125 |
| TG10Y-59 | .06 | 390 | $4 \times 10^{-5}$ | 1.000 | .700 | .125 |
| TG18W-56 | .09 | 550 | $2.4 \times 10^{-4}$ | 1.718 | .350 | .187 |
| TG18W-57 | .24 | 1025 | $4.8 \times 10^{-4}$ | 1.718 | .700 | .187 |
| TG18-54 | .17 | 520 | $3.2 \times 10^{-4}$ | 1.718 | .350 | .250 |
| TG18-55 | .39 | 980 | $6.7 \times 10^{-4}$ | 1.718 | .700 | .250 |
| TG25W-9 | .7 | 920 | $2 \times 10^{-3}$ | 2.500 | 1.000 | .250 |
| TG25W-10 | .5 | 500 | $1.5 \times 10^{-3}$ | 2.500 | .500 | .250 |
| TG34W-5 | 1.0 | 1000 | $4.2 \times 10^{-3}$ | 3.313 | .625 | .375 |
| TG34-41 | 1.5 | 825 | $9.1 \times 10^{-3}$ | 3.375 | .725 | .375 |
| TG40W-5 | 1.2 | 335 | $2 \times 10^{-2}$ | 4.000 | .850 | .375 |
| TG40W-3 | 2.5 | 535 | $4 \times 10^{-2}$ | 4.000 | 1.500 | .375 |
| TG52W-5 | 5.0 | 1100 | $1.1 \times 10^{-1}$ | 5.125 | 1.500 | .750 |
| TG52-7 | 3.7 | 360 | $1.4 \times 10^{-1}$ | 5.187 | 1.250 | .984 |

## For Commercial/Industrial Applications

Ask Aeroflex about the **Valueline**-Brushless, Wide Angle, Direct Drive, Low Cost, DC Torque Motors.

Available in a great variety of sizes and outputs, Valueline offers these designer benefits: • No gear trains required • System simplification • Precise positioning • Smooth, quiet output • Unlimited life

MOTOR PRODUCTS DIVISION

**AEROFLEX LABORATORIES INC.**

SOUTH SERVICE ROAD • PLAINVIEW, LONG ISLAND, N.Y. 11803

DEPT. EM TEL. (516) 694-6700

SPECIAL DESIGN FEATURES AVAILABLE . . .
- CHOICE OF OPERATING VOLTAGES
- POLY-PHASE DESIGN
- VARIABLE FREQUENCIES

ROTATING COMPONENTS DIVISION
**AEROFLEX LABORATORIES INC.**
SOUTH SERVICE ROAD • PLAINVIEW, LONG ISLAND, NY 11803
DEPT. EM TEL. (516) 694-6700

**THE SOURCE FOR THE BROADEST VARIETY OF ROTATING COMPONENTS FOR THE MILITARY AND INDUSTRIAL ELECTRONICS INDUSTRY**

- SYNCHRONOUS MOTORS
- INDUCTION MOTORS
- PM GENERATORS
- BRUSHLESS DC MOTORS
- SERVO MOTORS
- GEAR MOTORS
- TACHOMETER GENERATORS
- DRAG CUP MOTORS
- INDUCTION GENERATORS
- FANS
- BLOWERS

## GEAR MOTORS

R.C. offers a wide range of integral motor-gearhead combinations with synchronous and induction motors as well as Servo motors in all R.C.I. frame sizes including 8, 10, 11, 15, 18, on up to 3⅞ O.D.

- Precision engineered for long life.
- Torque up to 4000 in oz.
- All Ratios.
- Backlash: 30 minutes maximum.
- Temperature Range: −55°C to + 150°C.
- Lubrication: MIL-L-6085, MIL-G-3278.
- Environmental Testing: MIL-E-5272.
- Mechanical slip clutch available on request.
- Ball bearings are stainless steel ABEC 5 or better as reqd.
- All gears precision class 2 or better per AGMA 236.04

## INDUCTION DRIVE MOTORS

Powerful • Rugged • Extremely Reliable • Versatile in Application

**Frequencies:** 50-60-400 cps • Variable Frequency • Dual Frequency
**Speeds:** 450 thru 22,000 rpm • 1-2-3 Speeds
**Horsepower:** 1/2000 to ¼ H.P.
**Voltages:** To 440V AC • Single or Dual Voltages
**Phases:** 1-2-3 • Reversible or Unidirectional
**Bearings:** Precision Life Lubricated Ball Bearings
**Mounting:** Face, Base, Flange, Servo
**MIL SPECS:** Exceed MIL-M-7969, MIL-M-17059, MIL-M-13787, MIL-E-16400, MIL-E-5400, MIL-E-5272, MIL-STD-202 Also for quality commercial applications
**Life:** In excess of 10,000 hours in many designs
**Gearheads:** Available with all models Hundreds of models available

## BRUSHLESS DC MOTORS

• **IMPROVE YOUR PRODUCT** • **REPLACE BRUSH TYPE MOTORS, FANS, BLOWERS.**

**OPERATE FROM DC POWER SOURCES • SOLAR CELLS.**

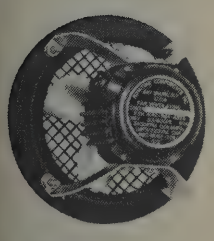
**LIFE** — extremely long — no brushes to replace — no brush dust.

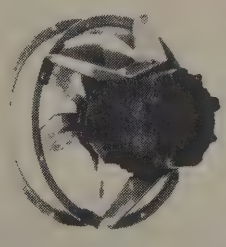
**SAFER** — no sparking in explosive atmosphere.

**RFI** — minimal.

**MIL SPEC APPROVED** for severe environments.
**SPEEDS** — wide selection as required.
**QUIET** — no brush noise.
**EFFICIENT** — low input power.
**SUPERIOR** at high altitudes.
**USES** — Aircraft — Submarines — Spacecraft — Ground Equipment — Any Electronic Equipment.

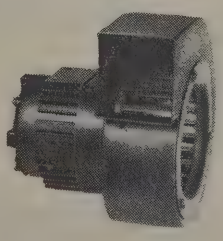
## FANS





- 50/60 Hz
- 400 Hz
- 1 or 3 Phase
- 115-208 Volts
- 3300-11,000 RPM
- 40-1000 CFM

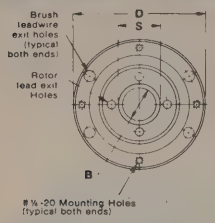
## BLOWERS

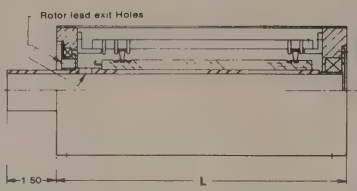


- Single
- Double
- 115-208 Volts
- 50-60 Hz
- 400 Hz
- 1 or 3 Phase

# SLIP RING ASSEMBLIES

## DAY-490 / DAY-499



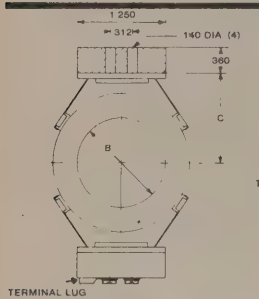



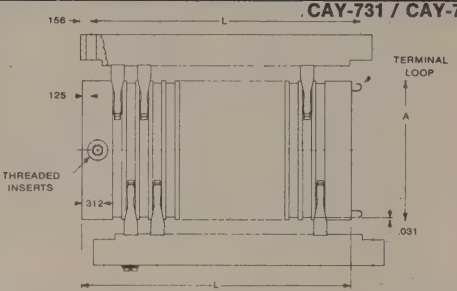
| MODEL | "B" DIA. | "D" DIA. | "S" DIA. | MAX RPM | MIN LIFE $10^6$ | TQUE IN-LBS. |
|---|---|---|---|---|---|---|
| DAY-490 | 1.00 | 4.00 | 1.250 | 5000 | 50 | .21 |
| DAY-491 | 1.75 | 5.00 | 2.125 | 4000 | 40 | .30 |
| DAY-492 | 2.75 | 6.50 | 3.125 | 3000 | 30 | .40 |
| DAY-493 | 3.75 | 7.50 | 4.125 | 2500 | 25 | .50 |
| DAY-494 | 4.75 | 8.50 | 5.125 | 2000 | 20 | .61 |
| DAY-495 | 5.75 | 9.50 | 6.125 | 1500 | 15 | .71 |
| DAY-496 | 6.75 | 10.50 | 7.125 | 1500 | 10 | .82 |
| DAY-497 | 7.75 | 11.50 | 8.125 | 1000 | 10 | .92 |
| DAY-498 | 8.75 | 13.00 | 9.125 | 1000 | 10 | 1.02 |
| DAY-499 | 9.75 | 14.00 | 10.125 | 750 | 7.5 | 1.12 |

| NO. OF CIRCUITS | "L" |
|---|---|
| 4-10 | 4.88 |
| 11-20 | 6.75 |
| 21-30 | 8.63 |
| 31-40 | 10.50 |
| 41-50 | 12.38 |

**FRAME:** Anodized Aluminum
**RINGS:** Coin Silver
**BRUSHES:** Silver Graphite
**LEAFS:** Beryllium Copper
**CIRCUIT TERMINATION:** Silver Lugs or Leadwire
**CURRENT:** 10 amp per circuit (20 amp available at extra cost)
**VOLTAGE:** 250V max. AC or DC
**DIELECTRIC STRENGTH:** 750 Vrms.
**INSULATION RESISTANCE:** 50 meg min
**CONTACT RESISTANCE VARIATION:** 10 milliohms max at max speed
**OPERATING TEMP.:** 0 to 250 F
**HUMIDITY:** 95% ° max.

## CAY-731 / CAY-740



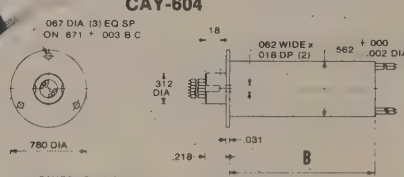




**RINGS:** Coin Silver
**BRUSHES:** Silver Graphite, two per ring
**LEAFS:** Beryllium Copper
**INSULATION:** Epoxy or Laminated Plastic
**CURRENT:** 10 amps per circuit standard (20 amps with 4 brushes per ring)
**VOLTAGE:** 250V max. AC or DC
**DIELECTRIC STRENGTH:** 750 Vrms.
**CONTACT RESISTANCE VARIATION:** 10 milliohms max
**NO. OF CIRCUITS:** 50 max

| PART NO. | A | B | C |
|---|---|---|---|
| CAY-731 | 1.875 | 1.250 | 1.447 |
| CAY-732 | 2.750 | 2.125 | 1.829 |
| CAY-733 | 3.750 | 3.125 | 2.281 |
| CAY-734 | 4.875 | 4.125 | 2.822 |
| CAY-735 | 5.875 | 5.250 | 3.307 |
| CAY-736 | 7.000 | 6.250 | 3.857 |
| CAY-737 | 8.000 | 7.250 | 4.342 |
| CAY-738 | 9.000 | 8.250 | 4.837 |
| CAY-739 | 10.000 | 9.250 | 5.332 |
| CAY-740 | 11.000 | 10.250 | 5.827 |

TO DETERMINE "L" DIMENSION USE THE FOLLOWING FORMULA:
"L" = .750 + .1875 x (No. of Rings)

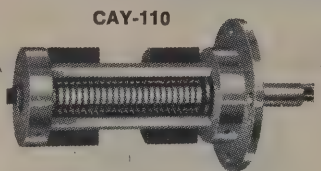
## CAY-604

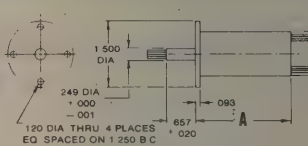



| NUMBER OF RINGS | "B" |
|---|---|
| 1 thru 12 | .741 |
| 13 thru 24 | 1.137 |
| 25 thru 40 | 1.665 |

**RINGS:** Gold Alloy
**BRUSHES:** Gold Alloy Wire, Spring Temper
**BALL BEARINGS:** Stainless Steel, Shielded
**SHAFT:** Stainless Steel
**HOUSING:** Anodized Aluminum
**TORQUE:** 1 in. — oz. max
**SPEED:** 200 RPM max

## CAY-110

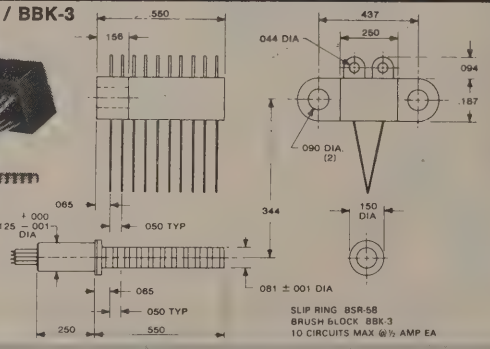





**CURRENT:** 1 amp max per ring
**VOLTAGE:** 100V max
**DIELECTRIC STRENGTH:** 500Vrms.
**CONTACT RESISTANCE VARIATION:** 20 milliohms max
**LIFE:** 5 x $10^6$ revs, min
**ROTATION:** Bi-directional
**LEADWIRE:** Teflon Insulated

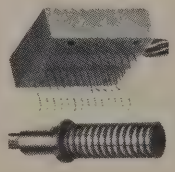
| NUMBER OF RINGS | "A" |
|---|---|
| 1 thru 12 | 1.48" |
| 13 thru 24 | 2.20" |
| 25 thru 30 | 2.56" |

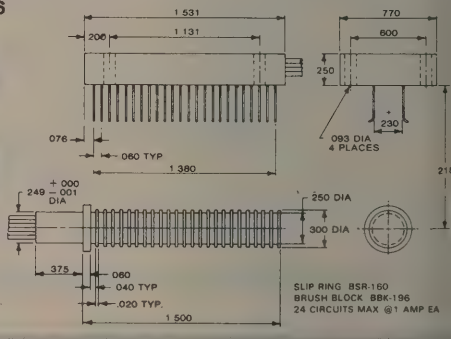
## BSR-58 / BBK-3




SLIP RING BSR-58
BRUSH BLOCK BBK-3
10 CIRCUITS MAX @½ AMP EA

## BSR-160 / BBK-196

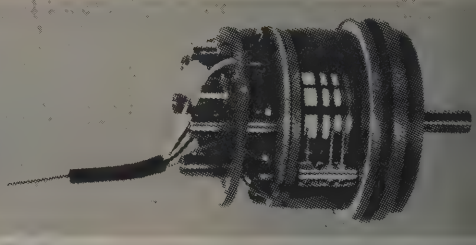




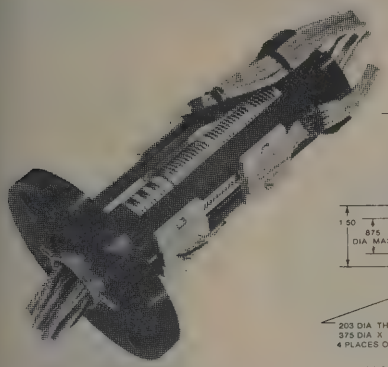

SLIP RING BSR-160
BRUSH BLOCK BBK-196
24 CIRCUITS MAX @1 AMP EA

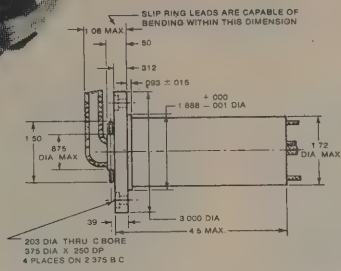
# ENCODERS & SWITCHES

Airflyte encoders and rotary switches feature drum construction with solid gold alloy conducting segments embedded in epoxy and machined flush. Brushes are multi-strand, spring-temper gold-alloy. As small as Size 5.



Airflyte ELECTRONICS CO.



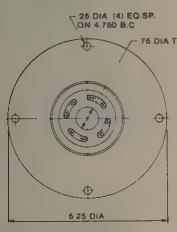


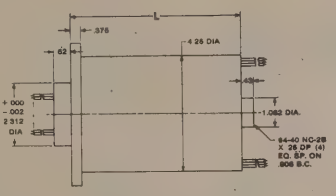

## CAY-150

**NOTES:**
**MECHANICAL**
1. **Rings:** Gold alloy
2. **Brushes:** Gold alloy wire, spring temper
3. **Ball Bearings:** Stainless steel
4. **Shaft:** Stainless steel, type 303
5. **Housing:** Anodized aluminum
6. **Torque:** 48 ring assembly 6.0 in-oz. maximum
7. **Speed:** 600 r.p.m. maximum-intermittent
8. **Life:** 2000 hours'@100 r.p.m.

**ORDERING INFORMATION:**
**CAY-150-**
No. of Rings (48 maximum)

**ELECTRICAL**
1. **Current:** Signal level to 2 amps.
2. **Voltage:** 400 vdc maximum
3. **Dielectric Strength:** 1000 Volts rms (all combinations).
4. **Contact Resistance:** A. Less than 8 milliohms @200 rpm
5. **No. of Rings:** 48 maximum
6. **Leadwire:** #28 awg 18" long



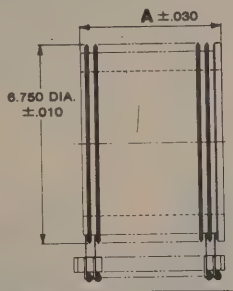

## DAY-705

**NOTES:**
**MECHANICAL**
1. **Rings:** Coin silver
2. **Brushes:** Silver graphite
3. **Ball Bearings:** Shielded
4. **Shaft:** Anodized aluminum
5. **Housing:** Anodized aluminum
6. **Torque:** ½ in.oz. per circuit
7. **Speed:** 500 rpm maximum
8. **Life:** 3000 hours at 100 rpm

**ORDERING INFORMATION:**
**DAY-705-☐**
No.of Rings (160 maximum)

**ELECTRICAL**
1. **Current:** 5 amps maximum per circuit
2. **Voltage:** 0 to 150 volts, AC or DC
3. **Dielectric Strength:** 500 Volts rms (all combinations).
4. **Contact Resistance Variation:** 8 milliohms peak at maximum speed
5. **No. of Rings:** 160 maximum
6. **Leadwire:** #24 awg, teflon insulated.

| No. of Rings | "L" ±.025" |
|---|---|
| 1-20 | 5.375 |
| 21-40 | 8.187 |
| 41-60 | 11.000 |
| 61-80 | 13.812 |
| 81-100 | 16.625 |
| 101-120 | 19.437 |
| 121-140 | 22.250 |
| 141-160 | 25.062 |

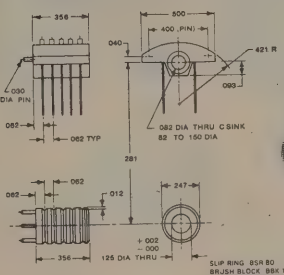



## CAY-94

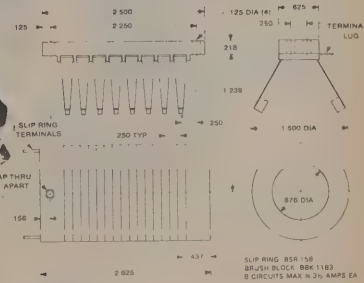
1. **Rings:** Coin silver
2. **Brushes:** Silver graphite (two per ring)
3. **Brush Leafs:** Beryllium copper
4. **Insulation:** Phenolic
5. **Leadwire:** Available upon request
6. **Speed:** 750 r.p.m.
7. **Life:** 1000 hours
8. **Current:** 5 amps per ring: 10 amps per ring when 4 brushes are used
9. **Voltage:** 300 V.R.M.S.
10. **Dielectric Strength:** 500 Volts rms (all combinations).
11. **Insulation Resistance:** 10 megohms minimum at 500 VDC
12. **Noise:** The Contact Resistance Change in Each Circuit Shall be Less Than .005 Ohms At Maximum Speed

| Part No. | A | B | No. of Rings |
|---|---|---|---|
| -41 | 6.065 | 6.497 | 41 |
| -37 | 5.499 | 5.931 | 37 |
| -33 | 4.933 | 5.365 | 33 |
| -29 | 4.367 | 4.799 | 29 |
| -25 | 3.801 | 4.233 | 25 |
| -21 | 3.235 | 3.667 | 21 |
| -19 | 2.952 | 3.384 | 19 |
| -17 | 2.669 | 3.101 | 17 |
| -15 | 2.386 | 2.818 | 15 |
| -13 | 2.103 | 2.535 | 13 |
| CAY-94 -11 | 1.820 | 2.252 | 11 |

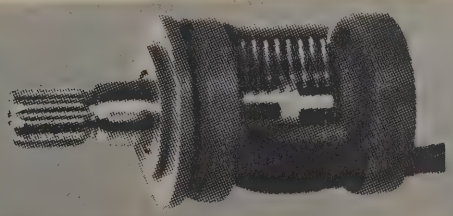
## BSR-80 / BBK-164




## BSR-158 / BBK-1183




**ENCODERS** A wide variety of encoders is available: T / B, BCD, Gray, etc. Special encoders may require nominal tooling charges. Encoders can be supplied with built-in logic circuitry. Sizes: 8-33.



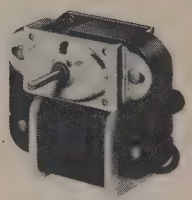
**SWITCHES** When close accuracy, repeatability and size are important, specify Airflyte rotary switches for timing and positioning applications. Successfully replaces snap action switches and cams. Pre-set to eliminate installation time. Zero hysteresis.

CATALOGS • MANY STOCK ITEMS • FINE DESIGN STAFF
CONTACT Airflyte ELECTRONICS CO.
NEW HOOK ROAD, BAYONNE, NEW JERSEY 07002
(201) 436-2230 • TWX 710-779-4489

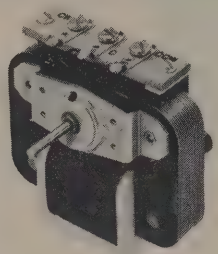
# BARBER-COLMAN MOTORS

## SHADED-POLE MOTORS • 2 POLE, 24/240 VOLTS, 50/60 Hz

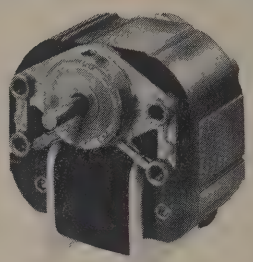
**YAA**
Rated HP to .005. Small and compact.



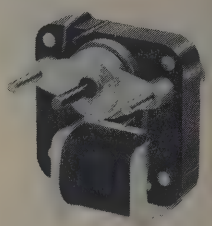
***YAB**
Rated HP to .012. 2.031″ mtg. centers. Most versatile.
*Synchronous models available.



**YAE**
Rated HP to .006. Reversible shading coils. Mechanical or electronic switching.



**YAR**
Rated HP to .042. Our highest powered motor.

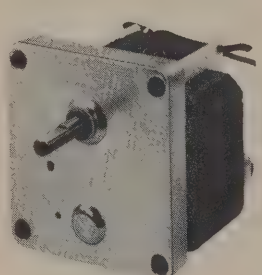


**YAX**
Rated HP to .0085. 1.875″ mtg. centers. Lowest cost in volume.

## SHADED-POLE GEARMOTORS • 2 POLE, 6/240 VOLTS, 50/60 Hz

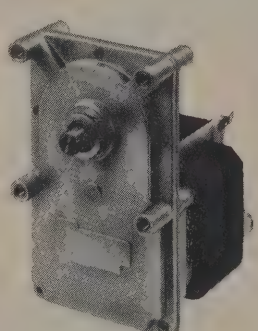
Type "A" gearmotors equipped with 2-pole shaded-pole motor, 6 to 240 volts, 50 or 60 Hz. Seven stack sizes available, ranging from .425″ to 2.0″. Output shaft diameters: 3/16, 1/4, 5/16, 3/8. Motors are designed to meet U.L. listing requirements.

Optional Features: thermal protection; stainless or plated shafts; cooling fan; solder terminals, leads or quick disconnect spades; brakes or clutch; low cost upper limit thermal protector; pinions; ball bearings.

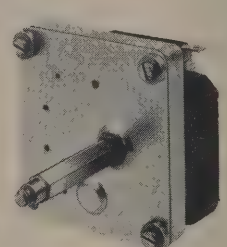


**A1**
Torque to 60 lb-in. Speed 11-800 RPM.

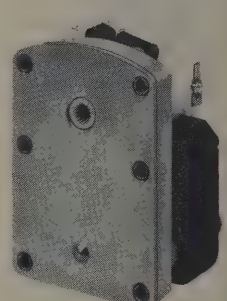
**A2**
Torque to 60 lb-in. Speed 8.7-800 RPM.



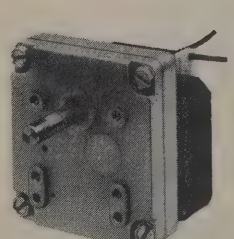
**A3**
Torque to 160 lb-in. Speed 1-200 RPM. Also available for 300 lb-in. Model A19.



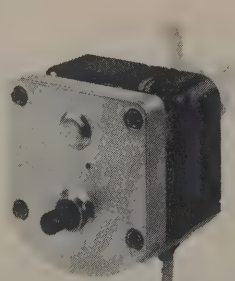
**A4**
Torque to 60 lb-in. Speed 1-800 RPM.



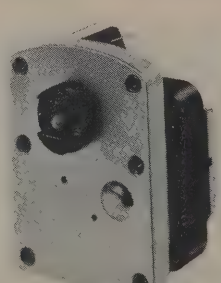
**A5**
Torque to 60 lb-in. Speed 3.7-800 RPM.



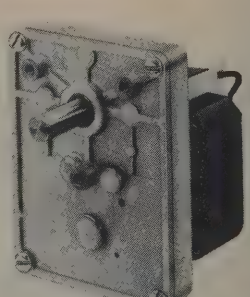
**A8**
Torque to 60 lb-in. Speed 1-800 RPM.



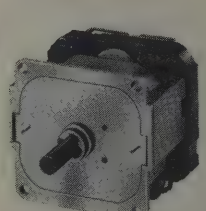
**A12**
Torque to 60 lb-in. Speed 24-800 RPM.



**A15**
Torque to 60 lb-in. Speed 1.6-800 RPM.



**A21**
Torque to 100 lb-in. Speed 1.2-800 RPM.

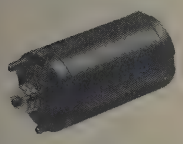


**MZ**
Torque to 15 lb-in. Speed 1-1000 RPM. On-center output shaft.

# D-C PERMANENT MAGNET MOTORS

Barber-Colman D-C motors have oil-impregnated sintered-bronze bearings and hardened steel shafts. Shaft configuration, magnetization and skew can be altered to closely adapt any basic motor or gearhead to the individual application. Various combinations of gear material are available. When required, noise filters are designed for specific frequency bands and internally mounted at the brushes for maximum noise reduction. Integral brushless tachometers for precise voltage/speed control are available for type FYQM, CYQM and GYQM motors.

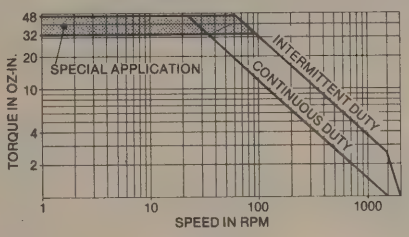
Barber-Colman's engineering depth and manufacturing capabilities combine to offer a broad line of motors and gearheads to meet the most demanding applications in the subfractional HP field.



## FYQM

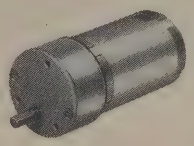
1.26″ Dia.
6–40V D-C.
Typical S/T 3000 RPM
at 1.5 oz-in.

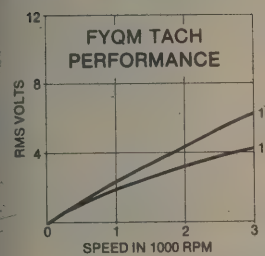
TYPICAL SPEED/TORQUE CURVES



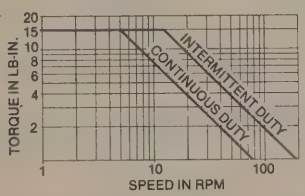

## FYQM-FYQH

1.38″
Max. Dia.

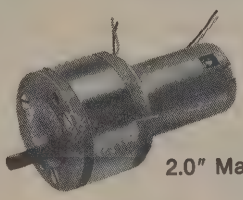




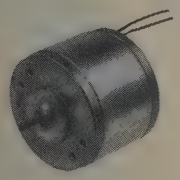

## FYQM Tach




## FYQM-CYQH

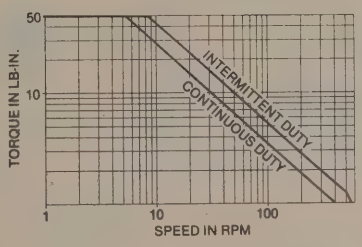


2.0″ Max. Dia.

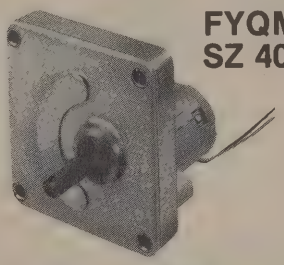


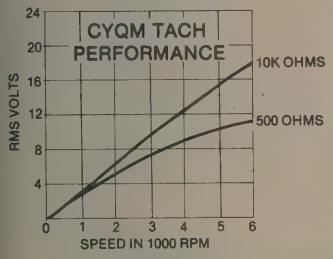
## CYQM

2.0″ Dia.
6–32V D-C.
Typical S/T 2700 RPM
at 4 oz-in.

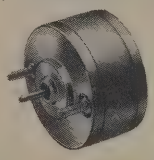


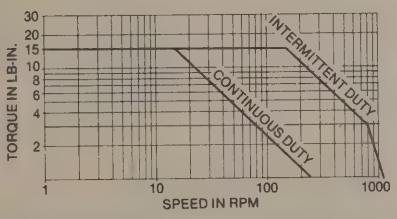

## FYQM-SZ 400





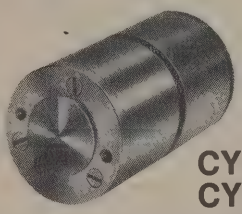

## CYQM Tach





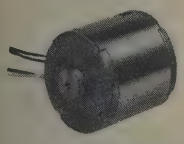

## CYQM-CYQH

2.0″ Max. Dia.



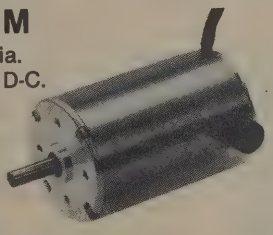
## GYQM

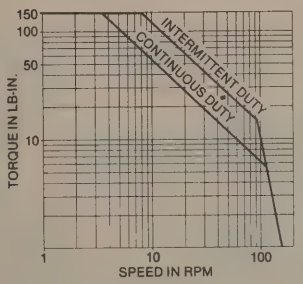
1.57″ Dia (40 mm).
6–40 Volts D-C.



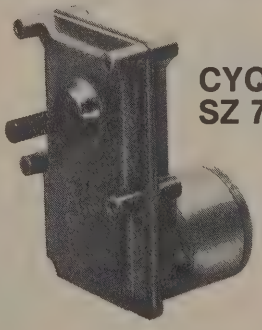
## KYQM

2.0″ Dia.
6–75V D-C.






## CYQM-SZ 700



The GYQM offers a package size different from the FYQM suitable for audio, computer peripheral and business machine applications. Typical S/T—See FYQM.

The KYQM is designed for high power/high current capability. Voltage range 6 to 75 VDC up to 100 mHP. Usable as a low-cost torquer and as a servo motor. Available with sintered-bronze or ball bearings and high-strength ceramic magnets.

**Barber-Colman Company**
**MOTOR DIVISION**
*Dept. G, 14116 Rock Street,*
*Rockford, Illinois, U.S.A., 61101*

# BERGER LAHR

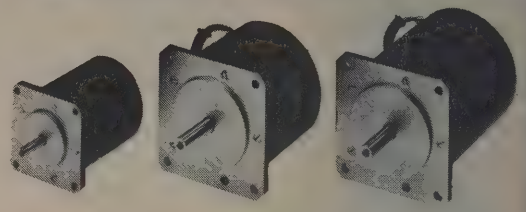
## 5-Phase PM Stepping Motors & Drives

**Step Angle** — .72° full and .36° half
**Steps per Revolution** — 500 and 1,000
**Accuracy** — ±3 min of arc
**Start/Stop Speed** — up to 2,500 full steps/sec (5,000 half)
**Slew Speed** — up to 100,000 steps/sec (6,000 rpm)

**Features** — Smallest step angle. Highest start/stop rates and slew frequencies. Finest resolution without gearing. No torque degradation at half step. Minimal resonance — will not lose synchronization (even unloaded) in resonant and harmonic regions. Inherently better damped, for fastest response and accel/decel times. Quiet operation.

**Constant Voltage Drives**
Model D100: Full .72° step only. 24 to 48V at 1.4A max.
Model D200: Selectable full/half step. 24 to 48V at 2.5A max or 70V at 1.5A max.

**Constant Current Drives**
Selectable full/half step. 90V dc. Current ranges fully adjustable. 19″ rack or OEM modules available.



| Model No. | Running Torque, oz in. | Holding Torque, oz in. | Phase Current, amps | Phase Resistance, ohms | Wgt, kg | Motor OD, in.(mm) | Shaft dia, in.(mm) |
|---|---|---|---|---|---|---|---|
| RDM 564/50 | 31 | 35 | 0.75 | 2.5 | 0.5 | 2.36(60) | .236(6) |
| RDM 566/50 | 52 | 56 | 0.75 | 4.0 | 0.8 | 2.36(60) | .236(6) |
| RDM 569/50 | 100 | 120 | 1.40 | 2.3 | 1.3 | 2.36(60) | .236(6) |
| RDM 596/50 | 160 | 175 | 1.25 | 2.1 | 1.5 | 3.34(85) | .374(9.5) |
| RDM 599/50 | 300 | 310 | 1.15 | 3.3 | 2.5 | 3.34(85) | .374(9.5) |
| RDM 5913/50 | 460 | 500 | 2.80 | 1.0 | 3.5 | 3.34(85) | .374(9.5) |
| RDM 51117/50 | 1,000 | 1,100 | 5.00 | 0.3 | 7.2 | 4.33(110) | .625(16) |

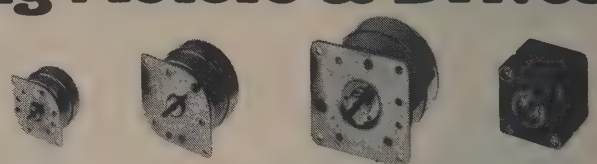
## 2-Phase PM Stepping Motors & Drives

**Step Angles** — 3.6°, 7.5°, 9°, 11.25°, 15°, 18°
**Steps per Revolution** — 20 to 100
**Start/Stop Speed** — up to 750 steps/sec
**Slew Speed** — up to 3,500 steps/sec

**Features** — Exclusive dual self-aligning sleeve or ball bearings. Unequaled reliability. Largest selection of angles per model. Wide choice of winding resistances. Performance unaffected by extremes in duty cycle and temperature (−20°C to +80°C). Exceptionally high shock immunity.

**3.6° Step Angle**
Model RDM253/25 features the only 3.6° step angle in the industry. Highest efficiency — rare earth magnet design results in optimum torque/inertia/power/size ratios.

**2-Phase Drives**
Inexpensive unipolar single chip translator driver (.35A/phase) with optional output drive chip (1.5A/phase). Bipolar constant current driver 90V dc (12.5A/phase).

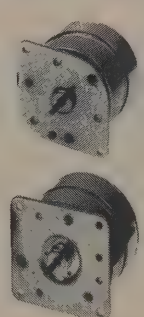


| Model No. | Step Angle, degrees | Running Torque, oz in. | Holding Torque, Energized, oz in. | Phase Current, amps | Phase Resistance, ohms | Wgt, kg | Motor OD, in.(mm) | Shaft Dia, in.(mm) |
|---|---|---|---|---|---|---|---|---|
| RDM 36/8 | 11.25 | 0.7 | 1.0 | 0.26 | 11.0 | 0.09 | 1.417(36) | .078(2) |
| RDM 36/10 | 9 | 0.6 | 0.9 | 0.26 | 10.8 | 0.09 | 1.417(36) | .078(2) |
| RDM 50/5 | 18 | 4.1 | 5.7 | 0.67 | 4.4 | 0.25 | 1.968(50) | .118(3) |
| RDM 50/6 | 15 | 4.9 | 6.9 | 0.67 | 4.4 | 0.25 | 1.968(50) | .118(3) |
| RDM 50/8 | 11.25 | 5.1 | 7.1 | 0.67 | 4.4 | 0.25 | 1.968(50) | .118(3) |
| RDM 50/10 | 9 | 5.4 | 7.1 | 0.67 | 4.4 | 0.25 | 1.968(50) | .118(3) |
| RDM 50/12 | 7.5 | 6.4 | 9.2 | 0.67 | 4.4 | 0.25 | 1.968(50) | .118(3) |
| RDM 63/8 | 11.25 | 15.6 | 21.2 | 1.10 | 3.2 | 0.50 | 2.519(64) | .157(4) |
| RDM 63/10 | 9 | 17.0 | 24.1 | 1.10 | 3.3 | 0.50 | 2.519(64) | .157(4) |
| RDM 63/12 | 7.5 | 21.2 | 28.3 | 1.10 | 3.3 | 0.50 | 2.519(64) | .157(4) |
| RDM 253/25 | 3.6 | 8.9 | 10.0 | 0.15 | 75.0 | 0.21 | 1.653(42) | .196(5) |

## PM Synchronous Motors

**Speeds** — 300, 360, 450, 600, 900 rpm at 60 Hz
**Torques** — from 1 to 25 oz in.

**Features** — Exclusive dual self-aligning sleeve or ball bearings, permanently lubricated. Broadest speed selection in industry. PM rotor gives high unenergized holding torque. Fast start/stop response — without accidental reversing. Fully reversible. Speed independent of voltage and load. Widest operating temperature range. Impedance protection. Can be stalled indefinitely without overheating. Available for 24 to 220V ac, 50/60 Hz.



## Gearheads

**Torque** — from 10 to 1,500 oz in.

Compatible with synchronous and 2-phase stepping motors. Wide choice of gear ratios (6.25:1 to 3,000:1).

## Engineering

With 40 years of manufacturing experience in electric motors, Berger-Lahr can help you. Our application engineering staff can give you expert assistance on our standard products as well as custom designs.

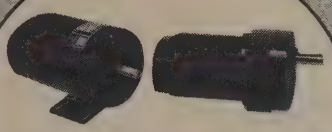
BERGER-Lahr Corporation • Peterborough Road • Jaffrey, New Hampshire 03452
Phone: (603) 532-7701 • Telex: 92-8445

# *Bodine offers a broad line of fhp motors, gearmotors and speed controls.*

More than 4000 standards. Hp from 1/2000 thru 1/2. Torques . . . 0.3 Oz-in. thru 350 Lb-in. Customs and specials . . . available in small and large quantities. Bodine distributors STOCK more than 425 motors, gearmotors, speed/torque controls. Call 312-478-3515 . . . or write for Catalog S. Bodine Electric Co., 2500 W. Bradley Place, Chicago, Illinois 60618.

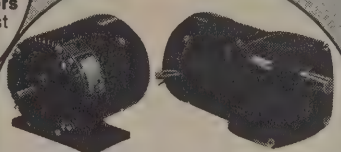
BODINE
ELECTRIC
COMPANY

BODINE MOTORS
GEARMOTORS
SPEED CONTROLS



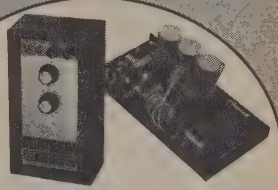
**42A Permanent Magnet D-C Motors and Parallel Shaft Gearmotors.** Just 4.30″ in diameter. Motors TENV 1/8, 1/6, 1/4 Hp. Gearmotors have helical steel gearing.

**New 32A Permanent Magnet D-C Motors and Right Angle Gearmotors.** Only 3.55″ in diameter. TENV Hp 1/12 thru 1/8 at 2500 Rpm. Many gear ratios available.

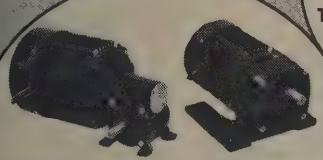


**42R Induction Motors and Parallel Shaft Gearmotors.** Motors 1/20 thru 1/4 Hp. All A-C winding types. Gearmotor ratios to 300:1. Helical steel gearing.

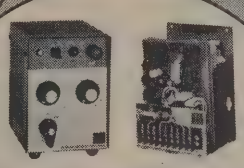
**Torque Motors.** Selected K-2, N-line and 48R motors for holding, positioning and winding applications. Intermittent and continuous duty. Standard ratings 7 thru 92 Oz-in.



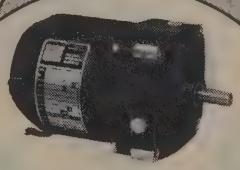
**Encased and Chassis-type Speed Controls for Permanent Magnet Drives.** Provides not only speed adjustment, but also adjustment of torque output. Available from stock.



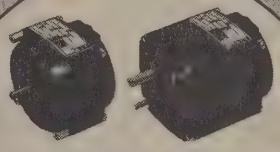
**48R Induction Motors . . . Right Angle and Parallel Shaft Gearmotors.** Motors thru 1/2 Hp. Available 115/230V in 50 or 60 Hz. Gearmotor ratios thru 30:1.



**Encased and Chassis-type D-C Motor Speed Controls for Shunt Wound D-C Control Motors and Gearmotors.** Nine encased models and four chassis models stocked.



**N-1S Gearmotors.** Special purpose gearmotors for applications not requiring the ruggedness of the N-1D. In-line shaft. Only 3.41″ square. 100 lot minimum order.



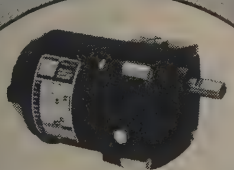
**K-2 Line A-C Motors and Gearmotors.** Instrument quality. Normal slip, high slip, and synchronous windings. Gearmotor torques thru 120 Oz-in. Only 2.405″ square. Stocked.

**N-Line Motors.** Three basic sizes; 3.36″, 4.50″ and 5.68″ in diameter. Stock ratings from 1/125 thru 1/4 Hp. All popular windings are available.

**K-4 Motors.** Special purpose motors for high volume applications. Standard ratings from 1/60 thru 1/20 Hp. Only 2.88″ square. 500 lot minimum order.

**Single Reduction Right Angle Worm Gearmotors.** 6 frame sizes with stock ratings to over 200 Lb-in. Ratios thru 60:1. Ample reserves for overloads.

**N-1R Gearmotors.** Single and double reduction right angle worm gearmotors. Stock ratings thru 5 Lb-in. Many ratios available for a wide range of speed selection.



**N-1D Gearmotors.** Parallel shaft helical and spur gearing. Ratings thru 40 Lb-in. Ratios thru 900:1. Only 3.41″ square.

**Double Reduction Right Angle Worm Gearmotors.** Provide high torques at low speeds. Stock ratings over 200 Lb-in. Ample reserves for overloads.

Canon®

# D.C. MOTORS for OEMS

## subfractional h.p.

Canon offers OEM users one of the world's broadest selections of subfractional h.p. d.c. motors at very competitive prices. Choose from literally hundreds of existing models, or, if you are a large quantity user, we'll supply units to your precise specs. Stall Torques range from 1/2 to 35 oz.-in., speeds to nearly 10,000 rpm ungeared. Most are available for broad voltage ranges, typically: 3-12, 3.3-16, 6-24, 24-70.

Mountings: Most are tapped for front mount. Others available.
Shafts: Length, flats, pinions, pulleys, etc. to customer specs.

## IRON CORE TYPE

**to 35 oz.-in. torque**

Ungoverned and Mechanically Governed. Line includes low cogging models and models with extra long life brushes

## BRUSHLESS TYPE

**0.14 to 4.17 oz.-in. torque**

with or without electronics

## MOTOR TACHOMETERS

**to 20 oz.-in. torque**

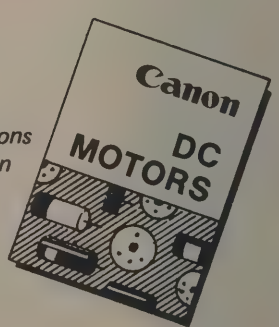
a.c. or d.c. output

## MOTOR GEARHEADS and GEARHEADS

**to 140 oz.-in. output torque**

Reductions from 1/5 to 1/3000 offset or concentric shafts. Mate with most Canon Iron Core and Brushless Motors.

*Short Form Specifications Catalog and Data Sheets on individual motors available.*




Canon®

**Canon U.S.A., Inc.**
Electronics Components Div.
10 Nevada Drive,
Lake Success, L. I., N. Y. 11040

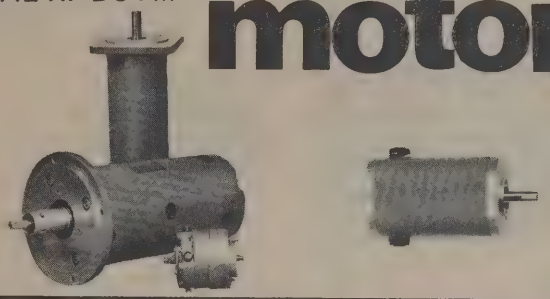
516/488-6700
Telex No. 96-1333
Cable - Canon USA LAKS

# CLIFTON PRECISION

More and more O.E.M.'s are changing to Clifton. They know that Clifton offers the finest motor technology, versatility and a responsiveness to customer's needs that is unmatched in the industry. Clifton designers have demonstrated an ability to solve seemingly impossible problems. Why not put Clifton technology to work for you?

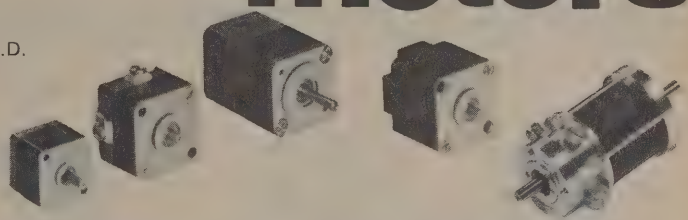
## FRACTIONAL HP DC PM motors

| APPLICATIONS | FEATURES |
|---|---|
| TAPE TRANSPORT DRIVES | Torques from 10 to 120 lb-ft |
| DISK MEMORY DRIVES | 2 inch to 5.5 inch O.D. |
| PRINTER CARRIAGE DRIVES | Advanced magnetic materials |
| MACHINE TOOL DRIVES | Cartridge brushes |
| CONVEYOR DRIVES | |



## MINIATURE DC PM INSTRUMENT motors

| APPLICATIONS | FEATURES |
|---|---|
| DAISY WHEEL DRIVES | Torques from 2 to 50 oz-in. |
| PRINT HEAD DRIVES | .75 inch cube to 1.25 inch O.D. |
| INSTRUMENT RECORDERS | Cartridge brushes |
| LABORATORY INSTRUMENTS | Alnico or rare earth magnets |

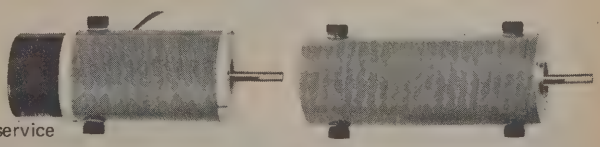


## PM STEPPER motors

| APPLICATIONS | FEATURES |
|---|---|
| PRINTER RIBBON DRIVES | Step angles 7.5°, 15°, 30°, 45°, 90° |
| PRINTER PLATTEN DRIVES | 1.1 inch to 2.8 inch O.D. |
| CARD SORTERS | Ceramic or rare earth magnets |
| OFFICE COPIERS | |

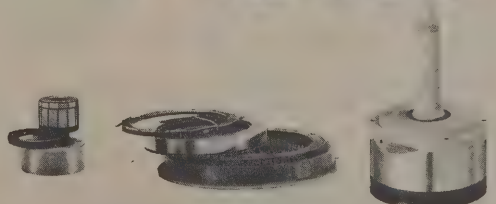
## INTEGRAL ENCODER AND motors MOTOR-TACHOMETER ASSEMBLIES

| APPLICATIONS | FEATURES |
|---|---|
| PRINTER CARRIAGE DRIVES | Optical encoder resolution to 1000 cycles |
| COPYING MACHINES | Solid state gallium arsenide light source |
| SPEED CONTROLS | Integral assemblies — no assembly or alignment necessary |
| MACHINE TOOL CONTROLS | Single source for motor/encoders eliminates costly assembly & simplifies service |



## DC PM HOLLOW SHAFT TORQUE motors

| APPLICATIONS | FEATURES |
|---|---|
| INERTIAL NAVIGATION PLATFORMS | Torques from 6 to 500 oz-in. |
| AIRCRAFT INSTRUMENTS | 1.1 inch to 5.2 inch O.D. |
| AIRCRAFT CONTROLS | Precision tolerances |
| | Gold commutators |
| | High reliability |

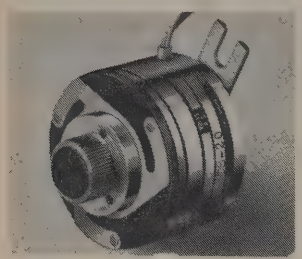


Litton CLIFTON PRECISION

*for further information, call John Staiber,*
(215) 622-1000
MARPLE & BROADWAY, CLIFTON HEIGHTS, PA. 19018

# CLUTCHES & BRAKES ELECTRO MAGNETIC

## SERIES 11 AND SERIES 20 . . . Two complete series of small clutches, brakes and clutch couplings for industrial and business machine applications.



### FEATURES

- High torque in compact package
- Fast response
- Ease of maintenance
- Available as stock items
- Standardized design at competitive price
- Flange or shaft mounting
- Long life
- Zero backlash armature with spring release
- **NO BURNISHING REQUIRED**

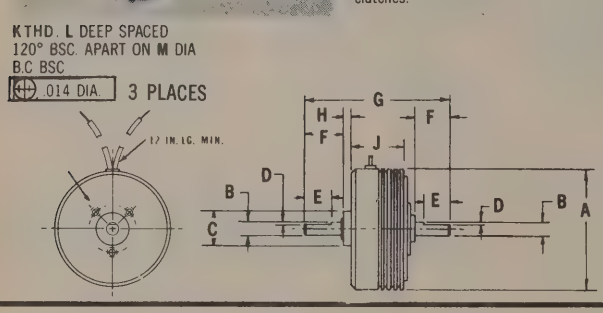
| CHARACTERISTICS | SERIES 11 | SERIES 20 |
|---|---|---|
| Diameter | 1.25" | 1.78" |
| Length (approx.) | 1.25" | 1.65" |
| Static Torque without burnishing | 5 lb. in. min. | 12 lb. in min. |
| Dynamic or slip torque | 5 lb. in. at 1800 RPM<br>4 lb. in. at 3600 RPM | 12 lb. in. at 1800 RPM<br>8 lb. in. at 3600 RPM |
| Mechanical response time | | |
| 65% rated torque | 20 MS* | 27 MS* |
| 100% rated torque | 40 MS* | 45 MS* |
| Electrical response time | 5 MS* | 12 MS* |
| Power requirement | 5 watts | 6 watts |
| Coil voltages available | 6,12,24,90 VDC | 12,24,90 VDC |
| Standard bore sizes | 3/16", 1/4", 5/16" | 1/4", 5/16", 3/8" |
| Standard lead wires | .26 AWG 12" L | 22 AWG 12" L |

*With forcing voltage the response time can be reduced and torque increased.

**For further information ask for Bulletin #11/20**

## HYSTERESIS CLUTCHES/BRAKES

A continuous slip device capable of providing precise, infinitely adjustable torque control. Units are basically direct current sensitive, having excellent reliability, repeatability and linearity. Described below are some of the infinite variations of Hysteresis Brakes manufactured. Also available are a similar wide variety of clutches.




## HYB-HYSTERESIS BRAKES SPECIFICATIONS

| Size | A ±.015 | B +.0000 −.0005 | C +.0000 −.0005 | D ±.005 | E ± .015 | F MIN. | G ± .015 | H ±.005 | J ± .015 | K THD.2B | L MIN. | M BSC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 1.250 | .1875 | .3750 | 020 | 375 | 500 | 2 125 | 050 | 900 | 4-40 | 125 | 687 |
| 20 | 1.750 | .1875 | .5000 | 020 | 375 | 500 | 2 030 | 090 | 765 | 4-40 | 125 | 687 |
| 30 | 1.953 | .1875 | 5000 | 020 | 375 | 500 | 2 280 | 090 | 1 000 | 4-40 | 125 | 687 |
| 35 | 2.093 | .2500 | 6250 | 030 | 500 | 750 | 3 020 | 090 | 1 200 | 6-32 | 250 | 937 |
| 40 | 2.875 | .2500 | .6250 | 030 | 500 | 750 | 3 415 | 090 | 1 540 | 8-32 | 312 | 1 000 |
| 45 | 3.625 | .3750 | .8750 | 062 | 750 | 1 000 | 4 155 | 125 | 1 530 | 8-32 | 312 | 1 500 |
| 50 | 4.437 | 5000 | 1 1250 | 062 | 1 000 | 1 250 | 5 140 | 150 | 2 000 | 10-32 | 500 | 1 750 |
| 55 | 5.484 | .5000 | 1 1250 | 062 | 1 000 | 1 250 | 5 175 | 150 | 2 060 | 10-32 | 562 | 1 750 |

Information on sizes 70/85/120 rated at 750/1600/3000 oz in respectively, available on request

| TECHNICAL DATA | 10 | 20 | 30 | 35 | 40 | 45 | 50 | 55 |
|---|---|---|---|---|---|---|---|---|
| Torque—Oz. In. Min. At Rated Voltage | 4 | 8 | 20 | 35 | 60 | 125 | 210 | 425 |
| Watts—Max. At Rated Voltage At 25°C. | 4 0 | 4 0 | 4 5 | 7 0 | 7 0 | 7 0 | 7 0 | 8 0 |
| Dissipation Capacity, Max: Avg.—Watts | 5 | 10 | 15 | 20 | 50 | 80 | 120 | 150 |
| Maximum Recommended Speed (Input)—RPM. | 3600 | 3600 | 3600 | 3600 | 3600 | 3600 | 3600 | 3600 |
| Moment Of Inertia—Oz. In. Sec.$^2$ x $10^{-3}$ (Input) | .144 | 57 | 58 | 1 4 | 4 57 | 12 7 | 30 6 | 91 3 |
| Drag Torque—Oz. In. Max. (De-energ. & Degaussed) | 20 | 20 | 20 | 30 | 40 | 70 | 1 0 | 1 0 |
| Weight—Lb. Max | 3 | 60 | 80 | 1 2 | 2 6 | 4 1 | 7 8 | 12 5 |

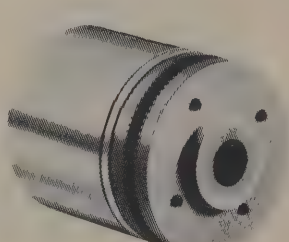
**For further information ask for Bulletin # HCB**

## OTHER AVAILABLE UNITS

### SUBMINIATURE CLUTCHES/ BRAKES

Fast response, low drag torque, high torque-to-inertia ratio, zero backlash. Torque from 3.5 to 240 oz in. and response time from 4 to 50 mili sec. Variety of designs for use as clutches, brakes, or clutch/brake combinations

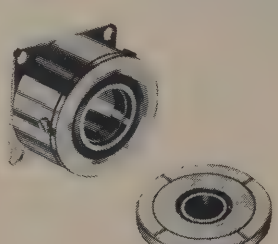
**For further information ask for Bulletin #SCB**



### TOOTH TYPE CLUTCHES

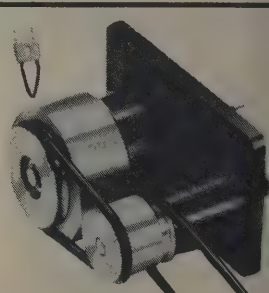
Positive engagement and high torque to weight ratio make them ideal for airborne and space applications. Clutches and brakes available to 700 lb. in Unit shown rated at 250 lb. in. in a 2-1/8" diameter x 2" long package

**For further information ask for Bulletin # TTC**



### APILON® FACED CLUTCHES and BRAKES

For severe service over extended periods of time. Special APILON ceramic friction facing has exceptionally high wear resistance and heat dissipation properties. Life expectancy of APILON faced units is in the area of 100 million operating cycles. The mechanical life of the unit matches the extraordinary life of the facings



### CUSTOM-DESIGNED UNITS

Delevan can provide units to meet the highly specialized requirements of virtually any commercial, industrial or military application. Here is a clutch/brake used to incrementally move recording type. The molded frame not only supports the clutch and brake, but also includes an idler pulley for a secondary speed output

**For further info ask for Bulletin #AFC**

Delevan Division

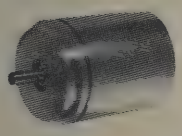
AMERICAN PRECISION INDUSTRIES INC.

270 QUAKER RD. / EAST AURORA, N. Y. 14052
TELEPHONE (716) 652-3600 TELEX 91-293

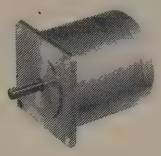
# Eastern Air Devices

Dover, N.H. 03820 • (603) 742-3330 • TWX (510) 297-4454

## STEPPING MOTORS



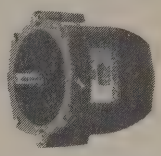
Sizes 8 through 20 VR and PM stepping motors, 7.5, 10, 15, 22.5, 30, 45, and 90 degree step angles with a wide range of voltage and torque ratings. Heat sinks and mechanical dampers available.



Size 23 (2 7/32" dia.) and size 34 (3⅜" dia.) permanent magnet stepping motors with 1.8, 1.875, 2, 2.5, 5, and 7.5 degree step angles. Torque ratings from 50 to 150 oz. in. for size 23, and 150 to 450 oz. in. for size 34.

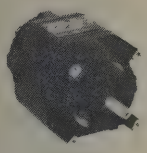
Size 42 (4 3/16" dia.) permanent magnet stepping motors with 1.8 degree step angles. Torque ratings from 150 to 400 oz. in.

## TACHOMETER ALTERNATOR



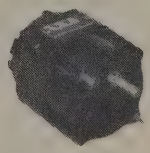
Model J15. Rugged PM design for maintenance free industrial applications. Output 5 volts/1000 RPM. 2.5% max. distortion, 0.1% linearity.

## INSTRUMENT MOTORS AND GEAR MOTORS

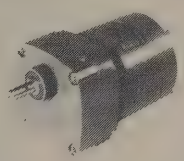


Holtzer Cabot Model M instrument motors with ratings up to 1/20 HP. Available as induction, torque, and synchronous motors in either face or foot mount. Only 2⅞" sq. Popular for floppy disk drive applications.

Holtzer Cabot Model L & S instrument motors with ratings up to 1/100 HP. Available as servo, polarized synchronous, synchronous, torque, induction, and DC motors. Only 2 5/16" square.



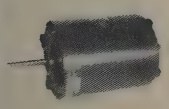
Holtzer Cabot Model L & S instrument gear motors with ratings through 150 oz. in. Available with gear reductions from 3:1 to 3600:1 in either spur or in helical gearing. Only 2 5/16" square.



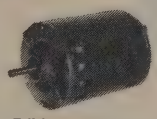
Size 34 (3⅜" dia.) synchronous and non-synchronous gear motors. Speeds from 2 RPM to 150 RPM. Torque output up to 40 lb. in. For applications that require quiet operation and long life.

Holtzer Cabot right angle gear motors. Up to ⅛ HP in a variety of voltages, either AC or DC. Gear ratios from 6:1 to 1140:1 in either single or double reduction gear reducers.

## SYNCHRONOUS AND INDUCTION MOTORS

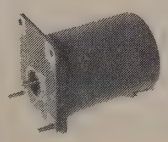


Size 34 (3⅜" dia.) and 44 (4⅜" dia.) synchronous and induction motors. 1/300 through ½ HP. 600 to 12,000 RPM. Single or dual speeds, single or dual voltage. 50/60 or 400 Hz.



Size 39 (3⅞" dia.) synchronous and induction motors. 1/200 through ½ HP. 600 to 3600 RPM. Single or dual speeds. 50/60 Hz.

## BRUSHLESS DC MOTORS

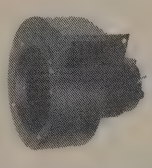


Size 15 brushless DC motors. Various voltage and torque ranges. Typical are 24 VDC, 0.6 oz. in. @ 3000 RPM and @ 45% efficiency.

## FANS AND BLOWERS

Propeller and Tubeaxial fans. Up to 12" dia. up to 1500 CFM. The EAD line of axial fans for cooling application is manufactured for continuous duty and efficient air circulation.

Vaneaxial fans. Available in 1½", 2", and 4¾" dia. from 3 to 500 CFM at high static pressures. EAD V-Line fans are small and powerful air moving devices particularly suited to high-density electronic packages.



Centrifugal blowers. From 3 to 2000 CFM, static pressures up to 5" of water. These centrifugal squirrel cage blowers have general-purpose performance characteristics for systems with medium back pressures.

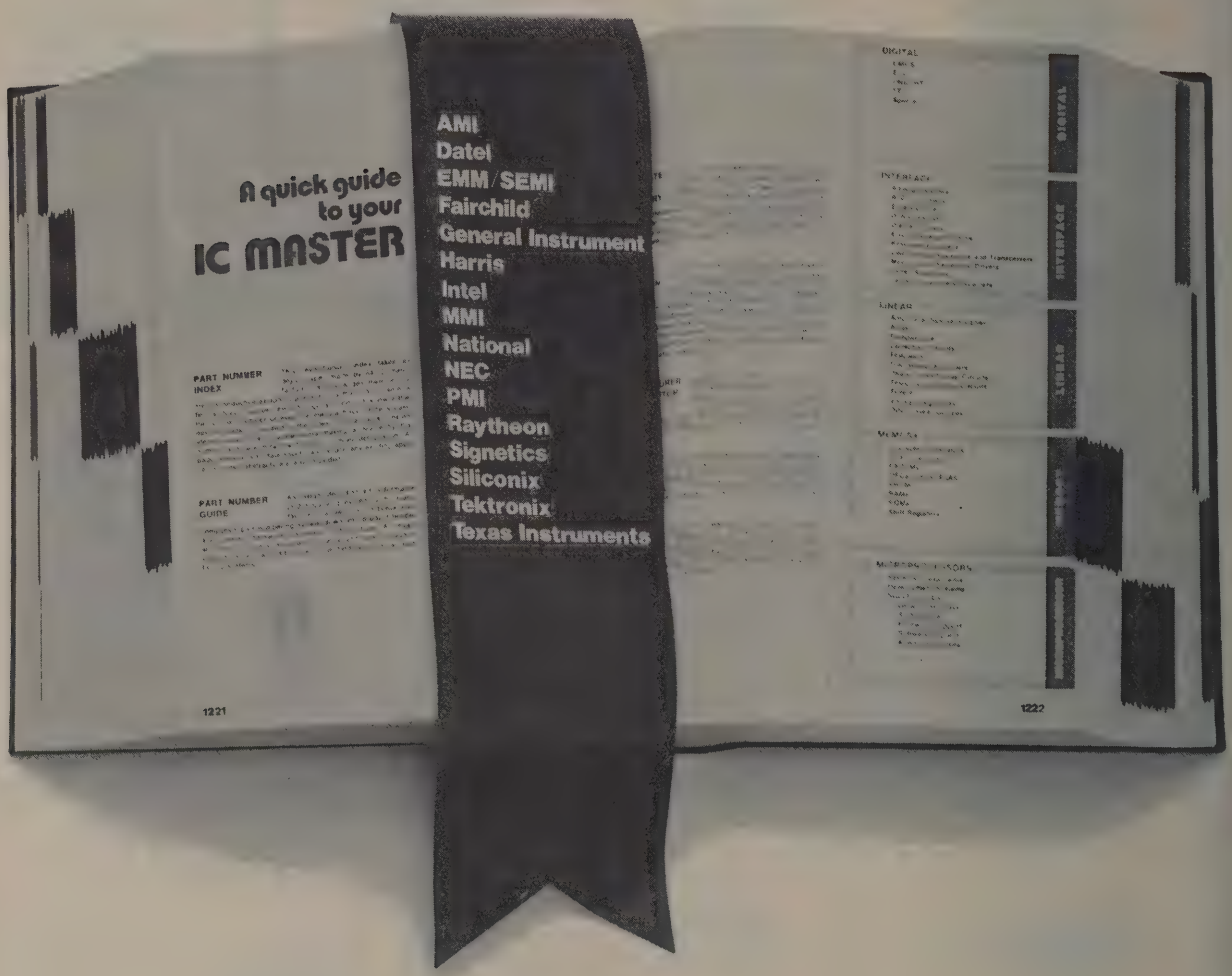
EAD Motors

Holtzer Cabot Instrument Motors

Janette Gear Motors and Reducers

A division of Electro Audio Dynamics, Inc.

# A GOOD BOOK IS KNOWN BY THE COMPANIES IT KEEPS




These manufacturers have invested in the IC MASTER to bring you the most comple information on their newest standard products.

WHEN USING THE IC MASTER, REFER TO THESE MANUFACTURERS' COMPLE DATA SHEETS TO HELP YOU IN YOUR IC SELECTION . . .

## THE WHOLE WORLD FOLLOWS THE MASTER.

**IC Master**
**1333 Lawrence Expressway, Suite 420**
**Santa Clara, CA 95051**
**(408) 248-8044**

***It's Faster With the Master***

# When you build with Electro-Craft, the whole is greater than the sum of the parts.

When you're looking for motion control components, you want products that will give your design an extra dimension of performance and capability. Products that will put life into your concepts. Vitality into your ideas. More than the sum of the parts.

That's what you get when you come to Electro-Craft—manufacturers of the broadest line of motion control components and systems in the industry. Iron core, moving coil and brushless DC motors, tachometers, optical encoders, servo amplifiers, speed control systems and full closed loop digital position control systems. Products that are designed and manufactured to work together to give you the maximum in accuracy and performance.

And, there's more. Electro-Craft engineers draw on nearly two decades of experience and expertise in thousands of motion control applications. That means you get in-depth design assistance, problems solved and overall performance enhanced.

And, if there is not a standard Electro-Craft product that fits your specific application, our engineers can likely design a system or component that will.

To find out how Electro-Craft products can make your design more than the sum, give us a call at 612/935-8226, or write Dept. 1009 for our free catalog. The fourth edition of our 500-page engineering handbook, DC MOTORS, SPEED CONTROLS, SERVO SYSTEMS AND ENCODERS, is available for $1.00 ($5.00 overseas).

ELECTRO-CRAFT CORPORATION

1600 Second Street South, Hopkins, Minn. 55343

# SLIP RING ASSEMBLIES

## STANDARD MODELS FROM THE FABRICAST CATALOG with BORE SIZES THRU 8 INCHE

## BEST DELIVERY SLIP RING ASSEMBLIES

### DELIVERY

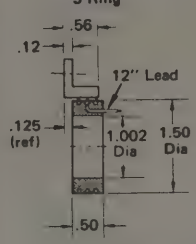
For BEST COST and BEST DELIVERY of multi-track units, Fabricast maintains all the components necessary to manufacture the slip ring assemblies shown.

**PART NUMBER CODING** – Specify fully when ordering

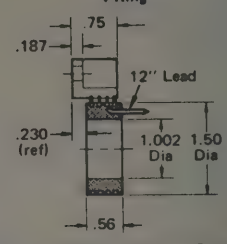
| Type | Bore (inches) | No. Rings | Lead Length (inches) | Lead Type (Shielded · S / Unshielded · U) |
|---|---|---|---|---|
| X | X | X | X | X |

**SEPARATE ROTOR AND BRUSH BLOCK ASSEMBLY**

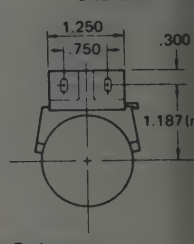
**TYPE 1301**
3 Ring




**TYPE 1401**
4 Ring

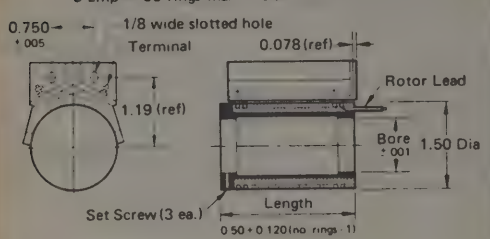



**TYPICAL END VIEW**

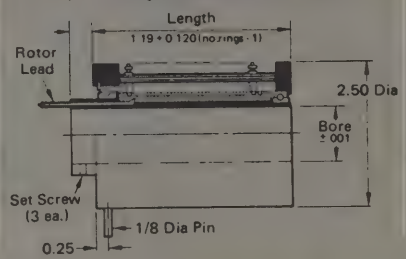



5 amp – 1000 VAC Hi-Pot – .010 ohm Dynamic Resistance
– Coin Silver Rings – Silver Graphite Brushes

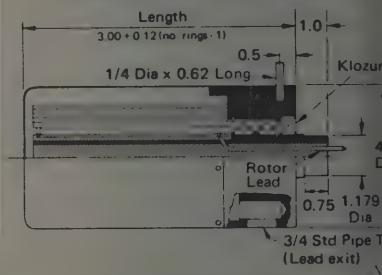
**Slip Ring Assembly Type 1057**
Separate Rotor and Brush Block
5 amp – 50 rings max – Bore 1.002 dia max



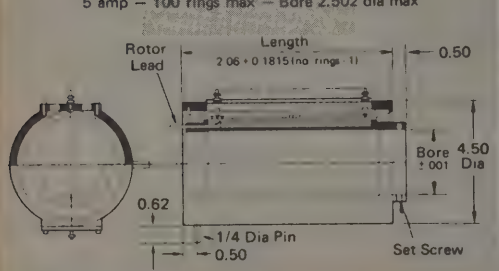

**Slip Ring Assembly Type 1186**
Self-contained – Shaft Mtg
5 amp – 50 rings max – Bore 1.002 dia max



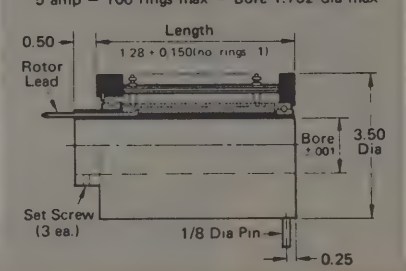

**Slip Ring Assembly Type 1302**
Self-contained – Sealed Housing
5 amp – 50 rings max – Solid Bore



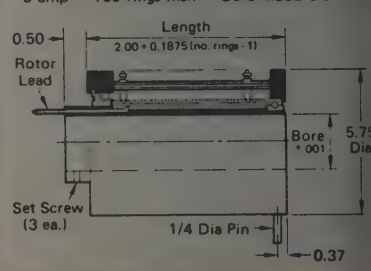

**Slip Ring Assembly Type 1067**
Self-contained – Shaft Mtg
5 amp – 100 rings max – Bore 2.502 dia max



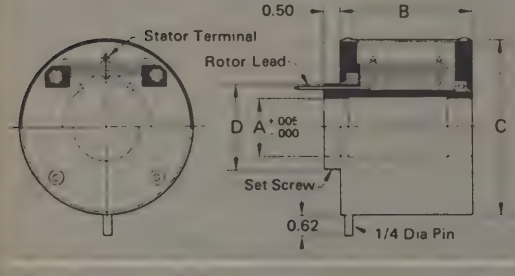

**Slip Ring Assembly Type 4268**
Self-contained – Shaft Mtg
5 amp – 100 rings max – Bore 1.752 dia max




**Slip Ring Assembly Type 1390**
Self-contained – Shaft Mtg
5 amp – 100 rings max – Bore 4.252 dia max




## SELF CONTAINED COVERED STATOR TERMINAL SLIP RING ASSEMBLIES




**PART NUMBER CODING** – Specify fully when ordering

| Type | Bore (inches) | No. Rings | Lead Length (inches) | Lead Type (Shielded · S / Unshielded · U) |
|---|---|---|---|---|
| X | X | X | X | X |

| TYPE | BORE DIA "A", inches Nominal | BORE DIA "A", inches Range | NO. RINGS MAX | CURRENT | LENGTH "B", inches | Housing Dia "C" | Sle Ext Dia |
|---|---|---|---|---|---|---|---|
| 1292 | SOLID | ——— | 41 | 5 amp std 2 brushes per ring | .85 + .088 (no. rings - 1) | 2.50 | 2. |
| 1294 | SOLID | ——— | 48 | | 1.12 + .110 (no. rings - 1) | 2.25 | .8 |
| 1295 | SOLID | ——— | 200 | | 7.50 + .150 (no. rings - 1) | 5.00 | 2. |
| 1297 | .500 | .378 - .565 | 50 | | 1.25 + .120 (no. rings - 1) | 2.75 | 1. |
| 1298 | 1.000 | .566 - 1.002 | 50 | | 1.25 + .120 (no. rings - 1) | 3.00 | 1. |
| 1272 | 1.000 | 1.000 - 1.750 | 100 | 10 amp or lo noise 4 brushes per ring | 2.00 + .150 (no. rings - 1) | 5.25 | 2. |
| 1273 | 2.000 | 1.750 - 2.625 | 100 | | 2.00 + .150 (no. rings - 1) | 6.25 | 3. |
| 1274 | 3.000 | 2.625 - 3.750 | 58 | | 2.00 + .160 (no. rings - 1) | 7.50 | 4. |
| 1275 | 4.000 | 3.750 - 4.750 | 48 | | 2.00 + .186 (no. rings - 1) | 9.00 | 6. |
| 1276 | 5.000 | 4.750 - 5.750 | 63 | | 2.00 + .186 (no. rings - 1) | 10.50 | 7. |
| 1277 | 6.000 | 5.750 - 6.750 | 58 | | 2.00 + .1875 (no. rings - 1) | 12.00 | 8. |
| 1278 | 8.000 | 6.750 - 8.750 | 58 | | 2.00 + .1875 (no. rings - 1) | 15.00 | 10 |
| 1282 | 1.000 | 1.000 - 1.250 | 16 | 50 amp std 100 amp 4 brushes per ring | 3.00 + 1.050 (no. rings - 1) | 8.00 | 2. |
| 1233 | 2.000 | 1.250 - 2.000 | 16 | | 3.00 + 1.050 (no. rings - 1) | 9.00 | 3. |
| 1284 | 3.000 | 2.000 - 3.125 | 9 | | 3.00 + 1.120 (no. rings - 1) | 10.00 | 4. |
| 1285 | 4.000 | 3.125 - 4.375 | 8 | | 3.00 + 1.116 (no. rings - 1) | 11.50 | 6. |
| 1286 | 5.000 | 4.375 - 5.375 | 10 | | 3.00 + 1.116 (no. rings - 1) | 12.50 | 7. |
| 1287 | 6.000 | 5.375 - 6.375 | 10 | | 3.00 + 1.125 (no. rings - 1) | 13.50 | 8. |
| 1288 | 8.000 | 6.375 - 8.375 | 10 | | 3.00 + 1.125 (no. rings - 1) | 16.00 | 10 |

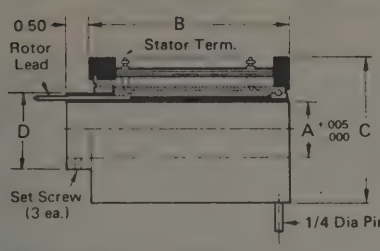
**CHARACTERISTICS** **HOUSING:** Bell, Bell Spacer and Cover type construction. All other characteristics same as for Self Contained Rigid Housing Slip Ring Assembly.

WRITE OR PHONE FOR THE FABRICAST CATALOG

**Fabricast, Inc.** MANUFACTURERS OF SLIP RING ASSEMBLIES

2517 SEAMAN AVENUE, SOUTH EL MONTE, CALIF. 91733 Phone 213/443-3247 (S. El Monte/Los Ang

# SELF CONTAINED RIGID HOUSING SLIP RING ASSEMBLIES



**PART NUMBER CODING** – Specify fully when ordering

| Type | Bore (inches) | No. Rings | Lead Length (inches) | Lead Type | Shielded - S / Unshielded - U |
|---|---|---|---|---|---|
| X | X | X | X | X | |

| TYPE | BORE DIA "A", inches Nominal | BORE DIA "A", inches Range | NO. RINGS MAX | CURRENT | LENGTH "B", inches | Housing Dia "C" | Sleeve Exten. Dia "D" |
|---|---|---|---|---|---|---|---|
| 4150 | 1.000 | .000 - 1.002 | 64 | 5 amp std | 1.19 + .120 (no. rings - 1) | 2.50 | 1.30 |
| 4200 | 1.312 | 1.000 - 1.312 | 100 | 2 brushes | 1.19 + .125 (no. rings - 1) | 3.00 | 1.81 |
| 4237 | 1.750 | 1.312 - 1.752 | 78 | per ring | 1.19 + .130 (no. rings - 1) | 3.37 | 2.31 |
| 4268 | 2.000 | 1.750 - 2.002 | 100 | | 1.28 + .150 (no. rings - 1) | 3.62 | 2.56 |
| 4350 | 2.750 | 2.250 - 2.752 | 100 | 10 amp std | 1.75 + .150 (no. rings - 1) | 4.50 | 3.50 |
| 4400 | 3.250 | 2.750 - 3.252 | 100 | or lo noise | 1.75 + .160 (no. rings - 1) | 5.00 | 4.00 |
| 4462 | 3.750 | 3.250 - 3.752 | 100 | 4 brushes | 1.75 + .160 (no. rings - 1) | 5.50 | 5.00 |
| 4500 | 4.250 | 3.750 - 4.252 | 100 | per ring | 1.75 + .187 (no. rings - 1) | 6.00 | 5.50 |
| 4600 | 5.250 | 4.250 - 5.252 | 79 | | 1.75 + .165 (no. rings - 1) | 7.00 | 6.00 |
| 4700 | 6.250 | 5.250 - 6.252 | 63 | | 1.75 + .186 (no rings - 1) | 8.00 | 7.00 |
| 4800 | 7.250 | 6.250 - 7.252 | 58 | | 1.75 + .187 (no rings - 1) | 9.00 | 8.00 |
| 4900 | 8.750 | 7.250 - 8.750 | 58 | | 1.75 + .187 (no rings - 1) | 11.00 | 10.00 |
| 1271 | 1.000 | .000 - 2.000 | 15 | 50 amp std | 3.50 + 1.050 (no. rings - 1) | 4.50 | 2.92 |
| 1291 | 3.000 | 2.000 - 3.252 | 9 | 50 amp std | 4.50 + 1.120 (no. rings - 1) | 6.50 | 5.00 |

### CHARACTERISTICS

**RPM:** Rigid one piece housing eliminates bearing alignment problems.

**RINGS:** Coin Silver 5 amp rings.
Copper 50 amp rings.

**BRUSHES:** Silver Graphite
Fabricast Grade FAG 180 (80% AG – 20% C)
Two brushes per ring.
Brushes individually removable and replaceable.

**NOISE:** 10 Milliohms dynamic resistance max
5 Milliohms max with 4 brushes per ckt.

**CURRENT:** Noted in tabulated block.
Rating may be doubled with 4 brushes per ckt.

**HI-POT:** 1200 VAC 60 cycle for 15 seconds.

**ROTOR:** One piece steel sleeve.
Ring complement vacuum cast on sleeve as unit with epoxy dielectric.

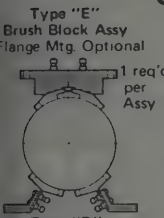
**ROTOR LEADS:** 5 amp Leads – 20 ga per MIL-W-16878 type "E"
50 amp Leads – 8 ga per MIL-W-16878 type "B"

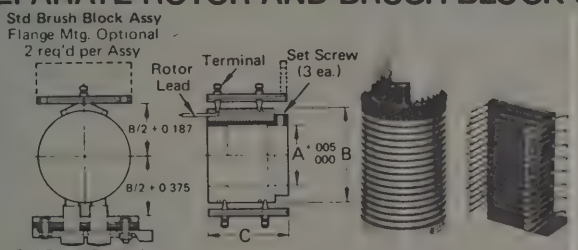
**HOUSING:** One piece steel tubing construction.

**COVER:** Easily removable for brush and ring inspection.

**BEARINGS:** Shielded or sealed ball bearings.

# SEPARATE ROTOR AND BRUSH BLOCK SLIP RING ASSEMBLIES




**PART NUMBER CODING** – Specify fully when ordering

| Type | Bore (inches) | No. Rings | Lead Length (inches) | Lead Type | Shielded - S / Unshielded - U | Type Brush Block |
|---|---|---|---|---|---|---|
| X | X | X | X | X | | X |

| TYPE | BORE DIA "A", inches Nominal | BORE DIA "A", inches Range | NO. RINGS MAX | CURRENT | Slip Ring Dia "B" | LENGTH "C", inches |
|---|---|---|---|---|---|---|
| 2050 | SOLID | .000 - .127 | 18 | 5 amp std | .500 | .625 + .125 (no. rings - 1) |
| 2087 | SOLID | .000 - .377 | 48 | 5 amp std | .875 | .625 + .110 (no. rings - 1) |
| 2112 | .375 | .000 - .627 | 100 | 5 amp std | 1.125 | .625 + .125 (no. rings - 1) |
| 2150 | .750 | .620 - 1.002 | 64 | 5 amp std | 1.500 | .625 + .120 (no. rings - 1) |
| 2237 | 1.250 | 1.000 - 1.502 | 78 | 5 amp std | 2.375 | .750 + .130 (no. rings - 1) |
| 2268 | 1.500 | 1.250 - 1.752 | 107 | 5 amp std | 2.687 | 1.000 + .150 (no. rings - 1) |
| 2350 | 2.000 | 1.750 - 2.502 | 100 | 5 amp std | 3.500 | 1.000 + .150 (no. rings - 1) |
| 2375 | 2.500 | 2.370 - 2.875 | 48 | 5 amp std | 3.750 | 1.000 + .200 (no. rings - 1) |
| 2462 | 3.000 | 2.750 - 3.752 | 112 | 5 amp std | 4.625 | 1.250 + .160 (no. rings - 1) |
| 2500 | 4.000 | 3.250 - 4.002 | 108 | 5 amp std | 5.000 | 1.250 + .187 (no. rings - 1) |
| 2600 | 5.000 | 4.000 - 5.002 | 48 | 5 amp std | 6.000 | 1.250 + .186 (no. rings - 1) |
| 2700 | 6.000 | 5.000 - 6.002 | 63 | 5 amp std | 7.000 | 1.250 + .186 (no. rings - 1) |
| 2800 | 7.000 | 6.000 - 7.002 | 58 | 5 amp std | 8.000 | 1.250 + .1875 (no. rings - 1) |
| 2900 | 8.000 | 7.000 - 9.002 | 58 | 5 amp std | 10.000 | 1.250 + .1875 (no. rings - 1) |
| 3268 | 1.000 | .750 - 1.187 | 16 | 50 amp std | 2.687 | 2.000 + 1.050 (no rings - 1) |
| 3300 | 1.500 | 1.187 - 1.500 | 6 | 50 amp std | 3.000 | 2.000 + 1.000 (no. rings - 1) |
| 3350 | 2.000 | 1.500 - 2.000 | 16 | 50 amp std | 3.500 | 2.000 + 1.050 (no. rings - 1) |
| 3462 | 3.000 | 2.000 - 3.125 | 9 | 50 amp std | 4.625 | 2.000 + 1.120 (no. rings - 1) |
| 3600 | 4.000 | 3.125 - 4.500 | 8 | 50 amp std | 6.000 | 2.000 + 1.116 (no rings - 1) |
| 3700 | 5.000 | 4.500 - 5.500 | 10 | 50 amp std | 7.000 | 2.000 + 1.116 (no. rings - 1) |
| 3800 | 6.000 | 5.500 - 6.500 | 10 | 50 amp std | 8.000 | 2.000 + 1.125 (no. rings - 1) |
| 3900 | 7.000 | 6.500 - 8.500 | 10 | 50 amp std | 10.000 | 2.000 + 1.125 (no. rings - 1) |

### CHARACTERISTICS

**RINGS:** Coin Silver 5 amp rings.
Copper 50 amp rings.

**BRUSHES:** Silver Graphite.
Fabricast Grade 180 (80% AG – 20% C)
Two Brushes per ring
Brushes individually removable and replaceable.

**NOISE:** 10 Milliohms dynamic resistance max.
5 Milliohms max with 4 brushes per ckt.

**CURRENT:** Noted in tabulated block.
Rating may be doubled with 4 brushes per ckt.

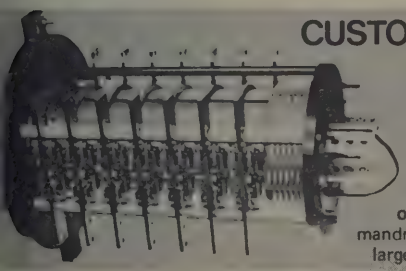
**HI-POT:** 1200 VAC 60 cycle for 15 seconds.

**ROTOR:** One piece steel sleeve.
Ring complement vacuum cast on sleeve as unit with epoxy dielectric.

**ROTOR LEADS:** 5 amp Leads – 20 ga per MIL-16878 type "E"
50 amp Leads – 8 ga per MIL-W-16878 type "B"

**BRUSH BLOCK:** Glass epoxy.
Optional mounting methods shown.

# CUSTOM DESIGNED SLIP RING ASSEMBLIES



### CUSTOM 7000 AMP SLIP RING ASSEMBLY

This slip ring assembly, as designed and manufactured by Fabricast, Inc., is used to supply 7000 amperes of current to the rotating mandrel of the world's second largest spin forging machine.

### CUSTOM 222 TRACK SLIP RING ASSEMBLY

This slip ring assembly as designed and manufactured by Fabricast, Inc. was used to complete the electrical circuits to the rotating arm of an astronaut carrying centrifuge.

The unit consists of 50 amp. power, 5 amp. instrumentation and 50 megacycle coaxial modules.

WRITE OR PHONE FOR THE FABRICAST CATALOG

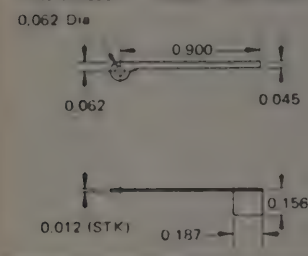
**Fabricast, Inc.** MANUFACTURERS OF SLIP RING ASSEMBLIES

17 SEAMAN AVENUE, SOUTH EL MONTE, CALIF. 91733 Phone 213/443-3247 (S. El Monte/Los Angeles)

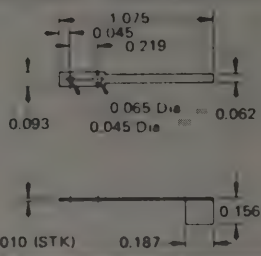
# BRUSH ASSEMBLIES

## LEAF TYPE (BRUSH MATERIAL - FAG 180 LEAF MATERIAL - BeCu)

2.0 AMP SINGLE BRUSH
P/N 1113007 BRUSH - .040 WIDE

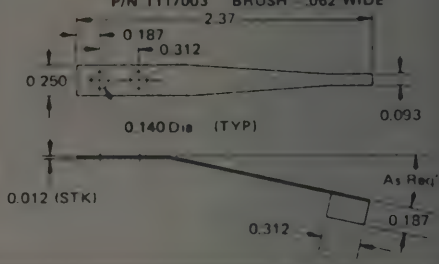



2.0 AMP SINGLE BRUSH
P/N 1120051 BRUSH - .040 WIDE

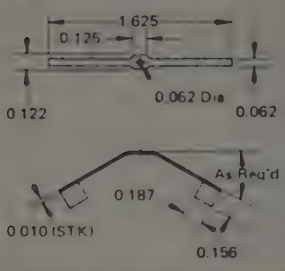



## STOCK DELIVERY

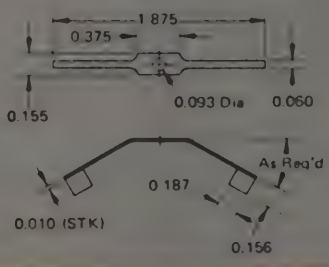
5.0 AMP SINGLE BRUSH
P/N 1117003 BRUSH - .062 WIDE



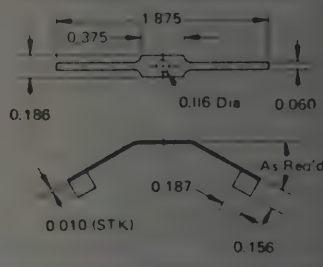

5.0 AMP DOUBLE BRUSH
P/N 1103004 BRUSH .040 WIDE




5.0 AMP DOUBLE BRUSH
P/N 1050006-5 BRUSH .040 WIDE

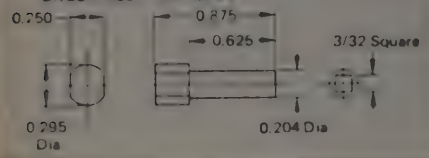



5.0 AMP DOUBLE BRUSH
P/N 1050006-2 BRUSH .040 WIDE

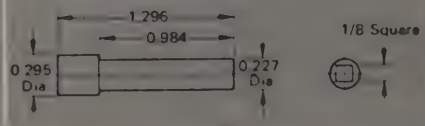



## PLUNGER TYPE (BRUSH MATERIAL - FAG 180 HOLDER - BRASS)

2.5 AMP CAPACITY 3/32" SQUARE BRUSH
HOLDER ASSY P/N 1070004
BRUSH ASSY P/N 1072-1

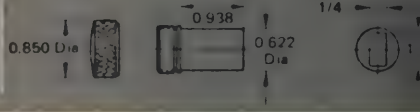



4.0 AMP CAPACITY - 1/8" SQUARE BRUSH
HOLDER ASSY P/N 1051032
BRUSH ASSY P/N 1072-2




## STOCK DELIVERY

25 AMP CAPACITY
1/4" x 1/2" RECTANGULAR BRUSH
HOLDER ASSY P/N 1092006
BRUSH ASSY P/N 1092003




## BRUSH MATERIAL

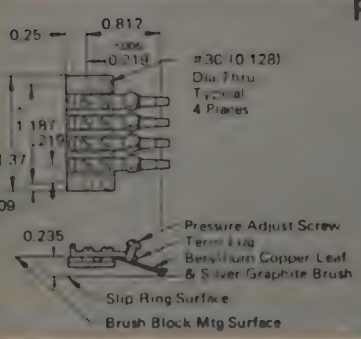
- Fabricast grade Fag 180, the universal low noise level grade used for all standard brush assembles.
- Fabricast grade FAG 193, the lowest noise level grade, however, the ring surface speed is limited to 250 SFM.
- Fabricast grade FAG 150, the highest surface speed grade, however, noise levels are compromised.

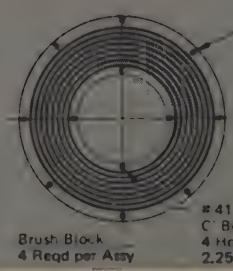
| Grade No. | Composition | Recommended Surface Speed | Carrying Capacity |
|---|---|---|---|
| FAG150 | 50% silver, 50% graphite | Over 3500 ft. per min. | 100 Amps per sq. in. |
| FAG180 | 80% silver, 20% graphite | Up to 3500 ft. per min. | 250 Amps per sq. in. |
| FAG193 | 93% silver, 7% graphite | Up to 250 ft. per min. | 300 Amps per sq. in. |

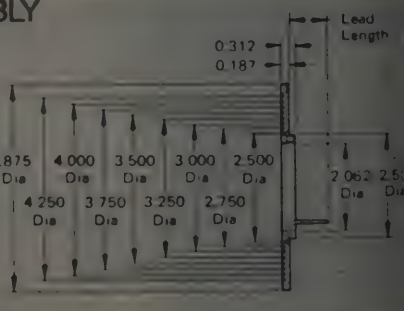
## COIN SILVER RINGS – ½" TO 24" DIA – QUOTATION UPON REQUEST

## PANCAKE TYPE SLIP RING ASSEMBLY

TYPE 1062 8 RINGS - 5 AMP CAPACITY





#41 (0.096) Dia Thru C Bore 0.156 Dia x 0.09 8 Holes Equispaced on 4.675 BC as shown
#41 (0.096) Dia Thru C Bore 0.156 Dia x 0.09 4 Hole Equispaced on 2.250 BC as shown
Brush Block 4 Reqd per Assy



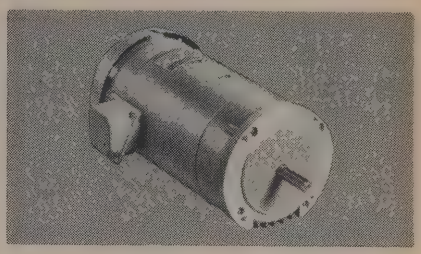

WRITE OR PHONE FOR THE FABRICAST CATALOG

**Fabricast, Inc.** MANUFACTURERS OF SLIP RING ASSEMBLIES

2517 SEAMAN AVENUE, SOUTH EL MONTE, CALIF. 91733 Phone 213/443-3247 (S. El Monte/Los Angel

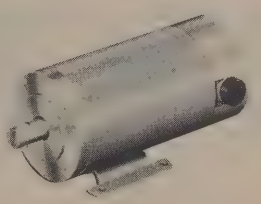
# AC and DC MOTORS

## DC Motors



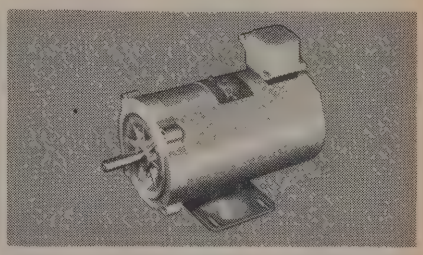
For general duty on variable- or constant-speed applications where the power supply is d-c or where a-c/d-c conversion is used for controlled speeds. Also ideal for reversing applications. Type BC direct-current motors will start, accelerate, and run fractional-horsepower devices smoothly and easily. They are available in open, totally enclosed, explosion-proof, and severe-duty enclosures with solid base, round frame, or end mounting in most ratings. Special-purpose type motors are also available for full- and half-wave rectified power drives. For complete information, write for Bulletins GEA-9956 and GEA-9965.

### Reel-Drive Motors



GE's 6⅝ inch diameter fhp direct-current motors are widely used for reel drives. Special end mountings and shaft extensions meet exacting application requirements. Series, split-series, compound, shunt, and compensated-shunt winding designs offer a broad design choice. Stall torque ratings from 3 to 120 ounce-feet and higher span various application needs, and motor voltage requirements are normally matched to your system design. Write for Bulletins GEA-9956 and GEA-9965.

### New Permanent Magnet Motors



GE's BPA-34 permanent-magnet motors are smaller and lighter than comparable wound-field motors of the same rating. Permanent magnets replace field windings, eliminating the need for field power supply and the chance of field-winding failure or burnout; and with battery power efficiency is increased, battery drain decreased. Two leads from power supply reduce connect and disconnect time. The motor features double shielded ball bearings.

In 3.4 inch-diameter totally enclosed frame, the BPA-34 is available in face, flange, or welded-base design for conventional d-c voltages, producing a d-c rating of about ⅓ hp at 3450 rpm, ⅕ hp at 1725 rpm, and 1/7 hp at 1140 rpm on a continuous basis.

New NEMA 56 frame 5⅝ inch diameter, permanent magnet motors at 1725 rpm, ⅛ thru 1 hp, are available in C-face and bolt-on base for rectified and d-c power supplies for conventional d-c voltages.

These motors are ideally suited for such applications as copy machines, tape reel drives, printers, and filing equipment, and for any other equipment, including heavier drive applications, utilizing variable-speed drives or battery power. Write for Bulletin GEA-10087.

## NEMA 48- and 56-Frame Ac Induction Motors

### Dependable Form G Motors in Thousands of Variations

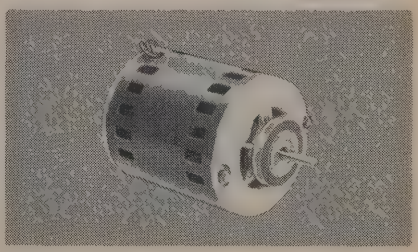
Form G a-c induction motors are available in most any electrical type, enclosure, and mounting in a variety of ratings from 1/20 to 5 hp for a complete range of commercial/industrial applications. For complete information write for Bulletins GEC-5000 and GEA-9964. New Form G5 motors (shown) also available in ⅛ through ¾ hp open split-phase and capacitor-start designs. Write for Bulletin GEA-10117.

## Small Induction and Synchronous Motors

Versatility is synonymous with General Electric Small Induction and Synchronous motors. With this complete line, GE offers the design engineer the widest possible application freedom, plus the traditional fine quality of General Electric motors.

These small diameter motors are designed to provide dependable power for a wide variety of applications, including data communication printers, cash registers, telecopiers, typewriters, audio recording equipment, air compressors, projectors, computer card readers, disc file drives, as well as various machine tool applications. And many other jobs as well.

**Such versatility is made possible by the choice of mounting styles, electrical types, bearing and insulation systems available.**



### M-49 FRAME MOTOR

The 3½ inch diameter M-49 motor is specifically built for applications requiring AC power in a limited space. This reversible motor can be mounted at any angle because it is available with either steel-backed babbit sleeve or ball bearings. The M-49 is offered in reluctance synchronous, permanent split-capacitor, split-phase and capacitor-start models. Shaft diameter is 5/16 or ⅜ inches.

### 19-FRAME MOTOR

The 3⅞ inch diameter 19-frame motor is designed to meet most small induction motor needs. Available with bolted cast-aluminum endshields, the 19-frame comes in synchronous, polyphase, permanent split-capacitor, split-phase and capacitor-start electrical types. This motor also features all-angle mounting, with the choice of either steel-backed babbit sleeve or ball bearings. On open models, a standard NEMA 42-frame mount is offered. Standard shaft diameters are 5/16 or ⅜ inches.

**Write for Bulletin GEA-9964**

For complete information contact your nearby GE Sales Office or write to General Electric Co., Section 998-52. Dept. EM, Schenectady, N.Y. 12345.

GENERAL ELECTRIC

GRAPHALLOY

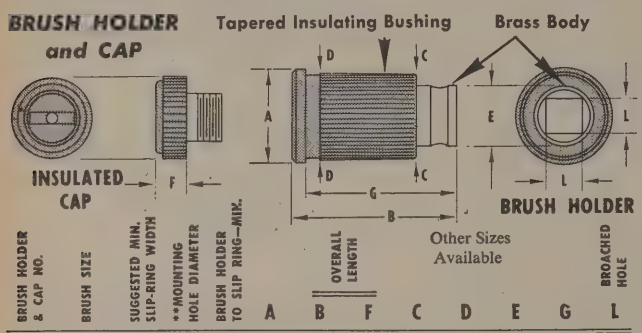
# SILVER GRAPHALLOY BRUSHES and BRUSH & SLIP-RING ASSEMBLIES...

## GRAPHALLOY BRUSHES

***are used on such equipment as...*** **SERVO SYSTEMS • SYNCHROS • CHOPPERS • RADAR • GYROS • INVERTERS • THERMOCOUPLE and STRAIN GAGE CIRCUITS • GUIDED MISSILES • PULSE SYSTEMS • DIGITAL COMPUTERS • WAVE GUIDES • SONAR • TRANSDUCERS • TORQUE INDICATORS**

***Silver GRAPHALLOY Brushes*** have been widely used becaus*e of* LOW *and* CONSTANT CONTACT DROP, EXTREMELY LOW ELEC TRICAL NOISE *and* LONG LIFE. Over 200 grades are now servin in a wide variety of applications. Silver GRAPHALLOY Brushe on ½"-diameter coin silver slip rings have operated successfull in highly critical electrical circuits at speeds up to 100,000 R.P.M *Our Engineering Department will assist in determining the exac grade of* GRAPHALLOY *for your needs.* Ask for our Brush Inquir Form 109.

***BRUSH HOLDER and CAP***




| BRUSH HOLDER & CAP NO. | BRUSH SIZE | SUGGESTED MIN. SLIP-RING WIDTH | **MOUNTING HOLE DIAMETER | BRUSH HOLDER TO SLIP RING—MIN. | A | B OVERALL LENGTH | F | C | D | E | G | L BROACHED HOLE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14326 | ⅛" sq. | 3/16" | 13/32" | 1/16" | .437" | ⅞" | 3/16" | .404" | .418" | .281" | 25/32" | .129" |
| 11509† | 5/32" sq. | ¼" | 13/32" | 1/16" | .437" | ⅞" | 3/16" | .404" | .418" | .281" | 25/32" | .160" |
| 11570† | 3/16" sq. | ¼" | 7/16" | 1/16" | .484" | ⅞" | 3/16" | .441" | .451" | .313" | 25/32" | .193" |
| 19011† | ¼" x 3/16" | 5/16" | 9/16" | ⅛" | .616" | 1 5/16" | 3/16" | .561" | .573" | .438" | 1 3/16" | .256 x .193" |
| 11527† | ¼" sq. | 5/16" | 9/16" | ⅛" | .616" | 1 5/16" | 3/16" | .561" | .573" | .438" | 1 3/16" | .256" |
| 14292† | ⅜" x ¼" | 7/16" | 43/64" | ⅛" | .718" | 1 7/16" | ¼" | .672" | .682" | .533" | 1 5/16" | .382 x .256" |
| 12166† | ⅜" sq. | 7/16" | 13/16" | ⅛" | .921" | 1 13/16" | ¼" | .813" | .828" | .628" | 1 5/8" | .382" |
| 31392† | ½" sq. | 9/16" | 1 1/8" | ⅛" | 1.237" | 1 13/16" | ¼" | 1.126" | 1.141" | .878" | 1 3/16" | .503" |
| 35439† | ¾" x ½" | ⅞" | 1 33/64" | ⅛" | 1.661" | 2 1/32" | 5/16" | 1.508" | 1.528" | 1.253" | 1 25/32" | .753" |
| 35440† | ¾" sq. | ⅞" | 1 33/64" | ⅛" | 1.661" | 2 1/32" | 5/16" | 1.508" | 1.528" | 1.253" | 1 25/32" | .753" |

†Shunts are provided. **Mounting hole diameter for brush holder dimension D.

*Request and fill in Brush Inquiry Sheet, Form 109, so that we can supply the proper grade of brush material.*

### *SLIP RINGS Solid Coin Silver*

Standard Coin Silver Slip Rings, both *cylindrical* and *flat* types, are illustrated at right. We recommend the cylindrical type rings with three brushes per ring . . . spaced at 120°. The cylindrical type are designed for press fitting over standard steel shafting. The flat type rings are designed for nesting either on an insulated plate or for molding into insulation. Insulated slip rings of either type or slip-ring assemblies can be furnished with leads attached.

**No. 168 Series** flat type to 20" O.D.

Standard "Flat" rings have ¼" r dial contact surface and ⅛" radi spacing between adjacent rings.

**No. 116 Series** cylindrical ty to 36" O.D.

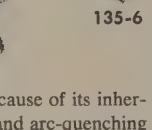
Copper Slip Rings, flat or cylindrical, are available.

***BRUSH ASSEMBLIES***

### *CONTACTS*

GRAPHALLOY, because of its inherent non-welding and arc-quenching characteristics, is used widely for contacts. Ask for Data Sheet 950.

### *BUSHINGS,* Oil-free



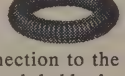
Replace oil-lubricated bushings in synchros, instruments, timers and missiles.

*Advantages:* 1) Lower friction at room temperatures. 2) No oil to solidify at low temperatures. 3) No oil to carbonize at prolonged elevated temperatures.

*Ask for Data Sheets 270 and 277 on Miniature Bronze-*GRAPHALLOY *Bushings.*

### *CONNECTORS*

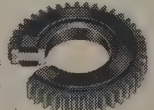
(garter springs)



These silver-plated coil spring Connectors make for positive electrical connection to the brass body of the brush holder by snapping into the groove on the holder. The connecting lead can be pre-soldered to the Connector.

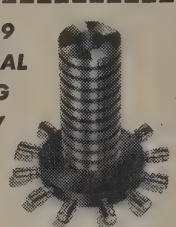
| GARTER SPRING CONNECTORS | BRUSH SIZE | BRUSH HOLDER NO. |
|---|---|---|
| 127-9 | ⅛" sq. | 14326 |
| 127-9 | 5/32" sq. | 11509 |
| 127-10 | 3/16" sq. | 11570 |
| 127-14 | ¼" x 3/16" | 19011 |
| 127-14 | ¼" sq. | 11527 |
| 127-18 | ⅜" x ¼" | 14292 |
| 127-20 | ⅜" sq. | 12166 |
| 127-24 | ½" sq. | 31392 |
| 127-32 | ¾" x ½" | 35439 |
| 127-32 | ¾" sq. | 35440 |

### *CLUTCH FACINGS and CLUTCH GEAR ASSEMBLIES*



Torque remains same within close operating limits despite changes in temperature and humidity. For instrumentation, guided missiles, constant friction devices.

### *Model 319 CYLINDRICAL SLIP-RING assembly*

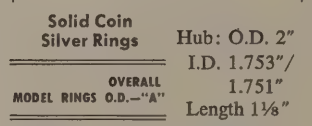


Solid Coin Silver Rings

| MODEL | RINGS | LENGTH |
|---|---|---|
| 319-4 | 4 | 2 9/16" |
| 319-6 | 6 | 3 5/16" |
| 319-10 | 10 | 4 13/16" |
| 319-14 | 14 | 6 5/16" |

O.D. Slip-ring 1⅝" Terminal 4" Assembly I.D.: .814"/.813" Range: Same as for Model 399

### *Model 409 FLAT SLIP-RING assembly*




Solid Coin Silver Rings

| MODEL | RINGS | OVERALL O.D.—"A" |
|---|---|---|
| 409-2 | 2 | 5½" |
| 409-4 | 4 | 7" |
| 409-6 | 6 | 8½" |
| 409-10 | 10 | 11½" |

Hub: O.D. 2" I.D. 1.753"/1.751" Length 1⅛" To 5 amps., 125 v. More rings on application.

### *SPRING BINDING POSTS*

*(with or without Insulated Cap)*

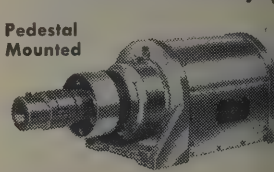
O.D.: ⅜", ½", 17/32"
Lgth.: ⅝", ¾", 25/32"

*Also Miniature Spring Type!*

19185 22978

### *Model 399 BRUSH and SLIP-RING assembly*

Pedestal Mounted



| MODEL | RINGS | bolt slot distances CL to CL WIDTH | bolt slot distances CL to CL LENGTH | **OVERALL |
|---|---|---|---|---|
| 399-4 | 4 | 4½" | 7¾" | 13 |
| 399-6 | 6 | 4½" | 8½" | 14 |
| 399-10 | 10 | 4½" | 10" | 16 |
| 399-14 | 14 | 4½" | 11½" | 18 |

Specifications: Width 6½"—Heig 6½". Shaft CL above base 3¼
Applications: from strain gage thermocouple up to 5 ampere 125 volts, 250°F.
Speeds to 5,000 RPM.
Three Silver-GRAPHALLOY Brush per solid coin silver slip ring.
Extraneous noise level low.
Rugged in design and constructio
Readily connected mechanical and electrically.
Complete coupling provided f 15/16" shaft.
More rings and higher speeds ava able upon application.

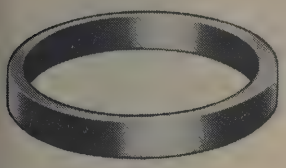
*Write for data sheets*

CALL ON OUR OVER 60 YEARS OF DESIGN EXPERIENCE FOR HELP IN SOLVING YOUR BRUSH PROBLEMS!

**GRAPHITE METALLIZING CORPORATION** : 1036 Nepperhan Avenue : YONKERS, New York 10702

# SLIP RINGS *of Solid Coin Silver*

Standard Coin-Silver Slip Rings, both cylindrical and flat types, are illustrated below. We recommend the cylindrical-type ring with three brushes per ring . . . spaced at 120°. The cylindrical rings are designed for press fitting over insulation on standard steel shafting. The flat-type rings are designed for nesting either on an insulated plate or for molding into insulation. Insulated slip rings of either type or slip-ring assemblies can be furnished with leads attached.



Cylindrical
116

Flat
168

## Standard Coin Silver Slip Rings

| Part No. | OD | ID | Width |
|---|---|---|---|
| 116S-4 | 1/4 | .127/ .123 | 3/16 |
| 116S-6 | 3/8 | .252/ .248 | 3/16 |
| 116S-8 | 1/2 | .377/ .373 | 3/16 |
| 116S-10 | 5/8 | .502/ .498 | 3/16 |
| 116S-12 | 3/4 | .627/ .623 | 3/16 |
| 116S-14 | 7/8 | .752/ .748 | 1/4 |
| 116S-16 | 1 | .877/ .873 | 1/4 |
| 116S-18 | 1 1/8 | 1.000/ .996 | 1/4 |
| 116S-19 | 1 3/16 | 1.000/ .996 | 1/4 |
| 116S-23 | 1 7/16 | 1.250/1.246 | 1/4 |
| 116S-27 | 1 11/16 | 1.500/1.496 | 1/4 |
| 116S-31 | 1 15/16 | 1.750/1.746 | 1/4 |
| 116S-35 | 2 3/16 | 2.000/1.996 | 1/4 |
| 116S-39 | 2 7/16 | 2.250/2.246 | 1/4 |
| 116S-43 | 2 11/16 | 2.500/2.496 | 1/4 |
| 116S-52 | 3 1/4 | 3.000/2.996 | 5/16 |
| 116S-60 | 3 3/4 | 3.500/3.496 | 5/16 |
| 116S-68 | 4 1/4 | 4.000/3.996 | 5/16 |
| 116S-76 | 4 3/4 | 4.500/4.496 | 5/16 |
| 116S-84 | 5 1/4 | 5.000/4.996 | 5/16 |
| 116S-92 | 5 3/4 | 5.500/5.496 | 5/16 |
| 116S-102 | 6 3/8 | 6.000/5.996 | 5/16 |
| 116S-118 | 7 3/8 | 7.000/6.996 | 5/16 |
| 116S-134 | 8 3/8 | 8.000/7.996 | 5/16 |
| 116S-150 | 9 3/8 | 9.000/8.996 | 5/16 |
| 116S-166 | 10 3/8 | 10.000/9.996 | 5/16 |

*Larger Cylindrical and Flat Rings are available!*

| Part No. | OD | ID | Thickness |
|---|---|---|---|
| 168S-20 | 1 1/4 | 3/4 | 3/16 |
| 168S-32 | 2 | 1 1/2 | 3/16 |
| 168S-44 | 2 3/4 | 2 1/4 | 3/16 |
| 168S-56 | 3 1/2 | 3 | 3/16 |
| 168S-68 | 4 1/4 | 3 3/4 | 3/16 |
| 168S-80 | 5 | 4 1/2 | 3/16 |
| 168S-92 | 5 3/4 | 5 1/4 | 3/16 |
| 168S-104 | 6 1/2 | 6 | 3/16 |
| 168S-116 | 7 1/4 | 6 3/4 | 3/16 |
| 168S-128 | 8 | 7 1/2 | 3/16 |
| 168S-140 | 8 3/4 | 8 1/4 | 3/16 |
| 168S-152 | 9 1/2 | 9 | 3/16 |
| 168S-164 | 10 1/4 | 9 3/4 | 3/16 |
| 168S-176 | 11 | 10 1/2 | 1/4 |
| 168S-188 | 11 3/4 | 11 1/4 | 1/4 |
| 168S-200 | 12 1/2 | 12 | 1/4 |
| 168S-212 | 13 1/4 | 12 3/4 | 1/4 |
| 168S-224 | 14 | 13 1/2 | 1/4 |
| 168S-236 | 14 3/4 | 14 1/4 | 1/4 |
| 168S-248 | 15 1/2 | 15 | 1/4 |
| 168S-260 | 16 1/4 | 15 3/4 | 5/16 |
| 168S-272 | 17 | 16 1/2 | 5/16 |
| 168S-284 | 17 3/4 | 17 1/4 | 5/16 |
| 168S-296 | 18 1/2 | 18 | 5/16 |
| 168S-308 | 19 1/4 | 18 3/4 | 5/16 |
| 168S-320 | 20 | 19 1/2 | 5/16 |

BRONZE and COPPER Slip Rings, cylindrical or flat, are available in the above sizes.

Cylindrical coin-silver rings, stacked with insulating rings between them, are press-fitted over insulation on the shaft. The insulation should be kept concentric on the shaft to avoid losing the high degree of concentricity already built into the slip rings and to maintain the effectiveness of the highly finished ring surface.

## Model 409 Flat Slip-Ring Assembly

Where cylindrical-type slip rings cannot be used because of axial space limitations, standard flat (or disc type) coin-silver slip rings will solve the problem. A series of these rings has been designed so that the rings will nest with a standard 1/8"-spacing between successive rings. Each ring provides a radial contact surface of 1/4" width. Our 3/16"-square brush in Brush Holder 11570 should be used with these rings. We strongly recommend three brushes per ring to reduce noise level to a minimum.

# BINDING POSTS

Binding Posts (normally spring-type 19185 or 22978) insure simple, low resistance, positive electrical connections between brush shunts (which have been threaded through brush-holder caps) and the external circuits. Binding posts are used also with brush and slip-ring assemblies and with brush-holder assemblies to make connection between the assembly and the external circuit.

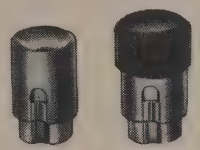
**Miniature (Spring-type)** Miniature binding posts are valuable where space is at a premium, particularly for some rotary strain-gage and rotary thermocouple applications. These miniature binding posts are not insulated.

30624 30625

Metal Binding Post (Spring-type) 30624
*Not Insulated*
1/8" O.D. x 1 1/32" long. Stud. 2-56 x 7/32" long.

Metal Binding Post (Spring-type) 30625
*Not Insulated*
5/32" O.D. x 1 5/32" long. Stud 2-56 x 7/32" long.

**Standard (Spring Type)** — Standard spring-type binding posts are used for most rotary strain-gage and thermocouple applications. These binding posts may be furnished with either *red or black* insulating caps.



19185 22978-1 22978-2

22978-A 40541-1 40541-2

Metal Binding Post (Spring-type) 19185
*No insulated cap.*
3/8" O.D. x 5/8" long. Wire hole dia. 3/32"
I.D. Thd. 6-32

Metal Binding Post (Spring-type) 22978
*Insulated Cap: Black—1; Red—2*
7/16" OD. x 3/4" long.
Wire hole dia. 3/32". I.D. Thd. 6-32

Metal Binding Post (Spring-type) 40541
*Insulated Cap: Black—1; Red—2*
1/2" O.D. x 3/4" long. Wire hole dia. 1/8" Thd. 6-32

Insulated Binding Post Base 22978-A
*For 22978-1 & 22978-2*

**Screw-Type Binding Posts** — Screw-type binding posts, such as are used for aircraft applications, provide constant blocking pressure on the wire. They are well insulated, and have non-removable phenolic knobs and molded bases. These posts are furnished in single, double or triple configuration.

20123 20124

20125

Single Binding Post (Screw-type) 20123
1/2" O.D. x 7/8" long. Stud 6-32 x 9/16" long.

Double Binding Post (Screw-type) 20124
Each Post 1/2" O.D. x 3/4" long.
Studs 6-32 x 1/2" long.
*Plate:* 1 1/16" x 2"

Triple Binding Post (Screw-type) 20125
Each Post 1/2" O.D. x 3/4" long.
Studs 6-32 x 1/2" long.
*Plate:* 1 1/16" x 2.4"

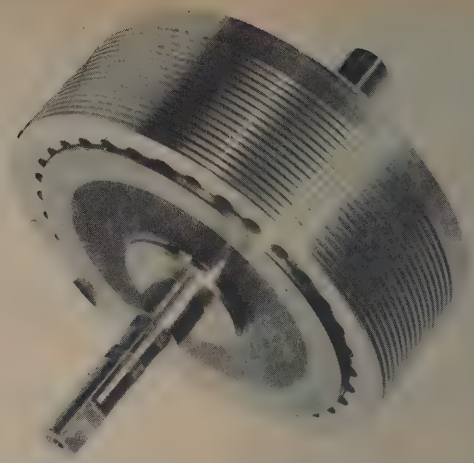
**SPECIAL BINDING POSTS**

Special binding posts are designed where particular characteristics are required.

GRAPHITE METALLIZING CORPORATION 1036 Nepperhan Avenue YONKERS, New York 10702

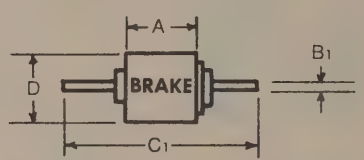
# HYSTERESIS CLUTCHES & BRAKES

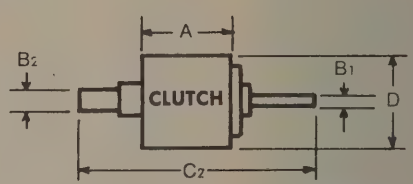
offer maximum reliability — smooth clutching minimum maintenance. They are ideal for tension control and power absorption devices where smooth variable slip torque is required. Torque is proportional to control current. Clutch-brake combinations and fixed field clutches also available.



| | PMC-6 PMB-6 | PMC-16 PMB-16 | PMC-35 PMB-35 | PMC-120 PMB-120 | PMC-175 PMB-175 | PMC-325 PMB-325 | PMC-.75K PMB-.75K | PMC-1.5K PMB-1.5K | PMC-3K PMB-3K | PMC-5K PMB-5K |
|---|---|---|---|---|---|---|---|---|---|---|
| A | .76 | .81 | 1.72 | 1.53 | 1.98 | 2.06 | 3.62 | 5.83 | 4.37 | 5.12 |
| $B_1$ | .187 | .187 | .250 | .375 | .500 | .500 | .75 | .875 | .786 | 1.181 |
| $B_2$ | .375 | .375 | .500 | .625 | .750 | .750 | 1.312 | 1.500 | 1.000 | 1.181 |
| $C_1$ | 2.12 | 2.15 | 3.82 | 3.96 | 4.37 | 5.15 | 6.37 | 10.00 | 10.04 | 12.12 |
| $C_2$ | 2.93 | 2.84 | 4.41 | 4.64 | 5.40 | 5.75 | 8.12 | 11.06 | 9.63 | 9.87 |
| D | 1.75 | 1.93 | 2.46 | 3.62 | 4.43 | 5.48 | 7.25 | 8.50 | 12.00 | 14.00 |

| SPECIFICATIONS | MODELS | | | | | |
|---|---|---|---|---|---|---|
| | PMC-6 PMB-6 | PMC-16 PMB-16 | PMC-35 PMB-35 | PMC-120 PMB-120 | PMC-175 PMB-175 | PMC-325 PMB-325 |
| TORQUE - RATED OZ. IN. | 6 | 16 | 35 | 120 | 175 | 325 |
| OUTPUT INERTIA SLUG FT² | 1.55 x 10⁻⁶ | 3.03 x 10⁻⁶ | 6.3 x 10⁻⁶ | 5.4 x 10⁻⁵ | 1.5 x 10⁻⁴ | 2.0 x 10⁻⁴ |
| CONTROL WATTAGE | 2.5 | 4.5 | 12 | 5 | 3 | 7 |
| | PMC-.75K PMB-.75K | PMC-1.5K PMB-1.5K | PMC-3K PMB-3K | PMC-5K PMB-5K | | |
| | 750 | 1500 | 3000 | 5000 | | |
| | 6.3 x 10⁻³ | 1.26 x 10⁻² | 2.68 x 10⁻² | 4.05 x 10⁻² | | |
| | 8.1 | 17 | 25 | 6 | | |




## FRICTION CLUTCHES & BRAKES — FLANGE MOUNTED

LOW COST • HIGH TORQUE • LOW CONTROL POWER • FAST RESPONSE • MIN. EFFECT BY AMBIENTS

| SPECIFICATIONS | MODELS | | | | | | |
|---|---|---|---|---|---|---|---|
| | FC-25 FB-25 | FFC-35 FFB-35 | FFC-60 FFB-60 | FFC-160 FFB-160 | FFC-480 FFB-480 | FFC-960 FFB-960 | FFC-3.5K FFB-3.5K |
| TORQUE - RATED OZ. IN. | 25 | 35 | 60 | 160 | 480 | 960 | 3500 |
| OUTPUT INERTIA - SLUG FT.² | 1.06 x 10⁻⁶ | 2 x 10⁻⁶ | 2.8 x 10⁻⁵ | 5.11 x 10⁻⁶ | 1.7 x 10⁻⁵ | 6.56 x 10⁻⁵ | 5.86 x 10⁻⁴ |
| CONTROL WATTAGE | 3 | 6 | 3.6 | 9 | 10 | 10 | 30 |

## CROWN TOOTH CLUTCHES & BRAKE

MAX. TORQUE – MIN. SIZE
POSITIVE ENGAGEMENT
LOW CONTROL POWER
FAST RESPONSE

## ADJUSTA-TORQ CLUTCHES & BRAKES

- CONSTANT REPEATABLE SLIP TORQUE
- LIFE LIMITED ONLY BY BEARINGS
- CAN BE RUN IN OIL

USE AS A TORQUE LIMITING SLIP DEVICE, CLUTCH COUPLING, CONSTANT DRAG BRAKE OR IN TENSIONING APPLICATIONS.

NEW!

PERMANENT MAGNET

## TENSION BRAKES

- CONSTANT PRESET TENSION
- MANUAL ADJUSTABLE TORQUE

0-3 OZ. IN. OR 0-10 OZ. IN.
PROVIDE SMOOTH, REPEATABLE TENSION FOR YARN, FIBER AND FINE WIRE

## FAIL-SAFE BRAKES

FOR POSITIVE SHAFT BRAKING WHEN POWER FAIL

PREVENTS
CREEPING • COASTING
HUNTING

Torque Ranges
8 to 7000 oz. in.

## SPECIALS

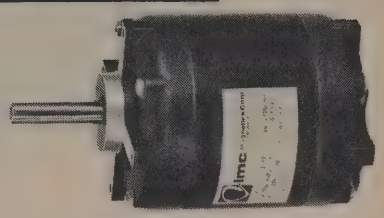
GEMCOR WILL DESIGN NEW UNITS OR MODIFY EXISTING UNITS TO SUIT CUSTOMER'S SPECIAL REQUIREMENTS. THIS SERVICE IS AVAILABLE ON HYSTERESIS, FRICTION AND PERMANENT MAGNET TYPES.

GENERAL ELECTRO-MECHANICAL CORP.
787 HERTEL AVE., BUFFALO, N. Y. 14207
TELEX: 91-222 AREA CODE 716 • 876-9685

GEMCOR

# CUSTOM DESIGNED MODELS

# FHP motors... precision, power, performance



Whatever your motor requirements, chances are IMC Eastern Division has a pre-engineered design to meet them. If not, we will custom engineer to your exact specifications.

IMC offers a complete range of motor types, sizes and performance characteristics.

Hysteresis synchronous, polarized and reluctance synchronous, induction, torque, and servo motors. 50, 60 400, 800 and 1000 Hz, multi-Hz and variable frequency types. Standard voltages from 13 to 230 V, single, 2 and 3-phase. Models include totally enclosed and open frame designs with or without internal cooling. Base, face, flange and servo mountings. Shafts offset, double-ended, with slots, keyways, tapers, etc. at customer option.

The tables below provide a few typical examples of IMC Eastern Division motor capability. For additional data on these designs, information on your individual requirements, or application engineering assistance, contact us at

**IMC MAGNETICS CORP.**
EASTERN DIVISION
570 MAIN STREET, WESTBURY, NEW YORK 11590

**Tel. (516) 334-7070, TWX 510-222-4469**

## INDUCTION MOTORS

| Motor No. Size | Type | Voltage (VAC) | Frequency (Hz) | Current (A) | Rated Torque (oz-in) | Speed (rpm) | Poles (No.) | H.P. Rated | Power Input (Watts) | Dimensions (Typ.) (inches) Housing O.D. | Housing length |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BC905 | 804 | 115 | 400 | .075 | .18 | 18000 | 2 | 1/350 | 8 | .937 | 1.178 |
| BC1307 | 1330 | 115 | 400 | .16 | 1.0 | 10500 | 4 | 1/90 | 17 | 1.500 | 1.468 |
| BT1310 | 1972 | 200 | 400 | .07 | .25 | 20000 | 2 | 1/200 | 10 | 1.500 | 1.768 |
| BC1507 | 520 | 115 | 60 | .06 | .10 | 3000 | 2 | 1/3000 | 6.5 | 1.700 | 1.703 |
| BC1511 | 338 | 115 | 60 | .095 | .90 | 1400 | 4 | 1/800 | 12 | 1.700 | 2.103 |
| FBC1615 | 101 | 115 | 400 | .70 | 3.8 | 8500 | 4 | 1/30 | 75 | 2.000 | 3.000 |
| BC2210 | 1246 | 115 | 60 | .31 | 5.0 | 3300 | 2 | 1/60 | 35 | 2.750 | 2.437 |
| BC2210 | 1382 | 115 | 60 | .45 | 7.5 | 3300 | 2 | 1/40 | 44 | 2.750 | 2.437 |
| BC2305 | 2151 | 115 | 60 | .065 | 0.75 | 1200 | 4 | 1/1100 | 7 | 2.500 | 1.500 |
| BC2910 | 2030 | 115 | 60 | .28 | 9.0 | 1600 | 4 | 1/70 | 30 | 3.312 | 3.187 |
| FBC2922 | 507 | 115 | 400 | 2.6 | 28.5 | 7000 | 6 | 1/5 | 300 | 3.312 | 5.312 |
| FBC3815 | 1392 | 220 | 60 | 1.4 | 64.0 | 2600 | 2 | 1/6 | 300 | 4.375 | 5.718 |
| FBT4525 | 1635 | 208 | 60 | 4.5 | 375.0 | 3400 | 2 | 1-1/4 | 1400 | 5.375 | 7.062 |
| FBT4530 | 1095 | 208 | 400 | 12.0 | 510.0 | 5800 | 8 | 3 | 2700 | 5.375 | 7.281 |
| FBT4625 | 1820 | 208 | 60 | 5.0 | 500.0 | 3400 | 2 | 1.7 | 1600 | 5.375 | 7.062 |

## HYSTERESIS & RELUCTANCE SYNCHRONOUS MOTORS

| Motor No. Size | Type | Volts (V) | Frequency (Hz) | Current (Amps) | Rated Torque (oz-in) | Start Torque (oz-in) | Speed (rpm) | Poles (No.) | H. P. Rated | Input Power (Watts) | Dimensions (Typ.) (inches) Housing O.D. | Housing length |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BC703H | 1787 | 26 | 400 | .27 | .025 | .022 | 24000 | 2 | 1/1700 | 6.9 | 0.750 | 0.865 |
| BC905H | 1032 | 26 | 400 | .210 | .070 | .10 | 8000 | 6 | 1/1800 | 4.7 | 0.937 | 1.178 |
| BC100TH | 1316 | 26 | 400 | .23 | .055 | .027 | 8000 | 6 | 1/2270 | 4.7 | 1.062 | 1.375 |
| BT1210H | 1272 | 26 | 60 | .28 | .38 | .59 | 3600 | 2 | 1/730 | 10.0 | 1.300 | 1.707 |
| BC130TH | 4.9 | 115 | 400 | .11 | .36 | .360 | 12000 | 4 | 1/230 | 11.0 | 1.500 | 1.468 |
| BC1404H | 1549 | 115 | 400 | .05 | .16 | .11 | 8000 | 6 | 1/780 | 5.7 | 1.437 | 1.363 |
| BC1510H | 1954 | 115 | 400 | .21 | .40 | .45 | 8000 | 6 | 1/300 | 15.0 | 1.700 | 2.003 |
| FBC1610H | 1832 | 115 | 400 | .24 | .90 | .6 | 6000 | 8 | 1/350 | 26.0 | 2.000 | 2.500 |
| FBC1615H | 633 | 115 | 400 | 1.20 | 1.9 | 2.3 | 12000 | 4 | 1/44 | 98.0 | 2.000 | 3.000 |
| BC230TH | 1900 | 115 | 60 | .25 | 1.5 | 3.0 | 3600 | 2 | 1/180 | 28.0 | 2.500 | 1.750 |
| FBC2922H | 2049 | 115 | 60 | 1.8 | 35.0 | 44.0 | 1800 | 4 | 1/16 | 150.0 | 3.312 | 5.312 |
| FBC3825H | 2095 | 115 | 50 | 1.9 | 60.0 | 86.0 | 1500 | 4 | 1/11 | 160.0 | 4.375 | 6.718 |
| FBC3830H | 749 | 115 | 60 | 2.41 | 74.0 | 72.0 | 1800 | 4 | 1/8 | 214.0 | 4.375 | 7.218 |
| FBC4530H | 2147 | 115 | 60 | 2.8 | 100.0 | 150.0 | 1200 | 6 | 1/8 | 210.0 | 5.375 | 7.562 |
| FBT4545H | 1691 | 208 | 60 | 3.6 | 180.0 | 432.0 | 1800 | 4 | 1/3 | 430.0 | 5.375 | 9.062 |

## TORQUE MOTORS

| Motor No. Size | Type | Volts (V) | Frequency (Hz) | Stall Current (Amps) | Stall Torque (oz-in) | No Load Speed (rpm) | Poles (No.) | Stall Watts | No Load Watts | Duty Cycle Class H% | Dimensions (Typ.) (inches) Housing O.D. | Housing length |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BT703T | 903 | 18/18 | 400 | .12/.12 | .15 | 6300 | 6 | 1.6/1.7 | 1.3/1.4 | cont. | 0.750 | 0.765 |
| BT707T | 948 | 115/33 | 400 | .05/.14 | .26 | 5900 | 6 | 3.4/3.0 | 3.0/2.5 | cont. | 0.750 | 1.165 |
| BC907T | 1835 | 115 | 400 | .05 | .27 | 7000 | 6 | 5.0 | 3.6 | cont. | 1.000 | 1.496 |
| BT1005T | 1687 | 115/36 | 400 | .05/.16 | .66 | 6200 | 6 | 3.4/3.5 | 1.6/1.5 | cont. | 1.062 | 1.175 |
| BT1210T | 1273 | 26 | 60 | .35 | 1.9 | 3300 | 2 | 15.0 | 7.9 | 50 | 1.300 | 1.707 |
| BC1307T | 162 | 115 | 400 | .17 | 1.25 | 5000 | 8 | 19.0 | 18.0 | 40 | 1.500 | 1.468 |
| BC1311T | 330 | 115 | 400 | .45 | 3.8 | 5500 | 8 | 60.0 | 60.0 | 15 | 1.500 | 1.868 |
| BT1406T | 599 | 24/24 | 60 | .24/.24 | 1.7 | 1600 | 4 | 4.6/4.4 | 4.7/4.5 | cont. | 1.437 | 1.563 |
| BC1507T | 96 | 115 | 60 | .105 | 2.7 | 1650 | 4 | 12.5 | 13.0 | cont. | 1.700 | 1.703 |
| BC1511T | 338 | 115 | 60 | .088 | 2.6 | 1600 | 4 | 10.7 | 10.5 | cont. | 1.700 | 2.103 |
| BC1615T | 347 | 115 | 400 | 1.4 | 9.0 | 10000 | 4 | 140.0 | 92.0 | 12 | 1.750 | 2.703 |
| BT1615T | 629 | 200 | 400 | 1.26 | 19.0 | 7300 | 6 | 290.0 | 64.0 | 7 | 1.750 | 2.703 |
| BC2210T | 1197 | 24 | 60 | 0.67 | 3.4 | 725 | 8 | 16.0 | 15.0 | cont. | 2.750 | 2.437 |
| BC2929T | 440 | 115 | 60 | 1.36 | 72.0 | 1100 | 6 | 145.0 | 120.0 | 30 | 3.312 | 5.125 |
| FBC3825T | 1208 | 115 | 60 | 1.3 | 110.0 | 830 | 8 | 142.0 | 100.0 | 55 | 4.375 | 6.718 |
| FBC3830T | 881 | 115 | 50 | 1.8 | 156.0 | 900 | 6 | 204.0 | 140.0 | 40 | 4.375 | 7.218 |
| BC4520T | 1718 | 115 | 60 | 2.7 | 250.0 | 810 | 8 | 305.0 | 220.0 | 35 | 5.375 | 6.562 |
| BC4530T | 1777 | 115 | 50 | 4.0 | 320.0 | 900 | 6 | 370.0 | 255.0 | 30 | 5.375 | 7.562 |

## ALPHA MAX-LOW INERTIA DC SERVO MOTORS

Available with integrally mounted incremental encoder or DC tachometer. Also with forced air internal cooling.

| Motor No. Size | Torque Constant (oz-in/Amp.) | Armature Inertia (oz-in-sec²) | Armature Inductance (microhenries) | Rated Power Output (Watts) | Terminal Resistance (Ohms) | Dimensions Housing O.D. (inches) | Housing length (inches) |
|---|---|---|---|---|---|---|---|
| IM4000 | 6.0 | .00039 | < 100 | 92 | 0.9 | 3.980 | 3.46 |

## SERVO MOTORS

**Motor-generators, motor-tachometers in BuOrd sizes 5-18. All available with precision gearheads.**

## BRUSHLESS DC MOTORS

**Newly developed IMCom Brushless DC Motor meets maximum power output requirements — up to two horsepower.**

## DC MOTORS

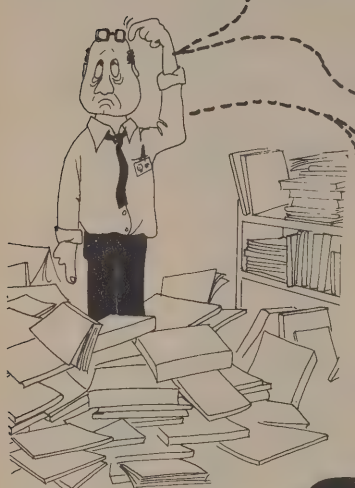
**IMC has introduced a new line of DC Motors for aerospace, military and high performance applications.**

## FREE

Our Driver Manual. It's your license to control all driving situations, free for the asking. 100 pages of detailed motor specifications, comprehensive theory and applications information (ref. cat. #EM2.). From IMC Eastern Division.

***What can I use to keep all the manufacturers' product data I receive in order?***

***What system makes filing or retrieving manufacturers' catalogs fast and easy?***



***Which file system have thousands of engineers purchased because they know it works?***

# eem FILE SYSTEM

## THE ONLY FILE SYSTEM DESIGNED SPECIALLY FOR THE ELECTRONIC ENGINEER

The publishers of **eem** have put together a unique filing system for electronic product information. The complete system includes: a product index booklet which classifies electronic products into 3,000 listings both alphabetically and by product group, and 45 file folders imprinted with the **eem** product sections (extra gummed labels included for expanding the system.)

As you receive manufacturers' catalog data sheets, technical bulletins, or clip magazine articles, jot down the proper Product Section Numbers from the **eem** PRODUCT-TO-SECTION INDEX. Then simply file in order. When you require information on a specific product, refer to PRODUCT-TO-SECTION INDEX again to locate the correct file folder. It's simple, and you'll always have the necessary data to compare, specify and buy, right at your fingertips.

**Here's how to order your eem FILE SYSTEM:**

For the complete system send $10 (plus tax; N.Y., 8%, CA, 6½%) in check or money order to:

United Technical Publications, Inc.,
645 Stewart Avenue, Garden City, N.Y. 11530
Att: Circulation dept.

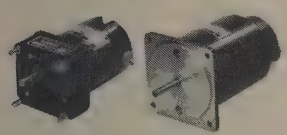
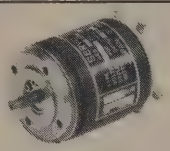
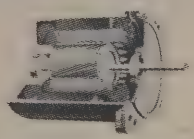
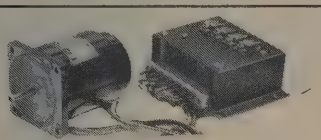
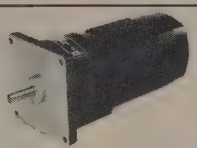
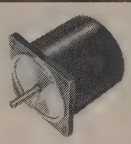
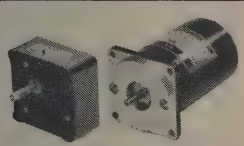
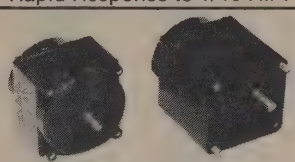
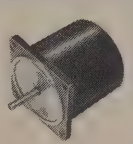
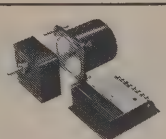
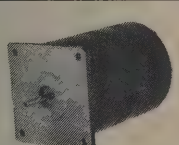
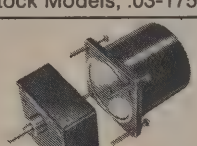
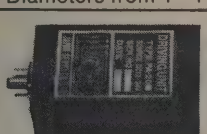
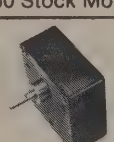
For an **eem FILE SYSTEM** without file folders send $7.50 (plus tax; N.Y. 8%; CA, 6½%).

*UNITED TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-25*

# Japan Servo

**THE WORLD'S LARGEST MANUFACTURER OF PRECISION INSTRUMENT MOTORS**

From 1/10,000 thru 1/10 H.P., Frame Sizes from 0.8 inches thru 5 inches Diameter.

| D.C. MOTORS | SPECIAL PURPOSE MOTORS | M-SERIES STOCK MOTORS |
|---|---|---|
|  **D.C. Motors** Diameter from 1.5" to 4.0" |  **A.C. Servo Motors** 60 & 400 HZ, Sizes 8-42 |  **Direct Drive Motors** 50 Stock Models, 1/750-1/10 H.P. |
|  **Brushless D.C. Motors** Diameters from 0.8"-4.0" |  **High-Power Servo Motors** Rapid Response to 1/10 H.P. |  **Single & Dual Speed Induction Motors** 200 Stock Models, 0.8-3000 RPM |
|  **nterchangeable Gearheads & Tachometers** 1-5000 RPM Speed Controlled |  **Type S Motors & Gearmotors** Retrofit Interchangeability |  **Single & Dual Speed Synchronous Motors** 200 Stock Models, 1-3600 RPM |
| **Variable Reluctance Steppers** 7.5°, 11.25°, 12°, 15°, 22°, 45°, 90° Steps | **Capstan Motors** Meets new DIN standards |  **Brushless Variable Speed Motors & Controls** 150 Stock Models, .03-1750 RPM |
|  **1.8° Permanent Magnet Steppers** Diameters from 1"-4" | **Direct Drive Turntable Motors** 0.035% Typical Wow/Flutter |  **Instantly Reversible Brake Motors** 150 Stock Models |
|  **Stepper Motor Drivers** Plug-In or P.C. Board Mounted | **Torque (Reel) Motors** Linear Torque/Speed Curves |  **Interchangeable Gearheads** 200 Stock Gear Reducers |

For additional information, call or write for complete new catalog.

**JAPANESE PRODUCTS CORPORATION**
**7 Westchester Plaza, Elmsford, N.Y. 10523**

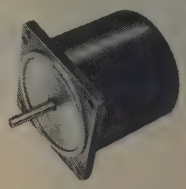
**For immediate action call (914) 592-8880 or telex 13-1581**

IMMEDIATE DELIVERY FROM STOCK

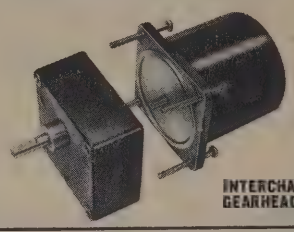
# Japan Servo U. L. LISTED

# "M" SERIES MOTORS AND INTERCHANGEABLE GEARHEADS

- 3 Frame Sizes — Rated 1/750 to 1/18 hp
- Torque Ratings from 0.7 to 1500 oz.-in.
- More than 600 Models Available from Stock
- Built by JAPAN SERVO COMPANY, Subsidiary of Hitachi, Ltd., Japan's Leading Maker of Precision Motors
- Instantly Reversible
- Totally Enclosed
- Permanently Lubricated
- Ball Bearing Construction



DIRECT DRIVE MOTORS



INTERCHANGEABLE GEARHEAD MOTORS

"M" Series motors are precision machined to highest quality standards; utilize permanently lubricated, electronically selected ball bearings. Rabbeted joints and brushed lead-wire openings form a totally enclosed, protected motor housing. All insulation materials are rated Class A or better. Modular concept, using interchangeable gearheads with pinion shaft motors, reduces costly tooling changes and permits a greater number of different models to be manufactured using common parts. Motors and gearheads never need re-oiling, insuring long service without maintenance. Designed for smooth, silent power; geartrains use high precision, accurately hobbed gears housed in a rigid diecast enclosure which combines great structural strength with efficient heat dissipation. Each motor is individually tested and run for six hours.

## INDUCTION MOTORS

Most popular type, with low starting current. May be started, stopped and reversed continuously with low-inertia loads. May be stalled at full voltage for short periods without damage. Continuous duty rated. Smooth, quiet and relatively efficient. Speed changes slightly with change in torque load.

### 1/250 hp MOTORS

| Model Number | Speed, rpm | Torque, Oz.-In. | Frame Dimensions, Reference | Net Each |
|---|---|---|---|---|
| IM6P3-1800 | 0.9 | 140 | 6G | $51.50 |
| IM6P3-900 | 1.7 | 140 | 6G | 51.50 |
| IM6P3-600 | 2.6 | 140 | 6G | 51.50 |
| IM6P3-450 | 3.4 | 140 | 6G | 50.50 |
| IM6P3-360 | 4.3 | 140 | 6G | 50.50 |
| IM6P3-300 | 5.2 | 140 | 6G | 50.50 |
| IM6P3-225 | 6.9 | 140 | 6G | 50.50 |
| IM6P3-180 | 8.6 | 140 | 6G | 50.50 |
| IM6P3-120 | 13 | 140 | 6G | 49.00 |
| IM6P3-90 | 17 | 140 | 6G | 49.00 |
| IM6P3-60 | 26 | 140 | 6G | 49.00 |
| IM6P3-36 | 43 | 94 | 6G | 49.00 |
| IM6P3-30 | 52 | 78 | 6G | 49.00 |
| IM6P3-18 | 86 | 55 | 6G | 48.00 |
| IM6P3-15 | 103 | 46 | 6G | 48.00 |
| IM6P3-10 | 155 | 31 | 6G | 48.00 |
| IM6P3-6 | 258 | 18 | 6G | 48.00 |
| IM6P3-5 | 310 | 15 | 6G | 48.00 |
| IM6S3 | 1500 | 3.5 | 6 | 36.00 |
| IM6S3D1 | 1500/3000 | 2.0 | 6 | 50.00 |

### 1/50 hp MOTORS

| Model Number | Speed, rpm | Torque, Oz.-In. | Frame Dimensions, Reference | Net Each |
|---|---|---|---|---|
| IM8P7-1800 | 0.9 | 600 | 8G-3 | $65.50 |
| IM8P7-900 | 1.7 | 600 | 8G-3 | 65.50 |
| IM8P7-600 | 2.6 | 600 | 8G-3 | 65.50 |
| IM8P7-450 | 3.4 | 600 | 8G-3 | 64.00 |
| IM8P7-360 | 4.3 | 600 | 8G-3 | 64.00 |
| IM8P7-300 | 5.2 | 600 | 8G-3 | 64.00 |
| IM8P7-225 | 6.9 | 600 | 8G-2 | 64.00 |
| IM8P7-180 | 8.6 | 600 | 8G-2 | 64.00 |
| IM8P7-120 | 13 | 600 | 8G-2 | 62.00 |
| IM8P15-90 | 17 | 600 | 8G-2 | 62.00 |
| IM8P15-60 | 26 | 600 | 8G-2 | 62.00 |
| IM8P15-36 | 43 | 390 | 8G-1 | 62.00 |
| IM8P15-30 | 52 | 325 | 8G-1 | 60.00 |
| IM8P15-18 | 86 | 196 | 8G-1 | 60.00 |
| IM8P15-15 | 103 | 163 | 8G-1 | 60.00 |
| IM8P15-10 | 155 | 108 | 8G-1 | 60.00 |
| IM8P15-6 | 258 | 65 | 8G-1 | 60.00 |
| IM8P15-5 | 310 | 54 | 8G-1 | 60.00 |
| IM8S15 | 1500 | 13.5 | 8 | 42.00 |
| IM8S12D6 | 1500/3000 | 5.0 | 8 | 60.00 |

### 1/25 hp MOTORS

| Model Number | Speed, rpm | Torque, Oz.-In. | Frame Dimensions, Reference | Net Each |
|---|---|---|---|---|
| IM10P30-180 | 8.6 | 1500 | 10G-2 | $126.00 |
| IM10P30-90 | 17 | 1500 | 10G-2 | 126.00 |
| IM10P30-60 | 26 | 1340 | 10G-2 | 126.00 |
| IM10P30-30 | 52 | 723 | 10G-1 | 122.00 |
| IM10P30-15 | 103 | 359 | 10G-1 | 122.00 |
| IM10P30-6 | 258 | 145 | 10G-1 | 122.00 |
| IM10S30 | 1500 | 27.8 | 10 | 76.00 |
| IM10S30D15 | 1500/3000 | 13.6 | 10 | 100.00 |

Induction motors listed above are also available with the following additional output speeds: 1, 2.1, 3.1, 4.1, 6.2, 8.3, 10, 16, 21, 31, 62, 124 rpm. Also available with dual output speeds.

## INDUCTION MOTORS WITH BUILT-IN BRAKING

Induction motor with built-in braking device has same advantages as Type IM, but will stop and reverse direction more rapidly without "coasting." Intended for duty cycles of 30 minutes or less requiring precise positioning or rapid direction reversal with holding brake action.

### 1/200 hp MOTORS WITH BRAKING

| Model Number | Speed, rpm | Torque, Oz.-In. | Frame Dimensions, Reference | Net Each |
|---|---|---|---|---|
| RM6P2-1800 | 0.9 | 140 | 6G | $55.50 |
| RM6P2-900 | 1.7 | 140 | 6G | 55.50 |
| RM6P2-600 | 2.6 | 140 | 6G | 55.50 |
| RM6P2-450 | 3.4 | 140 | 6G | 54.50 |
| RM6P2-360 | 4.3 | 140 | 6G | 54.50 |
| RM6P2-300 | 5.2 | 140 | 6G | 54.50 |
| RM6P2-225 | 6.9 | 140 | 6G | 54.50 |
| RM6P2-180 | 8.6 | 140 | 6G | 54.50 |
| RM6P2-120 | 13 | 140 | 6G | 53.00 |
| RM6P2-90 | 17 | 140 | 6G | 53.00 |
| RM6P4-60 | 26 | 140 | 6G | 53.00 |
| RM6P4-36 | 43 | 108 | 6G | 53.00 |
| RM6P4-30 | 52 | 90 | 6G | 53.00 |
| RM6P4-18 | 86 | 62 | 6G | 52.00 |
| RM6P4-15 | 103 | 52 | 6G | 52.00 |
| RM6P4-10 | 155 | 35 | 6G | 52.00 |
| RM6P4-6 | 258 | 21 | 6G | 52.00 |
| RM6P4-5 | 310 | 17 | 6G | 52.00 |
| RM6S4 | 1500 | 4 | 6 | 40.00 |

### 1/35 hp MOTORS WITH BRAKING

| Model Number | Speed, rpm | Torque, Oz.-In. | Frame Dimensions, Reference | Net Each |
|---|---|---|---|---|
| RM8P7-1800 | 0.9 | 600 | 8G-3 | $69.50 |
| RM8P7-900 | 1.7 | 600 | 8G-3 | 69.50 |
| RM8P7-600 | 2.6 | 600 | 8G-3 | 69.50 |
| RM8P7-450 | 3.4 | 600 | 8G-3 | 68.00 |
| RM8P7-360 | 4.3 | 600 | 8G-3 | 68.00 |
| RM8P7-300 | 5.2 | 600 | 8G-3 | 68.00 |
| RM8P7-225 | 6.9 | 600 | 8G-2 | 68.00 |
| RM8P7-180 | 8.6 | 600 | 8G-2 | 68.00 |
| RM8P7-120 | 13 | 600 | 8G-2 | 66.00 |
| RM8P7-90 | 17 | 600 | 8G-2 | 66.00 |
| RM8P20-60 | 26 | 600 | 8G-2 | 66.00 |
| RM8P20-36 | 43 | 590 | 8G-1 | 66.00 |
| RM8P20-30 | 52 | 492 | 8G-1 | 64.00 |
| RM8P20-18 | 86 | 296 | 8G-1 | 64.00 |
| RM8P20-15 | 103 | 247 | 8G-1 | 64.00 |
| RM8P20-10 | 155 | 163 | 8G-1 | 64.00 |
| RM8P20-6 | 258 | 98 | 8G-1 | 64.00 |
| RM8P20-5 | 310 | 82 | 8G-1 | 64.00 |
| RM8S20 | 1500 | 20.4 | 8 | 46.00 |

### 1/15 hp MOTORS WITH BRAKING

| Model Number | Speed, rpm | Torque, Oz.-In. | Frame Dimensions, Reference | Net Each |
|---|---|---|---|---|
| RM10P40-180 | 8.6 | 1500 | 10G-2 | $130.00 |
| RM10P40-90 | 17 | 1500 | 10G-2 | 130.00 |
| RM10P40-60 | 26 | 1500 | 10G-2 | 130.00 |
| RM10P40-30 | 52 | 1029 | 10G-1 | 126.00 |
| RM10P40-15 | 103 | 515 | 10G-1 | 126.00 |
| RM10P40-6 | 258 | 206 | 10G-1 | 126.00 |
| RM10S40 | 1500 | 39.6 | 10 | 80.00 |

Induction motors with braking device listed above are also available with the following additional output speeds: 1, 2.1, 3.1, 4.1, 6.2, 8.3, 10, 16, 21, 31, 62, 124 rpm.

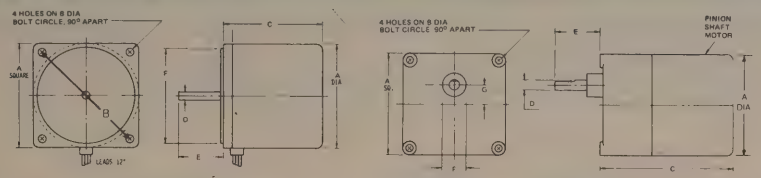
FOR IMMEDIATE DELIVERY

**JAPANESE PRODUCTS CORPORATION** • 7 Westchester Plaza, Elmsford, N. Y. 10523 • Tel: (914) 592-8880 • Telex: 13-1581

# Japan Servo

U. L. LISTED

# "M" SERIES MOTORS AND INTERCHANGEABLE GEARHEADS




## MOTOR FRAME DIMENSIONS, INCHES

| Reference | Body Dia., A | Bolt Circle, B | Body Lgth., C | Shaft Dia., D | Shaft Dia., E | Pilot, F | Shaft Offset, G |
|---|---|---|---|---|---|---|---|
| 6 | 2.36 | 2.756 | 2.56 | 3/16 | 0.87 | 2.126 | — |
| 6G | 2.36 | 2.756 | 3.62 | 1/4 | 1.04 | 0.472 | 0.394 |
| 8 | 3.15 | 3.701 | 2.95 | 1/4 | 1.26 | 2.874 | — |
| 8G-1 | 3.15 | 3.701 | 4.25 | 5/16 | 1.34 | 0.709 | 0.591 |
| 8G-2 | 3.15 | 3.701 | 4.49 | 5/16 | 1.34 | 0.709 | 0.591 |
| 8G-3 | 3.15 | 3.701 | 4.84 | 5/16 | 1.34 | 0.709 | 0.591 |
| 10 | 4.02 | 4.724 | 4.06 | 3/8 | 1.69 | 3.701 | — |
| 10G-1 | 4.02 | 4.724 | 5.67 | 3/8 | 1.26 | 0.945 | 0.787 |
| 10G-2 | 4.02 | 4.724 | 6.02 | 3/8 | 1.26 | 0.945 | 0.787 |

## SYNCHRONOUS MOTORS

Synchronous motors have same advantages as Type IM induction motors, but with constant speed and lower efficiency. Designed for use where precise speeds and/or timekeeping properties are required.

### 1/375 hp SYNCHRONOUS MOTORS

| Model Number | Speed, rpm | Torque, Oz.-In. | Frame Dimensions, Reference | Net Each |
|---|---|---|---|---|
| SM6P2-1800 | 1 | 140 | 6G | $53.50 |
| SM6P2-900 | 2 | 140 | 6G | 53.50 |
| SM6P2-600 | 3 | 140 | 6G | 53.50 |
| SM6P2-450 | 4 | 140 | 6G | 52.50 |
| SM6P2-360 | 5 | 140 | 6G | 52.50 |
| SM6P2-300 | 6 | 140 | 6G | 52.50 |
| SM6P2-225 | 8 | 140 | 6G | 52.50 |
| SM6P2-180 | 10 | 140 | 6G | 52.50 |
| SM6P2-120 | 15 | 135 | 6G | 51.00 |
| SM6P2-90 | 20 | 100 | 6G | 51.00 |
| SM6P2-60 | 30 | 67 | 6G | 51.00 |
| SM6P2-36 | 50 | 40 | 6G | 51.00 |
| SM6P2-30 | 60 | 34 | 6G | 51.00 |
| SM6P2-18 | 100 | 23 | 6G | 50.00 |
| SM6P2-15 | 120 | 20 | 6G | 50.00 |
| SM6P2-10 | 180 | 13 | 6G | 50.00 |
| SM6P2-6 | 300 | 8 | 6G | 50.00 |
| SM6P2-5 | 360 | 6 | 6G | 50.00 |
| SM6S2 | 1800 | 1.5 | 6 | 38.00 |
| HM6S2D1 | 1800/3600 | 0.75 | 6 | 60.00 |

### 1/75 hp SYNCHRONOUS MOTORS

| Model Number | Speed, rpm | Torque, Oz.-In. | Frame Dimensions, Reference | Net Each |
|---|---|---|---|---|
| SM8P5-1800 | 1 | 600 | 8G-3 | $67.50 |
| SM8P5-900 | 2 | 600 | 8G-3 | 67.50 |
| SM8P5-600 | 3 | 600 | 8G-3 | 67.50 |
| SM8P5-450 | 4 | 600 | 8G-3 | 66.00 |
| SM8P5-360 | 5 | 600 | 8G-3 | 66.00 |
| SM8P5-300 | 6 | 600 | 8G-3 | 66.00 |
| SM8P5-225 | 8 | 600 | 8G-2 | 66.00 |
| SM8P10-180 | 10 | 600 | 8G-2 | 66.00 |
| SM8P10-120 | 15 | 600 | 8G-2 | 64.00 |
| SM8P10-90 | 20 | 543 | 8G-2 | 64.00 |
| SM8P10-60 | 30 | 362 | 8G-2 | 64.00 |
| SM8P10-36 | 50 | 217 | 8G-1 | 64.00 |
| SM8P10-30 | 60 | 181 | 8G-1 | 62.00 |
| SM8P10-18 | 100 | 109 | 8G-1 | 62.00 |
| SM8P10-15 | 120 | 91 | 8G-1 | 62.00 |
| SM8P10-10 | 180 | 60 | 8G-1 | 62.00 |
| SM8P10-6 | 300 | 36 | 8G-1 | 62.00 |
| SM8P10-5 | 360 | 30 | 8G-1 | 62.00 |
| SM8S10 | 1800 | 7.5 | 8 | 44.00 |
| HM8S5D2 | 1800/3600 | 1.8 | 8 | 68.00 |

### 1/35 hp SYNCHRONOUS MOTORS

| Model Number | Speed, rpm | Torque, Oz.-In. | Frame Dimensions, Reference | Net Each |
|---|---|---|---|---|
| SM10P20-180 | 10 | 1500 | 10G-2 | $128.00 |
| SM10P20-90 | 20 | 1108 | 10G-2 | 128.00 |
| SM10P20-60 | 30 | 737 | 10G-2 | 128.00 |
| SM10P20-30 | 60 | 398 | 10G-1 | 124.00 |
| SM10P20-15 | 120 | 199 | 10G-1 | 124.00 |
| SM10P20-6 | 300 | 80 | 10G-1 | 124.00 |
| SM10S20 | 1800 | 15.3 | 10 | 78.00 |
| HM10S15D7 | 1800/3600 | 5.6 | 10 | 110.00 |

Synchronous motors listed above are also available with the following additional output speeds: 12, 18, 24, 36, 72, 144 rpm. Also available with dual output speeds.

## VARIABLE SPEED AC MOTORS

Variable speed AC motors feature 15:1 speed ratio with constant torque, tachometer-generator, feed-back regulated solid state control unit, instantly reversible, extremely smooth and quiet operation. AC design eliminates brush replacement and increases life expectancy more than tenfold.

### 1/250 hp VARIABLE SPEED AC MOTORS

| Model Number | Constant Torque Speed Range, rpm | Torque, Oz.-In. | Frame Dimensions, Reference | Net Each |
|---|---|---|---|---|
| IMT6P3-1800 | .06-.83 | 140 | 6G | $115.50 |
| IMT6P3-900 | .11-1.7 | 140 | 6G | 115.50 |
| IMT6P3-600 | .17-2.5 | 140 | 6G | 115.50 |
| IMT6P3-450 | .22-3.3 | 140 | 6G | 114.50 |
| IMT6P3-360 | .28-4.2 | 140 | 6G | 114.50 |
| IMT6P3-300 | .33-5.0 | 140 | 6G | 114.50 |
| IMT6P3-225 | 0.4-6.7 | 140 | 6G | 114.50 |
| IMT6P3-180 | 0.6-8.3 | 140 | 6G | 114.50 |
| IMT6P3-120 | 0.8-12.5 | 140 | 6G | 113.00 |
| IMT6P3-90 | 1.1-17 | 140 | 6G | 113.00 |
| IMT6P3-60 | 1.7-25 | 121 | 6G | 113.00 |
| IMT6P3-36 | 2.8-42 | 73 | 6G | 113.00 |
| IMT6P3-30 | 3.3-50 | 60 | 6G | 113.00 |
| IMT6P3-18 | 6-83 | 42 | 6G | 112.00 |
| IMT6P3-15 | 7-100 | 35 | 6G | 112.00 |
| IMT6P3-10 | 10-150 | 23 | 6G | 112.00 |
| IMT6P3-6 | 17-250 | 14 | 6G | 112.00 |
| IMT6P3-5 | 20-300 | 12 | 6G | 112.00 |
| IMT6S3 | 100-1500 | 2.7 | 6 | 100.00 |

### 1/50 hp VARIABLE SPEED AC MOTORS

| Model Number | Constant Torque Speed Range, rpm | Torque, Oz.-In. | Frame Dimensions, Reference | Net Each |
|---|---|---|---|---|
| IMT8P15-1800 | .06-.83 | 600 | 8G-3 | $143.50 |
| IMT8P15-900 | .11-1.7 | 600 | 8G-3 | 143.50 |
| IMT8P15-600 | .17-2.5 | 600 | 8G-3 | 143.50 |
| IMT8P15-450 | .22-3.3 | 600 | 8G-3 | 142.00 |
| IMT8P15-360 | .28-4.2 | 600 | 8G-3 | 142.00 |
| IMT8P15-300 | .33-5.0 | 600 | 8G-3 | 142.00 |
| IMT8P15-225 | 0.4-6.7 | 600 | 8G-2 | 142.00 |
| IMT8P15-180 | 0.6-8.3 | 600 | 8G-2 | 142.00 |
| IMT8P15-120 | 0.8-12.5 | 600 | 8G-2 | 140.00 |
| IMT8P15-90 | 1.1-17 | 550 | 8G-2 | 140.00 |
| IMT8P15-60 | 1.7-25 | 366 | 8G-2 | 140.00 |
| IMT8P15-36 | 2.8-42 | 220 | 8G-1 | 140.00 |
| IMT8P15-30 | 3.3-50 | 183 | 8G-1 | 138.00 |
| IMT8P15-18 | 6-83 | 110 | 8G-1 | 138.00 |
| IMT8P15-15 | 7-100 | 92 | 8G-1 | 138.00 |
| IMT8P15-10 | 10-150 | 61 | 8G-1 | 138.00 |
| IMT8P15-6 | 17-250 | 36 | 8G-1 | 138.00 |
| IMT8P15-5 | 20-300 | 30 | 8G-1 | 138.00 |
| IMT8S15 | 100-1500 | 7.6 | 8 | 120.00 |

### 1/25 hp VARIABLE SPEED AC MOTORS

| Model Number | Constant Torque Speed Range, rpm | Torque, Oz.-In. | Frame Dimensions, Reference | Net Each |
|---|---|---|---|---|
| IMT10P30-180 | 0.6-8.3 | 1500 | 10G-2 | $200.00 |
| IMT10P30-90 | 1.1-17 | 1195 | 10G-2 | 200.00 |
| IMT10P30-60 | 1.7-25 | 795 | 10G-2 | 200.00 |
| IMT10P30-30 | 3.3-50 | 429 | 10G-1 | 196.00 |
| IMT10P30-15 | 7-100 | 215 | 10G-1 | 196.00 |
| IMT10P30-6 | 17-250 | 86 | 10G-1 | 196.00 |
| IMT10S30 | 100-1500 | 16.5 | 10 | 150.00 |

Variable speed AC motors listed above are also available in 12 other speed ranges.

IMMEDIATE DELIVERY FROM STOCK

FOR IMMEDIATE DELIVERY

**JAPANESE PRODUCTS CORPORATION** • 7 Westchester Plaza, Elmsford, N. Y. 10523 • Tel: (914) 592-8880 • Telex: 13-1581

# NEW from JAPAN SERVO

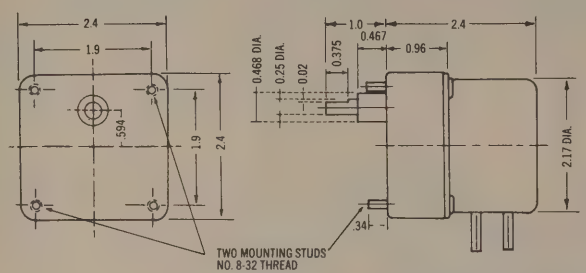
THE WORLD'S LARGEST MANUFACTURER OF PRECISION INSTRUMENT MOTORS

## A.C. PERMANENT MAGNET SYNCHRONOUS GEAR MOTORS

**MODEL-SR4**

**CHECK THE FEATURES:**

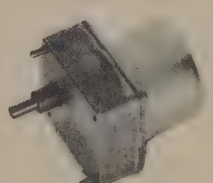
- Low-Cost
- High Torque
- Quiet Running
- Reversible
- Compact, Light Weight
- Heavy Duty Gear Train
- Permanent Lubrication
- Rapid Start and Stop




| | |
|---|---|
| VOLTAGE | 115 or 24 VAC |
| FREQUENCY | 60Hz |
| POLES | 16P |
| POWER INPUT | 7W MAX. |
| OUTPUT SPEED | 1.0 to 150 RPM |
| TORQUE | UP TO 200 OZ. IN. |
| CAPACITOR | 0.68 MF |
| RATING | CONTINUOUS |

**AC SYNCHRONOUS MOTOR**

| MODEL NUMBER | SPEED RPM | TORQUE OZ. IN. | NET EACH |
|---|---|---|---|
| SR4S-450 | 1 | 200 | $30.00 |
| SR4S-300 | 1.5 | 200 | 30.00 |
| SR4S-225 | 2 | 200 | 30.00 |
| SR4S-150 | 3 | 200 | 30.00 |
| SR4S-75 | 6 | 200 | 28.00 |
| SR4S-45 | 10 | 154 | 28.00 |
| SR4S-30 | 15 | 100 | 28.00 |
| SR4S-22.5 | 20 | 75 | 28.00 |
| SR4S-18.75 | 24 | 63 | 28.00 |
| SR4S-18 | 25 | 63 | 28.00 |
| SR4S-15 | 30 | 54 | 25.00 |
| SR4S-7.5 | 60 | 27 | 25.00 |
| SR4S-6.25 | 72 | 22 | 25.00 |
| SR4S-4.5 | 100 | 17 | 25.00 |
| SR4S-3.0 | 150 | 12 | 25.00 |
| SR4S | 450 | 5 | 18.00 |



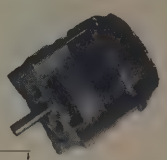
**LARGE QUANTITY DISCOUNTS AVAILABLE**

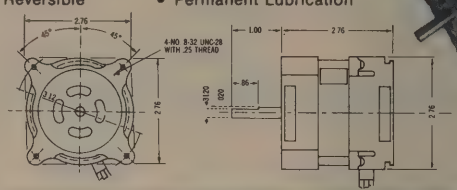
## FLOPPY DISC SYNCHRONOUS MOTORS

**MODEL-SU7**

**CHECK THE FEATURES:**

- Dual Voltage
- High Torque
- Reversible
- Low Cost
- Quality Construction
- Permanent Lubrication



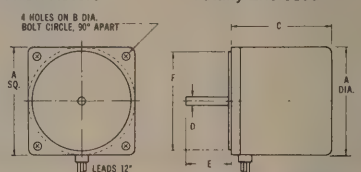



| Voltage (Dual) | 115V | | 220V | |
|---|---|---|---|---|
| Frequency (Hz) | 50 | 60 | 50 | 60 |
| Speed (RPM) | 1500 | 1800 | 1500 | 1800 |
| Capacitor (uF) | 2 | 2 | 2.5 | 2.5 |
| Starting Torque (oz. in.) | 6.3 | 6.4 | 7.4 | 6.7 |
| Pull-out torque (oz. in.) | 6.8 | 6.1 | 5.3 | 4.6 |

## AC TORQUE MOTORS

**FEATURES**

- Linear Speed vs. Torque
- High Stall Torque
- Brushless
- Soft Iron Rotors
- Permanently Lubricated
- Ball Bearing Construction
- Aluminum Body Castings
- Totally Enclosed

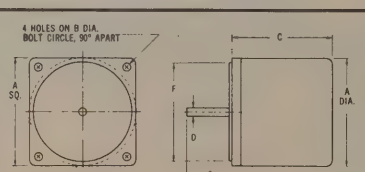


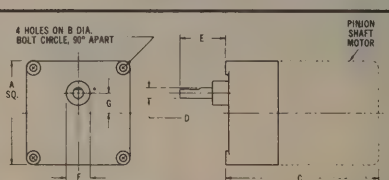

**AC TORQUE MOTORS**

| MODEL NUMBER | SPEED RPM | TORQUE OZ. IN. | BODY DIA. A | BOLT CIRCLE B | BODY LENGTH C | SHAFT DIA. D | NET EACH |
|---|---|---|---|---|---|---|---|
| TM6S3 | 0—1200 | 11.1 | 2.36 | 2.756 | 2.95 | 1/4 | $50.00 |
| TM8S10 | 0—1200 | 25.0 | 3.15 | 3.701 | 3.15 | 5/16 | 58.00 |
| TM10S20 | 0—1200 | 39.6 | 4.02 | 4.724 | 4.06 | 5/16 | 68.00 |

**LARGE QUANTITY DISCOUNTS AVAILABLE**

## DC MOTORS AND GEAR MOTORS



**MOTOR FRAME DIMENSIONS, INCHES**

| Reference | Body Dia., A | Bolt Circle, B | Body Lgth., C | Shaft Dia., D | Shaft Lgth., E | Pilot, F | Shaft Offset, G |
|---|---|---|---|---|---|---|---|
| 6 | 2.36 | 2.756 | 3.0 | 3/16 | 0.87 | 2.126 | — |
| 6G | 2.36 | 2.756 | 4.1 | 1/4 | 1.04 | 0.472 | 0.394 |
| 8 | 3.15 | 3.701 | 3.4 | 1/4 | 1.26 | 2.874 | — |
| 8G-1 | 3.15 | 3.701 | 4.7 | 5/16 | 1.34 | 0.709 | 0.591 |
| 8G-2 | 3.15 | 3.701 | 5.9 | 5/16 | 1.34 | 0.709 | 0.591 |
| 8G-3 | 3.15 | 3.701 | 6.3 | 5/16 | 1.34 | 0.709 | 0.591 |

**1/50 hp DC MOTORS**

| MODEL NUMBER | MAX. SPEED RPM | TORQUE OZ. IN. | FRAME SIZE REF. | NET EACH |
|---|---|---|---|---|
| DM60P-1800 | 2 | 140 | 6G | $ 65.50 |
| DM60P-900 | 4 | 140 | 6G | 65.50 |
| DM60P-600 | 6 | 140 | 6G | 65.50 |
| DM60P-450 | 8 | 140 | 6G | 64.50 |
| DM60P-360 | 11 | 140 | 6G | 64.50 |
| DM60P-300 | 13 | 140 | 6G | 64.50 |
| DM60P-225 | 17 | 140 | 6G | 64.50 |
| DM60P-180 | 22 | 140 | 6G | 64.50 |
| DM60P-120 | 33 | 140 | 6G | 63.00 |
| DM60P-90 | 44 | 140 | 6G | 63.00 |
| DM60P-60 | 66 | 140 | 6G | 63.00 |
| DM60P-36 | 111 | 108 | 6G | 63.00 |
| DM60P-30 | 133 | 83.1 | 6G | 63.00 |
| DM60P-18 | 222 | 55.4 | 6G | 62.00 |
| DM60P-15 | 266 | 48.5 | 6G | 62.00 |
| DM60P-6 | 666 | 19.4 | 6G | 62.00 |
| DM60P-5 | 800 | 16.6 | 6G | 62.00 |
| DM60S | 4000 | 4.2 | 6 | 50.00 |

**24 VDC and 90 VDC windings available.**

**1/25 hp DC MOTORS**

| MODEL NUMBER | MAX. SPEED RPM | TORQUE. OZ. IN. | FRAME SIZE REF. | NET EACH |
|---|---|---|---|---|
| DM80P-1800 | 1 | 600 | 8G-3 | $ 98.50 |
| DM80P-900 | 2 | 600 | 8G-3 | 98.50 |
| DM80P-600 | 3 | 600 | 8G-3 | 98.50 |
| DM80P-450 | 4 | 600 | 8G-3 | 97.00 |
| DM80P-360 | 5 | 600 | 8G-3 | 97.00 |
| DM80P-300 | 6 | 600 | 8G-3 | 97.00 |
| DM80P-225 | 8 | 600 | 8G-2 | 97.00 |
| DM80P-180 | 11 | 600 | 8G-2 | 97.00 |
| DM80P-120 | 16 | 600 | 8G-2 | 95.00 |
| DM80P-90 | 22 | 600 | 8G-2 | 95.00 |
| DM80P-60 | 33 | 600 | 8G-2 | 95.00 |
| DM80P-36 | 55 | 429.4 | 8G-1 | 95.00 |
| DM80P-30 | 66 | 401.7 | 8G-1 | 93.00 |
| DM80P-18 | 111 | 235.5 | 8G-1 | 93.00 |
| DM80P-15 | 133 | 193.9 | 8G-1 | 93.00 |
| DM80P-6 | 333 | 80.3 | 8G-1 | 93.00 |
| DM80P-5 | 400 | 66.5 | 8G-1 | 93.00 |
| DM80S | 2000 | 17.0 | 8 | 75.00 |

**24 VDC and 90 VDC windings available.**

**JAPANESE PRODUCTS CORPORATION • 7 WESTCHESTER PLAZA • ELMSFORD, N.Y. 10523 • (914) 592-8880**

# CATALOGUE DE L'ELECTRONIQUE POUR LES INGENIEURS
# DER PRODUKTKATALOG FÜR ELEKTRONIKER
# ELECTRONIC ENGINEERS CATALOGUE

## The 1978 edition is out...and the response is in...
## IMMEDIATE AND OVERWHELMING

ACCEPTANCE

The ELECTRONIC ENGINEERS CATALOGUE is the only comprehensive, trilingual catalogue/source-directory of electronic products available to—and from—Western Europe.

It is divided into three distinct sections: 1. **The Product Index and Directory,** which lists more than 3,000 product headings & cross-references alphabetically in English with their French and German equivalents. 2. **The Manufacturers' Catalogue Section,** which is a compilation of Manufacturers' Catalogues in alphabetical order. 3. **The Manufacturers' Sales Offices and Trade Marks Directory,** which alphabetically includes country, address, telex or TWX numbers of the Manufacturers' main and local sales offices and/or agents.

The ELECTRONIC ENGINEERS CATALOGUE offers U.S. manufacturers the most cost-efficient method of distributing their catalogue data to **25,000** electronic engineers and buyers throughout Western Europe. It represents the carefully conceived application of the time-proven **eem** "cataloging" concept to the elusive European marketplace.

ted Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Avenue, Garden City, New York 11530 / 516 222-2500

# Magnetic Technology®

## High Performance DC Torque Motors

### Brush type and Brushless, More than 500 standard models

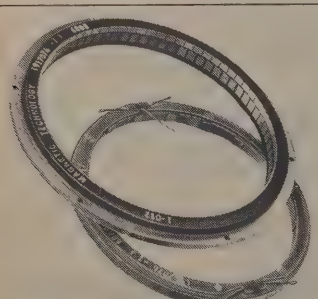
Magnetic Technology® offers designers the broadest standard line of high performance DC torque motors, as well as exotic one-of-a-kind units. These motors are produced to the most exacting reliability and performance standards, and have been proven in aerospace, ground-based and undersea applications.

Magnetic Technology® has paced the industry with developments such as 40 million oz-in/sec² power rate motors, ultra light-weight units for deep space use, 500°F temperature rated motors and compact units for implanted cardiac assist systems.

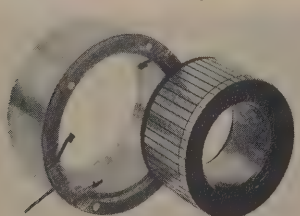
MAGTECH® DC torque motors combine high ratios of torque to power, speed and size with other desirable characteristics such as low electrical time constant and low ripple torque.

### Example Specifications

| Mag. Tech. Part No. | 1500G-050 | 1937G-050 | 2340-077 | 2813-100 | 3680-185 | 6960-195 | 14000E-300 |
|---|---|---|---|---|---|---|---|
| Peak Torque | 15 OZ.IN. | 20 OZ.IN. | 60 OZ.IN. | 90 OZ.IN. | 500 OZ.IN. | 10 LB.FT. | 120 LB.FT. |
| Power @ Tp (watts) | 40 | 56 | 60 | 42 | 110 | 112 | 695 |
| No Load Speed (rad/sec) | 340 | 375 | 134 | 60 | 29 | 7.5 | 4.0 |
| I.D. | .455 | .625 | 1.250 | 1.000 | 1.500 | 4.500 | 9.308 |
| O.D. (inches) | 1.500 | 1.937 | 2.343 | 2.813 | 3.680 | 6.960 | 14.000 |
| Length (inches) | 0.50 | 0.50 | 0.77 | 1.00 | 1.85 | 1.95 | 3.00 |
| Weight (oz.) | 2.5 | 4.2 | 7.6 | 18 | 49 | 145 | 850 |



Typical high performance units



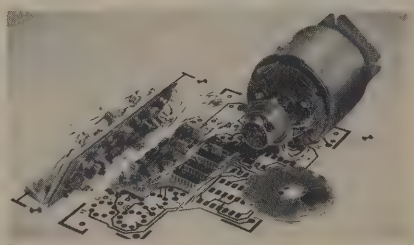
These permanent magnet, armature excited motors are furnished frameless for direct mounting to the driven load without gears. Large bore, minimum width and thin-ring configurations make possible compact system packaging.

Peak torque ratings of standard models range from 7 oz-in. to more than 120 lb-ft., OD's from 1.5 inches to more than 19 inches, and armature bores to more than 10 inches. Special designs may be furnished to meet specific customer requirements.

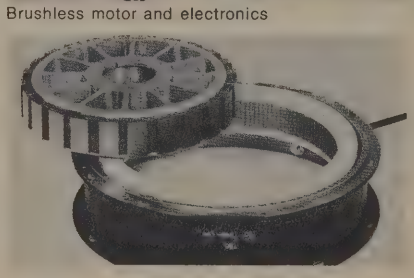
Brushless motors are continuous rotation type that have advantages over conventional brush-type DC torque motors in some applications.

### Example Brushless Specifications

| Mag Tech Part No. | 1600B-035 | 2375D-050 | 3625B-050 | 3350B 125 | 11500-082 | 19300-150 |
|---|---|---|---|---|---|---|
| Peak Torque (oz-in) | 6 | 32 | 45 | 300 | 1000 | 14000 |
| Pwr/Phase (watts) | 26 | 80 | 25 | 200 | 60 | 880 |
| O.D. | 1.6 | 2.375 | 3.625 | 3.35 | 11.478 | 19.30 |
| I.D. | .810 | 1.250 | 2.50 | 1.83 | 9.75 | 14.623 |



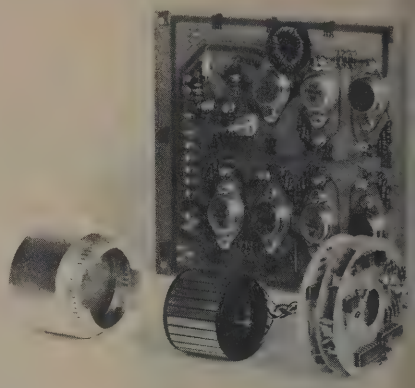
Brushless motor and electronics



Magnetic Technology®, a division of Vernitron Corporation, 21001 Kittridge Street, Canoga Park, California 91303. TWX 910-494-1217. Telephone (213) 887-7700.

## Special Products

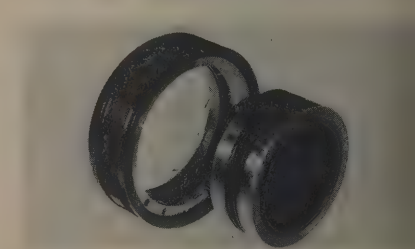
Magnetic Technology® also produces linear actuators, and a wide variety of custom devices including the examples below.



High Efficiency Brushless Motor System. The model 2250-150 operates at 1100 rpm with a 20 oz-in load. The overall system efficiency is above 70% for all input voltages between 18 and 32 volts and at temperatures between −55°C and 85°C.

Rare Earth Brushless DC motor. Special motor developed for use as cardiac assist incorporating rare earth magnets to prevent alteration of motor characteristics in case of over current. Motor designed for maximum efficiency, i.e. lowest temperature rise under continuous load conditions.

Limited Angle Brushless DC Torquers



Precision Motor Tachometer

Magnetic Technology®

# Magnetic Technology®

## Tachometers

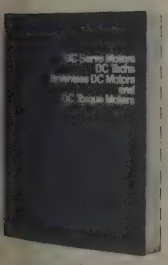
Any of the more than 500 standard MAGTECH® torque motors may be operated as a tachometer generator. In addition, separate product lines of precision tachometers and industrial tachometers are available. These range from .05% ripple voltage units usable at rates less than one revolution per day and units with 50,000:1 dynamic range, to popular industrial units.

These tachometers feature open, frameless configuration for direct drive mounting. The direct mounting without gears eliminates dead zones and inaccuracies that can result from gearing backlash and gear imperfections. Typical characteristics include high voltage gradient, low time constant, high coupling stiffness and resolution, and accuracy at low speeds.

### EXAMPLE TACHOMETER SPECIFICATIONS INCLUDING INDUSTRIAL TYPES*

| Mag. Tech. Part No. | 1917-067 | 2000-100* | 3069C-175* | 3375C-070 | 7200-160 | 15000-248 |
|---|---|---|---|---|---|---|
| O.D. (inch) | 1.917 | 2.000 | 3.069 | 3.375 | 7.200 | 15.75 |
| I.D. (inch) | 0.624 | 0.500 | 0.625 | 2.249 | 3.500 | 9.00 |
| Length (inch) | .67 | 1.00 | 1.75 | .68 | 1.59 | 2.80 |
| Volts/Krpm | 45.1 | 9.56 | 31.5 | 84 | 1218 | 6820 |
| Ripple (%) | 6 | 1.5 | 2 | 1.5 | 0.1 | 0.03 |
| Resistance (Ω) | 360 | 110 | 75 | 300 | 5000 | 3800 |
| Inertia (oz-in-sec²) | 0.0013 | 0.0012 | 0.011 | 0.02 | 0.56 | 15.9 |

Typical industrial units



**162 Pages of Vital Technical Assistance**

Send for your free copy.

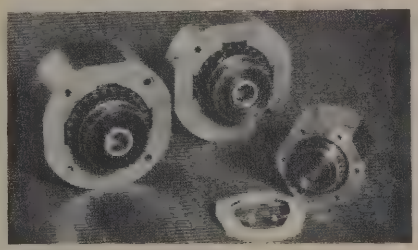
## Industrial DC Servo Motors

### Brushless and Brush-type, Frameless or Housed, Motor-Tach Combinations

Only subtle design, performance and materials variations distinguish these quality, direct drive motors from Magnetic Technology's® established military grade motors. Yet, through volume production they are priced for industrial applications.

Features include fast response, high torque, precise positioning, high tracking accuracy, quiet operation, and relatively low ripple. These DC servo motors utilize a permanent magnetic field for higher efficiency plus a moving iron armature for maximum thermal inertia.

The motors are available in frameless configuration to allow compact packaging and mounting of the armature directly on the driven load. Housed units, with shaft and bearings also are available. Direct coupling to the driven load eliminates the disadvantages of gears and couplings in servo systems. System simplification is possible and excellent system stability results.



Carriage drive motors for printers.

Send for your free copy of our new 162 page product and application guide. Magnetic Technology,® a division of Vernitron Corporation, 21001 Kittridge Street, Canoga Park, California 91303. TWX 910-494-1217. Telephone (213) 887-7700.

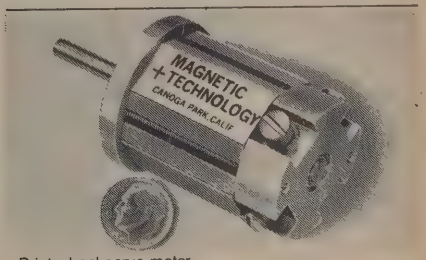
Applications for these units include disc memory systems, card sorters, tape transports and printers, N.C. machine table drives and feedback tachometers.

Continuous rotation brushless units, for constant or variable speed operation, also are available. Electronic drive and control systems can be supplied with these units.

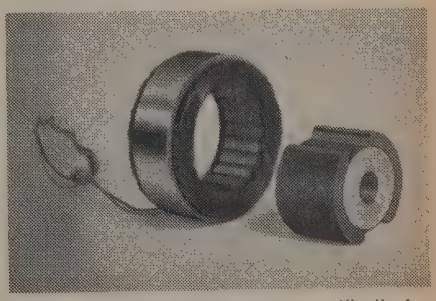
In addition to MAGTECH® industrial servo motors and tachometers, motor-tach combinations can be supplied. A number of standard combinations are available, but virtually any motor and tachometer can be combined to meet drive and tachometer sensitivity requirements. The combination unit is smaller, lighter, easier to mount and generally lower in cost than separate units. These units aid reduction of system resonances.

### Example Specifications

| Mag Tech Part No. | 1310-150 | 1837D-150 | 3069-175 | 3068-237 | H5500-550 | 6002-325 |
|---|---|---|---|---|---|---|
| Stall Torque (oz-in) | 22.5 | 50 | 85 | 175 | 1650 | 1350 |
| Pwr @ Tp @ 25°C (watts) | 58 | 50 | 67 | 123 | 1480 | 150 |
| Ripple Torque (%) | 5 | 5 | 6 | 6 | 3 | 10 |
| Elec Time Const (sec) | 0.0005 | .0006 | .001 | .015 | .003 | 0.002 |
| No Load Speed (rad/sec) | 320 | 140 | 105 | 95 | 120 | 15 |
| O.D. | 1.375 | 1.937 | 3.50 | 3.069 | 5.0 | 6.002 |
| Length | 1.50 | 1.50 | 2.50 | 2.37 | 5.50 | 3.25 |




Print wheel servo motor.



Brushless DC direct drive motor specifically for use in computer peripheral spindle drives — currently in high volume production.

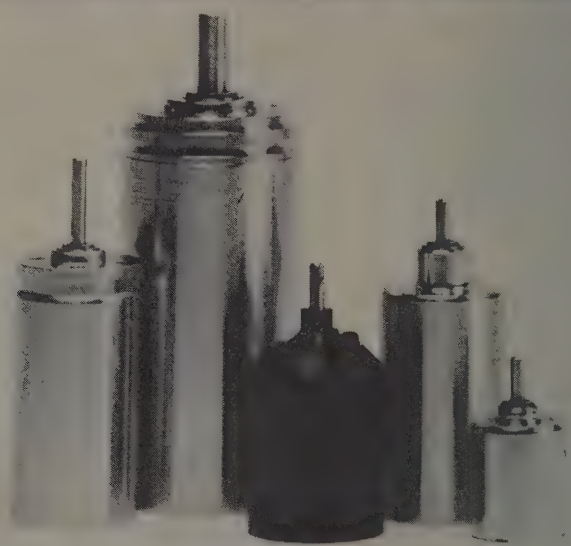
Magnetic Technology®

# Small... but mighty!

Little doesn't have to mean less. Micro-Mo miniature motors, gearheads and tachometers are built to the same high quality, high performance standards of their big world counterparts.

## MOTORS AND SERVO COMPONENTS

## GEARHEADS



## MOTORS AND TACHOMETERS

MME-1031

Our broad experience in the development of these precision products gives us the know-how to solve your small world problems fast. Problems such as servo-stability, thermal constraints, mechanical interfaces.

Call or write for application assistance. We've got what it takes to make your small world go 'round!

**Micro Mo ELECTRONICS, INC.**
3691 LEE ROAD, CLEVELAND, OHIO 44120
TELEPHONE: 216/921-1131, TWX-98-0650

## MOTOR SPECIFICATIONS

- Measured at 25°C (77°F)
- Operational temperature range: −50°C (−58°F) to +75°C (+167°F)
- Maximum rotor temperature: +75°C (+167°F); special models up to +125°C (+258°F)

| 1 | 2 | 3 | | 4 | 5 | 6 | 7 | 8 | 9 | | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Motor Type | Output Power (Max.) | Stall Torque | | Max. Efficiency | Test Voltage | No Load Speed ±15% | Specific Speed Per Volt ±15% | Volts Per 1000 rpm ±15% | Specific Torque ±15% | | Armature Resistance ±10% | Diameter of Motor | Range Availability of Test Volts |
| Units: | Watts | gr. cm. | oz-in | % | Volts | rpm | rpm/v | Volts | gr. cm/A | oz-in/A | Ohm | | |
| 060/006 | 0.50 | 6.6 | .092 | 50 | 4.5 | 33600 | 5900 | 0.17 | 18.7 | .26 | 17.0 | .473 | 2.0 to 12.0 |
| 050/....055 | 0.26 | 5.6 | .078 | 59 | 6.0 | 18800 | 3320 | 0.30 | 29.4 | .41 | 30.0 | .59 | 1.5 to 12.0 |
| 16161004 | — | 12.5 | .175 | 72 | 4.0 | 17100 | 4388 | 0.23 | 22.4 | .31 | 6.9 | .629 | 4.0 to 12.0 |
| 250/....055 | 0.43 | 14.0 | .195 | 72 | 6.0 | 11900 | 2030 | 0.49 | 48.0 | .67 | 20.0 | .59 | 6.0 to 12.0 |
| 1624E006 | — | — | — | — | — | — | 12000 | — | — | — | — | .629 | — |
| 030/....015 | 0.55 | 12.6 | .175 | 61 | 2.0 | 16400 | 8610 | 0.12 | 11.4 | .158 | 1.7 | .787 | 1.5 to 12.0 |
| 230/....06 | 0.53 | 24.2 | .333 | 69 | 12.0 | 8200 | 700 | 1.43 | 139.0 | 1.92 | 67.0 | .787 | 2.0 to 12.0 |
| 235/....10 | 0.75 | 39.3 | .547 | 76 | 6.0 | 7200 | 1120 | 0.82 | 80.0 | 1.13 | 12.0 | .866 | 3.0 to 12.0 |
| 330/....09-X | 2.3 | 81.6 | 1.18 | 85 | 18.0 | 8050 | 510 | 1.96 | 191.0 | 2.65 | 25.0 | .866 | 4.5 to 48.0 |
| 3540/220 | 6.6 | 42.0 | 5.8 | — | 12 | 6300 | 550 | 1.8 | 178 | 2.5 | 5 | 1.38 | 6 to 24 |
| 3557/240 | 9.0 | 67.5 | 9.4 | 72 | 6 | 5300 | 900 | 1.1 | 105 | 1.5 | 0.9 | 1.38 | 6 to 32 |

## GEAR HEAD SPECIFICATIONS

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| For Motor Type | Housing Material | Gearbox Type | Gear Ratio | Weight Without Motor | Length With Motor L | Outline Number | Efficiency | Output Torque (Max.) Continuous Duty | Output Torque (Max.) Intermittent Duty | Output Shaft Bearing Rating (Max.) Radial | Output Shaft Bearing Rating (Max.) Axial | Gearbox Shaft Axial Pressure (Max.) | Shaft Clearance (Max.) Radial | Shaft Clearance (Max.) Axial | Back Lash (Max.) | Ambient Temp. Range | Gear Ratio Availability |
| Units: | | | | oz | in | | % | oz-in | oz-in | oz (Force) | oz (Force) | oz (Force) | in | in | Degrees | °F | |
| 060..... | BRASS | 06/1 | 6:1 | .28 | .93 | 1 | 90 | 1.39 | 3.47 | 7.05 | 3.53 | 106 | .0012 | .004 | 4° | −60° | 6:1 to 1000000:1 |
| AND | NICKEL | — | 15:1 | .29 | 1.01 | 1 | 81 | 1.39 | 3.47 | 7.05 | 3.53 | 106 | .0012 | .004 | 4° | to | 15:1 to 1000000:1 |
| 1212..... | PLATED | — | 28:1 | .33 | 1.09 | 1 | 73 | 1.39 | 3.47 | 7.05 | 3.53 | 106 | .0012 | .004 | 4° | 248° | 28:1 to 1000000:1 |

| 1 | 2 | 3 | 4 | 5 | 6 | | | | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| For Motor Type | Housing Material | Gearbox Type | Gear Ratio | Weight Without Motor | Length Without Motor L1 | 050/0 L2 | 250/0 L2 | 030/4 L3 | 235/4 L3 | 330/4 L3 | Efficiency | Output Torque (Max.) Continuous Duty | Output Torque (Max.) Intermittent Duty | Output Shaft Bearing Rating (Max.) Radial | Output Shaft Bearing Rating (Max.) Axial | Gearbox Shaft Axial Pressure (Max.) | Shaft Clearance (Max.) Radial | Shaft Clearance (Max.) Axial | Back Lash (Max.) | Ambient Temp. Range | Gear Ratio Availability |
| Units | | | | oz | in | in | in | in | in | in | % | oz-in | oz-in | oz (Force) | oz (Force) | oz (Force) | in | in | Degrees | °F | |
| 050..... | PLASTIC | 05/1 | 3.45:1 | .092 | .645 | .881 | 1.23 | — | — | — | 90 | 2.78 | 8.34 | 3.52 | 1.76 | 17.62 | .0015 | .01 | 5° | −60° | 3.45:1 to 5750:1 |
| 250..... | | — | 6.3:1 | .092 | .685 | .944 | 1.29 | — | — | — | 81 | 2.78 | 8.34 | 3.52 | 1.76 | 140.97 | .0015 | .01 | 5° | to | 6.3:1 to 5750:1 |
| | | — | 11.8:1 | .106 | .685 | .944 | 1.29 | — | — | — | 81 | 2.78 | 8.34 | 3.52 | 1.76 | 140.97 | .0015 | .01 | 5° | 158° | 11.8:1 to 5750:1 |
| 050..... | BRASS | 05/2 | 3.45:1 | .32 | .71 | .83 | 1.15 | — | — | — | 90 | 4.1 | 13.89 | 10.57 | 7.05 | 105.73 | .001 | .007 | 2.5° | −60° | 3.45:1 to 235000:1 |
| 250..... | NICKEL | 05/3 | 6.3:1 | .36 | .79 | .91 | 1.23 | — | — | — | 81 | 4.1 | 13.89 | 10.57 | 7.05 | 352.42 | .001- | .007 | 2.5° | to | 6.3:1 to 235000:1 |
| | PLATED | 05/4 | 11.8:1 | .36 | .79 | .91 | 1.23 | — | — | — | 81 | 4.1 | 13.89 | 10.57 | 7.05 | 352.42 | .001 | .007 | 2.5° | 248° | 11.8:1 to 235000:1 |
| 2017.... | BRASS | 03/2 | 3.1:1 | 2.01 | — | — | — | 1.50 | 1.81 | 2.12 | 90 | 13.89 | 55.56 | 17.62 | 10.57 | 352.42 | .001 | .003 | 2.5° | −60° | 3.1:1 to 983447:1 |
| 2025.... | NICKEL | — | 5.4:1 | 2.08 | — | — | — | 1.50 | 1.81 | 2.12 | 90 | 13.89 | 55.56 | (70.48) | 10.57 | 352.42 | .001 | .003 | 2.5° | to | 5.4:1 to 983447:1 |
| 2233.... | PLATED | — | 9.7:1 | 2.40 | — | — | — | 1.72 | 2.03 | 2.35 | 86 | 13.89 | 55.56 | — | 10.57 | 352.42 | .001 | .003 | 2.5° | 248° | 9.7:1 to 983447:1 |

## TACHOMETER SPECIFICATIONS

- Measured at 25°C (77°F)
- Operational temperature range: −50°C (−58°F) to +75°C (+167°F)
- Maximum rotor temperature: +75°C (+167°F); special models up to +125°C (+258°F)

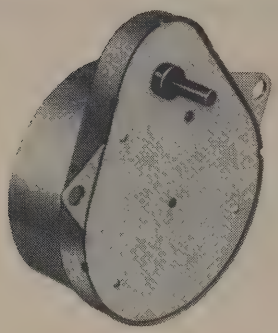
## OPTICAL TACHOMETER SPECIFICATIONS

| Tachometer Type | Motor Type | Output 1 Pulses/Rev. | Output 2 Pulses/Rev. | Linearity | L.E.D. Current-MA | L.E.D. Voltage @20 MA | Photo Transistor Vce Rating-Volts | Photo Transistor Max. Dissipation | Mech. Outline |
|---|---|---|---|---|---|---|---|---|---|
| 01A2 | 22mm | 15 | 15 | 0.4% | 5-20 MA | 1.65 V. | 40 V. | 50 MW | G |
| 01A3 | Any | 15 | 15 | 0.4% | 5-20 MA | 1.65 V. | 40 V. | 50 MW | H |
| 01A4 | 35mm | 15 | 15 | 0.4% | 5-20 MA | 1.65 V. | 40 V. | 50 MW | I |
| 01A9 | 22 | 15 | 1 | 0.4% | 5-20 MA | 1.65 V. | 40 V. | 50 MW | G |
| 01A10 | 15, 16 | 15 | 15 | 0.4% | 5-20 MA | 1.65 V. | 40 V. | 50 MW | J |

## MOTOR TACHOMETER SPECIFICATIONS

| MODEL | Peak Torque+ | Peak Power Input+ | Electrical T. Constant+ | Mechanical T. Constant | Armature Resistance+ | Thermal Resistance | Torque Constant+ | Tach Gradient | Tach Linearity | Ripple Output | Ripple Frequency | Mech. Outline |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Type | gr.cm/oz-in | Watts | msec. | msec. | Ohms | °C/watt | gr.cm/oz-in | Volts/1000 rpm | % | % | Hz/rev. | |
| 050/.....+0507/204-8 | — | — | — | 150 | — | 45 | — | .55 | ± 1% | ± 5% | 7 | K |
| 050/.....+0507/204-8 | — | — | — | 70 | — | 35 | — | .55 | ± 1% | ± 5% | 7 | L |
| 235/2.....+0307/205-8 | — | — | — | 36 | — | 28 | — | .60 | ± 1% | ± 5% | 7 | M |
| 339/5.....+2307/205-8 | — | — | — | 26 | — | 25 | — | .60 | ± 1% | ± 5% | 7 | M |
| 3540/ ....+0307/205-8 | — | — | — | 15 | — | 14 | — | .60 | ± 5% | ± 5% | 7 | N |
| 3557/ ....+3307/205-8 | — | — | — | 18 | — | 10 | — | 4.3 | ± 5% | ± 5% | 7 | N |

# AC & DC MOTORS

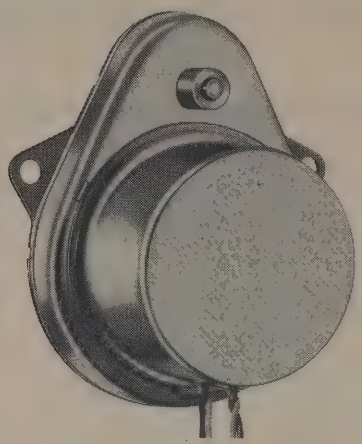


### Shaded Pole Synchronous Motors

Military or industrial. Available for 50 or 60 Hz operation. Five standard voltage ratings; 150 output speeds, clockwise or counterclockwise. Rotor speed 300 rpm at 60 Hz. Running torque 30 oz-in at 1 rpm.

| | |
|---|---|
| 22100 Series | Military Motor Unidirectional |
| 42100 Series | Industrial Motor Unidirectional U/L recognized |

Ask for Reference Sheet CM801

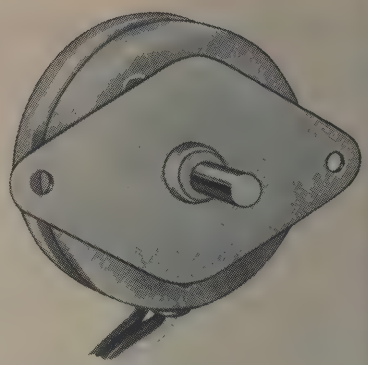


### Reversible Synchronous Motors

For commercial/industrial use. 50 or 60 Hz operation; voltages from 12 to 230. PM rotor, 2-coil windings. Electrically reversible. Rotor speeds 300 rpm at 60 Hz or 720 rpm at 60 Hz. Torque 0.75 oz-in and 1.1 oz-in respectively. Output speeds from 300 rpm to 1/1000 rpm.

| | |
|---|---|
| 81300 Series | 300 rpm rotor |
| S7100 Series | 720 rpm rotor |

Ask for Reference Sheets CM803 and S7100

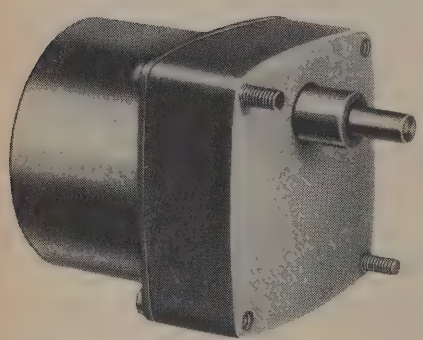


### Lightweight Reversible Synchronous Motors

High torque-to-frame size ratio. Produces 6.0 oz-in torque at 300 rpm or 4.0 oz-in at 600 rpm rotor speed. Electrically reversible. Fast start/stop characteristics. Low cost. Permanently lubricated bearing prolongs life, minimizes maintenance.

| | |
|---|---|
| 81700 Series | 300 rpm U/L recognized |
| 81800 Series | 600 rpm |

Ask for Reference Sheet CM821

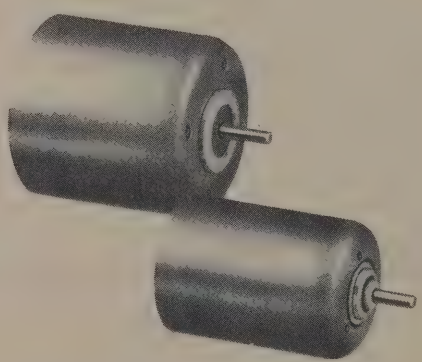


### Single and Dual Speed Instrument Drive Motors

Single speed reversible and dual speed unidirectional motors. Two rotor speeds 300 or 600 rpm. 24, 120 or 240 V ac, 60 Hz or 50 Hz. NEMA 2-11 gear box or square gear box available. U/L recognized.

| | |
|---|---|
| 86100 Series | Single speed reversible (300 rpm) |
| 86600 Series | Single speed reversible (600 rpm) |
| 86500 Series | Dual speed unidirectional (300 rpm) |
| 86700 Series | Dual speed unidirectional (600 rpm) |
| A86100 Series | Dual speed unidirectional (300 rpm) |
| 86800 Series | Dual speed unidirectional (600 rpm) |

Ask for Reference Sheet CM860

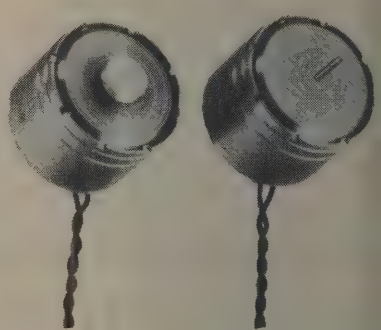


### Ironless Rotor DC Motors

Standard and miniature sizes. Low inertia, rapid response. Reversible. 12V dc and 24V dc models available. Time constants 11.5 ms or 19.6 ms. Available with integral tachometer for use in closed loop system.

| | |
|---|---|
| 4322 010 75110 | Motor 12V dc |
| 4322 010 75060 | Motor 24V dc |
| 4322 010 75140 | With Tachometer 24V dc |
| 4322 010 76050 | Miniature Motor 12V dc |
| 4322 010 76130 | With Tachometer 12V dc |

Ask for Reference Sheet CM823



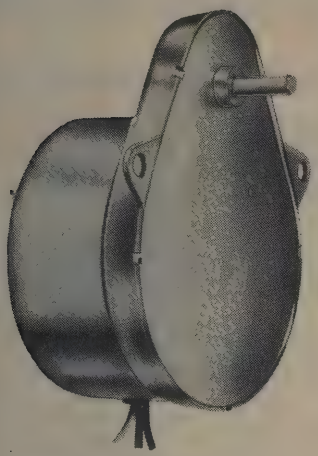
### Coin Size Ironless DC Motor

This motor has approximately the same diameter as a penny. Can be furnished with or without a pulley. 9V dc. Rotor speed 5320 ± 950 rpm nominal. Torque 3 gcm (.04 oz-in) Motor constant 50 mA-typical. Applications include portable dictating equipment, mini digital cassette or cartridge drives and paper drives for printers.

| | |
|---|---|
| 4322 010 59200 | With 8.1 mm dia. pulley |
| 4322 010 77000 | With 6 mm shaft |

Ask for Reference Sheet CM816

# STEPPER MOTORS

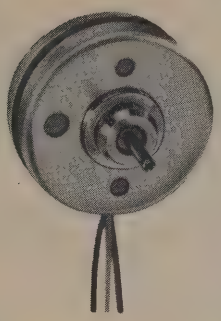


### Pulse Stepper Motors

Industrial, unidirectional or bidirectional. Step rate 0-80 steps/sec. Rotor torque 0.2 oz-in. Double-torque-version also available in unidirectional model. SPDT switching of input provides stepping pulses (no logic required). Rotor steps 15° with each pulse applied; can be supplied with gearing to increase torque or reduce step angle. Standard voltages are 6, 12 or 27V dc; other windings are available.

45100 Series Industrial, Unidirectional
44100 Series Industrial, Bidirectional
44600 Series Industrial, Unidirectional, Double Torque

Ask for Reference Sheets CM802, PI-107, PI-122

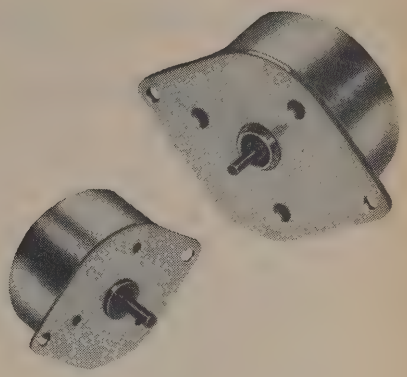


### Micro Miniature Logic Stepper Motor

Extremely small—1" diameter (approximately the same diameter as a 25¢ piece). Operating voltage 12V dc-15° step angle. Can be driven up to 500 PPS with torque up to 0.2 oz-in. Ideal for battery driven applications—automotive digital clocks, portable digital cassettes or cartridge drives and similar instruments where space and weight are at a premium.

82100 Series Logic Stepper Motor

Ask for Reference Sheet CM818

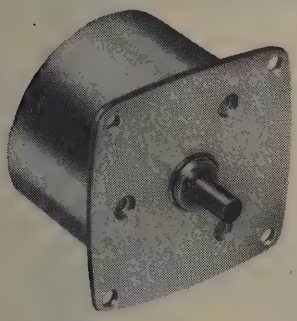


### Low-Cost Light Duty 4-phase Stepper Motors

7° 30′ step angle. Bidirectional. 5 or 12V dc models available. Excellent pull-in rates and good stepping accuracy. 82200 Series furnishes .750 oz-in pull-in/out torque and a pull-in rate to 440 steps/sec. 82400 Series furnishes 2.4 oz-in pull-in/out torque and a pull-in rate to 350 steps/sec. Gear box can be furnished to reduce step angle and increase torque on either series.

82200 Series 7° 30′ Step angle
82400 Series 7° 30′ Step angle

Ask for Reference Sheet CM814

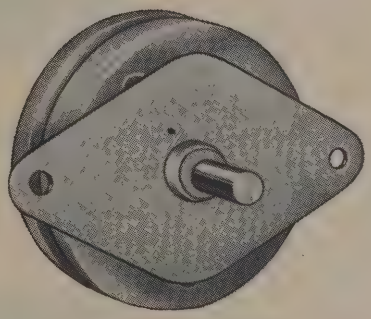


### Low-Cost Medium Duty 4-phase Stepper Motor

Available in either 5V dc or 12V dc models. 82600 Series offers 6.50 oz-in max. pull-in/out torque and 210 steps/sec. max. pull-in rate with 15° step angle .82800 Series offers 7.50 oz-in max. pull-in/out torque and 235 steps/sec. max. pull-in rate with 7° 30′ step angle. Can be fitted with gear box if desired.

82600 Series 15° Step Angle
82800 Series 7° 30′ Step Angle

Ask for Reference Sheet CM814

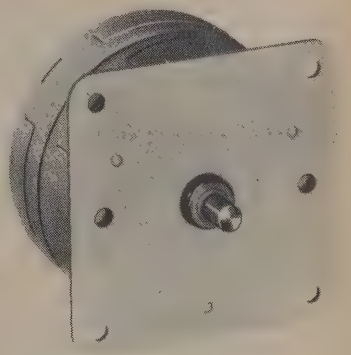


### Industrial-Type Stepper Motor

4-phase stator and permanent magnet rotor. Pull-in/out torque 7.5 oz-in—holding torque 13 oz-in. Pull-in/out rates to 120 steps/sec. Bidirectional. 5V or 12V dc. 7° 30′ step angle. Suitable for use in instrumentation and computer peripherals.

82700 Series 7° 30′ Step Angle

Ask for Reference Sheet CM819



### Low-Cost, High Torque Stepper Motor

A bidirectional permanent magnet stepper motor. Standard construction provides 2 or 4 phase operation, a 7° 30′ or 15° step angle and roller or sleeve bearings. Max. pull-in/out torque 23 oz-in. Max. pull-in rate 500 steps/sec. Operating voltages from 5V dc to 33V dc. Highly effective with long life and efficient utilization of power.

82900 Series 7° 30′ Step Angle

Ask for Reference Sheet CM820

A.W. HAYDON CO. PRODUCTS

NORTH AMERICAN PHILIPS CONTROLS CORP.

Cheshire, Conn. 06410 • (203) 272-0301

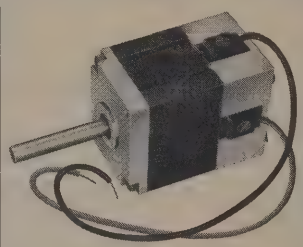
# The PITTMAN® Line of miniature D-C Motors..

## your answer to high performance, yet reasonable cost

### SERVO MOTORS

Our LO-COG® line of permanent-magnet field motors features 7-slot skewed armatures which minimize magnetic cogging at low speeds. Diameters of the three series are 1.2″, 1.6″ and 2″. Each is built in several lengths from 2″ upwards, exclusive of bearing bosses and shaft extensions. Inputs range from 6 to 30 VDC, with no load speeds up to 10,000 rpm. Stall torques range from about one oz.-in. to more than 100 oz.-in. Available with your choice of self-aligning sintered bronze bushings or double-shielded ball bearings. Custom modifications possible in production quantities.

### New High Acceleration Model



A new series of rare earth field motors with theoretical accelerations in excess of 75,000 radians/second². Cross-section size of only 1.00″ x 1.25″ and three lengths from 1.58″ to 1.80″. Stall torques range from 12 to 20 oz.-in. for no load speeds of about 4,000 rpm.

### GEARMOTORS

PITMO® units incorporating LO-COG servo motor sections with integral, totally-enclosed gearboxes. Two series with nominal gearbox diameters of 1.37″ and 2.00″. Overall lengths from 2.93″ to 3.69″, depending on motor selection, exclusive of bearing bosses and shaft extensions. Output shaft speeds from 2 to 650 rpm based on selection of armature winding and gear ratio. Torque output with standard gearing limited to 100 oz.-in. and 175 oz.-in. respectively for the two series. Any PITMO gearmotor can be ordered with integral tachometer noted below.

### MOTOR-TACHOMETERS

PITMO® motor-tachs supplied in two standard series having nominal diameters of 1.2″ and 1.6″. Separate motor and tachometer-generator armatures mounted on a single shaft operate with two different field magnet systems. Overall lengths from 3.72″ to 4.09″ depending on motor selection, exclusive of bearing bosses and shaft extensions. Standard gradient of 2 volts/1,000 rpm with typical ripple of 6% peak-to-peak with no filtering. Broad range of windings available for both motors and tachs.

*Call or write for specifications, performance data and prices.*

# THE PITTMAN CORPORATION

**A Subsidiary of Penn Engineering & Manufacturing Corp.**
**Harleysville, PA 19438**
**Phone 215:256-6601 • TWX 510-661-8696**

© 1978

# escap® DC MICROMOTORS

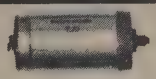
The Unique design and construction of escap® skew-wound ironless rotors provide low rotor inertia, rapid response (time constant down to less than 9 ms.), low starting voltage, high power to volume ratio, low torque ripple, and efficiencies of 80% and better. The escap® line reflects the highest level of engineering skills, Swiss precision manufacturing and the best performance-to-cost ratio available.

## escap® 15 Series

High efficiency — long life — low inertia — in a case size of 15 mm.

| | | | | |
|---|---|---|---|---|
| Output power (watts) | — | 0.24 | to | 0.4 |
| Operating voltage | — | 1.5 | to | 12 |
| Stall torques (oz-in) | — | 0.07 | to | 0.13 |
| No-load speed (rpm) | — | 15,000 | to | 20,600 |
| Moment of rotor inertia (gcm²) | — | 0.2 | to | 0.32 |
| Torque constants (oz-in/A) | — | 0.12 | to | 0.9 |

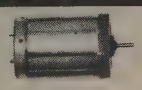
## escap® 16 Series



High efficiency — long life — torque practically pulse-free — in a case size of 16 mm. (Available as a tachometer).

| | | | | |
|---|---|---|---|---|
| Output power (watts) | — | 0.3 | to | 0.7 |
| Operating voltage | — | 4 | to | 12 |
| Stall torques (oz-in) | — | 0.14 | to | 0.41 |
| No-load speed (rpm) | — | 9,000 | to | 17,000 |
| Moment of rotor inertia (gcm²) | — | 0.32 | to | 0.7 |
| Torque constants (oz-in/A) | — | 0.31 | to | 1.3 |

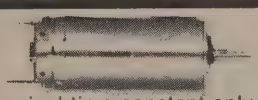
## escap® 22 Series



High starting torque — fast acceleration — in a case size of 22 mm.

| | | | | |
|---|---|---|---|---|
| Output power (watts) | — | 1.4 | to | 2.4 |
| Operating voltage | — | 3.5 | to | 36 |
| Stall torques (oz-in) | — | 1.0 | to | 1.7 |
| No-load speed (rpm) | — | 7,300 | to | 8,500 |
| Moment of rotor inertia (gcm²) | — | 1.5 | to | 3.5 |
| Torque constants (oz-in/A) | — | 0.6 | to | 6.0 |

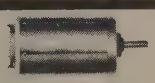
## escap® 23 D Series



Low inertia — mechanical time constant only 10 ms — in a case size of 23 mm.

| | | | | |
|---|---|---|---|---|
| Output power (watts) | — | 3.4 | to | 3.8 |
| Operating voltage | — | 6 | to | 15 |
| Stall torques (oz-in) | — | 3.5 | to | 4.2 |
| No-load speed (rpm) | — | 4,900 | to | 5,250 |
| Moment of rotor inertia (gcm²) | — | 4.7 | to | 5.9 |
| Torque constants (oz-in/A) | — | 1.6 | to | 3.8 |

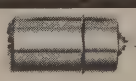
## escap® 26 P Series



High efficiency — long life — low inertia — in a case size of 26 mm. (Available as a tachometer).

| | | | | |
|---|---|---|---|---|
| Output power (watts) | — | 1.0 | to | 3.9 |
| Operating voltage | — | 3 | to | 24 |
| Stall torques (oz-in) | — | 0.72 | to | 4.0 |
| No-load speed (rpm) | — | 5,200 | to | 8,300 |
| Moment of rotor inertia (gcm²) | — | 3.8 | to | 8.5 |
| Torque constants (oz-in/A) | — | 0.5 | to | 4.6 |

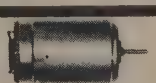
## escap® 28 D Series



Fastest response — mechanical time constant of only 9 ms — high efficiency.

| | | | | |
|---|---|---|---|---|
| Output power (watts) | — | 6.1 | to | 15 |
| Operating voltage | — | 6 | to | 24 |
| Stall torques (oz-in) | — | 10.4 | to | 15.6 |
| No-load speed (rpm) | — | 3,200 | to | 5,400 |
| Moment of rotor inertia (gcm²) | — | 16.9 | to | 19.2 |
| Torque constants (oz-in/A) | — | 2.5 | to | 6 |

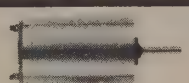
## escap® 28 PL Series



Good regulation — low inertia — high temperature rotor — in a case size of 28mm. (Available as motor-generator sets).

| | | | | |
|---|---|---|---|---|
| Output power (watts) | — | 4.5 | to | 7.6 |
| Operating voltage | — | 9 | to | 36 |
| Stall torques (oz-in) | — | 5.0 | to | 7.9 |
| No-load speed (rpm) | — | 4,700 | to | 5,250 |
| Moment of rotor inertia (gcm²) | — | 10.0 | to | 17.5 |
| Torque constants (oz-in/A) | — | 2.6 | to | 9.9 |

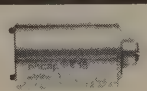
## escap® 34 L Series



High efficiency — large power output — in a case size of 34 mm.

| | | | | |
|---|---|---|---|---|
| Output power (watts) | — | 4.5 | to | 14.8 |
| Operating voltage | — | 4.5 | to | 36 |
| Stall torques (oz-in) | — | 4.6 | to | 16.0 |
| No-load speed (rpm) | — | 2,500 | to | 5,900 |
| Moment of rotor inertia (gcm²) | — | 16 | to | 32.2 |
| Torque constants (oz-in/A) | — | 2.4 | to | 8.1 |

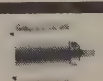
## escap® Reduction Gearboxes



Interface with 15 & 16 Series.

| Model | Running Torque | Ratios to: |
|---|---|---|
| E16 | 2.8 oz-in | 2090 |
| E26 | 8.0 oz-in | 560 |

## escap® Reduction Gearboxes



Interface with 22, 23, 26, 28 & 34 Series Motors.

| Model | Running Torque | Ratios to: |
|---|---|---|
| B26/K26 | 13 oz-in/21 oz-in | 2050 |
| A42/P42 | 70 oz-in/70 lb-in | 3840/2178 |

*Note: All values nominal for operational at 25°C ambient temperature. Specifications subject to change without notice.*

**PRECISION MADE IN SWITZERLAND**

**Portescap U.S.**

Member of the Portescap Group
730 Fifth Avenue
New York. N.Y. 10019

Call for additional information and applications assistance:
in New York: (212) 245-7715
in San Francisco: (415) 886-1618
in Los Angeles: (805) 522-4330
in Dallas: (214) 690-9000
in New England: (603) 888-4000
in Northwest: (503) 645-7523

# RAPID/SYN DRIVERS

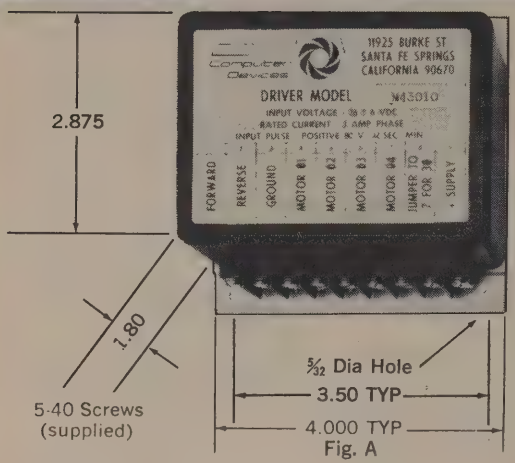


Fig. A

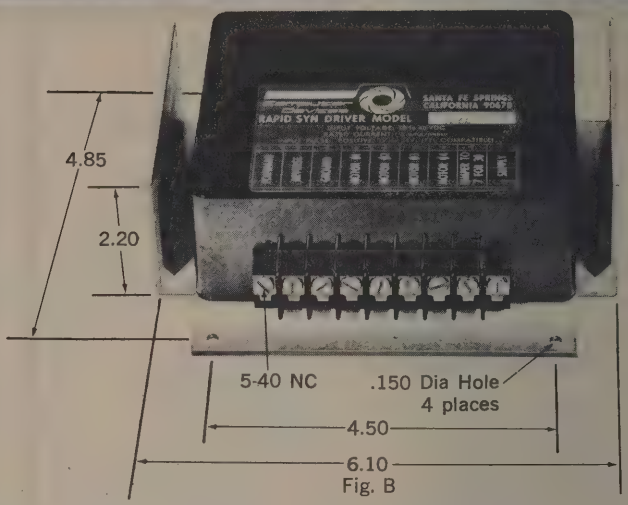


Fig. B

## DESCRIPTION

Rapid-Syn Drivers are solid state pulse-to-step converters capable of providing bi-directional operation of the stepping motor.

All Rapid-Syn Drivers listed, except Model M2301F, are designed to drive 3 Phase and 4 Phase motors regardless of type or step angle of the motor. Model M2301F is a bi-polar driver designed for 4 Phase PM motors.

All models require 2.4 to 30 volts positive going pulse with a minimum pulse width of 20 micro-seconds (TTL compatable). For rated input voltage and maximum current rating of various models, refer to table.

## GENERAL SPECIFICATIONS

Operating Temperature Range: 0°C to 60°C
Input Impedance: 3KΩ Minimum
Switching Capability: 10K PPS Minimum

| Model No. | Rated Current Amp/Phase Max. | Dimensions | Rated Voltage VDC | Excitation Mode | Connection Diagram | Type |
|---|---|---|---|---|---|---|
| M61 | 6 | B | 10 to 40 | Single Phase | Fig. 1, 2, 3 | Unipolar |
| M62 | 6 | B | 10 to 40 | Dual Phase | Fig. 1, 2, 3 | Unipolar |
| M68 | 6 | B | 10 to 40 | Half Angle | Fig. 1, 2, 3 | Unipolar |
| M43010 | 3 | A | 22 to 34 | Single Phase | Fig. 1, 2, 3 | Unipolar |
| M43020 | 3 | A | 22 to 34 | Dual Phase | Fig. 1, 2, 3 | Unipolar |
| M83010 | 3 | A | 22 to 34 | Half Angle | Fig. 1, 2, 3 | Unipolar |
| M2301F | 3 | A | 22 to 34 | Two Phase | Fig. 4 | Bipolar |
| BPM-5-15 | 5 | B | ±12 to 22 | Two Phase | — | Bipolar |

FIG. 1

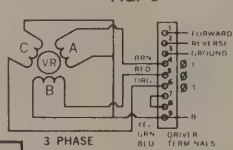



FIG. 3

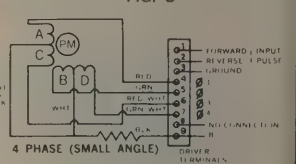



FIG. 2

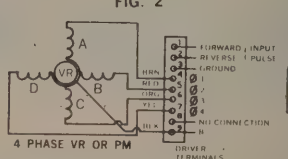
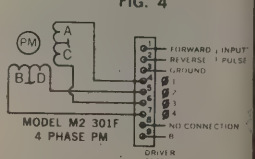



FIG. 4

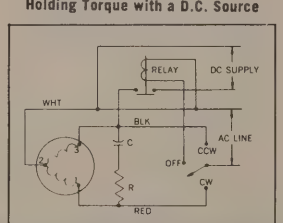



# AC SYNCHRONOUS MOTORS

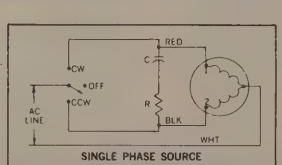
120 VAC
60 Hz

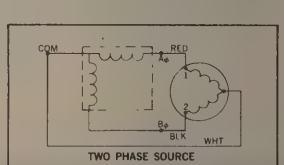
| Model No. | Size | Speed (RPM) | Resist. Per Phase (Ohms) | Torque (Oz. In.) | Rotor Inertia (GM CM²) | Phase Shifting Component Res. - 5% | Phase Shifting Component Cap. - 5% | Weight (Oz.) | Length (In.) | Fig. No. |
|---|---|---|---|---|---|---|---|---|---|---|
| 20PE-450 | 20 | 450 | 770 | 4.0 | 26 | — | 1.0 MFD-300VAC | 8 | 1.00 | 8 |
| 20PS-300 | 20 | 300 | 770 | 4.0 | 26 | — | 1.0 MFD-300VAC | 8 | 1.00 | 8 |
| 23H-400 | 23 | 200 | 420 | 25 | 120 | 200Ω-5W | 1.75MFD-330VAC | 32 | 3.25 | 6 |
| 23H-600 | 23 | 72 | 1100 | 25 | 50 | 500Ω-5W | .75MFD-330VAC | 20 | 2.25 | 6 |
| 28PF-600 | 28 | 600 | 1000 | 10 | 93 | — | 1.0 MFD-300VAC | 24 | 2.25 | 10 |
| 28PS-300 | 28 | 300 | 1000 | 12 | 93 | — | 1.0 MFD-300VAC | 24 | 2.25 | 10 |
| 34H-400 | 34 | 200 | 225 | 50 | 1100 | 300Ω-25W | 3.75MFD-330VAC | 75 | 3 1/16 | 7 |
| 34H-600 | 34 | 72 | 300 | 100 | 550 | 400Ω-25W | 2.25MFD-330VAC | 50 | 2 7/16 | 7 |

Synchronous Motors Increase Holding Torque with a D.C. Source




## — CONNECTION DIAGRAMS —




Rapidsyn
DANA
INDUSTRIAL POWER TRANSMISSION DIVISION
Formerly Computer Devices of California

Rapidsyn Company
11901 Burke Street
Santa Fe Springs, Calif. 90670
Tel. (213) 698-2595 Telex: 69-6352

# RAPID/SYN
## STEPPING MOTORS AND CONTROLS

## INCREASE PRODUCT RELIABILITY—REDUCE COSTS!

Choose Steppers and Controls from the broad, flexible line of Computer Devices Corporation, and be assured of top quality at prices you can live with. Check our widest range of step angles in 2, 3, 4 and 5 phase units—all designed to operate from a wide variety of solid state logics which are stock items. Also available, RAPID SYN Synchronous 72, 200, 300, 450 and 600 RPM motors . You'll like our service on your special requirements.

## RAPID-SYN STEPPERS . . . RATINGS AND CHARACTERISTICS*

| Step Angle | Size | *Model Number | Type | Res/$\phi$ (Ohms) | Rated Voltage (VDC) | Static Stall Torque (Oz. In.) | Detent Torque (Oz. In.) | Dynamic Torque (Oz. In.) | Response (PPS) | Induct. mh | Rotor Inertia (gm. cm.$^2$) | Weight (Oz.) | Length Max. (In.) | Fig. No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 23 | 23F-180 | VR/5$\phi$ | 0.4 | 2.0 | 50 | 0 | 25 | 2000 | 1.00 | 350 | 66 | 4.938 | 10 |
| | 23 | 23D-6102 | PM/4$\phi$ | 5.1 | 5.1 | 53 | 5 | 35 | 700 | 6.80 | 87 | 20 | 2.0 | 6 |
| | 23 | 23D-6108 | PM/4$\phi$ | 0.63 | 1.3 | 53 | 5 | 35 | 1100 | .68 | 87 | 20 | 2.0 | 6 |
| | 23 | 23D-6204 | PM/4$\phi$ | 2.6 | 4.3 | 100 | 8 | 65 | 900 | 6.30 | 200 | 32 | 3.25 | 6 |
| | 23 | 23D-6209 | PM/4$\phi$ | 0.37 | 1.7 | 100 | 8 | 65 | 1350 | .80 | 200 | 32 | 3.25 | 6 |
| | 23 | 23D-6306 | PM/4$\phi$ | 1.16 | 3.4 | 150 | 10 | 100 | 1050 | 3.90 | 320 | 44 | 4.0 | 6 |
| | 23 | 23D-6309 | PM/4$\phi$ | 0.48 | 2.2 | 150 | 10 | 100 | 1150 | 1.43 | 320 | 44 | 4.0 | 6 |
| | 23 | 23H-02 | PM/4$\phi$ | 80 | 28 | 30.0 | 1.0 | 20.0 | 700 | 73.00 | 30.0 | 17.0 | 2.000 | 6 |
| | 23 | 23H-05 | PM/4$\phi$ | 5 | 6 | 30.0 | 1.0 | 20.0 | 1000 | 5.10 | 30.0 | 17.0 | 2.000 | 6 |
| | 23 | 23H-501 | PM/4$\phi$ | 5 | 6 | 60.0 | 2.0 | 40.0 | 450 | 67.00 | 120.0 | 20.0 | 2.250 | 6 |
| | 23 | 23H-502 | PM/4$\phi$ | 20 | 12 | 60.0 | 2.0 | 40.0 | 425 | 16.30 | 120.0 | 20.0 | 2.250 | 6 |
| | 23 | 23H-503 | PM/4$\phi$ | 80 | 24 | 60.0 | 2.0 | 40.0 | 425 | 66.50 | 120.0 | 20.0 | 2.250 | 6 |
| 1.8° | 23 | 23H-700 | PM/4$\phi$ | 3 | 6 | 90.0 | 4.0 | 65.0 | 480 | 11.50 | 200.0 | 30.0 | 3.250 | 6 |
| | 34 | 34D-9106 | PM/4$\phi$ | 0.95 | 2.9 | 150 | 5 | 110 | 750 | 3.8 | 643 | 52 | 2.45 | 7 |
| | 34 | 34D-9109 | PM/4$\phi$ | 0.39 | 1.8 | 150 | 5 | 115 | 875 | 1.63 | 643 | 52 | 2.45 | 7 |
| | 34 | 34D-9209 | PM/4$\phi$ | 0.55 | 2.9 | 300 | 10 | 200 | 750 | 2.71 | 1200 | 88 | 3.7 | 7 |
| | 34 | 34D-9311 | PM/4$\phi$ | 0.52 | 2.8 | 450 | 15 | 300 | 650 | 1.90 | 1850 | 124 | 5.31 | 7 |
| | 34 | 34D-9314 | PM/4$\phi$ | 0.31 | 2.2 | 450 | 15 | 300 | 750 | 1.0 | 1850 | 124 | 5.31 | 7 |
| | 34 | 34H-02 | PM/4$\phi$ | 0.50 | 2 | 125.0 | 4.0 | 90.0 | 1100 | 1.76 | 375.0 | 45.0 | 2.500 | 7 |
| | 34 | 34H-501 | PM/4$\phi$ | 20 | 14 | 140.0 | 6.0 | 100.0 | 500 | 65.00 | 550.0 | 50.0 | 2.437 | 7 |
| | 34 | 34H-507 | PM/4$\phi$ | 150 | 35 | 140.0 | 6.0 | 100.0 | 500 | 1.25 | 550.0 | 50.0 | 2.437 | 7 |
| | 34 | 34H-508 | PM/4$\phi$ | 10 | 8 | 140.0 | 6.0 | 100.0 | 500 | 27.00 | 550.0 | 50.0 | 2.437 | 7 |
| | 34 | 34H-509 | PM/4$\phi$ | 4.50 | 5.5 | 140.0 | 6.0 | 100.0 | 500 | 20.00 | 550.0 | 50.0 | 2.437 | 7 |
| | 34 | 34H-510 | PM/4$\phi$ | 0.50 | 2.0 | 140.0 | 6.0 | 100.0 | 550 | 1.50 | 550.0 | 50.0 | 2.437 | 7 |
| | 34 | 34H-700 | PM/4$\phi$ | 0.70 | 3.0 | 280.0 | 10.0 | 200.0 | 800 | 4.00 | 1100.0 | 76.0 | 3.687 | 7 |
| | 34 | 34H-901 | PM/4$\phi$ | 1.1 | 4.5 | 500.0 | 15.0 | 250.0 | 600 | 6.13 | 1800.0 | 150.0 | 5.312 | 7 |
| | 42 | 42D-111-12 | PM/4$\phi$ | .37 | 2.3 | 625 | [illegible] | 425 | 500 | 2.4 | 3900 | 125 | 4.74 | 8 |
| | 42 | 42D-112-12 | PM/4$\phi$ | .60 | 3.6 | 1125 | [illegible]0 | 840 | 300 | 5.3 | 8150 | 232 | 6.99 | 8 |
| 2.25° | 23 | 23F-215 | VR/5$\phi$ | 0.4 | 2.0 | 50 | 0 | 25 | 2000 | 1.76 | 350 | 66 | 4.938 | 10 |
| | 23 | 23H-300 | PM/4$\phi$ | 3.0 | 6 | 45.0 | 6.0 | 30.0 | 350 | 5.80 | 120.0 | 30.0 | 3.25 | 6 |
| 5° | 23 | 23V-300 | VR/4$\phi$ | 3.0 | 6 | 40.0 | 0 | 22.0 | 420 | 7.50 | 120.0 | 30.0 | 3.25 | 6 |
| | 34 | 34H-300 | PM/4$\phi$ | 0.75 | 3 | 90.0 | 7 | 60.0 | 400 | 3.4 | 1200.0 | 75.0 | 3.687 | 7 |
| | 11 | 11RS-01 | VR/4$\phi$ | 100 | 28 | 2.3 | 0 | 1.20 | 750 | 45.00 | 2.5 | 5.0 | 1.400 | 2 |
| | 15 | 15RS-03 | VR/4$\phi$ | 55 | 28 | 8.0 | 0 | 5.0 | 1100 | 47.0 | 3.0 | 6.5 | 1.500 | 3 |
| 7.5° | 20 | 20PS-24S | PM/4$\phi$ | 90.0 | 24.0 | 7.0 | 2.0 | 4 | 275 | 40.0 | 26 | 8 | 1.00 | 8 |
| | 20 | 20RS-01 | VR/4$\phi$ | 20.0 | 28 | 30.0 | 0 | 10.0 | 700 | 47.0 | 10.0 | 20.0 | 2.500 | 5 |
| | 23 | 23PS-01B | PM/4$\phi$ | 70.0 | 28 | 13 | 1.2 | 8 | 425 | 66.5 | 30 | 8 | 1.050 | 8 |
| | 28 | 28PS-05-24 | PM/4$\phi$ | 175 | 24 | 18.5 | 3.0 | 12.5 | 140 | 260.0 | 93 | 24 | 2.25 | 11 |
| 11.25° | 20 | 20PE-24S | PM/4$\phi$ | 90.0 | 24.0 | 7.0 | 2.0 | 4 | 275 | 40.0 | 26 | 8 | 1.00 | 9 |
| | 8 | 08R-01 | VR/4$\phi$ | 100 | 28 | 1.0 | 0 | 0.6 | 1400 | 65.0 | 0.18 | 1.8 | 1.000 | 1 |
| | 8 | 08V-01 | VR/3$\phi$ | 60 | 28 | 1.3 | 0 | 0.50 | 1100 | 30.0 | 0.18 | 1.8 | 1.000 | 1 |
| | 11 | 11R-01 | VR/4$\phi$ | 55 | 28 | 5.8 | 0 | 3.25 | 1040 | 45.0 | 1.0 | 4.7 | 1.625 | 2 |
| | 11 | 11V-01 | VR/3$\phi$ | 80 | 28 | 2.75 | 0 | 1.75 | 630 | 56.0 | 1.0 | 4.7 | 1.625 | 2 |
| | 15 | 15R-01 | VR/4$\phi$ | 35 | 28 | 8.0 | 0 | 4.50 | 1170 | 60.00 | 0.7 | 6.5 | 1.500 | 3 |
| | 15 | 15V-01 | VR/3$\phi$ | 16 | 28 | 5.8 | 0 | 2.25 | 1000 | 14.0 | 0.6 | 6.5 | 1.500 | 3 |
| 15° | 18 | 18R-01 | VR/4$\phi$ | 55 | 28 | 11.5 | 0 | 8.0 | 620 | 140.0 | 5.0 | 13.0 | 1.875 | 4 |
| | 20 | 20R-03 | VR/4$\phi$ | 35 | 28 | 18.0 | 0 | 6.6 | 625 | 75.0 | 3.5 | 20.0 | 2.500 | 5 |
| | 20 | 20R-07 | VR/4$\phi$ | 20 | 28 | 38.0 | 0 | 25.0 | 400 | 51.0 | 10.0 | 20.0 | 2.500 | 5 |
| | 20 | 20R-17 | VR/4$\phi$ | 10 | 28 | 40.0 | 0 | 30.0 | 700 | 24.0 | 10.0 | 20.0 | 2.500 | 5 |
| | 20 | 20V-01 | VR/3$\phi$ | 10 | 28 | 50.0 | 0 | 13.6 | 475 | 30.0 | 10.0 | 20.0 | 2.500 | 5 |
| | 20 | 20V-03 | VR/3$\phi$ | 20 | 28 | 40.0 | 0 | 10.0 | 400 | 54.0 | 10.0 | 20.0 | 2.500 | 5 |
| | 28 | 28PF-08-24 | PM/4$\phi$ | 175 | 24 | 17.5 | 1.5 | 12.0 | 130 | 260.0 | 93 | 24 | 2.25 | 11 |
| | 8 | 08M-01 | PM/4$\phi$ | 65 | 28 | 1.0 | 0.10 | 0.35 | 700 | 35.0 | 0.3 | 1.75 | 1.000 | 1 |
| | 11 | 11M-01 | PM/4$\phi$ | 45 | 28 | 2.5 | 0.20 | 1.50 | 425 | 14.0 | 1.2 | 4.5 | 1.625 | 2 |
| 45° | 15 | 15M-01 | PM/4$\phi$ | 30 | 28 | 8.1 | 0.30 | 4.80 | 300 | 17.9 | 5.0 | 10.0 | 2.100 | 3 |
| | 18 | 18M-01 | PM/4$\phi$ | 40 | 28 | 6.0 | 0.25 | 3.5 | 350 | 14.0 | 4.0 | 13.0 | 1.875 | 4 |
| | 20 | 20M-01 | PM/4$\phi$ | 12 | 28 | 15.0 | 0.40 | 8.7 | 300 | 13.0 | 15.0 | 26.0 | 2.500 | 5 |
| | 8 | 08P-02 | PM/4$\phi$ | 100 | 28 | 0.8 | 0.10 | 0.25 | 350 | 18.0 | 0.3 | 1.75 | 1.000 | 1 |
| | 11 | 11P-01 | PM/4$\phi$ | 60 | 28 | 2.5 | 0.20 | 1.10 | 240 | 22.0 | 1.2 | 4.3 | 1.625 | 2 |
| 90° | 15 | 15P-03 | PM/4$\phi$ | 20 | 28 | 11.0 | 0.30 | 7.0 | 175 | 14.1 | 5.0 | 10.0 | 2.100 | 3 |
| | 18 | 18P-01 | PM/4$\phi$ | 20 | 28 | 8.0 | 0.25 | 6.0 | 260 | 20.0 | 4.0 | 13.0 | 1.875 | 4 |
| | 20 | 20P-03 | PM/4$\phi$ | 12 | 28 | 20.0 | 0.40 | 9.0 | 160 | 13.0 | 10.0 | 20.0 | 2.500 | 5 |

Fig. 1 Size 8 — ¾" Dia.

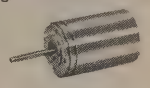


Fig. 2 Size 11 — 1 1/16" Dia.

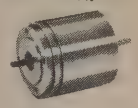


Fig. 3 Size 15 — 1 1/16" Dia.

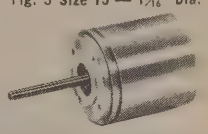


Fig. 4 Size 18 — 1¾" Dia.

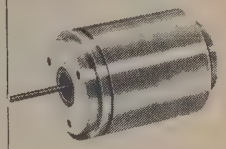


Fig. 5 Size 20 — 2" Dia.

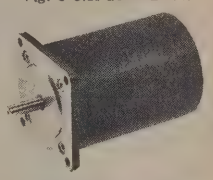


Fig. 6 Size 23 — 2½" Dia.

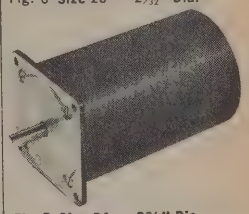


Fig. 7 Size 34 — 3⅜" Dia.

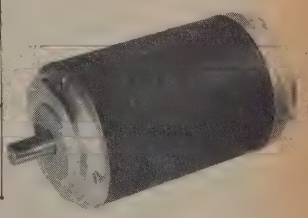
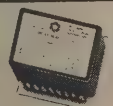


Fig. 8 Size 42 — 4½" Dia.

Pulse Source


Driver

ELECTRONIC ANCILLARIES

Preset Indexer

Adjustable Speed Drive

Accelerating Decelerating Drive

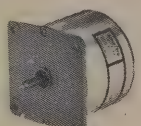


Fig. 11 Pacesetter 2.75" Dia.

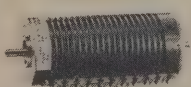


Fig.10 Five Phase Stepper 2.2" Dia.

Fig. 9 Commercial Grade Stepper 2.0" x 2.25" Dia.

*For complete Model No. and detailed specifications, call or write to factory

Rapidsyn

DANA

INDUSTRIAL POWER TRANSMISSION DIVISION
Formerly Computer Devices of California

Rapidsyn Company
11901 Burke Street
Santa Fe Springs, Calif. 90670
Tel. (213) 698-2595 Telex: 69-6352

# stay up to date

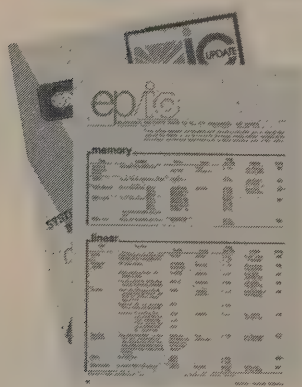
**SUBSCRIBE TO ELECTRONIC PRODUCTS MAGAZINE. IT'S YOUR *COMPLETE* GUIDE TO EVERYTHING THAT'S NEW IN THE FAST-CHANGING WORLD OF ELECTRONIC PRODUCTS AND SYSTEMS.**

**FEATURE STORIES** every month on electronic products, applications and availability.

**FORUMS**—Reports on meetings of manufacturers, users and distributors. Get the very latest news on a wide variety of products.

**NEW PRODUCT NEWS**—Hundreds of new products are introduced each month. You'll get the facts on not only what the new product is, but also where to get it, basic prices and current delivery.

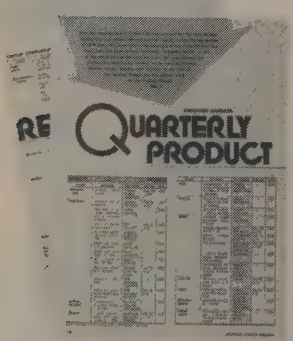
**EP/IC UPDATE**—Exclusive in ELECTRONIC PRODUCTS. A monthly report on *everything* that's new in the fast-moving world of integrated circuits.




**QUARTERLY PRODUCT REVIEW**—Another exclusive in ELECTRONIC PRODUCTS. A complete report of *every* new electronic product introduced in the previous quarter. This feature is in the January, April, July and October issues.

**QUARTERLY PRODUCT PLANNING DIRECTORY**—A compilation of the latest catalogs of a wide variety of electronic products and systems.

**OUTLOOK**—Important industry news affecting electronic products and systems.




**COMPONENT CAPERS**—A humorous look at the strange and wonderful world of electronics.

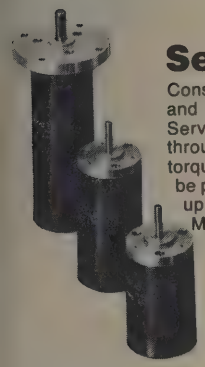
**MINI-GLOSSARIES,** Quizzes and more—Each and every month for over twenty years the readers of ELECTRONIC PRODUCTS learn something new about the products they work with and specify.

***If you are not now a subscriber, write to:***
***Dorothy Renoud, ELECTRONIC PRODUCTS MAGAZINE, 645 Stewart Avenue, Garden City, NY 11530.***
***Ask for a free qualification card.***

United Technical Publications, Inc., Div. of Cox Broadcasting Corp., 645 Stewart Ave., Garden City, NY 11530/(516) 222-2500

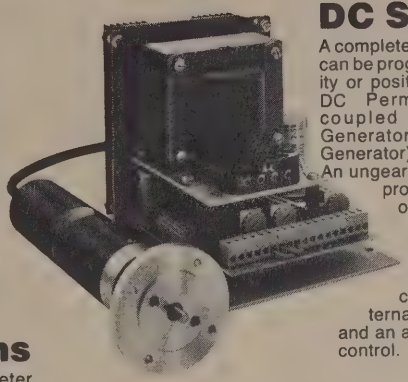
# Be selective, turn to SERVO-TEK

## FOREMOST IN SPEED MEASUREMENT AND CONTROL



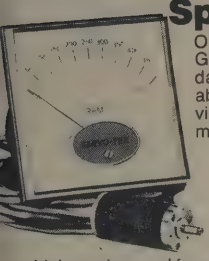
### Servo Motors

Constructed with permanently lubricated ball bearings and a unique Permanent Magnet field structure, our Servo Motors provide smooth cog-free operation throughout a speed range exceeding 10000:1. Output torques up to 2.0 oz.-in. at speeds of 10000 RPM can be provided in ungeared versions and output torques up to 300 oz.-in. with integral gearing. The Servo Motors can be combined on a single shaft with our DC Tachometer Generators (Motor-Generator) providing uncompromised performance in feedback control systems. A wide range of operating voltage and mechanical modifications are available to suit your particular application requirements.



### DC Servo Control

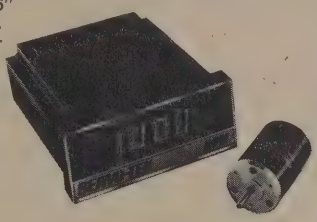
A complete DC Servo control package that can be programmed to operate in the velocity or positioning mode. It consists of our DC Permanent Magnet Servo Motor coupled with our DC Tachometer Generator on a common shaft (Motor-Generator) and modular control chassis. An ungeared output torque of 2.0 oz.-in. is provided throughout a speed range of 2000:1 with a base speed of 3600 RPM. Integral gearing is available for output torques up to 300 oz.-in. Features include remote programming capability, torque limiting, an internal highly stable reference supply and an auxiliary supply for isolated input control.



### Speed Indicating Systems

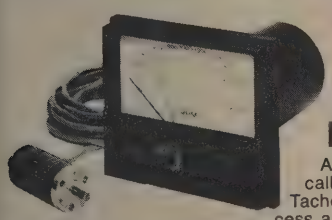
Our analog system consists of our DC Tachometer Generator and a 4½" d'Arsonval taut band meter. Standard ranges from 0-10 RPM up to 0-12000 RPM are available from stock. Special calibration or scales can be provided to satisfy customer's specific application requirements.

Our digital system also uses our DC Tachometer Generator in conjunction with a 3½ digit panel meter having a 0.6" LED display. Parallel BCD output is standard which can be used for record keeping or control purposes. A 4½ digit display is also available when greater resolution is required or wider speed ranges are to be monitored.



### Digital Comparator

A panel mounted instrument that compares 3½ digit (+ 1-2-4-8) BCD input data to preselected limits set by thumbwheel switches. The comparison is made algebraically (signed BCD) and when the set point is reached an output is provided as a logic level change or optionally as a relay contact closure. Available in both single and double independent set points with options including 115V AC or +5V DC operation and TTL or CMOS input compatibility.



### Control Meter Relay Systems

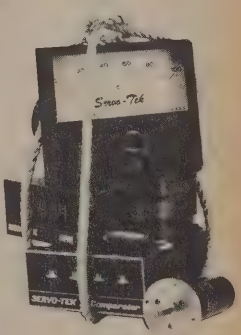
A speed monitoring system using an optically controlled meter relay and our DC Tachometer Generator. Ideal for use in process and control applications requiring under and over speed limit control while continuously monitoring speed settings and changes. Also can be used to directly control power to motors, alarms, solenoids, etc., without the use of power controls. Both single and double set point systems are available from 10 to 12000 RPM full scale. Output relay contacts are rated at 10 Amps @ 115V AC or 28V DC.

### DC Tachometer Generators

Our DC Tachometer Generators have been an industry standard for over 30 years. During that time we have pioneered improvements in brush life, stability, and temperature compensation. We can provide tachometers with output voltages up to 45V/1000 RPM and offer the flexibility of designing the mechanical configuration to meet with specific application needs.

The DC Tachometer still remains the most cost effective approach to rate feedback and velocity measurement applications.

## SERVO-TEK




### No Order Too Small Or Too Large

From our wide selection of off-the-shelf products we can select the right combination to promptly meet your exact requirements whether it is 1 or 1000 pieces.

CALL OR WRITE FOR OUR FULL LINE CATALOG AND TELL US YOUR APPLICATION REQUIREMENTS

**SERVO-TEK®**
PRODUCTS COMPANY
1086 Goffle St., Hawthorne, NJ 07506 • 201—427-3100

Cable Address: SERVOTEK, Hawthorne, N.J., U.S.A.
Contact us for Overseas Representatives

California Office:
SERVO-TEK OF CALIFORNIA, INC.
8155 Van Nuys Blvd., Panorama Towers, Suite 1015
Van Nuys, California 91402 • (213) 786-0690

# SLO-SYN® Synchronous/Stepping

**M SERIES STEPPING MOTORS** Shown in chart with M prefix. Represent the most advanced permanent magnet stepping motor design available and the most complete range in both torque ratings and size. Provide the highest torque per pound and torque to inertia ratios. Can be driven at rates above 20,000 steps per second with minimum of power input. Have Class B insulation and may be operated at ambients from −40°C to +65°C. Stepping increment is 1.8° using a 4-step input sequence; 8-step input sequence gives an 0.9° stepping increment. Step accuracy choice of either ±3% or ±5%. Chart shown gives off-the-shelf SLO-SYN drives for motors listed but custom drives can be designed by Superior Electric or built by the user if desired. For torque vs speed characteristics and complete ratings and specifications, request Superior Electric Catalog MSM1171.

**PRECISION STEPPING MOTORS** Shown in chart with HS prefix. Designed for phase-switched d-c stepping. Make 200 steps of 1.8° per shaft revolution. Each step is accurate within ±3% nonaccumulative. Can be used with SLO-SYN controls and drives or with user-designed and built drives. With proper circuitry, may be operated at speeds greater than 1000 steps per second witho missing steps.

**BIFILAR MOTORS** Shown in chart wi 4-number suffixes. Contain twice the win ings of a 3-lead motor for better L/R tim constant, better performance. Use simp drive circuitry or recommended SLO-SY drives. Make 200 steps of 1.8° per sha revolution except LS prefixed types whic have a 0.72° step angle and TS prefixe types which have a 5° step angle. X prefixe are explosion proof. Step accuracy is ±5 nonaccumulative.

## AC SYNCHRONOUS MOTORS

**PERMANENT MAGNET A-C CONTROL MOTORS** have no brushes, ratchets or detents feature extremely rapid starting, stopping and reversing characteristics. Need only a single-pole, 3-position switch for complete forward, reverse and "off" control. No excessive inrush current when energized because starting and operating currents are nearly identical. Can be completely stalled or overdriven without overheating and without harmful effects on components. Start or stop in less than 5° of shaft rotation; no need for electrical or mechanical braking. Phase-shifting resistor and capacitor must be used when operating from a single-phase source. Speeds available are 28.8, 72 or 200 rpm at 60 hertz.

| TYPE | MAXIMUM AMPERES | TORQUE (Oz-In) | MAXIMUM MOMENT OF INERTIA OF A RIGIDLY ATTACHED LOAD (Lb-In²) |
|---|---|---|---|
| **120 Volts, 50/60 hertz, 1 Phase, 28.8 RPM at 60 hertz** | | | |
| LS50 | 0.2 | 40 | 0.5 |
| **120 Volts, 50/60 hertz, 1 Phase, 200 RPM at 60 hertz** | | | |
| • TS25 | 0.2 | 25 | 0.12 |
| • TS50 | 0.3 | 50 | 0.25 |
| **120 Volts, 50/60 hertz, 1 Phase, 72 RPM at 60 hertz** | | | |
| • SS25 | 0.1 | 25 | 0.15 |
| • SS50 | 0.3 | 50 | 0.5 |
| • SS150 | 0.4 | 150 | 1.5 |
| SS150M† | 0.4 | 150 | 1.5 |
| • SS250 | 0.6 | 250 | 3 |
| • X250‡ | 0.6 | 250 | 3 |
| • SS400 | 0.6 | 400 | 4.5 |
| • X1000‡ | 3.0 | 1000 | 9 |
| • X1500 | 3.0 | 1500 | 12 |
| **240 Volts, 50/60 hertz, 1 Phase, 200 RPM at 60 hertz** | | | |
| TS52 | 0.2 | 50 | 0.25 |
| **240 Volts, 50/60 hertz, 1 Phase, 72 RPM at 60 hertz** | | | |
| SS52 | 0.2 | 50 | 0.5 |
| • SS152 | 0.2 | 150 | 1.5 |
| • SS252 | 0.4 | 250 | 3 |
| • X252‡ | 0.4 | 250 | 3 |
| • SS402 | 0.4 | 400 | 4.5 |
| • X1002‡ | 1.5 | 1000 | 9 |

† Militarized.

‡ Explosion-proof.

• Available off-the-shelf from distributor stock

## CONTROLS AND DRIVES

**TRANSLATOR ST1800B** For pulse-to-step conversion of data to bifilar motors. Converts low-level signal pulses or square waves into the correct switching sequence needed to drive a SLO-SYN motor at the desired stepping rate. Input is 105-125 volts a-c, 1.5 amps. Signal input impedance is 500 ohms. Input may be triggered by pulse or square wave or by an external switch. Operates in ambients from 0°C to +40°C. Ideal for a wide range of programmed positioning and indexing functions. Approx. shipping weight 12 lbs.

**ADJUSTABLE SPEED DRIVE ST1800BV** Essentially a translator with a built-in oscillator to supply triggering signals. The oscillator frequency can be adjusted to vary the speed from 4 steps per second up to the maximum permissible with the motor used. Have same other characteristics as SLO-SYN Translator ST1800B.

**TRANSLATOR MODULES** Plug-in printed circuit boards with logic capabilities for stepping SLO-SYN motors. STM1800 and STM1800C are basic translators capable of bidirectional operation of motors. Those suffixed V, i.e. STM1800V and STM1800CV, are similar but have built-in oscillators to provide triggering signals. Potentiometers are supplied with V-suffixed models for adjusting the oscillator speed. STM1800 and STM1800V have speeds to 500 steps/sec and are used with HS and bifilar motors. STM1800C and STM1800CV have speeds to 2000 steps/sec and are used with M Series motors. Types STM1800 and STM1800V require 8 amps power supply transformer T5934-G2. Types STM1800C and STM1800CV require 10 amp power supply transformer T6382.

**HIGH SPEED TRANSLATORS** Used with precision (HS prefix) and M series (M prefix) motors to provide high stepping speeds. High speed translator HTR400 has 50 to 2000 step/sec speed; HTR103RT has 100 to 3000 step/sec speed; and HTR105RT has 100 to 5000 step/sec speed. Acceleration and deceleration is adjustable. Each pulse received from a built-in oscillator or from an external source will cause the translator to advance the motor one step. Triggering pulses ca be supplied by tape readers, computers oscillators, etc. Ambient temperature: 0°C to 40°C operating; −55°C to 85°C storage Rack mounted design with plug-in solid-stat circuitry.

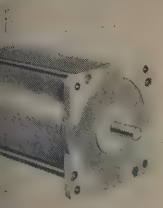
**BUFFERED TRANSLATOR** Drives M Series (M prefix) motors in response to com mands from computer, digital control o other device which operates at a fixed pulse rate. Acceleration and deceleration not re quired from pulse source. Translator stores incoming pulses and feeds them to the motor, automatically accelerating and decelerating at a rate compatible with the response characteristics of the motor. Acceleration and deceleration rates are approximately 6000 steps/sec² for BTR103RT and 15,000 steps/sec² for BTR105RT. Motor is driven one step for each pulse received from control unit. BTR103RT has speed of 100 to 3000 steps/sec, BTR105RT has speed of 100 to 5000 steps/sec. Rack mounted only.

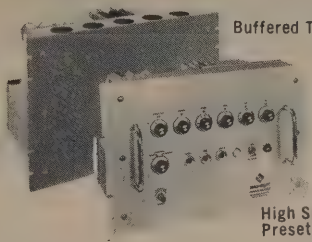
**PRESET INDEXER SP1800B-5** Controls indexing operations where bifilar motors are used for positioning. Automatically provides the correct switching sequence needed to drive motors the required number of steps. Has provision for actuating external equipment needed to perform related operations. Dials on control panel can be set to provide desired number of steps up to 99,999 counting range. Operates in ambients from 0°C to +40°C. Input current 1.25 amps. Approx. shipping weight 19 lbs.

**HIGH SPEED PRESET INDEXERS** Used with precision (HS prefix) and M Series (M prefix) motors in indexing and other positioning operations. HPR400R-5 has 50 to 2000 steps/sec speed; HPI 153RT has 100 to 3000 step/sec speed; and HPI 155RT has 100 to 5000 step/sec speed. Decade counter controls on front panel permit selecting positioning increments up to 99,999 counting range. On index command, unit drives the motor the prescribed number of steps and then actuates a relay which controls external equipment. Count can also be set by computer or external decade switches. Ambients: 0°C to 40°C operating; −55°C to 85°C storage. Rack mounted only.

THE SUPERIOR ELECTRIC COMPANY
1000 MIDDLE STREET • BRISTOL, CONN. 06010 • PHONE: (203) 582-9561

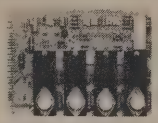
# lotors, Controls and Drives



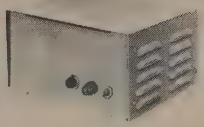


Buffered Translator

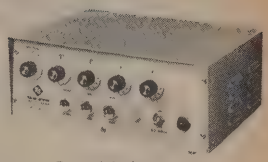
High Speed Preset Indexer



Translator Module



Translator



Preset Indexer

| DRIVE TYPE | | MOTOR TYPE | MOTOR RATINGS AND SPECIFICATIONS | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | STEP ACCURACY | DC VOLTS | AMPS PER WINDING | HOLDING TORQUE OZ-IN | MOTOR DIA. INCHES | MOTOR LENGTH INCHES | SHAFT DIA. INCHES | NET WT. LBS |
| **UP TO 500 STEPS/SEC** | | | | | | | | | | |
| ● ST1800B‡ Translator<br>ST1800BV Adj. Speed Drive<br>● STM1800§‡ Translator Module<br>● STM18G0V§‡ Translator Module | ● SP1800B-5‡ Preset Indexer | ● HS25 | ±3% | 5.4 | 1.5 | 70 | 2.22 | 3.25 | .250 | 2 |
| | | ● HS50 | ±3% | 3.0 | 4.0 | 175 | 3.38 | 3.69 | .375 | 4¾ |
| | | ● HS50L | ±3% | 4.5 | 3.5 | 320 | 3.38 | 5.31 | .375 | 7½ |
| | | ● LS50-1005* | ±5% | 3.0 | 4.0 | 75 | 3.38 | 3.69 | .375 | 4¾ |
| | | ● LS50-1006* | ±5% | 12.0 | 1.0 | 75 | 3.38 | 3.69 | .375 | 4¾ |
| | | ● SS25-1001 | ±5% | 11.8 | 0.44 | 28 | 2.72 | 2.25 | .250 | 1¼ |
| | | ● SS50-1008 | ±5% | 8.0 | 0.85 | 70 | 3.25 | 2.44 | .375 | 3 |
| | | ● SS150-1010 | ±5% | 10.0 | 1.25 | 250 | 4.19 | 4.44 | .375 | 6½ |
| | | ● SS250-1027 | ±5% | 4.6 | 3.1 | 300 | 4.19 | 4.72 | .375 | 6½ |
| | | ● SS400-1021 | ±5% | 5.3 | 3.4 | 500 | 4.19 | 6.59 | .500 | 12¼ |
| | | ● SS1800-1007 | ±5% | 11.5 | 3.9 | 3000 | 6.5 | 8.63 | .625 | 45 |
| | | TS25-1008** | ±5% | 5.4 | 1.5 | 40 | 2.22 | 3.25 | .250 | 2 |
| | | TS50-1001** | ±5% | 3.0 | 4.0 | 65 | 3.25 | 3.69 | .375 | 4¾ |
| | | X250-1003 | ±5% | 4.6 | 3.1 | 300 | 4.19 | 4.88 | .375 | 6½ |
| | | X1500-1001 | ±5% | 12.0 | 3.8 | 2500 | 6.5 | 7.63 | .625 | 38 |
| **UP TO 2000 STEPS/SEC** | | | | | | | | | | |
| ● STM1800C†††‡ Translator Module<br>● STM1800CV†††‡ Translator Module | | ● M061-FC08 | ±3% | 1.3 | 3.9 | 53 | 2.22 | 2 | .250 | 1¼ |
| | | ● M061-FD08 | ±5% | | | | | | | |
| | | ● M062-FC09 | ±3% | 1.7 | 4.7 | 100 | 2.22 | 3 | .250 | 2 |
| | | ● M062-FD09 | ±5% | | | | | | | |
| | | ● M063-FC09 | ±3% | 2.2 | 4.6 | 150 | 2.22 | 4 | .250 | 2¾ |
| | | ● M063-FD09 | ±5% | | | | | | | |
| | | ● M091-FC09 | ±3% | 1.8 | 4.7 | 150 | 3.25 | 2.45 | .375 | 3¼ |
| | | ● M091-FD09 | ±5% | | | | | | | |
| | | ● M092-FC09 | ±3% | 2.5 | 4.6 | 300 | 3.25 | 3.70 | .375 | 5½ |
| | | ● M092-FD09 | ±5% | | | | | | | |
| | | ● M093-FC11 | ±3% | 2.8 | 5.5 | 450 | 3.25 | 5.07 | .375 | 7¾ |
| | | ● M093-FD11 | ±5% | | | | | | | |
| | | ● M111-FD12 | ±5% | 2.3 | 6.1 | 625 | 4.19 | 4.72 | .375 | 8 |
| | | ● M112-FJ12 | ±5% | 3.6 | 6.1 | 1125 | 4.19 | 7.16 | .625 | 14½ |
| ● HTR400 Translator | ● HPR400R-5† Preset Indexer | ● HS25 | ±3% | 5.4 | 1.5 | 70 | 2.22 | 3.25 | .250 | 2 |
| | | ● HS50 | ±3% | 3.0 | 4.0 | 175 | 3.38 | 3.69 | .375 | 4¾ |
| | | ● HS50L | ±3% | 4.5 | 3.5 | 320 | 3.38 | 5.31 | .375 | 7¾ |
| | | HS400B-1003 | ±3% | 4.2 | 4.3 | 850 | 4.19 | 6.97 | .500 | 13¾ |
| **UP TO 3000 STEPS/SEC** | | | | | | | | | | |
| ● BTR103RT Buffered Translator<br>● HTR103RT Translator | ● HPI 153RT† Preset Indexer | ● M112-FJ25 | ±5% | 1.8 | 12.7 | 1125 | 4.19 | 7.16 | .625 | 14½ |
| **UP TO 5000 STEPS/SEC** | | | | | | | | | | |
| ● BTR105RT Buffered Translator<br>● HTR105RT Translator | ● HPI 155RT† Preset Indexer | ● M061-FC02§§ | ±3% | 5.1 | 1.0 | 53 | 2.22 | 2 | .250 | 1¼ |
| | | ● M061-FD02§§ | ±5% | | | | | | | |
| | | ● M062-FC04 | ±3% | 4.3 | 1.8 | 100 | 2.22 | 3 | .250 | 2 |
| | | ● M062-FD04 | ±5% | | | | | | | |
| | | ● M063-FC06 | ±3% | 3.4 | 2.9 | 150 | 2.22 | 4 | .250 | 2¾ |
| | | ● M063-FD06 | ±5% | | | | | | | |
| | | ● M091-FC06§§ | ±3% | 2.9 | 3.05 | 150 | 3.25 | 2.45 | .375 | 3¼ |
| | | ● M091-FD06§§ | ±5% | | | | | | | |
| | | ● M092-FC09 | ±3% | 2.5 | 4.6 | 300 | 3.25 | 3.70 | .375 | 5½ |
| | | ● M092-FD09 | ±5% | | | | | | | |
| | | ● M093-FC14 | ±3% | 2.2 | 7.0 | 450 | 3.25 | 5.07 | .375 | 7¾ |
| | | ● M093-FD14 | ±5% | | | | | | | |
| | | ● M111-FD16 | ±5% | 1.7 | 8.0 | 625 | 4.19 | 4.72 | .375 | 8 |

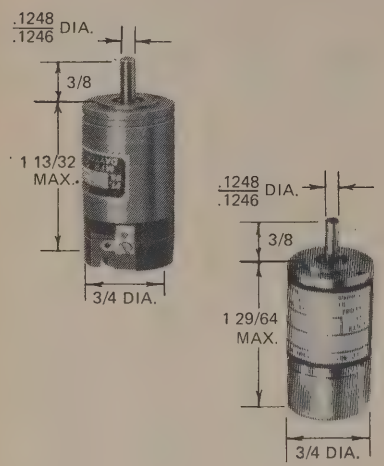
*LS50-1005 and LS50-1006 have 0.72° stepping increment.
**TS25-1008 and TS50-1001 have 5° stepping increment.
†Cabinet available at additional cost.
††Also requires T6382 power supply transformer.
‡Also requires series dropping resistor.
§Also requires T5934-G2 power supply transformer.
§§Require modified drives. Consult factory.

● **Available off-the-shelf from distributor stock.**

# TRW GLOBE MOTORS

## D.C. 3/4" DIA. PERMANENT MAGNET MOTORS AND PLANETARY GEARMOTORS

## TYPE SD — BASIC MOTOR

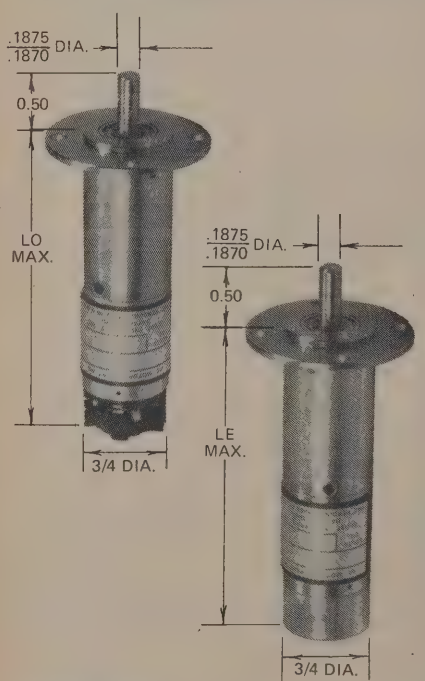



Type SD d.c. motors are designed to meet the requirements of MIL-M-8609; however, designs exceeding this specification to meet customer controlled applications are common. A variety of standard windings are available to provide a wide range of speed and torque characteristics.

### STANDARD PART NUMBERS AND DATA

| Voltage (v.d.c.) | Speed no load (rpm) | Torque max. rated (oz. in.) | Torque nominal stall (oz. in.) | Current max. no load (amps) | Current max. rated load (amps) | Current nominal stall (amps) | Part Number open 136A207 Armature Dash Number | Part Number enclosed 136A208 Armature Dash Number |
|---|---|---|---|---|---|---|---|---|
| 6 | 14,500-17,500 | 0.20 | 1.50 | .360 | 0.78 | 3.6 | -17 | -17 |
| 6 | 12,000-14,000 | 0.28 | 1.20 | .290 | 0.78 | 2.2 | -16 | -16 |
| 6 | 9,000-10,500 | 0.32 | 0.90 | .210 | 0.60 | 1.4 | -15 | -15 |
| 12 | 13,000-15,500 | 0.22 | 1.60 | .170 | .38 | 1.50 | -14 | -14 |
| 12 | 9,500-11,000 | 0.37 | 0.80 | .120 | .37 | 0.93 | -13 | -13 |
| 12 | 8,500-10,000 | 0.25 | 0.60 | .105 | .26 | 0.70 | -12 | -12 |
| 27 | 15,500-18,500 | 0.17 | 1.80 | .085 | .17 | 1.15 | -1 | -1 |
| 27 | 13,000-16,000 | 0.22 | 1.50 | .075 | .17 | 0.85 | -2 | -2 |
| 27 | 10,000-12,500 | 0.31 | 1.20 | .060 | .17 | 0.48 | -3 | -3 |
| 27 | 9,000-10,500 | 0.31 | 0.90 | .050 | .14 | 0.30 | -4 | -4 |
| 27 | 7,000- 8,500 | 0.24 | 0.80 | .045 | .08 | 0.21 | -5 | -5 |
| 50 | 13,000-15,500 | 0.26 | 0.90 | .040 | .10 | 0.22 | -7 | -7 |
| 50 | 11,500-13,500 | 0.31 | 1.10 | .035 | .10 | 0.26 | -6 | -6 |
| 50 | 11,000-13,000 | 0.26 | 0.75 | .032 | .08 | 0.18 | -8 | -8 |
| 50 | 8,000- 9,500 | 0.18 | 0.50 | .025 | .05 | 0.08 | -9 | -9 |
| 50 | 7,000- 8,300 | 0.15 | 0.45 | .022 | .04 | 0.07 | -10 | -10 |
| 50 | 5,500- 6,500 | 0.11 | 0.35 | .018 | .03 | 0.05 | -11 | -11 |

## TYPE SD PLANETARY GEARMOTORS




This small size, lightweight gearmotor is comprised of a ¾" Type SD motor coupled with a precision planetary geartrain. The combination provides smooth, dependable performance and maximum output torque in the smallest possible space. It is designed to provide a military quality gearmotor of exceptionally compact size.

### STANDARD PART NUMBERS AND DATA

| Speed Reduction Ratio | Maximum Continuous Torque (oz. in.) | Torque Multiplier Ratio | LO Max. | LE Max. | Standard Part Numbers Prefix* open type | Standard Part Numbers Prefix* enclosed type |
|---|---|---|---|---|---|---|
| 3.82:1 | 1.0 | 3.1 | 2 3/8" | 2 13/32" | 168A247 | 168A249 |
| 5.77:1 | 1.5 | 4.6 | | | 168A248 | 168A250 |
| 14.58:1 | 3.0 | 9.3 | 2 39/64" | 2 41/64" | 168A204 | 168A223 |
| 22.03:1 | 4.5 | 14 | | | 168A205 | 168A224 |
| 33.28:1 | 7.0 | 21 | | | 168A206 | 168A225 |
| 55.66:1 | 10 | 28 | 2 25/32" | 2 13/16" | 168A207 | 168A226 |
| 84.11:1 | 14 | 43 | | | 168A208 | 168A227 |
| 127.1:1 | 21 | 65 | | | 168A209 | 168A228 |
| 192:1 | 30 | 93 | | | 168A210 | 168A229 |
| 321:1 | 45 | 130 | 2 61/64" | 2 63/64" | 168A211 | 168A230 |
| 485:1 | 70 | 200 | | | 168A212 | 168A231 |
| 733:1 | 100 | 300 | | | 168A213 | 168A232 |
| 1108:1 | 150 | 450 | | | 168A214 | 168A233 |
| 1853:1 | 200 | 600 | 3 1/8" | 3 5/32" | 168A215 | 168A234 |
| 2799:1 | 300 | 900 | | | 168A216 | 168A235 |
| 4230:1 | 300 | 1400 | | | 168A217 | 168A236 |
| 6391:1 | 300 | 2100 | | | 168A218 | 168A237 |
| 10689:1 | 300 | 2800 | 3 19/64" | 3 21/64" | 168A219 | 168A238 |
| 16150:1 | 300 | 4200 | | | 168A220 | 168A239 |
| 24403:1 | 300 | 6400 | | | 168A221 | 168A240 |
| 36873:1 | 300 | 9700 | | | 168A222 | 168A241 |

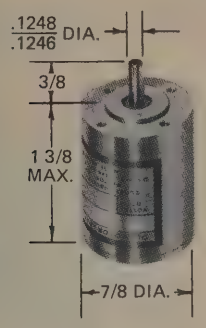
Max. Cont. Torque: The values in this column are based upon geartrain strength and capability for 1000 hrs. minimum life. Max. rated torque of motor selected x torque multiplier ratio must not exceed these values.
Max. Intermittent Torque = 2 x Max. Cont. Torque.
Momentary Stall Torque = 5 x Max. Cont. Torque.
Minimum Efficiency = Torque Multiplier Ratio divided by Speed Reduction Ratio x 100.

***HOW TO ORDER:**
The complete motor part number consists of the standard part number prefix, shown on the standard part number and data tables, plus the armature dash number. For gearmotors, each of the basic motor windings (dash no.), in the same type basic motor part number table, must be used, with the selected speed reduction ratio.

# TRW GLOBE MOTORS

## D.C. 7/8" DIA. PERMANENT MAGNET MOTORS AND PLANETARY GEARMOTORS

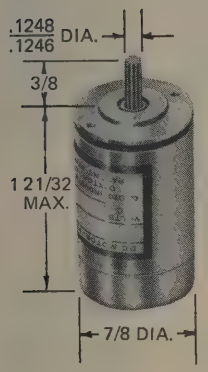
## TYPE SS—BASIC MOTOR




The Globe Types SS d.c. motor are specifically designed as a component for precision airborne accessory equipment, but may be applied to a variety of other applications where size and weight are important considerations. Type SS motors can be made with different windings to produce a variety of characteristics. Weight 2 oz.

### STANDARD PART NUMBERS AND DATA

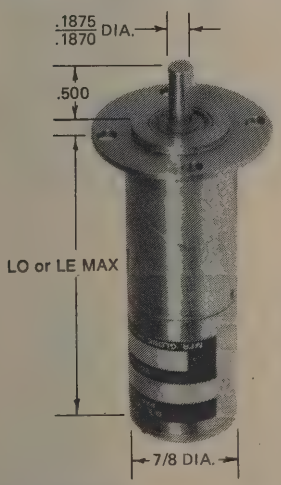
| Open Housing | Part Number Prefix* | |
|---|---|---|
| | Tapped Hole Mount | Servo Mount |
| Plain Shaft | 41A100 | 41A499 |
| *Pinion Shaft | 41A552 | 41A677 |
| **Enclosed Housing** | | |
| Plain Shaft | 41A119 | 41A678 |
| *Pinion Shaft | 41A676 | 41A679 |




| Voltage (v.d.c.) | Speed no load (rpm) | Torque max. rated (oz. in.) | Torque nominal stall (oz. in.) | Current max. no load (amps) | Current max. rated load (amps) | Current nominal stall (amps) | Armature Dash No.* |
|---|---|---|---|---|---|---|---|
| 6 | 11,000-13,500 | 0.28 | 1.6 | .46 | 1.00 | 4.1 | -17 |
| 6 | 8,000-11,000 | 0.38 | 1.3 | .37 | 1.00 | 2.7 | -16 |
| 12 | 13,500-17,000 | 0.22 | 2.0 | .27 | .54 | 3.2 | -15 |
| 12 | 10,000-13,000 | 0.33 | 1.7 | .21 | .54 | 1.9 | -14 |
| 27 | 17,000-20,000 | 0.17 | 2.9 | .15 | .26 | 2.4 | -13 |
| 27 | 15,000-18,000 | 0.20 | 2.5 | .14 | .25 | 1.7 | -12 |
| 27 | 12,000-15,000 | 0.25 | 2.0 | .11 | .24 | 1.15 | -1 |
| 27 | 10,000-13,000 | 0.31 | 1.6 | .095 | .23 | 0.76 | -2 |
| 27 | 8,000-10,500 | 0.45 | 1.3 | .08 | .23 | 0.48 | -3 |
| 27 | 6,500- 9,000 | 0.45 | 1.0 | .07 | .20 | 0.32 | -4 |
| 27 | 5,500- 7,500 | 0.36 | 0.82 | .055 | .15 | 0.21 | -5 |
| 50 | 10,200-12,500 | 0.32 | 0.97 | .05 | .13 | 0.23 | -7 |
| 50 | 8,600-11,000 | 0.42 | 1.20 | .055 | .13 | 0.26 | -6 |
| 50 | 6,100- 7,500 | 0.38 | 0.54 | .03 | .09 | 0.12 | -9 |

*Std. Pinion is 13 teeth 120 pitch.

## TYPE SS PLANETARY GEARMOTORS




### STANDARD PART NUMBERS AND DATA

| Speed Reduction Ratio | Max. Continuous Torque (oz. in.) | Torque Multiplier Ratio | Standard Part Number Prefix* enclosed type dimension LE | enclosed type part no. prefix | open type dimension LO | open type part no. prefix |
|---|---|---|---|---|---|---|
| 3.82:1 | 1.0 | 3.1 | 2 35/64" | 43A197 | 2 17/64" | 43A196 |
| 5.77:1 | 1.5 | 4.6 | | 43A200 | | 43A199 |
| 14.58:1 | 3.0 | 9.3 | 2 25/32" | 43A140 | 2 1/2" | 43A100 |
| 22.03:1 | 4.5 | 14 | | 43A141 | | 43A101 |
| 33.28:1 | 7.0 | 21 | | 43A142 | | 43A102 |
| 55.66:1 | 10 | 28 | 2 61/64" | 43A143 | 2 43/64" | 43A103 |
| 84.11:1 | 14 | 43 | | 43A144 | | 43A104 |
| 127.1:1 | 21 | 65 | | 43A145 | | 43A105 |
| 192:1 | 30 | 93 | | 43A146 | | 43A106 |
| 321:1 | 45 | 130 | 3 1/8" | 43A147 | 2 27/32" | 43A107 |
| 485:1 | 70 | 200 | | 43A148 | | 43A108 |
| 733:1 | 100 | 300 | | 43A149 | | 43A109 |
| 1108:1 | 150 | 450 | | 43A150 | | 43A110 |
| 1853:1 | 200 | 600 | 3 3/32" | 43A151 | 3" | 43A111 |
| 2799:1 | 300 | 900 | | 43A152 | | 43A112 |
| 4230:1 | 300 | 1400 | | 43A153 | | 43A113 |
| 6391:1 | 300 | 2100 | | 43A154 | | 43A114 |
| 10689:1 | 300 | 2800 | 3 29/64" | 43A155 | 3 11/64" | 43A115 |
| 16150:1 | 300 | 4200 | | 43A156 | | 43A116 |
| 24403:1 | 300 | 6400 | | 43A157 | | 43A117 |
| 36873:1 | 300 | 9700 | | 43A158 | | 43A118 |

***HOW TO ORDER:**

The complete motor part number consists of the standard part number prefix, shown on the standard part number and data tables, plus the armature dash number. For gearmotors, each of the basic motor windings (dash no.), in the same type basic motor part number table, must be used, with the selected speed reduction ratio.

Max. Cont. Torque: The values in this column are based upon geartrain strength and capability for 1000 hrs. minimum life. Max. rated torque of motor selected x torque multiplier ratio must not exceed these values.

Max. Intermittent Torque = 2 x Max. Cont. Torque.

Momentary Stall Torque = 5 x Max. Cont. Torque.

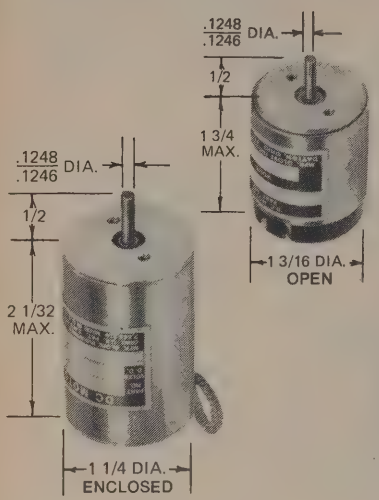
Minimum Efficiency = Torque Multiplier Ratio divided by Speed Reduction Ratio x 100.

# TRW GLOBE MOTORS

## D.C. 1-1/4" DIA. PERMANENT MAGNET MOTORS

### TYPE MM — BASIC MOTOR

These Globe d.c. motors are specifically designed for use in airborne equipment, missiles, and commercial applications where a combination of small size, reliability, and high torque is desired.

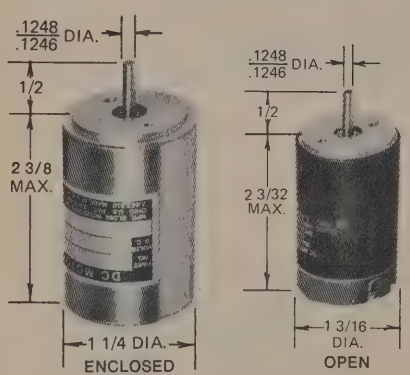



**STANDARD PART NUMBERS AND DATA**

| Voltage (v.d.c.) | Speed no load (rpm) | Torque max. rated (oz. in.) | Torque nom. stall (oz. in.) | Current max. no load (amps) | Current max. rated load (amps) | Current nom. stall (amps) | Standard Part Numbers* open type plain shaft | open type pinion** | enclosed type plain shaft | enclosed type pinion** |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 16,000-19,000 | .25 | 4.9 | 1.5 | 2.4 | 21. | 3A998-23 | 3A1524-23 | 3A1002-23 | 3A1525-23 |
| 6 | 18,900-22,500 | .5 | 7.4 | 1.2 | 2.3 | 24.9 | 3A998-14 | 3A1524-14 | 3A1002-14 | 3A1525-14 |
| 6 | 15,600-18,600 | .85 | 5.8 | 1.0 | 2.3 | 16.3 | 3A998-6 | 3A1524-6 | 3A1002-6 | 3A1525-6 |
| 6 | 12,000-14,000 | .75 | 4.6 | .80 | 2.0 | 9.9 | 3A998-5 | 3A1524-5 | 3A1002-5 | 3A1525-5 |
| 12 | 18,000-21,400 | .5 | 7.4 | .56 | 1.2 | 11.8 | 3A998-24 | 3A1524-24 | 3A1002-24 | 3A1525-24 |
| 12 | 14,500-17,000 | .7 | 5.9 | .50 | 1.2 | 7.5 | 3A998-3 | 3A1524-3 | 3A1002-3 | 3A1525-3 |
| 12 | 12,400-14,700 | .75 | 4.6 | .40 | 1.2 | 5.1 | 3A998-21 | 3A1524-21 | 3A1002-21 | 3A1525-21 |
| 12 | 11,000-13,000 | 1.0 | 4.6 | .35 | 1.2 | 4.6 | 3A998-4 | 3A1524-4 | 3A1002-4 | 3A1525-4 |
| 24 | 19,200-22,800 | .35 | 7.4 | .30 | .60 | 6.3 | 3A998-7 | 3A1524-7 | 3A1002-7 | 3A1525-7 |
| 24 | 16,000-19,000 | .6 | 5.8 | .25 | .60 | 3.8 | 3A998-1 | 3A1524-1 | 3A1002-1 | 3A1525-1 |
| 24 | 11,500-14,000 | 1.0 | 4.6 | .18 | .60 | 2.1 | 3A998-2 | 3A1524-2 | 3A1002-2 | 3A1525-2 |
| 24 | 10,700-12,700 | 1.0 | 3.6 | .17 | .60 | 1.6 | 3A998-8 | 3A1524-8 | 3A1002-8 | 3A1525-8 |
| 24 | 9,600-11,400 | 1.0 | 2.9 | .15 | .50 | 1.1 | 3A998-22 | 3A1524-22 | 3A1002-22 | 3A1525-22 |
| 24 | 8,000-10,000 | 1.0 | 2.9 | .13 | .45 | 0.93 | 3A998-10 | 3A1524-10 | 3A1002-10 | 3A1525-10 |
| 24 | 6,000- 7,000 | .8 | 2.3 | .08 | .30 | 0.55 | 3A998-11 | 3A1524-11 | 3A1002-11 | 3A1525-11 |
| 50 | 14,300-17,000 | .7 | 4.8 | .11 | .30 | 1.3 | 3A998-25 | 3A1524-25 | 3A1002-25 | 3A1525-25 |
| 50 | 9,500-11,500 | 1.0 | 3.8 | .07 | .30 | 0.71 | 3A998-16 | 3A1524-16 | 3A1002-16 | 3A1525-16 |
| 50 | 8,000-10,000 | 1.0 | 3.0 | .07 | .20 | 0.50 | 3A998-12 | 3A1524-12 | 3A1002-12 | 3A1525-12 |
| 50 | 6,700- 8,000 | .8 | 2.4 | .05 | .16 | 0.30 | 3A998-15 | 3A1524-15 | 3A1002-15 | 3A1525-15 |
| 50 | 4,600- 5,500 | .8 | 1.9 | .04 | .12 | 0.20 | 3A998-13 | 3A1524-13 | 3A1002-13 | 3A1525-13 |

**Std. Pinion is 10 teeth 96 pitch.

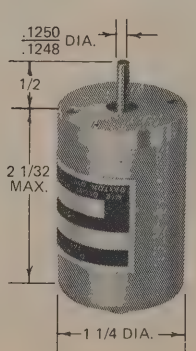
### TYPE LL — BASIC MOTOR




**STANDARD PART NUMBERS AND DATA**

| Voltage (v.d.c.) | Speed no load (rpm) | Torque max. rated (oz. in.) | Torque nom. stall (oz. in.) | Current max. no load (amps) | Current max. rated load (amps) | Current nom. stall (amps) | Part Number* open type | Part Number* enclosed type |
|---|---|---|---|---|---|---|---|---|
| 6 | 15,600-18,500 | 1.0 | 8.7 | 1.4 | 2.7 | 22.4 | 3A999-23 | 3A1003-23 |
| 6 | 12,500-14,500 | 1.3 | 8.7 | 1.1 | 2.4 | 17.7 | 3A999-14 | 3A1003-14 |
| 6 | 10,000-12,200 | 1.6 | 6.9 | .95 | 2.6 | 11.6 | 3A999-6 | 3A1003-6 |
| 6 | 7,600- 9,400 | 1.6 | 5.5 | .70 | 2.0 | 7.0 | 3A999-5 | 3A1003-5 |
| 12 | 11,500-14,000 | 1.1 | 8.7 | .52 | 1.7 | 8.4 | 3A999-24 | 3A1003-24 |
| 12 | 9,000-11,000 | 1.7 | 6.9 | .42 | 1.2 | 5.3 | 3A999-3 | 3A1003-3 |
| 24 | 16,000-19,000 | .75 | 11.0 | .36 | 1.0 | 7.3 | 3A999-21 | 3A1003-21 |
| 24 | 14,400-17,000 | .85 | 11.0 | .32 | .85 | 6.5 | 3A999-4 | 3A1003-4 |
| 24 | 12,000-14,500 | 1.0 | 8.7 | .28 | .80 | 4.5 | 3A999-7 | 3A1003-7 |
| 24 | 10,400-12,300 | 1.1 | 6.9 | .23 | .75 | 3.0 | 3A999-1 | 3A1003-1 |
| 24 | 7,400- 8,900 | 1.6 | 5.5 | .17 | .70 | 1.7 | 3A999-2 | 3A1003-2 |
| 24 | 6,900- 8,200 | 1.8 | 4.3 | .16 | .65 | 1.2 | 3A999-8 | 3A1003-8 |
| 24 | 6,200- 7,400 | 1.8 | 3.4 | .14 | .60 | 0.89 | 3A999-22 | 3A1003-22 |
| 24 | 5,200- 6,200 | 1.2 | 3.4 | .12 | .45 | 0.74 | 3A999-10 | 3A1003-10 |
| 50 | 7,600- 9,400 | 1.5 | 5.7 | .09 | .25 | 0.92 | 3A999-11 | 3A1003-11 |
| 75 | 14,000-17,000 | 1.0 | 8.6 | .10 | .29 | 1.6 | 3A999-25 | 3A1003-25 |
| 75 | 9,000-11,000 | 1.7 | 6.8 | .07 | .29 | 0.85 | 3A999-16 | 3A1003-16 |
| 75 | 8,000-10,000 | 1.8 | 5.4 | .06 | .26 | 0.60 | 3A999-12 | 3A1003-12 |
| 75 | 6,500- 8,000 | 1.2 | 4.3 | .05 | .20 | 0.37 | 3A999-15 | 3A1003-15 |
| 75 | 4,500- 5,300 | 1.0 | 3.4 | .04 | .10 | 0.23 | 3A999-13 | 3A1003-13 |

### TYPE JM — BASIC MOTOR



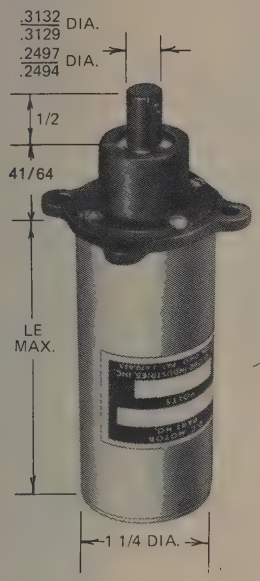

**STANDARD PART NUMBERS AND DATA**

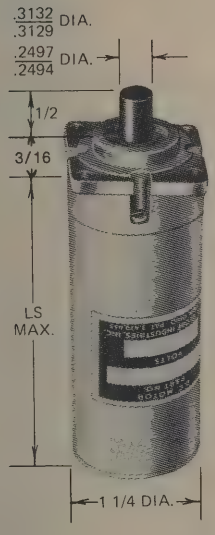
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6 | 11,200-13,700 | 1.20 | 8.2 | .70 | 3.50 | 15.4 | 178A100-1 |
| 6 | 9,100-11,100 | 1.50 | 6.5 | .55 | 2.80 | 9.9 | 178A100-2 |
| 6 | 7,500- 9,200 | 1.80 | 5.2 | .44 | 2.40 | 6.3 | 178A100-3 |
| 12 | 11,200-13,700 | 1.20 | 8.2 | .35 | 1.45 | 8.0 | 178A100-4 |
| 12 | 9,500-11,600 | 1.40 | 6.5 | .28 | 1.40 | 5.1 | 178A100-5 |
| 12 | 7,500- 9,200 | 1.60 | 5.2 | .23 | 1.15 | 3.2 | 178A100-6 |
| 27 | 13,700-16,700 | 1.10 | 9.9 | .18 | 0.80 | 4.5 | 178A100-7 |
| 27 | 10,500-13,000 | 1.60 | 7.9 | .14 | 0.75 | 2.8 | 178A100-8 |
| 27 | 8,700-10,600 | 1.70 | 6.2 | .12 | 0.70 | 1.8 | 178A100-9 |
| 27 | 7,000- 8,600 | 1.80 | 5.0 | .09 | 0.55 | 1.2 | 178A100-10 |
| 50 | 10,500-13,000 | 1.80 | 7.1 | .08 | 0.40 | 1.4 | 178A100-11 |
| 50 | 8,200-10,000 | 1.90 | 5.6 | .06 | 0.35 | .88 | 178A100-12 |
| 50 | 6,500- 8,000 | 1.80 | 4.5 | .05 | 0.26 | .56 | 178A100-13 |
| 50 | 5,200- 6,300 | 2.10 | 3.5 | .04 | 0.25 | .36 | 178A100-14 |
| 115 | 9,500-11,600 | 1.90 | 6.7 | .03 | 0.18 | .52 | 178A100-15 |
| 115 | 7,500- 9,200 | 1.90 | 5.3 | .03 | 0.14 | .33 | 178A100-16 |
| 115 | 6,000- 7,500 | 1.90 | 4.2 | .02 | 0.11 | .21 | 178A100-17 |
| 115 | 4,800- 5,800 | 1.20 | 3.4 | .02 | 0.09 | .14 | 178A100-18 |

***HOW TO ORDER:**
The complete motor part number consists of the standard part number prefix, shown on the standard part number and data tables, plus the armature dash number. For gearmotors, each of the basic motor windings (dash no.), in the same type basic motor part number table, must be used, with the selected speed reduction ratio.

# TRW GLOBE MOTORS

## D.C. 1-1/4" DIA. PLANETARY GEARMOTORS
## TYPE MM, LL, JM PLANETARY GEARMOTORS




These Globe planetary gearmotors provide torques to 1,250 oz. in. and are designed for use in airborne equipment, missiles and other applications where reliability and miniature size are governing factors.

### TYPE MM — STANDARD PART NUMBERS AND DATA

| Speed Reduction Ratio | Maximum Continuous Torque (oz. in.) | Torque Multiplier Ratio | Part Number Prefix* Eared Flange 3/16" shaft | Eared Flange 1/4" shaft | Square Flange 3/16" shaft | Square Flange 1/4" shaft | Dim. LE | Dim. LS |
|---|---|---|---|---|---|---|---|---|
| 18.78<br>27.94 | 20<br>29 | 12<br>17 | 5A537<br>5A539 | 5A2292<br>5A2293 | 5A538<br>5A540 | 5A2312<br>5A2313 | 2.437 | 2.891 |
| 81.37<br>121.10<br>147.70 | 70<br>105<br>128 | 41<br>62<br>75 | 5A541<br>5A543<br>5A545 | 5A2294<br>5A2295<br>5A2296 | 5A542<br>5A544<br>5A546 | 5A2314<br>5A2315<br>5A2316 | 2.562 | 3.016 |
| 352.60<br>524.60<br>639.90<br>780.60 | 247<br>366<br>445<br>544 | 145<br>215<br>262<br>320 | 5A547<br>5A549<br>5A551<br>5A553 | 5A2297<br>5A2298<br>5A2299<br>5A2300 | 5A548<br>5A550<br>5A552<br>5A554 | 5A2317<br>5A2318<br>5A2319<br>5A2320 | 2.828 | 3.281 |
| 1528.00<br>2273.00<br>3382.00<br>4126.00 | 850**<br>1250**<br>1250**<br>1250** | 500<br>740<br>1100<br>1350 | 5A555<br>5A557<br>5A559<br>5A561 | 5A2301<br>5A2302<br>5A2303<br>5A2304 | 5A556<br>5A558<br>5A560<br>5A562 | 5A2321<br>5A2322<br>5A2323<br>5A2324 | 3.203 | 3.656 |
| 6621.00<br>9851.00<br>12016.00<br>17879.00<br>21808.00 | 1250**<br>1250**<br>1250**<br>1250**<br>1250** | 1730<br>2580<br>3150<br>4700<br>5700 | 5A563<br>5A565<br>5A567<br>5A569<br>5A571 | 5A2305<br>5A2306<br>5A2307<br>5A2308<br>5A2309 | 5A564<br>5A566<br>5A568<br>5A570<br>5A572 | 5A2325<br>5A2326<br>5A2327<br>5A2328<br>5A2329 | 3.344 | 3.797 |

### TYPE LL — STANDARD PART NUMBERS AND DATA

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 18.78<br>27.94 | 20<br>29 | 12<br>17 | 5A501<br>5A503 | 5A2332<br>5A2333 | 5A502<br>5A504 | 5A2352<br>5A2353 | 2.781 | 3.234 |
| 81.37<br>121.10<br>147.70 | 70<br>105<br>128 | 41<br>62<br>75 | 5A505<br>5A507<br>5A509 | 5A2334<br>5A2335<br>5A2336 | 5A506<br>5A508<br>5A510 | 5A2354<br>5A2355<br>5A2356 | 2.928 | 3.375 |
| 352.60<br>524.60<br>639.90<br>780.60 | 247<br>366<br>445<br>544 | 145<br>215<br>262<br>320 | 5A511<br>5A513<br>5A515<br>5A517 | 5A2337<br>5A2338<br>5A2339<br>5A2340 | 5A512<br>5A514<br>5A516<br>5A518 | 5A2357<br>5A2358<br>5A2359<br>5A2360 | 3.187 | 3.641 |
| 1528.00<br>2273.00<br>3382.00<br>4126.00 | 850**<br>1250**<br>1250**<br>1250** | 500<br>740<br>1100<br>1350 | 5A519<br>5A521<br>5A523<br>5A525 | 5A2341<br>5A2342<br>5A2343<br>5A2344 | 5A520<br>5A522<br>5A524<br>5A526 | 5A2361<br>5A2362<br>5A2363<br>5A2364 | 3.562 | 4.016 |
| 6621.00<br>9851.00<br>12016.00<br>17879.00<br>21808.00 | 1250**<br>1250**<br>1250**<br>1250**<br>1250** | 1730<br>2580<br>3150<br>4700<br>5700 | 5A527<br>5A529<br>5A531<br>5A533<br>5A535 | 5A2345<br>5A2346<br>5A2347<br>5A2348<br>5A2349 | 5A528<br>5A530<br>5A532<br>5A534<br>5A536 | 5A2365<br>5A2366<br>5A2367<br>5A2368<br>5A2369 | 3.687 | 4.141 |

**1/4" dia. shaft units limited to 600 oz. in. maximum continuous duty torque. Use 3/16" dia. shaft if torque requirements exceed this value.

### TYPE JM — STANDARD PART NUMBERS AND DATA

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 18.78<br>27.94 | 20<br>29 | 12<br>17 | 311A201<br>311A203 | 311A237<br>311A239 | 311A202<br>311A204 | 311A238<br>311A240 | 2.437 | 2.891 |
| 81.37<br>121.10<br>147.70 | 70<br>105<br>128 | 41<br>62<br>75 | 311A205<br>311A207<br>311A209 | 311A241<br>311A243<br>311A245 | 311A206<br>311A208<br>311A210 | 311A242<br>311A244<br>311A246 | 2.562 | 3.016 |
| 352.60<br>524.60<br>639.90<br>780.60 | 247<br>366<br>445<br>544 | 145<br>215<br>262<br>320 | 311A211<br>311A213<br>311A215<br>311A217 | 311A247<br>311A249<br>311A251<br>311A253 | 311A212<br>311A214<br>311A216<br>311A218 | 311A248<br>311A250<br>311A252<br>311A254 | 2.828 | 3.281 |
| 1528.00<br>2273.00<br>3382.00<br>4126.00 | 850**<br>1250**<br>1250**<br>1250** | 500<br>740<br>1100<br>1350 | 311A219<br>311A221<br>311A223<br>311A225 | 311A255<br>311A257<br>311A259<br>311A261 | 311A220<br>311A222<br>311A224<br>311A226 | 311A256<br>311A258<br>311A260<br>311A262 | 3.203 | 3.656 |
| 6621.00<br>9851.00<br>12016.00<br>17879.00<br>21808.00 | 1250**<br>1250**<br>1250**<br>1250**<br>1250** | 1730<br>2580<br>3150<br>4700<br>5700 | 311A227<br>311A229<br>311A231<br>311A233<br>311A235 | 311A263<br>311A265<br>311A267<br>311A269<br>311A271 | 311A228<br>311A230<br>311A232<br>311A234<br>311A236 | 311A264<br>311A266<br>311A268<br>311A270<br>311A272 | 3.344 | 3.797 |

Max. Cont. Torque: The values in this column are based upon geartrain strength and capability for 1000 hrs. minimum life. Max. rated torque of motor selected x torque multiplier ratio must not exceed these values.

Max. Intermittent Torque = 2 x Max. Cont. Torque.

Momentary Stall Torque = 5 x Max. Cont. Torque.

Minimum Efficiency = Torque Multiplier Ratio divided by Speed Reduction Ratio x 100.

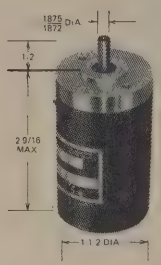
***HOW TO ORDER:**
The complete motor part number consists of the standard part number prefix, shown on the standard part number and data tables, plus the armature dash number. For gearmotors, each of the basic motor windings (dash no.), in the same type basic motor part number table, must be used, with the selected speed reduction ratio.

# TRW GLOBE MOTORS

## D.C. 1-1/2" DIA. PERMANENT MAGNET MOTORS

## TYPE BD — BASIC MOTOR

Globe Type BD d.c. motors are designed to missile and aircraft standards. Twenty-one standard armature windings provide a large number of speed and torque characteristics in a comprehensive range of voltages. Units for operation at other voltages can be made available.




### STANDARD PART NUMBERS AND DATA

| Voltage (v.d.c.) | Speed no load (rpm) | Torque max. rated (oz. in.) | Torque nom. stall (oz. in.) | Current max. no load (amps) | Current max. rated load (amps) | Current nom. stall (amps) | Standard Part No.* |
|---|---|---|---|---|---|---|---|
| 6 | 13,000-15,500 | 1.7 | 24 | 1.60 | 4.5 | 55.0 | 100A104-2 |
| 6 | 10,000-12,000 | 2.3 | 19 | 1.30 | 4.6 | 35.0 | 100A104-3 |
| 6 | 8,000- 9,500 | 3.2 | 15 | .97 | 4.6 | 22.0 | 100A104-4 |
| 12 | 12,500-14,500 | 1.8 | 24 | .76 | 2.3 | 27.0 | 100A104-5 |
| 12 | 10,000-12,000 | 2.4 | 19 | .60 | 2.3 | 17.0 | 100A104-6 |
| 12 | 8,000- 9,500 | 3.2 | 15 | .49 | 2.3 | 11.0 | 100A104-7 |
| 27 | 14,000-16,500 | 1.6 | 27 | .39 | 1.0 | 15.0 | 100A104-8 |
| 27 | 11,000-13,000 | 2.0 | 22 | .30 | 1.0 | 9.8 | 100A104-9 |
| 27 | 9,000-10,500 | 2.8 | 17 | .24 | 1.0 | 6.4 | 100A104-10 |
| 27 | 7,000- 8,500 | 3.6 | 14 | .20 | 1.0 | 3.9 | 100A104-11 |
| 50 | 10,500-12,500 | 2.1 | 20 | .16 | .5 | 4.6 | 100A104-12 |
| 50 | 8,000- 9,500 | 2.8 | 16 | .13 | .5 | 2.9 | 100A104-13 |
| 50 | 6,500- 8,000 | 3.7 | 13 | .10 | .5 | 1.8 | 100A104-14 |
| 50 | 5,000- 6,000 | 3.5 | 10 | .08 | .4 | 1.2 | 100A104-15 |
| 115 | 13,000-15,500 | 1.6 | 18 | .09 | .3 | 2.3 | 100A104-16 |
| 115 | 11,000-13,000 | 2.2 | 14 | .07 | .3 | 1.5 | 100A104-17 |
| 115 | 9,000-10,500 | 2.8 | 11 | .06 | .3 | 0.95 | 100A104-18 |
| 115 | 7,000- 8,500 | 3.6 | 9 | .05 | .3 | 0.61 | 100A104-19 |
| 115 | 6,000- 7,000 | 2.9 | 7 | .04 | .2 | 0.40 | 100A104-20 |
| 115 | 4,500- 5,500 | 2.7 | 6.5 | .04 | .2 | 0.26 | 100A104-21 |

## TYPE BL — BASIC MOTOR

Globe Type BL d.c. motors are designed to aircraft and missile quality standards. Twenty-one standard armature windings provide a large number of speed-torque characteristics at various voltages. Units for operation at other voltages can be made available.

### STANDARD PART NUMBERS AND DATA

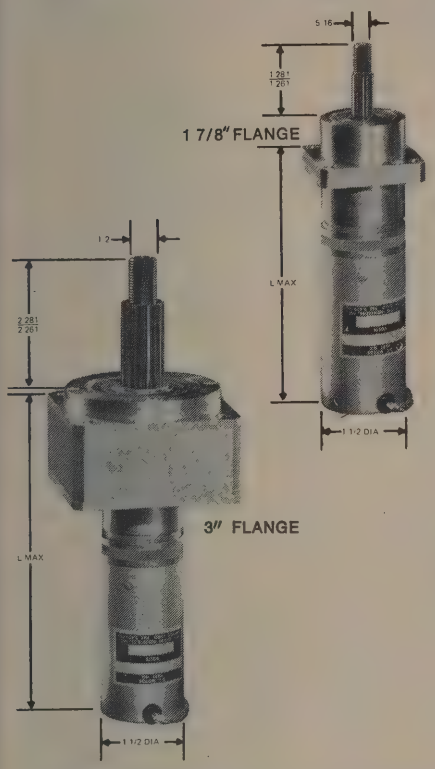
| Voltage (v.d.c.) | Speed no load (rpm) | Torque max. rated (oz. in.) | Torque nom. stall (oz. in.) | Current max. no load (amps) | Current max. rated load (amps) | Current nom. stall (amps) | Standard Part No.* |
|---|---|---|---|---|---|---|---|
| 6 | 10,000-12,500 | 3.3 | 37 | 1.50 | 5.2 | 62.0 | 100A108-1 |
| 6 | 8,500-10,500 | 4.0 | 29 | 1.20 | 5.2 | 45.0 | 100A108-2 |
| 6 | 6,500- 8,000 | 5.0 | 23 | .93 | 5.1 | 28.0 | 100A108-3 |
| 12 | 10,000-12,500 | 3.3 | 37 | .71 | 2.6 | 36.0 | 100A108-4 |
| 12 | 8,500-10,500 | 4.4 | 29 | .56 | 2.7 | 22.0 | 100A108-5 |
| 12 | 6,500- 8,000 | 5.0 | 23 | .44 | 2.8 | 14.0 | 100A108-6 |
| 27 | 11,500-14,000 | 2.9 | 42 | .36 | 1.4 | 20.0 | 100A108-7 |
| 27 | 8,500-10,500 | 3.7 | 33 | .28 | 1.4 | 12.0 | 100A108-8 |
| 27 | 7,000- 9,000 | 5.0 | 27 | .22 | 1.4 | 8.0 | 100A108-9 |
| 27 | 5,500- 7,000 | 6.0 | 21 | .18 | 1.4 | 5.2 | 100A108-10 |
| 50 | 8,500-10,500 | 3.8 | 31 | .15 | .72 | 5.9 | 100A108-11 |
| 50 | 6,500- 8,000 | 5.0 | 25 | .16 | .74 | 3.7 | 100A108-12 |
| 50 | 5,500- 7,000 | 6.5 | 20 | .09 | .73 | 2.4 | 100A108-13 |
| 50 | 4,500- 5,500 | 7.5 | 16 | .075 | .66 | 1.5 | 100A108-14 |
| 50 | 3,500- 4,500 | 6.0 | 12.5 | .055 | .43 | 0.94 | 100A108-15 |
| 115 | 8,500-10,500 | 4.2 | 22 | .065 | .34 | 1.9 | 100A108-16 |
| 115 | 7,000- 9,000 | 5.0 | 17 | .055 | .40 | 1.2 | 100A108-17 |
| 115 | 5,500- 7,000 | 5.0 | 14 | .045 | .28 | 0.77 | 100A108-18 |
| 115 | 4,500- 5,500 | 4.2 | 11 | .035 | .19 | 0.50 | 100A108-19 |
| 115 | 4,000- 5,000 | 3.5 | 8.8 | .030 | .14 | 0.33 | 100A108-20 |
| 115 | 3,000- 4,000 | 2.9 | 8.1 | .025 | .10 | 0.21 | 100A108-21 |

***HOW TO ORDER:**

The complete motor part number consists of the standard part number prefix, shown on the standard part number and data tables, plus the armature dash number. For gearmotors, each of the basic motor windings (dash no.), in the same type basic motor part number table, must be used, with the selected speed reduction ratio.

# TRW GLOBE MOTORS

## D.C. 1-7/8" & 3" FLANGE PLANETARY GEARMOTORS
## D.C. 2-1/4" DIA. PERMANENT MAGNET MOTORS
## TYPE BD, BL — PLANETARY GEARMOTORS




TRW/Globe's 1⅞" and 3" diameter planetary geartrains provide high torque outputs in a small package. Coupled to the Type BD or BL motor, they are ideal for business machinery, machine tools, aircraft, and missile applications.

### 1-7/8" FLANGE — STANDARD PART NUMBERS AND DATA

| Speed Reduction Ratio | Torque Multiplier | Max. Cont. Rating (lb. in.) | Type BD | | Type BL | |
|---|---|---|---|---|---|---|
| | | | "L" max. | Part No. Prefix | "L" max. | Part No. Prefix* |
| 3.81:1<br>5.54:1 | 3.5<br>5.1 | 1.1<br>1.6 | 3.34 | 102A152<br>102A153 | 3.72 | 102A170<br>102A171 |
| 14.5 :1<br>21.1 :1<br>30.7 :1 | 13<br>19<br>27 | 4.1<br>6.0<br>8.6 | 3.53 | 102A156<br>102A157<br>102A158 | 3.91 | 102A174<br>102A175<br>102A176 |
| 55.3 :1<br>80.4 :1<br>117.0 :1<br>170.0 :1 | 47<br>68<br>99<br>144 | 14.6<br>21.0<br>31.0<br>45.0 | 4.09 | 102A160<br>102A161<br>102A162<br>102A163 | 4.47 | 102A178<br>102A179<br>102A180<br>102A181 |
| 211.0 :1<br>306.0 :1<br>445.0 :1<br>647.0 :1<br>941.0 :1 | 171<br>248<br>360<br>524<br>762 | 53.0<br>77.0<br>100.0<br>100.0<br>100.0 | 4.28 | 102A189<br>102A190<br>102A191<br>102A192<br>102A193 | 4.66 | 102A199<br>102A200<br>102A201<br>102A202<br>102A203 |

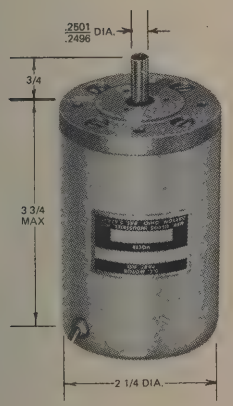
### 3" FLANGE — STANDARD PART NUMBERS AND DATA

| | | | | | | |
|---|---|---|---|---|---|---|
| 306:1<br>445:1<br>647:1<br>941:1 | 248<br>360<br>524<br>762 | 77<br>112<br>164<br>238 | 5⅜ | 102A929<br>102A930<br>102A931<br>102A932 | 5¾ | 102A939<br>102A940<br>102A941<br>102A942 |
| 1166:1<br>1696:1<br>2466:1<br>3584:1<br>5211:1 | 896<br>1305<br>1900<br>2760<br>4000 | 280<br>407<br>550<br>550<br>550 | 5 35/64 | 102A933<br>102A934<br>102A935<br>102A936<br>102A937 | 5 59/64 | 102A943<br>102A944<br>102A945<br>102A946<br>102A947 |

NOTE: Shaft spline details available from factory. For prototype use, TRW/Globe will broach holes in customer's parts.

Max. Cont. Torque: The values in this column are based upon geartrain strength and capability for 1000 hrs. minimum life. Max. rated torque of motor selected x torque multiplier ratio must not exceed these values.
Max. Intermittent Torque = 2 x Max. Cont. Torque.
Momentary Stall Torque = 5 x Max. Cont. Torque.
Minimum Efficiency = Torque Multiplier Ratio divided by Speed Reduction Ratio x 100.

## TYPE GRP — BASIC MOTOR




Type GRP precision permanent magnet d.c. motors provide extremely high output and efficiency for their frame size. This unit is designed to meet the requirements of MIL-M-8609; however, designs exceeding this specification to meet customer controlled applications are common. Various standard armature windings make it possible to furnish a wide range of speed and torque characteristics.

### STANDARD PART NUMBERS AND DATA

| Voltage (v.d.c.) | Speed no load (rpm) | Torque | | Current | | | Standard Part No.* |
|---|---|---|---|---|---|---|---|
| | | max. rated (oz. in.) | nom. stall (oz. in.) | max. no load (amps) | max. rated load (amps) | nominal stall (amps) | |
| 6 | 4,700-5,300 | 8.0 | 40 | 2.00 | 7.0 | 45.0 | 166A100-4 |
| 12<br>12 | 6,300-7,000<br>4,700-5,300 | 8.0<br>12.0 | 54<br>50 | 1.34<br>1.00 | 6.0<br>5.8 | 47.0<br>28.0 | 166A100-5<br>166A100-6 |
| 27<br>27<br>27<br>27 | 8,500-9,500<br>6,500-7,300<br>5,300-5,900<br>4,200-4,800 | 10.0<br>13.0<br>16.0<br>16.0 | 99<br>96<br>89<br>72 | 0.80<br>0.62<br>0.50<br>0.40 | 3.4<br>3.4<br>3.3<br>2.7 | 40.0<br>25.0<br>16.0<br>10.0 | 166A100-7<br>166A100-8<br>166A100-9<br>166A100-10 |
| 50<br>50<br>50 | 6,300-7,100<br>4,900-5,500<br>3,900-4,400 | 14.0<br>14.5<br>15.0 | 107<br>83<br>66 | 0.32<br>0.25<br>0.20 | 1.9<br>1.5<br>1.2 | 11.8<br>7.5<br>4.7 | 166A100-11<br>166A100-12<br>166A100-13 |
| 115<br>115<br>115<br>115<br>115<br>115 | 7,300-8,100<br>5,900-6,500<br>4,700-5,300<br>3,700-4,100<br>3,000-3,400<br>2,400-2,700 | 12.0<br>15.5<br>16.0<br>15.0<br>14.5<br>14.0 | 123<br>99<br>80<br>62<br>51<br>41 | 0.16<br>0.14<br>0.12<br>0.09<br>0.07<br>0.06 | 0.90<br>0.85<br>0.70<br>0.50<br>0.45<br>0.35 | 6.8<br>4.4<br>2.8<br>1.8<br>1.2<br>0.8 | 166A100-14<br>166A100-15<br>166A100-16<br>166A100-17<br>166A100-18<br>166A100-19 |

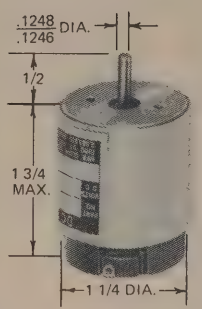
***HOW TO ORDER:**
The complete motor part number consists of the standard part number prefix, shown on the standard part number and data tables, plus the armature dash number. For gearmotors, each of the basic motor windings (dash no.), in the same type basic motor part number table, must be used, with the selected speed reduction ratio.

# TRW GLOBE MOTORS

## D.C. 1-1/4" DIA. PERMANENT MAGNET MOTORS

## TYPE CMM — BASIC MOTOR

Globe Type CMM motors are designed for applications which require small size, reliability and high torque. Planetary geartrains are available in a wide range of speed reductions. Type CMM motors are commercial versions of Globe military motors and have the same performance characteristics.

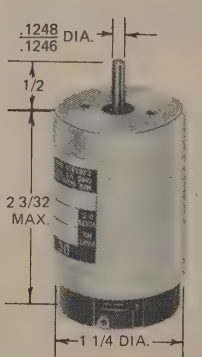



### STANDARD PART NUMBERS AND DATA

| Voltage (v.d.c.) | Speed no load (rpm) | Torque max. rated (oz. in.) | Torque nom. stall (oz. in.) | Current max. no load (amps) | Current max. rated load (amps) | Current nom. stall (amps) | Standard Part Numbers* front face mount |
|---|---|---|---|---|---|---|---|
| 4 | 16,000-19,000 | .25 | 4.9 | 1.5 | 2.4 | 21 | 235A106-23 |
| 6 | 18,900-22,500 | .5 | 7.4 | 1.2 | 2.3 | 24.9 | 235A106-14 |
| 6 | 15,600-18,600 | .85 | 5.8 | 1.0 | 2.3 | 16.3 | 235A106-6 |
| 6 | 12,000-14,000 | .75 | 4.6 | .80 | 2.0 | 9.9 | 235A106-5 |
| 12 | 18,000-21,400 | .50 | 7.4 | .56 | 1.2 | 11.8 | 235A106-24 |
| 12 | 14,500-17,000 | .70 | 5.9 | .50 | 1.2 | 7.5 | 235A106-3 |
| 12 | 12,400-14,700 | .75 | 4.6 | .40 | 1.2 | 5.1 | 235A106-21 |
| 12 | 11,000-13,000 | 1.0 | 4.6 | .35 | 1.2 | 4.6 | 235A106-4 |
| 24 | 19,200-22,800 | .35 | 7.4 | .30 | .60 | 6.3 | 235A106-7 |
| 24 | 16,000-19,000 | .60 | 5.8 | .25 | .60 | 3.8 | 235A106-1 |
| 24 | 11,500-14,000 | 1.0 | 4.6 | .18 | .60 | 2.1 | 235A106-2 |
| 24 | 10,700-12,700 | 1.0 | 3.6 | .17 | .60 | 1.6 | 235A106-8 |
| 24 | 9,600-11,400 | 1.0 | 2.9 | .15 | .50 | 1.1 | 235A106-22 |
| 24 | 8,000-10,000 | 1.0 | 2.9 | .13 | .45 | 0.93 | 235A106-10 |
| 24 | 6,000- 7,000 | .8 | 2.3 | .08 | .30 | 0.55 | 235A106-11 |
| 50 | 14,300-17,000 | .7 | 4.8 | .11 | .30 | 1.3 | 235A106-25 |
| 50 | 9,500-11,500 | 1.0 | 3.8 | .07 | .30 | 0.71 | 235A106-16 |
| 50 | 8,000-10,000 | 1.0 | 3.0 | .07 | .20 | 0.50 | 235A106-12 |
| 50 | 6,700- 8,000 | .8 | 2.4 | .05 | .16 | 0.30 | 235A106-15 |
| 50 | 4,600- 5,500 | .8 | 1.9 | .04 | .12 | 0.20 | 235A106-13 |

## TYPE CLL — BASIC MOTOR

Globe Type CLL motors are designed for applications which require small size, reliability and high torque. Planetary geartrains are available in a wide range of speed reductions. Type CLL motors are commercial versions of Globe military motors and have the same performance characteristics.




### STANDARD PART NUMBERS AND DATA

| Voltage (v.d.c.) | Speed no load (rpm) | Torque max. rated (oz. in.) | Torque nom. stall (oz. in.) | Current max. no load (amps) | Current max. rated load (amps) | Current nominal stall (amps) | Standard Part No.* |
|---|---|---|---|---|---|---|---|
| 6 | 15,600-18,500 | 1.0 | 8.7 | 1.4 | 2.7 | 22.4 | 313A102-23 |
| 6 | 12,500-14,500 | 1.3 | 8.7 | 1.1 | 2.4 | 17.7 | 313A102-14 |
| 6 | 10,000-12,200 | 1.6 | 6.9 | .95 | 2.6 | 11.6 | 313A102-6 |
| 6 | 7,600- 9,400 | 1.6 | 5.5 | .70 | 2.0 | 7.0 | 313A102-5 |
| 12 | 11,500-14,000 | 1.1 | 8.7 | .52 | 1.7 | 8.4 | 313A102-24 |
| 12 | 9,000-11,000 | 1.7 | 6.9 | .42 | 1.2 | 5.3 | 313A102-3 |
| 24 | 16,000-19,000 | .75 | 11.0 | .36 | 1.0 | 7.3 | 313A102-21 |
| 24 | 14,400-17,000 | .85 | 11.0 | .32 | .85 | 6.5 | 313A102-4 |
| 24 | 12,000-14,500 | 1.0 | 8.7 | .28 | .80 | 4.5 | 313A102-7 |
| 24 | 10,400-12,300 | 1.1 | 6.9 | .23 | .75 | 3.0 | 313A102-1 |
| 24 | 7,400- 8,900 | 1.6 | 5.5 | .17 | .70 | 1.7 | 313A102-2 |
| 24 | 6,900- 8,200 | 1.8 | 4.3 | .16 | .65 | 1.2 | 313A102-8 |
| 24 | 6,200- 7,400 | 1.8 | 3.4 | .14 | .60 | 0.89 | 313A102-22 |
| 24 | 5,200- 6,200 | 1.2 | 3.4 | .12 | .45 | 0.74 | 313A102-10 |
| 50 | 7,600- 9,400 | 1.5 | 5.7 | .09 | .25 | 0.92 | 313A102-11 |
| 75 | 14,000-17,000 | 1.0 | 8.6 | .10 | .29 | 1.6 | 313A102-25 |
| 75 | 9,000-11,000 | 1.7 | 6.8 | .07 | .29 | 0.85 | 313A102-16 |
| 75 | 8,000-10,000 | 1.8 | 5.4 | .06 | .26 | 0.60 | 313A102-12 |
| 75 | 6,500- 8,000 | 1.2 | 4.3 | .05 | .20 | 0.37 | 313A102-15 |
| 75 | 4,500- 5,300 | 1.0 | 3.4 | .04 | .10 | 0.23 | 313A102-13 |

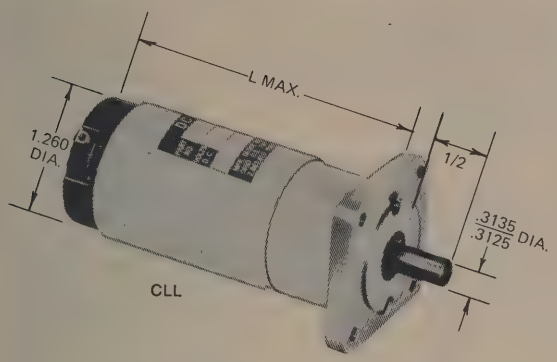
***HOW TO ORDER:**

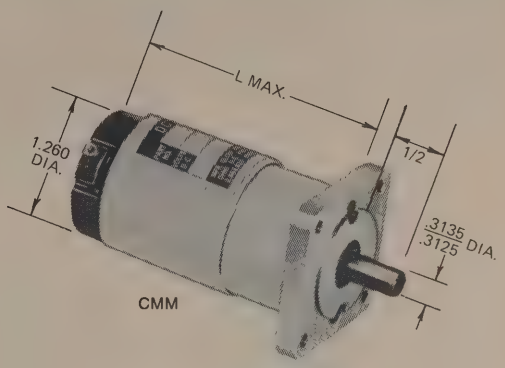
The complete motor part number consists of the standard part number prefix, shown on the standard part number and data tables, plus the armature dash number. For gearmotors, each of the basic motor windings (dash no.), in the same type basic motor part number table, must be used, with the selected speed reduction ratio.

# TRW GLOBE MOTORS

## D.C. 1-1/4" DIA. PERMANENT MAGNET PLANETARY GEARMOTORS

## TYPE CMM, CLL—PLANETARY GEARMOTORS




Type CLL and CMM gearmotors are of the same high quality construction as Globe MM and LL gearmotors and provide the same outstanding performance characteristics although NOT designed to meet MIL-specs for environmental protection. These gearmotors are specifically designed for application where small size, reliability and high torque are desired.

Globe Type CMM and CLL gearmotors are rugged, high-quality units combining Type CMM and CLL commercial motors with a proven planetary geartrain offering 83 standard speed reduction ratios from 4:1 to 46,656:1 with maximum continuous torque from 3.0 to 1250 oz. in. Since the geartrain is of modular design, literally thousands of special ratios can be furnished.

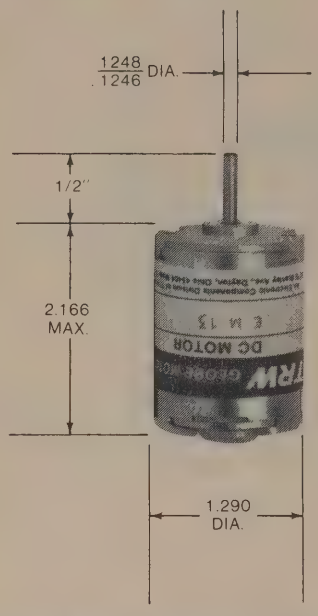
### STANDARD PART NUMBERS AND DATA

| Speed Reduction Ratio | Torque Multiplier | Max. Cont. Torque (oz. in.) | Type CMM Gearmotor | | Type CLL Gearmotor | |
|---|---|---|---|---|---|---|
| | | | dim. "L" | Part No.* | dim. "L" | Part No.* |
| 4:1 | 3.0 | 5.1 | 2.86 | 317A102 | 3.22 | 319A100 |
| 5:1 | 3.8 | 6.5 | 2.86 | 317A103 | 3.22 | 319A101 |
| 6:1 | 4.5 | 7.7 | 2.86 | 317A104 | 3.22 | 319A102 |
| 16:1 | 10 | 17 | 3.11 | 317A105 | 3.45 | 319A103 |
| 20:1 | 13 | 22 | 3.11 | 317A106 | 3.45 | 319A104 |
| 24:1 | 15 | 26 | 3.11 | 317A107 | 3.45 | 319A105 |
| 25:1 | 16 | 27 | 3.11 | 317A108 | 3.45 | 319A106 |
| 30:1 | 19 | 32 | 3.11 | 317A109 | 3.45 | 319A107 |
| 36:1 | 23 | 39 | 3.11 | 317A110 | 3.45 | 319A108 |
| 64:1 | 33 | 56 | 3.34 | 317A111 | 3.69 | 319A109 |
| 80:1 | 41 | 70 | 3.34 | 317A112 | 3.69 | 319A110 |
| 96:1 | 49 | 83 | 3.34 | 317A113 | 3.69 | 319A111 |
| 100:1 | 51 | 87 | 3.34 | 317A114 | 3.69 | 319A112 |
| 120:1 | 61 | 104 | 3.34 | 317A115 | 3.69 | 319A113 |
| 125:1 | 64 | 109 | 3.34 | 317A116 | 3.69 | 319A114 |
| 144:1 | 74 | 126 | 3.34 | 317A117 | 3.69 | 319A115 |
| 150:1 | 77 | 131 | 3.34 | 317A118 | 3.69 | 319A116 |
| 180:1 | 92 | 156 | 3.34 | 317A119 | 3.69 | 319A117 |
| 216:1 | 110 | 187 | 3.34 | 317A120 | 3.69 | 319A118 |
| 256:1 | 105 | 179 | 3.58 | 317A121 | 3.92 | 319A119 |
| 320:1 | 130 | 221 | 3.58 | 317A122 | 3.92 | 319A120 |
| 384:1 | 157 | 167 | 3.58 | 317A123 | 3.92 | 319A121 |
| 400:1 | 164 | 279 | 3.58 | 317A124 | 3.92 | 319A122 |
| 480:1 | 197 | 335 | 3.58 | 317A125 | 3.92 | 319A123 |
| 500:1 | 205 | 349 | 3.58 | 317A126 | 3.92 | 319A124 |
| 576:1 | 235 | 401 | 3.58 | 317A127 | 3.92 | 319A125 |
| 600:1 | 246 | 418 | 3.58 | 317A128 | 3.92 | 319A126 |
| 625:1 | 256 | 435 | 3.58 | 317A129 | 3.92 | 319A127 |
| 720:1 | 295 | 502 | 3.58 | 317A130 | 3.92 | 319A128 |
| 750:1 | 306 | 520 | 3.58 | 317A131 | 3.92 | 319A129 |
| 864:1 | 352 | 598 | 3.58 | 317A132 | 3.92 | 319A130 |
| 900:1 | 370 | 629 | 3.58 | 317A133 | 3.92 | 319A131 |
| 1,024:1 | 334 | 568 | 3.81 | 317A134 | 4.16 | 319A132 |
| 1,080:1 | 442 | 757 | 3.58 | 317A135 | 3.92 | 319A133 |
| 1,280:1 | 416 | 707 | 3.81 | 317A136 | 4.16 | 319A134 |
| 1,296:1 | 530 | 901 | 3.58 | 317A137 | 3.92 | 319A135 |
| 1,536:1 | 500 | 850 | 3.81 | 317A138 | 4.16 | 319A136 |
| 1,600:1 | 522 | 887 | 3.81 | 317A139 | 4.16 | 319A137 |
| 1,920:1 | 625 | 1063 | 3.81 | 317A140 | 4.16 | 319A138 |
| 2,000:1 | 652 | 1108 | 3.81 | 317A141 | 4.16 | 319A139 |
| 2,304:1 | 750 | 1250 | 3.81 | 317A142 | 4.16 | 319A140 |
| 2,400:1 | 780 | 1250 | 3.81 | 317A143 | 4.16 | 319A141 |
| 2,500:1 | 815 | 1250 | 3.81 | 317A144 | 4.16 | 319A142 |
| 2,880:1 | 940 | 1250 | 3.81 | 317A145 | 4.16 | 319A143 |
| 3,000:1 | 980 | 1250 | 3.81 | 317A146 | 4.16 | 319A144 |
| 3,125:1 | 1020 | 1250 | 3.81 | 317A147 | 4.16 | 319A145 |
| 3,456:1 | 1130 | 1250 | 3.81 | 317A148 | 4.16 | 319A146 |
| 3,600:1 | 1170 | 1250 | 3.81 | 317A149 | 4.16 | 319A147 |
| 3,750:1 | 1220 | 1250 | 3.81 | 317A150 | 4.16 | 319A148 |
| 4,096:1 | 1070 | 1250 | 4.03 | 317A151 | 4.39 | 319A149 |
| 4,320:1 | 1410 | 1250 | 3.81 | 317A152 | 4.16 | 319A150 |
| 4,500:1 | 1470 | 1250 | 3.81 | 317A153 | 4.16 | 319A151 |
| 5,120:1 | 1340 | 1250 | 4.03 | 317A154 | 4.39 | 319A152 |
| 5,184:1 | 1690 | 1250 | 3.81 | 317A155 | 4.16 | 319A153 |
| 5,400:1 | 1760 | 1250 | 3.81 | 317A156 | 4.16 | 319A154 |
| 6,144:1 | 1610 | 1250 | 4.03 | 317A157 | 4.39 | 319A155 |
| 6,400:1 | 1680 | 1250 | 4.03 | 317A158 | 4.39 | 319A156 |
| 6,480:1 | 2110 | 1250 | 3.81 | 317A159 | 4.16 | 319A157 |
| 7,680:1 | 2010 | 1250 | 4.03 | 317A160 | 4.39 | 319A158 |
| 7,776:1 | 2530 | 1250 | 3.81 | 317A161 | 4.16 | 319A159 |
| 8,000:1 | 2100 | 1250 | 4.03 | 317A162 | 4.39 | 319A160 |
| 9,216:1 | 2390 | 1250 | 4.03 | 317A163 | 4.39 | 319A161 |
| 9,600:1 | 2520 | 1250 | 4.03 | 317A164 | 4.39 | 319A162 |
| 10,000:1 | 2620 | 1250 | 4.03 | 317A165 | 4.39 | 319A163 |
| 11,520:1 | 3010 | 1250 | 4.03 | 317A166 | 4.39 | 319A164 |
| 12,000:1 | 3140 | 1250 | 4.03 | 317A167 | 4.39 | 319A165 |
| 12,500:1 | 3280 | 1250 | 4.03 | 317A168 | 4.39 | 319A166 |
| 13,824:1 | 3620 | 1250 | 4.03 | 317A169 | 4.39 | 319A167 |
| 14,400:1 | 3780 | 1250 | 4.03 | 317A170 | 4.39 | 319A168 |
| 15,000:1 | 3940 | 1250 | 4.03 | 317A171 | 4.39 | 319A169 |
| 15,625:1 | 4100 | 1250 | 4.03 | 317A172 | 4.39 | 319A170 |
| 17,280:1 | 4520 | 1250 | 4.03 | 317A173 | 4.39 | 319A171 |
| 18,000:1 | 4710 | 1250 | 4.03 | 317A174 | 4.39 | 319A172 |
| 18,750:1 | 4910 | 1250 | 4.03 | 317A175 | 4.39 | 319A173 |
| 20,736:1 | 5430 | 1250 | 4.03 | 317A176 | 4.39 | 319A174 |
| 21,600:1 | 5660 | 1250 | 4.03 | 317A177 | 4.39 | 319A175 |
| 22,500:1 | 4900 | 1250 | 4.03 | 317A178 | 4.39 | 319A176 |
| 25,920:1 | 6790 | 1250 | 4.03 | 317A179 | 4.39 | 319A177 |
| 27,000:1 | 7070 | 1250 | 4.03 | 317A180 | 4.39 | 319A178 |
| 31,104:1 | 8150 | 1250 | 4.03 | 317A181 | 4.39 | 319A179 |
| 32,400:1 | 8500 | 1250 | 4.03 | 317A182 | 4.39 | 319A180 |
| 38,880:1 | 10200 | 1250 | 4.03 | 317A183 | 4.39 | 319A181 |
| 46,656:1 | 12200 | 1250 | 4.03 | 317A184 | 4.39 | 319A182 |

***HOW TO ORDER:**
The complete motor part number consists of the standard part number prefix, shown on the standard part number and data tables, plus the armature dash number. For gearmotors, each of the basic motor windings (dash no.), in the same type basic motor part number table, must be used, with the selected speed reduction ratio.

# TRW GLOBE MOTORS

## D.C. ECONO-MITE PERMANENT MAGNET MOTORS
## TYPE EM-13 — BASIC 1¼" DIA. MOTOR

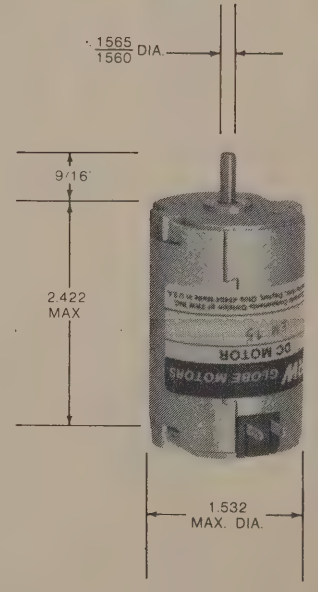



The EM-13 and EM-15 motors are the first of a new line designed for high-volume, low-cost production. Typical applications include tape decks, business machines, computer peripherals, audio-visual, automotive, medical, recreational, and other industrial equipment.

### STANDARD PART NUMBERS AND DATA

| Voltage (VDC) | Speed ± 800 No Load (RPM) | Current No Load (Max Amps) | Rated Torque (Oz. In.) | Current At Rated Torque (Max Amps) | Inertia X 10-4 (Oz. In. Sec.²) | Temp.* Rise (°C/Watt) | Torque Constant (Oz. In./ Amp) | Resistance ± 15% (Ohms) | Part Number** |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 4200 | 0.3 | 0.5 | 0.6 | 1.5 | 15 | 1.3 | 5.4 | 405A100-3 |
| 12 | 4800 | 0.15 | 0.5 | 0.3 | 1.5 | 15 | 2.6 | 15.3 | 405A100-1 |
| 24 | 4800 | 0.08 | 0.5 | 0.2 | 1.5 | 15 | 5.2 | 51.9 | 405A100-2 |
| 6 | 4500 | 0.3 | 1.0 | 1.4 | 1.5 | 15 | 1.3 | 2.4 | 405A119-3 |
| 12 | 5400 | 0.15 | 1.50 | 0.7 | 1.5 | 15 | 2.6 | 6.7 | 405A119-1 |
| 24 | 5600 | 0.08 | 1.7 | 0.45 | 1.5 | 15 | 5.2 | 28.0 | 405A119-2 |
| 6 | 5300 | 0.3 | 2.1 | 2.4 | 2.2 | 11 | 1.2 | 1.2 | 405A219-3 |
| 12 | 5400 | 0.15 | 2.5 | 1.1 | 2.2 | 11 | 2.8 | 4.8 | 405A219-1 |
| 24 | 5600 | 0.08 | 3.0 | 0.7 | 2.2 | 11 | 5.7 | 16.8 | 405A219-2 |

## TYPE EM-15 — BASIC 1½" DIA. MOTOR




Designed for economy in commercial and industrial applications, the EM-15 motor is available with the following special order options: geartrain, EMI filters, integral tachometer generators, stud mounting, and rear terminals.

### STANDARD PART NUMBERS AND DATA

**Sleeve Bearings**

| Voltage (VDC) | Speed ± 800 No Load (RPM) | Current No Load (Max Amps) | Rated Torque (Oz. In.) | Current At Rated Torque (Max Amps) | Inertia X 10-4 (Oz. In. Sec.²) | Temp.* Rise (°C/Watt) | Torque Constant (Oz. In./ Amp) | Resistance ± 15% (Ohms) | Part Number** |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 4800 | 0.5 | 3.0 | 3.0 | 4.75 | 8.5 | 1.4 | 0.7 | 403A114-1 |
| 12 | 5200 | 0.25 | 3.5 | 1.6 | 4.75 | 8.5 | 2.7 | 2.3 | 403A114-2 |
| 24 | 5400 | 0.125 | 4.0 | 1.0 | 4.75 | 8.5 | 5.5 | 8.3 | 403A114-3 |
| 6 | 5500 | 0.6 | 4.0 | 4.0 | 6.0 | 7.0 | 1.3 | 0.45 | 403A116-1 |
| 12 | 5500 | 0.3 | 4.5 | 2.2 | 6.0 | 7.0 | 2.7 | 1.7 | 403A116-2 |
| 24 | 5500 | 0.15 | 5.0 | 1.2 | 6.0 | 7.0 | 5.5 | 6.2 | 403A116-3 |

**Ball Bearings**

| Voltage (VDC) | Speed ± 800 No Load (RPM) | Current No Load (Max Amps) | Rated Torque (Oz. In.) | Current At Rated Torque (Max Amps) | Inertia X 10-4 (Oz. In. Sec.²) | Temp.* Rise (°C/Watt) | Torque Constant (Oz. In./ Amp) | Resistance ± 15% (Ohms) | Part Number** |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 5000 | 0.25 | 3.5 | 3.2 | 4.75 | 8.5 | 1.4 | 0.7 | 403A115-1 |
| 12 | 5300 | 0.125 | 4.0 | 1.8 | 4.75 | 8.5 | 2.7 | 2.3 | 403A115-2 |
| 24 | 5500 | 0.06 | 4.5 | 1.0 | 4.75 | 8.5 | 5.5 | 8.3 | 403A115-3 |
| 6 | 5600 | 0.4 | 4.5 | 4.0 | 6.0 | 7.0 | 1.3 | 0.45 | 403A117-1 |
| 12 | 5600 | 0.2 | 5.0 | 2.3 | 6.0 | 7.0 | 2.7 | 1.7 | 403A117-2 |
| 24 | 5600 | 0.1 | 5.5 | 1.3 | 6.0 | 7.0 | 5.5 | 6.2 | 403A117-3 |

*Winding temp rise measured when mounted to 8" x 8" x ¼" Alum plate. Multiply by 1.4 when mounted to a heat insulator.

****HOW TO ORDER:**

Units shown above are standard and may be ordered by part number. Consult TRW Globe for variations in mechanical or electrical performance to suit specific applications.

Ask for Bulletin E-2109 and E-2404 for complete details.

# TRW GLOBE MOTORS

## D.C. ECONO-MITE PERMANENT MAGNET

### TYPE EM-13 — (1¼" DIA.) PLANETARY GEARMOTORS

Type EM-13 gearmotors are of the same high quality construction as Globe military gearmotors and provide the same outstanding performance characteristics although **not** designed to meet MIL-Specs for environmental protection. These gearmotors are specifically designed for application where small size reliability and high torque are desired.

Globe EM-13 gearmotors are rugged, high-quality units combining EM-13 commercial motors (see Bulletin E-2109) with a proven planetary geartrain offering 30 standard speed reduction ratios from 4:1 to 46,656:1 with maximum continuous torque from 1.5 to 1250 oz. in. Since the geartrain is of modular design, literally thousands of special ratios can be furnished. Send complete application information to receive a prompt recommendation from Globe. Ask for Bulletin E-2129 for complete details.

#### STANDARD PART NUMBERS AND DATA

| | | 405A100 Type (Basic Motor) | | | 405A119 Type | | 405A219 Type | | |
|---|---|---|---|---|---|---|---|---|---|
| Speed Reduction | Torque Multiplier | Max Cont. Torque (Oz. In.) | Part No.* | "L" Max (Applies to both) | Max Cont. Torque | Part No.* | Max Cont. Torque | Part No.* | "L" Max |
| 4:1 | 3 | 1.5 | 407A100 | 3.158 | 5.1 | 407A184 | 9 | 407A267 | 3.476 |
| 5:1 | 3.8 | 1.9 | 407A101 | 3.158 | 6.5 | 407A185 | 11.5 | 407A268 | 3.476 |
| 16:1 | 10 | 5 | 407A103 | 3.347 | 17 | 407A187 | 30 | 407A270 | 3.715 |
| 20:1 | 13 | 7 | 407A104 | 3.347 | 22 | 407A188 | 40 | 407A271 | 3.715 |
| 25:1 | 16 | 8 | 407A106 | 3.347 | 27 | 407A190 | 48 | 407A273 | 3.715 |
| 36:1 | 23 | 12 | 407A108 | 3.347 | 39 | 407A192 | 69 | 407A275 | 3.715 |
| 64:1 | 33 | 14 | 407A109 | 3.630 | 56 | 407A193 | 100 | 407A276 | 3.948 |
| 80:1 | 41 | 21 | 407A110 | 3.630 | 70 | 407A194 | 125 | 407A277 | 3.948 |
| 100:1 | 51 | 26 | 407A112 | 3.630 | 87 | 407A196 | 155 | 407A279 | 3.948 |
| 125:1 | 64 | 32 | 407A114 | 3.630 | 109 | 407A198 | 195 | 407A281 | 3.948 |
| 180:1 | 92 | 46 | 407A117 | 3.630 | 156 | 407A201 | 275 | 407A284 | 3.948 |
| 256:1 | 105 | 53 | 407A119 | 3.863 | 179 | 407A203 | 315 | 407A286 | 4.181 |
| 320:1 | 130 | 65 | 407A120 | 3.863 | 221 | 407A204 | 390 | 407A287 | 4.181 |
| 400:1 | 164 | 85 | 407A122 | 3.863 | 279 | 407A206 | 495 | 407A289 | 4.181 |
| 500:1 | 205 | 105 | 407A124 | 3.863 | 349 | 407A208 | 620 | 407A291 | 4.181 |
| 625:1 | 256 | 130 | 407A127 | 3.863 | 435 | 407A211 | 770 | 407A294 | 4.181 |
| 750:1 | 306 | 155 | 407A129 | 3.863 | 520 | 407A213 | 920 | 407A296 | 4.181 |
| 1024:1 | 334 | 170 | 407A132 | 4.096 | 568 | 407A216 | 1000 | 407A299 | 4.414 |
| 1280:1 | 416 | 210 | 407A134 | 4.096 | 707 | 407A218 | 1250 | 407A301 | 4.414 |
| 1600:1 | 522 | 260 | 407A137 | 4.096 | 887 | 407A221 | 1250 | 407A304 | 4.414 |
| 2000:1 | 652 | 330 | 407A139 | 4.096 | 1108 | 407A223 | 1250 | 407A306 | 4.414 |
| 2500:1 | 815 | 410 | 407A142 | 4.096 | 1250 | 407A226 | 1250 | 407A309 | 4.414 |
| 3125:1 | 1020 | 500 | 407A145 | 4.096 | 1250 | 407A229 | 1250 | 407A312 | 4.414 |
| 4096:1 | 1070 | 540 | 407A149 | 4.329 | 1250 | 407A233 | 1250 | 407A316 | 4.747 |
| 5120:1 | 1340 | 670 | 407A152 | 4.329 | 1250 | 407A236 | | | |
| 6400:1 | 1680 | 840 | 407A156 | 4.329 | 1250 | 407A240 | | | |
| 8000:1 | 2100 | 1050 | 407A160 | 4.329 | 1250 | 407A244 | | | |
| 10000:1 | 2620 | 1250 | 407A163 | 4.329 | | | | | |
| 12500:1 | 3280 | 1250 | 407A166 | 4.329 | | | | | |
| 15625:1 | 4100 | 1250 | 407A170 | 4.329 | | | | | |

*Add dash number to part number for voltage: —1 = 12V —2 = 24V —3 = 6V

### TYPE EM-15 — (1½" DIA.) PLANETARY GEARMOTORS

Type EM-15 d.c. gearmotors are designed for high-volume, low-cost production. Typical applications include business machines, computer peripherals, audio-visual, automotive, medical, recreational, and other industrial equipment where high torque at lower speeds are needed. Request Bulletin E-2429 for complete details.

#### STANDARD PART NUMBERS AND DATA

| Ratio | Torque Multiplier | Part No.* | —1 Max Cont. Torque (Oz. In.) | —2 Max Cont. Torque | —3 Max Cont. Torque | "L" Max Inches | Part No.* | —1 Max Cont. Torque | —2 Max Cont. Torque | —3 Max Cont. Torque | "L" Max Inches |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 3 | 409A100 | 9 | 10.5 | 12 | 3.697 | 409A266 | 12 | 14 | 15 | 3.976 |
| 5 | 3.8 | 409A101 | 11.5 | 13.5 | 15 | 3.697 | 409A267 | 15 | 17 | 19 | 3.976 |
| 16 | 10 | 409A103 | 30 | 35 | 40 | 3.936 | 409A269 | 40 | 45 | 50 | 4.215 |
| 20 | 13 | 409A104 | 40 | 46 | 52 | 3.936 | 409A270 | 52 | 60 | 65 | 4.215 |
| 25 | 16 | 409A106 | 48 | 56 | 64 | 3.936 | 409A272 | 64 | 72 | 80 | 4.215 |
| 36 | 23 | 409A108 | 69 | 81 | 92 | 3.936 | 409A274 | 92 | 105 | 115 | 4.215 |
| 64 | 33 | 409A109 | 100 | 116 | 132 | 4.169 | 409A275 | 132 | 150 | 165 | 4.448 |
| 80 | 41 | 409A110 | 125 | 144 | 164 | 4.169 | 409A276 | 164 | 185 | 205 | 4.448 |
| 100 | 51 | 409A112 | 155 | 180 | 204 | 4.169 | 409A278 | 204 | 230 | 255 | 4.448 |
| 125 | 64 | 409A114 | 195 | 225 | 256 | 4.169 | 409A280 | 256 | 290 | 320 | 4.448 |
| 180 | 92 | 409A117 | 275 | 325 | 368 | 4.169 | 409A283 | 368 | 415 | 460 | 4.448 |
| 256 | 105 | 409A119 | 315 | 370 | 420 | 4.402 | 409A285 | 420 | 475 | 525 | 4.681 |
| 320 | 130 | 409A120 | 390 | 455 | 520 | 4.402 | 409A286 | 520 | 585 | 650 | 4.681 |
| 400 | 164 | 409A122 | 495 | 575 | 650 | 4.402 | 409A288 | 650 | 740 | 820 | 4.681 |
| 500 | 205 | 409A124 | 620 | 720 | 820 | 4.402 | 409A290 | 820 | 925 | 1025 | 4.681 |
| 625 | 256 | 409A127 | 770 | 900 | 1020 | 4.402 | 409A293 | 1020 | 1150 | 1250 | 4.681 |
| 750 | 306 | 409A129 | 920 | 1070 | 1250 | 4.402 | 409A295 | 1250 | 1250 | 1250 | 4.681 |
| 1024 | 334 | 409A132 | 1000 | 1170 | 1250 | 4.635 | 409A298 | 1250 | 1250 | 1250 | 4.914 |
| 1280 | 416 | 409A134 | 1250 | 1250 | 1250 | 4.635 | 409A300 | 1250 | 1250 | 1250 | 4.914 |
| 1600 | 522 | 409A137 | 1250 | 1250 | 1250 | 4.635 | 409A303 | | | | 4.914 |
| 2000 | 652 | 409A139 | 1250 | 1250 | 1250 | 4.635 | 409A305 | EM13 Recommended below double lines | | | 4.914 |
| 2500 | 815 | 409A142 | 1250 | 1250 | 1250 | 4.635 | 409A308 | | | | 4.914 |
| 3125 | 1020 | 409A145 | EM13 Recommended below double lines | | | 4.635 | 409A311 | | | | 4.914 |
| 4096 | 1070 | 409A149 | | | | 4.868 | 409A315 | | | | 5.147 |
| 5120 | 1340 | 409A152 | | | | 4.868 | 409A318 | | | | 5.147 |
| 6400 | 1680 | 409A156 | | | | 4.868 | 409A322 | | | | 5.147 |
| 8000 | 2100 | 409A160 | | | | 4.868 | 409A326 | | | | 5.147 |
| 10000 | 2620 | 409A163 | | | | 4.868 | 409A329 | | | | 5.147 |
| 12500 | 3280 | 409A166 | | | | 4.868 | 409A332 | | | | 5.147 |
| 15625 | 4100 | 409A170 | | | | 4.868 | 409A336 | | | | 5.147 |

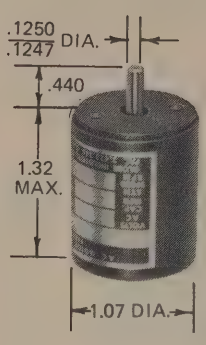
*Add dash number to part number for voltage: —1 = 6V —2 = 12V —3 = 24V

**Special order options:**
- — Integral tachometer generators.
- — Stud mounting.
- — Rear terminals.
- — Other ratios.
- — Ball bearing motors.

# TRW GLOBE MOTORS

## A.C. 1" DIA. HYSTERESIS SYNCHRONOUS AND INDUCTION PLANETARY GEARMOTORS

### TYPE SC — BASIC MOTOR




Globe Type SC a.c. motors are available in many variations. Motors are wound a) three-phase, two or four pole or b) single-phase, two, four, or six pole. Type SC motors are designed to meet the requirements of MIL-M-7969.

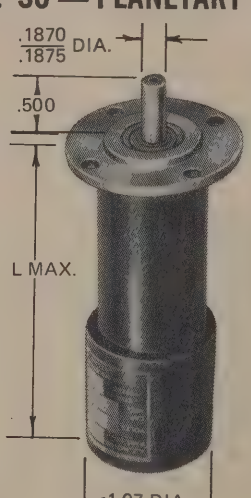
#### HYSTERESIS SYNCHRONOUS — STANDARD PART NUMBERS AND DATA

| Voltage (vac) | Freq. (Hz) | Poles | Phase | Schematic Wiring | Variable Lead Color B | C | Phasing Capacitor (mfd)(wvac) | Sync. Speed (rpm) | Max. Rated Load @ Sync. Speed (oz. in.) | Min. Pull Up Torque (oz. in.) | Max. Power (watts) No Load | Rated Load | Part No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | 400 | 2 | 1 | A | | Black | 1.50 100 | 24,000 | .16 | .16 | 11 | 11 | 53A1000-2 |
| 27 | 400 | 2 | 3 | B | | Black | Not Req'd | 24,000 | .13 | .13 | 11 | 11 | 53A1001-2 |
| 27 | 400 | 4 | 1 | A | | Green | 1.50 100 | 12,000 | .16 | .16 | 12 | 12 | 53A1002-2 |
| 27 | 400 | 4 | 3 | B | | Green | Not Req'd | 12,000 | .20 | .20 | 11 | 11 | 53A1003-2 |
| 27 | 400 | 6 | 1 | C | White | Gray | 1.50 100 | 8,000 | .10 | .10 | 12 | 12 | 53A111-2 |
| 115 | 400 | 2 | 1 | A | | Black | 0.068 300 | 24,000 | .16 | .16 | 11 | 11 | 53A1005-2 |
| 115 | 400 | 2 | 3 | B | | Black | Not Req'd | 24,000 | .13 | .13 | 11 | 11 | 53A1006-2 |
| 115 | 400 | 4 | 1 | A | | Green | 0.068 300 | 12,000 | .16 | .16 | 12 | 12 | 53A1007-2 |
| 115 | 400 | 4 | 3 | B | | Green | Not Req'd | 12,000 | .20 | .20 | 11 | 11 | 53A1008-2 |
| 115 | 400 | 6 | 1 | C | Black | Gray | 0.22 300 | 8,000 | .10 | .10 | 15 | 15 | 53A107-2 |
| 115 | 60 | 2 | 1 | D | White | | 2.00 200 | 3,600 | .07 | .07 | 8 | 8 | 53A118-2 |
| 115 | 60 | 4 | 1 | D | Red | | 2.00 200 | 1,800 | .07 | .07 | 12 | 12 | 53A338-2 |
| 115 | 60 | 6 | 1 | D | Black | | 2.50 200 | 1,200 | .05 | .04 | 9 | 9 | 53A117-2 |
| 200 | 400 | 2 | 3 | B | | Black | Not Req'd | 24,000 | .13 | .13 | 11 | 11 | 53A1010-2 |
| 200 | 400 | 4 | 3 | B | | Green | Not Req'd | 12,000 | .20 | .20 | 11 | 11 | 53A1011-2 |

#### INDUCTION — STANDARD PART NUMBERS AND DATA

| Voltage (vac) | Freq. (Hz) | Poles | Phase | Schematic Wiring | Variable Lead Color B | C | Phasing Capacitor (mfd)(wvac) | Min. Speed @ Rated Load (rpm) | Rated Load (oz. in.) | Min. Pull Up Torque (oz. in.) | Max. Power (watts) No Load | Rated Load | Part No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | 400 | 2 | 1 | A | | Black | 1.25 100 | 21,000 | .20 | .20 | 9 | 12 | 53A1000-1 |
| 27 | 400 | 2 | 3 | B | | Black | Not Req'd | 21,000 | .30 | .30 | 7 | 13 | 53A1001-1 |
| 27 | 400 | 4 | 1 | A | | Green | 1.50 100 | 10,000 | .25 | .25 | 13 | 13 | 53A1002-1 |
| 27 | 400 | 4 | 3 | B | | Green | Not Req'd | 10,000 | .30 | .30 | 11 | 13 | 53A1003-1 |
| 27 | 400 | 6 | 1 | C | White | Gray | 1.50 100 | 6,000 | .20 | .20 | 10 | 12 | 53A111-1 |
| 115 | 400 | 2 | 1 | A | | Black | 0.100 300 | 21,000 | .20 | .20 | 9 | 12 | 53A1005-1 |
| 115 | 400 | 2 | 3 | B | | Black | Not Req'd | 21,000 | .30 | .30 | 7 | 13 | 53A1006-1 |
| 115 | 400 | 4 | 1 | A | | Green | 0.068 300 | 10,000 | .25 | .25 | 13 | 13 | 53A1007-1 |
| 115 | 400 | 4 | 3 | B | | Green | Not Req'd | 10,000 | .30 | .30 | 11 | 13 | 53A1008-1 |
| 115 | 400 | 6 | 1 | C | Black | Gray | 0.22 300 | 6,000 | .12 | .12 | 14 | 14 | 53A107-1 |
| 115 | 60 | 2 | 1 | D | White | | 2.00 200 | 2,500 | .10 | .10 | 8 | 8 | 53A118-1 |
| 115 | 60 | 4 | 1 | D | Red | | 2.00 200 | 1,000 | .05 | .05 | 12 | 12 | 53A338-1 |
| 115 | 60 | 6 | 1 | D | Black | | 2.50 200 | 500 | .05 | .05 | 11 | 11 | 53A117-1 |
| 200 | 400 | 2 | 3 | B | | Black | Not Req'd | 21,000 | .30 | .30 | 7 | 13 | 53A1010-1 |
| 200 | 400 | 4 | 3 | B | | Green | Not Req'd | 10,000 | .30 | .30 | 11 | 13 | 53A1011-1 |

### TYPE SC — PLANETARY GEARMOTORS




This extremely small size and lightweight gearmotor consists of a Globe Type SC a.c. motor and a precision planetary geartrain. The combination provides smooth, dependable performance and maximum output torque in the smallest possible space.

Type SC gearmotors are designed to meet MIL-M-7969.

***HOW TO ORDER:**

To specify gearmotors, select the standard part number prefix from the standard part number and data table, plus the speed reduction ratios from page 3312, Type SD — Planetary Gearmotor chart.

#### HYSTERESIS SYNCHRONOUS — STANDARD PART NUMBERS AND DATA

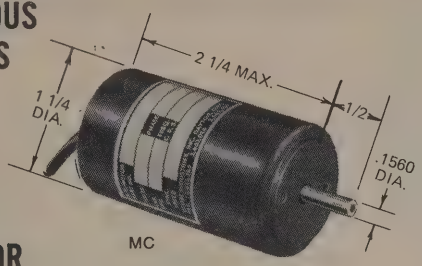
| Voltage (vac) | Freq. (Hz) | Poles | Phase | Schematic Wiring | Lead Color B | C | Var. | Phasing Capacitor (mfd)(wvac) | Sync. Speed (rpm) | Normal Rated Load @ Sync. Speed (oz. in.) | Min. Pull Up Torque (oz. in.) | Max. Power (watts) No Load | Rated Load | Part No.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | 400 | 2 | 1 | A | | | Blk | 1.25 100 | 24,000 | .16 | .16 | 11 | 11 | 59A1002 |
| 27 | 400 | 2 | 3 | B | | | Blk | Not Req'd | 24,000 | .13 | .13 | 11 | 11 | 59A1004 |
| 27 | 400 | 4 | 1 | A | | | Grn | 1.5 100 | 12,000 | .16 | .16 | 12 | 12 | 59A1006 |
| 27 | 400 | 4 | 3 | B | | | Grn | Not Req'd | 12,000 | .20 | .20 | 11 | 11 | 59A1008 |
| 115 | 400 | 2 | 1 | A | | | Blk | 0.068 300 | 24,000 | .16 | .16 | 11 | 11 | 59A1012 |
| 115 | 400 | 2 | 3 | B | | | Blk | Not Req'd | 24,000 | .13 | .13 | 11 | 11 | 59A1014 |
| 115 | 400 | 4 | 1 | A | | | Grn | 0.068 300 | 12,000 | .16 | .16 | 12 | 12 | 59A1016 |
| 115 | 400 | 4 | 3 | B | | | Grn | Not Req'd | 12,000 | .20 | .20 | 11 | 11 | 59A1018 |
| 115 | 400 | 6 | 1 | C | Blk | Gry | | 0.22 300 | 8,000 | .10 | .10 | 15 | 15 | 59A109 |
| 200 | 400 | 2 | 3 | B | | | Blk | Not Req'd | 24,000 | .13 | .13 | 11 | 11 | 59A1022 |
| 200 | 400 | 4 | 3 | B | | | Grn | Not Req'd | 12,000 | .20 | .20 | 11 | 11 | 59A1024 |
| 115 | 60 | 2 | 1 | D | | White | | 2.00 200 | 3,600 | .07 | .07 | 8 | 8 | 59A113 |
| 115 | 60 | 6 | 1 | D | | Blk | | 2.50 200 | 1,200 | .05 | .05 | 9 | 9 | 59A112 |

#### INDUCTION — STANDARD PART NUMBERS AND DATA

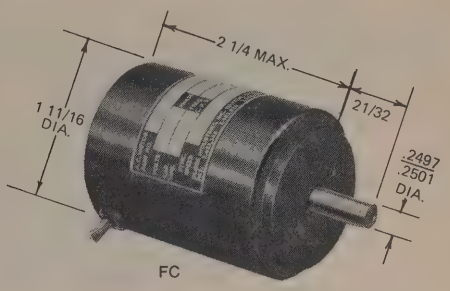
| Voltage (vac) | Freq. (Hz) | Poles | Phase | Schematic Wiring | Lead Color B | C | Var. | Phasing Capacitor (mfd)(wvac) | Min. Speed @ Rated Load (rpm) | Rated Load (oz. in.) | Min. Pull Up Torque (oz. in.) | Max. Power (watts) No Load | Rated Load | Part No.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | 400 | 2 | 1 | A | | | Blk | 1.50 100 | 21,000 | .20 | .20 | 9 | 12 | 59A1001 |
| 27 | 400 | 2 | 3 | B | | | Blk | Not Req'd | 21,000 | .30 | .30 | 7 | 13 | 59A1003 |
| 27 | 400 | 4 | 1 | A | | | Grn | 1.5 100 | 10,000 | .25 | .25 | 13 | 13 | 59A1005 |
| 27 | 400 | 4 | 3 | B | | | Grn | Not Req'd | 10,000 | .30 | .30 | 11 | 13 | 59A1007 |
| 115 | 400 | 2 | 1 | A | | | Blk | 0.10 300 | 21,000 | .20 | .20 | 9 | 12 | 59A1011 |
| 115 | 400 | 2 | 3 | B | | | Blk | Not Req'd | 21,000 | .30 | .30 | 7 | 13 | 59A1013 |
| 115 | 400 | 4 | 1 | A | | | Grn | 0.068 300 | 10,000 | .25 | .25 | 13 | 13 | 59A1015 |
| 115 | 400 | 4 | 3 | B | | | Grn | Not Req'd | 10,000 | .30 | .30 | 11 | 13 | 59A1017 |
| 115 | 400 | 6 | 1 | C | Blk | Gry | | 0.22 300 | 6,000 | .12 | .12 | 14 | 14 | 59A110 |
| 200 | 400 | 2 | 3 | B | | | Blk | Not Req'd | 21,000 | .30 | .30 | 7 | 13 | 59A1021 |
| 200 | 400 | 4 | 3 | B | | | Grn | Not Req'd | 10,000 | .30 | .30 | 11 | 13 | 59A1023 |

# TRW GLOBE MOTORS

## A.C. 1-1/4" & 1-11/16" DIA.
## HYSTERESIS SYNCHRONOUS AND INDUCTION MOTORS



MC



FC

## TYPE MC — BASIC MOTOR

Type MC motors are designed to meet the requirements of MIL-M-7969.

### HYSTERESIS SYNCHRONOUS — STANDARD PART NUMBERS AND DATA

| Voltage | Frequency (Hz) | Poles | Phase | Schematic | Variable Lead Color | Phasing Capacitor (mfd) | Phasing Capacitor (w.v.a.c.) | Sync Speed (rpm) | Max. Rated Load @ Sync Speed (oz. in.) | Min. Pull Up Torque (oz. in.) | Max. Power (watts) No Load | Max. Power (watts) Normal Rated Load | Part No. Tapped Hole Mount |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 115 | 60 | 2 | 1 | E | White | 1.00 | 200 | 3,600 | .70 | .50 | 12 | 12 | 18A108 |
| 115 | 60 | 4 | 1 | E | Black | 1.00 | 200 | 1,800 | .65 | .50 | 12 | 12 | 18A107 |
| 115 | 60 | 6 | 1 | F | Yellow | 1.00 | 200 | 1,200 | .50 | .40 | 12 | 12 | 18A437 |
| 115 | 400 | 2 | 1 | A | Black | 0.18 | 350 | 24,000 | .80 | .55 | 23 | 33 | 18A1003-2 |
| 115 | 400 | 2 | 3 | B | Black | Not Required | | 24,000 | .80 | .80 | 20 | 30 | 18A1004-2 |
| 115 | 400 | 4 | 1 | A | Green | 0.082 | 500 | 12,000 | .65 | .45 | 17 | 20 | 18A1005-2 |
| 115 | 400 | 4 | 3 | B | Green | Not Required | | 12,000 | .85 | .85 | 16 | 21 | 18A1006-2 |
| 115 | 400 | 6 | 1 | F | Gray | 0.15 | 400 | 8,000 | .45 | .25 | 16 | 18 | 18A250 |
| 200 | 400 | 2 | 3 | B | Black | Not Required | | 24,000 | .80 | .80 | 20 | 30 | 18A1008-2 |
| 200 | 400 | 4 | 3 | B | Green | Not Required | | 12,000 | .75 | .75 | 14 | 18 | 18A1009-2 |

### INDUCTION — STANDARD PART NUMBERS AND DATA

| Voltage | Frequency (Hz) | Poles | Phase | Schematic | Variable Lead Color | Phasing Capacitor (mfd) | Phasing Capacitor (w.v.a.c.) | Min. Speed @ Rated Load (rpm) | Rated Load (oz. in.) | Min. Pull Up Torque (oz. in.) | Max. Power (watts) No Load | Max. Power (watts) Rated Load | Part No. Tapped Hole Mount |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 115 | 400 | 2 | 1 | A | Black | 0.18 | 350 | 21,000 | 1.0 | .8 | 16 | 32 | 18A1003-1 |
| 115 | 400 | 2 | 3 | B | Black | Not Required | | 22,000 | 1.5 | 1.5 | 16 | 40 | 18A1004-1 |
| 115 | 400 | 4 | 1 | A | Green | 0.082 | 500 | 10,000 | 1.0 | 1.0 | 17 | 28 | 18A1005-1 |
| 115 | 400 | 4 | 3 | B | Green | Not Required | | 10,500 | 1.5 | 1.5 | 14 | 28 | 18A1006-1 |
| 200 | 400 | 2 | 3 | B | Black | Not Required | | 22,000 | 1.5 | 1.5 | 16 | 40 | 18A1008-1 |
| 200 | 400 | 4 | 3 | B | Green | Not Required | | 10,500 | 1.5 | 1.5 | 14 | 28 | 18A1009-1 |

## TYPE FC — BASIC MOTOR

Type FC motors are available with a wide variety of performance characteristics and are designed to meet the characteristics of MIL-M-7969.

### HYSTERESIS SYNCHRONOUS — STANDARD PART NUMBERS AND DATA

| Voltage | Frequency (Hz) | Poles | Phase | Schematic | Variable Lead Color B | Variable Lead Color C | Phasing Capacitor (mfd) | Phasing Capacitor (w.v.a.c.) | Sync Speed (rpm) | Max. Rated Load @ Sync Speed (oz. in.) | Min. Pull Up Torque (oz. in.) | Max. Power (watts) No Load | Max. Power (watts) Rated Load | Part No. Tapped Hole Mount |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 115 | 60 | 2 | 1 | G | White | Yellow | 3.0 | 200 | 3,600 | 1.0 | 1.0 | 20 | 20 | 75A121-2 |
| 115 | 60 | 4 | 1 | G | White | Green | 2.0 | 200 | 1,800 | 1.0 | 1.0 | 11 | 12 | 75A120-2 |
| 115 | 60 | 6 | 1 | H | White | Gray | 1.5 | 200 | 1,200 | 0.8 | 0.8 | 20 | 20 | 75A119-2 |
| 115 | 400 | 2 | 1 | A | | Black | 0.22 | 400 | 24,000 | 1.0 | 1.0 | 28 | 40 | 75A1003-2 |
| 115 | 400 | 2 | 3 | B | | Black | Not Required | | 24,000 | 1.0 | 1.0 | 23 | 37 | 75A1004-2 |
| 115 | 400 | 4 | 1 | A | | Green | 0.12 | 500 | 12,000 | 1.0 | 1.0 | 19 | 24 | 75A1005-2 |
| 115 | 400 | 4 | 3 | B | | Green | Not Required | | 12,000 | 1.2 | 1.2 | 21 | 26 | 75A1006-2 |
| 115 | 400 | 6 | 1 | H | Black | Gray | 1.3 | 200 | 8,000 | 0.8 | 0.8 | 35 | 45 | 75A107-2 |
| 200 | 400 | 2 | 3 | B | | Black | Not Required | | 24,000 | 1.0 | 1.0 | 24 | 38 | 75A1008-2 |
| 200 | 400 | 4 | 3 | B | | Green | Not Required | | 12,000 | 1.2 | 1.2 | 21 | 28 | 75A1009-2 |

### INDUCTION — STANDARD PART NUMBERS AND DATA

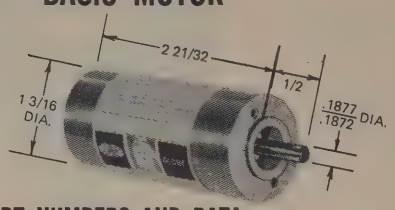
| Voltage | Frequency (Hz) | Poles | Phase | Schematic | Variable Lead Color B | Variable Lead Color C | Phasing Capacitor (mfd) | Phasing Capacitor (w.v.a.c.) | Min. Speed @ Rated Load (rpm) | Rated Load (oz. in.) | Min. Pull Up Torque (oz. in.) | Max. Power (watts) No Load | Max. Power (watts) Rated Load | Part No. Tapped Hole Mount |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 115 | 60 | 2 | 1 | G | White | Yellow | 3.0 | 200 | 3,000 | 1.4 | 1.4 | 18 | 20 | 75A121-1 |
| 115 | 60 | 4 | 1 | G | White | Green | 2.0 | 200 | 1,300 | 1.0 | 1.0 | 11 | 12 | 75A120-1 |
| 115 | 60 | 6 | 1 | H | White | Gray | 1.5 | 200 | 600 | 1.0 | 1.0 | 15 | 17 | 75A119-1 |
| 115 | 400 | 2 | 1 | A | | Black | 0.22 | 400 | 21,500 | 1.5 | 0.8 | 19 | 50 | 75A1003-1 |
| 115 | 400 | 2 | 3 | B | | Black | Not Required | | 22,500 | 2.5 | 2.5 | 10 | 65 | 75A1004-1 |
| 115 | 400 | 4 | 1 | A | | Green | 0.12 | 500 | 10,000 | 1.5 | 1.5 | 15 | 31 | 75A1005-1 |
| 115 | 400 | 4 | 3 | B | | Green | Not Required | | 11,000 | 2.5 | 2.5 | 12 | 40 | 75A1006-1 |
| 200 | 400 | 2 | 3 | B | | Black | Not Required | | 22,500 | 2.5 | 2.5 | 10 | 65 | 75A1008-1 |
| 200 | 400 | 4 | 3 | B | | Green | Not Required | | 11,000 | 2.5 | 2.5 | 12 | 40 | 75A1009-1 |

***HOW TO ORDER:**
The complete motor part number consists of the standard part number prefix, shown on the standard part number and data tables, plus the armature dash number. For gearmotors, each of the basic motor windings (dash no.), in the same type basic motor part number table, must be used, with the selected speed reduction ratio.

# TRW GLOBE MOTORS

## A.C. 1-3/16" & 1-1/4" DIA. HYSTERESIS SYNCHRONOUS AND INDUCTION PLANETARY GEARMOTORS

### TYPE CMC — BASIC MOTOR




Globe Type CMC motors are designed to meet requirements for extremely compact high-performance synchronous motors in high-quality industrial/commercial products. They are ideally suited to such applications as dictating machines, recorders, business machines, industrial timers, tools, and controls.

Thermosetting plastic encapsulation provides protection against shock and vibration and is impermeable to dirt and moisture.

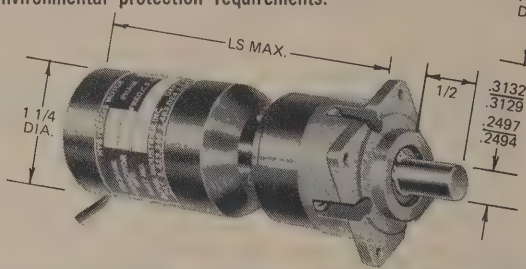
Induction versions and units for operation at other voltages and frequencies can be provided. Single phase operation requires a phasing capacitor (not furnished by Globe).

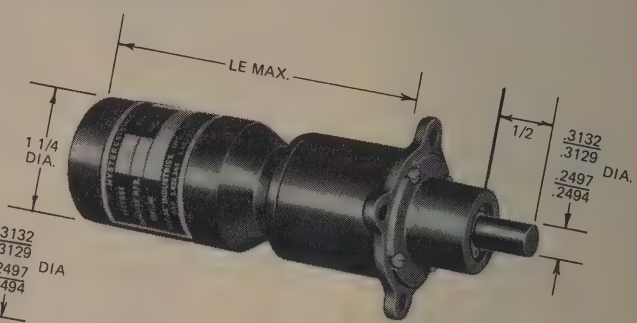
#### STANDARD PART NUMBERS AND DATA

| Voltage (v.a.c.) | Frequency (Hz) | Phase | Speed (rpm) | Torque max. start (oz. in.) | Torque max. sync. (oz. in.) | Current max. (amps) | Power input max. (watts) | Capacitor (mfd) | Capacitor (w.v.d.c.) | Standard* Part No. |
|---|---|---|---|---|---|---|---|---|---|---|
| 115 | 60 | 1 | 3,600 | .70 | .70 | .12 | 11 | 1.2 | 400 | 144A110-2 |
| 115 | 60 | 1 | 1,800 | .75 | .75 | .12 | 10 | 1.2 | 400 | 144A110-4 |

### TYPE MC — PLANETARY GEARMOTORS

These small, lightweight gearmotors consist of Globe Type MC hysteresis synchronous or induction motors and a precision planetary geartrain. Type MC planetary gearmotors are designed to meet all applicable MIL-specs including high and low temperature and complete environmental protection requirements.




#### HYSTERESIS SYNCHRONOUS — STANDARD PART NUMBERS AND DATA

| Voltage | Frequency (Hz) | Poles | Phase | Schematic | Variable Lead Color | Phasing Capacitor (mfd)(wvac) | Motor Sync. Speed (rpm) | Normal Rated Load @ Sync. Speed (oz. in.) | Motor Min. Pull Up Torque (oz. in.) | Max. Power (watts) No Load | Max. Power (watts) Normal Rated Load | Standard Part Number Prefix* Even Ratio eared flange 1/4" shaft | Even Ratio square flange 1/4" shaft | Odd Ratio square flange 1/4" shaft | Odd Ratio square flange 5/16" shaft | Odd Ratio square flange 1/4" shaft | Odd Ratio square flange 5/16" shaft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 115 | 60 | 2 | 1 | E | White | 1.00 200 | 3,600 | .70 | .50 | 12 | 12 | 33A603 | 33A613 | 33A648 | 33A513 | 33A643 | 33A638 |
| 115 | 60 | 4 | 1 | E | Black | 1.00 200 | 1,800 | .65 | .50 | 12 | 12 | 33A604 | 33A614 | 33A649 | 33A514 | 33A644 | 33A639 |
| 115 | 60 | 6 | 1 | F | Yellow | 1.00 200 | 1,200 | .65 | .40 | 12 | 12 | 33A1214 | 33A1215 | 33A1217 | 33A1216 | 33A1219 | 33A1218 |
| 115 | 400 | 6 | 1 | F | Gray | 0.15 400 | 8,000 | .45 | .25 | 16 | 18 | 33A1208 | 33A1209 | 33A1211 | 33A1210 | 33A1213 | 33A1212 |

| Voltage | Frequency (Hz) | Poles | Phase | Schematic | Variable Lead Color | Phasing Capacitor (mfd)(wvac) | Motor Sync. Speed (rpm) | Normal Rated Load @ Sync. Speed (oz. in.) | Motor Min. Pull Up Torque (oz. in.) | Max. Power (watts) No Load | Max. Power (watts) Normal Rated Load | All Ratios eared flange 1/4" shaft | All Ratios eared flange 5/16" shaft | All Ratios square flange 1/4" shaft | All Ratios square flange 5/16" shaft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 115 | 400 | 2 | 1 | A | Black | .18 350 | 24,000 | .80 | .55 | 23 | 33 | 33A2008 | 33A2108 | 33A2208 | 33A2308 |
| 115 | 400 | 2 | 3 | B | Black | Not Req'd | 24,000 | .80 | .80 | 20 | 30 | 33A2010 | 33A2110 | 33A2210 | 33A2310 |
| 115 | 400 | 4 | 1 | A | Green | 0.082 500 | 12,000 | .65 | .45 | 17 | 20 | 33A2012 | 33A2112 | 33A2212 | 33A2312 |
| 115 | 400 | 4 | 3 | B | Green | Not Req'd | 12,000 | .85 | .85 | 16 | 21 | 33A2014 | 33A2114 | 33A2214 | 33A2314 |
| 200 | 400 | 2 | 3 | B | Black | Not Req'd | 24,000 | .80 | .80 | 20 | 30 | 33A2018 | 33A2118 | 33A2218 | 33A2318 |
| 200 | 400 | 4 | 3 | B | Green | Not Req'd | 12,000 | .75 | .75 | 14 | 18 | 33A2020 | 33A2120 | 33A2220 | 33A2320 |

#### INDUCTION — STANDARD PART NUMBERS AND DATA

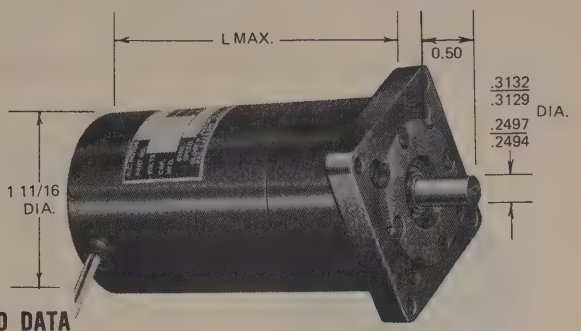
| Voltage | Frequency (Hz) | Poles | Phase | Schematic | Variable Lead Color | Phasing Capacitor (mfd)(wvac) | Motor Min. Speed @ Rated Load (rpm) | Normal Rated Load (oz. in.) | Motor Min. Pull Up Torque (oz. in.) | Max. Power (watts) No Load | Max. Power (watts) Normal Rated Load | Standard Part Number Prefix* All Ratios eared flange 1/4" shaft | All Ratios eared flange 5/16" shaft | All Ratios square flange 1/4" shaft | All Ratios square flange 5/16" shaft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 115 | 400 | 2 | 1 | A | Black | .18 350 | 21,000 | 1.0 | 0.8 | 16 | 32 | 33A2007 | 33A2107 | 33A2207 | 33A2307 |
| 115 | 400 | 2 | 3 | B | Black | Not Req'd | 22,000 | 1.5 | 1.5 | 16 | 40 | 33A2009 | 33A2109 | 33A2209 | 33A2309 |
| 115 | 400 | 4 | 1 | A | Green | 0.082 500 | 10,000 | 1.0 | 1.0 | 17 | 28 | 33A2011 | 33A2111 | 33A2211 | 33A2311 |
| 115 | 400 | 4 | 3 | B | Green | Not Req'd | 10,500 | 1.5 | 1.5 | 14 | 28 | 33A2013 | 33A2113 | 33A2213 | 33A2313 |
| 200 | 400 | 2 | 3 | B | Black | Not Req'd | 22,000 | 1.5 | 1.5 | 16 | 40 | 33A2017 | 33A2117 | 33A2217 | 33A2317 |
| 200 | 400 | 4 | 3 | B | Green | Not Req'd | 10,500 | 1.5 | 1.5 | 14 | 28 | 33A2019 | 33A2119 | 33A2219 | 33A2319 |

***HOW TO ORDER:**

To specify gearmotors, select the standard part number prefix from the standard part number and data table, plus the even speed reduction ratio desired from page 3119 or the odd speed reduction ratio from page 3125.

# TRW GLOBE MOTORS

## A.C. 1-11/16" DIA. HYSTERESIS SYNCHRONOUS AND INDUCTION PLANETARY GEARMOTORS TYPE FC




Globe Type FC planetary gearmotors offer 83 even (see shaded area page 3124) and 18 odd ratios ranging from 4:1 to 46,656.1. Special geartrains are available with ratios up to 17,000,000:1.

### HYSTERESIS SYNCHRONOUS — STANDARD PART NUMBERS AND DATA

| Voltage | Frequency (Hz) | Poles | Phase | Schematic | Lead Color B | Lead Color C | Phasing Capacitor (mfd) | Phasing Capacitor (wvac) | Motor Sync. Speed (rpm) | Normal Rated Load Sync. Speed (oz. in.) | Motor Min. Pull Up Torque (oz. in.) | Max. Power (watts) No Load | Max. Power (watts) Normal Rated Load | Standard Part No. Prefix* Odd Ratio 1/4" shaft | Odd Ratio 5/16" shaft | Even Ratio 1/4" shaft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 115 | 60 | 2 | 1 | G | White | Yellow | 3.0 | 200 | 3,600 | 1.0 | 1.0 | 20 | 20 | 83A510 | 83A116 | 83A138 |
| 115 | 60 | 4 | 1 | G | White | Green | 2.0 | 200 | 1,800 | 1.0 | 1.0 | 11 | 12 | 83A509 | 83A115 | 83A137 |
| 115 | 60 | 6 | 1 | H | White | Gray | 1.5 | 200 | 1,200 | .8 | .8 | 20 | 20 | 83A508 | 83A114 | 83A136 |
| 115 | 400 | 6 | 1 | H | Black | Gray | 1.3 | 200 | 8,000 | .8 | .8 | 35 | 45 | 83A113 | 83A108 | 83A122 |
| | | | | | | | | | | | | | | All Ratios 1/4" shaft | All Ratios 5/16" shaft | |
| 115 | 400 | 2 | 1 | A | Black | | 0.22 | 400 | 24,000 | 1.0 | 1.0 | 28 | 40 | 83A1008 | 83A1108 | |
| 115 | 400 | 2 | 3 | B | Black | | Not Required | | 24,000 | 1.0 | 1.0 | 23 | 37 | 83A1010 | 83A1110 | |
| 115 | 400 | 4 | 1 | A | Green | | 0.12 | 500 | 12,000 | 1.0 | 1.0 | 19 | 24 | 83A1012 | 83A1112 | |
| 115 | 400 | 4 | 3 | B | Green | | Not Required | | 12,000 | 1.2 | 1.2 | 21 | 26 | 83A1014 | 83A1114 | |
| 200 | 400 | 2 | 3 | B | Black | | Not Required | | 24,000 | 1.0 | 1.0 | 24 | 38 | 83A1018 | 83A1118 | |
| 200 | 400 | 4 | 3 | B | Green | | Not Required | | 12,000 | 1.2 | 1.2 | 21 | 28 | 83A1020 | 83A1120 | |

### INDUCTION — STANDARD PART NUMBERS AND DATA

| Voltage | Frequency (Hz) | Poles | Phase | Schematic | Lead Color B | Lead Color C | Lead Color D | Phasing Capacitor (mfd) | Phasing Capacitor (wvac) | Motor Min. Speed @ Rated Load (rpm) | Rated Load (oz. in.) | Min. Pull Up Torque (oz. in.) | Max. Power (watts) No Load | Max. Power (watts) Normal Rated Load | Standard Part No. Prefix* All Ratios 1/4" shaft | All Ratios 5/16" shaft |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 115 | 400 | 2 | 1 | A | Black | | | 0.22 | 400 | 21,500 | 1.5 | .8 | 19 | 50 | 83A1007 | 83A1107 |
| 115 | 400 | 2 | 3 | B | Black | | | Not Required | | 22,500 | 2.5 | 2.5 | 10 | 65 | 83A1009 | 83A1109 |
| 115 | 400 | 4 | 1 | A | Green | | | 0.12 | 500 | 10,000 | 1.5 | 1.5 | 15 | 31 | 83A1011 | 83A1111 |
| 115 | 400 | 4 | 3 | B | Green | | | Not Required | | 11,000 | 2.5 | 2.5 | 12 | 40 | 83A1013 | 83A1113 |
| 200 | 400 | 2 | 3 | B | Black | | | Not Required | | 22,500 | 2.5 | 2.5 | 10 | 65 | 83A1017 | 83A1117 |
| 200 | 400 | 4 | 3 | B | Green | | | Not Required | | 11,000 | 2.5 | 2.5 | 12 | 40 | 83A1019 | 83A1119 |

### DIMENSIONS — EVEN RATIOS

| Speed Reduction Ratio | Dimension LE | Dimension LS | Dim. "L" | Speed Reduction Ratio | Dimension LE | Dimension LS | Dim. "L" |
|---|---|---|---|---|---|---|---|
| 4:1 | 2.87 | 3.28 | 3.190 | 720:1 | 3.28 | 3.68 | 3.594 |
| 5:1 | 2.87 | 3.28 | 3.190 | 750:1 | 3.28 | 3.68 | 3.594 |
| 6:1 | 2.87 | 3.28 | 3.190 | 864:1 | 3.28 | 3.68 | 3.594 |
| 16:1 | 2.87 | 3.28 | 3.190 | 900:1 | 3.28 | 3.68 | 3.594 |
| 20:1 | 2.87 | 3.28 | 3.190 | 1,024:1 | 3.65 | 4.06 | 3.964 |
| 24:1 | 2.87 | 3.28 | 3.190 | 1,080:1 | 3.28 | 3.68 | 3.594 |
| 25:1 | 2.87 | 3.28 | 3.190 | 1,280:1 | 3.65 | 4.06 | 3.964 |
| 30:1 | 2.87 | 3.28 | 3.190 | 1,296:1 | 3.28 | 3.68 | 3.594 |
| 36:1 | 2.87 | 3.28 | 3.190 | 1,536:1 | 3.65 | 4.06 | 3.964 |
| 64:1 | 3.02 | 3.42 | 3.325 | 1,600:1 | 3.65 | 4.06 | 3.964 |
| 80:1 | 3.02 | 3.42 | 3.325 | 1,920:1 | 3.65 | 4.06 | 3.964 |
| 96:1 | 3.02 | 3.42 | 3.325 | 2,000:1 | 3.65 | 4.06 | 3.964 |
| 100:1 | 3.02 | 3.42 | 3.325 | 2,304:1 | 3.65 | 4.06 | 3.964 |
| 120:1 | 3.02 | 3.42 | 3.325 | 2,400:1 | 3.65 | 4.06 | 3.964 |
| 125:1 | 3.02 | 3.42 | 3.325 | 2,500:1 | 3.65 | 4.06 | 3.964 |
| 144:1 | 3.02 | 3.42 | 3.325 | 2,880:1 | 3.65 | 4.06 | 3.964 |
| 150:1 | 3.02 | 3.42 | 3.325 | 3,000:1 | 3.65 | 4.06 | 3.964 |
| 180:1 | 3.02 | 3.42 | 3.325 | 3,125:1 | 3.65 | 4.06 | 3.964 |
| 216:1 | 3.02 | 3.42 | 3.325 | 3,456:1 | 3.65 | 4.06 | 3.964 |
| 256:1 | 3.28 | 3.68 | 3.594 | 3,600:1 | 3.65 | 4.06 | 3.964 |
| 320:1 | 3.28 | 3.68 | 3.594 | 3,750:1 | 3.65 | 4.06 | 3.964 |
| 384:1 | 3.28 | 3.68 | 3.594 | 4,096:1 | 3.78 | 4.18 | 4.099 |
| 400:1 | 3.28 | 3.68 | 3.594 | 4,320:1 | 3.65 | 4.06 | 3.964 |
| 480:1 | 3.28 | 3.68 | 3.594 | 4,500:1 | 3.65 | 4.06 | 3.964 |
| 500:1 | 3.28 | 3.68 | 3.594 | 5,120:1 | 3.78 | 4.18 | 4.090 |
| 576:1 | 3.28 | 3.68 | 3.594 | 5,184:1 | 3.65 | 4.06 | 3.964 |
| 600:1 | 3.28 | 3.68 | 3.594 | 5,400:1 | 3.65 | 4.06 | 3.964 |
| 625:1 | 3.28 | 3.68 | 3.594 | 6,144:1 | 3.78 | 4.18 | 4.099 |

### DIMENSIONS — ODD RATIOS

| Speed Reduction Ratio | Torque Multiplier | Gear Train Max. Cont. Rating (oz. in.) | Dimension LE | Dimension LS | Dim. "L" |
|---|---|---|---|---|---|
| 4.33:1 | 3.2 | 5.4 | 2.87 | 3.28 | 3.190 |
| 5.28:1 | 4 | 6.8 | 2.87 | 3.28 | 3.190 |
| 18.78:1 | 12 | 20 | 2.87 | 3.28 | 3.190 |
| 27.94:1 | 17 | 29 | 2.87 | 3.28 | 3.190 |
| 81.37:1 | 41 | 70 | 3.02 | 3.42 | 3.325 |
| 121.1:1 | 62 | 105 | 3.02 | 3.42 | 3.325 |
| 147.7:1 | 75 | 128 | 3.02 | 3.42 | 3.325 |
| 352.6:1 | 145 | 247 | 3.28 | 3.68 | 3.594 |
| 524.6:1 | 215 | 366 | 3.28 | 3.68 | 3.594 |
| 639.9:1 | 262 | 445 | 3.28 | 3.68 | 3.594 |
| 780.6:1 | 320 | 544 | 3.28 | 3.68 | 3.594 |
| 1,528:1 | 500 | 850‡ | 3.66 | 4.06 | 3.964 |
| 2,273:1 | 740 | 1250‡ | 3.66 | 4.06 | 3.964 |
| 3,382:1 | 1100 | 1250‡ | 3.66 | 4.06 | 3.964 |
| 4,126:1 | 1350 | 1250‡ | 3.66 | 4.06 | 3.964 |
| 6,621:1 | 1730 | 1250‡ | 3.78 | 4.18 | 4.099 |
| 9,851:1 | 2580 | 1250‡ | 3.78 | 4.18 | 4.099 |
| 12,016:1 | 3150 | 1250‡ | 3.78 | 4.18 | 4.099 |
| 17,879:1 | 4700 | 1250‡ | 3.78 | 4.18 | 4.099 |
| 21,808:1 | 5700 | 1250‡ | 3.78 | 4.18 | 4.099 |

‡1/4 O.D. shafts are limited to 600 oz. in.

***HOW TO ORDER:**

To specify gearmotors, select the standard part number prefix from the standard part number and data table, plus the even or odd speed reduction ratio desired. See page 3119 for Torque Multiplier and Max. Continuous Torque. For higher ratios consult factory.

Max. Cont. Torque: The values in this column are based upon geartrain strength and capability for 1000 hrs. minimum life. Max. rated torque of motor selected x torque multiplier ratio must not exceed these values.

Max. Intermittent Torque = 2 x Max. Cont. Torque.

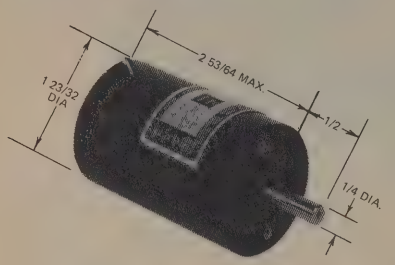
Momentary Stall Torque = 5 x Max. Cont. Torque.

Minimum Efficiency = Torque Multiplier Ratio divided by Speed Reduction Ratio x 100.

# TRW GLOBE MOTORS

## A.C. 1-23/32" DIA. HYSTERESIS SYNCHRONOUS AND INDUCTION MOTORS

### TYPE CFC — BASIC MOTOR




Type CFC motors are totally enclosed for dirt and moisture resistance, and have life-lubricated bearings. Induction versions, units for operation at other voltages and frequencies, and integral planetary geartrains are available. Single phase operation requires a phasing capacitor (not furnished by Globe).

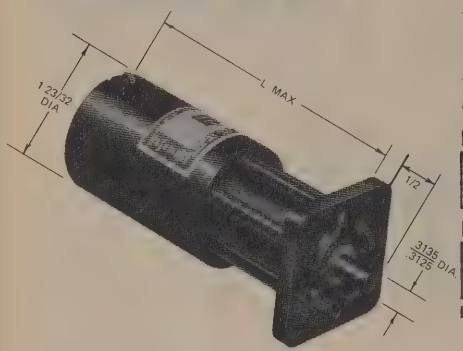
**HYSTERESIS SYNCHRONOUS — STANDARD PART NUMBERS AND DATA**

| Voltage (v.a.c.) | Freq. (Hz) | Ph. | Capacitor (mfd) | Capacitor (v.a.c.) | Speed no load (rpm) | Speed rated load (rpm) | Torque rated load (oz. in.) | Torque stall (oz. in.) | Power no load (watts) | Power rated load (watts) | Schematic | Standard Part No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 115 | 60 | 1 | 1.0 | 200 | 3600 | | 1.40 | 1.80 | 14 | 15 | K | 138A201-2 |
| 115 | 60 | 1 | 1.0 | 200 | 1800 | | 2.00 | 2.25 | 16 | 17 | L | 138A201-4 |
| 115 | 60 | 1 | 1.5 | 200 | 1200 | | 1.20 | 1.50 | 15 | 16 | M | 138A201-6 |

**INDUCTION — STANDARD PART NUMBERS AND DATA**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 115 | 60 | 1 | 1.0 | 200 | 3500 | 3000 | 1.5 | 2.5 | 14 | 15 | K | 138A202-2 |
| 115 | 60 | 1 | 3.5 | 200 | 1700 | 1550 | .75 | 3.8 | 16 | 17 | L | 138A202-4 |
| 115 | 60 | 1 | 1.5 | 200 | 1000 | 800 | .5 | 2.0 | 15 | 16 | M | 138A202-6 |

### TYPE CFC — PLANETARY GEARMOTORS
### COMMERCIAL MOTORS




Type CFC planetary gearmotors are lightweight a.c. commercial/industrial units designed to provide performance and size advantages of military gearmotors in lower cost package. Both hysteresis synchronous and induction versions can be provided with any of 83 standard planetary geartrains with speed reduction ratios (see shaded areas page 11) from 4:1 to 46,656:1, and torques to 1250 oz. in.

**HYSTERESIS SYNCHRONOUS — STANDARD PART NUMBERS AND DATA**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 115 | 60 | 1 | 1.0 | 200 | 3600 | 1.40 | 1.80 | 14 | 15 | K | 230A395 |
| 115 | 60 | 1 | 3.5 | 200 | 1800 | 2.00 | 2.25 | 16 | 16 | L | 230A396 |
| 115 | 60 | 1 | 1.5 | 200 | 1200 | 1.20 | 1.50 | 15 | 16 | M | 230A397 |

**INDUCTION — STANDARD PART NUMBERS AND DATA**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 115 | 60 | 1 | 1.0 | 200 | ** | 1.5 | 2.5 | 14 | 16 | K | 230A398 |
| 115 | 60 | 1 | 3.5 | 200 | ** | .75 | 3.8 | 16 | 17 | L | 230A399 |
| 115 | 60 | 1 | 1.5 | 200 | ** | .5 | 2.0 | 15 | 16 | M | 230A400 |

Low slip-high torque units available on special request.

### PERFORMANCE CHARACTERISTICS

| Speed Reduction Ratio | Dim. "L" | Gearmotor Output Speeds** 3,600 rpm input | 1,800 rpm input | 1,200 rpm input |
|---|---|---|---|---|
| 4:1 | 4.01 | 900.0 | 450.0 | 300.0 |
| 5:1 | 4.01 | 720.0 | 460.0 | 240.0 |
| 6:1 | 4.01 | 600.0 | 300.0 | 200.0 |
| 16:1 | 4.25 | 225.0 | 112.5 | 75.0 |
| 20:1 | 4.25 | 180.0 | 90.0 | 60.0 |
| 24:1 | 4.25 | 150.0 | 75.0 | 50.0 |
| 25:1 | 4.25 | 144.0 | 72.0 | 48.0 |
| 30:1 | 4.25 | 120.0 | 60.0 | 40.0 |
| 36:1 | 4.25 | 100.0 | 50.0 | 33.33 |
| 64:1 | 4.48 | 56.25 | 28.12 | 18.75 |
| 80:1 | 4.48 | 45.00 | 22.50 | 15.00 |
| 96:1 | 4.48 | 37.50 | 18.75 | 12.50 |
| 100:1 | 4.48 | 36.00 | 18.00 | 12.00 |
| 120:1 | 4.48 | 30.00 | 15.00 | 10.00 |
| 125:1 | 4.48 | 28.80 | 14.40 | 9.60 |
| 144:1 | 4.48 | 25.00 | 12.50 | 8.333 |
| 150:1 | 4.48 | 24.00 | 12.00 | 8.000 |
| 180:1 | 4.48 | 20.00 | 10.00 | 6.666 |
| 216:1 | 4.48 | 16.66 | 8.333 | 5.555 |
| 256:1 | 4.68 | 14.06 | 7.031 | 4.687 |
| 320:1 | 4.68 | 11.25 | 5.625 | 3.750 |
| 384:1 | 4.68 | 9.375 | 4.687 | 3.125 |
| 400:1 | 4.68 | 9.000 | 4.500 | 3.000 |
| 480:1 | 4.68 | 7.500 | 3.750 | 2.500 |
| 500:1 | 4.68 | 7.200 | 3.600 | 2.400 |
| 576:1 | 4.68 | 6.250 | 3.125 | 2.083 |
| 600:1 | 4.68 | 6.000 | 3.000 | 2.000 |
| 625:1 | 4.68 | 5.760 | 2.880 | 1.920 |
| 720:1 | 4.68 | 5.000 | 2.500 | 1.666 |
| 750:1 | 4.68 | 4.800 | 2.400 | 1.600 |
| 864:1 | 4.68 | 4.166 | 2.083 | 1.388 |
| 900:1 | 4.68 | 4.000 | 2.000 | 1.333 |
| 1,024:1 | 4.95 | 3.515 | 1.757 | 1.172 |
| 1,080:1 | 4.68 | 3.333 | 1.666 | 1.111 |
| 1,280:1 | 4.95 | 2.812 | 1.406 | 0.938 |
| 1,296:1 | 4.68 | 2.777 | 1.388 | 0.926 |
| 1,536:1 | 4.95 | 2.343 | 1.171 | 0.781 |
| 1,600:1 | 4.95 | 2.250 | 1.125 | 0.750 |
| 1,920:1 | 4.95 | 1.875 | 0.937 | 0.625 |
| 2,000:1 | 4.95 | 1.800 | 0.900 | 0.600 |
| 2,304:1 | 4.95 | 1.562 | 0.781 | 0.521 |
| 2,400:1 | 4.95 | 1.500 | 0.750 | 0.500 |
| 2,500:1 | 4.95 | 1.440 | 0.720 | 0.480 |
| 2,880:1 | 4.95 | 1.250 | 0.625 | 0.417 |
| 3,000:1 | 4.95 | 1.200 | 0.600 | 0.400 |
| 3,125:1 | 4.95 | 1.152 | 0.576 | 0.384 |
| 3,456:1 | 4.95 | 1.041 | 0.520 | 0.347 |
| 3,600:1 | 4.95 | 1.000 | 0.500 | 0.333 |
| 3,750:1 | 4.95 | 0.960 | 0.480 | 0.320 |
| 4,096:1 | 5.18 | 0.879 | 0.439 | 0.293 |
| 4,320:1 | 4.95 | 0.833 | 0.417 | 0.278 |
| 4,500:1 | 4.95 | 0.800 | 0.400 | 0.267 |
| 5,120:1 | 5.18 | 0.703 | 0.352 | 0.234 |
| 5,184:1 | 4.95 | 0.694 | 0.347 | 0.231 |
| 5,400:1 | 4.95 | 0.667 | 0.333 | 0.222 |
| 6,144:1 | 5.18 | 0.586 | 0.293 | 0.195 |
| 6,400:1 | 5.18 | 0.563 | 0.281 | 0.188 |
| 6,480:1 | 4.95 | 0.556 | 0.278 | 0.185 |
| 7,680:1 | 5.18 | 0.469 | 0.234 | 0.156 |
| 7,776:1 | 4.95 | 0.463 | 0.231 | 0.154 |
| 8,000:1 | 5.18 | 0.450 | 0.225 | 0.150 |
| 9,216:1 | 5.18 | 0.391 | 0.195 | 0.130 |
| 9,600:1 | 5.18 | 0.375 | 0.182 | 0.125 |
| 10,000:1 | 5.18 | 0.360 | 0.180 | 0.120 |
| 11,520:1 | 5.18 | 0.313 | 0.156 | 0.104 |
| 12,000:1 | 5.18 | 0.300 | 0.150 | 0.100 |
| 12,500:1 | 5.18 | 0.288 | 0.144 | 0.096 |
| 13,824:1 | 5.18 | 0.260 | 0.130 | 0.087 |
| 14,400:1 | 5.18 | 0.250 | 0.125 | 0.083 |
| 15,000:1 | 5.18 | 0.240 | 0.120 | 0.080 |
| 15,625:1 | 5.18 | 0.230 | 0.115 | 0.077 |
| 17,280:1 | 5.18 | 0.208 | 0.104 | 0.069 |
| 18,000:1 | 5.18 | 0.200 | 0.100 | 0.067 |
| 18,750:1 | 5.18 | 0.192 | 0.096 | 0.064 |
| 20,736:1 | 5.18 | 0.183 | 0.087 | 0.058 |
| 21,600:1 | 5.18 | 0.167 | 0.083 | 0.056 |
| 22,500:1 | 5.18 | 0.160 | 0.080 | 0.053 |
| 25,920:1 | 5.18 | 0.139 | 0.069 | 0.047 |
| 27,000:1 | 5.18 | 0.133 | 0.067 | 0.044 |
| 31,104:1 | 5.18 | 0.116 | 0.058 | 0.039 |
| 32,400:1 | 5.18 | 0.111 | 0.056 | 0.037 |
| 38,880:1 | 5.18 | 0.093 | 0.046 | 0.031 |
| 46,656:1 | 5.18 | 0.077 | 0.039 | 0.026 |

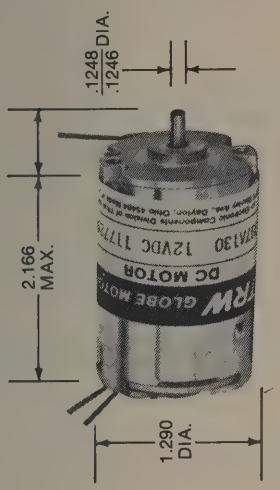
**Synchronous Motor. Output Torque = Torque Multiplier x Motor Torque.
Torque Multiplier = Reduction Ratio x Efficiency. Torque Max. Cont. Rating Refers to Max. Cont. Duty Rating of Geartrain.

***HOW TO ORDER:**

To specify gearmotors, select the standard part number prefix from the standard part number prefix from the standard part number and data table, plus speed reduction ratio desired. See page 3119 for Torque Multiplier and Max. Continuous Torque.

# TRW GLOBE MOTORS

## D.C. PERMANENT MAGNET MOTOR/TACHS
## TYPE EM-13 MOTOR/TACHS




Type EM13 motor/tachs consist of a permanent magnet D.C. motor and an A.C. tachometer. They are designed for high-volume, low-cost production, and for use in tape decks, business machines, computer peripherals, audio-visual, automotive, medical, recreational, and other industrial equipment.

Special order options: • Geartrain • EMI filters • Stud mounting.

### STANDARD PART NUMBERS AND DATA

**SLEEVE BEARINGS**

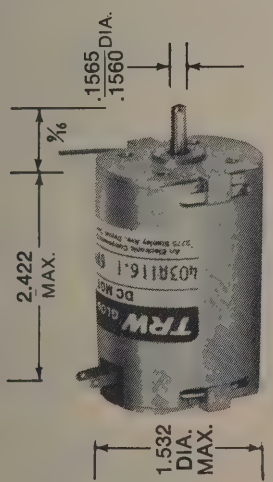
| Voltage (VDC) | Speed ±800 No Load (RPM) | Current No Load (Max. Amps) | Rated Torque (Oz. In.) | Current at Rated Torque (Max. Amps) | Inertia x $10^{-4}$ (Oz. In. $Sec.^2$) | Temp.* Rise (°C/Watt) | Torque Constant (Oz. In./ Amp) | Resistance ±15% (Ohms) | Part Number** |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 4600 | 0.5 | 3.0 | 3.0 | 4.9 | 8.5 | 1.4 | 1.1 | 397A108-1 |
| 12 | 5500 | 0.25 | 3.5 | 1.6 | 4.9 | 8.5 | 2.7 | 2.3 | 397A108-2 |
| 24 | 5700 | 0.125 | 4.0 | 1.0 | 4.9 | 8.5 | 5.5 | 8.3 | 397A-08-3 |
| 24 | 3600 | 0.10 | 4.0 | 0.8 | 4.9 | 8.5 | 7.5 | 16.5 | 397A108-4 |

**BALL BEARINGS**

| Voltage (VDC) | Speed ±800 No Load (RPM) | Current No Load (Max. Amps) | Rated Torque (Oz. In.) | Current at Rated Torque (Max. Amps) | Inertia x $10^{-4}$ (Oz. In. $Sec.^2$) | Temp.* Rise (°C/Watt) | Torque Constant (Oz. In./ Amp) | Resistance ±15% (Ohms) | Part Number** |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 5000 | 0.5 | 3.5 | 3.2 | 4.9 | 8.5 | 1.4 | 1.1 | 397A109-1 |
| 12 | 5600 | 0.25 | 4.0 | 1.8 | 4.9 | 8.5 | 2.7 | 2.7 | 397A109-2 |
| 24 | 5800 | 0.125 | 4.5 | 1.1 | 4.9 | 8.5 | 5.5 | 8.0 | 397A109-3 |
| 24 | 3700 | 0.10 | 4.5 | 0.9 | 4.9 | 8.5 | 7.7 | 16.5 | 397A109-4 |

*Winding temp. rise measured when mounted to 8″ x 8″ x ¼″ Alum. plate. Multiply by 1.4 when mounted to a heat insulator.

## TYPE EM-15 MOTOR/TACHS




Type EM-15 motor/tachs consist of a D.C. permanent magnet motor and an A.C. tachometer. They are are designed for high-volume, low-cost production, and for use in tape decks, business machines, computer peripherals, audio-visual, automotive, medical, recreational, and other industrial equipment.

Special order options: • Geartrain • EMI filters • Stud mounting • Rear terminal.

### STANDARD PART NUMBERS AND DATA

**SLEEVE BEARINGS**

| Voltage (VDC) | Speed ±800 No Load (RPM) | Current No Load (Max. Amps) | Rated Torque (Oz. In.) | Current at Rated Torque (Max. Amps) | Inertia x $10^{-4}$ (Oz. In. $Sec.^2$) | Temp* Rise (°C/Watt) | Torque Constant (Oz. In./ Amp) | Resistance ±15% (Ohms) | Part Number** |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 4500 | 0.32 | 1.0 | 1.4 | 1.5 | 11 | 1.5 | 2.3 | 397A106-1 |
| 12 | 5000 | 0.175 | 1.5 | 0.7 | 1.5 | 11 | 3.2 | 8.8 | 397A106-2 |
| 24 | 5200 | 0.10 | 1.7 | 0.45 | 1.5 | 11 | 4.8 | 24.0 | 397A106-3 |
| 12 | 6800 | 0.24 | 1.5 | 1.1 | 1.5 | 11 | 2.3 | 6.6 | 397A106-4 |

**BALL BEARINGS**

| Voltage (VDC) | Speed ±800 No Load (RPM) | Current No Load (Max. Amps) | Rated Torque (Oz. In.) | Current at Rated Torque (Max. Amps) | Inertia x $10^{-4}$ (Oz. In. $Sec.^2$) | Temp.* Rise (°C/Watt) | Torque Constant (Oz. In./ Amp) | Resistance ±15% (Ohms) | Part Number** |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 4700 | 0.32 | 1.0 | 1.4 | 1.5 | 11 | 1.5 | 2.3 | 397A107-1 |
| 12 | 5200 | 0.175 | 1.5 | 0.7 | 1.5 | 11 | 3.2 | 8.8 | 397A107-2 |
| 24 | 5400 | 0.10 | 1.7 | 0.45 | 1.5 | 11 | 5.3 | 24.0 | 397A107-3 |
| 12 | 6800 | 0.24 | 1.5 | 1.1 | 1.5 | 11 | 2.3 | 6.6 | 397A107-4 |

*Winding temp. rise measured when mounted to 8″ x 8″ x ¼″ Alum. plate. Multiply by 1.4 when mounted to a heat insulator.

### HOW TO ORDER

**Part Number. Units shown above are standard and may be ordered by part number. Consult TRW Globe for variations in mechanical or electrical performance to suit specific applications.

## *Permanent Magnet*

# DC Servo Motors & Servo Control Systems

## *for Analog or High-speed Stepper Applications*

### Snapper Series Permanent Magnet DC Servo Motors

2212

5115

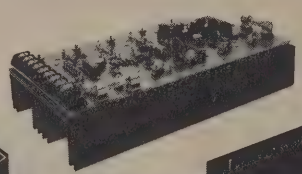
3323

*Optional for all motors

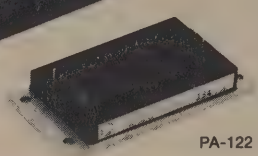
- 10 oz. - inches continuous to 100 ft. lbs. peak torque
- .01 to 15 HP
- 2" to 9.8" Frame Sizes
- Acceleration rates up to 50,000 radians/sec²
- Low Ripple Mating DC Tachometers*
- Integrally Mounted Optical Encoders*
- Double Shaft Extension on Motor/Tachometers*
- Low Cost for OEM use

### Wide Bandwidth DC Servo Amplifiers

PA-011



PA-601

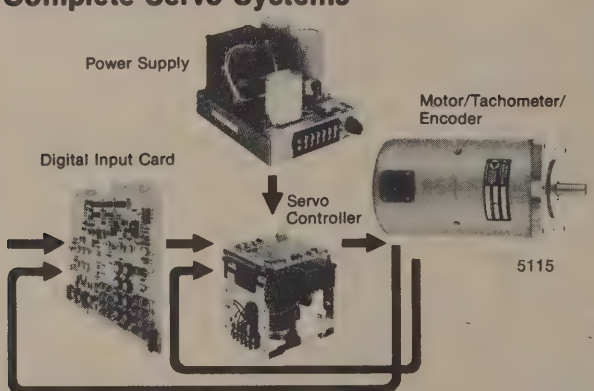


PA-122

*For Accurate Velocity or Position Control*

- Transistorized
- High Gain
- Short Circuit protected
- Priced for volume use
- Bi-directional

### Complete Servo Systems




*COMPLETE SYSTEMS include, as required, the following Torque Systems' hardware: Motor/Tachometer/Encoder Assembly; Rate Loop Controller Module; Line to DC Power Supply Module; Digital Input Card(s).*

*For Analog or Digital Velocity or Position – Input Commands can range from Manual to Computer*

- Horsepower Ratings 1/20 to over 1/2 HP
- Available as Modules of Pre-packaged
- Accelerations to over 300 rpm/millisecond
- Slew Rates to 50,000 steps per second (3,000 rpm)
- Overshoot Control
- **Microprocessor Based Systems with Programmable Velocity, Acceleration and Position**
- **Synchronized Dual Axis Systems for** smooth **Vector Generation**

***Call or write for complete catalogs (617) 891-0230 • TELEX 92-3424***

P.O. Box 588, 225E Crescent Street • Waltham, Massachusetts 02154

**"Torque Systems, When You Demand Reliable Performance"**

TORQUE SYSTEMS INCORPORATED

AN EG&G ROTRON COMPANY

# VERNITRON CONTROL COMPONENTS

a Division of Vernitron Corporation
1601 PRECISION PARK LANE • SAN DIEGO, CALIFORNIA 92073 • (714) 428-5581, TWX: 910-322-1862

## vernitorq® BRUSHLESS DC TORQUE MOTORS

| ype Number | | VBTM10-A | VBTM12-B | VBTM15-A | VBTM18-A | VBTM23-B | VBTM26-A | VBTM34-B | VBTM52-A |
|---|---|---|---|---|---|---|---|---|---|
| eak Torque | (oz-in) | 1.3 | 4.5 | 5 | 12 | 25 | 18 | 130 | 600 |
| ower @ Peak Torque | (watts) | 16 | 36 | 28 | 67 | 63 | 57 | 278 | 360 |
| ontinuous Torque | (oz-in) | .5 | .9 | 2.8 | 4 | 7 | 6 | 40 | 150 |
| ower @ Continuous Torque | (watts) | 2.4 | 1.5 | 9 | 8 | 5 | 6.5 | 27 | 23 |
| put Volt @ Cont. Torque | (volts) | 12 | 4 | 24 | 15 | 7 | 22 | 16 | 10 |
| orque Sensitivity | (oz-in/amp) | 2.5 | 2.25 | 7.5 | 8 | 10 | 6.5 | 24 | 67 |
| . C. Resistance | (ohms) | 60 | 9 | 62 | 30 | 10 | 7.5 | 9.5 | 4.5 |
| ngular Excursion | (degrees) | 120 | 120 | 50 | 120 | 60 | 60 | 120 | 40 |
| ack EMF | (volts/rad/sec) | .018 | .017 | .055 | .060 | .100 | .125 | .195 | .480 |
| ec. Time Constant L/R | (seconds) | $3x10^{-4}$ | $3x10^{-4}$ | $2.2x10^{-4}$ | $6x10^{-4}$ | $1.2x10^{-3}$ | $3.2x10^{-3}$ | $3.2x10^{-3}$ | $7.0x10^{-3}$ |
| otor Inertia | (oz-in $sec^2$) | $1.8x10^{-5}$ | $1.7x10^{-4}$ | $3.7x10^{-4}$ | $6.9x10^{-4}$ | $1.76x10^{-3}$ | $1.95x10^{-3}$ | $2.2x10^{-2}$ | $12x10^{-2}$ |
| scous Damping | (oz-in/rad/sec) | | | | | | | | |
| Infinite Source Impedance | | $1.5x10^{-5}$ | $7x10^{-5}$ | $8.3x10^{-5}$ | $5x10^{-4}$ | $3x10^{-2}$ | $3.2x10^{-2}$ | $1x10^{-2}$ | $2x10^{-2}$ |
| Zero Source Impedance | | $7.5x10^{-4}$ | $4.4x10^{-3}$ | $6.6x10^{-3}$ | $3.3x10^{-2}$ | 0.10 | .10 | .50 | 7.1 |
| eight | (oz) Max. | 1.5 | 2.5 | 3 | 3.9 | 8 | 7 | 26 | 88 |
| imensions | (inches) | | | | | | | | |
| | A | 1.000 | 1.178 | 1.500 | 1.719 | 2.270 | 2.500 | 3.400 | 5.250 |
| | B | .350 | .610 | .500 | .940 | .720 | .500 | 1.500 | 1.700 |
| | C | .125 | .125 | .125 | .187 | .250 | 250 | .250 | .500 |

NOTES: 1. Vernitorq motors have no friction or ripple torque.
2. Vernitorq brushless tachometer generators are also available in the various frame sizes.

## vernitorq® BRUSHLESS DC TORQUE MOTORS

• Limited rotation, wide angle • Infinite resolution for precise positioning • Direct drive for increased sensitivity, and response • Simplified design for economy, compact packaging.

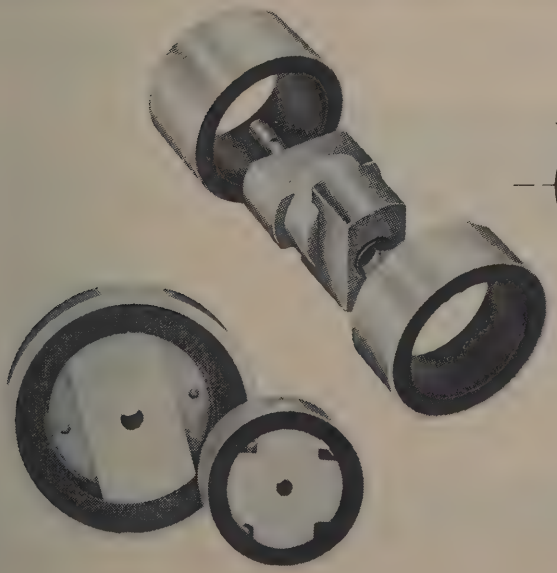
Elimination of brushes, use of toroidal field windings and permanent magnet rotors provides smooth operation without slot effect. Infinite resolution and high linearity result, allowing these motors to provide high accuracy in positioning, actuating, tensioning, measuring and indicating applications for both military and industrial use.

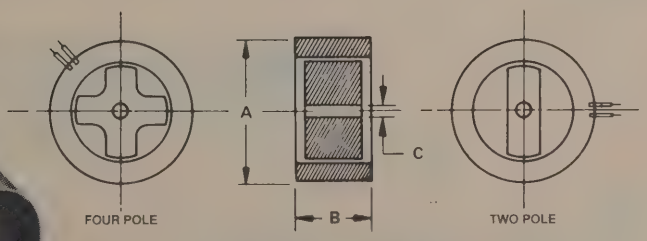
Vernitorq motors develop high torque with low input power and high acceleration rates which make it possible to couple them directly to the driven load without gears. The elimination of gearing aids response and eliminates backlash, gear tooth resilience, acceleration attenuation and other disadvantages of gearing.

Brushless and gearless operation eliminates electrical and mechanical noise, and explosion hazard. It also reduces the number of moving parts and associated friction wear.

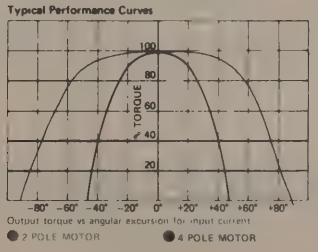
Vernitorq brushless DC torque motors are available in two and four-pole configurations, in a variety of sizes and outputs.

The motors are normally supplied "frameless" – without housing, shaft and bearings. Housed versions, with or without mounting flanges, are also available for all units.






Typical Performance Curves



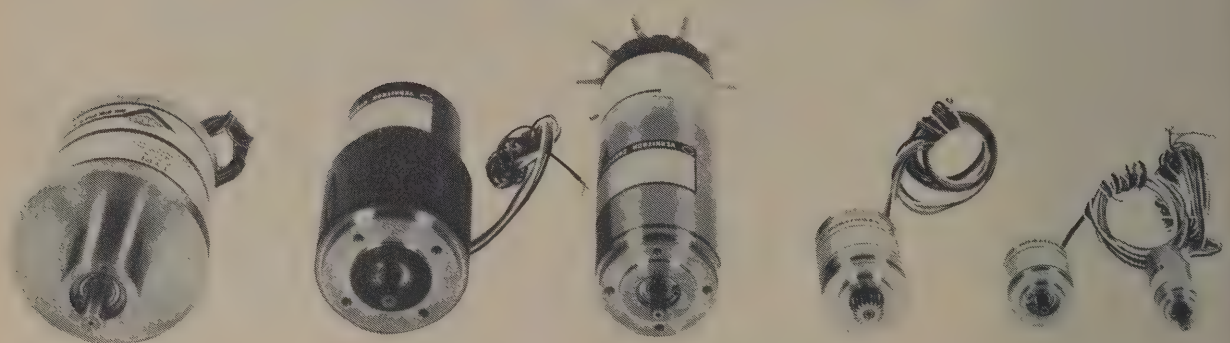

Output torque vs angular excursion for input current

# VERNITECH
Division of VERNITRON CORPORATION

*the best known name in*

## MOTORS, TACHOMETERS, INTEGRATORS & STEPPER MOTORS

**Over 1500 standard designs**
**or, custom designed to YOUR requirements**



## ALL UNITS WITH AND WITHOUT GEARHEADS

*the full range of motors*

| | | | | |
|---|---|---|---|---|
| **TYPES** | | Servomotors<br>Viscous Damped Motors<br>Inertially Damped Motors | Hysteresis Synchronous Motors<br>Stepper Motors<br>Motor Generators<br>Rate Motor Tachometers | Computing Motor Tachometers<br>Integrating Motor Tachometers<br>Spin (Gyro) Motors |
| **SIZES** | BuOrd Size 5 (0.5″ Dia.) to BuOrd Size 23 (2.250″ Dia.) | | | |
| **SPEEDS** | 900 RPM to 36,000 RPM<br>(Stepper Motors in Steps of 7.5°, 15°, 45°, and 90°) | | | |
| **FREQUENCY** | 50, 60, 80, 400, 420, 480, 1000, and 1200 (Sine or Square Wave)<br>Variable Frequency Motors are also standard at Vernitron | | | |
| **VOLTAGES** | 6.3V (Filament) to 280V | | | |
| **PHASES** | 1, 2, and 3 (In Stepper Motors—2, 3, and 4) | | | |

## PLUS THE NEW 14M4B SERIES INDUSTRIAL GRADE INDUCTION MOTORS

*typical data*

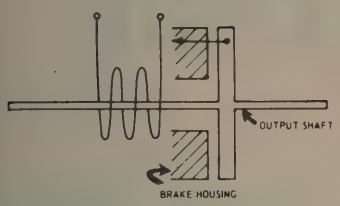
| | | | |
|---|---|---|---|
| **SIZE** | 1.375″ Dia. x 2.5″ | **VOLTAGE** | 115 VAC, Single $\phi$ |
| **BREAKDOWN TORQUE** | 1.0 Oz.-In. | **POWER** | 27 Watts |
| **NO LOAD SPEED** | 11,000 RPM | **FREQUENCY** | 400 Hz |

Also available in 60 Hz, 26 VAC versions. Ask about our industrial synchronous motors.

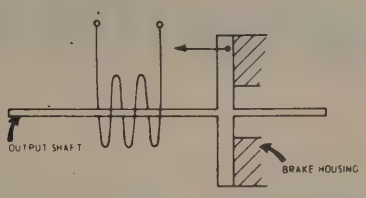
VERNITECH.
Division of VERNITRON CORPORATION
DEPT. EM, 300 MARCUS BOULEVAR
DEER PARK, LONG ISLAND, NY 1172
PHONE (516) 586-5100 TWX 510-227-607

# SCHEMATICS

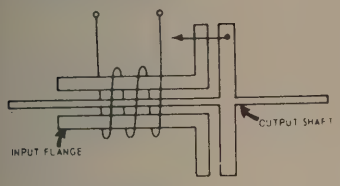
TYPE — MB
TYPE — WMB



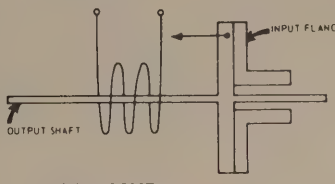

TYPE — SB
TYPE — WSB



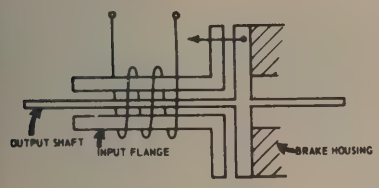

TYPE — MC
TYPE — WMC



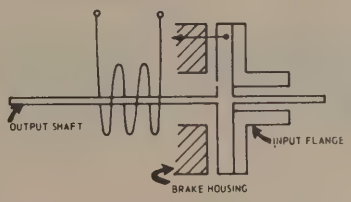

TYPE — SC
TYPE — WSC



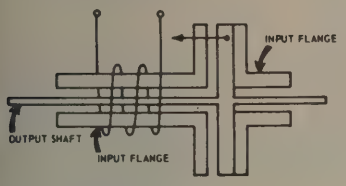

TYPE — MCSB
TYPE — WMCSB



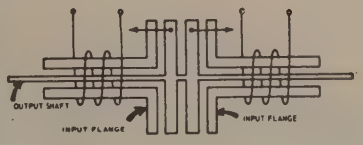

TYPE — SCMB
TYPE — WSCMB



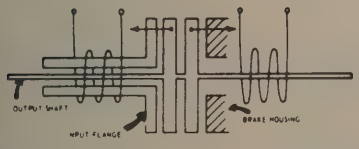

TYPE — MCSC
TYPE — WMCSC




TYPE — MCMC
TYPE — WMCMC




TYPE — MCMB
TYPE — WMCMB




VERNITECH
Division of VERNITRON CORPORATION

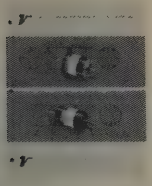
# DYNAMIC* CLUTCH AND BRAKE

*** FORMERLY DIVISION OF DYNAMIC INSTRUMENT CORP.**

## A COMPLETE LINE OF FRICTION CLUTCH AND BRAKE

- **Precision** Instrument Type Standard Length
- **Precision** Instrument Type Wafer Length
- **Industrial Type** (Enclosed Frame)
- **Industrial Type** (Open Frame)
- **Unitized Modules** (In-line Servo Assemblies)
- **Special** Application Units

**JUST OUT!**

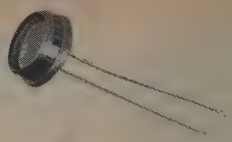


*SEND FOR OUR NEW GEARHEAD & SPEED REDUCER CATALOG*

VERNITECH.
Division of VERNITRON CORPORATION

DEPT. EM, 300 MARCUS BOULEVARD
DEER PARK, LONG ISLAND, NY 11729
PHONE (516) 586-5100 TWX 510-227-6079

# Clairex Photoconductive Cells



| Part No. | Diam. X Length (inches) | Resistance @ 2 ftc ± 33-1/3% | Minimum resistance ratio from 2 ftc to Dark within 5 sec. | Maximum voltage | Power Dissipation @ 25°C (mw) |
|---|---|---|---|---|---|
| CL5M9M | .55 X .18 | 11K | 1:1000 | 170 | 2000 500[1] |
| CL709L | .36 X .18 | 28K | | 100 | 125 |
| CL909L | .21 X .15 | 100K | | 100 | 50 |

Type 9 CdS, peak spectral response 5500 angstroms combines high speed with extreme temperature stability and high linearity.

| | | | | | |
|---|---|---|---|---|---|
| CL5M3 | .55 X .18 | 7.2K | 1:10,000 | 250 | 2000 500[1] |
| CL603 | .25 X .5 | 133K | | 300 | 75 |
| CL603A | .25 X .5 | 75K | | 300 | 75 |
| CL603AL | .25 X .5 | 3.5K | | 170 | 75 |
| CL703 | .36 X .18 | 133K | | 300 | 125 |
| CL703A | .36 X .18 | 67K | | 300 | 125 |
| CL703L | .36 X .18 | 2.7K | | 100 | 125 |
| CL903 | .21 X .15 | 133K | | 250 | 50 |
| CL903A | .21 X .15 | 67K | | 250 | 50 |
| CL903L | .21 X .15 | 6.0K | | 100 | 50 |

Type 3 CdSe, peak spectral response 7350 angstroms, fast response, and very high light-to-dark resistance ratio. Can be used for high speed switching or counting. Sensitive to near infra red. For use with incandescent or neon lamps.

| | | | | | |
|---|---|---|---|---|---|
| CL5M4 | .55 X .18 | 1.5K | 1:400 | 250 | 2000 500[1] |
| CL5M4L | .55 X .18 | 0.25K | | 170 | 2000 500[1] |
| CL604 | .25 X .5 | 30K | | 300 | 75 |
| CL604L | .25 X .5 | 1.5K | | 170 | 75 |
| CL704 | .36 X .18 | 30K | | 300 | 125 |
| CL704L | .36 X .18 | 0.6K | | 100 | 125 |
| CL904 | .21 X .15 | 30K | | 250 | 50 |
| CL904L | .21 X .15 | 2K | | 100 | 50 |

Type 4 CdSe, peak spectral response 6900 angstroms, lowest resistance photocells available. Can be used for "on-off" applications when low resistance is desired. For use with incandescent or neon lamps.

| | | | | | |
|---|---|---|---|---|---|
| CL5M5 | .55 X .18 | 9K | 1:100 | 250 | 2000 500[1] |
| CL5M5L | .55 X .18 | 1.5K | | 170 | 2000 500[1] |
| CL605 | .25 X .5 | 166K | | 300 | 75 |
| CL605L | .25 X .5 | 7.5K | | 170 | 75 |
| CL705 | .36 X .18 | 166K | | 300 | 125 |
| CL705L | .36 X .18 | 3.3K | | 100 | 125 |
| CL905 | .21 X .15 | 166K | | 250 | 50 |
| CL905L | .21 X .15 | 10K | | 100 | 50 |

Type 5 CdS, peak spectral response 5500 angstroms (closely matches the human eye), most stable, lowest memory photocell available. Can be used in light measuring applications and precision low speed switching. For use with incandescent, fluorescent or neon lamps.

| | | | | | |
|---|---|---|---|---|---|
| CL705HL | .36 X .18 | 28K | 1:1000 | 100 | 125 |
| CL905HLL | .21 X .15 | 15K | | 60 | 50 |
| CL905HL | .21 X .15 | 100K | | 100 | 50 |
| CL905HN | .21 X .15 | 700K | | 100 | 50 |

Type 5H CdS, peak spectral response 5500 angstroms (closely matches the human eye). Combines high speed, stability, linearity, and uniform color temperature response. Footnote 1. with and without heat sink.

| Part No. | Diam. X Length (inches) | Resistance @ 2 ftc ± 33-1/3% | Minimum resistance ratio from 2 ftc to Dark within 5 sec. | Maximum voltage | Power Dissipation @ 25°C (mw) |
|---|---|---|---|---|---|
| CL707H | .36 X .18 | 500K | 1:1000 | 300 | 125 |
| CL707HM | .36 X .18 | 100K | | 250 | 125 |
| CL907H | .21 X .15 | 600K | | 250 | 50 |
| CL907HN | .21 X .15 | 300K | | 100 | 50 |
| CL907HL | .21 X .15 | 24K | | 100 | 50 |

Type 7H CdS peak Spectral response 6200 angstroms. Very fast decay time coupled with low resistance and high linearity. Ideal for beam breaking applications.

| | | | | | |
|---|---|---|---|---|---|
| CL5M7 | .55 X .18 | 7.2K | 1:300 | 250 | 2000 500[1] |
| CL607 | .25 X .5 | 133K | | 300 | 75 |
| CL707 | .36 X .18 | 133K | | 300 | 125 |
| CL707L | .36 X .18 | 2.7K | | 100 | 125 |
| CL907 | .21 X .15 | 133K | | 250 | 50 |
| CL907N | .21 X .15 | 66K | | 100 | 50 |

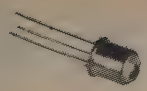
Type 7 CdS, peak spectral response 6150 angstroms, moderate speed and ratio. Can be used in general beam breaking applications. For use with incandescent, neon or fluorescent lamps.

| Part No. | Diam. X Length (inches) | Resistance @ 2 fc ± 33-1/3% | Minimum resistance ratio from 2 ftc to Dark within 5 sec. | Maximum voltage | Power Dissipation @ 25°C (mw) | Type |
|---|---|---|---|---|---|---|
| CL703/2 | .36 X .18 | 50K | 1:10,000 | 300 | 125 | 3 CdSe |
| CL703L/2 | .36 X .18 | 6.5K | 1:10,000 | 100 | 125 | 3 CdSe |
| CL704/2 | .36 X .18 | 17K | 1:400 | 300 | 125 | 4 CdSe |
| CL704L/2 | .36 X .18 | 1.5K | 1:400 | 100 | 125 | 4 CdSe |
| CL705/2 | .36 X .18 | 166K | 1:100 | 300 | 125 | 5 CdS |
| CL705L/2 | .36 X .18 | 7.5K | 1:100 | 100 | 125 | 5 CdS |

**Plastic Encapsulated Photoconductive Cells**

| | | | | | | |
|---|---|---|---|---|---|---|
| CL5P4 | .430 X .130 | 2.7K | 1:400 | 250 | 250 | Type 4 CdSe |
| CL5P4L | .430 X .130 | 0.45K | | 170 | 250 | |
| CL7P4 | .283 X .075 | 54K | | 300 | 125 | |
| CL7P4L | .283 X .075 | 1K | | 170 | 125 | |
| CL9P4L | .180 X .065 | 2K | | 100 | 50 | |
| CL5P5 | .430 X .130 | 9K | 1:100 | 250 | 250 | Type 5 CdS |
| CL5P5M | .430 X .130 | 6K | | 250 | 250 | |
| CL5P5L | .430 X .130 | 1.5K | | 170 | 250 | |
| CL7P5 | .283 X .075 | 166K | | 300 | 125 | |
| CL7P5L | .283 X .075 | 3.3K | | 170 | 125 | |
| CL9P5 | .180 X .065 | 166K | | 250 | 50 | |
| CL9P5L | .180 X .065 | 10K | | 100 | 50 | |
| CL7P5HL | .283 X .075 | 28K | 1:1000 | 170 | 125 | Type 5H CdS |
| CL9P5HL | .180 X .065 | 100K | | 100 | 50 | |
| CL7P7HL | .283 X .075 | 10K | 1:1000 | 170 | 125 | Type 7H CdS |
| CL7P7HM | .283 X .075 | 30K | | 400 | 125 | |
| CL9P7HL | .180 X .065 | 24K | | 100 | 50 | |
| CL9P7HLL | .180 X .065 | 4.5K | | 70 | 50 | |
| CL5P9M | .430 X .130 | 9K | 1:1000 | 250 | 250 | Type 9 CdS |
| CL7P9L | .283 X .075 | 28K | | 170 | 125 | |
| CL9P9L | .180 X .065 | 100K | | 100 | 50 | |
| CL9P9LL | .180 X .065 | 15K | | 70 | 50 | |

CLAIREX ELECTRONICS
A DIVISION OF CLAIREX® CORPORATION
560 South Third Avenue, Mount Vernon, N.Y. 10550 (914) 664-6602
WRITE FOR NAME OF YOUR NEAREST CLAIREX REPRESENTATIVE OR DISTRIBUTOR



# Clairex Phototransistors

## PHOTO TRANSISTORS and DARLINGTON PHOTOTRANSISTORS

### TO 18 FLAT WINDOW

| Part No. | $I_L$ (ma) $V_{CE}$ = 5V Min | Max | H (Note 1) mw/cm² | $BV_{CEO}$ Volts | $I_{CEO}$ (na) $V_{CE}$ = 10V | $P_T$ (mw) 25°C |
|---|---|---|---|---|---|---|
| CLT 2035 | 2.5 | 7.0 | 5.0 | 40 | 50 | 250 |
| CLT 2030 | 1.0 | 3.0 | 5.0 | 30 | 25 | 250 |
| CLT 2020 | 0.4 | 1.2 | 5.0 | 30 | 25 | 250 |
| CLR 2060 | 1.4<br>14.0 | 4.0<br>– | 0.20<br>2.0 | 40 | 100 | 250 |
| CLR 2050 | 0.6<br>6.0 | 1.8<br>– | 0.20<br>2.0 | 40 | 100 | 250 |
| CLR 2049 | .2 | .6 | 0.20 | 40 | 100 | 250 |

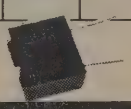
### TO 18 LENS

| Part No. | $I_L$ (ma) $V_{CE}$ = 5V Min | Max | H (Note 1) mw/cm² | $BV_{CEO}$ Volts | $I_{CEO}$ (na) $V_{CE}$ = 10V | $P_T$ (mw) 25°C |
|---|---|---|---|---|---|---|
| CLT 2165 | 15.0 | – | 5.0 | 40 | 50 | 250 |
| CLT 2164 | 7.0 | – | 5.0 | 40 | 50 | 250 |
| CLT 2160 | 4.0 | 12.0 | 5.0 | 30 | 25 | 250 |
| CLT 2150 | 2.4 | 7.2 | 5.0 | 40 | 25 | 250 |
| CLT 2140 | 1.2 | 3.6 | 5.0 | 40 | 25 | 250 |
| CLR 2180 | 0.6<br>4.0 | –<br>– | 0.02<br>0.20 | 40 | 100 | 250 |
| CLR 2170 | 0.2<br>2.0 | 0.8<br>– | 0.02<br>0.20 | 40 | 100 | 250 |

### WINDOW LENS .115 LENGTH X .077 DIAMETER

| Part No. | Lens | $I_L$ (ma) $V_{CE}$=5V Min | Max | H (Note 1) mw/cm² | $BV_{CEO}$ Volts | $I_{CEO}$ (na) $V_{CE}$=10V | $P_T$ (mw) 25°C |
|---|---|---|---|---|---|---|---|
| CLT 5170 | L | 1.4<br>6.0 | –<br>– | 5<br>20 | 40 | 25 | 50 |
| CLT 5160 | L | 0.5<br>2.0 | –<br>7.0 | 5<br>20 | 40 | 25 | 50 |
| CLR 5101 | L | 2.0<br>20.0 | –<br>– | 0.2<br>2.0 | 40 | 100 | 50 |

-2 Designation is with second lead welded to the header



### WINDOW LENS .110 LENGTH X .060 DIAMETER

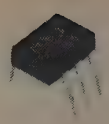
| Part No. | Window or Lens | $I_L$ (ma) $V_{CE}$=5V Min | Max | H (Note 1) mw/cm² | $BV_{CEO}$ Volts | $I_{CEO}$ (na) $V_{CE}$=10V | $P_T$ (mw) 25°C |
|---|---|---|---|---|---|---|---|
| CLR 3180 | L | 2.0 | – | 0.2 | 40 | 100 | 50 |
| CLT 3170 | L | 2.0<br>7.0 | –<br>– | 5<br>20 | 40 | 10 | 50 |
| CLT 3160 | L | 0.5<br>2.0 | –<br>7.0 | 5<br>20 | 50 | 10 | 50 |
| CLT 3030 | W | 0.25<br>1.0 | –<br>3.0 | 5<br>20 | 40 | 10 | 50 |
| CLT 3020 | W | 0.10<br>0.40 | –<br>1.2 | 5<br>20 | 50 | 10 | 50 |

### OPTICAL SWITCHES

| Part No. | Dimensions Height, Width, Thickness Inches | Gap Width Inches | Slit on Sensor | $I_{CE}$ min (ma) $V_{CE}$ = 5V | @ $I_F$ ma | $BV_{CEO}$ Volts | $I_D$ max (na) $V_{CE}$ = 10V | Internal $R_L$ | Sensor Darlington | Sensor Transistor |
|---|---|---|---|---|---|---|---|---|---|---|
| CLI55 | 1.3 x .950 x .500 | .250 | – | 12 | 10 | 30 | 100 | Yes | ✓ | |
| CLI55A | 1.3 x .950 x .500 | .250 | – | 1 | 20 | 30 | 100 | No | | ✓ |
| CLI55B | 1.3 x .950 x .500 | .250 | – | 12 | 10 | 30 | 100 | No | ✓ | |
| CLI55C | 1.3 x .950 x .500 | .250 | – | .5 | 10 | 30 | 100 | No | | ✓ |
| CLI200 | .425 x .500 x .250 | .100 | – | 1 | 20 | 40 | 50 | No | | ✓ |
| CLI200 D | .425 x .500 x .250 | .100 | – | 10 | 20 | 40 | 100 | No | ✓ | |
| CLI200S | .425 x .500 x .250 | .100 | .005 | .1 | 20 | 40 | 50 | No | | ✓ |
| CLI300 | 1.3 x .950 x .500 | .250 | – | 10 @ .5V | 20 | 30 | 100 | No | | ✓ |

CLAIREX ELECTRONICS
A DIVISION OF CLAIREX® CORPORATION
560 South Third Avenue, Mount Vernon, N.Y. 10550 (914) 664-6602
WRITE FOR NAME OF YOUR NEAREST CLAIREX REPRESENTATIVE OR DISTRIBUTOR

# Clairex Opto-Isolators



## LED PHOTOCONDUCTIVE CELL ISOLATORS

| Part No. | Package | R "ON" Ohms Max | R "OFF" Ohms Min | Cell Volts PAC | Td msec Typ |
|---|---|---|---|---|---|
| CLM6000 | Axial | 250@40ma | 500K | 60 | 350 |
| CLM6200 | Axial | 6K@16ma | 10Meg | 60 | 12 |
| CLM6500 | Axial | 300@16ma | 10Meg | 100 | 80 |
| CLM8000 | Axial | 400@40ma | 500K | 220 | 500 |
| CLM8200 | Axial | 2.8K@16ma | 10Meg | 220 | 20 |
| CLM8200/2 | Axial | 5.0K@16ma | 10Meg | 100 | 30 |
| CLM8500 | Axial | 2.0K@16ma | 10Meg | 220 | 40 |
| CLM8500/2 | Axial | 1.0K@16ma | 1Meg | 100 | 150 |
| CLM8500HV | Axial | 5K@16ma | 10Meg | 400 | 40 |
| CLM8600 | Axial | 2K@16ma | 10Meg | 500 | 40 |
| CLM9000 | Axial | 1.2Meg@16ma | 1000Meg | 3500 | 20 |
| CLM50 | DIP | 2.5K@16ma | 1Meg | 250 | 60 |
| CLM51 | DIP | 4.5K@1ma | 1Meg | 250 | 60 |
| CLM60 | DIP | 4K@±16ma | 1Meg | 250 | 60 |
| CLM61 | DIP | 7K@±1ma | 1Meg | 250 | 60 |

## IRED — PHOTOTRANSISTOR DIP ISOLATORS

| Part No. | C.T.R. $V_{CE}$=10V % Min | % Max | $I_F$ ma | Isolation Volts PAC | $BV_{CEO}$ $I_C$=1 ma Volts | $I_{CEO}$ @$V_{CE}$=10V na |
|---|---|---|---|---|---|---|
| CLI-2 | 30 | 100 | 10 | 2500 | 50 | 25 |
| CLI-3 | 100 | 200 | 10 | 2500 | 50 | 25 |
| | 30 | — | 1 | | | |
| CLI-4 | 150 | — | 10 | 2500 | 40 | 50 |
| | 40 | — | 1 | | | |
| CLI-5 | 20 | — | 10 | 2500 | 50 | 25 |
| CLI-6 | 50 | — | 10 | 2500 | 40 | 50 |
| CLI-7 | 12 | — | 16 | 2500 | 30 | 50 |
| CLI-8 | 20 | | 10 | 2500 | 30 | 50 |
| CLI-9 | 6 | 30 | 10 | 2500 | 30 | 100 |
| CLI506 | 6 | — | 10 | 2500 | 30 | 100 |
| CLI25 | 20 | — | ±10 | 2500 | 50 | 50 |
| | 5 | — | ± 1 | | | |
| CLI26 | 40 | — | ±10 | 2500 | 50 | 50 |
| | 10 | — | ± 1 | | | |

## IRED — PHOTOTRANSISTOR AXIAL ISOLATOR

| | | | | | | |
|---|---|---|---|---|---|---|
| CLA7 | 20 | | 10 | 7000 | 40 | 50 |

## IRED — PHOTODARLINGTON DIP ISOLATORS

| Part No. | C.T.R. $V_{CE}$=10V % Min | % Max | $I_F$ ma | Isolation Volts PAC | $BV_{CEO}$ $I_C$=.1 ma Volts | $I_{CEO}$ @ $V_{CE}$=10V na |
|---|---|---|---|---|---|---|
| CLI10 | 800 | — | 10 | 2500 | 50 | 100 |
| | 600 | — | 1 | | | |
| CLI11 | 500 | — | 1 | 2500 | 40 | 100 |
| CLI12 | 300 | — | 10 | 2500 | 40 | 100 |
| | 200 | — | 1 | | | |
| CLI13 | 100 | — | 10 | 2500 | 55 | 100 |
| CLI14 | 100 | — | 10 | 2500 | 30 | 100 |
| CLI27 | 400 | — | ±10 | 2500 | 40 | 100 |
| | 50 | — | ± 1 | | | |
| CLI28 | 600 | — | ±10 | 2500 | 40 | 100 |
| | 100 | — | ± 1 | | | |

## IRED — PHOTODARLINGTON AXIAL ISOLATOR

| | | | | | | |
|---|---|---|---|---|---|---|
| CLA7D | 400 | — | 10 | 7000 | 40 | 100 |

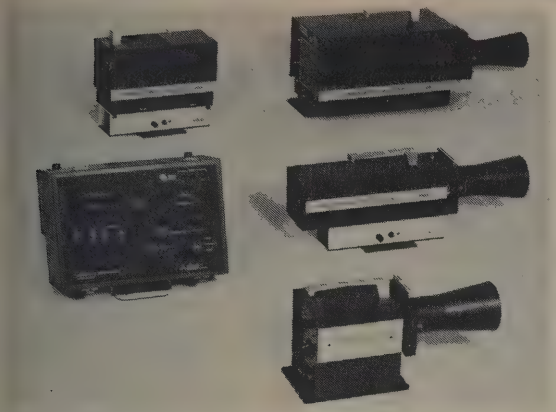
## PHOTOMOD® PHOTOCONDUCTIVE CELL — LAMP ISOLATORS

| Part No. | Dia. Inch | Length Inch | R "ON" Ohms Max | @ Lamp Rated Voltage Volts | R "OFF" Ohm Min | Cell Volts PAC | Isolation Voltage PAC |
|---|---|---|---|---|---|---|---|
| CLM3006A | .415 | 1.125 | 160 | 6 | 10 Meg | 100 | 2500 |
| CLM4006A | .415 | 1.125 | 55 | 6 | 1 Meg | 100 | 2500 |
| CLM3012A | .415 | 1.125 | 160 | 12 | 100 Meg | 100 | 2500 |
| CLM4012A | .415 | 1.125 | 30 | 12 | 1 Meg | 100 | 2500 |
| CLM5H10A | .415 | 1.125 | 3000 | 10 | 10 Meg | 100 | 2500 |
| CLM7H16A | .415 | 1.125 | 550 | 16 | 10 Meg | 170 | 2500 |
| CLM3120A | .415 | 1.125 | 1150 | 120 | 100 Meg | 100 | 2500 |
| CLM4120A | .415 | 1.125 | 160 | 120 | 1 Meg | 100 | 2500 |
| CLM3000 | .420 X .445 X .620 | | 500 | 14 | 1 Meg | 175 | 1600 |
| CLM3500 | .420 X .445 X .620 | | 160 | 120 | 1 Meg | 250 | 1600 |

**CLAIREX ELECTRONICS**
A DIVISION OF CLAIREX® CORPORATION
560 South Third Avenue, Mount Vernon, N.Y. 10550 (914) 664-6602
WRITE FOR NAME OF YOUR NEAREST CLAIREX REPRESENTATIVE OR DISTRIBUTOR

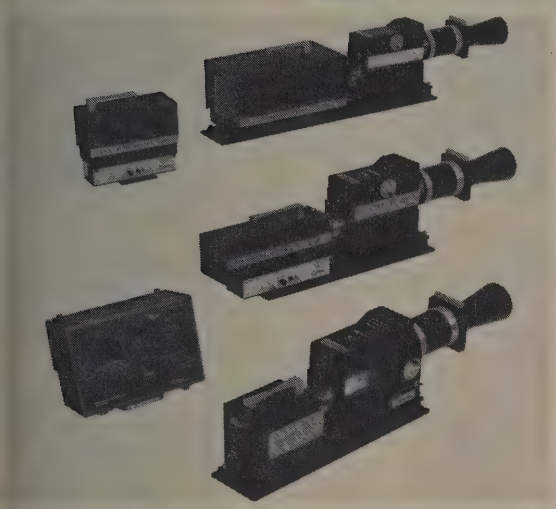
EG&G
ELECTRO-OPTICS DIVISION
DEPT. EM, 35 E CONGRESS STREET, SALEM, MASS. 01970 • TEL.: (617) 745-3200

# LIGHT MEASUREMENT INSTRUMENTS



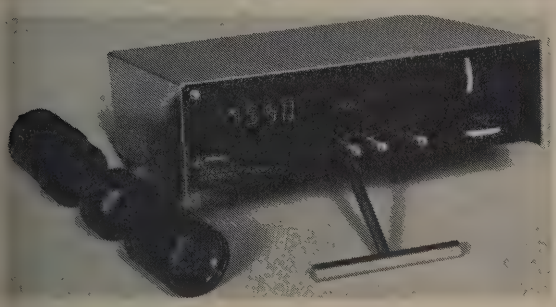
## MODEL 580 RADIOMETER/PHOTOMETER SYSTEMS

The Model 580 Systems provide fast, accurate measurements of optical radiation in radiometric and photometric terms. The systems are inherently capable of measuring both continuous (cw) sources as well as pulsed events as fast as one nanosecond in duration. An autoranging digital panel display provides readings of average power and integrated energy. The Detector Heads also have provision for oscilloscope display of pulsed light signals so that wave shape measurements can be made, i.e., peak power, pulse duration, and rise and fall times. The spectral range is from 0.2 $\mu$m (200 nm) in the ultraviolet to 3.2 $\mu$m (3200nm) in the near infrared. The overall dynamic range is over fifteen decades (full scale) of light intensities. The basic system concept can be used in a great variety of applications due to the designed modular approach of interchangeable Detector Heads and accessories. The Model 580 has become an industry standard for most laser output measurements.



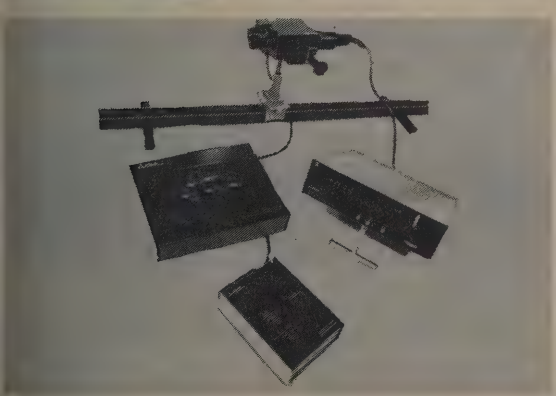
## MODEL 580/585 SPECTRORADIOMETER SYSTEMS

The Model 580/585 Systems add a digital grating monochromator and additional optics onto the Model 580 Radiometer Detector Head, thereby allowing absolute measurements of the power and energy of chromatic cw and pulsed light sources as a function of wavelength. A truly functional system with provision for recorder ouput and BCD computer interface, the 580/585 can measure over a 12-decade range of light levels. The system can also be used as a radiometer and photometer.



## MODEL 550 RADIOMETER/PHOTOMETER SYSTEM

The Model 550 Radiometer/Photometer provides fast, precise measurements with direct readings in 12 photometric and radiometric units. The direct readings, which are easily taken from a 3½ digit panel meter and digital decade indicator, eliminate the need for post measurement calculations. The system is both manual and autoranging over seven full scale decades. Measurements can be obtained of both pulsed and continuous sources with excellent accuracy, repeatability, and stability. Provision for ambient compensation permits its use outside of a dark room environment. High sensitivity is achieved through the use of a single, low noise silicon multiprobe detector.



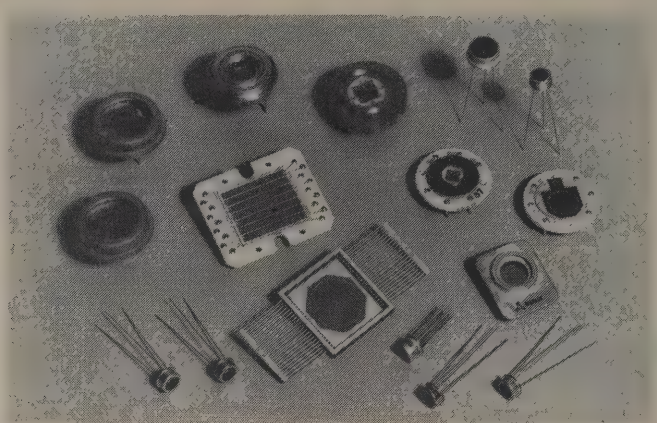
## MODEL 550/555 SPECTRORADIOMETER SYSTEM

The Model 550/555 Spectroradiometer System integrates all the state-of-the-art features of the Model 550 Radiometer with the precision and accuracy of a holographic grating monochromator to yield a low cost, compact, light weight, high efficiency measurement system capable of providing radiometric measurements of both continuous and pulsed sources as a function of wavelength. The Model 550/555 covers a wide spectral region extending from 280 nm in the ultraviolet to 1100 nm in the near-infrared with an absolute system measurement accuracy of ±3%. Ancillary components expand the basic manual system into a completely automatic measurement system with programmable wavelength scan ranges and scan speeds, automatic order sorting filter sequencing, and interface compatibility for automatic data acquisition, conversion, and printout.

**Other standard light measurement instruments together with accessories and optical calibration standards are available.**
**E G & G also offers complete optical calibration services.**

EG&G
ELECTRO-OPTICS DIVISION
35 E CONGRESS STREET, SALEM, MASS. 01970 • TEL.: (617) 745-3200

# SILICON PHOTODIODES



## SILICON PIN PHOTODIODES
## High Speed Photoconductive

- Spectral Range: 0.35 to 1.15 $\mu$m
- Responsivity: 0.5 A/W @ 0.9 $\mu$m; 0.42 A/W @ 1.06 $\mu$m (YAG Series)
- Linearity of Response: Within 5% over 7 Decades
- Operating Voltage: 0 to 180 Volts

| Type No. | Active Area ($mm^2$) | Package (JEDEC) | Dark Current (nA) | NEP ($\lambda$, 600, 1) (watts) | Rise Time (ns) | Capacitance (pf) | Test Voltage (V) |
|---|---|---|---|---|---|---|---|
| SGD-040A | 0.82 | TO-5 | 3 | $9.6 \times 10^{-14}$ @ 0.9 $\mu$m | 3 | 2 | 100 |
| SGD-040B | 0.82 | TO-46 | 3 | $9.6 \times 10^{-14}$ @ 0.9 $\mu$m | 3 | 2 | 100 |
| SGD-040L | 0.82 | TO-5/Lens | 3 | $9.6 \times 10^{-14}$ @ 0.9 $\mu$m | 3 | 2 | 100 |
| SGD-100A | 5.1 | TO-5 | 10 | $1.0 \times 10^{-13}$ @ 0.9 $\mu$m | 4 | 4 | 100 |
| SGD-160 | 13 | TO-8 | 50 | $3.0 \times 10^{-13}$ @ 0.9 $\mu$m | 7 | 8 | 100 |
| SGD-444 | 100 | TO-36 | 200 | $5.9 \times 10^{-13}$ @ 0.9 $\mu$m | 10 | 80 | 100 |
| SGD-444-2 | Same as SGD-444 but in bi-cell configuration | | | | | | |
| SGD-444-4 | Same as SGD-444 but in quad-cell configuration | | | | | | |
| YAG-100A | 5.1 | TO-5 | 20 | $2.2 \times 10^{-13}$ @ 1.06 $\mu$m | 8 | 3.5 | 180 |
| YAG-444 | 100 | TO-36 | 200 | $5.6 \times 10^{-13}$ @ 1.06 $\mu$m | 8 | 35 | 180 |
| YAG-444-4 | Same as YAG-444 but in quad-cell configuration | | | | | | |
| SND-130 | 0.82 | TO-46 | — | $1.5 \times 10^{-14}$ @ 0.9 $\mu$m | | | |
| SND-140 | 5.1 | TO-5 | — | $2.7 \times 10^{-14}$ @ 0.9 $\mu$m | | | |
| SND-680 | 23.6 | TO-8 | — | $5.5 \times 10^{-14}$ @ 0.9 $\mu$m | | | |
| DT-25 | 5.1 | TO-5 | 30 | $3.5 \times 10^{-13}$ @ 0.9 $\mu$m | 5 | 7 | 90 |
| DT-40 | 13 | TO-8 | 70 | $6.0 \times 10^{-13}$ @ 0.9 $\mu$m | 7 | 10 | 90 |
| DT-110 | 100 | TO-36 | 400 | $9.5 \times 10^{-13}$ @ 0.9 $\mu$m | 10 | 100 | 90 |
| SHS-100 | Similar to SGD-100A with 30% higher peak responsivity | | | | | | |

## FIBER OPTICS RECEIVER

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| FND-100 | 5.1 | TO-5 | <100 | $2.9 \times 10^{-13}$ @ 0.9 $\mu$m | <1 | 8.5 | 90 |
| FOD-100 | 5.1 | AMP 530525-1 | <100 | $2.9 \times 10^{-13}$ @ 0.9 $\mu$m | <1 | 8.5 | 90 |

## SILICON PHOTOVOLTAIC DETECTORS — Low Noise

- Spectral Range: 0.35 to 1.15 $\mu$m (PV Series); 0.20 to 1.15 $\mu$m (UV Series)
- Responsivity: 0.47 A/W @ .95 $\mu$m; 0.09 A/W @ 0.2 $\mu$m (UV Series)
- Linearity of Response: Within 1% over 7 Decades
- Operating Mode: Photovoltaic — no bias

| Type No. | Active Area ($mm^2$) | Package (JEDEC) | Shunt Resistance (M$\Omega$) | NEP ($\lambda$, 600, 1) (watts) | Rise Time (ns) | Capacitance (pf) |
|---|---|---|---|---|---|---|
| PV-040 | 0.82 | TO-46 | 500 | $1.0 \times 10^{-14}$ @ 0.95 $\mu$m | 12 | 25 |
| PV-100A | 5.1 | TO-5 | 100 | $3.2 \times 10^{-14}$ @ 0.95 $\mu$m | 25 | 150 |
| PV-215 | 23.6 | TO-8 | 50 | $4.3 \times 10^{-14}$ @ 0.95 $\mu$m | 30 | 700 |
| PV-444A | 100 | TO-36 | 10 | $9.0 \times 10^{-14}$ @ 0.95 $\mu$m | 45 | 2800 |
| PV-800A | 314 | Special | 5 | $1.3 \times 10^{-13}$ @ 0.95 $\mu$m | 75 | 9000 |
| UV-100A | 5.1 | TO-5 | 100 | $2.3 \times 10^{-13}$ @ 0.23 $\mu$m | 25 | 150 |
| UV-215 | 23.6 | TO-8 | 50 | $2.5 \times 10^{-13}$ @ 0.23 $\mu$m | 30 | 700 |
| UV-444A | 100 | TO-36 | 10 | $5.0 \times 10^{-13}$ @ 0.23 $\mu$m | 45 | 2800 |
| UV-800A | 314 | Special | 5 | $7.5 \times 10^{-13}$ @ 0.23 $\mu$m | 75 | 9000 |

## SILICON DETECTOR/ AMPLIFIER COMBINATIONS

- Spectral Range: 0.35 to 1.15 $\mu$m (except HUV Series); 0.20 to 1.15 $\mu$m (HUV Series)
- Supply Voltage: $\pm$15 Volts

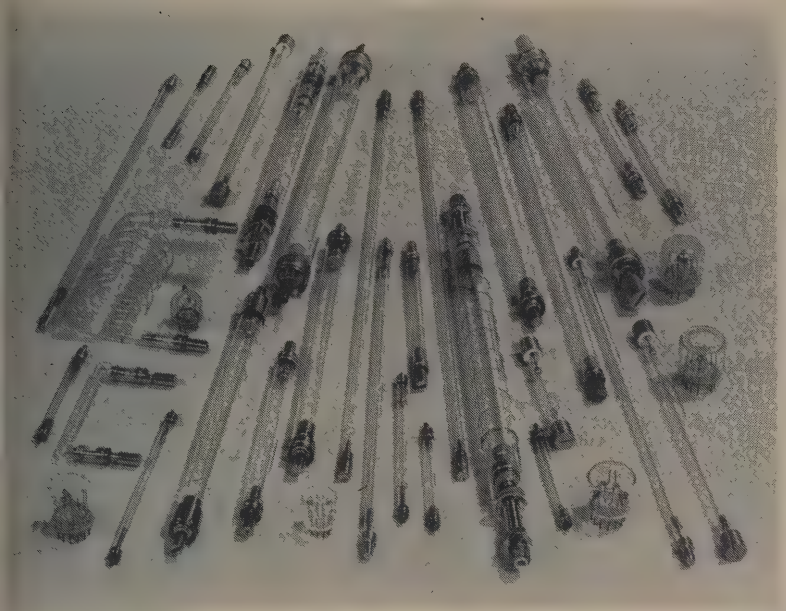
| Type No. | Active Area ($mm^2$) | Package (JEDEC) | Responsivity $R_f$ = 200 M$\Omega$ (V/W) | NEP ($\lambda$, f, 1) (watts) | Gain Bandwidth Product (MHz) | Slew Rate (V/$\mu$sec) |
|---|---|---|---|---|---|---|
| HAD-1000A | 5.1 | TO-5 | $10^8$ @ 0.9 $\mu$m | $1.5 \times 10^{-13}$ @ 0.95 $\mu$m @ 400Hz | 2.0 | 6 |
| HAV-1000 | 5.1 | TO-5 | $10^8$ @ 0.9 $\mu$m | $1.1 \times 10^{-13}$ @ 0.95 $\mu$m @ 400Hz | 1.0 | 6 |
| HAV-4000A | 100 | Modified DIP | $10^8$ @ 0.9 $\mu$m | $9.0 \times 10^{-14}$ @ 0.95 $\mu$m @ 400Hz | 0.1 | 5 |
| HUV-1000 | 5.1 | TO-5 | $10^7$ @ 0.23 $\mu$m | $7.0 \times 10^{-13}$ @ 0.23 $\mu$m @ 400Hz | 1.0 | 6 |
| HUV-4000A | 100 | Modified DIP | $10^7$ @ 0.23 $\mu$m | $6.0 \times 10^{-13}$ @ 0.23 $\mu$m @ 400Hz | 0.1 | 5 |
| MHZ-018 | 5.1 | Modified DIP | $10^8$ @ 0.9 $\mu$m | $4.7 \times 10^{-11}$ @ 0.95 $\mu$m @ 18MHz | 100 | |
| MHZ-018Y | 5.1 | Modified DIP | $5 \times 10^9$ @ 1.06 $\mu$m | $5.9 \times 10^{-11}$ @ 1.06 $\mu$m @ 18MHz | 100 | |
| MHZ-016 | 13 | Modified DIP | $10^8$ @ 0.9 $\mu$m | $6.8 \times 10^{-11}$ @ 0.95 $\mu$m @ 16MHz | 100 | |

## CUSTOM PHOTODIODES

In addition to these standard photodiode products, E G & G engineering and production capabilities permit the design and fabrication of custom photodiode devices. Special configurations such as larger and smaller areas, circular and rectangular active areas, arrays, matrices can b manufactured per specific customer requirements. Inquiries for bot small and OEM quantities are welcome.

EG&G
ELECTRO-OPTICS DIVISION
35 E CONGRESS STREET, SALEM, MASS. 01970 • TEL.: (617) 745-3200

# XENON FLASHTUBES



Xenon flashtubes. dc krypton arc lamps, and long arc Xenon lamps are available from E G & G in a wide variety of configurations and envelope materials. Tubes are available in linear, bulb-type, helical, "U" shape, coaxial, and air or liquid cooled designs. Envelope materials include quartz, UV inhibiting quartz, and hard glass with a wide range of bore and arc length sizes. Custom configurations are available upon request.

Common applications involve the use of these lamps as the primary light source for:

Laser stimulation
Photocopy systems
Phototypesetting machines
Microfiche systems
Strobes
UV curing of polymers
Marine, aircraft and satellite beacons
Warning beacons
Photoresist exposure
Large area indoor lighting

## LINEAR XENON FLASHTUBES — QUARTZ

| Type No. | Bore Size I.D. x O.D (mm) | Arc Length (inches) | Max. Energy 1.0 msec pulse (joules) | Min. Operating Voltage (kv) | Min. Trigger Voltage (kv) | Ave.* Power @ 25°C Ambient (watts) |
|---|---|---|---|---|---|---|
| FX-1C-6 | 4 x 6 | 6 | 1680 | 0.7 | 20 | 40 |
| FX-5C-9 | 4 x 6 | 9 | 2520 | 1.2 | 20 | 50 |
| FX-33C-1.5 | 4 x 6 | 1.5 | 420 | 0.5 | 15 | 10 |
| FX-33C-2 | 4 x 6 | 2 | 560 | 0.6 | 15 | 15 |
| FX-38C-2 | 4 x 6 | 2 | 560 | 0.6 | 15 | 15 |
| FX-38C-3 | 4 x 6 | 3 | 840 | 0.7 | 15 | 20 |
| FX-42C-3 | 7 x 9 | 3 | 1490 | 1.0 | 20 | 60 |
| FX-45C-6 | 7 x 9 | 6 | 2980 | 1.1 | 20 | 80 |
| FX-47C-3 | 13 x 15 | 3 | 2040 | 1.0 | 20 | 75 |
| FX-47C-6.5 | 13 x 15 | 6.5 | 5500 | 1.0 | 25 | 100 |
| FX-47C-12 | 13 x 15 | 12 | 8160 | 1.3 | 25 | 125 |
| FX-47C-18 | 13 x 15 | 18 | 12,240 | 1.6 | 25 | 135 |
| FX-52C-3S | 7 x 9 | 3 | 1490 | 1.0 | 20 | 60 |
| FX-55C-6S | 7 x 9 | 6 | 2980 | 1.1 | 20 | 80 |
| FX-77C-4 | 19 x 22 | 4 | 5040 | 1.0 | 25 | 125 |
| FX-77C-8 | 19 x 22 | 8 | 10,000 | 1.2 | 25 | 150 |
| FX-77C-13 | 19 x 22 | 13 | 16,400 | 1.5 | 25 | 200 |
| FX-81C-4 | 10 x 12 | 4 | 3080 | 1.0 | 25 | 80 |
| FX-81C-6.5 | 10 x 12 | 6.5 | 5000 | 1.0 | 25 | 90 |
| FX-81C-8 | 10 x 12 | 8 | 6160 | 1.0 | 25 | 100 |
| FX-84C-1.5 | 4 x 6 | 1.5 | 420 | 0.5 | 15 | 10 |
| FX-85C-3 | 4 x 6 | 3 | 840 | 0.7 | 15 | 20 |
| FX-98C-3 | 5 x 7 | 3 | 1050 | 0.8 | 15 | 30 |
| FX-103C-2 | 4 x 6 | 2 | 560 | 0.6 | 15 | 15 |
| FX-103C-3 | 4 x 6 | 3 | 840 | 0.7 | 15 | 20 |
| FX-147C-2 | 3 x 5 | 2 | 420 | 0.5 | 15 | 15 |

*Forced air cooling (10-15 cu. ft./min.) increases ave. power by approx. factor of 8. Water cooling (1.0 gpm) increases ave. power by approx. factor of 50.

## BULB TYPE XENON FLASHTUBES

| Type No. | Max. Energy (joules) | Average Power (watts) | Operating Voltage Range (volts) | Min. Trigger Voltage (kv) | Max. Rep. Rate (pps) | Arc Discharge Length (inches) |
|---|---|---|---|---|---|---|
| FX-6A, FX-6AU, FX-48, FX-101, FX-108, FX-108AU | 5 | 7 | 400-1000 | 2.5 | 500 | 5/16 |
| FX-6B, FX-6BU, FX-35B, FX-101B, FX-102, FX108B, FX-108BU | 5 | 7 | 500-1000 | 4.0 | 2500 | 5/16 |
| FX-127 | 5 | 7 | 500-1000 | 4.0 | 2500 | 1/8 |
| FX-76, FX-133, FX-138 | 20 | 20 | 500-1500 | 5.0 | 2500 | 5/16 |
| FX-124, FX-137 | 15 | 20 | 500-1500 | 5.0 | 2500 | 1/8 |
| FX-132 | 200 | 100 | 100-1500 | 7.0 | 500 | 3/8 |

## DC KRYPTON ARC DISCHARGE TUBES

| Type No. | Bore Dia. I.D. (mm) | Arc Length (ins.) | Ave. Power Water Cooled (kw) | Steady State Voltage (Vdc) | Steady State Current (Adc) | Static Impedance (Ohms) | Min. Anode Voltage (kvdc) | Min. Trigger Voltage (kv) |
|---|---|---|---|---|---|---|---|---|
| FK-99C-2 | 4 | 2 | 2750 | 81 | 34 | 2.3 | 1-1.5 | 15-20 |
| FK-99C-3 | 4 | 3 | 4000 | 125 | 32 | 3.9 | 1-1.5 | 15-20 |
| FK-111C-2 | 7 | 2 | 4000 | 80 | 50 | 1.6 | 1-1.5 | 15-20 |
| FK-111C-3 | 7 | 3 | 6000 | 115 | 52 | 2.2 | 1-1.5 | 15-20 |
| FK-125C-2 | 5 | 2 | 3500 | 81 | 43 | 1.9 | 1-1.5 | 15-20 |
| FK-125C-3 | 5 | 3 | 5000 | 115 | 44 | 2.6 | 1-1.5 | 15-20 |
| FK-128C-3 | 10 | 3 | 8000 | 97 | 84 | 1.2 | 1-1.5 | 15-20 |
| FK-128C-10 | 10 | 10 | 15000 | 276 | 56 | 4.9 | 1-1.5 | 15-20 |

## LINEAR WATERCOOLED XENON FLASHTUBES

| Type No. | Bore Dia. I.D. (mm) | Arc Length (inches) | Max. Energy (joules) | Average Power (kw) | Operating Voltage Range (kv) | Trigger Voltage Range (kv) |
|---|---|---|---|---|---|---|
| FX-62B-3 | 7 | 3 | 600 | 4 | 1.5-2.5 | 25-30 |
| FX-65B-6 | 7 | 6 | 2000 | 8 | 1.5-2.5 | 25-30 |
| FX-67B-6.5 | 13 | 6.5 | 4000 | 10 | 1.7-3.0 | 25-30 |
| FX-74B-1.5 | 4 | 1.5 | 100 | 0.5 | 1.2-1.8 | 25-30 |
| FX-73B-3 | 4 | 3 | 400 | 1.0 | 1.2-2.5 | 25-30 |

## XENON FLASHTUBES FOR PULSED DYE LASERS

| Type No. | Bore Dia. I.D. (mm) | Arc Length (inches) | Max. Energy (joules) | Operating Voltage (kv) | Pulse Width (μs) |
|---|---|---|---|---|---|
| FX-139C-3.5 | 3.5 | 3.5 | 10 | 10 | 1 |
| FX-140C-3.5 | 5.0 | 3.5 | 25 | 10 | 2 |
| FX-141C-3.5 | 7.0 | 3.5 | 100 | 10 | 3 |
| FX-142C-3.5 | 7.0 | 3.5 | 200 | 20 | 6 |
| FX-143C-6.0 | 15.0 | 6.0 | 1000 | 20 | 12 |

# NSL OPTOELECTRONIC

- PHOTOCELLS
- PHOTODIODES
- PHOTOTRANSISTORS
- PHOTODARLINGTONS

## CdS & CdSe PHOTOCELLS

| Cell Type No. | Typ. 1 Ftc Res. KΩ | Min. Dark Res. MΩ | Max. Peak Volt. | Max. Power MW. | Description |
|---|---|---|---|---|---|
| NSL-312 | 75 | 100 | 70 | 50 | CdSe Photoconductive Cell in Hermetic Glass and Metal TO-18. Hermetic CdS and epoxy coated "open pill" versions also available. |
| NSL-313 | 30 | 100 | 70 | 50 | |
| NSL-314 | 14 | 100 | 70 | 50 | |
| NSL-315 | 550 | 1000 | 250 | 50 | |
| NSL-316 | 260 | 1000 | 250 | 50 | |
| NSL-317 | 110 | 1000 | 250 | 50 | |
| NSL-318 | 50 | 500 | 120 | 50 | |
| NSL-443 | 200 | 300 | 2000 | 1000 | CdS Photoconductive Cell in Hermetic Glass and Metal 1.25" Dia Case. Epoxy coated "open pill" versions also available. |
| NSL-444 | 120 | 100 | 2000 | 1000 | |
| NSL-445 | 26.0 | 15 | 420 | 1000 | |
| NSL-446 | 11.4 | 5 | 420 | 1000 | |
| NSL-447 | 5.5 | 1 | 420 | 1000 | |
| NSL-361 | 65 | 200 | 70 | 100 | CdSe Photoconductive Cell in Hermetic Glass and Metal ¼" Dia. Case. Hermetic CdS versions also available. |
| NSL-362 | 28 | 200 | 70 | 100 | |
| NSL-363 | 12 | 200 | 70 | 100 | |
| NSL-364 | 5.2 | 200 | 70 | 100 | |
| NSL-365 | 550 | 3000 | 250 | 100 | |
| NSL-366 | 230 | 3000 | 250 | 100 | |
| NSL-367 | 100 | 3000 | 250 | 100 | |
| NSL-481 | 43.0 | 65 | 120 | 200 | CdS Photoconductive Cell in Hermetic Glass and Metal TO-5. Hermetic CdSe and epoxy coated "Open Pill" versions also available. |
| NSL-482 | 18.6 | 15 | 120 | 200 | |
| NSL-483 | 8 | 1.8 | 120 | 200 | |
| NSL-484 | 3.5 | 0.25 | 120 | 200 | |
| NSL-485 | 330 | 200 | 250 | 200 | |
| NSL-486 | 155 | 130 | 250 | 200 | |
| NSL-487 | 66 | 20 | 250 | 200 | |
| NSL-294 | .75 | 10 | 70 | 500 | CdS/Se photo-conductive cell |
| NSL-297 | 7.5 | 100 | 250 | 500 | |
| NSL-3921 | 4.0 | 2 | 80 | 200 | CdSe Photoconductive Cell in Plastic Case. Glass Lens and Epoxy Coated "Open Pill" and CdS versions also available |
| NSL-3931 | 1.7 | 2 | 80 | 200 | |
| NSL-3941 | 0.75 | 1 | 80 | 200 | |
| NSL-3951 | 40.0 | 20 | 320 | 200 | |
| NSL-3961 | 17.0 | 20 | 320 | 200 | |
| NSL-3971 | 7.5 | 10 | 320 | 200 | |
| NSL-491 | 9.3 | 14 | 80 | 500 | CdS Photoconductive Cell in Hermetic Glass and Metal TO-8. Hermetic CdSe version also available. |
| NSL-492 | 4.0 | 3.2 | 80 | 500 | |
| NSL-493 | 1.7 | 0.4 | 80 | 500 | |
| NSL-494 | 0.75 | 0.05 | 80 | 500 | |
| NSL-495 | 40 | 32 | 320 | 500 | |
| NSL-496 | 17 | 4.0 | 320 | 500 | |
| NSL-497 | 7.5 | 0.54 | 320 | 500 | |
| NSL-41385 | 18 | 6 | 150 | 250 | CdS Photoconductive Cell in .5" L x .33" W x .05" D rectangular, epxoy coated package. |
| NSL-41386 | 8 | 6 | 150 | 250 | |
| NSL-41387 | 3.5 | 1 | 150 | 250 | |
| NSL-41388 | 1.6 | 0.54 | 150 | 250 | |

## PHOTODETECTOR LAMP ASSEMBLIES

### CdSe Photodetector

| Module Type No. | Emitter Volts | Emitter Current MA | Detector Max. ON Res. Ω | Detector Min. OFF Res. MΩ | Detector Max. Volts | Detector Max. Power | Description |
|---|---|---|---|---|---|---|---|
| PL-1033-1 | 10 | 15 | 100 | 10 | 80 | 250 | Phenolic .75" x .75" x .625" Pin Leads for P.C. Board Mounting. (Matched, Multi-Detector Configurations also available) |
| PL-1036-1 | 10 | 15 | 400 | 100 | 320 | 250 | |
| PL-2H33-1 | 200 | 2 | 100 | 10 | 80 | 250 | |
| PL-2H36-1 | 200 | 2 | 400 | 100 | 320 | 250 | |
| PL-3A33-1 | 100 | 2 | 150 | 10 | 80 | 250 | |
| PL-3A36-1 | 100 | 2 | 500 | 100 | 320 | 250 | |
| PL-5S33-1 | 2 | 25 | 200 | 10 | 80 | 250 | |
| PL-5S36-1 | 2 | 25 | 2000 | 100 | 320 | 250 | |
| PLT-10384 | 10 | 15 | 400 | 10 | 80 | 100 | Standard Tube; Axial Leads |
| PLT-10387 | 10 | 15 | 5000 | 100 | 320 | 100 | |
| PLT-2H384 | 200 | 2 | 500 | 10 | 80 | 100 | |
| PLF-5S380 | 2 | 25 | 250 | 10 | 80 | 100 | 4 Leaded, Hermetic TO-5 |
| PLF-5S387 | 2 | 25 | 4000 | 100 | 320 | 100 | |
| PLS-5S380 | 2 | 25 | 250 | 10 | 80 | 100 | Small Tube, Axial Leads |
| PLS-5S387 | 2 | 25 | 4000 | 100 | 320 | 100 | |
| PLM-5S310 | 2 | 25 | 500 | 10 | 80 | 50 | Miniature Tube, Axial Leads |
| PLM-5S387 | 2 | 25 | 5000 | 100 | 320 | 50 | |

NATIONAL SEMICONDUCTORS LTD.

331 Cornelia St., Plattsburgh, N.Y. 12901 - Tel. (518) 561-3160
2150 Ward Street, Montreal, Que. H4M 1T7 - Tel. (514) 744-5507
TWX 610-421-3362

- PHOTOVOLTAIC CELLS
- OPTICALLY COUPLED ISOLATORS
- OPTOELECTRONIC ARRAYS
- UV/BLUE SENSITIVE LDRs

### Silicon Photodetector

| Module Type No. | Emitter Volts | Emitter Current MA | Detector Min. $BV_{CEO}$ | Coupled Characteristics Typ. Dark Curr. nA | Coupled Characteristics Curr. Trans. Ratio % | Coupled Characteristics Rise Fall Time μsec | Description |
|---|---|---|---|---|---|---|---|
| PLF-6S610 | 1.5 | 50 | 30 | 1 | 30 | 3 | 4 Leaded, Hermetic TO-5 Isolation: 700V |
| PLF-6S510 | 1.5 | 50 | 50 | 2 | 0.1 | 0.5 | |
| PLF-6S910 | 1.5 | 50 | 15 | 20 | 1000 | 70 | |
| PLM-6S610 | 1.5 | 50 | 30 | 1 | 30 | 3 | Miniature Tube, Axial Leads. Isolation: 2.5 kV |
| PLM-6S510 | 1.5 | 50 | 50 | 2 | 0.1 | 0.5 | |
| PLM-6S910 | 1.5 | 50 | 15 | 20 | 1000 | 70 | |
| PLS-6S610 | 1.5 | 50 | 30 | 1 | 30 | 3 | Small Tube, axial leads. Isolation: 5kV. |
| PLS-6S510 | 1.5 | 50 | 50 | 2 | 0.1 | 0.5 | |
| PLS-6S910 | 1.5 | 50 | 15 | 20 | 1000 | 70 | |

## PIN PHOTODIODES

| NSL Type No. | Light Current* MA | Dark Current | Rise Time | Fall Time | Description |
|---|---|---|---|---|---|
| NSLX-131 | .3 | 10 nA | 3 nS | 6 nS | TO-18 Package |
| NSLX-140 | 3 | 500 nA | 1 μSec | 1 μSec | .4" x .4" Chip —BNC Package |

* At 500 Ftc (25 MW/cm²) 2870°K Source

## SILICON PHOTODIODES

| NSL Type No. | Minimum Short Ckt.* Curr. MA | Min. Open Ckt.* Volt. | Dark Curr. μA @ 1 V @ 55°C | Reverse Voltage Recom. Maximum | Description |
|---|---|---|---|---|---|
| NSL-701-1 | 0.30 | 0.35 | 10 | 5 | .1" x .2" Chip. Wire Leads |
| NSL-801-1 | 0.325 | 0.275 | 5 | 10 | |
| NSL-701-9 | 0.30 | 0.35 | 10 | 5 | 9 element Cell, 0.1" Spacing |
| NSL-702 | 0.6 | 0.35 | 10 | 5 | .2" x .2" Chip. Wire Leads |
| NSL-802 | 0.65 | 0.275 | 5 | 10 | |
| NSL-703 | 1.4 | 0.35 | 40 | 5 | .2" x .4" Chip. Wire Leads |
| NSL-803 | 1.5 | 0.275 | 20 | 10 | |
| NSL-705 | 4.5 | 0.35 | 50 | 5 | .76" x .354" Chip. Wire Leads |
| NSL-805 | 4.77 | 0.275 | 25 | 10 | |
| NSL-706 | 2.9 | 0.35 | 40 | 5 | .4" x .4" Chip. Wire Leads |
| NSL-806 | 3.0 | 0.275 | 20 | 10 | |
| NSL-707 | 3.3 | 0.35 | 50 | 5 | .2" x 1" Chip. Wire Leads |
| NSL-807 | 3.5 | 0.275 | 25 | 10 | |
| NSL-708 | 1.3 | 0.35 | 30 | 5 | .1" x 1" Chip. Wire Leads |
| NSL-808 | 1.4 | 0.275 | 15 | 10 | |
| NSL-710 | 0.125 | 0.4 | 2 | 5 | TO-18 Package |
| NSL-810 | 0.150 | 0.275 | 1 | 10 | |
| NSL-751 | 1.4 | 0.35 | 40 | 5 | 0.5" dia. Epoxy Package |
| NSL-851 | 1.5 | 0.275 | 20 | 10 | |
| NSL-781 | 0.28 | 0.35 | 10 | 5 | Hermetic TO-5 Case |
| NSL-881 | 0.3 | 0.275 | 5 | 10 | |
| NSL-782 | 0.42 | 0.35 | 10 | 5 | |
| NSL-791 | 0.60 | 0.35 | 10 | 5 | Hermetic TO-8 Case |
| NSL-792 | 1.1 | 0.35 | 30 | 5 | |
| NSL-8932 | 0.65 | 0.275 | 5 | 10 | 0.5" Dia. Ceramic |

*At 500 Ftc (25 MW/cm²) 2870°K Source.

## SILICON PHOTOTRANSISTORS & PHOTODARLINGTONS

| NSL Type No. | $I_{CEO}$ MA @ 5 V Min. | $I_{CEO}$ MA @ 5 V Typ. | MW/cm² | Dark $I_{CEO}$ @ 15V 25°C — nA Typ. | Dark $I_{CEO}$ @ 15V 25°C — nA Max. | Description |
|---|---|---|---|---|---|---|
| NSL-610-1 | .2 | 1 | 10 | 1 | 50 | TO-18 Encased Power Dissipation @ 25°C 200 mW, $BV_{CEO}$ 30 volts |
| NSL-610-3 | 1 | 3 | 10 | 1 | 50 | |
| NSL-610-6 | 4 | 6 | 10 | 1 | 50 | |
| NSL-610-9 | 7 | 9 | 10 | 1 | 50 | |
| NSL-611 | 8 | 15 | 10 | 10 | 100 | |
| NSL-910 | 1 | 6 | .1 | 20 | 250 | TO-18, $BV_{CEO}$ 15 V |

## UV/BLUE SENSITIVE LDRs

| Cell Type No. | Type 1 Ftc Res. KΩ | Min. Dark Res. MΩ | Max. Peak Volt | Max. Power MW | Description |
|---|---|---|---|---|---|
| NSL-2129/3 | 2 | .5 | 80 | 200 | .5" Plastic Case, Quartz Window |
| NSL-2129/6 | 20 | 1 | 320 | 200 | |
| NSL-593 | 30 | 1.5 | 70 | 500 | TO-8 |

RAYTHEON

# OPTO-ISOLATORS—RAYSISTORS® PHOTOCONDUCTIVE CELLS

## RAYTHEON OPTOELECTRONICS

- **Standard and "State of the Art" Opto-Components**
- **Improved Cost/Performance Ratios**
- **Rugged Mechanical Construction with Certified Environmental Reliability**
- **Designed for Both Commercial and Military Opto-electronic Applications**

Raytheon is a specialist in the development and manufacture of quality, competitively priced photo-conductive cell/arrays and photo-optical isolators (Raysistors®). These components are designed with characteristics and features that meet the requirements of the various optical and/or isolation circuits in use today or in development for the future.

Raytheon standard photocells and arrays have been used effectively for more than a decade in a wide range of applications at all levels of industry. Raytheon is also prepared to comply with requests for special products to meet your specific application or required characteristics.

## OPTO-ISOLATORS RAYSISTORS®

Raysistor is a Raytheon trade mark for an optoelectronic circuit component (photo-optical isolator). The Raysistor combines a reliable energy emitter source (incandescent, neon, or light-emitting diode) and a bulk-effect photo-resistive element. A wide variety of package configurations, ratings, and electrical characteristics are available.

Raysistors perform a variety of switching and control functions where isolation between the controlling element and the controlled circuit is critical. The characteristics of these devices demonstrate their versatility, sensitive control property, circuit isolation, and lack of distortion in the signal. In addition to their suitability for general feedback systems, Raysistors are especially attractive for AGC, Logic Translation facsimile and photo multiplier systems, voltage or signal isolators, variable resistors, SCR and Triac firing circuits, signal modulators for audio effects, solid-state switches, etc. For dual function controls, the Raysistor is produced with multiple photo-cells and/or energy emitters to provide excellent tracking and matching characteristics.

## PHOTOCONDUCTIVE CELLS

Raytheon's extensive line of photo-conductive cells and arrays represents the "state of the art" in stability and uniformity of characteristics with aging. They are available in a wide range of sensitivities.

Standard Raytheon photocells are available in four different spectral response photosensitive materials, each of which exhibit its own individual optical characteristic. A variety of packages are available, including hermetically sealed, single or dual element, and plastic coated. Plastic coated devices are passivated for long term environmental protection.

## GENERAL NOTES

1. Energy emitter source: "N"-neon, "I"-incandescent, "L"-light emitting diode (LED). See tables.
2. Indicated control voltages or current will ensure long life. Constant operation at higher voltages will result in modified life expectancy. (Incandescent designs are derated to insure long life.)
3. "ON" Resistance: Measured after 16 hours of operation. All resistances measured with 1.5 volts applied to signal terminals.
4. Control to signal circuit isolation: Values indicated are maximum potentials (DC or peak AC) that can be applied between control and signal circuits. Tested per MIL STD 202D, Method 301.
5. "OFF" RESISTANCE: Measures 5 seconds after removal of control voltage or current. Ultimate dark resistance is many times greater.
6. Maximum Cell Voltage: Voltage applied to cell must not exceed specified maximum. Maximum voltage is normally present when cell is in dark condition.
7. Cell Power Dissipation: Ambient temperature directly effects maximum power dissipation of photoconductive cells. Rated power dissipation applies when device is operated at 30°C or below. Derating curves are specified on individual data sheets.
8. Response Speeds:
   - 8.1 "RISE TIME": Defined as time for voltage across photocell to fall to 10% of its initial value, measured from instant that maximum rated control voltage or current is applied to energy emitter source.
   - 8.2 "DECAY TIME": Defined as time for voltage across photocell to rise to either 50% or 90% of its final value from instant that maximum rated control voltage or current is removed from energy emitter source. Percentage values depend on specific component. Majority are 90%.
   - 8.3 Test Conditions:
     Control Voltage/Current—As Rated
     Signal Voltage—50 Volts DC
     Signal Circuit Load—100K Ohms
9. Capacitance: Measurements made in dark condition.

## OPTO-ISOLATORS—RAYSISTORS®

| Model No. | Control Circuit: Voltage Vdc | Control Circuit: Current (Ma) | Control Circuit: Isolation D.C. Peak Volts | Signal Circuit-Photodetector: Resistance-ohms Max On Res. | Signal Circuit-Photodetector: Resistance-ohms Min Off Res. | Signal Circuit-Photodetector: Voltage Max. Vdc | Signal Circuit-Photodetector: Power Max mW | Signal Circuit-Photodetector: Typ. Rise (sec) | Signal Circuit-Photodetector: Switching Decay (sec) | General: Shunt Cap (Pf) | General: Coupling Cap (Pf) | General: Construction■ Fig. | General: Emitter[1] Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FLYING LEAD—METAL TUBE** | | | | | | | | | | | | | |
| CK1101 | 120* | 0.5-3.5 | 1500 | 1000 | $10^7$ | 100 | 100 | .002 | .060 | 1.0 | .001 | A | N |
| CK1102 | 0-1 | 0-50 | 1500 | 700 | $10^7$ | 100 | 100 | .035 | .350 | 1.1 | .003 | A | I |
| CK1103 | 0-5 | 0-200 | 1500 | 150 | $10^7$ | 100 | 100 | .040 | .750 | 1.0 | .003 | A | I |
| CK1104 | 0-25 | 0-37 | 1500 | 150 | $5x10^6$ | 100 | 100 | .035 | .450 | 0.9 | .003 | A | I |
| CK1112 | 0-10 | 0-18 | 1500 | 700 | $10^7$ | 100 | 100 | .030 | .400 | 1.0 | .004 | A | I |
| CK1113 | † | 0-25 | 1500 | 750 | $10^7$ | 100 | 100 | .005 | .175 | 1.0 | .004 | A | L |
| **PRINTED CIRCUIT** | | | | | | | | | | | | | |
| CK1101P | 120* | 0.5-3.5 | 1500 | 1000 | $10^7$ | 100 | 100 | .002 | .060 | 1.0 | .001 | B | N |
| CK1102P | 0-1 | 0-50 | 1500 | 700 | $10^7$ | 100 | 100 | .035 | .350 | 1.1 | .003 | B | I |
| CK1103P | 0-5 | 0-200 | 1500 | 150 | $10^7$ | 100 | 100 | .040 | .750 | 1.0 | .003 | B | I |
| CK1104P | 0-25 | 0-37 | 1500 | 150 | $5x10^6$ | 100 | 100 | .035 | .450 | 0.9 | .003 | B | I |
| CK1112P | 0-10 | 0-18 | 1500 | 700 | $10^7$ | 100 | 100 | .030 | .400 | 1.0 | .004 | B | I |
| CK2008P | 120* | 0.5-3.5 | 1500 | 300 | $10^7$ | 100 | 100 | .005 | .120 | 1.0 | .003 | B | N |
| CK2025P | 0-10 | 0-18 | 1500 | 1000 | $10^6$ | 100 | 100 | .030 | .650 | 1.0 | .003 | B | I |
| CK1113P | † | 0-25 | 1500 | 750 | $10^7$ | 100 | 100 | .005 | .175 | 1.0 | .004 | B | L |

*Current limiting resistor must be used in series with neon light source. Typical value: 20 K ohms (100 K ohms for CK 1124). Control current is linear with voltage over stated range.
†Current limited source required for control input. Stable operation is best achieved with a constant current power supply, which may be approximated by stable voltage supply having a resistor in series with the LED. Control circuits of LED devices may also be driven by AC voltages by placing a rectifier diode in series of parallel with the LED.
[1]Outlines on pages 6 to 8

RAYTHEON COMPANY / DISTRIBUTOR PRODUCTS OPERATION
DEPT. EM / FOURTH AVE. / BURLINGTON, MA 01803 / TEL: (617) 272-6400 / TWX: 710-332-7641

RAYTHEON

# OPTO-ISOLATORS—RAYSISTORS® PHOTOCONDUCTIVE CELLS

## OPTO—ISOLATORS—RAYSISTORS® (Cont'd)

| | Control Circuit | | | Signal Circuit-Photodetector | | | | | | General | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model No. | Voltage Vdc | Current (Ma) | Isolation D.C. Peak Volts | Resistance-ohms Max On Res. | Resistance-ohms Min Off Res. | Voltage Max. Vdc | Power Max mW | Typ. Rise (sec) | Switching Decay (sec) | Shunt Cap (Pf) | Coupling Cap (Pf) | Construction Fig. | Emitter Source |
| **HIGH VOLTAGE—FLYING LEAD** | | | | | | | | | | | | | |
| CK2029 | 0-10 | 0-35 | 10,000 | 2000 | $10^8$ | 250 | 250 | .035 | .325 | 1.3 | .10 | C | I |
| CK2032 | 0-10 | 0-18 | 10,000 | 450 | $10^7$ | 250 | 250 | .030 | .300 | 1.3 | .10 | C | I |
| CK2034 | † | 0-25 | 10,000 | 500 | $10^7$ | 250 | 250 | .005 | .175 | 1.2 | .10 | C | L |
| CK2035 | 120* | 0.5-3.5 | 10,000 | 1000 | $10^7$ | 250 | 200 | .008 | .350 | 1.2 | .10 | C | N |
| CK2129 | 120* | 0.5-3.5 | 10,000 | 2000 | $10^7$ | 250 | 250 | .010 | .350 | 1.2 | .15 | C | N |
| **HIGH VOLTAGE—MOLDED CASE** | | | | | | | | | | | | | |
| CK1105 | 120* | 0.5-3.5 | 25,000 | 10,000 | $10^7$ | 250 | 250 | .010 | .800 | 1.8 | .2 | D | N |
| CK1106 | 0-120 | 0-25 | 25,000 | 300 | $10^7$ | 250 | 250 | .050 | .700 | 1.8 | .3 | D | I |
| CK1108 | 0-5 | 0-200 | 25,000 | 250 | $10^7$ | 300 | 250 | .040 | .650 | 1.7 | .2 | D | I |
| CK2030 | 0-10 | 0-18 | 25,000 | 700 | $10^7$ | 300 | 250 | .030 | .450 | 1.8 | .2 | D | I |
| CK2065 | 0-10 | 0-18 | 25,000 | 500 | $10^7$ | 300 | 250 | .030 | .500 | 1.8 | .2 | D | I |
| CK2066 | 0-25 | 0-37 | 25,000 | 350 | $10^7$ | 300 | 250 | .040 | .650 | 1.8 | .2 | D | I |
| CK2067 | † | 0-40 | 25,000 | 1000 | $10^7$ | 300 | 250 | .010 | .650 | 1.8 | .2 | D | L |
| **TUBULAR—AXIAL LEAD** | | | | | | | | | | | | | |
| CK2145 | † | 0-25 | 1500 | 250 | $5x10^5$ | 60 | 50 | .003 | .900 | 1.5 | .5 | E | L |
| CK2146 | † | 0-25 | 1500 | 2500 | $10^7$ | 100 | 100 | .002 | .030 | 1.5 | .5 | E | L |
| **TUBULAR—FLYING LEAD** | | | | | | | | | | | | | |
| CK2177 | 0-12 | 0-24 | 2000 | 400 | $10^7$ | 250 | 350 | .040 | .300 | 2.0 | 0.5 | F | I |
| CK2178 | 0-12 | 0-24 | 2000 | 1500 | $10^7$ | 300 | 350 | .040 | .500 | 2.0 | 0.5 | F | I |
| **TO-5** | | | | | | | | | | | | | |
| CK1114 | 0-1 | 0-18 | 500 | 650 | $10^7$ | 100 | 100 | .025 | .275 | 1.5 | 1.0 | G | I |
| CK1115 | 0-4 | 0-55 | 500 | 200 | $10^7$ | 200 | 100 | .035 | .300 | 2.0 | 1.0 | G | I |
| CK1116 | 0-4 | 0-20 | 500 | 350 | $10^7$ | 100 | 100 | .030 | .350 | 2.0 | 1.0 | G | I |
| CK1117 | 0-3 | 0-15 | 500 | 400 | $10^7$ | 100 | 100 | .030 | .300 | 2.0 | 1.0 | G | I |
| CK2002 | 0-5 | 0-60 | 500 | 40 | $5x10^6$ | 100 | 100 | .035 | .450 | 2.0 | 1.0 | G | I |
| CK2039 | 0-1 | 0-18 | 500 | 800 | $10^6$ | 100 | 100 | .030 | .300 | 1.5 | 1.0 | G | I |
| CK2046 | 0-1 | 0-18 | 500 | 350 | $10^6$ | 100 | 100 | .025 | .300 | 1.5 | 1.0 | G | I |
| CK2070 | 0-1 | 0-18 | 500 | 2500 | $10^6$ | 100 | 100 | .025 | .550 | 2.0 | 1.0 | G | I |
| CK2071 | 0-4 | 0-55 | 500 | 1000 | $10^6$ | 100 | 100 | .035 | .850 | 2.0 | 1.0 | G | I |
| CK2072 | 0-4 | 0-20 | 500 | 1800 | $10^6$ | 100 | 100 | .030 | .600 | 2.0 | 1.0 | G | I |
| CK2095 | 0-4 | 0-20 | 500 | 1200 | $10^6$ | 75 | 75 | .035 | .850 | 2.0 | 1.0 | G | I |
| CK2101 | 0-5 | 0-22 | 500 | 50 | $10^6$ | 100 | 100 | .020 | .500 | 1.5 | 1.0 | G | I |
| CK2124 | 0-3 | 0-15 | 500 | 450 | $10^6$ | 100 | 100 | .025 | .800 | 1.5 | 1.0 | G | I |
| CK2127 | 0-3 | 0-15 | 500 | 700 | $10^6$ | 100 | 100 | .025 | .700 | 1.5 | 1.0 | G | I |
| CK2118 | 0-4 | 0-55 | 500 | 100 | $10^6$ | 100 | 100 | .035 | .300 | 1.5 | 1.0 | G | I |
| CK2080 | 0-4 | 0-55 | 500 | 750 | $10^8$ | 240 | 150 | .035 | .550 | 2.5 | 1.0 | G | I |
| CK2140 | † | 0-25 | 500 | 7500 | $5x10^7$ | 100 | 75 | .002 | .015 | 2.0 | 1.0 | G | L |
| CK2141 | † | 0-25 | 500 | 5000 | $5x10^7$ | 150 | 100 | .004 | .120 | 2.0 | 1.0 | G | L |
| CK2142 | † | 0-25 | 500 | 500 | $10^7$ | 150 | 100 | .005 | .650 | 2.0 | 1.0 | G | L |
| CK2143 | † | 0-25 | 500 | 3000 | $5x10^6$ | 150 | 100 | .005 | .850 | 2.5 | 1.0 | G | L |
| **TO-8** | | | | | | | | | | | | | |
| CK2102 | 0-5 | 0-60 | 1500 | 300 | $10^7$ | 250 | 150 | .035 | .700 | 1.8 | 1.0 | AA | I |
| CK2103 | 0-5 | 0-60 | 1500 | 50 | $10^6$ | 100 | 100 | .035 | .900 | 1.8 | 1.0 | AA | I |
| CK2104 | 0-5 | 0-60 | 1500 | 50 | $10^6$ | 100 | 100 | .035 | 1.2 | 1.8 | 1.0 | AA | I |
| **CRYSTAL CAN** | | | | | | | | | | | | | |
| CK1121 | 0-5 | 0-55 | 1000 | 150 | $10^7$ | 100 | 100 | .035 | .300 | 2.0 | .10 | H | I |
| CK1121W | 0-5 | 0-55 | 500 | 150 | $10^7$ | 100 | 100 | .035 | .300 | 2.0 | .10 | H | I |
| CK1122 | 0-10 | 0-18 | 1000 | 750 | $10^7$ | 100 | 100 | .030 | .300 | 2.0 | .10 | H | I |
| CK1122B | 0-10 | 0-18 | 1000 | 600 | $10^8$ | 200 | 125 | .030 | .225 | 2.0 | .15 | H | I |
| CK1122W | 0-10 | 0-18 | 1000 | 850 | $10^8$ | 200 | 125 | .030 | .225 | 2.0 | .15 | H | I |
| CK1123 | 0-25 | 0-37 | 1000 | 150 | $10^7$ | 150 | 100 | .040 | .400 | 2.0 | .10 | H | I |
| CK1124 | 150* | .2-1.2 | 1000 | 3000 | $10^7$ | 150 | 100 | .005 | .125 | 1.8 | .10 | H | N |

*Current limiting resistor must be used in series with neon light source. Typical value: 20 K ohms (100 K ohms for CK 1124). Control current is linear with voltage over stated rang
†Current limited source required for control input. Stable operation is best achieved with a constant current power supply, which may be approximated by stable voltage supply having resistor in series with the LED. Control circuits of LED devices may also be driven by AC voltages by placing a rectifier diode in series of parallel with the LED.

RAYTHEON COMPANY / DISTRIBUTOR PRODUCTS OPERATION
DEPT. EM / FOURTH AVE. / BURLINGTON, MA 01803 / TEL: (617) 272-6400 / TWX: 710-332-7641

RAYTHEON

# OPTO-ISOLATORS—RAYSISTORS® PHOTOCONDUCTIVE CELLS

## OPTO—ISOLATORS—RAYSISTORS® (Cont'd)

| Model No. | Control Circuit: Voltage Vdc | Control Circuit: Current (Ma) | Control Circuit: Isolation D.C. Peak Volts | Signal Circuit-Photodetector: Resistance-ohms Max On Res. | Signal Circuit-Photodetector: Resistance-ohms Min Off Res. | Signal Circuit-Photodetector: Voltage Max. Vdc | Signal Circuit-Photodetector: Power Max mW | Signal Circuit-Photodetector: Typ. Rise (sec) | Signal Circuit-Photodetector: Switching Decay (sec) | General: Shunt Cap (Pf) | General: Coupling Cap (Pf) | General: Construc-tion Fig. | General: Emitter[1] Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CRYSTAL CAN** (Cont'd) | | | | | | | | | | | | | |
| CK2000 | 0-25 | 0-37 | 1000 | 40 | $10^7$ | 150 | 100 | .035 | .400 | 1.8 | .10 | H | I |
| CK2000B | 0-25 | 0-37 | 500 | 40 | $10^7$ | 100 | 100 | .040 | .400 | 1.8 | .10 | H | I |
| CK2003 | 0-10 | 0-18 | 500 | 225 | $10^7$ | 100 | 100 | .030 | .250 | 2.0 | .15 | H | I |
| CK2013 | 0-25 | 0-37 | 500 | 100 | $10^6$ | 100 | 100 | .035 | .700 | 2.0 | .10 | H | I |
| CK2015 | 0-25 | 0-37 | 1000 | 1500 | $10^8$ | 200 | 125 | .035 | .175 | 2.0 | .10 | H | I |
| CK2018 | 0-5 | 0-55 | 1000 | 200 | $10^9$ | 200 | 125 | .035 | .175 | 2.0 | .10 | H | I |
| CK2019 | 0-25 | 0-37 | 1000 | 1000 | $10^6$ | 150 | 100 | .040 | .750 | 2.5 | .15 | H | I |
| CK2028A | 0-25 | 0-37 | 1000 | 200 | $10^6$ | 100 | 100 | .040 | .850 | 2.0 | .10 | H | I |
| CK2028B | 0-25 | 0-37 | 500 | 200 | $10^6$ | 100 | 100 | .040 | .850 | 2.5 | .15 | H | I |
| CK2051 | 0-10 | 0-18 | 1000 | 2000 | $10^6$ | 125 | 125 | .030 | .950 | 2.0 | .10 | H | I |
| CK2052 | 0-25 | 0-37 | 1000 | 300 | $10^6$ | 125 | 125 | .040 | .950 | 2.0 | .10 | H | I |
| CK2053 | 0-5 | 0-55 | 1000 | 1250 | $10^6$ | 125 | 125 | .040 | .950 | 2.0 | .10 | H | I |
| CK2086 | 0-10 | 0-18 | 1000 | 1000 | $10^7$ | 150 | 125 | .030 | .300 | 1.8 | .10 | H | I |
| CK2112 | 0-10 | 0-18 | 500 | 300 | $10^7$ | 150 | 125 | .035 | .350 | 1.8 | .10 | H | I |
| CK2132 | 0-10 | 0-18 | 1000 | 750 | $10^8$ | 150 | 125 | .030 | .125 | 1.8 | .10 | H | I |
| CK2139 | 0-5 | 0-55 | 1000 | 100 | $10^7$ | 125 | 125 | .040 | .300 | 1.8 | .10 | H | I |
| CK2147 | † | 0-25 | 1000 | 1000 | $10^8$ | 150 | 125 | .003 | .075 | 1.8 | .10 | H | L |
| CK2148 | † | 0-25 | 1000 | 300 | $10^6$ | 125 | 125 | .015 | .350 | 1.8 | .10 | H | L |
| CK2149 | † | 0-25 | 1000 | 150 | $10^6$ | 125 | 125 | .015 | .700 | 1.8 | .10 | H | L |
| **TO-5 EPOXY SHELL** | | | | | | | | | | | | | |
| CK2078 | 0-10 | 0-18 | 1000 | 850 | $10^7$ | 150 | 125 | .035 | .350 | 2.0 | 1.0 | I | I |
| CK2137 | 0-12 | 0-25 | 1000 | 500 | $10^7$ | 150 | 125 | .050 | .750 | 2.0 | 1.0 | I | I |
| **TO-5—DUAL††** | | | | | | | | | | | | | |
| CK2150 | 0-5 | 0-55 | 500 | 300 | $10^6$ | 75 | 75 | .040 | .800 | 2.0 | 1.0 | J | I |
| CK2151 | 0-5 | 0-55 | 500 | 850 | $10^6$ | 75 | 75 | .060 | .850 | 2.0 | 1.0 | J | I |
| CK2153 | 0-3 | 0-15 | 500 | 1000 | $10^6$ | 75 | 75 | .050 | .800 | 2.0 | 1.0 | J | I |
| CK2154 | 0-3 | 0-15 | 500 | 8000 | $10^6$ | 75 | 75 | .050 | .850 | 2.0 | 1.0 | J | I |
| CK2155 | † | 0-40 | 500 | 900 | $10^6$ | 75 | 75 | .010 | .500 | 2.0 | 1.0 | J | L |
| CK2157 | † | 0-40 | 500 | 600 | $10^6$ | 75 | 75 | .010 | .650 | 2.0 | 1.0 | J | L |
| **CRYSTAL CAN—DUAL††** | | | | | | | | | | | | | |
| CK2170 | 0-10 | 0-18 | 500 | 850 | $10^6$ | 75 | 75 | .035 | .800 | 2.0 | 1.0 | K | I |
| CK2171 | 0-10 | 0-18 | 500 | 2000 | $10^6$ | 75 | 75 | .035 | .950 | 2.0 | 1.0 | K | I |
| CK2172 | 0-25 | 0-37 | 500 | 300 | $10^6$ | 75 | 75 | .045 | .950 | 2.0 | 1.0 | K | I |
| CK2173 | † | 0-25 | 500 | 600 | $10^6$ | 75 | 75 | .010 | .650 | 2.0 | 1.0 | K | L |
| **EPOXY TUBE, FLYING LEAD—DUAL††** | | | | | | | | | | | | | |
| CK2160 | 0-10 | 0-18 | 1500 | 850 | $10^7$ | 75 | 75 | .035 | .450 | 2.5 | 1.0 | L | I |
| CK2161 | 0-10 | 0-18 | 1500 | 3000 | $10^6$ | 75 | 75 | .035 | .850 | 2.5 | 1.0 | L | I |
| CK2162 | † | 0-25 | 1500 | 1500 | $10^6$ | 75 | 75 | .010 | .600 | 2.5 | 1.0 | L | L |
| **EPOXY 7 PIN—DUAL††** | | | | | | | | | | | | | |
| CK2033 | 0-10 | 0-18 | 1500 | 500 | $10^7$ | 200 | 125 | .040 | .500 | 2.5 | 1.0 | M | I |
| CK2038 | 0-10 | 0-18 | 1500 | 1500 | $10^6$ | 200 | 125 | .045 | .850 | 2.5 | 1.0 | M | I |
| CK2037 | † | 0-25 | 1500 | 1200 | $10^6$ | 200 | 125 | .012 | .450 | 2.5 | 1.0 | M | L |
| **EPOXY 9 PIN—DUAL††** | | | | | | | | | | | | | |
| CK2042 | 0-10 | 0-18 | 1500 | 1000 | $10^6$ | 150 | 125 | .035 | .950 | 2.0 | 1.0 | N | I |
| CK2043 | 0-25 | 0-37 | 1500 | 300 | $10^6$ | 150 | 125 | .045 | .950 | 2.0 | 1.0 | N | I |
| **PRINTED CIRCUIT—DUAL††** | | | | | | | | | | | | | |
| CK2040 | 0-25 | 0-37 | 1500 | 300 | $10^7$ | 200 | 150 | .055 | .500 | 3.0 | 1.0 | O | I |
| CK2041 | 120* | 0-3.5 | 1500 | 1000 | $10^7$ | 150 | 125 | .008 | .100 | 3.0 | 1.0 | O | N |

[1]Current limiting resistor must be used in series with neon light source. Typical value: 20 K ohms (100 K ohms for CK 1124). Control current is linear with voltage over stated range.
†Current limited source required for control input. Stable operation is best achieved with a constant current power supply, which may be approximated by stable voltage supply having a resistor in series with the LED. Control circuits of LED devices may also be driven by AC voltages by placing a rectifier diode in series of parallel with the LED.
††Signal Circuit ratings are for each half of cell. Typical dual isolators Cell to Cell resistance balance 90%, resistance tracking 10%.

RAYTHEON COMPANY / DISTRIBUTOR PRODUCTS OPERATION
DEPT. EM / FOURTH AVE. / BURLINGTON, MA 01803 / TEL: (617) 272-6400 / TWX: 710-332-7641

RAYTHEON

# OPTO-ISOLATORS—RAYSISTORS® PHOTOCONDUCTIVE CELLS

## PHOTOCONDUCTIVE CELLS—SINGLE

| Type | Sensitive Material | Pk Spectral Response A | Resistance-Ohms @ ±33% 2 Feet C | Dark Resistance "Off R" Ohms | Rise Time Typ. Sec | Decay Time Typ. Sec | Voltage Max. Vdc | Power Max. mW | Construction Type |
|---|---|---|---|---|---|---|---|---|---|
| **1/4" GLASS VIAL** | | | | | | | | | |
| CK1201 | CdSe | 7150 | 600 | $10^7$ | .005 | .080 | 75 | 75 | Q |
| CK1202 | CdSe | 7150 | 1200 | $10^7$ | .005 | .060 | 100 | 100 | Q |
| CK1203 | CdSe | 7150 | 3500 | $10^7$ | .006 | .060 | 150 | 100 | Q |
| CK1204 | CdSe | 7150 | 7000 | $10^8$ | .006 | .050 | 200 | 125 | Q |
| CK1205 | CdS/Se | 6550 | 10,000 | $10^6$ | .006 | .150 | 150 | 125 | Q |
| CK1206 | CdSe | 7150 | 20,000 | $10^8$ | .005 | .040 | 200 | 150 | Q |
| CK1207 | CdSe | 7150 | 100K | $10^9$ | .004 | .015 | 200 | 150 | Q |
| CK1208 | CdS/Se | 6150 | 3000 | $10^6$ | .005 | .175 | 75 | 75 | Q |
| CK1209 | CdS/Se | 5500 | 6000 | $10^6$ | .005 | .250 | 75 | 75 | Q |
| CK1221 | CdS | 5150 | 7000 | 500K | .007 | .900 | 75 | 75 | Q |
| CK1222 | CdS | 5150 | 12,000 | $10^6$ | .007 | .800 | 75 | 75 | Q |
| CK1223 | CdS | 5150 | 20,000 | $10^6$ | .007 | .500 | 100 | 100 | Q |
| CK1224 | CdS/Se | 6550 | 1000 | $10^7$ | .006 | .900 | 75 | 75 | Q |
| CK1225 | CdS/Se | 6150 | 10,000 | $10^7$ | .006 | .700 | 125 | 125 | Q |
| CK1226 | CdS/Se | 5500 | 15,000 | $10^6$ | .007 | .950 | 100 | 100 | Q |
| CK1227 | CdS/Se | 6150 | 100K | $5x10^7$ | .005 | .500 | 200 | 150 | Q |
| CK1228 | CdS | 5150 | 130K | $5x10^7$ | .005 | .500 | 200 | 150 | Q |
| **TO-5 HERMETIC** | | | | | | | | | |
| CK1241 | CdSe | 7150 | 800 | $10^7$ | .005 | .080 | 75 | 75 | Z |
| CK1242 | CdSe | 7150 | 1200 | $10^7$ | .005 | .060 | 100 | 100 | Z |
| CK1243 | CdSe | 7150 | 3500 | $10^7$ | .006 | .060 | 100 | 100 | Z |
| CK1244 | CdSe | 7150 | 7000 | $10^8$ | .006 | .060 | 100 | 100 | Z |
| CK1245 | CdS/Se | 6550 | 1500 | $10^6$ | .005 | .450 | 100 | 100 | Z |
| CK1246 | CdSe | 7150 | 10,000 | $10^8$ | .005 | .010 | 200 | 150 | Z |
| CK1247 | CdSe | 7150 | 30,000 | $10^8$ | .005 | .005 | 200 | 150 | Z |
| CK1248 | CdS/Se | 6150 | 7000 | $10^7$ | .005 | .250 | 100 | 125 | Z |
| CK1249 | CdS/Se | 6150 | 4000 | $10^6$ | .006 | .500 | 100 | 100 | Z |
| CK1261 | CdS | 5150 | 6000 | 500K | .007 | 1.200 | 75 | 75 | Z |
| CK1262 | CdS | 5150 | 12,000 | $10^6$ | .007 | .900 | 75 | 75 | Z |
| CK1263 | CdS | 5150 | 20,000 | $10^6$ | .007 | .500 | 100 | 100 | Z |
| CK1264 | CdS | 5150 | 10,000 | $10^7$ | .006 | .500 | 100 | 100 | Z |
| CK1265 | CdS/Se | 6550 | 3000 | $10^7$ | .005 | .400 | 100 | 100 | Z |
| CK1266 | CdS/Se | 6150 | 3000 | $10^6$ | .005 | .375 | 75 | 75 | Z |
| CK1267 | CdS/Se | 6150 | 15,000 | $10^7$ | .007 | .200 | 200 | 125 | Z |
| CK1268 | CdS | 5150 | 80,000 | $10^7$ | .006 | .300 | 200 | 125 | Z |
| **TO-8 HERMETIC** | | | | | | | | | |
| CK1251 | CdSe | 7150 | 250 | $10^7$ | .005 | .175 | 150 | 125 | R |
| CK1252 | CdSe | 7150 | 12,000 | $10^8$ | .005 | .150 | 300 | 250 | R |
| CK1253 | CdS/Se | 6550 | 8000 | $10^7$ | .005 | .450 | 200 | 150 | R |
| CK1254 | CdS/Se | 6550 | 10,000 | $10^7$ | .006 | .400 | 300 | 250 | R |
| CK1255 | CdS/Se | 6100 | 3000 | $10^6$ | .005 | .600 | 200 | 150 | R |
| CK1256 | CdS/Se | 6100 | 4000 | $10^7$ | .006 | .500 | 250 | 250 | R |
| CK1257 | CdS | 5150 | 10,000 | $10^6$ | .005 | .950 | 200 | 150 | R |
| CK1258 | CdS | 5150 | 12,000 | $10^8$ | .007 | .650 | 200 | 200 | R |
| **TO-3 POWERCELL** | | | | | | | | | |
| CK1286 | CdSe | 7150 | 12,000 | $10^8$ | 3.0 | .300 | 300 | 600 | S |
| CK1287 | CdS/Se | 6550 | 6500 | $10^8$ | 3.5 | .450 | 300 | 600 | S |
| CK1288 | CdS/Se | 5550 | 9000 | $10^8$ | 4.0 | .550 | 300 | 600 | S |
| CK1289 | CdS | 5150 | 12,000 | $10^8$ | 5.0 | .650 | 300 | 600 | S |

—All recorded measurements taken at room ambient of 25°C at 2850°K color temperature of a calibrated and aged incandescent light source after cells were light adapted at 30 ft-c 16 hours.

■Outlines on pages 6 to 8

**RAYTHEON COMPANY / DISTRIBUTOR PRODUCTS OPERATION**
DEPT. EM / FOURTH AVE. / BURLINGTON, MA 01803 / TEL: (617) 272-6400 / TWX: 710-332-7641

RAYTHEON

# OPTO-ISOLATORS—RAYSISTORS® PHOTOCONDUCTIVE CELLS

## PHOTOCONDUCTIVE CELLS—SINGLE (Cont'd)

| Type | Sensitive Material | Peak Spectral Response Å | Resistance @ ±33% 2 Feet C Ohms | Dark Resistance "Off R" Ohms | Rise Time Typ. Sec | Decay Time Typ. Sec | Voltage Max. VDC | Power Max. mW | Construction Type |
|---|---|---|---|---|---|---|---|---|---|
| **TO-6 HERMETIC** | | | | | | | | | |
| CK1290 | CdS | 5100 | 6500 | $10^7$ | 4.0 | .575 | 450 | 1000 | T |
| CK1291 | CdS | 5100 | 12,000 | $10^7$ | 4.0 | .575 | 450 | 1000 | T |
| CK1292 | CdS/Se | 5500 | 5000 | $10^7$ | 4.0 | .450 | 450 | 1000 | T |
| CK1293 | CdS/Se | 6100 | 3000 | $10^8$ | 3.0 | .325 | 450 | 1000 | T |
| **TO-18 DIA OPEN—EPOXY** | | | | | | | | | |
| CK1210 | CdSe | 7150 | 8500 | $10^7$ | .007 | .250 | 75 | 75 | U |
| CK1211 | CdS/Se | 6550 | 6000 | $10^6$ | .006 | .500 | 75 | 75 | U |
| CK1212 | CdS/Se | 6100 | 1500 | $5x10^5$ | .007 | 1.2 | 75 | 75 | U |
| CK1213 | CdS/Se | 5500 | 9000 | $5x10^5$ | .009 | 1.2 | 75 | 75 | U |
| CK1214 | CdS | 5100 | 7000 | $5x10^5$ | .010 | 1.3 | 75 | 75 | U |
| **TO-5 DIA OPEN—EPOXY** | | | | | | | | | |
| CK1216 | CdSe | 7150 | 1000 | $10^7$ | .005 | .175 | 100 | 100 | V |
| CK1217 | CdS/Se | 6550 | 1500 | $10^7$ | .004 | .400 | 100 | 100 | V |
| CK1218 | CdS/Se | 6550 | 3500 | $10^6$ | .005 | .550 | 150 | 100 | V |
| CK1219 | CdS/Se | 5500 | 5000 | $10^6$ | .006 | .700 | 100 | 100 | V |
| CK1220 | CdS | 5100 | 7000 | $10^6$ | .007 | .950 | 100 | 125 | V |
| **TO-8 DIA OPEN—EPOXY** | | | | | | | | | |
| CK1230 | CdSe | 7150 | 12,000 | $10^7$ | .005 | .125 | 175 | 200 | W |
| CK1231 | CdS/Se | 6550 | 10,000 | $10^7$ | .006 | .400 | 175 | 200 | W |
| CK1232 | CdS/Se | 6100 | 4000 | $10^6$ | .005 | .600 | 175 | 200 | W |
| CK1233 | CdS/Se | 5500 | 7500 | $10^6$ | .005 | .750 | 175 | 200 | W |
| CK1234 | CdS | 5100 | 14,000 | $10^6$ | .005 | .950 | 200 | 200 | W |

## PHOTO CONDUCTIVE CELLS—DUAL

| Type | Peak Spectral Response Å | Resistance @ ±33% 2 Feet C ½ Ohms | Dark Resistance ½ Ohms | Balance % | Tracking % | Number of Leads | Voltage ½ VDC | Power ½ mW | Construction Type |
|---|---|---|---|---|---|---|---|---|---|
| **TO-5 HERMETIC DUAL** | | | | | | | | | |
| CK1280 | 7150 | 1500 | $10^7$ | 85 | 10 | 4 | 125 | 75 | X |
| CK1281 | 6550 | 4500 | $10^7$ | 85 | 10 | 4 | 125 | 75 | X |
| CK1282 | 6150 | 9000 | $10^6$ | 85 | 10 | 4 | 125 | 75 | X |
| CK1283 | 5150 | 15K | $10^6$ | 85 | 10 | 4 | 125 | 75 | X |
| CK1284 | 7150 | 25K | $10^8$ | 85 | 10 | 4 | 125 | 75 | X |
| CK1285 | 7150 | 120K | $10^8$ | 85 | 10 | 3 | 150 | 100 | X |
| **TO-8 HERMETIC DUAL** | | | | | | | | | |
| CK1273 | 7150 | 1500 | $10^7$ | 85 | 10 | 3 | 125 | 125 | Y |
| CK1274 | 6550 | 6500 | $10^7$ | 85 | 10 | 3 | 125 | 125 | Y |
| CK1276 | 5150 | 6000 | $10^6$ | 85 | 10 | 3 | 125 | 125 | Y |
| CK1277 | 7150 | 1800 | $10^7$ | 85 | 10 | 4 | 125 | 125 | Y |
| CK1278 | 6550 | 7500 | $10^7$ | 85 | 10 | 4 | 125 | 125 | Y |
| CK1279 | 5150 | 12,000 | $10^6$ | 85 | 10 | 4 | 125 | 125 | Y |

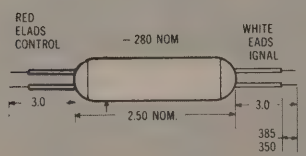
—All recorded measurements taken at room ambient of 25°C at 2850°K color temperature of a calibrated and aged incandescent light source after cells were light adapted at 30 ft-c for 16 hours.

AYTHEON COMPANY / DISTRIBUTOR PRODUCTS OPERATION
EPT. EM / FOURTH AVE. / BURLINGTON, MA 01803 / TEL: (617) 272-6400 / TWX: 710-332-7641

RAYTHEON

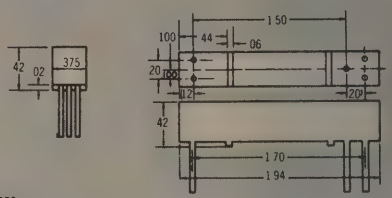
# OPTO-ISOLATORS—RAYSISTORS® PHOTOCONDUCTIVE CELLS

## (A)



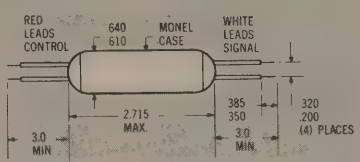

Terminal Connections
Red Leads - Control Crt (Lamp)
White Leads - Signal Crt. (Cell)

## (B) Printed Circuit



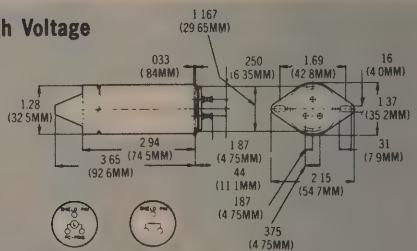

Terminal Connections
Pins 1, 2 Control Circuit (Light Source)
Pins 3 Shield (Ground)
Pins 4, 5 Signal Circuit (Photocell)

## (C) High Voltage



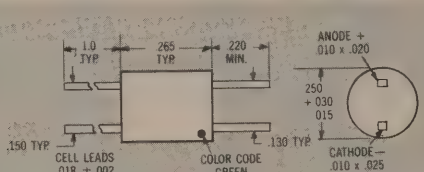

High Voltage - Flying Leads
Red Leads - Control Circuit (Lamp)
White Leads - Signal Circuit (Cell)

## (D) High Voltage

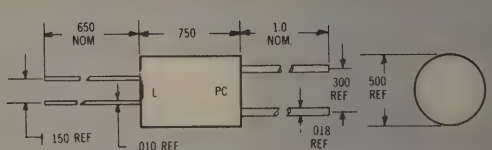



High Voltage - Epoxy Basing
Red Base - Control Circuit
Black Base - Signal Circuit

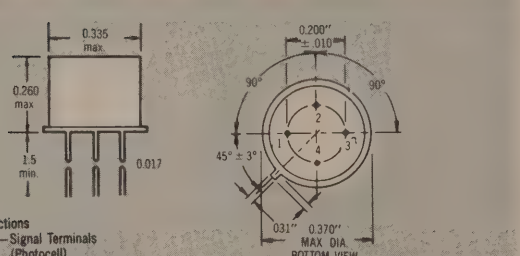
## (E)




## (F)

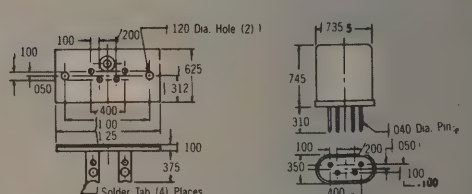



## (G)



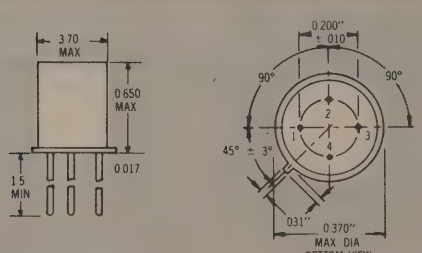

Terminal Connections
Leads 1 and 3—Signal Terminals (Photocell)
Leads 2 and 4—Control Terminals (Light Source)

## (H)



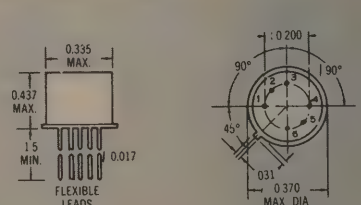

Terminal Connections
Pins 1 & 2 Control Circuit (Light Source)
1 2 3 4
Pins 3 & 4 Signal Circuit (Photoresistor)

## (I)




Terminal Connections
Pins 4 & 2 Control Circuit (Light Source)
Pins 3 & 1 Signal Circuit (Photoresistor)

## (J)



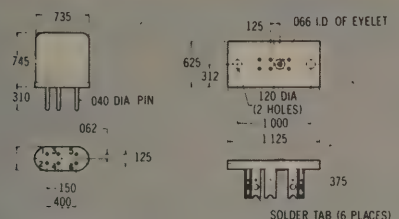

Terminal Connections
Pins #2 & #5—Control Circuit (Energy Emitter)
Pins #1 & #6—Signal Circuit (Photoresistor #1)
Pins #3 & #4—Signal Circuit (Photoresistor #2)

RAYTHEON COMPANY / DISTRIBUTOR PRODUCTS OPERATION
DEPT. EM / FOURTH AVE. / BURLINGTON, MA 01803 / TEL: (617) 272-6400 / TWX: 710-332-7641

RAYTHEON

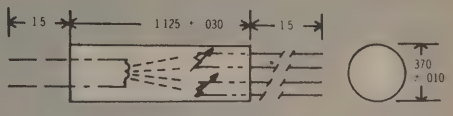
# OPTO-ISOLATORS—RAYSISTORS® PHOTOCONDUCTIVE CELLS

## (K)



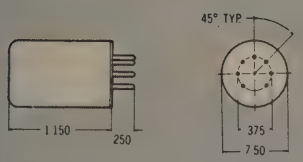

Terminal Connections
Crystal Can—6-Pin Header
Pin #1—PC #1
Pin #2—PC #2
Pin #3—PC #1
Pin #4—PC #2
Pin #5—Lamp Control
Pin #6—Lamp Control

## (L)



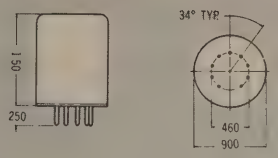

Terminal Connections.
Control Circuit
Pins #1 & #2—Energy Emitter
Identified—Yellow Dot.
Signal Circuit
Pins #3 & #4 Photo Resistor #1
Pins #5 & #6 Photo Resistor #2

## (M)



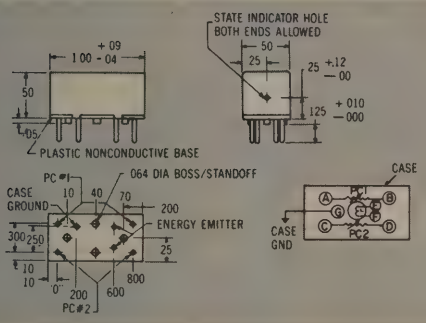

Terminal Connections
Pin #1—Lamp Control
Pin #2—PC #1
Pin #3—PC #1
Pin #4—NC
Pin #5—Lamp Control
Pin #6—PC #2
Pin #7—PC #2

## (N)

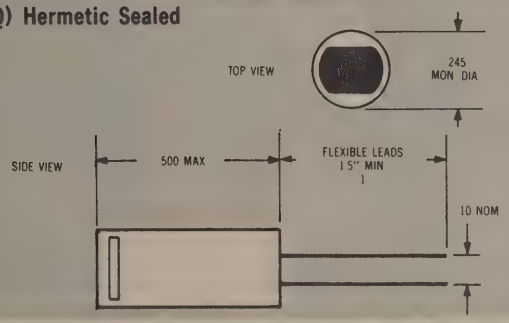



Terminal Connections
9-Pin Header—Epoxy Shell—Design
Pin #1—N.C.
Pin #2—PC #1
Pin #3—PC #1
Pin #4—Control Lamp
Pin #5—Control Lamp
Pin #6—PC #2
Pin #7—PC #2
Pin #8—PC #3
Pin #9—PC #3

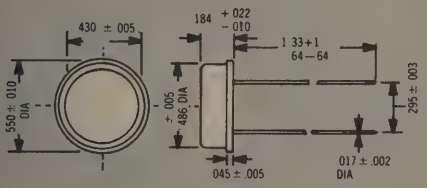
## (O)



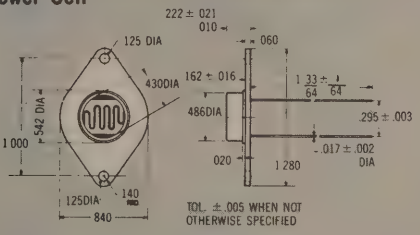

## (Q) Hermetic Sealed



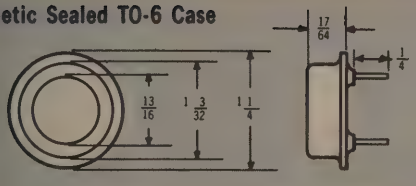

## (R) Hermetic Sealed TO-8 Case



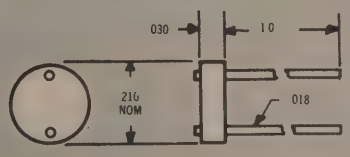

## (S) TO-3 Power Cell




## (T) Hermetic Sealed TO-6 Case




## (U) Epoxy Coated "Open" Photocell TO-18 Dia.

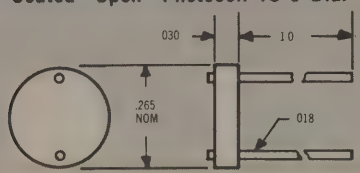



AYTHEON COMPANY / DISTRIBUTOR PRODUCTS OPERATION
EPT. EM / FOURTH AVE. / BURLINGTON, MA 01803 / TEL: (617) 272-6400 / TWX: 710-332-7641

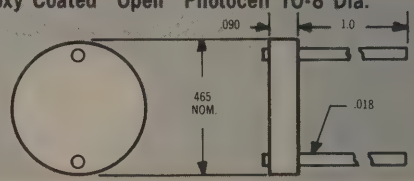
RAYTHEON

# OPTO-ISOLATORS—RAYSISTORS® PHOTOCONDUCTIVE CELLS

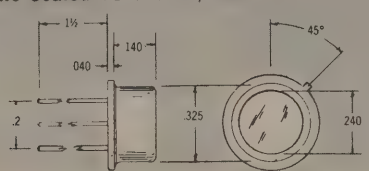
### (V) Epoxy Coated "Open" Photocell TO-5 Dia.



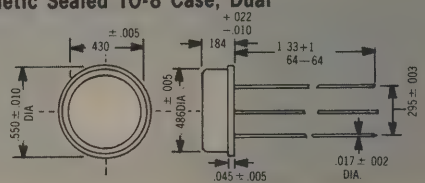

### (W) Epoxy Coated "Open" Photocell TO-8 Dia.



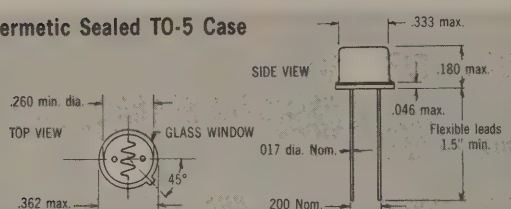

### (X) Hermetic Sealed TO-5 Case, Dual



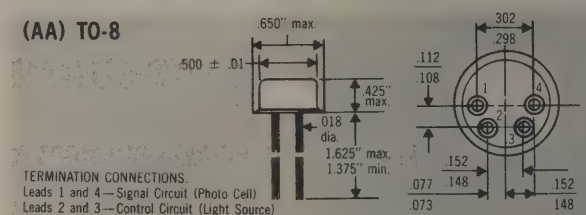

### (Y) Hermetic Sealed TO-8 Case, Dual




### (Z) Hermetic Sealed TO-5 Case




### (AA) TO-8



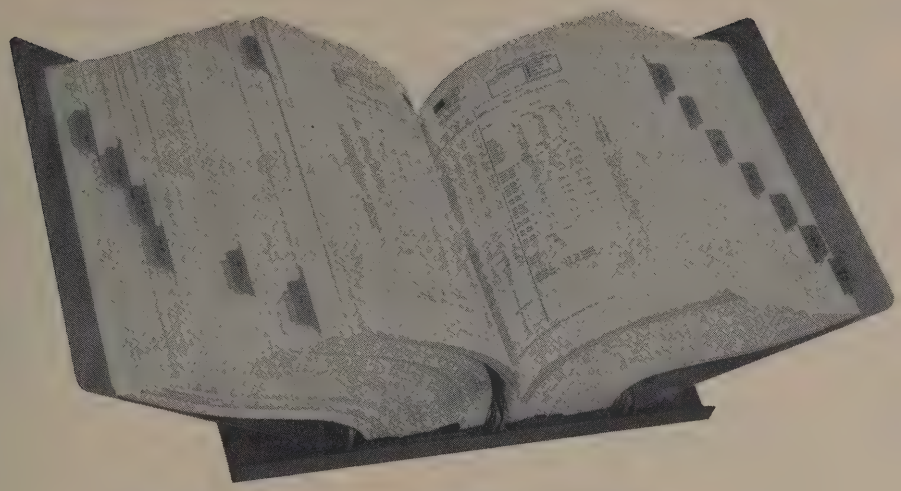

## LOCATING GUIDE OPTO-ISOLATORS (RAYSISTORS®)


| | | PAGE NO. |
|---|---|---|
| CK1101 | Metal Tube, FL | 1 |
| CK1101P | PC | 1 |
| CK1102 | Metal Tube, FL | 1 |
| CK1102P | PC | 1 |
| CK1103 | Metal Tube, FL | 1 |
| CK1103P | PC | 1 |
| CK1104 | Metal Tube, FL | 1 |
| CK1104P | PC | 1 |
| CK1105 | HV, Molded | 2 |
| CK1106 | HV, Molded | 2 |
| CK1108 | HV, Molded | 2 |
| CK1112 | Metal Tube, FL | 1 |
| CK1112P | PC | 1 |
| CK1113 | Metal Tube, FL | 1 |
| CK1113P | PC | 1 |
| CK1114 | TO-5 | 2 |
| CK1115 | TO-5 | 2 |
| CK1116 | TO-5 | 2 |
| CK1117 | TO-5 | 2 |
| CL1121 | Crystal Can | 2 |
| CL1121W | Crystal Can | 2 |
| CK1122 | Crystal Can | 2 |
| CK1122B | Crystal Can | 2 |
| CK1122W | Crystal Can | 2 |
| CK1123 | Crystal Can | 2 |
| CK1124 | Crystal Can | 2 |
| CK2000 | Crystal Can | 2 |
| CK2000B | Crystal Can | 3 |
| CK2002 | TO-5 | 2 |
| CK2003 | Crystal Can | 3 |
| CK2008P | PC | 1 |
| CK2013 | Crystal Can | 3 |
| CK2015 | Crystal Can | 3 |
| CK2018 | Crystal Can | 3 |
| CK2019 | Crystal Can | 3 |
| CK2025P | PC | 1 |
| CK2028A | Crystal Can | 3 |
| CK2028B | Crystal Can | 3 |
| CK2029 | HV, FL | 2 |
| CK2030 | HV, Molded | 2 |
| CK2032 | HV, FL | 2 |
| CK2033 | Epoxy 7 Pin Dual | 3 |
| CK2034 | HV, FL | 2 |
| CK2035 | HV, FL | 2 |
| CK2037 | Epoxy 7 Pin Dual | 3 |
| CK2038 | Epoxy 7 Pin Dual | 3 |
| CK2039 | TO-5 | 2 |
| CK2040 | PC Dual | 3 |
| CK2041 | PC Dual | 3 |
| CK2042 | Epoxy 9 Pin Dual | 3 |
| CK2043 | Epoxy 9 Pin Dual | 3 |
| CK2046 | TO-5 | 2 |
| CK2051 | Crystal Can | 3 |
| CK2052 | Crystal Can | 3 |
| CK2053 | Crystal Can | 3 |
| CK2056 | HV, Molded | 2 |
| CK2066 | HV, Molded | 2 |
| CK2067 | HV, Molded | 2 |
| CK2070 | TO-5 | 2 |
| CK2071 | TO-5 | 2 |
| CK2072 | TO-5 | 2 |
| CK2078 | TO-5 Epoxy | 3 |
| CK2080 | TO-5 | 2 |
| CK2086 | Crystal Can | 3 |
| CK2095 | TO-5 | 2 |
| CK2101 | TO-5 | 2 |
| CK2102 | TO-8 | 2 |
| CK2103 | TO-8 | |
| CK2104 | TO-8 | |
| CK2112 | Crystal Can | |
| CK2118 | TO-5 | |
| CK2124 | TO-5 | |
| CK2127 | TO-5 | |
| CK2129 | HV, FL | |
| CK2132 | Crystal Can | |
| CK2139 | Crystal Can | |
| CK2140 | TO-5 | |
| CK2141 | TO-5 | |
| CK2142 | TO-5 | |
| CK2143 | TO-5 | |
| CK2145 | Tubular, Axial | |
| CK2146 | Tubular, Axial | |
| CK2147 | Crystal Can | |
| CK2148 | Crystal Can | |
| CK2149 | Crystal Can | |
| CK2150 | TO-5 Dual | |
| CK2151 | TO-5 Dual | |
| CK2153 | TO-5 Dual | |
| CK2154 | TO-5 Dual | |
| CK2155 | TO-5 Dual | |
| CK2157 | TO-5 Dual | |
| CK2160 | Epoxy FL Dual | |
| CK2161 | Epoxy FL Dual | |
| CK2162 | Epoxy FL Dual | |
| CK2170 | Crystal Can Dual | |
| CK2171 | Crystal Can Dual | |
| CK2172 | Crystal Can Dual | |
| CK2173 | Crystal Can Dual | |
| CK2177 | Tubular FL | |
| CK2178 | Tubular FL | |


## LOCATING GUIDE—PHOTO CONDUCTIVE CELLS


| | PAGE NO. |
|---|---|
| CK1201 to CK1209 ¼" Glass Vial | 4 |
| CK1210 to CK1214 TO-18 Open | 5 |
| CK1216 to CK1228 ¼" Glass Vial | 4 |
| CK1230 to CK1234 TO-8 Open | 5 |
| CK1241 ro CK1249 TO-5 Hermetic | 4 |
| CK1251 to CK1258 TO-8 Hermetic | 4 |
| CK1261 to CK1268 TO-5 Hermetic | 4 |
| CK1273 to CK1279 TO-8 Hermetic, Dual | 5 |
| CK1280 to CK1285 TO-5 Hermetic, Dual | |
| CK1286 to CK1289 TO-3 Power Cell | |
| CK1290 to CK1293 TO-6 Hermetic | |


**RAYTHEON COMPANY / DISTRIBUTOR PRODUCTS OPERATION**
DEPT. EM / FOURTH AVE. / BURLINGTON, MA 01803 / TEL: (617) 272-6400 / TWX: 710-332-7641



# UNITED PRICING REPORTS

## the single source that speeds up ıvoicing, pricing, quoting, purchasing and estimating

ectronic component prices change so fast, you'd ed a team of people just to keep up.

ited Pricing Reports is the better way. When you bscribe to Pricing Reports you receive 1500 cing sheets (3000 pages) of the latest prices, of the date we ship them to you.

is gives you, in a single source, up-to-the minute selling prices on more than 500,000 electronic components.

United Pricing Reports gives you accurate resale prices at the exact moment you need them. Not hours or days later. So it helps you eliminate frantic phone calls, letter writing and catalog scanning to check on prices when you write an invoice or type a purchase order.

## Twice weekly price updates.

One week after you receive your Pricing Reports source book (1500 pricing sheets) you begin receiving twice weekly price updates. You simply take these new price pages and replace the now obsolete pages with them.

The whole process is simple. All information is organized alphabetically by manufacturer. And each manufacturer's price schedule is listed by part number in numerical/alphabetical sequence.

One more thing. When we promise twice weekly updates, we deliver. 52 weeks a year, consistently. Not monthly or every other month. We have a tradition of delivery on our promises, and we're certainly not going to stop now.

ECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500 TWX-510/222-1673

# VACTEC

## INDUSTRY'S BROADEST LINE OF DETECTORS

- Photoconductive Cells
- Phototransistors and Photodarlingtons
- Standard Silicon and Blue-Enhanced Photovoltaic Cells, Blue-Enhanced Photodiodes, and PIN Photodiodes
- Selenium Photovoltaic Cells
- Vactrols (Opto-Isolators)
- Custom I-C's Design and Fabrication (Not detailed in this short form)

## PHOTOCONDUCTIVE CELLS

LIGHT DEPENDENT RESISTORS

Photoconductors are thin films of CdS or CdSe on a ceramic substrate.
The material is designated by the second digit (O, 1, 2, 3, 4 or 7) of the part number.

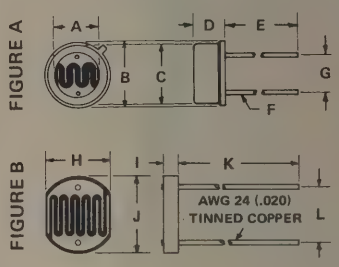
| Material | 0-CdS | 1-CdSe | 2-CdS | 3-CdS | 4-CdSe | 7-CdS |
|---|---|---|---|---|---|---|
| Peak Spectral nm | 565 | 735 | 515 | 550 | 675 | 615 |

FIGURE A

| DIM. | VT 200 | VT 300 | VT 500 |
|---|---|---|---|
| A | .155 | .240 | .430 |
| B | .210 | .360 | .550 |
| C | .183 | .325 | .486 |
| D | .140/.154 | .172/.183 | .190/.230 |
| E | 1.5/1.53 | 1.5/1.53 | 1.5/1.53 |
| F | .016/.019 | .016/.019 | .019 |
| G | .100 | .200 | .295 |

FIGURE B

| DIM. | VT 400 | VT 700 | VT 800 | VT 900 |
|---|---|---|---|---|
| H | .360/.380 | .300/.320 | .216/.236 | .144/.164 |
| I | .070/.090 | .070/.090 | .070/.090 | .070/.090 |
| J | .420/.440 | .353/.373 | .256/.276 | .172/.192 |
| K | .75 min. | .75 min. | .75 min. | .75 min. |
| L | .285/.305 | .255/.275 | .190/.210 | .090/.110 |




### VT 200 SERIES (Fig. A) Hermetic TO-18 (50 mW)

| Part No. | $R_1$* | $R_2$* |
|---|---|---|
| VT-201 | 4.3 | .5 |
| VT-202 | 8 | .75 |
| VT-202H | 15 | 1 |
| VT-203 | 22 | 5 |
| VT-203H | 44 | 5 |
| VT-204L | 88 | 10 |
| VT-204 | 110 | 20 |
| VT-205 | 1000 | 200 |
| VT-211 | 2.3 | .5 |
| VT-211H | 3.5 | 1 |
| VT-212L | 6 | 5 |
| VT-212 | 7.8 | 5 |
| VT-213L | 16 | 10 |
| VT-213 | 22 | 50 |
| VT-213H | 32 | 50 |
| VT-214L | 64 | 100 |
| VT-214 | 140 | 200 |
| VT-221 | 6.8 | .75 |
| VT-222 | 10 | 1 |
| VT-222H | 20 | 1 |
| VT-223 | 40 | 5 |
| VT-223H | 65 | 5 |
| VT-224L | 80 | 10 |
| VT-224 | 500 | 50 |
| VT-225 | 1000 | 200 |
| VT-23L | 11 | 1 |
| VT-231 | 22 | 1 |
| VT-232 | 100 | 50 |
| VT-233L | 150 | 50 |
| VT-233 | 350 | 100 |
| VT-234 | 700 | 200 |
| VT-235 | 1400 | 200 |
| VT-241 | 2 | .5 |
| VT-241H | 4 | 1 |
| VT-242L | 8 | 1 |
| VT-242 | 15 | 10 |
| VT-242H | 30 | 10 |
| VT-271 | 4 | 2.5 |
| VT-272 | 6 | 5 |

### VT 300 SERIES (Fig. A) Hermetic TO-5 (125 mW)

| Part No. | $R_1$* | $R_2$* |
|---|---|---|
| VT-30L | 1.8 | .1 |
| VT-301 | 3 | .2 |
| VT-301H | 3 | 1 |
| VT-302L | 10 | 1 |
| VT-302 | 16 | 5 |
| VT-303L | 32 | 10 |
| VT-303 | 70 | 10 |
| VT-304 | 144 | 50 |
| VT-305 | 1000 | 200 |
| VT-311L | 2.1 | .5 |
| VT-311 | 4.2 | 1 |
| VT-312L | 8.4 | 5 |
| VT-312 | 22 | 50 |
| VT-312H | 30 | 50 |
| VT-313L | 60 | 100 |
| VT-314 | 140 | 200 |
| VT-32L | 1.95 | .1 |
| VT-321 | 3.9 | .2 |
| VT-321H | 7.8 | 1 |
| VT-322L | 15.6 | 5 |
| VT-322 | 31.2 | 10 |
| VT-325 | 1000 | 200 |
| VT-333L | 14 | 5 |
| VT-333 | 28 | 10 |
| VT-34L | .6 | .1 |
| VT-341 | 1.2 | .2 |
| VT-341H | 2.4 | 1 |
| VT-342L | 4.8 | 1 |
| VT-342 | 7 | 5 |
| VT-343L | 14 | 10 |
| VT-343 | 28 | 10 |

DUAL ELEMENT

| Part No. | $R_1$* | $R_2$* |
|---|---|---|
| VT-301/2 | 7.5 | 1 |
| VT-302/2 | 16 | 5 |
| VT-303L/2 | 32 | 5 |
| VT-312/2 | 5 | 1 |
| VT-313L/2 | 10 | 1 |
| VT-333/2 | 60 | 25 |
| VT-34L/2 | 1.5 | .1 |
| VT-341/2 | 3 | .2 |

### VT 400 SERIES (Fig. B) (300 mW)

| Part No. | $R_1$* | $R_2$* |
|---|---|---|
| VT-401 | 1 | .25 |
| VT-402 | 9 | 1 |
| VT-431 | 6 | 1 |
| VT-432 | 10.5 | 1 |
| VT-433 | 18 | 10 |
| VT-434 | 32 | 10 |
| VT-435 | 60 | 10 |
| VT-436 | 110 | 10 |
| VT-471 | .9 | .3 |

### VT 500 SERIES (Fig. A) Hermetic TO-8 (300 mW)

| Part No. | $R_1$* | $R_2$* |
|---|---|---|
| VT-50L | 1.3 | .1 |
| VT-501 | 2.6 | .2 |
| VT-501H | 4 | .5 |
| VT-502L | 8 | 1 |
| VT-502 | 16 | 5 |
| VT-503L | 32 | 10 |
| VT-503 | 66 | 50 |
| VT-51L | .7 | .1 |
| VT-511L | 1.4 | .2 |
| VT-511 | 2.3 | .5 |
| VT-511H | 4.6 | 1 |
| VT-512L | 9.2 | 10 |
| VT-521 | 2.6 | .1 |
| VT-521H | 5 | .5 |
| VT-522L | 9 | 1 |
| VT-522 | 18 | 5 |
| VT-523L | 36 | 10 |
| VT-533L | 12.5 | 5 |
| VT-533 | 25 | 10 |
| VT-54L | .25 | .1 |
| VT-541 | .5 | .5 |
| VT-541H | 1 | 1 |
| VT-542L | 1.5 | 1 |
| VT-542 | 2 | 1 |

### VT 700 SERIES (Fig. B) (250 mW)

| Part No. | $R_1$* | $R_2$* |
|---|---|---|
| VT-70L | 1.6 | 1 |
| VT-701 | 3.0 | 5 |
| VT-721 | 2.6 | 1 |
| VT-721H | 4.8 | 2 |
| VT-732 | 10.0 | 10 |
| VT-74L | .45 | .5 |
| VT-741 | .90 | .5 |
| VT-771 | 2.0 | 2 |
| VT-773 | 8.4 | 10 |

### VT 800 SERIES (175 mW) (Fig. B)

| Part No. | $R_1$* | $R_2$* |
|---|---|---|
| VT-801 | 3.0 | .25 |
| VT-804 | 140.0 | 50 |
| VT-811 | 4 | 5 |
| VT-811H | 8 | 10 |
| VT-82L | 1.90 | .1 |
| VT-833 | 33.0 | 15 |
| VT-835 | 330.0 | 100 |
| VT-841L | .90 | .5 |
| VT-871 | 3.0 | 10 |

DUAL ELEMENT

| Part No. | $R_1$* | $R_2$* |
|---|---|---|
| VT-811/2 | 2.4* | 1 |
| VT-833/2 | 52 * | 10 |
| VT-841/2 | 2.4* | .5 |
| VT-871/2 | 8.8* | 1 |

### VT 900 SERIES (Fig. B) (80 mW)

| Part No. | $R_1$* | $R_2$* |
|---|---|---|
| VT-901 | 4.3 | .5 |
| VT-902 | 8.0 | .75 |
| VT-903H | 44.0 | 5 |
| VT-904L | 88.0 | 10 |
| VT-904 | 110.0 | 20 |
| VT-912L | 6.0 | 5 |
| VT-912 | 15.0 | 20 |
| VT-913H | 32.0 | 50 |
| VT-914L | 64.0 | 100 |
| VT-914 | 140.0 | 200 |
| VT-93L | 11.0 | 1 |
| VT-931 | 22.0 | 1 |
| VT-932 | 100.0 | 50 |
| VT-941 | 2.0 | .5 |
| VT-971 | 4.5 | 1 |

*$R_1$ 2fc resistance in K ohms (tolerance ±33⅓% (2850°K source) — Resistance for dual element cells is for each ½.
*R min dark resistance (Megohms) in 5 sec

## SILICON CELLS

PHOTOVOLTAIC CURRENT GENERATORS

POWER CONVERSION OR INSTRUMENT APPLICATIONS

### LOW CAPACITANCE DETECTORS High Speed Low leakage

| PART NO. | DIMENSIONS | $I_{SC}$@ 100fc |
|---|---|---|
| VTS 3080 | .8 x .8 in (2.03 x 2.03) cm | 2.5 mA |
| VTS 3081 | .8 x .4 in (2.03 x 1.02) cm | 1.2 mA |
| VTS 3082 | .4 x .4 in (1.02 x 1.02) cm | 0.6 mA |
| VTS 3083 | .8 x .2 in (2.03 x .51) cm | 0.55 mA |
| VTS 3084 | .4 x .2 in (1.02 x .51) cm | 0.27 mA |
| VTS 3085 | .2 x .2 in (.51 x .51) cm | 0.14 mA |
| VTS 3086 | .1 x .2 in (.25 x .51) cm | 0.065 mA |
| VTS 3087 | .087 x .2 in (.22 x .51) cm | 0.055 mA |
| VTS 1086 | See VT800 Series Dwg. | .065 mA |
| VTS 4085 | See VT700 Series Dwg. | .14 mA |
| VTS 5086 | See VT300 Series Dwg. | .065 mA |
| VTS 5088 | See VT300 Series Dwg. | .12 mA |
| VTS 6089 | See VT500 Series Dwg. | .28 mA |
| VTS 7080A | 1¼" diameter hermetic | 1.5 mA |

### BES BLUE ENHANCED DETECTORS

| PART NO. | DIMENSIONS | $I_{SC}$@ 100fc |
|---|---|---|
| VTS 3070 | .8 x .8 in (2.03 x 2.03) cm | 1.9 mA |
| VTS 3071 | .8 x .4 in (2.03 x 1.02) cm | .93 mA |
| VTS 3072 | .4 x .4 in (1.02 x 1.02) cm | .46 mA |
| VTS 3073 | .8 x .2 in (2.03 x .51) cm | .42 mA |
| VTS 3074 | .4 x .2 in (1.02 x .51) cm | .21 mA |
| VTS 3075 | .2 x .2 in (.51 x .51) cm | .10 mA |
| VTS 3076 | .1 x .2 in (.25 x .51) cm | .05 mA |
| VTS 3077 | .087 x .2 in (.22 x .51) cm | .042 mA |
| VTS 1076 | See VT800 Series Dwg. | .05 mA |
| VTS 4075 | See VT700 Series Dwg. | .10 mA |
| VTS 5076 | See VT300 Series Dwg. | .05 mA |
| VTS 5078 | See VT300 Series Dwg. | .09 mA |
| VTS 6079 | See VT500 Series Dwg. | .23 mA |
| VTS 7070A | 1¼" diameter hermetic | 1.12 mA |

### SOLAR CELLS

| PART NO. | DIMENSIONS | $I_L$* mA |
|---|---|---|
| VTS 3011 | .087 x .20 in (.22 x .51) cm | 1.7 |
| VTS 3012 | .10 x .20 in (.22 x .51) cm | 2.0 |
| VTS 3013 | .20 x .20 in (.51 x .51) cm | 4.2 |
| VTS 3014 | .40 x .20 in (1.02 x .51) cm | 8.4 |
| VTS 3018 | .80 x .20 in (2.03 x .51) cm | 17.0 |
| VTS 3020 | .40 x .40 in (1.02 x 1.02) cm | 18.0 |
| VTS 3022 | .40 x .40 in (1.02 x 1.02) cm | 21.0 |
| VTS 3024 | .80 x .40 in (2.03 x 1.02) cm | 38.0 |
| VTS 3026 | .80 x .40 in (2.03 x 1.02) cm | 44.0 |
| VTS 3028 | .80 x .80 in (2.03 x 2.03) cm | 79.0 |
| VTS 3050 | 1.25 ∅ in (2.86 ∅) cm | 110.0 |

*$I_L$ min @ 0.4 volts for 100 mW/cm² @ 2850°K (m = 1 Equivalent)

**VACTEC, INC.** 2423 Northline Ind. Blvd., Maryland Heights, Mo. 63043 Phone: (314) 872-8300

# VACTEC

## INDUSTRY'S BROADEST LINE OF DETECTORS

- Photoconductive Cells
- Phototransistors and Photodarlingtons
- Standard Silicon and Blue-Enhanced Photovoltaic Cells, Blue-Enhanced Photodiodes, and PIN Photodiodes
- Selenium Photovoltaic Cells
- Vactrols (Opto-Isolators)
- Custom I-C's Design and Fabrication (Not detailed in this short form)

BLUE ENHANCED

## PHOTODIODES

P.I.N.

### BLUE ENHANCED

| P.N. | $I_L$*(μA) | $I_D$* max | $C_J$* | P.N. | $I_L$*(μA) | $I_D$* max | $C_J$* |
|---|---|---|---|---|---|---|---|
| VTB1012 | 13 | 500pA | .31nF | VTB9415B | 1.3 | 4pA | .6nF |
| VTB1013 | 13 | 20 | .31 | VTB9416B | 1.3 | 2 | .6 |
| VTB9412 | 13 | 500 | .31 | VTB1112B | 6 | 500 | .31 |
| VTB9413 | 13 | 20 | .31 | VTB1113B | 6 | 20 | .31 |
| VTB1112 | 60 | 500 | .31 | VTB5040 | 45 | 2000 | 1.0 |
| VTB1113 | 60 | 20 | .31 | VTB5041 | 45 | 100 | 1.0 |
| VTB1012B | 1.3 | 500 | .31 | VTB5040B | 4.5 | 2000 | 1.0 |
| VTB1013B | 1.3 | 20 | .31 | VTB5041B | 4.5 | 100 | 1.0 |
| VTB9412B | 1.3 | 500 | .31 | VTB5050 | 130 | 3500 | 3.0 |
| VTB9413B | 1.3 | 20 | .31 | VTB5051 | 130 | 250 | 3.0 |
| VTB9414B | 1.3 | 10 | .6 | VTB6060 | 350 | 5000 | 8.0 |
| | | | | VTB6061 | 350 | 2000 | 8.0 |

### P.I.N.

| P.N. | $I_L$*(μA) | $I_D$* max | $C_J$* |
|---|---|---|---|
| VTP1012 | 17 | 7nA | 6pF |
| VTP1013 | 17 | 1.5 | 6 |
| VTP1112 | 60 | 7 | 6 |
| VTP1113 | 60 | 1.5 | 6 |
| VTP5040 | 54 | 15 | 15 |
| VTP5041 | 54 | 3 | 15 |
| VTP5050 | 71 | 18 | 20 |
| VTP5051 | 71 | 3.5 | 20 |
| VTP6060 | 240 | 35 | 60 |
| VTP6061 | 240 | 7 | 60 |

**PACKAGE STYLES**

See 931-932 Series under Phototransistors for all VTB94 — Series. For all VTB1 — and VTP1 — Series see TO-18, 101, 111 Series under Phototransistors. For VTB5 — and VTP5 — Series see VT300 under Photoconductive. For VTB6 — and VTP6 — Series see VT500 under Photoconductive.

*$I_L$ is measured at 100 f.c., $I_D$ at −2.0V for Blue Enhanced and −50V for P.I.N. $C_J$ is at zero bias, for Blue Enhanced and −15V for P.I.N. B Suffix indicates I-R cutoff filter.

## PHOTOTRANSISTORS • PHOTODARLINGTONS

NPN SILICON PASSIVATED

**Hermetic VTT, VTA 101 and 111 SERIES TO-18**

| | | P.N. | $I_{CEO}$ TYP.** | WINDOW |
|---|---|---|---|---|
| PHOTOTRANSISTORS | LARGE CHIP* | VTT1012 | .5 | Flat |
| | | VTT1011 | 1.0 | " |
| | | VTT1010 | 2.0 | " |
| | | VTT1013 | 4.0 | " |
| | | VTT1110 | 2.0 | Lens |
| | | VTT1111 | 3.5 | " |
| | | VTT1112 | 6.0 | " |
| | | VTT1113 | 12.0 | " |
| | SMALL CHIP* | VTT1020 | .125 | Flat |
| | | VTT1021 | .250 | " |
| | | VTT1022 | .500 | " |
| | | VTT1023 | 1.0 | " |
| | | VTT1120 | .5 | Lens |
| | | VTT1121 | 1.0 | " |
| | | VTT1122 | 2.0 | " |
| | | VTT1123 | 4.0 | " |
| PHOTODARLINGTONS | LARGE CHIP* | VTA1011 | 2.0 | Flat |
| | | VTA1012 | 6.0 | " |
| | | VTA1013 | 15.0 | " |
| | | VTA1111 | 9.0 | Lens |
| | | VTA1112 | 35.0 | " |
| | SMALL CHIP* | VTA1021 | .5 | Flat |
| | | VTA1022 | 1.5 | " |
| | | VTA1023 | 4.0 | " |
| | | VTA1121 | 3.0 | Lens |
| | | VTA1122 | 8.0 | " |

**VTT, VTA 312 SERIES — COAXIAL**

| | | P.N. | $I_{CEO}$ TYP.** | WINDOW |
|---|---|---|---|---|
| TRANS. | SM. CH. | VTT3121 | 1 | Lens |
| | | VTT3122 | 3 | " |
| | | VTT3123 | 8 | " |
| DARL. | SM. CH. | VTA3121 | 3 | Lens |
| | | VTA3122 | 8 | " |

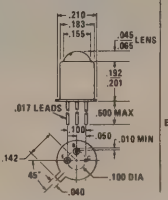
**VTT, VTA 931-932 SERIES — CERAMIC BASE**

| | | P.N. | $I_{CEO}$ TYP.** | WINDOW |
|---|---|---|---|---|
| PHOTOTRANS. | LG. CH. | VTT9310 | .5 | EPOXY LENS WITH SLIGHT MAGNIFICATION |
| | | VTT9311 | 1 | |
| | | VTT9312 | 2 | |
| | | VTT9313 | 4 | |
| | SM. CH. | VTT9320 | .125 | |
| | | VTT9321 | .25 | |
| | | VTT9322 | .5 | |
| | | VTT9323 | 1 | |
| PHOTODARL. | LG. CH. | VTA9311 | 2 | |
| | | VTA9312 | 6 | |
| | | VTA9313 | 15 | |
| | SM. CH. | VTA9321 | .5 | |
| | | VTA9322 | 1.5 | |
| | | VTA9323 | 4 | |

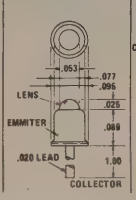
**CHIPS For Custom or Hybrid Mounting**

| | P.N. | $I_{CEO}$ TYP.** | $I_{CEO}$ TYP. RANGE | $V_{(BR)CEO}$ | SIZE (in.) |
|---|---|---|---|---|---|
| TRANS. | VTT-C25 | .5 | 4-1 | 40 | .025 x .025 |
| | VTT-C40 | 1.5 | 4-1 | 35 | .04 x .04 |
| | VTT-C50 | 2.0 | 4-1 | 30 | .05 x .05 |
| DARL. | VTA-C25 | 1.5 | 6-1 | 40 | .025 x .025 |
| | VTA-C50 | 8.0 | 6-1 | 30 | .05 x .05 |

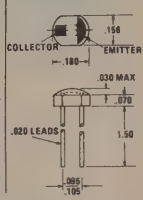
**101, 111, 102, 112 SERIES**




**312 SERIES**




**931 and 932 SERIES**




*Small chips are 25 x 25 mil., Large are 50 x 50 mil.

**$I_{CEO}$ -In mA @ 5 mW/cm² for phototransistors and .2 mW/cm² for darlingtons ($V_{CE}$ = 5V.)

PHOTOCONDUCTOR—LIGHT SOURCE OPTO-COUPLERS—ISOLATORS

## VACTROLS

INPUT-OUTPUT ISOLATION FOR ON-OFF OR PROPORTIONAL CONTROL OF OUTPUT RESISTANCE

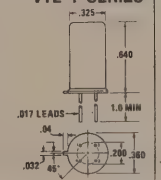
**VTL 3 SERIES — Photoconductor — Plastic Axial — INCANDESCENT TYPES**

| Part Number | LAMP OR LED mA | LAMP OR LED Volts | Cell Resis.-ohms ON Light Adap'd (max.) | Cell Resis.-ohms OFF (5 sec) (min.) |
|---|---|---|---|---|
| VTL3A11 | 55 | 1.5 | 350 | 5 x |
| VTL3A12 | 15 | 3.0 | 350 | $10^7$ |
| VTL3A13 | 60 | 4.0 | 160 | |
| VTL3A14 | 40 | 6.0 | 160 | |
| VTL3A15 | 14 | 10 | 350 | |
| VTL3A16 | 25 | 12 | 400 | |
| VTL3A17 | 40 | 12 | 160 | |
| VTL3A21 | 55 | 1.5 | 800 | $10^6$ |
| VTL3A22 | 15 | 3.0 | 600 | |
| VTL3A23 | 60 | 4.0 | 300 | |
| VTL3A24 | 40 | 6.0 | 350 | |
| VTL3A25 | 14 | 10 | 600 | |
| VTL3A26 | 25 | 12 | 500 | |
| VTL3A27 | 40 | 12 | 150 | |
| VTL3A31 | 55 | 1.5 | 5000 | $10^7$ |
| VTL3A32 | 15 | 3.0 | 4000 | |
| VTL3A33 | 60 | 4.0 | 500 | |
| VTL3A34 | 40 | 6.0 | 800 | |
| VTL3A35 | 14 | 10 | 3000 | |
| VTL3A36 | 25 | 12 | 2000 | |
| VTL3A37 | 40 | 12 | 300 | |
| VTL3A41 | 55 | 1.5 | 200 | $10^6$ |
| VTL3A42 | 15 | 3.0 | 200 | |
| VTL3A43 | 60 | 4.0 | 55 | |
| VTL3A44 | 40 | 6.0 | 55 | |
| VTL3A45 | 14 | 10 | 150 | |
| VTL3A46 | 25 | 12 | 100 | |
| VTL3A47 | 40 | 12 | 40 | |

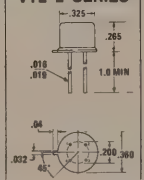
| | | Part Number | LAMP OR LED mA | LAMP OR LED Volts | Cell Resis.-ohms ON Light Adap'd (max.) | Cell Resis.-ohms OFF (5 sec) (min.) |
|---|---|---|---|---|---|---|
| VTL 3 SERIES | NEON TYPES | VTL3B18 | — | 120 | 7000 | $5 \times 10^7$ |
| | | VTL3B19 | — | 120 | 1150 | ↓ |
| | | VTL3B28 | — | 120 | 5000 | $10^6$ |
| | | VTL3B29 | — | 120 | 650 | ↓ |
| | | VTL3B38 | — | 120 | 15K | $10^7$ |
| | | VTL3B39 | — | 120 | 6000 | ↓ |
| | | VTL3B48 | — | 120 | 1000 | $10^6$ |
| | | VTL3B49 | — | 120 | 160 | ↓ |
| VTL 1 SERIES | INCAND. | VTL1A1 | 55 | 1.5 | 500 | $10^7$ |
| | | VTL1A2 | 40 | 6 | 250 | |
| | | VTL1A3 | 14 | 10 | 800 | |
| | | VTL1A4 | 25 | 12 | 250 | |
| | NEON | VTL1B5 | — | 150 | 1000 | |
| | | VTL1B6 | — | 90 | 5000 | |
| VTL 2 SERIES | LED | VTL2C1 | 40 | 1.5 | 10K | $10^8$ |
| | | VTL2C2 | 40 | 1.5 | 500 | $10^6$ |
| | | VTL2C3 | 40 | 1.5 | 2K | $10^7$ |
| | | VTL2C4 | 40 | 1.5 | 100 | $.4 \times 10^6$ |

| | | Part Number | LAMP OR LED mA | LAMP OR LED Volts | Cell Resis.-ohms ON Light Adap'd (max.) | Cell Resis.-ohms OFF (5 sec) (min.) |
|---|---|---|---|---|---|---|
| VTL 5 SERIES | LED | VTL5C1 | 40 | 1.5 | 500 | $5 \times 10^7$ |
| | | VTL5C2 | 40 | 1.5 | 500 | $10^6$ |
| | | VTL5C3 | 40 | 1.5 | 2000 | $10^7$ |
| | | VTL5C4 | 10 | — | 200 | $.4 \times 10^6$ |
| | | VTL5C6 | 40 | 1.5 | 3500 | $10^8$ |
| | | VTL5C7 | 2 | — | 1500 | $10^6$ |
| | | DUAL ELEMENT | | | | |
| | | VTL5C3/2 | 40 | 1.5 | 3000 | $10^7$ |
| | | VTL5C4/2 | 10 | — | 300 | $.4 \times 10^6$ |

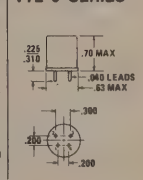
**VTL 1 SERIES**



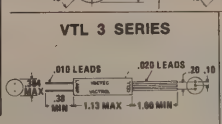

**VTL 2 SERIES**



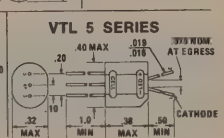

**VTL 9 SERIES**




**VTL 3 SERIES**




**VTL 5 SERIES**




**VACTEC, INC.** 2423 Northline Ind. Blvd., Maryland Heights, Mo. 63043 Phone: (314) 872-8300

# abbott Power Supply Modules

## The Next 12 Pages List 680 Regulated Modules with Specifications and Prices

The most complete line of small size MIL-Spec and OEM type power modules available in the industry is fully described in the following 12 pages. The Abbott line of power modules includes output voltages from 3 volts to 100 volts DC, output current from 2 milliamperes to 20 amperes and output power from 1 watt to 300 watts. Sizes, weights, regulations and environments are shown for the various input and output powers. Abbott is proud to continue its policy of introducing new products to meet the growing demands of our customers by listing a completely new line of power modules. The Model D Series is a high efficiency, industrial DC power supply. Inputs are 115 VAC, 220 VAC, 1$\phi$, 3$\phi$ and 48 VDC. Look through the next 12 pages and you may find the power module you want is a standard Abbott model.

## TABLE OF CONTENTS

**NEXT 12 PAGES**


| | | |
|---|---|---|
| **60 HERTZ** to: | DC, OEM, NL's | Page 3151 |
| | DC; Low Cost; LC/LLC's | Page 3152 |
| | DC, Industrial; RN/RRN's | Page 3153 |
| | DC, Hermetically sealed; V's | Page 3155 |
| | DC, Hi-efficiency, Mil-spec; VN's | Page 3156 |
| | DC, Hi-efficiency, Industrial; D's | Page 3157 |
| **400 HERTZ** to: | DC, Hi-performance; W/WW's | Page 3158 |
| | DC, Hi-efficiency; UN/UUN's | Page 3159 |
| **DC** to: | Sine Wave; KN/PN/LN's & Size Chart | Page 3154 |
| | DC, Hi-performance; C/CC's | Page 3160 |
| | DC, Hi-efficiency; BN/BBN's | Page 3161 |
| | DC, Hi-efficiency, Industrial; D's | Page 3157 |
| | Sine Wave; S's & Size Chart | Page 3162 |

See Abbott's 1978 catalog f complete information on all o products plus additional item such as:

- Quality Control System
- Thermal Data
- Input Currents
- Overvoltage Protectors
- Input Line Filters
- Operating Hints

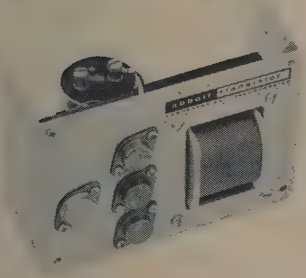
To receive your free copy of this comprehensive 60 page Power Supply Catalog, simply call or write Abbott.

abbott transistor
LABORATORIES, INCORPORATED

**GENERAL OFFICES**
DEPT. EM, 5200 W. Jefferson Blvd.
Los Angeles, CA 90016
(213) 936-8185
Telex 69-1398

**EASTERN OFFICES**
Dept. EM, 1224 Anderson Ave.
Fort Lee, NJ 07024
(201) 224-6900
Telex 13-5332

# abbott AC to DC Lowest Cost



## features

- 110/220 VAC Input
- Single, Dual, and Triple Outputs
- +71° Ambient Operation
- 47-440 Hz Input Frequency
- Hi-Reliability

## specifications

**INPUT VOLTAGE RANGE:** 105 to 125 VRMS, standard. 210 to 250 VRMS available at no additional charge. To specify this type range, add the prefix "E" to the Model No. (eg, ENLS5T3).
105 to 125/210 to 250 dual input available for an additional charge of $5.00. To specify this range, add the prefix "I" to the Model No. (eg. INLS5T3).

**INPUT FREQUENCY:** 47-440 Hz, single phase (derate current 10% for 50 Hz operation).

**LINE REGULATION:** 0.02% for 10% input change (single output).
0.1% for 10% input change (dual/triple output).

**LOAD REGULATION:** 0.1% for no load to full load change with line constant (single output).
0.2% for no load to full load change with line constant (dual/triple output).

**RIPPLE:** 1.0 mV RMS maximum; 1.5 mV peak-to-peak typical, 5 mV peak-to-peak maximum.

**LOAD TRANSIENT RECOVERY TIME:** 50 μSec typical after a 50% step change in load current.

**SHORT CIRCUIT PROTECTION:** Each unit is completely protected against a short circuit of any duration. The output voltage automatically restores to normal in approximately 5 mSec after removal of the short.

**REVERSE VOLTAGE PROTECTION:** Provided on output and on pass element.

**REMOTE ERROR SENSING:** Each unit contains a means by which the regulator circuit monitors the voltage directly at the load using extra sensing leads. The resulting circuit action compensates for a DC voltage drop of up to 0.5 Vdc in the load leads. Open sense lead protection is built-in.

**STABILITY:** Typically, ±.05% for 24 hours after warm-up (single output), and ±0.3% for 24 hours after warm-up (dual and triple output).

**TEMPERATURE:** Operating: 0°C to +50°C, derated to 40% at +71°C.
Storage: −40°C to +85°C.

**TEMPERATURE COEFFICIENT:** ±.04% per degree Celsius maximum, ±.002% per degree Celsius typical.

**EFFICIENCY:** Typically 45% to 60%.

**ENVIRONMENT:** Designed to meet vibration per MIL-STD-810B, Method 514, Procedure 1, and shock per MIL-STD-810B, Method 516, Procedure 5.

**OVERVOLTAGE PROTECTION:** Standard on 5V outputs. Available on all other outputs as an optional feature by adding "-1" to the Model No. Cost is $8 for single outputs and $16 for dual and triple output units.

**DELIVERY FROM STOCK**

| Output Voltage Range | Output Current (Amps) | Size | Weight (Lbs.) | Model Number | Price 1-24 Pcs. |
|---|---|---|---|---|---|
| **SINGLE OUTPUT** | | | | | |
| 4.75-5.25 | 3 | A | 2 | NLS5T3 | $39.00 |
| | 6 | B | 4 | NLS5T6 | 55.00 |
| | 9 | C | 5.5 | NLS5T9 | 69.00 |
| | 12 | D | 7.5 | NLS5T12 | 79.00 |
| | 17 | E | 10 | NLS5T17 | 99.00 |
| 11.5-12.5 | 1.8 | A | 2 | NLS12T1.8 | 39.00 |
| | 3.5 | B | 4 | NLS12T3.5 | 55.00 |
| | 5 | C | 5.5 | NLS12T5 | 69.00 |
| | 7 | D | 7.5 | NLS12T7 | 79.00 |
| | 10 | E | 10 | NLS12T10 | 99.00 |
| 14.5-15.5 | 1.5 | A | 2 | NLS15T1.5 | 39.00 |
| | 3 | B | 4 | NLS15T3 | 55.00 |
| | 4.5 | C | 5.5 | NLS15T4.5 | 69.00 |
| | 6 | D | 7.5 | NLS15T6 | 79.00 |
| | 9 | E | 10 | NLS15T9 | 99.00 |
| 23-25 | 1.2 | A | 2 | NLS24T1.2 | 39.00 |
| | 2.4 | B | 4 | NLS24T2.4 | 55.00 |
| | 3.6 | C | 5.5 | NLS24T3.6 | 69.00 |
| | 4.7 | D | 7.5 | NLS24T4.7 | 79.00 |
| | 7.1 | E | 10 | NLS24T7.1 | 99.00 |
| 27-29 | 1 | A | 2 | NLS28T1 | 39.00 |
| | 2 | B | 4 | NLS28T2 | 55.00 |
| | 3 | C | 5.5 | NLS28T3 | 69.00 |
| | 4 | D | 7.5 | NLS28T4 | 79.00 |
| | 6 | E | 10 | NLS28T6 | 99.00 |

| Output Voltage Range | Output Current (Amps) | Size | Weight (Lbs.) | Model Number | Price 1-24 Pcs. |
|---|---|---|---|---|---|
| **DUAL OUTPUTS** | | | | | |
| 11.5-13.5 | 1.0 | AA | 2 | NLD12T1 | $ 69.00 |
| 13.5-15.5 | 0.8 | | | NLD15T0.8 | |
| | 1.7 | BB | 4 | NLD12T1.7 | 82.00 |
| | 1.5 | | | NLD15T1.5 | |
| | 3.3 | CC | 7 | NLD12T3.3 | 109.00 |
| | 3.0 | | | NLD15T3 | |
| **TRIPLE OUTPUTS** | | | | | |
| 4.75-5.25 | 2 | AAA | 5 | NLT12T2 | 89.00 |
| ±11.5-±12.5 | 0.5 | | | | |
| | 6 | BBB | 8 | NLT12T6 | 115.00 |
| | 1.7 | | | | |
| | 12 | CCC | 11 | NLT12T12 | 149.00 |
| | 1.7 | | | | |
| 4.75-5.25 | 2 | AAA | 5 | NLT15T2 | 89.00 |
| ±14.5-±15.5 | 0.4 | | | | |
| | 6 | BBB | 8 | NLT15T6 | 115.00 |
| | 1.5 | | | | |
| | 12 | CCC | 11 | NLT15T12 | 149.00 |
| | 1.5 | | | | |

| Size | Length | Height | Depth |
|---|---|---|---|
| A | 4.87 | 4 | 1.62 |
| B | 5.62 | 4.87 | 2.5 |
| C | 7 | 4.87 | 2.75 |
| D | 9 | 4.87 | 2.75 |
| E | 14 | 4.87 | 2.75 |
| AA | 6.5 | 4 | 1.62 |
| BB | 7 | 4.87 | 2.5 |
| CC | 9.4 | 4.87 | 2.75 |
| AAA | 10.25 | 4 | 2.5 |
| BBB | 11 | 4.87 | 2.75 |
| CCC | 14.25 | 4.87 | 2.75 |

## QUANTITY DISCOUNTS

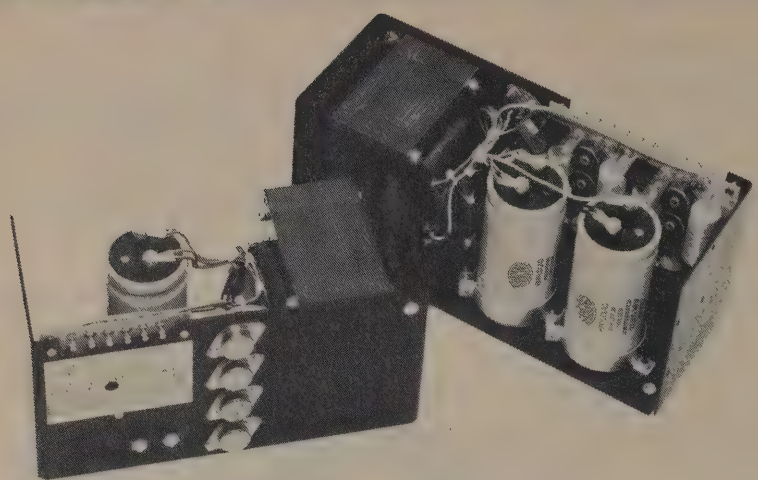
| | |
|---|---|
| 1-24 pieces | Price listed (This is the net price) |
| 25-49 pieces | Less 4% of the 1-24 piece price |
| 50-99 pieces | Less 8% of the 1-24 piece price |
| 100-199 pieces | Less 12% of the 1-24 piece price |
| Above 199 pieces | Write nearest office for exact quotation |

abbott transistor
INDUSTRIAL PRODUCTS DIVISION

**GENERAL OFFICES**
DEPT. EM, 5200 W. Jefferson Blvd.
Los Angeles, CA 90016
(213) 936-8185
Telex 69-1398

**EASTERN OFFICES**
Dept. EM, 1224 Anderson Ave.
Fort Lee, NJ 07024
(201) 224-6900
Telex 13-5332

# abbott AC to DC Low Cost

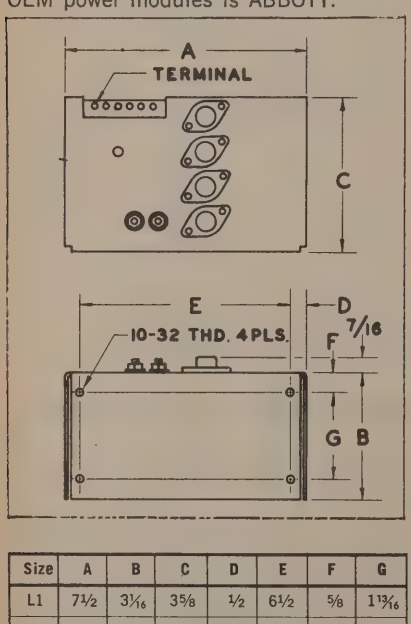


## *features*

- 1 Day Stock Delivery
- Single and Dual Outputs
- 0.1% Regulation
- +60°C Ambient Operation
- 47-420 Hz Input Frequency

**DELIVERY FROM STOCK**

These reliable Abbott power modules are designed to meet the needs of OEM engineers. For their intended application, these units are not only rated high in overall quality, but also priced relatively low. Thus, they provide more quality per dollar compared to similar items on the market. Your best buy in OEM power modules is ABBOTT.




| Size | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| L1 | 7½ | 3 1/16 | 3⅝ | ½ | 6½ | ⅝ | 1 13/16 |
| L2 | 8½ | 4 | 4¾ | ½ | 7½ | ⅝ | 2¾ |
| L3 | 9¼ | 4 | 4¾ | ½ | 8¼ | ⅝ | 2¾ |
| L4 | 9½ | 3 1/16 | 3⅝ | ½ | 8½ | ⅝ | 1 13/16 |
| L5 | 10 | 4 | 4¾ | ½ | 9 | ⅝ | 2¾ |
| L6 | 10¾ | 4 | 4¾ | ½ | 9¾ | ⅝ | 2¾ |

## *specifications*

**INPUT VOLTAGE RANGE:** 103 to 127 VRMS.

**INPUT FREQUENCY:** 47 to 420 Hertz, 1 Phase.

**LINE REGULATION:** 0.1% or 10 mV (whichever is greater), for input change of 103 to 127 VAC.

**LOAD REGULATION:** 0.1% or 10 mV, (whichever is greater), from no load to full load.

**RIPPLE:** 10 mV rms; 30 mV peak-to-peak.

**OUTPUT VOLTAGE ADJUSTMENT RANGE:** Voltage is continuously adjustable between the limits shown on the table by means of a screwdriver adjustment potentiometer.

**ISOLATION VOLTAGE:** 300 VDC between output terminals and chassis ground.

**INSULATION RESISTANCE:** 50 megohms between output terminals and chassis ground when measured at 50 VDC.

**POLARITY:** Inputs and outputs are isolated, either positive or negative side may be grounded.

**TEMPERATURE:** Operating: 0°C to +50°C ambient without derating, forced air or heat-sinking. Storage: −50°C to 85°C.

**TEMPERATURE COEFFICIENT:** 0.08% per degree Celsius.

**ALTITUDE:** 10,000 feet above sea level.

**SHORT CIRCUIT PROTECTION:** Each unit is completely protected against an overload or short circuit of any duration. The output voltage automatically restores to normal when the overload is removed within approx. 25 msec.

**LOAD TRANSIENT RECOVERY TIME:** Output voltag returns to regulation limits within 75 microsecon after a 50% step change in load current. Maximu overshoot/undershoot is 5% of nominal outp voltage.

**TURN ON/TURN OFF OVERSHOOT:** The output voltag overshoot during "turn on" or "turn off" will n exceed 1% of the output voltage.

**REMOTE ERROR SENSING:** Each unit contains a mea by which the regulator circuit monitors the voltag directly at the load using extra "sensing" lead The resulting circuit action compensates for a D voltage drop up to 0.5 volts in the load leads.

**OVERVOLTAGE PROTECTION:** Additional circuitry w reduce the output voltage to approximately 1 VD within 25 μsec typ., if the output voltage rises 10% or 2 VDC (whichever is greater) above nomina Available as an optional feature by adding "-1" the model number and $8 ($16 for dual outpu units) to the 1-24 piece price.

**OUTPUT IMPEDANCE:** DC to 1K Hz — .003 $R_L$ ohms .03 ohms, whichever is greater.
1K Hz to 10K Hz — .008 $R_L$ or .08 ohms, whichev is greater.
10K Hz to 100K Hz — .015 $R_L$ or .30 ohms, whic ever is greater.
$R_L$ = rated load resistance.

**RELIABILITY:** The Mean Time between failure (MTB per MIL-HDBK-217A under worst case operating co ditions is in excess of 100,000 hours per single ou put units and in excess of 70,000 hours per du output units. For example: LC12T10 - 114,268 hou (MTBF); LC28T1 - 158,290 hours (MTBF); LLC12T5 75,593.

**SINGLE OUTPUT**

| Output Voltage Range | Output Curr. (Amps) | Size (See Dwg) | Wt. (Lbs.) | Model Number | Price 1-24 Pieces |
|---|---|---|---|---|---|
| 4.5 - 5.5 | 6.0 | L1 | 5.5 | LC5T6 | $69.00 |
| | 10.0 | L3 | 12.5 | LC5T10 | 89.00 |
| 11.5 - 12.5 | 2.5 | L1 | 5.5 | LC12T2.5 | 69.00 |
| | 5.0 | L2 | 8.7 | LC12T5 | 79.00 |
| | 10.0 | L3 | 12.5 | LC12T10 | 99.00 |
| 14.5 - 15.5 | 2.0 | L1 | 5.5 | LC15T2 | 69.00 |
| | 4.0 | L2 | 8.7 | LC15T4 | 79.00 |
| | 8.0 | L3 | 12.5 | LC15T8 | 99.00 |
| 23 - 25 | 1.2 | L1 | 5.5 | LC24T1.2 | 69.00 |
| | 2.5 | L2 | 8.7 | LC24T2.5 | 79.00 |
| | 5.0 | L3 | 12.5 | LC24T5 | 99.00 |
| 27 - 29 | 1.0 | L1 | 5.5 | LC28T1 | 69.00 |
| | 2.1 | L2 | 8.7 | LC28T2.1 | 79.00 |
| | 4.3 | L3 | 12.5 | LC28T4.3 | 99.00 |

**DUAL OUTPUT**

| Output Voltage Range | Output Curr. (Amps) | Size (See Dwg) | Wt. (Lbs.) | Model Number | Price 1-24 Piece |
|---|---|---|---|---|---|
| ±11.5 - ±12.5 | 1.2 | L4 | 6.0 | LLC12T1.2 | $99.0 |
| | 2.5 | L5 | 9.2 | LLC12T2.5 | 104.0 |
| | 5.0 | L6 | 13.5 | LLC12T5 | 129.0 |
| ±14.5 - ±15.5 | 1.0 | L4 | 6.0 | LLC15T1 | 99.0 |
| | 2.0 | L5 | 9.2 | LLC15T2 | 104.0 |
| | 4.0 | L6 | 13.5 | LLC15T4 | 129.0 |

**Dual Output Units:**

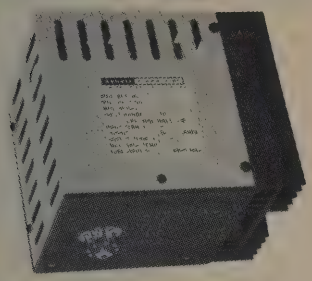
1. Both outputs are isolated and non-tracking so each output can be used as a completely separate power supply.
2. The output current listed is for each output voltage.

abbott transistor
INDUSTRIAL PRODUCTS DIVISION

GENERAL OFFICES
DEPT. EM, 5200 W. Jefferson Blvd.
Los Angeles, CA 90016
(213) 936-8185
Telex 69-1398

EASTERN OFFICES
Dept. EM, 1224 Anderson Av
Fort Lee, NJ 0702
(201) 224-690
Telex 13-533

# abbott AC to DC Industrial



## *features*

- Single and Dual Outputs
- −4 to +160°F ambient
- 5 to 37 VDC
- 0.15 to 20 amps
- 0.1% regulation
- Stock delivery

## *specifications*

**INPUT VOLTAGE RANGE:** 105-125 VRMS

**INPUT FREQUENCY RANGE:** 50-420 Hertz, 1 phase

**LINE REGULATION:** 0.1% or 10 mv (whichever is greater) for input change of 105-125 VRMS

**LOAD REGULATION:** 0.1% or 10 mv (whichever is greater) for change from no load to full load

**RIPPLE:** 0.02% or 5 mv RMS (whichever is greater)

**OUTPUT VOLTAGE ADJUSTMENT:** Voltage is continuously adjustable between the limits shown in table by means of an externally accessible screwdriver adjustment potentiometer

**ADJUSTMENT RESOLUTION:** 30 mv max.

**POLARITY:** Inputs and outputs are isolated; either positive or negative side may be grounded

**TEMPERATURE:** Operating: −4°F (−20°C) to +160°F (+71°C) without derating, forced air, or heatsinking. Storage: −40°F (−40°C) to +185°F (+85°C)

**TEMPERATURE COEFFICIENT:** 0.03% per degree Celsius

**SHORT CIRCUIT PROTECTION:** Each unit is completely protected against an overload or short circuit of any duration. The output voltage automatically restores to normal when the overload is removed.

**LOAD TRANSIENT RECOVERY TIME:** Output voltage returns to regulation limits within 75 microseconds after a 50% step change in load current

**TURN ON/TURN OFF OVERSHOOT:** The output voltage overshoot during "turn on" or "turn off" will not exceed 0.1% of the output voltage, or 20 mv, whichever is greater

**REMOTE ERROR SENSING:** Each unit contains a means by which the regulator circuit monitors the voltage directly at the load using extra "sensing" leads. The resulting circuit action compensates for a DC voltage drop up to 0.5 volts in the load leads.

**OVERVOLTAGE PROTECTION, 230 VAC OPERATION, AND REMOTE VOLTAGE ADJUSTMENT:** Available as optional features.

| Output Voltage Range | Output Curr. (Amps) | Size* | Wt. (Lbs.) | Model Number | Price 1-24 pcs. |
|---|---|---|---|---|---|
| 4.5-5.5 | 0.15 | AA | 3.0 | RN5S0.15 | $ 75 |
| | 0.3 | AA | 3.0 | **RN5S0.3** | 79 |
| | 0.6 | BB | 6.0 | RN5S0.6 | 99 |
| | 1.2 | BB | 6.0 | **RN5S1.2** | 109 |
| | 2.5 | CC | 8.0 | **RN5S2.5** | 115 |
| | 5.0 | DD | 13.0 | **RN5S5** | 126 |
| | 10 | FF | 22.0 | **RN5S10** | 189 |
| | 15 | GG | 28.0 | RN5T15 | 229 |
| | 20 | JJ | 33.0 | **RN5T20** | 262 |
| 5.5-6.5 | 0.15 | AA | 3.0 | RN6S0.15 | 75 |
| | 0.3 | AA | 3.0 | RN6S0.3 | 79 |
| | 0.6 | BB | 6.0 | RN6S0.6 | 99 |
| | 1.2 | BB | 6.0 | **RN6S1.2** | 109 |
| | 2.5 | CC | 8.0 | RN6S2.5 | 115 |
| | 5.0 | DD | 13.0 | RN6S5 | 126 |
| | 10 | FF | 22.0 | RN6S10 | 189 |
| | 15 | GG | 28.0 | RN6T15 | 229 |
| | 20 | JJ | 33.0 | RN6T20 | 262 |
| 6.5-7.5 | 0.15 | AA | 3.0 | RN7S0.15 | 75 |
| | 0.3 | AA | 3.0 | RN7S0.3 | 79 |
| | 0.6 | BB | 6.0 | RN7S0.6 | 99 |
| | 1.2 | BB | 6.0 | RN7S1.2 | 109 |
| | 2.5 | CC | 8.0 | RN7S2.5 | 115 |
| | 5.0 | DD | 13.0 | RN7S5 | 126 |
| | 10 | FF | 22.0 | RN7S10 | 189 |
| | 15 | GG | 28.0 | RN7T15 | 229 |
| | 20 | JJ | 33.0 | RN7T20 | 262 |
| 7.5-8.5 | 0.15 | AA | 3.0 | RN8S0.15 | 75 |
| | 0.3 | AA | 3.0 | RN8S0.3 | 79 |
| | 0.6 | BB | 6.0 | RN8S0.6 | 99 |
| | 1.2 | BB | 6.0 | RN8S1.2 | 109 |
| | 2.5 | CC | 8.0 | RN8S2.5 | 115 |
| | 5.0 | DD | 13.0 | RN8S5 | 126 |
| | 10 | FF | 22.0 | RN8S10 | 189 |
| | 15 | GG | 28.0 | RN8T15 | 229 |
| | 20 | JJ | 33.0 | RN8T20 | 262 |
| 8.5-9.5 | 0.15 | AA | 3.0 | RN9S0.15 | 75 |
| | 0.3 | AA | 3.0 | RN9S0.3 | 79 |
| | 0.6 | BB | 6.0 | RN9S0.6 | 99 |
| | 1.2 | BB | 6.0 | RN9S1.2 | 109 |
| | 2.5 | CC | 8.0 | RN9S2.5 | 115 |
| | 5.0 | DD | 13.0 | RN9S5 | 126 |
| | 10 | FF | 22.0 | RN9S10 | 189 |
| | 15 | HH | 31.0 | RN9T15 | 229 |
| | 20 | JJ | 33.0 | RN9T20 | 262 |
| 9.5-10.5 | 0.15 | AA | 3.0 | RN10S0.15 | 75 |
| | 0.3 | AA | 3.0 | RN10S0.3 | 79 |
| | 0.6 | BB | 6.0 | RN10S0.6 | 99 |
| | 1.2 | BB | 6.0 | RN10S1.2 | 109 |
| | 2.5 | CC | 8.0 | RN10S2.5 | 115 |
| | 5.0 | DD | 13.0 | RN10S5 | 126 |
| | 10 | FF | 22.0 | RN10S10 | 189 |
| | 15 | HH | 31.0 | RN10T15 | 229 |
| | 20 | JJ | 33.0 | RN10T20 | 262 |

| Output Voltage Range | Output Curr. (Amps) | Size* | Wt. (Lbs.) | Model Number | Price 1-24 pcs. |
|---|---|---|---|---|---|
| 11-13 | 0.15 | AA | 3.0 | RN12S0.15 | $ 75 |
| | 0.3 | AA | 3.0 | **RN12S0.3** | 79 |
| | 0.6 | BB | 6.0 | RN12S0.6 | 99 |
| | 1.2 | BB | 6.0 | **RN12S1.2** | 109 |
| | 2.5 | CC | 8.0 | RN12S2.5 | 115 |
| | 5.0 | DD | 13.0 | RN12S5 | 126 |
| | 10 | GG | 22.0 | RN12S10 | 189 |
| | 15 | HH | 31.0 | RN12T15 | 229 |
| | 20 | JJ | 33.0 | RN12T20 | 262 |
| 13-15 | 0.15 | AA | 3.0 | RN14S0.15 | 75 |
| | 0.3 | AA | 3.0 | RN14S0.3 | 79 |
| | 0.6 | BB | 6.0 | RN14S0.6 | 99 |
| | 1.2 | BB | 6.0 | **RN14S1.2** | 103 |
| | 2.5 | CC | 8.0 | RN14S2.5 | 110 |
| | 5.0 | DD | 13.0 | **RN14S5** | 157 |
| | 10 | GG | 28.0 | RN14T10 | 220 |
| | 15 | HH | 31.0 | RN14T15 | 267 |
| 14-16 | 0.15 | AA | 3.0 | RN15S0.15 | 75 |
| | 0.3 | AA | 3.0 | RN15S0.3 | 79 |
| | 0.6 | BB | 6.0 | RN15S0.6 | 99 |
| | 1.2 | BB | 6.0 | RN15S1.2 | 103 |
| | 2.5 | CC | 8.0 | RN15S2.5 | 110 |
| | 5.0 | DD | 13.0 | RN15S5 | 157 |
| | 10 | GG | 28.0 | RN15S10 | 220 |
| | 15 | HH | 31.0 | RN15S15 | 267 |
| 17-19 | 0.15 | AA | 3.0 | RN18S0.15 | 75 |
| | 0.3 | AA | 3.0 | RN18S0.3 | 79 |
| | 0.6 | BB | 6.0 | RN18S0.6 | 99 |
| | 1.2 | BB | 6.0 | RN18S1.2 | 103 |
| | 2.5 | CC | 8.0 | RN18S2.5 | 110 |
| | 5.0 | DD | 13.0 | RN18S5 | 157 |
| | 10 | GG | 28.0 | RN18T10 | 220 |
| 19-21 | 0.15 | AA | 3.0 | RN20S0.15 | 75 |
| | 0.3 | AA | 3.0 | RN20S0.3 | 79 |
| | 0.6 | BB | 6.0 | RN20S0.6 | 99 |
| | 1.2 | BB | 6.0 | RN20S1.2 | 103 |
| | 2.5 | CC | 8.0 | RN20S2.5 | 110 |
| | 5.0 | DD | 13.0 | RN20S5 | 157 |
| | 10 | GG | 28.0 | RN20T10 | 220 |
| 21-23 | 0.15 | AA | 3.0 | RN22S0.15 | 75 |
| | 0.3 | AA | 3.0 | RN22S0.3 | 79 |
| | 0.6 | BB | 6.0 | RN22S0.6 | 99 |
| | 1.2 | BB | 6.0 | RN22S1.2 | 103 |
| | 2.5 | CC | 8.0 | RN22S2.5 | 110 |
| | 5.0 | EE | 13.0 | RN22S5 | 157 |
| | 10 | GG | 28.0 | RN22T10 | 220 |

| Output Voltage Range | Output Curr. (Amps) | Size* | Wt. (Lbs.) | Model Number | Price 1-24 pcs. |
|---|---|---|---|---|---|
| 23-25 | 0.15 | AA | 3.0 | RN24S0.15 | $ 75 |
| | 0.3 | AA | 3.0 | RN24S0.3 | 79 |
| | 0.6 | BB | 6.0 | RN24S0.6 | 99 |
| | 1.2 | BB | 6.0 | **RN24S1.2** | 103 |
| | 2.5 | CC | 8.0 | RN24S2.5 | 110 |
| | 5.0 | EE | 13.0 | **RN24S5** | 157 |
| | 10 | GG | 28.0 | RN24T10 | 220 |
| 25-27 | 0.15 | AA | 3.0 | RN26S0.15 | 78 |
| | 0.3 | BB | 6.0 | RN26S0.3 | 93 |
| | 0.6 | BB | 6.0 | RN26S0.6 | 103 |
| | 1.2 | CC | 8.0 | RN26S1.2 | 110 |
| | 2.5 | DD | 13.0 | RN26S2.5 | 141 |
| | 5.0 | EE | 20.0 | RN26S5 | 157 |
| 27-29 | 0.15 | AA | 3.0 | RN28S0.15 | 78 |
| | 0.3 | BB | 6.0 | RN28S0.3 | 93 |
| | 0.6 | BB | 6.0 | **RN28S0.6** | 103 |
| | 1.2 | CC | 8.0 | **RN28S1.2** | 110 |
| | 2.5 | DD | 13.0 | RN28S2.5 | 141 |
| | 5.0 | EE | 20.0 | **RN28S5** | 157 |
| 29-31 | 0.15 | AA | 3.0 | RN30S0.15 | 78 |
| | 0.3 | BB | 6.0 | RN30S0.3 | 93 |
| | 0.6 | BB | 6.0 | RN30S0.6 | 103 |
| | 1.2 | CC | 8.0 | RN30S1.2 | 110 |
| | 2.5 | DD | 13.0 | RN30S2.5 | 141 |
| | 5.0 | EE | 20.0 | RN30S5 | 157 |
| 35-37 | 0.15 | AA | 3.0 | RN32S0.15 | 78 |
| | 0.3 | BB | 6.0 | RN32S0.3 | 93 |
| | 0.6 | BB | 6.0 | RN32S0.6 | 103 |
| | 1.2 | CC | 8.0 | RN32S1.2 | 110 |
| | 2.5 | DD | 13.0 | RN32S2.5 | 141 |
| | 5.0 | EE | 20.0 | RN32S5 | 157 |

### DUAL OUTPUT

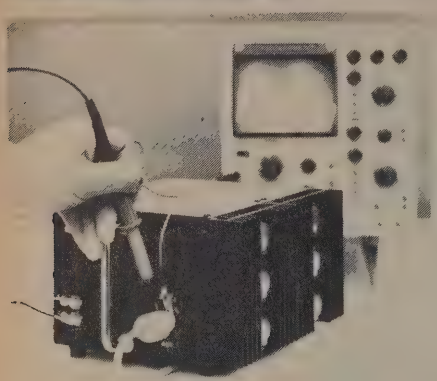
| Output Voltage Range | Output Current (Each Side) | Size | Weight (Lbs.) | Model Number | Price 1-24 Pcs. |
|---|---|---|---|---|---|
| ±11-±13 | 1.2 | 3C | 8.0 | RRN12S1.2 | $149 |
| | 2.5 | 3D | 11.0 | RRN12S2.5 | 169 |
| | 5.0 | 3F | 21.0 | RRN12S5 | 269 |
| ±14-±15 | 1.2 | 3C | 8.0 | RRN15S1.2 | $149 |
| | 2.5 | 3D | 11.0 | RRN15S2.5 | 169 |
| | 5.0 | 3F | 21.0 | RRN15S5 | 269 |

Note: Both outputs are isolated and non-tracking, so each output can be used as a separate power supply.

* See Page 3154 for size charts Note: Other standard models are available. For complete information, please consult our nearest office.

# abbott DC to 60 ∿ 1 ∅

## DC TO 60 Hz INVERTERS



### *features*

- Sine Wave Output
- 12, 24, 28, 36 VDC Inputs
- Low Cost
- High Reliability
- −20°C to +55°C ambient operation
- Reverse Polarity Protection

### *specifications*

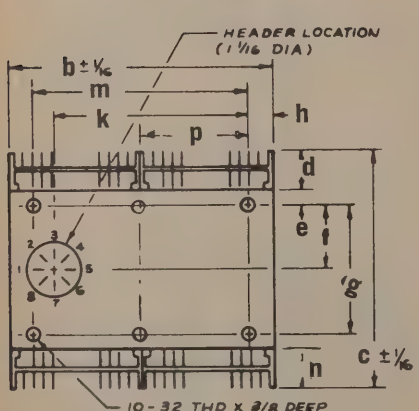
**INPUT VOLTAGE RANGE:** 11 to 15 VDC for KN's; 22 to 30 VDC for PN's; 29 to 38 VDC for LN's
**OUTPUT VOLTAGE:** 115 VAC ±2% 60 Hz or 220 VAC ±2% 50 Hz
**OUTPUT FREQUENCY STABILITY:** ±2 Hz
**LINE REGULATION:** 3% for specified input voltage range with load constant
**LOAD REGULATION:** 3% for load change of half load to full load with line constant: 6% for change of no load to full load
**WAVE FORM:** Sine wave with maximum 5% distortion
**LOAD POWER FACTOR:** Full rated output VA from unity to 0.7 PF lagging or leading
**EFFICIENCY:** At full load and nominal input voltage: 40% minimum on KN's; 50% minimum on PN's; 58% minimum on LN's
**OPERATING TEMPERATURE RANGE:** −4°F to +131°F (−20°C to +55°C) ambient air temperature
**INPUT TRANSIENT PROTECTION:** 45 VDC for 0.1 second
**ALTITUDE:** 10,000 feet above sea level
**OVERLOAD PROTECTION:** Magnetic type circuit breaker

**DELIVERY FROM STOCK**

Abbott has designed a new line of quality, low cost DC to 60 Hz Sine Wave inverters. These units will convert DC battery voltage to regulated 60 Hz power to drive any AC equipment, such as, lamps, compressors, motors, televisions, radios, power tools, appliances, test equipment, etc. Surge current capabilities of these units is up to 3 times rated output power.

| Input Voltage Range (VDC) | Output Power (VA) | Size (See Below) | Weight (Lbs.) | Model Number 115 VAC, 60 Hz Output | Model Number 220 VAC, 50 Hz Output | Unit Prices 1-4 pcs. |
|---|---|---|---|---|---|---|
| 11-15 | 30 | K2 | 16 | KN3T-115-60 | KN3T-220-50 | $275 |
| | 60 | F2 | 18 | KN6T-115-60 | KN6T-220-50 | 305 |
| | 120 | J2 | 30 | KN12T-115-60 | KN12T-220-50 | 375 |
| 22-30 | 60 | K2 | 16 | PN6T-115-60 | PN6T-220-50 | 275 |
| | 120 | F2 | 18 | PN12T-115-60 | PN12T-220-50 | 305 |
| | 240 | J2 | 30 | PN24T-115-60 | PN24T-220-50 | 375 |
| 29-38 | 80 | K2 | 16 | LN8T-115-60 | LN8T-220-50 | 275 |
| | 160 | F2 | 18 | LN16T-115-60 | LN16T-220-50 | 305 |
| | 320 | J2 | 30 | LN32T-115-60 | LN32T-220-50 | 375 |

# abbott Size Charts




| Size | a | b | c | d | e | f | g | h | k | m | n | p |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AA | 6½ | 4 | 1⅞ | — | ¼ | 1/16 | 1⅜ | ½ | 2⅜ | 3 | — | — |
| BB | 5 | 4 | 4½ | — | ⅜ | ⅞ | 3¾ | ⅜ | 1⅝ | 3 1/16 | — | — |
| CC | 5 | 4 | 5¾ | — | ⅜ | ⅞ | 3 7/16 | 1 | 1 | 2 7/16 | 1¼ | — |
| C3 | 7⅝ | 4 | 5¾ | — | ⅜ | ⅞ | 3 7/16 | 1 | 1 | 2 7/16 | 1¼ | — |
| DD | 5 | 4 | 7½ | — | ⅜ | ½ | 4⅜ | 1 | 1 | 2½ | 2⅜ | — |
| D3 | 7 5/16 | 4 | 7½ | — | ⅜ | ½ | 4¾ | 1 | 1 | 2½ | 2⅛ | — |
| EE | 5 | 8 | 8¾ | — | ½ | 2⅝ | 5¼ | ¾ | 5⅞ | 6½ | 2⅛ | — |
| FF | 5 | 8 | 8¾ | 1¼ | ½ | 2⅝ | 5¼ | ¾ | 5⅞ | 6½ | 1¼ | — |
| F2 | 5 | 8 | 8¾ | 1¼ | ½ | ** | 5¼* | ¾ | ** | 6½* | 1¼ | — |
| F3 | 5 | 8 | 8¾ | 1¼ | ½ | 2⅝ | 5¼ | ¾ | 5⅞ | 6¾ | 1¼ | — |
| GG | 5 | 12 | 8 | 1¼ | ⅜ | ** | 4¾ | 1¼ | ** | 9½ | 1¼ | 4¾ |
| HH | 6½ | 12 | 8 | 1¼ | ⅜ | ** | 4¾ | 1¼ | ** | 9½ | 1¼ | 4¾ |
| JJ | 6½ | 12 | 9¾ | 2⅛ | ⅜ | ** | 4¾ | 1¼ | ** | 9½ | 2⅛ | 4¾ |
| J2 | 6½ | 12 | 9¾ | 2⅛ | ⅜ | ** | 4¾† | 1¼ | ** | 9½† | 2⅛ | — |
| K2 | 5 | 8 | 7½ | — | ½ | ** | 5¼† | ¾ | ** | 6½† | 1¼ | — |

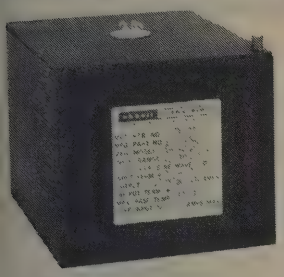
** Terminal strip located on A x C surface.
† Dimensions locate rubber feet in lieu of inserts.
‡ 8-32 x ⅜ on case AA; ¼-20 x ⅜ on case GG, HH, & JJ.

abbott transistor
INDUSTRIAL PRODUCTS DIVISION

GENERAL OFFICES
DEPT. EM, 5200 W. Jefferson Blvd.
Los Angeles, CA 90016
(213) 936-8185
Telex 69-1398

EASTERN OFFICES
Dept. EM, 1224 Anderson Ave
Fort Lee, NJ 07024
(201) 224-6900
Telex 13-5332

# abbott 60 ⌁ to DC Hermetically Sealed



## *features*

- Compact
- Hermetically Sealed
- Close Regulation
- High Reliability
- 5 to 740 Volts

## *specifications*

**INPUT VOLTAGE RANGE:** 105 to 125 volts AC

**INPUT FREQUENCY RANGE:** 55 to 65 Hertz, 1 phase

**INPUT TRANSIENT PROTECTION:** In accordance with MIL-STD-704A, Figure 3, Limit 1 (180 VAC for 0.1 sec.)

**LINE REGULATION:** ±0.2% for 105-125 VAC input, with constant load

**COMBINED LINE AND LOAD REGULATION:** ±0.5% for 105-125 VAC input and load variation of ½ to full load

**RIPPLE:** 0.2% RMS

**SHORT CIRCUIT PROTECTION:** Protected against short circuit conditions of any duration. Output automatically recovers upon removal of short.

**VOLTAGE ADJUSTMENT RANGE:** 12% by screwdriver adjustment

**TEMPERATURE:** +160°F (+71°C) maximum at mounting base using adequate heat sink
−4°F (−20°C) minimum at mounting base
Storage: −30°C to +85°C

**RELIABILITY:** 80,000 hours.

**ENVIRONMENT:** Encapsulated to meet the environmental requirements of MIL-STD-810B including: altitude, vibration, shock, acceleration, sand, dust, humidity, saltspray, fungus, explosion, etc.

**ISOLATION:** Inputs, outputs, and case are isolated so that either a plus or minus output voltage polarity can be obtained.

**OUTPUT VOLTAGE AND CURRENT:** See specific models listed

| Output Voltage Range | Output Current (Amps) | Size* | Wt. (Lbs.) | Model Number | Price 1 pc. | Price 2-4 pcs. |
|---|---|---|---|---|---|---|
| 4.7-5.3 | 1.0 | 9B | 4.0 | V05DS-5A | $210 | $194 |
| | 2.0 | 9A | 4.2 | V1DS-5A | 215 | 199 |
| | 4.0 | 10A | 6.1 | V2DS-5A | 231 | 210 |
| | 6.0 | 11C | 8.3 | V3DS-5A | 241 | 220 |
| | 12.0 | 13A | 16.1 | V6DS-5A | 304 | 278 |
| 5.3-5.9 | 0.9 | 9B | 4.0 | V05DS-5.6A | 210 | 194 |
| | 1.8 | 9A | 4.2 | V1DS-5.6A | 215 | 199 |
| | 3.6 | 10A | 6.1 | V2DS-5.6A | 231 | 210 |
| | 5.4 | 11C | 8.3 | V3DS-5.6A | 241 | 220 |
| | 10.8 | 13A | 16.1 | V6DS-5.6A | 304 | 278 |
| 5.9-6.6 | 0.8 | 9B | 4.0 | V05DS-6.3A | 210 | 194 |
| | 1.6 | 9A | 4.2 | V1DS-6.3A | 215 | 199 |
| | 3.2 | 10A | 6.1 | V2DS-6.3A | 231 | 210 |
| | 4.8 | 11C | 8.3 | V3DS-6.3A | 241 | 220 |
| | 9.6 | 13A | 16.1 | V6DS-6.3A | 299 | 273 |
| 6.6-7.4 | 0.7 | 9B | 4.0 | V05DS-7A | 210 | 194 |
| | 1.4 | 9A | 4.2 | V1DS-7A | 215 | 199 |
| | 2.8 | 10A | 6.1 | V2DS-7A | 231 | 210 |
| | 4.2 | 11C | 8.3 | V3DS-7A | 241 | 220 |
| | 8.4 | 13A | 16.1 | V6DS-7A | 299 | 273 |
| 7.4-8.3 | 0.63 | 9B | 4.0 | V05DS-7.9A | 208 | 189 |
| | 1.26 | 9A | 4.2 | V1DS-7.9A | 210 | 194 |
| | 2.52 | 10A | 6.1 | V2DS-7.9A | 220 | 208 |
| | 3.78 | 11C | 8.3 | V3DS-7.9A | 236 | 215 |
| | 7.56 | 12A | 11.6 | V6DS-7.9A | 299 | 273 |
| 8.3-9.3 | 0.57 | 9B | 4.0 | V05DS-8.8A | 208 | 189 |
| | 1.14 | 9A | 4.2 | V1DS-8.8A | 210 | 194 |
| | 2.28 | 10A | 6.1 | V2DS-8.8A | 220 | 208 |
| | 3.42 | 11C | 8.3 | V3DS-8.8A | 236 | 215 |
| | 6.84 | 12A | 11.6 | V6DS-8.8A | 299 | 273 |
| 9.3-10.4 | 0.50 | 9B | 4.0 | V05DS-9.9A | 208 | 189 |
| | 1.00 | 9A | 4.2 | V1DS-9.9A | 210 | 194 |
| | 2.00 | 10A | 6.1 | V2DS-9.9A | 220 | 208 |
| | 3.00 | 11C | 8.3 | V3DS-9.9A | 236 | 215 |
| | 6.00 | 12A | 11.6 | V6DS-9.9A | 299 | 273 |
| | 12.00 | 13A | 16.1 | V12DS-9.9A | 372 | 341 |
| 10.4-11.6 | 0.45 | 9B | 4.0 | V05DS-11A | 208 | 189 |
| | 0.91 | 9A | 4.2 | V1DS-11A | 210 | 194 |
| | 1.82 | 10A | 6.1 | V2DS-11A | 220 | 208 |
| | 2.73 | 11C | 8.3 | V3DS-11A | 236 | 215 |
| | 5.46 | 12A | 11.6 | V6DS-11A | 299 | 273 |
| | 10.92 | 13A | 16.1 | V12DS-11A | 372 | 341 |
| 11.6-13.0 | 0.40 | 9B | 4.0 | V05DS-12.3A | 208 | 189 |
| | 0.81 | 9A | 4.2 | V1DS-12.3A | 210 | 194 |
| | 1.62 | 10A | 6.1 | V2DS-12.3A | 220 | 208 |
| | 2.43 | 11C | 8.3 | V3DS-12.3A | 236 | 215 |
| | 4.86 | 12A | 11.6 | V6DS-12.3A | 294 | 267 |
| | 9.72 | 13A | 16.1 | V12DS-12.3A | 362 | 330 |
| | 19.44 | 16A | 16.3 | V24DS-12.3A | 451 | 414 |
| 13.0-14.8 | 0.36 | 9B | 4.0 | V05DS-13.8A | $199 | $183 |
| | 0.72 | 9A | 4.2 | V1DS-13.8A | 208 | 189 |
| | 1.44 | 10A | 6.1 | V2DS-13.8A | 215 | 199 |
| | 2.16 | 11C | 8.3 | V3DS-13.8A | 231 | 210 |
| | 4.32 | 12A | 11.6 | V6DS-13.8A | 294 | 267 |
| | 8.64 | 13A | 16.1 | V12DS-13.8A | 362 | 330 |
| | 17.28 | 16A | 16.3 | V24DS-13.8A | 451 | 414 |
| 14.8-16.6 | 0.32 | 9B | 4.0 | V05DS-15.7A | 199 | 183 |
| | 0.64 | 9A | 4.2 | V1DS-15.7A | 208 | 189 |
| | 1.28 | 10A | 6.1 | V2DS-15.7A | 215 | 199 |
| | 1.92 | 11C | 8.3 | V3DS-15.7A | 231 | 210 |
| | 3.84 | 12A | 11.6 | V6DS-15.7A | 294 | 267 |
| | 7.68 | 13A | 16.1 | V12DS-15.7A | 351 | 320 |
| | 15.36 | 16A | 16.3 | V24DS-15.7A | 441 | 404 |
| 16.6-18.6 | 0.28 | 9B | 4.0 | V05DS-17.6A | 199 | 183 |
| | 0.57 | 9A | 4.2 | V1DS-17.6A | 208 | 189 |
| | 1.14 | 10A | 6.1 | V2DS-17.6A | 215 | 199 |
| | 1.71 | 11C | 8.3 | V3DS-17.6A | 231 | 210 |
| | 3.42 | 12A | 11.6 | V6DS-17.6A | 294 | 267 |
| | 6.84 | 13A | 16.1 | V12DS-17.6A | 351 | 320 |
| | 13.68 | 16A | 16.3 | V24DS-17.6A | 441 | 404 |
| 18.6-20.8 | 0.255 | 9B | 4.0 | V05DS-19.7A | 199 | 183 |
| | 0.510 | 9A | 4.2 | V1DS-19.7A | 208 | 189 |
| | 1.02 | 10A | 6.1 | V2DS-19.7A | 215 | 199 |
| | 1.53 | 11C | 8.3 | V3DS-19.7A | 231 | 210 |
| | 3.06 | 12A | 11.6 | V6DS-19.7A | 288 | 262 |
| | 6.12 | 13A | 16.1 | V12DS-19.7A | 351 | 320 |
| | 12.24 | 16A | 16.3 | V24DS-19.7A | 441 | 404 |
| 20.8-23.3 | 0.230 | 9B | 4.0 | V05DS-22A | 194 | 178 |
| | 0.460 | 9A | 4.2 | V1DS-22A | 199 | 183 |
| | 0.920 | 10A | 6.1 | V2DS-22A | 210 | 194 |
| | 1.38 | 11C | 8.3 | V3DS-22A | 220 | 208 |
| | 2.76 | 12A | 11.6 | V6DS-22A | 288 | 262 |
| | 5.52 | 13A | 16.1 | V12DS-22A | 346 | 315 |
| | 11.02 | 16A | 16.3 | V24DS-22A | 430 | 393 |
| 23.3-26.1 | 0.205 | 9B | 4.0 | V05DS-24.7A | 194 | 178 |
| | 0.410 | 9A | 4.2 | V1DS-24.7A | 199 | 183 |
| | 0.820 | 10A | 6.1 | V2DS-24.7A | 210 | 194 |
| | 1.23 | 11C | 8.3 | V3DS-24.7A | 220 | 208 |
| | 2.46 | 12A | 11.6 | V6DS-24.7A | 288 | 262 |
| | 4.92 | 13A | 16.1 | V12DS-24.7A | 346 | 315 |
| | 9.84 | 16A | 16.3 | V24DS-24.7A | 430 | 393 |
| 26.1-29.2 | 0.180 | 9B | 4.0 | V05DS-27.6A | 194 | 178 |
| | 0.360 | 9A | 4.2 | V1DS-27.6A | 199 | 183 |
| | 0.720 | 10A | 6.1 | V2DS-27.6A | 210 | 194 |
| | 1.08 | 11C | 8.3 | V3DS-27.6A | 220 | 208 |
| | 2.16 | 12A | 11.6 | V6DS-27.6A | 288 | 262 |
| | 4.32 | 13A | 16.1 | V12DS-27.6A | 330 | 304 |
| | 8.64 | 16A | 16.3 | V24DS-27.6A | 420 | 383 |
| 29.2-32.6 | 0.160 | 9B | 4.0 | V05DS-31A | $194 | $178 |
| | 0.320 | 9A | 4.2 | V1DS-31A | 199 | 183 |
| | 0.640 | 10A | 6.1 | V2DS-31A | 210 | 194 |
| | 0.960 | 11C | 8.3 | V3DS-31A | 220 | 208 |
| | 1.92 | 12A | 11.6 | V6DS-31A | 288 | 262 |
| | 3.84 | 13A | 16.1 | V12DS-31A | 351 | 320 |
| | 7.68 | 16A | 16.3 | V24DS-31A | 441 | 404 |
| 32.6-36.5 | 0.145 | 9B | 4.0 | V05DS-34.6A | 194 | 178 |
| | 0.290 | 9A | 4.2 | V1DS-34.6A | 199 | 183 |
| | 0.580 | 10A | 6.1 | V2DS-34.6A | 210 | 194 |
| | 0.870 | 11C | 8.3 | V3DS-34.6A | 220 | 208 |
| | 1.74 | 12A | 11.6 | V6DS-34.6A | 288 | 262 |
| | 3.48 | 13A | 16.1 | V12DS-34.6A | 372 | 341 |
| | 6.96 | 16A | 16.3 | V24DS-34.6A | 462 | 420 |
| 36.5-40.9 | 0.130 | 9B | 4.0 | V05DS-38.7A | 194 | 178 |
| | 0.260 | 9A | 4.2 | V1DS-38.7A | 199 | 183 |
| | 0.520 | 10A | 6.1 | V2DS-38.7A | 210 | 194 |
| | 0.780 | 11C | 8.3 | V3DS-38.7A | 231 | 210 |
| | 1.56 | 12A | 11.6 | V6DS-38.7A | 294 | 267 |
| | 3.12 | 13A | 16.1 | V12DS-38.7A | 404 | 367 |
| | 6.24 | 16A | 16.3 | V24DS-38.7A | 483 | 441 |
| 40.9-45.8 | 0.115 | 9B | 4.0 | V05DS-43.3A | 194 | 178 |
| | 0.230 | 9A | 4.2 | V1DS-43.3A | 199 | 183 |
| | 0.460 | 10A | 6.1 | V2DS-43.3A | 210 | 194 |
| | 0.690 | 11C | 8.3 | V3DS-43.3A | 231 | 210 |
| | 1.38 | 12A | 11.6 | V6DS-43.3A | 294 | 267 |
| | 2.76 | 13A | 16.1 | V12DS-43.3A | 420 | 383 |
| | 5.52 | 16A | 16.3 | V24DS-43.3A | 509 | 467 |
| 45.8-51.4 | 0.103 | 9B | 4.0 | V05DS-48.6A | 199 | 183 |
| | 0.206 | 9A | 4.2 | V1DS-48.6A | 208 | 189 |
| | 0.412 | 10A | 6.1 | V2DS-48.6A | 225 | 199 |
| | 0.618 | 11C | 8.3 | V3DS-48.6A | 236 | 215 |
| | 1.24 | 12A | 11.6 | V6DS-48.6A | 299 | 273 |
| | 2.48 | 13A | 16.1 | V12DS-48.6A | 441 | 404 |
| | 4.94 | 16A | 16.3 | V24DS-48.6A | 530 | 483 |
| 51.4-59.0 | 0.091 | 9B | 4.0 | V05DS-55.2A | 215 | 199 |
| | 0.182 | 9A | 4.2 | V1DS-55.2A | 220 | 208 |
| | 0.365 | 10A | 6.1 | V2DS-55.2A | 236 | 215 |
| | 0.546 | 11C | 8.3 | V3DS-55.2A | 246 | 225 |
| | 1.10 | 12A | 11.6 | V6DS-55.2A | 304 | 278 |
| | 2.20 | 13A | 16.1 | V12DS-55.2A | 441 | 404 |
| | 4.40 | 16A | 16.3 | V24DS-55.2A | 530 | 483 |
| 59.0-740.0 | 174 other standard models are available with output voltages between 59.0 and 740.0 VDC at output power ratings of 5, 10, 20, 30, 60, 120 or 240 watts. For complete information, please consult one of the offices listed below. | | | | | |

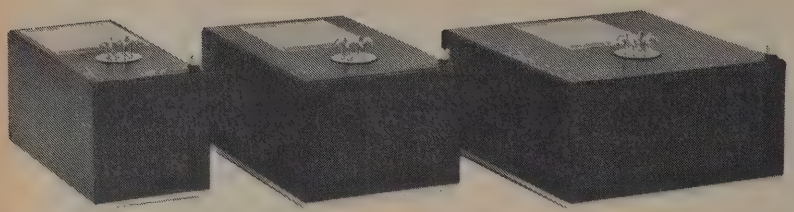
* See Page 3162 for size charts.

abbott transistor
LABORATORIES, INCORPORATED

**GENERAL OFFICES**
5200 W. Jefferson Blvd.
Los Angeles, CA. 90016
(213) 936-8185
Telex 69-1398

**EASTERN OFFICES**
1224 Anderson Ave.
Fort Lee, N.J. 07024
(201) 224-6900
Telex 13-5332

# abbott AC to DC Hi-Efficiency



## *features*

- Hi-Efficiency (64 to 77%)
- Low EMI
- Compact
- +160°F Operation
- Hi-Reliability
- Hermetically Sealed

## *specifications*

**INPUT VOLTAGE RANGE:** 115 VRMS, ±10%

**INPUT FREQUENCY RANGE:** 47 to 440 Hz, 1 Phase

**EFFICIENCY:** Typical efficiency ranges from 64 to 77%

**OUTPUT VOLTAGE AND CURRENT:** See specific models listed in tables

**LINE REGULATION:** 0.4% or 50 mv (whichever is greater) for input change of 103.5 to 126.5 VRMS with load constant

**LOAD REGULATION:** 0.4% or 50 mv (whichever is greater) from no load to full load with line constant

**RIPPLE AND NOISE (PARD):** 0.2% plus 125 mv peak-to-peak from +25°C to +71°C. At 0°C peak-to-peak ripple increases to 0.4% plus 200 mv maximum. Measurements made with a scope having a 25MHz bandwidth

**OUTPUT VOLTAGE ADJUSTMENT:** Voltage is continuously adjustable between the limits shown in the table by means of an externally accessible screwdriver adjustment potentiometer

**ADJUSTMENT RESOLUTION:**

| Nominal Output Voltage | Resolution |
|---|---|
| 3-16 VDC | 35 millivolts |
| 18-50 VDC | 60 millivolts |

**ISOLATION VOLTAGE:** 500 VDC input to output and input to case, 100 VDC output to case.

**INSULATION RESISTANCE:** 50 megohms minimum between input and output, input and case, and output and case when measured at 50 VDC

**POLARITY:** Inputs and outputs are isolated, either positive or negative side may be grounded

**TEMPERATURE RANGE:** Operating: 0°C (32°F) to +71°C (+160°F) baseplate temperature. Storage: −55°C (−65°F) to +85°C (+185°F)

**TEMPERATURE COEFFICIENT:** 0.03% per degree Celsius maximum

**ENVIRONMENT:** Hermetically sealed and encapsulated to meet severe environmental requirements, including:
Vibration: MIL-STD-810B, Method 514, Procedure I, Curve H (±10g's) and Procedure XII. Also MIL-STD-167B, Type I
Shock: MIL-STD-810B, Method 516, Procedure II (75g's crash safety)
Humidity: MIL-STD-810B, Method 507, Procedure I
Saltspray: MIL-STD-983E, Paragraph 4.4.12
Saltfog: MIL-STD-810B, Method 509, Procedure I.

**SHORT CIRCUIT PROTECTION:** Each unit is completely protected against an overload or short circuit of any duration

**INPUT TRANSIENT PROTECTION:** Unit will withstand 180 VAC for 0.1 second in accordance with MIL-STD-704A, Figure 3, Limit 1

**OVERVOLTAGE PROTECTION:** Available as separate modules.

**REMOTE ERROR SENSING:** Each unit contains a means by which the regulator circuit monitors the voltage directly at the load using extra "Sensing" leads. The resulting circuit action compensates for a DC voltage drop up to 0.3 volts in the load leads

**LOAD TRANSIENT RECOVERY TIME:** Output voltage returns to regulation limits within 7 msec. after a 50% step change in load current. Maximum over/undershoot is less than 0.8 VDC or 3% of the output voltage, whichever is greater

**OUTPUT IMPEDANCE:** DC to 1 KHz: .04 $R_L$ or 0.1 ohm, whichever is greater. 1 KHz to 10 KHz: .06 $R_L$ or 0.15 ohms, whichever is greater. 10 KHz to 100 KHz: .08 $R_L$ or 0.4 ohms, whichever is greater.
$R_L$ = Rated Load

**ELECTROMAGNETIC INTERFERENCE:** EMI filters are used in each unit for suppression of conducted interference

**RELIABILITY:** The Mean Time Betwen Failure (MTBF) per MIL-HDBK-217A under worst conditions of full rated output current, 126.5 VAC input voltage, and 40°C baseplate temperature was calculated to be 50,000 hours.

| Output Voltage Range | Output Current (Amps) | Size* | Weight (Lbs) | Model Number | Price 1-4 pcs |
|---|---|---|---|---|---|
| 4.7-5.3 | 5.0 | 11F | 2.8 | VN25D-5A | $362 |
| | 10.0 | 12C | 4.0 | VN50D-5A | 409 |
| | 20.0 | 14E | 5.4 | VN100D-5A | 433 |
| 5.3-5.9 | 4.5 | 11F | 2.8 | VN25D-5.6A | 362 |
| | 9.0 | 12C | 4.0 | VN50D-5.6A | 409 |
| | 18.0 | 14E | 5.4 | VN100D-5.6A | 433 |
| 5.9-6.6 | 4.0 | 11F | 2.8 | VN25D-6.3A | 362 |
| | 8.0 | 12C | 4.0 | VN50D-6.3A | 409 |
| | 16.0 | 14E | 5.4 | VN100D-6.3A | 433 |
| 6.6-7.4 | 3.6 | 11F | 2.8 | VN25D-7.0A | 362 |
| | 7.2 | 12C | 4.0 | VN50D-7.0A | 409 |
| | 14.4 | 14E | 5.4 | VN100D-7.0A | 433 |
| 7.4-8.3 | 3.2 | 11F | 2.8 | VN25D-7.9A | 362 |
| | 6.4 | 12C | 4.0 | VN50D-7.9A | 409 |
| | 12.8 | 14E | 5.4 | VN100D-7.9A | 433 |
| 8.3-9.3 | 2.8 | 11F | 2.8 | VN25D-8.8A | 362 |
| | 5.7 | 12C | 4.0 | VN50D-8.8A | 409 |
| | 11.4 | 14E | 5.4 | VN100D-8.8A | 433 |
| 9.3-10.4 | 2.5 | 11F | 2.8 | VN25D-9.9A | 362 |
| | 5.1 | 12C | 4.0 | VN50D-9.9A | 409 |
| | 10.2 | 14E | 5.4 | VN100D-9.9A | 433 |
| 10.4-11.6 | 2.3 | 11F | 2.8 | VN25D-11A | $362 |
| | 4.6 | 12C | 4.0 | VN50D-11A | 409 |
| | 9.2 | 14E | 5.4 | VN100D-11A | 433 |
| 11.6-13.0 | 2.0 | 11F | 2.8 | VN25D-12.3A | 362 |
| | 4.1 | 12C | 4.0 | VN50D-12.3A | 409 |
| | 8.2 | 14E | 5.4 | VN100D-12.3A | 433 |
| 13.0-14.8 | 1.8 | 11F | 2.8 | VN25D-13.8A | 362 |
| | 3.6 | 12C | 4.0 | VN50D-13.8A | 409 |
| | 7.2 | 14E | 5.4 | VN100D-13.8A | 433 |
| 14.8-16.6 | 1.6 | 11F | 2.8 | VN25D-15.7A | 362 |
| | 3.2 | 12C | 4.0 | VN50D-15.7A | 409 |
| | 6.4 | 14E | 5.4 | VN100D-15.7A | 433 |
| 16.6-18.6 | 1.4 | 11F | 2.8 | VN25D-17.6A | 362 |
| | 2.8 | 12C | 4.0 | VN50D-17.6A | 409 |
| | 5.6 | 14E | 5.4 | VN100D-17.6A | 433 |
| 18.6-20.8 | 1.2 | 11F | 2.8 | VN25D-19.7A | 362 |
| | 2.5 | 12C | 4.0 | VN50D-19.7A | 409 |
| | 5.0 | 14E | 5.4 | VN100D-19.7A | 433 |
| 20.8-23.3 | 1.1 | 11F | 2.8 | VN25D-22A | 362 |
| | 2.3 | 12C | 4.0 | VN50D-22A | 409 |
| | 4.6 | 14E | 5.4 | VN100D-22A | 433 |
| 23.3-26.1 | 1.0 | 11F | 2.8 | VN25D-24.7A | $362 |
| | 2.0 | 12C | 4.0 | VN50D-24.7A | 409 |
| | 4.0 | 14E | 5.4 | VN100D-24.7A | 433 |
| 26.1-29.2 | 0.9 | 11F | 2.8 | VN25D-27.6A | 362 |
| | 1.8 | 12C | 4.0 | VN50D-27.6A | 409 |
| | 3.6 | 14E | 5.4 | VN100D-27.6A | 433 |
| 29.2-32.6 | 0.8 | 11F | 2.8 | VN25D-31A | 362 |
| | 1.6 | 12C | 4.0 | VN50D-31A | 409 |
| | 3.2 | 14E | 5.4 | VN100D-31A | 433 |
| 32.6-36.5 | 0.7 | 11F | 2.8 | VN25D-34.6A | 362 |
| | 1.4 | 12C | 4.0 | VN50D-34.6A | 409 |
| | 2.8 | 14E | 5.4 | VN100D-34.6A | 433 |
| 36.5-40.9 | 0.6 | 11F | 2.8 | VN25D-38.7A | 362 |
| | 1.3 | 12C | 4.0 | VN50D-38.7A | 409 |
| | 2.6 | 14E | 5.4 | VN100D-38.7A | 433 |
| 40.9-45.8 | 0.5 | 11F | 2.8 | VN25D-43.3A | 362 |
| | 1.1 | 12C | 4.0 | VN50D-43.3A | 409 |
| | 2.2 | 14E | 5.4 | VN100D-43.3A | 433 |
| 45.8-50.0 | 0.5 | 11F | 2.8 | VN25D-47.9A | 362 |
| | 1.0 | 12C | 4.0 | VN50D-47.9A | 409 |
| | 2.0 | 14E | 5.4 | VN100D-47.9A | 433 |

* See Page 3162 for size charts.

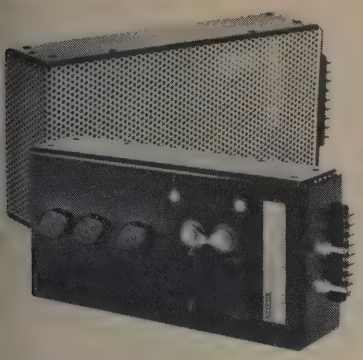
abbott transistor
LABORATORIES, INCORPORATED

GENERAL OFFICES
5200 W. Jefferson Blvd.
Los Angeles, CA. 90016
(213) 936-8185
Telex 69-1398

EASTERN OFFICE
1224 Anderson Ave
Fort Lee, N.J. 0702
(201) 224-690
Telex 13-533

# abbott

# AC (1ø/3ø) or 48 Vdc to DC Hi-Efficiency



## *features*

- 1.3 watts/in³
- Universal 1ϕ & 3ϕ AC input
- 48 Vdc input
- Up to 80% efficient
- Operation to −20°C

| AC INPUT — MODEL DA'S | | | | |
|---|---|---|---|---|
| Output Voltage | Output Current* (Amps) | Size | Model Number | Price 1-9 pcs. |
| 5 | 10.0 | D1 | DA50-5 | $345 |
| | 20.0 | D3 | DA100-5 | 360 |
| | 40.0 | D4 | DA200-5 | 375 |
| ±12 | 2.1 | D2 | DA50-12 | $385 |
| | 4.2 | D3 | DA100-12 | 390 |
| | 8.3 | D5 | DA200-12 | 395 |
| ±15 | 1.7 | D2 | DA50-15 | $385 |
| | 3.3 | D3 | DA100-15 | 390 |
| | 6.7 | D5 | DA200-15 | 395 |

| DC INPUT — MODEL DC'S | | | | |
|---|---|---|---|---|
| Output Voltage | Output Current* (Amps) | Size | Model Number | Price 1-9 pcs. |
| 5 | 10.0 | D1 | DC50-5 | $325 |
| | 20.0 | D3 | DC100-5 | 340 |
| | 30.0 | D4 | DC150-5 | 355 |
| ±12 | 2.1 | D2 | DC50-12 | $355 |
| | 4.2 | D3 | DC100-12 | 365 |
| | 6.3 | D5 | DC150-12 | 375 |
| ±15 | 1.7 | D2 | DC50-15 | $355 |
| | 3.3 | D3 | DC100-15 | 365 |
| | 5.0 | D5 | DC150-15 | 375 |

*For dual output units, output current listed is for each output.

| SIZE CHART | | | |
|---|---|---|---|
| Case Size | Width | Depth | Height |
| D1 | 5.5 | 9.4 | 2.0 |
| D2 | 5.5 | 10.2 | 2.0 |
| D3 | 5.5 | 10.5 | 2.5 |
| D4 | 5.5 | 11.0 | 2.5 |
| D5 | 5.5 | 11.2 | 2.5 |

## *specifications*

**INPUT: DA Models:** 103.5 to 126.5 Vrms, 1ϕ or 3ϕ"Y"; 207 to 253 Vrms, 1ϕ or 3ϕ"△"; 47 to 500 Hz

**DC Models:** 41 to 52 Vdc

**EFFICIENCY:** Minimum efficiency at full load is 60%. Efficiency typically ranges from 63% to 80%, depending on output voltage/power.

**AC INRUSH CURRENT:** Limited by series power thermistors.

**LINE EFFECT (REGULATION):** Less than 0.5% over full input range.

**LOAD EFFECT (REGULATION):** Less than 0.5% from no load to full load.

**PARD (RIPPLE & NOISE):** Less than 100 mV p-t-p, 0°C to +71°C, when measured with an oscilloscope with a 1 MHz bandwidth.

**OUTPUT VOLTAGE ADJUSTMENT:** Output is factory set to within 1% of nominal voltage. Units may be trimmed up to 6% above nominal voltage by means of external resistance. Remote voltage adjustment/programming is available as an optional feature. With this feature, output can be adjusted ±6% from nominal. This option can be specified by adding "-1" to the Model No. e.g., DA50-5-1 indicates inclusion of this feature. Charge is $10 additional for 1 to 9 pieces.

**ISOLATION:** Voltage — 500 Vdc input to case, input to output; 100 Vdc output to case. Resistance — 50 megohms @ 50 Vdc input to case, input to output, output to case.

**TEMPERATURE RANGE:** −20°C to +71°C ambient operating temperature. See load vs. temperature curve below.

**THERMAL PROTECTION:** Power shutdown if temperature exceeds safe operating limits.

**TEMPERATURE COEFFICIENT:** 0.01%/°C typical; 0.03%/°C maximum.

**SHORT CIRCUIT PROTECTION:** Complete protection from short circuits of any duration. Automatic recovery when short is removed.

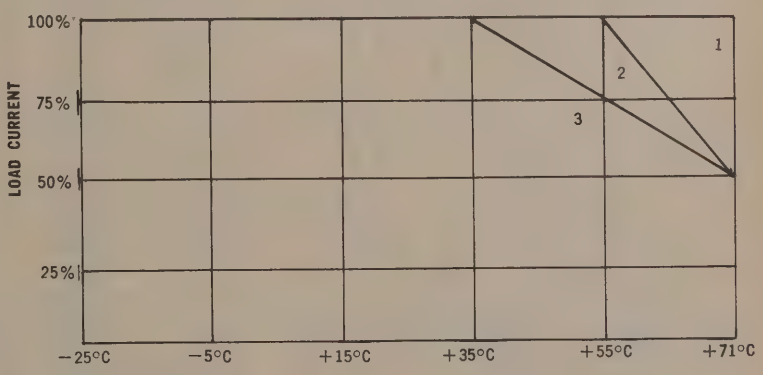
**OVERVOLTAGE PROTECTION:** Standard on all units. Set at 6.2 ±0.5 Vdc on 5V units, 14 ±1 Vdc on 12V units and 17 ±1 Vdc on 15V units.

**REMOTE ERROR SENSING:** Sensing terminals are provided to compensate for up to 0.5 Vdc drop in the load leads. Open sense lead protection is also provided.

**LOAD TRANSIENT RESPONSE:** Output returns to regulation band within 1.0 mS after a 50% step change in load current.

**TURN-ON/TRANSIENT OVERSHOOT:** Maximum output voltage overshoot is less than 0.8V under all conditions.

**HOLDUP TIME:** Typically 20 mS at full load and nominal line voltage.




1 All units, case temperature
2 All units except DA200-5 and DC150-5, ambient temperature
3 DA200-5 and DC150-5, ambient temperature

abbott transistor LABORATORIES, INCORPORATED

**GENERAL OFFICES**
DEPT. EM, 5200 W. Jefferson Blvd.
Los Angeles, CA 90016
(213) 936-8185
Telex 69-1398

**EASTERN OFFICES**
Dept. EM, 1224 Anderson Ave.
Fort Lee, NJ 07024
(201) 224-6900
Telex 13-5332

# abbott 400 ~ to DC Hi-Performance Single & Dual Output

## *features*

- Low Peak-to-Peak Ripple
- RFI/EMI to MIL-STD-461
- Small
- Hermetically Sealed
- +100°C Operation
- 0.1% Regulation

## *specifications*

**INPUT VOLTAGE RANGE:** 105 to 125 VRMS

**INPUT FREQUENCY RANGE:** 380 to 420 Hertz, 1 phase

**INPUT POWER:** Per MIL-STD-704A for category B equipment

**LINE REGULATION:** 0.1% (0.2% for duals) or 10 mv (whichever is greater) for input change of 105 to 125 VRM with load constant

**LOAD REGULATION:** 0.1% (0.2% for duals) or 20 mv (whichever is greater) for change from no load to full loa with line constant

**RIPPLE:** 0.02% or 5 mv (whichever is greater) 25 mv peak-to-peak maximum, each output, measured wi scope having 25 MHz bandwidth

**OUTPUT VOLTAGE ADJUSTMENT:** Voltage is continuously adjustable between the limits shown in the table means of an externally accesible screwdriver adjustment potentiometer

**TRACKING ACCURACY:** The negative output will track the positive output to within 1.0% or 100 mv (whichev is greater) for all rated conditions of input voltage, output current, operating temperature, and output volta adjustment

**ISOLATION VOLTAGE:** 750 vdc input to output and input to case • 200 vdc output to case

**INSULATION RESISTANCE:** 50 megohms minimum between input and output, input and case, and output a case when measured at 50 vdc

**POLARITY:** Inputs and outputs are isolated, either positive or negative side may be grounded

**TEMPERATURE RANGE:** Operating: −55° to +100°C maximum at center of mounting base
Storage: −65°C to +125°C

**TEMPERATURE COEFFICIENT:** 0.03% per degree Celsius maximum

**ENVIRONMENT:** Encapsulated to meet the environmental requirements of MIL-STD-810B and MIL-E-5400K, Cla 2, including: altitude (to a vacuum), vibration, shock, acceleration, sand, dust, humidity, salt spray, fungu explosion, etc.

**SHORT CIRCUIT PROTECTION:** Each unit is completely protected against an overload or short circuit of a duration. The output voltage automatically restores to normal when the overload is removed

**INPUT TRANSIENT PROTECTION:** MIL-STD-704A Figure 3, Limit 1 (180 VAC for 0.1 seconds)

**OVERVOLTAGE PROTECTION:** Overvoltage protection modules are available for these units.

**LOAD TRANSIENT RECOVERY TIME:** Output voltage returns to regulation limits within 100 microseconds (2 microseconds for duals) after 50% step change in load current

**ELECTROMAGNETIC INTERFERENCE:** Built to meet the requirements of MIL-STD-461 for generation of a susceptability to radiated and conducted interference

**RELIABILITY:** The Mean Time Between Failure (MTBF) per MIL-HDBK-217 under worst case operating conditio of full rated output current, 125 vac input voltage, and +100°C base plate temperature, has been calculate for typical units. Values are: W5D10 — 56,148 hrs; W95D0.3 — 47,393 hrs; WW3D0.3 — 67,385 hrs; WW30D4.0 — 48,618 hrs.

| Output Voltage Range | Output Curr. (Amps) | Size* | Wt. (Lbs.) | Model Number | Price 1 pc. | Price 2-4 pcs. |
|---|---|---|---|---|---|---|
| 4.5-5.5 | 2.5 | 2E | 1.9 | W5D2.5 | $299 | $273 |
| | 5.0 | 4D | 2.7 | W5D5.0 | 336 | 309 |
| | 10.0 | 10B | 5.1 | W5D10 | 423 | 385 |
| | 15.0 | 14C | 8.9 | W5D15 | 534 | 486 |
| | 20.0 | 14C | 8.9 | W5D20 | 575 | 523 |
| 5.5-6.5 | 2.5 | 2E | 1.9 | W6D2.5 | 299 | 273 |
| | 5.0 | 4D | 2.7 | W6D5.0 | 336 | 309 |
| | 10.0 | 10B | 5.1 | W6D10 | 423 | 385 |
| | 15.0 | 14C | 8.9 | W6D15 | 534 | 486 |
| | 20.0 | 14C | 8.9 | W6D20 | 575 | 523 |
| 6.5-7.5 | 2.5 | 2E | 1.9 | W7D2.5 | 299 | 273 |
| | 5.0 | 4D | 2.7 | W7D5.0 | 336 | 309 |
| | 10.0 | 10B | 5.1 | W7D10 | 423 | 385 |
| | 15.0 | 14C | 8.9 | W7D15 | 534 | 486 |
| | 20.0 | 14C | 8.9 | W7D20 | 575 | 523 |
| 7.5-8.5 | 2.5 | 2E | 1.9 | W8D2.5 | 299 | 273 |
| | 5.0 | 4D | 2.7 | W85D5.0 | 336 | 309 |
| | 10.0 | 10B | 5.1 | W8D10 | 423 | 385 |
| | 15.0 | 14C | 8.9 | W8D15 | 534 | 486 |
| | 20.0 | 14C | 8.9 | W8D20 | 575 | 523 |
| 8.5-9.5 | 2.5 | 2E | 1.9 | W9D2.5 | 309 | 283 |
| | 5.0 | 4D | 2.7 | W9D5.0 | 357 | 325 |
| | 10.0 | 10B | 5.1 | W9D10 | 447 | 407 |
| | 15.0 | 14C | 8.9 | W9D15 | 570 | 517 |
| | 20.0 | 14C | 8.9 | W9D20 | 610 | 554 |
| 9.5-10.5 | 2.5 | 2E | 1.9 | W10D2.5 | 309 | 283 |
| | 5.0 | 4D | 2.7 | W10D5.0 | 357 | 325 |
| | 10.0 | 10B | 5.1 | W10D10 | 447 | 407 |
| | 15.0 | 14C | 8.9 | W10D15 | 570 | 517 |
| | 20.0 | 14C | 8.9 | W10D20 | 610 | 554 |
| 10.5-11.5 | 2.5 | 2E | 1.9 | W11D2.5 | 309 | 283 |
| | 5.0 | 4D | 2.7 | W11D5.0 | 357 | 325 |
| | 10.0 | 10B | 5.1 | W11D10 | 447 | 407 |
| | 15.0 | 14C | 8.9 | W11D15 | 570 | 517 |
| | 20.0 | 14C | 8.9 | W11D20 | 610 | 554 |
| 11-13 | 2.5 | 2E | 1.9 | W12D2.5 | 309 | 283 |
| | 5.0 | 4D | 2.7 | W12D5.0 | 357 | 325 |
| | 10.0 | 10B | 5.1 | W12D10 | 447 | 407 |
| | 15.0 | 14C | 8.9 | W12D15 | 570 | 517 |
| | 20.0 | 14C | 8.9 | W12D20 | 610 | 554 |
| 13-15 | 1.2 | 2E | 1.9 | W14D1.2 | $299 | $273 |
| | 2.5 | 4D | 2.7 | W14D2.5 | 336 | 309 |
| | 5.0 | 10B | 5.1 | W14D5.0 | 423 | 385 |
| | 10.0 | 14C | 8.9 | W14D10 | 534 | 486 |
| | 15.0 | 14C | 8.9 | W14D15 | 575 | 523 |
| 14-16 | 1.2 | 2E | 1.9 | W15D1.2 | 299 | 273 |
| | 2.5 | 4D | 2.7 | W15D2.5 | 336 | 309 |
| | 5.0 | 10B | 5.1 | W15D5.0 | 423 | 385 |
| | 10.0 | 14C | 8.9 | W15D10 | 534 | 486 |
| | 15.0 | 14C | 8.9 | W15D15 | 575 | 523 |
| 15-17 | 1.2 | 2E | 1.9 | W16D1.2 | 299 | 273 |
| | 2.5 | 4D | 2.7 | W16D2.5 | 336 | 309 |
| | 5.0 | 10B | 5.1 | W16D5.0 | 423 | 385 |
| | 10.0 | 14C | 8.9 | W16D10 | 534 | 486 |
| | 15.0 | 14C | 8.9 | W16D15 | 575 | 523 |
| 17-19 | 1.2 | 2E | 1.9 | W18D1.2 | 299 | 273 |
| | 2.5 | 4D | 2.7 | W18D2.5 | 336 | 309 |
| | 5.0 | 10B | 5.1 | W18D5.0 | 423 | 385 |
| | 10.0 | 14C | 8.9 | W18D10 | 534 | 486 |
| 19-21 | 1.2 | 2E | 1.9 | W20D1.2 | 304 | 278 |
| | 2.5 | 4D | 2.7 | W20D2.5 | 357 | 325 |
| | 5.0 | 10B | 5.1 | W20D5.0 | 447 | 407 |
| | 10.0 | 14C | 8.9 | W20D10 | 570 | 517 |
| 21-23 | 1.2 | 2E | 1.9 | W22D1.2 | 304 | $278 |
| | 2.5 | 4D | 2.7 | W22D2.5 | 357 | 325 |
| | 5.0 | 10B | 5.1 | W22D5.0 | 447 | 407 |
| | 10.0 | 14C | 8.9 | W22D10 | 570 | 517 |
| 23-25 | 1.2 | 2E | 1.9 | W24D1.2 | 304 | 278 |
| | 2.5 | 4D | 2.7 | W24D2.5 | 357 | 325 |
| | 5.0 | 10B | 5.1 | W24D5.0 | 447 | 407 |
| | 10.0 | 14C | 8.9 | W24D10 | 570 | 517 |
| 25-27 | 1.2 | 2E | 1.9 | W26D1.2 | 304 | 278 |
| | 2.5 | 4D | 2.7 | W26D2.5 | 357 | 325 |
| | 5.0 | 10B | 5.1 | W26D5.0 | 447 | 407 |
| | 10.0 | 14C | 8.9 | W26D10 | 570 | 517 |

Other standard Models with any output up to 100 vdc are available. For complete information, please consult our nearest office.

| Output Voltage Range | Output Curr. (Amps) | Size* | Wt. (Lbs.) | Model Number | Price 1 pc. | Price 2-4 pcs. |
|---|---|---|---|---|---|---|
| 27-29 | 1.2 | 2E | 1.9 | W28D1.2 | $304 | 278 |
| | 2.5 | 4D | 2.7 | W28D2.5 | 357 | 325 |
| | 5.0 | 10B | 5.1 | W28D5.0 | 447 | 407 |
| | 10.0 | 14C | 8.9 | W28D10 | 570 | 517 |

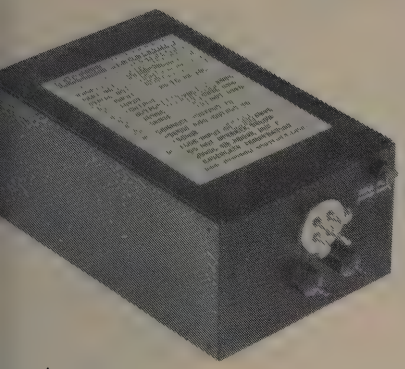
## DUAL OUTPUT

| Output Voltage Range | Output Curr. (Amps) | Size* | Wt. (Lbs.) | Model Number | Price 1 pc. | Price 2-4 pcs. |
|---|---|---|---|---|---|---|
| ±3.75-±4.25 | 0.3 | 8B | 1.9 | WW4D0.3 | $315 | $283 |
| | 0.5 | 9C | 2.2 | WW4D0.5 | 351 | 315 |
| | 1.0 | 9C | 2.2 | WW4D1.0 | 383 | 341 |
| | 2.0 | 9D | 3.1 | WW4D2.0 | 429 | 390 |
| | 4.0 | 11D | 5.5 | WW4D4.0 | 466 | 424 |
| ±4.5-±5.5 | 0.3 | 8B | 1.9 | WW5D0.3 | 315 | 283 |
| | 0.5 | 9C | 2.2 | WW5D0.5 | 351 | 315 |
| | 1.0 | 9C | 2.2 | WW5D1.0 | 383 | 341 |
| | 2.0 | 9D | 3.1 | WW5D2.0 | 429 | 390 |
| | 4.0 | 11D | 5.5 | WW5D4.0 | 466 | 424 |
| ±11-±13 | 0.3 | 8B | 1.9 | WW12D0.3 | 330 | 294 |
| | 0.5 | 9C | 2.2 | WW12D0.5 | 362 | 325 |
| | 1.0 | 9C | 2.2 | WW12D1.0 | 404 | 362 |
| | 2.0 | 9D | 3.1 | WW12D2.0 | 466 | 424 |
| | 4.0 | 11D | 5.5 | WW12D4.0 | 520 | 473 |
| ±14-±16 | 0.3 | 8B | 1.9 | WW15D0.3 | 330 | 294 |
| | 0.5 | 9C | 2.2 | WW15D0.5 | 362 | 325 |
| | 1.0 | 9C | 2.2 | WW15D1.0 | 404 | 362 |
| | 2.0 | 9D | 3.1 | WW15D2.0 | 466 | 424 |
| | 4.0 | 11D | 5.5 | WW15D4.0 | 520 | 473 |
| ±29-±31 | 0.3 | 9C | 2.2 | WW30D0.3 | 357 | 320 |
| | 0.5 | 9C | 2.2 | WW30D0.5 | 393 | 351 |
| | 1.0 | 9D | 3.1 | WW30D1.0 | 451 | 404 |
| | 2.0 | 11D | 5.5 | WW30D2.0 | 593 | 539 |
| | 4.0 | 14C | 8.0 | WW30D4.0 | 766 | 697 |

Other standard Models with any output between ±2.75 and ±31.0 vdc are available. For complete information, please consult our nearest office.

* See Page 3162 for size charts.

# abbott 400 ~ to DC Hi-Efficiency



## features

- Up to 70% Efficiency
- +100°C Operation
- EMI to MIL-STD-461
- Hermetically Sealed
- Environment to MIL-STD-810
- Single and Dual Outputs

n order to meet the high efficiency require-ents of many of today's airborne systems, bbott engineers have designed and developed new line of AC to DC power modules. Spe-ifically designed for 400 Hz operation, these ermetically sealed units achieve power con-ersion efficiencies of up to 70%. We have esignated this new line the Model UN series.

The UN's employ pulse width modulation at switching frequency of 18 to 20 KHz. Three ermetically sealed linear IC's are used to rovide stable and reliable control over the ull temperature range of −55°C to +100°C.

The performance features of the UN's make hem well suited for any application requiring eliable and rugged 400 Hz to DC conversion.

## specifications

**INPUT VOLTAGE RANGE:** 115 Vrms ±10%

**INPUT FREQUENCY RANGE:** 380 to 420 Hz, 1$\phi$

**EFFICIENCY:** Typical efficiency ranges from 53 to 70%

**INRUSH CURRENT:** Less than 8 times normal steady-state full load input current

**LINE EFFECT (REGULATION):** 0.3% for input change of 103.5 to 126.5 VAC RMS

**LOAD EFFECT (REGULATION):** 0.5% for load change of no load to full load

**PARD (RIPPLE & NOISE):** 100 mV peak-to-peak, 25 mV rms from +25°C to +100°C; 130 mV peak-to-peak, 40 mV rms from −55°C to +25°C. Measured at power module terminals with measurement system noise bandwidth of 25 MHz.

**OUTPUT VOLTAGE ADJUSTMENT:** Voltage is continuously adjustable between the limits shown by means of an externally accessible screwdriver adjustment potentiometer

**ADJUSTMENT RESOLUTION:**

| Nominal Output Voltage | Resolution |
|---|---|
| 5-10 VDC | 37 mV |
| 12-18 VDC | 49 mV |
| 24-31 VDC | 75 mV |

**ISOLATION VOLTAGE:** 250 VDC between input and output and input and case; 50 VDC between ouput and case

**INSULATION RESISTANCE:** 50 megohms minimum between input and output, input and case and output and case when measured at 50 VDC

**TEMPERATURE RANGE: Operating;** −55°C to +100°C baseplate temperature. Derate maximum output current linearly above 85°C baseplate temperature to 80% of full load rating at 100°C baseplate temperature. Storage; −65°C to +125°C

**TEMPERATURE EFFECT (COEFFICIENT):** 0.03% per degree Celsius

**ENVIRONMENT:** Hermetically sealed and encapsulated to meet the environmental requirements of MIL-STD-810 and MIL-E-5400, Class 2, including altitude (to a vacuum), vibration, shock, acceleration, sand, dust, humidity, salt spray, fungus, explosion, etc.

**SHORT CIRCUIT PROTECTION:** Each unit is completely protected against overloads (greater than 150% rated load) and short circuits of any duration. The output automatically restores to normal when the fault is removed

**INPUT TRANSIENT PROTECTION:** In accordance with MIL-STD-704A, Figure 3, Limit 1 (180 VAC for 0.1 sec)

**OVERVOLTAGE PROTECTION:** Internal OVP is available as an optional feature and is indicated by adding "-1" to the model number (i.e. UN25D-5A-1 indicates that OVP has been included). The price is $20.00 additional on 1-4 pieces. The overvoltage threshold is factory set to approximately 2V or 10% (whichever is greater) above the nominal output voltage. The OVP circuitry has a built-in delay of approximately 500 microseconds to minimize 'nuisance' tripping

**REMOTE ERROR SENSING:** Each unit contains a means by which the regulator circuit can monitor the voltage directly at the load by using extra "sense" leads. The resulting circuit action will compensate for a DC voltage drop of up to 0.3 volts in the load leads

**LOAD TRANSIENT RESPONSE:** Output voltage returns to regulation limits within 2 ms after a 50% step change in load current. Maximum overshoot is less than 0.8V

**TURN-ON/TURN-OFF OVERSHOOT:** No overshoot during turn-on into loads greater than half load. For loads less than half load, turn-on overshoot is less than 0.8V for 25 ms. No turn-off overshoot under any conditions

**OUTPUT IMPEDANCE:**
DC-500 Hz: 0.02$R_L$ or .04 ohm, whichever is greater
500-5 KHz: 0.10 $R_L$ or .35 ohm, whichever is greater
5K-100 KHz: 0.30 $R_L$ or .10 ohm, whichever is greater

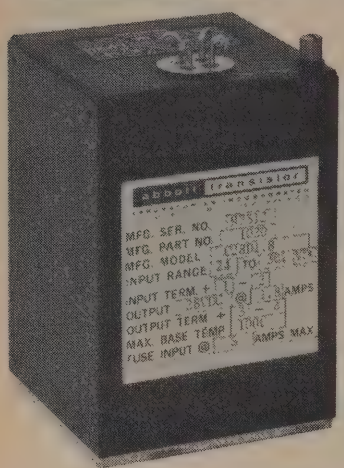
**ELECTROMAGNETIC INTERFERENCE:** Designed to meet the requirements of MIL-STD-461A for generation of conducted and radiated interference. Test report on a typical model is available

| Output Voltage Range | Output Current (Amps) | Size * | Wt. (Lbs.) | Model Number | Price 1-4 Pcs. |
|---|---|---|---|---|---|
| **SINGLE OUTPUT** | | | | | |
| 4.75-5.25 | 5.0 | 10G | 2.8 | UN25D-5A | $372 |
| | 10.0 | 11K | 4.8 | UN50D-5A | 446 |
| | 20.0 | 12G | 7.9 | UN100D-5A | 551 |
| 5.7-6.3 | 4.17 | 10G | 2.8 | UN25D-6A | 372 |
| | 8.33 | 11K | 4.8 | UN50D-6A | 446 |
| | 16.67 | 12G | 7.9 | UN100D-6A | 551 |
| 9.5-10.5 | 2.5 | 10G | 2.8 | UN25D-10A | 372 |
| | 5.0 | 11K | 4.8 | UN50D-10A | 446 |
| | 10.0 | 12G | 7.9 | UN100D-10A | 551 |
| 11.4-12.6 | 2.08 | 10G | 2.8 | UN25D-12A | 372 |
| | 4.17 | 11K | 4.8 | UN50D-12A | 446 |
| | 8.33 | 12G | 7.9 | UN100D-12A | 551 |
| 14.25-15.75 | 1.67 | 10G | 2.8 | UN25D-15A | $372 |
| | 3.33 | 11K | 4.8 | UN50D-15A | 446 |
| | 6.67 | 12G | 7.9 | UN100D-15A | 551 |
| 17.1-18.9 | 1.39 | 10G | 2.8 | UN25D-18A | 372 |
| | 2.78 | 11K | 4.8 | UN50D-18A | 446 |
| | 5.56 | 12G | 7.9 | UN100D-18A | 551 |
| 22.8-25.2 | 1.04 | 10G | 2.8 | UN25D-24A | 372 |
| | 2.08 | 11K | 4.8 | UN50D-24A | 446 |
| | 4.17 | 12G | 7.9 | UN100D-24A | 551 |
| 26.6-29.4 | 0.89 | 10G | 2.8 | UN25D-28A | 372 |
| | 1.79 | 11K | 4.8 | UN50D-28A | 446 |
| | 3.57 | 12G | 7.9 | UN100D-28A | 551 |
| 29.45-32.55 | 0.81 | 10G | 2.8 | UN25D-31A | 372 |
| | 1.61 | 11K | 4.8 | UN50D-31A | 446 |
| | 3.23 | 12G | 7.9 | UN100D-31A | 551 |
| 45.6-50.4 | 0.52 | 10G | 2.8 | UN25D-48A | $372 |
| | 1.04 | 11K | 4.8 | UN50D-48A | 446 |
| | 2.08 | 12G | 7.9 | UN100D-48A | 551 |
| **DUAL OUTPUT** | | | | | |
| ±11.4 to ±12.6 | 1.04 | 10H | 3.2 | UUN25D-12A | $414 |
| | 2.08 | 11K | 4.8 | UUN50D-12A | 488 |
| | 4.17 | 12G | 7.9 | UUN100D-12A | 624 |
| ±14.25 to ±15.75 | 0.83 | 10H | 3.2 | UUN25D-15A | 414 |
| | 1.67 | 11K | 4.8 | UUN50D-15A | 488 |
| | 3.33 | 12G | 7.9 | UUN100D-15A | 624 |

* See Page 3162 for size charts.

abbott transistor LABORATORIES, INCORPORATED

# abbott 28 VDC to DC Hi-Performance Single & Dual Output




## *features*

- Low Peak-to-Peak Ripple
- RFI/EMI to MIL-STD-461
- Small
- Hermetically Sealed
- +100°C Operation
- 0.1% Regulation

## *specifications*

**INPUT VOLTAGE RANGE:** 24 to 30 vdc. Other input ranges are available

**LINE REGULATION:** 0.1% (0.2% for duals) or 10 mv (whichever is greater) for input change of 24 to 30 vd with load constant

**LOAD REGULATION:** 0.1% (0.2% for duals) or 20 mv (whichever is greater) for load change of no load to fu load with line constant

**RIPPLE:** 0.02% or 5 mv RMS (whichever is greater) 50 mv peak-to-peak maximum, each output, measured wit scope having a bandwidth of 25 MHz

**OUTPUT VOLTAGE ADJUSTMENT:** Voltage is continuously adjustable between the limits shown in the table b means of an externally accessible screwdriver adjustment potentiometer.

**TRACKING ACCURACY:** The negative output will track the positive output to within 1.0% or 100 mv (whicheve is greater) for all rated conditions of input voltage, output current, operating temperature, and output voltag adjustment

**ISOLATION VOLTAGE:** 200 volts DC between input and output, input and case, and output and case.

**INSULATION RESISTANCE:** 50 megohms minimum at 50 volts DC between input and output, input and case and output and case.

**POLARITY:** Inputs and outputs are isolated; either positive or negative side may be grounded.

**TEMPERATURE RANGE:** Operating: −55°C to +100°C maximum at center of mounting base.
Storage: −65°C to +125°C..

**TEMPERATURE COEFFICIENT:** 0.03% per degree Celsius maximum

**ENVIRONMENT:** Encapsulated to meet the environmental requirements of MIL-STD-810B and MIL-E-5400K, Clas 2, including altitude (to a vacuum), vibration, shock, acceleration, sand, dust, humidity, salt spray, fungus explosion, etc.

**SHORT CIRCUIT PROTECTION**
Each unit is completely protected against an overload or short circuit of any duration. The output voltag automatically restores to normal when the overload is removed.

**INPUT TRANSIENT PROTECTION:** MIL-STD-704A, Limit 1, Category B (80 volts for 0.1 sec.).

**OVERVOLTAGE PROTECTION:** Overvoltage protection modules are available for use with these units.

**LOAD TRANSIENT RECOVERY TIME:** Output voltage returns to regulation limits within 100 microseconds (20 microseconds for duals) after 50% step change in load current

**ELECTROMAGNETIC INTERFERENCE:** Built to meet the requirements of MIL-STD-461 for generation of an susceptability to radiated and conducted interference.

**RELIABILITY:** The mean time between failure (MTFB) per MIL-HDBK-217 under worst case operating condi tions of full rated output current, 30 vdc input voltage, and +100°C base plate temperature has been calculate for typical units. Values are: C5D10 — 41,305 hrs; C95D0.25 — 55,463 hrs; CC3D3.5 — 34,710 hrs; CC30D3.5 — 20,105 hrs.

| Output Voltage Range | Output Curr. (Amps) | Size† | Wt. (Lbs.) | Model Number | Price 1 pc. | Price 2-4 pcs. |
|---|---|---|---|---|---|---|
| 4.5-5.5 | 2.5 | 2D | 1.2 | C5D2.5 | $305 | $278 |
| | 5.0 | 6B | 1.7 | C5D5.0 | 334 | 304 |
| | 10.0 | 7A | 2.6 | C5D10 | 414 | 376 |
| 5.5-6.5 | 2.5 | 2D | 1.2 | C6D2.5 | 305 | 278 |
| | 5.0 | 6B | 1.7 | C6D5.0 | 334 | 304 |
| | 10.0 | 7A | 2.6 | C6D10 | 414 | 376 |
| 6.5-7.5 | 2.5 | 2D | 1.2 | C7D2.5 | 305 | 278 |
| | 5.0 | 6B | 1.7 | C7D5.0 | 334 | 304 |
| | 10.0 | 7A | 2.6 | C7D10 | 414 | 376 |
| 7.5-8.5 | 1.8 | 2D | 1.2 | C8D1.8 | 305 | 278 |
| | 3.5 | 6B | 1.7 | C8D3.5 | 334 | 304 |
| | 7.5 | 7A | 2.6 | C8D7.5 | 414 | 376 |
| 8.5-9.5 | 1.8 | 2D | 1.2 | C9D1.8 | 305 | 278 |
| | 3.5 | 6B | 1.7 | C9D3.5 | 334 | 304 |
| | 7.5 | 7A | 2.6 | C9D7.5 | 414 | 376 |
| 9.5-10.5 | 1.8 | 2D | 1.2 | C10D1.8 | 305 | 278 |
| | 3.5 | 6B | 1.7 | C10D3.5 | 334 | 304 |
| | 7.5 | 7A | 2.6 | C10D7.5 | 414 | 376 |
| 10.5-11.5 | 1.8 | 2D | 1.2 | C11D1.8 | 305 | 278 |
| | 3.5 | 6B | 1.7 | C11D3.5 | 334 | 304 |
| | 7.5 | 7A | 2.6 | C11D7.5 | 414 | 376 |
| 11-13 | 1.2 | 2D | 1.2 | C12D1.2 | 305 | 278 |
| | 2.5 | 6B | 1.7 | C12D2.5 | 334 | 304 |
| | 5.0 | 7A | 2.6 | C12D5.0 | 414 | 376 |
| 13-15 | 1.2 | 2D | 1.2 | C14D1.2 | 305 | 278 |
| | 2.5 | 6B | 1.7 | C14D2.5 | 334 | 304 |
| | 5.0 | 7A | 2.6 | C14D5.0 | 414 | 376 |
| 14-16 | 1.2 | 2D | 1.2 | C15D1.2 | 305 | 278 |
| | 2.5 | 6B | 1.7 | C15D2.5 | 334 | 304 |
| | 5.0 | 7A | 2.6 | C15D5.0 | 414 | 376 |
| 15-17 | 1.2 | 2D | 1.2 | C16D1.2 | 305 | 278 |
| | 2.5 | 6B | 1.7 | C16D2.5 | 334 | 304 |
| | 5.0 | 7A | 2.6 | C16D5.0 | 414 | 376 |
| 17-19 | 1.2 | 2D | 1.2 | C18D1.2 | $305 | $278 |
| | 2.5 | 6B | 1.7 | C18D2.5 | 334 | 304 |
| | 5.0 | 7A | 2.6 | C18D5.0 | 414 | 376 |
| 19-21 | 0.8 | 2D | 1.2 | C20D0.8 | 305 | 278 |
| | 1.8 | 6B | 1.7 | C20D1.8 | 334 | 304 |
| | 3.5 | 7A | 2.6 | C20D3.5 | 414 | 376 |
| 21-23 | 0.8 | 2D | 1.2 | C22D0.8 | 305 | 278 |
| | 1.8 | 6B | 1.7 | C22D1.8 | 334 | 304 |
| | 3.5 | 7A | 2.6 | C22D3.5 | 414 | 376 |
| 23-25 | 0.8 | 2D | 1.2 | C24D0.8 | 305 | 278 |
| | 1.8 | 6B | 1.7 | C24D1.8 | 334 | 304 |
| | 3.5 | 7A | 2.6 | C24D3.5 | 414 | 376 |
| 25-27 | 0.8 | 2D | 1.2 | C26D0.8 | 305 | 278 |
| | 1.8 | 6B | 1.7 | C26D1.8 | 334 | 304 |
| | 3.5 | 7A | 2.6 | C26D3.5 | 414 | 376 |
| 27-29 | 0.8 | 2D | 1.2 | C28D0.8 | 305 | 278 |
| | 1.8 | 6B | 1.7 | C28D1.8 | 334 | 304 |
| | 3.5 | 7A | 2.6 | C28D3.5 | 414 | 376 |
| 29-31 | 0.6 | 2D | 1.2 | C30D0.6 | 305 | 278 |
| | 1.2 | 6B | 1.7 | C30D1.2 | 334 | 304 |
| | 2.5 | 7A | 2.6 | C30D2.5 | 414 | 376 |
| 31-33 | 0.6 | 2D | 1.2 | C32D0.6 | 305 | 278 |
| | 1.2 | 6B | 1.7 | C32D1.2 | 334 | 304 |
| | 2.5 | 7A | 2.6 | C32D2.5 | 414 | 376 |
| 33-35 | 0.6 | 2D | 1.2 | C34D0.6 | 305 | 278 |
| | 1.2 | 6B | 1.7 | C34D1.2 | 334 | 304 |
| | 2.5 | 7A | 2.6 | C34D2.5 | 414 | 376 |
| 35-37 | 0.6 | 2D | 1.2 | C36D0.6 | 305 | 278 |
| | 1.2 | 6B | 1.7 | C36D1.2 | 334 | 304 |
| | 2.5 | 7A | 2.6 | C36D2.5 | 414 | 376 |

Other standard Models with any output up to 100 vdc are available. For complete information, please consult our nearest office.

### DUAL OUTPUT

| Output Voltage Range | Output Curr. (Amps) | Size† | Wt. (Lbs.) | Model Number | Price 1 pc. | Price 2-4 pcs. |
|---|---|---|---|---|---|---|
| ±2.75-±3.25 | 0.5 | 10C | 2.3 | CC3D0.5 | $369 | $336 |
| | 1.0 | 10C | 2.3 | CC3D1.0 | 399 | 363 |
| | 2.0 | 10D | 2.5 | CC3D2.0 | 429 | 390 |
| | 3.5 | 11E | 3.9 | CC3D3.5 | 477 | 434 |
| ±4.5-±5.5 | 0.5 | 10C | 2.3 | CC5D0.5 | 369 | 336 |
| | 1.0 | 10C | 2.3 | CC5D1.0 | 399 | 363 |
| | 2.0 | 10D | 2.5 | CC5D2.0 | 429 | 390 |
| | 3.5 | 11E | 3.9 | CC5D3.5 | 477 | 434 |
| ±11-±13 | 0.5 | 10C | 2.3 | CC12D0.5 | 381 | 346 |
| | 1.0 | 10C | 2.3 | CC12D1.0 | 411 | 374 |
| | 2.0 | 10D | 2.5 | CC12D2.0 | 466 | 424 |
| | 3.5 | 11E | 3.9 | CC12D3.5 | 544 | 495 |
| ±14-±16 | 0.5 | 10C | 2.3 | CC15D0.5 | 381 | 346 |
| | 1.0 | 10C | 2.3 | CC15D1.0 | 411 | 374 |
| | 2.0 | 10D | 2.5 | CC15D2.0 | 466 | 424 |
| | 3.5 | 11E | 3.9 | CC15D3.5 | 544 | 495 |
| ±19-±21 | 0.5 | 10C | 2.3 | CC20D0.5 | 387 | 352 |
| | 1.0 | 10D | 2.5 | CC20D1.0 | 423 | 385 |
| | 2.0 | 11E | 3.9 | CC20D2.0 | 485 | 441 |
| | 3.5 | 14D | 7.9 | CC20D3.5 | 574 | 522 |
| ±23-±25 | 0.5 | 10C | 2.3 | CC24D0.5 | 393 | 358 |
| | 1.0 | 10D | 2.5 | CC24D1.0 | 435 | 396 |
| | 2.0 | 11E | 3.9 | CC24D2.0 | 509 | 463 |
| | 3.5 | 14D | 7.9 | CC24D3.5 | 593 | 539 |

Other standard Models with any output between ±2.75 and ±31.0 vdc are available. For complete information, please consult our nearest office.

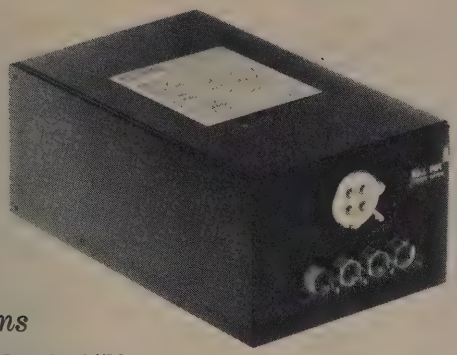
† See Page 3162 for size charts.

abbott transistor
LABORATORIES, INCORPORATED

GENERAL OFFICES
5200 W. Jefferson Blvd.
Los Angeles, CA. 90016
(213) 936-8185
Telex 69-1398

EASTERN OFFICES
1224 Anderson Ave.
Fort Lee, N.J. 07024
(201) 224-6900
Telex 13-5332

# abbott DC to DC Hi-Efficiency



## *features*

- Wide Range DC Input
- Up to 70% Efficiency
- EMI Filters
- Reverse Polarity Protection
- +100°C Operation
- Single & Dual Outputs

## *specifications*

**INPUT VOLTAGE RANGE:** 20 to 32 VDC

**EFFICIENCY:** Typical efficiency ranges from 50 to 70%.

**INRUSH CURRENT:** Less than 8 times normal steady-state full load input current

**LINE EFFECT (REGULATION):** 0.5% for input change of 20 to 32 VDC

**LOAD EFFECT (REGULATION):** 0.5% for load change of no load to full load

**CARD (RIPPLE & NOISE):** 100 mv peak-to-peak, 25 mv rms from 25°C to +100°C; 130 mv peak-to-peak, 40 mv rms from −55°C to +25°C. Measured at power module terminals with measurement system noise bandwidth of 25 MHz

**OUTPUT VOLTAGE ADJUSTMENT:** Voltage is continuously adjustable between the limits shown by means of an externally accessible screwdriver adjustment potentiometer. Wider output ranges are available by restricting the input voltage range. Consult the factory for further information

**ADJUSTMENT RESOLUTION:**

| Nominal Output Voltage | Resolution |
|---|---|
| 5-10 VDC | 37 mv |
| 12-18 VDC | 49 mv |
| 24-31 VDC | 75 mv |

**ISOLATION VOLTAGE:** 100 VDC between input & output and input & case; 50 VDC between output & case

**INSULATION RESISTANCE:** 50 megohms minimum between input & output, input & case and output & case when measured at 50 VDC

**POLARITY:** Inputs and outputs are isolated; either positive or negative side may be grounded.

**TEMPERATURE RANGE:** Operating; −55°C to +100°C baseplate temperature. Derate maximum output current linearly above 85°C baseplate temperature to 30% of full load rating at 100°C baseplate temperature. Storage; −65°C to +125°C

**TEMPERATURE EFFECT (COEFFICIENT):** 0.03% per degree Celsius

**ENVIRONMENT:** Hermetically sealed and encapsulated to meet the environmental requirements of MIL-STD-810 and MIL-E-5400, Class 2, including altitude (to a vacuum), vibration, shock, acceleration, sand, dust, humidity, salt spray, fungus, explosion, etc.

**SHORT CIRCUIT PROTECTION:** Each unit is completely protected against overloads (greater than 150% rated load) and short circuits of any duration. The output automatically restores to normal when the fault is removed

**INPUT TRANSIENT PROTECTION:** Each unit is completely protected against the transients of MIL-STD-704, Category B, (80 VDC for 0.1 sec) having rise times greater than 100 microseconds. Unit will turn off and resume operation when the input returns to normal

**OVERVOLTAGE PROTECTION:** Internal OVP is available as an optional feature and is indicated by adding "—1" to the model number (i.e.: BN25D-5A-1 indicates that OVP has been included.) The price is $20.00 additional on 1-4 pieces. The overvoltage threshold is factory set to approximately 2 V or 10% (whichever is greater) above the nominal output voltage. The OVP circuitry has a built-in delay of approximately 500 microseconds to minimize 'nuisance' tripping

**REMOTE ERROR SENSING:** Each unit contains a means by which the regulator circuit can monitor the voltage directly at the load by using extra "sense" leads. The resulting circuit action will compensate for a DC voltage drop of up to 0.3 volts in the load leads

**LOAD TRANSIENT RESPONSE:** Output voltage returns to regulation limits within 2 ms after a 50% step change in load current. Maximum overshoot is less than 0.8 V

**TURN-ON/TURN-OFF OVERSHOOT:** No overshoot during turn-on into loads greater than half load. For loads less than half load, turn-on overshoot is less than 0.8 V for 25 ms. No turn-off overshoot under any conditions

**OUTPUT IMPEDANCE:**

| | |
|---|---|
| DC-500 Hz | 0.02 $R_L$ or 0.04 ohms |
| 500-5K Hz | 0.10 $R_L$ or 0.35 ohms |
| 5K-100K Hz | 0.30 $R_L$ or 0.10 ohms |

**ELECTROMAGNETIC INTERFERENCE:** Designed to meet the requirements of MIL-STD-461 for generation of conducted and radiated interference. Test report on a typical model is available

**RELIABILITY:** The Mean Time Between Failures (MTBF) per MIL-HDBK-217A under worst case operating conditions of 32 VDC input, full load output, and 100°C baseplate temperature was calculated to be 13,950 hours for Model BN100D-5A. At 71°C baseplate temperature, the MTBF increases to 23,000 hours

| Output Voltage Range | Output Current (Amps) | Size* | Weight (Lbs.) | Model Number | Price 1-4 pcs. |
|---|---|---|---|---|---|
| 4.75-5.25 | 5.0 | 10E | 1.8 | BN25D-5A | $341 |
| | 10.0 | 11J | 2.9 | BN50D-5A | 393 |
| | 20.0 | 12F | 4.4 | BN100D-5A | 468 |
| 5.7-6.3 | 4.17 | 10E | 1.8 | BN25D-6A | 341 |
| | 8.33 | 11J | 2.9 | BN50D-6A | 393 |
| | 16.67 | 12F | 4.4 | BN100D-6A | 468 |
| 9.5-10.5 | 2.5 | 10E | 1.8 | BN25D-10A | 341 |
| | 5.0 | 11J | 2.9 | BN50D-10A | 393 |
| | 10.0 | 12F | 4.4 | BN100D-10A | 468 |
| 11.4-12.6 | 2.08 | 10E | 1.8 | BN25D-12A | 341 |
| | 4.17 | 11J | 2.9 | BN50D-12A | 393 |
| | 8.33 | 12F | 4.4 | BN100D-12A | 468 |
| 14.25-15.75 | 1.67 | 10E | 1.8 | BN25D-15A | 341 |
| | 3.33 | 11J | 2.9 | BN50D-15A | 393 |
| | 6.67 | 12F | 4.4 | BN100D-15A | 468 |
| 17.1-18.9 | 1.39 | 10E | 1.8 | BN25D-18A | 341 |
| | 2.78 | 11J | 2.9 | BN50D-18A | 393 |
| | 5.56 | 12F | 4.4 | BN100D-18A | 468 |
| 22.8-25.2 | 1.04 | 10E | 1.8 | BN25D-24A | 341 |
| | 2.08 | 11J | 2.9 | BN50D-24A | 393 |
| | 4.17 | 12F | 4.4 | BN100D-24A | 468 |

See Page 3162 for size charts.

| Output Voltage Range | Output Current (Amps) | Size* | Weight (Lbs.) | Model Number | Price 1-4 pcs. |
|---|---|---|---|---|---|
| 26.6-29.4 | 0.89 | 10E | 1.8 | BN25D-28A | $341 |
| | 1.79 | 11J | 2.9 | BN50D-28A | 393 |
| | 3.57 | 12F | 4.4 | BN100D-28A | 468 |
| 29.45-32.55 | 0.81 | 10E | 1.8 | BN25D-31A | 341 |
| | 1.61 | 11J | 2.9 | BN50D-31A | 393 |
| | 3.23 | 12F | 4.4 | BN100D-31A | 468 |
| 45.6-50.4 | 0.52 | 10E | 1.8 | BN25D-48A | 341 |
| | 1.04 | 11J | 2.9 | BN50D-48A | 393 |
| | 2.08 | 12F | 4.4 | BN100D-48A | 468 |
| ±11.4 to ±12.6 | 1.04 | 10F | 2.2 | BBN25D-12A | 393 |
| | 2.08 | 11J | 2.9 | BBN50D-12A | 457 |
| | 4.17 | 12F | 4.4 | BBN100D-12A | 522 |
| ±14.25 to ±15.75 | 0.83 | 10F | 2.2 | BBN25D-15A | 393 |
| | 1.67 | 11J | 2.9 | BBN50D-15A | 457 |
| | 3.33 | 12F | 4.4 | BBN100D-15A | 522 |

Dual Output Units: 1) The output current listed is for each output.

2) The negative output is "semiregulated" and will meet regulation specifications only when operated into a balanced load.

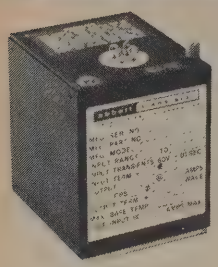
3) The negative output will typically be within 4% of the positive output voltage for load imbalances up to 4:1 in magnitude.

abbott transistor
LABORATORIES, INCORPORATED

**GENERAL OFFICES**
5200 W. Jefferson Blvd.
Los Angeles, CA. 90016
(213) 936-8185
Telex 69-1398

**EASTERN OFFICES**
1224 Anderson Ave.
Fort Lee, N.J. 07024
(201) 224-6900
Telex 13-5332

# abbott DC to Sine Wave 1 ∅



DC to 400 Hz

## POWER MODULES

### *features*

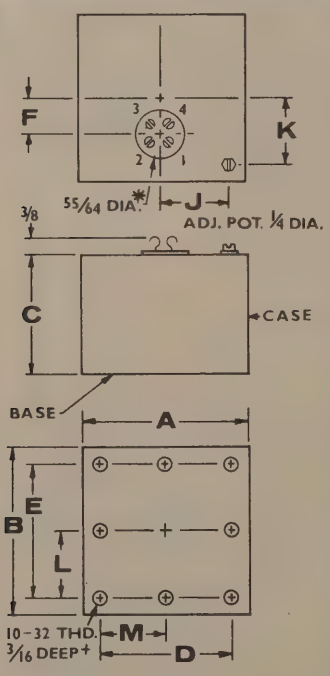
- Close regulation
- 400 or 1600 Hertz
- Hermetically sealed
- No moving parts
- Compact

### *specifications*

**Input Voltage Range:** 24 to 30 volts DC. Other input ranges are available.
**Load Regulation:** ±0.5% from ½ to full load.
**Frequency Stability:** ±0.5%
**Voltage Adjustment Range:** 12% by screwdriver adjustment.
**Reliability:** 55,000 hours MTBF typical per MIL-HDBK-217 under worst case operatio conditions.
**Input Transient Protection:** In accordance with MIL-STD-704A, Limit 1, Category (80 volts for 0.1 seconds).
**Environment:** +212°F max. at mtg. base using adequate heat sink. −65°F min. a mtg. surface. Altitude: To vacuum (true hermetic seal). Vibration, shock, sand, dust humidity, salt spray, fungus, sunshine, rain, and explosion to MIL-STD-810B an MIL-E-5400K.
**Output Voltage, Current, and Frequency:** See specific models listed (Outputs an inputs are isolated).
Output frequencies up to 1600 Hz are listed in our catalog as standard models Contact our nearest office for your free copy.

| Input Voltage Range | Output Frequency (Hertz) | Output Voltage Range | Output Power (Volt-Amps) | Harmonic Distortion (%) | Size (See Below) | Weight (Lbs.) | Model Number | Price 1 Piece | Price 2-4 Pieces |
|---|---|---|---|---|---|---|---|---|---|
| 24-30 | 400 | 25.4-28.6 | 5 | 2.0 | 4 | 1.6 | S05D-27A-400 | $342 | $311 |
| | | | 10 | 2.5 | 4C | 1.7 | S1D-27A-400 | 354 | 323 |
| | | | 20 | 2.5 | 4B | 2.3 | S2D-27A-400 | 367 | 334 |
| | | | 30 | 2.5 | 6A | 2.4 | S3D-27A-400 | 381 | 346 |
| | | | 60 | 3.0 | 12 | 4.8 | S6D-27A-400 | 502 | 457 |
| | | | 120 | 4.0 | 14 | 9.1 | S12D-27A-400 | 792 | 721 |
| 24-30 | 400 | 108-122 | 5 | 2.0 | 4 | 1.6 | S05D-115A-400 | 311 | 282 |
| | | | 10 | 2.5 | 4C | 1.7 | S1D-115A-400 | 323 | 294 |
| | | | 20 | 2.5 | 4B | 2.3 | S2D-115A-400 | 336 | 305 |
| | | | 30 | 2.5 | 6A | 2.4 | S3D-115A-400 | 348 | 317 |
| | | | 60 | 3.0 | 12 | 4.8 | S6D-115A-400 | 473 | 430 |
| | | | 120 | 4.0 | 14 | 9.1 | S12D-115A-400 | 754 | 686 |
| *24-30 | 800 | 25.4-28.6 | 5 | 2.0 | 4 | 1.6 | S05D-27A-800 | 374 | 340 |
| | | | 10 | 2.5 | 4C | 1.7 | S1D-27A-800 | 386 | 351 |
| | | | 20 | 2.5 | 4B | 2.3 | S2D-27A-800 | 399 | 363 |
| | | | 30 | 2.5 | 6A | 2.4 | S3D-27A-800 | 411 | 374 |
| | | | 60 | 3.0 | 12 | 4.8 | S6D-27A-800 | 502 | 457 |
| | | | 120 | 4.0 | 14 | 9.1 | S12D-27A-800 | 825 | 750 |
| 24-30 | 800 | 108-122 | 5 | 2.0 | 4 | 1.6 | S05D-115A-800 | 342 | 311 |
| | | | 10 | 2.5 | 4C | 1.7 | S1D-115A-800 | 334 | 323 |
| | | | 20 | 2.5 | 4B | 2.3 | S2D-115A-800 | 367 | 334 |
| | | | 30 | 2.5 | 6A | 2.4 | S3D-115A-800 | 381 | 346 |
| | | | 60 | 3.0 | 12 | 4.8 | S6D-115A-800 | 502 | 457 |
| | | | 120 | 4.0 | 14 | 9.1 | S12D-115A-800 | 792 | 721 |

# abbott Size Charts



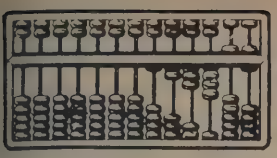

| Size | A | B | C | D | E | F | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1½ | 2¾ | 3 | 1.00 | 2.25 | 5/16 | ½ | 1⅛ | — | — |
| 1A | 1½ | 2¾ | 2¾ | 1.00 | 2.25 | 5/16 | ½ | 1⅛ | — | — |
| 1B | 1½ | 2 | 2 | 1.00 | 1.50 | 0 | ½ | ¾ | — | — |
| 2 | 1⅞ | 2¾ | 3¼ | 1.37 | 2.25 | ¾ | 1 1/16 | 1⅛ | — | — |
| 2C | 2 | 2¾ | 2⅛ | 1.50 | 2.25 | 0 | ¾ | 1⅛ | — | — |
| 2D | 2 | 3 | 3½ | 1.50 | 2.50 | ¾ | ¾ | 1¼ | — | — |
| 2E | 2⅛ | 3¼ | 3¼ | 1.62 | 2.75 | ⅞ | 1¾ | 1⅜ | — | — |
| 3 | 2¾ | 2¾ | 3 | 2.25 | 2.25 | ¾ | 1⅛ | 1⅛ | — | — |
| 3A | 2¾ | 2¾ | 2¾ | 2.25 | 2.25 | ¾ | 1⅛ | 1⅛ | — | — |
| 4 | 2¼ | 2¾ | 3¼ | 1.75 | 2.25 | ¾ | ⅞ | 1⅛ | — | — |
| 4B | 2½ | 3 | 3¾ | 2.00 | 2.50 | ¾ | 1 | 1¼ | — | — |
| 4C | 2¼ | 2¾ | 3½ | 1.75 | 2.25 | ¾ | ⅞ | 1⅛ | — | — |
| 4D | 2½ | 3½ | 3½ | 2.00 | 3.00 | 0 | 1 | 1½ | — | — |
| 5 | 2¾ | 2¾ | 3¼ | 2.25 | 2.25 | ¾ | 1⅛ | 1⅛ | — | — |
| 6 | 2¾ | 3 | 3¼ | 2.25 | 2.50 | ¾ | 1⅛ | 1¼ | — | — |
| 6A | 2¾ | 3 | 4 | 2.25 | 2.50 | ¾ | 1⅛ | 1¼ | — | — |
| 6B | 2¾ | 3⅛ | 3⅝ | 2.25 | 2.62 | ¾ | 1⅛ | 1⅜ | — | — |
| 7 | 2¾ | 2¾ | 4 | 2.25 | 2.25 | ¾ | 1⅛ | 1⅛ | — | — |
| 7A | 2⅞ | 3⅜ | 4½ | 2.37 | 2.87 | ¾ | 1¾ | 1¾ | — | — |
| 8B | 2⅝ | 3½ | 2⅞ | 2.12 | 3.00 | ¾ | 1¼ | 1½ | — | — |
| 9A | 2¾ | 4⅜ | 3¾ | 2.25 | 4.25 | 0 | 1⅛ | 2⅛ | — | — |
| 9B | 2¾ | 4¾ | 3½ | 2.25 | 4.25 | 0 | 1⅛ | 2⅛ | — | — |
| 9C | 2½ | 4⅜ | 3⅛ | 2.00 | 3.87 | 1 | 1 | 1 3/16 | — | — |
| 9D | 2⅝ | 4¾ | 3⅝ | 2.12 | 4.25 | 1 | 1 1/16 | 2⅛ | — | — |
| 10A | 3 | 5 | 4 | 2.50 | 4.50 | 0 | 1¼ | 2¼ | — | — |
| 10B | 2⅞ | 4¼ | 4⅜ | 2.37 | 3.75 | 1⅜ | 1¾ | 1⅞ | — | — |
| 10C | 3⅜ | 3⅜ | 3¾ | 2.87 | 2.87 | ¾ | 1 7/16 | 1 7/16 | — | — |
| 10D | 3½ | 3½ | 4 | 3.00 | 3.00 | ¾ | 1½ | 1½ | — | — |
| 10E | 2⅜ | 6¼ | 2½ | 1.87 | 5.75 | ** | ** | ** | 2.87 | — |
| 10F | 2¾ | 6¼ | 2½ | 2.25 | 5.75 | ** | ** | ** | 2.87 | — |
| 10G | 3½ | 5½ | 2½ | 3.00 | 3.50 | ** | ** | ** | — | — |
| 10H | 4 | 5½ | 2⅝ | 3.50 | 3.50 | ** | ** | ** | — | — |
| 11 | 3 | 5½ | 3¼ | 2.50 | 5.00 | 2⅛ | 1¼ | 2½ | 2.50 | — |
| 11C | 4¼ | 5¼ | 4 | 3.75 | 4.75 | 0 | 1⅞ | 2⅜ | 2.37 | — |
| 11D | 4 | 4⅞ | 3⅞ | 3.50 | 4.37 | 1⅜ | 1¾ | 2 1/16 | — | — |
| 11E | 3¾ | 4½ | 4¼ | 3.25 | 4.00 | ¾ | 1⅝ | 2 | — | — |
| 11F | 2¾ | 6¼ | 2¾ | 2.25 | 5.75 | 1 | 1⅛ | 2⅞ | 2.87 | — |
| 11J | 3⅜ | 6¼ | 2½ | 2.87 | 5.75 | ** | ** | ** | 2.87 | — |
| 11K | 3⅝ | 8 13/16 | 2⅝ | 2.55 | 4.31 | ** | ** | ** | — | — |
| 12 | 3 | 5½ | 4 | 2.50 | 5.00 | 2⅛ | 1¼ | 2½ | 2.50 | — |
| 12A | 4½ | 6 | 4 | 4.00 | 5.50 | 0 | 2 | 2¾ | 2.75 | — |
| 12C | 3⅞ | 6¼ | 2¾ | 3.37 | 5.75 | 1½ | 1 1/16 | 2⅞ | 2.87 | — |
| 12F | 5½ | 5⅞ | 2⅝ | 5.00 | 5.37 | ** | ** | ** | 2.68 | 2.50 |
| 12G | 5⅛ | 8¾ | 2⅝ | 4.62 | 6.56 | ** | ** | ** | 3.28 | — |
| 13A | 5½ | 6½ | 4½ | 5.00 | 6.00 | 0 | 2½ | 3 | 3.00 | 2.50 |
| 14 | 6 | 6 | 4 | 5.50 | 5.50 | 2⅜ | 2¾ | 2¾ | 2.75 | 2.75 |
| 14C | 5½ | 5½ | 3⅝ | 5.00 | 5.00 | 1⅞ | 2½ | 2½ | 2.50 | 2.50 |
| 14D | 6 | 6¼ | 3⅞ | 5.50 | 5.75 | 1¼ | 2¾ | 2⅞ | 2.87 | 2.75 |
| 14E | 5¾ | 6¼ | 2¾ | 5.25 | 5.75 | 1¼ | 2⅝ | 2⅞ | 2.87 | 2.62 |
| 16A | 6¾ | 7½ | 4¼ | 6.25 | 7.00 | 2¾ | 3⅛ | 3½ | 3.50 | 3.12 |

DIMENSIONAL TOLERANCES: FRACTIONS ±1/32; DEMICALS .XX ±0.015

* Models CC and WW use special 8 pin header.
Model VN uses special 9 pin header.
Size of special headers is 1 1/16 dia. by 5/16 high.

† 6-32 Thd, 3/16 deep on case size 1B.

** Model BN & UN uses special terminals on A x C face.



abacus controls inc.

DEPT. EM
89 READINGTON ROAD
SOMERVILLE, NJ 08876
(201) 526-6010

# POWER FREQUENCY CONVERTERS

## USEABLE AS AC POWER SUPPLY, MOTOR CONTROLLER, POWER OSCILLATOR, POWER CONVERTER, LABORATORY QUALITY AC SOURCE

| MODEL | 152- | 162- | 113- | 223- | 243- | 263- |
|---|---|---|---|---|---|---|
| **Output** | | | | | | |
| Power (Volt-Amps) | 500 | 600 | 1000 | 2000 | 4000 | 6000 |
| Phase | Single | Single | Single | Single | Single | Single |
| Voltage # | 100-130 | 100-130 | 100-130 | 100-130 | 115/230 | 115/230 |
| Frequency | See Below* | See Below* | See Below* | See Below* | See Below* | See Below* |
| Distortion | 4% | 4% | 4% | 4% | 4% | 4% |
| Regulation | 2% | 2% | 2% | 2% | 2% | 2% |
| **Input** | | | | | | |
| Voltage # | 105-125 | 105-125 | 105-125 | 120/208 | 120/208 | 120/208 |
| Phase | Single | Single | Single | Three | Three | Three |
| Frequency | 47-63** | 47-63** | 47-63** | 47-63** | 47-63** | 47-63** |

| MODEL | 117- | 118- | 228- | 238- | 268- | 219- |
|---|---|---|---|---|---|---|
| **Output** | | | | | | |
| Power (Volt-Amps) | 1000 | 1600 | 2500 | 3500 | 6000 | 10000 |
| Phase | Three | Three | Three | Three | Three | Three |
| Voltage # | 120/208 | 120/208 | 120/208 | 120/208 | 120/208 | 120/208 |
| Frequency | See Below* | See Below* | See Below* | See Below* | See Below* | See Below* |
| Distortion | 4% | 4% | 4% | 4% | 4% | 4% |
| Regulation | 5% | 5% | 5% | 5% | 5% | 5% |
| **Input** | | | | | | |
| Voltage # | 105-125 | 105-125 | 120/208 | 120/208 | 120/208 | 120/208 |
| Phase | Single | Single | Three | Three | Three | Three |
| Frequency | 47-63** | 47-63** | 47-63** | 47-63** | 47-63** | 47-63** |

*Frequency Options (Add Dash No. to Part No.)
-1 400 Hz ±.05%
-2 350-450 Hz ±.25%
-3 500 Hz ±.05%
-4 60 Hz ±.05%
-5 45-65 Hz ±.25%

**400 Hz Input Models also Available.

#Other Voltages Available. Consult Factory.

**FEATURES**

Digital Sine Wave Generation
Switching Power Transistors
High Efficiency
Input and Output Protected with Fuses and/or Circuit Breakers
Short Circuit Protected

## ● UNINTERRUPTIBLE POWER SUPPLIES (UPS)

STANDBY EMERGENCY POWER SUPPLIES

## ● BATTERY STANDBY POWER SUPPLIES

BATTERY CHARGERS

## ● POWER INVERTERS DC-AC

# More bore than ever before.

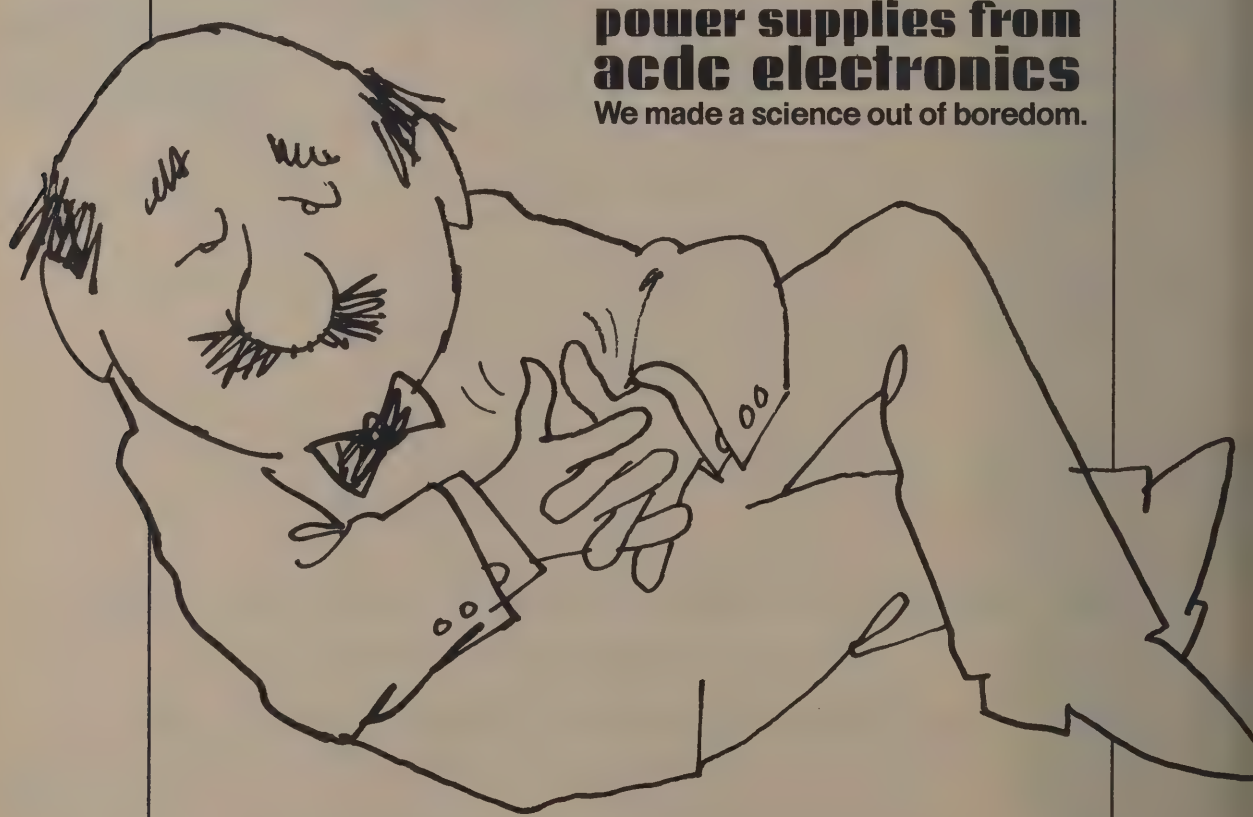
ACDC makes virtually every power supply product you'll ever need. And every one is guaranteed to be just as boring as possible. Boring because they're so dependable. Boring because they just keep working—and never give you any reason to get excited. And boring because they're just sitting in our warehouse—ready for off-the-shelf delivery to you. Name it, we've got it.

**EC Low Cost Power Supplies.** 42 single output models from 2V @ 3A to 24V @ 10A. Double and triple output models also available. Electrically and mechanically interchangeable in form, fit and function with other standard open frame power supplies. 2-year guarantee. Optional overvoltage protection. UL recognized. **OEM Value Engineered Series.** Features low price, excellent stability, overload protection, and built-in convection cooling. Single, dual, and triple outputs. 5-year guarantee. **HCM High Current Power Supplies.** 10 models with ratings from 25A @ 28V to 100A @ 5V. Two case sizes and two current ratings at 5, 12, 15, 24, and 28 volts. Overvoltage protection available. Excellent for multi-input, applications. **Modular Switchers.™** Designed for reliability, flexibility, and serviceability. Modular, plug-together construction. From 50-300 watts. UL recognition pending. Single and triple output. **JF & JT High Efficiency/High Current Switchers.** Designed to fit tight spaces—with heat sinks replaced by integral, but replaceable, fans. Available with single or dual outputs. **CPS Custom Power Supplies.** Features include auto-progression, margining, sequencing, transistor switching, phase control and series regulation, as well as special packaging configuration. **III Rack Systems.** Power supply systems can now be packaged in a single compact unit. Five basic models for standard 19" racks. Available in kit form, factory assembled, and/or factory wired. **EL750 Electronic Load Instrument.** A precision programmable instrument for static and dynamic testing of DC power sources. Dissipates up to 750 watts of DC power. Selectable constant current or constant resistance operating modes.

Find out more about our entire boring line of products. Send for our catalog. It's free. And that may be its only exciting feature. Write or call: 401 Jones Road, Oceanside, California 92054, (714) 757-1880, 509 South Avenue East, Cranford, New Jersey 07016, (201) 272-3377.

**power supplies from acdc electronics**

**We made a science out of boredom.**



EMERSON ®

# vhen you order any Acopian power module isted on the following 30 pages ...

# 3-DAY SHIPMENT IS GUARANTEED

**Any time you order Acopian power modules selected from the thousands of models described on the following pages, shipment will be made within 3 days after your purchase order is received. To save more time, telephone your order. Call us, or your local Acopian representative. We'll ship within 3 days after you've put down the phone.**

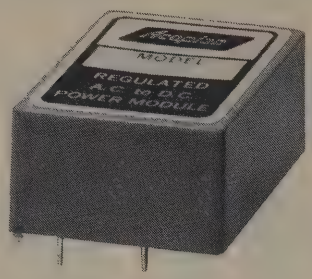

| | | | |
|---|---|---|---|
| Miniaturized Single Output | 2 | Series U Unregulated | 20 |
| Miniaturized Dual Output | 4 | Multiple Output Power Systems | 22 |
| Miniaturized Chassis Mounting | 6 | Rack Mounting | 24 |
| Series A Premium Performance, Series B General Purpose | 8 | Single Output Plug-In | 26 |
| Narrow Profile | 12 | Dual Output Plug-In | 27 |
| Dual Output for Op Amps | 14 | Unregulated Plug-In | 28 |
| Dual Output General Purpose | 15 | High Isolation Plug-In | 29 |
| Dual and Triple Output | 18 | Benchtop Power Supplies | 30 |

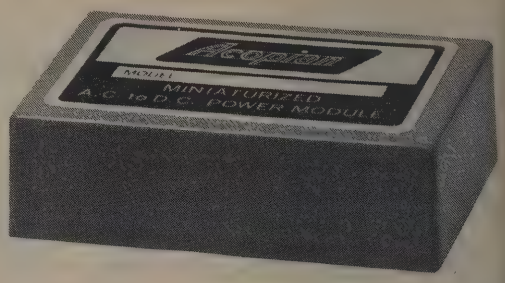

Acopian CORP., EASTON, PA. 18042 • TEL: (215) 258-5441 • TWX: (510) 651-4919

TOLL FREE NUMBER: (800) 523-9478

Acopian

# MINIATURIZED REGULATED SINGLE OUTPUT




**ALL MODELS U.L. RECOGNIZED**

Conserve space with mini-modules as small as 2.3" x 1.8" x 1.0". Models with outputs ranging from 1 to 75 volts, and from 30 ma to 2.5 amps are available. All feature excellent regulation and ripple parameters, and are short circuit protected.

Rugged encapsulated construction and generously derated components insure years of reliable operation. Mini-modules are also available with multiple outputs—see pages 4 and 5.

## STANDARD FEATURES

- May be used in series
- No derating or heat sinking required
- Short circuit protected
- Small, lightweight

## SPECIFICATIONS

**Input Voltage:** 105–125 VAC, 47 to 420 Hz, single phase.

**Output Specifications:** See table.

**Output Voltage Trim Adjustment:** Output is factory preset to ±2% (1 to 9 volt models) or ±1% (10 to 75 volt models) of nominal output voltage. Output may be trimmed to the nominal voltage rating with an external trim resistor.

**Polarity:** Output is floating. Either positive or negative terminal may be grounded.

**Ambient Operating Temperature:** −20 to +71°C. (Model 5E150, 0 to +71°C.) No derating required.

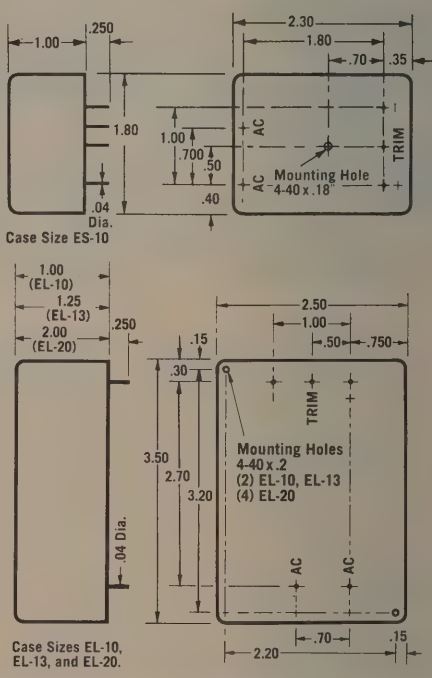
**Storage Temperature:** −55 to +85°C.

**Temperature Coefficient:** From 9 to 75 volts, approximate TC is .015%/°C; 1 to 8 volts, .03%/°C.

**Impedance:** 0.07 ohms at 1 kHz and 0.2 ohms at 10 kHz (approx.).

**Weight:** 7 oz. (Case size ES-10.)
1 lb. (Case size EL-10.)
1 lb. 3 oz. (Case size EL-13.)
2 lb. (Case size EL-20.)

**Optional 230 Volt Input:** All models can be alternately furnished for operation on an input of 210 to 250 VAC, 47-420 Hz. To order, add suffix "–230" to model number and $10.00 to price.

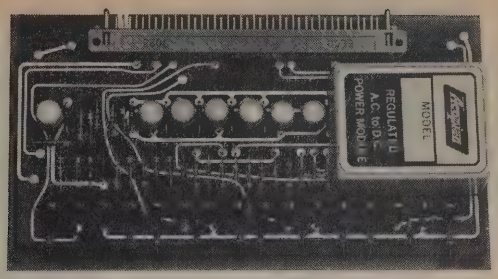



**High voltage displays** such as NIXIE* indicators may be powered with the Model NX-25A or NX-50. With an input of 115 VAC 47-420 Hz, they provide nominal (unregulated) outputs of 185 VDC.

*Registered trademark of Burroughs Corp.



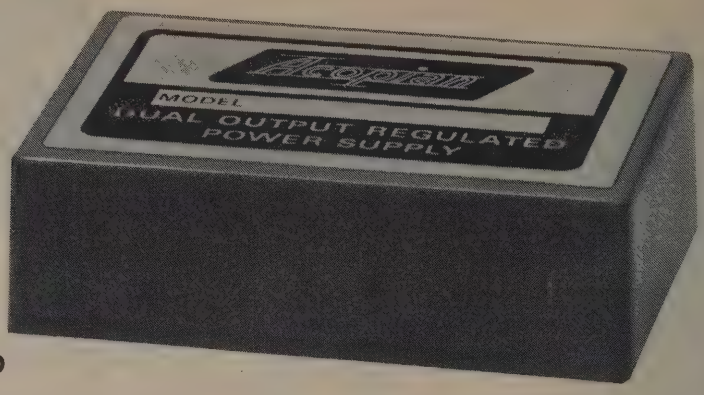
ACOPIAN CORP., EASTON, PA. 18042 • TEL: (215) 258-5441 • TWX: 510-651-4919 • 3-DAY SHIPMENT GUARANTEED




**Placement of a mini-module** on a printed circuit assembly eliminates the need for an outboard power supply, as well as all the associated wiring, connectors and hardware. Layout and construction are simplified, equipment size can be reduced, and system reliability is improved.

| Output Voltage | Output Current Amps. | Regulation Load ±% | Regulation Line ±% | Ripple mv RMS | Price | Model | Case Size |
|---|---|---|---|---|---|---|---|
| 1 | .250 | .1 | .05 | 0.5 | $ 49 | 1E25 | ES-10 |
| 1 | .500 | .2 | .05 | 1 | 59 | 1E50A | EL-10 |
| 1.5 | .250 | .1 | .05 | 0.5 | 49 | 1.5E25 | ES-10 |
| 1.5 | .500 | .2 | .05 | 1 | 59 | 1.5E50A | EL-10 |
| 1.5 | 1.0 | .3 | .05 | 1 | 98 | 1.5E100 | EL-13 |
| 1.5 | 2.5 | .3 | .05 | 1 | 125 | 1.5E250 | EL-20 |
| 2 | .200 | .1 | .05 | 0.5 | 49 | 2E20 | ES-10 |
| 2 | .400 | .2 | .05 | 1 | 59 | 2E40A | EL-10 |
| 3 | .250 | .1 | .05 | 0.5 | 49 | 3E25 | ES-10 |
| 3 | .500 | .2 | .05 | 1 | 59 | 3E50A | EL-10 |
| 3.6 | .250 | .05 | .05 | 0.5 | 39 | 3.6E25 | ES-10 |
| 3.6 | .500 | .1 | .05 | 1 | 59 | 3.6E50A | EL-10 |
| 3.6 | 1.0 | .3 | .05 | 1 | 98 | 3.6E100 | EL-13 |
| 3.6 | 2.5 | .3 | .05 | 1 | 125 | 3.6E250 | EL-20 |
| 4 | .200 | .05 | .05 | 0.5 | 49 | 4E20 | ES-10 |
| 4 | .400 | .1 | .05 | 1 | 59 | 4E40A | EL-10 |
| 5 | .250 | .05 | .05 | 0.5 | 39 | 5E25 | ES-10 |
| 5 | .500 | .1 | .05 | 1 | 49 | 5E50A | EL-10 |
| 5 | 1.0 | .2 | .05 | 1 | 69 | 5E100 | EL-13 |
| 5 | 1.5 | .3 | .1 | 1 | 98 | 5E150 | EL-13 |
| 5 | 2.0 | .15 | .05 | 1 | 110 | 5E200 | EL-20 |
| 5 | 2.5 | .15 | .05 | 1 | 125 | 5E250 | EL-20 |
| 6 | .200 | .05 | .05 | 0.5 | 39 | 6E20 | ES-10 |
| 6 | .400 | .1 | .05 | 1 | 59 | 6E40A | EL-10 |
| 6 | .550 | .2 | .05 | 1 | 79 | 6E55 | EL-10 |
| 6 | 1.0 | .2 | .05 | 1 | 98 | 6E100 | EL-13 |
| 6 | 1.75 | .15 | .05 | 1 | 125 | 6E175 | EL-20 |
| 7 | .170 | .05 | .05 | 0.5 | 49 | 7E17 | ES-10 |
| 7 | .340 | .1 | .05 | 1 | 59 | 7E34A | EL-10 |
| 7 | .450 | .2 | .05 | 1 | 79 | 7E45 | EL-10 |
| 7 | .900 | .2 | .05 | 1 | 98 | 7E90 | EL-13 |
| 7 | 1.15 | .15 | .05 | 1 | 125 | 7E115 | EL-20 |
| 8 | .150 | .05 | .05 | 0.5 | 49 | 8E15 | ES-10 |
| 8 | .300 | .1 | .05 | 1 | 59 | 8E30A | EL-10 |
| 8 | .700 | .2 | .05 | 1 | 98 | 8E70 | EL-13 |
| 8 | 1.1 | .15 | .05 | 1 | 125 | 8E110 | EL-20 |
| 9 | .130 | .05 | .05 | 0.5 | 39 | 9E13 | ES-10 |
| 9 | .260 | .1 | .05 | 1 | 59 | 9E26A | EL-10 |
| 9 | .450 | .15 | .05 | 1 | 79 | 9E45 | EL-10 |
| 9 | .850 | .15 | .05 | 1 | 98 | 9E85 | EL-13 |
| 9 | 1.5 | .15 | .05 | 1 | 125 | 9E150 | EL-20 |
| 10 | .120 | .02 | .02 | 0.5 | 30 | 10E12 | ES-10 |
| 10 | .240 | .05 | .05 | 1 | 59 | 10E24A | EL-10 |
| 10 | .400 | .15 | .05 | 1 | 79 | 10E40 | EL-10 |
| 10 | .750 | .15 | .05 | 1 | 98 | 10E75 | EL-13 |
| 10 | 1.2 | .1 | .05 | 1 | 125 | 10E120 | EL-20 |
| 11 | .110 | .02 | .02 | 0.5 | 39 | 11E11 | ES-10 |
| 11 | .220 | .05 | .05 | 1 | 59 | 11E22A | EL-10 |
| 11 | .350 | .15 | .05 | 1 | 79 | 11E35 | EL-10 |
| 11 | .600 | .15 | .05 | 1 | 98 | 11E60 | EL-13 |
| 11 | 1.0 | .1 | .05 | 1 | 125 | 11E100 | EL-20 |
| 12 | .100 | .02 | .02 | 0.5 | 30 | 12E10 | ES-10 |
| 12 | .200 | .05 | .05 | 1 | 59 | 12E20A | EL-10 |
| 12 | .400 | .1 | .05 | 1 | 79 | 12E40 | EL-10 |
| 12 | .700 | .1 | .05 | 1 | 98 | 12E70 | EL-13 |
| 12 | 1.2 | .15 | .05 | 1 | 125 | 12E120 | EL-20 |
| 13 | .100 | .02 | .02 | 0.5 | 39 | 13E10 | ES-10 |
| 13 | .200 | .05 | .05 | 1 | 59 | 13E20A | EL-10 |
| 13 | .350 | .1 | .05 | 1 | 79 | 13E35 | EL-10 |
| 13 | .600 | .1 | .05 | 1 | 98 | 13E60 | EL-13 |
| 13 | 1.0 | .1 | .05 | 1 | 125 | 13E100 | EL-20 |
| 14 | .100 | .02 | .02 | 0.5 | 39 | 14E10 | ES-10 |
| 14 | .200 | .05 | .05 | 1 | 59 | 14E20A | EL-10 |
| 14 | .300 | .1 | .05 | 1 | 79 | 14E30 | EL-10 |
| 14 | .500 | .1 | .05 | 1 | 98 | 14E50 | EL-13 |
| 14 | 1.0 | .1 | .05 | 1 | 125 | 14E100 | EL-20 |
| 15 | .100 | .02 | .02 | 0.5 | 30 | 15E10 | ES-10 |
| 15 | .200 | .05 | .05 | 1 | 59 | 15E20A | EL-10 |
| 15 | .400 | .1 | .05 | 1 | 79 | 15E40 | EL-10 |
| 15 | .600 | .1 | .05 | 1 | 98 | 15E60 | EL-13 |
| 15 | 1.0 | .1 | .05 | 1 | 125 | 15E100 | EL-20 |
| 16 | .080 | .02 | .02 | 0.5 | 39 | 16E08 | ES-10 |
| 16 | .160 | .05 | .05 | 1 | 59 | 16E16A | EL-10 |
| 16 | .350 | .1 | .05 | 1 | 79 | 16E35 | EL-10 |
| 16 | .500 | .1 | .05 | 1 | 98 | 16E50 | EL-13 |
| 16 | .900 | .1 | .05 | 1 | 125 | 16E90 | EL-20 |
| 17 | .070 | .02 | .02 | 0.5 | 39 | 17E07 | ES-10 |
| 17 | .140 | .05 | .05 | 1 | 59 | 17E14A | EL-10 |
| 17 | .325 | .1 | .05 | 1 | 79 | 17E33 | EL-10 |
| 17 | .450 | .1 | .05 | 1 | $ 98 | 17E45 | EL-13 |
| 17 | .750 | .1 | .05 | 1 | 125 | 17E75 | EL-20 |
| 18 | .060 | .02 | .02 | 0.5 | 30 | 18E06 | ES-10 |
| 18 | .120 | .05 | .05 | 1 | 59 | 18E12A | EL-10 |
| 18 | .270 | .1 | .05 | 1 | 79 | 18E27 | EL-10 |
| 18 | .400 | .1 | .05 | 1 | 98 | 18E40 | EL-13 |
| 18 | .550 | .1 | .05 | 1 | 125 | 18E55 | EL-20 |
| 19 | .060 | .02 | .02 | 0.5 | 39 | 19E06 | ES-10 |
| 19 | .120 | .05 | .05 | 1 | 59 | 19E12A | EL-10 |
| 19 | .250 | .1 | .05 | 1 | 79 | 19E25 | EL-10 |
| 19 | .400 | .1 | .05 | 1 | 98 | 19E40 | EL-13 |
| 19 | .700 | .1 | .05 | 1 | 125 | 19E70 | EL-20 |
| 20 | .060 | .02 | .02 | 0.5 | 39 | 20E06 | ES-10 |
| 20 | .120 | .05 | .05 | 1 | 59 | 20E12A | EL-10 |
| 20 | .200 | .1 | .05 | 1 | 79 | 20E20 | EL-10 |
| 20 | .400 | .1 | .05 | 1 | 98 | 20E40 | EL-13 |
| 20 | .700 | .1 | .05 | 1 | 125 | 20E70 | EL-20 |
| 21 | .060 | .02 | .02 | 0.5 | 39 | 21E06 | ES-10 |
| 21 | .120 | .05 | .05 | 1 | 59 | 21E12A | EL-10 |
| 21 | .175 | .1 | .05 | 1 | 79 | 21E18 | EL-10 |
| 21 | .375 | .1 | .05 | 1 | 98 | 21E38 | EL-13 |
| 21 | .600 | .1 | .05 | 1 | 125 | 21E60 | EL-20 |
| 22 | .050 | .02 | .02 | 0.5 | 39 | 22E05 | ES-10 |
| 22 | .100 | .05 | .05 | 1 | 59 | 22E10A | EL-10 |
| 22 | .150 | .1 | .05 | 1 | 79 | 22E15 | EL-10 |
| 22 | .300 | .1 | .05 | 1 | 98 | 22E30 | EL-13 |
| 22 | .500 | .1 | .05 | 1 | 125 | 22E50 | EL-20 |
| 23 | .050 | .02 | .02 | 0.5 | 39 | 23E05 | ES-10 |
| 23 | .100 | .05 | .05 | 1 | 59 | 23E10A | EL-10 |
| 23 | .200 | .1 | .05 | 1 | 79 | 23E20 | EL-10 |
| 23 | .300 | .1 | .05 | 1 | 98 | 23E30 | EL-13 |
| 23 | .600 | .1 | .05 | 1 | 125 | 23E60 | EL-20 |
| 24 | .050 | .02 | .02 | 0.5 | 30 | 24E05 | ES-10 |
| 24 | .100 | .05 | .05 | 1 | 59 | 24E10A | EL-10 |
| 24 | .200 | .1 | .05 | 1 | 79 | 24E20 | EL-10 |
| 24 | .350 | .1 | .05 | 1 | 98 | 24E35 | EL-13 |
| 24 | .600 | .1 | .05 | 1 | 125 | 24E60 | EL-20 |
| 25 | .050 | .02 | .02 | 0.5 | 39 | 25E05 | ES-10 |
| 25 | .100 | .05 | .05 | 1 | 59 | 25E10A | EL-10 |
| 25 | .190 | .1 | .05 | 1 | 79 | 25E19 | EL-10 |
| 25 | .325 | .1 | .05 | 1 | 98 | 25E33 | EL-13 |
| 25 | .550 | .1 | .05 | 1 | 125 | 25E55 | EL-20 |
| 26 | .040 | .02 | .02 | 0.5 | 39 | 26E04 | ES-10 |
| 26 | .080 | .05 | .05 | 1 | 59 | 26E08A | EL-10 |
| 26 | .170 | .1 | .05 | 1 | 79 | 26E17 | EL-10 |
| 26 | .300 | .1 | .05 | 1 | 98 | 26E30 | EL-13 |
| 26 | .450 | .1 | .05 | 1 | 125 | 26E45 | EL-20 |
| 27 | .040 | .02 | .02 | 0.5 | 39 | 27E04 | ES-10 |
| 27 | .080 | .05 | .05 | 1 | 59 | 27E08A | EL-10 |
| 27 | .160 | .1 | .05 | 1 | 79 | 27E16 | EL-10 |
| 27 | .300 | .1 | .05 | 1 | 98 | 27E30 | EL-13 |
| 27 | .500 | .1 | .05 | 1 | 125 | 27E50 | EL-20 |
| 28 | .040 | .05 | .05 | 0.5 | 39 | 28E04 | ES-10 |
| 28 | .080 | .02 | .02 | 1 | 59 | 28E08A | EL-10 |
| 28 | .150 | .1 | .05 | 1 | 79 | 28E15 | EL-10 |
| 28 | .300 | .1 | .05 | 1 | 98 | 28E30 | EL-13 |
| 28 | .500 | .1 | .05 | 1 | 125 | 28E50 | EL-20 |
| 30 | .080 | .02 | .02 | 1 | 59 | 30E08A | EL-13 |
| 32 | .070 | .02 | .02 | 1 | 59 | 32E07A | EL-13 |
| 34 | .060 | .02 | .02 | 1 | 59 | 34E06A | EL-13 |
| 35 | .050 | .02 | .02 | 1 | 59 | 35E05A | EL-13 |
| 36 | .050 | .02 | .02 | 1 | 59 | 36E05A | EL-13 |
| 38 | .040 | .02 | .02 | 1 | 59 | 38E04A | EL-13 |
| 40 | .030 | .02 | .02 | 1 | 62 | 40E03A | EL-13 |
| 40 | .060 | .02 | .02 | 1 | 89 | 40E06A | EL-13 |
| 42 | .030 | .02 | .02 | 1 | 62 | 42E03A | EL-13 |
| 44 | .030 | .02 | .02 | 1 | 62 | 44E03A | EL-13 |
| 45 | .030 | .02 | .02 | 1 | 62 | 45E03A | EL-13 |
| 48 | .030 | .02 | .02 | 1 | 62 | 48E03A | EL-13 |
| 48 | .050 | .02 | .02 | 1 | 89 | 48E05A | EL-13 |
| 50 | .030 | .02 | .02 | 1 | 62 | 50E03A | EL-13 |
| 50 | .050 | .02 | .02 | 1 | 89 | 50E05A | EL-13 |
| 55 | .040 | .02 | .02 | 1 | 89 | 55E04A | EL-13 |
| 60 | .050 | .02 | .02 | 1 | 89 | 60E05A | EL-13 |
| 65 | .050 | .02 | .02 | 1 | 89 | 65E05A | EL-13 |
| 70 | .040 | .02 | .02 | 1 | 89 | 70E04A | EL-13 |
| 75 | .030 | .02 | .02 | 1 | 89 | 75E03A | EL-13 |
| 185 | .025 | Unregulated | | 2V | 35 | NX-25A | EL-10 |
| 185 | .050 | Unregulated | | 3.5V | 49 | NX-50 | EL-13 |

Acopian




# MINIATURIZED REGULATED MULTIPLE OUTPUT

**ALL MODELS U.L. RECOGNIZED**

**These dual and triple output** mini-modules are compact and convenient sources of the voltages required to power operational amplifiers and related circuits. They may be mounted directly on printed circuit board assemblies, simplifying system layout and minimizing the connectors and wiring required.

## STANDARD FEATURES

- May be used in series
- No derating or heat sinking required
- Short circuit protected
- Compact, lightweight

## SPECIFICATIONS

**Input Voltage:** 105–125 VAC, 47 to 420 Hz, single phase.

**Output Specifications:** See table.

**Output Voltage Setting:** Each output is factory preset to ±2% (1 to 9 volt outputs) or ±1% (10 to 28 volt outputs) of the nominal output voltage. Outputs of Case Size END modules, except those marked (*), may be trimmed to the nominal voltage rating with an external trim resistor.

**Polarity:** Single output sections may be used in either polarity. Dual output sections, marked (*), are provided with a plus/common/minus output connection configuration.

**Ambient Operating Temperature:** −20 to +71°C. No derating required.

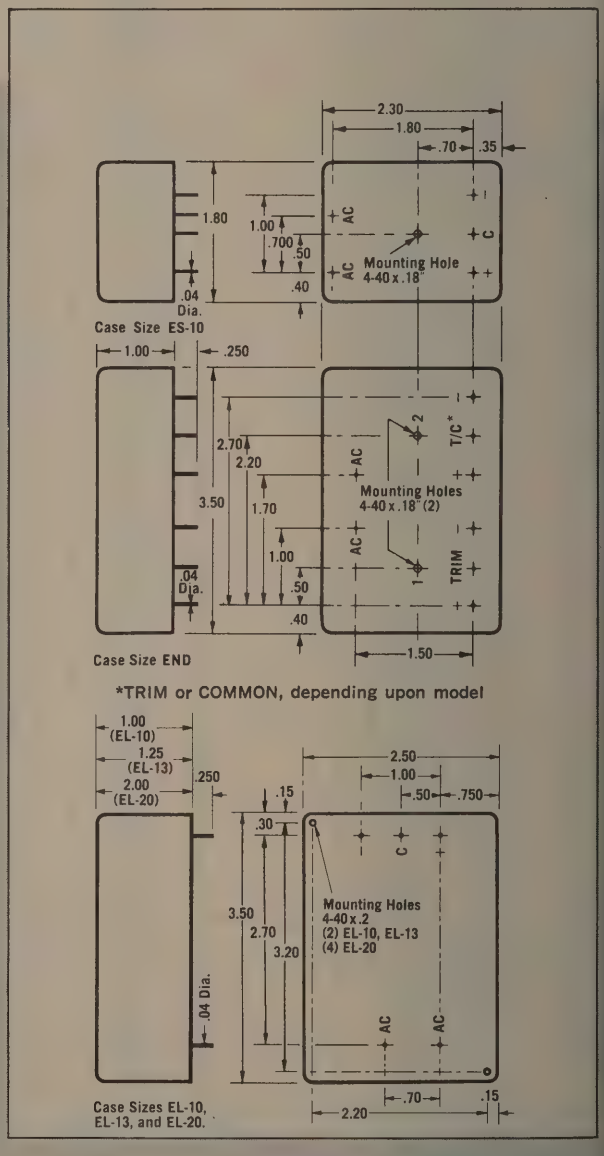
**Storage Temperature:** −55 to +85°C.

**Temperature Coefficient:** From 9 to 28 volts, approximate TC is .015%/°C; 1 to 8 volts, .03%/°C.

**Impedance:** 0.07 ohms at 1 kHz and 0.2 ohms at 10 kHz (approx.).

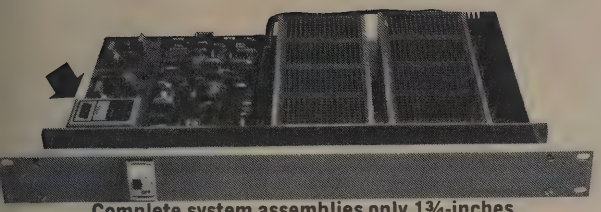
**Weight:** 7 oz. (Case size ES-10.)
13 oz. (Case size END.)
1 lb. (Case size EL-10.)
1 lb. 3 oz. (Case size EL-13.)
2 lb. (Case size EL-20.)

**Optional 230 Volt Input:** All models can be alternately furnished for operation on an input of 210 to 250 VAC, 47-420 Hz. To order, add suffix "–230" to model number and $10.00 to price.

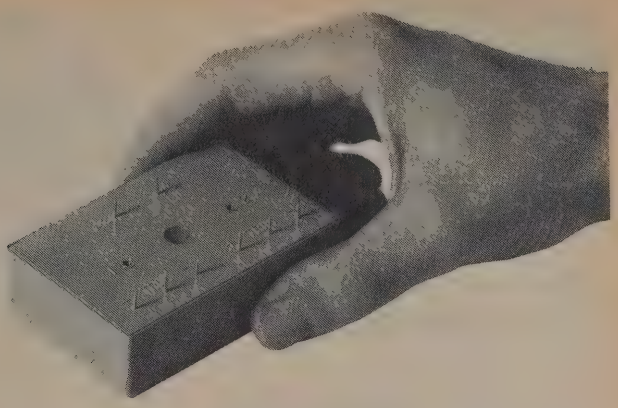





ACOPIAN CORP., EASTON, PA. 18042 • TEL: (215) 258-5441 • TWX: 510-651-4919 • 3-DAY SHIPMENT GUARANTEED



**Complete system assemblies only 1¾-inches high.** Mini-modules permit exceptional flexibility in the design of rack-mounting assemblies built on standard 19-inch panels as small as 1¾-inches high.



**Dual output modules** have isolated outputs; triples provide two balanced and tracking voltages in a three-terminal configuration, plus an isolated third output for logic, control circuits, etc.

## HOW TO ORDER:

Any two of the sections listed below, or two of the same section, can be combined into a multiple-output module. The complete model number is the combination of the two section numbers selected. Note that some sections provide two outputs; combination with a single output section results in a triple-output module.

Example: The combination of sections 6E20D and 15E10D is the Model 6E20D-15E10D. Always assign the lower voltage section first. For pricing purposes, add the costs of the sections selected. Example: The price of the Model 6E20D-15E10D is $39.00 plus $29.00, or $68.00 total.

| Output Voltage | Output Current Amps. | Regulation Load ±% | Regulation Line ±% | Ripple mv RMS | Price per Section | Section (See "How to order") | Case Size |
|---|---|---|---|---|---|---|---|
| 1 | .250 | .1 | .05 | 0.5 | $39 | 1E25D | END |
| 1.5 | .250 | .1 | .05 | 0.5 | 39 | 1.5E25D | END |
| 2 | .200 | .1 | .05 | 0.5 | 39 | 2E20D | END |
| 3 | .250 | .1 | .05 | 0.5 | 39 | 3E25D | END |
| 3.6 | .250 | .05 | .05 | 0.5 | 39 | 3.6E25D | END |
| 4 | .200 | .05 | .05 | 0.5 | 39 | 4E20D | END |
| 5 | .250 | .05 | .05 | 0.5 | 39 | 5E25D | END |
| 6 | .200 | .05 | .05 | 0.5 | 39 | 6E20D | END |
| 7 | .170 | .05 | .05 | 0.5 | 39 | 7E17D | END |
| 8 | .150 | .05 | .05 | 0.5 | 39 | 8E15D | END |
| 9 | .130 | .05 | .05 | 0.5 | 29 | 9E13D | END |
| 10 | .120 | .02 | .02 | 0.5 | 29 | 10E12D | END |
| ±12* | .050 | .10 | .05 | 1.0 | 49 | D12E05 | END |
| 12 | .100 | .02 | .02 | 0.5 | 29 | 12E10D | END |
| 12 | .150 | .05 | .05 | 0.5 | 33 | 12E15D | END |
| 13 | .100 | .02 | .02 | 0.5 | 29 | 13E10D | END |

| Output Voltage | Output Current Amps. | Regulation Load ±% | Regulation Line ±% | Ripple mv RMS | Price per Section | Section (See "How to order") | Case Size |
|---|---|---|---|---|---|---|---|
| 14 | .100 | .02 | .02 | 0.5 | $29 | 14E10D | END |
| ±15* | .050 | .10 | .05 | 1.0 | 49 | D15E05 | END |
| 15 | .100 | .02 | .02 | 0.5 | 29 | 15E10D | END |
| 15 | .150 | .05 | .05 | 0.5 | 33 | 15E15D | END |
| 16 | .080 | .02 | .02 | 0.5 | 29 | 16E08D | END |
| 17 | .070 | .02 | .02 | 0.5 | 29 | 17E07D | END |
| 18 | .060 | .02 | .02 | 0.5 | 29 | 18E06D | END |
| 20 | .060 | .02 | .02 | 0.5 | 29 | 20E06D | END |
| 21 | .060 | .02 | .02 | 0.5 | 29 | 21E06D | END |
| 22 | .050 | .02 | .02 | 0.5 | 29 | 22E05D | END |
| 23 | .050 | .02 | .02 | 0.5 | 29 | 23E05D | END |
| 24 | .050 | .02 | .02 | 0.5 | 29 | 24E05D | END |
| 25 | .050 | .02 | .02 | 0.5 | 29 | 25E05D | END |
| 26 | .040 | .02 | .02 | 0.5 | 29 | 26E04D | END |
| 27 | .040 | .02 | .02 | 0.5 | 29 | 27E04D | END |
| 28 | .040 | .02 | .02 | 0.5 | 29 | 28E04D | END |

*Dual output section. Combination with a single output section results in a triple output module.

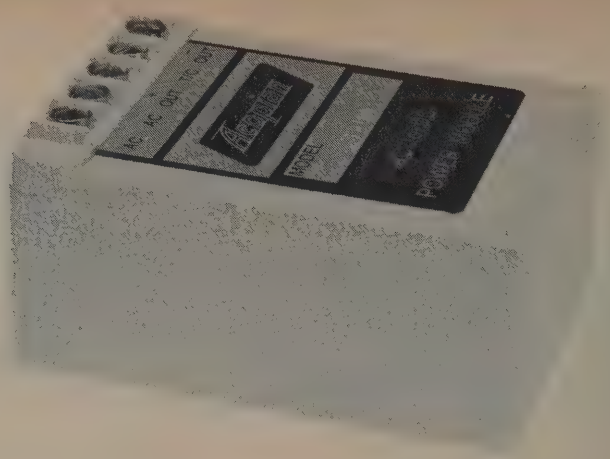
## DUAL OUTPUT SUPPLIES FOR OP AMPS

(These model numbers are complete as shown.)

| Nominal Output Voltages | Output Current Amps. | Regulation Load ±% | Regulation Line ±% | Ripple mv RMS | Price | Model | Case Size |
|---|---|---|---|---|---|---|---|
| ±12 | .025 | .1 | .05 | 1 | $ 24 | D12-03 | ES-10 |
| ±12 | .050 | .1 | .05 | 1 | 39 | D12-05 | ES-10 |
| ±12 | .100 | .05 | .05 | 1 | 49 | D12-10A | EL-10 |
| ±12 | .150 | .05 | .05 | 1 | 59 | D12-15A | EL-10 |
| ±12 | .200 | .05 | .05 | 1 | 69 | D12-20 | EL-10 |
| ±12 | .300 | .05 | .05 | 1 | 98 | D12-30 | EL-13 |
| ±12 | .350 | .05 | .05 | 1 | 105 | D12-35 | EL-13 |
| ±12 | .500 | .1 | .05 | 1 | 130 | D12-50 | EL-20 |

| Nominal Output Voltages | Output Current Amps. | Regulation Load ±% | Regulation Line ±% | Ripple mv RMS | Price | Model | Case Size |
|---|---|---|---|---|---|---|---|
| ±15 | .025 | .1 | .05 | 1 | $ 24 | D15-03 | ES-10 |
| ±15 | .050 | .1 | .05 | 1 | 39 | D15-05 | ES-10 |
| ±15 | .100 | .05 | .05 | 1 | 49 | D15-10A | EL-10 |
| ±15 | .150 | .05 | .05 | 1 | 59 | D15-15A | EL-10 |
| ±15 | .200 | .05 | .05 | 1 | 69 | D15-20 | EL-10 |
| ±15 | .300 | .05 | .05 | 1 | 98 | D15-30 | EL-13 |
| ±15 | .350 | .05 | .05 | 1 | 105 | D15-35 | EL-13 |
| ±15 | .500 | .1 | .05 | 1 | 130 | D15-50 | EL-20 |

Acopian



# MINIATURIZED REGULATED

## Terminal Strip Connections

**ALL MODELS U.L. RECOGNIZED**

**Although small in size,** these mini-modules offer high performance at modest prices. All models, with series regulated outputs ranging from 1 to 75 volts and as high as 2.5 amps, may be mounted in an area only 3.5" x 2.5". Dual output models are available with the ratings commonly required for driving op amps and other balanced loads. Terminal strip input/output connections eliminate all need for sockets or soldering. Short circuit protection, encapsulated construction, and conservative design assure long term reliability.

### STANDARD FEATURES

- May be used in series
- No derating or heat sinking required
- Short circuit protected
- Small, lightweight

### SPECIFICATIONS

**Input Voltage:** 105–125 VAC, 47 to 420 Hz, single phase.

**Output Specifications:** See tables.

**Output Voltage Trim Adjustment:** Outputs factory preset to ±2% (1 to 9 volt models) or ±1% (10 to 75 volt models) of nominal output voltage. Single output models may be trimmed to the nominal voltage rating with an external trim resistor.

**Polarity:** Either positive or negative terminal of a single output module may be grounded. Dual output modules have a positive/common/negative output terminal configuration.

**Ambient Operating Temperature:** −20 to +71°C. (Model 5EB150, 0 to +71°C.) No derating required.

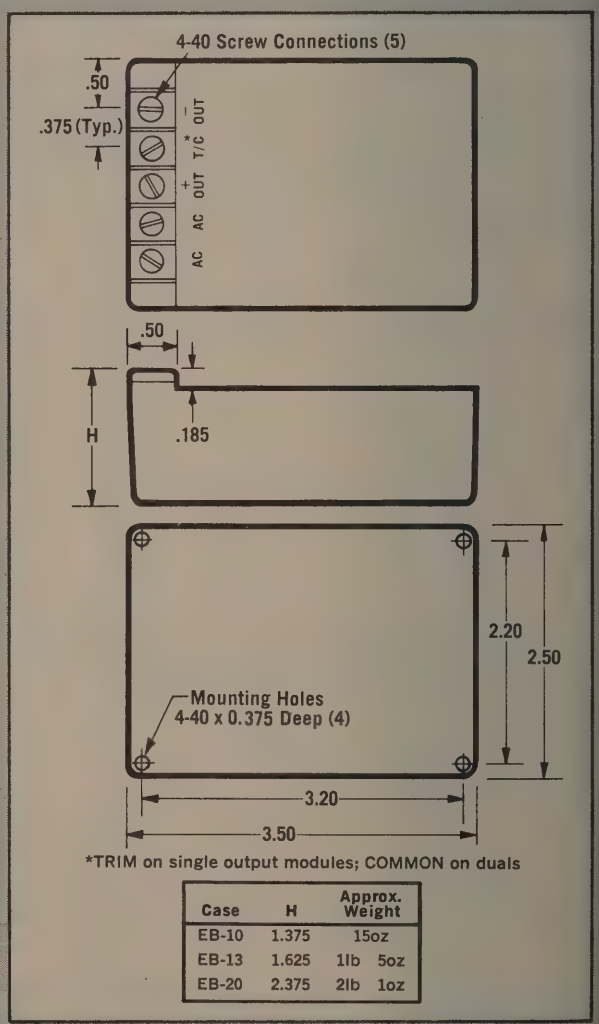
**Storage Temperature:** −55 to +85°C.

**Temperature Coefficient:** From 9 to 75 volts, approximate TC is .015%/°C; 1 to 8 volts, .03%/°C.

**Impedance:** 0.07 ohms at 1 kHz and 0.2 ohms at 10 kHz (approx.).

**Optional 230 Volt Input:** All models can be alternately furnished for operation on an input of 210 to 250 VAC, 47-420 Hz. To order, add suffix "–230" to model number and $10.00 to price.

**High voltage displays** such as NIXIE* indicators may be powered with the Model NX-25B or NX-50B. With an input of 115 VAC 47-420 Hz, they provide nominal (unregulated) outputs of 185 VDC.
*Registered trademark of Burroughs Corp.

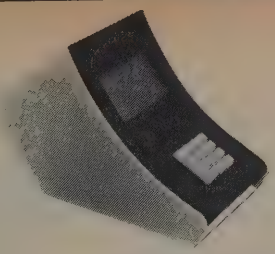



*TRIM on single output modules; COMMON on duals

| Case | H | Approx. Weight |
|---|---|---|
| EB-10 | 1.375 | 15oz |
| EB-13 | 1.625 | 1lb 5oz |
| EB-20 | 2.375 | 2lb 1oz |



ACOPIAN CORP., EASTON, PA. 18042 • TEL: (215) 258-5441 • TWX: 510-651-4919 • 3-DAY SHIPMENT GUARANTEED



**An Acopian miniaturized power module** is used in the Valitron credit validation system manufactured by Video Systems Corporation. A Valitron terminal is capable of retrieving and displaying credit information for any of 100,000 accounts on a six inch video screen, in response to an account number being entered via its keyboard.

## SINGLE OUTPUT MODELS

| Output Voltage | Output Current Amps. | Regulation Load ±% | Regulation Line ±% | Ripple mv RMS | Price | Model | Case Size |
|---|---|---|---|---|---|---|---|
| 1 | .500 | .4 | .05 | 1 | $ 65 | 1EB50 | EB-10 |
| 1.5 | .500 | .3 | .05 | 1 | 65 | 1.5EB50 | EB-10 |
| 1.5 | 1.0 | .5 | .05 | 1 | 105 | 1.5EB100 | EB-13 |
| 1.5 | 2.5 | .6 | .05 | 1 | 130 | 1.5EB250 | EB-20 |
| 2 | .400 | .25 | .05 | 1 | 65 | 2EB40 | EB-10 |
| 3 | .500 | .25 | .05 | 1 | 65 | 3EB50 | EB-10 |
| 3.6 | .500 | .15 | .05 | 1 | 65 | 3.6EB50 | EB-10 |
| 3.6 | 1.0 | .4 | .05 | 1 | 105 | 3.6EB100 | EB-13 |
| 3.6 | 2.5 | .4 | .05 | 1 | 130 | 3.6EB250 | EB-20 |
| 4 | .400 | .15 | .05 | 1 | 65 | 4EB40 | EB-10 |
| 5 | .500 | .15 | .05 | 1 | 55 | 5EB50 | EB-10 |
| 5 | 1.0 | .25 | .05 | 1 | 75 | 5EB100 | EB-13 |
| 5 | 1.5 | .35 | .1 | 1 | 105 | 5EB150 | EB-13 |
| 5 | 2.0 | .25 | .05 | 1 | 115 | 5EB200 | EB-20 |
| 5 | 2.5 | .25 | .05 | 1 | 130 | 5EB250 | EB-20 |
| 6 | .400 | .1 | .05 | 1 | 65 | 6EB40 | EB-10 |
| 6 | .550 | .25 | .05 | 1 | 85 | 6EB55 | EB-10 |
| 6 | 1.0 | .25 | .05 | 1 | 105 | 6EB100 | EB-13 |
| 6 | 1.75 | .2 | .05 | 1 | 130 | 6EB175 | EB-20 |
| 7 | .340 | .1 | .05 | 1 | 65 | 7EB34 | EB-10 |
| 7 | .450 | .2 | .05 | 1 | 85 | 7EB45 | EB-10 |
| 7 | .900 | .25 | .05 | 1 | 105 | 7EB90 | EB-13 |
| 7 | 1.15 | .2 | .05 | 1 | 130 | 7EB115 | EB-20 |
| 8 | .300 | .1 | .05 | 1 | 65 | 8EB30 | EB-10 |
| 8 | .700 | .2 | .05 | 1 | 105 | 8EB70 | EB-13 |
| 8 | 1.1 | .2 | .05 | 1 | 130 | 8EB110 | EB-20 |
| 9 | .260 | .1 | .05 | 1 | 65 | 9EB26 | EB-10 |
| 9 | .450 | .15 | .05 | 1 | 85 | 9EB45 | EB-10 |
| 9 | .850 | .2 | .05 | 1 | 105 | 9EB85 | EB-13 |
| 9 | 1.5 | .2 | .05 | 1 | 130 | 9EB150 | EB-20 |
| 10 | .240 | .05 | .05 | 1 | 65 | 10EB24 | EB-10 |
| 10 | .400 | .15 | .05 | 1 | 85 | 10EB40 | EB-10 |
| 10 | .750 | .2 | .05 | 1 | 105 | 10EB75 | EB-13 |
| 10 | 1.2 | .15 | .05 | 1 | 130 | 10EB120 | EB-20 |
| 11 | .220 | .05 | .05 | 1 | 65 | 11EB22 | EB-10 |
| 11 | .350 | .15 | .05 | 1 | 85 | 11EB35 | EB-10 |
| 11 | .600 | .15 | .05 | 1 | 105 | 11EB60 | EB-13 |
| 11 | 1.0 | .15 | .05 | 1 | 130 | 11EB100 | EB-20 |
| 12 | .200 | .05 | .05 | 1 | 65 | 12EB20 | EB-10 |
| 12 | .400 | .1 | .05 | 1 | 85 | 12EB40 | EB-10 |
| 12 | .700 | .15 | .05 | 1 | 105 | 12EB70 | EB-13 |
| 12 | 1.2 | .2 | .05 | 1 | 130 | 12EB120 | EB-20 |
| 13 | .200 | .05 | .05 | 1 | 65 | 13EB20 | EB-10 |
| 13 | .350 | .1 | .05 | 1 | 85 | 13EB35 | EB-10 |
| 13 | .600 | .1 | .05 | 1 | 105 | 13EB60 | EB-13 |
| 13 | 1.0 | .15 | .05 | 1 | 130 | 13EB100 | EB-20 |
| 14 | .200 | .05 | .05 | 1 | 65 | 14EB20 | EB-10 |
| 14 | .300 | .1 | .05 | 1 | 85 | 14EB30 | EB-10 |
| 14 | .500 | .1 | .05 | 1 | 105 | 14EB50 | EB-13 |
| 14 | 1.0 | .15 | .05 | 1 | 130 | 14EB100 | EB-20 |
| 15 | .200 | .05 | .05 | 1 | 65 | 15EB20 | EB-10 |
| 15 | .400 | .1 | .05 | 1 | 85 | 15EB40 | EB-10 |
| 15 | .600 | .1 | .05 | 1 | 105 | 15EB60 | EB-13 |
| 15 | 1.0 | .15 | .05 | 1 | 130 | 15EB100 | EB-20 |
| 16 | .160 | .05 | .05 | 1 | 65 | 16EB16 | EB-10 |
| 16 | .350 | .1 | .05 | 1 | 85 | 16EB35 | EB-10 |
| 16 | .500 | .1 | .05 | 1 | 105 | 16EB50 | EB-13 |
| 16 | .900 | .15 | .05 | 1 | 130 | 16EB90 | EB-20 |
| 17 | .140 | .05 | .05 | 1 | 65 | 17EB14 | EB-10 |
| 17 | .325 | .1 | .05 | 1 | 85 | 17EB33 | EB-10 |
| 17 | .450 | .1 | .05 | 1 | 105 | 17EB45 | EB-13 |
| 17 | .750 | .15 | .05 | 1 | 130 | 17EB75 | EB-20 |
| 18 | .120 | .05 | .05 | 1 | 65 | 18EB12 | EB-10 |
| 18 | .270 | .1 | .05 | 1 | 85 | 18EB27 | EB-10 |
| 18 | .400 | .1 | .05 | 1 | $105 | 18EB40 | EB-13 |
| 18 | .550 | .1 | .05 | 1 | 130 | 18EB55 | EB-20 |
| 19 | .120 | .05 | .05 | 1 | 65 | 19EB12 | EB-10 |
| 19 | .250 | .1 | .05 | 1 | 85 | 19EB25 | EB-10 |
| 19 | .400 | .1 | .05 | 1 | 105 | 19EB40 | EB-13 |
| 19 | .700 | .1 | .05 | 1 | 130 | 19EB70 | EB-20 |
| 20 | .120 | .05 | .05 | 1 | 65 | 20EB12 | EB-10 |
| 20 | .200 | .1 | .05 | 1 | 85 | 20EB20 | EB-10 |
| 20 | .400 | .1 | .05 | 1 | 105 | 20EB40 | EB-13 |
| 20 | .700 | .1 | .05 | 1 | 130 | 20EB70 | EB-20 |
| 21 | .120 | .05 | .05 | 1 | 65 | 21EB12 | EB-10 |
| 21 | .175 | .1 | .05 | 1 | 85 | 21EB18 | EB-10 |
| 21 | .375 | .1 | .05 | 1 | 105 | 21EB38 | EB-13 |
| 21 | .600 | .1 | .05 | 1 | 130 | 21EB60 | EB-20 |
| 22 | .100 | .05 | .05 | 1 | 65 | 22EB10 | EB-10 |
| 22 | .150 | .1 | .05 | 1 | 85 | 22EB15 | EB-10 |
| 22 | .300 | .1 | .05 | 1 | 105 | 22EB30 | EB-13 |
| 22 | .500 | .1 | .05 | 1 | 130 | 22EB50 | EB-20 |
| 23 | .100 | .05 | .05 | 1 | 65 | 23EB10 | EB-10 |
| 23 | .200 | .1 | .05 | 1 | 85 | 23EB20 | EB-10 |
| 23 | .300 | .1 | .05 | 1 | 105 | 23EB30 | EB-13 |
| 23 | .600 | .1 | .05 | 1 | 130 | 23EB60 | EB-20 |
| 24 | .100 | .05 | .05 | 1 | 65 | 24EB10 | EB-10 |
| 24 | .200 | .1 | .05 | 1 | 85 | 24EB20 | EB-10 |
| 24 | .350 | .1 | .05 | 1 | 105 | 24EB35 | EB-13 |
| 24 | .600 | .1 | .05 | 1 | 130 | 24EB60 | EB-20 |
| 25 | .100 | .05 | .05 | 1 | 65 | 25EB10 | EB-10 |
| 25 | .190 | .1 | .05 | 1 | 85 | 25EB19 | EB-10 |
| 25 | .325 | .1 | .05 | 1 | 105 | 25EB33 | EB-13 |
| 25 | .550 | .1 | .05 | 1 | 130 | 25EB55 | EB-20 |
| 26 | .080 | .05 | .05 | 1 | 65 | 26EB08 | EB-10 |
| 26 | .170 | .1 | .05 | 1 | 85 | 26EB17 | EB-10 |
| 26 | .300 | .1 | .05 | 1 | 105 | 26EB30 | EB-13 |
| 26 | .450 | .1 | .05 | 1 | 130 | 26EB45 | EB-20 |
| 27 | .080 | .05 | .05 | 1 | 65 | 27EB08 | EB-10 |
| 27 | .160 | .1 | .05 | 1 | 85 | 27EB16 | EB-10 |
| 27 | .300 | .1 | .05 | 1 | 105 | 27EB30 | EB-13 |
| 27 | .500 | .1 | .05 | 1 | 130 | 27EB50 | EB-20 |
| 28 | .080 | .05 | .05 | 1 | 65 | 28EB08 | EB-10 |
| 28 | .150 | .1 | .05 | 1 | 85 | 28EB15 | EB-10 |
| 28 | .300 | .1 | .05 | 1 | 105 | 28EB30 | EB-13 |
| 28 | .500 | .1 | .05 | 1 | 130 | 28EB50 | EB-20 |
| 30 | .080 | .02 | .02 | 1 | 65 | 30EB08 | EB-13 |
| 32 | .070 | .02 | .02 | 1 | 65 | 32EB07 | EB-13 |
| 34 | .060 | .02 | .02 | 1 | 65 | 34EB06 | EB-13 |
| 35 | .050 | .02 | .02 | 1 | 65 | 35EB05 | EB-13 |
| 36 | .050 | .02 | .02 | 1 | 65 | 36EB05 | EB-13 |
| 38 | .040 | .02 | .02 | 1 | 65 | 38EB04 | EB-13 |
| 40 | .030 | .02 | .02 | 1 | 69 | 40EB03 | EB-13 |
| 40 | .060 | .02 | .02 | 1 | 95 | 40EB06 | EB-13 |
| 42 | .030 | .02 | .02 | 1 | 69 | 42EB03 | EB-13 |
| 44 | .030 | .02 | .02 | 1 | 69 | 44EB03 | EB-13 |
| 45 | .030 | .02 | .02 | 1 | 69 | 45EB03 | EB-13 |
| 48 | .030 | .02 | .02 | 1 | 69 | 48EB03 | EB-13 |
| 48 | .050 | .02 | .02 | 1 | 95 | 48EB05 | EB-13 |
| 50 | .030 | .02 | .02 | 1 | 69 | 50EB03 | EB-13 |
| 50 | .050 | .02 | .02 | 1 | 95 | 50EB05 | EB-13 |
| 55 | .040 | .02 | .02 | 1 | 95 | 55EB04 | EB-13 |
| 60 | .050 | .02 | .02 | 1 | 95 | 60EB05 | EB-13 |
| 65 | .050 | .02 | .02 | 1 | 95 | 65EB05 | EB-13 |
| 70 | .040 | .02 | .02 | 1 | 95 | 70EB04 | EB-13 |
| 75 | .030 | .02 | .02 | 1 | 95 | 75EB03 | EB-13 |
| 185 | .025 | Unregulated | | 2V | 40 | NX-25B | EB-10 |
| 185 | .050 | Unregulated | | 3.5V | 55 | NX-50B | EB-13 |

## DUAL OUTPUT MODELS

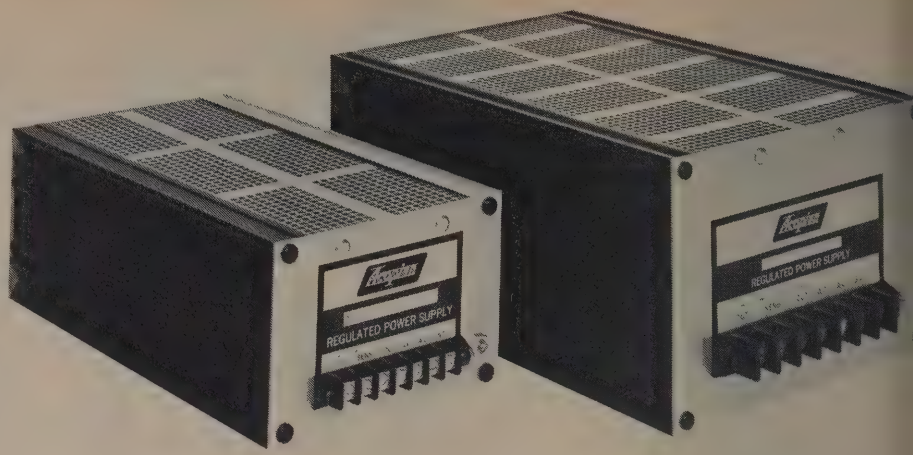
| Output Voltage Voltages | Output Current Amps. | Regulation Load ±% | Regulation Line ±% | Ripple mv RMS | Price | Model | Case Size |
|---|---|---|---|---|---|---|---|
| ±12 | .100 | .05 | .05 | 1 | $ 55 | DB12-10 | EB-10 |
| ±12 | .150 | .05 | .05 | 1 | 65 | DB12-15 | EB-10 |
| ±12 | .200 | .05 | .05 | 1 | 75 | DB12-20 | EB-10 |
| ±12 | .300 | .05 | .05 | 1 | 105 | DB12-30 | EB-13 |
| ±12 | .350 | .05 | .05 | 1 | 110 | DB12-35 | EB-13 |
| ±12 | .500 | .1 | .05 | 1 | 135 | DB12-50 | EB-20 |
| ±15 | .100 | .05 | .05 | 1 | $ 55 | DB15-10 | EB-10 |
| ±15 | .150 | .05 | .05 | 1 | 65 | DB15-15 | EB-10 |
| ±15 | .200 | .05 | .05 | 1 | 75 | DB15-20 | EB-10 |
| ±15 | .300 | .05 | .05 | 1 | 105 | DB15-30 | EB-13 |
| ±15 | .350 | .05 | .05 | 1 | 110 | DB15-35 | EB-13 |
| ±15 | .500 | .1 | .05 | 1 | 135 | DB15-50 | EB-20 |

Acopian

# SERIES A REGULATED PREMIUM PERFORMANCE

# SERIES B REGULATED LOWEST COST

**U.L. RECOGNIZED**




**A broad selection of power supplies** offering unusually high performance — many models have regulation of ±0.005%. Electronic current limiting and provision for remote voltage sensing are standard features; overvoltage protection is available as a built-in option. Rugged extruded aluminum cases include threaded mounting holes on bottom, back, and side, permitting mounting in any position.

## SERIES A PREMIUM PERFORMANCE POWER SUPPLIES

### STANDARD FEATURES

- Provision for remote sensing and/or external output adjustment
- Short circuit proof with automatic recovery (electronic current limiting)
- Can be mounted on any of three surfaces (case sizes H8, H11 and H16, two surfaces)
- Convection cooled — no heat sinking or forced-air ventilation is necessary
- Silicon semiconductors
- Completely serviceable

### SPECIFICATIONS

**Input Voltage:** 105–125 VAC, 50–400 Hz, single phase.

**Output Specifications:** See pages 10 and 11. Series A supplies have model numbers beginning with the letter A.

**Remote Voltage Sensing:** Provision for sensing the output voltage across the load, so that drops in the load line are compensated, is a standard feature.

**Polarity:** Output is floating; either positive or negative terminal may be grounded or floated up to 300 V above ground.

**Ambient Operating Temperature:** −20 to +71°C.

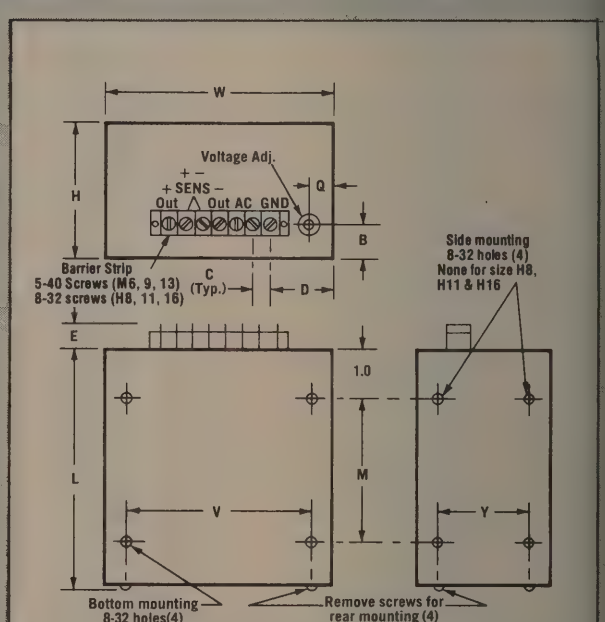
**Storage Temperature:** −55 to +85°C.

**Response Time:** Less than 20 microseconds.

### OPTIONS

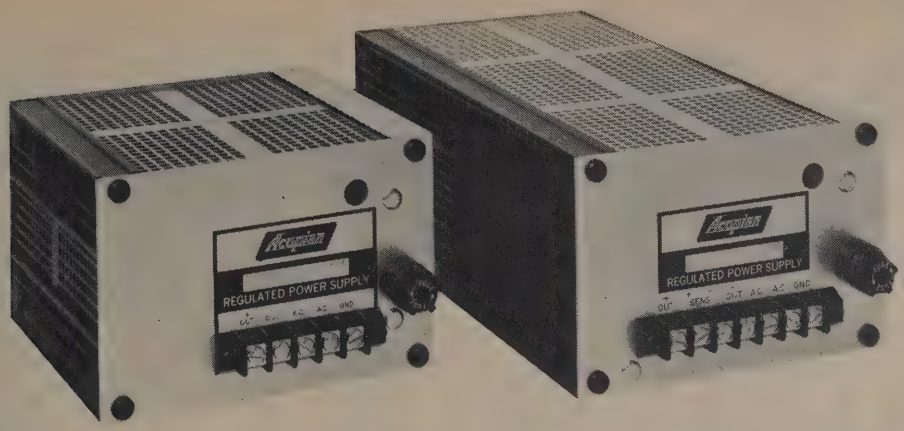
**Overvoltage Protection:** An internal preset overvoltage protector is available on all models with outputs of 3 to 70 volts. To order, add prefix "V" to the model number, and increase standard price as follows:

For all case sizes except H16:
Nominal output voltages from 3 to 28 V. $25.00
30 to 70 V. 35.00
Case size H16 (all voltages) . . . . . 75.00




| Size | L | W | H | M | V | Y | E | Q | B | C | D | Approx. Weight |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M6 | 6.59 | 5.12 | 3.44 | 4.0 | 4.5 | 3.0 | .38 | .5 | .75 | .375 | 1.44 | 4lb 4oz |
| M9 | 9.25 | 5.12 | 3.44 | 6.0 | 4.5 | 3.0 | .38 | .5 | .75 | .375 | 1.44 | 7lb 4oz |
| M13 | 13.25 | 5.12 | 3.44 | 10.0 | 4.5 | 3.0 | .38 | .5 | .75 | .375 | 1.44 | 11lb |
| H8 | 8.75 | 7.37 | 5.12 | 6.0 | 6.75 | 4.56 | .75 | 1.12 | 1.25 | .562 | 2.25 | 15lb 8oz |
| H11 | 11.25 | 7.37 | 5.12 | 8.0 | 6.75 | 4.56 | .75 | 1.12 | 1.25 | .562 | 2.25 | 18lb 4oz |
| H16 | 16.00 | 7.37 | 5.12 | 11.0 | 6.75 | 4.56 | .75 | 1.12 | 1.25 | .562 | 2.25 | 23lb |

**230 Volt Input:** All models can be alternately furnished for operation on inputs of 210–250 VAC, 50–400 Hz. To order, add suffix "-230" to model number and $10.00 to price.




**These low-cost supplies** provide the same high reliability as the Series A, and without sacrificing the basic features necessary for most applications. Many models have regulation of ±0.1% or better. All components are generously derated to insure a long and trouble-free life. And they use the same rugged construction as the Series A line. Overvoltage protection and other options are available.

## SERIES B LOW-COST POWER SUPPLIES

### STANDARD FEATURES

- Delivers current surges without damage—built-in fuse protects supply against prolonged overloads and shorts
- May be mounted on any of three surfaces
- Convection cooled—no heat sinking or forced-air ventilation is necessary
- Silicon semiconductors
- Completely serviceable

### SPECIFICATIONS

**Input Voltage:** 105–125 VAC, 50–400 Hz, single phase.

**Output Specifications:** See pages 10 and 11. Series B supplies have model numbers beginning with the letter B.

**Remote Voltage Adjustment/Sensing:** Available as an option. See below.

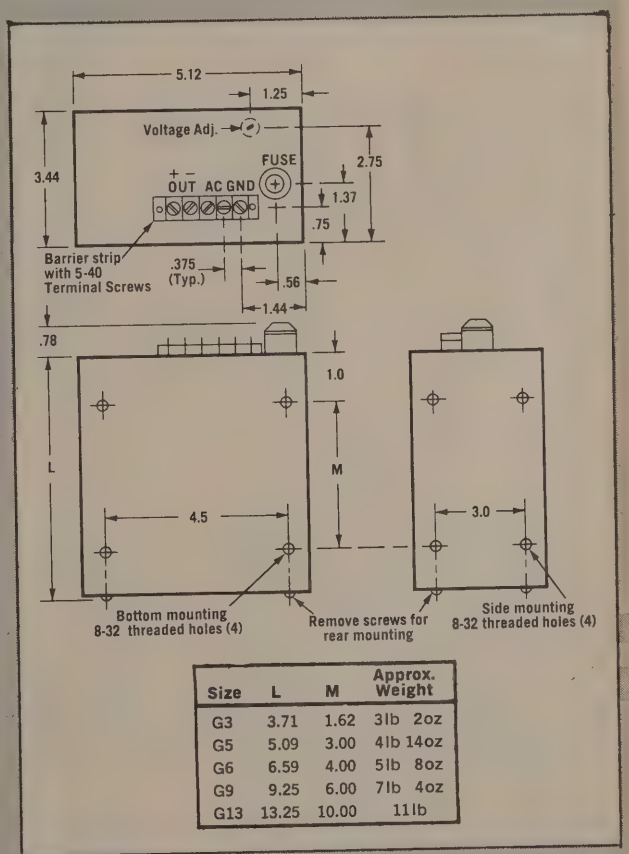
**Polarity:** Output is floating; either positive or negative terminal may be grounded or floated up to 300 V above ground.

**Ambient Operating Temperature:** 0 to +71°C.
**Storage Temperature:** −55 to +85°C.

### OPTIONS

**Overvoltage Protection:** An internal preset overvoltage protector is available on all models with outputs of 3 to 70 volts. To order, add prefix "V" to the model number and add $25.00 to the standard price of models with output voltages of 3 to 28 V, $35.00 to the price of models with output voltages from 30 to 70 V.

**Remote Voltage Sensing:** Provision for sensing the output voltage across the load, so that drops in the load lines are compensated, is available on all models. (This option also permits the use of an externally located potentiometer to adjust output voltage.) To order, add prefix "R" to the model number. No increase in price.




| Size | L | M | Approx. Weight |
|---|---|---|---|
| G3 | 3.71 | 1.62 | 3lb 2oz |
| G5 | 5.09 | 3.00 | 4lb 14oz |
| G6 | 6.59 | 4.00 | 5lb 8oz |
| G9 | 9.25 | 6.00 | 7lb 4oz |
| G13 | 13.25 | 10.00 | 11lb |

**230 Volt Input:** All models can be alternately furnished for operation on inputs of 210–250 VAC, 50–400 Hz. To order, add suffix "-230" to model number and $10.00 to price.

# Acopian SERIES A SERIES B

| Nominal Output Voltage | Adjust ±V. | Output Current Amps. at 40°C | 55°C | 71°C | Regulation Load ±%* | Line ±%* | Ripple mv RMS | Price | Model | Size |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.5 | .5 | 6.0 | 4.3 | 3.5 | .005 | .005 | .250 | $155 | A1.5MT600 | M6 |
| 1.5 | .5 | 9.0 | 7.2 | 5.5 | .005 | .005 | .250 | 180 | A1.5MT900 | M9 |
| 1.5 | .5 | 12.0 | 10.0 | 8.0 | .005 | .005 | .250 | 200 | A1.5MT1200 | M13 |
| 1.5 | .5 | 22.0 | 18.5 | 15.5 | .005 | .005 | .250 | 270 | A1.5HT2200 | H11 |
| 1.5 | .5 | 32.0 | 27.0 | 22.5 | .005 | .005 | .250 | 320 | A1.5HT3200 | H16 |
| 3 | .5 | .250 | .250 | .250 | .2 | .1 | 1 | 60 | B3GT25 | G3 |
| 3 | .5 | .500 | .500 | .500 | .2 | .1 | 1 | 75 | B3GT50 | G3 |
| 3 | .5 | .750 | .750 | .750 | .2 | .1 | 1 | 80 | B3GT75 | G3 |
| 3 | .5 | 1.2 | 1.1 | 1.0 | .2 | .1 | 1 | 90 | B3GT120 | G3 |
| 3 | .5 | 2.1 | 2.1 | 2.0 | .5 | .1 | 1 | 110 | B3GT210 | G5 |
| 3 | .5 | 4.0 | 3.5 | 3.0 | .5 | .1 | 1.5 | 135 | B3GT400 | G6 |
| 3 | .5 | 6.0 | 4.3 | 3.5 | .005 | .005 | .250 | 160 | A3MT600 | M6 |
| 3 | .5 | 7.0 | 5.9 | 4.9 | .5 | .1 | 1.5 | 170 | B3GT700 | G9 |
| 3 | .5 | 9.0 | 7.2 | 5.5 | .005 | .005 | .250 | 180 | A3MT900 | M9 |
| 3 | .5 | 10.0 | 9.0 | 7.0 | .5 | .1 | 1.5 | 190 | B3GT1000 | G13 |
| 3 | .5 | 12.0 | 10.0 | 8.0 | .005 | .005 | .250 | 200 | A3MT1200 | M13 |
| 3 † | .5 | 17.0 | 14.5 | 12.0 | .005 | .005 | .250 | 240 | A3H1700 | H8 |
| 3 | .5 | 20.0 | 16.5 | 13.5 | .005 | .005 | .250 | 270 | A3HT2000 | H11 |
| 3 | .5 | 30.0 | 25.0 | 20.0 | .005 | .005 | .250 | 320 | A3HT3000 | H16 |
| 3.6 | .5 | .250 | .250 | .250 | .2 | .1 | 1 | 60 | B3.6GT25 | G3 |
| 3.6 | .5 | .500 | .500 | .500 | .2 | .1 | 1 | 75 | B3.6GT50 | G3 |
| 3.6 | .5 | .750 | .750 | .750 | .2 | .1 | 1 | 80 | B3.6GT75 | G3 |
| 3.6 | .5 | 1.2 | 1.1 | 1.0 | .2 | .1 | 1 | 90 | B3.6GT120 | G3 |
| 3.6 | .5 | 2.1 | 2.1 | 2.0 | .5 | .1 | 1 | 110 | B3.6GT210 | G5 |
| 3.6 | .5 | 4.0 | 3.5 | 3.0 | .5 | .1 | 1.5 | 135 | B3.6GT400 | G6 |
| 3.6 | .5 | 6.0 | 4.3 | 3.5 | .005 | .005 | .250 | 160 | A3.6MT600 | M6 |
| 3.6 | .5 | 7.0 | 5.9 | 4.9 | .5 | .1 | 1.5 | 170 | B3.6GT700 | G9 |
| 3.6 | .5 | 9.0 | 7.2 | 5.5 | .005 | .005 | .250 | 180 | A3.6MT900 | M9 |
| 3.6 | .5 | 12.0 | 10.0 | 8.0 | .005 | .005 | .250 | 200 | A3.6MT1200 | M13 |
| 3.6† | .5 | 17.0 | 14.5 | 12.0 | .005 | .005 | .250 | 240 | A3.6H1700 | H8 |
| 3.6 | .5 | 22.0 | 18.5 | 15.5 | .005 | .005 | .250 | 270 | A3.6HT2200 | H11 |
| 3.6 | .5 | 32.0 | 27.0 | 22.5 | .005 | .005 | .250 | 320 | A3.6HT3200 | H16 |
| 5 | .5 | .250 | .250 | .250 | .1 | .1 | 1 | 60 | B5GT25 | G3 |
| 5 | .5 | .500 | .500 | .500 | .1 | .1 | 1 | 75 | B5GT50 | G3 |
| 5 | .5 | .750 | .750 | .750 | .1 | .1 | 1 | 80 | B5GT75 | G3 |
| 5 | .5 | 1.2 | 1.1 | 1.0 | .1 | .1 | 1 | 90 | B5GT120 | G3 |
| 5 | .5 | 1.7 | 1.5 | 1.3 | .2 | .1 | 1.5 | 95 | B5GT170 | G3 |
| 5 | .5 | 2.1 | 2.1 | 2.0 | .2 | .1 | 1.5 | 110 | B5GT210 | G5 |
| 5 | .5 | 4.0 | 3.5 | 3.0 | .3 | .1 | 1.5 | 130 | B5GT400 | G6 |
| 5 | .5 | 5.0 | 4.4 | 3.0 | .4 | .1 | 1.5 | 140 | B5GT500 | G6 |
| 5 | .5 | 5.1 | 3.6 | 2.6 | .005 | .005 | .250 | 150 | A5MT510 | M6 |
| 5 | .5 | 6.0 | 4.3 | 3.5 | .005 | .005 | .250 | 160 | A5MT600 | M6 |
| 5 | .5 | 8.0 | 7.0 | 5.0 | .4 | .1 | 1.5 | 165 | B5GT800 | G9 |
| 5 | .5 | 9.0 | 7.2 | 5.5 | .005 | .005 | .250 | 180 | A5MT900 | M9 |
| 5 | .5 | 10.0 | 9.0 | 7.0 | .4 | .1 | 1.5 | 185 | B5GT1000 | G13 |
| 5 | .5 | 12.0 | 10.0 | 8.0 | .005 | .005 | .250 | 200 | A5MT1200 | M13 |
| 5 † | .5 | 17.0 | 14.5 | 12.0 | .005 | .005 | .250 | 240 | A5H1700 | H8 |
| 5 | .5 | 22.0 | 18.5 | 15.0 | .005 | .005 | .250 | 270 | A5HT2200 | H11 |
| 5 | .5 | 32.0 | 27.0 | 22.0 | .005 | .005 | .250 | 320 | A5HT3200 | H16 |
| 6 | 1 | .250 | .250 | .250 | .1 | .1 | 1 | 60 | B6GT25 | G3 |
| 6 | 1 | .500 | .500 | .500 | .1 | .1 | 1 | 75 | B6GT50 | G3 |
| 6 | 1 | .750 | .750 | .750 | .1 | .1 | 1 | 80 | B6GT75 | G3 |
| 6 | .5 | 1.2 | 1.1 | 1.0 | .1 | .1 | 1 | 90 | B6GT120 | G3 |
| 6 | .5 | 1.7 | 1.5 | 1.3 | .2 | .1 | 1.5 | 95 | B6GT170 | G3 |
| 6 | .5 | 3.2 | 3.1 | 3.0 | .3 | .1 | 1.5 | 125 | B6GT320 | G6 |
| 6 | .5 | 4.9 | 3.5 | 2.5 | .005 | .005 | .250 | 140 | A6MT490 | M6 |
| 6 | .5 | 5.5 | 4.5 | 3.5 | .4 | .1 | 1.5 | 145 | B6GT550 | G6 |
| 6 | .5 | 6.0 | 4.5 | 3.5 | .005 | .005 | .250 | 160 | A6MT600 | M6 |
| 6 | .5 | 8.5 | 7.5 | 5.2 | .005 | .005 | .250 | 180 | A6MT850 | M9 |
| 6 | .5 | 8.8 | 6.9 | 5.0 | .4 | .1 | 1.5 | 180 | B6GT880 | G9 |
| 6 | .5 | 10.0 | 8.0 | 7.0 | .4 | .1 | 1.5 | 185 | B6GT1000 | G13 |
| 6 | .5 | 11.0 | 9.3 | 7.5 | .005 | .005 | .250 | 200 | A6MT1100 | M13 |
| 6 † | .5 | 16.0 | 13.6 | 11.2 | .005 | .005 | .250 | 240 | A6H1600 | H8 |
| 6 | .5 | 21.0 | 17.0 | 14.0 | .005 | .005 | .250 | 270 | A6HT2100 | H11 |
| 6 | .5 | 28.0 | 23.0 | 19.0 | .005 | .005 | .250 | 320 | A6HT2800 | H16 |
| 7 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 60 | B7GT20 | G3 |
| 7 | 1 | .500 | .500 | .500 | .1 | .05 | 1 | 75 | B7GT50 | G3 |
| 7 | 1 | .750 | .750 | .750 | .1 | .1 | 1 | 85 | B7GT75 | G3 |
| 7 | 1 | 1.0 | 1.0 | 1.0 | .1 | .1 | 1 | 90 | B7GT100 | G3 |
| 7 | .5 | 2.0 | 2.0 | 2.0 | .2 | .1 | 1.5 | 115 | B7GT200 | G5 |
| 7 | .5 | 3.0 | 2.7 | 2.5 | .3 | .1 | 1.5 | 125 | B7GT300 | G6 |
| 7 | .5 | 5.0 | 4.0 | 3.0 | .005 | .005 | .250 | 140 | A7MT500 | M6 |
| 7 | .5 | 6.5 | 5.2 | 4.0 | .4 | .1 | 1.0 | 160 | B7GT650 | G9 |
| 7 | .5 | 8.0 | 6.5 | 5.0 | .005 | .005 | .250 | 180 | A7MT800 | M9 |
| 7 | .5 | 10.0 | 8.0 | 7.0 | .4 | .1 | 1.5 | 190 | B7GT1000 | G13 |
| 7 | .5 | 10.0 | 8.8 | 7.0 | .005 | .005 | .250 | 200 | A7MT1000 | M13 |
| 8 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 60 | B8GT20 | G3 |
| 8 | 1 | .500 | .500 | .500 | .1 | .05 | 1 | 75 | B8GT50 | G3 |
| 8 | 1 | .750 | .750 | .750 | .1 | .1 | 1 | 80 | B8GT75 | G3 |
| 8 | 1 | 1.0 | 1.0 | 1.0 | .1 | .1 | 1 | 90 | B8GT100 | G3 |
| 8 | .5 | 2.0 | 2.0 | 2.0 | .2 | .1 | 1.5 | 115 | B8GT200 | G5 |
| 8 | .5 | 3.0 | 2.7 | 2.5 | .2 | .1 | 1.5 | 125 | B8GT300 | G6 |
| 8 | .5 | 5.0 | 4.0 | 3.5 | .005 | .005 | .250 | 140 | A8MT500 | M6 |
| 8 | .5 | 6.5 | 5.2 | 4.0 | .3 | .1 | 1.5 | 160 | B8GT650 | G9 |
| 8 | .5 | 8.0 | 6.5 | 5.0 | .005 | .005 | .250 | 180 | A8MT800 | M9 |
| 8 | .5 | 10.0 | 8.0 | 7.0 | .4 | .1 | 1.5 | 180 | B8GT1000 | G13 |
| 8 | .5 | 10.5 | 8.8 | 7.0 | .005 | .005 | .250 | 200 | A8MT1050 | M13 |
| 8 | .5 | 20.0 | 16.8 | 13.5 | .005 | .005 | .250 | 270 | A8HT2000 | H11 |
| 8 | .5 | 28.0 | 23.0 | 19.0 | .005 | .005 | .250 | 320 | A8HT2800 | H16 |
| 9 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 60 | B9GT20 | G3 |
| 9 | 1 | .500 | .500 | .500 | .1 | .05 | 1 | 75 | B9GT50 | G3 |
| 9 | 1 | .750 | .750 | .750 | .1 | .1 | 1 | 85 | B9GT75 | G3 |
| 9 | 1 | 1.0 | 1.0 | 1.0 | .1 | .1 | 1 | 90 | B9GT100 | G3 |
| 9 | .5 | 2.0 | 2.0 | 2.0 | .2 | .1 | 1.5 | 115 | B9GT200 | G5 |
| 9 | .5 | 3.0 | 2.7 | 2.5 | .2 | .1 | 1.5 | 125 | B9GT300 | G6 |
| 9 | .5 | 6.5 | 5.2 | 4.0 | .3 | .1 | 1.5 | 155 | B9GT650 | G9 |
| 9 | .5 | 10.0 | 8.3 | 7.0 | .4 | .1 | 1.5 | 190 | B9GT1000 | G13 |
| 9 | .5 | 10.0 | 8.3 | 7.0 | .005 | .005 | .250 | 200 | A9MT1000 | M13 |
| 10 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 60 | B10GT20 | G3 |
| 10 | 1 | .500 | .500 | .500 | .1 | .05 | 1 | 75 | B10GT50 | G3 |
| 10 | 1 | .750 | .750 | .75 | .1 | .1 | 1 | 85 | B10GT75 | G3 |
| 10 | 1 | 1.0 | 1.0 | 1.0 | .1 | .1 | 1 | 90 | B10GT100 | G3 |

| Nominal Output Voltage | Adjust ±V. | Output Current Amps. at 40°C | 55°C | 71°C | Regulation Load ±%* | Line ±%* | Ripple mv RMS | Price | Model | Size |
|---|---|---|---|---|---|---|---|---|---|---|
| 10 | .5 | 2.0 | 2.0 | 2.0 | .2 | .1 | 1.5 | $115 | B10GT200 | G |
| 10 | .5 | 3.0 | 2.7 | 2.5 | .2 | .1 | 1.5 | 125 | B10GT300 | G |
| 10 | .5 | 4.5 | 3.6 | 2.7 | .005 | .005 | .250 | 140 | A10MT450 | M |
| 10 | .5 | 6.0 | 5.0 | 4.0 | .3 | .1 | 1.5 | 165 | B10GT600 | G |
| 10 | .5 | 7.5 | 6.0 | 4.5 | .005 | .005 | .250 | 180 | A10MT750 | M |
| 10 | .5 | 10.0 | 8.3 | 7.0 | .4 | .1 | 1.5 | 180 | B10GT1000 | G1 |
| 10 | .5 | 10.0 | 8.3 | 7.0 | .005 | .005 | .250 | 200 | A10MT1000 | M1 |
| 10 † | .5 | 14.0 | 11.9 | 9.8 | .005 | .005 | .250 | 240 | A10H1400 | H |
| 10 | .5 | 18.0 | 15.0 | 12.0 | .005 | .005 | .250 | 270 | A10HT1800 | H1 |
| 10 | .5 | 25.0 | 20.0 | 16.5 | .005 | .005 | .250 | 320 | A10HT2500 | H1 |
| 12 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 60 | B12GT20 | G |
| 12 | 1 | .500 | .500 | .500 | .1 | .05 | 1 | 75 | B12GT50 | G |
| 12 | 1 | .750 | .750 | .750 | .1 | .1 | 1 | 85 | B12GT75 | G |
| 12 | 1 | 1.0 | 1.0 | 1.0 | .1 | .1 | 1 | 90 | B12GT100 | G |
| 12 | 1 | 1.3 | 1.1 | 1.0 | .1 | .1 | 1 | 95 | B12GT130 | G |
| 12 | 1 | 1.5 | 1.4 | 1.3 | .1 | .1 | 1.5 | 105 | B12GT150 | G |
| 12 | .5 | 2.0 | 1.7 | 1.5 | .2 | .1 | 1.5 | 110 | B12GT200 | G |
| 12 | .5 | 3.0 | 2.7 | 2.5 | .2 | .1 | 1.5 | 125 | B12GT300 | G |
| 12 | .5 | 3.8 | 3.3 | 2.6 | .2 | .1 | 1.5 | 130 | B12GT380 | G |
| 12 | .5 | 4.0 | 3.3 | 2.6 | .005 | .005 | .250 | 140 | A12MT400 | M |
| 12 | .5 | 6.5 | 5.3 | 4.0 | .3 | .1 | 1.5 | 165 | B12GT650 | G |
| 12 | .5 | 6.5 | 5.3 | 4.0 | .005 | .005 | .250 | 180 | A12MT650 | M |
| 12 | .5 | 9.0 | 7.5 | 6.0 | .4 | .1 | 1.5 | 190 | B12GT900 | G1 |
| 12 | .5 | 9.0 | 7.5 | 6.0 | .005 | .005 | .250 | 200 | A12MT900 | M1 |
| 12 † | .5 | 13.0 | 11.0 | 9.1 | .005 | .005 | .250 | 240 | A12H1300 | H |
| 12 | .5 | 17.0 | 14.3 | 11.5 | .005 | .005 | .250 | 270 | A12HT1700 | H1 |
| 12 | .5 | 21.0 | 17.5 | 14.5 | .005 | .005 | .250 | 320 | A12HT2100 | H1 |
| 13 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 60 | B13GT20 | G |
| 13 | 1 | .500 | .500 | .500 | .1 | .05 | 1 | 75 | B13GT50 | G |
| 13 | 1 | .750 | .750 | .750 | .1 | .1 | 1 | 85 | B13GT75 | G |
| 13 | 1 | 1.0 | 1.0 | 1.0 | .1 | .1 | 1 | 90 | B13GT100 | G |
| 13 | 1 | 1.5 | 1.4 | 1.3 | .1 | .1 | 1.5 | 105 | B13GT150 | G |
| 13 | .5 | 2.0 | 2.0 | 2.0 | .2 | .1 | 1.5 | 115 | B13GT200 | G |
| 13 | .5 | 3.0 | 2.7 | 2.5 | .2 | .1 | 1.5 | 130 | B13GT300 | G |
| 13 | .5 | 3.5 | 3.0 | 2.5 | .005 | .005 | .250 | 140 | A13MT350 | M |
| 13 | .5 | 5.0 | 4.5 | 4.0 | .2 | .1 | 1.5 | 155 | B13GT500 | G |
| 13 | .5 | 8.0 | 7.5 | 7.0 | .3 | .1 | 1.5 | 185 | B13GT800 | G1 |
| 13 | .5 | 8.0 | 7.5 | 7.0 | .005 | .005 | .250 | 200 | A13MT800 | M1 |
| 14 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 60 | B14GT20 | G |
| 14 | 1 | .500 | .500 | .500 | .1 | .05 | 1 | 75 | B14GT50 | G |
| 14 | 1 | 1.0 | 1.0 | 1.0 | .1 | .1 | 1 | 90 | B14GT100 | G |
| 14 | 1 | 1.5 | 1.4 | 1.3 | .1 | .1 | 1.5 | 105 | B14GT150 | G |
| 14 | .5 | 2.0 | 2.0 | 2.0 | .2 | .1 | 1.5 | 115 | B14GT200 | G |
| 14 | .5 | 3.0 | 2.7 | 2.5 | .2 | .1 | 1.5 | 130 | B14GT300 | G |
| 14 | .5 | 3.0 | 2.7 | 2.5 | .005 | .005 | .250 | 140 | A14MT300 | M |
| 14 | .5 | 5.0 | 4.5 | 4.0 | .2 | .1 | 1.5 | 155 | B14GT500 | G |
| 14 | .5 | 7.0 | 6.5 | 6.0 | .3 | .1 | 1.5 | 185 | B14GT700 | G1 |
| 14 | .5 | 8.0 | 6.7 | 7.0 | .005 | .005 | .250 | 200 | A14MT800 | M1 |
| 15 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 60 | B15GT20 | G |
| 15 | 1 | .500 | .500 | .500 | .1 | .05 | 1 | 75 | B15GT50 | G |
| 15 | 1 | .750 | .750 | .750 | .1 | .1 | 1 | 85 | B15GT75 | G |
| 15 | 1 | 1.0 | 1.0 | 1.0 | .1 | .1 | 1 | 90 | B15GT100 | G |
| 15 | 1 | 1.3 | 1.1 | 1.0 | .1 | .1 | 1 | 95 | B15GT130 | G |
| 15 | 1 | 1.5 | 1.4 | 1.3 | .1 | .1 | 1.5 | 105 | B15GT150 | G |
| 15 | .5 | 2.0 | 1.7 | 1.5 | .1 | .1 | 1.5 | 115 | B15GT200 | G |
| 15 | .5 | 3.0 | 2.8 | 2.5 | .1 | .1 | 1.5 | 130 | B15GT300 | G |
| 15 | .5 | 3.0 | 2.8 | 2.5 | .005 | .005 | .250 | 140 | A15MT300 | M |
| 15 | .5 | 4.2 | 3.8 | 3.0 | .15 | .1 | 1.5 | 155 | B15GT420 | G |
| 15 | .5 | 5.5 | 4.7 | 4.0 | .005 | .005 | .250 | 180 | A15MT550 | M |
| 15 | .5 | 6.0 | 5.0 | 4.0 | .2 | .1 | 1.5 | 180 | B15GT600 | G |
| 15 | .5 | 7.0 | 6.0 | 5.0 | .2 | .1 | 1.5 | 185 | B15GT700 | G1 |
| 15 | .5 | 8.0 | 6.5 | 5.5 | .005 | .005 | .250 | 200 | A15MT800 | M1 |
| 15 † | .5 | 11.5 | 9.7 | 8.0 | .005 | .005 | .250 | 240 | A15H1150 | H |
| 15 | .5 | 15.0 | 12.8 | 10.5 | .005 | .005 | .250 | 270 | A15HT1500 | H1 |
| 15 | .5 | 19.0 | 16.3 | 13.5 | .005 | .005 | .250 | 320 | A15HT1900 | H1 |
| 16 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 60 | B16GT20 | G |
| 16 | 1 | .500 | .500 | .500 | .1 | .05 | 1 | 75 | B16GT50 | G |
| 16 | 1 | .750 | .750 | .750 | .1 | .1 | 1 | 85 | B16GT75 | G |
| 16 | .5 | 1.0 | 1.0 | 1.0 | .1 | .1 | 1 | 95 | B16GT100 | G |
| 16 | .5 | 3.0 | 2.5 | 2.0 | .15 | .1 | 1 | 140 | B16GT300 | G |
| 16 | .5 | 5.0 | 5.0 | 5.0 | .2 | .1 | 1.5 | 180 | B16GT500 | G |
| 16 | .5 | 6.5 | 5.0 | 5.5 | .005 | .005 | .250 | 200 | A16MT650 | M1 |
| 18 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 60 | B18GT20 | G |
| 18 | 1 | .500 | .500 | .500 | .05 | .05 | 1 | 75 | B18GT50 | G |
| 18 | 1 | .750 | .750 | .750 | .1 | .1 | 1 | 80 | B18GT75 | G |
| 18 | .5 | 1.1 | 1.1 | 1.0 | .1 | .1 | 1 | 90 | B18GT110 | G |
| 18 | .5 | 2.1 | 2.0 | 1.8 | .1 | .1 | 1 | 115 | B18GT210 | G |
| 18 | .5 | 2.1 | 2.1 | 2.0 | .005 | .005 | .250 | 130 | A18MT210 | M |
| 18 | .5 | 3.0 | 2.8 | 2.5 | .15 | .1 | 1 | 150 | B18GT300 | G |
| 18 | .5 | 4.5 | 4.0 | 3.5 | .005 | .005 | .250 | 170 | A18MT450 | M |
| 18 | .5 | 5.5 | 5.0 | 5.0 | .2 | .1 | 1.5 | 180 | B18GT550 | G1 |
| 18 | .5 | 6.5 | 6.0 | 5.5 | .005 | .005 | .250 | 200 | A18MT650 | M1 |
| 18 | .5 | 14.0 | 12.0 | 10.0 | .005 | .005 | .250 | 270 | A18HT1400 | H1 |
| 18 | .5 | 18.0 | 15.5 | 13.0 | .005 | .005 | .250 | 320 | A18HT1800 | H1 |
| 20 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 60 | B20GT20 | G |
| 20 | 1 | .500 | .500 | .500 | .05 | .05 | 1 | 75 | B20GT50 | G |
| 20 | 1 | .750 | .750 | .750 | .1 | .05 | 1 | 80 | B20GT75 | G |
| 20 | 1 | 1.1 | 1.1 | 1.0 | .1 | .1 | 1 | 90 | B20GT110 | G |
| 20 | .5 | 1.7 | 1.7 | 1.5 | .1 | .1 | 1.5 | 105 | B20GT170 | G |
| 20 | .5 | 2.0 | 2.0 | 2.0 | .005 | .005 | .250 | 130 | A20MT200 | M |
| 20 | .5 | 2.7 | 2.0 | 1.2 | .15 | .1 | 1.5 | 150 | B20GT270 | G |
| 20 | .5 | 4.0 | 3.5 | 3.0 | .005 | .005 | .250 | 170 | A20MT400 | M |
| 20 | .5 | 5.0 | 5.0 | 5.0 | .15 | .1 | 1.5 | 180 | B20GT500 | G1 |
| 20 | .5 | 6.0 | 5.5 | 5.0 | .005 | .005 | .250 | 200 | A20MT600 | M1 |
| 20 † | .5 | 9.5 | 8.0 | 6.6 | .005 | .005 | .250 | 240 | A20H950 | H |
| 20 | .5 | 13.0 | 11.3 | 9.5 | .005 | .005 | .250 | 270 | A20HT1300 | H1 |
| 20 | .5 | 16.0 | 14.0 | 12.0 | .005 | .005 | .250 | 320 | A20HT1600 | H1 |
| 24 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 60 | B24GT20 | G |
| 24 | 1 | .500 | .500 | .500 | .05 | .05 | 1 | 75 | B24GT50 | G |
| 24 | 1 | .750 | .750 | .750 | .1 | .05 | 1 | 80 | B24GT75 | G |
| 24 | 1 | 1.1 | 1.1 | 1.0 | .1 | .1 | 1.5 | 95 | B24GT110 | G |
| 24 | .5 | 1.7 | 1.7 | 1.5 | .1 | .1 | 1.5 | 105 | B24GT170 | G |

*or 2 mv, whichever is greater

†Not U.L. recognized when this catalog was published.

| Nominal Output Voltage | Adjust ±V. | Output Current Amps. at 40°C | 55°C | 71°C | Regulation Load ±%* | Line ±%* | Ripple mv RMS | Price | Model | Size |
|---|---|---|---|---|---|---|---|---|---|---|
| 24 | .5 | 2.1 | 2.0 | 2.0 | .1 | .1 | 1.5 | $115 | B24GT210 | G5 |
| 24 | .5 | 2.1 | 2.0 | 2.0 | .005 | .005 | .250 | 130 | A24MT210 | M6 |
| 24 | .5 | 3.5 | 3.0 | 2.5 | .15 | .1 | 1.5 | 160 | B24GT350 | G9 |
| 24 | .5 | 3.5 | 3.0 | 2.5 | .005 | .005 | .250 | 175 | A24MT350 | M9 |
| 24 | .5 | 5.0 | 5.0 | 5.0 | .15 | .1 | 1.5 | 185 | B24GT500 | G13 |
| 24 | .5 | 5.5 | 5.0 | 4.5 | .005 | .005 | .250 | 200 | A24MT550 | M13 |
| 24 † | .5 | 8.5 | 7.2 | 5.9 | .005 | .005 | .250 | 240 | A24H850 | H8 |
| 24 | .5 | 12.0 | 10.5 | 9.0 | .005 | .005 | .250 | 270 | A24HT1200 | H11 |
| 24 | .5 | 15.0 | 13.0 | 11.0 | .005 | .005 | .250 | 320 | A24HT1500 | H16 |
| 25 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 65 | B25GT20 | G3 |
| 25 | 1 | .500 | .500 | .500 | .05 | .05 | 1 | 75 | B25GT50 | G3 |
| 25 | 1 | .750 | .750 | .750 | .1 | .05 | 1 | 80 | B25GT75 | G3 |
| 25 | 1 | 1.2 | 1.1 | 1.0 | .1 | .1 | 1.5 | 95 | B25GT120 | G5 |
| 25 | .5 | 1.7 | 1.7 | 1.5 | .1 | .1 | 1.5 | 115 | B25GT170 | G5 |
| 25 | .5 | 2.1 | 2.1 | 2.0 | .1 | .1 | 1.5 | 125 | B25GT210 | G5 |
| 25 | .5 | 3.5 | 3.0 | 2.5 | .15 | .1 | 1.5 | 160 | B25GT350 | G9 |
| 25 | .5 | 5.0 | 5.0 | 5.0 | .15 | .1 | 1.5 | 185 | B25GT500 | G13 |
| 28 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 65 | B28GT10 | G3 |
| 28 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 70 | B28GT20 | G3 |
| 28 | 1 | .500 | .500 | .500 | .05 | .05 | 1 | 75 | B28GT50 | G3 |
| 28 | 1 | .800 | .800 | .800 | .1 | .05 | 1 | 95 | B28GT80 | G5 |
| 28 | 1 | 1.1 | 1.1 | 1.0 | .1 | .05 | 1 | 110 | B28GT110 | G5 |
| 28 | .5 | 1.8 | 1.6 | 1.5 | .1 | .1 | 1.5 | 120 | B28GT180 | G5 |
| 28 | .5 | 2.1 | 2.1 | 2.0 | .1 | .1 | 1.5 | 125 | B28GT210 | G5 |
| 28 | .5 | 2.1 | 2.1 | 2.0 | .005 | .005 | .250 | 135 | A28MT210 | M6 |
| 28 | .5 | 3.0 | 2.7 | 2.5 | .15 | .1 | 1.5 | 145 | B28GT300 | G9 |
| 28 | .5 | 3.0 | 2.7 | 2.5 | .005 | .005 | .250 | 160 | A28MT300 | M9 |
| 28 | .5 | 5.0 | 5.0 | 5.0 | .15 | .1 | 1.5 | 185 | B28GT500 | G13 |
| 28 | .5 | 5.0 | 5.0 | 5.0 | .005 | .005 | .250 | 200 | A28MT500 | M13 |
| 28 † | .5 | 8.0 | 6.8 | 5.6 | .005 | .005 | .250 | 240 | A28H800 | H8 |
| 28 | .5 | 11.0 | 9.5 | 8.0 | .005 | .005 | .250 | 270 | A28HT1100 | H11 |
| 28 | .5 | 14.0 | 12.0 | 10.0 | .005 | .005 | .250 | 320 | A28HT1400 | H16 |
| 30 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 65 | B30GT10 | G3 |
| 30 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 70 | B30GT20 | G3 |
| 30 | 1 | .500 | .500 | .500 | .05 | .05 | 1 | 75 | B30GT50 | G3 |
| 30 | 1 | .750 | .750 | .700 | .1 | .05 | 1 | 95 | B30GT75 | G5 |
| 30 | 1 | 1.1 | 1.1 | 1.0 | .1 | .1 | 1 | 110 | B30GT110 | G5 |
| 30 | .5 | 1.7 | 1.6 | 1.5 | .1 | .1 | 1.5 | 120 | B30GT170 | G5 |
| 30 | .5 | 2.1 | 2.1 | 2.0 | .1 | .1 | 1.5 | 125 | B30GT210 | G5 |
| 30 | .5 | 2.1 | 2.1 | 2.0 | .005 | .005 | .250 | 140 | A30MT210 | M6 |
| 30 | .5 | 3.0 | 2.7 | 2.5 | .005 | .005 | .250 | 165 | A30MT300 | M9 |
| 30 | .5 | 5.0 | 5.0 | 5.0 | .15 | .1 | 1.5 | 185 | B30GT500 | G13 |
| 30 | .5 | 5.0 | 5.0 | 5.0 | .005 | .005 | .250 | 200 | A30MT500 | M13 |
| 30 † | .5 | 7.5 | 6.3 | 5.2 | .005 | .005 | .250 | 240 | A30H750 | H8 |
| 30 | .5 | 10.0 | 9.0 | 8.0 | .005 | .005 | .250 | 270 | A30HT1000 | H11 |
| 30 | .5 | 14.0 | 12.0 | 10.0 | .005 | .005 | .250 | 320 | A30HT1400 | H16 |
| 32 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 65 | B32GT10 | G3 |
| 32 | 1 | .300 | .300 | .300 | .05 | .05 | 1 | 75 | B32GT30 | G3 |
| 32 | 1 | .500 | .500 | .500 | .05 | .05 | 1 | 80 | B32GT50 | G3 |
| 32 | 1 | .600 | .600 | .600 | .1 | .05 | 1 | 95 | B32GT60 | G3 |
| 32 | 1 | 1.0 | 1.0 | 1.0 | .1 | .1 | 1 | 110 | B32GT100 | G5 |
| 32 | 1 | 1.5 | 1.5 | 1.5 | .1 | .1 | 1.5 | 125 | B32GT150 | G5 |
| 34 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 70 | B34GT20 | G3 |
| 34 | 1 | .800 | .800 | .800 | .1 | .1 | 1 | 105 | B34GT80 | G5 |
| 34 | 1 | 1.5 | 1.5 | 1.5 | .1 | .1 | 1.5 | 125 | B34GT150 | G5 |
| 35 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 65 | B35GT10 | G3 |
| 35 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 70 | B35GT20 | G3 |
| 35 | 1 | .500 | .500 | .500 | .05 | .05 | 1 | 80 | B35GT50 | G3 |
| 35 | 1 | .600 | .600 | .600 | .1 | .05 | 1 | 95 | B35GT60 | G3 |
| 35 | 1 | .800 | .800 | .800 | .1 | .1 | 1.5 | 105 | B35GT80 | G5 |
| 36 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 65 | B36GT10 | G3 |
| 36 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 75 | B36GT20 | G3 |
| 36 | 1 | .500 | .500 | .500 | .05 | .05 | 1 | 85 | B36GT50 | G3 |
| 36 | 1 | .600 | .600 | .500 | .1 | .05 | 1 | 95 | B36GT60 | G5 |
| 36 | 1 | .800 | .750 | .700 | .1 | .05 | 1 | 105 | B36GT80 | G5 |
| 36 | .5 | 1.3 | 1.3 | 1.3 | .1 | .1 | 1.5 | 115 | B36GT130 | G6 |
| 36 | .5 | 1.3 | 1.3 | 1.3 | .005 | .005 | .250 | 130 | A36MT130 | M6 |
| 36 | .5 | 2.3 | 2.0 | 1.8 | .1 | .1 | 1.5 | 160 | B36GT230 | G9 |
| 36 | .5 | 2.3 | 2.0 | 1.8 | .005 | .005 | .250 | 175 | A36MT230 | M9 |
| 36 | .5 | 4.0 | 3.2 | 2.5 | .005 | .005 | .250 | 210 | A36MT400 | M13 |
| 40 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 65 | B40GT10 | G3 |
| 40 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 75 | B40GT20 | G3 |
| 40 | 1 | .300 | .300 | .300 | .05 | .05 | 1 | 85 | B40GT30 | G3 |
| 40 | 1 | .400 | .400 | .400 | .05 | .05 | 1 | 90 | B40GT40 | G3 |
| 40 | 1 | .500 | .500 | .500 | .1 | .05 | 1 | 100 | B40GT50 | G5 |
| 45 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 65 | B45GT10 | G3 |
| 45 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 75 | B45GT20 | G3 |
| 45 | 1 | .300 | .300 | .300 | .05 | .05 | 1 | 85 | B45GT30 | G3 |
| 45 | 1 | .400 | .400 | .400 | .05 | .05 | 1 | 100 | B45GT40 | G3 |
| 48 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 70 | B48GT10 | G3 |
| 48 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 80 | B48GT20 | G3 |
| 48 | 1 | .300 | .300 | .300 | .05 | .05 | 1 | 95 | B48GT30 | G3 |
| 48 | 1 | .400 | .400 | .400 | .05 | .05 | 1 | 105 | B48GT40 | G3 |
| 48 | 1 | .600 | .600 | .600 | .1 | .1 | 1 | 120 | B48GT60 | G5 |
| 48 | 1 | 1.1 | 1.0 | .600 | .1 | .1 | 1.5 | 135 | B48GT110 | G6 |
| 48 | 1 | 1.8 | 1.6 | 1.2 | .1 | .1 | 1.5 | 165 | B48GT180 | G9 |
| 48 | 1 | 1.8 | 1.6 | 1.2 | .005 | .005 | .250 | 180 | A48MT180 | M9 |
| 48 | .5 | 3.0 | 2.6 | 2.1 | .005 | .005 | .250 | 210 | A48MT300 | M13 |
| 50 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 65 | B50GT10 | G3 |
| 50 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 75 | B50GT20 | G3 |
| 50 | 1 | .300 | .300 | .300 | .05 | .05 | 1 | 95 | B50GT30 | G3 |
| 50 | 1 | .400 | .400 | .400 | .05 | .05 | 1 | 105 | B50GT40 | G3 |
| 50 | 1 | .500 | .500 | .500 | .05 | .05 | 1 | 130 | B50GT50 | G5 |
| 50 | .5 | 2.7 | 2.3 | 1.8 | .005 | .005 | .250 | 220 | A50MT270 | M13 |
| 55 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 75 | B55GT10 | G3 |
| 55 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 95 | B55GT20 | G3 |
| 55 | 1 | .300 | .300 | .300 | .05 | .05 | 1 | 105 | B55GT30 | G3 |
| 55 | 1 | .400 | .400 | .400 | .05 | .05 | 1 | 125 | B55GT40 | G5 |
| 55 | 1 | .500 | .500 | .500 | .05 | .05 | 1 | 130 | B55GT50 | G5 |
| 60 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | $75 | B60GT05 | G3 |
| 60 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 85 | B60GT10 | G3 |
| 60 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 95 | B60GT20 | G3 |
| 60 | 1 | .300 | .300 | .300 | .05 | .05 | 1 | 125 | B60GT30 | G3 |
| 60 | 1 | .400 | .400 | .400 | .05 | .05 | 1 | 130 | B60GT40 | G5 |
| 65 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 75 | B65GT05 | G3 |
| 65 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 85 | B65GT10 | G3 |
| 65 | 1 | .300 | .300 | .300 | .05 | .05 | 1 | 125 | B65GT30 | G3 |
| 70 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 75 | B70GT05 | G3 |
| 70 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 85 | B70GT10 | G3 |
| 70 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 95 | B70GT20 | G3 |
| 70 | 1 | .300 | .300 | .300 | .05 | .05 | 1 | 125 | B70GT30 | G3 |
| 75 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 85 | B75GT05 | G3 |
| 75 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 95 | B75GT10 | G3 |
| 75 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 125 | B75GT20 | G3 |
| 75 | .5 | 2.0 | 1.8 | 1.5 | .005 | .005 | .250 | 220 | A75MT200 | M13 |
| 80 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 85 | B80GT05 | G3 |
| 80 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 95 | B80GT10 | G3 |
| 80 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 125 | B80GT20 | G3 |
| 85 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 90 | B85GT05 | G3 |
| 85 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 115 | B85GT10 | G3 |
| 85 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 125 | B85GT20 | G3 |
| 90 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 95 | B90GT05 | G3 |
| 90 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 120 | B90GT10 | G3 |
| 90 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 130 | B90GT20 | G3 |
| 90 | 1 | 1.5 | 1.3 | 1.0 | .005 | .005 | .250 | 220 | A90MT150 | M13 |
| 95 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 110 | B95GT05 | G3 |
| 95 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 120 | B95GT10 | G3 |
| 95 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 130 | B95GT20 | G3 |
| 100 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 110 | B100GT05 | G3 |
| 100 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 120 | B100GT10 | G3 |
| 100 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 130 | B100GT20 | G3 |
| 100 | 1 | .460 | .460 | .340 | .1 | .1 | 1.5 | 130 | B100GT46 | G6 |
| 100 | 1 | .650 | .650 | .650 | .1 | .1 | 1.5 | 160 | B100GT65 | G9 |
| 100 | 1 | 1.3 | 1.2 | 1.0 | .005 | .005 | .250 | 220 | A100MT130 | M13 |
| 110 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 115 | B110GT05 | G3 |
| 110 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 125 | B110GT10 | G3 |
| 110 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 135 | B110GT20 | G3 |
| 120 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 115 | B120GT05 | G3 |
| 120 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 125 | B120GT10 | G3 |
| 120 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 135 | B120GT20 | G3 |
| 120 | 1 | .400 | .400 | .300 | .1 | .1 | 1.5 | 150 | B120GT40 | G6 |
| 120 | 1 | .550 | .550 | .550 | .1 | .1 | 1.5 | 160 | B120GT55 | G9 |
| 120 | 1 | 1.2 | 1.1 | 1.0 | .005 | .005 | .250 | 220 | A120MT120 | M13 |
| 125 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 120 | B125GT05 | G3 |
| 125 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 130 | B125GT10 | G3 |
| 125 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 140 | B125GT20 | G3 |
| 130 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 140 | B130GT20 | G3 |
| 135 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 140 | B135GT20 | G3 |
| 140 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 140 | B140GT20 | G3 |
| 150 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 120 | B150GT05 | G3 |
| 150 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 130 | B150GT10 | G3 |
| 150 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 140 | B150GT20 | G3 |
| 150 | 1 | .320 | .320 | .250 | .1 | .1 | 1.5 | 140 | B150GT32 | G6 |
| 150 | 1 | .420 | .420 | .420 | .1 | .1 | 1.5 | 160 | B150GT42 | G9 |
| 150 | 1 | 1.0 | .900 | .800 | .005 | .005 | .250 | 240 | A150MT100 | M13 |
| 200 | 1 | .050 | .050 | .050 | .5 | .5 | 5 | 125 | B200GT05 | G3 |
| 200 | 1 | .100 | .100 | .100 | .5 | .5 | 5 | 135 | B200GT10 | G3 |

## MODELS WITH WIDE ADJUSTMENT RANGES

**Load Regulation:** ±0.005%*

**Line Regulation:** ±0.005%*

**Ripple:** 0.250 mv RMS

**Other Specifications:** Same as Series A

Contact factory for information on other models with wide adjustment ranges.

| Output Voltage Range | Output Current Amps. at 40°C | 55°C | 71°C | Price | Model | Size |
|---|---|---|---|---|---|---|
| 0-6 | 1.2 | 1.2 | 1.2 | $110 | A06MT120 | M6 |
| 0-6 | 2.0 | 2.0 | 2.0 | 125 | A06MT200 | M6 |
| 0-6 | 3.0 | 2.5 | 2.0 | 150 | A06MT300 | M6 |
| 0-6 | 5.0 | 4.0 | 3.0 | 170 | A06MT500 | M9 |
| 0-6 | 8.0 | 7.0 | 6.0 | 205 | A06MT800 | M13 |
| 0-6 | 12.0 | 10.0 | 7.0 | 275 | A06HT1200 | H11 |
| 0-6 | 16.0 | 13.0 | 10.0 | 325 | A06HT1600 | H16 |
| 0-15 | 1.0 | 1.0 | 1.0 | 110 | A015MT100 | M6 |
| 0-15 | 2.0 | 2.0 | 2.0 | 150 | A015MT200 | M6 |
| 0-15 | 2.5 | 2.0 | 1.5 | 170 | A015MT250 | M9 |
| 0-15 | 5.0 | 4.0 | 2.5 | 205 | A015MT500 | M13 |
| 0-15 | 8.0 | 6.0 | 4.0 | 275 | A015HT800 | H11 |
| 0-15 | 10.0 | 8.0 | 6.0 | 325 | A015HT1000 | H16 |
| 0-30 | .500 | .500 | .500 | 125 | A030MT50 | M6 |
| 0-30 | 1.0 | 1.0 | 1.0 | 150 | A030MT100 | M6 |
| 0-30 | 1.6 | 1.4 | 1.2 | 170 | A030MT160 | M9 |
| 0-30 | 2.5 | 2.0 | 1.5 | 205 | A030MT250 | M13 |
| 0-30 | 4.0 | 3.0 | 2.0 | 275 | A030HT400 | H11 |
| 0-30 | 5.0 | 4.0 | 3.0 | 325 | A030HT500 | H16 |
| 0-50 | .350 | .340 | .330 | 125 | A050MT35 | M6 |
| 0-50 | .600 | .500 | .400 | 150 | A050MT60 | M6 |
| 0-50 | .850 | .750 | .650 | 170 | A050MT85 | M9 |
| 0-100 | .100 | .090 | .080 | 160 | A0100MT10 | M6 |
| 0-100 | .250 | .200 | .150 | 180 | A0100MT25 | M6 |

*or 2 mv, whichever is greater

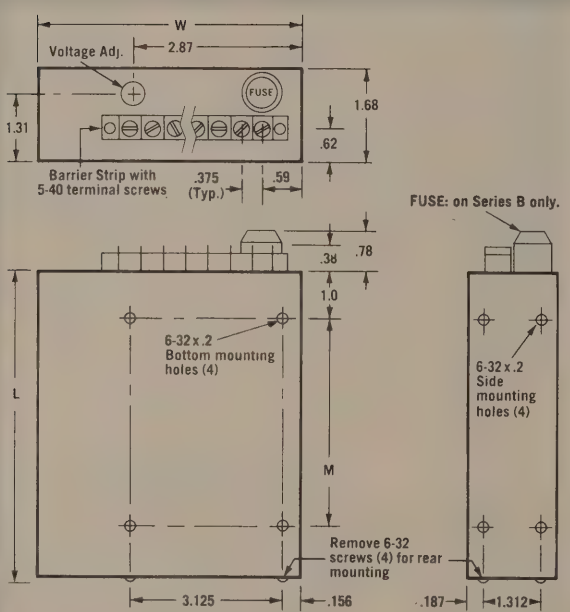
†Not U.L. recognized when this catalog was published.

Acopian

# NARROW PROFILE REGULATED

## ALL MODELS U.L. RECOGNIZED

**Where only a narrow mounting space** is available, Acopian narrow profile power supplies fit when many others cannot. Choose from Series A (high performance) and Series B (lower priced) models with output ratings up to 150 volts, up to 4 amps.




| Size | L | W | M | Approx. Weight |
|---|---|---|---|---|
| F6 | 6.59 | 3.44 | 4.0 | 2lb 4oz |
| F6T | 6.59 | 3.81 | 4.0 | 2lb 4oz |
| N8 | 8.47 | 3.44 | 5.0 | 3lb |
| F8T | 8.47 | 3.81 | 5.0 | 3lb 2oz |
| N8T | 8.47 | 3.81 | 5.0 | 3lb 2oz |
| N8H | 8.47 | 4.68 | 5.0 | 3lb 14oz |

## SPECIFICATIONS

**Input Voltage:** 105–125 VAC, 50–400 Hz, single phase.

**Output Specifications:** See table. Series A supplies have model numbers beginning with the letter A; Series B, with the letter B.

**Remote Voltage Adjustment/Sensing:** Standard in Series A, not available in Series B.

**Polarity:** Output is floating; either positive or negative terminal may be grounded or floated up to 300 V above ground.

**Ambient Operating Temperature:** Series A, −20 to +71°C; Series B, 0 to 71°C.

**Storage Temperature:** −55 to +85°C.

**Short Circuit and Overload Protection:** Series A, electronic current limiting with automatic recovery; Series B, fused – delivers current surges without damage.

## OPTIONS

**Overvoltage Protection:** An internal preset overvoltage protector is available on all models up to 70 V. To order, add prefix "V" to the model number and add $25.00 to the standard price of models with output voltages of 3 to 28 V, $35.00 to the price of models with output voltages from 30 to 70 V.

**230 Volt Input:** Available on some models. Contact factory for information.

### MODELS WITH WIDE ADJUSTMENT RANGES

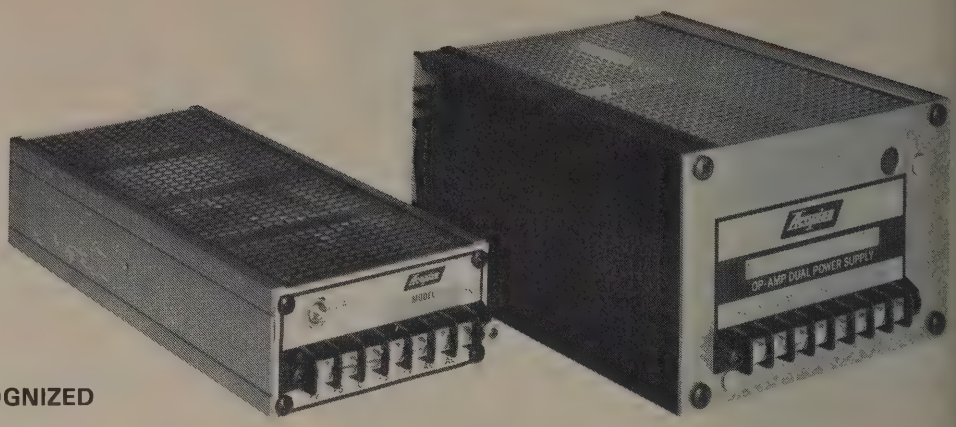
| Output Voltage Range | Output Current (To +71°C) | Regulation Load ±%* | Regulation Line ±%* | Ripple mv RMS | Price | Model | Size |
|---|---|---|---|---|---|---|---|
| 0-7 | 1.0 | 0.005 | 0.005 | 0.250 | $100 | A07NT100 | N8 |
| 0-7 | 2.1 | 0.005 | 0.005 | 0.250 | 135 | A07NT210 | N8H |
| 0-18 | .400 | 0.005 | 0.005 | 0.250 | 90 | A018NT40 | N8 |
| 0-18 | 1.0 | 0.005 | 0.005 | 0.250 | 120 | A018NT100 | N8H |
| 0-32 | .250 | 0.005 | 0.005 | 0.250 | 90 | A032NT25 | N8 |
| 0-32 | .600 | 0.005 | 0.005 | 0.250 | 130 | A032NT60 | N8H |
| 0-60 | .125 | 0.005 | 0.005 | 0.250 | 130 | A060NT12 | N8T |
| 0-60 | .250 | 0.005 | 0.005 | 0.250 | 150 | A060NT25 | N8H |
| 0-150 | .050 | 0.005 | 0.005 | 0.250 | 145 | A0150NT05 | N8T |
| 0-150 | .100 | 0.005 | 0.005 | 0.250 | 165 | A0150NT10 | N8H |

| Nominal Output Voltage | Adjust ±V. | Output Current Amps. at 40°C | 55°C | 71°C | Regulation Load ±%* | Line ±%* | Ripple mv RMS | Price | Model | Size |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .5 | 1.1 | 1.0 | 1.0 | .005 | .005 | .250 | $ 95 | A1NT110 | N8 |
| 1 | .5 | 2.2 | 2.1 | 2.0 | .005 | .005 | .250 | 125 | A1NT220 | N8T |
| 1 | .5 | 4.0 | 3.5 | 3.0 | .005 | .005 | .250 | 150 | A1NT400 | N8H |
| 1.5 | .5 | 1.1 | 1.0 | 1.0 | .005 | .005 | .250 | 95 | A1.5NT110 | N8 |
| 1.5 | .5 | 2.2 | 2.1 | 2.0 | .005 | .005 | .250 | 125 | A1.5NT220 | N8T |
| 1.5 | .5 | 4.0 | 3.5 | 3.0 | .005 | .005 | .250 | 150 | A1.5NT400 | N8H |
| 2 | .5 | 1.1 | 1.0 | 1.0 | .005 | .005 | .250 | 95 | A2NT110 | N8 |
| 2 | .5 | 2.2 | 2.1 | 2.0 | .005 | .005 | .250 | 125 | A2NT220 | N8T |
| 2 | .5 | 3.5 | 3.3 | 3.0 | .005 | .005 | .250 | 150 | A2NT350 | N8H |
| 3 | .5 | .500 | .500 | .500 | .5 | .05 | 1 | 80 | B3FT50 | F6 |
| 3 | .5 | 1.0 | 1.0 | 1.0 | .5 | .1 | 1 | 85 | B3FT100 | F6 |
| 3 | .5 | 1.1 | 1.0 | 1.0 | .005 | .005 | .250 | 95 | A3NT110 | N8 |
| 3 | .5 | 2.2 | 2.1 | 2.0 | .005 | .005 | .250 | 125 | A3NT220 | N8T |
| 3 | .5 | 4.0 | 3.5 | 3.0 | .005 | .005 | .250 | 150 | A3NT400 | N8H |
| 3.6 | .5 | .500 | .500 | .500 | .5 | .05 | 1 | 80 | B3.6FT50 | F6 |
| 3.6 | .5 | 1.0 | 1.0 | 1.0 | .5 | .1 | 1 | 85 | B3.6FT100 | F6 |
| 3.6 | .5 | 1.1 | 1.0 | 1.0 | .005 | .005 | .250 | 95 | A3.6NT110 | N8 |
| 3.6 | .5 | 2.2 | 2.1 | 2.0 | .005 | .005 | .250 | 125 | A3.6NT220 | N8T |
| 3.6 | .5 | 4.0 | 3.5 | 3.0 | .005 | .005 | .250 | 150 | A3.6NT400 | N8H |
| 5 | .5 | .500 | .500 | .500 | .1 | .1 | 1 | 80 | B5FT50 | F6 |
| 5 | .5 | 1.0 | | 1.0 | .1 | .1 | 1 | 85 | B5FT100 | F6 |
| 5 | .5 | 1.1 | 1.0 | 1.0 | .005 | .005 | .250 | 95 | A5NT110 | N8 |
| 5 | .5 | 2.2 | 2.1 | 2.0 | .005 | .005 | .250 | 125 | A5NT220 | N8T |
| 5 | .5 | 4.0 | 3.5 | 3.0 | .005 | .005 | .250 | 150 | A5NT400 | N8H |
| 6 | 1 | .500 | .500 | .500 | .1 | .1 | 1 | 80 | B6FT50 | F6 |
| 6 | .5 | 1.0 | 1.0 | 1.0 | .1 | .1 | 1 | 85 | B6FT100 | F6 |
| 6 | .5 | 1.1 | 1.0 | 1.0 | .005 | .005 | .250 | 95 | A6NT110 | N8 |
| 6 | .5 | 2.2 | 2.1 | 2.0 | .005 | .005 | .250 | 125 | A6NT220 | N8T |
| 6 | .5 | 3.0 | 3.0 | 3.0 | .005 | .005 | .250 | 150 | A6NT300 | N8H |
| 7 | 1 | .500 | .500 | .500 | .1 | .1 | 1 | 80 | B7FT50 | F6 |
| 7 | 1 | 1.0 | 1.0 | 1.0 | .1 | .1 | 1 | 90 | B7FT100 | F6 |
| 7 | .5 | 1.1 | 1.0 | 1.0 | .005 | .005 | .250 | 100 | A7NT110 | N8 |
| 7 | .5 | 2.0 | 2.0 | 2.0 | .005 | .005 | .250 | 130 | A7NT200 | N8H |
| 8 | 1 | .500 | .500 | .500 | .1 | .1 | 1 | 80 | B8FT50 | F6 |
| 8 | 1 | 1.0 | 1.0 | 1.0 | .1 | .1 | 1 | 90 | B8FT100 | F6 |
| 8 | .5 | 1.1 | 1.0 | 1.0 | .005 | .005 | .250 | 100 | A8NT110 | N8 |
| 8 | .5 | 2.0 | 2.0 | 2.0 | .005 | .005 | .250 | 135 | A8NT200 | N8H |
| 9 | 1 | .500 | .500 | .500 | .1 | .1 | 1 | 85 | B9FT50 | F6 |
| 9 | 1 | 1.0 | 1.0 | 1.0 | .1 | .1 | 1 | 95 | B9FT100 | F6 |
| 9 | .5 | 1.1 | 1.0 | 1.0 | .005 | .005 | .250 | 105 | A9NT110 | N8 |
| 9 | .5 | 2.0 | 2.0 | 2.0 | .005 | .005 | .250 | 135 | A9NT200 | N8H |
| 10 | 1 | .500 | .500 | .500 | .1 | .1 | 1 | 85 | B10FT50 | F6 |
| 10 | 1 | 1.0 | 1.0 | 1.0 | .1 | .1 | 1 | 95 | B10FT100 | F6 |
| 10 | .5 | 1.1 | 1.0 | 1.0 | .005 | .005 | .250 | 105 | A10NT110 | N8 |
| 10 | .5 | 2.0 | 2.0 | 2.0 | .005 | .005 | .250 | 135 | A10NT200 | N8H |
| 11 | 1 | .500 | .500 | .500 | .1 | .1 | 1 | 85 | B11FT50 | F6 |
| 11 | 1 | 1.0 | 1.0 | .750 | .1 | .1 | 1 | 95 | B11FT100 | F6 |
| 11 | .5 | 1.1 | 1.0 | 1.0 | .005 | .005 | .250 | 105 | A11NT110 | N8 |
| 11 | .5 | 2.0 | 2.0 | 2.0 | .005 | .005 | .250 | 135 | A11NT200 | N8H |
| 12 | 1 | .500 | .500 | .500 | .1 | .1 | 1 | 85 | B12FT50 | F6 |
| 12 | 1 | 1.0 | 1.0 | .750 | .1 | .1 | 1 | 95 | B12FT100 | F6 |
| 12 | .5 | 1.1 | 1.0 | 1.0 | .005 | .005 | .250 | 105 | A12NT110 | N8 |
| 12 | .5 | 2.0 | 2.0 | 2.0 | .005 | .005 | .250 | 135 | A12NT200 | N8H |
| 13 | 1 | .500 | .500 | .500 | .1 | .1 | 1 | 85 | B13FT50 | F6 |
| 13 | 1 | 1.0 | 1.0 | .750 | .1 | .1 | 1 | 95 | B13FT100 | F6 |
| 13 | .5 | 1.1 | 1.0 | 1.0 | .005 | .005 | .250 | 105 | A13NT110 | N8 |
| 13 | .5 | 2.0 | 2.0 | 2.0 | .005 | .005 | .250 | 135 | A13NT200 | N8H |
| 14 | 1 | .500 | .500 | .500 | .1 | .1 | 1 | 85 | B14FT50 | F6 |
| 14 | 1 | 1.0 | 1.0 | .750 | .1 | .1 | 1 | 95 | B14FT100 | F6 |
| 14 | .5 | 1.1 | 1.0 | 1.0 | .005 | .005 | .250 | 105 | A14NT110 | N8 |
| 14 | .5 | 2.0 | 2.0 | 2.0 | .005 | .005 | .250 | 135 | A14NT200 | N8H |
| 15 | 1 | .500 | .500 | .500 | .1 | .1 | 1 | 85 | B15FT50 | F6 |
| 15 | 1 | 1.0 | 1.0 | .750 | .1 | .1 | 1 | 95 | B15FT100 | F6 |
| 15 | .5 | 1.1 | 1.0 | 1.0 | .005 | .005 | .250 | 105 | A15NT110 | N8 |
| 15 | .5 | 2.0 | 2.0 | 2.0 | .005 | .005 | .250 | 135 | A15NT200 | N8H |
| 16 | 1 | .500 | .500 | .500 | .1 | .1 | 1 | 85 | B16FT50 | F6 |
| 16 | 1 | 1.0 | 1.0 | .750 | .1 | .1 | 1 | 95 | B16FT100 | F6 |
| 16 | .5 | 1.0 | 1.0 | 1.0 | .005 | .005 | .250 | 110 | A16NT100 | N8 |
| 16 | .5 | 1.75 | 1.75 | 1.75 | .005 | .005 | .250 | 135 | A16NT175 | N8H |
| 18 | 1 | .500 | .500 | .500 | .1 | .1 | 1 | 85 | B18FT50 | F6 |
| 18 | 1 | .750 | .750 | .750 | .1 | .1 | 1 | 95 | B18FT75 | F6 |
| 18 | .5 | 1.0 | 1.0 | 1.0 | .005 | .005 | .250 | 115 | A18NT100 | N8 |
| 18 | .5 | 1.5 | 1.5 | 1.5 | .005 | .005 | .250 | 130 | A18NT150 | N8H |
| 20 | 1 | .400 | .400 | .400 | .05 | .05 | 1 | 85 | B20FT40 | F6 |
| 20 | 1 | .750 | .750 | .750 | .1 | .1 | 1 | 95 | B20FT75 | F6 |
| 20 | .5 | .900 | .900 | .900 | .005 | .005 | .250 | 110 | A20NT90 | N8 |
| 20 | .5 | 1.25 | 1.25 | 1.25 | .005 | .005 | .250 | 130 | A20NT125 | N8H |
| 24 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 75 | B24FT20 | F6 |
| 24 | 1 | .400 | .400 | .400 | .05 | .05 | 1 | 85 | B24FT40 | F6 |
| 24 | 1 | .750 | .750 | .750 | .1 | .1 | 1 | 95 | B24FT75 | F6 |
| 24 | .5 | .900 | .800 | .750 | .005 | .005 | .250 | 110 | A24NT90 | N8 |
| 24 | .5 | 1.0 | 1.0 | 1.0 | .005 | .005 | .250 | 120 | A24NT100 | N8 |
| 24 | .5 | 1.25 | 1.25 | 1.25 | .005 | .005 | .250 | 130 | A24NT125 | N8H |
| 25 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 75 | B25FT20 | F6 |
| 25 | 1 | .400 | .400 | .400 | .05 | .05 | 1 | 85 | B25FT40 | F6 |
| 25 | 1 | .750 | .750 | .750 | .1 | .05 | 1 | 95 | B25FT75 | F6 |
| 25 | .5 | .750 | .750 | .750 | .005 | .005 | .250 | 120 | A25NT75 | N8 |
| 25 | .5 | 1.25 | 1.25 | 1.25 | .005 | .005 | .250 | 130 | A25NT125 | N8H |
| 26 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 75 | B26FT20 | F6 |
| 26 | 1 | .400 | .400 | .400 | .05 | .05 | 1 | 85 | B26FT40 | F6 |
| 26 | 1 | .750 | .750 | .750 | .1 | .05 | 1 | 95 | B26FT75 | F6 |
| 26 | .5 | 1.25 | 1.25 | 1.25 | .005 | .005 | .250 | 130 | A26NT125 | N8H |
| 28 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 75 | B28FT20 | F6 |
| 28 | 1 | .400 | .400 | .400 | .05 | .05 | 1 | 85 | B28FT40 | F6 |
| 28 | 1 | .700 | .700 | .700 | .1 | .05 | 1 | 95 | B28FT70 | F6 |
| 28 | .5 | .800 | .800 | .800 | .005 | .005 | .250 | 120 | A28NT80 | N8T |
| 28 | .5 | 1.25 | 1.25 | 1.25 | .005 | .005 | .250 | 130 | A28NT125 | N8H |
| 30 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 75 | B30FT20 | F6 |
| 30 | 1 | .400 | .400 | .400 | .05 | .05 | 1 | 85 | B30FT40 | F6 |
| 30 | 1 | .500 | .500 | .500 | .05 | .05 | 1 | 95 | B30FT50 | F6 |
| 30 | .5 | .750 | .750 | .750 | .005 | .005 | .250 | 125 | A30NT75 | N8T |
| 30 | .5 | 1.1 | 1.1 | 1.1 | .005 | .005 | .250 | 135 | A30NT110 | N8H |
| 32 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 75 | B32FT10 | F6 |
| 32 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 85 | B32FT20 | F6 |
| 32 | 1 | .400 | .400 | .400 | .05 | .05 | 1 | 95 | B32FT40 | F6 |
| 32 | .5 | .600 | .600 | .600 | .005 | .005 | .250 | 125 | A32NT60 | N8 |
| 32 | .5 | 1.1 | 1.1 | 1.1 | .005 | .005 | .250 | $135 | A32NT110 | N8H |
| 34 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 75 | B34FT10 | F6 |
| 34 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 85 | B34FT20 | F6 |
| 34 | 1 | .400 | .400 | .400 | .05 | .05 | 1 | 95 | B34FT40 | F6 |
| 34 | .5 | .600 | .600 | .600 | .005 | .005 | .250 | 125 | A34NT60 | N8 |
| 34 | .5 | 1.1 | 1.1 | 1.1 | .005 | .005 | .250 | 135 | A34NT110 | N8H |
| 35 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 75 | B35FT10 | F6 |
| 35 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 85 | B35FT20 | F6 |
| 35 | 1 | .400 | .400 | .400 | .05 | .05 | 1 | 95 | B35FT40 | F6 |
| 35 | .5 | .600 | .600 | .600 | .005 | .005 | .250 | 125 | A35NT60 | N8 |
| 35 | .5 | 1.1 | 1.1 | 1.1 | .005 | .005 | .250 | 135 | A35NT110 | N8H |
| 36 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 75 | B36FT10 | F6 |
| 36 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 85 | B36FT20 | F6 |
| 36 | 1 | .400 | .400 | .400 | .05 | .05 | 1 | 95 | B36FT40 | F6 |
| 36 | .5 | .600 | .600 | .600 | .005 | .005 | .250 | 125 | A36NT60 | N8 |
| 36 | .5 | 1.0 | 1.0 | 1.0 | .005 | .005 | .250 | 135 | A36NT100 | N8H |
| 38 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 75 | B38FT10 | F6 |
| 38 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 85 | B38FT20 | F6 |
| 40 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 75 | B40FT10 | F6 |
| 40 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 90 | B40FT20 | F6 |
| 40 | 1 | .400 | .400 | .400 | .05 | .05 | 1 | 100 | B40FT40 | F6 |
| 40 | .5 | .600 | .600 | .600 | .005 | .005 | .250 | 125 | A40NT60 | N8 |
| 40 | .5 | .750 | .750 | .750 | .005 | .005 | .250 | 135 | A40NT75 | N8T |
| 45 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 75 | B45FT10 | F6 |
| 45 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 90 | B45FT20 | F6 |
| 45 | 1 | .400 | .400 | .400 | .05 | .05 | 1 | 100 | B45FT40 | F6 |
| 45 | .5 | .600 | .600 | .600 | .005 | .005 | .250 | 135 | A45NT60 | N8T |
| 48 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 80 | B48FT05 | F6 |
| 48 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 90 | B48FT10 | F6 |
| 48 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 100 | B48FT20 | F6 |
| 48 | 1 | .400 | .400 | .400 | .05 | .05 | 1 | 110 | B48FT40 | F6 |
| 48 | .5 | .500 | .500 | .500 | .005 | .005 | .250 | 135 | A48NT50 | N8T |
| 50 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 80 | B50FT05 | F6T |
| 50 | 1 | .100 | .050 | .100 | .05 | .05 | 1 | 90 | B50FT10 | F6T |
| 50 | 1 | .200 | .050 | .200 | .05 | .05 | 1 | 100 | B50FT20 | F6T |
| 50 | 1 | .400 | .400 | .400 | .05 | .05 | 1 | 110 | B50FT40 | F6T |
| 50 | 1 | .450 | .450 | .450 | .005 | .005 | .250 | 135 | A50NT45 | N8T |
| 55 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 80 | B55FT05 | F6T |
| 55 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 90 | B55FT10 | F6T |
| 55 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 100 | B55FT20 | F6T |
| 55 | 1 | .400 | .400 | .400 | .005 | .005 | .250 | 140 | A55NT40 | N8T |
| 60 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 80 | B60FT05 | F6T |
| 60 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 90 | B60FT10 | F6T |
| 60 | 1 | .150 | .150 | .150 | .05 | .05 | 1 | 100 | B60FT15 | F6T |
| 60 | 1 | .300 | .300 | .300 | .05 | .05 | 1 | 125 | B60FT30 | F8T |
| 60 | 1 | .350 | .350 | .350 | .005 | .005 | .250 | 145 | A60NT35 | N8T |
| 65 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 80 | B65FT05 | F6T |
| 65 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 90 | B65FT10 | F6T |
| 65 | 1 | .250 | .250 | .250 | .05 | .05 | 1 | 125 | B65FT25 | F8T |
| 65 | 1 | .270 | .270 | .270 | .005 | .005 | .250 | 145 | A65NT27 | N8T |
| 67 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 80 | B67FT05 | F6T |
| 67 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 90 | B67FT10 | F6T |
| 70 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 80 | B70FT05 | F6T |
| 70 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 95 | B70FT10 | F6T |
| 70 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 105 | B70FT20 | F8T |
| 70 | 1 | .250 | .250 | .250 | .005 | .005 | .250 | 145 | A70NT25 | N8T |
| 75 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 90 | B75FT05 | F6T |
| 75 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 100 | B75FT10 | F6T |
| 75 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 125 | B75FT20 | F8T |
| 75 | 1 | .250 | .250 | .250 | .005 | .005 | .250 | 145 | A75NT25 | N8T |
| 80 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 90 | B80FT05 | F6T |
| 80 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 100 | B80FT10 | F6T |
| 80 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 125 | B80FT20 | F8T |
| 80 | 1 | .250 | .250 | .250 | .005 | .005 | .250 | 155 | A80NT25 | N8T |
| 85 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 100 | B85FT05 | F6T |
| 85 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 125 | B85FT10 | F6T |
| 85 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 125 | B85FT20 | F8T |
| 85 | 1 | .250 | .250 | .250 | .005 | .005 | .250 | 155 | A85NT25 | N8T |
| 90 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 100 | B90FT05 | F6T |
| 90 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 125 | B90FT10 | F6T |
| 90 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 135 | B90FT20 | F8T |
| 90 | 1 | .250 | .250 | .250 | .005 | .005 | .250 | 155 | A90NT25 | N8T |
| 95 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 115 | B95FT05 | F6T |
| 95 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 125 | B95FT10 | F6T |
| 95 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 135 | B95FT20 | F8T |
| 95 | 1 | .200 | .200 | .200 | .005 | .005 | .250 | 155 | A95NT20 | N8T |
| 100 | 1 | .020 | .020 | .020 | .05 | .05 | 1 | 105 | B100FT02 | F6T |
| 100 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 115 | B100FT05 | F6T |
| 100 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 130 | B100FT10 | F6T |
| 100 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 145 | B100FT20 | F8T |
| 100 | 1 | .200 | .200 | .200 | .005 | .005 | .250 | 155 | A100NT20 | N8T |
| 105 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 115 | B105FT05 | F6T |
| 105 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 130 | B105FT10 | F6T |
| 105 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 145 | B105FT20 | F8T |
| 105 | 1 | .200 | .200 | .200 | .005 | .005 | .250 | 155 | A105NT20 | N8T |
| 110 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 120 | B110FT05 | F6T |
| 110 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 135 | B110FT10 | F6T |
| 110 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 145 | B110FT20 | F8T |
| 110 | 1 | .200 | .200 | .200 | .005 | .005 | .250 | 155 | A110NT20 | N8T |
| 115 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 125 | B115FT05 | F6T |
| 115 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 135 | B115FT10 | F6T |
| 115 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 145 | B115FT20 | F8T |
| 115 | 1 | .200 | .200 | .200 | .005 | .005 | .250 | 155 | A115NT20 | N8T |
| 120 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 130 | B120FT05 | F6T |
| 120 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 145 | B120FT20 | F8T |
| 120 | 1 | .200 | .200 | .200 | .005 | .005 | .250 | 160 | A120NT20 | N8T |
| 125 | 1 | .050 | .050 | .050 | .05 | .05 | 1 | 130 | B125FT05 | F6T |
| 125 | 1 | .200 | .200 | .200 | .05 | .05 | 1 | 150 | B125FT20 | F8T |
| 125 | 1 | .200 | .200 | .200 | .005 | .005 | .250 | 160 | A125NT20 | N8T |
| 130 | 1 | .150 | .150 | .150 | .05 | .05 | 1 | 140 | B130FT15 | F8T |
| 130 | 1 | .170 | .170 | .170 | .005 | .005 | .250 | 160 | A130NT17 | N8T |
| 135 | 1 | .150 | .150 | .150 | .005 | .005 | .250 | 160 | A135NT15 | N8T |
| 140 | 1 | .130 | .130 | .130 | .005 | .005 | .250 | 160 | A140NT13 | N8T |
| 150 | 1 | .100 | .100 | .100 | .05 | .05 | 1 | 140 | B150FT10 | F8T |
| 150 | 1 | .100 | .100 | .100 | .005 | .005 | .250 | 160 | A150NT10 | N8T |

*or 2 mv, whichever is greater

Acopian

# DUAL OUTPUT For Op Amps.




**ALL MODELS U.L. RECOGNIZED**

**Series D dual output power supplies** are a convenient source of the tracking voltages required for powering operational amplifiers and related circuits. Their positive/common/negative output terminal configuration minimizes system wiring. Provision for remote sensing permits compensation of load line effects. Although moderately priced, they are sturdily constructed and conservatively rated.

## SPECIFICATIONS

**Input Voltage:** 105–125 VAC, 50–400 Hz, single phase.
**Output Voltages:** Tracking within 1%.
**Output Currents:**
**Output Voltage Adjustment Ranges:**
(See tables. Outputs are short circuit protected.)
**Load Regulation:** ±0.1%.
**Line Regulation:** ±0.1%.
**Ripple:** 1.5 mv RMS.
**Polarity:** Positive output, common, and negative output.
**Remote Voltage Sensing:** Standard.
**Ambient Operating Temperature:** −10 to +71°C.
**Storage Temperature:** −55 to +85°C.

## OPTIONS

**Overvoltage Protection:** A built-in preset overvoltage protection circuit is available on all models. If either output fails, both outputs are "crowbarred." To order, add prefix "V" to the model number, and increase standard price by $30.00.

**230 Volt Input:** All models can be alternately furnished for operation on inputs of 210–250 VAC, 50–400 Hz. To order, add suffix "-230" to model number and $10.00 to price.

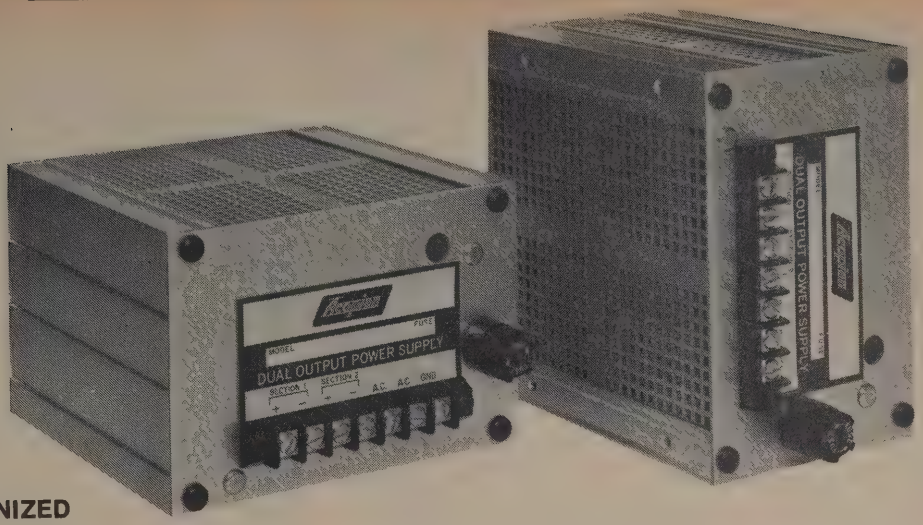
***Connections:**
(Supplies for Op Amps)

| Nominal Output Voltages | Adjust ±V. | Output Current Amps. at 40°C | 55°C | 71°C | Price | Model | Size* |
|---|---|---|---|---|---|---|---|
| ±5 | .5 | .750 | .650 | .550 | $125 | TD5-75 | TG5 |
| ±5 | .5 | 1.5 | 1.25 | 1.0 | 150 | TD5-150 | TG6 |
| ±5 | .5 | 2.5 | 2.0 | 1.5 | 160 | TD5-250 | TG9 |
| ±12 | 1 | 1.0 | .900 | .800 | 125 | TD12-100 | TG5 |
| ±12 | 1 | 1.6 | 1.4 | 1.0 | 150 | TD12-160 | TG6 |
| ±12 | 1 | 2.5 | 2.0 | 1.5 | 160 | TD12-250 | TG9 |
| ±12 | .5 | 4.5 | 3.7 | 3.0 | 215 | TD12-450 | TG13 |
| ±12 | .5 | 8.5 | 7.0 | 5.5 | 299 | TD12-850 | TH11 |
| ±15 | 1 | .400 | .400 | .400 | 85 | TD15-40 | TG5 |
| ±15 | 1 | 1.0 | .900 | .800 | 125 | TD15-100 | TG5 |
| ±15 | 1 | 1.6 | 1.4 | 1.0 | 150 | TD15-160 | TG6 |
| ±15 | 1 | 2.5 | 2.0 | 1.5 | 160 | TD15-250 | TG9 |
| ±15 | .5 | 4.5 | 3.7 | 3.0 | 225 | TD15-450 | TG13 |
| ±15 | .5 | 8.5 | 7.0 | 5.5 | 299 | TD15-850 | TH11 |

## NARROW PROFILE MODELS — for limited space applications

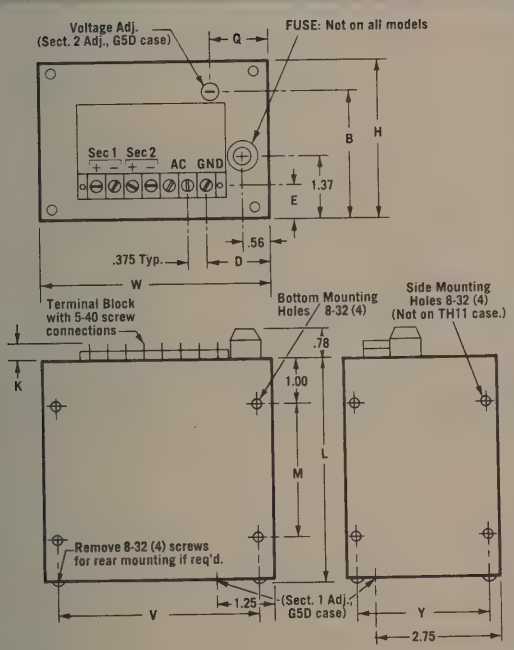
| Nominal Output Voltage | Adjust ±V. | Output Current Amps. at 40°C | 55°C | 71°C | Price | Model | Size* |
|---|---|---|---|---|---|---|---|
| ±12 | 1 | .500 | .500 | .400 | $115 | FD12-50 | TN6 |
| ±12 | .5 | 1.0 | .900 | .800 | 145 | LD12-100 | TN8H |
| ±15 | 1 | .500 | .500 | .400 | 115 | FD15-50 | TN6 |
| ±15 | .5 | 1.0 | .900 | .800 | 145 | LD15-100 | TN8H |

# DUAL OUTPUT General Purpose




**ALL MODELS U.L. RECOGNIZED**

**Acopian general purpose duals** furnish two completely independent outputs, either identical or different, in less space and at less cost than two equivalent single output supplies. Thousands of output voltage/current rating combinations are available. Mounting and system wiring are simplified. Quality components, generously derated, insure long-term reliability.




| Size | L | W | H | M | V | Y | E | Q | B | K | D | Approx. Weight |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| G5D | 5.09 | 5.12 | 3.44 | 3.00 | 4.50 | 3.00 | .75 | 1.25 | 2.73 | .38 | 1.44 | 4 lb |
| TG5 | 5.09 | 5.12 | 3.44 | 3.00 | 4.50 | 3.00 | .75 | 1.25 | 2.73 | .38 | 1.44 | 3 lb 4 oz |
| TG6 | 6.59 | 5.12 | 3.44 | 4.00 | 4.50 | 3.00 | .75 | 1.25 | 2.73 | .38 | 1.44 | 4 lb 4 oz |
| TG9 | 9.25 | 5.12 | 3.44 | 6.00 | 4.50 | 3.00 | .75 | 1.25 | 2.73 | .38 | 1.44 | 6 lb 8 oz |
| TG13 | 13.25 | 5.12 | 3.44 | 10.00 | 4.50 | 3.00 | .75 | 1.25 | 2.73 | .38 | 1.44 | 12 lb |
| TH11 | 11.25 | 7.37 | 5.12 | 8.00 | 6.75 | 4.56 | .75 | 2.73 | 4.36 | .38 | 2.38 | 18 lb 4 oz |
| TN6 | 6.59 | 3.44 | 1.68 | 4.00 | 3.12 | 1.31 | .62 | 2.87 | 1.31 | .53 | .59 | 2 lb 4 oz. |
| TN8H | 8.47 | 4.68 | 1.68 | 5.00 | 3.12 | 1.31 | .62 | 2.87 | 1.31 | .53 | .59 | 3 lb 14 oz |

## STANDARD FEATURES

- A broad selection of output combinations
- May be mounted on any of three surfaces
- Delivers current surges without damage—built-in fuse protects supply against prolonged overloads and shorts
- Silicon semiconductors
- Rugged construction

**HOW TO ORDER:** Select the two sections desired. The complete model number is the combination of the two sections selected. Example: The combination of section 5GT20D and section 8GT50D is Model 5GT20D-8GT50D. Always assign the lower voltage section first. For pricing purposes, add the cost of the individual sections selected. Example: The price of Model 5GT20D-8GT50D is $60.00 plus $65.00, or $125.00 total.

## SPECIFICATIONS

**Input Voltage:** 105–125 VAC, 50–400 Hz, single phase.

**Output Specifications:** See pages 16 and 17. No derating required through ambient temperature range of −10 to +71°C.

**Polarity:** Outputs are floating. Each output may be independently connected to provide any combination of positive and negative voltages. Outputs may be floated up to 300 V above ground.

**Ambient Operating Temperature:** −10 to +71°C.

**Storage Temperature:** −55 to +85°C.

**Dimensions and Weight:** Case size G5D.

**Optional 230 Volt Input:** All models can be alternately furnished for operation on inputs of 210–250 VAC, 50–400 Hz. To order, add suffix "-230" to the model number, and $10.00 to the standard price.

# Acopian DUAL OUTPUT

## (500 MA MAXIMUM)

| Nominal Output Voltage | Adjust ±V. | Output Current Amps. | Regulation Load ±% | Regulation Line ±% | Ripple mv RMS | Price per Section | Section (See "How to Order") |
|---|---|---|---|---|---|---|---|
| 1.5 | .5 | .200 | .4 | .05 | 1 | $60 | 1.5GT20D |
| 1.5 | .5 | .400 | .5 | .1 | 1 | 65 | 1.5GT40D |
| 2.5 | .5 | .200 | .4 | .05 | 1 | 60 | 2.5GT20D |
| 2.5 | .5 | .400 | .5 | .1 | 1 | 65 | 2.5GT40D |
| 3 | .5 | .200 | .3 | .05 | 1 | 60 | 3GT30D |
| 3 | .5 | .400 | .5 | .1 | 1 | 65 | 3GT40D |
| 3.6 | .5 | .200 | .2 | .05 | 1 | 60 | 3.6GT20D |
| 3.6 | .5 | .400 | .3 | .1 | 1 | 65 | 3.6GT40D |
| 5 | .5 | .200 | .2 | .05 | 1 | 60 | 5GT20D |
| 5 | .5 | .500 | .3 | .05 | 1 | 65 | 5GT50D |
| 6 | 1 | .200 | .05 | .05 | 1 | 60 | 6GT20D |
| 6 | 1 | .500 | .15 | .05 | 1 | 65 | 6GT50D |
| 7 | 1 | .200 | .05 | .05 | 1 | 60 | 7GT20D |
| 7 | 1 | .500 | .15 | .05 | 1 | 65 | 7GT50D |
| 8 | 1 | .200 | .05 | .05 | 1 | 60 | 8GT20D |
| 8 | 1 | .500 | .1 | .05 | 1 | 65 | 8GT50D |
| 9 | 1 | .200 | .05 | .05 | 1 | 60 | 9GT20D |
| 9 | 1 | .500 | .1 | .05 | 1 | 65 | 9GT50D |
| 10 | 1 | .250 | .05 | .05 | 1 | 60 | 10GT25D |
| 10 | 1 | .500 | .1 | .05 | 1 | 65 | 10GT50D |
| 11 | 1 | .250 | .05 | .05 | 1 | 60 | 11GT25D |
| 11 | 1 | .500 | .1 | .05 | 1 | 65 | 11GT50D |
| 12 | 1 | .250 | .05 | .05 | 1 | 60 | 12GT25D |
| 12 | 1 | .500 | .1 | .05 | 1 | 65 | 12GT50D |
| 13 | 1 | .250 | .05 | .05 | 1 | 60 | 13GT25D |
| 13 | 1 | .500 | .1 | .05 | 1 | 65 | 13GT50D |
| 15 | 1 | .150 | .05 | .05 | 1 | 55 | 15GT15D |
| 15 | 1 | .250 | .05 | .05 | 1 | 60 | 15GT25D |
| 15 | 1 | .500 | .1 | .05 | 1 | 65 | 15GT50D |
| 16 | 1 | .250 | .05 | .05 | 1 | 60 | 16GT25D |
| 16 | 1 | .500 | .1 | .05 | 1 | 65 | 16GT50D |
| 17 | 1 | .250 | .05 | .05 | 1 | 60 | 17GT25D |
| 17 | 1 | .500 | .1 | .05 | 1 | 65 | 17GT50D |
| 18 | 1 | .250 | .05 | .05 | 1 | 60 | 18GT25D |
| 18 | 1 | .500 | .1 | .05 | 1 | 65 | 18GT50D |
| 19 | 1 | .250 | .05 | .05 | 1 | 60 | 19GT25D |
| 19 | 1 | .500 | .1 | .05 | 1 | 65 | 19GT50D |
| 20 | 1 | .250 | .05 | .05 | 1 | 60 | 20GT25D |
| 20 | 1 | .500 | .1 | .05 | 1 | 65 | 20GT50D |
| 21 | 1 | .250 | .05 | .05 | 1 | 60 | 21GT25D |
| 21 | 1 | .500 | .1 | .05 | 1 | 65 | 21GT50D |
| 22 | 1 | .250 | .05 | .05 | 1 | 60 | 22GT25D |
| 22 | 1 | .500 | .1 | .05 | 1 | 65 | 22GT50D |
| 23 | 1 | .250 | .05 | .05 | 1 | 60 | 23GT25D |
| 23 | 1 | .500 | .1 | .05 | 1 | 65 | 23GT50D |
| 24 | 1 | .250 | .05 | .05 | 1 | 60 | 24GT25D |
| 24 | 1 | .500 | .05 | .05 | 1 | 65 | 24GT50D |
| 25 | 1 | .250 | .05 | .05 | 1 | 60 | 25GT25D |
| 25 | 1 | .500 | .05 | .05 | 1 | 65 | 25GT50D |
|  | 1 | .250 | .05 | .05 | 1 | 60 | 26GT25D |
| 26 | 1 | .400 | .05 | .05 | 1 | 65 | 26GT40D |
| 28 | 1 | .250 | .05 | .05 | 1 | 60 | 28GT25D |
| 28 | 1 | .400 | .05 | .05 | 1 | 65 | 28GT40D |
| 30 | 1 | .250 | .05 | .05 | 1 | 60 | 30GT25D |
| 30 | 1 | .400 | .05 | .05 | 1 | 65 | 30GT40D |
| 31 | 1 | .100 | .05 | .05 | 1 | 60 | 31GT10D |
| 31 | 1 | .300 | .05 | .05 | 1 | 65 | 31GT30D |
| 32 | 1 | .100 | .05 | .05 | 1 | 60 | 32GT10D |
| 32 | 1 | .300 | .05 | .05 | 1 | 65 | 32GT30D |
| 33 | 1 | .100 | .05 | .05 | 1 | 60 | 33GT10D |
| 33 | 1 | .300 | .05 | .05 | 1 | 65 | 33GT30D |

| Nominal Output Voltage | Adjust ±V. | Output Current Amps. | Regulation Load ±% | Regulation Line ±% | Ripple mv RMS | Price per Section | Section (See "How to Order") |
|---|---|---|---|---|---|---|---|
| 34 | 1 | .100 | .05 | .05 | 1 | $60 | 34GT10D |
| 34 | 1 | .300 | .05 | .05 | 1 | 65 | 34GT30D |
| 35 | 1 | .100 | .05 | .05 | 1 | 60 | 35GT10D |
| 35 | 1 | .200 | .05 | .05 | 1 | 65 | 35GT20D |
| 36 | 1 | .100 | .05 | .05 | 1 | 60 | 36GT10D |
| 36 | 1 | .200 | .05 | .05 | 1 | 65 | 36GT20D |
| 38 | 1 | .100 | .05 | .05 | 1 | 60 | 38GT10D |
| 38 | 1 | .200 | .05 | .05 | 1 | 65 | 38GT20D |
| 40 | 1 | .100 | .05 | .05 | 1 | 60 | 40GT10D |
| 40 | 1 | .200 | .05 | .05 | 1 | 65 | 40GT20D |
| 42 | 1 | .100 | .05 | .05 | 1 | 60 | 42GT10D |
| 42 | 1 | .200 | .05 | .05 | 1 | 65 | 42GT20D |
| 44 | 1 | .100 | .05 | .05 | 1 | 60 | 44GT10D |
| 44 | 1 | .200 | .05 | .05 | 1 | 65 | 44GT20D |
| 45 | 1 | .100 | .05 | .05 | 1 | 60 | 45GT10D |
| 45 | 1 | .200 | .05 | .05 | 1 | 65 | 45GT20D |
| 46 | 1 | .100 | .05 | .05 | 1 | 60 | 46GT10D |
| 46 | 1 | .200 | .05 | .05 | 1 | 65 | 46GT20D |
| 48 | 1 | .100 | .05 | .05 | 1 | 60 | 48GT10D |
| 48 | 1 | .200 | .05 | .05 | 1 | 65 | 48GT20D |
| 50 | 1 | .100 | .05 | .05 | 1 | 65 | 50GT10D |
| 50 | 1 | .200 | .05 | .05 | 1 | 70 | 50GT20D |
| 52 | 1 | .100 | .05 | .05 | 1 | 65 | 52GT10D |
| 52 | 1 | .200 | .05 | .05 | 1 | 70 | 52GT20D |
| 54 | 1 | .100 | .05 | .05 | 1 | 65 | 54GT10D |
| 54 | 1 | .200 | .05 | .05 | 1 | 70 | 54GT20D |
| 55 | 1 | .100 | .05 | .05 | 1 | 65 | 55GT10D |
| 55 | 1 | .200 | .05 | .05 | 1 | 70 | 55GT20D |
| 56 | 1 | .050 | .05 | .05 | 1 | 60 | 56GT05D |
| 56 | 1 | .100 | .05 | .05 | 1 | 65 | 56GT10D |
| 58 | 1 | .050 | .05 | .05 | 1 | 60 | 58GT05D |
| 58 | 1 | .100 | .05 | .05 | 1 | 65 | 58GT10D |
| 60 | 1 | .050 | .05 | .05 | 1 | 60 | 60GT05D |
| 60 | 1 | .100 | .05 | .05 | 1 | 65 | 60GT10D |
| 62 | 1 | .050 | .05 | .05 | 1 | 65 | 62GT05D |
| 62 | 1 | .100 | .05 | .05 | 1 | 70 | 62GT10D |
| 64 | 1 | .050 | .05 | .05 | 1 | 65 | 64GT05D |
| 64 | 1 | .100 | .05 | .05 | 1 | 70 | 64GT10D |
| 65 | 1 | .050 | .05 | .05 | 1 | 65 | 65GT05D |
| 65 | 1 | .100 | .05 | .05 | 1 | 70 | 65GT10D |
| 67 | 1 | .050 | .05 | .05 | 1 | 65 | 67GT05D |
| 67 | 1 | .100 | .05 | .05 | 1 | 70 | 67GT10D |
| 68 | 1 | .050 | .05 | .05 | 1 | 65 | 68GT05D |
| 68 | 1 | .100 | .05 | .05 | 1 | 70 | 68GT10D |
| 69 | 1 | .050 | .05 | .05 | 1 | 65 | 69GT05D |
| 69 | 1 | .100 | .05 | .05 | 1 | 70 | 69GT10D |
| 70 | 1 | .050 | .05 | .05 | 1 | 65 | 70GT05D |
| 70 | 1 | .100 | .05 | .05 | 1 | 70 | 70GT10D |
| 75 | 1 | .050 | .05 | .05 | 1 | 70 | 75GT05D |
| 75 | 1 | .100 | .05 | .05 | 1 | 75 | 75GT10D |
| 76 | 1 | .020 | .05 | .05 | 1 | 70 | 76GT02D |
| 76 | 1 | .050 | .05 | .05 | 1 | 75 | 76GT05D |
| 80 | 1 | .020 | .05 | .05 | 1 | 70 | 80GT02D |
| 80 | 1 | .050 | .05 | .05 | 1 | 75 | 80GT05D |
| 85 | 1 | .020 | .05 | .05 | 1 | 70 | 85GT02D |
| 85 | 1 | .050 | .05 | .05 | 1 | 75 | 85GT05D |
| 90 | 1 | .020 | .05 | .05 | 1 | 70 | 90GT02D |
| 90 | 1 | .050 | .05 | .05 | 1 | 75 | 90GT05D |
| 95 | 1 | .020 | .05 | .05 | 1 | 75 | 95GT02D |
| 95 | 1 | .050 | .05 | .05 | 1 | 80 | 95GT05D |
| 100 | 1 | .020 | .05 | .05 | 1 | 75 | 100GT02D |
| 100 | 1 | .050 | .05 | .05 | 1 | 80 | 100GT05D |

## (1 AMP MAXIMUM)

| Nominal Output Voltage | Adjust ±V. | Output Current Amps. | Regulation Load ±% | Regulation Line ±% | Ripple mv RMS | Price per Section | Section (See "How to Order") |
|---|---|---|---|---|---|---|---|
| 1.5 | .5 | .200 | .4 | .05 | 1 | $60 | 1.5GT20D |
| 1.5 | .5 | .400 | .5 | .1 | 1 | 65 | 1.5GT40D |
| 2.5 | .5 | .200 | .4 | .05 | 1 | 60 | 2.5GT20D |
| 2.5 | .5 | .400 | .5 | .1 | 1 | 65 | 2.5GT40D |
| 3 | .5 | .200 | .3 | .05 | 1 | 60 | 3GT20D |
| 3 | .5 | .400 | .5 | .1 | 1 | 65 | 3GT40D |
| 3 | .5 | .700 | .5 | .1 | 1 | 75 | 3GT70D |
| 3 | .5 | 1.0 | .5 | .1 | 1 | 85 | 3GT100D |
| 3.6 | .5 | .200 | .2 | .05 | 1 | 60 | 3.6GT20D |
| 3.6 | .5 | .400 | .3 | .1 | 1 | 65 | 3.6GT40D |
| 3.6 | .5 | .700 | .4 | .1 | 1 | 75 | 3.6GT70D |
| 3.6 | .5 | 1.0 | .5 | .1 | 1 | 85 | 3.6GT100D |
| 5 | .5 | .200 | .2 | .05 | 1 | 60 | 5GT20D |
| 5 | .5 | .500 | .3 | .05 | 1 | 65 | 5GT50D |
| 5 | .5 | .700 | .4 | .05 | 1 | 75 | 5GT70D |
| 5 | .5 | 1.0 | .5 | .05 | 1 | 85 | 5GT100D |
| 6 | 1 | .200 | .05 | .05 | 1 | 60 | 6GT20D |
| 6 | 1 | .500 | .15 | .05 | 1 | 65 | 6GT50D |
| 6 | .5 | .700 | .2 | .05 | 1 | 75 | 6GT70D |
| 6 | .5 | 1.0 | .3 | .05 | 1 | 85 | 6GT100D |
| 7 | 1 | .200 | .05 | .05 | 1 | 60 | 7GT20D |
| 7 | 1 | .500 | .15 | .05 | 1 | 65 | 7GT50D |
| 7 | .5 | .700 | .2 | .05 | 1 | 75 | 7GT70D |
| 7 | .5 | 1.0 | .3 | .05 | 1 | 85 | 7GT100D |
| 8 | 1 | .200 | .05 | .05 | 1 | 60 | 8GT20D |
| 8 | 1 | .500 | .1 | .05 | 1 | 65 | 8GT50D |
| 8 | .5 | .700 | .15 | .05 | 1 | 75 | 8GT70D |
| 8 | .5 | 1.0 | .2 | .05 | 1 | 85 | 8GT100D |
| 9 | 1 | .200 | .05 | .05 | 1 | 60 | 9GT20D |
| 9 | 1 | .500 | .1 | .05 | 1 | 65 | 9GT50D |
| 9 | .5 | .700 | .15 | .05 | 1 | 75 | 9GT70D |
| 9 | .5 | 1.0 | .2 | .05 | 1 | 85 | 9GT100D |
| 10 | 1 | .250 | .05 | .05 | 1 | $60 | 10GT25D |
| 10 | 1 | .500 | .1 | .05 | 1 | 65 | 10GT50D |
| 10 | .5 | .700 | .15 | .05 | 1 | 75 | 10GT70D |
| 10 | .5 | 1.0 | .2 | .05 | 1 | 85 | 10GT100D |
| 12 | 1 | .250 | .05 | .05 | 1 | 60 | 12GT25D |
| 12 | 1 | .500 | .1 | .05 | 1 | 65 | 12GT50D |
| 12 | .5 | .700 | .1 | .05 | 1 | 75 | 12GT70D |
| 12 | .5 | 1.0 | .1 | .05 | 1 | 85 | 12GT100D |
| 14 | 1 | .250 | .05 | .05 | 1 | 60 | 14GT25D |
| 14 | 1 | .500 | .1 | .05 | 1 | 65 | 14GT50D |
| 14 | .5 | .700 | .1 | .05 | 1 | 75 | 14GT70D |
| 14 | .5 | 1.0 | .1 | .05 | 1 | 85 | 14GT100D |
| 15 | 1 | .250 | .05 | .05 | 1 | 60 | 15GT25D |
| 15 | 1 | .500 | .1 | .05 | 1 | 65 | 15GT50D |
| 15 | .5 | .700 | .1 | .05 | 1 | 75 | 15GT70D |
| 15 | .5 | 1.0 | .1 | .05 | 1 | 85 | 15GT100D |
| 16 | 1 | .250 | .05 | .05 | 1 | 60 | 16GT25D |
| 16 | 1 | .500 | .1 | .05 | 1 | 65 | 16GT50D |
| 16 | .5 | .700 | .1 | .05 | 1 | 75 | 16GT70D |
| 16 | .5 | 1.0 | .1 | .05 | 1 | 85 | 16GT100D |
| 18 | 1 | .250 | .05 | .05 | 1 | 60 | 18GT25D |
| 18 | 1 | .500 | .1 | .05 | 1 | 65 | 18GT50D |
| 18 | .5 | .700 | .1 | .05 | 1 | 75 | 18GT70D |
| 18 | .5 | 1.0 | .1 | .05 | 1 | 85 | 18GT100D |
| 19 | 1 | .250 | .05 | .05 | 1 | 60 | 19GT25D |
| 19 | 1 | .500 | .1 | .05 | 1 | 65 | 19GT50D |
| 19 | .5 | .750 | .1 | .05 | 1 | 85 | 19GT75D |
| 20 | 1 | .250 | .05 | .05 | 1 | 60 | 20GT25D |
| 20 | 1 | .500 | .1 | .05 | 1 | 65 | 20GT50D |
| 20 | .5 | .750 | .1 | .05 | 1 | 85 | 20GT75D |

## (90 TO 150 VOLTS)

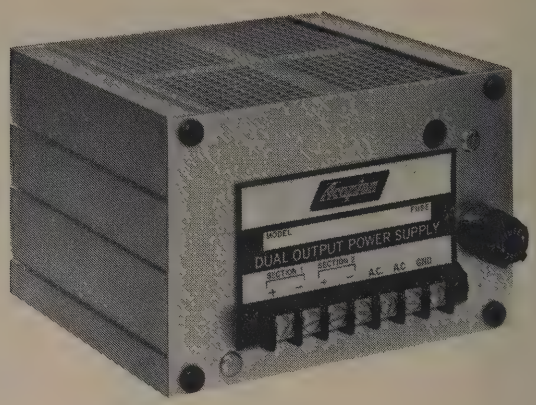
| Nominal Output Voltage | Adjust ±V. | Output Current Amps. | Regulation Load ±% | Regulation Line ±% | Ripple mv RMS | Price per Section | Section (See "How to Order") |
|---|---|---|---|---|---|---|---|
| 90 | 1 | .050 | .05 | .05 | 1 | $75 | 90GT05D |
| 90 | 1 | .100 | .05 | .05 | 1 | 85 | 90GT10D |
| 95 | 1 | .050 | .05 | .05 | 1 | 80 | 95GT05D |
| 95 | 1 | .100 | .05 | .05 | 1 | 85 | 95GT10D |
| 100 | 1 | .050 | .05 | .05 | 1 | 80 | 100GT05D |
| 100 | 1 | .100 | .05 | .05 | 1 | 85 | 100GT10D |
| 105 | 1 | .050 | .05 | .05 | 1 | 80 | 105GT05D |
| 105 | 1 | .100 | .05 | .05 | 1 | 85 | 105GT10D |
| 110 | 1 | .050 | .05 | .05 | 1 | 80 | 110GT05D |
| 110 | 1 | .100 | .05 | .05 | 1 | 85 | 110GT10D |
| 115 | 1 | .050 | .05 | .05 | 1 | 80 | 115GT05D |
| 115 | 1 | .100 | .05 | .05 | 1 | 85 | 115GT10D |
| 120 | 1 | .050 | .05 | .05 | 1 | 80 | 120GT05D |
| 120 | 1 | .100 | .05 | .05 | 1 | $85 | 120GT10D |
| 125 | 1 | .050 | .05 | .05 | 1 | 80 | 125GT05D |
| 125 | 1 | .100 | .05 | .05 | 1 | 85 | 125GT10D |
| 130 | 1 | .050 | .05 | .05 | 1 | 85 | 130GT05D |
| 130 | 1 | .100 | .05 | .05 | 1 | 90 | 130GT10D |
| 135 | 1 | .050 | .05 | .05 | 1 | 85 | 135GT05D |
| 135 | 1 | .100 | .05 | .05 | 1 | 90 | 135GT10D |
| 140 | 1 | .050 | .05 | .05 | 1 | 85 | 140GT05D |
| 140 | 1 | .100 | .05 | .05 | 1 | 90 | 140GT10D |
| 145 | 1 | .050 | .05 | .05 | 1 | 85 | 145GT05D |
| 145 | 1 | .100 | .05 | .05 | 1 | 90 | 145GT10D |
| 150 | 1 | .050 | .05 | .05 | 1 | 85 | 150GT05D |
| 150 | 1 | .100 | .05 | .05 | 1 | 90 | 150GT10D |

Acopian

# DUAL OUTPUT

## For Microprocessors

## Isolated Outputs




**Dual isolated output** power supplies may be connected to provide any desired arrangement of positive and negative output voltages. Each voltage is independently adjustable. No derating is required up to +60°C. A separate overvoltage protector on each output is available as a built-in option.

### SPECIFICATIONS

**Input Voltage:** 105-125 VAC, 50-400 Hz, single phase.

**Output Specifications:** No derating required through ambient temperature range.

**Polarity:** Outputs are floating. Each may be independently connected to provide any combination of positive and negative voltages. Outputs may be floated up to 300 V above ground.

**Ambient Operating Temperature:** −10 to +60°C.

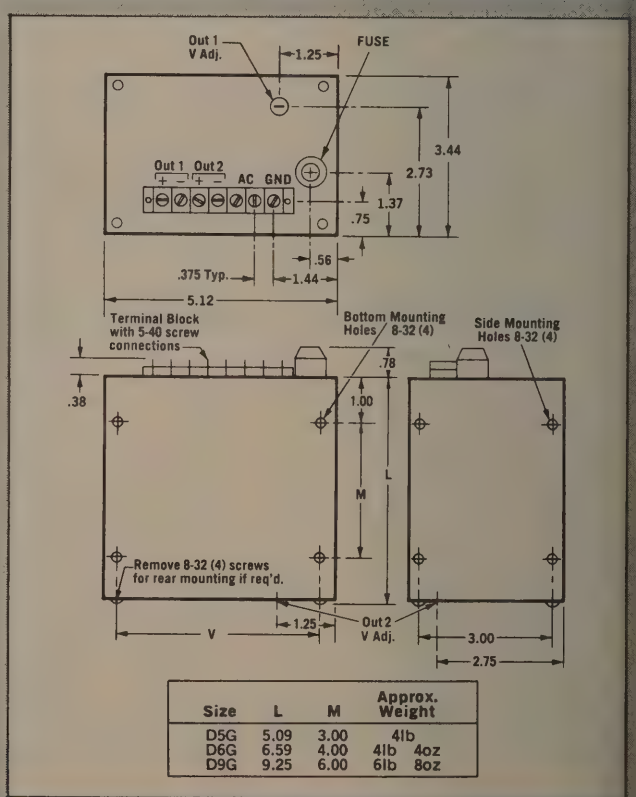
**Storage Temperature:** −55 to +85°C.

| Nominal Output Voltage | Adjustment ±Volts | Output Current Amps. | Regulation Load ±% | Regulation Line ±% | Ripple mv RMS | Price | Model | Size |
|---|---|---|---|---|---|---|---|---|
| 5<br>9 | .25<br>1 | 2.5<br>.400 | .15<br>.15 | .15<br>.15 | 1<br>1 | $135 | 59D5 | D5G |
| 5<br>9 | .25<br>1 | 4.0<br>.700 | .15<br>.15 | .15<br>.15 | 1<br>1 | 150 | 59D6 | D6G |
| 5<br>9 | .25<br>1 | 7.0<br>1.4 | .15<br>.15 | .15<br>.15 | 1<br>1 | 185 | 59D9 | D9G |
| 5<br>12 | .25<br>1 | 2.0<br>.600 | .15<br>.15 | .15<br>.15 | 1<br>1 | 135 | 512D5 | D5G |
| 5<br>12 | .25<br>1 | 3.0<br>1.2 | .15<br>.15 | .15<br>.15 | 1<br>1 | 150 | 512D6 | D6G |
| 5<br>12 | .25<br>1 | 6.0<br>2.4 | .15<br>.15 | .15<br>.15 | 1<br>1 | 185 | 512D9 | D9G |

### OPTIONS

**Overvoltage Protection:** Two separate, preset overvoltage protection circuits, one for each output. To order, add prefix "V" to model number and add $20.00 to the standard price.

**230 Volt Input:** All models can be alternately furnished for operation on inputs of 210-250 VAC, 50-400 Hz. To order, add suffix "-230" to the model number and $10.00 to the standard price.

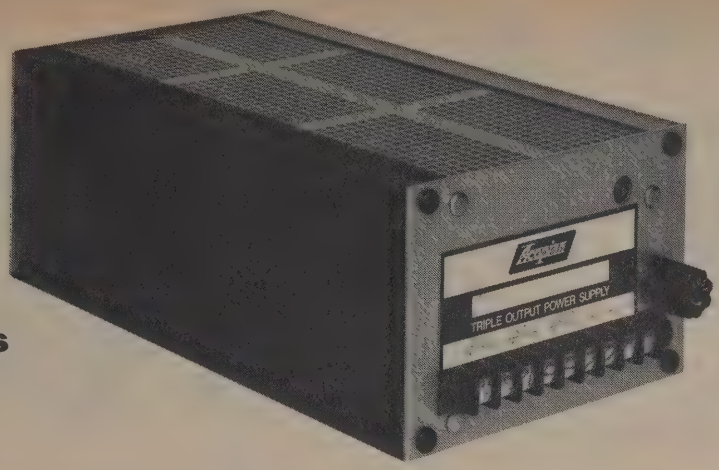



| Size | L | M | Approx. Weight |
|---|---|---|---|
| D5G | 5.09 | 3.00 | 4lb |
| D6G | 6.59 | 4.00 | 4lb 4oz |
| D9G | 9.25 | 6.00 | 6lb 8oz |

# TRIPLE OUTPUT

## For Microprocessors

## Isolated Outputs




**Triple isolated output** power supplies provide the features and characteristics of three supplies in one compact, easy-to-use package. They are available in the voltage combinations most frequently required for driving microprocessors and associated circuitry.

### SPECIFICATIONS

**Input Voltage:** 105-125 VAC, 50-400 Hz, single phase.

**Output Specifications:** No derating required through ambient temperature range of −10 to +60°C.

**Polarity:** Outputs are floating. Each output may be independently connected to provide any combination of positive and negative voltages. Outputs may be floated up to 300 V above ground.

**Ambient Operating Temperature:** −10 to +60°C.

**Storage Temperature:** −55 to +85°C.

| Nominal Output Voltage | Adjustment ±Volts | Output Current Amps. | Regulation Load ±% | Regulation Line ±% | Ripple mv RMS | Price | Model | Size |
|---|---|---|---|---|---|---|---|---|
| 5<br>5<br>12 | .25<br>.25<br>1 | 2.0<br>.500<br>.300 | .15<br>.15<br>.15 | .15<br>.15<br>.15 | 1<br>1<br>1 | $145 | 5512T5 | G5T |
| 5<br>5<br>12 | .25<br>.25<br>1 | 3.0<br>1.0<br>.600 | .15<br>.15<br>.15 | .15<br>.15<br>.15 | 1<br>1<br>1 | 160 | 5512T6 | G6T |
| 5<br>5<br>12 | .25<br>.25<br>1 | 6.0<br>2.0<br>1.2 | .15<br>.15<br>.15 | .15<br>.15<br>.15 | 1<br>1<br>1 | 195 | 5512T9 | G9T |
| 5<br>9<br>12 | .25<br>1<br>1 | 2.0<br>.400<br>.300 | .15<br>.15<br>.15 | .15<br>.15<br>.15 | 1<br>1<br>1 | 145 | 5912T5 | G5T |
| 5<br>9<br>12 | .25<br>1<br>1 | 3.0<br>.700<br>.600 | .15<br>.15<br>.15 | .15<br>.15<br>.15 | 1<br>1<br>1 | 160 | 5912T6 | G6T |
| 5<br>9<br>12 | .25<br>1<br>1 | 6.0<br>1.4<br>1.2 | .15<br>.15<br>.15 | .15<br>.15<br>.15 | 1<br>1<br>1 | 195 | 5912T9 | G9T |
| 5<br>12<br>12 | .25<br>1<br>1 | 2.0<br>.300<br>.300 | .15<br>.15<br>.15 | .15<br>.15<br>.15 | 1<br>1<br>1 | 145 | 51212T5 | G5T |
| 5<br>12<br>12 | .25<br>1<br>1 | 3.0<br>.600<br>.600 | .15<br>.15<br>.15 | .15<br>.15<br>.15 | 1<br>1<br>1 | 160 | 51212T6 | G6T |
| 5<br>12<br>12 | .25<br>1<br>1 | 6.0<br>1.2<br>1.2 | .15<br>.15<br>.15 | .15<br>.15<br>.15 | 1<br>1<br>1 | 195 | 51212T9 | G9T |
| 5<br>15<br>15 | .25<br>1<br>1 | 2.0<br>.250<br>.250 | .15<br>.15<br>.15 | .15<br>.15<br>.15 | 1<br>1<br>1 | 145 | 51515T5 | G5T |
| 5<br>15<br>15 | .25<br>1<br>1 | 3.0<br>.500<br>.500 | .15<br>.15<br>.15 | .15<br>.15<br>.15 | 1<br>1<br>1 | 160 | 51515T6 | G6T |
| 5<br>15<br>15 | .25<br>1<br>1 | 6.0<br>1.0<br>1.0 | .15<br>.15<br>.15 | .15<br>.15<br>.15 | 1<br>1<br>1 | 195 | 51515T9 | G9T |

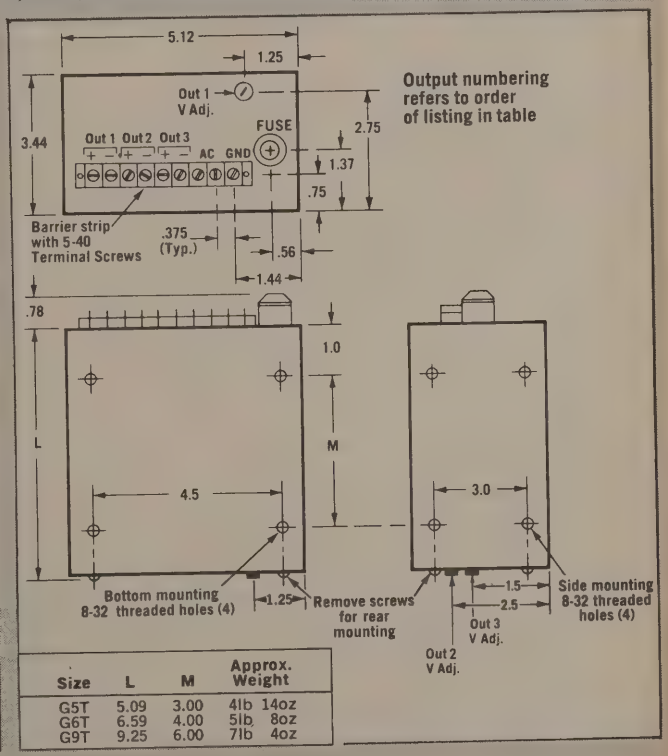
### OPTIONS

**Overvoltage Protection:**

On Output 1 only: Add prefix "V" to model number and add $10.00 to the standard price.

Separate overvoltage protection circuit on each output: Add prefix "3V" to model number and add $25.00 to the standard price.

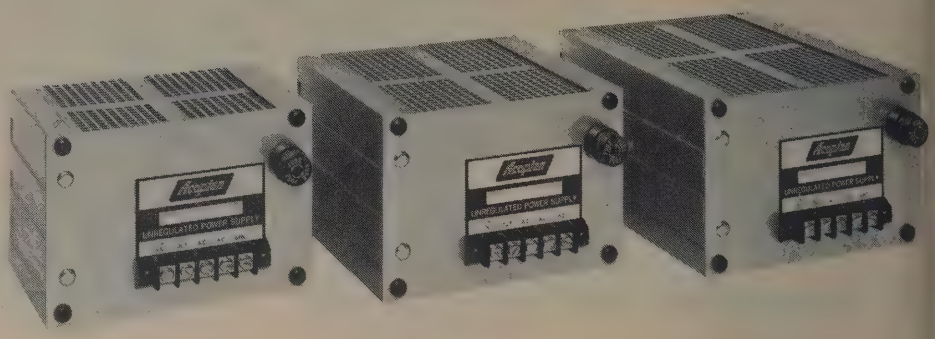
**230 Volt Input:** All models can be alternately furnished for operation on inputs of 210-250 VAC, 50-400 Hz. To order, add suffix "-230" to the model number and $10.00 to the standard price.




| Size | L | M | Approx. Weight |
|---|---|---|---|
| G5T | 5.09 | 3.00 | 4lb 14oz |
| G6T | 6.59 | 4.00 | 5lb 8oz |
| G9T | 9.25 | 6.00 | 7lb 4oz |

Acopian

# SERIES U UNREGULATED



**U.L. RECOGNIZED**

**Low-cost DC power** suitable for driving loads such as lamps, relays, and small motors is provided by Series U unregulated power supplies. All components are generously derated, insuring a long and trouble-free life; built-in fusing prevents damage due to prolonged overloading or short circuits. Mechanically similar to the regulated supplies shown on pages 8 and 9, they are housed in extruded aluminum cases which can be mounted in any position.

## STANDARD FEATURES

- Silicon rectifiers
- Capacitive filtering
- Fused input
- May be used in series or parallel
- No derating or heat sinking required
- Completely serviceable

## SPECIFICATIONS

**Input Voltage:** 0–125 VAC, 50–400 Hz, single phase.

**Output Voltage:**
**Output Current:** } See table
**Ripple:**

**Load Regulation:** Nominal output voltage is based on 115 VAC input, with approximately 50% of rated output current being drawn.

**Line Regulation:** With fixed load, output voltage change is proportional to input voltage change.

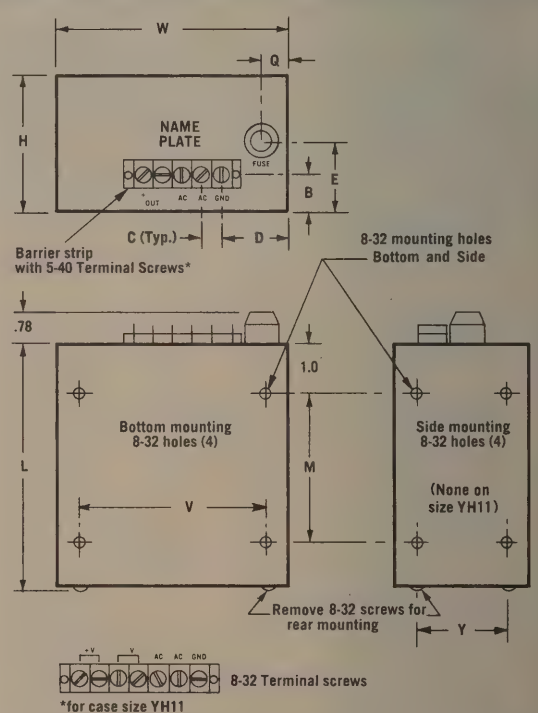
**Output Voltage Adjustment:** An adjustable autotransformer (not included) may be used to adjust output voltage by varying the AC input voltage to the supply.

**Polarity:** Output is floating; either positive or negative terminal may be grounded or floated up to 300 V above ground.

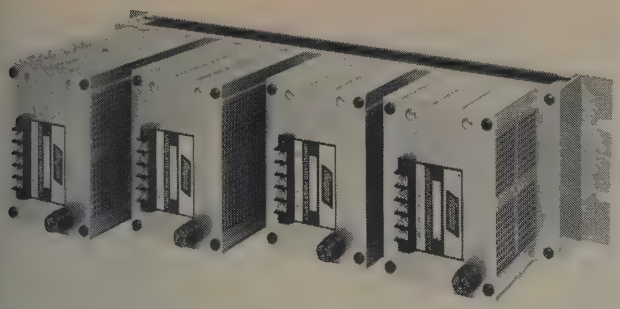
**Ambient Operating Temperature:** −10 to +65°C. No derating required.

**Storage Temperature:** −55 to +85°C.

**Optional 230 Volt Input**
Provision for inputs of 210–250 VAC, 50–400 Hz, replacing the standard 105–125 VAC input voltage range, is available on all models except those having an output current rating of 20 ma. To order, add the suffix "-230" to the model number, and $10.00 to the standard price.

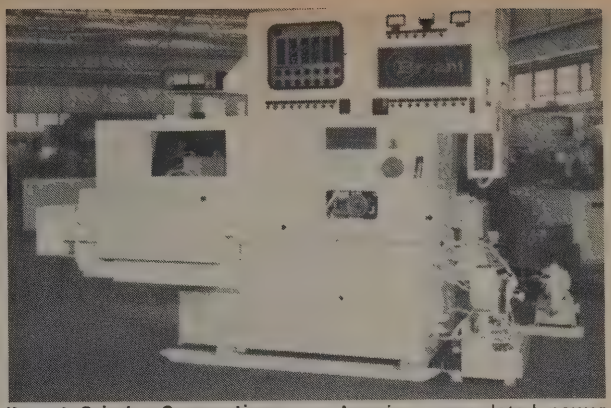



| Size | L | W | H | M | V | Y | Q | E | B | D | C | Approx. Weight |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Y3 | 3.71 | 5.12 | 3.44 | 1.62 | 4.5 | 3.0 | .56 | 1.37 | .75 | 1.44 | .375 | 2 lb. 8 oz. |
| Y5 | 5.09 | 5.12 | 3.44 | 3.00 | 4.5 | 3.0 | .56 | 1.37 | .75 | 1.44 | .375 | 4 lb. 8 oz. |
| Y6 | 6.59 | 5.12 | 3.44 | 4.00 | 4.5 | 3.0 | .56 | 1.37 | .75 | 1.44 | .375 | 7 lb. 8 oz. |
| YH11 | 11.25 | 7.37 | 5.12 | 8.0 | 6.75 | 4.56 | 1.10 | 2.64 | 1.25 | 2.25 | .562 | 18 to 23 lb. |



**The cross-sectional dimensions** of Series U power supplies permit efficient rear mounting on either 3½" or 5¼" rack assemblies. Threaded holes on three surfaces permit mounting in any position. See page 22.

| Nominal Output Voltage | Output Amps. | Output Voltage N/L—F/L | Ripple Volts RMS | Price | Model | Size |
|---|---|---|---|---|---|---|
| 4 | .200 | 4.4 to 3.6 | .2 | $35 | U4Y20 | Y3 |
| 5 | 10.0 (@ 5.0) | 7.6 to 3.0 (4.2) | 1.8 (1.5) | 85 | U5Y1000 | Y6 |
| 6 | .800 | 6.6 to 5.4 | .7 | 40 | U6Y80 | Y3 |
| 6 | 10.0 (@ 5.0) | 8.8 to 3.9 (5.1) | 2.2 (1.7) | 85 | U6Y1000 | Y6 |
| 7 | 1.0 | 7.7 to 6.3 | .8 | 40 | U7Y100 | Y3 |
| 8 | .400 | 8.8 to 7.2 | .4 | 35 | U8Y40 | Y3 |
| 9 | 1.0 | 9.9 to 8.1 | .7 | 40 | U9Y100 | Y3 |
| 9 | 10.0 (@ 5.0) | 11.5 to 5.7 (7.3) | 2.5 (2.0) | 85 | U9Y1000 | Y6 |
| 10 | 10.0 (@ 5.0) | 12.4 to 6.4 (8.0) | 2.7 (2.1) | 85 | U10Y1000 | Y6 |
| 11 | 10.0 (@ 5.0) | 14.0 to 7.6 (9.6) | 3.0 (2.2) | 85 | U11Y1000 | Y6 |
| 12 | 1.5 | 14.9 to 10.9 | 2.5 | 35 | U12Y150 | Y3 |
| 12 | 10.0 (@ 5.0) | 16.0 to 9.2 (11.3) | 3.4 (2.3) | 85 | U12Y1000 | Y6 |
| 14 | 1.0 | 15.4 to 12.6 | .7 | 40 | U14Y100 | Y3 |
| 14 | 10.0 (@ 5.0) | 17.2 to 10.5 (12.2) | 3.5 (2.4) | 85 | U14Y1000 | Y6 |
| 15 | 10.0 (@ 5.0) | 18.3 to 11.2 (13.4) | 3.6 (2.4) | 85 | U15Y1000 | Y6 |
| 16 | 1.0 | 17.6 to 14.4 | .7 | 40 | U16Y100 | Y3 |
| 16 | 10.0 (@ 5.0) | 19.5 to 12.0 (14.4) | 3.7 (2.5) | 85 | U16Y1000 | Y6 |
| 17 | .250 | 18.7 to 15.3 | .2 | 35 | U17Y25 | Y3 |
| 17 | 1.0 | 18.7 to 15.3 | .7 | 40 | U17Y100 | Y3 |
| 18 | 1.0 | 19.8 to 16.2 | .7 | 40 | U18Y100 | Y3 |
| 18 | 10.0 (@ 5.0) | 22.0 to 14.0 (16.5) | 4.0 (2.6) | 85 | U18Y1000 | Y6 |
| 19 | .600 | 20.9 to 17.1 | .5 | 35 | U19Y60 | Y3 |
| 20 | 10.0 (@ 5.0) | 24.8 to 16.5 (19.1) | 4.2 (2.6) | 85 | U20Y1000 | Y6 |
| 24 | 1.0 | 26.4 to 21.6 | 1.7 | 35 | U24Y100 | Y3 |
| 24 | 5.0 | 26.5 to 21.0 | 2.5 | 85 | U24Y500 | Y6 |
| 24 | 10.0 | 26.8 to 20.0 | 3.2 | 125 | U24Y1000 | Y6 |
| 24 | 17.0 | 26.4 to 21.6 | 1.5 | 160 | U24Y1700 | YH11 |
| 24 | 23.0 | 27.0 to 21.0 | 1.5 | 190 | U24Y2300 | YH11 |
| 25 | 5.0 | 28.1 to 22.3 | 2.5 | 85 | U25Y500 | Y6 |
| 27 | 5.0 | 30.0 to 24.0 | 2.6 | 85 | U27Y500 | Y6 |
| 28 | 1.0 | 30.8 to 25.2 | 1.7 | 35 | U28Y100 | Y3 |
| 28 | 5.0 | 31.2 to 24.8 | 2.6 | 85 | U28Y500 | Y6 |
| 28 | 8.0 | 31.4 to 25.0 | 3.2 | 125 | U28Y800 | Y6 |
| 28 | 15.0 | 30.8 to 25.2 | 1.5 | 160 | U28Y1500 | YH11 |
| 28 | 20.0 | 30.4 to 24.5 | 1.5 | 190 | U28Y2000 | YH11 |
| 30 | 1.0 | 33.0 to 27.0 | 1.6 | 45 | U30Y100 | Y5 |
| 30 | 2.0 | 33.0 to 27.0 | 1.5 | 65 | U30Y200 | Y5 |
| 30 | 5.0 | 33.0 to 26.5 | 2.6 | 85 | U30Y500 | Y6 |
| 32 | .400 | 35.2 to 28.8 | .6 | 35 | U32Y40 | Y3 |
| 32 | 5.0 | 35.5 to 28.0 | 3.3 | 85 | U32Y500 | Y6 |
| 35 | 1.0 | 38.5 to 34.5 | 1.6 | 45 | U35Y100 | Y5 |
| 35 | 2.0 | 38.5 to 31.5 | 1.5 | 65 | U35Y200 | Y5 |
| 35 | 5.0 | 38.0 to 30.0 | 3.3 | 85 | U35Y500 | Y6 |
| 37 | .400 | 40.3 to 33.7 | .6 | 35 | U37Y40 | Y3 |
| 37 | 5.0 | 40.5 to 32.2 | 3.3 | 85 | U37Y500 | Y6 |
| 38 | 5.0 | 43.0 to 34.0 | 3.3 | 85 | U38Y500 | Y6 |
| 40 | 1.0 | 44.0 to 36.0 | 1.6 | 45 | U40Y100 | Y5 |
| 40 | 2.0 | 44.0 to 36.0 | 1.5 | 65 | U40Y200 | Y5 |
| 40 | 5.0 | 45.0 to 37.0 | 3.3 | 85 | U40Y500 | Y6 |
| 41 | .400 | 45.1 to 36.9 | .6 | 35 | U41Y40 | Y3 |
| 42 | 5.0 | 48.0 to 36.0 | 6.5 | 85 | U42Y500 | Y6 |
| 44 | .100 | 48.4 to 39.6 | .7 | 50 | U44Y10 | Y3 |
| 44 | 2.0 | 48.4 to 39.6 | 1.5 | 65 | U44Y200 | Y5 |
| 45 | 1.0 | 49.5 to 40.5 | 1.6 | 50 | U45Y100 | Y5 |
| 45 | 5.0 | 51.0 to 38.5 | 6.5 | 85 | U45Y500 | Y6 |
| 48 | .400 | 52.8 to 43.2 | .6 | 45 | U48Y40 | Y3 |
| 50 | 1.0 | 55.0 to 45.0 | 1.6 | 50 | U50Y100 | Y5 |
| 52 | .400 | 57.2 to 46.8 | .6 | 45 | U52Y40 | Y3 |



**Bryant Grinder Corporation** uses Acopian unregulated power supplies in the programmable controller of the Centra-Form Grinder. The controller features a display which provides immediate diagnosis of machine malfunctions.

| Nominal Output Voltage | Output Amps. | Output Voltage N/L—F/L | Ripple Volts RMS | Price | Model | Size |
|---|---|---|---|---|---|---|
| 55 | .250 | 60.5 to 49.5 | .4 | $45 | U55Y25 | Y3 |
| 55 | 1.0 | 59.4 to 48.4 | 2.8 | 55 | U55Y100 | Y5 |
| 56 | .400 | 61.6 to 51.4 | .6 | 50 | U56Y40 | Y3 |
| 60 | 1.0 | 65.3 to 53.0 | 2.8 | 60 | U60Y100 | Y5 |
| 62 | .400 | 69.0 to 58.0 | 1.5 | 50 | U62Y40 | Y3 |
| 65 | .250 | 71.5 to 58.5 | .4 | 50 | U65Y25 | Y3 |
| 72 | .250 | 79.2 to 64.8 | .5 | 50 | U72Y25 | Y3 |
| 80 | .150 | 88.0 to 72.0 | .6 | 45 | U80Y15 | Y3 |
| 80 | .300 | 88.0 to 72.0 | 1.0 | 50 | U80Y30 | Y3 |
| 85 | .150 | 93.5 to 76.5 | .6 | 50 | U85Y15 | Y3 |
| 90 | .150 | 99.0 to 81.0 | 1.1 | 45 | U90Y15 | Y3 |
| 90 | .400 | 99.0 to 81.0 | 2.2 | 55 | U90Y40 | Y3 |
| 95 | .150 | 105 to 85 | 1.1 | 55 | U95Y15 | Y3 |
| 100 | .200 | 110 to 93 | 1.0 | 55 | U100Y20 | Y3 |
| 110 | .200 | 121 to 100 | 1.0 | 55 | U110Y20 | Y3 |
| 120 | .200 | 132 to 110 | 1.0 | 55 | U120Y20 | Y3 |
| 130 | .200 | 143 to 120 | 1.5 | 55 | U130Y20 | Y3 |
| 140 | .200 | 154 to 126 | 1.7 | 60 | U140Y20 | Y3 |
| 150 | .200 | 165 to 135 | 1.7 | 60 | U150Y20 | Y3 |
| 165 | .200 | 176 to 144 | 1.7 | 60 | U165Y20 | Y3 |
| 170 | .200 | 187 to 153 | 2.0 | 60 | U170Y20 | Y3 |
| 180 | .200 | 190 to 162 | 2.0 | 60 | U180Y20 | Y3 |
| 200 | .200 | 220 to 180 | 2.0 | 65 | U200Y20 | Y3 |
| 210 | .100 | 231 to 189 | 2.0 | 55 | U210Y10 | Y3 |
| 215 | .100 | 236 to 193 | 2.0 | 60 | U215Y10 | Y3 |
| 230 | .100 | 252 to 207 | 3.0 | 60 | U230Y10 | Y3 |
| 250 | .100 | 275 to 225 | 3.0 | 60 | U250Y10 | Y3 |
| 250 | .200 | 275 to 225 | 5.0 | 80 | U250Y20 | Y5 |
| 275 | .100 | 303 to 247 | 3.0 | 60 | U275Y10 | Y3 |
| 275 | .200 | 303 to 247 | 3.6 | 80 | U275Y20 | Y5 |
| 300 | .200 | 330 to 270 | 5.0 | 80 | U300Y20 | Y5 |
| 325 | .200 | 360 to 295 | 6.0 | 80 | U325Y20 | Y5 |
| 340 | .100 | 374 to 306 | 3.0 | 60 | U340Y10 | Y3 |
| 350 | .200 | 385 to 330 | 6.0 | 80 | U350Y20 | Y5 |
| 360 | .100 | 396 to 324 | 3.0 | 60 | U360Y10 | Y3 |
| 370 | .100 | 407 to 333 | 3.0 | 60 | U370Y10 | Y3 |
| 375 | .200 | 412 to 352 | 6.0 | 80 | U375Y20 | Y5 |
| 400 | .200 | 440 to 360 | 6.0 | 80 | U400Y20 | Y5 |
| 420 | .100 | 462 to 378 | 7.0 | 60 | U420Y10 | Y3 |
| 425 | .200 | 467 to 383 | 9.1 | 80 | U425Y20 | Y5 |
| 450 | .200 | 495 to 405 | 9.1 | 80 | U450Y20 | Y5 |
| 475 | .020 | 523 to 426 | 3.1 | 50 | U475Y02 | Y3 |
| 475 | .200 | 524 to 426 | 9.1 | 80 | U475Y20 | Y5 |
| 500 | .200 | 550 to 450 | 9.1 | 80 | U500Y20 | Y5 |
| 525 † | .100 | 574 to 473 | 4.8 | 80 | U525Y10 | Y5 |
| 550 † | .100 | 605 to 495 | 4.8 | 80 | U550Y10 | Y5 |
| 575 † | .100 | 630 to 518 | 4.8 | 80 | U575Y10 | Y5 |
| 580 † | .020 | 638 to 522 | 3.1 | 55 | U580Y02 | Y3 |
| 600 † | .100 | 660 to 540 | 10.0 | 80 | U600Y10 | Y5 |
| 625 † | .100 | 680 to 565 | 10.0 | 80 | U625Y10 | Y5 |
| 650 † | .100 | 715 to 595 | 10.0 | 80 | U650Y10 | Y5 |
| 675 † | .100 | 732 to 608 | 10.0 | 80 | U675Y10 | Y5 |
| 700 † | .100 | 770 to 630 | 10.0 | 80 | U700Y10 | Y5 |
| 725 † | .100 | 790 to 665 | 10.0 | 80 | U725Y10 | Y5 |
| 750 † | .020 | 825 to 675 | 3.1 | 60 | U750Y02 | Y3 |
| 750 † | .100 | 838 to 710 | 13.0 | 80 | U750Y10 | Y5 |
| 800 † | .100 | 880 to 720 | 13.0 | 80 | U800Y10 | Y5 |
| 850 † | .100 | 935 to 765 | 13.0 | 80 | U850Y10 | Y5 |
| 900 † | .020 | 990 to 810 | 5.0 | 65 | U900Y02 | Y3 |
| 900 † | .100 | 990 to 810 | 13.0 | 80 | U900Y10 | Y5 |
| 950 † | .100 | 1045 to 855 | 13.0 | 80 | U950Y10 | Y5 |
| 1000 † | .100 | 1100 to 900 | 13.0 | 80 | U1000Y10 | Y5 |

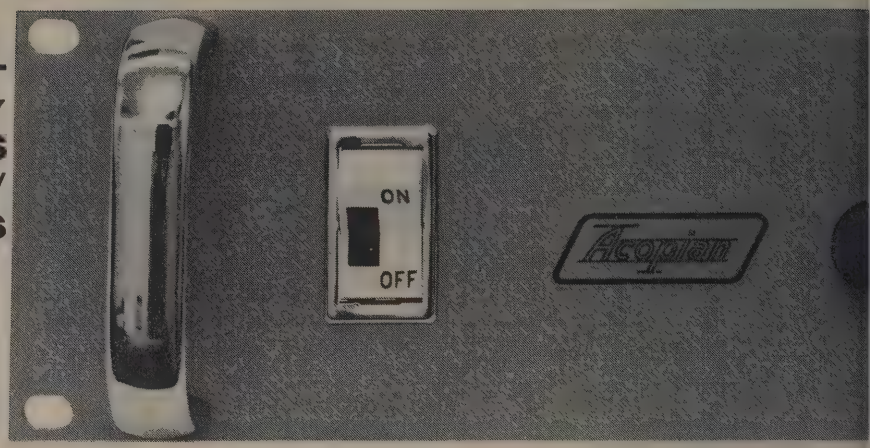
†Not U.L. recognized when this catalog was published.

Acopian

# MULTIPLE-OUTPUT POWER SUPPLY SYSTEMS

shipped in only

**9 days**




Now you can fill your requirements for completely wired multiple-output rack-mounting power supply systems, without any need to search through a catalog and prepare time-consuming mechanical layouts, item-by-item pricing and detailed purchase requisitions. Instead, simply call the Acopian "hotline" and specify the output voltages and currents that you require.

Acopian power systems offer the features that are most often required, and at reasonable cost. Each system is designed and constructed to provide an optimum mechanical and wiring configuration for the complement of power modules necessary to deliver the outputs specified. Acopian production expertise assures shipment of each system, completely wired and 100% tested, within 9 days after your order is received.

**Ordering an Acopian power system is this easy:**

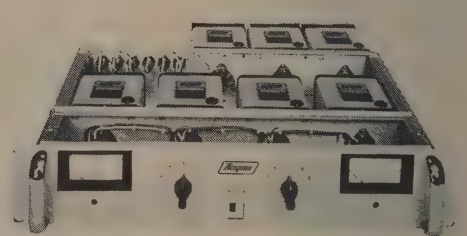
List the DC outputs that you require. (Or, select the power modules that you wish to be included.) Note the system features which you consider necessary. Then, call the "Power Systems Hotline" collect at (215) 258-5441 and ask for the POWER SYSTEM DEPARTMENT.

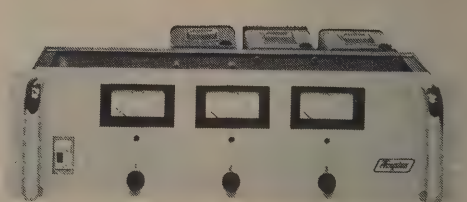
An Acopian Applications Engineer will answer—on the phone—any questions which you may have. A distinctive system model number will be assigned, and a firm price will be quoted. Your completely-wired power supply system will be shipped within 9 days.

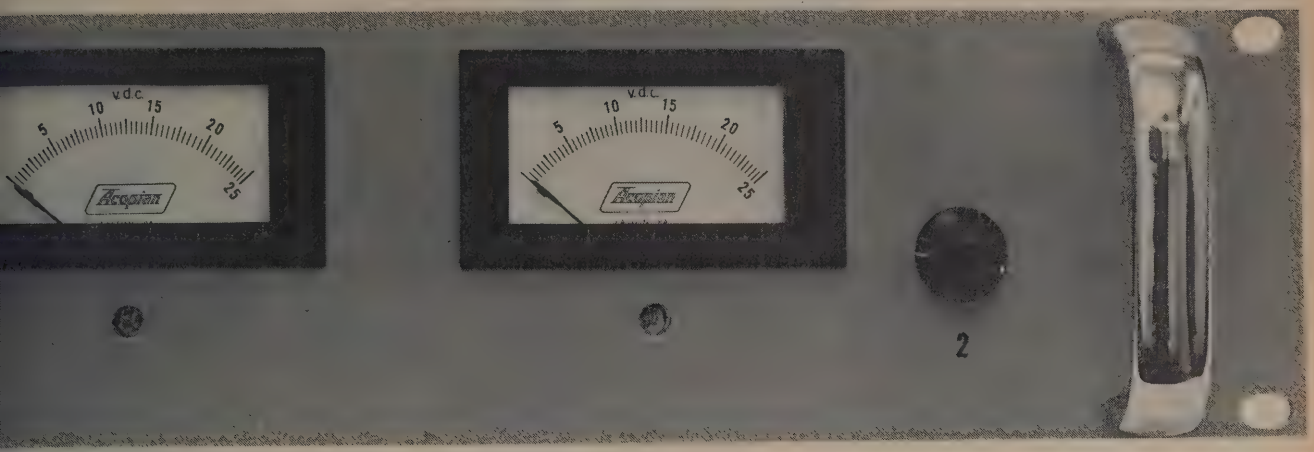
**System Description**

Any of the power modules listed in this catalog can be included in a power system. The rack assembly will be designed and wired in a manner optimum for the complement of modules included.

**TYPICAL BUILT-TO-ORDER POWER SUPPLY SYSTEMS**








**Now you can design your power system on the phone . . . just call Acopian.**

Pricing of assemblies equipped with plug-in type power modules is calculated as indicated below, and includes wiring, all necessary fuses, power switch/indicator on front panel, and all input and output connections via terminal strip(s) at the rear. When rear panel space is insufficient for terminal strips, a connector may alternately be furnished. Minimum price, $150.00.

To obtain pricing information for assemblies containing other than plug-in type modules, contact factory.

| Panel height (19" wide) | Price (not including plug-in power modules) |
|---|---|
| 3½" | $20.00 plus $5.00 per output |
| 5¼" | $25.00 plus $5.00 per output |
| 7" | $30.00 plus $5.00 per output |
| 8¾" | $35.00 plus $5.00 per output |
| 10½" | $40.00 plus $5.00 per output |

**Description**

The standard front panel is ⅛-inch aluminum finished in light gray baked enamel. Also available, at no additional cost, are Emcor or Amco gray formed steel panels. (The panel can also be supplied in any other color conventional type enamel supplied by customer, at an additional charge of $10 per purchase order.)

The rear portion of the assembly is normally constructed from extruded aluminum panels, alodyne finished.

**Redundant outputs**—For applications where extreme reliability is a critical consideration, as in data communications and process controls, the use of redundant output power systems is recommended. Two power modules are included for each output and interwired in a manner permitting one to continue furnishing the required output should the other fail. See pages 24-25 for further information, or call the "Power Systems Hotline," (215) 258-5441.

**Delivery**—Shipment of your completely-wired power supply system will be made nine days after receipt of order. Of course, the famous Acopian three-day shipping guarantee on any of 82,000 different individual power modules remains unchanged.

**Guarantee**—Acopian Corp. warrants each power supply system to be free from defects in material and workmanship for a period of five years from date of delivery.

## Accessories and Options

**Voltmeters and/or ammeters**– $15.00 each.

**Front panel voltage adjustments**– $5.00 each.

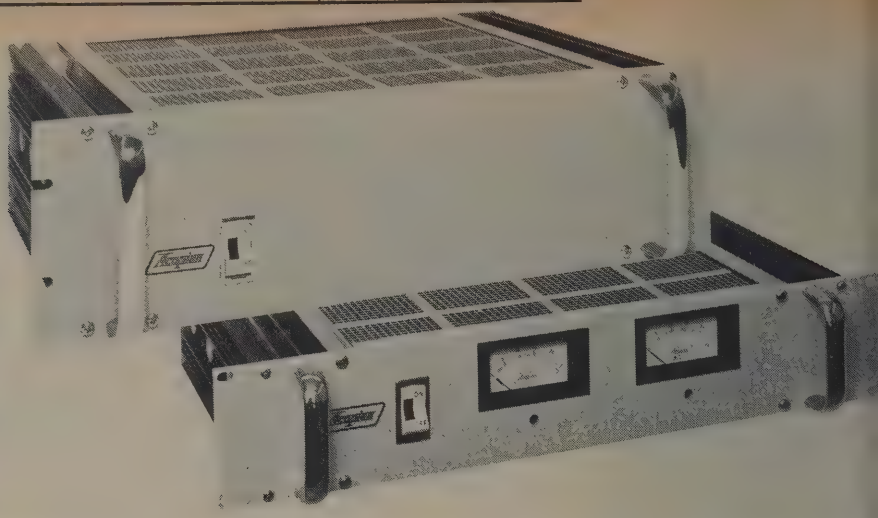
**Front panel handles**– $10.00/pair.

**Chassis slides**– $50.00/pair.

**Other features and accessories**

Should you require any non-standard features, call the Acopian "hotline" at Area Code 215, 258-5441 and discuss your needs with an Acopian Application Engineer. A procurement charge of $25.00 minimum (exclusive of material) will apply if components not stocked by Acopian are specified. Engineering charges to cover special layout and wiring may also apply. Extra charges are minimized and delivery accelerated when the customer provides any special components which he wishes to be incorporated into a power system.

Acopian



# RACK MOUNTING

## Up to 60 Volts
## Up to 60 Amps

**Shipped in 9 Days**

**U.L. RECOGNIZED**

**Acopian rack-mounting power supplies** feature excellent regulation and ripple specifications in 80 models with outputs up to 60 volts and 60 amps. Metering and overvoltage protection are available as options. These power supplies are constructed in sturdy extruded aluminum assemblies designed expressly for mounting in standard 19″ wide RETMA cabinet racks. The front panels are finished in light gray enamel; sides are black; the remaining casework is finished in gold alodyne.

### SPECIFICATIONS

**Input Voltage:** 105-125 VAC, 50-400 Hz, single phase.

**Remote Voltage Sensing:** Provision for sensing the output voltage across the load is a standard feature.

**Output Voltage/Current:**
**Line Regulation:**
**Load Regulation:**
**Ripple:**
**Output Voltage Adjustment Range:**
} See tables

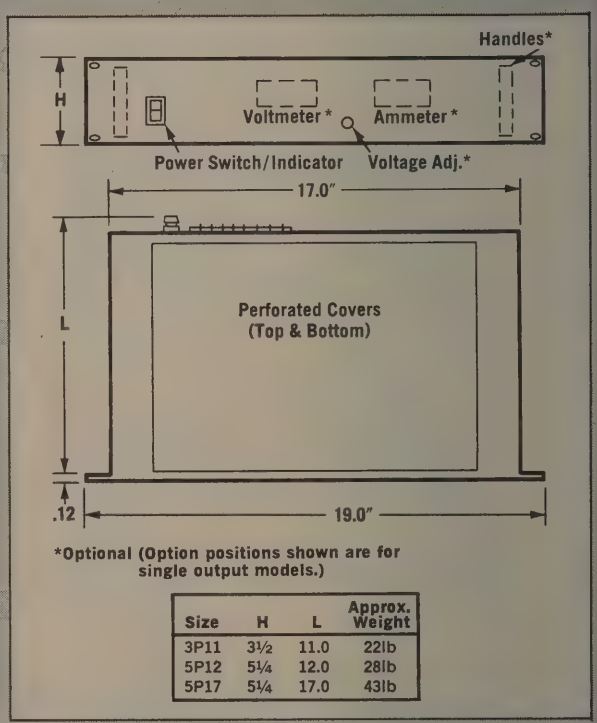
**Polarity—Single Output Models:** Output is floating; either positive or negative terminal may be grounded or floated up to 300V above ground.

**Polarity—Dual Output Models:** Positive output, common, negative output.

**Storage Temperature:** −55 to +85°C.

**Ambient Operating Temperature—**
**Single Output Models:** −20 to +55°C.
**Dual Output Models:** −10 to +55°C.

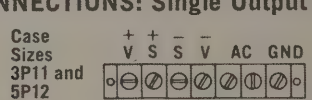
**Short Circuit and Overload Protection:** Electronic current limiting with automatic recovery.

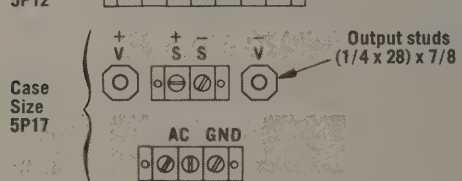



*Optional (Option positions shown are for single output models.)

| Size | H | L | Approx. Weight |
|---|---|---|---|
| 3P11 | 3½ | 11.0 | 22lb |
| 5P12 | 5¼ | 12.0 | 28lb |
| 5P17 | 5¼ | 17.0 | 43lb |

### CONNECTIONS: Single Output Models



## SINGLE OUTPUT

| Nominal Output Voltage | Adjust Range ±V | Output Current Amps. 40°C | 55°C | Regulation Load* ±% | Line* ±% | Ripple mv RMS | Price | Model | Size |
|---|---|---|---|---|---|---|---|---|---|
| 1.5 | .5 | 20 | 20 | .005 | .005 | .25 | $280 | 1.5PT20 | 3P11 |
| 1.5 | .5 | 32 | 27 | .005 | .005 | .25 | 330 | 1.5PT32 | 5P12 |
| 1.5 | .25 | 60 | 47 | .05 | .05 | 1 | 525 | 1.5PT60 | 5P17 |
| 3 | .5 | 20 | 20 | .005 | .005 | .25 | 280 | 3PT20 | 3P11 |
| 3 | .5 | 30 | 25 | .005 | .005 | .25 | 330 | 3PT30 | 5P12 |
| 3 | .25 | 60 | 47 | .05 | .05 | 1 | 525 | 3PT60 | 5P17 |
| 3.6 | .5 | 20 | 20 | .005 | .005 | .25 | 280 | 3.6PT20 | 3P11 |
| 3.6 | .5 | 32 | 27 | .005 | .005 | .25 | 330 | 3.6PT32 | 5P12 |
| 3.6 | .25 | 60 | 47 | .05 | .05 | 1 | 525 | 3.6PT60 | 5P17 |
| 4 | .25 | 60 | 47 | .05 | .05 | 1 | 525 | 4PT60 | 5P17 |
| 5 | .5 | 20 | 20 | .005 | .005 | .25 | 280 | 5PT20 | 3P11 |
| 5 | .5 | 32 | 27 | .005 | .005 | .25 | 330 | 5PT32 | 5P12 |
| 5 | .25 | 60 | 47 | .05 | .05 | 1 | 525 | 5PT60 | 5P17 |
| 6 | .5 | 20 | 20 | .005 | .005 | .25 | 280 | 6PT20 | 3P11 |
| 6 | .5 | 28 | 23 | .005 | .005 | .25 | 330 | 6PT28 | 5P12 |
| 6 | .25 | 58 | 45 | .05 | .05 | 1 | 525 | 6PT58 | 5P17 |
| 7 | .5 | 20 | 20 | .005 | .005 | .25 | 280 | 7PT20 | 3P11 |
| 8 | .5 | 20 | 20 | .005 | .005 | .25 | 280 | 8PT20 | 3P11 |
| 8 | .5 | 28 | 23 | .005 | .005 | .25 | 330 | 8PT28 | 5P12 |
| 8 | .25 | 54 | 42 | .05 | .05 | 1 | 525 | 8PT54 | 5P17 |
| 9 | .5 | 20 | 20 | .005 | .005 | .25 | 330 | 9PT20 | 3P11 |
| 9 | .5 | 52 | 41 | .05 | .05 | 1 | 550 | 9PT52 | 5P17 |
| 10 | .5 | 20 | 20 | .005 | .005 | .25 | 330 | 10PT20 | 3P11 |
| 10 | .5 | 25 | 20 | .005 | .005 | .25 | 350 | 10PT25 | 5P12 |
| 10 | .5 | 50 | 39 | .05 | .05 | 1 | 550 | 10PT50 | 5P17 |
| 12 | .5 | 17 | 17 | .005 | .005 | .25 | 280 | 12PT17 | 3P11 |
| 12 | .5 | 22 | 22 | .005 | .005 | .25 | 330 | 12PT22 | 5P12 |
| 12 | .5 | 45 | 35 | .05 | .05 | 1 | 550 | 12PT45 | 5P17 |
| 13 | .5 | 16 | 16 | .005 | .005 | .25 | 330 | 13PT16 | 3P11 |
| 13 | .5 | 43 | 34 | .05 | .05 | 1 | 550 | 13PT43 | 5P17 |
| 14 | .5 | 12 | 12 | .005 | .005 | .25 | 280 | 14PT12 | 3P11 |
| 15 | .5 | 10 | 10 | .005 | .005 | .25 | 280 | 15PT10 | 3P11 |
| 15 | .5 | 19 | 16 | .005 | .005 | .25 | 330 | 15PT19 | 5P12 |
| 15 | .5 | 40 | 31 | .05 | .05 | 1 | 590 | 15PT40 | 5P17 |
| 16 | .5 | 10 | 10 | .005 | .005 | .25 | 280 | 16PT10 | 3P11 |
| 18 | .5 | 10 | 10 | .005 | .005 | .25 | 280 | 18PT10 | 3P11 |
| 18 | .5 | 18 | 15 | .005 | .005 | .25 | 330 | 18PT18 | 5P12 |
| 18 | .5 | 36 | 28 | .05 | .05 | 1 | 590 | 18PT36 | 5P17 |
| 20 | .5 | 10 | 10 | .005 | .005 | .25 | $280 | 20PT10 | 3P11 |
| 20 | .5 | 16 | 14 | .005 | .005 | .25 | 330 | 20PT16 | 5P12 |
| 20 | .5 | 32 | 25 | .05 | .05 | 1 | 590 | 20PT32 | 5P17 |
| 22 | .5 | 10 | 10 | .005 | .005 | .25 | 280 | 20PT10 | 3P11 |
| 24 | .5 | 10 | 10 | .005 | .005 | .25 | 280 | 24PT10 | 3P11 |
| 24 | .5 | 15 | 13 | .005 | .005 | .25 | 330 | 24PT15 | 5P12 |
| 24 | .5 | 30 | 23 | .05 | .05 | 1 | 590 | 24PT30 | 5P17 |
| 25 | .5 | 10 | 10 | .005 | .005 | .25 | 280 | 25PT10 | 3P11 |
| 26 | .5 | 10 | 10 | .005 | .005 | .25 | 280 | 26PT10 | 3P11 |
| 28 | .5 | 10 | 10 | .005 | .005 | .25 | 280 | 28PT10 | 3P11 |
| 28 | .5 | 14 | 12 | .005 | .005 | .25 | 330 | 28PT14 | 5P12 |
| 28 | .5 | 28 | 22 | .05 | .05 | 1 | 590 | 28PT28 | 5P17 |
| 30 | .5 | 10 | 10 | .005 | .005 | .25 | 330 | 30PT10 | 3P11 |
| 30 | .5 | 14 | 12 | .005 | .005 | .25 | 350 | 30PT14 | 5P12 |
| 32 | .5 | 5 | 5 | .005 | .005 | .25 | 230 | 32PT5 | 3P11 |
| 32 | .5 | 10 | 10 | .005 | .005 | .25 | 280 | 32PT10 | 5P12 |
| 34 | .5 | 5 | 5 | .005 | .005 | .25 | 230 | 34PT5 | 3P11 |
| 34 | .5 | 10 | 10 | .005 | .005 | .25 | 280 | 34PT10 | 5P12 |
| 35 | .5 | 5 | 5 | .005 | .005 | .25 | 230 | 35PT5 | 3P11 |
| 35 | .5 | 10 | 10 | .005 | .005 | .25 | 280 | 35PT10 | 5P12 |
| 36 | .5 | 5 | 5 | .005 | .005 | .25 | 230 | 36PT5 | 3P11 |
| 36 | .5 | 10 | 10 | .005 | .005 | .25 | 280 | 36PT10 | 5P12 |
| 38 | .5 | 5 | 5 | .005 | .005 | .25 | 280 | 38PT5 | 3P11 |
| 38 | .5 | 10 | 10 | .005 | .005 | .25 | 330 | 38PT10 | 5P12 |
| 40 | .5 | 5 | 5 | .005 | .005 | .25 | 280 | 40PT5 | 3P11 |
| 40 | .5 | 10 | 10 | .005 | .005 | .25 | 330 | 40PT10 | 5P12 |
| 45 | .5 | 5 | 5 | .005 | .005 | .25 | 280 | 45PT5 | 3P11 |
| 45 | .5 | 10 | 10 | .005 | .005 | .25 | 330 | 45PT10 | 5P12 |
| 48 | .5 | 5 | 5 | .005 | .005 | .25 | 280 | 48PT5 | 3P11 |
| 48 | .5 | 10 | 10 | .005 | .005 | .25 | 330 | 48PT10 | 5P12 |
| 48† | .5 | 15 | 12 | .005 | .005 | .25 | 590 | 48PT15 | 5P17 |
| 50 | .5 | 5 | 5 | .005 | .005 | .25 | 280 | 50PT5 | 3P11 |
| 50 | .5 | 10 | 10 | .005 | .005 | .25 | 330 | 50PT10 | 5P12 |
| 55† | .5 | 5 | 3.8 | .005 | .005 | .25 | 320 | 55PT5 | 3P11 |
| 55† | .5 | 8 | 6 | .005 | .005 | .25 | 375 | 55PT8 | 5P12 |
| 60† | .5 | 5 | 3.8 | .005 | .005 | .25 | 320 | 60PT5 | 3P11 |
| 60† | .5 | 8 | 6 | .005 | .005 | .25 | 375 | 60PT8 | 5P12 |
| 60† | .5 | 12 | 9 | .005 | .005 | .25 | 590 | 60PT12 | 5P17 |

*or 2 mv, whichever is greater.

### OPTIONS

**Overvoltage Protection:** An internally installed and preset overvoltage protector is available for all models. To order, add the prefix "V" to the model number and $25.00 to the price of models with an output current rating of 20 amps or less (at 40°C); add $75.00 to the price of higher current models.

**Front Panel Voltage Adjustment:** Standard models have a voltage adjustment located at the rear. A voltage control mounted on the front panel is available as an option. To order, add suffix "P" to the model number and $5.00 to price.

**Voltmeter:** Add suffix "F" to model number and $15.00 to price.

**Ammeter:** Add suffix "A" to model number and $15.00 to price.

**230 Volt Input:** Add suffix "-230" to model number and $10.00 to price.

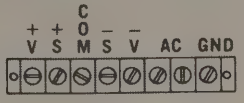
**Handles:** Add suffix "H" to model number and $10.00 to price.

**EXAMPLE:** The Model 5PT20 equipped with all options is designated as the Model V5PT20AFHP-230. (List suffix letters in alphabetical sequence.)

## DUAL OUTPUT

| Nominal Output Voltages | Adjust. Range ±V | Output Current Amps. 40°C | 55°C | Regulation Load ±% | Line ±% | Ripple mv RMS | Price | Model | Size |
|---|---|---|---|---|---|---|---|---|---|
| ±12 † | .5 | 7 | 5.6 | .1 | .1 | 1.5 | $370 | PD12-700 | 3P11 |
| ±12 † | .5 | 9 | 7.2 | .1 | .1 | 1.5 | 430 | PD12-900 | 5P12 |
| ±15 † | .5 | 7 | 5.6 | .1 | .1 | 1.5 | 370 | PD15-700 | 3P11 |
| ±15 † | .5 | 9 | 7.2 | .1 | .1 | 1.5 | 430 | PD15-900 | 5P12 |

### CONNECTIONS: Dual Output Models




### OPTIONS

**Overvoltage Protection:** An internally installed and preset overvoltage protector is available for all models. If either output fails, both outputs are "crowbarred." To order, add prefix "V" to the model number, and increase standard price by $30.00.

**Ammeters:** One for each output. Add suffix "A" to model number and $30.00 to price. "A" and "F" options cannot be combined in one power supply.

**Voltmeters:** One for each output. Add suffix "F" to model number and $30.00 to price. "A" and "F" options cannot be combined in one power supply.

†New model which was not U.L. recognized when this catalog was published.

**Voltmeter and Ammeter:** Each with switch for selecting output to be monitored. Add suffix "G" to model number and $60.00 to price.

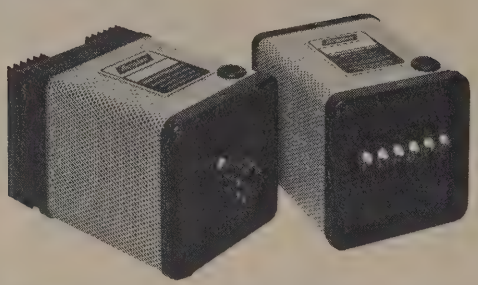
**Handles:** Add suffix "H" to model number and $10.00 to price.

**Front Panel Voltage Adjustment:** Standard models have a voltage adjustment located at the rear. A voltage control mounted on the front panel is available as an option. To order, add suffix "P" to the model number and $5.00 to price.

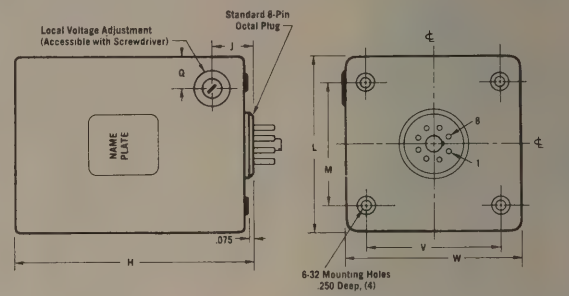
**230 Volt Input:** Add suffix "-230" to model number and $10.00 to price.

Acopian

# SINGLE OUTPUT REGULATED PLUG-IN



**An Acopian plug-in power module** can be installed in a matter of seconds. Simply plug it into an octal socket. You don't even have to screw it down (although threaded holes are provided) unless it is to be mounted in other than a vertical position, or will be subjected to shock or vibration.




| Size | L | W | H | M | V | J | Q | Approx. Weight |
|---|---|---|---|---|---|---|---|---|
| AS | 3.40 | 3.28 | 4.67 | 2.625 | 2.625 | 1.00 | 0.66 | 2lb 8oz |
| BS | 3.40 | 3.28 | 5.25 | 2.625 | 2.625 | 1.00 | 0.66 | 2lb 14oz |
| TS | 3.33 | 4.15 | 4.85 | 2.562 | 2.750 | 1.12 | 0.62 | 3lb 6oz |
| US | 3.33 | 4.15 | 5.43 | 2.562 | 2.750 | 1.12 | 0.62 | 3lb 8oz |
| WS | 3.40 | 5.02 | 5.43 | 2.562 | 3.562 | 1.12 | 0.62 | 4lb 14oz |
| HS | 3.40 | 5.02 | 6.57 | 2.562 | 3.562 | 1.12 | 0.62 | 5lb |

Standard models are available for any voltage from 1 to 200. For information on those not listed, contact factory.

## SPECIFICATIONS

**Input Voltage:** 105-125 VAC, 50-400 Hz, single phase.

**Polarity:** Output floating; either positive or negative terminal may be grounded or floated up to 300 V above ground.

**Ambient operating temperature:** −10 to +65°C. No derating required.

**MIL Tested/Increased Temperature Range:** Contact factory for specific information.

**Storage Temperature:** −55 to +85°C.

**Installation:** Plugs into standard octal socket. Mounting holes (6-32) provided at each corner for installation in any position.

### OPTIONS

**Solder Terminals:** All models can be furnished with solder terminals instead of the octal-type plug. To order, add suffix "L" to model number and $5.00 to price.

**Remote Output Adjustment:** All models have a local voltage adjustment. When provision for remote (external) adjustment is also desired, add prefix "E" to model number. No increase in price.

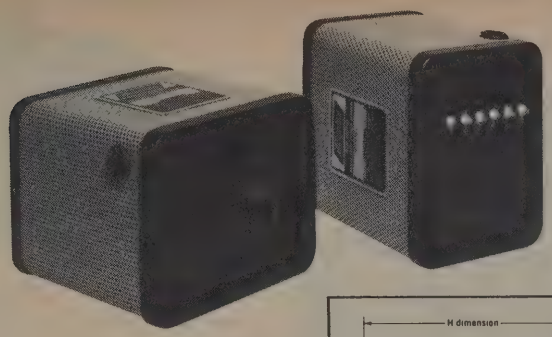
**Remote Sensing:** Provision for remote sensing of the output voltage to compensate for drops in the load lines can be furnished at an additional charge of $10.00 per unit. Add prefix "R" to model number when ordering. "R" power supplies have a local voltage adjustment and provision for remote (external) output adjustment.

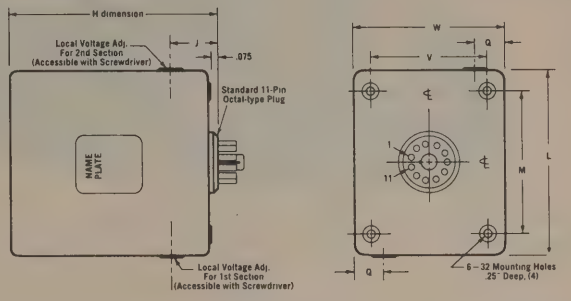
**230 Volt Input:** All models can be alternately furnished for operation on inputs of 210 to 250 VAC, 50-400 Hz. Add suffix "–230" to model number and $10.00 to price.

| Nominal Output Voltage | Adjustment ±Volts | Output Current Amps. | Regulation Load ±% | Regulation Line ±% | Ripple mv RMS | Price | Model | Size |
|---|---|---|---|---|---|---|---|---|
| 5 | 1 | .050 | .5 | .5 | 5 | $ 45 | 5L05 | AS |
| 5 | 1 | .100 | .5 | .5 | 5 | 50 | 5L10 | AS |
| 5 | 1 | .200 | .5 | .5 | 5 | 55 | 5L20 | AS |
| 5 | 1 | .200 | .2 | .05 | 1 | 65 | 5J20 | AS |
| 5 | 1 | .400 | .3 | .05 | 1 | 75 | 5J40 | AS |
| 5 | 1 | .750 | .4 | .05 | 1 | 80 | 5J75 | AS |
| 5 | .5 | 1.0 | .5 | .05 | 1 | 95 | 5J100 | AS |
| 5 | .5 | 1.5 | .4 | .05 | 1 | 115 | 5J150 | US |
| 5 | .5 | 2.0 | .5 | .05 | 1 | 145 | 5J200 | WS |
| 5 | .5 | 3.0 | .5 | .05 | 1 | 155 | 5J300 | WS |
| 5 | .5 | 4.0 | .5 | .05 | 1 | 165 | 5J400 | HS |
| 5 | .5 | 5.0 | .7 | .05 | 1 | 180 | 5J500 | HS |
| 12 | 1 | .100 | .5 | .5 | 5 | 45 | 12L10 | AS |
| 12 | 1 | .200 | .5 | .5 | 5 | 50 | 12L20 | AS |
| 12 | 1 | .200 | .05 | .05 | 0.5 | 60 | 12J20 | AS |
| 12 | 1 | .400 | .5 | .5 | 5 | 70 | 12L40 | AS |
| 12 | 1 | .400 | .1 | .05 | 1 | 75 | 12J40 | AS |
| 12 | 1 | .750 | .15 | .05 | 1 | 80 | 12J75 | AS |
| 12 | 1 | 1.0 | .1 | .05 | 1 | 95 | 12J100 | AS |
| 12 | .5 | 2.0 | .1 | .05 | 1 | 160 | 12J200 | WS |
| 12 | .5 | 3.0 | .25 | .05 | 1 | 170 | 12J300 | HS |
| 15 | 1 | .100 | .05 | .05 | 0.5 | 60 | 15J10 | AS |
| 15 | 1 | .200 | .05 | .05 | 0.5 | 65 | 15J20 | AS |
| 15 | 1 | .400 | .5 | .5 | 5 | 70 | 15L40 | AS |
| 15 | 1 | .400 | .1 | .05 | 1 | 75 | 15J40 | AS |
| 15 | 1 | .750 | .5 | .5 | 5 | 75 | 15L75 | AS |
| 15 | 1 | .750 | .15 | .05 | 1 | 80 | 15J75 | AS |
| 15 | 1 | 1.0 | .15 | .05 | 1 | 95 | 15J100 | AS |
| 15 | 1 | 1.5 | .2 | .05 | 1 | 135 | 15J150 | US |
| 15 | .5 | 2.0 | .1 | .05 | 1 | 160 | 15J200 | WS |
| 15 | .5 | 3.0 | .25 | .05 | 1 | 170 | 15J300 | HS |
| 24 | 1 | .100 | .05 | .05 | 0.5 | 60 | 24J10 | AS |
| 24 | 1 | .200 | .5 | .5 | 5 | 65 | 24L20 | AS |
| 24 | 1 | .200 | .05 | .05 | 0.5 | 70 | 24J20 | AS |
| 24 | 1 | .400 | .5 | .5 | 5 | 70 | 24L40 | AS |
| 24 | 1 | .400 | .05 | .05 | 1 | 75 | 24J40 | AS |
| 24 | 1 | .750 | .5 | .5 | 5 | 75 | 24L75 | AS |
| 24 | 1 | .750 | .1 | .05 | 1 | 85 | 24J75 | AS |
| 24 | 1 | 1.0 | .1 | .05 | 1 | 100 | 24J100 | US |
| 24 | 1 | 1.5 | .15 | .05 | 1 | 135 | 24J150 | WS |
| 24 | .5 | 2.0 | .1 | .05 | 1 | 160 | 24J200 | WS |
| 28 | 1 | .100 | .05 | .05 | 0.5 | 65 | 28J10 | AS |
| 28 | 1 | .200 | .5 | .5 | 5 | 65 | 28L20 | AS |
| 28 | 1 | .200 | .05 | .05 | 0.5 | 70 | 28J20 | AS |
| 28 | 1 | .400 | .5 | .5 | 5 | 70 | 28L40 | AS |
| 28 | 1 | .400 | .05 | .05 | 1 | 75 | 28J40 | AS |
| 28 | 1 | .750 | .1 | .05 | 1 | 95 | 28J75 | TS |
| 28 | 1 | 1.0 | .1 | .05 | 1 | 105 | 28J100 | US |
| 28 | 1 | 1.5 | .15 | .05 | 1 | 150 | 28J150 | WS |
| 28 | .5 | 2.0 | .1 | .05 | 1 | 175 | 28J200 | WS |

Acopian

# DUAL OUTPUT REGULATED PLUG-IN






| Size | L | W | H | M | V | J | Q | Approx. Weight |
|---|---|---|---|---|---|---|---|---|
| ADJ | 3.28 | 3.40 | 4.60 | 2.625 | 2.625 | 1.0 | .66 | 1lb 8oz |
| TDJ | 4.15 | 3.33 | 4.85 | 2.750 | 2.562 | 1.12 | .62 | 3lbs |
| UDJ | 4.15 | 3.33 | 5.43 | 2.750 | 2.562 | 1.12 | .62 | 3lbs |
| WDJ | 5.02 | 3.40 | 5.43 | 3.562 | 2.562 | 1.12 | .62 | 4lb 12oz |

**Space-saving Acopian duals** combine two electrically independent DC outputs in a single case. Either identical or different outputs may be selected. And with a choice of more than 300 output ratings, over 10,000 combinations can be supplied . . . each with Acopian's usual 3-day shipment guarantee.

## SPECIFICATIONS

**Input Voltage:** 105-125 VAC, 50-400 Hz, single phase.

**Output Adjustment Range:** ±1 volt.

**Polarity:** Outputs are floating. Each section may be independently connected to provide any combination of positive and negative outputs.

**Short Circuit Protection:** Delivers current surges without damage—to protect against prolonged overloads and shorts, use of an input fuse is recommended.

**Ambient operating temperature:** −10 to +65°C. No derating required.

**MIL Tested/Increased Temperature Range:** Contact factory for specific information.

**Storage Temperature:** −55 to +85°C.

## HOW TO ORDER

Select the two sections desired. The complete model number is the combination of the two sections selected. Example: The combination of section 6J20D and section 12L40D is Model 6J20D-12L40D. Always assign the lower voltage section first. Where the indicated case sizes for the two sections differ, the larger case size applies.

For pricing purposes, add the cost of the individual sections selected.

## OPTIONS

**Solder Terminals:** All models can be furnished with solder terminals instead of the 11-pin plug. To order, add suffix "L" to model number and $5.00 to price.

**Remote Output Adjustment:** All models have local voltage adjustments. When provision for remote (external) adjustments is also desired, add prefix "E" to model number.

**Remote Sensing:** Provision for remote sensing of the output voltages, to compensate for drops in the load lines, can be furnished at an additional charge of $20.00 per unit. Add prefix "R" to model number when ordering.

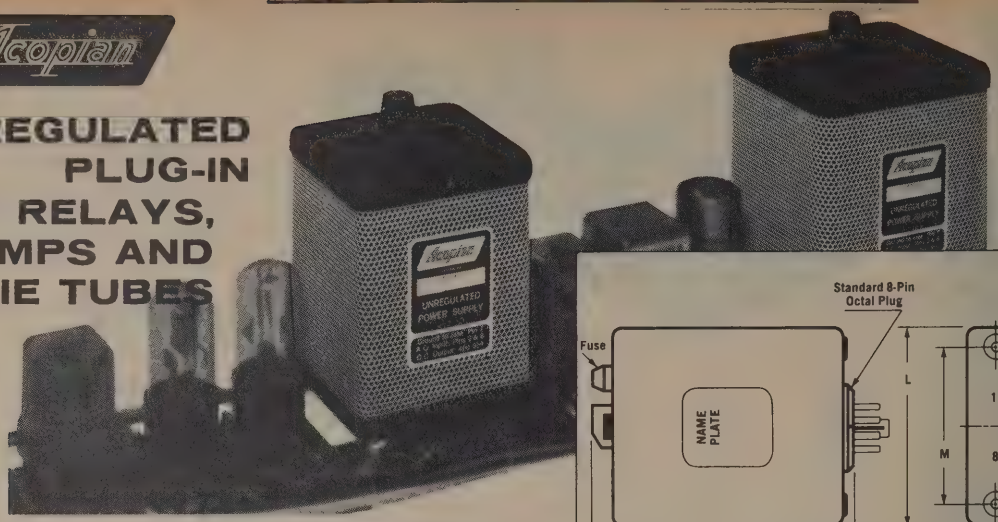
**230 Volt Input:** All models can be alternately furnished for operation on inputs of 210 to 250 VAC, 50-400 Hz. Add suffix "–230" to model number and $10.00 to price.

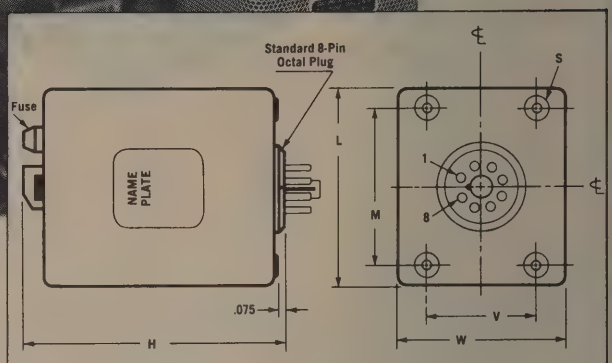
Standard models are available for any voltages from 1 to 150, and with current ratings to 1 amp. For information on those not listed, contact factory.

| Nominal Output Voltage | Output Current Amps. | Regulation Load ±% | Regulation Line ±% | Ripple mv RMS | Price per Section | Section (See "How to Order") | Size |
|---|---|---|---|---|---|---|---|
| 5 | .200 | .2 | .05 | 1 | $64 | 5J20D | TDJ |
| 5 | .400 | .3 | .05 | 1 | 67 | 5J40D | TDJ |
| 6 | .100 | .05 | .05 | 1 | 60 | 6J10D | ADJ |
| 6 | .200 | .5 | .5 | 5 | 55 | 6L20D | TDJ |
| 6 | .200 | .05 | .05 | 1 | 64 | 6J20D | TDJ |
| 6 | .400 | .5 | .5 | 5 | 64 | 6L40D | TDJ |
| 6 | .400 | .15 | .05 | 1 | 67 | 6J40D | TDJ |
| 10 | .100 | .05 | .05 | 1 | 55 | 10J10D | ADJ |
| 10 | .200 | .5 | .5 | 5 | 55 | 10L20D | TDJ |
| 10 | .200 | .05 | .05 | 1 | 60 | 10J20D | TDJ |
| 10 | .400 | .5 | .5 | 5 | 64 | 10L40D | TDJ |
| 10 | .400 | .1 | .05 | 1 | 67 | 10J40D | TDJ |
| 12 | .100 | .05 | .05 | 1 | 55 | 12J10D | ADJ |
| 12 | .200 | .5 | .5 | 5 | 55 | 12L20D | TDJ |
| 12 | .200 | .05 | .05 | 1 | 60 | 12J20D | TDJ |
| 12 | .400 | .5 | .5 | 5 | 64 | 12L40D | TDJ |
| 12 | .400 | .1 | .05 | 1 | 67 | 12J40D | TDJ |
| 15 | .060 | .02 | .02 | .25 | 44 | 15J06D | ADJ |
| 15 | .100 | .05 | .05 | 1 | 55 | 15J10D | ADJ |
| 15 | .200 | .5 | .5 | 5 | 55 | 15L20D | TDJ |
| 15 | .200 | .05 | .05 | 1 | 60 | 15J20D | TDJ |
| 15 | .400 | .5 | .5 | 5 | 64 | 15L40D | TDJ |
| 15 | .400 | .1 | .05 | 1 | 67 | 15J40D | TDJ |
| 18 | .100 | .5 | .5 | 5 | 55 | 18L10D | ADJ |
| 18 | .100 | .05 | .05 | 1 | 60 | 18J10D | ADJ |
| 18 | .200 | .5 | .5 | 5 | 60 | 18L20D | TDJ |
| 18 | .200 | .05 | .05 | 1 | 64 | 18J20D | TDJ |
| 18 | .400 | .5 | .5 | 5 | 64 | 18L40D | TDJ |
| 18 | .400 | .1 | .05 | 1 | 67 | 18J40D | TDJ |
| 24 | .100 | .05 | .05 | 1 | 60 | 24J10D | TDJ |
| 24 | .200 | .5 | .5 | 5 | 60 | 24L20D | TDJ |
| 24 | .200 | .05 | .05 | 1 | 64 | 24J20D | TDJ |
| 24 | .400 | .5 | .5 | 5 | 64 | 24L40D | TDJ |
| 24 | .400 | .1 | .05 | 1 | 67 | 24J40D | TDJ |
| 28 | .100 | .05 | .05 | 1 | 60 | 28J10D | TDJ |
| 28 | .200 | .5 | .5 | 5 | 60 | 28L20D | TDJ |
| 28 | .200 | .05 | .05 | 1 | 64 | 28J20D | TDJ |
| 28 | .400 | .5 | .5 | 5 | 64 | 28L40D | TDJ |
| 28 | .400 | .05 | .05 | 1 | 67 | 28J40D | TDJ |
| 30 | .100 | .05 | .05 | 1 | 60 | 30J10D | TDJ |
| 30 | .200 | .5 | .5 | 5 | 60 | 30L20D | TDJ |
| 30 | .200 | .05 | .05 | 1 | 64 | 30J20D | TDJ |
| 30 | .400 | .5 | .5 | 5 | 64 | 30L40D | TDJ |
| 30 | .400 | .05 | .05 | 1 | 67 | 30J40D | TDJ |

Acopian

# UNREGULATED PLUG-IN FOR RELAYS, LAMPS AND NIXIE TUBES






| Size | L | W | H | M | V | S | Approx. Weight |
|---|---|---|---|---|---|---|---|
| G | 3.40 | 3.28 | 5.0 | 2.625 | 2.625 | Four 6–32 x ¼" deep mounting holes | 2lb 8oz |
| K | 4.15 | 3.33 | 5.2 | 2.750 | 2.562 | Four 6–32 x ¼" deep mounting holes | 2lb 14oz |
| Q | 4.15 | 3.33 | 7.0 | 2.750 | 2.562 | Four 10–32 x ½" long mounting studs | 7lb |

**These low-cost, yet highly reliable** unregulated power supplies have been specially designed to power DC relays, lamps and NIXIE tubes. Each has husky silicon rectifiers and a fused input to insure long and trouble-free operation. Installation consists of simply plugging the unit into a standard octal socket.

## SPECIFICATIONS

**Input Voltage:** 0-125 VAC, 50-400 Hz, single phase.

**Output Voltage:**
**Output Current:**
**Ripple:**
} See table.

**Load Regulation:** Nominal voltage is based on 115 VAC input with approximately one-half load. At no load, the output voltage will increase by approximately 10%. At full load, the output voltage will be reduced by approximately 10%.

**Line Regulation:** Output voltage change due to input voltage change is directly proportional to the change in input.

**Polarity:** Output is floating; either positive or negative terminal may be grounded or floated up to 300 V above ground.

**Ambient Operating Temperature:** −10 to +65°C. No derating required.

**Storage Temperature:** −55 to 85°+.

**Installation:** Plugs into standard octal socket.

### OPTIONS

**Solder Terminals:** All models can be furnished with solder terminals instead of the octal plug. To order, add suffix "L" to model number and add $10.00 to price. Example: Model 24U100 becomes 24U100L.

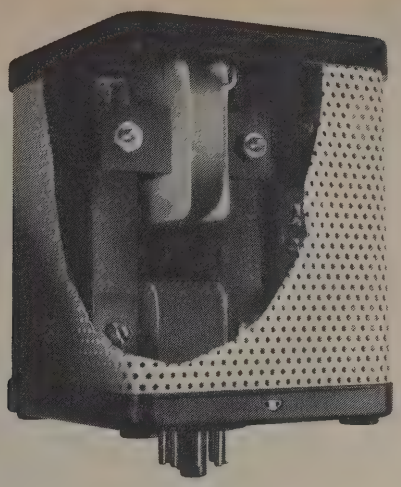
**230 Volt Input:** All models can be alternately furnished for operation on inputs of 210 to 250 VAC, 50-400 Hz. Add suffix "-230" to model number and $10.00 to price.

| Nominal Output Voltage | Output Current Amps. | Ripple Volts RMS | Model | Price | Size |
|---|---|---|---|---|---|
| 4 | .200 | .2 | 4U20 | $35 | G |
| 6 | .800 | .7 | 6U80 | 40 | G |
| 7 | 1.0 | .8 | 7U100 | 40 | G |
| 7 | 2.0 | 1.5 | 7U200 | 60 | Q |
| 8 | .400 | .4 | 8U40 | 35 | G |
| 9 | .600 | .6 | 9U60 | 35 | G |
| 9 | 1.0 | .7 | 9U100 | 40 | G |
| 13 | .600 | .5 | 13U60 | 35 | G |
| 13 | 2.5 | 1.8 | 13U250 | 65 | Q |
| 14 | 1.0 | .7 | 14U100 | 40 | G |
| 16 | 1.0 | .7 | 16U100 | 40 | G |
| 18 | 1.0 | .7 | 18U100 | 40 | G |
| 20 | 3.0 | 2.3 | 20U300 | 65 | Q |
| 22 | .400 | .7 | 22U40 | 40 | G |
| 24 | .600 | 1.1 | 24U60 | 35 | G |
| 24 | 1.0 | 1.7 | 24U100 | 35 | G |
| 24 | 3.0 | 2.2 | 24U300 | 65 | Q |
| 28 | 1.0 | 1.7 | 28U100 | 35 | G |
| 28 | 3.0 | 2.7 | 28U300 | 65 | Q |
| 30 | 1.0 | 1.6 | 30U100 | 45 | K |
| 30 | 2.0 | 1.5 | 30U200 | 65 | Q |
| 32 | .400 | .6 | 32U40 | 35 | G |
| 35 | 1.0 | 1.6 | 35U100 | 45 | K |
| 35 | 2.0 | 1.5 | 35U200 | 65 | Q |
| 40 | 1.0 | 1.6 | 40U100 | 45 | K |
| 40 | 2.0 | 1.5 | 40U200 | 65 | Q |
| 45 | 1.0 | 1.6 | 45U100 | 50 | K |
| 48 | .400 | .6 | 48U40 | 45 | G |
| 56 | .400 | .6 | 56U40 | 50 | G |
| 62 | .300 | 2.7 | 62U30 | 50 | K |
| 72 | .250 | .9 | 72U25 | 50 | G |
| 80 | .150 | .6 | 80U15 | 45 | G |
| 80 | .300 | 1 | 80U30 | 50 | K |
| 100 | .200 | 1 | 100U20 | 55 | K |
| 120 | .200 | 1 | 120U20 | 55 | K |
| 140 | .200 | 2 | 140U20 | 60 | K |
| 150 | .200 | 2 | 150U20 | 60 | K |
| 160 | .100 | 1.7 | 160U10 | 55 | G |
| *180 | .100 | 1.7 | 180U10 | 55 | G |
| *200 | .150 | 2 | 200U15 | 60 | K |
| 250 | .100 | 3 | 250U10 | 60 | K |
| 340 | .100 | 3 | 340U10 | 60 | K |
| 420 | .100 | 6.7 | 420U10 | 60 | K |
| 475 | .020 | 3.1 | 475U02 | 50 | G |
| 580 | .020 | 3.1 | 580U02 | 55 | G |
| 750 | .020 | 3.1 | 750U02 | 60 | G |
| 900 | .020 | 5 | 900U02 | 65 | G |

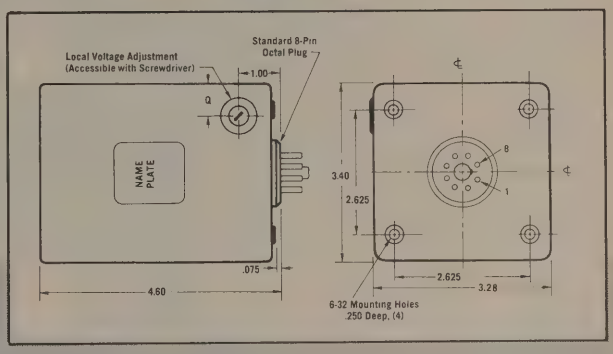
*Suitable for supplying input voltages to NIXIE tubes. NIXIE is a registered trademark of Burroughs Corporation.

Acopian

# HIGH ISOLATION REGULATED PLUG-IN



**For applications where high isolation** in a regulated power supply is required, such as in powering strain gage and other transducer bridge circuits, Acopian offers models with ratings from 5 to 36 volts and 0.050 to 0.200 amperes. All models feature input-output isolation of 10,000 megohms minimum to ground in parallel with 10 pF maximum. To install, simply plug into a standard octal socket. No other mounting is normally required, but threaded holes are provided in the base for fastening the module in other than a vertical position, or to secure it against shock or vibration. Both slot (narrow adjustment about a nominal voltage) and wide voltage adjustment models are available.




## SPECIFICATIONS

**Isolation:** 10,000 megohms to ground (min) in parallel with 10 pF (max).

**Leakage Current:** 10 uA max.

**Input-Output Coupling:** 1 pF max.

**Input Voltage:** 105-125 VAC, 50-60 Hz, single phase.

**Output Voltage:**
**Output Current:**
**Voltage Adjustment:**
**Ripple:**
} See table.

**Load Regulation:** ±0.05%

**Line Regulation:** ±0.05%

**Polarity:** Output floating; either positive or negative terminal may be grounded.

**Ambient Operating Temperature:** −20 to +71°C. No derating required.

**Storage Temperature:** −55 to +85°C.

**Installation:** Plugs into standard octal socket. Mounting holes (6-32) provided at each corner for installation in any position.

**Weight:** 1 lb 8 oz

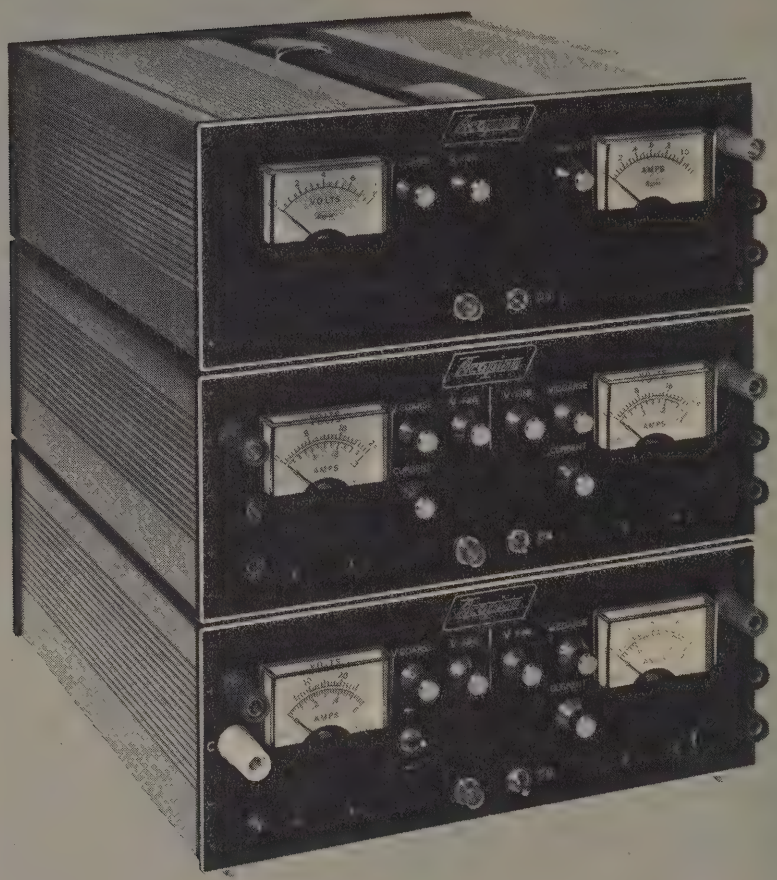
### OPTIONS

**Remote Output Adjustment:** All standard models are provided with local voltage adjustment. For remote (external) adjustment, add prefix "E" to model number. Example: Model 15X10 will be E15X10. No increase in price.

**Solder Terminals:** All Acopian plug-in power supplies are also available with solder terminals in place of an octal-type plug. To order, add suffix "L" to model number and $5.00 to price. Example: Model 12X20 becomes Model 12X20L.

| Nominal Output Voltage | Adjustment ± Volts | Output Current Amps. | Ripple μV RMS | Price | Model |
|---|---|---|---|---|---|
| 5 | 1 | .100 | 250 | $75 | 5X10 |
| 5 | 1 | .200 | 350 | 95 | 5X20 |
| 6 | 1 | .100 | 250 | 75 | 6X10 |
| 6 | 1 | .200 | 350 | 95 | 6X20 |
| 7 | 1 | .100 | 250 | 75 | 7X10 |
| 7 | 1 | .200 | 350 | 95 | 7X20 |
| 8 | 1 | .100 | 250 | 75 | 8X10 |
| 8 | 2 | .150 | 300 | 95 | 8X15 |
| 8 | 1 | .200 | 350 | 95 | 8X20 |
| 9 | 1 | .100 | 250 | 75 | 9X10 |
| 9 | 1 | .200 | 350 | 95 | 9X20 |
| 10 | 1 | .100 | 250 | 75 | 10X10 |
| 10 | 2 | .150 | 300 | 95 | 10X15 |
| 10 | 1 | .200 | 350 | 95 | 10X20 |
| 12 | 1 | .100 | 250 | 75 | 12X10 |
| 12 | 1 | .200 | 350 | 95 | 12X20 |
| 15 | 1 | .100 | 250 | 75 | 15X10 |
| 15 | 1 | .200 | 350 | 95 | 15X20 |
| 16 | 1 | .100 | 250 | 75 | 16X10 |
| 16 | 1 | .200 | 350 | 95 | 16X20 |
| 18 | 1 | .100 | 250 | 75 | 18X10 |
| 18 | 2 | .150 | 300 | 95 | 18X15 |
| 18 | 1 | .200 | 350 | 95 | 18X20 |
| 20 | 1 | .100 | 250 | 75 | 20X10 |
| 20 | 1 | .200 | 350 | 95 | 20X20 |
| 22 | 1 | .100 | 250 | 75 | 22X10 |
| 22 | 2 | .150 | 300 | 95 | 22X15 |
| 22 | 1 | .200 | 350 | 95 | 22X20 |
| 24 | 1 | .100 | 250 | 75 | 24X10 |
| 24 | 2 | .150 | 300 | 95 | 24X15 |
| 24 | 1 | .200 | 350 | 95 | 24X20 |
| 25 | 1 | .100 | 250 | 75 | 25X10 |
| 25 | 2 | .150 | 350 | 95 | 25X15 |
| 28 | 1 | .100 | 250 | 75 | 28X10 |
| 28 | 2 | .150 | 350 | 95 | 28X15 |
| 30 | 1 | .050 | 200 | 75 | 30X05 |
| 30 | 2 | .100 | 250 | 95 | 30X10 |
| 32 | 1 | .050 | 200 | 85 | 32X05 |
| 32 | 2 | .100 | 250 | 95 | 32X10 |
| 34 | 1 | .050 | 200 | 85 | 34X05 |
| 34 | 2 | .100 | 250 | 95 | 34X10 |
| 35 | 1 | .050 | 200 | 95 | 35X05 |
| 36 | 1 | .050 | 200 | 95 | 36X05 |

Acopian



# BENCHTOP POWER SUPPLIES

These benchtop power supplies provide all the performance and operating features necessary in a laboratory instrument. A wide choice of single and multiple output models offer optimum combinations of the operating features and output ratings that are most often needed.

They are also "human engineered" for convenience and ease of use. Two meters provide for the simultaneous monitoring of voltage and current on single output supplies, or a combination of two output voltages or currents on dual and triple output models. When more than one is required, they may be stacked to conserve bench space. Interlocking design prevents the upper units from slipping off.

Coarse and fine voltage controls permit setting outputs to a high degree of resolution, and adjustable current limiting prevents the load from drawing a higher current than intended. Many models provide constant voltage/constant current crossover, and may be used to deliver a regulated current to a varying impedance load. Some also include adjustable overvoltage protection.

The rugged casework is attractively finished in black and gold. "Five way" output binding posts and a retracting handle contribute to user convenience.

## SPECIFICATIONS

**Input Voltage:** 105-125 Vac, 50-400 Hz, single phase.

**Output Ratings:** See table.

**Regulation, Ripple (constant voltage operation):**
Line Regulation: ±0.01% or 2 mv, whichever is greater.
Load Regulation: ±0.01% or 2 mv, which is greater.
Ripple: 0.25 mv rms.
(Model KT7-20, ± 10-20 V outputs only: Line regulation, ±0.05%; load regulation, ±0.05%, ripple, 1.0 mv rms.)

**Regulation, Ripple (constant current operation):**
Line Regulation: 2.0 ma (Model K7S500, 6.0 ma).
Load Regulation: 10.0 ma.
Ripple: 1.0 ma rms (Model K7S500, 2.0 ma rms).

**Output Current Control:** Outputs marked ACL are short circuit and overload protected by means of a continuously adjustable rolloff type current limiting circuit.

Output marked CV/CC deliver a constant voltage with increasing load until the current limiting point (continuously adjustable) is reached, beyond which voltage decreases as required to maintain a constant current. In addition to providing short circuit and overload protection, this feature permits the supply to be used as a current regulated power source.

**Temperature Coefficient:** 0.015%/° C.

## SINGLE OUTPUT MODELS

| OUTPUT VOLTAGE RANGE | OUTPUT CURRENT, AMPS. | CURRENT CONTROL | PRICE | MODEL | CASE SIZE |
|---|---|---|---|---|---|
| 0-7 | 1.0 | ACL | $99 | K7S100 | K9 |
| 0-7 | 2.0 | CV/CC | 135 | K7S200 | K10 |
| 0-7 | 5.0 | CV/CC | 190 | K7S500 | K11 |
| 0-18 | 0.6 | ACL | 99 | K18S60 | K9 |
| 0-18 | 1.0 | CV/CC | 120 | K18S100 | K10 |
| 0-32 | 0.35 | ACL | 99 | K32S35 | K9 |
| 0-32 | 0.6 | CV/CC | 120 | K32S60 | K10 |
| 0-50 | 0.35 | CV/CC | 120 | K50S35 | K10 |

## DUAL OUTPUT MODELS

| OUTPUT VOLTAGE RANGES | CURRENT PER OUTPUT, AMPS. | CURRENT CONTROL | PRICE | MODEL | CASE SIZE |
|---|---|---|---|---|---|
| 0-20/0-20 | 0.25 | ACL | $139 | K20D25 | DK9 |
| 0-20/0-20 | 0.5 | ACL | 175 | K20D50 | DK10 |

## TRIPLE OUTPUT MODEL

| OUTPUT VOLTAGE RANGE | CURRENT PER OUTPUT, AMPS. | CURRENT CONTROL | PRICE | MODEL | CASE SIZE |
|---|---|---|---|---|---|
| 0-7<br>±10-20<br>(tracking) | 2.0<br>0.5 | CV/CC<br>Fixed | $235 | KT7-20 | TK10 |

**Stability:** Over an eight-hour period, following a 30 minute warmup.
Constant voltage operation: 0.1%.
Constant current operation: 15 ma.

**Temperature Range:**
Operating: 0 to +50° C.
Storage: −40 to +85° C.

**Protection:**
Input: Line fuse.
Overload: Adjustable electronic current limiting.
Overvoltage: "Crowbar" circuit, continuously adjustable down to 3 volts, protects load by effectively short circuiting output when "crowbar" trip point setting is exceeded. (Models K7S200, K7S500 and KT7-20 only.)

**Transient Response Time:** Less than 50 μsec, for a step change in input from 105 to 125 Vac, or in output current from no load to full rated output current.

**Output Impedance (constant voltage operation):**
Less than 0.03 ohms from dc to 1 kHz.
Less than 0.5 ohms from 1 kHz to 100 kHz.

**Meters:** Two, each accurate to 2% of full scale. On multiple output models, selector switches permit monitoring every output voltage and current.

**Controls:**
Power switch
Output voltage, coarse and fine adjustments
Output current limit
Overvoltage protection trip point (Models K7S200, K7S500 and KT7-20 only)
Meter switches (multiple output models only)

**Construction:** Gold-finished extruded aluminum top and sides. Bottom, perforated aluminum panel. Front and rear panels, molded black phenolic. Retracting handle. Input power cord, 3-wire UL approved. Output connections, "five way" binding posts.

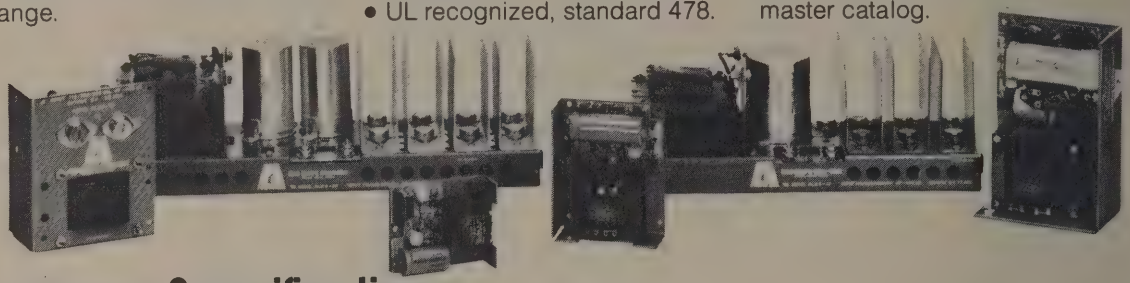
| Case Size | Dimensions (overall) H x W x D (inches) | Approx. Weight |
|---|---|---|
| K9<br>DK9 | 3.3 x 8.5 x 10.9 | 4 lb 1 oz<br>4 lb 6 oz |
| K10<br>DK10<br>TK10 | 3.3 x 8.5 x 11.3 | 5 lb<br>5 lb 6 oz<br>7 lb 6 oz |
| K11 | 3.3 x 8.5 x 12.2 | 7 lb 8 oz |

**Warranty:**
All Acopian products listed in this brochure are covered by a firm five year warranty which includes the cost of both parts and labor.

# Now the selection, availability, price, and performance you want in Open Frame Power Supplies

- Fifty-five models; single and dual outputs.
- Seven industry-standard sizes.
- In stock.
- Full performance over a wide 100-125 or 200-250 VAC input range.
- More power per package size.
- Full rated current with 50 Hz input.
- True remote sense capabilities.
- Fully adjustable current limit.
- Overload and shortcircuit protection.
- UL recognized, standard 478.

**More power conversion products:** Our Power House line includes a wide selection of encapsulated and ferroresonant power supplies as well as programmable solid state loads for testing. Write for our free master catalog.



## Common Specifications:

**AC Input:** 100-125 or 200-250 VAC, 47-440 Hz.
**Regulation** — Line or Load: 0.1%.
**Ripple and Noise:** 1.5 mV RMS, 5 mV P to P.
**Operating Temperature:** 0°-60°C.
**Transient Response:** 50 μsec.
**Cooling:** Convection.
**Stability:** ±0.2%.

## ALM Single Output Units:

### A Series — Price: $27

| Nominal Output Voltage | Current Rating @ 40°C. | Model No. |
|---|---|---|
| 2 | 1.5 | ALM 2-1.5 |
| 5 | 1.5 | ALM 5-1.5 |
| 6 | 1.3 | ALM 6-1.3 |
| 12 | 0.7 | ALM 12-0.7 |
| 15 | 0.7 | ALM 15-0.7 |
| 20 | 0.5 | ALM 20-0.5 |
| 24 | 0.5 | ALM 24-0.5 |

Overvoltage Protector — OVM-1 $8.00
Overall dimensions: 3.03 x 3.78 x 1.28.

### B Series — Price: $31

| Nominal Output Voltage | Current Rating @ 40°C. | Model No. |
|---|---|---|
| 2 | 4.0 | ALM 2-4.0 |
| 5 | 4.0 | ALM 5-4.0 |
| 6 | 3.3 | ALM 6-3.3 |
| 12 | 2.0 | ALM 12-2.0 |
| 15 | 1.7 | ALM 15-1.7 |
| 20 | 1.4 | ALM 20-1.4 |
| 24 | 1.3 | ALM 24-1.3 |

Overvoltage Protector — OVM-1 $8.00
Overall dimensions: 4.00 x 4.87 x 1.76

### C Series — Price: $54

| Nominal Output Voltage | Current Rating @ 40°C. | Model No. |
|---|---|---|
| 2 | 7.5 | ALM 2-7.5 |
| 5 | 7.5 | ALM 5-7.5 |
| 6 | 6.5 | ALM 6-6.5 |
| 12 | 4.0 | ALM 12-4.0 |
| 15 | 3.5 | ALM 15-3.5 |
| 20 | 3.2 | ALM 20-3.2 |
| 24 | 3.0 | ALM 24-3.0 |

Overvoltage Protector — OVM-1 $8.00
Overall dimensions: 4.87 x 5.62 x 2.50

### D Series — Price: $72

| Nominal Output Voltage | Current Rating @ 40°C. | Model No. |
|---|---|---|
| 2 | 11.0 | ALM 2-11 |
| 5 | 11.0 | ALM 5-11 |
| 6 | 10.0 | ALM 6-10 |
| 12 | 6.0 | ALM 12-6 |
| 15 | 5.0 | ALM 15-5 |
| 20 | 4.0 | ALM 20-4 |
| 24 | 3.8 | ALM 24-3.8 |

Overvoltage Protector — OVM-2 $16.00
Overall dimensions: 4.90 x 7.03 x 2.78

### E Series — Price: $88

| Nominal Output Voltage | Current Rating @ 40°C. | Model No. |
|---|---|---|
| 2 | 15.0 | ALM 2-15.0 |
| 5 | 15.0 | ALM 5-15.0 |
| 6 | 12.5 | ALM 6-12.5 |
| 12 | 8.8 | ALM 12-8.8 |
| 15 | 8.0 | ALM 15-8.0 |
| 20 | 7.0 | ALM 20-7.0 |
| 24 | 6.5 | ALM 24-6.5 |

Overvoltage Protector — OVM-2 $16.00
Overall dimensions: 4.87 x 9.00 x 2.75

### F Series — Price: $106

| Nominal Output Voltage | Current Rating @ 40°C. | Model No. |
|---|---|---|
| 2 | 20.0 | ALM 2-20.0 |
| 5 | 20.0 | ALM 5-20.0 |
| 6 | 17.0 | ALM 6-17.0 |
| 12 | 13.0 | ALM 12-13.0 |
| 15 | 10.7 | ALM 15-10.7 |
| 20 | 9.0 | ALM 20-9.0 |
| 24 | 8.2 | ALM 24-8.2 |

Overvoltage Protector — OVM-2 $16.00
Overall dimensions: 4.88 x 4.88 x 13.75

### G Series — Price: $128

| Nominal Output Voltage | Current Rating @ 40°C. | Model No. |
|---|---|---|
| 2 | 25.0 | ALM 2-25.0 |
| 5 | 25.0 | ALM 5-25.0 |
| 6 | 23.0 | ALM 6-23.0 |
| 12 | 16.0 | ALM 12-16.0 |
| 15 | 14.0 | ALM 15-14.0 |
| 20 | 11.5 | ALM 20-11.5 |
| 24 | 10.5 | ALM 24-10.5 |

Overvoltage Protector — OVM-2 $16.00
Overall dimensions: 4.88 x 4.88 x 16.75

## ALM Dual Output Units:

| Adjust Range | Current Rating @ 40°C. | Model No. | Series | Price |
|---|---|---|---|---|
| 12-15 | 0.55 | ALM 15D-0.55 | B | $ 45.00 |
| 12-15 | 1.10 | ALM 15D-1.1 | C | 55.00 |
| 12-15 | 2.20 | ALM 15D-2.2 | D | 68.00 |
| 12-15 | 3.30 | ALM 15D-3.3 | E | 91.00 |
| 12-15 | 4.40 | ALM 15D-4.4 | F | 114.00 |
| 12-15 | 8.00 | ALM 15D-8.0 | G | 136.00 |

Overvoltage Protector — Two OVM-1 $8.00 Each.

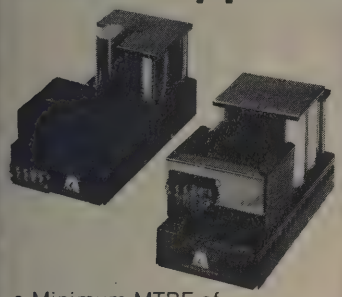
POWER HOUSE

Phone (716) 968-2400 TELEX 91-6451 TWX 510-245-2700

**Acme Electric Corporation**
Cuba, N.Y. 14727

Now the simplicity, efficiency, and economy you want in

# Ferroresonant Power Supplies.



- Minimum MTBF of 150,000 hours.
- Inherent overcurrent, shortcircuit, and overvoltage protection.
- High efficiency rating of 70 to 90%.
- Ideally suited for series or parallel banking to fulfill bulk power demands.
- UL listed; 100% tested.
- Inexpensive to buy, simple and economical to operate.
- Common specifications: Regulation: ± 2%; Ripple: 1% RMS; AC Input: 100-130 VAC, 60Hz.

## Model Specifications

| Model No. | Current @ 50°C. | Unit Price* |
|---|---|---|
| **12 Volt Models** | | |
| AFR 12-10 | 10 A | $140.00 |
| AFR 12-15 | 15 A | 170.00 |
| **24 Volt Models** | | |
| AFR 24-6.5 | 6.5 A | $155.00 |
| AFR 24-10 | 10 A | 175.00 |
| AFR 24-15 | 15 A | 230.00 |
| AFR 24-25 | 25 A | 290.00 |
| **28 Volt Models** | | |
| AFR 28-8 | 8 A | $175.00 |
| AFR 28-15 | 15 A | 230.00 |
| AFR 28-25 | 25 A | 290.00 |
| **48 Volt Models** | | |
| AFR 48-10 | 10 A | $265.00 |
| AFR 48-20 | 20 A | 340.00 |

*OEM prices available

Send for our master catalog, which includes open frame and encapsulated power supplies and unique solid state programmable loads.

POWER HOUSE

Phone (716) 968-2400 / Telex 91-6451
TWX 510-245-2700

**Acme Electric Corporation**
Cuba, N.Y. 14727

Now an easy, precise, convenient way to load and test DC power supplies and regulators.

# Programmable Solid State Loads

- Designed to fulfill a wide range of DC test applications requiring constant current, constant resistance, or both.
- Provides 0.02 ohm to 2K ohm adjustment in constant resistance mode.
- In the constant current mode, the PS²L may be used to load test DC regulators and power supplies, or act as a constant current discharge to battery and capacitor banks.
- Programmable with any number of waveforms for calculating or verifying power supply specifications, such as load regulation, transient response and output impedance.
- May be used with a DC power source to make an adjustable constant - current supply.
- Available in 500 and 1000 watt models.
- Bench top/rack mount adaptable.

## Performance Characteristics

| | PS²L-500 | PS²L-1000 |
|---|---|---|
| Maximum Loading Power @ 25°C | 500 Watts | 1000 Watts |
| Maximum Loading Voltage | 60 VDC | 60 VDC |
| Maximum Loading Current | 55 ADC | 110 ADC |
| Minimum Loading Voltage | 2 VDC | 2 VDC |
| Constant Resistance Range (Typ.) | .036Ω-2000Ω | .018Ω-2000Ω |
| Program Input Impedance (Typ.) | 50 K | 50 K |
| Programming Input Volt (Typ.) | .5V/10 Amp load | 1V/10 Amp load |
| Current Monitor Output (Typ.) | -100mV/Amp load | -50mV/Amp load |
| Square Wave Response (Typ.) | 80 μsec for 50 Amp step | 120 μsec for 100 Amp step |
| Regulation (constant current, constant resistance) | 1% | 1% |
| Overvoltage Crowbar Point (adjustable) | 70-78 VDC | 70-78 VDC |
| Operating Ambient | 0°-55°C. | 0°-55°C. |
| Input Voltage Requirements | 115/230VAC±10% | 115/230VAC±10% |
| Input Frequency Range | 47-63 Hz | 47-63 Hz |
| Maximum Input Current | 1 Amp | 1 Amp |
| Price | $630 | $725 |

Write for our master catalog, which includes open frame, encapsulated, and ferroresonant power supplies.

POWER HOUSE

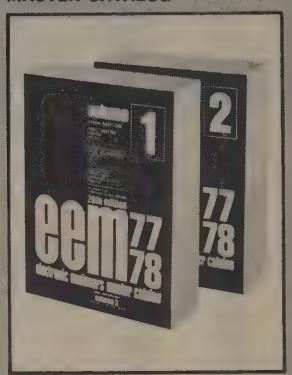
Phone (716) 968-2400 TELEX 91-6451 TWX 510-245-2700

**Acme Electric Corporation**
Cuba, N.Y. 14727

# WE KNOW OUR STUFF

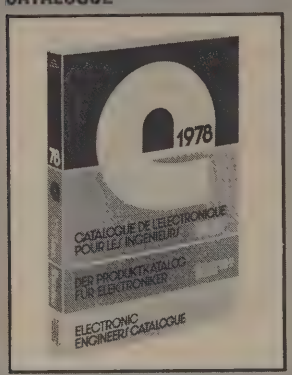
## 41 YEARS OF EXPERIENCE IN CATALOGING, 21 EDITIONS OF eem

### eem/ELECTRONIC ENGINEERS MASTER CATALOG —



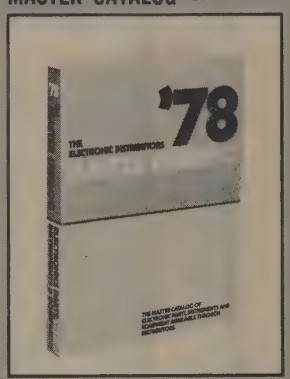

The "blue-ribbon" catalog/directory that has become "the standard of the industry" for electronic engineers, buyers and specifiers.

### ELECTRONIC ENGINEERS CATALOGUE



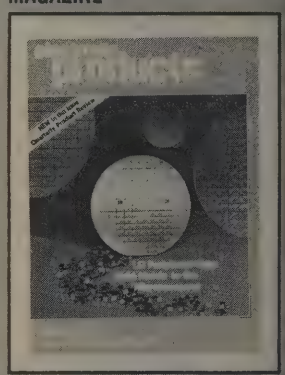

The new catalogue/directory of electronic products available to and from Western Europe and the United Kingdom. Designed especially for the European electronics engineer.

### ELECTRONIC DISTRIBUTORS MASTER CATALOG —



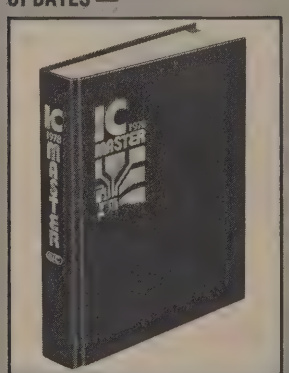

The only national catalog designed exclusively for distributors and their customers featuring electronic parts, instruments and equipment.

### ELECTRONIC PRODUCTS MAGAZINE —



The products magazine . . . A 100% product-oriented magazine including hundreds of new products and special features every month.

### IC MASTER AND THE UPDATES —




The only complete single-source directory including all IC devices manufactured in the United States. Updated three times yearly with accumulative supplements.

### eem FILE SYSTEM —

The only filing system designed especially for the electronics engineer. Instant retrieval and organization of data sheets and catalogs.

### UTP CUSTOM CATALOGS —

The Cadillac of individualized catalogs for the electronic parts distributor, featuring solely his lines and services.

### UNITED COST AND PRICING SERVICES —

The electronic distributors' proven method of being up to the minute on his cost and selling prices.

*United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Ave., Garden City, N.Y. 11530 / (516) 222-2500 TWX 510-222-1673*

# High Voltage Power Supplies and Modules

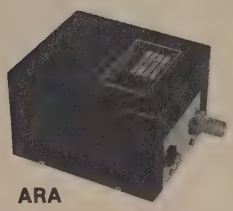
**Telephone: (213) 997-7222**

**Advanced High Voltage Company makes many other types of High Voltage Supplies. Telephone for complete catalog and application assistance.**

| $E_{OUT}$ Nom. kV | $I_{OUT}$ Max. mA | Model No. | Features, Specifications and Options |
|---|---|---|---|
| 200V | 15.0 | DRF 325 | Miniature, fully regulated DC to DC converter with 0.05% line and load regulation. Has remote programming capability. 3 watts output. Shielded, RFI decoupled. **Input:** 28 VDC. **Output Adjustment Range:** -30% to +10%. **Ripple:** 0.1% P-P. **TC:** 100 ppm. **Operating Temperature:** -10°C to +65°C. **Dimensions:** 3.0″ x 1.5″ x 0.6″. (Flange length is 3.625″.) **Weight:** 4 oz. **Options:** Negative output (-01), remote program (-05). |
| 400V | 7.5 | DRF 335 | |
| 600V | 5.0 | DRF 345 | |
| 800V | 3.7 | DRF 355 | |
| 1.1 | 3.0 | DRF 365 | |
| 1.5 | 2.0 | DRF 375 | |
| 2.0 | 1.5 | DRF 385 | |
| 200V | 30.0 | ARM 016 | Line operated, 6 watt supply for photomultiplier and similar applications. Units are shielded, serviceable, short circuit proof and light weight. Input and output are RFI decoupled. Standard adjustment range is -30% to +10%. Series has wide range of options. **Input:** 117 VAC, 50 to 400 Hz. **Regulation (L/L):** 0.02%, (better with less than 0 to full load changes). **Ripple and Noise:** 0.02% **Operating Tempreature:** -10°C to +65°C. **Size:** 3.04″ x 2.60″ x 4.23″. **Weight** 32 oz. **Options:** Negative output (-01), wide adjustment range (-04), remote program (-05). |
| 400V | 15.0 | ARM 026 | |
| 600V | 10.0 | ARM 036 | |
| 800V | 7.5 | ARM 046 | |
| 1.0 | 6.0 | ARM 056 | |
| 1.2 | 5.0 | ARM 066 | |
| 1.5 | 4.0 | ARM 076 | |
| 1.8 | 3.3 | ARM 086 | |
| 2.2 | 2.7 | ARM 096 | |
| 3.0 | 5.0 | ARA 106 | Line operated, 15 watt High Voltage Module. Adjustable and/or programmable to zero. Fully serviceable, short circuit proof and shielded. Standard adjustment range is -30% to +10%. **Input:** 117 VAC, 50 to 400 Hz. **Regulation (L/L):** 0.1%. **Ripple:** 0.1% P-P. **TC:** 100 ppm. **Operating Temperature:** -10°C to +65°C. **Dimensions:** 4.66″ x 3.98″ x 3.0″. **Weight:** 3.5 lbs. **Options:** 0 to 110% voltage adjustment (-03), remote program (-05), negative output (-01), lower ripple figure (-09). Other options. |
| 4.0 | 4.0 | ARA 116 | |
| 5.0 | 3.0 | ARA 126 | |
| 8.0 | 2.0 | ARA 146 | |
| 10 | 1.5 | ARA 156 | |
| 12 | 1.3 | ARA 166 | |
| 15 | 1.0 | ARA 176 | |
| 18 | 0.8 | ARA 186 | |
| 22 | 0.7 | ARA 196 | |
| 800V | 18.0 | DRM 105 | Fully regulated High Voltage Module. 15 watts output. All solid state silicon. Output adjustment +10%, -30%. Short-circuit proof. HV return may be floated to 500 volts from chassis. Magnetically shielded. Serviceable. **Input:** 28 VDC. **Regulation (L/L):** 0.1%. **Ripple:** 0.1% P-P. **TC:** 100 ppm. **Operating Temperature:** -20°C to +65°C. **Options:** Negative output (-01), wider adjustment range (-04), remote program (-05), wider operating temperature range (-16), 30 watts output power (-19), 15 volts input (-33). **Size:** 2.34 x 2.7 x 3.77 (to 5 KV), 3.04 x 3.54 x 4.84 (over 5 KV). Other options. |
| 1.0 | 15.0 | DRM 115 | |
| 1.5 | 10.0 | DRM 125 | |
| 2.5 | 6.0 | DRM 135 | |
| 3.5 | 4.0 | DRM 145 | |
| 5.0 | 3.0 | DRM 155 | |
| 7.5 | 2.0 | DRM 165 | |
| 10 | 1.5 | DRM 175 | |
| 12.5 | 1.2 | DRM 185 | |
| 15 | 1.0 | DRM 195 | |
| 18 | 0.8 | DRM 205 | |
| 22 | 0.6 | DRM 215 | |
| 800V | 18.0 | DUM 044 | 28 VDC operated High Voltage Modules similar to DRM series above, except HV output is not in the regulation loop. This allows floating HV option with only 30 to 40 pf capacitance to input. More economical than DRM series where the higher internal impedance can be tolerated. Input regulation, ripple and other data per DRM series. Also available as filament supplies, 2.2 volts and up. |
| 1.0 | 15.0 | DUM 054 | |
| 1.5 | 10.0 | DUM 064 | |
| 2.5 | 6.0 | DUM 074 | |
| 3.5 | 4.0 | DUM 084 | |
| 5.0 | 3.0 | DUM 094 | |
| 7.5 | 2.0 | DUM 104 | |
| 10 | 1.5 | DUM 114 | |
| 12.5 | 1.2 | DUM 124 | |
| 15 | 1.0 | DUM 134 | |
| 18 | 0.8 | DUM 144 | |
| 1.5 | 53 | NRL 612 | Medium power DC to DC High Voltage Converter, 80 watts (240 watts option). **Input:** 24 to 32 VDC, **Outputs** to 18 KV. Adjustable constant voltage/constant current operation. Units can be paralleled for higher power. Remote program of voltage and current. **Standard Adjustment Range:** +10%, -30% of rated output voltage. Efficiency better than 70%. Optional buffered metering outputs, voltage and current. **Operating Temperature:** -20°C to +65°C. **Ripple:** 0.1% P-P. **Regulation (L/L):** 0.1%. **Size:** 4.75 x 4.75 x 5.0 inches. **Weight:** approx. 6 lbs. |
| 2 | 40 | NRL 622 | |
| 2.5 | 32 | NRL 632 | |
| 3.5 | 22 | NRL 642 | |
| 5 | 16 | NRL 652 | |
| 8 | 10 | NRL 662 | |
| 10 | 8 | NRL 672 | |
| 15 | 5.3 | NRL 682 | |

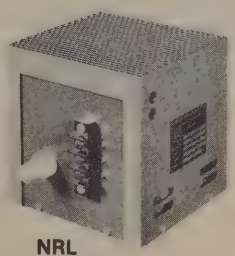
DRF

ARM



ARA

DRM/DUM



NRL

| $E_{OUT}$ Nom. kV | $I_{OUT}$ Max. mA | Model No. | DC Output Impedance Megohms | Case Width | Case Depth | Case Height | Terminal Height | Approx. Weight Pounds |
|---|---|---|---|---|---|---|---|---|
| | | | | Inches | | | | |
| 1.0 | 1.5 | AUC 017 | 0.90 | 3.75 | 1.75 | 3.38 | 0.38 | 1 |
| 1.0 | 5.0 | AUC 015 | 0.65 | 3.75 | 2.25 | 3.38 | 0.38 | 1 |
| 1.0 | 10.0 | AUC 011 | 0.04 | 3.75 | 2.25 | 3.38 | 0.38 | 2 |
| 2.0 | 1.5 | AUC 027 | 0.13 | 3.75 | 1.75 | 3.38 | 0.38 | 1 |
| 2.0 | 5.0 | AUC 025 | 1.10 | 3.75 | 2.25 | 3.38 | 0.38 | 2 |
| 2.5 | 10.0 | AUC 031 | 0.08 | 3.75 | 2.25 | 3.75 | 0.63 | 3 |
| 5.0 | 1.5 | AUC 037 | 0.40 | 3.75 | 2.25 | 3.38 | 0.56 | 2 |
| 5.0 | 5.0 | AUC 035 | 0.25 | 3.75 | 2.25 | 3.75 | 0.63 | 3 |
| 5.0 | 10.0 | AUC 041 | 0.13 | 3.75 | 4.56 | 5.88 | 1.06 | 11 |
| 10 | 1.5 | AUC 047 | 1.50 | 3.75 | 3.19 | 4.50 | 1.06 | 4 |
| 10 | 5.0 | AUC 045 | 0.50 | 3.75 | 4.56 | 5.88 | 1.06 | 8 |
| 10 | 10.0 | AUC 051 | 0.26 | 3.75 | 4.56 | 8.00 | 1.06 | 12 |
| 15 | 1.5 | AUC 057 | 1.60 | 3.75 | 3.19 | 5.50 | 1.69 | 5 |
| 15 | 5.0 | AUC 055 | 0.50 | 3.75 | 4.56 | 6.13 | 1.69 | 11 |
| 15 | 10.0 | AUC 061 | 0.28 | 4.69 | 6.00 | 8.50 | 1.69 | 20 |
| 20 | 1.5 | AUC 067 | 1.70 | 3.75 | 4.56 | 5.88 | 2.25 | 9 |
| 20 | 5.0 | AUC 065 | 0.86 | 3.75 | 4.56 | 8.00 | 2.25 | 12 |
| 25 | 10.0 | AUC 071 | 0.30 | 5.63 | 7.38 | 12.13 | 3.25 | 45 |
| 30 | 1.5 | AUC 077 | 2.00 | 3.75 | 4.56 | 7.50 | 3.25 | 11 |
| 30 | 5.0 | AUC 075 | 1.00 | 4.69 | 6.00 | 8.50 | 3.25 | 22 |
| 37.5 | 10.0 | AUC 081 | 1.30 | 11.13 | 14.63 | 16.25 | 4.31 | 124 |
| 50 | 1.5 | AUC 087 | 5.00 | 4.69 | 6.00 | 8.50 | 4.31 | 18 |
| 50 | 5.0 | AUC 085 | 1.20 | 5.63 | 7.38 | 12.13 | 4.31 | 40 |

## AUC SERIES

Economy High Voltage Module. Output adjustable by varying input voltage. Hermetically sealed. Shielded. **Input:** 117 VAC nom., 50 to 400 Hz. **Ripple at F/L:** 1% rms. **Operating Temperature:** 0 to +85° C.

ADVANCED HIGH VOLTAGE CO., INC.
14532 ARMINTA AVE. • VAN NUYS, CALIF. 91402 • PHONE: (213) 997-7222

# THE SWITCHERS

SINGLE OUTPUT | DUAL OUTPUT | TRIPLE OR QUAD OUTPUT

High efficiency over extreme input line voltage variation makes Almond Switchers ideal for new system designs or existing system update.

Ruggedized, modular construction provides a reliable power source for single or multiple DC output voltages.

375 or 750 watts output over −10°C to +60°C without derating.

Output regulation <.25% − output ripple and noise (PARD) < 1%.

All protective circuitry standard (i.e. soft start, current limit, OVP, thermal).

56 Standard Models available providing standard voltage combinations of 5, 12, 15, 18, 24-and 28 VDC at currents from 2 to 70 amperes. Special output requirements can be assembled from standard modules.

High reliability with over 40,000 hour MTBF.

Delivery:
Off the shelf to 30 days.

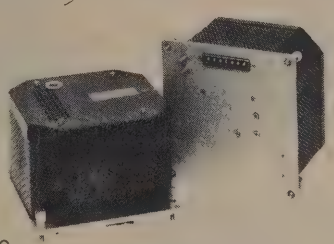
**CONTACT THE FACTORY OR YOUR ALMOND REPRESENTATIVE FOR DETAILED SPECIFICATIONS OR SPECIAL REQUIREMENTS. ASK FOR CATALOG AN1577.**

# FROM ALMOND

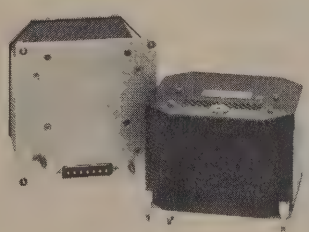
## MILITARY QUALIFIED POWER SUPPLIES

Over the past eight years, AIC has designed, developed and produced over 5,000 military-qualified power supplies for over 50 major programs. These power supplies are fully qualified to the following military specifications: MIL-E-16400, MIL-S-901, MIL-E-5400 and MIL-STD-461. Programs include U.S. Navy S3A; U.S. Navy DD963; U.S. Navy military retrofit programs; various U.S. Navy navigation systems; U.S. Air Force fighter aircraft; and aircraft computer power supplies. A few examples are shown below.

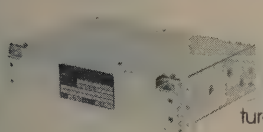
**LOW OUTPUT NOISE**
**P/N 2-11075**



Shipboard qualified to MIL-E-16400. Features 115V, 30, 400 Hz input ±15V at 3.2A output. Line/load regulation 0.01%. Output noise less than 10 microvolts narrow band noise from 100 Hz to 50 KHz.

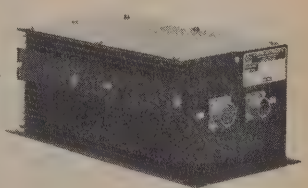


**P/N 2-10701**
Shipboard qualified to MIL-E-16400. Features 115V, 30, 400 Hz input, 5V at 25A output. Line/load regulation 0.5%. Ripple 25 mv p-p. Efficiency 47%.

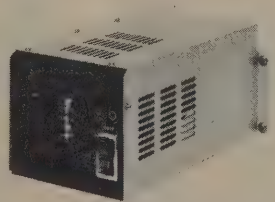


**P/N 2-11470**
Aircraft computer multiple output power supply qualified to MIL-E-5400. Input 28 ±4V. Features 4 separate regulated outputs and 2 watts/cu. in.

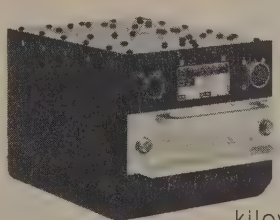
**P/N 2-10568D**
Shipboard qualified. Features low magnetic radiated noise. Input voltage 115/230, output 28V, 12A. Ripple 20 mv p-p.



**P/N 2-11020**



Shipboard qualified multiple input, multiple output. Features 115/230/28 Vdc input with 4 separate regulated DC outputs, output power 100 watts. This power supply contains internal battery charger and power on clear and power fail logic interface.

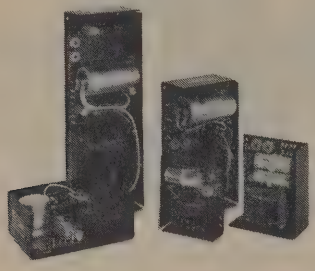


**P/N 2-11290**
480V input, 60 Hz, 30. Features low power line harmonic distortion reflected onto the power line due to rectification. This unit delivers up to 1 kilowatt of DC power and reflects less than 4% harmonic distortion onto the input power line.

**ALMOND**
**INSTRUMENTS COMPANY, INC.**
1330 EAST CYPRESS STREET
COVINA, CALIFORNIA 91724
PHONE (213) 967-9521
OR TWX 910-584-1320

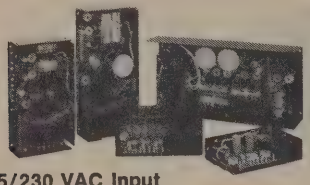
ALPHA POWER
DC POWER SUPPLIES DEPT. EM, 20536 PLUMMER ST, CHATSWORTH, CALIFORNIA 91311 (213) 998-9873

## SINGLE OUTPUT OEM III
### MODELS 3B, C, CC, D, DD



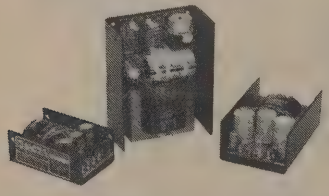
- 115/230 VAC Input
- OVP Built-in
- Industry Standard Case Sizes
- Foldback Current Limit
- 0.15% Regulation
- Remote Sense

## MULTIPLE OUTPUT OEM III
### MODELS 2BB, CC, D, P, Q, 3K, 3L



- 115/230 VAC Input
- OVP Built-in
- Foldback Current Limit
- 0.15% Regulation
- Remote Sense on 3K, L, and 5V Outputs
- Molex Output Connectors on 2P and 2Q Models

## MICRO-REG LOW POWER
### MODELS 1A, B, C



- Smallest, Lowest Priced Open Frame Available
- Fixed Voltage Monolythic Regulators Dramatically Increase Reliability
- OVP Built-in as Indicated

## SINGLE OUTPUT POWER SUPPLIES

| Voltage | Current | Model | Price 1-9 |
|---|---|---|---|
| 5 Volts | 0.5A | 1A5 | $18.95 |
| | 1.1A | 1B5 | 22.95 |
| | 2.2A | 1C5 | 26.95 |
| | 3.0A | 3B5 | 31.00 |
| | 6.0A | 3C5 | 51.00 |
| | 9.0A | 3CC5 | 63.00 |
| | 12.0A | 3D5 | 80.00 |
| | 18.0A | 3DD5 | 101.00 |
| 6 Volts | 2.0A | 1C6 | 26.95 |
| | 2.6A | 3B6 | 31.00 |
| | 5.0A | 3C6 | 51.00 |
| | 8.0A | 3CC6 | 63.00 |
| | 10.0A | 3D6 | 80.00 |
| | 15.5A | 3DD6 | 101.00 |
| 12 Volts | 0.25A | 1A12 | 18.95 |
| | 0.6A | 1B12 | 22.95 |
| | 1.2A | 1C12 | 26.95 |
| | 1.7A | 3B12 | 31.00 |
| | 3.4A | 3C12 | 51.00 |
| | 5.1A | 3CC12 | 63.00 |
| | 7.0A | 3D12 | 80.00 |
| | 10.0A | 3DD12 | 101.00 |

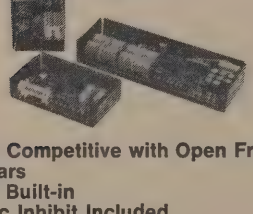
| Voltage | Current | Model | Price 1-9 |
|---|---|---|---|
| 15 Volts | 0.2A | 1A15 | $18.95 |
| | 0.5A | 1B15 | 22.95 |
| | 1.0A | 1C15 | 26.95 |
| | 1.5A | 3B15 | 31.00 |
| | 3.0A | 3C15 | 51.00 |
| | 4.5A | 3CC15 | 63.00 |
| | 6.0A | 3D15 | 80.00 |
| | 9.0A | 3DD15 | 101.00 |
| 20 Volts | 0.75A | 1C20 | 26.95 |
| | 1.3A | 3B20 | 31.00 |
| | 2.6A | 3C20 | 51.00 |
| | 3.9A | 3CC20 | 63.00 |
| | 5.2A | 3D20 | 80.00 |
| | 8.0A | 3DD20 | 101.00 |
| 24 Volts | 0.5A | 1C24 | 26.95 |
| | 1.2A | 3B24 | 31.00 |
| | 2.4A | 3C24 | 51.00 |
| | 3.6A | 3CC24 | 63.00 |
| | 4.8A | 3D24 | 80.00 |
| | 7.0A | 3DD24 | 101.00 |

Shading indicates output includes OVP

## MULTIPLE OUTPUT POWER SUPPLIES

| 1st Output | | 2nd Output | | 3rd Output | | | |
|---|---|---|---|---|---|---|---|
| Voltage | Current | Voltage | Current | Voltage | Current | Model | Price 1-9 |
| +12V | 0.13A | −12V | 0.13A | — | — | 1A12D | $24.95 |
| +12V | 0.30A | −12V | 0.30A | — | — | 1B12D | 27.95 |
| +12V | 0.60A | −12V | 0.60A | — | — | 1C12D | 31.95 |
| +12V | 1.0A | −12V | 1.0A | — | — | 2BB12D | 39.95 |
| 12V | 1.6A | 12V | 1.6A | — | — | 3K12D | 59.95 |
| 12V | 3.2A | 12V | 3.2A | — | — | 3L12D | 84.95 |
| +15V | 0.10A | −15V | 0.10A | — | — | 1A15D | 24.95 |
| +15V | 0.25A | −15V | 0.25A | — | — | 1B15D | 27.95 |
| +15V | 0.50A | −15V | 0.50A | — | — | 1C15D | 31.95 |
| +15V | 0.8A | −15V | 0.8A | — | — | 2BB15D | 39.95 |
| 15V | 1.5A | 15V | 1.5A | — | — | 3K15D | 59.95 |
| 15V | 3.0A | 15V | 3.0A | — | — | 3L15D | 84.95 |
| +5V | 0.25A | +12V | 0.06A | −12V | 0.06A | 1A512T | 30.95 |
| +5V | 0.50A | +12V | 0.13A | −12V | 0.13A | 1B512T | 33.95 |
| +5V | 1.00A | +12V | 0.25A | −12V | 0.25A | 1C512T | 39.95 |
| 5V | 3.0A | 12V | 0.5A | 12V | 0.5A | 2CC512T | 64.95 |
| 5V | 7.0A | 12V | 1.0A | 12V | 1.0A | 2D512T | 89.95 |
| 5V | 8.0A | +12V | 1.7A | −12V | 1.7A | 2P512T | 109.00 |
| 5V | 15.0A | +12V | 3.4A | −12V | 3.4A | 2Q512T | 159.00 |
| +5V | 0.25A | +15V | 0.05A | −15V | 0.05A | 1A515T | 30.95 |
| +5V | 0.50A | +15V | 0.13A | −15V | 0.13A | 1B515T | 33.95 |
| +5V | 1.00A | +15V | 0.25A | −15V | 0.25A | 1C515T | 39.95 |
| 5V | 3.0A | 15V | 0.5A | 15V | 0.5A | 2CC515TA | 64.95 |
| 5V | 7.0A | 15V | 1.0A | 15V | 1.0A | 2D515TA | 89.95 |
| 5V | 8.0A | +15V | 1.5A | −15V | 1.5A | 2P515T | 109.00 |
| 5V | 15.0A | +15V | 3.0A | −15V | 3.0A | 2Q515T | 159.00 |

Shading indicates output includes OVP




- Cost Competitive with Open Frame Linears
- OVP Built-in
- Logic Inhibit Included
- ≥ 70% Efficient
- 4 Flush Mounting Surfaces
- 0.15% Regulation

## "SWITCHING OEM" OPEN FRAME SWITCHING REGULATED POWER SUPPLIES

| Voltage | Current | Model | Price 1-9 |
|---|---|---|---|
| 5 Volts | 20.0A | 5C5 | $149.00 |
| | 35.0A | 5E5 | 199.00 |
| | 65.0A | 5G5 | 299.00 |
| 12 Volts | 8.3A | 5C12 | 149.00 |
| | 14.5A | 5E12 | 199.00 |
| | 27.0A | 5G12 | 299.00 |
| 15 Volts | 6.8A | 5C15 | 149.00 |
| | 11.8A | 5E15 | 199.00 |
| | 22.0A | 5G15 | 299.00 |

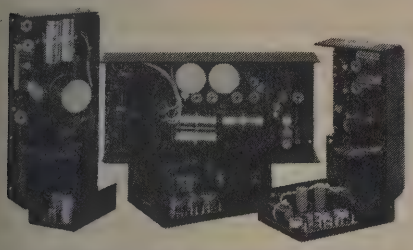
| Voltage | Current | Model | Price 1-9 |
|---|---|---|---|
| 20 Volts | 5.2A | 5C20 | $149.00 |
| | 9.0A | 5E20 | 199.00 |
| | 17.0A | 5G20 | 299.00 |
| 24 Volts | 4.5A | 5C24 | 149.00 |
| | 7.9A | 5E24 | 199.00 |
| | 15.0A | 5G24 | 299.00 |

Shading indicates output includes OVP

# ALPHA POWER

**DC POWER SUPPLIES** DEPT. EM, 20536 PLUMMER ST, CHATSWORTH, CALIFORNIA 91311 (213) 998-9873

## MICROPROCESSOR POWER SUPPLIES



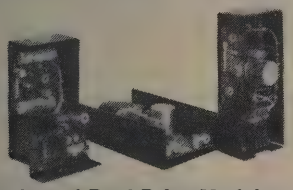
- Compatible with Most Microprocessor Systems
- OVP Built-in as Indicated
- Remote Sense on Most 5V Outputs
- Molex Output Connectors on 2P, Q

| Voltage | Current | Model | Price 1-9 |
|---|---|---|---|
| +5V<br>+12V<br>−5V | 1.0A<br>0.25A<br>0.4A | 1CMP | $39.95 |
| 5V<br>9-15V<br>or 5V | 2.0A<br>0.5A*<br>0.35A* | 2BBMPD | 44.95 |
| 5V<br>9-15V<br>9-15V<br>or 5V | 2.0A<br>0.25A<br>0.25A*<br>0.25A* | 2BBMP | 49.95 |
| 5V<br>12V<br>9-12V<br>or 5V | 3.0A<br>0.6A<br>0.6A*<br>0.38A* | 2CCMP | 69.95 |

| Voltage | Current | Model | Price 1-9 |
|---|---|---|---|
| 5V<br>12V<br>9V<br>or 5V | 7.0A<br>1.0A<br>1.2A*<br>0.75A* | 2DMP | $94.95 |
| 5V<br>+12V<br>−12V<br>5V | 8.0A<br>1.7A<br>1.0A<br>0.6A | 2PMP | 119.00 |
| 5V<br>+12V<br>−12V<br>5V | 15.0A<br>3.4A<br>1.7A<br>1.0A | 2QMP | 169.00 |

Shading indicates output includes OVP
*Indicates voltage is field selectable

## FLOPPY DISK POWER SUPPLIES



- Single and Dual Drive Models
- Model 2BXFD for Schugart Mini-Floppy
- Molex Output Connectors
- Repairable Construction

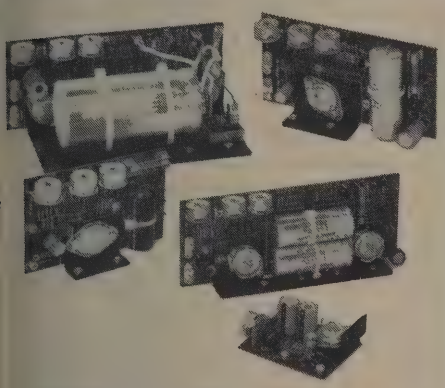
| Voltage | Current | Model | Price 1-9 |
|---|---|---|---|
| +5V<br>+12V | 0.5/0.7*<br>0.9/1.8* | 2BXFD | $46.95 |
| +5V<br>−5V<br>+24V<br>+8V$_{UNREG}$ | 2.2A<br>0.2A<br>1.2/3.0<br>2.0A | 2DFD | 79.50 |

*A$_{AVG}$/A$_{PEAK}$

| Voltage | Current | Model | Price 1-9 |
|---|---|---|---|
| 5V<br>5V<br>24V | 3.0A<br>0.6A<br>4.0A | 2PFD | $99.50 |
| +5V<br>−12V<br>24V | 6.0A<br>1.0A<br>4.0A | 2QXFD | 134.95 |

Shading indicates output includes OVP

## SUB-MODULAR REGULATIONS



- Standard Approach to Building Custom Power Supplies
- Adjustable Output Voltage Current Limit and OVP
- Remote Sensing with Optional Built-in Logic Inhibit Function
- Available as Individual Units, or Complete Kit Including Transformer
- Built-in OVP (except SMAA)

| Voltage | Current | Model | Price 1-9 |
|---|---|---|---|
| 2 Volts | 0.40A | SMAA2 | $17.50 |
| | 1.0A | SMA2 | 25.00 |
| | 3.0A | SMB2 | 30.00 |
| | 6.0A | SMC2 | 40.00 |
| | 12.0A | SMD2 | 50.00 |
| | 18.0A | SME2 | 60.00 |
| 5 Volts | 0.40A | SMAA5 | 17.50 |
| | 1.0A | SMA5 | 25.00 |
| | 3.0A | SMB5 | 30.00 |
| | 6.0A | SMC5 | 40.00 |
| | 12.0A | SMD5 | 50.00 |
| | 18.0A | SME5 | 60.00 |
| 6 Volts | 0.35A | SMAA6 | 17.50 |
| | 0.88A | SMA6 | 25.00 |
| | 2.5A | SMB6 | 30.00 |
| | 5.2A | SMC6 | 40.00 |
| | 10.4A | SMD6 | 50.00 |
| | 15.6A | SME6 | 60.00 |
| 12 Volts | 0.23A | SMAA12 | 17.50 |
| | 0.58A | SMA12 | 25.00 |
| | 1.7A | SMB12 | 30.00 |
| | 3.4A | SMC12 | 40.00 |
| | 6.8A | SMD12 | 50.00 |
| | 10.2A | SME12 | 60.00 |

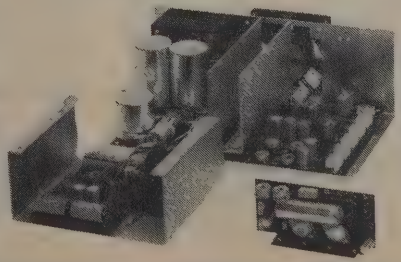
| Voltage | Current | Model | Price 1-9 |
|---|---|---|---|
| 15 Volts | 0.20A | SMAA22 | $17.50 |
| | 0.50A | SMA15 | 25.00 |
| | 1.5A | SMB15 | 30.00 |
| | 3.0A | SMC15 | 40.00 |
| | 6.0A | SMD15 | 50.00 |
| | 9.0A | SME15 | 60.00 |
| 18 Volts | 0.19A | SMAA18 | 17.50 |
| | 0.48A | SMA18 | 25.00 |
| | 1.4A | SMB18 | 30.00 |
| | 2.8A | SMC18 | 40.00 |
| | 5.6A | SMD18 | 50.00 |
| | 8.4A | SME18 | 60.00 |
| 20 Volts | 0.18A | SMAA20 | 17.50 |
| | 0.45A | SMA20 | 25.00 |
| | 1.3A | SMB20 | 30.00 |
| | 2.6A | SMC20 | 40.00 |
| | 5.2A | SMD20 | 50.00 |
| | 7.8A | SME20 | 60.00 |
| 24 Volts | 0.17A | SMAA24 | 17.50 |
| | 0.43A | SMA24 | 25.00 |
| | 1.2A | SMB24 | 30.00 |
| | 2.5A | SMC24 | 40.00 |
| | 5.0A | SMD24 | 50.00 |
| | 7.5A | SME24 | 60.00 |

Shading indicates output includes OVP

## CASE SIZES

| Model No. | Size H | W | D | Model No. | Size H | W | D |
|---|---|---|---|---|---|---|---|
| 1A | 1.80 x | 2.80 x | 1.48 | 3D | 4.87 x | 9.00 x | 3.20 |
| 1B | 2.20 x | 3.50 x | 1.68 | 3DD | 4.87 x | 14.00 x | 3.20 |
| 1C | 3.20 x | 4.00 x | 1.80 | 3K | 4.00 x | 7.87 x | 2.95 |
| 2BB | 4.00 x | 6.50 x | 1.93 | 3L | 4.87 x | 9.38 x | 3.20 |
| 2BX | 4.00 x | 5.50 x | 1.93 | 5C | 4.87 x | 8.50 x | 2.00 |
| 2CC | 4.87 x | 7.00 x | 3.20 | 5E | 4.87 x | 10.50 x | 2.25 |
| 2D | 4.87 x | 9.00 x | 3.20 | 5G | 4.87 x | 15.00 x | 2.37 |
| 2P | 4.87 x | 11.00 x | 3.13 | SMAA | 3.00 x | 2.50 x | 1.31 |
| 2Q | 6.25 x | 13.50 x | 3.75 | SMA | 3.00 x | 4.50 x | 1.31 |
| 2QX | 6.25 x | 10.50 x | 3.25 | SMB | 3.00 x | 5.75 x | 1.31 |
| 3B | 4.00 x | 4.87 x | 2.07 | SMC | 3.00 x | 7.50 x | 1.31 |
| 3C | 4.87 x | 5.62 x | 2.95 | SMD | 3.00 x | 7.00 x | 3.43 |
| 3CC | 4.87 x | 7.00 x | 3.20 | SME | 3.00 x | 7.00 x | 3.43 |

## CUSTOM DESIGNS

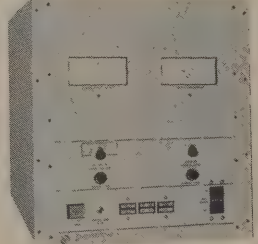


Call us for quotes on your high volume low cost linear or switching regulated custom supplies.

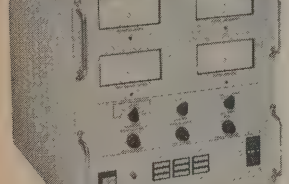
# FREQUENCY CHANGERS • INVERTERS UNINTERRUPTIBLE POWER SYSTEMS

**Model SMG-150-403**
150 KVA, 400 Hz Output

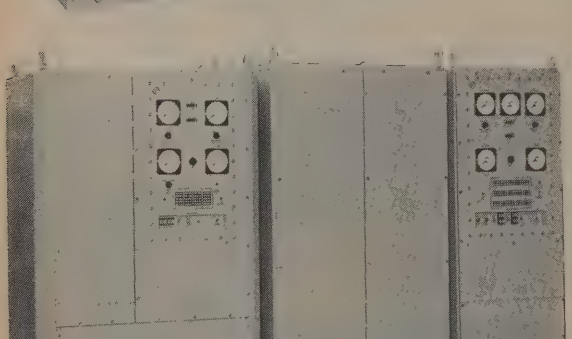
**Fully Militarized 10 KW System**
Operates Independently or Paralleled/Redundant



**Model SMG-5-51**
5 KVA, 50/60 Hz Output



**Model SMG-15-403**
15 KVA, 400 Hz Output



**Navy Shipboard System**
375 KVA, 400 Hz

**ALS has achieved major innovations in solid state power conversion techniques and power systems control. These accomplishments enable ALS to offer competitively priced frequency changers, inverters and uninterruptible power systems which embody the best characteristics of both solid state and rotating machine equipment without the performance and reliability limitations of either. Systems providing output capacities up to 1250 KVA and frequencies in the range of 45 to 450 Hz have been delivered.**

**In its SMG Series Frequency Changers, ALS has implemented a truly advanced and effective concept in solid state power conversion equipment. Immune to input power and output load conditions, these units are inherently dependable and totally self-protecting. Unlike ordinary units, the SMG Series will not be damaged or clear fuses despite line transients, loss of one or more input phases, output overload, short circuit or arbitrary operation of any control. Thermal and electrical stress of components is well below ratings. Power semiconductor devices in particular, are operated at less than 25% of ratings.**

**Most solid state systems produce less noise and vibration compared to their motor-generator predecessors. However, at 66 decibels, the SMG Series are the quietest units available.**

**Unquestionably, the SMG Series provides the optimum answer for most frequency changer requirements. However, should special requirements indicate the need for a unique design, ALS will welcome the opportunity to propose systems optimized to the application**

## EXCLUSIVE FEATURES

**Truly Quiet** — Produces a tenth or less of the noise inherent in other solid state units. The SMG Series is ideal for applications where noise is undesirable.

**Compact and Lightweight** — By far, the smallest and lightest units produced. The SMG Series is unexcelled for portable or mobile applications.

**Unprecedented Efficiency** — At full load, dissipates a third or less of the power lost by competitive units at no load. Relative to other systems, the SMG Series will recover the purchase price in saved energy alone within seven years.

**Convenient to Parallel** — Any number of units may be paralleled to increase capacity or obtain redundancy. Conversion to parallel operation is accomplished simply by mating a single cable for each unit. No control manipulation is required and units may be energized or de-energized in any sequence.

**Extremely Dependable** — Carefully limited stressing of critical components assures years of trouble-free operation.

**Total Protection** — Immune to problems associated with input power, output overload or short circuit, and control manipulation.

**Operational Simplicity** — Controls and indicators are self-explanatory and logically grouped. Training of operating personnel is not required.

**Reserve Capacity** — Will support loads with high inrush demand. The SMG Series is particularly useful for motor loads or systems with capacitive filters.

**Low Output Impedance** — Has about one-fourth the open loop impedance of ordinary frequency changers. In applications involving nonlinear or dynamic loads the SMG Series will out-perform other units of up to four times greater nameplate KVA ratings.

**Fast Response** — Following a 100% of rated current step change in load, the SMG Series will recover to the regulation band within two cycles of output. This in combination with its low impedance, makes the SMG Series absolutely unbeatable for the most demanding stepped load applications.

**Arbitrary Input Connection** — Operates on any input phase rotation. The SMG Series eliminates concern for damage whenever the input source is change

# SMG Series Solid State Frequency Changers 5 KVA to 300 KVA, 50/60 Hz or 400 Hz

## SPECIFICATIONS

**NPUT**

**Voltage:** Available in all standard, domestic and foreign nominal voltages ±10% or per customer specifications. Frequency 45 to 450 Hz.

**OUTPUT**

**Voltage:** Available in all standard, domestic and foreign voltages or per customer specifications. Output adjustment is ±10% from nominal or optionally 0 to 110%. Regulation is ±0.5% for the combined effects of line, load and temperature.

**Waveform:** 2% THD at full load. 1% available optionally.

**Current:** Adjustable current limit from 25 to 125% of ratings. Manual current limit override allows over 150% of rating for motor starting. Regulation is ±1% for the combined effect of line, load and temperature.

**Power Factor:** Full rated power from 0.5 capacitive to 0.5 inductive.

**Phase Displacement:** 120° ± < 1° for balanced loads. Load may be 100% unbalanced. Line-to-line voltage will remain within ±1% from the average for each 10% of load unbalance.

**Incidental Modulation:** 0.025% peak FM and 0.025% to 1.0% peak AM depending on input power frequency and phase unbalance.

**Response Time:** ¼ cycle for 400 Hz 3 phase, 1 cycle for 50 Hz single phase.

**Recovery Time:** 2 cycles for 400 Hz 3 phase, 4 cycles for 50 Hz single phase.

**Frequency:** 50, 60 and 400 Hz adjustable ±5% are standard. Stability is ±0.1% constant environment, ±0.5% from cold start. Quartz time base with ±0.001%.

**Instrumentation:** All indications are accurate to ±2% of full scale. Provided are input/output voltmeter, ammeter, dial and pointer frequency meter.

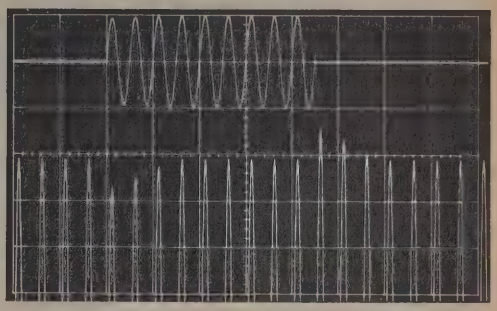
**Status Lamps:** Depending on model, 6 to 20 lamps indicate system operating status.

**Protection:** Combination of circuit breakers, fuses, sensing circuitry, air switches, thermostats and contactors positively protect the unit from fault loads, improper input voltages and consequential power train damage.

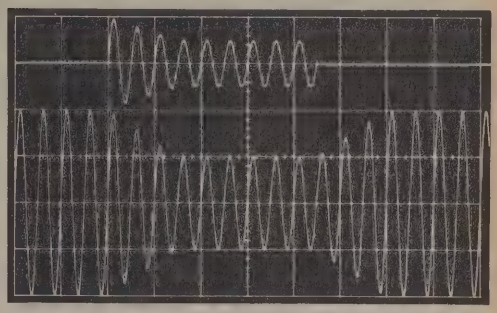
**Environment:** 0-50°C continuous, full ratings.

**EMI**

Shielded and filtered. Meets most EMI requirements. Optional filters for the most stringent requirements can be provided.



**Dynamic Characteristics** — The typical transient response and recovery characteristics of the SMG Series is shown. The upper trace is rated load current and the lower trace is output voltage expanded to 5% per division.



**Automatic Voltage/Current Crossover** — The typical crossover characteristics of the SMG Series is demonstrated by setting current limit at 50% of ratings and applying full rated load. For the first half cycle, full load current results. Thereafter the output voltage complies rapidly to half the initial value where the resulting load current is within the set 50% limit. Upon load removal, the output voltage returns to its initial value.

| Model | Power | Phase | Output Frequency | Size (Inches) H x W x D | Weight (Lbs.) | Paralleable Unit (Option 02) H x W x D | Paralleable Unit (Option 02) Weight |
|---|---|---|---|---|---|---|---|
| SMG-5-51 | 0-5 KVA | 1 | Fixed 50 or 60 Hz (Specify) | 21 x 17 x 25 | 450 | 21 x 17 x 25 | 485 |
| SMG-5-53 | | 3 | | 21 x 17 x 25 | 480 | 21 x 17 x 25 | 510 |
| SMG-7.5-51 | 0-7.5 KVA | 1 | Variable (Option 05) 45 to 55 Hz 50 to 60 Hz 55 to 65 Hz (Specify) | 24.5 x 17 x 25 | 520 | 24.5 x 17 x 25 | 600 |
| SMG-7.5-53 | | 3 | | 24.5 x 17 x 25 | 550 | 24.5 x 17 x 25 | 630 |
| SMG-15-53 | 0-15 KVA | 3 | | 45.5 x 17 x 25 | 850 | 45.5 x 17 x 25 | 910 |
| SMG-30-53 | 0-30 KVA | 3 | | 72 x 24 x 36 | 1200 | 72 x 24 x 36 | 1330 |
| SMG-5-401 | 0-5 KVA | 1 | Fixed 400 Hz Variable (Option 05) 380 to 420 Hz | 14 x 17 x 21.5 | 155 | 14 x 17 x 25 | 170 |
| SMG-5-403 | | 3 | | 14 x 17 x 21.5 | 165 | 14 x 17 x 25 | 190 |
| SMG-7.5-401 | 0-7.5 KVA | 1 | | 14 x 17 x 21.5 | 165 | 14 x 17 x 25 | 180 |
| SMG-7.5-403 | | 3 | | 14 x 17 x 21.5 | 175 | 14 x 17 x 25 | 200 |
| SMG-15-403 | 0-15 KVA | 3 | | 17.5 x 17 x 21.5 | 280 | 17.5 x 17 x 25 | 310 |
| SMG-30-403 | 0-30 KVA | 3 | | 31.5 x 17 x 21.5 | 480 | 31.5 x 17 x 25 | 530 |
| SMG-150-403 | 0-150 KVA | 3 | | 81 x 64 x 42 | 4600 | 81 x 64 x 42 | 5300 |

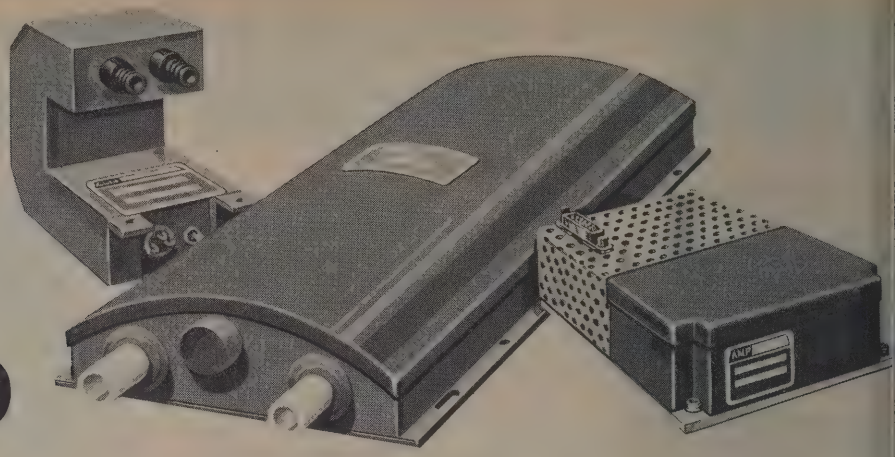
**Special Requirements.** ALS will design systems optimized for specific applications. We welcome your inquiry regarding special requirements and our application engineers will be pleased to assist you in the formulation of specifications tailored to your needs.

Our extensive experience in providing AC power for a wide variety of applications will be of value in identifying any characteristics of your application that may require special consideration.

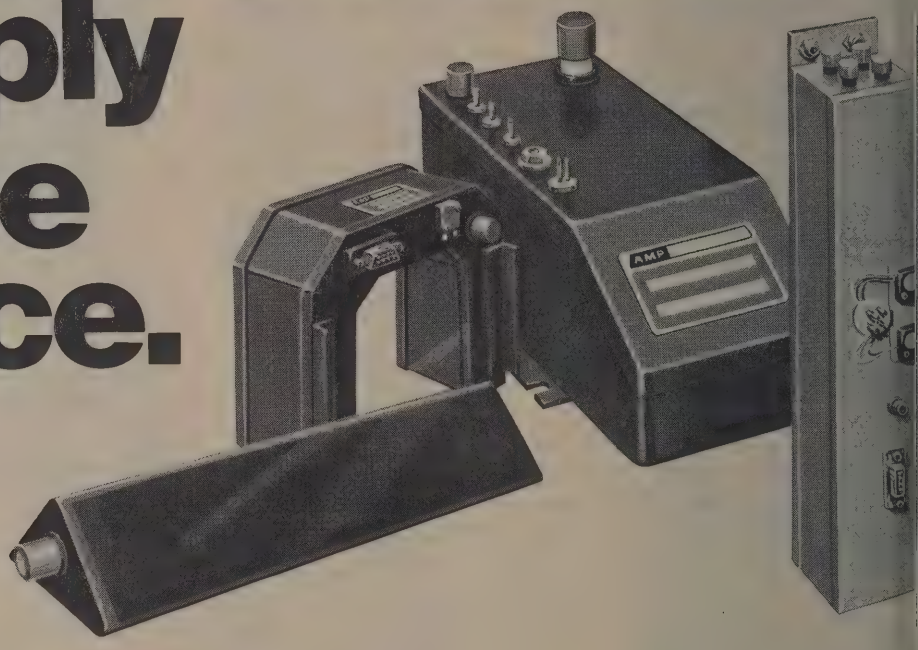
**Options (Specify by number)**

01 — 120/208 or 266/460 Dual Input Operation
02 — Parallel Operation
03 — Redundant Parallel Operation
04 — Wattmeter
05 — Dual Mode Fixed/Variable Output Frequency

**A·L·S ELECTRONICS CORPORATION**
400 N. Baxter Street • Anaheim, Calif. 92806 • (714) 956-9200 • TWX 910-591-2711



# AMP shapes the power supply to the space.



We specialize in special shapes for special problems. You'll get a perfect match to the space and system. AMP Capitron Division designs and manufactures power supplies to meet the most demanding environmental, performance, and miniaturization requirements. The use of advanced modular solid-state design and superior packaging techniques assure maximum voltage density in the smallest possible package.

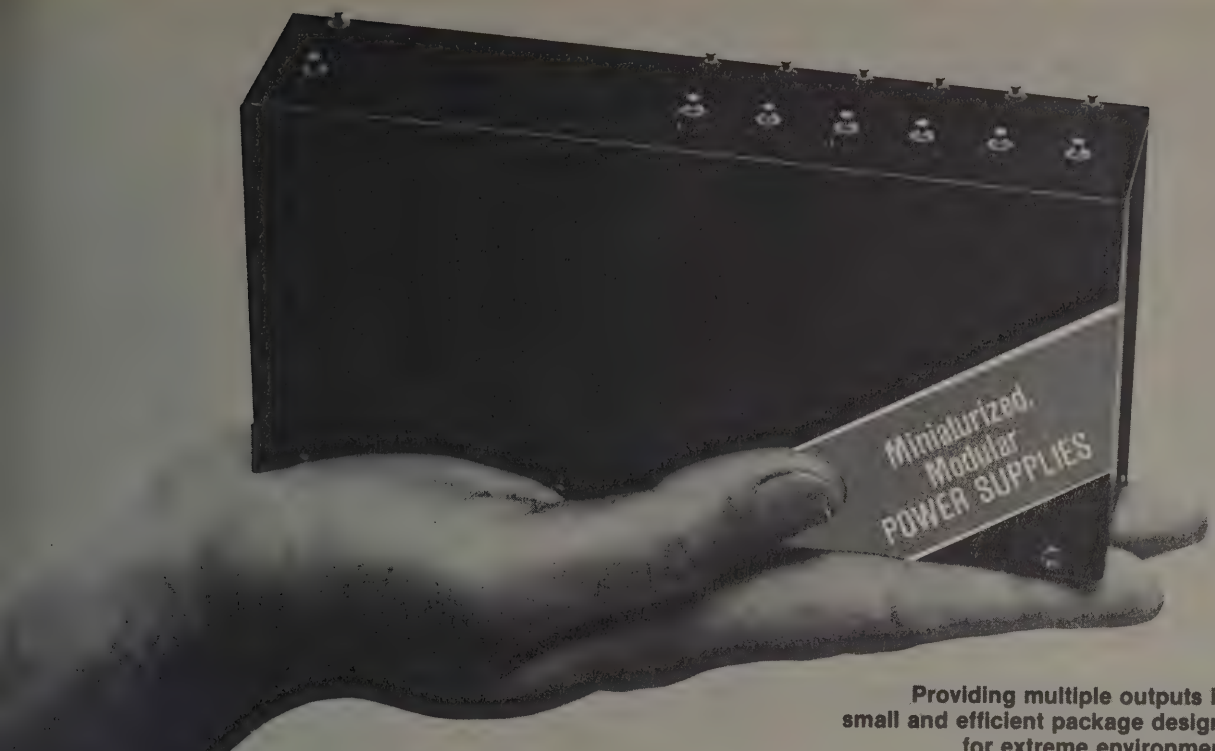
Whatever your application, military or commercial, AMP engineers will work closely with you in the initial design phase of new electronic systems to precisely tailor a power supply to your need. Or one of our more than 2000 existing designs—up to 60 kv and 2 kw—may match your requirements.

Learn more about the benefits of custom design. Send for our free Power Supply Specifying Guide.

AMP Incorporated
Capitron Division
Elizabethtown, PA 17022
(717) 367-1105
TWX 510-657-4561

AMP has a better way.

**AMP**
INCORPORATED

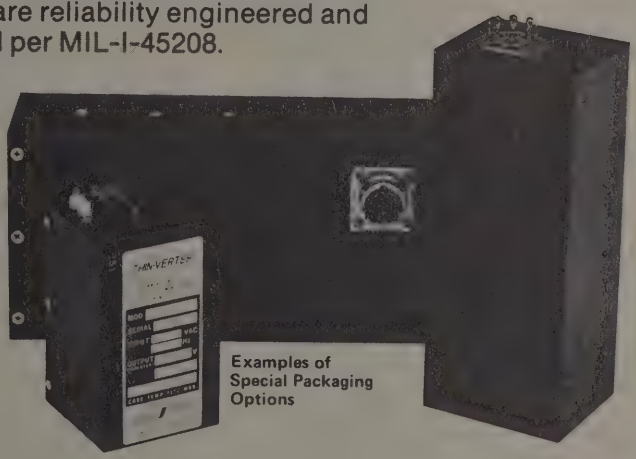



**Providing multiple outputs in a small and efficient package designed for extreme environments.**

# Design-as-you-Order

Our unique "Design-as-you-order" system offers you custom power supplies with the delivery and convenience of off-the-shelf units at catalog prices. All Arnold products are reliability engineered and inspected per MIL-I-45208.

- From 1 to 10 outputs, up to 400 Watts total
- Voltages from 4V to 300 VDC
- Up to 4 watts per cubic inch power density
- Compact, conduction-cooled design
- Fully potted to resist impact and vibration per MIL-STD-810B.
- High efficiency, low heat dissipation



Examples of Special Packaging Options

You select a Driver Module that is appropriate for your power source. That module then inverts the input to a high frequency waveform suitable for driving the supply's one or more Regulator Modules. The Regulator Modules convert the high frequency voltage into regulated DC outputs.

Also available are non-modular high-voltage AC-to-DC and DC-to-DC power supplies, and DC-to-AC solid state inverters.

ARNOLD MAGNETICS

## ARNOLD MAGNETICS CORPORATION

## You Design a Custom Power Supply

Arnold power supplies are designed and constructed to withstand extremely adverse environments. Pretested modules are mounted on a heat-sink base, and the completed assembly is fully tested. The unit is potted to withstand the vibration, humidity and other severe conditions of MIL-STD-810B. The power supply is then burn-in tested under full rated load before it receives final Quality-Assurance certification per MIL-I-45208.

## Driver Modules

Driver Modules operate with primary voltages of 115VAC (from 47 to 500Hz), or 12VDC, 28VDC, 48VDC, 115VDC and 150VDC. All Driver Modules are 25kHz switching inverters, with the exception of the 115V, 400Hz units (400Hz transformer input). Output windings on all Driving Modules are isolated (floating) and designed to fit into the custom power system.

## Driver Module Specifications

| MODEL | INPUT VOLTAGE & FREQUENCY | MAX. OUTPUT POWER |
|---|---|---|
| APS | 115 VAC 47-500Hz | 100 Watts |
| APT | 115 VAC 47-500Hz | 200 Watts |
| ATA | 115 VAC 400Hz | 50 Watts |
| ATB | 115 VAC 400Hz | 100 Watts |
| ASL | 12 VDC ±1 VDC — | 45 Watts |
| ASA | 12 VDC ±1 VDC — | 90 Watts |
| ASM | 28 VDC ±2 VDC — | 100 Watts |
| ASN | 28 VDC ±2 VDC — | 200 Watts |
| ASG | 48 VDC ±4 VDC — | 100 Watts |
| ASJ | 48 VDC ±4 VDC — | 200 Watts |
| ASH | 100-150 VDC — | 110 Watts |
| ASK | 100-150 VDC — | 220 Watts |

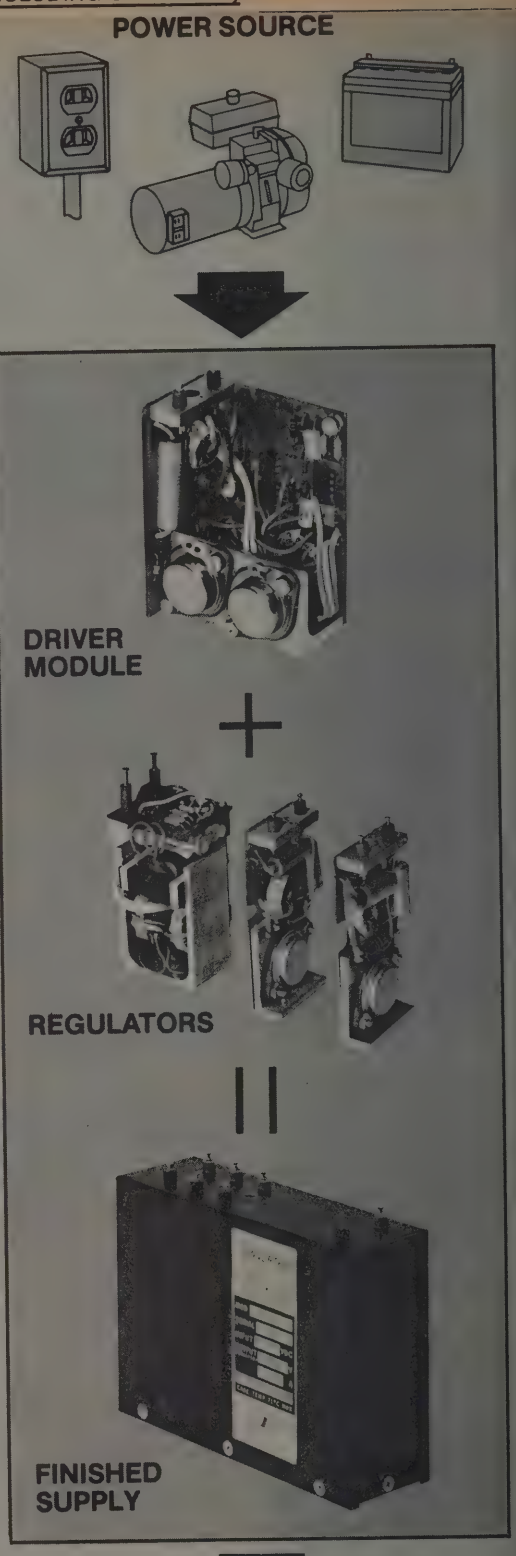
## Regulator Module Specifications

| MODEL | DESCRIPTION | VOLTAGE RANGE | CURRENT RANGE | MAX. POWER OUT |
|---|---|---|---|---|
| ARA | Series Pass* | 4 V to 30 VDC | 0 to 4 Amps | 30 Watts |
| ARC | Series Pass* | 4 V to 30 VDC | 4 to 6 Amps | 50 Watts |
| ARB | Series Pass* | 30 V to 300 VDC | 0 to 500 mA. | 30 Watts |
| ARF | Magnetic Amp** | 4 V to 100 VDC | 0 to 6 Amps | 40 Watts |
| ARM | Magnetic Amp** | 4 V to 100 VDC | 0 to 25 Amps | 125 Watts |
| ART | Switching** | 0 V to 30 VDC | 0 to 4 Amps | 30 Watts |

*Medium Efficiency **High Efficiency

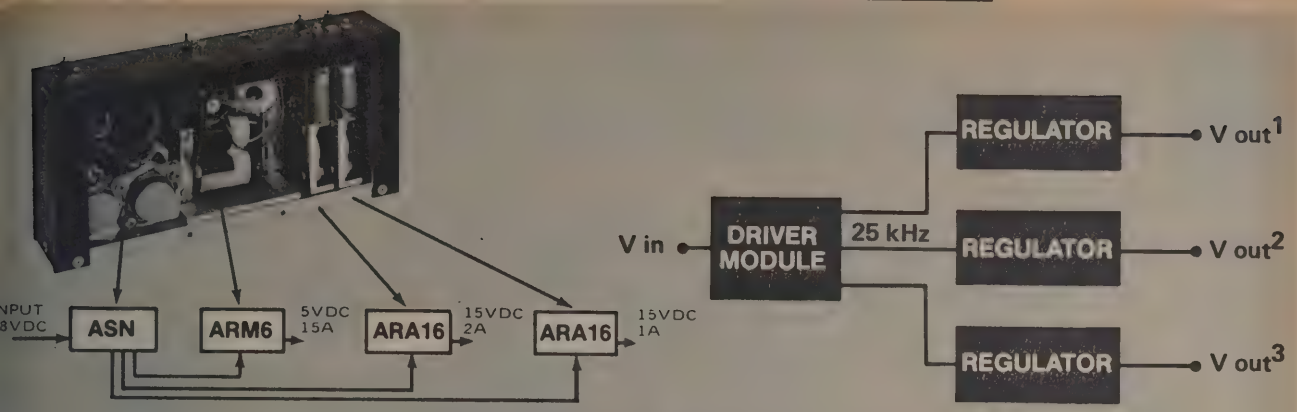
## Options

- Ultra Low Noise Filtering (to 10mV P-P)
- Input Transient Protection (per MIL-STD-704)
- Choice of Current Limit Setting
- Program-Voltage Control (zero to full output voltage)
- Special Packaging
  *(Contact the factory for special requirements.)*
- Brown-out Protection
- Tracking Outputs
- Over-Voltage Protection
- Turn-ON/OFF Sequencing
- Thermal Shutdown
- Varied Input Voltage Range
- Extreme Temperature Range




ARNOLD MAGNETICS

**ARNOLD MAGNETICS CORPORATION**




## Operating Specifications

**Line Voltage Regulation (max) for ±10% Variation**
0.1% + 10mV for ARA, ARB, ARC;
0.2% + 10mV for ARF, ARM;
1.0% + 10mV for ART.

**Output Load Regulation (max) from Half to Full Load**
0.1% + 10mV for ARA, ARB, ARC;
0.2% + 10mV for ARF, ARM;
1.0% + 10mV for ART.

**Output Adjustment Range**
±5% minimum voltage adjustment.

**Maximum Ripple and Noise (Volts rms)**
0.1% x Eout +10mV for ARA, ARB, ARC;
0.5% x Eout +10mV for ARF, ARM, ART.
(See option below.)

**Temperature Coefficient**
0.01% per °C for ARA, ARB, ARC;
0.02% per °C for ARF, ARM, ART.

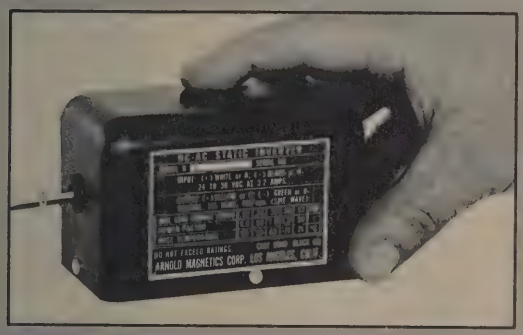
**Operating Case Temperature**
−10°C to +71°C.

**Isolation**
Input, case and outputs are isolated from each other (floating).

**Protection Circuitry**
All outputs short-circuit protected with foldback current limiting (straight-line current limiting on request, see options below).

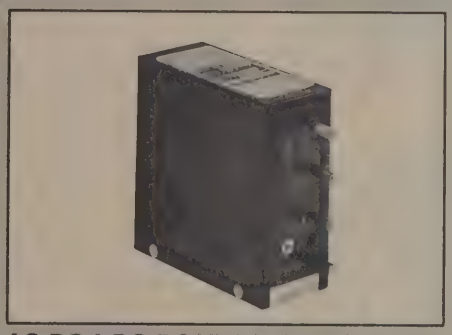
**Efficiency**
Varies with the driver module; typically 80%, minimum 55%.

**Dimensions**
Standard case widths are 1.625" and 3.25" with constant height of 3.625". Case length determined by number of output modules (regulators) selected.



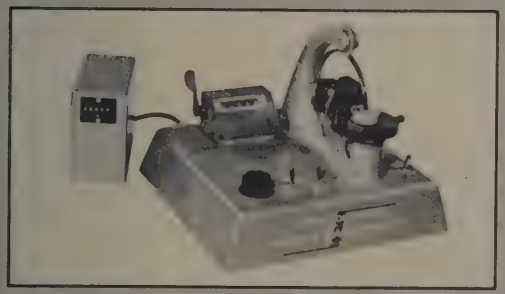
### Solid State Inverter

- Input 28VDC; Output 115VAC or 28VAC @ 400Hz
- Output Power Up to 100 Volt-Amps
- Low Harmonic Distortion
- Small Size and Light Weight
- Protected from: Short Circuit
  Input Transient
  Reverse Input Polarity



### AC-DC & DC-DC High Voltage Supplies

- Nominal Input Voltage 115VAC @ 47-500Hz, or 12V or 28VDC
- Any Output Voltage from 2VDC to 5,000VDC
- Single or Multiple Outputs in a compact 20 cubic inch case
- Conduction Cooled and Fully Potted
- Output Isolation to 5,000 Volts



### Model AMC-4 Toroidal Winding Machine

- Ideal for Prototype or Production Winding
- Low Cost
- Compact, Portable Design
- High Speed Winding with Variety of Wire Gauges

ARNOLD MAGNETICS

## ARNOLD MAGNETICS CORPORATION

11520 W. Jefferson Blvd.
Culver City, California 90230
Phone: (213) 870-7014
TWX: 910-343-6468

# BIKOR CORPORATION

## DC-DC REGULATED POWER CONVERTERS

■ 0.2% Line Regulation (LL-HL) ■ 0.2% or 20 mV Load Regulation (NL-FL) ■ High Efficiency (70% Typ. @ Fl. @ Nom. Line) ■ Isolated Input/Output ■ Pulse Width Modulated Inverters or Switching Output Regulators for Outputs > 10A or 100W ■ 0.3% Maximum Ripple ■ 5% Adjustment Range ■ Overload/Short Circuit Protected ■ Overvoltage Protection Option

### SINGLE OUTPUT MODELS

| 11 TO 14 VDC INPUT | | | | | 22 TO 30 VDC INPUT | | | | | 44 TO 56 VDC INPUT | | | | | 105 TO 140 VDC INPUT | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output @ 12 VDC Input | | | | | Output @ 24 VDC Input | | | | | Output @ 48 VDC Input | | | | | Output @ 110 VDC Input | | | | |
| Voltage (VDC) | Current (Amps) | Model No. | Case Size | Price (1-24) | Voltage (VDC) | Current (Amps) | Model No. | Case Size | Price (1-24) | Voltage (VDC) | Current (Amps) | Model No. | Case Size | Price (1-24) | Voltage (VDC) | Current (Amps) | Model No. | Case Size | Price (1-24) |
| 5 | 2.0 | DDR 1200 | A | 150.90 | 5 | 2.0 | DDR 2400 | A | 150.90 | 5 | 2.0 | DDR 4800 | A | 150.90 | 5 | 2.0 | DDR 11000 | A | 150.90 |
| | 5.0 | DDR 1201 | B | 160.90 | | 5.0 | DDR 2401 | B | 160.90 | | 5.0 | DDR 4801 | B | 160.90 | | 5.0 | DDR 11001 | B | 160.90 |
| | 10.0 | DDR 1202 | C | 184.50 | | 10.0 | DDR 2402 | C | 184.50 | | 10.0 | DDR 4802 | C | 184.50 | | 10.0 | DDR 11002 | C | 184.50 |
| | 22.0 | DDS 1209 | E | 335.30 | | 25.0 | DDS 2409 | E | 335.30 | | 25.0 | DDS 4809 | E | 335.30 | | 25.0 | DDS 11009 | E | 335.30 |
| 12 | 1.0 | DDR 1210 | A | 150.90 | 12 | 1.0 | DDR 2410 | A | 150.90 | 12 | 1.0 | DDR 4810 | A | 150.90 | 12 | 1.0 | DDR 11010 | A | 150.90 |
| | 2.0 | DDR 1211 | B | 160.90 | | 2.0 | DDR 2411 | B | 160.90 | | 2.0 | DDR 4811 | B | 160.90 | | 2.0 | DDR 11011 | B | 160.90 |
| | 4.0 | DDR 1212 | C | 184.50 | | 4.0 | DDR 2412 | C | 184.50 | | 4.0 | DDR 4812 | C | 184.50 | | 4.0 | DDR 11012 | C | 184.50 |
| | 12.0 | DDS 1213 | E | 335.30 | | 12.0 | DDS 2413 | E | 335.30 | | 12.0 | DDS 4813 | E | 335.30 | | 12.0 | DDS 11013 | E | 335.30 |
| 15 | 1.0 | DDR 1203 | A | 150.90 | 15 | 1.0 | DDR 2403 | A | 150.90 | 15 | 1.0 | DDR 4803 | A | 150.90 | 15 | 1.0 | DDR 11003 | A | 150.90 |
| | 2.0 | DDR 1204 | B | 160.90 | | 2.0 | DDR 2404 | B | 160.90 | | 2.0 | DDR 4804 | B | 160.90 | | 2.0 | DDR 11004 | B | 160.90 |
| | 4.0 | DDR 1205 | C | 184.50 | | 4.0 | DDR 2405 | C | 184.50 | | 4.0 | DDR 4805 | C | 184.50 | | 4.0 | DDR 11005 | C | 184.50 |
| | 10.0 | DDS 1214 | E | 335.30 | | 12.0 | DDS 2414 | E | 335.30 | | 12.0 | DDS 4814 | E | 335.30 | | 12.0 | DDS 11014 | E | 335.30 |
| 28 | 0.5 | DDR 1206 | A | 150.90 | 28 | 0.5 | DDR 2406 | A | 150.90 | 28 | 0.5 | DDR 4806 | A | 150.90 | 28 | 0.5 | DDR 11006 | A | 150.90 |
| | 1.0 | DDR 1207 | B | 160.90 | | 1.0 | DDR 2407 | B | 160.90 | | 1.0 | DDR 4807 | B | 160.90 | | 1.0 | DDR 11007 | B | 160.90 |
| | 2.0 | DDR 1208 | C | 184.50 | | 2.0 | DDR 2408 | C | 184.50 | | 2.0 | DDR 4808 | C | 184.50 | | 2.0 | DDR 11008 | C | 184.50 |
| | 5.0 | DDS 1215 | E | 335.30 | | 6.0 | DDS 2415 | E | 335.30 | | 6.0 | DDS 4815 | E | 335.30 | | 6.0 | DDS 11015 | E | 335.30 |
| 50 | 0.5 | DDR 1216 | A | 160.90 | 50 | 0.5 | DDR 2416 | A | 160.90 | 50 | 0.5 | DDR 4816 | A | 160.90 | 50 | 0.5 | DDR 11016 | A | 160.90 |
| 100 | 0.3 | DDR 1217 | A | 160.90 | 100 | 0.3 | DDR 2417 | A | 160.90 | 100 | 0.3 | DDR 4817 | A | 160.90 | 100 | 0.3 | DDR 11017 | A | 160.90 |
| 200 | 0.1 | DDR 1218 | A | 160.90 | 200 | 0.1 | DDR 2418 | A | 160.90 | 200 | 0.1 | DDR 4818 | A | 160.90 | 200 | 0.1 | DDR 11018 | A | 160.90 |
| 250 | 0.1 | DDR 1219 | A | 160.90 | 250 | 0.1 | DDR 2419 | A | 160.90 | 250 | 0.1 | DDR 4819 | A | 160.90 | 250 | 0.1 | DDR 11019 | A | 160.90 |

### MULTIPLE OUTPUT MODELS

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| +5 −5 | 4.0 4.0 | DDR 1220 | B | 232.10 | +5 −5 | 4.0 4.0 | DDR 2420 | B | 232.10 | +5 −5 | 4.0 4.0 | DDR 4820 | B | 232.10 | +5 −5 | 4.0 4.0 | DDR 11020 | B | 232.10 |
| +12 −12 | 0.5 0.5 | DDR 1238 | A | 162.10 | +12 −12 | 0.5 0.5 | DDR 2438 | A | 162.10 | +12 −12 | 0.5 0.5 | DDR 4838 | A | 162.10 | +12 −12 | 0.5 0.5 | DDR 11038 | A | 162.10 |
| +15 −15 | 0.5 0.5 | DDR 1221 | A | 162.10 | +15 −15 | 0.5 0.5 | DDR 2421 | A | 162.10 | +15 −15 | 0.5 0.5 | DDR 4821 | A | 162.10 | +15 −15 | 0.5 0.5 | DDR 11021 | A | 162.10 |
| +12 −12 | 2.0 2.0 | DDR 1239 | B | 232.10 | +12 −12 | 2.0 2.0 | DDR 2439 | B | 232.10 | +12 −12 | 2.0 2.0 | DDR 4839 | B | 232.10 | +12 −12 | 2.0 2.0 | DDR 11039 | B | 232.10 |
| +15 −15 | 2.0 2.0 | DDR 1222 | B | 232.10 | +15 −15 | 2.0 2.0 | DDR 2422 | B | 232.10 | +15 −15 | 2.0 2.0 | DDR 4822 | B | 232.10 | +15 −15 | 2.0 2.0 | DDR 11022 | B | 232.10 |
| +12 −12 | 4.0 4.0 | DDR 1240 | D | 345.20 | +12 −12 | 4.0 4.0 | DDR 2440 | D | 345.20 | +12 −12 | 4.0 4.0 | DDR 4840 | D | 345.20 | +12 −12 | 4.0 4.0 | DDR 11040 | D | 345.20 |
| +15 −15 | 4.0 4.0 | DDR 1223 | D | 345.20 | +15 −15 | 4.0 4.0 | DDR 2423 | D | 345.20 | +15 −15 | 4.0 4.0 | DDR 4823 | D | 345.20 | +15 −15 | 4.0 4.0 | DDR 11023 | D | 345.20 |
| +28 −28 | 1.0 1.0 | DDR 1224 | B | 232.10 | +28 −28 | 1.0 1.0 | DDR 2424 | B | 232.10 | +28 −28 | 1.0 1.0 | DDR 4824 | B | 232.10 | +28 −28 | 1.0 1.0 | DDR 11024 | B | 232.10 |
| +28 −28 | 2.0 2.0 | DDR 1225 | D | 345.20 | +28 −28 | 2.0 2.0 | DDR 2425 | D | 345.20 | +28 −28 | 2.0 2.0 | DDR 4825 | D | 345.20 | +28 −28 | 2.0 2.0 | DDR 11025 | D | 345.20 |
| +5 +12 −12 | 2.0 0.5 0.5 | DDR 1241 | B | 232.90 | +5 +12 −12 | 2.0 0.5 0.5 | DDR 2441 | B | 232.90 | +5 +12 −12 | 2.0 0.5 0.5 | DDR 4841 | B | 232.90 | +5 +12 −12 | 2.0 0.5 0.5 | DDR 11041 | B | 232.90 |
| +5 +15 −15 | 2.0 0.5 0.5 | DDR 1230 | B | 232.90 | +5 +15 −15 | 2.0 0.5 0.5 | DDR 2430 | B | 232.90 | +5 +15 −15 | 2.0 0.5 0.5 | DDR 4830 | B | 232.90 | +5 +15 −15 | 2.0 0.5 0.5 | DDR 11030 | B | 232.90 |
| +5 +12 −12 | 4.0 1.0 1.0 | DDR 1242 | C | 299.50 | +5 +12 −12 | 4.0 1.0 1.0 | DDR 2442 | C | 299.50 | +5 +12 −12 | 4.0 1.0 1.0 | DDR 4842 | C | 299.50 | +5 +12 −12 | 4.0 1.0 1.0 | DDR 11042 | C | 299.50 |
| +5 +15 −15 | 4.0 1.0 1.0 | DDR 1231 | C | 299.50 | +5 +15 −15 | 4.0 1.0 1.0 | DDR 2431 | C | 299.50 | +5 +15 −15 | 4.0 1.0 1.0 | DDR 4831 | C | 299.50 | +5 +15 −15 | 4.0 1.0 1.0 | DDR 11031 | C | 299.50 |
| +5 +12 −12 | 10.0 2.0 2.0 | DDR 1243 | E | 413.30 | +5 +12 −12 | 10.0 2.0 2.0 | DDR 2443 | E | 413.30 | +5 +12 −12 | 10.0 2.0 2.0 | DDR 4843 | E | 413.30 | +5 +12 −12 | 10.0 2.0 2.0 | DDR 11043 | E | 413.30 |
| +5 +15 −15 | 10.0 2.0 2.0 | DDR 1232 | E | 413.30 | +5 +15 −15 | 10.0 2.0 2.0 | DDR 2432 | E | 413.30 | +5 +15 −15 | 10.0 2.0 2.0 | DDR 4832 | E | 413.30 | +5 +15 −15 | 10.0 2.0 2.0 | DDR 11032 | E | 413.30 |
| +5 +12 −12 | 20.0 1.0 1.0 | DDS 1244 | G | 548.60 | +5 +12 −12 | 25.0 2.0 2.0 | DDS 2444 | G | 548.60 | +5 +12 −12 | 25.0 2.0 2.0 | DDS 4844 | G | 548.60 | +5 +12 −12 | 25.0 2.0 2.0 | DDS 11044 | G | 548.60 |
| +5 +15 −15 | 20.0 1.0 1.0 | DDS 1233 | G | 548.60 | +5 +15 −15 | 25.0 2.0 2.0 | DDS 2433 | G | 548.60 | +5 +15 −15 | 25.0 2.0 2.0 | DDS 4833 | G | 548.60 | +5 +15 −15 | 25.0 2.0 2.0 | DDS 11033 | G | 548.60 |
| +12 +15 −15 | 1.0 0.5 0.5 | DDR 1234 | B | 232.90 | +12 +15 −15 | 1.0 0.5 0.5 | DDR 2434 | B | 232.90 | +12 +15 −15 | 1.0 0.5 0.5 | DDR 4834 | B | 232.90 | +12 +15 −15 | 1.0 0.5 0.5 | DDR 11034 | B | 232.90 |
| +12 +15 −15 | 2.5 1.0 1.0 | DDR 1235 | C | 299.50 | +12 +15 −15 | 3.0 1.0 1.0 | DDR 2435 | C | 299.50 | +12 +15 −15 | 3.0 1.0 1.0 | DDR 4835 | C | 299.50 | +12 +15 −15 | 3.0 1.0 1.0 | DDR 11035 | C | 299.5 |
| +12 +15 −15 | 6.0 2.0 2.0 | DDR 1236 | E | 413.30 | +12 +15 −15 | 6.0 2.0 2.0 | DDR 2436 | E | 413.30 | +12 +15 −15 | 6.0 2.0 2.0 | DDR 4836 | E | 413.30 | +12 +15 −15 | 6.0 2.0 2.0 | DDR 11036 | E | 413.3 |
| +12 +15 −15 | 10.0 1.0 1.0 | DDS 1237 | G | 548.60 | +12 +15 −15 | 15.0 2.0 2.0 | DDS 2437 | G | 548.60 | +12 +15 −15 | 15.0 2.0 2.0 | DDS 4837 | G | 548.60 | +12 +15 −15 | 15.0 2.0 2.0 | DDS 11037 | G | 548.6 |

# BIKOR CORPORATION

## DC-DC UNREGULATED POWER CONVERTERS

High Efficiency (90% Typ. & Fl.) ■ Isolated Input/Output ■ 0.5% Maximum Ripple ■ Submodular Construction

| 11 TO 14 VDC INPUT | | | | | 22 TO 30 VDC INPUT | | | | | 44 TO 56 VDC INPUT | | | | | 105 TO 140 VDC INPUT | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output @ 12 VDC Input | | | | | Output @ 24 VDC Input | | | | | Output @ 48 VDC Input | | | | | Output @ 110 VDC Input | | | | |
| Voltage (VDC) | Current (Amps) | Model No. | Case Size | Price (1-24) | Voltage (VDC) | Current (Amps) | Model No. | Case Size | Price (1-24) | Voltage (VDC) | Current (Amps) | Model No. | Case Size | Price (1-24) | Voltage (VDC) | Current (Amps) | Model No. | Case Size | Price (1-24) |
| 12 | 4.0 | DDU 1201 | A | 127.40 | 12 | 4.0 | DDU 2401 | A | 127.40 | 12 | 4.0 | DDU 4801 | A | 127.40 | 12 | 4.0 | DDU 11001 | A | 127.40 |
| | 7.0 | DDU 1202 | B | 158.40 | | 7.0 | DDU 2402 | B | 158.40 | | 7.0 | DDU 4802 | B | 158.40 | | 7.0 | DDU 11002 | B | 158.40 |
| | 12.0 | DDU 1203 | D | 230.00 | | 15.0 | DDU 2403 | D | 230.00 | | 15.0 | DDU 4803 | D | 230.00 | | 15.0 | DDU 11003 | D | 230.00 |
| 24 | 2.0 | DDU 1204 | A | 127.40 | 24 | 2.0 | DDU 2404 | A | 127.40 | 24 | 2.0 | DDU 4804 | A | 127.40 | 24 | 2.0 | DDU 11004 | A | 127.40 |
| | 3.5 | DDU 1205 | B | 158.40 | | 3.5 | DDU 2405 | B | 158.40 | | 3.5 | DDU 4805 | B | 158.40 | | 3.5 | DDU 11005 | B | 158.40 |
| | 6.0 | DDU 1206 | D | 230.00 | | 8.0 | DDU 2406 | D | 230.00 | | 8.0 | DDU 4806 | D | 230.00 | | 8.0 | DDU 11006 | D | 230.00 |
| 48 | 1.0 | DDU 1207 | A | 127.40 | 48 | 1.0 | DDU 2407 | A | 127.40 | 48 | 1.0 | DDU 4807 | A | 127.40 | 48 | 1.0 | DDU 11007 | A | 127.40 |
| | 1.8 | DDU 1208 | B | 158.40 | | 1.8 | DDU 2408 | B | 158.40 | | 1.8 | DDU 4808 | B | 158.40 | | 1.8 | DDU 11008 | B | 158.40 |
| | 3.0 | DDU 1209 | D | 230.00 | | 4.0 | DDU 2409 | D | 230.00 | | 4.0 | DDU 4809 | D | 230.00 | | 4.0 | DDU 11009 | D | 230.00 |
| 110 | 0.5 | DDU 1210 | A | 127.40 | 110 | 0.5 | DDU 2410 | A | 127.40 | 110 | 0.5 | DDU 4810 | A | 127.40 | 110 | 0.5 | DDU 11010 | A | 127.40 |
| | 0.8 | DDU 1211 | B | 158.40 | | 0.8 | DDU 2411 | B | 158.40 | | 0.8 | DDU 4811 | B | 158.40 | | 0.8 | DDU 11011 | B | 158.40 |
| | 1.5 | DDU 1212 | D | 230.00 | | 2.0 | DDU 2412 | D | 230.00 | | 2.0 | DDU 4812 | D | 230.00 | | 2.0 | DDU 11012 | D | 230.00 |

## AC-DC REGULATED POWER CONVERTERS

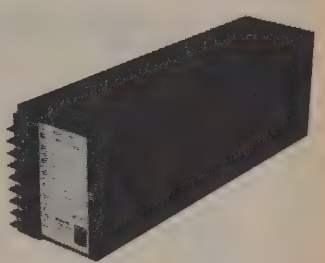
Pulse Width Modulated Inverters or Switching Output Regulators for Outputs > 10A or 100W ■ 220 VAC Input Option[2] ■ Operate on AC or DC Inputs
105-125 VAC, 47-420 Hz Input ■ 0.2% Line Regulation (LL-HL) ■ 0.2% or 20 mV Load Regulation (NL-FL) ■ 0.3% Maximum Ripple
Overload / Short Circuit Protected ■ Lightweight / Small Size ■ 5% Output Voltage Adjust Range ■ Overvoltage Protection Option[1]
Submodular Construction

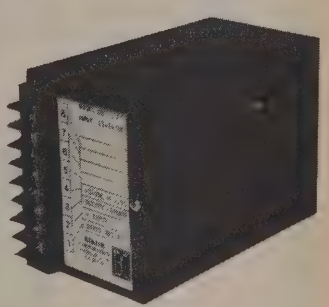
### SINGLE OUTPUT MODELS

| Output Voltage (VDC) | Output Current (Amps) | Model No. | Case Size | Price (1-24) |
|---|---|---|---|---|
| 5 | 5.0 | ADR 1100 | B | 185.90 |
| | 10.0 | ADR 1101 | C | 216.00 |
| | 25.0 | ADS 1112 | E | 385.30 |
| 12 | 2.0 | ADR 1102 | B | 185.90 |
| | 5.0 | ADR 1103 | C | 216.00 |
| | 13.0 | ADS 1113 | E | 385.30 |
| 15 | 2.0 | ADR 1104 | B | 185.90 |
| | 4.0 | ADR 1105 | C | 216.00 |
| | 12.0 | ADS 1114 | E | 385.30 |
| 28 | 1.0 | ADR 1106 | B | 185.90 |
| | 2.0 | ADR 1107 | C | 216.00 |
| | 8.0 | ADS 1115 | E | 385.30 |
| 48 | 0.5 | ADR 1108 | B | 195.90 |
| 48 | 1.0 | ADR 1109 | C | 236.00 |
| | 4.0 | ADR 1116 | E | 385.30 |
| 100 | 0.3 | ADR 1110 | B | 195.90 |
| 200 | 0.1 | ADR 1111 | B | 195.90 |
| 250 | 0.1 | ADR 1117 | B | 195.90 |

### MULTIPLE OUTPUT MODELS

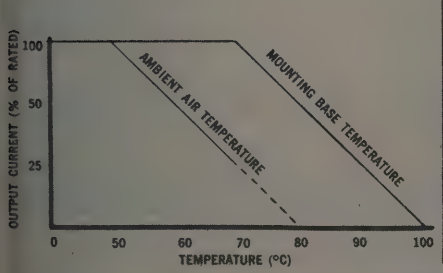
| Output Voltage (VDC) | Output Current (Amps) | Model No. | Case Size | Price (1-24) |
|---|---|---|---|---|
| +5 −5 | 4.0 4.0 | ADR 1120 | B | 258.80 |
| +12 −12 | 0.5 0.5 | ADR 1136 | B | 191.50 |
| +15 −15 | 0.5 0.5 | ADR 1121 | B | 191.50 |
| +12 −12 | 2.0 2.0 | ADR 1137 | B | 258.80 |
| +15 −15 | 2.0 2.0 | ADR 1122 | B | 258.80 |
| +12 −12 | 4.0 4.0 | ADR 1138 | E | 400.70 |
| +15 −15 | 4.0 4.0 | ADR 1127 | E | 400.70 |
| +28 −28 | 1.0 1.0 | ADR 1128 | B | 258.80 |
| +28 −28 | 2.0 2.0 | ADR 1129 | E | 400.70 |
| +5 +12 −12 | 2.0 0.5 0.5 | ADR 1139 | B | 261.60 |
| +5 +15 −15 | 2.0 0.5 0.5 | ADR 1123 | B | 261.60 |
| +5 +12 −12 | 5.0 1.0 1.0 | ADR 1140 | C | 338.60 |
| +5 +15 −15 | 5.0 1.0 1.0 | ADR 1124 | C | 338.60 |
| +5 +12 −12 | 8.0 0.5 0.5 | ADR 1141 | C | 307.70 |
| +5 +15 −15 | 8.0 0.5 0.5 | ADR 1125 | C | 307.70 |
| +5 +12 −12 | 10.0 2.0 2.0 | ADR 1142 | E | 452.40 |
| +5 +15 −15 | 10.0 2.0 2.0 | ADR 1133 | E | 452.40 |
| +5 +12 −12 | 25.0 2.0 2.0 | ADS 1143 | G | 623.30 |
| +5 +15 −15 | 25.0 2.0 2.0 | ADS 1134 | G | 623.30 |
| +12 +15 −15 | 1.0 0.5 0.5 | ADR 1135 | B | 261.60 |
| +12 +15 −15 | 3.0 1.0 1.0 | ADR 1130 | C | 338.60 |
| +12 +15 −15 | 6.0 2.0 2.0 | ADR 1131 | E | 452.40 |
| +12 +15 −15 | 15.0 2.0 2.0 | ADS 1132 | G | 623.30 |
| +5 +15 −15 +250 | 5.0 0.5 0.5 0.1 | ADR 1126 | C | 359.40 |



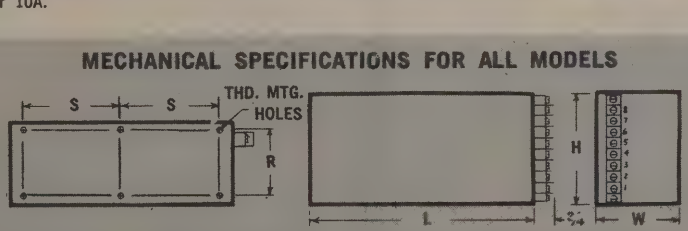


Overvoltage Option: Add "V" followed by voltage to be protected. Example: ADR1128 V5 has 5 VDC output protected.
Price: $20, for outputs up to 12A, $30 over 10A.
[2] 220 VAC Input: Contact factory.

### TEMPERATURE RATINGS FOR ALL MODELS




### MECHANICAL SPECIFICATIONS FOR ALL MODELS




| Case | L | W | H | R | S | Number of Mounting Holes / Thread Size | Weight (Typ.) |
|---|---|---|---|---|---|---|---|
| A | 5¾ (14.61) | 3 (7.62) | 4 (10.16) | 2.4 (6.10) | 5 (12.70) | 4 / #6-32 THD. | 1¼ (.57) |
| B | 8 (20.32) | 3 (7.62) | 4 (10.16) | 2.4 (6.10) | 3.5 (8.89) | 6 / #6-32 THD. | 1¾ (.79) |
| C | 12 (30.48) | 3 (7.62) | 4 (10.16) | 2.4 (6.10) | 5.5 (13.97) | 6 / #6-32 THD. | 2½ (1.13) |
| D | 10 (25.40) | 4 (10.16) | 4⅝ (11.75) | 3 (7.62) | 4.5 (11.43) | 6 / #10-32 THD. | 3½ (1.59) |
| E | 15 (38.10) | 4 (10.16) | 4⅝ (11.75) | 3 (7.62) | 4.5 (11.43) | 8 / #10-32 THD. | 4¼ (1.93) |
| G | 15 (38.10) | 6 (15.24) | 4⅝ (11.75) | 5 (12.7) | 4.5 (11.43) | 8 / #10-32 THD. | 6 (2.72) |

NOTE: Sizes, Inches (CM); Weight, Pounds (KG)

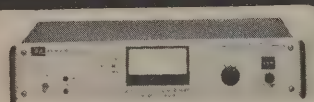
**PRICES SUBJECT TO CHANGE WITHOUT NOTICE**

BERTAN ASSOCIATES, INC.

# HIGH VOLTAGE
## REGULATED POWER SUPPLIES

**• Output to 50kV • Low Noise and High Stability**
**• Remote Programmable • Short Circuit and Arc Protected**

***Laboratory Instruments, OEM Modules and Custom Designs for Nuclear Instrumentation, Precision CRT, SEM and other High Performance Electron Beam Requirements***



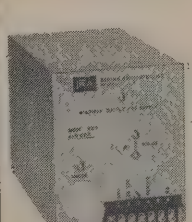
*Series 205A and 210*

**LABORATORY POWER SUPPLIES**

*Model 215*

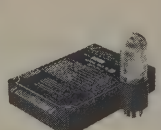
**NUCLEAR INSTRUMENTATION MODULES**
*Series NIM*

**PROGRAMMABLE HIGH VOLTAGE MODULES**
*Series 602B, 603, 605, 612*



**MULTIPLE OUTPUT CRT SUPPLIES**
*Models 620, 625 and 630*

**PRECISION PMT POWER SUPPLY**
*Model PMT-10A and PMT-20A*



| Model | Output Volts | Output mA | Regulation Line/Load % | Ripple mV p-p | Remote Program | H x W x D Inches | *Input Power |
|---|---|---|---|---|---|---|---|
| 205A-01R | 0 to ± 1,000 | 30 | 0.001/0.005 | 10 | ✓ | 3.5x19x10 | A |
| 205A-03R | 0 to ± 3,000 | 10 | 0.001/0.005 | 15 | ✓ | 3.5x19x10 | A |
| 205A-05R | 0 to ± 5,000 | 5 | 0.001/0.005 | 50 | ✓ | 3.5x19x10 | A |
| 205A-10P,N | 0 to 10,000** | 2 | 0.001/0.005 | 100 | ✓ | 3.5x19x10 | A |
| 205A-20P,N | 0 to 20,000** | 1 | 0.001/0.005 | 300 | ✓ | 3.5x19x10 | A |
| 205A-30P,N | 0 to 30,000** | 0.5 | 0.001/0.005 | 400 | ✓ | 5.3x19x15 | A |
| 205A-50P,N | 0 to 50,000** | 0.3 | 0.001/0.005 | 2V | ✓ | 5.3x19x15 | A |
| 210-01R | 0 to ± 1,000 | 150 | 0.001/0.01 | 50 | ✓ | 5.3x19x15 | A |
| 210-03R | 0 to ± 3,000 | 50 | 0.001/0.01 | 50 | ✓ | 5.3x19x15 | A |
| *Series 205A and 210 are available with remote digital programming option accepting either 16 bit binary or 4 decade BCD input. TTL compatible.* | | | | | | | |
| 215 | 0 to ± 3,000 | 5 | 0.001/0.01 | 10 | | 5x7.6x7.3 | A |
| NIM301 | 0 to ± 1,000 | 3 | 0.001/0.005 | 1 | ✓ | Dual NIM | B |
| NIM303 | 0 to ± 3,000 | 1 | 0.001/0.005 | 3 | ✓ | Dual NIM | B |
| NIM305 | 0 to ± 5,000 | 0.5 | 0.001/0.005 | 5 | ✓ | Dual NIM | B |
| NIM313 | 0 to ± 3,000 | 10 | 0.001/0.005 | 10 | ✓ | Dual NIM | A |
| NIM315 | 0 to ± 5,000 | 5 | 0.001/0.005 | 25 | ✓ | Dual NIM | A |
| NIM342 | 0 to ± 2,000 | 1 | 0.001/0.001 | 2 | ✓ | Single NIM | B |
| NIM345 | 0 to ± 5,000 | 0.3 | 0.001/0.001 | 5 | ✓ | Single NIM | B |
| NIM353 | 0 to ± 3,000 | 2 | 0.001/0.001 | 5 | ✓ | Single NIM | A |
| NIM355 | 0 to ± 5,000 | 1 | 0.001/0.001 | 10 | ✓ | Single NIM | A |
| 602B-15P,N | 0 to 1,500** | 10 | 0.001/0.005 | 15 | ✓ | 5x3x7⅝ | A |
| 602B-30P,N | 0 to 3,000** | 5 | 0.001/0.005 | 30 | ✓ | 5x3x7⅝ | A |
| 602B-50P,N | 0 to 5,000** | 2 | 0.001/0.005 | 50 | ✓ | 5x3x7⅝ | A |
| 602B-150P,N | 0 to 15,000** | 0.6 | 0.001/0.005 | 300 | ✓ | 5x3x7⅝ | A |
| 603-10P,N | 0 to 1,000** | 30 | 0.001/0.01 | 15 | ✓ | 5x5.5x7.5 | A |
| 603-15P,N | 0 to 1,500** | 20 | 0.001/0.01 | 20 | ✓ | 5x5.5x7.5 | A |
| 603-30P,N | 0 to 3,000** | 10 | 0.001/0.01 | 30 | ✓ | 5x5.5x7.5 | A |
| 603-50P,N | 0 to 5,000** | 5 | 0.001/0.01 | 50 | ✓ | 5x5.5x7.5 | A |
| 605-15P,N | 0 to 1,500** | 6 | 0.005/0.005 | 15 | | 5.1x2.8x4.8 | C,D |
| 605-30P,N | 0 to 3,000** | 3 | 0.005/0.005 | 30 | | 5.1x2.8x4.8 | C,D |
| 605-75P,N | 0 to 7,500** | 1 | 0.005/0.005 | 75 | | 5.1x2.8x4.8 | C,D |
| 605-150P,N | 0 to 15,000** | 0.3 | 0.005/0.005 | 150 | | 5.1x2.8x4.8 | C,D |
| 612-300P,N | 0 to 30,000** | 0.4 | 0.001/0.001 | 200 | ✓ | 4x8x9¼ | A |
| 620 | 6-20kV | 0.2 | 0.002/0.005 | 0.01% | ✓ | 6 x 5 x 10 | C,D |
| 620AC | 0-5kV | 0.2 | 0.002/0.005 | 0.01% | | | A |
| | 150-500V | 1 | 0.002/1 | 0.02% | | | |
| 625 | 4-15kV | 0.2 | 0.002/0.005 | 0.01% | | 5.1x2.8x4.8 | C,D |
| | 300-1,000V | 1 | 0.002/1 | 0.02% | | | |
| 630 | High Speed Dynamic Electrostatic Focus Supply. Static Focus Variable 0 to + 5,000 V @ 2 mA. Dynamic Focus 0 to 250 V/25 µsec. G-2 Supply +300 V included. | | | | ✓ | 5.1x5.3x6.5 | A |
| PMT-10AP,N | 0 to 1,000** | 4 | 0.001/0.001 | 2 | ✓ | 1.1x3.9x5.3 | D,E |
| PMT-20AP,N | 0 to 2,000** | 2 | 0.001/0.001 | 2 | ✓ | 1.1x3.9x5.3 | D,E |

***Input Power:** **A** - 115/230V±10%, 50-400 Hz. **B** - ± 12V,±24Vdc input from NIM bin. **C** - +28 Vdc. **D** - Other dc input available on special order. **E** - ±12 to ±18 or +24 to +36 Vdc.

****Specify Output Polarity Suffix:** P-Positive, N-Negative (e.g. 205A-10P specifies 0 to +10,000V).

*Specifications subject to change without no*

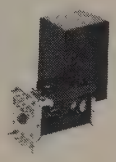
**BERTAN ASSOCIATES, Inc.** 3 Aerial Way, Syosset, N.Y. 11791 • (516) 433-3

# CEA

## A DIVISION OF BERKLEONICS, INC.

# POWER SUPPLY PRODUCTS

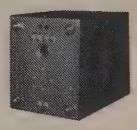
### CEA6



PRECISION VOLTAGE DISSIPATIVE REGULATORS SINGLE OUTPUT

Dissipated regulation allows for tighter output tolerances. Line plus load regulation on these models ranges from ±0.05% to ±0.0005% and up to 0.0003% RMS ripple, depending upon class of regulation specified. Output voltages from 3.5 to 500 VDC, 0.05 to 25 Amps (800 watts max.), 115 ± 10% VAC 50-420 HZ input.

### CEAT



RELIABLE TRIPLE OUTPUT POWER SUPPLIES AC/DC OR DC/DC

CEA's triple output power supplies, +5 and ±15 VDC, are dissipative regulators for low ripple and noise, 1mv RMS AC input and 50 mv (+5 VDC) 150mv (±15 VDC) on optional DC inputs. 5 different models: 12 watt, 23 watt, 55 watt, 95 watt and 175 watt. Inputs are AC: 115 ± 10%; 230± 10%; 50 to 420 HZ; or 10.5 to 55 VDC, depending upon options selected.

### CEAD6

PRECISION VOLTAGE DISSIPATIVE REGULATORS ± DUAL OUTPUT

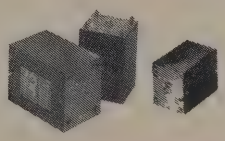
Dissipated regulation allows for tighter output tolerances. Line plus load regulation on these models ranges from ±0.05% to ± 0.0005% and up to 0.0003% RMS ripple, depending upon class of regulation specified. Output voltages from 3.5 to 500 VDC, 0.05 to 10 Amps (800 watts max.), 115 ± 10% VAC 50-420 HZ input.

### ISOLATOR

SHIELDED LINE ISOLATORS AC/AC

This series of highly shielded line isolators offers an opportunity to fully isolate electronic test equipment such as oscilloscopes, DVM's, power supplies, amplifiers, sensitive computer application and signal conditioning equipment. 5 different models, ranging from 250 VA to 2000 VA, and each type available in 0.01 pfd, 0.001 pfd or 0.0005 pfd coupling capacity. Input 115 ± 15 VAC, 50-65 HZ and output within 2% of input.

### CEA2



RELIABLE SWITCHING POWER SUPPLIES DC/DC

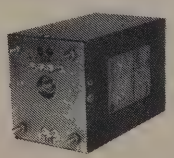
The efficient CEA 2 Series provides a regulated or unregulated DC input. These dependable modules are less than one-third the size of the CEA6 Series, which makes them ideal for high-density applications. Output voltages range from 3.5 to 500 VDC, 0.5 to 40 Amps (640 watts max.). Input options range from 10.5 to 60 VDC with 21 to 30 VAC standard.

### BATTERY CHARGER

FOR NI-CAD CELLS AND OTHER RECHARGEABLES

These 115 VAC, 60 HZ battery chargers are especially designed for nickel-cadmium and similar rechargeable cells. No damage if battery charger is left on indefinitely. Normal charge is 14-16 hours. Models range from 1.2 VDC to 36.0 (at 1.2 volt increments) and up to 1100 milliamps charging rate. Military and commercial styles available.

### CEA3



RELIABLE SWITCHING POWER SUPPLIES AC/DC

CEA has incorporated their reliable switching circuitry into the CEA3 Series for 115 VAC high-density applications. Like the CEA2 Series, this power supply will also work off 125 VDC input since the line is immediately rectified internally. Outputs range from 4.0 to 256 VDC, 0.1 to 40 Amps (640 watts max.).

CEA, DIVISION OF BERKLEONICS, INC.
1 Aerovista Park
San Luis Obispo, CA 93401
Phone (805) 544-5454
TWX 910-351-6705

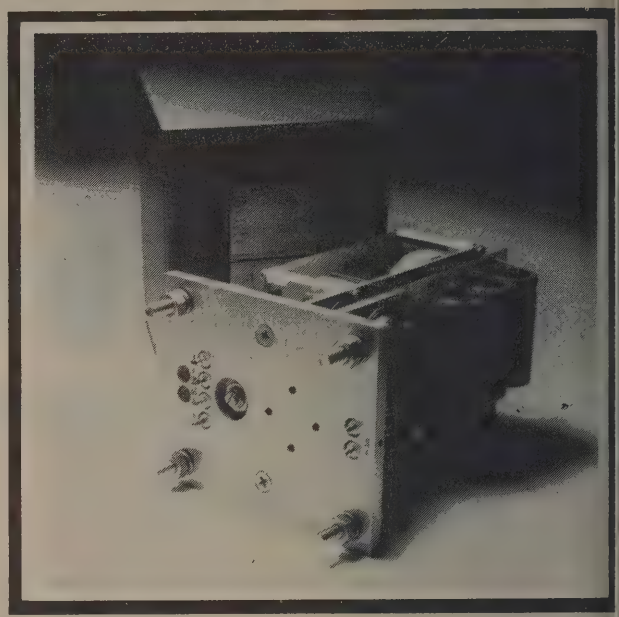
CEA
a Division of Berkleonics, Inc

# CEA'S DC TO DC SWITCHERS

## SINGLE OR TRIPLE OUTPUTS AVAILABLE

### FEATURES INCLUDE

- OUTPUT from 3.5 to 500VDC, .05 to 40AMPS, to 640 WATTS.
- INPUTS from 10.5 to 60VDC on CEA2 Series (CEA3 Series, 105-190VDC. 105-125VAC)
- REGULATION 0.5% for line or load.
- 80°C BASE TEMPERATURE without derating.
  - Floating outputs, + or − output may be ±500VDC from case.
  - Remote sensing on regulated models, eliminating load lead errors.
  - Adjustment of output ±5% regulated models. Other ranges are optional.
  - Remote adjustment optional at no charge.
  - Short circuit output currents will not damage supplies.
  - Modular case sizes with removable covers for servicing.
  - Critical components pretested, aged, and graded.
- BURN-IN (stabilization), 16 hrs. min. at rated load and high base temperature.
- 100% TESTING after burn-in, test data with shipment. **Specifications guaranteed, not just typical.**
- 3 YEAR WARRANTY for parts and labor against defects in workmanship and materials.



## CEA2 SERIES — DC TO DC

### SPECIFICATIONS

REGULATION — STABILITY — RIPPLE

| Class of Regulation | Line Regulation for Full DC Input Change | Load Regulation from 10% to Full Load | Ripple P-P* | Temperature Coefficient Per Degree C | Efficiency Up to | Option Required |
|---|---|---|---|---|---|---|
| A | None | 10% + .5V | 3.0% | 0.1% | 90% | F |
| C | 0.5% | 0.5% | 1.0% | 0.02% | 80% | None |

*Output ripple measured at 300 kHz bandwidth.

**Input Voltage:** 21 to 30VDC standard, other input ranges are optional.

**Output Voltage and Current:** 3.5 to 500VDC .05 to 40A. Triple outputs available, CEAT Series AC or DC Inputs, refer to AC/DC products data sheet for technical information.

**Recovery Time:** As fast as 10 $\mu$s for "A" regulation supplies. For "C" supplies typically less than 1ms for a 50% to 100% load change.

**Insulation Resistance:** 100 Megohms DC for input, output and case.

**Temperature, Base:** −20°C to +80°C operating, −40°C to +85°C storage.

**Size-Weight-Terminations:** Details associated mechanical data (FA thru RA), tabulated below, are shown on the back cover of this data sheet.

See correlation in table below

### HOW TO FIND CASE SIZE DATA

1. Find the output voltage between the limits in the table below. Follow that row to the appropriate current column. Case sizes are listed as, FA, HA, GA, etc
2. Turn to the back cover of this data sheet for mechanical data.
3. See price list for ordering information.

| OUTPUT VOLTAGE | | OUTPUT RATED CURRENT | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 Digits Under 10V 3 Digits 10V and Over | Decimal Code | .05A (500) | .1A (101) | .25A (251) | .5A (501) | 1A (102) | 2.5A (252) | 5A (502) | 10A (103) | 20A (203) | 40A (403) |
| select any voltage between limits | | Size | Size | Size | Size | Size | Size | Size | Size | Size | Size |
| | | | | | | "A" Regulation Below | | | | | |
| 3.5 to 9.9 | X | | | | | FA | GA | HA | KA | NA | QA |
| 10.0 to 15.9 | Y | | | | | FA | GA | JA | MA | PA | RA |
| 16.0 to 29.9 | Y | | | | FA | GA | JA | MA | PA | RA | |
| 30.0 to 59.9 | Y | | | | GA | JA | MA | PA | RA | | |
| 60.0 to 99.9 | Y | | FA | GA | HA | KA | NA | RA | | | |
| 100 to 159 | Z | | FA | GA | JA | MA | QA | | | | |
| 160 to 299 | Z | FA | GA | JA | MA | PA | | | | | |
| 300 to 500 | Z | GA | HA | LA | NA | RA | | | | | |
| | | | | | | "C" Regulation Below | | | | | |
| 3.5 to 9.9 | X | | | | | FA | GA | HA | KA | NA | QA |
| 10.0 to 15.9 | Y | | | | | FA | GA | JA | MA | PA | RA |
| 16.0 to 29.9 | Y | | | | FA | GA | JA | MA | PA | RA | |
| 30.0 to 59.9 | Y | | | | GA | JA | MA | PA | RA | | |
| 60.0 to 99.9 | Y | | FA | GA | HA | KA | NA | RA | | | |
| 100 to 159 | Z | | FA | GA | JA | MA | QA | | | | |
| 160 to 299 | Z | FA | GA | JA | MA | PA | | | | | |
| 300 to 500 | Z | GA | HA | LA | NA | RA | | | | | |

NOTE: Please refer to price list for additional options, pricing and limitations on specific models.

# CEA3 SERIES — DC TO DC / AC TO DC

## SPECIFICATIONS

REGULATION — STABILITY — RIPPLE

| Class of Regulation | Line Plus Load Regulated | Line Regulation for 10% Line Change | Load Regulation 10% Load to Full Load | Temperature Coefficient Per Degree C | Stability for 40 Hours | Ripple P-P* |
|---|---|---|---|---|---|---|
| A | 0.5% | 0.25% | 0.25% | 0.5% | 0.5% | 1.0% |
| B | ±0.1% | ±0.05% | ±0.05% | ±0.02% | ±0.1% | ±0.2% |

*Output ripple measured at 300 kHz bandwidth. Output voltages less than 10 VDC have minimum ripple of 20 mv.

**Input Voltage:** 120 to 180VDC/105 to 125VAC standard input.

**Output Voltage and Current:** 4.0 to 256VDC, 0.1 to 60A. See correlation in table below.

**Efficiency:** Up to 80%. The output rectifier voltage drop of a 5V output limits efficiency to 64% on some models.

**Recovery Time:** Typically less than 1ms for a 50% to 100% load change.

**Insulation Resistance:** 100 Megohm DC standard for input, output and case.

**Temperature, Base:** −20°C to +80°C operating, −40°C to +85°C storage.

**Size-Weight-Terminations:** Details associated with mechanical data (GA thru RA), tabulated below, are shown on the back cover of this data sheet.

## HOW TO FIND CASE SIZE DATA

1. Find the output voltage between the limits in the table below. Follow that row to the appropriate current column. Case sizes are listed as, FA, HA, GA, etc.
2. Turn to the back cover of this data sheet for mechanical data.
3. See price list for ordering information.

| 2 Digits Under 10V 3 Digits 10V and Over | Decimal Code | .1A (101) | .25A (251) | .5A (501) | 1A (102) | 2.5A (252) | 5A (502) | 10A (103) | 20A (203) | 40A (403) | 60A (603) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Select any voltages between the limits | | Size | Size | Size | Size | Size | Size | Size | Size | Size | Size |
| 4.0 to 7.9 | X | | | | | GA | HA | JA | MA | NA | PA |
| 8.0 to 15.9 | X<br>Y | | | | GA | HA | JA | KA | NA | RA | |
| 16.0 to 31.9 | Y | | | GA | HA | JA | KA | NA | RA | | |
| 32.0 to 63.9 | Y | | GA | HA | JA | KA | NA | RA | | | |
| 64.0 to 127 | Y<br>Z | GA | HA | JA | KA | NA | RA | | | | |
| 128 to 256 | Z | HA | JA | KA | NA | RA | | | | | |

NOTE: Please refer to price list for additional options, pricing and limitations on specific models.

## OPTIONAL FEATURES FOR DC TO DC POWER CONVERTERS

| Symbol Option | Option Description | CEA2's | CEA3's |
|---|---|---|---|
| | **FIXED OUTPUTS** | | |
| F | Fixed output | ±5% | ±1.0% |
| F1 | Fixed output | ±1% | ±0.2% |
| | **EXTENDED TEMPERATURE RANGE** | | |
| H1 | Temperature range −55°C to +80°C | | |
| H2 | Temperature range −40°C to +80°C | | |
| H3 | Temperature range −55°C to +115°C | | |
| | **SPECIAL CONNECTIONS** | | |
| N1 | Screw terminals #6-32 (LA or larger) | | |
| | **PROTECTION CIRCUITS** | | |
| Std. | Current limiting (110-150% of rated) | | |
| P2 | Overtemperature cutout above 80°C | | |
| P3 | Crowbar voltage limit 110% or 1.5V | | |

| Symbol Option | Option Description |
|---|---|
| | **REMOTE PROGRAMMING** |
| R | Remote adjust (no pot provided) |
| R1 | Remote adjust with 1% linearity |
| R2 | Remote adjust plus internal pot |
| R3 | Remote adjust with pot provided |
| | **HIGH FLOAT VOLTAGE** |
| U | Output float up to ±1000V |
| | **RUGGEDIZED** |
| W | Potted for ruggedization in polyurethane resin |
| | **Note:** Power supplies potted with polyurethane resin have been tested to the environmental stress levels called out in MIL-STD-810B without preformance degradation. |

(Subject to Change Without Notice)

CALL THE FACTORY FOR PRICES AND DELIVERY

1 Aerovista Park, San Luis Obispo, CA 93401/Phone 805-544-5454/TWX 910-351-6705

CEA
a Division of Berkleonics, Inc.

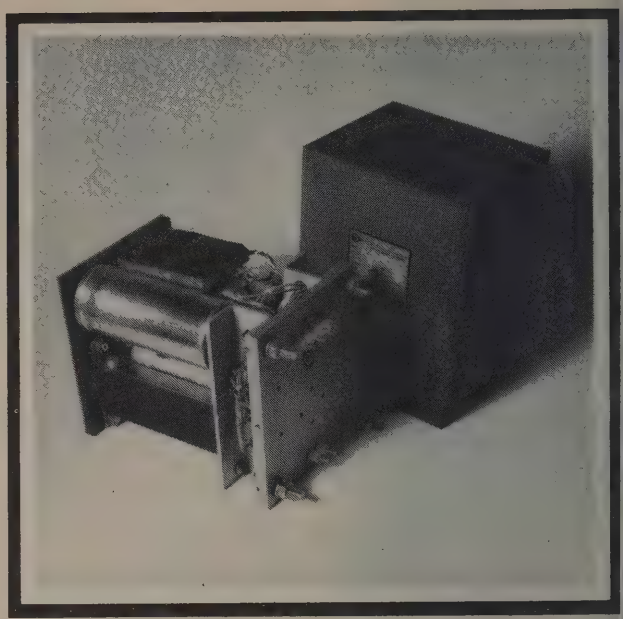
# AC TO DC POWER SUPPLIES

## STANDARD FEATURES INCLUDE

- INPUTS 50 to 420 Hz, 95 to 460VAC.
- REGULATION from .05% to .0005% for line plus load.
- 80°C BASE TEMPERATURE without derating.
- SHIELDING, line isolation, eliminating glitches and other noise problems. 20 db standard, up to 100 db optional.
  Floating outputs, + or − output may be ±500VDC from case.
  Remote sensing standard, all models, eliminates load lead errors.
  Adjustment of output ±5% standard. Other ranges are optional.
  Remote adjustment optional at no charge.
  Short circuit output current will not damage supplies.
  Modular case sizes with removable covers for servicing.
  Critical components pretested, aged, and graded.
- BURN-IN (stabilization), 16 hrs. min. at rated load and high base temperature.
- 100% TESTING after burn-in, test data with shipment.

**Specifications guaranteed, not just typical.**

- 3 YEAR WARRANTY for parts and labor against defects in workmanship and materials.



# CEA6 Single output and CEAD6 Dual output

## SPECIFICATIONS

REGULATION — STABILITY — RIPPLE — BASE MODEL PRICE

| Class of Regulation | Line Plus Load Regulation | Line Regulation for 10% Line Change | Load Regulation for No Load to Full Load | Temperature Coefficient Per Degree C | Stability for 40 Hours | RMS Ripple | CEA6 Options Required | CEAD6 Options Required | Output Current Limit |
|---|---|---|---|---|---|---|---|---|---|
| A | ±0.05% | ±0.01% | ±0.04% | ±0.01% | ±0.05% | 0.01% | None | F's or R's | 25A |
| B | ±0.01% | ±0.002% | ±0.008% | ±0.005% | ±0.01% | 0.001% | None | F's or R's | 25A |
| C | ±0.0025% | ±0.0005% | ±0.002% | ±0.001% | ±0.0025% | 0.0005% | F's or R's | F's or R's | 5A |
| D | ±0.0005% | ±0.0001% | ±0.0004% | ±0.0005% | ±0.0005% | 0.0003% | F's or R's | F's or R's | 1A |

**Input Voltage and Frequency:** 05 to 125 volts — 50 to 420 Hz are standard.

**Other Input Ranges:** Listed on AC/DC price list. Also see CEA3 series in DC/DC for AC off-line switching regulated suplies.

**Output Voltage and Current:** 3.5 to 500VDC — .05 to 25A. See correlation in table below.

**Recovery Time:** As fast as 10 microseconds, depending on model selected.

**Insulation Resistance:** 100 Megohms — standard for input, output and case; 1K Megohms for option "T"; 10K Megohms for option "TI."

**Temperature, Base:** −20°C to +80°C operating, −40°C to +85°C storage.

## HOW TO FIND CASE SIZE DATA

1. Find the output voltage between the limits in the table below. Follow that row to the appropriate current column. Case sizes are listed as, FA, HA, GA, etc.
2. Turn to the back cover of this data sheet for mechanical data.
3. See price list for ordering information.

| OUTPUT VOLTAGE | | OUTPUT RATED CURRENT | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 digits under 10V<br>3 digits 10V & over | Decimal Code | .05A (500) | | .1A (101) | | .25A (251) | | .5A (501) | | 1A (102) | | 2.5A (252) | | 5A (502) | | 10A (103) | | 25A (253) | |
| Select any voltage between limits | | Single | Dual | Single | Dual | Single | Dual | Single | Dual | Single | Dual | Single | Dual | Single | Dual | Single | Dual | Single | |
| 3.5 to 9.9 | X | | | FA | HA | GA | JA | HA | KA | JA | LA | MA | PA | NA | QA | QA | SA | SA | |
| 10.0 to 12.4 | Y | | | FA | HA | GA | JA | HA | KA | JA | LA | MA | PA | NA | QA | QA | SA | SA | |
| 12.5 to 27.4 | Y | | | GA | JA | HA | KA | JA | LA | KA | MA | NA | QA | PA | RA | RA | TA | TA | |
| 27.5 to 29.9 | Y | | | GA | JA | HA | KA | KA | MA | LA | NA | NA | QA | PA | RA | RA | TA | TA | |
| 30.0 to 39.9 | Y | | | GA | JA | JA | LA | LA | NA | NA | QA | PA | RA | QA | SA | SA | | | |
| 40.0 to 49.9 | Y | | | HA | KA | JA | LA | LA | NA | NA | QA | PA | RA | QA | SA | SA | | | |
| 50.0 to 59.9 | Y | HA | KA | JA | LA | KA | MA | MA | PA | PA | RA | QA | SA | RA | TA | TA | | | |
| 60.0 to 79.9 | Y | JA | LA | KA | MA | LA | NA | MA | PA | PA | RA | QA | SA | SA | | | | | |
| 80.0 to 89.9 | Y | JA | LA | KA | MA | LA | NA | MA | PA | PA | RA | RA | TA | SA | | | | | |
| 90.0 to 99.9 | Y | JA | LA | KA | MA | LA | NA | MA | PA | QA | SA | RA | TA | SA | | | | | |
| 100 to 119 | Z | KA | MA | LA | NA | MA | PA | NA | QA | QA | SA | SA | TA | TA | | | | | |
| 120 to 139 | Z | KA | MA | LA | NA | MA | PA | NA | QA | QA | SA | SA | TA | TA | | | | | |
| 140 to 159 | Z | KA | MA | LA | NA | MA | PA | NA | QA | RA | TA | SA | | | | | | | |
| 160 to 199 | Z | LA | NA | MA | PA | NA | QA | PA | RA | RA | TA | TA | | | | | | | |
| 200 to 219 | Z | LA | NA | MA | PA | NA | QA | PA | RA | RA | TA | TA | | | | | | | |
| 220 to 259 | Z | MA | PA | NA | QA | PA | RA | QA | SA | SA | TA | TA | | | | | | | |
| 260 to 279 | Z | MA | PA | NA | QA | PA | RA | QA | SA | SA | | | | | | | | | |
| 280 to 339 | Z | NA | QA | PA | PA | QA | SA | RA | TA | SA | | | | | | | | | |
| 340 to 379 | Z | NA | QA | PA | RA | QA | SA | RA | TA | TA | | | | | | | | | |
| 380 to 500 | Z | PA | RA | QA | SA | RA | TA | SA | TA | TA | | | | | | | | | |

## OPTIONAL FEATURES

Options for the CEA6, CEAD6 and CEAT power supplies vary according to product specifications and application. The options listed below are those common to all three output types. Other options and descriptions are available upon request. Please contact the factory in San Luis Obispo for details.

| Symbol Option | Option Description |
|---|---|
| | **FIXED OUTPUTS** |
| F | Fixed output ±1.0% |
| F1 | Fixed output ±0.1% |
| F2 | Fixed output ±0.01% |
| | **ADJUSTABLE OUTPUTS** |
| G | Output adjust range ±1% |
| Std. | Output adjust range ±5% |
| G1 | Output adjust range ±10% |
| G2 | Output adjust range ±20% |
| G3 | Output adjust range ±30% |
| G4 | Output adjust range ±40% |
| G5 | Output adjust range ±50% |

Note: Next larger case size may be required for Options G2, G3, G4 and G5. The temperature coefficient is degraded in Classes B, C and D for Options G2 thru G5.

| | |
|---|---|
| | **EXTENDED TEMPERATURE RANGE** |
| H1 | Temperature range −55°C to +80°C |
| H2 | Temperature range −40°C to +80°C |
| H3 | Temperature range −55°C to +115°C |
| | **DUAL OUTPUT ISOLATION** |
| K | Isolated outputs |
| | **AC INPUT VOLTAGE AND FREQUENCY** |
| L | Input 95-135V, 50-420 Hz |
| L1 | Input 208V ±10%, 50-420 Hz |
| L2 | Input 230V ±10%, 50-420 Hz |
| L3 | Input 460V ±10%, 50-420 Hz |
| L4 | Input 105-125V, 400 ±20 Hz |
| L5 | Input 115/230V, 50-420 Hz |
| | **SPECIAL CONNECTIONS** |
| N1 | Screw terminals #6-32 |
| | **PROTECTION CIRCUITS** |
| P1 | Current limiting |
| P2 | Overtemperature output |
| P3 | Crowbar voltage limit |

| Symbol Option | Option Description |
|---|---|
| | **REMOTE PROGRAMMING** |
| R | Remote adjust (no pot provided) |
| R1 | Remote adjust with 1% linearity |
| R3 | Remote adjust with pot provided (A&B only) |
| | **OPTIONAL STARTING CIRCUITS** |
| S1 | Start with 30,000 mfd/amp-100,000 mfd. max. |
| S2 | Start positive output first |
| S3 | Start negative output first |
| | **HIGH ISOLATION** |
| T | 40 db transformer shielding |
| T1 | 100 db transformer shielding |
| | **HIGH FLOAT VOLTAGE** |
| U | Output float up to ±1000V |
| | **RUGGEDIZED** |
| W | Potted for ruggedization in polyurethane resin |

Note: Power supplies potted with polyurethane resin have been tested to the environmental stress levels called out in MIL-STD-810B without preformance degradation.

# CEAT Series — Triple + 5V ±15V (Standard DC inputs available)

## SPECIFICATIONS

| Part Number | +5V Output Current | ±15V Output Current | Line Regulation (10% Charge) +5V | Line Regulation (10% Charge) ±15V | Load Regulation (N/L to F/L) +5V | Load Regulation (N/L to F/L) ±15V | RMS Ripple | Temperature Coefficient | Case Size |
|---|---|---|---|---|---|---|---|---|---|
| CEAT50J15 | 1.0A | .25A | | | | | | | JA |
| CEAT50M15 | 2.5A | .5A | ±.02% | ±.01% | ±.02% | ±.01% | 1 mV | ±.01%/°C | MA |
| CEAT50N15 | 5.0A | 1.0A | for all | for all | +.0005 U | for all | for all | for all | NA |
| CEAT50Q15 | 10.0A | 2.5A | Models | Models | for all | Models | Models | Models | QA |
| CEAT50S15 | 20.0A | 5.0A | | | Models | | | | SA |

SEE PRICE LIST FOR AVAILABLE OPTIONS AND PRICING.

**Input Voltage and Frequency:** 105 to 125VAC, 50 to 420 Hz are standard. DC and other voltage ranges are optional.

**Output Voltage and Current:** +5, ±15VDC. .25 to 20A. See correlation in table above. +4.5-6.0VDC. ±10-18VDC also available. Call factory.

**Voltage Setting Accuracy:** +5V ±1%. −15V ±1%. +15V tracks ±1%.

**Temperature, Base:** −20°C to +80°C operating. −40°C to +85°C storage.

**Size-Weight-Terminations:** Details associated with mechanical data (JA thru SA) in table above are shown on the back cover of this data sheet.

These standard catalog power supplies can be electrically and mechanically modified for specific applications. Our sales staff will be happy to discuss your particular requirements.

CALL THE FACTORY FOR PRICE AND DELIVERY

1 Aerovista Park, San Luis Obispo, CA 93401/Phone 805-544-5454/TWX 910-351-6705

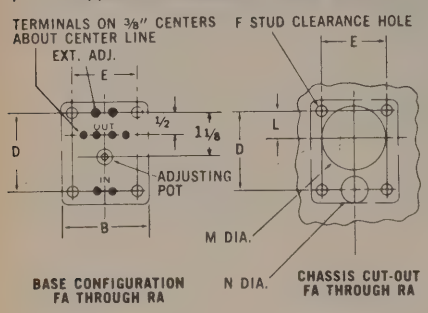
CEA
a Division of Berkleonics, Inc.

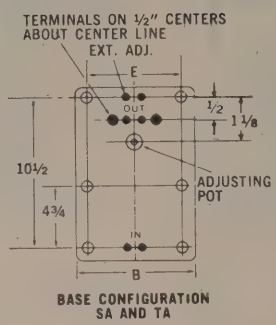
(Subject to Change Without Notice)

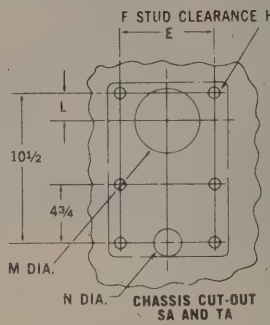
# MOUNTING AND TERMINATIONS

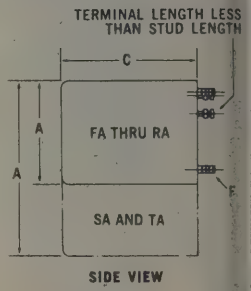
## MECHANICAL DATA

For convenience in mounting handling, the entire CEA line of standard power supplies are packaged in only 13 different case sizes. The physical dimensions and simplest chassis cutout dimensions are given below. Use adequate cooling to maintain base temperature below 80°C.




## MODEL DIMENSIONS/CASE SIZES AND WEIGHTS

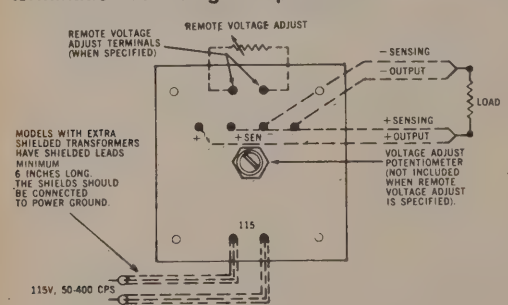
| Size‡ | A | B | C | D | E | F | 1/8 L | Chassis Clearance Holes† M | N | Standard* Wt. Lbs. | Potted Units Option W Lbs. | Base Area Sq. In. | Volume Cu. In. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FA | 2 5/16 | 2 1/16 | 3 1/8 | 1 11/16 | 1 7/16 | 6-32 x 3/8 | 1 1/16 | 1 11/16 | 3/4 | 1 | 1 1/4 | 4.8 | 13 |
| GA | 2 3/4 | 2 3/8 | 3 13/16 | 2 1/8 | 1 3/4 | 6-32 x 3/8 | 1 1/16 | 1 11/16 | 3/4 | 1 3/4 | 2 1/4 | 6.5 | 25 |
| HA | 3 1/16 | 2 5/8 | 4 1/4 | 2 13/64 | 1 55/64 | 6-32 x 3/8 | 1 1/16 | 1 11/16 | 3/4 | 2 1/2 | 3 | 8.0 | 34 |
| JA | 3 9/16 | 3 1/16 | 4 7/8 | 2 5/8 | 2 1/8 | 8-32 x 3/8 | 1 1/16 | 1 11/16 | 3/4 | 3 1/2 | 4 1/2 | 10.8 | 53 |
| KA | 3 15/16 | 3 3/8 | 5 1/4 | 3 | 2 7/16 | 10-32 x 1/2 | 1 1/16 | 1 11/16 | 3/4 | 4 1/4 | 6 1/4 | 13.3 | 70 |
| LA | 4 5/16 | 3 1/16 | 5 9/16 | 3 5/16 | 2 11/16 | 10-32 x 1/2 | 1 1/16 | 1 11/16 | 3/4 | 5 1/2 | 7 3/4 | 15.9 | 88 |
| MA | 4 11/16 | 4 | 6 | 3 11/16 | 3 | 1/4-20 x 5/8 | 1 1/16 | 1 11/16 | 3/4 | 7 | 9 1/2 | 18.7 | 112 |
| NA | 5 1/16 | 4 5/16 | 6 13/16 | 4 1/16 | 3 5/16 | 1/4-20 x 5/8 | 1 1/16 | 1 11/16 | 3/4 | 9 | 12 1/2 | 21.8 | 149 |
| PA | 6 1/16 | 4 13/16 | 6 13/16 | 5 1/16 | 3 13/16 | 1/4-20 x 5/8 | 1 1/16 | 1 11/16 | 3/4 | 12 | 16 1/2 | 28.4 | 198 |
| QA | 7 1/16 | 5 9/16 | 7 1/16 | 6 1/16 | 4 9/16 | 5/16-18 x 21/32 | 1 1/16 | 1 11/16 | 3/4 | 17 | 23 | 39.2 | 277 |
| RA | 8 1/16 | 6 1/16 | 7 1/16 | 7 1/16 | 5 11/16 | 5/16-18 x 21/32 | 1 1/16 | 1 11/16 | 3/4 | 30 | 38 | 53.9 | 381 |
| SA | 11 11/16 | 5 9/16 | 7 1/16 | — | 4 7/16 | 5/16-18 x 7/8 | 1 1/16 | 2 1/4 | 3/4 | 35 | 45 | 63.0 | 463 |
| TA | 11 11/16 | 6 1/16 | 8 1/16 | — | 5 9/16 | 5/16-18 x 7/8 | 1 1/16 | 2 1/4 | 3/4 | 50 | 65 | 78.2 | 632 |

†Chassis cutout dimensions are typical for all single output supplies and fixed output dual units. For dual output units with terminals, omit "N" hole and substitute "M" diameter hole using "L" dimensions both ends.

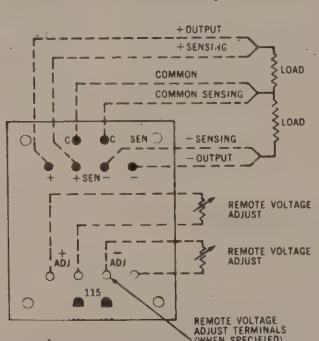
*Weights shown are approximate. CEA2's and CEA3's are 50% lighter.

## ELECTRICAL TERMINATION DATA

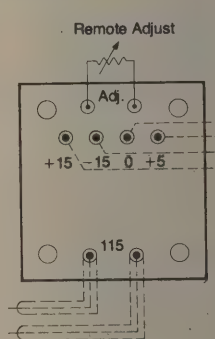
### termination data single output units


REMOTE VOLTAGE ADJUST TERMINALS (WHEN SPECIFIED)
REMOTE VOLTAGE ADJUST
-SENSING
-OUTPUT
LOAD
+SENSING
+OUTPUT
+SEN
MODELS WITH EXTRA SHIELDED TRANSFORMERS HAVE SHIELDED LEADS MINIMUM 6 INCHES LONG. THE SHIELDS SHOULD BE CONNECTED TO POWER GROUND.
VOLTAGE ADJUST POTENTIOMETER (NOT INCLUDED WHEN REMOTE VOLTAGE ADJUST IS SPECIFIED).
115
115V, 50-400 CPS

### termination data dual output units




### termination data TRIPLE output units




**Discounts:**

| | |
|---|---|
| 1-net | 10-24 less 18% |
| 2-4 less 7% | 25-99 less 22% |
| 5-9 less 13% | 100-up call factory |

20 Amps and Under—Solder Turret Type
Over 20 Amps—1/4-20 Studs (Input Terminal Spacing Modified)

**Terms and Conditions:** Net 30 days. F.O.B. San Luis Obispo

**Warranty:** 3 years parts and labor against manufacturing defects.

CALL THE FACTORY FOR PRICE AND DELIVERY

1 Aerovista Park, San Luis Obispo, CA 93401/Phone 805-544-5454/TWX 910-351-6705

CEA
a Division of Berkleonics, Inc.

Subject to Change Without Notice.

# DC to DC Converters

## MODEL NUMBERS

### CASE UNITS
**1.5" x 3" Extruded Aluminum**

**REGULATED**

| Basic Model No. | $I_{IN\ MAX}$ | Case Depth | Mounting Dim. | Base Price |
|---|---|---|---|---|
| PS 331 | .60 | 1.50 | .70 x 1.20 | 168.00 |
| PS 332 | 1.00 | 2.30 | 1.50 x 1.20 | 180.00 |
| PS 333 | 2.00 | 3.80 | 2.50 x 1.20 | 195.00 |
| PS 334 | 4.00 | 7.00 | 5.00 x 1.20 | 215.00 |

**UNREGULATED**

| | | | | |
|---|---|---|---|---|
| PS 336 | .60 | 1.00 | ¢ x 1.20 | 78.00 |
| PS 337 | 1.00 | 1.30 | ¢ x 1.20 | 81.00 |
| PS 338 | 2.00 | 2.00 | .70 x 1.20 | 94.00 |
| PS 339 | 4.00 | 3.50 | 2.00 x 1.20 | 121.00 |

### PC CARDS .75" Thick

**REGULATED**

| Basic Model No. | $I_{IN}$ | Hgt. | Lgth. | Mounting Dim. Fr. Edge CtoC | Base Price |
|---|---|---|---|---|---|
| PS 341 | .60 | 2.50 | 3.50 | .60 x 1.00 | 97.00 |
| PS 342 | 1.00 | 2.50 | 4.00 | .60 x 1.00 | 99.00 |
| PS 343 | 2.00 | 2.50 | 5.00 | 1.30 x 1.50 | 114.00 |
| PS 344 | 4.00 | 3.00 | 8.00 | 2.50 x 2.00 | 133.00 |

**UNREGULATED**

| | | | | | |
|---|---|---|---|---|---|
| PS 346 | .60 | 2.50 | 2.50 | .60 x 1.00 | 40.00 |
| PS 347 | 1.00 | 2.50 | 3.00 | .60 x 1.00 | 42.00 |
| PS 348 | 2.00 | 2.50 | 3.00 | .60 x 1.00 | 45.00 |
| PS 349 | 4.00 | 3.00 | 6.00 | 1.50 x 1.50 | 68.00 |

## RECTIFIER SYSTEMS

**To find unit price, multiply base price times multiplier**

| | Output Voltage | Base Price Multiplier |
|---|---|---|
| AC—AC Square Wave | 2 to 1500VAC | 1.00 |
| FW—Full Wave | 5 to 35VDC | 1.12 |
| BCT—Bridge Center Tap | 5 to 60VDC | 1.24 |
| B—Bridge | 36 to 1500VDC | 1.15 |
| VD—Voltage Doubler | 1501 to 3000VDC | 1.20 |
| VQ—Voltage Quadrupler | 3001 to 6000VDC | 1.35 |

## QUANTITY DISCOUNTS

| | Unit Price |
|---|---|
| 1-3 | |
| 4-29 | LESS 10% |
| 30-99 | LESS 20% |
| 100-499 | LESS 30% |
| 500-999 | LESS 40% |

Discounts on larger quantities negotiable.
Discounts applicable only on scheduled quantities
Contract not to exceed one (1) year.

## ORDERING INFORMATION

PS 207 — 22 — 3000 — VQ +F — P

❶ ❷ ❸ ❹ ❺ ❻

❶ **Basic Model Number Determines Wattage, Size and Mounting.**

❷ **Input Voltage: This number indicates $E_{IN\ MIN}$ on the regulated units and $E_{IN}$ Nom. on the unregulated units.**

❸ **Output Voltage: May be any voltage between 2 volts and 1500 volts AC or between 5 volts and 6000 volts DC.**

❹ **Rectifier System: Select for applicable output voltage, refer to rectifier systems above.**

❺ **When a positive ground is required add +F after rectifier system. Nothing is added for negative ground.**

❻ **Modifications:**
**—P for program connection.**
**—E for enable operation.**

A On output voltages less than 20 volts the switching spikes will be about 100 mv p-p. These can be easily reduced by adding a capacitor on the output terminals.

B Because of common mode ripple it is necessary to know when a positive ground system is used (see ordering information).

C The conversion frequency will be approximately 18KHz at nominal input and output voltages.

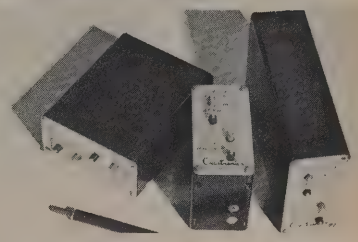
### ISOLATION

All outputs greater than 100 VDC will be isolated to 6000 VDC. All outputs less than 99 VDC will be isolated to 100 VDC. Isolation resistance will be greater than 10K Meg. For special isolation requirements call our engineering department.

**Reliability**

**Short Circuit Protected**

**Filtered Input**



**Crestronics Inc. DC to DC Converters are designed as a power supply for electronic circuits with a minimum of interference in the audio and rf ranges. The 18KHz conversion employed eliminates all audio range problems and an internal input filter reduces the rfi conductance noise to a level of less than 30 mv P-P across a one ohm resistor in series with the input.**

## REGULATED UNITS

**1.0 INPUT**

1.1 Voltage - $-E_{IN\ MIN}$ - - Customer may specify any input voltage between 11 and 28 volts DC. $E_{IN\ MIN}$ is the lowest input voltage applied. This should include the lowest excursion of ripple.

1.2 Input Voltage Differential - - $\Delta E_{IN}$ - - The normal $\Delta E_{IN}$ is 4 volts DC. For $\Delta E_{IN}$ greater than 4 volts derate the input current to

$$I \text{ derate} = \frac{6\ I_{IN\ MAX}}{\Delta E_{IN} + 2}$$

1.3 Input Current - - $I_{IN\ MAX}$ - - See Model Numbers

$I_{IN\ MAX}$ shall be derated for a $\Delta E_{IN}$ greater than 4 volts—See 1.2

$I_{IN\ MAX}$ shall be derated for greater than 70° operation—See 10.2

**2.0 OUTPUT**

2.1 Voltage - - $E_o$ - - Customer may specify output voltage up to 1500 VAC ⊓⊔ or 6000 VDC. See ordering information # ❸

2.1.1 The output voltage is screwdriver adjustable from —20% to +5% of nominal.

2.2 Power - - $P_o$ - - The output power is expressed as $(.7\ E_{IN\ MIN}\ I_{IN}) - I_o$

**3.0 REGULATION**

3.1 Line . . . . . .01%/△ input volt
3.2 Temperature . . . . . (.02%/°C) —2mv/°C
3.3 Load . . . . . 100% to 10%
For 30 VDC & Over . . . . . 3%
For 29 VDC & under . . . . . % = $\frac{(.02\ E_o) + .3}{E_o \times 10^{-2}}$

**4.0 EFFICIENCY** - - Efficiency is expressed in % as $\frac{(.7\ E_{IN\ MIN}\ I_{IN}) - I_o}{E_{IN\ MIN}\ I_{IN} \times 10^{-2}}$

## UNREGULATED UNITS

**5.0 INPUT**

5.1 Voltage - - $E_{IN}$ - - Customer may specify any input voltage between 5 and 35 VDC

5.2 Current - - $I_{IN}$ - - See Model Numbers

**6.0 OUTPUT**

6.1 Voltage - - $E_o$ - - Customer may specify any output voltage up to 1500 VAC or 6000 VDC.

$E_o$ is proportional to $E_{IN}$ Ratio = $\frac{E_{IN} - 1}{E_o}$

$E_o$ shall not exceed 1.1 $E_o$

6.2 Power - - $P_o$ - - $P_o = (.75\ E_{IN}\ I_{IN}) - I_o$

**7.0 REGULATION**

7.1 Line - - - - Directly proportional

7.2 Load - - - 100% to 10% % = $\frac{(.05\ E_o) + .3}{E_o \times 10^{-2}}$

**8.0 EFFICIENCY** - - Efficiency is expressed in % as $\frac{(.75\ E_{IN}\ I_{IN}) - I_o}{E_{IN}\ I_{IN} \times 10^{-2}}$

**9.0 RIPPLE** - - - - .3% P-P max.

## GENERAL

**10.0 TEMPERATURE**

10.1 Temperature measured at mounting surface

10.2 For temperature greater than 70°C — Derate input $I_{IN\ MAX}$ 1%/°C

**11.0 CASE** . . . . . Black Anodized Extruded Aluminum
11.1 Back Plate . . . . . Clear Anodized Aluminum
11.2 Name Plate . . . . . Metal Photo Corp.
11.3 Size . . . . . See Model
11.4 Mounting . . . . . See Model
11.5 Weight . . . . . 1.7 gram per cubic CM

**12.0 TO DETERMINE INPUT CURRENT** $I_{IN} = \frac{(E_o\ I_o) + I_o}{.7\ E_{IN\ MIN}}$

**13.0 PROGRAMMABLE** - - - - "P" Suffix with $E_o$ set at nominal, $E_o$ will be approximately 1%/.1ua or 1%/.1V. From the summing junction, approximately 7.0 volts.

**14.0 ENABLE** - - - - "E" Suffix unit will normally be inhibited with ½ $E_{IN}$ on enable lead. Unit will be Enabled when Enable lead is within 1V of negative input. Enable current will be $\frac{E_{IN}}{10K}$

Crestronics Inc.
1470 Hammer Rd.
Mohave Mesa
Rural Route # 1
Bullhead City, AZ, 86430
Phone (602) 768-4501

# CHRISTIE

Since 1929, Christie has provided the very best in high-current power supplies, various types of battery chargers, and electro-optical systems to industry and governments around the world. Christie's extensive line of state-of-the-art products enjoys an unimpeachable reputation for reliability and dependability, unmatched performance, and unparalleled life cycle.

Christie maintains this reputation by exercising complete control over all phases of design, manufacture, production, and QC testing. Christie's in-house capabilities include transformer and reactor manufacturing, Ni-Cad battery welding, sheet metal fabrication, electrostatic painting, and complete assembly line operations.

For more detailed information about any of our products, price quotations, and delivery, call collect, call toll-free, or send a TWX.

## HI-CURRENT DC POWER SUPPLIES

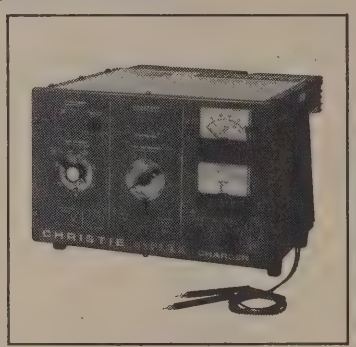
- Current ratings up to 1500 amps
- Unregulated
- Shunt regulated
- Magnetic amplifier regulated
- SCR regulated
- Transistor regulated

MOST ECONOMICAL — SCO — A — R/RA/T — K — EE — MOST SOPHISTICATED

This scale charts economy against sophistication. The darker the scale, the more sophisticated; the lighter, the more economical.

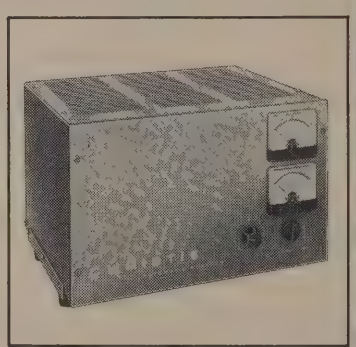
## REFLEX BATTERY CHARGER/ANALYZER MODEL RF80GT

- Aircraft Ni-Cad applications
- 1-hour full charge
- Frequent battery rejuvenation
- 95% vs. conventional 70% efficiency
- Higher battery capacity (Over 130% not unusual)
- Better cell balance, less "memory"
- Patented charging principle produces cool batteries



## SCR PRECISION BATTERY CHARGERS

- Float or Charge
- Lead-Acid Batteries
- Silver-Zinc Batteries
- ±0.25% regulation, typical
- 1% ripple, typical

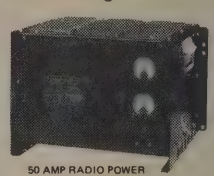


| Nominal Battery Voltages | Std. Current Ratings (amps) Ratings with • are 3-ph; all others 1-ph. | Service | Typical Regulation | Typical Ripple |
|---|---|---|---|---|
| 6, 12, 24<br>12, 24, 36<br>36, 48<br>72, 120 | 25, 50<br>150•<br>25, 50, 60•, 130•<br>12, 25, 30•, 50, 60•, 100• | Float or Charge | ±0.25% | 1% |

## MILITARY POWER SUPPLIES AND BATTERY CHARGERS

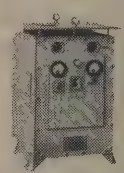
- Army
- Navy
- NASA
- Air Force

Helicopter Power Supply, 30 amp Automatic Battery Charger, 50 amp Radio Power, 75 amp Missile Testing Supply, 175 amp Forklift Truck Charger

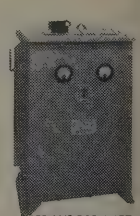


50 AMP RADIO POWER

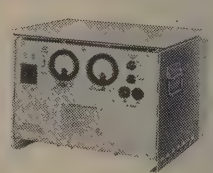
HELICOPTER STARTING POWER SUPPLY



75 AMP MISSILE TESTING SUPPLY



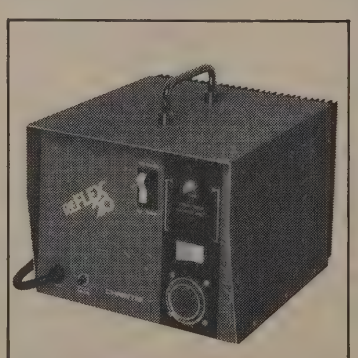
175 AMP FORKLIFT TRUCK CHARGER



30 AMP AUTOMATIC BATTERY CHARGER

## REFLEX 20 CHARGERS AND BATTERY PACKS

- 12 to 20 minute full charge
- Up to 10 times cycle life
- Sub C, C, 2/3 D, D Ni-Cad cell packs
- Patented charging principle employs depolarization pulses



**CHRISTIE**
ELECTRIC CORP.
3410 WEST 67TH STREET
LOS ANGELES, CALIFORNIA • 90043
(213) 750-1151 • TWX 910-321-3867

## TALK TO CHRISTIE

THE SOURCE SINCE 1929.
OUTSIDE CALIFORNIA
CALL TOLL-FREE 24 HRS.
(800) 421-2058

# CHRISTIE K Magamp Regulated Power Supplies

- MOST ECONOMICAL LOAD AND LINE REGULATED 3-PHASE UNITS
- EXTREME RELIABILITY AND LONG LIFE
- UP TO 500% INTERMITTENT LOAD CURRENT CAPABILITY
- AUTOMATIC BATTERY CHARGING OPTION

## STANDARD FEATURES

**D-C VOLTAGE RANGE:** Continuous adjustment over the entire range by means of one knob.

**SERIES OR PARALLEL OPERATION:** Units may be operated in series. They may also be operated in parallel, if the Current Limiting option under Optional Extras is included.

**REMOTE SENSING:** Provision for selecting "local" sensing at the power supply terminals, or "remote" sensing at the load terminals.

**REGULATION & RECTIFICATION:** All solid state design including magnetic amplifier and hermetically sealed silicon diodes. Peak voltages and currents during operation and switching held well within rated values.

**INTERMITTENT RATINGS (% of Rated Current):** 125% for 5 minutes every 20 minutes; 250% for 5 seconds every 20 seconds; 350% for 1 second; 500% peak.

**ON-OFF CONTROLS:** By a-c magnetic contactor; 3-wire start-stop pushbutton switch on front panel.

**CIRCUIT ISOLATION:** Output circuit completely isolated from input; either positive or negative d-c bus can be grounded.

**PROTECTION:** Fan failure as well as thermal overload protection (automatic reset type) for sustained overloads.

**SAFETY:** All "MH" models listed by Underwriters' Laboratories.

**AMBIENT TEMPERATURE:** Continuous operation from 0 to +55°C. (also —55°C. to 0°C. with decreased performance); storage at —62°C. to +70°C.

**COOLING:** Fan cooling by means of induction motor with sealed ball bearings, silicone lubricated for low and high temperatures.

**STABILITY:** Negligible temperature influence. Adjustable time constant.

**PILOT LIGHT:** Indicates when unit is energized.

**METERS:** 3½" voltmeter and ammeter, 2% accuracy.

**MULTIPLE INPUT:** Can be set for various a-c supply voltages by a simple reconnection.

**CABINET:** Inside readily accessible from front for inspection and routine maintenance.

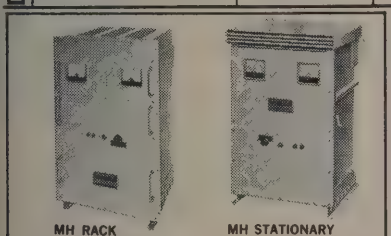
OPTIONS: Battery Charging, Parallel Operations, Remote Control, Militarizing, 50 Hz, Cabinet Styles

ENGINEERING DATA

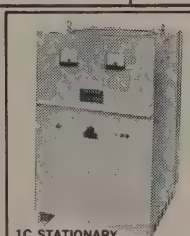
| Line | Model No.(1) (Stationary Style) | D-C Volts Output Nominal | D-C Volts Output Continuous Range | D-C Amps Continuous | D-C Voltage Regulation Static(2) ± | Dynamic(3) ± ½ Load | Dynamic(3) ± Full Load | Voltage Ripple rms | Response Time(4) Millisec. | Input A-C Volts 3-Phase 57-63 Hz | Approx. Max. A-C Amps per Phase at 220v. Suffix "2" | Approx. Max. A-C Amps per Phase at 440v. Suffix "4" | Net Weight Lbs. (Stationary) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | MH16-50K2S | 14 | 11-16 | 50 | 0.5% | 3.5v. | 5v. | 1% | 100 | 208/220(5) | 6 | 3 | 175 |
| 2 | MH16-100K2S | | | 100 | 0.5% | 3.5v. | 5v. | 1% | 100 | 208/220(5) | 11 | 5.5 | 200 |
| 3 | MH16-200K2S | | | 200 | 0.5% | 3.5v. | 5v. | 1% | 100 | 208/220(5) | 20 | 10 | 310 |
| 4 | MH16-300K2S | | | 300 | 0.5% | 3.5v. | 5v. | 1% | 100 | 208/220(5) | 30 | 15 | 330 |
| 5 | 1C15-1000K4S | 14 | 12-15 | 1000 | 0.5% | | | 1% | 100 | 440/480 | — | 43 | 700 |
| 6 | MH32-50K2S | 28 | 22-32 | 50 | 0.25% | 4v. | 6v. | 1% | 100 | 208/220(5) | 12 | 6 | 200 |
| 7 | MH32-100K24S | | | 100 | 0.25% | 4v. | 6v. | 1% | 50 | 208/220/440(7) | 22 | 11 | 245 |
| 8 | MH32-200K24S | | | 200 | 0.25% | 4v. | 6.5v. | 1% | 50(8) | 208/220/440(7) | 38 | 19 | 310 |
| 9 | MH32-300K24S | | | 300 | 0.25% | 4v. | 6.5v. | 1% | 50(8) | 208/220/440(7) | 55 | 27.5 | 370 |
| 10 | 1C36-400K4S | 28 | 26-36 | 400 | 0.25% | 5v. | 8v. | 1% | 100 | 440/480(6) | 84 | 42 | 650 |
| 11 | 1C36-500K4S | | | 500 | 0.25% | 5v. | 8v. | 1% | 100 | 440/480(6) | 104 | 52 | 720 |
| 12 | 1C36-600K4S | | | 600 | 0.25% | 5v. | 8v. | 1% | 100 | 440/480(6) | 126 | 63 | 780 |
| 13 | 2C36-800K4S | | | 800 | 0.25% | 5v. | 8v. | 1% | 100 | 440/480(6) | 168 | 84 | 980 |
| 14 | 2C36-1000K4S | | | 1000 | 0.25% | 6v. | 9v. | 1% | 100 | 440/480(6) | 200 | 100 | 1220 |
| 15 | 2C36-1200K4S | | | 1200 | 0.25% | 7v. | 10v. | 1% | 100 | 440/480(6) | 250 | 125 | 1325 |
| 16 | 2C32-1500K4S | 28 | 26-32 | 1500 | 0.25% | 5v. | 8v. | 1% | 140 | 440/480(6) | — | 130 | 1400 |
| 17 | MH36-50KK2S | 30 | 15-36 | 50 | 0.5% | 4v. | 6v. | 1% | 50 | 208/220(5) | 13 | 6.5 | 255 |
| 18 | MH36-100KK2S | | | 100 | 0.5% | 4v. | 6v. | 1% | 50 | 208/220(5) | 23 | 11.5 | 280 |
| 19 | MH36-200KK2S | | | 200 | 0.5% | 4v. | 7v. | 1% | 50(8) | 208/220(5) | 42 | 21 | 325 |
| 20 | 1C36-400KK4S | | | 400 | 0.5% | 6v. | 9v. | 1% | 100 | 440/480(6) | 90 | 45 | 750 |
| 21 | MH64-100K2S | 60 | 44-64 | 100 | 0.25% | 8v. | 12v. | 1% | 50 | 208/220(5) | 37 | 18.5 | 320 |
| 22 | 1C64-200K4S | | | 200 | 0.5% | 8v. | 12v. | 1% | 100 | 440/480(6) | 72 | 36 | 650 |
| 23 | 1C64-300K4S | | | 300 | 0.5% | 10v. | 15v. | 1% | 100 | 440/480(6) | 105 | 53 | 800 |
| 24 | MH135-40K2S | 120 | 110-135 | 40 | 0.25% | 9v. | 15v. | 1% | 50 | 208/220(5) | 30 | 15 | 285 |
| 25 | MH135-60K2S | | | 60 | 0.25% | 9v. | 15v. | 1% | 50 | 208/220(5) | 44 | 22 | 325 |
| 26 | 1C135-100K4S | | | 100 | 0.5% | 15v. | 25v. | 1% | 100 | 440/480(6) | 66 | 33 | 615 |
| 27 | 1C135-200K4S | | | 200 | 0.5% | 15v. | 25v. | 1% | 100 | 440/480(6) | 130 | 65 | 850 |
| 28 | 2C135-300K4S | | | 300 | 0.5% | 20v. | 30v. | 1% | 100 | 440/480(6) | 190 | 95 | 1100 |
| 29 | 2C280-100K4S | 250 | 220-280 | 100 | 0.5% | 30v. | 50v. | 1% | 100 | 440/480(6) | 130 | 65 | 850 |

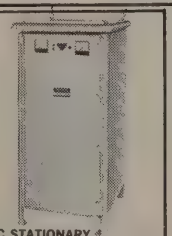
DIMENSIONS

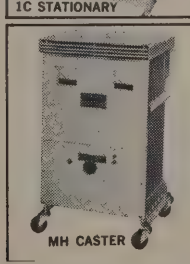
| Cabinet Style | Std. or Extra | Final Suffix | MH W | MH D | MH H | 1C W | 1C D | 1C H | 2C W | 2C D | 2C H |
|---|---|---|---|---|---|---|---|---|---|---|---|
| STATIONARY | Std. | S | 18⅞ | 19¼ | 30⅞ | 23½ | 25 | 38½ | 26¼ | 38 | 54½(11) |
| RACK | Extra | R | 19 | 18½(9) | 31½ | 24 | 23(9) | 35 | — | — | — |
| CASTER | Extra | C | 18⅞ | 19¼ | 35⅜ | 23½ | 25 | 43 | 26¼ | 38 | 60½(11) |
| 2-WHEEL | Extra | M | 22 | 20¼ | 31½(10) | — | — | — | — | — | — |


MH RACK


MH STATIONARY


1C STATIONARY


2C STATIONARY


MH CASTER

MH 2-WHEEL

(1) Insert suffixes for optional features in alphabetical order just after suffix "K" or "KK".

(2) Deviation of the d-c voltage from its average value for any combination of rated load and line variations.

(3) Maximum over or undershoot for a step change from no load to full (half) load or full (half) load to no load.

(4) For 63% reduction of transient.

(5) 220-245V.; can be reconnected for 208V. ±10%. Available for 440/480V. — substitute "4" for "2".

(6) 400-490V.; can be reconnected for 480 V. ±10%. Available for 208/220 V. — substitute "2" for "4" (at extra cost for units rated 800 amps and above).

(7) Can be connected for 208V. ±10%, 200-245V., or 400-490V.

(8) 75 milliseconds, full load to no load.

(9) Behind front panel.

(10) Add 14" for handle.

(11) Add 2" for lifting eyes.

NOTE: All values based on balanced supply line. Dynamic Regulation and Response Time based on nominal input and output.

NOTE: All dimensions given in inches.

# CHRISTIE RECTODYNE

## Load Regulated and Unregulated Power Supplies

- MOST ECONOMICAL OF ALL 3-PHASE UNITS
- EXTREME RELIABILITY AND LONG LIFE
- UP TO 600% INTERMITTENT LOAD CURRENT CAPABILITY

## STANDARD FEATURES

**OUTPUT CONTROL:** Rotary tap switch in primary circuit.

**SERIES OR PARALLEL OPERATION:** Units may be operated in series or parallel.

**RECTIFICATION:** Hermetically sealed silicon diodes. Peak voltages and currents during operation and switching held well within rated values.

**REGULATION:** Series "A" units are unregulated. Series "T" units employ single-stage, Series "R" units employ two-stage patented voltage stabilizer. The stabilizer provides regulation against changes in load only. (If regulation against line voltage is also required, refer to "K" series, page 6.) Maintains substantially constant a-c line current and drop.

**INTERMITTENT RATINGS (% of Rated Current):** 125% for 5 minutes every 20 minutes; 250% for 5 seconds every 20 seconds; 350% for 1 second; 500% peak.

**ON-OFF CONTROLS:** By a-c magnetic contactor; 3-wire start-stop pushbutton switch on front panel.

**CIRCUIT ISOLATION:** Output circuit completely isolated from input; either positive or negative d-c bus can be grounded.

**PROTECTION:** Fan failure (on units with fans) as well as thermal overload protection (automatic reset type) for sustained overloads.

**SAFETY:** All "MH", "A" and "H" models listed by Underwriters' Laboratories.

**AMBIENT TEMPERATURE:** Continuous operation from 0 to +55°C.; Storage at −62°C. to +70°C.

**COOLING:** Fan cooling by means of induction motor with sealed ball bearings, silicone lubricated for low and high temperatures.

**PILOT LIGHT:** Indicates when unit is energized.

**METERS:** Voltmeter and ammeter, 2% accuracy.

**MULTIPLE INPUT:** Connectable for a-c supply voltages shown.

**CABINET:** Inside readily accessible for inspection and routine maintenance.

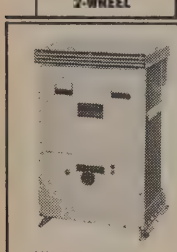
OPTIONS: Remote On-Off, Militarizing, Aircraft Starting, Cabinet Styles

### ENGINEERING DATA

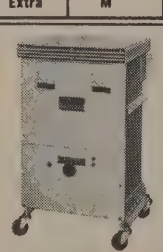
| | Series | Characteristic | D-C Volts | D-C Amps Continuous | Model Number[1] | No. of Voltage Control Steps | D-C Voltage Regulation[2] ± | Approximate Voltage Ripple RMS | Input A-C Volts 3-Phase 60 Hz | Approx. Max. A-C Amps per Phase 230V., 3-Ph. | Approx. Max. A-C Amps per Phase 460V., 3-Ph. | Approx. Net Weight Lbs. | Line |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | FIXED VOLTAGE & UNREGULATED (low impedance) | 28 | 100 | MH28-100A2S | 6 | 7.5% | 1% | 208/230V.[4] | 10 | 5 | 130 | 1 |
| | | | | 200 | MH28-200A2S | 6 | 7.5% | 1% | 208/230V.[4] | 18 | 9 | 225 | 2 |
| | R or T | FIXED VOLTAGE & LOAD REGULATED (no line regulation) | 14 / 28 | 200 / 100 | MH28-100DT2S | 6 | 4.5% | 1% | 208/230V.[4] | 10 | 5 | 205 | 3 |
| | | | 28 | 100 | MH28-100R2S | 6 | 2% | 1% | 208/230V.[4] | 10 | 5 | 130 | 4 |
| | | | | 200 | MH28-200R2S | 6 | 2% | 1% | 208/230V.[4] | 18 | 9 | 225 | 5 |
| | | | | 300 | MH28-300R2S | 6 | 2% | 1% | 208/230V.[4] | 26 | 13 | 250 | 6 |
| | | | | 400 | H28-400R2S | 6 | 2% | 1.5% | 208/230V.[4] | 35 | 17.5 | 300 | 7 |
| | | | | 600 | H28-600R2S | 6 | 2% | 1.5% | 208/230V.[4] | 50 | 25 | 450 | 8 |
| | | | | 1000 | A28-1000T4S | 6 | 3.75% | 1.5% | 416/460V. | 85 | 42.5 | 555 | 9 |
| | RA | AIRCRAFT STARTING & SERVICING | 28 | 100 | MH28-100RA2M | 6 | 2% | 1% | 208/230V.[4] | 10 | 5 | 140 | 10 |
| | | | | 200 | MH28-200RA24M | 6 | 2% | 1% | 208/230/460V. | 18 | 9 | 235 | 11 |
| | | | | 300 | MH28-300RA24M | 6 | 2% | 1% | 208/230/460V. | 26 | 13 | 260 | 12 |
| | | | | 400 | H28-400RA24M | 6 | 2% | 1.5% | 208/230/460V. | 35 | 17.5 | 315 | 13 |
| | | | | 600 | H28-600RA4M | 6 | 2% | 1.5% | 416/460V.[5] | 50 | 25 | 465 | 14 |
| | | | | 1000 | A28-1000TJA4M | 6 | 3.75% | 1.5% | 416/460V. | 85 | 42.5 | 575 | 15 |
| | A | FIXED VOLTAGE & UNREGULATED (low impedance) | 120 | 20 | MH120-20A2S | 6 | 3.5% | 1% | 208/230V.[4] | 7.5 | 4 | 150 | 16 |
| | | | | 40 | MH120-40A2S | 6 | 3.5% | 1% | 208/230V.[4] | 14 | 7 | 180 | 17 |
| | | | | 60 | MH120-60A2S | 6 | 3.5% | 1% | 208/230V.[4] | 22 | 11 | 300 | 18 |
| | | | | 80 | MH120-80A2S | 6 | 3.5% | 1% | 208/230V.[4] | 30 | 15 | 320 | 19 |
| | | | | 125 | MH120-125A2S | 6 | 3.5% | 1% | 208/230V.[4] | 46 | 23 | 360 | 20 |
| | | | | 200 | H120-200A4S | 6 | 3.5% | 1% | 416/460V.[5] | 75 | 37.5 | 400 | 21 |
| | | | | 400 | 1C120-400A4S[3] | 6 | 3% | 1% | 416/460V.[5] | 140 | 70 | 500 | 22 |
| | | | 240 | 200 | 1C240-200A4S[3] | 6 | 3% | 1% | 416/460V.[5] | 140 | 70 | 500 | 23 |

### DIMENSIONS

| Cabinet Style | Std. or Extra | Final Suffix | MH W | MH D | MH H | H W | H D | H H | 1C W | 1C D | 1C H | A W | A D | A H |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STATIONARY | Std. | S | 18⅞ | 19¼ | 30⅞ | 20¾ | 22¼ | 36⅛ | 23½ | 25½ | 43 | 26 | 28 | 42½ |
| CASTER | Extra | C | 18⅞ | 19¼ | 35⅜ | 20¾ | 22¼ | 41 | 22¾ | 23½ | 43⅜ | 26 | 28 | 48½ |
| RACK[7] | Extra | R[7] | 19 | 18½[8] | 31½ | — | — | — | 24 | 23½[8] | 38½ | — | — | — |
| 2-WHEEL | Extra | M | 22 | 20¾ | 31½[6] | 24 | 22¼ | 37[6] | — | — | — | 31½ | 28 | 43⅝[6] |

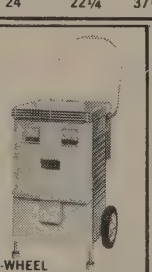


MH STATIONARY



MH CASTER

MH RACK



MH 2-WHEEL

1C STATIONARY

H 2-WHEEL

(1) Insert suffixes for optional features in alphabetical order just after series suffix "A", "R", "T", or "RA", respectively.

(2) Deviation of the d-c voltage from its average value for rated load variations, with constant a-c line voltage.

(3) Available with 3-wire output.

(4) Available for 460 V. — substitute "4" for "2".

(5) Available for 208/230 V. — substitute "2" for "4".

{ = Reconnectable from lower voltage range and higher current rating to higher voltage range and lower current rating.

(6) For handle add 8" for "H", 14" for "MH", 16" for "A".

(7) Not available on "R", "T" and "RA" series.

(8) Behind front panel.

NOTE: All values based on balanced supply line.

NOTE: All dimensions given in inches.

# CHRISTIE SCO, EE SCR Regulated Power Supplies

- 1/10 RIPPLE AND AT LEAST TWICE AS GOOD REGULATION AND RESPONSE TIME AS "K" SERIES
- CONTINUOUS RANGE DOWN TO NEAR 0 VOLTS
- VOLTAGE/CURRENT REGULATION
- AUTOMATIC BATTERY CHARGING OPTION

## STANDARD FEATURES

**C VOLTAGE RANGE:** Continuous adjustment over the entire nge by means of one knob.

**RIES OR PARALLEL OPERATION:** Units may be operated in ies or parallel.

**MOTE SENSING:** Provision for selecting "local" sensing at e power supply terminals, or "remote" sensing at the load minals. If remote sensing leads are opened, voltage will stay a safe value.

**GULATION & RECTIFICATION:** All solid state design includ- hermetically sealed SCR's. Peak voltages and currents ring operation and switching held well within rated values.

**CONTROL CIRCUIT:** Plug-in card for easy servicing.

**CURRENT REGULATION:** Continuously adjustable from 5% to 100% of full load. Regulates down to 0 volts (short circuit). Voltage remains constant as long as load current is less than current setting. At this point, the unit crosses over automatically to current regulation and current limiting.

**ON-OFF CONTROLS:** By a-c circuit breaker on "SCO". By a-c magnetic contactor with start-stop switch on front panel and terminals for remote start-stop switch on "EE"

**CIRCUIT ISOLATION:** Output circuit completely isolated from input; either positive or negative d-c bus can be grounded.

**AMBIENT TEMPERATURE:** Continuous operation from 0 to +50°C. (also −20°C. to 0°C. with decreased performance); storage at −62°C. to +70°C.

**COOLING:** 40 and 50 amp units cooled by natural convection. Others cooled by means of induction motor driven fan.

**STABILITY:** Negligible drift and temperature influence.

**METERS:** 3½" voltmeter and ammeter, 2% accuracy.

**MULTIPLE INPUT:** Can be set for various a-c supply voltages by a simple reconnection (Where applicable).

**CABINET:** Inside readily accessible for inspection and routine maintenance.

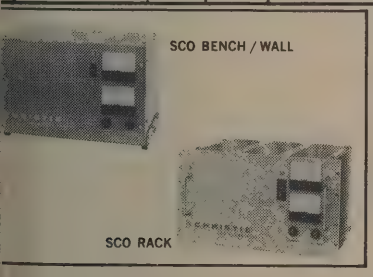
OPTIONS: Remote Adjust, Voltage Programming, Militarizing, 50 Hz, Cabinet Styles

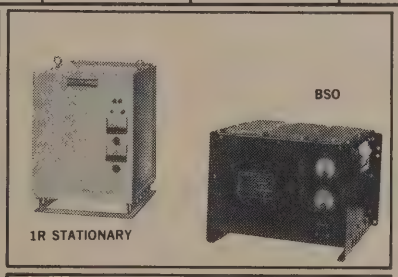
## ENGINEERING DATA

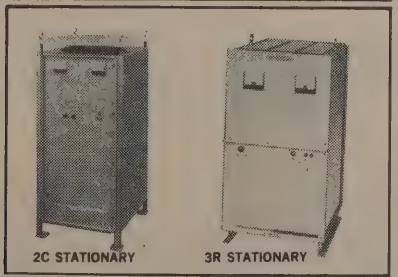
| | Line | MODEL NO.(1) (Stationary Style) | D-C VOLTS OUTPUT Nominal | D-C VOLTS OUTPUT Continuous Range | D-C AMPS CONT. | OUTPUT KW | D-C VOLTAGE REGULATION Static(2) ± Greater of | D-C VOLTAGE REGULATION Dynamic(3) ± | Current Regulation ± | Voltage Ripple rms | RESPONSE TIME Millisec(4) NL-FL | RESPONSE TIME Millisec(4) FL-NL | A-C Volts ±10% 57-63 Hz. | INPUT 1-ph. or 3-ph. | Approx. Max. Amps/Phase at 230v. | Approx. Max. Amps/Phase at 460v. | Approx. Net Weight lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SCO | 1 | SC015-100-12S | 12 | 2-15 | 0-100 | 1.5 | 0.2% or 25mv. | 3v. | 1a.(5) | 0.5% or 50mv. | 50-75 | 150 | 115/230 | | 15(7) | — | 120 |
| | 2 | SC036-50-12S | 28 | 2-37 | 0-50 | 1.8 | 0.25% or 70mv. | 5v. | 1.5a.(5) | 1% or 200mv. | 50-75 | 150 | 115/230 | 1-ph. | 13(7) | — | 110 |
| | 3 | SC048-40-12S | 36 | 2-48 | 0-40 | 1.9 | 0.25% or 70mv. | 5v. | 1.2a.(5) | 1% or 200mv. | 50-75 | 150 | 115/230 | | 13(7) | — | 105 |
| EE | 4 | 1C015-1000EE4S | 12 | 0-15 | 1000 | 15 | 0.2% or 30mv | 5v. | 850ma. | 40mv. | 100 | 200 | 460 | | — | 35 | 615 |
| | 5 | 2C030-1500EE4S | 24 | 0-30 | 1500 | 45 | 0.1% or 25mv | 5v. | 1.5a. | 30mv. | 50 | 125 | 460 | | — | 90 | 1575 |
| | 6 | 1R040-150EE24S | | | 150 | 6 | 0.1% or 25mv. | 3v. | 125ma. | 30mv. | 50 | 100 | 208/230 460 | | 28 | 14 | 300 |
| | 7 | 3R040-300EE24S | 28 | 0-40 | 300 | 12 | 0.1% or 25mv. | 3v. | 250ma. | 30mv. | 50 | 100 | 208/230 460 | | 56 | 28 | 410 |
| | 8 | 1C040-600EE4S | | | 600 | 24 | 0.1% or 25mv. | 3v. | 500ma. | 30mv. | 50 | 125 | 460 | 3-ph. | — | 54 | 660 |
| | 9 | 1C031-700EED4S(8) | 28 / 56 | 0-31 / 0-62 | 700 / 350 | 22 | 0.1% or 50mv. | 5v. / 10v. | 700ma. / 350ma. | 30mv. / 60mv. | 50 | 500 | 460 | | — | 44 | 660 |
| | 10 | 3R080-150EE2S | 60 | 0-80 | 150 | 12 | 0.1% or 100mv. | 8v. | 150ma. | 320mv. | 50 | 150 | 230 | | 55 | — | 400 |
| | 11 | 1C0135-150EE4S | 120 | 0-135 | 150 | 20 | 0.1% or 100mv. | 10v. | 125ma. | 100mv. | 50 | 125 | 460 | | — | 46 | 650 |
| | 12 | 2C0135-300EE4S | | | 300 | 40 | 0.1% or 100mv. | 10v. | 250ma. | 100mv. | 50 | 125 | 460 | | — | 92 | 775 |

## DIMENSIONS

| Cabinet Style | Std. or Extra | Final Suffix | SCO with wall bracket W | D | H | SCO without wall bracket W | D | H | SSO & BSO W | D | H | 1R W | D | H | 3R W | D | H | 1C W | D(9) | H | 2C W | D | H |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BENCH/WALL | Std. | S | 19 | 15 | 11¾ | 17⅝ | 14¾ | 11¾ | 19½ | 15¼ | 13½ | — | — | — | — | — | — | — | — | — | — | — | — |
| STATIONARY | Std. | S | — | — | — | — | — | — | — | — | — | 18 | 22⅞ | 25⅛ | 18 | 22⅞ | 33⅞ | 23½ | 25 | 38½ | 26¼ | 31½ | 54½ |
| RACK | Extra | R | — | — | — | 19 | 14⅝(9) | 10½ | — | — | — | 19 | 21¼(9) | 22¾ | 19 | 21⅝(9) | 31½ | 24 | 23(9) | 35 | — | — | — |
| CASTER(10) | Extra | C | — | — | — | — | — | — | — | — | — | 18 | 22⅞ | 29¾ | 18 | 22⅞ | 38½ | 23½ | 25 | 43 | 26¼ | 31½ | 60½ |



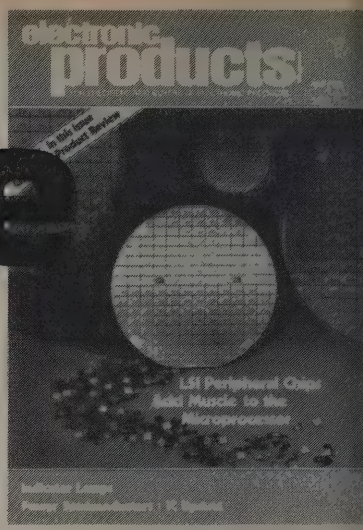




(1) Insert suffixes for optional features in alphabetical order just before final (cabinet) suffix.
(2) Deviation of the d-c voltage from its average value for any combination of rated load or line variations.
(3) Maximum instantaneous over or undershoot for load changes between no load (10% load on 135 volt units) and full load.
(4) For 63% reduction of transient in the range of 60-100% maximum rated output voltage.
(5) Up to 95% of maximum output voltage.
(6) Reconnectable from lower voltage range and higher current rating to higher voltage range and lower current rating.
(7) A-C current at 115v. is twice value at 230v.
(8) 1C031-700EED4S 4" deeper.
(9) Behind front panel.
(10) Available up to 24KW rating.

NOTE: All values for 3-phase units based on balanced supply line.
NOTE: All dimensions given in inches.

# stay up to date



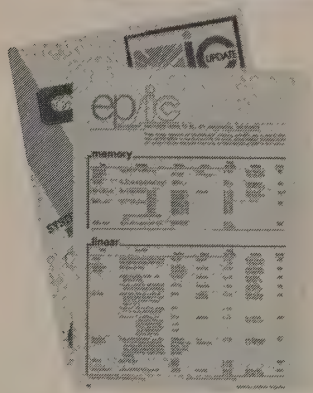

**SUBSCRIBE TO ELECTRONIC PRODUCTS MAGAZINE. IT'S YOUR *COMPLETE* GUIDE TO EVERYTHING THAT'S NEW IN THE FAST-CHANGING WORLD OF ELECTRONIC PRODUCTS AND SYSTEMS.**

**FEATURE STORIES** every month on electronic products, applications and availability.

**FORUMS**—Reports on meetings of manufacturers, users and distributors. Get the very latest news on a wide variety of products.

**NEW PRODUCT NEWS**—Hundreds of new products are introduced each month. You'll get the facts on not only what the new product is, but also where to get it, basic prices and current delivery.

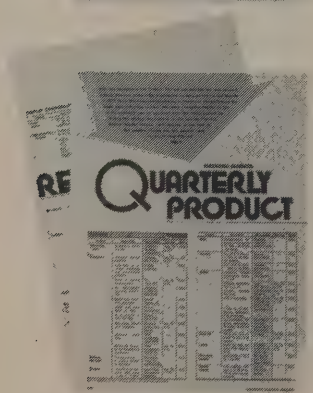
**EP/IC UPDATE**—Exclusive in ELECTRONIC PRODUCTS. A monthly report on *everything* that's new in the fast-moving world of integrated circuits.




**QUARTERLY PRODUCT REVIEW**—Another exclusive in ELECTRONIC PRODUCTS. A complete report of *every* new electronic product introduced in the previous quarter. This feature is in the January, April, July and October issues.

**QUARTERLY PRODUCT PLANNING DIRECTORY**—A compilation of the latest catalogs of a wide variety of electronic products and systems.

**OUTLOOK**—Important industry news affecting electronic products and systems.




**COMPONENT CAPERS**—A humorous look at the strange and wonderful world of electronics.

**MINI-GLOSSARIES,** Quizzes and more—Each and every month for over twenty years the readers of ELECTRONIC PRODUCTS learn something new about the products they work with and specify.

***If you are not now a subscriber, write to:***
***Dorothy Renoud, ELECTRONIC PRODUCTS MAGAZINE, 645 Stewart Avenue, Garden City, NY 11530.***
***Ask for a free qualification card.***

United Technical Publications, Inc., Div. of Cox Broadcasting Corp., 645 Stewart Ave., Garden City, NY 11530/(516) 222-2500

# DATEL

## POWER SUPPLIES

**CONTENTS**


| | PAGE |
|---|---|
| Single Output Modules | 2 |
| Dual Output Modules | 4 |
| Chassis Mounting Modules | 6 |
| Triple Output Modules | 8 |
| High Voltage Modules | 9 |
| MP Series | 10 |
| 1 & 3 Watt DC-DC | 12 |
| 5 & 10 Watt DC-DC | 14 |
| 4.5 Watt DC-DC | 16 |
| Model 1200 | 17 |


DATEL SYSTEMS, INC.

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

# Single Output Line Operated Power Modules

| SPECIFICATIONS, 25°C | UPM-5/250 | UPM-5/500 | UPM-5/1000 | UPM-5/1000B | UPM-5/2000 |
|---|---|---|---|---|---|
| Output Voltage | 5VDC | 5VDC | 5VDC | 5VDC | 5VDC |
| Output Voltage Accuracy | ±1% | ±1% | ±1% | ±2% | ±1% |
| Rated Output Current | 250mA | 500mA | 1.0A | 1.0A | 2.0A |
| Line Regulation, max. | .05% | .05% | .05% | 0.25% | .05% |
| Load Regulation, max. | 0.1% | 0.1% | 0.1% | 0.25% | 0.1% |
| Temp. Coefficient, max. | .02%/°C | .02%/°C | .02%/°C | .02%/°C | .02%/°C |
| Output Ripple, RMS max. | 1mV | 1mV | 1mV | 1mV | 1mV |
| Output Impedance, max. | .05Ω | .05Ω | .01Ω | .01Ω | .005Ω |
| Trans. Recovery Time, max. | 50 μsec. | 50 μsec. | 50 μsec. | 50 μsec. | 50 μsec. |
| Isolation Resistance, min. | 100 Meg. | 100 Meg. | 100 Meg. | 100 Meg. | 100 Meg. |
| Isolation Capacitance, max. | 250pF | 250pF | 250pF | 250pF | 250pF |
| Breakdown Voltage, min. | 1500VAC | 1500VAC | 1500VAC | 1500VAC | 1500VAC |
| Operating Temp. Range | | −25°C to +71°C (No Derating) | | | (2) |
| Storage Temp. Range | | −25°C to +85°C | | | |
| Case Material | Phenolic | Phenolic | Phenolic | Phenolic | Phenolic |
| Module Size, inches | 3.5X2.5X.875 | 3.5X2.5X.875 | 3.5X2.5X1.25 | 3.5X2.5X1.25 | 3.5X2.5X1.56 |
| Module Size, millimeters | 88,9X63,5X22,2 | 88,9X63,5X22,2 | 88,9X63,5X31,8 | 88,9X63,5X31,8 | 88,9X63,5X39, |
| Module Weight | 14 oz.(397g) | 14 oz.(397g) | 18 oz.(510g) | 18 oz. (510g) | 24 oz.(680g) |
| Case/Pin Configuration | C1 | C1 | C2 | C2 | C3 |
| Other Versions | E,J (1) | E,J (1) | E,J | E,J | E,J |
| Mating Socket | MS-7 | MS-7 | MS-7 | MS-7 | MS-7 |
| Price (1-9) | **$39.00** | **$49.00** | **$69.00** | **$49.00** | **$79.00** |

**Notes:** 1. For "E" version module size is C2 (3.5X2.5X1.25 inches, 18 oz.)
2. For UPM-5/2000 operating temp. range should be restricted for a max. case temperature of 80°C in use.

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

| UPM-6/150A | UPM-9/100A | UPM-12/100A | UPM-15/100A |
|---|---|---|---|
| 6VDC | 9VDC | 12VDC | 15VDC |
| ±1% | ±1% | ±1% | ±1% |
| 150mA | 100mA | 100mA | 100mA |
| .05% | .05% | .02% | .02% |
| 0.1% | 0.1% | .05% | .05% |
| .02%/°C | .02%/°C | .02%/°C | .02%/°C |
| 1mV | 2mV | 2mV | 2mV |
| .05Ω | 0.1Ω | 0.1Ω | 0.1Ω |
| 50 μsec. | 50 μsec. | 50 μsec. | 50 μsec. |
| 100 Meg. | 100 Meg. | 100 Meg. | 100 Meg. |
| 250pF | 250pF | 250pF | 250pF |
| 1500VAC | 1500VAC | 1500VAC | 1500VAC |
| | −25°C to +71°C (No Derating) | | |
| | −25°C to +85°C | | |
| Phenolic | Phenolic | Phenolic | Phenolic |
| 3.5X2.5X.875 | 3.5X2.5X.875 | 3.5X2.5X.875 | 3.5X2.5X.875 |
| 88,9X63,5X 22,2 | 88,9X63,5X 22,2 | 88,9X63,5X22,2 | 88,9X63,5X22,2 |
| 14 oz. (397g) | 14 oz. (397g) | 14 oz.(397g) | 14 oz.(397g) |
| C1 | C1 | C1 | C1 |
| E,J (1) | E,J (1) | E,J (1) | E,J (1) |
| MS-7 | MS-7 | MS-7 | MS-7 |
| **$39.00** | **$39.00** | **$49.00** | **$49.00** |

## DESCRIPTION

This line of single output, voltage regulated DC power supplies features six 5 volt output models with output currents from 250mA to 4 amperes. In addition, there are 4 other models with 6V to 15V outputs. All outputs have current limiting short circuit protection. Temperature coefficients are .02%/°C and output ripple voltage is 1 to 2 millivolts RMS.

## INPUT VOLTAGE SPECIFICATIONS

Standard input specification: 115VAC ±10% @ 60-440 Hz
E version: 220VAC ±10% @ 48-440 Hz
J version: 100VAC ±10% @ 48-440 Hz

There is no extra charge for E and J versions. When ordering, add E or J suffix after model number. Note that in some instances the module size is larger for the E version. MS-7 sockets are $3.50 each.

**THESE POWER SUPPLIES ARE COVERED BY GSA CONTRACT**

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

# Dual Output Line Operated Power Modules

| SPECIFICATIONS, 25°C | BPM-5/250 | BPM-5/500 | BPM-12/60 | BPM-12/100 | BPM-12/200 | BPM-12/300 |
|---|---|---|---|---|---|---|
| Output Voltage | ±5VDC | ±5VDC | ±12VDC | ±12VDC | ±12VDC | ±12VDC |
| Output Voltage Accuracy | ±1% | ±1% | ±1% | ±1% | ±1% | ±1% |
| Rated Output Current | ±250mA | ±500mA | ±60mA | ±100mA | ±200mA | ±300mA |
| Line Regulation, max. | .05% | .05% | .02% | .02% | .02% | .02% |
| Load Regulation, max. | 0.1% | 0.1% | .05% | .05% | .05% | .05% |
| Temp. Coefficient, max. | .02%/°C | .02%/°C | .02%/°C | .02%/°C | .02%/°C | .02%/°C |
| Output Ripple, RMS max. | 1mV | 1mV | 2mV | 2mV | 2mV | 2mV |
| Output Impedance, max. | .05Ω | .03Ω | 0.2Ω | 0.1Ω | .05Ω | .05Ω |
| Trans. Recovery Time, max. | 50 μsec. | 50 μsec. | 50 μsec. | 50 μsec. | 50 μsec. | 50 μsec. |
| Isolation Resistance, min. | 100 Meg. | 100 Meg. | 100 Meg. | 100 Meg. | 100 Meg. | 100 Meg. |
| Isolation Capacitance, max. | 250pF | 250pF | 250pF | 250pF | 250pF | 250pF |
| Breakdown Voltage, min. | 1500VAC | 1500VAC | 1500VAC | 1500VAC | 1500VAC | 1500VAC |
| Operating Temp. Range | −25°C to +71°C (No Derating) | | | | | (3) |
| Storage Temp. Range | −25°C to +85°C | | | | | |
| Case Material | Phenolic | Phenolic | Phenolic | Phenolic | Phenolic | Phenolic |
| Module Size, inches | 3.5X2.5X.875 | 3.5X2.5X1.25 | 3.5X2.5X.875 | 3.5X2.5X.875 | 3.5X2.5X1.25 | 3.5X2.5X1.56 |
| Module Size, millimeters | 88,9X63,5X22,2 | 88,9X63,5X31,8 | 88,9X63,5X22,2 | 88,9X63,5X22,2 | 88,9X63,5X31,8 | 88,9X63,5X39, |
| Module Weight | 14 oz.(397g) | 18 oz.(510g) | 14 oz.(397g) | 14 oz. (397g) | 18 oz.(510g) | 24 oz.(680g) |
| Case/Pin Configuration | C1 | C2 | C1 | C1 | C2 | C3 |
| Other Versions | E,J (1) | E,J (2) | E,J (1) | E,J (1) | E,J | E,J |
| Mating Socket | MS-7 | MS-7 | MS-7 | MS-7 | MS-7 | MS-7 |
| Price (1-9) | **$69.00** | **$79.00** | **$39.00** | **$49.00** | **$59.00** | **$79.00** |

Notes: 1. For "E" version module size is C2 (3.5X2.5X1.25 inches, 18 oz.)
2. For "E" version module size is C3 (3.5X2.5X1.56 inches, 24 oz.)
3. For BPM-12/300 and BPM-15/300, operating temp. range should be restricted for max. case temperature of 80°C in use.

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

| BPM-15/60 | BPM-15/100 | BPM-15/200 | BPM-15/300 |
|---|---|---|---|
| ±15VDC | ±15VDC | ±15VDC | ±15VDC |
| ±1% | ±1% | ±1% | ±1% |
| ±60mA | ±100mA | ±200mA | ±300mA |
| .02% | .02% | .02% | .02% |
| .05% | .05% | .05% | .05% |
| .02%/°C | .02%/°C | .02%/°C | .02%/°C |
| 2mV | 2mV | 2mV | 2mV |
| 0.2Ω | 0.1Ω | .05Ω | .03Ω |
| 50 μsec. | 50 μsec. | 50 μsec. | 50 μsec. |
| 100 Meg. | 100 Meg. | 100 Meg. | 100 Meg. |
| 250pF | 250pF | 250pF | 250pF |
| 1500VAC | 1500VAC | 1500VAC | 1500VAC |
| −25°C to +71°C (No Derating) | | | (3) |
| −25°C to +85°C | | | |
| Phenolic | Phenolic | Phenolic | Phenolic |
| 3.5X2.5X.875 | 3.5X2.5X.875 | 3.5X2.5X1.25 | 3.5X2.5X1.56 |
| 88,9X63,5X,22,2 | 88,9X63,5X,22,2 | 88,9X63,5X31,8 | 8,9X63,5X39,6 |
| 14 oz. (397g) | 14 oz. (397g) | 18 oz.(510g) | 24 oz.(680g) |
| C1 | C1 | C2 | C3 |
| E,J (1) | E,J (1) | E,J | E,J |
| MS-7 | MS-7 | MS-7 | MS-7 |
| **$39.00** | **$49.00** | **$59.00** | **$79.00** |

## DESCRIPTION

This broad line of dual output, voltage regulated DC power supplies features 10 different models with a wide choice of output voltages and currents. Output voltages are ±5, ±12, and ±15VDC with ±1% accuracy. Rated output currents range from ±60 to ±500mA with output short circuit protection.

Temperature coefficient is .02% per degree Centigrade and output ripple voltage is 1 to 2 millivolts RMS. These rugged, encapsulated modules are useful for powering a wide variety of devices including linear IC's, op amps, data converters, and other analog circuits.

## INPUT VOLTAGE SPECIFICATIONS

Standard input specification: 115VAC ±10% @ 60-440 Hz.

E version: 220VAC ±10% @ 48-440 Hz.
J version: 100VAC ±10% @ 48-440 Hz.

There is no extra charge for E and J versions. When ordering, add E or J suffix after model number. Note that in some instances the module size is larger for the E version. MS-7 sockets are $3.50 each.

**THESE POWER SUPPLIES ARE COVERED BY GSA CONTRACT**

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

# Chassis Mounting Modules

| SPECIFICATIONS, 25°C | UCM-5/250 | UCM-5/500 | UCM-5/1000 | UCM-5/1000B |
|---|---|---|---|---|
| Output Voltage | 5VDC | 5VDC | 5VDC | 5VDC |
| Output Voltage Accuracy | ±1% | ±1% | ±1% | ±2% |
| Rated Output Current | 250mA | 500mA | 1.0A | 1.0A |
| Line Regulation, max. | .05% | .05% | .05% | 0.25% |
| Load Regulation, max. | 0.1% | 0.1% | 0.1% | 0.25% |
| Temperature Coefficient, max. | .02%/°C | .02%/°C | .02%/°C | .02%/°C |
| Output Ripple, RMS max. | 1mV | 1mV | 1mV | 1mV |
| Output Impedance, max. | .05Ω | .05Ω | .01Ω | .01Ω |
| Transient Recovery Time, max. | 50μsec. | 50μsec. | 50μsec. | 50μsec. |
| Isolation Resistance, min. | 100 Meg. | 100 Meg. | 100 Meg. | 100 Meg. |
| Isolation Capacitance, max. | 250pF | 250pF | 250pF | 250pF |
| Breakdown Voltage, min. | 1500VAC | 1500VAC | 1500VAC | 1500VAC |
| Operating Temp. Range | | −25°C to +71°C (No Derating) | | |
| Storage Temp. Range | | −25°C to +85°C | | |
| Case Material | Phenolic | Phenolic | Phenolic | Phenolic |
| Module Size, inches | 3.5×2.5×.875 | 3.5×2.5×.875 | 3.5×2.5×1.25 | 3.5×2.5×1.25 |
| Module Size, millimeters | 88,9×63,5×22,2 | 88,9×63,5×22,2 | 88,9×63,5×31,8 | 88,9×63.5×31.8 |
| Module Weight | 14 oz.(397g) | 14 oz.(397g) | 18 oz.(510g) | 18 oz.(510g) |
| Case/Pin Configuration | D1 | D1 | D2 | D2 |
| Other Versions | E,J(1) | E,J(1) | E,J | E,J |
| Price (1-9) | **$39.00** | **$49.00** | **$69.00** | **$49.00** |

**NOTES:** 1. For "E" version module size is D2 (3.5×2.5×1.25 inches, 18 oz.)
2. For UCM-5/2000 and BCM-15/300 operating temp. range should be restricted for a max. case temperature of 80°C in use.

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424


Add Dept. EM to address to tell them you saw it in eem

his line of popular power supplies has input-output onnections made to a terminal strip on top of the odules. These supplies are useful in applications here it is impractical or undesirable to use printed rcuit cards or sockets. For simple mounting to a etal chassis, screw inserts are provided on the bot-m of the modules.

**IPUT VOLTAGE SPECIFICATIONS**

tandard Input Specification:
15VAC ±10% @ 60-440 Hz.
version: 220VAC ±10% @ 48-440 Hz.
version: 100VAC ±10% @ 48-440 Hz.

| UCM-5/2000 | BCM-15/60 | BCM-15/100 | BCM-15/200 | BCM-15/300 |
|---|---|---|---|---|
| 5VDC | ±15VDC | ±15VDC | ±15VDC | ±15VDC |
| ±1% | ±1% | ±1% | ±1% | ±1% |
| 2.0A | ±60mA | 100mA | 200mA | 300mA |
| .05% | .02% | .02% | .02% | .02% |
| 0.1% | .05% | .05% | .05% | .05% |
| .02%/°C | .02%/°C | .02%/°C | .02%/°C | .02%/°C |
| 1mV | 2mV | 2mV | 2mV | 2mV |
| .005Ω | 0.2Ω | 0.1Ω | .05Ω | .05Ω |
| 50μsec. | 50μsec. | 50μsec. | 50μsec. | 50μsec. |
| 100 Meg. | 100 Meg. | 100 Meg. | 100 Meg. | 100 Meg. |
| 250pF | 250pF | 250pF | 250pF | 250pF |
| 1500VAC | 1500VAC | 1500VAC | 1500VAC | 1500VAC |
| (2) | −25°C to +71°C (No Derating) | | | (2) |
| | −25°C to +85°C | | | |
| Phenolic | Phenolic | Phenolic | Phenolic | Phenolic |
| 3.5×2.5×1.56 | 3.5×2.5×.875 | 3.5×2.5×.875 | 3.5×2.5×1.25 | 3.5×2.5×1.56 |
| 88,9×63,5×39,6 | 88,9×63,5×22,2 | 88,9×63,5×22,2 | 88,9×63,5×31,8 | 88,9×63,5×39,6 |
| 24 oz.(680g) | 14 oz.(397g) | 14 oz.(397g) | 18 oz.(510g) | 24 oz.(680g) |
| D3 | D1 | D1 | D2 | D3 |
| E,J | E,J(1) | E,J(1) | E,J | E,J |
| **$79.00** | **$39.00** | **$54.00** | **$64.00** | **$79.00** |

**THESE POWER SUPPLIES ARE COVERED BY GSA CONTRACT.**

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

# Triple Output Modules

These power modules are specially designed for operation with data conversion and other circuits where both a dual analog supply and a 5V logic supply are required. Using a triple output supply to power these circuits can be more economical than using two separate equivalent supplies.

## INPUT VOLTAGE SPECIFICATIONS

Standard input specification: 115VAC ±10% @ 60-440 Hz
E version: 220VAC ±10% @ 48-440 Hz
J version: 100VAC ±10% @ 48-440 Hz

Mating MS-13 sockets are $3.50 each

| SPECIFICATIONS, 25°C | TPM-12/100-5/500 | TPM-15/100-5/500 |
|---|---|---|
| Output Voltages | ±12VDC/5VDC | ±15VDC/5VDC |
| Output Voltage Accuracy | ±1% | ±1% |
| Rated Output Current | ±100mA/500mA | ±100mA/500mA |
| Line Regulation, max. | .02% / .05% | .02% / .05% |
| Load Regulation, max. | .05% / 0.1% | .05% / 0.1% |
| Temperature Coefficient, max. | .02%/°C | .02%/°C |
| Output Ripple, RMS max. | 2mV/1mV | 2mV/1mV |
| Output Impedance, max. | 0.1/.05 ohm | 0.1/.05 ohm |
| Transient Recovery Time, max. | 50μsec. | 50μsec. |
| Isolation Resistance, min. | 100 Meg. | 100 Meg. |
| Isolation Capacitance, max. | 250pF | 250pF |
| Breakdown Voltage, min. | 1500VAC | 1500VAC |
| Operating Temp. Range | −25°C to +71°C (No Derating) | |
| Storage Temp. Range | −25°C to +85°C | |
| Case Material | Phenolic | Phenolic |
| Module Size, inches | 3.5X2.5X1.56 | 3.5X2.5X1.56 |
| Module Size, millimeters | 88,9X63,5X39,6 | 88,9X63,5X39,6 |
| Module Weight | 24 oz. (681g) | 24 oz. (681g) |
| Case/Pin Configuration | E3 | E3 |
| Other Versions | E,J | E J |
| Mating Socket | MS-13 | MS-13 |
| Price (1-9) | **$67.00** | **$67.00** |

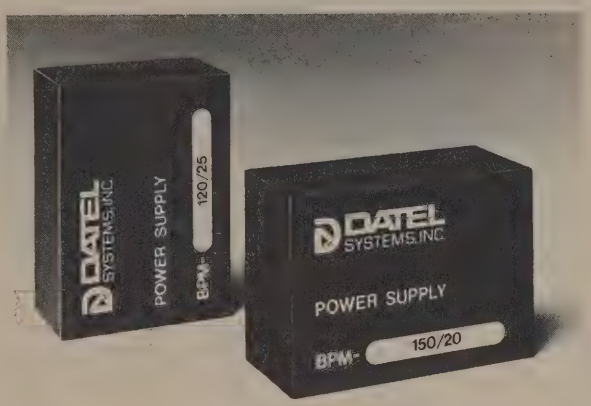
**THESE POWER SUPPLIES ARE COVERED BY GSA CONTRACT**

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-242


Add Dept. EM to address to tell them you saw it in eem

# High Voltage Modules

This series of dual high voltage supplies is specially designed for use with high voltage operational amplifiers such as Datel Systems AM-300 series. The 3 supplies in this series offer output voltages of ±120, ±150, and ±180 volts with excellent regulation, stability, and low output ripple.




## INPUT VOLTAGE SPECIFICATIONS

Standard input specification: 115VAC ±10% @ 60-440 Hz
E version: 220VAC ±10% @ 48-440 Hz
J version: 100VAC ±10% @ 48-440 Hz
Mating MS-7 sockets are $3.50 each

| SPECIFICATIONS, 25°C | BPM-120/25 | BPM-150/20 | BPM-180/16 |
|---|---|---|---|
| Output Voltage | ±120VDC | ±150VDC | ±180VDC |
| Output Voltage Accuracy | ±1% | ±1% | ±1% |
| Rated Output Current | 25mA | 20mA | 16mA |
| Line Regulation, max. | .05% | .05% | .05% |
| Load Regulation, max. | 0.2% | 0.2% | 0.2% |
| Temperature Coefficient, max. | .02%/°C | .02%/°C | .02%/°C |
| Output Ripple, RMS max. | 10mV | 10mV | 10mV |
| Output Impedance, max. | 5 ohms | 5 ohms | 5 ohms |
| Transient Recovery Time, max. | 50μsec. | 50μsec. | 50μsec. |
| Isolation Resistance, min. | 100 Meg. | 100 Meg. | 100 Meg. |
| Isolation Capacitance, max. | 250pF | 250pF | 250pF |
| Breakdown Voltage, min. | 1500VAC | 1500VAC | 1500VAC |
| Operating Temp. Range | −25°C to +71°C (No Derating) | | |
| Storage Temp. Range | −25°C to +85°C | | |
| Case Material | Phenolic | Phenolic | Phenolic |
| Module Size, inches | 3.5x2.5x1.56 | 3.5x2.5x1.56 | 3.5x2.5x1.56 |
| Module Size, millimeters | 88,9x63,5x39,6 | 88,9x63,5x39,6 | 88,9x63,5x39,6 |
| Module Weight | 24 oz. (681g.) | 24 oz. (681g.) | 24 oz. (681g.) |
| Case/Pin Configuration | C3 | C3 | C3 |
| Other Versions | E,J | E,J | E,J |
| Mating Socket | MS-7 | MS-7 | MS-7 |
| Price (1-9) | **$79.00** | **$79.00** | **$79.00** |

**THESE POWER SUPPLIES ARE COVERED BY GSA CONTRACT**

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
**TELEPHONE:** (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

# MP Series: High Power Line Operated Supplies

The MP Series high power, line operated supplies are new entries in the field of low cost, open frame type supplies. Although priced competitively with the open frame units, the MP Series offers significant advantage in performance and design features. The 16 models in this series offer popular single, dual, and triple outputs for use with data conversion devices, operational amplifiers, and other analog and digital circuits. Output power capability ranges from 15 Watts to 105 Watts and prices are from $38 to $149.

The unique feature of the MP Series over open frame type supplies is its conservative thermal design which results in full rated output over 0°C to 65°C ambient temperature and only 15% derating at 71°C. This results in approximately twice the output power at 65°C compared with open frame supplies. The careful attention to thermal design is evidenced by use of conservatively rated components including 85°C computer grade aluminum electrolytic capacitors, integral heat sink and chassis design, and a high efficiency linear regulator design. The power transformer is a low loss type with no derating for 50 Hz operation. It is layer wound with polyester impregnation, and incorporates a Faraday shield which is connected to chassis ground. Power supply efficiency is 50% for ±12V and ±15V outputs and 40% for 5V outputs.

Other significant features include output current limiting protection, .05% tracking of dual outputs, barrier strip terminal connector, ventilating protective cover, remote sensing with open lead protection, and ±5% output voltage adjustment by means of externally accessible trimming potentiometers. In addition, all 5V outputs have built-in overvoltage protection as a standard feature.

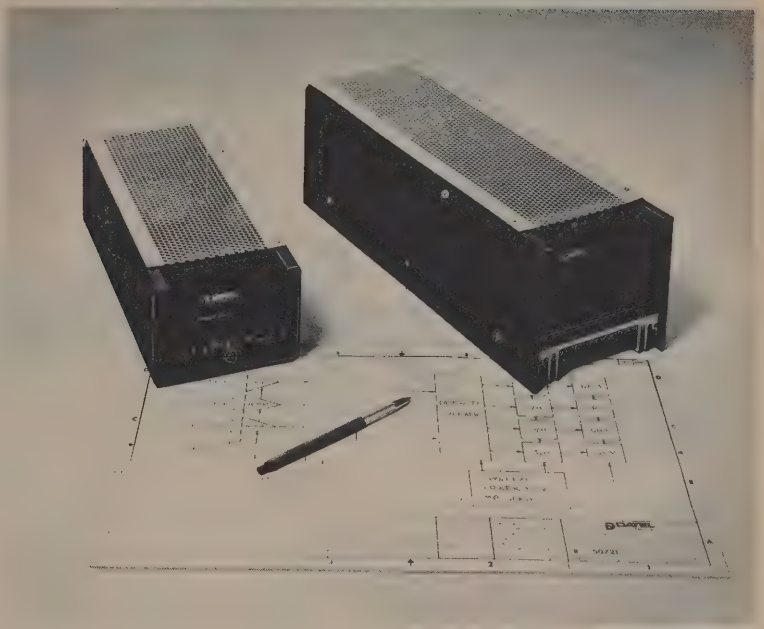
| MODEL | OUTPUT VOLTAGE & CURRENT (0 to 65°C) | OUTPUT I AT 71°C[1] | LINE REG. (MAX.)[2] | LOAD REG. (MAX.)[3] | TEMPCO (TYPICAL) | RIPPLE (RMS MAX.)[4] |
|---|---|---|---|---|---|---|
| **SINGLE OUTPUT** | | | | | | |
| MPS-5/3 | 5V @ 3.0A | 2.5A | 0.1% | 0.1% | .01%/°C | 1mV |
| MPS-5/6 | 5V @ 6.0A | 5.0A | 0.1% | 0.1% | .01%°C | 1mV |
| MPS-5/12 | 5V @ 12.0A | 10.0A | 0.1% | 0.1% | .01%°C | 1mV |
| MPS-5/18 | 5V @ 18.0A | 15.0A | 0.1% | 0.1% | .01%/°C | 1mV |
| **DUAL OUTPUT** | | | | | | |
| MPD-12/1 | ±12V @ 1.0A | 0.85A | .05% | .05% | .01%/°C | 1mV |
| MPD-15/1 | ±15V @ 1.0A | 0.85A | .05% | .05% | .01%/°C | 1mV |
| MPD-12/1.5 | ±12V @ 1.5A | 1.25A | .05% | .05% | .01%/°C | 1mV |
| MPD-15/1.5 | ±15V @ 1.5A | 1.25A | .05% | .05% | .01%/°C | 1mV |
| MPD-12/3 | ±12V @ 3.0A | 2.5A | .05% | .05% | .01%/°C | 1mV |
| MPD-15/3 | ±15V @ 3.0A | 2.5A | .05% | .05% | .01%/°C | 1mV |
| **TRIPLE OUTPUT** | | | | | | |
| MPT-12/1-5/3 | ±12V @ 1A /5V @ 3A | 0.85/2.5A | .05/0.1% | .05/0.1% | .01%/°C | 1mV |
| MPT-15/1-5/3 | ±15V @ 1A /5V @ 3A | 0.85/2.5A | .05/0.1% | .05/0.1% | .01%/°C | 1mV |
| MPT-12/1.5-5/6 | ±12V @ 1.5A /5V @ 6A | 1.25/5.0A | .05/0.1% | .05/0.1% | .01%/°C | 1mV |
| MPT-15/1.5-5/6 | ±15V @ 1.5A /5V @ 6A | 1.25/5.0A | .05/0.1% | .05/0.1% | .01%/°C | 1mV |
| MPT-12/1.5-5/12 | ±12V @ 1.5A /5V @ 12A | 1.25/10.0A | .05/0.1% | .05/0.1% | .01%/°C | 1mV |
| MPT-15/1.5-5/12 | ±15V @ 1.5A/5V @ 12A | 1.25/10.0A | .05/0.1% | .05/0.1% | .01%/°C | 1mV |

**Notes:** 1. 15% derating from 65°C output. 2. For ±10% line change. 3. No load to full load. 4. Typically 3mV peak to peak. 5. 0.1% tracking over operating temp. range.

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

## GENERAL SPECIFICATIONS COMMON TO ALL MODELS

**Input Voltage** . . . . . 115/230VAC ±10%
**Line Frequency** . . . . . 48-440 Hz
**Output Voltage Adjustment** . . . . . ±5%
**Output Ripple** . . . . . 1mV RMS, max. 3mV P-P typ.
**Transient Response** . . . . . 50μsec. max.
**Output Protection** . . . . . Current Limiting or Foldback Limiting
**Overvoltage Protection, 5V outputs** . . . . . 6.2V ±5%
**Voltage Stability, after warmup** . . . . . ±0.25%, 24 hours
**Dual Output Tracking** . . . . .05%, 0.1% over temp. range
**Operating Temperature Range** . . . . . 0°C to 71°C
**Storage Temperature Range** . . . . . −25°C to +85°C



| EFFICIENCY (NOM. LINE) | TRACKING (DUALS)[3] | REMOTE SENSING | OVER-VOLT. PROTECTION | CASE SIZE (HXWXL, INCHES/CM) | WEIGHT (LBS./KG) | PRICE (1-9) |
|---|---|---|---|---|---|---|
| 40% | — | YES | YES | 2.0X4.6X7.6 / 50,8X116,8X193,0 | 3.6/1,6 | $ 57.00 |
| 40% | — | YES | YES | 4.9X5.3X10.3 / 12,4X13,5X26,2 | 6.5/2,9 | $ 84.00 |
| 40% | — | YES | YES | 4.9X5.3X11.9 / 12,4X13,5X30,2 | 10.4/4,7 | $132.00 |
| 40% | — | YES | YES | 4.9X5.3X11.9 / 12,4X13,5X30,2 | 14.0/6,3 | $149.00 |
| 50% | .05% | YES | NO | 2.5X4.9X10.0 / 6,4X12,4X25,4 | 5.0/2,3 | $ 81.00 |
| 50% | .05% | YES | NO | 2.5X4.9X10.0 / 6,4X12,4X25,4 | 5.0/2,3 | $ 81.00 |
| 50% | .05% | YES | NO | 3.7X5.3X10.3 / 9,4X13,5X26,2 | 6.5/2,9 | $ 98.00 |
| 50% | .05% | YES | NO | 3.7X5.3X10.3 / 9,4X13,5X26,2 | 6.5/2,9 | $ 98.00 |
| 50% | .05% | YES | NO | 4.9X5.3X10.3 / 12,4X13,5X26,2 | 10.5/4,8 | $143.00 |
| 50% | .05% | YES | NO | 4.9X5.3X10.3 / 12,4X13,5X26,2 | 10.5/4,8 | $143.00 |
| 45% | .05% | 5V ONLY | 5V ONLY | 3.4X4.9X11.0 / 8,6X12,4X27,9 | 11.0/5,0 | $128.00 |
| 45% | .05% | 5V ONLY | 5V ONLY | 3.4X4.9X11.0 / 8,6X12,4X27,9 | 11.0/5,0 | $128.00 |
| 45% | .05% | 5V ONLY | 5V ONLY | 4.9X5.3X14.0 / 12,4X13,5X35,6 | 14.0/6,3 | $174.00 |
| 45% | .05% | 5V ONLY | 5V ONLY | 4.9X5.3X14.0 / 12,4X13,5X35,6 | 14.0/6,3 | $174.00 |
| 45% | .05% | 5V ONLY | 5V ONLY | 4.9X5.3X15.6 / 12,4X13,5X39,6 | 17.0/7,7 | $224.00 |
| 45% | .05% | 5V ONLY | 5V ONLY | 4.9X5.3X15.6 / 12,4X13,5X39.6 | 17.0/7,7 | $224.00 |

**THESE POWER SUPPLIES ARE COVERED BY GSA CONTRACT**

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

# 1 and 3 Watt DC-DC Converters

### 1 WATT SERIES

| MODEL | OUTPUT VOLTAGE | OUTPUT CURRENT | INPUT VOLTAGE | INPUT VOLT. TOLERANCE | NO LOAD INPUT CURRENT | FULL LOAD INPUT CURRENT | EFFICIENCY (FULL LOAD) | LINE REGULATI |
|---|---|---|---|---|---|---|---|---|
| UPM-5/200-D12 | + 5V | 200mA | 12VDC | ±10% | 40mA | 170mA | 50% | .05% |
| UPM-5/200-D28 | + 5V | 200mA | 28VDC | ±10% | 20mA | 72mA | 50% | .05% |
| UPM-12/80-D5 | +12V | 80mA | 5VDC | ±10% | 95mA | 370mA | 50% | .05% |
| UPM-12/80-D28 | +12V | 80mA | 28VDC | ±10% | 20mA | 65mA | 55% | .05% |
| UPM-24/40-D5 | +24V | 40mA | 5VDC | ±10% | 95mA | 370mA | 50% | .05% |
| UPM-24/40-D12 | +24V | 40mA | 12VDC | ±10% | 40mA | 150mA | 55% | .05% |
| UPM-28/25-D5 | +28V | 25mA | 5VDC | ±10% | 70mA | 280mA | 50% | .05% |
| UPM-28/25-D12 | +28V | 25mA | 12VDC | ±10% | 40mA | 105mA | 55% | .05% |
| BPM-12/25-D5 | ±12V | 25mA | 5VDC | ±10% | 90mA | 220mA | 55% | .05% |
| BPM-12/25-D12 | ±12V | 25mA | 12VDC | ±10% | 25mA | 90mA | 55% | .05% |
| BPM-12/25-D28 | ±12V | 25mA | 28VDC | ±10% | 15mA | 38mA | 55% | .05% |
| BPM-15/25-D5 | ±15V | 25mA | 5VDC | ±10% | 80mA | 300mA | 50% | .05% |
| BPM-15/25-D12 | ±15V | 25mA | 12VDC | ±10% | 40mA | 115mA | 55% | .05% |
| BPM-15/25-D28 | ±15V | 25mA | 28VDC | ±10% | 15mA | 48mA | 55% | .05% |
| BPM-18/25-D5 | ±18V | 25mA | 5VDC | ±10% | 95mA | 370mA | 50% | .05% |
| BPM-18/25-D12 | ±18V | 25mA | 12VDC | ±10% | 40mA | 136mA | 55% | .05% |
| BPM-18/25-D28 | ±18V | 25mA | 28VDC | ±10% | 15mA | 58mA | 55% | .05% |

### 3 WATT SERIES

| MODEL | OUTPUT VOLTAGE | OUTPUT CURRENT | INPUT VOLTAGE | INPUT VOLT-AGE TOLER. | NO LOAD INPUT CURRENT | FULL LOAD INPUT CURRENT | EFFICIENCY (FULL LOAD) | LINE REGULATI |
|---|---|---|---|---|---|---|---|---|
| UPM-5/500-D5 | +5V | 500mA | 5VDC | ±10% | 300mA | 1250mA | 40% | .05% |
| UPM-5/500-D12 | +5V | 500mA | 12VDC | ±10% | 100mA | 470mA | 45% | .05% |
| UPM-5/500-D28 | +5V | 500mA | 28VDC | ±10% | 50mA | 200mA | 45% | .05% |
| UPM-12/250-D5 | +12V | 250mA | 5VDC | ±10% | 300mA | 1250mA | 50% | .05% |
| UPM-12/250-D28 | +12V | 250mA | 28VDC | ±10% | 50mA | 195mA | 55% | .05% |
| UPM-24/125-D5 | +24V | 125mA | 5VDC | ±10% | 300mA | 1250mA | 50% | .05% |
| UPM-24/125-D12 | +24V | 125mA | 12VDC | ±10% | 90mA | 450mA | 55% | .05% |
| UPM-28/100-D5 | +28V | 100mA | 5VDC | ±10% | 270mA | 1120mA | 50% | .05% |
| UPM-28/100-D12 | +28V | 100mA | 12VDC | ±10% | 90mA | 420mA | 55% | .05% |
| BPM-12/100-D5 | ±12V | 100mA | 5VDC | ±10% | 210mA | 960mA | 50% | .05% |
| BPM-12/100-D12 | ±12V | 100mA | 12VDC | ±10% | 90mA | 400mA | 50% | .05% |
| BPM-12/100-D28 | ±12V | 100mA | 28VDC | ±10% | 40mA | 156mA | 55% | .05% |
| BPM-15/100-D5 | ±15V | 100mA | 5VDC | ±10% | 350mA | 1300mA | 45% | .05% |
| BPM-15/100-D12 | ±15V | 100mA | 12VDC | ±10% | 80mA | 460mA | 55% | .05% |
| BPM-15/100-D28 | ±15V | 100mA | 28VDC | ±10% | 50mA | 195mA | 55% | .05% |
| BPM-18/100-D5 | ±18V | 100mA | 5VDC | ±10% | 350mA | 1500mA | 50% | .05% |
| BPM-18/100-D12 | ±18V | 100mA | 12VDC | ±10% | 120mA | 545mA | 55% | .05% |
| BPM-18/100-D28 | ±18V | 100mA | 28VDC | ±10% | 60mA | 240mA | 55% | .05% |

**THESE POWER SUPPLIES ARE COVERED BY GSA CONTRACT**

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424



Add Dept. EM to address to tell them you saw it in eem

| LOAD EGULATION | TEMP. COEFFICIENT | OUTPUT IMPEDANCE | CASE CONFIG. | PRICE (1-9) |
|---|---|---|---|---|
| 0.1% | .02%/°C | .005Ω | G2 | **$69.00** |
| 0.1% | .02%/°C | .005Ω | G2 | **$69.00** |
| .05% | .02%/°C | .015Ω | G2 | **$69.00** |
| .05% | .02%/°C | .15Ω | G2 | **$69.00** |
| .05% | .02%/°C | .03Ω | G2 | **$69.00** |
| .05% | .02%/°C | .03Ω | G2 | **$69.00** |
| .05% | .02%/°C | .035Ω | G2 | **$69.00** |
| .05% | .02%/°C | .035Ω | G2 | **$69.00** |
| .05% | .02%/°C | .03Ω | G2 | **$75.00** |
| .05% | .02%/°C | .03Ω | G2 | **$75.00** |
| .05% | .02%/°C | .03Ω | G2 | **$75.00** |
| .05% | .02%/°C | .03Ω | G2 | **$75.00** |
| .05% | .02%/°C | .03Ω | G2 | **$75.00** |
| .05% | .02%/°C | .03Ω | G2 | **$75.00** |
| .05% | .02%/°C | .03Ω | G2 | **$75.00** |
| .05% | .02%/°C | .03Ω | G2 | **$75.00** |

| LOAD EGULATION | TEMP. COEFFICIENT | OUTPUT IMPEDANCE | CASE CONFIG. | PRICE (1-9) |
|---|---|---|---|---|
| 0.1% | .02%/°C | .005Ω | CB | **$89.00** |
| 0.1% | .02%/°C | .005Ω | CB | **$89.00** |
| .05% | .02%/°C | .02Ω | CB | **$89.00** |
| .05% | .02%/°C | .02Ω | CB | **$89.00** |
| .05% | .02%/°C | .02Ω | CB | **$89.00** |
| .05% | .02%/°C | .02Ω | CB | **$89.00** |
| .05% | .02%/°C | .02Ω | CB | **$89.00** |
| .05% | .02%/°C | .02Ω | CB | **$89.00** |
| .05% | .02%/°C | .02Ω | CB | **$94.00** |
| .05% | .02%/°C | .02Ω | CB | **$94.00** |
| .05% | .02%/°C | .02Ω | CB | **$94.00** |
| .05% | .02%/°C | .02Ω | CB | **$94.00** |
| .05% | .02%/°C | .02Ω | CB | **$94.00** |
| .05% | .02%/°C | .02Ω | CB | **$94.00** |
| .05% | .02%/°C | .02Ω | CB | **$94.00** |
| .05% | .02%/°C | .02Ω | CB | **$94.00** |

## DESCRIPTION

This comprehensive line of higher power DC-DC converters features 34 different models with both single and dual outputs. Input voltages are 5, 12, and 28V with single output voltages of 5, 12, 24, and 28 volts, and dual outputs of ±12, ±15, and ±18 volts. Output voltage accuracies are ±1% with .02%/°C temperature coefficients. Other features include low output ripple, 100 megohm isolation, and output current limiting protection.

## GENERAL SPECIFICATIONS — ALL MODELS

| | |
|---|---|
| Output Voltage Accuracy | ±1% |
| Output Noise and Ripple, max. | 20mV P-P (2mV RMS) |
| Back Ripple Current, max. | 1% of $I_{IN}$ |
| Capacitive Coupling, max. | 250 pF |
| Breakdown Voltage, min. | 300VDC |
| Transient Recovery Time, max. | 50μsec. |
| Operating Temp. Range | −25°C to +71°C |
| Storage Temp. Range | −55°C to +85°C |
| Case Material | Diallyl Phthalate (G2)<br>Phenolic (CB) |

## MODULE SIZES

| | |
|---|---|
| G2 Size: | 2.0X2.0X.750 inches<br>50,8X50,8X19,1mm |
| Weight | 4.5 oz. (128g.) |
| CB Size: | 3.5X2.5X.875 inches<br>88,9X63,5X22,2 mm |
| Weight | 14 oz. (397g.) |

The 5 watt series use 2 DILS-1 or DILS-2 terminal strips (at $5.00/pair) for sockets. The 10 watt series use the MS-7 socket at $3.50 each.

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

# 5 and 10 Watt DC-DC Converters

### 5 WATT SERIES

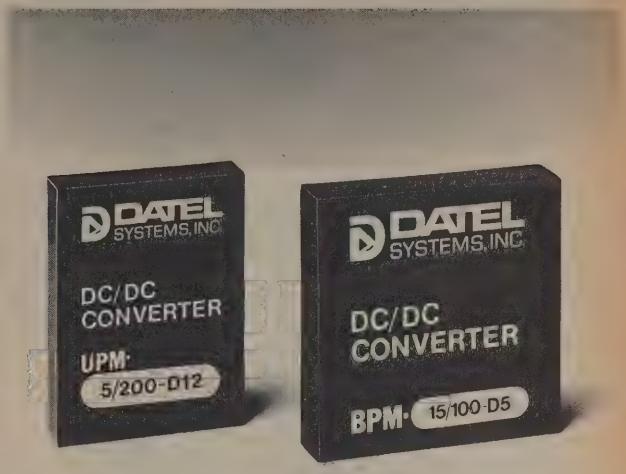
| MODEL | OUTPUT VOLTAGE | OUTPUT CURRENT | INPUT VOLTAGE | INPUT VOLTAGE TOLER. | NO LOAD INPUT CURRENT | FULL LOAD INPUT CURRENT | EFFICIENCY (FULL LOAD) | LINE REGULATI |
|---|---|---|---|---|---|---|---|---|
| UPM-5/1000-D12 | +5V | 1000mA | 12VDC | ±10% | 200mA | 830mA | 50% | .05% |
| UPM-5/1000-D28 | +5V | 1000mA | 28VDC | ±10% | 100mA | 360mA | 50% | .05% |
| UPM-12/420-D5 | +12V | 420mA | 5VDC | ±10% | 500mA | 2000mA | 50% | .05% |
| UPM-12/420-D28 | +12V | 420mA | 28VDC | ±10% | 75mA | 325mA | 55% | .05% |
| UPM-24/210-D5 | +24V | 210mA | 5VDC | ±10% | 400mA | 1830mA | 55% | .05% |
| UPM-24/210-D12 | +24V | 210mA | 12VDC | ±10% | 170mA | 760mA | 55% | .05% |
| UPM-28/180-D5 | +28V | 180mA | 5VDC | ±10% | 400mA | 1830mA | 55% | .05% |
| UPM-28/180-D12 | +28V | 180mA | 12VDC | ±10% | 170mA | 760mA | 55% | .05% |
| BPM-12/210-D5 | ±12V | 210mA | 5VDC | ±10% | 500mA | 2000mA | 50% | .05% |
| BPM-12/210-D12 | ±12V | 210mA | 12VDC | ±10% | 170mA | 760mA | 55% | .05% |
| BPM-12/210-D28 | ±12V | 210mA | 28VDC | ±10% | 75mA | 325mA | 55% | .05% |
| BPM-15/165-D5 | ±15V | 165mA | 5VDC | ±10% | 500mA | 2000mA | 50% | .05% |
| BPM-15/165-D12 | ±15V | 165mA | 12VDC | ±10% | 170mA | 760mA | 55% | .05% |
| BPM-15/165-D28 | ±15V | 165mA | 28VDC | ±10% | 75mA | 325mA | 55% | .05% |
| BPM-18/140-D5 | ±18V | 140mA | 5VDC | ±10% | 500mA | 2000mA | 55% | .05% |
| BPM-18/140-D12 | ±18V | 140mA | 12VDC | ±10% | 170mA | 760mA | 55% | .05% |
| BPM-18/140-D28 | ±18V | 140mA | 28VDC | ±10% | 75mA | 325mA | 55% | .05% |

### 10 WATT SERIES

| MODEL | OUTPUT VOLTAGE | OUTPUT CURRENT | INPUT VOLTAGE | INPUT VOLT. TOLERANCE | NO LOAD INPUT CURRENT | FULL LOAD INPUT CURRENT | EFFICIENCY (FULL LOAD) | LINE REGULATI |
|---|---|---|---|---|---|---|---|---|
| UPM-5/2000-D12 | +5V | 2000mA | 12VDC | ±10% | 300mA | 1660mA | 50% | .05% |
| UPM-5/2000-D28 | +5V | 2000mA | 28VDC | ±10% | 150mA | 720mA | 50% | .05% |
| UPM-12/840-D5 | +12V | 840mA | 5VDC | ±10% | 1000mA | 4000mA | 50% | .05% |
| UPM-12/840-D28 | +12V | 840mA | 28VDC | ±10% | 150mA | 650mA | 55% | .05% |
| UPM-24/420-D5 | +24V | 420mA | 5VDC | ±10% | 900mA | 3600mA | 55% | .05% |
| UPM-24/420-D12 | +24V | 420mA | 12VDC | ±10% | 360mA | 1530mA | 55% | .05% |
| UPM-28/360-D5 | +28V | 360mA | 5VDC | ±10% | 900mA | 3600mA | 55% | .05% |
| UPM-28/360-D12 | +28V | 360mA | 12VDC | ±10% | 360mA | 1530mA | 55% | .05% |
| BPM-12/420-D5 | ±12V | 420mA | 5VDC | ±10% | 1000mA | 4000mA | 50% | .05% |
| BPM-12/420-D12 | ±12V | 420mA | 12VDC | ±10% | 360mA | 1530mA | 55% | .05% |
| BPM-12/420-D28 | ±12V | 420mA | 28VDC | ±10% | 150mA | 650mA | 55% | .05% |
| BPM-15/330-D5 | ±15V | 330mA | 5VDC | ±10% | 1000mA | 4000mA | 50% | .05% |
| BPM-15/330-D12 | ±15V | 330mA | 12VDC | ±10% | 360mA | 1530mA | 55% | .05% |
| BPM-15/330-D28 | ±15V | 330mA | 28VDC | ±10% | 150mA | 650mA | 55% | .05% |
| BPM-18/280-D5 | ±18V | 280mA | 5VDC | ±10% | 900mA | 3600mA | 55% | .05% |
| BPM-18/280-D12 | ±18V | 280mA | 12VDC | ±10% | 360mA | 1530mA | 55% | .05% |
| BPM-18/280-D28 | ±18V | 280mA | 28VDC | ±10% | 150mA | 650mA | 55% | .05% |

**THESE POWER SUPPLIES ARE COVERED BY GSA CONTRACT**

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424




| LOAD REGULATION | TEMP. COEFFICIENT | OUTPUT IMPEDANCE | CASE CONFIG. | PRICE (1-9) |
|---|---|---|---|---|
| 0.1% | .02%/°C | .07Ω | F | $42.00 |
| 0.1% | .02%/°C | .07Ω | F | $42.00 |
| .05% | .02%/°C | 0.2Ω | F | $42.00 |
| .05% | .02%/°C | 0.2Ω | F | $42.00 |
| .05% | .02%/°C | 0.2Ω | F | $42.00 |
| .05% | .02%/°C | 0.2Ω | F | $42.00 |
| .05% | .02%/°C | 0.2Ω | F | $42.00 |
| .05% | .02%/°C | 0.2Ω | F | $42.00 |
| .05% | .02%/°C | 0.2Ω | F | $49.00 |
| .05% | .02%/°C | 0.2Ω | F | $49.00 |
| .05% | .02%/°C | 0.2Ω | F | $49.00 |
| .05% | .02%/°C | 0.2Ω | F | $49.00 |
| .05% | .02%/°C | 0.2Ω | F | $49.00 |
| .05% | .02%/°C | 0.2Ω | F | $49.00 |
| .05% | .02%/°C | 0.2Ω | F | $49.00 |
| .05% | .02%/°C | 0.2Ω | F | $49.00 |

| LOAD REGULATION | TEMP. COEFFICIENT | OUTPUT IMPEDANCE | CASE CONFIG. | PRICE (1-9) |
|---|---|---|---|---|
| 0.1% | .02%/°C | .07Ω | G1 | $64.00 |
| 0.1% | .02%/°C | .07Ω | G1 | $64.00 |
| 0.1% | .02%/°C | .07Ω | G1 | $64.00 |
| .05% | .02%/°C | 0.2Ω | G1 | $64.00 |
| .05% | .02%/°C | 0.2Ω | G1 | $64.00 |
| .05% | .02%/°C | 0.2Ω | G1 | $64.00 |
| .05% | .02%/°C | 0.2Ω | G1 | $64.00 |
| .05% | .02%/°C | 0.2Ω | G1 | $64.00 |
| .05% | .02%/°C | 0.2Ω | G1 | $64.00 |
| .05% | .02%/°C | 0.2Ω | G1 | $69.00 |
| .05% | .02%/°C | 0.2Ω | G1 | $69.00 |
| .05% | .02%/°C | 0.2Ω | G1 | $69.00 |
| .05% | .02%/°C | 0.2Ω | G1 | $69.00 |
| .05% | .02%/°C | 0.2Ω | G1 | $69.00 |
| .05% | .02%/°C | 0.2Ω | G1 | $69.00 |
| .05% | .02%/°C | 0.2Ω | G1 | $69.00 |
| .05% | .02%/°C | 0.2Ω | G1 | $69.00 |

## DESCRIPTION

This broad line of DC-DC converters features 17 one watt models and 18 three watt models with single and dual output voltages. Input voltages are 5, 12, and 28V with single outputs of 5, 12, 24, and 28V, and dual outputs of ±12, ±15, and ±18V. Output voltage accuracies are ±1% with .02%/°C temperature coefficient. Other features include low output ripple, 100 megohm isolation, and output current limiting.

## GENERAL SPECIFICATIONS — ALL MODELS

| | |
|---|---|
| Output Voltage Accuracy | ±1% |
| Output Noise and Ripple, max. | 20mV P-P (2mV RMS) |
| Back Ripple Current, max. | 1% of $I_{IN}$ |
| Capacitive Coupling, max. | 250 pF |
| Breakdown Voltage, min. | 300VDC |
| Transient Recovery Time, max. | 50μsec. |
| Operating Temp. Range | −25°C to +71°C |
| Storage Temp. Range | −55°C to +85°C |
| Case Material | Diallyl Phthalate |

## MODULE SIZES

| | |
|---|---|
| F Case: | 1.5X2.0X0.375 inches<br>38.1X50.8X9.5 mm |
| Weight: | 1.5 oz. (43g.) |
| G1 Case: | 2.0X2.0X0.432 inches<br>50.8X50.8X11.0 mm |
| Weight: | 2.5 oz. (71g.) |

Both 1 and 3 watt series use 2 DILS-1 or DILS-2 terminal strips (at $5.00/pair) for sockets.

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

# 4.5 Watt DC-DC Converters

These miniature, aluminum cased DC-DC converters are ideal for applications where mounting space is tight, yet highly regulated ±15VDC is required at up to 150mA output current. Specifications include voltage accuracy of ±1%, line regulation of .05% max., load regulation of .05% max., and tempco of .005%/°C. For convenient heat sinking, two 2-56 studs are provided on the bottom of the case. All models have output current limiting protection.

### OTHER SPECIFICATIONS

| | |
|---|---|
| Isolation Resistance, min. | 100 Meg. |
| Isolation Capacitance, max. | 100 pF |
| Breakdown Voltage, min. | 300VDC |
| Operating Temp. Range | −25° to +71°C |
| Storage Temp. Range | −55°C to +85°C |

MS-6 sockets are $3.50 each.

| SPECIFICATIONS, 25°C | BPM-15/150-D5 | BPM-15/150-D24 | BPM-15/150-D28 |
|---|---|---|---|
| Output Voltage | ±15VDC | ±15VDC | ±15VDC |
| Output Voltage Accuracy | ±1% | ±1% | ±1% |
| Rated Output Current[1] | ±150mA | ±150mA | ±150mA |
| Input Voltage | 5VDC | 24VDC | 28VDC |
| Input Voltage Tolerance | ±.25V | ±3.5V | ±4V |
| Maximum Input Current | 1.75A | 0.35A | 0.3A |
| Efficiency, full load | 51% | 54% | 54% |
| Line Regulation, max. | .05% | .05% | .05% |
| Load Regulation, max. | .05% | .05% | .05% |
| Temperature Coefficient, max. | .005%/°C | .005%/°C | .005%/°C |
| Output Ripple RMS max. | 1mV | 1mV | 1mV |
| Output Impedance, max. | .05Ω | .05Ω | .05Ω |
| Transient Recovery Time, max. | 50μsec. | 50μsec | 50μsec. |
| Case Material | Aluminum | Aluminum | Aluminum |
| Module Size, inches | 2.0X2.0X0.4 | 2.0X2.0X0.4 | 2.0X2.0X0.4 |
| Module Size, millimeters | 50,8X50,8X10,2 | 50,8X50,8X10,2 | 50,8X50,8X10,2 |
| Module Weight | 3.0 oz.(85g) | 3.0 oz.(85g) | 3.0 oz.(85g) |
| Case/Pin Configuration | B | B | B |
| Mating Socket | MS-6 | MS-6 | MS-6 |
| Price (1-9) | **$79.00** | **$79.00** | **$79.00** |

**NOTE:** 1. Above 35°C (95°F) mounting surface temperature, derate 1.3mA/°C.

**THESE POWER SUPPLIES ARE COVERED BY GSA CONTRACT**

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

# Model 1200: μC Supply

Model 1200 microcomputer supply is a DC-DC converter designed to operate from a 5 volt logic supply to power a CPU and 4K of memory. The output voltages of +12, −5, and −9V in conjunction with the 5V input will power an 8080 CPU and four 2107A RAM's or four 1702A ROM'S. This supply operates with a full load efficiency of 48% and has output current limiting protection.

Operating temperature range is −25°C to +71°C and storage temperature range is −55°C to +85°C.

Mating sockets, 2 DILS-1 or DILS-2 terminal strips, are $5.00 per pair.

| SPECIFICATIONS, 25°C | MODEL 1200 |
|---|---|
| Outputs | +12VDC @ 160mA |
| | −9VDC @ 300mA |
| | −5VDC @ 2mA |
| Output Voltage Accuracy | ±1% (+12V & −9V), ±5% (−5V) |
| Input Voltage | 5VDC ±0.25V |
| Input Current, no load | 350mA |
| Input Current, full load | 1.75 Amp. |
| Efficiency, full load | 53% |
| Line Regulation, max., all outputs | .05% |
| Load Regulation, max., +12V out | .05% |
| Load Regulation, max., −9V out | 0.1% |
| Load Regulation, max., −5V out | 1.0% |
| Temperature Coefficient, max. | .02%/°C |
| Output Ripple, RMS max. | 1mV |
| Transient Recovery Time, max. | 50 μsec. |
| Case Material | Diallyl Phthalate |
| Module Size, inches | 2.0X2.0X0.75 |
| Module Size, millimeters | 50,8X50,8X19,1 |
| Module Weight | 4.5 oz.(128g) |
| Case/Pin Configuration | K |
| Mating Socket | DILS-1, DILS-2 |
| Price (1-9) | $89.00 |

**THIS POWER SUPPLY IS COVERED BY GSA CONTRACT**

DATEL SYSTEMS, INC.
1020 TURNPIKE STREET / CANTON, MASSACHUSETTS 02021
TELEPHONE: (617) 828-8000 / TWX: 710-348-0135 / TELEX: 924461
WASHINGTON, D.C. (301) 840-9490,1 / HOUSTON (713) 932-1130,2 / DALLAS (214) 256-4444 /
SANTA ANA, CALIFORNIA (714) 835-2751 / LA EXCHANGE (213) 933-7256 / SUNNYVALE, CALIFORNIA (408) 733-2424

# HIGH VOLTAGE EQUIPMENT

## UNREGULATED MODULES COMPACT HIGH VOLTAGE

### SERIES "S"

These power supplies are designed for operation from either a 0-115 volt or 0-125 volt line at 60/400 cycles. Three input terminals are provided to permit proper line connection. The output is available from shielded polyethylene cables and may be varied over the full range by varying the input AC line. The two output cables are insulated for the full output voltage, so that either the positive or negative terminal may be grounded.* All units have selenium rectifiers and are hermetically sealed in an epoxy, vacuum filled, metal case.

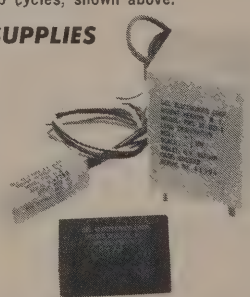
Units for 50 cycle operation at various line voltages are available on request.

*Model 40-2-4 is designed with one output cable for single polarity operation. When ordering, please specify polarity.

| Model No. | Max. Output Voltage | Max. Rated Current | **Ripple at Full Load % RMS/MA at 60 CPS | Dimensions (Inches) | Net Weight (Lbs.) |
|---|---|---|---|---|---|
| 2.5-2-6 | 0-2.5 KV | 2 MA | 0.25 | 3 x 2⅝ x 4¼ | 3¼ |
| 5-2-4 | 0-5.0 KV | 2 MA | 0.25 | 3 x 3½ x 3⅞ | 4¼ |
| 10-1-12 | 0-10 KV | 1.25 MA | 0.30 | 3 x 3½ x 4⅞ | 5½ |
| 15-1-8 | 0-15 KV | 1.25 MA | 0.25 | 4¼ x 5 x 5¾ | 11½ |
| 20-1-4 | 0-20 KV | 1.25 MA | 0.25 | 4¼ x 5⅛ x 6¾ | 14 |
| 25-1-3 | 0-25 KV | 1.25 MA | 0.30 | 4¾ x 6 x 7¼ | 20¼ |
| 30-1-5 | 0-30 KV | 1.25 MA | 0.20 | 5 x 6½ x 8 | 24½ |
| 40-1-1 | 0-40 KV | 1 MA | 0.15 | 6¼ x 8¼ x 7 | 26 |
| 40-2-4* | 0-40 KV | 2 MA | 0.30 | 6¼ x 8¼ x 7 | 30 |
| 50-1-5 | 0-50 KV | 1 MA | 0.25 | 9⅞ x 7¾ x 9⅜ | 52 |
| 60-1.5-1 | 0-60 KV | 1.5 MA | 0.15 | 12¼x9¼x11¼ | 87 |
| 1-5-2 | 1 KV | 5 MA | .20 | 3 x 2¾ x 4¼ | 3½ |
| 2.5-5-3 | 2.5 KV | 5 MA | .20 | 3½ x 3 x 5 | 5 |
| 5-5-4 | 5 KV | 5 MA | .25 | 4 x 3⅜ x 5¼ | 7½ |
| 7.5-5-1 | 7.5 KV | 5 MA | .20 | 4⅜ x 3¾ x 5½ | 8½ |
| 10-5-1 | 10 KV | 5 MA | .25 | 4⅜ x 3¾ x 5½ | 10 |
| 15-5-1 | 15 KV | 5 MA | .30 | 5¾ x 5 x 6¾ | 19½ |
| 20-5-3 | 20 KV | 5 MA | .25 | 6⅛ x 6⅛ x 6½ | 21 |
| 25-5-1 | 25 KV | 5 MA | .25 | 6¾ x 6¼ x 7¼ | 27¼ |
| 30-5-8 | 30 KV | 5 MA | .30 | 7¼ x 6½ x 7¾ | 38 |
| 1-10-1 | 1 KV | 10 MA | .10 | 3½ x 3 x 5 | 5 |
| 2.5-10-1 | 2.5 KV | 10 MA | .10 | 4 x 3⅜ x 5¼ | 6½ |
| 5-10-2 | 5 KV | 10 MA | .12 | 4⅜ x 3¾ x 5½ | 9 |
| 7.5-10-1 | 7.5 KV | 10 MA | .10 | 4¾ x 4 x 7¼ | 13½ |
| 10-10-3 | 10 KV | 10 MA | .10 | 5 x 4⅜ x 6¾ | 14½ |
| 15-10-2 | 15 KV | 10 MA | .15 | 6⅛ x 6⅛ x 6½ | 22½ |
| 20-10-3 | 20 KV | 10 MA | .15 | 6¾ x 6¼ x 7¼ | 27½ |
| 25-10-2 | 25 KV | 10 MA | .10 | 7½ x 6½ x 8½ | 38 |
| 30-10-3 | 30 KV | 10 MA | .15 | 8 x 7¾ x 8¾ | 50 |
| 40-15-1 | 40 KV | 15 MA | .3 | 8¼ x 9½ x 11¼ | 95 |

*Single polarity unit, state positive or negative output.
**Ripple at 400 cycles is 15% of ripple at 60 cycles, shown above.

## PHOTOMULTIPLIER POWER SUPPLIES PMS SERIES



The PMS Series is a family of extremely compact, rugged design DC to DC proportional converters for use as power sources for photomultiplier and other tube applications. They feature reverse polarity protection, output isolated from the input, and are momentary short circuit protected.

### SPECIFICATIONS

| Model | Input DC | Output Voltage | Output Load | Ripple P-P | Capacity Mfd. | Size D x L |
|---|---|---|---|---|---|---|
| PMS 1-1 | 3 - 15V | 300-1500V | 1.5 Meg | 1.5V | .02 | 1 x 2¼ |
| PMS 1-2 | 3 - 10V | 300-1000V | 800 K | 1.0V | .02 | 1 x 2⅝ |
| PMS 1-3A | 3 - 15V | 300-1500V Negative | 1.0 Meg | 1.0V | .02 | 1¼ x 2½ |
| PMS 1-4 | 3 - 19V | 300-2000V | 2.0 Meg | 7.0V. | .002 | 1 x 2¼ |
| PMS 1-5 | 3 - 10V | 300-1000V | 3.0 Meg | .5V | .02 | 1 x 2½ |
| PMS 1-6 | 3 - 15V | 400-2500V | 5 Meg | 30V | .003 | 1 x 2¼ |
| PMS 1-7 | 4 - 12V | 500-1500V | 1.0 Meg | 6.0V | .005 | 2.4 x 1.5 x .812 |
| PMS B2-.025 | 3 - 10V 12MA @ 1.8KV & 180 Meg | 300-2000V | 80 Meg MIN. | 3.0V | .002 | 1 x 2¼ |
| PMS 3-.5 | 3 - 15V | 300-3000V | 6 Meg | 7.5V | .005 | 1¼ x 2⅜ |
| PMS 5-.5 | 3 - 15V | 500-5000V | 10 Meg | 5.0V | .01 | 1 7/16 x 3⅛ |
| PMS 10-.025 | 3 - 10V | 3KV - 10KV | 25 ua | 50V | .002 | 2.07 x 2.32 x 3.13 |

## HIGHLY REGULATED ADJUSTABLE HIGH VOLTAGE MODULES SERIES "HRM"

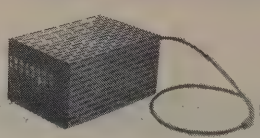
**SPECIFICATIONS**

**Input:** 115V ±10% 60 cps
**Output:** Regulation for 10% line change .03% max. Regulation for NL to FL .03% max
**Ripple:** .03% RMS max
**Temp. Range:** −54°C to +65°C operating
**Temp. Coefficient:** 0.02%/°C

- No voltage overshoot
- Adjustable output
- Short circuit proof (no fuses)
- Meet environmental and transient requirements of MIL-E-16400

| Model No. Pos. Output | Model No. Neg. Output | Output Voltage | Max. Current | Dimensions Inches | Net Wt. (Lbs.) |
|---|---|---|---|---|---|
| .6HRM5P1 | .6HRM5N1 | 300-600V | 5MA | 4⅜ x 3⅜ x 4¾ | 7 |
| 1.2HRM5P1 | 1.2HRM5N1 | 600-1.2KV | 5MA | 4⅜ x 3¾ x 4¾ | 7½ |
| 1.7HRM5P1 | 1.7HRM5N1 | 900-1.7KV | 5MA | 4⅜ x 3¾ x 4¾ | 9 |
| 2.5HRM4P1 | 2.5HRM4N1 | 1.3-2.5KV | 4MA | 4⅜ x 3¾ x 4¾ | 9 |
| 3.5HRM3P1 | 3.5HRM3N1 | 1.7-3.5KV | 3MA | 4 11/16 x 4 x 4 13/16 | 10 |
| 5HRM2P1 | 5HRM2N1 | 2.5-5.0KV | 2MA | 4 11/16 x 4 x 4 13/16 | 10 |
| 7HRM1.5P1 | 7HRM1.5N1 | 3.5-7.0KV | 1.5MA | 5½ x 4½ x 6 | 15 |
| 10HRM1P1 | 10HRM1N1 | 5.0-10KV | 1MA | 5½ x 4½ x 6 | 15 |
| 15HRM1.5P1 | 15HRM1.5N1 | 7.5-15KV | 1.5MA | 7¼ x 4⅝ x 7½ | 20 |
| 20HRM1P1 | 20HRM1N1 | 10-20KV | 1MA | 7¼ x 4⅝ x 8 | 20 |
| 25HRM2P1 | 25HRM2N1 | 12-25KV | 2MA | 9¼ x 5½ x 9⅝ | 35 |
| 30HRM.75P1 | 30HRM.75N1 | 15-30KV | 0.75MA | 8¼ x 5⅝ x 7⅞ | 37 |
| 40HRM.5P1 | 40HRM.5N1 | 20-40KV | 0.5MA | 6¼ x 8¼ x 8 | 42 |
| 50HRM.5P1 | 50HRM.5N1 | 25-50KV | 0.5MA | 10 x 8 x 10 | 60 |

## HARD/HDRD SERIES HIGHLY REGULATED MODULAR SUPPLIES



**Input:** HARD 115V 50/60 Hz 1φ
HDRD 28V DC ±10%
**Output:** Variable via resistive program from 50% to 100% of rated output (see chart)
**Regulation:** Line ±.005% for ±10% Line
Load ±.005% for 0 to Full Load
**Ripple:** .03% RMS at Full Load
**Temp. Range:** —20°C to +55°C
**Temp. Coef:** ±.02%/°C

| Model | Output Voltage | Output Current | Model | Output Voltage | Output Current |
|---|---|---|---|---|---|
| 1.2HARD2-1 | 1200 | 2 MA | 10HARD1-1 | 10 KV | 1 MA |
| 1.2HARD10-1 | 1200 | 10 MA | 10HARD2-1 | 10 KV | 2 MA |
| 1.2HARD20-1 | 1200 | 20 MA | 15HARD.25-1 | 15 KV | .25 MA |
| 2.5HARD1-1 | 2500 | 1 MA | 15HARD.5-1 | 15 KV | .5 MA |
| 2.5HARD4-1 | 2500 | 4 MA | 15HARD1-1 | 15 KV | 1 MA |
| 2.5HARD8-1 | 2500 | 8 MA | 20HARD.2-1 | 20 KV | .2 MA |
| 5HARD.5-1 | 5000 | .5 MA | 20HARD.5-1 | 20 KV | .5 MA |
| 5HARD2-1 | 5000 | 2 MA | 20HARD1-1 | 20 KV | 1 MA |
| 5HARD4-1 | 5000 | 4 MA | 30HARD.75-1 | 30 KV | .75 MA |
| 10HARD.25-1 | 10KV | .25 MA | 40HARD.5-1 | 40 KV | .5 MA |

## "HIGH POT" TESTERS "TC" SERIES POWER SUPPLIES

DEL TC Series multi-purpose D.C. Power Supplies are compact, fully instrumented and fully protected units providing ratings up to 80,000 volts D.C. continuously variable.

Seleninum Rectifiers used throughout to provide long life and instantaneous operation. No filament warm up time required.

All high voltage components immersed in special high grade insulating oil. This assures LONG trouble-free LIFE.

### STANDARD MODELS

| Model No. | Full Load Voltage Range (kv) | Current Range (ma) | Ripple* (% rms/ma at 60 Hz) | Dimensions** Complete Unit (in., w x d x h) | Dimensions** Tank Only (in., w x d x h) |
|---|---|---|---|---|---|
| 30TC-5-1 | 0-30 | 0-5 | 0.4 | 14½ x 13½ x 25¾ | 14 x 13 x 16½ |
| 40TC-5-1 | 0-40 | 0-5 | 0.5 | | |
| 50TC-5-1 | 0-50 | 0-5 | 0.4 | | |
| 60TC-5-1 | 0-60 | 0-5 | 0.4 | | |
| 30TC-20-1 | 0-30 | 0-20 | 0.4 | 17 x 17 x 32 | 16½ x 16½ x 21½ |
| 40TC-20-1 | 0-40 | 0-20 | 0.4 | | |
| 50TC-10-1 | 0-50 | 0-10 | 0.4 | | |
| 60TC-10-1 | 0-60 | 0-10 | 0.4 | | |
| 70TC-5-1 | 0-70 | 0-5 | 0.4 | | |
| 80TC-5-1 | 0-80 | 0-5 | 0.4 | | |

*%/ma is specified at maximum voltage and current. Percentage shown is also accurate for lower currents down to less than 15% of the maximum ma rating.
**Dimensions are nominal. Outline drawings available on request.

**Send for Complete Catalogs on • Capacitors • High Power Supplies • Transformers**

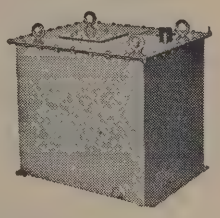
DEL ELECTRONICS CORP.
Dept. EM, 250 E. Sandford Blvd.
MOUNT VERNON, N.Y.
(914) 699-2000 TWX: 710-562-0130

## RACK MOUNT POWER SUPPLIES "RHPT" SERIES HIGH POT TESTER

The Del RHPT series of rack mounted Hi Pot Testers are general-purpose power supplies which are fully instrumented, completely enclosed, and fully protected. These units are designed for standard 19-inch racks and have light gray panels. They are recommended for all commercial, industrial, and laboratory uses where reliable dc high-voltage sources are required.

| Model No. | Output Voltage Range (kv) | Max. Current (ma) | Model No. | Output Voltage Range (kv) | Max. Current (ma) |
|---|---|---|---|---|---|
| 1RHPT-5-1 | 0-1 | 5 | 10RHPT-1.25-1 | 0-10 | 1.25 |
| 1RHPT-10-1 | 0-1 | 10 | 10RHPT-5-1 | 0-10 | 5 |
| 1RHPT-25-1 | 0-1 | 25 | 10RHPT-10-1 | 0-10 | 10 |
| 1RHPT-50-1 | 0-1 | 50 | 10RHPT-25-1 | 0-10 | 25 |
| 1RHPT-100-1 | 0-1 | 100 | 10RHPT-50-1 | 0-10 | 50 |
| 1RHPT-500-1 | 0-1 | 500 | 10RHPT-100-1 | 0-10 | 100 |
| 1RHPT-1000-1 | 0-1 | 1000 | 10RHPT-150-1 | 0-10 | 150 |
| 1RHPT-1500-1 | 0-1 | 1500 | 15RHPT-1.25-1 | 0-15 | 1.25 |
| 2.5RHPT-2-1 | 0-2.5 | 2 | 15RHPT-5-1 | 0-15 | 5 |
| 2.5RHPT-5-1 | 0-2.5 | 5 | 15RHPT-10-1 | 0-15 | 10 |
| 2.5RHPT-10-1 | 0-2.5 | 10 | 15RHPT-25-1 | 0-15 | 25 |
| 2.5RHPT-25-1 | 0-2.5 | 25 | 15RHPT-50-1 | 0-15 | 50 |
| 2.5RHPT-50-1 | 0-2.5 | 50 | 15RHPT-75-1 | 0-15 | 75 |
| 2.5RHPT-100-1 | 0-2.5 | 100 | 20RHPT-1.25-1 | 0-20 | 1.25 |
| 2.5RHPT-200-1 | 0-2.5 | 200 | 20RHPT-5-1 | 0-20 | 5 |
| 2.5RHPT-400-1 | 0-2.5 | 400 | 20RHPT-10-1 | 0-20 | 10 |
| 2.5RHPT-600-1 | 0-2.5 | 600 | 20RHPT-25-1 | 0-20 | 25 |
| 5RHPT-2-1 | 0-5 | 2 | 20RHPT-50-1 | 0-20 | 50 |
| 5RHPT-5-1 | 0-5 | 5 | 20RHPT-75-1 | 0-20 | 75 |
| 5RHPT-10-1 | 0-5 | 10 | 25RHPT-1.25-1 | 0-25 | 1.25 |
| 5RHPT-25-1 | 0-5 | 25 | 25RHPT-5-1 | 0-25 | 5 |
| 5RHPT-50-1 | 0-5 | 50 | 25RHPT-10-1 | 0-25 | 10 |
| 5RHPT-100-1 | 0-5 | 100 | 25RHPT-25-1 | 0-25 | 25 |
| 5RHPT-200-1 | 0-5 | 200 | 30RHPT-1.25-1 | 0-30 | 1.25 |
| 5RHPT-300-1 | 0-5 | 300 | 30RHPT-5-1 | 0-30 | 5 |
| 7.5RHPT-5-1 | 0-7.5 | 5 | 30RHPT-10-1 | 0-30 | 10 |
| 7.5RHPT-10-1 | 0-7.5 | 10 | 30RHPT-25-1 | 0-30 | 25 |
| 7.5RHPT-25-1 | 0-7.5 | 25 | 40RHPT-2-1† | 0-40 | 2 |
| 7.5RHPT-50-1 | 0-7.5 | 50 | 50RHPT-1-1 | 0-50 | 1 |
| 7.5RHPT-100-1 | 0-7.5 | 100 | 60RHPT-1-1 | 0-60 | 1 |

## SERIES "O" OIL INSULATED TANK UNITS



DEL SERIES "O", oil insulated, High Voltage Power Supplies offers one of the most comprehensive lines of basic high voltage units available to industry and laboratories. These D.C. supplies are designed to provide long, reliable service in such applications as dielectric testing, capacitor chargers, electrostatic precipitators, electron microscopes, image intensifiers, plasma research and accelerators. Series "O" supplies feature reversible polarity on most units, shielded polyethylene output cables, high quality insulating oil in dust free tank, quiet, long life operation with low corona.

### STANDARD MODELS

| Model No. | Output Voltage (kv) | Output Current (ma) | Model No. | Output Voltage (kv) | Output Current (ma) | Model No. | Output Voltage (kv) | Output Current (ma) |
|---|---|---|---|---|---|---|---|---|
| PSO20-200-3 | 20 | 200 | PSO50-50-8 | 50 | 50 | PSO100-300-1 | 100 | 300 |
| PSO20-300-2 | 20 | 300 | PSO50-75-1 | 50 | 75 | PSO100-500-1 | 100 | 500 |
| PSO25-50-2 | 25 | 50 | PSO50-100-4 | 50 | 100 | PSO120-5-3 | 120 | 5 |
| PSO25-200-11 | 25 | 200 | PSO50-200-5 | 50 | 200 | PSO120-10-1 | 120 | 10 |
| PSO25-400-1 | 25 | 400 | PSO50-220-2 | 50 | 220 | PSO120-30-1 | 120 | 30 |
| PSO25-500-6 | 25 | 500 | PSO50-300-1 | 50 | 300 | PSO130-2-3 | 130 | 2 |
| PSO30-3-2 | 30 | 3 | PSO50-500-3 | 50 | 500 | PSO150-5-5 | 150 | 5 |
| PSO30-5-4 | 30 | 5 | PSO60-1-1A† | 60 | 1 | PSO150-10-1 | 150 | 10 |
| PSO30-5-16 | 30 | 5 | PSO60-5-2 | 60 | 5 | PSO150-20-1 | 150 | 20 |
| PSO30-20-9 | 30 | 20 | PSO60-10-1 | 60 | 10 | PSO150-50-3 | 150 | 50 |
| PSO30-30-5 | 30 | 30 | PSO60-100-2 | 60 | 100 | PSO150-100-1 | 150 | 100 |
| PSO30-75-1 | 30 | 75 | PSO70-5-1 | 70 | 5 | PSO150-150-1 | 150 | 150 |
| PSO30-150-4 | 30 | 150 | PSO70-5-3 | 70 | 5 | PSO150-200-1 | 150 | 200 |
| PSO30-200-2 | 30 | 200 | PSO75-30-1 | 75 | 30 | PSO150-300-1 | 150 | 300 |
| PSO30-500-1 | 30 | 500 | PSO75-60-1 | 75 | 60 | PSO160-2-1 | 160 | 2 |
| PSO40-5-6 | 40 | 5 | PSO80-5-1 | 80 | 5 | PSO200-10-1 | 200 | 10 |
| PSO40-10-4 | 40 | 10 | PSO80-5-4 | 80 | 5 | PSO200-150-1 | 200 | 150 |
| PSO40-20-1 | 40 | 20 | PSO80-10-1B | 80 | 10 | PSO200-250-1 | 200 | 250 |
| PSO40-220-1 | 40 | 220 | PSO80-60-1 | 80 | 60 | PSO250-1-2 | 250 | 1 |
| PSO50-1-2† | 50 | 1 | PSO100-2-1 | 100 | 2 | PSO250-3-2 | 250 | 3 |
| PSO50-5-6 | 50 | 5 | PSO100-30-6 | 100 | 30 | PSO250-10-2 | 250 | 10 |
| PSO50-5-9 | 50 | 5 | PSO100-50-1 | 100 | 50 | PSO300-10-1 | 300 | 10 |
| PSO50-10-2 | 50 | 10 | PSO100-100-1 | 100 | 100 | PSO300-50-2 | 300 | 50 |
| PSO50-20-2 | 50 | 20 | PSO100-150-1 | 100 | 150 | | | |
| PSO50-30-4 | 50 | 30 | PSO100-200-3 | 100 | 200 | | | |

† Polarity — All units feature reversible polarity except Models PSO 40-2-3, PSO 50-1-2, and PSO 60-1-1A which supply positive outputs only.

**NOTE:** Larger units are shipped without oil to reduce transportation costs. See notations on price list.

**COMPLETE LINE OF CONTROL PANELS AND REGULATED CONTROLS AVAILABLE FOR ALL SERIES "O" POWER SUPPLIES.**

## HRPS SERIES HIGHLY-REGULATED — POWER SUPPLIES

- Designed to Withstand Vacuum Sparkovers
- Automatic Overload Tripout
- Hybrid Series Regulator
- Fast Dynamic Response
- Short Circuit Protection

**Input:** 115 or 230 volts 50/60 Hz.

**Output:** Adjustable 5 to 100% (See Chart Below)

**Ripple:** .01% RMS — at full load

**Response Time:** 100$\mu$sec

**Regulation:** Line: ±.0025% (For ±10% Line Change). Load: ±.005% (0 to Full Load)

**Resolution:** 1%

**Size:** 1-15KV Units—24 x 29 x 53 in. 30-50KV Units—24 x 29 x 70 in.

| Model Number | Output Current | Output Voltage | Insulation |
|---|---|---|---|
| HRPS1-1000 | 1000MA | 50V — 1000V | AIR |
| HRPS2.5-400 | 400MA | 125V — 2500V | AIR |
| HRPS5-200 | 200MA | 250V — 5000V | AIR |
| HRPS10-100 | 100MA | 500V — 10,000V | AIR |
| HRPS15-66 | 66MA | 750V — 15,000V | AIR |
| HRPS30-33 | 33MA | 1500V — 30,000V | OIL |
| HRPS50-20 | 20MA | 2500V — 50,000V | OIL |
| HRPS60-30 | 30MA | Also Available 30,000-60,000V | OIL |

## TRANSFORMER HIGH VOLTAGE LINE ISOLATION

**OPEN TYPE CONSTRUCTION — EPOXY COATED**

These Isolation Transformers are designed for continuous operation at rated voltage and power. They are epoxy coated for use in air and are well suited for applications requiring a reliable source of isolated line voltage at power ratings up to 1 KVA.

| Type | KVA | Size | Insulation KV DC Working | Type | KVA | Size | Insulation KV DC Working |
|---|---|---|---|---|---|---|---|
| AD 1640 | .200 | 6⅛x4x5⅛ | 10 | AD 3062 | .750 | 10½x7½x9½ | 30 |
| AD 1641 | .500 | 7⅝x5⅞x7¾ | 10 | AD 3063 | 1.000 | 11x9x9½ | 30 |
| AD 1642 | .750 | 9½x6 3/16x8¼ | 10 | AD 3064 | .250 | 10x7x6½ | 40 |
| AD 1643 | 1.000 | 8½x8x9¾ | 10 | AD 3065 | .500 | 11¼x7¼x8¾ | 40 |
| AD 1644 | .200 | 8½x4x5⅝ | 20 | AD 3066 | .750 | 12½x7½x9½ | 40 |
| AD 1645 | .500 | 10¼x5⅝x7½ | 20 | AD 3067 | 1.000 | 12¾x9x9½ | 40 |
| AD 1646 | .750 | 9¾x6¾x8 | 20 | AD 3068 | .250 | 12¼x7¼x6½ | 50 |
| AD 1647 | 1.000 | 11¼x6⅝x8¾ | 20 | AD 3069 | .500 | 13¼x7¼x8¾ | 50 |
| AD 3060 | .250 | 8½x7¼x6½ | 30 | AD 3070 | .750 | 14½x7½x9½ | 50 |
| AD 3061 | .500 | 9¾x7x8¾ | 30 | AD 3071 | 1.000 | 14¾x9x9½ | 50 |

**Primaries:** 115/230V 60 Hz. **Secondaries:** 115V.

## HIGH VOLTAGE TRANSFORMERS

**FOR VOLTAGE DOUBLER OR ONE END GROUND OPERATION**

These transformers are designed for either voltage doubler or one end ground use (except where noted). When used in voltage doubler applications, the D.C. voltage will be approximately two times the peak secondary voltage and the maximum D.C. current from the doubler can be approximately 30% of the maximum secondary current (RMS) and depends on the value of the doubler capacitors. Units are designed for use under oil and for use in air up to 15KVP epoxy coated. **Primary:** 115V-50/60 Hz.

| Type | Sec. Volts (Peak) | Max. Sec. Current (MA RMS) | Size |
|---|---|---|---|
| AD 4710 | 2,500 | 10 | 4¼x2½x3½ |
| AD 4711 | 5,000 | 10 | 3¼x3 3/16x4¼ |
| AD 4712 | 7,500 | 10 | 4½x4x5½ |
| AD 4713 | 10,000 | 10 | 5⅜x4⅜x6⅝ |
| AD 4714 | 15,000 | 10 | 6¾x3½x5¾ |
| AD 4715 | 20,000 | 10 | 8¾x8½x8 |
| AD 4716 | 30,000 | 10 | 9¼x5½x9¼ |
| AD 4717 | 50,000 | 10 | 10⅝x6½x11 |
| AD 4718 | 100,000* | 10 | 14¼x9½x15 |
| AD 4719 | 150,000* | 10 | 14⅛x10x16½ |
| AD 3100 | 2,500 | 30 | 3 3/16x3x4¼ |
| AD 3101 | 5,000 | 30 | 4½x4 5/16x5⅜ |
| AD 3102 | 7,500 | 30 | 6½x4⅛x6⅜ |
| AD 3103 | 10,000 | 30 | 7x4½x6¾ |
| AD 3104 | 20,000 | 30 | 8⅞x6x9⅞ |
| AD 3105 | 30,000 | 30 | 11⅞x7½x12½ |
| AD 3106 | 50,000 | 30 | 11⅜x10x14¾ |
| AD 3107 | 100,000* | 30 | 12⅞x12x17 |
| AD 3108 | 150,000* | 30 | 16⅛x13¾x20½ |
| AD 3109 | 2,500 | 60 | 3⅞x3¾x4⅝ |
| AD 3110 | 5,000 | 60 | 4⅜x4⅜x5⅞ |
| AD 3111 | 7,500 | 60 | 6¾x5¼x7⅛ |
| AD 3112 | 10,000 | 60 | 7⅜x5½x7¾ |
| AD 3113 | 20,000 | 60 | 9⅜x9⅛x13 |
| AD 3114 | 30,000 | 60 | 9⅞x7¾x11¾ |
| AD 3115 | 50,000 | 60 | 13½x10¼x15¾ |
| AD 3116 | 100,000* | 60 | 14x14x19½ |
| AD 3117 | 150,000* | 60 | 17¼x16¼x22 |

*End ground operation only.
Units also available in sturdy metal tanks designed for oil insulation and supplied with porcelain output bushings.

**Send for Complete Catalogs on • Capacitors • High Power Supplies • Transformers**

DEL ELECTRONICS CORP. MOUNT VERNON, N.Y.
Dept. EM, 250 E. Sandford Blvd. (914) 699-2000 TWX: 710-562-0130

# DORMEYER INDUSTRIES

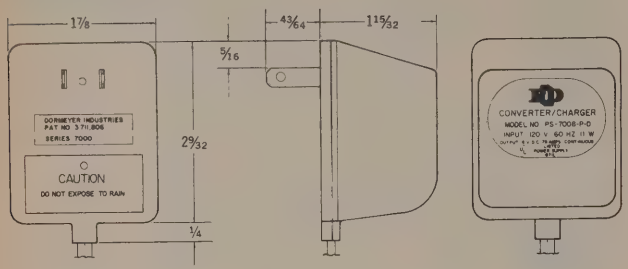
*A Division of A. F. Dormeyer Mfg. Co., Inc.*

# CONVERTER/CHARGER

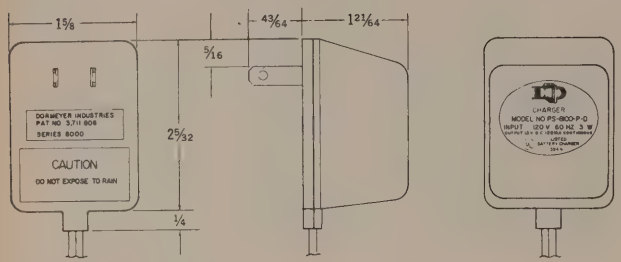
## CONVERTER/CHARGERS

### PHYSICAL CONFIGURATIONS

#### 7000 SERIES



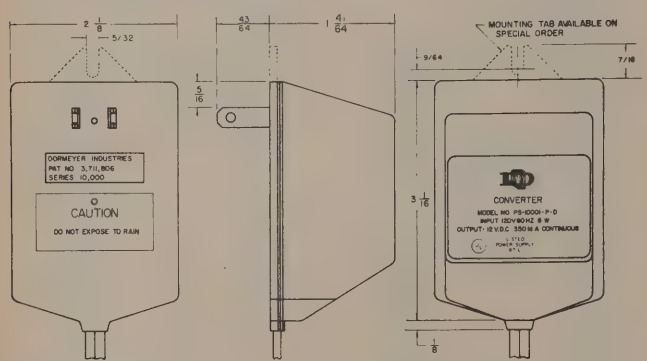

#### 8000 SERIES



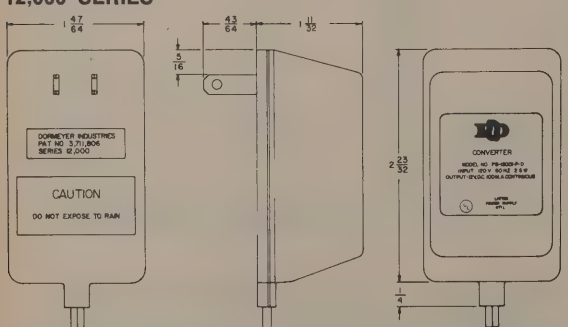

## FILTERED CONVERTER/CHARGERS

### PHYSICAL CONFIGURATIONS

#### 10,000 SERIES




#### 12,000 SERIES




This group of converters is primarily designed for products requiring low-voltage non-filtered DC with resistive or inductive loads such as light bulbs, DC motors and solenoids.

Table I lists the various current, voltage, duty and case sizes available.

Table I shows maximum continuous current output of the converter/charger. If the duty listed for the converter is rated intermittent, a maximum continuous current is listed for the charger. All current ratings are maximum.

The values of dropping resistor (R) are determined by the type, number of batteries and charge time required.

**TABLE I — HIGH POWER NON-FILTERED DC CONVERTER/CHARGER**

| Dormeyer Part No. | Converter Output Volts DC | Converter Output Amps DC Max. | Converter Duty | Max. Continuous Charger Current Amps | Input Watts | Case Size |
|---|---|---|---|---|---|---|
| PS-7001 | 12 | .45 | CONT. | .45 | 11 | 7000 |
| PS-8001 | 12 | .30 | CONT. | .30 | 9 | 8000 |
| PS-7002 | 12 | .75 | INT. | .34 | 20 | 7000 |
| PS-7003 | 12 | 1.0 | INT. | .38 | 30 | 7000 |
| PS-7004 | 9 | .55 | CONT. | .55 | 11 | 7000 |
| PS-8002 | 9 | .40 | CONT. | .40 | 9 | 8000 |
| PS-7005 | 9 | .75 | INT. | .43 | 15 | 7000 |
| PS-7006 | 9 | 1.0 | INT. | .45 | 21 | 7000 |
| PS-7008 | 6 | .75 | CONT. | .75 | 11 | 7000 |
| PS-8003 | 6 | .50 | CONT. | .50 | 8 | 8000 |
| PS-7009 | 6 | 1.0 | INT. | .63 | 15 | 7000 |
| PS-7010 | 6 | 1.5 | INT. | .51 | 26 | 7000 |
| PS-7012 | 4.8 | .85 | CONT. | .85 | 11 | 7000 |
| PS-8004 | 4.8 | .60 | CONT. | .60 | 8 | 8000 |
| PS-7013 | 4.8 | 1.5 | INT. | .59 | 22 | 7000 |
| PS-7015 | 3.6 | 1.0 | CONT. | 1.0 | 11 | 7000 |
| PS-8005 | 3.6 | .70 | CONT. | .70 | 7 | 8000 |
| PS-7016 | 3.6 | 1.5 | INT. | .70 | 16 | 7000 |
| PS-7017 | 3.6 | 2.0 | INT. | .70 | 23 | 7000 |
| PS-7018 | 2.4 | 1.3 | CONT. | 1.3 | 11 | 7000 |
| PS-8006 | 2.4 | .90 | CONT. | .90 | 6 | 8000 |
| PS-7019 | 2 4 | 2.0 | INT. | 1.1 | 15 | 7000 |
| PS-7020 | 20 | .35 | CONT. | .35 | 11 | 7000 |

NOTES:

Converter output current for continuous duty units is listed as maximum. Charger current is determined by the constant current dropping resistor. This current cannot exceed the values shown in Table I.

The values in Table I do not include voltage drops incurred in the output cord.

All converters rated intermittent duty or without a plug on the output cord will require U.L. application listing, if U.L. marking is required on the label.

All stock converters listed above have a #20/2 cord.

### FOR APPLICATION REQUIRING FILTERED DC WITH BATTERY OPERATED PRODUCTS

This group of AC to DC Converters is designed for battery operated products such as tape recorders, radios and calculators.

The stock filtered Converters listed in Table No. II, are designed and rated for operation with capacitor filters. The capacitor is located in the converter.

All filtered converters listed in Table No. II, are stocked with a filter capacitor rated at 1000 MFD for the 12,000 series and 1500 MFD for the 10,000 series. Converters with capacitor ratings other than noted above are available on special order.

This series of converters is designed with exceptionally low internal impedance and can be connected across the battery. This permits switching from the AC converter to battery operation without the need for an external switch.

**TABLE II — LOW POWER FILTERED D.C. CONVERTER**

| Dormeyer Part No. | Converter Output Volts DC | Converter Output Milliamps DC | Input Watts | Case Size |
|---|---|---|---|---|
| PS-12001 | 12 | 100 | 2.5 | 12,000 |
| PS-10001 | 12 | 350 | 8 | 10,000 |
| PS-12002 | 9 | 100 | 2 | 12,000 |
| PS-10002 | 9 | 350 | 6 | 10,000 |
| PS-12003 | 7.5 | 100 | 1.5 | 12,000 |
| PS-10003 | 7.5 | 350 | 6 | 10,000 |
| PS-12004 | 6 | 100 | 1.5 | 12,000 |
| PS-10004 | 6 | 350 | 5 | 10,000 |
| PS-12005 | 4.5 | 100 | 1 | 12,000 |
| PS-10005 | 4.5 | 350 | 5 | 10,000 |
| PS-12006 | 3 | 100 | 1 | 12,000 |
| PS-10006 | 3 | 350 | 4 | 10,000 |
| PS-12007 | 1.5 | 100 | 1 | 12,000 |
| PS-10007 | 1.5 | 350 | 4 | 10,000 |

NOTES:

All stock converters listed in Table II are rated for continuous duty.

The stock converters have a maximum peak to peak ripple of .75 V for the 12,000 Series and 1.5 V for the 10,000 Series at rated output, resistive load.

All converters have an internal filter capacitor rated at 1000 MFD for the 12,000 series and 1500 MFD for the 10,000 series. Converters with capacito ratings other than noted above are available on special order.

The values do not include voltage drops incurred in the output cord.

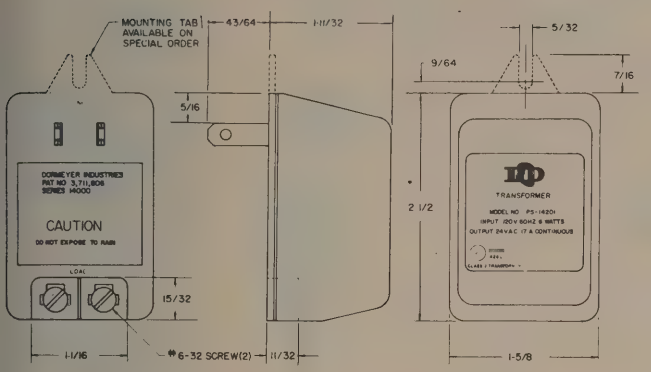
Stock converters with no plug on the output cord will require U.L. application listing, if U.L. marking is required on the label.

All stock converters have a #22 cord.

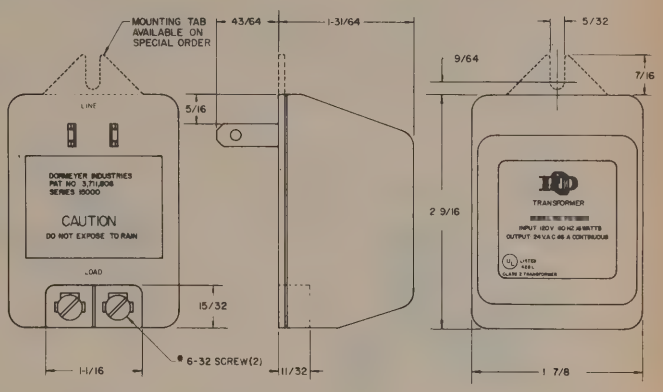
# TRANSFORMERS/CHARGERS

## AC/AC PLUG-IN TRANSFORMERS — PHYSICAL CONFIGURATIONS

**14,000 SERIES**




**15,000 SERIES**



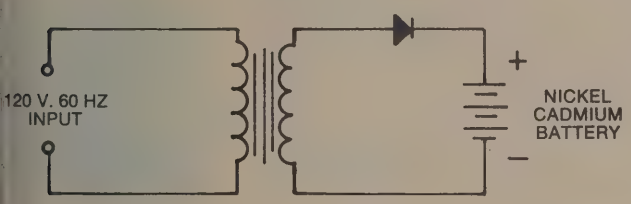

## BATTERY CHARGERS

### FOR APPLICATIONS REQUIRING SLOW RATE 14-16 HOURS CHARGING OF NICKEL-CADMIUM BATTERIES

A group of slow rate chargers for charging cylindrical type nickel-cadmium batteries is listed in Table III. All chargers are of the ½-wave design except those indicated by a †. The chargers indicated by a † are of the full-wave design. All chargers feature high internal resistance to provide a more constant charging current. See Fig. No. 5.

The chargers listed in Table III, are designed for applications requiring slow rate charging, 14 to 16 hours. Other types of chargers, fast rate and trickle charging are available. Chargers for other nickel-cadmium batteries such as button cells, industrial and cell sizes not listed in Table III, are also available.

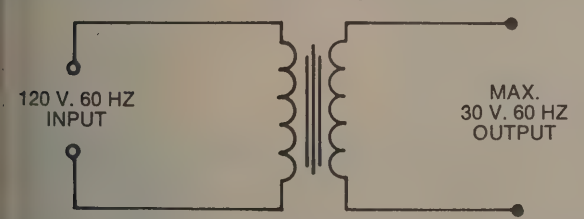
**FIG. No. 5**




For information on chargers other than those listed, write the Dormeyer Sales Department noting type of cell, number of cells and rate of charging required.

The basic converter can be used as an AC Class 2 plug-in, step-down transformer. Many secondary voltages are available, providing the secondary open circuit voltage does not exceed 30 volts. See Fig. No. 6.

**FIG. No. 6**




Stock AC/AC plug-in transformers are listed in Table IV. These stock transformers have screw terminal secondary connectors and are designated as the Series 14,000 and 15,000.

AC/AC plug-in transformers are available on special order with Type "A" #20 GA. cord outputs.

A mounting tab is available on special order for the 14,000 and 15,000 series.

**TABLE III — NICKEL-CADMIUM CHARGERS SLOW RATE 14-16 HOURS**

| Dormeyer Part No. | Charge Voltage DC | Max. Charging Current Milliamps | Nickel Cadmium Batt. Cell Type | No. of Cells | Case Size |
|---|---|---|---|---|---|
| †PS-7100 | 1.5 | 400 | D-4.0 A.H. | 1 | 7000 |
| †PS-7101 | 3 | 400 | D-4.0 A.H. | 2 | 7000 |
| †PS-7102 | 4.5 | 400 | D-4.0 A.H. | 3 | 7000 |
| †PS-7103 | 6 | 400 | D-4.0 A.H. | 4 | 7000 |
| †PS-7104 | 7.5 | 400 | D-4.0 A.H. | 5 | 7000 |
| PS-7105 | 1.5 | 200 | C-2.0 A.H. | 1 | 7000 |
| PS-7106 | 3 | 200 | C-2.0 A.H. | 2 | 7000 |
| PS-7107 | 4.5 | 200 | S-2.0 A.H. | 3 | 7000 |
| PS-7108 | 6 | 200 | C-2.0 A.H. | 4 | 7000 |
| SP-7109 | 7.5 | 200 | C-2.0 A.H. | 5 | 7000 |
| SP-8100 | 1.5 | 120 | Sub C 1.2 A.H. | 1 | 8000 |
| PS-8101 | 3 | 120 | Sub C 1.2 A.H. | 2 | 8000 |
| PS-8102 | 4.5 | 120 | Sub C 1.2 A.H. | 3 | 8000 |
| PS-8103 | 6 | 120 | Sub C 1.2 A.H. | 4 | 8000 |
| PS-8104 | 7.5 | 120 | Sub C 1.2 A.H. | 5 | 8000 |
| PS-7110 | 15 | 120 | Sub C 1.2 A.H. | 10 | 7000 |
| PS-8105 | 1.5 | 75 | ½ C .75 A.H. | 1 | 8000 |
| PS-8106 | 3 | 75 | ½ C .75 A.H. | 2 | 8000 |
| PS-8107 | 4.5 | 75 | ½ C .75 A.H. | 3 | 8000 |
| PS-8108 | 6 | 75 | ½ C .75 A.H. | 4 | 8000 |
| PS-8109 | 7.5 | 75 | ½ C .75 A.H. | 5 | 8000 |
| PS-8110 | 1.5 | 47 | AA .475 A.H. | 1 | 8000 |
| PS-8111 | 3 | 47 | AA .475 A.H. | 2 | 8000 |
| PS-8112 | 4.5 | 47 | AA .475 A.H. | 3 | 8000 |
| PS-8113 | 6 | 47 | AA .475 A.H. | 4 | 8000 |
| PS-8114 | 7.5 | 47 | AA .475 A.H. | 5 | 8000 |
| PS-8115 | 9.0 | 47 | AA .475 A.H. | 6 | 8000 |
| PS-8116 | 15 | 47 | AA .475 A.H. | 10 | 8000 |

NOTES:

All stock charges listed in Table III are rated for continuous duty.
The values do not include voltage drops incurred in the output cord.
Stock chargers with no plug on the output cord will require UL application listing, if UL marking is required on the label.
All stock chargers listed have a #22 cord.
Chargers indicated by a † in Table III are full-wave design. All others are half-wave.

**TABLE IV**

| Dormeyer Part No. | Output Volts AC | Ontput Amps AC | Input Watts | Case Size |
|---|---|---|---|---|
| PS-15201 | 24 | .46 | 16 | 15,000 |
| PS-14201 | 24 | .17 | 6 | 14,000 |
| PS-15202 | 20 | .51 | 14 | 15,000 |
| PS-14202 | 20 | .29 | 9 | 14,000 |
| PS-15203 | 16 | .70 | 16 | 15,000 |
| PS-14203 | 16 | .35 | 9 | 14,000 |
| PS-15204 | 12 | .93 | 17 | 15,000 |
| PS-14204 | 12 | .47 | 9 | 14,000 |
| PS-15205 | 10 | 1.0 | 14 | 15,000 |
| PS-14205 | 10 | .58 | 9 | 14,000 |
| PS-15206 | 6 | 1.8 | 16 | 15,000 |
| PS-14206 | 6 | .94 | 9 | 14,000 |
| PS-15207 | 3 | 3.1 | 18 | 15,000 |
| PS-14207 | 3 | 1.5 | 8 | 14,000 |

NOTES:

All stock AC/AC plug-in transformers noted in Table IV are rated for continuous duty, are UL listed and have the UL seal on the label.

# WALL PLUG-IN LOW VOLTAGE

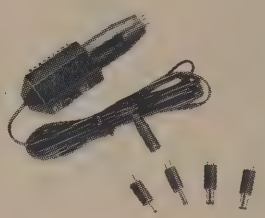
## CONVERTERS/POWER SUPPLIES/CHARGERS

### Modular Charging Systems

Makes any battery powered product instantly rechargeable without product redesign.

### Universal DC to DC Converters

For auto, truck, boat RV or motor home. Four replaceable tips fit all receptacles.



### Wall Plug In AC to DC Converters

- **Miniaturized external charging system.**
- **Compatible with commercially available battery holders having snap terminals.**
- **For AA penlights, C's, D's or 9-volt transistor type nickel-cadmium batteries.**
- **Charge 1000 times or more.**
- **No engineering or retooling required.**

**Dynamic Instrument Corp. has designed, developed and patented a complete range of low-voltage, filtered, transistor-regulated power supplies and chargers designed to supply the necessary power to a vast variety of Electronic equipment.**

**Utilizing a wall plug-in type unit eliminates or greatly reduces the problems involved with UL listing your product. They also remove the major heat source, reduce size and weight, and also greatly increase your design flexibility. The latest design applications of the Dynamic wall plug-in supplies are in conjunction with such sophisticated equipment as mini-computers, calculators, keyboard logic circuits, and remote CRT Terminals.**

**Just call or write: Dept. WPX-1.**

### AMERICAN AND EUROPEAN STANDARDS CATALOGS

- **Standard Converters**
- **Chargers**
- **Power Supplies**

...both wall plug-in and desk top models. Covers Nickel-cadmium and Lead-acid chargers. AC/DC converters. Contains:

- Specifications
- Regulation Charts and Curves
- Outline drawings

**Dynamic's product range and capabilities also cover:**

**POWER CONVERSION**
AC-AC for products requiring low-level AC voltage. AC-DC for small electric motor driven products that do not use batteries.

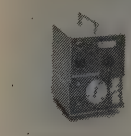
**SECONDARY BATTERY CHARGING**
Dynamic Chargers for charging Nickel-Cadmium; Lead-Acid and Manganese-Alkaline Batteries.

**AC-DC CONVERSION/CHARGING**
Dynamic Converter-Chargers providing rechargeability or instant use of battery operated products.

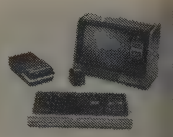
**FAST CHARGING SYSTEMS**
Dynamic design and production capability relative to Fast Charging Systems.

**TRANSFORMERS**
Internal, External and Wall-Mounted Dynamic Transformers.

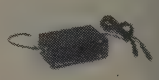
**SPECIALTY TRANSFORMERS**
Dynamic Plug-In, Printed Circuit Transformers; Sub-Miniature Transformers; Ferro-resonant Transformers; Multi-Input Voltage and Multi-Output Voltage Transformers.



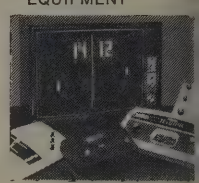
CONVERTER/ CHARGER FOR PORTABLE MEDICAL ELECTRONIC EQUIPMENT



CONVERTER/ CHARGER FOR MICROPROCESSORS

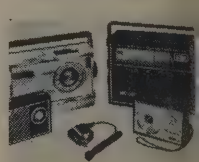


CONVERTER/ CHARGER FOR PORTABLE TEST EQUIPMENT



CONVERTER/ CHARGER FOR VIDEO GAMES

CONVERTER/ CHARGER FOR CALCULATORS



CONVERTER/ CHARGER FOR HOME ENTERTAINMENT PRODUCTS

"FAST" CHARGER FOR ELECTRONIC FLASH

**DYNAMIC INSTRUMENT CORP.**

MANUFACTURERS OF POWER CONVERSION AND BATTERY CHARGING SYSTEMS TO THE ORIGINAL EQUIPMENT MANUFACTURER

933 MOTOR PARKWAY
HAUPPAUGE, N.Y. 11787
**Telephone 516-234-2900**
**TWX 510-227-9884**

# the Carefree® Force

**. . . the largest line of maintenance free, rechargeable batteries in the world**

## Carefree®

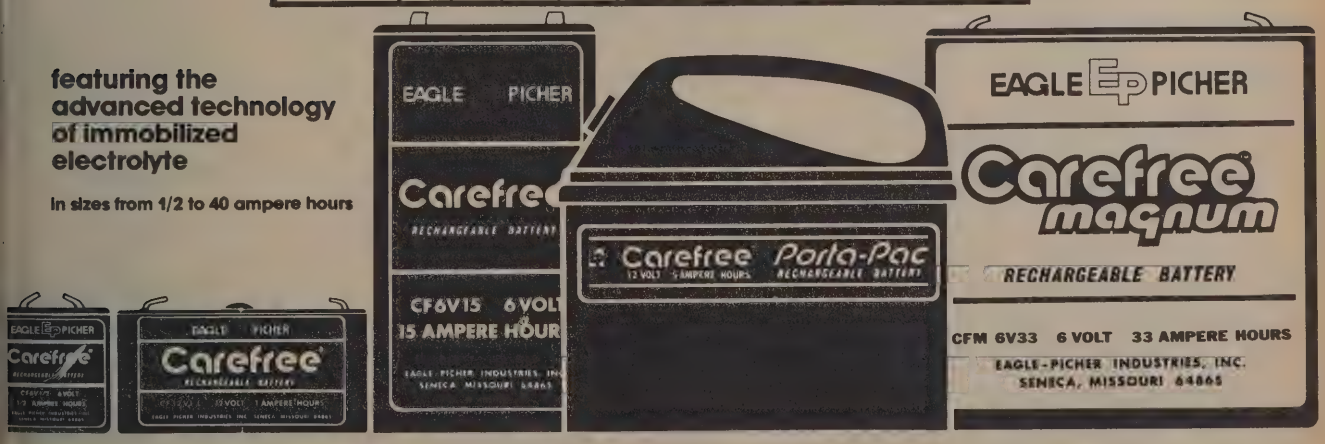
| BATTERY NUMBER | NORMAL VOLTAGE | NOMINAL CAPACITY @ 20 HR | 10 HR | 5 HR | 1 HR | DIMENSIONS (INCHES) LENGTH | WIDTH | HEIGHT | TO TERMINAL | WEIGHT (LBS.) | STANDARD PACKAGING |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CF2V2.5 | 2 | 2.6 | 2.4 | 2.2 | 1.6 | 2.3 | 1.04 | 2.625 | 2.94 | 0.5 | |
| CF2V5 | 2 | 5.2 | 5.0 | 4.5 | 3.0 | 2.33 | 1.06 | 3.95 | 4.33 | 0.78 | 44 |
| CF2V30 | 2 | 28.0 | 26.0 | 23.0 | 16.0 | 3.34 | 2.2 | 6.5 | 6.66 | 4.2 | 12 |
| CF6V½ | 6 | 0.45 | 0.38 | 0.35 | 0.23 | 1.92 | 1.0 | 2.0 | 2.25 | .3 | 72 |
| CF6V1 | 6 | 0.9 | 0.87 | 0.81 | 0.57 | 2.0 | 1.65 | 1.97 | 2.29 | .5 | 72 |
| CF6V2.6 | 6 | 2.6 | 2.5 | 2.3 | 1.6 | 5.3 | 1.33 | 2.36 | 2.54 | 1.3 | 30 |
| CF6V4.5 | 6 | 4.5 | 4.3 | 3.9 | 2.4 | 6.0 | 1.34 | 3.7 | 3.9 | 2.4 | 14 |
| CF6V8 | 6 | 8.0 | 7.7 | 7.0 | 4.5 | 6.0 | 2.0 | 3.75 | 3.93 | 3.6 | 12 |
| CF6V15 | 6 | 15.0 | 14.5 | 13.0 | 9.0 | 3.6 | 3.34 | 6.49 | 6.7 | 6.4 | 8 |
| CF6V30 | 6 | 28.0 | 26.0 | 23.0 | 16.0 | 6.25 | 3.35 | 6.5 | 6.75 | 11.5 | 2 |
| CF6V40 | 6 | 44.0 | 42.0 | 38.0 | 27.0 | 6.51 | 4.91 | 6.53 | 6.75 | 16.2 | 1 |
| CF8V6 | 8 | 6.5 | 5.7 | 5.3 | 3.5 | 3.34 | 2.16 | 6.5 | 6.66 | 3.8 | 12 |
| CF12V½ | 12 | 0.45 | 0.38 | 0.35 | 0.23 | 3.9 | 1.0 | 2.0 | 2.25 | 6 | |
| CF12V1 | 12 | 0.9 | 0.87 | 0.81 | 0.57 | 3.3 | 2.0 | 1.97 | 2.18 | 1.2 | 40 |
| CF12V1L | 12 | 0.9 | 0.87 | 0.81 | 0.57 | 4.02 | 1.65 | 1.97 | 2.18 | 1.2 | 40 |
| CF12V1.5 | 12 | 1.5 | 1.4 | 1.3 | .9 | 7.02 | 1.33 | 2.4 | 2.6 | 1.9 | 24 |
| CF12V2.6 | 12 | 2.6 | 2.5 | 2.3 | 1.6 | 5.3 | 2.72 | 2.37 | 2.56 | 2.8 | 16 |
| CF12V4.5 | 12 | 4.5 | 4.3 | 3.9 | 2.4 | 6.0 | 2.7 | 3.7 | 3.9 | 4.8 | 6 |
| CF12V5L | 12 | 5.2 | 5.0 | 4.5 | 3.0 | 6.12 | 2.42 | 3.94 | 4.12 | 4.75 | 10 |
| CF12V5PP | 12 | 5.2 | 5.0 | 4.5 | 3.0 | 6.12 | 2.43 | 6.6 | NA | 5.0 | 6 |
| CF12V8 | 12 | 8.0 | 7.7 | 7.0 | 5.0 | 6.0 | 4.0 | 3.75 | 3.97 | 7.5 | 5 |
| CF12V15 | 12 | 15.0 | 14.5 | 13.0 | 9.0 | 7.22 | 3.34 | 6.5 | 6.75 | 12.8 | 4 |
| CF12V20 | 12 | 20.0 | 19.0 | 17.5 | 12.5 | 6.51 | 4.91 | 6.53 | 6.75 | 16.2 | 2 |
| CF12V30 | 12 | 28.0 | 26.0 | 22.0 | 16.0 | 6.72 | 6.25 | 6.5 | 6.75 | 23 | 1 |
| CF12V30L | 12 | 28.0 | 26.0 | 23.0 | 16.0 | 10.04 | 4.31 | 6.5 | 6.75 | 23 | 2 |
| CF18V1 | 18 | 0.9 | 0.87 | 0.81 | 0.57 | 4.9 | 2.0 | 1.97 | 2.2 | 1.7 | 15 |
| CF24V20 | 24 | 20.0 | 19.0 | 17.5 | 12.5 | 9.83 | 6.51 | 6.53 | 6.75 | 33 | 1 |
| CF24V30 | 24 | 28.0 | 26.0 | 22.0 | 16.0 | 12.5 | 6.7 | 6.5 | 6.75 | 46.5 | 1 |

## Carefree magnum — more power in the same space

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CFM6V33 | 6 | 33.0 | 31.0 | 27.0 | 19.0 | 6.25 | 3.35 | 6.5 | 6.75 | 12.2 | 2 |
| CFM12V33 | 12 | 33.0 | 31.0 | 27.0 | 19.0 | 6.72 | 6.25 | 6.5 | 6.75 | 24.5 | 1 |

**featuring the advanced technology of immobilized electrolyte**

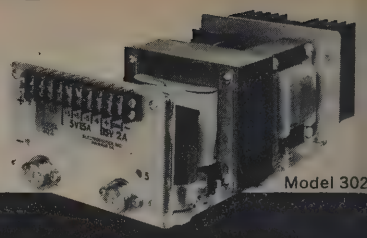
**In sizes from 1/2 to 40 ampere hours**




**EAGLE EP PICHER**

**EAGLE-PICHER INDUSTRIES, INC.** **P.O. Box 130, Seneca, Mo. 64865**
**Commercial Products Department** **Telephone (417) 776-2256**

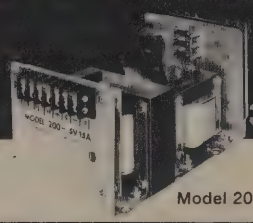
# low cost 24-hour delivery direct from stock


Model 302

# DC POWER SUPPLIES

**MICROPROCESSOR MODELS**

**SINGLES—DUALS—TRIPLES**


Model 200

Model 10

Model 55

## Full Rating To 71°C

## 60 WATTS $59

| MODEL | VOLTAGE | AMPS |
|---|---|---|
| 55 - 3 | 2.5 - 3.5 | 5.0 |
| 55 - 4 | 3.5 - 4.5 | 5.0 |
| 55 - 5 | 4.5 - 5.5 | 5.0 |
| 55 - 6 | 5.5 - 6.5 | 4.5 |
| 55 - 7 | 6.5 - 7.5 | 4.5 |
| 55 - 8 | 7.5 - 8.5 | 4.5 |
| 55 - 9 | 8.5 - 9.5 | 4.0 |
| 55 - 10 | 9.5 - 10.5 | 4.0 |
| 55 - 11 | 10.5 - 11.5 | 4.0 |
| 55 - 12 | 11.0 - 13.0 | 3.0 |
| 55 - 14 | 13.0 - 15.0 | 3.0 |
| 55 - 16 | 15.0 - 17.0 | 3.0 |
| 55 - 18 | 17.0 - 19.0 | 2.5 |
| 55 - 20 | 19.0 - 21.0 | 2.0 |
| 55 - 22 | 21.0 - 23.0 | 2.0 |
| 55 - 24 | 23.0 - 25.0 | 2.0 |
| 55 - 26 | 25.0 - 27.0 | 2.0 |
| 55 - 28 | 27.0 - 29.0 | 2.0 |
| 55 - 30 | 29.0 - 30.0 | 2.0 |
| 55 - 1212 | ±11.0 - 13.0 | 1.0 |
| 55 - 1515 | ±14.0 - 16.0 | 1.0 |
| 55 - 1818 | ±17.0 - 19.0 | 1.0 |

Size: 6.00 L x 3.50 W x 3.13 H Wt.: 4.25 lbs.

| QUANTITY | PRICE | WITH OVERVOLTAGE |
|---|---|---|
| **SINGLE** (Models 55 - 3 thru 55 - 30) | | |
| 1 - 9 | $59 ea. | $65 ea. |
| 10 - 24 | $56 ea. | $60 ea. |
| **DUAL** (Models 55 - 1212 thru 55 - 1818) | | |
| 1 - 9 | $69 ea. | $79 ea. |
| 10 - 24 | $65 ea. | $74 ea. |

## 10 WATTS $35

| MODEL | VOLTAGE | AMPS |
|---|---|---|
| 10 - 5 | 4.5 - 5.5 | 1.2 |
| 10 - 10 | 9 - 11 | 0.9 |
| 10 - 12 | 11 - 13 | 0.8 |
| 10 - 15 | 14 - 16 | 0.6 |
| 10 - 24 | 23 - 25 | 0.4 |
| 10 - 28 | 26 - 30 | 0.35 |
| 10 - 1212 | ±11 - 13 | 0.35 |
| 10 - 1515 | ±14 - 16 | 0.35 |
| 10 - 1818 | ±17 - 19 | 0.35 |

**ANY OUTPUT TO 30 VOLTS AVAILABLE**

Size: 4.5 L x 4.5 W x 1.63 H Wt.: 1.2 Lbs.

| | PRICE | WITH OVERVOLTAGE |
|---|---|---|
| **SINGLE** | | |
| 1 - 9 | $35 ea. | $40 ea. |
| 10 - 24 | $32 ea. | $36 ea. |
| **DUAL** | | |
| 1 - 9 | $45 ea. | $55 ea. |
| 10 - 24 | $42 ea. | $51 ea. |

## 30 WATTS $31

| MODEL | VOLTAGE | AMPS |
|---|---|---|
| 30 - 5 | 5 | 3.0 |
| 30 - 10 | 10 | 1.8 |
| 30 - 12 | 12 | 1.5 |
| 30 - 15 | 15 | 1.2 |
| 30 - 24 | 24 | 1.0 |
| 30 - 28 | 28 | 1.0 |

**ANY OUTPUT TO 30 VOLTS AVAILABLE**

Size: 4.0 L x 2.75 W x 4.5 H Wt.: 2.1 Lbs.

| QUANTITY | PRICE | WITH OVERVOLTAGE |
|---|---|---|
| 1 - 9 | $31.00 ea. | $36.00 ea. |
| 10 - 24 | $29.20 ea. | $33.70 ea. |

## TRIPLE $70

| MODEL | VOLTAGE | AMPS |
|---|---|---|
| 300 | 5 V | 1 |
| | ±12 or 15 V | 0.25 |
| 301 | 5 V | 5A |
| | ±12 or 15 V | 1A |
| 302 | 5 V | 15A |
| | ±12 or 15 V | 2A |
| 401 | 5 V | 25A |
| | ±12 or 15 V | 3A |

Size: 300 - 4.5 L x 4.5 W x 2.25 H; Wt.: 2 Lbs.
301 - 7.0 L x 6.0 W x 3.38 H; Wt.: 6 Lbs.
302 - 13.25 L x 6.0 W x 4.00 H; Wt.: 16.5 Lbs.
401 - 15.0 L x 7.0 W x 5.25 H; Wt.: 22.5 Lbs.

| | MODEL | PRICE | WITH OVERVOLTAGE |
|---|---|---|---|
| 1 - 9 | 300 - 12 | $ 70 ea. | $ 80 ea. |
| | 300 - 15 | | |
| | 301 - 12 | $ 99 ea. | $111 ea. |
| | 301 - 15 | | |
| | 302 - 12 | $159 ea. | $174 ea. |
| | 302 - 15 | | |
| | 401 - 12 | $279 ea. | $299 ea. |
| | 401 - 15 | | |
| 10 - 24 | 300 - 12 | $ 65 ea. | $ 75 ea. |
| | 300 - 15 | | |
| | 301 - 12 | $ 93 ea. | $104 ea. |
| | 301 - 15 | | |
| | 302 - 12 | $149 ea. | $163 ea. |
| | 302 - 15 | | |
| | 401 - 12 | $262 ea. | $280 ea. |
| | 401 - 15 | | |

## 200 WATTS $99

| MODEL | VOLTAGE | AMPS |
|---|---|---|
| 200 - 5 | 4.5 - 5.5 | 15.0 |
| 200 - 10 | 9.5 - 10.5 | 12.0 |
| 200 - 12 | 11.5 - 12.5 | 10.0 |
| 200 - 15 | 14.5 - 15.5 | 9.0 |
| 200 - 24 | 23.5 - 24.5 | 7.5 |
| 200 - 28 | 27.5 - 28.5 | 7.0 |
| 200 - 48 | 47.5 - 48.5 | 4.0 |
| 200 - 0505 | ± 4.5 - 5.5 | 7.0 |
| 200 - 1212 | ±11.5 - 12.5 | 5.0 |
| 200 - 1515 | ±14.5 - 15.5 | 4.5 |
| 200 - 2424 | ±23.5 - 24.5 | 3.5 |
| 200 - 2828 | ±27.5 - 28.5 | 3.5 |

**ANY SINGLE OUTPUT TO 50 VOLTS AVAILABLE**
**ANY DUAL OUTPUT TO 30 VOLTS AVAILABLE**

Size: 10.75 L x 5.50 W x 5.00 H Wt.: 15 Lbs.

| | PRICE | WITH OVERVOLTAGE |
|---|---|---|
| **SINGLE** | | |
| 1 - 9 | $99 ea. | $114 ea. |
| 10 - 24 | $94 ea. | $107 ea. |
| **DUAL** | | |
| 1 - 9 | $119 ea. | $129 ea. |
| 10 - 24 | $113 ea. | $122 ea. |

## 100 WATTS $72

| MODEL | VOLTAGE | AMPS |
|---|---|---|
| 100 - 5 | 5 | 10 |
| 100 - 10 | 10 | 7 |
| 100 - 12 | 12 | 6 |
| 100 - 15 | 15 | 6 |
| 100 - 24 | 24 | 4 |
| 100 - 28 | 28 | 3.5 |
| 100 - 0505 | ± 5 | 5 |
| 100 - 1212 | ±12 | 3.5 |
| 100 - 1515 | ±15 | 3 |
| 100 - 2424 | ±24 | 2 |
| 100 - 2828 | ±28 | 2 |

**ANY OUTPUT TO 30 VOLTS AVAILABLE**

Size: 7 L x 5.5 W x 5.5 H Wt.: 6 Lbs.

| | PRICE | WITH OVERVOLTAGE |
|---|---|---|
| **SINGLE** | | |
| 1 - 9 | $72 ea. | $78 ea. |
| 10 - 24 | $68 ea. | $73 ea. |
| **DUAL** | | |
| 1 - 9 | $85 ea. | $97 ea. |
| 10 - 24 | $81 ea. | $91 ea. |

## ELECTRICAL SPECIFICATIONS: ALL MODELS

**INPUT:** 105-125 VAC, 50-420 Hz (230V OPTIONAL)

**REGULATION:** LINE: 0.005% or 2 MV MIN (10 VOLT CHANGE)
LOAD: 0.05% or 10 MV MIN (FULL LOAD CHANGE)

**RIPPLE:** LESS THAN 250 MICROVOLTS

**IMPEDANCE:** 100 Hz - 0.001 OHMS
1 KHz - 0.005 OHMS
10 KHz - 0.01 OHMS
100 KHz - 0.1 OHMS

**RECOVERY TIME:** 25 MICROSECONDS

**OVERSHOOT:** NONE ON TURN ON OR OFF

**TEMPERATURE:**
OPERATING −20 TO +71°C
STORAGE −65 TO +85°C
COEFFICIENT 0.01%/°C MAX

**CURRENT LIMITING:** FIXED - FOLD-BACK TYPE - AUTOMATIC RECOVERY

**OUTPUT:** FLOATING

**SEMICONDUCTORS:** SILICON

**CAPACITORS:** COMPUTER GRADE 10 YEAR LIFE

**OVERVOLTAGE PROTECTION:** OPTIONAL

## ORDERING INFORMATION

All prices FOB San Diego
One Year Warranty
For Overvoltage Models Add -0 To Model Number
Free Catalog on Request

Prices and specifications subject to change without notice.

*"Quality Power Supplies Since 1965"*

**Electrostatics, inc.**

7718 CLAIREMONT MESA BLVD. • SAN DIEGO, CA 92111 • (714) 279-1414

# POWER SUPPLIES

## FROM

# ELECTRONIC MEASUREMENTS

## DC OUTPUT SCR REGULATED

On the next three pages you will find the industry's largest selection of DC output SCR regulated power supplies in the 500 watt to 60 KW range. All units regulate voltage and current output to 0.1% and feature low ripple, high efficiency and reliability and the smallest package sizes available.

## FOR CUSTOM POWER SUPPLIES

If your requirements cannot be satisfied with standard E/M products we are eager to make modifications to meet specific applications. Standard units can have special panels, optional features or alternate packages. If you are an OEM, a custom power supply may be required. Our design and production technology includes series pass, ferroresonant, switch mode and SCR phase control techniques. Prompt technical appraisal of your specification and a realistic quotation are only a letter or phone call away — if you give us the opportunity.

## OTHER POWER PRODUCTS

E/M is also actively engaged in design and production of special purpose power sources. These include Arc lamp power supplies for krypton, xenon and mercury lamps, plasma arc power supplies, battery eliminators, open frame power supplies and switch mode power sources. Contact us for specific information and applications assistance in any of these areas.

**ELECTRONIC MEASUREMENTS, INC.**

405 ESSEX ROAD / NEPTUNE, NEW JERSEY 07753 / (201) 922-9300

**TOLL FREE: 800-631-4298**

*Specialists in Power Conversion Equipment*

# DC OUTPUT SCR REGULATED POWER SUPPLIES

## FEATURES

- Highest wattage per cubic inch in the industry
- High efficiency
- Constant-voltage or constant-current output, with automatic crossover
- Remote sensing and programming
- Series or parallel operation
- Master/slave operation
- Circuit breaker or fuse protected
- Thermal overload protection
- Mode indicator lights
- Rack or bench mount
- Optional over-voltage protection
- Optional input voltages
- Five-year warranty

## APPLICATIONS

- CW lasers
- Pulse lasers
- Capacitor forming
- Focusing coils for accelerators
- Cryogenic magnet applications
- Electroplating
- Battery charging
- Aging racks for semiconductors and IC's
- Electronic memory systems
- General electronic applications

## SINGLE PHASE SCR MODELS

(500, 800, 1600, 2400 WATTS)

## MAJOR SPECIFICATIONS

**AC Input Voltage:** 500, 800, 1600 W Models — 10 130V, 47-63 Hz; 2400 W Models — 190-253V, 47- Hz. Optional inputs available.

**AC Input Current:** 500 W — 7.5A; 800 W — 12 1600 W — 24A; 2400 W — 18A (220V).

**DC Output:** Regulation, voltage mode — 0.1%; re ulation, current mode — 0.25%; stability — 0.05% 8 hours; temperature coefficient — 0.02%/°C.

**Size:** 500, 800 W Models — 3½"H x 19"W x 18½" (88mm x 483mm x 470mm); 1600 W Models — 5¼" x 19"W x 18½"D (133mm x 483mm x 470mm); 2400 Models — 7"H x 19"W x 18½"D (177mm x 483mm 470mm).

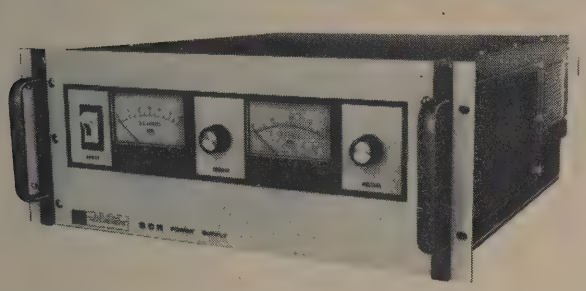
| Output Voltage (V) | Output Current (A) | Voltage Ripple (mV rms) | Current Ripple (mA rms) | Model | Price ($ |
|---|---|---|---|---|---|
| 0-7.5 | 60 | 80 | 640 | SCR7-5-60 | 550 |
| | 100 | | 1000 | SCR7.5-100 | 700 |
| | 180 | | 1920 | SCR7.5-180 | 950 |
| | 250 | | 2990 | SCR7.5-250 | 1100 |
| 0-10 | 40 | 80 | 320 | SCR10-40 | 495 |
| | 80 | | 600 | SCR10-80 | 700 |
| | 150 | | 1200 | SCR10-150 | 925 |
| | 210 | | 1680 | SCR10-210 | 1100 |
| 0-20 | 25 | 80 | 100 | SCR20-25 | 495 |
| | 40 | | 120 | SCR20-40 | 650 |
| | 80 | | 320 | SCR20-80 | 895 |
| | 120 | | 480 | SCR20-120 | 1100 |
| 0-40 | 13 | 100 | 33 | SCR40-13 | 475 |
| | 20 | 75 | 30 | SCR40-20 | 600 |
| | 40 | 100 | 100 | SCR40-40 | 850 |
| | 60 | 100 | 150 | SCR40-58 | 1100 |
| 0-60 | 9 | 120 | 18 | SCR60-9 | 495 |
| | 13 | 75 | 15 | SCR60-13 | 600 |
| | 26 | 90 | 39 | SCR60-26 | 900 |
| | 40 | 90 | 60 | SCR60-40 | 1100 |
| 0-80 | 6 | 150 | 11 | SCR80-6 | 495 |
| | 10 | 80 | 10 | SCR80-10 | 650 |
| | 20 | 120 | 30 | SCR80-20 | 950 |
| | 30 | 100 | 35 | SCR80-28 | 1100 |
| 0-150 | 3 | 300 | 6 | SCR150-3 | 450 |
| | 5 | 150 | 5 | SCR150-5 | 625 |
| | 10 | 200 | 13 | SCR150-10 | 950 |
| | 15 | 200 | 20 | SCR150-15 | 1100 |
| 0-300 | 1.5 | 500 | 3 | SCR300-1.5 | 525 |
| | 3 | 250 | 3 | SCR300-3 | 700 |
| | 5 | 300 | 5 | SCR300-5 | 950 |
| | 8 | 300 | 8 | SCR300-8 | 1100 |
| 0-600 | 0.75 | 1000 | 2 | SCR600-.75 | 500 |
| | 1.5 | 700 | 2 | SCR600-1.5 | 700 |
| | 3 | 700 | 4 | SCR600-3 | 950 |
| | 5 | 750 | 5 | SCR600-4 | 1100 |

**ELECTRONIC MEASUREMENTS INC.**
405 ESSEX ROAD / NEPTUNE, NEW JERSEY 07753
PHONE: (201) 922-9300 (NEW JERSEY) / TELEX: 132-424
*Specialists in Power Conversion Equipment*

**TOLL FREE 800-631-429**

# THREE PHASE SCR MODELS

(2500, 5000, 10,000 WATTS)



## MAJOR SPECIFICATIONS

**AC Input Voltage:** 2.5 KW Models — 190-240V, 3$\phi$ 47-63 Hz @ 10A; 5 KW Models — 190-240V, 3$\phi$ 47-63 Hz @ 20A; 10 KW Models — 400-505V, 3$\phi$ 57-63 Hz @ 18A. Optional inputs available.

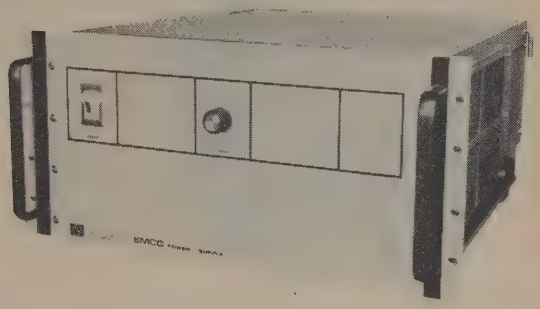
**DC Output:** Regulation, voltage and current mode — 0.1%; stability — 0.05; temperature coefficient, 0.05%/°C; operating temperature, 0-50°C.

**Sizes:** 2.5 KW Models — 7″H x 19″W x 20″D (177mm x 483mm x 508mm); 5 KW Models — 8¾″H x 19″W x 20″D (222mm x 483mm x 508mm); 10 KW Models — 12¼″H x 19″W x 20″D (311mm x 483mm x 508mm).

| Output Voltage (V) | Output Current (A) | Voltage Ripple (mV rms) | Current Ripple (mA rms) | Model | Price ($) |
|---|---|---|---|---|---|
| 0-6 | 600 | 10 | 300 | SCR6-600 | 2500 |
| 0-7.5 | 300 | 10 | 150 | SCR7.5-300 | 1700 |
| 0-10 | 250 | 10 | 125 | SCR10-250 | 1600 |
| | 500 | | 250 | SCR10-500 | 2400 |
| 0-20 | 125 | 10 | 30 | SCR20-125 | 1500 |
| | 250 | | 60 | SCR20-250 | 2050 |
| | 500 | | 120 | SCR20-500 | 3100 |
| 0-30 | 100 | 10 | 30 | SCR30-100 | 1500 |
| | 200 | | 60 | SCR30-200 | 2050 |
| 0-40 | 60 | 10 | 10 | SCR40-60 | 1500 |
| | 125 | | 30 | SCR40-125 | 1950 |
| | 250 | | 125 | SCR40-250 | 2900 |
| 0-50 | 200 | 10 | 60 | SCR50-200 | 3150 |
| 0-80 | 30 | 10 | 10 | SCR80-30 | 1500 |
| | 60 | | 10 | SCR80-60 | 1950 |
| 0-100 | 100 | 10 | 30 | SCR100-100 | 3150 |
| 0-120 | 20 | 10 | 3 | SCR120-20 | 1500 |
| | 40 | | 10 | SCR120-40 | 1950 |
| 0-160 | 15 | 10 | 3 | SCR160-15 | 1550 |
| | 30 | | 3 | SCR160-30 | 2000 |
| | 60 | | 10 | SCR160-60 | 2950 |
| 0-250 | 10 | 10 | 3 | SCR250-10 | 1500 |
| | 20 | | 3 | SCR250-20 | 2100 |
| | 40 | | 10 | SCR250-40 | 3150 |
| 0-500 | 5 | 10 | 3 | SCR500-5 | 1725 |
| | 10 | | 3 | SCR500-10 | 2500 |

# THREE PHASE EMCV & EMCC MODELS

(2500, 5000, 10,000 WATTS)



## MAJOR SPECIFICATIONS

**AC Input Voltage:** 2.5 KW Models — 190-240V, 3$\phi$ 47-63 Hz @ 10A; 5 KW Models — 190-240V; 3$\phi$ 47-63 Hz @ 20A; 10 KW Models — 400-505V; 3$\phi$ 57-63 Hz @ 18A. Optional inputs available.

**DC Output:** Regulation — 1%; stability — 0.05%; temperature coefficient — 0.05%/°C; operating temperature — 0-50°C.

**Sizes:** 2.5 KW Models — 7″H x 19″W x 20″D (177mm x 483mm x 508mm); 5 KW Models — 8¾″ x 19″W x 20″D (222mm x 483mm x 508mm); 10 KW Models — 12¼″H x 19″W x 20″D (311mm x 483mm x 508mm).

| EMCV Output | | EMCC Output | | Ripple* | | Model (EMCV or EMCC) | Price ($) |
|---|---|---|---|---|---|---|---|
| Volts | Amps | Amps | Volts | EMCV (mV rms) | EMCC (mA rms) | | |
| 1.5-6 | 600 | 50-600 | 6 | 150 | 17A | 6-600 | 2200 |
| 1.5-7.5 | 300 | 30-300 | 7.5 | 150 | 6A | 7.5-300 | 1500 |
| 1.5-10 | 250 | 50-250 | 10 | 150 | 4A | 10-250 | 1400 |
| | 500 | 100-500 | | | 8A | 10-500 | 2150 |
| 2-20 | 125 | 25-125 | 20 | 150 | 1A | 20-125 | 1300 |
| | 250 | 50-250 | | | 2A | 20-250 | 1800 |
| | 500 | 100-500 | | | 4A | 20-500 | 2700 |
| 3-30 | 100 | 25-100 | 30 | 150 | 500 | 30-100 | 1300 |
| | 200 | 50-200 | | | 1000 | 30-200 | 1750 |
| 4-40 | 60 | 10-60 | 40 | 150 | 225 | 40-60 | 1300 |
| | 125 | 25-125 | | | 475 | 40-125 | 1650 |
| | 250 | 50-250 | | | 1000 | 40-250 | 2500 |
| 5-50 | 200 | 40-200 | 50 | 150 | 600 | 50-200 | 2800 |
| 10-80 | 30 | 5-30 | 80 | 150 | 60 | 80-30 | 1300 |
| | 60 | 10-60 | | | 120 | 80-60 | 1700 |
| 15-100 | 100 | 20-100 | 100 | 150 | 500 | 100-100 | 2800 |
| 15-120 | 20 | 5-20 | 120 | 300 | 50 | 120-20 | 1300 |
| | 40 | 5-40 | | | 100 | 120-40 | 1650 |
| 20-160 | 15 | 5-15 | 160 | 300 | 30 | 160-15 | 1300 |
| | 30 | 5-30 | | | 60 | 160-30 | 1650 |
| | 60 | 10-60 | | | 120 | 160-60 | 2600 |
| 25-250 | 10 | 2-10 | 250 | 300 | 12 | 250-10 | 1300 |
| | 20 | 5-20 | | | 24 | 250-20 | 1750 |
| | 40 | 5-40 | | | 48 | 250-40 | 2800 |
| 50-500 | 5 | 1-5 | 500 | 300 | 6 | 500-5 | 1500 |
| | 10 | 2-10 | | | 12 | 500-10 | 2200 |

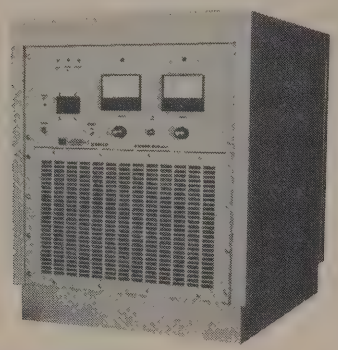
*At maximum output. Ripple is less at reduced power output.

**ELECTRONIC MEASUREMENTS INC.**
405 ESSEX ROAD / NEPTUNE, NEW JERSEY 07753
PHONE: (201) 922-9300 (NEW JERSEY) / TELEX: 132-424
*Specialists in Power Conversion Equipment*

**TOLL FREE: 800-631-4298**

# THREE PHASE EMHP MODELS

(20, 30, 60 KILOWATTS)



## FEATURES

- Low cost
- Reduced delivery time
- Greatly increased efficiency
- High performance

## APPLICATIONS

- Electromagnets
- Magnetic beam bending
- Cryogenic magnets
- Precision electroplating
- Electrochemical processes
- DC motor power
- Large relay systems
- High energy electronic systems
- High power illumination systems
- Thermodynamic and thermonuclear research
- Inverter power source
- Battery charging
- Industrial DC power

## MAJOR SPECIFICATIONS

**AC Input Voltage:** 460 VAC ±10%, 60 Hz. Optional inputs available.

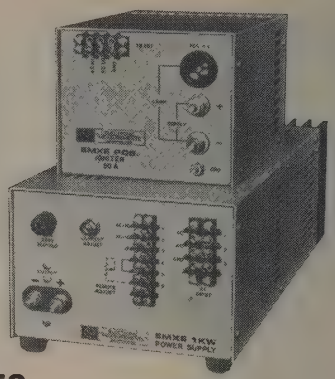
**DC Output:** Regulation, 0.1%; stability, 0.05%.

**Size:** Series 15 (19″ panel) — 21.69″W x 29.5″H x 25.00″D (55.1cm x 74.9cm x 63.5cm); Series 25 (24″ panel) — 26.75″W x 34.25″H x 25.00″D (67.9cm x 86.93cm x 63.5cm); Series 40 (24″ panel) — 26.75″W x 40.25″H x 29.00″D (67.9cm x 102.16cm x 73.6cm).

| Model | Voltage (V) | Current (A) | Voltage Ripple (V rms) | Current Ripple (A rms) | Typical Price ($) |
|---|---|---|---|---|---|
| **SERIES 15 (20 KW max., 19″ panel, 26⅝″ package)** | | | | | |
| EMHP10-1000 | 0-10 | 0-1000 | 0.10 | 10 | 4500 |
| EMHP20-750 | 0-20 | 0-750 | 0.15 | 5.7 | |
| EMHP40-400 | 0-40 | 0-400 | 0.25 | 2.5 | |
| EMHP80-250 | 0-80 | 0-250 | 0.50 | 1.6 | |
| EMHP150-130 | 0-150 | 0-130 | 0.75 | 0.7 | |
| EMHP600-30 | 0-600 | 0-30 | 3.00 | 0.2 | |
| **SERIES 25 (30 KW max., 24″ panel, 32″ package)** | | | | | |
| EMHP10-1500 | 0-10 | 0-1500 | 0.1 | 15 | 5500 |
| EMHP20-1000 | 0-20 | 0-1000 | 0.15 | 7.5 | |
| EMHP40-600 | 0-40 | 0-600 | 0.25 | 3.8 | |
| EMHP80-375 | 0-80 | 0-375 | 0.5 | 2.4 | |
| EMHP150-200 | 0-150 | 0-200 | 0.70 | 1.0 | |
| EMHP600-50 | 0-600 | 0-50 | 3.0 | 0.3 | |
| **SERIES 40 (60 KW max., 24″ panel, 47⅝″ package)** | | | | | |
| EMHP10-3000 | 0-10 | 0-3000 | 0.1 | 30 | 9500 |
| EMHP20-1500 | 0-20 | 0-1500 | 0.15 | 12 | |
| EMHP40-900 | 0-40 | 0-900 | 0.25 | 6 | |
| EMHP80-600 | 0-80 | 0-600 | 0.5 | 4 | |
| EMHP150-350 | 0-150 | 0-350 | 0.75 | 2 | |
| EMHP600-100 | 0-600 | 0-100 | 3.0 | 0.5 | |

# ARC LAMP POWER SUPPLIES

(XENON & MERCURY—35W TO 1 KW)



## FEATURES

- Small size
- Light weight
- Flexible mounting
- High efficiency
- Low ripple (better than 1%)
- Excellent regulation (better than 1%)
- Low in-rush currents
- Long-term stability
- Remotely adjustable (500 W and 1000 W, standard; 200 W, optional)
- No audible noise
- Low energy starting
- Input surge protection
- Automatic starting
- Adjustable output
- Modulation capability (optional)

## APPLICATIONS

**Optical Instrumentation:**
Metallographs
Monochromators
Spectrophotometers
Fluorescent microscopes
Artificial aging equipment
Optical test stands
Laser pumping
Weathering & light fastness testers

**Graphic Arts:**
Integrated circuit manufacture
Color matching

**Image Projection:**
Slide projectors
Motion picture projectors
Contour projection
Photoelectric scanning
Railway identification systems

**Medical:**
Photo coagulators
Skin irradiation equipment

## SPECIFICATIONS

**AC Input:** 100-130 VAC, 47-63 Hz. 200 W package, 2.5A; 500 W package, 8.4A; 1000 W package, 15A. Optional inputs available.

**DC Output:** 200 W package, to 13A; 500 W package, to 27A; 1000 W package, to 55A. Ripple, less than 0.1% below 20 kHz.

| Basic Model | Power Supply Unit: Voltage | Power Supply Unit: Current (amps DC) | Power Supply Unit: Mode | Igniter Unit: Peak Volt. | Igniter Unit: Boost Volt. | Lamp Applications |
|---|---|---|---|---|---|---|
| EMXE75 | 14 | to 7.0 | CP | 15KV | 180 | 35 & 75 watt xenon |
| EMXE150 | 20 | to 8.5 | CC or CP | 35KV | 180 | 150 watt xenon |
| EMXE150/ VIX | 12 | 12.5 | CC | 35KV | 180 | VIX 150 |
| EMHG200 | 65-50 | 3.1-4.0 | CP | 12KV | 180 | 200 watt mercury (50 & 100 watt avail.) |
| EMXE500 | 20 | to 27 | CC | 35KV | 180 | 450 & 500 watt xenon |
| EMHG500 | 85-70 | 5.9-7.1 | CP | 12KV | 180 | 300 to 500 watt merc. |
| EMXE1000 | 20 | to 55 | CC | 35KV | 180 | 600 to 1000 watt xenon |
| EMHG1000 | 80 | 12.5 | CP | 12KV | 180 | 600 to 1000 watt merc. |

**ELECTRONIC MEASUREMENTS INC.**
405 ESSEX ROAD / NEPTUNE, NEW JERSEY 07753
PHONE: (201) 922-9300 (NEW JERSEY) / TELEX: 132-424
*Specialists in Power Conversion Equipment*

**TOLL FREE: 800-631-4298**

# All Series Shall Pass... Except The Switcher!

Now! For the first time you have your choice of Switching or Series Pass power supplies...right off the shelf...from your local Distributors everywhere!

Only ELPAC gives you this choice. Only ELPAC Distributors have this wide range of single and multiple output power supplies...ready right now for delivery.

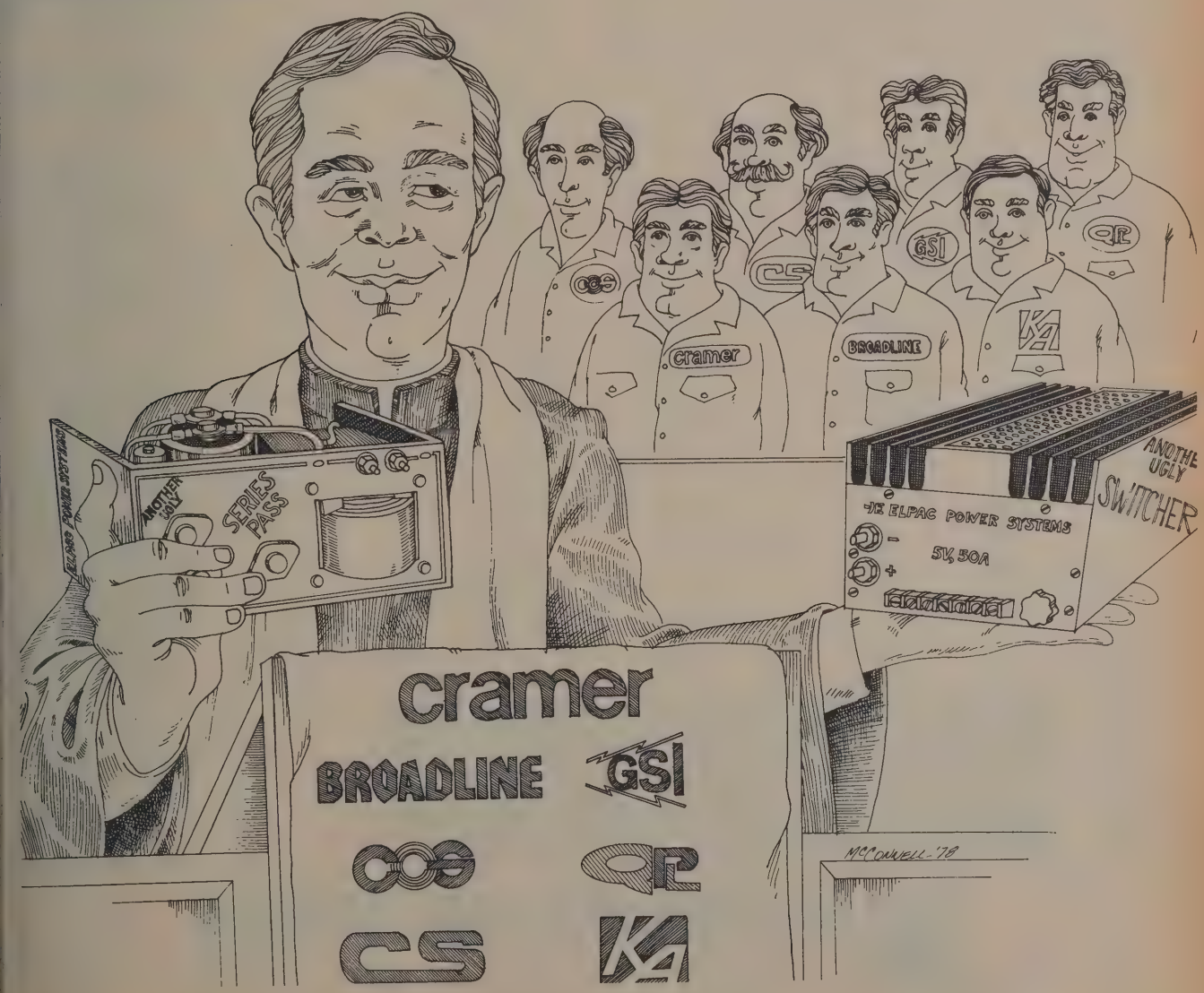
Order from the ELPAC line. Get innovative design that's warranteed for faithful performance...at a practical, down-to-earth cost!

Order the ELPAC of your choice. Switcher, Series Pass or DC/DC.

Become a believer...call your local Distributor today for prompt delivery of your Ugly.™ Off-the-shelf! Out-of-this-world!

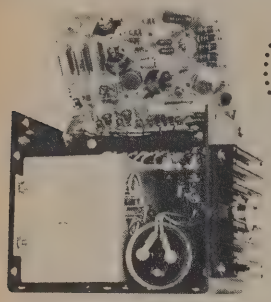
**Get UGLY™ Switchers, Series Pass and DC/DC power supplies from your local distributor:** Cramer, National; Broadline, Farmingdale, N.Y.; G.S.I., Roselle, N.J.; Q.P.L., Waltham, Ma.; Component Specialties, Inc., Tx. & Oka.; K.A., Garland, Tx; Series Pass Only: Newark, National; Utronics, Fairfields, Cn.; Shap, Huntingdon Valley, Pa.; Technico, Columbia, Md.; A.C.K. Radio Supply, Atlanta, Ga.

**ELPAC POWER SYSTEMS**
ELPAC Electronics, Inc.
3131 So. Standard Avenue
Santa Ana, Calif. 92705
(714) 979-4440
TWX 910-595-1513



**MIL SPEC MS SERIES**

# REPAIRABLE MS SERIES • MILITARY SPECIFICATIONS SINGLE/DUAL OUTPUT DC MODULAR POWER SUPPLIES



**75°C FREE AIR RATING**

## MEETS COMPONENT, WORKMANSHIP AND ENVIRONMENTAL REQUIREMENTS OF MIL-E-4158, MIL-E-5400, MIL-E-16400, MIL-E-5272, MIL-T-21200

Transpac MS Series DC Power Modules are capable of meeting the highest military requirements. These units incorporate full MIL components where applicable and are designed to meet full military environmental and component specifications. Transformers are per MIL-T-27A, semiconductors are MIL-STD-701 or MIL-S-19500 preferred types. Tantalum foil capacitors per MIL-C-3965 are used throughout except in the filter sections of higher current types where MIL-C-62 military grade electrolytic capacitors are used. These units have been fully tested to meet the component, workmanship, and environmental requirements of MIL-E-4158, MIL-E-5400, MIL-E-16400, MIL-E-5272, MIL-T-21200 and are supplied with an independent testing laboratory certification as to compliance for representative models.

**CERTIFIED** Certificate of Conformity by Independent Laboratory supplied on request

**Input:** 103.5-126.5 VAC (standard) or 108-132 VAC (specify), 47-440 Hz

**Ripple:** Less than 800 $\mu$V RMS except 50 through 310 VDC where ripple is less than 0.005% RMS

**Line Regulation:** Less than ±0.01% or 5 MV, whichever is greater, for full input change

**Load Regulation:** Less than 0.05% or 8 MV for 0-100% load change

**Transient Response:** Less than 50 $\mu$sec for step line or load change

**Maximum Case Temperature:** 115°C

**Free Air Operating Temperature:** −55°C to +75°C (full tantalum type up to 1 ampere most models) −40°C to +75°C (semitantalum type above 1 ampere) full ratings, no external heat sinking

**Temperature Coefficient:** Less than 0.01% per degree C or 3 MV

**Long Term Stability:** Within 10 MV or 0.1%, whichever is greater for 8 hours (line, load, temperature constant)

**Interconnection:** Series or parallel operation

**Voltage Adjustment:** External screwdriver voltage control

**Remote Voltage Control:** Provision for external control of output voltage

**Remote Sensing:** Remote sensing facilities provided

**Short Circuit Protection:** Automatic short circuit protection and automatic recovery

**Overvoltage Protection:** Fixed 5 volt and dual output units add suffix (-O) to model number. For other MS units order model OV448M

**Polarity:** Ungrounded or +/− grounded

**Transistor Types:** MIL-STD-701 and MIL-S-19500

**Military Specs:** MIL-E-4158, MIL-E-5400, MIL-E-16400, MIL-E-5272, MIL-T-21200 where applicable

### SINGLE OUTPUT

| Output Voltage (DC) | Current | Size - W x D x H (Inches) | Weight (Lbs.) | Model |
|---|---|---|---|---|
| 5VDC | 1 Amp | 4 x 4¾ x 5 15/16 | 6.1 | MS51 |
| 5VDC | 3 Amp | 5¾ x 7 3/16 x 5¼ | 11.3 | MS53 |
| 5VDC | 6 Amp | 6 x 8 15/16 x 6 5/16 | 22.5 | MS56 |
| 5VDC | 12 Amp | 6 15/16 x 10⅝ x 6 5/16 | 23.2 | MS512 |
| 5VDC | 20 Amp | 4 15/16 x 7½ x 14⅞ | 32.0 | MS520 |
| 0-7VDC | 500 MA | 3 5/16 x 4 3/16 x 5½ | 4.8 | MS07P5 |
| 0-7VDC | 1 Amp | 4 x 4¾ x 5 15/16 | 6.1 | MS071 |
| 0-7VDC | 2 Amp | 5¾ x 7 3/16 x 5¼ | 11.3 | MS072 |
| 0-7VDC | 4 Amp | 6 x 8 15/16 x 6 5/16 | 23.7 | MS074 |
| 0-7VDC | 8 Amp | 6 x 10⅝ x 6 5/16 | 24.1 | MS078 |
| 0-10VDC | 50 MA | 3 x 3 x 3¼ | 1.6 | MS01P05 |
| 10-20VDC | 250 MA | 3¼ x 3¼ x 4 31/32 | 3.9 | MS10P3 |
| 11-12VDC | 4 Amp | 6 x 8 15/16 x 6 5/16 | 23.7 | MS124 |
| 11-12VDC | 8 Amp | 6 x 10⅝ x 6 5/16 | 24.1 | MS128 |
| 11-13VDC | 500 MA | 3 5/16 x 4 3/16 x 5½ | 4.8 | MS12P5 |
| 11-13VDC | 1 Amp | 4 x 4¾ x 5 15/16 | 6.1 | MS121 |
| 11-13VDC | 2 Amp | 5¾ x 7 3/16 x 5¼ | 11.2 | MS122 |
| 14.5-15.5VDC | 500 MA | 3 5/16 x 4 3/16 x 5½ | 4.8 | MS15P5 |
| 14.5-15.5VDC | 1 Amp | 4 x 4¾ x 5 15/16 | 6.1 | MS151 |
| 14.5-15.5VDC | 2 Amp | 5¾ x 7 3/16 x 5¼ | 11.3 | MS152 |
| 14.5-15.5VDC | 4 Amp | 6 x 8 15/16 x 6 5/16 | 23.7 | MS154 |
| 14.5-15.5VDC | 8 Amp | 6 15/16 x 10⅝ x 6 5/16 | 24.8 | MS158 |
| 17-18VDC | 4 Amp | 6 x 8 15/16 x 6 5/16 | 23.7 | MS184 |
| 17-18VDC | 8 Amp | 6 15/16 x 10⅝ x 6 5/16 | 24.8 | MS188 |
| 17-19VDC | 500 MA | 3 5/16 x 4 3/16 x 5½ | 4.8 | MS18P5 |
| 17-19VDC | 1 Amp | 4 x 4¾ x 5 15/16 | 6.1 | MS181 |
| 17-19VDC | 2 Amp | 5¾ x 7 3/16 x 5¼ | 11.3 | MS182 |
| 19-21VDC | 5 Amp | 6 15/16 x 10⅝ x 6 5/16 | 24 | MS205V25R |
| 20-30VDC | 50 MA | 3 x 3 x 3¼ | 1.6 | MS20P05 |
| 20-30VDC | 250 MA | 3¼ x 3¼ x 4 31/32 | 3.9 | MS20P3 |
| 23-24VDC | 4 Amp | 6 x 8 15/16 x 6 5/16 | 23.7 | MS244 |
| 23-24VDC | 8 Amp | 6 15/16 x 10⅝ x 6 5/16 | 24.1 | MS248 |
| 23-25VDC | 500 MA | 3 5/16 x 4 3/16 x 5½ | 4.8 | MS24P5 |
| 23-25VDC | 1 Amp | 4 x 4¾ x 5 15/16 | 6.1 | MS241 |
| 23-25VDC | 2 Amp | 5¾ x 7 3/16 x 5¼ | 11.3 | MS242 |
| 27-28VDC | 4 Amp | 6 x 8 15/16 x 6 5/16 | 23.7 | MS284 |
| 27-28VDC | 8 Amp | 6 15/16 x 10⅝ x 6 5/16 | 24.1 | MS288 |

### SINGLE OUTPUT (CONTINUED)

| Output Voltage (DC) | Current | Size - W x D x H (Inches) | Weight (Lbs.) | Model |
|---|---|---|---|---|
| 27-29VDC | 500 MA | 3 5/16 x 4 3/16 x 5½ | 4.8 | MS28P5 |
| 27-29VDC | 1 Amp | 4 x 4¾ x 5 15/16 | 6.1 | MS281 |
| 27-29VDC | 2 Amp | 5¾ x 7 3/16 x 5¼ | 11.3 | MS282 |
| 30-40VDC | 250 MA | 3 5/16 x 4 3/16 x 5½ | 4.8 | MS30P3 |
| 31-32VDC | 4 Amp | 6 15/16 x 9¼ x 6 5/16 | 23.9 | MS324 |
| 31-33VDC | 500 MA | 3 5/16 x 4 3/16 x 5½ | 4.8 | MS32P5 |
| 31-33VDC | 1 Amp | 4 x 4¾ x 5 15/16 | 6.1 | MS321 |
| 40-50VDC | 50 MA | 3¼ x 3¼ x 4 31/32 | 3.9 | MS40P05 |
| 40-50VDC | 250 MA | 3 5/16 x 4 3/16 x 5½ | 4.8 | MS40P3 |
| 44-45VDC | 4 Amp | 6 15/16 x 9¼ x 6 5/16 | 23.9 | MS454 |
| 44-46VDC | 500 MA | 4 x 4¾ x 5 15/16 | 6.1 | MS45P5 |
| 44-46VDC | 1 Amp | 5¾ x 7 3/16 x 5¼ | 11.3 | MS451 |
| 44-46VDC | 2 Amp | 6 x 8 15/16 x 6 5/16 | 23.7 | MS452 |
| 50-60VDC | 50 MA | 3¼ x 3¼ x 4 31/32 | 3.9 | MS50P05 |
| 50-60VDC | 250 MA | 3 5/16 x 4 3/16 x 5½ | 4.8 | MS50P3 |
| 60-70VDC | 100 MA | 3¼ x 3¼ x 4 31/32 | 3.9 | MS60P1 |
| 70-80VDC | 100 MA | 3¼ x 3¼ x 4 31/32 | 3.9 | MS70P1 |
| 80-90VDC | 100 MA | 3¼ x 3¼ x 4 31/32 | 3.9 | MS80P1 |
| 90-100VDC | 100 MA | 3¼ x 3¼ x 4 31/32 | 3.9 | MS90P1 |
| 100-110VDC | 100 MA | 3¼ x 3¼ x 4 31/32 | 3.9 | MS100P1 |
| 150-160VDC | 100 MA | 5 x 5¾ x 6 | 9.5 | MS150P1 |
| 200-210VDC | 100 MA | 5 x 5¾ x 6 | 9.5 | MS200P1 |
| 247.5-260VDC | 100 MA | 5 x 5¾ x 6 | 9.5 | MS250PIR† |
| 250-260VDC | 100 MA | 5 x 5¾ x 6 | 9.5 | MS250P1 |
| 300-310VDC | 100 MA | 5 x 5¾ x 6 | 9.5 | MS300P1 |

### DUAL OUTPUT

| Output Voltage (DC) | Current | Size - W x D x H (Inches) | Model |
|---|---|---|---|
| ±12VDC | 500 MA | 5¾ x 7 3/16 x 5¼ | MS12P5-2 |
| ±12VDC | 1 Amp | 6 x 8 15/16 x 6 5/16 | MS121-2 |
| ±12VDC | 2 Amp | 6 15/16x 9¼ x 6 5/16 | MS122-2 |
| ±15VDC | 500 MA | 5¾ x 7 3/16 x 5¼ | MS15P5-2 |
| ±15VDC | 1 Amp | 6 x 8 15/16 x 6 5/16 | MS151-2 |
| ±15VDC | 2 Amp | 6 15/16 x 9¼ x 6 5/16 | MS152-2 |

**ERA TRANSPAC CORPORATION**
A Subsidiary of Electronic Research Associates, Inc.
311B East Park St., Dept. 1202, Moonachie, N. J. 07074 • (201) 641-3650 • TWX: 710-990-5064

**MTT SERIES**

# TECHNIPOWER "PM95" SERIES EQUIVALENTS FORM • FIT • FUNCTION DC MODULAR POWER SUPPLIES

**MEETS ENVIRONMENTAL REQUIREMENTS FOR "TYPE APPROVAL" OF MIL-E-4158, MIL-E-5400, MIL-E-16400, MIL-E-5272, MIL-T-21200**

DIRECT TECHNIPOWER REPLACEMENTS FOR "PM95" SERIES

ERA Transpac's "MTT" Series of Power Modules are designed to directly replace the Technipower "PM 95" Series . . . Form, Fit, and Function. The "MTT" Series allows OEM manufacturers a competitive alternate source for OEM or replacement.

**nput:** 105-125 VAC, 47-440 Hz

**ripple:** 2 MV RMS or .002%

**utput Control Range:** ±5%, screwdriver adjustment

**ine Regulation:** Less than 0.05% +5 MV for full input change

**oad Regulation:** Less than 0.05% +5 MV for 0-100% load change

**ransient Response:** Less than 50 microseconds for step line or load change

**emote Sensing:** Facilities provided

**perating Temperature:** −55°C to +95°C (Max. base Temperature)

**torage Temperature:** −62°C to +105°C

**emperature Coefficient:** 1MV/°C

**olarity:** Ungrounded or +/− Grounded

**hort Circuit Protection:** Automatic protection with automatic recovery

**vervoltage protection:** Optional

## SINGLE OUTPUT

| OUTPUT VOLTAGE (DC) | CURRENT | SIZE W x D x H INCHES | TECHNIPOWER MODEL | ERA MODEL |
|---|---|---|---|---|
| 5 VDC | 750 MA | 3-1/16 x 3-9/16 x 4-7/8 | PM-5.5-0.750 | MTT5P75 |
| 5 VDC | 1.5 AMP | 3-11/16 x 4-5/16 x 5-9/16 | PM-5.5-1.5 | MTT51P5 |
| 5 VDC | 3 AMP | 4 x 4-11/16 x 6 | PM-5.5-3.0 | MTT53 |
| 5 VDC | 6 AMP | 4-5/16 x 5-1/16 x 6-13/16 | OM-5.5-6.0 | MTT56 |
| 5 VDC | 12 AMP | 6-9/16 x 6-3/4 x 7 | PM-5.5-12.0 | MTT512 |
| 6 VDC | 750 MA | 3-1/16 x 3-9/16 x 4-7/8 | PM-6.0-0.750 | MTT6P75 |
| 6 VDC | 1.5 AMP | 3-11/16 x 4-5/16 x 5-9/16 | PM-6.0-1.5 | MTT61P5 |
| 6 VDC | 3 AMP | 4-5/16 x 5-1/16 x 6-13/16 | PM-6.0-3.0 | MTT63 |
| 6 VDC | 6 AMP | 4-15/16 x 6-9/16 x 7 | PM-6.0-6.0 | MTT66 |
| 6 VDC | 12 AMP | 6-9/16 x 6-3/4 x 7 | PM-6.0-12.0 | MTT612 |
| 12 VDC | 375 MA | 3-1/16 x 3-9/16 x 4-7/8 | PM-12.0-0.375 | MTT12P37 |
| 12 VDC | 750 MA | 3-3/8 x 3-15/16 x 5-1/4 | PM-12.0-0.750 | MTT12P75 |
| 12 VDC | 1.5 AMP | 4 x 4-11/16 x 6 | PM-12.0-1.5 | MTT121P5 |
| 12 VDC | 3 AMP | 4-15/16 x 6-9/16 x 7 | PM-12.0-3.0 | MTT123 |
| 15 VDC | 375 MA | 3-1/16 x 3-9/16 x 4-7/8 | PM-14.5-0.375 | MTT15P37 |
| 15 VDC | 750 MA | 3-3/8 x 3-15/16 x 5-1/4 | PM-14.5-0.750 | MTT15P75 |
| 15 VDC | 1.5 AMP | 4 x 4-11/16 x 6 | PM-14.5-1.5 | MTT151P5 |
| 15 VDC | 3 AMP | 4-15/16 x 6-9/16 x 7 | PM-14.5-3.0 | MTT153 |

## DUAL OUTPUT

| | | | | |
|---|---|---|---|---|
| ± 12 VDC | 1.5 AMP | 4-15/16 x 6-9/16 x 7 | — | MTT121P5-2 |
| ± 12 VDC | 3 AMP | 6-9/16 x 6-3/4 x 7 | — | MTT123-2 |
| ± 15 VDC | 1.5 AMP | 4-15/16 x 6-9/16 x 7 | — | MTT151P5-2 |
| ± 15 VDC | 3 AMP | 6-9/16 x 6-3/4 x 7 | — | MTT153-2 |

**CONTACT FACTORY FOR ANY UNLISTED VOLTAGE OR CURRENT REQUIREMENTS**

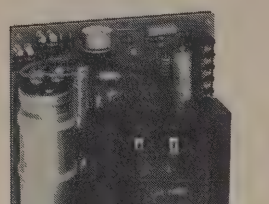

# ERA TRANSPAC CORPORATION

A Subsidiary of Electronic Research Associates, Inc.

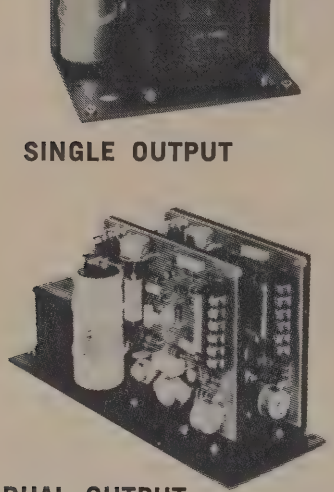
311B East Park St., Dept. 1202, Moonachie, N. J. 07074 • (201) 641-3650 • TWX: 710-990-5064

**OE SERIES**

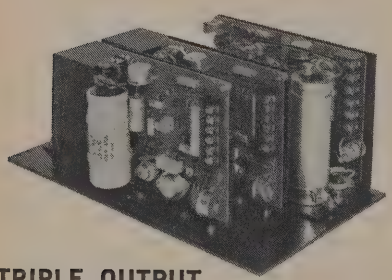
# "OEM" OPEN FRAME DC MODULAR POWER SUPPLIES



SINGLE OUTPUT



DUAL OUTPUT



TRIPLE OUTPUT

## "OE" SERIES POWER SUPPLIES

"OE" series power supplies are highly regulated open frame DC power supplies which come complete with isolating input transformers, OVP protective circuitry and full heat sinking. These low cost units are available in either single or multiple outputs and are ideally suited for OEM, IC, Op-Amp, Computer, and general application The "OE" series are premium engineere and conservatively designed using to quality components including comput grade capacitors. The power modules a fully repairable and of conservative the mal design.

**Input:** 105-125 VAC, 47-63 Hz, 380-420 Hz, single phase
**Output:** Refer to Model Table
**Adjustment Range:** ±0.5 volt or ±5%, whichever is smaller
**Input Regulation:** Within 0.05% +5 MV for ±10% input change
**Load Regulation:** Within 0.05% ±5 MV for 0 to 100% load change
**Ripple:** Less than 1.0 MV RMS
**Temperature Range:** −20°C to +71°C derated as follows:
(Percent of rated load) +40°C/100%, +50°C/75%, +60°C/50%, +71°C/40%
**Response Time:** Less than 50 μsec for 10-100% load change
**Overcurrent Protection:** Built-in, fold-back type
**Overvoltage Protection:** Built-in, full adjustment range
**Maximum Case Temperature:** 120°C measured at power transistor base
**Polarity:** Ungrounded or +/− grounded
**Line Derating:** Input 47-53 Hz, derated by 10%
**Logic Inhibit Circuitry:** Provided
**Remote Sensing:** Terminals are provided to maintain regulation at the load

## OPTIONS

**AC Input:** All models are available for 208 VAC input (Suffix "Y," or 230 VAC input Suffix "X")

**Dual AC Input:** Operation at either 115/230 VAC input can b provided. Use Suffix "Z"

## CUSTOM DESIGNS

The unique "building block" characteristics of ERA TRANSPAC DC power supply assemblies provide a practical solution to economic custom designed power supplies. Standard off-the-shelf assemblies are used to provide a variety of single or multiple voltage and current outputs. These are packaged to meet the customers unique form factor and only the transformer and metal work are custom designed. The result is a proven reliable desig with the high engineering and fabrication costs eliminated an available within a short delivery cycle.

Forward your specification requirements for our comments an fast quotation on a no obligation basis.

**ERA TRANSPAC CORPORATION**
A Subsidiary of Electronic Research Associates, Inc.
311B East Park St., Dept. 1202, Moonachie, N. J. 07074 • (201) 641-3650 • TWX: 710-990-5064

**OE SERIES**

# "OEM" OPEN FRAME DC MODULAR POWER SUPPLIES

## SINGLE OUTPUT

| Output Voltage | Current (40°C) | Model | Output Voltage | Current (40°C) | Model |
|---|---|---|---|---|---|
| 5VDC | 3 Amp | OE53/5 | 15VDC | 10.5 Amp | OE520/15 |
| 5VDC | 6 Amp | OE56/5 | 15VDC | 14.6 Amp | OE535/15 |
| 5VDC | 12 Amp | OE512/5 | 15VDC | 29 Amp | OE565/15 |
| 5VDC | 20 Amp | OE520/5 | 15VDC | 44 Amp | OE5100/15 |
| 5VDC | 35 Amp | OE535/5 | 24VDC | 900 MA | OE53/24 |
| 5VDC | 65 Amp | OE565/5 | 24VDC | 1.8 Amp | OE56/24 |
| 5VDC | 100 Amp | OE5100/5 | 24VDC | 3.8 Amp | OE512/24 |
| 12VDC | 1.5 Amp | OE53/12 | 24VDC | 7.5 Amp | OE520/24 |
| 12VDC | 3.3 Amp | OE56/12 | 24VDC | 10 Amp | OE535/24 |
| 12VDC | 6.5 Amp | OE512/12 | 24VDC | 19 Amp | OE565/24 |
| 12VDC | 12.8 Amp | OE520/12 | 24VDC | 29 Amp | OE5100/24 |
| 12VDC | 18 Amp | OE535/12 | 28VDC | 800 MA | OE53/28 |
| 12VDC | 25 Amp | OE565/12 | 28VDC | 1.5 Amp | OE56/28 |
| 12VDC | 53 Amp | OE5100/12 | 28VDC | 3.3 Amp | OE512/28 |
| 15VDC | 1 Amp | OE53/15 | 28VDC | 6.5 Amp | OE520/28 |
| 15VDC | 2.5 Amp | OE56/15 | 28VDC | 11 Amp | OE535/28 |
| 15VDC | 5.3 Amp | OE512/15 | 28VDC | 16 Amp | OE565/28 |
| | | | 28VDC | 25 Amp | OE5100/28 |

## DUAL OUTPUT

| Output Voltage #1 | Current #1 (40°) | Output Voltage #2 | Current #2(40°C) | Model |
|---|---|---|---|---|
| 12VDC | 1 Amp | 12VDC | 1 Amp | OE56-12T* |
| 15VDC | 1 Amp | 15VDC | 1 Amp | OE56-15T* |
| 12VDC | 1.5 Amp | 12VDC | 1.5 Amp | OE53-12/2 |
| 15VDC | 1.3 Amp | 15VDC | 1.3 Amp | OE53-15/2 |
| 12VDC | 3.2 Amp | 12VDC | 3.2 Amp | OE56-12/2 |
| 15VDC | 2.9 Amp | 15VDC | 2.9 Amp | OE56-15/2 |

* Voltage tracking within 0.1%

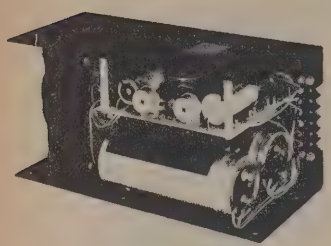
## TRIPLE OUTPUT

| Output Voltage #1 | Current #1 (40°C) | Output Voltage #2 | Current #2 (40°C) | Output Voltage #3 | Current #3 (40°C) | Model |
|---|---|---|---|---|---|---|
| 5VDC | 6 Amp | 12VDC | 1.5 Amp | 12VDC | 1.5 Amp | OE56-12/3 |
| 5VDC | 6 Amp | 15VDC | 1 Amp | 15VDC | 1 Amp | OE56-15/3 |
| 5VDC | 12 Amp | 12VDC | 3.5 Amp | 12VDC | 3.5 Amp | OE512-12/3 |
| 5VDC | 12 Amp | 15VDC | 3 Amp | 15VDC | 3 Amp | OE512-15/3 |

**ERA TRANSPAC CORPORATION**
A Subsidiary of Electronic Research Associates, Inc.
311B East Park St., Dept. 1202, Moonachie, N. J. 07074 • (201) 641-3650 • TWX: 710-990-5064

**S, D, T, SERIES**

# ACDC "OEM", "TR" & "HCM" SERIES EQUIVALENTS
# FORM • FIT • FUNCTION
# OPEN FRAME DC MODULAR POWER SUPPLIES



DIRECT ACDC REPLACEMENT FOR "OEM" SERIES

**Single, Dual and Triple Output**
**Open Frame Construction • 0.05% Regulation**
**Covers Available • Optional Overvoltage Protection**

ERA Transpac's "S, D, T" Series of power modules are designed to directly replace the ACDC "OEM" Series...Form, Fit and Function.The "S, D, T" Series allows OEM manufacturers a competitive alternate source for OEM or replacement.

## "S" SERIES SINGLE OUTPUT

| Output Voltage | Adj. Range ± V | Maximum Current Rating (Amps) 40°C | 55°C | 71°C | Case Size | ACDC Model Number | ERA Model Number (Add –0 for OVP) |
|---|---|---|---|---|---|---|---|
| 5 | .25 | 3 | 2.5 | 1.9 | H | OEM5N3.0 | S5H3 |
| | | 5.7 | 4.8 | 3.7 | A | OEM5N5.7 | S5A5P7 |
| | | 10 | 8.5 | 6.5 | B | OEM5N10 | S5B10 |
| | | 17 | 14.5 | 11.0 | C | OEM5N17 | S5C17 |
| | | 25 | 21.2 | 16.3 | D | OEM5N25 | S5D25 |
| | | 35 | 29.8 | 22.8 | E | OEM5N35 | S5E35 |
| 6 | .25 | 2.7 | 2.3 | 1.7 | H | OEM6N2.7 | S6H2P7 |
| | | 5.2 | 4.4 | 3.4 | A | OEM6N5.2 | S6A5P2 |
| | | 9.5 | 8.1 | 6.2 | B | OEM6N9.5 | S6B9P5 |
| | | 15 | 12.7 | 9.7 | C | OEM6N15 | S6C15 |
| | | 22 | 18.7 | 14.3 | D | OEM6N22 | S6D22 |
| | | 30.7 | 26.1 | 20.0 | E | OEM6N30.7 | S6E30P7 |
| 10 | .5 | 3.5 | 3.0 | 2.3 | A | OEM10N3.5 | S10A3P5 |
| | | 6.5 | 5.5 | 4.2 | B | OEM10N6.5 | S10B6P5 |
| | | 10.2 | 8.6 | 6.6 | C | OEM10N10.2 | S10C10P2 |
| | | 14.9 | 12.7 | 9.7 | D | OEM10N14.9 | S10D14P9 |
| | | 21.0 | 17.9 | 13.6 | E | OEM10N21 | S10E21 |
| 12 | .5 | 1.7 | 1.4 | 1.1 | H | OEM12N1.7 | S12H1P7 |
| | | 3.2 | 2.7 | 2.1 | A | OEM12N3.2 | S12A3P2 |
| | | 5.8 | 4.9 | 3.8 | B | OEM12N5.8 | S12B5P8 |
| | | 9.5 | 8.1 | 6.2 | C | OEM12N9.5 | S12C9P5 |
| | | 13.0 | 11.1 | 8.5 | D | OEM12N13 | S12D13 |
| | | 18.5 | 15.7 | 12.0 | E | OEM12N18.5 | S12E18P5 |
| 15 | .5 | 1.5 | 1.3 | 1.0 | H | OEM15N1.5 | S15H1P5 |
| | | 2.7 | 2.3 | 1.7 | A | OEM15N2.7 | S15A2P7 |
| | | 5.0 | 4.2 | 3.2 | B | OEM15N5 | S15B5 |
| | | 8.2 | 7.0 | 5.3 | C | OEM15N8.2 | S15C8P2 |
| | | 11.2 | 9.5 | 7.3 | D | OEM15N11.2 | S15D11P2 |
| | | 15.8 | 13.4 | 10.3 | E | OEM15N15.8 | S15E15P8 |
| 16 | .5 | 2.6 | 2.2 | 1.7 | A | OEM16N2.6 | S16A2P6 |
| | | 4.7 | 4.0 | 3.0 | B | OEM16N4.7 | S16B4P7 |
| | | 7.7 | 6.5 | 5.0 | C | OEM16N7.7 | S16C7P7 |
| | | 10.8 | 9.2 | 7.0 | D | OEM16N10.8 | S16D10P8 |
| | | 15.0 | 12.8 | 9.8 | E | OEM16N15 | S16E15 |
| 20 | 1 | 2.1 | 1.8 | 1.4 | A | OEM20N2.1 | S20A2P1 |
| | | 3.8 | 3.2 | 2.5 | B | OEM20N3.8 | S20B3P8 |
| | | 6.2 | 5.3 | 4.0 | C | OEM20N6.2 | S20C6P2 |
| | | 8.7 | 7.4 | 5.7 | D | OEM20N8.7 | S20D8P7 |
| | | 12.2 | 10.4 | 7.9 | E | OEM20N12.2 | S20E12P2 |
| 24 | 1 | 1.0 | .85 | .65 | H | OEM24N1.0 | S24H1 |
| | | 1.8 | 1.5 | 1.2 | A | OEM24N1.8 | S24A1P8 |
| | | 3.3 | 2.8 | 2.1 | B | OEM24N3.3 | S24B3P3 |
| | | 5.4 | 4.6 | 3.5 | C | OEM24N5.4 | S24C5P4 |
| | | 7.5 | 6.4 | 4.9 | D | OEM24N7.5 | S24D7P5 |
| | | 10.6 | 9.0 | 6.9 | E | OEM24N10.6 | S24E10P6 |
| 26 | 1 | 1.7 | 1.4 | 1.1 | A | OEM26N1.7 | S26A1P7 |
| | | 3.1 | 2.6 | 2.0 | B | OEM26N3.1 | S26B3P1 |
| | | 5.0 | 4.2 | 3.2 | C | OEM26N5.0 | S26C5 |
| | | 7.1 | 6.1 | 4.6 | D | OEM26N7.1 | S26D7P1 |
| | | 10.0 | 8.5 | 6.5 | E | OEM26N10.0 | S26E10 |
| 28 | 1 | 1.6 | 1.4 | 1.0 | A | OEM28N1.6 | S28A1P6 |
| | | 2.9 | 2.5 | 1.9 | B | OEM28N2.9 | S28B2P9 |
| | | 4.7 | 4.0 | 3.1 | C | OEM28N4.7 | S28C4P7 |
| | | 6.7 | 5.7 | 4.4 | D | OEM28N6.7 | S28D6P7 |
| | | 9.3 | 7.9 | 6.1 | E | OEM28N9.3 | S28E9P3 |

*See OE Series on page 0000 for "ACDC" "HCM" equivalents.

## "D" SERIES DUAL OUTPUT

| Output Voltage | Adj. Range ± V | Maximum Current Rating (Amps) 40°C | 55°C | 71°C | Case Size | ACDC Model Number | ERA Model Number (Add –0 for OVP) |
|---|---|---|---|---|---|---|---|
| ± 12 | .5 | 1.5 | 1.3 | 1.0 | A | OEM12D1.5 | D12A1P5 |
| | | 2.7 | 2.3 | 1.8 | B | OEM12D2.7 | D12B2P7 |
| ± 15 | .5 | 1.3 | 1.1 | 0.8 | A | OEM15D1.3 | D15A1P3 |
| | | 2.4 | 2.0 | 1.6 | B | OEM15D2.4 | D15B2P4 |

## "T" SERIES TRIPLE OUTPUT

| Output Voltage | Adj. Range ± V | Maximum Current Rating (Amps) 40°C | 55°C | 71°C | Case Size | ACDC Model Number | ERA Model Number (Add –0 for OVP) |
|---|---|---|---|---|---|---|---|
| 5 | 0.25 | 3.0 | 2.6 | 2.0 | A | TR101 | T101 |
| ± 12 | .5 | .75 | .64 | .49 | | | |
| 5 | 0.25 | 3.0 | 2.6 | 2.0 | A | TR102 | T102 |
| ± 15 | .5 | .64 | .54 | .42 | | | |
| 5 | 0.25 | 5.0 | 4.2 | 3.2 | B | TR201 | T201 |
| ± 12 | 0.5 | 1.0 | 0.85 | .65 | | | |
| 5 | 0.25 | 5.0 | 4.2 | 3.2 | B | TR202 | T202 |
| ± 15 | 0.5 | 0.85 | 0.72 | 0.55 | | | |
| 5 | 0.25 | 10.0 | 8.4 | 6.4 | C | TR301 | T301 |
| ± 12 | 0.5 | 1.0 | 0.85 | .65 | | | |
| 5 | 0.25 | 10.0 | 8.4 | 6.4 | C | TR302 | T302 |
| ± 15 | 0.5 | 0.85 | 0.72 | .55 | | | |

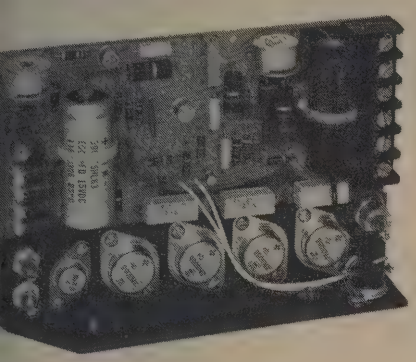
## DIMENSIONS AND WEIGHTS

| | Case Size | Height in. / mm | Width in. / mm | Depth in. / mm | Weight lbs. / Kg |
|---|---|---|---|---|---|
| S, D, & T | A | 3.19 / 81.0 | 6.25 / 158.8 | 4.94 / 125.5 | 4.5 / 2.0 |
| | B | 3.19 / 81.0 | 10.0 / 254.0 | 4.94 / 125.5 | 7.5 / 3.4 |
| | C | 4.94 / 125.4 | 10.0 / 254.0 | 4.94 / 125.5 | 12.0 / 5.4 |
| | D | 4.94 / 125.4 | 12.0 / 304.8 | 6.62 / 168.1 | 20.0 / 9.1 |
| | E | 4.94 / 125.4 | 16.0 / 406.4 | 7.25 / 184.2 | 29.0 / 13.2 |
| | H | 2.75 / 69.9 | 4.0 / 101.6 | 4.87 / 123.7 | 2.25 / 1.0 |

**ERA TRANSPAC CORPORATION**
A Subsidiary of Electronic Research Associates, Inc.
311B East Park St., Dept. 1202, Moonachie, N. J. 07074 • (201) 641-3650 • TWX: 710-990-5064

"R" SERIES

# "BUILD OR BUY" DC REGULATOR POWER SUPPLY ASSEMBLIES



The "R" series units are complete regulator assemblies which provide highly regulated DC output when used in conjunction with an external AC input source. The three and six ampere models (R53 and R56 types) require only an input transformer for operation. The higher current types (R512 and R520) require in addition, an input filter capacitance. Refer to "Application Notes" for recommended AC input, heat sinking, and other data.

**COMPLETE WITH:**

- ☐ Power Rectifiers
- ☐ Input Filter*
- ☐ IC Regulator
- ☐ Power Transistors
- ☐ Regulator Components
- ☐ Logic Inhibit

*Provided on R53 and R56 Models

- ☐ Adjust Controls
- ☐ Input/Output Terminations
- ☐ Mounting Facilities
- ☐ Over-Voltage Protector
- ☐ Over-Current Protector
- ☐ Thermal Protection†

†Provided on R512 and R520 Models

**nput:** AC center tapped, ±10% nominal, 47-63 Hz, 380-420 Hz. Refer to "Application Notes" for specific values.

**utput Voltage:** Nominal 4.7-30 VDC depending on model types. Refer to Model Chart.

**utput Current:** 1.2-20 amperes depending on model type and heat sinking. Refer to Model Chart and "Application Notes."

**nput Regulation:** Within 0.05% +5 MV for ±10% input change.

**oad Regulation:** Within 0.05% +5 MV for 0 to 100% load change.

**ipple:** Less than 1.0 MV RMS.

**emote Sensing:** Provided.

**Temperature Range:** −20°C to +71°C derated as follows: (Percent of rated load) +40°C/100%, +50°C/75%, +60°C/50%, +71°C/40%.

**Temperature Coefficient:** 0.01% +1 MV/per°C.

**Response Time:** Less than 50 μsec for 10-100% load change.

**Overcurrent Protection:** Built-in, fold-back type.

**Overvoltage Protection:** Built-in, full adjustment range.

**Maximum Case Temperature:** 120°C measured at power transistor base.

**Polarity:** Ungrounded or +/− grounded.

**Weight:** See listing under Case Size.

**Line Derating:** Input 47-53 Hz, derate by 10%.

**Logic Inhibit Circuitry:** Provided.

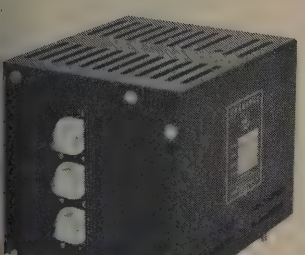
**SINGLE OUTPUT**

| Output Voltage | Current (40°C) | Model | Output Voltage | Current (40°C) | Model | Output Voltage | Current (40°C) | Model |
|---|---|---|---|---|---|---|---|---|
| 5VDC | 3 Amp | R53/5 | 12VDC | 2 Amp | R53/12 | 24VDC | 1.3 Amp | R53/24 |
| 5VDC | 6 Amp | R56/5 | 12VDC | 4 Amp | R56/12 | 24VDC | 2.6 Amp | R56/24 |
| 5VDC | 12 Amp | R512/5 | 12VDC | 8 Amp | R512/12 | 24VDC | 6 Amp | R512/24 |
| 5VDC | 20 Amp | R520/5 | 12VDC | 16 Amp | R520/12 | 24VDC | 12 Amp | R520/24 |
| 6VDC | 2.75 Amp | R53/6 | 15VDC | 1.8 Amp | R53/15 | 28VDC | 1.2 Amp | R53/28 |
| 6VDC | 5.5 Amp | R56/6 | 15VDC | 3.5 Amp | R56/15 | 28VDC | 2.4 Amp | R56/28 |
| 6VDC | 7.5 Amp | R512/6 | 15VDC | 6.5 Amp | R512/15 | 28VDC | 5 Amp | R512/28 |
| 6VDC | 5.5 Amp | R520/6 | 15VDC | 13 Amp | R520/15 | 28VDC | 10 Amp | R520/28 |

**DUAL VOLTAGE TRACKING MODELS**

| Output Voltage | Current #1 (40°C) | Output Voltage | Current #2 (40°C) | Model |
|---|---|---|---|---|
| ±12VDC | 1 Amp | ±12VDC | 1 Amp | R56-12T |
| ±15VDC | 1 Amp | ±15VDC | 1 Amp | R56-15T |

# Solid-State Sinusoidal AC Regulators



Transpac RT modular AC regulators are all solid-state designs for incorporation into equipment or for external and bench use. Utilizes a unique design approach incorporating a modulated AC bridge which is referenced to variations in the output level. This special circuitry permits fast-acting RMS regulation independent of input frequency, and provides sinusoidal output. RT units are highly efficient, require minimum no-load current and operate over a wide range of load power factors.

- Provide highly RMS-regulated sinusoidal output
- Operate over a wide range of AC inputs and frequencies
- Run cool and quiet with no distorted magnetic field interference
- Operate over a wide range of leading or lagging power factors
- Provide a modular AC Regulator for end-equipment or bench use

| Power Rating | Size (Inches) | Weight | Model |
|---|---|---|---|
| 250 VA | 6 5/16 x 7 1/4 x 4 7/8 | 13 lbs. | RT250 |
| 500 VA | 6 7/8 x 8 7/8 x 7 1/2 | 28 lbs. | RT500 |
| 1000 VA | 7 13/16 x 9 15/16 x 7 5/8 | 43 lbs. | RT1000 |


## ERA TRANSPAC CORPORATION

A Subsidiary of Electronic Research Associates, Inc.

311B East Park St., Dept. 1202, Moonachie, N. J. 07074 • (201) 641-3650 • TWX: 710-990-5064

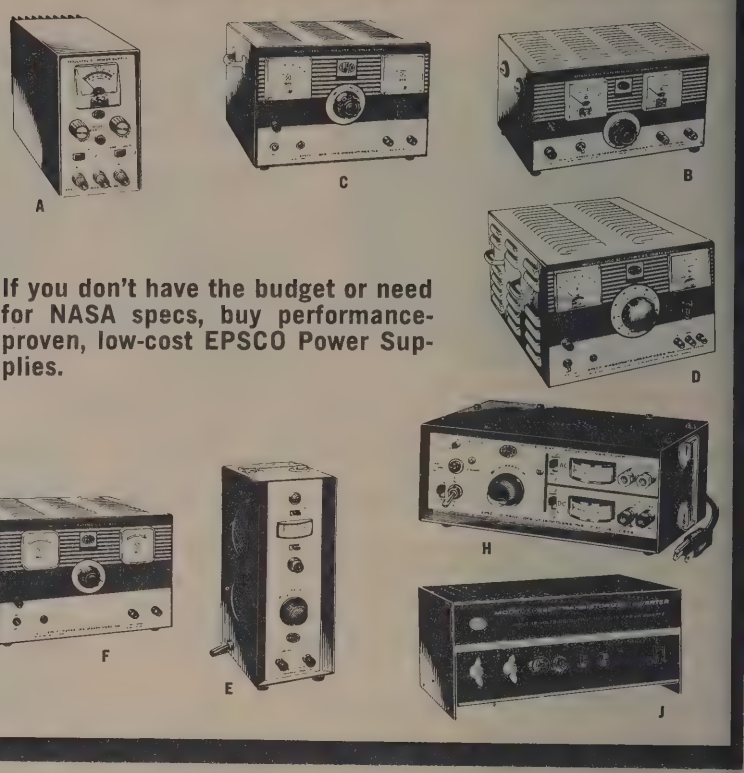
# EPSCO REGULATED & SEMI-REGULATED POWER SUPPLIES

Ruggedly-constructed, low voltage dc power supplies for use in design, development, testing of transistor circuitry . . . for servicing and operating auto, aircraft, marinecraft radio, electronic equipment . . . for production line testing, industrial and educational laboratory work and many other applications.

Precision made and engineered to give unequalled performance life per dollar. Features include: Voltage regulation, ac ripple filtering, adjustable output voltage, large easy-to-read meters, isolated output terminals, 1-year warranty.

INPUT — *Regulated Models:* 105-125 vac. 60 Hz *Industrial* and *General Purpose Models:* 117 vac 50/60 Hz. Models available to fit W.E. and EIA racks. Custom-design or modification of standard units to your specs.

INVERTER — Transistorized. Converts 12 vdc to 117 vac, 60 Hz to operate equipment from car, truck or boat battery, or other 12 vdc source for camping, traveling, boating. Reverse polarity and short circuit protection.




**If you don't have the budget or need for NASA specs, buy performance-proven, low-cost EPSCO Power Supplies.**

## REGULATED

| Model | Figure | Output Volts | Output Current | Line Reg.** | Load Reg.* | Max. Ripple, RMS | Meters†† | DC Imp. Ohms* | Size (H x W x D) | Wt. Lbs. | Net Price |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PSR-12-25 | A | 0-25 | 0-500mA | 0.01% +2mV | 0.01% | 100μV | 0-30V/600mA | .006 | 5¼ x 3⅛ x 10 | 6 | 169.74 |
| PSR-12-50 | A | 0-50 | 0-250mA | 0.01% +2mV | 0.01% | 100μV | 0-60V/300mA | .02 | 5¼ x 3⅛ x 10 | 6 | 169.74 |

## INDUSTRIAL

| Model | Figure | Output Voltage | Output Amps. | Load Regulation* (V/A)† | Max. Ripple % | Meters†† | DC Impedance Ohms* | Size (H x W x D) | Wt. Lbs. | Net Price |
|---|---|---|---|---|---|---|---|---|---|---|
| EF | B | 4-28<br>2-14 | 0-5<br>0-5 | 0.9 (1-5A)<br>0.6 (1-5A) | 1.0<br>1.0 | 0-50V, 0-6A | 0.9 (1-5A)<br>0.6 (1-5A) | 7 x 12 x 8½ | 21 | 193.84 |
| EFB | B | 0-32<br>0-16 | 0-4<br>0-8 | 1.25<br>1.0 | 0.1<br>0.1 | 0-40/20V, 0-10A | 1.25<br>1.0 | 7 x 12 x 8½ | 26 | 252.25 |
| EFBR‡ | | 0-32<br>0-16 | 0-4<br>0-8 | 1.25<br>1.0 | 0.1<br>0.1 | 0-40/20V, 0-10A | 1.25<br>1.0 | 8¾ x 19 x 8½ | 34 | 288.00 |
| GFL | C | 0-125 | 0-5 | 1.5 | 0.5 | 0-150V, 0-5A | 1.5 | 9¾ x 14¼ x 14¼ | 88 | 486.49 |
| GFLR‡ | | 0-125 | 0-5 | 1.5 | 0.5 | 0-150V, 0-5A | 1.5 | 10½ x 19 x 14¼ | 100 | 529.39 |
| NFB | C | 0-32 | 0-15 | 0.4 | 0.75 | 0-50V, 0-25A | 0.4 | 9¾ x 14¼ x 14¼ | 84 | 494.64 |
| NFBR‡ | | 0-32 | 0-15 | 0.4 | 0.75 | 0-50V, 0-25A | 0.4 | 10½ x 19 x 14¼ | 97 | 537.54 |
| PS-5 | C | 0-55 | 0-10 | 0.8 | 0.5 | 0-75V, 0-15A | 0.7 | 9¾ x 14¼ x 14¼ | 70 | 445.59 |
| PS-5R‡ | | 0-55 | 0-10 | 0.8 | 0.5 | 0-75V, 0-15A | 0.7 | 10½ x 19 x 14¼ | 89 | 488.49 |
| PS-1000-32 | D | 0-32 | 0-30 | 0.2 | 0.75 | 0-50V, 0-30A | 0.2 | 9¾ x 14¼ x 19¼ | 113 | 699.14 |
| PS-1000-55 | D | 0-55 | 0-20 | 0.5 | 0.5 | 0-75V, 0-30A | 0.5 | 9¾ x 14¼ x 19¼ | 113 | 699.14 |
| PS-1000-125 | D | 0-125 | 0-8 | 1.0 | Less than 1% | 0-150V, 0-10A | 1.0 | 9¾ x 14¼ x 19¼ | 113 | 699.14 |

## GENERAL PURPOSE

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| D-612T | B | 0-16<br>0-8 | 0-10<br>0-10 | 0.44 (3-10A)<br>0.3 (3-10A) | 0.5 @ 5A<br>2 @ 10A | 0-20V, 0-10A | 0.44 (3-10A)<br>0.3 (3-10A) | 7 x 12 x 8½ | 20 | 136.92 |
| H | B | 12 (adj.)<br>6 (adj.) | 0-10<br>0-20 | 0.23 (3-10A)<br>0.15 (3-20A) | 5<br>5 | 0-20V, 0-30A | 0.23 (3-10A)<br>0.15 (3-20A) | 7 x 12 x 8½ | 30 | 169.88 |
| EC-1 | E | 12 (adj.) | 0-5 | 1.4 | 0.5 | None | 1.4 | 10¾ x 4⅜ x 6½ | 12 | 68.14 |
| EC-2 | E | 0-16 | 0-5 | 1.8 | 0.5 | 0-20V, 10A | 1.8 | 10¾ x 4⅜ x 6½ | 11 | 101.17 |
| PS-30 | F | 12 (adj.) | 0-30 | 0.12 (6-30A) | 1 | 0-20V, 0-50A | 0.27 | 9¾ x 14¼ x 14¼ | 68 | 338.05 |
| PS-50 | F | 12 (adj.) | 0-50 | 0.17 | 0.5 | 0-20V, 0-50A | 0.17 | 9¾ x 14¼ x 19¼ | 106 | 666.81 |
| 3301 | H | 0-16 DC<br>0-20 AC | 0-3<br>0-3 | 1.8 (1-3A) | .5 | 0-20V, 0-5A DC<br>0-20V, 0-5A AC | 1.8 DC<br>0.5 AC | 4¾ x 10¾ x 6½ | 12 | 128.27 |

## INVERTER

| | | | | | |
|---|---|---|---|---|---|
| TI250B | J | **Input:** 12 vdc. **Output:** 117 vac, 60 Hz, 250 VA max. **Voltage Regulation:** 15% max. no load to full load constant battery voltage. **Frequency Regulation:** 4 Hz max. no load to full load. | 4½ x 10 x 7½ | 13 | 122.62 |

‡Rack mounted version.
*No-load to full-load unless otherwise specified.
†Output voltage change for each ampere of output current change, except on regulated units, % applies for either line or load.
††All 2% accuracy except 5% for general purpose units. Rectifiers: Selenium and Silicon ("avalanche" characteristics on Industrial unit
**From 105-125 VAC.

**EPSCO, INC.** 920-M WESTWOOD AVENUE, ADDISON, ILLINOIS 60101 • (312) 543-0410

*Prices Subject to Change Without Notice*

**FERROTRAN**
ELECTRONICS CO., INC.

# SOLID STATE POWER SUPPLY MODULES

ALL SILICON, LONG-LIFE SEMICONDUCTOR, REGULATED POWERTRAN POWER SUPPLY MODULES.
GUARANTEED 3 YEARS.

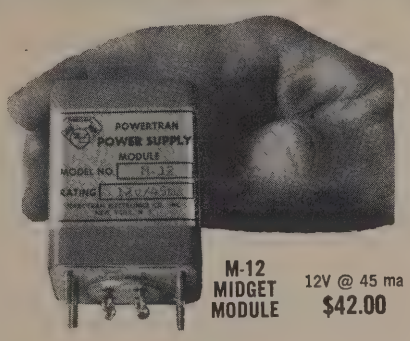
## OUR 20TH YEAR

## FIXED VOLTAGE MODULES

### INPUT VOLTAGE—115 Volts A.C.

Single output voltage; all-steel MIL-T-27 cases; 4 pin connector; screw type studs for fastening to the chassis; grey paint.

| Model | D.C. Volts | D.C. Cur. | % Reg. | % Rip. | Case | Price |
|---|---|---|---|---|---|---|
| M-2.5 | 2.5 | 50ma | 1.0 | .10 | EB | $46 |
| SML-5 | 5 | 80 | .5 | .10 | A | 50 |
| ML-5 | 5 | 150 | .5 | .2 | EB | 50 |
| -5 | 5 | 250 | .3 | .01 | FB | 58 |
| H-5 | 5 | 500 | .5 | .1 | GB | 62 |
| HC-5 | 5 | 1a | .5 | .2 | HA | 68 |
| LC-5 | 5 | 2a | .5 | .2 | JB | 74 |
| SML-6 | 6 | 75 | .5 | .10 | A | 50 |
| ML-6 | 6 | 125 | .5 | .1 | EB | 50 |
| -6 | 6 | 200 | .3 | .01 | FB | 58 |
| H-6 | 6 | 450 | .3 | .1 | GB | 62 |
| HC-6 | 6 | 900 | .5 | .2 | HA | 68 |
| LC-6 | 6 | 1.8a | .5 | .2 | JB | 74 |
| SML-10 | 10 | 70 | .5 | .20 | A | 50 |
| ML-10 | 10 | 100 | .5 | .1 | EB | 50 |
| -10 | 10 | 175 | .2 | .10 | FB | 58 |
| H-10 | 10 | 350 | .2 | .3 | GB | 62 |
| HC-10 | 10 | 600 | .5 | .2 | HA | 68 |
| LC-10 | 10 | 1.2a | .5 | .2 | JB | 74 |
| SML-12 | 12 | 65 | .5 | .20 | A | 50 |
| ML-12 | 12 | 100 | .5 | .2 | EB | 50 |
| -12 | 12 | 150 | .2 | .20 | FB | 58 |
| H-12 | 12 | 325 | .2 | .1 | GB | 62 |
| HC-12 | 12 | 550 | .5 | .2 | HA | 68 |
| LC-12 | 12 | 1.1a | .5 | .2 | JB | 74 |
| SML-15 | 15 | 60 | .8 | .20 | A | 50 |
| -15 | 15 | 150 | .2 | .05 | FB | 58 |
| H-15 | 15 | 300 | .2 | .1 | GB | 62 |
| HC-15 | 15 | 500 | .5 | .2 | HA | 68 |
| LC-15 | 15 | 1.0a | .5 | .2 | JB | 74 |
| SMF-20 | 20 | 30 | 1.2 | .25 | A | 46 |
| -20 | 20 | 120 | .2 | .10 | FB | 58 |
| H-20 | 20 | 250 | .2 | .1 | GB | 62 |
| HC-20 | 20 | 450 | .5 | .2 | HA | 68 |
| LC-20 | 20 | 900 | .5 | .2 | JB | 74 |
| SML-24 | 24 | 50 | .8 | .30 | A | 50 |
| -24 | 24 | 120 | .2 | .10 | FB | 58 |
| H-24 | 24 | 225 | .2 | .1 | GB | 62 |
| HC-24 | 24 | 400 | .2 | .1 | HA | 68 |
| LC-24 | 24 | 800 | .5 | .2 | JB | 74 |
| SMF-28 | 28 | 25 | 1.2 | .3 | A | 46 |
| -28 | 28 | 120 | .2 | .1 | FB | 60 |
| H-28 | 28 | 200 | .2 | .1 | GB | 64 |
| HC-28 | 28 | 300 | .2 | .1 | HA | 70 |
| LC-28 | 28 | 600 | .5 | .1 | JB | 76 |
| SMF-30 | 30 | 20 | 1.5 | .3 | A | 46 |
| -30 | 30 | 100 | .3 | .01 | GB | 60 |
| H-30 | 30 | 200 | .2 | .1 | GB | 64 |
| HC-30 | 30 | 275 | .2 | .1 | HA | 70 |
| LC-30 | 30 | 500 | .5 | .1 | JB | 76 |




**M-12 MIDGET MODULE** 12V @ 45 ma **$42.00**

| Model | D.C. Volts | D.C. Cur. | % Reg. | % Rip. | Case | Price |
|---|---|---|---|---|---|---|
| SMF-40 | 40 | 15ma | 1.5 | .2 | A | $48 |
| M-40 | 40 | 40 | 1.5 | .22 | EB | 48 |
| M-45 | 45 | 35 | 1.5 | .2 | EB | 48 |
| MC-45 | 45 | 100 | 1.5 | .1 | HB | 55 |
| SMF-50 | 50 | 15 | 1.5 | .2 | A | 50 |
| M-50 | 50 | 40 | 1.5 | .2 | EB | 51 |
| SMF-60 | 60 | 10 | 1.5 | .1 | A | 50 |
| HV-60 | 60 | 60 | 1.5 | .15 | GA | 62 |
| SMF-70 | 70 | 10 | 1.2 | .1 | A | 50 |
| HV-75 | 75 | 60 | 1.3 | .1 | GA | 62 |
| HM-100 | 100 | 6 | 1 | .05 | GB | 58 |
| HV-100 | 100 | 60 | 1.5 | .1 | GA | 68 |
| HV-120 | 120 | 55 | 1.3 | .12 | HA | 72 |
| HM-150 | 150 | 5 | 1 | .05 | GB | 58 |
| HV-150 | 150 | 40 | 1 | .1 | HA | 72 |
| HV-175 | 175 | 40 | 1.2 | .12 | HA | 72 |
| HM-200 | 200 | 5 | .5 | .05 | GB | 62 |
| HV-200 | 200 | 40 | 1.3 | .12 | HA | 72 |
| HM-250 | 250 | 4 | 1 | .05 | HB | 64 |
| HV-250 | 250 | 40 | 1.5 | .05 | JB | 76 |
| HM-300 | 300 | 3 | 1 | .05 | HB | 66 |
| HV-300 | 300 | 35 | 1.5 | .1 | JB | 78 |
| HM-400 | 400 | 2 | 1 | .05 | HB | 70 |
| HV-400 | 400 | 20 | 1.5 | .2 | JA | 83 |
| HM-500 | 500 | 1.8 | 1 | .05 | JB | 70 |
| HV-500 | 500 | 15 | 1.5 | .2 | JB | 82 |
| HVE-500 | 500 | 20 | 1.5 | .2 | JA | 88 |
| HM-750 | 750 | 1.2 | 1 | .1 | JB | 74 |
| HV-750 | 750 | 8.5 | 1.2 | .3 | JB | 99 |
| HVE-750 | 750 | 12 | 1.3 | .3 | JA | 109 |
| HM-1000 | 1000 | 1 | 1 | .1 | JB | 78 |
| HV-1000 | 1000 | 5 | 1.3 | .3 | LB | 105 |
| HVE-1000 | 1000 | 8 | 1.3 | .3 | LB | 115 |

Most units shown are available with 220 volts A.C. input and with P.C. pins.

### CASE DIMENSIONS

| | L | W | H | | L | W | H |
|---|---|---|---|---|---|---|---|
| EB | 1 13/16 | 1 13/16 | 2 1/16 | HB | 3 1/16 | 2 5/8 | 3 3/16 |
| FB | 2 5/16 | 2 1/16 | 2 1/2 | JA | 3 7/16 | 3 1/16 | 4 7/8 |
| GA | 2 3/4 | 2 3/8 | 3 13/16 | JB | 3 7/16 | 3 1/16 | 3 7/8 |
| GB | 2 3/4 | 2 3/8 | 2 13/16 | LB | 4 5/16 | 3 11/16 | 4 1/2 |
| HA | 3 1/16 | 2 5/8 | 4 1/4 | A | 3 | 1 3/16 | 1 1/4 |

We can package a power supply in a high or low silhouette, with blind inserts or studs, with solder pin connectors or porcelain terminals.
We offer this service at no extra charge.

**WRITE FOR COMPLETE CATALOG OF POWER SUPPPLIES AND RECTIFIER TRANSFORMERS. NO CHARGE.**

## UNREGULATED MODULES

### INPUT VOLTAGE — 115 Volts A.C.

| Model | D.C. Volts | D.C. Current | Case | Price |
|---|---|---|---|---|
| SU-300 | 300 | .06a | HA | $48 |
| SU-400 | 400 | .06 | HA | 50 |
| SU-500 | 500 | .05 | LB | 60 |
| SU-750 | 750 | .03 | LB | 70 |
| SU-1000 | 1000 | .02 | LB | 72 |
| NI-4 | 200 | 12ma | EB | 42 |
| NI-6 | 175 | 35 | FB | 42 |
| NI-7 | 180 | 30 | FB | 42 |
| NI-8 | 200 | 25 | FB | 42 |

## ADJ. OUTPUT MODULES

### INPUT VOLTAGE — 115 Volts A.C.

Output voltage adjustable thru screwdriver control on stud side of case.

| Model | D.C. Volts | D.C. Cur. | % Reg. | % Rip. | Case | Price |
|---|---|---|---|---|---|---|
| MV-5 | 4.5-5.5 | 200ma | .7 | .1 | GB | $62 |
| MCS-5 | 4.5-5.5 | 450 | .8 | .1 | HB | 68 |
| HCV-5 | 4.5-5.5 | 1a | .4 | .2 | JB | 84 |
| MV-6 | 5.8-7 | 200 | .6 | .2 | GB | 62 |
| MCS-6 | 5.8-7 | 450 | .8 | .3 | HB | 68 |
| HCV-6 | 5.5-6.8 | 1a | .4 | .2 | JB | 84 |
| MV-10 | 9-12 | 200 | .4 | .03 | GB | 62 |
| MCS-10 | 9-11 | 450 | .5 | .1 | HB | 68 |
| HCV-10 | 8.5-11.8 | 1a | .4 | .1 | JB | 84 |
| MV-12 | 11-13 | 200 | .2 | .025 | GB | 62 |
| MCS-12 | 11-13 | 400 | .5 | .05 | HB | 68 |
| HCV-12 | 11-14.5 | 1a | .4 | .05 | JB | 84 |
| MV-15 | 14-16 | 200 | .5 | .03 | GB | 62 |
| MCS-15 | 14-16 | 350 | .5 | .05 | HB | 68 |
| HCV-15 | 14-18 | 800 | .4 | .1 | JB | 84 |
| MV-20 | 19-22 | 180 | .5 | .03 | HB | 62 |
| MCS-20 | 19-22 | 350 | .5 | .05 | HB | 70 |
| HCV-20 | 18-22 | 700 | .4 | .3 | JB | 85 |
| MV-24 | 23-26 | 180 | .5 | .04 | GB | 62 |
| MCS-24 | 23-26 | 350 | .5 | .05 | HB | 70 |
| HCV-24 | 23-26 | 700 | .4 | .3 | JB | 85 |
| MV-28 | 27-29 | 150 | .5 | .04 | GB | 62 |
| MCS-28 | 27-29 | 300 | .4 | .04 | HB | 72 |
| HCV-28 | 26.5-29 | 600 | .25 | .3 | JB | 85 |
| MV-30 | 28-32 | 150 | .5 | .04 | GB | 64 |
| MCS-30 | 28-32 | 300 | .4 | .04 | HB | 70 |
| HCV-30 | 29-31 | 500 | .3 | .3 | JB | 88 |
| HCV-100 | 97-103 | 60 | 1.2 | .1 | GA | 85 |
| HCV-200 | 197-203 | 50 | 1.3 | .1 | HA | 96 |
| HCV-250 | 247-253 | 40 | 1.4 | .05 | JB | 110 |

## DUAL OUTPUT MODULES

### INPUT VOLTAGE — 115 Volts A.C.

These modules furnish two matched output voltages from independent units. Current shown is available from each tap.

| Model | D.C. Volts | D.C. Cur. | % Reg. | % Rip. | Case | Price |
|---|---|---|---|---|---|---|
| EE-5 | 5, 5 | 150ma | .5 | .10 | FB | $66 |
| EEH-5 | 5, 5 | 300 | .3 | .01 | GB | 71 |
| EEHC-5 | 5, 5 | 1a | .2 | .05 | JB | 90 |
| EE-6 | 6, 6 | 150 | .4 | .10 | FB | 66 |
| EEH-6 | 6, 6 | 300 | .3 | .01 | GB | 71 |
| EEHC-6 | 6, 6 | 750 | .2 | .05 | JB | 90 |
| EEH-10 | 10, 10 | 250 | .3 | .01 | GB | 71 |
| EE-12 | 12, 12 | 120 | .3 | .05 | FB | 66 |
| EEH-12 | 12, 12 | 225 | .3 | .01 | GB | 71 |
| EEHC-12 | 12, 12 | 400 | .2 | .05 | JB | 90 |
| MM-15 | 15, 15 | 55 | 1 | .006 | GB | 59 |
| EE-15 | 15, 15 | 100 | .3 | .04 | FB | 66 |
| EEH-15 | 15, 15 | 200 | .3 | .01 | GB | 71 |
| EEHC-15 | 15, 15 | 350 | .2 | .05 | JB | 90 |
| EEH-20 | 20, 20 | 150 | .3 | .01 | HB | 71 |
| EE-24 | 24, 24 | 100 | .3 | .05 | FB | 66 |
| EEH-24 | 24, 24 | 150 | .3 | .01 | GB | 71 |
| EE-28 | 28, 28 | 80 | 1 | .01 | GB | 66 |
| MM-30 | 30, 30 | 45 | 1 | .01 | HB | 59 |
| HMC-30 | 30, 30 | 100 | 1.5 | .15 | JB | 60 |
| HMC-45 | 45, 45 | 80 | 1.5 | .15 | JB | 71 |
| HHV-50 | 50, 50 | 40 | 1 | .2 | JB | 66 |
| HHV-60 | 60, 60 | 40 | 1 | .2 | JB | 71 |
| HHV-70 | 70, 70 | 40 | 1 | .2 | JB | 72 |
| HHV-100 | 100, 100 | 30 | 1 | .08 | JB | 76 |
| HHV-120 | 120, 120 | 25 | 1 | .05 | JB | 76 |
| HHV-150 | 150, 150 | 20 | 1 | .05 | JB | 79 |

**FERROTRAN ELECTRONICS COMPANY, INC.**
11 W. 25TH STREET ■ NEW YORK, N.Y. 10010 ■ PHONE 212 - 691-3610

# NOBRUSH® FREQUENCY GEORATOR™ CORPORATION

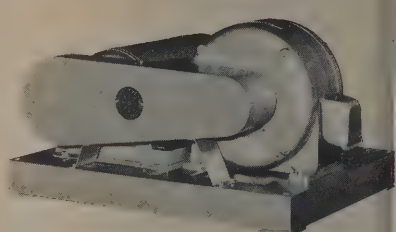
*Celebrating our 28th anniversary*

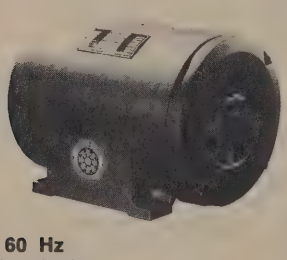
## PERMANENT MAGNET GENERATOR DESIGN

"NoBrush" Motor Generators and Frequency Converters are efficient, compact, dependable, quiet running units for powering all types of electronic systems and electrical equipment. The heart of each "NoBrush" power system is a "NoBrush" permanent magnet generator which features a cast aluminum rotor designed to give superior voltage stability. • A typical "NoBrush" generator is mounted with a high quality induction or synduction motor within a single aluminum alloy shell. • Oversize pre-lubricated ball bearings sealed for life, coupled with the absence of brushes, commutators or slip rings, insure long-term maintenance-free operation. • Georator brushless permanent magnet generators are noted for their compact construction, ruggedness, ability to withstand short circuits, and excellent wave form. • All Georator power systems whether utilized for frequency conversion or basic power requirements, provide true "line isolation and stabilization" for protecting sensitive electronic systems from momentary power interruptions, switching transients, brown outs, or voltage spikes.

**PERMANENT MAGNET FEATURES:**

- ☐ *Line Isolation and Stabilization*
- ☐ *Stable Output Voltage*
- ☐ *High Overload Capacity*
- ☐ *Withstands Short Circuits*
- ☐ *Extremely Low R. F. Noise*
- ☐ *Minimum Maintenance*
- ☐ *Lightweight*
- ☐ *Low Audible Noise*
- ☐ *Cool Operation*
- ☐ *Operates in Adverse Environments*



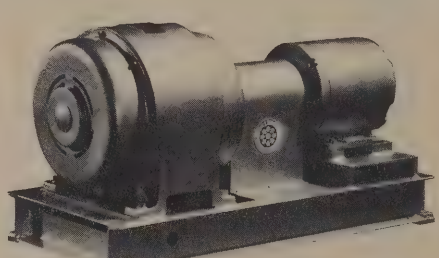


### 60 TO 60 Hz LINE ISOLATOR SERIES 30 UNIT SHELL

This small isolator stabilizer Motor-Generator offers full line isolation for small power requirements up to 1 KVA. Permanent magnet field generator coupled with the high inertia of the rotating system assures maximum electrical isolation between line and load. The rugged unit shell construction gives long, maintenance-free operation.

| Model No. | KVA Rating | Phase In/Out | Output Voltage | Input Voltage | Dimensions H"/L"/Weight |
|---|---|---|---|---|---|
| 35-118 | 0.35 | 1/1 | 115/230 | 115/230 | 14.5"/14.0"/110 lbs. |
| 30-194 | 0.5 | 3/1 | 115/230 | 230/460 | 14.8"/16.1"/120 lbs. |
| 30-198 | 0.5 | 1/1 | 115/230 | 115/230 | 14.8"/16.1"/120 lbs. |
| 30-195 | 1.0 | 3/3 | 120/208 | 230/460 | 14.8"/16.1"/130 lbs. |
| 30-199 | 1.0 | 1/3 | 120/208 | 115/230 | 14.8"/16.1"/130 lbs. |

These 60 to 60 Hz brushless generators, including those in the next column are designed to accept long term input variation of up to ±15% from nominal with no change in output. Inertia stabilization allows these units to absorb input line transients of as much as 30% for as long as 500 milliseconds with less than 1% change in output.



### 60 TO 60 Hz ISOLATOR STABILIZER SERIES 37 IN LINE

Larger Motor Generators in ratings up to 25 KVA are also available to provide full line isolation and distortion free power to protect electronic equipment from power line excursions and momentary power loss.

| Model No. | KVA Rating | Phase In/Out | Output Voltage | Input Voltage | Dimensions H"/L"/Weight |
|---|---|---|---|---|---|
| 37-015 | 1.5 | 3/1 | 115/230 | 220/440 | 18.3"/34"/300 lbs. |
| 37-118 | 1.5 | 1/1 | 115/230 | 230 | 18.3"/34"/315 lbs. |
| 37-130 | 2.5 | 3/3 | 120/208 | 220/440 | 18.3"/34"/215 lbs. |
| 37-133 | 2.5 | 1/3 | 120/208 | 230 | 18.3"/34"/400 lbs. |
| 37-070 | 2.5 | 3/1 | 115/230 | 220/440 | 18.3"/34"/335 lbs. |
| 37-134 | 2.5 | 1/1 | 115/230 | 230 | 18.3"/34"/400 lbs. |
| 37-123 | 5.0 | 3/3 | 120/208 | 220/440 | 18.3"/38"/410 lbs. |
| 37-AAA | 6.25 | 3/1 | 120/240 | 220/440 | 26.0"/48"/650 lbs. |
| 37-129 | 12.5 | 3/1 | 120/240 | 230/460 | 29.0"/62"/910 lbs. |
| 37-135 | 12.5 | 3/3 | 120/208 | 230/460 | 29.0"/62"/910 lbs. |
| 37-136 | 18.75 | 3/3 | 120/240 | 230/460 | 37.5"/70"/1300 lbs. |
| 37-137 | 18.75 | 3/1 | 120/208 | 230/460 | 29.0"/63"/1000 lbs. |
| 37-138 | 25 | 3/3 | 120/240 | 230/460 | 37.5"/72"/1550 lbs. |
| 37-139 | 25 | 3/1 | 120/208 | 230/460 | 29.0"/65"/1230 lbs. |

Series 37 Data Sheets containing detailed specifications are available upon request.

### 50 TO 60 Hz and 60 TO 50 Hz FREQUENCY CONVERTERS

These ruggedly built, belt driven, mot generator sets are mounted on a stur steel frame base. Units in the 0.5 to KVA power range are designed arou the highly efficient NoBrush Perman Magnet Generator. Units in the 6.25 to KVA power range have brushless rotati rectifier type generators with voltage re ulators, to provide ±1% output volta regulation. These motor-generators p vide frequency conversion, basic pow and superior line isolation and stabili tion for exported and imported electri and electronic equipment.

50 to 60 Hz

| Model No. | KVA Rating | Phase In/Out | Voltage Output | Appr Wt. |
|---|---|---|---|---|
| 37-110 | 2.0 | 1/1 | 115/230 | 4 |
| 37-151 | 2.5 | 3/1 | 115/230 | 4 |
| 37-109 | 5.0 | 3/3 | 120/208 | 4 |
| 37-177 | 6.25 | 3/1 | 115/230 | 7 |
| 37-184 | 12.5 | 3/1 | 115-120/230-240 | 10 |
| 37-xxx | 25.0 | 3/3 | 208-240/416-480 | 15 |

60 to 50 Hz

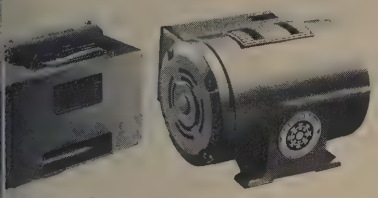
| Model No. | KVA Rating | Phase In/Out | Voltage Output | Appr Wt. |
|---|---|---|---|---|
| 37-105 | 0.5 | 1/1 | 115/230 | 2 |
| 37-102 | 1.5 | 1/1 | 115/220 | 4 |
| 37-111 | 1.5 | 3/1 | 115/230 | 4 |
| 37-095 | 2.5 | 3/1 | 115/230 | 4 |
| 37-197 | 6.25 | 3/1 | 115/230 | 7 |
| 37-180 | 12.5 | 3/3 | 220/440 | 10 |
| 37-170 | 12.5 | 3/1 | 115-120/230-240 | 11 |
| 37-192 | 25.0 | 3/1 | 208-240/230-240 | 15 |

Universal 50/60 to 60/50 Hz

| Model No. | KVA Rating | Phase In/Out | Voltage Output | Appr Wt. |
|---|---|---|---|---|
| 37-116 | 1.5 | 3/1 | 115/230 | 3 |
| 37-112 | 2.5/1.5 | 3/3-1 | 115/200 & 115 | 4 |

# ONVERTERS & GENERATORS

**simplest, most rugged, most dependable power source.**

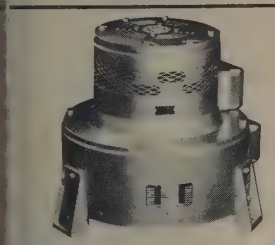


**'O 400 Hz**
**QUENCY CONVERTERS**
**IES 30 UNIT SHELL**

ghly compact, brushless, Motor Gen-
r Set for conversion of 50 or 60 Hz
er to 400 Hz or higher frequencies.
erator and Motor Rotors are pressed
common shaft, with shielded ball
ing at ends of shaft, all contained
n an aluminum alloy shell.

| KVA Rating | Phase In/Out | Output Voltages Full Load * | Input Voltage ** | Dimensions H"/L"/Weight |
|---|---|---|---|---|
| 0.15 | 1/1 | 115/200 | 115/230 | 8"/11"/40 lbs. |
| 0.25 | 1/1 | 115 | 115/230 | 8"/11"/43 lbs. |
| 0.25 | 1/3 | 115/200 | 115/230 | 8"/11"/43 lbs. |
| 0.5 | 1/1 | 115 | 115/230 | 8"/11"/51 lbs. |
| 0.5 | 1/3 | 115/200 | 115/230 | 8"/11"/51 lbs. |
| 0.5 | 3/3 | 115/200 | 208-220/440 | 8"/11"/51 lbs. |
| 0.75 | 3/3 | 115/200 | 208-220/440 | 8"/11"/51 lbs. |
| 1.0 | 1/1 | 115 | 115/230 | 12¼"/15¼"/118 lbs. |
| 1.0 | 1/3 | 115/200 | 115/230 | 12¼"/15¼"/107 lbs. |
| 2.0 | 1/3 | 115/200 | 115/230 | 12¼"/15¼"/137 lbs. |
| 2.0 | 3/3 | 115/200 | 208-220/440 | 12¼"/15¼"/121 lbs. |
| 2.5 | 3/3 | 115/200 | 208-220/440 | 12¼"/15¼"/153 lbs. |

ther Generator Outputs Available:
20, 180, 280, 360, and 840 Hz
ther Standard and Non-Standard
oltages.
xact 400 Hz Output.
C Outputs at Low or High Voltage.



**) 400 Hz**
**QUENCY CONVERTER**
**IES 33 VERTICAL**

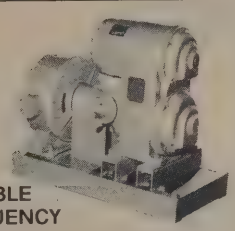
quality induction motor is close cou-
to a "NOBRUSH" generator providing a
compact high power to weight and size
. Available variations include: 50 Hz in-
multiple standard and non-standard AC
ut voltages; Dual AC and DC outputs;
militarized construction.

| L | KVA Rating | Phase In/Out | Output Voltages Full Load | Dimensions Diameter"/H"/Lbs. |
|---|---|---|---|---|
| 1 | 2.5 | 3/3 | 115 | 16.8"/18.3"/173 |
| 2 | 3.5 | 3/1 | 115 | 16.8"/18.3"/178 |
| 3 | 5.0 | 3/1 | 115 | 16.8"/18.3"/273 |
| 4 | 5.0 | 3/3 | 115/200 | 16.8"/18.3"/250 |
| 5 | 7.5 | 3/3 | 115/200 | 16.8"/19.5"/259 |
| 6 | 10.0 | 3/3 | 115/200 | 16.8"/19.5"/280 |
| 3 | 10.0 | 3/1 | 115 | 20.6"/21.8"/405 |
| 4 | 12.5 | 3/3 | 115/200 | 20.6"/21.6"/410 |
| 2 | 15.0 | 3/3 | 115/200 | 20.6"/24.2"/485 |
| 0 | 25.0 | 3/3 | 115/200 | 23.0"/26.5"/1213 |

**EXACT 400 Hz**
**FREQUENCY CONVERTERS**
**SYNCHRONOUS DRIVEN**
**SERIES 35 IN LINE**

60 Hz to exact 400 Hz frequency conversion. Low rotational speed (1200 RPM) provides long life and minimum audible noise (65db). High/low AC and DC outputs available.

| Model No. | KVA Rating | Phase In/Out | Output Voltage Full Load | Output Frequency Exact | Dimensions H"/L"/Weight |
|---|---|---|---|---|---|
| 35-001 | 2.5 | 3/1 | 115 | 400 Hz | 16.5/26/470 Lbs. |
| 35-003 | 3.0 | 3/3 | 115/200 | 400 Hz | 16.5/26/472 Lbs. |
| 35-002 | 5.0 | 3/1 | 115 | 400 Hz | 16.5/30/620 Lbs. |
| 35-004 | 5.0 | 3/3 | 115/200 | 400 Hz | 16.5/28/586 Lbs. |
| 35-005 | 10.0 | 3/3 | 115/200 | 400 Hz | 16.5/30/665 Lbs. |



**VARIABLE**
**FREQUENCY**
**CONVERTERS SERIES 32**

Available both in standard designs and to customer specifications—in ratings from 0.5 to 15 KVA. Variacs supplied with unit for voltage adjustment. Other frequency variations available.

| Model No. | KVA Rating | Phase Out | Variable Frequency | Output Voltage |
|---|---|---|---|---|
| 32-037 | 2.5 | 1 | 45-65 Hz | 100-140/180-240 |
| 32-040 | 5 | 3 | 45-65 Hz | 105-125/183-217 |
| 32-002 | 1 | 3 | 380-420 Hz | 105-125/183-217 |
| 32-022 | 1 | 1 | 380-420 Hz | 105/127 |
| 32-016 | 5 | 3 | 380-420 Hz | 105-125/183-127 |
| 32-038 | 5 | 1 | 380-420 Hz | 100-140/180-240 |
| 38-035 | 10 | 3 | 380-420 Hz | 105-125/183-217 |
| 38-043 | 15 | 3 | 380-420 Hz | 105-125/183-217 |

**LIGHTWEIGHT**
**400 Hz ENGINE-GENERATORS**

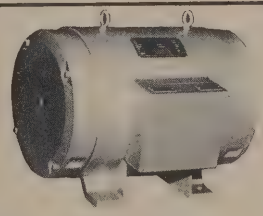
Lightweight 400 Hz permanent magnet engine-generators are available with 1Ø, or 3Ø, or DC, or dual AC/DC outputs. Applications include: geophysical, navigation, and communication systems; also fish conservation.

| Model No. | KVA Rating | DC/Phase Out | Output Voltage | Weight |
|---|---|---|---|---|
| 31-001 | 0.5 | 1Ø AC | 115/230 | 43 |
| 31-002 | 0.5 | DC/1Ø AC | 115/230 | 44 |
| 31-008 | 0.75 | 3Ø AC | 115/200 | 50 |
| 31-014 | 0.5 | DC | 250/500 | 44 |

**VOLTAGE REGULATED**
**60 TO 400 Hz**
**FREQUENCY CONVERTERS**

This new, Series 39, Regulated, Vertical Frequency Converter combines the "No-Brush" permanent magnet generator together with control windings and simplified sensing electronics, to provide both the traditional "Brushless" rugged design and a closely regulated 400 Hz power system. Voltage regulation is ±1.5% no load to full load, 0.8 to 1.0 power factor, with a voltage adjustment feature of ±5%.

| Model No. | KVA Rating | Voltage Output | Voltage Regulation | Phase In/Out |
|---|---|---|---|---|
| 39-001 | 5 | 120/208 | ±1.5% | 3/3 |
| 39-002 | 5 | 115/230 | ±1.5% | 3/1 |
| 39-004 | 6.5 | 120/208 | ±1.5% | 3/3 |



**60 TO 180 Hz, 360 Hz, 840 Hz**
**FREQUENCY CONVERTERS**
**FOR HIGH FREQUENCY**
**TOOLS, MOTORS, AND LIGHTING**

These frequency converters are available for powering high frequency metal-working tools, wood-working tools, motors, and lighting systems. The highly dependable, minimum maintenance, PERMANENT MAGNET BRUSHLESS DESIGNS are available in many ratings up to: 5 KVA for 180 Hz applications; 10 KVA for 360 Hz applications; and 30 KVA for 840 Hz applications.

## GEORATOR™ CORPORATION

**Makers of NOBRUSH® power systems**

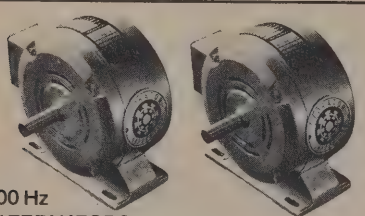
9617 Center Street • P.O. Box 70
Manassas, Virginia 22110
Telephone (703) 368-2101

# GEORATOR™ CORPORATION

# PERMANENT MAGNET ALTERNATORS

## FEATURES:

- ☐ High Efficiency
- ☐ Excellent Wave Form
- ☐ Stable Output Voltage
- ☐ Short Circuit Immunity
- ☐ High Overload Capacity
- ☐ Essentially "0" RF Noise
- ☐ Brushless
- ☐ Compact Design
- ☐ Cool Operation



### 400 Hz ALTERNATORS PERMANENT MAGNET

The original, revolutionary, "NoBrush" generator. Permanent magnets yield stability, reproducibility, ruggedness and virtually zero R.F. noise. Available in large variety of ratings, frequencies and voltages. Supplementary windings with rectifiers available for D.C. output.

400 Hz ALTERNATORS

| Model No. | KVA Rating | Phase Out | Speed RPM | Dimensions H"/L"/Weight |
|---|---|---|---|---|
| 36-001 | 0.25 | 1 | 3428 | 8¼"/4 1/16"/17 lbs. |
| 36-003 | 0.5 | 1 | 3428 | 8¼"/4 1/16"/22 lbs. |
| 36-030 | 0.5 | 3 | 3428 | 8¼"/4 1/16"/21½ lbs. |
| 36-006 | 1.0 | 1 | 1714 | 12 3/16"/4 9/16"/35½ lbs. |
| 36-007 | 1.0 | 3 | 1714 | 13 3/16"/4 9/16"/35½ lbs. |
| 36-008 | 2.0 | 3 | 1714 | 13 3/16"/4 9/16"/45 lbs. |
| 36-009 | 2.5 | 1 | 1714 | 17¼"/6¾"/105 lbs. |
| 36-010 | 5.0 | 1 | 1714 | 17¼"/6¾"/137 lbs. |
| 36-011 | 5.0 | 3 | 1714 | 17¼"/6¾"/103½ lbs. |
| 36-012 | 7.5 | 3 | 1714 | 17¼"/6¾"/120 lbs. |
| 36-013 | 10.0 | 3 | 1714 | 17¼"/6¾"/135 lbs. |
| 36-151 | 15.0 | 3 | 1714 | 25"/11.2"/310 lbs. |
| 36-152 | 25.0 | 3 | 1714 | 25.3"/17"/730 lbs. |

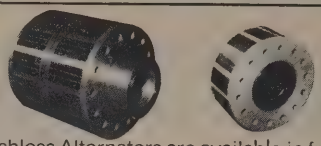
- ☐ Alternator Frequencies Available Include: 50, 60, 120, 180, 240, 300, 360, 420, 840 and 1000 Hz.
- ☐ All Units are Available with:
  - Standard and Non-Standard AC Voltages.
  - Multiple DC Outputs/Low Voltage taps.
  - Special Housings for Flange Mountings.
  - Double Shafts.
  - Militarized Construction.

### 60 Hz ALTERNATORS 50 Hz ALTERNATORS PERMANENT MAGNET

These industrial type generators provide output voltage stability within ±1% for constant load and constant driving speed (from cold to hot and ambient temperatures of −20° F to 130° F).

| MODEL NO. | KVA RATING | PHASE OUT | OUTPUT VOLTAGE NOMINAL | FREQUENCY Hz | SPEED RPM | DIMENSIONS H"L"/WEIGHT |
|---|---|---|---|---|---|---|
| 36-138 | 0.5 | 1 | 115/230 | 60 | 1800 | 12/10.3/90 lbs. |
| 36-103 | 1.0 | 3 | 120/208 | 60 | 1800 | 12/10.3/90 lbs. |
| 36-021 | 1.5 | 1 | 115/230 | 60 | 1800 | 14/19/185 lbs. |
| 36-149 | 2.5 | 3 | 120/208 | 60 | 1800 | 14/19/185 lbs. |
| 36-135 | 2.5 | 1 | 115/230 | 60 | 1800 | 14/19/200 lbs. |
| 36-006 | 5.0 | 3 | 120/208 | 60 | 1800 | 14/19/200 lbs. |
| 36-154 | 10.0 | 3 | 120 | 60 | 3600 | 18/25/753 lbs. |

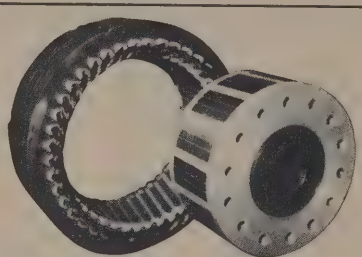
- ☐ All units listed are available with 50 Hz output.



## APPLICATIONS:

Permanent Magnet Brushless Alternators are available in frequencies up to 1,000 Hz and i power ratings from 150 VA to 25 KVA. Wherever a rugged, continuous duty, industrial typ long life generator is required for:

- Special industrial applications 120 Hz, 180 Hz, 360 Hz.
- High frequency power up to 1,000 Hz.
- Low frequency power 60 Hz, 50 Hz or lower.
- Variable frequency....
- Electrical power source in hazardous locations.
- Military 400 Hz electronic equipment.
- Source of multiple AC outputs for rectification to DC power.
- Power static exciter—voltage regulators of large engine generators.
- Pilot excitation and field flashing of large generators.
- Tachometer feedback for large rotating apparatus.
- Lighting Systems.
- Electric brake excitation.
- Power for process control equipment in hazardous environments.
- Special vehicular applications.
- As computer peripheral rotating power supply providing basic power, line isolation, rid through, and multiple outputs.



### ROTORS AND STATORS

Separate permanent magnet rotors and stators are available for a wide range of OEM applications engineered to fit customer shaft or shaft extensions. From speeds as low as 720 RPM to 12,000 RPM in selected ratings. In power ratings from 50 VA to 25 KVA.

### TOTALLY ENCLOSED AND EXPLOSION PROOF

Totally enclosed and explosion proof designs are available in selected ratings. Some typical units are:

| MODEL NO. | KVA RATING | PHASE OUT | VOLTAGE OUT | FREQUENCY/ RPM | DESCRIPTION |
|---|---|---|---|---|---|
| 36-168 | 1.5 | 1 | 120 | 60 Hz/1800 | Totally enclosed. |
| 36-173 | 1.5 | 1 | 115/230 | 60 Hz/1800 | Explosion Proof. |

### FLANGE MOUNTED ROTORS AND STATORS

Cast aluminum alloy housings to fit on cus mer stub shaft.

### SPECIAL PM DESIGNS

Examples of special 2 bearing units of uniq industrial application-

| MODEL NO. | RATING | PHASE OUT | VOLTAGE OUT | DESCRIPTION |
|---|---|---|---|---|
| 36-094 | 165 watts | DC | 5, 12, 24, 48 VDC | Multiple DC outputs for computer peripheral |
| 36-169 | 2.5 KVA | 1Ø | 240 VAC | 1000 Hz, 4286 RPM Un Industrial Application. |
| 36-167 | 3.0 KVA | 3Ø | 115/200 VAC | 200 Hz, 3000 RPM Vehicular application. |

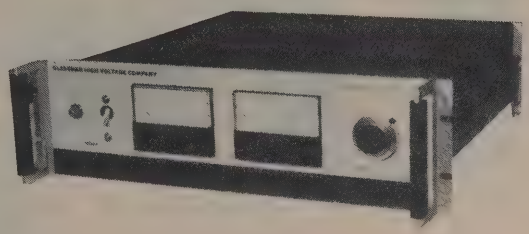
# GEORATOR™ CORPORATION

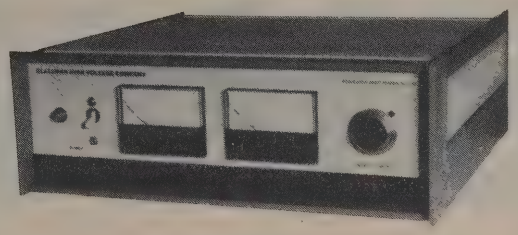
## Makers of NOBRUSH® power systems

P.O. Box 70
9617 Center Street
Manassas, Virginia 22110
Telephone (703) 368-2101

# GLASSMAN HIGH VOLTAGE INC.

## REGULATED SOLID STATE/HIGH VOLTAGE HIGH FREQUENCY/LOW ENERGY POWER SUPPLIES





### *DESIGN FEATURES*

**Reversible Polarity:** The output voltage polarity of all Series LG models is easily reversed. All polarity sensitive circuitry in the control system operates automatically for either positive or negative output polarity.

**Voltage-Current Regulation with Automatic Cross-Over:** All models feature both **voltage** and **current regulation,** with automatic cross over to voltage or current mode.

**Remote Programming and Monitoring:** Remote programming capability is provided for both the voltage and current control function. Programming is accomplished by either a potentiometer (using the power supply internal reference system), or an external 0-10 volt positive programming voltage, with return to case ground.

Monitoring circuitry for both output voltage and load current is provided as a 0-10 volt signal with respect to ground.

**Metering:** All power supplies in this series are equipped with meters that display both the output voltage and the output current.

**Modular Construction:** All major functional circuitry, including power transistors, are mounted on a single printed circuit board, for ease of maintenance and repair. The high voltage circuitry in the entire family of power supplies is also constructed from modular subassemblies, so that replacement or repair, if required, is simple and economical.

**Protection:** The new oscillator-rectifier circuitry provides inherent self protection against four of the most common problems encountered in earlier high voltage power supply designs. In addition, overload, short-circuit, and arc protection is provided by automatic current regulation, and by careful surge limiting design.

**High Efficiency:** Efficiency is typically better than 75% at full load, which ensures low internal dissipation and thereby increases reliability.

**Low Stored Energy:** Like all RF oscillator power supplies, the LG series is inherently safer to operate than line-frequency high voltage supplies, because the output capacitance is extremely low, so that the total stored energy available is quite small . . . on the order of 1 Joule.

**Low Ripple:** The high oscillator frequency makes it relatively easy to achieve low ripple in these supplies. Standard ripple is 0.1%, and even lower ripple is available on special order.

**Excellent Transient Response:** The typical recovery time from a 50% load transient is less than 5 milliseconds.

**Tight Static Regulation:** Both line and load regulation are better than 0.005% over the entire rated range of input voltage and output current.

**Radio Frequency Interference:** A conducted-noise line filter is provided.

### *APPLICATIONS*

**Manufacturing Processes:** Spraying and Flocking Systems, Ion Implantation, Fault Detection, Corona Testing, Precipitation and Deposition Systems.

**Displays:** Image Intensification, Radar Displays, Flying Spot Generators and Scanners, Waveform Generators, Large Screen CRT Display, Oscilloscopes, Projection TV.

**R & D Instrumentation:** Mass Spectrometers, Electron Microscopes, Air Pollution Instrumentation, Capacitor Bank Charging, Nuclear Apparatus. Radiation Counters, Lasers, Voltmeter/Voltbox Calibrators, Plasma and Pinch System.

**Powering HV Devices:** X-ray Sources, Photomultipliers, BWO/TWT/Klystron Tubes, Radiation Detectors, Accelerators, Electron Gun Devices.

### *PARTIAL SPECIFICATIONS*

**Input:** 105-125 Vrms, 50-60 Hz, single phase.

**Output:** Continuous, stable adjustability from 0 to rated voltage and current.

**Voltage Regulation:** 0.005%.

**Stability:** 0.01% per hour after ½ hour warm-up. 0.05% per 8 hours.

**Temperature Coefficient:** 0.01%/°C.

**Polarity:** Reversible or fixed. Units available with positive, negative or reversible high voltage with respect to chassis ground.

**Protection:** Automatic current regulation protects power supply against all overload conditions, including arcs and short circuits.

**FRONT PANEL ELEMENTS**

Circuit breaker, pilot lamp, kilovoltmeter, milliammeter, 10 turn voltage control with "Duodial"® readout and lock set.

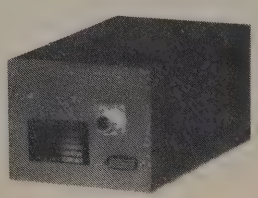
### *LG SERIES — RACK OR CABINET STYLE*

| Output Voltage | Output Current | Panel Height |
|---|---|---|
| 0-5 KV | 20.0 mA | 5¼" |
| 0-10 KV | 15.0 mA | 5¼" |
| 0-20 KV | 7.5 mA | 5¼" |
| 0-30 KV | 5.0 mA | 5¼" |
| 0-40 KV | 3.5 mA | 5¼" |
| 0-50 KV | 3.0 mA | 5¼" |
| 0-60 KV | 2.5 mA | 5¼" |
| 0-80 KV | 1.5 mA | 8¾" |
| 0-100 KV | 1.0 mA | 8¾" |

Many options available.

### *MG SERIES — MODULES*

| Output Voltage (kilovolts) | Output Current (micro-amps) | Size W x H x L (inches) |
|---|---|---|
| 0-5 KV | 2000 | 5 x 4 x 6 |
| 0-10 KV | 1000 | 5 x 4 x 6 |
| 0-20 KV | 400 | 5 x 4 x 8 |
| 0-30 KV | 250 | 5 x 4 x 8 |
| 0-40 KV | 150 | 5 x 4 x 11 |
| 0-50 KV | 100 | 5 x 4 x 11 |
| 0-60 KV | 50 | 5 x 4 x 11 |



**GLASSMAN HIGH VOLTAGE INC.**
(EM) 124 WEST MAIN STREET / HIGH BRIDGE, NEW JERSEY 08829
TELEPHONE: (201) 735-8800 TELEX 847481 COMPT PWR

# The big switch

## ...is to switching power supplies.

For better performance more and more design engineers are switching from linear to switching power supplies.

Switchers are 1/3 the size and 1/4 the weight of linears; they use only half as much energy and they offer far better protection against brownouts and power interruptions.

And Gould makes it easy to make the switch.

Forty-six single and multiple output switchers with power levels from 8-2,250 watts are available in a wide variety of voltage/current combinations. The char below will give you a brief overview.

Or if you need custom supplies Gould can provide designs to meet your exact specification.

You'll be backed by a high-volume production capability and a worldwide service network that only a $1.6 billion company like Gould could offer.

Gould Inc., Electronic Components Division, 4601 North Arden Drive, El Monte, CA. Phone (213) 442-7755 or TWX 910-587-4934.

| | No. of Outputs | Output watts | Fan or Convection Cooled | Holdup ($\mu$secs) | Efficiency (%) | Maximum Operating Temp. (C°) |
|---|---|---|---|---|---|---|
| MG Series | 1 | 50-500 | F | 28 | 70 | 50 |
| SMG Series | 1 | 8-250 | C | 24-44 | 58-70 | 40 |
| SMG Series | 1 | 500-2250 | F | 17-22 | 70 | 50 |
| MMG Series | 1 | 25 | C | User defined | 65-75 | 50 |
| MGT Series | 3 | 140-400 | C | 28 | 60-75 | 50 |
| MGQ Series | 4 | 300-650 | C | 28 | 70 | 50 |

**Gould.**
**The power in switching power supplies**

GOULD

HEWLETT hp PACKARD

# DC Power Supplies

- Low-Cost Lab Supplies
- General Purpose Lab & System Supplies
- High-Power, High-Efficiency Supplies
- OEM Modular Power Supplies
- Custom Power Systems
- Bipolar Power Supply/Amplifiers
- Precision Voltage & Current Sources
- High Voltage Power Supplies
- AC/DC Meter Calibrator
- Power Supply Programmers
- Digitally Controlled Power Sources
- Multiprogrammer

## SALES AND SERVICE OFFICES

**ALABAMA**
Huntsville
(205) 881-4591

**ARIZONA**
Phoenix
(602) 244-1361

**CALIFORNIA**
Fullerton
(714) 870-1000
North Hollywood
(213) 877-1282
Los Angeles
(213) 970-7710
Santa Clara
(408) 249-7000
Sacramento
(916) 929-7222
San Diego
(714) 279-3200

**COLORADO**
Englewood
(303) 771-3455

**CONNECTICUT**
New Haven
(203) 389-6551

**FLORIDA**
Ft. Lauderdale
(305) 731-2020
Orlando
(305) 859-2900

**GEORGIA**
Atlanta
(404) 955-1500

**HAWAII**
Honolulu
(808) 955-4455

**ILLINOIS**
Rolling Meadows
(312) 255-9800

**INDIANA**
Indianapolis
(317) 842-1000

**IOWA**
Iowa City
(319) 338-9466

**LOUISIANA**
Kenner
(504) 721-6201

**MARYLAND**
Baltimore
(301) 944-5400
Rockville
(301) 948-6370

**MASSACHUSETTS**
Lexington
(617) 861-8960

**MICHIGAN**
Farmington Hills
(313) 476-6400

**MINNESOTA**
St. Paul
(612) 636-0700

**MISSOURI**
Kansas City
(816) 763-8000
Maryland Heights
(314) 878-0200

**NEW JERSEY**
Paramus
(201) 265-5000

**NEW MEXICO**
Albuquerque
(505) 292-1330
Las Cruces
(505) 526-2485

**NEW YORK**
Albany
(518) 458-1550
Poughkeepsie
(914) 454-7330
Rochester
(716) 223-9950
Syracuse
(315) 454-2486
Woodbury
(516) 921-0300

**NORTH CAROLINA**
High Point
(919) 885-8101

**OHIO**
Cleveland
(216) 243-7300
Dayton
(513) 859-8202

**OKLAHOMA**
Oklahoma City
(405) 721-0200

**OREGON**
Tualatin
(503) 620-3350

**PENNSYLVANIA**
Pittsburgh
(412) 782-0400
King of Prussia
(215) 265-7000

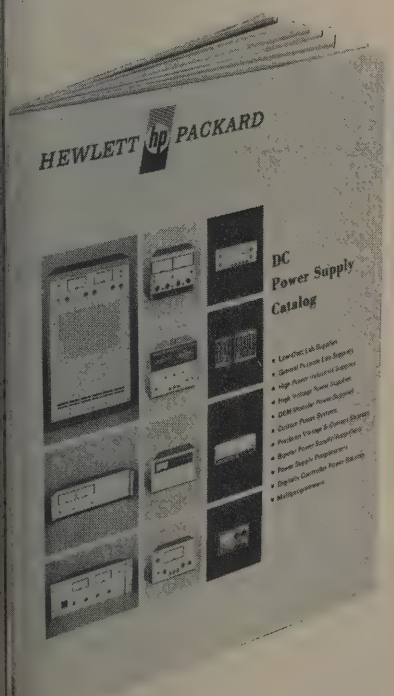
**SOUTH CAROLINA**
Columbia
(803) 782-6493

**TEXAS**
Richardson
(214) 231-6101
Houston
(713) 776-6400
San Antonio
(512) 434-8241

**UTAH**
Salt Lake City
(801) 972-4711

**VIRGINIA**
Richmond
(804) 285-3431

**WASHINGTON**
Bellevue
(206) 454-3971




# Everything You Need To Know About HP DC Power Supplies

*CALL FOR YOUR COPY!*

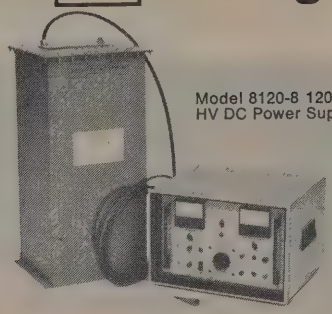
HEWLETT hp PACKARD

1507 Page Mill Road, Palo Alto, California 94304

21802

HIPOTRONICS

# High Voltage DC Power Supplies



Model 8120-8 120kV — 8 mA
HV DC Power Supply

**Hipotronics offers a full line of unregulated power supplies with output voltages ranging from 1 to 1,000 kV and current outputs from 1.3 mA to 50 A.**

**Conservatively designed for continuous use, every model is supplied with a fully instrumented control console. The type of transformer insulation varies according to the voltage requirements. All units below 30 kV are air insulated while oil insulation is provided for higher voltages.**

**A complete overload system with surge devices protects the control circuitry against repeated short circuits at full output and ensures safe, trouble free operation.**

## Design Features

- Reversible polarity
- Output-connected, triple-range voltage meter
- Triple-range current meter in return leg of HV circuit
- Adjustable overload relay, 10% to 110% rated current, with reset button
- Rated current available from zero to rated voltage
- Meter recalibration potentiometers

## Customized Capability

Hipotronics has designed and custom-manufactured a wide variety of power supplies for a wide variety of uses. Customized power supplies include application-oriented units for: Electrostatics, accelerators, lasers, high power radar, high voltage component testing, and many more.

## Personnel Safety Features

- Output shorting solenoid and/or bleeder resistor
- Series-limiting resistor in output circuit
- External interlock provision and pilot light
- Zero start interlock and pilot light

## Equipment Safety Features

- Surge protection for meters and relays
- Backup circuit breaker in primary of HV transformer
- Input circuit breakers and pilot light

### Specifications

**1 KILOWATT OUTPUT UNITS**

| Model No. | Current (mA) | Voltage (kV) |
|---|---|---|
| 801-1000 | 1000 | 1 |
| 802-500 | 500 | 2 |
| 803-330 | 330 | 3 |
| 804-250 | 250 | 4 |
| 805-200 | 200 | 5 |
| 806-165 | 165 | 6 |
| 807.5-130 | 130 | 7.5 |
| 810-100 | 100 | 10 |
| 815-65 | 65 | 15 |
| 820-50 | 50 | 20 |
| 825-40 | 40 | 25 |
| 830-33 | 33 | 30 |
| 840-25 | 25 | 40 |
| 850-20 | 20 | 50 |
| 860-16 | 16 | 60 |
| 875-13 | 13 | 75 |
| 890-11 | 11 | 90 |
| 8100-10 | 10 | 100 |
| 8120-8 | 8 | 120 |
| 8150-6.5 | 6.5 | 150 |
| 8200-5 | 5 | 200 |

**Input:** 115 volts, 50/60 Hz, 1 phase, 12 amps.
**Regulation:** 15% no load to full load.
**Ripple:** 2% rms.
**HV Output:** 20-foot shielded cable (bushing available on request).

**1.5 KILOWATT OUTPUT UNITS**

| Model No. | Current (mA) | Voltage (kV) |
|---|---|---|
| 801-1500 | 1500 | 1 |
| 802-750 | 750 | 2 |
| 803-500 | 500 | 3 |
| 804-375 | 375 | 4 |
| 805-300 | 300 | 5 |
| 806-250 | 250 | 6 |
| 807.5-200 | 200 | 7.5 |
| 810-150 | 150 | 10 |
| 815-100 | 100 | 15 |
| 820-75 | 75 | 20 |
| 825-60 | 60 | 25 |
| 830-50 | 50 | 30 |
| 840-37.5 | 37.5 | 40 |
| 850-30 | 30 | 50 |
| 860-25 | 25 | 60 |
| 875-20 | 20 | 75 |
| 890-17 | 17 | 90 |
| 8100-15 | 15 | 100 |
| 8120-12.5 | 12.5 | 120 |
| 8150-10 | 10 | 150 |
| 8200-7.5 | 7.5 | 200 |
| 8250-6.0 | 6 | 250 |
| 8300-5.0 | 5 | 300 |

**Input:** 115 volts, 50/60 Hz, 1 phase, 20 amps.
**Regulation:** 15% no load to full load.
**Ripple:** 2% rms.
**HV Output:** 20-foot shielded cable (bushing available on request).

**2.5 KILOWATT OUTPUT UNITS**

| Model No. | Current (mA) | Voltage (kV) |
|---|---|---|
| 801-2500 | 2500 | 1 |
| 802-1250 | 1250 | 2 |
| 803-830 | 830 | 3 |
| 804-625 | 625 | 4 |
| 805-500 | 500 | 5 |
| 806-425 | 425 | 6 |
| 807.5-300 | 300 | 7.5 |
| 810-250 | 250 | 10 |
| 815-160 | 160 | 15 |
| 820-125 | 125 | 20 |
| 825-100 | 100 | 25 |
| 830-80 | 80 | 30 |
| 840-60 | 60 | 40 |
| 850-50 | 50 | 50 |
| 860-40 | 40 | 60 |
| 875-33 | 33 | 75 |
| 890-27 | 27 | 90 |
| 8100-25 | 25 | 100 |
| 8120-20 | 20 | 120 |
| 8150-16 | 16 | 150 |
| 8200-12.5 | 12.5 | 200 |
| 8250-10 | 10 | 250 |
| 8300-8 | 8 | 300 |
| 8400-6 | 6 | 400 |
| 8500-5 | 5 | 500 |

**Input:** 115 volts, 50/60 Hz, 1 phase, 30 amps.
**Regulation:** 15% no load.
**Ripple:** 2% rms.
**HV Output:** 20-foot shielded cable (bushing available on request).

**5 KILOWATT OUTPUT UNITS**

| Model No. | Current (mA) | Voltage (kV) | Input |
|---|---|---|---|
| 801-5000 | 5000 | 1 | 208/220 v, 3 phase, 50/60 Hz, 20 amps |
| 802-2500 | 2500 | 2 | |
| 803-1666 | 1666 | 3 | |
| 804-1250 | 1250 | 4 | |
| 805-1000 | 1000 | 5 | |
| 806-840 | 840 | 6 | |
| 807.5-670 | 670 | 7.5 | |
| 810-500 | 500 | 10 | |
| 815-335 | 335 | 15 | |
| 820-250 | 250 | 20 | |
| 825-200 | 200 | 25 | |
| 830-166 | 166 | 30 | 208/220 v, single phase, 50/60 Hz, 35 amps |
| 840-125 | 125 | 40 | |
| 850-100 | 100 | 50 | |
| 860-84 | 84 | 60 | |
| 875-67 | 67 | 75 | |
| 890-56 | 56 | 90 | |
| 8100-50 | 50 | 100 | |
| 8120-41.5 | 41.5 | 120 | |
| 8150-33.3 | 33.3 | 150 | |
| 8200-25 | 25 | 200 | |
| 8250-20 | 20 | 250 | |
| 8300-16.6 | 16.6 | 300 | |
| 8400-12.5 | 12.5 | 400 | |
| 8500-10.0 | 10 | 500 | |

**Regulation:** 10% 3 phase, 15% 1 phase, no load to full load.
**Ripple:** 1% or 5% rms, 3 phase units; 2% rms.
**HV Output:** 20-foot shielded cable (bushing available on request).

**10 KILOWATT OUTPUT UNITS**

| Model No. | Current (mA) | Voltage (kV) | Input |
|---|---|---|---|
| 801-10A | 10 amp | 1 | 208/220 v, 3 phase, 50/60 Hz, 40 amps |
| 802-5A | 5 amp | 2 | |
| 803-3.3A | 3.3 amp | 3 | |
| 804-2.5A | 2.5 amp | 4 | |
| 805-2A | 2 amp | 5 | |
| 806-1.65A | 1.65 amp | 6 | |
| 807.5-1.3A | 1.3 amp | 7.5 | |
| 810-1A | 1 amp | 10 | |
| 815-650 | 650 | 15 | |
| 820-500 | 500 | 20 | |
| 825-400 | 400 | 25 | |
| 830-330 | 330 | 30 | |
| 840-250 | 250 | 40 | 440/480 v, single phase, 50/60 Hz, 35 amps |
| 850-200 | 200 | 50 | |
| 860-160 | 160 | 60 | |
| 875-130 | 130 | 75 | |
| 890-110 | 110 | 90 | |
| 8100-100 | 100 | 100 | |
| 8120-80 | 80 | 120 | |
| 8150-65 | 65 | 150 | |
| 8200-50 | 50 | 200 | |
| 8250-40 | 40 | 250 | |
| 8300-33 | 33 | 300 | |
| 8400-25 | 25 | 400 | |
| 8500-20 | 20 | 500 | |
| 8600-16 | 16 | 600 | |
| 8750-13 | 13 | 750 | |
| 81000-10 | 10 | 1000 | |

**Regulation:** 10% 3 phase, 18% 1 phase, no load to full load.
**Ripple:** 1% or 5% rms, 3 phase units; 2% rms, 1 phase units (see chart).
**HV Output:** Cable to 60 kV; Toroid over 600 kV.

Tables continued on next page ›

continued from preceding page.

**15 KILOWATT OUTPUT UNITS**

| Model No. | Current (mA) | Voltage (kV) | Input |
|---|---|---|---|
| 801-15A | 15 amp | 1 | 440/480 v, 3 phase, 25 amps |
| 802-7.5A | 7.5 amp | 2 | |
| 803-5A | 5 amp | 3 | |
| 804-3.75A | 3.75 amp | 4 | |
| 805-3A | 3 amp | 5 | |
| 806-2.5A | 2.5 amp | 6 | |
| 807.5-2A | 2 amp | 7.5 | |
| 810-1.5A | 1.5 amp | 10 | |
| 815-1A | 1 amp | 15 | |
| 820-750 | 750 | 20 | |
| 825-600 | 600 | 25 | |
| 830-500 | 500 | 30 | |
| 840-375 | 375 | 40 | |
| 850-300 | 300 | 50 | |
| 860-250 | 250 | 60 | |
| 875-200 | 200 | 75 | 440/480 v, 1 phase, 50/60 Hz, 45 amps |
| 890-170 | 170 | 90 | |
| 8100-150 | 150 | 100 | |
| 8120-125 | 125 | 120 | |
| 8150-100 | 100 | 150 | |
| 8200-75 | 75 | 200 | |
| 8250-60 | 60 | 250 | |
| 8300-50 | 50 | 300 | |
| 8400-37.5 | 37.5 | 400 | |
| 8500-30 | 30 | 500 | |
| 8600-25 | 25 | 600 | |
| 8750-20 | 20 | 750 | |
| 81000-15 | 15 | 1000 | |

**Regulation:** 10% 3 phase, 18% 1 phase, no load to full load.
**Ripple:** 1% or 5% rms, 3 phase units; 2% rms, 1 phase units (see chart).
**HV Output:** Cable to 600 kV; Toroid over 600 kV.

**25 KILOWATT OUTPUT UNITS**

| Model No. | Current (mA) | Voltage (kV) | Input |
|---|---|---|---|
| 801-25A | 25 amp | 1 | 440/480 v, 3 phase, 50/60 Hz, 45 amps |
| 802-12.5A | 12.5 amp | 2 | |
| 803-8.8A | 8.8 amp | 3 | |
| 804-6.2A | 6.2 amp | 4 | |
| 805-5A | 5 amp | 5 | |
| 806-4.2A | 4.2 amp | 6 | |
| 807.5-3.3A | 3.3 amp | 7.5 | |
| 810-2.5A | 2.5 amp | 10 | |
| 815-1.7A | 1.7 amp | 15 | |
| 820-1.25A | 1.25 amp | 20 | |
| 825-1A | 1 amp | 25 | |
| 830-830 | 830 | 30 | |
| 840-620 | 620 | 40 | |
| 850-500 | 500 | 50 | |
| 860-420 | 420 | 60 | |
| 875-335 | 335 | 75 | |
| 890-280 | 280 | 90 | |
| 8100-250 | 250 | 100 | 1 phase, 80 amps |
| 8120-200 | 200 | 120 | |
| 8150-170 | 170 | 150 | |
| 8200-125 | 125 | 200 | |
| 8250-100 | 100 | 250 | |
| 8300-85 | 85 | 300 | |
| 8400-62 | 62 | 400 | |
| 8500-50 | 50 | 500 | |
| 8600-42 | 42 | 600 | |
| 8750-33 | 33 | 750 | |
| 81000-25 | 25 | 1000 | |

**Regulation:** 10% 3 phase, 18% 1 phase, no load to full load.
**Ripple:** 1% or 5% rms, 3 phase units; 2% rms, 1 phase units (see chart).
**HV Output:** Cable to 600 kV; Toroid over 600 kV.

**50 KILOWATT OUTPUT UNITS**

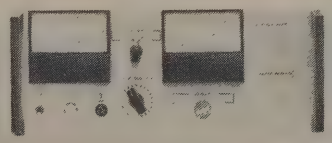
| Model No. | Current (mA) | Voltage (kV) | Input |
|---|---|---|---|
| 801-50A | 50 amp | 1 | 440/480 v, 3 phase, 50/60 Hz, 90 amps |
| 802-25A | 25 amp | 2 | |
| 803-16.6A | 16.6 amp | 3 | |
| 804-12.5A | 12.5 amp | 4 | |
| 805-10A | 10 amp | 5 | |
| 806-8.4A | 8.4 amp | 6 | |
| 807.5-6.7A | 6.7 amp | 7.5 | |
| 810-5A | 5 amp | 10 | |
| 815-3.3A | 3.3 amp | 15 | |
| 820-2.5A | 2.5 amp | 20 | |
| 825-2A | 2 amp | 25 | |
| 830-1.7A | 1.7 amp | 30 | |
| 840-1.25A | 1.25 amp | 40 | |
| 850-1A | 1 amp | 50 | |
| 860-830 | 830 | 60 | |
| 875-670 | 670 | 75 | |
| 890-560 | 560 | 90 | |
| 8100-500 | 500 | 100 | |
| 8120-420 | 420 | 120 | 1 phase, 160 amps |
| 8150-335 | 335 | 150 | |
| 8200-250 | 250 | 200 | |
| 8250-200 | 200 | 250 | |
| 8300-166 | 166 | 300 | |
| 8400-125 | 125 | 400 | |
| 8500-100 | 100 | 500 | |
| 8600-83 | 83 | 600 | |
| 8750-67 | 67 | 750 | |
| 81000-50 | 50 | 1000 | |

**Regulation:** 10% 3 phase, 18% 1 phase, no load to full load.
**Ripple:** 1% or 5% rms, 3 phase units; 2% rms, 1 phase units (see chart).
**HV Output:** Cable to 600 kV; Toroid over 600 kV.

# Metered Power Packs

The R Series consists of eight metered DC high voltage power packs with output voltages from 2.5 to 60 kV and a current rating of 5 mA on all models except the R60 A which has a 2.5 mA rating.

These compact, highly miniaturized units are designed for long life and trouble free operation. All units are housed in hermetically sealed cans, and are filled with mineral type transformer oil or epoxy. The conservative design precludes component failure caused by long term corona degradation of the insulation and guarantees a pure DC output free of interfering high frequency signals which might possibly influence or affect the system which it is powering.



MODEL R20B, 20 kV-5 mA HV SUPPLY

**Specifications**
**Input:** 0-125 volts, output voltages and currents (stated for nominal 117 volt input)
**Regulation:** 10 to 15% no load to full load
**Ripple:** 0.5% rms per milliampere output

**Optional Extras**
1. Bench top cabinet
2. Short circuit limiter — ideal for capacitor charging, flocking, electrostatic operations, etc. Supply will short circuit on output and limit current to 5 mA

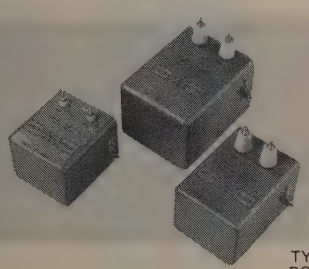
| Model No. | Output (kV) | Current (mA) | (% rms/mA) Ripple | Polarity | kV Meter (kV) | Current Meter (mA) | Size WxHxD (in.) |
|---|---|---|---|---|---|---|---|
| R2B | 0-2.5 | 5 | .5 | Reversible | 0-3 | 0-5 | 19x7x8 |
| R5B | 0-5 | 5 | .5 | Reversible | 0-6 | 0-5 | 19x7x8 |
| R10B | 0-10 | 5 | .5 | Reversible | 0-12 | 0-5 | 19x7x8 |
| R15B | 0-15 | 5 | .5 | Reversible | 0-15 | 0-5 | 19x7x8 |
| R20B | 0-20 | 5 | .5 | Reversible | 0-25 | 0-5 | 19x7x8 |
| R30B | 0-30 | 5 | .5 | Reversible | 0-30 | 0-5 | 19x12x10 |
| R50B | 0-50 | 5 | .5 | Reversible | 0-50 | 0-5 | 19x12x10 |
| R60B | 0-60 | 2.5 | .5 | Reversible | 0-60 | 0-2.5 | 19x12x10 |

# Standard HV Power Packs

A wide range of durable, lightweight power packs are available with outputs from 2.5 to 60 kV and current ratings from 2 to 10 mA. Solid state rectifiers ensure compactness and good regulation on every unit.

The output connections are high voltage ceramic bushings on Models 30 kV and below, and plug-in receptacles for coaxial cables on higher voltage units.

Every component in the supply is operated below its design rating and pre-assembly hipot tested at 1½ times its operating voltage.



TYPICAL HV POWER PACKS

**Specifications**

| Model No. | Output (kV) | Current (mA) | Size HxWxD (in.) |
|---|---|---|---|
| 2.5B | 2.5 | 5 | 3 1/16x3 3/4x2 3/4 |
| 2.5C | 2.5 | 10 | 4 3/8x3 7/8x3 3/16 |
| 5B | 5 | 5 | 4 3/8x3 7/8x3 3/16 |
| 7.5C | 7.5 | 10 | 5 5/16x3 15/16x3 3/8 |
| 10B | 10 | 5 | 5 5/16x3 15/16x3 3/8 |
| 10C | 10 | 10 | 6 1/8x4 5/8x4 |
| 15B | 15 | 5 | 6x4 5/8x4 |
| 15C | 15 | 10 | 8x6x5 |
| 20B | 20 | 5 | 6 1/16x4 5/8x4 |
| 25C | 25 | 10 | 10x6x5 |
| 30B | 30 | 5 | 8x6x5 |
| 40A | 40 | 2 | 10x6x5 |
| 50B | 50 | 5 | 10 1/16x8x6 |
| 60A | 60 | 2.5 | 10 1/16x8x6 |

**Input:** 0-125 volts, output voltages and currents (stated for nominal 117 volt input)
**Regulation:** 10 to 15% no load to full load
**Ripple:** 0.5% rms per milliampere output

HIPOTRONICS®
HIPOTRONICS, INC.
Brewster, N. Y. 10509 / (914) 279-8031
TELEX: 710-574-2420

For more information call or write our sales department. See other Hipotronics' listings under Test Instruments.

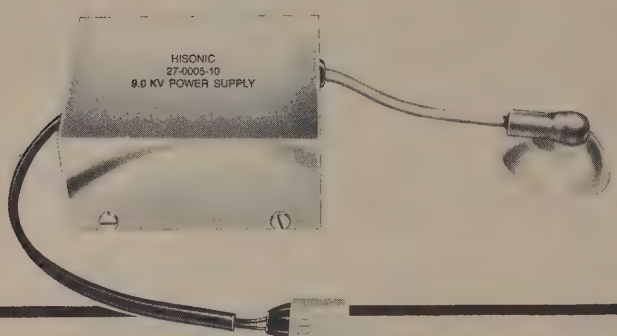
Prices and specifications subject to change without notice.

hisonic inc.

249 N. TROOST • OLATHE, KANSAS 66061
PHONE: 913-782-0012
TELEX: 4-2562

# CUSTOM POWER SUPPLIES

**DC To DC Or DC To AC**
- Custom designed
- High reliability
- Operation temperatures up to 125°C
- High efficiency
- Low E.M.I.
- Wide variety of package configurations.
- Voltage regulators designed to meet customer requirements.

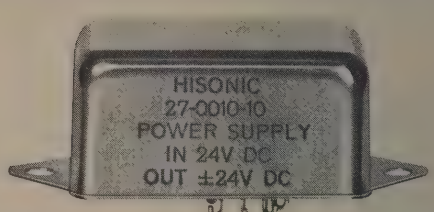


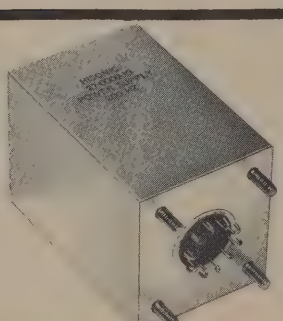

## HIGH VOLTAGE DC TO DC POWER SUPPLY

DC Input: 23 V @ 240 ma
Outputs: 9 KV DC @ 60 ua
400 V DC @ 4 ma
12 V RMS (13 KHZ) @ 75 ma
Special characteristics: designed for operation @ 35,000 ft.
Physical size:
3.7" x 2.81" x 1.75" metal cased

## LOW VOLTAGE DUAL OUTPUT DC TO DC POWER SUPPLY

DC Input: 24 V @ 350 ma
Outputs: +24 V @ 125 ma
−24 V @ 125 ma
Special characteristics: hermetically sealed.
Physical size: 2.125" x 1.25" x .875" metal cased



## MULTI-OUTPUT DC TO AC POWER SUPPLY

DC Input: 28 V @ 2.5 a
Outputs: 30 V peak @ 270 ma
30 V peak @ 630 ma
30 V peak @ 1 ma w/ct
3.8 V peak @ 320 ma
Special characteristics: all outputs are 200 HZ square wave — hermetically sealed
Physical size: 3.125" x 2.312" x 2.06" metal cased
Output voltage(s) may be revised as long as the total power remains the same.

## STANDARD EPOXY INCAPSULATED DC TO DC POWER SUPPLIES

DC Input 12 V @ 150 ma

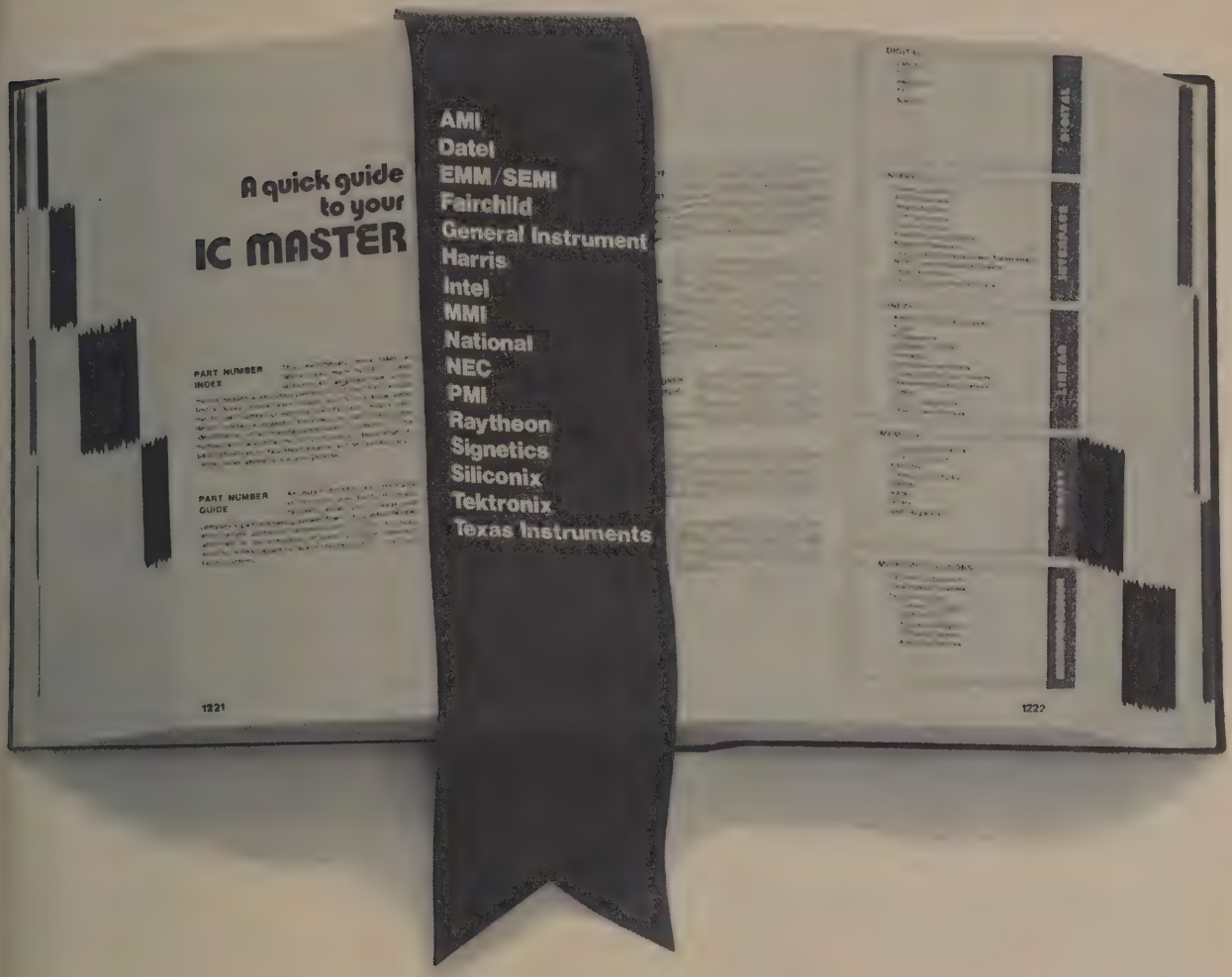
| Part No's | Output |
|---|---|
| 27-0011-11 | ±6 V DC @ 100 ma |
| -12 | ±10 V DC @ 60 ma |
| -13 | ±12 V DC @ 50 ma |
| -14 | ±18 V DC @ 32 ma |
| -15 | ±24 V DC @ 25 ma |

Physical size: 1.65" x 1.3" x 1"

hisonic inc.

OTHER PRODUCTS: Precision Inductors • Transformers & Reactors • Tuned Circuits • Amp/Phase Equalizers • Lumped Constant Delay Lines

# A GOOD BOOK IS KNOWN BY THE COMPANIES IT KEEPS.




These manufacturers have invested in the IC MASTER to bring you the most complete information on their newest standard products.

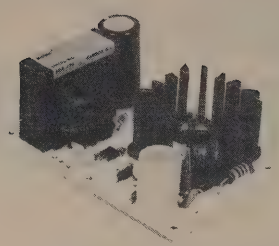
WHEN USING THE IC MASTER, REFER TO THESE MANUFACTURERS' COMPLETE DATA SHEETS TO HELP YOU IN YOUR IC SELECTION . . .

## THE WHOLE WORLD FOLLOWS THE MASTER.

**IC Master**
**1333 Lawrence Expressway, Suite 420**
**Santa Clara, CA 95051**
**(408) 248-8044**

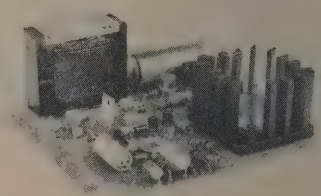
*It's Faster With the Master*

# HOPE ELECTRONICS



## POWER SUPPLIES

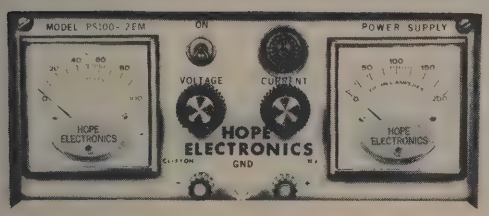
**LOW COST PLUG-IN**



| Model | Output Voltage | Output Current | Regulation | Ripple & Noise | Dimensions W L H | Price 1-24 |
|---|---|---|---|---|---|---|
| EP5-.750 | 4.5V to 5.5V | 0-750 ma | 1% | <10 mv | 4½ x3x1⅞ | $24.50 |
| EP5-1/5 | 4.5V to 5.5V | 0-1.5 amps | 1% | <10 mv | 4½ x4½ x1¾ | $31.50 |
| EP5-2.5 | 4.5V to 5.5V | 0-2.5 amps | 1% | <10 mv | 4½ x6½ x2½ | $37.50 |
| EP5-4 | 4.5V to 5.5V | 0-4 amps | 1% | <10 mv | 4½ x6½ x3 | $45.50 |
| EP15-.400 | 11.5V to 15.5V | 0-400 ma | 1% | <10 mv | 4½ x3x1⅞ | $24.50 |
| EP15-.700 | 11.5V to 15.5V | 0-700 ma | 1% | <10 mv | 4½ x4½ x1¾ | $31.50 |
| EP15-1 | 11.5V to 15.5V | 0-1 amp | 1% | <10 mv | 4½ x6½ x2½ | $37.50 |
| IP5-1/.1 | 4.5V to 5.5V | 0-1 amp | 0.1% | <1 mv | 4½ x4½ x2¼ | $33.00 |
| IP5-2.5/.1 | 4.5V to 5.5V | 0-2.5 amps | 0.1% | <1 mv | 4½ x6½ x2½ | $45.00 |
| IP15-.5/.1 | 11.5V to 15.5V | 0-500 ma | 0.1% | <1 mv | 4½ x4½ x2¼ | $33.00 |
| IP15-1/.1 | 11.5V to 15.5V | 0-1 amp | 0.1% | <1 mv | 4½ x6½ x2½ | $45.00 |
| IP30-.2/.1 | 15V to 30V | 0-200 ma | 0.1% | <2 mv | 4½ x4½ x2¼ | $35.00 |
| IP50-.1/.1 | 25V to 55V | 0-100 ma | 0.1% | <50 mv | 4½ x4½ x2¼ | $45.00 |
| IP100-.05/.1 | 50V to 105V | 0-50 ma | 0.1% | <100 mv | 4½ x4½ x2¼ | $45.00 |
| IP200-.025/.1 | 100 to 210V | 0-25 ma | 0.1% | <200 mv | 4½ x4½ x2¼ | $45.00 |
| **DUAL OUTPUT** | | | | | | |
| EP12-.200/D | ±11 to 13 | 0-200 ma | 1% | <10 mv | 4½ x4½ x1⅞ | $45.00 |
| EP15-.200/D | ±14 to 16 | 0-200 ma | 1% | <10 mv | 4½ x4½ x1⅞ | $45.00 |
| **DUAL OUTPUT TRACKING** | | | | | | |
| IP12-.200/DT | ±11V to 13V | 0-200 ma | 0.1% | <2 mv | 4½ x6½ x2¼ | $59.00 |
| IP15-.200/DT | ±11V to 16V | 0-200 ma | 0.1% | <2 mv | 4½ x6½ x2¼ | $59.00 |
| IP15-.025/DT | 15V | 0-25 ma | 0.1% | <2 mv | 4½ x3x1⅞ | $29.00 |
| IP12-.400/DT | ±11V to 13V | 0-400 ma | 0.1% | <2 mv | 4½ x7½ x2½ | $85.00 |
| IP15-.400/DT | ±14V to 16V | 0-400 ma | 0.1% | <2 mv | 4½ x7½ x2½ | $85.00 |
| **WIDE RANGE ADJUSTABLE TO 0 VOLTS** | | | | | | |
| PC15-1EM | 0-15V | 0-1 amp | .05% | <1 mv | 4½x6½x2½ | $68.00 |
| PC30-.5EM | 0-30V | 0-500 ma | .05% | <1 mv | 4½x6½x2½ | $68.00 |
| PC50-.2EM | 0-50V | 0-200 ma | .05% | <2 mv | 4½x6½x2½ | $78.00 |
| PC100-.1EM | 0-100V | 0-100 ma | .05% | <2 mv | 4½x6½x2½ | $95.00 |
| PC200-.05EM | 0-200V | 0-50 ma | .05% | <5 mv | 4½x6½x2½ | $125.00 |
| PC400-.02EM | 0-400V | 0-20 ma | .05% | <20 mv | 4½x6½x2½ | $150.00 |
| **SWITCHING REGULATORS** | | | | | | |
| SW5-5A | 4.5V to 5.5V | .5-5 amps | 2% | <200 mv | 4½x6½x2½ | $75.00 |
| SW12-3A | 11 to 13V | .2-3 amps | 2% | <200 mv | 4½x6½x2½ | $75.00 |
| SW15-2A | 14 to 16V | .2-2 amps | 2% | <200 mv | 4½x6½x2½ | $75.00 |

**HOPE ELECTRONICS** 20 NEWARK POMPTON TURNPIKE, WAYNE N.J. 07470 (201) 777-35

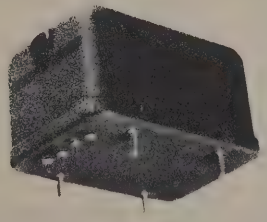
# HOPE ELECTRONICS




## LAB SUPPLIES

| Model | Output Voltage | Output Current | Regulation | Ripple & Noise | Dimensions W L H | Price 1-24 |
|---|---|---|---|---|---|---|
| PS15-2EM | 0 to 15V | 0-2 amps | .05% | <500 μv | 8½x10x3½ | $148.00 |
| PS15-4EM | 0 to 15V | 0-5 amps | .1% | <1 mv | 8½x13x5¼ | $168.00 |
| PS30-.3EM | 0 to 30V | 0-300 ma | .05% | <500 μv | 8½x10x3½ | $148.00 |
| PS30-1EM | 0 to 30V | 0-1 amp | .05% | <1 mv | 8½x10x3¼ | $158.00 |
| PS30-2EM | 0 to 30V | 0-2 amps | .1% | <1 mv | 8½x13x5¼ | $168.00 |
| PS50-.3EM | 0 to 50V | 0-300 ma | .05% | <1 mv | 8½x10x3½ | $158.00 |
| PS50-1EM | 0 to 50V | 0-1 amp | .1% | <2 mv | 8½x13x5¼ | $178.00 |
| PS100-.2EM | 0 to 100V | 0-200 ma | .1% | <2 mv | 8½x10x3½ | $168.00 |
| PS100-.5EM | 0 to 100V | 0-500 ma | .1% | <4 mv | 8½x13x5¼ | $178.00 |
| PS200-.1EM | 0 to 200V | 0-100 ma | .1% | <4 mv | 8½x10x3½ | $168.00 |
| PS200-.25EM | 0 to 200V | 0-250 ma | .1% | <5 mv | 8½x13x5¼ | $188.00 |
| **DUAL OUTPUT LAB SUPPLIES** | | | | | | |
| PS15D-1EM | ±15V | 0-1 amp | .05% | <1 mv | 8½x13x5¼ | $155.00 |
| PS12D-1EM | ±12V | 0-1 amp | .05% | <1 mv | 8½x13x5¼ | $155.00 |
| **TRIPLE OUTPUT LAB SUPPLIES** | | | | | | |
| PST12-500EM | +5V | 0-amp | .05% | <1 mv | 8½x13x5¼ | $185.00 |
| PST12-500EM | +12V | 0-500 ma | .05% | <1 mv | 8½x13x5¼ | $185.00 |
| PST12-500EM | —12V | 0-500 ma | .05% | <1 mv | 8½x13x5¼ | $185.00 |
| PST15-500EM | +5V | 0-amp | .05% | <1 mv | 8½x13x5¼ | $185.00 |
| PST15-500EM | +15V | 0-500 ma | .05% | <1 mv | 8½x13x5¼ | $185.00 |
| PST15-500EM | —12V | 0-500 ma | .05% | <1 mv | 8½x13x5¼ | $185.00 |

## MODULAR SUPPLIES



| Model | Output Voltage | Output Current | Regulation | Ripple & Noise | Price 1-24 |
|---|---|---|---|---|---|
| MPS-SAE-5 | 5V | 750 ma | .5% | <10 mv | $35.00 |
| MPS-SAE-12 | 12V | 400 ma | .5% | <10 mv | $35.00 |
| MPS-SAE-15 | 15V | 250 ma | .5% | <10 mv | $35.00 |
| MPS-SAE-24 | 24V | 250 ma | .5% | <10 mv | $35.00 |
| MPS-SAE-28 | 28V | 250 ma | .5% | <10 mv | $35.00 |

| Model | Output Voltage | Output Current | Regulation | Ripple & Noise | Price 1-24 |
|---|---|---|---|---|---|
| MPS-SB-5 | 5V | 1 amp | 1% | <10 mv | $45.00 |
| MPS-SB-12 | 12V | 500 ma | 1% | <10 mv | $45.00 |
| MPS-SB-15 | 15V | 500 ma | 1% | <10 mv | $45.00 |
| MPS-SB-24 | 24V | 300 ma | 1% | <10 mv | $45.00 |
| MPS-SB-28 | 28V | 300 ma | 1% | <10 mv | $45.00 |

**HOPE ELECTRONICS 20 NEWARK POMPTON TURNPIKE, WAYNE N.J. 07470 (201) 777-3522**

# Integrated Circuits Incorporated

# μPower™-MINI

## DC/DC CONVERTERS

**ACTUAL SIZE**
.875″ × 1.75″ × .375″

- **UP TO 9 WATTS OUTPUT POWER**
- **SMALL SIZE – 1.5 IN² (10 CM²)**
- **HIGH-EFFICIENCY HYBRID MICROELECTRONICS DESIGN**
- **LOW COST — HIGH RELIABILITY**
- **SINGLE OR DUAL OUTPUTS**
- **FULLY ISOLATED TO >100 MEGOHMS AT 500VDC**
- **REGULATED AND UNREGULATED MODELS**
- **SOLID POTTED MODULE WITH HEAVY-DUTY PINS**
- **CUSTOM INPUT/OUTPUT CONFIGURATIONS TO YOUR SPECIFICATION**

*The* **μPower-MINI** product line is comprised of a broad family of miniature *DC-to-DC Converters designed for "on-card" power con* *version where high power outputs are required, but little space is provided.* **μPower-MINI** converters can provide up to 9 watts out put, depending on the input/output configuration selected. Available in *SINGLE or DUAL OUTPUTS,* these converters can provide + or ± OUTPUTS with *100 MEGOHM @ 500VDC ISOLATION.* The **μPower-MINI** converter's small size is misleading, as they operat very efficiently and reliably, even when operating at maximum loads. *HYBRID MICROELECTRONIC* construction provides mor power per dollar than competitive units in their size/price range.

**APPLICATIONS:** μProcessors, μComputers, Digital Circuits, Analog Circuits, Displays and Readouts in Computers, Industrial, Aerc space, Telephone, Automotive, Marine and Communications electronic equipment. **μPower-MINI** converters are also available, o special order, in Military grades which meet *MIL-STD-883,* CLASS B and *MIL-M-38510.*

| MODEL | VDC INPUT | OUTPUT — FULL LOAD @ 25°C | | | T.C. | REGULATION | | MAXIMUM |
|---|---|---|---|---|---|---|---|---|
| | | VDC | mA | EFF. % | %/°C | LINE % | LOAD % | WATTS |
| **UNREGULATED SINGLE AND DUAL OUTPUT MODELS** | | | | | | | | |
| DC0512D | 5 ± 25% | ± 12 ± 6% | 250 | 75 | ± 0.02 | •• | ± 5% | 6.00 |
| DC0515D | 5 ± 25% | ± 15 ± 6% | 200 | 75 | ± 0.02 | •• | ± 5% | 6.25 |
| DC1205S | 12 ± 25% | 5 ± 6% | 1250 | 65 | ± 0.02 | •• | ± 5% | 7.20 |
| DC1212D | 12 ± 25% | ± 12 ± 6% | 300 | 75 | ± 0.02 | •• | ± 5% | 7.50 |
| DC1215D | 12 ± 25% | ± 15 ± 6% | 250 | 75 | ± 0.02 | •• | ± 5% | 9.00 |
| DC1218D | 12 ± 25% | ± 18 ± 6% | 250 | 75 | ± 0.02 | •• | ± 5% | 6.25 |
| DC2805S | 28 ± 15% | 5 ± 6% | 1250 | 65 | ± 0.02 | •• | ± 5% | 7.20 |
| DC2812D | 28 ± 15% | ± 12 ± 6% | 300 | 75 | ± 0.02 | •• | ± 5% | 7.50 |
| DC2815D | 28 ± 15% | ± 15 ± 6% | 250 | 75 | ± 0.02 | •• | ± 5% | 9.00 |
| DC2818D | 28 ± 15% | ± 18 ± 6% | 250 | 75 | ± 0.02 | •• | ± 5% | 6.25 |
| DC4805S | 48 ± 16% | 5 ± 6% | 1250 | 65 | ± 0.02 | •• | ± 5% | 7.20 |
| DC4812D | 48 ± 16% | ± 12 ± 6% | 300 | 75 | ± 0.02 | •• | ± 5% | 7.50 |
| DC4815D | 48 ± 16% | ± 15 ± 6% | 250 | 75 | ± 0.02 | •• | ± 5% | 9.00 |
| DC4818D | 48 ± 16% | ± 18 ± 6% | 250 | 75 | ± 0.02 | •• | ± 5% | 6.00 |
| **REGULATED DUAL TRACKING OUTPUT MODELS** | | | | | | | | |
| DCR0512DT | 5 ± 10% | ± 12 ± 0.8% | 170 | 55 | ± 0.02 | 0.05 | 0.03 | 4.00 |
| DCR0515DT | 5 ± 10% | ± 15 ± 0.7% | 150 | 55 | ± 0.02 | 0.05 | 0.03 | 4.50 |
| DCR1212DT | 12 ± 15% | ± 12 ± 0.8% | 180 | 55 | ± 0.02 | 0.05 | 0.03 | 4.30 |
| DCR1215DT | 12 ± 15% | ± 15 ± 0.7% | 150 | 55 | ± 0.02 | 0.05 | 0.03 | 4.50 |
| DCR2812DT | 28 ± 15% | ± 12 ± 0.8% | 180 | 55 | ± 0.02 | 0.05 | 0.03 | 4.30 |
| DCR2815DT | 28 ± 15% | ± 15 ± 0.7% | 150 | 55 | ± 0.02 | 0.05 | 0.03 | 4.50 |
| DCR4812DT | 48 ± 15% | ± 12 ± 0.8% | 180 | 55 | ± 0.02 | 0.05 | 0.03 | 4.50 |
| DCR4815DT | 48 ± 15% | ± 15 ± 0.7% | 150 | 55 | ± 0.02 | 0.05 | 0.03 | 4.30 |
| **REGULATED SINGLE OUTPUT MODELS** | | | | | | | | |
| SR0505S* | 5 ± 10% | 5 ± 1.0% | 1000 | 70 | ± 0.02 | 0.05 | 0.05 | 5.00 |
| SR1205S* | 12 ± 15% | 5 ± 1.0% | 1500 | 70 | ± 0.02 | 0.05 | 0.05 | 7.50 |
| SR2805S* | 28 ± 15% | 5 ± 1.0% | 1500 | 72 | ± 0.02 | 0.05 | 0.05 | 7.50 |
| SR4805S* | 48 ± 15% | 5 ± 1.0% | 1500 | 72 | ± 0.02 | 0.05 | 0.05 | 7.50 |

*SR MODELS ARE .925″ × 1.875″ × .43″ (1.7IN²—11CM²)

**PROPORTIONAL TO OUTPUT VOLTAG

**ALL UNITS SHOWN ARE STOCK. DELIVERY ON LARGE QUANTITIES: STOCK TO 90 DAYS ARC**

Other *INPUT/OUTPUT* voltage and power configurations in consumer, industrial, computer and military grades can be custom designed in the **μPower-MINI** package to me your specific requirements. Custom versions use the same proprietary circuitry as those above, but are tailored to meet your specific application and are quoted on a individual basis.

***CUSTOM THICK-FILM HYBRID MICROELECTRONICS ARE OUR SPECIALTY. CONTACT ICI FOR QUOTATIONS ON YOUR CURRENT OR FUTURE REQUIREMENTS ON AN ANALOG, DIGITAL OR POWER CIRCUITS....YOUR DESIGN OR OURS.***

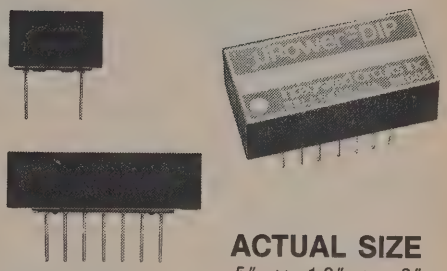
**(206)747-8556 • 13256 Northup Way, Bellevue, WA 98005 • TWX 910-433-230**

# Integrated Circuits Incorporated

# μPower™-DIP

## DC/DC CONVERTERS

- 14 PIN SINGLE DUAL-IN-LINE (DIP) PACKAGE
- DIP SOCKET COMPATIBLE
- HIGH-EFFICIENCY HYBRID MICROELECTRONICS DESIGN
- LOW COST — HIGH RELIABILITY
- SINGLE OR MULTIPLE OUTPUTS
- 3 TO 7VDC, 5VDC, 12VDC, 24VDC AND 48VDC INPUT RANGES
- UP TO 1.5 WATTS REGULATED OUTPUT
- REGULATED AND ISOLATED MODELS AVAILABLE
- CUSTOM INPUT/OUTPUT CONFIGURATIONS TO YOUR SPECIFICATIONS



**ACTUAL SIZE**
.5″ × 1.0″ × .3″

The **μPower-DIP** product line is comprised of a broad family of micro-miniature *DC-to-DC Converters* designed for "on-card" power conversion. All **μPower-DIP** models are pin compatible with standard 14 PIN DIP sockets. Depending on the input/output configuration selected, up to 1.5 watts of output power can be provided by a single **μPower-DIP.** Their small size allows better use of space in new and existing designs by requiring only one primary supply source. Available in *SINGLE or DUAL OUTPUTS,* the **μPower-DIP** can provide +, +/− or ± voltages as shown in the chart below. The *HYBRID MICROELECTRONIC* construction of the **μPower-DIP** provides more power in a smaller package than any other competitive unit regardless of price.

**APPLICATIONS:** μProcessors, μComputers, Digital Circuits, Analog Circuits, Displays and Readouts in Computers, Industrial, Aerospace, Telephone, Automotive, Marine and Communications electronic equipment. **μPower-DIP** converters are also available, on special order, in Military grades which meet *MIL-STD-883,* CLASS B and *MIL-M-38510.*

| MODEL | VDC INPUT | OUTPUT VDC FULL LOAD @ 25°C | EFF. % | MAX WATTS |
|---|---|---|---|---|
| ISOLATED DUAL TRACKING MODELS | | | | |
| DIP512DT | 5 ± 0.5V | ±12V @ 38mA | 55 | 0.90 |
| DIP515DT | 5 ± 0.5V | ±15V @ 30mA | 55 | 0.90 |
| DIP1212DT | 12 ± 2.0V | ±12V @ 38mA | 55 | 0.90 |
| DIP1215DT | 12 ± 2.0V | ±15V @ 30mA | 55 | 0.90 |
| DIP2812DT | 28 ± 4.0V | ±12V @ 38mA | 55 | 0.90 |
| DIP2815DT | 28 ± 4.0V | ±15V @ 30mA | 55 | 0.90 |
| DIP5012DT | 50 ± 6.0V | ±12V @ 38mA | 55 | 0.90 |
| DIP5015DT | 50 ± 6.0V | ±15V @ 30mA | 55 | 0.90 |
| NON-ISOLATED DUAL OUTPUT REGULATED/UNREGULATED MODELS | | | | |
| DIP370505DP | +3 TO +7V | + 5 REG/− 5 $\overline{\text{REG}}$* | 70 | 1.10 |
| DIP371205DP | +3 TO +7V | +12 REG/− 5 $\overline{\text{REG}}$* | 78 | 1.25 |
| DIP371212DP | +3 TO +7V | +12 REG/−12 $\overline{\text{REG}}$* | 78 | 1.25 |
| DIP371212DN | +3 TO +7V | −12 REG/+12 $\overline{\text{REG}}$* | 78 | 1.25 |
| DIP371212DB | +3 TO +7V | ±12 REG, BAL, $\overline{\text{REG}}$ | 78 | 1.25 |
| DIP371515DB | +3 TO +7V | ±15 REG, BAL. $\overline{\text{REG}}$ | 78 | 1.25 |
| DIP505SN | +5 ±0.5V | −5V REG SINGLE OUTPUT | 70 | 1.10 |
| DIP51205DP | +5 ±0.5V | +12 REG/− 5 $\overline{\text{REG}}$* | 78 | 1.25 |
| DIP51212DP | +5 ±0.5V | +12 REG/−12 $\overline{\text{REG}}$* | 78 | 1.25 |

ALSO AVAILABLE, ON SPECIAL ORDER, WITH BOTH OUTPUTS REGULATED.

| MODEL | VDC INPUT | OUTPUT VDC FULL LOAD @ 25°C | EFF. % | MAX WATTS |
|---|---|---|---|---|
| NON-ISOLATED DUAL OUTPUT REGULATED/UNREGULATED MODELS | | | | |
| DIP51212DN | + 5 ±0.5V | −12 REG/+12 $\overline{\text{REG}}$* | 78 | 1.25 |
| DIP51212DB | + 5 ±0.5V | ±12 REG, BAL. $\overline{\text{REG}}$ | 78 | 1.25 |
| DIP51515DB | + 5 ±0.5V | ±15 REG, BAL. $\overline{\text{REG}}$ | 78 | 1.25 |
| DIP120505DP | +12 ±3.0V | + 5 REG/− 5 $\overline{\text{REG}}$* | 72 | 1.20 |
| DIP121205DN | ±12 ±3.0V | −12 REG/+ 5 $\overline{\text{REG}}$* | 80 | 1.50 |
| DIP240505DP | +24 ±8.0V | + 5 REG/− 5 $\overline{\text{REG}}$* | 72 | 1.20 |
| DIP241205DP | +24 ±8.0V | +12 REG/− 5 $\overline{\text{REG}}$* | 80 | 1.50 |
| DIP241212DP | +24 ±8.0V | +12 REG/−12 $\overline{\text{REG}}$* | 80 | 1.50 |
| DIP241212DN | +24 ±8.0V | −12 REG/+12 $\overline{\text{REG}}$* | 80 | 1.50 |
| DIP241212DB | +24 ±8.0V | ±12 REG, BAL. $\overline{\text{REG}}$ | 80 | 1.50 |
| DIP241515DB | +24 ±8.0V | ±15 REG, BAL. $\overline{\text{REG}}$ | 80 | 1.50 |
| DIP500505DP | −50 ±8.0V | + 5 REG/− 5 $\overline{\text{REG}}$* | 72 | 1.20 |
| DIP501205DP | −50 ±8.0V | ±12 REG/− 5 $\overline{\text{REG}}$* | 80 | 1.50 |
| DIP501212DP | −50 ±8.0V | +12 REG/−12 $\overline{\text{REG}}$* | 80 | 1.50 |
| DIP501212DN | −50 ±8.0V | −12 REG/+12 $\overline{\text{REG}}$* | 80 | 1.50 |
| DIP501212DB | −50 ±8.0V | ±12 REG, BAL. $\overline{\text{REG}}$ | 80 | 1.50 |
| DIP501515DB | −50 ±8.0V | ±15 REG, BAL. $\overline{\text{REG}}$ | 80 | 1.50 |
| CONTACT ICI FOR ADDITIONAL MODELS NOT SHOWN | | | | |

$\overline{\text{REG}}$ INDICATES NOT REGULATED

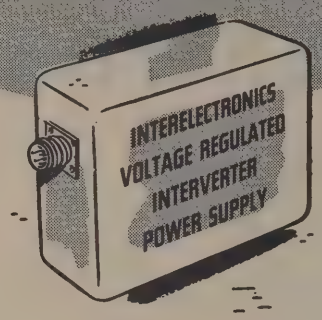
**ALL UNITS SHOWN ARE STOCK. DELIVERY ON LARGE QUANTITIES: STOCK TO 90 DAYS ARO.**

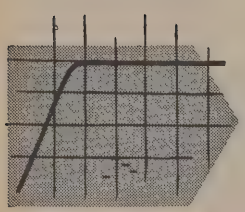
Other *INPUT/OUTPUT* voltage and power configurations in consumer, industrial, computer and military grades can be custom designed in the **μPower-DIP** package to meet your specific requirements. Custom versions use the same proprietary circuitry as shown above, but are tailored to meet your specific application and are quoted on an individual basis.

**CUSTOM THICK-FILM HYBRID MICROELECTRONICS ARE OUR SPECIALTY. CONTACT ICI FOR QUOTATIONS ON YOUR CURRENT OR FUTURE REQUIREMENTS ON ANY ANALOG, DIGITAL OR POWER CIRCUITS....YOUR DESIGN OR OURS.**

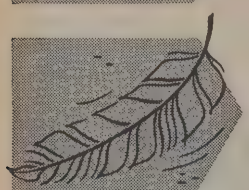
**TWX 910-443-2302 • 13256 Northup WAY, Bellevue, WA 98005 • (206) 747-8556**

# PROVEN RELIABILITY—
## DC-DC, DC-AC, SOLID-STATE POWER INVERTERS
## over 260,000 logged hours— voltage-regulated, frequency-controlled, for missile, telemeter, ground-support, 135°C all-silicon units available now—

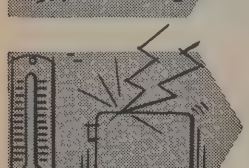


Interelectronics all-silicon thyratron-like gating elements and cubic-grain toroidal magneti components convert DC to any desired number of AC or DC outputs from 1 to 10,000 watts.

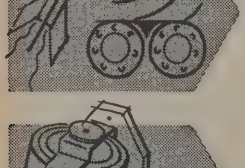


Ultra-reliable in operation (over 260,000 logged hours), no moving parts, unharmed by shortin output or reversing input polarity. High conversion efficiency (to 92%, including voltage regulatio by Interelectronics patented reflex high-efficiency magnetic amplifier circuitry).

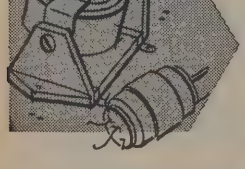


Wide input voltage range (1 to 250 volts DC). Wide input voltage regulation (output voltag maintained with variations up to 50% in input voltage).

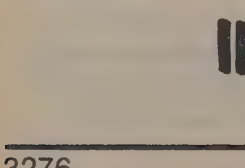
Light weight (to 6 watts/oz.), compact (to 8 watts/cu. in.), low ripple (to 0.01 mv. p-p), excelle voltage regulation (to 0.1%), precise frequency control (to 0.2%) with Interelectronics extrem environment magnetostrictive standards or to 0.0001% with fork or piezoelectric standards.



Complies with MIL specs. for shock (100G 11 misc.), acceleration (100G 15 min.), vibratic (100G 5 to 5,000 cps.), temperature (to 150 degrees C), RF noise (I-26600).



AC single and polyphase units supply sine waveform output (to 2% harmonics), will deliver u to ten times rated line current into a short circuit to actuate MIL type magnetic circuit breakers fuses, will start gyros and motors with starting current surges up to ten times normal operating lir current.



Now in use in major missiles, powering telemeter transmitters, radar beacons, electronic equi ment. Single and polyphase units now power airborne and marine missile gyros, synchros, servo magnetic amplifiers.

Interelectronics—first and most experienced in the solid-state power supply field produces its ov all-silicon solid-state gating elements, all high flux density magnetic components, high temperatu ultra-reliable film capacitors and components, has complete facilities and know how—has design and delivered more working KVA than any other firm!

For complete engineering data, write Interelectronics today, or call (914) EL 8-8000 in Conger

# INTERELECTRONICS CORPORATION
## 550 U.S. Route 303, Congers, New York 10920

JEROME INDUSTRIES
391E LAKESIDE AVENUE
ORANGE, NJ 07050 • (201) 678-9595

# POWER PLUG-IN ADAPTERS

- Transformers
- Battery Chargers
- Power Supplies
- Battery Eliminators
- Power Supply/Chargers.

## FOR USE WITH ELECTRICALLY OPERATED:

- Computers and Calculators
- Office Equipment
- Home Appliances
- Alarm Systems
- Instruments
- Photographic Equipment
- Games and Toys
- Medical Appliances
- Gardening Appliances

The Jerome plug-in power units are primarily isolation step down transformers (fig. 1) making the products they operate safer to use.

Power supplies, battery chargers, battery eliminators, and combinations of these, include the isolation transformers plus rectifying and voltage regulating circuits (fig. 2 and 3).

Although many standard units are available, electrically most are engineered and designed to meet the specific requirements of the products they are to energize. Accessories can also be designed for special applications.

By using these plug-in units the designer has more flexibility and can simplify, enhance the appearance, and improve the portability of his product by not having to include a power supply in the product enclosure.

Other advantages:

- Power supply heat not included in product
- Easier maintenance of power source
- Reduction or elimination of the costly need to submit equipment for U.L. and CSA investigation.

## MODELS PI-B, PI-D, PI-E, PI-F AND PI-G

These units come in attractive stylized molded cases to make them suitable accessories for any consumer, commercial or industrial product.

**MECHANICAL FEATURES**

- Model PI-B — cord set output (terminal plugs to specification)
- Model PI-D — screw terminal output
- Model PI-E (Same as PI-B except smaller case)
- Model PI-F — large version of PI-B
- Model PI-G (Large version of PI-D)
- Molded case — dual tapered surfaces for positive push-pull grip
- Case can be molded in a variety of colors and materials
- Hot leafed stamped logos or design enhance the case appearance.
- Designed for U.L. and C.S.A. listing

**ELECTRICAL FEATURES**

- Units available to supply voltage output up to 30 volts and 35 watts of power.
- Isolated — low voltage operation of product.

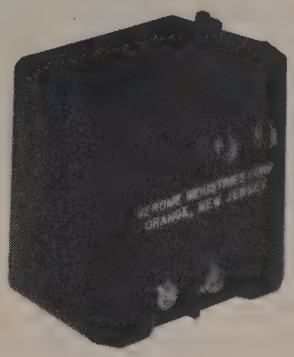
## GENERAL FOR ALL ADAPTERS

**AVAILABLE AS:**

- Transformers
- Power supplies
- Battery chargers for Ni-Cad, Lead Acid, Manganese-Alkaline and other batteries
- Battery eliminators

**OTHER AVAILABLE FEATURES**

- On and Off switch
- Pilot light
- Regulated output
- Fast Charge Circuits
- Cut off circuits
- And others to customer requirements.
- 240/120 switchable input



FACING AREA CUSTOMER LABELED

MODEL PI-D

MODEL PI-B

MODEL PI-E (SMALLER CASE)

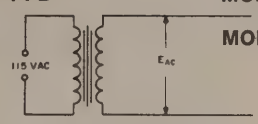



Fig. 1

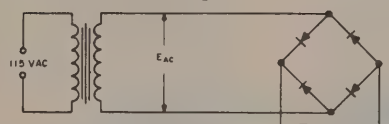



Fig. 2

TYPICAL OF MANY CIRCUITS AVAILABLE

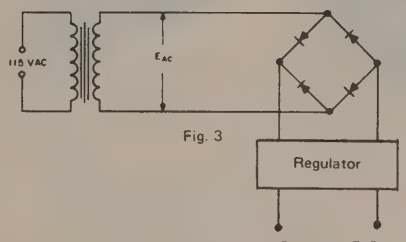
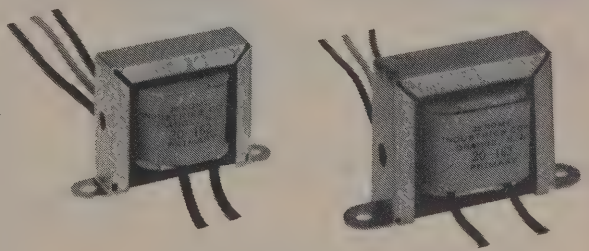
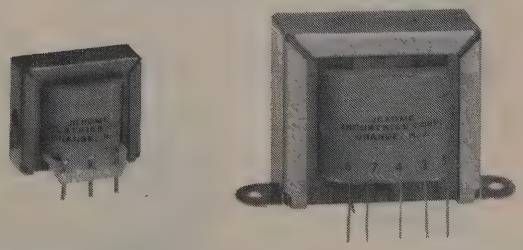



Fig. 3

### TRANSFORMERS — CHASSIS MOUNT



### TRANSFORMER — PRINTED CIRCUIT MOUNT



**Designed for Minimum Size and Weight, Single and Multiple Input and Output.**

# KEPCO power supplies

**Power Supplies for the OEM, Power Supplies for the Laboratory. Power Supplies for the System Designer . . .**

Kepco offers a broad spectrum of well made a-c to d-c and d-c to d-c voltage and current stabilizers employing various control techniques:

**LINEAR:** Series pass and shunt circuits.
**FERRORESONANT:** Modular & systems styles.
**SWITCHING:** 25 KHz modules for small size.

## KEPCO also produces a variety of specialty Power Supplies.

**UNIPOLAR OPERATIONAL:** programmable power supplies responsive to analog controls, variable resistance and analog inputs (including an IEEE-488 compatible programmer).

**UNIPOLAR OPERATIONAL - High Speed:** programmable at substantially faster rates than the conventionally filtered models for application where the energy storage of an ordinary output capacitor is not desired.

**BIPOLAR OPERATIONAL - High Speed:** called "BOP", these power supplies are programmable in four quadrants (plus and minus voltage, plus and minus current, source & sink) going linearly through zero. BOP's function just like a power op-amp.

**OEM MODULAR:** these models, provided without meters or controls, are designed to be built right into your system. There are three different types catalogued below; Linear (series pass), Ferroresonant (saturating transformer) and Switching (25 KHz).

## OEM LINEAR MODULES

(Please refer to the JQE and CPS designs which are available unmetered as OEM LINEAR MODULES.)

### 20 WATT PROGRAMMABLE MODELS

**PAT**

Programmable voltage stabilizer, current limited.

**PCX**

Programmable voltage stabilizer, current limited.

Table of volt-amperes for PAT, PCX, CCP and OPS-I.

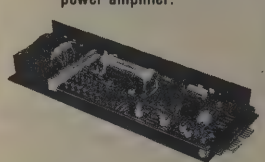
| VOLTS | AMPS |
|---|---|
| 0-7 | 0-2 |
| 0-15 | 0-1.5 |
| 0-21 | 0-1 |
| 0-40 | 0-0.5 |
| 0-72 | 0-0.3 |
| 0-100 | 0-0.2 |

**CCP**

Programmable current stabilizer, voltage limited.

**OPS group I**

Fast programmable, model for use as operational power amplifier.



### 50 WATT PROGRAMMABLE MODELS

**PTR**

Programmable voltage/current stabilizer with automatic crossover and optional overvoltage protection, conventional speed design.

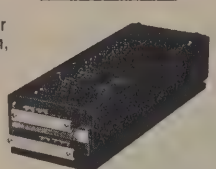
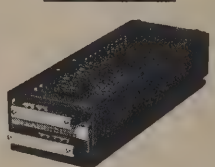


Table of volts-amperes for PTR and OPS-III.

| VOLTS | AMPS |
|---|---|
| 0-7 | 0-5.5 |
| 0-15 | 0-3.3 |
| 0-21 | 0-2.5 |
| 0-40 | 0-1.4 |
| 0-72 | 0-0.8 |
| 0-100 | 0-0.6 |

**OPS group III**



OPS-III is like the PTR, except is a fast programmable design for high speed programming. As a current stabilizer, it has fast recovery. No OVP available.

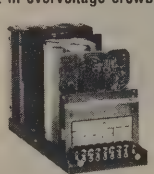
### LINEAR OEM POWER SUPPLIES

**BKFI**

Non-programmable voltage stabilizers with re-entrant current limiting, built-in overvoltage crowbar.

**BKFII**

Non-programmable, voltage stabilizer with re-entrant current limting. Built-in overvoltage crowbar.



**BKFI**

| VOLTS | AMPS |
|---|---|
| 1.25 ± 10% | 0-7 |
| 3.5 ± 10% | 0-5 |
| 5.0 ± 10% | 0-3 |
| 5.0 ± 10% | 0-5 |
| 12.0 ± 10% | 0-1.4 |
| 12.0 ± 10% | 0-2.4 |
| 15.0 ± 10% | 0-1.2 |
| 15.0 ± 10% | 0-2 |
| 24.0 ± 10% | 0-0.8 |
| 24.0 ± 10% | 0-1.2 |
| 28.0 ± 10% | 0-0.6 |
| 28.0 ± 10% | 0-1 |

**BKFII**

| VOLTS | AMPS |
|---|---|
| 5 ± 5% | 0-11 |
| 8 ± 5% | 0-10 |
| 12 ± 5% | 0-7 |
| 15 ± 5% | 0-6 |
| 24 ± 5% | 0-4 |
| 28 ± 5% | 0-4 |
| 36 ± 5% | 0-3 |
| 48 ± 5% | 0-2.5 |

**DTM**

Dual, plus-minus outputs track a single control.

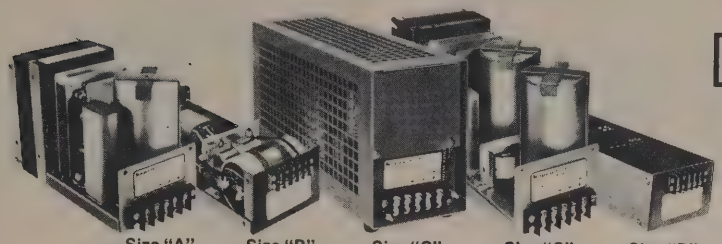
**DTM**

| VOLTS | AMPS |
|---|---|
| 0- ± 16 | 0- ± 0.6 |

KEPCO, INC. • 131-38 SANFORD AVENUE • FLUSHING, N.Y. 11352 U.S.A. • (212) 461-7000 • TWX #710-582-2631 • Cable: KEPCOPOWER NEWYORK

# FERRORESONANT OEM MODULES

**Fixed output, heavy duty stabilizers for exceptional longevity under rugged conditions. PRM's offer high efficiency (60-75%) and excellent source isolation.**
**For custom volt-ampere combinations, consult factory.**




PRM

**Tap adjustable output, 60 Watts.**

## Size D

| VOLTS | AMPS |
|---|---|
| 5.0 | 10.0 |
| 6.3 | 8.0 |
| 8.0 | 7.0 |
| 10.0 | 6.0 |
| 12.0 | 5.0 |
| 15.0 | 4.0 |
| 18.0 | 3.3 |
| 21.0 | 2.9 |
| 26.0 | 2.3 |
| 36.0 | 1.7 |
| 48.0 | 1.25 |
| 60.0 | 1.00 |
| 70.0 | 0.86 |
| 90.0 | 0.67 |
| 120.0 | 0.50 |
| 160.0 | 0.37 |
| 240.0 | 0.25 |

**Fixed output 120 Watts.**

## Size B

| VOLTS | AMPS |
|---|---|
| 5.2 | 0-15 |
| 6.3 | 0-15 |
| 12.0 | 0-10 |
| 18.0 | 0-6.7 |
| 24.0 | 0-5 |
| 28.0 | 0-4.3 |
| 36.0 | 0-3.3 |
| 48.0 | 0-2.5 |
| 60.0 | 0-2 |
| 120.0 | 0-1 |

**Fixed output 180 Watts.**

## Size A

| VOLTS | AMPS |
|---|---|
| 5.2 | 0-25 |
| 6.3 | 0-25 |
| 12.0 | 0-15 |
| 18.0 | 0-10 |
| 24.0 | 0-8 |
| 28.0 | 0-7 |
| 36.0 | 0-5 |
| 48.0 | 0-4 |
| 60.0 | 0-3 |
| 120.0 | 0-1.5 |

**180 Watts with an extra Pi section filter for low ripple.**

## Size C

| VOLTS | AMPS |
|---|---|
| 5.2 | 0-25 |
| 6.3 | 0-25 |
| 12.0 | 0-15 |
| 18.0 | 0-10 |
| 24.0 | 0-8 |
| 28.0 | 0-7 |
| 36.0 | 0-5 |
| 48.0 | 0-4 |
| 60.0 | 0-3 |
| 120.0 | 0-1.5 |

**300 Watts comprised of two 150 Watt sections in dual output configuration.**

## Size C

| VOLTS | AMPS |
|---|---|
| 4.5 | 0-20 |
| 5.2 | 0-20 |
| 6.3 | 0-20 |
| 12.0 | 0-12 |
| 15.0 | 0-10 |
| 18.0 | 0-8 |
| 24.0 | 0-6 |
| 28.0 | 0-5 |
| 36.0 | 0-4 |
| 48.0 | 0-3 |
| 60.0 | 0-2.5 |

**Fixed output 450 Watts.**

## Size C

| VOLTS | AMPS |
|---|---|
| 12 | 0-35 |
| 24 | 0-20 |
| 28 | 0-17 |
| 48 | 0-10 |

For 60 Hz ±3 Hz only.
For 50 Hz service areas, a reduced-output (80%) version of the ferroresonant power supplies is available.

# SWITCHING MODE OEM MODULES

RMK **100-130V a-c, a-c input (130-170V d-c)**

RMX **Selectable 100-130V a-c or 200-260V a-c (260-340V d-c).**

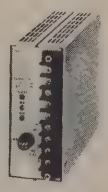
**High frequency, high efficiency power supplies with built-in overvoltage and current limiter.**

## Size S

| VOLTS | OUTPUT CURRENT - AMPERES VS. TEMPERATURE | | | | |
|---|---|---|---|---|---|
| | 30°C | 40°C | 50°C | 60°C | 71°C |
| 3.5-5.5 | 6.9 | 6.4 | 6.0 | 4.2 | 2.4 |
| 6.3-9.9 | 4.1 | 3.7 | 3.3 | 2.3 | 1.3 |
| 8.4-13.2 | 3.0 | 2.7 | 2.5 | 1.7 | 1.0 |
| 10.5-16.5 | 2.4 | 2.2 | 2.0 | 1.4 | 0.8 |
| 16.8-26.4 | 1.6 | 1.4 | 1.3 | 0.9 | 0.5 |

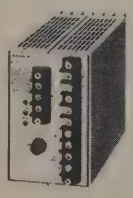
## Size A

| VOLTS | OUTPUT CURRENT - AMPS VS. TEMPERATURE | | | | |
|---|---|---|---|---|---|
| | 30°C | 40°C | 50°C | 60°C | 71°C |
| 3.5-5.5 | 12.0 | 10.8 | 10.0 | 8.3 | 5.0 |
| 6.3-9.9 | 7.6 | 6.8 | 6.0 | 5.2 | 2.7 |
| 8.4-13.2 | 6.3 | 5.6 | 5.0 | 4.3 | 2.0 |
| 10.5-16.5 | 5.0 | 4.5 | 4.0 | 3.4 | 1.7 |
| 16.8-26.4 | 3.2 | 2.8 | 2.5 | 2.2 | 1.0 |
| 19.6-30.8 | 2.65 | 2.40 | 2.15 | 1.90 | 0.90 |



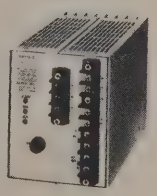
## Size B

| VOLTS | OUTPUT CURRENT - AMPS VS. TEMPERATURE | | | | |
|---|---|---|---|---|---|
| | 30°C | 40°C | 50°C | 60°C | 71°C |
| 3.5-5.5 | 36.0 | 34.0 | 26.0 | 17.0 | 9.0 |
| 6.3-9.9 | 20.0 | 17.0 | 15.0 | 10.0 | 5.2 |
| 8.4-13.2 | 16.6 | 15.0 | 12.0 | 8.0 | 4.2 |
| 10.5-16.5 | 13.3 | 13.3 | 10.2 | 6.2 | 3.3 |
| 16.8-26.4 | 8.5 | 8.5 | 7.5 | 4.7 | 2.3 |
| 19.6-30.8 | 7.2 | 6.8 | 6.4 | 4.6 | 2.0 |



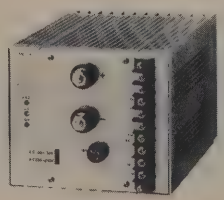
## Size C

| VOLTS | OUTPUT CURRENT - AMPS VS. TEMPERATURE | | | | |
|---|---|---|---|---|---|
| | 30°C | 40°C | 50°C | 60°C | 71°C |
| 3.5-5.5 | 40.0 | 38.0 | 30.0 | 21.5 | 14.0 |
| 6.3-9.9 | 22.0 | 22.0 | 17.2 | 12.5 | 7.7 |
| 8.4-13.2 | 17.0 | 17.0 | 14.6 | 10.5 | 5.8 |
| 10.5-16.5 | 14.0 | 14.0 | 12.3 | 8.3 | 4.7 |
| 16.8-26.4 | 9.0 | 9.0 | 8.0 | 5.5 | 3.0 |
| 19.6-30.8 | 7.7 | 7.7 | 6.8 | 4.7 | 2.5 |



## Size D

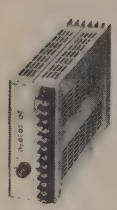
| VOLTS | OUTPUT CURRENT - AMPS VS. TEMPERATURE | | | | |
|---|---|---|---|---|---|
| | 30°C | 40°C | 50°C | 60°C | 71°C |
| 3.5-5.5 | 70.0 | 70.0 | 60.0 | 42.0 | 30.0 |
| 6.3-9.9 | 37.0 | 37.0 | 32.0 | 24.0 | 16.0 |
| 8.4-13.2 | 36.0 | 36.0 | 32.0 | 22.0 | 12.0 |
| 10.5-16.5 | 32.0 | 32.0 | 27.0 | 14.0 | 11.0 |
| 16.8-26.4 | 18.0 | 18.0 | 16.0 | 11.0 | 6.0 |
| 19.6-30.8 | 15.4 | 15.4 | 13.7 | 9.4 | 5.1 |



# KEPCO POWER SUPPLIES

## SWITCHING MODE OEM MODULES

### RMT TRIPLE OUTPUT MODELS



**Size AA Models**

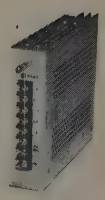
| MODEL * | PRINCIPAL OUTPUT #1 | | AUXILIARY OUTPUT #2 | | AUXILIARY OUTPUT #3 | |
|---|---|---|---|---|---|---|
| | VOLTS | AMPS | VOLTS | AMPS | VOLTS | AMPS |
| RMT 001 AA | +5 | 10 | +12 | 1 | −12 | 1 |
| RMT 002 AA | +5 | 10 | +15 | 1 | −15 | 1 |
| RMT 003 AA | +5 | 10 | +12 | 1 | −5 | 1 |
| RMT 004 AA | +5 | 10 | +15 | 1 | −5 | 1 |
| RMT 005 AA | +5 | 10 | +12 | 1 | −9 | 1 |

50°C ratings. At +71°C. derate principal output to 4.0A. Derate each auxiliary output to 0.3A.

**Size SA Models**

| MODEL | PRINCIPAL OUTPUT #1 | | AUXILIARY OUTPUT #2 | | AUXILIARY OUTPUT #3 | |
|---|---|---|---|---|---|---|
| | VOLTS | AMPS | VOLTS | AMPS | VOLTS | AMPS |
| RMT 021 SA | +5 | 6 | +12 | 0.3 | −12 | 0.3 |
| RMT 022 SA | +5 | 6 | +15 | 0.3 | −15 | 0.3 |
| RMT 023 SA | +5 | 6 | +12 | 0.3 | −5 | 0.3 |
| RMT 024 SA | +5 | 6 | +15 | 0.3 | −5 | 0.3 |
| RMT 025 SA | +5 | 6 | +12 | 0.3 | −9 | 0.3 |

50°C ratings. At +71°C. derate the principal output to 2.4A. Derate each auxiliary output to 0.1A.



* These models for 100-130V a-c, a-c input only. For identical models operating from 200-260V a-c, add the suffix "-230" to the model number.

### RMD d-c to d-c CONVERTERS

**Size A - 24V d-c input.**

| VOLTS | OUTPUT CURRENT - AMPERES VS. TEMPERATURE | | | | |
|---|---|---|---|---|---|
| | 30°C | 40°C | 50°C | 60°C | 71°C |
| 3.5-5.5 | 12.0 | 12.0 | 10.0 | 8.3 | 5.0 |
| 6.3-9.9 | 7.6 | 6.8 | 6.0 | 5.2 | 2.7 |
| 8.4-13.2 | 6.3 | 5.6 | 5.0 | 4.3 | 2.0 |
| 10.5-16.5 | 5.0 | 4.5 | 4.0 | 3.4 | 1.7 |
| 16.8-26.4 | 3.2 | 2.8 | 2.5 | 2.2 | 1.0 |

**Size A - 48V d-c input.**

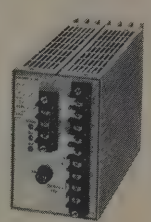
| VOLTS | OUTPUT CURRENT - AMPERES VS. TEMPERATURE | | | | |
|---|---|---|---|---|---|
| | 30°C | 40°C | 50°C | 60°C | 71°C |
| 3.5-5.5 | 12.0 | 10.8 | 10.0 | 8.3 | 5.0 |
| 6.3-9.9 | 7.6 | 6.8 | 6.0 | 5.2 | 2.7 |
| 8.4-13.2 | 6.3 | 5.6 | 5.0 | 4.3 | 2.0 |
| 10.5-16.5 | 5.0 | 4.5 | 4.0 | 3.4 | 1.7 |
| 16.8-26.4 | 3.2 | 2.8 | 2.5 | 2.2 | 1.0 |

**Size B - 24V d-c input.**

| VOLTS | OUTPUT CURRENT - AMPERES VS. TEMPERATURE | | | | |
|---|---|---|---|---|---|
| | 30°C | 40°C | 50°C | 60°C | 71°C |
| 3.5-5.5 | 28.0 | 28.0 | 26.0 | 17.0 | 9.0 |
| 6.3-9.9 | 16.0 | 16.0 | 15.0 | 10.0 | 5.2 |
| 8.4-13.2 | 12.0 | 12.0 | 12.0 | 8.0 | 4.2 |
| 10.5-16.5 | 9.5 | 9.5 | 9.5 | 6.2 | 3.3 |
| 16.8-26.4 | 6.0 | 6.0 | 6.0 | 4.7 | 2.3 |

**Size B - 48V d-c input.**

| VOLTS | OUTPUT CURRENT - AMPERES VS TEMPERATURE | | | | |
|---|---|---|---|---|---|
| | 30°C | 40°C | 50°C | 60°C | 71°C |
| 3.5-5.5 | 36.0 | 34.0 | 26.0 | 17.0 | 9.0 |
| 6.3-9.9 | 20.0 | 17.0 | 15.0 | 10.0 | 5.2 |
| 8.4-13.2 | 15.0 | 15.0 | 12.0 | 8.0 | 4.2 |
| 10.5-16.5 | 12.0 | 12.0 | 10.2 | 6.2 | 3.3 |
| 16.8-26.4 | 7.5 | 7.5 | 7.5 | 4.7 | 2.3 |



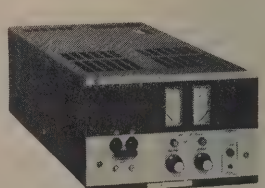
## LABORATORY/SYSTEMS MODELS

### ATE

**The power supplies for Automatic Test Equipment systems. Automatic crossover, programmable, voltage, current, overvoltage protector.**

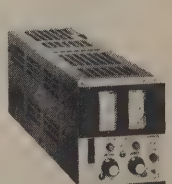
**250 Watt**
**Half-rack Models**

| VOLTS | AMPS |
|---|---|
| 0-6 | 0-25 |
| 0-15 | 0-15 |
| 0-25 | 0-10 |
| 0-36 | 0-8 |
| 0-55 | 0-5 |
| 0-75 | 0-3 |
| 0-100 | 0-2.5 |
| 0-150 | 0-1.5 |



**50 Watt**
**Quarter-rack Models**

| VOLTS | AMPS |
|---|---|
| 0-6 | 0-5 |
| 0-15 | 0-3 |
| 0-25 | 0-2 |
| 0-36 | 0-1.5 |
| 0-55 | 0-1 |
| 0-75 | 0-0.7 |
| 0-100 | 0-0.5 |

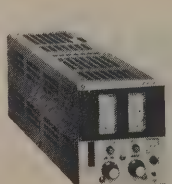


**500 Watt**
**Three-quarter Rack Models**

| VOLTS | AMPS |
|---|---|
| 0-6 | 0-50 |
| 0-15 | 0-25 |
| 0-25 | 0-20 |
| 0-36 | 0-15 |
| 0-55 | 0-10 |
| 0-75 | 0-8 |
| 0-100 | 0-5 |
| 0-150 | 0-3.5 |

**100 Watt**
**Quarter-rack Models**

| VOLTS | AMPS |
|---|---|
| 0-6 | 0-10 |
| 0-15 | 0-6 |
| 0-25 | 0-4 |
| 0-36 | 0-3 |
| 0-55 | 0-2 |
| 0-75 | 0-1.5 |
| 0-100 | 0-1 |



**1000 Watt**
**Full-Rack Models**

| VOLTS | AMPS |
|---|---|
| 0-6 | 0-100 |
| 0-15 | 0-50 |
| 0-25 | 0-40 |
| 0-36 | 0-30 |
| 0-55 | 0-20 |
| 0-75 | 0-15 |
| 0-100 | 0-10 |
| 0-150 | 0-7 |

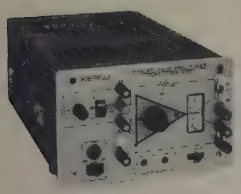
KEPCO, INC. • 131-38 SANFORD AVENUE • FLUSHING, N.Y. 11352 U.S.A. • (212) 461-7000 • TWX #710-582-2631 • Cable: KEPCOPOWER NEWYORK

# KEPCO POWER SUPPLIES

## LABORATORY/SYSTEMS MODELS

### BOP

Bipolar operational power amplifiers for bi-directional control linearly through zero.



| VOLTS | AMPS |
|---|---|
| +15 to −15 | +20 to −20 |
| +36 to −36 | +1.5 to −1.5 |
| +36 to −36 | +5 to −5 |
| +72 to −72 | +1.5 to −1.5 |
| +72 to −72 | +5 to −5 |

See HIGH VOLTAGE MODELS for additional BOP units.

### MPS

Multiple output voltage stabilizer with adjustable current limits.

| | |
|---|---|
| Output #1 | 0-6V, 0-5A |
| Output #2 | 0 to +20V, 0-1A |
| Output #3 | 0 to −20V, 0-1A |

Outputs 2 and 3 are tracked. Output 1 is protected by an overvoltage crowbar.

Model MPS 620M is the ideal bench power supply for the logic experimenter.

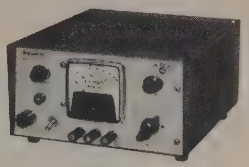
### PRR

Ferroresonant stabilized 1000 W designs producing fixed voltages.

| VOLTS | AMPS |
|---|---|
| 12 | 0-77 |
| 24 | 0-42 |
| 28 | 0-36 |
| 48 | 0-22 |

### ABC

Small bench-style voltage stabilizers with current limiting.

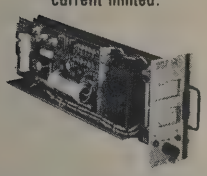


| VOLTS | AMPS |
|---|---|
| 0-2 | 0-1 |
| 0-7.5 | 0-2 |
| 0-10 | 0-0.75 |
| 0-15 | 0-1 |
| 0-18 | 0-0.5 |
| 0-30 | 0-0.3 |
| 0-40 | 0-0.5 |
| 0-100 | 0-0.2 |

## PLUG-IN POWER SUPPLIES

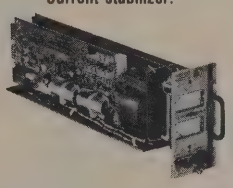
### PCX-MAT

Voltage stabilizers, current limited.



### CC

Current stabilizer.



### OPS group II

Fast programmable power amplifiers with operational patch panel.

Table of volts-amperes for PCX-MAT, CC and OPS II

| VOLTS | AMPS |
|---|---|
| 0-7 | 0-2 |
| 0-15 | 0-1.5 |
| 0-21 | 0-1 |
| 0-40 | 0-0.5 |
| 0-72 | 0-0.3 |
| 0-100 | 0-0.2 |

PCX-MAT, CC and OPS-II models may be plugged into a choice of single, dual or triple bench-style housings or into rack housings RA-32 and RA 22-6A. (See Hardware.)

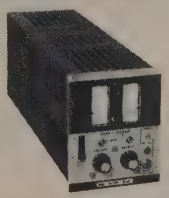
## 50-100 WATT STABILIZERS IN "QUARTER-RACK" FORMAT

### JQE

General purpose Laboratory/Systems voltage stabilizers featuring adjustable current limiting, programmability, optional overvoltage protection. JQE are also available unmetered for OEM use.

### JMK

System oriented automatic crossover voltage-current stabilizers with built-in overvoltage protector.



### OPS group IV-V

Similar to JMK, except the capacitorless output circuit is suitable for fast programming applications. No overvoltage protector.

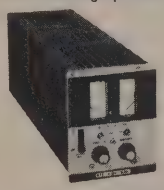


Table of volts-amperes for JQE* JMK and OPSIV-V

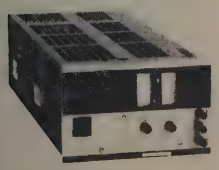
| VOLTS | AMPS |
|---|---|
| 0-6 | 0-5 |
| *0-6 | 0-10 |
| 0-15 | 0-3 |
| *0-15 | 0-6 |
| 0-25 | 0-2 |
| *0-25 | 0-4 |
| 0-36 | 0-1.5 |
| *0-36 | 0-3 |
| 0-55 | 0-1 |
| *0-55 | 0-2 |
| 0-75 | 0-0.7 |
| *0-75 | 0-1.5 |
| 0-100 | 0-0.5 |
| *0-100 | 0-1 |

The OPS/JMK designs include all volt/ampere combinations listed. JQE design includes only models marked (*).

## 250 WATT, 500 WATT AND 1500 WATT STABILIZERS

### JQE

General purpose Laboratory/Systems voltage stabilizers featuring adjustable current limiting, programmability, optional overvoltage protection. JQE are also available unmetered for OEM use.



### OPS VI-VII-VIII

Similar to the JQE models, except the capacitorless output circuit is suitable for fast programming applications. No overvoltage protector options.

Tables of volts-amperes for JQE and OPS VI-VII-VIII

**Full Rack, 1000 W**

| VOLTS | AMPS |
|---|---|
| 0-6 | 0-90 |
| 0-15 | 0-50 |
| 0-25 | 0-40 |
| 0-36 | 0-30 |
| 0-55 | 0-20 |
| 0-75 | 0-15 |
| 0-100 | 0-10 |
| 0-150 | 0-7 |

**Half Rack, 250/500 W**

| VOLTS | AMPS |
|---|---|
| 0-6 | 0-22 |
| 0-6 | 0-45 |
| 0-15 | 0-12 |
| 0-15 | 0-25 |
| 0-25 | 0-10 |
| 0-25 | 0-20 |
| 0-36 | 0-8 |
| 0-36 | 0-15 |
| 0-55 | 0-5 |
| 0-55 | 0-10 |
| 0-75 | 0-3 |
| 0-75 | 0-8 |
| 0-100 | 0-2.5 |
| 0-100 | 0-5 |
| 0-150 | 0-1.5 |
| 0-150 | 0-3.5 |

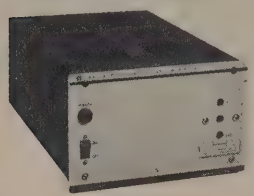
KEPCO, INC. • 131-38 SANFORD AVENUE • FLUSHING, N.Y. 11352 U.S.A. • (212) 461-7000 • TWX #710-582-2631 • Cable: KEPCOPOWER NEWYORK

# KEPCO POWER SUPPLIES

## LABORATORY/SYSTEMS MODELS

### NTC

Low power shunt stabilized power supplies that can be used on their own, or serve as an interface for higher-powered operational power supplies.



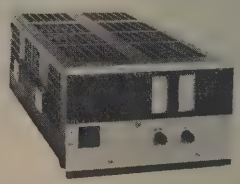
| VOLTS | AMPS |
|---|---|
| 0-200 | 0.01 |
| 0-2000 | 0.001 |

The NTC as an interface, permits programming with the negative terminal common.

all KEPCO products are backed by a firm 5-Year Warranty

### CPS

Low voltage systems power supplies optimized for logic systems. Programmable voltage stabilization with adjustable current limiting, built-in adjustable crowbar.



| VOLTS | AMPS |
|---|---|
| 0-6 | 0-10 |
| 0-6 | 0-22 |
| 0-6 | 0-45 |
| 0-6 | 0-90 |

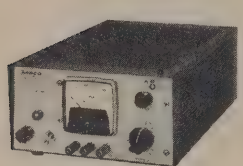
| VOLTS | AMPS |
|---|---|
| 0-15 | 0-6 |
| 0-15 | 0-12 |
| 0-15 | 0-25 |
| 0-15 | 0-50 |

CPS is available in quarter, half and full-rack sized packages.

## HIGH VOLTAGE MODELS

### ABC

Small bench-style voltage stabilizers with current limiting.



High Voltage (Hybrid)

| VOLTS | AMPS |
|---|---|
| 0-200 | 0-0.1 |
| 0-425 | 0-0.05 |
| 0-1000 | 0-0.02 |
| 0-1500 | 0-0.01 |
| 0-2500 | 0-0.002 |

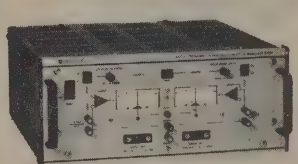
### APH

High voltage laboratory power supplies offering continuously adjustable/programmable voltage and current in an automatic crossover configuration.

| VOLTS | AMPS |
|---|---|
| 0-500 | 0-0.04 |
| 0-1000 | 0-0.02 |
| 0-2000 | 0-0.01 |

### BOP

Bipolar operational power amplifiers for bi-directional control linearly through zero.

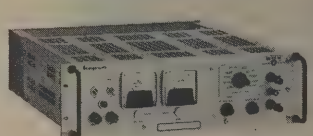


High Voltage Models

| VOLTS | AMPS |
|---|---|
| +500 to −500 | +0.08 to −0.08 |
| +1000 to −1000 | +0.04 to −0.04 |

### BHK

Programmable voltage and current stabilizer for high voltage arranged in an automatic crossover configuration. Provision is made for disconnecting the output capacitor for high speed programming.



| VOLTS | AMPS |
|---|---|
| 0-500 | 0-0.4 |
| 0-1000 | 0-0.2 |
| 0-2000 | 0-0.1 |

## HIGH VOLTAGE MODELS

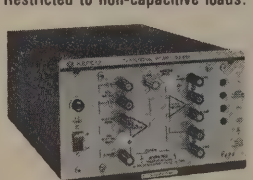
### HB

Adjustable voltage stabilizers.

| VOLTS | AMPS |
|---|---|
| 0-325 | 0-0.4 |
| 0-325 | 0-0.8 |
| 0-525 | 0-0.5 |

### OPS group IXB

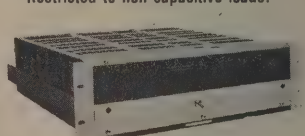
Similar to APH, except equipped with an operational patch panel and featuring a capacitorless output for fast programming applications. Restricted to non-capacitive loads.



| VOLTS | AMPS |
|---|---|
| 0-500 | 0-0.04 |
| 0-1000 | 0-0.02 |
| 0-2000 | 0-0.01 |

### OPS group X

A capacitorless, fast-programmable design for high voltage. Restricted to non-capacitive loads.

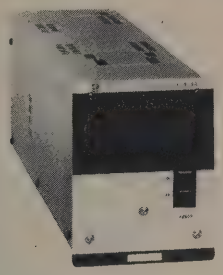


| VOLTS | AMPS |
|---|---|
| 0-3500 | 0-0.01 |
| 0-5000 | 0-0.005 |

KEPCO, INC. • 131-38 SANFORD AVENUE • FLUSHING, N.Y. 11352 U.S.A. • (212) 461-7000 • TWX #710-582-2631 • Cable: KEPCOPOWER NEWYORK

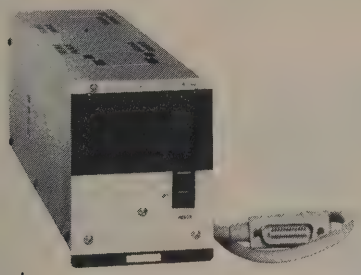
# PROGRAMMERS

**These programmers are designed for use with all Kepco operationally-programmable power supplies (high speed *and* conventionally filtered). They enable you to interface your d-c power supplies with the logic bus of a computer-controlled system.**



**SN-500**—Parallel Input

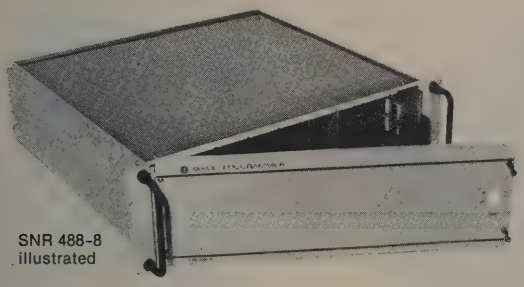
| | | |
|---|---|---|
| SN 500-121 | 1 channel | 12-bit binary |
| SN 500-122 | 2 channel | 12 bit binary |
| SN 500-031 | 1 channel | 3-digit BCD |
| SN 500-032 | 2 channel | 3-digit BCD |



**SN-488**—Serial Input

A Kepco implementation of IEEE-488 for small one and two channel systems on the GP-IB.

| | | |
|---|---|---|
| SN 488-121 | 1 channel | 12-bit binary |
| SN 488-122 | 2 channel | 12-bit binary |
| SN 488-031 | 1 channel | 3-digit BCD |
| SN 488-032 | 2 channel | 3-digit BCD |



SNR 488-8 illustrated

**SNR-488:** A Kepco implementation of IEEE-488 for multiple channel installations on the GP-IB.

SNR 488-4 can accommodate (4) plug-in, 2-channel program cards.

SNR 488-8 can accommodate (8) plug-in, 2-channel program cards.

**Plug-in Cards for SNR Card Cages:**

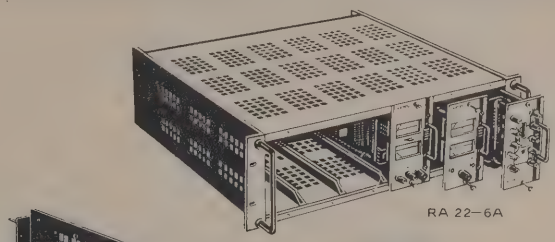
| | | |
|---|---|---|
| SN-488B | 2 channels | 12-bit binary |
| SN-488D | 2 channels | 3-digit BCD |

# KEPCO POWER SUPPLIES HARDWARE

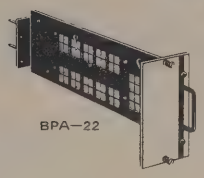
## RA 22-6A Rack System

**FOR PLUG-IN MODELS: OPS–II, PCX–MAT and CC**

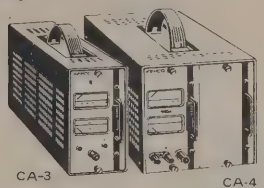
(OPS-I and PCX models can also be mounted using BPA-22 Adapter)



RA 22–6A

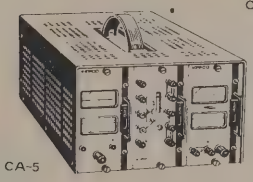


BPA–22



CA-3

CA-4

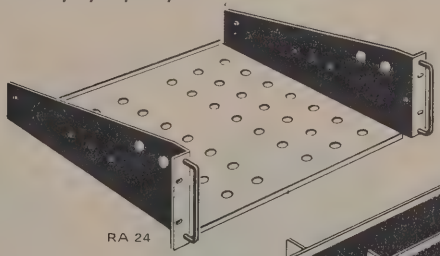


CA-5

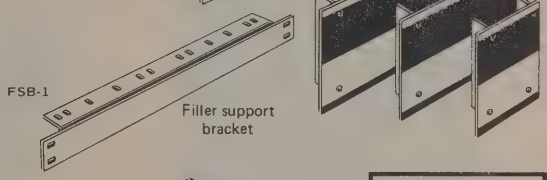
Bench Housings:
CA-3 — Single
CA-4 — Dual
CA-5 — Triple

## RA 24 Rack System

**The RA–24 will house ¼-, ½-, and ¾-rack models in the following groups: APH, BOP, CPS, JMK, JQE, NTC, MPS, OPS IV, V, VI, VII, IX-B.**



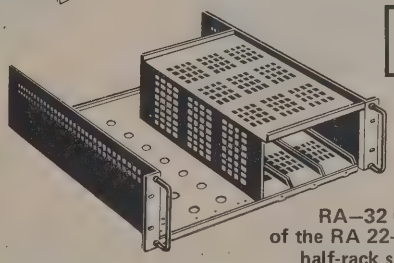
RA 24



FSB-1

Filler support bracket

## RA-32 Rack System



**RA–32 Combines (3) slots of the RA 22–6A system with a half-rack space from RA–24.**

Data subject to change without notice.

all KEPCO products are backed by a firm 5-Year Warranty

Kepco's more than 32 years experience as the foremost supplier of voltage and current stabilizers has resulted in an unusually comprehensive inventory of power supplies in all styles, ranges, degrees of precision and power. All are backed by an unconditional 5-year warranty.

For complete specifications—
write Dept. CAM-61 for New Kepco Catalog/Handbook

KEPCO, INC. • 131-38 SANFORD AVENUE • FLUSHING, N.Y. 11352 U.S.A. • (212) 461-7000 • TWX #710-582-2631 • Cable: KEPCOPOWER NEWYORK

# Switchers from

**Wide selection of power ratings and configurations**

We make a wider variety of switching regulated power supplies than anybody else. And that's all we make. Seven standard series, 22 case styles, in thousands of different models, 75 to 1500 watts. Convection-cooled and fan-cooled.

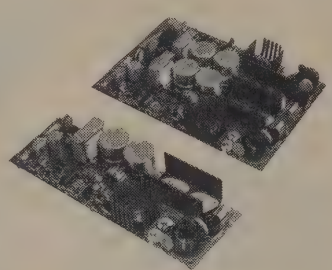
We offer one- through seven-output units — and a variety of packaged and open-frame configurations for a broad range of applications.

**More power in smaller packages**

Nobody packs more power in smaller, more compact, lightweight (as little as 1.25 lbs.) packages than we do. Up to 2.45 watts/in.$^3$—more than twice the density of competitive switchers; four to five times the density of linears... Up to 80% efficiency ... Many models UL-recognized; all models designed to meet UL 478... Each carries a 2-year guarantee.

**Seventh in the MITE Series**

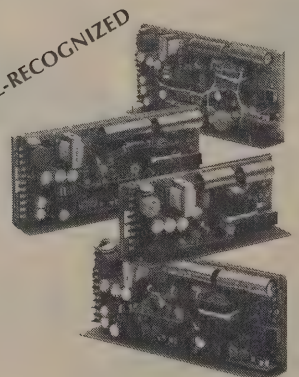
Here's our newest — the Teeny-Tiny MITE Series. This economical, plug-in circuit board switcher series is convection-cooled, 75 watts, 1 - outputs, UL-designed. Input: 92 - 1 V AC or 180 - 260 V AC, 47-440 Hz. TTM-11 delivers 75 watts in a singl output unit, 5 - 28 V DC, that me sures 10.5" L x 3.5" W x 2" H. TTM- Series delivers 75 watts in multipl output (1 - 4) models — primary: 5 DC @ 10 amps; auxiliary: 5 - 24 V D @ up to 1.5 amps — that (tentativel measure 10.5" L x 7" W x 2" H.



**Have we got switchers for you!**

Review the general specificatio for our switchers. Chances are you find that we *do* have a switcher tha ideal for your application. Sized to small-space requirements. Priced to small-budget requirements. Less tha 60¢/watt in quantity. Call or write f details.

UL-RECOGNIZED



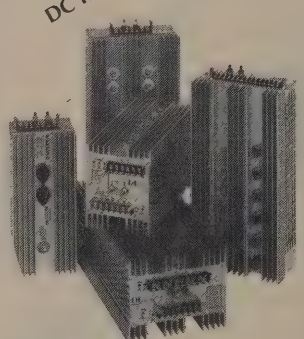
## Tiny-MITE™

**TM Series**

Economical, open-frame, convection-cooled, low power, UL-recognized.

| | |
|---|---|
| **Input** | 92 - 130 V AC or 180 - 260 V AC, 47 - 440 Hz |
| **Power** | 100 - 175 watts |
| **Outputs** | 1 - 4 |

DC INPUT



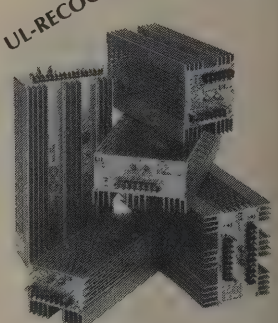
## Dyna-MITE™

**DM Series**

DC input, convection-cooled, medium power, UL-designed.

| | |
|---|---|
| **Input** | 48 ±10% V DC |
| **Power** | 250 - 600 watts |
| **Outputs** | 1 - 4 |

UL-RECOGNIZED



## Little-MITE™

**LM Series**

Convection-cooled, medium power, UL-recognized.

| | |
|---|---|
| **Input** | 92 - 130 V AC or 180 - 260 V AC, 47 - 440 Hz |
| **Power** | 250 - 600 watts |
| **Outputs** | 1 - 4 |

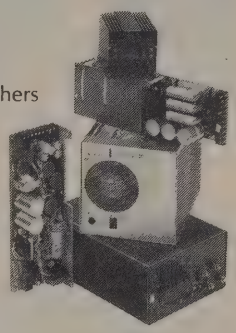
LH RESEARCH

**THE WORLD'S LARGEST SWITCHER MANUFACTURER**
**Representatives in Major Industrial Areas.**

# LH Research

**SPECIFICATIONS**
(Applicable to all series unless otherwise noted).
Efficiency ... Up to 80%
Load Regulation ... 0.4% from zero to full load.
Line Regulation ... 0.4% over entire input range.
Ripple and Noise ... 1% or 50 mv peak-to-peak.
Overvoltage Protection ... Standard on primary output, factory set at 125% ±5%. Optional for auxiliary outputs.
Overshoot and Undershoot ... 2% peak deviation for a load change of 25% @ 5A/μsec.
Response Time ... 200 μsec to 1% after a 25% load change @ 5A/μsec.
Dropout Time ... Outputs remain in regulation for 20 msec (SM Series, 50 msec) after nominal AC power is removed.
Current Limit ... Fold-back current limiting provided. Constant current limiting optionally available.
Temperature Coefficient ... ±0.02%/°C.
Operating Temperature Range ... 0°C to +50°C (0°C to +40°C on LH and MM Series), derating to 70°C.
Storage Temperature Range ... −55°C to +85°C.
Power Fail Detection ... When AC is removed, power-fail signal drops to logic (0) — logic (1) for LH Series — 10 msec before output loss.
Straight Paralleling ... Parallel operation standard on TTM. TM, LM, MM, DM, and SM Series (primary output only). Available on LH Series with constant current option.
Added Brown-out Protection ... Standard on TTM, TM, LM, and SM Series. Special AC input ranges can be provided for added protection against brown-out on LH and MM Series.
DC Inputs ... Standard 48 V DC on DM Series. LH Series units can be configured for 24, 28, 48, and 120 V DC.

**Custom designs, too**
If LH's standard switchers aren't quite suited to your needs, we can custom-design one that fits perfectly. Send us your inquiry. We'll get back to you with technical data—price and delivery information, too.



## *Mighty-**MITE*** ™

**MM Series**

Fan-cooled, medium-to-high-power, UL-recognized.

115 ±10% V AC or 230 ±10% V AC, 47 - 63 Hz; 115/230 ±10% V AC, 47 - 63 Hz (optional)

375 - 750 watts

1 - 7

## *Super-**MITE*** ™

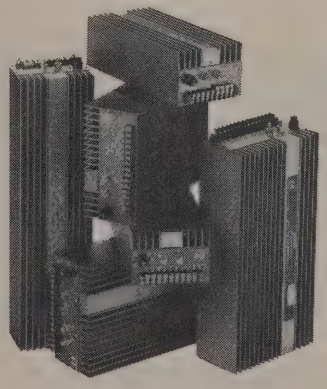
**SM Series**

Fan-cooled, high power, UL-pending, VDE internal filter meets N minus 12 curve.

85 - 130 V AC or 166 - 260 V AC, 47 - 63 Hz

750 - 1000 watts

1 - 4



## LH Series

Convection- and fan-cooled, medium power, UL-designed.

115 ±10% V AC or 230 ±10% V AC, 47 - 440 Hz (externally selectable) 47 - 63 Hz (for LH-700 and LH-800)

**Input**

250 - 1500 watts

1 - 4

**Power Outputs**

**LH RESEARCH** 1821 Langley Avenue, Irvine, CA 92714 (714) 546-5279 TWX 910-595-2540

# HIGHER VOLTAGE

**REGULATED POWER SUPPLIES:** Precise voltage or current regulation of ±0.01% for line or load changes. Adjustable from Zero. Short circuit protected. R or E programming. **Completely solid state.** AC/DC ratings to 2 Megavolts and 1 Megawatt.

**Bulletin RDC-1000**

**ADJUSTABLE POWER SUPPLIES:** DC unregulated. All models fully controlled and protected with ratings from 1KV to 2000 KV at 1 Megawatt. Special "S" model with simple or no controls. Many variations in options and features available.

**Bulletin ADC-1000**

**PRECISION DIVIDERS:** Accuracies of 0.01%, 0.1%, 1.0%. DC/ACP, DC, AC RMS. Variable ratios.

**Bulletin HVD-1000**

**DC INSULATION TESTERS:** Qualitative or quantitative testing to 1 Megavolt. Portable or mobile. Burn and "Thumper" feature.

**Bulletin DCI-2000**

**AC INSULATION TESTERS:** Ratings to 400KV/1000KVA. Memory meter indicates breakdown voltage. High speed overload. Options include, Corona free, automatic voltage sequencing, variable speed control. Conforms to ASTM.

**Bulletin ACI-3000**

**TRANSFORMERS:** Isolation to 500KVDC. Filament. Air, Oil, Gas, Insulation. Ratings to 300KVRMS/400 KVA.

**IMPULSE GENERATORS:** Ratings to 5 megavolts, 10KJ.

**Bulletin IGS-1000**

**CUSTOM COMPONENTS:** Spark gaps. Crowbars. Oil filled bushings. Anti-corona Spheres and Toroids. Shielded cables. Shorting and Disconnect Switches. Series Limiting Resistors. Capacitors. Rectifiers.

**TYPICAL APPLICATIONS** Dielectric Heating • Electro Static Cooling • Carbon Deposition • Beam Separator • X-Ray Thickness Gauge • Pulse Charging Lines • Capacitor Charging • Air Purifying • Paint Spraying • Fiber Flocking • Mineral Separation • Grain Cleansing • Recovery of Precious Metal Dust • Electron and Field Ion Microscopy • Testing Large Rotating Machinery • Cloud Chamber • Vacuum Arc Experiments • Removal of Liquid Fuel Contaminants • Killing Bacteria • Electron Beam Welding and Machining • Zone Heating • Testing Liquid and Solid Dielectrics • Processing Razor-Blades • Processing Vegetables • Spectroscopy • Spark Chamber • Processing Synthetic Rubber • Charging Electrostatic Antennae for Cloud Study • Ion Propulsion Engines • Injection and Focusing Devices on High Energy Accelerators • Sparking of Cathode Ray Tubes • Life Testing and Processing of Vacuum Tubes • Energizing Laser Devices • Charging Paper for Xerography Printing • Radar • Image Intensifier • Sputtering Processes • Impulse Testing • Explosive Forming • Electrophoresis • Ion Implantation • Tomography • TWT

- 400 Standard Models with Voltage Ranges to 2 Megavolt and Powers to 1000 KW
- Completely Solid State, Self Protecting
- Safe Simple, Foolproof Operation
- Maximum Personnel and Equipment Protection
- Standard Models Easily Modified for Custom Design.

**MEGAVOLT CORPORATION**

110 Hobart Street, Hackensack, N.J. 07601

(201) 487-0100 • Telex: UNAWORLD CRESSKILL 135489

*HIGHER VOLTAGE SPECIALISTS*

# Mid-Eastern Products

Eanco, Inc.

DEPT. EM 539 Jacksonville Road • Warminster, Pennsylvania 18974 • (215) 672-4800


## PR Constant Voltage/ Current Silicon Supplies

### ■ Features

High Power — Small Size
Remotely Programmable
All Silicon Semiconductors
Mode Lites
.01% Regulation
Low Ripple
Constant Voltage/Constant Current
Parallel Operation

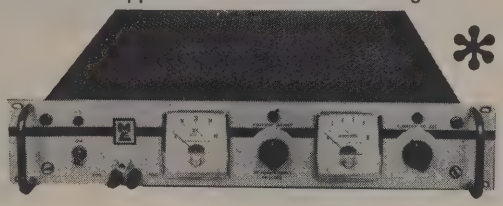
| Model Number | Output | | Regulation | | | | Panel Ht. | Price |
|---|---|---|---|---|---|---|---|---|
| | | | Line | | Load | | | |
| | Volts | Amps | CV | CC | CV | CC | | |
| PR 20-15 | 0-20 | 0-15 | 0.01% | 0.01% | 0.01% | 0.25% | 3½" | $855. |
| PR 40-10 | 0-40 | 0-10 | 0.01% | 0.01% | 0.01% | 0.25% | 3½" | 805. |
| PR 60-7 | 0-60 | 0-7 | 0.01% | 0.01% | 0.01% | 0.25% | 3½" | 855. |
| PR 125-3.2 | 0-125 | 0-3.2 | 0.01% | 0.01% | 0.01% | 0.25% | 3½" | 955. |
| PR 20-25 | 0-20 | 0-25 | 0.01% | 0.01% | 0.01% | 0.25% | 5¼" | 955. |
| PR 40-20 | 0-40 | 0-20 | 0.01% | 0.01% | 0.01% | 0.25% | 5¼" | 905. |
| PR 60-14 | 0-60 | 0-14 | 0.01% | 0.01% | 0.01% | 0.25% | 5¼" | 955. |
| PR 125-6.5 | 0-125 | 0-6.5 | 0.01% | 0.01% | 0.01% | 0.25% | 5¼" | 1055. |

*Photograph illustrates both PR and HV Series.

## HV Constant High Voltage Supplies

### ■ Features

All Solid State
Adjustable Current Limit
< 1 Millivolt Ripple
10-Turn Voltage Adjustments
Remote Programming
Remote Sensing

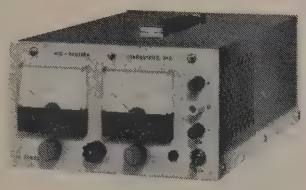


| Model Number | Output | | Regulation | | Size | Price |
|---|---|---|---|---|---|---|
| | Volts | Amps | Line | Load | | |
| HV 350-1 | 0-350 | 1 | 0.005% | 0.01% | 3½ x 19 x 16½ | $1225. |
| HV 350-2 | 0-350 | 2 | 0.005% | 0.01% | 5¼ x 19 x 16½ | 1475. |
| HV 350-3 | 0-350 | 3 | 0.005% | 0.01% | 7 x 19 x 16½ | 1675. |

## HW Constant Voltage/ Constant Current Power Supplies

### ■ Features

Models up to 200 Volts
Remotely Programmable
Remote Sensing
Series and Parallel Operation
500μ Volts Ripple
.01% Load Regulation
Half Rack Size
Separate Voltmeter and Ammeter
Rack or Bench mounted
.005% Line Regulation



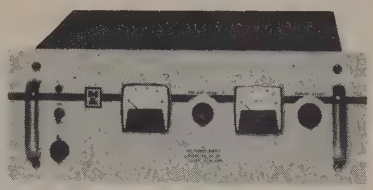
| Model Number | Output | | Regulation | | | | Price |
|---|---|---|---|---|---|---|---|
| | Volt-age | Amps | Line | | Load | | |
| | | | CV | CC | CV | CC | |
| HW 10-8 | 0-10 | 0-8 | 0.01% | 0.1% | 0.01% or 1 mv | 0.5% | $375. |
| HW 10-15 | 0-10 | 0-15 | 0.01% | 0.1% | 0.01% or 1 mv | 0.5% | 475. |
| HW 20-4 | 0-20 | 0-4 | 0.01% | 0.1% | 0.01% or 1 mv | 0.5% | 365. |
| HW 20-10 | 0-20 | 0-10 | 0.01% | 0.1% | 0.01% or 1 mv | 0.5% | 465. |
| HW 40-2 | 0-40 | 0-2 | 0.01% | 0.1% | 0.01% or 1 mv | 0.5% | 355. |
| HW 40-5 | 0-40 | 0-5 | 0.01% | 0.1% | 0.01% or 1 mv | 0.5% | 455. |
| HW 60-1.5 | 0-60 | 0-1.5 | 0.01% | 0.1% | 0.01% or 1 mv | 0.5% | 365. |
| HW 60-3 | 0-60 | 0-3 | 0.01% | 0.1% | 0.01% or 1 mv | 0.5% | 465. |
| HW 100-2 | 0-100 | 0-2 | 0.01% | 0.1% | 0.01% or 1 mv | 0.5% | 525. |
| HW 200-1 | 0-200 | 0-1 | 0.01% | 0.1% | 0.01% or 1 mv | 0.5% | 625. |

Prices include: meters, case, carry handle, and rubber feet.
Options: overvoltage, 10-turn potentiometers, and special input voltage.

## RA Constant Voltage Silicon Supplies

### ■ Features

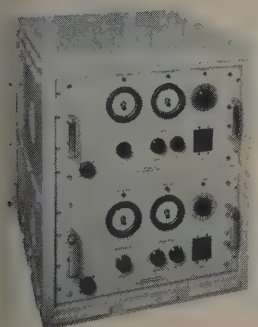
High Power — Small Size
Remotely Programmable
Low Ripple
Parallel Operation
.01% Regulation
All Silicon Semiconductors



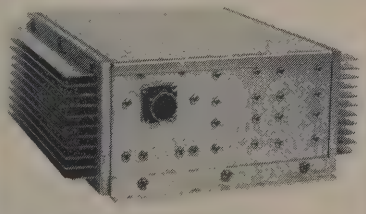
| Model Number | Output | | Voltage Regulation | | Panel Height | Price |
|---|---|---|---|---|---|---|
| | Voltage | Amps | Line | Load | | |
| RA 20-15 | 0-20 | 0-15 | 0.01% | 0.01% | 3½" | $695. |
| RA 40-10 | 0-40 | 0-10 | 0.01% | 0.01% | 3½" | 645. |
| RA 60-7 | 0-60 | 0-7 | 0.01% | 0.01% | 3½" | 695. |
| RA 125-3.2 | 0-125 | 0-3.2 | 0.01% | 0.01% | 3½" | 775. |
| RA 20-25 | 0-20 | 0-25 | 0.01% | 0.01% | 5½" | 795. |
| RA 40-20 | 0-40 | 0-20 | 0.01% | 0.01% | 5½" | 775. |
| RA 60-14 | 0-60 | 0-14 | 0.01% | 0.01% | 5½" | 795. |
| RA 125-6.5 | 0-125 | 0-6.5 | 0.01% | 0.01% | 5½" | 895. |
| RA 40-30 | 0-40 | 0-30 | 0.01% | 0.01% | 7" | 1025. |
| RA 60-20 | 0-60 | 0-20 | 0.01% | 0.01% | 7" | 1155. |
| RA 125-10 | 0-125 | 0-10 | 0.01% | 0.01% | 7" | 1250. |

Options include: meters, overvoltage, 10-turn potentiometers, and special input voltages.

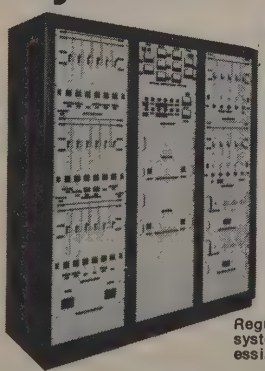
## Custom Power Supplies and Systems



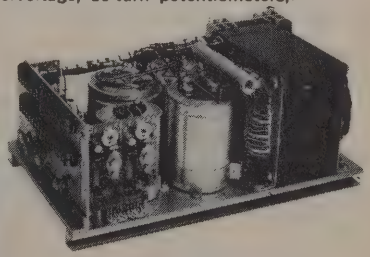
High power, 150-Volt, constant current//constant voltage, shipboard-qualified power supply.



Mil Spec 4 output regulated power supply.



Regulated, no-break, redundant power distribution system with battery back-up for petroleum processing industry.



Regulated multi-output power supply for mini-computer.

PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

# PRECISION CURRENT & VOLTAGE SOURCES

## PRECISION CURRENT SOURCES

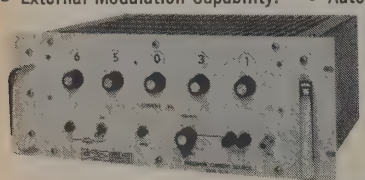
**ACCURACIES TO 0.01%** **STABILITIES TO 2 PPM**

**APPLICATIONS:**

- Laboratory and Production Testing of Semiconductors, Gyros, Lamps, Meters, Thermistors, etc.
- Systems requiring a Precision Constant Current Setting such as X-ray Equipments, Electron Beam Welders, and Electron Beam Microscopes.

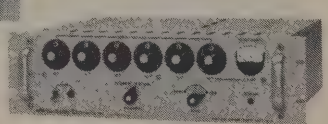
**FEATURES:**

- Digital In-Line Current Setting and Readout.
- 5 or 6 Decade Dividers for Setting to 1 Part in 100,000 or 1 Part in 1,000,000 of Full Scale.
- Uni- and Bi-Polar Models.
- Externally Programmable Models.
- External Modulation Capability.
- Automatic Protection Circuits.

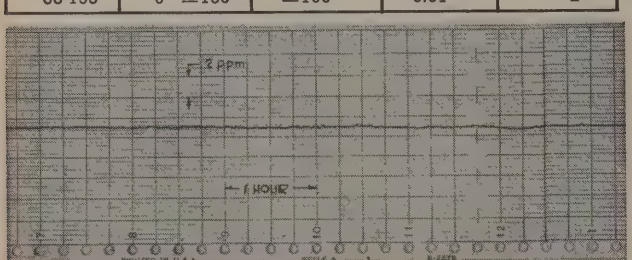


CS-11

CS-31



| Model | Current Range (mA) | Compliance Range (V) | Accuracy (%) | Stability (ppm) |
|---|---|---|---|---|
| CS-11 | 0 - 100 | 100 | 0.015 | 10 |
| CS-12 | 0 - 1000 | 12.5 | 0.015 | 10 |
| CS-13 | 0-5000 | 25 | 0.03 | 10 |
| CS-14 | 0 - 10,000 | 12.5 | 0.03 | 10 |
| CS-21 | 0 - ±500 | ±100 | 0.05 | 10 |
| CS-31 | 0 - 2000 | 60 | 0.01 | 5 |
| CS-111 | 0 - 500 | 250 | 0.1 | 30 |
| CS-120 | 0 - 10 | 2000 | 2.0 | 1000 |
| CS-151 | 0 - ±10 | ± 10 | 0.01 | 2 |
| CS-152 | 0 - ±150 | ± 25 | 0.01 | 2 |
| CS-153 | 0 - ±150 | ±100 | 0.01 | 2 |




## DIGITAL PRECISION CURRENT, VOLTAGE AND VOLTAGE/CURRENT SOURCES

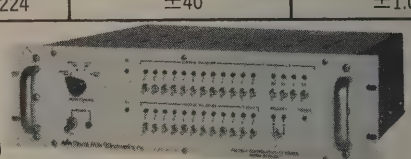
### FOR COMPUTER-CONTROLLED AUTOMATIC TEST SYSTEMS

**Output Selection:** 4 digit BCD or 16 bit binary
**Accuracy:** 0.02% +½ LSB
**Stability:** 50 ppm
**Regulation**
vs. line: 10 ppm
vs. load: 10 ppm
vs. temperature: 25 ppm/°C
**Response Time:** 100 μsec

| CONSTANT VOLTAGE | | |
|---|---|---|
| Model DVS-40 | Full-Scale Volts | Max. Amps. |
| −010 | 10 | 2 |
| −015 | 15 | 1.5 |
| −020 | 20 | 1 |
| −050 | 50 | 0.5 |
| −075 | 75 | 0.3 |
| −110 | 100 | 0.2 |

| CONSTANT CURRENT | | |
|---|---|---|
| Model DCS-30 | Full-Scale Amps. | Max. Volts |
| −110 | 0.1 | 100 |
| −150 | 0.5 | 40 |
| −210 | 1 | 40 |
| −220 | 2 | 40 |
| −250 | 5 | 20 |
| −310 | 10 | 10 |

| CONSTANT VOLTAGE/CURRENT | | |
|---|---|---|
| Model | Full-Scale Volts | Full-Scale Amps. |
| DCVS-220 | ±100 | ±0.33 |
| DCVS-222 | ±20 | ±2.0 |
| DCVS-224 | ±40 | ±1.0 |



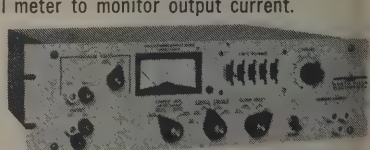
DCVS-220

## PRECISION VOLTAGE/CURRENT SOURCES

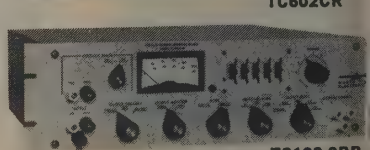
These highly stable and accurate precision sources can be operated in either constant voltage or constant current modes.
All models include such features as manual and remote programming, and output voltage regulation by either local or remote sensing.
Voltage and current outputs are selected on decade switches whose markings form an in-line digital readout.

Automatic protection limits output voltage and current to safe levels. No voltage or current overshoot occurs during turn-on or turn-off. A warning indicator alerts the operator if the actual output should differ from the dialed setting beyond the specified limits. Models TC-100.2BR and TC-602CR include a panel meter to monitor output current.

| Model | Constant Voltage (V) | Constant Current (mA) | Accuracy (%) | Stability (ppm) | Decades |
|---|---|---|---|---|---|
| CVS-264 | 0 to ±100 @ 100 mA max. | 0 to ±100 @ 100 V max. | 0.1 | 25 | 5 |
| TC-100.2 BR | 0 to 100 @ 200 mA max. | 0 to 100 @ 100 V max. | 0.01 | 5 | 5 + vernier |
| TC-602 CR | 0 to 60 @ 2 A max. | 0 to 2000 @ 60 V max. | 0.01 | 5 | 5 + vernier |



TC602CR

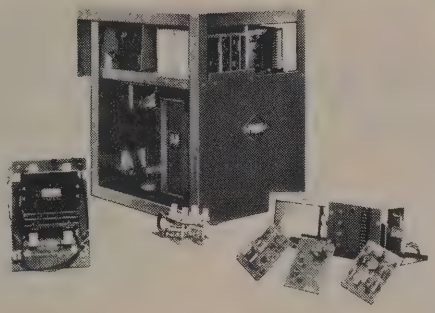


TC100.2BR

# CUSTOM BUILT AC/DC POWER SUPPLIES, INDUSTRIAL AND LABORATORY TYPES,

## TO YOUR SPECIFICATIONS – HIGH OR LOW CURRENT, VOLTAGE OR FREQUENCY, CONSTANT OUTPUT, PRECISE REGULATION FOR SPECIALIZED APPLICATIONS

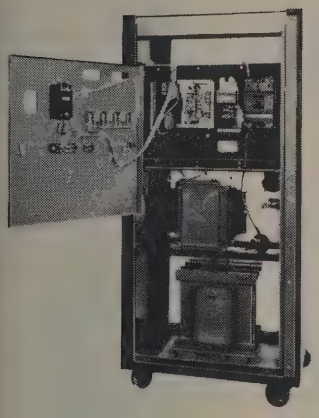
**Manufacturing power supplies utilizing forced air, water, natural convection and oil cooling systems; both regulated and non-regulated using saturable reactor; variac or SCR controls.**



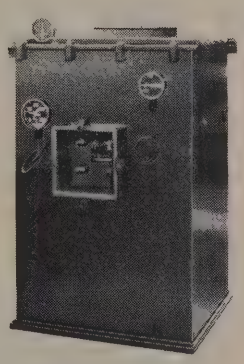
75 KVA water-cooled SCR controlled supply for electric melting furnace.

**MANUFACTURING RANGE**

Up to 150 KV
1 ma to 50,000 AMP
4 Hz to 20 Khz
5 KVA to 2000 KVA
50 lb. to 15,000 lb.

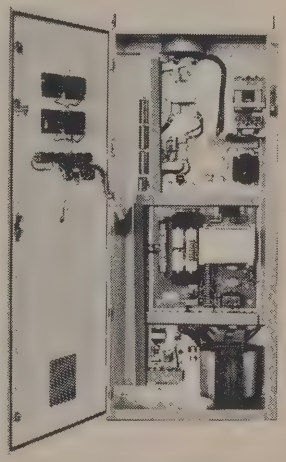


45.5 KVA Saturable Reactor controlled precisely regulated high voltage power supply for sputtering film application.



This unit is typical of our oil-filled power supplies and is rated 45 KV DC at 1 amp output.

Distortion free high current low voltage programmed power supply with precise regulation used for laboratory component testing.



Solid State SCR type Controller with current limiter and spark rate control used with an NWL manufactured Transformer Rectifier set.

**NWL also manufactures various types of power transformers, reactors, chokes. See our full page ad in the transformer section of EEM.**

**Our engineers are available to assist you in selecting magnetic components to meet your application requirements.**

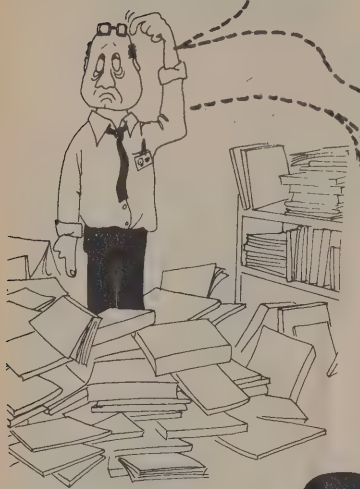
**NWL TRANSFORMERS**

*"Manufacturers of the World's Finest Electrical Equipment"*

• RISING SUN ROAD • BORDENTOWN, N.J. 08505 • 609-298-7300 •

***What can I use to keep all the manufacturers' product data I receive in order?***

***What system makes filing or retrieving manufacturers' catalogs fast and easy?***



***Which file system have thousands of engineers purchased because they know it works?***

# eem FILE SYSTEM

## THE ONLY FILE SYSTEM DESIGNED SPECIALLY FOR THE ELECTRONIC ENGINEER!

The publishers of **eem** have put together a unique filing system for electronic product information. The complete system includes: a product index booklet which classifies electronic products into 3,000 listings both alphabetically and by product group, and 45 file folders imprinted with the **eem** product sections (extra gummed labels included for expanding the system.)

As you receive manufacturers' catalog data sheets, technical bulletins, or clip magazine articles, jot down the proper Product Section Numbers from the **eem** PRODUCT-TO-SECTION INDEX. Then simply file in order. When you require information on a specific product, refer to PRODUCT-TO-SECTION INDEX again to locate the correct file folder. It's simple, and you'll always have the necessary data to compare, specify and buy, right at your fingertips.

**Here's how to order your eem FILE SYSTEM:**

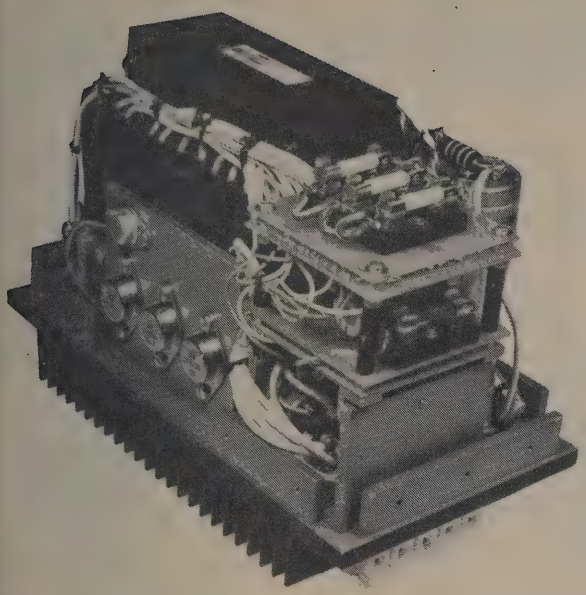
For the complete system send $10 (plus tax; N.Y., 8%, CA, 6½%) in check or money order to:

United Technical Publications, Inc.,
645 Stewart Avenue, Garden City, N.Y. 11530
Att: Circulation dept.

For an **eem FILE SYSTEM** without file folders send $7.50 (plus tax; N.Y. 8%; CA, 6½%).

*UNITED TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500*

# CUSTOM POWER SUPPLIES
# CUSTOM TRANSFORMERS



This custom Naval Underwater 3 Phase 400 Hz multiple output power supply was delivered ready for dockside installation exactly eight weeks after receipt of order.

## CUSTOM POWER SUPPLIES

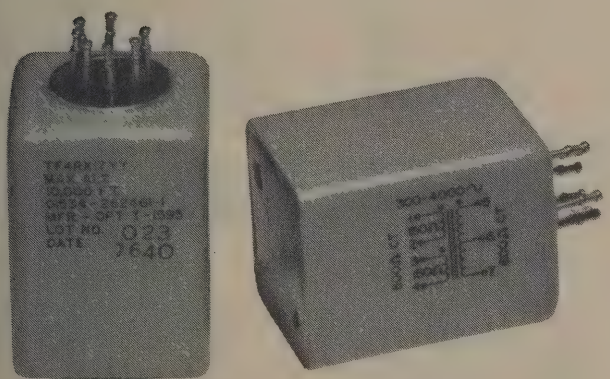
- Switching Regulator
- DC to DC Converter
- Linear
- Ferroresonant

OPT specializes in custom designed high reliability military, and hi-grade commercial linear and pulse width modulated switching regulator power supplies.

At OPT, custom power supplies are professionally designed and skillfully manufactured to achieve outstanding reliability and performance.

Our high quality standards are reflected by our strong participation in many advanced military and aerospace programs.

We would be pleased to discuss your requirements. Our outstanding power supply design team, augmented by our excellent magnetics group, offers seasoned engineering solutions to your power supply requirements.



## CUSTOM TRANSFORMERS

- MIL-T-27
- MIL-T-16315
- MIL-T-21038
- Quality OEM Commercial Magnetics

OPT offers you one source for all your custom transformer requirements, military and commercial. Our technology and production capability run the full gamut of todays demanding magnetic requirements and include: power, audio pulse, hybrid, D.C. converter, reactor, toroids, ferroresonant, multiphase, high Q coils, magnetic amplifiers and special purpose transformers.

**SEE OTHER OPT INDUSTRIES PRODUCT LINES IN eem**
**OPT INDUSTRIES ALSO MANUFACTURES CUSTOM FILTERS/CRYSTAL, L. C. AND ACTIVE**
**SEE OUR PRODUCT DATA ON THESE PRODUCTS IN SECTION 2300 PAGE 0000**

opt INDUSTRIES INC.

*Dept. EM, 300 Red School La.*
*Phillipsburg, NJ 08865*
*(201) 454-2600 TWX 510-235-2920*

***Call or Write for Our Facilities and Capabilities Brochure***

# Panasonic

## PRIMARY BATTERY SYSTEMS

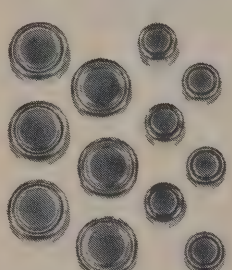
### CARBON ZINC

WIDE RANGE OF CHOICES / EXCELLENT SHELF LIFE AND LEAK RESISTANCE

### ALKALINE

HIGH POWER AND HIGH CURRENT PERFORMANCE / LONG SHELF LIFE AND A BROAD OPERATING TEMPERATURE RANGE

### WATCH AND HEARING AID BATTERIES



SILVER OXIDE AND MERCURY SYSTEMS

### LITHIUM

RELIABLE INERT PACKAGING / HIGH ENERGY DENSITY AND CELL VOLTAGE / LONG SHELF LIFE

### SPECIFICATIONS — DRY BATTERIES (CARBON - ZINC)

| Model | Size | (V) | Dimensions Diam. (inches) | Dimensions Height (inches) | Weight (oz.) | Representative Performance | |
|---|---|---|---|---|---|---|---|
| UM-1N | D | 1.5 | 1.339 | 2.421 | 3.74 | 540 min. (2Ω 30 min. x 2/D) | 54 hrs. (10Ω 4 hrs./D) |
| UM-1D | D | 1.5 | 1.339 | 2.421 | 3.46 | 385 min. (2Ω 30 min. x 2/D) | 38.5 hrs. (10Ω 4 hrs./D) |
| UM-1 | D | 1.5 | 1.339 | 2.421 | 3.07 | 720 min. (4Ω 30 min. x 2/D) | 155 hrs. (40Ω 4 hrs./D) |
| UM-2N | C | 1.5 | 1.024 | 1.969 | 1.87 | 200 min. (2Ω 15 min. x 2/D) | 22 hrs. (10Ω 2 hrs./D) |
| UM-2D | C | 1.5 | 1.024 | 1.969 | 1.66 | 135 min. (2Ω 15 min. x 2/D) | 15.5 hrs. (10Ω 2 hrs./D) |
| UM-2 | C | 1.5 | 1.024 | 1.969 | 1.59 | 275 min. (4Ω 30 min./D) | 145 hrs. (75Ω 4 hrs./D) |
| UM-3N | AA | 1.5 | 0.571 | 1.969 | 0.67 | 195 min. (5Ω 15 min. x 2/D) | 5.8 hrs. (10Ω 1 hr./D) |
| UM-3D | AA | 1.5 | 0.571 | 1.969 | 0.67 | 170 min. (5Ω 15 min. x 2/D) | 4.9 hrs. (10Ω 1 hr./D) |
| UM-3 | AA | 1.5 | 0.571 | 1.969 | 0.53 | 305 min. (10Ω 30 min./D) | 83 hrs. (150Ω 4 hrs./D) |
| UM-3PZ | AA | 1.5 | 0 571 | 1.969 | 0.57 | 150 min. (5Ω 15 min. x 2/D) | 4.8 hrs. (10Ω 1 hr./D) |
| UM-4D | AAA | 1.5 | 0.413 | 1.752 | 0.29 | 320 min. (15Ω 10 min./D) | |
| UM-5D | N | 1.5 | 0.473 | 1.181 | 0.23 | 200 min. (15Ω 10 min./D) | |
| 006PD | — | 9.0 | 0.689 x 1.024 x 1.929 wide long tall | | 1.34 | 29 hrs. (600Ω 4 hrs./D) | 13.4 hrs. (600Ω cont.) |
| 006P | — | 9.0 | 0.689 x 1.024 x 1.929 wide long tall | | 1.31 | | 37 hrs. (900Ω 4 hrs./D) |
| 006PN | — | 9.0 | 0.689 x 1.024 x 1.929 | | 1.42 | | 28.3 hrs. (600Ω cont.) |

### SPECIFICATIONS — ALKALINE - Mn BATTERIES

| Model | Size | (V) | Capacity (to 0.9V/cell) | Dimensions Diam. (inches) | Dimensions Height (inches) | Weight (oz.) | Rated Drain (mA) |
|---|---|---|---|---|---|---|---|
| AM-1 | D | 1.5 | 31 hrs. (4Ω cont.) | 1.339 | 2.402 | 5.05 | 320 |
| AM-2 | C | 1.5 | 12.5 hrs. (4Ω cont.) | 1.024 | 1.969 | 2.58 | 300 |
| AM-3 | AA | 1.5 | 12 hrs. (10Ω cont.) | 0.571 | 1.969 | 0.88 | 130 |
| AM-4 | AAA | 1.5 | 27 hrs. (50Ω cont.) | 0.414 | 1.752 | 0.42 | 25 |
| AM-5 | N | 1.5 | 19 hrs. (50Ω cont.) | 0.473 | 1.181 | 0.35 | 25 |
| 6AM6 | — | 9 | 4 hrs. (125Ω cont.) | 1.024 x 0.689 x 1.929 | | 1.77 | 20 |
| PX-825 | — | 1.5 | 11 hrs. (50Ω cont.) | 0.910 | 0.240 | 0.28 | 25 |
| PX-30 | — | 3 | 11 hrs. (100Ω cont.) | 0.945 | 0.492 | 0.55 | 25 |

### SPECIFICATIONS — SILVER OXIDE BATTERIES (SILVER)

| Model | (V) | Cap. (mAh) | Dimensions Diam. (inches) | Dimensions Height (inches) | Weight (oz.) | Rated Drain (μA) |
|---|---|---|---|---|---|---|
| WS-1 | 1.55 | 35 | 0.311 | 0.142 | 0.028 | 75 |
| WS-6 | 1.55 | 60 | 0.311 | 0.213 | 0.043 | 100 |
| WS-11 | 1.55 | 100 | 0.457 | 0.165 | 0.064 | 100 |
| WS-14 | 1.55 | 165 | 0.457 | 0.221 | 0.095 | 240 |
| WL-1 | 1.55 | 38 | 0.311 | 0.142 | 0.028 | 100 |
| WL-6 | 1.55 | 70 | 0.311 | 0.213 | 0.043 | 100 |
| WL-11 | 1.55 | 120 | 0.457 | 0.165 | 0.074 | 240 |
| WL-14 | 1.55 | 190 | 0.457 | 0.213 | 0.099 | 240 |

### SPECIFICATIONS — MERCURY CELLS

| Model | (V) | Cap. (mAh) | Dimensions Diam. (inches) | Dimensions Height (inches) | Weight (oz.) | Standard Drain (mA) | Maximum Drain (mA) |
|---|---|---|---|---|---|---|---|
| H-A | 1.35 | 40 | 0.311 | 0.142 | 0.03 | 1 | 1.5 |
| H-B | 1.35 | 55 | 0.457 | 0.138 | 0.05 | 1.2 | 2 |
| H-C | 1.35 | 125 | 0.457 | 0.213 | 0.09 | 2.5 | 5 |
| H-D | 1.35 | 225 | 0.618 | 0.240 | 0.16 | 5 | 10 |
| H-G | 1.35 | 2,000 | 1.000 | 0.670 | 1.06 | 20 | 40 |
| H-J | 1.35 | 2,000 | 1.213 | 0.520 | 1.13 | 40 | 60 |
| H-L | 1.35 | 3,000 | 1.213 | 0.670 | 1.52 | 40 | 60 |
| H-N | 1.35 | 450 | 0.646 | 0.449 | 0.32 | 10 | 20 |
| HM-N | 1.4 | 450 | 0.646 | 0.449 | 0.32 | 10 | 20 |
| H-O | 1.35 | 225 | 0.465 | 0.579 | 0.21 | 5 | 10 |
| H-P | 1.35 | 800 | 0.646 | 0.662 | 0.49 | 20 | 40 |
| H-R | 1.35 | 640 | 0.473 | 1.162 | 0.46 | 20 | 35 |
| H-T | 1.35 | 1,850 | 0.571 | 1.969 | 1.06 | 40 | 100 |
| H-U | 1.35 | 2,900 | 0.650 | 1.969 | 1.52 | 80 | 150 |
| H-Ya | 1.35 | 11,500 | 1.339 | 2.402 | 6.00 | 310 | 500 |

### SPECIFICATIONS — Li BATTERIES

| Model | Type | (V) | Capacity (mAh) | Dimensions (max.) Diam. (inches) | Dimensions (max.) Height (inches) | Weight (oz.) | Standard Disch. (mA) | Maximum Disch. (mA) |
|---|---|---|---|---|---|---|---|---|
| BR-425 | Pin | 2.8 | 20 | 0.165 | 1.020 | 0.02 | 0.5 | 1 |
| BR-435 | Pin | 2.8 | 40 | 0.165 | 1.413 | 0.03 | 1 | 2 |
| BR-2325 | Coin | 2.8 | 140 | 0.906 | 0.098 | 0.11 | 0.5 | 5 |
| LR-1/2A | Cylinder | 2.8 | 750 | 0.661 | 0.886 | 0.335 | 20 | 40 |
| LR-2/3A | Cylinder | 2.8 | 1200 | 0.661 | 1.315 | 0.477 | 35 | 70 |
| LR-C | Cylinder | 2.8 | 5000 | 1.024 | 1.969 | 1.66 | 150 | 300 |

**Panasonic /** ELECTRONIC COMPONENTS DIVISION
ONE PANASONIC WAY / SECAUCUS, NEW JERSEY 07094 / (201) 348-7000
**JUST SLIGHTLY AHEAD OF OUR TIME**

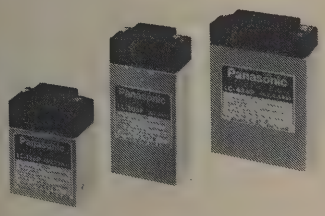
# Panasonic

## RECHARGEABLE BATTERIES

### NICKEL CADMIUM

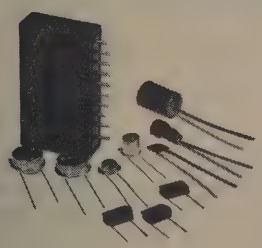
STATE OF THE ART / HIGH RATE, FAST AND STANDARD CHARGE CYLINDRICAL CELLS SINTERED ELECTRODES AND RESEALABLE VENTS / HUNDREDS OF CYCLES OR LONG STANDBY SERVICE

### GEL CELL LEAD ACID



USABLE IN ANY POSITION / GELLED CONTROLLED ELECTROLYTE / LEAD CALCIUM GRIDS / EXCELLENT CAPACITY, CHARGE RETENTION AND CYCLE LIFE

### SOLAR CELLS



SILICON POWER GENERATING AND DETECTION DEVICES

### SPECIFICATIONS — Ni - Cd BATTERIES

| Model | (V) | Capacity 5 hr. (mAh) | Dimensions Diam. (inches) | Dimensions Height (inches) | Weight (oz.) | Quick Charge (mA) | Quick Charge (hrs.) | Standard Charge (mA) | Standard Charge (hrs.) |
|---|---|---|---|---|---|---|---|---|---|
| NR-N | 1.2 | 150 | 0.473 | 1.181 | 0.300 | 38 | 6 | 15 | 15 |
| NR-AAA | 1.2 | 180 | 0.414 | 1.752 | 0.353 | 45 | 6 | 18 | 15 |
| NR-2/3AA | 1.2 | 250 | 0.571 | 1.181 | 0.424 | 75 | 4.5 | 25 | 15 |
| NR-AA | 1.2 | 500 | 0.571 | 1.988 | 0.742 | 150 | 4.5 | 50 | 15 |
| NR-1/2SC | 1.2 | 600 | 0.906 | 1.044 | 0.988 | 150 | 6 | 60 | 15 |
| NR-1/2C | 1.2 | 800 | 1.024 | 1.221 | 1.518 | | | 80 | 15 |
| NR-SC | 1.2 | 1,200 | 0.906 | 1.693 | 1.589 | 300 | 6 | 120 | 15 |
| NR-C | 1.2 | 1,800 | 1.024 | 1.969 | 2.471 | | | 180 | 15 |
| NR-D | 1.2 | 4,000 | 1.299 | 2.402 | 4.942 | | | 400 | 15 |
| NR-F | 1.2 | 6,000 | 1.339 | 3.583 | 8.119 | | | 600 | 15 |
| NR-SC.H | 1.2 | 1,200 | 0.906 | 1.693 | 1.589 | | | 40 | 48 up |
| NR-C.H | 1.2 | 1,800 | 1.024 | 1.969 | 2.471 | | | 60 | 48 up |
| NR-D.H | 1.2 | 4,000 | 1.299 | 2.402 | 4.942 | | | 133 | 48 up |

### SPECIFICATIONS — LEAD - ACID BATTERIES

| Model | (V) | Capacity (Ah) | Dimensions (inches) long | Dimensions (inches) wide | Dimensions (inches) tall | Weight (oz.) | Remarks |
|---|---|---|---|---|---|---|---|
| LC-156 | 6 | 1.5 (10h. rate) | 2.60 | 1.30 | 3.347 | 13.4 | |
| LC-306 | 6 | 3.0 (10h. rate) | 2.60 | 1.30 | 4.921 | 23.3 | |
| LC-456 | 6 | 4.5 (10h. rate) | 3.701 | 1.30 | 4.921 | 32.5 | |
| LC-606 | 6 | 6.0 (10h. rate) | 3.583 | 1.929 | 4.528 | 42.4 | |
| LC-756 | 6 | 7.5 (10h. rate) | 4.528 | 1.929 | 4.528 | 53.0 | |
| TY-355C | 6 | 3.0 (5h. rate) | 2.60 | 1.30 | 4.921 | 23.3 | Special use |
| 4-TY-355C | 24 | 3.0 (5h. rate) | 2.756 | 5.355 | 5.118 | 95.3 | Special use |
| TY-360-1 | 12 | 9.0 (3h. rate) | 1.890 | 9.528 | 7.284 | 169.4 | Special use |
| LCB-350 | 12 | 3.5 (5h. rate) | 8.386 | 4.961 | 2.166 | 77.7 | Liquid Electrolyte Special use |

### SPECIFICATIONS — SILICON PHOTO - VOLTAIC DETECTOR

| Model | Type | Element Size (inch) | Active Area (inch²) | Open Circuit Voltage (mV) | Short Circuit Current (μA) | Conjunction Capacity (pF) | Response Time Rise Up (μS) | Response Time Fall Down (μS) | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| BP-4M | Mesa | 0.16φ | 0.018 | 380 | 80 | 2030 | 16 | 17 | |
| BP-4MC | Mesa | 0.16φ x 0.31 | 0.018 | 380 | 80 | 2030 | 16 | 17 | Phenol |
| BP-35K | Mesa | 0.12 x 0.2 | 0.021 | 380 | 100 | 2400 | 18 | 19 | |
| BP-5S | Mesa | 0.2 x 0.2 | 0.036 | 380 | 170 | 3450 | 21 | 23 | |
| BP-5SA | Mesa | 0.2 x 0.2 x 0.4 | 0.036 | 380 | 170 | 3450 | 21 | 23 | Phenol |
| BP-410K | Mesa | 0.16 x 0.4 | 0.057 | 380 | 270 | 4500 | 27 | 29 | |
| BP-8M | Mesa | 0.32φ | 0.074 | 380 | 360 | 6100 | 32 | 35 | |
| BP-10S | Mesa | 0.4 x 0.4 | 0.147 | 380 | 600 | 9500 | 37 | 39 | |
| BP-2SPC | Planar | 0.08 x 0.08 | 0.004 | 450 | 22 | 450 | 7 | 7 | Glass Seal |
| BP-2SPM | Planar | 0.08 x 0.08 | 0.004 | 460 | 35 | 450 | 7 | 8 | Resin Mold |
| BP-2SPL | Planar | 0.08 x 0.08 | 0.004 | 470 | 50 | 450 | 7 | 8 | Lens Glass Seal |
| BP-3SPC | Planar | 0.12 x 0.12 | 0.011 | 450 | 55 | 780 | 13 | 13 | Glass Seal |
| BP-3SPM | Planar | 0.12 x 0.12 | 0.011 | 460 | 75 | 780 | 13 | 14 | Resin Mold |
| BP-3SPL | Planar | 0.12 x 0.12 | 0.011 | 470 | 80 | 780 | 13 | 13 | Lens Glass Seal |
| BP-2SPS | Planar | 0.08 x 0.08 | 0.004 | 450 | 20 | 400 | 5 | 5 | Ceramic Stem |
| BP-24KPS | Planar | 0.09 x 0.15 | 0.010 | 450 | 45 | 760 | 7 | 7 | Ceramic Stem |
| BP-3SPS | Planar | 0.12 x 0.12 | 0.011 | 450 | 50 | 780 | 8 | 8 | Ceramic Stem |
| BP-4SPS | Planar | 0.15 x 0.15 | 0.018 | 450 | 80 | 1300 | 10 | 10 | Ceramic Stem |
| Remarks | | | | $T_a$=25°C =77°F | $T_a$=25°C =77°F | $V_R$=0V f=1MHz | $V_R$=0V $R_L$=1kΩ | $V_R$=0V $R_L$=1kΩ | |

### SPECIFICATIONS — SILICON SOLAR CELLS

| Model (Unit Module) | Dimensions (inches) | Peak Power V | Peak Power mA | Peak Power mW |
|---|---|---|---|---|
| BP-M260 | 1.023 Dia. | 0.42 | 119 | 50 |
| BP-M500 | 1.969 Dia. | 0.45 | 420 | 189 |
| BP-2040K | 0.787 x 1.575 Rect. | 0.45 | 173 | 78 |

"PANAQUICK" QUICK CHARGE CONTROL MODULES FOR NICKEL CADMIUM AND LEAD ACID SYSTEMS

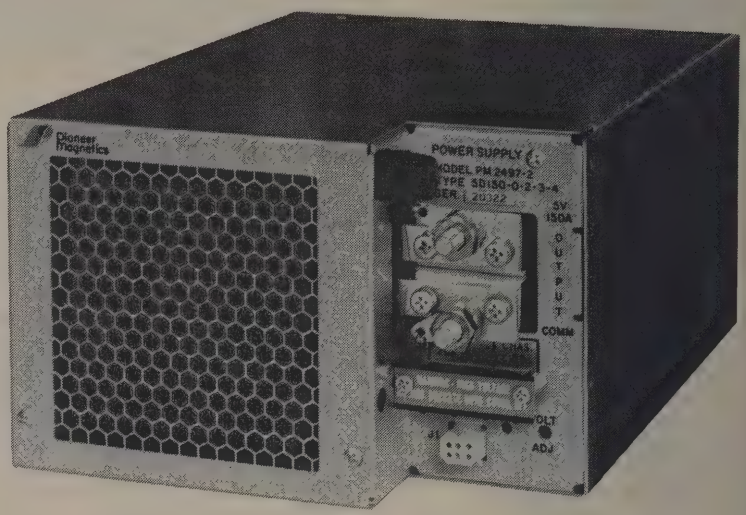
**Panasonic** / ELECTRONIC COMPONENTS DIVISION
ONE PANASONIC WAY / SECAUCUS, NEW JERSEY 07094 / (201) 348-7000

JUST SLIGHTLY AHEAD OF OUR TIME

# Pioneer Magnetics' Brownoutproof Switching Power Supplies: the Dependables.

## Features:

- ☐ Widest range of brownout protection
- ☐ 30 mS typical output holdup after input power loss with full load
- ☐ Full output rating at 50°C ambient
- ☐ 60% to over 80% efficiency
- ☐ Soft start
- ☐ Shortcircuit proof
- ☐ Overvoltage protection
- ☐ Designed to meet or recognized to UL478 and CSA154
- ☐ MTTR less than 15 minutes
- ☐ Field proven MTBF of 100,000 hours for slot supplies; calculated over 72,000 hours per MIL-HBK-217B



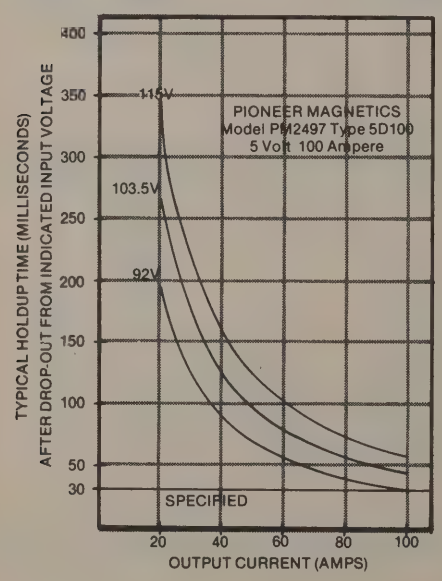

**The Dependables**

The Dependables are a family of single and multiple output, high current, switching regulated power supplies designed primarily for OEM digital applications where superior dynamic load and line performance is required. Their low RFI/EMI radiation and low output ripple also make them attractive for analog applications.

**Brownoutproof = More Uptime**

Beyond inherent advantages of switching supplies over linear types (i.e., high efficiency, low weight and small size), the Dependables are uniquely immune to most utility power variations. They can supply their specified regulated outputs at full load over input variations from 92 to 138 or 184 to 250 VAC; and they'll continue to do so for several minutes even if input voltages drop to 70 or 140 VAC.

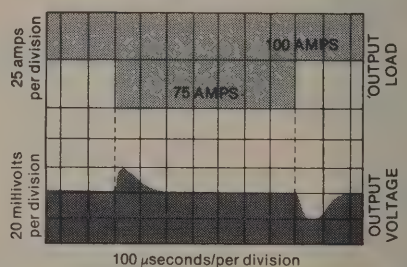
**HOLDUP TIME VS OUTPUT CURRENT**




**Easy to Specify**

Unique to the Dependables is a worst-case method of specifying voltage regulation that simplifies the design engineer's task by giving a known limit to cumulative tolerances. This limit, ±2%, defines the maximum deviation from a set value from any combination of Drift, Line Regulation, Static and Dynamic Loads, and Peak-to-Peak Noise and Ripple. Well within this ±2% error band, the typical transient response of a 5 Volt 100 Ampere supply to a 25 Ampere load step is approximately 20 mVolts.

**TYPICAL TRANSIENT RESPONSE TO 25% LOAD STEP**




This is the response of a Model PM2497, 5 Volt, 100 ampere unit to a 25 ampere load step.

**DC to DC Units Too**

The Dependables are also available as DC input versions with 24, 48, 120 or 240 VDC as standard source voltages. Pioneer Magnetics can provide units that operate from both AC and DC sources allowing ease of switching to battery back-up for UPS applications. Check with us for further information.

**Our Experience**

Since 1958 Pioneer Magnetics has specialized in the design and manufacture of switching power supplies. A continual development program ensures that every switching supply we manufacture is properly designed, conservatively rated and thoroughly tested. Only then do we feel that it has earned the name: the Dependables.

# General Specifications

**Total Error Band:** ±2% (±100 mV for 2 and 3-volt units) including the following (See factory for 4th channel ratings.):
- Input power variation over the specified range.
- Static loads from 0 to 100%.
- Dynamic Load Steps (10μSec rise) 25% on 5 VDC units, up to 90% on higher voltage units.
- Ripple and switching spikes.
- Temperature stability over full operating range 0° to 50°C.
- Drift for an 8-hour period following initial warmup.

**Overshoot:** No turn-on or turn-off overshoot.

**Power Loss Holdup:** For AC-input units only. Output will remain within regulation 30 milliseconds after loss of AC input when operating at full load and nominal line.

**Overvoltage Protection:** *Single Output Units* - Overvoltage shutdown to protect the load is provided and set at 125% ±10% of rated output. An additional overvoltage crowbar is available as an option. *Multiple Output Units* - Automatic shutdown is provided on the main channel as standard. OVP on other channels can be provided as an option. Overvoltage crowbar is optionally available for the main channel.

**Overload Protection:** Current limiting (foldback) circuits protect all units against overload and short-circuits. The output automatically recovers from overcurrent shutdown after load fault is removed.

**Overtemperature Protection:** Automatically shuts unit down in the event of an overtemperature condition.

**Reverse Voltage Protection:** Supply is protected against reverse voltage applied across the output terminals.

**Remote Sense:** *Single Output Units* - Standard on all units. Handles up to one volt drop in output leads.
*Multiple Output Units* - Standard on main and channels two and three. Handles up to one-half volt drop in the output leads.

**Input Fuse:** Standard on all units.

**EMI:** Meets VDE 0875 Level N requirements for input conducted EMI with external filter.

**Environmental:** *Temperature, operating* - 0° to 50°C at 100% rated power, derates linearly to 80% of rated power at 71°C.
*Temperature, storage* - -55°C to +85°C.
*Humidity* - 5% to 95% without condensation.

**Safety Standards:** Standard models recognized to UL478.

**Size and Weight:** *Single Output Units* - See output chart.
*Multiple Output Units* - Size 5" × 8" × 11¾" (PM2677 and PM2678 add 1-9/16" for external fan). Weight: 20 pounds.

# Options

The following standard options are available:
- Power Fail Signal
- Logic Inhibit
- True Inhibit
- OV Crowbar
- Remote Program/Margin Check to ±5% or ±10%
- Local Margin Check
- Paralleling
- Reverse Input Protection (DC-Input Units)
- Output Out of Tolerance
- Output Power Good

Other special options are available and designed to exact requirements:
- Additional Outputs
- Automatic Battery Backup and Charging
- Additional EMI Filtering
- Sequencing

# Single Output Power Supplies

**AC-Input Units:** 92 to 138 or 184 to 250 VRMS (specify choice), other ranges available on request, single phase, 47 to 63 Hz, 380 to 440 Hz also available. Will regulate through line dips to 70 or 140 VRMS.

**DC-Input Units:**

| NOMINAL VOLTAGE | INPUT RANGE |
|---|---|
| 24 | 22-31 |
| 48 | 42-66 |
| 120 | 100-145 |
| 220 | 200-250 |

**Outputs:** See chart below.

| AC INPUT MODEL / DC INPUT MODEL** | | | PM2496 / PM272* | PM2497 / PM2722 | PM2498 / — — — |
|---|---|---|---|---|---|
| OUTPUT VOLTAGE | TYPE NUMBERS (Add Amps in Blanks) AC MODELS | DC MODELS | OUTPUT CURRENT | OUTPUT CURRENT | OUTPUT CURRENT |
| 2 | 2D____ | 2F____ | 100 | 200 | 400 |
| 3 | 3D____ | 3F____ | 60 | 100 | 200 |
| 5 | 5D____ | 5F____ | 50 | 100 | 200 |
| 5 | 5D____ | 5F____ | 60 | 120 | — |
| 5 | 5D____ | 5F____ | — | 150 | 300 |
| 12 | 12D____ | 12F____ | 25 | 60 | 120 |
| 15 | 15D____ | 15F____ | 25 | 50 | 100 |
| 18 | 18D____ | 18F____ | 22 | 45 | 90 |
| 21 | 21D____ | 21F____ | 18 | 38 | 76 |
| 24 | 24D____ | 24F____ | 16 | 33 | 66 |
| 28 | 28D____ | 28F____ | 13 | 27 | 54 |
| 48 | 48D____ | 48F____ | 8 | 16 | 32 |
| SIZE (INCHES) | | | 5×8×11 | 5×8×11 | 5×16×11 |
| WEIGHT | | | 16 pounds | 18 pounds | 35 pounds |

*Other output volt/amp combinations are available.
**For 24 VDC input, check factory for output ratings.

# Multiple Output Power Supplies

Standard Multiple Output Power Supplies with the flexibility to meet your exact custom requirements. Specifications are similar to single-output supplies.

**Outputs:** Up to four completely isolated outputs. Either polarity can be chosen for each output. See chart below.

| AC INPUT MODEL / DC INPUT MODEL (See note 6.) | | PM2675 / PM2775 | PM2676 / PM2776 | PM2677 / PM2777 | PM2678 / PM2778 |
|---|---|---|---|---|---|
| MAXIMUM TOTAL OUTPUT POWER IN WATTS | | 375 | 600 | 750 | 850 (see note 1) |
| MAIN CHANNEL (see note 2) | OUTPUT VOLTAGES AVAILABLE | 2, 3, 5, 12, 15, 18, 21, 24, 28, 48 | | | |
| | MAXIMUM POWER IN WATTS (see note 3) | 250 | 500 | 600 | 750 |
| SECOND CHANNEL | OUTPUT VOLTAGE | 5 | 12 / 15 | 18 / 21 | 24 / 28 |
| | OUTPUT CURRENT MAX. (see note 4) | 7 | 7 / 7 | (see note 5) | |
| THIRD CHANNEL | OUTPUT VOLTAGE | 5 | 12 / 15 | 18 / 21 | 24 / 28 |
| | OUTPUT CURRENT MAX. (see note 4) | 10 | 10 / 10 | (see note 5) | |
| FOURTH CHANNEL | OUTPUT VOLTAGE | 5 | 12 / 15 | 18 / 21 | 24 / 28 |
| | OUTPUT CURRENT MAXIMUM | 4 | 4 / 4 | 4 / 4 | 3 / 3 |

**NOTE** 1. Brownout capability reduced for this Model.
2. Main channel must maintain 50 watt minimum load so that other channels regulate properly.
3. Maximum power for 2 and 3 volt outputs is 60% figure given.
4. Check with factory for higher current ratings.
5. Check with factory for current ratings on these and other special voltages.
6. Check with factory for 24 VDC ratings.

Contact us today for complete details on our line of standard and customized switching power supplies to meet your specific needs.

Pioneer Magnetics

1745 Berkeley Street • Santa Monica, CA 90404
Telephone (213) 829-6751 • TWX 910-343-6249

# ± 15 VDC DUAL POWER SUPPLIES

## $16.75 MODEL P31 1-9 QTY

## +5VDC @ 500MA $25. MODEL P37 1-9 QTY.

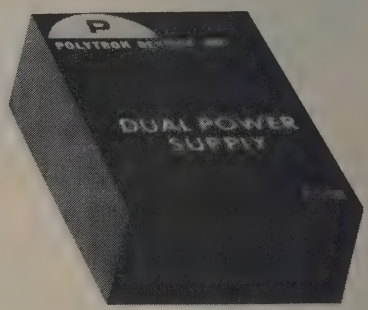
## FEATURES

**FROM STOCK**

- OUTPUT VOLTAGE ERROR - ± 1% MAX
- LINE & LOAD REGULATION - 0.2% TO 0.02%
- SHORT CIRCUIT PROTECTION - CURRENT LIMITED
- INPUT ISOLATION - 50 MEGOHMS
- DESIGNED FOR P.C. CARD MOUNTING

**The Polytron Devices, Inc. P30 Power Supply Series is designed specifically for use with Digital or Linear IC'S, function modules and similar devices requiring clean, well regulated dual or single voltage excitation.**

**Useful for industrial and laboratory applications, these power supplies are manufactured with all hi performance solid state components offering exceptional reliability over extended periods; the P30 series features the lowest cost modular supplies on the present market.**




| SPECIFICATIONS:① | ±15 VDC | | | | +5 VDC | | |
|---|---|---|---|---|---|---|---|
| Model | P31 /P31-1 | P33 /P33-1 | P34 /P34-1 | P35 /P35-1 | P37 /P37-1 | P38 /P38-1 | P39 |
| Rated Output② Voltage | ± 15 VDC @ ± 25 mA | ± 15VDC @ ± 100mA | ± 15VDC @ ± 200mA | ± 15VDC @ ± 350mA | + 5VDC @ 500mA | + 5VDC @ 1000mA | + 5VDC @ 2000mA |
| Rated Input Voltage | 105 VAC to 125 VAC 50 HZ to 400 HZ | | | | | | |
| Output Error (max) | ± 1% | ± 1% | ± 1% | ± 1% | ± 1% | ± 1% | ± 1% |
| Regulation 105 to 125VAC Load, 0 to 100% | 0.2% /0.02%<br>0.2% /0.02% | 0.2% /0.02%<br>0.2% /0.05% | 0.2% /0.02%<br>0.2% /0.05% | 0.1% /0.05%<br>0.1% /0.05% | 0.2% /0.02%<br>0.2% /0.05% | 0.2% /0.02%<br>0.2% /0.05% | 0.02%<br>0.15% |
| Temp. Coefficient (/°C)<br>Operating Temp. (°C)<br>Warm up Drift | 0.015%<br>-25 to +85<br>30 mV | 0.015%<br>-25 to +71<br>35 mV | 0.015%<br>-25 to +71<br>35mV | 0.015%<br>-25 to +71<br>35mV | 0.015%<br>-25 to +71<br>35mV | 0.015%<br>-25 to +71<br>35mV | 0.015%<br>-25 to +71<br>35mV |
| Ripple & Noise (max) | 1 mV rms | 1 mv rms | 1 mV rms | 1mV rms | 1 mV rms | 1 mV rms | 1 mV rms |
| Delivery Price (1-9) | STOCK $16.75 /$20 | STOCK $25 /$28 | STOCK $42 /$49 | STOCK $49 /$53 | STOCK $25.00 /$37 | STOCK $35 /$45 | STOCK $62.00 |

① 115 VAC, 50 to 400 HZ, @25°C

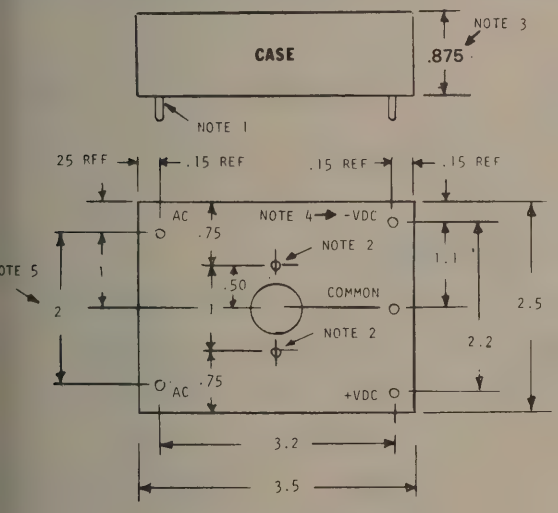
② OTHER STANDARD VOLTAGES AVAILABLE FROM STOCK SEE REVERSE SIDE

## POLYTRON DEVICES, INC.

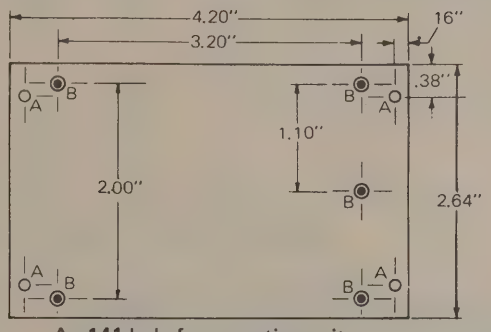
P.O. BOX 398, PATERSON, N.J. 07524 (201) 365-0401

# OTHER MODELS AVAILABLE FROM STOCK

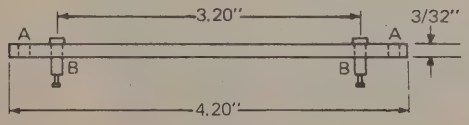
| Part No. | Voltage (DC) | Current | Regulation Line and Load | Ripple and Noise | Price 1-9 Qty. | |
|---|---|---|---|---|---|---|
| P33-6S | 6.0 VDC | 125MA | 0.1% | 1.0 MV RMS | $22.00 | Single Voltage Units |
| P33-12S | 12.0 VDC | 100MA | 0.1% | 1.0 MV RMS | $23.00 | |
| P34-12S | 12.0 VDC | 200MA | 0.1% | 1.0 MV RMS | $35.00 | |
| P37-12S | 12.0 VDC | 500MA | 0.2% | 2.0 MV RMS | $45.00 | |
| P33-15S | 15.0 VDC | 100MA | 0.1% | 1.0 MV RMS | $22.00 | |
| P34-15S | 15.0 VDC | 200MA | 0.1% | 1.0 MV RMS | $32.00 | |
| P35-15S | 15.0 VDC | 300MA | 0.1% | 1.0 MV RMS | $39.00 | |
| P32-18S | 18.0 VDC | 50MA | 0.1% | 1.0 MV RMS | $22.00 | |
| P35-24S | 24.0 VDC | 300MA | 0.1% | 1.0 MV RMS | $47.00 | |
| P31-5 | ±5 VDC | ±25MA | 0.02% | 1.0 MV RMS | $22.00 | Dual Voltage Units |
| P32-5 | ±5 VDC | ±50MA | 0.1% | 1.0 MV RMS | $27.00 | |
| P33-5 | ±5 VDC | ±100MA | 0.1% | 1.0 MV RMS | $37.00 | |
| P34-5 | ±5 VDC | ±200MA | 0.1% | 1.0 MV RMS | $43.00 | |
| P35-5 | ±5 VDC | ±300MA | 0.1% | 1.0 MV RMS | $49.00 | |
| P31-12 | ±12 VDC | ±25MA | 0.1% | 1.0 MV RMS | $16.75 | |
| P32-12 | ±12 VDC | ±50MA | 0.1% | 1.0 MV RMS | $24.50 | |
| P33-12 | ±12 VDC | ±100MA | 0.1% | 1.0 MV RMS | $33.50 | |
| P34-12 | ±12 VDC | ±200MA | 0.1% | 1.0 MV RMS | $49.00 | |
| P35-12 | ±12 VDC | ±300MA | 0.1% | 1.0 MV RMS | $59.50 | |
| P32 | ±15 VDC | ±50 MA | 0.1% | 1.0 MV RMS | $23.50 | |
| P32-18 | ±18 VDC | ±50 MA | 0.1% | 1.0 MV RMS | $24.50 | |
| P34-24 | ±24 VDC | ±200MA | 0.1% | 1.0 MV RMS | $79.00 | |




BOTTOM VIEW CASE




A. .141 hole for mounting unit
B. Teflon inserts




SOCKET
MODEL S-5 $4.25/ea.

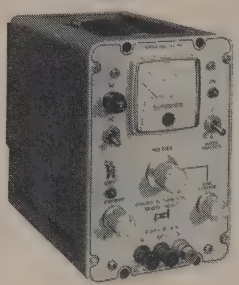
1. FIVE PINS, .040 dia., .2" long min.
2. TWO MOUNTING INSERTS, #4-40 x .10" deep min.
3. 1.25" for models P38, P38-1, P33-65 P31-5, P32-5, P33-5, P34-5, P35-5
   1.56" for models P34, P34-1, P34-15S, P35, P35-1, P35-15S, P35-24S, P35-12, P37-12S P34-24
   1.98" for models P39
4. -VDC internally connected to common for single voltage units.
5. 2.2" AC Pin spacing available upon request.

POLYTRON DEVICES INC., BOX 398, PATERSON, N.J. 07524 201-365-0401

TECHNICAL DATA

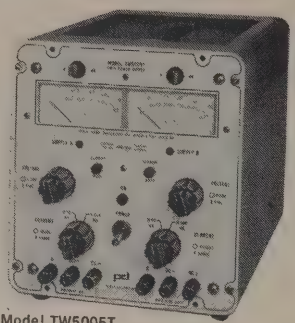
# LABORATORY POWER SUPPLIES

SINGLE OUTPUT



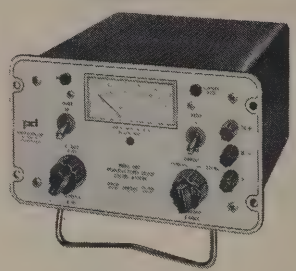
Model 5015T
5¾″ w x 8⅝″ h x 10⅞″ d
Case B

DUAL OUTPUT



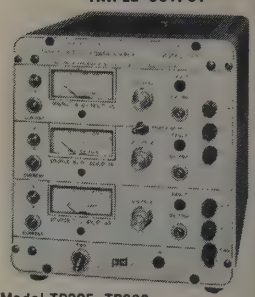
Model TW5005T
7¾″ w x 8⅝″ h x 13½″ d
Case C

SINGLE OUTPUT



Model 6010
Case A 8⅜″ w x 4¾″ h x 9″ d
Case A1 : 12″ d

TRIPLE OUTPUT



Model TP325, TP330
7¾″ w x 8⅝″ h x 13½″ d
Case D

## PARTIAL LIST OF AVAILABLE UNITS

• Laboratory workhorse power supplies with over 15 years of field history • Continuously adjustable voltage, current or current limiting controls with limiter or current mode indicating lamps • No RFI generating SCR or switching circuits • Modular package construction suitable for bench or rack mounting • Processed under a "Predictable Reliability" Program for 5-year minimum operation to published specifications. This program features: Avalanche-controlled rectifiers, 100% stress testing of transistors, pre-aged zener references with maximum I/F noise specifications, computer grade capacitors, low T.C. 1% tin oxide film resistors in critical circuits, etc. • Supplies are burned in under full load for a minimum of 50 hours prior to test.

| Model | Voltage | Current Amps | Voltage Regulation | Current Regulation | Ripple Pk to Pk mV | Case | *PRICE |
|---|---|---|---|---|---|---|---|
| 6010△ | 0-20/ 50/60 | 1.5/1.0/ 0.5 | 0.005% +1 mV | better than 500μA | 1.0 | A | $239.00 |
| 1255△ | 0-50/ 125 | 0.5/.25 | 0.005% +1 mV | better than 1.0 mA | 1.0 | A | $275.00 |
| 6050B△ | 0-6/15/ 30/60 | 5.0/3.0/ 2.0/1.0 | 0.005% +1 mV | better than 1.0 mA | 1.0 | A1 | $349.00 |
| 5015T | 0-50 | 0-1.5 | +0.01% or 3 mV† | current limit only | 1.0 | B | $259.00 |
| TW5005T (dual) | 0-50, 0-0.5A each output | | each output 0.005% +1 mV | each output better than 500μA | 1.0 | C | $319.00 |
| 4050 | *0-40 | 0-5.0 | 0.01% +3 mV | current limit only | 3.0 | C | $349.50 |
| 1120S | 0-120 | 0-1.0 | 0.01% +3 mV | current limit only | 1.0 | C | $324.50 |
| *TP325 Triple Output | **0-32 | 0-1A | 0.01% +1 mV | adj. current limit | 1.0 | D | $420.00 |
| | **0-32 | 0-1A | 0.01% +1 mV | adj. current limit | 1.0 | | |
| | 0-6 | 0-5A | 0.01% +1 mV per amp | adj. current limit | 2.0 | | |
| TP330 Triple Output | Same as Model TP325 except 6V supply replaced with 0-15V, 0-2.5A. For COS/MOS applications. | | | | | D | $435.00 |

† Whichever is greater
* Built-in adj. overvoltage crowbar
** Tracking or non-tracking operation by panel switch with common output terminal
△Uniply® Technique. Model 6050B uses digital display.

# HIGH VOLTAGE POWER SOURCES

MODEL 1556B

## CALIBRATED POWER SOURCES FOR PHOTOMULTIPLIER PROPORTIONAL AND SOLID STATE DETECTORS, ELECTRON OPTICS, LASERS, CRT DISPLAYS

Calibrated high voltage power sources supplying tightly regulated DC for critical applications where stability, low noise and reliability are of prime consideration. • .25% calibration accuracy • 10 MV resolution • Sealed transformers and rectifiers • Self-restoring overload and short circuit protection • All solid state except for "Series" Pass Tube • Voltage and current metering.

## PARTIAL LIST OF AVAILABLE UNITS

| Model | Voltage | Current mA | Regulation Line or Load | Ripple Pk to Pk mV | △Size Panel Ht. | PRICE |
|---|---|---|---|---|---|---|
| 2K10M | 0-2000 | 0-10 | .005% or 10 mV | 1.0 | 4¾″ (size A) | $295.00 |
| 2K20 | 1-2012 | 0-20 | 0.001% +2 mV | 1.0 | 3½″ | $370.00 |
| 1570 | 1-3012 | *0-40 | 0.001% +2 mV | 1.0 | 5¼″ | $575.00 |
| 1556B | 10-6021 | 0-20 | 0.001% +2 mV | 1.0 | 7″ | $750.00 |
| 1543A | 10-10021 | 0-10 | 0.001% +2 mV | 5.0 | 10½″ | $995.00 |
| **3K10B | 10-3000 | 0-10 | .001% +3 mV | 3.0 | 3.0″ | $390.00 |

*Panel adj. current limiting, 5-40 mA
**All solid state. Size: 3″ x 8½″ x 11½″
△Units are std. 19″ rack mtg. except 2K10M and 3K10B

Prices subject to change without notice • F.O.B. Westbury, N.Y.

## POWER DESIGNS

**POWER DESIGNS INC.**
1700 SHAMES DRIVE ■ WESTBURY, N.Y. 11590
Tel: 516-333-6200 ■ TWX 510-222-6561

**POWER DESIGNS PACIFIC INC.**
3381 MIRANDA AVENUE ■ PALO ALTO, CALIF. 94304
Tel: 415-493-6111 ■ TWX 910-373-1251

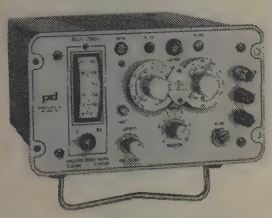
TECHNICAL DATA

# CALIBRATED POWER SOURCES

## CALIBRATED, STABLE, LOW NOISE, HIGH RESOLUTION POWER SOURCES FOR PRECISION LABORATORY APPLICATIONS

### 0-20 VDC/0-500 mA

**MODEL 2005A**

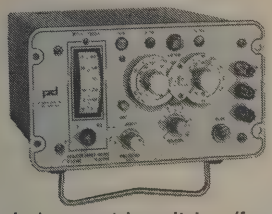


***$370.00**

• Two dual concentric switches (four decades) and a calibrated potentiometer provide digital readout to five significant figures • A toggle switch provides readout to six figures above 10 volts • Last-place potentiometer has 10 μV resolution • Source impedance is less than two milliohms at DC, less than 0.5 ohms at 1 MHz • Recovery time is less than 25 microseconds to return within a 100 μV band of the programmed voltage for an 80% load change • Front and rear access terminals.

• Better than 0.1% calibration accuracy • Critical components in temperature stabilized oven • 10 PPM plus 100 μV stability for 8 hours • Temperature coefficient better than 10 PPM or 50 μV per °C • Self-restoring overload and short circuit protection with adjustable current limit control and flashing limit indicator • 100 μV maximum peak-to-peak ripple (250 μV on Model C400) • Solid silver decade switch contacts • 100 hour minimum burn-in prior to calibration • Individual calibration data furnishd with each unit • Provisions for remote sensing and remote resistance programming at 1000 Ω/volt • Voltage or current metering.

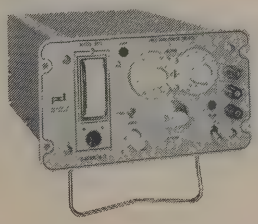
### 0-20 VDC/0-2 A



• Two dual concentric switches (four decades) and a calibrated potentiometer provide digital readout to five significant figures • A toggle switch provides readout to six figures above 10 volts • Last-place potentiometer has 10 μV resolution • Source impedance is less than two milliohms at DC, less than 0.5 ohms at 1 MHz • Recovery time is less than 25 microseconds to return within a 100 μV band of the programmed voltage for an 80% load change • Front and rear access terminals.

**MODEL 2020A** ***$395.00**

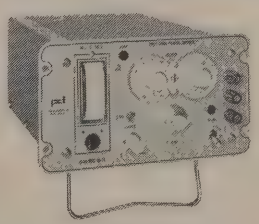
### 0-40 VDC/0-1 A



• Two dual concentric switches (4 decades) and a calibrated 10-turn potentiometer provide calibrated readout to six significant figures • Sixth place interpolation with 10 microvolt resolution • Dial accuracy is 0.1% plus one millivolt below one volt, 0.1% from one to forty volts • Front and rear access terminals • Bail/carrying handle tilts front panel for viewing ease • Electrical characteristics similar to Model 2005A.

**MODEL 4010** ***$395.00**

### 0-100 VDC/0-400 mA



• Two dual concentric switches (4 decades) and a calibrated 10-turn potentiometer provide calibrated readout to six significant figures • Sixth place interpolation with 10 microvolt resolution • Dial accuracy is 0.1% plus one millivolt below one volt, 0.1% from one to 100 volts • Front and rear access terminals • Bail/carrying handle tilts front panel for viewing ease • Electrical characteristics similar to Model 2005A.

**MODEL C400** ***$395.00**

## PARTIAL LIST OF AVAILABLE PRECISION POWER SOURCES

| Model | Range Volts | Current Amps | Regulation Line/Load | Max. Ripple Pk to Pk | Stability | TC Per °C | Size | Special Features | *Price |
|---|---|---|---|---|---|---|---|---|---|
| 2005A | 0-20 | 0-0.5 | .0005% +100 μV | 100 μV | .001% +100 μV/8 hrs. | .001% or 50μV | 8⅜ x 4¾ x 8²⁷⁄₃₂ | 4 decade readout with .1% accuracy. Continuous current limiting with panel pushbutton setting. Remote programmable 1000Ω/V. | $370.00 |
| 2020A | 0-20 | 0-2.0 | .0005% +100 μV | 100 μV | .001% +100 μV/8 hrs. | .001% or 50μV | 8⅜ x 4¾ x 11⅞ | 4 decade readout with .1% accuracy. Remote programmable 1000Ω/V. | $395.00 |
| 4010 | 0-40 | 0-1.0 | .0005% | 100 μV | .001% +100 μV/8 hrs. | .001% or 50μV | 8⅜ x 4¾ x 11⅞ | Same as 2020A. | $395.00 |
| C400 | 0-100 | 0-0.4 | .001% +100 μV | 250 μV | .001% +100 μV•8 hrs. | .001% or 50μV | 8⅜ x 4¾ x 11⅞ | 4 decade readout with 1% accuracy. Continuous current limiting. Remote programmable 1000Ω•V. | $395.00 |
| 3K10B | 10-3000 | 0-0.01 | .001% or 3 mV | 3 mV | .005% +1V•8 hrs. | .005% | 3 x 8½ x 11½ | Calibrated readout to ¼%. Arc and short circuit proof. | $390.00 |

## POWER DESIGNS

**POWER DESIGNS INC.**
1700 SHAMES DRIVE ■ WESTBURY, N.Y. 11590
Tel: 516-333-6200 ■ TWX 510-222-6561

* F.O.B. Westbury, New York
Prices subject to change without notice.

**POWER DESIGNS PACIFIC INC.**
3381 MIRANDA AVENUE ■ PALO ALTO, CALIF. 94304
Tel: 415-493-6111 ■ TWX 910-373-1251

**TECHNICAL DATA**

# Uniply®

## A Laboratory of Power Supplies in a Single Package

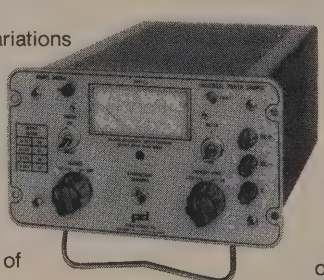
The UNIPLY® principle involves a regulator technique that provides a general purpose power source functionally replacing four conventional power supplies.
The regulator system comprises a number of unregulated DC sources, a number of power semiconductors selected for optimum voltage and current characteristics and a single control amplifier which selects through "OR" gates that combination of unregulated source and power semiconductors that satisfy the demands of the load and the panel control settings with minimum power supply losses.
Ranging is automatic and transient-free. Operation is electronic, without relays or manual switching and utilizes linear circuits only. No triacs, SCR's or switching circuits are employed.

A built-in front panel continuously adjustable overvoltage "crowbar" in conjunction with an inhibit switch limiting the automatic ranging to 6 volts provides completely safe operation with digital circuit loads. The UNIPLY® technique permits increased power supply capability with increasing AC line voltages. Up to 150% of panel ratings is available at line voltages over 105 volts. Useful output at reduced levels is available at line voltages as low as 85 volts. A flashing panel indicator signals loss of regulation if load demands exceed the regulator capability or AC input voltages are inadequate.
Two voltage and current ranges are provided on the taut-band suspension panel meter to increase resolution. Ranges switch automatically with range switch setting.

## Model 6050A: 0-7V at 5A / 0-15V at 3A / 0-25V at 2A / 0-60V at 1A *$259.00

### SPECIFICATIONS

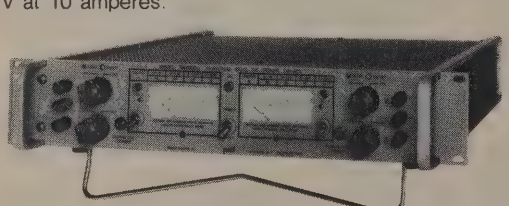
**Input:** 105-125 volts, 57-440 Hz, 100 watts nominal.
**Line Regulation:** 0.01% + 1 millivolt.
**Load Regulation:** 0.01% + 1 millivolt for load variations from 0-100% of rated output current.
**Polarity:** Either positive or negative output terminal may be operated at ground potential
**Ripple and Noise:** Less than 1 millivolt peak-to-peak.
**Source Impedance:** <0.005 Ω at DC, 0.1 Ω to 20 KHz, 1.0 to 1 MHz.
**Recovery Time:** Less than 50 microseconds to return to within a 15 millivolt band of the original voltage for a step change in rated load of 10% to 100% (1 microsecond rise time).
**Stability:** 0.02% +3 millivolts per 24 hours.
**Operating Temperature:** 0-50°C at full load. Storage: −20°C to +85°C.
**Temperature Coefficient:** 0.02% per degree C.



**Current Limiting:** Concentric switch/potentiometer provides continuous adjustment in two ranges: 0-500 milliamperes, 0-5 amperes.
**Metering:** Front panel taut-band meter and a selector switch permit monitoring voltage or current with an accuracy of ±3% of full scale. Voltage ranges 0-6V/0-60V change automatically with voltage range control. Current ranges 0-500 mA/0-5A change automatically with current range control.
**Output Terminals: Front Panel:** Three binding posts for positive, negative and ground.
**Rear Panel:** Seven terminal barrier strip for output voltage, sensing, voltage programming and parallel operation.
**Dimensions:** 8⅜" wide x 4¾" high x 11⁹⁄₁₆" deep.
**Weight:** 15½ lbs.
**Overvoltage Crowbar:** Built-in overvoltage crowbar adjustable from 2.0 V to 70 V from the front panel.

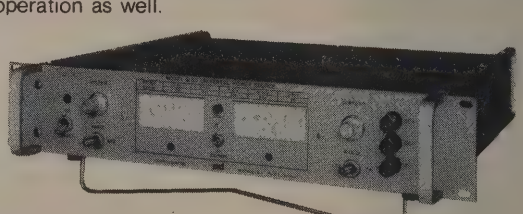
## Model TW6050A: TWO MODEL 6050A SOURCES IN A 3-1/2" x 19" RACK MOUNTING PACKAGE *$449.00

More compact than two Model 6050A units, the Model TW6050A offers two independent sources which are electrically identical to the Model 6050A, but permit series operation to 120 V at 1 ampere or parallel operation to 7V at 10 amperes.



## Model 6150: 0-7V at 15A / 0-15V at 7.5A 0-25V at 5A / 0-60V at 2A *$370.00

The Model 6150 offers more than twice the output power of the Model 6050A, with essentially the same electrical characteristics. Two taut-band meters are provided. Each instrument has two voltage and current ranges 0-6V/0-60V, 0-1.5A/0-15A. Ranges switch automatically with range switch setting. The Model 6150 mounts in a 19" rack, measures 3½"H x 16"D and is suitable for laboratory bench operation as well.



* FOB Westbury, New York
Prices subject to change without notice.

## POWER DESIGNS

**POWER DESIGNS INC.**
1700 SHAMES DRIVE ■ WESTBURY, N.Y. 11590
Tel: 516-333-6200 ■ TWX 510-222-6561

**POWER DESIGNS PACIFIC INC**
3381 MIRANDA AVENUE ■ PALO ALTO, CALIF. 94304
Tel: 415-493-6111 ■ TWX 910-373-1251

**TECHNICAL DATA**

# MODULAR HIGH VOLTAGE PRECISION POWER SOURCES

## 10-2000 VDC, 0-20 MA
## 10-3000 VDC, 0-10 MA
## 10-5000 VDC, 0-5 MA

The UPMD series of high voltage sources are compact modular units designed for critical applications where high stability, low noise and flexibility of output voltage control are important considerations.

They are ideal for such applications as photomultipliers, Geiger-Muller counters, proportional detectors, CRT sources, high resolution video displays, electrostatic lenses, etc.

Remote control of the high voltage output is achieved by means of an external potentiometer operating at low potentials with respect to ground. Output voltage resolution is a function of the resolution of this control. Options are available for remote voltage control at any desired input/output voltage ratio or for digital operation with an external D/A converter.

A unique overvoltage/arc suppression system is incorporated to protect the supply and its load in the event of loss of output voltage control or an overvoltage due to L di/dt transients generated by sustained load arcing. The circuit operates to clamp the output voltage to approximately 200 volts above any setting, hold this clamp for approximately two seconds and shutting down the supply electronically if the fault persists. The supply may be manually reset by momentary interruption of the AC line.

An internal 1% multiplier permits connection of an external meter for monitoring. A zener diode across the metering terminals minimizes shock hazard.

The compact size (4½″ x 6″ x 7½″), excluding the high voltage connector and light weight (8 lbs.) is achieved through the use of high frequency inverter technology in conjunction with a fast series regulator. RFI and EMI is held to low levels through the use of careful shielding and low pass AC line and DC output filters.

High voltage transformers and high voltage components encapsulated in readily replaceable epoxy modules. Low voltage components are accessible on epoxy coated PC boards.

An SHV (Safety High Voltage) BNC receptacle is utilized for the output voltage. A mating connector is furnished with each unit.

### Characteristics

**INPUT:** 105-125 V, 47-440 Hz, 60 w (115 V line)

**OUTPUT:** See Table

**REGULATION:** .001% or 10 MV (whichever is greater), for line or load variations.

**NOISE AND RIPPLE:** 10 MV peak-to-peak to 1 MHz

**STABILITY:** Less than .01% or 15 MV (whichever is greater)

**TEMPERATURE:** 0-50°C

**TEMPERATURE COEFFICIENT:** Less than 50 PPM/°C

**PROTECTION:** Current limiter and overvoltage system limits output to safe levels.

**SIZE:** 4½″ x 6″ x 7½″

**WEIGHT:** 8 lbs.

**MOUNTING:** In any plane

### Table

| MODEL | *OUTPUT POLARITY | VOLTAGE RANGE | OUTPUT CURRENT | **UNIT PRICE |
|---|---|---|---|---|
| UPMD-220N | NEGATIVE | 10-2000 VDC | 0-20 MA | $385.00 |
| UPMD-220P | POSITIVE | 10-2000 VDC | 0-20 MA | 395.00 |
| UPMD-310N | NEGATIVE | 10-3000 VDC | 0-10 MA | 385.00 |
| UPMD-310P | POSITIVE | 10-3000 VDC | 0-10 MA | 395.00 |
| UPMD-550N | NEGATIVE | 10-5000 VDC | 0-5 MA | 440.00 |
| UPMD-550P | POSITIVE | 10-5000 VDC | 0-5 MA | 450.00 |

*Corresponding output terminal connected to chassis. **Subject to change without notice. FOB Westbury, N.Y.

**OPTIONS** 1. Remote voltage programming (specify ratio) **$50.00**
2. Isolation up to 250V above chassis **$50.00**

## POWER DESIGNS

**POWER DESIGNS INC.**
700 SHAMES DRIVE ■ WESTBURY, N.Y. 11590
Tel: 516-333-6200 ■ TWX 510-222-6561

**POWER DESIGNS PACIFIC INC.**
3381 MIRANDA AVENUE ■ PALO ALTO, CALIF. 94304
Tel: 415-493-6111 ■ TWX 910-373-1251

# Nickel - Cadmium

RECHARGEABLE

## Sealed Cells and Batteries

## CAPACITIES UP TO 2000 AMPERE HOURS ON REQUEST

**MR. BATTERY SAYS:**

"We have over 10,000 cell and battery sizes in stock. If you don't see exactly what you are looking for here, let us know, chances are we'll be able to take care of your application immediately. We'd be happy to answer any questions. If we can't help you, no one can."

**TYPICAL CYLINDRICAL CELLS**
**(FIG. A) 1.2 VOLTS PER CELL**

| Type | Capacity mAH | Dimensions (in.) A | Dimensions (in.) B | Wt. (oz.) |
|---|---|---|---|---|
| 110SC | 110 | 0.574 | 0.702 | 0.3 |
| 150SC | 150 | 0.475 | 1.135 | 0.4 |
| 170SC | 170 | 0.643 | 0.656 | 0.4 |
| 180SC | 180 | 0.405 | 1.730 | 0.4 |
| 200SC | 200 | 0.673 | 0.655 | 0.5 |
| 225SC | 225 | 0.675 | 0.646 | 0.4 |
| 250SCS | 250 | 0.565 | 1.165 | 0.5 |
| 450SC | 450 | 0.675 | 1.120 | 0.7 |
| 500SC | 500 | 0.554 | 1.920 | 1.0 |
| 600SC | 600 | 0.625 | 1.920 | 1.0 |
| 750SC | 750 | 1.020 | 0.910 | 1.1 |
| 900SC | 900 | 0.562 | 3.532 | 1.4 |
| 1000SC | 1000 | 1.000 | 1.280 | 1.1 |
| 1200SC | 1200 | 0.875 | 1.600 | 1.5 |
| 1800SC | 1800 | 1.000 | 1.840 | 2.5 |
| 2000SC | 2000 | 1.272 | 1.400 | 2.8 |
| 4000SC | 4000 | 1.289 | 2.300 | 4.6 |
| 7000SC | 7000 | 1.290 | 3.490 | 7.6 |
| 10,000SC | 10,000 | 1.683 | 4.218 | 12.5 |

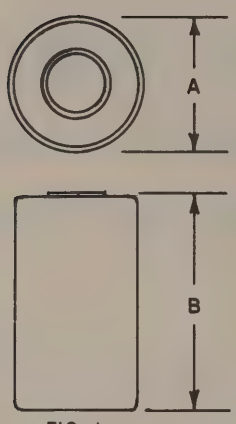



FIG. A

Oval cell also available (Fig. C) in 4000 mAH, W-2.080, T-1.260 and H-1.656. Wt. 0.37 oz.
All battery configurations available with pressure contact buttons or solder lug terminals.

**TYPICAL BUTTON CELLS**
**(FIG. B) 1.2 VOLTS PER CELL**

| Type | Capacity mAH | Dimensions (in.) C | Dimensions (in.) D | Wt. (oz.) |
|---|---|---|---|---|
| 20B | 20 | 0.449 | 0.201 | 0.04 |
| 50B | 50 | 0.606 | 0.230 | 0.09 |
| 100B | 100 | 0.984 | 0.240 | 0.28 |
| 150B | 150 | 0.984 | 0.260 | 0.30 |
| 180VBH* | 180 | 0.984 | 0.290 | 0.39 |
| 225B | 225 | 0.984 | 0.339 | 0.41 |
| 225BH* | 225 | 0.984 | 0.347 | 0.44 |
| 250VBH* | 250 | 1.340 | 0.210 | 0.58 |
| 400B | 400 | 0.992 | 0.571 | 0.66 |
| 450B | 450 | 1.689 | 0.299 | 1.10 |
| 500BH* | 500 | 1.340 | 0.374 | 0.90 |
| 1000VBH* | 1000 | 2.000 | 0.330 | 2.24 |
| 2000VBH* | 2000 | 2.000 | 0.590 | 3.50 |

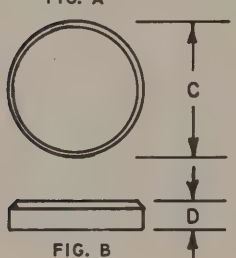



FIG. B

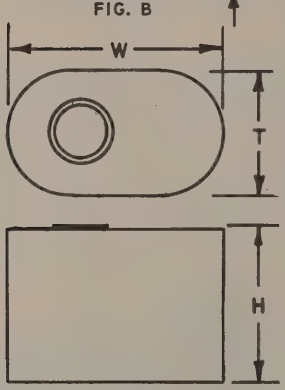



FIG. C

*H denotes high rate discharge capability.

**ALSO MARKETS:**

Emergency lighting units.
Flashlight and lantern rechargeable batteries.
Custom and prototype design battery packs built to your specifications.
Battery chargers for all types of batteries.

Batteries - NICKLE CADMIUM - SILVER CADMIUM - SILVER ZINC - MERCURY - SEALED LEAD-ACID.

All cylindrical and oval battery types feature a pressure safety device for security and reliability making them especially suited for cordless consumer and electronic products.

### CUSTOM BATTERY PACKS

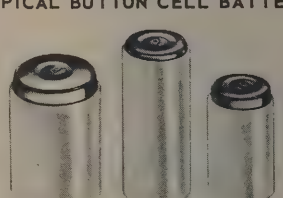
Cylindrical cells are incased in a rigid, high impact case. Case materials are highly dielectric to provide maximum cell insulation at minimum cost. The case is vented to each cell to provide cooling and long life. Packs are available to your specifications in any voltage.

### FAST CHARGE CELLS

Special fast charge cells are available on special order either individually or in custom battery packs with thermistors for extra fast recharge capability.

Button cell batteries are constructed of sealed nickle cadmium button cells (see fig. B) to meet almost any application requirement. The compact size of button cells permits easy stacking to form multiple cell batteries of optimum power/volume ratio and space utilization. Completely sealed button cells are ideally suited for portable radios, flashlights, photoflash, alarms, and any low-drain, high capacity application.

**TYPICAL BUTTON CELL BATTERIES**



**INVESTIGATE** direct current emergency power sources available in any regulated voltage or current, featuring automatic SCR solid state switchover to a self-contained battery. We have the answer to reliable economical D.C. power with automatic emergency back-up.

## ORDER DIRECT FROM


# POWER INCORPORATED
## MARKETING DIVISION

12809 EAGLE RIDGE DRIVE • BURNSVILLE, MINNESOTA 55337

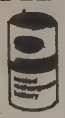
PHONE: (612) 890-1360

## SEALED RECHARGEABLE LEAD-ACID STANDARD CELLS AND BATTERIES
## SPECIAL BATTERY CONFIGURATIONS AVAILABLE ON SPECIAL ORDER

### D CELLS

Button-Top FIG. 1

1–Tab FIG. 2



2–Tab FIG. 3

| Product No. | Voltage | Capacity (A.H.) 20 Hr. Rate | Capacity (A.H.) 10 Hr. Rate | Discharge Current at 10 Hr. Rate | Length | Dia. | Weight | Fig. |
|---|---|---|---|---|---|---|---|---|
| 0810-0001 | 2 | 2.7 | 2.5 | 250ma | 2.46 | 1.35 | 6.4 oz. | 1 |
| 0810-0002 | 2 | 2.7 | 2.5 | 250ma | 2.58 | 1.35 | 6.4 oz. | 2 |
| 0810-0003 | 2 | 2.7 | 2.5 | 250ma | 2.58 | 1.34 | 6.4 oz. | 3 |

### X CELLS

Button-Top FIG. 1

1–Tab FIG. 2

2–Tab FIG. 3

| Product No. | Voltage | Capacity (A.H.) 20 Hr. Rate | Capacity (A.H.) 10 Hr. Rate | Discharge Current at 10 Hr. Rate | Length | Dia. | Weight | Fig. |
|---|---|---|---|---|---|---|---|---|
| 0800-0001 | 2 | 5.2 | 5.0 | 500ma | 2.91 | 1.74 | 13.4 oz. | 1 |
| 0800-0002 | 2 | 5.2 | 5.0 | 500ma | 3.1 | 1.74 | 13.4 oz. | 2 |
| 0800-0003 | 2 | 5.2 | 5.0 | 500ma | 3.1 | 1.74 | 13.4 oz. | 3 |
| 25 amp hour | 2 | 25 | 25 | | | | 59.5 | 3 |

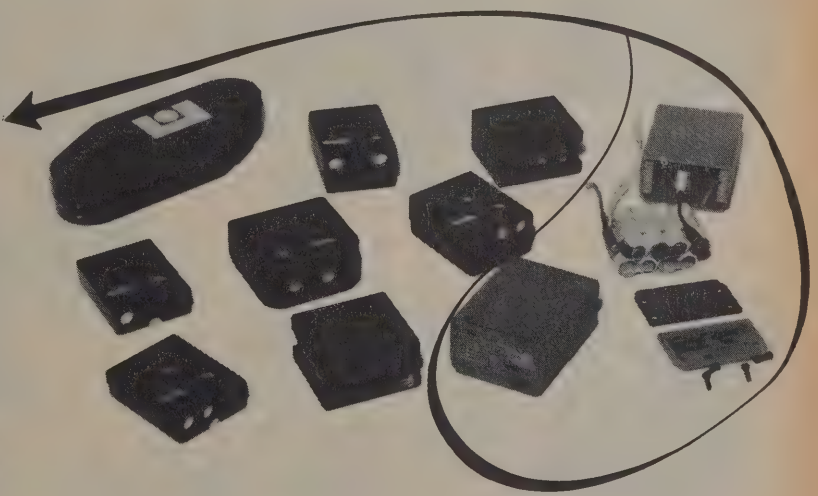
# Custom Replacement Batteries for portable test equipment and other battery operated devices available.

**Send us your dead battery for a quotation. Custom chargers available for all battery types.**

**Our specialty is manufacturing new rechargeable nickel-cadmium batteries . . . but we are also equipped to rebuild dead batteries . . . send us your dead battery . . . we can rebuild it at a lower cost.**

**For example, we have developed a do-it-yourself battery kit for all RCA hand held radio rechargeable nickel cadmium batteries. When a dead battery is sent to Power Incorporated, the case is cut open, threaded inserts are placed on the walls, a special gasket is supplied and counter sunk holes are placed in the cover. The dead internal battery pack is removed and replaced with a new unit.**

**We can offer this general type of repair service on portable test equipment and other battery operated designs.**



*"If we can't help you — no one can!"*

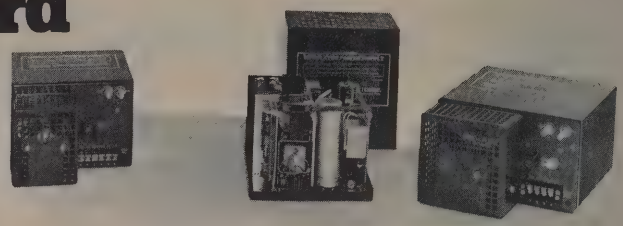
## POWER INCORPORATED
### MARKETING DIVISION

12809 EAGLE RIDGE DRIVE • BURNSVILLE, MINNESOTA 55337

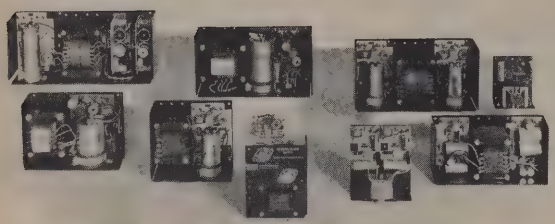
PHONE: (612) 890-1360

# The Power/Mate power supply

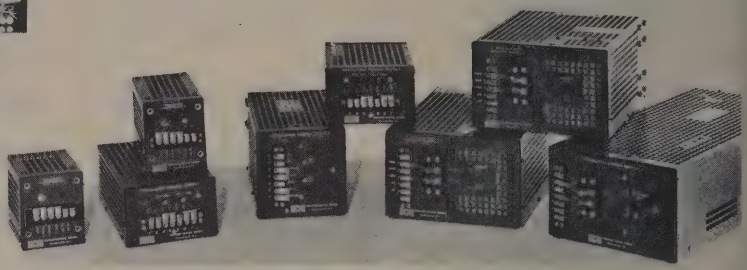
## When you can't afford failure, you can't afford less!



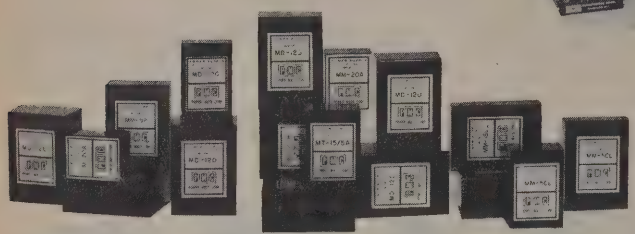
**The First Switching Supplies Designed For Reliability!**



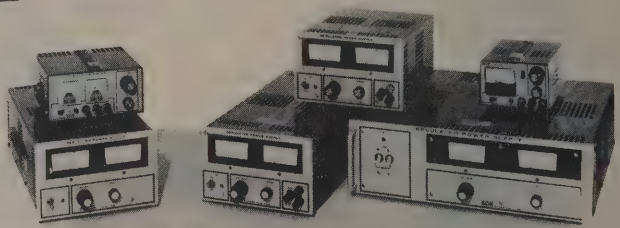
**The Open-Frame Supplies With 33% More Power!**



**The Modular Supplies That Are A Generation Ahead!**



**Mini Size, Mini Price, Maximum Performance!**



**Laboratory Quality At Production Prices!**

**Send for our FREE catalog of over 1,000 power supplies. All stocked in-depth for same day shipment!**

# PMC Power/Mate Corp.

514 S. River St., Hackensack, N.J. 07601 Phone (201) 343-6294

**THE WORLD'S LARGEST MANUFACTURER OF QUALITY POWER SUPPLIES**

# Fast delivery of power supplies is no problem for Power/Mate.

If you need open frames, sub-modules, switchers and other power supplies now, call Power/Mate.

90% of all catalog items are ready to be shipped to you today.

Power/Mate's East and West Coast plants are fully stocked with reliable open frame, sub-modular and switching power supplies ready for immediate delivery.

But our in-depth stock isn't the only thing that has kept us the leader in the field of power supplies.

Our in-the-field representatives, factory trained applications engineers, telephone salespeople and complete repair facilities make us a company that's just as dependable when it comes to service.

We'll make sure you get the power supply you need when you need it. Because keeping you ahead of your competition keeps us ahead of ours.

For more information call us or write:

PMC

**POWER/MATE CORP.**

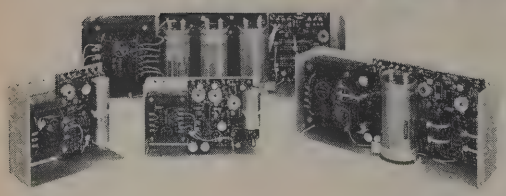
514 S. River St./Hackensack, New Jersey 07601/(201) 343-6294/TWX (710) 990-5023
17942 Skypark Circle/Irvine, California 92714/(714) 957-1606/TWX (910) 595-1766

**The world's largest supplier of quality power supplies.**

"Talk about

# OPEN FRAMES

NUMBER 1 IN OPEN FRAMES



## ONLY POWER-ONE OFFERS THESE EXCLUSIVE FEATURES:

**QUALITY** • Two-Year Warranty — fully transferable to your customer • Two-Hour Burn-in — plus *two* full functional tests on every unit • UL Recognized, CSA Certified
**SERVICE** • 83 Standard Stocked Models — the industry's largest selection • Local Stocking Centers Nationwide — stocked for immediate delivery
**ECONOMY** • The industry's most cost-effective D.C. power supplies • Liberal discount for quantity buyers

## SINGLE OUTPUT — STANDARD

±.02% REGULATION • REMOTE SENSING

| VOLTS | AMPS | MODEL | PRICE 1-9 | VOLTS | AMPS | MODEL | PRICE 1-9 | VOLTS | AMPS | MODEL | PRICE 1-9 | VOLTS | AMPS | MODEL | PRICE 1-9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 3.0 | B5-3 | $24.95 | 12 | 1.7 | B15-1.5 | $24.95 | 18 | 1.3 | B24-1.2 | $24.95 | 24 | 1.2 | B24-1.2 | $24.95 |
| | 6.0 | C5-6 | 44.95 | | 3.4 | C15-3 | 44.95 | | 2.6 | C24-2.4 | 44.95 | | 2.4 | C24-2.4 | 44.95 |
| | 12.0 | D5-12 | 74.95 | | 6.8 | D15-6 | 74.95 | | 5.2 | D24-4.8 | 74.95 | | 4.8 | D24-4.8 | 74.95 |
| | 18.0 | E5-18 | 104.95 | | 10.2 | E15-9 | 104.95 | | 7.8 | E24-7.2 | 104.95 | | 7.2 | E24-7.2 | 104.95 |
| 6 | 3.0 | B5-3 | $24.95 | 15 | 1.5 | B15-1.5 | $24.95 | 20 | 1.3 | B24-1.2 | $24.95 | — | — | — | — |
| | 6.0 | C5-6 | 44.95 | | 3.0 | C15-3 | 44.95 | | 2.6 | C24-2.4 | 44.95 | | | | |
| | 12.0 | D5-12 | 74.95 | | 6.0 | D15-6 | 74.95 | | 5.2 | D24-4.8 | 74.95 | | | | |
| | 18.0 | E5-18 | 104.95 | | 9.0 | E15-9 | 104.95 | | 7.8 | E24-7.2 | 104.95 | | | | |

## SINGLE OUTPUT — HI-VOL

115/230 VAC INPUT • OVP ON 5V MODELS

| VOLTS | AMPS | MODEL | PRICE 1-9 | VOLTS | AMPS | MODEL | PRICE 1-9 | VOLTS | AMPS | MODEL | PRICE 1-9 | VOLTS | AMPS | MODEL | PRICE 1-9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 3.0 | HB2-3 | $29.95 | 12 | 0.5 | HA15-0.5 | $22.95 | 24 | 1.2 | HB24-1.2 | $24.95 | 48 | 0.5 | HB48-0.5 | $29.95 |
| | 6.0 | HC2-6 | 49.95 | | 1.7 | HB12-1.7 | 24.95 | | 2.4 | HC24-2.4 | 44.95 | | 1.0 | HC48-1 | 49.95 |
| | 12.0 | HD2-12 | 79.95 | | 3.4 | HC12-3.4 | 44.95 | | 3.6 | HN24-3.6 | 64.95 | | 3.0 | HD48-3 | 79.95 |
| | 18.0 | HE2-18 | 109.95 | | 5.1 | HN12-5.1 | 64.95 | | 4.8 | HD24-4.8 | 74.95 | | 4.0 | HE48-4 | 109.95 |
| 5 | 1.2 | HA5-1.2/OVP* | $22.95 | | 6.8 | HD12-6.8 | 74.95 | | 7.2 | HE24-7.2 | 104.95 | | | | |
| | 3.0 | HB5-3/OVP* | 24.95 | | 10.2 | HE12-10.2 | 104.95 | | | | | | | | |
| | 6.0 | HC5-6/OVP* | 49.95 | 15 | 0.5 | HA15-0.5 | $22.95 | 28 | 1.0 | HB24-1.2 | $24.95 | 180, 200 | 0.12 | HB200-0.12 | $34.95 |
| | 9.0 | HN5-9/OVP* | 69.95 | | 1.5 | HB15-1.5 | 24.95 | | 2.0 | HC28-2 | 44.95 | | | | |
| | 12.0 | HD5-12/OVP* | 79.95 | | 3.0 | HC15-3 | 44.95 | | 3.0 | HN28-3.0 | 64.95 | | | | |
| | 18.0 | HE5-18/OVP* | 114.95 | | 4.5 | HN15-4.5 | 64.95 | | 4.0 | HD28-4 | 74.95 | | | | |
| | | | | | 6.0 | HD15-6 | 74.95 | | 6.0 | HE28-6 | 104.95 | 250 | 0.1 | HB250-0.1 | $34.95 |
| | | | | | 9.0 | HE15-9 | 104.95 | | | | | | | | |

## SINGLE OUTPUT — HIGH POWER

115/230 VAC INPUT • OVP ON 5V MODELS

| VOLTS | AMPS | MODEL | PRICE 1-9 |
|---|---|---|---|
| 5 | 25.0 | F5-25/OVP* | $149.00 |
| | 35.0 | G5-35/OVP* | 185.00 |
| 12 | 16.0 | F15-15 | $149.00 |
| 15 | 15.0 | F15-15 | $149.00 |
| 24 | 12.0 | F24-12 | $149.00 |
| 28 | 10.0 | F24-12 | $149.00 |

## SINGLE OUTPUT — HIGH EFFICIENCY

EFFICIENCY UP TO 66% • RELIABLE LINEAR DESIGN

| VOLTS | AMPS | EFFICIENCY @ NOMINAL LINE | MODEL | PRICE 1-9 |
|---|---|---|---|---|
| 5 | 9 | 66% | RD5-15/OVP* | $ 99.95 |
| | 12 | 63% | | |
| | 15 | 60% | | |
| 5 | 14 | 63% | RE5-23/OVP* | $130.00 |
| | 18 | 60% | | |
| | 23 | 57% | | |
| 5 | 25 | 63% | RG5-40/OVP* | $220.00 |
| | 32 | 60% | | |
| | 40 | 57% | | |

## DUAL OUTPUT — STANDARD

TRACKING REGULATORS • ±.02% REGULATION

| MODEL | OUTPUT #1 | OUTPUT #2 | PRICE 1-9 |
|---|---|---|---|
| AA15-0.8 | 12V @ 1.0A or 15V @ 0.8A | −12V @ 1.0A or −15V @ 0.8A | $42.95 |
| BB15-1.5 | 12V @ 1.7A or 15V @ 1.5A | −12V @ 1.7A or −15V @ 1.5A | $53.95 |
| CC15-3.0 | 12V @ 3.4A or 15V @ 3.0A | −12V @ 3.4A or −15V @ 3.0A | $84.95 |

## DUAL OUTPUT — HI-VOL

115/230 VAC INPUT • OVP ON 5V MODELS

| MODEL | OUTPUT #1 | OUTPUT #2 | PRICE 1-9 |
|---|---|---|---|
| **±12 to 15V** | | | |
| HAA15-0.8 | 12V @ 1.0A or 15V @ 0.8A | −12V @ 1.0A or −15V @ 0.8A or −5V @ 0.4A | $39.95 |
| HBB15-1.5 | 12V @ 1.7A or 15V @ 1.5A | −12V @ 1.7A or −15V @ 1.5A or −5V @ 0.7A | 49.95 |
| HCC15-3.0 | 12V @ 3.4A or 15V @ 3.0A | −12V @ 3.4A or −15V @ 3.0A | 79.95 |
| **±18 to 24V** | | | |
| HAA24-0.6 | 18-20V @ 0.4A or 24V @ 0.6A | (−)18-20V @ 0.4A or −24V @ 0.6A | $39.95 |
| **±5V** | | | |
| HBB5-3/OVP | 5V @ 3.0A* | −5V @ 3.0A* | $61.95 |
| HCC5-6/OVP | 5V @ 6.0A* | −5V @ 6.0A* | 92.95 |
| **5V and 9-15V** (Isolated Outputs) | | | |
| HAA512 | 5V @ 2.0A* | 9-15V @ 0.5A | $44.95 |
| HBB512 | 5V @ 3.0A* | 9-15V @ 1.25A | 54.95 |
| HCC512 | 5V @ 6.0A* | 9-15V @ 2.5A | 86.95 |

## TRIPLE OUTPUT — STANDARD

TRACKING REGULATORS • ±.02% REGULATION

| MODEL | OUTPUT #1 | OUTPUT #2 | OUTPUT #3 | PRICE 1-9 |
|---|---|---|---|---|
| BAA-40W | 5V @ 3.0A | 12V @ 1.0A or 15V @ 0.8A | −12V @ 1.0A or −15V @ 0.8A | $ 69.95 |
| CBB-75W | 5V @ 6.0A | 12V @ 1.7A or 15V @ 1.5A | −12V @1.7A or −15V @ 1.5A | $ 91.95 |
| DBB-105W | 5V @ 12.0A | 12V @ 1.7A or 15V @ 1.5A | −12V @ 1.7A or −15V @ 1.5A | $126.95 |

## TRIPLE OUTPUT — HI-VOL

115/230 VAC INPUT • OVP ON 5V MODELS

| MODEL | OUTPUT #1 | OUTPUT #2 | OUTPUT #3 | PRICE 1-9 |
|---|---|---|---|---|
| HTAA-16W | 5V @ 2.0A* | 9-15V @ 0.4A | (−)9-15V @ 0.4A or −5V @ 0.2A | $ 49.95 |
| HBAA-40W | 5V @ 3.0A* | 12V @ 1.0A or 15V @ 0.8A | −12V @ 1.0A or −15V @ 0.8A or −5V @ 0.4A | $ 69.95 |
| HCBB-75W | 5V @ 6.0A* | 12V @ 1.7A or 15V @ 1.5A | −12V @ 1.7A or −15V @ 1.5A or −5V @ 0.7A | $ 91.95 |
| CP-131 | 5V @ 8.0A* | 12V @ 1.7A or 15V @ 1.5A | −12V @ 1.7A or −15V @ 1.5A or −5V @ 0.7A | $110.00 |
| HDBB-105W | 5V @ 12A* | 12V @ 1.7A or 15V @ 1.5A | −12V @ 1.7A or −15V @ 1.5A or −5V @ 0.7A | $126.95 |
| HDCC-150W | 5V @ 12A* | 12V @ 3.4A or 15V @ 3.0A | −12V @ 3.4A or −15V @ 3.0A | $149.00 |

## FLOPPY-DISK SERIES

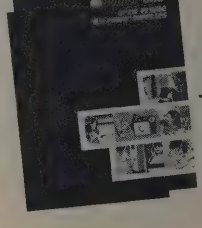
SINGLE/DUAL DRIVE MODELS • FOR 5.25" & 8.0" MEDIA DRIVES

| DISK-DRIVE MODEL | OUTPUT RATINGS | | | | PRICE 1-9 |
|---|---|---|---|---|---|
| | +5V* | −5V* | +12V AVG./PK | +24V AVG./PK | |
| +5V and +12V | | | | | |
| CP-249 | 0.7A | — | 1.1A/1.7A | — | $ 39.95 |
| +24V and ±5V | | | | | |
| CP-205 | 1A | 0.5A | — | 1.5A/1.7A | $ 69.95 |
| CP-206 | 2.5A | 0.5A | | 3.0A/3.4A | $ 91.95 |
| CP-162 | 3A | 0.6A | | 5A/6A | $120.00 |

*INCLUDES BUILT-IN OVP, SET @ 6.2V ±0.4V.

## NEW '78 CATALOG!

Get Your FREE Copy Now!



"Think about

# power-one INC.

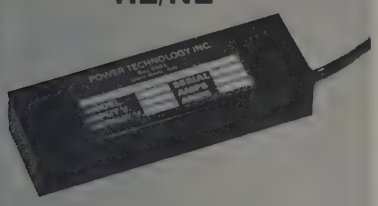
D.C. POWER SUPPLIES

Power One Drive • Camarillo, CA 93010 • (805) 484-2806 • TWX 910-336-1297

# ELECTRO-OPTIC POWER

## LASER POWER SUPPLIES

### HE/NE



**L23**

Tried and proven, the L23 features exceptionally high efficiency, switching mode current regulation of ± 0.1mA, compact size, and low cost. Many shapes and sizes are available, including numerous options. Input range is 10 to 17V DC; and the power output is 5 to 25W. Size: 15/16″ X 1 7/16″ X 4 1/2″.

### HE/NE

**L41 — L43 — L45**

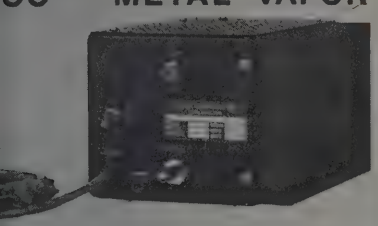
This series allows your choice of AC input voltages from 117 to 265V AC, 50-400Hz., which is particularly appropriate for foreign applications. All three models are exceptionally compact, .945″ X 1.445″ X 6.05″, and lightweight, 8.8 ounces, for supplies that deliver up to 24 watts with high efficiency and switching mode regulation.

### HE/NE

**L80 — L81**

Unbelievable! The ultra miniature L80 and L81. The L80 is just ONE cubic inch in size and weighs 40 grams! Starting voltage is 6KV minimum, output power 2 to 8 watts, current regulation ± 0.1mA, output voltage 500V to 2.5KV, and input voltage 10 to 16V DC. Superior efficiency, minimum heat dissipation, and switching mode regulation are features that you will appreciate. The L80 measures 1/2″ X 1″ X 2″, and the L81, 1″ dia. X 2″ length.

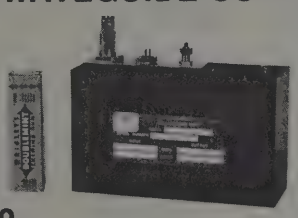
### $CO^2$ — METAL VAPOR



**L35 — L36 — L37**

Pick from this series to power $CO^2$ lasers requiring 300W or less input. They are compact, lightweight, operate from 117V AC, 50-400Hz, and utilize switching mode regulation. Select from an output voltage range of 2 to 18KV and starting voltages of 5 to 20KV. Size: 5″ X 6 3/4″ X 9″.

### WAVEGUIDE $CO^2$



**L29**

Designed for operating low power single discharge waveguide $CO^2$ lasers from 28V DC sources. Positive or negative output is available for any of seven operating ranges from 2 to 18KV. The regulated output current is field programmable, and the output power is 25 to 50W. Size: 1 3/16″ X 3″ X 4 7/8″.

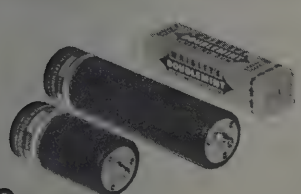
### WAVEGUIDE $CO^2$

**L42 — L44**

Designed for waveguide $CO^2$ lasers, these two units supply regulated dual outputs (both positive or both negative) and operate from 117V AC, 50-400Hz. Model L42 delivers 50 to 75 watts power output and L44, 100 to 150 watts. Output voltage is factory adjusted 2 to 18KV. The current output is field programmable and regulated to ± 0.1mA.

## DIODE PULSERS

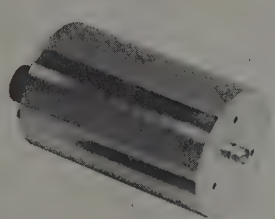
### SINGLE OR STACK



**ILC**

The ILC produces more average output power for driving laser diodes at 7 to 200ns pulse widths than avalanche or SCR pulsers. Models are available for pulse currents of 1 through 100A. Fast rise and fall times, with internal clock for pulse rates of 1 through 10,000 PPS. Size: (with internal supply) 1 or 1 1/4″ dia. X 4 1/4″, (with customer supplied external supply) 1 or 1 1/4″ dia. X 2 1/2″.

### ARRAY



**ILA**

Multi-junction stacks and arrays containing 7 to 60 series junctions may be driven with the ILA Series. Pulse currents of 25 to 75A and widths of 20 to 200ns are available at a rate limited only by the duty factor of the laser. Voltage input range 24 to 32V DC or 90 to 110V DC. Size: 2 3/4″ dia. X 4″ length.

## SIMULATOR

### 1.06 MICRON

**CS100 — CS101**

These convenient, easy to use laser simulators are compact and self contained. They provide a pulsed 1.06u infrared signal source emulating a laser. Because of their portability, they are ideally suited to laboratory or field testing of laser systems or fiber optics. A double pulse option allows testing of laser rangefinders. Output power is 20mW at 20ns and 1.06 microns. Input voltage can be 115V AC, 230V AC, or 12V DC. The CS101 is a cabinet or rack mount with higher optic power output.

Power Technology Inc.

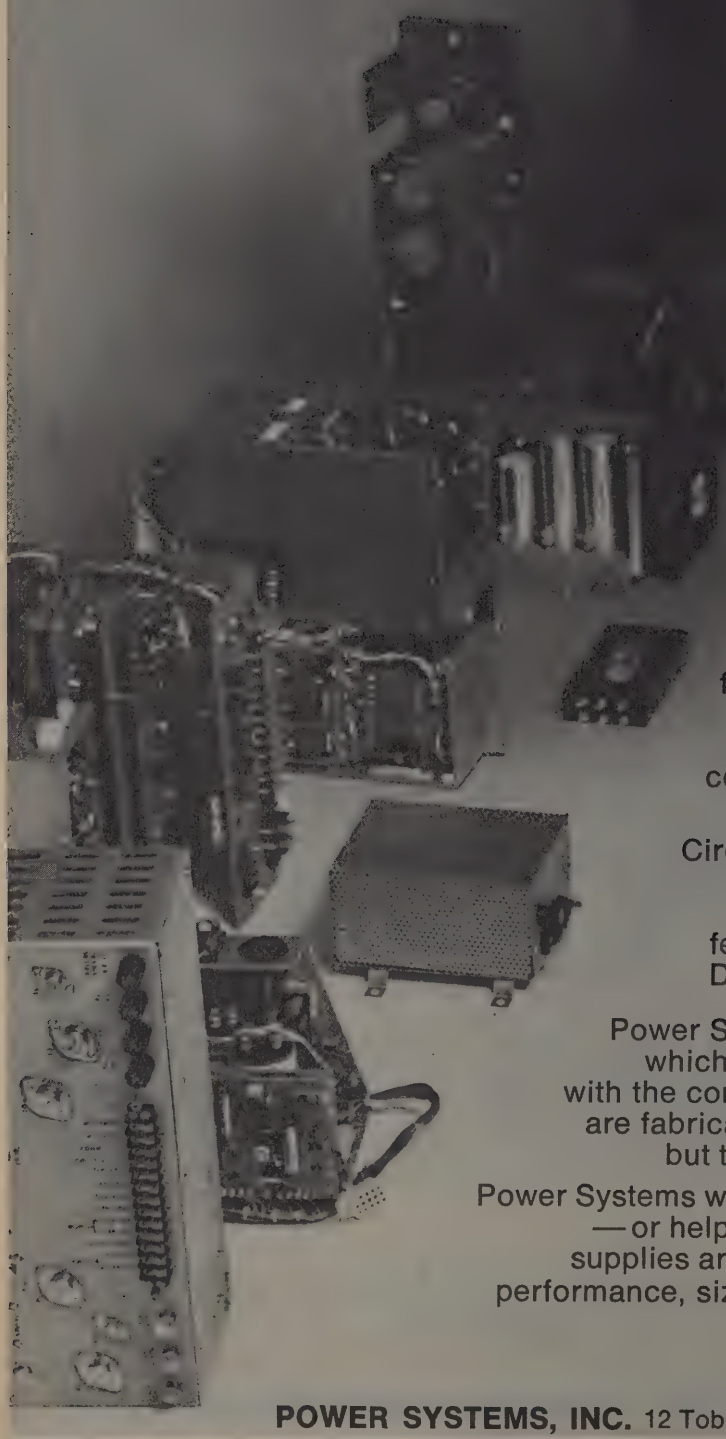
## Power Technology Incorporated

Address correspondence to: Box 4403 Little Rock, Arkansas 72214
Plant location: 7925 Mabelvale Cutoff Mabelvale, Arkansas 72103

501—568-1995

**Power Systems inc**

12 Tobey Road
Bloomfield, CT 06002
(203) 243-0357



CUSTOM DESIGNED POWER SUPPLIES FOR OEM APPLICATIONS

Power Systems, Inc. designs, develops and manufactures power supplies and power control systems for O.E.M. applications. Power Systems offers an experienced approach to application engineering which assures complete system compatibility, optimum performance and long term reliability.

Circuits are chosen to fit the requirements of the end user system — these include switching regulators, series regulators, ferroresonant and unregulated supplies, DC-DC converters and DC-AC inverters.

Power Systems provides complex sub-systems which are designed to interface successfully with the complete production unit. Power supplies are fabricated not only to meet customer's specs but to integrate fully with the entire system.

Power Systems will review your particular specifications — or help write them. Our custom crafted power supplies are designed to meet your goals for cost, performance, size, mounting, environment, packaging, and most of all, reliability in the field.

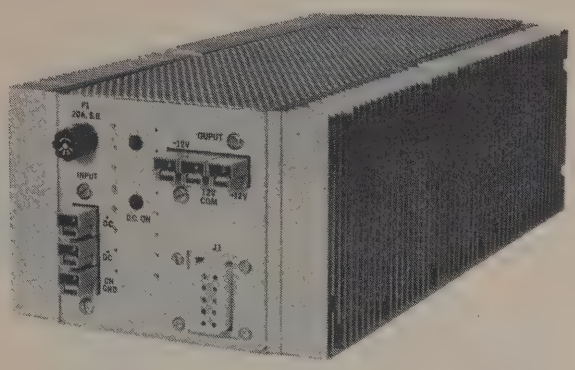
**POWER SYSTEMS, INC.** 12 Tobey Road, Bloomfield, CT 06002 (203) 243-0357

# SWITCHING REGULATORS AC-DC and DC-DC

Power Systems inc

## SINGLE OUTPUT

| MODEL NO. | VDC | AMPS | INPUT |
|---|---|---|---|
| PS-1266 | 6.3 | 4.0 | 115 |
| PS-1357 | 5 | 80 | 115/230 |
| PS-1340 | 5 | 105 | 115/230 |
| PS-1380 | 5 | 150 | 115/230 |
| PS-1360 | 5 | 80 | 48 VDC |
| PS-1271 | 5 | 100 | 48 VDC |
| PS-1270 | ±12 | 12 | 48 VDC |



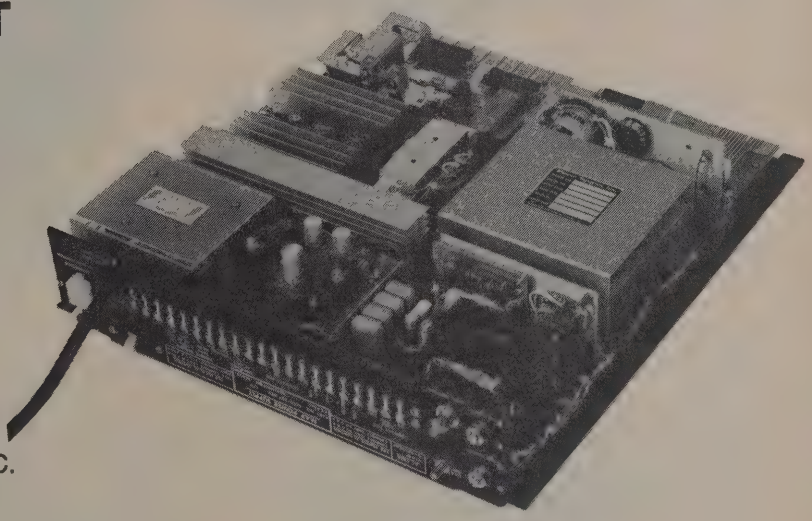
PS-1270

STANDARD FEATURES
Efficiency 70% (typ).
Designed for U.L./CSA approval.
20 kHz operation.

## MULTIPLE OUTPUT

MODEL PS-1268
COMPLETE POWER SYSTEM

+5 VDC at 105 Amps
+12 VDC at 9 Amps
−5 VDC at 0.5 Amps



AC Power Fail, Power Good Logic
Remote power turn-on 115/230 VAC.
Slides into 16" W. card frame.
Height 3½ inches.
Plated edge output connections.

PS-1268

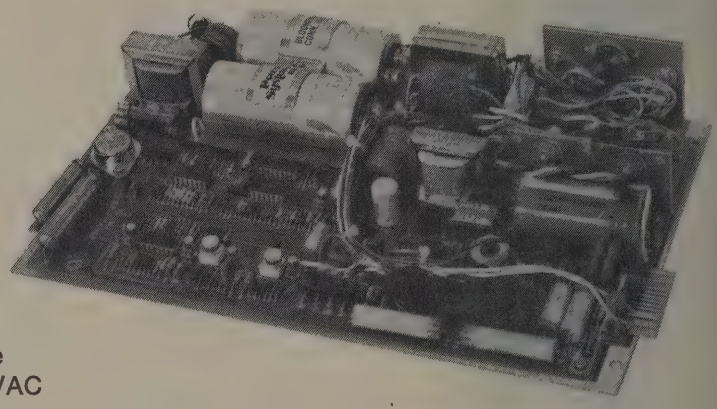
**POWER SYSTEMS, INC.** 12 Tobey Road, Bloomfield, CT 06002 (203) 243-0357

# SWITCHING REGULATOR TERMINAL SUPPLIES

Power Systems inc

## PS-1352 SERIES

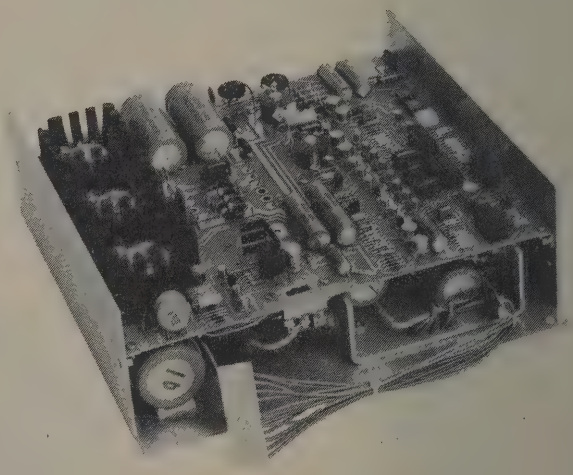
| VDC | AMPS |
|---|---|
| +5.15 | 6.0 |
| +12 | 1.5 |
| −12 | 1.0 |
| −45 | 0.2 |
| +70 | 0.5 |



These designs can include filtering, power fail and power good logic, remote inhibit, 30 to 40 msec storage, 115/230 VAC conversion by plug or switch and many other system-interactive features.

## PS-1440 SERIES

Input 115/230 ±15%
Regulation ±0.5 to 2%
OVP and overload protection



### AVAILABLE OPTIONS

A. Screened Cover
B. Soft Start Module
C. Overvoltage Crowbars for all outputs
D. Remote Sensing for +5V (0.25 drop)
E. Power Fail/Power Good Logic

| MODEL NUMBER | OUTPUTS (VDC @ AMPS) 1 | 2 | 3 | 4 | SIZE |
|---|---|---|---|---|---|
| PS-1440 | +5 @ 12 | +15 @ 3 | −15 @ 3 | (NA) | 9 x 9.25 x 3 H |
| PS-1441 | +5 @ 15 | +15 @ 2.5 | −15 @ 2.5 | (NA) | 9 x 9.25 x 3 H |
| PS-1442 | +5 @ 12 | +12 @ 4 | −12 @ 4 | (NA) | 9 x 9.25 x 3 H |
| PS-1443 | +5 @ 15 | +12 @ 3 | −12 @ 3 | (NA) | 9 x 9.25 x 3 H |
| PS-1445 | +5 @ 12 | +12 @ 2.5 | −12 @ 2.5 | 55 @ 0.5 | 9.5 x 9.5 x 4 H |
| PS-1447 | +5 @ 12 | +15 @ 2 | −15 @ 2 | 70 @ 0.4 | 9.5 x 9.5 x 4 H |
| Regulation | ±0.5% | ±0.5% | ±0.5% | ±2.0% | |

**POWER SYSTEMS, INC.** 12 Tobey Road, Bloomfield, CT 06002 (203) 243-0357

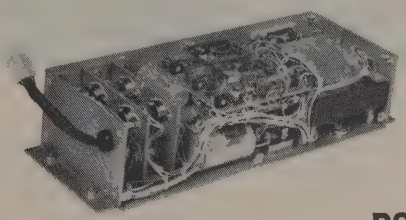
# SERIES REGULATED SUPPLIES

**Power Systems inc**

Power Systems designs are noted for high reliability, high efficiency (up to 55%) and for packaging concepts that solve critical space problems. Outputs are adjustable, short circuit and OV protected; offer good regulation and low ripple/noise.

## PS-1348

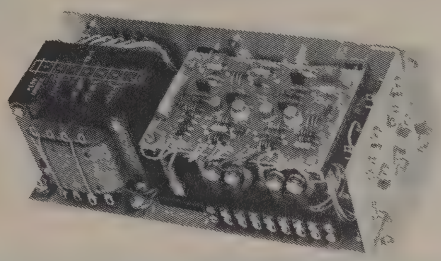
Six regulated outputs, 95 watts including a 115 W. surge; no forced air or conduction; weight 10 lbs.
Size: 12 L x 4.75 x 3 H.



**PS-1348**

## PS-1331

115/230 VAC 47-63 Hz
+12 VDC at 2.5 A Reg. ±0.1% L & L
−12 VDC at 2.5 A Reg. ±0.1% L & L
+15 VDC at 0.5 A Unreg.
If either + or − 12 deviates by more than 10% both shall decay in <100 μsec.
Size: 9.6 x 4.0 x 3.0 H



**PS-1331**

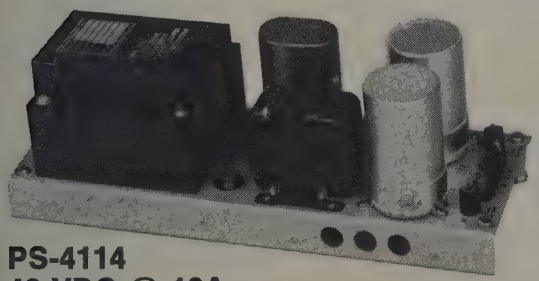
## PS-1273

DOUBLE DISK POWER SUPPLY
115/230 VAC 57-63 Hz
+5 VDC at 7 Amps
+12 VDC at 4 Amps
−12 VDC at 4 Amps
Reg. ±0.25% L & L

**PS-1273**

# FERRORESONANT D.C. POWER SUPPLIES

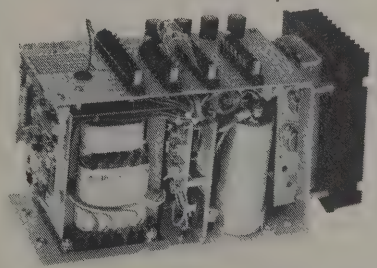
Best choice for reliability, efficiency and low cost.
Inputs: 115 VAC 60 Hz or 230 VAC 50 Hz
Outputs: Single or Dual outputs from 6 to 48 VDC



**PS-4114**
**48 VDC @ 10A**

# FERRO WITH SERIES REGULATORS

These designs combine the best features of ferro transformers with the good regulation and low ripple/noise of the series regulator.
Inputs: 100/110/115/120/127/200/208/220/240 VAC 50/60 Hz.
Outputs: +5.1 VDC at 10 Amps
+12 VDC at 4.0 Amps
−12 VDC at 1.0 Amps



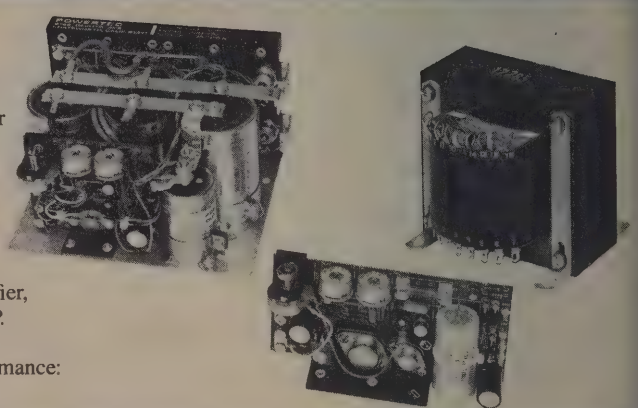
**PS-1258**

Product data sheets, catalogs, specification guidelines available directly or through our authorized representatives.

**POWER SYSTEMS, INC.** 12 Tobey Road, Bloomfield, CT 06002 (203) 243-0357

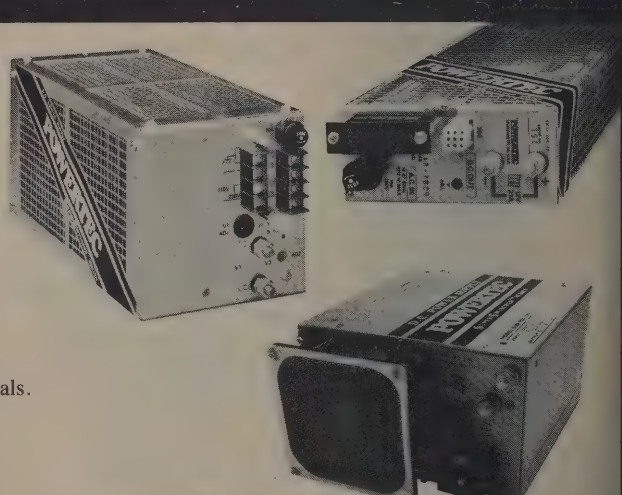
# THE BEST POWER FROM THE BEST

## SM SERIES



**SUB-MODULES** These standard "off-the-shelf" sub-modular units enable custom DC power supplies to be joined at minimal assembly cost and maximum form factor flexibility. Transformers, heatsinks, and sub-modules are the only components required for ease of sparing and maintenance. Sub-modules can be combined in a completely engineered, tested, and documented kit form. A custom input transformer will provide an almost unlimited variety of multiple outputs, each at the required voltage and current. FEATURES—Built-in rectifier, filter, regulator. Adjustable voltage, current limit and OVP. Logic inhibit function. Remote sensing and programming. Computer-grade capacitors. Fuse protected. Proven performance: 100,000 + hour MTBF per MIL-HDBK 217B.

## SUPERSWITCHERS

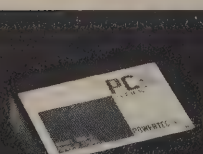


**SWITCHING REGULATORS** 9N Series—The industry "standard," forced-air SuperSwitcher provides up to 750 watts of DC output power in a compact 5″ x 8″ x 10″ package. This series is field proven with more than 10,000 units in operation during the past 5 years.

9E Series—Versatile low profile (2.25″) packaging offers 250 watts of DC output power with a density of 1.4 watts/inch.$^3$ Absolutely quiet 40KHz convection-cooled operation is perfectly suited to either office or lab environments.

9F Series—New, 250 watt multiple output power supply offers up to three independent outputs enabling it to power complete microprocessor based systems or computer peripherals.

The entire SuperSwitcher series has a wide input range of +10 to −20% with 20 milliseconds or more of hold-up. Complete protective circuitry and logic inhibit are standard on all units. Efficiency is rated to 80%.



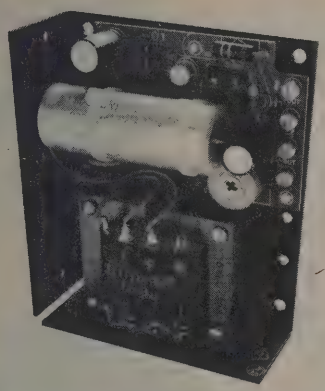
**PC SERIES**
- Fixed DC voltage
- PC card mountable
- Single/dual output
- Potted construction
- 5-24 VDC to 1 Ampere

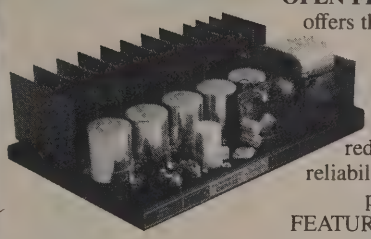
**DCR SERIES**
- DC voltage regulators
- Up to 24 VDC
- Up to 12 Amperes
- 2 power ratings

**XR SERIES**
- 3 Package sizes
- Single/dual output
- Up to 36V
- Up to 3 Amperes
- Built-in OVP

**SR SERIES**
- 4 package sizes
- Up to 28V
- Up to 35 Amperes
- Built-in OVP
- 55°C full rated

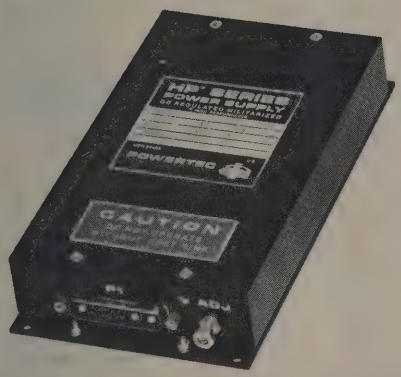
# SUPPLIES
# POWER SUPPLIER





## OEM II

**OPEN FRAMES** This second generation open-frame design offers the industry's widest choice of voltages and package configurations. Single, dual, and triple output units are available at power levels to 375 watts. FEATURES—Standard 115/230 VAC input eliminates dual stocking. Electrostatic shielding reduces transients. Improved thermal design increases reliability. Conservatively rated computer-grade capacitors provide longer life. UL recognized. ADDITIONAL FEATURES—IC regulator design. Lifetime guaranteed, all hermetically sealed power semiconductors. Adjustable current limiting. Remote sensing. Fully isolated multiple outputs which can be connected in any positive/negative configuration.




## HP SERIES

**HIGH PERFORMANCE** These high performance units are designed to MIL-E-5400 specifications. Their flat pack, high density packages are well-suited to submarine, shipboard, fixed or mobile land based and airborne applications. They have excellent power/cost ratios and *no* NRE. FEATURES—Input: 115VAC, 3Ø, 400Hz. Outputs to 28VDC and up to 120 Amperes. Low RFI, series regulated design. Completely protected for overvoltage and overload conditions. High efficiencies of 50% or greater plus conduction cooling allows power densities of 5 watt/inch.$^3$

- **Powertec maintains a strong applications group and an innovative engineering staff for modified standard and custom designs.**
- **Prices and specifications are subject to change without notice.**
- **Write or phone for complete details and prices.**

# POWERTEC

**20550 Nordhoff Street, Chatsworth, California 91311**
**(213) 882-0004 · TWX (910) 494-2092**

# RO ASSOCIATES

## switching power supplies

5 year warranty

- MTBF'S TO 126,000 HOURS
- OVER 60,000 SWITCHERS DELIVERED
- 12 YEARS EXPERIENCE IN SWITCHING POWER SUPPLIES
- 100% BURN-IN TO PREVENT INFANT MORTALITIES
- ONLY COMPUTER GRADE COMPONENTS
- VACUUM EPOXY IMPREGNATED MAGNETICS
- 90/110/220/240 VAC INPUTS AVAILABLE

### SINGLE OUTPUTS

| Volts DC | Amps | Model | Price |
|---|---|---|---|
| 1.5–6.0 | 5 | 105 | $115. |
| 5.0 | 1 | ET-13 | 77. |
| | 5 | 105 | 115. |
| | 10 | 210 | 245. |
| | 25 | 325 | 320. |
| | 50 | 705 | 525. |
| | 100 | 710 | 595. |
| | 120 | 712 | 650. |
| | 150 | 801 | oem only |
| 6.0 | 5 | 105 | 115. |
| | 20 | 325C | 320. |
| | 100 | 710C | 650. |
| 6–12 | 3 | 108 | 115. |
| 6–28 | 1.5 | 106 | 115. |
| 12 | 3 | 108 | 115. |
| 12–15 | 2.5 | 107 | 115. |
| | 4 | 250 | 260. |
| | 10 | 350 | 320. |
| | 40 | 750 | 595. |
| 16–23 | 1.5 | 106 | 115. |
| 24–28 | 1.5 | 106 | 115. |
| | 2 | 251 | 260. |
| | 5 | 351 | 320. |
| | 20 | 751 | 595. |
| 30 | .750 | 115 | 115. |
| | 5 | 351 | 320. |
| | 20 | 751 | 595. |
| 250 | .030 | ET-19 | 95. |

### DUAL OUTPUTS

| Volts DC | Amps | Model | Price |
|---|---|---|---|
| ±12 | ±.200 | ET-21 | $ 77. |
| ±12 | ±3 | 303 | 395. |
| ±12 to ±15 | ±.750 | 115 | 115. |
| ±15 | ±.200 | ET-24 | 77. |
| ±15 | ±3 | 302 | 395. |

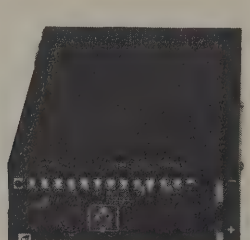
### DC to DC CONVERTERS

| Input | Volts DC | Amps | Model | Price |
|---|---|---|---|---|
| 48VDC | 5 | 10 | 2105 | $395. |
| 48VDC | 12–15 | 4 | 2505 | 395. |
| 48VDC | 24–28 | 2 | 2515 | 395. |

### MULTI OUTPUTS

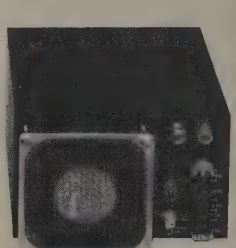
| Output 1 | Output 2 | Output 3 | Model | Price |
|---|---|---|---|---|
| 5V @ .6A | +12V @ .1A | −12V @ .1A | ET-31 | $ 91. |
| 5V @ .5A | +15V @ .1A | −15V @ .1A | ET-32 | 91. |
| 5V @ 5A | 12V @ 1A | — | 214 | 275. |
| 5V @ 5A | +12V @ .4A | −12V @ .4A | 213 | 345. |
| 5V @ 5A | +15V @ .4A | −15V @ .4A | 213 | 345. |
| 5V @ 10A | 12V @ 2A | — | 314 | 375. |
| 5V @ 8A | 12V @ 3A | — | 315 | 375. |
| 5V @ 12A | 12V @ 1A | — | 316 | 375. |
| 5V @ 10A | +12V @ 1A | −12V @ 1A | 312 | 395. |
| 5V @ 10A | +15V @ 1A | −15V @ 1A | 313 | 395. |

ET SERIES


700 SERIES

100 SERIES

200 and 2000 SERIES


800 SERIES

300 SERIES

RO ASSOCIATES

**Call or write for complete catalog**

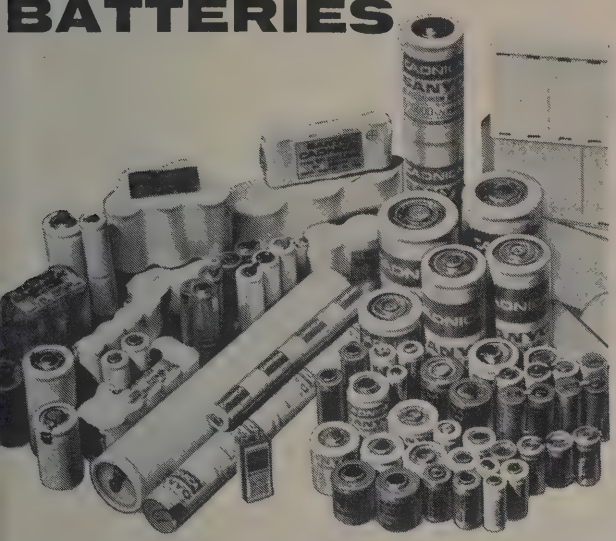
**RO ASSOCIATES, INCORPORATED**

246 CASPIAN DRIVE / SUNNYVALE, CA 94086 / (408) 744-1450 / TWX 910-378-5929

SANYO

CADNICA

# RECHARGEABLE NICKEL-CADMIUM BATTERIES



From one of the world's largest battery manufacturers . . . high performance sealed nickel-cadmium batteries in a wide range of sizes . . . quick charge and fast charge models . . . rechargeable battery assemblies. Call Sanyo . . . for speedy shipment from inventory . . . or for a power source designed to meet your special need.

SANYO

**SANYO ELECTRIC INC.** Battery Division
51 Joseph St., Moonachie, N.J. 07074
(201) 641-2333
1200 W. Artesia Blvd., Compton, Cal. 90220
(213) 537-5830

## CADNICA NICKEL-CADMIUM Standard Cylindrical Cells

| Model No. | Remarks | Nominal Voltage (V) | Nominal Capacity (5-H Rate) (mAH) | Outside Dimensions (mm) Dia. (D) | Outside Dimensions (mm) Height (H) | Weight (gr.) |
|---|---|---|---|---|---|---|
| N-6U | 1/3 AA size | 1.2 | 100 | 14.5+0 −0.5 | 17.0+0 −1 | 8 |
| N-150N | N size | 1.2 | 150 | 12.0+0 −0.5 | 30.0+0 −1 | 9 |
| N-160A | 1/3 A size | 1.2 | 160 | 18.0+0 −1.5 | 51.0+0 −2 | 11 |
| N-180AAA | AAA size | 1.2 | 180 | 10.5+0 −0.5 | 44.5+0 −1 | 10 |
| N-250AA | 2/3 AA size | 1.2 | 250 | 14.5+0 −0.5 | 30.0+0 −1 | 14 |
| N-450AA | AA size | 1.2 | 450 | 14.0+0 −0.5 | 50.0+0 −1 | 23 |
| N-500AA | AA size | 1.2 | 500 | 14.5+0 −0.5 | 50.0+0 −1 | 24 |
| N-600SC | 2/3 SC size | 1.2 | 600 | 23.0+0 −1 | 26.0+0 −1 | 29 |
| N-900C | 2/3 C size | 1.2 | 900 | 26.0+0 −1 | 30.0+0 −1 | 44 |
| N-1200SC | SC size | 1.2 | 1200 | 23.0+0 −1 | 43.0+0 −2 | 52 |
| N-1650C | C size | 1.2 | 1650 | 26.0+0 −1 | 50.0+0 −1 | 70 |
| N-2500D | 2/3 D size | 1.2 | 2500 | 34.0+0 −2 | 45.0+0 −2 | 75 |
| N-3500D | D size | 1.2 | 3500 | 34.0+0 −2 | 61.0+0 −2 | 160 |
| N-4000D | D size | 1.2 | 4000 | 34.0+0 −2 | 61.0+0 −2 | 160 |
| N-6000F | F size | 1.2 | 6000 | 34.0+0 −2 | 91.0+0 −2 | 230 |
| N-10000M | M size | 1.2 | 10000 | 43.0+0 −2 | 91.0+0 −2 | 400 |
| 6N-75P | 9V appl. | 7.2 | 75 | 16 x 27 x 49+0 −1 | | 40 |
| N-1U | D size | 1.2 | 1200 | 33.0 | 60.0 | 69 |
| N-2U | C size | 1.2 | 1200 | 26.0 | 50.0 | 58 |

## CADNICA NICKEL-CADMIUM Quick Charge Cells

| | | | | | | |
|---|---|---|---|---|---|---|
| N-250AAF | 2/3 AA size | 1.2 | 225 | 14.5+0 −0.5 | 30.0+0 −1 | 14 |
| N-450AAF | AA size | 1.2 | 450 | 14.0+0 −0.5 | 50.0+0 −1 | 23 |
| N-500AAF | AA size | 1.2 | 450 | 14.5+0 −0.5 | 50.0+0 −1 | 24 |
| N-600SCF | 2/3 SC size | 1.2 | 550 | 23.0+0 −1 | 26.0+0 −1 | 29 |
| N-1200SCF | SC size | 1.2 | 1100 | 23.0+0 −1 | 43.0+0 −2 | 52 |

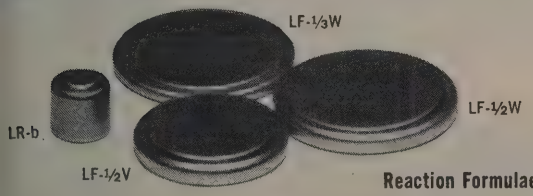
## CADNICA NICKEL-CADMIUM Fast Charge Cells

| | | | | | | |
|---|---|---|---|---|---|---|
| N-1200SCR | SC size | 1.2 | 1000 | 23.0+0 −1 | 43.0+0 −2 | 52 |
| N-1800CR | C size | 1.2 | 1500 | 26.0+0 −1 | 50.0+0 −2 | 70 |
| N-4000DR | D size | 1.2 | 3500 | 34.0+0 −2 | 61.0+0 −2 | 160 |

## CADNICA BATTERY CHARGERS

| | NC 1230 | NC 450S | NC 75P |
|---|---|---|---|
| Power Source | AC: 117V 50/60Hz | AC: 117V 50/60Hz | AC: 117V 50/60Hz |
| Output Power | DC: 2.4V 36-100mA | DC: 2.4V 38mA | DC: 7.2V 15mA |
| Size of Battery | N-1U, N-3500D (size D)<br>N-2U, N-1650C (size C)<br>N-3U, N-450AA (size AA)<br>N-500AA (size AA) | N-3U, N-450AA (size AA)<br>N-500AA (size AA)<br>—<br>— | 6N-75P (9V appl.) |
| No. of Batteries | 2 or 4 | 2 or 4 | 1 |
| Dimen. (WxDxH) | 3 1/16 x 7 1/16 x 2 5/16" (100x195x58mm) | 2 3/4 x 3 3/4 x 1 1/4" (70x95x33mm) | 1 3/8 x 3 15/16 x 1 3/4" (35x100x45mm) |
| Weight | 1 lb. 2 ozs. (500g) approx. | 7 ozs. (200g) approx. | 2.5 ozs. (70g) approx. |

## NEW! SANYO LITHIUM BATTERIES




| Model No. | Nominal Voltage (V) | Outside Diameter (mm) | Total Height (mm) | Weight (g) | Capacity (mAh) |
|---|---|---|---|---|---|
| LF-1/2V | 3 | 20.0 | 3.2 | 2.6 | 170 |
| LF-1/2W | 3 | 24.5 | 2.8 | 4.0 | 200 |
| LF-1/2WH | 3 | 24.5 | 2.8 | 4.0 | 160 |
| LF-1/3W | 3 | 24.5 | 2.0 | 3.0 | 120 |
| LR-b | 3 | 7.9 | 7.2 | 0.9 | 50 |

**Reaction Formulae:** • Anode Reaction: $Li \rightarrow Li^{+} + e$ • Cathode Reaction: $MnO_2 + Li^{+} + e \rightarrow MnO_2(Li^{+})$ • Total Cell Reaction: $Li + MnO_2 \rightarrow MnO_2(Li^{+})$

# Multi-Output, 25 Watt, Off-Line Converters... Accept AC or DC Input, Outputs Protected

**US, CS**

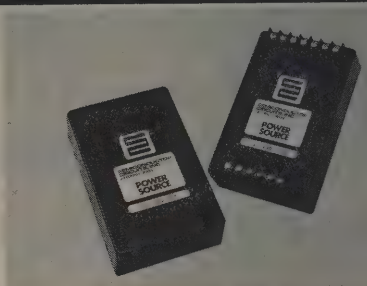
*Value Products from the NO. 1 SOURCE* **ANOTHER NEW PRODUCT**

- **AC OR DC: 70-140VAC/100-200VDC OR 140-280VAC/200-400VDC**
- **OPTO-ISOLATED REMOTE POWER SHUTDOWN**
- **O.V. CLAMPED POWER OUTPUT PROTECTS LOGIC CHIPS**

**The US, CS Series** are highly efficient Off-Line converters with quadruple, triple and single outputs that deliver up to 25 Watts. Featuring bi-modal operation, each model performs equally well from an AC or DC power input which may vary over a 2:1 range.

All models feature overcurrent-protected outputs, employ overvoltage clamping and include opto-isolated remote power shutdown via standard logic-level signals. Other features include a $\pi$ input filter to minimize input reflected ripple and floating outputs having I/O isolation to 2500Vdc.

The E option allows operation from inputs of either 70-140Vac, 140-280Vac or 200-400Vdc by external pin connection.



## GENERAL SPECIFICATIONS (Derived outputs are ±12V, ±15V and −5V)

**INPUT VOLTAGE RANGE**
See Ordering Table

**A.C. INPUT FREQUENCY**
47-440 Hz

**INPUT INRUSH CURRENT**
25 Amperes (max)

**OUTPUT VOLTAGE TOLERANCE**
±2% Fixed (Primary)
±1% Fixed (Derived)

**REGULATION**
Line: 0.2% (Primary)
0.1% (Derived)
Load: 0.2% (Primary)
0.15% (±12/±15V)
0.5% (−5V)

**RIPPLE AND NOISE**
Primary: 5mV RMS
Derived: 3mV RMS
All Outputs: 50mV pk-pk

**OPERATING TEMPERATURE RANGE**
−25°C to +71°C
(No Derating)

**STORAGE TEMPERATURE RANGE**
−40°C to +85°C

**EFFICIENCY**
Primary: 75%
Derived: 60%

**TEMP. COEFFICIENT**
0.02%/°C

**I/O ISOLATION**
**Primary-to-Input:**
2500Vdc (min)
**Primary-to-Derived**
300Vdc (min)

**OUTPUT PROTECTION**
**Primary Output:**
Power Foldback and Over Voltage Clamping
**Derived Outputs:**
Current Limiting

**REMOTE OUTPUT SHUTDOWN**
**(At Either TTL Input)**
Shutdown: >2.2V @8mA
Normal: ≤1.0V @ 10 μA
No Overshoots

## ORDERING INFORMATION

| Input Voltage Range AC IN (VAC) | Input Voltage Range DC IN (VDC) | Output Voltage (VDC) | Output Current (mA) | Pkg. (Fig.) | Model Number | Unit Price | Special In-Stock Pricing Qty. (3-9) | Special In-Stock Pricing Qty. (10&up) |
|---|---|---|---|---|---|---|---|---|
| **SINGLE OUTPUTS** | | | | | | | | |
| 70-140 | 100-200 | +5V | +5000 | 1 | US1-5S50 | 169.95 | 161.50 | 153.50 |
| | | | | 2 | CS1-5S50 | | | |
| 140-280 | 200-400 | | | 1 | US2-5S50 | 174.95 | 166.25 | 158.00 |
| | | | | 2 | CS2-5S50 | | | |
| 70-140 | 100-200 | +12V | +2000 | 1 | US1-12S20 | 169.95 | 161.50 | 153.50 |
| | | | | 2 | CS1-12S20 | | | |
| 140-280 | 200-400 | | | 1 | US2-12S20 | 174.95 | 166.25 | 158.00 |
| | | | | 2 | CS2-12S20 | | | |
| **TRIPLE OUTPUTS** | | | | | | | | |
| 70-140 | 100-200 | +5V/−5V/+12V | +1000/−1000/+600 | 1 | US1-12S6-5D10 | 239.95 | 228.00 | 217.00 |
| | | | | 2 | CS1-12S6-5D10 | | | |
| 140-280 | 200-400 | | | 1 | US2-12S6-5D10 | 245.95 | 233.75 | 222.50 |
| | | | | 2 | CS2-12S6-5D10 | | | |
| 70-140 | 100-200 | | +2000/−100/+600 | 1 | US1-12S6-5D20/1 | 239.95 | 228.00 | 217.00 |
| | | | | 2 | CS1-12S6-5D20/1 | | | |
| 140-280 | 200-400 | | | 1 | US2-12S6-5D20/1 | 245.95 | 233.75 | 222.50 |
| | | | | 2 | CS2-12S6-5D20/1 | | | |
| 70-140 | 100-200 | +5V/±15V | +2000/±300 | 1 | US1-5S20-15D3 | 239.95 | 228.00 | 217.00 |
| | | | | 2 | CS1-5S20-15D3 | | | |
| 140-280 | 200-400 | | | 1 | US2-5S20-15D3 | 245.95 | 233.75 | 222.50 |
| | | | | 2 | CS2-5S20-15D3 | | | |
| **QUADRUPLE OUTPUTS** | | | | | | | | |
| 70-140 | 100-200 | ±5V/±12V | ±1000/±300 | 1 | US1-5D10-12D3 | 259.95 | 247.00 | 235.00 |
| | | | | 2 | CS1-5D10-12D3 | | | |
| 140-280 | 200-400 | | | 1 | US2-5D10-12D3 | 265.95 | 252.75 | 240.50 |
| | | | | 2 | CS2-5D10-12D3 | | | |
| 70-140 | 100-200 | +5V/−5V/±12V | +2000/−100/±300 | 1 | US1-5D20/1-12D3 | 259.95 | 247.00 | 235.00 |
| | | | | 2 | CS1-5D20/1-12D3 | | | |
| 140-280 | 200-400 | | | 1 | US2-5D20/1-12D3 | 265.95 | 252.75 | 240.50 |
| | | | | 2 | CS2-5D20/1-12D3 | | | |

Available Options

E Option — Operation from 70-140Vac, 140-280Vac or 200-400Vdc by external pin connection. Add $15.00 to USI- or CSI- model price.

AVAILABLE UPON REQUEST, PLEASE CONSULT FACTORY:
Other Voltages and Currents — Different Pin Configurations

## MECHANICAL INFORMATION

FIG. 1

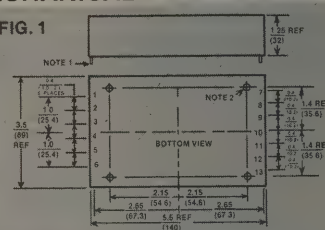
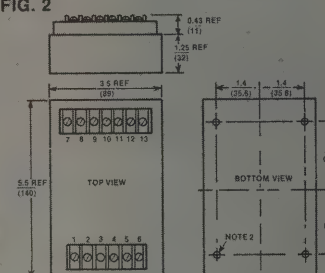



FIG. 2




**CONNECTIONS**

| PIN/TERM. | COMMENTS |
|---|---|
| 1. TTL Input (floating) | Isolated Power Shutdown Input |
| 2. TTL Return (floating) | Isolated Power Shutdown Return |
| 3. Case ground | Connect to Pin 12 |
| 4. Vin Return | Return for Pin 5 and Pin 6 |
| 5. 110 Vac In. | AC (Standard) |
| 6. 220 Vac In. | AC (E Option) |
| 7. −5 Vdc Out | Derived Output No. 1 |
| 8. +12/15 Vdc Out | Derived Output No. 2 |
| 9. Common Out | Derived Output Common |
| 10. −12/15 Vdc | Derived Output No. 3 |
| 11. TTL Input | Non-Isolated Shutdown − Input Return is Pin 12 |
| 12. −Vdc Out | Primary Output Common |
| 13. +Vdc Out | Primary Output Voltage |

NOTES:
1. Thirteen Pins, 0.040 (1) Dia. × 0.20 (5.1) Lg. Min.
2. Four Mounting Inserts, 4-40 × 0.10 (2.5) Dp. Min.
3. Four Mounting studs, 4-40 × 0.4 (10) Lg. Max.

**PRIMARY (+5Vdc) OUTPUT CURRENT DISTRIBUTION FOR TRIPLE OUTPUT MODELS**

In triple output models, the Primary power supply delivers +5Vdc @ 5A max. This output powers both the internal DC/DC converter and an external load. The amount of Primary Output current available for powering its external load (I load) is determined by Derived Output loading:
−5D10 Models: I load = 5-4 (Pda/Pdm) in Amperes
−5D20 Models: I load = 5-3 (Pda/dm) in Amperes
Pda = Total required Derived Output power
Pdm = Maximum available Derived Output Power (total)

Example: The Model USI-1256-5D10 can deliver fully rated Derived Outputs of −5Vdc @ 1A and +12Vdc @ 0.6A. for a Pdm of 12.2 Watts, total. For Derived Output loading of −5Vdc @ −0.5A and +12Vdc @0.3A, Pda = (2.5 + 3.6) Watts = 6.1 Watts. For this −5D10 Model: I load = 5-4 (6.1/12.2) = 3 Amps, the amount of Primary Output current available for its external load.

Sockets and Options — Refer to catalog pages 40 and 41.

Prices and Specifications Subject to Change Without Notice

SEMICONDUCTOR CIRCUITS, INC. POWER SOURCES DIVISION
218 RIVER STREET • HAVERHILL, MASSACHUSETTS 01830 TEL. (617) 373-9104 • TWX 710-347-0269

# High Efficiency Power Supplys® Chassis Mount and Plug-In Packages

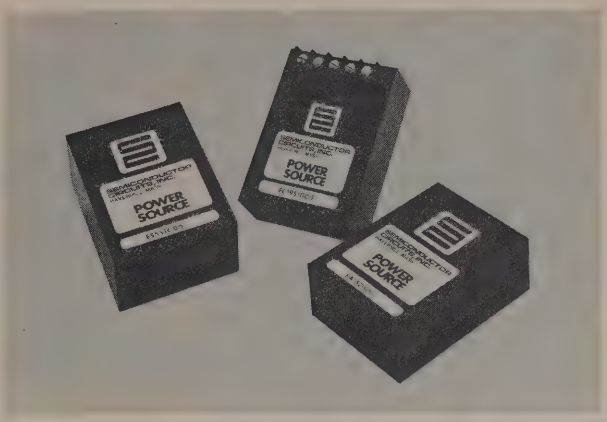
**ES, EA, EC**

*alue Products from the NO. 1 SOURCE*

**NEAR-CONSTANT EFFICIENCY TO 80%: 105-125 VAC IN**
**LINE TRANSIENT IMMUNITY >60 dB**
**LOW CASE TEMPERATURE RISE: 15°C TYP**

**he ES, EA and EC Series** of line operated power supplys ature high, near constant efficiency over the rated input oltage range. These electrically-identical families employ a ghly efficient, closed loop ripple regulation circuit which con- ins a low pass filter. This combination provides cooler opera- on, higher overall system reliability and greater line transient mmunity. . .all to a degree unmatched by equivalent conven- onal power supply designs.

he ES and EA Series are plug-in modules offering a choice of wo industry-standard pin-outs. The EC Series are chassis ount versions with a top-mounted, five-terminal barrier strip r power entry/exit.




## ENERAL SPECIFICATIONS

**IPUT VOLTAGE AND FREQUENCY**
105 to 125 Vac-50 to 440Hz

**UTPUT VOLTAGE TOLERANCE**
±1% (Fixed)

**EGULATION (Line/Load)**
0.15/0.15%

**RIPPLE AND NOISE (PARD)**
7 mV RMS

**TEMPERATURE COEFFICIENT**
0.02%/°C (typ)

**OPERATING TEMPERATURE RANGE**
−25°C to +71°C (No Derating)

**STORAGE TEMPERATURE RANGE**
−40°C to +85°C

**I/O ISOLATION**
Voltage: 1500V RMS
Resistance: 50 Megohms
Capacitance: 125pF

**OVERCURRENT PROTECTION**
Power Foldback

## RDERING INFORMATION

| Output Voltage (Vdc) | Output Current (mA) | AC Pin Spacing Inches (mm) | Pkg. (Fig.) | Model Number | Special In-Stock Pricing Unt Price | Qty. (3-9) | Qty. (10&up) |
|---|---|---|---|---|---|---|---|
| | 1000 | 2.0 (51) | 1-B | ES5S1000 | $ 56.95 | $ 51.25 | $45.25 |
| | | 2.2 (56) | 1-B | EA5S1000 | 57.95 | 51.75 | 45.75 |
| | | — | 2-C | EC5S1000 | 58.95 | 52.75 | 46.75 |
| | 1500 | 2.0 (51) | 1-B | ES5S1500 | 59.95 | 53.75 | 47.50 |
| | | 2.2 (56) | 1-B | EA5S1500 | 60.95 | 54.25 | 48.00 |
| | | — | 2-C | EC5S1500 | 61.95 | 55.75 | 49.00 |
| | 2000 | 2.0 (51) | 1-C | ES5S2000 | 65.95 | 59.25 | 52.25 |
| | | 2.2 (56) | 1-C | EA5S2000 | 66.95 | 59.75 | 52.75 |
| 5V | | — | 2-D | EC5S2000 | 67.95 | 60.75 | 53.75 |
| | 3000 | 2.0 (51) | 1-C | ES5S3000 | 72.95 | 65.50 | 58.00 |
| | | 2.2 (56) | 1-C | EA5S3000 | 73.95 | 66.00 | 58.50 |
| | | — | 2-D | EC5S3000 | 74.95 | 67.00 | 59.50 |
| | 4000 | 2.0 (51) | 1-D | ES5S4000 | 109.95 | 99.00 | 88.00 |
| | | 2.2 (56) | 1-D | EA5S4000 | 110.95 | 99.50 | 88.50 |
| | | — | 2-D | EC5S4000 | 111.95 | 100.50 | 89.50 |
| | 800 | 2.0 (51) | 1-B | ES12S800 | 65.95 | 59.25 | 52.25 |
| | | 2.2 (56) | 1-B | EA12S800 | 66.95 | 59.75 | 52.75 |
| | | — | 2-C | EC12S800 | 67.95 | 60.75 | 53.75 |
| 12V | 1200 | 2.0 (51) | 1-D | ES12S1200 | 71.95 | 64.50 | 57.00 |
| | | 2.2 (56) | 1-D | EA12S1200 | 72.95 | 65.00 | 57.50 |
| | | — | 2-D | EC12S1200 | 73.95 | 66.00 | 58.50 |
| | 1500 | 2.0 (51) | 1-D | ES12S1500 | 72.95 | 65.50 | 58.00 |
| | | 2.2 (56) | 1-D | EA12S1500 | 73.95 | 66.00 | 58.50 |
| | | — | 2-D | EC12S1500 | 74.95 | 67.00 | 59.50 |
| | 650 | 2.0 (51) | 1-B | ES15S650 | 65.95 | 59.25 | 52.25 |
| 15V | | 2.2 (56) | 1-B | EA15S650 | 66.95 | 59.75 | 52.75 |
| | | — | 2-C | EC15S650 | 67.95 | 60.75 | 53.75 |
| | 1000 | 2.0 (51) | 1-D | ES19S1000 | 66.95 | 60.25 | 53.25 |
| 19V | | 2.2 (56) | 1-D | EA19S1000 | 67.95 | 60.75 | 53.75 |
| | | — | 2-D | EC19S1000 | 68.95 | 61.75 | 55.25 |
| | 400 | 2.0 (51) | 1-B | ES24S400 | 65.95 | 59.25 | 52.25 |
| 24V | | 2.2 (56) | 1-B | EA24S400 | 66.95 | 59.75 | 52.75 |
| | | — | 2-C | EC24S400 | 67.95 | 60.75 | 53.75 |
| | | 2.0 (51) | 1-D | ES12D500 | 70.95 | 63.50 | 56.00 |
| ±12V | ±500 | 2.2 (56) | 1-D | EA12D500 | 71.95 | 64.00 | 56.50 |
| | | — | 2-D | EC12D500 | 72.95 | 65.00 | 57.50 |
| | | 2.0 (51) | 1-D | ES15D500 | 70.95 | 63.50 | 56.00 |
| ±15V | ±500 | 2.2 (56) | 1-D | EA15D500 | 71.95 | 64.00 | 56.50 |
| | | — | 2-D | EC15D500 | 72.95 | 65.00 | 57.50 |

VAILABLE UPON REQUEST, PLEASE CONSULT FACTORY:
ther Voltages and Currents — Different Pin Configurations

## MECHANICAL INFORMATION

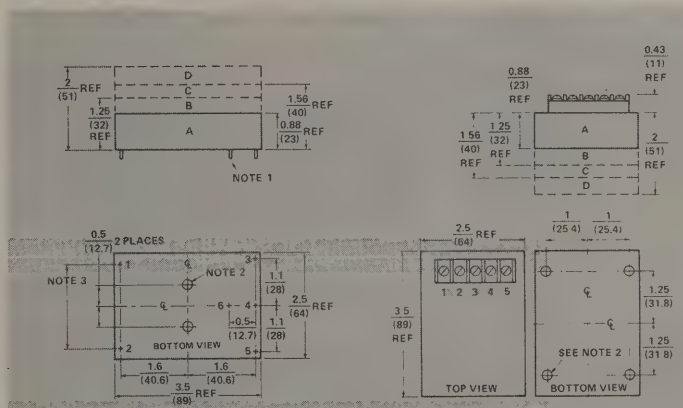



Fig. 1 Fig. 2

**CONNECTIONS**

| ES & EA Series (Fig. 1) Single Output 2.0" AC Pin Spacing | ES & EA Series (Fig. 1) Single Output 2.2" AC Pin Spacing | ES & EA Series (Fig. 1) Dual Outputs 2.0" & 2.2" AC Pin Spacing | EC Series (Fig. 2) Single Output TERM | EC Series (Fig. 2) Dual Outputs TERM |
|---|---|---|---|---|
| PIN 1. AC in | PIN 1. AC in | PIN 1. AC in | 1. AC(PWR) | 1. AC (PWR) |
| 2. AC in | 2. AC in | 2. AC in | 2. AC (PWR) | 2. AC (PWR) |
| 3. −Vdc out | 3. Do Not Connect | 3. −Vdc out | 3. +Vdc out | 3. +Vdc out |
| 4. Do Not Connect | 4. −Vdc out | 4. Common out | 4. Do Not Connect | 4. Common out |
| 5. +Vdc out | 5. +Vdc out | 5. +Vdc out | 5. −Vdc out | 5. −Vdc out |
| 6. High Isolation* | 6. High Isolation* | 6. High Isolation* | | |

*PIN 6 is provided in J option only

NOTES:
1. Pins 0.040 (1) Dia × 0.20 (5.1) Lg Min
2. Mounting Inserts No. 4-40 × 0.10 (2.5) Dp Min
3. See Pin Spacing in Ordering Information
4. All Dimensions in Inches and (mm)

Sockets and Options — Refer to catalog pages 40 and 41
Prices and Specifications Subject to Change Without Notice

SEMICONDUCTOR CIRCUITS, INC. POWER SOURCES DIVISION
218 RIVER STREET • HAVERHILL, MASSACHUSETTS 01830 TEL. (617) 373-9104 • TWX 710-347-0269

# Multi-Output, 76 Watt Ripple Regulator Power Supplys® — High Efficiency

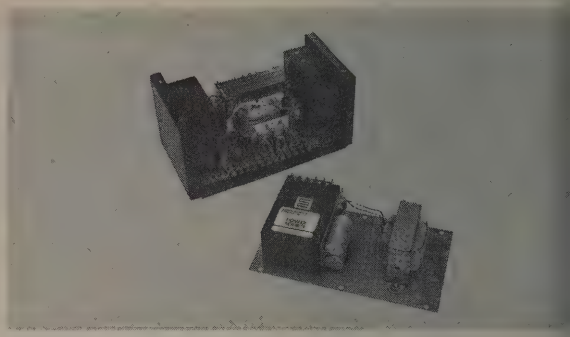
OE

*Value Products from the NO. 1 SOURCE*

- **SINGLE, DUAL & TRIPLE OUTPUTS — TO 76 WATTS**
- **LINE TRANSIENT IMMUNITY EXCEEDS 60 dB**
- **HIGH, NEAR-CONSTANT EFFICIENCY — 60 to 70%**

**The OE Series** of high efficiency ripple regulator power supply consists of single and multiple isolated-output models which deliver up to 76 Watts of power. Any model can be user-connected to operate from inputs of either 105 to 125 Vac or 210 to 250 Vac at 50 to 440 Hz.

All OE series models maintain high, nearly constant efficiency over the entire input voltage range. High efficiency reduces internal power losses, promoting cooler operation and greater overall system reliability. The key to this performance is ripple regulation, which dissipates only 20 to 25% the power of equivalent conventional power supply designs. In addition, low pass filtering within the ripple regulator circuit affords a degree of immunity to line transients which far surpasses that of other regulation techniques.



## GENERAL SPECIFICATIONS

**INPUT VOLTAGE AND FREQUENCY**
By External Connection, Either:
105 to 125Vac @ 50 to 440Hz or
210 to 250Vac @ 50 to 440Hz.

**OUTPUT VOLTAGE TOLERANCE**
±2% (Adjustable): Single Output Models
±2% (Fixed): Multi-Output Models

**REGULATION (Line/Load)**
0.5/0.5%

**RIPPLE AND NOISE**
13mV RMS (PARD)

**OPERATING TEMPERATURE RANGE**
−25°C to +60°C (No Derating)

**STORAGE TEMPERATURE RANGE**
−25°C to +85°C

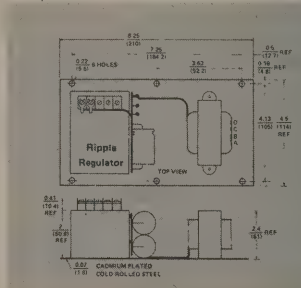
**EFFICIENCY**
60 to 70%

**I/O ISOLATION**
Voltage: 1500V RMS
Resistance: 50 Megohms
Capacitance: 125pF

**OVERCURRENT PROTECTION**
Power Foldback

## MECHANICAL INFORMATION

(All dimensions are in inches and (mm)).




**CONNECTIONS (Fig. 1)**
**Ripple Regulator**

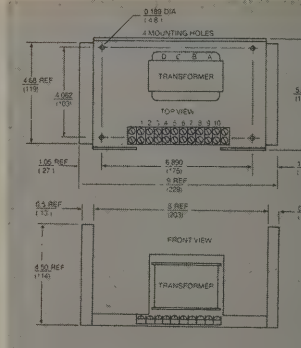
| | |
|---|---|
| Terminal 1 | +Vdc in |
| 2 | −Vdc in |
| 3 | +Vdc out |
| 4 | Trim Adjust |
| 5 | −Vdc out |

| Input AC Line (Vac) | Transformer Jumper Pins |
|---|---|
| 105 to 125 | A & B, C & D |
| 210 to 250 | B & C Only |

## ORDERING INFORMATION

| Output Voltage (Vdc) | Output Current (mA) | Pkg. (Fig.) | Model Number | Unit Price | Special In-Stock Pricing Qty. (3-9) | Special In-Stock Pricing Qty. (10&up) |
|---|---|---|---|---|---|---|
| SINGLE OUTPUTS | | | | | | |
| 5V | 4000 | 1 | OE5S4000K2 | 128.25 | 115.45 | 102.60 |
| | 6500 | 1 | OE5S6500K2 | 141.55 | 127.30 | 112.85 |
| | 8000 | 1 | OE5S8000K2 | 151.20 | 136.15 | 121.05 |
| 12V | 2000 | 1 | OE12S2000K2 | 110.70 | 99.70 | 88.65 |
| | 3500 | 1 | OE12S3500K2 | 141.55 | 127.30 | 112.85 |
| DUAL OUTPUTS | | | | | | |
| +5V/ +12V* | +3000/ +3500 | 2 | OE5S30/ 12S35K2 | 269.95 | 228.00 | 210.00 |
| | +6500/ +2000 | 2 | OE5S65/ 12S20K2 | 269.95 | 228.00 | 210.00 |
| TRIPLE OUTPUTS | | | | | | |
| +5V/ ±12V | +3000/ ±1500 | 2 | OE5S30/ 12D15K2 | 249.95 | 211.00 | 194.00 |
| | +6500/ ±1000 | 2 | OE5S65/ 12D10K2 | 269.95 | 228.00 | 210.00 |
| | +8000/ ±1500 | 2 | OE5S80/ 12D15K2 | 299.95 | 255.00 | 235.00 |
| +5V/ ±15V | +3000/ ±1500 | 2 | OE5S30/ 15D15K2 | 249.95 | 211.00 | 194.00 |
| | +6500/ ±1000 | 2 | OE5S65/ 15D10K2 | 269.95 | 228.00 | 210.00 |
| | +8000/ ±1000 | 2 | OE5S80/ 15D10K2 | 299.95 | 255.00 | 235.00 |

*The 12V output appears across pins 5 and 6 of Fig. 2.



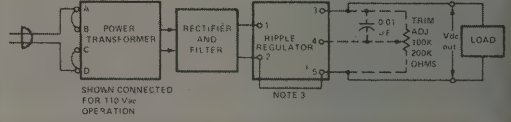

**CONNECTIONS (Fig. 2)**
**Ripple Regulator**

| | |
|---|---|
| Terminal 1 | AC in |
| 2 | AC in |
| 3 | Chassis Ground |
| 4 | Do Not Connect |
| 12/15 V Output 1 5 | −12 (−15) Vdc out |
| 6 | +12 (+15) Vdc out |
| 12/15V Output 2 7 | −12 (−15) Vdc out |
| 8 | +12 (+15) Vdc out |
| 9 | −5 Vdc out |
| 10 | +5 Vdc out |

AC Input Connections
Transformer interconnections same as for Figure 1.

NOTES FOR SINGLE OUTPUT MODEL ONLY:

1. The circuit below provides a ±5% trim which zeroes the output voltage tolerance offset.
2. If TRIM ADJ potentiometer leads exceed 4", connect a 0.01µ capacitor close to or at regulator terminals 3 and 4.
3. Pins 2 and 5 are internally connected. For specified performance these pins must be externally connected as below.




AVAILABLE UPON REQUEST, PLEASE CONSULT FACTORY:
Other Voltages and Currents — Different Pin Configurations

Sockets and Options — Refer to catalog pages 40 and 41
Prices and Specifications Subject to Change Without Noti

SEMICONDUCTOR CIRCUITS, INC. POWER SOURCES DIVISION
218 RIVER STREET • HAVERHILL, MASSACHUSETTS 01830 TEL. (617) 373-9104 • TWX. 710-347-0269

# Industry Standard, High Performance Power Higher Voltage Models for Plasma Displays Supplys®

**P, SP5900 ED**

*ue Products from the NO. 1 SOURCE*

**HIGH PERFORMANCE-REGULATION TO 0.01%**
**FULL OPERATION TO +85°C (M OPTION — P & SP5900**
**OUTPUTS TO 250 VOLTS — ED SERIES**

**e P and SP Series** boast a decade of reliable, field proven service and are the lustry standard for high performance encapsulated modular power supplys. ntinuous design improvements give these units MTBF's >150,000 hrs, lower se heat-rise (to 18°C cooler) and the highest in-circuit performance. Milita- ed versions (M Option) for demanding environments employ hermetically aled components and tantalum capacitors to maintain full rated operation ough +85°C.**

e ED Series models deliver higher voltage outputs for powering a variety of e more widely used plasma digital displays.

## ENERAL SPECIFICATIONS

**PUT VOLTAGE AND FREQUENCY**
05 to 125Vac — 50 to 440 Hz

**TPUT VOLTAGE TOLERANCE**
±1% (Fixed): P,SP5900
±2% (Fixed): ED

**PPLE AND NOISE (PARD)**
mV RMS

**AL OUTPUT TRACKING**
mV/mV (typ)

**MPERATURE COEFFICIENT**
.02%/°C (typ)

**OPERATING TEMPERATURE RANGE****
−25°C to +71°C (No Derating)

**STORAGE TEMPERATURE RANGE****
−40°C to +85°C

**I/O ISOLATION**
Voltage: 1500V RMS
Resistance: 50 Megohms
Capacitance: 125pF

**OVERCURRENT PROTECTION**
Current Limiting

## RDERING INFORMATION

| Output Voltage (Vdc) | Output Current (mA) | Regulation Line (%) | Regulation Load (%) | AC PIN Spacing Inches (mm) | Pkg (Fig. 1) | Model Number | Unit Price | Special In-Stock Pricing Qty. (3-9) | Special In-Stock Pricing Qty (10&up) |
|---|---|---|---|---|---|---|---|---|---|
| 5V | 500 | 0.05<br>0.05 | 0.05<br>0.05 | 2.0 (51)<br>2.2 (56) | A | P1.5.500<br>SP5903* | $41.95<br>45.95 | $37.75<br>41.75 | $33.50<br>37.50 |
| | 1000 | 0.05<br>0.05 | 0.1<br>0.1 | 2.0 (51)<br>2.2 (56) | B | P1.5.1000<br>SP5905* | 45.95<br>49.95 | 41.50<br>45.50 | 36.75<br>40.75 |
| | 2000 | 0.05<br>0.05 | 0.2<br>0.2 | 2.0 (51)<br>2.2 (56) | C | P1.5.2000<br>SP5941 | 60.95<br>61.95 | 54.75<br>55.25 | 48.25<br>48.75 |
| 12V | 500 | 0.05 | 0.1 | 2.0 (51) | B | P12S500 | 49.95 | 44.75 | 39.50 |
| 50V | 100 | 1.0 | 1.0 | 2.0 (51) | D | ED150S100 | 89.95 | 81.00 | 71.95 |
| 80V | 30 | 1.0 | 1.0 | 2.0 (51) | B | ED180S30 | 49.95 | 44.50 | 39.00 |
| 50V | 30 | 1.0 | 1.0 | 2.0 (51) | B | ED250S30 | 54.95 | 47.50 | 40.00 |
| ±5V | ±500 | 0.05<br>0.05 | 0.05<br>0.05 | 2.0 (51)<br>2.2 (56) | B | P5D500<br>SP5925 | 49.95<br>50.95 | 44.75<br>45.25 | 39.50<br>40.50 |
| | ±100 | 0.01<br>0.01 | 0.05<br>0.05 | 2.0 (51)<br>2.2 (56) | A | P2.12.100<br>SP5908-2 | 41.95<br>42.95 | 37.50<br>38.00 | 33.00<br>33.50 |
| 12V | ±200 | 0.01<br>0.01 | 0.05<br>0.05 | 2.0 (51)<br>2.2 (56) | B | P2.12.200<br>SP5921 | 49.95<br>50.95 | 44.75<br>45.25 | 39.80<br>40.00 |
| | ±300 | 0.01<br>0.01 | 0.05<br>0.05 | 2.0 (51)<br>2.2 (56) | C | P2.12.300<br>SP5950 | 55.95<br>56.95 | 50.25<br>50.75 | 44.25<br>44.75 |
| | ±30 | 0.05<br>0.05 | 0.05<br>0.05 | 2.0 (51)<br>2.2 (56) | A | P2.15.25<br>SP5915 | 31.95<br>32.95 | 28.75<br>29.25 | 25.50<br>26.00 |
| | ±60 | 0.01<br>0.01 | 0.05<br>0.05 | 2.0 (51)<br>2.2 (56) | A | P2.15.60<br>SP5904 | 38.95<br>39.95 | 35.25<br>35.75 | 31.25<br>31.75 |
| 15V | ±100 | 0.01<br>0.01 | 0.05<br>0.05 | 2.0 (51)<br>2.2 (56) | A | P2.12.100<br>SP5902-2 | 41.95<br>42.95 | 37.50<br>38.00 | 33.00<br>33.50 |
| | ±200 | 0.01<br>0.01 | 0.05<br>0.05 | 2.0 (51)<br>2.2 (56) | B | P2.15.200<br>SP5920 | 49.95<br>50.95 | 44.75<br>45.25 | 39.50<br>40.00 |
| | ±300 | 0.01<br>0.01 | 0.05<br>0.05 | 2.0 (51)<br>2.2 (56) | C | P2.15.300<br>SP5951 | 55.95<br>56.95 | 50.25<br>50.75 | 44.25<br>44.75 |
| 18V | ±100 | 0.01<br>0.01 | 0.05<br>0.05 | 2.0 (51)<br>2.2 (56) | B | P18D100<br>SP5932 | 49.95<br>50.95 | 44.75<br>45.25 | 39.80<br>40.00 |
| 24V | ±100 | 0.01<br>0.01 | 0.05<br>0.05 | 2.0 (51)<br>2.2 (56) | B | P24D100<br>SP5934 | 49.95<br>50.95 | 44.75<br>45.25 | 39.80<br>40.00 |
| 120V | +20 | 0.01 | 0.05 | 2.0 (51) | C | P2 120 20 | 67.95 | 61.00 | 54.00 |

des clamp type over voltage protection set at approximately 6.5Vdc
ption Temperature Ranges −40°C to +85°C (operating) −55°C to +85°C (storage)

LABLE UPON REQUEST, PLEASE CONSULT FACTORY:
her Voltages and Currents — Different Pin Configurations

## MECHANICAL INFORMATION

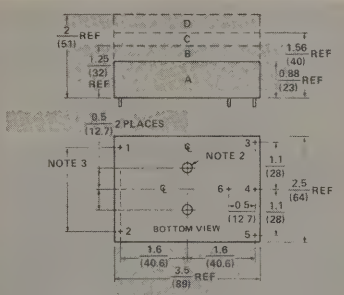



Fig. 1

### CONNECTIONS

**Single Outputs 2.0" AC Pin Spacing**

PIN 1 AC in
2 AC in
3 -Vdc out
4 Do Not Connect
5 +Vdc out
6 High Isolation (J Option Only)

**Single Outputs 2.2" AC Pin Spacing**

PIN 1 AC in
2 AC in
3 Do Not Connect
4 -Vdc out
5 +Vdc out
6 High Isolation (J Option Only)

**Dual Outputs 2.0" and 2.2" AC Pin Spacing**

PIN 1 AC in
2 AC in
3 -Vdc out
4 Common out
5 +Vdc out
6 High Isolation (J Option Only)

NOTES:
1. Five Pins 0.040 (1.0) Dia x 0.20 (5.1) Lg Min
2. Two Mounting Inserts No 4-40 x 0.10 (2.5) Dp Min
3. See Pin Spacing in Ordering Information
4. All Dimensions are in Inches and (mm)

Sockets and Options — Refer to catalog pages 40 and 41.
Prices and Specifications Subject to Change Without Notice.

SEMICONDUCTOR CIRCUITS, INC. POWER SOURCES DIVISION
218 RIVER STREET • HAVERHILL, MASSACHUSETTS 01830 TEL. (617) 373-9104 • TWX 710-347-0269

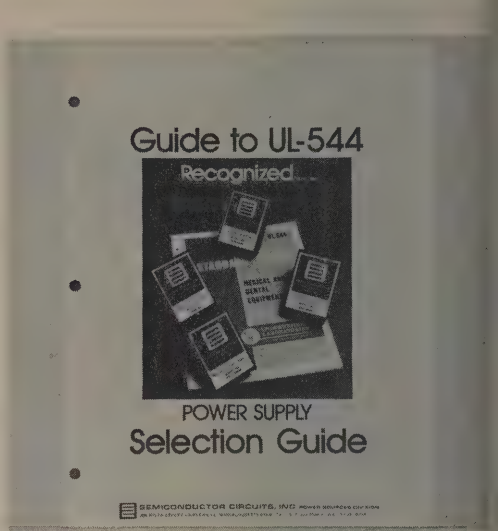
# Standard for Safety — Medical & Dental Equipment

UL544

*Value Products from the NO. 1 SOURCE*

- **PATIENT CONTACT RATED (W OPTION)**
- **2500 VOLT BREAKDOWN**
- **FARADAY SHIELDED TRANSFORMERS**

**The UL544 Series** consists of more than 250 power supply models which have met the stringent requirements for Patient Contact rating as defined by Underwriters Laboratories, Inc., under UL544; STANDARD for SAFETY — MEDICAL and DENTAL EQUIPMENT. All models are recognized and listed accordingly under File E50975 of the U.L. Component Recognition Program. These units are based upon standard, reliable, S.C.I. product families which are specifically modified to meet the severe demands of UL544. All models utilize a Faraday shielded power transformer which holds AC leakage current down to well below the 10 μA maximum. Effective isolation techniques give these units a higher-than-required Voltage Breakdown rating of 2500 V (min).




## GENERAL SPECIFICATIONS

**INPUT VOLTAGE AND FREQUENCY**
105-125Vac — 50 to 60Hz

**RIPPLE AND NOISE (PARD)**
P,SP5900 Series: 1 mV RMS
ES, EA Series: 7 mV RMS
OF Series: 2 mV RMS

**TEMPERATURE COEFFICIENT**
0.02%/°C (Typ)

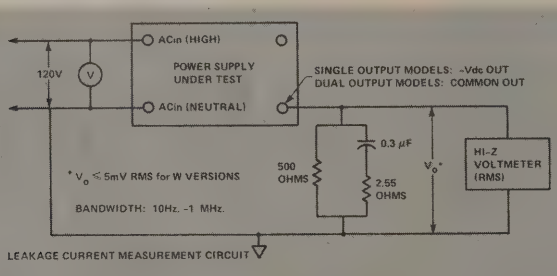
**OPERATING TEMPERATURE RANGE**
−25°C to +71°C (No Derating)

**STORAGE TEMPERATURE RANGE**
**P,SP5900, ES, EA Series:**
−40°C to +85°C
OF Series: −25°C to +85°C

**SHORT CIRCUIT PROTECTION**
P,SP5900 Series: Current Limiting
ES, EA Series: Power Foldback
OF Series: Continuous

**INPUT TO OUTPUT ISOLATION**
2500 Volts (min)
(Patient Contact Rated)

**AC LEAKAGE CURRENT**
<10 μAmps (Patient Contact Rated)



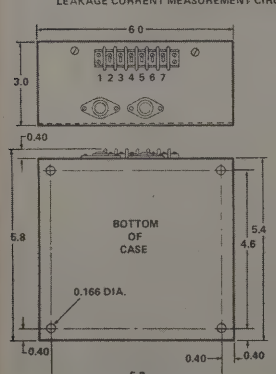




Fig. 2

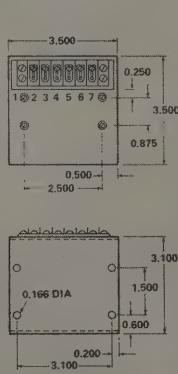



Fig. 3

**CONNECTIONS (Fig. 2 & 3)**

**Single Outputs (Fig. 2)**
PIN 1 Case Ground
2 ACin (High)
3 ACin (Neutral)*
4 +Vdc out
5 +Vdc Sense
6 −Vdc Sense
7 −Vdc out

**Dual Outputs (Fig. 3)**
PIN 1 Ground
2 ACin (High)
3 ACin (Neutral)*
4 +Vdc out
5 Common OUt
6 −Vdc out
7 Do Not Connect

## MECHANICAL INFORMATION

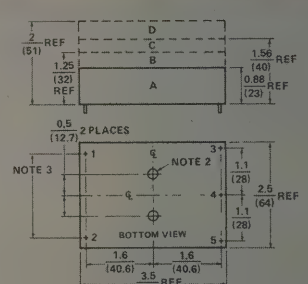



Fig. 1

**CONNECTIONS (Fig. 1)**

| Pin Function | Dual Outputs AC Pin Spacing 2.0" & 2.2" | Single Outputs AC Pin Spacing 2.0" | Single Outputs AC Pin Spacing 2.2" |
|---|---|---|---|
| ACin (High) | 1 | 1 | 1 |
| ACin (Neutral)* | 2 | 2 | 2 |
| −Vdc out | 3 | 3 | 4 |
| Common out | 4 | — | — |
| +Vdc out | 5 | 5 | 5 |
| Do Not Connect | — | 4 | 3 |

*Faraday Shield Connected Internally

NOTES:
1. Five Pins 0.40 (1) Dia × 0.20 (5.1) Lg Min
2. Two Mounting Inserts No. 4-40 × 0.10 (2.5) Dp Min
3. See Pin Spacing in Ordering Information
4. All Dimensions are in Inches and (mm)

AVAILABLE UPON REQUEST, PLEASE CONSULT FACTORY:
Other Voltages and Currents — Different Pin Configurations

Sockets and Options — Refer to catalog pages 40 and 41
Prices and Specifications Subject to Change Without Notice

**SEMICONDUCTOR CIRCUITS, INC.** POWER SOURCES DIVISION
218 RIVER STREET • HAVERHILL, MASSACHUSETTS 01830 TEL. (617) 373-9104 • TWX 710-347-0269

# Power Supplys® Recognized Under UL544 Standard for Safety — continued

UL544

*Value Products from the NO. 1 SOURCE*

**A SAMPLING: The more than 31 models described below are a modest sampling of our total capability in the UL544 category.**

## ORDERING INFORMATION

| Output Voltage (Vdc) | Output Current (mA) | Regulation Line (%) | Regulation Load (%) | AC Pin Spacing Inches (mm) | Pkg. (Fig.) | Reference Catalog Page | Model Number | Unit Price | Special In-Stock Pricing Qty. (3-9) | Special In-Stock Pricing Qty. 10&up) |
|---|---|---|---|---|---|---|---|---|---|---|
| 5V | 1000 | 0.05<br>0.05 | 0.1<br>0.1 | 2.0 (51)<br>2.2 (56) | 1-B | 19 | P1.5.1000W<br>SP5905W* | $48.95<br>52.95 | $44.00<br>48.00 | $39.25<br>43.25 |
| | | 0.15<br>0.15 | 0.15<br>0.15 | 2.0 (51)<br>2.2 (56) | 1-B | 15 | ES5S1000W<br>EA5S1000W | 59.95<br>60.95 | 53.75<br>54.25 | 47.75<br>48.25 |
| | 1500 | 0.15<br>0.15 | 0.15<br>0.15 | 2.0 (51)<br>2.2 (56) | 1-B | 15 | ES5S1500W<br>EA5S1500W | 62.95<br>63.95 | 56.25<br>56.75 | 50.00<br>50.50 |
| | 2000 | 0.15<br>0.15 | 0.15<br>0.15 | 2.0 (51)<br>2.2 (56) | 1-C | 15 | ES5S2000W<br>EA5S2000W | 68.95<br>69.96 | 61.75<br>62.25 | 54.75<br>55.75 |
| | 3000 | 0.15<br>0.15 | 0.15<br>0.15 | 2.0 (51)<br>2.2 (56) | 1-C | 15 | ES5S3000W<br>EA5S3000W | 75.95<br>76.95 | 68.00<br>68.50 | 60.50<br>61.00 |
| | 7000 | 0.01 | 0.15 | — | 2 | 22 | OF1.5.7000W | 87.95 | 83.50 | 79.50 |
| 12V | 800 | 0.15 | 0.15 | 2.0 (51) | 1-B | 15 | ES12S800W | 68.95 | 61.75 | 54.75 |
| | 1200 | 0.15 | 0.15 | 2.0 (51) | 1-D | 15 | ES12S1200W | 74.95 | 67.00 | 59.50 |
| 15V | 650 | 0.15 | 0.15 | 2.0 (51) | 1-B | 15 | ES15S650W | 68.95 | 61.75 | 54.75 |
| 19V | 1000 | 0.15 | 0.15 | 2.0 (51) | 1-D | 15 | ES19S1000W | 69.95 | 62.75 | 55.75 |
| ± 12V | ± 60 | 0.01<br>0.01 | 0.05<br>0.05 | 2.0 (51)<br>2.2 (56) | 1-A | 19 | P2.12.60W<br>SP5909W | 41.95<br>42.95 | 37.75<br>38.25 | 33.75<br>34.25 |
| | ± 100 | 0.01 | 0.05 | 2.0 (51) | 1-A | 19 | P2.12.100W | 44.95 | 40.00 | 35.50 |
| | ± 200 | 0.01<br>0.01 | 0.05<br>0.05 | 2.0 (51)<br>2.2 (56) | 1-B | 19 | P2.12.200W<br>SP5921W | 52.95<br>53.95 | 47.25<br>47.75 | 42.00<br>42.50 |
| | ± 500 | 0.01 | 0.1 | — | 3 | 22 | OF2.12.500W | 77.95 | 70.00 | 62.50 |
| ± 15V | ± 25 | 0.01<br>0.01 | 0.05<br>0.05 | 2.0 (51)<br>2.2 (56) | 1-A | 19 | P2.15.25W<br>SP5915W | 34.95<br>35.95 | 41.25<br>31.75 | 28.00<br>28.50 |
| | ± 60 | 0.01<br>0.01 | 0.05<br>0.05 | 2.0 (51)<br>2.2 (56) | 1-A | 19 | P2.15.60W<br>SP5904W | 41.95<br>42.95 | 37.75<br>40.00 | 33.75<br>34.25 |
| | ± 100 | 0.01<br>0.01 | 0.05<br>0.05 | 2.0 (51)<br>2.2 (56) | 1-A | 19 | P2.15.100W<br>SP5902-2W | 44.95<br>45.95 | 40.00<br>40.50 | 35.50<br>36.00 |
| | ± 200 | 0.01<br>0.01 | 0.05<br>0.05 | 2.0 (51)<br>2.2 (56) | 1-B | 19 | P2.15.200W<br>SP5920W | 52.95<br>53.95 | 47.25<br>47.75 | 42.00<br>42.50 |
| | ± 500 | 0.01 | 0.1 | — | 3 | 22 | OF2.15.500W | 77.95 | 70.00 | 62.50 |

*Includes Clamp Type Over Voltage Protection Set at Approximately 6.5Vdc

AVAILABLE UPON REQUEST, PLEASE CONSULT FACTORY:
Other Voltages and Currents — Different Pin Configurations

Sockets and Options — Refer to catalog pages 40 and 41
Prices and Specifications Subject to Change Without Notice

SEMICONDUCTOR CIRCUITS, INC. POWER SOURCES DIVISION
218 RIVER STREET • HAVERHILL, MASSACHUSETTS 01830 TEL. (617) 373-9104 • TWX 710-347-0269

# Multi-Output, 25 Watt DC/DC Converters. . . Input & Outputs Protected, Economy Priced

U,CU

*Value Products from the NO. 1 SOURCE* **ANOTHER NEW PRODUCT**

- **INPUT RANGE TO 4:1**
- **SHUTS DOWN FOR INPUT UNDER/OVER VOLTAGE**
- **CLAMPED LOGIC POWER OUTPUT PROTECTS CHIPS**

**The U,CU Series** are quadruple, triple and single output DC/DC converters which efficiently deliver up to 25-Watts of output power. Featuring self-resetting shutdown for input over/under voltage and output over voltage conditions, these unique converters protect both the input source and the output load from damage. All models tolerate extremely large input voltage variations — up to 4:1 — and employ a Pi-input filter which isolates the input source from internally generated "spikes." All outputs are free of chip-damaging overshoot.

All models feature floating outputs with input-to-output (I/O) isolation of 2500Vdc min and primary-to-derived output isolation of 300Vdc min. These devices are ideal for powering data conversion/acquisition systems, μP's and memories in mobile and portable applications where reliability and battery life are prime concerns.

## GENERAL SPECIFICATIONS (Derived outputs are ±12V, ±15V and −5V)

**INPUT REFLECTED RIPPLE**
20 mA pk-pk(max)

**OUTPUT VOLTAGE TOLERANCE**
±2% Fixed (Primary)
±1% Fixed (Derived)

**REGULATION**
Line: 0.2% (Primary)
0.1% (Derived)
Load: 0.2% (Primary)
0.15% (±12/±15V)
0.5% (−5V)

**RIPPLE AND NOISE**
5mV RMS (Primary)
3mV RMS (Derived)
30mV pk-pk (All Outputs)

**OPERATING TEMPERATURE RANGE**
−25°C to +71°C (No Derating)

**STORAGE TEMPERATURE RANGE**
−40°C to +85°C

**EFFICIENCY**
73% (Primary)
60% (Derived)

**ISOLATION**
I/O: 2500Vdc (min)
Between Primary & Derived Outputs: 300Vdc (min)

**TEMP. COEFFICIENT**
0.02%/°C (typ)

**OUTPUT PROTECTION**
Primary: Power Foldback and OverVoltage Clamp
Derived: Current Limiting

**INPUT PROTECTION***
(Converter Shutdown)
**9-36V Rated Input:**
8.8V > Vin > 37V
60V Vin Sustained
**18-72Vdc Rated Input:**
17.5V > Vin > 78V
100V Vin Sustained
**28-90V Rated Input:**
27V > Vin > 95V
160V Vin Sustained

## ORDERING INFORMATION

| SINGLE OUTPUTS | | Pkg. (Fig.) | Model Number | Special In-Stock Pricing | | |
|---|---|---|---|---|---|---|
| +5V @ +mA | +12V @ +mA | | | Unit Price | Qty. (3-9) | Qty. (10&up) |
| +5000 | — | 1<br>2 | UXX-5S50<br>CUXX-5S50 | $149.95 | $142.00 | $135.00 |
| — | +2000 | 1<br>2 | UXX-12S20<br>CUXX-12S20 | 149.95 | 142.00 | 135.00 |

| TRIPLE OUTPUTS | | | | | | | |
|---|---|---|---|---|---|---|---|
| +5V @ +mA/ −5V @ −mA | +12V @ +mA | ±15V @ ±mA | Pkg. (Fig.) | Model Number | Unit Price | Qty. (3-9) | Qty. (10&up) |
| +1000/−1000 | +600 | — | 1<br>2 | UXX-12S6-5D10<br>CUXX-12S6-5D10 | $209.95 | $199.00 | $189.00 |
| +2000/−100 | +600 | — | 1<br>2 | UXX-12S6-5D20/1<br>CUXX-12S6-5D20/1 | 209.95 | 199.00 | 189.00 |
| +2000 | — | ±300 | 1<br>2 | UXX-5S20-15D3<br>CUXX-5S20-15D3 | 209.95 | 199.00 | 189.00 |

| QUADRUPLE OUTPUTS | | | | | | |
|---|---|---|---|---|---|---|
| +5V @ +mA/ −5V @ −mA | ±12V @ ±mA | Pkg. (Fig.) | Model Number | Unit Price | Qty. (3-9) | Qty. (10&up) |
| +1000/−1000 | ±300 | 1<br>2 | UXX-5D10-12D3<br>CUXX-5D10-12D3 | $229.95 | $218.00 | $207.00 |
| +2000/−100 | ±300 | 1<br>2 | UXX-5D20/1-12D3<br>CUXX-5D20/1-12D3 | 229.95 | 218.00 | 207.00 |

| INPUT VOLTAGE DESIGNATOR (XX) | | | |
|---|---|---|---|
| Designator UXX-/CUXX- | U18-/CU18- | U36-/CU36- | U48-/CU48- |
| Input Voltage Range | 9-36Vdc | 18-72Vdc | 28-90Vdc |

*Threshold settings for 24V, 60V and other standard battery voltages can be provided. Please consult factory.

AVAILABLE UPON REQUEST, PLEASE CONSULT FACTORY:
Other Voltages and Currents — Different Pin Configurations

## MECHANICAL INFORMATION

(All dimensions are in inches and (mm)).

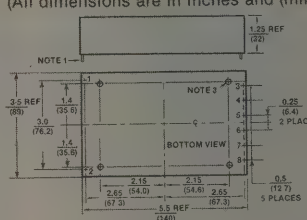



Fig. 1

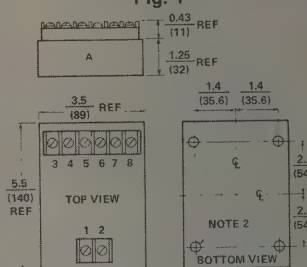
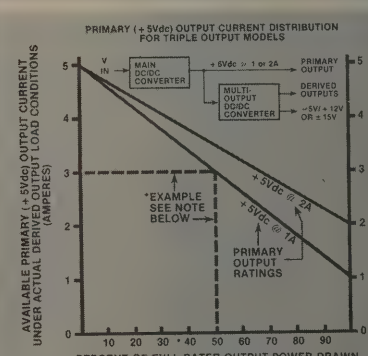



Fig. 2

### CONNECTIONS

| TERM. (Primary) | | TERM. (Derived) | |
|---|---|---|---|
| 1 | −Vdc in | 3 | −5Vdc out |
| 2 | +Vdc in | 4 | +12/15Vdc out |
| 7 | −Vdc out | 5 | common out |
| 8 | +Vdc out | 6 | −12/15Vdc out |

NOTES:
1. Eight Pins, 0.040 (1) Dia x 0.20 (5.1)Lg min.
2. Four Mounting Inserts, 4-40 x 0.10(2.5)Dp min.
3. Four Mounting Studs, 4-40 x 0.4(10) Lg max.


PRIMARY (+5Vdc) OUTPUT CURRENT DISTRIBUTION FOR TRIPLE OUTPUT MODELS
AVAILABLE PRIMARY (+5Vdc) OUTPUT CURRENT UNDER ACTUAL DERIVED OUTPUT LOAD CONDITIONS (AMPERES)
V IN
MAIN DC/DC CONVERTER
+5Vdc @ 1 or 2A
PRIMARY OUTPUT
MULTI-OUTPUT DC/DC CONVERTER
DERIVED OUTPUTS
−5V, +12V OR ±15V
*EXAMPLE SEE NOTE BELOW
+5Vdc @ 2A
+5Vdc @ 1A
PRIMARY OUTPUT RATINGS
PERCENT OF FULL RATED OUTPUT POWER DRAWN BY DERIVED OUTPUT

*EXAMPLE: The Model U18-12S6-5D10 delivers full rated derived outputs of −5V @ −1A and +12V @ 0.6A, or 12.2 Watts. For derived output loading of −5V @ −0.5A and +12V @ +0.3A, which is 50% of full rated output, the primary (+5Vdc) output has 3A available for an external load.

Sockets and Options — Refer to catalog pages 40 and 41
Prices and Specifications Subject to Change Without Notice

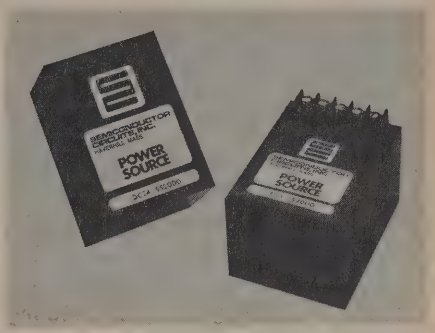
SEMICONDUCTOR CIRCUITS, INC. POWER SOURCES DIVISION
218 RIVER STREET • HAVERHILL, MASSACHUSETTS 01830 TEL (617) 373-9104 • TWX 710-347-0269

# Higher Efficiency, Broad Input Range Single Output DC/DC Converters

DC, CC

*Value Products from the NO. 1 SOURCE*

- **WIDER INPUT RANGE - to 200%**
- **IDEAL FOR BATTERY OPERATION**
- **CHOICE OF PC BOARD OR CHASSIS MOUNT PACKAGE**




**The DC and CC Series** are highly efficient, single output, regulated DC/DC converters that tolerate input voltage variations to 200% and operating efficiencies to 80% (See catalog page 11). These units are ideal for operation from batteries, motor generators, fuel cells and other poorly regulated sources of dc input power. All models feature I/O isolation, which enables the user to obtain either polarity of output regardless of the input voltage polarity.

The DC Series models are designed for PC board mounting. The electrically identical CC Series are chassis mount versions, which achieve power entry and exit via a top-mounted, 5-terminal barrier strip.

Models having rated outputs of 180Vdc and 250Vdc for powering plasma digital displays are available on request.

## GENERAL SPECIFICATIONS

**OUTPUT VOLTAGE TOLERANCE**
±2% (Fixed)

**REGULATION**
Line/Load: 1.0/1.0%

**RIPPLE AND NOISE**
7 mV RMS

**OPERATING TEMPERATURE RANGE**
−25°C to +71°C (No Derating)

**STORAGE TEMPERATURE RANGE**
−40°C to +85°C

**I/O ISOLATION**
Voltage: 300Vdc
Resistance: 100 Megohms
Capacitance: 50 pF

**OVERCURRENT PROTECTION**
Power Foldback

## ORDERING INFORMATION

| Input Voltage Range (Vdc) | Output Voltage (Vdc) | Output Current (ma) | Efficiency (%) | Pkg. (Fig.) | Model Number | Unit Price | Special In-Stock Pricing Qty. (3-9) | Special In-Stock Pricing Qty. (10&up) |
|---|---|---|---|---|---|---|---|---|
| 9-18 | 5V | 2000 | 55-65 | 1-C | DC-12-5S2000 | $ 96.95 | $ 87.25 | $77.50 |
| | | | | 2-D | CC12-5S2000 | 101.95 | 91.25 | 81.50 |
| 18-36 | | | 55-65 | 1-C | DC24-5S2000 | 96.95 | 87.25 | 77.50 |
| | | | | 2-D | CC24-5S2000 | 101.95 | 91.25 | 81.50 |
| 35-70 | | | 55-65 | 1-C | DC48-5S2000 | 96.95 | 87.25 | 77.50 |
| | | | | 2-D | CC48-5S2000 | 101.95 | 91.25 | 81.50 |
| 18-36 | | 3000 | 55-65 | 1-C | DC24-5S3000 | 106.95 | 96.25 | 85.50 |
| | | | | 2-D | CC24-5S3000 | 111.95 | 100.25 | 89.50 |
| 35-70 | | | 55-65 | 1-C | DC48-5S3000 | 106.95 | 96.25 | 85.50 |
| | | | | 2-D | CC48-5S3000 | 111.95 | 100.25 | 89.50 |
| 9-18 | 12V | 1000 | 70-75 | 1-C | DC12-12S1000 | 96.95 | 87.25 | 77.50 |
| | | | | 2-D | CC12-12S1000 | 101.95 | 91.25 | 81.50 |
| 18-36 | | | 70-75 | 1-C | DC24-12S1000 | 96.95 | 87.25 | 77.50 |
| | | | | 2-D | CC24-12S1000 | 101.95 | 91.25 | 81.50 |
| 35-70 | | | 70-80 | 1-C | DC48-12S1000 | 96.95 | 87.25 | 77.50 |
| | | | | 2-D | CC48-12S1000 | 101.95 | 91.25 | 81.50 |
| 35-70 | | 2000 | 70-75 | 1-D | DC48-12S2000 | 112.95 | 101.50 | 90.00 |
| 9-18 | 15V | 800 | 70-75 | 1-C | DC12-15S800 | 96.95 | 87.25 | 77.50 |
| | | | | 2-D | CC12-15S800 | 101.95 | 91.25 | 81.50 |
| 35-70 | | | 70-80 | 1-C | DC48-15S800 | 96.95 | 87.25 | 77.50 |
| | | | | 2-D | CC48-15S800 | 101.95 | 91.25 | 81.50 |
| 35-70 | | 1000 | 70-80 | 1-C | DC48-15S1000 | 101.95 | 91.50 | 81.00 |
| | | | | 2-D | CC48-15S1000 | 106.95 | 95.50 | 85.00 |
| 35-70 | | 2000 | 70-80 | 1-D | DC48-15S2000 | 112.95 | 101.50 | 90.00 |

AVAILABLE UPON REQUEST, PLEASE CONSULT FACTORY:
Other Voltages and Currents — Different Pin Configurations

## MECHANICAL INFORMATION

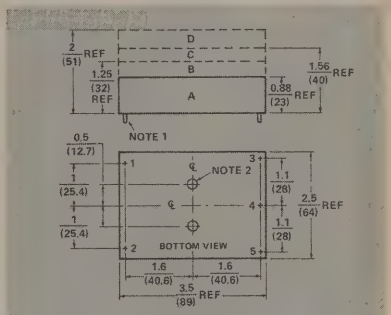



Fig. 1

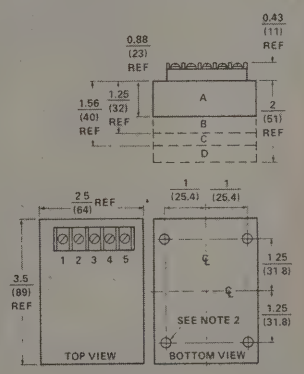



Fig. 2

**CONNECTIONS**

PIN 1 +Vdc in
2 −Vdc in
3 +Vdc out
4 Do Not Connect
5 −Vdc out

NOTES:
1. Five Pins 0.040 (1.0) Dia × 0.20 (5.1) Lg Min
2. Mounting Inserts 4-40 × 0.10 (2.5) Dp Min
3. All Dimensions are in Inches and (mm)

Sockets and Options — Refer to catalog pages 40 and 41
Prices and Specifications Subject to Change Without Notice

SEMICONDUCTOR CIRCUITS, INC. POWER SOURCES DIVISION
218 RIVER STREET • HAVERHILL, MASSACHUSETTS 01830 TEL. (617) 373-9104 • TWX 710-347-0269

# High Efficiency, Ripple Regulator, Single Output DC/DC Converters

SW, CW

*Value Products from the NO. 1 SOURCE*

- **OUTPUT POWER TO 40 WATTS**
- **IDEAL FOR BATTERY APPLICATIONS**
- **WIDE INPUT RANGE - TO 200%**

**The SW and CW Series** are highly efficient, single output DC/DC converters. Proportional energy transfer techniques enable these encapsulated modular converters to maintain well regulated outputs despite large variations of input voltage. The SW and CW Series are ideal for applications where the input dc power is derived from a battery, a motor generator or other types of poorly regulated power sources.

## GENERAL SPECIFICATIONS

**OUTPUT VOLTAGE TOLERANCE**
±2% (Trim Adjustable)

**REGULATION (Line/Load)**
0.3/0.3% — Rated Output to 3 Amps
0.5/0.5% — Rated Output above 3 Amps

**RIPPLE AND NOISE**
7 mV RMS — Rated Output to 3 Amps
13 mV RMS — Rated Output above 3 Amps

**OPERATING TEMPERATURE RANGE**
−25°C to +71°C — Rated Output to 3 Amps
−25°C to +60°C — Rated Output above 3 Amps

**STORAGE TEMPERATURE RANGE**
−25°C to +85°C

**EFFICIENCY**
60-70% — Rated Output to 12V
60-80% — Rated Output above 12V

**I/O ISOLATION**
Not Galvanically Isolated

**OVERCURRENT PROTECTION**
Power Foldback

## ORDERING INFORMATION

| Input Voltage Range (Vdc) | Output Voltage (Vdc) | Output Current (ma) | Pkg. (Fig.) | Model Number | Unit Price | Special In-Stock Pricing Qty. (3-9) | Special In-Stock Pricing Qty. (10&up) |
|---|---|---|---|---|---|---|---|
| +(9-18) | + 5V | 1000 | 1 | SW12-5S1000 | 34.95 | 31.50 | 28.00 |
| +(18-32) | | | 2 | SW24-5S1000 | 34.95 | 31.50 | 28.00 |
| +(9-18) | | 2000 | 1 | SW12-5S2000 | 38.95 | 35.00 | 30.75 |
| | | | 4-B | CW12-5S2000 | 43.95 | 39.50 | 35.00 |
| +(18-32) | | | 2 | SW24-5S2000 | 38.95 | 35.00 | 30.75 |
| | | | 4-B | CW24-5S2000 | 43.95 | 39.50 | 35.00 |
| +(9-18) | | 3000 | 3-B | SW12-5S3000 | 46.95 | 42.00 | 37.00 |
| | | | 4-C | CW12-5S3000 | 51.95 | 46.50 | 41.00 |
| +(18-32) | | | 3-B | SW24-5S3000 | 46.95 | 42.00 | 37.00 |
| | | | 4-C | CW24-5S3000 | 51.95 | 46.50 | 41.00 |
| +(9-18) | | 4000 | 3-B | SW12-5S4000 | 56.95 | 51.00 | 45.00 |
| | | | 4-C | CW12-5S4000 | 61.95 | 55.50 | 49.00 |
| +(18-32) | | | 3-B | SW24-5S4000 | 56.95 | 51.00 | 45.00 |
| | | | 4-C | CW24-5S4000 | 61.95 | 55.50 | 49.00 |
| +(9-18) | | 6500 | 4-D | CW12-5S6500 | 90.95 | 81.50 | 72.00 |
| +(18-32) | | | 4-D | CW24-5S6500 | 90.95 | 81.50 | 72.00 |
| +(9-18) | | 8000 | 4-D | CW12-5S8000 | 101.95 | 91.25 | 81.00 |
| +(18-32) | | | 4-D | CW24-5S8000 | 101.95 | 91.25 | 81.00 |
| +(18-32) | + 12V | 1000 | 2 | SW24-12S1000 | 39.95 | 35.75 | 31.50 |
| | | | 4-C | CW24-12S1000 | 45.95 | 41.00 | 36.00 |
| | | 2000 | 2 | SW24-12S2000 | 45.95 | 41.00 | 36.00 |
| | | | 4-C | CW24-12S2000 | 50.95 | 45.50 | 40.00 |
| | | 3500 | 3-D | SW24-12S3500 | 85.95 | 77.00 | 68.00 |
| | | | 4-D | CW24-12S3500 | 90.95 | 81.50 | 72.00 |
| +(18-32) | + 15V | 1000 | 2 | SW24-15S1000 | 39.95 | 35.75 | 31.50 |
| | | | 4-C | CW24-15S1000 | 45.95 | 41.00 | 36.00 |
| | | 2000 | 2 | SW24-15S2000 | 45.95 | 41.00 | 36.00 |
| | | | 4-C | CW24-15S2000 | 50.95 | 45.50 | 40.00 |

AVAILABLE UPON REQUEST, PLEASE CONSULT FACTORY:
Other Voltages and Currents — Different Pin Configurations

## MECHANICAL INFORMATION

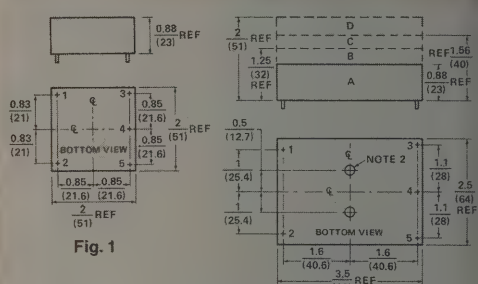



Fig. 1

Fig. 3

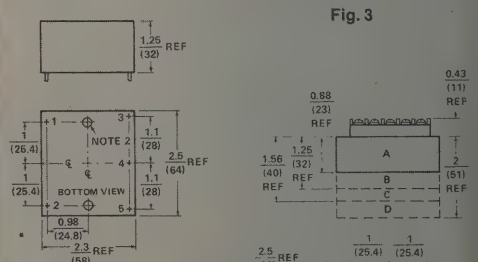



Fig. 2

**CONNECTIONS**
PIN/TERMINAL
1 +Vdc in
2 −Vdc in (com)[6]
3 +Vdc out
4 Trim Adjust
5 −Vdc out (com)[6]

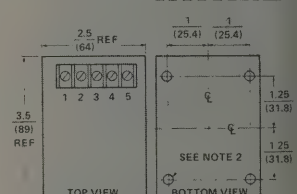
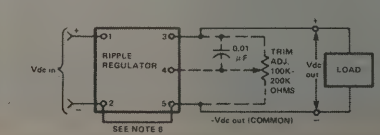



Fig. 4

NOTES:
1. Five Pins, 0.040 (1) Dia × 0.20 (5.1) Lg Min
2. Mounting Inserts 4-40 × 0.1 (2.5) Lg Min
3. Dimensions are given in both Inches and (mm)
4. For ±5% Output Trim, Connect a 100K 200K Ohm Potentiometer as shown below
5. If the Lengths of the Trim Potentiometers Leads exceed 4", connect a 0.01μF Capacitor in close Proximity to Pins/Terminals 3 and 4
6. Pins/Terminals 2 and 5 internally connected, and form a signal common; Connect Externally using Heavy Conductor to Form a Low Impedance Power Current Return (See Below)




Sockets and Options — Refer to catalog pages 40 and 41
Prices and Specifications Subject to Change Without Notice

**SEMICONDUCTOR CIRCUITS, INC.** POWER SOURCES DIVISION
218 RIVER STREET • HAVERHILL, MASSACHUSETTS 01830 TEL. (617) 373-9104 • TWX 710-347-0269

# μP Compatible, Multi-Output DC/DC Converters. . . Including High Performance, Low Noise Duals

**100C, MC**

- **TRIPLE AND DUAL OUTPUTS FOR μC AND LINEAR APPLICATIONS**
- **OUTPUT POWER TO 12 WATTS — OVERCURRENT PROTECTED**
- **PI INPUT FILTER FOR LOW INPUT REFLECTED RIPPLE**

The 100C and MC Series are efficient multi-output DC/DC converters that match the power requirements for a wide variety of μC and linear applications. These converters are ideal local power sources with short circuit protected outputs that are free of chip-damaging overshoots; a high performance π input filter isolates the input source.

The MC Series models feature triple outputs at levels suitable for μP's, data converters, DAS's and memory arrays. Input ratings of 5, 12, 24 or 48Vdc are available by model designation.

The 100C Series consists of dual output models which deliver tightly regulated ±12 or ±15Vdc outputs (depending on model) for critical linear applications.

All models have MTBF's in excess of 100,000 hours and deliver full rated outputs in a 71°C ambient.

## GENERAL SPECIFICATIONS

**INPUT REFLECTED RIPPLE**
<1% of Vin (max)

**OUTPUT VOLTAGE TOLERANCE**
±1% (Fixed)

**REGULATION (Line/Load)**
**100C Series**
0.02/0.02%
**MC Series**
5V Outputs: 0.15/0.5%
12 & 15V Outputs: 0.15/0.15%

**RIPPLE AND NOISE**
**100C Series**
1mV RMS; 15mV pk-pk (typ)
**MC Series**
2mV RMS; 30mV pk-pk (typ)

**OPERATING TEMPERATURE RANGE**
−25°C to +71°C
(No Derating)

**STORAGE TEMPERATURE RANGE**
−40°C to +85°C

**EFFICIENCY**
**100C Series:** 55-76%
**MC Series:** 55-65%

**INPUT TO OUTPUT ISOLATION**
Voltage: 300Vdc (min)
Resistance: 100 Megohms
Capacitance: 50pF

**OVERCURRENT PROTECTION**
Short Circuit Protection

## ORDERING INFORMATION

| Input Voltage Range (Vdc) | Multiple Output Ratings +5V @ +mA/ −5V @ −mA | +12V @ +mA/ −12V @ −mA | ±15V @ ±mA | Pkg. (Fig.) | Model Number | Unit Price | Special In-Stock Pricing Qty. (3-9) | Qty. (10&up) |
|---|---|---|---|---|---|---|---|---|
| DUAL OUTPUT MODELS | | | | | | | | |
| 10.8-15.0 | — | ±425 | — | 1 | 100C12-12D425 | $ 90.95 | $ 81.50 | $ 72.00 |
| 21.6-30.0 | | | | 1 | 100C24-12D425 | $ 90.95 | $ 81.50 | $ 72.00 |
| 42.0-56.0 | | | | 1 | 100C48-12D425 | $ 90.95 | $ 81.50 | $ 72.00 |
| 10.8-15.0 | — | — | ±330 | 1 | 100C12-15D330 | 90.95 | 81.50 | 72.00 |
| 21.6-30.0 | | | | 1 | 100C24-15D330 | 90.95 | 81.50 | 72.00 |
| 42.0-56.0 | | | | 1 | 100C48-15D330 | 90.95 | 81.50 | 72.00 |
| 4.5-5.5 | −100 | +600 | — | 2-C | MC5-12S60-5S10 | 94.95 | 90.00 | 86.00 |
| TRIPLE OUTPUT MODELS | | | | | | | | |
| 4.5-5.5 | −100 | +300/−300 | | 2-C | MC5-12D30-5S10 | $ 99.95 | $ 95.00 | $ 91.00 |
| 4.5-5.5 | −100 | +400/−200 | — | 2-C | MC5-12D40/20-5S10 | 99.95 | 95.00 | 91.00 |
| 4.5-5.5 | +300 | +200/−200 | — | 2-C | MC5-5S30-12D20 | 99.95 | 95.00 | 91.00 |
| 4.5-5.5 | +500 | — | ±150 | 2-C | MC5-5S50-15D15 | 99.95 | 95.00 | 91.00 |
| 10.0-15.0 | +1000 | — | ±300 | 2-D | MC12-5S100-15D30 | 109.95 | 105.00 | 100.00 |
| 21.0-32.0 | | | | 2-D | MC24-5S100-15D30 | 109.95 | 105.00 | 100.00 |
| 42.0-56.0 | | | | 2-D | MC48-5S100-15D30 | 109.95 | 105.00 | 100.00 |
| 10.0-15.0 | +1000 | +300/−300 | — | 2-D | MC12-5S100-12D30 | 109.95 | 105.00 | 100.00 |
| 21.0-32.0 | | | | 2-D | MC24-5S100-12D30 | 109.95 | 105.00 | 100.00 |
| 42.0-56.0 | | | | 2-D | MC48-5S100-12D30 | 109.95 | 105.00 | 100.00 |
| 10.0-15.0 | +1000 | +400/−200 | — | 2-D | MC12-5S100-12D40/20 | 109.95 | 105.00 | 100.00 |
| 21.0-32.0 | | | | 2-D | MC24-5S100-12D40/20 | 109.95 | 105.00 | 100.00 |
| 42.0-56.0 | | | | 2-D | MC48-5S100-12D40/20 | 109.95 | 105.00 | 100.00 |
| 10.0-15.0 | +1250/−100 | +450 | — | 2-D | MC12-12S45-5D125/10 | 109.00 | 105.00 | 100.00 |
| 21.0-32.0 | | | | 2-D | MC24-12S45-5D125/10 | 109.95 | 105.00 | 100.00 |
| 42.0-56.0 | | | | 2-D | MC48-12S45-5D125/10 | 109.95 | 105.00 | 100.00 |
| 10.0-15.0 | +1500 | — | ±150 | 2-D | MC12-5S150-15D15 | 109.95 | 105.00 | 100.00 |
| 21.0-32.0 | | | | 2-D | MC24-5S150-15D15 | 109.95 | 105.00 | 100.00 |
| 21.0-32.0 | | | | 2-D | MC48-5S150-15D15 | 109.95 | 105.00 | 100.00 |

## MECHANICAL INFORMATION

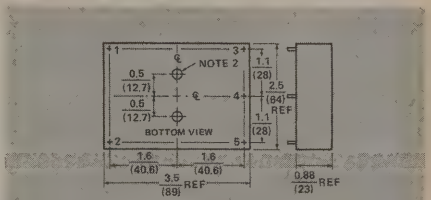


Fig. 1

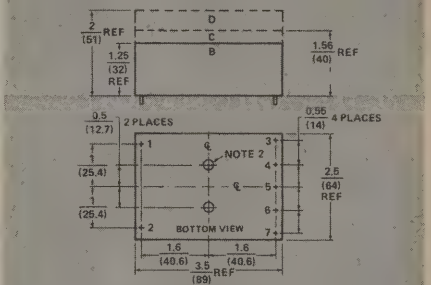


Fig. 2

**CONNECTIONS**

| PIN | ±15V Ouputs | −5V/+12V Outputs |
|---|---|---|
| 1 | +Vdc in | +Vdc in |
| 2 | −Vdc in | −Vdc in |
| 3 | +15Vdc out | Do not connect |
| 4 | Common[3] | Common[4] |
| 5 | −15Vdc out | +12Vdc out |
| 6 | No pin | Common[4] |
| 7 | No pin | −5Vdc out |

| PIN | ±5V/12V Outputs | +5V/±12(±5)V Outputs |
|---|---|---|
| 1 | +Vdc in | +Vdc in |
| 2 | −Vdc in | −Vdc in |
| 3 | +12Vdc out | +12(+15)Vdc out |
| 4 | Common[4] | Common[4] |
| 5 | −5Vdc out | −12(−15)Vdc out |
| 6 | Common[4] | Common[4] |
| 7 | +5Vdc out | +5Vdc out |

NOTES:
1. Connecting Pins 0.040(1.0)Dia × 0.20 (5.1)Lg Min.
2. Two Mounting Inserts No 4-40 ×0.10(2.5) Dp. Min.
3. Fig.1: Metal Case (Shield) connected to Output Common.
4. Fig. 2: Pins 4 and 6 Internally connected. Jumper These Pins externally for Best Performance.

AVAILABLE UPON REQUEST, PLEASE CONSULT FACTORY:
Other Voltages and Currents — Different Pin Configurations

Sockets and Options — Refer to catalog pages 40 and 41
Prices and Specifications Subject to Change Without Notice

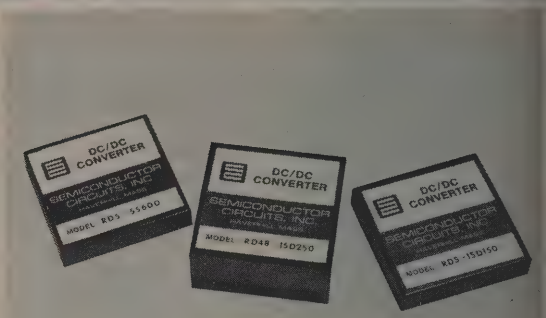
**SEMICONDUCTOR CIRCUITS, INC.** POWER SOURCES DIVISION
218 RIVER STREET • HAVERHILL, MASSACHUSETTS 01830 TEL. (617) 373-9104 • TWX 710-347-0269

# Low Profile, Second Sourceable Regulated DC/DC Converters. . .Two Pin-Outs

**LD, LA, RD, RA**

*Value Products from the NO. 1 SOURCE*

- **LOW PROFILE CASED ONLY 0.375" HIGH (LD, LA SERIES)**
- **HIGH PERFORMANCE INPUT FILTER**
- **OVERCURRENT-PROTECTED OUTPUTS**




**The LD, LA and RD, RA Series** are economy priced, high performance DC/DC converters designed for all but the most demanding analog and digital applications. The LD and LA Series models feature low profile packaging for 0.5 inch on-center card file applications. The RD and RA Series models deliver greater output power from within a slightly higher profile case. Both families feature efficiency to 65%, a $\pi$ input filter for minimum input reflected ripple, MTBFs >150,000 hrs. and overcurrent-protected outputs.

The LD and RD Series pin-out enjoys widespread industrial useage. The LA and RA Series models are pinned out for plug-in compatibility with equivalent competitive units.

## ORDERING INFORMATION

| Input Voltage Range (Vdc) | Output Voltage (Vdc) | Output Current (MA) | Pkg. (Fig.) | Model Number | Unit Price | Special In-Stock Pricing Qty. (3-9) | Special In-Stock Pricing Qty. (10&up) |
|---|---|---|---|---|---|---|---|
| 4.5-5.5 | 5V | 600 | 1-B | LD5-5S600 | $61.95 | $55.50 | $49.00 |
| | | | 2-B | LA5-5S600 | 62.95 | 55.75 | 49.25 |
| 10.8-13.2 | | | 1-B | LD12-5S600 | 61.95 | 55.55 | 49.00 |
| | | | 2-B | LA12-5S600 | 62.95 | 55.75 | 49.25 |
| 21.6-26.4 | | | 1-B | LD24-5S600 | 61.95 | 55.50 | 49.00 |
| | | | 2-B | LA24-5S600 | 62.95 | 55.75 | 49.25 |
| 42.0-56.0 | | | 1-B | LD48-5S600 | 61.95 | 55.50 | 49.00 |
| | | | 2-B | LA48-5S600 | 62.95 | 55.75 | 49.25 |
| 4.5-5.5 | | 1000 | 1-C | RD5-5S1000 | 67.95 | 61.25 | 54.25 |
| | | | 2-C | RA5-5S1000 | 68.95 | 61.50 | 54.50 |
| 10.8-13.2 | | | 1-C | RD12-5S1000 | 67.95 | 61.25 | 54.25 |
| | | | 2-C | RA12-5S1000 | 68.95 | 61.50 | 54.50 |
| 21.6-26.4 | | | 1-C | RD24-5S1000 | 67.95 | 61.25 | 54.25 |
| | | | 2-C | RA24-5S1000 | 68.95 | 61.50 | 54.50 |
| 42.0-56.0 | | | 1-C | RD48-5S1000 | 67.95 | 61.25 | 54.25 |
| | | | | | 68.95 | 61.50 | 54.50 |
| 4.5<br>10.8-13.2<br>21.6-26.4<br>42.0-56.0 | 12V | 300 | 1-B | LD5-12S300<br>LD12-12S300<br>LD24-12S300<br>LD48-12S300 | 61.95<br>61.95<br>61.95<br>61.95 | 55.50<br>55.50<br>55.50<br>55.50 | 49.00<br>49.00<br>49.00<br>49.00 |
| 4.5-5.5<br>10.8-13.2<br>21.6-26.4<br>42.0-56.0 | | 500 | 1-C | RD5-12S500<br>RD12-12S500<br>RD24-12S500<br>RD48-12S500 | 67.95<br>67.95<br>67.95<br>67.95 | 61.25<br>61.25<br>61.25<br>61.25 | 54.25<br>54.25<br>54.25<br>54.25 |
| 4.5-5.5 | ±12V | ±150 | 1-B | LD5-12D150 | 57.95 | 47.25 | 46.40 |
| | | | 2-B | LA5-12D150 | 58.95 | 47.50 | 46.65 |
| 10.8-13.2 | | | 1-B | LD12-12D150 | 57.95 | 47.25 | 46.40 |
| | | | 2-B | LA12-12D150 | 58.95 | 47.50 | 46.65 |
| 21.6-26.4 | | | 1-B | LD24-12D150 | 57.95 | 47.25 | 46.40 |
| | | | 2-B | LA24-12D150 | 58.95 | 47.50 | 46.65 |
| 42.0-56.0 | | | 1-B | LD48-12D150 | 57.95 | 47.25 | 46.40 |
| | | | 2-B | LA48-12D150 | 58.95 | 47.50 | 46.65 |
| 4.5-5.5 | | ±250 | 1-C | RD5-12D250 | 61.95 | 55.50 | 49.00 |
| | | | 2-C | RA5-12D250 | 62.95 | 55.75 | 49.25 |
| 10.8-13.2 | | | 1-C | RD12-12D250 | 61.95 | 55.50 | 49.00 |
| | | | 2-C | RA12-12D250 | 62.95 | 55.75 | 49.25 |
| 21.6-26.4 | | | 1-C | RD24-12D250 | 61.95 | 55.50 | 49.00 |
| | | | 2-C | RD24-12D250 | 62.95 | 55.75 | 49.25 |
| 42.0-56.0 | | | 1-C | RD48-12D250 | 61.95 | 55.50 | 49.00 |
| | | | 2-C | RA48-12D250 | 62.95 | 55.75 | 49.25 |
| 4.5-5.5 | ±15V | ±150 | 1-B | LD5-15D150 | 48.95 | 47.25 | 44.75 |
| | | | 2-B | LA5-15D150 | 49.95 | 47.50 | 45.00 |
| 10.8-13.2 | | | 1-B | LD12-15D150 | 48.95 | 47.25 | 44.75 |
| | | | 2-B | LA12-15D150 | 49.95 | 47.50 | 45.00 |
| 21.6-26.4 | | | 1-B | LD24-15D150 | 48.95 | 47.25 | 44.75 |
| | | | 2-B | LA24-15D150 | 49.95 | 47.50 | 45.00 |
| 42.0-56.0 | | | 1-B | LD48-15D150 | 48.95 | 47.25 | 44.75 |
| | | | 2-B | LA48-15D150 | 49.95 | 47.50 | 45.00 |
| 4.5-5.5 | | ±250 | 1-C | RD5-15D250 | 61.95 | 55.50 | 49.00 |
| | | | 2-C | RA5-15D250 | 62.95 | 55.75 | 49.25 |
| 10.8-13.2 | | | 1-C | RD12-15D250 | 61.95 | 55.50 | 49.00 |
| | | | 2-C | RA12-15D250 | 62.95 | 55.75 | 49.25 |
| 21.6-26.4 | | | 1-C | RD24-15D250 | 61.95 | 55.50 | 49.00 |
| | | | 2-C | RA24-15D250 | 62.95 | 55.75 | 49.25 |
| 42.0-56.0 | | | 1-C | RD48-15D250 | 61.95 | 55.50 | 49.00 |
| | | | 2-C | RA48-15D250 | 62.95 | 55.75 | 49.25 |

AVAILABLE UPON REQUEST, PLEASE CONSULT FACTORY:
Other Voltages and Currents — Different Pin Configurations

## GENERAL SPECIFICATIONS

**INPUT REFLECTED RIPPLE**
1% Ein (max)

**OUTPUT VOLTAGE TOLERANCE**
±1% (Fixed)

**REGULATION (Line/Load)**
5V Out Models: 0.05/0.1%
ALL OTHER MODELS:
0.05/0.05%

**RIPPLE AND NOISE**
1mV RMS (max); 30mV p-p (typ)

**OPERATING TEMPERATURE RANGE**
−25°C to +71°C (No Derating)

**STORAGE TEMPERATURE RANGE**
−40°C to +85°C

**EFFICIENCY**
55-65%

**I/O ISOLATION**
Voltage: 300 Vdc
Resistance: 100 Megohms
Capacitance: 50pF

**OSCILLATOR FREQUENCY RANGE**
6-20 lower case kHz

**TEMPERATURE COEFFICIEN**
0.02%/°C (typical)

**DUAL OUTPUT TRACKING**
1mV/mV (typical)

**OVERCURRENT PROTECTIO**
Current Limiting

## MECHANICAL INFORMATION

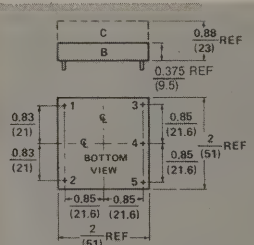



Fig. 1

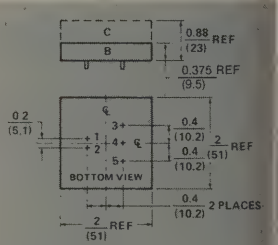



Fig. 2

### CONNECTIONS

| Single Outputs | Dual Outputs |
|---|---|
| PIN 1 +Vdc in | PIN 1 +Vdc in |
| 2 -Vdc in | 2 -Vdc in |
| 3 +Vdc out | 3 +Vdc out |
| 4 Do Not Connect | 4 Common out |
| 5 -Vdc out | 5 -Vdc out |

NOTES:
1. Five Pins 0.040 (1.0) Dia x 0.2 (5.1) Lg Min
2. All Dimensions are in Inches or (mm)

Sockets and Options — Refer to catalog pages 40 and 4
Prices and Specifications Subject to Change Without No

**SEMICONDUCTOR CIRCUITS, INC.** POWER SOURCES DIVISION
218 RIVER STREET • HAVERHILL, MASSACHUSETTS 01830 TEL. (617) 373-9104 • TWX 710-347-0269

# 24 Pin Dip DC/DC Converters. . . Regulation to 0.2%

μD, μR

*lue Products from the NO. 1 SOURCE*

**24 PIN DIP PACKAGED-NEW REGULATORS IN μR SERIES**
**0.5" ON-CENTER P.C. BOARD MOUNTING**
**SHORT CIRCUIT-PROTECTED OUTPUTS**

**e μD and μR Series** are Ultra-miniature DC/DC converters that are nned-out for 24 pin Dip-compatibility. These units are encased in low ofile, minimal area packages and are ideal for P.C. card files requiring 5 inch on-center mounting.

e μD Series features high efficiency. These units contain no output gulator, but effective design affords them ample regulation for a wide riety of analog and digital application. The μR Series are higher per-rmance devices which feature 0.2% regulation and low output noise. oth families offer single and dual output models. All outputs are over-rrent protected and require no derating to +71°C. Input-to-output O) Isolation is a standard feature.

## ENERAL SPECIFICATIONS

**PUT VOLTAGE RANGE**
Vin ±10%

**JTPUT VOLTAGE TOLERANCE**
μD: ±3% @ F.L. and nominal Vin
μR: ±5% (Fixed)

**EGULATION (Line/Load)**
μD Series:
Line: 1%/% Vin
Load: See Fig. 2
μR Series: 0.2/0.2%

**PPLE AND NOISE (PARD)**
μD: 30mV RMS
μR: 3mV RMS

**EMPERATURE COEFFICIENT**
μR: 1mV/°C (typ)

**OPERATING TEMPERATURE RANGE**
−25°C to +71°C; (No Derating)

**STORAGE TEMPERATURE RANGE**
−55°C to +85°C

**EFFICIENCY**
To 85%

**I/O ISOLATION**
Voltage: 300Vdc (min)
Resistance: 100 Megohms
Capacitance: 50pF

**OSCILLATOR FREQUENCY RANGE**
40 to 60 kHz

## RDERING INFORMATION

| Input Voltage (Vdc) | Output Voltage (Vdc) | Output Current (mA) | Model Number | Unit Price | Special In-Stock Pricing Qty. (3-9) | Special In-Stock Pricing Qty. (10&up) |
|---|---|---|---|---|---|---|
| 5 | 5V | 220 | UD5-5S220 | $26.95 | $22.00 | $20.90 |
| 12 | | | UD12-5S220 | | | |
| 5 | 12V<br>±12V | 100<br>±50 | UD5-12D50* | 31.95 | 22.00 | 20.90 |
| 12 | 24V | 50 | UD12-12D50* | | | |
| 5 | 15V<br>±15V | 90<br>±45 | UD5-15D45* | 31.95 | 22.00 | 20.90 |
| 12 | 30V | 45 | UD12-15D45* | | | |
| 5 | 5V | 100 | UR5-5S100 | 31.00 | 25.50 | 24.05 |
| 12 | | | UR12-5S100 | | | |
| 5 | 12V | 60 | UR5-12S60 | 36.75 | 25.50 | 24.05 |
| 12 | | | UR12-12S60 | | | |
| 5 | ±12V | ±40 | UR5-12D40 | 36.75 | 25.50 | 24.05 |
| 12 | | | UR12-12D40 | | | |
| 5 | ±15V | ±40 | UR5-15D40 | 36.75 | 25.50 | 24.05 |
| 12 | | | UR12-15D40 | | | |

Dual output models of the μD Series only can be wired externally to deliver a single out-t at full rated power.
ee Connections.

AILABLE UPON REQUEST, PLEASE CONSULT FACTORY:
Other Voltages and Currents — Different Pin Configurations

## MECHANICAL INFORMATION

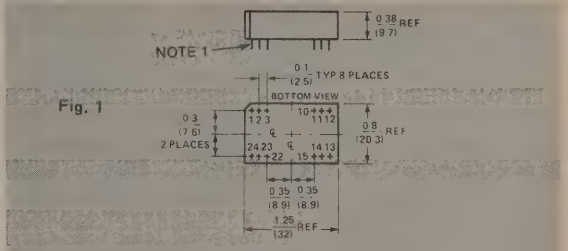



Fig. 1

### CONNECTIONS

| PINS | μD and μR Series ±5, 12 or 15Vdc | μR Series ±12 or ±15 Vdc | μD Series Only 24 or 30Vdc |
|---|---|---|---|
| 1 & 24 | +Vdc in | +Vdc in | +Vdc in |
| 2 & 23 | Do not connect | −Vdc out | −Vdc out |
| 3 & 22 | −Vdc out | Common out | Do not connect |
| 10 & 15 | −Vdc out | Common out | Do not connect |
| 11 & 14 | +Vdc out | +Vdc out | +Vdc out |
| 12 & 13 | −Vdc in | −Vdc in | −Vdc in |

NOTE: 1. Twelve pins 0.020 (0.5) Dia × 0.15 (3.8) Lg Min

LOAD CURVE

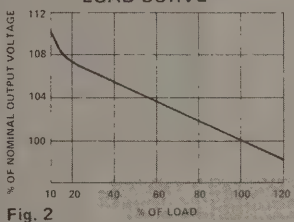



Fig. 2

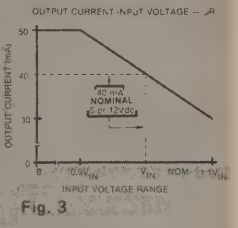
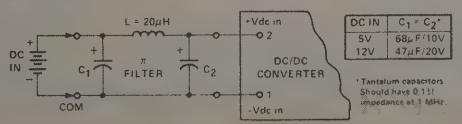



Fig. 3

HINTS

1. IMPORTANT: In both test and usage, each μD Series output should be decoupled by connection of a 10uF tantalum capacitor AS CLOSE AS POSSIBLE TO THE LOAD. Dual output models require 2 capacitors. Noise measurements taken across each bypass capacitor — rather than at the supply — will give the most realistic and useful readings.
2. If required, the user can connect the π filter of Fig. 4 for a 60dB attenuation of switching spikes appearing at the converter input.

EXTERNAL π FILTER FOR 60 dB SPIKE ATTENUATION




| DC IN | $C_1 = C_2$* |
|---|---|
| 5V | 68μF/10V |
| 12V | 47μF/20V |

*Tantalum capacitors Should have 0.1 Ω impedance at 1 MHz.

Sockets and Options — Refer to catalog pages 40 and 41
Prices and Specifications Subject to Change Without Notice

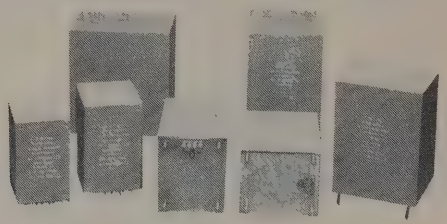
SEMICONDUCTOR CIRCUITS, INC. POWER SOURCES DIVISION
218 RIVER STREET • HAVERHILL, MASSACHUSETTS 01830 TEL. (617) 373-9104 • TWX 710-347-0269

Sigma power

POWER ELECTRONICS

MAGNETICS

# HIGH RELIABILITY/HIGH TEMP. / SERIES STABILIZED AC-DC POWER SUPPLIES



## FEATURES

- Hermetically Sealed
- Hi-Temp +212°F (base temp.) F.R.
- 8-500 Watts
- Wide input voltage and frequent operation
- Input transient protected
- Short circuit protected with foldback
- Qualified to MIL-Environments

## SPECIFICATIONS

**Input Voltage:** 103 to 132 VAC.

**Input Frequency:** 47 to 420 Hz, 1 phase (3 phase units available).

**Input Transient Protection:** MIL-S70-704A Fig. 3, Limit 1.

**Line and Load Regulation (combined):** 0.25% std. models, 0.05% "A" models.

**Ripple:** 5 mv or .01% std. models (47-63 Hz oper.) "A" models 1 mv or .002%. 10 mv or .04% std. models (380-420 Hz oper.) "A" models: 3 mv or .004%.

**Voltage Adjustment:** +5% @ Full rating (F.R.), ±10% @ 80% F.R.

**Temp. Coefficient:** .025%/°C.

**Recovery Time:** (½ load to F.L. to ½ load): 50μ sec. max.

**Operating Temperature:** −55°C to +100°C.

**Storage Temperature:** −62°C to +115°C.

**Polarity:** Floating, either positive or negative may be grounded up to 250 V — consult factory for higher potentials.

**Protection:** Overload and short circuit protected with foldback dissipating equal to or less than normal operation. Automatic recovery.

**Reliability:** 50,000 hrs. MTBF @ max. base temp./MIL-HDBK-217A.

**Environments:** Qualified to MIL-Environments (including 50 G's for 11 m sec. and 100 G's for 6 m sec.)

## HOW TO ORDER

Series No.

VxA Rating (75 VA)

Current Rating (3.0A)

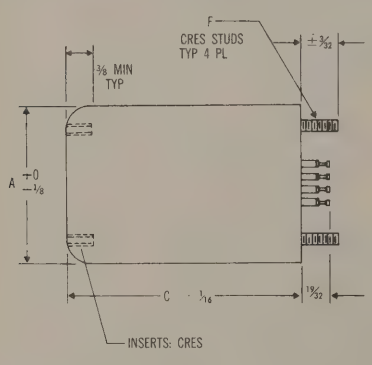
Output Voltage (24V

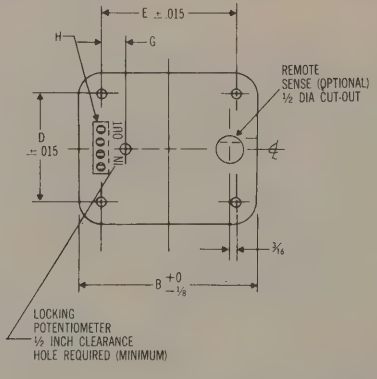
V=Variable
F=Fixed voltage

Add Suffi for "A" models

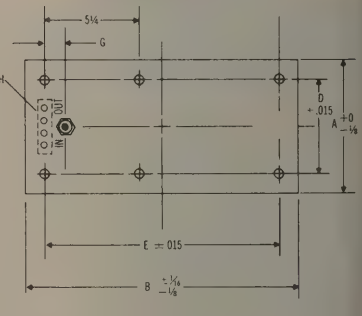
**SR60 — 075 — 030 — 024V — A**

| Series No. | VxA Rating | Max. Avail. Current | A Length | B Width | C Height | D Mtg. | E Mtg. | F Stud | G | H Cut-Out | Case Size Hole | Weight (Lbs.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SR10 | 8 | 1.5A | 3 1/16 | 3 3/16 | 4 7/8 | 2 1/8 | 2 5/8 | 8-32 x 11/32 | 13/32 | 3/8 x 1 5/16 | A | 2.8 |
| SR20 | 10 | 2.0A | 3 3/8 | 3 15/16 | 5 1/4 | 2 7/16 | 3 | 10-32 x 15/32 | 13/32 | 3/8 x 1 5/16 | B | 3.4 |
| SR30 | 15 | 2.5A | 3 11/16 | 4 5/16 | 5 5/16 | 2 11/16 | 3 5/16 | 10-32 x 15/32 | 13/32 | 3/8 x 1 5/16 | C | 4.0 |
| SR40 | 25 | 3.0A | 4 | 4 11/16 | 6 | 3 | 3 11/16 | 10-32 x 5/16 | 13/32 | 3/8 x 1 5/16 | D | 11.5 |
| SR50 | 50 | 6.0A | 4 5/16 | 5 1/16 | 6 13/16 | 3 5/16 | 4 1/16 | 1/4-20 x 5/16 | 13/32 | 3/8 x 1 5/16 | E | 13.5 |
| SR60 | 75 | 7.0A | 4 15/16 | 6 5/16 | 7 | 3 5/8 | 5 1/4 | 5/16-18 x 21/32 | 3/4 | 1/2 x 2 | F | 16.5 |
| SR70 | 125 | 10.0A | 6 5/16 | 6 3/4 | 7 | 5 1/4 | 5 7/16 | 5/16-18 x 21/32 | 3/4 | 1/2 x 2 | G | 25.5 |
| SR80 | 250 | 25.0A | 4 15/16 | 13 1/16 | 7 | 3 5/8 | 11 13/16 | 5/16-18 x 21/32 | 3/4 | 5/8 x 2 1/2 | H | 34.0 |
| SR90 | 500 | 25.0A | 6 5/16 | 13 1/16 | 7 1/16 | 5 7/16 | 11 13/16 | 5/16-18 x 21/32 | 3/4 | 5/8 x 2 1/2 | J | 47.0 |




SR80/SR90 SERIES




# UNREGULATED AC-DC MODULES/HERMETICALLY SEALED

## SPECIFICATIONS

**Input Voltage:** 103-137 VAC, 1φ (consult factory for 3φ modules)

**Input Frequency:** 47-420 Hz

**F.L. Output Voltage Setting:** ±5% @ 115 VAC, 60 Hz (may change 5% from set value @ 400 Hz)

**Line Regulation:** Output voltage varies proportionally to input

**No Load Voltage (Typ.):** 4-150V: 10% +1V/ 150-500V: <10%

**Output Voltage:** 4 to 500 VDC

**Output Current:** ¼A to 25A (see table for va rating)

**Ripple:** 5% RMS @ 60 Hz

**MTBF:** 250,000 hrs. per MIL-HDBK-217A

**Operating Temperature:** −55°C to +105°C (Base Temp.)

**Storage Temperature:** −62°C to +115°C

**Environments:** Same as regulated versions

| Series No. | VA Rating | Maximum Voltage | Maximum Current | Case Size | Weight (Lbs.) |
|---|---|---|---|---|---|
| SU40 | 30 | 500 | 5 | D | 11 |
| SU50 | 70 | 500 | 5 | E | 13 |
| SU60 | 120 | 500 | 8 | F | 16 |
| SU70 | 150 | 500 | 10 | G | 24 |
| SU80 | 250 | 500 | 25 | H | 33 |

## HOW TO ORDER

Series No.

VA Rating (70va)

Current Rating (5.0

Outpu Volta (15V)

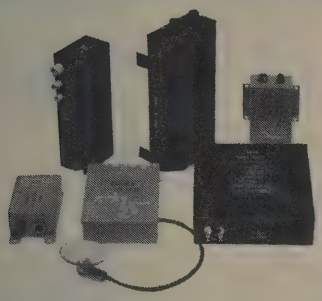
**SU — 070 — 050 — 01**

Sigma power

POWER ELECTRONICS

MAGNETICS

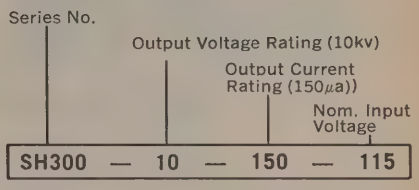
# HIGH VOLTAGE/AC & DC POWER MODULES REGULATED



## FEATURES

- Proven reliability
- 20 KHz operation
- Negligible input noise reflection
- Small size
- Fast dynamic response
- Arc protected
- Qualified to MIL-Environments

## HOW TO ORDER

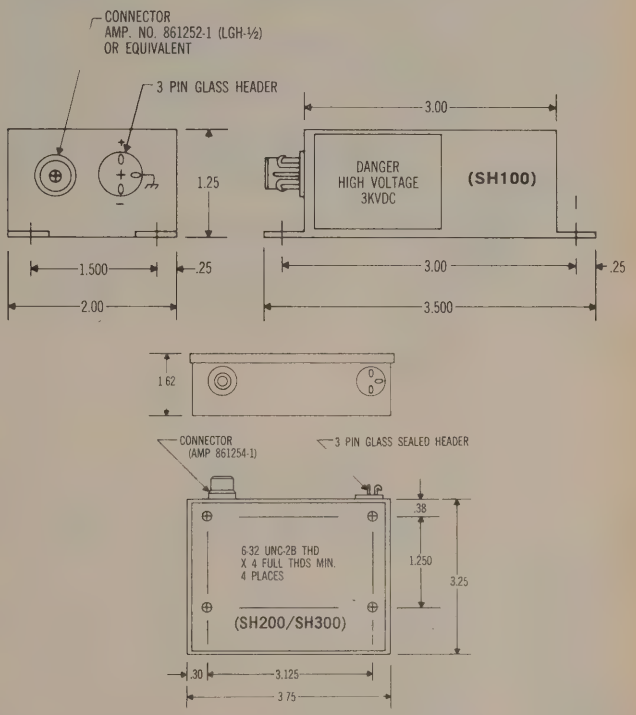



## SPECIFICATIONS

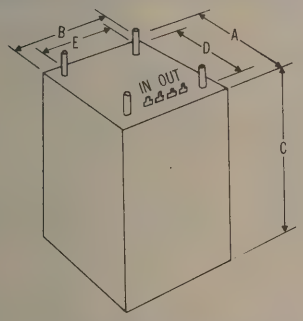
| Series | SH100 | SH200 | SH300 |
|---|---|---|---|
| Input Voltage | 22-32 VDC | 22-32 VDC | 103-132 VAC |
| Input Frequency | — | — | 47-420 Hz |
| Output Voltage | Up to 4 kv | 5-12 kv | 5-12 kv |
| Voltage Setting | 1% | 1% | 1% |
| Output Current | 100μa | 200μa | 250μa |
| Load & Line | 1% std. | 1% Std. | 1% std. |
| Regulation (comb). | 0.5% | 0.5% | 0.5% |
| Ripple & Noise | 0.15% | 0.15% | 0.15% |
| Temp. Coefficient | 0.025%/C | 0.025%/C | 0.025%/C |
| Weight | 14 oz. | 1.8 lbs. | 2.8 lbs. |
| Oper. Temp. | | −55°C to + 71°C | |
| Storage Temp. | | −55°C to +105°C | |
| Protection | Short circuit & arc protected | | |

or unregulated Modules to 20kv and 1ma, consult factory.

## MECHANICAL SPECIFICATIONS



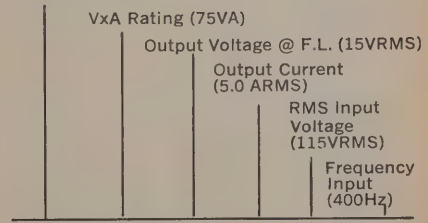

## MECHANICAL SPECIFICATIONS (TF500 SERIES)




# MIL-T-27 TRANSFORMERS AND CHOKES/HERMETICALLY SEALED

| MIL-T-27 Size | Part No. | VA 60 Hz | VA 400 Hz | LI² | A Length | B Width | C Height | D Mounting ±.015 | E Mounting ±.015 | Stud Size | Unit Weight |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AG | TF501 | — | 4.0 | .008 | 1 | 1 | 1⅜ | 0.75 | DIAG. | 4-40 x ⅜ | .25 |
| AH | TF502 | 1.0 | 10.0 | .040 | 1⅝ | 1⅝ | 1¾ | 1.25 | DIAG. | 6-32 x ⅜ | .50 |
| AJ | TF503 | 3.0 | 25.0 | .090 | 1⅝ | 1⅝ | 2⅜ | 1⅜ | 1⅜ | 6-32 x ⅜ | 1.80 |
| EA | TF504 | 9.0 | 40.0 | .180 | 1 1⅝ | 1 1⅜ | 2¾ | 1⅜ | 1¼ | 6-32 x ⅜ | 2.00 |
| FA | TF505 | 19.0 | 70.0 | .250 | 2⅝ | 2⅛ | 3⅛ | 1 1⅛ | 1⅞ | 6-32 x ⅜ | 3.50 |
| GA | TF506 | 50.0 | 120.0 | .400 | 2¾ | 2⅜ | 3 1⅜ | 2⅛ | 1¾ | 6-32 x ⅜ | 4.50 |
| HA | TF507 | 75.0 | 175.0 | .670 | 3⅛ | 2⅝ | 4¼ | 2 1⅞ | 1 55⁄64 | 8-32 x ⅜ | 6.00 |
| JA | TF508 | 100.0 | 250.0 | 1.200 | 3⅝ | 3⅛ | 4⅞ | 2⅝ | 2⅛ | 8-32 x ⅜ | 8.00 |
| KB | TF509 | 125.0 | 250.0 | 1.600 | 3 1⅝ | 3⅜ | 4⅝ | 3 | 2⅞ | 10-32 x ½ | 9.00 |
| LB | TF510 | 150.0 | 370.0 | 2.100 | 4⅝ | 3 1⅛ | 4½ | 3⅝ | 2 1⅛ | 10-32 x ½ | 14.00 |
| MB | TF511 | 200.0 | 600.0 | 2.500 | 4 1⅛ | 4 | 4 1⅝ | 3 1⅛ | 3 | ¼-20 x ⅝ | 18.00 |

## HOW TO ORDER


Series No.
VxA Rating (75VA)
Output Voltage @ F.L. (15VRMS)
Output Current (5.0 ARMS)
RMS Input Voltage (115VRMS)
Frequency Input (400Hz)
TF507 — 075 — 015 — 050 — 115 — 400

## CUSTOM PRODUCTS

HI-VOLTAGE TRANSFORMERS
. φ & 3 φ TRANSFORMERS
REACTORS
DC-DC TRANSFORMERS/TOROIDS

PRECISION INDUCTORS
TUNED CIRCUITS
DC-DC CONVERTERS
DC-AC INVERTERS

AC-AC FREQUENCY CHANGERS
MULTI-OUTPUT SUPPLIES WITH POWER FAIL & MEMORY DISSABLE SIGNALS

TWT POWER SUPPLIES (PWM, 500μ SEC. RECOVERY)

SPELLMAN
HIGH VOLTAGE ELECTRONICS CORPORATION

*OUR FOURTH DECADE OF LEADERSHIP IN HIGH VOLTAGE TECHNOLOGY*

7 FAIRCHILD AVE., PLAINVIEW, N. Y. 11803 • (516) 822-2130 • TWX: 510-221-21

# HIGH VOLTAGE POWER SUPPLIES

## RACK MOUNTED • MODULAR • CUSTOM

*for Commercial, Industrial, Military Applications*

***The Spellman line of rack mounted high voltage power supplies offers —***

- Models through 400KV and 400 Watts
- Wide variety of options
- Fixed or reversible polarity
- Fully protected — "Arc-Proof"
- Current Limiting
- Low temperature coefficients

***Spellman's line of high voltage power supply modules includes —***

- Models through 30KV and 30 Watts
- Fully adjustable
- Super-regulated, Well-regulated, Regulated and Proportional Models
- Multiple Output CRT Supplies
- "Slot" units
- Excellent Regulation, Ripple and Transient response
- Militarized to MIL-E-5400

## FEATURES

| | MODELS | MAXIMUM VOLTAGE RANGE (KV) | MAXIMUM POWER (WATTS) | RACK | MODULAR | REGULATION % | RIPPLE % | PROGRAMMING / V (VOLTAGE), R (RESISTANCE) | FULLY ADJUSTABLE | MILITARIZED VERSION AVAILABLE | MULTIPLE OUTPUT | SIZE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RACK | RHSR | 60 | 60 | √ | | .001 | .001 | V,R | √ | | * | 5¼ x 19 x 16½ in 133MM x 483MM x 41 |
| RACK | RHR | 400 | 400 | √ | | .01 | .02 | V*,R* | √ | | * | |
| RACK | UHR | 400 | 400 | √ | | 1 | .1 | | √ | | | |
| RACK | CRT 30,40 | 40 | 120 | √ | | .01 | .01 | V,R | √ | | √ | |
| RACK | SEM 60 | 60 | 25 | √ | | .001 | .001 | V,R | √ | | √ | |
| MODULAR | SRM | 30 | 30 | | √ | .001 | .001 | V,R | √ | | * | 3½ x 5½ x 9½ in. 88MM x 140MM x 241 |
| MODULAR | FWRM | 30 | 30 | | √ | .01 | .01 | V,R | | | * | 3⅝ x 6⅝ x 2⅛ in 91MM x 168MM x 51. |
| MODULAR | WRM | 30 | 30 | | √ | .01 | .01 | V,R | √ | | * | |
| MODULAR | FRM | 30 | 10 | | √ | 1 | .01 | V,R | | | * | 3⅝ x 5⅛ x 1¾ in 91MM x 130MM x 39 |
| MODULAR | RM | 30 | 10 | | √ | 1 | .01 | V,R | √ | | * | |
| MODULAR | UM | 24 | 1.5 | | √ | 15 | .1 | V,R | √ | | | 2⅝ x 4½ x 1¾ in. 66MM x 113MM x 39 |
| MODULAR | RMC | 15 | 6 | | √ | .05 | .01 | | | | √ | 3⅝ x 6⅝ x 2¼ in 91MM x 168MM x 51. |
| MODULAR | RV20P10 | 20 | 10 | | √ | .005 | .01 | V,R | √ | √ | | 4⅞ x 3⅛ x 2⅛ in 122MM x 78MM x 51. |
| MODULAR | RV16P8F | 16 | 8 | | √ | .005 | .01 | V,R | √ | √ | √ | |
| MODULAR | PMT2N10 | 2 | 10 | | √ | .005 | 10MV | V,R | | | | 3 x 5 x 7¾ in. 75MM x 127MM x 19 |
| | HP | 30 | 4000 | √ | | .002 | .01 | | √ | | | 22 x 24 x 50 in. 559MM x 610MM x 127 |

*OPTIONAL

SPELLMAN
HIGH VOLTAGE ELECTRONICS CORPORATION

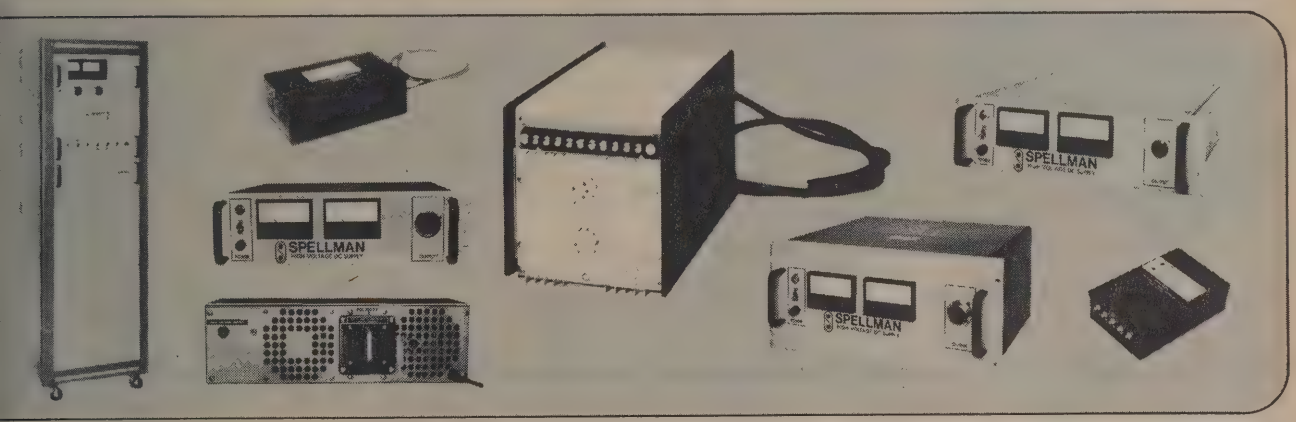
*OUR FOURTH DECADE OF LEADERSHIP IN HIGH VOLTAGE TECHNOLOGY*

7 FAIRCHILD AVE., PLAINVIEW, N. Y. 11803 • (516) 822-2130 • TWX: 510-221-2155

# HIGH VOLTAGE POWER SUPPLIES

## RACK MOUNTED • MODULAR • CUSTOM

*for Commercial, Industrial, Military Applications*




| | MODELS | APPLICATIONS: CRT | SEM | PMT | IMAGE INTENSIFIER | ION SOURCE | ION, ELECTRON ACCELERATOR | CAPACITOR CHARGING | GENERAL LABORATORY | ELECTROSTATIC | LASER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RACK | RHSR | √ | √ | √ | | √ | | | √ | | √ |
| RACK | RHR | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| RACK | UHR | √ | | √ | √ | √ | √ | √ | √ | √ | √ |
| RACK | CRT 30, 40 | √ | | | | | | | √ | | |
| RACK | SEM 60 | | √ | | | | | | √ | | |
| MODULAR | SRM | √ | √ | √ | | √ | | | √ | | |
| MODULAR | FWRM | √ | √ | √ | √ | √ | | | √ | √ | |
| MODULAR | WRM | √ | √ | √ | √ | √ | | | √ | √ | √ |
| MODULAR | FRM | √ | | √ | | | | | √ | √ | |
| MODULAR | RM | √ | | √ | | | | | √ | √ | √ |
| MODULAR | UM | √ | | √ | | | | | √ | √ | |
| MODULAR | RMC | √ | | √ | | | | | √ | | |
| MODULAR | RV20P10 | √ | | | | | | | √ | | |
| MODULAR | RV16P8F | √ | | | | | | | √ | | |
| MODULAR | PMT2N10 | | | √ | | | | | | | |
| | HP | | | | | √ | √ | √ | √ | | √ |

*Call or write for full line catalog*

STANDARD POWER SUPPLIES

# Standard Power Supplies Selector Guide



## FEATURES

- **Stocked and Sold Thru 70 Plus Distributor Locations**
- **200 Plus Standard Models to Select**
- **Field Proven Reliability**
- **U.L. Recognized**
- **Quality Production**
- **New Switchers**
- **State of the Art Engineering and Design**
- **Fully Tested**

*Select the power supplies that set the standards for dependability and value.*

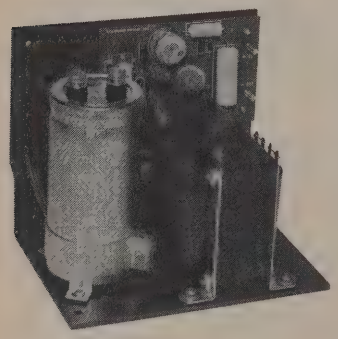
## GENERAL SPECIFICATIONS*

**Input:** 115/230 VAC ± 10%, 47 to 440 Hz.
**Line Regulation:** ± 0.1%.
**Load Regulation:** ± 0.1%, no load to full load.
**Ripple:** 0.1%, typically 0.5 to 2mV rms.
**Short Circuit Protection:** Fold-back current limiting, adjustable from 20% to full load.
*Excluding unregulated Black Line and Switchers.

**Response Time:** 50 microsec.
**Temperature Rating:** 0 to 50° C. (to 70° C with derating.)
**Adjustable Voltage Range** ± 10%
**Models with fans:** 50/60 Hz

All dimensions in inches. All weight in pounds.

## Open-Frame Blue Line



SPS Series

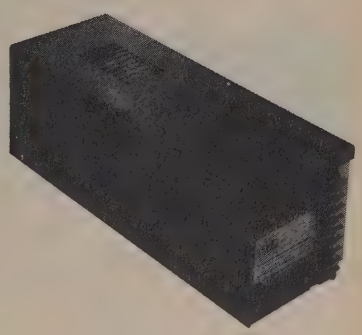
| Model | Volts | Amps | OVP | Remarks | Size | Wt. (lbs.) | Price w/o OVP |
|---|---|---|---|---|---|---|---|
| SPS 30-3 | 3 | 3.5 | -91 | | 4.75 x 4.00 x 2.5 | 2.3 | $ 29.95 |
| SPS 15-5 | 5 | 1.5 | -91 | | 4.75 x 4.00 x 2.06 | 1.7 | 24.95 |
| SPS 30-5 | 5 | 3.0 | -91 | | 4.75 x 4.00 x 2.5 | 2.3 | 29.95 |
| SPS 40-5 | 5 | 5.0 | -91 | | 5.65 x 4.94 x 3.25 | 3.8 | 52.00 |
| SPS 60-5 | 5 | 6.0 | -91 | Remote Sen. | 6.00 x 4.94 x 4.94 | 6.5 | 64.50 |
| SPS 75-5 | 5 | 10 | -91 | Remote Sen. | 6.00 x 4.94 x 4.94 | 6.5 | 74.50 |
| SPS 120-5 | 5 | 12 | -91 | Remote Sen. | 7.00 x 6.60 x 5.00 | 14 | 105.00 |
| SPS 180-5 | 5 | 18 | -91 | Remote Sen. | 7.00 x 6.60 x 5.00 | 14 | 119.00 |
| SPS 220-5 | 5 | 25 | -91 | Remote Sen. | 15 x 6.70 x 5 | 23 | 179.00 |
| SPS 320-5 | 5 | 35 | -91 | Remote Sen. | 15 x 6.70 x 5 | 23 | 199.00 |
| SPS 250-5 | 5 | 25 | -91 | Fan-Cooled | 15 x 5 x 5 | 22 | 189.00 |
| SPS 350-5 | 5 | 35 | -91 | Fan-Cooled | 15 x 5 x 5 | 22 | 210.00 |
| SPS 30-6 | 6 | 3.0 | -91 | | 4.75 x 4.00 x 2.5 | 2.3 | 29.95 |
| SPS 30-8 | 8 | 2.0 | -91 | | 4.75 x 4.00 x 2.5 | 2.3 | 29.95 |
| SPS 30-10 | 10 | 1.8 | -91 | | 4.75 x 4.00 x 2.5 | 2.3 | 29.95 |
| SPS 15-12 | 12 | 0.8 | -91 | | 4.75 x 4.00 x 2.06 | 1.7 | 24.95 |
| SPS 30-12 | 12 | 1.8 | -91 | | 4.75 x 4.00 x 2.5 | 2.3 | 29.95 |
| SPS 40-12 | 12 | 3.5 | -91 | | 5.65 x 4.94 x 3.25 | 3.8 | 52.00 |
| SPS 60-12 | 12 | 5.0 | -91 | Remote Sen. | 6.00 x 4.94 x 4.94 | 6.5 | 64.50 |
| SPS 120-12 | 12 | 10 | -91 | Remote Sen. | 7.00 x 6.60 x 5.00 | 14 | 105.00 |
| SPS 220-12 | 12 | 20 | -91 | Remote Sen. | 15 x 6.70 x 5 | 23 | 179.00 |
| SPS 250-12 | 12 | 20 | -91 | Fan-Cooled | 15 x 5 x 5 | 22 | 189.00 |
| SPS 15-15 | 15 | 0.7 | -91 | | 4.75 x 4.00 x 2.06 | 1.7 | 24.95 |
| SPS 30-15 | 15 | 1.6 | -91 | | 4.75 x 4.00 x 2.5 | 2.3 | 29.95 |
| SPS 40-15 | 15 | 3.0 | -91 | | 5.65 x 4.94 x 3.25 | 3.8 | 52.00 |
| SPS 60-15 | 15 | 4.0 | -91 | Remote Sen. | 6.00 x 4.94 x 4.94 | 6.5 | 64.50 |
| SPS 120-15 | 15 | 8 | -91 | Remote Sen. | 7.00 x 6.60 x 5.00 | 14 | 105.00 |
| SPS 220-15 | 15 | 18 | -91 | Remote Sen. | 15 x 6.70 x 5 | 23 | 179.00 |
| SPS 250-15 | 15 | 18 | -91 | Fan-Cooled | 15 x 5 x 5 | 22 | 189.00 |
| SPS 30-18 | 18 | 1.5 | -91 | | 4.75 x 4.00 x 2.5 | 2.3 | 29.95 |
| SPS 15-24/28 | 24-28 | 0.5/0.4 | -91 | | 4.75 x 4.00 x 2.06 | 1.7 | 24.95 |
| SPS 30-24/28 | 24-28 | 1.2/0.8 | -91 | | 4.75 x 4.00 x 2.5 | 2.3 | 29.95 |
| SPS 40-24/28 | 24-28 | 1.8/1.6 | -91 | | 5.65 x 4.94 x 3.25 | 3.8 | 52.00 |
| SPS 60-24/28 | 24-28 | 2.5 | -91 | Remote Sen. | 6.00 x 4.94 x 4.94 | 6.5 | 64.50 |
| SPS 120-24/28 | 24-28 | 6 | -91 | Remote Sen. | 7.00 x 6.60 x 5.00 | 14 | 105.00 |
| SPS 220-24/28 | 24-28 | 12 | -91 | Remote Sen. | 15 x 6.70 x 5 | 23 | 179.00 |
| SPS 250-24/28 | 24-28 | 12 | -91 | Fan-Cooled | 15 x 5 x 5 | 22 | 189.00 |
| SPS 30-30 | 30 | 1.0 | -91 | | 4.75 x 4.00 x 2.5 | 2.3 | 29.95 |
| SPS 30-48 | 48 | 0.6 | -91 | | 4.75 x 4.00 x 2.5 | 2.3 | 39.50 |
| SPS 60-48 | 48 | 1.2 | -91 | Remote Sen. | 6.00 x 4.94 x 4.94 | 6.5 | 75.00 |
| SPS 120-48 | 48 | 3 | -91 | Remote Sen. | 7.00 x 6.60 x 5.00 | 14 | 115.00 |
| SPS 30-100 | 100 | 0.15 | | | 4.75 x 4.00 x 2.5 | 2.3 | 49.00 |
| SPS 120-100 | 100 | 1 | | | 7.00 x 6.60 x 5.00 | 14 | 130.00 |
| SPS 30-120 | 120 | 0.15 | | | 4.75 x 4.00 x 2.5 | 2.3 | 49.00 |
| SPS 120-120 | 120 | 1 | | | 7.00 x 6.60 x 5.00 | 14 | 130.00 |
| SPS 30-250 | 250 | 0.05 | | | 4.75 x 4.00 x 2.5 | 2.3 | 49.00 |
| SPS 120-250 | 250 | 0.5 | | | 7.00 x 6.60 x 5.00 | 14 | 130.00 |

# 2 Standard Power Supplies Selector Guide

STANDARD POWER SUPPLIES

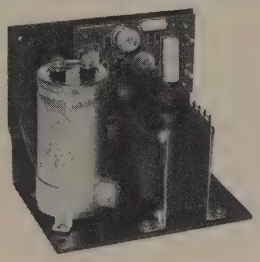
## Covered Blue Line

| Model | Volts | Amps | OVP | Remarks | Size | Wt. (lbs.) | Price w/o OVP |
|---|---|---|---|---|---|---|---|
| CPS 30-5 | 5 | 3 | -91 | | 5.88 x 3.88 x 2.60 | 2.5 | $ 49.00 |
| CPS 60-5 | 5 | 6 | -91 | | 9.90 x 4.95 x 3.30 | 7.8 | 90.00 |
| CPS 75-5 | 5 | 10 | -91 | | 9.90 x 4.95 x 3.30 | 7.8 | 95.00 |
| CPS 120-5 | 5 | 12 | -91 | | 9.90 x 4.95 x 4.95 | 14 | 130.00 |
| CPS 180-5 | 5 | 18 | -91 | | 9.90 x 4.95 x 4.95 | 14 | 150.00 |
| CPS 220-5 | 5 | 25 | -91 | | 15.00 x 6.70 x 5.12 | 23 | 195.00 |
| CPS 320-5 | 5 | 35 | -91 | | 15.00 x 6.70 x 5.12 | 23 | 210.00 |
| CPS 250-5 | 5 | 25 | -91 | Fan-Cooled | 15.00 x 5.12 x 5.12 | 24 | 199.00 |
| CPS 350-5 | 5 | 35 | -91 | Fan-Cooled | 15.00 x 5.12 x 5.12 | 24 | 220.00 |
| CPS 500-5 | 5 | 50 | -91 | Fan-Cooled | 15.12 x 8.00 x 5.10 | 35 | 345.00 |
| CPS 30-12 | 12 | 1.8 | -91 | | 5.88 x 3.88 x 2.60 | 2.5 | 49.00 |
| CPS 60-12 | 12 | 5 | -91 | | 9.90 x 4.95 x 3.30 | 7.8 | 90.00 |
| CPS 120-12 | 12 | 10 | -91 | | 9.90 x 4.95 x 4.95 | 14 | 130.00 |
| CPS 220-12 | 12 | 20 | -91 | | 15.00 x 6.70 x 5.12 | 23 | 195.00 |
| CPS 250-12 | 12 | 20 | -91 | Fan-Cooled | 15.00 x 5.12 x 5.12 | 24 | 199.00 |
| CPS 500-12 | 12 | 40 | -91 | Fan-Cooled | 15.12 x 8.00 x 5.10 | 35 | 345.00 |
| CPS 30-15 | 15 | 1.6 | -91 | | 5.88 x 3.88 x 2.60 | 2.5 | 49.00 |
| CPS 60-15 | 15 | 4 | -91 | | 9.90 x 4.95 x 3.30 | 7.8 | 90.00 |
| CPS 120-15 | 15 | 8 | -91 | | 9.90 x 4.95 x 4.95 | 14 | 130.00 |
| CPS 220-15 | 15 | 18 | -91 | | 15.00 x 6.70 x 5.12 | 23 | 195.00 |
| CPS 250-15 | 15 | 18 | -91 | Fan-Cooled | 15.00 x 5.12 x 5.12 | 24 | 199.00 |
| CPS 500-15 | 15 | 33 | -91 | Fan-Cooled | 15.12 x 8.00 x 5.10 | 35 | 345.00 |
| CPS 30-24/28 | 24-28 | 1.2/0.8 | -91 | | 5.88 x 3.88 x 2.60 | 2.5 | 49.00 |
| CPS 60-24/28 | 24-28 | 2.5 | -91 | | 9.90 x 4.95 x 3.30 | 7.8 | 90.00 |
| CPS 120-24/28 | 24-28 | 6 | -91 | | 9.90 x 4.95 x 4.95 | 14 | 130.00 |
| CPS 220-24/28 | 24-28 | 12 | -91 | | 15.00 x 6.70 x 5.12 | 23 | 195.00 |
| CPS 250-24/28 | 24-28 | 12 | -91 | Fan-Cooled | 15.00 x 5.12 x 5.12 | 24 | 199.00 |
| CPS 500-24/28 | 24-28 | 20 | -91 | Fan-Cooled | 15.12 x 8.00 x 5.10 | 35 | 345.00 |
| CPS 30-48 | 48 | 0.6 | -91 | | 5.88 x 3.88 x 2.60 | 2.5 | 59.00 |



CPS Series

## Constant Current



CC Series

| Model | Volts | Amps | Size | Wt. (lbs.) | Price |
|---|---|---|---|---|---|
| SCC 30-1 | 30 | .03-1 | 4.75 x 4.00 x 2.5 | 2.3 | $ 55.00 |
| SCC 30-2 | 15 | .05-2 | 4.75 x 4.00 x 2.5 | 2.3 | 55.00 |
| SCC 60-2 | 30 | .05-2 | 6.00 x 4.94 x 4.94 | 6.5 | 84.00 |
| SCC 60-4 | 15 | 0.1-4 | 6.00 x 4.94 x 4.94 | 6.5 | 84.00 |
| SCC 120-4 | 30 | 0.1-4 | 7.00 x 6.60 x 5.00 | 14 | 125.00 |
| SCC 120-12 | 8 | 0.1-12 | 7.00 x 6.60 x 5.00 | 14 | 125.00 |
| SCC 250-15 | 15 | 0.1-15 | 15 x 5.92 x 5.00 | 22 | 225.00 |

## Slim Line

| Model | Volts | Amps | Size | Wt. (lbs.) | Price |
|---|---|---|---|---|---|
| SLS 32-5 | 5 | 3.0 | 4.88 x 4.00 x 2.07 | 2.3 | $ 32.00 |
| SLS 32-5/OV | 5 | 3.0 | 4.88 x 4.00 x 2.07 | 2.3 | 34.00 |
| SLS 42-5 | 5 | 6.0 | 5.62 x 4.88 x 2.95 | 4.0 | 53.00 |
| SLS 42-5/OV | 5 | 6.0 | 5.62 x 4.88 x 2.95 | 4.0 | 55.00 |
| SLS 92-5 | 5 | 12.0 | 9.00 x 4.87 x 3.25 | 7.6 | 84.00 |
| SLS 92-5/OV | 5 | 12.0 | 9.00 x 4.87 x 3.25 | 7.6 | 90.00 |
| SLS 122-5 | 5 | 18.0 | 14.00 x 4.87 x 3.20 | 8.2 | 109.00 |
| SLS 122-5/OV | 5 | 18.0 | 14.00 x 4.87 x 3.20 | 8.2 | 119.00 |
| SLS 32-9 | 9 | 2.0 | 4.88 x 4.00 x 2.07 | 2.3 | 32.00 |
| SLS 42-9 | 9 | 4.0 | 5.62 x 4.88 x 2.95 | 4.0 | 53.00 |
| SLS 32-12 | 12 | 1.8 | 4.88 x 4.00 x 2.07 | 2.3 | 32.00 |
| SLS 42-12 | 12 | 3.5 | 5.62 x 4.88 x 2.95 | 4.0 | 53.00 |
| SLS 92-12 | 12 | 6.8 | 9.00 x 4.87 x 3.25 | 7.6 | 84.00 |
| SLS 122-12 | 12 | 10.2 | 14.00 x 4.87 x 3.20 | 8.2 | 109.00 |
| SLS 32-15 | 15 | 1.6 | 4.88 x 4.00 x 2.07 | 2.3 | 32.00 |
| SLS 42-15 | 15 | 3.0 | 5.62 x 4.88 x 2.95 | 4.0 | 53.00 |
| SLS 92-15 | 15 | 6.0 | 9.00 x 4.87 x 3.25 | 7.6 | 84.00 |
| SLS 122-15 | 15 | 9.0 | 14.00 x 4.87 x 3.20 | 8.2 | 109.00 |
| SLS 32-24 | 24 | 1.2 | 4.88 x 4.00 x 2.07 | 2.3 | 32.00 |
| SLS 42-24 | 24 | 2.3 | 5.62 x 4.88 x 2.95 | 4.0 | 53.00 |
| SLS 92-24 | 24 | 4.8 | 9.00 x 4.87 x 3.25 | 7.6 | 84.00 |
| SLS 122-24 | 24 | 7.2 | 14.00 x 4.87 x 3.20 | 8.2 | 109.00 |
| SLS 32-28 | 28 | 1.0 | 4.88 x 4.00 x 2.07 | 2.3 | 32.00 |
| SLS 42-28 | 28 | 1.8 | 5.62 x 4.88 x 2.95 | 4.0 | 53.00 |
| SLS 92-28 | 28 | 4.0 | 9.00 x 4.87 x 3.25 | 7.6 | 84.00 |
| SLS 122-28 | 28 | 6.0 | 14.00 x 4.87 x 3.20 | 8.2 | 109.00 |

SLS Series
Narrow Silhouette

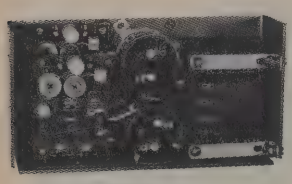
STANDARD POWER, INCORPORATED, 1400 So. Village Way, Santa Ana, CA 92705, (714) 558-8512, TWX: 910-595-1760

STANDARD POWER SUPPLIES

# Standard Power Supplies Selector Guide



## Dual-Output Blue Line



SPS-D Series

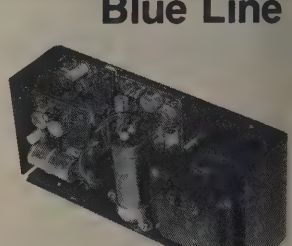
| Model | Volts | Amps | OVP | Size | Wt. (lbs.) | Price w/o OVP |
|---|---|---|---|---|---|---|
| SPS 30D-12/15 | 12-15, -12-15 | 0.7, 0.7 | -93 | 4.75 x 4.00 x 2.80 | 2.3 | $ 45.00 |
| SPS 30DA-5/12 | 5, 10-12 | 2, 0.6 | -92 | 4.75 x 4.00 x 2.80 | 2.3 | 49.00 |
| SPS 30DA-12/15 | 12-15, 12-15 | 0.7, 0.7 | -93 | 4.75 x 4.00 x 2.80 | 2.3 | 49.00 |
| CPS 30DA-12/15 | 12-15, 12-15 | 0.7, 0.7 | -93 | 7.25 x 4.00 x 2.60 | 3.0 | 69.00 |
| SPS 40D-5/5 | 5, 5 | 2, 2 | -92 | 4.94 x 4.25 x 3.25 | 3.4 | 60.00 |
| SPS 40D-5/12 | 5, 10-12 | 2, 0.8/1.0 | -92 | 4.94 x 4.25 x 3.25 | 3.4 | 60.00 |
| SPS 40D-12/15 | 12-15, 12-15 | 1.2, 1.2 | -93 | 4.94 x 4.25 x 3.25 | 3.4 | 60.00 |
| SPS 60D-5/12 | 5, 10-12 | 3, 1.5/1.8 | -92 | 6.10 x 4.12 x 3.25 | 5.8 | 75.00 |
| SPS 60D-12/15 | 12-15, 12-15 | 1.6, 1.6/1.8 | -93 | 6.10 x 4.12 x 3.25 | 5.8 | 75.00 |
| SPS 90D-5/12 | 5, 10-12 | 6, 2.5/3 | -92 | 9.38 x 4.88 x 3.12 | 8.0 | 94.00 |
| SPS 90D-12/15* | 12-15, 12-15 | 3, 3 | -93 | 9.38 x 4.88 x 3.12 | 8.0 | 94.00 |
| SPS 130D-5/12 | 5, 10-12 | 10, 3.5/4 | -92 | 15.00 x 4.88 x 4.00 | 14 | 139.00 |
| SPS 130D-12/15* | 12-15, 12-15 | 5/4, 5/4 | -93 | 15.00 x 4.88 x 4.00 | 14 | 139.00 |
| SPS 250D-5/12 | 5, 10-12 | 12, 7/8 | -92 | 15.00 x 4.88 x 4.00 | 20 | 179.00 |
| SPS 250D-12/15* | 12-15, 12-15 | 8/6, 8/6 | -93 | 15.00 x 4.88 x 4.00 | 20 | 179.00 |

*Shipped with 15V transformer tap connected.

## Triple-Output Blue Line

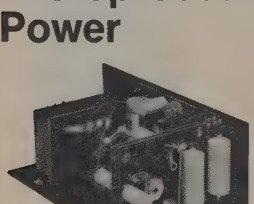
| Model | Volts | Amps | OVP | Size | Wt. (lbs.) | Price w/o OVP |
|---|---|---|---|---|---|---|
| SPS 30TA-5/12/15* | 5, 12-15, 12-15 | 2, 0.25, 0.25 | -95 | 4.75 x 4.12 x 3.44 | 2.9 | $ 75.00 |
| SPS 50TA-5/12/15* | 5, 12-15 , 12-15 | 3, 0.7, 0.7 | -95 | 7.50 x 4.88 x 4.00 | 7.0 | 89.00 |
| SPS 60TA-5/12/15* | 5, 12-15 , 12-15 | 5, 0.7, 0.7 | -95 | 7.50 x 4.88 x 4.00 | 7.0 | 95.00 |
| SPS 70T-5/12/15* | 5, 12-15, 12-15 | 3, 1.5, 1.5 | -95 | 8.25 x 4.50 x 3.38 | 7.0 | 98.00 |
| SPS 80T-5/12/15* | 5, 12-15, 12-15 | 5, 1.6, 1.6 | -95 | 8.25 x 4.50 x 3.38 | 7.0 | 104.00 |
| SPS 80T-5/5/12-15* | 5, 5, 12-15 | 5, 3, 1.5 | -95 | 8.25 x 4.50 x 3.38 | 7.0 | 104.00 |
| SPS 80T-5/12-15/24-28* | 5, 12-15, 24-28 | 5, 1.5, 1 | -95 | 8.25 x 4.00 x 3.38 | 7.0 | 104.00 |
| SPS 90T-5/12/15* | 5, 12-15 , 12-15 | 7, 1.6, 1.6 | -95 | 11.00 x 4.88 x 2.88 | 8.0 | 119.00 |
| SPS 120T-5/12/15* | 5, 12-15 , 12-15 | 7, 3, 3 | -95 | 11.00 x 5.00 x 4.88 | 13.5 | 139.00 |
| SPS 120T-5/5/12-15* | 5, 5, 12-15 | 7, 5, 3, 6/3 | -95 | 11.00 x 5.00 x 4.88 | 13.5 | 139.00 |
| SPS 120T-5/12-15/24-28* | 5, 12-15, 24-28 | 7, 3, 5/1.8 | -95 | 11.00 x 5.00 x 4.88 | 13.5 | 139.00 |
| SPS 220T-5/12/15* | 5, 12-15, 12-15 | 12, 1.5, 1.5 | -95 | 14.25 x 4.87 x 3.20 | 14.0 | 149.00 |
| SPS 240T-5/12/15* | 5, 12-15, 12-15 | 12, 3, 5/3, 3.5/3 | -95 | 15.00 x 4.87 x 4.45 | 16.0 | 159.00 |
| SPS 250T-5/12/15* | 5, 12-15, 12-15 | 12, 3, 5/3, 3.5/3 | -95 | 15.00 x 4.80 x 4.00 | 18.0 | 179.00 |

*Shipped with 15V transformer tap connected.



SPS-T Series

## Microprocessor Power



SMP Series

| Model | Amps @ +5V | Amps +12V | Amps -5V | Amps -9-12V | Remarks | Size | Wt. (lbs.) | Price |
|---|---|---|---|---|---|---|---|---|
| SMP 30-1 | 1.0* | 0.5* | | 0.4/0.5 | | 12.07 x 8.58 x 8.58 | 2.1 | $ 49.00 |
| SMP 30-2 | 1.0* | 0.5* | 0.07* | 0.4/0.5 | | 12.07 x 8.58 x 8.58 | 2.1 | 54.00 |
| SMP 32-5 | 2.5 | — | — | — | Single Output | 4.88 x 4.00 x 2.07 | 2.3 | 29.00 |
| SMP 50-1 | 3.0 | 0.6* | — | 0.4/0.5 | | 17.15 x 10.80 x 8.58 | 5.5 | 72.00 |
| SMP 50-2 | 3.0 | 0.6* | 0.5* | 0.4/0.5 | | 17.15 x 10.8 x 8.58 | 5.5 | 84.00 |
| SMP 42-5 | 4.5 | — | — | — | Single Output | 5.62 x 4.88 x 2.50 | 4.0 | 48.00 |
| SMP 60-1 | 5.0 | 0.6* | — | 0.4/0.5 | | 17.15 x 10.80 x 8.58 | 6.0 | 92.00 |
| SMP 60-2 | 5.0 | 0.6* | 0.5* | 0.4/0.5 | | 17.15 x 10.80 x 8.58 | 6.0 | 99.00 |
| SMP 80-1 | 6.0 | 1.5 | — | 1.2/1.5 | | 20.96 x 12.07 x 8.59 | 8.0 | 115.00 |
| SMP 80-2 | 6.0 | 1.5 | 0.5* | 1.2/1.5 | | 20.96 x 12.07 x 8.59 | 8.0 | 129.00 |
| SMP 100-1 | 8.0 | 2.5 | — | 1.2/1.5 | | 25.4 x 14.61 x 10.16 | 12 | 137.00 |
| SMP 100-2 | 8.0 | 2.5 | 0.5* | 1.2/1.5 | | 25.4 x 14.61 x 10.16 | 12 | 149.00 |
| SMP 30B | 9Vdc @ 1.0A | | ± 18Vdc @ 0.5A | | Unregulated | 4.75 x 3.38 x 3.38 | 2.1 | 27.50 |

*Fixed output

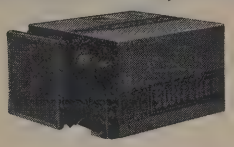
# Standard Power Supplies Selector Guide

STANDARD POWER SUPPLIES

*New Product*

## Switchers – State of The Art

- All New
- 80% Efficient
- Hi-Rel Line
- 20 KHz
- Low EMI/RFI
- No Turn-on or Turn-off Voltage Overshoots
- Lowest Component Count

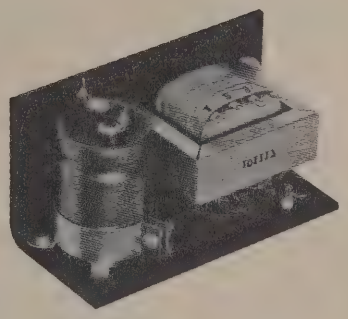


SWS Series

| Model | Volts | Amps | Size | Wt. (lbs.) | Price |
|---|---|---|---|---|---|
| *SWS 750-5 | 5 | 150 | 10.10 x 7.75 x 4.94 | 15 | $695.00 |
| *SWS 750-12 | 12 | 60 | 10.10 x 7.75 x 4.94 | 15 | 695.00 |
| *SWS 750-15 | 15 | 50 | 10.10 x 7.75 x 4.94 | 15 | 695.00 |
| *SWS 750-24 | 24 | 33 | 10.10 x 7.75 x 4.94 | 15 | 695.00 |
| *SWS 750-28 | 28 | 28 | 10.10 x 7.75 x 4.94 | 15 | 695.00 |

*New Product ± 0.2% regulation

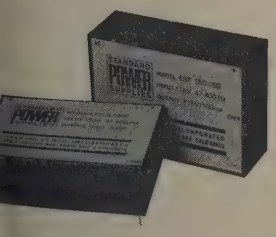
## Black Line



B Series
Unregulated Raw Power

| Model | Typ. Vdc out (at 115 Vac In) No Load | Half Load | Full Load | Amps Full Load | Size | Wt. | Price |
|---|---|---|---|---|---|---|---|
| 5 B7 | 11.0 | 9.0 | 7.5 | 1.8 | 4.62 x 2.75 x 2.09 | 1.7 | $ 19.00 |
| 0 B7 | 10.0 | 8.5 | 7.5 | 3.0 | 5.88 x 3.25 x 2.72 | 2.6 | 23.00 |
| 0 B7 | 10 | 8.5 | 7.5 | 6.0 | 6.25 x 3.71 x 3.00 | 4.0 | 36.00 |
| 00 B7 | 11.0 | 9.5 | 8.5 | 10 | 7.12 x 4.00 x 3.25 | 6.7 | 46.00 |
| 00 B7 | 11.0 | 10.0 | 9.0 | 20 | 8.10 x 5.00 x 3.88 | 12 | 64.00 |
| 5 B12 | 16.0 | 13.0 | 11.0 | 1.2 | 4.62 x 2.75 x 2.09 | 1.7 | 19.00 |
| 0 B12 | 17.0 | 14.0 | 12.0 | 2.4 | 5.88 x 3.25 x 2.72 | 2.6 | 23.00 |
| 0 B12 | 17.0 | 14.0 | 12.0 | 4.8 | 6.25 x 3.71 x 3.00 | 6.7 | 36.00 |
| 00 B12 | 15.5 | 13.5 | 12.5 | 7.0 | 7.12 x 4.00 x 3.25 | 6.7 | 46.00 |
| 00 B12 | 15.5 | 13.5 | 12.5 | 15 | 8.10 x 5.00 x 3.88 | 12 | 64.00 |
| 5 B16 | 21.2 | 18.8 | 17.0 | 0.9 | 4.62 x 2.75 x 2.09 | 1.7 | 19.00 |
| 0 B16 | 20.0 | 18.0 | 16.0 | 1.8 | 5.88 x 3.25 x 2.72 | 2.6 | 23.00 |
| 0 B16 | 20 | 18 | 16 | 3.6 | 6.25 x 3.71 x 3.00 | 4.0 | 36.00 |
| 00 B16 | 21.0 | 19.0 | 17.0 | 6.0 | 7.12 x 4.00 x 3.25 | 6.7 | 46.00 |
| 00 B16 | 22.0 | 18.5 | 16.5 | 12.5 | 8.10 x 5.00 x 3.88 | 12 | 64.00 |
| 5 B20 | 24.7 | 21.8 | 19.8 | 0.75 | 4.62 x 2.75 x 2.09 | 1.7 | 19.00 |
| 0 B20 | 25.8 | 22.3 | 19.8 | 1.5 | 5.88 x 3.25 x 2.72 | 2.6 | 23.00 |
| 0 B20 | 25.8 | 22.3 | 19.8 | 3.0 | 6.25 x 3.71 x 3.00 | 4.0 | 36.00 |
| 00 B20 | 24.0 | 21.7 | 19.4 | 5.0 | 7.12 x 4.00 x 3.25 | 6.7 | 46.00 |
| 00 B20 | 26.8 | 22.4 | 20.0 | 10 | 8.10 x 5.00 x 3.88 | 12 | 64.00 |
| 5 B24 | 31.0 | 27.5 | 25.0 | 0.6 | 4.62 x 2.75 x 2.09 | 1.7 | 19.00 |
| 0 B24 | 34.5 | 29.5 | 26.5 | 1.2 | 5.88 x 3.25 x 2.72 | 2.6 | 23.00 |
| 0 B24 | 34.5 | 29.5 | 26.5 | 2.4 | 6.25 x 3.72 x 3.00 | 4.0 | 34.00 |
| 00 B24 | 31.5 | 27.5 | 25.5 | 3.5 | 7.12 x 4.00 x 3.25 | 6.7 | 46.00 |
| 00 B24 | 31.7 | 29.0 | 27.5 | 7.5 | 8.10 x 5.00 x 3.88 | 12 | 64.00 |
| 00 B24 | 29.2 | 26.8 | 24.6 | 20 | 9.00 x 5.62 x 4.62 | 20 | 120.00 |
| 50 B24 | 32 | 29.8 | 26.7 | 30 | 9.5 x 8.00 x 5.68 | 28 | 195.00 |
| 5 B48 | 59 | 52 | 48 | 0.3 | 4.62 x 2.75 x 2.09 | 1.7 | 19.00 |
| 0 B48 | 62 | 55 | 48 | 0.6 | 5.88 x 3.25 x 2.72 | 2.6 | 23.00 |
| 0 B48 | 62 | 55 | 48 | 1.2 | 6.25 x 3.71 x 3.00 | 4.0 | 36.00 |
| 00 B48 | 56 | 51 | 48 | 1.8 | 7.12 x 4.00 x 3.25 | 6.7 | 46.00 |
| 00 B48 | 54 | 50 | 47 | 4 | 8.10 x 5.00 x 3.88 | 12 | 64.00 |
| 00 B48 | 56.6 | 52.8 | 48.4 | 10 | 9.00 x 5.62 x 4.62 | 20 | 120.00 |
| 5 B120 | 135 | 121 | 113 | 0.12 | 4.62 x 2.75 x 2.09 | 1.7 | 25.00 |
| 0 B120 | 149 | 131 | 120 | 0.25 | 5.88 x 3.25 x 2.72 | 2.6 | 30.00 |
| 5 B250 | 286 | 265 | 247 | 0.05 | 4.62 x 2.75 x 2.09 | 1.7 | 25.00 |
| 0 B250 | 298 | 267 | 248 | 0.1 | 5.88 x 3.25 x 2.72 | 2.6 | 30.00 |

## omputer Modules



SP Series
capsulated for PC Board Mounting

| Model | Volts | Current (mA) | Size | Wt. (lbs.) | Price |
|---|---|---|---|---|---|
| *Single Output* | | | | | |
| ESP 5-500 | 5 | 500 | 3.50 x 2.50 x 0.875 | 1.0 | $ 53.00 |
| ESP 5-1000 | 5 | 1000 | 3.50 x 2.50 x 1.25 | 1.0 | 72.00 |
| ESP 10-120†† | 10 | 120 | 2.25 x 1.75 x 1.00 | 1.0 | 39.00 |
| ESP 15-100 | 15 | 100 | 2.25 x 1.75 x 1.00 | 1.0 | 32.00 |
| *Dual Outputs* | | | | | |
| ESP 12D-120 | ±12 | 120 | 3.50 x 2.50 x 0.875 | 1.0 | 53.00 |
| ESP 12D-240 | ±12 | 240 | 3.50 x 2.50 x 1.25 | 1.0 | 72.00 |
| ESP 12D-400 | ±12 | 400 | 3.50 x 2.50 x 1.625 | 1.0 | 99.00 |
| ESP 15D-25†† | ±15 | 25 | 3.50 x 2.50 x 0.875 | 1.0 | 38.00 |
| ESP 15D-100 | ±15 | 100 | 3.50 x 2.50 x 0.875 | 1.0 | 53.00 |
| ESP 15D-200 | ±15 | 200 | 3.50 x 2.50 x 1.25 | 1.0 | 72.00 |
| ESP 15D-350†† | ±15 | 350 | 3.50 x 2.50 x 1.625 | 1.0 | 99.00 |

†† ± 0.2% regulation

Prices and specifications subject to change. For custom and special requirements, contact the factory.
Request 1978 catalog for detailed specifications, options, overvoltage protection circuits, etc.

STANDARD POWER, INCORPORATED, 1400 So. Village Way, Santa Ana, CA 92705, (714) 558-8512, TWX: 910-595-1760

STEVENS INCORPORATED ARNOLD

# DC/DC Converters

*The Super Isolation People*

## STANDARD SERIES SELECTION CHART ②

DC/DC POWER FROM A 5VDC, 5.8V, 12V, 24V, 28V, 48VDC OR 60VDC INPUT

| Data Sheet # | Series | Output Power | D.C. Outputs | Regulation (NL-FL) | Efficiency @ FL | Input Filter | Isolation ④ Yes | Isolation ④ No | Case Type | Unit Price (1-9) | SELECTION FEATURES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **SINGLE OUTPUT** | | | | | | | | | | | |
| 617 | CP | 50W | 5V @ 10A | ±0.5% | 80% | √ | | √ | S | $189 | **Hi-Performance** Switching Regulator. Wide $E_{IN}$: 7VDC to 40VDC Filtered, Shielded and Clocked ① |
| | CP | 25W | 5V @ 5A | ±0.5% | 80% | √ | | √ | T | $149 | |
| 609 | P | 25W | 5V @ 5A, 6V @ 4A, 8V @ 3A, 12V @ 2A or 15V @ 1.6A | ±0.1% | 65% | √ | √ | | V | $160 | DC/DC Converter. Low Noise, Shielded ① |
| 618 | WM | 15W | 5V @ 3A | ±1% | 80% | | | √ | X | $ 52 | **Economy** Switching Regulator. |
| | WM | 10W | 5V @ 2A | ±1% | 75% | | | √ | X | $ 42 | Wide $E_{IN}$: 7VDC to 40VDC |
| 608 | M | 10W | 5V @ 2A, 6V @ 2A, 8V @ 1A, 10V @ 1A, 12V @ 1A or 15V @ 0.67A | ±0.1% | 65% | √ | √ | | X | $ 99 | DC/DC Converter. Low Noise, Shielded |
| 619 | K | 6W | 5V, 10V, 12V, 16V, 24V or 30V | ±10% | 75% | √ | √ | | W | $ 39 | **Unregulated**, Filtered DC/DC Converter Ultra-Miniature 1" x 2" x 0.375" H. Package |
| 606 | F | 5W | 3V @ 1A, 5V @ 1A, 6V @ 1A, 9V @ 500mA, 12V @ 500mA or 15V @ 350mA | ±0.02% | 70% | √ | √ | | Z | $ 89 | DC/DC Converter. Low Noise, Hi Efficiency, Shielded |
| 611 | F | 3W | 3V, 5V, 6V, 9V, 12V or 15V | ±0.02% | 60% | √ | √ | | Z | $ 69 | **Economy**, Shielded DC/DC Converter. 5V, 600mA |
| 607 | H | 1.5W | 5V @ 200mA, 6V @ 200mA, 8V @ 185mA 12V @ 125mA or 15V @ 100mA | ±0.75% | 45% | √ | √ | | W | $ 34 | **Economy**, DC/DC Converter. Isolated, Filtered, Shie Ultra-Miniature 1" x 2" x 0.375" H. Package |
| **DUAL OUTPUTS** | | | | | | | | | | | |
| 602 | A | 0.9W<br>1.8W<br>3W<br>4.5W | ±12V or ±15V @ ±30mA<br>±12V or ±15V @ ±60mA<br>±12V or ±15V @ ±100mA<br>±12V or ±15V @ ±150mA | ±0.01% | 45%<br>52%<br>60%<br>65% | √ | √ | | Z | $ 42<br>$ 52<br>$ 69<br>$ 79 | **Hi-Performance**, Low Noise DC/DC Converter Filtered — Shielded Common Mode Noise Current: <200μA P-P Wideband Output Noise: <10mV P-P Miniature 2" x 2" x 0.375" H. Package |
| 603 | EA | 1.8W | ±12V or ±15V @ ±60mA | ±0.5% | 60% | √ | √ | | W | $ 29 | **Economy**: DC/DC Converter. 5VDC Input. Ultra-Miniature 1" x 2" x 0.375" H. Package For Less-Critical Applications |
| 602 | B | 1.8W | ±12V or ±15V @ ±60mA | ±0.05% | 52% | √ | √ | | Y | $ 62 | **Super** Iso-Pak DC/DC Converter Isolation: 8000VDC, 5pF, 1" x $10^{11}$ Ω (Plastic Ca For Medical, Utility, Industrial Applications |
| 616 | UA | 3W | +12V @ 210mA, 5V @ 100mA | ±0.05% | 50% | √ | √ | | Z | $ 69 | Low noise. Microprocessor DC/DC Converter. Filtered — Shielded |
| | UB | 7W | +12V @ 500mA, −5V @ 200mA | ±0.05% | 53% | √ | √ | | X | $ 99 | |
| 603 | N | 10W | ±12V or ±15V @ ±330mA | ±0.07% | 63% | √ | √ | | X | $ 99 | DC/DC Converter. Low Noise, Shielded |
| 609 | R | 25W | ±12V or ±15V @ ±830mA | ±0.07% | 63% | √ | √ | | V | $165 | DC/DC Converter. Low Noise, Shielded ① |
| 612 | J | 6W | ±20V @ ±150mA ±18V @ ±165mA | ±10% | 85% | √ | √ | | W | $ 42 | **Unregulated** DC/DC Converter. High Power Density: 8 Watts/Cu. In. |
| **TRIPLE OUTPUTS** | | | | | | | | | | | |
| 604 | C | 9W | ±12V or ±15V @ ±165mA<br>5V @ 750mA | ±0.02%/±0.1% | 50% | √ | √ | | X | $ 99 | DC/DC Converter. Low Noise, Shielded. Transformer Isolated Output Commons |
| 609 | S | 25W | ±12V or ±15V @ ±330mA<br>5V @ 3A | ±0.07%/±0.1% | 63% | √ | √ | | V | $175 | DC/DC Converter. Low Noise, Shielded. Transformer Isolated Output Commons ① |
| 616 | SA | 30W | +12V @ 1A, +5V @ 3A<br>−5V @ 500mA | ±0.1% | 60% | √ | √ | | V | $189 | DC/DC Converter. Low Noise, Shielded. Microprocessor/Microcomputer Series. Transformer Isolated Output Commons ① |
| SF-613 | WC | 8W | ±12V or ±15V @ ±100mA Ⓐ Derived<br>+5V @ 1A Ⓑ | ±0.1%/±0.2% | 65% | | Ⓐ | Ⓑ | X | $114 | **Derived** Converter/Switching Regulator Type. Wide $E_{IN}$: 7VDC to 40VDC. Converter's Dual Output Is Derived From Switching Regulator's Single Output |
| | WC | 15W | ±12V or ±15V @ ±165mA Ⓐ Derived<br>+5V @ 2A Ⓑ | ±0.1%/±0.2% | 70% | | Ⓐ | Ⓑ | U | $129 | |
| 620 | CS | 15W | ±12V or ±15V @ ±165mA Ⓐ Derived<br>+5V @ 2A Ⓑ | ±0.05%/±0.2% | 70% | √ | Ⓐ | Ⓑ | T | $165 | **High Performance Derived** Converter/Switching Regulator Type. Wide $E_{IN}$: 7VDC to 40VDC. Filtered, Shielded and Clocked Converter's Dual Output Is Derived From Switching Regulator's Single Output |

NOTE: UNLESS OTHERWISE SPECIFIED

① External heat sink required (Factory Repairable Series)

② All specifications are typical @ nominal input @ + 25°C TA. Ambient operating temperature range: −25° to + 71°C.

③ Regulated converter noise voltage; 40mV P-P max. (B.W., 5Hz to 20MHz)

④ DC/DC converter isolation: 1 x $10^9$ Ω min. 500VDC min.

### METAL PACKAGE DIMENSIONS

| | | | | | |
|---|---|---|---|---|---|
| Z Package: | 2" x 2" x 0.375" seated height | Y Package: | 2" x 3" x 0.6" seated ht. (plastic) | W Package: | 1" x 2" x 0.375" seated height |
| X Package: | 2.56" x 3" x 0.75" seated height | T Package: | 3.2" x 7" x 0.83" seated ht. ① | V Package: | 4" x 6" x 0.8" seated height |
| | | | | U Package: | 2.56" x 4.56" x 0.75" seated height |



Add Dept. EM to address to tell them you saw it in eem

eem

STEVENS INCORPORATED ARNOLD

# DC/DC Converters

*The Super Isolation People*

## The Total EMI-RFI Modular Shielding Concept

*Stevens-Arnold Pioneered the total EMI/RFI Shielding Concept in Ultra-Miniature Low Noise DC/DC Converter Modules 7 years ago.*

### WHY MODULAR PACKAGING?

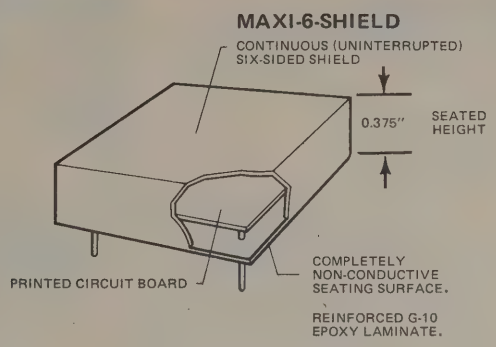
Modular packaging DC/DC Converter Circuitry in Shielded Encapsulated Modules, Significant Advantages are obtained in Noise Reduction, Noise Containment, Environmental Reliability and Minimal Field Service.

High Power Modules are Factory Repairable.

### WHY TOTAL MODULAR SHIELDING?

To Minimize Radiated Interference and Conducted Input/Output Noise we use ALL of the following Factors plus Careful Manufacturing to Produce a "Clean" DC/DC Converter.

1. Six Sided Continuous Package Shield
2. Multiple Transformer Shielding
3. A Full $\pi$ type Input Filter
4. Low Noise Circuit Design
5. Low Noise Transformer Design




### THE MAXI-6-SHIELD

The Maxi-6-Shield is a Continuous Six Sided EMI/RFI Package Shield.

The Module seating surface is a Non-Conductive Reinforced G-10 Epoxy Laminate.

There are no metal corners or edges to contact component side P.C. Ground Plane or wiring runs.

The Metal Cased Plug-in Modules have a Non-Conductive Flat Black Finish on the other 5 sides.

## DC/DC Converter Features

- 1 TO 50 WATTS
- ISOLATED — LOW NOISE
- SWITCHING FREQUENCY >20KHz (Inaudible)
- ALL REGULATED OUTPUTS:
  Short-Protected.
  +5V Std. O.V.P. (Internal)
- TOTAL EMI/RFI SHIELDING CONCEPT
  Continuous Six-sided package Shield
  Multiple Shielding
  $\pi$ type input Filter
- RELIABILITY
  100% Testing
  100 HR Burn-in at FL
  1 Year Warranty
  Hi-Power Modules Factory Repairable

*Exciting new converters! Next page.*

## How to Order DC/DC Converters

| Series | Nominal Input Voltage | | Number of Outputs | Output #1 Voltage | | Output #1 Current | | Package Configuration |
|---|---|---|---|---|---|---|---|---|
| SA | 12 | / | T (Triple) | 12 | / | 1000 | / | V |

EXAMPLE: 12VDC input. +12V, 1A +5V, 3A —5V, 500mA outputs

### CALL OUR APPLICATIONS ENGINEERING DEPARTMENT FOR:

- Free application engineering notes
- Comprehensive specification sheets
- Non-standard inputs up to 140VDC
- DC/DC power supply design-a-kit form 610 for special requirements

## *WE SPECIALIZE IN SPECIALS*

**A large part of our business consists of designing and building custom DC/DC supplies**

**Micropower and Beyond — Isolated . . . Regulated . . . Single or Multiple Outputs**

**LOW ENGINEERING COSTS . . . FAST TURN-AROUND**

*Contact us for an immediate quote — Request Form DAS-1*

F-21

**STEVENS INCORPORATED ARNOLD**

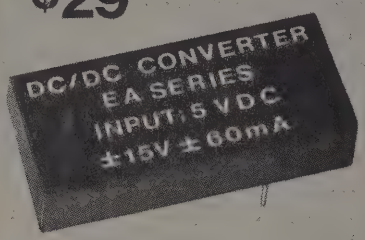
*The Super Isolation People*

# DC/DC Converters

NEW

## Iso-Pak™

**$29** 1.8 Watts

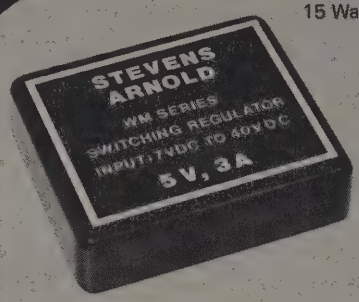



EA Series 1" x 2" x 0.375"H.

NEW

## Switch-Pak™

15 Watts

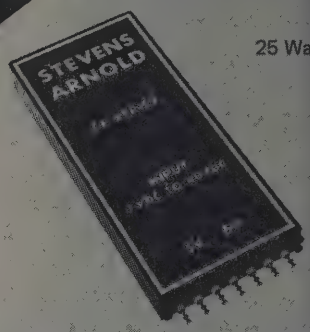



WM Series 2.56" x 3" x 0.75" H.

NEW

## Switch-Pa

25 Wat




CP Series 3.2" x 7" x 0.83"

## Small Package Big Value

Another first from the Originators of the 0.375" Low Profile

- A Break-through for Applications that were previously Cost prohibitive
- ±12V, ±60 MA Outputs also available
- May be used single ended as a 30V, 60 MA Supply
- Isolation; $1x10^9\Omega$/500 VDC minimum
- Regulation; ±0.5% (NL-FL)
- Non-Latching output Current Limiting
- 100,000 Hr. MTBF/Per 217 Handbook

$29 (1-9)

Request Data Sheet #603

## Economy Switching Regulator

Input: 7 VDC to 40 VDC

- 80% Efficiency
- ±1.0% Regulation from a 7 VDC to 40 VDC Input
- Expands the voltage-usable Range of low cost Dry Cells
- Reduces the charge-duty-cycle of 12V Rechargeable Cells
- Increases "Back Up Power" operating time in U.P.S. applications

5V, 2A $42 (1-9)

5V, 3A $52 (1-9)

Request Data Sheet #618

## Hi-Performance Switching Regulat

Input: 7 VDC to 40 VDC

- 80% Efficiency.
- ±0.5% Regulation
- Factory Repairable
- Total Shielding, Filtered & Clocked
- Output Parameters virtually constant over 7V to 40 VD input range

5V, 5A $149 (1-9)

Also Available: 5V, 10A

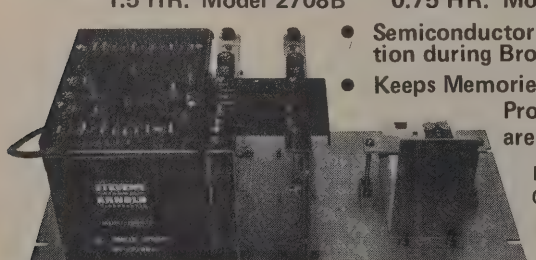
Request Data Sheet #617

## Mini-U.P.S. Helps System Memories Remember

Fully Self Contained — 7" depth behind a standard 8.75" rack panel with sealed Rechargeable Cell. Temperature compensated Charge Control and Limit Protection circuitry.

- Power for Ram's, Rom's, Up's, DTL, TTL, C-Mos etc.
- Will support 32K of MSV-11C Memory and refresh Logic

1.5 HR. Model 2708B 0.75 HR. Model 2708A



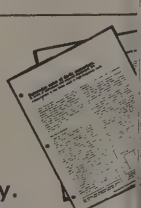
- Semiconductor Switching for Memory Retention during Brownout or Power Interruptions
- Keeps Memories up while "Unlimited Protection Time" AC generators are in the Start and Transfer cycle.

Input; 110/220 VAC; 50/60 Hz
Outputs: 5VDC, 3A 12 VDC, 1A

Prices Start at $395

Request Catalog #622

FREE APPLICATIONS INFORMATION



Request this helpful information today.

DC/DC CONVERTERS

AN-1 Determine Noise of DC/DC Converters
AN-2 Prevent Damaging Overload DC/DC Converters
AN-3 Tips on Specifying Modular DC/DC Converter Power Su
AN-4 DC/DC Converters for Strai Applications
AN-5 Switching Regulator Input
AN-6 Protecting DC/DC Converte

NANOTRANS™

AN-7 Watch your Specs on Signa Transformers - Save 10%

STEVENS INCORPORATED ARNOLD

*The Super Isolation People*

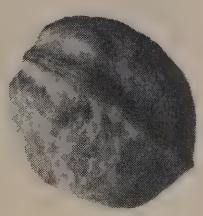
# Transformers
## Custom Built High Isolation Types

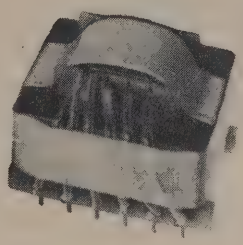
## Low Noise Shielded "Switcher" Transformers
### Switch-Tran™

he new Switch-Tran™ Hi-Frequency "Switcher" ransformers are an industrial extension of our UL-544 edical shielding techniques.

you are an OEM designing 20 KHZ, 30 KHZ or 50 HZ Switchers, you may be able to reduce your Noise id Filtering costs by using a shielded Switch-Tran™. sk for our IT-3649 Specifications and App. Note List-g. Prototype quantities are available to help you get our breadboard running. We can then build OEM quan-ties to your Specifications and delivery requirements.

200 Watts





IT-3649
20 KHZ

1.81" x 1.56" x 1.375"

## High Isolation Transformers
### Iso-Tran™

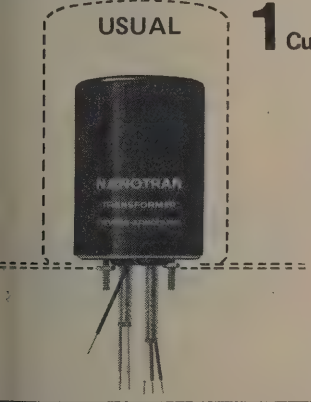
*FOR UL-544 MEDICAL AND LOW LEVEL INDUSTRIAL APPLICATIONS*

- ALL CORE TYPES
  Laminated, Toroid, Pot, C, E, etc.
- HI-BREAKDOWN VOLTAGE
  2500 VRMS up to 8000 VDC
- UL-544 THERMAL PROTECTION
  Incorporated Internally
- OEM DESIGNS FOR VDE STANDARDS
- LOW LEAKAGE CURRENT
  <1μA available
- UL-544 CONSTRUCTION
  Meets Para. 19 Requirements
- HIGH NOISE IMMUNITY
  Multiple shielding

## Super Shielded Signal Transformers
### Nanotran™

*HOW TO GET THE MOST FOR YOUR MONEY IN SIGNAL TRANSFORMERS*
*New Design Concepts—New Materials—New Manufacturing Techniques*

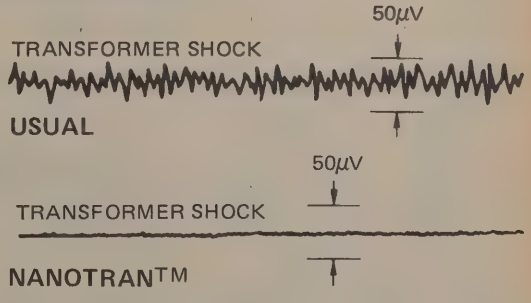
USUAL



**1** Cut Size — Often 30%

**2** Cut Cost — Often 10%
Request Publication # 595
3-Page Application Note on how to do it. Ask for AN-7

**3** Cut Microphonics




*The Super Isolation People*

STEVENS INCORPORATED ARNOLD

7 ELKINS STREET,
SOUTH BOSTON, MASS. 02127
TEL: 617-268-1170
Cable Address Stearco

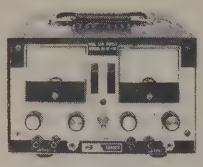
Copyright 1978 Printed in U.S.A.

F-23

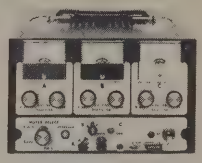
SYSTRON DONNER

# DC POWER SUPPLIES
## Product Guide & Price List

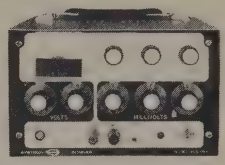
## Laboratory Power Supplies
## Manual & Computer Controlled



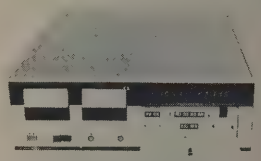
### Dual Lab
- Dual outputs—independently adjustable
- Serial or parallel operation
- Adjustable current limiting
- Two 40 watt supplies in a half rack case
- Load voltage regulated to 0.01%
- U.S. domestic price: $400



### Triple Lab
- Triple outputs—independently adjustable
- Overvoltage protected, 24 watt TTL supply
- Two 30 watt analog supplies (0-32 volts)
- Three metered supplies in a half-rack case
- Load voltage regulated to 0.02%
- U.S. domestic price: $375

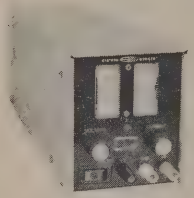


### Precision Lab
- Calibrated voltage in 1 millivolt steps
- Five decade dials and current vernier
- Remotely programmable by voltage or resistance
- Precision 50 watt supply in a half rack case
- Load voltage regulated to 0.001%
- U.S. domestic price: $450

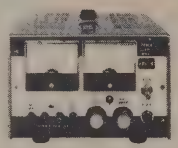


### Digital Power Source
- Bus controlled power per IEEE-488
- Two independent, bipolar outputs
- Programmable voltage, current, and overvoltage
- Two 50 watt supplies and interface in a 5" high rack chassis
- Resolution to 1 mV, regulation to 500 μV
- U.S. domestic price: $3000

## Wide-Range Bench & Rack Power Supplies
## Constant Voltage/Constant Current



### HHB Series
- 50 watt floating output power supplies
- Remote sensitivity and remote voltage programming
- Panel meters, overload and overvoltage protection
- Quarter rack chassis for bench or system
- Load voltage regulated to 0.005%
- U.S. domestic price: $375

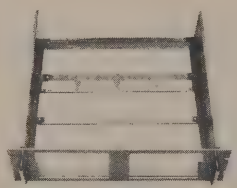


### HR Series
- 250 watt floating output power supplies
- Remote sensing and remote voltage programming
- Panel meters, overload and overvoltage protection
- Half rack chassis for bench or system
- Load voltage regulated to 0.01%
- U.S. domestic price: $550 to $700

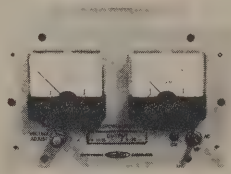
### RS Series
- 500 watt floating output power supplies
- Remote sensing, remote voltage programming
- Panel meters, overload and overvoltage protection
- Compact, 3½" high RETMA rack chassis
- Load voltage regulated to 0.01%
- U.S. domestic price: $750 to $850

### Mercury Series
- Choose from 1000 watt or 2000 watt models
- Remote sensing, remote programming
- Paralleling and tracking connections
- RETMA rack chassis: 5¼" and 7" high
- Load voltage regulated to 0.005%
- U.S. domestic price: $1100 to $2000

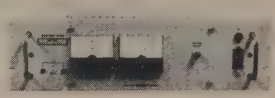
## Slot Range Systems Power Supplies
## Constant Voltage/Current Limiting



### Rack Adapters
- RPA-2 panel for two HR models
- RAC-1 rack adapter for HR models
- RAH-2 rack adapter for VPH models



### VPH Series
- 400 watt floating output power supplies
- Efficient, reliable design
- Panel meters, overload and overvoltage protection
- Compact half-rack chassis for systems
- Load voltage regulated to 0.02%
- U.S. domestic price: $595



### VP Series
- 1400 watt floating output power supplies
- Efficient, reliable design
- Panel meters, overload and overvoltage protection
- Housed in a 5¼" high RETMA chassis
- Load voltage regulated to 0.02%
- U.S. domestic price: $875

### VPL Series
- 2800 watt floating output power supplies
- Efficient, reliable design
- Panel meters, overload and overvoltage protection
- Housed in a 7" high RETMA chassis
- Load voltage regulated to 0.02%
- U.S. domestic price: $1675

*CONCORD INSTRUMENTS DIVISION, SYSTRON-DONNER CORPORATION*
*TEN SYSTRON DRIVE, CONCORD, CALIFORNIA 94518 • Phone (415) 676-5000 • TWX 910-481-9479*

# DC POWER SUPPLIES Product Guide & Price List (continued)

## SELECTION BY MODEL OR SERIES

| Model | Domestic Price ($) | Voltage Range (VDC) | Rated Current (Amps) | Package Size |
|---|---|---|---|---|
| **LAB SERIES** | | | | |
| DL40-1A | 400 | 0 to 40 | 1 | Half Rack |
| | | 0 to 40 | 1 | |
| TL8-3 OV | 375 | 0 to 8 | 3 | Half Rack |
| | | 0 to +32 | 1 | |
| | | 0 to −32 | 1 | |
| PLS 50-1 | 450 | 0 to 50 | 1 | Half Rack |
| DPSD-50 | 3,000 | 0 to 50 | 1 | 5¼" Rack |
| | | 0 to 50 | 1 | |
| **HHB SERIES** | | | | |
| HHB6-5 | 375 | 0 to 6 | 5 | Qtr. Rack |
| HHB20-2 | 375 | 0 to 20 | 2 | Qtr. Rack |
| HHB50-1 | 375 | 0 to 50 | 1 | Qtr. Rack |
| HHB150-300 | 375 | 0 to 150 | 0.3 | Qtr. Rack |
| **HR SERIES** | | | | |
| HR20-12C OV | 550 | 0 to 20 | 12 | Half Rack |
| HR40-10C OV | 575 | 0 to 40 | 10 | Half Rack |
| HR60-8C OV | 575 | 0 to 60 | 8 | Half Rack |
| HR160-3C OV | 675 | 0 to 160 | 3 | Half Rack |
| **RS SERIES** | | | | |
| RS20-20B OV | 750 | 0 to 20 | 20 | 3½" Rack |
| RS40-15B OV | 775 | 0 to 40 | 15 | 3½" Rack |
| RS60-12B OV | 775 | 0 to 60 | 12 | 3½" Rack |
| RS160-4B OV | 825 | 0 to 160 | 4 | 3½" Rack |
| RS320-2C | 825 | 0 to 320 | 2 | 3½" Rack |
| **SUPER MERCURY SERIES** | | | | |
| M5C15-50 OV | 1,125 | 0 to 15 | 50 | 5¼" Rack |
| M5C40-30 OV | 1,100 | 0 to 40 | 30 | 5¼" Rack |
| M5C60-20 OV | 1,125 | 0 to 60 | 20 | 5¼" Rack |
| M5C160-8 OV | 1,175 | 0 to 160 | 8 | 5¼" Rack |
| M7C15-80 OV | 1,395 | 0 to 15 | 80 | 7" Rack |
| M7C40-50 OV | 1,345 | 0 to 40 | 50 | 7" Rack |
| M7C60-30 OV | 1,395 | 0 to 60 | 30 | 7" Rack |
| M7C160-15 OV | 1,945 | 0 to 160 | 15 | 7" Rack |
| **VALUPOWER HALF RACK SERIES** | | | | |
| VPH 5-60 | 625 | 4.8 to 5.5 | 60 | Half Rack |
| VPH 12-35 | 595 | 11 to 13 | 35 | Half Rack |
| VPH 15-31 | 595 | 14 to 16 | 60 | Half Rack |
| VPH 24-22 | 595 | 23 to 26 | 22 | Half Rack |
| VPH 28-19 | 595 | 26 to 30 | 19 | Half Rack |
| **VALUPOWER RACK SERIES** | | | | |
| VP 5-135 | 895 | 4.8 to 5.5 | 135 | 5¼" Rack |
| VP 12-90 | 875 | 11 to 13 | 90 | 5¼" Rack |
| VP 15-85 | 875 | 14 to 16 | 85 | 5¼" Rack |
| VP 24-60 | 875 | 23 to 26 | 60 | 5¼" Rack |
| VP 28-50 | 875 | 26 to 30 | 50 | 5¼" Rack |
| VP 48-30 | 875 | 46 to 52 | 30 | 5¼" Rack |
| **VALUPOWER LIBERATOR SERIES** | | | | |
| VPL 5-300 | 1,695 | 4.8 to 5.5 | 300 | 8¾" Rack |
| VPL 12-200 | 1,675 | 11 to 13 | 200 | 8¾" Rack |
| VPL 15-200 | 1,675 | 14 to 16 | 200 | 8¾" Rack |
| VPL 24-100 | 1,675 | 23 to 26 | 100 | 8¾" Rack |
| VPL 28-100 | 1,675 | 26 to 30 | 100 | 8¾" Rack |

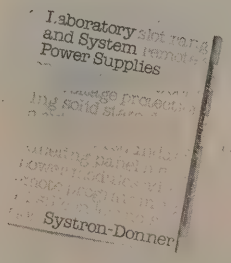
SD/USA–3/78

## SELECTION BY SUPPLY VOLTAGE

| Voltage Range (VDC) | Rated Current (Amps) | Package Size | Model | Domestic Price ($) |
|---|---|---|---|---|
| 0 to 6 | 5 | Qtr. Rack | HHB6-5 | 375 |
| 0 to 8 | 3 | Half Rack | TL8-3 OV | 375 |
| 0 to +32 | 1 | | | |
| 0 to −32 | 1 | | | |
| 0 to 15 | 3 | Qtr. Rack | HH15-3 OV | 325 |
| 0 to 15 | 50 | 5¼" Rack | M5C15-50 OV | 1,125 |
| 0 to 15 | 80 | 7" Rack | M7C15-80 OV | 1,395 |
| 0 to 20 | 2 | Qtr. Rack | HHB20-2 | 375 |
| 0 to 20 | 12 | Half Rack | HR20-12C OV | 550 |
| 0 to 20 | 20 | 3½" Rack | RS20-20B OV | 750 |
| 0 to 40 | 1 | Half Rack | DL40-1A | 400 |
| 0 to 40 | 1 | | | |
| 0 to 40 | 10 | Half Rack | HR40-10C OV | 575 |
| 0 to 40 | 15 | 3½" Rack | RS40-15B OV | 775 |
| 0 to 40 | 30 | 5¼" Rack | M5C40-30 OV | 1,100 |
| 0 to 40 | 50 | 7" Rack | M7C40-50 OV | 1,345 |
| 0 to 50 | 1 | Half Rack | PLS50-1 | 450 |
| 0 to 50 | 1 | Qtr. Rack | HHB50-1 | 375 |
| 0 to 60 | 8 | Half Rack | HR60-8C OV | 575 |
| 0 to 60 | 12 | 3½" Rack | RS60-12B OV | 775 |
| 0 to 60 | 20 | 5¼" Rack | M5C60-20 OV | 1,125 |
| 0 to 60 | 30 | 7" Rack | M7C60-30 OV | 1,395 |
| 0 to 150 | 0.3 | Qtr. Rack | HHB150-300 | 375 |
| 0 to 160 | 3 | Half Rack | HR160-3C OV | 675 |
| 0 to 160 | 4 | 3½" Rack | RS160-4B OV | 825 |
| 0 to 160 | 8 | 5¼" Rack | M5C160-8 OV | 1,175 |
| 0 to 160 | 15 | 7" Rack | M7C160-15 OV | 1,945 |
| 0 to 320 | 2 | 3½" Rack | RS320-2C | 825 |

## SLOT RANGE SYSTEM POWER SUPPLIES

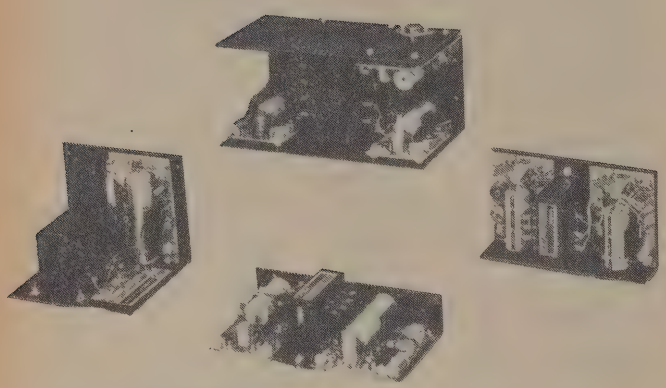
| Voltage Range (VDC) | Rated Current (Amps) | Package Size | Model | Domestic Price ($) |
|---|---|---|---|---|
| 4.8 to 5.5 | 60 | Half Rack | VPH 5-60 | 625 |
| 4.8 to 5.5 | 135 | 5¼" Rack | VP 5-135 | 895 |
| 4.8 to 5.5 | 300 | 8¾" Rack | VPL 5-300 | 1,695 |
| 11 to 13 | 35 | Half Rack | VPH 12-35 | 595 |
| 11 to 13 | 90 | 5¼" Rack | VP 12-90 | 875 |
| 11 to 13 | 200 | 8¾" Rack | VPL 12-200 | 1,675 |
| 14 to 16 | 31 | Half Rack | VPH 15-31 | 595 |
| 14 to 16 | 85 | 5¼" Rack | VP 15-85 | 875 |
| 14 to 16 | 200 | 8¾" Rack | VPL 15-200 | 1,675 |
| 23 to 26 | 22 | Half Rack | VPH 24-22 | 595 |
| 23 to 26 | 60 | 5¼" Rack | VP 24-60 | 875 |
| 23 to 26 | 100 | 8¾" Rack | VPL 24-100 | 1,675 |
| 26 to 30 | 19 | Half Rack | VPH 28-19 | 595 |
| 26 to 30 | 50 | 5¼" Rack | VP 28-50 | 875 |
| 26 to 30 | 100 | 8¾" Rack | VPL 28-100 | 1,675 |
| 46 to 52 | 30 | 5¼" Rack | VP 48-30 | 875 |

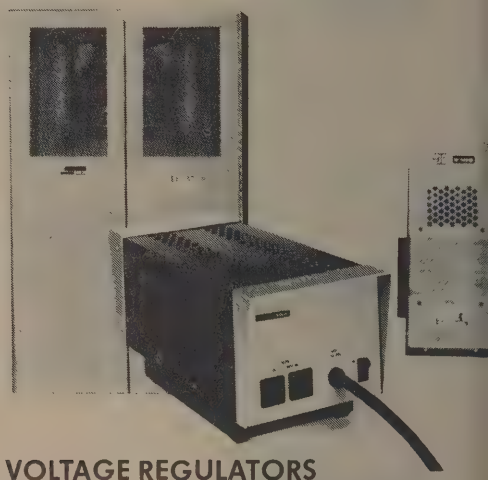



### DO YOU USE POWER SUPPLIES?

*Send for our convenient file folder and Selector Guide. Data sheets on all Systron-Donner power supplies are included.*

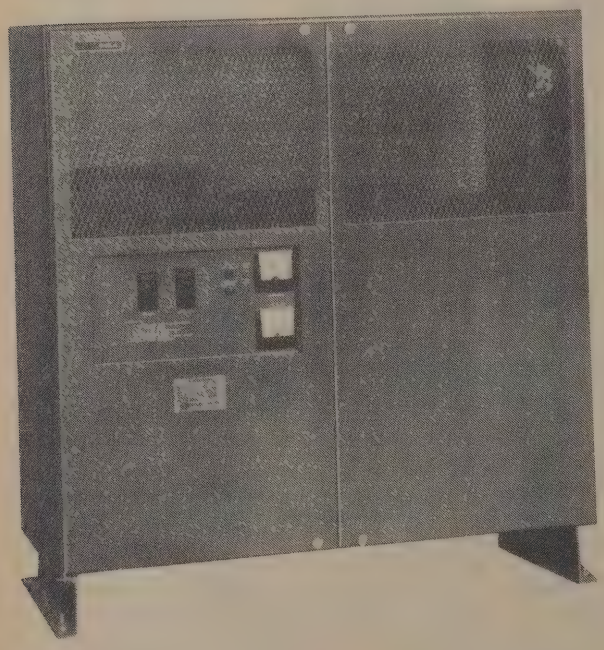
# Sola First in Voltage Regulation





**POWER SUPPLIES**
Sola can supply your needs. Single, dual and triple outputs. From microprocessors to the largest electronic equipment. Available off-the-shelf from your electronic distributor. Think of us as your supply line.

**VOLTAGE REGULATORS**
Sola . . . the #1 name in voltage regulation. From Constant Voltage Transformers to Minicomputer Regulators to our famous Solatron® Line Voltage Regulator for computers and industrial use. See what a difference clean power can make to the performance of your equipment.



**UNINTERRUPTIBLE POWER SOURCES**
Even under an extreme −20% brownout condition, the Sola UPS continues to provide regulated AC output while maintaining battery level. What's more, harmonic distortion is limited to an impressive 3% maximum.

When you consider uninterruptible power sources, consider one that also provides maximum brownout protection.

**FOR MORE INFORMATION**
See our Sales Representative listing in the EEM Yellow Pages. Or contact: Sola Electric, 1717 Busse Road, Elk Grove Village, Illinois 60007. Phone: (312) 439-2800.

**It's part of the Sola package.** GS SOLA ELECTRIC A UNIT OF GENERAL SIGNAL

TAUBER ELECTRONICS FOR IMMEDIATE DELIVERY ON:

# SEALED RECHARGEABLE BATTERIES

## Standard Cells and Batteries

**OUTSTANDING BENEFITS:**

**HIGH VALUE.** You get a high watt-hr. per dollar value because the materials used in Gates sealed lead-acid batteries are readily available and low in cost.

**LONG SERVICE LIFE.** You can get more than 600 deep discharge cycles . . . and even longer life when the battery is used as a standby . . . 8 to 10 years.

**PACKAGING FLEXIBILITY.** You get individual cell availability for broad flexibility in packaging, added flexibility because cells can be used in series or in parallel and may be operated, charged or stored in any position. You can select your choice of voltage and current.

**EASY RECHARGE.** You get the utmost versatility in the charging methods—constant voltage; modified constant voltage with tapering charge current; or constant current.

**WIDE RANGE OF DISCHARGE RATES.** You get the option of high discharge rates due to very low internal impedances — greater than 100 amps from the D cell, 500 amps from the X cell and 1,000 amps from the BC cell, are possible for short periods of time.

**WIDE TEMPERATURE RANGE FOR OPERATION.** You get the option of discharging Gates batteries over a wide range of temperatures, the capacity being a function of both temperature and discharge rate.

**SEALED CONSTRUCTION.** You get individual cells in a sealed case that prevents acid, water and acid vapor leakage. The rugged metal case also maximizes resistance to shock and vibration.

**LONG SHELF LIFE.** You get an exceptionally low self-discharge rate, 2½ years at room temperature.

**SAFETY.** You have virtually no problems with thermal runaway caused by overcharging.

### Cells

| Product Number | Description | Length inches/mm | Diameter inches/mm | Approx. Weight ounces/grams |
|---|---|---|---|---|
| 0810-0004 | 2V. 2.5 Ah. Steel Protective jacket | 2.40 60.96 | 1.34 34.16 | 6.4 182 |
| 0800-0004 | 2V. 5.0 Ah. Steel Protective jacket | 2.85 72.39 | 1.74 44.32 | 13.0 368 |
| 0820-0004 | 2V. 25.0 Ah. Steel Protective jacket | 6.18 157.00 | 2.59 65.78 | 58.72 1670 |

### Batteries (Assembled from Above 2 Basic Cells)

| Product Number | Description | Length inches / mm | Diameter inches / mm | Height inches / mm | Approx. Weight pounds / kilograms |
|---|---|---|---|---|---|
| 0810-0011 | 6V, 2.5 Ah, ABS Plastic Case | 4.2 106.7 | 1.5 38.1 | 2.7 68.6 | 1.3 0.59 |
| 0800-0011 | 6V, 5.0 Ah, ABS Plastic Case | 5.4 137.2 | 1.9 48.3 | 3.1 78.7 | 2.8 1.27 |
| 0802-0008 | 6V, 10.0 Ah, Styrene Plastic Case | 5.4 137.2 | 3.6 91.4 | 3.1 78.7 | 5.3 2.40 |
| 0810-0017 | 6V, 2.5 Ah, Lantern Battery | 2.6 66.6 | 2.6 66.6 | 3.8 97.5 | 1.5 0.69 |
| 0800-0027 | 8V, 5.0 Ah, ABS Plastic Case | 7.1 180.3 | 1.9 48.3 | 3.1 78.7 | 3.7 1.68 |
| 0810-0008 | 12V, 2.5 Ah, ABS Plastic Case | 4.2 106.7 | 2.8 71.1 | 2.7 68.6 | 2.5 1.13 |
| 0810-0016 | 12V, 2.5 Ah, ABS Plastic Case | 8.2 208.3 | 1.5 38.1 | 2.7 68.6 | 2.5 1.13 |
| 0800-0008 | 12V, 5.0 Ah, ABS Plastic Case | 5.4 137.2 | 3.6 91.4 | 3.1 78.7 | 5.3 2.40 |
| 0800-0016 | 12V, 5.0 Ah, ABS Plastic Case | 10.6 269.2 | 1.9 48.3 | 3.1 78.7 | 5.3 2.40 |
| 0801-0001 | 12V, 5.0 Ah, Portable Battery Pack | 7.9 200.2 | 3.5 88.9 | 4.1 104.6 | 6.1 2.78 |

V = Volts  Ah = Amp Hour Capacity at 10 Hour Rate

TAUBER ELECTRONICS FOR IMMEDIATE DELIVERY ON:

# ETERNACELL® LITHIUM PRIMARY BATTERIES

The lithium primary battery with organic electrolyte is the most significant improvement in battery technology in the past 25 years. Compared with all other primary battery types, the lithium system is markedly superior in every aspect of battery performance. The Power Conversion ETERNACELL is the first commercially available lithium primary battery.

**OUTSTANDING FEATURES:**

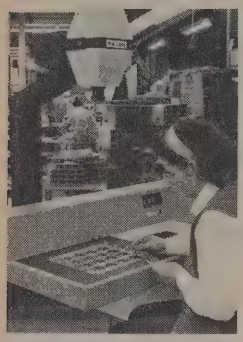
- 3.0 volts-per-cell nominal operating voltage (with adapter, single cell replaces 2 ordinary cells).
- Highest energy per unit weight and volume to 145WH-Hr./LB. 5-10 year shelf life
- Outstanding high and low-temperature performance–down to −65F and + up to +165F.
- 1/2AA, AA, C, 1-1/4C, D, 9V Transistor type to 30 A.H., . . . hermetically sealed cells available.

### General Specifications

| Model No. | Equiv. Size | Capacity Ah | Weight oz. | Dia. in. | Height in. |
|---|---|---|---|---|---|
| 400-5S | ½AA | .525 | .28 | .56 | .98 |
| 440S | | 1.0 | .42 | .64 | 1.33 |
| 400S | AA | 1.2 | .46 | .56 | 2.00 |
| 440-1S | | 1.3 | .63 | .64 | 1.69 |
| 440-2S | | 2.2 | .85 | .63 | 2.62 |
| 660-2S | ¾C | 3.0 | 1.34 | 1.01 | 1.63 |
| 660S | C | 4.0 | 1.62 | 1.01 | 2.00 |
| 1500-10S | | 4.0 | 1.83 | 1.51 | 1.12 |
| 660-3S | 1¼C | 5.0 | 1.97 | 1.01 | 2.40 |
| 550S | D | 8.0 | 2.96 | 1.31 | 2.40 |
| 660-4S | | 10.0 | 3.56 | 1.64 | 2.00 |
| 660-50S | | 10.0 | 4.05 | 1.01 | 5.00 |
| 1500-20S | | 10.0 | 3.17 | 1.51 | 2.00 |
| 660-5S | | 25.0 | 7.82 | 1.64 | 4.50 |
| 1500-50S | | 25.0 | 7.75 | 1.51 | 5.00 |
| 660-5AS | | 30.0 | 10.1 | 1.64 | 5.50 |

IMMEDIATE DELIVERY ON
GATES & ETERNACELL BATTERIES

**TAUBER ELECTRONICS, INC.**
650 Clairemont Drive, Suite 8, San Diego, California 92117
Telephone (714) 274-7242

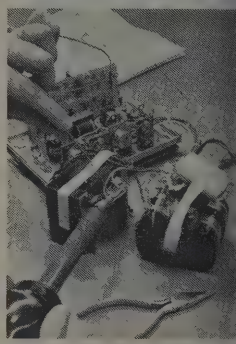


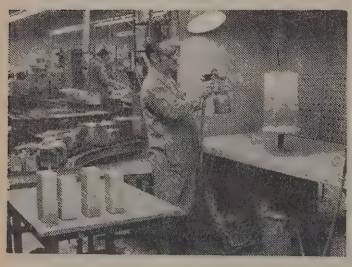
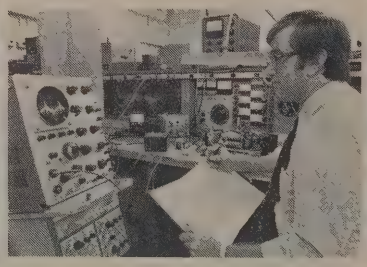
TECHNIPOWER
A PENRIL DIVISION

# THE SOURCE FOR ENCAPSULATED AND OPEN CONSTRUCTION POWER SUPPLIES

**MIL-SPEC and Commercial/Industrial Applications**

- Extreme Environment AC-DC Series
- Moderate Environment AC-DC Series
- High Efficiency AC-DC Switcher Series
- High Efficiency DC-DC Converter Series
- High Efficiency DC-AC Sine Wave Inverter Series



Technipower was founded on the principle of providing the system engineer with a reliable, practical and economical alternative to expensive custom-built or laboratory type power supplies. The concept developed by Technipower to accomplish this objective is to assemble and package the highest quality parts and materials into a standard module. In this way, the system engineer can specify precision regulated power by selecting a single part number as he would a component. Costly software documentation and servicing logistics are kept to a minimum. No elaborate parts lists or expensive servicing manuals are required. □ From design through production, every stage in the making of power supplies is done in-house at the modern complex in Danbury, Connecticut. The comprehensive Technipower design/data catalog provides a large range of models from which the designer can select the exact power supply required. Complete details, including specifications, application data and model capabilities are provided. Our staff of expert power supply engineers is available to assist the equipment designer in catalog module modification or in custom designing.

**All Technipower Power Modules Are Backed By A Full 5-Year Warranty**

For the newest issue of the Technipower Catalog Call: (203) 748-7001
Write: Technipower, Commerce Drive, Commerce Park, P.O. Box 222, Danbury, CT 06810
or Penril Technical S.A., #6 Rue de la Corsaz, C.H.-1820, Montreux, Switzerland

# Tecnetics' broad range of power converters, the stepping stones to your product's success

Whether you are designing military hardware, space vehicles, communication equipment or other high technology products, the components you select can mean the difference between success or failure in the final product. That's why more and more design engineers are finding the power converters they need in the Tecnetics catalog.

Tecnetics offers the broadest range of state of the art DC-DC power converters, and we are now extending our expertise into 400 Hz power supplies. We have been developing and refining these products since 1959, so that today each one is unsurpassed in terms of efficiency, reliability, control circuitry and documentation.

The nearly one-thousand products in our catalog give the design engineer a wide choice of options and features including:

• Efficiencies up to 86% • MTBF up to 40,000 hrs. • Single, dual and triple outputs • Remote error sensing • Densities up to 1.65 watts per cubic inch • EMI protection • Mil spec environmental protection • Short circuit and overload protection • Input-output isolation.

Send for our catalog today. You're sure to find a stepping stone to your product's success.

**tecnetics®** The Power Conversion Specialists

P.O. Box 910, 1625 Range Street, Boulder, CO 80302
(303) 442-3837 TWX 910-940-3246

| SERIES DC-DC | OUTPUT POWER Watts | OUTPUT VOLTAGE VDC | INPUT VOLTAGE VDC | PRICE RANGE 1 to 9 |
|---|---|---|---|---|
| 3150-48 | 150 | 5-48 | 48 | 595-620 |
| 3100-48 | 100 | 5-48 | 48 | 495-520 |
| 3100-28 | 100 | 5-48 | 28 | 495-520 |
| 3050-48 | 50 | 5-48 | 48 | 425-450 |
| 3050-28 | 50 | 5-48 | 28 | 425-450 |
| 3025-48 | 25 | 5-48 | 48 | 395-420 |
| 3025-28 | 25 | 5-48 | 28 | 395-420 |
| 9525-48 | 25 | 5-24 | 48 | 250-365 |
| 9525-28 | 25 | 5-24 | 28 | 250-365 |
| 9586 | 10 | 5V-5KV | 28 | 235-415 |
| 9584 | 10 | 5V-5KV | 28 | 210-310 |
| 9591 | 6 | 5V-5KV | 28 | 215-305 |
| 9589 | 6 | 5V-5KV | 28 | 190-280 |
| 9567 | 3 | 5V-5KV | 28 | 180-270 |
| 9583 | 1 | 3V-3KV | 28 | 200-280 |
| 1200 | 25 | 5-28 | 12,24,28,48 | 198-249 |
| 1000 | 10 | 5-24 | 5,6,12,24,28,48 | 115-140 |
| 1600 | 6 | 5-24 | 5,6,12,24,28,48 | 89-109 |
| 1300 | 3 | 5-24 | 5,6,12,24,28,48 | 79-99 |
| 1100 | 1 | 5-24 | 5,6,12,24,28,48 | 59-65 |
| 100 | max. 6 | 5-15 | 5,21,24,28 | 60-75 |
| HC | max. 3 | 5-300 | 5,12,20 | 49-69 |
| HCH, N, E | max. 3 | 5-300 | 5,6,12,15,20,24,28 | 49-69 |
| **AC (400Hz)-DC** | | | | |
| 4200-3 | 200 | 5-48 | 115 | 750-950 |
| 4100-1 | 100 | 5-48 | 115 | 450-650 |
| 4050-1 | 50 | 5-48 | 115 | 425-625 |
| 4025-1 | 25 | 5-48 | 115 | 395-420 |
| 4100-3 | 100 | 5-48 | 115 | 450-650 |
| 4050-3 | 50 | 5-48 | 115 | 425-625 |
| 4025-3 | 25 | 5-48 | 115 | 395-420 |
| 420 | 20 | 5-28 | 115 | 250-365 |
| 415 | 15 | 5-28 | 115 | 240-335 |
| 410 | 10 | 5-28 | 115 | 230-325 |
| 406 | 6 | 5-28 | 115 | 210-305 |
| 403 | 3 | 5-28 | 115 | 200-295 |

# Eveready® wants you to know

## how to choose the right battery for the right job, at the right price

### CARBON ZINC

OUR "GOOD" BATTERY FOR OCCASIONAL GENERAL PURPOSE AND TRANSISTOR USE

- Our lowest price battery family
- Variety of shapes and sizes
- Provides from 1.5 volts to 510 volts
- Good shelf life
- Voltage drops gradually with use

APPLICATIONS

**Low to medium periodic power needs or occasional use.** Radios, flashlights, lanterns, fluorescent lanterns, video games, small lighted toys and novelties, cameras, flashguns, high voltage electronic photoflash, barricade flashers, lighting and alarm systems, electric fence controllers, laboratory instruments, telephone amplifiers, marine depth finders, paging and signaling devices, R/C models.

### HEAVY DUTY (Zinc Chloride)

OUR "BETTER" BATTERY FOR HEAVY DUTY USE

- Intermediate price
- Variety of shapes and sizes
- Provides 1.5 Volts, 6 Volts, or 9 Volts
- Good shelf life
- "Better" voltage maintenance under load than General Purpose Batteries
- "Better" low temperature characteristics than General Purpose Batteries

APPLICATIONS

**Medium to heavy current or regular use.** Flashlights, lanterns, fluorescent lanterns, calculators, radios, motor driven toys, portable tape recorders and players, video games, motor driven devices, communication equipment, cameras.

### ALKALINE MANGANESE (Primary-Secondary)

OUR "BEST," LONGEST LASTING ALL PURPOSE POWER SOURCE

PRIMARY

- Premium Price
- Variety of shapes and sizes
- Provides 1.5 Volts, 3 Volts, 4.5 Volts, 6 Volts and 9 Volts
- "Best" shelf life — outlasts Carbon-Zinc and Heavy Duty
- "Best" voltage maintenance under load
- "Best" low temperature characteristics

SECONDARY

- Rechargeable Battery at lowest price
- Up to 50 cycles at controlled depth of discharge
- Provides 4.5 Volts, 6 Volts, 7.5 Volts, 13.5 Volts

APPLICATIONS

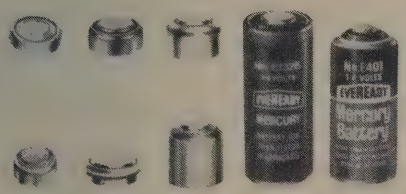
**Heavy current or continuous use.** Electronic photoflash, movie cameras, still cameras and motor drives, motor toys, portable tape recorders and players, calculators, smoke detectors, shavers, television sets, portable communication systems, motor driven devices, medical instruments, signal lights.

# Recommend the right EVEREADY® battery for the right job

## "EVEREADY" BATTERY SYSTEMS AND THEIR PROMINENT FEATURES

. . . FROM THE MANUFACTURER OF THE MOST COMPLETE DRY BATTERY LINE IN THE WORLD

## MINIATURE ALKALINE (Silver Oxide, Mercuric Oxide)



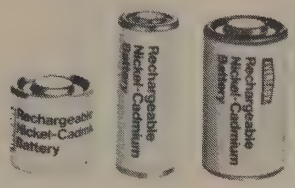
HIGH ENERGY DENSITY MINIATURE POWER SOURCE

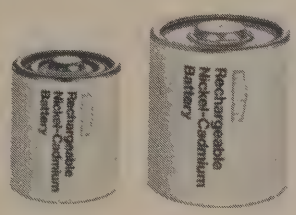
- Variety of shapes and sizes
- Provides 1.35 Volts to 12.6 Volts
- "Best" shelf life — outlasts Carbon-Zinc
- "Best" voltage maintenance under load
- "Good" low temperature characteristic
- Exceptional sealing

APPLICATIONS

**Miniature battery powered electronic equipment.** LCD, LED, or Analog electronic watches, hearing aids, calculators, cameras, electronic thermometers, miniature radios, medical instruments, wireless microphones, paging devices, test instruments.

## NICKEL-CADMIUM RECHARGEABLE (High Rate and Fast Charge Types)




OUR "BEST" RECHARGEABLE POWER SOURCE

- Premium price
- Variety of shapes and sizes
- Standard voltages 1.2 Volts to 14.4 Volts
- Custom batteries available
- Good high and low temperature performance
- High rate discharge
- Long cycle life
- Fast Charge types available
- Consumer cells and chargers available

APPLICATIONS

**Rechargeable devices, standby power and replacement cells for high usage devices.** Portable tools and appliances, electronic photoflash, calculators, tape recorders, and dictating equipment, toys, R/C models, electronic memory standby power, timer standby power, alarm systems, professional communication and recording equipment.

"Eveready," "Energizer," Cat with "Nine Lives," "Mini-Max," "Hot Shot," "Columbia," and "Gray Label" are trademarks of

## UNION CARBIDE CORPORATION

## BATTERY PRODUCTS DIVISION

270 Park Avenue
New York, N.Y. 10017

Sales Offices: Atlanta, Chicago, Cleveland, Dallas, San Francisco, Hackensack, N.J.

Union Carbide Corporation provides a consulting service of experienced battery engineers as an aid to manufacturers in need of special battery designs. For help with your specific battery problems, call (212) 551-3833 or write Battery Engineering Dept. No. 18 in New York (address shown on this page).

# ADJUSTABLE HIGH VOLTAGE DC POWER SUPPLIES

## VOLTAGE RANGES TO 2,000,000 VOLTS DC

BA 70-10 ADJUSTABLE HIGH VOLTAGE DC POWER SUPPLIES
BA 70-11 EXTRA HIGH VOLTAGE DC POWER SUPPLIES
BA 70-13 MULTI-RANGE, HIGH VOLTAGE POWER SUPPLIES
BPE 70-5 HIGH VOLTAGE DC POWER PACKS ENCAPSULATED
BPO 70-5 HIGH VOLTAGE DC POWER PACKS OIL IMMERSED

Series "BA" adjustable power supplies and series "BP" power packs are available at voltage ratings from 1 KVDC through 2000 KVDC at output power ratings from 1 watt to 250 kilowatts continuous. The adjustable series includes applications oriented control features and package design. The power pack series has many applications in OEM systems and for general laboratory use.

☐ **CONSERVATIVELY RATED — HIGH RELIABILITY**

Every UVC power supply includes conservatively rated high voltage components designed and manufactured under the strict control of the specialized UVC technical staff to insure continuous duty, long term, trouble free operation.

Each power supply offers a standard ripple specification of 5% maximum or better. Optional filters and attenuators are available for every UVC supply to reduce ripple to as low as .01% rms.

☐ **REVERSIBLE POLARITY**

Each power supply offers the flexibility of reversible output polarity performance.

☐ **FULLY SELF-PROTECTING**

Overvoltage and overcurrent protection features are available as both adjustable range and fixed value circuits. All access areas and doors are interlocked for personnel protection and all energy storage components and circuits are discharge protected for personnel protection.

☐ **"APPLICATIONS ORIENTED" CONTROLS OPTIONAL**

Rack mounted, floor and bench operable as well as portable design are among the packages available for UVC standard high voltage power supplies.

☐ **12-MONTHS WARRANTY**

A one year factory backed and field supported warranty policy accompanies each shipment.

# HIGH VOLTAGE TERMINATIONS

C70-7 HIGH VOLTAGE TERMINATIONS

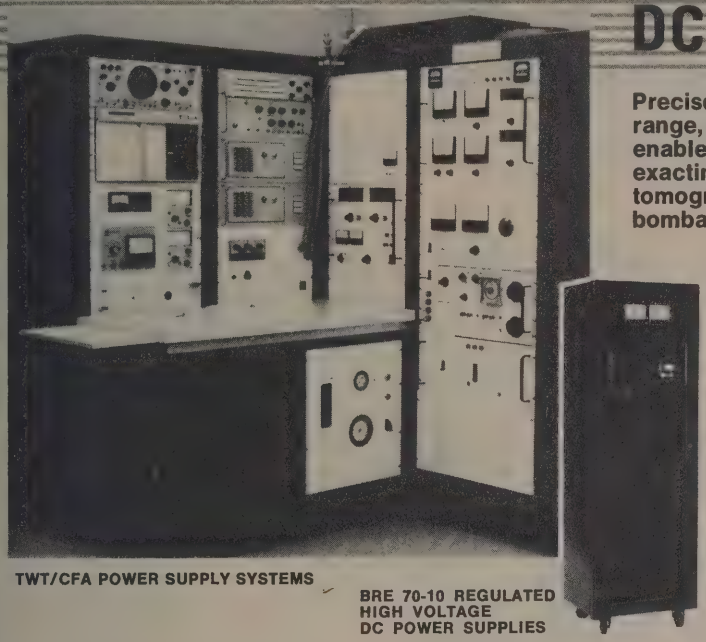
☐ **CORONA-FREE TERMINATIONS**
☐ **ELIMINATES THE HIGH STRESS POINTS**
☐ **MORE LINEAR DISTRIBUTION OF VOLTAGE GRADIENTS**

UVC high voltage terminations and connection links have been designed and fabricated specifically for use in high voltage applications requiring careful attention to terminal and connection problems • The standard terminations have been manufactured in a variety of geometrical configurations which have been chosen for their well-defined corona and leakage onset characteristics • Accurate machining and polishing, along with adequate theoretical and field experience on these terminals have given UVC the ability to advise on a particular size, shape or spacing for a particular application or site condition.

**WRITE OR PHONE FOR SPECIFIC BULLETINS AND COMPLETE INFORMATION:**

Write or call
**UNIVERSAL VOLTRONICS CORPORATION**
27 Radio Circle Drive, Mount Kisco, N.Y. 10549
(914) 241-1300

# PRECISION REGULATED HIGH VOLTAGE DC POWER SUPPLIES



TWT/CFA POWER SUPPLY SYSTEMS

BRE 70-10 REGULATED HIGH VOLTAGE DC POWER SUPPLIES

**Precisely regulated performance over wide adjustment range, low ripple, fast response and high stability enable the series "BRE" power supplies to be used in exacting work for X-Ray Spectroscopy, computerized tomography, electron microscopes, TWT's, ion bombardment experiments, particle separators.**

☐ **FROM 1KV THROUGH 500 KVDC**

These precisely regulated power supplies are available in voltage ratings from 1 KV through 500 KVDC at continuous duty output power up to 100 KW. Our regulation circuitry techniques realize performance specifications which are virtually independent of input line variations or no load-full load changes.

☐ **LOW RIPPLE . . . HIGH STABILITY**

Ripple in most cases is 0.01% rms and the output polarity is available as both fixed and reversible. Two voltage adjustment schemes are offered, namely digital dialable control for the most exacting applications and continuous coarse and vernier controls.

☐ **WIDE ADJUSTMENT RANGE**

In the digital dialable scheme, we allow for adjustment in increments of 10 KV, 1 KV, 100 volts, 10 volts, 1 volt and 0-1 volt vernier. This system provides the assurance that the actual output is always within 1% of the dial readings. As indicated you may select a coarse, and vernier voltage adjustment scheme and realize economic savings without sacrificing basic regulated performance. Regulation accuracy of ± 0.25%; ± 0.1%; ± 0.05% and ± 0.01% for line or load changes is available on most series "BRE" power supplies.

☐ **TWT/CFA POWER SUPPLY SYSTEMS**

Available with Cathode, Heater, Collector, Anode and Helix outputs. Each UVC Black Box system features:

- **PULSED OR CW OPERATION**
- **TURN ON/OFF SEQUENCE CONTROL TO INSURE SAFE AND PROPER PERFORMANCE**
- **FAST-ACTING CROWBAR PROTECTION**

You can forget about power problems when you marry your TWT's to UVC Black Boxes.

# HIGH VOLTAGE DIVIDERS

C70-8 HIGH VOLTAGE DIVIDERS

UVC offers five types of voltage dividers for measurement of various types and shapes of high voltages. These include Resistive, Capacitive, Mixed (Resistive-Capacitive), Impulse Resistive, Impulse Capacitive. Selection of a voltage divider type depends upon the shape of measured voltage and the kind of information required.

These dividers may also be used for measurement and/or sensing of special high voltage transients. They are optimized in such a way as to drain a minimum of power from the voltage source and can be placed within close proximity to grounded objects without significant interferences on the divider ratio.

The low voltage components are enclosed in the bottom cylinder, which is made of steel for the purpose of shielding. The BNC connector for connections of instruments and the attenuating switch are mounted directly on the steel cylinder. High voltage components are enclosed in phenolic type cylinders. Specially designed high voltage terminals facilitate high voltage connections.

**WRITE OR PHONE FOR SPECIFIC BULLETINS AND COMPLETE INFORMATION:**

Write or call

**UNIVERSAL VOLTRONICS CORPORATION**

27 Radio Circle Drive, Mount Kisco, N.Y. 10549

(914) 241-1300

# CATALOGUE DE L'ELECTRONIQUE POUR LES INGENIEURS
# DER PRODUKTKATALOG FÜR ELEKTRONIKER
# ELECTRONIC ENGINEERS CATALOGUE

**The 1978 edition is out...and the response is in...**
**IMMEDIATE AND OVERWHELMING**

ACCEPTANCE

The ELECTRONIC ENGINEERS CATALOGUE is the only comprehensive, trilingual catalogue/source-directory of electronic products available to—and from—Western Europe.

It is divided into three distinct sections: 1. **The Product Index and Directory,** which lists more than 3,000 product headings & cross-references alphabetically in English with their French and German equivalents. 2. **The Manufacturers' Catalogue Section,** which is a compilation of Manufacturers' Catalogues in alphabetical order. 3. **The Manufacturers' Sales Offices and Trade Marks Directory,** which alphabetically includes country, address, telex or TWX numbers of the Manufacturers' main and local sales offices and/or agents.

The ELECTRONIC ENGINEERS CATALOGUE offers U.S. manufacturers the most cost-efficient method of distributing their catalogue data to **25,000** electronic engineers and buyers throughout Western Europe. It represents the carefully conceived application of the time-proven **eem** "cataloging" concept to the elusive European marketplace.

United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Avenue, Garden City, New York 11530 / 516 222-2500

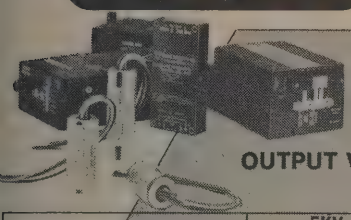
**MINIATURE HIGH VOLTAGE POWER SUPPLIES**

# Venus Scientific Inc.

**Electro-Optics • CRT Display • Night Vision Equipment**

VENUS

## STD PRODUCT (QUICK) SELECTION CHART



| Model No. | OUTPUT VOLTAGE RANGE | −55° to +71°C Full Rating | Output Proportional to Input | Floating Bias Supply | Switching Penetron | Low Power Battery Operated | PMT | Focus | Dynamic Focus | CRT | Hi-Bright CRT | X-Ray Microscope | High Al + Version Avail. | Volume in Cubic Inches | Wt. (lb.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1KV / 5KV / 10KV / 15KV / 20KV / 25KV / 30KV | | | | | | | | | | | | | | |
| C-8T | CENTER TAPPED | 2 ma | ✓ | ✓ | | | | ✓ | ✓ | | | | | 3 | .25 |
| C-2T | CENTER TAPPED | 8 ma | ✓ | ✓ | | | | | ✓ | | | | | 3 | .25 |
| C-15 | | 1 ma | ✓ | | | | ✓ | ✓ | ✓ | | | | ✓ | 3 | .25 |
| C-30 | | 500 μa | ✓ | | | | ✓ | ✓ | ✓ | | | | ✓ | 3 | .25 |
| CS-14 | | 320 μa | | | ✓ | | | | | ✓ | | | | 60 | 3 |
| CS-18 | | 200 μa | | | ✓ | | | | | ✓ | ✓ | | | 180 | 9 |
| F-6 | | 16 ma | | ✓ | | | | ✓ | ✓ | | | | | 7 | .58 |
| F-12 | | 8 ma | | ✓ | | | ✓ | ✓ | ✓ | | | | | 7 | .58 |
| F-25 | | 4 ma | | | | | ✓ | ✓ | ✓ | | | | | 7 | .58 |
| F-50 | | 2 ma | | | | | | ✓ | ✓ | | | | | 7 | .58 |
| G-6 | | 500 μa | | | | | | ✓ | | ✓ | | | | 15 | 1.25 |
| G-10 | | 500 μa | | | | | | | | ✓ | | | | 15 | 1.25 |
| G-12 | | 500 μa | | | | | | | | ✓ | | | | 15 | 1.25 |
| H-16F | | 500 μa | | | | | | ✓ | | ✓ | | | | 31 | 2.5 |
| H-20 | | 500 μa | | | | | | | | ✓ | ✓ | ✓ | | 31 | 2.5 |
| H-20N | NEG | 500 μa | | | | | | | | ✓ | ✓ | ✓ | | 31 | 2.5 |
| H-30 | | 300 μa | | | | | | | | ✓ | ✓ | ✓ | | 44 | 3.8 |
| H-30N | NEG | 300 μa | | | | | | | | ✓ | ✓ | ✓ | | 44 | 3.8 |
| K-15 | | 1 ma | ✓ | | | | ✓ | ✓ | ✓ | | | | ✓ | 2 | .22 |
| K-30 | | 500 μa | ✓ | | | | ✓ | ✓ | ✓ | | | | ✓ | 3 | .22 |
| LR-2N | NEG | 5ma | | | | | ✓ | | | | | | | 33 | 2.4 |
| LR-6 | | 500 μa | | | | | | ✓ | | | | | | 33 | 2.2 |
| LR-15 | | 300 μa | | | | | | ✓ | | ✓ | | | | 33 | 2 |
| LR-20 | | 150 μa | | | | | | ✓ | | ✓ | | | | 33 | 2 |
| LU-15 | | 300 μa | ✓ | | | | | ✓ | | ✓ | | | | 27 | 2.25 |
| M-15N | NEG | 10 μa | ✓ | | | ✓ | | | | | | | | 3 | .19 |
| MF-8 | | 1 ma | | ✓ | | | | ✓ | ✓ | | | | | 4 | .19 |
| MF-25 | | 1 ma | | | | | ✓ | ✓ | ✓ | | | | | 4 | .25 |
| MG-3 | | 1 ma | | | | | ✓ | ✓ | | ✓ | | | | 7 | .5 |
| MG-12 | | 500 μa | | | | | | | | ✓ | | | | 7 | .5 |
| O-6.75 | A.C. OUTPUT | — | | | | ✓ | | | | | | | | 2 | .125 |
| Q-15 | | 400 μa | ✓ | | | ✓ | ✓ | ✓ | | | | | | 2 | .22 |
| Q-30 | | 200 μa | ✓ | | | ✓ | ✓ | ✓ | | | | | | 2 | .22 |
| ST-10N | NEG | 10 μa | ✓ | | | ✓ | | | | | | | | 7 | .5 |

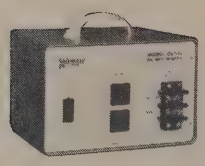
- *Off the shelf delivery*
- *Proven economical designs*
- *Field tested by many companies*
- *No non-recurring engineering or development costs*
- *MIL and commercial power supplies available*
- *MIL-Q-9858A*
- *Custom power supplies*

**Venus Scientific Inc.**
399 SMITH STREET, FARMINGDALE, NEW YORK 11735
• **Telephone** (516) 293-4100 • **TWX:** 510-224-6492

Wilmore Electronics Company, Inc.

# POWER CONVERSION EQUIPMENT

## DC-TO-AC INVERTERS . . . UPS/STANDBY POWER

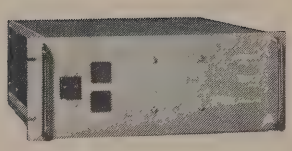


### MODEL 1057 300-WATT STEPPED-WAVE INVERTER

Economically priced and ideally suited for instruments requiring frequency stability, the 300-watt Mode 1057 is an inexpensive alternative to sine-wave power. The switching-mode wave-shaping techniqu yields a three-level-step waveshape which has approximately the same peak-to-rms voltage ratio as true sine wave. Versions for input voltages of 12 Vdc, 24 Vdc, 28 Vdc and 32 Vdc are standard. Output of 115 Vac or 230 Vac and 50 Hz or 60 Hz are also standard. All models are more than 80% efficien and have a frequency stability of ±0.25%. Units are 8¼"h x 11"w x 8½"d and weigh 25 lbs Single piece price is $295.00 for all versions. For more detailed specifications request Bulletin 9091C

### MODEL 1172 500-WATT SQUARE-WAVE INVERTER

The Model 1172 is an inexpensive, rugged 500-watt inverter designed to power heavy duty loads. The inverter will provide 1000 watts for a short period of time for surge-demanding loads such as refrigera tor compressors and small power tools. The Model 1172 is a modular inverter and two units may be easily paralleled in the field for added continuous and surge power. Versions for input voltages of 12 Vdc 24 Vdc and 32 Vdc are standard. Outputs of 115 Vac or 230 Vac and 50 Hz or 60 Hz are also standard This square-wave-output inverter is more than 80% efficient for most of the output load range. The frequency stability is ±2 Hz and the output voltage is proportional to the input dc line. All units are 7"h x 8½"w x 11"d and weigh 32 lbs. The price of the twelve-volt-input version is $225.00, while the 24-V and 32-V versions are $280.00 each. For more detailed specifications request Bulletin 1101A



### MODEL 1081 500-WATT SINE-WAVE INVERTER

Designed to power those loads that are extremely wave-shape and frequency sensitive, the Model 108 inverter offers a well-filtered sine wave with a frequency stability of ±0.25% and a voltage regulatio of ±2% with line, load and temperature. Standard input voltages are 12 Vdc, 24 Vdc, 48 Vdc and 120 Vdc. The output for all versions is 115 Vac at 60 Hz. All units are for mounting in a standard 19" rack and measure 6¾"h and 20½"d. All units weigh approximately 100 lbs. The single piece price fo the Model 1081 is $995.00. For more detailed information request Bulletin 9091C.

### OTHER STANDARD INVERTERS

Wilmore Electronics manufactures a complete line of solid-state inverters ranging in output power fror 15 watts to 1500 watts. These units include highly efficient and economical square-wave-output units, units whose output wave shape is a three-level-step approximation to a sine wave and, for the mos demanding loads, low-distortion sine wave output units. Pictured is the 1500 watt Model 1207, availabl in input voltages up to 120 Vdc, providing a frequency-stable, single-phase 60 Hz output at either 11 Vac or 230 Vac. All standard Wilmore inverters are protected against overloads and short circuits. Fo information about other standard inverters or about a custom-designed inverter to meet a particula requirement, please contact our sales department or our applications engineering group.

### MODEL 1252 AUTOMATIC STANDBY AC POWER SOURCE

When commercial ac power fails, this standby ac power source continues to supply needed power t critical loads by switching to inverter operation. Upon restoration of ac power, the Model 1252 aut matically returns to normal operation, and the internal battery charger recharges the batteries. Tw basic versions are available, one providing a stepped-wave approximation to a sine wave output ar 250 watts of power and the other supplying 500 watts of square-wave power. Standard battery inp voltages are 12 Vdc and 24 Vdc. All units are 5¼"h x 17"w x 14"d and weigh 45 lbs. Single piece pric is $525.00. Battery not included. For more detailed information request Bulletin 6021.

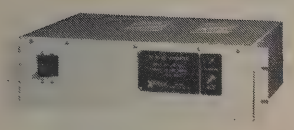
# Wilmore Electronics Company, Inc.

# POWER CONVERSION EQUIPMENT

## SINGLE- AND MULTIPLE-OUTPUT DC-TO-DC CONVERTERS

### MODEL 1265 48-V AND 24-V TO 13-V DC-TO-DC CONVERTERS

The Model 1265, capable of delivering 420 watts, is a highly efficient, rugged converter which has been used in a variety of applications including that of providing power for mobile-radio base stations that are located where battery voltages other than 12 Vdc are available. The Model 1265 is particularly well-suited for applications in which extended periods of "standby" service are encountered because of the minimal no-load power required, less than 5 watts. These units are well regulated and fully protected and isolated. Units are 5¼"h x 19"w x 12"d and weigh 15 lbs. Price in quantity of ten is $470.00 each. For more detailed specifications request Bulletin 5061.

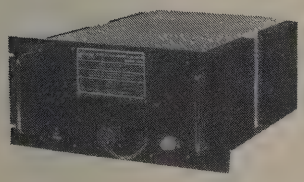


### SERIES 1240 DC-TO-DC CONVERTERS

The Series 1240 converters are designed to take power from standard station batteries at 48V, 125V or 250V and convert to output voltages ranging from 24 Vdc to 125 Vdc. These converters are highly efficient up to 87% for some models, and are fully protected against large input transients as well as short circuits and overloads. Typical applications include uses within the utilities industries, with supervisory control systems and to power alarm and security systems. There are sixteen standard models with output power ranging from 240 watts to 600 watts. All models are 5¼"h x 19"w x 14"d and weigh approximately 40 lbs. Prices in quantity of ten begin at $580.00. For more information request Bulletin 4011.

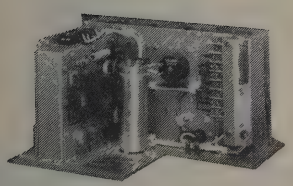
### MULTIPLE-OUTPUT DC-TO-DC CONVERTERS

Wilmore specializes in both standard and custom multiple-output dc-to-dc converters. One example, pictured at the left, is a Series 1260 converter. This series accepts standard input voltages of 24V, 48V or 125V and offers dual, triple or quadruple outputs at all standard output voltages such as 5V, ±12V, ±15V, etc. The combined output power capability of this series is 250 watts, available in almost any combination of voltages and current levels. Standard enclosures are 5¼"h x 19"w for rack mounting, but the modular design allows for considerable flexibility in packaging. For information about these converters or other multiple-output converters, please contact our applications engineering department.



### MODEL 1254 STANDARD CAPACITOR-CHARGING CONVERTER

Intended for use with lasers, flash lamps and other pulsed-load systems, these dc-input power converters are designed to charge energy-storage capacitors repetitively to a precisely regulated peak voltage. Special advantages of these converters include an overall efficiency of approximately 70%, a peak-voltage regulation precision of better than ±0.5%, and the ability to be used with essentially any size of load capacitor and with pulse-discharge repetition rates ranging from zero to several hundred pulses per second. There are three standard versions of the Model 1254 with energy delivery rates of 300, 600 and 1200 joules per second. The standard input voltage range is 20-32 Vdc and outputs are available in three standard ranges from 450 volts to 2800 volts. The Model 1254 units are intended for mounting in a standard 19" rack; smaller, lighter, higher-efficiency units are available for military (and similar) applications. The Model 1254-1200 (pictured at left) measures 8¾"h x 20"d and weighs 35 lbs. Single piece prices begin at $940.00 for the Model 1254-300. For additional information request Bulletin 6031.



### CUSTOM-DESIGNED POWER CONDITIONING EQUIPMENT

Because user's needs tend to be highly individualized, the majority of Wilmore's manufacturing involves custom, rather than standard, units. Engineering charges for custom units are modest; turn-around times are exceedingly short. Especially if you are an OEM, a custom unit can probably save you money by ensuring that you get exactly what you want but no more, by ensuring that you have thermal and electronic safety margins where you need them, and by being carefully integrated in numerous other ways with the overall electrical and mechanical planning for your product. Wilmore's custom-designed converters are serving throughout the world in both industrial and aerospace applications. Uses range from spacecraft (LES-6, OSO, IMP, SAS, Pioneer 10 & 11 to name a few) to providing power conversion for the communications system for the Trans-Alaskan Pipeline. We would like to bring our cost-reducing problem-solving experience to bear on your problems.

# ACDCo *Power WHERE you need it!*

## Inverters-Uninterruptible Power Systems -Battery Chargers-Frequency Changers-Power Supplies

ACDCo Power Equipment is designed to meet high reliability and performance standards providing maximum life with minimum maintenance to protect all system circuits that require dependable, high quality power.

### HARDWARE

**Inverters, Power — DC to AC Output:** Fixed-base, portable, mobile and marine.

**ACDCo INVERTERS** are used in one of the **roughest** of Marine Environments on the **U.S. Coast Guard's - Rescue Life Boats** to power their Navigation and Communication equipment.

**Uninterruptible AC Power Systems:** 36 VA to 5 KVA.

**Frequency Converters — AC to AC:** 50/60 Hz, 60/50 Hz, 50/400 Hz and 60/400 Hz.

**Battery Chargers — AC to DC Power Supply:** 0-30 VDC/30-300 VDC Auctioneer Units and Automatic Transfer.

**Power Supplies:** Constant current and constant voltage current regulated and modular.

**Power Monitors (AC & DC) & Fault Detectors:** Special & custom power analizing, monitoring & recording systems, & controls.

### TYPICAL SPECIFICATIONS

**Input:** ±15% from nominal.

**Output:** Sine wave, 120 Volts RMS, 60 Hz.

**Voltage Regulation:** 2% over full input and load range.

**Frequency Regulation:** 1% over full input and load range.

**Power Factor:** .9 Lead to .8 Lag.

**Efficiency:** Over 80% at nominal input.

**Distortion:** Less than 5%.

**Overload:** Within specifications for ONE MINUTE at 140% load.

**Overload Protection:** No damage from short to open circuit, reversal of input, or input voltage to 140% nominal.

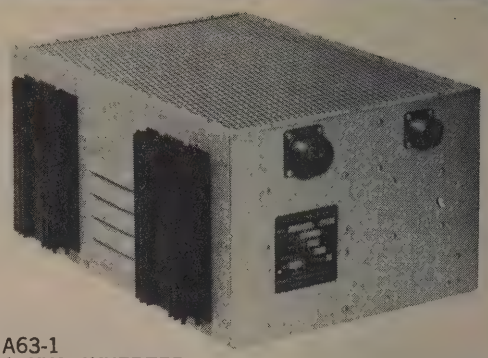
### DESIGN FEATURES

Ruggedized construction, no moving parts, completely solid state, easy servicing — sides fold down, plug-in transistors and I/C's on Printed Circuit Boards, all P/C boards plug-in removable.

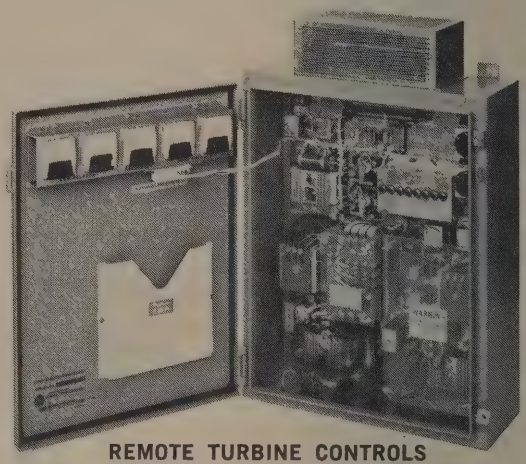
### STATIC INVERTER MODELS

| Rating | 12VDC | 24VDC | 32VDC | 48VDC | 120VDC |
|---|---|---|---|---|---|
| 36VA | A12-1 | A13-1 | A19-1 | A14-1 | A16-1 |
| 72VA | A22-1 | A23-1 | A29-1 | A24-1 | A26-1 |
| 125VA | A32-1 | A33-1 | A39-1 | A34-1 | A36-1 |
| 250VA | A42-1 | A43-1 | A49-1 | A44-1 | A46-1 |
| 500VA | A52-1 | A53-1 | A59-1 | A54-1 | A56-1 |
| 1000VA | | A63-1 | A69-1 | A64-1 | A66-1 |
| 1750VA | | A63-2 | | A64-2 | A66-2 |
| 2500VA | | A73-1 | | A74-1 | A76-1 |
| 3750VA | | | | A74-2 | A76-2 |
| 5000VA | | | | A84-1 | A86-1 |

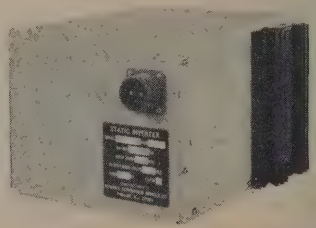
Three Phase Models Available up to 15KVA



A63-1
**1 KVA INVERTER**



**REMOTE TURBINE CONTROLS FOR THE ALASKAN PIPELINE**



A43-1
**250VA INVERTER**

A12-1
**36VA INVERTER**

## ADVANCE CONVERSION DEVICES COMPANY

109 EIGHTH STREET PASSAIC, NEW JERSEY 07055 Phone (201) 778-0707 ACDCo

# ACDCo Power WHEN you need it!

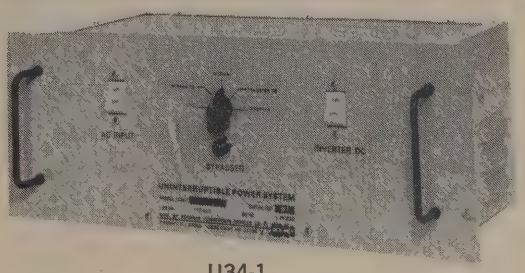
## Protect Against Costly Power Interruptions

ACDCo Uninterruptible Power Systems protect critical circuits for computer peripherals, process controls, telephone switch boards, high risk medical or experimental procedures and all systems requiring dependable emergency power when normal AC is lost.

### UNINTERRUPTIBLE POWER SYSTEMS

Your margin of safety to insure continuous high quality power even in the event of any utility line or generator power fluctuation or failure. ACDCo's UPS systems are designed to provide full output capacity even under "brownout" conditions where voltage reductions as severe as 15% are encountered. The reserve (battery back-up) for power outages is not diminished by extended operation in brownout conditions.

The use of power transistors rather than SCR's in the inverter greatly reduces the susceptibility to transients which can be present on power lines due to faults, switchovers, lightning and other factors. These transients usually cause the problems that the UPS was intended to protect. If the inverter can malfunction as a result of the transient, then the expected protection is absent when it is most needed.



U34-1

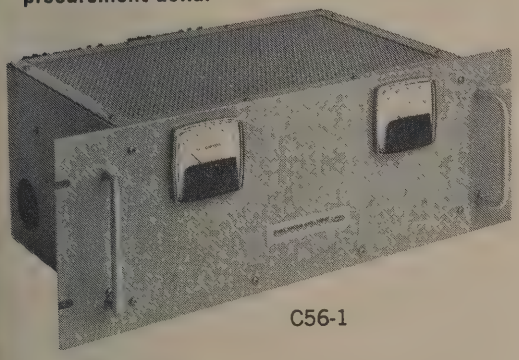
**Typical UPS Model U34-1** is used to power a critical liquid hydrogen temperature control system at a major government research nuclear reactor.

### DESIGN FEATURES

- **Ruggedized construction**
- **Easy servicing**
- **Plug-in Transistors and I/C's**
- **Removable P/C Boards**
- **Optimized design to provide maximum value for the procurement dollar**

| VA Rating | 36VA | 72VA | 125VA | 250VA | 500VA | 1KVA | 1.75KVA | 2.5KVA | 3.75KVA | 5KVA |
|---|---|---|---|---|---|---|---|---|---|---|
| Model No. | U14-1 | U24-1 | U34-1 | U44-1 | U54-1 | U64-1 | U64-2 | U74-1<br>U76-1 | U74-2<br>U76-2 | U84-1<br>U86-1 |

Three phase models also available from 100VA to 1500VA.
Typical specifications relate to those of static inverters.

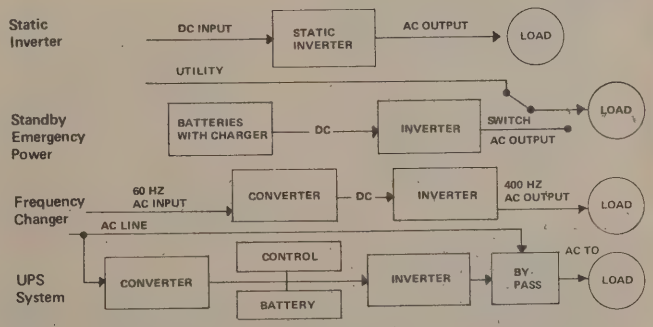


C56-1

### SPECIAL POWER SYSTEMS BULLETIN

Ask for our power systems outline discussion in which ACDCo answers many outstanding questions of systems configuration.

### ACDCo POWER SYSTEMS FUNCTIONAL DIAGRAMS




### AC TO AC FREQUENCY CONVERTERS

Available in eight power sizes from 36VA to 5000VA plus three phase up to 15 KVA. Power frequencies changed from: 50 to 60 Hz, 60 to 50 Hz, 50 to 400 Hz, and 60 to 400 Hz.

Options available for laboratory applications include metering, front panel controls, etc.

### WIND DRIVEN SYSTEMS

ACDCo designs and manufactures the electronic control, regulation, and power subsystems for "modern" power conversion from this "ancient" energy source.

## ADVANCE CONVERSION DEVICES COMPANY

109 EIGHTH STREET PASSAIC, NEW JERSEY 07055 Phone (201) 778-0707 ACDCo

# stay up to date

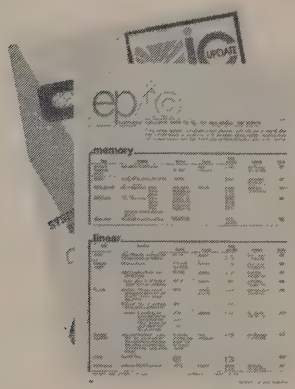
**SUBSCRIBE TO ELECTRONIC PRODUCTS MAGAZINE. IT'S YOUR *COMPLETE* GUIDE TO EVERYTHING THAT'S NEW IN THE FAST-CHANGING WORLD OF ELECTRONIC PRODUCTS AND SYSTEMS.**

**FEATURE STORIES** every month on electronic products, applications and availability.

**FORUMS**—Reports on meetings of manufacturers, users and distributors. Get the very latest news on a wide variety of products.

**NEW PRODUCT NEWS**—Hundreds of new products are introduced each month. You'll get the facts on not only what the new product is, but also where to get it, basic prices and current delivery.

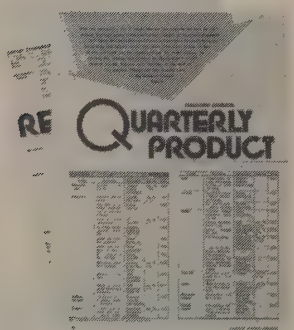
**EP/IC UPDATE**—Exclusive in ELECTRONIC PRODUCTS. A monthly report on *everything* that's new in the fast-moving world of integrated circuits.



**QUARTERLY PRODUCT REVIEW**—Another exclusive in ELECTRONIC PRODUCTS. A complete report of *every* new electronic product introduced in the previous quarter. This feature is in the January, April, July and October issues.

**QUARTERLY PRODUCT PLANNING DIRECTORY**—A compilation of the latest catalogs of a wide variety of electronic products and systems.

**OUTLOOK**—Important industry news affecting electronic products and systems.




**COMPONENT CAPERS**—A humorous look at the strange and wonderful world of electronics.

**MINI-GLOSSARIES,** Quizzes and more—Each and every month for over twenty years the readers of ELECTRONIC PRODUCTS learn something new about the products they work with and specify.

***If you are not now a subscriber, write to:***
***Dorothy Renoud, ELECTRONIC PRODUCTS MAGAZINE, 645 Stewart Avenue, Garden City, NY 11530.***
***Ask for a free qualification card.***

United Technical Publications, Inc., Div. of Cox Broadcasting Corp., 645 Stewart Ave., Garden City, NY 11530/(516) 222-2500

**INVERTERS, VIBRATORS, "A" ELIMINATORS, ETC.**

# ATR ELECTRONICS, INC.

MANUFACTURERS OF QUALITY PRODUCTS SINCE 1931
(612) 222-3791 • 300 East Fourth St., St. Paul, Minnesota 55101

**ALL ATR INVERTERS LISTED ARE FREQUENCY STABLE AND HAVE AUTOMATIC FREQUENCY CONTROL**

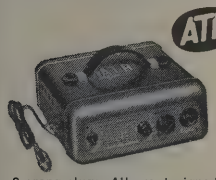
## DC TO AC UNIVERSAL INVERTERS

*Frequency Stable with Automatic Frequency Control.*

**New, universal inverters for operating 110V, 60 cycle AC equipment from DC voltages in autos, buses, trucks, boats, trains, planes and DC districts. Designed especially for standard 110 VAC tape recorders, TV sets, radios, PA systems, electric razors, test equipment, etc.** Units are carefully engineered and ruggedly constructed to provide long life operation. All feature complete RF interference suppression and exceptional frequency stability. Have operating efficiency in excess of 75%. Four-point voltage regulator corrects output voltage for minimum and maximum loads, and also helps compensate for input voltages lower or higher than normal. Inverters are recommended for use with loads having power factors in excess of 70%. Built-in toggle switch selects most efficient operation for use with TV sets or tape recorders. Inverters are not recommended for use with large motor driven appliances such as refrigerators, washing machines, etc. All have On-Off switches. Housed in attractive brown hammerloid metal cabinet with convenient leather carrying strap. Sizes: Standard Model RSF, 8½x9⅞x5¼"; Heavy-Duty Model RHG, 6⅞x11¼x 8½"; Extra-Heavy-Duty Model HSJ, 6½x12⅞x8¼". With battery cables for instant connection to power source. Models with "P" suffix equipped with adapter cord for use in auto cigarette lighter receptacles.

| Mfr's Type | DC Input (Volts) | AC Output 60 Cycles (Volts) | Output Wattage Int. | Output Wattage Cont. | Shipping Wt. (Lbs.) | Net Price |
|---|---|---|---|---|---|---|
| 12U-RSF | 12 | 110 | 175 | 150 | 22 | **$92.51** |
| 12U-RSF-P | 12 | 110 | 175 | 150 | 22 | **92.51** |
| 12U-RHG | 12 | 110 | 275 | 250 | 27 | **116.46** |
| 12U-HSJ | 12 | 110 | 300 | 275 | 37 | **156.99** |
| *28U-RSF | 28 | 110 | 125 | 100 | 22 | **120.69** |
| *28U-RHG | 28 | 110 | 175 | 150 | 27 | **151.50** |
| *28U-HSJ | 28 | 110 | 250 | 200 | 37 | **188.09** |
| 32U-RSF | 32 | 110 | 150 | 100 | 22 | **120.69** |
| 32U-RHG | 32 | 110 | 200 | 180 | 30 | **151.50** |
| 32U-HSJ | 32 | 110 | 325 | 225 | 37 | **188.09** |
| 50U-RSF | 50 | 110 | 150 | 100 | 22 | **120.69** |
| 50U-RHG | 50 | 110 | 225 | 200 | 27 | **163.36** |
| 110U-RSF | 110 | 110 | 250 | 150 | 22 | **96.13** |
| 110AU-RHG | 110 | 110 | 325 | 250 | 27 | **137.75** |
| 110BU-RHG | 110 | 110 | 450 | 350 | 30 | **163.36** |
| 110U-HSJ | 110 | 110 | 600 | 400 | 37 | **179.43** |
| 220U-RSF | 220 | 110 | 250 | 150 | 22 | **116.46** |
| 220U-RHG | 220 | 110 | 325 | 250 | 27 | **163.36** |
| 220U-HSJ | 220 | 110 | 500 | 300 | 37 | **188.09** |

*Recommended for 24V battery operation. **Before ordering, check wattage of equipment with which inverter will be used.**



## PORTABLE PLUG-IN TYPE INVERTERS — DC TO AC

*Frequency Stable with Automatic Frequency Control.*

**Specially Designed for Operating Standard AC Dictating Machines, Record Players, Incandescent Lamps, Electric Razors, Electronic Test Equipment, and other Small Electrical and Electronic Devices from DC Voltages in Automobiles, Buses, Trucks, Boats, Planes, Trains, and DC Districts.**
Lightweight inverters for operating 110 VAC equipment from DC voltage sources. Feature excellent frequency stability and high efficiency. 12V units plug into cigarette lighter receptacle of any vehicle; others are equipped with standard 2-prong plugs. All are designed especially for use with dictating machines; record players, electric razors, test equipment, etc. Not recommended for large tape recorders and motor driven appliances such as refrigerators, washing machines, etc. Brown Hammerloid case with leather carrying strap. Sizes: DME, 5¼x4¾x2¾"; RME & RMF, 8⅜x8x3¾".

| Mfr's Type | DC Input (Volts) | AC Output 60 Cycles (Volts) | Output Wattage Int. | Output Wattage Cont. | Shipping Wt. (Lbs.) | Net Price |
|---|---|---|---|---|---|---|
| 12-DME | 12 | 110 | 60 | 40 | 5 | **$30.47** |
| †12T-RME-1 | 12 | 110 | 125 | 110 | 14 | **63.21** |
| *28-RME | 28 | 110 | 100 | 80 | 12 | **79.78** |
| 32-RME | 32 | 110 | 100 | 80 | 12 | **79.78** |
| 110-RME | 110 | 110 | 150 | 100 | 12 | **76.53** |
| 220-RME | 220 | 110 | 150 | 100 | 12 | **79.78** |

*Recommended for 24V operation. **Check wattage rating of equipment before ordering. RME Model Inverters equipped with voltage regulator.**
†**This Inverter specially designed and recommended also for use with portable TV set.**

## ± SOLID STATE INVERTERS — DC TO AC

*Frequency Stable with Automatic Frequency Control.*

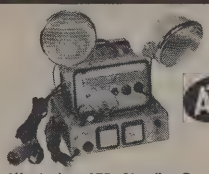
**Specially Designed to Provide 117V 60 Cycle AC Power for the Operation of Tape Recorders, VTR Equipment, Public Address Systems, TV Sets, Ham Gear, Small Portable Tools and Appliances, Test Instruments, Closed Circuit TV, Scientific Laboratory and Hospital Equipment, Small AC-DC Universal Motors, Fluorescent and Incandescent Lamps from 12 VDC Storage Battery Power in Automobiles, Buses, Trucks, Campers, Motor Homes, Boats, and Aircraft.**
ATR SOLID STATE Inverters are Universal Type Inverters recommended for the applications as listed above plus hundreds more! These Inverters are very well filtered and feature quick starting, frequency stability with varying load and input voltage, rugged heavy-duty construction, reverse polarity protection, and built-in power factor corrector utilizing a simple toggle switch. With ATR Inverters, the need for special equipment is eliminated. They are designed for quiet, long-life operation at high efficiency and maximum reliability. All models indicated here are equipped with heavy duty power transistors and plug-in oscillator for automatic frequency control. These Inverters also come equipped with four-point voltage regulators which make possible the correct output voltage for minimum to maximum loads and also help compensate for input voltages which are lower or higher than normal. The operating efficiency is approximately 80%. To figure approximate current consumption from storage battery, divide the rated input wattage of the load being operated by the storage battery voltage, and further divide this answer by .80 which will give the approximate current consumption from the battery based on the actual load being operated. These Inverters are recommended primarily for use with loads having power factors in excess of 70%. **Inverters come complete with battery cables ready for operation.**

| Mfr's Type | DC Input (Volts) | AC Output 60 Cycles (Volts) | Output Wattage Int. | Output Wattage Cont. | Shipping Wt. (Lbs.) | Net Price |
|---|---|---|---|---|---|---|
| 12U-S3A | 12 | 117 | 325 | 300 | 17 | **$168.78** |
| *12U-S3A-P | 12 | 117 | 325 | 300 | 17 | **168.78** |
| 12U-S5G | 12 | 117 | 600 | 550 | 27 | **276.19** |
| 12U-S6M | 12 | 117 | 700 | 650 | 36 | **320.35** |
| 12U-S9M | 12 | 117 | 1000 | 900 | 37 | **369.75** |

*"-P" model is equipped with cigarette lighter cord set to plug into dash receptacle. Caution — Do not load beyond 150 watts due to possible damage to cigarette receptacle wiring.
±**Inverters equipped with Solid State Oscillator.**
Dimensions of Model 12U-S3A, 11x9x4". Dimensions of Model 12U-S5G, 11x9¾x5¼". Dimensions of Model 12U-S6M or 12U-S9M, 11x11¼x6¾".

**All ATR Inverters are housed in attractively finished brown-hammerloid metal cabinets and are complete with battery cables ready for operation.**

**Note Carefully: ATR Inverters are not recommended for the operation of refrigerators, washing machines, or similar motor-driven appliances; also, ATR Inverters are not recommended for operating toasters, electric irons, sun lamps, or similar appliances of high wattage or low power factor. Any attempt to use the Inverter for applications not recommended will ruin the Inverter immediately and void the guarantee.**



## STANDBY POWER SYSTEMS FOR EMERGENCY LIGHTING AND POWER

**Illustrates ATR Standby Power System complete with lamps, automatic crossover, and battery charger.**
Completely Automatic Standby Power Units specially designed to permit the instantaneous continued operation of critical lighting equipment, PA systems, amplifiers, intercom systems, burglar alarms, fire alarms, synchronous electric clocks, electric time and recording clocks, incubators, gas valves, telephone and test equipment, and similar critical devices in the event of 115 volt AC commercial power line failure. For use: In hospitals, banks, hotels, theatres, factories, office buildings, schools, homes and other areas of operation.

| Type | Storage Battery Input (Volts) | AC Output 60 Cyc. (Volts) | Output Wattage Int. | Output Wattage Cont. | Shipping Wt. (lbs.) | Net Price Without Lamps |
|---|---|---|---|---|---|---|
| ‡1232-ETS | 12 | 110 | 175 | 150 | 38 | **$322.40** |
| ‡1233-ETH | 12 | 110 | 275 | 250 | 43 | **346.36** |
| ‡1234-ETJ | 12 | 110 | 300 | 275 | 53 | **386.85** |
| †1235-S3A | 12 | 110 | 325 | 300 | 33 | **398.68** |
| †1236-S5G | 12 | 110 | 600 | 550 | 43 | **506.08** |
| †1237-S6M | 12 | 110 | 700 | 650 | 50 | **556.29** |

†Solid State type. ‡Vibrator type.
For Units with Lamps add **$49.61** additional Net.

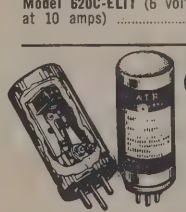
All Models designated above are housed in attractively finished brown-hammerloid metal cabinets. Dimensions of all Models **without lamps** are as follows: ETS, 11"Wx11¾"Dx9"H; ETH, 11"Wx11¾"Dx 11"H; ETJ, 11"Wx13"Dx12½"H;S3A, 11"Wx11¾"Dx 7¾"H; S5G, 11"Wx11¾"Dx9"H: S6M, 11"Wx11¾"D x11"H. For units with Lamps, change W to 16" and add 7½" to H; also increase shipping weight by 5 lbs.

## SHAV-PAKS

Every man should have this lightweight ATR Inverter in his car for that "Keep Clean-Shaved Look." Will operate standard AC electric shavers and other small electrical devices from your car or boat. Complete with 3 ft. cord set. Plugs into cigarette lighter receptacle. Fuse protected, rugged construction, and attractively housed in grey hammerloid-finish steel case. Input: 12 VDC. Output: 110 VAC. 60 cycles, 15-25 watts. Size: 4x2⅝x2¾". Ship. wt., 2½ lbs.
**Model 12-SPB** ..... Net **$22.75**

## BATTERY ELIMINATOR & CHARGER

**For Demonstrating and Testing Transistor or Vibrator-Type Auto Radios. Ideal as a Power Supply for Model Railroad Trains, Radio Sets, Electro Plating Outfits, and other 6 or 12 VDC Equipment. May also be used as a Battery Charger.** Designed for testing DC electrical apparatus on regular 110 VAC lines — equipped with full-wave solid state rectifier, assuring noiseless, interference-free operation. Fully automatic and fool-proof; has voltmeter, ammeter, and 8-position voltage control. Fuse protected and housed in heavy gauge brown hammerloid-finish metal case. 6 ft. cord set included. Size: Model 610C-ELIF, 6½x8⅛x 8½", ship. wt., 22 lbs.; Model 620C-ELIT, 6½x12⅞x 8½", ship. wt., 33 lbs.
**Model 610C-ELIF** (6 volt at 10 amps or 12 volt at 6 amps) ..... Net **$90.75**
**Model 620C-ELIT** (6 volt at 20 amps or 12 volt at 10 amps) ..... Net **120.70**



## VIBRATORS

**For All Auto Radio Sets Since 1954 Use One of the ATR Vibrators Listed Below.**

**ATR Vibrators Feature:** Ceramic Stack Spacers with two-bolt stack construction. Instant Starting—as a result of highly efficient magnetic circuit with formed base for more uniform operation on both high and low voltages. Large Oversize Tungsten Contacts having Full Wiping Action — for greater reliability and longer life. Perforated Reed of Highest Quality Swedish Spring Steel. Highest Precision Construction and Workmanship.

Ship. Wt., ½ lb.
**ATR No. 1400** (Bulk), 4 Prong, 6 Volt. Net **$5.95**
**ATR No. 1843** (Bulk), 3 Prong, 12 Volt. Net **5.95**
**ATR No. 1840** (Bulk), 4 Prong, 12 Volt. Net **5.95**

**Vibrators: ATR manufactures many different styles and types of light-duty and heavy-duty vibrators. If you have a requirement, give all available information including manufacturer and vibrator type number and then request availability and price information.**

POWER CONVERSION FROM A² AVIONIC INSTRUMENTS, INC.

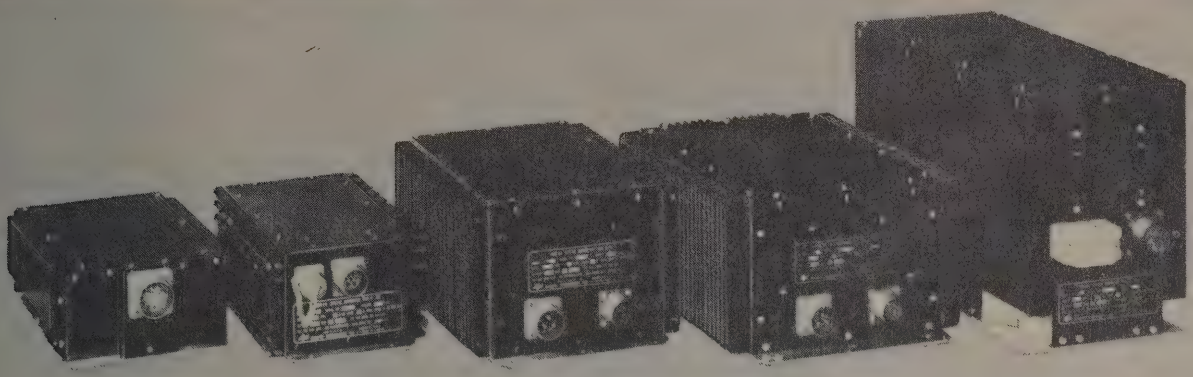
# if you're a weight watcher,

# yet hungry for power...

...here's good news from THE INVERTER PEOPLE

POWER CONVERSION FROM AVIONIC INSTRUMENTS, INC.

# Lightweight conversion for all 50 Hz – 60 Hz – 400 Hz applications



350VA rating | 250VA rating | 700VA rating | 1000VA rating | 2500VA rating

## DESIGN FEATURES

- 15 lbs. per KVA all frequencies.
- Fast response — high frequency switching.
- Non-standard frequencies available.
- Meet FAA/MIL specs where applicable.
- Solid-state — cool efficient operation.

PHONE: MAIN OFC. — (201) 388-3500 • DALLAS OFC. — (214) 242-0811

CONTINUED▶

POWER CONVERSION FROM AVIONIC INSTRUMENTS, IN

# Precise Power

## for a multitude of demanding applications

**AIRBORNE**
Avionics
Flight Test Systems
50/60 Hz Appliances
Air Ambulances

**MARINE**
Communications
Navigation
Hydrofoil Stabilization
Radar

**GROUND**
UPS
Telecommunications
Bench Power
Computer

**MOBILE**
Portable Shelters
Fire Control
Direction Finding
Terminals

**AEROSPACE**
Guidance Systems
Surveillance
Telemetry
Skylab

**POWER CONVERSION FROM AVIONIC INSTRUMENTS, INC.**

# DC TO AC STATIC INVERTERS

## 50-60-400 Hz • 100VA to 10kVA • 1ø / 3ø

### GENERAL SPECIFICATIONS

| | |
|---|---|
| INPUT VOLTAGE(s) | 20-37 VDC, 100-140 VDC |
| OUTPUT VOLTAGE | Sine Wave 26/115/203 VAC RMS ±1%<br>No Load to Full Load |
| OUTPUT FREQUENCY | 50, 60, 400; ±1%<br>Non-Standard Frequencies Available |
| EFFICIENCY | 75%-85% |
| HARMONIC DISTORTION | 3% THD |
| LOAD POWER FACTOR | .7 Lead to .7 Lag |
| MOUNTING | Rack or Hard Mount |
| OPERATING TEMPERATURE RANGE | −55°C to +71°C |
| FAULT CLEARANCE CAPABILITY | Up to 160% Rated Current |
| PROTECTIVE CIRCUITRY | Output Overvoltage and Under Frequency<br>Thermal Overheat |

# FREQUENCY CONVERTERS

## AC TO AC • 50-60-400 Hz • Up to 10kVA
## 1ø / 3ø • UPS APPLICATIONS

### GENERAL SPECIFICATIONS

| | |
|---|---|
| INPUT VOLTAGE(s) | 115 VAC, 115/208 VAC RMS |
| INPUT FREQUENCY | 47 to 65 Hz/380 to 420 Hz |
| OUTPUT VOLTAGE(s) | Sine Wave 120/208 VAC RMS (60 Hz/400 Hz)<br>220/380 VAC RMS (50 Hz) |
| OUTPUT FREQUENCY | 50, 60, 400 Hz;<br>Non-Standard Frequencies Available |
| LOAD POWER FACTOR | .7 Lead to .7 Lag<br>(Not damaged by any power factor) |
| EFFICIENCY | 75% Minimum |
| PACKAGING | Standard 19″ Rack or Hard Mount |
| METERS | Voltmeter, Ammeter, Frequency Meter,<br>Available as Options |

**PHONE:**
**MAIN OFC. —**
**(201) 388-3500**
**DALLAS OFC. —**
**(214) 242-0811**

**THE INVERTER PEOPLE**

**AVIONIC INSTRUMENTS INC.** Dept. E, 943 East Hazelwood Ave., Rahway, NJ (U.S.A.) 07065

*International Sales:* REA International Limited, 937 East Hazelwood Ave., Rahway, N.J. 07065 • Tel: (201) 382-7100 Telex: 884-413
*European Inverter Center:* REA International Europe B.V. Hangar 7, Schiphol-Oost The Netherlands • Tel: 020-473334 Telex: 13451

AVTEL

# FREQUENCY CONVERTERS
## 1 KA to 75 KVA SINE WAVE
## 50/60 Hz to 400 Hz

Unitron

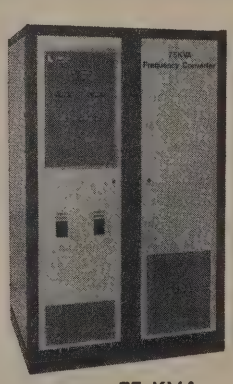
### GENERAL SPECIFICATIONS

| POWER RATING | INPUT PHASE & VOLTAGE | OUTPUT PHASE & VOLTAGE |
|---|---|---|
| 1.0 KVA | 1φ 115 VRMS | 1φ * 115 VRMS |
| 2.0 KVA | 3φ 115/200 VRMS | 1φ 115 VRMS |
| 2.5 KVA | 3φ 115/200 VRMS | 3φ * 115/200 VRMS |
| 3.5 KVA | 3φ 115/200 VRMS | 1φ 115 VRMS |
| 5.0 KVA | 3φ 115/200 VRMS | 3φ * 115/200 VRMS |
| 7.5 KVA | 3φ 115/200 VRMS | 3φ * 115/200 VRMS |
| 10.0 KVA | 3φ 115/200 VRMS | 3φ * 115/200 VRMS |
| 12.0 KVA | 3φ 115/200 VRMS | 3φ * 115/200 VRMS |
| 15.0 KVA | 3φ 115/200 VRMS | 3φ * 115/200 VRMS |
| 75.0 KVA | 3φ * 115/200 VRMS | 3φ * 115/200 VRMS |

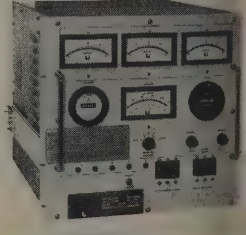
* Available in other standard voltages

Unitron has supplied its products and services to meet the requirements of virtually every type of power application existing in todays world of modern technology, from commercial applications to the most exacting military requirements.

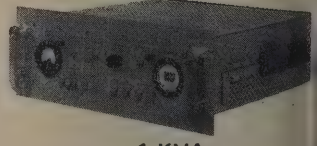
FEATURES:
- MIL SPECIFICATIONS (Standard power)
- FEDERAL & NATIONAL STOCK LISTED
- LIGHT WEIGHT
- RFI PROTECTION
- HIGH EFFICIENCY
- LOW DISTORTION
- LOW AUDIO NOISE
- LONG MAINTENANCE FREE OPERATION
- SHORT CIRCUIT & OVERLOAD PROTECTION



75 KVA



5.0 KVA



1 KVA

APPLICATIONS:
SHIPBOARD ■ SHELTERS ■ GROUND SUPPORT ■ SIMULATORS ■ AVIONICS TEST & REPAIR ■ LABORATORIES ■ Wherever precision power is required.

**Unitron Incorporated**
2826 West Kingsley Road • Garland, Texas 75041 • P.O. Box 2159 • 214/271-4531 • TELEX 73-0644

AVTEL

# FREQUENCY CONVERTERS
## 400 to 8000 VA SINE WAVE
# 400 Hz to 60*Hz

Unitron

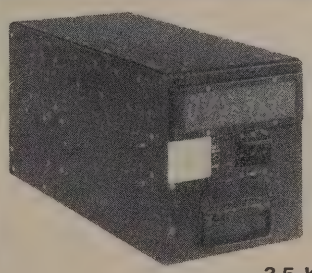
## GENERAL SPECIFICATIONS

| POWER RATING | INPUT PHASE | INPUT VOLTAGE | OUTPUT PHASE | OUTPUT VOLTAGE |
|---|---|---|---|---|
| 400 VA | 3φ | 115/200 VRMS | 1φ | 115 VRMS |
| 750 VA | 3φ | 115/200 VRMS | 1φ | 115 VRMS |
| * 2000 VA | 3φ | 115/200 VRMS | 1φ | 115 VRMS |
| * 3500 VA | 3φ | 115/200 VRMS | 1φ | 115 VRMS |
| 8000 VA | 3φ | 115/200 VRMS | 1φ | 115 VRMS |

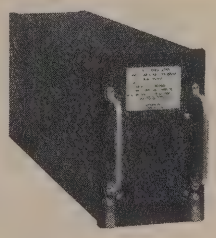
*** Available in 50 Hz output**

ITRON IS THE LEADING MFG. OF 400 TO 60 Hz FREQUENCY CONVERTERS, WITH **EXPERIENCE CEEDING 18,000,000 HOURS OF FIELD OPERATION** IN AIRBORNE ☐ SHIPBOARD ☐ TRANSPORTABLE ELTERS & GROUND POWER ENVIRONMENTS.

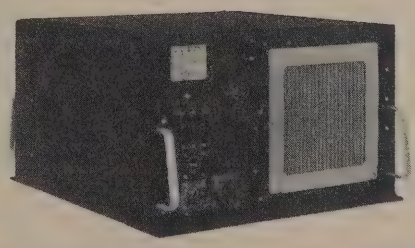
EATURES:
- MIL SPECIFICATIONS (Standard power)
- FEDERAL & NATIONAL STOCK LISTED
- LIGHT WEIGHT
- LOW DISTORTION
- PRECISE FREQUENCY
- FULLY PROTECTED
- SINE WAVE OUTPUT
- HIGH EFFICIENCY
- LOW AUDIO NOISE
- SELF COOLED
- LONG MAINTENANCE FREE OPERATION
- 2000 + NOW IN AIRBORNE OPERATION
- HIGH RELIABILITY
- LOW COST



3.5 KVA



400 VA



8.0 KVA

PPLICATIONS: AIRBORNE ■ COMPUTERS ■ VIDEO SYS. ■ TELETYPE ■ CONVENIENCE ITEMS ■ OVIE PROJECTOR ■ RECORDERS ■ TRASH COMPACTORS ■ TEST EQUIPMENT ■ DATA ACQUISTION ■ TC. ■ SHIPBOARD ■ GROUND & AIR TRANSPORTABLE SHELTERS ■ FLYING LABORATORIES ■ MED– AL EVACUATION ■ THERMAL BLANKETS ■ EKG'S ■ BREATHING APPARATUS ■ LIFE SUPPORT ■

**Unitron Incorporated**
2826 West Kingsley Road • Garland, Texas 75041 • P.O. Box 2159 • 214/271-4531 • TELEX 73-0644

AVTEL

## STATIC INVERTERS
## 250 to 3600 VA SINE WAVE
# 28 VDC to 60 Hz

Unitron

GENERAL SPECIFICATIONS

| POWER RATING | INPUT VOLTAGE | OUTPUT PHASE | OUTPUT VOLTAGE |
|---|---|---|---|
| 250 VA | 24–32 VDC | 1φ | 115 VRMS |
| 500 VA | 24–32 VDC | 1φ | 115 VRMS |
| 2000 VA | 24–32 VDC | 1φ | 115 VRMS |

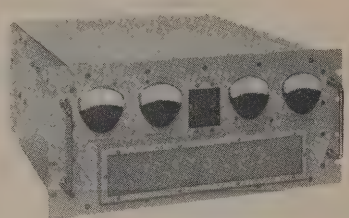
APPLICATIONS:

AIRBORNE ☐ SHIPBOARD ☐ MOBILE ☐ FLYING LABORATORIES ☐ MEDICAL EVACUATION

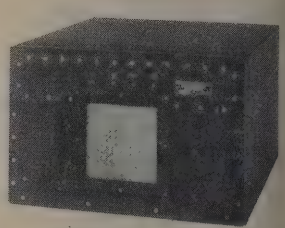
These instruments provide an excellent source of 60 Hz power for cryptographic machines—teletypes—recorders and various test equipment.

FEATURES:

- MIL SPECIFICATIONS
- FEDERAL & NATIONAL STOCK LISTED
- HIGH EFFICIENCY
- LOW DISTORTION
- FULLY PROTECTED
- RFI PROTECTION
- LOW AUDIO NOISE
- LONG MAINTENANCE FREE OPERATION



2000 VA



3600 VA

AVTEL

## STATIC INVERTERS
## 125 to 3000 VA SINE WAVE OUTPUT
# 28 VDC to 400 Hz

Unitron

GENERAL SPECIFICATIONS

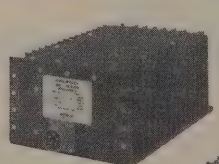
| POWER RATING | INPUT VOLTAGE | OUTPUT PHASE | OUTPUT VOLTAGE |
|---|---|---|---|
| 125 VA | 24–32 VDC | 1φ | 115 VRMS |
| 250 VA | 24–32 VDC | 1φ | 115 VRMS |
| 500 VA | 24–32 VDC | 1φ | 115 VRMS |
| 750 VA | 24–32 VDC | 3φ | 115 VRMS |

APPLICATIONS:

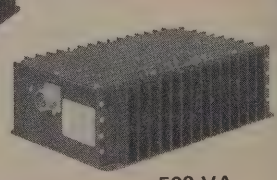
AIRBORNE ☐ SHIPBOARD ☐ MOBILE ☐ Wherever 400 Hz is required from dc buss.

FEATURES:

- MIL SPECIFICATIONS (Standard power)
- FEDERAL & NATIONAL STOCK LISTED
- HIGH EFFICIENCY
- LOW AUDIO NOISE
- LOW DISTORTION
- RFI PROTECTION
- STABLE OUTPUT VOLTAGE & FREQUENCY
- LIGHT WEIGHT
- FULLY PROTECTED
- LONG MAINTENANCE FREE OPERATION



250 VA



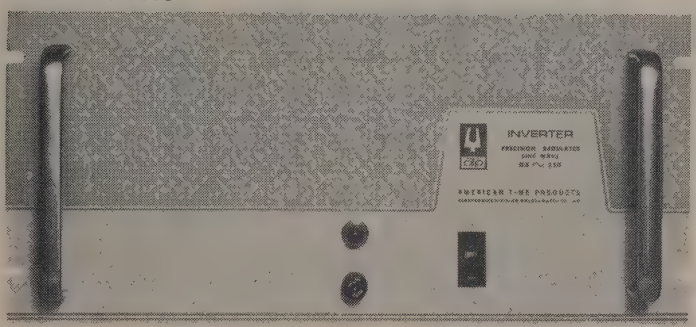
500 VA

750 VA

**Unitron Incorporated**
2826 West Kingsley Road • Garland, Texas 75041 • P.O. Box 2159 • 214/271-4531 • TELEX 73-0644

# BULOVA® Inverters and Frequency Changers

## INVERTERS




(Meters optional)

| Model | Input VDC | Output VA | Output Freq. Hz | Output Volt | Wt. Lbs. (2) | Dimensions (For 19" Rack) H | Dimensions (For 19" Rack) D |
|---|---|---|---|---|---|---|---|
| DA-100S | 22-30 | 100 | 50 or 60 | 115(1) | 65 | 5¼" | 13" |
| DA-250S | 22-30 | 250 | 50 or 60 | 115(1) | 70 | 8¾" | 13" |
| DA-500S | 22-30 | 500 | 50 or 60 | 115(1) | 130 | 10½" | 15" |

(1) 230 Volt Available (2) For 50 Hz, add about 5 lbs.

## FREQUENCY CHANGERS

(Meters optional)

| Model | Input VAC. ±10% | Input Freq. Hz | Output VA | Output Freq. Hz | Output Volt | Wt. Lbs. (2) | Dimensions (For 19" Rack) H | Dimensions (For 19" Rack) D |
|---|---|---|---|---|---|---|---|---|
| ADA-100S | 115/230 | 45-65 | 100 | 50 or 60 | 115 | 75 | 5¼" | 13" |
| ADA-250S | 115/230 | 45-65 | 250 | 50 or 60 | 115 (1) | 80 | 8¾" | 13" |
| ADA-500S | 115/230 | 45-65 | 500 | 50 or 60 | 115 | 130 | 10½" | 15" |

(1) 230 Volt Available (2) For 50 Hz, add about 5 lbs.

**Features:**

- Up to 500–VA Output
- Fully Regulated Sine Wave
- All Solid-State
- Protected Input/Output

**Performance Specifications:**

**OUTPUT:**

**Frequency Output:** 50 or 60 Hz, standard; other specific frequency, custom

**Frequency Regulation:** ±1%, ±.1%, ±.015%, ±.005% or better.

**Temperature Range:** 0° C to + 50° C

**Wave Shape:** Sine Wave, 3% Distortion max.

**Output Voltage:** 115 or 230V AC nominal

**Voltage Regulation:** ± 1% any combination of full line and load change

**INPUT:**

115V AC or 230V AC, ±10%, 45 to 65 Hz; or 22 to 30V DC

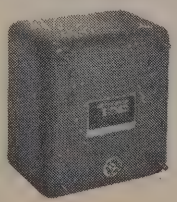
**Applications:**

Ideally suited for synchronous motor drives, chronographs, stroboscopes, generator frequency control; running timers, clock and time-of-day systems, tape recorders, general laboratory use.

## 5VA INVERTER — PRECISION FREQUENCY

Model DA5S

Standard 115 V 60 Hz, available at any fixed frequency from 50 to 400 Hz



- Accuracy to ±.0002%
- Sine Wave, max. THD 5%
- Input 28V DC ± 4V

Size: 4½" x 5" x 3¼"
Weight: 3 lbs. approx.

**BULOVA**
ELECTRONICS DIVISION
OF BULOVA WATCH COMPANY, INC.
61-20 WOODSIDE AVENUE
WOODSIDE, N. Y. 11377 • 212 335-6000

AMERICAN TIME PRODUCTS

**NEED MORE INFO?**
*Call or Write for Full Spec Bulletin*

Behlman Engineering Corporation
P.O. BOX 4518 • 427 N. NOPAL STREET • SANTA BARBARA, CALIFORNIA 93103 • (805) 963-8691

# A.C. POWER

**FROM THE A.C. POWER SUPPLY PROBLEM SOLVERS**
**STANDARDS ■ SPECIALS ■ CUSTOM**

## A.C. POWER SUPPLY RATING COMPARISONS

The methods used in arriving at the ratings of A.C. Power Supplies vary greatly from manufacturer to manufacturer. There are no standards existing for the purpose of quick and valid comparisons and a certain amount of "Specsmanship" has been the result. This can easily lead to getting very much less for your power supply dollar than you are entitled to.

**THERE ARE SIX MAJOR AND VERY IMPORTANT CONSIDERATIONS TO TAKE INTO ACCOUNT WHEN LOOKING INTO THE NAMEPLATE RATINGS OF A.C. POWER SUPPLIES. THEY ARE:**

1. The Output Power or Voltampere (VA) Rating.
2. The Output Current Rating.
3. The Effect On The Supply Of Loads Having High Inrush or High Peak Recurrent Currents.
4. How The Ratings Are Affected By Low Input Line Voltages.
5. How The Ratings Are Affected By Low Power Factor Loads.
6. Is The Supply Fully Isolated, Both Input and Output, For Reasons Of Safety and Flexibility?

Please Contact Us For Additional Information Concerning A.C. Power Supply Rating Comparisons.

- ☐ Single, two and three phase outputs
- ☐ Up to 5000 VA per phase in 144 standard models
- ☐ Fixed or variable output frequencies, 45 Hz - 10 kHz
- ☐ Tight regulation vs. line and load changes
- ☐ Instant response time
- ☐ Low output distortion
- ☐ Full rated output into loads of any power factor
- ☐ Up to 150% of rated output with high power factor loads
- ☐ Instantaneous overload protection, automatic recover
- ☐ Complete transformer-couple isolation, input and output
- ☐ All silicon solid state, entirely new circuit concepts
- ☐ Smaller, lighter, simpler, less expensive, more reliable
- ☐ Can be used as linear power amplifier
- ☐ Complete line of plug-in oscillators
- ☐ Digital LED readout for frequency, volts and amperes
- ☐ Wide variety of options available

## SPECIFICATIONS

**INPUT VOLTAGE:** 115 VAC ± 10%, single phase. Units up to 750 VA output.

115/230 VAC ± 10%, single phase. 1000 to 1500 VA output. Three phase inputs available.

120/208 or 230 VAC ± 10%, three phase. Units over 1500 VA output.

**INPUT FREQUENCY:** 48-72 Hz

**EFFICIENCY:** 50-70%, depending on operating conditions.

Various input voltage, frequency and power options are available, many at no extra charge.

**OUTPUT VOLTAGE:** 0-130 for single phase and 0-130 line to neutral for 2 or 3 phase units. Other ranges or combinations of ranges available.

**LOAD REGULATION:** ± 0.5%. No load to full load. Adjustable through zero for specific loads.

**LINE REGULATION:** ± 0.1% for ± 10% line change.

**POWER FACTOR:** Full rated VA into any power factor loa down to zero, lead or lag.

**DISTORTION:** 0.5% max. harmonic distortion at frequen extremes. Less at mid-band.

**OVERLOAD AND FAULT PROTECTION:** Instantaneous, aut matic recovery short circuit and overload protection. Fa acting main circuit breaker for fault protection.

**METERING:** Output voltmeter. Digital readout optional.

**EXTERNAL INPUT:** Via optional plug-in. 9 volts RMS. 1 ohms input impedance.

**OPERATING TEMPERATURE:** 0° to 55°C.

**FRONT PANEL COLOR:** Dark grey, white lettering.

Some of the special options available include input power types, output voltage ranges or combinations of ranges, metering, digital LED readout for frequen volts, amperes and phase angle, higher and lower frequency outputs, higher and lower power outputs, physical configurations, paint colors, tigh regulation specifications, single to multi-phase output switching, etc. Completely special or custom units providing solutions to virtually any A.C. power supp problem can be furnished.

# Behlman Engineering Corporation

P.O. BOX 4518 • 427 N. NOPAL STREET • SANTA BARBARA, CALIFORNIA 93103 • (805) 963-8691

## 10/500 SERIES

The 10/500 series of AC Power Supplies are linear power amplifiers driven by plug-in oscillators. Fixed and variable frequency oscillators, with frequency accuracies to 0.001% and 0.1%, respectively, are available in a wide variety of standard models. An almost unlimited variety of oscillators with various degrees of accuracy and many special features can be provided.

For single phase power output a power amplifier is driven by a single phase oscillator. Two separate power amplifiers driven by a two phase oscillator and three separate power amplifiers driven by a three phase oscillator are used to provide two and three phase power outputs. Units are available capable of providing a choice of single or multi-phase output by means of a front panel mode selector switch.

The output power is transformer coupled and completely isolated. It can be left floating or one side grounded.

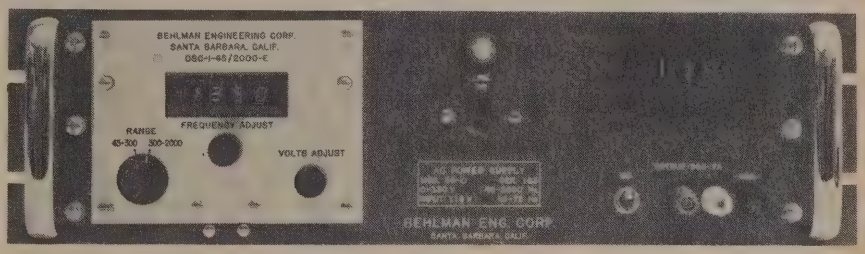
Line input to these units is via very advanced isolating magnetics.

These power supplies are capable of providing continuous full-rated volt-ampere output under worst case conditions, i.e., zero power factor loads either leading or lagging, 10% low line and output voltage at 75% of maximum. With unity power factor loads, nominal line and maximum output voltage, continuous duty at 150% of rating is permissible. The graph outlined below shows maximum power output for various conditions of load power factor output voltage, line voltage and ambient temperature. Even though these power supplies are rated under worst case conditions and in addition have a 50% overload capability they are nevertheless smaller, lighter and less expensive than other supplies whose ratings have been derived under considerably more favorable operating conditions.

Complete overload, short circuit and fault protection is provided by a combination of an instantaneous, automatic-recovery electronic protector plus a fast acting main circuit breaker.

## NEW from Behlman

**Model 50-C with Plug-In OSC-1-45/2000-E**




Digital readouts with LED's now available as an optional feature on all Behlman Engineering Corporation A.C. Power Sources, Plug-In Oscillators and URS. The digital display of Volts, Frequency in hertz (see price list), Amperes and Phase Angle in degrees may be obtained. Please call or write for additional details.

The graph to the right relates output power limits, expressed as a percentage of rated output, to various conditions of output voltage, load power factor, line voltage, ambient temperature and proximity to minimum frequency ratings.

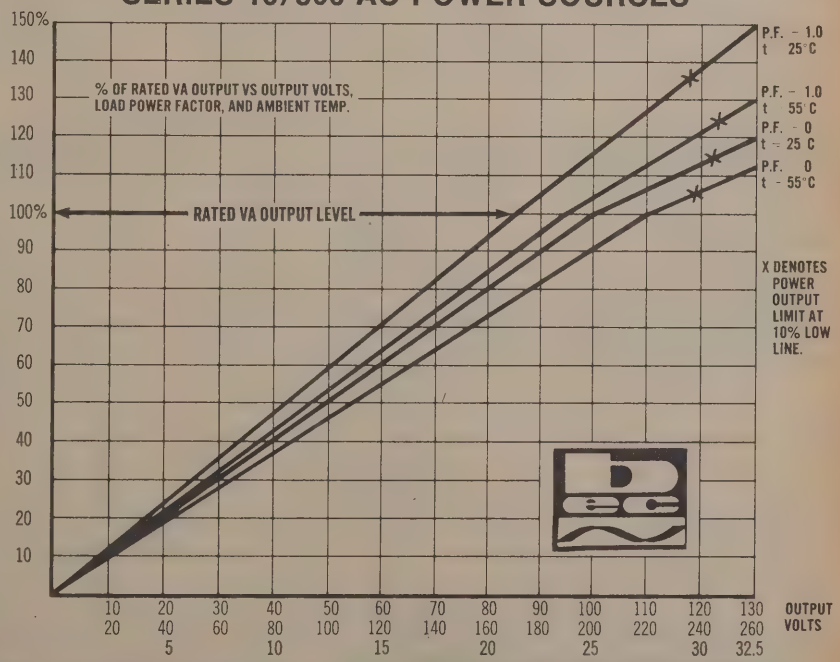
The output voltages shown are the three most popular ranges. Other voltage ranges are comparable on a pro-rata basis.

An important advantage, inherent in Behlman Engineering Corp. A.C. Power Sources, lies in the availability of power amplifiers in four separate output frequency ranges. The narrow band power supplies effect cost and weight savings that add to the already existing size, weight and cost advantages of our full frequency models.

Many AC power supplies require derating to half power in the 5 kHz to 10 kHz range. This derating is not required with the Behlman Engineering 10/500 series.

**This graph carries an important message: Don't buy an AC power supply without knowing how its ratings were determined.**

## SERIES 10/500 AC POWER SOURCES



Behlman Engineering Corporation
P.O. BOX 4518 • 427 N. NOPAL STREET • SANTA BARBARA, CALIFORNIA 93103 • (805) 963-8691

## SERIES 10/500 AC POWER SOURCES — MAIN FRAME AMPLIFIERS

TO ORDER: Use model number corresponding to output power level and number of phases required. Add letter corresponding to desired frequency range. All units are in rack mounting enclosure. Cabinet enclosed versions of any of these units are available. Order plug-in oscillator as listed below. For digital LED voltage readout in place of the analog voltmeter, add $85.00 to the prices listed below and designate with -D at the end of the model number. (Example, 3-10-C-D).

| OUTPUT POWER | MAXIMUM AMPERES (per phase 0-130 V.) | MODEL NUMBER | OUTPUT FREQUENCY RANGE (Hz) | | | | WEIGHT (lbs.) A MODELS | DIMENSIONS |
|---|---|---|---|---|---|---|---|---|
| | | | 150-2000 | 150-10,000 | 45-2000 | 45-10,000 | | |
| **SINGLE PHASE** | | | **A** | **B** | **C** | **D** | | |
| 100 VA | 1.2 | 10- | $ 640 | CONSULT FACTORY FOR PRICE AND DELIVERY | $ 675 | CONSULT FACTORY FOR PRICE AND DELIVERY | 26 | 5¼″Hx15″Dx19″W |
| 250 VA | 3.0 | 25- | 790 | | 830 | | 38 | 5¼″Hx15″Dx19″W |
| 350 VA | 4.2 | 35- | 885 | | 915 | | 50 | 5¼″Hx15″Dx19″W |
| 500 VA | 6.0 | 50- | 1135 | | 1195 | | 60 | 5¼″Hx19″Dx19″W |
| 750 VA | 9.0 | 75- | 1705 | | 1795 | | 65 | 5¼″Hx19″Dx19″W |
| 1000 VA | 12.0 | 100- | 2110 | | 2225 | | 95 | 8¾″Hx19″Dx19″W |
| 1500 VA | 18.0 | 150- | 2895 | | 3045 | | 120 | 14″Hx19″Dx19″W |
| 2000 VA | 24.0 | 200- | 3845 | | 4050 | | 135 | 14″Hx19″Dx19″W |
| 3000 VA | 36.0 | 300- | 5415 | | 5700 | | 180 | 21″Hx19″Dx19″W |
| 5000 VA | 60.0 | 500- | 7455 | | 7850 | | 300 | 29¾″Hx19″Dx19″W |
| **TWO PHASE *** | | | | | | | | |
| 200 VA | 1.2 | 2-10- | $ 1305 | | $ 1375 | | 42 | 5¼″Hx15″Dx19″W |
| 500 VA | 3.0 | 2-25- | 1610 | | 1695 | | 70 | 5¼″Hx19″Dx19″W |
| 700 VA | 4.2 | 2-35- | 1760 | | 1855 | | 80 | 7″Hx19″Dx19″W |
| 1000 VA | 6.0 | 2-50- | 2290 | | 2410 | | 105 | 8¾″Hx19″Dx19″W |
| 1500 VA | 9.0 | 2-75- | 3445 | | 3625 | | 130 | 14″Hx19″Dx19″W |
| 2000 VA | 12.0 | 2-100- | 4245 | | 4470 | | 140 | 14″Hx19″Dx19″W |
| 3000 VA | 18.0 | 2-150- | 5815 | | 6120 | | 185 | 21″Hx19″Dx19″W |
| 4000 VA | 24.0 | 2-200- | 7735 | | 8140 | | 210 | 21″Hx19″Dx19″W |
| 6000 VA | 36.0 | 2-300- | 10880 | | 11455 | | 300 | 28″Hx19″Dx19″W |
| 10000 VA | 60.0 | 2-500- | 14990 | | 15780 | | 500 | 45½″Hx19″Dx19″W |
| **THREE PHASE Y** | | | | | | | | |
| 300 VA | 1.2 | 3-10- | $ 1675 | | $ 1765 | | 42 | 5¼″Hx19″Dx19″W |
| 750 VA | 3.0 | 3-25- | 2185 | | 2300 | | 72 | 7″Hx19″Dx19″W |
| 1050 VA | 4.2 | 3-35- | 2910 | | 3065 | | 110 | 8¾″Hx19″Dx19″W |
| 1500 VA | 6.0 | 3-50- | 3510 | | 3695 | | 145 | 14″Hx19″Dx19″W |
| 2250 VA | 9.0 | 3-75- | 5175 | | 5450 | | 155 | 14″Hx19″Dx19″W |
| 3000 VA | 12.0 | 3-100- | 6330 | | 6665 | | 200 | 21″Hx19″Dx19″W |
| 4500 VA | 18.0 | 3-150- | 8460 | | 8905 | | 280 | 28″Hx19″Dx19″W |
| 6000 VA | 24.0 | 3-200- | 11248 | | 11840 | | 325 | 28″Hx19″Dx19″W |
| 9000 VA | 36.0 | 3-300- | 15830 | | 16665 | | 390 | 42″Hx19″Dx19″W |
| 15000 VA | 60.0 | 3-500- | 21375 | | 22500 | | 675 | 70″Hx19″Dx19″W |

* Also available with 3-phase Scott T output. Add "T" after "2" in model no. For example: 2T-35-.

## SERIES OSC PLUG-IN OSCILLATORS

The OSC series oscillators are designed to plug into the front panel of all Behlman Engineering Corporation AC Power Supplies. They are available in a wide variety of fixed and variable frequency outputs. Single, two and three phase models provide suitable drive signals for multi-phase supplies. These oscillators readily synchronize with external signals. In addition to the standard units shown below virtually any combination of fixed or variable frequencies to any practical degree of accuracy can be provided. Many special features, including provisions for external sync or drive, can be supplied.

| FIXED FREQUENCY | MODEL | FREQUENCY ACCURACY 1% | 0.5% | 0.25% | 0.1% | 0.01% | 0.001% |
|---|---|---|---|---|---|---|---|
| | | **E** | **F** | **G** | **H** | **J** | **K** |
| SINGLE PHASE | OSC-1-XXX*— | $ 95 | $110 | $130 | $155 | $330 | $485 |
| TWO PHASE | OSC-2-XXX*— | 170 | 190 | 210 | 235 | 395 | 555 |
| THREE PHASE T | OSC-2T-XXX*— | 180 | 200 | 220 | 245 | 410 | 475 |
| THREE PHASE Y | OSC-3-XXX*— | 195 | 220 | 240 | 265 | 445 | 585 |

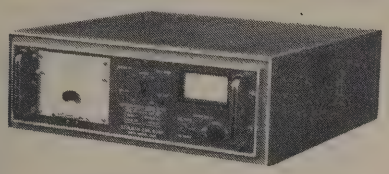
*Insert desired frequeny in place of XXX. Add code letter for desired frequency accuracy to model number.

| VARIABLE FREQUENCY | MODEL | | | | | |
|---|---|---|---|---|---|---|
| SINGLE PHASE | OSC-1-380/420— | $245 | $270 | $295 | $365 | "For digital LED frequency readout in place of the circular dial, add $125.00 to the variable frequency model prices and designate with OSCD in place of OSC in the model number." |
| | OSC-1-350/450— | 245 | 270 | 295 | | |
| | OSC-1-300/500— | 285 | 310 | 335 | | |
| | OSC-1-44/66— | 285 | 310 | 335 | | |
| | OSC-1-44/66—320/480— | 350 | 375 | 400 | | |
| | OSC-1-45/2000— | 360 | | | | |
| | OSC-1-150/2000— | 350 | | | | |
| | OSC-1-45/10000— | 410 | | | | |
| | OSC-1-150/10000— | 390 | | | | |
| TWO PHASE | -2- | ADD 25% TO SINGLE PHASE PRICE | | | | |
| THREE PHASE T | -2T- | ADD 30% TO SINGLE PHASE PRICE | | | | |
| THREE PHASE Y | -3- | ADD 35% TO SINGLE PHASE PRICE | | | | |
| EXTERNAL INPUT PLUG-IN | EIP-1 | $35 For one phase external input | | | | |
| | EIP-2, 2T | 45 For two phase external input | | | | |
| | EIP-3 | 60 For three phase external input | | | | |
| EXTERNAL SYNC | -SN | 35 May be added to all fixed or variable frequency oscillators | | | | |

# Behlman Engineering Corporation

P.O. BOX 4518 • 427 N. NOPAL STREET • SANTA BARBARA, CALIFORNIA 93103 • (805) 963-8691


## NINTERRUPTIBLE A.C. OWER OURCES



e UPS-10/500 Series of uninterruptible A.C. power sources e available in the same basic sizes and power ratings as the ries 10/500 standard line of A.C. Power Supplies. Battery ck-up power can be furnished by a variety of gelled or liquid ectrolyte storage batteries. The lower powered units (100- 0 VA) can be furnished with built-in gelled electrolyte bat- ies.

The photograph illustrates a Model UPS-25 with an output wer capability of 250 VA and a self-contained battery pack 15 minutes of standby operation.

These UPS systems are unique in that they are linear transistorized power amplifiers which inherently do not generate EMI or RFI either conducted or radiated and can have lower distortion (under ±0.5%), tighter regulation (under ±0.5%). In addition, they can be supplied as frequency changers with battery backup capabilities.

All of the UPS units include a battery charger, electromechanical or solid state bypass switch, appropriate indicating lights and power line failure alarm provisions. The output frequency of the UPS is phase locked to the input power line frequency under conditions of normal operation. In the event the A.C. power line fails, the UPS continues to furnish the load with A.C. power by operating from the battery bank. The output frequency of the UPS is then determined by the highly stable internal oscillator. During normal operation the load is supplied with power from the output of the UPS. Therefore, there is no switch overtime involved if input power is interrupted.

Battery banks can be furnished for relay rack mounting or to the customer's specific requirements. Battery interconnect cables are provided with all standard UPS configurations. Please call or write for additional details.

| OUTPUT POWER | MAXIMUM AMPERES (per phase) | MODEL NUMBER | | WEIGHT (lbs.) | DIMENSIONS** (Not incl. Batteries) |
|---|---|---|---|---|---|
| | | ELECTRO-MECH. BYPASS SW. | SOLID STATE BYPASS SW. | | |
| **SINGLE PHASE** | | | | | |
| 100 VA | 1.2 | UPS-10-C | UPS-10-C-SS | 28 | *5¼"H x 15"D x 19"W |
| 250 VA | 3.0 | UPS-25-C | UPS-25-C-SS | 41 | *5¼"H x 15"D x 19"W |
| 350 VA | 4.2 | UPS-35-C | UPS-35-C-SS | 54 | *5¼"H x 15"D x 19"W |
| 500 VA | 6.0 | UPS-50-C | UPS-50-C-SS | 65 | 5¼"H x 19"D x 19"W |
| 750 VA | 9.0 | UPS-75-C | UPS-75-C-SS | 70 | 5¼"H x 19"D x 19"W |
| 1000 VA | 12.0 | UPS-100-C | UPS-100-C-SS | 102 | 8¾"H x 19"D x 19"W |
| 1500 VA | 18.0 | UPS-150-C | UPS-150-C-SS | 129 | 14"H x 19"D x 19"W |
| 2000 VA | 24.0 | UPS-200-C | UPS-200-C-SS | 145 | 14"H x 19"D x 19"W |
| 3000 VA | 36.0 | UPS-300-C | UPS-300-C-SS | 194 | 21"H x 19"D x 19"W |
| 5000 VA | 60.0 | UPS-500-C | UPS-500-C-SS | 308 | 29¾"H x 19"D x 19"W |
| **THREE PHASE Y** | | | | | |
| 300 VA | 1.2 | UPS3-10-C | UPS3-10-C-SS | 45 | 5¼"H x 19"D x 19"W |
| 750 VA | 3.0 | UPS3-25-C | UPS3-25-C-SS | 77 | 7"H x 19"D x 19"W |
| 1050 VA | 4.2 | UPS3-35-C | UPS3-35-C-SS | 118 | 8¾"H x 19"D x 19"W |
| 1500 VA | 6.0 | UPS3-50-C | UPS3-50-C-SS | 159 | 14"H x 19"D x 19"W |
| 2250 VA | 9.0 | UPS3-75-C | UPS3-75-C-SS | 167 | 14"H x 19"D x 19"W |
| 3000 VA | 12.0 | UPS3-100-C | UPS3-100-C-SS | 215 | 21"H x 19"D x 19"W |
| 4500 VA | 18.0 | UPS3-150-C | UPS3-150-C-SS | 301 | 28"H x 19"D x 19"W |
| 6000 VA | 24.0 | UPS3-200-C | UPS3-200-C-SS | 349 | 28"H x 19"D x 19"W |
| 9000 VA | 36.0 | UPS3-300-C | UPS3-300-C-SS | 420 | 42"H x 19"D x 19"W |
| 15000 VA | 60.00 | UPS3-500-C | UPS3-500-C-SS | 725 | 70"H x 19"D x 19"W |

Available with salf-contained gel-cels
Add 5.25 inches for all -SS models.

## ROGRAMMABLE A.C. POWER SOURCES

e entire Series 10/500 A.C. Power Supplies are available th programmable plug-in oscillators. These units may be ogrammed for output voltage level, frequency or phase gle/s. Any or all of the above functions may be incorporated o a single plug-in oscillator.

All of the generally accepted methods of programming can e used with these units. This includes resistance and voltage ogramming as well as digital programming with either binary BCD format from computers, micro-processors, keyboards, nched tape or key punched cards.

Manual local control over voltage, frequency or phase angle n be provided on the front panel of the plug-in oscillator in e form of multi-turn potentiometers. Selection of either local or automatic remote control is an optional feature. A digital readout display mounted on the main front panel of the A.C. Power Supply can be provided to display the functions outlined above. The selection of the desired function to be displayed (Voltage, Frequency or Phase Angle) may be made by either local manual control or remote control.

These programmable A.C. Power Supplies can greatly simplify the design of automatic checkout systems, simulation of A.C. power line anomalies, environmental testing, automatic production testing, etc.

Please call or write for more details. Your inquiries will receive prompt attention.

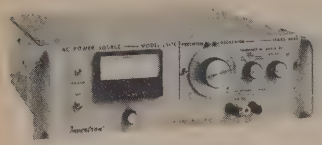
## HE A.C. POWER SUPPLY PROBLEM SOLVERS

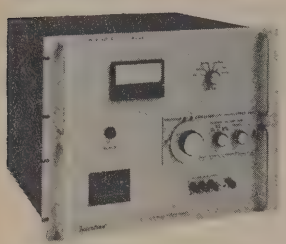
**DO YOU HAVE A SPECIAL AC PROBLEM?**

- Behlman Engineering versatility can solve it.
- A great variety of options provide solutions to many special requirements.
- Completely special or custom units or systems can be provided.

**California Instruments**
A Norlin Technology Company

AC POWER SOURCES
FREQUENCY CHANGERS





# SOLID STATE *Invertron*®

## THE MOST RESPECTED NAME IN AC POWER FOR THE GENERATION CORRECTION AND CONTROL OF AC AMPLITUDE, FREQUENCY, AND PHASE.

- 100 VA TO 10,000 VA SINGLE-PHASE OUTPUT
- 200 VA 2$\phi$ TO 30,000 VA 3$\phi$ OUTPUT
- FREQUENCY RESPONSES FROM 45Hz TO 20KHz
- SINE-WAVE WITH LOW HARMONIC DISTORTION
- EXCELLENT LINE AND LOAD REGULATION TO .01%
- SWITCHABLE OUTPUT VOLTAGE RANGES FOR FULL POWER AT LOWER VOLTAGES
- BROAD CHOICE OF INTERCHANGEABLE PLUG-IN OSCILLATORS
- OVERLOAD AND SHORT-CIRCUIT PROTECTION
- OPTIONAL INPUT VOLTAGES: 117V 1$\phi$ TO 460 V 3$\phi$

Invertrons® have earned world-wide respect through their versatility, reliability, and outstanding performance. In addition to low distortion, high input stability and high power density, these silicon solid-state AC power sources use plug-in oscillators as frequency-determining elements and can be stacked electrically to provide one-, two-, or three-phase power. All Invertrons® fit a standard 19" rack, or may be ordered with the appropriate cabinet for floor or bench use.

| Output Power | $\phi$* | Standard Output Voltage Ranges** | Frequency Range | Model Number |
|---|---|---|---|---|
| 100VA | 1 | 0-135 L to N | 45Hz-10KHz | 101T |
| 150VA | 3 | 0-17.5, 30, 75, 130 L-N | 45Hz-20KHz | 153T |
| 160VA | 1 | 0-120 L to N | 45Hz- 5KHz | 161T |
| 200VA | 3Δ | 0-35 L to N | 45Hz-10KHz | 200T/2-3D |
| 250VA | 1 | 0-30, 75, 135 L to N | 45Hz-20KHz | 251T |
| 250VA | 1 | 0-67.5, 135 L to N | 45Hz- 5KHz | 251TC |
| 300VA | 3 | 0-135 L to N | 45Hz-10KHz | 300T/3-3 |
| 320VA | 3Δ | 0-120 L to N | 45Hz- 5KHz | 320T/2-3D |
| 350VA | 1 | 0-120, 240 L to N | 45Hz- 5KHz | 351TC |
| 480VA | 3 | 0-120 L toN | 45Hz- 5KHz | 480TC/3-3 |
| 500VA | 1 | 0-135, 270 L to N | 45Hz- 5KHz | 501TC |
| 500VA | 3Δ | 0-30, 75, 135 L to N | 45Hz-20KHz | 500T/2-3D |
| 500VA | 3Δ | 0-135, 270 L to N | 45Hz- 5KHz | 500TC/2-3D |
| 500VA | 3 | 0-30, 45, 75, 135 L-N | 45Hz-10KHz | 503T |
| 700VA | 3Δ | 0-120, 240 L to N | 45Hz- 5KHz | 700TC/2-3D |
| 750VA | 1 | 0-30, 75, 135, 270 L-N | 45Hz-10KHz | 751T |
| 750VA | 3 | 0-30, 75, 135 L to N | 45Hz-20KHz | 750T/3-3 |
| 750VA | 3 | 0-67.5, 135 L to N | 45Hz- 5KHz | 750TC/3-3 |
| 900VA | 1 | 0-30, 60, 120, 240 L-N | 45Hz- 5KHz | 901T |
| 1000VA | 1 | 0-30, 75, 135, 270 L-N | 45Hz-10KHz | 1001T |
| 1000VA | 3Δ | 0-135, 270 L to N | 45Hz- 5KHz | 1000TC/2-3D |
| 1050VA | 3 | 0-120, 240 L to N | 45Hz- 5KHz | 1050TC/3-3 |
| 1200VA | 1 | 0-30, 60, 120, 240 L-N | 45Hz- 5KHz | 1201T |
| 1500VA | 1 | 0-30, 60, 120, 240 L-N | 45Hz- 5KHz | 1501T |

*Models designated "D" are open delta configuration; all others 4-wire wye.
**Other output ranges available on special order.

| Output Power | $\phi$* | Standard Output Voltage Ranges** | Frequency Range | Model Numbe |
|---|---|---|---|---|
| 1500VA | 3Δ | 0-30, 75, 135, 270 L-N | 45Hz-10KHz | 1500T/2- |
| 1500VA | 3 | 0-135, 270 L to N | 45Hz- 5KHz | 1500TC/ |
| 1500VA | 3 | 0-75, 135 L to N | 45Hz- 5KHz | 1503T |
| 1800VA | 1 | 0-60, 120, 240 L to N | 45Hz- 5KHz | 1800T/2- |
| 1800VA | 3Δ | 0-30, 60, 120, 240 L-N | 45Hz- 5KHz | 1800T/2- |
| 2000VA | 3Δ | 0-30, 75, 135, 270 L-N | 45Hz-10KHz | 2000T/2- |
| 2250VA | 3 | 0-30, 75, 135, 270 L-N | 45Hz-10KHz | 2250T/3- |
| 2400VA | 1 | 0-60, 120, 240 L to N | 45Hz- 5KHz | 2400T/2- |
| 2400VA | 3Δ | 0-30, 60, 120, 240 L-N | 45Hz- 5KHz | 2400T/2- |
| 2700VA | 3 | 0-30, 60, 120, 240 L-N | 45Hz- 5KHz | 2700T/3- |
| 3000VA | 1 | 0-60, 120, 240 L to N | 45Hz- 5KHz | 3000T/2- |
| 3000VA | 3Δ | 0-30, 60, 120, 240 L-N | 45Hz- 5KHz | 3000T/2- |
| 3000VA | 3 | 0-30, 75, 135, 270 L-N | 45Hz-10KHz | 3000T/3- |
| 3600VA | 3 | 0-30, 60, 120, 240 L-N | 45Hz- 5KHz | 3600T/3- |
| 4000VA | 1 | 0-120 L to N | 45Hz- 2KHz | 4000T/4- |
| 4500VA | 3 | 0-30, 60, 120, 240 L-N | 45Hz- 5KHz | 4500T/3- |
| 4800VA | 1 | 0-120, 240 L to N | 45Hz- 2KHz | 4800T/4- |
| 5400VA | 3 | 0-60, 120, 240 L to N | 45Hz- 5KHz | 5400T/6- |
| 6000VA | 1 | 0-120, 240 L to N | 45Hz- 2KHz | 6000T/4- |
| 7200VA | 3 | 0-60, 120, 240 L to N | 45Hz- 5KHz | 7200T/6- |
| 9000VA | 3 | 0-60, 120, 240 L to N | 45Hz- 5KHz | 9000T/6- |
| 12000VA | 3 | 0-120, 240 L to N | 45Hz- 2KHz | 12000T/ |
| 14400VA | 3 | 0-120, 240 L to N | 45Hz- 2KHz | 14400T/ |
| 18000VA | 3 | 0-120, 240 L to N | 45Hz- 2KHz | 18000T/ |

2 phase versions available at comparable power levels.

## REMOTE-PROGRAMMABLE INVERTRONS®

Solid state Invertrons® combined with 830T-Series Programmable Oscillators provide the most advanced programmable AC power sources available on the market today. 830T-Series Programmable Oscillators feature simultaneous and independent programming of frequency, phase, and amplitude compatible with remote controllers such as a computer, punched tape, cards, etc. Models are available in single, two or three phase. BCD or IEEE 488-1975 Interface.

CALIFORNIA INSTRUMENTS
A Norlin Technology Company
5150 Convoy Street • San Diego, California 92111 • (714) 279-8620 • Telex: 6950
Representatives in principal cities throughout the world.

# California Instruments
A Norlin Technology Company

## OSCILLATORS
## AC LINE CORRECTORS
## AC LINE COMPENSATORS

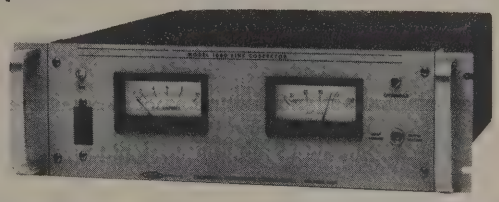
## 00T-SERIES PLUG-IN OSCILLATORS

| Frequency Range | Frequency Accuracy At 25°C | 800T VARIABLE FREQUENCY MODELS Single Phase Model | Two Phase Model | Three Phase Model |
|---|---|---|---|---|
| 0 to 5KHz n three bands | ±0.5% | 800T-40/5K-5-1 | 800T-40/5K-5-2 | 800T-40/5K-5-3<br>800T-40/5K-5-3D |
| 5 to 75Hz n one band | ±0.25% | 800T-45/75-25-1 | 800T-45/75-25-2 | 800T-45/75-25-3<br>800T-45/75-25-3D |
| 00 to 500Hz n one band | ±0.25% | 800T-300/500-25-1 | 800T-300/500-25-2 | 800T-300/500-25-3<br>800T-300/500-25-3D |
| 5 to 75Hz and 00 to 500Hz n two bands | ±0.25% | 800T-45/75-300/500-25-1 | 800T-45/75-300/500-25-2 | 800T-45/75-300/500-25-3 |
| 0 to 20KHz n three bands | ±1% | 800T-20/20K-1-1 | 800-20/20K-1-2 | 800T-20/20K-1-3<br>800T-20/20K-1-3D |

| Frequency Range | Frequency Accuracy At 25°C | 810T FIXED FREQUENCY HIGH STABILITY MODELS Single Phase Model | Two Phase Model | Three Phase Model |
|---|---|---|---|---|
| 0Hz | ±0.1% | 810T-50-1-1 | 810T-50-1-2 | 810T-50-1-3<br>810T-50-1-3D |
| 0Hz | ±0.1% | 810T-60-1-1 | 810T-60-1-2 | 810T-60-1-3<br>810T-60-1-3D |
| 00Hz | ±0.1% | 810T-400-1-1 | 810T-400-1-2 | 810T-400-1-3<br>810T-400-1-3D |
| ny single req. from 5Hz to 10KHz | ±0.1% | 810T-Freq-1-1 | 810T-Freq-1-2 | 810T-Freq-1-3<br>810T-Freq-1-3D |
| ny single req. from 5Hz to 10KHz | ±0.1% | 810T-Freq-1-1-115 | System - Servo oscillator with servo feedback set to maintain power source output at 115 VAC 0.1%. Provides 0.01% line and load regulation from power source. Available for single phase only. | |
| ny single req. from 5Hz to 10KHz | ±0.1% | 810T-Freq-1-1-105/135 | System - Servo oscillator with serve feedback adjustable to produce power source output of 105 to 135 VAC. Provides 0.01% line and load regulation from power source. Available for single phase only. | |

| Frequency Range | Frequency Accuracy At 25°C | 820T FIXED FREQUENCY CRYSTAL CONTROLLED MODELS Single Phase Model | Two Phase Model | Three Phase Model |
|---|---|---|---|---|
| 00Hz | ±0.01%<br>±0.0001% | 820T-400-01-1<br>820T-400-0001-1 | 820T-400-01-2<br>820T-400-0001-2 | 820T-400-01-3<br>820T-400-0001-3 |
| ny single req. from 5Hz to 10KHz | ±0.01% | 820T-Freq-01-1 | 820T-Freq-01-2 | 820T-Freq-01-3<br>820T-Freq-01-3D |
| ny single req. from 5Hz to 10KHz | ±0.0001% | 820T-Freq-0001-1 | 820T-Freq-0001-2 | 820T-Freq-0001-3<br>820T-Freq-0001-3D |

## SERIES 1000 DYNAMIC SOLID STATE AC LINE CORRECTORS
### For Precision AC Power Independent of Powerline Disturbances



- REDUCES 500 VOLT 10 μSEC TRANSIENTS BY 1000-TO-1
- SUPER REGULATION LINE — 0.025% LOAD — 0.025%
- PURE SINE WAVE POWER
- HARMONIC DISTORTION REDUCTION OF 50:1
- IMPULSE SETTLING TIME LESS THAN 20 MICROSECONDS
- 100 DB COMMON MODE ISOLATION
- HIGH STABILITY — 0.05%/24 HOURS
- AUTOMATICALLY RECOVERS FROM OVERLOAD IN LESS THAN ONE CYCLE

### 115 VOLT OUTPUT MODELS

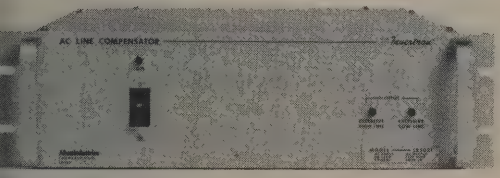
| Model | Input Voltage Range | Freq. Hz | Output Power (VA) Continuous | Output Power (VA) Max. Inst. Peak | Exact Output Volts |
|---|---|---|---|---|---|
| LC1241B<br>LC1201A<br>LC1201B | 95-115, 105-125, 115-135 (selectable by tap switch) | 380-420<br>47-53<br>57-63 | 1200 | 5000 | 115V RMS ±0.15% Setable to 0.01% (±0.25% 400Hz Models) |
| 1340<br>1350<br>1360 | | 380-420<br>47-53<br>57-63 | 3000 | 15,000 | |
| 1361 | 180-264 in three ranges | 57-63 | | | |

### 220 VOLT OUTPUT MODELS

| | | | | | |
|---|---|---|---|---|---|
| LC1252B<br>LC1262B | 180-220, 198-244, 216-264 (selectable by tap switch) | 47-53<br>57-63 | 1000 | 5000 | 220,230 or 240V RMS ±0.15% Setable to 0.01% (Single Output voltage only; specify on order) |
| 1352<br>1362 | | 47-53<br>57-63 | 3000 | 15,000 | |

*At power factors of 1.0 to ±0.7.

## R SERIES
## C Line Compensators
### or Regulated AC Load Power
### rom −27% to +15% Line Changes

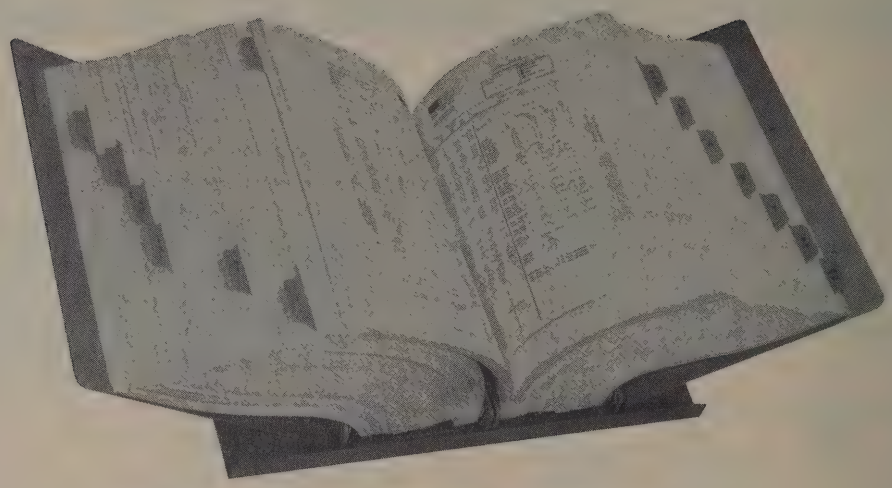


ficiency: 97% worst case
stortion: Adds less than .2% THD
gulation: ±5% maximum for −27% to +15% line change
erating Frequency: 47Hz to 65Hz
oling: Internal fan
dicator lights: Power on; excessive low input; excessive high input

| Model No. | Output Power | Output Voltage |
|---|---|---|
| LR 1521 | 1.5KVA 1 ϕ | 115V |
| LR 1528 | 1.5KVA 1 ϕ | 208V |
| LR 3021 | 3.0KVA 1 ϕ | 115V |
| LR 3028 | 3.0KVA 1 ϕ | 208V |
| LR 5021 | 5.0KVA 1 ϕ | 115V |
| LR 5028 | 5.0KVA 1 ϕ | 208V |
| LR 4521/3-3 | 4.5KVA 3 ϕ | 115V L-N |
| LR 9021/3-3 | 9.0KVA 3 ϕ | 115V L-N |
| LR 1531/3-3 | 15 KVA 3 ϕ | 115V L-N |

220/230/240V input available

CALIFORNIA INSTRUMENTS
A Norlin Technology Company
150 Convoy Street • San Diego, California 92111 • (714) 279-8620 • Telex: 695047
Representatives in principal cities throughout the world.



# UNITED PRICING REPORTS

## the single source that speeds up invoicing, pricing, quoting, purchasing and estimating

Electronic component prices change so fast, you'd need a team of people just to keep up.

United Pricing Reports is the better way. When you subscribe to Pricing Reports you receive 1500 pricing sheets (3000 pages) of the latest prices, as of the date we ship them to you.

This gives you, in a single source, up-to-the minute selling prices on more than 500,000 electronic components.

United Pricing Reports gives you accurate resale prices at the exact moment you need them. Not hours or days later. So it helps you eliminate frantic phone calls, letter writing and catalog scanning to check on prices when you write an invoice or type a purchase order.

## Twice weekly price updates.

One week after you receive your Pricing Reports source book (1500 pricing sheets) you begin receiving twice weekly price updates. You simply take these new price pages and replace the now obsolete pages with them.

The whole process is simple. All information is organized alphabetically by manufacturer. And each manufacturer's price schedule is listed by part number in numerical/alphabetical sequence.

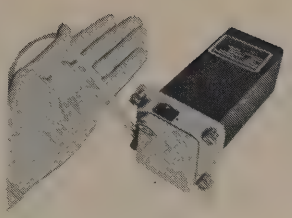
One more thing. When we promise twice weekly updates, we deliver. 52 weeks a year, consistently. Not monthly or every other month. We have a tradition of delivery on our promises, and we're certainly not going to stop now.

*UNITED TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500 TWX-510/2*

# ATA PRINTERS

## TRIP PRINTERS

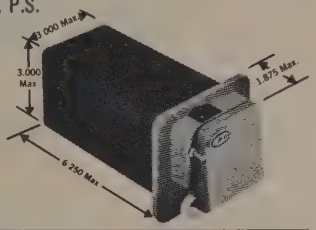
### ODEL AN16



high reliability, compact, light-eight, fully alpha-numeric Strip inter utilizing the simplest ethod of data reproduction, im-cting pressure sensitive paper tween a hammer and a character heel "on-the-fly." Designed for litary airborne applications, it eets all the requirements of MIL-5400, Class 2, Curve III.

- High Reliability: 5000 hours airborne MTBF
- Compact Size: 3″ x 3″ x 6.25″
- Lightweight: 4 pounds
- Low Maintenance: No lubrication or adjustments
- DTμL Input: 6 BIT parallel
- Character Selection: 64 characters, ASCII
- Character Rate: 25 per second
- Configuration: 1A) Printer with controls
  2A) 1A with paper storage
  3A) 2A with 400 Hz, P.S.
  4A) 1A with 400 Hz, P.S.

### N-16-1A STRIP PRINTER



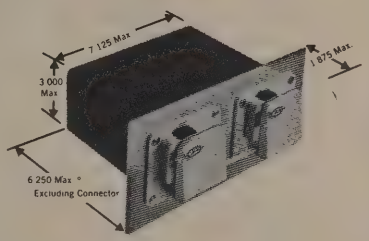

**put Power AN-16-1A and -2A only**

| Voltage | Regulation | Standard |
|---|---|---|
| +26 VDC | ±2 VDC | 1.5a ave<br>2.5a peak<br>12% duty cycle |
| +12 VDC | ±5% | 20 ma max. |
| −12 VDC | ±5% | 20 ma max. |
| +4.9 VDC | ±5% | 350 ma max. |

### N-16-2A

**r Record Storage**

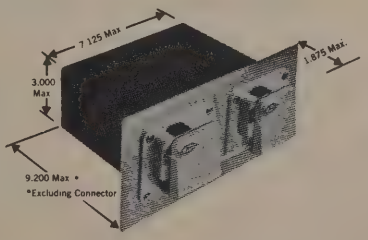
hen the system application re-ires a take-up spooler which will ore all or any portion of a printed cord, the spooler module is added the printer and both modules e then mounted to a common nel and enclosed by a single rear ver. Power for the spooler is de-ed at the printer interface con-ctor at the rear of the enclosure.




### N-16-3A

**r Record Storage and tegrated Power Supply**

the system application requires at the printer and spooler derive own DC voltages, a power sup-y module is added to the rear of e spooler module and suitably terconnected into the printer and ooler modules.




**put Power**

| Voltage | Regulation | Standard |
|---|---|---|
| 28 VDC | ±5% | 75 ma max. |
| 115V<br>400 Hz 3φ | ±10%<br>±20 Hz | 60 Watts max. |

## LINE PRINTERS

### MODEL 2000

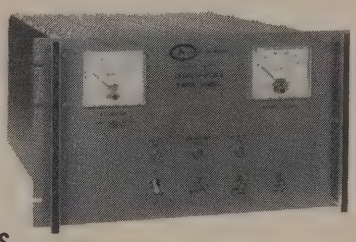
This Digital Line Printer utilizes a unique hypocyclodial printing mechanism to provide high reliability, at high printing speeds in rugged military environments. Designed to meet the requirements of MIL-E-16400 for use in military programs.

- High Reliability: 2000 hours shipboard MTBF
- Size: 19″W x 10.5″H x 20″D
- Weight: 70 pounds
- DTμL Data Input: 4 BIT, parallel BCD
- Data Columns: 21 maximum
- Character Positions: 12 per column
- Printing Speed: 15 lines per second

## UNINTERRUPTIBLE POWER

We have come to depend on the wall socket, but when all else fails, you can rely on the Clary uninterruptible power source. Perfect insurance against utility outages, brown out and line transients. The Clary "MINI-UPS" is available in single phase ratings from 625 VA to 10 KVA. Ask for our brochure/specification.

| VA | Unit Price |
|---|---|
| 625 | $1650 |
| 1250 | $2050 |
| 2500 | $3390 |
| 5000 | $7500 |
| 7500 | $10,300 |
| 10,000 | $11,100 |



### THE RELIABLE POWER SOURCE

### MINI-UPS SPECIFICATIONS

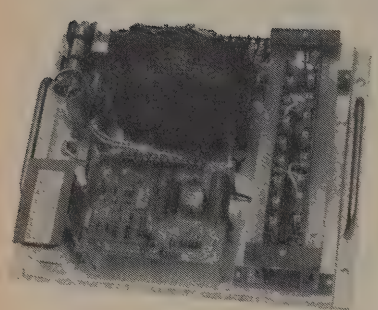
| Model Number | UPS 625-1 | UPS 1250-1 | UPS 2500-1 | UPS 5000-1/-3 |
|---|---|---|---|---|
| INPUT Voltage (VAC) | 115 ±15% | 115 ±15% | 115 ±15% | 115 or 230 ±15% |
| Frequency* (Hz) ±3 | 60 | 60 | 60 | 60 |
| Phase | Single 2 Wire & GND | Single 2 Wire & GND | Single 2 Wire & GND | Single 3 Wire & GND |
| Current** (Max. Amp) | 11A | 22A | 44A | 88/44A |
| BATTERY VOLTAGE | 84 VDC | 84 VDC | 84 VDC | 84 VDC |
| Full load back-up time*** | Optional | Optional | Optional | Optional |
| OUTPUT Voltage (VAC) | 115 ±2% | 115 ±2% | 115 ±2% | 115 or 230 ±15% |
| Frequency* (Hz) ±0.25% | 60 | 60 | 60 | 60 |
| Phase | Single 2 Wire & GND | Single 2 Wire & GND | Single 2 Wire & GND | Single 3 Wire & GND |
| Power KVA 0.8 pf | 0.625 | 1.250 | 2.500 | 5.000 |
| Current (Amps) at: (Cont.) 100% | 5.4 | 10.9 | 22.0 | 44/22 |
| (15 Min.) 110% | 5.9 | 12.0 | 24.0 | 48/24 |
| (15 Sec.) 150% | 8.1 | 16.4 | 33.0 | 66/33 |
| (15 Cycles) 200% | 10.8 | 21.8 | 44.0 | 88/44 |
| HARMONIC DISTORTION at: 100% load | 2½% THD | 2½% THD | 2½% THD | 2½% THD |
| Size — Inches (H x W x D) | 10½x19x19 | 10½x19x19 | 21x19x19 | 50x23x23 |
| Weight — Lbs. (less battery) | 110 | 125 | 220 | 500 |

*Input 50 Hz / Output 50 Hz (Optional)
**At full load and discharged battery, input at 115 VAC
***Batteries are available in separate rack or free-standing enclosures. Back-up time to be specified by customer.

CLARY CORPORATION
PRECISION INSTRUMENT DIVISION / 320 W. Clary Ave., San Gabriel, CA 91776 / (213) 287-6111

# computer power, inc

## SINGLE PHASE INVERTERS DC TO AC
## SINE WAVE 60 Hz FOR ALL TYPES OF LOADS
## 250 VA TO 12 kVA



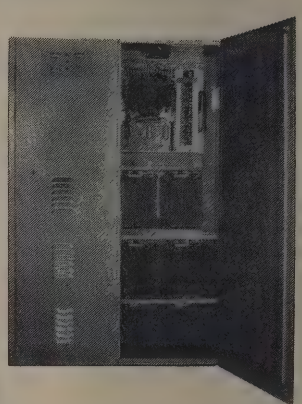
OPEN FRAME MODULE TYPE INVERTER

**SPECIAL FEATURES**

- High MTBF
- 70-85% efficiency
- New patented design
- No feed back loops
- Overload protection
- Low cost
- Self clearing power components, no SCRs
- Regulated output
- Built to meet UL 924
- 50 Hz available
- Low level start-stop, for remote control
- Automatic low voltage disconnect protects batteries from damage

**TYPICAL USES**

- Telephone switching systems
- Electronic cash registers
- Intercoms
- Microwave relay
- Industrial control equipment
- Emergency radios
- Relays and transformers
- Teletype or Telex
- TV monitors
- Fire alarms
- Remote unattended equipment
- Burglar alarms
- Hospital electronics
- Computer equipment
- R.F. transmitters and receivers
- Key telephones



ENCLOSED CABINET TYPE INVERTER shown with right door open and battery compartment belo

These compact modules are designed for mounting in equipment which requires DC to AC conversion. Input and output terminations are terminal blocks and buss bars. Semiconductor switching heat sinks are removable with quick disconnected terminations. PC control card is plug or terminal block terminated for easy removal. Simplified circuitry provides ease of maintenance.

These are floor and/or wall mounted inverter units mount in heavy gauge sheet metal cabinets with front opening k locked doors. The cabinets contain ventilation louvers a knockouts for interwiring with BX, Romex or conduit. The i ternal construction of each cabinet consists of a DC to A inverter and battery compartment. Above 4 kVA a separate ba tery cabinet or open rack is required which is optional. O tional front panel meters and controls available. Battery pric on request.

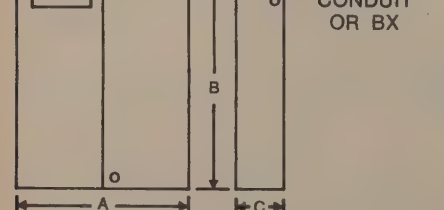
**MODULE TYPE INVERTER UNITS (Partial Listing)**

| Model Number | Input Batt. Volt. | Output Volt.-Amps. | Min. Eff. @ Full Load | Width in Inches | Height in Inches | Depth in Inches | Weight in Pounds | 100 Piece Qty. Price |
|---|---|---|---|---|---|---|---|---|
| IN-M24-500 | 24 | 500 | 75% | 13¾ | 7 | 14 | 38 | $ 340 |
| IN-M48-1000 | 48 | 1000 | 80% | 13¾ | 7½ | 14 | 52 | $ 430 |
| IN-M48-1500 | 48 | 1500 | 80% | 13¾ | 7½ | 14 | 60 | $ 590 |
| IN-M36-2400 | 36 | 2400 | 78% | 33 | 9¾ | 17½ | 125 | $1210 |
| IN-M48-3000 | 48 | 3000 | 80% | 33 | 9¾ | 17½ | 135 | $1310 |
| IN-M48-4500 | 48 | 4500 | 80% | 46 | 10¾ | 32 | 195 | $1640 |
| IN-M54-6000 | 54 | 6000 | 83% | 46 | 13½ | 32 | 225 | $2150 |
| IN-M60-10,000 | 60 | 10,000 | 85% | 46 | 15½ | 32 | 350 | $3100 |

**CABINET TYPE INVERTER UNITS (Partial Listing)**

| Model Number | Input Batt. Volt. | Output Volt-Amps. | Min. Eff. @ Full Load | Width in Inches | Height in Inches | Depth in Inches | Weight in Pounds | 10 Pie Qty Pric |
|---|---|---|---|---|---|---|---|---|
| IN-CAB24-500 | 24 | 500 | 75% | 39 | 36½ | 10 | 150 | $ 58 |
| IN-CAB48-1000 | 48 | 1000 | 80% | 39 | 48½ | 10 | 200 | $ 74 |
| IN-CAB48-1500 | 48 | 1500 | 80% | 39 | 48½ | 10 | 210 | $ 9 |
| IN-CAB36-2400 | 36 | 2400 | 78% | 39 | 60½ | 18 | 325 | $11 |
| IN-CAB48-3000 | 48 | 3000 | 80% | 39 | 60½ | 18 | 335 | $13 |
| IN-CAB48-4500 | 48 | 4500 | 80% | 39 | 60½ | 18 | 395 | $17 |
| IN-CAB54-6000 | 54 | 6000 | 83% | 39 | 60½ | 18 | 425 | $23 |
| IN-CAB60-10,000 | 60 | 10,000 | 85% | 39 | 60½ | 18 | 550 | $39 |

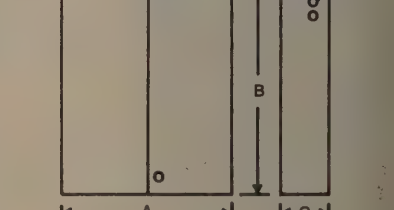
Batteries are external to electronics cabinet above 4 kVA, separate cabinet m be ordered if batteries are to be enclosed.




INVERTER CABINET DIMENSIONS SHOWN ABOVE

**ELECTRICAL SPECIFICATIONS**

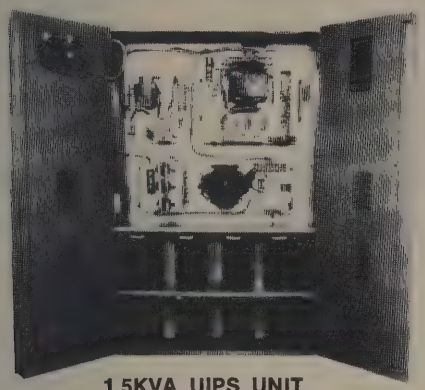
INPUT BATTERY VOLTAGE RANGE: ±15%
OUTPUT VOLTAGE: 1φ 120/240/277
EFFICIENCY: 70 to 85% depending on model
VOLTAGE REGULATION: ±5%
FREQUENCY STABILITY: ±1%
OUTPUT WAVE FORM: Sine wave
PROTECTIVE CIRCUITS: Overload and short circuit
PEAK OUTPUT CURRENT: 2 times full load max.
AMBIENT TEMPERATURE OPERATING RANGE: 0 to 60°C
NON-OPERATING: −55 to +85°C




BATTERY CABINET DIMENSIONS NOT SHOWN ABOVE (OPTIONAL)

# computer power, inc

## UNINTERRUPTABLE POWER SYSTEMS



**1.5KVA UIPS UNIT**
Shown with two front doors open.

### SOLID STATE, BATTERY POWERED EMERGENCY AC POWER GENERATORS
### 250VA TO 12KVA OUTPUT UNINTERRUPTABLE UPS SERIES OR INTERRUPTABLE IPS SERIES SINE WAVE OUTPUT

These are floor and/or wall mounted inverter units mounted in heavy gauge sheet metal cabinets with front opening key locked doors. The cabinets contain ventilation louvers and knockouts for interwiring with BX, Romex or conduit. The internal construction of each cabinet consists of battery charger, DC to AC inverter and batteries. Above 1.5KVA in UPS and 4KVA in IPS requires an external battery cabinet. For typical uses see preceeding page.

### NIQUE FEATURES

- Automatic operation upon power failure, no switch to throw.
- Automatic battery equalization every few months, no timers to turn.
- Inverter output closely resembles the AC sine wave from the utility power cord.
- Regulated 60Hz frequency output.
- Regulated voltage output.
- Heavy gauge sheet metal cabinets with special air louvers.
- Front locked doors for easy access.
8. Lower maintenance required due to automatic features mentioned above.
9. Absolutely no interrupt during a utility power failure on UPS series.
10. Automobile batteries can be used in an emergency to increase running time.
11. Optional front panel meters and controls available.
12. Built to meet UL924 with U.L. recognized transformers built at Computer Power and regularly inspected by U.L. inspectors.
13. 50Hz and other output voltages available on request.
14. Special three phase connections are available on request.
15. Long life 10 year lead batteries with oversized water reserves. Water seldom added during normal life.
16. High MTBF.
17. Patented design.
18. No feedback loops.
19. Factory service available.
20. Automatic low battery disconnect protects batteries from permanent damage after a prolonged power failure.

### LECTRICAL SPECIFICATIONS

**put voltage:** 120V or 240VAC (specify as required, other voltages available request).

**put frequency:** 60Hz ±1Hz (50Hz available on request).

**eady state output voltage:** 120 or 240VAC ±5%, for changes in AC load rrent and battery voltage changes during power failure.

**itput frequency:** 60Hz ±1Hz (50Hz available on request).

**itput wave:** Sine wave, approximately 10% distortion into resistive load. % available on request.)

**wer factor load range:** 75 Lag to .9 lead.

**ort circuit on input lines:** Remote wall breaker and/or fuse protection for otection of the UPS unit itself.

**ort circuit and overload protection of output:** Electronic and magnetic.

**me to transfer to inverter on UPS series after a utility power failure:** None, the inverter runs continuously.

**me to transfer to inverter on IPS series after a utility power failure:** 1 sec. ax.

**itput specifications:** All output specifications are for UPS in normal or wer fail mode or IPS in power fail mode. IPS in normal mode has output ecifications of the AC input.

**Overload capability during emergency:** 130% for 5 minutes after utility power failure.

**Emergency run time standard:** 1½ hours with fully charged batteries (longer times available on request).

**Optional UPS front panel controls group:** Battery DC voltmeter. Output AC voltmeter. Utility power OK indicator. Inverter bi-passed indicator. System Test Switch. Hi-charge indicator. Battery trickle charge ammeter. (See M option.)

**Optional IPS front panel controls group:** Battery DC voltmeter: Output AC voltmeter. Utility power OK indicator. Emergency power activated indicator. System Test Switch. Hi-charge indicator. Battery trickle charge ammeter. (See M option.)

**Automatic bypass switch UPS only:** Upon an inverter failure the AC utility automatically transfers to the load with a mechanical switch (fast solid state 3 to 6MS swiching available on special request).

**Ambient operating temperature limits:** 32F to 120F (temperatures above 100F will shorten battery life considerably).

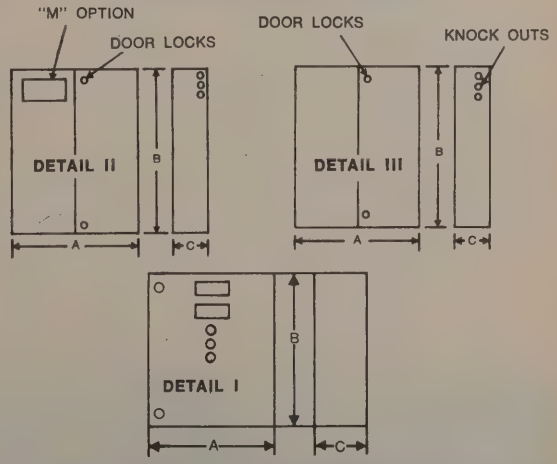
**Battery charger:** Automatic boost charge (equalize) is applied with a solid state timer approximately every 3 months. Trickle charge applied constantly.

### PARTIAL LISTING OF OUR MANY MODELS, CONSULT FACTORY.

| | ELECTRONICS & BATTERY CABINET | | | | REQUIRED BATTERY CABINET | | | |
|---|---|---|---|---|---|---|---|---|
| MODEL NUMBER | DETAIL | A | B | C | DETAIL | A | B | C |
| UPS-24-500 | II | 39 | 48½ | 10 | None | | | |
| UPS-48-1000 | II | 39 | 60½ | 10 | None | | | |
| UPS-48-1500 | II | 39 | 60½ | 10 | None | | | |
| *UPS-48-3000 | II | 39 | 60½ | 18 | III | 39 | 60½ | 10 |
| UPS-48-4500 | II | 39 | 68½ | 18 | III | 39 | 48½ | 18 |
| UPS-48-6000 | II | 39 | 68½ | 18 | 2 Req'd | 39 | 48½ | 18 |
| UPS-48-7500 | II | 39 | 68½ | 18 | 2 Req'd | 39 | 48½ | 18 |
| *IPS-12-250 | I | 15 | 22 | 8 | None | | | |
| IPS-24-500 | II | 39 | 36½ | 10 | None | | | |
| IPS-36-1000 | II | 39 | 48½ | 10 | None | | | |
| IPS-48-1500 | II | 39 | 48½ | 10 | None | | | |
| IPS-36-2400 | II | 39 | 60½ | 18 | None | | | |
| IPS-54-3600 | II | 39 | 60½ | 18 | None | | | |
| *IPS-48-4500 | II | 39 | 60½ | 18 | III | 39 | 48½ | 18 |
| IPS-54-6000 | II | 39 | 60½ | 18 | 2 Req'd | 39 | 60½ | 18 |
| IPS-70-12500 | II | 39 | 60½ | 18 | 2 Req'd | 39 | 60½ | 18 |

*One (1) hour emergency run only.
*Batteries are external to electronics cabinet above 4KVA in IPS models and 1.5KVA in UPS models. A separate cabinet must be ordered if batteries are to be enclosed.

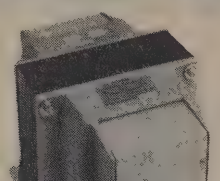
### MECHANICAL ENCLOSURES



DELTEC CORPORATION

# SUPER-ISOLATION TRANSFORMERS
## 250VA to 5KVA 1ϕ, 9KVA and 15KVA 3ϕ

### STOP LINE NOISE • ELIMINATE POWER AND SYSTEM GROUND LOOPS • REMOVE ELECTROMAGNETIC NOISE



MODEL DT 250RI

**COMMON-MODE REJECTION:** >140db

**LOAD REGULATION:** ±3% Output to Input no load to full load

**INTERCOUPLING NOISE SUPPRESSION:** >150db 10KHz to 1Mhz

**ISOLATION:** Capacitance .0005 pf or.001pf Resistance greater than 10,000 Megohms

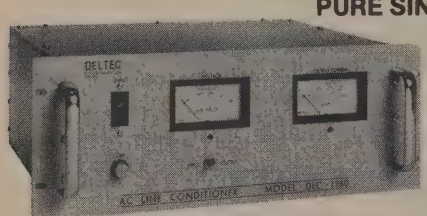
| Model Number | Power (VA) | Output Current (Amps) | Interwinding Capacitance .001 Pf | Interwinding Capacitance .0005 Pf | Primary VAC | Secondary VAC | Termination | H | Size W | L | Mounting MW | Mounting ML | Wt (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT25R1 | 250 | | X | | 120 | 120 | Receptacle | | | | | | |
| DT25T1 | 250 | 2.1 | X | | 120 | 120 | Terminals | 4.75 | 5.4 | 8.60 | 4.38 | 3.13 | 1 |
| DT25R5 | 250 | | | X | 120 | 120 | Receptacle | | | | | | |
| DT25T5 | 250 | 2.1 | | X | 120 | 120 | Terminals | 4.75 | 5.4 | 8.60 | 4.38 | 3.13 | 1 |
| DT50R1 | 500 | | X | | 120 | 120 | Receptacle | | | | | | |
| DT50T1 | 500 | 4.2 | X | | 120 | 120 | Terminals | 4.75 | 5.4 | 9.4 | 4.38 | 4.00 | 1 |
| DT50R5 | 500 | | | X | 120 | 120 | Receptacle | | | | | | |
| DT50T5 | 500 | 4.2 | | X | 120 | 120 | Terminals | 4.75 | 5.4 | 9.4 | 4.38 | 4.00 | 1 |
| DT100R1 | 1000 | | X | | 120 | 120 | Receptacle | | | | | | |
| DT100T1 | 1000 | 8.4 | X | | 120 | 120 | Terminals | 6.6 | 8.2 | 10.35 | 6.76 | 2.90 | 3 |
| DT100R5 | 1000 | | | X | 120 | 120 | Receptacle | | | | | | |
| DT100T5 | 1000 | 8.4 | | X | 120 | 120 | Terminals | 6.6 | 8.2 | 10.35 | 6.76 | 2.90 | 3 |
| DT250R1 | 2500 | | X | | 120 | 120 | Receptacle | | | | | | |
| DT250T1 | 2500 | 21 | X | | 120 | 120 | Terminals | 6.6 | 8.2 | 11.60 | 6.76 | 4.10 | 4 |
| DT251T1 | 2500 | | X | | Note (1) | Note (1) | Terminals | | | | | | |
| DT250R5 | 2500 | | | X | 120 | 120 | Receptacle | | | | | | |
| DT250T5 | 2500 | 21 | | X | 120 | 120 | Terminals | 6.6 | 8.2 | 11.60 | 6.76 | 4.10 | 4 |
| DT251T5 | 2500 | | | X | Note (1) | Note (1) | Terminals | | | | | | |
| DT500T1 | 5000 | | X | | 120 | 120 | Terminals | | | | | | |
| DT501T1 | 5000 | 42 | X | | Note (1) | Note (1) | Terminals | 6.6 | 8.2 | 13.60 | 6.76 | 6.10 | 6 |
| DT500T5 | 5000 | | | X | 120 | 120 | Terminals | | | | | | |
| DT501T5 | 5000 | 42 | | X | Note (1) | Note (1) | Terminals | 6.6 | 8.2 | 13.60 | 6.76 | 6.10 | 6 |
| | | | | | THREE-PHASE MODELS | | | | | | | | |
| DT900T-3 | 9000 | | X | | 120/208 | 120/208 | Terminals | 7.5 | 16.9 | 26.25 | 3.75 | 27.62 | 15 |
| DT1500T-3 | 15,000 | | X | | 120/208 | 120/208 | Terminals | 7.5 | 16.9 | 26.25 | 7.25 | 27.62 | 20 |

Note (1) These DT and DLC models indicate special input/output voltages other than 120/120.

DELTEC CORPORATION

# IVACON® ISOLATED AC LINE CONDITIONERS
## 1200VA to 30KVA 1ϕ, 3600VA to 90KVA 3ϕ

### PURE SINE WAVE OUTPUT • HIGH EFFICIENCY • WIDE INPUT VOLTAGE RANG • ELIMINATE COMMON-MODE NOISE & GROUND LOOPS, BROWNOU PROBLEMS • OVERLOAD & SHORT-CIRCUIT PROTECTION




MODEL DLC 1260

**AC Output**
**Regulation:** ±3% of Nominal Output
**Isolation:** Input to Output Capacitance .005 pf

**Normal-Mode Noise**
**Suppression:** >120 db, 1 KHz to 1 MHz
**Harmonic Distortion:** <5%, 50% — 100% Load

| | INPUT | | OUTPUT | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Model Number | Volts AC | Freq Hz | Volts AC | Power VA | Circuit Breaker | Meters | H | W | D |
| DLC 1260 | 90-125 | 58-62 | 115 | 1200 | Yes | Yes | 7 | 17 | 14¼ |
| DLC 1260A | 90-125 | 58-62 | 115 | 1200 | No | No | 7 | 17 | 14¼ |
| DLC 1262 | Note (1) | 58-62 | Note (1) | 1200 | Yes | Yes | 7 | 17 | 14¼ |
| DLC 1262A | Note (1) | 58-62 | Note (1) | 1200 | No | No | 7 | 17 | 14¼ |
| DLC 1860 | 90-125 | 58-62 | 115 | 1800 | Yes | Yes | 8¾ | 17 | 20 |
| DLC 1860A | 90-125 | 58-62 | 115 | 1800 | No | No | 8¾ | 17 | 20 |
| DLC 1862 | Note (1) | 58-62 | Note (1) | 1800 | Yes | Yes | 8¾ | 17 | 20 |
| DLC 1862A | Note (1) | 58-62 | Note (1) | 1800 | No | No | 8¾ | 17 | 20 |
| DLC 3060 | 90-125 | 58-62 | 115 | 3000 | Yes | Yes | 14 | 17 | 20 |
| DLC 3060A | 90-125 | 58-62 | 115 | 3000 | No | No | 14 | 17 | 20 |
| DLC 3062 | Note (1) | 58-62 | Note (1) | 3000 | Yes | Yes | 14 | 17 | 20 |
| DLC 3062A | Note (1) | 58-62 | Note (1) | 3000 | No | No | 14 | 17 | 20 |
| DLC 5060 | 90-125 | 58-62 | 115 | 5000 | Yes | Yes | 14 | 17 | 20 |
| DLC 5060A | 90-125 | 58-62 | 115 | 5000 | No | No | 14 | 17 | 20 |
| DLC 5062 | Note (1) | 58-62 | Note (1) | 5000 | Yes | Yes | 14 | 17 | 20 |
| DLC 5062A | Note (1) | 58-62 | Note (1) | 5000 | No | No | 14 | 17 | 20 |
| DLC 7560A | Note (1) | 58-62 | Note (1) | 7500 | No | No | 26 | 30 | 19 |
| DLC 10060A | Note (1) | 58-62 | Note (1) | 10,000 | No | No | 26 | 30 | 19 |
| DLC 15060A | Note (1) | 58-62 | Note (1) | 15,000 | No | No | 26 | 30 | 19 |
| DLC 20060A | Note (1) | 58-62 | Note (1) | 20,000 | No | No | 32 | 36 | 22 |
| DLC 30060A | Note (1) | 58-62 | Note (1) | 30,000 | No | No | 32 | 36 | 22 |

Note (1) These DT and DLC models indicate special input/output voltages other than 120/120.

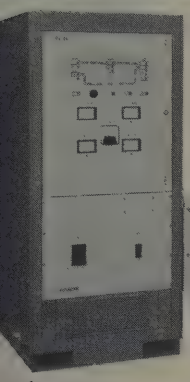
DELTEC CORPORATION

980 BUENOS AVENUE • SAN DIEGO, CA 92110 • (714) 275-1331 • TWX 910 335 1241

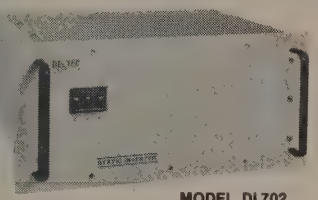
DELTEC CORPORATION

# DC TO AC INVERTERS 300VA TO 30KVA 1ϕ, 9KVA TO 37.5KVA 3ϕ

## SINE WAVE OUTPUT • AC MOTOR START CAPABILITY • RELIABLE ¼-START SYSTEM • OVERLOAD AND SHORT CIRCUIT PROTECTION



MODEL DI 7502A



MODEL DI 702

**put**
**VOLTAGES:** 12/24 VDC, 48 VDC, 125 VDC, 250 VDC
**utput**
**VOLTAGE:** 115 VAC ±2 VAC (230 VAC available)
**REGULATION:** ±3% of nominal for line and load changes
**HARMONIC DISTORTION:** <5% near full load, nominal output

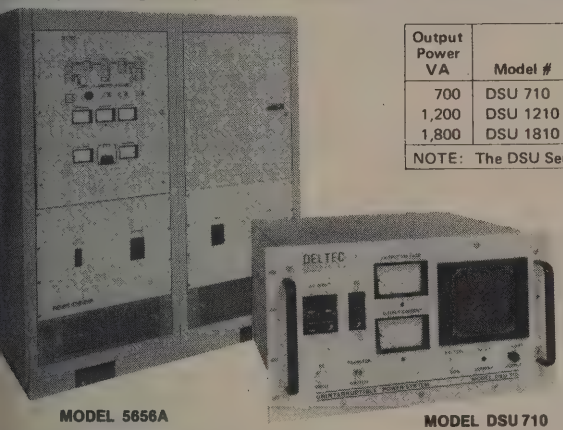
| Model # | Input VDC | Imput Current No Load | Imput Current Full Load | Power VA | Output VAC/Hz | Front Panel H x W | Case* H x W x D |
|---|---|---|---|---|---|---|---|
| DI 302 | 48 | 3.5 | 10 | 300 | 120/60 | 5.25 x 19 | 4.75 x 16.7 x 13.5 |
| DI 303 | 125 | 1.3 | 3.9 | 300 | 120/60 | 5.25 x 19 | 4.75 x 16.7 x 13.5 |
| DI 702 | 48 | 6.3 | 21. | 700 | 120/60 | 8.75 x 19 | 8.25 x 16.7 x 18 |
| DI 703 | 125 | 2.4 | 2.4 | 700 | 120/60 | 8.75 x 19 | 8.25 x 16.7 x 18 |
| DI 704 | 250 | 1.2 | 4.0 | 700 | 120/60 | 8.75 x 19 | 8.25 x 16.7 x 18 |
| DI 1202 | 48 | 6 | 33 | 1,200 | 120/60 | 8.75 x 19 | 8.25 x 16.7 x 18 |
| DI 1203 | 125 | 3.5 | 13 | 1,200 | 120/60 | 8.75 x 19 | 8.25 x 16.7 x 18 |
| DI 1204 | 250 | 1.8 | 6.5 | 1,200 | 120/60 | 8.75 x 19 | 8.25 x 16.7 x 18 |
| DI 2002 | 48 | 12.5 | 50 | 2,000 | 120/60 | 14 x 19 | 13.5 x 16.7 x 20 |
| DI 2003 | 125 | 4.8 | 19.2 | 2,000 | 120/60 | 14 x 19 | 13.5 x 16.7 x 20 |
| DI 3002A | 48 | 21 | 84 | 3,000 | 120/60 | – | 30 x 17 x 21 |
| DI 3003A | 125 | 8 | 32 | 3,000 | 120/60 | – | 30 x 17 x 21 |
| DI 5002A | 48 | 34 | 138 | 5,000 | 120/60 | – | 61 x 24 x 32 |
| DI 5003A | 125 | 13.8 | 53.5 | 5,000 | 120/60 | – | 61 x 24 x 32 |
| DI 7502A | 48 | 52 | 208 | 7,500 | 120/60 | – | 61 x 29 x 32 |
| DI 7503A | 125 | 20 | 80 | 7,500 | 120/60 | – | 61 x 29 x 32 |
| DI 100002A | 48 | 52 | 260 | 10,000 | 120/60 | – | 61 x 29 x 32 |
| DI 100003A | 125 | 20 | 100 | 10,000 | 120/60 | – | 61 x 29 x 32 |

*W – Case width only, screw heads protrude 17 inches each side
D – Case depth only, connections protrude 5 inches on units through DI 2003. Connections on DI 3002A through DI 10003A are inside the case
WT – Weights are approximate

DELTEC CORPORATION

# UNINTERRUPTIBLE POWER SYSTEMS FROM 700VA TO 37.5KVA 1ϕ and 3ϕ

## • ON-LINE SYSTEMS (NO-BREAK POWER) • REDUNDANT SYSTEMS AVAILABLE • OVERLOAD/SHORT-CIRCUIT PROTECTION • ALL SOLID STATE - MODULAR • PURE SINE WAVE OUTPUT • HIGH EFFICIENCY



MODEL 5656A

MODEL DSU 710

| Output Power VA | Model # | Input VAC | Input Phase | Input Hz | Output VAC | Output Phase | Output Hz | Battery | Backup Time | H x W x D |
|---|---|---|---|---|---|---|---|---|---|---|
| 700 | DSU 710 | 120 | 1 | 47-63 | 115 | 1 | 60 | Internal | 5-60 minutes | 10½ x 17 x 20 |
| 1,200 | DSU 1210 | 120 | 1 | 47-63 | 115 | 1 | 60 | Internal | 15-40 minutes | 15¾ x 17 x 20 |
| 1,800 | DSU 1810 | 120 | 1 | 47-63 | 115 | 1 | 60 | Internal | 10-30 minutes | 24½ x 17 x 20 |

NOTE: The DSU Series is provided with sealed internal batteries.

**TANDARD OPTIONS—Sensors, Alarms, Controls • tatic Reverse Transfer Switch (4 ms) • Frequency ynchronization and Phase Lock**

DSU" Systems are low- to medium-power-systems, ck-mountable, and self-contained for simplicity of stallation. Built-in gelled-electrolyte batteries provide liable, maintenance-free power. The systems are omplete with circuit breakers, rectifier/battery-harger, inverter, batteries, meters, sensors, alarms nd control circuitry.

5000" Series Models are capable of providing long-rm battery power for standard loads. The basic sys-m consists of: circuit breakers, rectifier/battery-harger, inverter and standard sensing and control rcuitry. Modular design permits building the system customer requirements.

| Output Power VA | Input Model # | Input Phase | Input Hz | Output Phase | Output Hz | Battery (External) | H x W x D |
|---|---|---|---|---|---|---|---|
| 2,000 | 5244 | 1 | 47-63 | 1 | 60 | 48 VDC | 61 x 24 x 32 |
| | 5245 | 1 | 47-63 | 1 | 60 | 125 VDC | |
| 3,000 | 5246 | 1 | 47-63 | 1 | 60 | 48 VDC | 61 x 24 x 32 |
| | 5247 | 1 | 47-63 | 1 | 60 | 125 VDC | |
| 5,000 | 5248 | 1 | 47-63 | 1 | 60 | 125 VDC | 61 x 24 x 32 |
| | 5249 | 3 | 47-63 | 1 | 60 | | |
| 7,500 | 5250 | 3 | 47-63 | 1 | 60 | 125 VDC | 61 x 28 x 32 |
| 10,000 | 5254 | 3 | 47-63 | 1 | 60 | 125 VDC | 61 x 46 x 32 |
| 15,000 | 5255 | 3 | 47-63 | 1 | 60 | 125 VDC | 61 x 55 x 32 |
| 20,000 | 5256 | 3 | 47-63 | 1 | 60 | 125 VDC | 70 x 68 x 32 |
| 25,000 | 5257 | 3 | 47-63 | 1 | 60 | 125 VDC | 70 x 68 x 32 |
| 30,000 | 5258 | 3 | 47-63 | 1 | 60 | 125 VDC | 70 x 68 x 32 |
| 6,000 | 5262 | 3 | 47-63 | 3 | 60 | 125 VDC | 61 x 68 x 32 |
| 9,000 | 5263 | 3 | 47-63 | 3 | 60 | 125 VDC | 61 x 68 x 32 |
| 15,000 | 5264 | 3 | 47-63 | 3 | 60 | 125 VDC | 61 x 68 x 32 |
| 22,500 | 5265 | 3 | 47-63 | 3 | 60 | 125 VDC | 70x117 x 32 |
| 30,000 | 5266 | 3 | 47-63 | 3 | 60 | 125 VDC | 70x117 x 32 |
| 37,500 | 5267 | 3 | 47-63 | 3 | 60 | 125 VDC | 70x117 x 32 |

NOTE:
1) Battery chargers for external battery systems are sized for reservoir up to 1 hour backup time, others available on request. Backup time to be specified by customer.
2) Single phase input/output voltages available – 115 to 440 VAC (customer specified).
3) Three phase input/output voltages available – 208 to 480 VAC (customer specified).

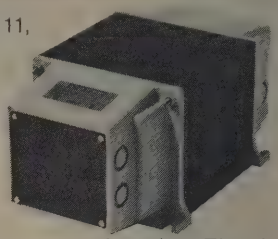
DELTEC CORPORATION

980 BUENOS AVENUE • SAN DIEGO, CA 92110 • (714) 275-1331 • TWX 910 335 1241

# ELGAR

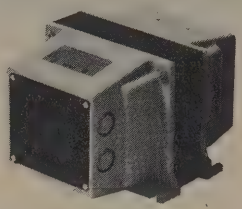
## HIGH ISOLATION TRANSFORMERS

8225 Mercury Court, San Diego, California 92111,
Phone (714) 565-1155, TWX-910-335-1246.



A HIT is a power transformer that provides an extremely low effective interwinding capacitance (0.005 to 0.0005 pF) between primary and secondary windings. It is triple-shielded with primary and secondary box shields between the two.

A HIT will isolate sensitive equipment from noisy power lines, or it will isolate noise-producing equipment that shares the same



power lines. While virtually eliminating common-mode noise problems, the HIT provides excellent attenuation of HF transverse-mode noise. Elgar's transformer operates on either a 50Hz to 60Hz power line at various nominal voltages, and can be used as a step-up or step-down transformer.

## GENERAL SPECIFICATIONS

**Input/Output Voltages: All HITs (except receptacle-type units) feature dual primary and secondary windings and are designed to operate with voltages that vary ±15% of nominal (see tables below for standard voltages).**
**Operating Frequency: 47 to 63Hz**
**Regulation: 3% No-load to Full Load Resistive**
**Dielectric Strength:**
**1.0 to 7.5KVA Single Phase, 2500VAC;**
**3.0 to 22.5KVA Three Phase, 2500VAC;**
**10.0 to 20KVA Single Phase, 4000VAC;**
**30.0 to 60.0KVA Three Phase, 4000VAC.**
**Full Rated Operating Temperature Range: 0-40°C designed for Class B (80°C) temperature rise, using a Class H (180°C) "UL Recognized" insulation system.**
**Overload: 200% of full rated current for 30 minutes.**
**Efficiency: Greater than 97% at rated load.**
**Common Mode Noise Attenuation: .005pF-126dB; .001pF-140dB; .0005pF-146dB**
**DC Isolation: 10,000 megohms minimum; primary-to-secondary, and either primary or secondary to ground.**
**Receptacle Type Units, 1KVA & 2.4KVA only ("R" suffix): All are wired for 120VAC single phase service.**

## STANDARD ELGAR SINGLE PHASE HITs

| Model No. | Rating (KVA) | Input Voltage (VAC) | Output Voltage (VAC) | Dimensions (inches/mm) A | C | B | Weight (lbs./kg.) |
|---|---|---|---|---|---|---|---|
| HIT-1.0* | 1.0 | 120/240 | 120/240 | 6.7/170 | 8.5/216 | 10.25/260 | 36/16.3 |
| HIT-1.0*R | 1.0 | 120 | 120 | 6.7/170 | 8.5/216 | 10.25/260 | 37/16.8 |
| HIT-2.4*R | 2.4 | 120 | 120 | 6.7/170 | 8.5/216 | 12.25/311 | 59/26.8 |
| HIT-2.5* | 2.5 | 120/240 | 120/240 | 6.7/170 | 8.5/216 | 12.25/311 | 58/26.3 |
| HIT-5.0* | 5.0 | 120/240 | 120/240 | 6.7/170 | 8.5/216 | 15.0/381 | 93/42.2 |
| HIT-7.5* | 7.5 | 120/240 | 120/240 | 6.7/170 | 8.5/216 | 20.0/508 | 146/66.2 |
| HIT-10.0* | 10.0 | 240/480 | 120/240 | 14.75/375 | 12.34/313 | 26.25/667 | 238/108 |
| HIT-15.0* | 15.0 | 240/480 | 120/240 | 14.75/375 | 12.34/313 | 28.25/718 | 300/136 |
| HIT-20.0* | 20.0 | 240/480 | 120/240 | 14.75/375 | 12.34/313 | 30.75/781 | 369/167 |

*The complete model number includes the effective interwinding capacitance. Thus, for a 1KVA with 140dB (.001pF) common mode noise attenuation, specify a Model HIT-1.0-.001.

**THREE PHASE SYSTEMS**
The user has the choice of ordering three each of the standard single-phase HITs and connecting them in the desired three-phase configuration, or ordering an Elgar three-phase system which also utilizes three single-phase HITs. In the latter case, the user only concerns himself with input/output wiring. To attain maximum noise immunity in a three-phase system, it is desirable to operate from a DELTA source and have a WYE connected secondary with balanced loads on each phase. This minimizes current flow in the neutral line. As with the single-phase units, the effective interwinding capacitance becomes part of the model number; thus a HIT-45.0-.001T is a three-phase unit providing 140dB of common-mode noise attenuation.

## STANDARD ELGAR THREE PHASE HITs

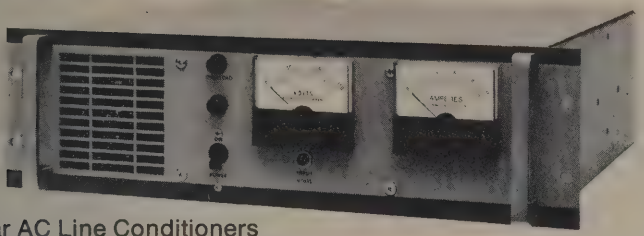
| Model No. | Rating (KVA) | Input Voltage (specify WYE or DELTA when ordering) WYE | DELTA | Output Voltage (VAC) | Dimensions (inches/mm) A | C | B | Weight (lbs./kg.) |
|---|---|---|---|---|---|---|---|---|
| HIT-3.0*T | 3.0 | 208Y/120 | 240 | 208Y/120 | 7.7/196 | 38.5/978 | 10.25/260 | 135/61.2 |
| HIT-7.5*T | 7.5 | 208Y/120 | 240 | 208Y/120 | 7.7/196 | 38.5/978 | 12.25/311 | 200/90.7 |
| HIT-15.0*T | 15.0 | 208Y/120 | 240 | 208Y/120 | 7.7/196 | 38.5/978 | 15.0/381 | 305/139 |
| HIT-22.5*T | 22.5 | 208Y/120 | 240 | 208Y/120 | 7.7/196 | 38.5/978 | 20.0/508 | 465/211 |
| HIT-30.0*T | 30.0 | N/A | 240 or 480 | 208Y/120 | 16.5/419 | 53.0/1346 | 26.25/667 | 715/325 |
| HIT-45.0*T | 45.0 | N/A | 240 or 480 | 208Y/120 | 16.5/419 | 53.0/1346 | 28.25/718 | 1000/454 |
| HIT-60.0*T | 60.0 | N/A | 240 or 480 | 208Y/120 | 16.5/419 | 53.0/1346 | 30.75/781 | 1220/554 |

*Add desired effective interwinding capacitance.

# ELGAR

## AC LINE CONDITIONERS

8225 Mercury Court, San Diego, California 92111,
Phone (714) 565-1155, TWX-910-335-1246.



Elgar AC Line Conditioners ovide precise, clean AC power to itical loads by eliminating high- peed AC line and load transients nd distortion as well as providing recise regulation. These versatile struments have response times 000 times faster than the fastest onventional AC line regulators and line isolation of 70 to 100 dB, far superior to mere isolation transformers. All Elgar AC line conditioners are designed for continuous operation and are contained in rack-mount enclosures. Front panel controls include meters to monitor input and output voltages and output load current, an overload indicator and an input circuit breaker.

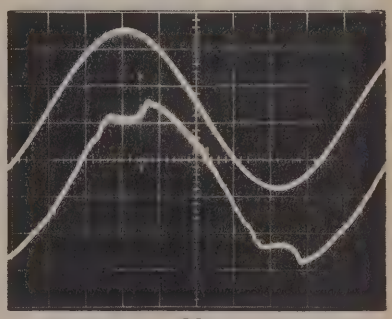
Users of voltage-sensitive equipment need isolation from high-speed AC line transients. These transients can cause erratic operation, component failures, and a reduction in equipment life. In sensitive instrumentation and data processing equipment, high-speed line transients often are the cause of erroneous information.

Elgar AC Line Conditioners are the best, most reliable solution to these problems.

## ENERAL SPECIFICATIONS

**PUT / OUTPUT ISOLATION: 100 dB (60 Hz)**
**JTPUT DISTORTION: 0.2% max for up to 10% input harmonic distortion***
**NE REGULATION: ±0.025% for ±10% input AC line variation**
**AD REGULATION: ±0.025% for no load/full change full current into unity to zero lagging or leading load.****
**EDUCES 500V 10μ SEC TRANSIENTS BY 1000:1**
**IPPLIES PEAK CURRENTS 3.5 TIMES RMS RATING**
**EMPERATURE COEFFICIENT: 0.005% per °C**
**EAK AMPLITUDE STABILITY: ±0.01% (cycle to cycle)**
**MPLITUDE DRIFT: ±0.05% 24 hrs constant line, load and temperature**
**IMPULSE SETTLING TIME: less than 20 μ sec**
**AMBIENT TEMPERATURE: 0-55°C**
**OVERLOAD INDICATION: Front panel lamp lights when rated output current is exceeded**
**OVERLOAD PROTECTION: Continuous overload actuates front panel circuit breaker**
**METERING: Reads: input voltage, output voltage, & output current**
**COOLING: Forced Air**

***400 Hz models 0.5% max.**
****400 Hz models ±0.1%**




**Y=75 volts/cm** **X=2 millisec/cm**

The lower trace shows a very distorted input AC line waveform with a 75 volt peak spike riding on it. The upper trace shows the output of the Elgar AC Line Conditioner which is perfectly clean and shows no trace of the AC input anomalies.

## STANDARD MODELS

| ODEL | OUTPUT POWER, VA Cont. | OUTPUT POWER, VA Peak | OUTPUT Voltage VRMS | OUTPUT FREQ HZ | INPUT Voltage Range[2] |
|---|---|---|---|---|---|
| 6006B | 1000 | 5000 | 115 | 57-63 | 95-135 |
| 6106B | 870 | 4300 | 100[1] | 57-63 | 80-120 |
| 6226B | 1000 | 5000 | 220 | 57-63 | 180-260 |
| 6426B | 1000 | 5000 | 240 | 57-63 | 200-280 |
| 6005B | 1000 | 5000 | 115 | 47-53 | 95-135 |
| 6105B | 870 | 4300 | 100[1] | 47-53 | 80-120 |
| 6225B | 1000 | 5000 | 220 | 47-53 | 180-260 |
| 6245B | 1000 | 5000 | 240 | 47-53 | 200-280 |
| 6004B | 1000 | 5000 | 115 | 380-420 | 95-135 |
| 3006B | 3000 | 15000 | 115 | 57-63 | 95-135[3] |
| 3106B | 2600 | 13000 | 100[1] | 57-63 | 80-120[4] |
| 3226B | 3000 | 15000 | 220 | 57-63 | 180-260 |
| 3246B | 3000 | 15000 | 240 | 57-63 | 200-280 |

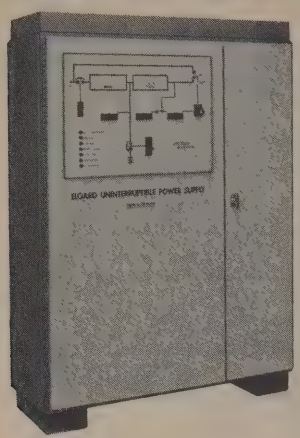
| MODEL | OUTPUT POWER, VA Cont. | OUTPUT POWER, VA Peak | OUTPUT Voltage VRMS | OUTPUT FREQ HZ | INPUT Voltage Range[2] |
|---|---|---|---|---|---|
| 3006B | 3000 | 15000 | 115 | 57-63 | 95-135[3] |
| 3106B | 2600 | 13000 | 100[1] | 57-63 | 80-120[4] |
| 3226B | 3000 | 15000 | 220 | 57-63 | 180-260 |
| 3246B | 3000 | 15000 | 240 | 57-63 | 200-280 |
| 3004B | 3000 | 15000 | 115 | 380-420 | 95-135 |
| 5005B | 5000 | 25000 | 115 | 47-53 | 95-135[3] |
| 5105B | 4350 | 21500 | 100[1] | 47-53 | 80-120[4] |
| 5225B | 5000 | 25000 | 220 | 47-53 | 180-260 |
| 5245B | 5000 | 25000 | 240 | 47-53 | 200-280 |
| 5006B | 5000 | 25000 | 115 | 57-63 | 95-135[3] |
| 5106B | 4350 | 21500 | 100[1] | 57-63 | 80-120[4] |
| 5226B | 5000 | 25000 | 220 | 57-63 | 180-260 |
| 5246B | 5000 | 25000 | 240 | 57-63 | 200-280 |

NOTES:
1. Rear panel switch for 115V output.
2. Input voltage ranges selected by 3 position tap switch
   95-115, 105-125, 115-135V for 95-135V range
   80-100, 90-110, 100-120V for 80-120V range
   180-220, 200-240, 220-260V for 180-260V range
   200-240, 220-260, 240-280V for 200-280V range
3. 115V output with 230V input available. Add -230 to model number, e.g., 3006B-230
4. 100V output with 200V input available. Add -200 to model number, e.g., 5106B-200

| MODEL | SIZE—Inches/mm Height | Width | Depth | WEIGHT Lbs./Kg. |
|---|---|---|---|---|
| SERIES 6000B | 5.25/133 | 19/483 | 16/406 | 65/30 |
| SERIES 3000B | 12.25/311 | 19/483 | 20/508 | 175/80 |
| SERIES 5000B | 24.5/622 | 19/483 | 20/508 | 375/170 |

# ELGAR UPS/INVERTERS

8225 Mercury Court, San Diego, California 92111,
Phone (714) 565-1155, TWX-910-335-1246.

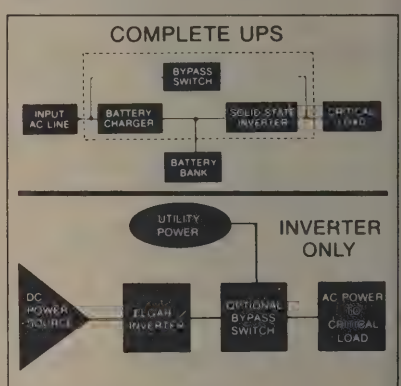


Elgar's, all solid-state Uninterruptible Power Systems (UPS), combine a battery charger, battery bank, solid-state inverter and bypass switch to provide clean, continuous power to critical loads. The battery charger converts AC line power to DC. Normally, this DC power simultaneously float-charges the battery bank and powers the inverter. Upon loss of input AC, the inverter continues to furnish the critical load with uninterruptible AC power by drawing its energy from the battery bank. Since the battery bank is always connected to the inverter as well as to the battery charger, there is no switchover time. AC output frequency from the Uninterruptible Power Source is phase-locked to the input AC under normal conditions. When there is no input AC, the output frequency is automatically determined by the stable internal oscillator.

In the unlikely event of a component failure within the Uninterruptible Power Source, the bypass switch will be activated and the critical load will automatically transfer to the input AC line. Elgar single-phase output UPS come equipped with an electromechanical contactor which performs the reverse transfer with a 50- to 150-millisecond interruption. An optional solid-state bypass switch (SBS) that can make the transfer with no interruption in power to the load is available for all single-phase UPS and Inverter models, and is standard in all three-phase UPS.

Elgar Inverters are designed to accept DC input power (derived from a nominally 125 or 130VDC rectifier system or from a battery bank with a final discharge voltage of 105VDC) and convert it to tightly regulated, single-phase AC power.

Elgar UPS are designed for a useful life of 15 to 20 years. Mathematical analysis and operating history indicate the anticipated mean-time between failures (MTBF) will be about 20,000 hours, depending upon the model and features selected. With appropriate interface of the bypass switch (electromechanical or static) with the load, so that bypass action does not cause a transient greater than the load can tolerate, an MTBF in excess of 100,000 hours for the output load bus can be demonstrated.




## UPS GENERAL SPECIFICATIONS

**Voltage Regulation:** ±1%
**Instantaneous Transient (30% load change):**
- **Single phase models:** ±10%
- **Three phase models:** ±6%

**Frequency Stability:** ±0.25%
**Continuous Power:** Rated KVA at 0.8 to 1.0P.F.
**Load Power Factor:** 0.7 lag to unity
**Harmonic Distortion:** 5% THD maximum
**Overload Rating:**
- **0.5 to 2.5KVA:**
  - 110% for 15 minutes
  - 150% for 5 seconds
  - 200% for 5 cycles
- **5KVA and above:**
  - 125% for 20 minutes
  - 150% for 10 seconds
  - 200% for 10 cycles

**Inverter Efficiency at Full Load:**
- 0.5 to 2.5KVA: 75% minimum
- 5KVA to 15KVA: 80% minimum
- 20KVA and above: 84% minimum

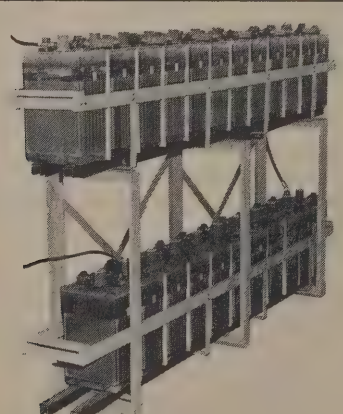
**STANDARD INSTRUMENTS:**
- DC Voltmeter, AC Voltmeter, Output AC Ammeter—5KVA & above

**STANDARD INDICATORS:**
- Input Power On
- Low DC
- Bypass Switch Position
- Fuse(s) Open—5KVA & above
- Battery Operation
- Overheat—5KVA & above
- Overload

**CONSTRUCTION:**
- In accordance with applicable NEMA standards and the National Electric Code (NEC).

**ENVIRONMENT:**
- Operating Temperature: 0 to 50°C
- Humidity: to 95%

## BATTERIES FOR YOUR UPS



Elgar's Uninterruptible Power Systems (UPS) are designed to interface with storage batteries of virtually any type. Elgar's chargers provide plus or minus one-half percent voltage regulation and are electronically current limited. They have adjustable float and optional equalize potentials and can thus provide outputs compatible with any battery desired. Elgar's inverters provide specified output performance over a wide range of DC input voltage, normally ±18% from the chemical (nominal) battery voltage levels. To select a battery, the primary concern is the correct number of cells placed in series to achieve the voltage necessary for proper UPS operation (see the data on the facing page for individual UPS model requirements). Next, the ampere hour capacity needed to achieve the desired period of support time must be determined.

When you purchase a battery through Elgar with your UPS, you are assured of a balanced system with appropriate features and guaranteed performance. (Equalize capability, for example, is included in the price of a system which is sold with nickel-cadmium or lead antimony batteries which require equalization, but not included with lead-calcium batteries which do not.) For those overseas customers who wish to purchase batteries directly from the manufacturer for purposes of convenience and economy, Elgar's application engineering staff will be pleased to assis you in selection.

# ELGAR

## STANDARD UPS MODELS

8225 Mercury Court, San Diego, California 92111,
Phone (714) 565-1155, TWX-910-335-1246.

## MINI-UPS, 0.5 TO 2.5KVA, RACK MOUNTABLE

| odel | Output Rating | Inverter Input Current at 73.5VDC (Discharge Voltage) (1.) | Dimensions in./mm HxWxD | Weight lbs./kg. |
|---|---|---|---|---|
| **60Hz, 115VAC INPUT & OUTPUT MODELS** | | | | |
| PS-501-1* | 500VA | 7.2A | 7/178x19/483x19/483 | 132/60 |
| PS-501-1-113 | 500VA | 7.2A | 7/178x19/483x19/483 | 60/27 |
| PS-102-1* | 1000VA | 14.1A | 12.25/311x19/483x19/483 | 244/110 |
| PS-102-1-132 | 1000VA | 14.1A | 12.25/311x19/483x19/483 | 125/57 |
| PS-172-1 | 1750VA | 24.4A | 12.25/311x19/483x19/483 | 220/100 |
| PS-252-1 | 2500VA | 34.9A | 14/356x19/483x19/483 | 260/115 |
| **50Hz, 230VAC INPUT & OUTPUT MODELS** | | | | |
| PS-1025-1* | 1000VA | 14.2A | 12.25/311x19/483x19/483 | 253/115 |
| PS-1025-1-102 | 1000VA | 14.2A | 12.25/311x19/483x19/483 | 137/62 |
| PS-2525-1 | 2500VA | 35A | 19.25/489x19/483x19/483 | 275/125 |
| **50Hz, 115VAC INPUT & OUTPUT MODELS** | | | | |
| PS-4015-1* | 400VA | 5.8A | 7/178x19/483x19/483 | 132/50 |
| PS-4015-1-113 | 400VA | 5.8A | 7/178x19/483x19/483 | 60/27 |

inute internal battery included in these models only.

## SINGLE PHASE UPS, 5-20KVA

| odel | Input/Output Frequency, Hz | Output Rating | Standard Input Voltage/Config. (2.)(4.) | Standard Output Voltage (4.) | Nominal Battery Bus VDC | Inverter Input Range VDC | Inverter Input Current at Lowest DC Level (1.) | Dimensions in./mm HxWxD | Weight lbs./kg. |
|---|---|---|---|---|---|---|---|---|---|
| -502-1 | 60 | 5KVA | 115/230, split Φ | 115/230, split Φ | 168 | 147-200 | 34A | 60.5/1537x43/1092x17.5/445 | 1050/477 |
| -103-1 | 60 | 10KVA | 115/230, split Φ | 115/230, split Φ | 168 | 147-200 | 67A | 72.5/1842x55/1397x19/483 | 1800/818 |
| -153-1 | 60 | 15KVA | 120/208, 3Φ | 115/230, split Φ | 120 | 105-145 | 139A | 76.5/1943x55/1392x26/660 | 2300/1045 |
| -203-1 | 60 | 20KVA | 120/208, 3Φ | 115/230, split Φ | 120 | 105-145 | 183A | 80/2032x60/1524x24/610 | 2600/1182 |
| -5025-1 | 50 | 5KVA | 230, 2 wire | 230, 2 wire | 168 | 147-200 | 34A | 60.5/1537x43/1092x17.5/445 | 1200/545 |
| -1035-1 | 50 | 10KVA | 230, 2 wire | 230, 2 wire | 168 | 147-200 | 67A | 72.5/1842x55/1392x19/483 | 2000/909 |
| -1535-1 | 50 | 15KVA | 230/400, 3Φ | 230, 2 wire | 120 | 105-145 | 139A | 76.5/1943x55/1392x26/660 | 2500/1136 |
| -2035-1 | 50 | 20KVA | 230/400, 3Φ | 230, 2 wire | 120 | 105-145 | 183A | 80/2032x60/1524x24/610 | 2800/1273 |

## THREE PHASE UPS WITH BUILT-IN STATIC BYPASS SWITCHES

| odel | Input/Output Frequency, Hz | Output Rating | Standard Input/Output Voltage (4.) | Nominal Battery Bus VDC | Inverter Input Range VDC | Inverter Input Current at Lowest DC Level (1.) | Dimensions in./mm H x W x D | Weight lbs./kg |
|---|---|---|---|---|---|---|---|---|
| -502-3 | 60 | 5KVA | 120/208 | 168 | 147-200 | 34A | 60.5/1537x43/1092x17.5/445 | 1200/545 |
| -103-3A | 60 | 10KVA | 120/208 | 120 | 105-145 | 94A | 72.5/1842x55/1392x19/483 | 2000/909 |
| -153-3A | 60 | 15KVA | 120/208 | 120 | 105-145 | 139A | 76.5/1943x55/1392x19/483 | 2250/1023 |
| -253-3 | 60 | 25KVA | 120/208 | 120 | 105-145 | 227A | 80/2032x102.5/2604(3.)x26.5/673 | 4004/1820 |
| -373-3 | 60 | 37.5KVA | 120/208 | 120 | 105-145 | 340A | 80/2032x102.5/2604(3.)x26.5/673 | 4700/2136 |
| -453-3 | 60 | 45KVA | 120/208 | 120 | 105-145 | 403A | 80/2032x102.5/2604(3.)x26.5/673 | 5100/2318 |
| -1035-3 | 50 | 10KVA | 230/400 | 120 | 105-145 | 94A | 72.5/1842x55/1392x19/483 | 2240/1018 |
| -1535-3 | 50 | 15KVA | 230/400 | 120 | 105-145 | 139A | 76.5/1943x55/1392x26/660 | 2500/1136 |
| -2735-3 | 50 | 27.5KVA | 230/400 | 120 | 105-145 | 249A | 80/2032x102.5/2604(3.)x26.5/673 | 4400/2000 |
| -3735-3 | 50 | 37.5KVA | 230/400 | 120 | 105-145 | 340A | 80/2032x102.5/2604(3.)x26.5/673 | 5300/2409 |

s:
Based upon full inverter output load at 0.8 p.f., 147VDC for 168VDC nominal systems, 105VDC for 120VDC nominal systems.
nput taps provided on 50Hz units for nominally 220, 230 or 240.

(3.) Breaks into two sections (Charger & Inverter) for shipment.
(4.) Many optional input and output voltages are available.

### TIONAL FEATURES INCLUDE:

ditional Annunciation, Float Equalize Switch and/or ner, Maintenance Bypass Switch, Narrow Frequency nc Window, Slow Slew Circuit, and Remote Status nels. Consult factory for details.

### FREQUENCY CONVERSION WITH AN ELGAR UPS

An Elgar AC Power Source is suitable for most frequency conversion requirements. For 10KVA and above (where neither variable frequency nor voltage is required), a UPS may be ordered for 60Hz input to 50Hz output or vice versa.

# ELGAR

## AC POWER SOURCES

8225 Mercury Court, San Diego, California 92111,
Phone (714) 565-1155, TWX-910-335-1246.

Elgar has long been the industry leader in producing solid-state Frequency Converters (AC Power Sources) for a variety of applications. These include laboratories, receiving inspection, production testing, computer-controlled automatic test systems, and facilities which require variable voltage, fixed or variable frequencies independent of power line and load variations.

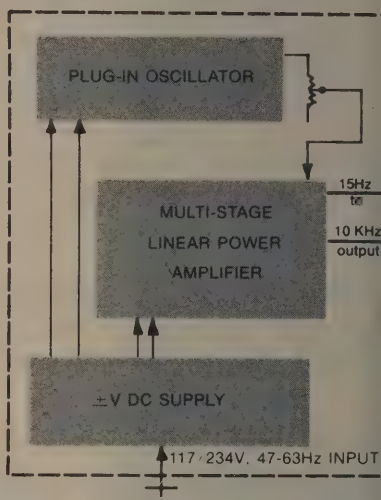
Think of an Elgar AC power source as a high-power linear amplifier driven by a precision oscillator. Actually, the basic power amplifier consists of a ±DC supply and a multi-state amplifier with a multiple-tap power output transformer. Output frequency is established by a plug-in oscillator.

Although frequently classed as instruments, Elgar power sources are actually power systems. They can deliver a variety of voltages and frequencies at the output, and the phase angles of the oscillators can be controlled, enabling the user to interconnect the output of two or more power sources into 2-phase and either Delta or Wye, 3-phase configurations.

Because of the relative ease of control of the output frequency, amplitude and phase angle, Elgar power sources can be externally programmed by a computer or other digital commands via an Elgar Decoder Programmer Oscillator.

This enables avionics and other system designers to automatically "exercise" their end products under simulated power conditions.

Since the many possible outp variations are achieved either by a plug-in device or by external interconnection, Elgar power sources can serve many needs without fear of obsolescence.




## GENERAL SPECIFICATIONS

**Input: 115 or 230VAC, 47-63Hz single-phase, standard for all models through 1500VA; 230/400V or 120/208V 3-phase for 1751, 3001, 1753A.**
**Output Voltage Ranges: 0-32, 0-130, 0-260**
**Output Frequency Range: 45-10,000 Hz**
**Load Power Factor: ±0.7 at full VA**
**Output Harmonic Distortion: 0.6% THD worst case**
**Line Regulation:**
**±0.25% at full load vs. ±10% change of input line voltage.**
**Load Regulation:**
**±1% from no load to full load over full frequency range and ±10% input range. Adjustable to better than 0.1% for specific load conditions. Fixed frequency systems always less than ±0.25%.**
**Response Time: Less than 50 μsec.**

## STANDARD MODELS

| SINGLE PHASE | | TWO PHASE | | THREE PHASE | | | |
|---|---|---|---|---|---|---|---|
| MODEL | RATING VA | MODEL | RATING VA | MODEL | RATING VA | MODEL | RATING VA |
| 121 | 120 | 240-2 | 240 | 153A | 150 | 1500-3 | 1500 |
| 251 | 250 | 500-2 | 500 | 240-3D | 240 | 1753A | 1750 |
| 351 | 350 | 700-2 | 700 | 360-3 | 360 | 2000-3D | 2000 |
| 501A | 500 | 1000-2 | 1000 | 503 | 500 | 2250-3 | 2250 |
| 751A | 750 | 1500-2 | 1500 | 500-3D | 500 | 3000-3 | 3000 |
| 1001A | 1000 | 2000-2 | 2000 | 750-3 | 750 | 3500-3D | 3500 |
| 1751 | 1750 | 3500-2 | 3500 | 1000-3D | 1000 | 5250-3 | 5250 |
| 2000-1 | 2000 | 6000-2 | 6000 | 1000-3Y | 1000 | 9000-3 | 9000 |
| 3001 | 3000 | | | 1050-3 | 1050 | 10500-3 | 10500 |
| 3500-1 | 3500 | | | | | 18000-3 | 18000 |
| 6000-1 | 6000 | | | | | | |

Note: D is an open delta configuration.

**Noise Level: 70db below full output. Includes plug-in oscillator.**
**Gain Stability:**
**±0.25% for 24 hours at constant line, load and temperature.**

**Temperature Range:**
**Operating, −20° to +50°C;**
**Storage, −40° to +80°C.**

## STANDARD AMPLIFIER MAIN FRAME DATA

| MODEL | OUTPUT POWER VA | Height In./mm. | Width In./mm. | Depth In./mm. | Weight Lbs./kg. |
|---|---|---|---|---|---|
| 121 | 120 | 3.5/89 | 19/482 | 15/381 | 45/20 |
| 251 | 250 | 5.25/133 | 19/482 | 16/406 | 70/32 |
| 351 | 350 | 5.25/133 | 19/482 | 16/406 | 75/34 |
| 501A | 500 | 7/178 | 19/482 | 17/432 | 100/46 |
| 751A | 750 | 7/178 | 19/482 | 19/482 | 115/52 |
| 1001A | 1000 | 12.25/311 | 19/482 | 19/482 | 210/96 |
| 1751 | 1750 | 14/356 | 19/482 | 19/482 | 230/105 |
| 3001 | 3000 | 17.5/455 | 19/482 | 22/560 | 340/155 |
| 153B | 150 | 5.25/133 | 19/482 | 16.5/419 | 70/32 |
| 503A | 500 | 8.75/220 | 19/482 | 19/482 | 115/52 |
| 1753A | 1750 | 14/256 | 19/482 | 19/482 | 230/105 |

## NEW "C" SERIES MODELS

Elgar's new "C" series provides lighter weight, reduced size and high efficiency than the standard line. While available only with a single range output (0-125V) due to the transformerless approach employed, an optional auto-transformer is available to provide 65V or 250V outpu ranges.

| MODEL | OUTPUT POWER VA | Height In./mm. | Width In./mm. | Depth In./mm. | Weight Lbs./kg |
|---|---|---|---|---|---|
| 251C | 250 | 5.25/133 | 19/482 | 16/406 | 34/15 |
| 501C | 500 | 5.25/133 | 19/482 | 16/406 | 46/21 |
| 1001C | 1000 | 8.75/222 | 19/482 | 20/508 | 76/35 |
| 1503C | 1500 | 8,75/222 | 19/482 | 20/508 | 110/45 |

# ELGAR

# OSCILLATORS FOR AC POWER SOURCES

8225 Mercury Court, San Diego, California 92111,
Phone (714) 565-1155, TWX-910-335-1246.

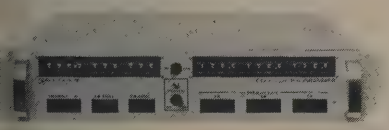
VARIABLE FREQUENCY OSCILLATOR

## FREQUENCY GENERATION TECHNIQUES

The output frequency of the power source is determined by the plug-in oscillator which develops the low distortion sine wave to the power amplifier. A variety of interchangeable versions are available, including .5Hz to 10KHz, narrow range variable or fixed frequencies with accuracies to 0.0001%.

Depending on the accuracy of frequency control desired, either of two methods of frequency generation is utilized. One method employs a modified phase shift oscillator.

This technique is used in both the variable and fixed frequency plug-ins since it requires only a change of resistance to produce a change in frequency. External sync capability is a standard option to this group of oscillators and the external sync signal can be sine or square wave, fundamental or odd order harmonics. The other method uses a crystal for precision fixed frequency. By utilizing these two methods of frequency generation, Elgar offers over 50 standard plug-in oscillators and programmable oscillators as well.



DIGITAL/ANALOG PROGRAMMER

## PROGRAMMABLE OSCILLATORS

Digital/Analog Programmers (DAPs) which provide the interface between a computer and any Elgar AC Power Source System are available to enable programming of every function controllable in an AC Source including frequency, voltage amplitude, and phase angle in multi-phase systems. Special purpose programmable oscillators such as Elgar's TG-704A are also available to simulate transients and line distortion as well.

Available with BCD inputs or per the IEEE standard interface bus, Elgar's DAPs enable the use of Elgar AC Power Sources with the most advanced Automatic Test equipment.

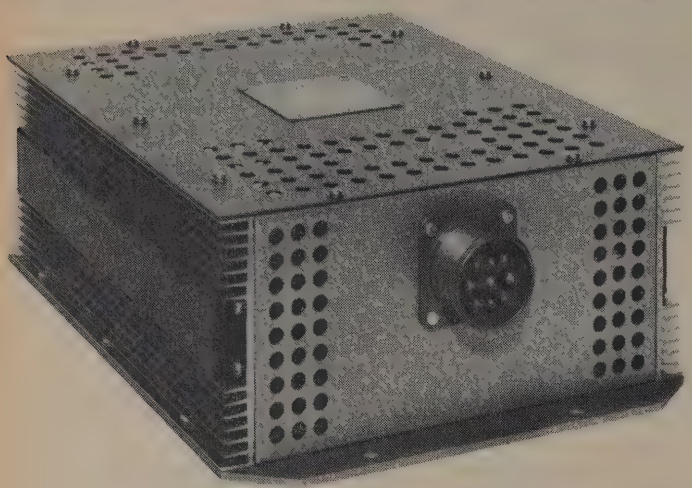
Specifications subject to change without notice

### PLUG-IN OSCILLATOR MODULES AVAILABLE FOR USE WITH ALL ELGAR AC POWER SOURCES

| Type | Model | Frequency Range (Hz) | Phase | Calibration Accuracy | Phase Angle | Frequency Temp. Coeff. |
|---|---|---|---|---|---|---|
| **VARIABLE FREQUENCY** | | | | | | |
| Decade Dial | 401-V | 45-10000 | 1 | ±1% | — | ±0.02%/°C |
| | 402-V | 45-10000 | 2 | " | 90±1° | " |
| | 403-V | 45-10000 | 3 | " | 120±1° | " |
| Continuous Dial | 431-V | 300-500 | 1 | ±0.25% | — | ±0.02%/°C |
| | 432-V | 300-500 | 2 | " | 90±1° | " |
| | 433-V | 300-500 | 3 | " | 120±1° | " |
| | 461-V | 45-70 | 1 | " | — | " |
| | 462-V | 45-70 | 2 | " | 90±1° | " |
| | 463-V | 45-70 | 3 | " | 120±1° | " |
| | 4641-V | 45-70 & 350-450 | 1 | " | — | " |
| | 4642-V | 45-70 & 350-450 | 2 | " | 90±1° | " |
| | 4643-V | 45-70 & 350-450 | 3 | " | 120±1° | " |
| **FIXED FREQUENCY** | | | | | | |
| R-C Phase Shift | 451-.1 | 50 | 1 | ±0.1% | — | ±0.015%/°C |
| | 452-.1 | 50 | 2 | " | 90±1° | " |
| | 453-.1 | 50 | 3 | " | 120±1° | " |
| | 461-.1 | 60 | 1 | " | — | " |
| | 462-.1 | 60 | 2 | " | 90±1° | " |
| | 463-.1 | 60 | 3 | " | 120±1° | " |
| | 441-.1 | 400 | 1 | " | — | " |
| | 442-.1 | 400 | 2 | " | 90±1° | " |
| | 443-.1 | 400 | 3 | " | 120±1° | " |
| Crystal Control | 461-.01 | 60 | 1 | ±0.01% | — | ±0.0002%/°C |
| | 462-.01 | 60 | 2 | " | 90±1° | " |
| | 463-.01 | 60 | 3 | " | 120±1° | " |
| | 441-.01 | 400 | 1 | " | — | " |
| | 442-.01 | 400 | 2 | " | 90±1° | " |
| | 443-.01 | 400 | 3 | " | 120±1° | " |
| | 461-.0001 | 60 | 1 | ±0.0001% | — | ±0.00005%/°C |
| | 463-.0001 | 60 | 3 | " | 120±1° | " |
| | 441-.0001 | 400 | 1 | " | — | " |
| | 443-.0001 | 400 | 3 | " | 120±1° | " |
| Crystal Control with Amplitude Servo Control | 461-.01SS | 60 | 1 | ±0.01% | — | ±0.0002%/°C |
| | 463-.01SS | 60 | 3 | " | 120±0.01° | " |
| | 441-.01SS | 400 | 1 | " | — | " |
| | 443-.01SS | 400 | 3 | " | 120±0.01° | " |

These oscillators provide 0.01% line and 0.01% load regulation and 0.01° phase angle regulation around the power amplifier(s) at the point(s) of sense. They also provide 0.1% amplitude and 0.1° phase angle stability for 1000 hours at constant line, load and temperature. Normally for fixed voltage applications. Please specify voltage. Amplitude temperature coeff. 0.005%/°C.

# FLITE-TRONICS 60 Hz & 400 Hz STATIC INVERTERS



## Other Inverters Available:

- Model PC-14B(A) 125 VA
- Model PC-15BC( ) 250 VA
- Model PC-15H ( ) 300 VA
- Model PC-17 600 VA

Environmental specifications of the above models, same as PC-17A

- 12 VDC to 24 VDC Converters
- 24 VDC to 12 VDC Converters
- Three Phase Converters Model PH-3$\phi$-400

## FAA TSO'd PC-17A

For applications requiring greater than 750 VA of continuous power, the Flite-Tronics' Model PC-17A Inverter can be paralleled as necessary to double, triple, or quadruple the output power of a single unit. This is simply done by phase locking the oscillator in the PC-17A. Malfunction of a single unit when connected in this manner will not damage the other units in parallel. Each unit has its own overload protection. Each device is capable of self-preservation.

**Now Available PC-50 TSO'd**

## SPECIFICATIONS MODEL PC-17A (750 VA) STATIC INVERTER

**INPUT VOLTAGE:**
28 VDC ±2.0 VDC

**INPUT CURRENT:**
39A — full load
1.5A — no load

**OUTPUT VOLTAGES:**
115 VAC +5% −7%
26 VAC +5% −7%

**OUTPUT FREQUENCY:**
400 Hz ±1%

**OUTPUT POWER:**
750 VA continuous for 115 VAC output
150 VA continuous for 26 VAC output
NOTE: Total continuous output power 750 VA.

**OUTPUT WAVEFORM:**
Sine Wave, Single Phase

**HARMONIC DISTORTION:**
7% maximum (Typically 3%)

**POWER FACTOR:**
.8 to −.95

**ALTITUDE:**
45,000 feet

**EFFICIENCY:**
70% typical

**TEMPERATURE:**
−65°F to 160°F

**WEIGHT:**
16.2 lbs.

**SIZE:**
Width 8½″
Length 12″
Height 4⅛″

**INPUT OVERVOLTAGE:**
Withstands 130% overvoltage (37 VDC) for five minutes minimum while delivering full rated 750 VA output power. Output voltage under this condition 115 VAC +5% −7%.

**EMISSION RFI:**
Radiated & Conducted . . . 90KC to 1000MC.
Far below levels specified in Appendix A of RTCA Paper 120-61/DO-108 Category "A".

**HUMIDITY:**
Greater than 95% for ten days, temperature cycled between 75°F to 160°F.

**VIBRATION:**
Tested to withstand in three directions:
.08 DA 5-15 Hz
.036 DA 15-70 Hz
10 G's 70-500 Hz

**SHOCK:**
To withstand at least 10 G's for 11 milliseconds in three directions.

**OVERLOAD CAPABILITY:**
Deliver 150% of rated output current at rated output voltage for a duration of not less than 5 minutes (i.e., 900 volt amp load).

**INPUT VOLTAGE PROTECTION:**
Unit withstands transients of 88 volts lasting 1 millisecond on the 28.0 VDC input line.

**EXCESSIVE OVERLOAD & OUTPUT SHORT CIRCUIT:**
Withstands without damage or degradation loads exceeding 150% nominal to an output short circuit. Unit delivers rated output on removal of above condition.

## SPECIFICATIONS MODEL PC-16 STATIC INVERTER

**POWER OUTPUT:**
250 VA Continuous
150% Overload 5 minutes
pf — .8 to 1.0

**VOLTAGE INPUT:**
1. 28 VDC ±2 Volts
2. Withstands 88 Volt Transient for 1 Millisecond

**INPUT CURRENT:**
14 Amp — full load
1 Amp — no load

**FREQUENCY:**
60 HZ ±1 Hz

**VOLTAGE OUTPUT:**
115 VAC RMS +5% −7%

**AMPLITUDE DISTORTION:**
Less than 7%

**WAVE FORM:**
Sine Wave

**PHASE:**
Single

**SHORT CIRCUIT**
Withstand for 1 minute or longer

**TEMPERATURE:**
−65°F to +160°F

**ALTITUDE:**
45,000 Ft.

**WEIGHT:**
16 lbs.

**SIZE:**
7½″ x 12″ x 4″ overall dimensions

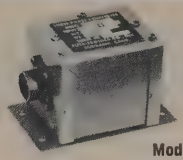
**For application requiring greater than 250 VA of continuous power Model PC-16 can be paralleled to double or triple the output power of a single unit.**

**FLITE-TRONICS, co., inc.**
Attention: Marketing Dept. E-1
2525 Naomi Street, Burbank, Calif. 91504 U.S.A.
Phone: (213) 849-1483 Telex: 69-1487

# FLITE-TRONICS 400 Hz INVERTERS & 3-PHASE CONVERTER

FAA TSO-C73 Model PC-15BC ( )

FAA TSO-C73 Model PC-17



Model PH-3$\phi$-400

## PC-15BC ( ) TSO'D (250 VA) STATIC INVERTER

**PECIFICATIONS:**

**NPUT VOLTAGE:**
28.0VDC ±2VDC, operates electrically down to 20VDC.

**NPUT CURRENT:**
13.2A Full Load
.75A No Load

**UTPUT VOLTAGE:**
115VAC rms +5% −7%
26VAC +5% −7%

**UTPUT FREQUENCY:**
400Hz ±1%

**UTPUT POWER:**
250VA @ 115VAC and 75VA @ 26VAC. Total load not to exceed 250VA

**UTPUT CONFIGURATION:**
1 Phase Sine Wave

**ARMONIC DISTORTION:**
Typically 3% (7% max)

**OWER FACTOR:**
.8 to 1.0

**ALTITUDE:**
45,000 feet

**EFFICIENCY:**
70% typical

**TEMPERATURE:**
−65°F. to 160°F.

**WEIGHT:**
7.5 lbs.

**DIMENSIONS:**
W6″ L10⅝″ H3$\frac{3}{32}$″

**INPUT OVERVOLTAGE:**
Withstand 130% input overvoltage for 5 minutes while supplying full rated VA output power. Output voltage under this condition 115VAC +5% −7%.

**OVERLOAD CAPACITY:**
Capable of 150% output current overload for at least 5 minutes.

**INPUT VOLTAGE PROTECTION:**
Inverter withstands transients of 88 volts lasting 1 millisecond on the 28.0VDC input line.

**EXCESSIVE OVERLOAD AND OUTPUT SHORT CIRCUITS**
Withstand without damage or degradation loads exceeding 150% of rated output to an output short circuit. Inverter delivers rated output on removal of above condition.

**HUMIDITY:**
Tested to greater than 95% for ten days, temperature was cycled between 75°F. to 160°F.

**VIBRATION:**
Tested to withstand in three directions:
.08 DA 5-15 Hz
.036 DA 15-70 Hz
10 G's 70-500 Hz

**SHOCK:**
Tested to withstand at least 10 G's for 11 milliseconds in three directions.

**EMISSION RFI:**
Radiated and conducted . . .90 KC to 1000 MC, far below specification limits of RTCA Paper 120-61/DO-108, Appendix A.

## PC-17 TSO'D (600 VA) STATIC INVERTER

**PECIFICATIONS:**

**NPUT VOLTAGE:**
28.0VDC ±2VDC, operates electrically down to 20.0VDC.

**NPUT CURRENT:**
31 Amps full load
1¼A no load typical

**UTPUT VOLTAGE:**
115VAC +5% −7%
26VAC +5% −7%

**UTPUT FREQUENCY:**
400 Hz ±1%

**UTPUT POWER:**
600VA @ 115VAC and 125VA @ 26VAC. Total load not to exceed 600VA.

**UTPUT CONFIGURATION:**
Sine Wave, Single Phase

**ARMONIC DISTORTION:**
Typically 3% (7% max)

**OWER FACTOR:**
.8 to −.95

**ALTITUDE:**
45,000 feet

**EFFICIENCY:**
70% typical

**TEMPERATURE:**
−65°F. to 160°F.

**WEIGHT:**
14.6 lbs.

**DIMENSIONS:**
W8½″ L12″ H4$\frac{1}{16}$″

**INPUT OVERVOLTAGE:**
Withstand 130% input overvoltage for 5 minutes while supplying full rated VA output power. Output voltage under this condition 115VAC +5% −7%.

**OVERLOAD CAPACITY:**
Capable of 150% output current overload for at least 5 minutes.

**INPUT VOLTAGE PROTECTION:**
Inverter withstands transients of 88 volts lasting 1 millisecond on the 28.0VDC input line.

**EXCESSIVE OVERLOAD AND OUTPUT SHORT CIRCUITS:**
Withstand without damage or degradation loads exceeding 150% of rated output to an output short circuit. Inverter delivers rated output on removal of overload condition.

**HUMIDITY:**
Tested to greater than 95% for ten days, temperature was cycled between 75°F. to 160°F.

**VIBRATION:**
Tested to withstand in three directions:
.08 DA 5-15 Hz
.036 DA 15-70 Hz
10 G's 70-500 Hz

**SHOCK:**
Tested to withstand at least 10 G's for 11 milliseconds in three directions.

**EMISSION RFI:**
Radiated and conducted . . . 90 KC to 1000MC, far below specification limits of RTCA Paper 120-61/DO-108, Appendix A.

## PH-3$\phi$-400 THREE PHASE CONVERTER

Flite-Tronics Co., Inc. introduces a three phase converter Model PH-3$\phi$-400, for use with Flite-Tronics' 400 Hz static inverters.

The PH-3$\phi$-400 is designed to convert two Flite-Tronics' inverters into a 115VAC, 400 Hz DELTA three phase power source with 60 degrees between phases. A transformer can be used to realize 120 degrees between phases. The PH-3$\phi$-400 will also convert three inverters into a WYE 115/200VAC, 400 Hz three phase operation.

**SPECIFICATIONS:**

**INPUT:**
28VDC at .15 Amp. max.

**FREQUENCY:**
400 Hz

**FUNCTION:**

**DELTA CONFIGURATION**

| 2 Each Inverters | Output VAC | Phase Angle | Total Power |
|---|---|---|---|
| PC-15BC ( ) | 115 | 60° | 500VA |
| PC-17 | 115 | 60° | 1200VA |
| PC-17A | 115 | 60° | 1500VA |

**WYE CONFIGURATION**

| 3 Each Inverters | Output VAC | Phase Angle | Total Power |
|---|---|---|---|
| PC-15BC ( ) | 115/200 | 120° | 750VA |
| PC-17 | 115/200 | 120° | 1800VA |
| PC-17A | 115/200 | 120° | 2250VA |

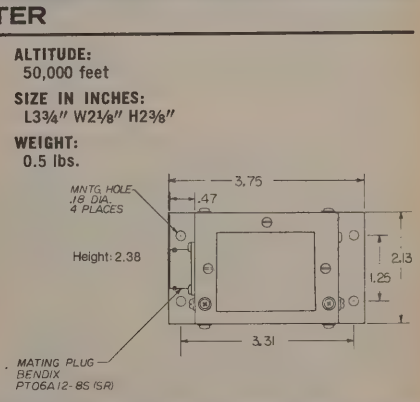
**ENVIRONMENTAL:**
Designed to meet RTCA paper DO-138 Category A

**TEMPERATURE:**
−55°C. to 71°C.

**ALTITUDE:**
50,000 feet

**SIZE IN INCHES:**
L3¾″ W2⅛″ H2⅜″

**WEIGHT:**
0.5 lbs.




FLITE-TRONICS, co., inc.
Attention: Marketing Dept. E-1
2525 Naomi Street, Burbank, Calif. 91504 U.S.A.
Phone: (213) 849-1483 Telex: 69-1487

# NOBRUSH® FREQUENCY GEORATOR™ CORPORATION

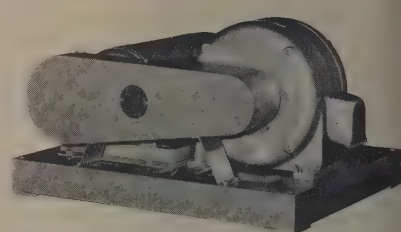
*Celebrating our 28th anniversary*

## PERMANENT MAGNET GENERATOR DESIGN

"NoBrush" Motor Generators and Frequency Converters are efficient, compact, dependable, quiet running units for powering all types of electronic systems and electrical equipment. The heart of each "NoBrush" power system is a "NoBrush" permanent magnet generator which features a cast aluminum rotor designed to give superior voltage stability. • A typical "NoBrush" generator is mounted with a high quality induction or synduction motor within a single aluminum alloy shell. • Oversize pre-lubricated ball bearings sealed for life, coupled with the absence of brushes, commutators or slip rings, insure long-term maintenance-free operation. • Georator brushless permanent magnet generators are noted for their compact construction, ruggedness, ability to withstand short circuits, and excellent wave form. • All Georator power systems whether utilized for frequency conversion or basic power requirements, provide true "line isolation and stabilization" for protecting sensitive electronic systems from momentary power interruptions, switching transients, brown outs, or voltage spikes.

## PERMANENT MAGNET FEATURES:

- ☐ *Line Isolation and Stabilization*
- ☐ *Stable Output Voltage*
- ☐ *High Overload Capacity*
- ☐ *Withstands Short Circuits*
- ☐ *Extremely Low R. F. Noise*
- ☐ *Minimum Maintenance*
- ☐ *Lightweight*
- ☐ *Low Audible Noise*
- ☐ *Cool Operation*
- ☐ *Operates in Adverse Environments*

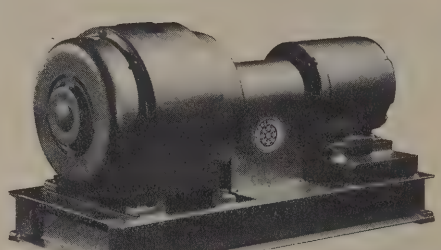


### 60 TO 60 Hz LINE ISOLATOR SERIES 30 UNIT SHELL

This small isolator stabilizer Motor-Generator offers full line isolation for small power requirements up to 1 KVA. Permanent magnet field generator coupled with the high inertia of the rotating system assures maximum electrical isolation between line and load. The rugged unit shell construction gives long, maintenance-free operation.

| Model No. | KVA Rating | Phase In/Out | Output Voltage | Input Voltage | Dimensions H"/L"/Weight |
|---|---|---|---|---|---|
| 35-118 | 0.35 | 1/1 | 115/230 | 115/230 | 14.5"/14.0"/110 lbs. |
| 30-194 | 0.5 | 3/1 | 115/230 | 230/460 | 14.8"/16.1"/120 lbs. |
| 30-198 | 0.5 | 1/1 | 115/230 | 115/230 | 14.8"/16.1"/120 lbs. |
| 30-195 | 1.0 | 3/3 | 120/208 | 230/460 | 14.8"/16.1"/130 lbs. |
| 30-199 | 1.0 | 1/3 | 120/208 | 115/230 | 14.8"/16.1"/130 lbs. |

These 60 to 60 Hz brushless generators, including those in the next column are designed to accept long term input variation of up to ±15% from nominal with no change in output. Inertia stabilization allows these units to absorb input line transients of as much as 30% for as long as 500 milliseconds with less than 1% change in output.



### 60 TO 60 Hz ISOLATOR STABILIZER SERIES 37 IN LINE

Larger Motor Generators in ratings up to 25 KVA are also available to provide full line isolation and distortion free power to protect electronic equipment from power line excursions and momentary power loss.

| Model No. | KVA Rating | Phase In/Out | Output Voltage | Input Voltage | Dimensions H"/L"/Weight |
|---|---|---|---|---|---|
| 37-015 | 1.5 | 3/1 | 115/230 | 220/440 | 18.3"/34"/300 lbs. |
| 37-118 | 1.5 | 1/1 | 115/230 | 230 | 18.3"/34"/315 lbs. |
| 37-130 | 2.5 | 3/3 | 120/208 | 220/440 | 18.3"/34"/215 lbs. |
| 37-133 | 2.5 | 1/3 | 120/208 | 230 | 18.3"/34"/400 lbs. |
| 37-070 | 2.5 | 3/1 | 115/230 | 220/440 | 18.3"/34"/335 lbs. |
| 37-134 | 2.5 | 1/1 | 115/230 | 230 | 18.3"/34"/400 lbs. |
| 37-123 | 5.0 | 3/3 | 120/208 | 220/440 | 18.3"/38"/410 lbs. |
| 37-AAA | 6.25 | 3/1 | 120/240 | 220/440 | 26.0"/48"/650 lbs. |
| 37-129 | 12.5 | 3/1 | 120/240 | 230/460 | 29.0"/62"/910 lbs. |
| 37-135 | 12.5 | 3/3 | 120/208 | 230/460 | 29.0"/62"/910 lbs. |
| 37-136 | 18.75 | 3/3 | 120/240 | 230/460 | 37.5"/70"/1300 lbs. |
| 37-137 | 18.75 | 3/1 | 120/208 | 230/460 | 29.0"/63"/1000 lbs. |
| 37-138 | 25 | 3/3 | 120/240 | 230/460 | 37.5"/72"/1550 lbs. |
| 37-139 | 25 | 3/1 | 120/208 | 230/460 | 29.0"/65"/1230 lbs. |

Series 37 Data Sheets containing detailed specifications are available upon request.

### 50 TO 60 Hz and 60 TO 50 Hz FREQUENCY CONVERTERS

These ruggedly built, belt driven, moto generator sets are mounted on a stur steel frame base. Units in the 0.5 to KVA power range are designed arou the highly efficient NoBrush Permane Magnet Generator. Units in the 6.25 to KVA power range have brushless rotati rectifier type generators with voltage re ulators, to provide ±1% output voltag regulation. These motor-generators pr vide frequency conversion, basic powe and superior line isolation and stabiliz tion for exported and imported electric and electronic equipment.

50 to 60 Hz

| Model No. | KVA Rating | Phase In/Out | Voltage Output | Appro Wt. lb |
|---|---|---|---|---|
| 37-110 | 2.0 | 1/1 | 115/230 | 42 |
| 37-151 | 2.5 | 3/1 | 115/230 | 42 |
| 37-109 | 5.0 | 3/3 | 120/208 | 46 |
| 37-177 | 6.25 | 3/1 | 115/230 | 75 |
| 37-184 | 12.5 | 3/1 | 115-120/230-240 | 1,05 |
| 37-xxx | 25.0 | 3/3 | 208-240/416-480 | 1,55 |

60 to 50 Hz

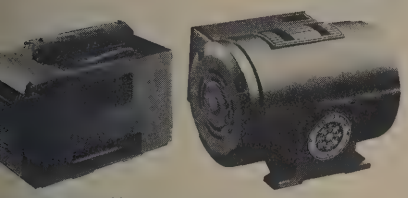
| Model No. | KVA Rating | Phase In/Out | Voltage Output | Appro Wt. lb |
|---|---|---|---|---|
| 37-105 | 0.5 | 1/1 | 115/230 | 23 |
| 37-102 | 1.5 | 1/1 | 115/220 | 40 |
| 37-111 | 1.5 | 3/1 | 115/230 | 40 |
| 37-095 | 2.5 | 3/1 | 115/230 | 44 |
| 37-197 | 6.25 | 3/1 | 115/230 | 75 |
| 37-180 | 12.5 | 3/3 | 220/440 | 1,00 |
| 37-170 | 12.5 | 3/1 | 115-120/230-240 | 1,10 |
| 37-192 | 25.0 | 3/1 | 208-240/230-240 | 1,58 |

Universal 50/60 to 60/50 Hz

| Model No. | KVA Rating | Phase In/Out | Voltage Output | Appro Wt. lb |
|---|---|---|---|---|
| 37-116 | 1.5 | 3/1 | 115/230 | 38 |
| 37-112 | 2.5/1.5 | 3/3-1 | 115/200 & 115 | 40 |

# CONVERTERS & GENERATORS

**he simplest, most rugged, most dependable power source.**

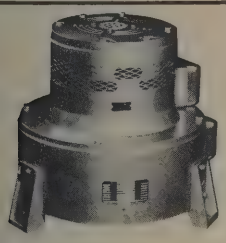


**0 TO 400 Hz**
**FREQUENCY CONVERTERS**
**SERIES 30 UNIT SHELL**

A highly compact, brushless, Motor Generator Set for conversion of 50 or 60 Hz power to 400 Hz or higher frequencies. Generator and Motor Rotors are pressed on a common shaft, with shielded ball bearing at ends of shaft, all contained within an aluminum alloy shell.

| Model No. | KVA Rating | Phase In/Out | Output Voltages Full Load * | Input Voltage ** | Dimensions H"/L"/Weight |
|---|---|---|---|---|---|
| 30-021 | 0.15 | 1/1 | 115/200 | 115/230 | 8"/11"/40 lbs. |
| 30-001 | 0.25 | 1/1 | 115 | 115/230 | 8"/11"/43 lbs. |
| 30-004 | 0.25 | 1/3 | 115/200 | 115/230 | 8"/11"/43 lbs. |
| 30-002 | 0.5 | 1/1 | 115 | 115/230 | 8"/11"/51 lbs. |
| 30-005 | 0.5 | 1/3 | 115/200 | 115/230 | 8"/11"/51 lbs. |
| 30-016 | 0.5 | 3/3 | 115/200 | 208-220/440 | 8"/11"/51 lbs. |
| 30-006 | 0.75 | 3/3 | 115/200 | 208-220/440 | 8"/11"/51 lbs. |
| 30-003 | 1.0 | 1/1 | 115 | 115/230 | 12¼"/15¼"/118 lbs. |
| 30-025 | 1.0 | 1/3 | 115/200 | 115/230 | 12¼"/15¼"/107 lbs. |
| 30-007 | 2.0 | 1/3 | 115/200 | 115/230 | 12¼"/15¼"/137 lbs. |
| 30-020 | 2.0 | 3/3 | 115/200 | 208-220/440 | 12¼"/15¼"/121 lbs. |
| 30-029 | 2.5 | 3/3 | 115/200 | 208-220/440 | 12¼"/15¼"/153 lbs. |

- Other Generator Outputs Available: 120, 180, 280, 360, and 840 Hz
- Other Standard and Non-Standard Voltages.
- Exact 400 Hz Output.
- DC Outputs at Low or High Voltage.



**60 to 400 Hz**
**FREQUENCY CONVERTER**
**SERIES 33 VERTICAL**

High quality induction motor is close coupled to a "NOBRUSH" generator providing a very compact high power to weight and size ratio. Available variations include: 50 Hz input; multiple standard and non-standard AC output voltages; Dual AC and DC outputs; and militarized construction.

| MODEL NO. | KVA RATING | PHASE IN/OUT | OUTPUT VOLTAGES FULL LOAD | DIMENSIONS DIAMETER"/H"/Lbs. |
|---|---|---|---|---|
| 33-001 | 2.5 | 3/3 | 115 | 16.8"/18.3"/173 |
| 33-002 | 3.5 | 3/1 | 115 | 16.8"/18.3"/178 |
| 33-003 | 5.0 | 3/1 | 115 | 16.8"/18.3"/273 |
| 33-004 | 5.0 | 3/3 | 115/200 | 16.8"/18.3"/250 |
| 33-005 | 7.5 | 3/3 | 115/200 | 16.8"/19.5"/259 |
| 33-006 | 10.0 | 3/3 | 115/200 | 16.8"/19.5"/280 |
| 33-103 | 10.0 | 3/1 | 115 | 20.6"/21.8"/405 |
| 33-124 | 12.5 | 3/3 | 115/200 | 20.6"/21.6"/410 |
| 33-102 | 15.0 | 3/3 | 115/200 | 20.6"/24.2"/485 |
| 30-120 | 25.0 | 3/3 | 115/200 | 23.0"/26.5"/1213 |

**EXACT 400 Hz**
**FREQUENCY CONVERTERS**
**SYNCHRONOUS DRIVEN**
**SERIES 35 IN LINE**

60 Hz to exact 400 Hz frequency conversion. Low rotational speed (1200 RPM) provides long life and minimum audible noise (65db). High/low AC and DC outputs available.

| MODEL NO. | KVA RATING | PHASE IN/OUT | OUTPUT VOLTAGE FULL LOAD | OUTPUT FREQUENCY EXACT | DIMENSIONS H"/L"/WEIGHT |
|---|---|---|---|---|---|
| 35-001 | 2.5 | 3/1 | 115 | 400 Hz | 16.5/26/470 Lbs. |
| 35-003 | 3.0 | 3/3 | 115/200 | 400 Hz | 16.5/26/472 Lbs. |
| 35-002 | 5.0 | 3/1 | 115 | 400 Hz | 16.5/30/620 Lbs. |
| 35-004 | 5.0 | 3/3 | 115/200 | 400 Hz | 16.5/28/586 Lbs. |
| 35-005 | 10.0 | 3/3 | 115/200 | 400 Hz | 16.5/30/665 Lbs. |

**VARIABLE**
**FREQUENCY**
**CONVERTERS SERIES 32**

Available both in standard designs and to customer specifications—in ratings from 0.5 to 15 KVA. Variacs supplied with unit for voltage adjustment. Other frequency variations available.

| MODEL NO. | KVA RATING | PHASE OUT | VARIABLE FREQUENCY | OUTPUT VOLTAGE |
|---|---|---|---|---|
| 32-037 | 2.5 | 1 | 45-65 Hz | 100-140/180-240 |
| 32-040 | 5 | 3 | 45-65 Hz | 105-125/183-217 |
| 32-002 | 1 | 3 | 380-420 Hz | 105-125/183-217 |
| 32-022 | 1 | 1 | 380-420 Hz | 105/127 |
| 32-016 | 5 | 3 | 380-420 Hz | 105-125/183-127 |
| 32-038 | 5 | 1 | 380-420 Hz | 100-140/180-240 |
| 38-035 | 10 | 3 | 380-420 Hz | 105-125/183-217 |
| 38-043 | 15 | 3 | 380-420 Hz | 105-125/183-217 |

**LIGHTWEIGHT**
**400 Hz ENGINE-GENERATORS**

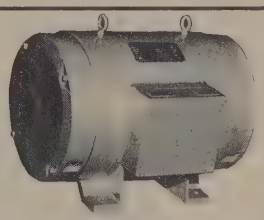
Lightweight 400 Hz permanent magnet engine-generators are available with 1Ø, or 3Ø, or DC, or dual AC/DC outputs. Applications include: geophysical, navigation, and communication systems; also fish conservation.

| MODEL NO. | KVA RATING | DC/PHASE OUT | OUTPUT VOLTAGE | WEIGHT |
|---|---|---|---|---|
| 31-001 | 0.5 | 1Ø AC | 115/230 | 43 |
| 31-002 | 0.5 | DC/1Ø AC | 115/230 | 44 |
| 31-008 | 0.75 | 3Ø AC | 115/200 | 50 |
| 31-014 | 0.5 | DC | 250/500 | 44 |

**VOLTAGE REGULATED**
**60 TO 400 Hz**
**FREQUENCY CONVERTERS**

This new, Series 39, Regulated, Vertical Frequency Converter combines the "No-Brush" permanent magnet generator together with control windings and simplified sensing electronics, to provide both the traditional "Brushless" rugged design and a closely regulated 400 Hz power system. Voltage regulation is ± 1.5% no load to full load, 0.8 to 1.0 power factor, with a voltage adjustment feature of ± 5%.

| MODEL NO. | KVA RATING | VOLTAGE OUTPUT | VOLTAGE REGULATION | PHASE IN/OUT |
|---|---|---|---|---|
| 39-001 | 5 | 120/208 | ±1.5% | 3/3 |
| 39-002 | 5 | 115/230 | ±1.5% | 3/1 |
| 39-004 | 6.5 | 120/208 | ±1.5% | 3/3 |



**60 TO 180 Hz, 360 Hz, 840 Hz**
**FREQUENCY CONVERTERS**
**FOR HIGH FREQUENCY**
**TOOLS, MOTORS, AND LIGHTING**

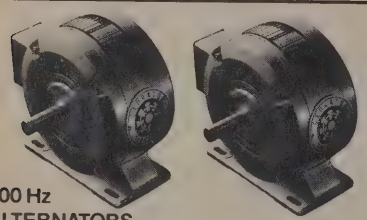
These frequency converters are available for powering high frequency metal-working tools, wood-working tools, motors, and lighting systems. The highly dependable, minimum maintenance, PERMANENT MAGNET BRUSHLESS DESIGNS are available in many ratings up to: 5 KVA for 180 Hz applications; 10 KVA for 360 Hz applications; and 30 KVA for 840 Hz applications.

**GEORATOR**™
**CORPORATION**
**Makers of NOBRUSH power systems**
9617 Center Street • P.O. Box 70
Manassas, Virginia 22110
Telephone (703) 368-2101

# GEORATOR™ CORPORATION
# PERMANENT MAGNET ALTERNATORS

## FEATURES:

- ☐ High Efficiency
- ☐ Excellent Wave Form
- ☐ Stable Output Voltage
- ☐ Short Circuit Immunity
- ☐ High Overload Capacity
- ☐ Essentially "0" RF Noise
- ☐ Brushless
- ☐ Compact Design
- ☐ Cool Operation



**400 Hz**
**ALTERNATORS**
**PERMANENT MAGNET**

The original, revolutionary, "NoBrush" generator. Permanent magnets yield stability, reproducibility, ruggedness and virtually zero R.F. noise. Available in large variety of ratings, frequencies and voltages. Supplementary windings with rectifiers available for D.C. output.

**400 Hz ALTERNATORS**

| Model No. | KVA Rating | Phase Out | Speed RPM | Dimensions H"/L"/Weight |
|---|---|---|---|---|
| 36-001 | 0.25 | 1 | 3428 | 8¼"/4 1/16"/17 lbs. |
| 36-003 | 0.5 | 1 | 3428 | 8¼"/4 1/16"/22 lbs. |
| 36-030 | 0.5 | 3 | 3428 | 8¼"/4 1/16"/21½ lbs. |
| 36-006 | 1.0 | 1 | 1714 | 12 3/16"/4 9/16"/35½ Lbs. |
| 36-007 | 1.0 | 3 | 1714 | 13 3/16"/4 9/16"/35½ lbs. |
| 36-008 | 2.0 | 3 | 1714 | 13 3/16"/4 9/16"/45 lbs. |
| 36-009 | 2.5 | 1 | 1714 | 17¼"/6¾"/105 lbs. |
| 36-010 | 5.0 | 1 | 1714 | 17¼"/6¾"/137 lbs. |
| 36-011 | 5.0 | 3 | 1714 | 17¼"/6¾"/103½ lbs. |
| 36-012 | 7.5 | 3 | 1714 | 17¼"/6¾"/120 lbs. |
| 36-013 | 10.0 | 3 | 1714 | 17¼"/6¾"/135 lbs. |
| 36-151 | 15.0 | 3 | 1714 | 25"/11.2"/310 lbs. |
| 36-152 | 25.0 | 3 | 1714 | 25.3"/17"/730 lbs. |

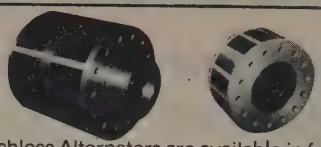
- ☐ Alternator Frequencies Available Include: 50, 60, 120, 180, 240, 300, 360, 420, 840 and 1000 Hz.
- ☐ All Units are Available with:
  - Standard and Non-Standard AC Voltages.
  - Multiple DC Outputs/Low Voltage taps.
  - Special Housings for Flange Mountings.
  - Double Shafts.
  - Militarized Construction.

**60 Hz ALTERNATORS**
**50 Hz ALTERNATORS**
**PERMANENT MAGNET**

These industrial type generators provide output voltage stability within ±1% for constant load and constant driving speed (from cold to hot and ambient temperatures of −20° F to 130° F).

| Model No. | KVA Rating | Phase Out | Output Voltage Nominal | Frequency Hz | Speed RPM | Dimensions H"L"/Weight |
|---|---|---|---|---|---|---|
| 36-138 | 0.5 | 1 | 115/230 | 60 | 1800 | 12/10.3/90 lbs. |
| 36-103 | 1.0 | 3 | 120/208 | 60 | 1800 | 12/10.3/90 lbs. |
| 36-021 | 1.5 | 1 | 115/230 | 60 | 1800 | 14/19/185 lbs. |
| 36-149 | 2.5 | 3 | 120/208 | 60 | 1800 | 14/19/185 lbs. |
| 36-135 | 2.5 | 1 | 115/230 | 60 | 1800 | 14/19/200 lbs. |
| 36-006 | 5.0 | 3 | 120/208 | 60 | 1800 | 14/19/200 lbs. |
| 36-154 | 10.0 | 3 | 120 | 60 | 3600 | 18/25/753 lbs. |

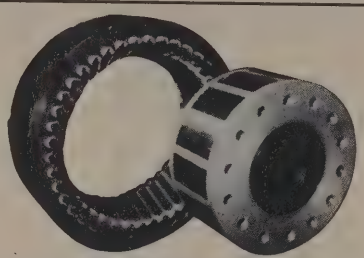
- ☐ All units listed are available with 50 Hz output.



## APPLICATIONS:

Permanent Magnet Brushless Alternators are available in frequencies up to 1,000 Hz and in power ratings from 150 VA to 25 KVA. Wherever a rugged, continuous duty, industrial type long life generator is required for:

- Special industrial applications 120 Hz, 180 Hz, 360 Hz.
- High frequency power up to 1,000 Hz.
- Low frequency power 60 Hz, 50 Hz or lower.
- Variable frequency....
- Electrical power source in hazardous locations.
- Military 400 Hz electronic equipment.
- Source of multiple AC outputs for rectification to DC power.
- Power static exciter—voltage regulators of large engine generators.
- Pilot excitation and field flashing of large generators.
- Tachometer feedback for large rotating apparatus.
- Lighting Systems.
- Electric brake excitation.
- Power for process control equipment in hazardous environments.
- Special vehicular applications.
- As computer peripheral rotating power supply providing basic power, line isolation, ride through, and multiple outputs.



**ROTORS AND STATORS**

Separate permanent magnet rotors and stators are available for a wide range of OEM applications engineered to fit customer shaft or shaft extensions. From speeds as low as 720 RPM to 12,000 RPM in selected ratings. In power ratings from 50 VA to 25 KVA.

**TOTALLY ENCLOSED AND EXPLOSION PROOF**

Totally enclosed and explosion proof designs are available in selected ratings. Some typical units are:

| Model No. | KVA Rating | Phase Out | Voltage Out | Frequency/ RPM | Description |
|---|---|---|---|---|---|
| 36-168 | 1.5 | 1 | 120 | 60 Hz/1800 | Totally enclosed. |
| 36-173 | 1.5 | 1 | 115/230 | 60 Hz/1800 | Explosion Proof. |

**FLANGE MOUNTED ROTORS AND STATORS**

Cast aluminum alloy housings to fit on customer stub shaft.

**SPECIAL PM DESIGNS**

Examples of special 2 bearing units of unique industrial application-

| Model No. | Rating | Phase Out | Voltage Out | Description |
|---|---|---|---|---|
| 36-094 | 165 watts | DC | 5, 12, 24, 48 VDC | Multiple DC outputs for computer peripheral. |
| 36-169 | 2.5 KVA | 1ø | 240 VAC | 1000 Hz, 4286 RPM Unique Industrial Application. |
| 36-167 | 3.0 KVA | 3ø | 115/200 VAC | 200 Hz, 3000 RPM Vehicular application. |

# GEORATOR™ CORPORATION

**Makers of NOBRUSH® power systems**


**P.O. Box 70**
**9617 Center Street**
**Manassas, Virginia 22110**
**Telephone (703) 368-2101**

# Powertron SOLID STATE AC POWER SUPPLIES

**The Powertron AC Power Supplies provide stable, low distortion, AC power at frequencies within the audio frequency spectrum. These highly reliable and versatile power sources find wide application in calibration and test stations, motor drives, gyro wheel supplies, laboratory use, military component testing, and operating foreign equipment. These supplies may be used whenever it is necessary to provide AC power at a frequency not available from the power lines.**

**The various supplies feature all solid state construction, wide operating frequency range, low distortion, and a wide variety of output voltages and impedances. The units are designed to be used in modular form so that a single unit can provide single phase output, and two or three units may be used to provide two phase or three phase outputs respectively.**

## AMPLIFIER SPECIFICATIONS

(Series 250S, Illustrated)

**Output Circuit:**
Single phase, isolated (Ground terminal is provided for optional grounding of output.)

**Output Power:**
250 VA

**Load Power Factor:**
.7 Lead through .7 Lag for full power output. Useable to .2 at reduced power.

**Output Voltage Range:**
0-130 V RMS (An output connector provided at the rear of the unit may readily be reconnected to provide optimum power output at other voltages. Ranges available are 0-260 V, 0-190 V, 0-130 V, 0-90 V, 0-75 V, 0-67 V, 0-60 V, 0-38 V, 0-30 V, and 0-17 V.

**Output Frequency Range:**
45 Hz to 10,000 Hz for full power out. 20 Hz to 20,000 Hz at reduced power.

**Output Distortion:**
0.1% mid band

**Load Regulation:**
Factory set to ±0.5% mid band (A control is provided for zero regulation adjustment over most of frequency range.)

**Line Regulation:**
±0.1% for ±5% line change.

**Transient Response:**
50 Microseconds.

**Hum Level:**
80 db approx. below rated output voltage.

**Thermal Overload Protection:**
Output transistors protected by thermal cut-out circuit.

**Short Circuit Protection:**
Output may be shorted indefinitely without damage to unit.

**External Amplifier Input:**
An input connector is provided at the rear of the unit when it is desired to drive the amplifier from an external source. Model XA-1 plug-in Module is required for this mode of operation.

**External Sync. Input:**
An input connector is provided at the rear when it is desired to synchronize the plug in oscillator with an external frequency source.

**Convenience Outlets:**
Two convenience outlets controlled by the power switch are provided at the rear of the unit. These permit single control operation of one or two additional amplifiers when 2ø or 3ø outputs are required. When not used for this purpose, the outlets may also be used to turn on auxiliary equipment which is mounted in the same test console.

**Meter:**
A voltmeter with range of 0-150 V RMS is provided to monitor the output voltage.

**Input Power:**
115 V or 230 V, 50-60 Hz (400 Hz input available).

**Ambient Temperature Range:**
0° C to 55° C.

**Dimensions:**
5¼ x 19" Rack Panel x 14" Deep.

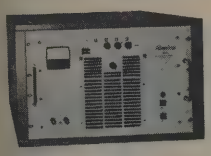
**Weight:**
75 Lbs. Approx.

---

The ordering designations listed below are for convenience of specifying the components required for various power supply configurations. To select an appropriate unit for your requirements first determine which category, 1-phase, 2-phase, or 3-phase, is most suitable to your intended load.

Then use the ordering designation adjacent to the required output power within that category. For the complete ordering designation replace the asterisk with the ordering code letters of the plug-in-oscillator listed

## 1Ø Power Supplies (For Use with Single Phase Loads)

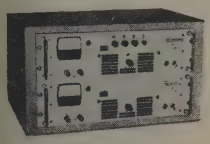


Model 1000S-1-N

| Ordering Designation | Total Output Power | Output Voltage Range | Input |
|---|---|---|---|
| 80S-1-* | 80VA | 17, 30, 38, 60, 67, 75, 90, **130**, 190, 260 | 1-Phase **115**, 230 |
| 250S-1-* | 250VA | | |
| 500S-1-* | 500VA | 35, 60, 75, 120, **135**, 150, 180, 260, 380 | |
| 750S-1-* | 750VA | 50, 90, **115**, 180, 200, 225, 270, 390 | |
| 1000S-1-* | 1KVA | 65, 76, **130**, 140, 150, 260, 300 | 3-Phase, Line to Line 190, **208**, 225, 380, 450 |
| 1500S-1-* | 1.5KVA | | |
| 2000S-1-* | 2KVA | **130**, 150, 260, 280, 300 | |
| 3000S-1-* | 3KVA | | |

## 2Ø - 3Ø (Open Delta) Power Supplies

(For use with 2ø loads and 3ø, 3 wire Delta loads.

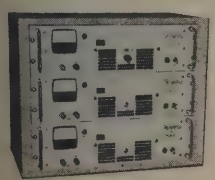


Model 500S-23-MM

| Ordering Designation | Total Output Power | Output Voltage Range | Input |
|---|---|---|---|
| 160S-23-* | 160VA | 17, 30, 38, 60, 67, 75, 90, **130**, 190, 260 | 1-Phase **115**, 230 |
| 500S-23-* | 500VA | | |
| 1000S-23-* | 1KVA | 35, 60, 75, 120, **135**, 150, 180, 260, 380 | |
| 2000S-23-* | 2KVA | 65, 76, **130**, 140, 150, 260, 300 | 3-Phase, Line to Line 190, **208**, 225, 240, 380, 450 |
| 3000S-23-* | 3KVA | | |
| 4000S-23-* | 4KVA | **130**, 150, 260, 280, 300 | |
| 6000S-23-* | 6KVA | | |

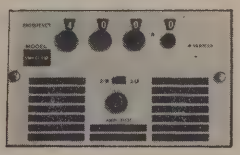
## 3Ø Wye-Delta Power Supplies

(For use with 3ø, 4 wire wye loads or 3ø, 3 wire, Delta Loads.



Model 750S-3-AA

| Ordering Designation | Total Output Power | Output Voltage Ranges (line to neutral) | Input |
|---|---|---|---|
| 240S-3-* | 240VA | 17, 30, 38, 60, 67, 75, 90, **130**, 190, 260 | 1-Phase **115**, 230 |
| 750S-3-* | 750VA | | |
| 1500S-3-* | 1.5KVA | 35, 60, 75, 120, **135**, 150, 180, 260, 380 | |
| 3000S-3-* | 3KVA | 65, 76, **130**, 140, 150, 260, 300 | 3-Phase, Line to Line 190, **208**, 225, 240, 380, 450 |
| 4500S-3-* | 4.5KVA | | |
| 6000S-3-* | 6KVA | **130**, 150, 260, 280, 300 | |
| 9000S-3-* | 9KVA | | |



## PLUG-IN OSCILLATORS

Single phase (1ø) and polyphase (Pø) oscillators are available for both fixed frequency and variable frequency output. A coarse and fine concentric control is included on each oscillator panel for precise amplitude adjustment. Polyphase oscillators include a switch on the front panel which provides either two-phase or three-phase output. All plug-in oscillators are provided with Sync. capability which permits locking-in their output frequency with an external source of the same nominal frequency.

| CODE | | FREQUENCY | ACCURACY |
|---|---|---|---|
| Single Phase | Poly Phase | | |
| A | AA | 400 Hz | 0.1% |
| B | BB | 60 Hz | 0.1% |
| C | CC | Specify | 0.1% |
| D | DD | Specify | 0.01% |
| E | EE | Specify | 0.001% |
| K | KK | 10 Hz - 10 KHz | 1.0% |
| L | LL | 10 Hz - 100 Hz | 1.0% |
| M | MM | 100 Hz - 1 KHz | 1.0% |
| N | NN | 350 Hz - 450 Hz | 0.25% |
| P | PP | 300 Hz - 500 Hz | 0.25% |
| Q | QQ | 1 KHz - 10 KHz | 1.0% |

**WRITE FOR CATALOG 969**

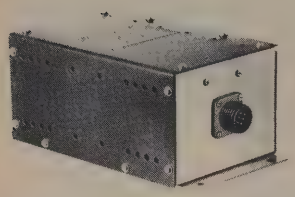
**ITECO INDUSTRIAL TEST EQUIPMENT CO.** 21 Yennicock Ave., Port Washington, N. Y. 11050 Phone (516) 883-1700

K.G.S. electronics, inc.

**kgs electronics** A GAR Enterprises Co.

*2029 North Lincoln Avenue • Pasadena, California 91103 • Telephone (213) 798-0786*

# 400 Hz STATIC INVERTER — SPC SERIES



The KGS ELECTRONICS' static inverter utilizes solid state circuitry to convert 28 VDC to 115 VAC, 400 Hz sine wave power. Design features include pulse-width modulated square to sine wave power conversion permitting lightweight and reliable operation.

The SPC Series are capable of delivering an overload of 150% of rated current for a duration not less than five minutes under all environmental conditions.

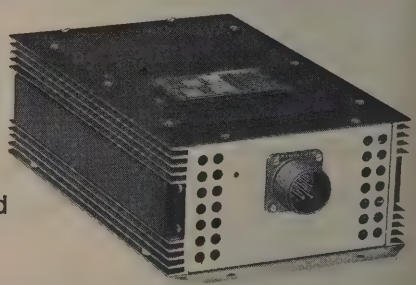
GENERAL SPECIFICATIONS

| | |
|---|---|
| Input Voltage: | 1. 22 to 32 VDC<br>2. Withstands 88 Volt Transient for 1 Millisecond |
| Power Factor: | .8 to −.95 |
| Amplitude Distortion: | Less than 7% |
| Wave Form: | Sine Wave |
| Phase: | Single |
| Short-Circuit: | Withstand for 1 minute |
| Temperature: | −65°F to +160°F (−55°C to +70°C) |
| Altitude: | 45,000 ft. |
| Efficiency: | 75% typical |
| Input Overvoltage: | Withstand 130% input overvoltage for 5 minutes while supplying full rated VA output power. Output voltage under this condition 115 VAC +5% −7%. |
| Input Voltage Protection: | Inverter withstands transients of 88 volts lasting 1 millisecond on the 28.0 VDC input line. |
| Overload Capacity: | Capable of 150% output current overload for at least 5 minutes. |
| Excessive Overload and Output Short Circuits: | Withstand without damage or degradation loads exceeding 150% of rated output to an output short circuit. Inverter delivers rated output on removal of above condition. |
| Humidity: | Withstand greater than 95% for ten days, temperature was cycled between 75°F to 160°F. |
| Environmental: | Designed to meet RTCA DO-160 Env. Cat. D2ZAR - - - |

| Model | Output Voltages VAC | Output Power VA | Freq. Hz | Input Current ADC | Weight Lbs. (Kg) |
|---|---|---|---|---|---|
| SPC-7 | 26/115 | 70 | 400 ±1% | 3.2 | 5.0 (2.3) |
| SPC-10 | 115/26 | 100 | 400 ±1% | 5.2 | 5.2 (2.4) |

# 60 Hz/50 Hz STATIC INVERTER

These inverters are particularly applicable as a source of 60 Hz power for the operation of Projectors, Tape Recorders, TV Systems, Medical Equipment, Spectrometers, Typewriters, on Aircraft that have a 28 VDC electrical system. For applications requiring greater power the inverters can be paralleled for higher output.



The inverters available in other voltages, frequency and power are listed in the table below.

GENERAL SPECIFICATIONS

| | |
|---|---|
| Input Voltage: | 1. 28 VDC ±2 volts<br>2. Withstands 88 Volt Transient for 1 Millisecond |
| Power Factor: | .8 to 1.0 |
| Amplitude Distortion: | Less than 7% |
| Wave Form: | Sine Wave |
| Phase: | Single |
| Short-Circuit: | Withstand for 1 minute or longer |
| Temperature: | −65°F to +160°F (−55°C to +70°C) |
| Altitude: | 45,000 ft. |

| Model | Output Voltages VAC | Output Power VA | Freq. Hz | Input Current ADC | Weight Lbs. (Kg) |
|---|---|---|---|---|---|
| SPS-206 | 115 | 200 | 60 ±1 | 10.5 | 14.5 (6.6) |
| SPS-306 | 115 | 300 | 60 ±1 | 15.8 | 18.0 (8.2) |
| SPS-205 | 115 | 200 | 50 ±1 | 10.5 | 14.5 (6.6) |
| SPS-2052 | 230 | 200 | 50 ±1 | 10.5 | 14.5 (6.6) |
| SPS-305 | 115 | 270 | 50 ±1 | 15.8 | 18.0 (8.2) |
| SPS-3052 | 230 | 270 | 50 ±1 | 15.8 | 18.0 (8.2) |

Since 1959, KGS Electronics has specialized in the design and manufacture of power conversion and magnetic components for aerospace, government, and consumer applications. Included in our output are: Power Supplies, AC Static Inverters, Regulated and Unregulated Power Converters, Line Stabilizers, Power Boosters, Power Boost Isolators, Transformers, UL 544 Medical Isolation Transformers and other related equipment.

Please write for complete and latest information on products in which you are interested, and also see our ads on P. 3273 and P. 4422, **eem**, Vol. 2, 77/78 issue.

CML MACARR®

POWER SUPPORT EQUIPMENT

NEW!

# uninterruptible power supplies

## PEP™ portable electric power

The CML MACARR PEP SYSTEM is a completely self-contained, regulated mobile electric power source. It provides regulated, portable electric power wherever needed and eliminates the need for duplicating expensive instrumentation at more than one location. Now, sophisticated equipment, (such as mini-computers, etc.) may be moved around without the loss of memory or the troublesome turn-on, turn-off transients when relocating instrumentation. In addition, this system is **UNINTERRUPTIBLE,** providing up to one and one half hour of built-in power in the event of a power interruption.

The PEP Mobile Uninterruptible Unit comes complete with stainless steel cart as illustrated.

### Applications

- Mini-computers — memory banks
- Microprocessors
- Chemical and other process control
- Monitoring equipment

### Features

- Protects sensitive instrumentation during power line disturbances
- Absorbs line transients
- Regulates fluctuating line voltages
- Provides undistorted sine wave
- Smoothes line clips and spikes

### Specifications

**Input:** 115V ±10% 57-63 Hz 1φ

**Output:** 115V ±5% at rated power or current 60 Hz ±.5 Hz

**Voltage Regulation:** ±1.0% NL-FL

**Power Factor:** .8 lead or lag

**Harmonic Distortion:** Less than 3% @ full load

**Frequency Stability:** ±.25%

**Operating Temperature:** 20°C to 40°C

**Battery:** Maintenance-free, sealed. Back up for 30 minutes at rated load. Option to 8 hrs. on special order.

**Overload Rating:** 110% 15 min.
150% 5 sec.
200% 5 cycles

**Internal Battery Charger:** Capable of restoring battery in full charge in a maximum of 16 hours on standard models.

### Operation

For easy operation, a Status Panel on the unit consisting of:

1. Low Voltage Warning — Flashing light when approximately 5 minutes of power is left in battery at rated load.
2. AC Bypass Switch — Connects AC line input directly to AC output receptacle.
3. Battery Monitor — Show in minutes the ampere hours left in battery under any load condition.
4. Battery Test Switch — Allows for periodic check and calibration of battery monitor to assure readout is consistent with condition of the battery.

In addition two AC convenience outlets are provided for easy connection of equipment plus a 10 ft. long retractable AC cord.

### STANDARD MODELS — 115V 60 Hz

| MODEL | OUTPUT VA | AMPS | DIMENSIONS WITH CART | SHIPPING WT. LBS. |
|---|---|---|---|---|
| UPS-100H | 100 | 0.87 | 21W x 39L x 35H | 135 |
| UPS-250H | 250 | 2.17 | 21W x 39L x 35H | 165 |
| UPS-500H | 500 | 4.34 | 21W x 39L x 35H | 185 |

*A PRODUCT LINE OF*

**MARINE ELECTRIC RPD INC.**

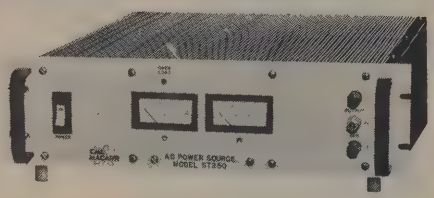
DEPT. EM, 167 NATIONAL ROAD, EDISON, NEW JERSEY 08817
(201) 287-2810 • TELEX 833351 • TWX 710-998-0560 • FMC 00062

CML MACARR®
POWER SUPPORT EQUIPMENT

# NEW! SYNAMP® solid state AC power sources synthesized sine wave NOW IN STOCK!!

## single phase 50-60-400 Hz

## ST series 250VA to 4000VA



MODEL ST250-41VA

| MODEL | OUTPUT POWER VA | INPUT | DIMENSIONS H x W x D | SHIPPING WEIGHT |
|---|---|---|---|---|
| ST250 | 250 | 115/230 1φ 47-63 Hz | 5¼ x 19 x 20 | 60 lbs. |
| ST500 | 500 | 115/230 1φ 47-63 Hz | 5¼ x 19 x 20 | 70 lbs. |
| ST1000 | 1000 | 115/230 1φ 47-63 Hz | 7 x 19 x 21 | 85 lbs. |
| ST2000 | 2000 | 208/230 3φ 47-63 Hz | 8¾ x 19 x 21 | 95 lbs. |
| ST4000 | 4000 | 208/230 3φ 47-63 Hz | 17½ x 19 x 21 | 185 lbs. |

## three phase 50-60-400 Hz

## TT series 750VA to 12000VA

| MODEL | OUTPUT POWER VA | INPUT | DIMENSIONS H x W x D | SHIPPING WEIGHT |
|---|---|---|---|---|
| TT750 | 750 | 115/230 1φ 47-63 Hz | 8¾ x 19 x 20 | 100 lbs. |
| TT1500 | 1500 | 208/230 3φ 47-63 Hz | 10½ x 19 x 20 | 105 lbs. |
| TT3000 | 3000 | 208/230 3φ 47-63 Hz | 14 x 19 x 20 | 180 lbs. |
| TT6000 | 6000 | 208/230 3φ 47-63 Hz | 17½ x 19 x 20 | 225 lbs. |
| TT12000 | 12000 | 208/230 3φ 47-63 Hz | 32 x 19 x 20 | 340 lbs. |

### Ordering Information

To specify give model number and option code number as shown below. For example: 500VA single phase 45-66 Hz. Model ST500-01 Add (-VA) for Voltmeter and Ammeter on Model ST250.

| Frequency | Code | Mode |
|---|---|---|
| 45-66 Hz | -01 | variable |
| 320-460 Hz | -02 | variable |
| 45-66 Hz and 320-460 Hz | -03 | 2 range variable |
| 50 Hz | -50 | fixed |
| 60 Hz | -60 | fixed |
| 400 Hz | -41 | fixed |

- High Efficiency 75% Typical
- Rack Mount Construction
- Versatility — may be used as a Frequency Converter or Precision AC Power Source
- Output Voltage Range: 105-130VAC
- Output Frequency Range: 45-460 Hz at Full Rated Output
- Modular Power Transistor Assemblies

### Specifications

**OUTPUT CONFIGURATION:** Single phase — two wire isolated. Three phase — four wire WYE with floating neutral and taps for delta load.

**INPUT CONFIGURATION:** 115/230 ±10% 1φ 47-63 Hz all models thru 1KVA, others 208/230 ±10% 3φ 47-63 Hz. Special voltages available at slight extra cost.

**OUTPUT VOLTAGE:** Single phase, 105-130V @ full power. Three phase, 105-130V/185-225V line to line, or line to neutral @ full power.

**VOLTAGE ADJUSTMENT:** Internally adjustable. Optional front panel mounted (add -P to Model No.).

**PHASE DISPLACEMENTS:** Three phase units 3° with balanced loads.

**LOAD POWER FACTOR:** .7 lead or lag at rated output.

**EFFICIENCY:** 75% typical.

**VOLTAGE REGULATION:** ±1% with ±10% line, ±1% NL-FL.

**FREQUENCY STABILITY:** .25% standard, options to .001%.

**RESPONSE TIME:** Less than 200 milliseconds at 60 Hz and 100 milliseconds at 400 Hz.

**HARMONIC DISTORTION:** 4% maximum at no load, 3% at full load.

**AMBIENT TEMPERATURE:** −20°C to +50°C.

**TEMPERATURE STABILITY:** Voltage .01% per degree C typical. Frequency .05% per degree C typical.

**CONTROLS AND METERS:** All models 500VA and up include panel voltmeter and ammeter. Variable frequency models have front panel mounted frequency control dial.

**PROTECTION:** Input line circuit breaker. Current limit on output. Circuit breaker available at extra cost.

**TERMINATIONS:** Output on front and rear. Input on rear mounted barrier strip.

**CONSTRUCTION:** Standard 19″ rack mount with full dust covers. Bench adaptors available at extra cost. Add (-C) to Model No.

**FINISH:** Front panels finished in satin finish aluminum or ivory paint with black marking. Chassis surfaces are protected by clear irridite.

*A PRODUCT LINE OF*

## MARINE ELECTRIC RPD INC.

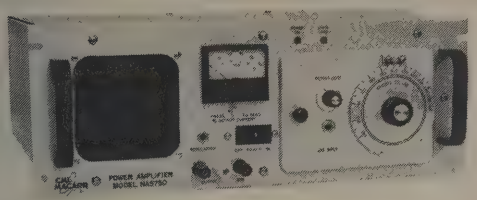
DEPT. EM, 167 NATIONAL ROAD, EDISON, NEW JERSEY 08817
(201) 287-2810 • TELEX 833351 • TWX 710-998-0560 • FMC 00062

CML MACARR®
POWER SUPPORT EQUIPMENT

# NEW! SOLID STATE WIDE BAND AC POWER SUPPLIES—45-10KHz Single Phase and Three Phase NOW IN STOCK!!

## NAS series 200VA to 1KVA

### Single Phase



MODEL NAS-750-1/SSG15A

| MODEL | OUTPUT POWER VA | INPUT POWER | DIMENSIONS H x W x D | SHIPPING WEIGHT |
|---|---|---|---|---|
| NAS-200 | 200 | 115/230 1φ 47-63 Hz | 7 x 19 x 16 | 75 lbs. |
| NAS-300 | 300 | 115/230 1φ 47-63 Hz | 7 x 19 x 16 | 90 lbs. |
| NAS-500 | 500 | 115/230 1φ 47-63 Hz | 7 x 19 x 17 | 95 lbs. |
| NAS-750 | 750 | 115/230 1φ 47-63 Hz | 7 x 19 x 19 | 140 lbs. |
| NAS-1000 | 1000 | 208/230 3φ 47-63 Hz | 12¼ x 19 x 19 | 210 lbs. |

## TAS series 500VA to 3KVA

### Three Phase

| MODEL | OUTPUT POWER VA | INPUT POWER | DIMENSIONS H x W x D | SHIPPING WEIGHT |
|---|---|---|---|---|
| TAS-500 | 500 | 115/230 3φ 47-63 Hz | 8¾ x 19 x 19 | 130 lbs. |
| TAS-1500 | 1500 | 208/230 3φ 47-63 Hz | 14 x 19 x 19 | 205 lbs. |
| TAS-2000 | 2000 | 208/230 3φ 47-63 Hz | 14 x 19 x 19 | 225 lbs. |
| TAS-3000 | 3000 | 208/230 3φ 47-63 Hz | 20 x 19 x 19 | 290 lbs. |

## Plug-In Oscillators

| Frequency | 1φ* | 3φ | Frequency Stability .25 | .1 | .01 | .001 |
|---|---|---|---|---|---|---|
| 400 | SSG14 | SSG34 | A | B | — | — |
| 400 | STG14 | STG34 | — | — | E | G |
| 50 | SSG11 | SSG31 | A | B | — | — |
| 50 | STG11 | STG31 | — | — | E | G |
| 60 | SSG12 | SSG32 | A | B | — | — |
| 60 | STG12 | STG32 | — | — | E | G |
| 45-70 | SSG13 | SSG33 | A | C | — | — |
| 350-450 | SSG15 | SSG35 | A | C | — | — |
| 300-2 kHz | SSG16 | SSG36 | A | C | — | — |
| 45-6 kHz | SSG17 | SSG37 | A | C | — | — |
| 45-10 kHz | SSG10 | SSG30 | A | C | — | — |
| External Signal Adapter (0-5V) | SA2T | N/A | — | — | — | — |

* All 1φ oscillators have 600 ohm jack receptacle for external oscillators.
C- Available on special order.

- Plug-In Oscillators
- Low Harmonic Distortion
- Outputs 0-65, 0-130, 260V available
- Minimum Package Sizes 200VA in 5¼" high standard rack space
- Response time 50 microseconds
- Frequency stability .25% to .001%

## Specifications

**OUTPUT CONFIGURATION:** Single phase two wire isolated. Three phase four wire. WYE with traps for Delta loads.

**OUTPUT VOLTAGE:** Single phase units, models NAS 200-500 standard; (-1) 0-130V with full power @ 105-130V. Optional; (-2) 0-65/0-130/0-260V with full power @ 55-65V/105-130V/210-260V respectively. Includes automatic range voltmeter, current readout and range indicator lights. All other models 0-130V/0-260V with full power 105-130V/210-260V. All Three Phase units — 105-130V/185-225V line to line WYE or Delta loads.

**PROTECTION:** Current overload with automatic reset. Optional current limit.

**LOAD POWER FACTOR:** .7 lead or lag.

**HARMONIC DISTORTION:** Less than .5%, 45-10 KHz @ full load. Less than 1% with plug-in oscillator.

**REGULATION:** ±.25% with ±10% input line variation ±1.0% NF-FL.

**OUTPUT PHASE SEPARATION:** 120 ±1° for fixed frequency models as well as 350-450 Hz models. 120 ±2° for 45-70 and 300-2,000 Hz models. 120 ±3° for 45-6,000 Hz models.

**NOISE LEVEL:** 70 db below rated output.

**OPERATING TEMPERATURE:** −20°C to +40°C.

**TEMPERATURE STABILITY:** Voltage .01% per degree C typical. Frequency .05% per degree C typical.

**METERS:** Models 500 VA and up include panel mounted output voltmeters. Optional at extra cost on lower power models. Add (-V) to model no.

**CONTROLS:** Output voltage and frequency controls mounted on plug-in oscillator panels where required.

**CONSTRUCTION:** Standard 19" rack mount with full dust covers. Bench adaptors available at extra cost.

**FINISH:** Front panels finished in satin finish aluminum with black marking. Chassis surfaces are protected by clear irridite.

**MODIFICATIONS AVAILABLE ON SPECIAL ORDER**

### Single Phase and Two Phase Output

Standard 3 phase power supplies may be used to provide a 2 phase output at ⅔ of rated power. An internal selector switch internally provides either 90 degrees or 120 degrees phase separation for 2 or 3 phases respectively.

Standard 3 phase power supplies may be used to provide a 1 phase output of 57% of rated power over an adjustable range of 105-130 volts.

*A PRODUCT LINE OF*

## MARINE ELECTRIC RPD INC.

DEPT. EM, 167 NATIONAL ROAD, EDISON, NEW JERSEY 08817
(201) 287-2810 • TELEX 833351 • TWX 710-998-0560 • FMC 00062

CML MACARR®

POWER SUPPORT EQUIPMENT

# wide band power amplifiers for audio and sonar testing

## SPG series 1KVA to 100KVA

**MODEL S5K**
PASSES THROUGH
A STANDARD
SUBMARINE HATCH

| MODEL | OUTPUT POWER KVA | LOAD POWER FACTOR RANGE AT RATED KVA | STANDARD OUTPUT IMPEDANCE TAPS OHMS | DIMENSIONS* H x W x D (APPROX.) | WEIGHT (APPROX.) LBS. | TYPE OF COOLING |
|---|---|---|---|---|---|---|
| A1K | 1 | ±0.4 to Unity | 4/16/36/64/144/576 | 22¾″ x 19″ x 20½″ | 345 | ↑ |
| A2K | 2 | ±0.4 to Unity | 4/16/36/64/144/576 | 22¾″ x 19″ x 17″ | 400 | ↑ |
| S2K | 2 | ±0.4 to Unity | 4/16/36/64/144/576 | 22¾″ x 17″ x 17″ | 400 | ↑ |
| A3K | 3 | ±0.1 to Unity | 4/16/36/64/144/576 | 53″ x 27″ x 26″ | 750 | FORCED AIR |
| S5K | 5 | ±0.4 to Unity | 16/64/256 | 68″ x 17″ x 17″ | 800 | FORCED AIR |
| B5K | 5 | ±0.1 to Unity | 8/32/72/128/288/1152 | 45″ x 24″ x 24″ | 850 | FORCED AIR |
| A10K | 10 | ±0.1 to Unity | 16/64/144/256/576/2304 | 47″ x 68″ x 24″ | 1,700 | FORCED AIR |
| A20K | 20 | ±0.3 to Unity | 16/64/144/256/576 | 47″ x 68″ x 24″ | 2,100 | FORCED AIR |
| VA30K | 30 | ±0.1 to Unity | 16/64/144/256/576 | 72″ x 72″ x 36″ | 3,000 | ↓ |
| VA50K | 50 | ±0.4 to Unity | 16/64/144/256/576 | 72″ x 72″ x 36″ | 4,200 | WATER COOLED |
| VA100K | 100 | ±0.1 to Unity | 16/64/144/256 | 2 sections, ea. 90″ x 72″ x 57″ | 9,400 | WATER COOLED ↓ |

* Model A1K and A2K are standard 19″ rack mount units; bench adapters available on special order. All other models are furnished complete in cabinet enclosures. Models A3K, S5K and B5K include casters. Models S2K and S5K are designed to go through a 25″ standard submarine hatch.

### Specifications

**FREQUENCY RESPONSE:** ±0.5 db, 100-10,000 Hz; Model A3K ±0.5 db, 200-15,000 Hz. Other frequency ranges between 5 Hz and 100 KHz available on a custom basis.

**HARMONIC DISTORTION:** Less than 3% over rated frequency range; less than 1.5% midband.

**HUM & NOISE:** At least 60 db below rated tap voltage.

## NA series 500VA to 15KVA single phase AC power supplies

**OUTPUT VOLTAGE:** Adjustable 0-125 Volts; full power available at output of 110-125 Volts.

| MODEL | OUTPUT POWER — VA | INPUT | DIMENSIONS* H x W x D | WEIGHT (APPROX.) LBS. |
|---|---|---|---|---|
| N500A | 500 | REPLACED BY OUR NEW SOLID STATE SERIES | | |
| N750B | 750 | | | |
| N1000A | 1,000 | | | |
| N1500A | 1,500 | 208/230V, 3φ, 57-65 Hz | 22¾″ x 19″ x 17″ | 315 |
| N2000A | 2,000 | 208/230V, 3φ, 57-65 Hz | 22¾″ x 19″ x 17″ | 325 |
| N5000A | 5,000 | 208/230V, 3φ, 57-65 Hz | 51″ x 24″ x 24″ | 850 |
| N15000A | 15,000 | 208/230V, 3φ, 57-65 Hz | 47″ x 68″ x 24″ | 1600 |

*Models N1500A and N2000 are standard rack mount. Add ¾″ to height if bench adapters are included. 5000VA and 15000VA units are cabinet models. For plug-in Oscillators see NAS Series.

## TA series 300VA to 20KVA three phase AC power supplies

### Single Phase & Two Phase Output

Standard 3 phase amplifiers may be used to provide a 2 phase output at ⅔ of rated output power. Special plug-in oscillators are available with selectable 90° or 120° phase separation for 2 phases or 3 phase operation respectively.
Standard 3 phase amplifiers may be used to provide a single phase output at 57% of rated output power over an adjustable voltage range of 110-125 volts.

| MODEL | φ OUTPUT POWER — VA | INPUT | DIMENSIONS H x W x D | WT. APPROX. LBS. |
|---|---|---|---|---|
| T300B | 300 | REPLACED BY OUR NEW SOLID STATE SERIES | | |
| T500 | 500 | | | |
| T750 | 750 | | | |
| T1200 | 1,200 | | | |
| T1750 | 1,750 | | | |
| T2500A | 2,500 | | | |
| T5000 | 5,000 | 208/230V, 3φ, 47-65 Hz | 45″ x 24″ x 24″ | 950 |
| T10000 | 10,000 | 208/230V, 3φ, 57-65 Hz | 78″ x 35″ x 36″ | 1650 |
| T15000 | 15,000 | 208/230V, 3φ, 57-65 Hz | 78″ x 35″ x 36″ | 1700 |
| T20000 | 20,000 | 208/230V, 3φ, 57-65 Hz | 78″ x 35″ x 36″ | 1900 |

**For Plug-in oscillators, see TAS Series.**

### Specifications

**OUTPUT CONFIGURATION:** Three Phase, 4 wire wye, neutral floating.
**OUTPUT VOLTAGE:** 0-125 Volts line-to-line and 0-217 Volts line-to-line; both sets of terminals are presented at output. Full power available at output of 110-125 volts and 190-217 volts. Master gain control and phase 2 and 3 trim controls provided on front panel.
**OUTPUT POWER:** Rated output power for each model is shown in chart. Maximum power per phase is ⅓ of 3φ output.
**LOAD POWER FACTOR:** 0.7 lead or lag to unity at rated output; wider power factor range with slight derating.
**FREQUENCY RANGE:** Each amplifier model is rated at full power 45-6,000 Hz except for the models T10000A-T20000A which have a 45-2000 Hz full power range. The operating output frequency range is determined by the particular plug-in oscillator which is used.
**HARMONIC DISTORTION:** Less than 3% over the entire 45 6,000 Hz amplifier range; less than 1%, 300-1000 Hz.
**HUM AND NOISE:** 60 db below maximum output voltage.
**OUTPUT PHASE SEPARATION:** 120 ±1° for fixed frequency models as well as 350-450 Hz models. 120 ±2° for 45-70 and 300-2,000 Hz models. 120 ±3° for 45-6,000 Hz models.
**CONSTRUCTION:** Models rated 300VA to 2500VA are standard 19″ rack mount units with full dust covers. Bench adapters available as accessories for these models; specify suffix (−C). Side support is recommended for rack mount models. Slides are available as optional accessories; specify suffix (−S). 5VA-20KVA models are furnished complete in cabinet enclosure.

*A PRODUCT LINE OF*

**MARINE ELECTRIC RPD INC.**

DEPT. EM, 167 NATIONAL ROAD, EDISON, NEW JERSEY 08817
(201) 287-2810 • TELEX 833351 • TWX 710-998-0560 • FMC 00062

CML MACARR®
POWER SUPPORT EQUIPMENT

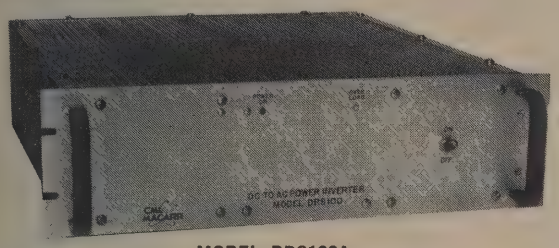
NEW!

# solid state transistorized rack mounted power inverters

# dc to 50-60-400 Hz

## MRS and DRS series

**Output Voltage:** Adjustable 110-120V



MODEL DRS100A

## MRS series - 50/60 Hz

**Output:** 115V rms, Single Phase
**Input:** Standard, 22-30V DC, also available 41-55V, replace (-24) with (-48) in model no.
**Voltage & Frequency Regulation:** 0.5%

| MODEL | OUTPUT VA | DIMENSIONS H x W x D | NET WT. LBS. (APPROX.) |
|---|---|---|---|
| MRS-50A-24 | 50 | 5¼″ x 19″ x 21″ | 28 |
| MRS-100A-24 | 100 | 5¼″ x 19″ x 21″ | 33 |
| MRS-200A-24 | 200 | 5¼″ x 19″ x 21″ | 63 |

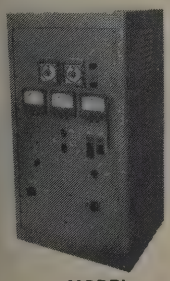
## DRS series - 400 Hz

**Output:** 115V rms, Single Phase
**Input:** Standard, 22-30V DC, also available 41-55V, replace (-24) with (-48) in model no.
**Voltage & Frequency Regulation:** 0.5%

| MODEL | OUTPUT VA | DIMENSIONS H x W x D | NET WT. LBS. (APPROX.) |
|---|---|---|---|
| DRS-50A-24 | 50 | 5¼″ x 19″ x 21″ | 25 |
| DRS-100A-24 | 100 | 5¼″ x 19″ x 21″ | 30 |
| DRS-200A-24 | 200 | 5¼″ x 19″ x 21″ | 60 |

- 50 to 200VA output.
- Low distortion sine wave.
- Highly regulated.
- Reliable.
- Quiet operation.
- Overload and short circuit protection.
- Protected against input polarity reversal.
- High efficiency.
- Input to output isolation.
- No auxiliary cooling required.

# battery service and analysis equipment



MODEL 505-50

Specifications

| MODEL | 12-30.1-101 | 505-50 | 403KA3A |
|---|---|---|---|
| Input Power | 115/230V, 1$\phi$, 60 Hz | 230V, 1$\phi$, 60 Hz | 115V, 1$\phi$, 60 Hz |
| Output Charge | 35A @ 35V | 50A @ 6V/12V/24V | 5A @ 50V per channel |
| Output Discharge | 35A @ 35V | 40A @ 28.5V | 45A @ 24V |
| Charge Channels | 1 | 4 | 2 |
| Discharge Channels | 1 | 1 | 1 |
| Type of Charge: | | | |
| Constant Current | Yes | Yes | Yes |
| Constant Potential | Yes | Yes | Yes |
| Modified Constant Potential | Yes | Yes | Yes |
| Pulse Charge | No | Yes | No |
| Analyzer | Yes | Yes | No |
| Size H x W x D (Approx.) | 21″ x 27″ x 15¼″ | 42″ x 22″ x 18″ | 43″ x 22″ x 18″ |
| Weight (Approx.) | 225 lbs. | 250 lbs. | 235 lbs. |

# ground support starting high current-low voltage DC supplies

## MODELS 28-UP MOBILE POWER SUPPLIES FOR AIRCRAFT

- Mobile — extremely rugged and reliable.
- Good load regulation, low ripple.
- All units feature heavy intermittent load capability.
- Easily maneuvered... large units have pneumatic tires.
- Weatherproof construction for outdoor duty.

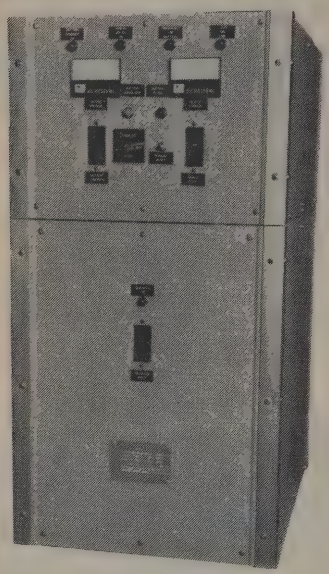
**SEND FOR DETAILS**

*A PRODUCT LINE OF*

## MARINE ELECTRIC RPD INC.

DEPT. EM, 167 NATIONAL ROAD, EDISON, NEW JERSEY 08817
(201) 287-2810 • TELEX 833351 • TWX 710-998-0560 • FMC 00062

# 1ϕ UNINTERRUPTIBLE 3ϕ POWER SYSTEMS



The Nova Uninterruptible Power System is a solid state system designed to provide uninterrupted A.C. power to critical loads. Systems 2.5 KVA and up carry a THREE YEAR WARRANTY!

Nova high efficiency systems, 85% typical, minimize battery requirements. Nova systems utilize smaller battery systems than those used to power comparable competitive systems.

Small size and relatively light weight minimize floor space and floor loading.

Deliveries for many systems range from stock to 30 days.

## SPECIFICATIONS:

**Input:** 115, 230 480 VAC, 1ϕ or 3ϕ (others)
**Frequency:** 60 Hz., 50 Hz.
**Voltage Regulation:** ±1%
**Frequency Regulation:** ±0.05%
**Power Factor Range:** 0.7 lead to lag
**Distortion:** Less than 5% THD
Less than 3% Singl
**Efficiency:** 85% typical
**Temperature:** −20° to +50°C
**Current Limited**
**Thermal Protected**

## SINGLE PHASE

| KVA | MODEL | DIMENSIONS W | D | H | WT. |
|---|---|---|---|---|---|
| .5 | 11-.5K60-*† | 24 | 10 | 30 | 110 |
| 1 | 11-1K60-*† | 24 | 10 | 30 | 170 |
| 2.5 | 11-2.5K60-* | 17 | 24 | 31 | 350 |
| 5 | 11-5K60-* | 17 | 24 | 31 | 410 |
| 7.5 | 11-7.5K60-* | 22 | 30 | 48 | 550 |
| 10 | 11-10K60-* | 22 | 30 | 48 | 750 |
| 15 | 11-15K60-* | 44 | 30 | 64 | 1060 |
| 20 | 11-20K60-* | 44 | 30 | 64 | 1500 |

*Add standby time to model number (10 mins. = 10M; 2 hours = 2H).
All weights and dimensions excluding batteries.
For 50 Hz. models change model numbers as follows: "60" in model no. to "50" or "3/6" to "3/5".
† NEMA-1 Enclosure.

## THREE PHASE

| KVA | MODEL | DIMENSIONS W | D | H | WT. |
|---|---|---|---|---|---|
| 5 | 11-5K-3/6-* | 17 | 24 | 56 | 650 |
| 7.5 | 11-7.5K-3/6-* | 34 | 24 | 42 | 730 |
| 10 | 11-10K-3/6-* | 34 | 24 | 42 | 810 |
| 15 | 11-15K-3/6-* | 44 | 30 | 64 | 1050 |
| 20 | 11-20K-3/6-* | 44 | 30 | 64 | 1600 |
| 30 | 11-30K-3/6-† | 66 | 30 | 76 | 2200 |

## 1ϕ FREQUENCY CHANGERS 3ϕ

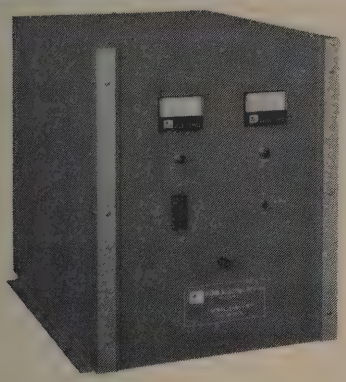
125 VA to 30 KVA, 1ϕ and 3ϕ
115 VAC, 220 VAC, 240 VAC, others
Sine Wave Output — 50, 60, 400 Hz.
Specifications same as Inverters on opposite page.

## AVAILABLE OPTIONS

- Alarms and Alarm Contacts
- Solid State or Electro-Mechanical Transfer Switch
- Manual Bypass
- Meters
- Extended Back-up Time
- Additional Metering
- 0.05% Frequency Regulation
- Audible Alarms and Acknowledge
- NEMA Enclosures
- Battery Charger Timer
- Visual Alarm and Alarm Contacts
  - Loss of Synchronization
  - Low Output Voltage
  - Battery Charger Failure
  - Battery Charger Low Output Voltage
  - Battery Charger High Output Voltage
  - Inverter Over-Temperature
  - Charger Over-Temperature
  - Output Overload
  - Transfer Switch Position
- Visual Alarm and Alarm Contacts (continued)
  - Static Switch Failure
  - Ground Detection
  - Low A.C. Input
  - Battery Input Not Present
  - Low Battery
  - Load on Bypass
  - Inverter Failure
  - Fan Failure (Forced Air Cooled Models)
  - Battery Charger Float/Equalizer

**NOVA ELECTRIC MANUFACTURING CO.**
Dept. EM, 263 Hillside Avenue
Nutley, New Jersey 07110 / (201) 661-3434

# NOVA SINE WAVE FIXED FREQUENCY INVERTERS 50 • 60 • 400 Hz



All Items on GSA Schedule Contact GS-005-04791

## SPECIFICATIONS:

**Output:**

**Voltage:** 115/230 VAC 1$\phi$ (others) 115/200, 3$\phi$ (others)

**Voltage Regulation:** ±1% for line or load

**Voltage Adjustment Range:** ±10% of nominal

**Frequency Regulation:** ±0.15% for line and load

**Frequency Adjustment Range:** ±5% of nominal

**Frequency/Temperature Coefficient:** 0.01% per °C.

**Transient Response:** less than 50 mSec for 100% Load Change

**Maximum Distortion:** less than 5%

**Efficiency:** 75% (except 12 and 24 volt models) 90%-2.5 KVA and up

**Load Power Factor:** .7 lead or lag

## CIRCUIT PROTECTION:

Reverse input polarity protection
Short circuit protection
Output automatic current limited
Thermal protected

## THREE PHASE INVERTERS

### 60 Hz.* INVERTERS

| Output VA | Input VDC | Model No. | Input Amps | Weight Lb. | Weight Kg. | Size |
|---|---|---|---|---|---|---|
| 5000 | 48<br>120 | 5K-3/6-48<br>5K-3/6-120 | 118<br>46 | 410 | 186 | 42 x 17 x 24 |
| 7500 | 24<br>48<br>120<br>240 | 7.5K-3/6-24<br>7.5K-3/6-48<br>7.5K-3/6-120<br>7.5K-3/6-240 | 480<br>240<br>66<br>33 | 615 | 280 | 63 x 17 x 24 |
| 10000 | 48<br>120<br>240 | 10K-3/6-48<br>10K-3/6-120<br>10K-3/6-240 | 260<br>95<br>46 | 530 | 241 | 42 x 17 x 24 |
| 15000 | 48<br>120<br>240 | 15K-3/6-48<br>15K-3/6-120<br>15K-3/6-240 | 276<br>138<br>69 | 800 | 364 | 63 x 17 x 24 |
| 20000 | 120<br>240 | 20K-3/6-120<br>20K-3/6-240 | 184<br>92 | 1100 | 500 | 32 x 44 x 30 |
| 30000 | 120<br>240 | 30K-3/6-120<br>30K-3/6-240 | 285<br>143 | 1650 | 750 | 32 x 66 x 30 |

*Also available in 50 Hz. and 400 Hz. models. Change 3/16 to 3/5 or 3/4.

## OTHER FEATURES:

**Operating Temperature:** −20°C. to +50°C.

Adaptable for rack mounting

Three phase inverters may be operated with unbalanced loads

**Other inverters available with inputs to 600 VDC.**

## SINGLE PHASE INVERTERS

### 60 Hz.* INVERTERS

| Output VA | Input VDC | Model No. | Input Amps | Weight Lb. | Weight Kg. | Size |
|---|---|---|---|---|---|---|
| 125 | 12<br>24<br>48<br>120 | 1260-12<br>1260-24<br>1260-48<br>1260-120 | 17.4<br>8.0<br>3.7<br>1.1 | 19 | 8.6 | 5¼ x 6½ x 9¾ |
| 250 | 12<br>24<br>48<br>120 | 2560-12<br>2560-24<br>2560-48<br>2560-120 | 35<br>16<br>7.5<br>2.2 | 37 | 16.8 | 6⅞ x 9 x 13¼ |
| 500 | 12<br>24<br>48<br>120 | 5060-12<br>5060-24<br>5060-48<br>5060-120 | 70<br>32<br>15<br>4.4 | 60 | 27.3 | 6⅞ x 11¼ x 14¼ |
| 1000 | 12<br>24<br>48<br>120 | 1K60-12<br>1K60-24<br>1K60-48<br>1K60-120 | 140<br>64<br>30<br>9 | 125<br>100 | 56.8<br>45.5 | 8⅝ x 17 x 17<br>8⅝ x 13¾ x 16 |
| 1500 | 24<br>48<br>120 | 1.5K60-24<br>1.5K60-48<br>1.5K60-120 | 96<br>45<br>13.3 | 145 | 65.9 | 12¼ x 17 x 24 |
| 2000 | 24<br>48<br>120 | 2K60-24<br>2K60-48<br>2K60-120 | 128<br>60<br>17.8 | 200 | 90.9 | 12¼ x 17 x 24 |
| 2500 | 24<br>48<br>120 | 2.5K60-24<br>2.5K60-48<br>2.5K60-120 | 140<br>60<br>30 | 250 | 114 | 21 x 17 x 24 |
| 5000 | 48<br>120 | 5K60-48<br>5K60-120 | 118<br>46 | 265 | 120 | 21 x 17 x 24 |
| 7500 | 120<br>240 | 7.5K60-120<br>7.5K60-240 | 69<br>35 | 405 | 185 | 32 x 22 x 30 |
| 10000 | 120<br>240 | 10K60-120<br>10K60-240 | 92<br>46 | 550 | 250 | 32 x 22 x 30 |

*50 Hz. models, change "60" to "50" in model no.

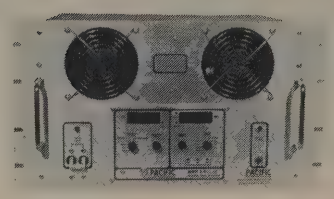
### 400 Hz. INVERTERS

| | | | | | | |
|---|---|---|---|---|---|---|
| 125 | 12<br>24 | 12400-12<br>12400-24 | 17.4<br>8 | 14 | 6.4 | 5¼ x 6½ x 9¾ |
| 250 | 12<br>24 | 25400-12<br>25400-24 | 35.0<br>16 | 25 | 11.4 | 6⅞ x 9 x 13¼ |
| 500 | 12<br>24 | 50400-12<br>50400-24 | 70<br>32 | 45 | 20.5 | 6⅞ x 11¼ x 14¼ |
| 1000 | 12<br>24 | 1K400-12<br>1K400-24 | 140<br>64 | 70 | 31.8 | 6⅞ x 11¼ x 14¼ |
| 1500<br>2000<br>2500<br>5000<br>10000 | 24<br>24<br>24<br>120<br>120 | 1.5K400-24<br>2K400-24<br>2.5K400-24<br>5K400-120<br>10K400-120 | 96<br>128<br>175<br>46<br>92 | 115<br>140<br>160<br>205<br>405 | 52.3<br>63.6<br>72.7<br>93.2<br>184 | 12¼ x 17 x 24<br>12¼ x 17 x 24<br>21 x 17 x 24<br>21 x 17 x 24<br>32 x 22 x 30 |

**NOVA ELECTRIC MANUFACTURING CO.**
Dept. EM, 263 Hillside Avenue
Nutley, New Jersey 07110 / (201) 661-3434

# PACIFIC

## K SERIES | BENCH-TOP & OEM AC POWER SOURCES



PACIFIC "K" series machines are linear AC power sources in light-weight one-man-portable cases for laboratory or rack mount OEM use. The 'K' series power range is 250 to 4500 VA output in single phase, 3 phase DELTA and 3 phase WYE configurations.

Output characteristics are as described under POWER AMPLIFIERS on the opposite page. Control characteristics are determined by the plug-in oscillator selected.

## "D" SUFFIX DIGITAL OSCILLATORS

The "D" module is recommended for all variable 3 phase applications and single phase applications requiring a high degree of control versatility.

The digital signal generator forms both single and three phase vectors from a common high frequency clock. It produces sinusoidal waveforms of exceptional purity and stability over a wide range of frequencies.

The "D" signal generators include two 3½ digit 0.6" LED readouts. The first monitors frequency continuously; the other is switch selectable to read volts or amps of any phase. Special frequency control ranges and digital control interface can be supplied to users special requirements.

**Frequency Control**: Two continuously variable ranges 20-200 and 200-2000 Hz, plus three precision fixed frequencies at 50, 60, 400 Hz, or at other user specified frequencies.

NOTE: Units with internal autoformer. Model numbers with suffix D will have the low frequency range restricted to 45 Hz and the high frequency range restricted to 500 Hz.

**Amplitude Control**: Continuously variable 0 to V max. Three phase units include balance controls for each phase with a range of ± 10%.

**Phase Separation Accuracy**: ± 1° max (3Ø units only).

**Signal Distortion**: 0.25% max.

**Amplitude Stability**: 0.01% per °C.

**Frequency Stability**: 0.01% per °C.

**Freq. Meter Accuracy**: 0.25% ± 1 digit.

**Freq. Meter Resolution**: 0.1 Hz on 20-200 range; 1.0 Hz on 200-2000 range.

**Voltmeter Function**: Nine position function switch permits user to monitor volts any phase to neutral, volts phase to phase and amps any phase.

**Voltmeter Accuracy**: 0.25% ± 1 digit.

**Ammeter Accuracy**: 5.0%.

## "V" SUFFIX VARIABLE OSCILLATORS

The "V" module consists of a FET stabilized, dual range variable, linear oscillator. Its two frequency ranges are centered around the popular power frequencies, continuously variable by multiturn control and calibrated frequency dial. The module includes a panel voltmeter which monitors output voltage.

This module is recommended for single phase power sources where only narrow range frequency control is required.

**Frequency Control**: Two continuously variable ranges 45 to 75 Hz and 300 to 500 Hz.

**Dial Accuracy**: 1%.

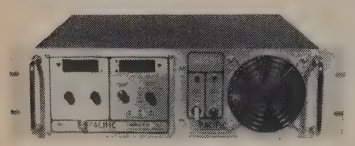
**Frequency Stability**: 0.01% per °C.

**Amplitude Control**: 0 to V max by panel control.

**Voltmeter Accuracy**: 3%.

**Distortion**: 0.25% max.

**External Input**: Allows the power source to be used as an amplifier only. Gain = 100, BW = 20-2000 Hz full scale, 5-20,000 Hz small signal. Input impedance 600 ohms.



## "F" SUFFIX FIXED OSCILLATORS

The "F" suffix module provides a single fixed frequency' specified by the user. High stability frequency determining components are used as well as a FET stabilized amplitude control loop. This module is recommended for fixed parameter, low cost OEM, and all unattended use applications requiring high long term stability.

Panel voltmeter (3% accuracy) is included in both single and 3 phase versions.

**Frequency Control**: Fixed, as specified by user within the range 20-2000 Hz.

**Amplitude Control**: 0 to V max by panel control with locknut.

**Frequency Stability**: 0.01% per °C.

**Amplitude Stability**: 0.003% per °C.

**Distortion**: 0.25% max.

**Phase Angle Accuracy**: 1° (3Ø units only).

**Balance Controls**: ± 5% control range, adjustable through front panel (3Ø units only).

## "X" SUFFIX AMPLIFIER ADAPTER

The "X" suffix adapter allows any power source to be used as a wide-band linear amplifier. Input signal is applied through a front panel BNC connector to a small signal audio transformer. Input is isolated from chassis and amplifier output.

**Gain** = 125

**Bandwidth** = 20-2000 Hz full power; 5Hz-20,000 Hz Small Signal

**Input Impedance** = 50 ohms

## "K" SERIES POWER AMPLIFIERS

All "K" series machines use identical output stages except for power level. The power amplifier section is a wide band direct coupled output linear amplifier. The amplifier is designed to operate from a 5 vrms signal from the signal generator module.

**Input Power**: 105-125 VAC 1Ø 47-63 Hz. May be reconnected for any of the following inputs: 210-250 VAC, 95-115 VAC, 190-230 VAC.

**Output Voltage**: See model listings.

—R models produce output vectors of 0-125 VAC 1Ø or 0-125 VAC L-N if 3Ø WYE, or 0-125 VAC L-L if 3Ø DELTA.

—S models produce a balanced output (2 vectors 180° apart) of 125-0-125 VAC, plus a 250 VAC output.

—T models produce a 0-125 VAC vector, plus 0-250 VAC through an output autoformer. Both outputs may be loaded simultaneously. Other autoformer tap voltages as specified by user. T model frequency range limited to 45-500 Hz.

**Line Regulation**: 0.1% max.

**Load Regulation**: 0.25% max. at amplifier output terminals. (May be higher at transformer tap points.)

The specifications below describe overall output characteristics, when driven by any of the oscillator modules listed.

**Distortion**: 0.25% amplifier only, 0.5% max. combined distortion of signal generator and amplifier.

**Load Power Factor**: Full Power ÷ 0.7.

**Peak Overcurrent**: Approximately three times rms current available at crest of output sine wave.

**Bandwidth**: 20-2000 Hz Full Power; 5-20,000 Hz small signal.

**Transient Response**: 30 microseconds.

**Output Control**: Panel switch for On-Off control.

**Output Protection**: Protected against overloads and shorts with automatic recovery.

**Output Reference**: Floating. Any output terminal may be tied to chassis.

**Efficiency**: 65% at maximum undistorted output voltage.

**Temperature Range**: 0-55° C operating.

## MECHANICAL:

All models are mounted in case A or one or more case B — as shown below. Both case sizes are equipped with rack mount tabs for installation into standard 19" racks if desired. Cooling is by self-contained fans — front intake, rear exhaust. Flow is approximately 100 CFM for case A, 200 CFM for case B.

Input power is by 6' linecord, output power available at terminal strip, both at rear of unit.

Model 315K-D

## SINGLE PHASE MODELS

| Model | VA | Output Current (Amps) | Output Voltage Range (VAC) | Osc-ill-ator | Case Size | Weight |
|---|---|---|---|---|---|---|
| 103K-FR | 250 | 2 | 0-125 | F | A | 30 |
| 103K-VR | 250 | 2 | 0-125 | V | A | 30 |
| 103K-DR | 250 | 2 | 0-125 | D | A | 30 |
| 103K-FT | 250 | 2/1 | 0-125/0-250 | F | A | 35 |
| 103K-VT | 250 | 2/1 | 0-125/0-250 | V | A | 35 |
| 103K-DT | 250 | 2/1 | 0-125/0-250 | D | A | 35 |
| 105K-FR | 500 | 4 | 0-125 | F | A | 40 |
| 105K-VR | 500 | 4 | 0-125 | V | A | 40 |
| 105K-DR | 500 | 4 | 0-125 | D | A | 40 |
| 105K-FS | 500 | 2/2/2 | 125-0-125/250 | F | A | 40 |
| 105K-VS | 500 | 2/2/2 | 125-0-125/250 | V | A | 40 |
| 105K-DS | 500 | 2/2/2 | 125-0-125/250 | D | A | 40 |
| 105K-FT | 500 | 4/2 | 0-125/0-250 | F | A | 48 |
| 105K-VT | 500 | 4/2 | 0-125/0-250 | V | A | 48 |
| 105K-DT | 500 | 4/2 | 0-125/0-250 | D | A | 48 |
| 108K-FR | 750 | 6 | 0-125 | F | A | 54 |
| 108K-VR | 750 | 6 | 0-125 | V | A | 54 |
| 108K-DR | 750 | 6 | 0-125 | D | A | 54 |
| 108K-FT | 750 | 6/3 | 0-175/0-250 | F | A | 65 |
| 108K-VT | 750 | 6/3 | 0-125/0-250 | V | A | 65 |
| 108K-DT | 750 | 6/3 | 0-125/0-250 | D | A | 65 |
| 110K-FR | 1KVA | 8 | 0-125 | F | B | 80 |
| 110K-VR | 1KVA | 8 | 0-125 | V | B | 80 |
| 110K-DR | 1KVA | 8 | 0-125 | D | B | 80 |
| 110K-FS | 1KVA | 4/4/4 | 125-0-125/250 | F | B | 80 |
| 110K-VS | 1KVA | 4/4/4 | 125-0-125/250 | V | B | 80 |
| 110K-DS | 1KVA | 4/4/4 | 125-0-125/250 | D | B | 95 |
| 110K-FT | 1KVA | 8/4 | 0-125/0-250 | F | B | 95 |
| 110K-VT | 1KVA | 8/4 | 0-125/0-250 | V | B | 95 |
| 110K-DT | 1KVA | 8/4 | 0-125/0-250 | D | B | 95 |
| 112K-FR | 1.25KVA | 10 | 0-125 | F | B | 92 |
| 112K-VR | 1.25KVA | 10 | 0-125 | V | B | 92 |
| 112K-DR | 1.25KVA | 10 | 0-125 | D | B | 92 |
| 112K-FT | 1.25KVA | 10/5 | 0-125/0-250 | F | B | 107 |
| 112K-VT | 1.25KVA | 10/5 | 0-125/0-250 | V | B | 107 |
| 112K-DT | 1.25 KVA | 10/5 | 0-125/0-250 | D | B | 107 |
| 115K-FR | 1.5KVA | 12 | 0-125 | F | B | 105 |
| 115K-VR | 1.5KVA | 12 | 0-125 | V | B | 105 |
| 115K-DR | 1.5KVA | 12 | 0-125 | D | B | 105 |
| 115K-FS | 1.5KVA | 6/6/6 | 125-0-125/250 | F | B | 105 |
| 115K-VS | 1.5KVA | 6/6/6 | 125-0-125/250 | V | B | 105 |
| 115K-DS | 1.5KVA | 6/6/6 | 125-0-125/250 | D | B | 105 |
| 115K-VT | 1.5KVA | 12/6 | 0-125/0-250 | F | B | 125 |
| 115K-VT | 1.5KVA | 12/6 | 0-125/0-250 | V | B | 125 |
| 115K-DT | 1.5KVA | 12/6 | 0-125/0-250 | D | B | 125 |
| 120K-FR | 2KVA | 16 | 0-125 | F | B | 160 |
| 120K-VR | 2KVA | 16 | 0-125 | V | B | 160 |
| 120K-DR | 2KVA | 16 | 0-125 | D | B | 160 |
| 120K-FS | 2KVA | 8/8/8 | 0-125-0-125/250 | F | 2EA B | 160 |
| 120K-VS | 2KVA | 8/8/8 | 0-125-0-125/250 | V | 2EA B | 160 |
| 120K-DS | 2KVA | 8/8/8 | 0-125-0-125/250 | D | 2EA B | 160 |
| 120K-FT | 2KVA | 16/8 | 0-125/0-250 | F | 2EA B | 195 |
| 120K-VT | 2KVA | 16/8 | 0-125/0-250 | V | 2EA B | 195 |
| 120K-DT | 2KVA | 16/8 | 0-125/0-250 | D | 2EA B | 195 |
| 130K-FR | 3KVA | 24 | 0-125 | F | 2EA B | 210 |
| 130K-VR | 3KVA | 24 | 0-125 | V | 2EA B | 210 |
| 130K-DR | 3KVA | *24 | 0-125 | D | 2EA B | 210 |
| 130K-FS | 3KVA | 12/12/12 | 0-125-0-125/250 | F | 2EA B | 210 |
| 130K-VS | 3KVA | 12/12/12 | 0-125-0-125/250 | V | 2EA B | 210 |
| 130K-DS | 3KVA | 12/12/12 | 0-125-0-125/250 | D | 2EA B | 210 |
| 130K-FT | 3KVA | 24/12 | 0-125/0-250 | F | 2EA B | 250 |
| 130K-VT | 3KVA | 24/12 | 0-125/0-250 | V | 2EA B | 250 |
| 130K-DT | 3KVA | 24/12 | 0-125/0-250 | D | 2EA B | 250 |

## THREE PHASE DELTA MODELS

| Model | VA | Output Current (Amps/Phase) | Output Voltage Range (V L-L) | Osc-ill-ator | Case Size | Weight |
|---|---|---|---|---|---|---|
| 205K-DR | 430 | 2 | 0-125 | D | A | 40 |
| 205K-DT | 430 | 2/1 | 0-125/0-250 | D | A | 50 |
| 210K-DR | 860 | 4 | 0-125 | D | B | 80 |
| 210K-DT | 860 | 4/2 | 0-125/0-250 | D | B | 95 |
| 215K-DR | 1.3KVA | 6 | 0-125 | D | B | 105 |
| 215K-DT | 1.3KVA | 6/3 | 0-125/0-250 | D | B | 125 |
| 220K-DR | 1.7KVA | 8 | 0-125 | D | 2EA B | 160 |
| 220K-DT | 1.7KVA | 8/4 | 0-125/0-250 | D | 2EA B | 190 |
| 225K-DR | 2.2KVA | 10 | 0-125 | D | 2EA B | 184 |
| 225K-DT | 2.2KVA | 10/5 | 0-125/0-250 | D | 2EA B | 214 |
| 230K-DR | 2.6KVA | 12 | 0-125 | D | 2EA B | 210 |
| 230K-DT | 2.6KVA | 12/6 | 0-125/0-250 | D | 2EA B | 250 |

## THREE PHASE WYE MODELS

| Model | VA | Output Current (Amps/Phase) | Output Voltage Range (VL-N) | Osc-ill-ator | Case Size | Weight |
|---|---|---|---|---|---|---|
| 305K-FR | 500 | 2* | 0-125 | F | A | 44 |
| 305K-DR | 500 | 2* | 0-125 | D | A | 44 |
| 305K-FT | 500 | 2*/1 | 0-125/0-250 | F | A | 54 |
| 305K-DT | 500 | 2*/1 | 0-125/0-250 | D | A | 54 |
| 308-FR | 750 | 2 | 0-125 | F | A | 55 |
| 308-DR | 750 | 2 | 0-125 | D | A | 55 |
| 308-FT | 750 | 2/1 | 0-125/0-250 | F | A | 65 |
| 308-DT | 750 | 2/1 | 0-125/0-250 | D | A | 65 |
| 315K-FR | 1.5KVA | 4 | 0-125 | F | B | 115 |
| 315K-DR | 1.5KVA | 4 | 0-125 | D | B | 115 |
| 315K-FT | 1.5KVA | 4/2 | 0-125/0-250 | F | B | 135 |
| 315K-DT | 1.5KVA | 4/2 | 0-125/0-250 | D | B | 135 |
| 323K-FR | 2.25KVA | 6 | 0-125 | F | 3EA A | 165 |
| 323K-DR | 2.25KVA | 6 | 0-125 | D | 3EA A | 165 |
| 323K-FT | 2.25KVA | 6/3 | 0-125/0-250 | F | 3EA A | 195 |
| 323K-DT | 2.25KVA | 6/3 | 0-125/0-250 | D | 3EA A | 195 |
| 330K-FR | 3KVA | 8 | 0-125 | F | 3EA B | 240 |
| 330K-DR | 3KVA | 8 | 0-125 | D | 3EA B | 240 |
| 330K-FT | 3KVA | 8/4 | 0-125/0-250 | F | 3EA B | 285 |
| 330K-DT | 3KVA | 8/4 | 0-125/0-250 | D | 3EA B | 285 |
| 345K-FR | 4.5KVA | 12 | 0-125 | F | 3EA B | 315 |
| 345K-DR | 4.5KVA | 12 | 0-125 | D | 3EA B | 315 |
| 345K-FT | 4.5KVA | 12/6 | 0-125/0-250 | F | 3EA B | 375 |
| 345K-DT | 4.5KVA | 12/6 | 0-125/0-250 | D | 3EA B | 375 |

* Total Current 4 Amps Max.
All Specifications Subject to Change Without Notice

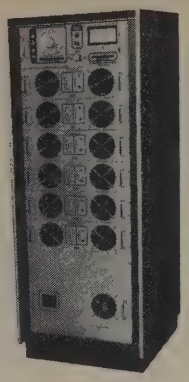
Case size B — 10½H X 19W X 19D

Case size A — 6¼H X 19W X 19D

PACIFIC
POWER SOURCE DIVISION
Pacific Electronic Ent. Inc.

5291 Systems Drive,
Huntington Beach, Ca. 92649
Phone: (714) 898-2691 — Toll Free (800) 854-2433

# J Series MULTI-KVA AC POWER SYSTEMS 2 to 70 KVA



# PACIFIC AC POWER SYSTEMS

Pacific's "J" Series systems are fully regulated, all solid state, linear AC Power converters, for the production of single phase, three phase delta, or three phase WYE output power.

### BASIC SYSTEM CONSTRUCTION

"J" Series power systems utilize modular construction to permit instant assembly of systems to a wide variety of configurations and power levels.

Two module types are utilized to assemble all systems: The control module which houses the oscillator and dictates the output configuration, and the requisite number of identical paralellable 1.3 KVA power modules. All are mounted in an attractive main frame, forming a complete system.

Easy servicing is insured by the fact that there are only two basic modules to be knowledgeable of, one of which (the power amplifier) has self-diagnostic circuitry which not only locates the defective device but isolates it as well, allowing the system to continue operating unaffected for servicing when convenient, thus greatly increasing the system output reliability.

## CONTROL CHARACTERISTICS

Each Pacific AC Power System is equipped with a control module. This control module contains the oscillator, dictates the output configuration and provides all of the control functions.

Control modules are available for both single and 3 phase systems.

### "B" VARIABLE CONTROL — 3 Phase

**FREQUENCY RANGE:** Continuously variable 47 to 500 Hz Accuracy ± 2%, Stability 0.25%

**FIXED FREQUENCIES:** Three pushbutton selectable fixed frequencies 50, 60 and 400 Hz or as specified by user. Accuracy ± 0.1%, Stability 0.1%. Pushbutton switches are equipped with lock button to prevent accidental changes.

**CONFIGURATION:** WYE or Delta

**METERING:** Output voltage, pushbutton selectable phases A, B and C to Neutral and A to B, B to C and A to C. Current meter located on each power amplifier module.

**AMPLITUDE CONTROL:** Master varies all outputs 0 to full output; ± 10% trim on each phase.

**EXTERNAL INPUTS:** One per phase allows the system to be utilized as 3 independent amplifiers.

**SIZE:** 7"H x 19"W x 17"D

**WEIGHT:** 20 lbs.

The "B" type control modules offer variable operating parameters and are intended for lab type use where a great degree of flexibility is required.

The "H" type control modules are intended for fixed parameter applications, often preferred because they prevent unauthorized changes in operating parameters.

### "B" VARIABLE CONTROL — 1 Phase

**FREQUENCY RANGE:** Continuously Variable 47 to 500 Hz. Accuracy — ± 2%, Stability — 0.25%

**FIXED FREQUENCIES:** Three pushbotton selectable fixed frequencies 50, 60 and 400 Hz or as specified by user. Accuracy — 0.1%, Stability — 0.1% Pushbutton switches are equipped with lock button to prevent accidental charges.

**EXTERNAL INPUT:** Allows unit to be used as power amplifier.

**METERING:** Output voltage current meters on each power amplifier.

**AMPLITUDE CONTROL:** 0 to full output

**SIZE:** 7"H x 19"W x 17"D

**WEIGHT:** 20 lbs.

## STANDARD MODELS

Each of the following listed models are complete systems ready for use. The control characteristics of each model are referenced for your convenience. Although these models will answer most power requirements, variations of each model are available.

## SINGLE PHASE SYSTEMS

| Model | Output Power (KVA) | Output Current (Amps) | Output Voltage Range | Control Characteristics | Frame Size |
|---|---|---|---|---|---|
| 120J-B | 2.5 | 20 | 0-130 VAC | B | 3MF |
| 120J-BT | 2.5 | 20/10 | 0-120/0-260 VAC | B | 3MF |
| 130J-B | 4 | 30 | 0-130 VAC | B | 3MF |
| 130J BT | 4 | 30/15 | 0-130/0-260 VAC | B | 3MF |
| 140J-B | 5 | 40 | 0-130 VAC | B | 6MF |
| 140J-BT | 5 | 40/20 | 0-130/0-260 VAC | B | 6MF |
| 150J-B | 6.5 | 50 | 0-130 VAC | B | 6MF |
| 150J-BT | 6.5 | 50/25 | 0-130/0-260 VAC | B | 6MF |
| 160J-B | 8 | 60 | 0-130 VAC | B | 6MF |
| 160J BT | 8 | 60/30 | 0-130/0-260 VAC | B | 6MF |
| 170J-B | 9 | 70 | 0-130 VAC | B | 9MF |
| 170J-BT | 9 | 70/35 | 0-130/0-260 VAC | B | 9MF |
| 180J-B | 10.5 | 80 | 0-130 VAC | B | 9MF |
| 180J-BT | 10.5 | 80/40 | 0-130/0-260 VAC | B | 9MF |
| 190J-B | 12 | 90 | 0-130 VAC | B | 9MF |
| 190J-BT | 12 | 90/45 | 0-130/0-260 VAC | B | 9MF |
| 1120J-B | 15 | 120 | 0-130 VAC | B | 2 ea. 6MF |
| 1120J-BT | 15 | 120/60 | 0-130/0-260 VAC | B | 2 ea. 6MF |
| 1180J-B | 24 | 180 | 0-130 VAC | B | 2 ea. 9MF |
| 1180-J-BT | 24 | 180/90 | 0-130/0-260 VAC | B | 2 ea. 9MF |
| 1270J-B | 35 | 270 | 0-130 VAC | B | 3 ea. 9MF |
| 1270J-BT | 35 | 270/125 | 0-130/0-260 VAC | B | 3 ea. 9MF |
| 1360J-B | 45 | 360 | 0-130 VAC | B | 4 ea. 9MF |
| 1360J-BT | 45 | 360/180 | 0-130/0-260 VAC | B | 4 ea. 9MF |
| 1450J-B | 60 | 450 | 0-130 VAC | B | 5 ea. 9MF |
| 1450J-BT | 60 | 450/225 | 0-130/0-260 VAC | B | 5 ea. 9MF |
| 1540J-B | 70 | 540 | 0-130 VAC | B | 6 ea. 9MF |
| 1540J-BT | 70 | 540/270 | 0-130/0-260 VAC | B | 6 ea. 9MF |

## BASIC MODEL 113JO POWER AMPLIFIER

The Model 113-JO 1.3 KVA Power Module is the heart of Pacific's AC Power Systems. It is a completely self-contained linear power amplifier, with Pacific's disconnect feature built in. There are two disconnect features in this module, one is the self-healing circuitry which isolates and locates faulty power devices, and the other is the module disconnect which permits the entire module to disconnect. These features combined with conservative designs have provided for the ultimate in reliability.

**OUTPUT POWER:** 1.3 KVA (See chart on Page 5).
**OUTPUT VOLTAGE:** 0-130 VAC.
**OUTPUT CURRENT:** 10 amps RMS.
**OUTPUT PEAK CURRENT:** 20 amps at crest of sine wave.
**METERING:** 0-10 amps.
**AUTOMATIC DISCONNECT:** Self-healing circuitry incorporated which removes failed output device without disturbing output power or derating module capability.

**PARALLEL:** Any number of modules may be connected in parallel for increased power within a system.
**COOLING:** Forced air front intake, rear exhaust.
**SIZE:** 5¼"H x 19"W x 17"D (fits any standard 19" Rack).
**WEIGHT:** 25 lbs.

*For detailed performance specifications see system PERFORMANCE Section next page

## SYSTEM PERFORMANCE

The following specifications apply to all of the listed models, in the case of 3 phase outputs the performance parameters refer to each phase.

The control characteristics of each model are determined by the control module utilized. The model listing include a designation for control characteristics.

**VOLTAGE RANGE:** See Model Listings.
**OUTPUT CURRENT:** See Model Listings.
**OUTPUT PEAK CURRENT:** Twice rms current of sinewave for driving peak type loads such as DC power supplies.
**POWER FACTOR:** Full Power ± 0.7.
**LOAD REGULATION:** 0.25% 0-130 VAC Range— Other Ranges add 2%
**LINE REGULATION:** 0.1% Max.
**OUTPUT DISTORTION:** 0.75% Max. (Typical 0.4%).
**OUTPUT MODULATION:** 0.25% Max.
**ISOLATION:** Floating output, any output terminal may be grounded.

**OUTPUT PROTECTION:** Electronic current limiting with auto-recovery. Bypass network protects unit from transients fed back into the output terminals.
**RESPONSE TIME:** 50 microseconds.
**METERING:** Voltage—in control module. Current meter located in each 1.3 KVA module.
**COOLING:** Each module has forced air cooling. Front intake rear exhaust; top exhaust is optional.
**TEMPERATURE RANGE:** 0-55 degrees Cent.
**EFFICIENCY:** 60% max. (Varies with load P.F. and output voltage).
**LINE SURGE:** Special circuits prevent excessive line surges during turn on.
**INPUT POWER:** Almost any 1 phase or 2 phase line may be accommodated. See Main Frame Specifications.
**OUTPUT STORAGE:** Unit maintains full output when subjected to a 6 ms line power interruption.

## MAIN FRAMES

3 basic main frames are utilized for all of the "J" Series models. These main frames are used separately or may be combined for high power systems. These main frames contain mounting slides for modules, line power circuit breaker, AC and DC power distribution and space for optional equipment.

**3MF:** Houses up to 3 power amplifier modules (4KVA) and 1 control module.

**6MF:** Houses up to 6 power amplifier modules (8KVA) and 1 control module.

**9MF:** Houses up to 9 power amplifier modules (12KVA) and 1 control module.

WYE and Delta outputs may be provided for simultaneous use by the addition of a Wye to Delta transformer in the main frame. Systems of power capacity between 12 and 70 KVA are housed in multiple cabinets.

| MAIN FRAME | DIMENSIONS | WEIGHT | ACCEPTABLE INPUT POWER FORMS |
|---|---|---|---|
| 3MF | 43"HX23"WX25½"D | 370 | A B C E & F |
| 6MF | 61"HX23"WX25½"D | 575 | A B C D E & F |
| 9MF | 78"HX23"WX25½"D | 675 | A B C & D |

### INPUT POWER FORMS

| | | | |
|---|---|---|---|
| Form A. | 240 VAC ± 10% | 47 to 63 HZ | 3Ø Delta |
| Form B. | 120 VAC ± 10% | 47 to 63 HZ | 3Ø Delta |
| Form C. | 120/208 VAC ± 10% | 47 to 63 HZ | 3Ø Wye |
| Form D. | 440 VAC ± 10% | 47 to 63 HZ | 3Ø Delta |
| Form E. | 240 VAC ± 10% | 47 to 63 HZ | 1Ø |
| Form F. | 120 VAC ± 10% | 47 to 63 HZ | 1Ø |

## 3-PHASE DELTA SYSTEMS

| Model | Total Output Power KVA | Current Per Leg (Amps) | Output Voltage Range | Control Characteristics | Frame Size |
|---|---|---|---|---|---|
| 220J-B | 2 | 10 | 0-130 VAC | B | 3MF |
| 220J-BT | 2 | 10/5 | 0-130/0-260 VAC | B | 3MF |
| 250J-B | 4 | 20 | 0-130 VAC | B | 3MF |
| 240J BT | 4 | 20/10 | 0-130/0-260 VAC | B | 6MF |
| 260J-B | 6 | 30 | 0-130 VAC | B | 6MF |
| 260J-BT | 6 | 30/15 | 0-130/0-260 VAC | B | 6MF |
| 280J-B | 8 | 40 | 0-130 VAC | B | 2 ea. 6MF |
| 280J BT | 8 | 40/20 | 0-130/0-260 VAC | B | 2 ea. 6MF |
| 2120J-B | 12 | 60 | 0-130 VAC | B | 2 ea. 6MF |
| 2120J-BT | 12 | 60/30 | 0-130/0-260 VAC | B | 2 ea. 6MF |
| 2180J-B | 18 | 90 | 0-130 VAC | B | 2 ea. 9MF |
| 2180J-BT | 18 | 90/45 | 0-130/0-260 VAC | B | 2 ea. 9MF |
| 2240J-B | 24 | 120 | 0-130 VAC | B | 4 ea. 6MF |
| 2240J-BT | 24 | 120/60 | 0-130/0-260 VAC | B | 4 ea. 6MF |
| 2360J-B | 36 | 180 | 0-130 VAC | B | 4 ea. 9MF |
| 2360J-BT | 36 | 180/90 | 0-130/0-260 VAC | B | 4 ea. 9MF |
| 2540J-B | 54 | 270 | 0-130 VAC | B | 6 ea. 9MF |
| 2540J-BT | 54 | 270/135 | 0-130/0-260 VAC | B | 6 ea. 9MF |

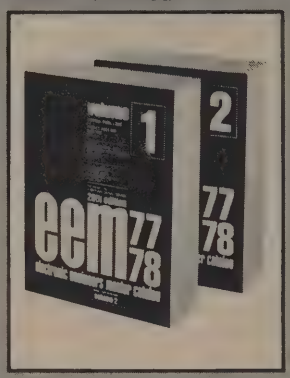
## 3-PHASE WYE SYSTEMS

| Model | Total Output Power KVA | Current Per Leg (Amps) | Output Voltage Range | Control Characteristics | Frame Size |
|---|---|---|---|---|---|
| 330J-B | 4 | 10 | 0-130 VAC | B | 3MF |
| 330J-BT | 4 | 10/5 | 0-130/0-260 VAC | B | 3MF |
| 360J-B | 8 | 20 | 0-130 VAC | B | 6MF |
| 360J-BT | 8 | 20/10 | 0-130/0-260 VAC | B | 6MF |
| 390J-B | 12 | 30 | 0-130 VAC | B | 9MF |
| 390J-BT | 12 | 30/15 | 0-130/0-260 VAC | B | 9MF |
| 3120J-B | 15 | 40 | 0-130 VAC | B | 2 ea. 6MF |
| 3120J-BT | 15 | 40/20 | 0-130/0-260 VAC | B | 2 ea. 6MF |
| 3180J-B | 24 | 60 | 0-130 VAC | B | 3 ea. 6MF |
| 3180J-BT | 24 | 60/30 | 0-130/0-260 VAC | B | 3 ea. 6MF |
| 3270J-B | 35 | 90 | 0-130 VAC | B | 3 ea. 9MF |
| 3270J-BT | 35 | 90/45 | 0-130/0-260 VAC | B | 3 ea. 9MF |
| 3360J-B | 45 | 120 | 0-130 VAC | B | 4 ea. 9MF |
| 3360J-BT | 45 | 120/60 | 0-130/0-260 VAC | B | 4 ea. 9MF |
| 3450J-B | 60 | 150 | 0-130 VAC | B | 5 ea. 9MF |
| 3450J-BT | 60 | 150/75 | 0-130/0-260 VAC | B | 5 ea. 9MF |
| 3540J-B | 70 | 180 | 0-130 VAC | B | 6 ea. 9MF |
| 3540J-BT | 70 | 180/90 | 0-130/0-260 VAC | B | 6 ea. 9MF |

# WE KNOW OUR STUFF

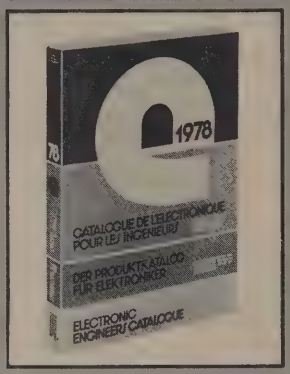
## 41 YEARS OF EXPERIENCE IN CATALOGING, 21 EDITIONS OF eem

### eem/ELECTRONIC ENGINEERS MASTER CATALOG —



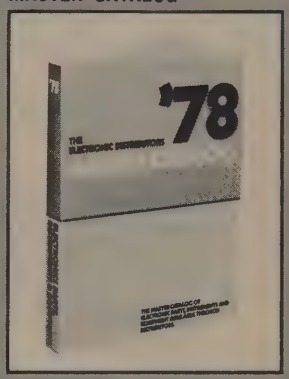

The "blue-ribbon" catalog/directory that has become "the standard of the industry" for electronic engineers, buyers and specifiers.

### ELECTRONIC ENGINEERS CATALOGUE



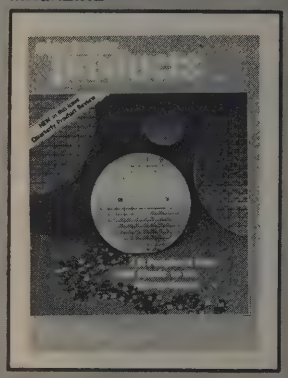

The new catalogue/directory of electronic products available to and from Western Europe and the United Kingdom. Designed especially for the European electronics engineer.

### ELECTRONIC DISTRIBUTORS MASTER CATALOG —



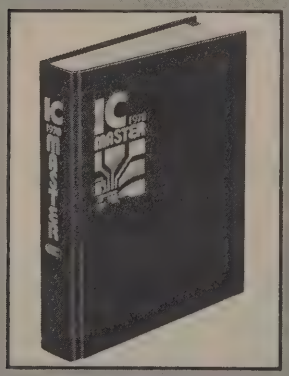

The only national catalog designed exclusively for distributors and their customers featuring electronic parts, instruments and equipment.

### ELECTRONIC PRODUCTS MAGAZINE —



The products magazine . . . A 100% product-oriented magazine including hundreds of new products and special features every month.

### IC MASTER AND THE UPDATES —




The only complete single-source directory including all IC devices manufactured in the United States. Updated three times yearly with accumulative supplements.

### eem FILE SYSTEM —

The only filing system designed especially for the electronics engineer. Instant retrieval and organization of data sheets and catalogs.

### UTP CUSTOM CATALOGS —

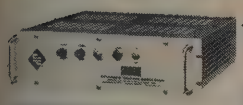
The Cadillac of individualized catalogs for the electronic parts distributor, featuring solely his lines and services.

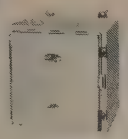
### UNITED COST AND PRICING SERVICES —

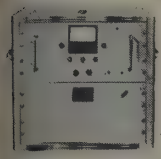
The electronic distributors' proven method of being up to the minute on his cost and selling prices.

*United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Ave., Garden City, N.Y. 11530 / (516) 222-2500 TWX 510-222-1673*

# STABILINE® automatic VOLTAGE REGULATORS


TYPE IES9101


TYPE EMT10228


TYPE EMT4115B

Deliver a constant output voltage regardless of variations in input voltage or changes in line current. Types available from 0.25 to 275 kva. Submit specifications for ratings desired but not given in the charts. Input voltage ranges shown are at nominal output voltage; input range shifts with output voltage setting.

**EMT SERIES** – Electro Mechanical Transistorized types with virtually zero waveform distortion, 47-63 hertz frequency range, very low internal impedance, negligible phase shift and efficiency approximately 99%. Rated accuracy ±.75% for all line voltage or load current variations within unit stated range. Insensitive to load magnitude and power factor; no effect on system power factor.

**EMS SERIES** – Electro Mechanical Transistorized types for heavier load requirements. Same operating characteristics as EMT Series. Units with letter I before first digit in type number have individual control for each line-to-neutral voltage.

**EMK SERIES** – Electro Mechanical Transistorized types providing faster correction times than other electromechanical models.

**IES SERIES** – Instantaneous Electronic Solid-State types having extremely fast correction, no moving parts. Will maintain output voltage within a 100 millivolt rms band for any combination of rated input voltage and/or load from 1.0 to 0 power factor lagging. Efficiency to 95%. All units have provision for remote sensing and have plug-in solid-state circuit boards.

**MILITARIZED** – Meet requirements of applicable military specifications. Type EMTH41007MH is 3½ x 6 x 4½"; type EM4108MCR fits standard 19" relay rack. Accuracy ±1.0%.

## STABILINE®
### Full Range REGULATOR CONTROLLERS

Designed for use with any motor-driven POWERSTAT Variable Transformer to provide full range regulation of a-c voltage, a-c current or d-c voltage. Output voltage will remain within a 2-volt band when used with 120 volt units and a 4-volt band when used with 240 volt models. Output current can be maintained within ±1% of maximum current setting with user supplied current transformer and Superior Electric transformer T6340. Type FR501DC and user supplied d-c power will provide regulated d-c voltage.

### EMT SERIES

| NOMINAL OUTPUT VOLTAGE | OUTPUT VOLTAGE (ADJUSTABLE) | INPUT VOLTAGE RANGE‡‡ | MAXIMUM OUTPUT AMPERES | RATED OUTPUT KVA | CORRECTION RATE AT 60 HERTZ (SECONDS/VOLT) | TYPE |
|---|---|---|---|---|---|---|
| **50/60 HERTZ, SINGLE PHASE OPERATION** | | | | | | |
| 115 | 110-120 | 95-135 | 20 | 2.3 | 0.075 | EMT4102B† |
| | | | 57 | 6.6 | 0.075 | EMT4106C§ |
| | | 90-115 | 52 | 6.0 | 0.12 | EMT10228 |
| | | 105-125 | 114 | 13.0 | 0.15 | EMT4112B§* |
| | | 95-135 | 144 | 16.6 | 0.125 | EMT4115B |
| 120¶ | 110-120 | 108-137 | 35 | 4.2 | 0.10 | EMT4104B†† |
| 230‡ | 220-240 | 195-255 | 36 | 8.3 | 0.083 | EMT4207B |
| | | | 93 | 21.4 | 0.083 | EMT4220 |
| | | 205-250 | 130 | 29.9 | 0.111 | EMT4228C |
| 240‡¶ | 220-240 | 228-256 | 35 | 8.4 | 0.10 | EMT4104B†† |
| 460 | 440-480 | 400-520 | 20 | 9.2 | 0.041 | EMT4407B |
| | | | 45 | 20.7 | 0.041 | EMT4418B |
| **50/60 HERTZ, THREE PHASE OPERATION** | | | | | | |
| 230‡ | 220-240 | 195-255 | 33 | 13.1 | 0.083 | EMT6210YB |
| | | | 48 | 19.1 | 0.083 | EMT6215YB |
| | | | 63 | 25.1 | 0.083 | EMT6220YB |
| | | | 145 | 57.8 | 0.25 | EMT6245YB |
| | | | 188 | 74.9 | 0.25 | EMT6270DB |
| 460 | 440-480 | 400-520 | 18 | 14.3 | 0.041 | EMT6412YB |
| | | | 24 | 19.1 | 0.041 | EMT6417YB |
| | | | 35 | 27.9 | 0.041 | EMT6425YB |
| | | | 75 | 59.8 | 0.125 | EMT6450YB |
| | | | 100 | 75.0 | 0.125 | EMT6475YB |
| | | 420-500 | 148 | 118 | 0.188 | EMT64100YB |

### EMS SERIES

| | | | | | | |
|---|---|---|---|---|---|---|
| **60 HERTZ, SINGLE PHASE, 2-WIRE** | | | | | | |
| 115 | 110-120 | 103.5-126.5 | 833 | 100 | 0.65 | EMS41100 |
| 230‡ | 220-240 | 218.5-241.5 | 435 | 100 | 0.22 | EMS42100‡ |
| **50/60 HERTZ, SINGLE PHASE, 3-WIRE, INDIVIDUAL LINE CONTROL** | | | | | | |
| 240/120 | 230-250/115-125 | 204-276/102-138 | 104 | 25.0 | .03/.06 | EMSI4225 |
| | | | 250 | 60.0 | .03/.06 | EMSI4260 |
| | 220-240/110-120 | 228-252/114-126 | 417 | 100 | .10/.21 | EMSI42100 |
| **50/60 HERTZ, THREE PHASE, SINGLE CONTROL** | | | | | | |
| 230‡ | 220-240 | 203-257 | 339 | 135 | 0.28 | EMS62135Y‡ |
| 460 | 440-480 | 445-495 | 230 | 180 | 0.30 | EMS64180Y |
| | | | 347 | 275 | 0.30 | EMS64275Y |
| **50/60 CYCLE, THREE PHASE, INDIVIDUAL LINE CONTROL** | | | | | | |
| 208/120 | 191-217/115-125 | 177-239/102-138 | 250 | 90.0 | .08/.14 | EMSI6290Y |
| | | 165-233/95-135 | 525 | 190 | .37/.22 | EMSI62190Y |

### EMK SERIES

| | | | | | | |
|---|---|---|---|---|---|---|
| **50/60 CYCLE, SINGLE PHASE** | | | | | | |
| 115 | 110-120 | 95-135 | 23 | 2.6 | 0.02 | EMK4105† |
| | | 105-125 | 46 | 5.3 | 0.04 | |

### IES SERIES

| | | | | | | |
|---|---|---|---|---|---|---|
| **50 OR 60 CYCLE ±10%, SINGLE PHASE** | | | | | | |
| 115 | 110-120 | 95-135** | 4.3 | 0.5 | — | IES91005 |
| | | | 8.7 | 1.0 | — | IES9101 |
| | | | 26.1 | 3.0 | — | IES9103 |
| | | | 52.2 | 6.0 | — | IES9106 |
| | | | 130 | 15.0 | — | IES9115 |
| 230 | 220-240 | 195-255** | 13 | 3.0 | — | IES9203 |
| | | | 26.1 | 6.0 | — | IES9206 |
| | | | 65 | 15.0 | — | IES9215 |

### MILITARIZED TYPES

| | | | | | | |
|---|---|---|---|---|---|---|
| **45-66 HERTZ, SINGLE PHASE** | | | | | | |
| 120 | 115-125 | 105-135 | 66.6 | 8.0 | 0.10 | EM4108MCR |
| **380-420 HERTZ, SINGLE PHASE** | | | | | | |
| 115 | 115 | 103.5-126.5 | 6 | 0.69 | 0.13▲ | EMTH41007MH |

▲At 400 Hertz
†Also available as rack model (suffix R when ordering).
¶For 60 Hertz operation only.
*Can also be operated on an input range of 95 to 135 volts with a rating of 57 amperes, 6.6 kva and a correction rate of 0.075 seconds per volt.
§Also available as rack (suffix R when ordering) or wall mounted (suffix W when ordering) models.
‡Unit can be converted for 208 volt operation by simple tap changes. Input and output voltage ranges change proportionally.
**At nominal output. Shifts with output voltage setting but not proportionally.
††Also available in open construction (suffix U) and with screened and enclosed (suffix UT) construction.
‡‡At nominal output. Shifts proportionally with output voltage setting

THE SUPERIOR ELECTRIC COMPANY
1000 MIDDLE STREET, BRISTOL, CONN. 06010
PHONE: (203) 582-9561

**SHORT FORM CATALOG**

**TOPAZ**
ELECTRONICS

# Topaz has the guaranteed solution to your power line problem.

Topaz manufactures a complete line of equipment for protecting electronic systems from erratic operation or failure due to power line transients, fluctuations and interruptions. Topaz devices are designed to protect sensitive equipment that requires clean, stable power for reliable operation. Equipment that should be protected by Topaz devices includes:

- Computers and computer peripherals
- Minicomputers
- Microprocessors
- Electronic cash registers
- Point-of-sale terminals
- Numerical control systems
- Process control systems
- Communications systems
- Telephone systems
- Electronic instrumentation equipment
- Life support systems
- Security systems
- Other sensitive electronic equipment

**Selecting the right Topaz protection.**
Your equipment is vulnerable to failure due to power line problems: blackouts, brownouts, lightning transients; load transients caused by air conditioners, elevators, X-ray machines, diathermies; and normal utility generated noise caused by load switching and balancing, to name a few.

Dedicated power lines and/or line filters do not solve the problem. Topaz protective devices—properly selected—deliver the quality power your equipment needs.

**Using the problem-solver table.**
The selection table lists some typical power line problems and the Topaz solution to each.

Often you may be blaming operating or service people or the equipment itself for problems that actually are caused by the power line problems listed in this table. These abnormalities can cause data processing errors, computer memory loss, computer program wipe out, false transducer and sensor readings, errors in critical processes, erratic control in control systems, false alarms, erroneous readings, system degradation and even system damage.

**The answer is Topaz protection.**
Give your equipment Topaz protection. You'll never have a power related problem again.

| PROBLEM-SOLVER TABLE | TOPAZ PROTECTIVE DEVICE | | | | | |
|---|---|---|---|---|---|---|
| POWER LINE PROBLEM | Ultra-Isolation Transformers | AC Line Regulators | Power Line Conditioners | Uninterruptible Power Systems | DC to AC Inverters | Frequency Converters |
| Lightning strikes causing up to 3000-volt transients. | ● | | ● | ● | | |
| Spikes caused by utility network switching. | ● | | ● | ● | | |
| Transients produced by operating machine tools, air conditioners, copiers, lighting systems and other office equipment. | ● | | ● | ● | | |
| Voltage fluctuations and noise caused by heavy equipment using same line. | | ● | ● | ● | | |
| Temporary outage caused by standby system startup. | | | | ● | ● | |
| Steady state voltage variations from nominal. Chronic low line voltage. | | ● | ● | ● | | |
| Voltage fluctuations caused by user-owned generators. | | ● | ● | ● | | |
| Frequency variations caused by user-owned generators. | | | | ● | | ● |
| Ringing disturbances caused by power factor correction capacitor switching carried out by your utility. | ● | | ● | ● | | |
| Undervoltages or overvoltages caused by faults and fault clearing devices. | | ● | ● | ● | | |
| Momentary power interruptions from faults or overloads on your powerline. | | | | ● | | |
| Shock hazard to automatic systems, operators or users. | ● | | ● | | | |
| Brownouts | | ● | ● | ● | | |
| Blackouts | | | | ● | | |
| Wrong power line frequency. | | | | | | ● |

**TOPAZ ELECTRONICS** 3855 Ruffin Road, San Diego, California 92123—(714) 279-0831—TWX (910) 335-1526

TOPAZ ELECTRONICS

SHORT FORM CATALOG

# 98 Percent Efficient AC Line Regulators

## 500 VA to 100 kVA

Topaz line regulators are the smallest, lightest, most efficient, most distortion-free units of their type commercially available. They completely eliminate the inherent problems of ferroresonant devices such as low efficiency, wasted power and frequency sensitivity.

### Topaz saves money six ways.

- **Cost less to buy.** More regulator for your money.
- **Cost less to operate.** 98% efficiency means minimal power losses.
- **Cost less to install.** Less than 1/4 the size and weight of most regulators.
- **Feeder hardware costs less.** No oversize input circuit breakers and other hardware.
- **Air conditioning costs less.** One-ninth the heat loss of other line regulators.
- **Lower power factor correction costs.** Reduces need for expensive power factor correction equipment.

### Features and Benefits

**Fast Response:** Topaz AC line regulators respond to voltage fluctuations faster. Units monitor line voltage and correct for changes in less than one cycle of operating frequency.

**Low Distortion:** Less than 0.1% distortion. Other line regulators distort output waveform up to 5% and distort input waveform too. Distortion can degrade equipment performance.

**Input Power Factor:** Topaz regulators reflect the power factor of the load almost exactly. Most other line regulation techniques have a highly detrimental effect on power factor.

**Wide Input Frequency Range:** Topaz AC Line Regulators operate over input frequencies of 47-63 Hz. Ferroresonant regulators do not.

**Compact:** One-quarter the size and weight of ferroresonant transformers.

### Specifications

**Line Voltage Regulation:**
±3.3% maximum for series 73000
±5% maximum for series 75000
±7% maximum for series 77000

**Efficiency:** 98% minimum

**Operating Temperature:** 0°C to 50°C

**Temperature Coefficient:** 0.05%/°C maximum

**Output Distortion:** No spike; adds less than 0.1% Total Harmonic Distortion

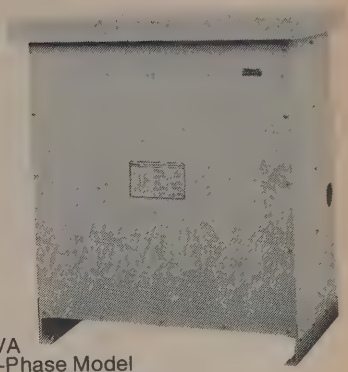
**Response Time:** 1 cycle maximum

**Operating Frequency:** 47-63 Hz, sine wave

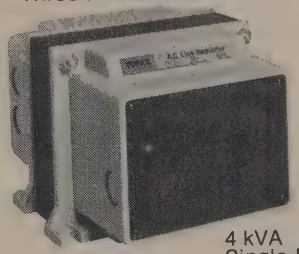
**Load Regulation:** Less than 1% from no load to full load

**Sizes** (Inches/Centimeters)

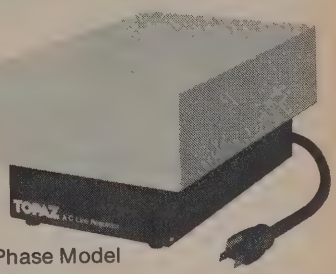
| SIZES | HEIGHT (in.) | HEIGHT (cm.) | WIDTH (in.) | WIDTH (cm.) | DEPTH (in.) | DEPTH (cm.) |
|---|---|---|---|---|---|---|
| A | 5.25 | 13 | 7.5 | 19 | 12.0 | 30 |
| B | 6.31 | 16 | 8.38 | 21 | 9.0 | 23 |
| C | 6.31 | 16 | 8.38 | 21 | 10.0 | 25 |
| D | 6.31 | 16 | 8.38 | 21 | 10.25 | 26 |
| E | 6.31 | 16 | 8.38 | 21 | 11.0 | 28 |
| F | 6.31 | 16 | 8.38 | 21 | 11.5 | 29 |
| G | 18.0 | 46 | 14.0 | 36 | 9.0 | 23 |
| H | 6.31 | 16 | 8.38 | 21 | 11.88 | 30 |
| I | 6.31 | 16 | 8.38 | 21 | 12.75 | 32 |
| J | 6.31 | 16 | 8.38 | 21 | 15.5 | 39 |
| K | 7.88 | 20 | 29.5 | 75 | 13.0 | 33 |
| L | 7.88 | 20 | 29.5 | 75 | 13.25 | 34 |
| M | 7.88 | 20 | 29.5 | 75 | 14.0 | 36 |
| N | 7.88 | 20 | 29.5 | 75 | 14.5 | 37 |
| O | 36.0 | 91 | 28.0 | 71 | 18.0 | 46 |
| P | 7.88 | 20 | 29.5 | 75 | 12.0 | 30 |
| Q | 7.88 | 20 | 29.5 | 75 | 14.9 | 38 |
| R | 7.88 | 20 | 29.5 | 75 | 15.75 | 40 |
| S | 7.88 | 20 | 29.5 | 75 | 18.5 | 47 |
| T | 47.0 | 119 | 42.0 | 107 | 28.0 | 71 |
| U | 6.31 | 16 | 8.38 | 21 | 9.31 | 24 |



100 kVA
Three-Phase Model



4 kVA
Single-Phase Model



1.5 kVA
Single-Phase Model
(Size A)

**SERIES 73000 AC LINE REGULATORS** are intended for use in installations requiring close regulation of power lines subject to normal operating fluctuations. Output voltage is regulated to within ±3.3% of nominal.

| PART NO. | POWER kVA | OUTPUT VAC | INPUT VAC | WEIGHT (lb/kg) | SIZE |
|---|---|---|---|---|---|
| **SINGLE-PHASE MODELS** | | | | | |
| 73198 | 0.8 | 115 | 105-125 | 15/7 | A |
| 73199 | 1.5 | 115 | 105-125 | 20/9 | A |
| 73102 | 2 | 115 | 105-125 | 25/11 | B |
| 73202 | 2 | 220 | 202-239 | 30/14 | H |
| 73302 | 2 | 230 | 211-250 | 30/14 | H |
| 73402 | 2 | 240 | 220-260 | 30/14 | H |
| 73104 | 4 | 115 | 105-125 | 35/16 | C |
| 73204 | 4 | 220 | 202-239 | 43/20 | I |
| 73304 | 4 | 230 | 211-250 | 43/20 | I |
| 73404 | 4 | 240 | 220-260 | 43/20 | I |
| 73108 | 8 | 115 | 105-125 | 60/27 | G |
| 73208 | 8 | 220 | 202-239 | 64/29 | J |
| 73308 | 8 | 230 | 211-250 | 64/29 | J |
| 73408 | 8 | 240 | 220-260 | 64/29 | J |
| 73216 | 16 | 220 | 202-239 | 108/49 | G |
| 73316 | 16 | 230 | 211-250 | 108/49 | G |
| 73416 | 16 | 240 | 220-260 | 108/49 | G |
| **THREE-PHASE MODELS** (WYE INPUT, WYE OUTPUT) | | | | | |
| 73506 | 6 | 115L/N | 105-125 | 85/38 | P |
| 73606 | 6 | 220L/N | 202-239 | 100/45 | Q |
| 73706 | 6 | 240L/N | 220-260 | 100/45 | Q |
| 73512 | 12 | 115L/N | 105-125 | 115/52 | K |
| 73612 | 12 | 220L/N | 202-239 | 140/64 | R |
| 73712 | 12 | 240L/N | 220-260 | 140/64 | R |
| 73538 | 24 | 115L/N | 105-125 | 260/117 | O |
| 73638 | 24 | 220L/N | 202-239 | 325/147 | O |
| 73550 | 50 | 120L/N | 111-130 | 600/272 | T |
| 73850 | 50 | 277L/N | 255-300 | 600/272 | T |
| 73575 | 75 | 120L/N | 111-130 | 900/408 | T |
| 73875 | 75 | 277L/N | 255-300 | 900/408 | T |
| 73580 | 100 | 120L/N | 111-130 | 1200/544 | T |
| 73880 | 100 | 277L/N | 255-300 | 1200/544 | T |

**SERIES 75000 AC LINE REGULATORS** are intended for use on power lines subject to severe fluctuations and moderate brownout conditions. Output voltage is regulated to within ±5% of nominal.

| PART NO. | POWER kVA | OUTPUT VAC | INPUT VAC | WEIGHT (lb/kg) | SIZE |
|---|---|---|---|---|---|
| **SINGLE-PHASE MODELS** | | | | | |
| 75197 | 0.7 | 120 | 96-126 | 21/10 | A |
| 75199 | 1.3 | 120 | 96-126 | 29/13 | A |
| 75101 | 1.5 | 120 | 96-126 | 25/11 | B |
| 75201 | 1.5 | 220 | 176-231 | 25/11 | U |
| 75102 | 2.5 | 120 | 96-126 | 40/18 | C |
| 75202 | 2.5 | 220 | 176-231 | 40/18 | D |
| 75302 | 2.5 | 230 | 184-242 | 40/18 | D |
| 75402 | 2.5 | 240 | 192-252 | 40/18 | D |
| 75105 | 5 | 120 | 96-126 | 50/23 | E |
| 75205 | 5 | 220 | 176-231 | 50/23 | F |
| 75305 | 5 | 230 | 184-242 | 50/23 | F |
| 75405 | 5 | 240 | 192-252 | 50/23 | F |
| 75110 | 10 | 120 | 96-126 | 75/34 | G |
| 75210 | 10 | 220 | 176-231 | 75/34 | G |
| 75310 | 10 | 230 | 184-242 | 75/34 | G |
| 75410 | 10 | 240 | 192-252 | 75/34 | G |
| 75220 | 20 | 220 | 176-231 | 108/49 | G |
| 75320 | 20 | 230 | 184-242 | 108/49 | G |
| 75420 | 20 | 240 | 192-252 | 108/49 | G |
| **THREE-PHASE MODELS** (WYE INPUT, WYE OUTPUT) | | | | | |
| 75507 | 7.5 | 120L/N | 96-126 | 130/59 | K |
| 75607 | 7.5 | 220L/N | 176-231 | 130/59 | L |
| 75707 | 7.5 | 240L/N | 192-252 | 130/59 | L |
| 75515 | 15 | 120L/N | 96-126 | 160/73 | M |
| 75615 | 15 | 220L/N | 176-231 | 160/73 | N |
| 75715 | 15 | 240L/N | 192-252 | 160/73 | N |
| 75531 | 30 | 120L/N | 96-126 | 325/147 | O |
| 75631 | 30 | 220L/N | 176-231 | 345/156 | O |
| 75550 | 50 | 120L/N | 96-126 | 900/408 | T |
| 75850 | 50 | 277L/N | 220-290 | 900/408 | T |
| 75575 | 75 | 120L/N | 96-126 | 1200/544 | T |
| 75875 | 75 | 277L/N | 220-290 | 1200/544 | T |
| 75580 | 100 | 120L/N | 96-126 | 1500/680 | T |
| 75880 | 100 | 277L/N | 220-290 | 1500/680 | T |

**SERIES 77000 AC LINE REGULATORS** are intended for use on power lines subject to severe brownout conditions. Output voltage is regulated to within ±7% of nominal.

| PART NO. | POWER kVA | OUTPUT VAC | INPUT VAC | WEIGHT (lb/kg) | SIZE |
|---|---|---|---|---|---|
| **SINGLE-PHASE MODELS** | | | | | |
| 77196 | 0.6 | 117 | 85-125 | 21/10 | A |
| 77199 | 1.2 | 117 | 85-125 | 30/14 | A |
| 77101 | 1 | 117 | 85-125 | 25/11 | B |
| 77201 | 1 | 220 | 160-235 | 25/11 | U |
| 77102 | 2 | 117 | 85-125 | 40/18 | C |
| 77202 | 2 | 220 | 160-235 | 40/18 | D |
| 77302 | 2 | 230 | 167-246 | 40/18 | D |
| 77402 | 2 | 240 | 175-255 | 40/18 | D |
| 77104 | 4 | 117 | 85-125 | 50/23 | E |
| 77204 | 4 | 220 | 160-235 | 50/23 | F |
| 77304 | 4 | 230 | 167-246 | 50/23 | F |
| 77404 | 4 | 240 | 175-255 | 50/23 | F |
| 77108 | 8 | 117 | 85-125 | 75/34 | G |
| 77208 | 8 | 220 | 160-235 | 75/34 | G |
| 77308 | 8 | 230 | 167-246 | 75/34 | G |
| 77408 | 8 | 240 | 175-255 | 75/34 | G |
| 77216 | 16 | 220 | 160-235 | 108/49 | G |
| 77316 | 16 | 230 | 167-246 | 108/49 | G |
| 77416 | 16 | 240 | 175-255 | 108/49 | G |
| **THREE-PHASE MODELS** (WYE INPUT, WYE OUTPUT) | | | | | |
| 77506 | 6 | 117L/N | 85-125 | 130/59 | K |
| 77606 | 6 | 220L/N | 160-235 | 130/59 | L |
| 77706 | 6 | 240L/N | 175-255 | 130/59 | L |
| 77512 | 12 | 117L/N | 85-125 | 160/73 | M |
| 77612 | 12 | 220L/N | 160-235 | 160/73 | N |
| 77712 | 12 | 240L/N | 175-255 | 160/73 | N |
| 77538 | 24 | 117L/N | 85-125 | 315/143 | O |
| 77638 | 24 | 220L/N | 160-235 | 325/147 | O |
| 77550 | 50 | 120L/N | 88-128 | 900/408 | T |
| 77850 | 50 | 277L/N | 202-296 | 900/408 | T |
| 77575 | 75 | 120L/N | 88-128 | 1200/544 | T |
| 77875 | 75 | 277L/N | 202-296 | 1200/544 | T |
| 77580 | 100 | 120L/N | 88-128 | 1500/680 | T |
| 77880 | 100 | 277L/N | 202-296 | 1500/680 | T |

**TOPAZ ELECTRONICS** 3855 Ruffin Road, San Diego, California 92123—(714) 279-0831—TWX (910) 335-1526

**SHORT FORM CATALOG**

**TOPAZ**
ELECTRONICS

# New Topaz Line 2 Power Line Conditioners
## 1 kVA and 2 kVA

Topaz line 2 combines all the performance of Topaz AC line regulators and Topaz Ultra-Isolation Transformers together in one outstanding unit. Topaz line 2 protects against brownouts and other long-term voltage variations while it protects against transients, spikes and noise. Thus, Topaz line 2 eliminates the requirement for a dedicated power line.

### Features
- Response less than one cycle
- Negligible distortion
- Low output impedance
- 94% efficiency
- Low coupling capacitance
- 0°C to 40°C ambient temperature range
- Low audible noise of 40 dB max ANSI "A" scale

| Part No. | Output Power kVA | Input VAC | Frequency Hz | Output VAC | Weight (lb/kg) | NEMA Connector Configuration Plug | Receptacle |
|---|---|---|---|---|---|---|---|
| 70303 | 1 kVA | 90-140 | 57-63 | 120±7% | 46/21 | NEMA 5-15P | NEMA 5-15R |
| 70306 | 2 kVA | 90-140 | 57-63 | 120±7% | 75/34 | NEMA L5-30P | NEMA 5-20R |
| 70302 | 800 VA | 163-253 | 47-53 | 220±7% | 46/21 | Standard European | |
| 70305 | 1600 VA | 163-253 | 47-53 | 220±7% | 75/34 | Standard European | |

# Uninterruptible Power Systems 300 VA to 15 kVA

Topaz UPS maintain continuous high-quality power to your equipment regardless of the quality or continuity of the commercial ac power line. The load is protected from instantaneous and subcycle power losses and line disturbances as well as from brownouts and blackouts. During power outages the system is supplied by a battery bank. The Topaz UPS high design reliability has been proven in thousands of installations worldwide.

### Specifications

**Inverter output:** Sinusoidal, with less than 5% total harmonic distortion. 10% voltage overshoot/undershoot for 20% instantaneous load change.

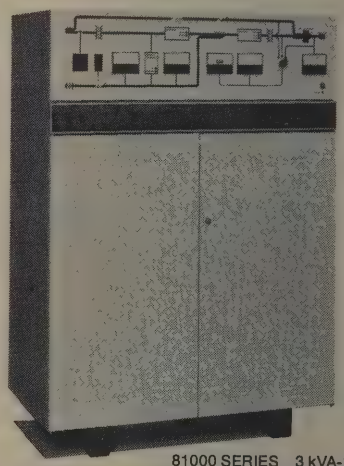
**Protection:** Input power has fuse or circuit breaker protection. Undervoltage protection on all inverters. Reverse polarity protection on all inverters. Current limiting on all chargers. Overload and short-circuit protection on all inverters.

**Automatic Load Transfer:** 25 millisecond transfer (typical). Panel light indicates that load is powered by the ac line. 4 millisecond solid state switch optional.

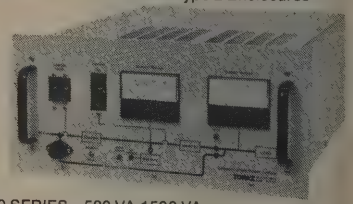
**Mimic Bus:** Instantaneous system status shown by red, amber, and green lights.

### Standard Models

| Output Power (VA) | System Part Number | Input VAC | Input Phase | Output VAC | Output Phase | Output Current | Freq. Hz | Battery | Full load Backup Time | Recharge Time or Battery Charging Current | Size (in./cm.) | Approximate Weight (lb/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 500 | 82195 | 115 | 1 | 115 | 1 | 4.3A | 60 | External 72V (Note 2) | Dependent on batteries | 12 Amperes | 19" rack mount 8¾/22 H 20/51 D | 100/45 Plus batteries |
| 1000 | 82101 | 115 | 1 | 115 | 1 | 8.7A | 60 | External 72V (Note 2) | Dependent on batteries | 12 Amperes | 19" rack mount 8¾/22H 20/51 D | 125/57 Plus batteries |
| 1500 | 82102 | 115 | 1 | 115 | 1 | 13.0A | 60 | External 72V (Note 2) | Dependent on batteries | 12 Amperes | 19" rack mount 8/22 H 20/51 D | 146/66 Plus batteries |
| 3000 | 81103 | 120 | 1 | 120 | 1 | 25.0A | 60 | External 120V (Note 2) | Dependent on batteries | 8 Amperes | NEMA Type 2 enclosure 60/152 H 42/107 W 24/61 D | 800/315 Plus batteries |
| | 81403 | 240 | 1 | 240 | 1 | 13.0A | 60 | | | | | |
| | 81203 | 220 | 1 | 220 | 1 | 13.6A | 50 | | | | | |
| 5000 | 81105 | 120 | 1 | 120 | 1 | 42.0A | 60 | External 120V (Note 2) | Dependent on batteries | 12 Amperes | NEMA Type 2 enclosure 60/152 H 42/107 W 24/61 D | 950/431 Plus batteries |
| | 81405 | 240 | 1 | 240 | 1 | 21.0A | 60 | | | | | |
| | 81205 | 220 | 1 | 220 | 1 | 22.7A | 50 | | | | | |
| 7500 | 81507 | 208Y/120 | 3 | 120 | 1 | 65.0A | 60 | External 120V (Note 2) | Dependent on batteries | 18 Amperes | NEMA Type 2 enclosure 60/152 H 42/107 W 24/61 D | 1200/540 Plus batteries |
| | 81407 | 240 | 1 | 240 | 1 | 32.5A | 60 | | | | | |
| 10,000 | 81510 | 208Y/120 | 3 | 120 | 1 | 83.0A | 60 | External 120V (Note 2) | Dependent on batteries | 24 Amperes | NEMA Type 2 enclosure 72/183 H 52/132 W 24/61 D | 1500/680 Plus batteries |
| | 81410 | 240 | 1 | 240 | 1 | 42.0A | 60 | | | | | |
| | 81210 | 220 | 1 | 220 | 1 | 45.4A | 50 | | | | | |
| | 81610 | 380Y/220 | 3 | 220 | 1 | 45.4A | 50 | | | | | |
| 15,000 | 81515 | 208Y/120 | 3 | 120 | 1 | 125.0A | 60 | External 120V (Note 2) | Dependent on batteries | 36 Amperes | NEMA Type 2 enclosure 72/183 H 52/132 W 24/61 D | 1800/816 Plus batteries |
| | 81415 | 240 | 1 | 240 | 1 | 63.0A | 60 | | | | | |
| | 81215 | 220 | 1 | 220 | 1 | 68.2A | 50 | | | | | |
| | 81615 | 380Y/220 | 3 | 220 | 1 | 68.2A | 50 | | | | | |



81000 SERIES 3 kVA-15 kVA
NEMA Type 2 Enclosures



82000 SERIES 500 VA-1500 VA
Rack Mount Type

Notes:
1. Sealed internal batteries are supplied as part of this model. External batteries may be connected in parallel with the internal batteries, thus extending the backup and recharge times. Battery information is available on request.
2. External batteries are not supplied with the basic system. External batteries may be procured from Topaz with the basic system or purchased from another source.

**Also available: Low Cost 300 VA Models** (†) denotes UL listed

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 300 | 9234* | 120 | 1 | 120 | 1 | 2.6A | 60 | External 12V (Note 2) | Dependent on batteries | 3 Amperes | 7/18 H 7/18 W 5½/14 D | 13/6 Plus batteries |
| 300 | †2645-1* | 120 | 1 | 120 | 1 | 2.6A | 60 | Internal | 10 minutes minimum 12 minutes typical | 24 hours full charge | 9½/24 H 8½/22 W 16/41 D | 36/16 |
| 300 | †2645-2* | 120 | 1 | 120 | 1 | 2.6A | 60 | Internal | 27 minutes minimum 35 minutes typical | 24 hours full charge | 9½/24 H 8½/22 W 16/41 D | 53/24 |

*The 300 VA models are square wave output, off-line forward transfer UPS. They are low cost alternatives for many less critical applications. They contain no meters.

SQUARE WAVE 300 VA

**TOPAZ ELECTRONICS** 3855 Ruffin Road, San Diego, California 92123—(714) 279-0831—TWX (910) 335-1526

**SHORT FORM CATALOG**

TOPAZ ELECTRONICS

# Ultra-Isolation Noise-Suppression Transformers

## 125 VA to 130 kVA

### Guaranteed protection from power line noise.

Topaz Ultra-Isolation Noise-Suppression Transformers prevent such power line transients as voltage fluctuations and spikes caused by lightning, utility network switching, air conditioners and other noise sources from reaching your equipment. The low capacitive coupling between primary and secondary of these transformers, provided by a unique triple-box shielding technique, produces a common-mode noise rejection ratio of over *10 Million to one.* And Topaz Ultra-Isolation Transformers are guaranteed to do the job. Or your money back.

### Standard Ultra-Isolation Transformers

**Single-phase models**—All Topaz standard endbell type and encased type Ultra-Isolation Transformers are manufactured with dual-voltage primary and secondary windings and are rated for operation at either 50 or 60 Hz. For maximum versatility, the dual-voltage windings permit hookup in any combination of the listed voltages—one to one, step-up or step-down. Single-phase transformers are available in two styles:

- **Terminal Style:** Available in all power ratings. Transformers are supplied with terminals or lugs for direct-wired installations. Wiring instructions are included with each transformer.
- **Line Cord/Receptacle Style:** Available on models with power ratings through 2.4 kVA. Transformers are supplied prewired in a 120 V-120 V configuration. There is a plug on the six foot input line cord and a standard 120 V receptacle on the secondary.

  125 VA through 500 VA models have a NEMA 5-15P plug attached to the input cord and a NEMA 5-15R output receptacle.

  1 kVA models have a NEMA 5-15P input plug and a duplex NEMA 5-15R output receptacle.

  2.4 kVA models are limited to 20 amperes input and have a NEMA L5-20P twist lock input plug and a duplex NEMA 5-15R output receptacle.

**Three-phase models**—Standard models are available prewired for specified operating voltages.

**Non-standard Ultra-Isolation Transformers**—The following list includes all standard transformers. Transformers can be designed and manufactured to suit a full range of special requirements, such as 400 Hz and non-standard voltages. Please contact Topaz for additional information.

**Typical Specifications: Standard 50/60 Hz single-phase models**

**Common-Mode Noise**

**Attenuation:*** .005 pF—126 dB; .001 pF—140 dB; .0005 pF—146 dB

**Operating Voltages:** To 110% of nominal

**DC Isolation:** 1000 megohms winding-to-winding and winding-to-ground

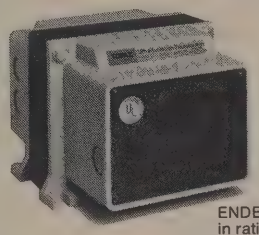
**Dielectric Strength:** 1000 VAC minimum

**Operating Frequency:** 50/60 Hz

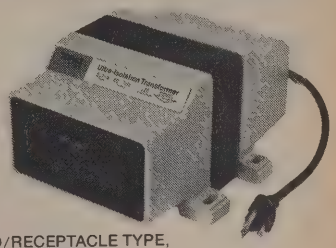
**Electromagnetic Noise:** Less than 0.10 Gauss (20 dB) at 18" distance

*for unknown noise conditions with any computer application, the .0005 pF model is recommended.

ENCASED TYPE, available in 75 to 130 kVA ratings, three-phase



ENDBELL TYPE, available in ratings from 125 VA through 5 kVA single phase



LINE CORD/RECEPTACLE TYPE, available in ratings from 125 VA through 2.4 kVA

| POWER RATING | PRIMARY VAC (Nominal) | SECONDARY VAC (Nominal) | FREQ. Hz | PART NUMBERS TERMINAL STYLE EFFECTIVE COUPLING CAPACITANCE .005pF | .001pF | .0005pF | PART NUMBERS LINE CORD/RECEPTACLE STYLE EFFECTIVE COUPLING CAPACITANCE .005pF | .001pF | .0005pF | % REG.* | DIMENSIONS Inches/Centimeters H | W | D | MW | MD | APPROX. WEIGHT (lb/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SINGLE-PHASE MODELS** | | | | | | | | | | | | | | | | |
| 125 VA | 120/240 | 120/240 | 50/60 | 91091-11† | 91091-21† | 91091-31† | 91091-12† | 91091-22† | 91091-32† | 3.5 | 4.4/11 | 7.1/18 | 7.9/20 | 6.3/16 | 3.0/8 | 11.5/5 |
| 250 VA | 120/240 | 120/240 | 50/60 | 91092-11† | 91092-21† | 91092-31† | 91092-12† | 91092-22† | 91092-32† | 3.5 | 4.4/11 | 7.1/18 | 8.3/21 | 6.3/16 | 3.4/9 | 14.0/6 |
| 500 VA | 120/240 | 120/240 | 50/60 | 91095-11† | 91095-21† | 91095-31† | 91095-12† | 91095-22† | 91095-32† | 3.5 | 4.4/11 | 7.1/18 | 9.4/24 | 6.3/16 | 4.5/11 | 20.5/9 |
| 750 VA | 120/240 | 120/240 | 50/60 | 91097-11† | 91097-21† | 91097-31† | 91097-12† | 91097-22† | 91097-32† | 3.5 | 4.4/11 | 7.1/18 | 10.2/26 | 6.3/16 | 5.4/14 | 30.0/13.6 |
| 1 kVA | 120/240 | 120/240 | 50/60 | 91001-11† | 91001-21† | 91001-31† | 91001-12† | 91001-22† | 91001-32† | 3.5 | 6.3/16 | 8.4/21 | 10.0/25 | 7.3/19 | 3.2/8 | 38.0/17 |
| 1.8 kVA | 120/240 | 120/240 | 50/60 | 91018-11† | 91018-21† | 91018-31† | 91018-12† | 91018-22† | 91018-32† | 3.5 | 6.3/16 | 8.4/21 | 11.0/28 | 7.3/19 | 5.0/13 | 140/63.5 |
| △2.5 kVA | 120/240 | 120/240 | 50/60 | 91002-11† | 91002-21† | 91002-31† | 91002-12 | 91002-22 | 91002-32 | 3.5 | 6.3/16 | 8.4/21 | 11.8/30 | 7.3/19 | 5.8/15 | 57.5/26 |
| 5 kVA | 120/240 | 120/240 | 50/60 | 91005-11† | 91005-21† | 91005-31† | | | | 3.5 | 6.3/16 | 8.4/21 | 14.3/36 | 7.3/19 | 8.2/21 | 90.5/41 |
| 5 kVA | 240/480 | 120/240 | 50/60 | 91105-11† | 91105-21† | 91105-31† | | | | 3.5 | 6.3/16 | 8.4/21 | 14.3/36 | 7.3/19 | 8.2/21 | 90.5/41 |
| 10 kVA | 120/240 | 120/240 | 50/60 | 93010-11† | 93010-21† | 93010-31† | | | | 3.5 | 22.8/58 | 15.1/38 | 14.3/36 | | | 222/101 |
| 15 kVA | 240/480 | 120/240 | 50/60 | 93115-11† | 93115-21† | 93115-31† | | | | 3.5 | 22.8/58 | 15.1/38 | 14.3/36 | | | 269/122 |
| 20 kVA | 240/480 | 120/240 | 50/60 | 93120-11† | 93120-21† | 93120-31† | | | | 3.5 | 22.8/58 | 15.1/38 | 14.3/36 | | | 332/151 |
| **THREE-PHASE MODELS** | | | | | | | | | | | | | | | | |
| 3 kVA | 208Y/120 | 208Y/120 | 50/60 | 91403-11† | 91403-21† | 91403-21† | | | | 3.5 | 7.8/20 | 34.6/88 | 10.0/25 | 33.1/84 | 3.8/10 | 139/63 |
| 3 kVA | 240 | 208Y/120 | 50/60 | 91503-11† | 91503-21† | 91503-31† | | | | 3.5 | 7.8/20 | 34.6/88 | 10.0/25 | 33.1/84 | 3.8/10 | 139/63 |
| 7.5 kVA | 208Y/120 | 208Y/120 | 50/60 | 91407-11† | 91407-21† | 91407-31† | | | | 3.5 | 7.8/20 | 34.6/88 | 11.8/30 | 33.1/84 | 5.5/14 | 198/90 |
| 7.5 kVA | 240 | 208Y/120 | 50/60 | 91507-11† | 91507-21† | 91507-31† | | | | 3.5 | 7.8/20 | 34.6/88 | 11.8/30 | 33.1/84 | 5.5/14 | 198/90 |
| 15 kVA | 208Y/120 | 208Y/120 | 50/60 | 91415-11 | 91415-21 | 91415-31 | | | | 3.5 | 7.8/20 | 34.6/88 | 14.2/36 | 33.1/84 | 8.0/20 | 296/134 |
| 15 kVA | 240 | 208Y/120 | 50/60 | 91515-11 | 91515-21 | 91515-31 | | | | 3.5 | 7.8/20 | 34.6/88 | 14.2/36 | 33.1/84 | 8.0/20 | 296/134 |
| 15 kVA | 480 | 208Y/120 | 50/60 | 91615-11 | 91615-21 | 91615-31 | | | | 3.5 | 7.8/20 | 34.6/88 | 14.2/36 | 33.1/84 | 8.0/20 | 296/134 |
| 22.5 kVA | 208/240 | 208Y/120 | 60 | 93322-11 | 93322-21 | 93322-31 | | | | 3.5 | 36.0/91 | 28.0/71 | 18.0/46 | 23.7/60 | 15/38 | 610/276.7 |
| 22.5 kVA | 380 | 388Y/220 | 50 | 93822-11 | 93822-21 | 93822-31 | | | | 3.5 | 36.0/91 | 28.0/71 | 18.0/46 | 23.7/60 | 15/38 | 615/278.9 |
| 30 kVA | 208/240 | 208Y/120 | 60 | 93330-11 | 93330-21 | 93330-31 | | | | 3.5 | 36.0/91 | 28.0/71 | 18.0/46 | 23.7/60 | 15/38 | 650/294.8 |
| 30 kVA | 380 | 388Y/220 | 50 | 93830-11 | 93830-21 | 93830-31 | | | | 3.5 | 36.0/91 | 28.0/71 | 18.0/46 | 23.7/60 | 15/38 | 850/385.6 |
| 45 kVA | 208/240 | 208Y/120 | 60 | 93345-11 | 93345-21 | 93345-31 | | | | 3.5 | 36.0/91 | 28.0/71 | 18.0/46 | 23.7/60 | 15/38 | 650/294.8 |
| 45 kVA | 380 | 388Y/220 | 50 | 93845-11 | 93845-21 | 93845-31 | | | | 3.5 | 36.0/91 | 28.0/71 | 18.0/46 | 23.7/60 | 15/38 | 840/381 |
| 75 kVA | 208 | 208Y/120 | 60 | 94775-11 | 94775-21 | 94775-31 | | | | 2 | 47/119 | 42/107 | 28/71 | | | 1160/526 |
| 75 kVA | 240 | 208Y/120 | 60 | 94575-11 | 94575-21 | 94575-31 | | | | 2 | 47/119 | 42/107 | 28/71 | | | 1160/526 |
| 75 kVA | 480 | 208Y/120 | 60 | 94675-11 | 94675-21 | 94675-31 | | | | 2 | 47/119 | 42/107 | 28/71 | | | 1160/526 |
| 100 kVA | 208 | 208Y/120 | 60 | 94780-11 | 94780-21 | 94780-31 | | | | 2 | 47/119 | 42/107 | 28/71 | | | 1469/666 |
| 100 kVA | 240 | 208Y/120 | 60 | 94580-11 | 94580-21 | 94580-31 | | | | 2 | 47/119 | 42/107 | 28/71 | | | 1469/666 |
| 100 kVA | 480 | 208Y/120 | 60 | 94680-11 | 94680-21 | 94680-31 | | | | 2 | 47/119 | 42/107 | 28/71 | | | 1469/666 |
| 130 kVA | 208 | 208Y/120 | 60 | 94785-11 | 94785-21 | 94785-31 | | | | 2 | 47/119 | 42/107 | 28/71 | | | 1820/826 |
| 130 kVA | 240 | 208Y/120 | 60 | 94585-11 | 94585-21 | 94585-31 | | | | 2 | 47/119 | 42/107 | 28/71 | | | 1820/826 |
| 130 kVA | 480 | 208Y/120 | 60 | 94685-11 | 94685-21 | 94685-31 | | | | 2 | 47/119 | 42/107 | 28/71 | | | 1820/826 |

†Denotes UL Listed.
*Regulation is specified in percent voltage change from no load to full resistive load.
△Line Cord/Receptacle Type Rated 20A Maximum (2.4 kVA)

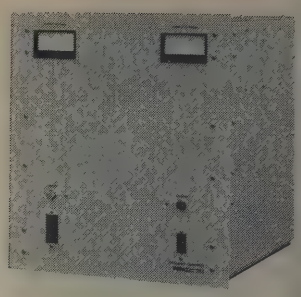
**TOPAZ ELECTRONICS** 3855 Ruffin Road, San Diego, California 92123—(714) 279-0831—TWX (910) 335-1526

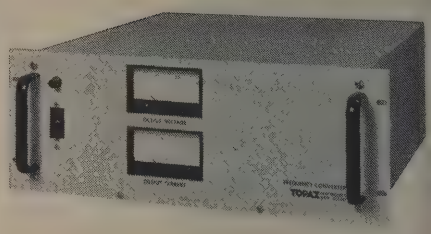
**SHORT FORM CATALOG PAGE SIX**

TOPAZ ELECTRONICS

# DC to AC Sine Wave Inverters Frequency Converters

## 200 VA to 30 kVA





Topaz inverters convert DC to sinusoidal AC. They can supply highly reliable AC with accurate frequency control. They are ideal for high starting current loads and loads with varying power factors. They employ circuitry which provides simplicity, higher reliability, better isolation and current limiting, good waveform shaping and inherent static voltage regulation. Topaz Frequency Converters are used to change available power frequency to 50, 60 or 400 Hz. They offer the same advantages and features as the inverters.

**Input Protection:** High and low voltage Reverse polarity

**Static Regulation:** *Line regulation* ± 1% maximum for line variations between low line and high line at half load.

*Load regulation* ±2% maximum for load variations between no load and full load at nominal line.

### General Specifications

**Frequency Stability:** ±0.5% of fixed frequency. ±0.01% optional

**Output Protection:** Overload and short circuit.

**Total Harmonic Distortion:** Less than 5% at full load and nominal line.

**Operating Temperature:** −10°C to +55°C

**Inverter Efficiency:** Typically 75% at full load.

**Recovery Time:** 50 milliseconds for 20% load change.

### Options and Accessories

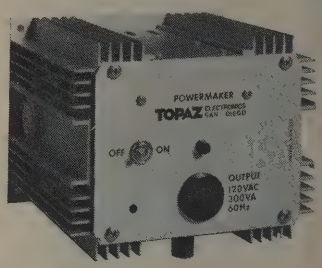
- Precision frequency control
- External frequency synchronization
- Voltage and/or current meters
- Automatic restart
- Static transfer switches (X line family only)

### Input Frequency Ranges

FZ 45 to 500 Hz (50 and 60 Hz Models)
FZ 45 to 65 Hz (400 Hz Models)
FX 48 to 420 Hz

## Powermaker Inverters

Versatile 300 VA, 60 Hz square wave inverter. Models available for operation from 12 VDC, 24 VDC and 48 VDC. 50 Hz models available.




### INVERTERS

| OUTPUT VA | PRODUCT SERIES | INPUT VOLTAGE | OUTPUT FREQ | OUTPUT VOLTAGE | SIZE | WEIGHT (lb/kg) |
|---|---|---|---|---|---|---|
| **50 Hz Output Inverters, Single-phase** | | | | | | |
| 200 | GZ | 12/24, 28, 48 or 125* | 50 | 115/230 | C | 39/18 |
| 400 | GZ | 12/24, 28, 48 or 125* | 50 | 115/230 | C | 65/29 |
| 800 | GZ | 12/24, 28, 48, or 125* | 50 | 115/230 | C | 95/43 |
| 1,600 | GZ | 12/24 or 28* | 50 | 115/230 | E | 190/86 |
| 2,000 | GX | 48 or 125* | 50 | 115 or 230* | F | 185/84 |
| 2,400 | GZ | 12/24 or 28* | 50 | 115/230 | J | 285/129 |
| 4,000 | GX | 48 or 125* | 50 | 115 or 230* | K | 265/120 |
| 8,000 | GX | 125 or 250* | 50 | 115 or 230* | L | 700/317 |
| **60 Hz Output Inverters, Single-phase** | | | | | | |
| 250 | GZ | 12/24, 28, 48 or 125* | 60 | 115 | C | 39/18 |
| 500 | GZ | 12/24, 28, 48, 125* | 60 | 115 | C | 65/29 |
| 1,000 | GZ | 12/24, 28, 48, 125* (250) | 60 | 115 or 115/230* | C(D) | 95/43 |
| 1,500 | GZ | 12/24, 28, 48 or 125* | 60 | 115 | E | 160/73 |
| 2,000 | GZ | 12/24 or 28* | 60 | 115 or 115/230* | E | 190/86 |
| 2,500 | GX | 48 or 125* | 60 | 115 or 230* | F | 185/84 |
| 3,000 | GZ | 12/24 or 28* | 60 | 115 or 115/230* | J | 285/129 |
| 5,000 | GX | 48 or 125* | 60 | 115 or 230* | K | 265/120 |
| 10,000 | GX | 125 or 250* | 60 | 115 or 230* | L | 700/317 |
| **400 Hz Output Inverters, Single-phase** | | | | | | |
| 250 | GZ | 12/24, 28 | 400 | 115 | C | 29/13 |
| 500 | GZ | 12/24, 28 | 400 | 115 | C | 45/20 |
| 1,000 | GZ | 12/24, 28 | 400 | 115 | C | 55/25 |
| 2,000 | GZ | 12/24 or 28* | 400 | 115 | E | 110/50 |
| 2,500 | GX | 125 | 400 | 115 | F | 130/59 |

*Specify with order.
All three-phase outputs are wye connected. Output voltages are 208Y/120 VAC or 400Y/230 VAC

### FREQUENCY CONVERTERS

| OUTPUT VA | PRODUCT SERIES | INPUT VOLTAGE | OUTPUT FREQUENCY | OUTPUT VOLTAGE | SIZE | WEIGHT (lb/kg) |
|---|---|---|---|---|---|---|
| **50 Hz Output Frequency Converters, Single-phase** | | | | | | |
| 200 | FZ | 115 | 50 | 115/230 | C | 45/21 |
| 200 | FZ | 230 | 50 | 115/230 | C | 58/27 |
| 400 | FZ | 115 | 50 | 115/230 | D | 73/33 |
| 400 | FZ | 230 | 50 | 115/230 | D | 86/39 |
| 800 | FZ | 115 | 50 | 115/230 | D | 110/50 |
| 800 | FZ | 230 | 50 | 115/230 | D | 135/61 |
| 1,600 | FZ | 115 | 50 | 115/230 | G | 220/100 |
| 1,600 | FZ | 230 | 50 | 115/230 | G | 270/122 |
| 2,000 | FX | 115, 208, 230 or 240* | 50 | 115 or 230* | F | 240/109 |
| 2,400 | FZ | 115 | 50 | 115/230 | H | 330/150 |
| 2,400 | FZ | 230 | 50 | 115/230 | H | 405/184 |
| 4,000 | FX | 115, 208, 230 or 240* | 50 | 115 or 230* | K | 325/147 |
| 8,000 | FX | 115, 208, 230 or 240* | 50 | 115 or 230* | L | 850/385 |
| **60 Hz Output Frequency Converters, Single-phase** | | | | | | |
| 250 | FZ | 115 | 60 | 115 | C | 45/20 |
| 250 | FZ | 230 | 60 | 115 | C | 58/27 |
| 500 | FZ | 115 | 60 | 115 | D | 73/33 |
| 500 | FZ | 230 | 60 | 115 | D | 86/39 |
| 1,000 | FZ | 115 | 60 | 115 or 115/230* | D | 110/50 |
| 1,000 | FZ | 230 | 60 | 115 or 115/230* | D | 135/61 |
| 2,000 | FZ | 115 | 60 | 115 or 115/230* | G | 220/100 |
| 2,000 | FZ | 230 | 60 | 115 or 115/230* | G | 270/122 |
| 2,500 | FX | 115, 208, 230 or 240* | 60 | 115 or 230* | F | 240/109 |
| 3,000 | FZ | 115 | 60 | 115 or 115/230* | H | 330/150 |
| 3,000 | FZ | 230 | 60 | 115 or 115/230* | H | 405/184 |
| 5,000 | FX | 115, 208, 230 or 240* | 60 | 115 or 230* | K | 325/147 |
| 10,000 | FX | 115, 208, 230 or 240* | 60 | 115 or 230* | L | 850/385 |

### SIZES (Inches/Centimeters)

| Code | Height | Width | Depth | Code | Height | Width | Depth |
|---|---|---|---|---|---|---|---|
| C | 7/18 | 19/49 | 13/33 | K | 21/54 | 19/49 | 21/54 |
| D | 7/18 | 19/49 | 18½/47 | L | 62/158 | 23¼/59 | 31/79 |
| E | 14/36 | 19/49 | 13/33 | M | 83¼/212 | 23¼/59 | 31/79 |
| F | 14/36 | 19/49 | 21/54 | N | 62/158 | 69¼/176 | 31/79 |
| G | 14/36 | 19/49 | 18½/47 | O | 62/158 | 93/237 | 31/79 |

### POWERMAKER INVERTERS

| Model Number | Input Voltage |
|---|---|
| 315-B-12 | 12 VDC |
| 315-B-24 | 24 VDC |
| 315-B-48 | 48 VDC |

**TOPAZ ELECTRONICS** 3855 Ruffin Road, San Diego, California 92123—(714) 279-0831—TWX (910) 335-1526

# VARO, INC., POWER SYSTEMS DIVISION

# STATIC POWER CONVERSION EQUIPMENT
## · SHIPBOARD · HIGH VOLTAGE · AIRBORNE ·

Varo, Inc., Power Systems Division has an unusual variety of expertise in the design of highly specialized power conversion equipment. Since 1946, Varo has continually advanced the development of more reliable, smaller, lighter and more versatile power conversion equipment to meet exacting specifications for widely varied applications and environments.

Three major product areas are addressed by Power Systems —

SHIPBOARD POWER SYSTEMS *including*

- INVERTERS
- CONVERTERS
- FREQUENCY CHANGERS

HIGH VOLTAGE POWER SUPPLIES *including*

- IMAGE CONVERTER POWER SUPPLIES
- IMAGE INTENSIFIER POWER SUPPLIES

AIRBORNE POWER SYSTEMS *including*

- INVERTERS
- POWER SUPPLIES

The products shown on this page represent a sample of Power Systems' various capabilities.

## SHIPBOARD POWER SYSTEMS

Power Systems has specialized for many years in the design, development and production of ruggedized shipboard power conversion equipment. Most equipment is designed and qualified to meet the shock and vibration requirements of MIL-S-901 and MIL-STD-167. New equipment currently under development utilizes the STANDARD ELECTRONIC MODULE (SEM) concept for increased maintainability and reliability considerations.

The Model 4406 Static Inverter was developed to provide 10KVA, 400Hz power to critical shipboard navigation equipment. Provision for parallel operation with external power sources are provided with the design of the Model 4406. Modular construction and use of Standard Electronic Modules minimize down time and reduces shipboard provisioning requirements.

## HIGH VOLTAGE POWER SUPPLIES

Power Systems has produced many thousands of high voltage power supplies for image intensifier, image converter, low light TV, X-Ray, and a multitude of other low power high voltage applications. Standard power supplies for single, two and three stage 18MM, 25MM and 40MM image intensifier assemblies are available.

The Model 3258 High Voltage Power Supply shown above has been designed to operate both grounded and ungrounded cone 25mm 2nd Generation Microchannel Inverter Image Intensifier tubes (type MX-9644/UV). The Model 3258 meets or exceeds MIL-P-49090 (EL).

## AIRBORNE POWER SYSTEMS

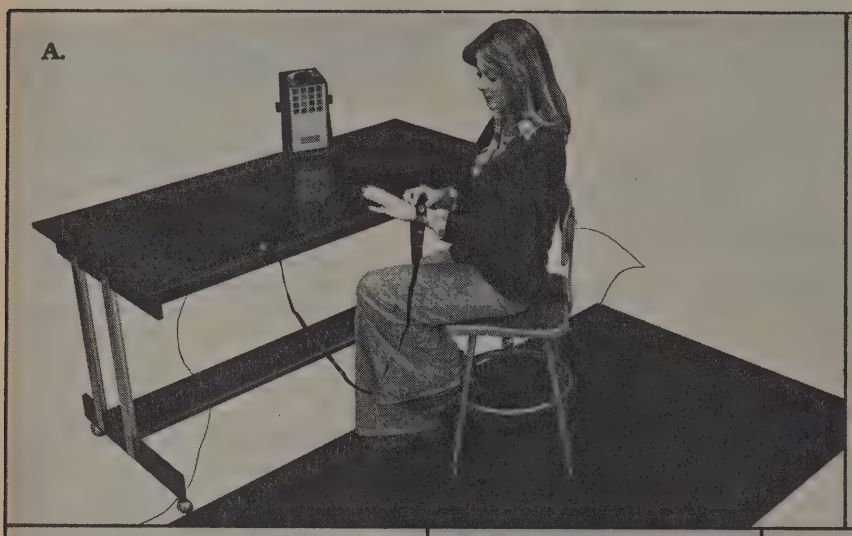
Power Systems has been an industry leader for many years in airborne power systems. Varo launched its initial product line with the development of one of the first successful static airborne inverters.

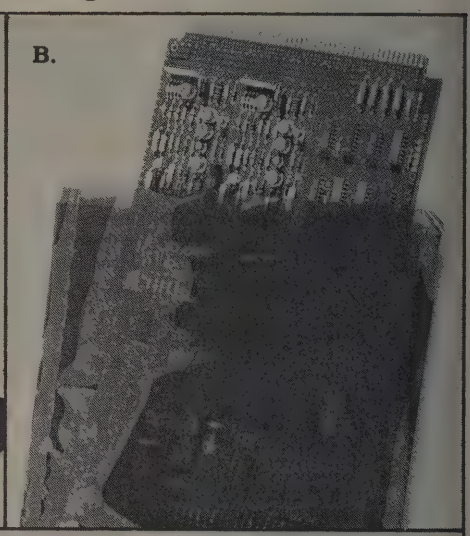
The Model 4405 Inverter/Converter illustrated above was developed to provide guidance system power for an advanced electro-optically guided missile. The Model 4405 was designed to meet requirements of MIL-STD-704 power, MIL-I-461 EMI and MIL-E-5400 environmental specifications. These military performance specifications are typical of the requirements that are met by airborne power systems developed at Power Systems.

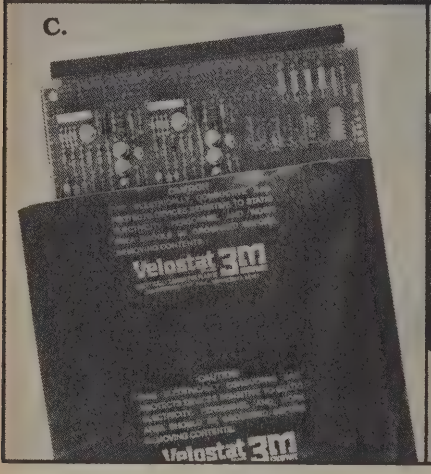
VARO®

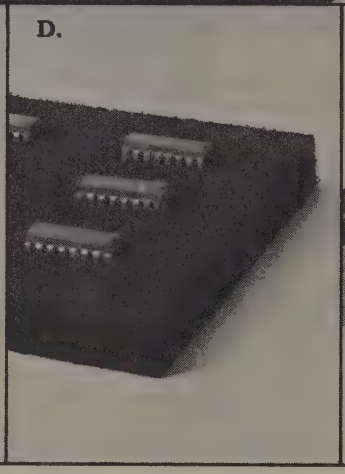
**VARO, INC., POWER SYSTEMS DIVISION.** 555 N. FIFTH ST., P.O. BOX 401267, GARLAND, TEXAS 75040 (214) 276-6141 (TWX) 910-860-5093

# 3M Static Control Systems.



**A. Safeguard Work Station Grounding Kit** This basic work station provides all the materials needed to create a static-safe work area. The kit adapts easily to most production operations including fabrication, assembly, storage, kitting, and testing of static-sensitive boards and microelectronic devices.

Included in grounding kit:

1. **Conductive Floor Mat** drains static charge from personnel and prevents static generation. Complete with grounding cord.
2. **Conductive Table Top** provides a static-free work surface. Also grounds conductive bags, carriers and equipment resting on the surface.
3. **Conductive Wrist Strap** connects personnel to ground system. Direct body contact insures personnel are kept at zero static potential.
4. **Conductive Ground Cord** connects table top to floor mat and complete system to ground.
5. **3M Model 909 Ionized Air Blower** is part of the complete Safeguard System, but is leased separately. (See next page).

Type 8003. Items above also sold separately.

**B. 3M Brand Transparent Static Shielding Bags** These bags provide the same conductive, humidity-independent protection as VELOSTAT Opaque Bags, but you can clearly see your product inside. The bags feature a puncture-resistant, high-strength metallic-coated polyester film that creates an electrostatic shield. The polyester is laminated to a heat sealable, anti-static polyethylene inner layer that prevents static charge generation inside the bag. The bags are available in many sizes, can be custom manufactured and feature convenient "J" lip design for easy opening. Type 2100.

**Standard sizes (in inches) for 3M Brand Transparent Static Shielding Bags and VELOSTAT® Brand Electrically Conductive Bags.**

| Width | Length | Width | Length |
|---|---|---|---|
| 4 | 4 | 8 | 12 |
| 3 | 5 | 10 | 12 |
| 4 | 6 | 10 | 14 |
| 5 | 8 | 11 | 15 |
| 8 | 8 | 12 | 16 |
| 5 | 10 | 12 | 18 |
| 6 | 10 | 14 | 18 |
| 8 | 10 | 15 | 18 |

**C. VELOSTAT® Brand Opaque Electrically Conductive Bags** These bags are made of VELOSTAT Conductive Film. They provide shielding from electrostatic discharge by safely enveloping static-sensitive devices and boards in a humidity-independent Faraday Cage. The effectiveness of the product is unaffected by humidity, age and most chemicals. Bags are available in many sizes and can be specially manufactured to your specifications. All VELOSTAT Bags are heat sealable. Type 2004.

**D. VELOSTAT Brand Conductive Foam** The foam provides physical and electrostatic protection for sensitive microelectronic parts. The leads can be inserted in the foam, shunted, and kept at equal potential. Cushioning prevents physical damage.

Type 1900. Thicknesses: ⅛", ¼", ⅜", ½", ¾", 1". Sold in 25" (±1") x 75" (±1") sheets. High and low density foams both available.

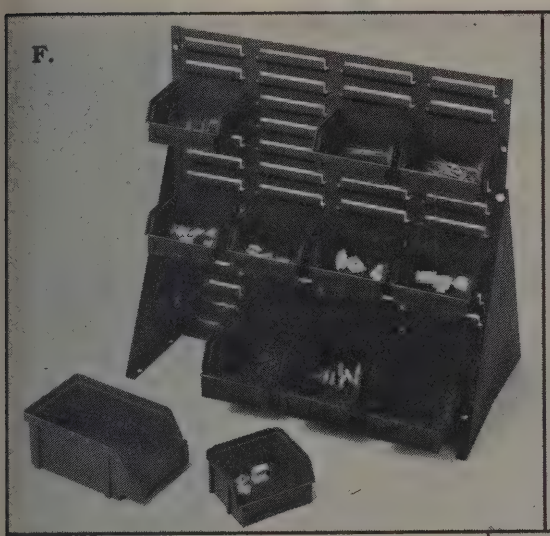
**E. VELOSTAT Brand Trays and Containers** Made of VELOSTAT Conductive Plastic, these trays are ideal for static-safe storage, kitting and shipping of microelectric devices.

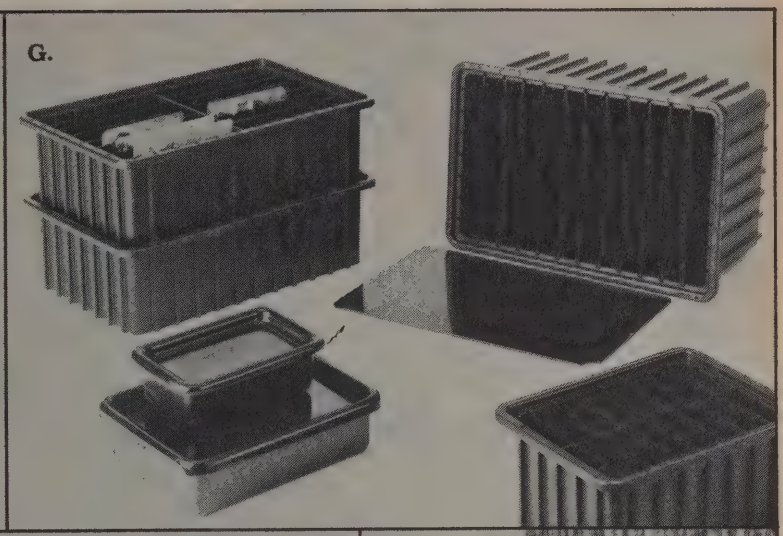
Type 4010-20 and 4061-62. Available in a variety of shapes and sizes.

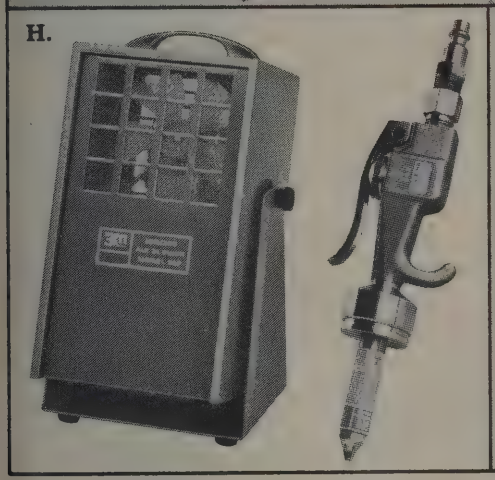
For more information phone (612) 733-9420 or write Static Control Systems, 3M Company, St. Paul, MN 55101.

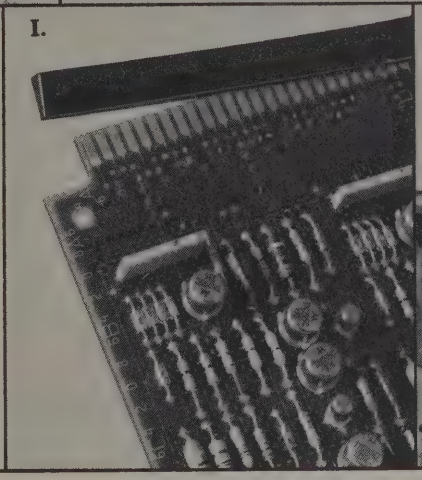
3M COMPANY

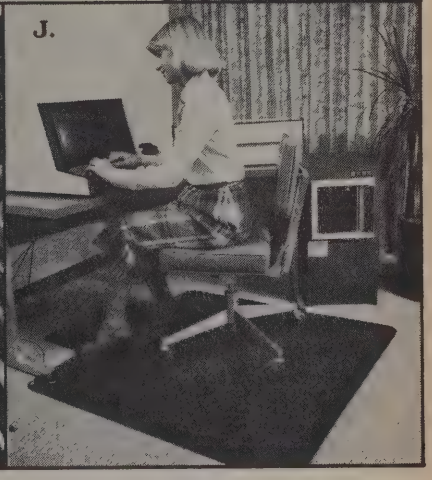
# 3M Static Control Systems.




**F. VELOSTAT Brand Conductive Parts Bins and Assembly Stands** This unit creates an organized grounded system for parts assembly. The bins have been designed with a hopper front for easy access and quick identification. They are held by a convenient bench top rack. Because they are made of conductive plastic, they will never rust, corrode, or damage contents. The arrangement of parts bins on the assembly stand can be customized to the needs of each assembly station.

Sizes: Type 4016 Small Bin. I.D. 3"L x 3⅜"W x 1¾"H. Wt. .11 lbs.

Type 4017 Large Bin. I.D. 6"L x 3½"W x 2½"H. Wt. .22 lbs.

Type 4018 Stand. 17⅝"H x 18"W x 5½"D. Holds 20 small bins or 16 large bins.

**G. VELOSTAT Brand Conductive Tote Boxes** These plastic tote boxes combine conductivity with rigidity. They are injection molded for strength with a hard formula of VELOSTAT Brand Electrically Conductive Material. Unlike heavy metal, VELOSTAT is light-weight. And unlike ordinary plastic, VELOSTAT boxes are truly conductive. Static-sensitive parts are shielded from a static charge that could blow or degrade them. For example, leads on P.C. boards can actually be shunted simply by contacting the sides of the box. Each box features a smooth finish and rib-reinforced sides. Each nests snugly in the other for stable, efficient stacking.

| INSIDE BOTTOM DIMENSIONS | | | Stacked (usable) height |
|---|---|---|---|
| Type | Length | Width | |
| 4415 | 9-3/16" | 6-9/16" | 4-1/2" |
| 4425 | 14-3/4" | 9-3/16" | 4-1/2" |
| 4428 | 14-7/8" | 9-1/4" | 7-1/2" |
| 4438 | 20-1/8" | 15-1/8 " | 7-1/2" |
| 4439 | 20-1/8" | 15-1/16" | 11-1/2" |

Slip-in dividers and covers available for most sizes.

**H. 3M Brand Air Ionizers** The 3M Ionizing Air Guns and Nozzles remove dust and static from parts and equipment and keep it from coming back. Lightweight and easy to use, they readily attach to air lines. No electricity, cords or transformers needed.

A Model 909 Ionized Air Blower bathes working areas with gentle, static-neutralizing ionized air. It eliminates static on such non-conductors as styrofoam and clothing. And it's so gentle, it won't disturb delicate parts.

**I. VELOSTAT Brand Conductive Shunt Bars** These shunt bars slip over the tabs of PC Boards to protect them from physical and static damage during soldering, insertion, assembly and shipping. The conductive shunts also tie the tabs together electrically so they are kept at equal potential.

Type 5020. Sizes: 4", 5", 6", 8", 36".

**J. VELOSTAT Brand Conductive Chair Mats** These conductive mats protect minicomputers, data entry terminals, disk drives, and all types of intelligent peripherals from memory alteration or loss due to static charge on personnel. When placed where personnel must touch the mat to use the equipment, the charge is instantly drained to ground. The rigid mat structure permits easy movement of wheeled chairs, even on plush carpeting.

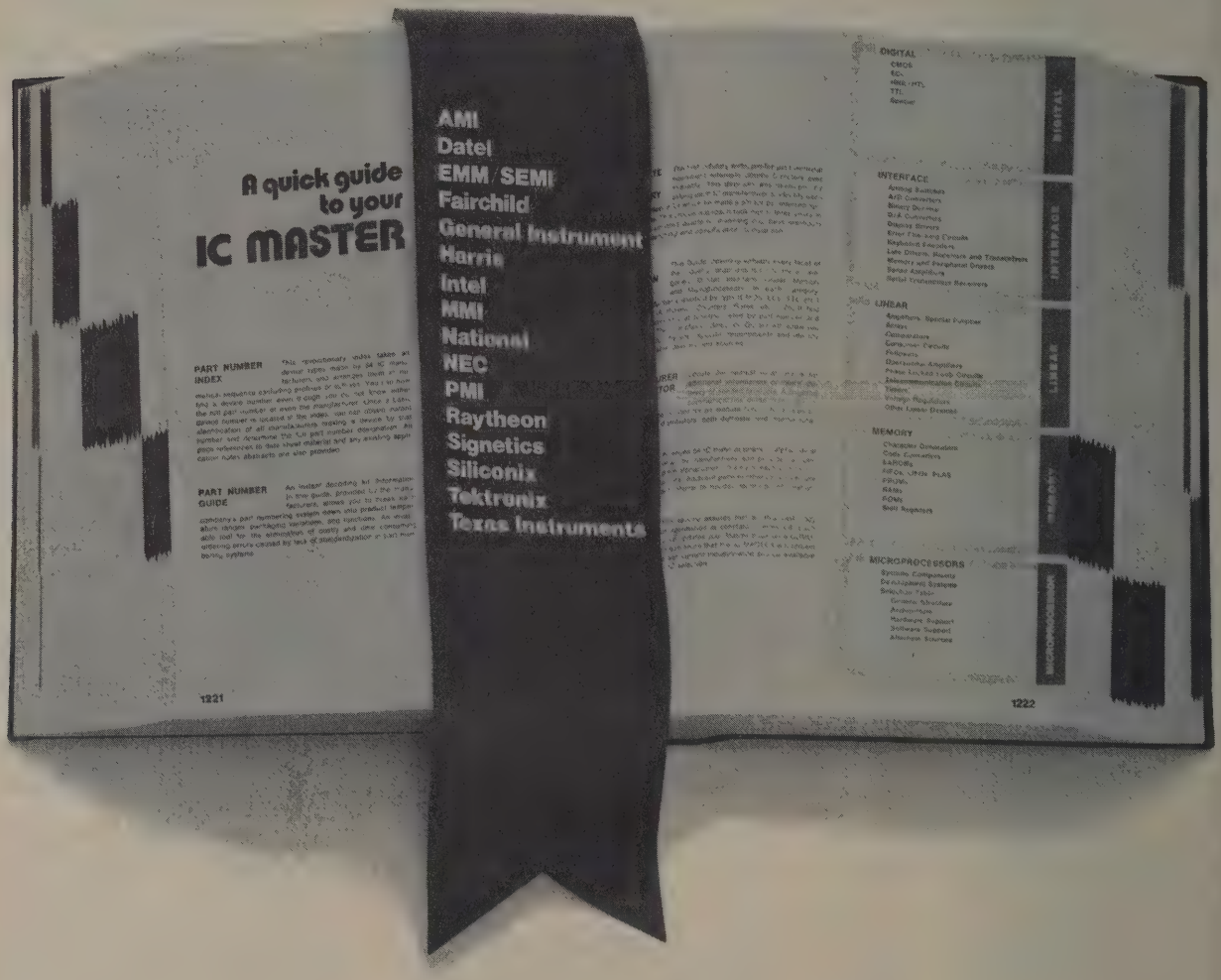
Sizes: Type 1852- 24" x 32" x ⅛"
Type 1853- Overall 4' x 5' x ⅛" including 30" x 10" lip
Type 1854- 4' x 8' x ⅛"

For more information phone (612) 733-9420 or write Static Control Systems, 3M Company, St. Paul, MN 55101.

VELOSTAT IS A REGISTERED TRADEMARK OF 3M COMPANY. ST. PAUL, MN. 55101

3M COMPANY

# A GOOD BOOK IS KNOWN BY THE COMPANIES IT KEEPS




These manufacturers have invested in the IC MASTER to bring you the most complete information on their newest standard products.

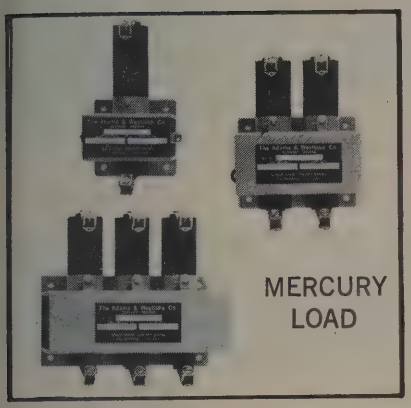
WHEN USING THE IC MASTER, REFER TO THESE MANUFACTURERS' COMPLET DATA SHEETS TO HELP YOU IN YOUR IC SELECTION . . .

**THE WHOLE WORLD FOLLOWS THE MASTER.**

**IC Master**
**1333 Lawrence Expressway, Suite 420**
**Santa Clara, CA 95051**
**(408) 248-8044**

***It's Faster With the Master***

# SWITCHING EXPERTS



MERCURY LOAD

Adlake
SINCE 1857

## YESTERDAY—

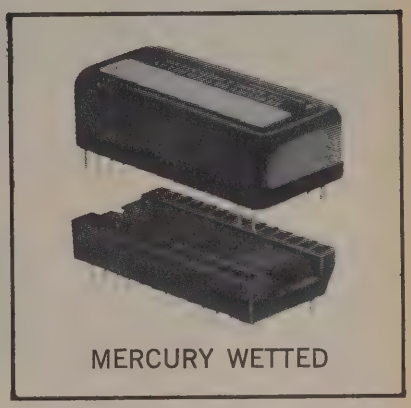
**"...over four decades of proven performance..."**

## TODAY—

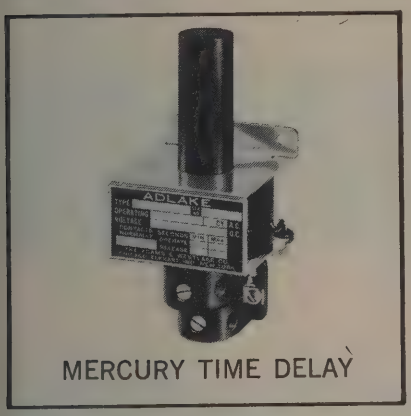
**"...customer service is our business..."**

## TOMORROW—

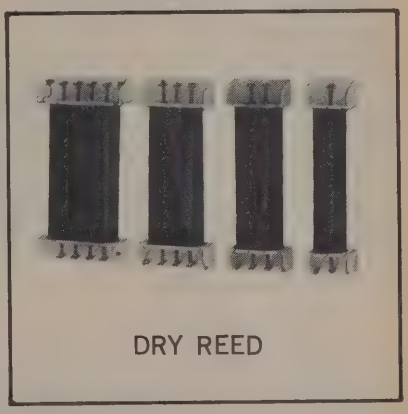
**"...innovative mercury and solid state technology..."**



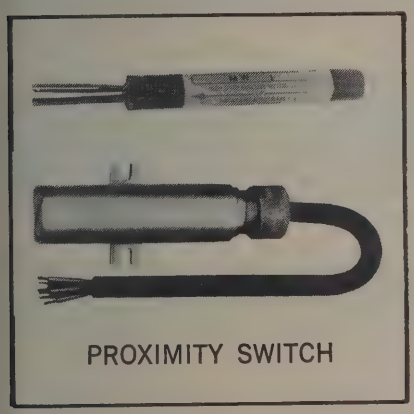
MERCURY WETTED



MERCURY TIME DELAY



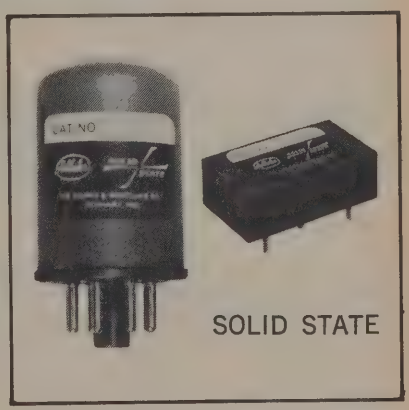
DRY REED



PROXIMITY SWITCH

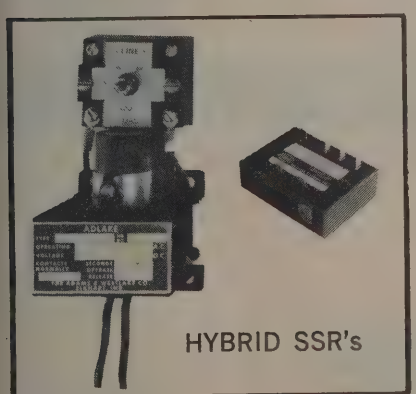
*when size makes the difference*

**—ADLAKE—**
**MAKES THE SIZE**

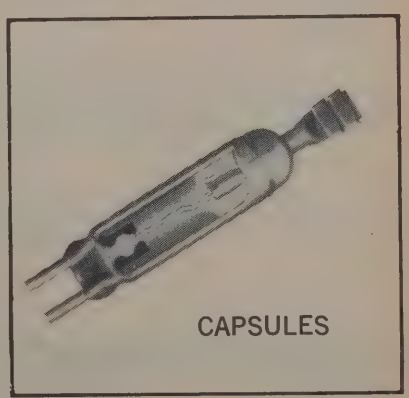


SOLID STATE

**Adlake** relays are designed and built to meet the most exacting demands of the electronic/electrical industry. All the care required for the manufacture of high-grade instruments is used to produce Adlake relay components. Serving a worldwide market through manufacturer's representatives and franchise distributors, the Adams and Westlake Company is ready to supply you with the superior features of long life and quality in relay components.



HYBRID SSR's

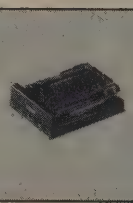


CAPSULES

**The Adams & Westlake Company**
1025 N. Michigan Street
Elkhart, Indiana 46514
(219) 264-1141
TELEX 25-8458

# GENERAL PURPOSE RELAYS

**For detailed technical information, call us collect at 714/540-4190. For sales information, call our local sales office listed in the eem yellow section.**



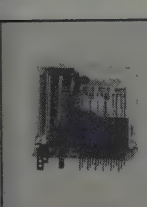
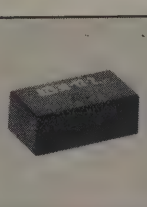
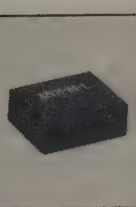
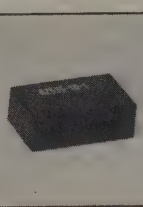
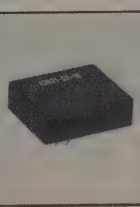
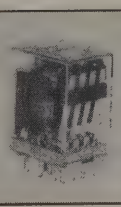
| SERIES | | | AZ 4U | AZ 5 | AZ 6 | AZ 7 | AZ 8 | AZ 420/ 421 |
|---|---|---|---|---|---|---|---|---|
| CONTACTS | FORM | | SPDT | 1-3 PDT | 1-4 PDT | 2-6 PDT | 6 PDT | 1-4 PDT |
| | AMPS | | 5/3 | 2 | 10 | 0 to 2/0.5 | 0 to 2/0.5 | 0 to 5/3 |
| | VOLTS | | 24VDC 115VAC | 24VDC 115VAC | 30VDC 115VAC | 30VDC 115VAC | 28VDC 115VAC | 26VDC 115VAC |
| NOMINAL OPERATING VOLTAGES AND DC COIL RESISTANCE IN OHMS | AC | 6 | 16 | 14 | 19 | | | 75 |
| | AC | 12 | 60 | 52 | 77 | | | 300 |
| | AC | 24 | 200 | 250 | 300 | N/A | N/A | 835 |
| | AC | 115 | 6800 | 5750 | 7,210 | | | 3,800 |
| | DC | 3 | 25 | — | — | — | — | 14* |
| | DC | 6 | 100 | 31 | 47 | 115 | 35 | 52* |
| | DC | 12 | 400 | 125 | 188 | 430 | 130 | 185* |
| | DC | 24 | 1600 | 500 | 750 | 1650 | 590* | 700* |
| | DC | 48 | 6400 | 2000 | 2,660 | 6000 | 2100* | 2,500* |
| | DC | 115 | — | — | 11,000 | — | — | 15,000 |
| TERMINALS SOLDER/PLUG-IN | | | — | X | X | — | — | X |
| TERMINALS PC | | | X | X | X | X | X | X |
| TERMINALS OCTAL PLUG-IN | | | — | — | — | — | — | — |
| TERMINALS QUICK CONNECT | | | — | — | X | — | — | — |
| TYPICAL LIFE (OPERATIONS) | | | 100,000 | 200,000 | 500,000 | 1,000,000 | 100,000 | 1,000,000 |
| DIELECTRIC STRENGTH (VRMS) | | | 1000 | 1000 | 2000 | 1000 | 500 | 1000 |
| OPERATING TEMPERATURE RANGE | | | −55°C to +70°C | −45°C to +60°C | −45°C to +40°C | −55°C to +85°C | −55°C to +65°C | −55°C to +80°C |
| WEIGHT | | | 10 grams | 18 grams | 24-74 grams | 13-20 grams | 42 grams | 28 grams |
| HERMETICALLY SEALED | | | Available | No | No | Available | No | No |
| MAXIMUM SIZE IN INCHES | | L | 0.860 | 0.893 | 1.084 | 1.173 | 1.07 | 0.940 |
| | | X | X | X | X | X | X | X |
| | | W | 0.630 | 0.712 | 0.552 | 0.765 | 1.00 | 0.735 |
| | | X | X | X | X | X | X | X |
| | | H | 0.900 | 1.019 | 1.403 | 0.375 | 1.24 | 1.187 |
| U/L RECOGNIZED | | | Yes | Yes | Yes | No | No | Yes |
| CSA CERTIFIED | | | Pending | Pending | Yes | No | No | Yes |

All listed data are for the type with the minimum number of contacts.
For more detailed information, request individual data sheets.

*"It's a better relay"*

**AMERICAN ZETTLER, INC.**
16881 Hale Avenue, Irvine, California 92714
Telephone (714) 540-4190 • Telex 67-8472

# FROM AMERICAN ZETTLER.

|  | |  |  |  |  |  | |
|---|---|---|---|---|---|---|---|
| **AZ 430** | **AZ 480** | **AZ 530/ AZ 2530** | **AZ 531/ AZ 2531** | **AZ 535/ AZ 2535** | **AZ 521/ AZ 2521** | **AZ 1300** | **AZ 1279** |
| 6 PDT<br>0 to 5/3<br>26VDC<br>115VAC | 1-4 PDT<br>10<br>30VDC<br>115VAC | SPDT<br>Low to 2/1<br>26VDC<br>115VAC | DPDT<br>Low to 2/1<br>26VDC<br>115VAC | SPDT<br>5/3<br>26VDC<br>220VAC | 4 PDT<br>Low to 2/1<br>26VDC<br>115VAC | 2/4 PDT<br>5<br>26VDC<br>115VAC | 1-3 PDT<br>10<br>28VDC<br>220VAC |
| N/A | 6<br>24<br>85<br>2,250 | N/A | N/A | N/A | N/A | 10<br>43<br>160<br>3,900 | 4.2<br>18<br>72<br>1,700 |
| —<br>25*<br>90*<br>430*<br>1800*<br>9000 | —<br>32<br>130<br>500<br>2,100<br>10,500 | —<br>90*<br>310*<br>950*<br>4,500*<br>14,000 | —<br>60*<br>260*<br>670*<br>3,800*<br>19,000 | —<br>37<br>125<br>440<br>1,930<br>10,500 | —<br>52<br>210<br>1,050<br>3,200<br>16,000 | —<br>40<br>160<br>650<br>2,600<br>13,000 | —<br>32<br>120<br>472<br>1,800<br>10,000 |
| X<br>X<br>—<br>— | X<br>X<br>X<br>— | —<br>X<br>—<br>— | —<br>X<br>—<br>— | —<br>X<br>—<br>— | —<br>X<br>—<br>— | X<br>X<br>—<br>— | —<br>X<br>—<br>X |
| 1,000,000 | 250,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 500,000 |
| 1000 | 1500 | 500 | 500 | 2500 | 500 | 1500 | 1500 |
| −55°C<br>to<br>+80°C | −45°C<br>to<br>+50°C | −55°C<br>to<br>+55°C | −55°C<br>to<br>+65°C | −55°C<br>to<br>+60°C | −55°C<br>to<br>+75°C | −45°C<br>to<br>+70°C | −45°C<br>to<br>+70°C |
| 30 grams | 85 grams | 11 grams | 14 grams | 15 grams | 25 grams | 42 grams | 85 grams |
| No | No | Available | Available | Available | Available | No | No |
| 1.375<br>X<br>0.735<br>X<br>1.187 | 1.38<br>X<br>1.38<br>X<br>2.10 | 1.090<br>X<br>0.593<br>X<br>0.445 | 1.090<br>X<br>0.888<br>X<br>0.445 | 1.285<br>X<br>0.791<br>X<br>0.467 | 1.475<br>X<br>1.275<br>X<br>0.490 | 1.109<br>X<br>0.859<br>X<br>1.340 | 1.33<br>X<br>1.33<br>X<br>1.69 |
| Yes | Yes | Yes | Yes | Yes | No | Yes | Yes |
| Yes | Pending | Pending | Pending | Pending | No | Yes | Yes |

*Higher coil resistances or sensitive version available.

*"It's a better relay"*

**AMERICAN ZETTLER, INC.**

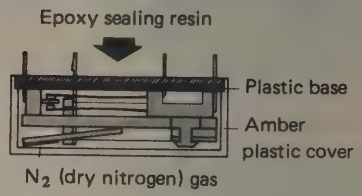
16881 Hale Avenue, Irvine, California 92714
Telephone (714) 540-4190 • Telex 67-8472

# Amber Relays NFE, KE, HCE

## What is the Amber Relay?

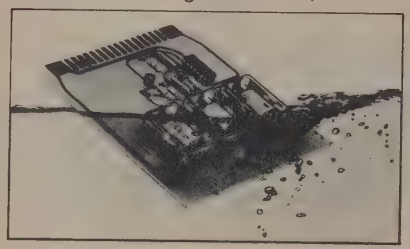
The NF, K and HC relay lines have found wide use and have proven their reliability over the past years. Nevertheless, certain applications have been restricted because of environmental factors, or because of printed circuit board fabrication processes employed. After much research and testing, the sealed versions of these relays have been developed; the Amber Relay line. These relays, with their high density seal and inert atmosphere considerably broaden the range of applications and can improve the reliability of your product at a reasonable cost.

### Sealed construction

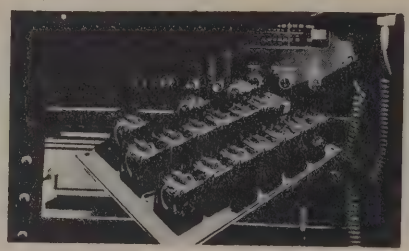



## Major Features

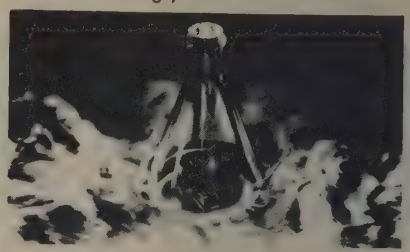
1. Solution to PC board soldering and cleaning problems-costly hand soldering eliminated.

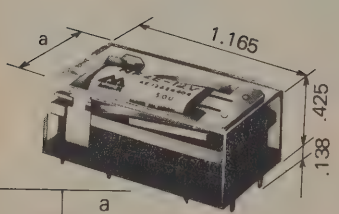


2. Highly stable contact resistance maintained, even after long periods of idle use.



3. Adverse environments—where sealed amber relays perform outstandingly!






| | a |
|---|---|
| NF2E | .772 |
| NF4E | .953 |

**NFE type**

### Types and Data

| Type | | Coils: Voltage | Coils: Res. (Ω) | Coils: Nom. Power (mW) | Contacts: Arrangement | Contacts: Rating (A) | Sugg. List Price |
|---|---|---|---|---|---|---|---|
| NF2E– | 5V | 5VDC | 90 | 278 | 2C | 2 | $5.15 |
| | 6V | 6 | 137 | 260 | | | 5.15 |
| | 12V | 12 | 500 | 290 | | | 5.15 |
| | 24V | 24 | 2,000 | 290 | | | 5.15 |
| | 48V | 48 | 7,000 | 330 | | | 6.00 |
| | 60V | 60 | 9,700 | 370 | | | 7.05 |
| NF4E– | 5V | 5VDC | 53 | 472 | 4C | 2 | $6.10 |
| | 6V | 6 | 90 | 400 | | | 6.10 |
| | 12V | 12 | 330 | 440 | | | 6.10 |
| | 24V | 24 | 1,200 | 480 | | | 6.10 |
| | 48V | 48 | 4,200 | 550 | | | 6.75 |
| | 60V | 60 | 7,000 | 510 | | | 8.15 |

**Note:** 1. MBB types available. 2. Standard packing → Carton: 20 pcs./Case: 200 pcs.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| K2E– (K2ET*) | 3V-1 | 3VDC | 28 | 320 | 2C | 2 | $4.90 |
| | 6V-1 | 6 | 110 | 330 | | | 4.90 |
| | 12V-1 | 12 | 530 | 270 | | | 4.90 |
| | 24V-1 | 24 | 1,700 | 340 | | | 4.90 |
| | 48V-1 | 48 | 7,600 | 300 | | | 5.65 |
| | 110V-1 | 110 | 16,000 | 760 | | | 7.30 |

*Remember us? ... we used to be known as Arrow-M.*

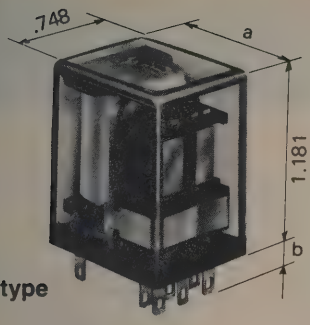
**Aromat**
Member of Matsushita Group

**Aromat Corporation**
250 Sheffield St.
Mountainside, N.J. 07092
(201) 232-4260
Telex: 138-213

*Mid-Western Office*
311 Lively Blvd.
Suite 1
Elk Grove Village, IL 60007
(312) 593-8535
Telex: 28-3421

*Western Office:*
22010 So. Wilmington Ave.
Suites 300 & 301
Carson, Calif. 90745
(213) 775-3512
Telex: 69-1712

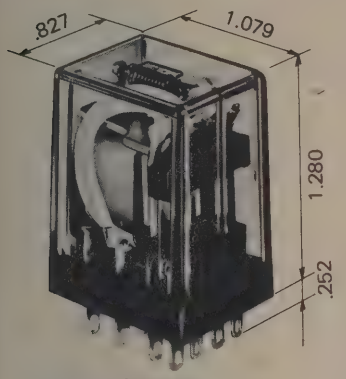
## Types and Data



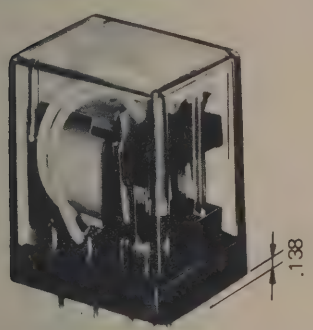

**KE type**

| | a |
|---|---|
| K2E | .929 |
| K4E | 1.157 |
| K6E | 1.370 |

| | b |
|---|---|
| Plug-in | .236 |
| P/C board | .157 |




**HCE plug-in type**




**HCE P/C board type**

| Type | Coils: Voltage | Coils: Res. (Ω) | Coils: Nom. Power (mW) | Contacts: Arrangement | Contacts: Rating (A) | Sugg. List Price |
|---|---|---|---|---|---|---|
| K2E— 3V-9 | 3VDC | 10 | 900 | | | $4.90 |
| (K2ET*) 6V-9 | 6 | 52 | 690 | | | 4.90 |
| 12V-9 | 12 | 185 | 780 | 2C | 2 | 4.90 |
| 24V-9 | 24 | 700 | 820 | | | 4.90 |
| 48V-9 | 48 | 2,500 | 920 | | | 5.65 |
| 115V-9 | 115 | 15,000 | 880 | | | 7.30 |
| K4E— 3V-1 | 3VDC | 18 | 500 | | | $5.65 |
| (K4ET*) 6V-1 | 6 | 58 | 620 | | | 5.65 |
| 12V-1 | 12 | 250 | 580 | 4C | 2 | 5.65 |
| 24V-1 | 24 | 890 | 650 | | | 5.65 |
| 48V-1 | 48 | 3,200 | 720 | | | 6.20 |
| 110V-1 | 110 | 16,000 | 760 | | | 8.05 |
| K4E— 3V-9 | 3VDC | 10 | 900 | | | $5.65 |
| (K4ET*) 6V-9 | 6 | 52 | 690 | | | 5.65 |
| 12V-9 | 12 | 185 | 780 | 4C | 2 | 5.65 |
| 24V-9 | 24 | 700 | 820 | | | 5.65 |
| 48V-9 | 48 | 2,500 | 920 | | | 6.20 |
| 115V-9 | 115 | 15,000 | 880 | | | 8.05 |
| K6E— 6V-9 | 6VDC | 25 | 1,440 | | | $7.80 |
| (K6ET*) 12V-9 | 12 | 90 | 1,600 | | | 7.80 |
| 24V-9 | 24 | 430 | 1,340 | 6C | 2 | 7.80 |
| 48V-9 | 48 | 1,500 | 1,540 | | | 7.90 |
| 115V-9 | 115 | 9,000 | 1,340 | | | 9.00 |

**Note:** 1. T*: Denotes PC terminal relay.
2. Standard packing → Carton: 20 pcs./Case: 200 pcs.

| | | | | | | |
|---|---|---|---|---|---|---|
| HC1E— 6VDC | 6VDC | 40 | | | | $6.40 |
| (HC1E-P*) 12VDC | 12 | 160 | approx. | | | 6.40 |
| 24VDC | 24 | 650 | 900 | 1C | 5 | 6.40 |
| 48VDC | 48 | 2,600 | | | | 6.40 |
| 110VDC | 110 | 11,000 | | | | 6.80 |
| HC1E— 6VAC | 6VAC | | | | | $6.40 |
| (HC1E-P*) 12VAC | 12 | | approx. | | | 6.40 |
| 24VAC | 24 | | 1,200 | 1C | 5 | 6.40 |
| 48VAC | 48 | | | | | 6.40 |
| 115VAC | 115 | | | | | 6.80 |
| 240VAC | 240 | | | | | 7.75 |
| HC2E— 6VDC | 6VDC | 40 | | | | $6.80 |
| (HC2E-P*) 12VDC | 12 | 160 | approx. | | | 6.80 |
| 24VDC | 24 | 650 | 900 | 2C | 3 | 6.80 |
| 48VDC | 48 | 2,600 | | | | 6.80 |
| 110VDC | 110 | 11,000 | | | | 7.65 |
| HC2E— 6VAC | 6VAC | | | | | $6.80 |
| (HC2E-P*) 12VAC | 12 | | | | | 6.80 |
| 24VAC | 24 | | approx. | | | 6.80 |
| 48VAC | 48 | | 1,200 | 2C | 3 | 6.80 |
| 115VAC | 115 | | | | | 7.65 |
| 240VAC | 240 | | | | | 8.60 |
| HC4E— 6VDC | 6VDC | 40 | | | | $7.65 |
| (HC4E-P*) 12VDC | 12 | 160 | approx. | | | 7.65 |
| 24VDC | 24 | 650 | 900 | 4C | 2 | 7.65 |
| 48VDC | 48 | 2,600 | | | | 7.65 |
| 110VDC | 110 | 11,000 | | | | 8.45 |
| HP4E— 6VAC | 6VAC | | | | | $7.65 |
| (HP4E-P*) 12VAC | 12 | | | | | 7.65 |
| 24VAC | 24 | | approx. | | | 7.65 |
| 48VAC | 48 | | 1,200 | 4C | 2 | 7.65 |
| 115VAC | 115 | | | | | 8.45 |
| 240VAC | 240 | | | | | 9.45 |

**Note:** 1. P*: Denotes PC terminal relay.
2. Standard packing → Carton: 20 pcs./Case: 200 or 800 pcs.

**Note:** 1. Top mounting (TM) types are available.
2. Standard relays' sockets meet amber relays.

**Aromat Corporation**
250 Sheffield St.
Mountainside, N.J. 07092
(201) 232-4260
Telex: 138-213

*Mid-Western Office*
311 Lively Blvd.
Suite 1
Elk Grove Village, IL 60007
(312) 593-8535
Telex: 28-3421

*Western Office:*
22010 So. Wilmington Ave.
Suites 300 & 301
Carson, Calif. 90745
(213) 775-3512
Telex: 69-1712

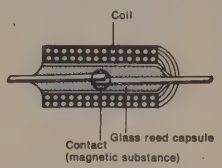
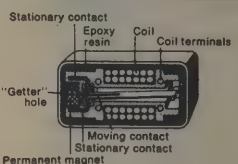
Aromat
Member of Matsushita Group

# Half-size Amber R Relays

## New kind of high speed SPDT reed relay

- High speed — up to 500 cycle/sec. operations
- Long life (mechanical) — more than $10^9$ operations
- Large contact capacity — 1A 20VDC (power)
- Low operating power — 80mW (Single side stable) 40mW (Bistable 1 coil)
- Latching type available

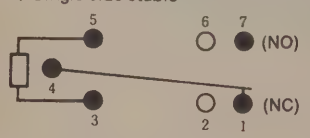
### Differences between General reed and R relays

| | General reed relays | R relays |
|---|---|---|
| Structure |   |   |
| Contact arrangement | 1NC or 1NO contact | 1NC contact |
| Contact capacity | 5 to 10W | 20W (high contact pressure) |
| Operating function | Single side stable | Single side stable<br>Latching |

### Wiring diagram

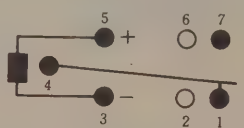
(Terminal View)
■: Energized coil □: De-energized coil

1. Single side stable



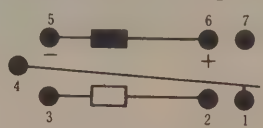

De-energized position

2. Latching: 1 coil latching

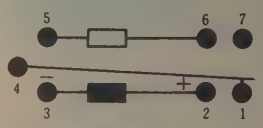



"Reset" position when terminal 5(+) and 3 (–) are energized.

3. Latching: 2 coil latching



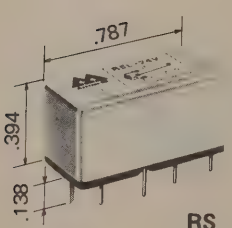

"Reset" position when terminal 5 (–) and 6 (+) are energized.




"Reset" position when terminal 3 (–) and 2 (+) are energized.

### Types and Data

| Type | | Coils: Voltage | Coils: Res. (Ω) | Coils: Nom. Power (mW) | Contacts: Arrangement | Contacts: Rating (A) | Sugg. List Price |
|---|---|---|---|---|---|---|---|
| Single side stable | | | | | | | |
| RS– | 5VDC | 5VDC | 170 | 147 | | | $3.90 |
| | 6VDC | 6 | 220 | 164 | | | 3.90 |
| | 12VDC | 12 | 890 | 162 | 1C | 1 | 3.90 |
| | 24VDC | 24 | 2,000 | 288 | | | 3.90 |
| | 48VDC | 48 | 8,000 | 221 | | | 6.60 |
| RS–D*– | 5VDC | 5VDC | 170 | 147 | | | $3.90 |
| | 6VDC | 6 | 220 | 164 | | Min. | 3.90 |
| | 12VDC | 12 | 890 | 162 | 1C | 100μ | 3.90 |
| | 24VDC | 24 | 2,000 | 288 | | | 3.90 |
| | 48VDC | 48 | 8,000 | 221 | | | 6.60 |
| R1a–S– | 5VDC | 5VDC | 170 | 147 | | | $3.10 |
| | 6VDC | 6 | 220 | 164 | | | 3.10 |
| | 12VDC | 12 | 890 | 162 | 1a | 1 | 3.10 |
| | 24VDC | 24 | 2,000 | 288 | | | 3.10 |
| | 48VDC | 48 | 8,000 | 221 | | | 5.80 |




RS

R1A

*Remember us? ... we used to be known as Arrow-M.*

**Aromat Corporation**
250 Sheffield St.
Mountainside, N.J. 07092
(201) 232-4260
Telex: 138-213

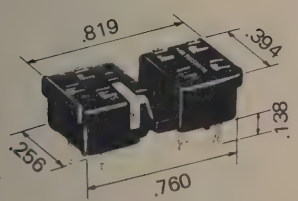
*Mid-Western Office*
311 Lively Blvd.
Suite 1
Elk Grove Village, IL 60007
(312) 593-8535
Telex: 28-3421

*Western Office:*
22010 So. Wilmington Ave.
Suites 300 & 301
Carson, Calif. 90745
(213) 775-3512
Telex: 69-1712

Aromat
Member of Matsushita Group

## Types and Data

| Type | | Coils | | | Contacts | | Sugg. List Price |
|---|---|---|---|---|---|---|---|
| | | Voltage | Res. (Ω) | Nom. Power (mW) | Arrange-ment | Rating (A) | |
| R1a–SD*– | 5VDC | 5VDC | 170 | 147 | | | $3.10 |
| | 6VDC | 6 | 220 | 167 | | Min. | 3.10 |
| | 12VDC | 12 | 890 | 162 | 1a | 100μ | 3.10 |
| | 24VDC | 24 | 2,000 | 288 | | | 3.10 |
| | 48VDC | 48 | 8,000 | 221 | | | 5.80 |
| 1 coil latching | | | | | | | |
| RSL– | 5VDC | 5VDC | 340 | 74 | | | $3.90 |
| | 6VDC | 6 | 450 | 80 | | | 3.90 |
| | 12VDC | 12 | 1,500 | 96 | 1C | 1 | 3.90 |
| | 24VDC | 24 | 6,000 | 96 | | | 4.90 |
| | 48VDC | 48 | 12,000 | 147 | | | 7.50 |
| RSLD*– | 5VDC | 5VDC | 340 | 74 | | | $3.90 |
| | 6VDC | 6 | 450 | 80 | | Min. | 3.90 |
| | 12VDC | 12 | 1,500 | 96 | 1C | 100μ | 3.90 |
| | 24VDC | 24 | 6,000 | 96 | | | 4.90 |
| | 48VDC | 48 | 12,000 | 147 | | | 7.50 |
| RSL–1a– | 5VDC | 5VDC | 340 | 74 | | | $3.10 |
| | 6VDC | 6 | 450 | 80 | | | 3.10 |
| | 12VDC | 12 | 1,500 | 96 | 1a | 1 | 3.10 |
| | 24VDC | 24 | 6,000 | 96 | | | 4.10 |
| | 48VDC | 48 | 12,000 | 147 | | | 6.70 |
| RSLD*–1a– | 5VDC | 5VDC | 340 | 74 | | | $3.10 |
| | 6VDC | 6 | 450 | 80 | | Min. | 3.10 |
| | 12VDC | 12 | 1,500 | 96 | 1a | 100μ | 3.10 |
| | 24VDC | 24 | 6,000 | 96 | | | 4.10 |
| | 48VDC | 48 | 12,000 | 147 | | | 6.70 |
| 2 coil latching | | | | | | | |
| RSL2– | 5VDC | 5VDC | 170 | 147 | | | $4.60 |
| | 6VDC | 6 | 225 | 160 | | | 4.60 |
| | 12VDC | 12 | 650 | 230 | 1C | 1 | 4.60 |
| | 24VDC | 24 | 2,700 | 213 | | | 5.60 |
| | 48VDC | 48 | 6,500 | 321 | | | 8.20 |
| RSL2D*– | 5VDC | 5VDC | 170 | 147 | | | $4.60 |
| | 6VDC | 6 | 225 | 160 | | Min. | 4.60 |
| | 12VDC | 12 | 650 | 230 | 1C | 100μ | 4.60 |
| | 24VDC | 24 | 2,700 | 213 | | | 5.60 |
| | 48VDC | 48 | 6,500 | 321 | | | 8.20 |
| RSL2–1a– | 5VDC | 5VDC | 170 | 147 | | | $3.80 |
| | 6VDC | 6 | 225 | 160 | | | 3.80 |
| | 12VDC | 12 | 650 | 230 | 1a | 1 | 3.80 |
| | 24VDC | 24 | 2,700 | 213 | | | 4.80 |
| | 48VDC | 48 | 6,500 | 321 | | | 7.40 |
| RSL2D*–1a– | 5VDC | 5VDC | 170 | 147 | | | $3.80 |
| | 6VDC | 6 | 225 | 160 | | Min. | 3.80 |
| | 12VDC | 12 | 650 | 230 | 1a | 100μ | 3.80 |
| | 24VDC | 24 | 2,700 | 213 | | | 4.80 |
| | 48VDC | 48 | 6,500 | 321 | | | 7.40 |




R Socket

**Note:** 1. D*: Denotes dry-circuit types.
2. Standard packing → Carton 50 pcs./Case 500 pcs.

## R Socket

| | |
|---|---|
| R–PS | $0.80 |

**Aromat Corporation**
250 Sheffield St.
Mountainside, N.J. 07092
(201) 232-4260
Telex: 138-213

*Mid-Western Office*
311 Lively Blvd.
Suite 1
Elk Grove Village, IL 60007
(312) 593-8535
Telex: 28-3421

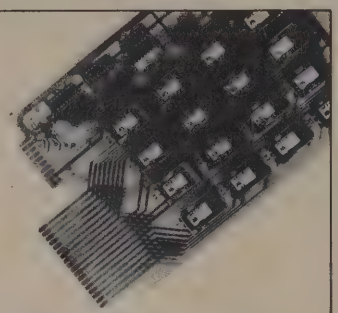
*Western Office:*
22010 So. Wilmington Ave.
Suites 300 & 301
Carson, Calif. 90745
(213) 775-3512
Telex: 69-1712

Aromat
ember of Matsushita Group

# NF Relays

## Flatpack with high sensitivity and reliability

- Low profile — stands only .402 inches high
  Ideal for high packaging density
- High sensitivity — Minimum operating
  NF2/140mW, NF4/235mW
- UL, VDE recognized
- Variety of available lines —
  Sealed Amber types
  MBB (Form D) contact types
  High breakdown voltage types for transient protection — 1,000 Vrms between open contacts, contact sets

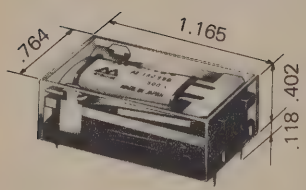


A typical printed circuit application for microwave communication as designed by Granger Associates.

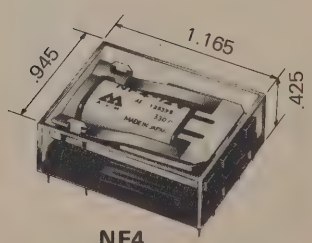
### Typical Applications

NF relays are widely acceptable in applications where small size and high sensitivity are requirements. Such applications include:

Electronic equipment, Household applications, Alarm systems, Office machines, Communication equipment, Measuring equipment, Remote control systems, General control circuits, Machine tools, Industrial machinery, etc.




NF2




NF4

### Types and Data

| Type | | Coils | | | Contacts | | Sugg. List Price |
|---|---|---|---|---|---|---|---|
| | | Voltage | Res. (Ω) | Nom. Power (mW) | Arrangement | Rating (A) | |
| NF2– | 5V | 5VDC | 90 | 278 | 2C | 2 | $4.50 |
| | 6V | 6 | 137 | 260 | | | 4.50 |
| | 12V | 12 | 500 | 290 | | | 4.50 |
| | 24V | 24 | 2,000 | 290 | | | 4.50 |
| | 48V | 48 | 7,000 | 330 | | | 5.35 |
| | 60V | 60 | 9,700 | 370 | | | 6.40 |
| NF4– | 5V | 5VDC | 53 | 472 | 4C | 2 | $5.45 |
| | 6V | 6 | 90 | 400 | | | 5.45 |
| | 12V | 12 | 330 | 440 | | | 5.45 |
| | 24V | 24 | 1,200 | 480 | | | 5.45 |
| | 48V | 48 | 4,200 | 550 | | | 6.10 |
| | 60V | 60 | 7,000 | 510 | | | 7.50 |
| NF2–2M– | 5V | 5VDC | 90 | 278 | 2C –2D | 2 | $4.80 |
| | 6V | 6 | 137 | 260 | | | 4.80 |
| | 12V | 12 | 500 | 290 | | | 4.80 |
| | 24V | 24 | 2,000 | 290 | | | 4.80 |
| | 48V | 48 | 7,000 | 330 | | | 5.65 |
| | 60V | 60 | 9,700 | 370 | | | 6.75 |
| NF4–2M– | 5V | 5VDC | 53 | 472 | 4C –2D | 2 | $5.80 |
| | 6V | 6 | 90 | 400 | | | 5.80 |
| | 12V | 12 | 330 | 440 | | | 5.80 |
| | 24V | 24 | 1,200 | 480 | | | 5.80 |
| | 48V | 48 | 4,200 | 550 | | | 6.40 |
| | 60V | 60 | 7,000 | 510 | | | 7.80 |
| NF4–4M– | 5V | 5VDC | 53 | 472 | 4C –4D | 2 | $6.00 |
| | 6V | 6 | 90 | 400 | | | 6.00 |
| | 12V | 12 | 330 | 440 | | | 6.00 |
| | 24V | 24 | 1,200 | 480 | | | 6.00 |
| | 48V | 48 | 4,200 | 550 | | | 6.65 |
| | 60V | 60 | 7,000 | 510 | | | 8.05 |

**Note:** Standard packing → Carton: 20 pcs./Case: 200 pcs.

*Remember us? ... we used to be known as Arrow-M.*

**Aromat Corporation**
250 Sheffield St.
Mountainside, N.J. 07092
(201) 232-4260
Telex: 138-213

*Mid-Western Office*
311 Lively Blvd.
Suite 1
Elk Grove Village, IL 60007
(312) 593-8535
Telex: 28-3421

*Western Office:*
22010 So. Wilmington Ave.
Suites 300 & 301
Carson, Calif. 90745
(213) 775-3512
Telex: 69-1712

Aromat
Member of Matsushita Group



Add Dept. EM to address to tell them you saw it in eem

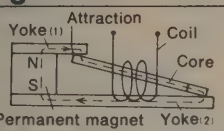
NEW

# NC Relays

## TTL compatible 5 AMP DIL relays

- Space saver – Flatpack and Lean line
- High contact capacity – 5A 250V AC
- Low operating power – 2C, 230 mW
  4C, 460 mW (Single side stable)
- Soldering flux inflow prevented by terminal location
- Latching type available
- High breakdown voltage for transient protection – 1,000 Vrms between open contacts, contact sets
- Patented in U.S.A. Patent No. 3950718

### Magnetic Structure



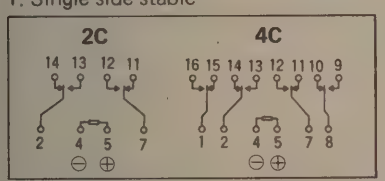

NC relays are constructed in a manner which makes the most efficient use of the magnetic forces inherent to the relay. No springs or other mechanical devices are employed to transfer contacts: all forces are magnetic, either attracting or repelling, so that no external force must be overcome for transfer. Power requirements are thereby reduced and contact release simplified. The result is greater sensitivity and reliability plus longer life.

### Wiring Diagram

(Top view)

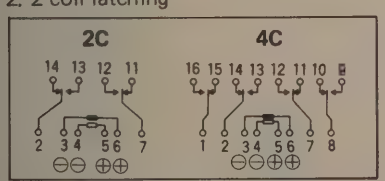
▭ De-energized coil ■ Energized coil

1. Single side stable




De-energized position

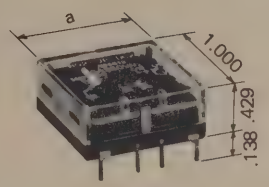
2. 2 coil latching




"Reset" position when terminals 3 and 6 are energized. Energize terminals 4 and 5 to transfer contacts.

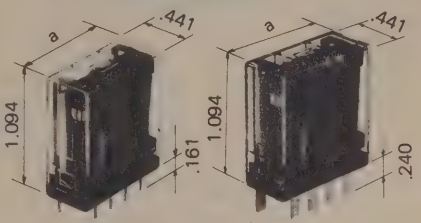
### Two Space Savibg form!

#### —Flatpack—




| | a |
|---|---|
| 2C | 1.000 |
| 4C | 1.500 |

#### —Lean line—




(P/C board) (Plug-in)

| | a |
|---|---|
| 2C | 1.000 |
| 4C | 1.500 |

#### For compact card-rack mounting

#### For high packaging density

### Ordering Nomenclature

Ex. NC | 2 | J | P | L2 | — | 6VDC

Number of contacts: 2, 4C

Shape: Nil = Lean line
J = Flatpack

Terminal arrangement:
Nil = plug-in
P = For P/C board

Operation function:
Nil = single side stable
L2 = 2 coil latching

Coil voltage:
5, 6, 12, 24, 48, 60 VDC

**Aromat Corporation**
250 Sheffield St.
Mountainside, N.J. 07092
(201) 232-4260
Telex: 138-213

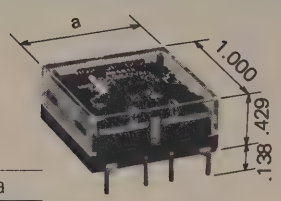
*Mid-Western Office*
311 Lively Blvd.
Suite 1
Elk Grove Village, IL 60007
(312) 593-8535
Telex: 28-3421

*Western Office:*
22010 So. Wilmington Ave.
Suites 300 & 301
Carson, Calif. 90745
(213) 775-3512
Telex: 69-1712

Aromat
Member of Matsushita Group

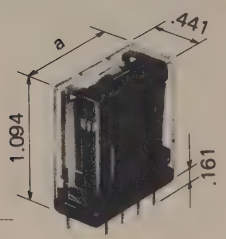
## Types and Data

### Flatpack



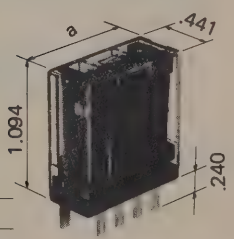

| | a |
|---|---|
| 2C | 1.000 |
| 4C | 1.500 |

### Lean line (P/C board)




| | a |
|---|---|
| 2C | 1.000 |
| 4C | 1.500 |

### Lean line (Plug-in)




| | a |
|---|---|
| 2C | 1.000 |
| 4C | 1.500 |

| Type | | Coils: Voltage | Coils: Res. (Ω) | Coils: Nom. Power (mW) | Contacts: Arrangement | Contacts: Rating (A) | Sugg. List Price |
|---|---|---|---|---|---|---|---|
| NC2–JP– | 5VDC | 5VDC | 69.4 | 360 | | | $4.10 |
| | 6VDC | 6 | 100 | 360 | | | 4.10 |
| | 12VDC | 12 | 400 | 360 | 2C | 5 | 4.10 |
| | 24VDC | 24 | 1,600 | 360 | | | 4.10 |
| | 48VDC | 48 | 6,400 | 360 | | | 4.70 |
| | 60VDC | 60 | 10,000 | 360 | | | 5.60 |
| NC4–JP– | 5VDC | 5VDC | 34.7 | 720 | | | $4.80 |
| | 6VDC | 6 | 50 | 720 | | | 4.80 |
| | 12VDC | 12 | 200 | 720 | 4C | 5 | 4.80 |
| | 24VDC | 24 | 800 | 720 | | | 4.80 |
| | 48VDC | 48 | 3,200 | 720 | | | 5.50 |
| | 60VDC | 60 | 5,000 | 720 | | | 6.45 |
| NC2–JPL2– | 5VDC | 5VDC | 31.3 | 800 | | | $5.20 |
| | 6VDC | 6 | 45 | 800 | | | 5.20 |
| | 12VDC | 12 | 180 | 800 | 2C | 5 | 5.20 |
| | 24VDC | 24 | 720 | 800 | | | 5.20 |
| | 48VDC | 48 | 2,880 | 800 | | | 5.85 |
| | 60VDC | 60 | 4,500 | 800 | | | 6.80 |
| NC4–JPL2– | 5VDC | 5VDC | 15.6 | 1,600 | | | $6.35 |
| | 6VDC | 6 | 22.5 | 1,600 | | | 6.35 |
| | 12VDC | 12 | 90 | 1,600 | 4C | 5 | 6.35 |
| | 24VDC | 24 | 360 | 1,600 | | | 6.35 |
| | 48VDC | 48 | 1,440 | 1,600 | | | 7.15 |
| | 60VDC | 60 | 2,250 | 1,600 | | | 8.00 |
| NC2–P– | 5VDC | 5VDC | 69.4 | 360 | | | $4.10 |
| | 6VDC | 6 | 100 | 360 | | | 4.10 |
| | 12VDC | 12 | 400 | 360 | 2C | 5 | 4.10 |
| | 24VDC | 24 | 1,600 | 360 | | | 4.10 |
| | 48VDC | 48 | 6,400 | 360 | | | 5.70 |
| | 60VDC | 60 | 10,000 | 360 | | | 5.60 |
| NC4–P– | 5VDC | 5VDC | 34.7 | 720 | | | $4.80 |
| | 6VDC | 6 | 50 | 720 | | | 4.80 |
| | 12VDC | 12 | 200 | 720 | 4C | 5 | 4.80 |
| | 24VDC | 24 | 800 | 720 | | | 4.80 |
| | 48VDC | 48 | 3,200 | 720 | | | 5.50 |
| | 60VDC | 60 | 5,000 | 720 | | | 6.45 |
| NC2–PL2– | 5VDC | 5VDC | 31.3 | 800 | | | $5.20 |
| | 6VDC | 6 | 45 | 800 | | | 5.20 |
| | 12VDC | 12 | 180 | 800 | 2C | 5 | 5.20 |
| | 24VDC | 24 | 720 | 800 | | | 5.20 |
| | 48VDC | 48 | 2,880 | 800 | | | 5.85 |
| | 60VDC | 60 | 4,500 | 800 | | | 6.80 |
| NC4–PL2– | 5VDC | 5VDC | 15.6 | 1,600 | | | $6.35 |
| | 6VDC | 6 | 22.5 | 1,600 | | | 6.35 |
| | 12VDC | 12 | 90 | 1,600 | 4C | 5 | 6.35 |
| | 24VDC | 24 | 360 | 1,600 | | | 6.35 |
| | 48VDC | 48 | 1,440 | 1,600 | | | 7.15 |
| | 60VDC | 60 | 2,250 | 1,600 | | | 8.00 |
| NC2– | 5VDC | 5VDC | 69.4 | 360 | | | $4.10 |
| | 6VDC | 6 | 100 | 360 | | | 4.10 |
| | 12VDC | 12 | 400 | 360 | 2C | 5 | 4.10 |
| | 24VDC | 24 | 1,600 | 360 | | | 4.10 |
| | 48VDC | 48 | 6,400 | 360 | | | 4.70 |
| | 60VDC | 60 | 10,000 | 360 | | | 5.60 |
| NC2–L2– | 5VDC | 5VDC | 31.3 | 800 | | | $5.20 |
| | 6VDC | 6 | 45 | 800 | | | 5.20 |
| | 12VDC | 12 | 180 | 800 | 2C | 5 | 5.20 |
| | 24VDC | 24 | 720 | 800 | | | 5.20 |
| | 48VDC | 48 | 2,880 | 800 | | | 5.85 |
| | 60VDC | 60 | 4,500 | 800 | | | 6.80 |

**Note:** Standard packing → Carton: 20 pcs./Case: 200 pcs.

Remember us?
...we used to be known as Arrow-M.

**Aromat Corporation**
250 Sheffield St.
Mountainside, N.J. 07092
(201) 232-4260
Telex: 138-213

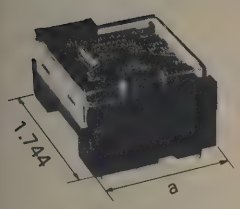
*Mid-Western Office*
311 Lively Blvd.
Suite 1
Elk Grove Village, IL 60007
(312) 593-8535
Telex: 28-3421

*Western Office:*
22010 So. Wilmington Ave.
Suites 300 & 301
Carson, Calif. 90745
(213) 775-3512
Telex: 69-1712

Aromat
Member of Matsushita Group

## Types and Data

| Type | | Coils: Voltage | Coils: Res. (Ω) | Coils: Nom. Power (mW) | Contacts: Arrangement | Contacts: Rating (A) | Sugg. List Price |
|---|---|---|---|---|---|---|---|
| NC4– | 5VDC | 5VDC | 34.7 | 720 | | | $4.80 |
| | 6VDC | 6 | 50 | 720 | | | 4.80 |
| | 12VDC | 12 | 200 | 720 | 4C | 5 | 4.80 |
| | 24VDC | 24 | 800 | 720 | | | 4.80 |
| | 48VDC | 48 | 3,200 | 720 | | | 5.50 |
| | 60VDC | 60 | 5,000 | 720 | | | 6.45 |
| NC4–L2– | 5VDC | 5VDC | 15.6 | 1,600 | | | $6.35 |
| | 6VDC | 6 | 22.5 | 1,600 | | | 6.35 |
| | 12VDC | 12 | 90 | 1,600 | 4C | 5 | 6.35 |
| | 24VDC | 24 | 360 | 1,600 | | | 6.35 |
| | 48VDC | 48 | 1,440 | 1,600 | | | 7.15 |
| | 60VDC | 60 | 2,250 | 1,600 | | | 8.00 |




| | a |
|---|---|
| NC2- | 1.000 |
| NC4- | 1.575 |

**For Flatpack**

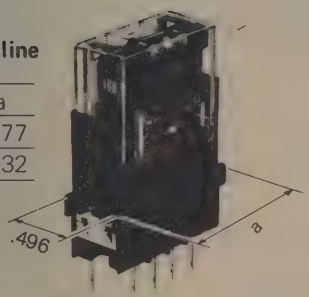
**Note:** 1. These new relays will be available in April, 1977.
2. Standard packing → Carton: 20 pcs./Case: 200 pcs.

## Accessories

| Type | Terminals | Mating Relay | Sugg. List Price |
|---|---|---|---|
| NC2-JPS | P/C board | NC2-JP | $0.75 |
| NC4-JPS | P/C board | NC4-JP | 1.00 |
| NC2-JPL2S | P/C board | NC2-JPL2 | 0.85 |
| NC4-JPL2S | P/C board | NC4-JPL2 | 1.05 |
| NC2-PS | P/C board | NC2-P | $0.75 |
| NC4-PS | P/C board | NC4-P | 1.00 |
| NC2-SS | Solder | NC2 | 0.75 |
| NC4-SS | Solder | NC4 | 1.00 |
| NC2-L2PS | P/C board | NC2-PL2 | 0.85 |
| NC4-L2PS | P/C board | NC4-PL2 | 1.05 |
| NC2-L2SS | Solder | NC2-L2 | 0.85 |
| NC4-L2SS | Solder | NC4-L2 | 1.05 |

**For Lean line**

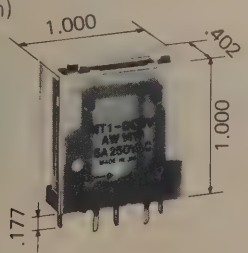
| | a |
|---|---|
| NC2- | 1.177 |
| NC4- | 1.732 |




# NEW NT Relays

## Vertical flat power relays

- High contact capacity up to 5A 250VAC
- Sensitive relay – 140mW (DC) low operating power
- Compact size-small mounting space for high density packaging
- Long life-Mechanical: more than $10^7$ operations
  Electrical (5A 250VAC resistive): more than $2 \times 10^5$ operations
- International terminal pitch – .100 inch (2.54 mm)




## Types and Data

| Type | | Coils: Voltage | Coils: Res. (Ω) | Coils: Nom. Power (mW) | Contacts: Arrangement | Contacts: Rating (A) | Sugg. List Price |
|---|---|---|---|---|---|---|---|
| NT1– | 6VDC | 6VDC | 130 | 280 | | | $3.05 |
| | 12VDC | 12 | 500 | 290 | 1C | 5A | 3.05 |
| | 24VDC | 24 | 2,000 | 290 | | | 3.05 |
| | 48VDC | 48 | 8,000 | 290 | | | 3.45 |
| NT1– | 6VAC | 6VAC | | | | | $3.15 |
| | 12VAC | 12 | | | | | 3.15 |
| | 24VAC | 24 | | 0.75VA | 1C | 5A | 3.15 |
| | 48VAC | 48 | | | | | 3.15 |
| | 115VAC | 115 | | | | | 3.45 |

**Note:** Standard packing → Carton: 50 pcs./Case: 500 pcs.

**Aromat Corporation**
250 Sheffield St.
Mountainside, N.J. 07092
(201) 232-4260
Telex: 138-213

*Mid-Western Office*
311 Lively Blvd.
Suite 1
Elk Grove Village, IL 60007
(312) 593-8535
Telex: 28-3421

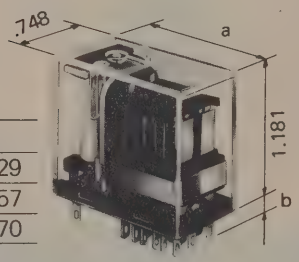
*Western Office:*
22010 So. Wilmington Ave.
Suites 300 & 301
Carson, Calif. 90745
(213) 775-3512
Telex: 69-1712

Aromat
Member of Matsushita Group

# K Relays

## Uniquely designed highly sensitive relays

- Interchangeable with existing cradle relays
- 100 times more reliable through simplified design and bifurcated contacts
- Extra long life (mechanical) — more than $10^8$ operations (electrical 1A 30W) — more than $10^7$ operations
- Patented highly sensitive magnetic system
- Sealed Amber types available
- UL, CSA, VDE recognized.




| | a |
|---|---|
| K2 | .929 |
| K4 | 1.157 |
| K6 | 1.370 |

| | b |
|---|---|
| Plug-in | .236 |
| P/C board | .157 |

| | a |
|---|---|
| K2 | .953 |
| K4 | 1.181 |
| K6 | 1.394 |

Remember us? ... we used to be known as Arrow-M.

### Types and Data

| Type | | Coils: Voltage | Coils: Res. (Ω) | Coils: Nom. Power (mW) | Contacts: Arrangement | Contacts: Rating (A) | Sugg. List Price: K | Sugg. List Price: KY |
|---|---|---|---|---|---|---|---|---|
| K2– | 3V-1 | 3VDC | 28 | 320 | | | $3.45 | $3.75 |
| (K2T*) | 6V-1 | 6 | 110 | 330 | | | 3.45 | 3.75 |
| (K2Y") | 12V-1 | 12 | 530 | 270 | | (K2, K2T) | 3.45 | 3.75 |
| (K2YT*) | 24V-1 | 24 | 1,700 | 340 | 2C | 2 | 3 45 | 3.75 |
| | 48V-1 | 48 | 7,600 | 300 | | (K2Y, K2YT) | 4.60 | 4.50 |
| | 110V-1 | 110 | 16,000 | 760 | | 3 | 6.20 | 6.10 |
| K2– | 3V-9 | 3VDC | 10 | 900 | | | $3.85 | $3.75 |
| (K2T*) | 6V-9 | 6 | 52 | 690 | | | 3.85 | 3.75 |
| (K2Y") | 12V-9 | 12 | 185 | 780 | | (K2, K2T) | 3.85 | 3.75 |
| (K2YT*) | 24V-9 | 24 | 700 | 820 | 2C | 2 | 3.85 | 3.75 |
| | 48V-9 | 48 | 2,500 | 920 | | (K2Y, K2YT) | 4.60 | 4.50 |
| | 115V-9 | 115 | 15,000 | 880 | | 3 | 6.20 | 6.10 |
| K4– | 3V-1 | 3VDC | 18 | 500 | | | $4.60 | $4.40 |
| (K4T*) | 6V-1 | 6 | 58 | 620 | | | 4.60 | 4.40 |
| (K4Y") | 12V-1 | 12 | 250 | 580 | | (K4, K4T) | 4.60 | 4.40 |
| (K4YT*) | 24V-1 | 24 | 890 | 650 | 4C | 2 | 4.60 | 4.40 |
| | 48V-1 | 48 | 3,200 | 720 | | (K4Y, K4YT) | 5.15 | 4.90 |
| | 110V-1 | 110 | 16,000 | 760 | | 3 | 6.95 | 6.75 |
| K4– | 3V-9 | 3VDC | 10 | 900 | | | $4.60 | $4.40 |
| (K4T*) | 6V-9 | 6 | 52 | 690 | | | 4.60 | 4.40 |
| (K4Y") | 12V-9 | 12 | 185 | 780 | | (K4, K4T) | 4.60 | 4.40 |
| (K4YT*) | 24V-9 | 24 | 700 | 820 | 4C | 2 | 4.60 | 4.40 |
| | 48V-9 | 48 | 2,500 | 920 | | (K4Y, K4YT) | 5.15 | 4.90 |
| | 115V-9 | 115 | 15,000 | 880 | | 3 | 6.95 | 6.75 |
| K6– | 6V-9 | 6VDC | 25 | 1,440 | | | $6.75 | $6.00 |
| (K6T*) | 12V-9 | 12 | 90 | 1,600 | | (K6, K6T) | 6.75 | 6.00 |
| (K6Y") | 24V-9 | 24 | 430 | 1,340 | 6C | 2 | 6.75 | 6.00 |
| (K6YT*) | 48V-9 | 48 | 1,500 | 1,540 | | (K6, K6YT) | 6.85 | 6.10 |
| | 115V-9 | 115 | 9,000 | 1,340 | | 3 | 7.90 | 7.20 |
| K2F– | 6V-9 | 6VDC | 52 | 690 | | | $4.40 | |
| (K2FT*) | 12V-9 | 12 | 185 | 780 | | | 4.40 | |
| | 24V-9 | 24 | 700 | 820 | 2C | 5 | 4.40 | |
| | 48V-9 | 48 | 2,500 | 920 | | | 4.50 | |
| | 115V-9 | 115 | 15,000 | 880 | | | 6.85 | |
| K2A– | 6V | 6VAC | 17 | 0.6VA | | | $5.45 | $5.45 |
| (K2AT*) | 12V | 12 | 69 | 0.7 | | (K2A, K2AT) | 5.45 | 5.45 |
| (K2Y") | 24V | 24 | 260 | 0.6 | 2C | 2 | 5.45 | 5.45 |
| (K2YAT*) | 48V | 48 | 1,100 | 0.7 | | (K2YA, K2YAT) | 5.65 | 5.65 |
| | 110V | 110 | 6,100 | 0.7 | | 3 | 6.55 | 6.55 |
| | 220V | 220 | 22,600 | 1.1 | | | 7.80 | 7.80 |

**Note:** 1. T*: Denotes PC terminal relay.
2. Y": Denotes 3 Amp. contact realy.
3. MBB contact (Form D) types are available.
4. Standard packing:

| | K2, K4 | K6 |
|---|---|---|
| Carton | 50 pcs. | 20 pcs. |
| Case | 200 pcs. | 200 pcs. |

### Sockets

| Plug-in | PC terminal | Sugg. List Price |
|---|---|---|
| K2-SS | K2-PS | $0.65 |
| K4-SS | K4-PS | 0.85 |
| K6-SS | K6-PS | 1.05 |

**Aromat Corporation**
250 Sheffield St.
Mountainside, N.J. 07092
(201) 232-4260
Telex: 138-213

*Mid-Western Office*
311 Lively Blvd.
Suite 1
Elk Grove Village, IL 60007
(312) 593-8535
Telex: 28-3421

*Western Office:*
22010 So. Wilmington Ave.
Suites 300 & 301
Carson, Calif. 90745
(213) 775-3512
Telex: 69-1712

Aromat
Member of Matsushita Group

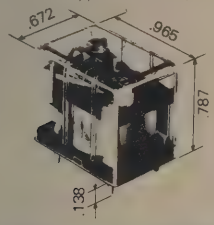


Add Dept. EM to address to tell them you saw it in eem

# HT Relays

## Economical, high reliability subminiature relay

- For low level load applications – Stabilized and low contact resistance
- Small size for use in limited space
- UL, CSA, VDE recognized
- Extra sensitive types available.




### Types and Data

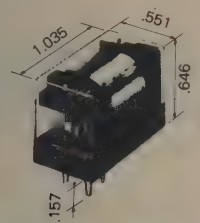
| Type | | Coils | | | Contacts | | Sugg. List Price |
|---|---|---|---|---|---|---|---|
| | | Voltage | Res. (Ω) | Nom. Power (mW) | Arrange-ment | Rating (A) | |
| HT–C– | 3VDC | 3VDC | 11 | 800 | 1C | 2 | $1.95 |
| | 6VDC | 6 | 45 | | | | 1.95 |
| | 12VDC | 12 | 180 | | | | 1.95 |
| | 24VDC | 24 | 720 | | | | 1.95 |
| | 48VDC | 48 | 3,200 | | | | 2.40 |
| HT–C– | 6VDC-1 | 6VDC | 100 | 360 | 1C | 2 | $2.15 |
| | 12VDC-1 | 12 | 400 | | | | 2.15 |
| | 24VDC-1 | 24 | 1,600 | | | | 2.15 |

**Note:** 1. AgCdO contact types are available
2. Standard packing → Carton: 100 pcs./Case: 500 pcs. or 2,000 pcs.

# NEW HA Relays

## Cost saving flux tight subminiature PC board relays

- Compact construction
- Sensitive – very low operating power
- Soldering flux inflow prevented by mold construction
- Contact capacity – 3A 250VAC, 30VDC




### Types and Data

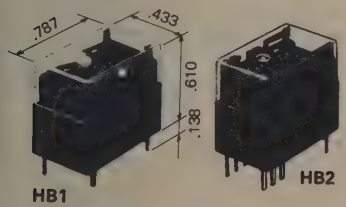
| Type | | Coils | | | Contacts | | Sugg. List Price |
|---|---|---|---|---|---|---|---|
| | | Voltage | Res. (Ω) | Nom. Power (mW) | Arrange-ment | Rating (A) | |
| HA1–DC | 3VDC | 3VDC | 25 | 360 | 1C | 3 | $2.00 |
| | 5VDC | 5 | 69 | 360 | | | 2.00 |
| | 6VDC | 6 | 100 | 360 | | | 2.00 |
| | 9VDC | 9 | 225 | 360 | | | 2.00 |
| | 12VDC | 12 | 400 | 360 | | | 2.00 |
| | 24VDC | 24 | 1,600 | 360 | | | 2.00 |
| | 48VDC | 48 | 6,400 | 360 | | | 2.00 |
| HA1–AV | 6VAC | 6VAC | – | 0.9VA | 1C | 3 | $2.00 |
| | 12VAC | 12 | – | 0.9VA | | | 2.00 |
| | 24VAC | 24 | – | 0.9VA | | | 2.00 |
| | 48VAC | 48 | – | 0.9VA | | | 2.00 |
| | 115VAC | 115 | – | 0.9VA | | | 2.25 |

**Note:** Standard packing → Carton: 100 pcs./Case: 500 pcs.

# NEW HB Relays

## Cost saving flux tight subminiature DIP relays

- Small size for increased packaging density
- Sensitive – very low operating power
- Soldering flux inflow prevented by molded construction
- Simple mechanism for stable quality – just 7 piece parts
- DIP – matching 16 pin IC socket
- Contact capacity – 1A 125VAC, 2A 30VDC




### Types and Data

| Type | | Coils | | | Contacts | | Sugg. List Price |
|---|---|---|---|---|---|---|---|
| | | Voltage | Res. (Ω) | Nom. Power (mW) | Arrange-ment | Rating (A) | |
| HB1– | 3V | 3VDC | 25 | 360 | 1C | 2A | $1.65 |
| | 5V | 5 | 69 | 360 | | | 1.65 |
| | 6V | 6 | 100 | 360 | | | 1.65 |
| | 12V | 12 | 400 | 360 | | | 1.65 |
| | 24V | 24 | 1,600 | 360 | | | 1.65 |
| | 48V | 48 | 6,000 | 384 | | | 1.90 |
| HB2– | 3V | 3VDC | 15.6 | 576 | 2C | 2A | $2.60 |
| | 5V | 5 | 43.4 | 576 | | | 2.60 |
| | 6V | 6 | 62.5 | 576 | | | 2.60 |
| | 12V | 12 | 250 | 576 | | | 2.60 |
| | 24V | 24 | 1,000 | 576 | | | 2.60 |
| | 48V | 48 | 4,000 | 576 | | | 2.85 |

**Note:** Standard packing → Carton: 100 pcs./Case: 500 pcs.

**Aromat Corporation**
250 Sheffield St.
Mountainside, N.J. 07092
(201) 232-4260
Telex: 138-213

*Mid-Western Office*
311 Lively Blvd.
Suite 1
Elk Grove Village, IL 60007
(312) 593-8535
Telex: 28-3421

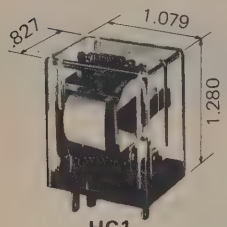
*Western Office:*
22010 So. Wilmington Ave.
Suites 300 & 301
Carson, Calif. 90745
(213) 775-3512
Telex: 69-1712

Aromat
Member of Matsushita Group

# HC Relays

## Highly qualified miniature relays for wider applications

- Interchangeable with comparable relays.
- Extra long life – more than $10^8$ mechanical operations.
- 4 types of contact arrangement – 4C (5A 250VAC), 3C (7A 250VAC), 2C (7A 250VAC), 1C (10A 250VAC)
- UL, CSA, VDE recognized.

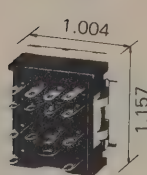


HC1

HC2

HC3

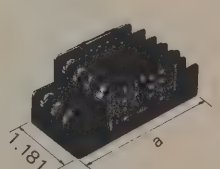
HC4



HC4-SS

HC4-WS

HC4-PS



HC-HSF

| | a |
|---|---|
| HC-HSF | 2.323 |
| HC2-SF | 1.575 |
| HC3-HSF | 2.638 |

*Remember us? ... we used to be known as Arrow-M.*

### Types and Data

| Type | Coils | | | Contacts | | Sugg. List Price |
|---|---|---|---|---|---|---|
| | Voltage | Res. (Ω) | Nom. Power (mW) | Arrange-ment | Rating (A) | |
| HC1– 6VDC | 6VDC | 40 | | | | $4.60 |
| (HC1-P*) 12VDC | 12 | 160 | approx. | | | 4.60 |
| 24VDC | 24 | 650 | 900 | 1C | 10 | 4.60 |
| 48VDC | 48 | 2,600 | | | | 4.60 |
| 110VDC | 110 | 11,000 | | | | 5.40 |
| HC1– 6VAC | 6VAC | | | | | $4.60 |
| (HC1-P*) 12VAC | 12 | | | | | 4.60 |
| 24VAC | 24 | | approx. | | | 4.60 |
| 48VAC | 48 | | 1,200 | 1C | 10 | 4.60 |
| 115VAC | 115 | | | | | 5.40 |
| 240VAC | 240 | | | | | 6.40 |
| HC2– 6VDC | 6VDC | 40 | | | | $5.40 |
| (HC2-P*) 12VDC | 12 | 160 | approx. | | | 5.40 |
| 24VDC | 24 | 650 | 900 | 2C | 7 | 5.40 |
| 48VDC | 48 | 2,600 | | | | 5.40 |
| 110VDC | 110 | 11,000 | | | | 6.25 |
| HC2– 6VAC | 6VAC | | | | | $5.40 |
| (HC2-P*) 12VAC | 12 | | | | | 5.40 |
| 24VAC | 24 | | approx. | | | 5.40 |
| 48VAC | 48 | | 1,200 | 2C | 7 | 5.40 |
| 115VAC | 115 | | | | | 6.25 |
| 240VAC | 240 | | | | | 7.20 |
| HC3– 6VDC | 6VDC | 40 | | | | $5.85 |
| (HC3-P*) 12VDC | 12 | 160 | approx. | | | 5.85 |
| 24VDC | 24 | 650 | 900 | 3C | 7 | 5.85 |
| 48VDC | 48 | 2,600 | | | | 5.85 |
| 110VDC | 110 | 11,000 | | | | 6.65 |
| HC3– 6VAC | 6VAC | | | | | $5.85 |
| (HC3-P*) 12VAC | 12 | | | | | 5.85 |
| 24VAC | 24 | | approx. | | | 5.85 |
| 48VAC | 48 | | 1,200 | 3C | 7 | 5.85 |
| 115VAC | 115 | | | | | 6.65 |
| 240VAC | 240 | | | | | 7.65 |
| HC4– 6VDC | 6VDC | 40 | | | | $6.25 |
| (HC4-P*) 12VDC | 12 | 160 | approx. | | | 6.25 |
| 24VDC | 24 | 650 | 900 | 4C | 5 | 6.25 |
| 48VDC | 48 | 2,600 | | | | 6.25 |
| 110VDC | 110 | 11,000 | | | | 7.40 |
| HC4– 6VAC | 6VAC | | | | | $6.25 |
| (HC4-P*) 12VAC | 12 | | | | | 6.25 |
| 24VAC | 24 | | approx. | | | 6.25 |
| 48VAC | 48 | | 1,200 | 4C | 5 | 6.25 |
| 115VAC | 115 | | | | | 7.40 |
| 240VAC | 240 | | | | | 8.15 |

**Note:** 1. P*: Denotes PC terminal relay.
2. Top mounting (TM) types and lamp-wired types are available.
3. Standard packing → Carton: 20 pcs./Case: 200 pcs. or 800 pcs.

### HC Sockets

| Socket for Soldering | List Price | Socket for P/C board | List Price | Socket for Wrapping | List Price | Screw Termi-nal Socket | List Price |
|---|---|---|---|---|---|---|---|
| HC1-SS | $0.85 | HC1-SS | $0.85 | HC1-WS | $1.95 | HC-HSF | $4.00 |
| HC2-SS | 0.90 | HC2-SS | 0.90 | HC2-WS | 2.10 | HC2-SF | 2.50 |
| HC3-SS | 0.95 | HC3-SS | 0.95 | HC3-WS | 2.20 | HC3-HSF | 3.35 |
| HC4-SS | 1.05 | HC4-SS | 1.05 | HC4-WS | 2.35 | HC Bracket | 0.15 |
| | | | | | | HC Mounting Strip | 2.90 |

**Aromat Corporation**
250 Sheffield St.
Mountainside, N.J. 07092
(201) 232-4260
Telex: 138-213

*Mid-Western Office*
311 Lively Blvd.
Suite 1
Elk Grove Village, IL 60007
(312) 593-8535
Telex: 28-3421

*Western Office:*
22010 So. Wilmington Ave.
Suites 300 & 301
Carson, Calif. 90745
(213) 775-3512
Telex: 69-1712

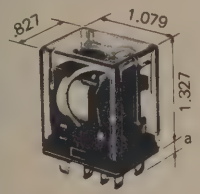
Aromat
Member of Matsushita Group

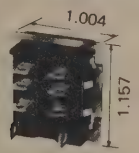
# HL Relays

## 10 AMP space saving power relays

- High switching capacity in a compact size —
  SPDT (15A 125VAC),
  DPDT (10A 250VAC)
- High quality assured through advanced manufacturing techniques —
  Integral molding, Heat riveting and Spot welding
- Long life — Mechanical : more than $10^8$ operations (DC), more than $5x10^7$ operations (AC)
  Electrical: more than $5x10^5$ operations
- UL recognized.

| | a |
|---|---|
| Plug-in | .250 |
| P/C board | .138 |




### Types and Data

| Type | | Coils: Voltage | Coils: Res. (Ω) | Coils: Nom. Power (mW) | Contacts: Arrangement | Contacts: Rating (A) | Sugg. List Price |
|---|---|---|---|---|---|---|---|
| HL1— | 6VDC | 6VDC | 40 | | | | $3.75 |
| (HL1-P*) | 12VDC | 12 | 160 | approx. | | | 3.75 |
| | 24VDC | 24 | 650 | 900 | 1C | 15 | 3.75 |
| | 48VDC | 48 | 2,600 | | | | 3.75 |
| | 110VDC | 110 | 11,000 | | | | 4.15 |
| HL1— | 6VAC | 6VAC | | | | | $3.75 |
| (HL1-P*) | 12VAC | 12 | | | | | 3.75 |
| | 24VAC | 24 | | approx. | | | 3.75 |
| | 48VAC | 48 | | 1,200VA | 1C | 15 | 3.75 |
| | 115VAC | 115 | | | | | 4.15 |
| | 240VAC | 240 | | | | | 4.85 |
| HL2— | 6VDC | 6VDC | 40 | | | | $4.30 |
| (HL2-P*) | 12VDC | 12 | 160 | approx. | | | 4.30 |
| | 24VDC | 24 | 650 | 900 | 2C | 10 | 4.30 |
| | 48VDC | 48 | 2,600 | | | | 4.30 |
| | 110VDC | 110 | 11,000 | | | | 4.70 |
| HL2— | 6VAC | 6VAC | | | | | $4.30 |
| (HL2-P*) | 12VAC | 12 | | | | | 4.30 |
| | 24VAC | 24 | | approx. | | | 4.30 |
| | 48VAC | 48 | | 1,200VA | 2C | 10 | 4.30 |
| | 115VAC | 115 | | | | | 4.70 |
| | 240VAC | 240 | | | | | 5.40 |

**Note:** 1. P*: Denotes PC terminal relay.
2. Top mounting (TM) types are available.
3. Standard packing → Carton: 20 pcs./Case: 200 pcs.

### HL Socket

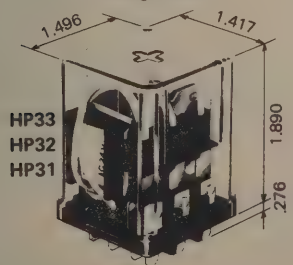
| Plug-in | PC terminal | Sugg. List Price |
|---|---|---|
| HL1-SS | HL1-PS | $0.65 |
| HL2-SS | HL2-PS | 0.70 |

**Note:** HL1-PS and HL2-PS will be available in July, 1977

# HP Relays

## Highly reliable construction 10 AMP power relays

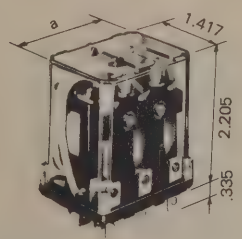
- Interchangeable with existing models
- Longer life insured by screwless assembly —
  Simplified and non-loosening molding blocks of contact spring holder and terminal base.
- High quality insured by mass production with excellent manufacturing technique
  Integral molding, Heat-riveting and Spot welding
- Versatile application of terminal for plug-in, soldering and Q.C. terminals.
- UL, CSA recognized.




# HG Relays

## Compact, large capacity relays for AC, DC application

- Up to 20A 250VAC resistive load, 1.5 KW 3 phase 220VAC motor load
- Available with plug-in, solder or QC terminals (Faston 250)
- UL, CSA recognized.

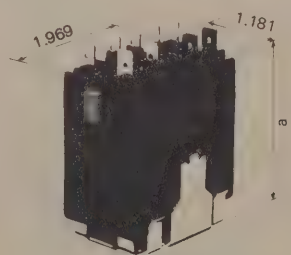



| | a |
|---|---|
| HG2 | 1.389 |
| HG3 | 1.966 |
| HG4 | 2.607 |

# VC Relays

## Compact, easy maintenance heavy duty power relay

- Control air conditioners, office machines, heaters and appliances
- Large capacity: 1.5 KW 1 phase through 3.7 KW 3 phase 240V AC motor
- Multipositional Snap-mounting
- Lever action mechanism
- UL, CSA recognized.




| | a |
|---|---|
| VC15, VC10, VC20A | 2.241 |
| VC15S | 2.480 |

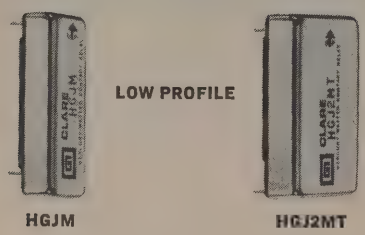
**Aromat Corporation**
250 Sheffield St.
Mountainside, N.J. 07092
(201) 232-4260
Telex: 138-213

*Mid-Western Office*
311 Lively Blvd.
Suite 1
Elk Grove Village, IL 60007
(312) 593-8535
Telex: 28-3421

*Western Office:*
22010 So. Wilmington Ave.
Suites 300 & 301
Carson, Calif. 90745
(213) 775-3512
Telex: 69-1712

Aromat
Member of Matsushita Group

# C. P. CLARE MERCURY-WETTED CONTACT RELAYS



## HGJM HIGH SPEED MODULAR RELAYS

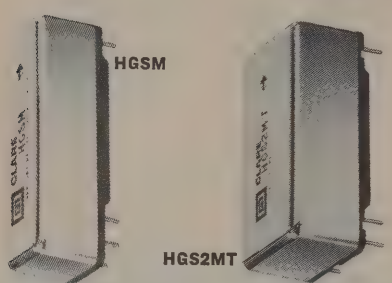
### HGJM

C. P. Clare HGJM relays have established new industry standards for quiet, fast and stable operation. HGJM Series SPDT relays have the 100VA load and multi-billion operation reliability characteristics of all our mercury relays and are recommended for all new applications. Single-side-stable and bistable adjustment is possible. Coils are available for a wide range of drive voltages.

Noise levels are less than 10$\mu$V at 5ms after coil energization (10kHz bandwidth). The relays are stable at 200Hz, with on and off times down to 2.5ms. The 1 Form C contact will switch $\mu$V, nanoampere loads to 2A or 500V loads (100VA max, ac or dc) with proper contact protection. The relays are offered in a standard height of 0.400 inches for greater sensitivity and low profile version of 0.350". Both mount on staggered 0.100" PCB grid patterns. The low profile models permit 0.5" board centers.

### HGJ2MT

C. P. Clare HGJ2MT relays feature the same outstanding electrical characteristics as the HGJM relays in a DPDT (2 Form C) package. Standard height HGJ2MT relays can have common open time durations of 50$\mu$s min. at 100Hz for capacitor transfer technique applications. Electrostatic shielding is available on all models.



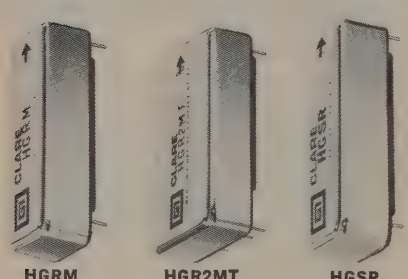

## HGSM MODULAR RELAYS

### HGSM

C. P. Clare HGSM relays are PCB mount models with 2A or 500V (100VA max. with proper contact protection) switching capabilities. The HGSM series SPDT relay is recommended for replacement applications only. New applications should specify the smaller, faster HGJM series with the same load switching capabilities, life expectancy and lower noise. The HGSM package is .640" high and mounts on staggered 0.100" grid patterns. Coils for many drive parameters and sensitivity ranges are available.

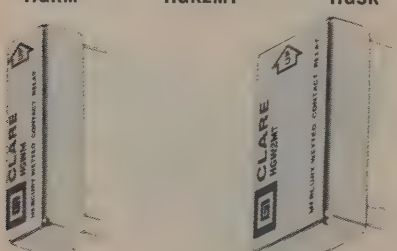
### HGS2MT

The HGS2MT relays have the same ratings and life expectancy as the HGSM series in a DPDT model. The relay is recommended for replacement purposes only.




## HGRM/HGR2MT, HGSR MODULAR RELAYS

These time proven standard mercury-wetted contact relays have 100VA, 500V or 2A maximum load characteristics and multi-billion operation reliability. The HGRM, HGR2MT and HGSR all have packages .400" high. The HGSR has staggered pins on .093" centers, and the HGRM on .100" centers.




## HGW SERIES COMPACT MODULAR RELAYS

### HGWM

The HGW series was designated for use where printed circuit board space is at a premium. Even though the package size has been reduced there has been no sacrifice in contact ratings. The HGW series has a 100VA rating and multibillion operation reliability.

### HGW2MT

The HGWM offers single-side-stable and bistable functions while the HGW2MT offers the single-side-stable function with a common open time of 50 $\mu$sec. All HGW relays mount on standard 0.100" grid patterns.

## HG SERIES PLUG-IN RELAYS

C. P. Clare HG, HG2A, HG3A and HG4A heavy duty mercury-wetted contact relays offer 1, 2, 3 or 4 Form D packages respectively in standard industrial plug-in styles. The entire series feature heavy duty 250VA, maximum, (with proper contact protection) 500V or 5A per pole maximum ratings for rugged loads. The HG series have plated steel covers which provide excellent mechanical protection and electrical shielding. The life expectancy of the HG series is 20 x $10^9$ operations.

C. P. CLARE & COMPANY
GENERAL INSTRUMENT CORPORATION
3101 W. Pratt Avenue • Chicago, Illinois 60645 • (312) 262-7700

# C. P. CLARE MERCURY-WETTED CONTACT RELAYS

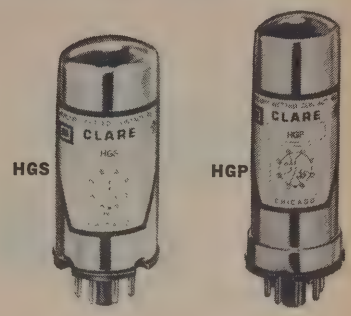
## HGS, HGP OCTAL PLUG RELAYS

### HGS

HGS mercury-wetted relays offer increased speed and reliability along with high sensitivity. The HGS 1000 Series provide SPDT make-before-break and HGS 5000 Series provide SPDT break-before-make. Both are rated at 2A, 500V and 100VA maximum with proper contact protection. The relays are available in single element assemblies for single-side-stable, bistable and chopper service. The life expectancy is 20 x $10^9$ at specified ratings.

### HGP

The HGP mercury-wetted contact relay is similar to the HG series except for the inclusion of bias magnets. The magnets provide increased sensitivity or polar operation. Contacts are SPDT make-before-break rated at 5A, 500V and 250VA maximum with proper contact protection. The life expectancy of the HGP relay is 20 x $10^9$ at the specified ratings.




## HGX SWITCH CAPSULE

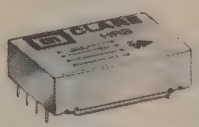
The HGX series mercury-wetted switch capsule finds use as a limit switch, float switch, stepping switch, pulse generation, and time base, or in other applications where it may be actuated by a permanent magnet.

# C. P. CLARE REED CAPSULE RELAYS

## MERCURY-WETTED REED RELAYS

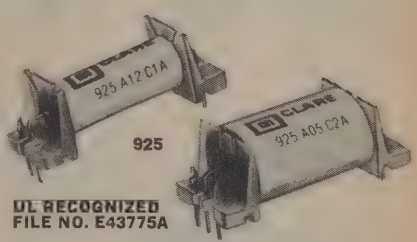
### HRB SERIES

Clare's HRB series Mercury-Wetted Microclareed Relays are superior in life and load to dry reed relays of the same size. The relay has a reliable no-bounce mercury-wetted switch capsule. Rating is 1 ampere or 350 volts, 50VA maximum. The HRB relays have molded epoxy bases with stamped metal covers and 1.00″ x .150″ grid mounting centers for printed circuit board mounting.




## 925 OPEN TYPE DRY REED RELAYS

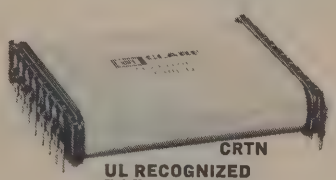
Clare's new 925 series dry reed relays utilize an economical open type construction and the reliable Microclareed® miniature dry reed switch which gives up to 10 million operations at rated load. The relay frame is formed in a single molded piece for greater strength and rigidity. The relays are available in 1 Form A, 2 Form A and 1 Form B contact arrangements with 5/6, 12, or 24Vdc coils.




UL RECOGNIZED
FILE NO. E43775A

## CRTN SERIES CLAREED® DRY REED RELAYS

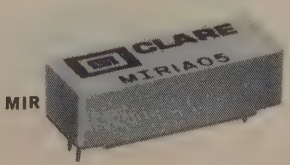
Clare's economical CRTN standard size reed relays offer signal level to 15VA power handling capabilities, total input/output isolation, and low millisecond switching speeds. CRTN relays are direct replacements for our CRT series relays. Like all Clare reed relays, they are immune to false operation and are insensitive to overload transients that affect solid state devices. Clareed relays are rated for millions of reliable, trouble free operations. Optional CRTN series contact configurations are 3 & 5 Form A, 1B or 2B, 1C or 2C, and 1A latching or 2A latching. Special relays are available with up to twelve contacts. UL recognized versions of our 1 to 12 Form A relays are available as listed in UL File E43775. The relays feature open assembly construction and PCB 2.5″ x .218″ grid mounting centers.



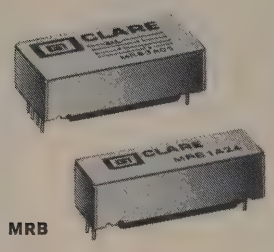

UL RECOGNIZED
FILE NO. E43775

## MIR SERIES DRY REED SUBMERSABLE RELAY

The MIR relay provides 10 watt switching capability in a low cost sealed package. Although the MIR is a sealed relay, it is not molded or potted, thus reducing the capsule stress associated with molded and potted packages. For more information, please contact our local Sales Office.



# C. P. CLARE REED CAPSULE RELAYS



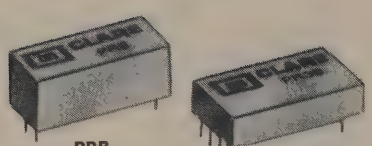

MRB

## MRB METAL COVERED MICROCLAREED® DRY REED RELAYS

Clare's MRB Microreed relays offer versatile signal level to 10VA switching capabilities, total input/output isolation, 800 microsecond typical switching speeds in the miniature sized relay family.

The MRB relays operate with coil power requirements as low as 10 milliwatts. The ultra-reliable operation will exceed 100 x $10^6$ operations at signal level loads or 100 x $10^6$ operations at the rated load.

Optional MRB relays are available in 3 or 5 Form A, 2 Form B, 3 or 4 Form C. 1A latching or 2A latching and 2A2B contact forms. UL recognized versions in all but Form C are available as listed in UL File E43775. The relays have molded epoxy bases with stamped metal covers and convenient 1.000″ x 0.100″ grid mounting centers for printed circuit board mounting. This low profile package will mount on 0.5″ PCB centers. Electrostatic shielding is available. 1.000″ x 0.150″ grid mounting models are available in 1 to 5 Form A versions.



PRB PRBH

## PRB, PRBH METAL COVERED PICOREED® DRY REED RELAYS

Clare's micro-miniature PRB and PRBH series Picoreed relays offer signal level to 10VA switching characteristics, power requirements ranging from 48 to 500 milliwatts (dependent on relay configuration) and operate times typically less than 500 microseconds in economical space saving packages. The low profile PRB series permits 0.375″ PCB mounting centers and the high sensitivity PRBH series will mount on 0.5″ PCB centers.

The 5 volt PRB/PRBH relays are fully compatible with the standard 5 volt DTL/TTL logic families and will solve many interface application problems. Both series have molded epoxy bases with stamped metal covers and mount on 0.70″ x 0.100″ grid patterns. The PRB low profile models are also available in 6 Form A, 1B and 1A1B contact configurations. Electrostatic shielding is available.

PRMA

## PRMA SERIES PICOREED DIP DRY REED RELAYS

The C. P. Clare dual-in-line package (DIP), the PRMA PICOREED relay represents a significant addition to the Clare reed relay line. The PRMA series features 5 different contact forms with an extra coil termination provided on pin 13. This provision gives greater versatility in printed circuit board layout.

The 5V one Form A is compatible with TTL logic. All contact forms of the PRMA series can be inserted into PCB using automatic insertion equipment.

# C. P. CLARE MATRIX PRODUCTS

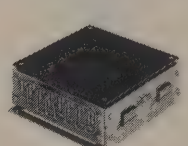


FIG. 1

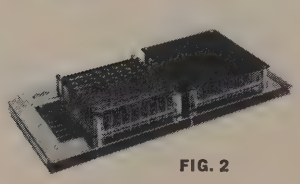


FIG. 2

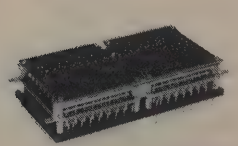


FIG. 3

C. P. Clare's type 969 Memory Matrix products offer X-Y coordinate switching in compact packages. The Memory Matrix consists of 64 crosspoint relays arranged in an eight column by eight row array. The features of cordwood style construction combined with automatic coil winding techniques provide the ultimate in low cost, high density hard contact switching.

Each crosspoint consists of either two or four Clare magnetic self-latching reed capsules whose contacts are sealed in an inert atmosphere. Once closed, these contacts require no external power to remain closed.

Crosspoint operation is performed easily: To set a crosspoint (close it's contacts), simultaneously pulse the desired X and Y coil circuits for one millisecond. Resetting this crosspoint (opening it's contacts) is achieved by pulsing either the X coil circuit alone or the Y coil circuit alone, again for only one millisecond.

1. **Cable Plug-In (figure 1)**
   Designed to be used with the popular flat cable interconnection technique. Available are 2 or 4 poles per crosspoint, in an 8x8 array.
2. **PCB Plug-In (figure 2)**
   Ready to plug into your prewired backplane, on 2.0 inch card mounting centers. Available in 2 poles per crosspoint, in either 8x8 or 8x16 arrays.
3. **Modular Matrix (figure 3)**
   Designed to be flow-soldered to your board assembly. Pins are on 0.100 inch grid centers. Available in 2 poles per crosspoint, in either 8x8 or 8x16 arrays.

C. P. CLARE & COMPANY
GENERAL INSTRUMENT CORPORATION
3101 W. Pratt Avenue • Chicago, Illinois 60645 • (312) 262-7700

# C. P. CLARE SOLID STATE RELAYS

## 203 SERIES MINIATURE ZERO CROSSING AC RELAYS

Clare's 203 series solid-state relays provide reliable AC power switching in a compact DIP package with pin mounting for standard PC boards. These models are all solid-state and feature opto-isolation and zero cross synchronous switching. In one of the smallest zero crossing packages available, they are capable of switching up to 1½ amps (2 amps with 100 LFM of moving air), 240Vac at a 0.35 power factor. Designed to be directly compatable with DTL/TTL logic, these units also feature 2,000Vrms isolation, 12½ amps peak one cycle surge rating, high dv/dt resistance and models that can withstand up to 600 volt transients.

UL RECOGNIZED
FILE NO. E61258

## 212 SERIES HEAVY DUTY AC RELAYS

Clare's 212 series AC solid-state relays have heavy duty switching capabilities with 10 or 25 amp rating at 140 or 250Vac. These units are pure solid-state with opto-isolation and zero crossing synchronous switching. The opto-isolation provides total input/output isolation and the sensitive input is fully compatible with DTL/TTL logic (control voltage of 3 to 28Vdc). The 212 series relays are recommended for heavy duty AC applications and are ideally suited for switching motor, process control and inductive loads. Every relay features both quick connect and screw type terminals. The 212 type relays are UL recognized under file E61258, as Electronic Motor Controllers.

UL RECOGNIZED
FILE NO. E61258

## 222 SERIES MODULAR AC RELAYS

Clare's modular 222 series AC solid-state relays have heavy duty switching capabilities with 5 or 10 amp ratings at 140 or 250Vac. These models are pure solid-state and feature opto-isolation with zero crossing synchronous switching. The opto-isolator provides total input/output isolation and the input is fully compatible with DTL/TTL logic (control voltage of 3 to 28Vdc. The 222 series one cycle surge is one thousand percent of rated current, and is ideally suited for heavy duty AC applications. Available is a choice of .032 pins, quick connect and screw terminals. The series is UL recognized under file E61877.

UL RECOGNIZED
FILE NO. E61877

222

## 223 SERIES MODULAR DC RELAY

Clare's 223 series modular DC solid-state relays have fast 100 microsecond switching capabilities with 2 or 5 amp ratings at 50Vdc. The opto-isolator provides total input/output isolation and the input is fully compatible with DTL/TTL logic (control voltage of 3 to 28Vdc). A choice of .032 pins, quick connect or screw terminals is available. The 223 series relays are ideally suited for motor and servo controllers in process control and machine tool applications.

223

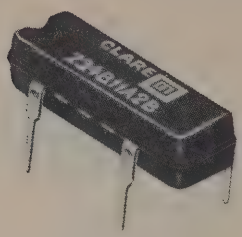
## 233 SERIES DC/DIP RELAYS

Clare's miniature 233 solid-state DIP relays give you a choice of DC switching: 400 milliamps at 60Vdc or 100 milliamps at 250Vdc. These relays are pure solid-state and feature fast, 1 microsecond response time, compatibility with 5 volt digital logic, total input/output isolation, and a standard 14 pin dual in line package. The 233 is recommended for line drivers, data couplers, lamp, solenoid, and motor drivers.

233

C. P. CLARE & COMPANY
GENERAL INSTRUMENT CORPORATION
3101 W. Pratt Avenue • Chicago, Illinois 60645 • (312) 262-7700

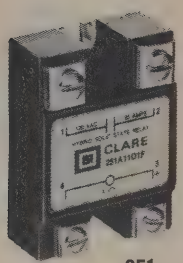
# C. P. CLARE SOLID STATE RELAYS



234

## 234 SERIES — AC/DC DIP RELAYS

Clare's miniature 234 series DIP relays are pure solid-state devices with a bipola output that switches both AC and DC loads. These devices feature fast microsecon response time, capability with 5 volt DTL/TTL digital logic, total input/output isola tion, low offset voltage, and is housed in a standard 14 pin dual in line package o molded epoxy. The 234 series is ideal for analog/transducer signal switching, lin and lamp drivers, data couplers, A/D converters, multiplexers, and scanners.

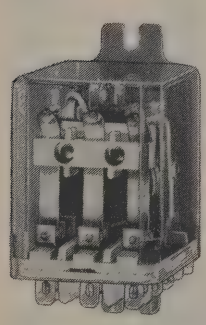


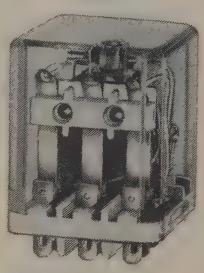
251

## 251 SERIES HYBRID INDUSTRY STANDARD AC RELAYS

Clare's 251 Hybrid solid-state relay utilizes a reed relay input and a solid-state (triac output. It is packaged in the industry standard outline case with additional improve ments; square terminal bosses stop wire clamp rotation, a slotted "U" mounting hol in the base simplifies panel mounting, high temperature thermoset plastic materia used for the case is not only flame retardant, but is also highly resistive to mos chemicals, a closed cell foam potting material reduces stress on internal component while sealing out humidity. The 251 series was designed to operate at 5Vdc DTL TTL inputs while having the capability of switching heavy duty AC loads (10 and 2 amps, 120 and 240Vac). A 200 amp peak one cycle surge rating (90 amp peak fo 10 amp models) and 4,000V peak isolation provide reliable motor, heater, coil, an lamp load switching. Heavy duty dv/dt filter components and a gas filled reed capsul insure a minimum life of 20 million operations (10 million for the 240Vac models).

# C. P. CLARE GENERAL PURPOSE RELAYS





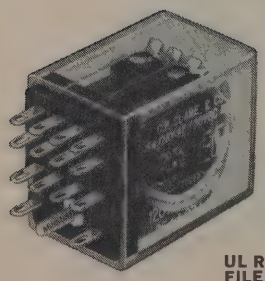
UL RECOGNIZED
FILE NO. E47012

## GP3 HEAVY DUTY RELAYS

The GP3 relays are UL recognized (UL File E47012) and CSA certified as Magnetic Motor Controllers. The rugged AC or DC relays are available in SPDT, DPDT and 3PDT configurations with Gold flashed Silver Cadmium Oxide contacts rated at 10 amperes at 30Vdc resistive or 120Vac, .8 power factor. The GP3 plain case models are available with matching molded nylon sockets for plug-in applications. The GP3 bracket case model is available for direct chassis mounting only. Mechanical life expectancy is 10 million operations, electrical life 100,000 operations minimum at rated load .187" quick connect terminals are standard.

The relays are 1.906" high, 1.531" wide and 1.406" deep.

(See Catalog GP3 for more information).



UL RECOGNIZED
FILE NO. E47012

## 352/354 MINIATURE 2- & 4-POLE RELAYS

The 352/354 relay handles motor, lamp and solenoid switching requirements in every thing from vending machines to disc drive applications. They also switch signal levels in intercoms, two-way radios and small telephone exchanges plus input multiplexing in control systems.

The options make it all possible. Contact ratings up to 10 amperes (2 pole) or 5 amperes (4 pole) AC or DC coils, plus solder lug/plug-in, taper tab quick-connect or PCB terminals. The relays have UL recognition, File E47012, as Magnetic Moto Controllers for use in industrial applications.

The 352/354 relays are .859" maximum wide and 1.109" maximum deep. The maximum height for mounting above a chassis is 1.290", above a PCB is 1.385" and above a chassis in a socket is 1.450".

(See Catalog 352/354 for more information).

C. P. CLARE & COMPANY
GENERAL INSTRUMENT CORPORATION
3101 W. Pratt Avenue • Chicago, Illinois 60645 • (312) 262-7700

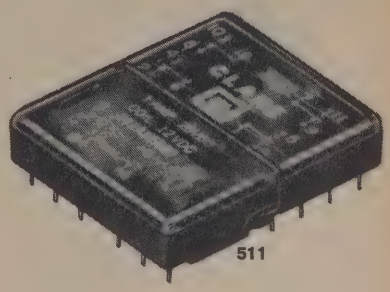
# C. P. CLARE TELEPHONE RELAYS

## 511 LOW PROFILE RELAYS

Clare's new 511A series Modern Telephone relays offer reliable low level to 1 ampere switching capabilities in 2 and 4 Form C or D models. The low profile package is only 0.35″ high and a more sensitive model, type 511B, has a height of 0.405″ maximum. Both models are 1.32″ maximum wide and allow PCB mounting and standard 0.5″ centers. The 2 pole models are 1.22″ deep and the 4 pole models are 1.52″ deep. Coil voltages of 6 to 48Vdc are available for both types.

The 511 series enclosures feature an amber polycarbonate dust cover and a molded base of thermosetting electrical grade plastic material. This box type base with molded-in terminal pins fully protects the inside of the relay during wave soldering and subsequent partial immersion cleaning operations.

(See Catalog 511 for more information).

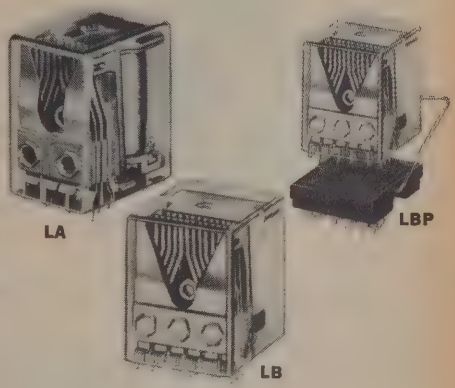



## LA, LB, LBP MINIATURE COVERED RELAYS

Designed for the user who must have high quality at a reasonable price. The LA relays have 4PDT contacts and the LB/LBP relays have 6PDT contacts. These miniature relays have extraordinary switching capacity and versatility for their size. Contacts rated 2 amps at 28Vdc. LA/LB series is for direct PCB mounting; and the LBP series is for direct plug into socket mounting. These relays are ideal components for industrial and telecommunications applications.

The relays are a maximum of 1.24″ high and 1.07″ deep. Maximum width of the LA is .75″ and the LB is 1.0″. Coil voltages of 6 to 60Vdc are available.

(See Catalog 501 for more information).



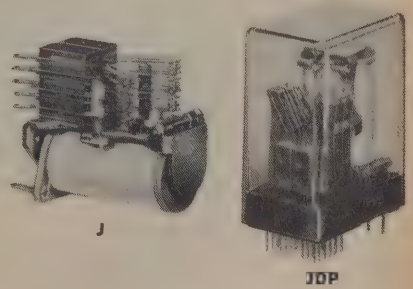

## J, JDP OPEN TYPE RELAYS

J & JDP relays are compact telephone type relays for applications ranging from simple switching in alarm circuits to complex computer functions. Contact combinations of 4, 6 and 8 pole double throw are rated 4A at 120Vac, 60Hz or 30Vdc resistive. Mechanical life exceeds 70 x $10^9$ operations.

Type J relays are open type construction for direct chassis mounting. Series JDP relays are furnished with a socket with solder lug terminals and a dust cover enclosure.

Type J relays are 1.88″ high and 1.12″ wide. The depth of the 4 and 8 pole models are 1.50″ and 1.94″ respectively.

Type JDP relays are 2.64″ high and 1.39″ wide. The depth of the 4 pole and 8 pole models are 1.72″ and 2.11″ respectively.

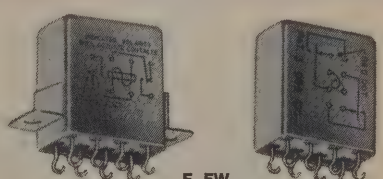



# C. P. CLARE MINIATURE/INDUSTRIAL CRYSTAL CAN RELAYS

## F, FW FULL SIZE AND HF, HFW HALF SIZE RELAYS

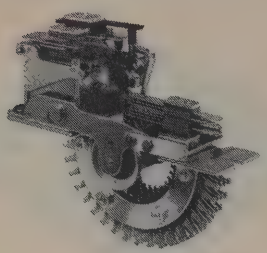
Clare provides full and half-size crystal can relays of unusual versatility, capable of reliable long life operation under adverse environments. The relays are available in both solder seal versions (F & HF) and welded seal models (FW & HFW). These relays are ideal for use in industrial application as well as military and aerospace. Relays employ a rigid frame to maintain permanent alignment of all elements. Contact arrangements are Form C. These relays are manufactured to meet MIL-R-5757 or MIL-R-39016, as applicable, with many part numbers on QPL for the specification.

(See Catalog F/FW and HF/HFW for more information).

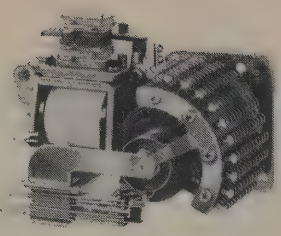


C. P. CLARE & COMPANY
GENERAL INSTRUMENT CORPORATION
3101 W. Pratt Avenue • Chicago, Illinois 60645 • (312) 262-7700

# C. P. CLARE STEPPING SWITCHES



TYPE 20



TYPE 210

## 20, 26, 210, 211 SERIES SEQUENTIAL SWITCHING

Clare stepping switches offer an economical alternative to solid state switching. Multiplexing, counting and sequencing problems are easily solved by providing the greatest working capacity in the smallest space. Clare stepping switches allow you to select interrupt or change connections in a succession of circuits in response to current pulses.

### TYPE 20/26

The Type 20 or 26 offer 1 to 16 levels of 20 or 26 points. They are also available in 1 to 12 levels of 40 or 52 points.

### TYPE 210/211

Type 210 or 211 offer 1 to 15 levels of 10 or 11 points. They are also available in 1 to 5 levels of 30 or 33 points.

Contacts are rated 0.1A at 115Vac or 30Vdc resistive with a 3A carry rating. Switch life (mechanical) is 50 to 28 million steps depending on type and number of levels.

Switches operate on DC pulses at ratings to 35 per second. Separate interrupter contacts are provided which operate on each coil pulse.

Off normal contacts can also be provided which operate only in "home" position.

All switches listed have 1 bridging level with the remaining levels being non-bridging. 2C off-normal and 2C interrupter contacts are standard.

| STOCK PART NO. | | NOMINAL VOLTAGE (0°C) | COIL RESISTANCE (OHMS ±) | LEVELS | POINTS | DIMENSIONS | | |
|---|---|---|---|---|---|---|---|---|
| 210 | 211 | | | | | H | W | D |
| 210-2403A | 211-2403A | 24 | 24 | 3 | 10 | 2¾ | 4⅝ | 1¹⁹⁄₆₄ |
| 210-2406A | 211-2406A | 24 | 24 | 6 | 10 | 2¾ | 4⅝ | 1¹³⁄₁₆ |
| 210-2412A | 211-2412A | 24 | 20 | 12 | 10 | 2¾ | 4⅝ | 2¹³⁄₁₆ |
| 210-11003A | 211-11003A | 110 | 600 | 3 | 11 | 2¾ | 4⅝ | 1¹⁹⁄₆₄ |
| 210-11006A | 211-11006A | 110 | 600 | 6 | 11 | 2¾ | 4⅝ | 1¹³⁄₁₆ |
| 210-11012A | 211-11012A | 110 | 400 | 12 | 11 | 2¾ | 4⅝ | 2¹³⁄₁₆ |
| 20-2404A | | 24 | 35 | 4 | 20 | 4⅝ | 5⅝ | 2⅛ |
| 20-2408A | | 24 | 35 | 8 | 20 | 4⅝ | 5⅝ | 2⅛ |
| 20-11004A | | 110 | 600 | 4 | 20 | 4⅝ | 5⅝ | 2⅛ |
| 20-11008A | | 110 | 600 | 8 | 20 | 4⅝ | 5⅝ | 2⅛ |
| 26-2404A | | 24 | 35 | 4 | 26 | 4⅞ | 6⅝ | 2½ |
| 26-2408A | | 24 | 35 | 8 | 26 | 4⅞ | 6⅝ | 2½ |
| 26-11004A | | 110 | 600 | 4 | 26 | 4⅞ | 6⅝ | 2½ |
| 26-11008A | | 110 | 600 | 8 | 26 | 4⅞ | 6⅝ | 2½ |
| 26-11026 | | 110 | 600 | 6 | 52 | 4⅞ | 6⅝ | 2¾ |
| RP8047G4 | | Rectifier Kit | | | | | | |
| RP9466 | | Standard Lubrication Kit | | | | | | |
| RP11375 | | Tool Kit | | | | | | |

C. P. CLARE & COMPANY
GENERAL INSTRUMENT CORPORATION
3101 W. Pratt Avenue • Chicago, Illinois 60645 • (312) 262-7700



Add Dept. EM to address to tell them you saw it in eem

# Relays

CDE CORNELL-DUBILIER



# A SUPER RELAY

## FROM

CDE

**The CDE Type 700 Series Relay represents a real break-through for Electronic Circuit Design Engineers who demand quality, compactness, and low cost.**

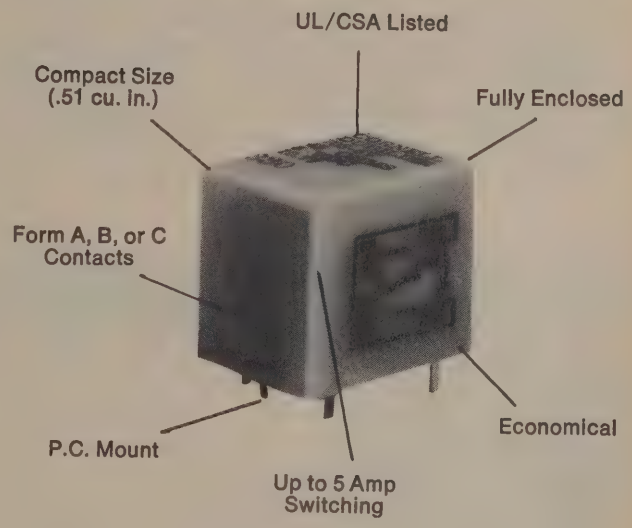
The 700 Series is ideally suited for a wide variety of uses because of its extremely small size, reliable contacts and low cost. Typical applications would include use in control circuits in audio systems, visual aid devices, automotive applications, medical electronics, business machines, communications equipment, remote control television and many others.

The 700 Series occupies a volume of approximately ½ cubic inch. With a base dimension of .67 inches by .97 inches and a height of .79 inches, it is ideally suited for high density packaging with a low profile on printed circuit board assemblies.

Standard contacts are a special gold alloy cross-bar design, for switching loads from low level through 3 amperes resistive at 28 VDC or 120 VAC. Other contact materials are available for special applications up to 5 amps.

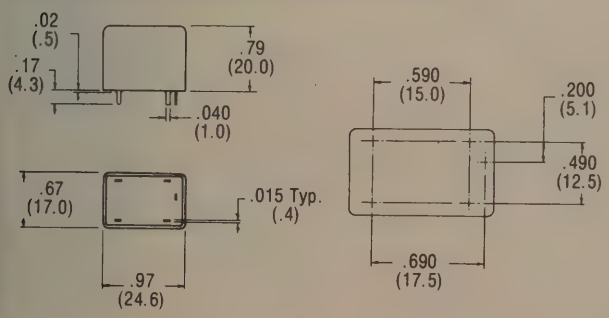
Contact forms are available in 1A (SPST-NO), 1B (SPST-NC), and 1C (SPDT). The standard stock items have 1C contacts.

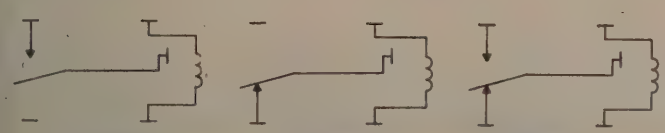
Stock relays are available having DC coils for nominal 6, 12 and 24 volt operation. Coils for other nominal voltages or currents are available on special order.




## DIMENSIONS AND SCHEMATICS

DIMENSIONS IN PARENTHESES ARE MILLIMETERS



FORM A SPST (NO) | FORM B SPST (NC) | FORM C SPDT

### Standard Stock Ratings —( 3 amp Resistive)

| Part Number | Contacts | Nominal Coil Voltage | Coil Resistance* (Ohms) | Pull-in* Voltage | Nominal* Coil Power |
|---|---|---|---|---|---|
| 703-6G | 1C | 6 VDC | 45 | 4.5 | 800 MW |
| 703-12G | 1C | 12 VDC | 180 | 9.0 | 800 MW |
| 703-24G | 1C | 24 VDC | 720 | 18.0 | 800 MW |
| 703-306G | 1C | 6 VDC | 75 | 4.5 | 480 MW |
| 703-312G | 1C | 12 VDC | 310 | 9.0 | 480 MW |
| 703-324G | 1C | 24 VDC | 1400 | 18.0 | 420 MW |

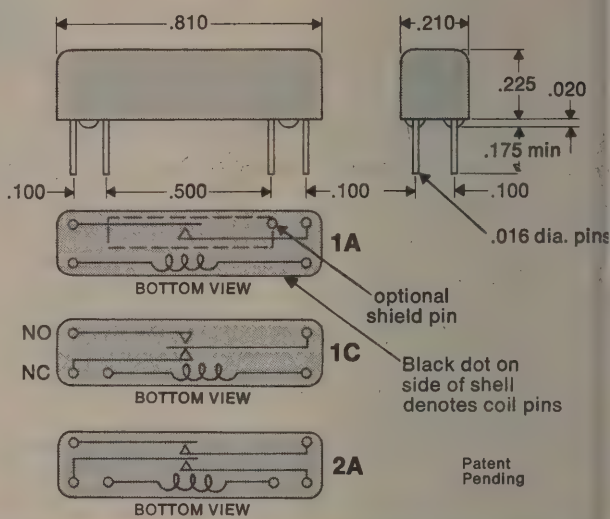
*At 25°C.

# MICRO-MINIATURE REED RELAYS
## Series CR-2200

**Coto's micro-miniature CR-2200 series reed relays offer the same versatility, dependability and switching capabilities as the larger "miniature" relays . . . yet in a package ⅓ smaller than a "DIP". A wide variety of contact types are available to meet most micro-miniature switching needs. Coto utilizes premium grade reed switches exclusively. The relays are encapsulated and thoroughly tested by the most modern and sophisticated techniques. Again, the finest quality . . . from Coto.**

- Relay occupies only .17 sq. in. of PC Board space . . . smaller than a DIP!
- Wide variety of contact types to meet most switching applications
- A choice of coil resistances at each voltage
- All relays are epoxy encapsulated in a magnetically shielded can, which has been coated with a bright, chemically resistant and insulating epoxy.
- Electrostatic shielding available
- Less than 500 microsecond switching speed typical on most models

Shown actual size




Patent Pending

| Relay Contact Type | Model Number and Coil Voltage | Initial Contact Resist. Ohms Max. | Contact Rating Watts Max. | Switch Volts DC Max. | Switch Amps Max. Resist. | Breakdown Volts DC Min. | Available Coils # | Electrostatic shield avail. |
|---|---|---|---|---|---|---|---|---|
| **1A** Standard | CR-2203 -5, 12 | .150 | 10 | 100 | .5 | 250 | 2, 3, 4 | A |
| **1A*** High Reliability | CR-2204 -5, 12 | .100 | 10 | 200 | .5 | 250 | 2, 3, 4 | A |
| **1C** Standard | CR-2211 -5, 12 | .150 | 3 | 100 | .250 | 200 | 2, 3 | N/A |
| **1A**** Mercury Wet | CR-2220 -5, 12 | .100 | 3 | 28 | .100 | 1000 | 1 | A |
| **1A** High Voltage Standard | CR-2231 -5, 12 | .150 | 10 | 300 | .5 | 400 | 2, 3 | N/A |
| **2A** Standard | CR-2253 -5, 12 | .150 | 10 | 100 | .5 | 250 | 2, 3 | N/A |

*High reliability relays are run-in and tested for dynamic contact resistance. This relay is recommended for low-level loads.

**Consult factory for availibility. Mercury wet relay may be mounted in any position.

| OPERATING PARAMETERS @ 25°C | | |
|---|---|---|
| Nominal Volts | 5 | 12 |
| Must Operate Volts | 3.7 | 9.0 |
| Must Release Volts | 0.4 | 1.0 |
| Coil #1 Resistance Ohms | 60 | 370 |
| Coil #2 Resistance Ohms | 150 | 900 |
| Coil #3 Resistance Ohms | 230 | 1500 |
| Coil #4 Resistance Ohms | 370 | — |

Insulation Resistance $10^{10}$ Ohms min @ 100VDC, 25°C, 40% Rel. Humidity

### ORDERING INFORMATION

CR — 22XX — XX — XX

- MODEL No.
- COIL VOLTAGE
- "1" — COIL #1
- "2" — COIL #2
- "3" — COIL #3
- "4" — COIL #4
- "0" — no electro-static shield
- "1" — electro-static shield

Specifications subject to change without notice.

Coto's staff of reed relay specialists will be pleased to assist you in designing and specifying the prop relay for any special application. Write for information on our complete line of stock reed relays.

**COTO-COIL COMPANY, INC.**
Dept. EM, 57 Pavilion Ave., Providence, R. I. 02905 • Telephone (401) 467-4777

# DIP REED RELAY

## Series CR-2600

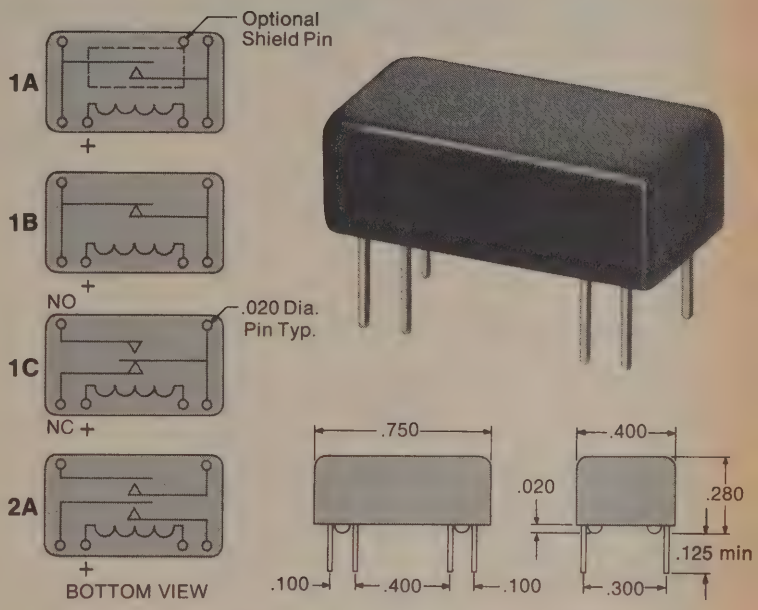
Coto's DIP reed relay is designed for versatility and reliability. A wide variety of contact types and coil resistances are offered to meet most switching applications.

All relays are encapsulated in a magnetically shielded steel shell that has been coated with a bright chemically resistant and insulating epoxy. A semiflexible epoxy potting compound provides stress-free encapsulation and avoids the problems common to molded relays. All relay contacts are run-in and tested for dynamic contact resistance, which enhances the reliability of the relays for low-level switching.

This relay provides the advanced design, quality and versatility the industry has come to expect from Coto.

### OPTIONS AVAILABLE:

- Electrostatic Shielding
- Diode Coil Suppression
- Alternate Switch and Coil Connections




| Relay Contact Type | Model Number and Coil Voltage | Initial Contact Resist. Ohms Max. | Contact Rating Watts Max. | Switch Volts DC Max. | Switch Amps Max. Resist. | Breakdown Volts DC Min. | Available Coils # | Electrostatic shield avail. |
|---|---|---|---|---|---|---|---|---|
| 1A | CR-2604 -5,12 | .100 | 10 | 200 | .5 | 250 | 2,3,4 | YES |
| 1B* | CR-2640 -5,12 | .150 | 10 | 200 | .5 | 250 | 2,3 | YES |
| 1C | CR-2611 -5,12 | .150 | 3 | 100 | .250 | 200 | 2,3 | NO |
| 1A** Mercury Wet | CR-2620 -5,12 | .100 | 3 | 28 | .100 | 1000 | 1 | YES |
| 1A High Voltage | CR-2631 -5,12 | .150 | 10 | 300 | .5 | 400 | 2,3 | NO |
| 2A* | CR-2653 5-12 | .150 | 10 | 100 | .5 | 250 | 2,3 | YES |

*Internal Suppression Diode not available on these types.

**Consult factory for availability. Mercury wet relay may be mounted in any position.

Specifications subject to change without notice.

| OPERATING PARAMETERS @ 25°C | | |
|---|---|---|
| Nominal Volts | 5 | 12 |
| Must Operate Volts | 3.7 | 9.0 |
| Must Release Volts | 0.4 | 1.0 |
| Coil #1 Resistance Ohms | 60 | 370 |
| Coil #2 Resistance Ohms | 150 | 900 |
| Coil #3 Resistance Ohms | 230 | 1500 |
| Coil #4 Resistance Ohms | 500 | — |

Insulation Resistance $10^{10}$ Ohms min @ 100VDC, 25°C, 40% Rel. Humidity

### ORDERING INFORMATION

CR— 26XX — XX — XXX

MODEL No.

COIL VOLTAGE

"1" — COIL #1
"2" — COIL #2
"3" — COIL #3
"4" — COIL #4

"0" — no electro-static shield
"1" — electro-static shield

OMIT — No Diode
"1" — Diode

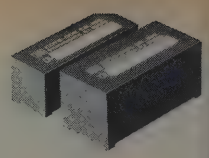
Coto's staff of reed relay specialists will be pleased to assist you in designing and specifying the proper relay for any special application. Write for information on our complete line of stock reed relays.

**COTO-COIL COMPANY, INC.**

65 Pavilion Avenue. Providence, R. I. 02905 • Telephone (401) 467-4777

# LOW THERMAL EMF REED RELAYS

## Series CR-3200

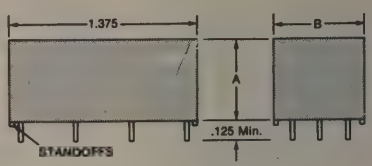


Coto-Coil has developed a unique new method* that virtually eliminates offsets caused by thermal emf's in almost any type of reed switch. This design now allows the entire spectrum of reed relays to be used for very low signal switching. These new COTO relays are especially designed for scanning low-level analog and digital signals, multiplexing, data acquisition, and automatic testing of components and systems. They offer all the advantages of an encapsulated reed relay, such as high isolation, speed and long lifetime under practically any environmental conditions, in addition to a very low and stable offset.

*Patented

COTO's new line of low-offset relays is offered with a large variety of contact combinations, switch types and thermal offset ratings, in order to meet each customer's requirement with maximum performance at a minimum cost. The relays are encapsulated in an epoxy-filled shell, and the offsets that are present are remarkably independent of ambient temperature and external environment.

| RELAYS | MODEL NO. | COIL (Nominal) VOLT. (volts) | COIL (Nominal) RESIS. (ohms) | COIL (Nominal) POWER (watts) | CONTACT FORMS | THERMAL EMF RATINGS* | PIN CONFIG. | PKG. |
|---|---|---|---|---|---|---|---|---|
| Dry Miniature | CR-3201-5 or -6 -12 | 5 or 6 12 | 1000 4000 | .035 | 1A | 5, 7, 8 | A | I |
| | CR-3202-5 or -6 -12 | 5 or 6 12 | 450 2200 | .075 | 2A | 5, 7, 8, 9 | B | I |
| | CR-3203-5 or -6 -12 | 5 or 6 12 | 350 1750 | .100 | 3A | 7, 8, 9 | C | II |
| | CR-3204-5 or -6 -12 | 5 or 6 12 | 450 2200 | .075 | 1B | 5, 7, 8, 9 | A | I |
| | CR-3205-5 or -6 -12 | 5 or 6 12 | 350 1750 | .100 | 2B | 7, 8, 9 | B | II |
| | CR-3206-5 or -6 -12 | 5 or 6 12 | 350 1750 | .100 | 1A1B | 7, 8, 9 | B | II |
| | CR-3207-5 or -6 -12 | 5 or 6 12 | 780/780 3000/3000 Bifilar | .045 | Single Pole Latch | 4, 7 | D | I |
| | CR-3250-5 or -6 -12 | 5 or 6 12 | 350 1750 | .100 | 3A (2 low therm. 1 high " ) | 5, 7, 8, 9 | C | II |
| High Voltage Miniature | CR-3221-5 or -6 -12 | 5 or 6 12 | 450 2200 | .075 | 1A | 8, 9 | A | I |
| | CR-3222-5 or -6 -12 | 5 or 6 12 | 325 1200 | .120 | 2A | 8, 9 | B | I |
| | CR-3223-5 or -6 -12 | 5 or 6 12 | 450 2200 | .075 | 1B | 8, 9 | A | I |
| Hg Wet Miniature | CR-3231-5 or -6 -12 | 5 or 6 12 | 150 600 | .240 | 1A | 9 | A | II |
| | CR-3232-5 or -6 -12 | 5 or 6 12 | 90 350 | .400 | 2A | 9 | B | II |
| | CR-3233-5 or -6 -12 | 5 or 6 12 | 90 350 | .400 | 1B | 9 | A | II |




Package I : 1.375 x .500(A) x .500(B)

Package II : 1.375 x .600(A) x .650(B)

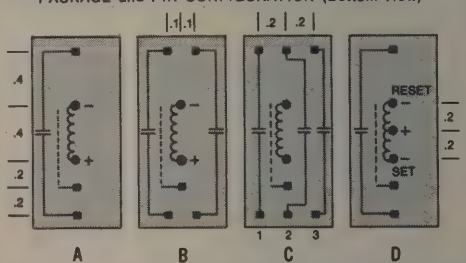
Shield and switch pins are .025" square, tinned copper.

Coil pins are .036" dia., nickel copper.

Pin pattern is centered within the case by ±.010".

Relays are encapsulated in a phenolic case, epoxy-filled.

PACKAGE and PIN CONFIGURATION (Bottom View)




Relays 3204, 3205, 3206, 3223 and 3233 contain a bias magnet, and coil polarity shown above must be observed.

Mercury-wetted Relays 3231, 3232 and 3233 must be mounted vertically with the arrow pointing up and shield pin at the bottom.

Switches 2 and 3 in Diagram C are the low-thermal switches in Relay 3250.

*Thermal Offset Ratings Per Switch:

| | |
|---|---|
| 4 <200nV | 8 <3μV |
| 5 <500nV | 9 <5μV |
| 7 <1μV | 0 <100μV |

Thermal offset measurements are made across each switch, except in Relays 3202, 3205, 3250, 3222 and 3232 where measurements are made differentially between the two low-thermal switches.

NOTES:
1) All relays are magnetically shielded.
2) Unless otherwise specified, all relays are electrostatically shielded.
3) Isolation resistance of $10^{10}$ or $10^{12}$ ohms is available.

| CONTACTS· | DRY | HIGH VOLTAGE | MERCURY WET |
|---|---|---|---|
| Max. Power (Volt-Amps) | 10 | 10 | 28 |
| Max. Voltage (DC or Peak AC) | 200 | 1000 | 100 |
| Max. Current (Amps) | .500 | .500* | 1.0 |
| Initial Contact Resis. (Ohms) | .300 | .300 | .300 |
| Min. Breakdown Voltage (DC or Peak AC) | 300 | 1000 | 800 |
| Isolation Resis. (Ohms) | $10^{10}$ | $10^{10}$ | $10^{10}$ |
| Operate Time (Typ. —msec) | 1.5 | 1.5 | 2.0 |
| Release Time (Typ. —msec) | .2 | .2 | .5 |
| Average Life at Full Rating (# operations) | 50x$10^6$ | 50x$10^6$ | 100x$10^6$ |

*0.010 Amperes max. @ 1000 VDC

**INSULATION RESISTANCE**
$10^{10}$ ohms minimum at 100VDC, +25°C, 50% relative humidity between all isolated pins. $10^{12}$ ohms is also available.

**CAPACITANCE**
The contact-to-contact capacitance for low thermal contacts is approximately 2.0pf. This value is composed of 0.2pf from the reed contacts and 1.8pf from the low thermal offset circuitry. With the electrostatic shield the contact-to-coil capacitance is typically 2.0pf.

**MUST OPERATE and RELEASE VOLTAGES**
Must-operate voltages at 25°C:
5v relay — 3.8; 6v relay — 4.5; 12v relay — 9.0
Must-release voltages at 25°C:
5v relay — 0.4; 6v relay — 0.5; 12v relay — 1.0

**INITIAL CONTACT RESISTANCE**
The maximum initial contact resistance for each contact is 0.3 ohms. Typically the initial contact resistance measures to be 0.250 ohms and is composed of 0.070 ohms from the reed contacts and 0.180 ohms from the low thermal offset circuitry.

**TESTING and RELIABILITY**
The low thermal emf reed relays are most commonly used under essentially dry circuit conditions. For these low-level loads the life of a clean contamination-free switch can exceed 500 million operations. In order to assure the highest possible reliability each switch and completed relay is subjected to an extensive series of cycling and dynamic testing. In addition each isolated pin is checked against every other pin for insulation resistance at the rated breakdown voltage. Finally a thermal offset test at the rated voltage is performed.

**THERMAL TESTING.** Care must be exercised in setting up in-house testing procedures for measuring thermal offsets of the CR-3200 relays. Without properly designed test circuitry and instrumentation, far greater thermal EMF offsets can be generated external to the relay than internally. Coto's engineering department will be pleased to assist in recommending testing circuitry and components for Q/C testing.

**EFFECT OF AMBIENT TEMPERATURES.** One of the specific design features of the CR-3200 low thermal relay is its exceptional stability with ambient temperature changes. For the purpose of rating, all standard CR-3200 relays are tested at a nominal 25°C ambient. However, temperature excursions from 0°C to 50°C will result in no more than a 500 nanovolt offset change in a 1μV rated relay.

Specifications subject to change without notice

### ORDERING INFORMATION

CR — XXXX — XX — XXX

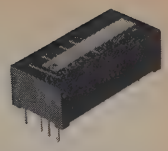
- Model No.
- Coil Voltage
- Thermal
- Electrostatic Shield include · — Suffix "1" Omit — Suffix "0"
- Contact Isolation (Ohms) $10^{10}$ — Suffix "0" $10^{12}$ — Suffix "1"

To order a COTO LOW THERMAL RELAY a part number can be assembled from the data sheet to describe the desired parameters as shown above. EXAMPLE: Typical part number for a 5 volt relay, 1 Form A with 1 μV offset, $10^{12}$ isolation and electrostatic shield: CR-3201-5-711.

Specifications subject to change without notice.

**COTO-COIL COMPANY, INC.**
Dept. EM. 57 Pavilion Ave., Providence, R. I. 02905 • Telephone (401) 467-4777

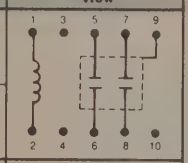
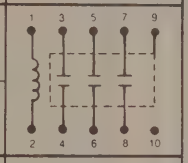
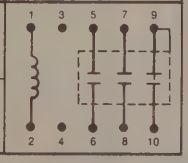
# LOW THERMAL EMF REED RELAYS FOR LOW-LEVEL DATA ACQUISITION SYSTEMS

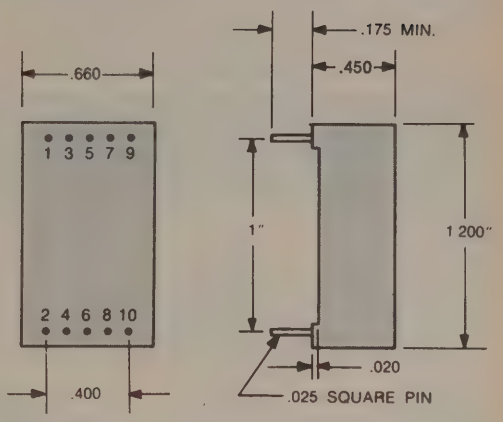


## SERIES CR-3300

After many years as the leading supplier of ultra-low thermal EMF relays for low-level data acquisition systems, Coto has now developed a new generation of low thermal EMF reed relays. The CR-3300 series relays utilize a new simpler design that reduces the cost, while increasing the performance and reliability of the relays.

The CR-3300 relays are designed especially as input devices for data acquisition systems. These systems, along with process controllers and monitors, datascanners, multiplexers and digital and analog multipoint recorders, often require as many as 1000 input relays in one system which must switch signals to 1 microvolt resolution in an industrial environment. These applications require ultra-high reliability, low and stable thermal offset voltage, superior packaging and high control/signal circuit isolation. The CR-3300 relays are designed to meet these requirements and more, at a reasonable cost.

| CONTACT FORM | Model Number | Nominal Coil VDC | Coil Res. Ohms ±10% | Must Operate VDC | Must Release VDC | Pin. Dia. Bottom View |
|---|---|---|---|---|---|---|
| 2A | CR-3302-5 | 5 | 350 | 3.8 | 0.4 |  |
| | CR-3302-12 | 12 | 2000 | 9.0 | 1.0 | |
| 3A | CR-3350-5 | 5 | 350 | 3.8 | 0.4 |  |
| | CR-3350-12 | 12 | 2000 | 9.0 | 1.0 | |
| 3A | CR-3360-5 | 5 | 350 | 3.8 | 0.4 |  |
| | CR-3360-12 | 12 | 2000 | 9.0 | 1.0 | |




Pin 9 is the electrostatic shield pin.
NOTE: For Model CR-3360 the 3rd non-low thermal switch (9-10) is connected in common with the electrostatic shield at Pin 9.

Switches connected to pins 5-6 and 7-8 are the low thermal EMF switches.

### PACKAGING

Relays are epoxy encapsulated in a flame-retardant polyester case (SE-O rated). The reed switches are coated with a silicone rubber to provide a stress-free encapsulation.
Tinned electrolytic copper pins minimize thermal EMF junctions at the PC Board connections.
The coil and coil terminations are well isolated from the switches and shield which provide a minimum of 1500 VRMS isolation between control and signal circuits.
All relays are magnetically shielded.
Unused terminals are omitted.

| PARAMETER | | TEST CONDITIONS | VALUE |
|---|---|---|---|
| Max. Switch Voltage | | DC/Peak AC | 150 Volts |
| Max. Switch Current | | DC/Peak AC Resistive | 500 mA |
| Max. Carry Current | | | 2.0 Amps |
| Max. Contact Rating | | DC Resistive | 10 Watts |
| Life Expectancy | | At Signal Level | 100 x $10^6$ Cyc. |
| | | At Rated Load | 10 x $10^6$ Cyc. |
| Static Contact Resistance (Initial) | | 0.050 Volt, 10 mA Contact Load | 0.100 Ohms Max. |
| Dynamic Contact Resistance (Initial) | | 0.5 Volt, 50 mA Load 100 hz, 1.5 msec after coil energized | 0.200 Ohms Max. |
| Insulation Resistance | | Between all isolated pins @ 100 V, 25 deg. C, 40% relative humidity. | $10^{10}$ ohms min. ($10^{12}$ ohms avail.) |
| Open Contact Capacitance | | Shield Floating | 1.0 pf Typ. |
| | | Shield as Guard | 0.4 pf Typ. |
| Contact to Shield Capacitance | | Contacts Open | 1.5 pf Typ. |
| | | Shield & Coil shorted together | 1.5 pf Typ. |
| Dielectric Strength (Minimum) | Between Contacts | DC/Peak AC Static Conditions | 250 Volts |
| | Contacts to Shield | | 500 Volts |
| | Contacts and Shield to Coil | AC VRMS | 1500 Volts |
| Operating Time (Including Bounce) | | At Nominal Voltage 30 hz Sq. wave | 1.0 msec Typ. |
| Release Time | | Zener Diode Clamp Coil Suppression | 100 μsec Typ. |

### THERMAL EMF

**RATINGS.** The thermal EMF is specified differentially between the two low thermal EMF switches (pins 5-6 and 7-8). This measurement is made by shorting pins 5 and 7 with a copper shunt and connecting a microvolt meter across pins 6 and 8.
The CR-3300 relays are available with maximum differential thermal EMF ratings of either 10 μV, 5 μV, 3 μV or 1 μV. The ratings are determined by 100% testing and sorting according to the thermal EMF's measured after the coil has been energized for 15 minutes at its nominal voltage.

**EFFECT OF AMBIENT TEMPERATURE.** CR-3300 relays are exceptionally stable with ambient temperature changes. For the purpose of rating, the thermal EMF is measured at a nominal 25 degrees C ambient. Slow temperature excursions from 0 degrees C to 50 degrees C should result in no more than a 1 μV thermal EMF variation. External heat sources which create thermal gradients in the relay may cause larger variations and should be avoided.

**COIL POWER AND DUTY CYCLE.** The thermal EMF of the CR-3300 relays is directly proportional to coil power or the square of the applied voltage. When the relays are operated in a scanning mode the thermal EMF will be proportional to the coil duty cycle. Thus a 5 μV relay operated at a 10% duty cycle will normally exhibit less than a 1 μV offset.

**TESTING.** Care must be exercised in testing the thermal EMF of the CR-3300 relays. Large errors in the thermal EMF readings may be introduced by an improperly designed test set up. The connections to the copper switch pins should be made with 4 identical low mass connectors and lead wires. Care should be taken to avoid all external thermal gradients. Pure copper wire and connections should be used throughout. Coto's engineering department will be pleased to assist in recommending thermal EMF test procedures.

### ENVIRONMENTAL RATINGS

Storage Temperature: —50 to +100°C
Operating Temperature: —20 to +70°C
NOTE: (The must operate and must release voltages and the coil resistance are specified at 25 degrees C. These values vary by approximately 0.4%/degrees C as the ambient temperature varies).
Vibration: 20 g's to 2000 hz
Shock: 50 g's

### TESTING AND RELIABILITY

All relays utilize premium quality, contamination free reed switches with rhodium contacts. In order to assure the highest possible reliability each switch and completed relay is subjected to an extensive series of cycling and dynamic testing. In addition each isolated pin is checked against every other pin for insulation resistance at the rated breakdown voltage. Finally a thermal EMF test at the rated voltage is performed.

### ORDERING INFORMATION

CR—XXXX—XX—XXX

- Model No.
- Coil Voltage
- *Thermal
- Electrostatic Shield Include — Suffix "1" Omit — Suffix "0"

*
- < 10μV—Suffix 1
- < 5μV—Suffix 9
- < 3μV—Suffix 8
- < 1μV—Suffix 7

Contact Isolation (Ohms)
- $10^{10}$ — Suffix "0"
- $10^{12}$ — Suffix "1"

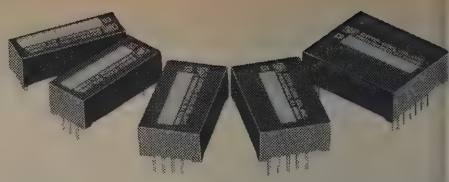
To order a COTO LOW THERMAL RELAY a part number can be assembled from the data sheet to describe the desired parameters as shown above.

Specifications subject to change without notice.

COTO-COIL COMPANY, INC.
57 Pavilion Avenue
Providence, R. I. 02905
Telephone (401) 467-4777

# MINIATURE REED RELAYS

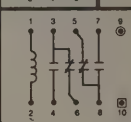
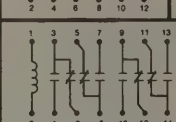
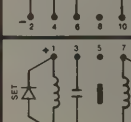
## Series CR-2000 • • 1″ x .100″ Grid



**DESCRIPTION** Coto-Coil's Series CR-2000 is a new family of relays which have a pin termination on the popular 1″ x .100″ grid pattern. They are economical and available with a large variety of options (see reverse side).

The CR-2000 can be completely epoxy-encapsulated in a phenolic shell for maximum environmental protection and high insulation resistance. They are also available in a covered but non-encapsulated form for maximum economy.

| Contact Form | Nominal Volts | Nominal mW | Res. Ohms ±10% @ 25°C | PART NO. | DWG. | Pin Diagram Bottom View |
|---|---|---|---|---|---|---|
| 1A | 5 | 125 | 175 | CR-2001-5 | A | |
| | 6 | | 300 | -6 | | |
| | 12 | | 1100 | -12 | | |
| | 24 | | 4200 | -24 | | |
| 2A | 5 | 230 | 100 | CR-2002-5 | B | |
| | 6 | | 150 | -6 | | |
| | 12 | | 640 | -12 | | |
| | 24 | | 2450 | -24 | | |
| 3A | 5 | 350 | 65 | CR-2003-5 | C | |
| | 6 | | 100 | -6 | | |
| | 12 | | 490 | -12 | | |
| | 24 | | 1550 | -24 | | |
| 4A | 5 | 475 | 55 | CR-2004-5 | D | |
| | 6 | | 80 | -6 | | |
| | 12 | | 315 | -12 | | |
| | 24 | | 1350 | -24 | | |
| 5A | 5 | 525 | 45 | CR-2005-5 | E | |
| | 6 | | 73 | -6 | | |
| | 12 | | 275 | -12 | | |
| | 24 | | 1100 | -24 | | |
| 6A | 5 | 525 | 45 | CR-2006-5 | E | |
| | 6 | | 73 | -6 | | |
| | 12 | | 275 | -12 | | |
| | 24 | | 1100 | -24 | | |
| *1B | 5 | 125 | 100 | CR-2021-5 | B | |
| | 6 | | 150 | -6 | | |
| | 12 | | 640 | -12 | | |
| | 24 | | 2450 | -24 | | |
| *2B | 5 | 350 | 65 | CR-2022-5 | C | |
| | 6 | | 100 | -6 | | |
| | 12 | | 490 | -12 | | |
| | 24 | | 1550 | -24 | | |

| Contact Form | Nominal Volts | Nominal mW | Res. Ohms ±10% @ 25°C | PART NO. | DWG. | Pin Diagram Bottom View |
|---|---|---|---|---|---|---|
| 1C | 5 | 125 | 175 | CR-2041-5 | A | |
| | 6 | | 300 | -6 | | |
| | 12 | | 1100 | -12 | | |
| | 24 | | 4200 | -24 | | |
| 2C | 5 | 350 | 65 | CR-2042-5 | C |  |
| | 6 | | 100 | -6 | | |
| | 12 | | 490 | -12 | | |
| | 24 | | 1550 | -24 | | |
| 3C | 5 | 475 | 55 | CR-2043-5 | D | |
| | 6 | | 80 | -6 | | |
| | 12 | | 315 | -12 | | |
| | 24 | | 1350 | -24 | | |
| 4C | 5 | 525 | 45 | CR-2044-5 | E |  |
| | 6 | | 73 | -6 | | |
| | 12 | | 275 | -12 | | |
| | 24 | | 1100 | -24 | | |
| 1A 1B *‡ | 5 | 475 | 55 | CR-2060-5 | D | |
| | 6 | | 80 | -6 | | |
| | 12 | | 315 | -12 | | |
| | 24 | | 1350 | -24 | | |
| 2A 2B *‡ | 5 | 525 | 45 | CR-2061-5 | E | |
| | 6 | | 73 | -6 | | |
| | 12 | | 275 | -12 | | |
| | 24 | | 1100 | -24 | | |
| 1A Latch * | 5 | 65 | 550/550 | CR-2052-5 | B |  |
| | 6 | | | -6 | | |
| | 12 | | | -12 | | |
| | 24 | | | -24 | | |

External Resistors to limit coil current

| Nominal Volts | 12 | 24 |
|---|---|---|
| Ohms (¼ watt) | 500 | 1500 |

Internal diode suppression standard

◉ Electro-static shield pin ◉ Alternate coil pin * These relays contain bias magnets and correct input polarity must be observed. Magnetic shield standard.

‡ Break before make not guaranteed.

**RELAY SPECS:**

| Nominal Operating Volts | 5 | 6 | 12 | 24 |
|---|---|---|---|---|
| Must Operate Volts | 3.75 | 4.5 | 9 | 18 |
| Must Release Volts | 0.4 | 0.5 | 1.0 | 2.0 |

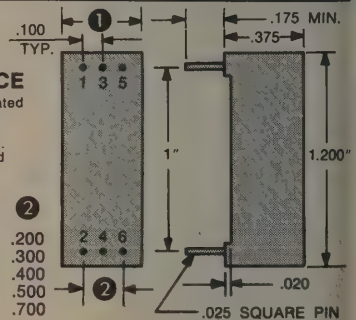
NOTE: Measurements taken at 25°C. Max coil volts are 50% greater than nom. volts for 10 min.

**ISOLATION RESISTANCE**

$10^9$ ohms minimum — non-encapsulated

$10^{12}$ ohms minimum — encapsulated

100VDC, 25°C, 40% relative humidity. Measured between coil & contact and contact & contact.




**DRAWINGS**

| | ❶ | ❷ |
|---|---|---|
| A | .410 | .200 |
| B | .510 | .300 |
| C | .660 | .400 |
| D | .760 | .500 |
| E | .990 | .700 |

**SWITCH SPECIFICATIONS**

| | Form A & B | Form C |
|---|---|---|
| **Contact Rating** — DC | 10 watts max. | 3 watts max. |
| **Switching Voltage** — DC or peak AC | 200 volts max. | 28 volts max. |
| **Maximum Current** — DC or peak AC — Resistive | 0.500 amps | 0.250 amps |
| **Initial Contact Resistance** | 0.2 ohms max. | 0.2 ohms max. |
| **Breakdown Voltage** — DC or peak AC | 250 volts min. | 200 volts min. |
| **Actuating Time** — average — incl. Bounce | 1.5 milliseconds | 1.5 milliseconds |
| **Release Time** | 1.0 millisecond | 2.0 milliseconds |
| **Life expectancy** | $100 \times 10^6$ operations at signal level; $10 \times 10^6$ operations at rated load | |

**ORDERING INFORMATION**

CR — 20XX — XX — XXXX

- MODEL No.
- COIL VOLTAGE
- "0" — not encapsulated / "1" — encapsulated
- "0" — no magnetic shield / "1" — magnetic shield
- "0" — no electro-static shield / "1" — electro-static shield
- "0" — standard / "1" — high reliability

If all options are "0" omit last four digits.

**AVAILABLE OPTIONS**

- Relay — non-encapsulated — for economy
- Relay — encapsulated — for maximum protection and high insulation resistance
- Electro-static shield and/or magnetic shield
- Breakdown volts DC or peak AC — 1000 volts minimum
- High-reliability relays which have been conditioned by a special run-in and dynamic testing
- Other relay sensitivities and operating voltages

Specifications subject to change without notice

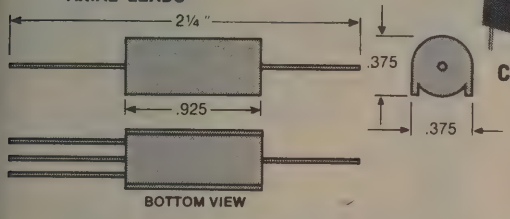
# High Quality Low-Cost REED RELAYS Series CR-4000 CR-4200

**These new uniquely-designed reed relays are manufactured and tested by the most advanced production techniques, which result in minimum customer costs, and a high standard of quality and performance.**

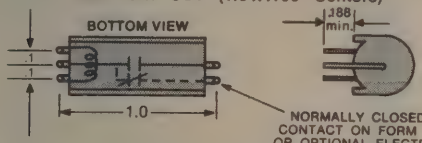
- Only premium grade catalogued reed switches used throughout
- 100% testing of switches, coils and completed relays
- Relays are completely encased in a tough flame-retardant shell.

## CR-4000

AXIAL LEADS



LEADS BENT and CUT (1.0 x .100" Centers)




| OPERATING PARAMETERS @ 25°C | | | | |
|---|---|---|---|---|
| Nominal Volts | 5 | 6 | 12 | 24 |
| Must Operate Volts | 3.7 | 4.5 | 9.0 | 18.0 |
| Must Release Volts | 0.4 | 0.5 | 1.0 | 2.0 |
| Standard Coil Resistance Ohms | 65 | 105 | 500 | 1800 |
| High Sensitivity Coil Resistance Ohms | 175 | 300 | 1000 | 4000 |

**CR-4000**

Insulation Resistance 10⁹ Ohms min @ 100VDC, 25°C, 40% Rel. Humidity

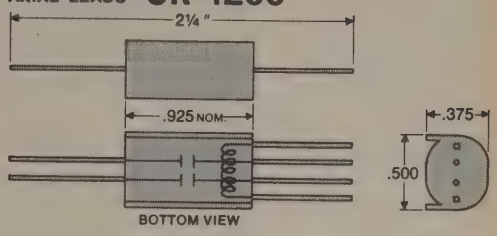
| Relay Contact Type | Model Number and Coil Voltage | Initial Contact Resist. Ohms Max. | Contact Rating Watts Max. | Switch Volts DC Max. | Switch Amps Max. Resist. | Break-down Volts DC Min. |
|---|---|---|---|---|---|---|
| 1A Low Cost | CR-4002-5, 6, 12, 24 | .500 | 10 | 100 | .5 | 250 |
| 1A Standard | CR-4003-5, 6, 12, 24 | .150 | 10 | 100 | .5 | 300 |
| 1A High Reliability | CR-4004-5, 6, 12, 24 | .100 | 10 | 200 | .5 | 300 |
| 1C Low Cost | CR-4010-5, 6, 12, 24 | .500 | 3 | 28 | .110 | 250 |
| 1C Standard | CR-4011-5, 6, 12, 24 | .150 | 3 | 28 | .250 | 250 |
| 1A* Mercury Wet | CR-4020-5, 6, 12, 24 | .050 | 28 | 100 | 1.0 | 1000 |
| 1A High Voltage Low Cost | CR-4030-5, 6, 12, 24 | .150 | 10 | 240 VAC | .5 | 600 |
| 1A High Voltage Standard | CR-4031-5, 6, 12, 24 | .150 | 10 | 500 | .5 | 1000 |

*Standard coil only. Mount Hg Wet relay vertically with coil leads down.

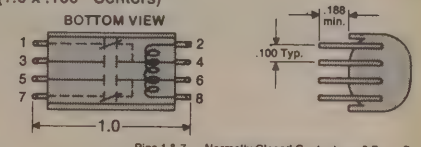
Specifications subject to change without notice.

## CR-4200

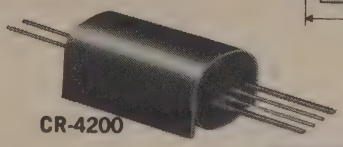
AXIAL LEADS




LEADS BENT and CUT (1.0 x .100" Centers)




Pins 1 & 7 — Normally Closed Contacts on 2 Form C
Pin 1 — Optional Electrostatic Shield Terminal on Form A and Form B Relays
Pin 2 — Positive Coil Terminal to Actuate 1 Form B or to Set Latch Relay
Pins 3 & 4 — 1 Form B or Latch Contact Terminals




| OPERATING PARAMETERS @ 25°C | | | | |
|---|---|---|---|---|
| Nominal Volts | 5 | 6 | 12 | 24 |
| Must Operate Volts | 3.7 | 4.5 | 9.0 | 18.0 |
| Must Release Volts | 0.4 | 0.5 | 1.0 | 2.0 |
| Standard Coil Resistance Ohms | 60 | 100 | 400 | 1600 |
| High Sensitivity Coil Resistance Ohms | 150 | 250 | 1000 | 4000 |

**CR-4200**

Insulation Resistance 10⁹ Ohms min @ 100VDC, 25°C, 40% Rel. Humidity

| Relay Contact Type | Model Number and Coil Voltage | Initial Contact Resist. Ohms Max. | Contact Rating Watts Max. | Switch Volts DC Max. | Switch Amps Max. Resist. | Break-down Volts DC Min. |
|---|---|---|---|---|---|---|
| 2A Low Cost | CR-4202-5, 6, 12, 24 | .500 | 10 | 100 | .5 | 250 |
| 2A Standard | CR-4203-5, 6, 12, 24 | .150 | 10 | 200 | .5 | 300 |
| 2A High Reliability | CR-4204-5, 6, 12, 24 | 100 | 10 | 200 | .5 | 300 |
| 2C Standard | CR-4211-5, 6, 12, 24 | .150 | 3 | 28 | .250 | 250 |
| 2A High Voltage Low Cost | CR-4230-5, 6, 12, 24 | 150 | 10 | 240 VAC | .5 | 600 |
| 2A High Voltage Standard | CR-4231-5, 6, 12, 24 | .150 | 10 | 1000 | .5 | 1200 |
| 1B Standard | CR-4240-5 6, 12, 24 | .150 | 10 | 200 | .5 | 300 |
| 1A Latch Single Coil | CR-4245-5, 6, 12, 24 | .200 | 10 | 200 | .5 | 300 |

1. Available with 1000 ohm coil only.
2. External series limiting resistance recommended: 5 or 6V — None 12V — 1000 ohms 24V — 3000 ohms
3. Coil polarity must be reversed to set and reset latch.
4. External coil suppression recommended for proper latch operation.

**ORDERING INFORMATION**

CR — 4XXX — XX — XXXX

- MODEL No.
- COIL VOLTAGE
- "0" — standard coil; "1" — high sen. coil
- "0" — no magnetic shield; "1" — magnetic shield
- "0" — axial leads; "1" — bent and cut leads
- "0" — no electro-static shield; "1" — electro-static shield

If all options are "0" omit last four digits.

**COTO-COIL COMPANY, INC.**
Dept. EM, 57 Pavilion Avenue
Providence, R.I. 02905
Telephone (401) 467-4777

# COTO REED COILS

| | END DRAWING (Actual Size) | TYPE | DIMENSIONS Nominal | D.C. VOLTS | RESIS. Ohms Nominal | COIL CURRENT mA | mW Nominal | AMP/TURNS Nominal | REED SWITCHES No. REEDS | REED TYPES | CONTACT FORMS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MINIATURE | U UF | U | OD .375 Lg .800 ID .140 | 6 12 24 32 48 | 150 625 2500 4000 8600 | 40 20 9.6 8 5.5 | 240 | 125 | 1 1 | 1 or 2 3 | 1A 1C |
| | | UF | Ht .437 Wd .375 Lg .800 ID .140 | | | | | | | | |
| | | UD | Ht .375 Wd .500 Lg .800 ID .140 x .287 | 6 12 24 32 48 | 86 350 1320 2250 5500 | 69.7 34 18 14.2 8 | 400 | 125 | 3 2 2 2 2 2 | 1 1 1 1 2 3 | 3A 2B* 1A & 1B* 1C* 2A 2C |
| | | UT | Ht .350 Wd .710 Lg .725 ID .130 x .500 | 6 12 24 32 48 | 85 340 1300 2550 5300 | 70.5 35.2 18.4 12.5 9 | 420 | 105 | 6 5 5 5 4 4 4 | 1 1 1 1 1 2 3 | 6A 5A 4A & 1B* 3A & 2B* 4B* 4A 4C |
| MICRO MINIATURE | | UM | OD .300 Lg .400 ID .090 | 3 6 12 24 | 55 215 850 3500 | 55 28 14 7 | 170 | 70 | 1 | 7 | 1A |
| | | UMM | OD .290 Lg .435 ID .112 | 3 6 12 24 | 55 215 850 3500 | 55 28 14 7 | 170 | 70 | 1 | 8 or 9 | 1A or 1C |
| | | UMD | Ht .200 Wd .315 Lg .450 ID .071x 168 | 3 6 12 24 | 40 150 600 2400 | 75 40 20 10 | 240 | 70 | 1 2 1 | 8 8 8 & 9 | 1B* 2A 1A & 1C |
| STANDARD | SR SF | SR | OD .500 Lg 2.00 ID .220 | 6 12 24 32 48 | 113 450 1650 2840 5890 | 53 26.5 14.5 11 8.2 | 330 | 200 | 1 1 | 4 or 5 6 | 1A 1C |
| | | SF | Ht .500 Wd .500 Lg 2.00 ID .220 | | | | | | | | |
| | | SD | Ht .500 Wd .720 Lg 2.00 ID .220 x .440 | 6 12 24 32 48 | 84 335 1290 2165 5700 | 66 36 18.5 15 8.5 | 430 | 200 | 1 2 2 2 | 4 or 5 4, 5, 6 5 & 6 4 & 6 | 1B* 2A or 2C 1A & 1C 1A & 1C |
| | | SG3 | Ht .500 Wd 1.00 Lg 2.00 ID .220 x .660 | 6 12 24 32 48 | 52 205 850 1430 3800 | 86 58.5 28 22 13 | 700 | 210 | 2 3 | 4 or 5 4, 5, 6 | 2B* 1B & 1A* 3A or 3C 1A & 2C 2A & 1C |
| | | SH4 | Ht .750 Wd 1.375 Lg 2.00 ID .220 x .800 | 6 12 24 32 48 | 40 160 650 1090 2500 | 150 75 37 29.4 19 | 900 | 260 | 4 3 | 4, 5, 6 4 or 5 | 4A or 4C 1A & 3C 2A & 2C 3A & 1C 2B & 1A* 1B & 2A* |
| | | SJ5 | Ht .750 Wd 1.500 Lg 2.00 ID .220 x 1.020 | 6 12 24 32 48 | 33 130 520 830 1950 | 182 92 46 38 24 | 1150 | 280 | 5 4 | 4, 5, 6* 4 or 5 | 5A or 5C 1A & 4C 2A & 3C 3A & 2C 4A & 1C 2B & 2A* 1B & 3A* |
| | | SK6 | Ht .750 Wd 1.750 Lg 2.00 ID .220 x 1.220 | 6 12 24 32 48 | 25 100 400 680 1575 | 240 120 60 47 30 | 1450 | 310 | 6 5 | 4, 5, 6 4 or 5 | 6A or 6C 1A & 5C 2A & 4C 3A & 3C 4A & 2C 5A & 1C 4B* 2B & 3A* 1B & 4A* |
| COMPACT | SP SPF | SP | OD .470 Lg 1.450 ID .220 | 6 12 24 32 48 | 150 600 2400 4000 9200 | 40.6 20 10 8 5.2 | 250 | 150 | 1 | 5 or 6 | 1A or 1C |
| | | SPF | Ht .500 Wd .470 Lg 1.450 ID .220 | | | | | | | | |
| | SE SEF | SE | Ht .625 Wd .812 Lg 1.450 ID .220 x .450 | 6 12 24 32 48 | 117 433 1610 2740 7200 | 51 28 14.9 11.6 6.7 | 350 | 160 | 2 1 2 | 5 or 6 5 5 & 6 | 2A or 2C 1B* 1A & 1C |
| | | SEF | Ht .655 Wd .812 Lg 1.450 ID .220 x .450 | | | | | | | | |
| | | T | Ht .500 Wd .875 Lg .690 ID .136 x .490 | 6 12 24 32 48 | 100 400 1600 2800 5800 | 60 30 15 11.4 8.2 | 350 | 125 | 6 5 4 | 1 1 2 or 3 | 6A 5A 4A or 4C |
| | | UH | Ht .875 Wd 1.375 Lg .718 ID .250x .750 | 6 12 24 32 48 | 45 180 720 1400 2640 | 133 67 33 23 18 | 800 | 200 | Combinations to 23 12 | 1 2 | 23A 12A or 12C |
| OTHER | | SA | OD .700 Lg 1.187 ID .320 | 6 12 24 32 48 | 65 255 965 1810 3660 | 92 47 25 17.6 13 | 575 | 200 | Jumbo Reed Swt. Coil | | |
| | | S | OD .562 Lg 2.00 ID .220 | 6 12 24 32 48 | 105 360 1400 1930 5150 | 57 33 17 16.5 9.5 | 400 | 250 | 1 1 | 4 or 5 6 | 1A 1C |
| | | M | OD .843 Lg 2.00 ID .468 | 6 12 24 32 48 | 50 175 820 1400 3120 | 120 69 29 23 15 | 700 | 250 | 3 | 4, 5, 6 | 3A or 3C |
| | | | | | | | | | Drive Coil for High Voltage Reed Switches—Above 10KV (Order with Bore Bushing) | | |
| | | SPH | OD .470 Lg 1.450 ID .220 | 6 12 24 32 48 | 70 260 1070 1690 4000 | 86 46 23 19 12 | 575 | 225 | Drive Coil for High Voltage Reed Switches—To 10KV | | |

# COTO REED COILS

*Bias Magnet Required

# COTO REED SWITCHES

| TYPES | CONTACTS | CONT. FORM w/magnet* bias | GLASS DIAMETER | GLASS LENGTH | MOUNTING POSITION | NOM. POWER RATING |
|---|---|---|---|---|---|---|
| 1 | Dry Form A | Form B | .090 Max | .800 Max | Any | 10 Watt |
| | High Frequency A | — | .090 Max | .800 Max | Any | .3 Watt |
| 2 | Dry Form A | Form B | .130 Max | .800 Max | Any | 10 Watt |
| | Hg./Wet A | Form B | .130 Max | .800 Max | Vert to 30° | 28 Watt |
| | Low Thermal A | — | .130 Max | .800 Max | Any | .3 Watt |
| | High Isolation A | — | .130 Max | .800 Max | Any | 10 Watt |
| 3 | Dry Form C | — | .130 Max | .800 Max | Any | 3 Watt |
| 4 | Dry Form A | Form B | .210 Max | 1.950 Max | Any | To 450 Watt |
| | Hg./Wet A | Form B | .210 Max | 1.950 Max | Vert to 30° | 50 Watt |
| | High Voltage | Form B, | .210 Max | 1.950 Max | Any | 50 Watt |
| 5 | Dry Form A | Form B | .210 Max | 1.425 Max | Any | To 100 Watt |
| 6 | Dry Form C | — | .218 Max | 1.562 Max | Any | To 20 Watt |
| 7 | Dry Form A | Form B | .090 Max | .375 Max | Any | .3 Watt |
| 8 | Dry Form A | Form B | .070 Max | .470 Max | Any | 3 Watt |
| 9 | Dry Form C | — | .070 x .110 Max | .435 Max | Any | .1 Watt |

Dimensions subject to change without notice.

The above listing of magnetic reed switches does not constitute a complete listing of all switches commercially available to fit Coto Coil reed relay coils. It does indicate the most common types and sizes manufactured by various companies. Coto's sales department will be pleased to assist you in recommending a source for your switch requirements or supplying the complete relay for your application.

COTO-COIL COMPANY, INC.
Dept. EM, 57 Pavilion Avenue
Providence, R.I. 02905
Telephone (401) 467-4777

# for prompt service and "off-the-shelf" availability, call... DIPLOMAT

FOR OUR COMPLETE COMPREHENSIVE INVENTORY SELECTION

## SEMICONDUCTORS AND IC's
Alpha (Microwave)
AmPower
Carter Semiconductor
CDI Compensated Devices
Computer Diode
Crystalonics/Teledyne
Delco
EDI
Exar
General Instrument
General Semiconductor
ITT
Intersil
Kertron Semiconductor
Microsemiconductor Corp.
Microwave Associates
Monolithic Memories
Mostek
NAE North American Electronics
NEC Microcomputer Inc.
Optron
Semicon
Semtech
Sensitron
Signetics
Silicon General
Silicon Transistor Corp.
Solid Power Corp.
Solid State Devices
Solid State Scientific
Solitron Devices
SMC Microsystems Corp.
Syntron
Teledyne
Texas Instruments
Western Digital
Xciton

## CAPACITORS AND FILTERS
ARCO
Capar
CAL-R
Cornel Dubilier
ITT
Johanson
Mallory
NCI
San Fernando/Westcap
Sangamo

## CONNECTORS AND SOCKETS
Amphenol
Cinch
Robinson Nugent
Sullins
Texas Instruments

## CONTROLS AND SWITCHES
Alco Switch
Cherry
CTS
Hamlin
Mallory
Omron

## FANS & BLOWERS
Howard Industries

## FUSES AND HOLDERS
Bussman
Littelfuse

## HARDWARE AND CABINETS
Bud Radio
Hammond
H.H. Smith
Hollingsworth
Ungar

## METERS OF TEST EQUIPMENT
Simpson
Triplett

## OPTOELECTRONICS
Chicago Miniature
General Electric
Monsanto
Optron
Xciton

## POTENTIOMETERS AND TRIMMERS
Clarostat
CTS
Spectrol
Weston/Sangamo
VRN (IRC)

## RELAYS
Allied Controls
Deltrol
Electrol
Guardian
Hamlin
IDEC
Potter & Brumfield
Omron

## RESISTORS
American Corp.
CAL-R
Capar
Clarostat
Mallory
Memcor
RCL
Shallcross
Stackpole
Ward-Leonard

## R.F. CHOKES
J.W. Miller

## THERMISTORS AND RF FILTERS
CORCOM
Fenwal
Gulton Industries

## TRANSFORMERS AND POWERSTATS
Chicago Stancor

## TUBES
Amperex

## WIRE, CABLE, INSULATION PRODUCTS
Alpha
Belden
Cable-Tech
Cimco
Coleflex
Columbia
Dearborn
DeWire
Electronized Chemical Corp.
Harbor Industries
Hi Temp
Insultab
ITT
Manhattan
Norflex
Rainbow

**Each of the Above Listed Lines are Franchised at one or more of the Following Locations.**

DIPLOMAT

**DIPLOMAT ELECTRONICS, INC.**
Woodbury, N.Y.
(516) 921-9373

**DIPLOMAT ELECTRONICS, INC.**
Farmington, Mich.
(313) 477-3200

**DIPLOMAT ELECTRONICS, INC.**
Totowa, N.J.
(201) 785-1830

**DIPLOMAT ELECTRONICS, INC.**
Elk Grove Village, Ill.
(312) 595-1000

**DIPLOMAT ELECTRONICS, INC.**
Chicopee Falls, Mass.
(413) 592-9441

**DIPLOMAT ELECTRONICS, INC.**
Minneapolis, Minn.
(612) 788-8601

**DIPLOMAT ELECTRONICS, INC.**
Mt. Laurel, N.J.
(609) 234-8080

**DIPLOMAT ELECTRONICS, INC.**
Salt Lake City, Utah
(801) 486-4134

**DIPLOMAT ELECTRONICS, INC.**
St. Louis, Mo.
(314) 645-8550

**DIPLOMAT ELECTRONICS, INC.**
Holliston, Mass.
(617) 429-4120

**DIPLOMAT ELECTRONICS, INC.**
Sunnyvale, Calif.
(408) 734-1900

**DIPLOMAT ELECTRONICS, INC.**
Clearwater, Fla.
(813) 443-4514

**DIPLOMAT ELECTRONICS, INC.**
Ft. Lauderdale, Fla.
(305) 771-0440

**DIPLOMAT ELECTRONICS, INC.**
Woodbury, N.Y.
(516) 921-7920

# DELTROL CONTROLS

## Makers of RELAYS, SOLENOIDS and TIMERS

A Division of Deltrol Corp, 2745 S. 19th St., Milwaukee, WI 53215, Phone (414) 671-6800, Telex 2-6871

## SALES REPRESENTATIVES

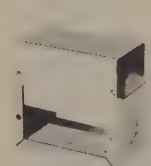
**Alabama,** JWL Associates, 704-364-3177
**Alaska,** Cummings & Associates, 503-287-6050
**Arizona,** Cummings & Associates, 213-340-6035
**Arkansas,** Weisler & Associates, Inc., 314-428-3934
**California (No.)** Cummings & Associates, 408-247-8656
**California (So.),** Cummings & Associates, 213-340-6035
**Colorado,** Cummings & Associates, 303-455-6860
**Connecticut,** Sands Company, 203-628-4363
**Delaware,** Naudain Associates, 609-235-1801
**Florida,** Jack Krutek & Associates, 305-941-6544
**Georgia,** JWL Associates, 704-364-3177
**Hawaii,** Aloha Associates, 808-941-1574
**Idaho,** Cummings & Associates, 503-287-6050
**Illinois (No.),** E. J. McCaffrey, 312-272-2820
**Illinois (So.),** Weisler & Associates, Inc., 314-394-4543
**Indiana (No.),** Walter W. Bieberich, Inc., 219-432-2537
**Indiana (So.),** Walter W. Bieberich, Inc., 812-945-3187
**Iowa,** Kencotronics, 612-645-7717
**Kansas,** Weisler & Associates, Inc., 816-421-1679
**Kentucky,** Walter W. Bieberich, Inc., 812-945-3187
**Louisiana,** Ray—May, 214-276-5214
**Maine,** Sands Company, 203-628-4363
**Maryland,** Naudain Associates, 301-442-2270
**Massachusetts,** Sands Company, 203-935-7495
**Michigan,** Deltrol Controls, 414-671-6800
**Minnesota,** Kencotronics, 612-645-7717
**Mississippi,** Ray—May, 214-276-5214
**Missouri,** Weisler & Associates, Inc., 314-394-4543
**Montana,** Cummings & Associates, 503-287-6050
**Nebraska,** Weisler & Associates, Inc., 816-421-1679
**Nevada,** Cummings, & Associates, 213-340-6035
**New Hampshire,** Sands Company, 203-628-4363
**New Jersey (No.),** Coughlin Associates, Inc., 516-799-7743
**New Jersey (So.),** Naudain Associates, 609-235-1801
**New Mexico,** Cummings & Associates, 213-340-6035
**New York (Metro),** Coughlin Associates, Inc., 516-799-7743
**New York (Upper),** Deltrol Controls, 716-473-3340
**North Carolina,** JWL Associates, 704-364-3177
**North Dakota,** Kencotronics, 612-645-7717
**Ohio, (No.),** Nationwide Component Reps, Inc., 216-562-9666
**Ohio, (So.),** Nationwide Component Reps, Inc., 513-294-2303
**Oklahoma,** Weisler & Associates, Inc., 314-394-4543
**Oregon,** Cummings & Associates, 505-287-6050
**Pennsylvania,** Naudain Associates, 609-235-1801
**Rhode Island,** Sands Company, 203-628-4363
**South Carolina,** JWL Associates, 704-364-3177
**South Dakota,** Kencotronics, 612-645-7717
**Tennessee,** Walter W. Bieberich, Inc., 219-432-2537
**Texas,** Ray—May, 214-276-5214
**Texas, (SW),** Cummings, & Associates, 213-340-6035
**Utah,** Cummings & Associates, 303-455-6860
**Vermont,** Sands Company, 203-628-4363
**Virginia,** Naudain Associates, Southern 301-442-2270
**Washington,** Cummings & Associates, 503-287-6050
**West Virginia,** Nationwide Component Reps, Inc., 513-294-2303
**Wisconsin,** Kencotronics, 414-961-7303
**Wyoming,** Cummings & Associates, 303-455-6860

# DELTROL CONTROLS RELAYS

L = 1-7/8
W = 1-1/2
H = 1-9/32

### 100U/101U SERIES

Small general purpose relay for light power load applications such as other relays, solenoids and small motors. Continuous duty operation. 5 amp contacts: 1/8" dia. 10 amp contacts: 3/16" dia. Contact material: Gold-flashed fine silver and silver-cadmium oxide is standard. Mounting: No. 6-32 stud and locating tab. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). CSA listed (File No. 20690).



L = 4
W = 2-1/4
H = 2-1/4

### B-4 DUST COVER

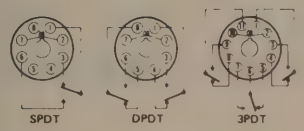
Sealed knock-out holes for standard conduit fittings. Relay mounts on pre-drilled base. Constructed of Aluminum. Snap action cover release. Accommodates following relay series 100, 100D/100F, 100RF, 100T, 100U/101U, 110, 120 and 130.

**(S/N 20256-80) List $2.65**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 20061-81 | 100U | SPDT | 5A | 12VAC | 21 | 2.0VA | 4.90 |
| 20061-82 | 100U | SPDT | 5A | 24VAC | 82 | 2.0VA | 4.90 |
| 20061-84 | 100U | SPDT | 5A | 120VAC | 2,250 | 2.0VA | 4.90 |
| 20061-85 | 100U | SPDT | 5A | 240VAC | 9,100 | 2.0VA | 5.55 |
| 20062-81 | 101U | SPDT | 10A | 12VAC | 21 | 2.0VA | 4.95 |
| 20062-82 | 101U | SPDT | 10A | 24VAC | 82 | 2.0VA | 4.95 |
| 20062-84 | 101U | SPDT | 10A | 120VAC | 2,250 | 2.0VA | 4.95 |
| 20062-85 | 101U | SPDT | 10A | 240VAC | 9,100 | 2.0VA | 5.60 |
| 20063-81 | 100U | DPDT | 5A | 12VAC | 19 | 2.2VA | 5.90 |
| 20063-82 | 100U | DPDT | 5A | 24VAC | 74 | 2.2VA | 5.90 |
| 20063-84 | 100U | DPDT | 5A | 120VAC | 1,800 | 2.2VA | 5.90 |
| 20063-85 | 100U | DPDT | 5A | 240VAC | 6,800 | 2.2VA | 6.40 |
| 20064-81 | 101U | DPDT | 10A | 12VAC | 19 | 2.2VA | 6.00 |
| 20064-82 | 101U | DPDT | 10A | 24VAC | 74 | 2.2VA | 6.00 |
| 20064-84 | 101U | DPDT | 10A | 120VAC | 1,800 | 2.2VA | 6.00 |
| 20064-85 | 101U | DPDT | 10A | 240VAC | 6,800 | 2.2VA | 6.50 |
| 20065-81 | 100U | 3PDT | 5A | 12VAC | 19 | 2.2VA | 6.60 |
| 20065-82 | 100U | 3PDT | 5A | 24VAC | 74 | 2.2VA | 6.60 |
| 20065-84 | 100U | 3PDT | 5A | 120VAC | 1,800 | 2.2VA | 6.60 |
| 20065-85 | 100U | 3PDT | 5A | 240VAC | 6,800 | 2.2VA | 7.20 |
| 20066-81 | 101U | 3PDT | 10A | 12VAC | 19 | 2.2VA | 6.65 |
| 20066-82 | 101U | 3PDT | 10A | 24VAC | 74 | 2.2VA | 6.65 |
| 20066-84 | 101U | 3PDT | 10A | 120VAC | 1,800 | 2.2VA | 6.65 |
| 20066-85 | 101U | 3PDT | 10A | 240VAC | 6,800 | 2.2VA | 7.35 |
| 20067-81 | 100U | SPDT | 5A | 12VDC | 120 | 1.2W | 4.75 |
| 20067-82 | 100U | SPDT | 5A | 24VDC | 472 | 1.2W | 4.75 |
| 20067-84 | 100U | SPDT | 5A | 110VDC | 10,000 | 1.2W | 5.55 |
| 20068-81 | 101U | SPDT | 10A | 12VDC | 120 | 1.2W | 4.80 |
| 20068-82 | 101U | SPDT | 10A | 24VDC | 472 | 1.2W | 4.80 |
| 20068-84 | 101U | SPDT | 10A | 110VDC | 10,000 | 1.2W | 5.60 |
| 20069-81 | 100U | DPDT | 5A | 12VDC | 120 | 1.2W | 5.15 |
| 20069-82 | 100U | DPDT | 5A | 24VDC | 472 | 1.2W | 5.15 |
| 20069-84 | 100U | DPDT | 5A | 110VDC | 10,000 | 1.2W | 6.10 |
| 20070-81 | 101U | DPDT | 10A | 12VDC | 120 | 1.2W | 5.35 |
| 20070-82 | 101U | DPDT | 10A | 24VDC | 472 | 1.2W | 5.35 |
| 20070-84 | 101U | DPDT | 10A | 110VDC | 10,000 | 1.2W | 6.25 |
| 20071-81 | 100U | 3PDT | 5A | 12VDC | 120 | 1.2W | 6.25 |
| 20071-82 | 100U | 3PDT | 5A | 24VDC | 472 | 1.2W | 6.25 |
| 20071-84 | 100U | 3PDT | 5A | 110VDC | 10,000 | 1.2W | 7.10 |
| 20072-81 | 101U | 3PDT | 10A | 12VDC | 120 | 1.2W | 6.50 |
| 20072-82 | 101U | 3PDT | 10A | 24VDC | 472 | 1.2W | 6.50 |
| 20072-84 | 101U | 3PDT | 10A | 110VDC | 10,000 | 1.2W | 7.25 |

**105 SERIES** General purpose plug-in relay for continuous duty operation. Eight and 11-pin plugs for up to 3PDT configuration. Contact material: Gold-flashed fine silver and silver-cadmium oxide is standard. Add $ .40 to list for 105G neoprene gasket version. Plastic Cover. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066).

L = 1-3/8
W = 1-3/8
H = 2




**BASE DIAGRAMS FOR 105 SERIES**

**B-3 HOLD DOWN SPRING**
(S/N 20171-00) $0.16 Net Any Qty.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 20105-84 | 105 | SPDT | 5A | 120VAC | 2,250 | 2.0VA | 8.15 |
| 20106-82 | 105 | SPDT | 10A | 24VAC | 82 | 2.0VA | 8.45 |
| 20106-84 | 105 | SPDT | 10A | 120VAC | 2,250 | 2.0VA | 8.45 |
| 20107-82 | 105 | DPDT | 5A | 24VAC | 74 | 2.2VA | 9.25 |
| 20107-84 | 105 | DPDT | 5A | 120VAC | 1,800 | 2.2VA | 9.25 |
| 20108-80 | 105 | DPDT | 10A | 6VAC | 4.7 | 2.0VA | 9.40 |
| 20108-81 | 105 | DPDT | 10A | 12VAC | 19 | 2.0VA | 9.40 |
| 20108-82 | 105 | DPDT | 10A | 24VAC | 74 | 2.0VA | 9.40 |
| 20108-84 | 105 | DPDT | 10A | 120VAC | 1,800 | 2.0VA | 9.40 |
| 20108-85 | 105 | DPDT | 10A | 240VAC | 6,800 | 2.0VA | 9.85 |
| 20109-84 | 105 | 3PDT | 5A | 120VAC | 1,800 | 2.2VA | 11.40 |
| 20109-85 | 105 | 3PDT | 5A | 240VAC | 6,800 | 2.2VA | 11.90 |
| 20110-80 | 105 | 3PDT | 10A | 6VAC | 4.7 | 2.2VA | 11.60 |
| 20110-81 | 105 | 3PDT | 10A | 12VAC | 19 | 2.2VA | 11.60 |
| 20110-82 | 105 | 3PDT | 10A | 24VAC | 74 | 2.2VA | 11.60 |
| 20110-84 | 105 | 3PDT | 10A | 120VAC | 1,800 | 2.2VA | 11.60 |
| 20110-85 | 105 | 3PDT | 10A | 240VAC | 6,800 | 2.2VA | 12.50 |
| 20112-81 | 105 | SPDT | 10A | 12VDC | 120 | 1.2W | 8.25 |
| 20112-82 | 105 | SPDT | 10A | 24VDC | 472 | 1.2W | 8.25 |
| 20113-81 | 105 | DPDT | 5A | 12VDC | 120 | 1.2W | 9.20 |
| 20113-82 | 105 | DPDT | 5A | 24VDC | 472 | 1.2W | 9.20 |
| 20114-80 | 105 | DPDT | 10A | 6VDC | 30 | 1.2W | 9.35 |
| 20114-81 | 105 | DPDT | 10A | 12VDC | 120 | 1.2W | 9.35 |
| 20114-82 | 105 | DPDT | 10A | 24VDC | 472 | 1.2W | 9.35 |
| 20114-83 | 105 | DPDT | 10A | 48VDC | 1,800 | 1.2W | 10.05 |
| 20114-84 | 105 | DPDT | 10A | 110VDC | 10,000 | 1.2W | 10.25 |
| 20116-81 | 105 | 3PDT | 10A | 12VDC | 120 | 1.2W | 11.55 |
| 20116-82 | 105 | 3PDT | 10A | 24VDC | 472 | 1.2W | 11.55 |
| 20116-83 | 105 | 3PDT | 10A | 48VDC | 1,800 | 1.2W | 12.10 |
| 20116-84 | 105 | 3PDT | 10A | 110VDC | 10,000 | 1.2W | 12.45 |

**161 SERIES**

Inexpensive 10 amp plug-in general purpose relay. Molded nylon coil. Coil terminates in panel for greater strength. Combination .187 quick connect/solder termination. Recognized under the Components Program of Underwriter's Laboratories, Inc. (File No. E37066). Also CSA Recognized.

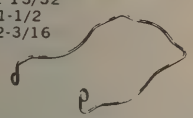
L = 1.250
1.625 w/stud
W = 1.450
H = 2.101 max.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 20300-84 | 161 | SPDT | 10A | 120VAC | 2,250 | 2.0VA | 5.05 |
| 20301-82 | 161 | DPDT | 10A | 24VAC | 74 | 2.2VA | 6.35 |
| 20301-84 | 161 | DPDT | 10A | 120VAC | 1,800 | 2.2VA | 6.35 |
| 20302-82 | 161 | 3PDT | 10A | 24VAC | 74 | 2.2VA | 7.05 |
| 20302-84 | 161 | 3PDT | 10A | 120VAC | 1,800 | 2.2VA | 7.05 |
| 20304-82 | 161 | DPDT | 10A | 24VDC | 472 | 1.2W | 5.65 |
| 20305-82 | 161 | 3PDT | 10A | 24VDC | 472 | 1.2W | 6.65 |

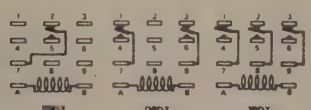
**165/166 SERIES**

Plastic covered general purpose plug-in relay. Molded nylon coil. Continuous duty operation. 5 amp contacts: 1/8" dia. 10 amp contacts: 3/16" dia. Contact material: Gold-flashed fine silver and silver-cadmium oxide is standard. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). Also CSA Recognized.

L = 1-13/32
W = 1-1/2
H = 2-3/16



**165 HOLD DOWN SPRING**
**S/N 20902-00 $ .16 ea. any qty.**




**WIRING DIAGRAM FOR 165/166 SERIES**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 20324-84 | 165 | DPDT | 5A | 120VAC | 1,800 | 2.2VA | 6.40 |
| 20307-82 | 166 | DPDT | 10A | 24VAC | 74 | 2.2VA | 6.50 |
| 20307-84 | 166 | DPDT | 10A | 120VAC | 1,800 | 2.2VA | 6.50 |
| 20307-85 | 166 | DPDT | 10A | 240VAC | 6,800 | 2.2VA | 7.20 |
| 20308-82 | 166 | 3PDT | 10A | 24VAC | 74 | 2.2VA | 7.25 |
| 20308-84 | 166 | 3PDT | 10A | 120VAC | 1,800 | 2.2VA | 7.25 |
| 20308-85 | 166 | 3PDT | 10A | 240VAC | 6,800 | 2.2VA | 7.95 |
| 20309-81 | 166 | SPDT | 10A | 12VDC | 120 | 1.2W | 5.30 |
| 20310-80 | 166 | DPDT | 10A | 6VDC | 30 | 1.2W | 5.90 |
| 20310-81 | 166 | DPDT | 10A | 12VDC | 120 | 1.2W | 5.90 |
| 20310-82 | 166 | DPDT | 10A | 24VDC | 472 | 1.2W | 5.90 |
| 20310-84 | 166 | DPDT | 10A | 110VDC | 10,000 | 1.2W | 6.70 |
| 20328-82 | 165 | 3PDT | 5A | 24VDC | 472 | 1.2W | 6.55 |
| 20311-81 | 166 | 3PDT | 10A | 12VDC | 120 | 1.2W | 6.70 |
| 20311-82 | 166 | 3PDT | 10A | 24VDC | 472 | 1.2W | 6.70 |
| 20311-84 | 166 | 3PDT | 10A | 110VDC | 10,000 | 1.2W | 7.50 |

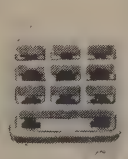
**SOCKETS – 165/166 SERIES**

| | | | |
|---|---|---|---|
| 20312-82 | 3PDT | SOLDER TERMINALS | .95 |
| 20313-82 | 3PDT | .187 QUICK-CONNECT TERMINALS | 1.35 |
| 20314-82 | 3PDT | PRINTED CIRCUIT TERMINALS | 1.04 |
| 20395-82 | 3PDT | BARRIER TYPE .187 QC TERMINALS | 1.55 |

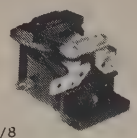
Solder

Quick-Connect

Printed Circuit


Barrier Type

# DELTROL CONTROLS RELAYS

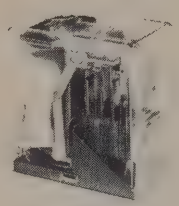


L = 1-7/8
W = 1-5/8
H = 1-1/4

### 170 SERIES

Medium duty relays for industrial control applications. Molded nylon encapsulated coil is resistant to fungus and moisture. Ratings: (SPST-NO-DM): 25 amp, 1 hp, 120 VAC; Contacts: Silver cadmium oxide, gold flashed. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066).

| Stock No. | Series | Contact Poles | Rating in Amps | Coil Voltage/ Current | Resistance (Ohms) | Nominal Coil Power | List Price |
|---|---|---|---|---|---|---|---|
| **20392-83** | 170 | SPST-NO-DM | 25A | 120VAC | 1,100 | 4.7VA | 6.20 |
| **20394-82** | 170 | | 25A | 24VDC | 288 | 2W | 5.85 |



W = 61/64
D = 49/64
L = 1-3/16

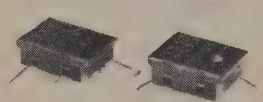
### 250 SERIES

Miniature general purpose cradle relay. DPDT or 4PDT configuration rated 3 amps @ 28VDC/120VAC. Signal input as low as 10 mW. Contact Resistance: 50 milliohms maximum. Terminals: printed circuit pins or solder type. Coil Treatment: tape wrapped. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066).

250 — Solder Terminal
250P — Printed Circuit Terminal

**DPDT SOCKETS**
**20805-80** Solder Terminal
**20805-81** PC Terminal
**$0.65 net each**

**4PDT SOCKETS**
**20806-80** Solder Terminal
**20806-81** PC Terminal
**$0.85 net each**



Sockets include retaining clips.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **20808-80** | 250 | DPDT | 3A | 6VDC | 52 | 700MW | 4.15 |
| **20808-81** | 250 | DPDT | 3A | 12VDC | 185 | 700MW | 4.15 |
| **20808-82** | 250 | DPDT | 3A | 24VDC | 700 | 700MW | 4.15 |
| **20809-80** | 250 | 4DPT | 3A | 6VDC | 52 | 700MW | 4.55 |
| **20809-81** | 250 | 4DPT | 3A | 12VDC | 185 | 700MW | 4.55 |
| **20809-82** | 250 | 4DPT | 3A | 24VDC | 700 | 700MW | 4.55 |
| **20810-80** | 250P | DPDT | 3A | 6VDC | 52 | 700MW | 4.15 |
| **20810-81** | 250P | DPDT | 3A | 12VDC | 185 | 700MW | 4.15 |
| **20820-82** | 250P | DPDT | 3A | 24VDC | 700 | 700MW | 4.15 |
| **20811-80** | 250P | 4DPT | 3A | 6VDC | 52 | 700MW | 4.55 |
| **20811-81** | 250P | 4DPT | 3A | 12VDC | 185 | 700MW | 4.55 |
| **20811-82** | 250P | 4DPT | 3A | 24VDC | 700 | 700MW | 4.55 |

W = 1-1/2
D = 1-7/16
H = 2-1/2

### 268 SERIES

Plastic covered general purpose plug-in relay. Molded nylon coil. Continuous duty operation. 15 amp contacts: 1/4" dia. Contact material: silver, cadium oxide. Recognized under the components program of Underwriter's Laboratories, Inc., File No. E37066; and CSA recognized.

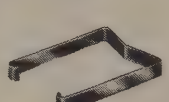
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **20683-84** | 268 | SPDT | 15A | 120VAC | 1800 | 2.0VA | 6.70 |
| **20684-82** | 268 | DPDT | 15A | 24VAC | 74 | 2.2VA | 7.15 |
| **20684-84** | 268 | DPDT | 15A | 120VAC | 1800 | 2.2VA | 7.15 |
| **20686-82** | 268 | DPDT | 15A | 24VDC | 472 | 1.2W | 6.50 |
| **20686-84** | 268 | DPDT | 15A | 110VDC | 10,000 | 1.2W | 7.40 |

### 280 SERIES MINIATURE RELAYS

L = 1-7/32
W - 55/64
H = 1-7/64

L = 1-7/32
W = 55/64
H = 1-7/64

**SOCKET FOR 280/290 SERIES**
20614-80 Solder Term.
20615-80 PC Term.
**$0.65 net each.**



**HOLD DOWN SPRING**
**21089-00 List $0.16**

Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066).

| Stock No. | Series | Contact Poles | Rating in Amps | Coil Voltage/ Current | Resistance (Ohms) | Nominal Coil Power | List Price |
|---|---|---|---|---|---|---|---|
| 20649-82 | 280* | 4PDT | 3A | 24VDC | 650 | 0.9W | 7.00 |
| 20651-82 | 280P | 4PDT | 3A | 24VDC | 650 | 0.9W | 7.00 |
| 20649-85 | 280* | 4PDT | 3A | 110VDC | 11,000 | 0.9W | 8.05 |
| 20651-85 | 280P | 4PDT | 3A | 110VDC | 11,000 | 0.9W | 8.05 |
| 20650-84 | 280* | 4PDT | 3A | 120VAC | 3,500 | 1.2VA | 8.30 |
| 20652-84 | 280P | 4PDT | 3A | 120VAC | 3,500 | 1.2VA | 8.30 |

P = Printed-Circuit Term. * = Solder Term

### 290 SERIES

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **20612-80** | 290* | DPDT | 10 | 24VDC | 650 | 0.9W | 7.50 |
| **20613-80** | 290* | DPDT | 10 | 120VAC | 3,500 | 1.3VA | 8.60 |

* = Solder Term



Prices Subject To Change Without Notice.



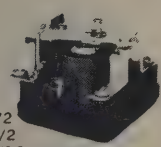
Add Dept. EM to address to tell them you saw it in eem

W = 1-3/16
D = 1/2
H = 1

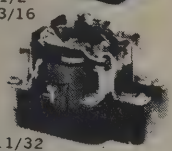
### 404/405/406/407 SERIES

Plastic covered, miniature, high current printed circuit relay. Continuous duty operation. Provides up to 6 amp switching capability. 2 amp contacts: (stationary) silver; (moveable) silver. 6 amp contacts: (stationary) silver; (moveable) silver cadium oxide. Recognized under the components program of Underwriter's Laboratories, Inc., file no. E37066

| Stock No. | Series | Contact Poles | Rating in Amps | Coil Voltage Current | Resistance (Ohms) | Nominal Coil Power | List Price |
|---|---|---|---|---|---|---|---|
| **20692-83** | 404 | SPDT | 2A | 12VDC | 280 | .514W | 2.70 |
| **20692-84** | 404 | SPDT | 2A | 24VDC | 1100 | .524W | 2.70 |
| **20693-83** | 405 | SPDT | 6A | 12VDC | 280 | .514W | 2.75 |
| **20693-84** | 405 | SPDT | 6A | 24VDC | 1100 | .524W | 2.75 |
| 20764-83 | 406 | DPDT | 2A | 12VDC | 170 | .847W | 3.55 |
| 20764-84 | 406 | DPDT | 2A | 24VDC | 740 | .778W | 3.55 |
| 20765-83 | 407 | DPDT | 6A | 12VDC | 170 | .847W | 3.65 |
| 20765-84 | 407 | DPDT | 6A | 24VDC | 740 | .778W | 3.65 |



L = 2-1/2
W = 2-1/2
H = 2-3/16



L = 3-11/32
W = 2-1/2
H = 2-3/8

### 900 SERIES

Heavy duty power relay for industrial control applications. Particularly suited for motor controls, heater loads, welder loads, and other power switching applications. Molded nylon coil resists fungus and moisture, has a cleaner appearance. Long life, rugged construction. Rating: 25 amps, 1-½ hp, 120/240 VAC. Contacts: 5/16" dia. silver cadmium oxide, gold-flashed. Heavy duty screw-type terminals. Mounting: two 3/16" holes on 1-7/8" centers. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). CSA listed (File No. 20690).

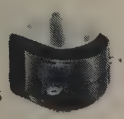
L = 5
W = 4
H = 3

### B-5 DUST COVER

Sealed knock-out holes for standard conduit fittings. Relay mounts on pre-drilled base. Constructed of Aluminum. Snap action cover release. Accommodates relay series 900.

**(S/N 20257-80) List $3.75**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **20237-82** | 900 | SPST-NO | 30A | 24VAC | 12 | 9.5VA | 6.05 |
| **20237-83** | 900 | SPST-NO | 30A | 120VAC | 290 | 9.5VA | 6.05 |
| **20238-82** | 900 | SPST NO-DM | 30A | 24VAC | 12 | 9.5VA | 6.20 |
| **20238-83** | 900 | | 30A | 120VAC | 290 | 9.5VA | 6.20 |
| **20238-84** | 900 | | 30A | 240VAC | 1,200 | 9.5VA | 6.70 |
| **20239-82** | 900 | SPDT | 30A | 24VAC | 12 | 9.5VA | 6.85 |
| **20239-83** | 900 | SPDT | 30A | 120VAC | 290 | 9.5VA | 6.85 |
| **20239-84** | 900 | SPDT | 30A | 240VAC | 1,200 | 9.5VA | 7.05 |
| **20240-82** | 900 | DPST-NO | 30A | 24VAC | 12 | 9.5VA | 7.55 |
| **20240-83** | 900 | DPST-NO | 30A | 120VAC | 290 | 9.5VA | 7.55 |
| **20240-84** | 900 | DPST-NO | 30A | 240VAC | 1,200 | 9.5VA | 7.75 |
| **20241-82** | 900 | DPDT | 30A | 24VAC | 12 | 9.5VA | 9.15 |
| **20241-83** | 900 | DPDT | 30A | 120VAC | 290 | 9.5VA | 9.15 |
| **20241-84** | 900 | DPDT | 30A | 240VAC | 1,200 | 9.5VA | 9.85 |
| **20242-82** | 900 | SPST NO-DM | 30A | 24VDC | 290 | 2W | 6.15 |
| **20242-84** | 900 | | 30A | 110VDC | 6,050 | 2W | 7.00 |
| **20243-81** | 900 | SPDT | 30A | 12VDC | 72 | 2W | 6.40 |
| **20243-84** | 900 | SPDT | 30A | 110VDC | 6,050 | 2W | 7.25 |
| **20244-81** | 900 | DPST-NO | 30A | 12VDC | 72 | 2W | 7.30 |
| **20244-82** | 900 | DPST-NO | 30A | 24VDC | 290 | 2W | 7.30 |
| **20245-81** | 900 | DPDT | 30A | 12VDC | 72 | 2W | 9.10 |
| **20245-82** | 900 | DPDT | 30A | 24VDC | 290 | 2W | 9.10 |
| **20245-84** | 900 | DPDT | 30A | 110VDC | 6,050 | 2W | 10.10 |



L = 1-1/16
W = 1-1/4
H = 7/8

### BZ BUZZER

Continuous or intermittent duty buzzer which buzzes when coil is energized. Operates on 50/60 cycle AC voltage. Mounting: No. 6-32 tapped core. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). CSA listed (File No. 20690).

| Stock No. | Series | Contact Poles | Rating in Amps | Coil Voltage/ Current | Resistance (Ohms) | Nominal Coil Power | List Price |
|---|---|---|---|---|---|---|---|
| 20000-81 | BZ | | | 12VAC | 32 | 3.0VA | 2.65 |
| 20000-82 | BZ | | | 24VAC | 132 | 3.0VA | 2.65 |
| 20000-83 | BZ | | | 120VAC | 2,250 | 3.0VA | 2.65 |

# DELTROL CONTROLS CLAPPER

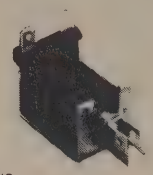
L = 1-1/2
W = 1-1/4
H = 1-1/4 +
mtg. stud

### 100 C CLAPPER

Medium duty, long life clapper mechanism with adjustable stop. Provided with 6-32 mounting stud and locator key and two threaded adaptor mounting bolts.

| Stock No. | Coil Voltage/ Current | Resistance (Ohms) | Approx. Coil Power | List Price |
|---|---|---|---|---|
| **20013-84** | 120VAC | 1,800 | 2.2VA | 2.95 |
| **20014-81** | 12VDC | 120 | 1.2W | 2.75 |
| **20014-82** | 24VDC | 472 | 1.2W | 2.75 |

# DELTROL CONTROLS SOLENOIDS



L = 1-1/8
W = 55/64
H = 1-17/64

## C-6 PULL TYPE

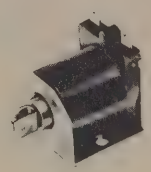
Low cost, low power solenoid for applications such as appliances, vending machines, and automobiles. Molded nylon coil for fungus and moisture resistance. Terminals molded into the coil for extra strength, virtually eliminating open coils. Available with optional buzz trimmer that eliminates AC hum.

NOTE: Standard intermittent duty cycle is one (1) minute on and three (3) minutes off.

| Stock No. | Volts/ Type | Duty | Approx. Amps | Approx. Resist. | Approx. Coil Power | List Price |
|---|---|---|---|---|---|---|
| 53685-83 | 24VDC | Cont. | .19 | 129 | 4.7W | 3.50 |
| 53686-83 | 24VDC | Int. | .50 | 48 | 12W | 3.50 |
| 53687-94 | 120VAC | Cont. | .05 | 778 | 6.2VA | 3.65 |
| 53688-94 | 120VAC | Int. | .11 | 487 | 19VA | 3.65 |

STROKE (INCHES) FORCE (OUNCES)

| | 1/16 | 1/8 | 3/16 | 1/4 |
|---|---|---|---|---|
| DC Cont. | 7 | 3 | 2 | 1-1/2 |
| DC Int. | 15 | 8 | 5 | 3-1/2 |
| AC Cont. | 10 | 7 | 5 | 4 |
| AC Int. | 21 | 13 | 11 | 8 |



L= 1-9/64
W = 1-1/16
H = 1-13/32

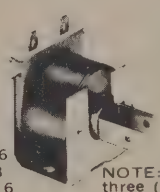
## C-7 PULL TYPE

NOTE: Standard intermittent duty cycle is three (3) minutes on and nine (9) minutes off.

| | | | | | | |
|---|---|---|---|---|---|---|
| 53634-83 | 24VDC | Cont. | .27 | 88 | 6.6W | 3.85 |
| 53635-83 | 24VDC | Int. | .48 | 50 | 11W | 3.85 |
| 53637-94 | 120VAC | Cont. | .08 | 390 | 9VA | 4.00 |
| 53638-94 | 120VAC | Int. | .21 | 181 | 24VA | 4.00 |

STROKE (INCHES) FORCE (OUNCES)

| | 1/16 | 1/8 | 3/16 | 1/4 |
|---|---|---|---|---|
| DC Cont. | 19 | 8 | 5 | 3 |
| DC Int. | 28 | 12 | 8 | 5 |
| AC Cont. | 17 | 12 | 10 | 8 |
| AC Int. | 30 | 22 | 19 | 17 |



L = 1- 1/16
W = 1- 3/8
H = 1-13/16

## TYPE C-9 PULL TYPE

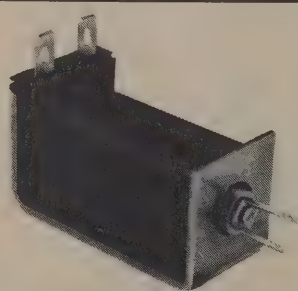
Medium power solenoid for volume applications where low cost is essential. Standard construction includes a nylon plunger guide for long operational life.

NOTE: Standard intermittent duty cycle is three (3) minutes on and nine (9) minutes off.

| Stock No. | Volts/ Type | Duty | Approx. Amps | Approx. Resist. | Approx. Coil Power | List Price |
|---|---|---|---|---|---|---|
| 53676-83 | 24VDC | Cont. | .35 | 69 | 8.4W | 4.25 |
| 53677-83 | 24VDC | Int. | .65 | 37 | 15.6 | 4.25 |
| 53673-94 | 120VAC | Cont. | .11 | 256 | 13VA | 4.40 |
| 53674-94 | 120VAC | Int. | .32 | 101 | 32VA | 4.40 |

STROKE (INCHES) FORCE (OUNCES)

| | 1/16 | 1/8 | 3/16 | 1/4 | 1/2 |
|---|---|---|---|---|---|
| AC Cont. | 20 | 15 | 14 | 13 | 9 |
| AC Int. | 37 | 30 | 26 | 24 | 16 |
| DC Cont. | 22 | 15 | 10-1/2 | 8 | 2-1/2 |
| DC Int. | 35 | 25 | 18 | 13-1/2 | 4-1/2 |



L = 1-3/4
W = 27/32
H = 59/64 (1-25/64 max.)

## TYPE C-15 PULL TYPE

NOTE: Standard intermittent duty cycle is three (3) minutes on and nine (9) minutes off.

| | | | | | | |
|---|---|---|---|---|---|---|
| 53679-94 | 120VAC | Cont. | .1 | 235 | 12VA | 4.60 |
| 53680-94 | 120VAC | Int. | .2 | 140 | 24VA | 4.60 |
| 53682-83 | 24VDC | Cont. | .28 | 86 | 6.7W | 4.40 |
| 53683-83 | 24VDC | Int. | .7 | 34 | 17 W | 4.40 |

STROKE (INCHES) FORCE (OUNCES)

| | 1/16 | 1/8 | 3/16 | 1/4 | 3/8 | 1/2 |
|---|---|---|---|---|---|---|
| AC Cont. | 15 | 11 | 10 | 9-1/2 | 9 | 8-1/2 |
| AC Int. | 24 | 17 | 15 | 14 | 13-1/2 | 12-1/2 |
| DC Cont. | 26 | 13 | 11 | 7-1/2 | 4 | 3 |
| DC Int. | 39 | 30 | 24 | 18 | 11 | 7-1/2 |

L = 1-27/32
W = 15/16
H = 1-3/16

## TYPE D-18 PULL TYPE

NOTE: Standard intermittent duty cycle is three (3) minutes on and nine (9) minutes off.

| | | | | | | |
|---|---|---|---|---|---|---|
| 53593-81 | 12VDC | Cont. | .67 | 18 | 8W | 4.40 |
| 53593-83 | 24VDC | Cont. | .33 | 72 | 8W | 4.40 |
| 53594-81 | 12VDC | Int. | 1.5 | 8 | 18W | 4.40 |
| 53594-83 | 24VDC | Int. | .75 | 32 | 18W | 4.40 |
| 53591-94 | 120VAC | Cont. | 0.1 | 200 | 12VA | 4.50 |
| 53592-94 | 120VAC | Int. | 0.35 | 85 | 42VA | 4.50 |

STROKE (INCHES) FORCE (OUNCES)

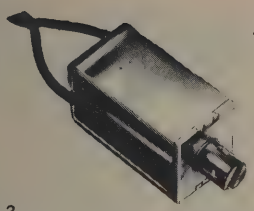
| | 1/16 | 1/8 | 3/16 | 1/4 | 1/2 | 3/4 |
|---|---|---|---|---|---|---|
| DC Cont. | 38 | 28 | 16 | 11 | 4 | 3 |
| DC Int. | 55 | 40 | 24 | 22 | 10 | 6 |
| AC Cont. | 14 | 12 | 9 | 8 | 7 | 6 |
| AC Int. | 45 | 25 | 20 | 18 | 15 | 14 |



Prices Subject To Change Without Notice.



Add Dept. EM to address to tell them you saw it in eem



**TYPE D-30 PULL TYPE**

L = 2
W = 1
H = 1-7/32

NOTE: Standard intermittent duty cycle is three (3) minutes on and nine (9) minutes off.

| Stock No. | Volts Type | Duty | Approx. Amps. | Approx. Resist. | Approx. Coil Power | List Price |
|---|---|---|---|---|---|---|
| 51002-81 | 12VDC | Cont. | .61 | 20 | 7.2W | 4.70 |
| 51002-83 | 24VDC | Cont. | .30 | 80 | 7.2W | 4.70 |
| 51002-93 | 115VDC | Cont. | .06 | 1,850 | 7.2W | 4.75 |
| 50025-81 | 12VDC | Int. | 1.6 | 8 | 19W | 4.70 |
| 50025-83 | 24VDC | Int. | .8 | 30 | 19W | 4.70 |
| 50025-93 | 115VDC | Int. | .17 | 700 | 19W | 4.75 |
| 51038-94 | 120VAC | Cont. | .08 | 404 | 9.5VA | 4.75 |
| 50010-94 | 120VAC | Int. | .20 | 165 | 25VA | 4.75 |

**STROKE (INCHES) FORCE (OUNCES)**

| | 1/16 | 1/8 | 3/16 | 1/4 | 1/2 | 3/4 |
|---|---|---|---|---|---|---|
| DC Cont. | 31-1/4 | 19-3/4 | 13-3/4 | 10-1/4 | 3-1/4 | 1-1/4 |
| DC Int. | 85 | 70 | 58 | 38 | 12 | 4 |
| AC Cont. | 9 | 7 | 5 | 4-1/2 | 4 | 3 |
| AC Int. | 21 | 15 | 13 | 12 | 10 | 6 |

**TYPE D-45 PULL TYPE**

L = 2
W = 1-7/16
H = 1-5/8

NOTE: Standard intermittent duty cycle is three (3) minutes on and nine (9) minutes off.

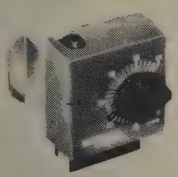
| | | | | | | |
|---|---|---|---|---|---|---|
| 51000-81 | 12VDC | Cont. | .84 | 14 | 10W | 7.35 |
| 51000-83 | 24VDC | Cont. | .42 | 58 | 10W | 7.35 |
| 51000-93 | 115VDC | Cont. | .09 | 1,330 | 10W | 7.40 |
| 50027-81 | 12VDC | Int. | 2.2 | 6 | 26W | 7.35 |
| 50027-83 | 24VDC | Int. | 1.2 | 22 | 26W | 7.35 |
| 50027-93 | 115VDC | Int. | .22 | 510 | 26W | 7.40 |
| 51045-94 | 120VAC | Cont. | .13 | 176 | 14VA | 7.40 |
| 50012-94 | 120VAC | Int. | .37 | 61 | 45VA | 7.40 |

**STROKE (INCHES) FORCE (OUNCES)**

| | 1/16 | 1/8 | 3/16 | 1/4 | 1/2 | 3/4 |
|---|---|---|---|---|---|---|
| DC Cont. | 68 | 52 | 42 | 30 | 10 | 4 |
| DC Int. | 95 | 80 | 70 | 58 | 20 | 8 |
| AC Cont. | 14 | 10 | 9 | 8 | 7 | 6 |
| AC Int. | 38 | 30 | 26 | 22 | 18 | 16 |

# DELTROL CONTROLS TIMERS

**SERIES 700 AUTOMATIC RESET TIMER (INTERVAL)**



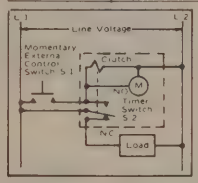
L = 3-7/32
W = 3-3/8
D = 2-17/32
Mounting Centers = 2-7/8

Unit has adjustable time cycle and features interval timing cycles up to six hours. Switch contact and terminal specifications are the same as Series 600.

Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E19033).

CSA Recognized

| | | | | | |
|---|---|---|---|---|---|
| 46396-81 | 701-00B | 0.4 Sec. | 10 Sec. | 120VAC 60HZ | 19.35 |
| 46398-81 | 701-00D | 0.8 Sec. | 20 Sec. | 120VAC 60HZ | 19.35 |
| 46400-81 | 701-00F | 2.4 Sec. | 60 Sec. | 120VAC 60HZ | 19.35 |
| 46401-81 | 701-00G | 12 Sec. | 5 Min. | 120VAC 60HZ | 19.35 |
| 46404-81 | 701-00J | 48 Sec. | 20 Min. | 120VAC 60HZ | 19.35 |
| 46405-81 | 701-00K | 72 Sec. | 30 Min. | 120VAC 60HZ | 19.35 |
| 46406-81 | 701-00L | 144 Sec. | 60 Min. | 120VAC 60HZ | 19.35 |



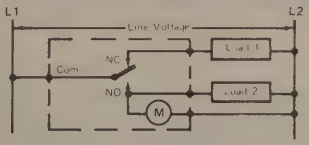

**SERIES 800 PUSH BUTTON AUTOMATIC RESET TIMER (INTERVAL)**

L = 2-7/8
W = 2-1/2
D = 3-5/16

CSA Recognized

Unit has adjustable time cycle and features interval timing up to 24 hours. Zero position to Emergency Off. Timer switch: SPDT, 15 amps at 120 VAC or 240 VAC (non-inductive). 11 amps tungsten 120 or 240 VAC.

| Stock No. | Model No. | Time Cycle | Voltage | List Price |
|---|---|---|---|---|
| 46467-81 | 801-0-B | 0-30 Sec. | 120V, 60 HZ | 14.70 |
| 46468-81 | 801-0-C | 0-1 Min. | 120V, 60 HZ | 15.50 |
| 46470-81 | 801-0-E | 0-5 Min. | 120V, 60 HZ | 14.70 |
| 46472-81 | 801-0-G | 0-30 Min. | 120V, 60 HZ | 15.50 |




**DELTROL** *controls*
Division Of Deltrol Corp

2745 S. 19th Street, Milwaukee, Wisconsin 53215
Phone (414) 671-6800, Telex 2-6871

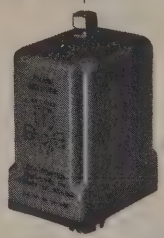
# DIVERSIFIED ELECTRONICS, INC.

Manufacturers of Solid State Protective Devices for Instrumentation and Control of Electrical Equipment

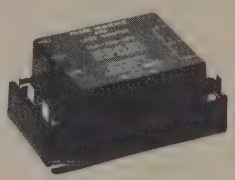
## PHASE MONITOR / RELAYS

### PHASE LOSS, PHASE SEQUENCE & UNDER VOLTAGE

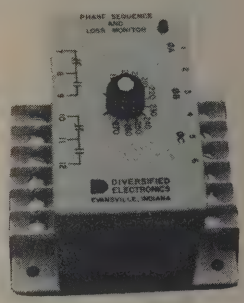
SLA SERIES
Used for protection and control of electrical equipment due to adverse conditions such as Phase Loss (Single Phasing), phase reversal (CBA sequence) and under voltage (brown outs). Relay is energized, and an indicator light glows when a "no fault" condition exists. This is a "fail safe" mode of operation, Four field adjustable model cover standard voltages up to 757 VAC. Factory stock on standard items. Relay contacts capable of switching 24 to 600 VAC control circuits.



STYLE A



STYLE N




STYLE E

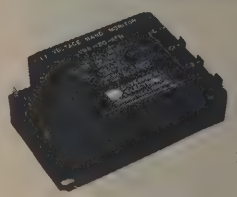
### PHASE UNBALANCE, PHASE SEQUENCE & PHASE LOSS

SLB SERIES
For applications where critical protection is required, the phase unbalance monitor will maintain a condition between all phases, required for satisfactory operation of electrical equipment. The field adjustable trip point operates over a range from 2 to 15% voltage unbalance. An adjustable time delay is incorporated to prevent nuisance tripping. This device also detects phase loss and phase reversal. Any fault condition must last longer than the pre set drop-out time for the relay to de-energize.

## VOLTAGE MONITOR / RELAYS

### UNDER VOLTAGE

UOA SERIES
Offers protection to single phase equipment which is required to operate above a pre selected safe voltage limit. When the voltage falls below the trip point for longer than the drop-out time, the relay drops out. The voltage must rise through a dead band (Hysteresis) before the relay will energize. The fixed time dealy is incorporated to accommodate start up transients and prevent nuisance tripping. Available in various enclosure style for either AC or DC operation.



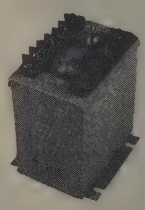
STYLE N

### VOLTAGE BAND (sinlge & three phase)

VBA SERIES
Are single phase Voltage Band Monitors designed to detect when the monitored voltage goes above or below the pre selected limits. With the trip points being adjustable over wide ranges,very tight voltage tolerances can be obtained. The design incorporates a fixed time delay on drop-out to accommodate start up transients and prevent nuisance tripping. With normal operating voltage applied, the internal relay is energized. Then the voltage goes above or below the preset limits for longer than the drop-out time, the relay de-energizes. Available in various enclosure styles for either AC or DC operation.

STYLE A

PBA SERIES
Offers protection to Three Phase equipment which is required to operate between two voltage limits. The voltage is monitored for a pre selected under and over voltage limit on all phases. The design incorporates a fixed delay on drop-out accommodate start up transients and prevent nuisance tripping due to line fluxuations. With normal operating voltage supplied, the internal relay is energized. When any one of the three (3) phases goes above or below the pre selected limit for longer than the drop-out delay, the internal relay drops out. Field adjustable limits on both over and under voltage allows tight tolerances for critical applications. Available in style "M" enclosure only.

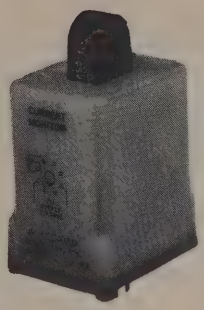


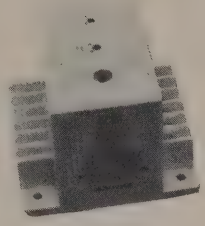
STYLE M

DIVERSIFIED ELECTRONICS, INC.
119 N. Morton Avenue
Evansville, Indiana 47711
(812) 426-2806

# AC CURRENT MONITOR / RELAYS

STYLE A





STYLE E

CMO SERIES
Over current protection adjustable time delay on pick-up, automatic reset, typically used in motor over current protective applications.

CMU SERIES
Under current protection, adjustable time delay on drop-out, automatic reset, typically used to detect when current goes under some pre-set trip point.

CML SERIES
Over current protective identical to the CMO SERIES except this device has manual lock-out feature. Once tripped, an operator must manually reset the current monitor.

CMB SERIES
Enexpensively designed merely to show a presence or absence of current. Can be used in either the under of over current mode.

CMI SERIES
Over current protection to motor equipment, features adjustable delay on pick-up for by passing inrush currents, adjustable range up to 20 amps AC. Available in style E enclosure only. The unique feature is, the relay will not trip during times of high inrush current. After the initial delay has elasped, the internal relay will drop-out immediately when the current rises above the pre-selected trip point. Typically used for applications such as conveyor jam-up protection. The device must be manually reset after a fault condition has been detected before the system will again become operative.

# TIME DELAY RELAYS

Adjustable Models

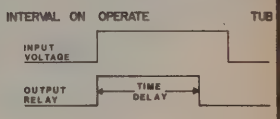
Lexan Dust Cover

Plug-In Socket

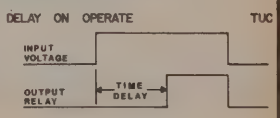
U.L. Recognized
File #E55826
Reference Spec: UL-508

C.S.A. Certified
File #LR40123
Reference Spec: C22.2 No. 0 and C22.2 No.14

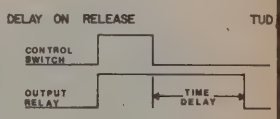
**TIMING ACTION**



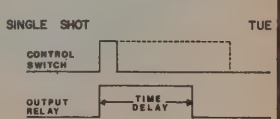

The TUB Series are INTERVAL ON OPERATE timers. Contacts of the internal relay close for an interval of time after input voltage has been applied. If input voltage is removed before the timer has timed out, the relay will de-energize and the time delay will reset.




The TUC Series are DELAY ON OPERATE timers that will not false transfer when power is removed before completion of the timing cycle. When input voltage is applied,the delay period begins. On completion of the time delay period, the internal relay contact close. When voltage is removed, the relay returns to normal. A fast recycle allows accurate high speed continuous operations. Delay on operate timers are used where it is required to delay the start on an event.




The TUD Series are DELAY ON RELEASE TIMERS. Voltage is applied to the input at all times. Upon closure on the control switch the internal relay energizes and the contact immediately transfer. The relay remains energized if no further action is taken. Immediately upon opening the switch, the time delay period begins. If the switch is not reclosed before the end of the delay period, the relay will de-energize. Closure of the switch before time out will reset the timer. Time delay on release is used where it is necessary to delay the end of an event for a period of time.




The TUE Series are SINGLE SHOT TIMERS. Voltage is applied to the input at all times. Upon closure of the control switch (momentarily or maintained), the internal relay energizes. At the end of the delay period, the relay will de-energize. Single shot timers remove any dependence of an operator from the process during the timing period. After closure of the control switch, timing continues until completion, regardless of the control switch position.

# DORMEYER INDUSTRIES

*A Division of A. F. Dormeyer Mfg. Co., Inc.*

## SOLENOIDS

# BOX FRAME SOLENOIDS B-18/B-19/B-20

### GENERAL SPECIFICATIONS

**Standard Voltages:**
AC: 120, 24 and 12. 240 (B-20 only).
DC: 48, 24, 12 and 6. 115 (B-20 only).
Voltages available from distributor stock are indicated in screened area of chart.
Other voltages available on request.

**AC Frequency**
60 Hz standard.
50 Hz available on request.

**Coil Temperature:**
These solenoids are designed to give approximately 65°C temperature rise when operated at recommended duty cycle and voltage.

**Duty Cycle:**
Continuous: at 40°C ambient temperature.
Intermittent: 20% on time, 80% off time. On time not to exceed 3 min. at 40°C ambient temperature.

**Coil Insulation:**
Class "A": 105°C max. temperature, standard.
Class "B": 130°C max. temperature available on request.

**Materials and Finish:**
Coil: Polyester tape varnished.
Bobbin: Phenolic
Frame: C.R. steel zinc dichromate plating.
Plunger: C.R. steel zinc chromate plating.
Biasing Spring: Stainless steel.

**Plunger Linkage:**
Link type construction Type "C" standard. Request drawing.
One piece machined construction Type "A" available (B-18).
Type "A" standard (B-19).
Type "B" standard (B-20).
Link Type "C" available (B-19-20).

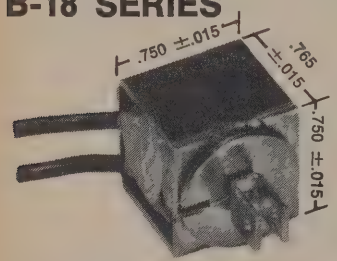
**Biasing Spring:**
Wire type spring per drawing, standard.

**Coil Termination:**
6″ leads Type #3, standard. Solder lugs Type #1 (B-20 only). Other terminations available.

**Average Total Weight:**
1.2 oz. (B-18); 1.6 oz. (B-19); 2.3 oz. (B-20).

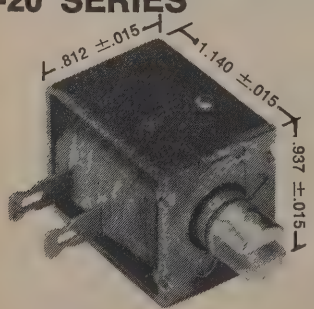
NOTE: DC solenoids do not have the magnetic disc shown in the drawing.

## B-18 SERIES




## B-19 SERIES

## B-20 SERIES




## AC SOLENOIDS

### B-18 SERIES

| PART NO. | B18-7-A-3 | B18-9-A-3 | B18-10-A-3 | B18-507-A-3 | B18-509-A-3 | B18-510-A-3 |
|---|---|---|---|---|---|---|
| Volts — 60 Hz | 120 | 24 | 12 | 120 | 24 | 12 |
| Duty | Cont. | Cont. | Cont. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 1500 | 47 | 11.9 | 984 | 39 | 9.9 |
| Watts Seated ±10% | 4.5 | 5.3 | 5.9 | 7.9 | 6.5 | 7.0 |
| Amps Seated ±10% | .05 | .28 | .59 | .08 | .37 | .74 |
| Amps @ ¼″ ±10% | .07 | .42 | 89 | .10 | .46 | .92 |
| Amps @ ⅛″ ±10% | .07 | .47 | .97 | .11 | .50 | 1.00 |
| Amps @ ¾″ ±10% | .07 | .48 | .98 | .12 | .51 | 1.10 |
| Amps @ ¼″ ±10% | .08 | .50 | .98 | .12 | .52 | 1.20 |
| Force @ 100% Rated Voltage 35°C. ¼″ Max. Stroke | 18 oz. @ Min. 1 oz. @ Max. | | | 18 oz. @ Min. 1.8 oz. @ Max. | | |

### B-19 SERIES

| PART NO. | B19-1-A-3 | B19-3-A-3 | B19-4-A-3 | B19-501-A-3 | B19-503-A-3 | B19-504-A-3 |
|---|---|---|---|---|---|---|
| Volts — 60 Hz | 120 | 24 | 24 | 120 | 24 | 12 |
| Duty | Cont. | Cont. | Cont. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 1100 | 40.5 | 10.4 | 675 | 25.6 | 6.3 |
| Watts Seated ±10% | 4.4 | 4.8 | 4.7 | 7.4 | 7.9 | 7.6 |
| Amps Seated ±10% | .05 | .27 | .56 | .09 | .48 | .99 |
| Amps @ ⅛″ ±10% | .09 | .46 | .94 | .14 | .73 | 1.50 |
| Amps @ ¼″ ±10% | .10 | .52 | 1.00 | .16 | .83 | 1.65 |
| Amps @ ⅜″ ±10% | .11 | .58 | 1.10 | .17 | .90 | 1.75 |
| Amps @ ½″ ±10% | .12 | .60 | 1.20 | .18 | .92 | 1.90 |
| Force @ 100% Rated Voltage: 35°C. ½″ Max. Stroke | 20 oz. @ Min. 1.5 oz. @ Max. | | | 20 oz. @ Min. 2 oz. @ Max. | | |

### B-20 SERIES

| PART NO. | B20-1-A-1 | B20-2-A-1 | B20-3-A-1 | B20-4-A-1 | B20-501-A-1 | B20-502-A-1 | B20-503-A-1 | B20-504-A-1 |
|---|---|---|---|---|---|---|---|---|
| Volts — 60 Hz | 120 | 240 | 24 | 12 | 120 | 240 | 24 | 12 |
| Duty | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms at 25°C.) | 580 | 3000 | 31 | 7.6 | 338 | 1410 | 13.5 | 3.4 |
| Watts Seated ±10% | 6.0 | 5.3 | 4.5 | 4.5 | 12.5 | 12.0 | 11.2 | 11.5 |
| Amps Seated ±10% | .07 | .03 | .28 | .57 | .14 | .07 | .65 | 1.40 |
| Amps @ ⅛″ ±10% | .14 | .06 | .56 | 1.20 | .25 | .12 | 1.20 | 2.50 |
| Amps @ ¼″ ±10% | .17 | .07 | .84 | 1.40 | .23 | .14 | 1.45 | 2.95 |
| Amps @ ⅜″ ±10% | .18 | .07 | .72 | 1.40 | .30 | .15 | 1.60 | 3.10 |
| Amps @ ½″ ±10% | .19 | .07 | .76 | 1.55 | .32 | .16 | 1.65 | 3.50 |
| Force @ 100% Rated Voltage: 35°C. ½″ Max. Stroke | 20 oz. @ Min. 3.5 oz. @ Max. | | | | 34 oz. @ Min. 4.0 oz. @ Max. | | | |

## DC SOLENOIDS

### B-18 SERIES

| PART NO. | B18-256-A-3 | B18-256-A-3 | B18-260-A-3 | B18-261-A-3 | B18-756-A-3 | B18-759-A-3 | B18-760-A-3 | B18-761-A-3 |
|---|---|---|---|---|---|---|---|---|
| Volts — DC | 48 | 24 | 12 | 6 | 48 | 24 | 12 | 6 |
| Duty | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 482 | 119 | 29 | 7.3 | 380 | 93.5 | 24.2 | 5.8 |
| Max. Watts | 5.3 | 5.5 | 5.5 | 5.5 | 6.7 | 7.0 | 6.6 | 6.9 |
| Max. Amps. | .11 | .23 | .46 | .91 | .14 | .29 | .55 | 1.15 |
| Force @ 100% Rated Voltage: 35°C. ¼″ Max. Stroke | 18 oz. @ Min. 1 oz. @ Max. | | | | 18 oz. @ Min. 1.5 oz. @ Max. | | | |

### B-19 SERIES

| PART NO. | B19-252-A-3 | B19-253-A-3 | B19-254-A-3 | B19-255-A-3 | B19-752-A-3 | B19-753-A-3 | B19-754-A-3 | B19-755-A-3 |
|---|---|---|---|---|---|---|---|---|
| Volts — DC | 48 | 24 | 12 | 6 | 48 | 24 | 12 | 6 |
| Duty | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 440 | 110 | 27.8 | 6.9 | 260 | 67.8 | 16.6 | 4.3 |
| Max. Watts | 5.8 | 5.8 | 5.8 | 5.8 | 10.1 | 9.6 | 9.7 | 9.3 |
| Max. Amps | .12 | .24 | 4.8 | .97 | .21 | .40 | .81 | 1.55 |
| Force @ 100% Rated Voltage @ 35°C. ½″ Max. Stroke | 20 oz. @ Min. 1 oz. @ Max. | | | | 20 oz. @ Min. 1.5 oz. @ Max. | | | |

### B-20 SERIES

| PART NO. | B20-251-A-1 | B20-252-A-1 | B20-253-A-1 | B20-254-A-1 | B20-255-A-1 | B20-751-A-1 | B20-752-A-1 | B20-753-A-1 | B20-754-A-1 | B20-755-A-1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Volts — DC | 115 | 48 | 24 | 12 | 6 | 115 | 48 | 24 | 12 | 6 |
| Duty | Cont. | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 2300 | 398 | 99 | 25 | 6.22 | 1100 | 193 | 49 | 12 | 3 |
| Max. Watts | 6.9 | 6.7 | 6.5 | 6.4 | 6.4 | 13.8 | 13.5 | 13.2 | 13.3 | 13.3 |
| Max. Amps | .06 | .14 | .27 | .53 | 1.07 | .12 | .28 | .55 | 1.11 | 2.22 |
| Force @ 100% Rated Voltage: 35°C. ½″ Max. Stroke | 18 oz. @ Min. 1.0 oz. @ Max. | | | | | 32 oz. @ Min. 2.0 oz. @ Max. | | | | |

NOTE: Solenoids available from distributor stock are indicated in screen.

# BOX FRAME SOLENOIDS B-21/B-22/B-24

## GENERAL SPECIFICATIONS

**Standard Voltages:**
AC: 240, 120, 24 and 12.
DC: 115, 48, 24, 12 and 6.
Voltages available from distributor stock are indicated in screened area of chart.
Other voltages available on request.

**AC Frequency:**
60 Hz standard.
50 Hz available on request.

**Coil Temperature:**
These solenoids are designed to give approximately 65°C temperature rise when operated at recommended duty cycle and voltage.

**Duty Cycle:**
Continuous: at 40°C ambient temperature.
Intermittent: 20% on time, 80% off time. On time not to exceed 3 min. at 40°C ambient temperature.

**Coil Insulation:**
Class "A": 105°C max. temperature, standard.
Class "B": 130°C max. temperature available on request (except for B-24).

**Materials and Finish:**
Coil: Polyester tape varnished.
Cotton tape varnished (B-22/B-24).
Bobbin: Phenolic.
Nylon with brass tube (B-24).
Frame: C.R. steel zinc dichromate plating.
Plunger: C.R. steel zinc chromate plating.
Biasing Spring: Stainless steel.

**Biasing Spring:**
Wire type spring per drawing, standard.

**Coil Termination:**
Solder lugs, Type #1 per drawing, standard.
Other terminations available.

**Plunger Linkage:**
Request drawing.
One piece machined construction Type "B" standard.
Link Type "C" available.

**Average Total Weight:**
5.4 oz. (B-21); 7.9 oz. (B-22); 8.1 oz. (8-24).

## AC SOLENOIDS

### B-21 SERIES

| PART NO. | B21-1-A-1 | B21-2-A-1 | B21-3-A-1 | B21-4-A-1 | B21-501-A-1 | B21-502-A-1 | B21-503-A-1 | B21-504-A-1 |
|---|---|---|---|---|---|---|---|---|
| Volts — 60 Hz | 120 | 240 | 24 | 12 | 120 | 240 | 24 | 12 |
| Duty | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms ± 25°C.) | 234 | 950 | 9.5 | 2.5 | 124 | 498 | 3.9 | 1.1 |
| Watts Seated ±10% | 7.8 | 8.0 | 7.3 | 7.5 | 19.5 | 19.8 | 22.0 | 20.0 |
| Amps Seated ±10% | .10 | .06 | .53 | 1.10 | .25 | .11 | 1.40 | 2.80 |
| Amps @ 1/16" ±10% | .25 | .12 | 1.20 | 2.50 | .50 | .28 | 2.90 | 5.70 |
| Amps @ 1/8" ±10% | .32 | .16 | 1.60 | 3.20 | .63 | .31 | 3.70 | 7.60 |
| Amps @ 3/16" ±10% | .38 | .19 | 1.90 | 3.80 | .70 | .36 | 4.50 | 8.30 |
| Amps @ 1/4" ±10% | .43 | .21 | 2.00 | 4.00 | .76 | .41 | 5.00 | 9.50 |
| Amps @ 5/16" ±10% | .44 | .22 | 2.20 | 4.50 | .82 | .42 | 5.20 | 10.00 |
| Force @ 100% Rated Voltage: 35°C. 5/16" Max. Stroke | 54 oz. @ Min. 6.0 oz. @ Max. | | | | 72 oz. @ Min. 12.0 oz. @ Max. | | | |

### B-22 SERIES

| PART NO. | B22-1-A-1 | B22-2-A-1 | B22-3-A-1 | B22-4-A-1 | B22-501-A-1 | B22-502-A-1 | B22-503-A-1 | B22-504-A-1 |
|---|---|---|---|---|---|---|---|---|
| Volts — 60 Hz | 120 | 240 | 24 | 12 | 120 | 240 | 24 | 12 |
| Duty | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 119 | 471 | 4.3 | 1.1 | 45 | 179 | 1.8 | .46 |
| Watts Seated ±10% | 10.5 | 10.4 | 10.8 | 10.8 | 39.1 | 41.0 | 33.5 | 32.0 |
| Amps Seated ±10% | .15 | .07 | .80 | 1.80 | .50 | .23 | 2.40 | 4.10 |
| Amps @ 1/4" ±10% | .37 | .19 | 2.00 | 4.10 | 1.00 | .54 | 5.00 | 9.40 |
| Amps @ 1/2" ±10% | .54 | .26 | 3.00 | 6.10 | 1.50 | .74 | 6.90 | 13.00 |
| Amps @ 3/4" ±10% | .70 | .35 | 3.80 | 7.80 | 1.90 | .98 | 8.60 | 17.00 |
| Amps @ 1" ±10% | .82 | .41 | 4.50 | 8.90 | 2.20 | 1.00 | 10.00 | 19.00 |
| Force @ 100% Rated Voltage: 35°C. 1" Max. Stroke | 28 oz. @ Min. 11 oz. @ Max. | | | | 72 oz. @ Min. 30 oz. @ Max. | | | |

### B-24 SERIES

| PART NO. | B24-1-A-1 | B24-2-A-1 | B24-3-A-1 | B24-4-A-1 | B24-501-A-1 | B24-502-A-1 | B24-503-A-1 | B24-504-A-1 |
|---|---|---|---|---|---|---|---|---|
| Volts — 60 Hz | 120 | 240 | 24 | 12 | 120 | 240 | 24 | 12 |
| Duty | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. |
| Coil Resistance ±% (Ohms @ 25°C.) | 173 | 706 | 6.8 | 1.7 | 67.2 | 270 | 2.6 | .66 |
| Watts Seated ±10% | 12.0 | 12.5 | 12.4 | 14.0 | 36.2 | 36.5 | 37.5 | 42.0 |
| Amps Seated ±10% | .12 | .06 | .60 | 1.30 | .36 | .18 | 1.80 | 3.90 |
| Amps @ 1/4" ±10% | .23 | .11 | 1.20 | 2.50 | .62 | .32 | 3.20 | 6.20 |
| Amps @ 1/2" ±10% | .30 | .15 | 1.50 | 3.20 | 83 | .40 | 4.20 | 8.20 |
| Amps @ 3/4" ±10% | .40 | .20 | 2.00 | 4.30 | 1.00 | .54 | 5.00 | 10.50 |
| Amps @ 1" ±10% | .50 | .25 | 2.60 | 5.50 | 1.30 | .66 | 6.50 | 12.80 |
| Amps @ 1 1/4" ±10% | .58 | .29 | 3.00 | 5.90 | 1.46 | .73 | 7.90 | 14.50 |
| Force @ 100% Rated Voltage: 35°C. 1 1/4" Max. Stroke | 24 oz. @ Min. 6 oz. @ Max. | | | | 28 oz. @ Min. 16 oz. @ Max. | | | |

## DC SOLENOIDS

### B-21 SERIES

| PART NO. | B21-251-A-1 | B21-252-A-1 | B21-253-A-1 | B21-254-A-1 | B21-255-A-1 | B21-751-A-1 | B21-752-A-1 | B21-753-A-1 | B21-754-A-1 | B21-755-A-1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Volts — DC | 115 | 48 | 24 | 12 | 6 | 115 | 48 | 24 | 12 | 6 |
| Duty | Cont. | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 1800 | 286 | 72.3 | 17.5 | 4 | 640 | 116 | 28 | 7 | 1.8 |
| Max. Watts | 8.1 | 9.1 | 8.9 | 9.1 | 10.0 | 23.0 | 22.1 | 22.8 | 22.8 | 22.2 |
| Max. Amps | .07 | .19 | .37 | .76 | 1.67 | .20 | .46 | .95 | 1.90 | 3.70 |
| Force @ 100% Rated Voltage: 35°C. 1/8" Max. Stroke | 64 oz. Min. 2.0 oz. @ Max. | | | | | 128 oz. @ Min. 4.0 oz. @ Max. | | | | |

### B-22 SERIES

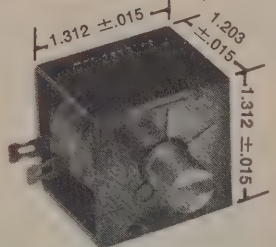
| PART NO. | B22-251-A-1 | B22-252-A-1 | B22-253-A-1 | B22-254-A-1 | B22-255-A-1 | B22-751-A-1 | B22-752-A-1 | B22-753-A-1 | B22-754-A-1 | B22-755-A-1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Volts — DC | 115 | 48 | 24 | 12 | 6 | 115 | 48 | 24 | 12 | 6 |
| Duty | Cont. | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 1420 | 266 | 66 | 16.5 | 4 | 493 | 84 | 22 | 5.3 | 1.4 |
| Max. Watts | 10.4 | 9.6 | 9.6 | 9.7 | 10.0 | 29.9 | 30.7 | 29.0 | 30.3 | 28.6 |
| Max. Amps | .09 | .20 | .40 | .81 | 1.67 | .26 | .64 | 1.21 | 2.52 | 4.76 |
| Force @ 100% Rated Voltage: 35°C 1" Max. Stroke | 54 oz. @ Min. 1.5 oz. @ Max. | | | | | 136 oz. @ Min. 3.0 oz. @ Max. | | | | |

### B-24 SERIES

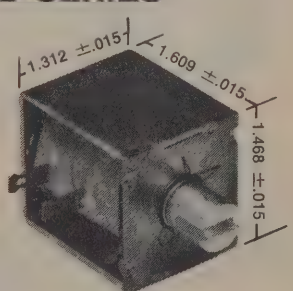
| PART NO. | B24-251-A-1 | B24-252-A-1 | B24-253-A-1 | B24-254-A-1 | B24-255-A-1 | B24-751-A-1 | B24-752-A-1 | B24-753-A-1 | B24-754-A-1 | B24-755-A-1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Volts — DC | 115 | 48 | 24 | 12 | 6 | 115 | 48 | 24 | 12 | 6 |
| Duty | Cont. | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 1348 | 238 | 60 | 14.7 | 4 | 615 | 107 | 25.4 | 6.3 | 1.8 |
| Max. Watts | 11.5 | 10.6 | 10.6 | 10.9 | 10.0 | 24.2 | 24.0 | 25.2 | 25.5 | 25.0 |
| Max. Amps | .10 | .22 | .44 | .91 | 1.67 | .21 | .50 | 1.05 | 2.12 | 4.17 |
| Force @ 100% Rated Voltage: 35°C. 5/16" Max. Stroke | 54 oz. @ Min. 3 oz. @ Max. | | | | | 60 oz. @ Min. 4 oz. @ Max. | | | | |

NOTE: Solenoids available from distributor stock are indicated in screen.

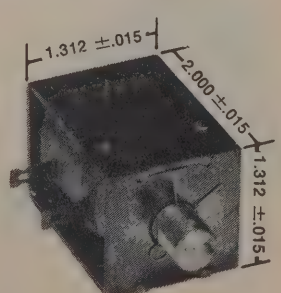
## B-21 SERIES




## B-22 SERIES




## B-24 SERIES



# DORMEYER INDUSTRIES

*A Division of A. F. Dormeyer Mfg. Co., Inc.*

# SOLENOIDS

## BOX FRAME SOLENOIDS B-25/B-27

### GENERAL SPECIFICATIONS

**Standard Voltages:**
AC: 240, 120, 24 and 12/DC: 115, 48, 24, 12 and 6. Voltages available from distributor stock are indicated in screened area of chart.
Other voltages available on request.

**AC Frequency**
60 Hz standard / 50 Hz available on request.

**Coil Temperature:**
These solenoids are designed to give approximately 65°C temperature rise when operated at recommended duty cycle and voltage.

**Duty Cycle:**
Continuous: at 40°C ambient temperature.
Intermittent: 20% on time, 80% off time. On time not to exceed 3 min. at 40°C ambient temperature.

**Coil Insulation:**
Class "A": 105°C max. temperature.
Class "B": 130°C max. temperature available on request (B-27).

**Materials and Finish:**
Coil: Cotton tape varnished.
Bobbin: Nylon with brass tube. Phenolic (B-27).
Frame: C.R. steel zinc dichromate plating.
Plunger: C.R. steel zinc chromate plating.
Biasing Spring: Stainless steel.

**Biasing Spring:**
Wire type spring per drawing, standard.

**Coil Termination:**
Solder lugs, Type #1, standard. Other terminations available.

**Plunger Linkage:**
Request drawing.
One piece machined construction.
Type "B" standard (B-27).
Link Type "C" available (B-27).

**Average Total Weight:**
12.0 oz. (B-25); 3.5 oz. (B-27).

### AC SOLENOIDS

**B-25 SERIES**

| PART NO. | B25-1-A-1 | B25-2-A-1 | B25-3-A-1 | B25-4-A-1 | B25-501-A-1 | B25-502-A-1 | B25-503-A-1 | B25-504-A-1 |
|---|---|---|---|---|---|---|---|---|
| Volts — 60 Hz | 120 | 240 | 24 | 12 | 120 | 240 | 24 | 12 |
| Duty | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 121 | 462 | 6.3 | 1.5 | 46 | 187 | 1.6 | .42 |
| Watts Seated ±10% | 13.0 | 14.0 | 12.3 | 11.8 | 38.0 | 38.0 | 45.0 | 43.5 |
| Amps Seated ±10% | .12 | .08 | .65 | 1.20 | .38 | .20 | 2.30 | 4.50 |
| Amps @ ⅛" ±10% | .25 | .15 | 1.30 | 2.50 | .76 | .38 | 4.40 | 8.40 |
| Amps @ 1" ±10% | .43 | .24 | 2.00 | 4.00 | 1.30 | .58 | 6.60 | 13.50 |
| Amps @ 1⅛" ±10% | .70 | .36 | 3.10 | 5.90 | 1.80 | .88 | 10.00 | 19.20 |
| Amps @ 2" ±10% | .88 | .46 | 3.80 | 7.10 | 2.50 | 1.10 | 12.00 | 22.00 |
| Force @ 100% Rated Voltage: 35°C. 2" Max. Stroke | 16 oz. @ Min. 3 oz. @ Max. | | | | 32 oz. @ Min. 8 oz. @ Max. | | | |

**B-27 SERIES**

| PART NO. | B27-1-A-1 | B27-2-A-1 | B27-3-A-1 | B27-4-A-1 | B27-501-A-1 | B27-502-A-1 | B27-503-A-1 | B27-504-A-1 |
|---|---|---|---|---|---|---|---|---|
| Volts — 60 Hz | 120 | 240 | 24 | 12 | 120 | 240 | 24 | 12 |
| Duty | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 474 | 1982 | 19.1 | 4.72 | 200 | 793 | 8.0 | 1.93 |
| Watts Seated ±10% | 6.7 | 5.7 | 6.0 | 5.6 | 16.8 | 17.1 | 17.0 | 16.6 |
| Amps Seated ±10% | .07 | .05 | .48 | .80 | .21 | .10 | 1.10 | 2.05 |
| Amps @ ¼" ±10% | .18 | .09 | .96 | 1.90 | .42 | .21 | 2.00 | 4.20 |
| Amps @ ½" ±10% | .24 | .11 | 1.20 | 2.40 | .51 | .26 | 2.50 | 4.80 |
| Amps @ ¾" ±10% | .26 | .12 | 1.30 | 2.45 | .54 | .27 | 2.75 | 5.30 |
| Amps @ 1" ±10% | .28 | .13 | 1.40 | 2.50 | .58 | .29 | 2.90 | 5.60 |
| Force @ 100% Rated Voltage: 35°C. 1" Max. Stroke | 16 oz. @ Min. 2 oz. @ Max. | | | | 32 oz. @ Min. 4 oz. @ Max. | | | |

### DC SOLENOIDS

**B-25 SERIES**

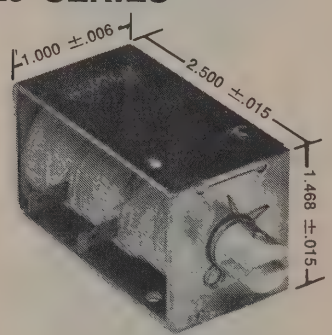
| PART NO. | B25-251-A-1 | B25-252-A-1 | B25-253-A-1 | B25-254-A-1 | B25-255-A-1 | B25-751-A-1 | B25-752-A-1 | B25-753-A-1 | B25-754-A-1 | B25-755-A-1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Volts — DC | 115 | 48 | 24 | 12 | 6 | 115 | 48 | 24 | 12 | 6 |
| Duty | Cont. | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 1162 | 187 | 46 | 11.4 | 2.9 | 544 | 87 | 22 | 5.7 | 1.3 |
| Max. Watts | 12.7 | 13.9 | 13.4 | 14.1 | 13.8 | 27.6 | 29.3 | 29.1 | 28.1 | 30.8 |
| Max. Amps | .11 | .29 | .58 | 1.17 | 2.30 | .24 | .61 | 1.21 | 2.34 | 5.31 |
| Force @ 100% Rated Voltage: 35°C. 1" Max. Stroke | 112 oz. @ Min. 4 oz. @ Max. | | | | | 128 oz. @ Min. 8 oz. @ Max. | | | | |

**B-27 SERIES**

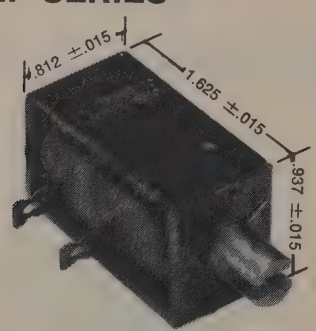
| PART NO. | B27-251-A-1 | B27-252-A-1 | B27-253-A-1 | B27-254-A-1 | B27-255-A-1 | B27-751-A-1 | B27-752-A-1 | B27-753-A-1 | B27-754-A-1 | B27-755-A-1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Volts — DC | 115 | 48 | 24 | 12 | 6 | 115 | 48 | 24 | 12 | 6 |
| Duty | Cont. | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 1953 | 317 | 79 | 20 | 4.9 | 1065 | 144 | 36 | 9.1 | 2.2 |
| Max. Watts | 8.1 | 8.2 | 8.2 | 8.2 | 8.2 | 13.8 | 17.8 | 17.8 | 17.5 | 18.2 |
| Max. Amps | .07 | .17 | .34 | .68 | 1.36 | .12 | .37 | .74 | 1.46 | 3.03 |
| Force @ 100% Rated Voltage: 35°C. ¾" Max. Stroke | 20 oz. @ Min. 1 oz. @ Max. | | | | | 40 oz. @ Min. 2 oz. @ Max. | | | | |

NOTE: Solenoids available from distributor stock are indicated in screen.

## B-25 SERIES




## B-27 SERIES



# SOLENOIDS

## PULL-TYPE TUBULAR SOLENOIDS P-2/P-4/P-6/P-8

**(PATENTS: NOS. 3,303,445 AND 3,400,351)**

### GENERAL SPECIFICATIONS

**Standard Voltages:**
DC: 12 and 24.
All voltages available from distributor.
Other DC voltages available on request.

**Coil Temperature:**
These solenoids are designed to give approximately 65°C temperature rise when operated at recommended duty cycle and voltage.

**Duty Cycles:**
Continuous: at 40°C ambient temperature.:
Intermittent: 20% on time, 80% off time. On time not to exceed 3 min. at 40°C ambient temperature.
Pulse: 10% duty cycle. 90% off time. On time not to exceed 1 sec. at 40°C ambient temperature.

**Coil Insulation:**
Class "A": 105°C max. temperature standard.
Class "F": 155°C max. temperature available on request.

**Material and Finish (Metal Parts):**
Metal Parts: Steel zinc chromate plating.
Plunger: Steel with special corrosion resistant low friction coating.
Plunger Cavity: Stainless steel.
Lock Washer: Spring steel zinc plated.
Plunger Stop Stainless steel; brass (P-8).
Push Pin: Stainless steel.
Plunger Return Spring: Stainless steel.
Plunger Retaining Cap: High temperature plastic.
Plastic Cap Retaining Spring: Music wire zinc plated.

**Materials (Coil):**
Coil Insulation: Polyester.
Leads: #28 GA. P.V.C.
Lead Seal: Epoxy.

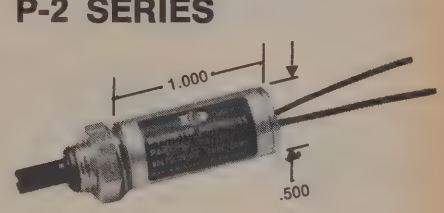
**Coil Termination:**
6″ leads standard.
Solder lug termination available.

**Average Total Weight:**
1.0 oz. (P-2); 3.0 oz. (P-4); 6.4 oz. (P-6); 1.1 oz. (P-8).

NOTE: Solenoids include mounting hardware.

**P-2 SERIES**

| PART NO. | P2-1L | P2-2L | P2-101L | P2-102L | P2-201L | P2-202L |
|---|---|---|---|---|---|---|
| Volts — DC | 12 | 24 | 12 | 24 | 12 | 24 |
| Duty | Cont. | Cont. | Int. | Int. | Pulse | Pulse |
| Coil Resistance (Ohms) ±10% @ 25°C. | 39 | 168 | 30.5 | 105 | 6.9 | 30.5 |
| Maximum Coil Current (Amps) | .34 | .16 | .44 | .26 | 1.94 | .88 |
| Minimum Holding Force @ Rated Voltage: 35°C. (Oz.) | 5.3 | 5.3 | 10.5 | 10.5 | 20 | 20 |
| Minimum Holding @ 85% Rated Voltage: 65°C. (Oz.) | 3.2 | 3.2 | 6.5 | 6.5 | 15 | 15 |
| Force @ 100% Rated Voltage: 35°C. 3/16″ Max. Stroke | 4 oz. @ Min.<br>¼ oz. @ Max. | | 8 oz. @ Min.<br>½ oz. @ Max. | | 16 oz. @ Min.<br>1 oz. @ Max. | |

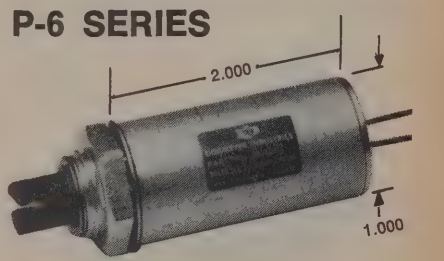



**P-4 SERIES**

| PART NO. | P4-1L | P4-2L | P4-101L | P4-102L | P4-201L | P4-202L |
|---|---|---|---|---|---|---|
| Volts — DC | 12 | 24 | 12 | 24 | 12 | 24 |
| Duty | Cont. | Cont. | Int. | Int. | Pulse | Pulse |
| Coil Resistance (Ohms) ±10% @ 25°C. | 23.3 | 99 | 15.3 | 54.5 | 3.6 | 15.3 |
| Maximum Coil Current (Amps) | .57 | .27 | .87 | .49 | 3.7 | 1.8 |
| Minimum Holding Force @ Rated Voltage: 35°C. (Oz.) | 39 | 39 | 46 | 46 | 71 | 71 |
| Minimum Holding @ 85% Rated Voltage: 65°C. (Oz.) | 28 | 28 | 34 | 34 | 65 | 65 |
| Force @ 100% Rated Voltage: 35°C. 5/16″ Max. Stroke | 20 oz. @ Min.<br>¾ oz. @ Max. | | 36 oz. @ Min.<br>1 oz. @ Max. | | 64 oz. @ Min.<br>4 oz. @ Max. | |

**P-6 SERIES**

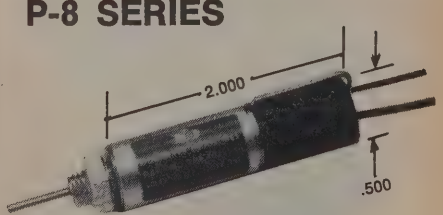
| PART NO. | P6-1L | P6-2L | P6-101L | P6-102L | P6-201L | P6-202L |
|---|---|---|---|---|---|---|
| Volts — DC | 12 | 24 | 12 | 12 | 12 | 24 |
| Duty | Cont. | Cont. | Int. | Int. | Pulse | Pulse |
| Coil Resistance (Ohms) ±10% @ 25°C. | 19.5 | 82 | 8.4 | 32.9 | 3.3 | 14.3 |
| Maximum Coil Current (Amps) | .69 | .33 | 1.59 | .81 | 4.1 | 1.87 |
| Minimum Holding Force @ Rated Voltage: 35°C. (Oz.) | 79 | 79 | 110 | 110 | 180 | 180 |
| Minimum Holding @ 85% Rated Voltage: 65°C. (Oz.) | 67.5 | 67.5 | 101 | 101 | 158 | 158 |
| Force @ 100% Rated Voltage: 35°C. 5/16″ Max. Stroke | 64 oz. @ Min.<br>3 oz. @ Max. | | 112 oz. @ Min.<br>6 oz. @ Max. | | 128 oz. @ Min.<br>12 oz. @ Max. | |




**P-8 SERIES**

| PART NO. | P8-1L | P8-2L | P8-101L | P8-102L | P8-201L | P8-202L |
|---|---|---|---|---|---|---|
| Volts — DC | 12 | 24 | 12 | 24 | 12 | 24 |
| Duty | Cont. | Cont. | Int. | Int. | Pulse | Pulse |
| Coil Resistance (Ohms) ±10% @ 25°C. | 39 | 168 | 30.5 | 105 | 6.9 | 30.5 |
| Maximum Coil Current (Amps) | .34 | .16 | .44 | .26 | 1.94 | .88 |
| Minimum Holding Force @ Rated Voltage: 35°C. (Oz.) | 3.2 | 3.2 | 7 | 7 | 17 | 17 |
| Minimum Holding @ 85% Rated Voltage: 65°C. (Oz.) | 1.7 | 1.7 | 3.4 | 3.4 | 12.5 | 12.5 |
| Force @ 100% Rated Voltage: 35°C. 3/16″ Max. Stroke | 3¼ oz. @ Min.<br>⅛ oz. @ Max. | | 7 oz. @ Min.<br>⅛ oz. @ Max. | | 16 oz. @ Min.<br>2⅛ oz. @ Max. | |

NOTE: Solenoids available from distributor stock are indicated in screen.



# DORMEYER INDUSTRIES

*A Division of A. F. Dormeyer Mfg. Co., Inc.*

# SOLENOIDS

## PUSH-TYPE TUBULAR SOLENOIDS P-10 (PATENTS: NOS. 3,303,445 AND 3,400,351)

### GENERAL SPECIFICATIONS

**Standard Voltages:**
DC: 12 and 24.
All voltages available from distributor stock.
Other DC voltages available on request.

**Coil Temperature:**
These solenoids are designed to gixe approximately 65°C temperature rise when operated at recommended duty cycle and voltage.

**Duty Cycles:**
Continuous: at 40°C ambient temperature.
Intermittent: 20% on time, 80% off time. On time not to exceed 3 min. at 40°C ambient temperature.
Pulse: 10% duty cycle. 90% off time at 40°C ambient temperature.

**Coil Insulation:**
Class "A": 105°C max. temperature standard.
Class "F": 155°C max. temperature available on request.

**Materials and Finish (Metal Parts):**
Metal Parts: Steel zinc chromate plating.
Plunger: Steel with special corrosion resistant low friction coating.
Plunger Cavity: Stainless steel.
Lock Washer: Spring steel zinc plated.
Plunger Stop: Brass.
Push Pin: Stainless steel.
Plunger Retaining Cap: High temperature plastic.
Plunger Return Spring: Stainless steel.
Plastic Cap Retaining-Spring: Music wire zinc plated.

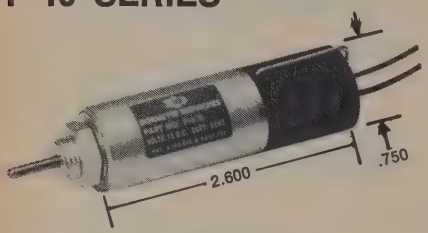
**Materials (Coil):**
Coil Insulation: Polyester.
Leads: #28 GA. P.V.C.
Lead Seal: Epoxy.

**Coil Termination:**
6" leads per drawing.

**Average Total Weight:**
3.2 oz.

NOTE: Solenoids include mounting hardware. Push type tubular solenoids include plunger return spring and plunger stop.

## P-10 SERIES




| PART NO. | P10-1L | P10-2L | P10-101L | P10-102L | P10-201L | P10-202L |
|---|---|---|---|---|---|---|
| Volts — DC | 12 | 24 | 12 | 24 | 12 | 24 |
| Duty | Cont. | Cont. | Int. | Int. | Pulse | Pulse |
| Coil Resistance (Ohms) ±10% @ 25°C. | 23.3 | 99 | 15.3 | 54.5 | 3.6 | 15.3 |
| Maximum Coil Current (Amps) | .58 | .27 | .87 | .49 | 3.7 | 1.8 |
| Minimum Holding Force @ Rated Voltage: 35°C. (Oz.) | 29 | 29 | 33 | 33 | 66 | 66 |
| Minimum Holding @ 85% Rated Voltage: 85°C. (Oz.) | 22 | 22 | 26 | 26 | 55 | 55 |
| Force @ 100% Rated Voltage: 35°C. ¼" Max. Stroke | 29 oz. @ Min. 2½ oz. @ Max. | | 31 oz. @ Min. 4½ oz. @ Max. | | 84 oz. @ Min. 19 oz. @ Max. | |

## LAMINATED AC SOLENOIDS 1000 (½" STACK) / 1000 (¾" STACK)

### GENERAL SPECIFICATIONS

**Standard Voltages:**
AC: 240, 120, 48 and 24.
Voltages available from distributor stock are indicated in screened area of chart.
Other AC voltages available on request.

**AC Frequency:**
60 Hz standard / 50 Hz available on request.

**Coil Temperature:**
These solenoids are designed to give approximately 65°C temperature rise when operated at recommended duty cycle and voltage.

**Duty Cycle:**
Continuous: at 40°C ambient temperature.
Intermittent: 20% on time, 80% off time. On ime not to exceed 3 min. at 40°C ambient temperature.

**Coil Insulation:**
Class "A": 105°C max. temperature standard.
Class "B": 130°C max. temperature, glass tape wound coil available on request.

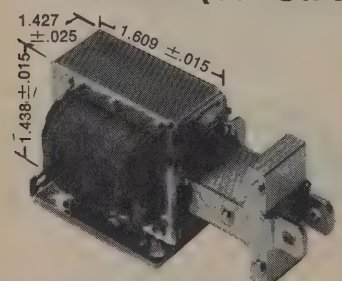
**Materials and Finish:**
Coil: Polyester encapsulated (1000 - ½"). Cotton tape varnished (1000 - ¾").
Bobbin: Phenolic.
Frame: Laminated steel zinc dichromate plated.
Plunger: Laminated steel zinc dichromate plated.
Anti-Residual Spring: Stainless steel.
Plunger Stop Spring: Spring steel.
Plunger Guides: Brass.

**Coil Termination:**
Solder lugs Type #1 per drawing standard. Other termination available.

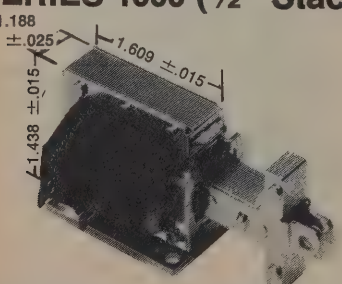
**Plunger Linkage:**
Straight, reinforced and link type available.

**Average Total Weight:**
6.5 oz. (1000 - ½"); 9.2 oz. (1000 - ¾").

## SERIES 1000 (¾" Stack)




## SERIES 1000 (½" Stack)




**SERIES 1000 (½" STACK)**

| PART NO. | 1000-M-1 | 1001-M-1 | 1003-M-1 | 1004-M-1 | 1500-M-1 | 1501-M-1 | 1503-M-1 | 1504-M-1 |
|---|---|---|---|---|---|---|---|---|
| Volts — 60 Hz | 120 | 240 | 48 | 24 | 120 | 240 | 48 | 24 |
| Duty | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 88 | 354 | 14.2 | 3.6 | 58 | 240 | 9.5 | 2.3 |
| Watts Seated ±10% | 9.5 | 10.0 | 7.5 | 8.0 | 20.0 | 18.5 | 16.0 | 16.0 |
| Amps Seated ±10% | .24 | .15 | .48 | 1.10 | .52 | .24 | 1.10 | 2.20 |
| Amps @ ⅛" ±10% | .72 | .38 | 1.80 | 3.70 | 1.20 | .53 | 2.70 | 5.10 |
| Amps @ ¼" ±10% | .92 | .47 | 2.30 | 4.40 | 1.40 | .64 | 3.30 | 6.60 |
| Amps @ ⅜" ±10% | 1.00 | .52 | 2.70 | 5.00 | 1.70 | .76 | 3.80 | 7.50 |
| Amps @ ½" ±10% | 1.20 | .56 | 2.90 | 5.40 | 1.80 | .81 | 4.00 | 8.50 |
| Amps @ ⅝" ±10% | 1.22 | .60 | 3.00 | 5.60 | 1.90 | .84 | 4.00 | 9.00 |
| Force @ 100% Rated Voltage: 35°C. ¾" Max. Stroke | 128 oz. @ Min. 15 oz. @ Max. | | | | 144 oz. @ Min. 25 oz. @ Max. | | | |

**SERIES 1000 (¾" STACK)**

| PART NO. | 1250-A-1 | 1251-A-1 | 1253-A-1 | 1254-A-1 | 1750-A-1 | 1751-A-1 | 1753-A-1 | 1754-A-1 |
|---|---|---|---|---|---|---|---|---|
| Volts — 60 Hz | 120 | 240 | 48 | 24 | 120 | 240 | 48 | 24 |
| Duty | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 64 | 258 | 10 | 2.5 | 40.5 | 161 | 6.4 | 1.6 |
| Watts Seated ±10% | 10.7 | 9.0 | 9.8 | 8.5 | 17.7 | 19.5 | 16.0 | 16.2 |
| Amps Seated ±10% | .28 | .13 | .66 | 1.20 | .50 | .26 | 1.10 | 2.30 |
| Amps @ ⅛" ±10% | .96 | .44 | 2.40 | 4.60 | 1.40 | .72 | 3.60 | 7.00 |
| Amps @ ¼" ±10% | 1.20 | .58 | 3.00 | 5.80 | 1.80 | .93 | 4.70 | 9.20 |
| Amps @ ⅜" ±10% | 1.40 | .63 | 3.50 | 6.80 | 2.10 | 1.10 | 5.00 | 9.90 |
| Amps @ ½" ±10% | 1.60 | .72 | 3.80 | 7.50 | 2.40 | 1.30 | 5.50 | 11.60 |
| Amps @ ⅝" ±10% | 1.70 | .78 | 4.00 | 8.00 | 2.60 | 1.40 | 6.00 | 12.70 |
| Force @ 100% Rated Voltage: 35°C. ¾" Max. Stroke | 128 oz. @ Min. 18 oz. @ Max. | | | | 288 oz. @ Min. 34 oz. @ Max. | | | |

NOTE: Solenoids available from distributor stock are indicated in screen.

# LAMINATED AC SOLENOIDS 2000 (¾" STACK) / 2000 (1" STACK) / 3000 (1" STACK)

## GENERAL SPECIFICATIONS

**Standard Voltages:**
AC: 240, 120, 48 (2000 - ¾", 2000 - 1")
24 (2000 - ¾")
240, 120 (3000).
Voltages available from distributor stock are indicated in screened area of chart.
Other AC voltages available on request.

**AC Frequency:**
60 Hz standard.
50 Hz available on request.

**Coil Temperature:**
These solenoids are designed to give approximately 65°C temperature rise when operated at recommended duty cycle and voltage.

**Duty Cycle:**
Continuous: at 40°C ambient temperature.
Intermittent: 20% on time, 80% off time. On time not to exceed 3 min. at 40°C ambient temperature.

**Coil Insulation:**
Class "A": 105°C max. temperature standard.
Class "B": 130°C max. temperature, glass tape wound coil available on request.

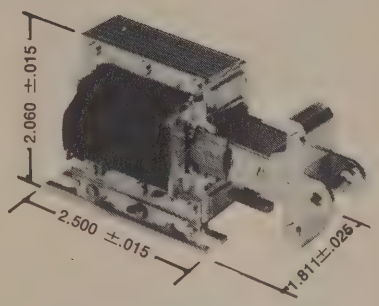
**Materials and Finish:**
Coil: Polyester encapsulated.
Bobbin: Phenolic.
Frame: Laminated steel zinc dichromate plated.
Plunger: Laminated steel zinc dichromate plated.
Anti-Residual Spring: Stainless steel.
Plunger Stop Spring: Spring steel.
Plunger Guides: Brass.

**Coil Termination:**
Solder lugs Type #1 per drawing standard.
Other termination available.

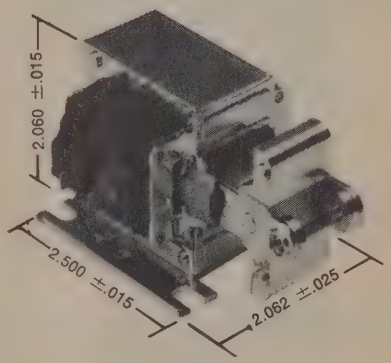
**Plunger Linkage:**
Straight, formed, reinforced and link type available.

**Average Total Weight:**
18 oz. (2000 - ¾")
22 oz. (2000 - 1").
43 oz. (3000 - 1").

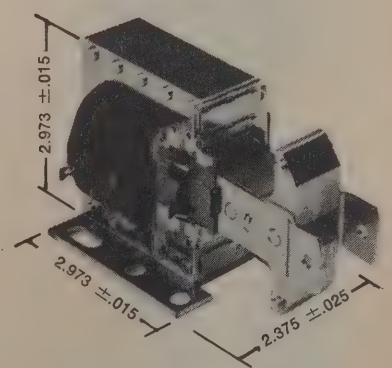
## 2000 — ¾"




## 2000 — 1"




## 3000 — 1"




### SERIES 2000 (¾" STACK)

| PART NO. | 2005-M-1 | 2006-M-1 | 2008-M-1 | 2009-M-1 | 2255-M-1 | 2256-M-1 | 2258-M-1 | 2259-M-1 |
|---|---|---|---|---|---|---|---|---|
| Volts — 60 Hz | 120 | 240 | 48 | 24 | 120 | 240 | 48 | 24 |
| Duty | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 20.5 | 82 | 3.3 | .81 | 18.3 | 73.5 | 3.0 | .75 |
| Watts Seated ±10% | 17.9 | 17.5 | 17.5 | 16.5 | 23.5 | 23.8 | 19.5 | 19.5 |
| Amps Seated ±10% | .43 | .22 | 1.10 | 2.30 | .64 | .32 | 1.25 | 2.80 |
| Amps @ ¼" ±10% | 2.30 | 1.10 | 5.10 | 11.00 | 2.80 | 1.40 | 6.00 | 12.00 |
| Amps @ ½" ±10% | 3.30 | 1.60 | 8.00 | 16.00 | 4.00 | 2.00 | 9.00 | 18.00 |
| Amps @ ¾" ±10% | 4.10 | 2.10 | 10.00 | 20.00 | 5.00 | 2.60 | 12.00 | 23.00 |
| Amps @ 1" ±10% | 4.90 | 2.50 | 11.20 | 22.00 | 6.00 | 2.90 | 14.00 | 26.00 |
| Force @ 100% Rated Voltage: 35°C. 1" Max. Stroke | 256 oz. @ Min. 64 oz. @ Max. | | | | 256 oz. @ Min. 68 oz. @ Max. | | | |

### SERIES 2000 (1" STACK)

| PART NO. | 2536-M-1 | 2537-M-1 | 2539-M-1 | 2786-M-1 | 2787-M-1 | 2789-M-1 |
|---|---|---|---|---|---|---|
| Volts — 60 Hz | 120 | 240 | 48 | 120 | 240 | 48 |
| Duty | Cont. | Cont. | Cont. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 14.9 | 60 | 2.3 | 11.9 | 48 | 2 |
| Watts Seated ±10% | 19.0 | 18.0 | 21.0 | 36.5 | 36.0 | 32.5 |
| Amps Seated ±10% | .48 | .24 | 1.40 | .95 | .48 | 2.00 |
| Amps @ ¼" ±10% | 2.90 | 1.50 | 7.00 | 4.30 | 2.20 | 10.00 |
| Amps @ ½" ±10% | 4.40 | 2.20 | 10.50 | 6.00 | 3.00 | 14.50 |
| Amps @ ¾" ±10% | 5.50 | 2.70 | 13.00 | 7.50 | 3.80 | 18.00 |
| Amps @ 1" ±10% | 6.50 | 3.20 | 16.00 | 8.50 | 4.30 | 19.50 |
| Force @ 100% Rated Voltage: 35°C. 1" Max. Stroke | 256 oz. @ Min. 90 oz. @ Max. | | | 512 oz. @ Min. 120 oz. @ Max. | | |

### SERIES 3000 (1" STACK)

| PART NO. | 3000-M-1 | 3001-M-1 | 3500-M-1 | 3501-M-1 |
|---|---|---|---|---|
| Volts — 60 Hz | 120 | 240 | 120 | 240 |
| Duty | Cont. | Cont. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 6.5 | 26 | 4.8 | 19.3 |
| Watts Seated ±10% | 26.0 | 23.5 | 47.0 | 48.0 |
| Amps Seated ±10% | .66 | .33 | 1.80 | .68 |
| Amps @ ¼" ±10% | 3.80 | 1.80 | 6.50 | 3.20 |
| Amps @ ½" ±10% | 5.50 | 2.80 | 9.50 | 4.80 |
| Amps @ ¾" ±10% | 7.50 | 3.90 | 13.00 | 6.60 |
| Amps @ 1" ±10% | 10.00 | 5.20 | 15.50 | 7.70 |
| Amps @ 1¼" ±10% | 12.00 | 6.50 | 17.00 | 8.50 |
| Force @ 100% Rated Voltage: 35°C. 1¼" Max. Stroke | 512 oz. @ Min. 200 oz. @ Max. | | 576 oz. @ Min. 264 oz. @ Max. | |

NOTE: Solenoids available from distributor stock are indicated in screen.

# DORMEYER INDUSTRIES

*A Division of A. F. Dormeyer Mfg. Co., Inc.*

T.M.

## SOLENOIDS

# "C" FRAME SOLENOIDS C-8 / C-9 / C-15

### GENERAL SPECIFICATIONS

**Standard Voltages:**
AC: 240, 120, 24 and 12.
DC: 115, 48, 24, 12 and 6.
Voltages available from distributor stock are indicated in screened area of chart.
Other voltages available on request.

**AC Frequency:**
60 Hz standard.
50 Hz available on request.

**Coil Temperature:**
These solenoids are designed to give approximately 65°C temperature rise when operated at recommended duty cycle and voltage.

**Duty Cycle:**
Continuous: at 40°C ambient temperature.
Intermittent: 20% on time, 80% off time. On time not to exceed 3 min. at 40°C ambient temperature.

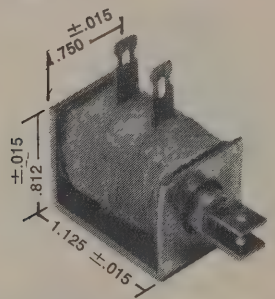
**Coil Insulation:**
Class "A": 105°C max. temperature.

**Materials and Finish:**
Coil: Polyester tape varnished (C-8); cotton tape varnished (C-9/C-15).
Bobbin: Nylon.
Frame: C.R. steel zinc dichromate plating.
Plunger: C.R. steel zinc chromate plating.

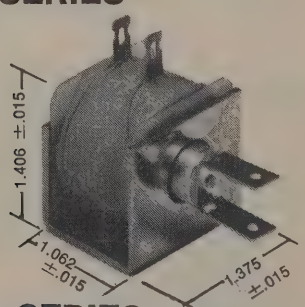
**Biasing Spring:**
Wire type spring available.

**Coil Termination:**
Solder lugs Type #14 per drawing, standard.
Other terminations available.

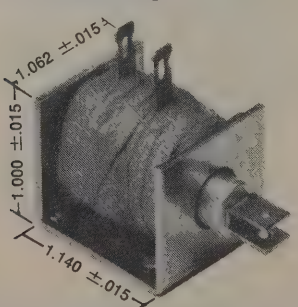
## C-8 SERIES




## C-9 SERIES




## C-15 SERIES




**Plunger Linkage:**
Link type construction; Type "A" standard (C-8/C-15); Type "B" standard (C-9).
One piece machined construction Type "C" available (C-8); Type "D" and Link Type "A" available (C-9); Type "E" available (C-15).

**Residual Spring:**
Leaf type spring available. See page ??. Must be used with link plunger, Type "A".

**Average Total Weight**
1.7 oz. (C-8); 4.7 oz. (C-9); 2.7 oz. (C-15).

## AC SOLENOIDS

### C-8 SERIES

| PART NO. | C8-19-A-14 | C8-20-A-14 | C8-21-A-14 | C8-22-A-14 | C8-519-A-14 | C8-520-A-14 | C8-521-A-14 | C8-522-A-14 |
|---|---|---|---|---|---|---|---|---|
| Volts — 60 Hz | 120 | 240 | 24 | 12 | 120 | 240 | 24 | 12 |
| Duty | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 620 | 2500 | 24.2 | 6.3 | 361 | 1550 | 15 | 3.6 |
| Watts Seated ±10% | 5.8 | 5.9 | 6.0 | 6.0 | 11.8 | 11.5 | 11.3 | 11.5 |
| Amps Seated ±10% | .07 | .05 | .40 | .75 | .14 | .08 | .70 | 1.40 |
| Amps @ ⅛" ±10% | .16 | .08 | .72 | 1.45 | .22 | .13 | 1.30 | 2.40 |
| Amps @ ¼" ±10% | .19 | .09 | .86 | 1.70 | .25 | .14 | 1.50 | 2.80 |
| Amps @ ⅜" ±10% | .20 | 10 | .90 | 1.80 | .27 | .15 | 1.60 | 2.90 |
| Amps @ ½" ±10% | .21 | .11 | .93 | 1.90 | .29 | .16 | 1.70 | 3.00 |
| Force @ 100% Rated Voltage: 35°C. ½" Max. Stroke | 16 oz. @ Min. 2,5 oz. @ Max. | | | | 32 oz. @ Min. 5.0 oz. @ Max. | | | |

### C-9 SERIES

| PART NO. | C9-19-A-14 | C9-20-A-14 | C9-21-A-14 | C9-22-A-14 | C9-519-A-14 | C9-520-A-14 | C9-521-A-14 | C9-522-A-14 |
|---|---|---|---|---|---|---|---|---|
| Volts — 60 Hz | 120 | 240 | 24 | 12 | 120 | 240 | 24 | 12 |
| Duty | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 172 | 698 | 6.8 | 1.7 | 74 | 295 | 3.1 | .7 |
| Watts Seated ±10% | 11.2 | 10.8 | 10.8 | 10.8 | 30.0 | 31.0 | 29.7 | 29.8 |
| Amps Seated ±10% | .18 | .09 | .80 | 1.60 | .42 | .23 | 2.30 | 4.25 |
| Amps @ ⅛" ±10% | .34 | .17 | 1.60 | 3.20 | .71 | .38 | 3.80 | 7.50 |
| Amps @ ¼" ±10% | .44 | .22 | 2.10 | 4.10 | .96 | .48 | 4.90 | 9.70 |
| Amps @ ⅜" ±10% | .52 | .26 | 2.60 | 5.10 | 1.10 | .56 | 5.70 | 11.00 |
| Amps @ ½" ±10% | .58 | .28 | 2.80 | 5.50 | 1.35 | .60 | 6.10 | 14.00 |
| Force @ 100% Rated Voltage: 35°C. ½" Max. Stroke | 54 oz. @ Min. 12 oz. @ Max. | | | | 112 oz. @ Min. 28 oz. @ Max. | | | |

### C-15 SERIES

| PART NO. | C15-19-A-14 | C15-20-A-14 | C15-21-A-14 | C15-22-A-14 | C15-519-A-14 | C15-520-A-14 | C15-521-A-14 | C15-522-A-14 |
|---|---|---|---|---|---|---|---|---|
| Volts — 60 Hz | 120 | 240 | 24 | 12 | 120 | 240 | 24 | 12 |
| Duty | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 350 | 1450 | 13.5 | 3.4 | 220 | 880 | 88 | 2.1 |
| Watts Seated ±10% | 8.0 | 8.1 | 8.0 | 8.0 | 14.0 | 14.5 | 14.2 | 14.0 |
| Amps Seated ±10% | .12 | .06 | .51 | 1.05 | .20 | .09 | 1.00 | 1.80 |
| Amps @ ⅛" ±10% | .23 | .12 | 1.20 | 2.10 | .35 | .16 | 1.80 | 3.40 |
| Amps @ ¼" ±10% | .27 | .14 | 1.40 | 2.80 | .42 | .21 | 2.20 | 4.10 |
| Amps @ ⅜" ±10% | .31 | .16 | 1.60 | 3.00 | .48 | .24 | 2.40 | 4.65 |
| Amps @ ½" ±10% | .32 | .17 | 1.70 | 3.20 | .51 | .26 | 2.60 | 5.00 |
| Force @ 100% Rated Voltage: 35°C. ½" Max. Stroke | 28 oz. @ Min. 6.0 oz. @ Max. | | | | 52 oz. @ Min. 9.0 oz. @ Max. | | | |

## DC SOLENOIDS

### C-8 SERIES

| PART NO. | C8-269-A-14 | C8-270-A-14 | C8-271-A-14 | C8-272-A-14 | C8-273-A-14 | C8-769-A-14 | C8-770-A-14 | C8-771-A-14 | C772-A-14 | C8-773-A-14 |
|---|---|---|---|---|---|---|---|---|---|---|
| Volts — DC | 115 | 48 | 24 | 12 | 6 | 115 | 48 | 24 | 12 | 6 |
| Duty | Cont. | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 2400 | 510 | 126 | 31 | 7.8 | 1500 | 235 | 59 | 14.8 | 3.3 |
| Max. Watts | 5.8 | 5.3 | 5.1 | 5.2 | 5.2 | 10.4 | 11.0 | 10.8 | 11.8 | 12.1 |
| Max. Amps | .05 | .11 | .21 | .43 | .86 | .09 | .23 | .45 | .90 | 2.02 |
| Force @ 100% Rated Voltage: 35°C. ½" Max. Stroke | 16 oz. @ Min. .75 oz. @ Max. | | | | | 16 oz. @ Min. 1.5 oz. @ Max. | | | | |

### C-9 SERIES

| PART NO. | C9-269-A-14 | C9-270A-14 | C9-271-A-14 | C9-272-A-14 | C9-273-A-14 | C9-769-A-14 | C9-770-A-14 | C9-771-A-14 | C9-772-A-14 | C9-773-A-14 |
|---|---|---|---|---|---|---|---|---|---|---|
| Volts — DC | 115 | 48 | 24 | 12 | 6 | 115 | 48 | 24 | 12 | 6 |
| Duty | Cont. | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 1460 | 276 | 69 | 17.4 | 4.3 | 786 | 146 | 37 | 9 | 2.5 |
| Max. Watts | 10.4 | 9.1 | 9.4 | 9.3 | 9.6 | 18.4 | 17.8 | 17.3 | 17.8 | 16.0 |
| Max. Amps | .09 | .19 | .39 | .77 | 1.6 | .18 | .37 | .72 | 1.48 | 2.67 |
| Force @ 100% Rated Voltage: 35°C. ½" Max. Stroke | 32 oz. @ Min. 2.5 oz. @ Max. | | | | | 54 oz. @ Min. 4.5 oz. @ Max. | | | | |

### C-15 SERIES

| PART NO. | C15-269-A-14 | C15-270-A-14 | C15-271-A-14 | C15-272-A-14 | C15-273-A-14 | C15-769-A-14 | C15-770-A-14 | C15-771-A-14 | C15-772-A-14 | C15-773-A-14 |
|---|---|---|---|---|---|---|---|---|---|---|
| Volts — DC | 115 | 48 | 24 | 12 | 6 | 115 | 48 | 24 | 12 | 6 |
| Duty | Cont. | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 1925 | 363 | 89.6 | 22.4 | 5.56 | 1230 | 205 | 51.5 | 12.7 | 3.14 |
| Max. Watts | 8.1 | 7.2 | 7.2 | 7.2 | 7.2 | 12.7 | 12.5 | 12.5 | 12.6 | 12.7 |
| Max. Amps | .07 | .15 | .30 | .60 | 1.20 | .11 | .26 | .52 | 1.05 | 2.12 |
| Force @ 100% Rated Voltage: 35°C. ½" Max. Stroke | 16 oz. @ Min. 1.3 oz @ Max. | | | | | 48 oz. @ Min. 3.0 oz. @ Max. | | | | |

NOTE: Solenoids available from distributor stock are indicated in screen.

# SOLENOIDS

## "C" FRAME SOLENOIDS 3-32 / C-33

### GENERAL SPECIFICATIONS

**Standard Voltages:**
AC: 240, 120, 24 and 12.
DC: 115, 48, 24, 12 and 6.
Voltages available from distributor stock are indicated in screened area of chart.
Other voltages available on request.

**AC Frequency:**
60 Hz standard.
50 Hz available on request.

**Coil Temperature:**
These solenoids are designed to give approximately 65°C temperature rise when operated at recommended duty cycle and voltage.

**Duty Cycle:**
Continuous: at 40°C ambient temperature.
Intermittent: 20% on time, 80% off time. On time not to exceed 3 min. at 40°C ambient temperature.

**Coil Insulation:**
Class "A": 105°C max. temperature.

**Materials and Finish:**
Coil: Polyester tape varnished (C-32). Polyester encapsulated (C-33).
Bobbin: Nylon.
Frame: C.R. steel zinc dichromate plating.
Plunger: C.R. steel zinc chromate plating.

**Biasing Spring:**
Wire type spring available.

**Coil Termination:**
Solder lugs Type #14 per drawing, standard. ¼" connectors Type #33 per drawing standard (C-33).

**Plunger Linkage:**
Link type construction Type "A" standard. One piece machined construction Type "E" available.

**Average Total Weight:**
3.0 oz. (C-32); 4.3 oz. (C-33).

### AC SOLENOIDS

#### C-32 SERIES

| PART NO. | C32-19-A-14 | C32-20-A-14 | C32-21-A-14 | C32-22-A-14 | C32-519-A-14 | C32-520-A-14 | C32-521-A-14 | C32-522-A-14 |
|---|---|---|---|---|---|---|---|---|
| Volts — 60 DC | 120 | 240 | 24 | 12 | 120 | 240 | 24 | 12 |
| Duty | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C) | 395 | 1602 | 19 | 4.7 | 226 | 894 | 9 | 2.2 |
| Watts Seated ± 10% | 7.0 | 6.5 | 5.5 | 6.0 | 14.5 | 13.9 | 13.5 | 13.3 |
| Amps Seated ±10% | .11 | .08 | .38 | 1.00 | .18 | .10 | .98 | 1.80 |
| Amps @ ¼" ±10% | .20 | .10 | .98 | 2.00 | .36 | .17 | 1.80 | 3.70 |
| Amps @ ½" ±10% | .26 | .12 | 1.20 | 2.40 | .45 | .22 | 2.20 | 4.50 |
| Amps @ ¾" ±10% | .30 | .14 | 1.40 | 3.10 | .52 | .25 | 2.50 | 5.10 |
| Amps @ 1" ±10% | .32 | .15 | 1.50 | 3.20 | .54 | .26 | 2.70 | 5.30 |
| Force @ 100% Rated Voltage: 35°C. 1" Max. Stroke | 20 oz. @ Min. 3.0 oz. @ Max. | | | | 24 oz. @ Min. 3.8 oz. @ Max. | | | |

#### C-33 SERIES

| PART NO. | C33-19-M-36 | C33-20-M-36 | C33-21-M-36 | C33-22-M-36 | C33-519-M-36 | C33-520-M-36 | C33-521-M-36 | C33-522-M-36 |
|---|---|---|---|---|---|---|---|---|
| Volts — 60 Hz | 120 | 240 | 24 | 12 | 120 | 240 | 24 | 12 |
| Duty | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 303 | 1201 | 11.9 | 3.0 | 170 | 678 | 6.7 | 1.7 |
| Watts Seated ±10% | 8.0 | 8.3 | 8.2 | 8.0 | 18.0 | 17.5 | 18.0 | 18.0 |
| Amps Seated ±10% | .14 | .07 | .56 | 1.20 | .26 | .10 | 1.40 | 2.70 |
| Amps @ ⅛" ±10% | .26 | .13 | 1.30 | 2.40 | .46 | .24 | 2.30 | 4.50 |
| Amps @ ¼" ±10% | .32 | .16 | 1.60 | 3.00 | .52 | .28 | 2.70 | 5.10 |
| Amps @ ⅜" ±10% | .36 | .18 | 1.80 | 3.40 | .60 | .31 | 3.10 | 5.60 |
| Amps @ ½" ±10% | .38 | .19 | 1.90 | 3.60 | .65 | .33 | 3.30 | 6.00 |
| Force @ 100% Rated Voltage: 35°C. ½" Max. Stroke | 32 oz. @ Min. 6.0 oz. @ Max. | | | | 56 oz. @ Min. 9.0 oz. @ Max. | | | |

### DC SOLENOIDS

#### C-32 SERIES

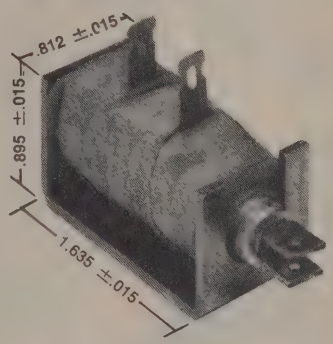
| PART NO. | C32-269-A-14 | C32-270-A-14 | C32-271-A-14 | C32-272-A-14 | C32-273-A-14 | C32-769-A-14 | C32-770-A-14 | C32-771-A-14 | C32-772-A-14 | C32-773-A-14 |
|---|---|---|---|---|---|---|---|---|---|---|
| Volts — DC | 115 | 48 | 24 | 12 | 6 | 115 | 48 | 24 | 12 | 6 |
| Duty | Cont. | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 2226 | 362 | 90 | 23 | 5.6 | 1356 | 226 | 56 | 13.7 | 3.5 |
| Max. Watts | 5.9 | 6.3 | 6.3 | 6.3 | 6.4 | 9.7 | 10.2 | 10.3 | 10.4 | 10.3 |
| Max. Amps | .05 | .13 | .27 | .53 | 1.00 | .08 | .21 | .43 | .87 | 1.70 |
| Force @ 100% Rated Voltage: 35°C. ¾" Max. Stroke | 16 oz. @ Min. .5 oz. @ Max. | | | | | 20 oz. @ Min. 1.0 oz. @ Max. | | | | |

#### C-33 SERIES

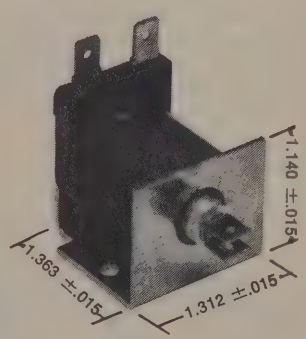
| PART NO. | C33-269-M-36 | C33-270-M-36 | C33-271-M-36 | C33-272-M-26 | C33-273-M-36 | C33-769-M-36 | C33-770-M-36 | C33-771-M-36 | C33-772-M-36 | C33-773-M-36 |
|---|---|---|---|---|---|---|---|---|---|---|
| Volts — DC | 115 | 48 | 24 | 12 | 6 | 115 | 48 | 24 | 12 | 6 |
| Duty | Cont. | Cont. | Cont. | Cont. | Cont. | Int. | Int. | Int. | Int. | Int. |
| Coil Resistance ±10% (Ohms @ 25°C.) | 1978 | 309 | 76 | 19 | 4.7 | 938 | 147 | 37 | 9.4 | 2.2 |
| Max. Watts | 8.1 | 8.2 | 8.4 | 8.4 | 8.5 | 16.1 | 17.3 | 17.3 | 17.1 | 18.2 |
| Max. Amps | .07 | .17 | .35 | .70 | 1.42 | .14 | .36 | .72 | 1.42 | 3.03 |
| Force @ 100% Rated Voltage: 35°C. ½" Max. Stroke | 28 oz. @ Min. 1.8 oz. @ Max. | | | | | 48 oz. @ Min. 3.0 oz. @ Max. | | | | |

NOTE: Solenoids available from distributor stock are indicated in screen.

### C-32 SERIES




### C-33 SERIES



# DOUGLAS RANDALL

Division of Walter Kidde & Company, Inc.

KIDDE

6 PAWCATUCK AVENUE / PAWCATUCK, CONNECTICUT 02891 / (203) 599-1750 / TELEX: 966427 / CABLE: DORANI

# REED RELAYS

## new UL RECOGNIZED REED RELAYS
**FILE NO. E/54552; C.C. NRNT2**

| Fig. | Part No. | Nom. Volt. | DCR Ohms ±10% | Contact Rating |
|---|---|---|---|---|
| 1 & A | 377455<br>377885<br>377886 | 6<br>12-19<br>24 | 250<br>1200<br>4000 | 10W, .5A or 200VDC<br>120VAC @ .275 Amp<br>Use for gating triacs @ 120VAC |
| 1 & B | 377472<br>375388<br>377471 | 6<br>12-19<br>24 | 250<br>1200<br>4000 | |
| 1 & C | 377327<br>377806<br>377807 | 5<br>12<br>24 | 250<br>1000<br>4000 | 240VAC @ .040 Amp<br>Use for gating triacs @ 240VAC |
| 2 & D | 377307<br>377410<br>377201 | 6<br>12<br>24 | 175<br>700<br>2880 | 3A @ 17VDC<br>1A @ 100VDC<br>.3A @ 300VAC<br>For inductive AC loads up to the ratings shown. |
| 3 | 377808<br>377809<br>377810<br>373350 | 6<br>12<br>24<br>48 | 250<br>1000<br>2150<br>2150 | 10W, .5A or 500VDC<br>240VAC @ .040 Amp<br>Use for triac gating @ 240VAC |

FIRST TIME

1. Form C Hg Switches, p 3459 and p 3460
2. All Position Hg Wet Relays, p 3459 and p 3460
3. Six Form A or Four Form C for MG Series, p 3460

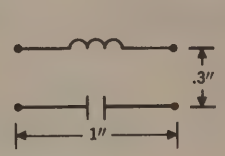


Fig. A

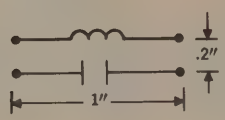


Fig. B

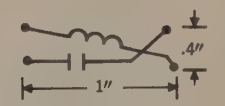


Fig. C

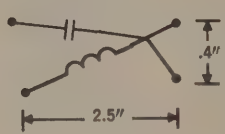


Fig. D

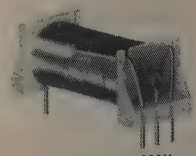
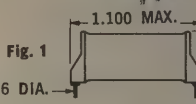


Fig. 1



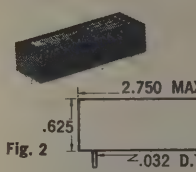



Fig. 2

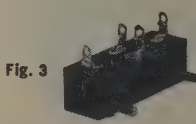


Fig. 3

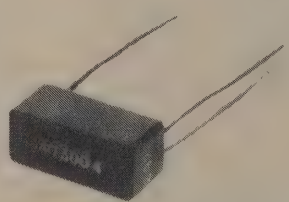
## SPECIAL DESIGNS

### HIGH INSULATION RESISTANCE RELAYS

Two typical designs are shown above:
**A** — A miniature reed relay with a floating lead to maintain high IR.
**B** — This is a relay using Form A and Form B switches timed to provide a Form C (break before make) function with flying leads to maintain $10^{13}$ ohms. Up to 5 Form A contacts are available @ $10^{13}$ ohms.

### PROXIMITY SWITCHES
**FORM B**

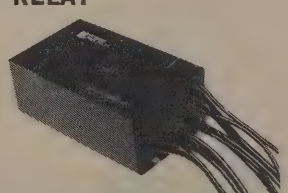
This is a Form B switch and magnet assembly, .7" L x .150" Sq. The normally closed switch opens, when approached by an ⅛" Sq. steel rod.



Epoxy molded switch and magnet assemblies are available in many sizes, contact ratings and terminal arrangements.

### SPECIAL HIGH VOLTAGE RELAY

This relay has three separate coils, each containing a 5,000VDC and a 10,000VDC switch. The package is molded with a flame retardant epoxy and constructed to withstand 15,000VDC between the switches and all other conductors. The relay is 3⅞" L x 2⅜" W x 1½" H.

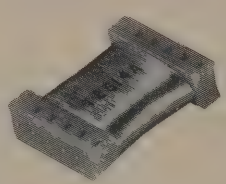


## SPECIAL DESIGNS

Douglas Randall makes custom designed relays to solve difficult problems. A few models are shown below to illustrate the variety of variations available. Special molding techniques make it possible to manufacture unusual sizes, shapes and terminal arrangements with low tooling costs.

The electrical variations possible with Reed Relays are practically limitless.
Douglas Randall will gladly review your applications and offer rapid engineering and prototype service.

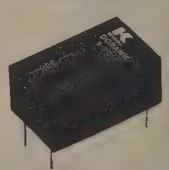
### SNAP-IN RELAYS



This 4 pole relay mounts in Berg-clips, like the Series SI on page 3466. Douglas Randall can now duplicate the following discontinued IBM models:
1 — Position: 766040, 766042, 766059, 766060, 766065, 766068 and 766086
2 — Position: 766043, 766044, 766057, 766067, 766072 and 766087
4 — Position: 766046, 766047, 766066, 766071 and 766079

### HIGH SENSITIVITY RELAYS

The relays shown will operate at 10 MW coil power.

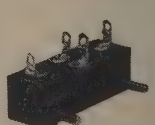


### PLUG-IN RELAYS

Reed relays are easily adapted to standard style headers for socket mounting.

### SPECIAL TERMINALS AND MOUNTING SCREWS

The relay shown has terminals to accept #16 lead wire and mounting screws. Entire package is epoxy encapsulated for mechanical strength.



# DOUGLAS RANDALL

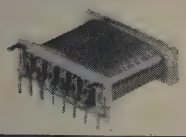
Division of Walter Kidde & Company, Inc.

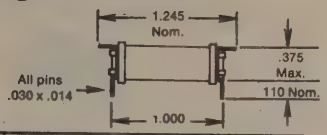
KIDDE

# REED RELAYS

6 PAWCATUCK AVENUE / PAWCATUCK, CONNECTICUT 02891 / (203) 599-1750 / TELEX: 966427 / CABLE: DORANIC

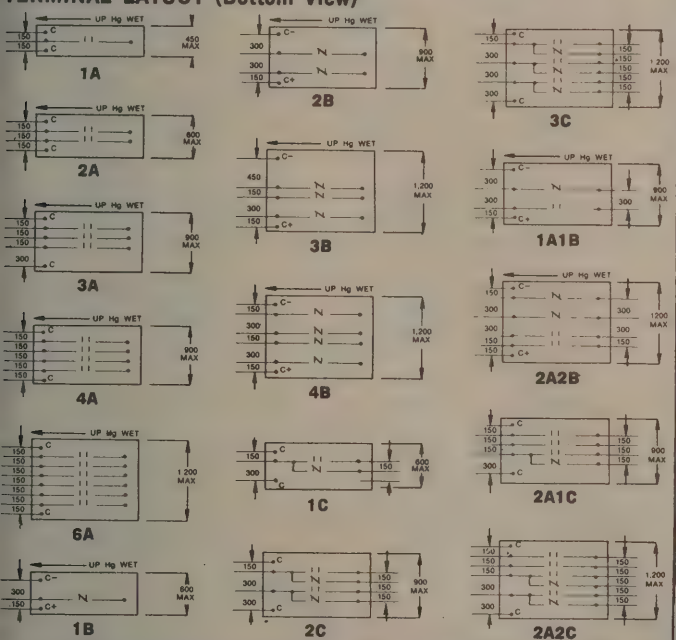
## LOW PROFILE — LP, HgLP SERIES



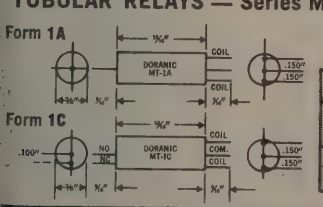


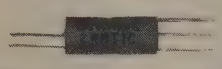

| Form | Nominal Voltage | Part Number | DCR Ohms ±10% | Form | Part Number | DCR Ohms ±10% |
|---|---|---|---|---|---|---|
| 1A | 6 | 6LP1A | 240 | 4B | 6LP4B | 45 |
| | 12 | 12LP1A | 950 | | 12LP4B | 180 |
| | 24 | 24LP1A | 3800 | | 24LP4B | 700 |
| 2A | 6 | 6LP2A | 155 | 1C | 6LP1C | 155 |
| | 12 | 12LP2A | 625 | | 12LP1C | 625 |
| | 24 | 24LP2A | 2500 | | 24LP1C | 2500 |
| 3A | 6 | 6LP3A | 80 | 2C | 6LP2C | 80 |
| | 12 | 12LP3A | 325 | | 12LP2C | 325 |
| | 24 | 24LP3A | 1300 | | 24LP2C | 1300 |
| 4A | 6 | 6LP4A | 80 | 3C | 6LP3C | 45 |
| | 12 | 12LP4A | 325 | | 12LP3C | 180 |
| | 24 | 24LP4A | 1300 | | 24LP3C | 700 |
| 6A | 6 | 6LP6A | 45 | 1A1B | 6LP1A1B | 80 |
| | 12 | 12LP6A | 180 | | 12LP1A1B | 325 |
| | 24 | 24LP6A | 700 | | 24LP1A1B | 1300 |
| 1B | 6 | 6LP1B | 155 | 2A2B | 6LP2A2B | 45 |
| | 12 | 12LP1B | 625 | | 12LP2A2B | 180 |
| | 24 | 24LP1B | 2500 | | 24LP2A2B | 700 |
| 2B | 6 | 6LP2B | 80 | 2A1C | 6LP2A1C | 80 |
| | 12 | 12LP2B | 325 | | 12LP2A1C | 325 |
| | 24 | 24LP2B | 1300 | | 24LP2A1C | 1300 |
| 3B | 6 | 6LP3B | 45 | 2A2C | 6LP2A2C | 45 |
| | 12 | 12LP3B | 180 | | 12LP2A2C | 180 |
| | 24 | 24LP3B | 700 | | 24LP2A2C | 700 |

### TERMINAL LAYOUT (Bottom View)




## TUBULAR RELAYS — Series MT



| Form | Nominal Voltage | Part Number | DCR Ohms ±10% |
|---|---|---|---|
| 1A | 6 | 6MT1A | 185 |
| | 12 | 12MT1A | 750 |
| | 24 | 24MT1A | 3000 |
| 1C | 6 | 6MT1C | 185 |
| | 12 | 12MT1C | 750 |
| | 24 | 24MT1C | 3000 |

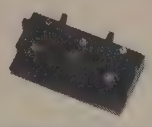
## OPERATING DATA — Series LP, HgLP, MT

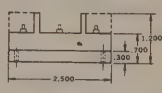
Must Operate — 70% Nominal Voltage
Must Release — 10% Nominal Voltage
Maximum Voltage —
Form A and C — 200% Nominal
Form B and Latching — 130% Nominal
Duty — Continuous

### NOTES

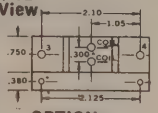
Magnetic shields standard on Form B Relays. Optional on Form A and Form C Relays. 1000VDC switches (to 2000VDC breakdown) available on Form A and Form B Dry Reed Relays.

## HIGH VOLTAGE RELAYS — HV SERIES

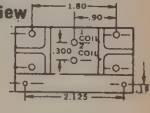





1A or 1B Top View




2A Top View




| Form | Nom. Volt. | Part Number | DCR Ohms ±10% |
|---|---|---|---|
| 1A (1B*) | 6 | 6HV1A | 25 |
| | 12 | 12HV1A | 100 |
| | 24 | 24HV1A | 400 |
| 2A | 6 | 6HV2A | 20 |
| | 12 | 12HV2A | 80 |
| | 24 | 24HV2A | 320 |

**OPTION:**
* Relays available in Form B up to 7,500V.

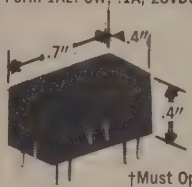
**Note:** To order, specify as follows: 6HV1A 35 is a 6HV1A relay with 3,500VDC switch.

### CONTACT DATA

| Series | Maximum Resistive Rating | | | Breakdown Voltage (min.) | Initial Resistance |
|---|---|---|---|---|---|
| 35 | 3,500VDC | 3.0A | 50W | 5,000VDC | .100 Ohms |
| 75 | 7,500VDC | 3.0A | 50W | 10,000VDC | .100 Ohms |
| 100 | 10,000VDC | 3.0A | 50W | 12,500VDC | .100 Ohms |

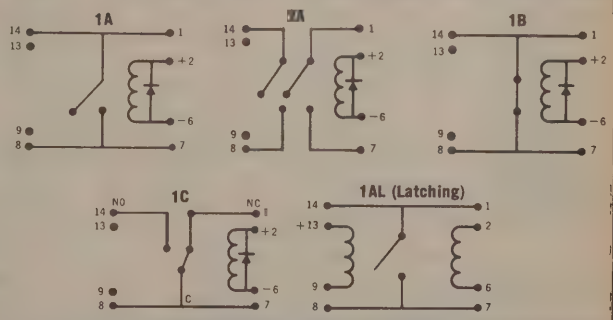
## DIP MOLDED RELAYS SERIES DI

**Contact Rating**
Form 1A, 2A, 1B:
10W, .25A, 100VDC
Form 1C: 3W, .25A, 28VDC
Form 1AL: 3W, .1A, 28VDC




| Contact Arrangement | Nominal† Voltage | DCR Ohms ±10% | Part Number |
|---|---|---|---|
| 1A | 5 | 500 | 5DI1A |
| | 12 | 500 | 12DI1A |
| | 24 | 2200 | 24DI1A |
| 2A | 5 | 150 | 5DI2A |
| | 12 | 500 | 12DI2A |
| | 24 | 1200 | 24DI12A |
| 1B | 5 | 500 | 5DI1B |
| | 12 | 1200 | 12DI1B |
| | 24 | 2200 | 24DI1B |
| 1C | 5 | 200 | 5DI1C |
| | 12 | 500 | 12DI1C |
| | 24 | 1200 | 24DI1C |
| 1AL | 5 | 450/450 | 5DI1AL |
| | 12 | 450/450 | 12DI1AL |
| | 24 | 1000/1000 | 24DI1AL |

†Must Operate — 75% Nominal — Must Release — 10% Nominal.




## CONTACT DATA — Series LP, MT and Hg Versions

| Contact Type | Contact Rating Form A | Form B | Form C |
|---|---|---|---|
| Dry | 10W<br>12VA<br>.5A<br>250VDC<br>.15Ω* | 10W<br>12VA<br>.5A<br>250VDC<br>.15Ω* | 3W<br>4VA<br>.25A<br>28VDC<br>.2Ω* |
| Hg Wet | 28W<br>—<br>1A<br>1000VDC<br>.05Ω* | 28W<br>—<br>1A<br>1000VDC<br>.05Ω* | 14W<br>—<br>.5A<br>1000VDC<br>.05Ω* |
| All Position Hg Wet | 3W<br>2.5VA<br>.25A<br>1000VDC<br>.05Ω* | —<br>—<br>—<br>—<br>— | —<br>—<br>—<br>—<br>— |

*Initial Resistance

## ENVIRONMENTAL DATA — Series LP, MT and Hg Versions

| Temperature | Vibration | Shock |
|---|---|---|
| —20°C to 65°C | 35g to 2000cps | 50g |

# DOUGLAS RANDALL

Division of Walter Kidde & Company, Inc.

KIDDE

# REED RELAYS

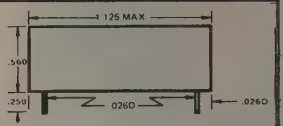
6 PAWCATUCK AVENUE / PAWCATUCK, CONNECTICUT 02891 / (203) 599-1750 / TELEX: 966427 / CABLE: DORANIC

## MINIATURE REED RELAYS

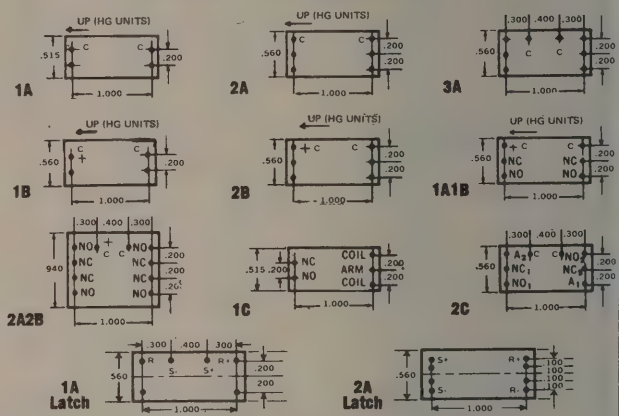
**Molded — Series MM Dry, HgM Mercury Wet**
**Open — Series MG Dry Reed, HgMG Mercury Wet**

| Form | Nominal Voltage | DCR Ohms ±10% | MM Series Part Number | MG Series Part Number |
|---|---|---|---|---|
| 1A | 6<br>12<br>24 | 250<br>1000<br>4000 | 6MM1A<br>12MM1A<br>24MM1A | 6MG1A<br>12MG1A<br>24MG1A |
| 2A | 6<br>12<br>24 | 170<br>675<br>2700 | 6MM2A<br>12MM2A<br>24MM2A | 6MG2A<br>12MG2A<br>24MG2A |
| 3A | 6<br>12<br>24 | 110<br>450<br>1800 | 6MM3A<br>12MM3A<br>24MM3A | 6MG3A<br>12MG3A<br>24MG3A |
| 4A | 6<br>12<br>24 | 80<br>320<br>1280 | —<br>—<br>— | 6MG4A<br>12MG4A<br>24MG4A |
| 5A | 6<br>12<br>24 | 80<br>320<br>1280 | —<br>—<br>— | 6MG5A<br>12MG5A<br>24MG5A |
| 6A | 6<br>12<br>24 | 80<br>320<br>1280 | —<br>—<br>— | 6MG6A<br>12MG6A<br>24MG6A |
| 1B | 6<br>12<br>24 | 170<br>675<br>2700 | 6MM1B<br>12MM1B<br>24MM1B | 6MG1B<br>12MG1B<br>24MG1B |
| 2B | 6<br>12<br>24 | 110<br>450<br>1800 | 6MM2B<br>12MM2B<br>24MM2B | 6MG2B<br>12MG2B<br>24MG2B |
| 1A1B | 6<br>12<br>24 | 110<br>450<br>1800 | 6MM1A1B<br>12MM1A1B<br>24MM1A1B | 6MG1A1B<br>12MG1A1B<br>24MG1A1B |
| 2A2B | 6<br>12<br>24 | 50<br>200<br>800 | 6MM2A2B<br>12MM2A2B<br>24MM2A2B | |
| 1C | 6<br>12<br>24 | 250<br>1000<br>4000 | 6MM1C<br>12MM1C<br>24MM1C | 6MG1C<br>12MG1C<br>24MG1C |
| 2C | 6<br>12<br>24 | 170<br>675<br>2700 | 6MM2C<br>12MM2C<br>24MM2C | 6MG2C<br>12MG2C<br>24MG2C |
| 3C | 6<br>12<br>24 | 110<br>450<br>1800 | —<br>—<br>— | 6MG3C<br>12MG3C<br>24MG3C |
| 4C | 6<br>12<br>24 | 80<br>320<br>1280 | —<br>—<br>— | 6MG4C<br>12MG4C<br>24MG4C |
| 1A Latch | 6<br>12<br>24 | 85/85<br>340/340<br>1350/1350 | 6MML1A<br>12MML1A<br>24MML1A | 6MGL1A<br>12MGL1A<br>24MGL1A |
| 2A Latch | 6<br>12<br>24 | 55/55<br>225/225<br>900/900 | 6MML2A<br>12MML2A<br>24MML2A | 6MGL2A<br>12MGL2A<br>24MGL2A |

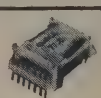
**Miniature Molded, MM**

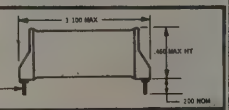



**Terminal Layout Series MM (Bottom View)**

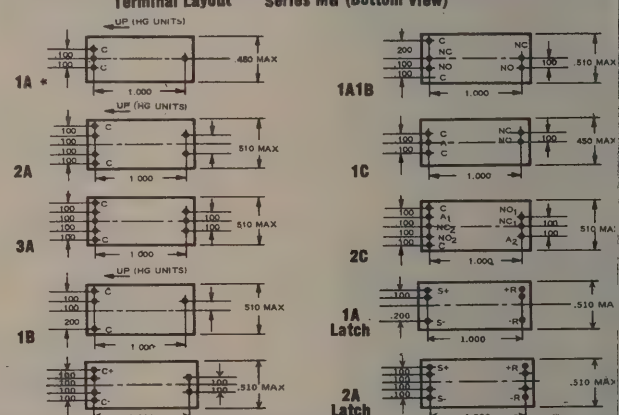



**Miniature Open, MG**






**Terminal Layout Series MG (Bottom View)**



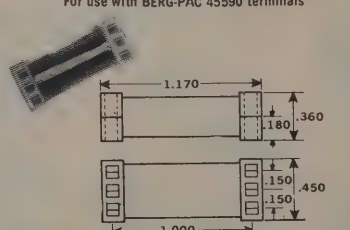

### Contact Data — Series MM, SI, MG, XMG and Hg Versions

| Contact Type | Contact Rating Form A | Form B | Form C |
|---|---|---|---|
| Dry | 10W<br>12VA<br>.5A<br>250VDC<br>.15Ω* | 10W<br>12VA<br>.5A<br>250VDC<br>.15Ω* | 3W<br>3VA<br>.25A<br>100VDC<br>.2Ω* |
| Hg Wet | 28W<br>—<br>1A<br>1000VDC<br>.05Ω* | 28W<br>—<br>1A<br>1000VDC<br>.05Ω* | 14W<br>14VA<br>.5A<br>1000VDC<br>.05Ω* |
| All Position Hg Wet | 3W<br>2.5VA<br>.25A<br>1000VDC<br>.05Ω* | —<br>—<br>—<br>—<br>— | —<br>—<br>—<br>—<br>— |

* Initial Resistance

### SNAP-IN RELAYS SERIES SI

For use with BERG-PAC 45590 terminals

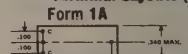



| Form | Nominal Voltage | Part Number | DCR Ohms ±10% |
|---|---|---|---|
| 1A | 6<br>12<br>24 | 6SI1A<br>12SI1A<br>24SI1A | 250<br>1000<br>4000 |

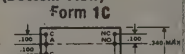
### LOW PROFILE OPEN RELAYS SERIES XMG (Dry Reed)

**Terminal Layouts (Bottom View)**

Form 1A




Form 1C




| Form | Nominal Voltage | Part Number | DCR Ohms ±10% |
|---|---|---|---|
| 1A* | 6<br>12<br>24 | 6XMG1A<br>12XMG1A<br>24XMG1A | 168<br>675<br>2700 |
| 1C* | 6<br>12<br>24 | 6XMG1C<br>12XMG1C<br>24XMG1C | 168<br>675<br>2700 |

Note: Nylon Cover Available.
* Hg wet switches available.

### NOTES

1. E/M shields std. all Series MM and all Form B and Form L.
2. E/S shields optional.
3. 1000VDC switches available all Form A and B relays.
4. Premium run-in switches available all models.
5. Ultra sensitive relays available.
6. Series MML/1A, MML/2A have internal diodes.
7. Series MM available up to 8 Form A, 4 Form C.

### OPERATING DATA — All Series

Must Operate — 70% Nominal
Must Release — 10% Nominal
Maximum Voltage —
Form A and C — 200% Nominal
Form B and Latching — 130% Nominal
Environmental Data: −20°C to +65°C; vibration 35g to 2000cps; shock, 30g.



Add Dept. EM to address to tell them you saw it in eem

# DOUGLAS RANDALL

Division of Walter Kidde & Company, Inc.

KIDDE

# REED RELAYS

6 PAWCATUCK AVENUE / PAWCATUCK, CONNECTICUT 02891 / (203) 599-1750 / TELEX: 966427 / CABLE: DORANIC

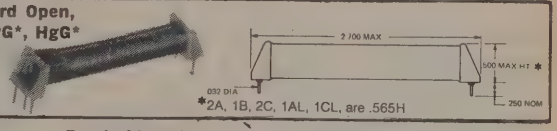
## STANDARD SIZE REED RELAYS

**Molded — Series SM, HP*, Hg***
**Open — Series SG, HPG*, HgG***

| | | SM Series | Molded | SG Series | Open |
|---|---|---|---|---|---|
| Form | Nominal Voltage | Part Number | DCR Ohms ±10% | Part Number | DCR Ohms ±10% |
| 1A | 6 | 6SM1A | 180 | 6SG1A | 180 |
| | 12 | 12SM1A | 725 | 12SG1A | 720 |
| | 24 | 24SM1A | 2900 | 24SG1A | 2880 |
| 2A | 6 | 6SM2A | 175 | 6SG2A | 110 |
| | 12 | 12SM2A | 700 | 12SG2A | 440 |
| | 24 | 24SM2A | 2750 | 24SG2A | 1760 |
| 1B | 6 | 6SM1B | 175 | 6SG1B | 110 |
| | 12 | 12SM1B | 700 | 12SG1B | 440 |
| | 24 | 24SM1B | 2750 | 24SG1B | 1760 |
| 2B | 6 | 6SM2B | 140 | | |
| | 12 | 12SM2B | 550 | | |
| | 24 | 24SM2B | 2200 | | |
| 1C | 6 | 6SM1C | 180 | 6SG1C | 180 |
| | 12 | 12SM1C | 725 | 12SG1C | 720 |
| | 24 | 24SM1C | 2900 | 24SG1C | 2880 |
| 2C | 6 | 6SM2C | 175 | 6SG2C | 110 |
| | 12 | 12SM2C | 700 | 12SG2C | 440 |
| | 24 | 24SM2C | 2750 | 24SG2C | 1760 |
| 1A Latch | 6 | 6SML1A | 85/85 | 6SGL1A | 85/85 |
| | 12 | 12SML1A | 340/340 | 12SGL1A | 340/340 |
| | 24 | 24SML1A | 1350/1350 | 24SGL1A | 1350/1350 |
| 1C Latch | 6 | 6SML1C | 85/85 | 6SGL1C | 85/85 |
| | 12 | 12SML1C | 340/340 | 12SGL1C | 340/340 |
| | 24 | 24SML1C | 1350/1350 | 24SGL1C | 1350/1350 |

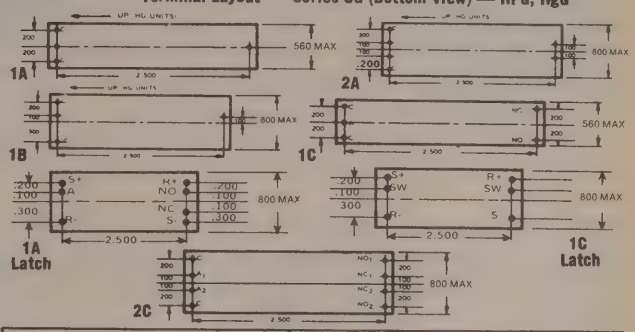
*For part numbers and DCR values contact factory. See specification table for contact ratings.

Standard Open, SG, HPG*, HgG*

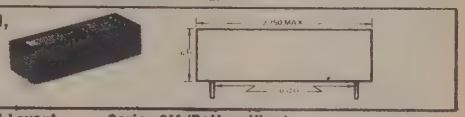



*2A, 1B, 2C, 1AL, 1CL, are .565H

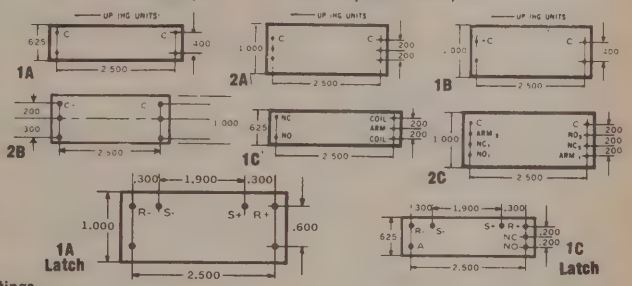
Terminal Layout — Series SG (Bottom View) — HPG, HgG




Standard Molded, SM, HP*, HG

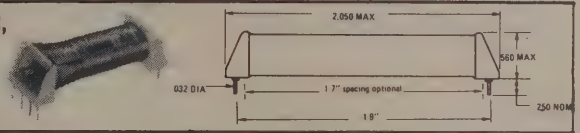


Terminal Layout — Series SM (Bottom View)




## COMPACT OPEN REED RELAYS

CG Dry Reed, HPCG*, High Power




| Form | Nom. Volt. | Part Number | DCR Ohms ±10% | Part Number | DCR Ohms ±10% | Terminal Layout (Bottom View) |
|---|---|---|---|---|---|---|
| 1A | 6 | 6CG1A | 165 | 6HPCG1A | 105 | |
| | 12 | 12CG1A | 660 | 12HPCG1A | 420 | |
| | 24 | 24CG1A | 2640 | 24HPCG1A | 1680 | |
| 2A | 6 | 6CG2A | 100 | 6HPCG2A | 65 | |
| | 12 | 12CG2A | 400 | 12HPCG2A | 260 | |
| | 24 | 24CG2A | 1600 | 24HPCG2A | 1040 | |
| 1B | 6 | 6CG1B | 100 | 6HPCG1B | 65 | |
| | 12 | 12CG1B | 400 | 12HPCG1B | 260 | |
| | 24 | 24CG1B | 1600 | 24HPCG1B | 1040 | |
| 1C | 6 | 6CG1C | 165 | 6HPCG1C | 105 | |
| | 12 | 12CG1C | 660 | 12HPCG1C | 420 | |
| | 24 | 24CG1C | 2640 | 24HPCG1C | 1680 | |
| 2C | 6 | 6CG2C | 100 | 6HPCG2C | 65 | |
| | 12 | 12CG2C | 400 | 12HPCG2C | 260 | |
| | 24 | 24CG2C | 1600 | 24HPCG2C | 1040 | |
| 1A Latch | 6 | 6CGL1A | 60/60 | | | |
| | 12 | 12CGL1A | 250/250 | | | |
| | 24 | 24CGL1A | 1000/1000 | | | |
| 1C Latch | 6 | 6CGL1C | 60/60 | | | |
| | 12 | 12CGL1C | 250/250 | | | |
| | 24 | 24CGL1C | 1000/1000 | | | |

### Common Specifications, All Series

**OPERATING DATA**
Must Operate — 70% Nominal
Must Release — 10% Nominal
Max. Voltage — Form A & C — 200% Nominal
Form B & Latch — 130% Nominal

**ENVIRONMENTAL DATA**
Temperature — 20°C to +65°C
Shock — 30g
Vibration — 35g to 2000 Hz

**CONTACT RATINGS**
**Series SM, SG, CG (Standard)**

| Form | Max. Res. Load | Initial Contact Resistance |
|---|---|---|
| A & B | 15W, 1.0A, 400VDC | .100Ω |
| C | 10W, .5A, 200VDC | .150Ω |

**Series HG*, HgG* (Mercury Wet)**

| | | |
|---|---|---|
| A & B | 50W, 3.0A, 400VDC | .050Ω |

**Series HP*, HPG*, HPCG***

| Form | Suffix | Max. Res. Load | Initial Contact Resistance |
|---|---|---|---|
| A & B | −25 | 25W, 1.0A, 1000VDC | .100Ω |
| A & B | −50 | 50W, 3.0A, 1000VDC | — |
| A & B | −100 | 110VA, 3.0A, 110VAC | — |
| C | — | 20W. 1.5A, 500VDC | .200Ω |



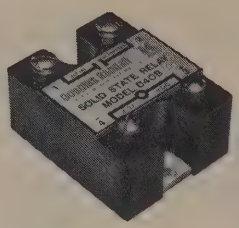
For Manufacturers Sales Offices refer to MANUFACTURERS AND SALES OFFICES DIRECTORY

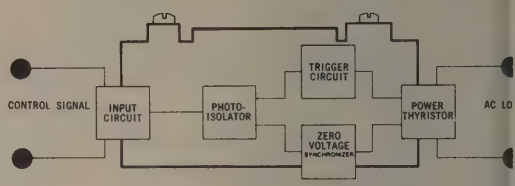
# DOUGLAS RANDALL SOLID STATE COMPONENTS

Division of Walter Kidde & Company, Inc.
KIDDE
6 PAWCATUCK AVENUE / PAWCATUCK, CONNECTICUT 02891 / (203) 599-1750 / TELEX: 966427 / CABLE: DORANI

## SOLID STATE RELAYS RATINGS TO 40 AMPS

### AC OUTPUT / DC OR AC CONTROL UL RECOGNIZED / FILE NO. E60556 / C.C. NMFT2






Douglas Randall's line of solid state AC output relays are UL recognized (File E60556 / C.C. NMFT2). Featuring opto-isolation and zero-voltage switching models are available to handle up to 40 Amp. DC or AC control signals can be specified and Form A or B output.

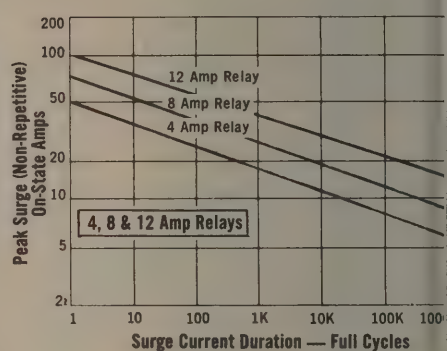
### INPUT SIGNAL DATA (AC OR DC)

| | DC | AC |
|---|---|---|
| Range | 3-32V[5] | 90-240VAC (80-140VDC) |
| Must Operate | 3VDC | 90VDC (80VDC) |
| Must Release | 1VDC | 10VAC (10VDC) |
| Input Impedance | 1000Ω Min., 40KΩ Min. | |
| Isolation | | |
| Signal to Load | 1500V, $10^{10}$Ω DC | |
| Signal to Base | 1500V, $10^{10}$Ω DC | |
| Capacitance | 15 pF Signal to Load | |
| Temperature Range | −30°C to +80°C | |

### MODEL NUMBERS (NOTE 4)

| Output Rating | | DC Signal | AC Signal |
|---|---|---|---|
| 90-140VAC | 4A | D04A | A04A |
| | 8A | D08A | A08A |
| | 12A | D12A | A12A |
| | 25A | D25A | A25A |
| | 40A | D40A | A40A |
| 200-280VAC | 4A | D04B | A04B |
| | 8A | D08B | A08B |
| | 12A | D12B | A12B |
| | 25A | D25B | A25B |
| | 40A | D40B | A40B |

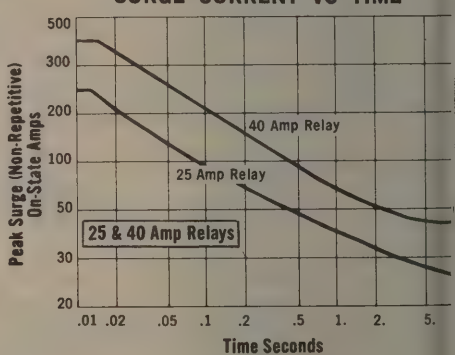
### SURGE CURRENT VS TIME




### OUTPUT DATA (AC OUTPUT)

| Maximum Current | 4A | 8A | 12A | 25A | 40A |
|---|---|---|---|---|---|
| One Cycle Surge Current | 50A | 75A | 100A | 250A | 400A |
| Overload (1 sec., RMS) | 25A | 35A | 40A | 40A | 75A |
| Minimum Current | 10mA Typ. 20mA Max. | 10mA Typ. 20mA Max. | 10mA Typ. 20mA Max. | 10mA Typ. 25mA Max. | 10mA Typ. 25mA Max. |

### SURGE CURRENT VS TIME




**AC Line Voltage:** 90/140V or 200/280V[1] @ 47-63 Hz[2]
**Voltage Drop @ Rated Current:** 1.6V Max.
**Typical Turn-on Voltage:** 5V
**Response Time (DC Signal):** ½ Cycle Max.
**dv/dt[6] Off State:** 5V/μsec
**Commutating:** 100V/μsec

**Off State Leakage Current:**
**90/140VAC** — 4.5mA Typ.
**200/280VAC** — 5.5mA Typ.
**Isolation Output to Base:** 1500V, $10^{10}$Ω DC[3]
**Contact Form:** SPST (NO)[4]

### NOTES AND OPTIONS

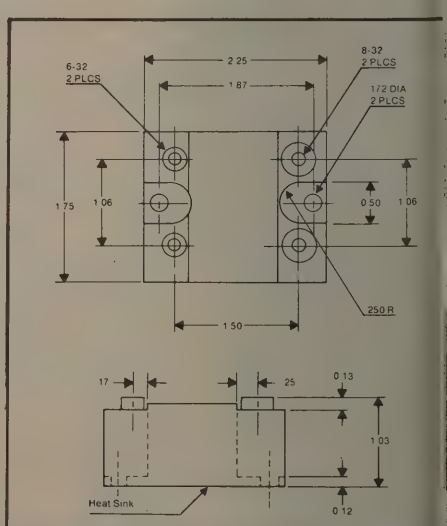
1. Special wide range models can be made which will switch loads from 19V to 140V. These relays can handle either 24VAC or 120VAC loads.
2. Special models are available which switch loads at 400 Hz.
3. 2500VAC isolation can be supplied on request.
4. Form A (SPST-NO) relays are standard. Form B (SPST-NC) switching is optional. Models incorporating this feature are designated by NC. e.g. A40B-NC.
5. All DC models are TTL compatible over the full operating temperature range.
6. All relays incorporate an RC snubber network which prevents false operation from transients up to the dv/dt level shown. More severe transients may require additional external protection. We will review your application and recommend the additional protection needed.

### MECHANICAL SPECIFICATIONS

**Size:** 2¼"L x 1¾"W x 1⅛" maximum.

**Weight:** 4 ounces maximum.

**Termination:** Standard Models — Control Signal: 6-32 screws. Output: 8-32 screws.
Standard Models are furnished with ¼" Quick Connect adapters.
Special Models can be provided with lead wires or other types of termination in OEM quantities. Consult the factory for details.




### SPECIAL DESIGNS

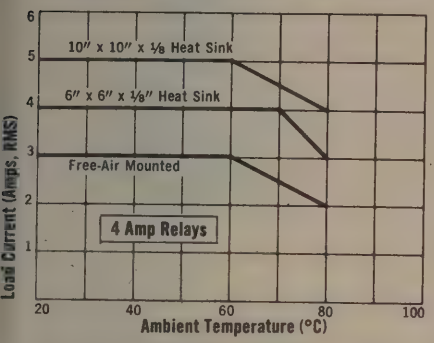
Douglas Randall has designed many special solid state relays, such as a polarized, latching, SPDT unit which will switch 12A at 28VDC. We also have the capability of making special package sizes and terminal arrangements for our solid state relays at moderate tool cost. Your inquiries will be reviewed promptly.

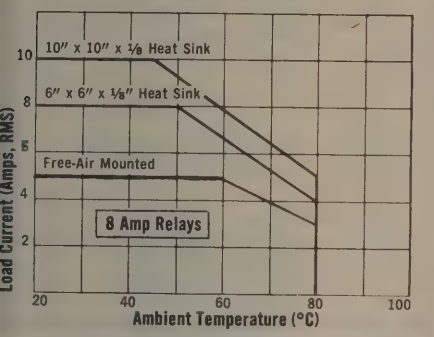
# DOUGLAS RANDALL SOLID STATE COMPONENTS

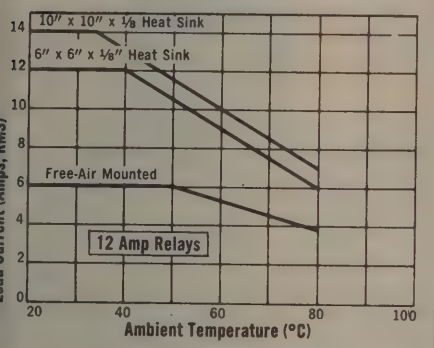
Division of Walter Kidde & Company, Inc.
KIDDE
6 PAWCATUCK AVENUE / PAWCATUCK, CONNECTICUT 02891 / (203) 599-1750 / TELEX: 966427 / CABLE: DORANIC

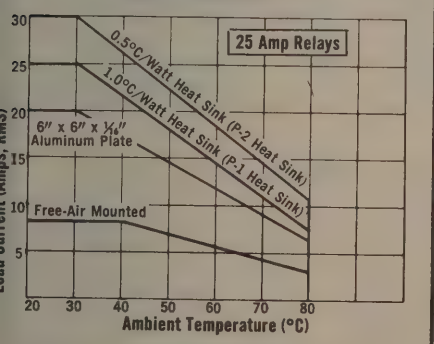
## AC OUTPUT (Cont'd)

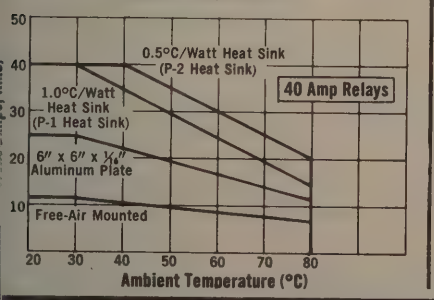
### LOAD CURRENT VS TEMPERATURE



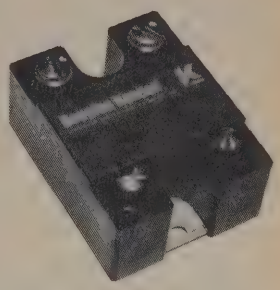





25 Amp Relays
0.5°C/Watt Heat Sink (P-2 Heat Sink)
1.0°C/Watt Heat Sink (P-1 Heat Sink)
6" x 6" x ¼" Aluminum Plate
Free-Air Mounted
Ambient Temperature (°C)


0.5°C/Watt Heat Sink (P-2 Heat Sink)
1.0°C/Watt Heat Sink (P-1 Heat Sink)
40 Amp Relays
6" x 6" x ¼" Aluminum Plate
Free-Air Mounted
Ambient Temperature (°C)

# PROPOSITIONAL CONTROLS

## AC OUTPUT / RESISTOR CONTROL*



Douglas Randall Proportional Control Modules provide a variable AC output voltage to loads up to 15 Amps. They are solid state, full wave SCR phase angle control units, which offer a reliable, compact method of controlling motors, heaters, incandescent lamps, and other AC devices. Standard models vary the output from 0% to 90%.

### INPUT*

Variable Resistor (150,000Ω, 1 watt) — For 120VAC
Variable Resistor (1 Megohm, ½ watt) — For 240VAC

### MODEL NUMBERS

| Output Voltage | 90-130VAC | | | 200-240VAC | | |
|---|---|---|---|---|---|---|
| Model Number | R05A | R10A | R15A | R05B | R10B | R15B |
| Current | 5A | 10A | 15A | 5A | 10A | 15A |

### OUTPUT DATA

| Maximum Current | 5A | 10A | 15A |
|---|---|---|---|
| One Cycle Surge Current | 50A | 75A | 100A |
| Overload (1 sec., RMS) | 25A | 45A | 65A |
| Minimum Current | .040A | .040A | .040A |
| AC Line Voltage | 90/130V or 200/240V @ 47-63Hz | | |

### OPTIONS

**Preset Minimum/Maximum:**
Set internally at the factory to any value in the control range.

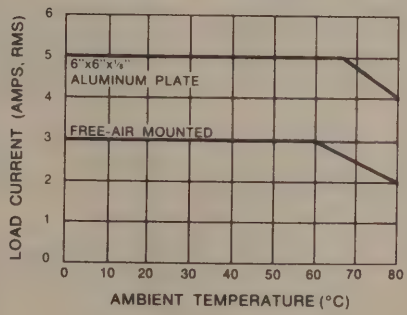
**Preset Output:**
Not variable — fixed output is preset internally to any value in the control range.

**Special Ranges, Control Potentiometers and 400 Hz Load Controls are available as special designs.**

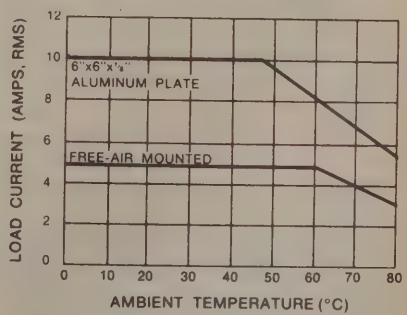
**Mechanical Arrangement:**
See AC output relays opposite page.

*Special designs can be driven by DC signals.

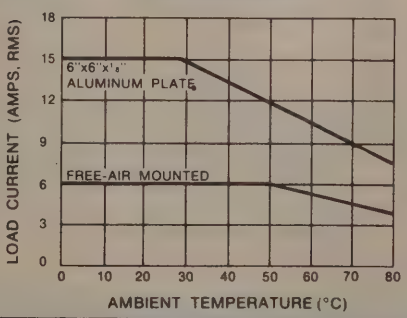
LOAD CURRENT vs TEMPERATURE
5 AMP CONTROLLERS



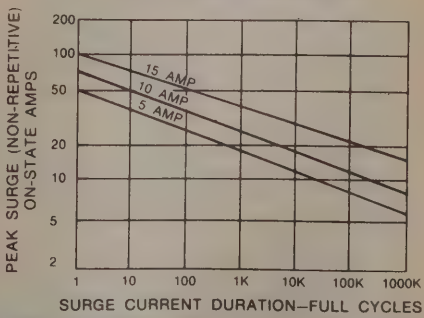

LOAD CURRENT vs TEMPERATURE
10 AMP CONTROLLERS




LOAD CURRENT vs TEMPERATURE
15 AMP CONTROLLERS




SURGE CURRENT vs TIME
5, 10, 15 AMP CONTROLLERS



# DOUGLAS RANDALL SOLID STATE COMPONENTS

Division of Walter Kidde & Company, Inc.

KIDDE 6 PAWCATUCK AVENUE / PAWCATUCK, CONNECTICUT 02891 / (203) 599-1750 / TELEX: 966427 / CABLE: DORANI

## SOLID STATE RELAYS SERIES K
## DC OUTPUT / DC CONTROL SIGNAL

Douglas Randall Series K are SPST (NO) relays which will switch loads of 4, 8 or 12 Amps @ 2-32VDC or 2-55VDC. They provide rapid switching and opto-isolation between input and output. The sensitive inputs are compatible with DTL or TTL logic. Arc free switching makes these relays suitable for hazardous atmospheres.

### MODEL NUMBERS

| Output Voltage* | Current | Model |
|---|---|---|
| 2-32VDC | 4 Amp | K04A |
| | 8 Amp | K08A |
| | 12 Amp | K12A |
| 2-55VDC | 4 Amp | K04B |
| | 8 Amp | K08B |
| | 12 Amp | K12B |

*Inductive loads must be diode suppressed.

### INPUT SIGNAL DATA

| | |
|---|---|
| Range | 3-32VDC |
| Must Operate | 3VDC |
| Must Release | 1VDC |
| Input Impedance | 1000Ω Min. |
| Isolation | |
| Signal to Load | 1500V |
| Signal to Base | 1500V |
| Temperature | −30°C to +80°C |

### MECHANICAL ARRANGEMENT

See AC output relays on page 2144

### OUTPUT DATA

| | |
|---|---|
| Continuous Current | 4A, 8A, or 12A |
| DC Line Voltage | 2-32VDC or 2-55VDC |
| Off State Leakage | 10mA DC |
| Turn On Time | 50 Micro Sec. |
| Turn Off Time | 500 Micro Sec. |
| Voltage Drop @ Rate Current | 1.5VDC Max. |
| Isolation Load to Base | 1500V |

SIZE:
2¼L x 1¾W x 1⅛H Max.

WEIGHT:
4 Ounces Max.

TERMINATION:
Standard Models —

Control Signal:
6-32 Screws

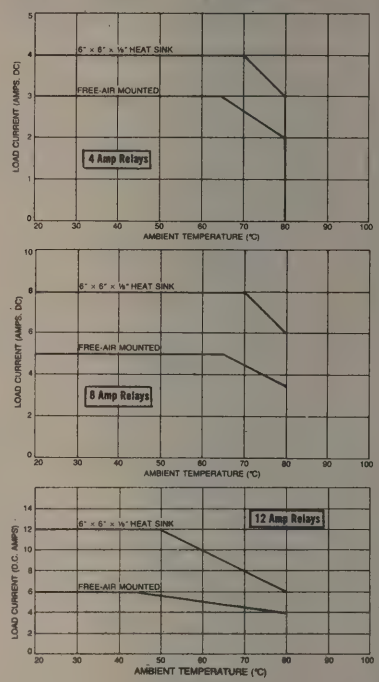
Output:
8-32 Screws

Standard Models are furnished with ¼" Quick Connect adapters.

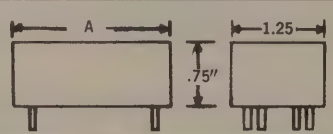
Special Models can be provided with lead wires or other types of termination in OEM quantities. Consult the factory for details.

See p 3462 for Mechanical Details.

### LOAD CURRENT VS TEMPERATURE




## SOLID STATE RELAYS — SERIES CV
## PC MOUNTED —




| INPUT DATA | | | OUTPUT DATA | |
|---|---|---|---|---|
| | CV1 | CV2 | | CV1 & CV2 |
| Nominal Voltage | 5.5VDC | 28VDC | Current | 3A RMS |
| Voltage Range | 4-10VDC | 10-32VDC | Surge Current | 80A Peak |
| Must Operate | 4VDC | 10VDC | Minimum Current | 10mA |
| Must Release | .4VDC | .4VDC | Off State Leakage | 8mA |
| Current @ Nominal Voltage | 10mA | 18mA | Voltage | 24 to 240VAC @ 47 to 63 Hz |
| Isolation | 1500V | 1500V | | |
| Capacitance | 15pF | 15pF | Voltage Drop | 2.0VAC |
| | | | Offstate dv/dt | 100V/μsec. |
| | | | Turn On Time | 8.3msec. |
| | | | Turn Off Time | 16 msec. |

| INPUT DATA | | | OUTPUT DATA | |
|---|---|---|---|---|
| | CV3 | CV6 | | CV3 & CV6 |
| Nominal Voltage | 5.5VDC | 28VDC | Maximum Current | 3A DC |
| Voltage Range | 4-10VDC | 10-32VDC | Voltage Range | 4-55VDC |
| Must Operate | 4VDC | 10VDC | Voltage Drop | 1.6VDC |
| Must Release | .4VDC | .4VDC | Off State Leakage | 10mA DC |
| Current @ Nominal Voltage | 10mA | 18mA | Turn On Time | 500μsec. |
| | | | Turn Off Time | 1.5msec. |

| INPUT DATA | | | OUTPUT DATA | |
|---|---|---|---|---|
| | CV4 | CV5 | | CV4 & CV5 |
| Voltage Range | 10-55VDC | 90-130VAC | Voltage | 30VDC |
| Current | 10mA | 10mA | Current | 16mA Max. |
| Must Not Operate | 3mADC | .8mA RMS | Leakage | 100μA |
| Isolation | 1500V | 1500V | Voltage Drop | .4VDC |
| Capacitance | 10pF | 10pF | Logic Supply Volt. | 4-5-6VDC |
| | | | Logic Supply Cur. | 10mA @ 6VDC |

### AC OUTPUT / DC CONTROL SIGNAL

These relays operate from 5.5VDC (CV-1) or 28VDC (CV-2) signals and switch loads to 3 Amps @ 120/240VAC, 60 Hz. Opto-Isolation provides complete separation of the logic circuit inputs from the AC power loads. Zero-Crossover switching and internal suppression enable the relays to switch AC motors, motor starters, solenoids and lamp loads. Dimension A is 2.00" max.

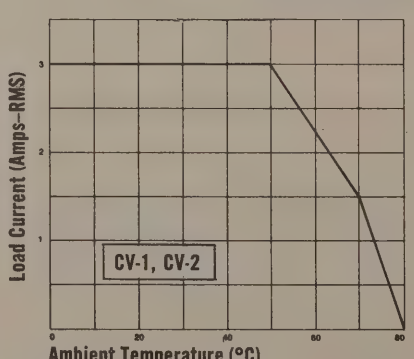
### DC OUTPUT / DC CONTROL SIGNAL

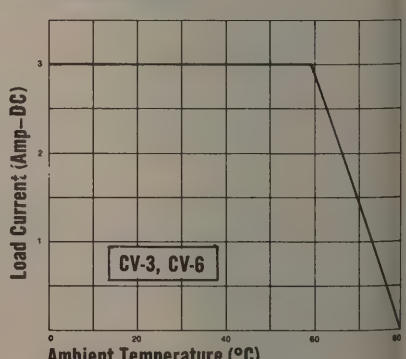
Operating from 5.5VDC (CV-3) or 28VDC (CV-6) signals, these relays switch loads to 3 Amps @ 55VDC. Opto-Isolation provides complete decoupling of the input signals from the power loads. These relays can switch DC motors, motor starters, solenoids and lamp loads. Dimension A is 2.00" max.

### DC OUTPUT / AC OR DC CONTROL SIGNAL

These relays (sometimes referred to as converters) accept power level signals up to 55VDC (CV-4) or 120VAC (CV-5) and provide an open collector transistor output. When the input terminals are energized, the output transistor switches to the ON state (saturated) providing logic level signals for all standard purposes, including DTL, TTL and CMOS among others. Opto-Isolation provides complete decoupling between the input and output terminals. A ±5VDC power supply is required to operate with these units. Dimension A is 1.25" max.

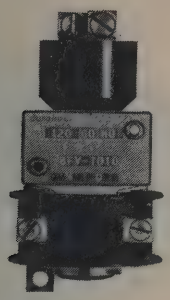
### LOAD CURRENT VS TEMPERATURE

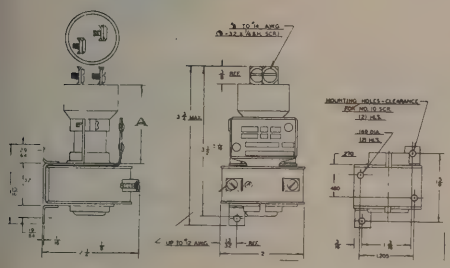


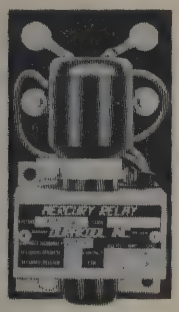



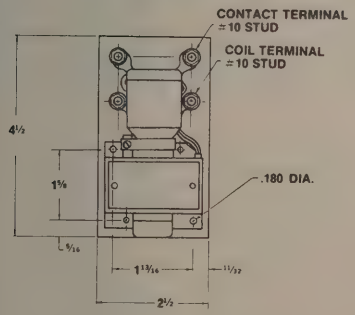
durakool®

# TIME DELAY RELAYS
## UL







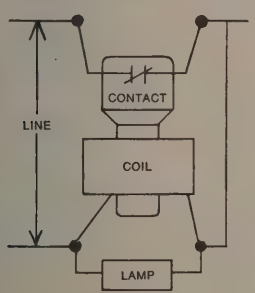



All Durakool time delay relays feature the advantages of mercury to mercury contacts in stainless steel hermetically sealed contact tubes. Release delay functions are performed without the necessity of auxiliary external switches. All catalog numbers shown are U.L. listed bracket mount types; panel mount and cased versions are also available. Virtually hundreds of additional timing ranges and AC/DC operating coil voltages are available.

| Series Timer | Form Contact | Timing Mode of Operation | G.P. Load Ratings AC Amperes | | |
|---|---|---|---|---|---|
| | | | 120V | 240V | 480V |
| BFT | N.O. | Quick Operate — Timed Release | 20 | 15 | 10 |
| BFU | N.O. | Timed Operate — Timed Release | 15 | 10 | 6 |
| BFV | N.O. | Timed Operate — Quick Release | 15 | 10 | 6 |
| BBU | N.C. | Timed Operate — Timed Release | 15 | 10 | 6 |
| BBT | N.C. | Quick Operate — Timed Release | 15 | 10 | 6 |

| Operating Coil Voltage | Part Number and Time Delay | | | | | Coil Data | | |
|---|---|---|---|---|---|---|---|---|
| | ½ sec. | 1 sec. | 3 sec. | 5 sec. | 10 sec. | (Watts) | Current (Amps) | Resistance (DC Ohms) |
| **BFT SERIES/Quick Operate—Timed Release** | | | | | | | | |
| 24/60 | BFT-7009 | BFT-7021 | BFT-7041 | BFT-7053 | BFT-7069 | 3.8 | 3.3 | 23 |
| 120/60 | BFT-7010 | BFT-7022 | BFT-7042 | BFT-7054 | BFT-7070 | 3.8 | .064 | 580 |
| 240/60 | BFT-7011 | BFT-7023 | BFT-7043 | BFT-7055 | BFT-7071 | 3.8 | .033 | 2400 |
| 480/60 | BFT-7012 | BFT-7024 | BFT-7044 | BFT-7056 | BFT-7072 | 3.9 | .017 | 9600 |
| **BFU SERIES/Timed Operate—Timed Release** | | | | | | | | |
| 24/60 | BFU-7005 | BFU-7013 | BFU-7029 | BFU-7041 | BFU-7057 | 2.2 | .178 | 36 |
| 120/60 | BFU-7006 | BFU-7014 | BFU-7030 | BFU-7042 | BFU-7058 | 2.9 | .045 | 902 |
| 240/60 | BFU-7007 | BFU-7015 | BFU-7031 | BFU-7043 | BFU-7059 | 2.8 | .022 | 3700 |
| 480/60 | BFU-7008 | BFU-7016 | BFU-7032 | BFU-7044 | BFU-7060 | 2.7 | .010 | 15000 |
| **BFV SERIES/Timed Operate—Quick Release** | | | | | | | | |
| 24/60 | BFV-7009 | BFV-7017 | BFV-7041 | BVF-7053 | BFV-7069 | 2.4 | .195 | 36 |
| 120/60 | BFV-7010 | BFV-7018 | BFV-7042 | BFV-7054 | BFV-7070 | 2.7 | .043 | 902 |
| 240/60 | BFV-7011 | BFV-7019 | BFV-7043 | BFV-7055 | BFV-7071 | 2.7 | .022 | 3700 |
| 480/60 | BFV-7012 | BFV-7020 | BFV-7044 | BFV-7056 | BFV-7072 | 2.8 | .012 | 1500 |
| **BBU SERIES/Timed Operate—Timed Release** | | | | | | | | |
| 24/60 | BBU-7005 | BBU-7013 | BBU-7029 | BBU-7037 | BBU-7049 | 2.8 | .200 | 36 |
| 120/60 | BBU-7006 | BBU-7014 | BBU-7030 | BBU-7038 | BBU-7050 | 3.2 | .047 | 902 |
| 240/60 | BBU-7007 | BBU-7015 | BBU-7031 | BBU-7039 | BBU-7051 | 3.2 | .024 | 3700 |
| 480/60 | BBU-7008 | BBU-7016 | BBU-7032 | BBU-7040 | BBU-7052 | 3.3 | .013 | 15000 |
| **BBT SERIES—Quick Operate—Timed Release** | | | | | | | | |
| | ½ sec. | ¾ sec. | 1 sec. | 1½ sec. | 2 sec. | | | |
| 24/60 | BBT-7001 | BBT-7005 | BBT-7009 | BBT-7013 | BBT-7017 | 3.8 | .350 | 23 |
| 120/60 | BBT-7002 | BBT-7006 | BBT-7010 | BBT-7014 | BBT-7018 | 3.9 | .065 | 580 |
| 240/60 | BBT-7003 | BBT-7007 | BBT-7011 | BBT-7015 | BBT-7019 | 3.8 | .033 | 2400 |
| 480/60 | BBT-7004 | BBT-7008 | BBT-7012 | BBT-7016 | BBT-7020 | 3.9 | .016 | 9600 |

* Typical Timing Tolerances Are ±10%.




## FLASHERS

Durakool BBU Timers function as self-energized recycling flashers when connected as shown above. Flashing cycles can be provided from 15 flashes to 200 flashes per minute in both AC and DC operating coil voltages.

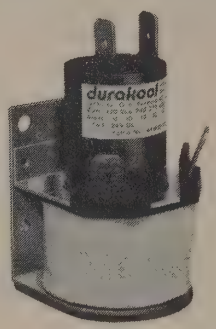
* Flashing Rate Tolerance ±10%.

durakool®

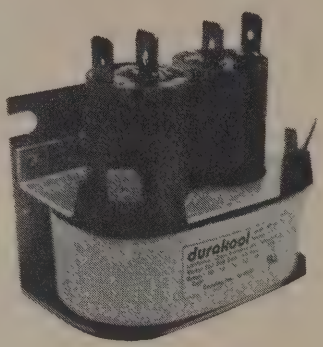
# GENERAL PURPOSE RELAYS—10 AMP—15 AMP—20 AMP

## AFM Series — Normally Open

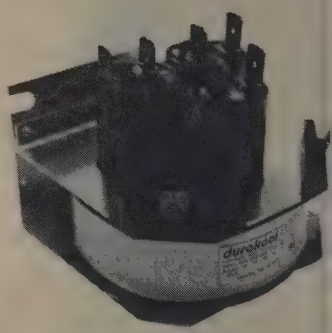
AFM — SINGLE POLE



AFM2 — TWO POLE



AFM3 — THREE POLE



AFM300 Series Single Pole Relays are U.L. Component Rated — General Purpose and Tungsten/U.L. file #35126 and C.S.A. file #22416.

AFM 10, 15 and 20 Amp relays have been tested for 100,000 cycles and meet the criteria of the Underwriter's Laboratory requirements for General Purpose loads and 6000 cycles for Tungsten loads.

At the time of printing, this catalog AFM2 (Two Pole) and AFM3 (Three Pole) series were recently released and had not been submitted to the Underwriter's Laboratories. Please consult the factory for current U.L. status on AFM2 and AFM3 series.

Only popular operating coil voltages are shown, consult the factory for part numbers of other AC and DC coils. Leaded versions are also available. See page 9 for U.L. and non-U.L. contact ratings.

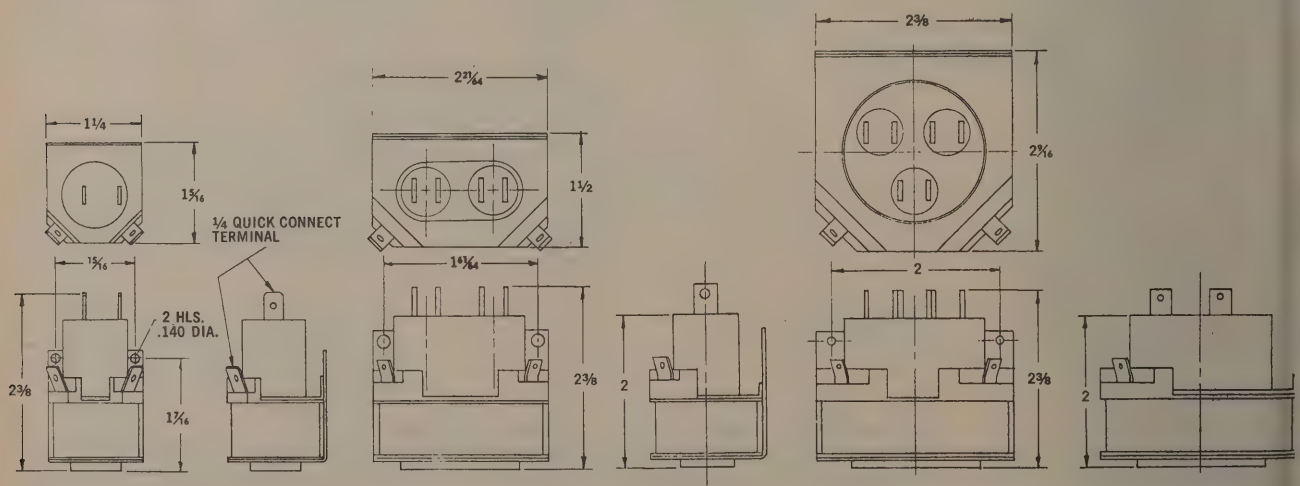
**Typical operating times at normal voltage — operate .04 sec/release .10 sec**

| Contact Rating | Relay Selection Information — Relay Series: One Pole | Two Pole | Three Pole |
|---|---|---|---|
| 10 Amp | AFM10- | AFM210- | AFM310- |
| 15 Amp | AFM15- | AFM215- | AFM315- |
| 20 Amp | AFM20- | AFM220- | AFM320- |

* When ordering, the appropriate operating coil suffix number should follow the selected relay series.

| Coil Voltage Suffix* | AFM SPST — Coil Data — Typical: Coil Voltage | DC Ohms | Steady State Amps | VA | Wattage | Max. Low Pull In Volts |
|---|---|---|---|---|---|---|
| -315 | 6V 60 Hz | 8.8 | .368 | 2.2 | 1.7W | 5.1V |
| -316 | 12V | 35 | .184 | 2.2 | 1.7W | 10.2V |
| -301 | 24V | 140 | .092 | 2.2 | 1.7W | 20.4V |
| -302 | 48V | 560 | .046 | 2.2 | 1.7W | 40.8V |
| -303 | 120V | 3900 | .018 | 2.2 | 1.7W | 102 V |
| -304 | 208V | 11500 | .011 | 2.2 | 1.7W | 177 V |
| -305 | 240V | 15600 | .009 | 2.2 | 1.7W | 204 V |
| -306 | 277V | 25000 | .008 | 2.2 | 1.7W | 236 V |
| -307 | 480V | 62400 | .0045 | 2.2 | 1.7W | 408 V |
| -308 | 6V DC | 15.4 | .390 | 2.4 | 2.4W | 5.1V |
| -309 | 12V DC | 62 | .194 | 2.4 | 2.4W | 10.2V |
| -310 | 24V DC | 247 | .097 | 2.4 | 2.4W | 20.4V |
| -311 | 48V DC | 986 | .049 | 2.4 | 2.4W | 40.8V |

Above coil data applies only to single pole device. Consult the factory for coil data on two and three pole configurations.



durakool®

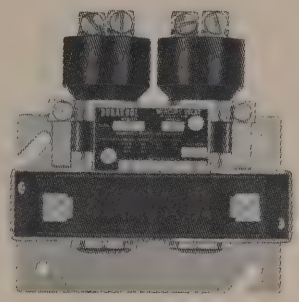
# GENERAL PURPOSE RELAYS—30 AMP

UL CSA

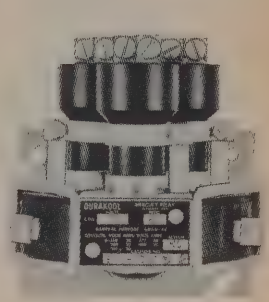
## BF Series—Normally Open

## BB Series—Normally Closed

Model BF7000



Model BF2 7000



Model BF3 7000

BF and BB 7000 series devices are U.L. listed under file #E35126 and C.S.A. file #22416. Catalog numbers other than the 7000 series do not carry either U.L. or C.S.A. listings. Contact ratings for this series of relays are shown on page 9.

Leaded versions are also available; consult the factory office for part numbers. Many other AC and DC coil voltages are available. See BFL series for industrial lug type terminations on top and bottom of contact tubes.

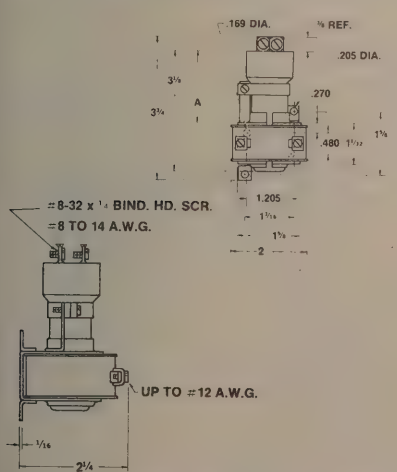
## BF SERIES/Normally Open

| Contacts | Part # | Volts | COIL DATA—TYPICAL Power (Watts) | Current (Amps) | V.A. | Resistance (DC Ohms) |
|---|---|---|---|---|---|---|
| One Form "A" S.P.S.T. N.O. | BF-7031 | 24V60Hz | 3.2 | .228 | 5.47 | 36 |
| | BF-7032 | 120V60Hz | 2.5 | .047 | 5.64 | 915 |
| | BF-7033 | 208V60Hz | 2.7 | .025 | 5.20 | 3100 |
| | BF-7034 | 240V60Hz | 2.4 | .022 | 5.28 | 3700 |
| | BF-7035 | 277V60Hz | 2.4 | .019 | 5.26 | 5410 |
| | BF-7036 | 480V60Hz | 2.7 | .011 | 5.28 | 14700 |
| | BF-7058 | 12VDC | 2.7 | .210 | — | 57 |
| | BF-7046 | 24VDC | 2.7 | .110 | — | 230 |
| Two Form "A" D.P.S.T. N.O. | BF2-7026 | 24V60Hz | 5.3 | .450 | 10.8 | 15 |
| | BF2-7027 | 120V60Hz | 4.9 | .098 | 11.8 | 350 |
| | BF2-7028 | 208V60Hz | 5.5 | .065 | 13.5 | 960 |
| | BF2-7029 | 240V60Hz | 4.8 | .049 | 11.8 | 1400 |
| | BF2-7030 | 277V60Hz | 4.6 | .040 | 11.1 | 2300 |
| | BF2-7031 | 480V60Hz | 4.8 | .025 | 11.8 | 5600 |
| | BF2-7041 | 12VDC | 6.0 | .500 | — | 24 |
| | BF2-7032 | 24VDC | 6.1 | .255 | — | 95 |
| Three Form "A" 3P.S.T. N.O. | BF3-7023 | 24V60Hz | 9.0 | .941 | 22.6 | 5 |
| | BF3-7024 | 120V60Hz | 8.7 | .200 | 24.0 | 135 |
| | BF3-7025 | 208V60Hz | 8.2 | .110 | 22.9 | 480 |
| | BF3-7026 | 240V60Hz | 7.8 | .102 | 24.5 | 520 |
| | BF3-7027 | 277V60Hz | 7.0 | .078 | 21.6 | 830 |
| | BF3-7028 | 480V60Hz | 7.8 | .050 | 24.0 | 2100 |
| | BF3-7037 | 12VDC | 11.0 | .940 | — | 13 |
| | BF3-7038 | 24VDC | 11.0 | .470 | — | 51 |

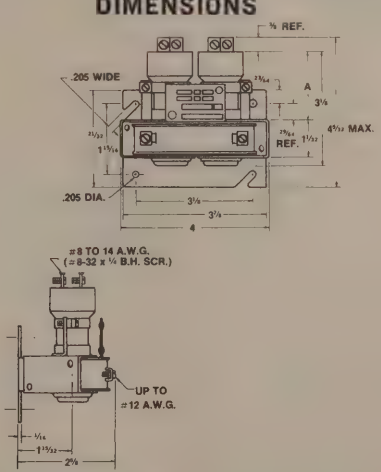
## BB SERIES/Normally Closed

| Contacts | Part # | Volts | COIL DATA—TYPICAL Power (Watts) | Current (Amps) | V.A. | Resistance (DC Ohms) |
|---|---|---|---|---|---|---|
| One Form "B" S.P.S.T. N.C. | BB-7001 | 24V60Hz | 2.5 | .204 | 4.90 | 36 |
| | BB-7002 | 120V60Hz | 2.0 | .039 | 4.68 | 915 |
| | BB-7003 | 208V60Hz | 2.2 | .023 | 4.78 | 3100 |
| | BB-7004 | 240V60Hz | 2.0 | .019 | 4.56 | 3700 |
| | BB-7005 | 277V60Hz | 2.0 | .017 | 4.71 | 5410 |
| | BB-7006 | 480V60Hz | 2.0 | .010 | 4.80 | 14700 |
| | BB-7027 | 12VDC | 2.7 | .220 | — | 57 |
| | BB-7007 | 24VDC | 2.7 | .110 | — | 230 |
| Two Form "B" D.P.S.T. N.C. | BB2-2001 | 24V60Hz | 4.0 | .390 | 9.36 | 15 |
| | BB2-2020 | 120V60Hz | 4.3 | .09 | 10.80 | 350 |
| | BB2-2002 | 208V60Hz | 4.8 | .06 | 12.50 | 960 |
| | BB2-2023 | 240V60Hz | 3.8 | .042 | 10.08 | 1400 |
| | BB2-2024 | 277V60Hz | 3.8 | .035 | 9.70 | 2300 |
| | BB2-2003 | 480V60Hz | 4.0 | .021 | 10.08 | 5600 |
| | BB2-2018 | 12VDC | 6.0 | .50 | — | 24 |
| | BB2-2004 | 24VDC | 6.1 | .225 | — | 95 |
| Three Form "B" 3P.S.T. N.C. | BB3-2008 | 24V60Hz | 7.7 | .910 | 21.84 | 5.0 |
| | BB3-2002 | 120V60Hz | 7.4 | .175 | 21.0 | 135 |
| | BB3-2009 | 208V60Hz | 6.8 | .095 | 19.76 | 480 |
| | BB3-2010 | 240V60Hz | 6.4 | .090 | 21.6 | 520 |
| | BB3-2011 | 277V60Hz | 6.2 | .070 | 19.39 | 830 |
| | BB3-2012 | 480V60Hz | 7.0 | .045 | 21.6 | 2100 |
| | BB3-2013 | 12VDC | 11.0 | 1.00 | — | 12.8 |
| | BB3-2014 | 24VDC | 11.0 | .470 | — | 51 |

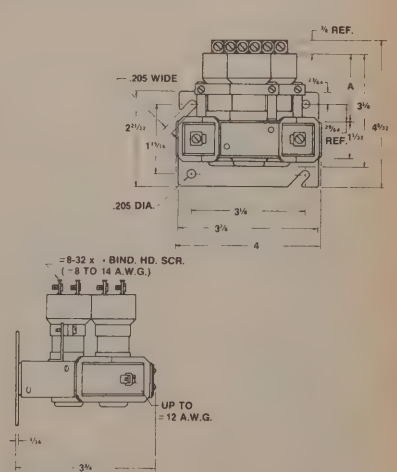
## DIMENSIONS




| CATALOG DESIGNATION | A 60 Hz | A DC |
|---|---|---|
| BF | 1 55/64 | 1 47/64 |
| BB | 1 3/32 | 1 3/8 |




| CATALOG DESIGNATION | A 60 Hz | A DC |
|---|---|---|
| BF2 | 1 55/64 | 1 47/64 |
| BB2 | 1 3/32 | 1 3/8 |




| CATALOG DESIGNATION | A 60 Hz | A DC |
|---|---|---|
| BF3 | 1 55/64 | 1 47/64 |
| BB3 | 1 3/32 | 1 3/8 |

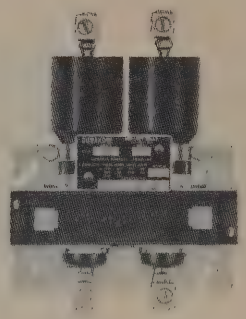
durakool®

# GENERAL PURPOSE RELAYS—35 AMP—AT 480 VAC

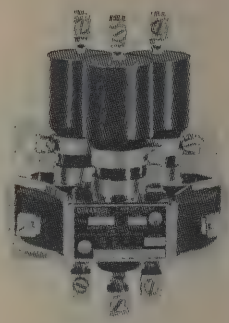
UL CSA

## BFL Series — Normally Open

Model BFL 7000



Model BFL2 7000



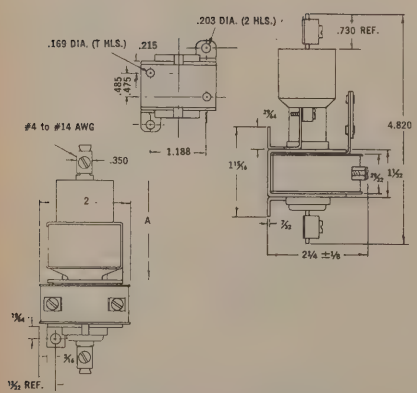
Model BFL3 7000

BFL 7000 series devices are U.L. listed under file #E35126 and C.S.A. file #22416. Catalog numbers other than the 7000 series do not carry either U.L. or C.S.A. listings. Contact ratings for this series of relays are shown on page 9. Leaded versions are also available; consult the factory office for part numbers. Many other AC and DC coil voltages are available. Durakool's BF series feature top tube screw type terminations for installations where wire routing requires in and out wiring from the top of the contact tubes. See detailed drawings and data in this catalog.

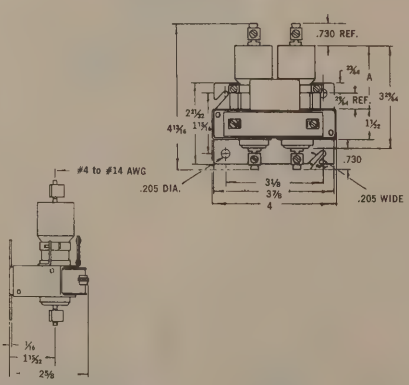
### BFL SERIES/Normally Open

| Contacts | Part # | Coil Data — Typical | | | | |
|---|---|---|---|---|---|---|
| | | Volts | Power (Watts) | Current (Amps) | V.A. | Resistance (DC Ohms) |
| One Form "A" S.P.S.T. N.O. | BFL-7031 | 24V 60 Hz | 3.2 | .228 | 5.47 | 36 |
| | BFL-7032 | 120V 60 Hz | 2.5 | .047 | 5.64 | 915 |
| | BFL-7033 | 208V 60 Hz | 2.7 | .025 | 5.20 | 3100 |
| | BFL-7034 | 240V 60 Hz | 2.4 | .022 | 5.28 | 3700 |
| | BFL-7035 | 277V 60 Hz | 2.4 | .019 | 5.26 | 5410 |
| | BFL-7036 | 480V 60 Hz | 2.7 | .011 | 5.28 | 14700 |
| | BFL-7058 | 12V DC | 2.7 | .210 | — | 57 |
| | BFL-7048 | 24V DC | 2.7 | .110 | — | 230 |
| Two Form "A" D.P.S.T. N.O. | BFL2-7026 | 24V 60 Hz | 5.3 | .450 | 10.8 | 15 |
| | BFL2-7027 | 120V 60 Hz | 4.9 | .098 | 11.8 | 350 |
| | BFL2-7028 | 208V 60 Hz | 5.5 | .065 | 13.5 | 960 |
| | BFL2-7029 | 240V 60 Hz | 4.8 | .049 | 11.8 | 1400 |
| | BFL2-7030 | 277V 60 Hz | 4.6 | .040 | 11.1 | 2300 |
| | BFL2-7031 | 480V 60 Hz | 4.8 | .025 | 11.8 | 5600 |
| | BFL2-7041 | 12V DC | 6.0 | .500 | — | 24 |
| | BFL2-7032 | 24V DC | 6.1 | .255 | — | 95 |
| Three Form "A" 3P.S.T. N.O. | BFL3-7023 | 24V 60 Hz | 9.0 | .941 | 22.6 | 5 |
| | BFL3-7024 | 120V 60 Hz | 8.7 | .200 | 24.0 | 135 |
| | BFL3-7025 | 208V 60 Hz | 8.2 | .110 | 22.9 | 480 |
| | BFL3-7026 | 240V 60 Hz | 7.8 | .102 | 24.5 | 520 |
| | BFL3-7027 | 277V 60 Hz | 7.0 | .078 | 21.6 | 830 |
| | BFL3-7028 | 480V 60 Hz | 7.8 | .050 | 24.0 | 2100 |
| | BFL3-7037 | 12V DC | 11.0 | .940 | — | 13 |
| | BFL3-7038 | 24V DC | 11.0 | .470 | — | 51 |

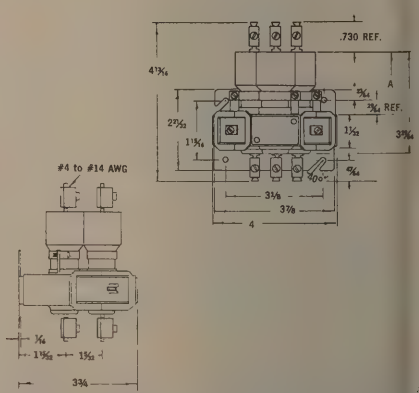
### DIMENSIONS




| A Dimension | Frequency |
|---|---|
| 2 1/32 | DC |
| 2 7/64 | 50 Hz |
| 2 3/16 | 60 Hz |




| A Dimension | Frequency |
|---|---|
| 2 1/32 | DC |
| 2 7/64 | 50 Hz |
| 2 3/16 | 60 Hz |




| A Dimension | Frequency |
|---|---|
| 2 3/16 | 60 Hz |
| 2 7/64 | 50 Hz |
| 2 1/32 | DC |

durakool®

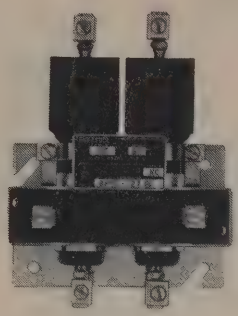
# CONTACTORS—60 AMP

UL CSA

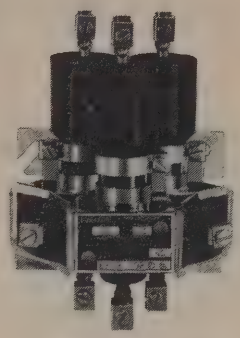
## BFC Series—Normally Open

## BBC Series—Normally Closed

Model BFC700



Model BFC2 700



Model BFC3 700

BFC and BBC 700 series devices are listed under U.L. file #E35126 and C.S.A. file #22416. Catalog numbers other than 700 series are not U.L. or C.S.A. listed. Contact ratings are shown on page 9. Leaded versions are also available. Only popular operating coil voltages are shown; consult the factory for part numbers of other AC and DC coils.

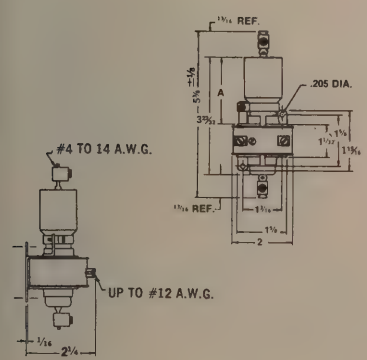
## BFC SERIES/Normally Open

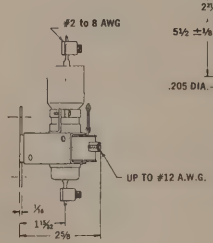
| Contacts | Part # | COIL DATA—TYPICAL Volts | Power (Watts) | Current (Amps) | V.A. | Resistance (DC Ohms) |
|---|---|---|---|---|---|---|
| One Form "A" S.P.S.T. N.O. | BFC-716 | 24V60Hz | 4.0 | .275 | 6.60 | 36 |
| | BFC-717 | 120V60Hz | 3.0 | .054 | 6.48 | 915 |
| | BFC-718 | 208V60Hz | 3.5 | .030 | 6.24 | 3100 |
| | BFC-719 | 240V60Hz | 3.0 | .028 | 6.72 | 3700 |
| | BFC-720 | 277V60Hz | 3.2 | .022 | 6.10 | 5410 |
| | BFC-721 | 480V60Hz | 3.5 | .015 | 7.20 | 14700 |
| | BFC-730 | 12VDC | 2.7 | .210 | — | 57 |
| | BFC-722 | 24VDC | 2.7 | .110 | — | 230 |
| Two Form "A" D.P.S.T. N.O. | BFC2-726 | 24V60Hz | 6.3 | .535 | 12.8 | 15 |
| | BFC2-727 | 120V60Hz | 5.8 | .110 | 13.2 | 350 |
| | BFC2-728 | 208V60Hz | 5.8 | .067 | 13.9 | 960 |
| | BFC2-729 | 240V60Hz | 5.6 | .055 | 13.2 | 1400 |
| | BFC2-730 | 277V60Hz | 5.2 | .044 | 12.2 | 2300 |
| | BFC2-731 | 480V60Hz | 5.8 | .028 | 13.4 | 5600 |
| | BFC2-741 | 12VDC | 6.0 | .500 | — | 24 |
| | BFC2-733 | 24VDC | 6.1 | .255 | — | 95 |
| Three Form "A" 3P.S.T. N.O. | BFC3-707 | 24V60Hz | 10.7 | 1.13 | 27.1 | 5 |
| | BFC3-708 | 120V60Hz | 10.5 | .230 | 27.6 | 135 |
| | BFC3-709 | 208V60Hz | 10.0 | .128 | 26.6 | 480 |
| | BFC3-710 | 240V60Hz | 9.2 | .118 | 28.3 | 520 |
| | BFC3-711 | 277V60Hz | 10.5 | .082 | 22.7 | 830 |
| | BFC3-712 | 480V60Hz | 10.5 | .059 | 28.3 | 2100 |
| | BFC3-720 | 12VDC | 11.3 | .938 | — | 13 |
| | BFC3-721 | 24VDC | 11.0 | .470 | — | 51 |

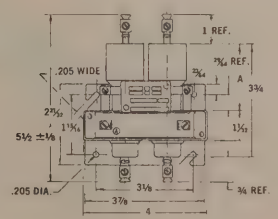
## BBC SERIES/Normally Closed

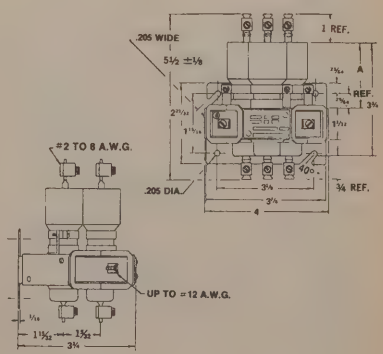
| Contacts | Part # | COIL DATA—TYPICAL Volts | Power (Watts) | Current (Amps) | V.A. | Resistance (DC Ohms) |
|---|---|---|---|---|---|---|
| One Form "B" S.P.S.T. N.C. | BBC-701 | 24V60Hz | 3.4 | .242 | 5.81 | 36 |
| | BBC-702 | 120V60Hz | 2.6 | .048 | 5.76 | 915 |
| | BBC-703 | 208V60Hz | 2.8 | .028 | 5.82 | 3100 |
| | BBC-704 | 240V60Hz | 2.6 | .024 | 5.76 | 3700 |
| | BBC-705 | 277V60Hz | 2.6 | .020 | 5.54 | 5410 |
| | BBC-706 | 480V60Hz | 2.4 | .012 | 5.76 | 14700 |
| | BBC-719 | 12VDC | 2.5 | .210 | — | 57 |
| | BBC-707 | 24VDC | 2.7 | .110 | — | 230 |
| Two Form "B" D.P.S.T. N.C. | BBC2-309 | 24V60Hz | 5.2 | .480 | 11.52 | 15 |
| | BBC2-305 | 120V60Hz | 5.3 | .105 | 12.6 | 350 |
| | BBC2-310 | 208V60Hz | 5.8 | .096 | 19.97 | 960 |
| | BBC2-306 | 240V60Hz | 5.0 | .052 | 12.48 | 1400 |
| | BBC2-311 | 277V60Hz | 5.0 | .043 | 11.91 | 2300 |
| | BBC2-312 | 480V60Hz | 5.0 | .026 | 12.48 | 5600 |
| | BBC2-313 | 12VDC | 6.0 | .500 | — | 24 |
| | BBC2-308 | 24VDC | 6.1 | .255 | — | 95 |
| Three Form "B" 3P.S.T. | BBC3-308 | 24V60Hz | 8.8 | 1.040 | 24.96 | 5.0 |
| | BBC3-303 | 120V60Hz | 8.5 | .200 | 24.0 | 135 |
| | BBC3-309 | 208V60Hz | 7.6 | .108 | 22.46 | 480 |
| | BBC3-306 | 240V60Hz | 7.6 | .100 | 24.0 | 520 |
| | BBC3-310 | 277V60Hz | 7.4 | .080 | 22.16 | 830 |
| | BBC3-311 | 480V60Hz | 8.0 | .048 | 23.0 | 2100 |
| | BBC3-312 | 12VDC | 11.0 | 1.00 | — | 12.8 |
| | BBC3-313 | 24VDC | 11.0 | .470 | — | 51 |

## DIMENSIONS




| Catalog Designation | A Dimension 60 Hz | A Dimension DC |
|---|---|---|
| BFC | 2 5/16 | 2 3/4 |
| BBC | 1 37/64 | 1 5/8 |

| 2 3/4 | DC |
|---|---|
| | 25 CY |
| 2 3/16 | 50 CY |
| 2 5/16 | 60 CY |
| A Dimension | Frequency |

| Catalog Designation | A Dimension 60 Hz | A Dimension DC |
|---|---|---|
| BFC3 | 2 5/16 | 2 3/4 |
| BBC3 | 1 37/64 | 1 5/8 |

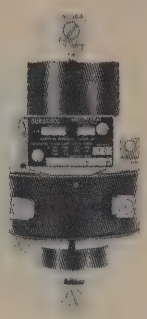
durakool®

# CONTACTORS—100 AMP

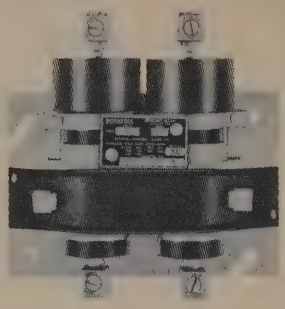
UL CSA

## CFC Series—Normally Open

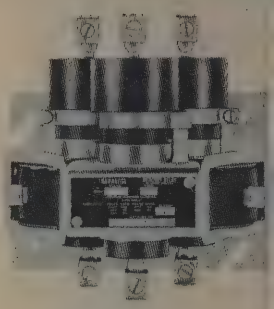
## CBC Series—Normally Closed



Model CFC 700



Model CFC2 700



Model CFC3 700

CFC and CBC 700 series devices are listed under U.L. file #E35126 and CSA file #22416. Catalog numbers other than 700 series are not U.L. or C.S.A. listed. Contact ratings are shown on page 9. Leaded versions are also available. Only popular operating coil voltages are shown; consult the factory for part numbers of other AC and DC coils.

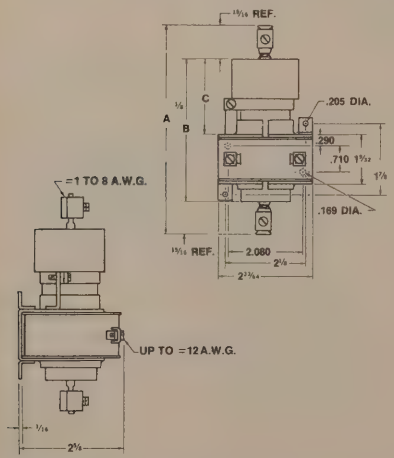
## CFC SERIES/Normally Open

| Contacts | Part # | Volts | COIL DATA—TYPICAL Power (Watts) | Current (Amps) | V.A. | Resistance (D.C. Ohms) |
|---|---|---|---|---|---|---|
| One Form "A" S.P.S.T. N.O. | CFC-717 | 24V60Hz | 9.0 | .820 | 19.7 | 7.1 |
| | CFC-718 | 120V60Hz | 8.0 | .170 | 20.4 | 180 |
| | CFC-719 | 208V60Hz | 8.2 | .098 | 20.4 | 600 |
| | CFC-720 | 240V60Hz | 8.0 | .085 | 20.4 | 680 |
| | CFC-721 | 277V60Hz | 8.0 | .070 | 19.4 | 1000 |
| | CFC-722 | 480V60Hz | 8.0 | .045 | 21.6 | 2700 |
| | CFC-731 | 12VDC | 5.4 | .445 | — | 27 |
| | CFC-723 | 24VDC | 5.3 | .220 | — | 111 |
| Two Form "A" D.P.S.T. N.O. | CFC2-726 | 24V60Hz | 16.6 | 1.85 | 44.4 | 2.8 |
| | CFC2-727 | 120V60Hz | 15.6 | .380 | 45.6 | 66 |
| | CFC2-728 | 208V60Hz | 19.6 | .246 | 51.2 | 165 |
| | CFC2-729 | 240V60Hz | 17.0 | .190 | 45.6 | 260 |
| | CFC2-730 | 277V60Hz | 17.0 | .180 | 49.9 | 430 |
| | CFC2-731 | 480V60Hz | 17.0 | .095 | 45.6 | 1100 |
| | CFC2-741 | 12VDC | 14.4 | 1.20 | — | 10 |
| | CFC2-733 | 24VDC | 14.4 | .600 | — | 40 |
| Three Form "A" 3P.S.T. N.O. | CFC3-707 | 24V60Hz | 29.0 | 3.40 | 81.6 | 1.04 |
| | CFC3-708 | 120V60Hz | 28.0 | .700 | 84.0 | 27 |
| | CFC3-709 | 208V60Hz | 28.8 | .380 | 79.0 | 100 |
| | CFC3-710 | 240V60Hz | 29.0 | .350 | 84.0 | 110 |
| | CFC3-711 | 277V60Hz | 29.0 | .300 | 83.1 | 150 |
| | CFC3-712 | 480V60Hz | 29.0 | .180 | 86.4 | 440 |
| | CFC3-720 | 12VDC | 14.4 | 1.20 | — | 10 |
| | CFC3-721 | 24VDC | 14.4 | .600 | — | 40 |

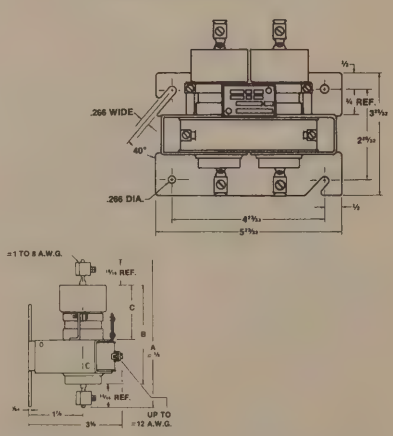
## CBC SERIES/Normally Closed

| Contacts | Part # | Volts | COIL DATA—TYPICAL Power (Watts) | Current (Amps) | V.A. | Resistance (D.C. Ohms) |
|---|---|---|---|---|---|---|
| One Form "B" S.P.S.T. N.C. | CBC-701 | 24V60Hz | 7.0 | .770 | 18.4 | 7.1 |
| | CBC-702 | 120V60Hz | 6.6 | .150 | 18.0 | 180 |
| | CBC-703 | 208V60Hz | 7.0 | .085 | 17.7 | 600 |
| | CBC-704 | 240V60Hz | 7.0 | .075 | 18.0 | 680 |
| | CBC-705 | 277V60Hz | 7.0 | .065 | 18.0 | 1000 |
| | CBC-706 | 480V60Hz | 7.0 | .038 | 18.2 | 2700 |
| | CBC-719 | 12VDC | 5.4 | .455 | — | 27 |
| | CBC-707 | 24VDC | 5.3 | .220 | — | 111 |
| Two Form "B" D.P.S.T. N.C. | CBC2-315 | 24V60Hz | 14.8 | 1.660 | 39.84 | 2.8 |
| | CBC2-309 | 120V60Hz | 14.2 | .365 | 43.80 | 66 |
| | CBC2-316 | 208V60Hz | 16.6 | .244 | 50.75 | 165 |
| | CBC2-306 | 240V60Hz | 17.0 | .188 | 45.12 | 260 |
| | CBC2-317 | 277V60Hz | 17.0 | .170 | 47.09 | 430 |
| | CBC2-313 | 480V60Hz | 17.0 | .094 | 45.12 | 1100 |
| | CBC2-318 | 12VDC | 14.5 | 1.20 | — | 10 |
| | CBC2-319 | 24VDC | 14.4 | .600 | — | 40 |
| Three Form "B" D.P.S.T. N.C. | CBC3-307 | 24V60Hz | 27.0 | 3.16 | 75.84 | 1.04 |
| | CBC3-304 | 120V60Hz | 21.2 | .64 | 76.80 | 27 |
| | CBC3-308 | 208V60Hz | 22.8 | .36 | 74.88 | 100 |
| | CBC3-306 | 240V60Hz | 21.2 | .32 | 76.80 | 110 |
| | CBC3-309 | 277V60Hz | 21.2 | .29 | 80.33 | 150 |
| | CBC3-305 | 480V60Hz | 21.2 | .16 | 76.80 | 440 |
| | CBC3-310 | 12VDC | 14.5 | 1.20 | — | 10 |
| | CBC3-311 | 24VDC | 14.4 | .600 | — | 40 |

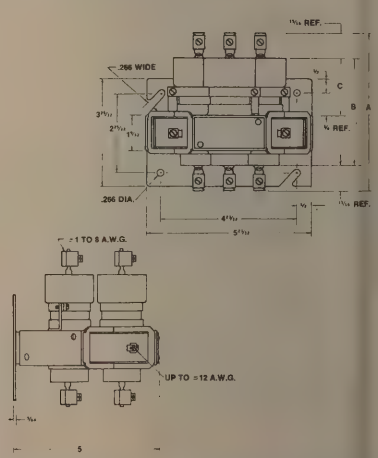
## DIMENSIONS




| CATALOG DESIGNATION | A | B | C 60 Hz | C DC |
|---|---|---|---|---|
| CFC | 5 5/16 | 3 3/4 | 1 61/64 | 1 11/16 |
| CBC | 5 13/16 | 4 1/64 | 1 3/64 | 1 11/32 |




| CATALOG DESIGNATION | A | B | C 60 Hz | C DC |
|---|---|---|---|---|
| CFC2 | 5 5/16 | 3 3/4 | 1 61/64 | 1 11/16 |
| CBC2 | 5 13/16 | 4 1/64 | 1 3/64 | 1 11/32 |



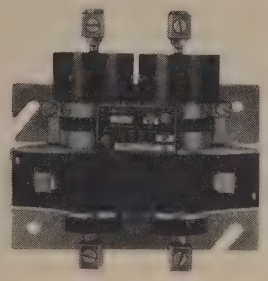

| CATALOG DESIGNATION | A | B | C 60 Hz | C DC |
|---|---|---|---|---|
| CFC3 | 5 5/16 | 3 3/4 | 1 61/64 | 1 11/16 |
| CBC3 | 5 13/16 | 4 1/64 | 1 3/64 | 1 11/32 |

# durakool®

## CONTACTORS—150 AMP

### DFC — Normally Open

Model DFC-300



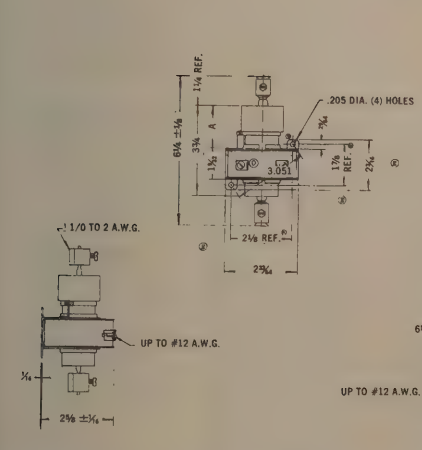
Model DFC2-300

Model DFC3-300

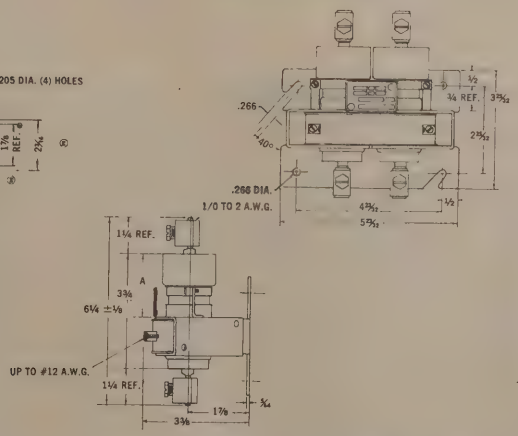
DFC 300 Series contactors per pole contact ratings are shown on page 9. Leaded versions are also available. Only popular operating coil voltages are shown in the selection chart. Consult the factory for part numbers of other AC and DC coils.

| Contacts | Part Number | Coil Data — Typical | | | | |
|---|---|---|---|---|---|---|
| | | Volts | Power (Watts) | Current (Amps) | V.A. | Resistance (Ω) |
| One Form "A" S.P.S.T. N.O. | DFC-307 | 24V 60 Hz | 9.0 | .820 | 19.7 | 7.1 |
| | DFC-301 | 120V 60 Hz | 8.0 | .170 | 20.4 | 180. |
| | DFC-304 | 208V 60 Hz | 8.2 | .098 | 20.4 | 600. |
| | DFC-303 | 240V 60 Hz | 8.0 | .085 | 20.4 | 680. |
| | DFC-305 | 277V 60 Hz | 8.0 | .070 | 19.4 | 1000. |
| | DFC-306 | 480V 60 Hz | 8.0 | .045 | 21.6 | 2700. |
| | DFC-313 | 12V DC | 5.4 | .445 | — | 27. |
| | DFC-310 | 24V DC | 5.3 | .220 | — | 111. |
| Two Form "A" D.P.S.T. N.O. | DFC2-307 | 24V 60 Hz | 16.6 | 1.85 | 44.4 | 2.8 |
| | DFC2-301 | 120V 60 Hz | 15.6 | .380 | 45.6 | 66. |
| | DFC2-304 | 208V 60 Hz | 19.6 | .246 | 51.2 | 165. |
| | DFC2-303 | 240V 60 Hz | 17.0 | .190 | 45.6 | 260. |
| | DFC2-305 | 277V 60 Hz | 17.0 | .180 | 49.9 | 430. |
| | DFC2-306 | 480V 60 Hz | 17.0 | .095 | 45.6 | 1100. |
| | DFC2-313 | 12V DC | 14.4 | 1.20 | — | 10. |
| | DFC2-310 | 24V DC | 14.4 | .60 | — | 40. |
| Three Form "A" 3P.S.T. N.O. | DFC3-307 | 24V 60 Hz | 32.0 | 3.6 | 86. | .68 |
| | DFC3-301 | 120V 60 Hz | 32.0 | .72 | 86. | 18. |
| | DFC3-304 | 208V 60 Hz | 32.0 | .41 | 86. | 55.4 |
| | DFC3-303 | 240V 60 Hz | 32.0 | .36 | 86. | 69. |
| | DFC3-305 | 277V 60 Hz | 32.0 | .31 | 86. | 100. |
| | DFC3-306 | 480V 60 Hz | 32.0 | .18 | 86. | 275. |
| | DFC3-313 | 12V DC | 14.4 | 1.2 | — | 10. |
| | DFC3-310 | 24V DC | 14.4 | .6 | — | 40. |

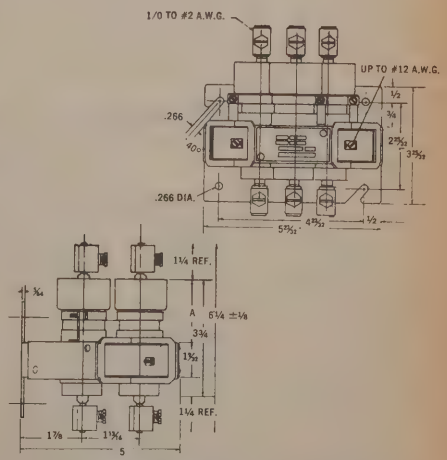
## DIMENSIONS




| A Dimension | Coil Frequency |
|---|---|
| 1 11/16 | DC |
| 1 53/64 | 25 Hz |
| 1 29/32 | 50 Hz |
| 1 61/64 | 60 Hz |




| A Dimension | Coil Frequency |
|---|---|
| 1 11/16 | DC |
| 1 53/64 | 25 Hz |
| 1 29/32 | 50 Hz |
| 1 61/64 | 60 Hz |

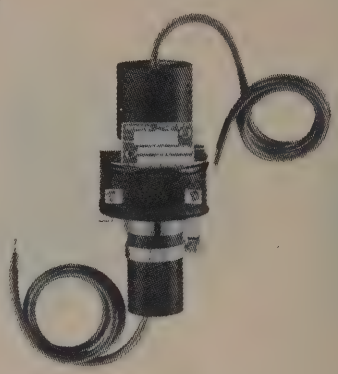



| A Dimension | Coil Frequency |
|---|---|
| 1 11/16 | DC |
| — | 25 Hz |
| — | 50 Hz |
| 1 57/64 | 60 Hz |

durakool®

# HIGH VOLTAGE CONTACTORS—2500-3500 V

Durakool High Voltage Units are available in either leaded or industrial field termination types. Operating coil voltages other than part numbers shown are available. Contact factory engineering personnel for special application assistance.



## HIGH VOLTAGE/Leaded Terminations

* Black Rubber Insulation #18 AWG High Voltage Flexible Leads are Rated at 5000 Volt Working Voltage

** Red Polyethylene (Korona-Guard) Insulation #18 AWG High Voltage Leads are Rated at 40,000 DC Working Voltage

| | Contacts | | | | Coil Data — Typical | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Part # | Lead Color | Form | Volts AC | Amps | Volts | Power (Watts) | Current (Amps) | V.A. | Resistance (D.C. Ohms) |
| CF-215 | Black | N.O. | 2500 | 10 | 230V 60 Hz | 8.1 | .074 | 17.8 | 680 |
| CF-216 | Black | N.O. | 2500 | 10 | 115V 60 Hz | 8.1 | .148 | 17.8 | 170 |
| CF-219 | Black | N.O. | 2500 | 10 | 230V 50 Hz | 8.0 | .070 | 16.1 | 680 |
| CF-226 | Black | N.O. | 2500 | 10 | 24V DC | 5.5 | .230 | — | 111 |
| CF-229 | Red | N.O. | 2500 | 10 | 230V 60 Hz | 8.1 | .074 | 17.8 | 680 |
| CF-230 | Red | N.O. | 2500 | 10 | 230V 50 Hz | 8.0 | .070 | 16.1 | 680 |
| CF-231 | Red | N.O. | 2500 | 10 | 208V 50 Hz | 8.0 | .077 | 16.1 | 600 |
| CF-232 | Red | N.O. | 2500 | 10 | 115V 60 Hz | 8.1 | .148 | 17.8 | 170 |
| CF-233 | Red | N.O. | 2500 | 10 | 115V 50 Hz | 8.0 | .143 | 16.5 | 170 |
| CF-234 | Red | N.O. | 2500 | 10 | 100V 50 Hz | 8.0 | .165 | 16.5 | 150 |
| CF-235 | Red | N.O. | 2500 | 10 | 200V 50 Hz | 8.0 | .0805 | 16.1 | 580 |
| CF-238 | Black | N.O. | 2500 | 10 | 48V DC | 6.0 | .115 | — | 440 |
| CB-215 | Black | N.C. | 2500 | 10 | 230V 60 Hz | 7.0 | .075 | 18.0 | 680 |
| CB-218 | Black | N.C. | 2500 | 10 | 115V 60 Hz | 7.0 | .156 | 18.72 | 180 |
| CB-221 | Black | N.C. | 2500 | 10 | 24V DC | 5.3 | .220 | — | 108 |
| CB-222 | Black | N.C. | 2500 | 10 | 230V 50 Hz | 6.9 | .078 | 18.0 | 680 |
| CB-223 | Red | N.C. | 2500 | 10 | 230V 60 Hz | 7.0 | .075 | 18.0 | 680 |
| CB-224 | Red | N.C. | 2500 | 10 | 115V 60 Hz | 7.0 | .156 | 18.72 | 180 |
| CB-225 | Black | N.C. | 2500 | 10 | 115V 50 Hz | 6.9 | .156 | 18.0 | 180 |
| CB-226 | Red | N.C. | 3500 | 10 | 230V 50 Hz | 6.9 | .078 | 18.0 | 680 |

## HIGH VOLTAGE/Industrial Field Wiring Terminations

| | Contacts | | | Coil Data — Typical | | | | |
|---|---|---|---|---|---|---|---|---|
| Part # | Form | Volts AC | Amps | Volts | Power (Watts) | Current (Amps) | V.A. | Resistance (D.C. Ohms) |
| CF-302 | N.O. | 2500 | 10 | 115V 60 Hz | 8.1 | .148 | 17.8 | 170 |
| CF-303 | N.O. | 2500 | 10 | 230V 50/60 Hz | 8.1 | .074 | 17.8 | 680 |
| CF-305 | N.O. | 2500 | 10 | 115V 50/60 Hz | 8.1 | .148 | 17.8 | 170 |
| CFC-387 | N.O. | 3500 | 10 | 230V 60Hz | 8.0 | .085 | 20.4 | 680 |
| CFC-389 | N.O. | 3500 | 10 | 230V 50 Hz | 7.9 | .080 | 18.4 | 680 |
| CFC-390 | N.O. | 3500 | 10 | 115V 60 Hz | 8.0 | .170 | 20.4 | 180 |
| CFC-392 | N.O. | 3500 | 10 | 115V 50 Hz | 7.9 | .160 | 18.4 | 170 |
| CFC-395 | N.O. | 3500 | 10 | 230V 50/60 Hz | 8.0 | .085 | 20.4 | 680 |
| CFC-396 | N.O. | 3500 | 10 | 24V DC | 5.3 | .220 | — | 111 |
| CB-302 | N.C. | 2500 | 10 | 115V 60 Hz | 7.0 | .156 | 18.72 | 180 |
| CB-303 | N.C. | 2500 | 10 | 230V 60Hz | 7.0 | .075 | 18.0 | 680 |
| CB-305 | N.C. | 2500 | 10 | 115V 50 Hz | 6.9 | .154 | 17.71 | 180 |
| CBC-333 | N.C. | 3500 | 10 | 115V 60 Hz | 6.6 | .150 | 18.0 | 180 |
| CBC-335 | N.C. | 3500 | 10 | 230V 60Hz | 7.0 | .075 | 18.0 | 680 |
| CBC-336 | N.C. | 3500 | 10 | 200V 50 Hz | 6.9 | .089 | 17.8 | 640 |
| CBC-337 | N.C. | 3000 | 10 | 210V 50/60 Hz | 7.0 | .085 | 17.8 | 600 |
| CBC-339 | N.C. | 3500 | 10 | 48V DC | 5.2 | .109 | — | 440 |

durakool®

# RELAY AND CONTACTOR DATA

CONTACT RATINGS/PER POLE — See appropriate chart
LIFE EXPECTANCY
Mechanical Life ..... 25 million minimum
General Purpose Load ..... 8 million minimum

OPERATE TIME ..... 80 milliseconds typical
RELEASE TIME ..... 100/120 milliseconds typical

**Electrical Ratings Per Pole — Non U.L. & C.S.A. listed devices**

## ELECTRICAL RATINGS OF NORMALLY OPEN CONTACTORS

| Basic Catalog Designations | General Purpose Load Ratings — Amperes | | | | | | | | Tungsten Lamp Load at 120V 60 Hz | | AC Motor Ratings in HP - Singe Phase | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AC | | | | | | DC | | | | | |
| | 120V | 208V | 240V | 277V | 480V | 600V | 120V | 240V | Amp | KW | 120V | 240V |
| AFM10 | 10 | 10 | 10 | 10 | 10 | 5 | 5 | 3 | 10 | 1.2 | ½ | ¾ |
| AFM15 | 15 | 15 | 15 | 15 | 15 | 7½ | 7½ | 5 | 10 | 1.2 | ¾ | 1 |
| AFM20 | 20 | 20 | 20 | 20 | 20 | 10 | 10 | 8 | 10 | 1.2 | 1 | 2 |
| BF | 35 | 35 | 30 | 30 | 30 | 30 | 25 | 15 | 30 | 4 | 2 | 3 |
| BFL | 35 | 35 | 35 | 35 | 35 | 35 | 25 | 15 | 30 | 4 | 2 | 3 |
| BFC | 60 | 60 | 60 | 60 | 60 | 60 | 30 | 20 | 60 | 6.6 | 3 | 5 |
| CF | 80 | 68 | 65 | 63 | 50 | 40 | 35 | 25 | 75 | 8 | 5 | 7½ |
| CFC | 100 | 92 | 90 | 88 | 75 | 70 | 50 | 30 | 100 | 10 | 7½ | 10 |
| DFC | 150 | 140 | 135 | 130 | 120 | 110 | — | — | — | — | — | — |

## ELECTRICAL RATINGS OF NORMALLY CLOSED CONTACTORS

| Basic Catalog Designations | General Purpose Load Ratings — Amperes | | | | | | | | Lamp Load at 120V 60 Hz | | AC Motor Ratings in HP - Singe Phase | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AC | | | | | | DC | | | | | |
| | 120V | 208V | 240V | 277V | 480V | 600V | 120V | 240V | Amp | KW | 120V | 240V |
| BB | 30 | 22 | 20 | 18 | 10 | 8 | 20 | 10 | 20 | 2.5 | 1½ | 2 |
| BBC | 60 | 47 | 45 | 45 | 35 | 25 | 30 | 20 | 55 | 6.6 | 3 | 5 |
| CB | 80 | 68 | 65 | 63 | 50 | 40 | 35 | 25 | 75 | 8 | 5 | 7½ |
| CBC | 100 | 92 | 90 | 88 | 75 | 70 | 50 | 30 | 90 | 10 | 7½ | 10 |

## ELECTRICAL RATINGS PER POLE — U.L. & C.S.A. LISTED DEVICES

**The below listed ratings apply to all U.L. and C.S.A. listed devices Series AFM300; BF & BB 7000; BFC & BBC 700; CF 700 and CFC & CBC 700 Series.**

### ELECTRICAL RATINGS OF NORMALLY OPEN CONTACTORS

| Basic Catalog Designation | General Purpose Load Ratings Amperes — AC | | | | | UL Tungsten Lamp Load at 120V 60 Hz | |
|---|---|---|---|---|---|---|---|
| | 120V | 208V | 240V | 277V | 480V | Amp | KW |
| AFM10 | 10 | 10 | 10 | 10 | 10 | 10 | 1.2 |
| AFM15 | 15 | 15 | 15 | 15 | 15 | 10 | 1.2 |
| AFM20 | 20 | 20 | 20 | 20 | 20 | 10 | 1.2 |
| BF | 30 | 30 | 30 | 30 | 30 | 30 | 3.6 |
| BFL | 35 | 35 | 35 | 35 | 35 | 35 | 4.2 |
| BFC | 60 | 60 | 60 | 60 | 60 | 60 | 7.2 |
| CF | 80 | 65 | 65 | 55 | 50 | 75 | 9 |
| CFC | 100 | 90 | 90 | 60 | 60 | 100 | 12 |

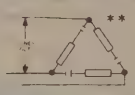
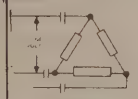
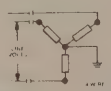
### ELECTRICAL RATINGS OF NORMALLY CLOSED CONTACTORS

| Basic Catalog Designation | General Purpose Load Ratings Amperes — AC | | | | | UL Tungsten Lamp Load at 120V 60 Hz | |
|---|---|---|---|---|---|---|---|
| | 120V | 208V | 240V | 277V | 480V | Amp | KW |
| BB | 30 | 22 | 20 | 18 | 10 | — | — |
| BBC | 60 | 45 | 45 | 45 | 35 | 55 | 6.6 |
| CB | — | — | — | — | — | — | — |
| CBC | 100 | 90 | 90 | 60 | 60 | 90 | 10.8 |

* At the time of printing AFM per pole U.L. ratings applied only to the single pole device. Please check the factory for U.L. status on 2 & 3 pole configurations.

** U.L. ratings on AFM, BF and BFL series were established on the basis of 100,000 cycle testing by the Underwriters Laboratories.

### K.W. RATINGS FOR 3-PHASE BALANCED HEATER LOADS BASED ON U.L. LISTED AMPS

| 3-Phase Contactor in Circuit | |  | |  | |  | |
|---|---|---|---|---|---|---|---|
| Catalog Designation | Line Volts | Amps Per Pole | Total KW Heater Load | Amps Per Pole | Total KW Heater Load | Amps Per Pole | Total KW Heater Load |
| BF3 | 208 | 30 | 18.7 | 30 | 10.8 | 30 | 10.8 |
| | 240 | 30 | 21.6 | 30 | 12.4 | 30 | 12.4 |
| | 480 | 30 | 43.2 | 30 | 24.9 | 30 | 24.9 |
| BFL3 | 208 | 35 | 21.4 | 35 | 12.3 | 35 | 12.3 |
| | 240 | 35 | 25.2 | 35 | 14.5 | 35 | 14.5 |
| | 480 | 35 | 50.4 | 35 | 29.0 | 35 | 29.0 |
| BFC3 | 208 | 60 | 36.7 | 60 | 21.5 | 60 | 21.5 |
| | 240 | 60 | 43.2 | 60 | 24.9 | 60 | 24.9 |
| | 480 | 60 | 86.4 | 60 | 49.8 | 60 | 49.8 |
| CFC3 | 208 | 90 | 55.1 | 90 | 32.3 | 100 | 35.9 |
| | 240 | 90 | 64.8 | 90 | 37.3 | 90 | 37.3 |
| | 480 | 60 | 86.4 | 60 | 49.8 | 60 | 49.8 |

** Interrupting device for line voltage required. Ratings subject to change without notice.

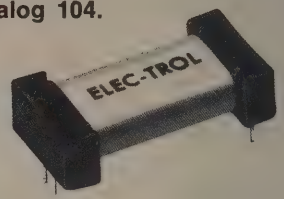
**Sales of Durakool Incorporated products are subject to terms and conditions per supplemental sheet form #D160.**

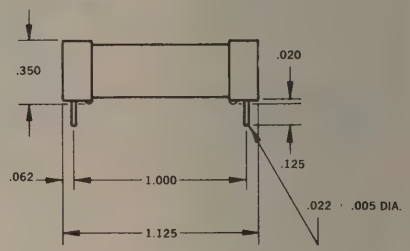
durakool inc., 1010 N. MAIN ST. • ELKHART, IND. 46514 • 219/264-1116 • TELEX—25-8482

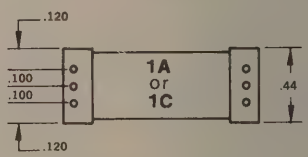
# ELEC-TROL OPEN LINE REED RELAYS

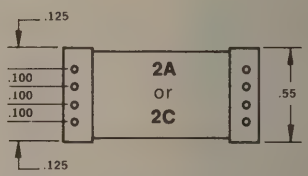
High performance at a remarkably low cost where the environment is not severe. Available up to 6 poles, with forms A, B, C and A mercury wetted contacts. **Ask for Catalog 104.**

| CONTACT FORM | PART NUMBER .100" TERMINAL SPACING | COIL V.D.C. | COIL RES. (ohms) @ 20°C | CIRCUIT DIAGRAM (Top View of Relay) |
|---|---|---|---|---|
| 1A 10W .5A 200V | RA30311051 | 5 | 500 | |
| | RA30311061 | 6 | 125 | |
| | RA30311121 | 12 | 500 | |
| | RA30311241 | 24 | 2000 | |
| | RA30311481 | 48 | 8000 | |
| 2A 10W .5A 200V | RA30312051 | 5 | 200 | |
| | RA30312061 | 6 | 110 | |
| | RA30312121 | 12 | 440 | |
| | RA30312241 | 24 | 1750 | |
| | RA30312481 | 48 | 7000 | |
| 1C 3W .25A 28V | RA30321051 | 5 | 500 | |
| | RA30321061 | 6 | 125 | |
| | RA30321121 | 12 | 500 | |
| | RA30321241 | 24 | 2000 | |
| | RA30321481 | 48 | 8000 | |
| 2C 3W .25A 28V | RA30322051 | 5 | 200 | |
| | RA30322061 | 6 | 80 | |
| | RA30322121 | 12 | 310 | |
| | RA30322241 | 24 | 1250 | |
| | RA30322481 | 48 | 5000 | |



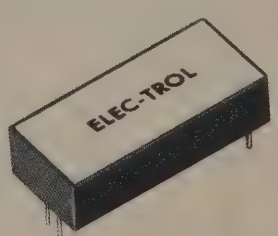



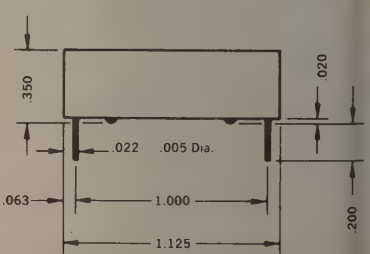



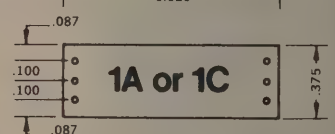

# ELEC-TROL ENCASED LINE REED RELAYS

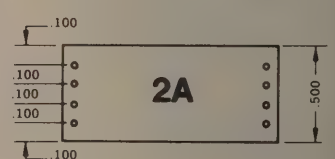
Total environmental protection, completely sealed with epoxy. Available up to 6 poles, forms A, B, C and A mercury wetted contacts. **Ask for Catalog 105.**

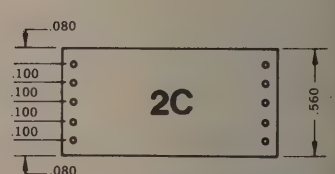
| CONTACT FORM and RATING | PART NUMBER .100" TERMINAL SPACING | COIL V.D.C. | COIL RES. (ohms) @ 20°C | CIRCUIT DIAGRAM (Top View of Relay) |
|---|---|---|---|---|
| 1A 10W .5A 200V | RA30551051 | 5 | 500 | |
| | RA30551061 | 6 | 125 | |
| | RA30551121 | 12 | 500 | |
| | RA30551241 | 24 | 2000 | |
| | RA30551481 | 48 | 8000 | |
| 2A 10W .5A 200V | RA30552051 | 5 | 250 | |
| | RA30552061 | 6 | 110 | |
| | RA30552121 | 12 | 440 | |
| | RA30552241 | 24 | 1750 | |
| | RA30552481 | 48 | 7000 | |
| 1C 3W .25A 28V | RA30571051 | 5 | 500 | |
| | RA30571061 | 6 | 125 | |
| | RA30571121 | 12 | 500 | |
| | RA30571241 | 24 | 2000 | |
| | RA30571481 | 48 | 8000 | |
| 2C 3W .25A 28V | RA30572051 | 5 | 250 | |
| | RA30572061 | 6 | 80 | |
| | RA30572121 | 12 | 310 | |
| | RA30572241 | 24 | 1250 | |
| | RA30572481 | 48 | 5000 | |



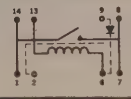
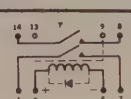



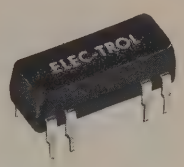



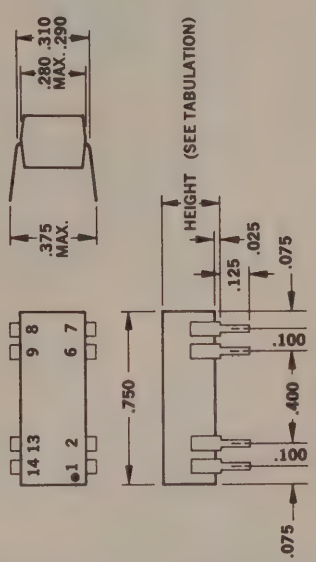



# ELEC-TROL DIP REED RELAYS

Standard 8 and 14 pin DIP packages suited for insertion in 14 pin DIP sockets or printed circuit boards. Can be driven directly by TTL. Available in 35 different style models, 1A, 2A, 1B, 1C and 1A mercury wetted contacts. **Ask for Catalog 103.**

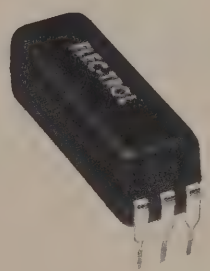
| CONTACT FORM + RATING | PART NUMBER | | COIL V.D.C. | COIL RES. (ohms) @ 20°C | HEIGHT | CIRCUIT DIAGRAM (Top View of Relay) |
|---|---|---|---|---|---|---|
| | NO DIODE | WITH DIODE | | | | |
| 1A 3W .11A 28V | RA30921051 | RA31201051 | 5 | 500 | .225" |  |
| | RA30921121 | RA31201121 | 12 | 500 | | |
| | RA30921241 | RA31201241 | 24 | 1400 | | |
| | RA30381051 | RA30391051 | 5 | 500 | .225" | |
| | RA30381121 | RA30391121 | 12 | 500 | | |
| | RA30381241 | RA30391241 | 24 | 1400 | | |
| 1A 10W .5A 100V | RA30451051 | RA30461051 | 5 | 500 | .275" | |
| | RA30451121 | RA30461121 | 12 | 500 | | |
| | RA30451241 | RA30461241 | 24 | 2150 | | |
| 2A 3W .11A 28V | RA30982051 | RA31232051 | 5 | 200 | .275" |  |
| | RA30982121 | RA31232121 | 12 | 500 | | |
| | RA30982241 | RA31232241 | 24 | 2150 | | |
| 1B 10W .5A 100V | RA30511051 | RA30521051 | 5 | 500 | .275" | |
| | RA30511121 | RA30521121 | 12 | 500 | | |
| | RA30511241 | RA30521241 | 24 | 2150 | | |
| 1C 3W .25A 28V | RA30421051 | RA30441051 | 5 | 200 | .275" | |
| | RA30421121 | RA30441121 | 12 | 500 | | |
| | RA30421241 | RA30441241 | 24 | 2000 | | |



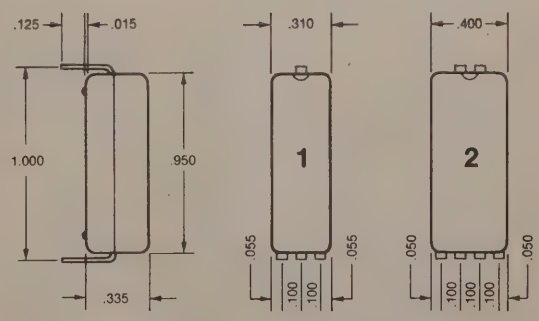




# ELEC-TROL MOLDED-LINE REED RELAYS

Total environmental protection at low cost, completely molded in epoxy. Available in 1 and 2 form A contacts. **Ask for Catalog 114.**




| CONTACT FORM | PART NUMBER | COIL V.D.C. | COIL RES. (ohms) @ 20°C | CIRCUIT DIAGRAM (Top View of Relay) |
|---|---|---|---|---|
| 1A 10W .5A 200V | RA31571051 | 5 | 500 | |
| | RA31571061 | 6 | 125 | |
| | RA31571121 | 12 | 500 | |
| | RA31571241 | 24 | 2000 | |
| | RA31571481 | 48 | 8000 | |
| 2A 10W .5A 200V | RA31572051 | 5 | 250 | |
| | RA31572061 | 6 | 110 | |
| | RA31572121 | 12 | 440 | |
| | RA31572241 | 24 | 1750 | |
| | RA31572481 | 48 | 7000 | |

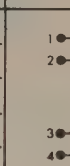


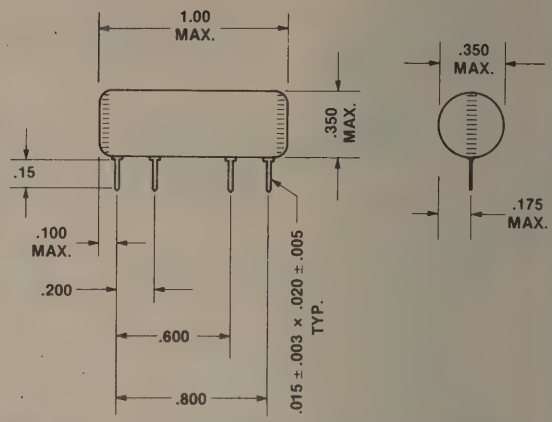

Elec-Trol, Inc., 26477 N. Golden Valley Road, Saugus, CA 91350, (213) 788-7292, (805) 252-8330 TWX 910-336-1556

NOTE: ELECTROSTATIC SHIELD (E) WHERE SHOWN IS OPTIONAL. CONSULT FACTORY.

# ELEC-TROL BLUE BOY REED RELAYS

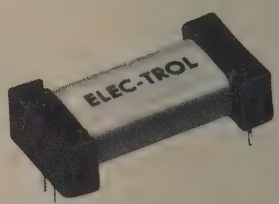
Low cost, rock hard epoxy coated reed relays available with general purpose or logic level 10w, 1 form A contact. **Ask for Catalog 112.**

| PART NUMBER | COIL V.D.C. | COIL RES. (OHMS) @ 20°C | CIRCUIT DIAGRAM (TOP VIEW OF RELAY) |
|---|---|---|---|
| RA31441051 | 5 | 500 |  |
| RA31441061 | 6 | 125 | |
| RA31441121 | 12 | 500 | |
| RA31441241 | 24 | 2000 | |
| RA31441481 | 48 | 8000 | |



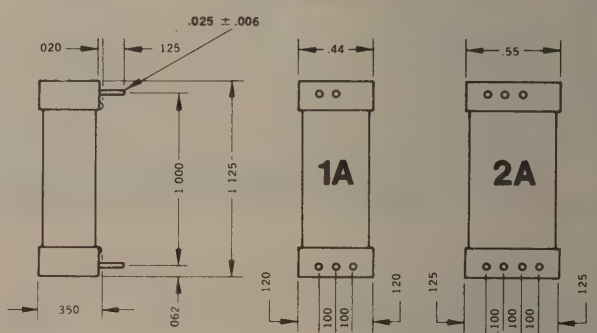

# ELEC-TROL POWERMITE REED RELAYS

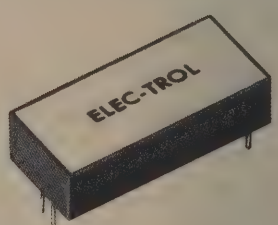
100 watt (1A-200V) switching in Open Line or Encased Line styles. Available up to 4 form A contacts. **Ask for catalog 116.**




## OPEN STYLE

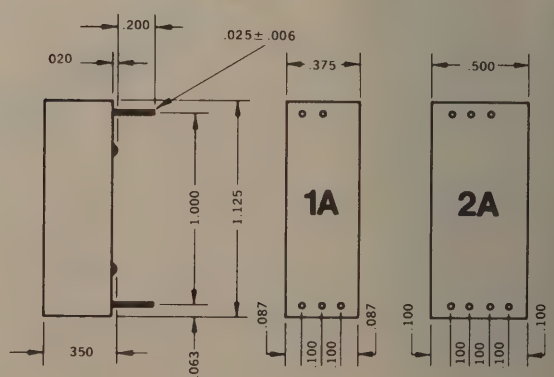
| CONTACT FORM | PART NO. .100" TERMINAL SPACING | COIL VDC | COIL RES. (ohms) @ 20° C | CIRCUIT DIAGRAM (Top View of Relay) |
|---|---|---|---|---|
| 1A 100W 1.0A 200V | RA31601051 | 5 | 75 | |
| | RA31601121 | 12 | 300 | |
| | RA31601241 | 24 | 1200 | |
| | RA31601481 | 48 | 4800 | |
| 2A 100W 1.0A 200V | RA31602051 | 5 | 45 | |
| | RA31602121 | 12 | 175 | |
| | RA31602241 | 24 | 700 | |
| | RA31602481 | 48 | 2800 | |



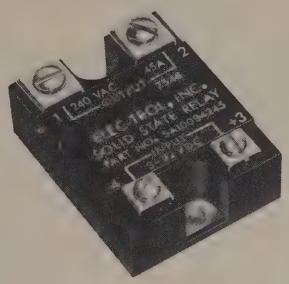

## ENCASED STYLE

| CONTACT FORM | PART NO. .100" TERMINAL SPACING | COIL VDC | COIL RES. (ohms) @ 20° C | CIRCUIT DIAGRAM (Top View of Relay) |
|---|---|---|---|---|
| 1A 100W 1.0A 200V | RA31621051 | 5 | 75 | |
| | RA31621121 | 12 | 300 | |
| | RA31621241 | 24 | 1200 | |
| | RA31621481 | 48 | 4800 | |
| 2A 100W 1.0A 200V | RA31622051 | 5 | 45 | |
| | RA31622121 | 12 | 175 | |
| | RA31622241 | 24 | 700 | |
| | RA31622481 | 48 | 2800 | |

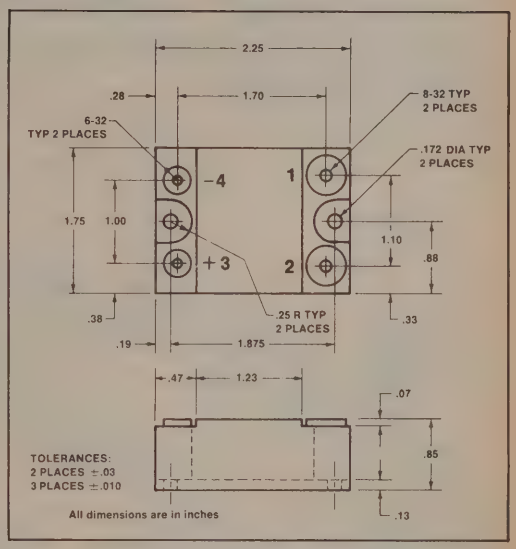


# ELEC-TROL SOLID STATE RELAYS

AC and DC input models switch 120 or 240 VRMS, 6 or 10 amps, TRIAC or SCR output can be driven directly by TTL. All feature zero crossover switching and photo isolation between input and output. **Ask for Catalog 106 (TRIAC) or Catalog 113 (SCR).**



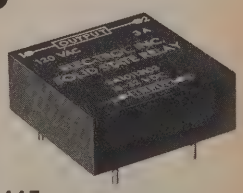
| PART NUMBER (TRIAC OUTPUT) | PART NUMBER (SCR OUTPUT) | INPUT VOLTAGE | OUTPUT SWITCHING ABILITY | |
|---|---|---|---|---|
| | | | MAX. CURRENT (AMPS) | LINE VOLTAGE (VRMS) |
| SA10014106 | SA10094106 | 3-32 VDC | 6 | 120 |
| SA10014110 | SA10094110 | 3-32 VDC | 10 | |
| SA10014206 | SA10094206 | 3-32 VDC | 6 | 240 |
| SA10014210 | SA10094210 | 3-32 VDC | 10 | |
| SA10029106 | SA10109106 | 90-280 VRMS | 6 | 120 |
| SA10029110 | SA10109110 | 90-280 VRMS | 10 | |
| SA10029206 | SA10109206 | 90-280 VRMS | 6 | 240 |
| SA10029210 | SA10109210 | 90-280 VRMS | 10 | |

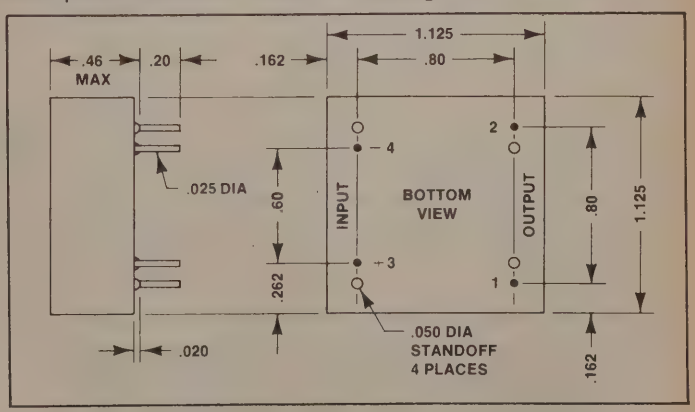



# ELEC-TROL PCB SOLID STATE RELAYS

| PART NUMBER | INPUT VOLTAGE | OUTPUT SWITCHING ABILITY | |
|---|---|---|---|
| | | MAX. CURRENT (AMPS) | LINE VOLTAGE (VRMS) |
| SA10111101 | 3-8 | 1.5 | 120 |
| SA10111103 | 3-8 | 3.0 | |
| SA10111201 | 3-8 | 1.5 | 240 |
| SA10111203 | 3-8 | 3.0 | |
| SA10112101 | 8-18 | 1.5 | 120 |
| SA10112103 | 8-18 | 3.0 | |
| SA10112201 | 8-18 | 1.5 | 240 |
| SA10112203 | 8-18 | 3.0 | |
| SA10113101 | 18-32 | 1.5 | 120 |
| SA10113103 | 18-32 | 3.0 | |
| SA10113201 | 18-32 | 1.5 | 240 |
| SA10113203 | 18-32 | 3.0 | |

DC input with output switching 120 or 240 VRMS at 1.5 or 3 amps. Mounts directly on printed circuit board, can be driven directly by TTL, has zero crossover switching and photo isolation. **Ask for Catalog 115.**

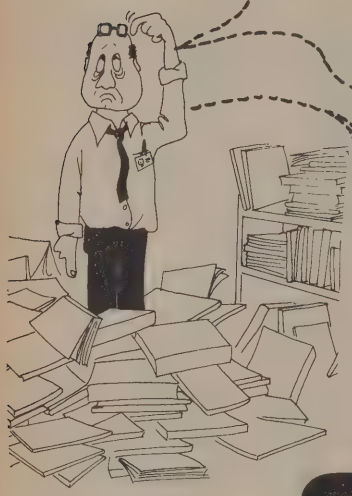





Elec-Trol, Inc., 26477 N. Golden Valley Road, Saugus, CA 91350, (213) 788-7292, (805) 252-8330 TWX 910-336-1556

***What can I use to keep all the manufacturers' product data I receive in order?***

***What system makes filing or retrieving manufacturers' catalogs fast and easy?***



***Which file system have thousands of engineers purchased because they know it works?***

# eem FILE SYSTEM

## THE ONLY FILE SYSTEM DESIGNED SPECIALLY FOR THE ELECTRONIC ENGINEER!

The publishers of **eem** have put together a unique filing system for electronic product information. The complete system includes: a product index booklet which classifies electronic products into 3,000 listings both alphabetically and by product group, and 45 file folders imprinted with the **eem** product sections (extra gummed labels included for expanding the system.)

As you receive manufacturers' catalog data sheets, technical bulletins, or clip magazine articles, jot down the proper Product Section Numbers from the **eem** PRODUCT-TO-SECTION INDEX. Then simply file in order. When you require information on a specific product, refer to PRODUCT-TO-SECTION INDEX again to locate the correct file folder. It's simple, and you'll always have the necessary data to compare, specify and buy, right at your fingertips.

**Here's how to order your eem FILE SYSTEM:**

For the complete system send $10 (plus tax; N.Y., 8%, CA, 6½%) in check or money order to:
United Technical Publications, Inc.,
645 Stewart Avenue, Garden City, N.Y. 11530
Att: Circulation dept.

For an **eem FILE SYSTEM** without file folders send $7.50 (plus tax; N.Y. 8%; CA, 6½%).

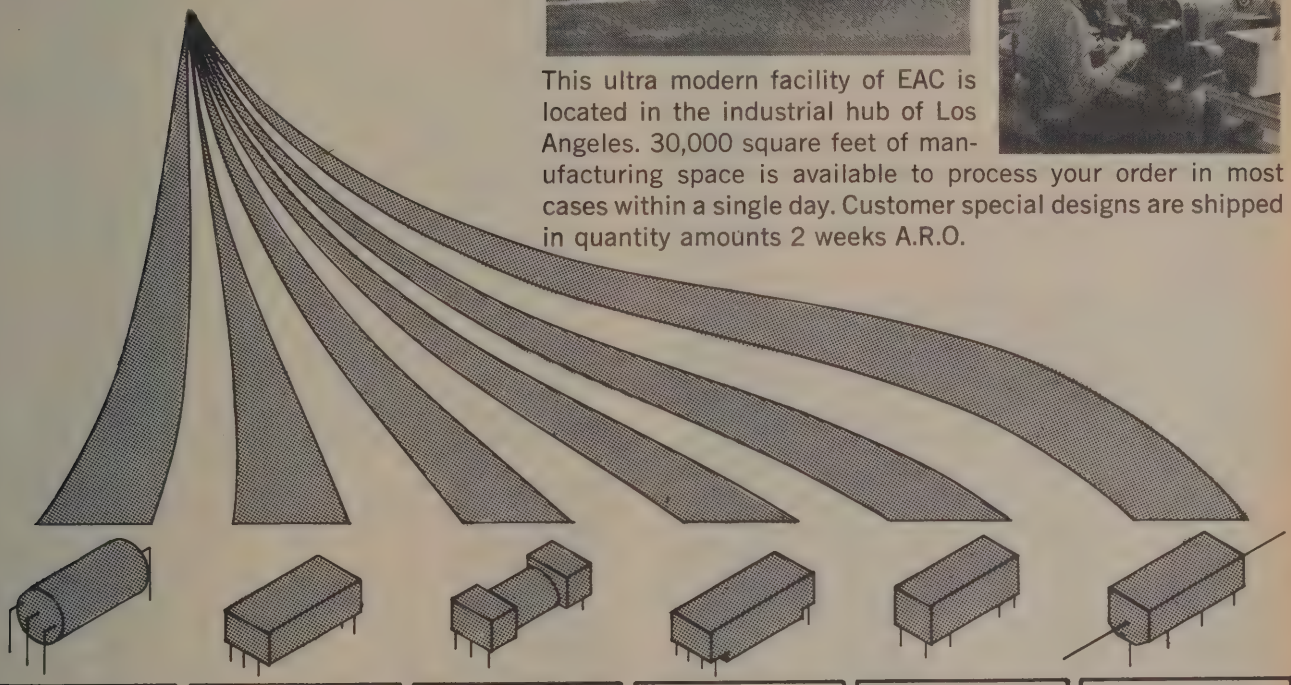
*UNITED TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500*

EAC

ELECTRONIC APPLICATIONS COMPANY
4918 SANTA ANITA AVENUE
EL MONTE, CALIFORNIA 91734

# INNOVATIVE RELAY DESIGNS SINCE 1959

This ultra modern facility of EAC is located in the industrial hub of Los Angeles. 30,000 square feet of manufacturing space is available to process your order in most cases within a single day. Customer special designs are shipped in quantity amounts 2 weeks A.R.O.



| TUBULAR | MOLDED | LITTLE GEM | JENCO Division of EAC | DIP REPLACEMENT Pin Compatible | CUSTOMER SPECIAL DESIGN |
|---|---|---|---|---|---|
| Highest volume production.<br>Magnetic shield.<br>Lowest cost.<br>Same day shipment from stock.<br>1A to 3A, 1C to 2C, Latch, Mercury, High Voltage. | PCB mounting. Vacuum impregnation of polyamide epoxy.<br>Highest reliability.<br>Highest insulation resistance.<br>1A to 6A, 1C to 3C, Latch, Mercury, High Voltage. | PCB mounting.<br>Open frame.<br>Magnetic shield, encapsulated.<br>.1 and .15 pin spacing is standard.<br>1A to 6A, 1C to 3C, Latch Mercury, High Voltage. | EAC acquired the Jenco line in 1974.<br>Manufacturers of fine, high performance relays.<br>All Jenco relays are readily available from EAC/Jenco stock. | These relays are available in all competitive configurations.<br>Because of their inherent higher reliability, they are slightly larger than the standard DIP relay. | Design your own relay. Any pin configuration, any size, any shape, any degree of reliability.<br>Use our EAC Application Questionnaire. |
| Highest overall performance for most competitive cost. | Pricing consistent with reliability requirements.<br>See Catalog, or call EAC. | 1 Form A under .75 @ 2500 pcs.<br>2 Form A under 1.00 @ 5000 pcs. | Jenco has relays to switch 25kv.<br>Reliability is inherent with EAC/Jenco. | Call us for price quotations.<br>Relay reliability is not large or expensive. | Price is **very** competitive.<br>Tell us our limits and your requirements. |

**FREE CATALOGS ARE AVAILABLE BY REQUEST. TELEPHONE, TWX OR WRITE TO US OF YOUR NEEDS.**

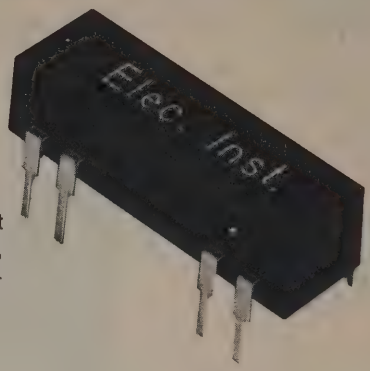
**TELEPHONE 213/442-3212**
**TWX 910/587-3351**

# ELECTRONIC INSTRUMENT & SPECIALTY CORP.

# DIP Reed Relays Epoxy Molded

**Form 1A, 1B, and 1C**

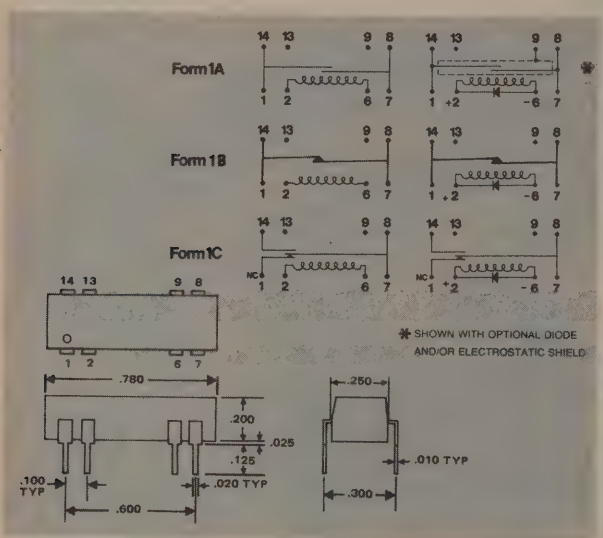
Now high-performance DIP reed relays available in low-cost Lead-Frame configuration. Offering extremely easy access, these superbly engineered relays are made to provide reliable, trouble-free operation at inexpensive prices.



ACTUAL SIZE

- **Low Profile**
- **Automatic Insertion**
- **Improved Accessibility**
- **Driven Directly from TTL & DTL Logic**

Electronic Instrument and Specialty Corporation is a leading producer of reed relays for industrial and commercial applications. EI&S Corp. assures highest quality and superior performance from all reed relays under the most demanding conditions.




| Contact Rating: | Form 1A | Form 1B<br>Form 1C |
|---|---|---|
| Amp. max. DC | ½ | ¼ |
| Volts max. DC | 100 | 28 |
| Ohm max. initial contact resistance | .150 | .200 |
| Watts max. DC power limitation | 10 | 3 |
| Volts min. DC breakdown voltage | 250 | 200 |

ALL VALUES AT 20°C

| Cat. No. | Volts | Coil Resist. ±10% | Max. Pull-In | Min. Drop-Out | Price 100 Qty. |
|---|---|---|---|---|---|
| **DL1A05** | 5 | 500 | 3.8 | .8 | $1.98 |
| **DL1A06** | 6 | 500 | 4.8 | .9 | 1.98 |
| **DL1A12** | 12 | 1000 | 9.6 | 1.8 | 2.23 |
| **DL1A24** | 24 | 1500 | 19.2 | 3.6 | 2.40 |
| **DL1B05** | 5 | 200 | 3.8 | .8 | 3.82 |
| **DL1B06** | 6 | 200 | 4.8 | .9 | 3.82 |
| **DL1B12** | 12 | 600 | 9.6 | 1.8 | 4.09 |
| **DL1B24** | 24 | 1500 | 19.2 | 3.6 | 4.35 |
| **DL1C05** | 5 | 200 | 3.8 | .8 | 3.82 |
| **DL1C06** | 6 | 200 | 4.8 | .9 | 3.82 |
| **DL1C12** | 12 | 600 | 9.6 | 1.8 | 4.09 |
| **DL1C24** | 24 | 1500 | 19.2 | 3.6 | 4.35 |

Prices and specifications subject to change without notice.

## OPTIONS:

**Coil Pins @ 6 & 13 - add suffix C**

**For Electrostatic Shield, Form A only add Suffix S (connected to pin #9)**

**For Diode across coil, add suffix D (Pin #2 positive; Pin #6 negative)**

| | Form 1A | Form 1B | Form 1C |
|---|---|---|---|
| Operating Time, Typical | .350 ms | .100 ms | .500 ms |
| Release Time, Typical | .100 ms | .500 ms | .100 ms |
| Bounce Time, Typical | .150 ms | .500 ms | .500 ms |
| Insulation Resistance, Ohms min. | $10^{10}$ | $10^{10}$ | $10^{9}$ |
| Operate Temperature | -30°C to +65°C | | |
| Storage Temperature | -55°C to +100°C | | |
| Life Expectancy @ low level | $100 \times 10^{6}$ | $50 \times 10^{6}$ | $50 \times 10^{6}$ |
| @ rated load | $10 \times 10^{6}$ | $5 \times 10^{6}$ | $5 \times 10^{6}$ |

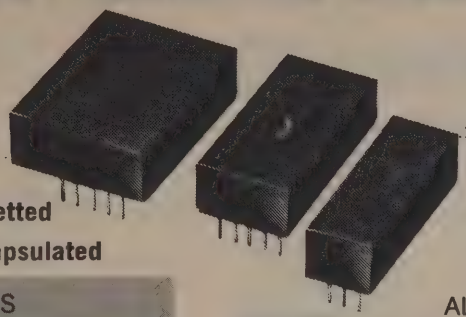
**CALL FOR ENGINEERING ASSISTANCE & FREE CATALOG!**

**617/438·5300**

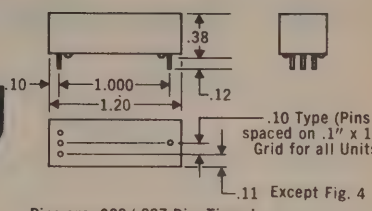
**42 PLEASANT STREET / STONEHAM, MASSACHUSETTS 02180 / TELEPHONE (617) 438-5300**

# ELECTRONIC INSTRUMENT & SPECIALTY CORP.

# Miniature Reed Relays



Dimensions Typical of all Units

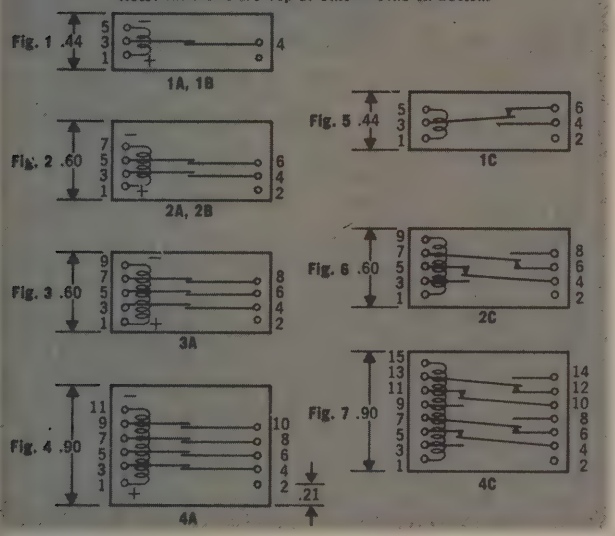



Pins are .022/.027 Dia. Tinned

- .10" x 1.00" Grid
- Mercury Wetted
- Dry Reed
- Epoxy Encapsulated

## SCHEMATICS/DIMENSIONS

Note: All Views are Top of Unit — Pins on Bottom




## OPTIONS

For Electrostatic Shield, add Suffix S (connected to Pin #2)
For Magnetic Shield, add Suffix H

## CONTACT RATING

**Dry Reed, Form A, B:**
½ amp. max., 200 volts max. with 10 watts power limitation. Initial contact resistance .10 ohm max. Breakdown voltage 300 volts min.

**DRY Reed, Form C:**
¼ amp. max., 28 volts max. with 3 watts power limitation. Initial contact resistance .15 ohm max. Breakdown voltage 250 volts min.

**Mercury Wetted Form A:**
2 amp max., 100 volts max. with 50 watts power limitation. Initial contact resistance .05 ohm max. Breakdown voltage 1000 volts min.

## GENERAL SPECIFICATIONS

| Switching Speed, Typical* | Operate Time | Release Time | Bounce Time |
|---|---|---|---|
| Dry Reed, Form A | .5 ms | .1 ms | .2 ms |
| Dry Reed, Form B | .2 ms | .2 ms | .3 ms |
| Dry Reed, Form C | .5 ms | .1 ms | N.O. .5 ms<br>N.C. 1.5 ms |
| Mercury Wetted, Form A | 2.0 ms | 2.0 ms | .0 ms |

**Insulation Resistance:**
Greater than $1 \times 10^{10}$ ohms, except Form C ($1 \times 10^{9}$) at 100 VDC 40% rel. hum.

**Life Expectancy:**
100 x $10^6$ operations at low level
10 x $10^6$ at rated load
Mercury Wetted 10 X higher

**Operate Temperature:** −30°C to +65°C

**Storage Temperature:** −55°C to +85°C

* Consult factory or local representative for performance details.

## ALL VALUES AT 20°C

**DRY REED**

| Cat. No. | Contact Form | Volts | Coil Resist. ±10% | Max. Pull-in | Min. Drop-out | Fig. | Price 100 Qty. |
|---|---|---|---|---|---|---|---|
| MS1A05 | 1A | 5 | 100 | 4.0 | .8 | 1 | 2.19 |
| MS1A06 | | 6 | 125 | 4.8 | .9 | | |
| MS1A12 | | 12 | 500 | 9.6 | 1.8 | | |
| MS1A24 | | 24 | 2000 | 19.2 | 3.6 | | |
| MS2A05 | 2A | 5 | 85 | 4.0 | .8 | 2 | 3.19 |
| MS2A06 | | 6 | 110 | 4.8 | .9 | | |
| MS2A12 | | 12 | 440 | 9.6 | 1.8 | | |
| MS2A24 | | 24 | 1750 | 19.2 | 3.6 | | |
| MS3A05 | 3A | 5 | 65 | 4.0 | .8 | 3 | 3.97 |
| MS3A06 | | 6 | 85 | 4.8 | .9 | | |
| MS3A12 | | 12 | 340 | 9.6 | 1.8 | | |
| MS3A24 | | 24 | 1350 | 19.2 | 3.6 | | |
| MS4A05 | 4A | 5 | 45 | 4.0 | .8 | 4 | 4.75 |
| MS4A06 | | 6 | 60 | 4.8 | .9 | | |
| MS4A12 | | 12 | 250 | 9.6 | 1.8 | | |
| MS4A24 | | 24 | 1000 | 19.2 | 3.6 | | |
| MS1B05 | 1B | 5 | 100 | 4.0 | .8 | 1 | 2.94 |
| MS1B06 | | 6 | 125 | 4.8 | .9 | | |
| MS1B12 | | 12 | 500 | 9.6 | 1.8 | | |
| MS1B24 | | 24 | 2000 | 19.2 | 3.6 | | |
| MS2B05 | 2B | 5 | 85 | 4.0 | .8 | 2 | 3.68 |
| MS2B06 | | 6 | 110 | 4.8 | .9 | | |
| MS2B12 | | 12 | 440 | 9.6 | 1.8 | | |
| MS2B24 | | 24 | 1750 | 19.2 | 3.6 | | |
| MS1C05 | 1C | 5 | 100 | 4.0 | .8 | 5 | 4.47 |
| MS1C06 | | 6 | 125 | 4.8 | .9 | | |
| MS1C12 | | 12 | 500 | 9.6 | 1.8 | | |
| MS1C24 | | 24 | 2000 | 19.2 | 3.6 | | |
| MS2C05 | 2C | 5 | 60 | 4.0 | .8 | 6 | 7.46 |
| MS2C06 | | 6 | 80 | 4.8 | .9 | | |
| MS2C12 | | 12 | 310 | 9.6 | 1.8 | | |
| MS2C24 | | 24 | 1250 | 19.2 | 3.6 | | |
| MS4C05 | 4C | 5 | 22 | 4.0 | .8 | 7 | 13.36 |
| MS4C06 | | 6 | 30 | 4.8 | .9 | | |
| MS4C12 | | 12 | 125 | 9.6 | 1.8 | | |
| MS4C24 | | 24 | 500 | 19.2 | 3.6 | | |

**† MERCURY WETTED**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MS1A05M | 1A | 5 | 70 | 4.0 | .8 | 1 | 4.60 |
| MS1A06M | | 6 | 95 | 4.8 | .9 | | |
| MS1A12M | | 12 | 375 | 9.6 | 1.8 | | |
| MS1A24M | | 24 | 1500 | 19.2 | 3.6 | | |
| MS2A05M | 2A | 5 | 45 | 4.0 | .8 | 2 | 7.04 |
| MS2A06M | | 6 | 60 | 4.8 | .9 | | |
| MS2A12M | | 12 | 250 | 9.6 | 1.8 | | |
| MS2A24M | | 24 | 1000 | 19.2 | 3.6 | | |
| MS4A05M | 4A | 5 | 18 | 4.0 | .8 | 4 | 12.54 |
| MS4A06M | | 6 | 25 | 4.8 | .9 | | |
| MS4A12M | | 12 | 100 | 9.6 | 1.8 | | |
| MS4A24M | | 24 | 400 | 19.2 | 3.6 | | |

Prices and specifications subject to change without notice.

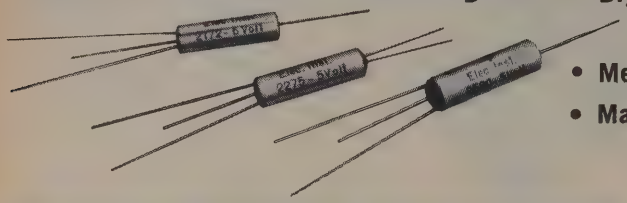
† Must be mounted vertically. Coil pins at bottom.

42 PLEASANT STREET / STONEHAM, MASSACHUSETTS 02180 / TELEPHONE (617) 438-5300

# ELECTRONIC INSTRUMENT & SPECIALTY CORP.

## Axial Reed Relays

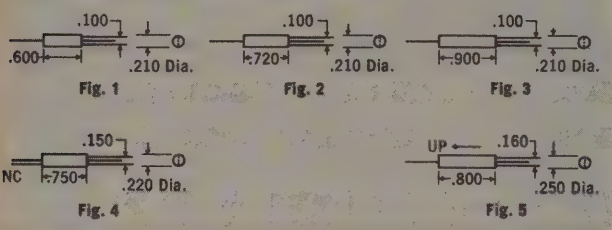
- Microminiature
- Dry Reed
- Mercury Wetted
- Magnetically Shielded



**CALL FOR ENGINEERING ASSISTANCE & FREE CATALOG!**

**617/438-5300**

### SCHEMATICS/DIMENSIONS




### GENERAL SPECIFICATIONS

| Speed, Typical* | Operate Time (excluding bounce) | Release Time |
|---|---|---|
| Dry Reed, Form 1A | .2 to .5 ms | .1 ms |
| Dry Reed, Form 1C (N.O.) | .4 ms | .1 ms |
| Mercury Wetted, Form 1A | 2 ms | 2 ms |

**Insulation Resistance:** 1 x $10^{11}$ ohms min., except Form C (1 x $10^{10}$)

**Life Expectancy:** 100 x $10^6$ operations at low level; 10 x $10^6$ at rated load, Mercury Wetted 10 X higher

**Operate Temperature:** 0°C to +65°C

**Storage Temperature:** −55°C to +85°C

*Consult factory for performance details.

### OPTIONS

For Electrostatic Shield, add Suffix S

| Cat. No. | 2160S | | | 2160R | | | | 2172 | | | | 2190 | | | | 2275 | | | | 2580 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dimensions | Fig. 1 | | | Fig. 1 | | | | Fig. 2 | | | | Fig. 3 | | | | Fig. 4 | | | | Fig. 5 | | | |
| Contact Type | DRY REED | | | | | | | | | | | | | | | | | | | Mercury Wetted | | | |
| Contact Arrangement | 1A | | | 1A | | | | 1A | | | | 1A | | | | 1C | | | | 1A | | | |
| Nominal Voltage | 5 | 6 | 12 | 5 | 6 | 12 | 24 | 5 | 6 | 12 | 24 | 5 | 6 | 12 | 24 | 5 | 6 | 12 | 24 | 5 | 6 | 12 | 24 |
| Coil Resist., Ohms | 750 | 1000 | 3800 | 375 | 500 | 2100 | 4800 | 400 | 630 | 2800 | 5500 | 400 | 630 | 2800 | 5500 | 240 | 325 | 1200 | 5000 | 105 | 105 | 400 | 1700 |
| **Contact Ratings** | | | | | | | | | | | | | | | | | | | | | | | |
| Current, Max. | 10 ma | | | 10 ma | | | | ¼ amp. | | | | ½ amp. | | | | ¼ amp. | | | | 1 amp. | | | |
| Voltage, Max. | 28 volts | | | 28 volts | | | | 100 volts | | | | 200 volts | | | | 28 volts | | | | 100 volts | | | |
| Power, Max. | .3 watts | | | .3 watts | | | | 10 watts | | | | 10 watts | | | | 3 watts | | | | 28 watts | | | |
| Initial Contact Resistance Max. | .200 ohms | | | .200 ohms | | | | .150 ohms | | | | .100 ohms | | | | .150 ohms | | | | .050 ohms | | | |
| Price 100 Qty., $ | 4.21 | 4.21 | 4.84 | 3.66 | 3.66 | 4.21 | 5.49 | 3.66 | 3.66 | 4.21 | 5.49 | 3.66 | 3.66 | 4.21 | 5.49 | 5.68 | 5.68 | 6.24 | 7.37 | 4.64 | 4.64 | 5.21 | 6.41 |
| Pull-in Voltage Max. @ 20°C | 80% of nominal voltage | | | | | | | | | | | | | | | | | | | | | | |
| Drop-out Voltage Min. @ 20°C | 15% of nominal voltage | | | | | | | | | | | | | | | | | | | | | | |

Prices subject to change without notice.

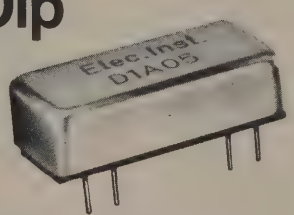
**ORDERING INFORMATION**

To order, specify Catalog Number, Coil Voltage and Optional Electrostatic Shield if required.

**Example:** 2160S (Catalog Number) 12 (Coil Voltage) S (Electrostatic Shield)

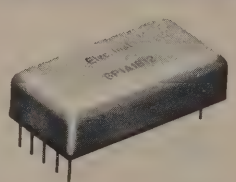
## OTHER STANDARD REED RELAY SERIES

### Dip



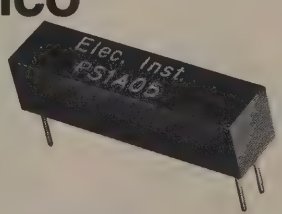

- Contact Form:
  - Dry Reed
    - 1A, 2A, 1B, 1C
  - Mercury Wetted
    - 1A

### Metal Encased




- Contact Form:
  - 1A, 2A, 3A, 4A, 1B, 2B, 1A1B, 1A2B, 2A1B, 2A2B
- .15″ × 1.35″ Grid

### Pico




- Contact Form:
  - 1A, 2A, 1B
- .10″ × .70″ Grid

### Low Thermal Emf

- Contact Form:
  - 1A, 2A
- 3, 5 & 10 Microvolt offsets
- Thermal Offsets Rated at 100% Duty Cycle

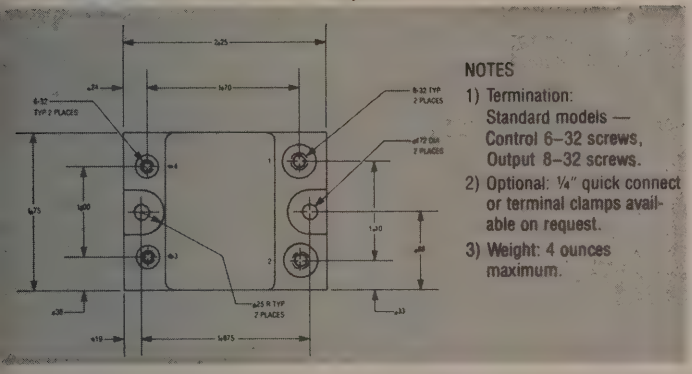
**Whenever you need Reed Relays, contact EI&S — the *quality* leader — first.**

42 PLEASANT STREET / STONEHAM, MASSACHUSETTS 02180 / TELEPHONE (617) 438-5300

# ELECTRONIC INSTRUMENT & SPECIALTY CORP.

## OPTO-Isolated AC Solid State Relays

- Zero Voltage Turn-on
- 3, 6, 10 and 25 AMP Current Ratings
- Internal Snubber Network
- 120 & 240 VRMS Switching Voltages



NOTES
1) Termination: Standard models — Control 6–32 screws, Output 8–32 screws.
2) Optional: ¼" quick connect or terminal clamps available on request.
3) Weight: 4 ounces maximum.

MODEL SELECTION

| Model NO. | Max. Current (AMPS RMS) | Line Voltage (VOLTS RMS) | Control Voltage |
|---|---|---|---|
| 120EI03-01<br>120EI03-02<br>120EI03-AC | 3 | 120 | 3.5- 15 VDC<br>9- 32 VDC<br>90-280 VAC |
| 120EI06-01<br>120EI06-02<br>120EI06-AC | 6 | 120 | 3.5- 15 VDC<br>9- 32 VDC<br>90-280 VAC |
| 120EI10-01<br>120EI10-02<br>120EI10-AC | 10 | 120 | 3.5- 15 VDC<br>9- 32 VDC<br>90-280 VAC |
| 120EI25-01<br>120EI25-02<br>120EI25-AC | 25 | 120 | 3.5- 15 VDC<br>9- 32 VDC<br>90-280 VAC |
| 240EI03-01<br>240EI03-02<br>240EI03-AC | 3 | 240 | 3.5- 15 VDC<br>9- 32 VDC<br>90-280 VAC |
| 240EI06-01<br>240EI06-02<br>240EI06-AC | 6 | 240 | 3.5- 15 VDC<br>9- 32 VDC<br>90-280 VAC |
| 240EI10-01<br>240EI10-02<br>240EI10-AC | 10 | 240 | 3.5- 15 VDC<br>9- 32 VDC<br>90-280 VAC |
| 240EI25-01<br>240EI25-02<br>240EI25-AC | 25 | 240 | 3.5- 15 VDC<br>9- 32 VDC<br>90-280 VAC |

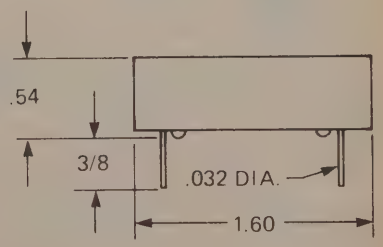
## PCB Solid State Relays

- Zero Voltage Crossover
- Contacts AC SPST (Normally Open)
- Optoelectronic Isolation
- Requires Little Power; TTL, MOS Logic or even a Photocell Provides Ample Power

MODEL SELECTION

| Model No. | Current (AMPS RMS) | Line Voltage (VOLTS RMS) | Control Voltage |
|---|---|---|---|
| 905 | 3 | 120 | 3.5–15 VDC |
| 906 | 3 | 120 | 9–32 VDC |
| *907 | 5 | 120 | 3.5–15 VDC |
| *908 | 5 | 120 | 9–32 VDC |

* Height deviation 1"




**Whenever you need Solid State Relays, contact EI&S — The *quality* leader — first.**

42 PLEASANT STREET / STONEHAM, MASSACHUSETTS 02180 / TELEPHONE (617) 438-5300

**ELECTRONIC SPECIALTY DIVISION**
**DATRON SYSTEMS INC.** / 18900 N.E. Sandy Blvd. / Portland, Oregon 97230
(503) 665-0121 / TWX 910-469-8782

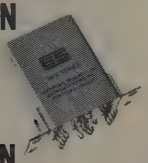
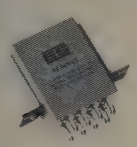
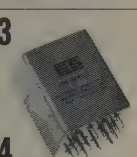
# STANDARD HERMETIC SEALED RELAY SPECIFICATION

| | General Information | Contact Form | Contact Rating | Size | Sensitivity | Coil Voltage | Coil Resistance ±10% | Max. Pick Up Latch Voltage/ Current @ +25°C | Min. Drop Out Voltage/ Current @ +25°C |
|---|---|---|---|---|---|---|---|---|---|
| **40** | Especially designed for low power input, as low as 15 mw, with dry circuit to 5 amps switching capability. | 1PDT or 2PDT | Dry circuit to 5 Amp 28 VDC Resistive | .970 x .970 x 1.781 | 20 mw 1PDT 40 mw 2PDT | 6.0 VDC 12.0 VDC 26.5 VDC | 200 Ohms 1000 Ohms 5000 Ohms | 14 MADC 6.3 MADC 2.8 MADC | 5 MADC 2.3 MADC 1.0 MADC |
| **50** | Qualified to M39016/6. | 2PDT | D/C to 2A 28 VDC Resistive | .4 x .41 x .800 | 250 mw Pick Up | 6.0 VDC 12.0 VDC 26.5 VDC | 40 Ohms 150 Ohms 700 Ohms | 3.0 VDC 6.0 VDC 13.0 VDC | 0.6 VDC 1.2 VDC 2.3 VDC |
| **55N** | ½ size sensitive latching relay qualified to M5757/76, all dash numbers. | 2PDT | D/C to 2A 28 VDC Resistive | .4 x .41 x .800 | 90 mw Latch/Reset | 6.0 VDC 12.0 VDC 26.5 VDC | 100 Ohms 500 Ohms 1800 Ohms | 3.0 VDC 6.7 VDC 12.7 VDC | N/A |
| **68N** | Crystal can "Lazy S" header. | 2PDT | D/C to 2A 28 VDC Resistive | .359 x .797 x .875 | 300 mw Pick Up | 6.0 VDC 12.0 VDC 26.5 VDC | 35 Ohms 140 Ohms 552 Ohms | 3.2 VDC 6.5 VDC 13.0 VDC | 0.5 VDC 1.1 VDC 2.3 VDC |
| **71N** | Sensitive crystal can relay. | 2PDT | D/C to 2A 28 VDC Resistive | .4 x .8 x 1.280 | 40 mw Pick Up | 6.0 VDC 12.0 VDC 26.5 VDC | 200 Ohms 1000 Ohms 5000 Ohms | 14.2 MADC 6.3 MADC 2.8 MADC | 1.42 MADC 0.63 MADC 0.28 MADC |
| **72N** | Micro miniature sensitive flat pack relay. | 2PDT | D/C to 2A 28 VDC Resistive | .46 x .8 x 1.390 | 40 mw Pick Up | 6.0 VDC 12.0 VDC 26.5 VDC | 200 Ohms 1000 Ohms 5000 Ohms | 14.2 MADC 6.3 MADC 2.8 MADC | 1.42 MADC 0.63 MADC 0.28 MADC |
| **77R** | Crystal can. Sensitive latching relay. | 2PDT | Dry Circuit to 3 Amps 28 VDC Resistive | .4 x .8 x .875 | 90 mw Latch/Reset | 6.0 VDC 12.0 VDC 26.5 VDC | 100 Ohms 500 Ohms 1800 Ohms | 3.0 VDC 6.7 VDC 12.7 VDC | N/A |

| | | | | | |
|---|---|---|---|---|---|
| **SHOCK:** | 20 G's | 50 G's | 100 G's | | |
| **SERIES:** | 68, | 40, 71N, 72N, 77R | 50, 55N, | | |
| **VIBRATION:** | 10 G's 10-500 Hz | 10 G's 40-500 Hz | 20 G's 56-2000 Hz | 30 G's 56-2000 Hz | 30 G's 56-3000 Hz |
| **SERIES:** | 71N, | 40, | 72N, | 77R, | 50, 55N, 68N, |
| **OPERATE TIME MAX:** | 4.0 MS | 5.0 MS | 15.0 MS | 35.0 MS | |
| **SERIES:** | 50, | 55N, 68N, 77R | 71N, 72N, | 40, | |
| **RELEASE TIME MAX:** | 4.0 MS | 5.0 MS | 10.0 MS | 15.0 MS | |
| **SERIES:** | 50, | 68N, 77R | 71N, 72N, | 40, | |

**ELECTRONIC SPECIALTY DIVISION**
**DATRON SYSTEMS INC.** / 18900 N.E. Sandy Blvd. / Portland, Oregon 97230
(503) 665-0121 / TWX 910-469-8782

# STANDARD HERMETIC SEALED RELAY SPECIFICATION

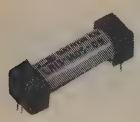
| | General Information | Contact Form | Contact Rating | Size | Sensitivity | Coil Voltage | Coil Resistance ±10% | Max. Pick Up Latch Voltage/ Current @ +25°C | Min. Drop Out Voltage/ Current @ +25°C |
|---|---|---|---|---|---|---|---|---|---|
| **79N** | Crystal can. Non-latching relay. Qualified to MIL-R-5757/10. | 2PDT | Dry Circuit to 3 Amps 28 VDC Resistive | .4 x .8 x .875 | 250 mw Pick Up | 6.0 VDC<br>12.0 VDC<br>26.5 VDC | 35 Ohms<br>140 Ohms<br>600 Ohms | 3.0 VDC<br>5.9 VDC<br>12.5 VDC | 0.3 VDC<br>0.6 VDC<br>1.5 VDC |
| **80N** | Sensitive — double seal construction. Coils are in hermetically sealed compartments, separate from contact chamber. | 2PDT | Dry Circuit to 3 Amps 28 VDC Resistive | .41 x .915 x 1.281 | 40 mw Pick Up | 6.0 VDC<br>12.0 VDC<br>26.5 VDC | 200 Ohms<br>1000 Ohms<br>5000 Ohms | 14.2 MADC<br>6.3 MADC<br>2.8 MADC | 1.42 MADC<br>0.63 MADC<br>0.28 MADC |
| **90N**  **92N** | 90N Series — Non-latching.<br>92N Series — Latching. | 4PDT | Dry Circuit to 3 Amps 28 VDC Resistive | .602 x 1.032 x 1.278 | 80 mw Pick Up | 12.0 VDC<br>26.5 VDC | 500 Ohms<br>2000 Ohms | 12.6 MADC<br>6.3 MADC | 1.26 MADC<br>0.63 MADC |
| | | | | | 80 mw Latch/Reset | 12.0 VDC<br>26.5 VDC | 500 Ohms<br>2000 Ohms | 6.3 VDC<br>12.6 VDC | N/A |
| **93**  **94** | 93 Series — Non-latching. Welded versions avail. 94 Series — Latching. | 2PDT | 10 Amps 28 VDC Resistive | .515 x 1.032 x 1.300 | 500 mw Pick Up | 12.0 VDC<br>26.5 VDC | 65 Ohms<br>300 Ohms | 5.8 VDC<br>12.5 VDC | 1.1 VDC<br>2.3 VDC |
| | | | | | 150 mw Latch/Reset | 12.0 VDC<br>26.5 VDC | 240 Ohms<br>1000 Ohms | 6.0 VDC<br>12.3 VDC | N/A |
| **100N** **102N** | 100N Series — Non-latching.<br>102N Series — Latching. | 4PDT | Dry Circuit to 3 Amps 28 VDC Resistive | .852 x 1.032 x 1.278 | 150 mw Pick Up | 12.0 VDC<br>26.5 VDC | 200 Ohms<br>1000 Ohms | 27.4 MADC<br>12.2 MADC | 2.74 MADC<br>1.22 MADC |
| | | | | | 150 mw Latch/Reset | 12.0 VDC<br>26.5 VDC | 250 Ohms<br>1000 Ohms | 6.1 VDC<br>12.3 VDC | N/A |
| **103**  **104** | 103 Series — Non-latching.<br>104 Series — Latching. | 4PDT | 10 Amps 28 VDC Resistive | .852 x 1.032 x 1.3 | 1000 mw Pick Up | 12.0 VDC<br>26.5 VDC | 32 Ohms<br>150 Ohms | 5.8 VDC<br>12.5 VDC | 1.1 VDC<br>2.3 VDC |
| | | | | | 300 mw Latch/Reset | 12.0 VDC<br>26.5 VDC | 125 Ohms<br>500 Ohms | 6.1 VDC<br>12.3 VDC | N/A |
| **F/H** | Miniature coaxial relays with 8" min. RG178 B/U cables attached.<br>Welded sealing. | 1PDT RF Plus Auxiliary 1PDT or 2PDT RF | RF to 1.5 Amps 50 Watt Max. | Freq. Range to 500 MHz. VSWR — 1:1.1 Typical. Characteristic Imp. — 50 Ohm Typical. Cross Talk — 50 dB Typical. | | 12.0 VDC<br>26.5 VDC | 140 Ohms<br>600 Ohms | 5.9 VDC<br>12.5 VDC | 1.0 VDC<br>2.3 VDC |
| | | | | | | 12.0 VDC<br>26.5 VDC | 150 Ohms<br>700 Ohms | 6.0 VDC<br>13.0 VDC | 1.2 VDC<br>2.3 VDC |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **SHOCK:** | 50 G's | | | | 100 G's | | | |
| **SERIES:** | 80N, 90N, 92N, 93, 94, 100N, 102N, 103, 104, | | | | 79N, | | | |
| **VIBRATION:** | 20 G's 56-2000 Hz | | | | | | | |
| **SERIES:** | 79N, 80N, 90N, 92N, 93, 94, 100N, 102N, 103, 104, | | | | | | | |
| **OPERATE TIME MAX:** | 5.0 MS | 7.0 MS | 8.0 MS | 9.0 MS | 10.0 MS | 15.0 MS | 18.0 MS | 20.0 MS |
| **SERIES:** | 79N, H, F, | 93, | 100N, 102N, 103, | 92N, 104, | 94, | 80N, | 100N, | 90N, |
| **RELEASE TIME MAX:** | 3.0 MS | 5.0 MS | | 10.0 MS | | | | |
| **SERIES:** | 93, | 79N, 90N, 100N, 103, H.F., | | 80N, | | | | |

**ELECTRONIC SPECIALTY DIVISION**
DATRON SYSTEMS INC. / 18900 N.E. Sandy Blvd. / Portland, Oregon 97230
(503) 665-0121 / TWX 910-469-8782

# LR SERIES

## STANDARD REED RELAY OPEN FRAME



| Contact Form | Coil VDC | Coil Resistance ±10% @ 25°C | Pick Up Voltage @ 25°C | Dim. A | Part Number | Circuit Diagram Top View | Part Number | Circuit Diagram Top View | Part Number | Circuit Diagram Top View |
|---|---|---|---|---|---|---|---|---|---|---|
| 1A | 5 | 180 | 4.0 | .375 | LR11-1A05-0B | | LR12-1A05-0B | | LR13-1A05-0B | |
| | 6 | 270 | 4.8 | .375 | LR11-1A06-0B | | LR12-1A06-0B | | LR13-1A06-0B | |
| | 12 | 1500 | 9.6 | .375 | LR11-1A12-0B | | LR12-1A12-0B | | LR13-1A12-0B | |
| | 24 | 3500 | 19.2 | .375 | LR11-1A24-0B | | LR12-1A24-0B | | LR13-1A24-0B | |
| 2A | 5 | 100 | 4.0 | .475 | LR21-2A05-0B | | LR22-2A05-0B | | LR23-2A05-0B | |
| | 6 | 150 | 4.8 | .475 | LR21-2A06-0B | | LR22-2A06-0B | | LR23-2A06-0B | |
| | 12 | 750 | 9.6 | .475 | LR21-2A12-0B | | LR22-2A12-0B | | LR23-2A12-0B | |
| | 24 | 3000 | 19.2 | .475 | LR21-2A24-0B | | LR22-2A24-0B | | LR23-2A24-0B | |
| 1B | 5 | 100 | 4.0 | .475 | LR21-1B05-0B | | LR22-1B05-0B | | LR23-1B05-0B | |
| | 6 | 150 | 4.8 | .475 | LR21-1B06-0B | | LR22-1B06-0B | | LR23-1B06-0B | |
| | 12 | 750 | 9.6 | .475 | LR21-1B12-0B | | LR22-1B12-0B | | LR23-1B12-0B | |
| | 24 | 3000 | 19.2 | .475 | LR21-1B24-0B | | LR22-1B24-0B | | LR23-1B24-0B | |
| 1C | 5 | 100 | 4.0 | .475 | LR21-1C05-0G | | LR22-1C05-0G | | LR23-1C05-0G | |
| | 6 | 150 | 4.8 | .475 | LR21-1C06-0G | | LR22-1C06-0G | | LR23-1C06-0G | |
| | 12 | 750 | 9.6 | .475 | LR21-1C12-0G | | LR22-1C12-0G | | LR23-1C12-0G | |
| | 24 | 3000 | 19.2 | .475 | LR21-1C24-0G | | LR22-1C24-0G | | LR23-1C24-0G | |
| 2B | 5 | 50 | 4.0 | .675 | LR41-2B05-0B | | LR42-2B05-0B | | LR43-2B05-0B | |
| | 6 | 100 | 4.8 | .675 | LR41-2B06-0B | | LR42-2B06-0B | | LR43-2B06-0B | |
| | 12 | 380 | 9.6 | .675 | LR41-2B12-0B | | LR42-2B12-0B | | LR43-2B12-0B | |
| | 24 | 1600 | 19.2 | .675 | LR41-2B24-0B | | LR42-2B24-0B | | LR43-2B24-0B | |
| 3A | 5 | 50 | 4.0 | .675 | LR41-3A05-0B | | LR42-3A05-0B | | LR43-3A05-0B | |
| | 6 | 100 | 4.8 | .675 | LR41-3A06-0B | | LR42-3A06-0B | | LR43-3A06-0B | |
| | 12 | 380 | 9.6 | .675 | LR41-3A12-0B | | LR42-3A12-0B | | LR43-3A12-0B | |
| | 24 | 1600 | 19.2 | .675 | LR41-3A24-0B | | LR42-3A24-0B | | LR43-3A24-0B | |
| 2C | 5 | 50 | 4.0 | .675 | LR41-2C05-0G | | LR42-2C05-0G | | LR43-2C05-0G | |
| | 6 | 100 | 4.8 | .675 | LR41-2C06-0G | | LR42-2C06-0G | | LR43-2C06-0G | |
| | 12 | 380 | 9.6 | .675 | LR41-2C12-0G | | LR42-2C12-0G | | LR43-2C12-0G | |
| | 24 | 1600 | 19.2 | .675 | LR41-2C24-0G | | LR42-2C24-0G | | LR43-2C24-0G | |
| 4A | 5 | 26 | 4.0 | .775 | LR51-4A05-0B | | LR52-4A05-0B | | LR53-4A05-0B | |
| | 6 | 45 | 4.8 | .775 | LR51-4A06-0B | | LR52-4A06-0B | | LR53-4A06-0B | |
| | 12 | 200 | 9.6 | .775 | LR51-4A12-0B | | LR52-4A12-0B | | LR53-4A12-0B | |
| | 24 | 1100 | 19.2 | .775 | LR51-4A24-0B | | LR52-4A24-0B | | LR53-4A24-0B | |

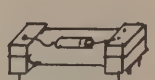
### LR RELAY — Switching and Load Characteristics

The standard switches (Options B and G) are recommended for general use. Low level switching applications require other instrument grade switches (Options C and H) or mercury wetted contacts (Option E).

| Switch Option | Contact Configuration | Description | Maximum Resistive Contact Rating VA | Amps | VDC | Initial Contact Resistance Ohms | Average Minimum Breakdown Voltage VDC | Typical Times in Milliseconds OP | OP Bounce | REL | REL Bounce |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B | Form A Form B | Standard | 10 | .50 | 200 | .100 | 400 / 275 | .45 | .35 | .75 | .35 |
| C | Form A Form B | Instrument Grade (Low Level) | 10 | .50 | 200 | .100 | 300 / 250 | .70 | .35 | .75 | .35 |
| D | Form A | High Voltage Switching | 10 | .50 | 500 | .100 | 1500 / 1350 | .90 | .45 | — | — |
| E | Form A | Mercury Wetted Contacts (Zero Bounce) | 50 | 2.0 | 100 | .050 | 2000 / 1500 | 2.50 | 0.00 | 1.70 | — |
| G | Form C Form B | Standard | 3 | .25 | 28 | .150 | 300 / 250 | .35 | .60 | .30 | 1.40 |
| H | Form C Form B | Instrument Grade (Low Level) | 3 | .25 | 28 | .150 | 300 / 250 | .35 | .60 | .30 | 1.40 |
| K | Form A | Power Switching | 50 | 1.0 | 200 | .200 | 400 / 350 | .70 | .35 | — | — |

### RELAY OPTIONS:

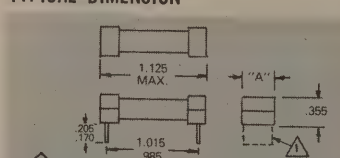
1. Electromagnetic shielding
2. Electrostatic shielding
3. Diode (Top mounted thus: LR1, LR2 mounted internal LR3, LR4, LR5.)



### SWITCH OPTIONS:

| Type | Description |
|---|---|
| 1. B & G | Standard: .5A, 10W, Form A; .25A, 3W, Form C |
| 2. C & H | Low level dry switch, instrument grade |
| 3. E | Mercury wetted contacts |
| 4. D | Hi voltage switching |
| 5. K | Power switching |

### TYPICAL DIMENSION




1 Terminal pin spacing is on .1" grid. Standard terminals are .025 diameter tin coated copper for coil and .022 diameter tin or gold plated "Alloy 52" for switch terminals.

### LR REED RELAY SPECIFICATIONS

**Characteristics:** @ 25°C
**Coil Resistance:** ±10% of nominal.
**Maximum Pull In:** 80% of Nominal Voltage.
**Minimum Drop-Out:** 8% of Nominal Voltage.
**Coil Voltage:** Available in 5, 6 & 24 VDC. See table for nominal resistance values.
**Temperature Range:** Operating: −40°C to +85°C (−40°F to +185°F).
Storage: −40°C to +105°C (−40°F to +220°F).

### DEFINITION OF PART NUMBER

See detail sheets for detail explanation.

**LR 5 2-4A 12-0B ***

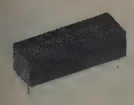
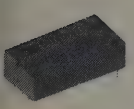
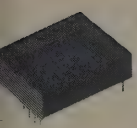
- Reed switch type B thru H, K
- Shielding Options:
  - 0 - Basic Relay.
  - 1 - Electromagnetic shielding.
  - 2 - Electrostatic shielding.
  - 3 - Electromagnetic and electrostatic shielding.
- Nominal coil voltage (expressed as two digits).
- Switch configuration.
- Coil terminal location (top view): 1 - Diagonal. 2 - Side. 3 - End.
- Relay width:
  - 1 - .375 Max.
  - 2 - .475 Max.
  - 3 - .575 Max.
  - 4 - .675 Max.
  - 5 - .775 Max.
- Basic Series: 1.25 max. long by .355 max. high.

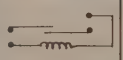
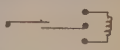
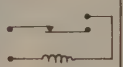
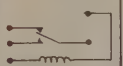
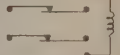
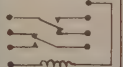
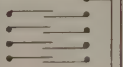
* D added to the P/N indicates a suppression diode.
* L added to the P/N indicates 390 coil option available on LR1*-1A05-0B or LR1*-1A05-0C.

**ELECTRONIC SPECIALTY DIVISION**
DATRON SYSTEMS INC. / 18900 N.E. Sandy Blvd. / Portland, Oregon 97230
(503) 665-0121 / TWX 910-469-8782

# LS SERIES

## STANDARD REED RELAY EPOXY ENCAPSULATED

| Contact Form | Coil VDC | Coil Resistance ±10% @ 25°C | Pick Up Voltage @ 25°C | Dim. A | Part Number | Circuit Diagram Top View | Part Number | Circuit Diagram Top View | Part Number | Circuit Diagram Top View |
|---|---|---|---|---|---|---|---|---|---|---|
| 1A | 5 | 180 | 4.0 | .375 | LS011-1-1A05-0B |  | LS012-1-1A05-0B | | LS013-1-1A05-0B |  |
| | 6 | 270 | 4.8 | .375 | LS011-1-1A06-0B | | LS012-1-1A06-0B | | LS013-1-1A06-0B | |
| | 12 | 1500 | 9.6 | .375 | LS011-1-1A12-0B | | LS012-1-1A12-0B | | LS013-1-1A12-0B | |
| | 24 | 3500 | 19.2 | .375 | LS011-1-1A24-0B | | LS012-1-1A24-0B | | LS013-1-1A24-0B | |
| 2A | 5 | 100 | 4.0 | .475 | LS021-1-2A05-0B | | LS022-1-2A05-0B | | LS023-1-2A05-0B | |
| | 6 | 150 | 4.8 | .475 | LS021-1-2A06-0B | | LS022-1-2A06-0B | | LS023-1-2A06-0B | |
| | 12 | 750 | 9.6 | .475 | LS021-1-2A12-0B | | LS022-1-2A12-0B | | LS023-1-2A12-0B | |
| | 24 | 3000 | 19.2 | .475 | LS021-1-2A24-0B | | LS022-1-2A24-0B | | LS023-1-2A24-0B | |
| 1B | 5 | 100 | 4.0 | .475 | LS021-1-1B05-0B |  | LS022-1-1B05-0B | | LS023-1-1B05-0B | |
| | 6 | 150 | 4.8 | .475 | LS021-1-1B06-0B | | LS022-1-1B06-0B | | LS023-1-1B06-0B | |
| | 12 | 750 | 9.6 | .475 | LS021-1-1B12-0B | | LS022-1-1B12-0B | | LS023-1-1B12-0B | |
| | 24 | 3000 | 19.2 | .475 | LS021-1-1B24-0B | | LS022-1-1B24-0B | | LS023-1-1B24-0B | |
| 1C | 5 | 100 | 4.0 | .375 | LS011-1-1C05-0G |  | LS012-1-1C05-0G | | LS013-1-1C05-0G | |
| | 6 | 150 | 4.8 | .375 | LS011-1-1C06-0G | | LS012-1-1C06-0G | | LS013-1-1C06-0G | |
| | 12 | 750 | 9.6 | .375 | LS011-1-1C12-0G | | LS012-1-1C12-0G | | LS013-1-1C12-0G | |
| | 24 | 3000 | 19.2 | .375 | LS011-1-1C24-0G | | LS012-1-1C24-0G | | LS013-1-1C24-0G | |
| 2B | 5 | 50 | 4.0 | .575 | LS031-1-2B05-0B | | LS032-1-2B05-0B | | LS033-1-2B05-0B |  |
| | 6 | 100 | 4.8 | .575 | LS031-1-2B06-0B | | LS032-1-2B06-0B | | LS033-1-2B06-0B | |
| | 12 | 380 | 9.6 | .575 | LS031-1-2B12-0B | | LS032-1-2B12-0B | | LS033-1-2B12-0B | |
| | 24 | 1600 | 19.2 | .575 | LS031-1-2B24-0B | | LS032-1-2B24-0B | | LS033-1-2B24-0B | |
| 3A | 5 | 50 | 4.0 | .575 | LS031-1-3A05-0B | | LS032-1-3A05-0B | | LS033-1-3A05-0B | |
| | 6 | 100 | 4.8 | .575 | LS031-1-3A06-0B | | LS032-1-3A06-0B | | LS033-1-3A06-0B | |
| | 12 | 380 | 9.6 | .575 | LS031-1-3A12-0B | | LS032-1-3A12-0B | | LS033-1-3A12-0B | |
| | 24 | 1600 | 19.2 | .575 | LS031-1-3A24-0B | | LS032-1-3A24-0B | | LS033-1-3A24-0B | |
| 2C | 5 | 50 | 4.0 | .575 | LS031-1-2C05-0G |  | LS032-1-2C05-0G | | LS033-1-2C05-0G | |
| | 6 | 100 | 4.8 | .575 | LS031-1-2C06-0G | | LS032-1-2C06-0G | | LS033-1-2C06-0G | |
| | 12 | 380 | 9.6 | .575 | LS031-1-2C12-0G | | LS032-1-2C12-0G | | LS033-1-2C12-0G | |
| | 24 | 1600 | 19.2 | .575 | LS031-1-2C24-0G | | LS032-1-2C24-0G | | LS033-1-2C24-0G | |
| 4A | 5 | 26 | 4.0 | .675 | LS041-1-4A05-0B |  | LS042-1-4A05-0B | | LS043-1-4A05-0B | |
| | 6 | 45 | 4.8 | .675 | LS041-1-4A06-0B | | LS042-1-4A06-0B | | LS043-1-4A06-0B | |
| | 12 | 200 | 9.6 | .675 | LS041-1-4A12-0B | | LS042-1-4A12-0B | | LS043-1-4A12-0B | |
| | 24 | 1100 | 19.2 | .675 | LS041-1-4A24-0B | | LS042-1-4A24-0B | | LS043-1-4A24-0B | |

## LS RELAY — Switching and Load Characteristics

The standard switches (Options B and G) are recommended for general use. Low level switching applications require other instrument grade switches (Options C and H) or mercury wetted contacts (Option E).

| Switch Option | Contact Configuration | Description | Maximum Resistive Contact Rating VA | Amps | VDC | Initial Contact Resistance Ohms | Average Minimum Breakdown Voltage VDC | Typical Times in Milliseconds OP | OP Bounce | REL | REL Bounce |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B | Form A Form B | Standard | 10 | .50 | 200 | .100 | 400 / 275 | .45 | .35 | .75 | .35 |
| C | Form A Form B | Instrument Grade (Low Level) | 10 | .50 | 200 | .100 | 300 / 250 | .70 | .35 | .75 | .35 |
| D | Form A | High Voltage Switching | 10 | .50 | 500 | .100 | 1500 / 1350 | .90 | .45 | — | — |
| E | Form A | Mercury Wetted Contacts (Zero Bounce) | 50 | 2.0 | 100 | .050 | 2000 / 1500 | 2.50 | 0.00 | 1.70 | — |
| G | Form C Form B | Standard | 3 | .25 | 28 | .150 | 300 / 250 | .35 | .60 | .30 | 1.40 |
| H | Form C Form B | Instrument Grade (Low Level) | 3 | .25 | 28 | .150 | 300 / 250 | .35 | .60 | .30 | 1.40 |
| K | Form A | Power Switching | 50 | 1.0 | 200 | .200 | 400 / 350 | .70 | .35 | — | — |

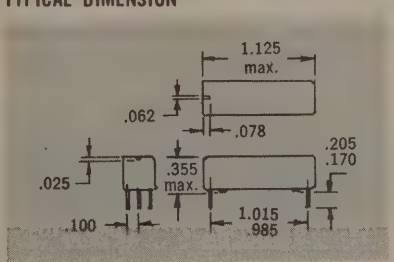
### RELAY OPTIONS:

1. Electromagnetic shielding
2. Electrostatic shielding
3. Diode suppression

### SWITCH OPTIONS:

| Type | Description |
|---|---|
| 1. B & G | Standard: .5A, 10W, Form A; .25A, 3W, Form C |
| 2. C & H | Low level dry switch, instrument grade |
| 3. E | Mercury wetted contacts |
| 4. D | Hi voltage switching |
| 5. K | Power switching |

### TYPICAL DIMENSION




### LS REED RELAY SPECIFICATIONS

**Characteristics:** @ 25°C
**Coil Resistance:** ±10% of nominal.
**Maximum Pull In:** 80% of Nominal Voltage.
**Minimum Drop-Out:** 8% of Nominal Voltage.
**Coil Voltage:** Available in 5, 6 & 24 VDC. See table for nominal resistance values.
**Temperature Range:** Operating: −40°C to +85°C (−40°F to +185°F).
Storage: −40°C to +105°C (−40°F to +220°F).

### DEFINITION OF PART NUMBER

LS 04 1 - 1 - 4A 24 - 0 B

- LS — Basic Series 1.125 max. long x .355 max. high encapsulated reed relay
- 04 — Relay Width and Pin Spacing Indicator: 01 - .375 max. wide* 02 - .475 max. wide* 03 - .575 max. wide* 04 - .675 max. wide*
- 1 — Coil Terminal Location (top view): 0 - Special 1 - Diagonal 2 - Side 3 - End
- 1 — Number of Coils
- 4A — Contact Number and Form
- 24 — Nominal Voltage (expressed as two digits)
- 0 — Options:
  - 0 - Basic relay
  - 1 - Electromagnetic shield
  - 2 - Electrostatic shield
  - 3 - Electromagnetic & electrostatic shield
  - 4 - Diode suppression
  - 5 - Diode suppression w/electromagnetic shield
  - 6 - Diode suppression w/electrostatic shield
  - 7 - Diode suppression w/electromagnetic & electrostatic shield
- B — Switch Option (B, C, D, E, G, H, K)

*1.0 x .100 grid †1.0 x .150 grid

# CATALOGUE DE L'ELECTRONIQUE POUR LES INGENIEURS
# DER PRODUKTKATALOG FÜR ELEKTRONIKER
# ELECTRONIC ENGINEERS CATALOGUE

**The 1978 edition is out...and the response is in...**
**IMMEDIATE AND OVERWHELMING**

**ACCEPTANCE**

The ELECTRONIC ENGINEERS CATALOGUE is the only comprehensive, trilingual catalogue/source-directory of electronic products available to—and from—Western Europe.

It is divided into three distinct sections: 1. **The Product Index and Directory,** which lists more than 3,000 product headings & cross-references alphabetically in English with their French and German equivalents. 2. **The Manufacturers' Catalogue Section,** which is a compilation of Manufacturers' Catalogues in alphabetical order. 3. **The Manufacturers' Sales Offices and Trade Marks Directory,** which alphabetically includes country, address, telex or TWX numbers of the Manufacturers' main and local sales offices and/or agents.

The ELECTRONIC ENGINEERS CATALOGUE offers U.S. manufacturers the most cost-efficient method of distributing their catalogue data to **25,000** electronic engineers and buyers throughout Western Europe. It represents the carefully conceived application of the time-proven **eem** "cataloging" concept to the elusive European marketplace.

United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Avenue, Garden City, New York 11530 / 516 222-2500

# THE dB RELAY

## HALF THE PRICE OF OTHER MERCURY RELAYS

## AND IT WORKS IN ALL POSITIONS!

OUR dB RELAYS OFFER EXCEPTIONAL RELIABILITY AT EXTREMELY LOW COST

Self-healing contacts in a welded steel contact chamber have demonstrated a Mean Cycle between Failure of over 2.0 billion operations. This means less down time for your equipment.

Contact resistance is the same regardless of whether the load is a full 20 watts or a bone dry signal of nanowatt level. The resistance of the wet mercury film contacts changes by less than 0.02 ohms over its extended life. Your product may need expensive recalibration.

A patented design keeps the mercury film in place within the contact chamber. Operation is unaffected by mounting position. You have total packaging flexibility without regard for relay orientation.

The dB relay has no contact bounce. There can be no false triggering of sensitive following solid state circuits.

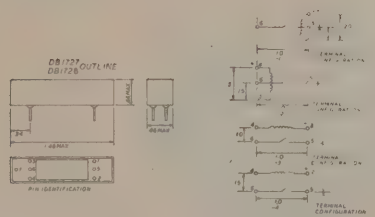
The contact chamber of this relay is built of rugged steel. It is not a fragile glass capsule. Early failures due to stressed or leaking glass switching capsules are eliminated.

Terminal pin and coil resistance options permit the direct replacement of many dry reed and mercury wetted relay models.

The dB relay is not a premium priced product. It sells for about half the price of most mercury relays and less than some dry reed relays.

Why settle for less than optimum performance or suffer with restrictions on equipment orientation when you can use this problem solving product?

MODEM LINE PULSING
DATA ACCESS
TELEPHONE LINE SWITCHING
PERIPHERAL EQUIPMENT
TOUCH TONE CONVERTERS
TEST EQUIPMENT
INDUSTRIAL CONTROLS
OVER 1,000,000 UNITS IN THE FIELD



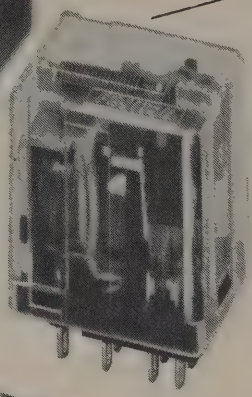

A WIDE VARIETY OF OTHER FOOTPRINTS ARE AVAILABLE. CONTACT FACTORY.

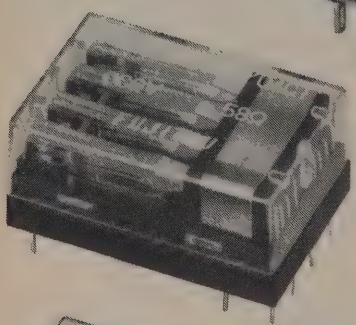
**SPECIFICATIONS**

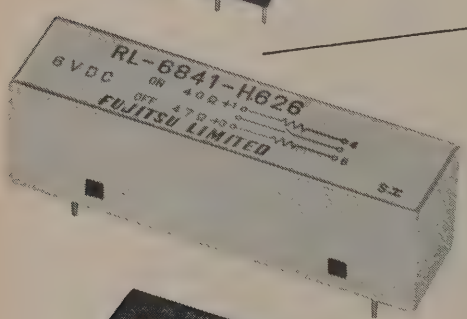
| RELAY PART NUMBER | CONTACT FORM | NOMINAL COIL DC VOLTS | COIL RESISTANCE OHMS ±10% | MAXIMUM JUST. OPERATE VOLTS | MINIMUM JUST. RELEASE VOLTS | TYPICAL OPERATE TIME (Milliseconds) | TYPICAL RELEASE TIME (Milliseconds) | LIFE | RELIABILITY | RATED LOAD CURRENT @ 52 VDC | RATED LOAD CURRENT @ 200 VDC | END OF LIFE CONTACT RESISTANCE | CONTACT RESISTANCE STABILITY | OPEN CONTACT BREAKDOWN | CONTACT TO COIL BREAKDOWN | OPERATIONAL TEMPERATURE (degrees C) | MAGNETIC SHIELD | ALUMINUM COVER | CONTACT BOUNCE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| dB 1727-A-1-1-5 | A | 5 | 200 | 4 | 0.5 | 3.5 | 3.5 | INDEFINITE | 2.0 x $10^9$ MCBF @ 90% C.L. | 0.25 AMPERES | 0.10 AMPERES | 0.25 OHMS | ±0.02 OHMS OPERATION TO OPERATION | 1700 VOLTS PEAK MIN. 600 VOLTS DC MIN. | 2500 VOLTS PEAK MIN. | −37 | Y | N | NONE |
| dB 1727-A-1-1-12 | A | 12 | 1152 | 9.6 | 1.2 | 3.5 | 3.5 | | | | | | | | | to | Y | N | |
| dB 1727-A-1-1-24 | A | 24 | 4608 | 19.2 | 2.4 | 3.5 | 3.5 | | | | | | | | | +85 | Y | N | |
| dB 1727-A-1-2-5 | A | 5 | 100 | 4 | 0.5 | 3.0 | 3.0 | | | | | | | | | −37 | Y | N | |
| dB 1727-A-1-2-12 | A | 12 | 576 | 9.6 | 1.2 | 3.0 | 3.0 | | | | | | | | | to | Y | N | |
| dB 1727-A-1-2-24 | A | 24 | 2304 | 19.2 | 2.4 | 3.0 | 3.0 | | | | | | | | | +85 | Y | N | |
| dB 1727-B-1-2-5 | B | 5 | 100 | 4 | 0.5 | 3.0 | 3.0 | | | | | | | | | −37 | N | Y | |
| dB 1727-B-1-2-12 | B | 12 | 576 | 9.6 | 1.2 | 3.0 | 3.0 | | | | | | | | | to | N | Y | |
| dB 1727-B-1-2-24 | B | 24 | 2304 | 19.2 | 2.4 | 3.0 | 3.0 | | | | | | | | | +65 | N | Y | |

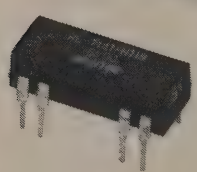
**FIFTH DIMENSION INC.**
5-D
707 ALEXANDER ROAD • PRINCETON, NEW JERSEY 08540
TELEPHONE: (609) 452-1200 • TWX: 510-685-2387

# FUJITSU: RELAYS







### HEAVY DUTY GENERAL PURPOSE RELAYS
### FRL250 SERIES

Designed with particular attention to reliability, cost performance and versatility of application. Offered with three different contact arrangements (SPDT, DPDT and 3PDT), ac and dc coils, and with a selection of mountings that include solder, plug-in, PCB and quick connect terminals. Capable of handling loads up to 10A at 30 Vdc or 10A at 240 Vac, resistive. Available in 6, 12, 24, 48, 100, and 110 Vdc and 12, 24, 48, 100, 120, 200 and 240 Vac. Size: 2.165 x 1.406 x 1.531 inches. Price range for 1000 pieces from $1.81 to $2.60, depending on model. UL recognized (UL File E 63614) and CSA certified (CSA File LR 40304-1). Numerous applications include industrial control equipment, vending and amusement machines, etc.

### MINIATURE GENERAL PURPOSE RELAYS
### FRL260 SERIES

Relays with proven performance, versatility and top quality. Offered in choice of ac or dc coils and with PCB terminals, solder/plug-in or quick connect. Three major types of relays are: DPDT rated up to 10A at 30 Vdc or 120 Vac, resistive; 4PDT rated up to 3A at 30 Vdc or 120 Vac, resistive; 4PST rated up to 3A at 30 Vdc or 120 Vac, resistive. Available in 6, 12, 24, 48 and 100 Vdc, and 6, 12, 24, 48, 100, 120, 200 Vac. Standard case size: 1.291 x .858 x 1.110 inches. Bracket case also available. Price range for 1000 pieces from $1.76 to $2.32, depending on model. UL recognized (UL File E 63614/E 63615) and CSA certified (CSA File LR 40304-2). For wide range of industrial applications. 4PST relay has bifurcated contacts for low level signals and other light loads.

### FLAT PACKAGE RELAYS FOR PC BOARD MOUNTING
### FRL410

Low power consumption relays available in both DPDT and 4PDT (2 Form C and 4 Form C) contact arrangements. Bifurcated contacts assure high reliability for numerous demanding applications, including telecommunications, data processing and controls. Capable of handling 1A at 30 Vdc or 1A at 100 Vac, resistive. Available in 5, 6, 12, 24 and 48 Vdc. Molded base offers flux contamination immunity. Low profile. Stands 1.21 x .82 x .49 inch high. Price range for 1000 pieces from $1.73 to $2.60, depending on model.

### MAGNETIC LATCHING REED RELAYS
### 6800 SERIES

The blades of this relay remain magnetically latched even after the applied magnetic field is removed, making it ideal for applications where the memory function is essential. There is no power dissipation during latching. Available in 1 Form A, 2 Form A and 3 Form A, and in 6, 12, 24, and 48 Vdc. Popular .1" pin spacing. Size: 1.89" long by .47" high. Price range for 1000 pieces from $2.87 to $6.48, depending on model. Typical applications: Memory elements, vending machines, control systems, display devices, measuring and testing instruments.

### DIP REED RELAYS FOR PC BOARD MOUNTING
### RL7100, FRL700, FRL710L SERIES

Compatible with standard 14 pin dual inline IC package and can be driven directly by TTL and DTL's. Epoxy molded and highly sensitive. The variety available from Fujitsu is almost limitless. Take your choice of relays with or without diodes: regular or latching type; with or without magnetic shielding; with or without electrostatic shielding; 1 Form A or 2 Form A; 5, 6 or 12 Vdc. Price range for 1000 pieces from $1.46 to $2.63, depending on model. Whether your application is for data processing, telecommunications, control systems, vending machines or display devices, Fujitsu should have a DIP Reed Relay for you.

Call or write Fujitsu America, Inc. for literature or more information on any of these products.

FUJITSU

**FUJITSU AMERICA, INC.**

COMPONENT SALES DIVISION
910 SHERWOOD DRIVE LAKE BLUFF, ILLINOIS 60044 TEL. (312) 295-2610 TWX: 910-651-2259

AND CAPACITORS AND CONNECTORS AND

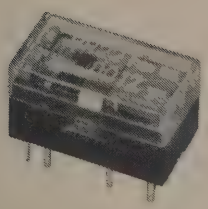
# FUJITSU: RELAYS

### MINIATURE RELAYS FOR PC BOARD MOUNTING
### BR111 SERIES

Low cost SPDT (1 Form C) relay with a load handling capability of 3A at 24 Vdc or 3A at 100 Vac, resistive. Available in 5, 6, 9, 12 and 24 Vdc. Has low coil power dissipation of 360 mW. This sensitive relay is designed to be mounted directly on PC boards and features small, simplified construction. Stands .85 x .67 x .89 inch high. Price depending on model. Ideal for use in numerical control equipment, vending machines, game machines, automotive and other control applications.

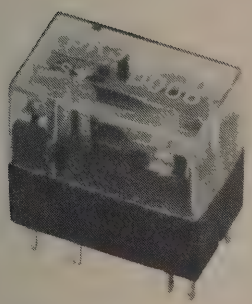
### ULTRA MINIATURE RELAYS FOR PC BOARD MOUNTING
### BR211 SERIES

The ultra small size (only .1 cubic inch) allows high component density for savings in both equipment size and cost. These highly sensitive relays with SPDT (1 Form C) contacts have load handling capabilities of 1A at 24 Vdc or 0.5A at 100 Vac, resistive. Available in 1.5, 3, 5, 6, 9, 12, and 24 Vdc. Molded base offers flux contamination immunity. Has .1" pin spacing for PC board applications and stands only .610 x .413 x .413 inch high. Price range for 1000 pieces from $0.69 to $1.38, depending on model. Ideal for use in audio and radio communications, office and vending machines, automotive and other control applications.



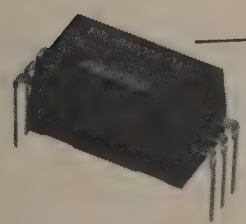
### ULTRA MINIATURE DPDT RELAYS FOR PCB MOUNTING
### BR221 SERIES

Virtually the same reliable relay as above, except for contact form. DPDT (2 Form C) contacts offer more flexibility from relay mounted in equally small area. Stands only .846 x .413 x .465 inch high. Price range for 1000 pieces from $1.17 to $1.38, depending on model.



### MINIATURE RELAYS FOR PC BOARD MOUNTING
### BR321 SERIES

Slightly larger version of the ultra miniature PCB relays featured above. Comes with DPDT (2 Form C) contacts and capable of handling 3A at 24 Vdc or 3A at 100 Vac, resistive. Available in 5, 6, 12, and 24 Vdc. Stands .83 x .53 x .63 inch high. Price range for 1000 pieces from $1.50 to $2.00, depending on model.



### MOLDED MICRO REED RELAYS FOR PCB MOUNTING
### FRL640 SERIES

Epoxy molded, low profile PCB relay has many applicational advantages over others; immersion cleaning safety is one. Solid construction is another. Comes in 1 Form A, 1 Form B, 2 Form A and 2 Form B contacts. Low power consumption, low contact noise and stable contact resistance. Type S for switching under standard load and Type K for switching under heavy load condition. Popular .1" pin spacing. Lengthwise pin spacing .8" or 1.0". Stands only .354" high. Magnetic shielding for isolation offered optionally. Price range for 1000 pieces from $0.92 to $2.06, depending on model. Ideal for audio equipment, data processing, telecommunications, measuring and control equipment applications.

Call or write Fujitsu America, Inc. for literature or more information on any of these products.

FUJITSU

**FUJITSU AMERICA, INC.**

**COMPONENT SALES DIVISION**
910 SHERWOOD DRIVE LAKE BLUFF, ILLINOIS 60044 TEL. (312) 295-2610 TWX: 910-651-2259

KEYBOARDS AND KEY SWITCHES AND

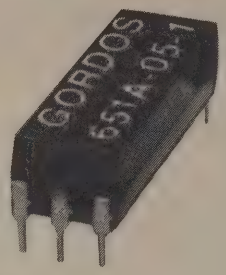
GORDOS

DRY REED RELAYS

# 65 & 76 SERIES

## MOLDED-EPOXY MINIATURE

### 65 SERIES




- Standard .150" x 1.00" PCB pattern
- Available in 1A, 1B, 1C, and 2A forms
- Molded epoxy
- Environmental immunity assured
- Interface with microprocessor

### 76 SERIES

- LOW COST
- Popular standard .100" x 1.00" PCB mounting
- Available 1A, 1B, 1C, and 2A forms
- Molded epoxy
- Environmental immunity assured

### RELAY CHARACTERISTICS

| Form | Model Number | Coil Resistance (Ohms) ±10% @ 25°C | Nom. (VDC) | 1-24 pc. Price |
|---|---|---|---|---|
| **65 SERIES** | | | | |
| 1A | 651A-05-1 | 150 | 5 | $3.33 |
| | 651A-12-1 | 575 | 12 | 3.45 |
| | 651A-24-1 | 2150 | 24 | 4.05 |
| 1B | 651B-05-1 | 80 | 5 | 5.12 |
| | 651B-12-1 | 320 | 12 | 5.24 |
| | 651B-24-1 | 1500 | 24 | 5.83 |
| 2A | 652A-05-1 | 80 | 5 | 5.12 |
| | 652A-12-1 | 320 | 12 | 5.24 |
| | 652A-24-1 | 1500 | 24 | 5.83 |
| 1C | 651C-05-1 | 100 | 5 | 7.02 |
| | 651C-12-1 | 450 | 12 | 7.14 |
| | 651C-24-1 | 1750 | 24 | 7.74 |
| **76 SERIES** | | | | |
| 1A | 761A051-1 | 150 | 5 | $2.00 |
| | 761A121-1 | 575 | 12 | 2.00 |
| | 761A241-1 | 2150 | 24 | 2.71 |
| 1B | 761B051-1 | 110 | 5 | 4.40 |
| | 761B121-1 | 440 | 12 | 4.40 |
| | 761B241-1 | 1750 | 24 | 5.10 |
| 2A | 762A052-1 | 110 | 5 | 2.95 |
| | 762A122-1 | 440 | 12 | 2.95 |
| | 762A242-1 | 1750 | 24 | 3.67 |
| 1C | 761C051-1 | 150 | 5 | 4.05 |
| | 761C121-1 | 575 | 12 | 4.05 |
| | 761C241-1 | 2150 | 24 | 4.76 |

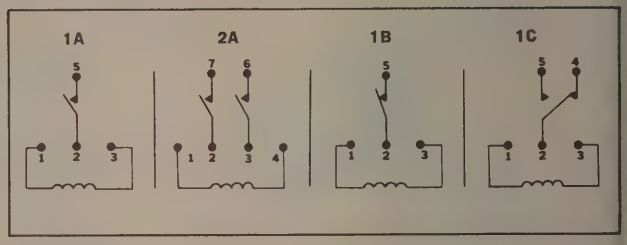
### CONTACT RATINGS/CHARACTERISTICS

| Form | A | B | C |
|---|---|---|---|
| Operate time (mSec) | .5 | .35 | 1.5 (N/C) |
| Release time (mSec) | .05 | .5 | 1.0 (N/O) |
| Contact rating (watts) | 10 | 10 | 3 |
| Maximum initial contact reistance (ohms) | .200 | .200 | .200 |
| Maximum switching (VDC) | 200 | 200 | 28 |
| Maximum switching (amps) | .5 | .5 | .250 |

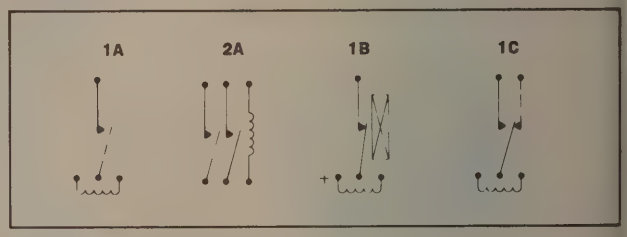
Typical values at 25°C.

### SCHEMATICS (TOP VIEW)

65 SERIES

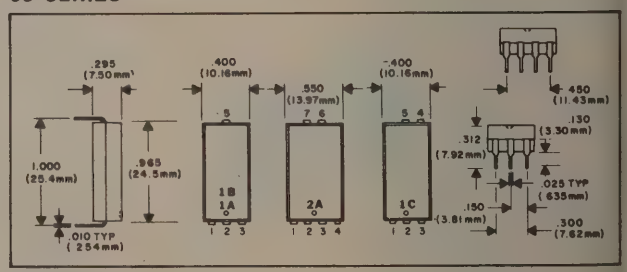



76 SERIES

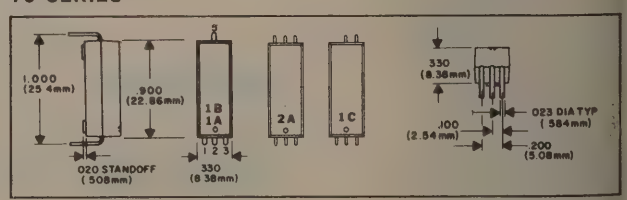



### OUTLINE DIMENSIONS

65 SERIES




76 SERIES



GORDOS

DRY REED RELAYS

# 741 & 83 SERIES

## 741 SERIES

## MOLDED-EPOXY SINGLE-IN-LINE PACKAGE (SIP)

- Designed for high density packaging
- Two relays can be mounted in a single DIP socket
- Available in 1A and 1B forms
- Molded epoxy
- Environmental immunity assured
- Logic compatible
- Interface with microprocessor

## 83 SERIES

## MOLDED-EPOXY DUAL-IN-LINE PACKAGE (DIP)

- Standard DIP package fits TO-116 socket
- Available 1A, 1B, 1C and 2A forms
- Molded epoxy for environmental immunity
- Logic compatible

## RELAY CHARACTERISTICS

| Form | Model Number | Coil Resistance (Ohms) ±10% @ 25°C | Nom. (VDC) | Clamp Diode | 1-24 pc. Price |
|---|---|---|---|---|---|
| **741 SERIES** | | | | | |
| 1A | 741A-1 | 380 | 5 | No | $3.45 |
| | 741A-2 | 380 | 5 | Yes | 4.05 |
| | 741A-9 | 500 | 5 | No | 3.45 |
| | 741A-10 | 500 | 5 | Yes | 4.05 |
| | 741A-3 | 500 | 12 | No | 3.45 |
| | 741A-4 | 500 | 12 | Yes | 4.05 |
| | 741A-7 | 1750 | 24 | No | 4.17 |
| | 741A-8 | 1750 | 24 | Yes | 4.76 |
| 1B | 741B-3 | 150 | 5 | No | 5.83 |
| | 741B-4 | 150 | 5 | Yes | 6.43 |
| | 741B-9 | 450 | 5 | No | 5.83 |
| | 741B-10 | 450 | 5 | Yes | 6.43 |
| | 741B-5 | 450 | 12 | No | 5.83 |
| | 741B-6 | 450 | 12 | Yes | 6.43 |
| | 741B-7 | 1750 | 24 | No | 6.55 |
| | 741B-8 | 1750 | 24 | Yes | 7.14 |
| **83 SERIES** | | | | | |
| 1A | 831A-1 | 380 | 5 | No | 3.17 |
| | 831A-2 | 380 | 5 | Yes | 3.75 |
| | 831A-3 | 500 | 5 | No | 3.17 |
| | 831A-4 | 500 | 5 | Yes | 3.75 |
| | 831A-5 | 500 | 12 | No | 3.17 |
| | 831A-6 | 500 | 12 | Yes | 3.75 |
| | 831A-7 | 1750 | 24 | No | 3.35 |
| | 831A-8 | 1750 | 24 | Yes | 3.95 |
| 2A | 832A-1 | 150 | 5 | No | 5.05 |
| | 832A-2 | 150 | 5 | Yes | 5.25 |
| | 832A-3 | 450 | 12 | No | 5.05 |
| | 832A-4 | 450 | 12 | Yes | 5.25 |
| | 832A-5 | 1750 | 24 | No | 5.25 |
| | 832A-6 | 1750 | 24 | Yes | 5.65 |
| 1B | 831B-1 | 150 | 5 | No | 4.80 |
| | 831B-2 | 150 | 5 | Yes | 5.30 |
| | 831B-3 | 450 | 5 | No | 4.80 |
| | 831B-4 | 450 | 5 | Yes | 5.30 |
| | 831B-5 | 450 | 12 | No | 4.80 |
| | 831B-6 | 450 | 12 | Yes | 5.30 |
| | 831B-7 | 1750 | 24 | No | 5.10 |
| | 831B-8 | 1750 | 24 | Yes | 5.60 |
| 1C | 831C-1 | 150 | 5 | No | 4.67 |
| | 831C-2 | 150 | 5 | Yes | 5.13 |
| | 831C-3 | 450 | 12 | No | 4.67 |
| | 831C-4 | 450 | 12 | Yes | 5.13 |
| | 831C-5 | 1750 | 24 | No | 5.25 |
| | 831C-6 | 1750 | 24 | Yes | 5.75 |
| | 835C-1 | 150 | 5 | No | 4.67 |
| | 835C-2 | 150 | 5 | Yes | 5.13 |
| | 835C-3 | 450 | 12 | No | 4.67 |
| | 835C-4 | 450 | 12 | Yes | 5.13 |
| | 835C-5 | 1750 | 24 | No | 5.25 |
| | 835C-6 | 1750 | 24 | Yes | 5.75 |

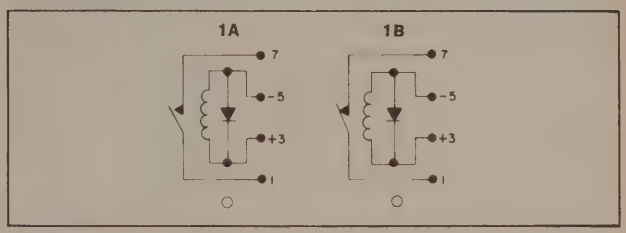
## CONTACT RATINGS/CHARACTERISTICS

| | 741 Series | | 83 Series | | | |
|---|---|---|---|---|---|---|
| | Form A | Form B | 1A | 2A | 1B | 1C |
| Operate time (mSec) | .50 | .35 | .50 | .50 | .35 | 1.5 (N/C) |
| Release time (mSec) | .05* | .50 | .05 | .05 | .50 | 1.0 (N/O) |
| Contact rating (watts) | 10 | 10 | 10 | 3 | 10 | 3 |
| Maximum initial contact resistance (ohms) | .200 | .200 | .200 | .200 | .200 | .200 |
| Maximum switching (VDC) | 100 | 100 | 100 | 28 | 100 | 28 |
| Maximum switching (amps) | .250 | .250 | .250 | .250 | .250 | .250 |

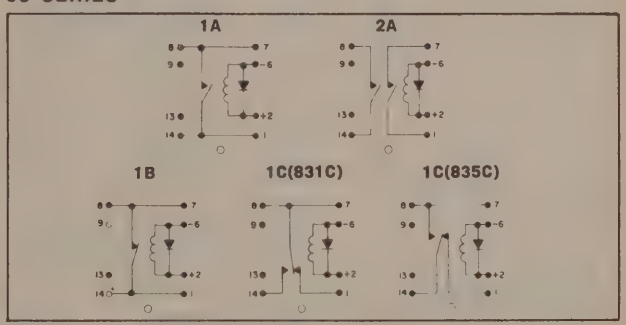
Typical values at 25°C  * 15 mSec suppressed

## SCHEMATICS (TOP VIEW)

### 741 SERIES

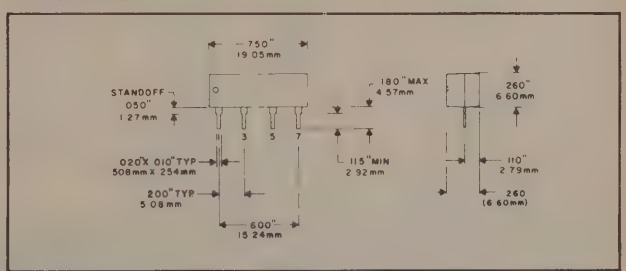



### 83 SERIES

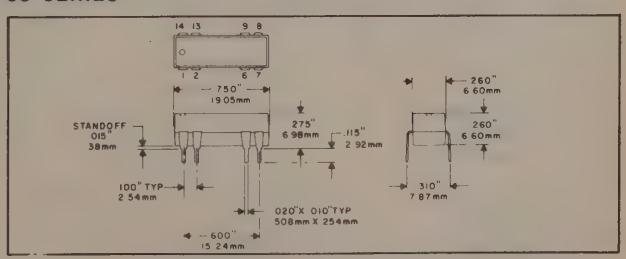



## OUTLINE DIMENSIONS

### 741 SERIES




### 83 SERIES



GORDOS

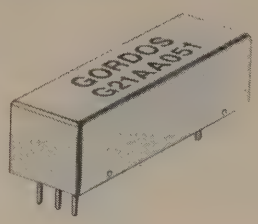
DRY REED RELAYS

# G2 & H SERIES

## G2 SERIES

## MINIATURE OPEN FRAME

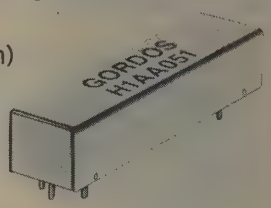
- Popular standard .100" x 1.00" PCB mounting
- Available in 1 thru 4 form A, 1 form C, and 1 form B
- Available with 1000V high voltage contact (form 1A)
- Magnetic box shield standard on all G2 relays




## H SERIES

## STANDARD OPEN FRAME

- .200" x 2.400" pin spacing (1A and 2A form)
- 1.0 Ampere switching (1A and 2A form)
- 3.0 Ampere switching (1A form)
- Magnetic box shield standard on all relays
- Available with 50W high power contact

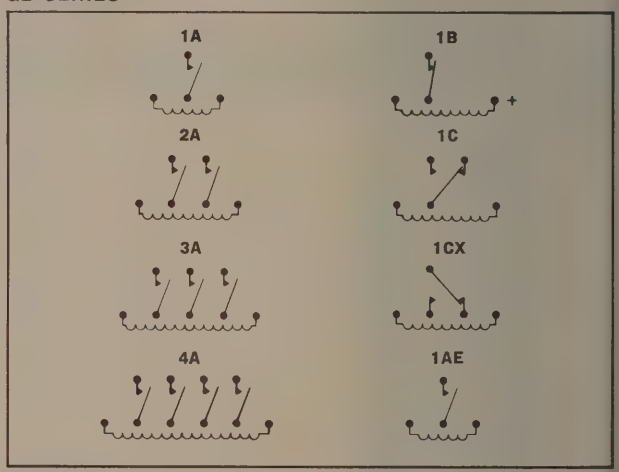



## RELAY CHARACTERISTICS

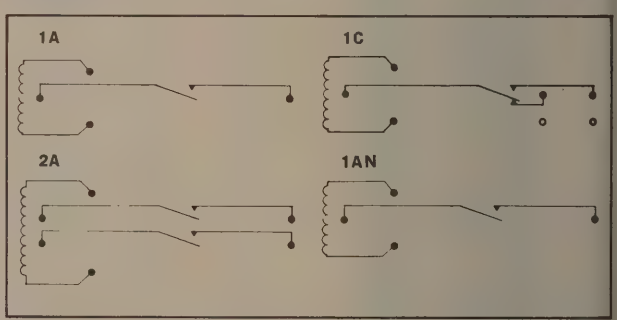
| Contact Form | Width* | Voltage | Ohms | Part Number | 1-24 pc. Price |
|---|---|---|---|---|---|
| **G2 SERIES** | | | | | |
| STANDARD CONTACT | | | | | |
| 1A | .375 (9.5) | 5 | 225 | G21AA051 | $2.81 |
| | | 12 | 1400 | G21AA121 | 2.81 |
| | | 24 | 4340 | G21AA241 | 3.40 |
| 2A | .475 (12.1) | 5 | 105 | G22AA051 | 3.81 |
| | | 12 | 730 | G22AA121 | 3.81 |
| | | 24 | 2500 | G22AA241 | 4.40 |
| 3A | .575 (14.6) | 5 | 82 | G23AA051 | 4.76 |
| | | 12 | 570 | G23AA121 | 4.76 |
| | | 24 | 1540 | G23AA241 | 5.36 |
| 4A | .675 (17.1) | 5 | 60 | G24AA051 | 5.74 |
| | | 12 | 320 | G24AA121 | 5.74 |
| | | 24 | 1090 | G24AA241 | 6.33 |
| 1B | .475 (12.1) | 5 | 105 | G21BB051 | 4.26 |
| | | 12 | 730 | G21BB121 | 4.26 |
| | | 24 | 2580 | G21BB241 | 4.86 |
| 1C | .475 (12.1) | 5 | 105 | G21CC051 | 4.79 |
| | | 12 | 730 | G21CC121 | 4.79 |
| | | 24 | 2500 | G21CC241 | 5.38 |
| | .475 (12.1) | 5 | 105 | G21CX051 | 4.79 |
| | | 12 | 730 | G21CX121 | 4.79 |
| | | 24 | 2500 | G21CX241 | 5.38 |
| HIGH VOLTAGE CONTACT | | | | | |
| 1A | .375 (9.5) | 5 | 225 | G21AE051 | 5.05 |
| | | 12 | 1400 | G21AE121 | 5.05 |
| | | 24 | 4340 | G21AE241 | 5.64 |
| **H SERIES** | | | | | |
| STANDARD CONTACT | | | | | |
| 1A | .680 (17.3) | 5 | 135 | H1AA051 | 4.76 |
| | | 12 | 600 | H1AA121 | 4.76 |
| | | 24 | 2400 | H1AA241 | 5.36 |
| 2A | .920 (23.4) | 5 | 90 | H2AA051 | 6.67 |
| | | 12 | 400 | H2AA121 | 6.67 |
| | | 24 | 1600 | H2AA241 | 7.26 |
| 1C | .680 (17.3) | 5 | 135 | H1C051 | 7.14 |
| | | 12 | 600 | H1C121 | 7.14 |
| | | 24 | 2400 | H1C241 | 7.74 |
| HIGH POWER CONTACT | | | | | |
| 1A | .680 (17.3) | 5 | 135 | H1AN051 | 7.14 |
| | | 12 | 600 | H1AN121 | 7.14 |
| | | 24 | 2400 | H1AN241 | 7.74 |

## SCHEMATICS (PIN VIEW)

### G2 SERIES




### H SERIES



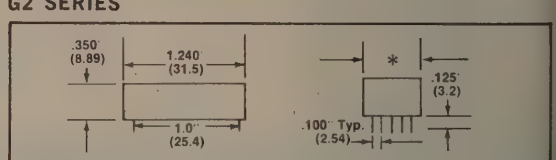

## CONTACT RATINGS/CHARACTERISTICS

| Switching Ratings | G2 Series | | | H Series | | |
|---|---|---|---|---|---|---|
| | Form A or B Standard | Form A High Voltage | Form C Standard | Form A Standard Contact | Form A High Power Contact | Form C Standard Contact |
| Current (amperes, DC max.) | .500 | .500 | .250 | 1.0 | 3.0* | .250 |
| Voltage (volts, DC max.) | 200 | 1000 | 28 | 250 | 1500 | 100 |
| Breakdown (AC RMS volts) | 350 | 1200 | 200 | 300 | 2000 | 250 |
| Power (watts) | 10 | 10 | 3 | 15 | 50 | 5 |
| Operating time (milliseconds typical including bounce) | 1.0 | 1.0 | 1.5 (N/C) | 2.0 | 2.5 | 3.5 (N/C) |
| Release time (milliseconds typical) | .50 | .50 | 1.0 (N/O) | .50 | .50 | 2.5 (N/O) |
| Initial contact resistance (ohms max. at rated coil voltage) | .200 | .200 | .200 | .100 | .500 | .200 |

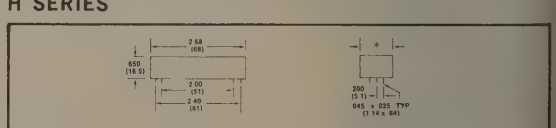
* Derate to .002 amp at 1000 VDC

## OUTLINE DIMENSIONS

### G2 SERIES




### H SERIES



GORDOS

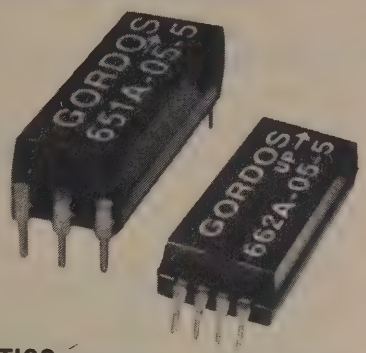
## MERCURY WETTED REED RELAYS

# 65/66 & 847 SERIES

### 65/66 SERIES

## MOLDED-EPOXY MINIATURE

- Low stable contact resistance
- No bounce
- Extremely long life




### 847 SERIES

## MOLDED-EPOXY DUAL-IN-LINE PACKAGE (DIP)

- Low stable contact resistance
- No bounce
- Extremely long life
- Fits standard TO-116 DIP socket
- Available 1 form A or 1 form C

### RELAY CHARACTERISTICS

| Form | Model Number | Coil Resistance (Ohms) ±10% @ 25°C | Nom. (VDC) | Max. (VDC) | Must Operate (VDC) | Must Release (VDC) | Clamp Diode | 1-24 pc. Price |
|---|---|---|---|---|---|---|---|---|
| **65/66 SERIES** | | | | | | | | |
| 1A | 651A-05-5 | 70 | 5 | 7.5 | 4.0 | .5 | — | $6.50 |
| | 651A-12-5 | 320 | 12 | 15.0 | 9.6 | 1.2 | — | 6.62 |
| | 651A-24-5 | 1600 | 24 | 32.0 | 19.2 | 2.4 | — | 7.21 |
| 2A | 652A-05-5 | 40 | 5 | 7.5 | 4.0 | .5 | — | 11.19 |
| | 652A-12-5 | 170 | 12 | 12.0 | 9.6 | 1.2 | — | 11.31 |
| | 652A-24-5 | 725 | 24 | 32.0 | 19.2 | 2.4 | — | 11.90 |
| 1C | 651C-05-5 | 70 | 5 | 7.5 | 4.0 | .5 | — | 11.00 |
| | 651C-12-5 | 320 | 12 | 15.0 | 9.6 | 1.2 | — | 11.00 |
| | 651C-24-5 | 1600 | 24 | 32.0 | 19.2 | 2.4 | — | 11.71 |
| 1A | 661A-05-5 | 70 | 5 | 7.5 | 4.0 | .5 | — | 6.50 |
| | 661A-12-5 | 320 | 12 | 15.0 | 9.6 | 1.2 | — | 6.62 |
| | 661A-24-5 | 1600 | 24 | 32.0 | 19.2 | 2.4 | — | 7.21 |
| 2A | 662A-05-5 | 40 | 5 | 7.5 | 4.0 | .5 | — | 11.19 |
| | 662A-12-5 | 170 | 12 | 12.0 | 9.6 | 1.2 | — | 11.31 |
| | 662A-24-5 | 725 | 24 | 32.0 | 19.2 | 2.4 | — | 11.90 |
| 1C | 661C-05-5 | 70 | 5 | 7.5 | 4.0 | .5 | — | 11.00 |
| | 661C-12-5 | 320 | 12 | 15.0 | 9.6 | 1.2 | — | 11.00 |
| | 661C-24-5 | 1600 | 24 | 32.0 | 19.2 | 2.4 | — | 11.71 |
| **847 SERIES** | | | | | | | | |
| 1A | 847A-1 | 70 | 5 | 7.5 | 4.0 | .5 | No | $5.77 |
| | 847A-2 | 70 | 5 | 7.5 | 4.0 | .5 | Yes | 6.47 |
| | 847A-3 | 320 | 12 | 15.0 | 9.6 | 1.2 | No | 5.91 |
| | 847A-4 | 320 | 12 | 15.0 | 9.6 | 1.2 | Yes | 6.57 |
| | 847A-5 | 1600 | 24 | 32.0 | 19.2 | 2.4 | No | 6.30 |
| | 847A-6 | 1600 | 24 | 32.0 | 19.2 | 2.4 | Yes | 7.03 |
| 1C | 847C-1 | 70 | 5 | 7.5 | 4.0 | .5 | No | 8.90 |
| | 847C-2 | 70 | 5 | 7.5 | 4.0 | .5 | Yes | 9.63 |
| | 847C-3 | 320 | 12 | 15.0 | 9.6 | 1.2 | No | 9.03 |
| | 847C-4 | 320 | 12 | 15.0 | 9.6 | 1.2 | Yes | 9.77 |
| | 847C-5 | 1600 | 24 | 32.0 | 19.2 | 2.4 | No | 9.43 |
| | 847C-6 | 1600 | 24 | 32.0 | 19.2 | 2.4 | Yes | 10.17 |

### CONTACT RATINGS

| Type Unit | Maximum Switching (D.C.) Watts | Maximum Switching (D.C.) Volts | Maximum Current (Amps) Switch | Maximum Current (Amps) Carry | Maximum Initial Contact Resistance (Ohms) | Min. Breakdown Voltage (VAC) Across Contacts | Min. Breakdown Voltage (VAC) Contacts Coil |
|---|---|---|---|---|---|---|---|
| **65/66 SERIES** | | | | | | | |
| A | 50 | 500 | 1.0 | 2.0 | .070 | 1000 | 1000 |
| C | 50 | 500 | 1.0 | 2.0 | .070 | 1000 | 1000 |
| **847 SERIES** | | | | | | | |
| 847A | 50 | 500 | 1.0* | 2.0 | .070 | 1000 | 1000 |
| 847C | 50 | 500 | 1.0* | 2.0 | .070 | 1000 | 1000 |

* Derate to .002 amp at 500 VDC

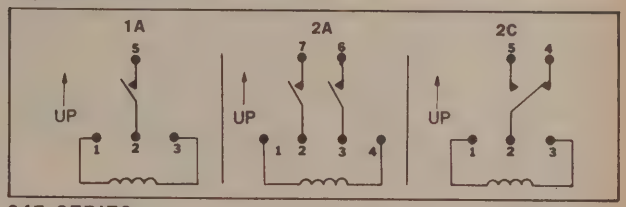
### CHARACTERISTICS

| Operate Time (Typical) | | | Release Time (Typical) | |
|---|---|---|---|---|
| | Form C | | Coil Unsuppressed | Coil Suppressed |
| Form A | N/O | N/C | Form A | Form A |
| 2.00 | 2.00 | 2.00 | 1.50 | 1.50 |

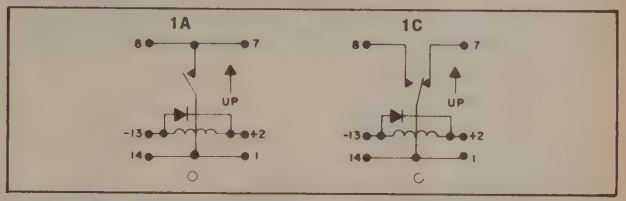
Operate and release time are in milliseconds
Typical values at 25°C

### SCHEMATICS (TOP VIEW)

**65/66 SERIES**

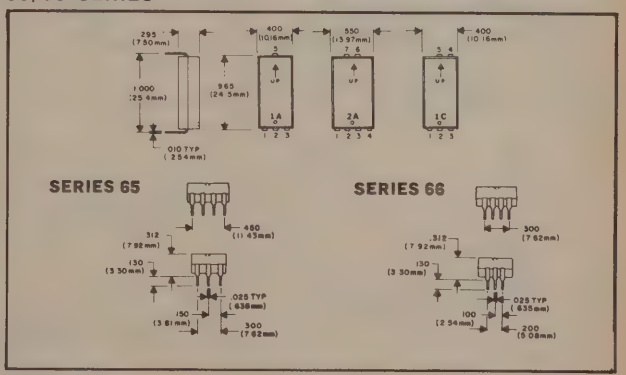



**847 SERIES**

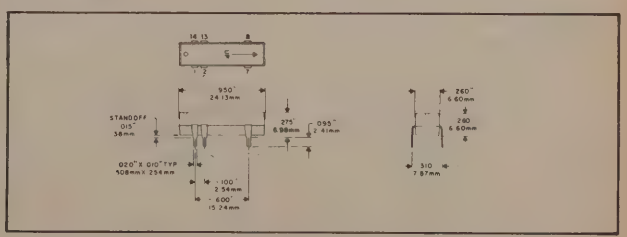



### OUTLINE DIMENSIONS

**65/66 SERIES**




**847 SERIES**



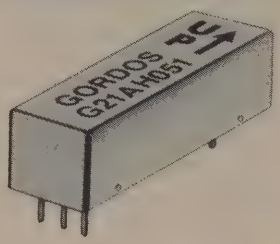
GORDOS

# MERCURY WETTED REED RELAYS

# G2 & 13 SERIES

## G2 SERIES
## MINIATURE OPEN FRAME

- Low stable contact resistance
- No bounce
- Extremely long life
- .100″ x 1.00″ PCB grid
- Available 1A, 2A and 1C forms




### RELAY CHARACTERISTICS

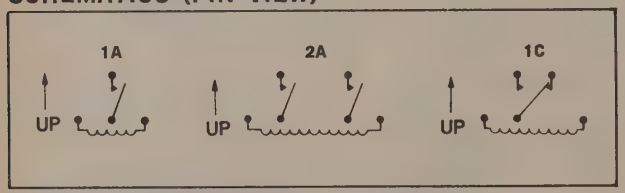
| Contact Form | Width* | Voltage | Ohms | Part No. | 1-24 pc. Price |
|---|---|---|---|---|---|
| 1A | .375 (9.5) | 5 | 140 | G21AH051 | $5.05 |
| | | 12 | 800 | G21AH121 | 5.05 |
| | | 24 | 3200 | G21AH241 | 5.64 |
| 2A | .575 (14.6) | 5 | 36 | G22AH051 | 7.83 |
| | | 12 | 225 | G22AH121 | 7.83 |
| | | 24 | 900 | G22AH241 | 8.43 |
| 1C | .475 (12.1) | 5 | 65 | G21CH051 | 11.00 |
| | | 12 | 400 | G21CH121 | 11.00 |
| | | 24 | 1600 | G21CH241 | 11.71 |

Typical values at 25°C

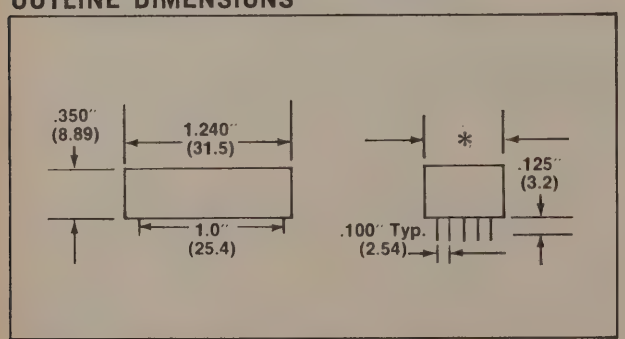
### CONTACT RATINGS/CHARACTERISTICS

| Switching Ratings | Form A and C Mercury Wetted |
|---|---|
| Current (amperes, DC max.) | 1.0 |
| Voltage (volts, DC max.) | 500 |
| Breakdown (AC RMS volts) | 1500 |
| Power (watts) | 50 |
| Operating time (milliseconds typical including bounce) | 2.00 |
| Release time (milliseconds) typical | 1.50 |
| Initial contact resistance (ohms max. at rated coil voltage) | .070 |

### SCHEMATICS (PIN VIEW)

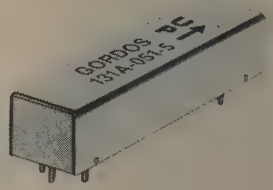



### OUTLINE DIMENSIONS




## 13 SERIES
## STANDARD OPEN FRAME

- Low stable contact resistance
- No bounce
- Extremely long life
- .200″ x 2.40″ PCB grid




### RELAY CHARACTERISTICS

| Form | Model Number | Coil Resistance Ohms ±10% @ 25°C | Nom. VDC | Max. VDC | Must Operate VDC | Must Release VDC | 1-24 pc. Price |
|---|---|---|---|---|---|---|---|
| 1A | 131A-051-5 | 135 | 5 | 7.5 | 4.0 | .5 | $7.52 |
| | 131A-121-5 | 600 | 12 | 15 | 9.6 | 1.2 | 7.52 |
| | 131A-241-5 | 2400 | 24 | 32 | 19.2 | 2.4 | 8.13 |
| 2A | 132A-051-5 | 90 | 5 | 7.5 | 4.0 | .5 | 9.58 |
| | 132A-121-5 | 400 | 12 | 15 | 9.6 | 1.2 | 9.58 |
| | 132A-241-5 | 1600 | 24 | 32 | 19.2 | 2.4 | 10.04 |

### CONTACT RATINGS

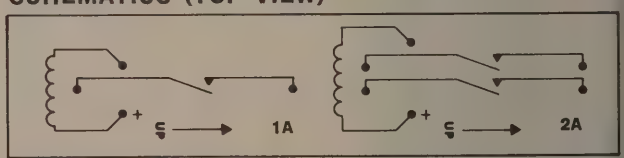
| Form Unit | Maximum Switching (D.C.) Watts | Volts | Maximum Current (Amps) Switch | Carry | Maximum Initial Contact Resistance (Ohms) | Min. Breakdown Voltage (VAC) Across Contacts | Coil Contacts |
|---|---|---|---|---|---|---|---|
| A | 60 | 500 | 3 | 5 | .060 | 1500 | 1500 |

### CHARACTERISTICS

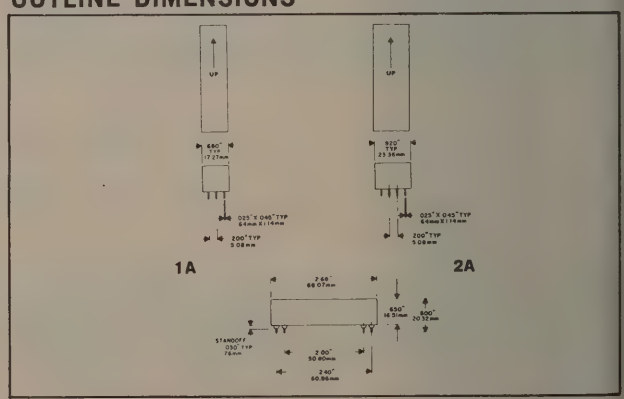
| Series | Operate Time Typical (milliseconds) Form A | Release Time Typical (milliseconds) Form A |
|---|---|---|
| 13 | 2.0 | 1.5 |

Typical values at 25°C

### SCHEMATICS (TOP VIEW)

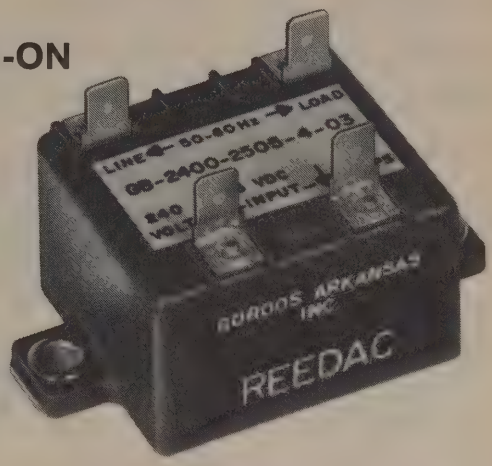



### OUTLINE DIMENSIONS



# 2000 SERIES

## HYBRID (REED-COUPLED) RANDOM TURN-ON AC POWER SOLID STATE RELAY




- Output rating — 24 to 280 VAC, .05 to 25 amps RMS
- 5 VDC TTL compatible control input
- 1500 VAC isolation
- Standard output RC network
- Standard diode clamp
- U.L. recognized file E46203 and E61991
- CSA certified file 38595

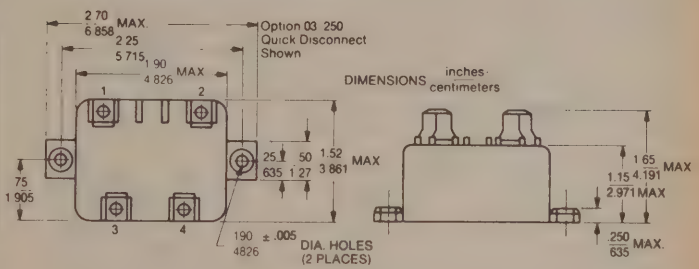
## SPECIFICATIONS AND RATINGS

| CONTROL CIRCUIT (INPUT) | | |
|---|---|---|
| Nominal voltage rating | 5.0 VDC[1] | |
| Must-operate voltage | 4.0 VDC | |
| Must-release voltage | 0.5 VDC | |
| Maximum voltage rating | 7.5 VDC | |
| Nominal current rating | 12.5 ma | |
| **POWER CIRCUIT (OUTPUT)** | | |
| Max. load current | 10.0 a rms | 25.0 a rms |
| Max. 1-cycle surge | 100 a peak | 250 a peak |
| Max. on-state voltage | 1.8 V | |
| Off-state dv/dt[2] | 200 V/$\mu$S | |
| Max. off-state leakage | 15 ma rms | |
| Switching voltage range | 24 to 280 V rms | |
| Minimum load current | .050 a rms | |
| **OPERATING RATING** | | |
| Isolation to ground | 1500 VAC | |
| Isolation input to output | 1500 VAC | |
| Sine wave frequency range | 47 to 63 Hz | |
| Max. turn-on time | 1.5 mS | |
| Max. turn-off time | ½ AC cycle | |
| Operating temperature range | −25 to +80°C | |
| Storage temperature range | −40 to +100°C | |

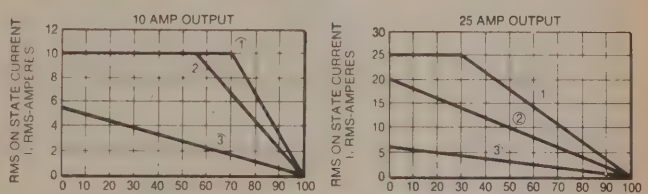
[1] TTL compatible
[2] Output RC network included

| Model Number | Maximum Output Rating | 1-24 Piece Price |
|---|---|---|
| GB2200-1005-4-03 | 140 VAC/10 Amps | $11.67 |
| GB2200-2505-4-03 | 140 VAC/25 Amps | 14.08 |
| GB2400-1005-4-03 | 280 VAC/10 Amps | 14.38 |
| GB2400-2505-4-03 | 280 VAC/25 Amps | 20.39 |

## OUTLINE DIMENSIONS

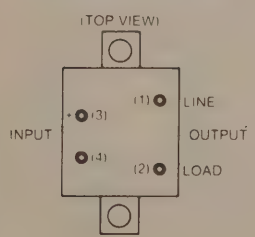



## TEMPERATURE DERATING CHART


10 AMP OUTPUT
25 AMP OUTPUT
RMS ON STATE CURRENT
I, RMS-AMPERES
0 10 20 30 40 50 60 70 80 90 100
MAXIMUM ALLOWABLE AMBIENT TEMPERATURE (°C)

1—MOUNTED ON A 1°C/WATT HEAT SINK
2—MOUNTED ON A 2°C/WATT HEAT SINK
(APPROXIMATELY 6" x 6" x ⅛" AL)
3—FREE AIR RATING, NO HEAT SINK

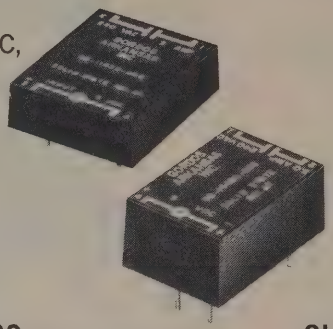
## CONNECTIONS



# 11000 & 14000 & 15000 SERIES

## ALL-SOLID-STATE PHOTO-COUPLED ZERO VOLTAGE TURN-ON AC POWER SOLID STATE RELAY

### 11000 & 14000 SERIES



- Output rating — 24 to 270 VAC, .05 to 3.0 amps RMS
- 5 or 12 VDC control (TTL compatible)
- 2500 VAC isolation
- Standard output RC network
- U.L. recognized file E46203
- CSA certified file 38595

### 15000 SERIES

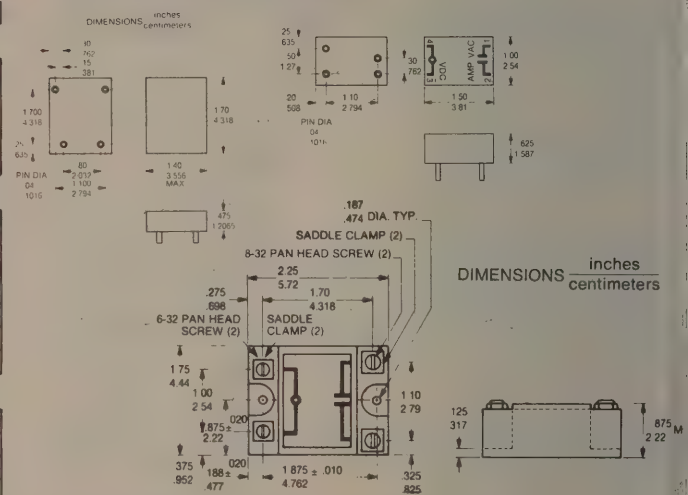
- Output rating — 24 to 280 VAC, .05 to 40 amps RMS
- 3 to 32 VDC TTL compatible control output
- 2500 VAC isolation
- Standard output RC network
- Reverse polarity protected
- U.L. recognized file E46203 and E61991
- CSA certified file 38595

## SPECIFICATIONS AND RATINGS

| | 11000 | 14000 | 15000 |
|---|---|---|---|
| **CONTROL CIRCUIT (INPUT)** | | | |
| Nominal voltage rating | 5.0[1] | 12.0 | 3 to 32 VDC |
| Must-operate voltage | 4.0 | 9.0 | 3.0 VDC |
| Must-release voltage | 0.5 | 1.0 | 1.0 VDC |
| Maximum voltage rating | 7.5 | 18.0 | 32 VDC |
| Nominal current rating | 5.0 | 12.0 | 1.0 mA per volt |
| **POWER CIRCUIT (OUTPUT)** | | | |
| Maximum load current | 3.0 a rms | 10.0 a rms | 25.0 a rms |
| Maximum 1-cycle surge | 100 a peak | 100 a peak | 250 a peak |
| Maximum on-state voltage | 1.8 V | 1.8 V | |
| Off-state dv/dt[2] | 100 V/μS | 200 V/μS | |
| Maximum off-state leakage | 12 ma rms | 15 ma rms | |
| Switching voltage range | 24 to 270 V rms | 24 to 280 V rms | |
| Minimum load current | .05 a rms | .050 a rms | |
| **OPERATING RATING** | | | |
| Isolation to ground | 2500 VAC | 2500 VAC | |
| Isolation input to output | 2500 VAC | 2500 VAC | |
| Sine wave frequency range | 47 to 63 Hz | 47 to 63 Hz | |
| Maximum turn-on time | ½ AC cycle | ½ AC cycle | |
| Maximum turn-off time | ½ AC cycle | ½ AC cycle | |
| Operating temp. range | −25 to +80°C | −25 to +80°C | |
| Storage temp. range | −40 to +100°C | −40 to +100°C | |

[1] TTL compatible, reverse polarity protected.
[2] Output RC network included.

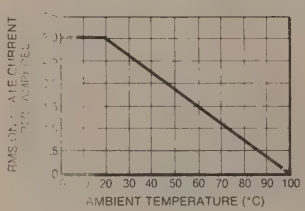
## OUTLINE DIMENSIONS

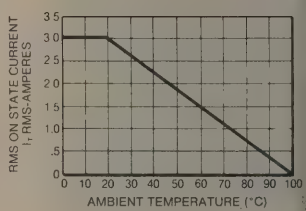



| Model Number | Maximum Output Rating | Control Voltage | RC | 1-24 pc. Price |
|---|---|---|---|---|
| **11000 SERIES** | | | | |
| GB11230-05S | 140 VAC/3.0 Amps | 5 VDC | Yes | $10.21 |
| GB11230-05X | 140 VAC/3.0 Amps | 5 VDC | No | 9.80 |
| GB11230-12S | 140 VAC/3.0 Amps | 12 VDC | Yes | 10.21 |
| GB11230-12X | 140 VAC/3.0 Amps | 12 VDC | No | 9.80 |
| GB11430-05S | 270 VAC/3.0 Amps | 5 VDC | Yes | 10.94 |
| GB11430-05X | 270 VAC/3.0 Amps | 5 VDC | No | 10.53 |
| GB11430-12S | 270 VAC/3.0 Amps | 12 VDC | Yes | 10.94 |
| GB11430-12X | 270 VAC/3.0 Amps | 12 VDC | No | 10.53 |
| **14000 SERIES** | | | | |
| GB14230-05S | 140 VAC/3.0 Amps | 5 VDC | Yes | 9.62 |
| GB14230-05X | 140 VAC/3.0 Amps | 5 VDC | No | 9.23 |
| GB14230-12S | 140 VAC/3.0 Amps | 12 VDC | Yes | 9.62 |
| GB14230-12X | 140 VAC/3.0 Amps | 12 VDC | No | 9.23 |
| GB14430-05S | 270 VAC/3.0 Amps | 5 VDC | Yes | 10.41 |
| GB14430-05X | 270 VAC/3.0 Amps | 5 VDC | No | 10.02 |
| GB14430-12S | 270 VAC/3.0 Amps | 12 VDC | Yes | 10.41 |
| GB14430-12X | 270 VAC/3.0 Amps | 12 VDC | No | 10.02 |
| **15000 SERIES** | | | | |
| GB15210-2 | 140 VAC/10 Amps | — | — | 17.38 |
| GB15225-2 | 140 VAC/25 Amps | — | — | 22.49 |
| GB15240-2 | 140 VAC/40 Amps | — | — | 29.37 |
| GB15410-2 | 280 VAC/10 Amps | — | — | 17.68 |
| GB15425-2 | 280 VAC/25 Amps | — | — | 22.79 |
| GB15440-2 | 280 VAC/40 Amps | — | — | 29.66 |

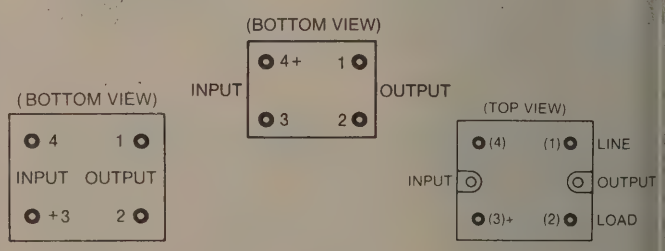
## TEMPERATURE DERATING CHART

### 11000 & 14000 SERIES



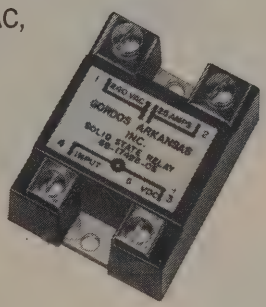

## CONNECTIONS



# 17000 & 18000 SERIES

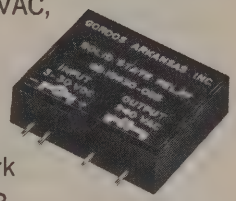
## 17000 SERIES
## HYBRID REED-COUPLED RANDOM TURN-ON AC POWER SOLID STATE RELAY

- Output rating — 24 to 280 VAC, .05 to 40 amps RMS
- 5 VDC TTL compatible control input
- 2500 VAC isolation
- Standard output RC network
- Standard diode clamp
- U.L. recognized file E46203 and E61991
- CSA certified file 38595



## 18000 SERIES
## ALL-SOLID-STATE PHOTO-COUPLED ZERO VOLTAGE TURN-ON AC POWER SOLID STATE RELAY

- Output rating — 24 to 270 VAC, .05 to 3.0 amps RMS
- 5 or 12 VDC control (TTL compatible)
- 2500 VAC isolation
- Standard output RC network
- U.L. recognized file E46203
- CSA certified file 38595



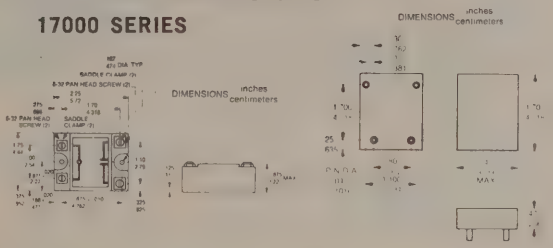
## SPECIFICATIONS AND RATINGS

| | 17000 | 18000 | |
|---|---|---|---|
| **CONTROL CIRCUIT (INPUT))** | | | |
| Nominal voltage rating | 5.0 VDC[1] | 5.0[1] | 12.0 |
| Must-operate voltage | 4.0 VDC | 4.0 | 9.0 |
| Must-release voltage | 0.5 VDC | 0.5 | 1.0 |
| Maximum voltage rating | 7.5 VDC | 7.5 | 18.0 |
| Nominal current rating | 12.5 ma | 5.0 | 12.0 |
| **POWER CIRCUIT (OUTPUT)** | | | |
| Maximum load current | 10.0 a rms 25.0 a rms 40.0 a rms | 3.0 a rms | |
| Maximum 1-cycle surge | 100 a peak 250 a peak 400 a peak | 100 a peak | |
| Maximum on-state voltage | 1.8 V | 1.8 V | |
| Off-state dv/dt[2] | 200 V/μS | 100 V/μS | |
| Maximum off-state leakage | 15 ma rms | 12 ma rms | |
| Switching voltage range | 24 to 280 V rms | 24 to 270 V rms | |
| Minimum load current | .050 a rms | .05 a rms | |
| **OPERATING RATING** | | | |
| Isolation to ground | 2500 VAC | 2500 VAC | |
| Isolation input to output | 2500 VAC | 2500 VAC | |
| Sine wave frequency range | 47 to 63 Hz | 47 to 63 Hz | |
| Maximum turn-on time | 1.5 mS | ½ AC cycle | |
| Maximum turn-off time | ½ AC cycle | ½ AC cycle | |
| Operating temp. range | −25 to +80°C | −25 to +80°C | |
| Storage temp. range | −40 to +100°C | −40 to +100°C | |

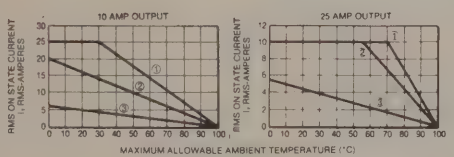
[1] TTL compatible, reverse polarity protected.
[2] Output RC network included,

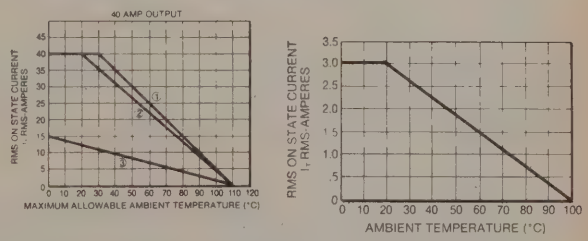
| Model Number | Maximum Output Rating | Control Voltage | RC | 1-24 pc. Price |
|---|---|---|---|---|
| **17000 SERIES** | | | | |
| GB17210-05 | 140 VAC/10 Amps | — | — | $13.63 |
| GB17225-05 | 140 VAC/25 Amps | — | — | 16.05 |
| GB17240-05 | 140 VAC/40 Amps | — | — | 25.99 |
| GB17410-05 | 280 VAC/10 Amps | — | — | 16.34 |
| GB17425-05 | 280 VAC/25 Amps | — | — | 22.35 |
| GB17440-05 | 280 VAC/40 Amps | — | — | 28.68 |
| **18000 SERIES** | | | | |
| GB18230-05S | 140 VAC/3.0 Amps | 5 VDC | Yes | 9.62 |
| GB18230-05X | 140 VAC/3.0 Amps | 5 VDC | No | 9.23 |
| GB18230-12S | 140 VAC/3.0 Amps | 12 VDC | Yes | 9.62 |
| GB18230-12X | 140 VAC/3.0 Amps | 12 VDC | No | 9.23 |
| GB18430-05S | 270 VAC/3.0 Amps | 5 VDC | Yes | 10.41 |
| GB18430-05X | 270 VAC/3.0 Amps | 5 VDC | No | 10.02 |
| GB18430-12S | 270 VAC/3.0 Amps | 12 VDC | Yes | 10.41 |
| GB18430-12X | 270 VAC/3.0 Amps | 12 VDC | No | 10.02 |

## OUTLINE DIMENSIONS
### 17000 SERIES




## TEMPERATURE DERATING CHART

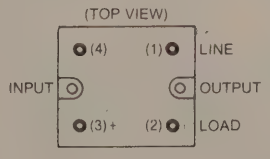


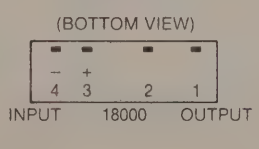

1 — MOUNTED ON A 1°C/WATT HEAT SINK
2 — MOUNTED ON A 2°C/WATT HEAT SINK (APPROXIMATELY 6" x 6" x ⅛" AL)
3 — FREE AIR RATING, NO HEAT SINK

## CONNECTIONS

**17000**




**18000**



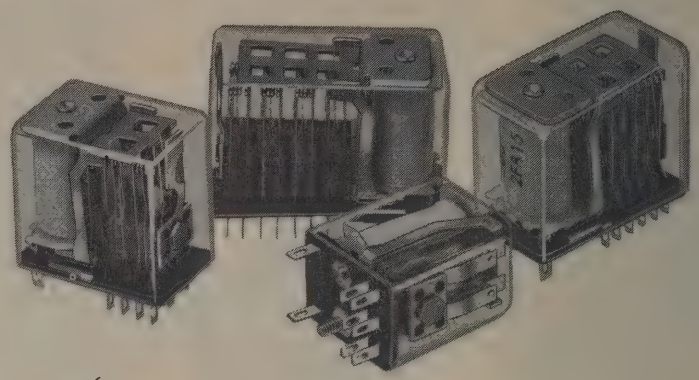
# Allied Control Relays

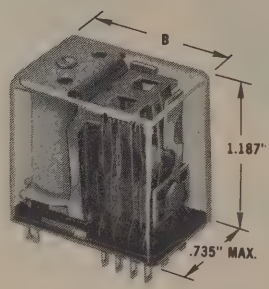
## General Purpose Relays

### CRADLE® SERIES T154/163

### DC Relays — Current and Voltage Adjusted

### AC Relays — Voltage Adjusted






| DIMENSION B | |
|---|---|
| 2C | .937 |
| 4C | 1.172 |
| 6C | 1.391 |
| 8C | 1.594 |

## FEATURES

- **T154 Single-Point Contacts**
- **T163 Bifurcated Contacts**
- **Proven Cradle® reliability**
- **100 million mechanical operations**
- **Contact selection to match application**
- **Contact configuration:**
  DC Voltage: up to 8 Form C
  AC Voltage: up to 4 Form C
- **Input voltages:**
  DC Voltage: from 3 VDC to 115 VDC
  AC Voltage: from 6 VAC to 220 VAC
  50/60 Hz
- **Sensitivity as low as 20 MW/pole** (DC Voltage only)
- **Low-priced relays**
- **Versatile mounting configurations**
- **High density packaging**
- **UL File E20604 / CSA File 34171**

## TYPICAL OPERATING CONDITIONS @ 25°C

### ELECTRICAL

**Minimum drop-out** (DC voltage):
10% of maximum pick-up value (5% for single and double-pole relays)

**Dielectric Strength:**
1000 VRMS coil to contacts and between gaps
500 VRMS between contact gaps on ultrasensitive relays

**Insulation resistance:**
10,000 megohms minimum

**Capacitance, DC Voltage:**
Closed contacts to frame 3.0 pf
Open contacts to frame 3.0 pf
Between open contacts 3.0 pf
(energized or de-energized)

**Capacitance, AC Voltage:**
Contact to contact 3.0 pf
Coil to contact 3.0 pf
Coil to frame 30 pf

**Operate time, DC Voltage:**
15 MS max. at nominal voltage

**Operate time, AC Voltage:** 25 MS

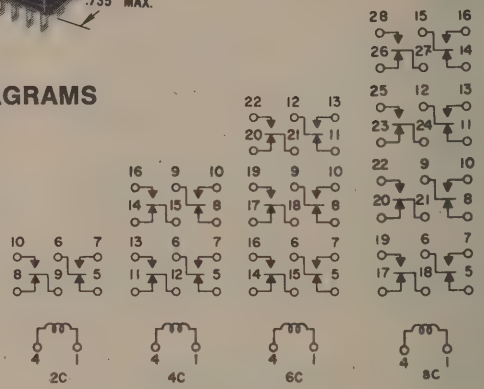
**Release time, DC Voltage:**
8 MS max. at nominal voltage

**Release time, AC Voltage:** 25 MS

### ENVIRONMENTAL

**Ambient temperature:** −55°C to 71°C

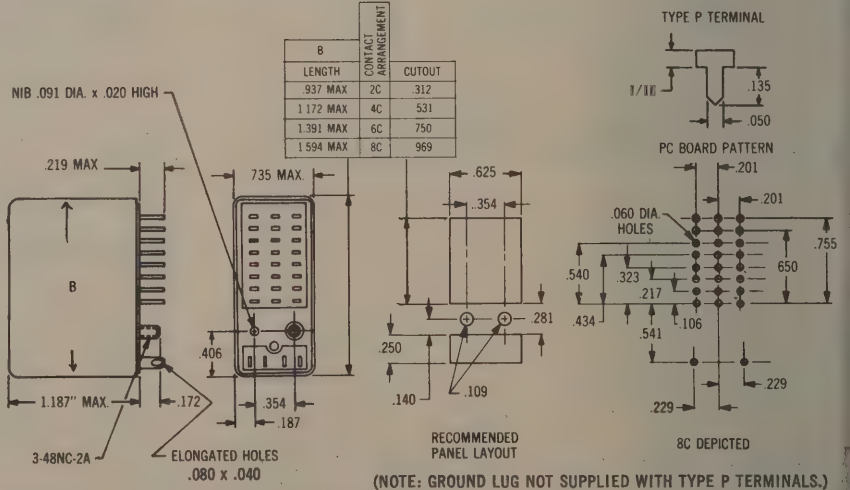
## WIRING DIAGRAMS




CIRCUIT DIAGRAMS-UNENERGIZED

## DETAILED DIMENSIONS

| B LENGTH | CONTACT ARRANGEMENT | CUTOUT |
|---|---|---|
| .937 MAX | 2C | .312 |
| 1.172 MAX | 4C | .531 |
| 1.391 MAX | 6C | .750 |
| 1.594 MAX | 8C | .969 |




(NOTE: GROUND LUG NOT SUPPLIED WITH TYPE P TERMINALS.)

**Gould Inc., Circuit Protection and Controls Division**
100 Relay Road, Plantsville, CT 06479
Telephone (203) 621-6771 TWX 710-473-0079

GOULD

# Allied Control Relays

## General Purpose Relays

### CRADLE® SERIES T154/163

## DC RELAYS

| Catalog No. 1 2 | Coil Res. | Input | Pick-up | Pick-up Power | Contact 3 Arrangement | Contact 4 Rating |
|---|---|---|---|---|---|---|
| **STANDARD DC VOLTAGE ADJUSTMENT** | | | | | | |
| T154-2C-6VDC | 52Ω | 6V | 4.5V | 500mW | 2C | 2 Amp |
| T154-2C-12VDC | 185Ω | 12V | 9.0V | 500mW | 2C | 2 Amp |
| T154-2C-24VDC | 700Ω | 24V | 18.0V | 500mW | 2C | 2 Amp |
| T154-2C-48VDC | 2,500Ω | 48V | 36.0V | 500mW | 2C | 2 Amp |
| T154-2C-115VDC | 15,000Ω | 115V | 86.0V | 500mW | 2C | 2 Amp |
| T154-4C-6VDC | 52Ω | 6V | 4.5V | 500mW | 4C | 2 Amp |
| T154-4C-12VDC | 185Ω | 12V | 9.0V | 500mW | 4C | 2 Amp |
| T154-4C-24VDC | 700Ω | 24V | 18.0V | 500mW | 4C | 2 Amp |
| T154-4C-48VDC | 2,500Ω | 48V | 36.0V | 500mW | 4C | 2 Amp |
| T154-4C-115VDC | 15,000Ω | 115V | 86.0V | 500mW | 4C | 2 Amp |
| T154-6C-6VDC | 25Ω | 6V | 4.5V | 8.50W | 6C | 2 Amp |
| T154-6C-12VDC | 90Ω | 12V | 9.0V | 8.50W | 6C | 2 Amp |
| T154-6C-24VDC | 430Ω | 24V | 18.0V | 8.50W | 6C | Amp |
| T154-6C-48VDC | 1,550Ω | 48V | 36.0V | 8.50W | 6C | 2 Amp |
| T154-6C-115VDC | 9,000Ω | 115V | 86.0V | 8.50W | 6C | 2 Amp |
| T154-8C-6VDC | 20Ω | 6V | 4.5V | 1.000W | 8C | 2 Amp |
| T154-8C-12VDC | 75Ω | 12V | 9.0V | 1.000W | 8C | 2 Amp |
| T154-8C-24VDC | 430Ω | 24V | 18.0V | 1.000W | 8C | 2 Amp |
| T154-8C-48VDC | 1,275Ω | 48V | 36.0V | 1.000W | 8C | 2 Amp |
| T154-8C-115VDC | 9,000Ω | 115V | 86.0V | 1.000W | 8C | 2 Amp |
| **SENSITIVE DC VOLTAGE ADJUSTMENT** | | | | | | |
| TS154-2C-6VDC | 185Ω | 6V | 4.5V | 100mW | 2C | 2 Amp |
| TS154-2C-12VDC | 800Ω | 12V | 9.0V | 100mW | 2C | 2 Amp |
| TS154-2C-24VDC | 3,200Ω | 24V | 18.0V | 100mW | 2C | 2 Amp |
| TS154-2C-48VDC | 13,000Ω | 48V | 36.0V | 100mW | 2C | 2 Amp |
| TS154-4C-6VDC | 110Ω | 6V | 4.5V | 175mW | 4C | 2 Amp |
| TS154-4C-12VDC | 430Ω | 12V | 9.0V | 175mW | 4C | 2 Amp |
| TS154-4C-24VDC | 1,800Ω | 24V | 18.0V | 175mW | 4C | 2 Amp |
| TS154-4C-48VDC | 7,500Ω | 48V | 36.0V | 175mW | 4C | 2 Amp |
| TS154-6C-6VDC | 75Ω | 6V | 4.5V | 250mW | 6C | 2 Amp |
| TS154-6C-12VDC | 350Ω | 12V | 9.0V | 250mW | 6C | 2 Amp |
| TS154-6C-24VDC | 1,275Ω | 24V | 18.0V | 250mW | 6C | 2 Amp |
| TS154-6C-48VDC | 5,200Ω | 48V | 36.0V | 250mW | 6C | 2 Amp |
| TS154-8C-6VDC | 52Ω | 6V | 4.5V | 400mW | 8C | 2 Amp |
| TS154-8C-12VDC | 190Ω | 12V | 9.0V | 400mW | 8C | 2 Amp |
| TS154-8C-24VDC | 800Ω | 24V | 18.0V | 400mW | 8C | 2 Amp |
| TS154-8C-48VDC | 3,200Ω | 48V | 36.0V | 400mW | 8C | 2 Amp |

| Catalog No. 1 2 | Coil Res. | Input | Pick-up | Pick-up Power | Contact 3 Arrangement | Contact 4 Rating |
|---|---|---|---|---|---|---|
| **ULTRA-SENSITIVE VOLTAGE ADJUSTMENT** | | | | | | |
| TSS154-2C-6VDC | 500Ω | 6V | 4.5V | 40mW | 2C | 1 Amp |
| TSS154-2C-12VDC | 2,000Ω | 12V | 9.0V | 40mW | 2C | 1 Amp |
| TSS154-2C-24VDC | 7,500Ω | 24V | 18.0V | 40mW | 2C | 1 Amp |
| TSS154-4C-6VDC | 250Ω | 6V | 4.5V | 80mW | 4C | 1 Amp |
| TSS154-4C-12VDC | 1,000Ω | 12V | 9.0V | 80mW | 4C | 1 Amp |
| TSS154-4C-24VDC | 3,700Ω | 24V | 18.0V | 80mW | 4C | 1 Amp |
| **SENSITIVE DC CURRENT ADJUSTMENT** | | | | | | |
| TS154-2C-8.5Madc | 1,000Ω | 8.5Madc | 8.5Madc | 85mW | 2C | 2 Amp |
| TS154-2C-5.8Madc | 2,500Ω | 5.8Madc | 5.8Madc | 85mW | 2C | 2 Amp |
| TS154-2C-4.1Madc | 5,000Ω | 4.1Madc | 4.1Madc | 85mW | 2C | 2 Amp |
| TS154-2C-3.1Madc | 10,000Ω | 3.1Madc | 3.1Madc | 85mW | 2C | 2 Amp |
| TS154-2C-2.6Madc | 15,000Ω | 2.6Madc | 2.6Madc | 85mW | 2C | 2 Amp |
| TS154-4C-13.0Madc | 1,000Ω | 13.0Madc | 13.0Madc | 175mW | 4C | 2 Amp |
| TS154-4C-8.4Madc | 2,500Ω | 8.4Madc | 8.4Madc | 175mW | 4C | 2 Amp |
| TS154-4C-6.2Madc | 5,000Ω | 6.2Madc | 6.2Madc | 175mW | 4C | 2 Amp |
| TS154-4C-4.5Madc | 10,000Ω | 4.5Madc | 4.5Madc | 175mW | 4C | 2 Amp |
| TS154-4C-3.5Madc | 15,000Ω | 3.5Madc | 3.5Madc | 175mW | 4C | 2 Amp |
| TS154-6C-16.0Madc | 1,000Ω | 16.0Madc | 16.0Madc | 250mW | 6C | 2 Amp |
| TS154-6C-10.0Madc | 2,500Ω | 10.0Madc | 10.0Madc | 250mW | 6C | 2 Amp |
| TS154-6C-7.2Madc | 5,000Ω | 7.2Madc | 7.2Madc | 250mW | 6C | 2 Amp |
| TS154-6C-5.0Madc | 10,000Ω | 5.0Madc | 5.0Madc | 250mW | 6C | 2 Amp |
| TS154-6C-4.2Madc | 15,000Ω | 4.2Madc | 4.2Madc | 250mW | 6C | 2 Amp |
| TS154-8C-20.0Madc | 1,000Ω | 20.0Madc | 20.0Madc | 400mW | 8C | 2 Amp |
| TS154-8C-13.0Madc | 2,500Ω | 13.0Madc | 13.0Madc | 400mW | 8C | 2 Amp |
| TS154-8C-9.0Madc | 5,000Ω | 9.0Madc | 9.0Madc | 400mW | 8C | 2 Amp |
| TS154-8C-6.4Madc | 10,000Ω | 6.4Madc | 6.4Madc | 400mW | 8C | 2 Amp |
| TS154-8C-5.3Madc | 15,000Ω | 5.3Madc | 5.3Madc | 400mW | 8C | 2 Amp |
| **ULTRA-SENSITIVE CURRENT ADJUSTMENT** | | | | | | |
| TSS154-2C-6.5Madc | 1,000Ω | 6.5Madc | 6.5Madc | 40mW | 2C | 1 Amp |
| TSS154-2C-4.1Madc | 2,500Ω | 4.1Madc | 4.1Madc | 40mW | 2C | 1 Amp |
| TSS154-2C-2.9Madc | 5,000Ω | 2.9Madc | 2.9Madc | 40mW | 2C | 1 Amp |
| TSS154-2C-2.0Madc | 10,000Ω | 2.0Madc | 2.0Madc | 40mW | 2C | 1 Amp |
| TSS154-2C-1.7Madc | 15,000Ω | 1.7Madc | 1.7Madc | 40mW | 2C | 1 Amp |
| TSS154-4C-9.0Madc | 1,000Ω | 9.0Madc | 9.0Madc | 80mW | 4C | 1 Amp |
| TSS154-4C-5.8Madc | 2,500Ω | 5.8Madc | 5.8Madc | 80mW | 4C | 1 Amp |
| TSS154-4C-4.1Madc | 5,000Ω | 4.1Madc | 4.1Madc | 80mW | 4C | 1 Amp |
| TSS154-4C-3.0Madc | 10,000Ω | 3.0Madc | 3.0Madc | 80mW | 4C | 1 Amp |
| TSS154-4C-2.4Madc | 15,000Ω | 2.4Madc | 2.4Madc | 80mW | 4C | 1 Amp |

## AC RELAYS

| Catalog No. 1 2 | Coil Res. | Input | Pick-up | Contact 3 Arrangement | Contact 4 Rating |
|---|---|---|---|---|---|
| T154-2C-6VAC | 14Ω | 6V | 5.0V | 2PDT | 2 Amp |
| T154-2C-12VAC | 65Ω | 12V | 9.0V | 2PDT | 2 Amp |
| T154-2C-24VAC | 280Ω | 24V | 18.0V | 2PDT | 2 Amp |
| T154-2C-48VAC | 1,250Ω | 48V | 36.0V | 2PDT | 2 Amp |
| T154-2C-115VAC | 6,000Ω | 115V | 86.0V | 2PDT | 2 Amp |
| T154-2C-220VAC | 15,000Ω | 220V | 170.0V | 2PDT | 2 Amp |

| Catalog No. 1 2 | Coil Res. | Input | Pick-up | Contact 3 Arrangement | Contact 4 Rating |
|---|---|---|---|---|---|
| T154-4C-6VAC | 14Ω | 6V | 5.0V | 4PDT | 2 Amp |
| T154-4C-12VAC | 65Ω | 12V | 9.0V | 4PDT | 2 Amp |
| T154-4C-24VAC | 280Ω | 24V | 18.0V | 4PDT | 2 Amp |
| T154-4C-48VAC | 1,250Ω | 48V | 36.0V | 4PDT | 2 Amp |
| T154-4C-115VAC | 6,000Ω | 115V | 86.0V | 4PDT | 2 Amp |
| T154-4C-220VAC | 15,000Ω | 220V | 170.0V | 4PDT | 2 Amp |

**NOTES:**

1. Single-point contacts shown as standard; for bifurcated contacts, substitute "163" for "154".
2. Solder lug terminals shown as standard; for printed circuit mounts, add "P" after "T", "TS" or "TSS".
   **Note:** Solder Lug terminals not supplied on printed circuit mount relays.
3. Form C contact arrangement shown as standard; for Form A, B or D, substitute appropriate letter.
4. 5-amp and 10-amp contacts are also available for Standard DC and AC single-point-contact relays; if desired, add "F" after "T" for 5-amp; and add "Y" after "T" for 10-amp.

**Gould Inc., Circuit Protection and Controls Division**
100 Relay Road, Plantsville, CT 06479
Telephone (203) 621-6771 TWX 710-473-0079

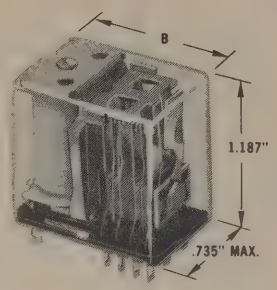
GOULD

# Allied Control Relays

## General Purpose Relays (cont'd)

### CRADLE® SERIES T351/T362

### MAGNETIC LATCH RELAYS

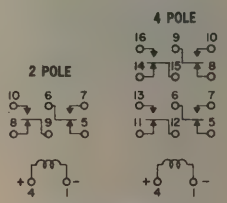



| | |
|---|---|
| B | .937" for 2C |
| B | 1.172" for 4C |

| Catalog No. 1 2 | Coil Res. | Input | Transfer Voltage | Contact 3 Arrangement | Contact 4 Rating |
|---|---|---|---|---|---|
| **SINGLE COIL** | | | | | |
| T351-2C-12VDC | 166Ω | 12V | 3.6V | 2C | 2 Amp |
| T351-2C-24VDC | 630Ω | 24V | 7.0V | 2C | 2 Amp |
| T351-4C-12VDC | 166Ω | 12V | 3.6V | 4C | 2 Amp |
| T351-4C-24VDC | 630Ω | 24V | 7.0V | 4C | 2 Amp |
| **DUAL COIL** | | | | | |
| T351-2C-2/12VDC | 134/134Ω | 2/12V | 9.2V | 2C | 2 Amp |
| T351-2C-2/24VDC | 485/485Ω | 2/24V | 18.0V | 2C | 2 Amp |
| T351-4C-2/12VDC | 134/134Ω | 2/12V | 9.2V | 4C | 2 Amp |
| T351-4C-2/24VDC | 485/485Ω | 2/24V | 18.0V | 4C | 2 Amp |

**NOTES:**
1. Single-point contacts shown as standard; for bifurcated contacts, substitute "362" for "351."
2. Solder lug terminals shown as standard; for printed circuit mounts, add "P" after "T."
3. Form C contact arrangement shown as standard; for Form A, B or D, substitute appropriate letters.
4. 5-amp contacts are also available for single-point-contact relays; if desired, add "F" after "T" for 5-amp, and add "Y" after "T" for 10-amp.

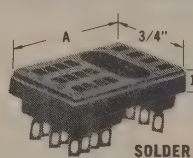
**WIRING DIAGRAM (RESET POSITION SHOWN)**



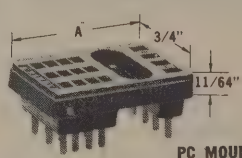

SINGLE WINDING CIRCUIT DIAGRAMS TO OPERATE REVERSE POLARITY

DUAL WINDING CIRCUIT DIAGRAMS
1-4 OPERATE · 2-3 RESET

### CRADLE® SOCKETS AND HARDWARE



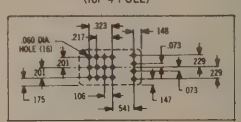
SOLDER LUG



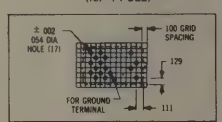
PC MOUNT

| Dimensions | |
|---|---|
| Poles | A |
| 2 Pole | 31/32" |
| 4 Pole | 1-13/64" |
| 6 Pole | 1-13/32" |
| 8 Pole | 1-41/64" |

TYPICAL PC MOUNT TERMINAL LAYOUT (for 4-POLE)




TYPICAL .1 x .1 GRID TERMINAL LAYOUT (for 4-POLE)




| Selection Guide Terminal Options | Without Hold Down Spring | | With Hold Down Spring | |
|---|---|---|---|---|
| | New Cat. No. 0211-011- | Superseded Cat. No. 30054- | New Cat. No. 0211-012- | Superseded Cat. No. 30055- |
| **2 POLE** | | | | |
| Solder Lug | -001-000 | -1 | -001-000 | -1 |
| PC Mount | -005-000 | -5 | -005-000 | -5 |
| .1 x .1 Grid | -003-000 | -3 | -003-000 | -3 |
| **4 POLE** | | | | |
| Solder Lug Special* | -008-000 | -8 | -008-000 | -8 |
| Solder Lug | -002-000 | -2 | -002-000 | -2 |
| PC Mount | -006-000 | -6 | -006-000 | -6 |
| .1 x .1 Grid | -004-000 | -4 | -004-000 | -4 |
| **6 POLE** | | | | |
| Solder Lug | -020-000 | -20 | -020-000 | -20 |
| PC Mount | -024-000 | -24 | -024-000 | -24 |
| .1 x .1 Grid | -028-000 | -28 | -028-000 | -28 |
| **8 POLE** | | | | |
| Solder Lug | -030-000 | -30 | -030-000 | -30 |
| PC Mount | -031-000 | -31 | -031-000 | -31 |
| .1 x .1 Grid | -032-000 | -32 | -032-000 | -32 |

*These sockets have longer than standard center terminals.

**INDIVIDUAL PARTS**

| Part Name | Part No. | Diagram |
|---|---|---|
| **GROUND WIRE** For Solder and standard spaced printed circuit | 30052-1 **(0256-002-001)** | To be inserted into socket recess under mounting screw head |
| **GROUND WIRE** For .100 grid spaced printed circuit sockets | 30174-1 **(0256-003-001)** | To be inserted into socket recess |

| For | Retainer Part No. | Diagram |
|---|---|---|
| 2 Pole | 30040-1 **(0228-001-001)** | To be inserted into recesses on narrow sides of sockets |
| 4 Pole | 30040-2 **(0228-001-002)** | |
| 6 Pole | 30040-3 **(0228-001-003)** | |
| 8 Pole | 0330-031-001 Flat Retainer | |

**UL Recognized File No. E-20604**

**Gould Inc., Circuit Protection and Controls Division**
100 Relay Road, Plantsville, CT 06479
Telephone (203) 621-6771 TWX 710-473-0079

GOULD

# Allied Control Relays

## Midget Power Relays

**NEW!**
**GH SERIES — 10 AMPS**
**GY SERIES — 3 AMPS**

### FEATURES

- **Low contact resistance**
- **UL and CSA listed**
- **GH Series:** Smallest 10 amp relay

### SPECIFICATIONS

**SERIES GH**

**Contact resist.:** 100 milliohms max.

**Operate time:**
SPDT, DPDT: 20 ms max.
4PDT: 25 ms max.

**Release time:**
SPDT, DPDT: 20 ms max.
4PDT: 25 ms max.

**Power consumption:**
SPDT, AC: app. 1 VA (60 Hz)
SPDT, DC: app. 0.8W
DPDT, AC: app. 1.2 VA (60 Hz)
SPDT, DC: app. 0.9W
4PDT, AC: app. 2 VA (60 Hz)
4PDT, DC: app. 1.5W

**SERIES GY**

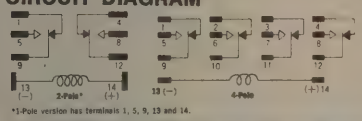
**Contact resist.:** 100 milliohms max.

**Operate time:** 20 ms max.

**Release time:** 20 ms max.

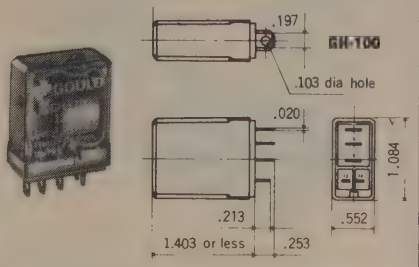
**Power consumption:**
DPDT, AC: app. 1 VA (60 Hz)
DPDT, DC: app. 0.8W
4PDT, AC: app. 1.2 VA (60 Hz)
4PDT, DC: app. 0.9W

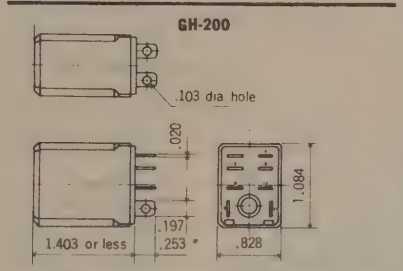
**CIRCUIT DIAGRAM**

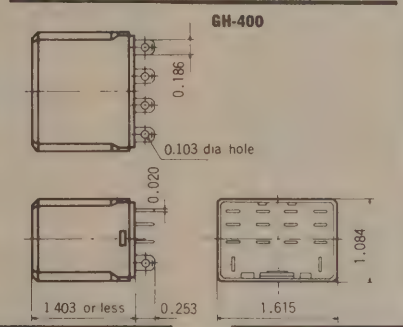



*1-Pole version has terminals 1, 5, 9, 13 and 14.

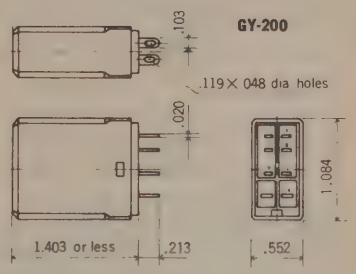
**MODEL GH**
Plug-in Type (Blade Terminal)

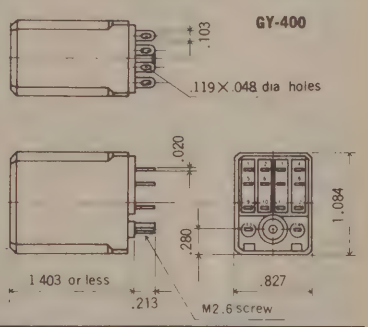



**MODEL GY**
Plug-in Type (Solder Terminal)




| Catalog No. 1 | Coil Res. | Input | Pick-up 2 | Contact Arrangement | Contact Rating |
|---|---|---|---|---|---|
| **DC VOLTAGE ADJUSTMENT** | | | | | |
| GH100-6VDC | 47Ω | 6V | 4.8V | SPDT | 10 Amp |
| GH100-12VDC | 188Ω | 12V | 9.6V | SPDT | 10 Amp |
| GH100-24VDC | 750Ω | 24V | 19.2V | SPDT | 10 Amp |
| GH100-48VDC | 2,660Ω | 48V | 38.4V | SPDT | 10 Amp |
| GH200-6VDC | 40Ω | 6V | 4.8V | DPDT | 10 Amp |
| GH200-12VDC | 160Ω | 12V | 9.6V | DPDT | 10 Amp |
| GH200-48VDC | 2,600Ω | 48V | 38.4V | DPDT | 10 Amp |
| GH200-110VDC | 11,000Ω | 110V | 88.0V | DPDT | 10 Amp |
| GH400-6VDC | 40Ω | 6V | 4.8V | 4PDT | 10 Amp |
| GH400-12VDC | 160Ω | 12V | 9.6V | 4PDT | 10 Amp |
| GH400-48VDC | 2,600Ω | 48V | 38.4V | 4PDT | 10 Amp |
| GH400-110VDC | 11,000Ω | 110V | 88.0V | 4PDT | 10 Amp |
| GY200-6VDC | 47Ω | 6V | 4.8V | DPDT | 3 Amp |
| GY200-12VDC | 188Ω | 12V | 9.6V | DPDT | 3 Amp |
| GY200-24VDC | 750Ω | 24V | 19.2V | DPDT | 3 Amp |
| GY200-48VDC | 2,660Ω | 48V | 38.4V | DPDT | 3 Amp |
| GY400-6VDC | 40Ω | 6V | 4.8V | 4PDT | 3 Amp |
| GY400-12VDC | 160Ω | 12V | 9.6V | 4PDT | 3 Amp |
| GY400-24VDC | 650Ω | 24V | 19.2V | 4PDT | 3 Amp |
| GY400-48VDC | 2,600Ω | 48V | 38.4V | 4PDT | 3 Amp |
| GY400-110VDC | 11,000Ω | 110V | 88.0V | 4PDT | 3 Amp |

| Catalog No. 1 | Coil Res. | Input | Pick-up 2 | Contact Arrangement | Contact Rating |
|---|---|---|---|---|---|
| **AC VOLTAGE ADJUSTMENT** | | | | | |
| GH100-6VAC | 18.8Ω | 6V | 4.8V | SPDT | 10 Amp |
| GH100-12VAC | 76.8Ω | 12V | 9.6V | SPDT | 10 Amp |
| GH100-24VAC | 300Ω | 24V | 19.2V | SPDT | 10 Amp |
| GH100-120VAC | 7,680Ω | 120V | 96.0V | SPDT | 10 Amp |
| GH200-6VAC | 11.5Ω | 6V | 4.8V | DPDT | 10 Amp |
| GH200-12VAC | 46Ω | 12V | 9.6V | DPDT | 10 Amp |
| GH200-24VAC | 184Ω | 24V | 19.2V | DPDT | 10 Amp |
| GH200-120VAC | 4,580Ω | 120V | 96.0V | DPDT | 10 Amp |
| GH200-240VAC | 14,400Ω | 240V | 192.0V | DPDT | 10 Amp |
| GH400-6VAC | 11.5Ω | 6V | 4.8V | 4PDT | 10 Amp |
| GH400-12VAC | 46Ω | 12V | 9.6V | 4PDT | 10 Amp |
| GH400-24VAC | 184Ω | 24V | 19.2V | 4PDT | 10 Amp |
| GH400-120VAC | 4,580Ω | 120V | 96.0V | 4PDT | 10 Amp |
| GH400-240VAC | 14,400Ω | 240V | 192.0V | 4PDT | 10 Amp |
| GY200-6VAC | 18.8Ω | 6V | 4.8V | DPDT | 3 Amp |
| GY200-12VAC | 76.8Ω | 12V | 9.6V | DPDT | 3 Amp |
| GY200-24VAC | 300Ω | 24V | 19.2V | DPDT | 3 Amp |
| GY200-120VAC | 7,680Ω | 120V | 96.0V | DPDT | 3 Amp |
| GY400-6VAC | 11.5Ω | 6V | 4.8V | 4PDT | 3 Amp |
| GY400-12VAC | 46Ω | 12V | 9.6V | 4PDT | 3 Amp |
| GY400-24VAC | 184Ω | 24V | 19.2V | 4PDT | 3 Amp |
| GY400-120VAC | 4,580Ω | 120V | 96.0V | 4PDT | 3 Amp |
| GY400-240VAC | 14,400Ω | 240V | 192.0V | 4PDT | 3 Amp |

**NOTE:**
1. Solder/plug-in terminals standard; for variations, consult factory.
2. Dropout Voltage: 10% of rated voltage for D.C.
30% of rated voltage for A.C.

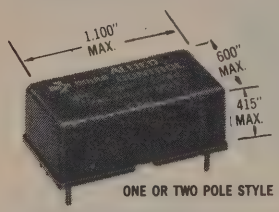
**Gould Inc., Circuit Protection and Controls Division**
100 Relay Road, Plantsville, CT 06479
Telephone (203) 621-6771 TWX 710-473-0079

GOULD

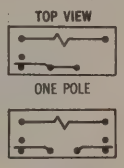
# Allied Control Relays

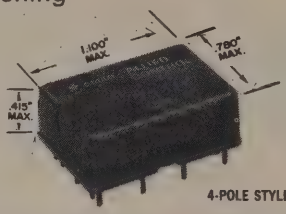
## Low Profile Relays

**SERIES MPC** — Miniature PC, Standard
**SERIES MPCS** — Miniature PC, Sensitive
**SERIES MPCL** — Miniature PC, Latching



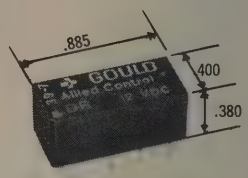
ONE OR TWO POLE STYLE



4-POLE STYLE

**SERIES DR** — DIP



ACTUAL SIZE

### FEATURES

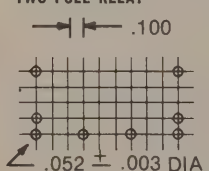
- **MPC:** Smallest 4-pole
- **DIP:** Lowest profile
- **Low cost**
- **Long life with high reliability**
- **Sensitive coil operation:**
  1 amp @ 28 VDC (DR) 2 amp @ 28 VDC (MPC's)
- **Sealed construction available**
  **Wave solder and cleanable**

### SERIES MPC — STANDARD VERSION

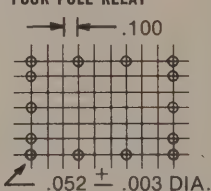
| Catalog No. | Coil Res. | Input | Pull-in | Drop-out | Pick-up Power | Contact Rating |
|---|---|---|---|---|---|---|
| **DPDT[1]** | | | | | | |
| MPC-2C-5VDC | 35Ω | 5V | 3.7V | 0.37V | 400mW | 2 Amp |
| MPC-2C-6VDC | 50Ω | 6V | 4.5V | 0.45V | 400mW | 2 Amp |
| MPC-2C-12VDC | 200Ω | 12V | 9.0V | 0.9V | 400mW | 2 Amp |
| MPC-2C-20VDC | 550Ω | 20V | 15.0V | 1.5V | 400mW | 2 Amp |
| MPC-2C-24VDC | 800Ω | 24V | 18.0V | 1.8V | 400mW | 2 Amp |
| MPC-2C-48VDC | 3,200Ω | 48V | 36.0V | 3.6V | 400mW | 2 Amp |
| **4PDT[2]** | | | | | | |
| MPC-4C-5VDC | 26Ω | 5V | 3.7V | 0.37V | 550mW | 2 Amp |
| MPC-4C-6VDC | 38Ω | 6V | 4.5V | 0.45V | 550mW | 2 Amp |
| MPC-4C-12VDC | 150Ω | 12V | 9.0V | 0.9V | 550mW | 2 Amp |
| MPC-4C-20VDC | 400Ω | 20V | 15.0V | 1.5V | 550mW | 2 Amp |
| MPC-4C-24VDC | 600Ω | 24V | 18.0V | 1.8V | 550mW | 2 Amp |
| MPC-4C-48VDC | 2,400Ω | 48V | 36.0V | 3.6V | 550mW | 2 Amp |

**NOTES:**
1. For SPDT, substitute "1C" for "2C" (i.e., MPC-1C-5VDC).
2. For a 3PDT, substitute "3C" for "4C."

**TWO POLE RELAY**




**FOUR POLE RELAY**




**Note:** Consult factory for dual source footprint layout.

### SERIES MPCS — SENSITIVE VERSION

Operates from TTL — Driver Circuits

| Catalog No. | Coil Res. | Input | Pull-in | Drop-out | Pick-up Power | Contact Rating |
|---|---|---|---|---|---|---|
| **DPDT[1]** | | | | | | |
| MPCS-2C-5VDC | 80Ω | 5V | 46mA | 5mA | 160mW | 2 Amp |
| MPCS-2C-6VDC | 125Ω | 6V | 4.5V | 0.45V | 160mW | 2 Amp |
| MPCS-2C-12VDC | 500Ω | 12V | 9.0V | 0.9V | 160mW | 2 Amp |
| MPCS-2C-24VDC | 2,000Ω | 24V | 18.0V | 1.8V | 160mW | 2 Amp |
| MPCS-2C-48VDC | 8,000Ω | 48V | 36.0V | 3.6V | 160mW | 2 Amp |

**NOTE:**
1. For SPDT, substitute "1C" for "2C" (i.e., MPCS-1C-5VDC).

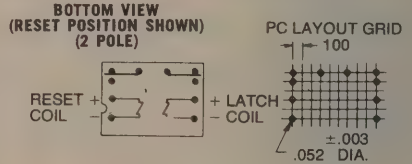
### NEW! SERIES MPCL — LATCHING VERSION

Series MPCL — Latching Version

Two completely isolated coils; no need for protection due to continuous application of coil voltage.

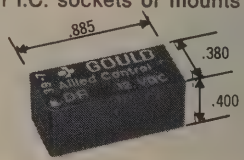
| Catalog No. | Coil Res. | Input | Latch or Reset Voltage | Power | Contact Rating |
|---|---|---|---|---|---|
| **DPDT[1]** | | | | | |
| MPCL-2C-5VDC | 28Ω | 5V | 3.7V | 500mW | 2 Amp |
| MPCL-2C-6VDC | 40Ω | 6V | 4.5V | 500mW | 2 Amp |
| MPCL-2C-12VDC | 160Ω | 12V | 9.0V | 500mW | 2 Amp |
| MPCL-2C-24VDC | 640Ω | 24V | 18.0V | 500mW | 2 Amp |
| MPCL-2C-48VDC | 2,500Ω | 48V | 36.0V | 500mW | 2 Amp |

**NOTE:**
1. For SPDT, substitute "1C" for "2C" (i.e., MPCL-1C-5VDC).



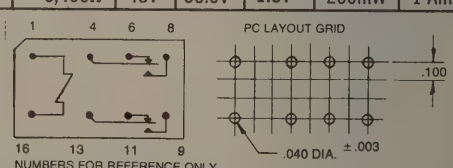

### NEW! SERIES DR — DUAL-IN-LINE

Fits standard 16 pin I.C. sockets or mounts directly on PC board.




| Catalog No. | Coil Res. | Input | Pull-in | Drop-out | Pick-up Power | Contact Rating |
|---|---|---|---|---|---|---|
| **DPDT** | | | | | | |
| DR-2C-3VDC | 25Ω | 3V | 2.3V | 0.12V | 200mW | 1 Amp |
| DR-2C-5VDC | 63Ω | 5V | 3.7V | 0.19V | 200mW | 1 Amp |
| DR-2C-6VDC | 100Ω | 6V | 4.5V | 0.23V | 200mW | 1 Amp |
| DR-2C-9VDC | 250Ω | 9V | 6.8V | 0.34V | 200mW | 1 Amp |
| DR-2C-12VDC | 400Ω | 12V | 9.0V | 0.45V | 200mW | 1 Amp |
| DR-2C-18VDC | 1,000Ω | 18V | 13.5V | 0.70V | 200mW | 1 Amp |
| DR-2C-24VDC | 1,600Ω | 24V | 18.0V | 0.90V | 200mW | 1 Amp |
| DR-2C-36VDC | 4,000Ω | 36V | 27.0V | 1.4V | 200mW | 1 Amp |
| DR-2C-48VDC | 6,400Ω | 48V | 36.0V | 1.8V | 200mW | 1 Amp |

**BOTTOM VIEW**




Consult factory for 1A, 2A, 1B, 2B contact configurations.

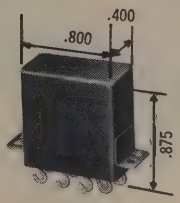
**Gould Inc., Circuit Protection and Controls Division**
100 Relay Road, Plantsville, CT 06479
Telephone (203) 621-6771 TWX 710-473-0079

GOULD

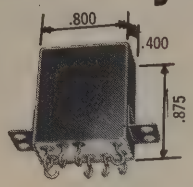
# Allied Control Relays

## Military Relays

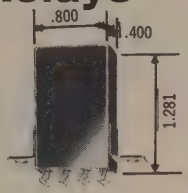
SERIES S
Now per MIL-R-39016



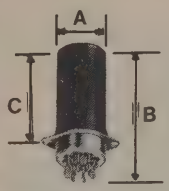
SERIES WKJ



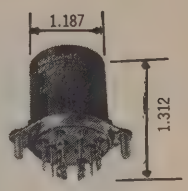
SERIES WKY



SERIES WJS



SERIES MH/MHB/MHJ



SERIES MHY

| | (Dim. in Inches) A | B | C |
|---|---|---|---|
| DPDT | .635 | 1.312 | 1.796 |
| 4PDT | 1.046 | 1.312 | 1.750 |
| 6PDT | 1.187 | 1.312 | 1.750 |

## FEATURES

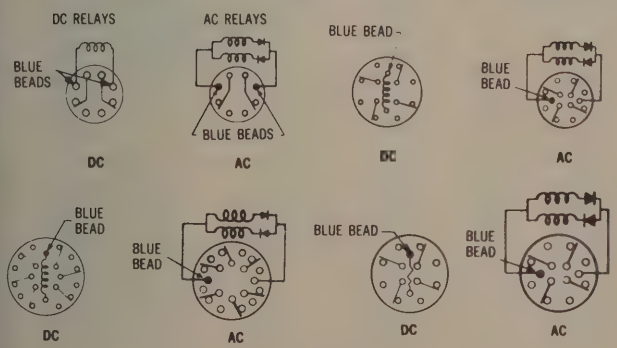
- **Series S:** ½ Size Crystal Can, 2 amps
- **Series WKJ/WKY:** Crystal Can, 3 amps
- **Series WJS:** Sensitive, Long Crystal Can, 3 amps
- **Series MH/MHB/MHJ:** Miniature Round Can, 5 amps
- **Series MHY:** Miniature Round Can, 10 amps

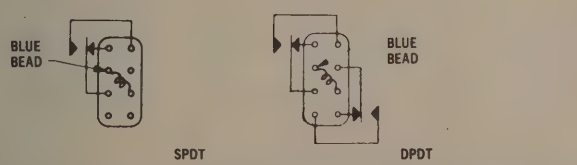
*Specification per MIL-R-5757 and MIL-R-39016 as applicable.*

### CRYSTAL CAN RELAYS

Bifurcated contacts make these relays ideal for dry circuit loads up to rated amperage.

| Catalog No. | Contact Arrangement | Coil Res. | Input | Contact Rating |
|---|---|---|---|---|
| **SERIES S — DC RELAYS** | | | | |
| S6-A1-12VDC | DPDT | 140Ω | 12.0V | 2 Amp |
| S6-A1-26.5VDC | DPDT | 700Ω | 26.5V | 2 Amp |
| **SERIES WKJ/WKY — DC RELAYS** | | | | |
| WKJ-6D-12VDC | DPDT | 150Ω | 12.0V | 3 Amp |
| WKJ-6D-26.5VDC | DPDT | 600Ω | 26.5V | 3 Amp |
| WKJ-6D-115VDC | DPDT | 10,000Ω | 115.0V | 3 Amp |
| WKY-6D-12VDC | DPDT | 150Ω | 12.0V | 3 Amp |
| WKY-6D-26.5VDC | DPDT | 600Ω | 26.5V | 3 Amp |
| WKY-6D-115VDC | DPDT | 10,000Ω | 115.0V | 3 Amp |
| **SERIES WJS — DC RELAYS** | | | | |
| WJS-3D-5.0Madc | SPDT | 1,000Ω | 5.0Madc | 3 Amp |
| WJS-3D-3.2Madc | SPDT | 2,500Ω | 3.2Madc | 3 Amp |
| WJS-3D-1.6Madc | SPDT | 10,000Ω | 1.6Madc | 3 Amp |
| WJS-6D-6.3Madc | DPDT | 1,000Ω | 6.3Madc | 3 Amp |
| WJS-6D-4.0Madc | DPDT | 2,500Ω | 4.0Madc | 3 Amp |
| WJS-6D-2.0Madc | DPDT | 10,000Ω | 2.0Madc | 3 Amp |




### MINIATURE ROUND CAN RELAYS

Series MH/MHB/MHJ — DC Relays — 5 amps

| Catalog No. | Contact Arrangement | Coil Res. | Input | Temp. Range | Contact Rating |
|---|---|---|---|---|---|
| **SERIES MH — DC RELAYS** | | | | | |
| MH-6D-12VDC | DPDT | 82Ω | 12.0V | | 5 Amp |
| MH-6D-26.5VDC | DPDT | 400Ω | 26.5V | | 5 Amp |
| MH-6D-115VDC | DPDT | 6,500Ω | 115.0V | | 5 Amp |
| MH-12D-12VDC | 4PDT | 60Ω | 12.0V | −55°C | 5 Amp |
| MH-12D-26.5VDC | 4PDT | 300Ω | 26.5V | to | 5 Amp |
| MH-12D-115VDC | 4PDT | 5,000Ω | 115.0V | +85°C | 5 Amp |
| MH-18D-12VDC | 6PDT | 48Ω | 12.0V | | 5 Amp |
| MH-18D-26.5VDC | 6PDT | 240Ω | 26.5V | | 5 Amp |
| MH-18D-115VDC | 6PDT | 3,500Ω | 115.0V | | 5 Amp |
| **SERIES MHB — DC RELAYS** | | | | | |
| MHB-6D-12VDC | DPDT | 65Ω | 12.0V | | 5 Amp |
| MHB-6D-26.5VDC | DPDT | 325Ω | 26.5V | | 5 Amp |
| MHB-6D-115VDC | DPDT | 6,000Ω | 115.0V | | 5 Amp |
| MHB-12D-12VDC | 4PDT | 50Ω | 12.0V | −65°C | 5 Amp |
| MHB-12D-26.5VDC | 4PDT | 250Ω | 26.5V | to | 5 Amp |
| MHB-12D-115VDC | 4PDT | 5,000Ω | 115.0V | +125°C | 5 Amp |
| MHB-18D-12VDC | 6PDT | 40Ω | 12.0V | | 5 Amp |
| MHB-18D-26.5VDC | 6PDT | 200Ω | 26.5V | | 5 Amp |
| MHB-18D-115VDC | 6PDT | 3,500Ω | 115.0V | | 5 Amp |
| **SERIES MHJ — DC RELAYS** | | | | | |
| MHJ-12D-12VDC | 4PDT | 50Ω | 12.0V | | 5 Amp |
| MHJ-12D-26.5VDC | 4PDT | 250Ω | 26.5V | −65°C | 5 Amp |
| MHJ-12D-115VDC | 4PDT | 5,000Ω | 115.0V | to | 5 Amp |
| MHJ-18D-12VDC | 6PDT | 40Ω | 12.0V | +125°C | 5 Amp |
| MHJ-18D-26.5VDC | 6PDT | 200Ω | 26.5V | | 5 Amp |
| MHJ-18D-115VDC | 6PDT | 3,500Ω | 115.0V | | 5 Amp |

(MHJ capabilities 20G to 2000 Hz)

| | | | | | |
|---|---|---|---|---|---|
| **SERIES MHB-MHJ — AC RELAYS** | | | | | |
| MHB-6A-115VAC | DPDT | 4215/4215 | 115.0V | −65°C to +125°C | 5 Amp |
| MHJ-12A-115VAC | 4PDT | 2765/2765 | 115.0V | | 5 Amp |
| MHJ-18A-115VAC | 6PDT | 2635/2635 | 115.0V | | 5 Amp |

(MHJ capabilities 20G to 2000 Hz)

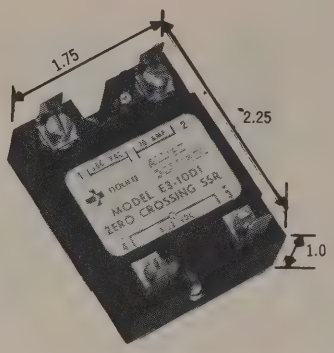
| | | | | | |
|---|---|---|---|---|---|
| **SERIES MHY — AC AND DC RELAYS** | | | | | |
| MHY-12A-115VAC | 4PDT | 2635/2635 | 115.0V | −55°C to +85°C | 10 Amp |
| MHY-12D-12VDC | 4PDT | 40Ω | 12.0V | −65°C | 10 Amp |
| MHY-12D-26.5VDC | 4PDT | 200Ω | 26.5V | to | 10 Amp |
| MHY-12D-115VDC | 4PDT | 3,500Ω | 115.0V | +125°C | 10 Amp |

**Gould Inc., Circuit Protection and Controls Division**
100 Relay Road, Plantsville, CT 06479
Telephone (203) 621-6771 TWX 710-473-0079

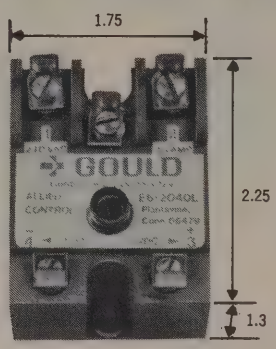
GOULD

# Allied Control Relays

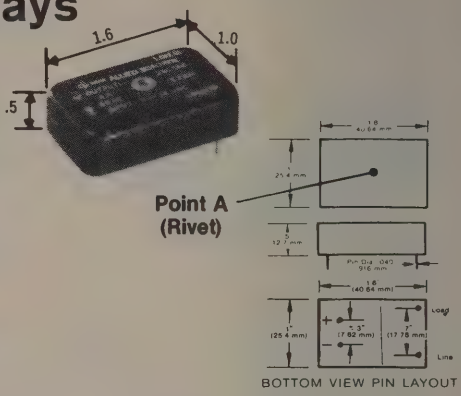
## Solid State Relays




**SERIES E3** — Optically isolated, zero crossing.




**SERIES E6** — Optically isolated, zero crossing, "integral cycling," optional output light.




**SERIES E22** — Optically isolated, miniature full-wave power switching pc mounting.

## FEATURES

- Bounceless switching
- Long life
- Integrated circuit compatibility
- High noise immunity
- Photo isolated

**Note: Consult factory for technical data on heat sink and special applications:**

| Catalog Number | Max. Load Current | Input | Output (AC) | Contact Type | Surge One Cycle | Max. Contact Voltage Drop | Off State Leakage Current | Pick-up Voltage | Drop-out Voltage | Input Impedance |
|---|---|---|---|---|---|---|---|---|---|---|
| **SERIES E3** | | | | | | | | | | |
| E3-10D1A | 10A | 3-32VDC | 280 | A | 100A | 1.6V | 2MA | 3VDC | 1VDC | 2200Ω |
| E3-10D1B | 10A | 3-32VDC | 280 | B | 100A | 1.6V | 2MA | 3VDC | 1VDC | 2200Ω |
| E3-10A0A | 10A | 20-28VAC | 280 | A | 100A | 1.6V | 2MA | 18VAC | 10VAC | 10KΩ |
| E3-10A0B | 10A | 20-28VAC | 280 | B | 100A | 1.6V | 2MA | 18VAC | 10VAC | 10KΩ |
| E3-10A4A | 10A | 100-135VAC | 280 | A | 100A | 1.6V | 2MA | 90VAC | 10VAC | 40KΩ |
| E3-10A4B | 10A | 100-135VAC | 280 | B | 100A | 1.6V | 2MA | 90VAC | 10VAC | 40KΩ |
| E3-25D1A | 25A | 3-32VDC | 280 | A | 250A | 2V | 4MA | 3VDC | 1VDC | 2200Ω |
| E3-25D1B | 25A | 3-32VDC | 280 | B | 250A | 2V | 4MA | 3VDC | 1VDC | 2200Ω |
| E3-25A0A | 25A | 20-28VAC | 280 | A | 250A | 2V | 4MA | 18VAC | 10VAC | 10KΩ |
| E3-25A0B | 25A | 20-28VAC | 280 | B | 250A | 2V | 4MA | 18VAC | 10VAC | 10KΩ |
| E3-25A4A | 25A | 100-135VAC | 280 | A | 250A | 2V | 4MA | 90VAC | 10VAC | 40KΩ |
| E3-25A4B | 25A | 100-135VAC | 280 | B | 250A | 2V | 4MA | 90VAC | 10VAC | 40KΩ |
| E3-40D1A | 40A | 3-32VDC | 280 | A | 400A | 2V | 4MA | 3VDC | 1VDC | 2200Ω |
| E3-40D1B | 40A | 3-32VDC | 280 | B | 400A | 2V | 4MA | 3VDC | 1VDC | 2200Ω |
| E3-40A0A | 40A | 20-28VAC | 280 | A | 400A | 2V | 4MA | 18VAC | 10VAC | 10KΩ |
| E3-40A0B | 40A | 20-28VAC | 280 | B | 400A | 2V | 4MA | 18VAC | 10VAC | 10KΩ |
| E3-40A4A | 40A | 20-28VAC | 280 | A | 400A | 2V | 4MA | 90VAC | 10VAC | 40KΩ |
| E3-40A4B | 40A | 20-28VAC | 280 | B | 400A | 2V | 4MA | 90VAC | 10VAC | 40KΩ |
| **SERIES E6** | | | | | | | | | | |
| E61010 | 10A | 3-32VDC | 120 | A | 100A | 1.6V | 6MA | 3VDC | 1VDC | 1KΩ |
| E62010 | 10A | 3-32VDC | 240 | A | 100A | 1.6V | 7.5MA | 3VDC | 1VDC | 1KΩ |
| E64010 | 10A | 3-32VDC | 480 | A | 100A | 1.6V | 8MA | 3VDC | 1VDC | 1KΩ |
| E61025 | 25A | 3-32VDC | 120 | A | 250A | 2V | 6MA | 3VDC | 1VDC | 1KΩ |
| E62025 | 25A | 3-32VDC | 240 | A | 250A | 2V | 7.5MA | 3VDC | 1VDC | 1KΩ |
| E64025 | 25A | 3-32VDC | 480 | A | 250A | 2V | 8MA | 3VDC | 1VDC | 1KΩ |
| E61040 | 40A | 3-32VDC | 120 | A | 400A | 2V | 6MA | 3VDC | 1VDC | 1KΩ |
| E62040 | 40A | 3-32VDC | 240 | A | 400A | 2V | 7.5MA | 3VDC | 1VDC | 1KΩ |
| E64040 | 40A | 3-32VDC | 480 | A | 400A | 2V | 8MA | 3VDC | 1VDC | 1KΩ |
| **SERIES E22** | | | | | | | | | | |
| E22N | 4A | 3-32VAC | 260 | A | 60A | 1.6V | 5MA | 3VDC | 1VDC | 2200Ω |

1. Max current load when proper heat sink applied.

**Gould Inc., Circuit Protection and Controls Division**
100 Relay Road, Plantsville, CT 06479
Telephone (203) 621-6771 TWX 710-473-0079

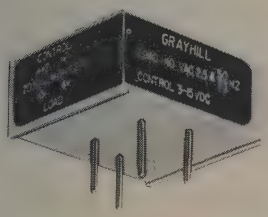
GOULD

Grayhill

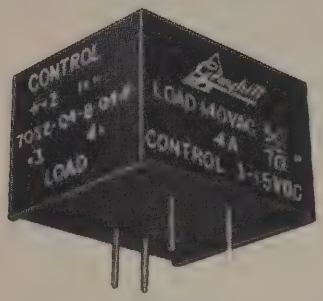
# SOLID STATE RELAYS

## SWITCH HIGH POWER AC LOADS FROM LOGIC CIRCUITS WITH SOLID STATE RELIABILITY THAT VIRTUALLY ELIMINATES REPLACEMENT

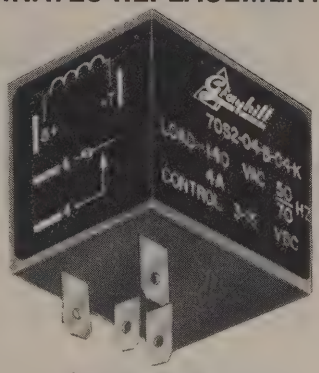
## THE INTERMEDIATE SIZE SPACE SAVERS




MICROCUBE
PC MOUNT — PACKAGE STYLE H
1.2" x 1.0" x 0.475" HIGH




MINICUBE
PC MOUNT — PACKAGE STYLE F
1.2" x 1.0" x 0.850" HIGH




MINICUBE — PLUG IN
FITS STANDARD SOCKET — PACKAGE STYLE K
1.2" x 1.0" x 1.0" ABOVE SOCKET

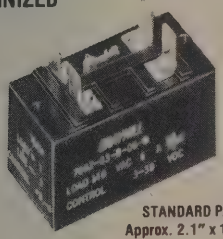
### DESIGN FEATURES

- LOGIC COMPATIBLE, OPTICALLY COUPLED
- INCLUDES ZERO VOLTAGE TURN-ON CIRCUIT
- TRANSIENT PROTECTED
- HIGH DV / DT AND BLOCKING VOLTAGE
- DESIGNED TO SWITCH INDUCTIVE LOADS

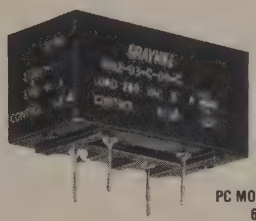
| Load Control | | Load Current Amps | Control Voltage VDC | Pkg. Style | UL File No. | Part No. | Unit Price |
|---|---|---|---|---|---|---|---|
| 75 to 140 VAC | 150 to 240 VAC | | | | | | |
| X | | 0.1 to 2.5 | 3-15 | H | E58632 | 70S2-04-B-02-H | $15.00 |
| X | | 0.1 to 2.5 | 14-30 | H | E58632 | 70S2-05-B-02-H | 15.00 |
| | X | 0.1 to 2.5 | 3-15 | H | E58632 | 70S2-04-C-02-H | 16.45 |
| | X | 0.1 to 2.5 | 14-30 | H | E58632 | 70S2-05-C-02-H | 16.45 |
| X | | 0.1 to 4.0 | 3-15 | F | E58632 | 70S2-04-B-04-F | 15.00 |
| X | | 0.1 to 4.0 | 14-30 | F | E58632 | 70S2-05-B-04-F | 15.00 |
| | X | 0.1 to 4.0 | 3-15 | F | E58632 | 70S2-04-C-04-F | 16.45 |
| | X | 0.1 to 4.0 | 14-30 | F | E58632 | 70S2-05-C-04-F | 16.45 |
| X | | 0.1 to 4.0 | 3-15 | K | --- | 70S2-04-B-04-K | 15.80 |
| X | | 0.1 to 4.0 | 14-30 | K | --- | 70S2-05-B-04-K | 15.80 |
| | X | 0.1 to 4.0 | 3-15 | K | --- | 70S2-04-C-04-K | 17.25 |
| | X | 0.1 to 4.0 | 14-30 | K | --- | 70S2-05-C-04-K | 17.25 |

## POWER SWITCHING TO 15 AMPS INCLUDES ALL THE DESIGN FEATURES LISTED ABOVE

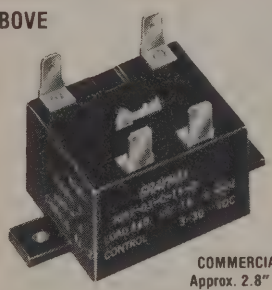
UL RECOGNIZED



STANDARD PACKAGE
Approx. 2.1" x 1.1" x 1.4"



PC MOUNT PACKAGE —
6 AMP MAX.
Approx. 2.1" x 1.1" x 1.4"



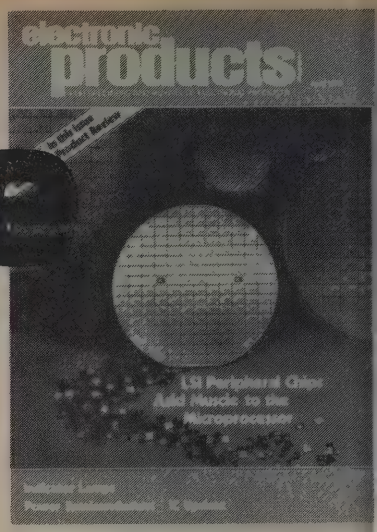
COMMERCIAL PACKAGE
Approx. 2.8" x 1.5" x 1.4"

| Load Voltage VAC | | Load Current Amps | | | PACKAGE | | | UL File No. | Part Number | Unit Price |
|---|---|---|---|---|---|---|---|---|---|---|
| 75 to 140 | 150 to 240 | .25 to 6 | .25 to 10 | .25 to 15 | Taper Tab Std. | Taper Tab Comm. | PC Mount | | | |
| X | | X | | | | | X | E58632 | 70S2-03-B-06-C | $23.50 |
| X | | X | | | X | | | E58632 | 70S2-03-B-06-B | 23.50 |
| X | | X | | | | X | | E58632 | 70S2-03-B-06-D | 23.00 |
| X | | | X | | X | | | E58632 | 70S2-03-B-10-B | 23.65 |
| X | | | X | | | X | | E58632 | 70S2-03-B-10-D | 23.15 |
| X | | | | X | X | | | E58632 | 70S2-03-B-15-B | 24.60 |
| X | | | | X | | X | | E58632 | 70S2-03-B-15-D | 24.10 |
| | X | X | | | | | X | E58632 | 70S2-03-C-06-C | 24.45 |
| | X | X | | | X | | | E58632 | 70S2-03-C-06-B | 24.45 |
| | X | X | | | | X | | E58632 | 70S2-03-C-06-D | 23.95 |
| | X | | X | | X | | | E58632 | 70S2-03-C-10-B | 24.60 |
| | X | | X | | | X | | E58632 | 70S2-03-C-10-D | 24.10 |
| | X | | | X | X | | | E58632 | 70S2-03-C-15-B | 25.90 |
| | X | | | X | | X | | E58632 | 70S2-03-C-15-D | 25.90 |

Transformer Isolated and Hybrid Solid State Relays, and Screw Terminal Adapters are also available. See Grayhill Solid State Relay Catalog. Price Subject to Change Without Notice

Grayhill, Inc. / 569 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040 / TWX: 910-683-1850

# stay up to date



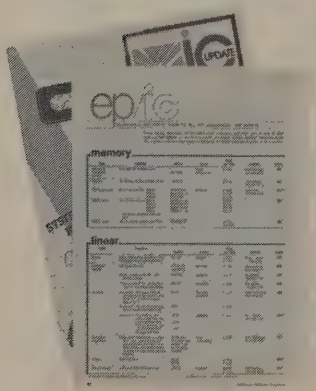

**SUBSCRIBE TO ELECTRONIC PRODUCTS MAGAZINE. IT'S YOUR *COMPLETE* GUIDE TO EVERYTHING THAT'S NEW IN THE FAST-CHANGING WORLD OF ELECTRONIC PRODUCTS AND SYSTEMS.**

**FEATURE STORIES** every month on electronic products, applications and availability.

**FORUMS**—Reports on meetings of manufacturers, users and distributors. Get the very latest news on a wide variety of products.

**NEW PRODUCT NEWS**—Hundreds of new products are introduced each month. You'll get the facts on not only what the new product is, but also where to get it, basic prices and current delivery.

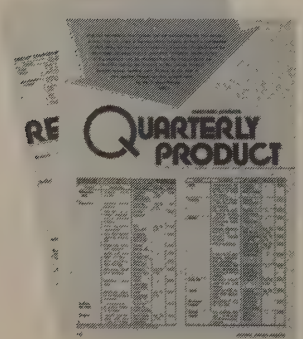
**EP/IC UPDATE**—Exclusive in ELECTRONIC PRODUCTS. A monthly report on *everything* that's new in the fast-moving world of integrated circuits.




**QUARTERLY PRODUCT REVIEW**—Another exclusive in ELECTRONIC PRODUCTS. A complete report of *every* new electronic product introduced in the previous quarter. This feature is in the January, April, July and October issues.

**QUARTERLY PRODUCT PLANNING DIRECTORY**—A compilation of the latest catalogs of a wide variety of electronic products and systems.

**OUTLOOK**—Important industry news affecting electronic products and systems.




**COMPONENT CAPERS**—A humorous look at the strange and wonderful world of electronics.

**MINI-GLOSSARIES,** Quizzes and more—Each and every month for over twenty years the readers of ELECTRONIC PRODUCTS learn something new about the products they work with and specify.

***If you are not now a subscriber, write to:***
***Dorothy Renoud, ELECTRONIC PRODUCTS MAGAZINE, 645 Stewart Avenue, Garden City, NY 11530.***
***Ask for a free qualification card.***

United Technical Publications, Inc., Div. of Cox Broadcasting Corp., 645 Stewart Ave., Garden City, NY 11530/(516) 222-2500

# GUARDIAN® SOLENOIDS

**NEW UNI-GUARD® II LEADS**

Lead wire adapters specifically designed for use with Guardian's new Uni-Guard® II coil construction which features QC lug termination. Each of these leads has a minimum overall length of 6" and is made of 22 gauge wire (U/L style 1015 with temperature rating of 105°). Termination at one end is in a choice of .187" or .110" insulated female QC lug which mates with corresponding lug on the solenoid. Wire at opposite end is stripped ¼" minimum. Two lead wire adapters are required for easy conversion of each Uni-Guard® II solenoid from QC to lead termination.

| Guardian No. | Lug Size | Package of 50 | Package of 100 |
|---|---|---|---|
| LW-22-187 | .187" | $4.20 | $8.38 |
| LW-22-110 | .110" | 4.20 | 8.38 |

## PULL TYPE

| Guardian No. | Duty | Coil Voltage | Ohms | LIFTS AND STROKES @ 25°C (Minimum) | LIFTS AND STROKES @ 25°C (Maximum) | Shpg. Wts. oz. | Net ea. 1-24 |
|---|---|---|---|---|---|---|---|
| 1A1 | — Inter. | — 120AC | 300 | 8 oz. at 1/8" | 2 oz. at 1/2" | 4.5 | $ 5.83 |
| 1A1 | — Cont. | — 120AC | 675 | 3 oz. at 1/8" | 0.5 oz. at 3/8" | 4.5 | 5.83 |
| 2 | — Inter. | — 120AC | 60 | 45 oz. at 1/8" | 11 oz. at 7/8" | 10 | 6.56 |
| 2 | — Cont. | — 120AC | 166 | 14 oz. at 1/8" | 3 oz. at 7/8" | 10 | 6.56 |
| 2 | — Inter. | — 24DC | 20 | 100 oz. at 1/8" | 85 oz. at 3/4" | 10 | 6.86 |
| 2 | — Cont. | — 24DC | 58 | 40 oz. at 1/8" | 3 oz. at 3/4" | 10 | 6.86 |
| 2HD | — Inter. | — 120AC | 36 | 70 oz. at 1/8" | 16 oz. at 3/4" | 10 | 9.14 |
| 2HD | — Cont. | — 120AC | 113 | 25 oz. at 1/8" | 6 oz. at 3/4" | 10 | 9.14 |
| 2HD | — Inter. | — 24DC | 20 | 96 oz. at 1/8" | 10 oz. at 3/4" | 10 | 9.45 |
| 2HD | — Cont. | — 24DC | 64 | 48 oz. at 1/8" | 6 oz. at 5/8" | 10 | 9.45 |
| 3HD | — Inter. | — 24DC | 21 | 160 oz. at 1/16" | 10 oz. at 3/4" | 14 | 7.09 |
| 3HD | — Cont. | — 24DC | 52 | 100 oz. at 1/16" | 4 oz. at 3/4" | 14 | 7.09 |
| 4 | — Inter. | — 120AC | 37 | 36 oz. at 1/8" | 26 oz. at 1" | 14.5 | 7.88 |
| 4 | — Cont. | — 120AC | 133 | 8 oz. at 1/8" | 7 oz. at 1" | 14.5 | 7.88 |
| 4 | — Inter. | — 24DC | 15 | 115 oz. at 1/8" | 16 oz. at 1" | 14.5 | 7.77 |
| 4 | — Cont. | — 24DC | 54 | 63 oz. at 1/8" | 6 oz. at 7/8" | 14.5 | 7.77 |
| 4 | — Inter. | — 110DC | 346 | 115 oz. at 1/8" | 16 oz. at 1" | 14.5 | 7.98 |
| 4 | — Cont. | — 110DC | 1300 | 63 oz. at 1/8" | 6 oz. at 7/8" | 14.5 | 7.98 |
| 4HD | — Inter. | — 120AC | 15 | 100 oz. at 1/8" | 32 oz. at 1 1/4" | 16 | 8.40 |
| 4HD | — Cont. | — 120AC | 53 | 23 oz. at 1/8" | 11 oz. at 1 1/4" | 16 | 8.40 |
| 4HD | — Inter. | — 24DC | 15 | 145 oz. at 1/8" | 23 oz. at 3/4" | 16 | 7.88 |
| 4HD | — Cont. | — 24DC | 50 | 75 oz. at 1/8" | 8 oz. at 3/4" | 16 | 7.88 |
| 4HD | — Inter. | — 110DC | 350 | 145 oz. at 1/8" | 23 oz. at 3/4" | 16 | 8.03 |
| 4HD | — Cont. | — 110DC | 1200 | 75 oz. at 1/8" | 8 oz. at 3/4" | 16 | 8.03 |
| 9 | — Inter. | — 120AC | 220 | 18 oz. at 1/8" | 7 oz. at 1/2" | 4 | 6.04 |
| 9 | — Cont. | — 120AC | 350 | 11 oz. at 1/8" | 2 oz. at 1/2" | 4 | 6.04 |
| 9 | — Inter. | — 24DC | 52 | 14 oz. at 1/8" | 2 oz. at 1/2" | 4 | 5.93 |
| 9 | — Cont. | — 24DC | 90 | 9 oz. at 1/8" | 1.5 oz. at 1/2" | 4 | 5.93 |
| 10 | — Inter. | — 120AC | 74 | 42 oz. at 1/8" | 25 oz. at 1/2" | 6.5 | 6.14 |
| 10 | — Cont. | — 120AC | 172 | 15 oz. at 1/8" | 7 oz. at 1/2" | 6.5 | 6.14 |
| 10 | — Inter. | — 24DC | 37 | 24 oz. at 1/8" | 5 oz. at 1/2" | 6.5 | 5.99 |
| 10 | — Cont. | — 24DC | 69 | 15 oz. at 1/8" | 3.5 oz. at 1/2" | 6.5 | 5.99 |
| 11 | — Inter. | — 24AC | 3.5 | 21 oz. at 1/8" | 11 oz. at 3/4" | 5 | 4.83 |
| 11 | — Cont. | — 24AC | 8 | 12 oz. at 1/8" | 6 oz. at 3/4" | 5 | 4.83 |
| 11 | — Inter. | — 120AC | 85 | 21 oz. at 1/8" | 11 oz. at 3/4" | 5 | 4.83 |
| 11 | — Cont. | — 120AC | 200 | 12 oz. at 1/8" | 6 oz. at 3/4" | 5 | 4.83 |
| 11 | — Inter. | — 6DC | 2 | 40 oz. at 1/8" | 6 oz. at 3/4" | 5 | 4.78 |
| 11 | — Cont. | — 6DC | 4.5 | 24 oz. at 1/8" | 3 oz. at 3/4" | 5 | 4.78 |
| 11 | — Inter. | — 24DC | 31 | 40 oz. at 1/8" | 6 oz. at 3/4" | 5 | 4.78 |
| 11 | — Cont. | — 24DC | 72 | 24 oz. at 1/8" | 3 oz. at 3/4" | 5 | 4.78 |

## PUSH TYPE

| Guardian No. | Duty | Coil Voltage | Ohms | LIFTS AND STROKES @ 25°C (Minimum) | LIFTS AND STROKES @ 25°C (Maximum) | Shpg. Wts. oz. | Net ea. 1-24 |
|---|---|---|---|---|---|---|---|
| 11P | — Inter. | — 24AC | 3.5 | 16.8 oz. at 1/8" | 8.8 oz. at 3/4" | 5.5 | $ 5.61 |
| 11P | — Cont. | — 24AC | 8 | 9.6 oz. at 1/8" | 4.8 oz. at 3/4" | 5.5 | 5.61 |
| 11P | — Inter. | — 120AC | 85 | 16.8 oz. at 1/8" | 8.8 oz. at 3/4" | 5.5 | 5.78 |
| 11P | — Cont. | — 120AC | 200 | 9.6 oz. at 1/8" | 4.8 oz. at 3/4" | 5.5 | 5.78 |
| 11P | — Inter. | — 6DC | 2 | 32 oz. at 1/8" | 4.8 oz. at 3/4" | 5.5 | 5.50 |
| 11P | — Cont. | — 6DC | 4.5 | 19.2 oz. at 1/8" | 2.4 oz. at 3/4" | 5.5 | 5.50 |
| 11P | — Inter. | — 24DC | 31 | 32 oz. at 1/8" | 4.8 oz. at 3/4" | 5.5 | 5.50 |
| 11P | — Cont. | — 24DC | 72 | 19.2 oz. at 1/8" | 2.4 oz. at 3/4" | 5.5 | 5.50 |

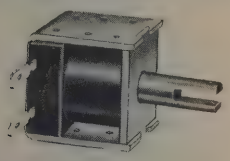
## SOLENOID SWITCH - SPDT — 10 AMP

| Guardian No. | Duty | Coil Voltage | Ohms | LIFTS AND STROKES @ 25°C (Minimum) | LIFTS AND STROKES @ 25°C (Maximum) | Shpg. Wts. oz. | Net ea. 1-24 |
|---|---|---|---|---|---|---|---|
| 11S | — Inter. | — 120AC | 85 | 21 oz. at 1/8" | 11 oz. at 3/4" | 5.5 | $ 8.09 |
| 11S | — Cont. | — 120AC | 200 | 12 oz. at 1/8" | 6 oz. at 3/4" | 5.5 | 8.09 |
| 11S | — Inter. | — 24DC | 31 | 40 oz. at 1/8" | 6 oz. at 3/4" | 5.5 | 7.98 |
| 11S | — Cont. | — 24DC | 72 | 24 oz. at 1/8" | 3 oz. at 3/4" | 5.5 | 7.98 |

### NO. 1A1 AC

**L 1 5/32"/D 1 1/16"**

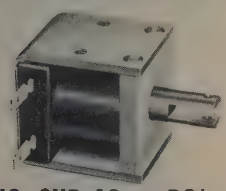
Insulation material: Class "A" (110°C). Coil finish: Acetate yarn, coalesced with acetone. Termination: External leads.



### NO. 2 AC*

**L 1 5/8"/W 1 1/16"/H 1 5/8"**

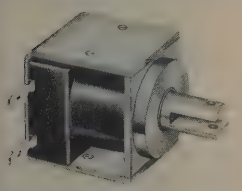
Insulation material: Class "A" (110°C). Coil construction: Uni-Guard® II molded bobbin and coil cover. Termination: .187" QC lugs.



### NO. 2HD AC or DC*

**L 1 13/16"/W 1 1/16"/H 1 11/16"**

Insulation material: Class "A" (110°C). Coil construction: Uni-Guard® II molded bobbin and coil cover. Termination: .187" QC lugs.



### NO. 3HD DC*

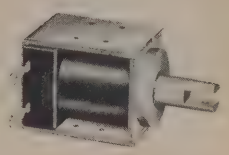
**L 1 25/32"/W 1 1/16"/H 1 5/8"**

Insulation material: Class "A" (110°C). Uni-Guard® II molded bobbin and coil cover. Termination: .187" QC.

### NO. 4 AC or DC*

**L 2 1/16"/W 1 3/16"/H 1 5/8"**

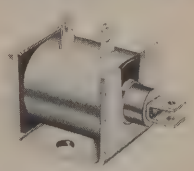
Insulation material: Class "A" (110°C). Coil finish: Uni-Guard® II molded bobbin and coil cover. Termination: .187" QC.



### NO. 4HD AC or DC*

**L 2 3/16"/W 1 1/16"/H 1 5/8"**

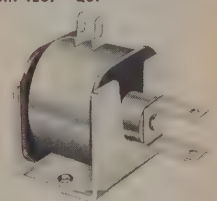
Insulation material: Class "A" (110°C). Coil construction: Uni-Guard® II molded bobbin and coil cover. Termination: .187" QC lugs.



### NO. 9 AC or DC

**L 1 5/32"/W 1 1/16"/H 1.00"**

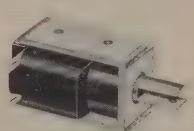
Insulation material: Class "A" (110°C). Coil finish: Acetate yarn, coalesced with acetone. Termination: .187" QC.



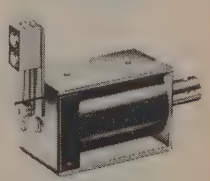
### NO. 10 AC or DC

**L 1 1/16"/W 1 3/8"/H 1 13/32"**

Insulation material: Class "A" (110°C). Coil finish: Acetate yarn, coalesced with acetone. Termination: .187" QC.



**L 1 7/8"/W 1 3/16"/H 1 3/16"**



**SOLENOID WITH SWITCH**

**L 1 7/8"/W 1 3/16"/H w/Sw. 2.00" w/Sw. 2 5/64"**

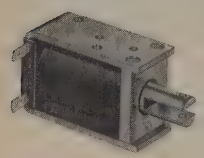
### NO. 11 AC or DC*

Pull type, push type or solenoid switch. Insulation material: Class "A" (110°C). Coil construction: Uni-Guard® II molded bobbin and coil cover. Termination: .187" QC lugs.

# GUARDIAN® SOLENOIDS

## PULL TYPE

| Guardian No. | Duty | Coil Voltage | Ohms | LIFTS AND STROKES @ 25°C (Minimum) | (Maximum) | Shpg. Wts. oz. | Net ea. 1-24 |
|---|---|---|---|---|---|---|---|
| 11HD | — Inter. — | 120AC | 75 | 25 oz. at 1/8" | 7½ oz. at 1" | 8 | $ 5.50 |
| 11HD | — Cont. — | 120AC | 165 | 12 oz. at 1/8" | 3½ oz. at 1" | 8 | 5.50 |
| 11HD | — Inter. — | 24DC | 29 | 60 oz. at 1/8" | 5 oz. at 7/8" | 8 | 5.40 |
| 11HD | — Cont. — | 24DC | 68 | 30 oz. at 1/8 | 2½ oz. at 5/8" | 8 | 5.40 |
| 12 | — Inter. — | 120AC | 100 | 48 oz. at 1/8" | 9 oz. at 7/8" | 6 | 7.96 |
| 12 | — Cont. — | 120AC | 150 | 28 oz. at 1/8" | 6 oz. at 7/8" | 6 | 7.96 |
| 14 | — Inter. — | 120AC | 11 | 108 oz. at 1/8" | 56 oz. at 1 1/2" | 9 | 12.90 |
| 14 | — Cont. — | 120AC | 18 | 75 oz. at 1/8" | 40 oz. at 1 1/2" | 9 | 12.90 |
| 16 | — Inter. — | 120AC | 41 | 110 oz. at 1/8" | 28 oz. at 1/4" | 7.5 | 7.14 |
| 16 | — Cont. — | 120AC | 85 | 63 oz. at 1/8" | 15 oz. at 1/4" | 7.5 | 7.14 |
| 16 | — Inter. — | 240AC | 200 | 110 oz. at 1/8" | 28 oz. at 1/4" | 7.5 | 7.19 |
| 16 | — Cont. — | 240AC | 350 | 63 oz. at 1/8" | 15 oz. at 1/4" | 7.5 | 7.19 |



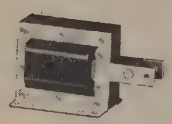
### NO. 11HD AC or DC*

**L 2 1/8"/ W 1 5/16"/H 1 1/4"**

Insulation material: Class "A" (110°C). Coil construction: Uni-Guard® II molded bobbin and coil cover. Termination: .187" QC lugs.

## PUSH TYPE

| Guardian No. | Duty | Coil Voltage | Ohms | LIFTS AND STROKES @ 25°C (Minimum) | (Maximum) | Shpg. Wts. oz. | Net ea. 1-24 |
|---|---|---|---|---|---|---|---|
| 16P | — Inter. — | 120AC | 41 | 88 oz. at 1/8" | 22.5 oz. at 1/4" | 7.5 | $ 8.53 |
| 16P | — Cont. — | 120AC | 85 | 50.5 oz. at 1/8" | 12 oz. at 1/4" | 7.5 | 8.53 |



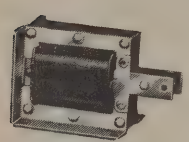
### NO. 12 AC*

**L 1 5/8"/W 1 1/4"/H 1 7/16"**

Laminated solenoid. Insulation material: Class "A" (110°C). Coil finish: Acetate yarn, coalesced with acetone. Termination: External leads.

## PULL TYPE

| Guardian No. | Duty | Coil Voltage | Ohms | LIFTS AND STROKES @ 25°C (Minimum) | (Maximum) | Shpg. Wts. oz. | Net ea. 1-24 |
|---|---|---|---|---|---|---|---|
| 18 | — Inter. — | 120AC | 8.8 | 350 oz. at 1/8" | 208 oz. at 7/8" | 1.65 | $11.22 |
| 18 | — Cont. — | 120AC | 19.7 | 152 oz. at 1/8" | 100 oz. at 7/8" | 16.5 | 11.22 |
| 18 | — Inter. — | 240AC | 45 | 350 oz. at 1/8" | 208 oz. at 7/8" | 16.5 | 11.28 |
| 18 | — Cont. — | 240AC | 78 | 152 oz. at 1/8" | 100 oz. at 7/8" | 16.5 | 11.28 |



### NO. 14 AC*

**L 2 1/16"/W 1 13/16"/H 2 1/16"**

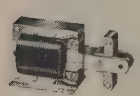
Laminated solenoid. Insulation material: Class "A" (110°C). Coil finish: Acetate yarn, coalesced with acetone. Termination: External leads.

## PUSH TYPE

| Guardian No. | Duty | Coil Voltage | Ohms | LIFTS AND STROKES @ 25°C (Minimum) | (Maximum) | Shpg. oz. Wts. | 1-24 Net ea. |
|---|---|---|---|---|---|---|---|
| 18P | — Inter. — | 120AC | 8.8 | 315 oz. at 1/8" | 187 oz. at 7/8" | 16.5 | $13.75 |
| 18P | — Cont. — | 120AC | 19.7 | 137 oz. at 1/8" | 90 oz. at 7/8" | 16.5 | 13.75 |

## PULL TYPE

| Guardian No. | Duty | Coil Voltage | Ohms | LIFTS AND STROKES @ 25°C (Minimum) | (Maximum) | Shpg. Wts. oz. | Net ea. 1-24 |
|---|---|---|---|---|---|---|---|
| 22 | — Inter. — | 120AC | 590 | 120 oz. at 1/16" | 1 oz. at 1/2" | 1.75 | $ 4.50 |
| 22 | — Cont. — | 120AC | 980 | 7 oz. at 1/16" | 1/2 oz. at 1/2" | 1.75 | 4.50 |
| 22 | — Inter. — | 6DC | 4 | 20 oz. at 1/16" | 2 oz. at 3/8" | 1.75 | 3.15 |
| 22 | — Cont. — | 6DC | 9 | 12 oz. at 1/16" | 1.7 oz. at 3/8" | 1.75 | 3.15 |
| 22 | — Inter. — | 24DC | 60 | 20 oz. at 1/16" | 2 oz. at 3/8" | 1.75 | 3.20 |
| 22 | — Cont. — | 24DC | 144 | 12 oz. at 1/16" | 1.7 oz. at 3/8" | 1.75 | 3.20 |
| 24 | — Inter. — | 120AC | 310 | 17 oz. at 1/16" | 4 oz. at 5/8" | 5 | 4.20 |
| 24 | — Cont. — | 120AC | 500 | 10 oz. at 1/16" | 2 oz. at 5/8" | 5 | 4.20 |
| 24 | — Inter. — | 24DC | 52 | 27 oz. at 1/16" | 4 oz. at 1/2" | 5 | 3.94 |
| 24 | — Cont. — | 24DC | 114 | 13 oz. at 1/16" | 1.5 oz. at 1/2" | 5 | 3.94 |



**PULL TYPE**
**L 1 5/8"/W 1 1/4"/H 1 1/2"**

## SOLENOID SWITCH - SPDT — 10 AMP

| Guardian No. | Duty | Coil Voltage | Ohms | LIFTS AND STROKES @ 25°C (Minimum) | (Maximum) | Shpg. Wts. oz. | Net ea. 1-24 |
|---|---|---|---|---|---|---|---|
| 24S | — Inter. — | 24DC | 52 | 27 oz. at 1/16" | 4 oz. at 1/2" | 5.5 | $ 7.15 |
| 24S | — Cont. — | 24DC | 114 | 13 oz. at 1/16" | 1.5 oz. at 1/2" | 5.5 | 7.15 |

**PUSH TYPE**
**L 1 5/8"/W 1 1/4"/H 1 1/2"**

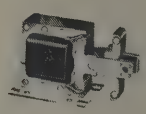
### NO. 16 AC*

Laminated solenoid. Insulation material: Class "A" (110°C). Coil finish: Uni-Guard® II molded polyester. Termination: Dual purpose, solder lugs or .187" QC.

## PULL TYPE

| Guardian No. | Duty | Coil Voltage | Ohms | LIFTS AND STROKES @ 25°C (Minimum) | (Maximum) | Shpg. Wts. oz. | Net ea. 1-24 |
|---|---|---|---|---|---|---|---|
| 26 | — Inter. — | 120AC | 140 | 32 oz. at 1/16" | 4 oz. at 7/8" | 6 | $ 4.94 |
| 26 | — Cont. — | 120AC | 250 | 17 oz. at 1/16" | 6 oz. at 5/8" | 6 | 4.94 |
| 26 | — Inter. — | 24DC | 33 | 46 oz. at 1/16" | 4 oz. at 3/4" | 6 | 4.73 |
| 26 | — Cont. — | 24DC | 85 | 26 oz. at 1/16" | 1 oz. at 1/2" | 6 | 4.73 |

* Recognized under the Component Program of Underwriters' Laboatories, Inc.

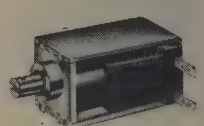


**PULL TYPE**
**L 2 1/2"/W 1 13/16"/H 2 3/32"**

**PUSH TYPE**
**L 2 1/2"/W 1 13/16"/H 2 1/16"**

### NO. 18 AC*

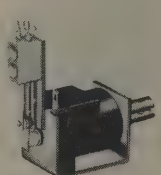
Laminated solenoid. Insulation material: Class "A" (110°C). Coil finish: Acetate yarn, coalesced with acetone. Termination: Solder lugs.



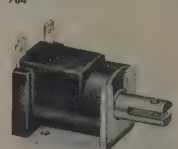
### NO. 22 AC or DC*

**L 1 3/32"/W 3/4"/H 3/4"**

Insulation material: Class "A" (110°C). Coil construction: Uni-Guard® II molded bobbin and coil cover. Termination: .110" QC lugs.



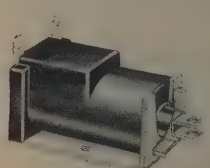
**SOLENOIDS WITH SWITCH**
**L 1 1/4"/W 27/32"/H 1"**
**w/Sw. 25/64"**



**PULL TYPE**
**L 1 1/4"/W 27/32"/H 1"**

### NO. 24 AC or DC*

Insulation material: Class "A" (110°C). Coil construction: Uni-Guard® II molded bobbin and coil cover. Termination: .187" QC lugs.



### NO. 26 AC or DC*

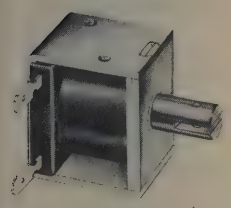
**L 1 3/4"/W 27/32"/H 1 13/16"**

Insulation material: Class "A" (110°C). Coil construction: Uni-Guard® II molded bobbin and coil cover. Termination: .187" QC lugs.

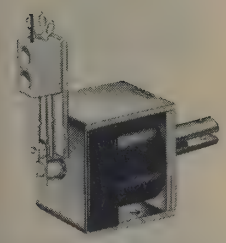
# GUARDIAN® SOLENOIDS

## PULL TYPE

| Guardian No. | Duty | Coil Voltage | Ohms | LIFTS AND STROKES @ 25°C (Minimum) | (Maximum) | Shpg. Wts. oz. | Net ea. 1-24 |
|---|---|---|---|---|---|---|---|
| 28 | — Inter. — | 24AC | 7.5 | 40 oz. at 1/16" | 7 oz. at 1/2" | 5 | $ 4.52 |
| 28 | — Cont. — | 24AC | 17.4 | 24 oz. at 1/16" | 5 oz. at 1/2" | 5 | 4.52 |
| 28 | — Inter. — | 120AC | 220 | 40 oz. at 1/16" | 7 oz. at 1/2" | 5 | 4.57 |
| 28 | — Cont. — | 120AC | 400 | 24 oz. at 1/16" | 5 oz. at 1/2" | 5 | 4.57 |
| 28 | — Inter. — | 6DC | 3.2 | 40 oz. at 1/16" | 3 oz. at 1/2" | 5 | 4.46 |
| 28 | — Cont. — | 6DC | 7.7 | 25 oz. at 1/16" | 2 oz. at 1/2" | 5 | 4.46 |
| 28 | — Inter. — | 12DC | 13 | 40 oz. at 1/16" | 3 oz. at 1/2" | 5 | 4.46 |
| 28 | — Cont. — | 12DC | 27 | 25 oz. at 1/16" | 2 oz. at 1/2" | 5 | 4.46 |
| 28 | — Inter. — | 24DC | 50 | 40 oz. at 1/16" | 3 oz. at 1/2" | 5 | 4.46 |
| 28 | — Cont. — | 24DC | 104 | 25 oz. at 1/16" | 2 oz. at 1/2" | 5 | 4.46 |



PULL TYPE
L 1 1/8"/ W 1 3/32"/ H T 3/16"



SOLENOID WITH SWITCH
L 1 1/8"/ W 1 3/16"/ H1 3/16"

### NO. 28 AC or DC*

Insulation material: Class "A" (110°C). Coil construction: Uni-Guard® II molded bobbin and coil cover. Termination: .187" QC lugs.

## PULL TYPE

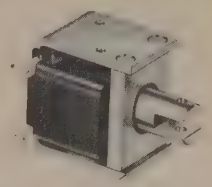
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 28HD | — Inter. — | 120AC | 200 | 30 oz. at 1/16" | 3 1/2 oz. at 1/2" | 6 | 5.60 |
| 28HD | — Cont. — | 120AC | 370 | 20 oz. at 1/16" | 2 oz. at 1/2" | 6 | 5.60 |
| | | | 50 | 20 oz. at 1/8" | 3 1/2 oz. at 3/8" | 6 | 5.45 |
| 28HD | — Cont. — | 24DC | 90 | 12 oz. at 1/8" | 2 oz. at 3/8" | 6 | 5.45 |
| 34 | — Inter. — | 120AC | 400 | 18 oz. at 1/16" | 4.5 oz. at 3/8" | 3 | 3.94 |
| 34 | — Cont. — | 120AC | 865 | 9 oz. at 1/16" | 1.5 oz. at 3/8" | 3 | 3.94 |
| 34 | — Inter. — | 24DC | 65 | 14 oz. at 1/16" | 2.5 oz. at 1/4" | 3 | 3.73 |
| 34 | — Cont. — | 24DC | 145 | 6.5 oz. at 1/16" | 1.8 oz. at 1/4" | 3 | 3.73 |
| 42 | — Inter. — | 12DC | | 1/2 oz. at 1/8" | 2 1/2 oz. at 1/32" | 3 | 2.90 |
| 42 | — Cont. — | 12DC | | 1/4 oz. at 1/8" | 1 1/2 oz. at 1/32" | 3 | 2.90 |
| 42 | — Inter. — | 24DC | | 1/2 oz. at 1/8" | 2 1/2 oz. at 1/32" | 3 | 3.10 |
| 42 | — Cont. — | 24DC | | 1/4 oz. at 1/8" | 1 1/2 oz. at 1/32" | 3 | 3.10 |

## PUSH TYPE

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 28P | — Inter. — | 24AC | 7.5 | 32 oz. at 1/16" | 5.6 oz. at 1/2" | 5.5 | $ 5.45 |
| 28P | — Cont. — | 24AC | 17.4 | 19.2 oz. at 1/16" | 4 oz. at 1/2" | 5.5 | 5.45 |
| 28P | — Inter. — | 120AC | 220 | 32 oz. at 1/16" | 5.6 oz. at 1/2" | 5.5 | 5.50 |
| 28P | — Cont. — | 120AC | 400 | 19.2 oz. at 1/16" | 4 oz. at 1/2" | 5.5 | 5.50 |
| 28P | — Inter. — | 6DC | 3.3 | 32 oz. at 1/16" | 2.4 oz. at 1/2" | 5.5 | 4.95 |
| 28P | — Cont. — | 6DC | 7.7 | 20 oz. at 1/16" | 1.6 oz. at 1/2" | 5.5 | 4.95 |
| 28P | — Inter. — | 12DC | 13 | 32 oz. at 1/16" | 2.4 oz. at 1/2" | 5.5 | 4.95 |
| 28P | — Cont. — | 12DC | 27 | 20 oz. at 1/16" | 1.6 oz. at 1/2" | 5.5 | 4.95 |
| 28P | — Inter. — | 24DC | 50 | 32 oz. at 1/16" | 2.4 oz. at 1/2" | 5.5 | 4.95 |
| 28P | — Cont. — | 24DC | 104 | 20 oz. at 1/16" | 1.6 oz. at 1/2" | 5.5 | 4.95 |

## SOLENOID SWITCH - SPDT — 10 AMP

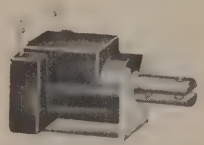
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 28S | — Inter. — | 24DC | 50 | 40 oz. at 1/16" | 3 oz. at 1/2" | 5.5 | $ 7.98 |
| 28S | — Cont. — | 24DC | 104 | 25 oz. at 1/16" | 2 oz. at 3/8" | 5.5 | 7.98 |



### NO. 28 HD AC or DC*

L 1 5/16"/ W 1 5/16"/ H 1 1/4"

Insulation material: Class "A" (110°C). Coil construction: Uni-Guard® II molded bobbin and coil cover. Termination: .187" QC lugs.



### NO. 34 AC or DC*

L 1 1/8"/ W 3/4"/ H 1 3/64"

Insulation material: Class "A" (110°C). Coil construction: Uni-Guard® II molded bobbin and coil cover. Termination: .187" QC lugs.

### NO. 42 DC

L 3/32"/W .378"/H 3/64"

Insulaion material: Class "A" (110°C). Termination: Solder terminal (pins).

# TUBULAR SOLENOIDS

## PULL TYPE

| Guardian No. | Duty | Coil Voltage | LIFTS AND STROKES @ 25°C (Minimum) | (Maximum) | Shpg. Wt. oz. | Ω | W. | Net ea. 1-24 |
|---|---|---|---|---|---|---|---|---|
| T3.5 x 9 | — Inter. — | 12DC | 8.5 oz. at 1/32" | 1.2 oz. at 1/2" | 9 | 14 | 10 | $ 5.81 |
| T3.5 x 9 | — Cont. — | 12DC | 5.5 oz. at 1/32" | 75 oz. at 5/16" | 9 | 80 | 2 | 5.81 |
| T3.5 x 9 | — Inter. — | 24DC | 8.5 oz. at 1/32" | 1.2 oz. at 1/2" | 9 | 57 | 10 | 5.81 |
| T3.5 x 9 | — Cont. — | 24DC | 5.5 oz. at 1/32" | 75 oz. at 5/16" | 9 | 260 | 2 | 5.81 |
| T4 x 7 | — Inter. — | 12DC | 12 oz. at 1/32" | .8 oz. at 3/8" | 11 | 20 | 7 | 5.97 |
| T4 x 7 | — Cont. — | 12DC | 6 oz. at 1/32" | 1 oz. at 3/16" | 11 | 60 | 2.4 | 5.97 |
| T4 x 7 | — Inter. — | 24DC | 12 oz. at 1/32" | .8 oz. at 3/8" | 11 | 80 | 7 | 5.97 |
| T4 x 7 | — Cont. — | 24DC | 6 oz. at 1/32" | 1 oz. at 3/16" | 11 | 240 | 2.4 | 5.97 |
| T4 x 12 | — Inter. — | 12DC | 14 oz. at 1/32" | 1.5 oz. at 7/8" | 17 | 10 | 15 | 6.18 |
| T4 x 12 | — Cont. — | 12DC | 7 oz. at 1/32" | 1.5 oz. at 1/4" | 17 | 41 | 3.5 | 6.18 |
| T4 x 12 | — Inter. — | 24DC | 14 oz. at 1/32" | 1.5 oz. at 7/8" | 17 | 38 | 15 | 6.18 |
| T4 x 12 | — Cont. — | 24DC | 7 oz. at 1/32" | 1.5 oz. at 1/4" | 17 | 160 | 3.5 | 6.18 |

PULL TYPE
L 1 1/8"/ W 1 1/8"/ D 7/16"/ Spcg. 1 3/16"

PUSH TYPE
L 1 1/8"/D 7/16"

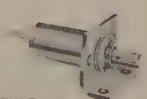
### NO. T3.5 x 9*

Insulation material: Class "A" (110°C). Termination: 6 inch leads. Mounting hardware included. Mounting thread size: 5/16"-32.

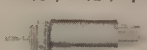
## PUSH TYPE

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| TP3.5 x 9 | — Inter. — | 12DC | 6.8 oz. at 1/32" | .96 oz. at 1/2" | 9 | 14 | 10 | $ 7.15 |
| TP3.5 x 9 | — Cont. — | 12DC | 4.4 oz. at 1/32" | .6 oz. at 5/16" | 9 | 80 | 2 | 7.15 |
| TP3.5 x 9 | — Inter. — | 24DC | 6.8 oz. at 1/32" | .96 oz. at 1/2" | 9 | 57 | 10 | 7.15 |
| TP3.5 x 9 | — Cont. — | 24DC | 4.4 oz. at 1/32" | .6 oz. at 5/16" | 9 | 260 | 2 | 7.15 |
| TP4 x 7 | — Inter. — | 24DC | 9.6 at 1/32" | .64 oz. at 3/8" | 11 | 80 | 7 | 7.31 |
| TP4 x 7 | — Cont. — | 24DC | 4.8 at 1/32" | .8 oz. at 3/16" | 11 | 240 | 2.4 | 7.31 |
| TP4 x 12 | — Inter. — | 24DC | 11.2 oz. at 1/32" | 1.2 oz. at 7/8" | 17 | 38 | 15 | 7.36 |
| TP4 x 12 | — Cont. — | 24DC | 5.6 oz. at 1/32" | 1.2 oz. at 1/4" | 17 | 160 | 3.5 | 7.36 |

*Recognized under the Component Program of Underwriters' Laboatories, Inc.



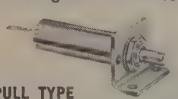
PULL TYPE
L 7/8"/ W1 1/8"/ D 1/2"/ Spcg. 1 3/16"



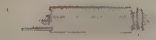
PUSH TYPE L 7/8"/ D 1/2"

### NO. T4 x 7*

Insulation material: Class "A" (110°C). Termination: 6 inch leads. Mounting hardware included. Mounting thread size: 3/8"-32.



PULL TYPE
L 1 1/2"/ W1 1/8"/ D 1/2"/ Spcg. 1 3/16"



PUSH TYPE L 1 1/2"/ D 1/2"

### NO. T4 x 12*

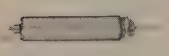
Insulation material: Class "A" (110°C). Termination: 6 inch leads. Mounting hardware included. Mounting thread size: 3/8"-32.

# GUARDIAN® TUBULAR SOLENOIDS

## PULL TYPE

| Guardian No. | Duty | Coil Voltage | LIFTS AND STROKES @ 25°C (Minimum) | LIFTS AND STROKES @ 25°C (Maximum) | Shpg. Wt. oz. | Ω | W. | Net ea. 1-24 |
|---|---|---|---|---|---|---|---|---|
| T4 x 16 | — Inter. — | 12DC | 7 oz. at 1/16" | 4 oz. at 1" | 19 | 6 | 20 | $ 6.67 |
| T4 x 16 | — Cont. — | 12DC | 6.5 oz. at 1/16" | 1.5 oz. 1" | 19 | 36 | 4 | 6.67 |
| T4 x 16 | — Inter. — | 24DC | 7 oz. at 1/16" | 4 oz. at 1" | 19 | 24 | 20 | 6.67 |
| T4 x 16 | — Cont. — | 24DC | 6.5 oz. at 1/16" | 1.5 oz. 1" | 19 | 145 | 4 | 6.67 |
| T6 x 12 | — Inter. — | 12DC | 30 oz. at 1/16" | 4 oz. at 3/4" | 3 | 6.5 | 22 | 6.45 |
| T6 x 12 | — Cont. — | 12DC | 12 oz. at 1/16" | 1 oz. at 3/4" | 3 | 41 | 3.5 | 6.45 |
| T6 x 12 | — Inter. — | 24DC | 30 oz. at 1/16" | 4 oz. at 3/4" | 3 | 25 | 22 | 6.45 |
| T6 x 12 | — Cont. — | 24DC | 12 oz. at 1/16" | 1 oz. at 3/4" | 3 | 165 | 3.5 | 6.45 |
| T8 x 9 | — Inter. — | 12DC | 52 oz. at 1/16" | 6 oz. at 7/16" | 6 | 7.5 | 19 | 7.20 |
| T8 x 9 | — Cont. — | 12DC | 23 oz. at 1/16" | 3 oz. at 7/16" | 6 | 36 | 4 | 7.20 |
| T8 x 9 | — Inter. — | 24DC | 52 oz. at 1/16" | 6 oz. at 7/16" | 6 | 30 | 19 | 7.20 |
| T8 x 9 | — Cont. — | 24DC | 23 oz. at 1/16" | 3 oz. at 7/16" | 6 | 145 | 4 | 7.20 |
| T8 x 16 | — Inter. — | 12DC | 80 oz. at 1/16" | 14 oz. at 7/8" | 7.8 | 2.7 | 38 | 7.79 |
| T8 x 16 | — Cont. — | 12DC | 35 oz. at 1/16" | 5.5 oz. at 7/8" | 7.8 | 26 | 5.5 | 7.79 |
| T8 x 16 | — Inter. — | 24DC | 80 oz. at 1/16" | 14 oz. at 7/8" | 7.8 | 15 | 38 | 7.79 |
| T8 x 16 | — Cont. — | 24DC | 35 oz. at 1/16" | 5.5 oz. at 7/8" | 7.8 | 105 | 5.5 | 7.79 |
| T12 x 13 | — Inter. — | 12DC | 150 oz. at 1/8" | 14 oz. at 3/4" | 10.5 | 3.6 | 40 | 10.54 |
| T12 x 13 | — Cont. — | 12DC | 50 oz. at 1/8" | 4 oz. at 3/4" | 10.5 | 20 | 7 | 10.54 |
| T12 x 13 | — Inter. — | 24DC | 150 oz. at 1/8" | 14 oz. at 3/4" | 10.5 | 14 | 40 | 10.54 |
| T12 x 13 | — Cont. — | 24DC | 50 oz. at 1/8" | 4 oz. at 3/4" | 10.5 | 85 | 7 | 10.54 |
| T12 x 19 | — Inter. — | 12DC | 150 oz. at 1/8" | 12 oz. at 1 1/2" | 21.4 | 2.4 | 60 | 11.28 |
| T12 x 19 | — Cont. — | 12DC | 80 oz. at 1/8" | 5 oz. at 1 1/2" | 21.4 | 14 | 10 | 11.28 |
| T12 x 19 | — Inter. — | 24DC | 150 oz. at 1/8" | 12 oz. at 1 1/2" | 21.4 | 9.5 | 60 | 11.28 |
| T12 x 19 | — Cont. — | 24DC | 80 oz. at 1/8" | 5 oz. at 1 1/2" | 21.4 | 59 | 10 | 11.28 |

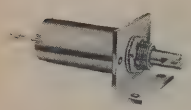
PULL TYPE
L 2"/ W 1 1/8"/ D 1/2"/ Spcg. 13/16"



PUSH TYPE
L 2"/ D 1/2"

### NO. T4 x 16*

Insulation material: Class "A" (110°C). Termination: 6 inch leads. Mounting hardware included. Mounting thread size: 1/8"-32.

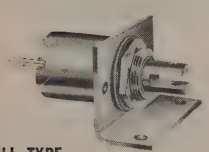


PULL TYPE
L 1 1/2"/ W 1 3/8"/ D 3/4"/ Spcg. 1 1/16"

PUSH TYPE
L 1 1/2"/ D 3/4"

### NO. T6 x 12*

Insulation material: Class "A" (110°C). Termination: 6 inch leads. Mounting hardware included. Mounting thread size: 5/32"-32.



PULL TYPE
L 1 1/8"/ W 2"/ D 1"/ Spcg. 1 1/2"

PUSH TYPE L 1 1/8"/ D 1"

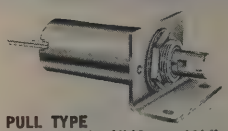
### NO. T8 x 9*

Tubular solenoid. Insulation material: Class "A" (110°C). Termination: 6 inch leads. Mounting hardware included. Mounting thread size: 3/4"-24.

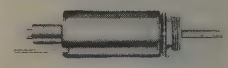
## PUSH TYPE

| Guardian No. | Duty | Coil Voltage | LIFTS AND STROKES @ 25°C (Minimum) | LIFTS AND STROKES @ 25°C (Maximum) | Shpg. Wt. oz. | Ω | W. | Net ea. 1-24 |
|---|---|---|---|---|---|---|---|---|
| TP4 x 16 | — Inter. — | 12DC | 5.6 oz. at 1/16" | 32 oz. at 1" | 19 | 6 | 20 | $ 8.06 |
| TP4 x 16 | — Cont. — | 12DC | 5.2 oz. at 1/16" | 12 oz. at 1" | 19 | 36 | 4 | 8.06 |
| TP4 x 16 | — Inter. — | 24DC | 5.6 oz. at 1/16" | 32 oz. at 1" | 19 | 24 | 20 | 8.06 |
| TP4 x 16 | — Cont. — | 24DC | 5.2 oz. at 1/16" | 12 oz. at 1" | 19 | 145 | 4 | 8.06 |
| TP6 x 12 | — Inter. — | 12DC | 24 oz. at 1/16" | 3.2 oz. at 3/4" | 3 | 6.5 | 22 | 7.31 |
| TP6 x 12 | — Cont. — | 12DC | 9.6 oz. at 1/16" | 8 oz. at 3/4" | 3 | 41 | 3.5 | 7.31 |
| TP6 x 12 | — Inter. — | 24DC | 24 oz. at 1/16" | 3.2 oz. at 3/4" | 3 | 25 | 22 | 7.31 |
| TP6 x 12 | — Cont. — | 24DC | 9.6 oz. at 1/16" | 8 oz. at 3/4" | 3 | 165 | 3.5 | 7.31 |
| TP8 x 9 | — Inter. — | 24DC | 41.6 oz. at 1/16" | 4.8 oz. at 7/16" | 6 | 30 | 19 | 9.03 |
| TP8 x 9 | — Cont. — | 24DC | 18.4 oz. at 1/16" | 2.4 oz. at 7/16" | 6 | 145 | 4 | 9.03 |
| TP8 x 16 | — Inter. — | 12DC | 64 oz. at 1/16" | 11.2 oz. at 7/8" | 7.8 | 2.7 | 38 | 9.19 |
| TP8 x 16 | — Cont. — | 12DC | 28 oz. at 1/16" | 4.4 oz. at 7/8" | 7.8 | 26 | 5.5 | 9.19 |
| TP8 x 16 | — Inter. — | 24DC | 64 oz. at 1/16" | 11.2 oz. at 7/8" | 7.8 | 15 | 38 | 9.19 |
| TP8 x 16 | — Cont. — | 24DC | 28 oz. at 1/16" | 4.4 oz. at 7/8" | 7.8 | 105 | 5.5 | 9.19 |
| TP12 x 13 | — Inter. — | 24DC | 120 oz. at 1/8" | 11.2 oz. at 3/4" | 10.5 | 14 | 40 | 11.45 |
| TP12 x 13 | — Cont. — | 24DC | 40 oz. at 1/8" | 3.2 oz. at 3/4" | 10.5 | 85 | 7 | 11.45 |
| TP12 x 19 | — Inter. — | 24DC | 120 oz. at 1/8" | 9.6 oz. at 1 1/2" | 21.4 | 9.5 | 60 | 12.90 |
| TP12 x 19 | — Cont. — | 24DC | 64 oz. at 1/8" | 4 oz. at 1 1/2" | 21.4 | 59 | 10 | 12.90 |

*UL Recognized under the Component Program of Underwriters' Laboatories, Inc.



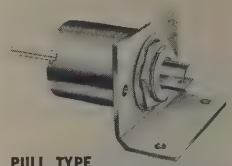
PULL TYPE
L 2"/ W 2"/ D 1"/ Spcg. 1 1/2"



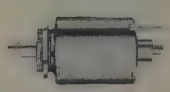
PUSH TYPE L 2"/ D 1"

### NO. T8 x 16*

Tubular solenoid. Insulation material: Class "A" (110°C). Termination: 6 inch leads. Mounting hardware included. Mounting thread size: 3/4"-24.



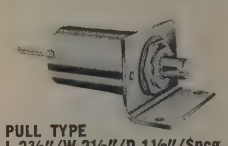
PULL TYPE
L 1 5/8"/ W 2 1/2"/ D 1 1/2"/ Spcg. 2"



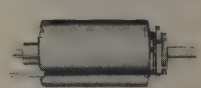
PUSH TYPE L 1 5/8"/ D 1 1/2"

### NO. T12 x 13*

Tubular solenoid. Insulation material: Class "A" (110°C). Termination: 6 inch leads. Mounting hardware included. Mounting thread size: 1"-27.



PULL TYPE
L 2 3/8"/ W 2 1/2"/ D 1 1/2"/ Spcg. 2"



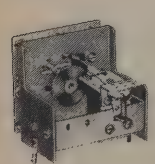
PUSH TYPE L 2 3/8"/ D 1 1/2"

### NO. T12 x 19*

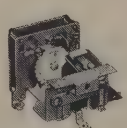
Tubular solenoid. Insulation material: Class "A" (110°C). Termination: 6 inch leads. Mounting hardware included. Mounting thread size: 1"-27.

# STEPPERS

## CONTINUOUS ROTATION



L 3 7/16"/ W 3 3/8"/ H 3 1/32"



L 3 3/8"/ W 2 15/16"/ H 2 3/16"

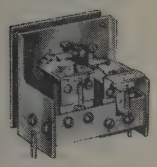
The circuit selection wiper on Continuous Rotation Steppers moves in one direction only, upon energization of the step coil. This type of stepper is available in standard 24 point (MC) or 40 point (PC). The 24 bridging contact deck is evenly divisible by eight possible sequences. The PC stepper features self-stepping speeds up to 30 steps per second and mechanical life expectancy of over 4,000,000 steps.

| Guardian No. | Watts | Volt Amperes | No. of Points | No. of Active Contacts | Max. Steps per Second | Shipping Weight Ounces | Net ea. 1-24 |
|---|---|---|---|---|---|---|---|
| PC-120AC | 20 | 35 | 40 | 40 | 20 | 17 | $34.00 |
| MC-120AC | 17 | 30 | 24 | 24 | 20 | 9½ | 25.17 |

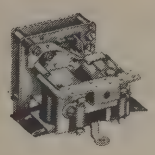
# GUARDIAN®

# STEPPERS

## ELECTRICAL RESET



L 3⅜" / W 3⅝₆" / H 2⅜₆"



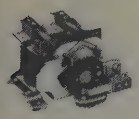
L 3¼₆" / W 3⅜" / H 3½₂"

**Type MER.** A direct drive (steps on energization) with positive mechanical reset interlock actuated by the reset magnet and unlocked on the first energization of the step magnet. Assures positive reset on as short a pulse as one-hundredth of a second. By interconnecting two or more steppers, count can be increased to any desired total, counting by tens, or any convenient multiple. Will control a sequence of operation and then automatically reset to starting position. The circuit selecting wiper on Electrical Reset Steppers can be reset to zero or home from any desired position, by energization of the reset magnet.

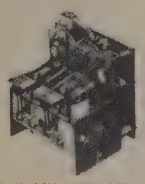
**Type PER.** Operation same as MER but with up to 52 active contacts.

| Guardian No. | Watts | Volt Amperes | No. of Points | No. of Active Contacts | Max. Steps per Second | Shipping Weight Ounces | Net ea. 1-24 |
|---|---|---|---|---|---|---|---|
| PER/40-120AC | 35-7¶ | 60-10¶ | 40 | 36 | 20 | 22 | $44.75 |
| PER/52-120AC | 65-7¶ | 115-10¶ | 52 | 52 | 20 | 22 | 48.99 |
| MER-120AC | 20-7¶ | 40-10¶ | 24 | 22 | 20 | 11½ | 28.96 |
| MER-24DC | 20-8¶ | | 24 | 22 | 20 | 11½ | 28.96 |

## ADD AND SUBTRACT



L 3⅛" / W 3¼" / H 1¹⁵⁄₁₆"



L 3⅜₆" / W 3½" / H 3½"

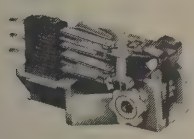
Add and subtract steppers are basically continuous rotation types with the added feature of being able to reverse the movement of the selecting wiper when required.

**Type MAS.** A midget add and subtract stepper incorporating a cam actuated switch which operates at zero position. Used primarily to indicate a zero balance between pulses supplied to the "add" coil as compared to pulses received by the "subtract" coil.

**Type PAS.** Bi-directional steppers whereby the selector wiper moves either direction depending on which of the coils is energized. Supplied with .058" dia. AMP quick-connect terminals arranged in circle on deck, and also includes a form "C" cam switch.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MAS-120AC | 9 | 12 | 30 | ‡ | 10 | 11 | $33.89 |
| PAS-120AC | 35 | 60 | 40 | 40† | 29 | 22 | 47.03 |

## SERIES 660 - 665 SEQUENCE

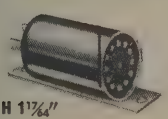


L 3¹⁄₁₆" / W 2¼" Max. / H 2³⁄₁₆" Max.

Intended to perform switching operations in a repetitive transfer sequence. Each electrical impulse moves the switch contacts to the opposite position in the sequence. Contacts rated up to 15 amps at 120V, 60 Hz, non-inductive load. Shipping weight, 8 oz. Mounting: 4 holes 8-32 (NC-2B).

| Guardian No. | Coil Voltage | Contact Comb. | Net ea. 1-24 |
|---|---|---|---|
| 660-C-24A | 24AC | SPDT | $10.21 |
| 660-2C-24A | 24AC | DPDT | 11.03 |
| 660-4C-24A | 24AC | 4PDT | 16.06 |
| 660-C-120A | 120AC | SPDT | 10.21 |
| 660-2C-120A | 120AC | DPDT | 11.03 |
| 660-4C-120A | 120AC | 4PDT | 16.06 |
| 665-C-24D | 24DC | SPDT | 10.21 |
| 665-2C-24D | 24DC | DPDT | 11.03 |
| 665-4C-24D | 24DC | 4PDT | 16.06 |

## ROTOMITE STEPPER SERIES 705



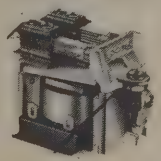
L 3" / D 1¹³⁄₆₄" / H 1¹⁷⁄₆₄"

An entirely new concept in stepper design, the Guardian "Rotomite" is first with maximum stepper control in minimum space. Offering high contact rating of 3 amps resistive, 1 amp inductive (50% PF). Featuring continuous duty operation with life well in excess of one million steps, the completely enclosed Rotomite is geared for continuous rotation of 12 positions.

| | | | |
|---|---|---|---|
| 705-12P-6D | 12 | 6DC | $10.73 |
| 705-12P-12D | 12 | 12DC | 10.73 |
| 705-12P-24D | 12 | 24DC | 10.73 |

## SERIES 840LS - 845LS ON/OFF RELAY

**SINGLE COIL IMPULSE OPERATED MECHANICAL LATCHING RELAY**



L 2¼" / W ³⁵⁄₆₄" / H 2³⁄₁₆" Max.

Compact AC or DC Latching Relay for positive on/off SPDT, DPDT or 4PDT contact combinations. Impulse as short as 20 MS energizes coil to reverse position of switches. Holds last position of switch with coil de-energized. Contacts rated for 10 amps at 120 VAC, 60 Hz non-inductive. Power requirement: 22 volt-amperes. Solder lug terminals for coils and contacts. Shipping weight, 5.2 oz. Mounting: Single mounting hole tapped 8-32 (NC-2B).

| | | | |
|---|---|---|---|
| 840LS-C-24A | 24AC | SPDT | $ 7.64 |
| 840LS-2C-24A | 24AC | DPDT | 9.21 |
| 840LS-4C-24A | 24AC | 4PDT | 13.44 |
| 840LS-C-120A | 120AC | SPDT | 7.64 |
| 840LS-2C-120A | 120AC | PDPT | 9.21 |
| 840LS-4C-120A | 120AC | 4PDT | 13.44 |
| 845LS-C-12D | 12DC | SPDT | 7.64 |
| 845LS-2C-12D | 12DC | DPDT | 8.35 |
| 845LS-4C-12D | 12DC | 4PDT | 13.44 |
| 845LS-C-24D | 24DC | SPDT | 7.64 |
| 845LS-2C-24D | 24DC | DPDT | 8.35 |
| 845LS-4C-24D | 24DC | 4PDT | 13.44 |

NOTES: All steppers except Series 705 are intermittent duty. All are direct drive units with switching operation completed upon energization. All contact points are rated 1½ amps resistive at 120V, 60 Hz. Coil Voltage* are 120 VAC, 60 Hz and 24 DC.

* Steppers will operate satisfactorily at 15% below or 10% above rated voltage. † Includes Zero (0) position. ¶ Listings are for stepping coil and reset coil, respectively. ‡ Zero (0) position switch only.

# OPEN RELAYS

## SERIES 220

**HEAVY DUTY INDUSTRIAL AC RELAY — 20 AMPERE**

L 3" / W 1¾" / H 1⅞"

This rugged unit makes and breaks up to 20 amps, at 240 volts. Armature is equipped with phenolic contact mounting block carrying ¾" dual contacts. Phenolic is tested at 1500 volts breakdown to ground. Contacts are silver alloy. Relay is available in dual SPST, normally open contact combination only. Contact rating 20 amps at 60 Hz, 240 VAC non-inductive load. Mounting: Mounting holes — clearance for 8-32 with 2³⁄₃₂" centers Shipping weight, 5.5 oz.

| Guardian No. | Coil Voltage | Coil Res. | Cont. Comb. | Net ea. 1-24 |
|---|---|---|---|---|
| 220-A-24A | 24AC | 25 | SPST* | $10.16 |
| 220-A-120A | 120AC | 600 | SPST* | 10.16 |
| 220-A-240A | 240AC | 2500 | SPST* | 10.43 |

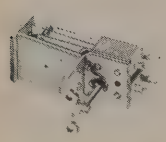
* Normally open.

# GUARDIAN®

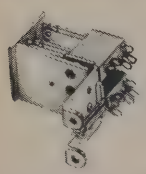
# OPEN RELAYS

## SERIES 200 RELAY WITH COMPLETELY INTERCHANGEABLE COIL AND CONTACT ASSEMBLIES

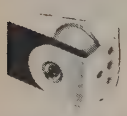
The coil consists of the coil and field piece; the contact assembly consists of switch blades, armature, return spring and mounting bracket.



L 2⅝"/W 1 7/32"/H 1 1/32"



L 1 13/16"/W 1 3/32"/H 1 1/32"



L 1¾"/W 5/64"/H 1⅛"

### SERIES 200 RELAY

| Guardian No. | Volts | Coil | Net ea. 1-24 |
|---|---|---|---|
| 200-6A | 6 | AC | $3.16 |
| 200-12A | 12 | AC | 3.16 |
| 200-24A | 24 | AC | 3.16 |
| 200-120A | 120 | AC | 3.70 |
| 200-240A | 240 | AC | 4.88 |
| 200-6D | 6 | DC | 3.43 |
| 200-12D | 12 | DC | 3.43 |
| 200-24D | 24 | DC | 3.43 |
| 200-32D | 32 | DC | 3.43 |
| 200-110D | 110 | DC | 4.54 |
| 200-5,000D | † | DC | 3.92 |
| 200-10,000D | † | DC | 4.54 |

† Plate Circuit

### CONTACT SWITCH ASSEMBLIES

| Guardian No. | Type | Cont. Amps | Cont. Comb. | Net ea. 1-24 |
|---|---|---|---|---|
| 200-1 | Standard | 8 | SPDT | $2.90 |
| 200-2 | Standard | 8 | DPDT | 3.80 |
| 200-4 | Standard | 12.5 | DPDT | 4.27 |
| 200-5 | Standard | 8 | 4PDT | 6.69 |
| 200-M1 | Midget | 10 | SPDT | 2.74 |
| 200-M2 | Midget | 10 | DPDT | 3.34 |
| 200-M5 | Midget | 8 | 4PDT | 5.42 |

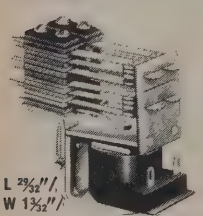
### CONTACT SWITCH PARTS

| Guardian No. | Type | Net ea. 1-24 |
|---|---|---|
| 200-3 | Standard | $2.89 |
| 200-M3 | Midget | 2.89 |

Use contact switch parts 200-3 for adding poles to contact switch assemblies 200-1 and 200-2. Use midget contact switch parts 200-M3 for adding poles to midget contact switch assemblies 200-M1 and 200-M2.

## SERIES 240U - 245U

Contact rating is 15 amp, 120V, 60 Hz non-inductive load. Assembly with 8-32 single screw, center-hole mounting. Shipping weight, 4.5 oz.



L 2 3/32"/W 1 3/32"/H 2 1/16"

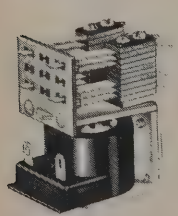
### 15 AMPERE RELAY

| Guardian No. | Coil Res. | Coil Vltg. | Cont. Comb. | Net ea. 1-24 |
|---|---|---|---|---|
| 240U-2C-24A | 24 | 24AC | DPDT | $ 9.14 |
| 240U-4C-24A | 24 | 24AC | 4PDT | 13.87 |
| 240U-2C-120A | 550 | 120AC | DPDT | 9.25 |
| 240U-4C-120A | 550 | 120AC | 4PDT | 14.08 |
| 245U-2C-12D | 50 | 12DC | DPDT | 9.08 |
| 245U-4C-12D | 50 | 12DC | 4PDT | 13.98 |
| 245U-2C-24D | 200 | 24DC | DPDT | 9.30 |
| 245U-4C-24D | 200 | 24DC | 4PDT | 14.14 |

Ⓤ Recognized under the Component Program of Underwriters' Laboratories, Inc.

## SERIES 640U - 645U

All contact ratings are 10 amps. Contact ratings at 60 Hz, 120V non-inductive load. 8-32 single screw, center hole mounting. Shipping weight, 3.5 oz.



L 1⅞"/W 3/32"/H 2 5/32"

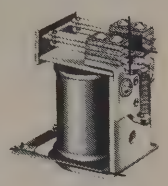
### ALL PURPOSE ECONOMY RELAY — 10 AMPERE

| Guardian No. | Coil Res. | Coil Vltg. | Cont. Comb. | Net ea. 1-24 |
|---|---|---|---|---|
| 640U-A-24A | 24 | 24AC | SPST* | $ 3.98 |
| 640U-C-24A | 24 | 24AC | SPDT | 4.95 |
| 640U-2C-24A | 24 | 24AC | DPDT | 6.61 |
| 640U-4C-24A | 24 | 24AC | 4PDT | 9.35 |
| 640U-A-120A | 550 | 120AC | SPST* | 4.09 |
| 640U-C-120A | 550 | 120AC | SPDT | 5.05 |
| 640U-2C-120A | 550 | 120AC | DPDT | 6.77 |
| 640U-4C-120A | 550 | 120AC | 4PDT | 9.46 |
| 640U-2C-240A | 2950 | 240AC | DPDT | 7.20 |
| 645U-A-12D | 50 | 12DC | SPST* | 4.19 |
| 645U-C-12D | 50 | 12DC | SPDT | 4.95 |
| 645U-2C-12D | 50 | 12DC | DPDT | 6.99 |
| 645U-4C-12D | 50 | 12DC | 4PDT | 9.68 |
| 645U-A-24D | 200 | 24DC | SPST* | 4.25 |
| 645U-C-24D | 200 | 24DC | SPDT | 5.05 |
| 645U-2C-24D | 200 | 24DC | DPDT | 6.99 |
| 645U-4C-24D | 200 | 24DC | 4PDT | 9.68 |
| 645U-A-110D | 4000 | 110DC | SPST* | 5.06 |
| 645U-C-110D | 4000 | 110DC | SPDT | 5.81 |
| 645U-2C-110D | 4000 | 110DC | DPDT | 7.69 |
| 645U-4C-110D | 4000 | 110DC | 4PDT | 10.43 |

* Normally open.

Ⓤ Recognized under the Component Program of Underwriters' Laboratories, Inc.

## SERIES 625 PLATE CIRCUIT DC RELAY — 10 AMPERE



L 2"/W 1⅛"/H 2⅛"

Adaptable to voltage operation as well as sensitive plate circuit control installations. Coil impregnated for reliability and longer life. Average power requirement, 0.2 watt. Contacts, fine silver. Contact ratings, 10 amps. Mounting: One 8-32 (NC-2) center hole. Shipping weight, 5.5 oz.

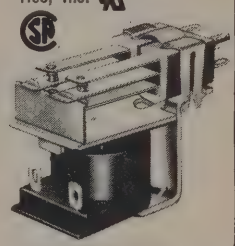
| Guardian No. | Oper. Mils | Coil Res. | Cont. Comb. | Net ea. 1-24 |
|---|---|---|---|---|
| 625-2.5 | 9 MA | 2500 | DPDT | $8.88 |
| 625-5 | 6.3 MA | 5000 | DPDT | 9.41 |
| 625-10 | 4.5 MA | 10,000 | DPDT | 9.94 |

## SERIES 900 - 905 / SERIES 910 - 915 10 AMP RELAY

Series 910 is exactly the same as the 900 relay, both electrically and mechanically, but with 3/16" quick disconnects instead of soldered termination.

DPDT relay. Contacts all rated 10 amps, 120 VAC resistive load. Has molded switches, one-piece mounting clip and return spring; molded bobbin and coil cover. Average shipping weight, 6 oz.

Recognized under the Component Program of Underwriters' Laboratories, Inc. Ⓤ



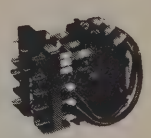
L 2 1/16"/W 1 3/64"/H 2 3/32"

| Guardian No. | Coil Res. | Coil Voltage | Net ea. 1-24 |
|---|---|---|---|
| 900-2C-24A | 24 | 24AC | $2.90 |
| 900-2C-120A | 750 | 120AC | 2.90 |
| 900-2C-240A | 2950 | 240AC | 2.90 |
| 905-2C-6D | 8 | 6DC | 2.90 |
| 905-2C-12D | 32 | 12DC | 2.90 |
| 905-2C-24D | 130 | 24DC | 2.90 |
| 910-2C-24A | 24 | 24AC | 2.90 |
| 910-2C-120A | 750 | 120AC | 2.90 |
| 910-2C-240A | 2950 | 240AC | 2.90 |
| 915-2C-6D | 8 | 6DC | 2.90 |
| 915-2C-12D | 32 | 12DC | 2.90 |
| 915-2C-24D | 130 | 24DC | 2.90 |

## SERIES 1240 - 1245 NEW SMALL, EFFICIENT MEDIUM POWER RELAY — 10 AMPERE

All terminals are solder lug type and molded in phenolic panel block for coils as well as contacts. Barriers in panel block raised to meet U/L over-surface spacing. Contacts rated 10 amps at 60 Hz, 120 VAC, non-inductive load. Mounting: Single mounting hole, 6-32 tap. Shipping weight, 2.5 oz.

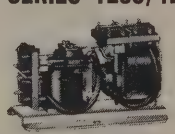
Recognized under the Component Program of Underwriters' Laboratories, Inc. Ⓤ



L 1 45/64"/W 1 1/32"/H 1¼"

| Guardian No. | Coil Res. | Coil Voltage | Cont. Comb. | Net ea. 1-24 |
|---|---|---|---|---|
| 1240-2C-6A | 2.4 | 6AC | DPDT | $5.35 |
| 1240-3C-6A | 2.8 | 6AC | 3PDT | 6.06 |
| 1240-2C-24A | 59 | 24AC | DPDT | 5.35 |
| 1240-3C-24A | 50 | 24AC | 3PDT | 6.06 |
| 1240-2C-120A | 1190 | 120AC | DPDT | 5.35 |
| 1240-3C-120A | 1000 | 120AC | 3PDT | 6.06 |
| 1240-2C-240A | 5340 | 240AC | DPDT | 5.59 |
| 1240-3C-240A | 4750 | 240AC | 3PDT | 6.33 |
| 1245-2C-6D | 18 | 6DC | DPDT | 5.31 |
| 1245-3C-6D | 18 | 6DC | 3PDT | 5.99 |
| 1245-2C-12D | 75 | 12DC | DPDT | 5.31 |
| 1245-3C-12D | 75 | 12DC | 3PDT | 5.99 |
| 1245-2C-24D | 300 | 24DC | DPDT | 5.31 |
| 1245-3C-24D | 300 | 24DC | 3PDT | 5.99 |
| 1245-2C-110D | 6500 | 110DC | DPDT | 6.02 |
| 1245-3C-110D | 6500 | 110DC | 3PDT | 6.33 |

## INTERLOCK RELAYS
## SERIES 1200/1200 / SERIES 1200/1200UB



L 2⅞"/W 1¾"/H 1⅞"

Two interlocking AC relays. Used to maintain circuits continuously without coil power consumption. Units are electrically pulse operated with mechanical hold and electrical release. Contacts rated for 10 amps, at 60 Hz, 120 VAC, non-inductive load. Coil resistance is 1,100 ohms. Shipping weight, 5.5 oz.

L 2 31/32"/W 1 1/16"/H 1⅞"

| Guardian No. | Cont. Comb. | Coil Vltg. | Net ea. 1-24 |
|---|---|---|---|
| 1200/1200-4C-120A | 4PDT | 120AC | $15.54 |
| 1200/1200UB-4C-120 | 4PDT | 120AC | 15.54 |

# GUARDIAN® OPEN RELAYS

## SERIES 2600U - 2605U

**25 AMPERE POWER RELAY / REPLACES SERIES 2100-2105 AND SERIES 2300-2305**

Power relays with double pole double throw contacts rated at 25 amps. Inverted coil construction protects armature and contacts from inadvertent mechanical damage or electrical shorting. Series 2600U-DPDT AC coils are rated for continuous duty. Operating power requirements are 9 volt amps AC and 3.6 watts DC. Series 2600U and 2605U have easily accessible screw type terminals as pictured; also available are ¼ AMP QC as pictured on Series 2620U and 2625U. (Purchase 2600-QC terminal kit for easy "do-it-yourself" conversion.) "Press to Test" armature lever makes for convenient manual circuit testing. Recessed SPDT auxiliary switch as illustrated is not included but is simple to mount and may be purchased separately if needed; auxiliary switch has solder lug blade tails and is rated for 10 amp operation. These new 25 amp power relays are very compact with a shipping weight of only 8 oz. For mounting there are two .196" diameter holes in the base; these are located on 1⅞" centers.

Recognized under the Component Program of Underwriters' Laboratories, Inc.

L 3⅝"/W 2½"/H 2⅛"

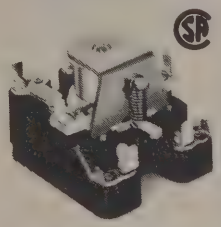
| Guardian No. | Volts | Net ea. 1-24 |
|---|---|---|
| 2600U-DPDT-24A | 24AC | $12.39 |
| 2600U-DPDT-120A | 120AC | 12.39 |
| 2600U-DPDT-240A | 240AC | 12.76 |
| 2605U-DPDT-12D | 12DC | 12.39 |
| 2605U-DPDT-24D | 24DC | 12.39 |
| 2605U-DPDT-110D | 110DC | 12.76 |

## SERIES 2620U - 2625U

**25 AMPERE POWER RELAY / REPLACES SERIES 2110-2115**

Compatible line of power relays with double pole single throw contacts (normally open). Same inverted coil construction as for 2600U and 2605U. Important note: Series 2620U and 2625U are manufactured with the easily accessible screw type terminals as pictured on Series 2600U and 2605U. The ¼ AMP QC terminals pictured here are available in the 2600U-QC terminal kit for easy "do-it-yourself" installation. Same "Press to Test" armature lever as for 2600U and 2605U. Auxiliary switch may be added if desired. Overall dimensions, shipping weight and mounting provisions are identical to the compatible DPDT units of the 2600U and 2605U Series.

Recognized under the Component Program of Underwriters' Laboratories, Inc.



L 3⅝"/W 2½"/H 2⅛"

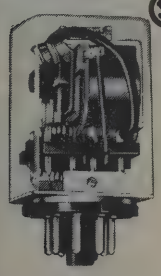
| Guardian No. | Volts | Net ea. 1-24 |
|---|---|---|
| 2620U-DPST-24A | 24AC | $11.76 |
| 2620U-DPST-120A | 120AC | 11.76 |
| 2620U-DPST-240A | 240AC | 12.11 |
| 2625U-DPST-12D | 12DC | 11.76 |
| 2625U-DPST-24D | 24DC | 11.76 |
| 2625U-DPST-110D | 110DC | 12.11 |
| 2600U-SPDT-Aux.-SW | — | 2.28 |
| 2600U-QC. Terminal Kit | — | 1.06 |

# ENCLOSED RELAYS

## SERIES 1210 - 1215 ENCLOSED PLUG-IN RELAY — 10 AMPERE

Relay available with 8 pin octal plug for DPDT and 11 pin for 3PDT. Contacts rated for 10 amps at 60 Hz, 120 VAC non-inductive load. Shipping weight, 3.5 oz.

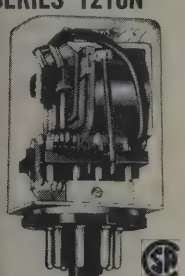
Recognized under the Component Program of Underwriters' Laboratories, Inc.



L 2⅛"/W 1⅜"/H 1⅜"

| Guardian No. | Coil Mils | Coil Res. | Cont. Comb. | Net ea. 1-24 |
|---|---|---|---|---|
| 1215-2C-2.5 | 10 MA | 2500 | DPDT | $ 9.35 |
| 1215-3C-2.5 | 12 MA | 2500 | 3PDT | 10.94 |
| 1215-2C-5 | 7.2 MA | 5000 | DPDT | 9.51 |
| 1215-3C-5 | 8.5 MA | 5000 | 3PDT | 11.31 |
| 1215-2C-10 | 5 MA | 10,000 | DPDT | 9.79 |
| 1215-3C-10 | 6 MA | 10,000 | 3PDT | 11.69 |
| 1210-2C-6A | 6AC | 3.3 | DPDT | 8.71 |
| 1210-3C-6A | 6AC | 3.3 | 3PDT | 10.52 |
| 1210-2C-24A | 24AC | 54 | DPDT | 8.71 |
| 1210-3C-24A | 24AC | 54 | 3PDT | 10.52 |
| 1210-2C-120A | 120AC | 1100 | DPDT | 8.71 |
| 1210-3C-120A | 120AC | 1100 | 3PDT | 10.52 |
| 1210-2C-240A | 240AC | 5000 | DPDT | 9.18 |
| 1210-3C-240A | 240AC | 5000 | 3PDT | 10.88 |
| 1215-2C-6D | 6DC | 18 | DPDT | 8.71 |
| 1215-3C-6D | 6DC | 18 | 3PDT | 10.52 |
| 1215-2C-12D | 12DC | 75 | DPDT | 8.71 |
| 1215-3C-12D | 12DC | 75 | 3PDT | 10.52 |
| 1215-2C-24D | 24DC | 300 | DPDT | 8.71 |
| 1215-3C-24D | 24DC | 300 | 3PDT | 10.52 |
| 1215-2C-110D | 110DC | 6500 | DPDT | 9.26 |
| 1215-3C-110D | 110DC | 6500 | 3PDT | 11.21 |

## SERIES 1210N



L 2⅜"/W 1⅜"/H ⅜"

**ENCLOSED PLUG-IN AC RELAY WITH BUILT-IN NEON LAMP TO INDICATE CIRCUIT FAULTS — 10 AMPERE**

This plug-in relay utilizes a miniature neon lamp connected across coil terminals. The lamp lights each time the coil is energized, or indicates a circuit fault when lamp is "dark." Available with 8 pin octal plug for DPDT and 11 pin for 3PDT. Contacts rated 10 amps at 120 VAC, 60 Hz, non-inductive load. Shipping weight, 3.5 oz.

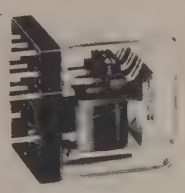
| Guardian No. | Coil Voltage | Coil Res. | Cont. Comb. | Net ea. 1-24 |
|---|---|---|---|---|
| 1210N-2C-120A | 120AC | 1100 | DPDT | $10.11 |
| 1210N-3C-120A | 120AC | 1100 | 3PDT | 11.99 |

(5 amps only)

Recognized under the Component Program of Underwriters' Laboratories, Inc.

## SERIES 1220 AC - 1225 DC

Series use the terminal panel itself as the male plug. "UNI-GUARD" continuous-loop moving blades eliminates soldered connections. Cover snap-locks in place with flush fit that guards against shorting. Universal terminals function as solder-lug, .110" quick connect, or socket plug-in. Mounting bracket for above chassis installation included with each relay. Contacts will safely switch 10 amps at 120 VAC non-inductive in most applications and are U/L approved at 7 amps.



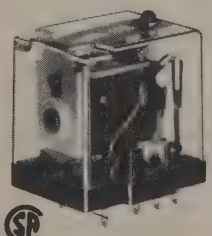
L 1¾"/W 1³⁷⁄₆₄"/H ⁴⁵⁄₆₄"

Recognized under the Program of Underwriters' Laboratories, Inc.

| Guardian No. | Coil Vltg. | Coil Res. | Cont. Comb. | Net ea. 1-24 |
|---|---|---|---|---|
| 1220-2C-24A | 24AC | 54 | DPDT | $6.83 |
| 1220-2C-120A | 120AC | 1110 | DPDT | 7.85 |
| 1220-2C-240A | 240AC | 5000 | DPDT | 7.20 |
| 1220-3C-24A | 24AC | 54 | 3PDT | 8.22 |
| 1220-3C-120A | 120AC | 1110 | 3PDT | 7.63 |
| 1220-3C-240A | 240AC | 5000 | 3PDT | 8.65 |
| 1225-2C-6D | 6DC | 18 | DPDT | 6.56 |
| 1225-2C-12D | 12DC | 75 | DPDT | 7.53 |
| 1224-2C-24D | 24DC | 300 | DPDT | 6.61 |
| 1225-2C-110D | 110DC | 6500 | DPDT | 7.58 |
| 1225-3C-6D | 6DC | 18 | 3PDT | 6.72 |
| 1225-3C-12D | 12DC | 75 | 3PDT | 7.74 |
| 1225-3C-24D | 24DC | 300 | 3PDT | 7.42 |
| 1225-3C-110D | 110DC | 6500 | 3PDT | 8.44 |

## SERIES 1220M AC - 1225M DC MANUAL RESET RELAY

Series 1220 AC and 1225 DC are obtainable off-the-shelf in a manual reset version. Unit is built to meet U/L requirements. Double pole double throw contacts transfer when coil is energized, locking in the transferred position without further coil energy. Lock is released and contacts re-transfer only when manual reset button is pressed.

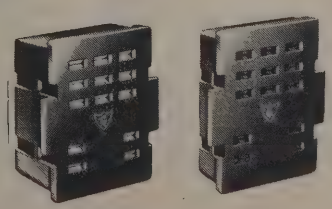


L ⁴⁵⁄₆₄"/W 1⁷⁄₆₄"/H ¾"

| Guardian No. | Coil Vltg. | Coil Res. | Cont. Comb. | Net ea. 1-24 |
|---|---|---|---|---|
| 1220M-2C-24A | 24A | 54 | DPDT | $10.48 |
| 1220M-2C-120A | 120A | 1110 | DPDT | 10.54 |
| 1225M-2C-24D | 24D | 300 | DPDT | 10.32 |

Recognized under the Component Program of Underwriters' Laboratories, Inc.

## 1220 SOCKETS



L 1⅝"/W ⅞"/H ³¹⁄₃₂"

L 1⅝"/W ½"/ H 1³¹⁄₃₂"

**1-24 NET: $1.40 EA. — 25 AND UP NET: $1.18**

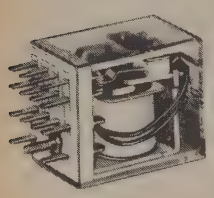
The 1220 snap-in socket has U/L component recognition when used with Guardian Relays. Socket terminal lugs can be soldered to or will accept AMP Series 110 quick connects.

# GUARDIAN® ENCLOSED RELAYS

## SERIES 1310 - 1315 LONG LIFE 4PDT, 5 AMPERE — MINIATURE RELAY

4PDT — 5 amp Plug-in Relay available AC or DC. Contacts rated 5 amps at 30 VDC or 120 VDC resistive. Life in excess of 100 million operations. Weight: 1⅛ oz.

Recognized under the Component Program of Underwriters Laboratories, Inc.



L 1 11/32"/W 5 5/64"/H 1 7/64"

| Guardian No. | Coil Voltage | Net ea. 1-24 |
|---|---|---|
| 1310-4C-6A | 6AC | $5.68 |
| 1310-4C-12A | 12AC | 5.68 |
| 1310-4C-24A | 24AC | 5.68 |
| 1310-4C-120A | 120AC | 5.94 |
| 1315-4C-6D | 6DC | 5.74 |
| 1315-4C-12D | 12DC | 5.74 |
| 1315-4C-24D | 24DC | 5.74 |
| 1315-4C-48D | 48DC | 6.26 |
| 1315-4C-90D | 90DC | 6.26 |
| 1315-4C-110D | 110DC | 6.26 |

## SERIES1310P - 1315P

**MINIATURE RELAY WITH PRINTED CIRCUIT TERMINATION**

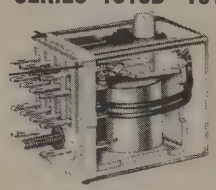
4PDT — 5 amp Printed Circuit Relay available AC or DC. Contacts rated 5 amps at 30 VDC or 120 VAC resistive. Life in excess of 100 million operations. Weight: 1⅛ oz.

Recognized under the Component Program of Underwriters' Laboratories, Inc.

L 1 11/32"/W 5 5/64"/H 7/64"

| Guardian No. | Coil Voltage | Net ea. 1-24 |
|---|---|---|
| 1310P-4C-6A | 6AC | $5.78 |
| 1310P-4C-12A | 12AC | 5.78 |
| 1310P-4C-24A | 24AC | 5.78 |
| 1310P-4C-120A | 120AC | 6.04 |
| 1315P-4C-6D | 6DC | 5.84 |
| 1315P-4C-12D | 12DC | 5.84 |
| 1315P-4C-24D | 24DC | 5.84 |
| 1315P-4C-48D | 48DC | 6.36 |
| 1315P-4C-90D | 90DC | 6.36 |
| 1315P-4C-110D | 110DC | 6.36 |

## SERIES 1310B - 1315B PUSH-TO-TEST RELAY

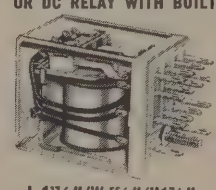


L 1 1/32"/W 5 5/64"/H 1 7/64"

4PDT, 5 amp miniature relay is equipped with a readily accessible, insulated button which provides for checking relay and circuit performance without applying voltage to the relay coil. Weight: 1⅛ oz.

| Guardian No. | Coil Voltage | Net ea. 1-24 |
|---|---|---|
| 1310B-4C-120A | 120AC | $6.97 |
| 1315B-4C-24D | 24DC | 5.90 |
| 1315B-4C-110D | 110DC | 6.55 |

## SERIES 1310N - 1315N ENCLOSED, LONG LIFE MINIATURE PLUG-IN AC OR DC RELAY WITH BUILT-IN NEON LAMP TO INDICATE CIRCUIT FAULTS



L 1 11/32"/W 5 5/64"/H 1 7/64"

Relay is 4PDT with 120 VAC operating coil. Contacts rated at 5 amps at 30 VDC or 120 resistive. Weight: 1⅛ oz.

| Guardian No. | Coil Voltage | Cont. Comb. | Net ea. 1-24 |
|---|---|---|---|
| 1310N-4C-120A | 120AC | 4PDT | $7.67 |
| 1315N-4C-24D | 24DC | 4PDT | 6.48 |
| 1315N-4C-110D | 110DC | 4PDT | 7.21 |

## SERIES 1310 SOCKET

L 1.345"/W .750"/H 1.550"

L ¾"/W 2 1/32"/H 1 5/32"

1310-1 ST Series Relay Socket (Solder Terminals) ..... $ .85 ea.
1310-2 PC Series Relay Socket (Printed Circuit) ..... $ .85 ea.
1310-4 WW Series Relay Socket (Wire Wrap Terminals) ..... $1.69 ea.

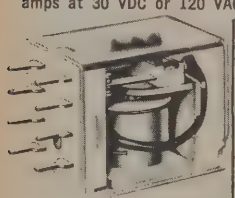
Panel cutout for sockets should measure 1.015" x .858" with 0.25" radii at all four corners.

# MINIATURE ENCLOSED RELAYS

## SERIES 1330P - 1335P

**COMPACT, LOW COST MINIATURE RELAY WITH PRINTED CIRCUIT TERMINATION**

DPDT . . . 5 amp Printed Circuit Relay available AC or DC. Contacts rated 5 amps at 30 VDC or 120 VAC resistive. Weight: ¾ oz.



L 1 3/32"/W ¾"/H 57/64"

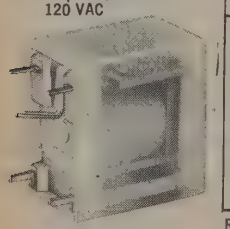
| Guardian No. | Coil Voltage | Coil Res. | Net ea. 1-24 |
|---|---|---|---|
| 1330P-2C-6A | 6AC | 15 | $4.44 |
| 1330P-2C-12A | 12AC | 50 | 4.44 |
| 1330-2C-24A | 24AC | 245 | 4.44 |
| 1330P-2C-120A | 120AC | 5400 | 4.54 |
| 1335P-2C-6D | 6DC | 30 | 4.34 |
| 1335P-2C-12D | 12DC | 125 | 4.34 |
| 1335P-2C-24D | 24DC | 500 | 4.34 |

Recognized under the Component Program of Underwriters' Laboratories, Inc.

## SERIES 1345 10 AMP RELAY IN YOUR CHOICE OF SPST-NO, SPST-NC, SPDT

10 amps resistive at 12 VDC
5 amps resistive at 30 VDC
3.5 amps resistive at 120 VAC

Heat resistant nylon cover. Weight: 1 oz.



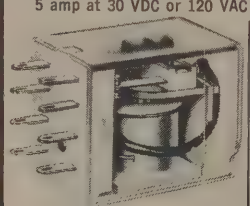
L 1.188"/W .766"/H1.22"

| Guardian No. | Coil Vltg. | Coil Res. | Cont. Comb. | Net ea. 1-24 |
|---|---|---|---|---|
| 1345-1A-6D | 6DC | 350 | SPST-NO | $2.60 |
| 1345-1A-12D | 12DC | 1400 | SPST-NO | 2.60 |
| 1345-1A-24D | 24DC | 5600 | SPST-NO | 2.82 |
| 1345-1B-6D | 6DC | 350 | SPST-NC | 2.60 |
| 1345-1B-12D | 12DC | 1400 | SPST-NC | 2.60 |
| 1345-1B-24D | 24DC | 5600 | SPST-NC | 2.82 |
| 1345-1C-6D | 6DC | 350 | SPDT | 2.94 |
| 1345-1C-12D | 12DC | 1400 | SPDT | 2.94 |
| 1345-1C-24D | 24DC | 5600 | SPDT | 3.20 |

Recognized under the Component Program of Underwriters' Laboratories, Inc.

## SERIES 1330 - 1335 LOW COST DPDT PLUG-IN RELAYS FOR LARGE CONTROL CAPACITY IN A SMALL SIZE

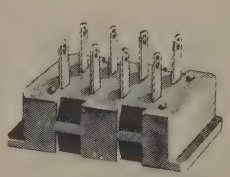
Compact new DPDT . . . 5 amp Plug-In Relay available AC or DC. Contacts rated 5 amp at 30 VDC or 120 VAC resistive. Heat resistant Lexan cover. Weight: ¾ oz.



L 1 3/32"/W ¾"/H 37/64"

| Guardian No. | Coil Voltage | Coil Res. | Net ea. 1-24 |
|---|---|---|---|
| 1330-2C-6A | 6AC | 15 | $4.34 |
| 1330-2C-12A | 12AC | 50 | 4.34 |
| 1330-2C-24A | 24AC | 245 | 4.34 |
| 1330-2C-120A | 120AC | 5400 | 4.44 |
| 1335-2C-6D | 6DC | 30 | 4.24 |
| 1335-2C-12D | 12DC | 125 | 4.24 |
| 1335-2C-24D | 24DC | 500 | 4.24 |

Recognized under the Component Program of Underwriters' Laboratories, Inc.



L ¾"/W 1 1/32"/H 1 1/16"

## SERIES 1330 SOCKETS

Panel cutout for socket should measure .759" x .830" with .025" radii at all four corners. Recommended for .031" to .062" thick chassis.

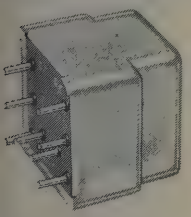
1330-1 ST Series Relay Socket (Solder Terminals) ..... $ .69 ea.
1330-2 PC Series Relay Socket (Printed Circuit) ..... $ .69 ea.

# GUARDIAN®

# ENCLOSED RELAYS

## SERIES 1360PC - 1365PC PRINTED CIRCUIT RELAYS—DPDT SWITCHING

For low power solid state circuitry. .060″ dia. terminals on .1″ grid spacing for standard printed circuit board. Solders right on PC board or use mating socket. 1 watt normal power . . . 3500 ohms coil resistance (120 VAC-60 Hz). Mechanical life in excess of 10 million operations. 5 amp resistive 120 VAC 60 Hz contact rating. DPDT switching. Weight: 1 oz.



L 1″/W 1 3/32″/H 1 1/16″

| Guardian No. | Coil Voltage | Net ea. 1-24 |
|---|---|---|
| 1360PC-2C-24A | 24AC | $670 |
| 1360PC-2C-120A | 120AC | 6.84 |
| 1365PC-2C-6D | 6DC | 6.00 |
| 1365PC-2C-12D | 12DC | 6.00 |
| 1365PC-2C-24D | 24DC | 6.00 |

Also available in SPDT and SPST configurations on special order.

Recognized under the Component Program of Underwriters' Laboratories, Inc. UL

## SERIES 1360 SOCKET

Panel cutout for socket should measure 1.265″ x 1.078″ with .015″ radii at all four corners. .062″ chassis thickness recommended.

1360-1 ..... $ .87 ea.

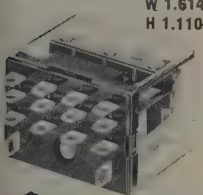
Recognized under the Component Program of Underwriters' Laboratories, Inc. UL

L 1 1/16″ App./W 1 1/4″ App./H 1 1/4″ App.

## SERIES 1380 - 1385 4PDT, 13 AMP RELAY IN A SMALL LOW COST PACKAGE

Mechanical life: 100 million operations. Electrical life: 100,000 operations minimum at 120V 60 Hz. Dual type (solder lug or 3/16″ QC) termination. Silver cadmium oxide contacts. Rated 13 amps resistive at 30 VDC or 120V 60 Hz; 1/3 HP at 120V 60 Hz.

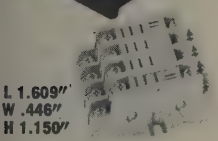
L 1.381″
W 1.614″
H 1.110″



L 2.047″
W 2.126″
H .886″

| Guardian No. | Coil Voltage | Coil Res. | Net ea. 1-24 |
|---|---|---|---|
| 1380-4C-6A | 6AC | 5.5 | $ 9.78 |
| 1380-4C-12A | 12AC | 20 | 9.78 |
| 1380-4C-24A | 24AC | 80 | 9.78 |
| 1380-4C-120A | 120AC | 2500 | 10.22 |
| 1385-4C-6D | 6DC | 25 | 9.02 |
| 1385-4C-12D | 12DC | 100 | 9.02 |
| 1385-4C-24D | 24DC | 350 | 9.02 |
| 1385-4C-90D | 90DC | 5000 | 9.68 |
| 1385-4C-110D | 110DC | 7000 | 9.68 |

## SERIES 1380 SOCKETS



L 1.609″
W .446″
H 1.150″

Panel mount for sockets should measure 1.625″ x 1.000″.

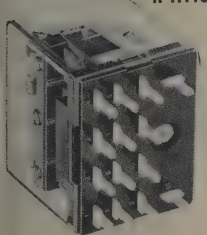
1380-1 ST Series Relay Socket (Solder Lug Terminals) ..... $1.80 ea.

1380-2 PC Series Relay Socket (Printed Circuit) ..... $1.85 ea.

1380-5 SM Series Relay Socket (Screw Mount) ..... $4.90 ea.

## SERIES 1380P - 1385P 4 PDT, 13 AMP RELAY WITH PRINTED CIRCUIT TERMINATION

L 1.614″/
W .831″/
H 1.110″

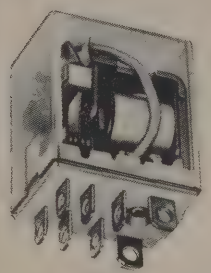


| Guardian No. | Coil Voltage | Coil Res. | Net ea. 1-24 |
|---|---|---|---|
| 1380P-4C-6A | 6AC | 5.5 | $9.88 |
| 1380P-4C-12A | 12AC | 20 | 9.88 |
| 1380P-4C-24A | 24AC | 80 | 9.88 |
| 1380P-4C-48A | 48AC | 350 | 10.32 |
| 1380P-4C-120A | 120AC | 2500 | 10.32 |
| 1385P-4C-6D | 6DC | 25 | 9.12 |
| 1385P-4C-12D | 12DC | 100 | 9.12 |
| 1385P-4C-24D | 24DC | 350 | 9.12 |
| 1385P-4C-90D | 90DC | 5000 | 9.82 |
| 1385P-4C-110D | 110DC | 7000 | 9.82 |

## SERIES 1390 - 1395 SPACE-SAVING, COMPACT DPDT, 13 AMP RELAY

Rugged construction, with mechanical life of 100 million operations and 100,000 operations minimum at rated loads. Contacts rated 13 amps at 30 VDC or resistive; 1/3 hp at 120 VAC. Heat resistant Lexan cover. Weight: 1.25 oz.

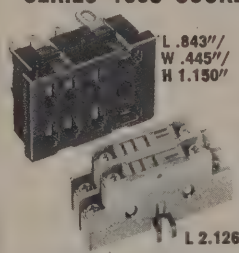
Recognized under the Component Program of Underwriters' Laboratories, Inc.



L 1.381″/W.831″/H 1.110″

| Guardian No. | Coil Voltage | Coil Res. | Net ea. 1-24 |
|---|---|---|---|
| 1390-2C-6A | 6AC | 10 | $5.72 |
| 1390-2C-12A | 12AC | 45 | 5.72 |
| 1390-2C-24A | 24AC | 160 | 5.72 |
| 1390-2C-48A | 48AC | 670 | 6.04 |
| 1390-2C-120A | 120AC | 3900 | 6.04 |
| 1390-2C-6D | 6DC | 40 | 5.52 |
| 1390-2C-12D | 12DC | 160 | 5.52 |
| 1390-2C-24D | 24DC | 650 | 5.52 |
| 1390-2C-90D | 90DC | 9000 | 6.32 |
| 1390-2C-110D | 110DC | 11000 | 6.32 |

## SERIES 1390 SOCKET



L .843″/
W .445″/
H 1.150″

L 2.126″/W 2.047″/H .886

1390-1 ST Socket accepts AMP Series .187 quick connects 1390-2 PC Socket with printed circuit terminals. Panel cutout for socket should measure .858″ x 1.015″ with .025″ radii at all four corners. Chassis thickness of .031″ to .062″ recommended.

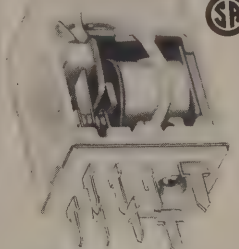
1390-1 ST Series Relay Socket (Solder Terminal) ..... $ .85 ea.

1390-2 PC Series Relay Socket (Printed Circuit) ..... $ .85 ea.

1390-5 SM Series Relay Socket (Screw Mount) ..... $3.45 ea.

## SERIES 1390P - 1395P COMPACT DPDT, 13 AMP RELAY WITH PRINTED CIRCUIT TERMINATION

Printed circuit relay available AC or DC. Contacts rated 13 amps at 28 VDC or 130 VAC resistive; 7.5 amps at 120 VAC inductive; 1/3 hp at 120 VAC. Heat resistant Lexan cover. Weight: 1.25 oz.



L 1.381″/W.831″/H 1.110″

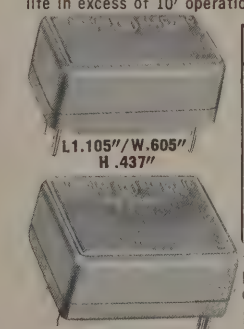
| Guardian No. | Coil Voltage | Coil Res. | Net ea. 1-24 |
|---|---|---|---|
| 1390P-2C-6A | 6AC | 10 | $5.82 |
| 1390P-2C-12A | 12AC | 45 | 5.82 |
| 1390P-2C-24A | 24AC | 160 | 5.82 |
| 1390P-2C-48A | 48AC | 670 | 6.14 |
| 1390P-2C-120A | 120AC | 3900 | 6.14 |
| 1395P-2C-6D | 6DC | 40 | 5.62 |
| 1395P-2C-12D | 12DC | 160 | 5.62 |
| 1395P-2C-24D | 24DC | 650 | 5.62 |
| 1395P-2C-90D | 90DC | 9000 | 6.42 |
| 1395P-2C-110D | 110DC | 11000 | 6.42 |

Recognized under the Component Program of Underwriters' Laboratories, Inc. UL

## SERIES 1475

**LOW PROFILE ELECTROMECHANICAL RELAY IN A CHOICE OF SPDT OR DPDT**

PC terminals on .1″ grid spacing. Sealed thermoset housing and cover construction. Contacts rated 5 amps at 6 and 12 VDC; 3 amps at 24 and 28 VDC; 5 amps at 6, 12 and 24 VAC ; 1.5 amps at 120 VAC. (AC loads are resistive.) Mechanical life in excess of 10′ operations. Weight: 10 grams SPDT; 14 grams DPDT.



L1.105″/W.605″
H .437″

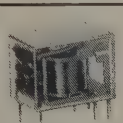
L 1.105″/W.905″/H .437″

| Guardian No. | Coil Voltage | Coil Res. | Cont. Comb. | Net ea. 1-24 |
|---|---|---|---|---|
| 1475-1C-5D | 5DC | 44 | SPDT | $3.80 |
| 1475-1C-6D | 6DC | 70 | SPDT | 3.80 |
| 1475-1C-12D | 12DC | 288 | SPDT | 3.80 |
| 1475-1C-24D | 24DC | 1152 | SPDT | 3.96 |
| 1475-2C-5D | 5DC | 415 | DPDT | 4.51 |
| 1475-2C-6D | 6DC | 60 | DPDT | 4.51 |
| 1475-2C-12D | 12DC | 240 | DPDT | 4.51 |
| 1475-2C-24D | 24DC | 960 | DPDT | 4.62 |

Recognized under the Component Program of Underwriters' Laboratories, Inc. UL

## SERIES 1505 RELAY THE SMALLEST, NEWEST RELAY OF THEM ALL IS SPDT, DC, RATED 1 AMP RESISTIVE

Terminals mount directly to PC board. Mechanical life: 5 million operations min. Electrical life: 50,000 min. at 30 VDC. 1 amp. Silver contacts are rated 1 amp resistive at 30 VDC; 0.5 amp resistive at 100 VAC. Power: 0.45 watts at nominal voltage and 25°C. Weight: 3.5 grams.



L .433″/W .590″/H .394″

| Guardian No. | Coil Voltage | Coil Res. | Net ea. 1-24 |
|---|---|---|---|
| 1505-1C-3D | 3DC | 21 | $2.20 |
| 1505-1C-6D | 6DC | 84 | 2.20 |
| 1505-1C-12D | 12DC | 333 | 2.20 |
| 1505-1C-24D | 24DC | 1330 | 2.24 |

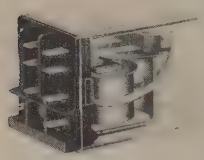
# GUARDIAN®

# ENCLOSED RELAYS

## SERIES 1510-1515

**INDUSTRIAL TYPE GENERAL PURPOSE ENCLOSED RELAYS IN CHOICE OF SPDT, DPDT, 3PDT, 12 AMP**

12 amp general purpose relays with .187" quick connect/solder lug termination. Contacts are silver-cadmium-oxide rated 12 amps at 30 VDC or 240 VAC resistive. Electrical life: 100,000 operations minimum at rated load. Approximate weight: 3 oz.



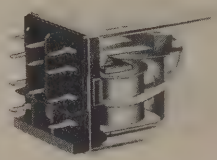
L 1.906"/W 1.531"/H 1.406"

| Guardian No. | Coil Voltage | Coil Res. | Cont. Comb. | Net ea. 1-24 |
|---|---|---|---|---|
| 1510-1C-6A | 6AC | 6 | SPDT | $5.56 |
| 1510-1C-12A | 12AC | 21 | SPDT | 5.56 |
| 1510-1C-24A | 24AC | 85 | SPDT | 5.56 |
| 1510-1C-48A | 48AC | 340 | SPDT | 5.86 |
| 1510-1C-120A | 120AC | 2250 | SPDT | 5.86 |
| 1515-1C-6D | 6DC | 32 | SPDT | 5.44 |
| 1515-1C-12D | 12DC | 120 | SPDT | 5.44 |
| 1515-1C-24D | 24DC | 472 | SPDT | 5.44 |
| 1515-1C-90D | 90DC | 6800 | SPDT | 6.02 |
| 1515-1C-110D | 110DC | 10000 | SPDT | 6.02 |
| 1510-2C-6A | 6AC | 6 | DPDT | 6.26 |
| 1510-2C-12A | 12AC | 21 | DPDT | 6.26 |
| 1510-2C-24A | 24AC | 85 | DPDT | 6.26 |
| 1510-2C-48A | 48AC | 340 | DPDT | 6.60 |
| 1510-2C-120A | 120AC | 2250 | DPDT | 6.60 |
| 1515-2C-6D | 6DC | 32 | DPDT | 6.30 |
| 1515-2C-12D | 12DC | 120 | DPDT | 6.30 |
| 1515-2C-24D | 24DC | 472 | DPDT | 6.30 |
| 1515-2C-90D | 90DC | 6800 | DPDT | 6.84 |
| 1515-2C-110D | 110DC | 10000 | DPDT | 6.84 |
| 1510-3C-6A | 6AC | 4.2 | 3PDT | 7.10 |
| 1510-3C-12A | 12AC | 18 | 3PDT | 7.10 |
| 1510-3C-24A | 24AC | 72 | 3PDT | 7.10 |
| 1510-3C-48A | 48AC | 288 | 3PDT | 7.24 |
| 1510-3C-120A | 120AC | 1700 | 3PDT | 7.24 |
| 1515-3C-6D | 6DC | 32 | 3PDT | 6.94 |
| 1515-3C-12D | 12DC | 120 | 3PDT | 6.94 |
| 1515-3C-24D | 24DC | 472 | 3PDT | 6.94 |
| 1515-3C-90D | 90DC | 6800 | 3PDT | 7.56 |
| 1515-3C-110D | 110DC | 10000 | 3PDT | 7.56 |

## SERIES 1510P-1515P

**INDUSTRIAL TYPE GENERAL PURPOSE ENCLOSED RELAYS WITH PRINTED CIRCUIT TERMINATION**

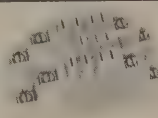
12 amp general purpose relays with printed circuit termination. Identical in all other respects to 1510-1515 relay described above.



L 1.906"/W 1.531"/H 1.406"

| Guardian No. | Coil Voltage | Coil Res. | Cont. Comb. | Net ea. 1-24 |
|---|---|---|---|---|
| 1510P-1C-6A | 6AC | 6 | SPDT | $5.64 |
| 1510P-1C-12A | 12AC | 21 | SPDT | 5.64 |
| 1510P-1C-24A | 24AC | 85 | SPDT | 5.64 |
| 1510P-1C-48A | 48AC | 340 | SPDT | 5.94 |
| 1510P-1C-120A | 120AC | 2250 | SPDT | 5.94 |
| 1515P-1C-6D | 6DC | 32 | SPDT | 5.52 |
| 1515P-1C-12D | 12DC | 120 | SPDT | 5.52 |
| 1515P-1C-24D | 24DC | 472 | SPDT | 5.52 |
| 1515P-1C-90D | 90DC | 6800 | SPDT | 6.10 |
| 1515P-1C-110D | 110DC | 10000 | SPDT | 6.10 |
| 1510P-2C-6A | 6AC | 6 | DPDT | 6.34 |
| 1510P-2C-12A | 12AC | 21 | DPDT | 6.34 |
| 1510P-2C-24A | 24AC | 85 | DPDT | 6.34 |
| 1510P-2C-48A | 48AC | 340 | DPDT | 6.68 |
| 1510P-2C-120A | 120AC | 2250 | DPDT | 6.68 |
| 1515P-2C-6D | 6DC | 32 | DPDT | 6.38 |
| 1515P-2C-12D | 12DC | 120 | DPDT | 6.38 |
| 1515P-2C-24D | 24DC | 472 | DPDT | 6.38 |
| 1515P-2C-90D | 90DC | 6800 | DPDT | 6.92 |
| 1515P-2C-110D | 110DC | 10000 | DPDT | 6.92 |
| 1510P-3C-6A | 6AC | 4.2 | 3PDT | 7.18 |
| 1510P-3C-12A | 12AC | 18 | 3PDT | 7.18 |
| 1510P-3C-24A | 24AC | 72 | 3PDT | 7.18 |
| 1510P-3C-48A | 48AC | 288 | 3PDT | 7.32 |
| 1510P-3C-120A | 120AC | 1700 | 3PDT | 7.32 |
| 1515P-3C-6D | 6DC | 32 | 3PDT | 7.02 |
| 1515P-3C-12D | 12DC | 120 | 3PDT | 7.02 |
| 1515P-3C-24D | 24DC | 472 | 3PDT | 7.02 |
| 1515P-3C-90D | 90DC | 6800 | 3PDT | 7.64 |
| 1515P-3C-110D | 110DC | 10000 | 3PDT | 7.64 |

L 1.687"/W .875"



L 1.97"/W 3.000"/H .88"

## SERIES 1510 SOCKETS — BASIC SOCKET / SCREW TERMINAL SOCKET

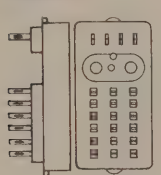
1510-1 ST Series Relay Socket (Solder Terminals) ..... $ .90 ea.

1510-187 QC Series Relay Socket (Quick Connect Terminals) ..... $1.35 ea.

1510-2 PC Series Relay Socket (Printed Circuit) ..... $1.00 ea.

1510-5 SM Series Relay Socket (Screw Terminals) ..... $4.10 ea.

## SERIES 1555 SOCKETS



L 6 Pole 1.437";4 Pole 1.201";
2 Pole .965"/W .748"/H .571"

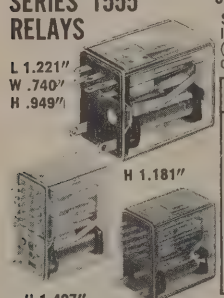
| | Price Each | | |
|---|---|---|---|
| | 2 Pole | 4 Pole | 6 Pole |
| 1555-ST Series Relay Socket (Solder Terminals) | $ .53 | $ .63 | $1.47 |
| 1555-PCG Series Relay Socket (Printed Circuit, 1" Grid) | .53 | .63 | 1.47 |
| 1555-PC Series Relay Socket (Printed Circuit, In Line) | 1.44 | 1.72 | 3.50 |

Recognized under the Component Program of Underwriters' Laboratories, Inc.

## SERIES 1555 RELAYS

**CRADLE TYPE MINIATURE ENCLOSED DC RELAYS**

Single silver contacts for loads up to 2 amps. Solder lug terminals. Choice of 2 Form C (2PDT); 4 Form C (4PDT) or 6 Form C (6PDT). Approximate weight: ¼ oz. DPDT; 1 oz. 4PDT; 1¼ oz. 6PDT.



L 1.221"
W .740"
H .949"

H 1.181"

H 1.407"

| Guardian No. | Coil Voltage | Coil Res. | Cont. Comb. | Net ea. 1-24 |
|---|---|---|---|---|
| 1555-2C-6D | 6DC | 52 | DPDT | $3.94 |
| 1555-2C-12D | 12DC | 185 | DPDT | 3.94 |
| 1555-2C-24D | 24DC | 700 | DPDT | 3.94 |
| 1555-4C-6D | 6DC | 52 | 4PDT | 4.46 |
| 1555-4C-12D | 12DC | 185 | 4PDT | 4.46 |
| 1555-4C-24D | 24DC | 700 | 4PDT | 4.46 |
| 1555-6C-6D | 6DC | 25 | 6PDT | 5.83 |
| 1555-6C-12D | 12DC | 90 | 6PDT | 5.83 |
| 1555-6C-24D | 24DC | 430 | 6PDT | 5.83 |

## SERIES 1555P RELAY — CRADLE TYPE MINIATURE ENCLOSED DC RELAYS WITH PRINTED CIRCUIT TERMINATION

Identical in all respects to 1555 relay described on preceding page only with printed circuit termination.

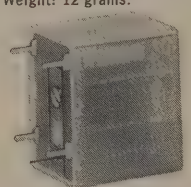
L 1.221"/W .740"/H .949"

| Guardian No. | Coil Voltage | Coil Res. | Cont. Comb. | Net ea. 1-24 |
|---|---|---|---|---|
| 1555P-2C-6D | 60DC | 52 | DPDT | $3.94 |
| 1555P-2C-12D | 12DC | 185 | DPDT | 3.94 |
| 1555P-2C-24D | 24DC | 700 | DPDT | 3.94 |
| 1555P-4C-6D | 6DC | 52 | 4PDT | 4.46 |
| 1555P-4C-12D | 12DC | 185 | 4PDT | 4.46 |
| 1555P-4C-24D | 24DC | 700 | 4PDT | 4.46 |
| 1555P-6C-6D | 6DC | 25 | 6PDT | 5.83 |
| 1555P-6C-12D | 12DC | 90 | 6PDT | 5.83 |
| 1555P-6C-24D | 24DC | 430 | 6PDT | 5.83 |

Recognized under the Component Program of Underwriters' Laboratories, Inc.

## SERIES 1565 RELAY — MINIATURE 3 AMP RELAYS IN CHOICE OF SPDT OR SPST-NO

Terminals mount directly to PC board. Mechanical life: 20,000,000 operations. Electrical life: 200,000 operations at rated load. Molded nylon dust cover. Rated 3 amp at 250V, 60 Hz or 30 VDC resistive. Silver cadmium oxide contacts. Weight: 12 grams.

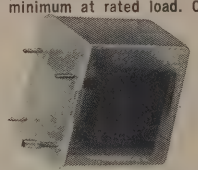


L .810"/W .678"/H 9.70"

| Guardian No. | Coil Vltg. | Coil Res. | Cont. Comb. | Net ea. 1-24 |
|---|---|---|---|---|
| 1565-1A-3D | 3DC | 11 | SPST-NO | $2.18 |
| 1565-1A-6D | 6DC | 45 | SPST-NO | 2.18 |
| 1565-1A-12D | 12DC | 180 | SPST-NO | 2.18 |
| 1565-1A-24D | 24DC | 720 | SPST-NO | 2.21 |
| 1565-1C-3D | 3DC | 11 | SPDT | 2.32 |
| 1565-1C-6D | 6DC | 45 | SPDT | 2.32 |
| 1565-1C-12D | 12DC | 180 | SPDT | 2.32 |
| 1565-1C-24D | 24DC | 720 | SPDT | 2.38 |

## SERIES 1575 RELAY — OUR LOWEST COST MINIATURE 3 AMP ENCLOSED RELAY, SPDT, DC

Terminals mount directly to PC board. Cover and base are sealed together. Expected mechanical life: 1 million operations. Electrical life: 100,000 operations minimum at rated load. Contacts are silver cadmium oxide flashed with gold. Rating is 3 amps at 30 VDC or 120 VAC resistive. Weight: 14 grams.



L 8.66"/W .614"/H .850"

| Guardian No. | Coil Voltage | Coil Res. | Net ea. 1-24 |
|---|---|---|---|
| 1574-1C-6D | 6DC | 100 | $2.02 |
| 1575-1C-12D | 12DC | 400 | 2.02 |
| 1575-1C-24D | 24DC | 1600 | 2.14 |
| 1575-1C-48D | 48DC | 6400 | 2.54 |

## MINI DIP SWITCH — MINI DIP SWITCHES FOR PC BOARDS IN 4-POLE, 6-POLE AND 8-POLE

Mount directly to PC boards to switch circuits. Adaptable to any kind of PC board because of same package dimensions as most IC's. Gold plated terminals and heat resistant plastic material for molded parts. Rated 5 VDC, 100 mA without switching; 5 VDC, 100 mA with switching; 25 VDC, 25 mA with switching. Contact resistance less than 50M at 2 VDC, 10 mA. Electrical life: More than 10,000 switching.

W .378"/H 0.21"
L — DNS 04 — 0.46"
L — DNS 06 — 0.66"
L — DNS 08 — 0.86"

| Guardian No. | No. of Circuits | Plating Thickness (Inches) | Net ea. 1-24 |
|---|---|---|---|
| DNS-04-GF | 4 | 0.1 | $2.20 |
| DNS-04-G1 | 4 | 1.0 | 3.12 |
| DNS-04-G2 | 4 | 2.0 | 3.78 |
| DNS-06-GF | 6 | 0.1 | 2.50 |
| DNS-06-G1 | 6 | 1.0 | 3.76 |
| DNS-06-G2 | 6 | 2.0 | 4.31 |
| DNS-08-GF | 8 | 0.1 | 2.70 |
| DNS-08-G1 | 8 | 1.0 | 4.57 |
| DNS-08-G2 | 8 | 2.0 | 5.21 |

# GUARDIAN®/CALIFORNIA SOLID STATE CONTROLS

On the pages that follow are solid state controls produced by Guardian Electric Manufacturing Company of California, Inc., 4030 West Spencer Street, Torrance, California 90503. Like all Guardian products, these are immediately available from any franchised Guardian Distributor. For additional data, call your Guardian Distributor . . . or Guardian/California at (213) 542-8651.

## PROTECTIVE SENSORS

3-phase (IR-AV2), Close Differential (IR-VS3), Over-Voltage (IR-VS1), Under-Voltage (IR-VS2), 4 wire Phase Sequence (IR-PR1), Adjustable Frequency (IR-FS1) and AC Current Sensors (CS1 Sensor with CT1 XFormer). The relay is 3PDT 10 amps resistive with 24 VDC, 24 VAC or 120 VAC, available. Mounting is by socket, chassis mount or directly into a printed circuit (110). Temperature range is from 0°C to +50°C. Life is 100,000 operations minimum and protection for transient voltage is to 600 volts for the 3 phase model, 2500 volts for all others.

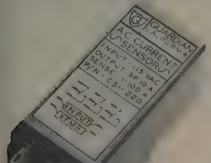
| Guardian No. | Nom. Input | Current Sensing Range | Net ea. |
|---|---|---|---|
| CS1-220 | 90-125 VAC, 50-60 Hz | Time Delay Range 25-500 MS | $36.21 |
| CT1-201 | | .1 to 1A, 50-60 Hz | 12.12 |
| CT1-202 | | 1 to 10A, 50-60 Hz | 17.15 |
| CT1-203 | | 5 to 50A, 50-60 Hz | 17.15 |
| CT1-204 | | 10 to 100A, 50-60 Hz | 17.15 |

| Guardian No. | Nominal Input (VAC, Hz) | Sense Point | Differential | Net ea. |
|---|---|---|---|---|
| AV2-611 | 120, 60 | | | $39.37 |
| AV2-621 | 120, 400 | | | 39.37 |
| VS3-610 | 120, 60 | 105 to 130* | 2.5 to 15* | 61.63 |
| VS3-620 | 120, 400 | 105 to 130* | 2.5 to 15* | 61.63 |
| VS3-300 | 24VDC | 23 to 32† | 1 to 5† | 61.74 |
| VS3-410 | 24, 60 | 23 to 32* | 1 to 5* | 60.82 |
| VS3-420 | 24, 400 | 23 to 32* | 1 to 5* | 60.82 |

* VAC † VDC

L 1.87"/W 1.25"/H 1.00"

| Guardian No. | Nominal Input | Adjustable Voltage Range | Net ea. |
|---|---|---|---|
| VS1-610 | 120VAC, 60Hz | 90 to 130VAC | $48.27 |
| VS1-620 | 120VAC, 400Hz | 90 to 130VAC | 48.27 |
| VS1-300 | 24VDC | 18 to 32VDC | 48.27 |
| VS1-410 | 24VAC, 60Hz | 18 to 32VAC | 47.46 |
| VS1-420 | 24VAC, 400Hz | 18 to 32VAC | 47.46 |
| VS2-610 | 120VAC, 60Hz | 90 to 130VAC | 48.24 |
| VS2-620 | 120VAC, 400Hz | 90 to 130VAC | 48.24 |
| VS2-300 | 24VDC | 18 to 32VDC | 46.95 |
| VS2-410 | 24VAC, 60Hz | 18 to 32VAC | 47.46 |
| VS2-420 | 24VAC, 400Hz | 18 to 32VAC | 47.46 |
| FR1-610 | 120VAC, 60Hz | | 44.00 |
| PR1-620 | 120VAC, 400Hz | | 44.00 |




W 1.58" MAX./H 3.00" MAX.

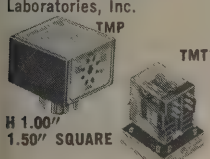
| Guardian No. | Nominal Input | Adjustable Frequency Range | Net ea. |
|---|---|---|---|
| FS1-610 | 120VAC, 60Hz | 45 to 66Hz | $62.08 |
| FS1-620 | 120VAC, 400Hz | 360 to 440Hz | 62.08 |
| FS2-610 | 120VAC, 60Hz | 45 to 66Hz | 62.08 |
| FS2-620 | 120VAC, 400Hz | 360 to 440Hz | 62.08 |

## TMP AND TMT SERIES TIMING MODULES

Series TMP/TMT Time Delay Modules are available in "on operate" and "on release" configurations with two time delays and three standard input voltage ranges. Time delay is externally adjustable within two ranges from ½ to 100 seconds and 100 to 300 seconds. Repeatability is ±1% under normal conditions. Life expectancy is one million cycles. Standard input voltages are 24 VAC, 120 VAC and 24 VDC, TMP is terminated in an octal plug for quick mounting and remote control of relay and other switching devices. The TMT "Flat Pack" package. was designed to accept Guardian relays mounted to it, or to allow stacking of modules for extension of timing periods, or direct installation into a printed circuit board.

Recognized under the Component Program of Underwriters' Laboratories, Inc.

| Guardian No. | Volts | Time Range (Sec.) | Net ea. |
|---|---|---|---|
| TMT-O-100-24D | 24VDC | .5 to 100 | $13.16 |
| TMT-O-300-24D | 24VDC | 100 to 300 | 16.77 |
| TMT-O-100-24A | 24VAC | .5 to 100 | 14.05 |
| TMT-O-300-24A | 24VAC | 100 to 300 | 17.67 |
| TMT-O-100-120A | 120VAC | .5 to 100 | 13.16 |
| TMT-O-300-120A | 120VAC | 100 to 300 | 16.77 |
| TMT-R-100-24D | 24VDC | .5 to 100 | 17.72 |
| TMT-R-300-24D | 24VDC | 100 to 300 | 21.26 |
| TMT-R-100-24A | 24VAC | .5 to 100 | 18.24 |
| TMT-R-300-24A | 24VAC | 100 to 300 | 21.80 |
| TMT-R-100-120A | 120VAC | .5 to 100 | 17.72 |
| TMT-R-300-120A | 120VAC | 100 to 300 | 21.26 |
| TMP-O-100-24D | 24VDC | .5 to 100 | 14.95 |
| TMP-O-300-24D | 24VDC | 100 to 300 | 17.65 |
| TMP-O-100-24A | 24VAC | .5 to 100 | 15.52 |
| TMP-O-300-24A | 24VAC | 100 to 300 | 18.24 |
| TMP-O-100-120A | 120VAC | .5 to 100 | 14.95 |
| TMP-O-300-120A | 120VAC | 100 to 300 | 17.65 |
| TMP-R-100-24D | 24VDC | .5 to 100 | 20.23 |
| TMP-R-300-24D | 24VDC | 100 to 300 | 22.99 |
| TMP-R-100-24A | 24VAC | .5 to 100 | 20.78 |
| TMP-R-300-24A | 24VAC | 100 to 300 | 23.34 |
| TMP-R-100-120A | 120VAC | .5 to 100 | 20.23 |
| TMP-R-300-120A | 120VAC | 100 to 300 | 22.99 |




H 1.00" 1.50" SQUARE

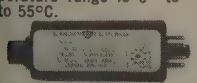
H .63" 2.00" SQUARE

* Relay illustrated with Model TMT not included in TMT prices. Q in part number indicates delay on operate, R delay on release.

## TAP SERIES TIME DELAY

Hybrid time delay incorporating a solid state control circuit with relay contact output. Delay on operate. Contacts transfer at conclusion of timing period initiated upon application of control voltage. Delay adjustment controlled by knob located on top of relay housing. Enclosed in tubular plastic housing terminating in a radio style octal plug. Output contacts rated 5 amp resistive at 120 VAC. Standard operating temperature range is 0° to to 55°C.

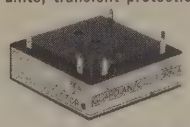
| Guardian No. | Input Voltage | Time Delay (Sec.) | Net ea. |
|---|---|---|---|
| TAP-10 | 24VDC/120VAC | 1 to 10 | $16.88 |
| TAP-50 | 24VDC/120VAC | 5 to 50 | 17.68 |
| TAP-100 | 24VDC/120VAC | 10 to 100 | 17.68 |



L 3.0"/W 1.47"

## VOLTAGE LEVEL DETECTORS

Voltage Level Detector molded modules incorporate circuits comprised of silicon semiconductor devices to form a peak detecting voltage differential amplifier, signal amplifier and a solid state output switch suitable for driving a number of Guardian relays. The unit's sense level is adjustable (either fixed or variable) over ranges of 85-135 VAC, 50-60 Hz, 20-30 VAC, 50-60 Hz, 20-30 VDC, 180-250 VAC, 50-60 Hz by external resistance. This broad adjustment range permits operation as either an under or over level detector. Transient suppressed, they will withstand 2500V peak (short duration) without damage or malfunction. On DC units, transient protection is 600 volts.



L 2.00"/W 2.00"/H .63"

| Guardian No. | Volts | Net ea. |
|---|---|---|
| LDT-100-24A | 24VAC | $16.32 |
| LDT-100-120A | 120VAC | 16.32 |
| LDT-100-230A | 230VAC | 21.17 |
| LDT-100-24D | 24VDC | 16.64 |
| LDP-100-24A | 24VAC | 19.73 |
| LDP-100-120A | 123VAC | 19.73 |
| LDP-100-230A | 230VAC | 24.68 |
| LDP-100-24D | 24VDC | 19.35 |

## HSSR SERIES HYBRID SOLID STATE RELAY

Combines best characteristics of electromechanical and solid state to achieve isolated control with the long life of a triac output switch. Housed in rugged nylon cover with isolated metal mounting base with .250" QC terminals. Completely encapsulated. AC reactive load switching takes place regardless of power factor and arcing of the back EMF is eliminated in inductive loads as the triac turns off at zero current.

| Guardian No. | Must Operate (Volts DC) | Load (Volts AC) | Time Range (Sec.) | Net ea. |
|---|---|---|---|---|
| HSSR-1A-10 | 4.2 | 24-140 | 7 | $13.16 |
| HSSR-1A-20 | 9.5 | 24-140 | 7 | 13.16 |
| HSSR-1A-30 | 21 | 24-140 | 7 | 13.16 |
| HSSR-2A-10 | 4.2 | 24-280 | 7 | 13.64 |
| HSSR-2A-20 | 9.5 | 24-280 | 7 | 13.64 |
| HSSR-2A-30 | 21 | 24-280 | 7 | 13.64 |
| HSSR-1B-10 | 4.2 | 24-140 | 10 | 14.10 |
| HSSR-1B-20 | 9.5 | 24-140 | 10 | 14.10 |
| HSSR-1B-30 | 21 | 24-140 | 10 | 14.10 |
| HSSR-2B-10 | 4.2 | 24-280 | 10 | 14.12 |
| HSSR-2B-20 | 9.5 | 24-280 | 10 | 14.42 |
| HSSR-2B-30 | 21 | 24-280 | 10 | 14.42 |

L 2.64"/W 1.55"/H 1.07"

## SSRT SERIES SOLID STATE TIME DELAY RELAY

Housed in a rugged nylon cover with isolated metal mounting base. Mounts easily and terminates in .250" QC terminals. Control input is logic levels compatible or 24 VDC. Optically coupled for sensitivity and high isolation (1500 VAC min.), this relay features a line synchronized triac output which eliminates arcing and reduces RFI and EMI to a minimum. The synchronous feature reduces in-rush current by as much as 60%, greatly increasing life of tungsten lamps. AC reactive load switching takes place regardless of power factor and arcing of the back EMF is eliminated on inductive loads because the triac turns off at zero current.

| Guardian No. | (Volts DC) Must Operate | Load (Volts AC) | Time Range (Sec.) | Net ea. |
|---|---|---|---|---|
| SSR-1A-10 | 3.5-12 | 24-140 | 7 | $19.18 |
| SSR-1A-20 | 12-32 | 24-140 | 7 | 19.18 |
| SSR-2A-10 | 3.5-12 | 24-280 | 7 | 19.32 |
| SSR-2A-20 | 12-32 | 24-280 | 7 | 19.32 |
| SSR-1B-10 | 3.5-12 | 24-140 | 10 | 19.68 |
| SSR-1B-20 | 12-32 | 24-140 | 10 | 19.68 |
| SSR-2B-10 | 3.5-12 | 24-280 | 10 | 19.94 |
| SSR-2B-20 | 12-32 | 24-280 | 10 | 19.94 |

L 2.64"/W1.55"/H 1.07"

## SSR SERIES SOLID STATE TIME DELAY RELAY

Combines a time delayed DC input stage optically coupled into a line synchronized triac output. Housed in rugged nylon cover with isolated metal base. Mounts easily and terminates in .250" QC terminals. Time delay is adjustable by external resistance. Virtually noise immune and premature timeouts are eliminated. Both EMI and RFI reduced to a minimum while giving extra life to tungsten lamp loads. AC reactive loads are switched regardless of power factor. Arcing of the back EMI eliminated because the triac turns off at zero current.

| Guardian No. | Must Operate (Volts DC) | Load (Volts AC) | Time Range (Sec.) | Net ea. |
|---|---|---|---|---|
| SSRT-1A-11 | 3.5-12 | 24-140 | 0.1-1.0 | $23.24 |
| SSRT-1A-12 | 3.5-12 | 24-140 | 1.0-10 | 23.24 |
| SSRT-1A-13 | 3.5-12 | 24-140 | 5.0-50 | 23.24 |
| SSRT-1A-21 | 12-32 | 24-140 | 0.1-1.0 | 23.24 |
| SSRT-1A-22 | 12-32 | 24-140 | 1.0-10 | 23.24 |
| SSRT-1A-23 | 12-32 | 24-140 | 5.0-50 | 23.24 |
| SSRT-2A-11 | 3.5-12 | 24-280 | 0.1-1.0 | 23.68 |
| SSRT-2A-12 | 3.5-12 | 24-280 | 1.0-10 | 23.68 |
| SSRT-2A-13 | 3.5-12 | 24-280 | 5.0-50 | 23.68 |
| SSRT-2A-21 | 12-32 | 24-280 | 0.1-1.0 | 23.68 |
| SSRT-2A-22 | 12-32 | 24-280 | 1.0-10 | 23.68 |
| SSRT-2A-23 | 12-32 | 24-280 | 5.0-50 | 23.68 |

Load Current — Amps (RMS): 7

| | | | | |
|---|---|---|---|---|
| SSRT-1B-11 | 3.5-12 | 24-140 | 0.1-1.0 | $23.82 |
| SSRT-1B-12 | 3.5-12 | 24-140 | 1.0-10 | 23.82 |
| SSRT-1B-12 | 3.5-12 | 24-140 | 5.0-50 | 23.82 |
| SSRT-1B-21 | 12-32 | 24-140 | 0-1-1.0 | 23.82 |
| SSRT-1B-22 | 12-32 | 24-140 | 1.0-10 | 23.82 |
| SSRT-1B-23 | 12-32 | 24-140 | 5.0-50 | 23.82 |
| SSRT-2B-11 | 3.5-12 | 24-280 | 0.1-1.0 | 24.28 |
| SSRT-2B-12 | 3.5-12 | 24-280 | 1.0-10 | 24.28 |
| SSRT-2B-13 | 3.5-12 | 24-280 | 5.0-50 | 24.28 |
| SSRT-2B-21 | 12-32 | 24-280 | 0.1-1.0 | 24.28 |
| SSRT-2B-22 | 12-32 | 24-280 | 1.0-10 | 24.28 |
| SSRT-2B-23 | 12-32 | 24-280 | 5.0-50 | 24.28 |

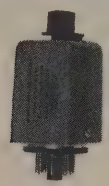
Load Current — Amps (RMS): 10

L 2.64"/W 1.55"/H 1.07"

# GUARDIAN®/CALIFORNIA SOLID STATE CONTROLS

## BD2 AND BD4 SERIES TIME DELAY RELAYS

The BD2 Series are delay on operate and the BD3 Series is the popular 3 wire delay on release. They terminate in octal plugs with 8 and 11 pins respectively. Three standard timing ranges are offered in both series, covering 1-100 seconds in AC and DC input ranges. The output rating is a full 5 amp resistive and 2PDT is the standard configuration.



| Guardian No. | Voltage | Delay Range (Sec.) | Net ea. |
|---|---|---|---|
| BD2-10-24D | 24VDC | 1-10 | $25.77 |
| BD2-50-24D | 24VDC | 5-50 | 26.80 |
| BD2-100-24D | 24VDC | 10-100 | 27.06 |
| BD2-10-120A | 120VAC | 1-10 | 25.77 |
| BD2-50-120A | 120VAC | 5-50 | 26.80 |
| BD2-100-120A | 120VAC | 10-100 | 27.06 |
| BD3-10-24D | 24VDC | 1-10 | 26.11 |
| BD3-50-2D | 24VDC | 5-50 | 27.13 |
| BD3-100-24D | 24VDC | 10-100 | 27.38 |
| BD3-10-120A | 120VAC | 1-10 | 26.11 |
| BD3-50-120A | 120VAC | 5-50 | 27.13 |
| BD3-100-120A | 120VAC | 10-100 | 27.38 |

BD2 = Delay on operate; BD3 = Delay on release

## MET SERIES—TIME DELAY ON OPERATE OR ON RELEASE

Designed for on-operate and on-release, with a range of .5 to 300 seconds. Time Delays provide a DPDT relay output of 10 amp resistive, 120 VAC, 50-60 Hz and operate on inputs of 120 VAC, 50-60 Hz, 24 VDC, 50-60 Hz or 24 VDC, polarity protected. Time Delays feature accuracy of ±10% of nominal setting over voltage and temperature range, repeatability to 1% within fixed conditions, a single turn potentiometer and time delays of .5 to 15, .5 to 100 and 100 to 300 seconds over a temperature of 0° to 55°C.

L 2.90"/W 2.40"
Max./H 1.90" Max.

| Guardian No. | Volts | Delay Range (Sec.) | Net ea. |
|---|---|---|---|
| MET-0-100-24A | 24VAC | .5 to 100 | $25.67 |
| MET-0-300-24A | 24VAC | 100 to 300 | 26.76 |
| MET-0-015-120A | 120VAC | .5 to 15 | 25.00 |
| MET-0-100-120A | 120VAC | .5 to 100 | 25.67 |
| MET-0-300-120A | 120VAC | 100 to 300 | 26.76 |
| MET-0-100-240A | 240AC | .5 to 100 | 49.39 |
| MET-0-015-24D | 24VDC | .5 to 15 | 24.60 |
| MET-0-100-24D | 24VDC | .5 to 100 | 25.08 |
| MET-0-300-24D | 24VDC | 100 to 300 | 25.98 |
| MET-R-100-24A | 24VAC | .5 to 300 | 34.63 |
| MET-R-300-24A | 24VAC | 100 to 300 | 35.56 |
| MET-R-015-120A | 120VAC | .5 to 15 | 33.99 |
| MET-R-100-120A | 120VAC | .5 to 100 | 34.63 |
| MET-R-300-120A | 120VAC | 100 to 300 | 35.56 |
| MET-R-015-24D | 24VDC | .5 to 15 | 33.54 |
| MET-R-100-24D | 24VDC | .5 to 100 | 34.03 |
| MET-R-300-24D | 24VDC | 100 to 300 | 34.94 |

O in part number indicates delay on operate, R delay on release.

## TAF, TAS, THF AND THS SERIES TIME DELAY RELAYS

Hybrid time delays incorporating a solid state control circuit with relay contact output. Delay on operate. Contacts transfer at conclusion of timing period initiated upon application of control voltage. Time delay (on adjustable models) is set by external resistance connected across plug pins #3 and #4. Timer enclosed in tubular plastic housing terminating in radio style octal plug. Output contacts rated 5 amp resistive to 120 VAC.

| Guardian No. | Input Voltage | Time Delay (Sec.) | Net ea. |
|---|---|---|---|
| TAF-01 | 24VDC/120VAC | 1 | $15.62 |
| TAF-02 | 24VDC/120VAC | 2 | 15.62 |
| TAF-03 | 24VDC/120VAC | 3 | 15.62 |
| TAF-04 | 24VDC/120VAC | 4 | 15.62 |
| TAF-05 | 24VDC/120VAC | 5 | 15.62 |
| TAF-10 | 24VDC/120VAC | 10 | 15.62 |
| TAF-15 | 24VDC/120VAC | 15 | 15.62 |
| TAF-20 | 24VDC/120VAC | 20 | 15.62 |
| TAS-10 | 24VDC/120VAC | 1-10 | 15.62 |
| TAS-50 | 24VDC/120VAC | 5-50 | 16.40 |
| TAS-100 | 24VDC/120VAC | 10-100 | 16.40 |
| THF-01 | 24VDC/120VAC | 1 | 14.36 |
| THF-02 | 24VDC/120VAC | 2 | 14.36 |
| THF-03 | 24VDC/120VAC | 3 | 14.36 |
| THF-05 | 24VDC/120VAC | 5 | 14.36 |
| THF-10 | 24VDC/120VAC | 10 | 14.36 |
| THF-15 | 24VDC/120VAC | 15 | 14.36 |
| THF-20 | 24VDC/120VAC | 20 | 14.36 |
| THS-10 | 24VDC/120VAC | 1-10 | 14.36 |
| THS-50 | 24VDC/120VAC | 5-50 | 15.16 |
| THS-100 | 24VDC/120VAC | 10-100 | 15.16 |

Series TAF and THF are fixed time delays.
Series TAS and THS are externally adjustable thru header.
Series TAF and TAS repeatability = ±10%.
Series THF and THS repeatability = ±30% depending on recycle time.

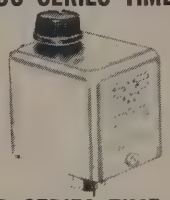
## TAE AND THE SERIES TIME DELAY RELAYS

Hybrid time delays incorporating a solid state control circuit with relay contact output. Delay on operate. Contacts transfer at conclusion of timing period initiated upon application of control voltage. Time delay adjusted by external resistance connected across screw terminals on top of relay housing. Timer enclosed in tubular plastic housing, terminating in a radio style octal plug.

| Guardian No. | Input Voltage | Time Delay (Sec.) | Net ea. |
|---|---|---|---|
| TAE-10 | 24VDC/120VAC | 1-10 | $17.12 |
| TAE-50 | 24VDC/120VAC | 5-50 | 17.92 |
| TAE-100 | 24VDC/120VAC | 10-100 | 17.92 |
| THE-10 | 24VDC/120VAC | 1-10 | 15.38 |
| THE-50 | 24VDC/120VAC | 5-50 | 16.18 |
| THE-100 | 24VDC/120VAC | 10-100 | 16.18 |

Series TAE repeatability = ±10%.
Series THE repeatability = ±30% depending on recycle time.

## TDO SERIES TIME DELAY



Contacts rated at 5 amps, DPDT, 120 VAC with adjustable delay of 0.5 to 30 seconds on attract with a ten turn potentiometer. Repeatability is within 5% after a line interruption of 100 milliseconds. Standard unit available is 120 VAC.

| Guardian No. | Volts | Delay Range (Sec.) | Net ea. |
|---|---|---|---|
| TDO-62C30-120A | 120VAC | 5 to 30 | $29.27 |

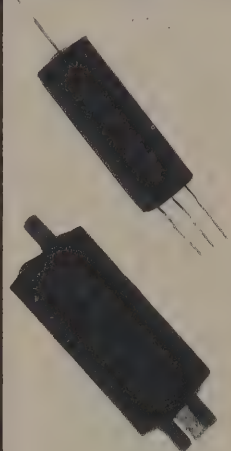
## TD SERIES TIME DELAY

Adjustable delays from 1 to 180 seconds. 15 turn potentiometer provides high adjustment resolution. Accurate to 5% of nominal setting over complete temp. and voltage range. Repeatability, 2% after line interruption of 100 MS. Delays on attract. 9PDT contacts rated at 10 amps resistive.

| Guardian No. | Volts | Delay Range (Sec.) | Net ea. |
|---|---|---|---|
| TD-33C15-24D | 24VDC | 1 to 15 | $27.48 |
| TD-33C60-24D | 24VDC | 10 to 60 | 28.60 |
| TD-33C180-24D | 24VDC | 50 to 180 | 36.43 |
| TD-63C15-120A | 120VAC | 1 to 15 | 33.72 |
| TD-63C60-120A | 120VAC | 10 to 60 | 34.13 |
| TD-63C180-120A | 120VAC | 50 to 180, | 41.84 |

## SERIES 6425 AND 6435 INLINE TIME DELAY

### REPLACES SERIES GU INLINE TIME DELAY



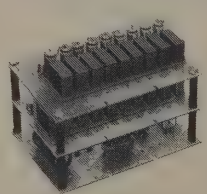
Totally solid state Inline Time Delay. Available in low (12 to 48 VDC) and high (90 to 130 VDC) voltage versions in your choice of three externally-adjustable time ranges: .1 to 10 seconds, 5 to 120 seconds and 10 to 300 seconds. Accuracy and repeatability after first time out: Accuracy, ±10% of setting for combined variations of ambient temperature and power supply regulation: Repeatability, ±2% for fixed line input. Operating temperature range of −20°C to +55°C. Minimum operations $10^7$. Termination in your choice of 3/16" quick connect or solid lead. Delay on operate. Adjustment by 1 meg. ohm potentiometer.

| Guardian No. | Volts | Time Range (Sec.) | Net ea. |
|---|---|---|---|
| 6425-2L-10 | 12 to 48VDC | .1 to 10 | $10.00 |
| 6435-2L-10 | 12 to 48VDC | .1 to 10 | 10.10 |
| 6424-2H-10 | 90 to 130VDC | .1 to 10 | 10.00 |
| 6435-2H-10 | 90 to 130VDC | .1 to 10 | 10.10 |
| 6425-2L-120 | 12 to 48VDC | 5 to 120 | 10.10 |
| 6435-2L-120 | 12 to 48VDC | 5 to 120 | 10.19 |
| 6425-2H-120 | 90 to 130VDC | 5 to 120 | 10.10 |
| 6435-2H-120 | 90 to 130VDC | 5 to 120 | 10.19 |
| 6425-2L-300 | 12 to 48VDC | 10 to 300 | 11.85 |
| 6435-2L-300 | 12 to 48VDC | 10 to 300 | 12.52 |
| 6425-2H-300 | 90 to 130VDC | 10 to 300 | 11.85 |
| 6435-2H-300 | 90 to 130VDC | 10 to 300 | 12.52 |

6425 part number = solid lead termination.
6435 part number = 3/16" QC termination.

## SLS SOLID STATE LOGIC STEPPER

The SLS 100 Series Solid State Steppers are the only power solid state steppers to accept either high level or logic level inputs with high noise immunity for industrial applications. The output of each step is a 120 VAC 2½ amp switch. Units can be cascaded or paralleled to perform complex switching and control functions. Guardian Steppers are built for operation on input power of 120 VAC, 50-60 Hz or 400 Hz and 24 VDC. All solid state construction offers the advantages of mechanical noise-free operation.



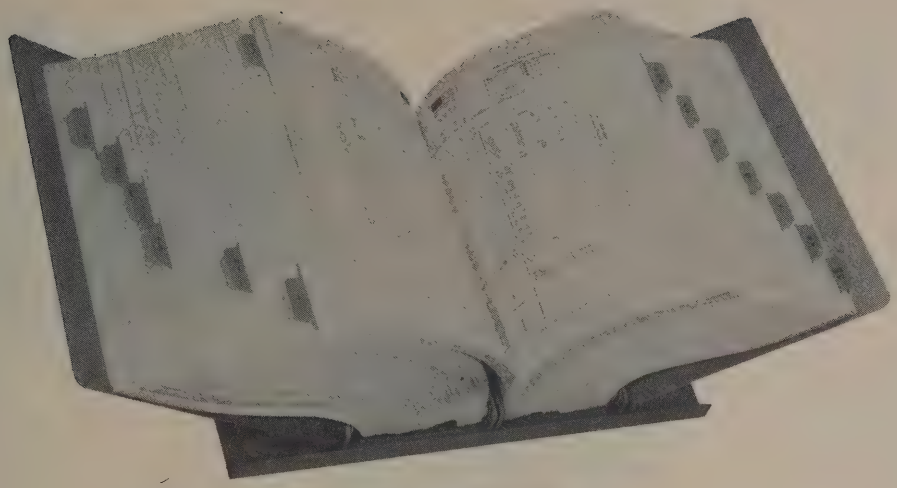
| Guardian No. | Volts | Steps | Net ea. |
|---|---|---|---|
| SLS-110-2A111* | 120VAC | 10 | $143.62 |
| SLS-110-1A211* | 24VDC | 10 | 123.97 |
| SLS-120-2A111* | 120VAC | 20 | 249.04 |
| SLS-120-1A211* | 24VDC | 20 | 208.43 |
| SLS-110-25111† | 120VAC | 10 | 151.80 |
| SLS-110-15211† | 24VDC | 10 | 132.15 |
| SLS-120-25111† | 120VAC | 20 | 257.30 |
| SLS-120-15211† | 24VDC | 20 | 218.37 |
| SLS Connector Kit | | | 1.10 |

* Step advance by either mechanical switch closure or DC Pulse.
† Self-stepping.

**ALL PRODUCTS IN THIS CATALOG** are immediately available from any franchised Guardian Distributor.

**CATALOG PRICES:** All prices in this catalog are list prices which were in effect at the time of printing. Contact your Guardian Distributor for quantity discounts or special bulk pricing.

**GUARDIAN ELECTRIC MANUFACTURING CO.**
1550 West Carroll Avenue, Chicago IL 60607 — (312) 243-1100
**GUARDIAN ELECTRIC MANUFACTURING CO. OF CALIF. INC.**
4030 West Spencer Street, Torrance, CA 90503 — (212) 542-8651



# UNITED PRICING REPORTS

## the single source that speeds up invoicing, pricing, quoting, purchasing and estimating

Electronic component prices change so fast, you'd need a team of people just to keep up.

United Pricing Reports is the better way. When you subscribe to Pricing Reports you receive 1500 pricing sheets (3000 pages) of the latest prices, as of the date we ship them to you.

This gives you, in a single source, up-to-the minute selling prices on more than 500,000 electronic components.

United Pricing Reports gives you accurate resale prices at the exact moment you need them. Not hours or days later. So it helps you eliminate frantic phone calls, letter writing and catalog scanning to check on prices when you write an invoice or type a purchase order.

## Twice weekly price updates.

One week after you receive your Pricing Reports source book (1500 pricing sheets) you begin receiving twice weekly price updates. You simply take these new price pages and replace the now obsolete pages with them.

The whole process is simple. All information is organized alphabetically by manufacturer. And each manufacturer's price schedule is listed by part number in numerical/alphabetical sequence.

One more thing. When we promise twice weekly updates, we deliver. 52 weeks a year, consistently. Not monthly or every other month. We have a tradition of delivery on our promises, and we're certainly not going to stop now.

TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500 TWX-510/222-1673

HAMLIN INC

REED SWITCHES / INDUSTRIAL SENSORS / LIQUID CRYSTAL DISPLAYS

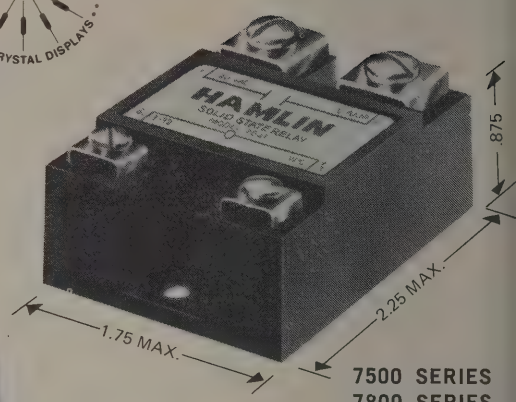
DEPT. EM, 628 LAKE STREET • LAKE MILLS, WISCONSIN 53551
PHONE: SALES (414) 648-2361 • TWX 910-260-3740

# OPTO-ISOLATED SOLID-STATE RELAYS 2 to 40 AMPS

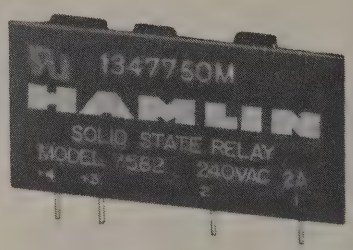
Solid-state relays ready for your circuit design. PCB or surface mounted units designed to switch inductive, capacitive or resistive loads up to 40 amps.

**Special features:**

- Optically coupled
- Zero voltage synchronous switching
- 1500 VAC isolation
- 2 to 40 ampere rating
- PCB mount or lug terminals
- Epoxy encapsulation
- 120 or 240 VAC switching capability.




7500 SERIES
7800 SERIES




7580 SERIES

## 7500 SERIES — Opto-Isolated

| Model | AC Line Voltage 47 to 63 Hz | Peak Repetitive Blocking Volt. Max. | Line Current Max. # | 1 Cycle Surge (60 Hz) Max. | List Price 1-9 |
|---|---|---|---|---|---|
| 7581 | 120 VAC (24-140 VAC)† | 200 | 2 RMS | 70 | $ 9.15 |
| 7582 | 240 VAC (24-280 VAC)† | 400 | 2 RMS | 70 | 9.50 |
| 7511 | 120 VAC (24-140 VAC)† | 200 | 5 RMS | 80 | 17.35 |
| 7512 | 240 VAC (24-280 VAC)† | 400 | 5 RMS | 80 | 18.50 |
| 7521 | 120 VAC (24-140 VAC)† | 200 | 10 RMS | 100 | 18.65 |
| 7522 | 240 VAC (24-280 VAC)† | 400 | 10 RMS | 100 | 20.30 |
| 7531 | 120 VAC (24-140 VAC)† | 200 | 25 RMS | 100 | 24.00 |
| 7532 | 240 VAC (24-280 VAC)† | 400 | 25 RMS | 100 | 26.00 |
| 7551 | 120 VAC (24-140 VAC)† | 200 | 40 RMS | 100 | 37.75 |
| 7552 | 240 VAC (24-280 VAC)† | 400 | 40 RMS | 100 | 46.40 |

† Low voltage operation results in some waveform distortion.

**NOTE:** Control signal options: **A** - 90-280 VAC, 80-140 VDC. **D** - 3-32 VDC Resistive input. Add letter to 4-digit model no. 7580 models only available with 3-32 VDC input.

## 7800 SERIES

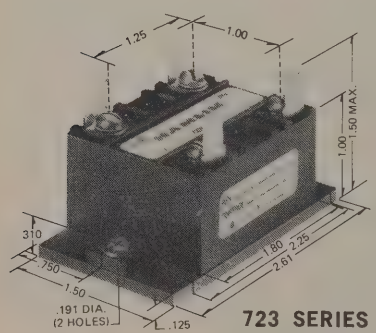
**Hybrid SSR, Reed relay isolation with triac output and random switching feature.**

| Model | AC Line Voltage 47-63 Hz V, RMS | Repetitive Blocking Voltage V, Pk, Max. | Load Current A, RMS, Max. | 1 Cycle Surge Current A, Pk, Max. | List Price 1-9 |
|---|---|---|---|---|---|
| 7811-X | 120 (24-140) | 200 | 5 | 50 | $15.30 |
| 7812-X | 240 (24-280) | 400 | 5 | 50 | 16.30 |
| 7821-X | 120 (24-140) | 200 | 10 | 100 | 16.45 |
| 7822-X | 240 (24-280) | 400 | 10 | 100 | 17.90 |
| 7831-X | 120 (24-140) | 200 | 25 | 250 | 21.15 |
| 7832-X | 240 (24-280) | 400 | 25 | 250 | 22.95 |
| 7851-X | 120 (24-140) | 200 | 40 | 400 | 33.30 |
| 7852-X | 240 (24-280) | 400 | 40 | 400 | 40.95 |

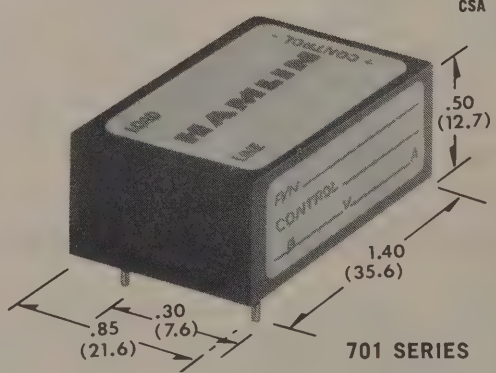
**TO ORDER:** Substitute control option for letter "x" in basic model number; 3 = 14-28 VDC, 5 = 13 VDC.

**UL** **File Nos.:** E61761 and E47258
**Models:** 7511, 7512, 7521, 7522, 7531, 7532, 7551, 7552, 723, 773, 701, 7581, 7582

**CSA** **File No.** LR 40640
**Models:** 7511, 7512, 7521, 7522, 7531, 7532, 7551, 7552




723 SERIES




701 SERIES

| Output and General Specifications | | Basic Model Numbers — See Below to Order | | | |
|---|---|---|---|---|---|
| | | 723-11-A 773-11-A | 723-12-A 773-12-A | 701-11-A | 701-12-A |
| AC Line Voltage, 50/60 Hz. | | 120V RMS | 240V RMS | 120V RMS | 240V RMS |
| Blocking Voltage, Max. | | 200V Peak | 400V Peak | 200V Peak | 400V Peak |
| On-State Voltage Drop @ Rated Current, Max. | | 1.7V Peak | | 1.7V Peak | |
| Load Current, Max. | | 6 Amps RMS | | 1.5 Amps RMS | |
| One Cycle Surge Current, Non-Repet., Max. | | 60 Amps Peak | | 15 Amps Peak | |
| One Second Overload Current, Max. | | 24 Amps Peak | | 6 Amps Peak | |
| Off-State Leakage Current, Max. | | 7 MA RMS | 13 MA RMS | 7 MA RMS | 7 MA RMS |
| Operate Time, Max. | On/Off Switching | 1 Millisecond | | 1 Millisecond | |
| Release Time, Max. | On/Off Switching | ½ Cycle of the AC Line | | ½ Cycle of the AC Line | |
| Isolation, Min. | | 1500V RMS to Heatsink and Control Circuit | | | |

**TO ORDER:** Substitute control option for letter A in basic model number; 3 = 14-28 VDC, 5 = 3-13 VDC.

# HYBRID SOLID-STATE RELAYS 1½ to 6 amps

PCB or surface mounted units capable of controlling inductive, capacitive, high-inrush or resistive loads.

**Special features:**

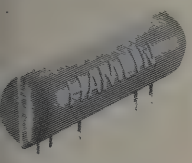
- 1500 VAC isolation
- On/off switching
- 1½ — 6 amps rating
- PCB mounting or lug terminals
- Epoxy encapsulation
- 120 or 240 VAC switching capability

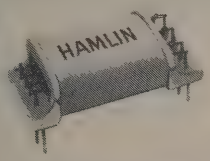
# HAMLIN INC

DEPT. EM, 628 LAKE STREET • LAKE MILLS, WISCONSIN 53551
PHONE: SALES (414) 648-2361 • TWX 910-260-3740

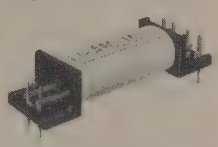
REED SWITCHES · INDUSTRIAL SENSORS · LIQUID CRYSTAL DISPLAYS

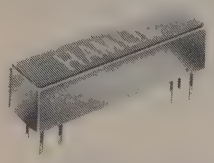
## REED RELAYS

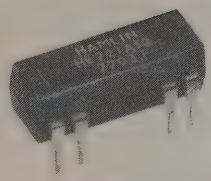

SERIES 300



SERIES HE 400


SERIES HS 400


SERIES HX 400


SERIES 700

SERIES 800

### 300 SERIES — SIP (Single in-line Package)

Standard industry pin-configurations, plus available in Form B, C, Mercury wetted, and new 100 watt form A "Powerhouse."

| Relay Part Number | Coil Voltage [V] | Coil Resistance [Ω] (±10%) | Operate Current [A] | Must Operate Voltage V Max. | Must Release Voltage V Min. | Operate Time [ms] | Release Time* [ms] | Switch Type | Contact Form | Switch Voltage Max. [V] | Switch Current Max. [A] | Switch Rating Max. [W] | Min. Voltage Hold-Off VDC | Insulation Resistance Ω | Contact Resistance Ω |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HE321A05 | 5 | 500 | 0.010 | 3.75 | 1.0 | 0.5 | 0.5 | MDRR-4 | 1A | 200 | 0.500 | 10 | 250 | $10^{10}$ | .200 |
| HE321A12 | 12 | 1000 | 0.012 | 8.0 | 1.0 | 0.5 | 0.5 | MDRR-4 | 1A | 200 | 0.500 | 10 | 250 | $10^{10}$ | .200 |
| HE321A24 | 24 | 2150 | 0.011 | 16.0 | 2.0 | 0.5 | 0.5 | MDRR-4 | 1A | 200 | 0.500 | 10 | 250 | $10^{10}$ | .200 |

Switching forms. Others available, consult factory.

### 400 SERIES — MINIATURE — HE (1" x .100" or 1" x .150" Grid)

Industry standard open frame package with the widest range of switches and options in the industry. From economy version to mercury wet, to hi-voltage, to power switch, one package will handle all of your switching needs. Up to 5 form A or 4 form C, with choice of .100" or .150" pin spacing. Options include: plastic or drawn metal cover, special schematics and a wide variety of switches.

### 400 SERIES — STANDARD SIZE — HS (2.4" x .200" Grid)

This long established standard size relay on 2.4" centers, built for large switching loads, higher breakdown voltage. Available in a choice of schematics, range of switch values from 15W to 100W, 500V to 1500V, 1 amp to 3 amp, with and without metal cover.

### 400 SERIES — MICRO-MINIATURE — HX (.700" x .100" Grid)

Miniature high density package, standard magnetic shield, choice of 5 to 12 volt input, 1 or 2 form A, with or without electrostatic shield.

| Relay Part Number | Coil Voltage | Coil Resistance | Switch Type | Form | Switch Voltage | Switch Current | Switch Rating | Min. Voltage Hold-Off | IR | CR |
|---|---|---|---|---|---|---|---|---|---|---|
| HE421A0500 | 5 | 240 | MARC-2 | A | 200 | .5 | 10 | 250 | $10^{9}$ | .150 |
| HE432A0500 | 5 | 240 | MDC-1 | A | 100 | 2.0 | 50 | 1000 | $10^{12}$ | .070 |
| HE441A0500 | 5 | 240 | MTHG-2 | A | 28 | .100 | 3 | 1000 | $10^{11}$ | .100 |
| HE451A0500 | 5 | 240 | MARR-8 | A | 500 | .5 | 10 | 1000 | $10^{9}$ | .150 |
| HE461A0500 | 5 | 240 | MRT-2 | A | 200 | 1.0 | 100 | 250 | $10^{8}$ | .150 |
| HE491A0500 | 5 | 240 | MLC-2 | A | 200 | .5 | 10 | 250 | $10^{9}$ | .250 |

### 700 SERIES — DIP — Dual in-line (Industry Standard Configuration)

Hamlin 8 pin .275" package is available in 1A, 2A, 1B, IC inputs — 5, 12, 24 volt — standard, mercury-wetted — and now on all position Hg wet. Extensive testing at final inspection insures switch integrity for complete quality assurance.

| Relay Part Number | Coil Voltage [V] | Coil Resistance [Ω] (±10%) | Operate Current [A] | Must Operate Voltage V Max. | Must Release Voltage V Min. | Operate Time [ms] | Release Time* [ms] | Switch Type | Contact Form | Switch Voltage Max. [V] | Switch Current Max. [A] | Switch Rating Max. [W] | Min. Voltage Hold-Off VDC | Insulation Resistance Ω | Contact Resistance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HE721A05 | 5 | 500 | 0.010 | 3.75 | 1.0 | 0.5 | 0.5 | MDRR-4 | 1A | 200 | 0.500 | 10 | 250 | $10^{10}$ | .200 |
| HE722A05 | 5 | 200 | 0.025 | 3.75 | 1.0 | 0.5 | 0.5 | MINI-2 | 2A | 100 | 0.110 | 3 | 200 | $10^{10}$ | .250 |
| HE721B05 | 5 | 200 | 0.010 | 3.75 | 1.0 | 0.5 | 0.5 | MDRR-DT | 1B | 200 | 0.250 | 3 | 250 | $10^{9}$ | .200 |
| HE721C05 | 5 | 200 | 0.025 | 3.75 | 0.5 | 0.5 | 0.5 | MDRR-DT | 1C | 200 | 0.250 | 3 | 250 | $10^{9}$ | .200 |
| MERCURY WETTED CONTACTS TO OPERATE WITHIN 30° VERTICAL. | | | | | | | | | | | | | | | |
| HE731A05 | 5 | 55 | 0.091 | 3.75 | 0.5 | 2.00 | 1.50 | MDC-1 | 1A | 100 | 2.000 | 50 | 1000 | $10^{11}$ | .070 |

All above available in 12, 24 volt input, with diode, with electrostatic shield.

### 800 SERIES — DIL — Dual in-line (1" x .100" Grid)

An alternate design to DIP, allows for greater package flexibility than DIP at a cost saving to the user. Available in 1A, 2A, 1B, 1C, 2C, in various switches, i.e. Mercury Wet, Mercury Wet all position and High Voltage hold-off (600 VDC across contacts).

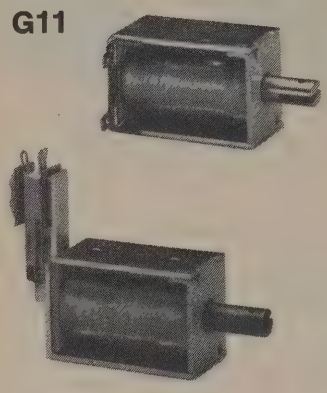
| Relay Part Number | Coil Voltage [V] | Coil Resistance [Ω] (±10%) | Operate Current [A] | Must Operate Voltage V Max. | Must Release Voltage V Min. | Operate Time [ms] | Release Time* [ms] | Switch Type | Contact Form | Switch Voltage Max. [V] | Switch Current [Max. A] | Switch Rating Max. [W] | Min. Voltage Hold-Off VDC | Insulation Resistance Ω | Contact Resistance Ω |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HE821A05 | 5 | 190 | .026 | 3.75 | 0.4 | 0.5 | 0.5 | MDRR-4 | A | 200 | 0.500 | 10 | 250 | $10^{10}$ | .200 |
| HE822A05 | 5 | 105 | .048 | 3.75 | 0.4 | 0.5 | 0.5 | MDRR-4 | 2A | 200 | 0.500 | 10 | 250 | $10^{10}$ | .200 |
| HE821B05 | 5 | 175 | .029 | 3.75 | 0.4 | 0.5 | 0.5 | MDRR-DT | B | 200 | 0.250 | 3 | 200 | $10^{9}$ | .200 |
| HE821C05 | 5 | 300 | .017 | 3.75 | 0.4 | 0.5 | 0.5 | MDRR-DT | C | 200 | 0.250 | 3 | 200 | $10^{9}$ | .200 |
| HE822C05 | 5 | 85 | .059 | 3.75 | 0.4 | 0.5 | 0.5 | MDRR-DT | 2C | 200 | 0.250 | 3 | 200 | $10^{9}$ | .200 |
| MERCURY WETTED CONTACTS — MOUNTED WITHIN 30° OF THE VERTICAL | | | | | | | | | | | | | | | |
| HE831A05 | 5 | 50 | .100 | 3.75 | 0.4 | 2.0 | 1.5 | MDC-1 | A | 100 | 2.0 | 50 | 1000 | $10^{11}$ | .070 |
| MERCURY WETTED CONTACTS — ANY PLANE | | | | | | | | | | | | | | | |
| HE841A05 | 5 | 55 | .091 | 3.75 | 0.4 | 2.0 | 1.5 | MTHG-2 | A | 28 | 0.100 | 10 | 1000 | $10^{11}$ | .100 |
| HIGH VOLTAGE HOLD-OFF RELAY† | | | | | | | | | | | | | | | |
| HE851A05 | 5 | 190 | .026 | 3.75 | 0.4 | 0.5 | 0.5 | MDRR-8 | A | 200 | 0.500 | 10 | 600 | $10^{10}$ | .200 |

Above available in 12, 24 volt input, electrostatic shield, and diode option.

**MAGNETEC CORPORATION**
96 GRANBY STREET / BLOOMFIELD, CONNECTICUT 06002
TEL: (203) 243-8941 / TWX: HIGINC 710-420-0592
SUBSIDIARY OF **HI-G, INCORPORATED**

# OPEN FRAME SOLENOIDS "THE INTERCHANGEABLES"

## G11



L = 1⅞
W = 15/16
H = 1 3/16

### HOW TO ORDER

**G11 _ 6D1**

- **A:** Pull Type — Machined hole & slot
- **B.** Pull Type — Spring Clip
- **P:** Push Type
- **S:** Switch Type — Machined hole & slot
- **T:** Switch Type — Spring Clip

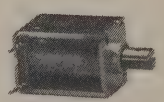
| Part No. | Coil Voltage | Duty Cycle | Coil Resistance (Approx.) | Operating Current (Approx.) | Coil Power (Approx.) |
|---|---|---|---|---|---|
| G11 _ 6D1 | 6VDC | 100% | 4.5 Ohms | 1.33 Amp | 8 Watts |
| G11 _ 6D2 | 6VDC | 25/50% | 2 Ohms | 3 Amp | 18 Watts |
| G11 _ 6D3 | 6VDC | 10% | .7 Ohms | 8.96 Amp | 53.7 Watts |
| G11 _ 12D1 | 12VDC | 100% | 18 Ohms | .67 Amp | 8 Watts |
| G11 _ 12D2 | 12VDC | 25/50% | 8 Ohms | 1.5 Amp | 18 Watts |
| G11 _ 12D3 | 12VDC | 10% | 2.7 Ohms | 4.49 Amp | 53.9 Watts |
| G11 _ 24D1 | 24VDC | 100% | 72 Ohms | .33 Amp | 8 Watts |
| G11 _ 24D2 | 24VDC | 25/50% | 31 Ohms | .77 Amp | 18.6 Watts |
| G11 _ 24D3 | 24VDC | 10% | 10.7 Ohms | 2.25 Amp | 54 Watts |

**Force (ounces) vs Stroke (inches)**

| Duty Cycle | .000" | .125" | .250" | .375" | .500" | .625" | .750" |
|---|---|---|---|---|---|---|---|
| 100% | 85 oz. | 24 oz. | 11 oz. | 6.2 oz. | 4.5 oz. | 3.9 oz. | 3.5 oz. |
| 25/50% | 90 oz. | 40 oz. | 22 oz. | 13.5 oz. | 10 oz. | 7.5 oz. | 5.1 oz. |
| 10% | 95 oz. | 52 oz. | 34 oz. | 28 oz. | 22 oz. | 14 oz. | 7.2 oz. |

FORCE @ 25°C @ 100% VOLTS

## G22



L = 1 5/32
W = ¾
H = ¾

### HOW TO ORDER

**G22 _ 6D1**

- **A:** Pull Type — Machined hole & slot
- **P:** Push Type
- **S:** Switch Type — Machined hole & slot

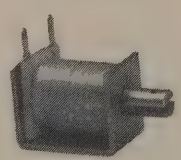
| Part No. | Coil Voltage | Duty Cycle | Coil Resistance (Approx.) | Operating Current (Approx.) | Coil Power (Approx.) |
|---|---|---|---|---|---|
| G22 _ 6D1 | 6VDC | 100% | 9 Ohms | .67 Amp | 4 Watts |
| G22 _ 6D2 | 6VDC | 25/50% | 4 Ohms | 1.5 Amp | 9 Watts |
| G22 _ 6D3 | 6VDC | 10% | 1.3 Ohms | 4.5 Amp | 27.1 Watts |
| G22 _ 12D1 | 12VDC | 100% | 36 Ohms | .33 Amp | 4 Watts |
| G22 _ 12D2 | 12VDC | 25/50% | 16 Ohms | .75 Amp | 9 Watts |
| G22 _ 12D3 | 12VDC | 10% | 5.3 Ohms | 2.26 Amp | 27.1 Watts |
| G22 _ 24D1 | 24VDC | 100% | 144 Ohms | .17 Amp | 4 Watts |
| G22 _ 24D2 | 24VDC | 25/50% | 60 Ohms | .4 Amp | 9.6 Watts |
| G22 _ 24D3 | 24VDC | 10% | 21.3 Ohms | 1.13 Amp | 27 Watts |

**Force (ounces) vs Stroke (inches)**

| Duty Cycle | .000" | .050" | .100" | .150" | .200" | .250" | .500" |
|---|---|---|---|---|---|---|---|
| 100% | 34 oz. | 13 oz. | 7.5 oz. | 3.8 oz. | 2.4 oz. | 1.8 oz. | .70 oz. |
| 25/50% | 44 oz. | 22 oz. | 13.5 oz. | 7.2 oz. | 4.8 oz. | 4.1 oz. | 1 oz. |
| 10% | 50 oz. | 40 oz. | 31.5 oz. | 14 oz. | 10.1 oz. | 8.8 oz. | 3.2 oz. |

FORCE @ 25°C @ 100% VOLTS

## G24



L = 1¼
W = ⅞
H = 1

### HOW TO ORDER

**G24 _ 6D1**

- **A:** Pull Type — Machined hole & slot
- **P:** Push Type

| Part No. | Coil Voltage | Duty Cycle | Coil Resistance (Approx.) | Operating Current (Approx.) | Coil Power (Approx.) |
|---|---|---|---|---|---|
| G24 _ 6D1 | 6VDC | 100% | 7.2 Ohms | .83 Amp | 5 Watts |
| G24 _ 6D2 | 6VDC | 25/50% | 3.3 Ohms | 1.82 Amp | 11 Watts |
| G24 _ 6D3 | 6VDC | 10% | 1.3 Ohms | 4.62 Amp | 27.7 Watts |
| G24 _ 12D1 | 12VDC | 100% | 28.8 Ohms | .42 Amp | 5 Watts |
| G24 _ 12D2 | 12VDC | 25/50% | 13.1 Ohms | .92 Amp | 11 Watts |
| G24 _ 12D3 | 12VDC | 10% | 5.2 Ohms | 2.31 Amp | 27.7 Watts |
| G24 _ 24D1 | 24VDC | 100% | 115.2 Ohms | .21 Amp | 5 Watts |
| G24 _ 24D2 | 24VDC | 25/50% | 52.4 Ohms | .46 Amp | 11 Watts |
| G24 _ 24D3 | 24VDC | 10% | 21 Ohms | 1.14 Amp | 27.4 Watts |

**Force (ounces) vs Stroke (inches)**

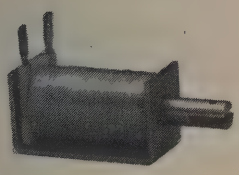
| Duty Cycle | .000" | .050" | .100" | .150" | .200" | .250" | .500" |
|---|---|---|---|---|---|---|---|
| 100% | 48 oz. | 15 oz. | 8.8 oz. | 6 oz. | 4.8 oz. | 4 oz. | 1.7 oz. |
| 25/50% | 60 oz. | 29.5 oz. | 18 oz. | 11.5 oz. | 9.8 oz. | 8 oz. | 4 oz. |
| 10% | 74 oz. | 42 oz. | 24 oz. | 17.8 oz. | 13.1 oz | 10.2 oz. | 6.2 oz. |

FORCE @ 25°C @ 100% VOLTS

**MAGNETEC CORPORATION**
96 GRANBY STREET / BLOOMFIELD, CONNECTICUT 06002
TEL: (203) 243-8941 / TWX: HIGINC 710-420-0592
SUBSIDIARY OF HI-G, INCORPORATED

# OPEN FRAME SOLENOIDS "THE INTERCHANGEABLES"

## G26



L = 1¾
W = ⅞
H = 1

### HOW TO ORDER

**G26 _ 6D1**

- **A:** Pull Type — Machined hole & slot
- **P:** Push Type

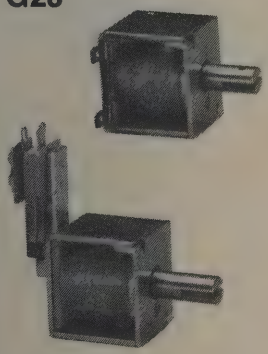
| Part No. | Coil Voltage | Duty Cycle | Coil Resistance (Approx.) | Operating Current (Approx.) | Coil Power (Approx.) |
|---|---|---|---|---|---|
| G26 _ 6D1 | 6VDC | 100% | 4.6 Ohms | 1.3 Amp | 7.8 Watts |
| G26 _ 6D2 | 6VDC | 25/50% | 1.9 Ohms | 3.23 Amp | 19.3 Watts |
| G26 _ 6D3 | 6VDC | 10% | .7 Ohms | 8.96 Amp | 54 Watts |
| G26 _ 12D1 | 12VDC | 100% | 18.6 Ohms | .65 Amp | 7.7 Watts |
| G26 _ 12D2 | 12VDC | 25/50% | 7.5 Ohms | 1.61 Amp | 19.3 Watts |
| G26 _ 12D3 | 12VDC | 10% | 2.7 Ohms | 4.49 Amp | 54 Watts |
| G26 _ 24D1 | 24VDC | 100% | 74.3 Ohms | .32 Amp | 7.7 Watts |
| G26 _ 24D2 | 24VDC | 25/50% | 29.8 Ohms | .81 Amp | 19.3 Watts |
| G26 _ 24D3 | 24VDC | 10% | 10.6 Ohms | 2.26 Amp | 54 Watts |

**Force (ounces) vs Stroke (inches)**

| Duty Cycle | .000" | .100" | .200" | .300" | .400" | .500" | .750" |
|---|---|---|---|---|---|---|---|
| 100% | 64 oz. | 16.6 oz. | 8.8 oz. | 6 oz. | 4.8 oz. | 5 oz. | 1.2 oz. |
| 25/50% | 72 oz. | 35.5 oz. | 21.8 oz. | 13.6 oz. | 8.6 oz. | 7.1 oz. | 3.9 oz. |
| 10% | 80 oz. | 58 oz. | 27 oz. | 16 oz. | 11 oz. | 7.9 oz. | 5.8 oz. |

FORCE @ 25°C @ 100% VOLTS

## G28



L = 1⅛
W = 15/16
H = 1 3/16

### HOW TO ORDER

**G28 _ 6D1**

- **A:** Pull Type — Machined hole & slot
- **B:** Pull Type — Spring Clip
- **P:** Push Type
- **S:** Switch Type — Machined hole & slot
- **T:** Switch Type — Spring Clip

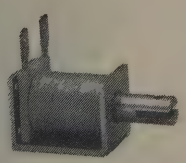
| Part No. | Coil Voltage | Duty Cycle | Coil Resistance (Approx.) | Operating Current (Approx.) | Coil Power (Approx.) |
|---|---|---|---|---|---|
| G28 _ 6D1 | 6VDC | 100% | 7.7 Ohms | .78 Amp | 4.7 Watts |
| G28 _ 6D2 | 6VDC | 25/50% | 3.3 Ohms | 1.82 Amp | 10.9 Watts |
| G28 _ 6D3 | 6VDC | 10% | 1.1 Ohms | 5.26 Amp | 31.6 Watts |
| G28 _ 12D1 | 12VDC | 100% | 27 Ohms | .44 Amp | 5.3 Watts |
| G28 _ 12D2 | 12VDC | 25/50% | 13 Ohms | .92 Amp | 11.1 Watts |
| G28 _ 12D3 | 12VDC | 10% | 4 Ohms | 3.01 Amp | 36.1 Watts |
| G28 _ 24D1 | 24VDC | 100% | 104 Ohms | .23 Amp | 5.5 Watts |
| G28 _ 24D2 | 24VDC | 25/50% | 50 Ohms | .48 Amp | 11.5 Watts |
| G28 _ 24D3 | 24VDC | 10% | 15.4 Ohms | 1.56 Amp | 37.4 Watts |

**Force (ounces) vs Stroke (inches)**

| Duty Cycle | .000" | .050" | .100" | .150" | .200" | .250" | .500" |
|---|---|---|---|---|---|---|---|
| 100% | 72 oz. | 28 oz. | 14 oz. | 8.5 oz. | 5.1 oz. | 5 oz. | 1.2 oz. |
| 25/50% | 76 oz. | 42 oz. | 25 oz. | 16 oz. | 9.8 oz. | 8.1 oz. | 3.8 oz. |
| 10% | 82 oz. | 76 oz. | 52 oz. | 40 oz. | 30.1 oz. | 20 oz. | 5.8 oz. |

FORCE @ 25°C @ 100% VOLTS

## G34



L = 1⅛
W = ¾
H = ⅞

### HOW TO ORDER

**G34 _ 6D1**

- **A:** Pull Type — Machined hole & slot
- **P:** Push Type

| Part No. | Coil Voltage | Duty Cycle | Coil Resistance (Approx.) | Operating Current (Approx.) | Coil Power (Approx.) |
|---|---|---|---|---|---|
| G34 _ 6D1 | 6VDC | 100% | 8 Ohms | .75 Amp | 4.5 Watts |
| G34 _ 6D2 | 6VDC | 25/50% | 4.1 Ohms | 1.46 Amp | 8.8 Watts |
| G34 _ 6D3 | 6VDC | 10% | 1.5 Ohms | 4 Amp | 24 Watts |
| G34 _ 12D1 | 12VDC | 100% | 32 Ohms | .38 Amp | 4.5 Watts |
| G34 _ 12D2 | 12VDC | 25/50% | 16.4 Ohms | .73 Amp | 8.8 Watts |
| G34 _ 12D3 | 12VDC | 10% | 5.8 Ohms | 2.07 Amp | 25 Watts |
| G34 _ 24D1 | 24VDC | 100% | 128 Ohms | .19 Amp | 4.5 Watts |
| G34 _ 24D2 | 24VDC | 25/50% | 65 Ohms | .37 Amp | 8.8 Watts |
| G34 _ 24D3 | 24VDC | 10% | 23 Ohms | 1.04 Amp | 25 Watts |

**Force (ounces) vs Stroke (inches)**

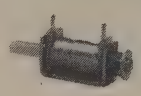
| Duty Cycle | .000" | .050" | .100" | .150" | .200" | .250" | .500" |
|---|---|---|---|---|---|---|---|
| 100% | 93 oz. | 8 oz. | 3.5 oz. | 2.3 oz. | 1.6 oz. | 1.5 oz. | — |
| 25/50% | 125 oz. | 16.2 oz. | 8 oz. | 3.8 oz. | 2.8 oz. | 2.2 oz. | — |
| 10% | 155 oz. | 40 oz. | 18 oz. | 9.4 oz. | 4.1 oz. | 3.2 oz. | — |

FORCE @ 25°C @ 100% VOLTS

**MAGNETEC CORPORATION**
96 GRANBY STREET / BLOOMFIELD, CONNECTICUT 06002
TEL: (203) 243-8941 / TWX: HIGINC 710-420-0592
SUBSIDIARY OF HI-G, INCORPORATED

# C-FRAME SOLENOIDS "THE PROBLEM SOLVERS"

## SAA



L = 21/32
W = 23/64
H = 1/2

### HOW TO ORDER

SAA ___ 6D1

**Action Option**
0 _ None
1 _ Spring return
2 _ Shock dampener
3 _ Spring return & shock dampener

**Linkage Option**
_ 4 None
_ 5 Clevis
_ 6 Push Rod
_ 7 Push Rod & Plastic Tip
_ 8 Clevis & Push Rod
_ 9 Clevis, Push Rod & Plastic Tip

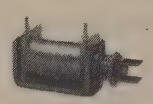
| Part No. | Coil Voltage | Duty Cycle | Coil Resistance (Approx.) | Operating Current (Approx.) | Coil Power (Approx.) |
|---|---|---|---|---|---|
| SAA _ _ 6D1 | 6VDC | 100% | 18.5 Ohms | .33 Amp | 2 Watts |
| SAA _ _ 6D2 | 6VDC | 25/50% | 6.5 Ohms | .93 Amp | 5.6 Watts |
| SAA _ _ 6D3 | 6VDC | 10% | 2.9 Ohms | 2.11 Amp | 12.7 Watts |
| SAA _ _ 12D1 | 12VDC | 100% | 78 Ohms | .15 Amp | 1.9 Watts |
| SAA _ _ 12D2 | 12VDC | 25/50% | 26.4 Ohms | .46 Amp | 5.5 Watts |
| SAA _ _ 12D3 | 12VDC | 10% | 11.3 Ohms | 1.10 Amp | 12.8 Watts |
| SAA _ _ 24D1 | 24VDC | 100% | 300 Ohms | .08 Amp | 1.9 Watts |
| SAA _ _ 24D2 | 24VDC | 25/50% | 106 Ohms | .23 Amp | 5.4 Watts |
| SAA _ _ 24D3 | 24VDC | 10% | 46 Ohms | .52 Amp | 12.5 Watts |

**Force (ounces) vs Stroke (inches)**

| Duty Cycle | .000" | .025" | .050" | .075" | .100" | .150" | .300" |
|---|---|---|---|---|---|---|---|
| 100% | 8.8 oz. | 3.5 oz. | 1.5 oz. | .75 oz. | .5 oz. | — | — |
| 25/50% | 12.5 oz. | 4.1 oz. | 2.25 oz. | 1.6 oz. | 1.2 oz. | .75 oz. | — |
| 10% | 14.8 oz. | 10 oz. | 8.75 oz. | 4 oz. | 3.2 oz. | 2.4 oz. | 1.4 oz. |

FORCE @ 25°C @ 100% VOLTS

## SBA



L = 63/64
W = 1/2
H = 19/32

### HOW TO ORDER

SBA ___ 6D1

**Action Option**
0 _ None
1 _ Spring return
2 _ Shock dampener
3 _ Spring return & shock dampener

**Linkage Option**
_ 4 None
_ 5 Clevis
_ 6 Push Rod
_ 7 Push Rod & Plastic Tip
_ 8 Clevis & Push Rod
_ 9 Clevis, Push Rod & Plastic Tip

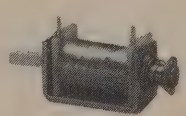
| Part No. | Coil Voltage | Duty Cycle | Coil Resistance (Approx.) | Operating Current (Approx.) | Coil Power (Approx.) |
|---|---|---|---|---|---|
| SBA _ _ 6D1 | 6VDC | 100% | 14.3 Ohms | .42 Amp | 2.5 Watts |
| SBA _ _ 6D2 | 6VDC | 25/50% | 5.7 Ohms | 1.05 Amp | 6.3 Watts |
| SBA _ _ 6D3 | 6VDC | 10% | 2.1 Ohms | 2.93 Amp | 17.6 Watts |
| SBA _ _ 12D1 | 12VDC | 100% | 60.5 Ohms | .20 Amp | 2.4 Watts |
| SBA _ _ 12D2 | 12VDC | 25/50% | 22.8 Ohms | .53 Amp | 6.3 Watts |
| SBA _ _ 12D3 | 12VDC | 10% | 8 Ohms | 1.51 Amp | 18.1 Watts |
| SBA _ _ 24D1 | 24VDC | 100% | 235 Ohms | .10 Amp | 2.5 Watts |
| SBA _ _ 24D2 | 24VDC | 25/50% | 92 Ohms | .26 Amp | 6.3 Watts |
| SBA _ _ 24D3 | 24VDC | 10% | 32.5 Ohms | .74 Amp | 17.7 Watts |

**Force (ounces) vs Stroke (inches)**

| Duty Cycle | .000" | .025" | .050" | .075" | .100" | .150" | .300" |
|---|---|---|---|---|---|---|---|
| 100% | 16.5 oz. | 5.7 oz. | 2.5 oz. | 1.6 oz. | 1.1 oz. | .6 oz. | .3 oz. |
| 25/50% | 21.3 oz. | 13 oz. | 7.5 oz. | 4.9 oz. | 3.2 oz. | 2 oz. | 9 oz. |
| 10% | 29.9 oz. | 23.2 oz. | 19 oz. | 14 oz. | 11 oz. | 7 oz. | 3.3 oz. |

FORCE @ 25°C @ 100% VOLTS

## SCA



L = 1 7/32
W = 5/8
H = 25/32

### HOW TO ORDER

SCA ___ 6D1

**Action Option**
0 _ None
1 _ Spring return
2 _ Shock dampener
3 _ Spring return & shock dampener

**Linkage Option**
_ 4 None
_ 5 Clevis
_ 6 Push Rod
_ 7 Push Rod & Plastic Tip
_ 8 Clevis & Push Rod
_ 9 Clevis, Push Rod & Plastic Tip

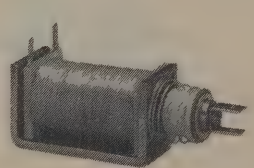
| Part No. | Coil Voltage | Duty Cycle | Coil Resistance (Approx.) | Operating Current (Approx.) | Coil Power (Approx.) |
|---|---|---|---|---|---|
| SCA _ _ 6D1 | 6VDC | 100% | 9.7 Ohms | .62 Amp | 3.7 Watts |
| SCA _ _ 6D2 | 6VDC | 25/50% | 3.9 Ohms | 1.54 Amp | 9.2 Watts |
| SCA _ _ 6D3 | 6VDC | 10% | 1.6 Ohms | 3.82 Amp | 22.9 Watts |
| SCA _ _ 12D1 | 12VDC | 100% | 38.8 Ohms | .31 Amp | 3.7 Watts |
| SCA _ _ 12D2 | 12VDC | 25/50% | 16.1 Ohms | .75 Amp | 8.9 Watts |
| SCA _ _ 12D3 | 12VDC | 10% | 6.3 Ohms | 1.9 Amp | 22.8 Watts |
| SCA _ _ 24D1 | 24VDC | 100% | 160 Ohms | .15 Amp | 3.6 Watts |
| SCA _ _ 24D2 | 24VDC | 25/50% | 62 Ohms | .39 Amp | 9.3 Watts |
| SCA _ _ 24D3 | 24VDC | 10% | 25.4 Ohms | .95 Amp | 22.7 Watts |

**Force (ounces) vs Stroke (inches)**

| Duty Cycle | .000" | .025" | .050" | .075" | .100" | .150" | .300" |
|---|---|---|---|---|---|---|---|
| 100% | 36 oz. | 18 oz. | 10 oz. | 7.8 oz. | 5 oz. | 3 oz. | .75 oz. |
| 25/50% | 41 oz. | 30 oz. | 20 oz. | 15.2 oz. | 10.2 oz. | 6 oz. | 3.1 oz. |
| 10% | 50 oz. | 40 oz. | 31 oz. | 24 oz. | 21.5 oz. | 14 oz. | 5.4 oz. |

FORCE @ 25°C @ 100% VOLTS

## SDA



L = 1 31/64
W = 3/4
H = 53/64

### HOW TO ORDER

SDA ___ 6D1

**Action Option**
0 _ None
1 _ Spring return
2 _ Shock dampener
3 _ Spring return & shock dampener

**Linkage Option**
_ 4 None
_ 5 Clevis
_ 6 Push Rod
_ 7 Push Rod & Plastic Tip
_ 8 Clevis & Push Rod
_ 9 Clevis, Push Rod & Plastic Tip

| Part No. | Coil Voltage | Duty Cycle | Coil Resistance (Approx.) | Operating Current (Approx.) | Coil Power (Approx.) |
|---|---|---|---|---|---|
| SDA _ _ 6D1 | 6VDC | 100% | 6.6 Ohms | .91 Amp | 5.5 Watts |
| SDA _ _ 6D2 | 6VDC | 25/50% | 2.3 Ohms | 2.58 Amp | 15.5 Watts |
| SDA _ _ 6D3 | 6VDC | 10% | .9 Ohms | 6.38 Amp | 38.3 Watts |
| SDA _ _ 12D1 | 12VDC | 100% | 27 Ohms | .44 Amp | 5.3 Watts |
| SDA _ _ 12D2 | 12VDC | 25/50% | 9.2 Ohms | 1.3 Amp | 15.6 Watts |
| SDA _ _ 12D3 | 12VDC | 10% | 3.8 Ohms | 3.2 Amp | 38.4 Watts |
| SDA _ _ 24D1 | 24VDC | 100% | 105 Ohms | .23 Amp | 5.5 Watts |
| SDA _ _ 24D2 | 24VDC | 25/50% | 38 Ohms | .63 Amp | 15.2 Watts |
| SDA _ _ 24D3 | 24VDC | 10% | 14.6 Ohms | 1.64 Amp | 39.5 Watts |

**Force (ounces) vs Stroke (inches)**

| Duty Cycle | .000" | .050" | .100" | .150" | .200" | .250" | .500" |
|---|---|---|---|---|---|---|---|
| 100% | 68 oz. | 25 oz. | 13.8 oz. | 7.5 oz. | 4.8 oz. | 3.6 oz. | 1.2 oz. |
| 25/50% | 74 oz. | 45 oz. | 30 oz. | 20 oz. | 14.8 oz. | 10.2 oz. | 4.8 oz. |
| 10% | 82 oz. | 60 oz. | 50 oz. | 40 oz. | 30 oz. | 25 oz. | 11.2 oz. |

FORCE @ 25°C @ 100% VOLTS

**MAGNETEC CORPORATION**
96 GRANBY STREET / BLOOMFIELD, CONNECTICUT 06002
TEL: (203) 243-8941 / TWX: HIGINC 710-420-0592
SUBSIDIARY OF HI-G, INCORPORATED

# C-FRAME SOLENOIDS "THE PROBLEM SOLVERS"

## SEA

L = 1 47/64
W = 7/8
H = 63/64

### HOW TO ORDER

SEA ___ ___ 6D1

**Action Option**
0 _ None
1 _ Spring return
2 _ Shock dampener
3 _ Spring return & shock dampener

**Linkage Option**
_ 4 None
_ 5 Clevis
_ 6 Push Rod
_ 7 Push Rod & Plastic Tip
_ 8 Clevis & Push Rod
_ 9 Clevis, Push Rod & Plastic Tip

| Part No. | Coil Voltage | Duty Cycle | Coil Resistance (Approx.) | Operating Current (Approx.) | Coil Power (Approx.) |
|---|---|---|---|---|---|
| SEA _ _ 6D1 | 6VDC | 100% | 7 Ohms | .85 Amp | 5.1 Watts |
| SEA _ _ 6D2 | 6VDC | 25/50% | 2.2 Ohms | 2.76 Amp | 16.6 Watts |
| SEA _ _ 6D3 | 6VDC | 10% | .9 Ohms | 7.06 Amp | 424 Watts |
| SEA _ _ 12D1 | 12VDC | 100% | 23.3 Ohms | .52 Amp | 6.2 Watts |
| SEA _ _ 12D2 | 12VDC | 25/50% | 8.6 Ohms | 1.41 Amp | 16.9 Watts |
| SEA _ _ 12D3 | 12VDC | 10% | 3.4 Ohms | 3.52 Amp | 42.2 Watts |
| SEA _ _ 24D1 | 24VDC | 100% | 96 Ohms | .25 Amp | 6 Watts |
| SEA _ _ 24D2 | 24VDC | 25/50% | 35 Ohms | .69 Amp | 16.5 Watts |
| SEA _ _ 24D3 | 24VDC | 10% | 13.1 Ohms | 1.83 Amp | 44 Watts |

**Force (ounces) vs Stroke (inches)**

| Duty Cycle | .000" | .100" | .200" | .300" | .400" | .500" | .750" |
|---|---|---|---|---|---|---|---|
| 100% | 83 oz. | 17.8 oz. | 7.8 oz. | 4 oz. | 2 oz. | 1 oz. | .25 oz. |
| 25/50% | 105 oz. | 50 oz. | 21.8 oz. | 14 oz. | 9.6 oz. | 7.2 oz. | 4.8 oz. |
| 10% | 120 oz. | 74 oz. | 49 oz. | 31.5 oz. | 23 oz. | 17 oz. | 8.6 oz. |

FORCE @ 25°C @ 100% VOLTS

## SFA

L = 1 63/64
W = 1
H = 1 1/64

### HOW TO ORDER

SFA ___ ___ 6D1

**Action Option**
0 _ None
1 _ Spring return
2 _ Shock dampener
3 _ Spring return & shock dampener

**Linkage Option**
_ 4 None
_ 5 Clevis
_ 6 Push Rod
_ 7 Push Rod & Plastic Tip
_ 8 Clevis & Push Rod
_ 9 Clevis, Push Rod & Plastic Tip

| Part No. | Coil Voltage | Duty Cycle | Coil Resistance (Approx.) | Operating Current (Approx.) | Coil Power (Approx.) |
|---|---|---|---|---|---|
| SFA _ _ 6D1 | 6VDC | 100% | 4.7 Ohms | 1.28 Amp | 7.7 Watts |
| SFA _ _ 6D2 | 6VDC | 25/50% | 1.9 Ohms | 3.17 Amp | 19.1 Watts |
| SFA _ _ 6D3 | 6VDC | 10% | .7 Ohms | 8.22 Amp | 49.3 Watts |
| SFA _ _ 12D1 | 12VDC | 100% | 18.7 Ohms | .64 Amp | 7.7 Watts |
| SFA _ _ 12D2 | 12VDC | 25/50% | 7.7 Ohms | 1.57 Amp | 18.8 Watts |
| SFA _ _ 12D3 | 12VDC | 10% | 3 Ohms | 4.03 Amp | 48.3 Watts |
| SFA _ _ 24D1 | 24VDC | 100% | 75 Ohms | .32 Amp | 7.7 Watts |
| SFA _ _ 24D2 | 24VDC | 25/50% | 30 Ohms | .8 Amp | 19.2 Watts |
| SFA _ _ 24D3 | 24VDC | 10% | 11.9 Ohms | 2.02 Amp | 48.4 Watts |

**Force (ounces) vs Stroke (inches)**

| Duty Cycle | .000" | .100" | .200" | .300" | .400" | .500" | .750" |
|---|---|---|---|---|---|---|---|
| 100% | 137 oz. | 40 oz. | 16.5 oz. | 10 oz. | 6 oz. | 4.8 oz. | 1.7 oz. |
| 25/50% | 147 oz. | 74 oz. | 40 oz. | 23 oz. | 16.8 oz. | 10 oz. | 4.8 oz. |
| 10% | 173 oz. | 111 oz. | 78 oz. | 58 oz. | 37 oz. | 28 oz. | 15 oz. |

FORCE @ 25°C @ 100% VOLTS

## SGA

L = 2 15/64
W = 1 1/8
H = 1 27/64

### HOW TO ORDER

SGA ___ ___ 6D1

**Action Option**
0 _ None
1 _ Spring return
2 _ Shock dampener
3 _ Spring return & shock dampener

**Linkage Option**
_ 4 None
_ 5 Clevis
_ 6 Push Rod
_ 7 Push Rod & Plastic Tip
_ 8 Clevis & Push Rod
_ 9 Clevis, Push Rod & Plastic Tip

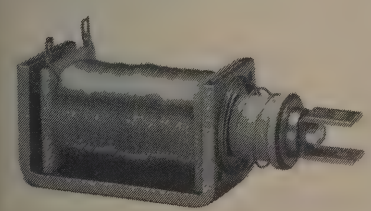
| Part No. | Coil Voltage | Duty Cycle | Coil Resistance (Approx.) | Operating Current (Approx.) | Coil Power (Approx.) |
|---|---|---|---|---|---|
| SGA _ _ 6D1 | 6VDC | 100% | 4 Ohms | 1.52 Amp | 9.1 Watts |
| SGA _ _ 6D2 | 6VDC | 25/50% | 1.6 Ohms | 3.8 Amp | 22.5 Watts |
| SGA _ _ 6D3 | 6VDC | 10% | .6 Ohms | 10 Amp | 60 Watts |
| SGA _ _ 12D1 | 12VDC | 100% | 16.3 Ohms | .74 Amp | 8.9 Watts |
| SGA _ _ 12D2 | 12VDC | 25/50% | 6.5 Ohms | 1.86 Amp | 22.3 Watts |
| SGA _ _ 12D3 | 12VDC | 10% | 2.5 Ohms | 4.84 Amp | 58.1 Watts |
| SGA _ _ 24D1 | 24VDC | 100% | 65 Ohms | .37 Amp | 8.9 Watts |
| SGA _ _ 24D2 | 24VDC | 25/50% | 26 Ohms | .92 Amp | 22.2 Watts |
| SGA _ _ 24D3 | 24VDC | 10% | 9.2 Ohms | 2.61 Amp | 62.6 Watts |

**Force (ounces) vs Stroke (inches)**

| Duty Cycle | .000" | .100" | .250" | .375" | .500" | .750" | 1.000" |
|---|---|---|---|---|---|---|---|
| 100% | 174 oz. | 58 oz. | 20 oz. | 11 oz. | 8 oz. | 3 oz. | .75 oz. |
| 25/50% | 193 oz. | 89 oz. | 42 oz. | 23 oz. | 18 oz. | 10 oz. | 5 oz. |
| 10% | 241 oz. | 152 oz. | 100 oz. | 62 oz. | 48 oz. | 28 oz. | 18 oz. |

FORCE @ 25°C @ 100% VOLTS

## SHA



L = 2 31/64
W = 1 1/4
H = 1 27/64

### HOW TO ORDER

SHA ___ ___ 6D1

**Action Option**
0 _ None
1 _ Spring return
2 _ Shock dampener
3 _ Spring return & shock dampener

**Linkage Option**
_ 4 None
_ 5 Clevis
_ 6 Push Rod
_ 7 Push Rod & Plastic Tip
_ 8 Clevis & Push Rod
_ 9 Clevis, Push Rod & Plastic Tip

| Part No. | Coil Voltage | Duty Cycle | Coil Resistance (Approx.) | Operating Current (Approx.) | Coil Power (Approx.) |
|---|---|---|---|---|---|
| SHA _ _ 6D1 | 6VDC | 100% | 2.9 Ohms | 2.05 Amp | 12.3 Watts |
| SHA _ _ 6D2 | 6VDC | 25/50% | 1.4 Ohms | 4.32 Amp | 25.9 Watts |
| SHA _ _ 6D3 | 6VDC | 10% | .5 Ohms | 12 Amp | 72 Watts |
| SHA _ _ 12D1 | 12VDC | 100% | 13.8 Ohms | .87 Amp | 10.4 Watts |
| SHA _ _ 12D2 | 12VDC | 25/50% | 5.4 Ohms | 2.21 Amp | 26.5 Watts |
| SHA _ _ 12D3 | 12VDC | 10% | 2.1 Ohms | 5.85 Amp | 70.2 Watts |
| SHA _ _ 24D1 | 24VDC | 100% | 55 Ohms | .44 Amp | 10.5 Watts |
| SHA _ _ 24D2 | 24VDC | 25/50% | 22 Ohms | 1.09 Amp | 26.2 Watts |
| SHA _ _ 24D3 | 24VDC | 10% | 8 Ohms | 3 Amp | 72 Watts |

**Force (ounces) vs Stroke (inches)**

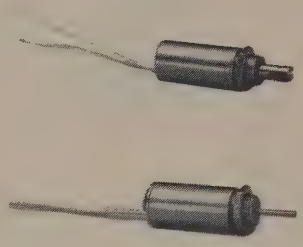
| Duty Cycle | .000" | .100" | .250" | .375" | .500" | .750" | 1.000" |
|---|---|---|---|---|---|---|---|
| 100% | 225 oz. | 82 oz. | 31 oz. | 21 oz. | 12 oz. | 7 oz. | 2.5 oz. |
| 25/50% | 251 oz. | 140 oz. | 70 oz. | 43 oz. | 30 oz. | 15 oz. | 9 oz. |
| 10% | 295 oz. | 202 oz. | 130 oz. | 81 oz. | 60 oz. | 31 oz. | 18 oz. |

FORCE @ 25°C @ 100% VOLTS

**MAGNETEC CORPORATION**
96 GRANBY STREET / BLOOMFIELD, CONNECTICUT 06002
TEL: (203) 243-8941 / TWX: HIGINC 710-420-0592
SUBSIDIARY OF **HI-G, INCORPORATED**

# TUBULAR SOLENOIDS "THE INTERCHANGEABLES"

## T16



½ D x 1 L

### HOW TO ORDER

**T16 _ 326D1**

**C:** Extra duty pull
**D:** Extra duty push

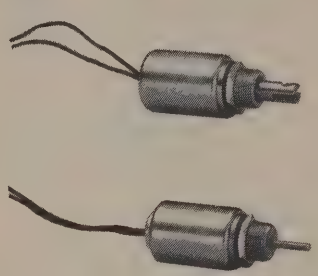
| Part No. | Coil Voltage | Duty Cycle | Coil Resistance (Approx.) | Operating Current (Approx.) | Coil Power (Approx.) |
|---|---|---|---|---|---|
| T16 _ 326D1 | 6VDC | 100% | 9 Ohms | .67 Amp | 4 Watts |
| T16 _ 326D2 | 6VDC | 25/50% | 4.5 Ohms | 1.33 Amp | 8 Watts |
| T16 _ 326D3 | 6VDC | 10% | .9 Ohms | 6.67 Amp | 40 Watts |
| T16 _ 3212D1 | 12VDC | 100% | 36 Ohms | .33 Amp | 4 Watts |
| T16 _ 3212D2 | 12VDC | 25/50% | 18 Ohms | .67 Amp | 8 Watts |
| T16 _ 3212D3 | 12VDC | 10% | 3.6 Ohms | 3.33 Amp | 40 Watts |
| T16 _ 3224D1 | 24VDC | 100% | 144 Ohms | .17 Amp | 4 Watts |
| T16 _ 3224D2 | 24VDC | 25/50% | 72 Ohms | .33 Amp | 8 Watts |
| T16 _ 3224D3 | 24VDC | 10% | 14.4 Ohms | 1.67 Amp | 40 Watts |

**Force (ounces) vs Stroke (inches)**

| Duty Cycle | .000" | .050" | .100" | .150" | .200" | .250" | .500" |
|---|---|---|---|---|---|---|---|
| 100% | 12 oz. | 4.5 oz. | 2.5 oz. | 1.5 oz. | 1 oz. | .75 oz. | .05 oz. |
| 25/50% | 12 oz. | 7.25 oz. | 4.75 oz. | 3 oz. | 2 oz. | 2.5 oz. | .15 oz. |
| 10% | 12 oz. | 15 oz. | 12 oz. | 10 oz. | 8 oz. | 6 oz. | 1 oz. |

FORCE @ 25°C @ 100% VOLTS

## T24



¾ D x 1⅛ L

### HOW TO ORDER

**T24 _ 366D1**

**A:** Standard duty pull
**B:** Standard duty push

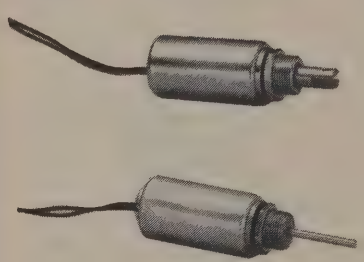
| Part No. | Coil Voltage | Duty Cycle | Coil Resistance (Approx.) | Operating Current (Approx.) | Coil Power (Approx.) |
|---|---|---|---|---|---|
| T24 _ 366D1 | 6VDC | 100% | 10.4 Ohms | .56 Amp | 3.5 Watts |
| T24 _ 366D2 | 6VDC | 25/50% | 6 Ohms | 1.01 Amp | 6.1 Watts |
| T24 _ 366D3 | 6VDC | 10% | 1.8 Ohms | 3.26 Amp | 19.6 Watts |
| T24 _ 3612D1 | 12VDC | 100% | 41.8 Ohms | .29 Amp | 3.4 Watts |
| T24 _ 3612D2 | 12VDC | 25/50% | 21.2 Ohms | .57 Amp | 6.8 Watts |
| T24 _ 3612D3 | 12VDC | 10% | 7.4 Ohms | 1.63 Amp | 19.6 Watts |
| T24 _ 3624D1 | 24VDC | 100% | 164.8 Ohms | .15 Amp | 3.5 Watts |
| T24 _ 3624D2 | 24VDC | 25/50% | 84.7 Ohms | .28 Amp | 6.8 Watts |
| T24 _ 3624D3 | 24VDC | 10% | 29.4 Ohms | .82 Amp | 19.6 Watts |

**Force (ounces) vs Stroke (inches)**

| Duty Cycle | .000" | .025" | .050" | .075" | .100" | .150" | .300" |
|---|---|---|---|---|---|---|---|
| 100% | 35 oz. | 20.2 oz. | 9.6 oz. | 5.8 oz. | 3.9 oz. | 1.9 oz. | .40 oz. |
| 25/50% | 48 oz. | 30.8 oz. | 29.1 oz. | 12.6 oz. | 8.2 oz. | 3.9 oz. | .95 oz. |
| 10% | 53 oz. | 42 oz. | 33 oz. | 25.7 oz. | 20.1 oz. | 10.1 oz. | 2.9 oz. |

FORCE @ 25°C @ 100% VOLTS. FORCES FOR T24A36 SLIGHTLY HIGHER. ABOVE FORCES MADE WITH "B" UNITS.

## T24



¾ D x 1½ L

### HOW TO ORDER

**T24 _ 486D1**

**A:** Standard duty pull
**B:** Standard duty push

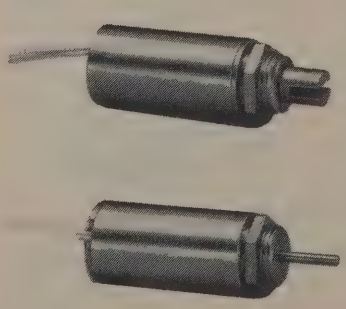
| Part No. | Coil Voltage | Duty Cycle | Coil Resistance (Approx.) | Operating Current (Approx.) | Coil Power (Approx.) |
|---|---|---|---|---|---|
| T24 _ 486D1 | 6VDC | 100% | 8.9 Ohms | .68 Amp | 4.1 Watts |
| T24 _ 486D2 | 6VDC | 25/50% | 4.3 Ohms | 1.41 Amp | 8.5 Watts |
| T24 _ 486D3 | 6VDC | 10% | 2 Ohms | 3 Amp | 18 Watts |
| T24 _ 4812D1 | 12VDC | 100% | 36.8 Ohms | .33 Amp | 3.9 Watts |
| T24 _ 4812D2 | 12VDC | 25/50% | 17.3 Ohms | .69 Amp | 8.3 Watts |
| T24 _ 4812D3 | 12VDC | 10% | 6.2 Ohms | 1.94 Amp | 23.3 Watts |
| T24 _ 4824D1 | 24VDC | 100% | 142.7 Ohms | .17 Amp | 4 Watts |
| T24 _ 4824D2 | 24VDC | 25/50% | 70.3 Ohms | .34 Amp | 8.2 Watts |
| T24 _ 4824D3 | 24VDC | 10% | 24 Ohms | 1 Amp | 24 Watts |

**Force (ounces) vs Stroke (inches)**

| Duty Cycle | .000" | .100" | .200" | .300" | .400" | .500" | .750" |
|---|---|---|---|---|---|---|---|
| 100% | 45 oz. | 13 oz. | 4.1 oz. | 2 oz. | 1.8 oz. | 1 oz. | — |
| 25/50% | 45 oz. | 15 oz. | 5.2 oz. | 3.6 oz. | 2.6 oz. | 1.5 oz. | — |
| 10% | 45 oz. | 21 oz. | 9.1 oz. | 6.2 oz. | 4.9 oz. | 3.2 oz. | — |

FORCE @ 25°C @ 100% VOLTS

## T32



1 D x 2 L

### HOW TO ORDER

**T32 _ 646D1**

**C:** Extra duty pull
**D:** Extra duty push

| Part No. | Coil Voltage | Duty Cycle | Coil Resistance (Approx.) | Operating Current (Approx.) | Coil Power (Approx.) |
|---|---|---|---|---|---|
| T32 _ 646D1 | 6VDC | 100% | 4.5 Ohms | 1.33 Amp | 8 Watts |
| T32 _ 646D2 | 6VDC | 25/50% | .6 Ohms | 9.38 Amp | 56 Watts |
| T32 _ 646D3 | 6VDC | 10% | .4 Ohms | 16.67 Amp | 100 Watts |
| T32 _ 6412D1 | 12VDC | 100% | 18 Ohms | .67 Amp | 8 Watts |
| T32 _ 6412D2 | 12VDC | 25/50% | 2.6 Ohms | 4.67 Amp | 56 Watts |
| T32 _ 6412D3 | 12VDC | 10% | 1.4 Ohms | 8.33 Amp | 100 Watts |
| T32 _ 6424D1 | 24VDC | 100% | 72 Ohms | .33 Amp | 8 Watts |
| T32 _ 6424D2 | 24VDC | 25/50% | 10.3 Ohms | 2.33 Amp | 56 Watts |
| T32 _ 6424D3 | 24VDC | 10% | 5.8 Ohms | 4.17 Amp | 100 Watts |

**Force (ounces) vs Stroke (inches)**

| Duty Cycle | .000" | .100" | .200" | .300" | .400" | .500" | .750" |
|---|---|---|---|---|---|---|---|
| 100% | 46 oz. | 30 oz. | 18 oz. | 9.6 oz. | 6.2 oz. | 5.6 oz. | 2.1 oz. |
| 25/50% | 46 oz. | 72 oz. | 54 oz. | 40 oz. | 30 oz. | 22 oz. | 14 oz. |
| 10% | 46 oz. | 100 oz. | 78 oz. | 61 oz. | 48.9 oz. | 44 oz. | 30 oz. |

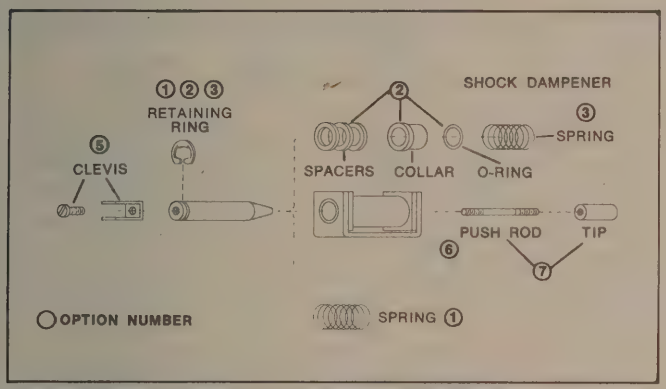
FORCE @ 25°C @ 100% VOLTS

**MAGNETEC CORPORATION**
96 GRANBY STREET / BLOOMFIELD, CONNECTICUT 06002
TEL: (203) 243-8941 / TWX: HIGINC 710-420-0592
SUBSIDIARY OF HI-G, INCORPORATED

# DESIGN ENGINEERS SOLENOID KIT

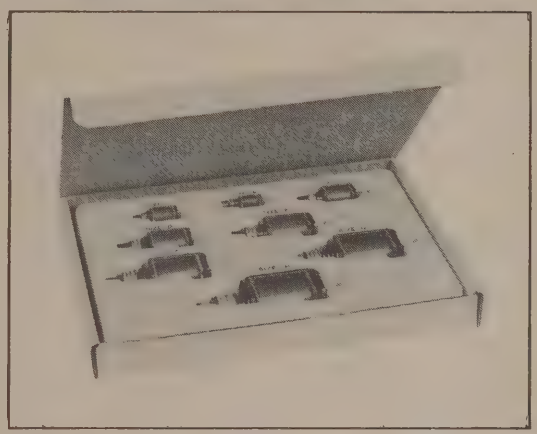
**A MAGNETEC INNOVATION . . .** A unique C-frame Solenoid Kit which the design engineer will find indispensable. The **192 combinations** of Series 'S' Solenoids included in the kit allow the engineer to go from initial design concept to final specification by simply tailoring his own . . . right on the spot! The Kit includes:

- 8 solenoid sizes
- 6 linkage options
- 4 action options
- 24VDC coils
- force range of 8 oz. to 14 lbs.
- all options assembled




**EXPLODED VIEW OF TYPICAL SOLENOID IN KIT**

**MODEL SK-2**
**A $48.00 VALUE FOR $24.95**



**REFER TO SERIES "S" C-FRAME SOLENOIDS FOR PERFORMANCE DATA**

## ABOUT MAGNETEC

Magnetec Corporation specializes in the design and manufacture of D.C. linear solenoids. Available styles include C-frame, D-frame, and tubulars. All styles are available with already designed numerous additional features, including spring returns, shock dampeners, push rods with or without plastic tips, and various clevis configurations. Coil windings may be tailored to the application for optimized solenoid performance. Merely provide us with the actual duty cycle, your force and stroke requirements, and your preferred coil voltage.

## CUSTOM SOLENOIDS

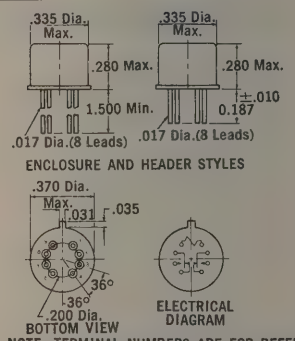
Solenoid technology has become highly specialized and we take pride in our engineering capability. Our custom designed solenoids are used in applications, including dot matrix impact printers, camera shutter actuators, electrical shut-off devices in diesel fuel injection pumps for automobiles, valves for adaptive braking systems for trucks, and ground fault interrupters. We are serving industries, including data communications, business equipment, photography, appliance, safety equipment, medical equipment, audio equipment, banking and vending equipment, aircraft, instrumentation, and automotive.

Whether your need is for an industry standard solenoid or a customized solenoid, our applications engineers would be pleased to offer their assistance and make their technical recommendations. Our detailed catalog literature is available upon request.

# TO-5 SERIES RELAY

## MA

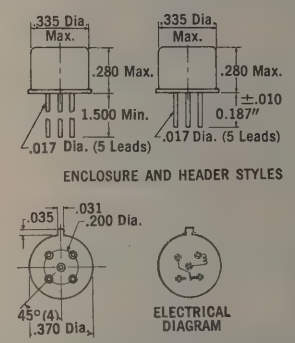
**DPDT CONTACTS**




NOTE: TERMINAL NUMBERS ARE FOR REFERENCE ONLY AND DO NOT APPEAR ON PART.

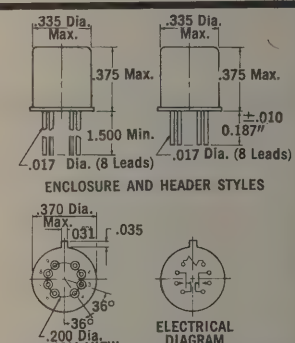
## 1MA

**SPDT CONTACTS**




## MS

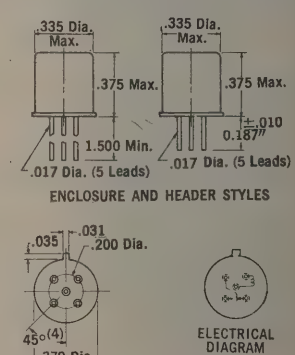
**DPDT CONTACTS**




NOTE: TERMINAL NUMBERS ARE FOR REFERENCE ONLY AND DO NOT APPEAR ON PART.

## 1MS

**SPDT CONTACTS**




## GENERAL SPECIFICATIONS

### CONTACT CAPABILITIES

**RATING**
10,000,000 operations at low level. 1,000,000 operations at 0.5 amp, 28V d-c resistive load. 100,000 operations at 1.0 amp, 28V d-c resistive load.

**CONTACT RESISTANCE**
0.1 ohm maximum before life (measured ⅛" from header). 0.15 ohm maximum after life at maximum rated current (measured ⅛" from header).

**CONTACT BOUNCE**
1.5 milliseconds maximum

**OVERLOAD**
2 amps at 28V d-c for 100 operations minimum

**INSULATION RESISTANCE**
10,000 megohms minimum between mutually insulated terminals

**ENCLOSURE**
Hermetically sealed. All welded.

### ENVIRONMENTAL CHARACTERISTICS

**TEMPERATURE RANGE**
— 65°C to + 125°C. (Higher temperature ratings on special order)

**VIBRATION**
.06" DA or 30G, 10-3000 cps.

**SHOCK**
75 G's

### MILITARY SPECIFICATIONS

All Hi-G MA and MS Series relays are manufactured in accordance with Military Specification MIL-R-39016 and its applicable detail specification. Level "L" or "M" Qualification available.

HI-G CO., INC. Relay Division, 580 Spring Street, Windsor Locks, Conn. 06096 / Phone (203) 623-2481 / TWX: 710-420-0592

**Qualified**

**Sensitivity:**
130 milliwatts

**Operate Time:**
2.5 milliseconds maximum at nom. coil voltage over temperature range.

**Release Time:**
1.5 milliseconds maximum at nom. coil voltage over temperature range.
With diode suppression 4.0 millisec.

**Dielectric Strength:**
500V RMS 60 cycles at sea level
125V RMS 60 cycles at 70,000 feet

**Weight:**
0.07 ounce with leads trimmed to ⅛", add 0.02 ounce for leads

| Hi-G Part No. | | Military Part MIL-R-39016 | | Coil Voltage (VDC) | | DC Coil Resistance Ohms ±10% @ 25°C | Pull In Voltage (VDC) Max.** | Drop Out Voltage (VDC)** | |
|---|---|---|---|---|---|---|---|---|---|
| Wire Term. | Pin Term. | Wire Term. | Pin Term. | Nom. | Max. | | | Max. | Min. |
| JMAW5* | JMAP5* | /9-001 | /9-007 | 5.0 | 5.8 | 50 | 3.5 | 2.3 | 0.14 |
| JMAW6* | JMAP6* | /9-002 | /9-008 | 6.0 | 8.0 | 98 | 4.5 | 3.2 | 0.18 |
| JMAW9* | JMAP9* | /9-003 | /9-009 | 9.0 | 12.0 | 220 | 6.8 | 4.9 | 0.35 |
| JMAW12* | JMAP12* | /9-004 | /9-010 | 12.0 | 16.0 | 390 | 9.0 | 6.5 | 0.41 |
| JMAW18* | JMAP18* | /9-005 | /9-011 | 18.0 | 24.0 | 880 | 13.5 | 10.0 | 0.59 |
| JMAW26* | JMAP26* | /9-006 | /9-012 | 26.5 | 32.0 | 1560 | 18.0 | 13.0 | 0.89 |
| JMAW30* | JMAP30* | /9-049 | /9-050 | 30.0 | 36.0 | 2500 | 22.0 | 16.00 | 1.0 |

* Add Failure Rate designation ** Over temperature range

**Qualified**

**Sensitivity:**
100 milliwatts

**Operate Time:**
2.0 milliseconds maximum at nom. coil voltage over temperature range.

**Release Time:**
2.0 milliseconds maximum at nom. coil voltage over temperature range.
With diode suppression 4.0 millisec.

**Dielectric Strength:**
500V RMS 60 cycles at sea level
300V RMS 60 cycles at 70,000 feet

**Weight:**
0.06 ounce with leads trimmed at ⅛", add 0.02 ounce for leads

| Hi-G Part No. | | Military Part MIL-R-39016 | | Coil Voltage (VDC) | | DC Coil Resistance Ohms ±10% @ 25°C | Pull In Voltage (VDC) Max.** | Drop Out Voltage (VDC)** | |
|---|---|---|---|---|---|---|---|---|---|
| Wire Term. | Pin Term. | Wire Term. | Pin Term. | Nom. | Max. | | | Max. | Min. |
| J1MAW5* | J1MAP5* | /7-001 | /7-002 | 5.0 | 6.0 | 63 | 3.7 | 2.4 | 0.15 |
| J1MAW6* | J1MAP6* | /7-003 | /7-004 | 6.0 | 8.0 | 125 | 4.5 | 2.8 | 0.18 |
| J1MAW9* | J1MAP9* | /7-005 | /7-006 | 9.0 | 12.0 | 280 | 6.8 | 4.2 | 0.35 |
| J1MAW12* | J1MAP12* | /7-007 | /7-008 | 12.0 | 16.0 | 500 | 9.0 | 5.6 | 0.40 |
| J1MAW18* | J1MAP18* | /7-009 | /7-010 | 18.0 | 24.0 | 1130 | 13.5 | 8.4 | 0.58 |
| J1MAW26* | J1MAP26* | /7-011 | /7-012 | 26.5 | 32.0 | 2000 | 18.0 | 10.4 | 0.89 |

* Add Failure Rate designation ** Over temperature range

**Qualified**

**Sensitivity:**
60 milliwatts

**Operate Time:**
4.0 milliseconds maximum at nom. coil voltage over temperature range.

**Release Time:**
2.0 milliseconds maximum at nom. coil voltage over temperature range.
With diode suppression 7.5 millisec.

**Dielectric Strength:**
500V RMS 60 cycles at sea level
125V RMS 60 cycles at 70,000 feet

**Weight:**
0.10 ounce with leads trimmed to ⅛", add 0.02 ounce for leads

| Hi-G Part No. | | Military Part MIL-R-39016 | | Coil Voltage (VDC) | | DC Coil Resistance Ohms ±10% @ 25°C | Pull In Voltage (VDC) Max.** | Drop Out Voltage (VDC)** | |
|---|---|---|---|---|---|---|---|---|---|
| Wire Term. | Pin Term. | Wire Term. | Pin Term. | Nom. | Max. | | | Max. | Min. |
| JMSW5* | JMSP5* | /11-001 | /11-002 | 5.0 | 7.5 | 100 | 3.5 | 2.5 | 0.12 |
| JMSW6* | JMSP6* | /11-003 | /11-004 | 6.0 | 10.0 | 200 | 4.5 | 3.2 | 0.18 |
| JMSW9* | JMSP9* | /11-013 | /11-014 | 9.0 | 15.0 | 400 | 6.8 | 4.9 | 0.35 |
| JMSW12* | JMSP12* | /11-005 | /11-006 | 12.0 | 20.0 | 850 | 9.0 | 6.5 | 0.41 |
| JMSW18* | JMSP18* | /11-015 | /11-016 | 18.0 | 30.0 | 1600 | 13.5 | 10.0 | 0.59 |
| JMSW26* | JMSP26* | /11-007 | /11-008 | 26.5 | 40.0 | 3300 | 18.0 | 13.0 | 0.89 |
| JMSW36* | JMSP36* | /11-009 | /11-010 | 36.0 | 57.0 | 6500 | 27.0 | 19.0 | 1.25 |
| JMSW48* | JMSP48* | /11-011 | /11-012 | 48.0 | 75.0 | 11000 | 36.0 | 26.0 | 1.60 |

* Add Failure Rate designation ** Over temperature range

**Qualified**

**Sensitivity:**
40 milliwatts

**Operate Time:**
4.0 milliseconds maximum at nom. coil voltage over temperature range

**Release Time:**
2.5 milliseconds maximum at nom. coil voltage over temperature range
With diode suppression 7.5 millisec.

**Dielectric Strength:**
500V RMS 60 cycles at sea level
300V RMS 60 cycles at 70,000 feet

**Weight:**
.08 ounce with leads trimmed to ⅛", add 0.02 ounce for leads

| Hi-G Part No. | | Military Part MIL-R-39016 | | Coil Voltage (VDC) | | DC Coil Resistance Ohms ±10% @ 25°C | Pull In Voltage (VDC) Max.** | Drop Out Voltage (VDC)** | |
|---|---|---|---|---|---|---|---|---|---|
| Wire Term. | Pin Term. | Wire Term. | Pin Term. | Nom. | Max. | | | Max. | Min. |
| J1MSW5* | J1MSP5* | /10-001 | /10-002 | 5.0 | 8.0 | 125 | 3.7 | 2.0 | 0.15 |
| J1MSW6* | J1MSP6* | /10-003 | /10-004 | 6.0 | 11.0 | 255 | 4.5 | 2.8 | 0.18 |
| J1MSW9* | J1MSP9* | /10-013 | /10-014 | 9.0 | 12.0 | 630 | 6.8 | 4.2 | 0.35 |
| J1MSW12* | J1MSP12* | /10-005 | /10-006 | 12.0 | 22.0 | 1025 | 9.0 | 5.6 | 0.40 |
| J1MSW18* | J1MSP18* | /10-015 | /10-016 | 18.0 | 24.0 | 2300 | 13.5 | 8.4 | 0.58 |
| J1MSW26* | J1MSP26* | /10-007 | /10-008 | 26.5 | 45.0 | 4000 | 18.0 | 10.4 | 0.89 |
| J1MSW32* | J1MSP32* | /10-009 | /10-010 | 32.0 | 57.0 | 6500 | 24.0 | 15.0 | 1.0 |
| J1MSW40* | J1MSP40* | /10-011 | /10-012 | 40.0 | 75.0 | 11000 | 30.0 | 18.7 | 1.3 |

* Add Failure Rate designation ** Over temperature range

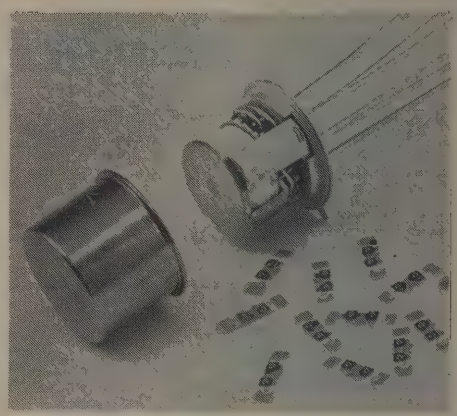
**Ordering Information:** Standard items may be ordered by part number shown. For variation consult factory.

**HI-G CO., INC. Relay Division, 580 Spring Street, Windsor Locks, Conn. 06096 / Phone (203) 623-2481 / TWX: 710-420-0592**

# TO5 HYBRID RELAYS

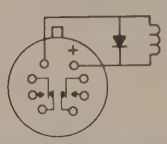
## GENERAL SPECIFICATIONS

**RATING:** 10,000,000 operations at low level. 1,000,000 operations at 0.5 amp, 28V d-c resistive load. 100,000 operations at 1.0 amp, 28V d-c resistive load.
**CONTACT RESISTANCE:** 0.1 ohm maximum before life (measured ⅛" from header). 0.2 ohm maximum after life at maximum rated current (measured ⅛" from header).
**CONTACT BOUNCE:** 1.5 milliseconds maximum.
**OVERLOAD:** 2 amps at 28V d-c for 100 operations minimum.
**INSULATION RESISTANCE:** 10,000 megohms minimum between mutually insulated terminals.
**ENCLOSURE:** Hermetically sealed. All welded.
**TEMPERATURE RANGE:** −65°C to +125°C.
**VIBRATION:** .06" DA or 30G, 10-3000 cps.
**SHOCK:** 80G's for 11 milliseconds.
**DIODE CHARACTERISTICS 25°C:** PIV 100V min.
**MAXIMUM COIL TRANSIENT:**
Transistor Coil Drive: 1.0V Suppression: 2.0V
**TRANSISTOR CHARACTERISTICS 25°C:**
Emitter-Base Voltage: 6V max.
Collector-Base Breakdown Voltage: 80V min. @ 100 μa.



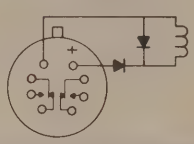
### SUPPRESSION
Each of Hi-G's relays are available with an integrated coil suppression diode to provide inhibition of the inductive arc voltage produced by the coil.

TYPE "D"



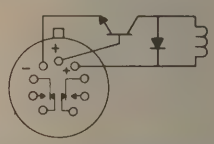
### SUPPRESSION/STEERING
The addition of a series diode to the suppressed coil circuit provides the added advantage of polarity reversal protection and the elimination of diode damage.

TYPE "DD"



### TRANSISTOR DRIVEN
The addition of an internal transistor coil drive provides increased operating sensitivity, high isolation while retaining the high level switching capability of the contacts.

TYPE "T"



## ORDERING INFORMATION

MAW D — 26

Series
D — Diode Suppression
DD — Supression/Steering
T — Transistor Driven
Coil Voltage

## MILITARY DESIGNATION

39016/X-XXX*

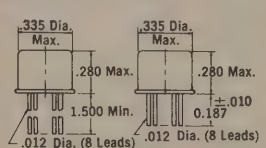
Basic Specification
Type
Voltage & Pin Configuration
* Failure Rate "L" or "M"

**Qualified**

All Hi-G Co., Inc. Hybrid TO-5 Relays are produced in accordance with the applicable Military specification noted below. The Hi-G part number can be derived by using the how to order information and this number can then be converted to the appropriate Military designation by reference pages 3538 and 3539 in this Volume.

| SUPPRESSED | SUPPRESSION/STEERING | TRANSISTOR DRIVEN |
|---|---|---|
| Type "D" | Type "DD" | Type "T" |
| MAWD-5 | MAWDD-5 | MAWT-5 |
| M39016/15-006* | M39016/20-001* | M28776/1-001* |

## MAW SERIES DPDT




**OPERATE TIME:** 2.5 milliseconds maximum at nom. coil voltage over temperature range.
**RELEASE TIME:** Transistor Driven — 7.5 milliseconds maximum at nom. coil voltage over temperature range.
**RELEASE TIME:** Coil Suppression — 4.0 milliseconds maximum at nom. coil voltage over temperature range.
**DIELECTRIC STRENGTH:** 500V RMS 60 cycles at sea level. 125V RMS 60 cycles at 70,000 feet.
**WEIGHT:** 0.07 ounce with leads trimmed to ⅛", add 0.02 ounce for leads.

See p. 3541 for pin and schematic diagrams.

| Relay Part No. / Type | MAW-5 D | MAW-5 DD | MAW-5 T | MAW-6 D | MAW-6 DD | MAW-6 T | MAW-9 D | MAW-9 DD | MAW-9 T | MAW-12 D | MAW-12 DD | MAW-12 T | MAW-18 D | MAW-18 DD | MAW-18 T | MAW-26 D | MAW-26 DD | MAW-26 T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Coil Nominal | 5 VDC | | | 6 VDC | | | 9 VDC | | | 12 VDC | | | 18 VDC | | | 26.5 VDC | | |
| Coil Resistance ± 10% | 50 | 39 | 50 | 98 | 78 | 98 | 220 | 220 | 220 | 390 | 390 | 390 | 880 | 880 | 880 | 1560 | 1560 | 1560 |
| Pull-in (max.) VDC | 3.5 | 3.9 | | 4.5 | 5.2 | | 6.8 | 7.8 | | 9.0 | 10.0 | | 13.5 | 14.5 | | 18.0 | 19.0 | |
| Base Current to turn-on (min.) MADC | | | 3.00 | | | 2.04 | | | 1.36 | | | 1.03 | | | 0.68 | | | 0.50 |
| Drop-out (max.) VDC | 2.3 | 2.3 | | 3.2 | 3.2 | | 4.9 | 4.9 | | 6.5 | 6.5 | | 10.0 | 10.0 | | 13.0 | 13.0 | 13.0 |

HI-G CO., INC. Relay Division, 580 Spring Street, Windsor Locks, Conn. 06096 / Phone (203) 623-2481 / TWX: 710-420-0592

# TO5 HYBRID RELAYS

## Qualified

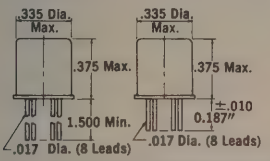
All Hi-G Co., Inc. Hybrid TO-5 Relays are produced in accordance with the applicable Military specification noted below. The Hi-G part number can be derived by using the how to order information and this number can then be converted to the appropriate Military designation by referencing pages 3538 and 3539 in this Volume.

**SUPPRESSED**
Type "D"
MSWD-5
M39016/16-001*

**SUPPRESSION/STEERING**
Type "DD"
MSWDD-5
M39016/21-001*

**TRANSISTOR DRIVEN**
Type "T"
MSWT-5
M28776/3-001*

## MSW SERIES SENSITIVE DPDT




See p. 3541 for pin and schematic diagrams.

**OPERATE TIME:** 4.0 milliseconds maximum at nom. coil voltage over temperature range.
**RELEASE TIME:** Transistor Driven — 7.5 milliseconds maximum at nom. coil voltage over temperature range.
**RELEASE TIME:** Coil Suppression — 7.5 milliseconds maximum at nom. coil voltage over temperature range.
**DIELECTRIC STRENGTH:** 500V RMS 60 cycles at sea level. 125V RMS 60 cycles at 70,000 feet.
**WEIGHT:** 0.10 ounce with leads trimmed to ⅛", add 0.02 ounce for leads.

| Relay Part No. / Type | MSW-5 | | | MSW-6 | | | MSW-9 | | | MSW-12 | | | MSW-18 | | | MSW-26 | | | MSW-36 | | | MSW-48 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | D | DD | T | D | DD | T | D | DD | T | D | DD | T | D | DD | T | D | DD | T | D | DD | T | D | DD | T |
| Coil Nominal | 5 VDC | | | 6 VDC | | | 9 VDC | | | 12 VDC | | | 18 VDC | | | 26.5 VDC | | | 36 VDC | | | 48 VDC | | |
| Coil Resistance ±10% | 100 | 64 | 100 | 200 | 125 | 200 | 400 | 400 | 400 | 850 | 850 | 850 | 1600 | 1600 | 1600 | 3300 | 3300 | 3300 | 6500 | 6500 | 6500 | 11000 | 11000 | 11000 |
| Pull-in (max.) VDC | 3.5 | 3.6 | | 4.5 | 4.8 | | 6.8 | 8.0 | | 9.0 | 11.0 | | 13.5 | 14.5 | | 18.0 | 19.0 | | 27.0 | 27.0 | | 36.0 | 36.0 | |
| Base Current to turn-on (min.) MADC | | | 1.50 | | | 1.0 | | | 0.75 | | | 0.47 | | | 0.38 | | | 0.24 | | | 0.17 | | | 0.13 |
| Drop-out (max.) VDC | 2.5 | 2.5 | | 3.2 | 3.2 | | 4.9 | 4.9 | | 6.5 | 6.5 | | 10.0 | 10.0 | | 13.0 | 13.0 | | 19.0 | 19.0 | | 26.0 | 26.0 | |

## Qualified

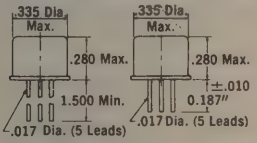
All Hi-G Co., Inc. Hybrid TO-5 Relays are produced in accordance with the applicable Military specification noted below. The Hi-G part number can be derived by using the how to order information and this number can then be converted to the appropriate Military designation by referencing pages 3538 and 3539 in this Volume.

**SUPPRESSED**
Type "D"
1MAWD-5
M39016/23-001*

**SUPPRESSION/STEERING**
Type "DD"
1MAWDD-5
M39016/24-001*

**TRANSISTOR DRIVEN**
Type "T"
1MAWT-5
M28776/5-001*

## 1MAW SERIES SPDT




See p. 3541 for pin and schematic diagrams.

**OPERATE TIME:** 2.0 milliseconds maximum at nom. coil voltage over temperature range.
**RELEASE TIME:** Transistor Driven — 7.5 milliseconds maximum at nom. coil voltage over temperature range.
**RELEASE TIME:** Coil Suppression — 4.0 milliseconds maximum at nom. coil voltage over temperature range.
**DIELECTRIC STRENGTH:** 500V RMS 60 cycles at sea level. 300V RMS 60 cycles at 70,000 feet.
**WEIGHT:** 0.06 ounce with leads trimmed to ⅛", add 0.02 ounce for leads.

| Relay Part No. / Type | 1MAW-5 | | | 1MAW-6 | | | -MAW-9 | | | 1MAW-12 | | | 1MAW-18 | | | 1MAW-26 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | D | DD | T | D | DD | T | D | DD | T | D | DD | T | D | DD | T | D | DD | T |
| Coil Nominal | 5 VDC | | | 6 VDC | | | 9 VDC | | | 12 VDC | | | 18 VDC | | | 26.5 VDC | | |
| Coil Resistance ± 10% | 63 | 50 | 63 | 125 | 98 | 125 | 280 | 280 | 280 | 500 | 500 | 500 | 1130 | 1130 | 1130 | 2000 | 2000 | 2000 |
| Pull-in (max.) VDC | 3.7 | 3.9 | | 4.5 | 5.2 | | 6.8 | 7.8 | | 9.0 | 10.0 | | 13.5 | 14.5 | | 18.0 | 19.0 | |
| Base Current to turn-on (min.) MADC | | | 2.38 | | | 1.60 | | | 1.07 | | | 0.80 | | | 0.53 | | | 0.40 |
| Drop-out (max.) VDC | 2.4 | 2.4 | | 2.8 | 2.8 | | 4.2 | 4.2 | | 5.6 | 5.6 | | 8.4 | 8.4 | | 10.4 | 10.4 | |

## Qualified

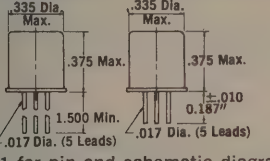
All Hi-G Co., Inc. Hybrid TO-5 Relays are produced in accordance with the applicable Military specification noted below. The Hi-G part number can be derived by using the how to order information and this number can then be converted to the appropriate Military designation by reference pages 3538 and 3539 in this Volume.

**SUPPRESSED**
Type "D"
1MSWD-5
M39016/25-001*

**SUPPRESSION/STEERING**
Type "DD"
1MSWDD-5
M39016/26-001*

**TRANSISTOR DRIVEN**
Type "T"
1MSWT-5
M28776/4-001*

## 1MSW SERIES SENSITIVE SPDT




See p. 3541 for pin and schematic diagrams.

**OPERATE TIME:** 4.0 milliseconds maximum at nom. coil voltage over temperature range.
**RELEASE TIME:** Transistor Driven — 7.5 milliseconds maximum at nom. coil voltage over temperature range.
**RELEASE TIME:** Coil Suppression — 7.5 milliseconds maximum at nom. coil voltage over temperature range.
**DIELECTRIC STRENGTH:** 500V RMS 60 cycles at sea level. 300V RMS 60 cycles at 70,000 feet.
**WEIGHT:** 0.08 ounce with leads trimmed to ⅛", add 0.02 ounce for leads.

| Relay Part No. / Type | 1MSW-5 | | | 1MSW-6 | | | 1MSW-9 | | | 1MSW-12 | | | 1MSW-18 | | | 1MSW-26 | | | 1MSW-32 | | | 1MSW-40 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | D | DD | T | D | DD | T | D | DD | T | D | DD | T | D | DD | T | D | DD | T | D | DD | T | D | DD | T |
| Coil Nominal | 5 VDC | | | 6 VDC | | | 9 VDC | | | 12 VDC | | | 18 VDC | | | 26.5 VDC | | | 36 VDC | | | 48 VDC | | |
| Coil Resistance ±10% | 125 | 100 | 125 | 255 | 200 | 255 | 630 | 630 | 630 | 1025 | 1025 | 1025 | 2300 | 2300 | 2300 | 4000 | 4000 | 4000 | 6500 | 6500 | 6500 | 11000 | 11000 | 11000 |
| Pull-in (max.) VDC | 3.7 | 3.8 | | 4.5 | 4.8 | | 6.8 | 7.8 | | 9.0 | 10.0 | | 13.5 | 14.5 | | 18.0 | 19.0 | | 24.0 | 24.0 | | 30.0 | 30.0 | |
| Base Current to turn-on (min.) MADC | | | 1.20 | | | 0.78 | | | 0.48 | | | 0.39 | | | 0.26 | | | 0.20 | | | 0.16 | | | 0.13 |
| Drop-out (max.) VDC | 2.0 | 2.0 | | 2.8 | 2.8 | | 4.2 | 4.2 | | 5.6 | 5.6 | | 8.4 | 8.4 | | 10.4 | 10.4 | | 15.0 | 15.0 | | 18.7 | 18.7 | |

# CRYSTAL CAN RELAYS

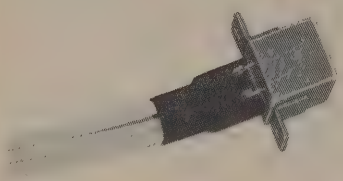
## RADIO FREQUENCY RELAYS

RF contacts are terminated with RG-196/U Teflon insulated coaxial cable, 6″ in length. Other lengths, types of cable, or coaxial connector terminations available on special order. These relays meet or exceed the applicable portions of MIL-R-5757 and MIL-S-3928.

| RADIO FREQUENCY CHARACTERISTICS | |
|---|---|
| **Frequency Range** | 0 - 500 MHz* |
| **Voltage Standing Wave Ratio (VSWR)** | <1.1:1 typical |
| **Insertion Loss** | 0.16db typical |
| **Characteristic Impedance** | 50 ohms† |
| **Crosstalk** | −50db typical |

** Usable to 1000 MHz with reduced RF characteristics*
*† Other impedances available on special order*

## DICE CUBE RADIO FREQUENCY RELAY — SERIES RFC PRODUCT BULLETIN 159



**Operate Power 150 mW**

| | |
|---|---|
| **Relay Type** | RFC |
| **Size** | 0.5-inch cube |
| **Contact Rating** | 200 watts RF cold switching<br>75 watts RF hot switching |
| **Maximum Weight** | 0.3 ounce (without terminations) |

Housing details on p. 3540 and 3541.

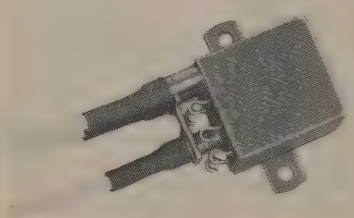
## HALF SIZE CRYSTAL-CAN RADIO FREQUENCY RELAY— SERIES RFK PRODUCT BULLETIN 156

**Operate Power 250 mW**

| | |
|---|---|
| **Relay Type** | RFK |
| **Size** | .4 x .8 x .4 inch |
| **Contact Rating** | 200 watts RF cold switching<br>75 watts RF hot switching |
| **Maximum Weight** | 0.37 ounce (without terminations) |

NOTE: Electrical characteristics & housing same as series K p. 3535.
Housing details on p. 3540 and 3541.

## CRYSTAL-CAN RADIO FREQUENCY RELAY — SERIES RFB PRODUCT BULLETIN 157

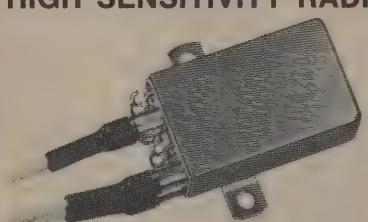


**Operate Power 250 mW**

| | |
|---|---|
| **Relay Type** | RFB |
| **Size** | .875 x .800 x .400 inch |
| **Contact Rating** | 200 watts RF cold switching<br>75 watts RF hot switching |
| **Maximum Weight** | 0.95 ounce (without terminations) |

NOTE: Electrical characteristics & housing same as series B p. 3536.
Housing details on p. 3540 and 3541.

## HIGH SENSITIVITY RADIO FREQUENCY RELAY — SERIES RFBC PRODUCT BULLETIN 158



**Operate Power 40 mW**

| | |
|---|---|
| **Relay Type** | RFBC |
| **Size** | 1.275 x .800 x .400 inch |
| **Contact Rating** | 200 watts RF cold switching<br>75 watts RF hot switching |
| **Maximum Weight** | 1.0 ounce (without terminations) |

NOTE: Electrical characteristics & housing same as series BC p. 3536.
Housing details on p. 3540 and 3541.

**ENVIRONMENTAL CHARACTERISTICS FOR STANDARD CRYSTAL CAN SERIES**

**Life:** 100,000 operations at 125°C and rated load.
**Temperature:** −65°C to +125°C, operating.
**Vibration:** 10 to 2000 Hz, 20G min.
**Shock:** 100 G
**Sealing:** Hermetic, to 80,000′

**Insulation Resistance:** 1000 megohms min., except coil-to-case at high temperature 500 megohms min.

**Dielectric Strength:** Contacts-to-case: 1000 volts rms, 60 Hz, mutually insulated terminals: 500 volts rms standard.

HI-G CO., INC. Relay Division, 580 Spring Street, Windsor Locks, Conn. 06096 / Phone (203) 623-2481 / TWX: 710-420-0592



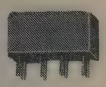
Add Dept. EM to address to tell them you saw it in eem

# CRYSTAL CAN RELAYS

## .150 GRID RELAY — SERIES G

Product Bulletin 95

Qualified



### CONTACT RATING

- 1 ampere resistive at 30 volts DC max.
- 0.125 amperes resistive at 115 volts RMS, 400 Hz, case grounded.
- Low level 0 to 0.1 ampere at 50 mV DC or AC.
- 2 ampere resistive at 30 volts DC max. (50,000 operations min.).

**VIBRATION:** 0.5″ DA from 5-34 Hz, 30G from 34-3000 Hz, 10$\mu$s max. contact opening.

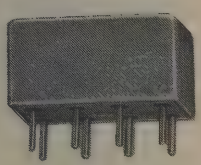
| Voltage Code | Coil Voltage (VDC) | | DC Coil Resistance | Max. Pull-in Voltage (VDC) | | Min. Drop-out Voltage (VDC) | |
|---|---|---|---|---|---|---|---|
| | Nom. | Max. | (Ohm ±10% @ 25°C) | 25°C | 125°C | 25°C | −65°C |
| 105 | 5 | 7 | 44 | 2.4 | 3.3 | 0.26 | 0.16 |
| 106 | 6 | 8 | 56 | 2.7 | 3.8 | 0.30 | 0.18 |
| 109 | 9 | 12 | 140 | 4.4 | 6.0 | 0.5 | 0.3 |
| 112 | 12 | 16 | 210 | 5.4 | 7.4 | 0.60 | 0.36 |
| 118 | 18 | 24 | 650 | 9.5 | 12.8 | 1.0 | 0.6 |
| 126 | 26.5 | 35 | 1350 | 13.5 | 18.0 | 1.50 | 0.9 |
| 136 | 36 | 46 | 2245 | 17.1 | 23.0 | 1.9 | 1.2 |

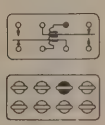
Housing details on p. 3540 and 3541.

## HALF-SIZE CRYSTAL CAN RELAY — SERIES 2K

Product Bulletin 102

Qualified





### CONTACT RATING

2 amperes resistive at 30 volts DC, 1 ampere resistive at 115 volts RMS, 400 Hz, case grounded and dry circuit.

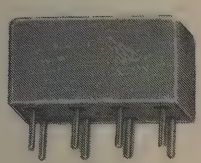
### ALL WELDED CONSTRUCTION

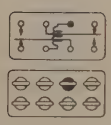
| Voltage Code | Nominal DC Coil Voltage | Max. Continuous Coil Voltage | Max. Pull-in Voltage @ 25°C | Min. Drop-out Voltage @ 25°C | DC Coil Resistance Ohms ±10% @ 25°C |
|---|---|---|---|---|---|
| 106 | 6 | 7.2 | 3.25 | .35 | 40 |
| 112 | 12 | 14.4 | 6.5 | .75 | 150 |
| 126 | 26.5 | 32 | 13.5 | 1.5 | 675 |

Housing details on p. 3540 and 3541.

## SENSITIVE HALF-SIZE 2 AMP RELAY — SERIES KA

Product Bulletin 110





### CONTACT RATING

- Low level — dry circuit.
- 2.0 ampere resistive at 30 volts DC
- 1.0 ampere resistive, 115 volts RMS, 400 Hz.
- 0.3 ampere resistive at 115 volts RMS, 60 Hz.
- 0.75 ampere inductive at 30 volts DC

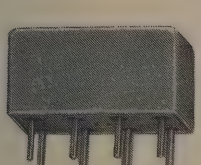
**VIBRATION:** 20G, 10-2000 Hz.

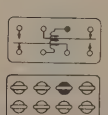
| Voltage Code | Nominal DC Coil Voltage | Max. Continuous Coil Voltage | Max. Pull-in Voltage @ 25°C | Min. Drop-out Voltage @ 25°C | Effective DC Coil Resistance ±10% @ 25°C |
|---|---|---|---|---|---|
| 106 | 6 | 7.2 | 3.6 | .35 | 130 |
| 112 | 12 | 14.4 | 7.2 | .7 | 518 |
| 126 | 26.5 | 32.0 | 14.4 | 1.4 | 2075 |
| 148 | 48 | 57.6 | 28.8 | 2.8 | 8300 |

Housing details on p. 3540 and 3541.

## HALF-PINT® MINIATURE 4 AMP RELAY — SERIES 2HA

Product Bulletin 100





### CONTACT RATING

4 amperes resistive at 30 volts DC, 1 ampere resistive at 115 volts RMS, 400 Hz, case grounded.

| Voltage Code | Nominal DC Coil Voltage | Max. Continuous Coil Voltage | Max. Pull-in Voltage @ 25°C | Min. Drop-out Voltage @ 25°C | DC Coil Resistance Ohms ±10% @ 25°C |
|---|---|---|---|---|---|
| 106 | 6 | 7.2 | 3.4 | .35 | 40 |
| 112 | 12 | 14.4 | 6.5 | .75 | 150 |
| 126 | 26.5 | 32 | 13.0 | 1.5 | 600 |

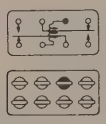
Housing details on p. 3540 and 3541.

# CRYSTAL CAN RELAYS

## 2 AMP CRYSTAL CAN RELAY — SERIES 2B

Product Bulletin 120

Qualified



**CONTACT RATING**
2 amperes resistive at 30 volts DC, 1 ampere resistive at 115 volts RMS, 400 Hz, case grounded and dry circuit.

**NOTE:** BR types for operation at 60 to 400 Hz with specifications shown. Units may be used at higher frequencies, but individual values of voltage may change.

2-pole units only available as standard catalog item.

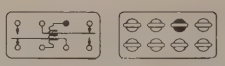
| Voltage Code | Nominal DC Coil Voltage | Max. Continuous Coil Voltage | Max. Pull-in Voltage @ 25°C | Min. Drop-out Voltage @ 25°C | DC Coil Resistance Ohms ±10% @ 25°C |
|---|---|---|---|---|---|
| **2B (DC Only, 2-Pole Only)** | | | | | |
| 106 | 6 | 7.2 | 3.1 | .5 | 40 |
| 112 | 12 | 14.4 | 6.3 | .75 | 160 |
| 126 | 26.5 | 32 | 13.0 | 1.5 | 675 |
| 148 | 48 | 58 | 25.0 | 2.5 | 2500 |
| 176 | 76 | 90 | 35.0 | 3.0 | 5000 |
| **2BR (AC Only, 2-Pole Only)** | | | | | |
| 126 | 26.5 | 32 | 15 | 2 | 600 |
| 148 | 48 | 58 | 28 | 3 | 2000 |
| 176 | 76 | 90 | 44 | 4 | 5000 |
| 215 | 115 | 125 | 66 | 5 | 10000 |

Housing details on p. 3540 and 3541.

## CURRENT SENSITIVE CRYSTAL CAN RELAY — 40 mW — SERIES BC

Product Bulletin 135

Qualified



**CONTACT RATING**
2 amperes resistive at 30 volts DC, 1 ampere resistive at 115 volts RMS, 400 Hz, case grounded.

| 2BC RELAY — DPDT — 40 mW | | | | | | 1 BC RELAY — SPDT — 25 mW | | | |
|---|---|---|---|---|---|---|---|---|---|
| Voltage Code | Coil Res. @ 25°C | Nominal Coil Voltage (VDC) | Nominal Coil Current (mA) | Max P.I. Current (mA) | Min. D.O. Current (mA) | Nominal Coil Voltage (VDC) | Nominal Coil Current (mA) | Max P.I. Current (mA) | Min. D.O. Current (mA) |
| 101 | 20 | 1.8 | 89.2 | 44.6 | 4.5 | 1.4 | 70.6 | 35.3 | 3.5 |
| 102 | 30 | 2.2 | 73.0 | 36.5 | 3.7 | 1.8 | 57.6 | 28.8 | 2.9 |
| 103 | 50 | 2.8 | 56.6 | 28.3 | 2.8 | 2.2 | 44.6 | 22.3 | 2.3 |
| 104 | 75 | 3.5 | 46.2 | 23.1 | 2.3 | 2.8 | 36.6 | 18.3 | 1.8 |
| 105 | 100 | 4.0 | 40.0 | 20.0 | 2.0 | 3.2 | 31.6 | 15.8 | 1.6 |
| 106 | 200 | 5.7 | 28.4 | 14.2 | 1.4 | 4.5 | 22.4 | 11.2 | 1.2 |
| 107 | 300 | 7.0 | 23.0 | 11.5 | 1.2 | 5.5 | 18.2 | 9.1 | .90 |
| 109 | 500 | 9.0 | 17.8 | 8.9 | .90 | 7.1 | 14.2 | 7.1 | .70 |
| 112 | 875 | 12.0 | 13.5 | 6.8 | .70 | 9.4 | 10.7 | 5.4 | .54 |
| 113 | 1000 | 12.6 | 12.6 | 6.5 | .60 | 10.0 | 10.0 | 5.0 | .50 |
| 118 | 2000 | 18.0 | 8.9 | 4.5 | .50 | 14.2 | 7.1 | 3.6 | .36 |
| 120 | 2500 | 20.0 | 8.0 | 4.0 | .40 | 15.8 | 6.3 | 3.2 | .32 |
| 128 | 5000 | 28.0 | 5.6 | 2.8 | .30 | 22.5 | 4.5 | 2.3 | .23 |
| 135 | 8000 | 36.0 | 4.5 | 2.3 | .23 | 29.0 | 3.6 | 1.8 | .18 |
| 140 | 10000 | 40.0 | 4.0 | 2.0 | .20 | 32.0 | 3.2 | 1.6 | .16 |

Housing details on p. 3540 and 3541.

## 5 AMP CRYSTAL CAN RELAYS

| | Sensitivity | Height | Product Bulletin |
|---|---|---|---|
| SERIES 2BCN | 80 MW | 1.281″ | 120A |
| SERIES 2BN | 280 MW | .900″ | 135A |

**CONTACT RATING**
5 amperes resistive at 30 volts DC, 3 ampere resistive at 115 volts RMS, 400 Hz, case grounded; 2 ampere resistive at 115 volts RMS, 60 Hz, case grounded.

**NOTE:** For AC operation BNR types are available on request.

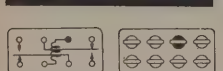
| Voltage Code | Nominal DC Coil Voltage | Max. Continuous Coil Voltage | Max. Pull-in Voltage @ 25°C | Min. Drop-out Voltage @ 25°C | DC Coil Resistance Ohms ±10% @ 25°C |
|---|---|---|---|---|---|
| **SERIES 2BN** | | | | | |
| 106 | 6 | 7.2 | 3.1 | .5 | 35 |
| 112 | 12 | 14.4 | 6.3 | .75 | 140 |
| 126 | 26.5 | 32 | 13.0 | 1.5 | 600 |
| 148 | 48 | 58 | 25.0 | 2.5 | 2200 |
| 176 | 76 | 90 | 35.0 | 3.0 | 4400 |
| **SERIES 2BCN** | | | | | |
| 106 | 6 | 54.5 mA | 27.3 mA | 3.0 mA | 110 |
| 112 | 12 | 26.7 mA | 13.4 mA | 1.4 mA | 450 |
| 128 | 28 | 11.2 mA | 5.6 mA | .6 mA | 2500 |
| 140 | 40 | 8.0 mA | 4.0 mA | .4 mA | 5000 |

Housing details on p. 3540 and 3541.

## 10 AMP CRYSTAL CAN RELAY — SERIES T

Product Bulletin 150

Qualified



**CONTACT RATING**
Standard rating 10 amperes resistive at 30 VDC, 5 amperes resistive at 115 V or 115 V, 400 Hz, case grounded.

| Voltage Code | Nominal DC Coil Voltage | Max. Continuous Coil Voltage | Max. Pull-in Voltage @ 25°C | Min. Drop-out Voltage @ 25°C | DC Coil Resistance Ohms ±10% @ 25°C |
|---|---|---|---|---|---|
| 106 | 6 | 7.2 | 3.3 | .5 | 22 |
| 112 | 12 | 14.4 | 6.7 | 1.0 | 90 |
| 126 | 26.5 | 32 | 13.0 | 2.0 | 330 |
| 215 | 115 | 125 | 63.0 | 5 | 7500 |

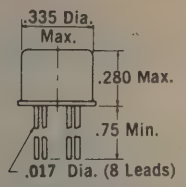
Housing details on p. 3540 and 3541.

HI-G CO., INC. Relay Division, 580 Spring Street, Windsor Locks, Conn. 06096 / Phone (203) 623-2481 / TWX: 710-420-0592

# INDUSTRIAL TO5 SERIES

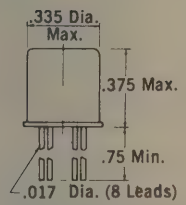
• Standard Version • Sensitive Version

## CAW SERIES DPDT



| Relay Part No. | CAW-5 | CAW-6 | CAW-9 | CAW-12 | CAW-18 | CAW-26 |
|---|---|---|---|---|---|---|
| Coil Nominal | 5VDC | 6VDC | 9VDC | 12VDC | 18VDC | 26.5VDC |
| Coil Resistance ±10% | 50 | 100 | 200 | 390 | 880 | 1560 |
| Pull-in (max.) VDC | 3.0 | 4.3 | 6.0 | 8.5 | 12.8 | 17.0 |

## CSW SERIES DPDT



| Relay Part No. | CSW-5 | CSW-6 | CSW-9 | CSW-12 | CSW-18 | CSW-26 |
|---|---|---|---|---|---|---|
| Coil Nominal | 5VDC | 6VDC | 9VDC | 12VDC | 18VDC | 26.5VDC |
| Coil Resistance ±10% | 100 | 200 | 400 | 850 | 1600 | 3300 |
| Pull-in (max.) VDC | 3.0 | 4.3 | 6.0 | 8.5 | 12.8 | 17.0 |

The Hi-G CA & CS Series relays are manufactured to the same exacting standards as its Military counterpart. Each relay boasts an all welded construction to afford hermeticity of seal and insurance of chamber cleanliness. This low price TO5 type relay will comply to all of your switching requirements between dry circuit and 1.0 ampere.

### GENERAL SPECIFICATIONS

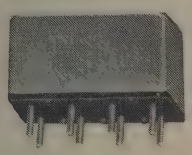
**OPERATE POWER:** CA Series, 185mw; CS Series, 90mw.
**OPERATE TIME:** CA, 4.0ms; CS, 6.0ms @ nominal volt.
**RELEASE TIME:** CA, 3.0ms; CS, 3.0ms.
**DIELECTRIC STRENGTH:** 350VRMS 60 Hz.
**INSULATION RESISTANCE:** 1,000 Megohms min.
**VIBRATION:** .06" DA 10-55 Hz, 10G to 500 Hz.
**SHOCK:** 30G Mil-Std 202 Method 213.
**TEMPERATURE** −55° to +71°C.
**LIFE:** 10,000,000 ops, mechanical,
1,000,000 ops, 0.5A 28VDC
100,000 ops, 1.0A 28VDC
**WEIGHT:** CA-0.08 oz., CS-0.15 oz.

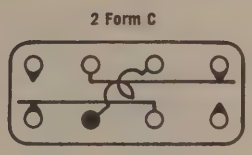
### ORDERING INFORMATION

CAW — 26
Series — Coil Voltage

**Also available with diode suppressed coil or Transistor Driver. Add D or T to Series.**

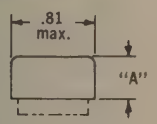
# INDUSTRIAL 2 AMP AND 5 AMP - FS2 AND FS5 FLAGSHIP SERIES

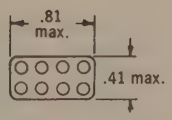





### Enclosure Styles

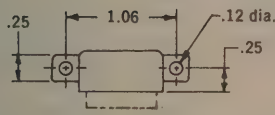
Style A

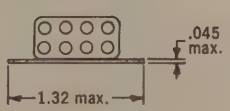


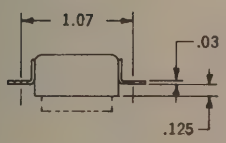

FS2 "A" Dimension .410
FS5 "A" Dimension .460

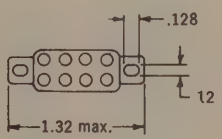
Style B



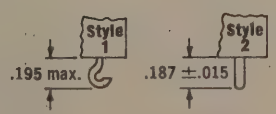




Style G




### Terminal Styles




### GENERAL SPECIFICATIONS

**OPERATE POWER:** FS2 350mw max.
FS5 725mw max.
**OPERATE TIME:** FS2 4.0ms max.
FS5 5.0ms max.
**RELEASE TIME:** FS2 2.0ms max.
FS5 3.0ms max.
**TEMPERATURE:** −55°C to +85°C
**DIELECTRIC STRENGTH:** 500VRMS all points
**INSULATION RESISTANCE:** 1000 megohms min.
**VIBRATION:** 10G 10-500 Hz
**SHOCK:** 50G 11ms

### ELECTRICAL SPECIFICATIONS

**FS2**

| Voltage Code | 106 | 112 | 124 | 136 | 148 |
|---|---|---|---|---|---|
| Nom. Coil Voltg | 6 VDC | 12 VDC | 24 VDC | 36 VDC | 48 VDC |
| Nom. Coil Resist. | 55 | 220 | 870 | 1960 | 3480 |
| Max. Pickup Volt. | 4.4 VDC | 8.7 VDC | 17.5 VDC | 26.0 VDC | 35.0 VDC |

**FS5**

| Voltage Code | 106 | 112 | 124 | 136 | 148 |
|---|---|---|---|---|---|
| Nom. Coil Volt. | 6 VDC | 12 VDC | 24 VDC | 36 VDC | 48 VDC |
| Nom. Coil Resist. ±10% at 25°C | 25 | 100 | 400 | 900 | 1600 |
| Max. Pickup Volt. | 4.3 VDC | 8.5 VDC | 17.0 VDC | 24.0 VDC | 34.0 VDC |

### SWITCHING SPECIFICATIONS

**CONFIGURATION:** 2 Form C - DPDT
**LOAD RATING:** FS2 Low Level, 2.0 Amp Resistive 30 VDC, 0.5 Amp 115 VAC 60-400 Hz
FS5 5.0 Amp Resistive 30 VDC, 3.0 Amp Resistive 115 VRMS 400 Hz.
**SWITCHING LIFE:** 1,000,000 operations minimum at maximum rated load
**CONTACT RESISTANCE:** FS2 0.05 ohms max. initial at rated load
FS5 100 millivolts max. initial max. rated load

### ORDERING INFORMATION

FS2 or FS5 — 1 A — 124
Series — Terminal — Enclosure — Voltage Code

HI-G CO., INC. Relay Division, 580 Spring Street, Windsor Locks, Conn. 06096 / Phone (203) 623-2481 / TWX: 710-420-0592

# HI-G QPL PRODUCTS

## qualified to the requirements of MIL-R-39016 MIL-R-28776 MIL-R-5757

### MIL-R-39016/7

| | |
|---|---|
| J1MAW-5 | M39016/7-001* |
| J1MAP-5 | M39016/7-002* |
| J1MAW-6 | M39016/7-003* |
| J1MAP-6 | M39016/7-004* |
| J1MAW-9 | M39016/7-005* |
| J1MAP-9 | M39016/7-006* |
| J1MAW-12 | M39016/7-007* |
| J1MAP-12 | M39016/7-008* |
| J1MAW-18 | M39016/7-009* |
| J1MAP-18 | M39016/7-010* |
| J1MAW-26 | M39016/7-011* |
| J1MAP-26 | M39016/7-012* |

### MIL-R-39016/9

| | |
|---|---|
| JMAW-5 | M39016/9-001* |
| JMAW-6 | M39016/9-002* |
| JMAW-9 | M39016/9-003* |
| JMAW-12 | M39016/9-004* |
| JMAW-18 | M39016/9-005* |
| JMAW-26 | M39016/9-006* |
| JMAP-5 | M39016/9-007* |
| JMAP-6 | M39016/9-008* |
| JMAP-9 | M39016/9-009* |
| JMAP-12 | M39016/9-010* |
| JMAP-18 | M39016/9-011* |
| JMAP-26 | M39016/9-012* |
| JMAW-30 | M39016/9-049* |
| JMAP-30 | M39016/9-050* |

### MIL-R-39016/10

| | |
|---|---|
| J1MSW-5 | M39016/10-001* |
| J1MSP-5 | M39016/10-002* |
| J1MSW-6 | M39016/10-003* |
| J1MSP-6 | M39016/10-004* |
| J1MSW-12 | M39016/10-005* |
| J1MSP-12 | M39016/10-006* |
| J1MSW-26 | M39016/10-007* |
| J1MSP-26 | M39016/10-008* |
| J1MSW-32 | M39016/10-009* |
| J1MSP-32 | M39016/10-010* |
| J1MSW-40 | M39016/10-011* |
| J1MSP-40 | M39016/10-012* |
| J1MSW-9 | M39016/10-013* |
| J1MSP-9 | M39016/10-014* |
| J1MSW-18 | M39016/10-015* |
| J1MSP-18 | M39016/10-016* |

### MIL-R-39016/11

| | |
|---|---|
| JMSW-5 | M39016/11-001* |
| JMSP-5 | M39016/11-002* |
| JMSW-6 | M39016/11-003* |
| JMSP-6 | M39016/11-004* |
| JMSW-12 | M39016/11-005* |
| JMSP-12 | M39016/11-006* |
| JMSW-26 | M39016/11-007* |
| JMSP-26 | M39016/11-008* |
| JMSW-36 | M39016/11-009* |
| JMSP-36 | M39016/11-010* |
| JMSW-48 | M39016/11-011* |
| JMSP-48 | M39016/11-012* |
| JMSW-9 | M39016/11-013* |
| JMSP-9 | M39016/11-014* |
| JMSW-18 | M39016/11-015* |
| JMSP-18 | M39016/11-016* |

### MIL-R-39016/6

| | | | |
|---|---|---|---|
| J2K-4730-104 | M39016/6-104* | J2K-4730-204 | M39016/6-204* |
| J2K-4730-105 | M39016/6-105* | J2K-4730-205 | M39016/6-205* |
| J2K-4730-106 | M39016/6-106* | J2K-4730-206 | M39016/6-206* |
| J2K-4730-107 | M39016/6-107* | J2K-4730-207 | M39016/6-207* |
| J2K-4730-108 | M39016/6-108* | J2K-4730-208 | M39016/6-208* |
| J2K-4730-109 | M39016/6-109* | J2K-4730-209 | M39016/6-209* |
| J2K-4730-110 | M39016/6-110* | J2K-4730-210 | M39016/6-210* |
| J2K-4730-111 | M39016/6-111* | J2K-4730-211 | M39016/6-211* |
| J2K-4730-112 | M39016/6-112* | J2K-4730-212 | M39016/6-212* |
| J2K-4730-113 | M39016/6-113* | J2K-4730-213 | M39016/6-213* |
| J2K-4730-114 | M39016/6-114* | J2K-4730-214 | M39016/6-214* |
| J2K-4730-115 | M39016/6-115* | J2K-4730-215 | M39016/6-215* |
| J2K-4730-116 | M39016/6-116* | J2K-4730-216 | M39016/6-216* |
| J2K-4730-117 | M39016/6-117* | J2K-4730-217 | M39016/6-217* |
| J2K-4730-118 | M39016/6-118* | J2K-4730-218 | M39016/6-218* |
| J2K-4730-119 | M39016/6-119* | J2K-4730-219 | M39016/6-219* |
| J2K-4730-120 | M39016/6-120* | J2K-4730-220 | M39016/6-220* |
| J2K-4730-121 | M39016/6-121* | J2K-4730-221 | M39016/6-221* |
| J2K-4730-122 | M39016/6-122* | J2K-4730-222 | M39016/6-222* |
| J2K-4730-123 | M39016/6-123* | J2K-4730-223 | M39016/6-223* |
| J2K-4730-124 | M39016/6-124* | J2K-4730-224 | M39016/6-224* |
| J2K-4730-125 | M39016/6-125* | J2K-4730-225 | M39016/6-225* |
| J2K-4730-126 | M39016/6-126* | J2K-4730-226 | M39016/6-226* |
| J2K-4730-127 | M39016/6-127* | J2K-4730-227 | M39016/6-227* |

### MIL-R-39016/13

| | | | |
|---|---|---|---|
| J2G-4650-55 | M39016/13-055* | J2G-4650-74 | M39016/13-074* |
| J2G-4650-56 | M39016/13-056* | J2G-4650-75 | M39016/13-075* |
| J2G-4650-57 | M39016/13-057* | J2G-4650-76 | M39016/13-076* |
| J2G-4650-58 | M39016/13-058* | J2G-4650-77 | M39016/13-077* |
| J2G-4650-59 | M39016/13-059* | J2G-4650-78 | M39016/13-078* |
| J2G-4650-60 | M39016/13-060* | J2G-4650-79 | M39016/13-079* |
| J2G-4650-61 | M39016/13-061* | J2G-4650-80 | M39016/13-080* |
| J2G-4650-62 | M39016/13-062* | J2G-4650-81 | M39016/13-081* |
| J2G-4650-63 | M39016/13-063* | J2G-4650-82 | M39016/13-082* |
| J2G-4650-64 | M39016/13-064* | J2G-4650-83 | M39016/13-083* |
| J2G-4650-65 | M39016/13-065* | J2G-4650-84 | M39016/13-084* |
| J2G-4650-66 | M39016/13-066* | J2G-4650-85 | M39016/13-085* |
| J2G-4650-67 | M39016/13-067* | J2G-4650-86 | M39016/13-086* |
| J2G-4650-68 | M39016/13-068* | J2G-4650-87 | M39016/13-087* |
| J2G-4650-69 | M39016/13-069* | J2G-4650-88 | M39016/13-088* |
| J2G-4650-70 | M39016/13-070* | J2G-4650-89 | M39016/13-089* |
| J2G-4650-71 | M39016/13-071* | J2G-4650-90 | M39016/13-090* |
| J2G-4650-72 | M39016/13-072* | J2G-4650-91 | M39016/13-091* |
| J2G-4650-73 | M39016/13-073* | | |

### MIL-R-5757/23

| | | | | | |
|---|---|---|---|---|---|
| 2T-2911-1 | M5757/23-001 | 2T-2911-17 | M5757/23-017 | | |
| 2T-2911-2 | M5757/23-002 | 2T-2911-18 | M5757/23-018 | | |
| 2T-2911-3 | M5757/23-003 | 2T-2911-19 | M5757/23-019 | | |
| 2T-2911-4 | M5757/23-004 | 2T-2911-20 | M5757/23-020 | | |
| 2T-2911-5 | M5757/23-005 | 2T-2911-21 | M5757/23-021 | | |
| 2T-2911-6 | M5757/23-006 | 2T-2911-22 | M5757/23-022 | | |
| 2T-2911-7 | M5757/23-007 | 2T-2911-23 | M5757/23-023 | | |
| 2T-2911-8 | M5757/23-008 | 2T-2911-24 | M5757/23-024 | | |
| 2T-2911-9 | M5757/23-009 | 2T-2911-25 | M5757/23-025 | | |
| 2T-2911-10 | M5757/23-010 | 2T-2911-26 | M5757/23-026 | | |
| 2T-2911-11 | M5757/23-011 | 2T-2911-27 | M5757/23-027 | | |
| 2T-2911-12 | M5757/23-012 | 2T-2911-28 | M5757/23-028 | | |
| 2T-2911-13 | M5757/23-013 | 2T-2911-29 | M5757/23-029 | | |
| 2T-2911-14 | M5757/23-014 | 2T-2911-30 | M5757/23-030 | | |
| 2T-2911-15 | M5757/23-015 | | | | |
| 2T-2911-16 | M5757/23-016 | 2T-2994-1 | M5757/28-001 | | |

### MIL-R-39016/15

| | |
|---|---|
| JMAWD-6 | M39016/15-001* |
| JMAWD-9 | M39016/15-002* |
| JMAWD-12 | M39016/15-003* |
| JMAWD-18 | M39016/15-004* |
| JMAWD-26 | M39016/15-005* |
| JMAWD-5 | M39016/15-006* |
| JMAPD-6 | M39016/15-017* |
| JMAPD-9 | M39016/15-018* |
| JMAPD-12 | M39016/15-019* |
| JMAPD-18 | M39016/15-020* |
| JMAPD-26 | M39016/15-021* |
| JMAPD-5 | M39016/15-022* |

### MIL-R-39016/16

| | |
|---|---|
| JMSWD-5 | M39016/16-001* |
| JMSWD-6 | M39016/16-002* |
| JMSWD-12 | M39016/16-003* |
| JMSWD-26 | M39016/16-004* |
| JMSWD-36 | M39016/16-005* |
| JMSWD-48 | M39016/16-006* |
| JMSWD-9 | M39016/16-007* |
| JMSWD-18 | M39016/16-008* |
| JMSPD-5 | M39016/16-009* |
| JMSPD-6 | M39016/16-010* |
| JMSPD-12 | M39016/16-011* |
| JMSPD-26 | M39016/16-012* |
| JMSPD-36 | M39016/16-013* |
| JMSPD-48 | M39016/16-014* |
| JMSPD-9 | M39016/16-015* |
| JMSPD-18 | M39016/16-016* |

### MIL-R-39016/20

| | |
|---|---|
| JMAWDD-5 | M39016/20-001* |
| JMAWDD-6 | M39016/20-002* |
| JMAWDD-9 | M39016/20-003* |
| JMAWDD-12 | M39016/20-004* |
| JMAWDD-18 | M39016/20-005* |
| JMAWDD-26 | M39016/20-006* |
| JMAPDD-5 | M39016/20-025* |
| JMAPDD-6 | M39016/20-026* |
| JMAPDD-9 | M39016/20-027* |
| JMAPDD-12 | M39016/20-028* |
| JMAPDD-18 | M39016/20-029* |
| JMAPDD-26 | M39016/20-030* |

### MIL-R-39016/21

| | |
|---|---|
| JMSWDD-5 | M39016/21-001* |
| JMSWDD-6 | M39016/21-002* |
| JMSWDD-9 | M39016/21-003* |
| JMSWDD-12 | M39016/21-004* |
| JMSWDD-18 | M39016/21-005* |
| JMSWDD-26 | M39016/21-006* |
| JMSPDD-5 | M39016/21-013* |
| JMSPDD-6 | M39016/21-014* |
| JMSPDD-9 | M39016/21-015* |
| JMSPDD-12 | M39016/21-016* |
| JMSPDD-18 | M39016/21-017* |
| JMSPDD-26 | M39016/21-018* |
| JMSWDD-36 | M39016/21-025* |
| JMSWDD-48 | M39016/21-026* |
| JMSPDD-36 | M39016/21-027* |
| JMSPDD-48 | M39016/21-028* |

* Add Applicable Failure Rate Level.

HI-G CO., INC. Relay Division, 580 Spring Street, Windsor Locks, Conn. 06096 / Phone (203) 623-2481 / TWX: 710-420-0592

# HI-G QPL PRODUCTS

## qualified to the requirements of MIL-R-39016 MIL-R-28776 MIL-R-5757

### MIL-R-39016/23

| | |
|---|---|
| J1MAWD-5 | M39016/23-001* |
| J1MAWD-6 | M39016/23-002* |
| J1MAWD-9 | M39016/23-003* |
| J1MAWD-12 | M39016/23-004* |
| J1MAWD-18 | M39016/23-005* |
| J1MAWD-26 | M39016/23-006* |
| J1MAPD-5 | M39016/23-007* |
| J1MAPD-6 | M39016/23-008* |
| J1MAPD-9 | M39016/23-009* |
| J1MAPD-12 | M39016/23-010* |
| J1MAPD-18 | M39016/23-011* |
| J1MAPD-26 | M39016/23-012* |

### MIL-R-39016/24

| | |
|---|---|
| J1MAWDD-5 | M39016/24-001* |
| J1MAWDD-6 | M39016/24-002* |
| J1MAWDD-9 | M39016/24-003* |
| J1MAWDD-12 | M39016/24-004* |
| J1MAWDD-18 | M39016/24-005* |
| J1MAWDD-26 | M39016/24-006* |
| J1MAPDD-5 | M39016/24-007* |
| J1MAPDD-6 | M39016/24-008* |
| J1MAPDD-9 | M39016/24-009* |
| J1MAPDD-12 | M39016/24-010* |
| J1MAPDD-18 | M39016/24-011* |
| J1MAPDD-26 | M39016/24-012* |

### MIL-R-39016/25

| | |
|---|---|
| J1MSWD-5 | M39016/25-001* |
| J1MSWD-6 | M39016/25-002* |
| J1MSWD-12 | M39016/25-003* |
| J1MSWD-26 | M39016/25-004* |
| J1MSWD-32 | M39016/25-005* |
| J1MSWD-40 | M39016/25-006* |
| J1MSPD-5 | M39016/25-007* |
| J1MSPD-6 | M39016/25-008* |
| J1MSPD-12 | M39016/25-009* |
| J1MSPD-26 | M39016/25-010* |
| J1MSPD-32 | M39016/25-011* |
| J1MSPD-40 | M39016/25-012* |
| J1MSWD-9 | M39016/25-013* |
| J1MSWD-18 | M39016/25-014* |
| J1MSPD-9 | M39016/25-015* |
| J1MSPD-18 | M39016/25-016* |

### MIL-R-39016/26

| | |
|---|---|
| J1MSWDD-5 | M39016/26-001* |
| J1MSWDD-6 | M39016/26-002* |
| J1MSWDD-12 | M39016/26-003* |
| J1MSWDD-26 | M39016/26-004* |
| J1MSWDD-32 | M39016/26-005* |
| J1MSWDD-40 | M39016/26-006* |
| J1MSPDD-5 | M39016/26-007* |
| J1MSPDD-6 | M39016/26-008* |
| J1MSPDD-12 | M39016/26-009* |
| J1MSPDD-26 | M39016/26-010* |
| J1MSPDD-32 | M39016/26-011* |
| J1MSPDD-40 | M39016/26-012* |
| J1MSWDD-9 | M39016/26-013* |
| J1MSWDD-18 | M39016/26-014* |
| J1MSPDD-9 | M39016/26-015* |
| J1MSPDD-18 | M39016/26-016* |

### MIL-R-5757/10

| | | | |
|---|---|---|---|
| 2B-1506-1 | M5757/10-001 | 2B-1506-25 | M5757/10-025 |
| 2B-1506-2 | M5757/10-002 | 2B-1506-26 | M5757/10-026 |
| 2B-1506-3 | M5757/10-003 | 2B-1506-27 | M5757/10-027 |
| 2B-1506-4 | M5757/10-004 | 2B-1506-28 | M5757/10-028 |
| 2B-1506-5 | M5757/10-005 | 2B-1506-29 | M5757/10-029 |
| 2B-1506-6 | M5757/10-006 | 2B-1506-30 | M5757/10-030 |
| 2B-1506-7 | M5757/10-007 | 2B-1506-31 | M5757/10-031 |
| 2B-1506-8 | M5757/10-008 | 2B-1506-32 | M5757/10-032 |
| 2B-1506-9 | M5757/10-009 | 2B-1506-33 | M5757/10-033 |
| 2B-1506-10 | M5757/10-010 | 2B-1506-34 | M5757/10-034 |
| 2B-1506-11 | M5757/10-011 | 2B-1506-35 | M5757/10-035 |
| 2B-1506-12 | M5757/10-012 | 2B-1506-36 | M5757/10-036 |
| 2B-1506-13 | M5757/10-013 | 2B-1506-37 | M5757/10-037 |
| 2B-1506-14 | M5757/10-014 | 2B-1506-38 | M5757/10-038 |
| 2B-1506-15 | M5757/10-015 | 2B-1506-39 | M5757/10-039 |
| 2B-1506-16 | M5757/10-016 | 2B-1506-40 | M5757/10-040 |
| 2B-1506-17 | M5757/10-017 | 2B-1506-41 | M5757/10-041 |
| 2B-1506-18 | M5757/10-018 | 2B-1506-42 | M5757/10-042 |
| 2B-1506-19 | M5757/10-019 | 2B-1506-43 | M5757/10-043 |
| 2B-1506-20 | M5757/10-020 | 2B-1506-44 | M5757/10-044 |
| 2B-1506-21 | M5757/10-021 | 2B-1506-52 | M5757/10-052 |
| 2B-1506-22 | M5757/10-022 | 2B-1506-53 | M5757/10-053 |
| 2B-1506-23 | M5757/10-023 | 2B-1506-54 | M5757/10-054 |
| 2B-1506-24 | M5757/10-024 | 2B-1506-141 | M5757/10-141 |

### MIL-R-5757/13

| | | | |
|---|---|---|---|
| 2BC-1501-11 | M5757/13-011 | 2BC-1510-52 | M5757/13-052 |
| 2BC-1510-12 | M5757/13-012 | 2BC-1510-53 | M5757/13-053 |
| 2BC-1510-13 | M5757/13-013 | 2BC-1510-54 | M5757/13-054 |
| 2BC-1510-14 | M5757/13-014 | 2BC-1510-55 | M5757/13-055 |
| 2BC-1510-15 | M5757/13-015 | 2BC-1510-56 | M5757/13-056 |
| 2BC-1510-16 | M5757/13-016 | 2BC-1510-57 | M5757/13-057 |
| 2BC-1510-17 | M5757/13-017 | 2BC-1510-58 | M5757/13-058 |
| 2BC-1510-18 | M5757/13-018 | 2BC-1510-59 | M5757/13-059 |
| 2BC-1510-19 | M5757/13-019 | 2BC-1510-60 | M5757/13-060 |
| 2BC-1510-20 | M5757/13-020 | 2BC-1510-61 | M5757/13-061 |
| 2BC-1510-31 | M5757/13-031 | 2BC-1510-62 | M5757/13-062 |
| 2BC-1510-32 | M5757/13-032 | 2BC-1510-63 | M5757/13-063 |
| 2BC-1510-33 | M5757/13-033 | 2BC-1510-64 | M5757/13-064 |
| 2BC-1510-34 | M5757/13-034 | 2BC-1510-65 | M5757/13-065 |
| 2BC-1510-35 | M5757/13-035 | 2BC-1510-66 | M5757/13-066 |
| 2BC-1510-36 | M5757/13-036 | 2BC-1510-67 | M5757/13-067 |
| 2BC-1510-37 | M5757/13-037 | 2BC-1510-68 | M5757/13-068 |
| 2BC-1510-38 | M5757/13-038 | 2BC-1510-69 | M5757/13-069 |
| 2BC-1510-39 | M5757/13-039 | 2BC-1510-70 | M5757/13-070 |
| 2BC-1510-40 | M5757/13-040 | 2BC-1510-72 | M5757/13-072 |
| 2BC-1510-41 | M5757/13-041 | 2BC-1510-73 | M5757/13-073 |
| 2BC-1510-42 | M5757/13-042 | 2BC-1510-74 | M5757/13-074 |
| 2BC-1510-43 | M5757/13-043 | 2BC-1510-75 | M5757/13-075 |
| 2BC-1510-44 | M5757/13-044 | 2BC-1510-76 | M5757/13-076 |
| 2BC-1510-45 | M5757/13-045 | 2BC-1510-77 | M5757/13-077 |
| 2BC-1510-46 | M5757/13-046 | 2BC-1510-78 | M5757/13-078 |
| 2BC-1510-47 | M5757/13-047 | 2BC-1510-79 | M5757/13-079 |
| 2BC-1510-48 | M5757/13-048 | 2BC-1510-80 | M5757/13-080 |
| 2BC-1510-49 | M5757/13-049 | 2BC-1510-81 | M5757/13-081 |
| 2BC-1510-50 | M5757/13-050 | 2BC-1510-82 | M5757/13-082 |
| 2BC-1510-51 | M5757/13-051 | | |

### MIL-R-28776/1

| | |
|---|---|
| JMAWT-5 | M28776/1-001* |
| JMAWT-6 | M28776/1-002* |
| JMAWT-9 | M28776/1-003* |
| JMAWT-12 | M28776/1-004* |
| JMAWT-18 | M28776/1-005* |
| JMAWT-26 | M28776/1-006* |
| JMAPT-5 | M28776/1-007* |
| JMAPT-6 | M28776/1-008* |
| JMAPT-9 | M28776/1-009* |
| JMAPT-12 | M28776/1-010* |
| JMAPT-18 | M28776/1-011* |
| JMAPT-26 | M28776/1-012* |

### MIL-R-28776/3

| | |
|---|---|
| JMSWT-5 | M28776/3-001* |
| JMSWT-6 | M28776/3-002* |
| JMSWT-9 | M28776/3-003* |
| JMSWT-12 | M28776/3-004* |
| JMSWT-18 | M28776/3-005* |
| JMSWT-26 | M28776/3-006* |
| JMSWT-36 | M28776/3-007* |
| JMSWT-48 | M28776/3-008* |
| JMSPT-5 | M28776/3-009* |
| JMSPT-6 | M28776/3-010* |
| JMSPT-9 | M28776/3-011* |
| JMSPT-12 | M28776/3-012* |
| JMSPT-18 | M28776/3-013* |
| JMSPT-26 | M28776/3-014* |
| JMSPT-36 | M28776/3-015* |
| JMSPT-48 | M28776/3-016* |

### MIL-R-28776/4

| | |
|---|---|
| J1MSWT-5 | M28776/4-001* |
| J1MSWT-6 | M28776/4-002* |
| J1MSWT-9 | M28776/4-003* |
| J1MSWT-12 | M28776/4-004* |
| J1MSWT-18 | M28776/4-005* |
| J1MSWT-26 | M28776/4-006* |
| J1MSWT-32 | M28776/4-007* |
| J1MSWT-40 | M28776/4-008* |
| J1MSPT-5 | M28776/4-009* |
| J1MSPT-6 | M28776/4-010* |
| J1MSPT-9 | M28776/4-011* |
| J1MSPT-12 | M28776/4-012* |
| J1MSPT-18 | M28776/4-013* |
| J1MSPT-26 | M28776/4-014* |
| J1MSPT-32 | M28776/4-015* |
| J1MSPT-40 | M28776/4-016* |

### MIL-R-28776/5

| | |
|---|---|
| J1MAWT-5 | M28776/5-001* |
| J1MAWT-6 | M28776/5-002* |
| J1MAWT-9 | M28776/5-003* |
| J1MAWT-12 | M28776/5-004* |
| J1MAWT-18 | M28776/5-005* |
| J1MAWT-26 | M28776/5-006* |
| J1MAPT-5 | M28776/5-007* |
| J1MAPT-6 | M28776/5-008* |
| J1MAPT-9 | M28776/5-009* |
| J1MAPT-12 | M28776/5-010* |
| J1MAPT-18 | M28776/5-011* |
| J1MAPT-26 | M28776/5-012* |

* Add Applicable Failure Rate Level.

HI-G CO., INC. Relay Division, 580 Spring Street, Windsor Locks, Conn. 06096 / Phone (203) 623-2481 / TWX: 710-420-0592

# HI G CRYSTAL CAN RELAYS

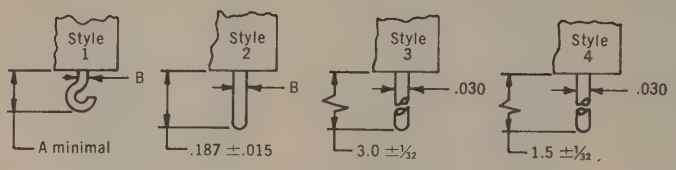
## HOW TO ORDER BY PART NUMBER

| 2BC | — | 1 | A | — | 128 |
|---|---|---|---|---|---|
| Series | | Terminal Style | Enclosure Style | | Voltage Code |

Variations of Terminals and Enclosure styles are available from the factory on special order.

**Q.P.L. PRODUCTS MAY BE ORDERED BY THEIR MILITARY TYPE DESIGNATION USING THE APPROPRIATE DASH NUMBER.**

### Terminal Styles



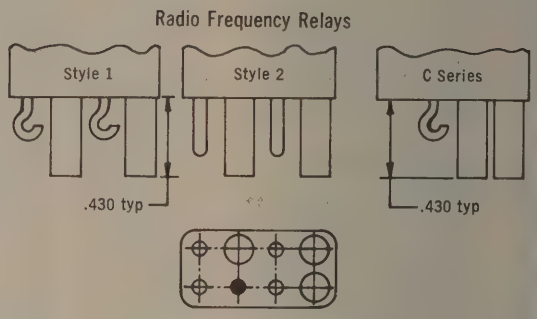

**Styles 1 & 2**
Available for all relay series

| | A | B |
|---|---|---|
| G Series | .130″ | .030″ |
| T Series | .250″ | .050″ |
| 4B Series | .250″ | .030″ |
| All others | .187″ | .030″ |

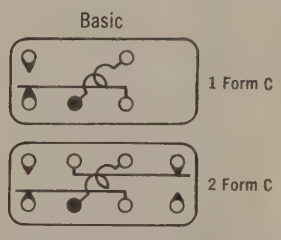
**Style 3**
Not Available
T Series
KL Series

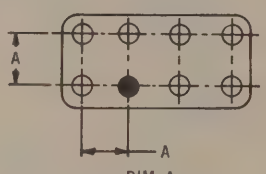
**Style 4**
Not Available
T Series
KL Series
BN Series
BCN Series
G Series

Radio Frequency Relays



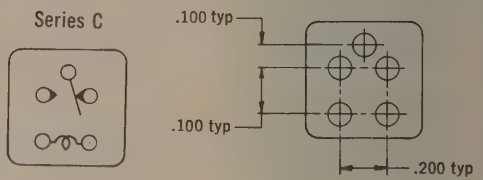

### Schematics & Terminal Locations



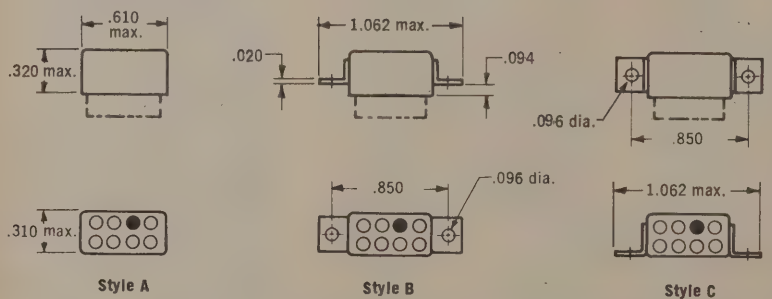




DIM. A
G Series .150 typ
All others .200 typ

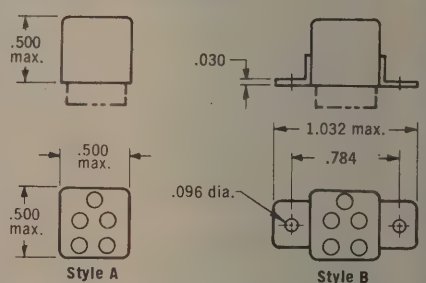
### RFC Series



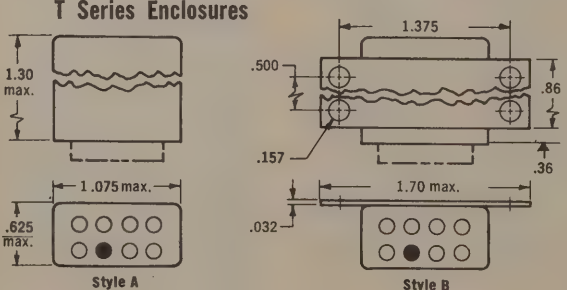

### G Series Enclosures




### RFC Series Enclosures



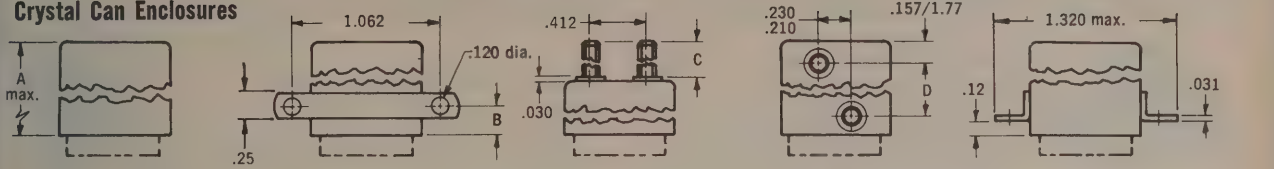

### T Series Enclosures




HI-G CO., INC. Relay Division, 580 Spring Street, Windsor Locks, Conn. 06096 / Phone (203) 623-2481 / TWX: 710-420-0592

# CRYSTAL CAN RELAYS

## Crystal Can Enclosures



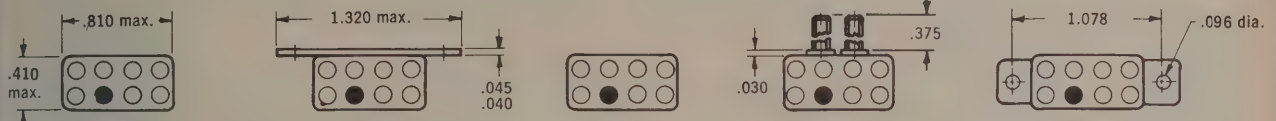



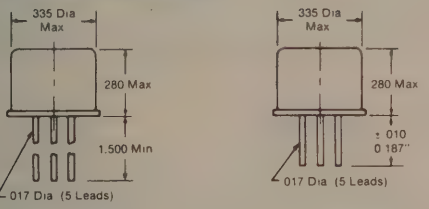

Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5

| Relay Series | Enclosure Style | | | | | Dimensions | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Fig. 1 | Fig. 2 | Fig. 3 | Fig. 4 | Fig. 5 | A | B | C | D |
| B, BK, BN, BNR, BR, RFB | Style A | Style B | Style C | Style D | Style E | .900 | .370 | .375 | .498 / .478 |
| BC, BCN, RFBC | Style A | Style B | Style C | Style D | Style E | 1.281 | .370 | .375 | .885 / .865 |
| K, RFK | Style A | Style B | * | NA | Style C | .410 | .250 | * | * |
| HA | Style A | Style B | * | NA | Style C | .450 | .250 | * | * |
| KA | Style A | Style B | Style D | NA | Style C | .510 | .250 | .313 | * |

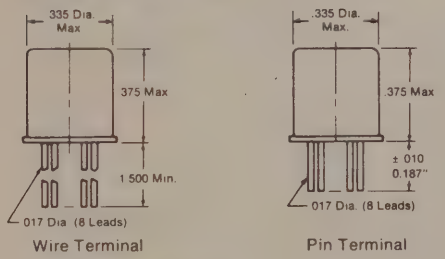
Notes: Stud thread size 4-40 NC 2A * Available special order NA — Not Available

# TO-5 SERIES RELAY

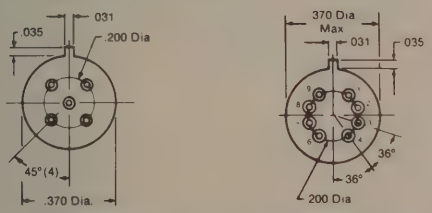
## Series MA Enclosure




## Series MS Enclosure

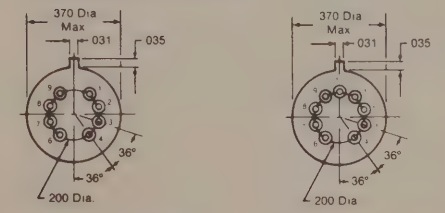



## Header SPDT contacts



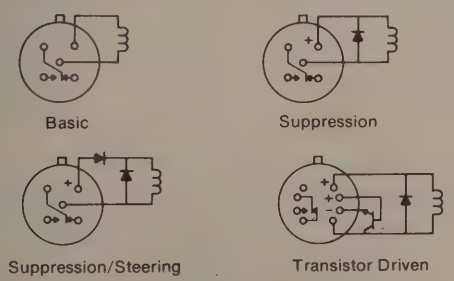

NOTE: Terminal numbers are for reference only and do not appear on part

## Header DPDT contacts



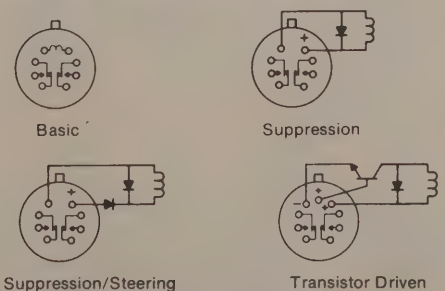

NOTE: Terminal numbers are for reference only and do not appear on part

## Electrical Diagram SPDT contacts




Schematics are viewed from terminals

## Electrical Diagram DPDT contacts

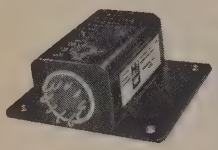



Schematics are viewed from terminals

# SENSORS/ VOLTAGE, PHASE, FREQUENCY

HI-G CO., INC.
ELECTRONICS DIVISION
580 SPRING STREET
WINDSOR LOCKS, CT 06096
(203) 623-2481

## AC AND DC VOLTAGE 1300 SERIES



### FEATURES

#### DC SENSOR — SERIES 1310

The Hi-G 1310 Series DC Voltage Sensor is essentially a voltage monitoring device operating a snap-action transistor circuit with low drift and inherent temperature compensation. This device will either open or close a circuit when a predetermined voltage is present at the input. By using a Hi-G electro-mechanical relay as the output of the voltage sensor, a positive switching action can be achieved with very close difference between pull-in and drop-out voltages.

#### AC SENSOR — SERIES 1350

The Hi-G 1350 Series AC Voltage Sensor energizes a relay when the monitored power line voltage reaches a predetermined level. This rugged unit with reliable solid state design, provides precise, repeatable operation over a wide temperature range.

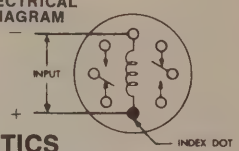
The input voltage is fed into a temperature compensated comparator circuit. When the input reaches the pre-set level, transistor amplifiers switch the output relay. This output may control any external devices, process, or warning system to protect expensive equipment.

The units for both series are potted and hermetically sealed and are designed to meet the environmental requirements of airborne applications. The following are available for both the 1310 and 1350:

### STANDARD OPTIONS

1. Solid-State Output.
2. Two Stage Sensing (Voltage Band).
3. Up to 10 Amp Relay Output.
4. 3 Phase AC Version Available.
5. Controlled Drop-out Differential.
6. Operate with Auxiliary Control Voltage.

ELECTRICAL DIAGRAM




### PART TYPE CHARACTERISTICS

| Specification | Part Number 1310 | Part Number 1350 |
|---|---|---|
| Pull-in Voltage | 5 to 150 VDC | 5 to 440 VAC |
| Smallest Increment | 0.1 Volt | 50, 60 or 400 Hz |
| Drop-out Voltage (Rel. to Pull-in) | –0, +0.5 Volts | 1.0 Volt +0, –3.0 Volts |
| Current Drain @ 25°C | 15 ma Max. | 100 ma Max. |

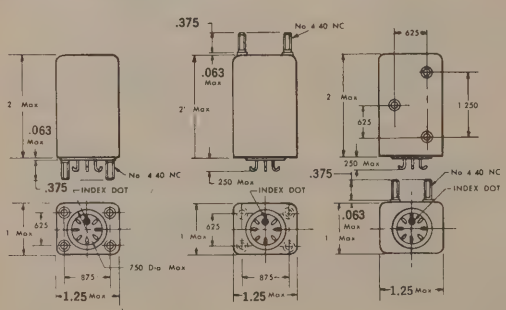
### ELECTRICAL SPECIFICATIONS

**ACCURACY:** ±2½% of set point over temperature range.
**MAXIMUM ALLOWABLE APPLIED VOLTAGE:** 150% of specified pull-in voltage.
**AUXILIARY VOTAGE:** None required.
**OPERATE AND RELEASE TIMES:** 50 milliseconds maximum over the temperature range.
**LIFE:** 100,000 operations minimum.
**CONTACT ARRANGEMENTS:** 2PDT.
**CONTACT RATING:** 2 amperes resistive at 30 volts DC; 0.3 amperes resistive at 115 volts RMS, 400 Hz.

### ENVIRONMENTAL CHARACTERISTICS

**TEMPERATURE:** –55°C to +125°C.
**VIBRATION:** 20 G's, 10 to 2000 Hz.
**SHOCK:** 50 G's, 11 ±1 milliseconds duration.
**INSULATION RESISTANCE:** 1000 megohms minimum at 500 volts DC, all terminals to case.
**DIELECTRIC STRENGTH:** 1000 volts RMS, 60 Hz at sea level, all terminals to case.
**SEALING:** Hermetic, 1.3 inches of mercury.

### MOUNTING STYLES — 1310 AND 1350




DIMENSIONS ARE IN INCHES

**HOW TO ORDER**

1310 (Type) – 2 (2PDT) – A (Mounting Style) – 24.5 (Pull-in Voltage)

## PHASE SENSOR 1400 SERIES

### TWO STANDARD TYPES

#### P TYPE FOR STATIC LOAD

With line voltages and frequency within operating limits, P-Type units will energize only when output phase are in sequence A - B - C. They will de-energize only when power is removed. The P-Type unit is best suited to applications where static loads are used and where regenerated voltage will not be present if a phase opens.

#### Q TYPE FOR MOTOR LOADS

Q-Type units perform the same function as the P-Type since they will energize only when input phases are in sequence A - B - C. In addition, the units will de-energize when any phase is disconnected or grounded provided the voltage input to the unit is below 50% of the nominal phase-to-phase voltage input. Q-Type units are suitable for motor loads where a regenerated voltage is produced.

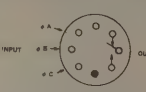
#### NO NEUTRAL CONNECTION

**Neither P- or Q-Type units require connection to neutral leg.**
For high-current applications, phase sensors are used with slave relays having heavy duty contact ratings.
For applications having special requirements as to voltage, frequency, contact arrangements, and ratings, consult the factory.

### ENVIRONMENTAL CHARACTERISTICS

**TEMPERATURE:** –55°C to +85°C.
**VIBRATION:** 200 G's, 10 to 2000 Hz.
**SHOCK:** 50 G's, 11 ±1 millisecond.
**INSULATION RESISTANCE:** 1000 megohms minimum at 500 volts DC, all terminals to case.
**DIELECTRIC STRENGTH:** 1000 volts RMS, 60 Hz, at sea level, all terminals to case.

### ELECTRICAL SPECIFICATIONS



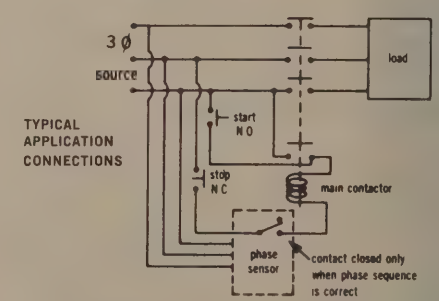

**OPERATE TIME:** 50 milliseconds maximum.
**RELEASE TIME:** 100 milliseconds maximum.
**CONTACTS:** 1PDT.
**CONTACT RATING:** 2 amperes resistive at 30 volts DC. 0.5 ampere inductive at 30 volts DC. 0.25 ampere resistive or inductive at 115 volts, 60 or 400 Hz.

### STANDARD MODELS

| Basic Model No. | Load Type | Line to Line Voltage ±10% | Frequency ±10% | Max. Power Required | Mounting Style |
|---|---|---|---|---|---|
| 1407 | P | 115 V | 60 Hz | 4 Watts | Similar to 4 Amp. 1600 Series Catalog Type |
| 1408 | P | 115 V | 400 Hz | 4 Watts | |
| 1409 | P | 208 V | 60 Hz | 6 Watts | |
| 1410 | P | 208 V | 400 Hz | 6 Watts | |
| 1437 | Q | 115 V | 60 Hz | 6 Watts | Similar to 10 Amp. 1600 Series Catalog Type |
| 1438 | Q | 115 V | 400 Hz | 6 Watts | |
| 1439 | Q | 208 V | 60 Hz | 9 Watts | |
| 1440 | Q | 208 V | 400 Hz | 9 Watts | |

### HOW TO ORDER

1408 (Type) – -1 (Output 1PDT) – A (Mounting)



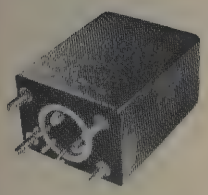

**FREQUENCY SENSOR 7000 SERIES**
**SINGLE OR DOUBLE SENSE POINT**
**60 Hz TO 400 Hz**
**CONSULT THE FACTORY**

HI-G CO., INC.
ELECTRONICS DIVISION
580 SPRING STREET
WINDSOR LOCKS, CT 06096
(203) 623-2481

# TIME DELAY RELAYS,

## DELAY-ON-OPERATE

### ADJUSTABLE SERIES 1700



#### 4 AND 10 AMPERES RATING CHART

| Type | DC, 10 Amp | AC or DC, 4 Amp |
|---|---|---|
| Input Voltages | 18 to 31 VDC, unregulated | DC Units, 18 to 31 volts, Unregulated<br>AC Units, 105 to 125 volts, Specify 400 Hz or 60 Hz |
| Delay Time | 50 millisecond to 240 seconds (Adj.)<br>50 millisecond to 600 seconds (Fixed) | |
| Contact Rating at 30 Volts DC | 10 amps, Resistive<br>5 amps, Inductive | 4 amperes, Resistive |
| Contact Configuration | 1, 2 Poles, double-throw | 1-, 2-, 3- and 4-pole, double throw |
| Current Drain at 25°C at 28 Volts DC | 135 ma maximum | 1-pole: 100 ma maximum;<br>2-pole: 150 ma maximum;<br>3 and 4 pole: 200 ma max. |

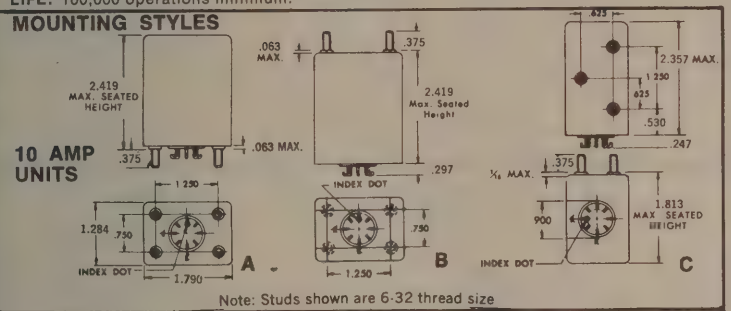
#### ELECTRICAL SPECIFICATIONS

**INPUT VOLTAGES:** Refer to above chart.
**DELAY TIMES:** 50 milliseconds to 240 seconds adjustable, 600 seconds fixed. Delays to 2 hours available.
**FUNCTION:** Delay on operate.
**TIMING TOLERANCE:** ±10% or 10 milliseconds standard. ±5% available.
**RECYCLE TIME:** 10 msec. (DC), 50 msec. (AC).
**RECOVERY TIME:** 10 msec. (DC), 50 msec. (AC).
**RESET TIME:** 10 milliseconds maximum for DC units and 40 milliseconds maximum for AC units.

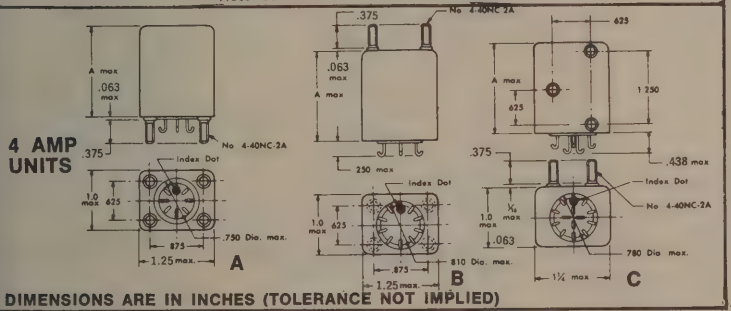
#### ENVIRONMENTAL CHARACTERISTICS

**TEMPERATURE RANGE:** −55°C to +85°C or −55°C to +125°C.
**VIBRATION:** 20 G's; 10 to 2000 Hz.
**SHOCK:** 50 G's, 11 ±1 millisecond duration.
**INSULATION RESISTANCE:** 1000 megohms at 500 volts DC, all terminals to case.
**DIELECTRIC STRENGTH:** 1000 volts RMS, 60 Hz, all terminals to case.
**SEALING:** Hermetic, 1.3 inches mercury.
**LIFE:** 100,000 operations minimum.

#### MOUNTING STYLES




Note: Studs shown are 6-32 thread size




DIMENSIONS ARE IN INCHES (TOLERANCE NOT IMPLIED)

#### ADJUSTABLE TIMING FORMULA

The resistance required to obtain timing within this range is determined by using the formula:

Rx = 400K (T/T max.) −40K
Rx = External Res. in OHMS

T = Desired time in seconds
T max. = Maximum time (code)

A high quality deposited carbon ±1%, .1w (min.) resistor is recommended for external resistance.

### FIXED SERIES 1600

#### 10 AMPERE MODULE SERIES NUMBER — TABLE

| Series | Function | Contact Arrangement |
|---|---|---|
| 1610<br>1611 | Fixed<br>Fixed | 1PDT<br>2PDT |

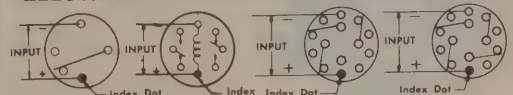
| Series | Contact Arrangement | Adjustable Range | Timing Code |
|---|---|---|---|
| 1710 | 1PDT | .1 to 1.0 sec. | 1001 |
| 1711 | 1PDT | .5 to 5 sec. | 5001 |
| 1712 | 1PDT | 1.0 to 10 sec. | 1002 |
| 1713 | 1PDT | 5 to 50 sec. | 5002 |
| 1714 | 1PDT | 18 to 180 sec. | 1803 |
| 1715 | 2PDT | .1 to 1.0 sec. | 1001 |
| 1716 | 2PDT | .5 to 5 sec. | 5001 |
| 1717 | 2PDT | 1.0 to 10 sec. | 1002 |
| 1718 | 2PDT | 5 to 50 sec. | 5002 |
| 1719 | 2PDT | 18 to 180 sec. | 1803 |

#### 4 AMPERE MODULE SERIES NUMBER — FIXED & ADJUSTABLE TABLE

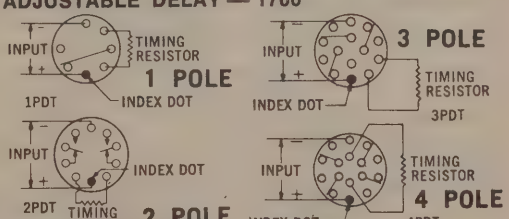
| Series | Input | Temperature Range | Housing Length (Dim. "A") | Contact Arrangement |
|---|---|---|---|---|
| 1601 | DC | −55°C to +85°C | 1.656 | 1PDT |
| 1602 | DC | −55°C to +85°C | 1.656 | 2PDT |
| 1603 | DC | −55°C to +85°C | 2.00 | 3PDT |
| 1604 | DC | −55°C to +85°C | 2.00 | 4PDT |
| 1621 | DC | −55°C to +125°C | 1.656 | 1PDT |
| 1622 | DC | −55°C to +125°C | 1.656 | 2PDT |
| 1623 | DC | −55°C to +125°C | 2.00 | 3PDT |
| 1624 | DC | −55°C to +125°C | 2.00 | 4PDT |
| 1651 | AC | −55°C to +85°C | 2.00 | 1PDT |
| 1652 | AC | −55°C to +85°C | 2.00 | 2PDT |
| 1653 | AC | −55°C to +85°C | 2.375 | 3PDT |
| 1654 | AC | −55°C to +85°C | 2.375 | 4PDT |
| 1671 | AC | −55°C to +125°C | 2.00 | 1PDT |
| 1672 | AC | −55°C to +125°C | 2.00 | 2PDT |
| 1673 | AC | −55°C to +125°C | 2.375 | 3PDT |
| 1674 | AC | −55°C to +125°C | 2.375 | 4PDT |
| 1701 | DC | −55°C to +85°C | 1.656 | 1PDT |
| 1702 | DC | −55°C to +85°C | 1.656 | 2PDT |
| 1703 | DC | −55°C to +85°C | 2.00 | 3PDT |
| 1704 | DC | −55°C to +85°C | 2.00 | 4PDT |
| 1721 | DC | −55°C to +125°C | 1.656 | 1PDT |
| 1722 | DC | −55°C to +125°C | 1.656 | 2PDT |
| 1723 | DC | −55°C to +125°C | 2.00 | 3PDT |
| 1724 | DC | −55°C to +125°C | 2.00 | 4PDT |
| 1751 | AC | −55°C to +85°C | 2.00 | 1PDT |
| 1752 | AC | −55°C to +85°C | 2.00 | 2PDT |
| 1753 | AC | −55°C to +85°C | 2.375 | 3PDT |
| 1754 | AC | −55°C to +85°C | 2.375 | 4PDT |
| 1771 | AC | −55°C to +125°C | 2.00 | 1PDT |
| 1772 | AC | −55°C to +125°C | 2.00 | 2PDT |
| 1773 | AC | −55°C to +125°C | 2.375 | 3PDT |
| 1774 | AC | −55°C to +125°C | 2.375 | 4PDT |

**Note:** 1700 series are adjustable.

#### ELECTRICAL DIAGRAM — FIXED DELAY 1600




#### ADJUSTABLE DELAY — 1700




### DETERMINATION OF MODULE PART NUMBER — ORDERING INFORMATION

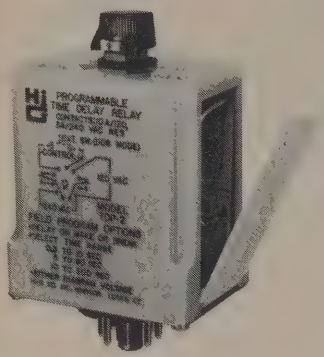
Hi-G Adjustable Time Delay Modules cover one decade, e.g., 62 milliseconds to 620 milliseconds; you may select any decade that best suits your application within the range of 50 milliseconds to 240 seconds. (Of course, longer ranges are available on special order.) The upper decade limit is $T_{max.}$ in the timing formula and is the timing code number in the part number described in the following paragraph.

The part number for a Hi-G Time Delay Module consists of three elements: The series number (from the Table), a letter signifying mounting style, and the timing code number. The timing code number consists of four digits and gives the time in milliseconds. The first three digits are the significant figures and the last digit is the number of zeroes following the significant figures; thus, 50 milliseconds would be coded 0500, 1.1 seconds would read 1101, and 1 minute (60 seconds) would be 6002.

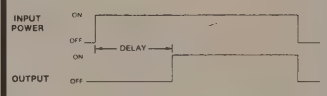
A typical part number for an adjustable timing module is 1722-C-1102; this is a DC unit in the −55°C to +125°C temperature range with a 2PDT contact arrangement, in a Style C mounting, and with a time delay range of 1.1 to 11 seconds.

# TIME DELAY RELAYS, INDUSTRIAL

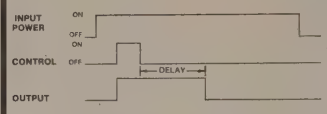
HI-G CO., INC.
ELECTRONICS DIVISION
580 SPRING STREET
WINDSOR LOCKS, CT 06096
(203) 623-248



## LOGIC DIAGRAMS




DELAY-ON-OPERATE TIMER




DELAY-ON-RELEASE TIMER

## TDP SERIES FIELD PROGRAMMABLE

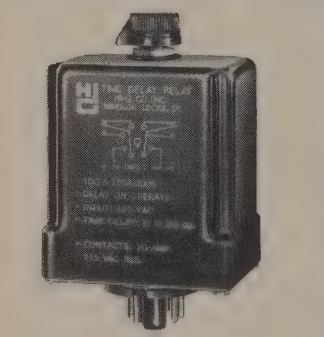
Each TDP Model in this series performs in two (2) Delay modes, operates on multiple input voltages and functions on several time delay ranges. All these selections are easily accomplished in the field.

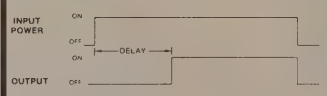
These versatile CMOS Digital Timers, programmed as required, will replace a multiplicity of conventional units selected by specific operating voltage, functional mode and time delay range. In addition to obvious R&D uses, production products designed with the TDP Series devices will benefit by providing component standardization, permit low inventory levels and at the same time enhance spare parts availability.

| Model | Delay Range | Operating Voltages ±10% |
|---|---|---|
| TDP-5 | A | 12 Vdc and 24 Vdc |
| TDP-1 | A | 24 Vac, 24 Vdc and 120 Vac |
| TDP-2 | A | 120 Vac and 240 Vac |
| TDP-6 | B | 12 Vdc and 24 Vdc |
| TDP-3 | B | 24 Vac, 24 Vdc and 120 Vac |
| TDP-4 | B | 120 Vac and 240 Vac |

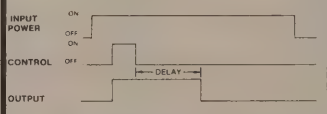
**Range A** — 0.3 to 10, 3 to 80 and 10 to 300 seconds.

**Range B** — 1 to 15, 2 to 30, 4 to 60 and 8 to 120 minutes.






DELAY-ON-OPERATE TIMER

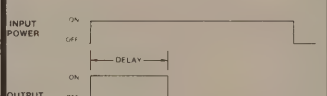



DELAY-ON-RELEASE TIMER

## MODEL TDO DELAY-ON-OPERATE
## MODEL TDR DELAY-ON-RELEASE

| Standard Delay Periods | | External Control TDO-E & TDR-E | |
|---|---|---|---|
| Factory Fixed TDO-F & TDR-F | Knob Adjustable TDO-A & TDR-A | Delay Ranges | Approx. External Resistor Values |
| Time period from 0.3 secs. to 120 mins. standard. For periods outside of this range consult factory | 0.3 to 10 sec.<br>3 to 80 sec.<br>10 to 300 sec.<br>1 to 15 min.<br>2 to 30 min.<br>4 to 60 min.<br>8 to 120 min. | 0.3 to 10 sec.<br>3 to 80 sec.<br>10 to 300 sec.<br>1 to 15 min.<br>2 to 30 min.<br>4 to 60 min.<br>8 to 120 min. | 2 Meg Ohms For Max. Delay, 0 Ohms Min. Delay |

| Standard Input Voltages ±10% | |
|---|---|
| AC Inputs | DC Inputs |
| 24, 120, | 12, 24, 48, 125 |




INTERVAL TIMER

## TDN SERIES INTERVAL TIMERS

| Standard Delay Periods | | | External Control TDN-E | |
|---|---|---|---|---|
| Factory Fixed TDN-F | | Knob Adjustable TDN-A | Delay Ranges* | Approx. External† Resistor Values |
| Secs. | Mins. | | | |
| 10<br>30 | 1<br>2<br>3<br>5<br>10<br>15<br>30<br>60 | 0.3 to 10 sec.<br>3 to 80 sec.<br>10 to 300 sec.<br>1 to 15 min.<br>2 to 30 min.<br>4 to 60 min.<br>8 to 120 min. | 0.3 to 10 sec.<br>3 to 80 sec.<br>10 to 300 sec.<br>1 to 15 min.<br>2 to 30 min.<br>4 to 60 min.<br>8 to 120 min. | 2 Meg Ohms For Max. Delay, 0 Ohms Min. Delay |

| Standard Input Voltages ±10% | |
|---|---|
| AC Inputs | DC Inputs |
| 24, 120 | 12, 24, 48, 125 |

## STANDARD CHARACTERISTICS

**Contacts:** DPDT, 10 amp resistive @ 120 Vac
5 amp resistive @ 240 Vac

**Accuracy:** ±10% over voltage and temperature range

**Repeatability:** ±2%

**Recycle Time:** 300 milliseconds max. AC input
100 milliseconds max. DC input

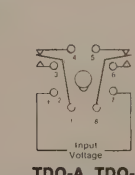
**Reset Time:** Less than 100 milliseconds

**Current Drain:** Less than 150 milliamps

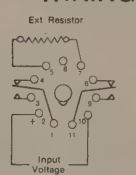
**Temperature Range:** Operational −10°C to +55°C
Storage −40°C to +85°C

**Transient Protection:** Twice input voltage for 1 millisecond standard
Optional protection up to 2500 Vac available at extra cost

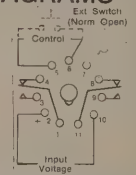
## WIRING DIAGRAMS



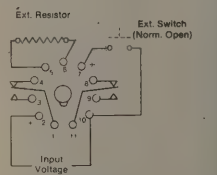

TDO-A, TDO-F, TDN-A, TDN-F




TDO-E, TDN-E

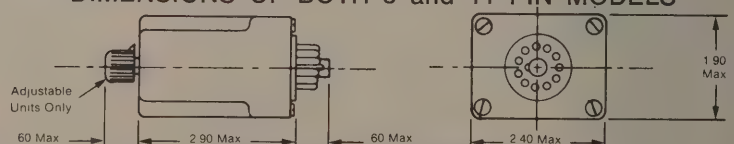



TDR-A, TDR-F, TDP*




TDR-E

## DIMENSIONS OF BOTH 8 and 11 PIN MODELS




* External switch for Delay-On-Release mode only.

HI-G CO., INC.
ELECTRONICS DIVISION
580 SPRING STREET
WINDSOR LOCKS, CT 06096
(203) 623-2481

# TIME DELAY RELAYS, INDUSTRIAL

## SERIES TDF REPEAT CYCLE TIMER
## SERIES TDI DELAYED INTERVAL TIMER

**TDF**

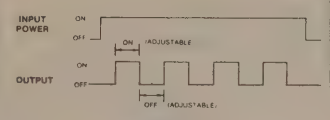
Application of power automatically initiates continuous OFF-ON Cycling of the output relay. Applications include flashing of lights, warning horns, periodic lubrication and other continuing alternate action requirements.

**TDI**

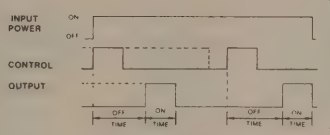
Designed to provide a single OFF-ON-OFF output cycle for each initiation. A new cycle is started by either a momentary or maintained external contact closure. Input power is to be applied continuously. This device combines the functions of separate Delay-On-Make and Interval Type timers in one package.

- **INPUT:** 24 Vac or 24 Vdc or 120 Vac.
- **TEMPERATURE RANGE:** −10°C to +55°C.
- **ACCURACY:** ±10% over temp./volt range.
- **REPEATABILITY:** ±2%.
- **CURRENT DRAIN:** 150 milliamps maximum.
- **TIME RANGES:**
  Range 1 - 0.3 to 10 seconds.
  Range 2 - 3 to 80 seconds.
  Range 3 - 10 to 300 seconds.

### LOGIC DIAGRAMS




**MODEL TDF**



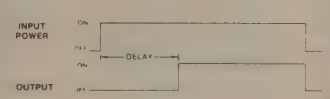

**MODEL TDI**

## SERIES TLO DELAY-ON-OPERATE
## SERIES TLN INTERVAL TIMER

### Standard Delay Ranges

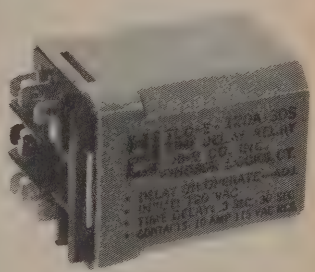
| Adjustable | |
|---|---|
| Range | Range |
| 0.1 sec. to 10 sec. | 6.0 sec. to 600 sec. |
| 0.3 sec. to 30 sec. | 18.0 sec. to 30 min. |
| 0.6 sec. to 60 sec. | 36.0 sec. to 60 min. |
| 3.0 sec. to 300 sec. | 72.0 sec. to 120 min. |

| Factory Fixed |
|---|
| Time period from 0.3 secs. to 120 mins. standard. For periodsoutside of this range consult factory |




**SERIES TLO**

**SERIES TLN**



## SERIES VS
## DUAL SET POINT VOLTAGE SENSOR

### Standard Voltage Ranges

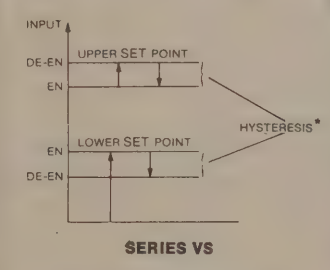
| Adjustable | |
|---|---|
| 18 - 30 Vac | 18 - 30 Vdc |
| 35 - 60 Vac | 35 - 60 Vdc |
| 90 - 150 Vac | 90 - 150 Vdc |

| Fixed (Lower/Upper Set Point) | |
|---|---|
| 21 - 27 Vac | 21 - 27 Vdc |
| 45 - 53 Vac | 45 - 53 Vdc |
| 105 - 130 Vac | 105-130 Vdc |

(Other set points available within the specified operating range)

**Output Relay:** DPDT — 10 amp @ 120 Vac, 5 amp @ 240 Vac (resistive)

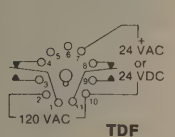
**Duty Cycle:** Continuous
**Reverse Polarity Protection:** On DC units
**Repeatability:** ±1% max.
**Temperature Range:** −10°C to +55°C
**Temperature Coefficient: (Accuracy)** 0.1% per °C
**Transient Protected:** 1000 Vrms for 100 microseconds
**Time Delay:** 1 second Delay-On-Dropout
**Hysteresis:*** 3 volts nominal



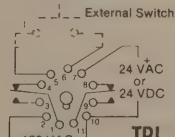

**SERIES VS**

* (Difference between energize & de-energize sensed voltage)

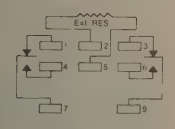
### WIRING DIAGRAMS



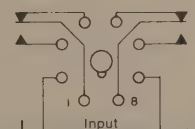

**TDF**




**TDI**



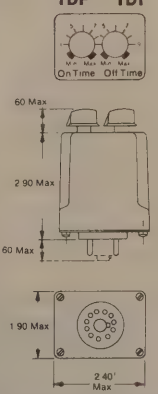

Polarity For DC Units Only **TL**



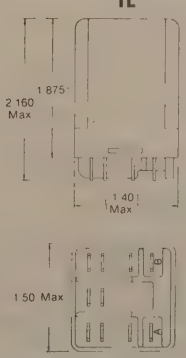

Polarity For DC Units Only **VS**

### DIMENSIONS

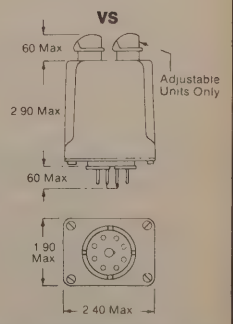
**TDF TDI**




**TL**




**VS**



HI-G CO., INC.
ELECTRONICS DIVISION
580 SPRING STREET
WINDSOR LOCKS, CT 06096
(203) 623-2481

# SOLID STATE CONTROL 10 AMP AC

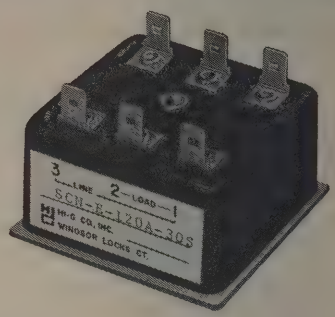
## SERIES SC

- **10 Amp AC**
- **Solid State Output**
- **Digital Timing Circuit**

All innovation in solid state control which offers:
Three operating modes • Fixed or Externally Adjustable Time Ranges • CMOS Digital Circuitry • External Control Switch Operation • Small Size • Low Cost • Simple Mounting & Wiring • Low Power Consumption • Built-in Transient Protection • Can Be Used In Delay-On-Release Mode.

NEW

This self contained power switching unit has the capability to control industrial loads such as Relays, Motors, Contactors, Motor Starters and Solenoids.




## OPERATION:

**Delay-On-Operate:** Input voltage starts timing cycle; at end of cycle output switch latches on.
**Interval Timing:** Input voltage starts timing cycle and switches output on. Upon completion of timing cycle output switch latches off.
**Repeat Cycle:** Input voltage causes output switch to cycle on and off continuously.

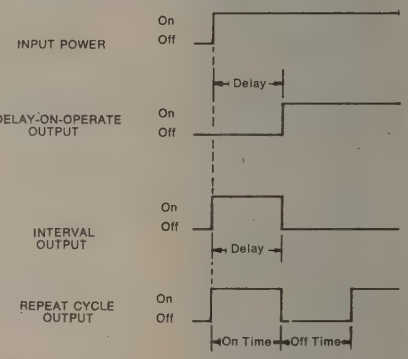
## SPECIFICATIONS

- **Input Voltage:** 24VAC or 120VAC ±10% 50/60Hz.
- **Output Current:** SPNO, 10 AMP @ 120VAC (see temperature derating curve).
- **Surge Current:** 10 times temperature derated steady-state current for milliseconds, repeated every 5 seconds maximum.
- **Timing Range:** 0.1 sec. to 2 hours (fixed or adjustable).
- **Timing Accuracy:** ±10% over temperature & voltage ranges.
- **Recycle Time:** 200 milliseconds maximum.
- **Repeatability:** ±1% at fixed temperature & voltage.
- **Power Consumption:** 3 watts maximum.
- **Temperature Range:** −10°C to +55°C.
- **Transient Protection:** 1000 volts for 100 microseconds.

## OPTIONS

- AC inputs other than 24VAC, 120VAC.
- Accuracy ±5%
- Special Timing Ranges

## LOGIC DIAGRAMS

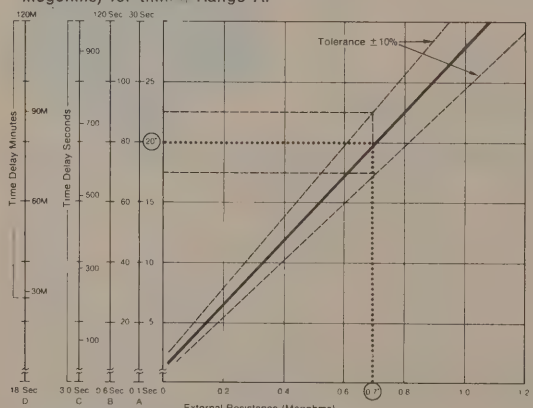



## CHARACTERISTICS

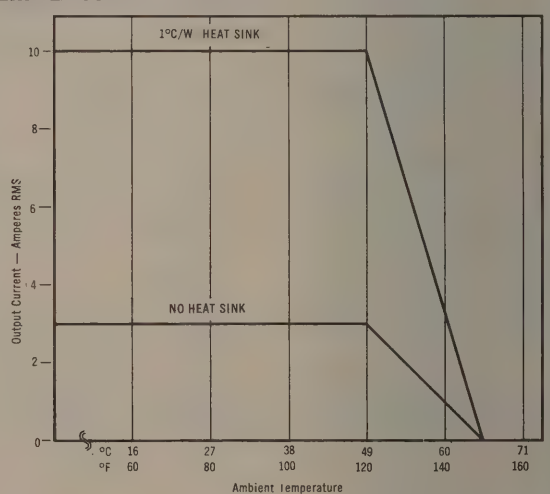
| Stock Delay Ranges | | | |
|---|---|---|---|
| Fixed | | Adjustable | Ranges |
| Seconds | Minutes | | |
| 10 | 1 | | |
| 30 | 1.5 | 0.1 Second to 30 Seconds | A |
| 60 | 3 | 0.6 Second to 120 Seconds | B |
| 120 | 6 | 3 Seconds to 900 Seconds | C |
| 180 | 9 | 18 Seconds to 120 Minutes | D |
| 300 | 12 | | |

## TIMING CURVE (Adjustable Models Only)

Timing can be field adjusted by selecting a Range, then a resistor or potentiometer value from the chart below.
Example * R external for T = 20 seconds is approximately 700 K (0.7 megohms) for timing Range A.




## TEMPERATURE DERATING CURVE




## ORDERING INFORMATION

SCO — F — 120 — 300S

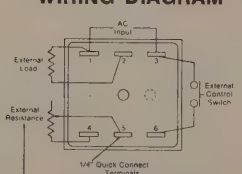
Series — O — Delay-On-Operate; N — Interval Timer; F — Repeat Cycle

F — Fixed Timing; E — Externally Adjustable

120 — 120VAC; /024 — 24VAC

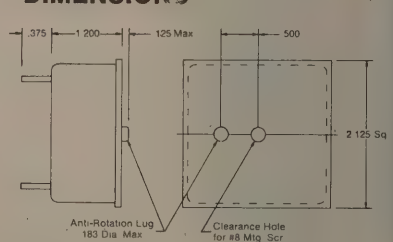
S — Seconds; M — Minutes; H — Hours

## WIRING DIAGRAM




For **externally adjustable** units see timing curve. For **fixed** units, only terminals 1, 2 and 3 are used.

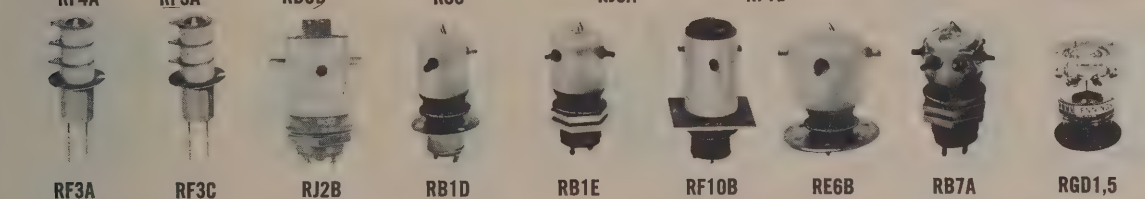
## DIMENSIONS



# vacuum relays

ITT Jennings manufactures Vacuum and Gas Relays to exacting standards for use in transferring high voltage circuits. They are available in voltage ranges up to 30 KVAC, with up to 75 A. current ratings, and with operating frequencies through the VHF band. These relays are widely used in airborne, mobile and marine communications where their characteristics are particularly desirable. They have high operating speeds, withstand high voltages and carry heavy currents with high reliability ... without developing high contact resistance or generating electrical noise. The majority of applications for these relays includes the switching of antennas, frequency bands, transmit/receive modes, power circuits and elements in pulse forming networks.

*Engineering information on the use of vacuum relays for DC, AC, and RF switching as well as special capacitive circuits in included in this 16-page catalog. Specifications on various relays are organized for ease in selecting the best unit for your applications.*




| Relay Type | Contact Arrangement | Rated Operating Voltage | | | Continuous Current | | | Contact Capacity | | Contact Resistance | Operate Time | Release Time | Coil Resistance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | DC or 60 Hz (KV Peak) | 2.5 MHz (KV Peak) | 16 MHz (KV Peak) | DC or 60 Hz (Amps RMS) | 2.5 MHz (Amps RMS) | 16 MHz (Amps RMS) | Open Contact to Ground (pF) | Between Open Contacts (pF) | (Max.) Ohms | (Max.) (MS) | (Max.) (MS) | 26.5 V ±10% (Ohms) |
| **Single Pole, Single Throw** | | | | | | | | | | | | | |
| RF4A | SPST N/C | 8 | 7 | 6 | 30 | 25 | 15 | 2.5 | 2.5 | .015 | 18 | 18 | 156 |
| RF5A | SPST N/C | 7.5 | 7.5 | 7 | 8/12 | 10 | 5 | 2.0 | 1.6 | .020 | 12 | 12 | 920 |
| RD5A/6A | SPST N/O/N/C | 15 | 10 | 10 | 15 | 10 | 6 | 1.0 | 0.5 | .012 | 18 | 8 | 265 |
| RD5B/6B | SPST N/O/N/C | 15 | 10 | 10 | 15 | 10 | 6 | 1.0 | 0.5 | .010 | 18 | 8 | 265 |
| RS8/10 | SPST N/O/N/C | 28 | 25 | 25 | 75 | 35 | 22 | 1.5 | 0.7 | .003 | 30 | 10 | 120 |
| RJ8A | SPST N/O | 28 (60 Hz) | 25 | 25 | 110 | 60 | 40 | 1.0 | 1.3 | .003 | 30 | 10 | 120 |
| **Single Pole, Double Throw** | | | | | | | | | | | | | |
| RF1D/E | SPDT | 2 | 2 | 2 | 8 | 6 | 4 | 2.0 | 1.6 | .030 | 10 | 10 | 920 |
| RF1J | SPDT Latch | 2 | 2 | 2 | 8 | 6 | 4 | 2.0 | 1.6 | .030 | 10 | n/a | 18.3 |
| RJ1A | SPDT | 3.5 | 2.5 | 2 | 18 | 14 | 9 | 2.5 | 2.0 | .010 | 8 | 8 | 335 |
| RJ1H | SPDT | 2.5 (DC) | hot brk. | n/a | 3 | hot brk. | n/a | n/a | n/a | .030 | 6 | 6 | 335 |
| RF3A | SPDT | 8 | 7 | 6 | 30 | 25 | 15 | 2.5 | 4.0 | .015 | 18 | 18 | 156 |
| RF3C | SPDT | 10 (60 Hz) | 7 | 6 | 30 | 25 | 15 | 2.5 | 4.0 | .015 | 10 | 10 | 12 |
| RJ2B/C | SPDT | 12 | 10 | 8 | 50 | 30 | 17.5 | 1.0 | 0.5 | .012 | 18 | 9 | 270 |
| RB1D/H | SPDT | 12 | 10 | 8 | 15 | 10 | 6 | 1.0 | 0.5 | .012 | 18 | 8/9 | 265/270 |
| RB1E/J | SPDT | 12 | 10 | 8 | 15 | 10 | 6 | 1.0 | 0.5 | .012 | 18 | 8/9 | 265/270 |
| RF10B | SPDT | 15 | 13 | 10 | 75 | 22 | 15 | 1.5 | 1.8 | .012 | 30 | 10 | 225 |
| RE6B | SPDT | 25 | 20 | 15 | 25 | 13 | 8 | 2.5 | 1.0 | .010 | 25 | 10 | 120 |
| **Multi-Pole, Double Throw** | | | | | | | | | | | | | |
| RB7A/B | DPDT | 7 | 4 | 3 | 14 | 9 | 4 | 2.0 | 1.0 | .020 | 15 | 5 | 270 |
| RB3 | DPDT | 12 /8** | 10/5** | 8/4** | 30 | 10 | 6 | 2.5 | 1.0 | .010 | 20 | 8 | 120 |
| RB2A | DPDT | 20 | 15 | 10 | 20 | 12 | 6 | 2.5 | 1.0 | .010 | 20 | 10 | 225 |
| RB4 | 4PDT | 15 | 12 | 10 | 20 | 10 | 6 | 2.5 | 1.0 | .010 | 45 | 10 | 131 |
| RGD1, 5* | DPDT | 18 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 17 | 17 | 25 @ 12 Volts |
| RGD6* | DPDT | 7.5 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 20 | 20 | 18 @ 12 Volts |

* Defibrilator Relay

** Note: Top Contacts/Bottom Contacts

ITT JENNINGS Dept. EM, 970 McLaughlin Ave. • San Jose, CA 95122 • (408) 292-4025

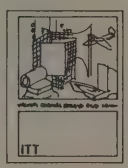
DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

# vacuum coaxial relays

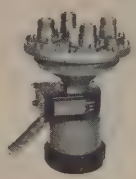
ITT Jennings manufactures a broad line of coaxial relays for use where circuit currents must be contained completely within a coax system. Vacuum coaxial relays have high power handling capabilities at frequencies up to 600 MHz. Inert gas filled switches offer advantages where power levels are low and maximum system flexibility demands modular, stackable configurations.

These relays and switches have characteristics that are well suited to airborne, marine and mobile communication systems, as well as fixed installations. These characteristics include: • Low insertion loss and VSWR • High RF power capability • High isolation • Fast operation • Low, stable contact resistance • No noise generation or IM distortion • Extreme high reliability combined with ruggedness for high altitude or heavy vibration environments • Small size and lightweight for their power handling capacity • Wide bandpass characteristics. Typical applications for these units might include multiple antenna-transmit switching systems such as high speed switching from omnidirectional to directional antennas, transmit-receive switching, and where tunable elements are to be switched in transmitter and receivers. Other applications include crossbar matrices and switching trees, CCTV, CATV, and microwave telemetry and data acquisition links, as well as general coaxial instrumentation.

*This 16-page catalog describes in detail the complete line of vacuum coaxial relays, including crossover types designed for use in HF and VHF matrix crossbar systems. Also listed are a variety of fittings for assembling crossbar networks using 1-5/8, 3-1/8 and 6-1/8" lines. Typical crossbar switching matrices are described.*



RC41


RC53

RC5

RC6

RC10

RC21

RC54

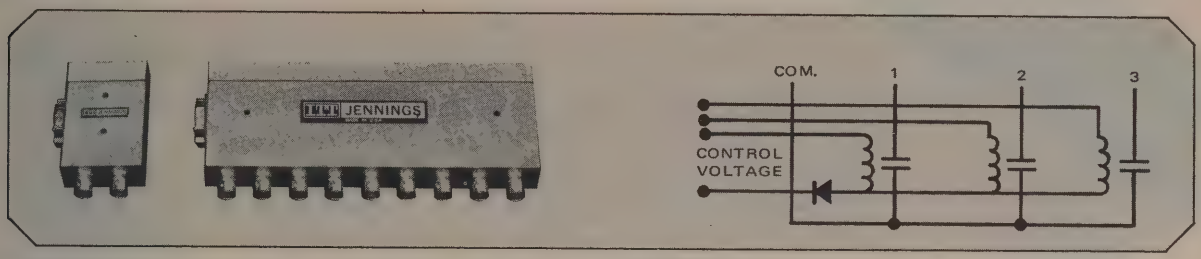
| Model Number | RC41 | RC53 | RC5 | RC6 | RC10 | RC21 | RC54 |
|---|---|---|---|---|---|---|---|
| Power Rating | 3 KW CW at 30 MHz | 4 KW CW at 30 MHz | 25 KW CW at 30 MHz | 25 KW CW at 30 MHz | 90 KW CW at 30 MHz | 90 KW CW at 30 MHz 2 MW PEAK Spec. Order RC26/RC27 | 7.5 KW CW at 30 MHz |
| Frequency Range | 0 to 500 MHz | 0 to 600 MHz | 0 to 100 MHz | 0 to 150 MHz | 0 to 100 MHz | 0 to 500 MHz | 0 to 600 MHz |
| VSWR with Respect to 50 Ohms | 1.1:1 Max. | 1.1:1 Max. | 1.02:1 Max. to 30 MHz 1.05:1 Max. to 60 MHz | 1.05:1 Max. to 150 MHz | 1.02:1 Max. to 30 MHz 1.05:1 Max. to 60 MHz | 1.15:1 Max. to 500 MHz | 1.1:1 Max. |
| Crosstalk | Greater than 30 dB isolation at 300 MHz | Greater than 75 dB isolation at 30 MHz | Greater than 70 dB isolation at 30 MHz | Greater than 50 dB isolation at 30 MHz | Greater than 65 dB isolation at 30 MHz | Greater than 60 dB isolation at 30 MHz | Greater than 53 dB isolation at 500 MHz |
| Insertion Loss | 0.1 dB Max. | 0.1 dB Max. | 0.02 dB Max. | 0.01 dB Max. | 0.02 dB Max. | 0.01 dB Max. | 0.1 dB Max. |
| Coil Resistance ±10% 26.5 VDC Coil | 265 Ohms | 18 Ohms | 18.8 Ohms | 15.4 Ohms | 19 Ohms | 18.7 Ohms | 19 Ohms |
| Contact Configuration | SPDT | 2 pole, 2 position crossover transfer | SPST | SPDT | SPST | SPDT | DPDT |
| Line/Connector Size | C | N | 1⅝" | 1⅝" | 3⅛" | 3⅛" | LC |
| Actuation | Non-latching continuous duty coil | Permanent magnet latching | Permanent magnet latching | Permanent magnet latching | Permanent magnet latching | Permanent magnet latching | Permanent magnet latching |
| Operate Time | 25 Millisecs Max. | 15 Millisecs Typ. 30 Millisecs Max. | 15 Millisecs Typ. 30 Millisecs Max. | 50 Millisecs Max. | 15 Millisecs Typ. 30 Millisecs Max. | 40 Millisecs Max. | 30 Millisecs Max. |
| Weight | 14.5 oz. | 2 lbs., 12 oz. | 1 lb., 13 oz. | 8 lbs. | 3 lbs., 12 oz. | 14 lbs. | 6 lbs., 8 oz. |

ITT JENNINGS Dept. EM, 970 McLaughlin Ave. • San Jose, CA 95122 • (408) 292-4025

DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

# coaxial switch modules

## RC1100 SERIES




### APPLICATIONS

- Electrically controlled switching of wideband signals, DC — 300 MHz.
- Design of complex switching circuits such as SP42T, 9P3T and other unusual switching trees.
- CATV and CCTV distribution switching.
- Telemetry and data handling networks.
- Satellite communications.
- Microwave trunks (base band and IFF frequency).
- Automatic switching of computer controlled measuring systems.
- Network analyzing digital pulse information.

### FEATURES

- One to eight throws.
- Sealed RF contacts for long life, stable contact resistance.
- Designed for over 1800 switchings/day for 30 years.
- Special contact material prevents "sticking" due to feedback currents or dry circuit operation.
- DC coils are diode protected against effects of transient voltages or use of wrong polarity.
- All-aluminum flatpack housing is easily stacked to provide multi-pole, multi-throw operation.
- Low RF leakage input and output assured up to 300 MHz.

| Specifications | Model 1100 |
|---|---|
| Bandwidth | |
| (1x1, 1x2, 1x3) | DC — 300 MHz |
| (1x4) | DC — 250 MHz |
| (1x5, 1x6, 1x7, 1x8) | DC — 100 MHz |
| VSWR (typ) @ | |
| 50 MHz | 1.1:1 |
| 100 MHz | 1.25:1 |
| 300 MHz | 1.50:1 |
| Insertion Loss (typ) @ | |
| 50 MHz | .25 dB |
| 100 MHz | .30 dB |
| 300 MHz | .50 dB |
| Isolation (typ) @ | |
| 50 MHz | −45 dB |
| 100 MHz | −50 dB |
| 300 MHz | −30 dB |

| Specifications | Model 1100 |
|---|---|
| Impedance | 50 or 75 ohms |
| RF Power, CW (nom) | 10 Watts |
| RF Peak Voltage | 250 VDC |
| Switching Time (max) | 1 millisecond |
| Control Voltage (nom) | 12-28 VDC |
| Connector Type | BNC (Quick Disconnect) |
| Mounting | Any Position |
| Life | $20 \times 10^6$ |
| Temperature Range | |
| Operating | −55°C to 75°C (−67°F to 167°F) |
| Storage | −65°C to 85°C (−85°F to 185°F) |

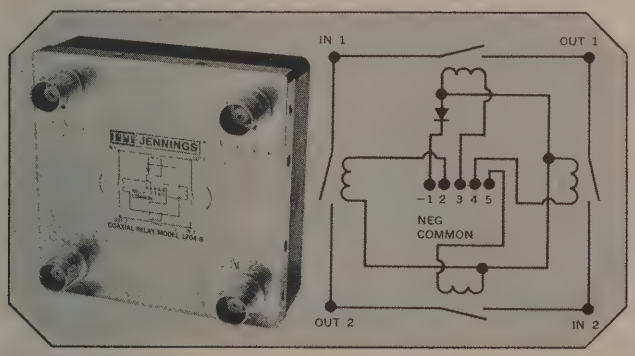
### OPTIONS AVAILABLE

Control Voltage — 6 or 48 VDC

| Configuration | Model Numbers Non-Latching 50-Ohm | 75-Ohm |
|---|---|---|
| 1 x 1 | RC1101A | RC1101B |
| 1 x 2 | RC1102A | RC1102B |
| 1 x 3 | RC1103A | RC1103B |
| 1 x 4 | RC1104A | RC1104B |
| 1 x 5 | RC1105A | |
| 1 x 6 | RC1106A | |
| 1 x 7 | RC1107A | |
| 1 x 8 | RC1108A | |

# 2 x 2 high isolation coaxial switches

## RC1204 SERIES




### APPLICATIONS

- Switch wideband signals, DC — 300 MHz.
- Electrically controlled switching in circuits requiring high isolation (such as IF video circuits) or very high isolation (such as RF video circuits).
- CATV and CCTV.
- Computer controlled measuring systems.
- Non-duplication switching in RF head-end networks.
- Communications Systems.

### FEATURES

- Minimum open circuit leakage over entire frequency range.
- Broadband frequency response — DC to 300 MHz range.
- Universal mounting design for panels, railings or brackets.
- Control connector adaptable to flexible ribbon for stripline or PC board interface.
- Rugged two-part housing — aluminum die casting and molded polycarbonate cover.
- Silver-plated signal paths shielded for maximum EMI protection.
- Reed switch elements hermetically sealed in nitrogen atmosphere.
- Rhodium-plated contacts prevent "sticking" due to feedback currents or dry circuit operation.
- DC coils are diode protected against effects of transients or use of wrong polarity.
- DC coils can be independently controlled or sequenced in pairs.

| Specifications | Model 1204 | |
|---|---|---|
| Bandwidth | DC — 300 MHz | |
| VSWR | Model "BH" | Model "B" |
| (max) | 1.5 | 1.5 |
| (typ) | 1.25 | 1.25 |
| Insertion Loss (typ) | 1.0 dB | 0.8 dB |
| Isolation (min) | −70 dB | −45 dB |
| Impedance | 75 Ohms | |
| RF Power, CW (nom) | 3 Watts | |
| RF Peak Voltage | 250V | |

| Specifications | Model 1204 |
|---|---|
| Switching Time (max) | 1 millisecond |
| Control Voltage (nom) | 12-28 VDC |
| Connector Type | BNC (Quick Disconnect) |
| Mounting | Any Position |
| Life | $20 \times 10^6$ |
| Temperature Range | |
| Operating | −55°C to +75°C (−67°F to +167°F) |
| Storage | −65°C to +85°C (−85°F to +185°F) |

### OPTIONS AVAILABLE

Control Voltage — 6 or 48 VDC

| Configuration | Isolation | Model No. |
|---|---|---|
| 2 x 2 | High (−45 dB) | 1204B |
| 2 x 2 | Very High (−70 dB) | 1204BH |

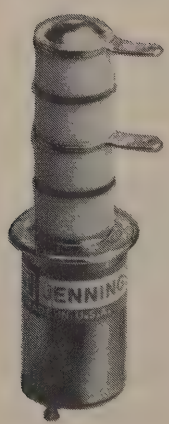
ITT JENNINGS Dept. EM, 970 McLaughlin Ave. • San Jose, CA 95122 • (408) 292-4025
DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

introducing
# A NEW SERIES

ITT Jennings offers the RF 40, 50 and 60 Series of Vacuum Relays which combine both high and stable voltage and current capabilities in a very small package.

These relays are ideal in applications where space is limited, weight critical, and high reliability of primary concern whether airborne, backpack, unattended or remote operations.

Rugged ceramic and copper construction allows use in high G shock and vibration environments. Voltage ratings to 7 kV, current ratings to 10A RMS, and operating frequencies from DC to 76 MHz.



## TYPICAL APPLICATIONS INCLUDE:

—Digitally-tuned RF amplifiers
—RF antenna couplers, tuners and matrices
—TWT cathode power supplies
—Heart defibrillator bleeder relays
—High voltage power supply bleeders
—Radar pulse forming networks

## SPECIFICATIONS

| Models (−55°C to +125°C) | RF40/40A* | RF41 | RF42 | RF43 | RF50 |
|---|---|---|---|---|---|
| Figure | A†/F | A | A | C† | C |
| Contact Arrangement | SPST | SPST | SPST | SPST | SPST |
| Form | Lock-Up(b) | B | A | Lock-Up(b) | B |
| Peak Test Voltage (DC or 60 Hz, KV) | 4 | 4 | 4 | 9 | 9(a) |
| Peak Test Voltage to Ground (KV) | 4 | 4 | 4 | 9 | 9(a) |
| Rated Operating Voltage (KV peak) (c) | | | | | |
| DC or 60 Hz | 3.6 | 3.6 | 3.6 | 7 | 7(a) |
| 2.5 MHz | 3.6 | 3.6 | 3.6 | 7 | 7 |
| 16 MHz | 3.2 | 3.2 | 3.2 | 6 | 6 |
| 32 MHz | 2.5 | 2.5 | 2.5 | 5 | 5 |
| Rated Operating Voltage to Ground (KVP) | 3.0 | 3.0 | 3.0 | 7 | 7(a) |
| Continuous Current (Carry) A rms (d) | | | | | |
| DC or 60 Hz | 10 | 10 | 10 | 10 | 10 |
| 2.5 MHz | 10 | 10 | 10 | 10 | 10 |
| 16 MHz | 6 | 6 | 6 | 6 | 6 |
| 32 MHz | 5 | 5 | 5 | 5 | 5 |
| Contact Capacity (pF) Nom | | | | | |
| Open Contact to Ground | 2 | 2 | 2 | 2 | 2 |
| Between Open Contacts | 2 | 2 | 2 | 2 | 2 |
| Contact Resistance (Ohms) | 0.020 | 0.020 | 0.020 | 0.020 | 0.020 |
| Operate Time (Max ms) | 10 | 10 | 10 | 10 | 15 |
| Release Time (Max ms) | 10 | 10 | 10 | 10 | 15 |
| Coil Resistance (Ohms), ±10%, 26.5V | 47 | 290 | 290 | 47 | 290 |
| Pull-In Voltage (Max), 26.5 VDC | | | | | |
| 20°C | 16 | 16 | 16 | 16 | 16 |
| 125°C | 22 | 22 | 22 | 22 | 22 |
| Dropout Voltage (−55°C to 125°C), 26.5 VDC | NA | 1-10 | 1-10 | NA | 1-10 |
| Shock ½ Sin 11 ms (Peak G's) | 50 | 50 | 50 | 50 | 30 |
| Vibration (Peak G's — Hz) | 10g:55 to 2000 Hz | 10g:55 to 2000 Hz | 10g:55 to 2000 Hz | 10g:55 to 2000 Hz | 10g:55 to 2000 Hz |
| Expected Mech. Life | $5x10^5$ | $5x10^5$ | $5x10^5$ | $5x10^5$ | $5x10^5$ |
| Weight (ounces) Nom | 1 | 1 | 1 | 1 | 1 |

† Similar to, but with pin leads.
* "A" versions have threaded mounting arrangements, instead of a sleeve.
a Voltage limited by external breakdown; can be increased by using in a suitable insulating medium.
b Lock-up relay using intermittent coils.
c @ 25°C.
d Based on 120° unit temperature in a 20°C ambient

ITT JENNINGS
DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
Dept. EM, 970 McLaughlin Ave. • San Jose, CA 95122 • (408) 292-4025

# vacuum relays

## VACUUM DIELECTRIC

A vacuum provides the ideal dielectric for relay contacts for the following reasons:

1) The vacuum in a typical vacuum relay is below $10^{-7}$ Torr. This gives extremely high voltage breakdown characteristics as well as a fast dielectric recovery rate, as great as 10 KV per microsecond. The high dielectric strength permits close contact spacing on the order of 1000 volts per mil, and this, coupled with low mass actuators, allows quick operating speeds.

2) The vacuum provides an absolutely inert and non-reactive environment for the contacts of the relay, so contact surfaces stay clean and assure LOW contact resistance that stays low throughout the useful long life of the relay.

3) Contacts sealed in a vacuum make a relay especially suitable for use in corrosive or explosive atmospheres and they are unaffected by changes in barometric pressure, temperature or humidity, permitting trouble-free use in almost any extreme environment.

## SPECIFICATIONS

| Models (−55°C to +125°C) | RF51 | RF60/60A* | RF61 | RF62 | RF63/63A |
|---|---|---|---|---|---|
| Figure | C | B†/E | B | D†† | D/D††† |
| Contact Arrangement | SPST | SPDT | SPDT | SPDT | SPDT |
| Form | A | Lock-Up(b) | C | C | Lock-Up(b) |
| Peak Test Voltage (DC or 60 Hz, KV) | 9(a) | 4 | 4 | 9 | 9 |
| Peak Test Voltage to Ground (KV) | 9(a) | 4 | 4 | 9 | 9 |
| Rated Operating Voltage (KV Peak) (c) | | | | | |
| DC or 60 Hz | 7(a) | 3.6 | 3.6 | 7 | 7 |
| 2.5 MHz | 7 | 3.6 | 3.6 | 7 | 7 |
| 16 MHz | 6 | 3.2 | 3.2 | 7 | 7 |
| 32 MHz | 5 | 2.5 | 2.5 | 5 | 5 |
| Rated Operating Voltage to Ground (KVP) | 7(a) | 3.0 | 3.0 | 7 | 7 |
| Continuous Current (Carry) A rms (d) | | | | | |
| DC or 60 Hz | 10 | 10 | 10 | 10 | 10 |
| 2.5 MHz | 10 | 10 | 10 | 10 | 10 |
| 16 MHz | 6 | 6 | 6 | 6 | 6 |
| 32 MHz | 5 | 5 | 5 | 5 | 5 |
| Contact Capacity (pF) Nom | | | | | |
| Open Contact to Ground | 2 | 2 | 2 | 2 | 2 |
| Between Open Contacts | 2 | 2 | 2 | 2 | 2 |
| Contact Resistance (Ohms) | 0.020 | 0.020 | 0.020 | 0.020 | 0.020 |
| Operate Time (Max ms) | 15 | 10 | 10 | 15 | 10 |
| Release Time (Max ms) | 15 | 10 | 10 | 15 | 10 |
| Coil Resistance (Ohms), ±10%, 26.5V | 290 | 47 | 290 | 290 | 47 |
| Pull-In Voltage (Max), 26.5 VDC | | | | | |
| 20°C | 16 | 16 | 16 | 16 | 16 |
| 125°C | 22 | 22 | 22 | 22 | 22 |
| Dropout Voltage (−55°C to 125°C), 26.5 VDC | 1-10 | NA | 1-10 | 1-10 | NA |
| Shock ½ Sin 11 ms (Peak G's) | 30 | 50 | 50 | 30 | 50 |
| Vibration (Peak G's — Hz) | 10g:55 to 2000 Hz | 10g:55 to 2000 Hz | 10g:55 to 2000 Hz | 10g:55 to 2000 Hz | 10g:55 to 2000 Hz |
| Expected Mech. Life | $5x10^5$ | $5x10^5$ | $5x10^5$ | $5x10^5$ | $5x10^5$ |
| Weight (ounces) Nom | 1 | 1 | 1 | 1 | 1 |

† Similar to, but with pin leads. †† Similar to, but with terminals. ††† Similar to, but with threaded sleeve.
* "A" versions have threaded mounting arrangements, instead of a sleeve.
a Voltage limited by external breakdown; can be increased by using a suitable insulating medium.
b Lock-up relay using intermittent coils.
c @ 25°C.
d Based on 120° unit temperature in a 20°C ambient.

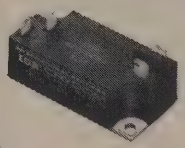
ITT JENNINGS Dept. EM, 970 McLaughlin Ave. • San Jose, CA 95122 • (408) 292-4025
DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

INTERNATIONAL RECTIFIER IOR CRYDOM SOLID STATE RELAYS
Crydom Division • 1521 Grand Ave. • El Segundo, California 90245 • Phone: (213) 322-4987

# PHOTO ISOLATED SOLID STATE POWER RELAYS AND INPUT & OUTPUT SWITCHES

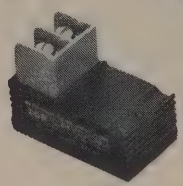
SERIES 1

SERIES 2



SERIES 30

SERIES 3/37



SERIES 4

- Ultra-Long Cyclic Life
- Minimum RFI
- Zero Voltage Crossover
- Photo Isolated
- Fast Response
- Silent Operation
- Logic Compatible Inputs
- Reverse Polarity Protected
- Integral Snubbers on Most AC Types
- Output Transient Suppression on Most DC Types
- UL Recognized and CSA Approved on Most Models
- Computer-Compatible

Photo-isolated, solid state power relay performs general purpose switching of AC loads from 2 to 40 amperes at line voltage from 90 to 480 VAC. Have normally open power contacts. Feature zero voltage switching, logic level inputs with 1500 VAC signal isolation by a unique photo-isolator. 2500 VAC and 3750 VAC also available on most models.

Generally used in applications for control of motors, lamps, solenoids, power contactors, and resistance heaters.

These relays do not contain transformers, coils or reed relays. This advanced method of input isolation provides excellent dielectric strength and transient-free de-coupling of sensitive inputs from the AC load power. All switching functions are performed by long-life, solid state semiconductor circuitry. Zero-voltage switching assures transient-free operation. Eliminates radio frequency interference, transient surges and electrical noise generated by arcing contacts or high rate-of-rise inrush current. Computer-compatible, the DC input models operate directly from low-level digital signals.

AC input models operate over a wide signal range of 90-140 VAC. Excellent surge and power-factor capabilities eliminate need for derating because of inductive or tungsten lamp loads. Almost all models contain an internal RC snubber network.

## SERIES 1 AC OUTPUT PANEL MOUNT HEAVY DUTY RELAYS
### 2.5 TO 40 AMPS, 120, 240, 480 VAC

These heavy duty panel mount solid state relays make it possible to switch AC power loads up to ten kilowatts. The output circuit is an inverse-parallel arrangement of dual SCR's to meet the most demanding requirements. Screw type terminals provide maximum connection flexibility. This series of Crydom relays has been the "standard of the industry" in heater, motor control, solenoid lamp and other load controls.

All specified maximum load ratings are based on adequate heat sink mounting of the relay base. See technical data sheets for derating and heat-sink requirements.

### GENERAL SPECIFICATIONS

Isolation Voltage: 1500 VAC Std., 2500 VAC and 3750 VAC available
Temperature Range: −30°C to +80°C
Size: 1.75″W x 2.25″D x 0.875″H
Case Style: 1

### LOW-COST TRIAC MODELS

The TD1210 and TD2410 solid-state relays are a lower cost triac output unit for applications that do not require the features of the above dual SCR output types. A glass passivated triac with unique thermal management construction provides reliable and long life operation. They have the same DC input control range and characteristics as the D1210 and D2410 models.
Control Signal Range: 3-32 VDC
Must Operate: 3 VDC
Must Release: 1 VDC
Input Impedance: 1.4 KΩ
RC Snubber Network: Included

| Model No. | Line VAC (47-63 Hz) | Max. Load Current, Amps | One-Cycle Surge, Amps | 1 Sec. Surge, Amps |
|---|---|---|---|---|
| TD1210 | 12-140 | 10 | 80 | 24 |
| TD2410 | 48-280 | 10 | 80 | 24 |

Note: For 2500 VAC isolation add suffix -1. Example: TD1210-1.

### 400 HERTZ RELAYS

High power, photo isolated solid-state relays are also available in 400 Hz versions for avionic and ground support equipment. Comparable models to the Series 1 DC input and AC input types are available for 120 and 240 VAC loads. For 400 Hz types add prefix 4, ie. 4D2410. Applies to models D12 and D24 only.

### DC INPUT MODELS

2.5 to 40 Amps. 120, 240, and 480 VAC.
Control Signal Range: 3-32 VDC
Must Operate: 3 VDC Max.
Must Release: 1 VDC Min.
Input Impedance: 1.5 KΩ
Snubber: Internal

| Model No. | Line VAC (47-63 Hz) | Max. Load Current, Amps | One-Cycle Surge, Amps | 1 Sec. Surge, Amps |
|---|---|---|---|---|
| D1202 | 100-140 | 2.5 | 15 | 5 |
| D1210 | 100-140 | 10 | 80 | 24 |
| D1225 | 100-140 | 25 | 175 | 40 |
| D1240 | 100-140 | 40 | 450 | 80 |
| D2402 | 200-280 | 2.5 | 15 | 5 |
| D2410 | 200-280 | 10 | 80 | 24 |
| D2425 | 200-280 | 25 | 175 | 40 |
| D2440 | 200-280 | 40 | 450 | 80 |
| D4808* | 340-480 | 8 | 50 | 17 |
| D4812* | 340-480 | 12 | 60 | 20 |
| D4825* | 340-480 | 25 | 175 | 40 |

*Control signal range, 3-20 VDC; input impedance, 500 ohms, min.
Note: For 2500 VAC isolation add suffix -1. Example: D2410-1.

### AC INPUT MODELS

2.5 to 40 Amps. 120, 240, and 480 VAC.
Control Signal Range: 90-280 VAC. 80 to 140 VDC
Must Operate: 90 VAC or 80 VDC
Must Release: 10 VAC or 10 VDC
Input Impedance: 40 KΩ
Snubber: Internal

| Model No. | Line VAC (47-63 Hz) | Max. Load Current, Amps | One-Cycle Surge, Amps | 1 Sec. Surge, Amps |
|---|---|---|---|---|
| A1202 | 100-140 | 2.5 | 15 | 5 |
| A1210 | 100-140 | 10 | 80 | 24 |
| A1225 | 100-140 | 25 | 175 | 40 |
| A1240 | 100-140 | 40 | 450 | 80 |
| A2402 | 200-280 | 2.5 | 15 | 5 |
| A2410 | 200-280 | 10 | 80 | 24 |
| A2425 | 200-280 | 25 | 175 | 40 |
| A2440 | 200-280 | 40 | 450 | 80 |
| A4808* | 340-480 | 8 | 50 | 17 |
| A4812* | 340-480 | 12 | 60 | 20 |
| A4825* | 340-480 | 25 | 175 | 40 |

*Control signal range, 90-120 VAC; input impedance, 12K ohms, min.
Note: For 2500 VAC isolation add suffix -1. Example: A1240-1.

IOR

# SERIES 2 AC OUTPUT PANEL MOUNT RELAYS
## 8 AND 15 AMPS, 120 AND 240 VAC

The Crydom Series 2 Solid State Relays combine small size and high current rating in a package designed for heat sink or panel mounting. Standard 0.187" push-on terminals allow quick connection and are positioned to provide maximum isolation between signal and power circuits. They are controlled directly by logic level DC signals and turn on and off within one-half cycle. Most models are U.L. recognized and CSA approved.

These units have 8 and 15 ampere ratings when heat sink mounted and contain an internal snubber, yet occupy less than 1.0 cubic inch. For heat-sink requirements and derating see technical data sheets.

### GENERAL SPECIFICATIONS

Control Signal Range: 3.5-8 VDC
Must Operate +3.5 VDC Max.
Must Release 1 VDC Min.
Must Operate Current: 12 mA Max.
Isolation Voltage: 1500 VAC. Also available with 2500 VAC
Temperature Range: —30°C to +80°C
Snubber: Internal
Case Style: 2

| Model No. | Line VAC (47-63 Hz) | Max. Load Cur. @ 40°C (Amps RMS) | One-Cycle Surge (Amps PK) | 1 Sec. Surge (Amps PK) |
|---|---|---|---|---|
| S218 | 20-140 | 8 | 120 | 42 |
| S228 | 40-280 | 8 | 120 | 42 |
| S2115 | 20-140 | 15 | 240 | 66 |
| S2215 | 40-280 | 15 | 240 | 66 |

Note: For 2500 VAC isolation add suffix -1. Example: S218-1.

# SERIES 3 AC OUTPUT P.C. BOARD MOUNT RELAYS
## 2 AND 4 AMPS, 120 AND 240 VAC. INTEGRAL HEAT RADIATOR S3714, S3724

Series 3 combines small size, maximum current rating and minimum off-state leakage in a package designed for solder connection into printed circuit boards. The units are 0.4 cubic inch in volume and consume only 1.0 square inch of PCB mounting space. An overall height of 0.4", on most models, allows PCB spacing on ½" centers. The square rigid pins are also suitable for wire wrap or push-on connectors. The S3714 and S3724 provide a P.C. mount unit with the greatest available output, (4A because of its unique integral heat radiator). All relays are rated at 40°C ambient temperature. For derating at high ambient see technical data sheets. All except the S310, S320, S312 and S322 have internal snubbers (resistor capacitor transient suppression networks).

### GENERAL SPECIFICATIONS

Control Signal Range: 3.5-8 VDC
Must Operate: +3.5 VDC
Must Release: 1.0 VDC, Min.
Must Operate Current: 12 mA
Isolation Voltage: 1500 VAC. Also available with 2500 VAC
Temperature Range: —30°C to 80°C
Snubbers: Intergral, except S312, S322

| Size | Model | Case Style |
|---|---|---|
| .60"W, 1.2"D, .63"H | S312 and S322 | 3 |
| .60"W, 1.45"D, .63"H | S3012 and S3022 | 30 |
| .80"W, 1.45"D, 1.10"H | S3714 and S3724 | 37 |

| Model No. | Line VAC (47-63 Hz) | Max. Load Current @ 40°C Amps (RMS) | One-Cycle Surge, Peak (Amps) PK | 1 Sec. Surge (Amps) PK | Internal Snubbers |
|---|---|---|---|---|---|
| S310 | 20-140 | 0.3 | 4.0 | 2.5 | No |
| S320 | 40-280 | 0.3 | 4.0 | 2.5 | No |
| S312 | 20-140 | 2 | 55 | 14 | No |
| S3012 | 20-140 | 2 | 55 | 14 | No |
| S322 | 40-280 | 2 | 55 | 14 | Yes |
| S3022 | 40-280 | 2 | 55 | 14 | Yes |
| S3714 | 20-140 | 4 | 80 | 18 | Yes |
| S3724 | 40-280 | 4 | 80 | 18 | Yes |

# SERIES 30 DC OUTPUT SOLID STATE RELAYS
## 0.5 AMP, 200 VDC LOAD. P.C. BOARD MOUNT

The B3020 DC Relays are available in two models: the low cost model B3020R5, without internal transient suppression, and the model B3020R5A, with internal suppression. Both models provide features of fast response, photo isolation, input and output reverse voltage protection, and direct control by digital logic circuits. Applications include replacement of discrete component solid state switches for control of solenoids, valves, motors and lamps. The package size and termination are similar to relay S3012.

### GENERAL SPECIFICATIONS

Control Signal Range: 3-8V
Must Operate: 3V, Max.
Must Release: 1V, Min.
Input Impedance @ 5 VDC: 10 mA DC, Max.
Isolation Voltage: 1500 VAC RMS
Temperature Range: —30°C to + 80°C
Size: 0.8"W, 1.45"D, 0.63"H
Case Style: 30

| Model No. | Line VDC | Max. Load Current @ 50°C (Amps) | One-Cycle Surge (Amps) | 50 mSec. Surge (Amps) | Transient Suppression |
|---|---|---|---|---|---|
| B3020R5 | 10-200 | 0.5 | 240 | 3 | No |
| B3020R5A | 10-200 | 0.5 | 240 | 3 | Yes |

# SERIES 4 AC AND DC INPUT AND OUTPUT SWITCHES
## UP TO 4 AMPS OUTPUT RATING

The Crydom Series 4 Input/Output switches offer a complete and highly flexible set of AC and DC devices that provide isolated interfaces between programmable controllers, microprocessors, computerized machine controls, and the outside field elements including solenoids, valves, heaters, motors, etc.

Each switch contains a clearly visible, but recessed for protection, LED status indicator associated with the control condition of the device for easy program set up and testing.

Output units can deliver 2.75A at 70°C and 4A at 40°C — power levels necessary for high reliability industrial applications. Lower load-rated switches are also available.

The Series 4 Output switches are essentially four terminal solid-state relays which accept logic level control signals and switch a DC or AC power load. The input switches accept power level potential controls and convert them to an isolated logic level (TTL, CMOS, etc.) signal. The entire set of Crydom Input/Output switches provides an electrically clean, isolated, and noise-free interface between "smart" circuitry and external power-operated load functions. The output units have wide compatibility with resistive and inductive loads through the inclusion of internal transient suppression on the DC models and internal snubber networks on the AC models.

### GENERAL SPECIFICATIONS

***Logic Load For All Input Switches**
Supply Voltage: 4.5 VDC/18 VDC, Max.
Supply Current: 7 mA, Max.
Isolation Voltage: 1500 VAC
Temperature Range: —30°C to +80°C
Case Style: Style 4
Color Coding: AC Field — Red Terminal Block
DC Field — Blue Terminal Block
Input Unit — White Case
Output Unit — Black Case

****Logic Control For All Output Switches**
Control Range: 4-8 VDC
Control Current: 16 mA, Max.
Must Operate Voltage: 4 VDC
Must Release Voltage: 0.8 VDC

| Switch Type | Part No. | Control Voltage | Max. Load Voltage | Max. Load Current |
|---|---|---|---|---|
| DC Input* | S410 | 10-32 VDC | 30 VDC | Logic |
| DC Input* | S411 | 10-55 VDC | 30 VDC | Logic |
| DC Input* | S412 | 40-120 VDC | 30 VDC | Logic |
| AC Input* | S420 | 90-135 VAC | 30 VDC | — |
| AC Input* | S421 | 180-270 VAC | 30 VDC | — |
| DC Output** | S430 | 4-8 VDC | 55 VDC | 4A |
| DC Output** | S432 | 4-8 VDC | 55 VDC | 2A |
| AC Output** | S440 | 4-8 VDC | 120 VAC | 4A RMS |
| AC Output** | S441 | 4-8 VDC | 240 VAC | 4A RMS |
| AC Output** | S442 | 4-8 VDC | 120 VAC | 2A RMS |
| AC Output** | S443 | 4-8 VDC | 240 VAC | 2A RMS |

# HEAT SINKS FOR SERIES 1 AND 2 RELAYS

These aluminum alloy heat sinks provide excellent heat dissipation and allow maximum power to be handled by the solid state relays. Note: All current ratings are based upon the use of a suitable thermally-conductive component (e.g.) silicone grease between the SSR mounting base and the mounting surface.

| Model No. | Current Rating (Use for) | Use for Series |
|---|---|---|
| HS-1 | Below 10 Amps | 1 and 2 |
| HS-2 | 5 to 20 Amps | 1 and 2 |
| HE-54 | Above 20 Amps | 1 |

# CALL US BY OUR FIRST NAME

At ITT Components Group we are proud of our worldwide resources. 2,000 people . . . one million square feet of manufacturing space . . . throughout seven countries. We manufacture and market the most modern and most reliable relays and they are available to you from one location.

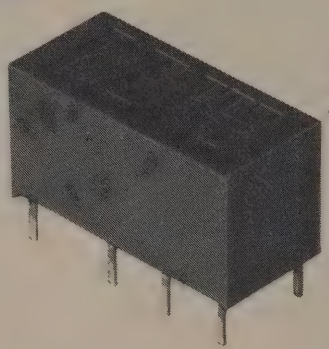
The ITT name — known the globe over — sets our very high standards. Our R&D facilities provide the latest in materials and switching techniques assuring the highest reliability at the most economical cost.

On this page and the five following. we present some highlights from our relay line. First two pages: specifications of our subminiature PCB relays. Next two pages: printed-circuit, low-profile PZ relays designed especially for high speed switching applications in logic, control, and communications equipment. Last two pages: Type 24/25/26 cradle relays which are available in single, bifurcated, and heavy duty versions.

## RZ
## 1A DUAL-IN-LINE RELAYS

**$1.85***

- **2 Form C Crossbar Contacts**
- **Dual-In-Line Configuration**
- **Low Profile, Printed Circuit or DIP Socket**
- **Molded Construction Ideal for Flow-Solder**
- **Automated Assembly and Test**

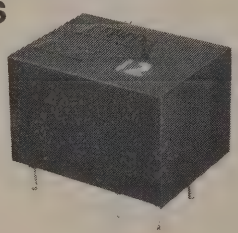


ITT Components Group is a powerhouse of relay resources. And here is our smallest powerhouse — the RZ relay. This subminiature dual-in-line printed circuit board relay, a significant advancement in relay state-of-the-art, has a unique symmetrical layout in a DIP package and a 2 Form C (DPDT) design with single silver cross--bar contacts which provides switching characteristics of 1A, 30W, or 50VA. Size? The RZ stands only 0.433 inches above the board.

That's a lot of power in a little package.

## LZ
## 5A SUB-MINIATURE PRINTED CIRCUIT RELAYS

**$1.30***

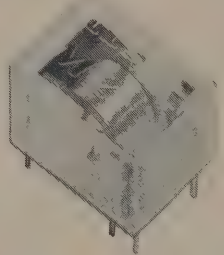


- **Low Cost, Low Profile**
- **Vibration and Shock Resistant**
- **Printed Circuit Mounting (0.1 in.)**
- **Sub-miniature Size**
- **Designed to Satisfy UL and CSA Requirements**
- **Dust-Free Enclosure**
- **Low Level to 5A**

The LZ miniature printed circuit relays are specifically designed to withstand high shock and vibration conditions. These 5A, 1 Form C relays, have been designed for mounting on standard printed circuit boards and are sealed to help prevent soldering and cleaning problems.

## MZ
## 1A SUB-MINIATURE PRINTED CIRCUIT RELAYS

**$1.25***

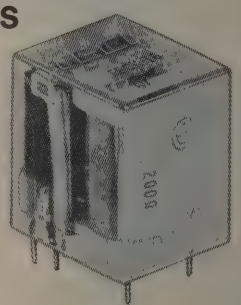


- **1 Form C General Purpose**
- **Dual-In-Line Configuration**
- **Gold Contacts for Low-Level Loads GS Contacts for Normal Loads**
- **Improved Shock and Vibration Characteristics**
- **Miniature Size — 0.4″ Height**
- **Dust-Free Enclosure**
- **Economical/Low Cost**

The MZ series of sub-miniature dual-in-line relays are ideal for current cost conscious engineers for design of low profile printed circuit equipment requiring speed, reliability and repeatability. They are available with 1 Form C (SPDT) crossbar contacts either low level or standard 1A (for 2 Form C see TECK specifications). Efficient design for shock and vibration applications. They are provided with a dust-free enclosure.

## TECK
## 0.5A MINIATURE PRINTED CIRCUIT RELAYS

**$1.60***



- **Miniature 2 Form C**
- **Rugged Construction**
- **High Reliability**
- **Low Cost**
- **Dust-Free Enclosure**

The TECK series printed circuit relays are ideally suited for applications where space is at a premium. Their small size, reliability, ruggedness and low cost make them a unique series of relays. They are available in a variety of contact configurations with SPDT and DPDT bifurcated contacts standard, and all types come standard with a dust-free enclosure.

*1000 piece price.

ITT COMPONENTS GROUP • 1551E OSGOOD STREET • NORTH ANDOVER, MA 08145 • (617) 686-1110
A UNIT OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

Components ITT

# SUB-MINIATURE PRINTED CIRCUIT BOARD RELAYS

## 1A SUB-MINIATURE PRINTED CIRCUIT RELAYS — MZ*

**Standard Coil and Contact Combinations (20°C)**

| Nominal Voltage | Pull-In Voltage* | Maximum Continuous Voltage | Coil Resistance ±10% Ohms | Ordering Code Au Overlay Ag Pd Base |
|---|---|---|---|---|
| 1.5 | 1.05 | 1.65 | 5 | MZ1.5HG |
| 3 | 2.1 | 3.3 | 20 | MZ3HG |
| 5 | 3.5 | 5.5 | 56 | M5ZHG |
| 6 | 4.2 | 6.6 | 80 | MZ6HG |
| 9 | 6.3 | 9.9 | 180 | MZ9HG |
| 12 | 8.4 | 13.2 | 320 | MZ12HG |
| 24 | 16.8 | 26.4 | 1280 | MZ24HG |
| **Ultra Sensitive Types** | | | | |
| 1.5 | 1.05 | 1.65 | 12 | MZ1.5HS |
| 3 | 2.1 | 3.3 | 45 | MZ3HS |
| 5 | 3.5 | 5.5 | 120 | MZ5HS |
| 6 | 4.2 | 6.6 | 180 | MZ6HS |
| 9 | 6.3 | 9.9 | 400 | MZ9HS |
| 12 | 8.4 | 13.2 | 700 | MZ12HS |
| 24 | 16.8 | 26.4 | 2800 | MZ24HS |

Must release voltage is 10% of nominal.

### CONTACT DATA

**LOAD — Switched power:** 25W, 100VA. **Switched current:** 1A. **Switched voltage:** 24VDC, 100VAC.

**LIFE — Electrical expectancy:** $1x10^6$ operations @ 80mVDC, 50μA-MZHG series. $5x10^5$ operations @ 24VDC, 1A-MZH series. **Mechanical expectancy:** $10x10^6$ operations minimum.

**CONTACT RESISTANCE** — 100mΩ.

**OPERATE AND RELEASE TIME — Operate time (approximate):** 3ms. **Release time (approximate):** 2ms.

**INSULATION RESISTANCE** — >5MΩ.

**CONTACT MATERIAL — 50μA type:** Gold overlay, silver palladium. **0.5A-1A Type:** Silver 90%, Gold 10%.

**CONTACT FORM:** 1 Form C.

### COIL DATA

**POWER CONSUMPTION @ 20°C — Coils at nominal voltage:** 0.45W.

**CONTINUOUS COIL POWER — Maximum allowable @ 20°C:** 1W. **@ 50°C:** 0.48W.

## 1A DUAL-IN-LINE RELAYS — RZ*

**Standard Coil and Contact Combinations (20°C)**

| Nominal Voltage | Pull-In Voltage* | Maximum Continuous Voltage | Coil Resistance ±10% Ohms | Ordering Code |
|---|---|---|---|---|
| 5 | 3.2 | 6.9 | 45 | RZ-4.5 |
| 6 | 4.3 | 8.9 | 60 | RZ-6 |
| 12 | 8.4 | 19.2 | 280 | RZ-12 |
| 24 | 17.3 | 36.6 | 1070 | RZ-24 |
| 48 | 36.0 | 72.0 | 4000 | RZ-48 |

Must release voltage is 10% of nominal.

### CONTACT DATA

**LOAD — Switched power:** 50VA. **Switched current:** 1A. **Switched voltage:** 125VAC, 150VDC.

**LIFE — Electrical expectancy:** 60VDC/20W: $1x10^6$ operations. 60VAC/20W: $1.5x10^6$ operations. **Mechanical expectancy:** $1x10^7$ operations.

**CONTACT RESISTANCE** — ≤50mΩ.

**OPERATE AND RELEASE TIME — Operate time:** ≤6ms. **Release time:** ≤3ms.

**INSULATION RESISTANCE** — 100MΩ.

**CONTACT MATERIAL** — Crossbar - silver.

**CONTACT FORM** — 2 Form C.

### COIL DATA

**POWER CONSUMPTION — Coils at nominal voltage:** 515 to 600mW.

**CONTINUOUS COIL POWER — Maximum allowable @ 20°C:** 1050mW. **@ 40°C:** 840mW. **@ 55°C:** 680mW.

## 5A SUB-MINIATURE PRINTED CIRCUIT RELAYS — LZ*

**Standard Coil and Contact Combinations (20°C)**

| Nominal Voltage | Pull-In Voltage | Maximum Continuous Voltage | Coil Resistance ±10% Ohms | Ordering Code* |
|---|---|---|---|---|
| **Standard Types — 3A** | | | | |
| 5 | 4.0 | 5.5 | 56 | LZ-5 |
| 6 | 4.8 | 6.6 | 80 | LZ-6 |
| 9 | 7.2 | 9.9 | 180 | LZ-9 |
| 12 | 9.6 | 13.2 | 320 | LZ-12 |
| 24 | 19.2 | 26.4 | 1280 | LZ-24 |
| 48 | 38.4 | 52.8 | 3800 | LZ-48 |
| **Power Types — 5A** | | | | |
| 5 | 4.0 | 5.5 | 56 | LZ-5H |
| 6 | 4.8 | 6.6 | 80 | LZ-6H |
| 9 | 7.2 | 9.9 | 180 | LZ-9H |
| 12 | 9.6 | 13.2 | 320 | LZ-12H |
| 24 | 19.2 | 26.4 | 1280 | LZ-24H |
| 48 | 38.4 | 52.8 | 3800 | LZ-48H |
| **High Sensitive Types** | | | | |
| 5 | 4.0 | 5.5 | 80 | LZ-5S |
| 6 | 4.8 | 6.6 | 110 | LZ-6S |
| 9 | 7.2 | 9.9 | 250 | LZ-9S |
| 12 | 9.6 | 13.2 | 440 | LZ-12S |
| 24 | 19.2 | 26.4 | 1780 | LZ-24S |

For bifurcated contacts (Silver Palladium Gold Overlay) add "W" to ordering code.

### CONTACT DATA

**LOAD — Switched power:** 90W, 300VA. **Switched current:** 3A. **Switched voltage:** 24VDC, 100VAC.

**LIFE — Electrical expectancy:** $1x10^5$ operations at 3A, 100VAC. $5 \times 10^5$ operations at 3A, 24VDC. **Mechanical expectancy:** $20x10^6$ operations.

**CONTACT RESISTANCE** — 100mΩ.

**OPERATE AND RELEASE TIME — Operate time:** 5ms typical. **Release time:** 3ms typical.

**INSULATION RESISTANCE** — 250MΩ.

**CONTACT MATERIAL — Single:** Silver/Gold overlay. **Bifurcated:** Silver Palladium Gold overlay.

**CONTACT FORM** — 1 Form C (for 2 Form C see TECK specifications).

### COIL DATA

**POWER CONSUMPTION — Coils at nominal voltage @ 20°C:** 450mW for standard type. 330mW for high sensitive type.

**CONTINUOUS COIL POWER — Maximum allowable @ 20°C:** 1.5W.

## 0.5A MINIATURE PRINTED CIRCUIT RELAYS — TECK

**Standard Coil and Contact Combinations (20°C)**

| Nominal Voltage | Pull-In Voltage | Maximum Continuous Voltage | Coil Resistance ±10% Ohms | Ordering Code |
|---|---|---|---|---|
| **SPDT** | | | | |
| 1.5 | .85 | 1.65 | 12 | TECK-T1.5 |
| 3 | 1.7 | 3.3 | 50 | TECK-T3 |
| 6 | 3.5 | 6.6 | 200 | TECK-T6 |
| 9 | 5.0 | 9.9 | 400 | TECK-T9 |
| 12 | 7.5 | 13.0 | 800 | TECK-T12 |
| 24 | 14.0 | 27.0 | 2500 | TECK-T24 |
| **DPDT** | | | | |
| 1.5 | .91 | 1.65 | 8 | TECK-TT1.5 |
| 3 | 1.7 | 3.3 | 30 | TECK-TT3 |
| 6 | 3.6 | 6.6 | 125 | TECK-TT6 |
| 9 | 5.2 | 9.9 | 250 | TECK-TT9 |
| 12 | 7.5 | 13.0 | 500 | TECK-TT12 |
| 24 | 13.8 | 27.0 | 1500 | TECK-TT24 |

Flow solder, submergible versions are available for use in normal cleaning solutions. Add the letter "P" after voltage.

### CONTACT DATA

**LOAD — Switched power:** 50VA. **Switched current:** .5A. **Switched voltage:** 100V.

**LIFE — Electrical expectancy:** $20x10^6$ operations. **Mechanical expectancy:** $50x10^6$ operations.

**CONTACT RESISTANCE** — 50mΩ (typical).

**OPERATE AND RELEASE TIME — Operate time:** 7ms. **Release time:** 3ms.

**INSULATION RESISTANCE** — >50MΩ.

**CONTACT MATERIAL** — Gold/silver, PGS and Pt contacts available.

**CONTACT FORM — TECK-T:** SPDT. **TECK-TT:** DPDT.

### COIL DATA

**POWER CONSUMPTION — Coils at nominal voltage:** 0.15W.

**CONTINUOUS COIL POWER — Maximum allowable:** 1.75W.

# PRINTED CIRCUIT MINIATURE RELAYS

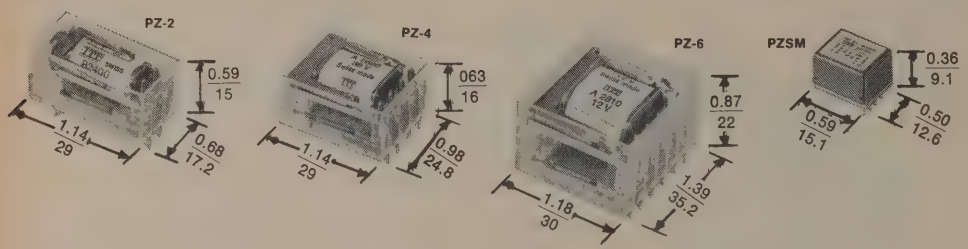
PZ

## PZ-2 PZ-4 PZ-6

These low profile relays were designed especially for printed circuit applications utilizing standard pulse communication techniques. They are also available in latching versions as well as in sub-miniature packages. Contacts are gold and silver alloys to insure specified contact resistance over full life. Totally automated production eliminates human error and guarantees all parameters. Their polycarbonate case is designed to be used with or without top cover. There are more than 70 standard types. All are UL Recognized (File E57102).

## PZSM

- 15 Years Proven Telecommunications Experience
- Switch 1A in 1.7 Cubic Centimeter
- Subminiature Size — Height 0.36″
- High Reliability
- 2 Form C in 0.1 Cubic Inch
- Operates From IC Logic and Standard DC Voltages
- 0.1 Inch Grid Spacing
- Printed Circuit Board Application
- Less Than 0.3in² on PC Board
- Standard Flow-Solder Techniques
- Sealed Enclosure Immune to Washing Process




ALL DIMENSIONS IN INCHES / MM

## GENERAL SPECIFICATIONS

**Coil Data — Standard Relays**

| Nominal Voltage | Coil Resistance ±10% Ohms | Ordering Code AgPd Contacts* | Ordering Code Au/Ag Contacts† |
|---|---|---|---|
| **PZ-2‡** | | | |
| 6 | 60 | A2400 | A2405 |
| 12 | 210 | A2410 | A2415 |
| 18 | 500 | A2412 | A2417 |
| 24 | 850 | A2420 | A2425 |
| 36 | 1600 | A2430 | A2435 |
| 48 | 3000 | A2440 | A2445 |
| **PZ-4‡** | | | |
| 6 | 40 | A2640 | A2645 |
| 12 | 210 | A2600 | A2605 |
| 18 | 500 | A2612 | A2617 |
| 24 | 850 | A2610 | A2615 |
| 36 | 1600 | A2620 | A2625 |
| 48 | 3000 | A2630 | A2635 |
| 60 | 4800 | A2650 | A2655 |
| **PZ-6‡** | | | |
| 6 | 66 | A2800 | A2805 |
| 12 | 270 | A2810 | A2815 |
| 18 | 520 | A2812 | A2817 |
| 24 | 900 | A2820 | A2825 |
| 36 | 1900 | A2830 | A2835 |
| 48 | 3600 | A2840 | A2845 |
| 60 | 6100 | A2850 | A2855 |

**PZSM**

| Nominal Voltage | Pull-In Voltage | Coil Resistance ±5% Ohms | Au/Ag Contacts† Ordering Code |
|---|---|---|---|
| 5 | 3.0 | 135 | PZSM—D1005 |
| 12 | 7.2 | 724 | PZSM—D1012 |
| 24 | 14.4 | 2760 | PZSM—D1024 |
| 48 | 34.1 | 11,100 | PZSM—D1048 |

* Silver Palladium alloy, 70% Silver, 30% Palladium
† Gold/Silver alloy, 80% Gold, 20% Silver
‡ Available in Remanent latch versions designed for pulse applications

## CONTACT DATA

**Load**

| | | |
|---|---|---|
| Switched power | PZ-2, 4, 6 | 30VA |
| | PZSM | 12VA |
| Switched current | PZ-2, 4, 6 | 1A |
| | PZSM | 0.5A |
| Switched voltage | PZ-2, 4, 6 | 120V |
| | PZSM | 100V |

**Life**

| | | |
|---|---|---|
| Electrical expectancy | PZ-2, 4, 6 @ 0.5A, 30V | 10 x $10^6$ oper. |
| | PZSM @ 6VA | 1 x $10^6$ oper. |
| Mechanical expectancy | PZ-2, 4, 6 | 200 x $10^6$ oper. |
| | PZSM | 200 x $10^6$ oper. |

**Contact Resistance**

| | | |
|---|---|---|
| | PZ-2, 4, 6 | 40 mΩ |
| | PZSM | 50 mΩ |

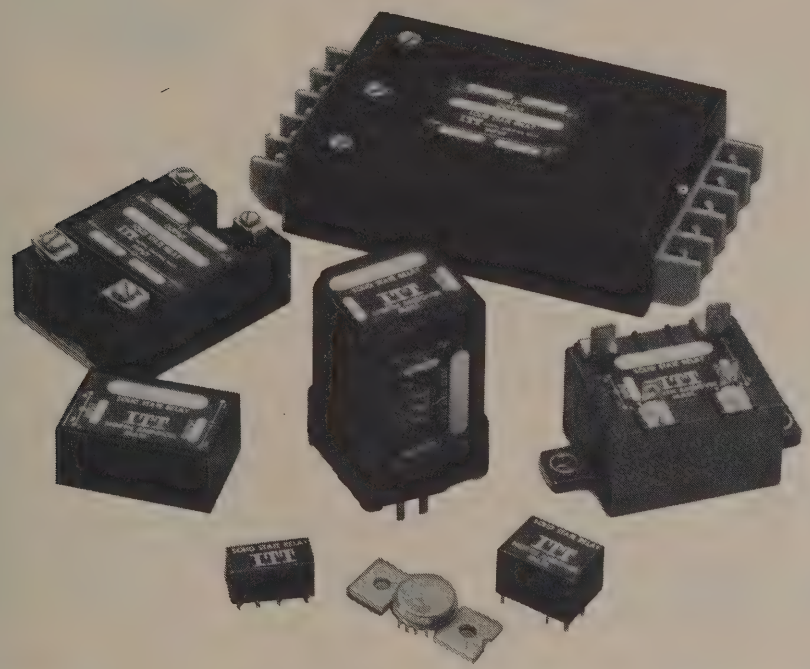
**Operate & Release Time**

| | | |
|---|---|---|
| Operate (including bounce) | PZ-2, 4, 6 | 10 ms |
| | PZSM | 3.5 ms |
| Release | PZ-2, 4, 6 | 2.5 ms |
| | PZSM | 1.5 ms |

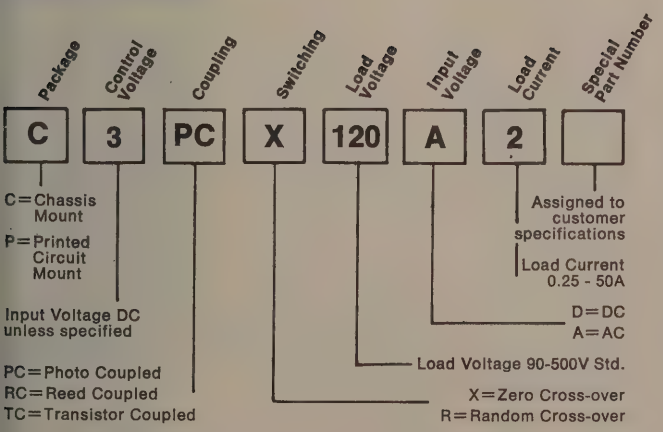
# SOLID STATE RELAYS

- 70 Models in 12 Package Styles
- 1A to 40A in AC and DC Versions
- All Internal Triacs and SCRs Are Triple Tested and Selected
- Smallest Packages Consistent With Thermal Considerations

It takes an EMR expert, like ITT Components Group, to translate your switching and isolation needs into solid state technology. We offer built-in snubbers, unique heat dissipation systems for high surge capability, and true zero cross-over circuitry. You can choose from photo, transistor and reed coupling. And you can build your own part number from the chart below and order a solid state relay customized to your own requirements. Or choose a standard ITT solid state relay from any of the types listed in the Basic Cross Reference chart. Either way you get the reliability and long life which makes our SSRs an excellent alternative to electromechanical relays.



## Ordering Codes




**Example:** **C12PCX120A2**

The above code signifies a chassis mount, photo coupled SSR with input voltage of 3 VDC, load voltage of 120VAC, designed for zero cross-over in an AC application. Load current is 2A.

## Basic Cross Reference Chart

| ITT Components Group | Crydom | Opto 22 | Teledyne | ERI | Hamlin | Gordos' Grigsby-Barton |
|---|---|---|---|---|---|---|
| C3PCX120D2.5 | D1202 | 120D3 | | S505-SJ202 | | |
| C3PCX120D10 | D1210 | 120D10 | 611-17 | S505-SJ210 | 7521 | GB15210 |
| C3PCX120D25 | D1225 | 120D25 | 611-11 | S505-SJ225 | 7531 | GB15225 |
| C3PCX120D45 | D1240 | 120D45 | 611-15 | S505-SJ240 | 7551 | GB15240 |
| C3PCX240D2.5 | D2402 | 240D3 | | S505-SJ402 | | |
| C3PCX240D10 | D2410 | 240D10 | 611-18 | S505-SJ410 | 7522 | GB15410 |
| C3PCX240D25 | D2425 | 240D25 | 611-12 | S505-SJ425 | 7532 | GB15425 |
| C3PCX240D40 | D2440 | 240D45 | 611-16 | S505-SJ440 | 7552 | GB15440 |
| C3PCX330D2.5 | | | 611-18H | S505-SJ602 | | |
| C3PCX330D10 | | | 611-12H | S505-SJ610 | | |
| C3PCX330D25 | | | 611-16H | S505-SJ625 | | |
| C3PCX330D40 | | | | S505-SJ640 | | |
| C3PCX480D10 | D4808E<br>D4812 | 480D10 | | S505-SJ12010 | | |

Consult factory for other combinations of package, voltage, current, etc.

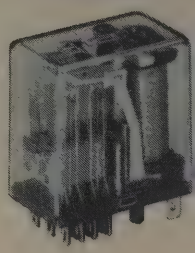
# MINIATURE RELAYS



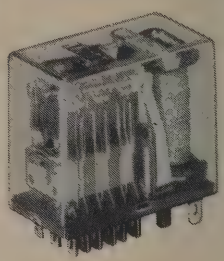
- **One Piece Core and Yoke** giving improved magnetic efficiency and stability
- **One Piece Bobbin and Terminal** gives rigid coil terminations
- **Polycarbonate Insulation** — negligible moisture absorption ensuring stability of spring-set adjustment
- **Underwriters Laboratories Recognized (#E57102)**
- **CSA Approved (LR38310-1)**

Type 24

Type 25



Type 26



ITT Type 24/25/26 miniature relays are fully interchangeable in form fit and function with all well known cradle types. 2, 4 & 6 Form C is standard; 2, 4 or 6 Form A or B is available on request. A variety of contact materials is available in single and twin light duty. Heavy duty single contacts are available; these are listed in the Load and Life Data table. Several options are available to meet different load requirements. Single silver contacts are excellent for loads up to 2A. Twin (bifurcated) contacts should be used for carrying low loads, 100mA and lower (dry circuits). Heavy duty single cadminum oxide contacts give 5A ratings. Twin contacts are available in gold alloy or fine silver.

## Load and Life Data

| | Single and Bifurcated Contact Materials | | | Heavy Duty Contact Materials | |
|---|---|---|---|---|---|
| | A<br>Silver | B<br>Gold Nickel Alloy 95%:5% | C<br>Silver/ Palladium Alloy 40%:60% | D<br>Large Diameter Heavy Duty Silver | E<br>Silver/ Cadmium-Oxide for Inductive Loads |
| Max. switched power<br>a.c. (VA)<br>d.c. (W) | <br>60<br>30 | <br>40<br>20 | <br>100<br>50 | <br>250<br>100 | <br>500<br>100 |
| Max. switched current<br>a.c. or d.c. (A) | 2 | 2 | 2 | 5 | 5 |
| Max. switched voltage<br>a.c. or d.c. (V) | 110 | 110 | 110 | 250 | 250 |

## Ordering Codes

ITT Miniature relays are ordered by means of a picture code for standard cataloged items:

| A. Frame Size | B Contact Material | C Spring-Set Arrangement | D Coil No. | E Mounting |
|---|---|---|---|---|
| 24 (small)<br>25 (medium)<br>26 (large) | A. Silver<br>B. Gold/Nickel 95%:5%<br>C. Silver/Palladium 40%:60%<br>D. Large diameter heavy duty silver<br>E. Silver cadmium-oxide for inductive loads | 0. Single<br>1. Bifurcated<br>2. Two<br>4. Four<br>6. Six<br>C. Form C | See Standard Coil and Contact Combination Table | C. Plug-in 3-48 NC stud<br>E. Direct PC without ground<br>G. 0.1 in. direct PC without ground |

Example

25 A 14C 09 G

- G — 0.1 in. direct PC without ground
- 09 — Coil voltage 5.4-10.6VDC
- 14C — Bifurcated contacts, four Form C
- A — Silver
- 25 — Medium size relay

| | | |
|---|---|---|
| Ambient temperature range | | −40°C to +80°C |
| Test voltages | contact to contact<br>contact to frame<br>coil to frame<br>coil to contacts | 1000 V r.m.s.<br>50Hz |
| Electrical Life—Operations at Rated Load 1A@28VDC | | $10 \times 10^6$ |
| Mechanical Operations | | $100 \times 10^6$ |
| Contact Resistance | | 50mΩ |

# MINIATURE RELAYS



## STANDARD COIL AND CONTACT COMBINATIONS (20°C)

| Relay Size Box A of Code | | 24 | | | | 25 | | | 26 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Contacts & Springset Code | Single | A02C | | | | A04C | | | A06C | | |
| | Bifurcated | | A12C | | | | A14C | | | A16C | |
| | Heavy Duty | | | D02C | D02C | | | D04C | | | D06C |

| STANDARD COIL PARAMETERS | | | | | Minimum Voltages at 20°C | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Coil Number | Coil Resistance | Tolerance (%) | Max. Volts at 20°C | Nominal Voltage | | | | | | | | | | |
| 01 | 1.3 | ±10 | 1.7 | | 0.38 | 0.57 | 0.57 | 0.57 | 0.57 | 0.85 | 0.85 | 0.76 | 0.95 | 0.95 |
| 02 | 3 | ±10 | 2.5 | | 0.58 | 0.88 | 0.88 | 0.88 | 0.88 | 1.32 | 1.32 | 1.17 | 1.47 | 1.47 |
| 03 | 4.5 | ±10 | 3.1 | | 0.69 | 1.04 | 1.04 | 1.04 | 1.04 | 1.56 | 1.56 | 1.39 | 1.74 | 1.74 |
| 04 | 5 | ±10 | 3.3 | | 0.72 | 1.08 | 1.08 | 1.08 | 1.08 | 1.62 | 1.62 | 1.44 | 1.80 | 1.80 |
| 05 | 8.2 | ±10 | 4.2 | | 0.94 | 1.42 | 1.42 | 1.42 | 1.42 | 2.13 | 2.13 | 1.90 | 2.37 | 2.37 |
| 06 | 14 | ±10 | 5.5 | | 1.25 | 1.88 | 1.88 | 1.88 | 1.88 | 2.82 | 2.82 | 2.51 | 3.10 | 3.10 |
| 07 | 15 | ±10 | 5.7 | | 1.29 | 1.94 | 1.94 | 1.94 | 1.94 | 2.91 | 2.91 | 2.59 | 3.23 | 3.23 |
| **08** | **28** | **±10** | **7.8** | **6†** | 1.8 | 2.7 | 2.7 | 2.7 | 2.7 | 4.0 | 4.0 | **3.6** | **4.5** | **4.5** |
| **09** | **52** | **±10** | **10.6** | **6** | **2.4** | **3.6** | **3.6** | **3.6** | **3.6** | **5.4** | **5.4** | 4.8 | 6.0 | 6.0 |
| 10 | 58 | ±10 | 11.2 | | 2.6 | 3.9 | 3.9 | 3.9 | 3.9 | 5.8 | 5.8 | 5.2 | 6.5 | 6.5 |
| **11** | **90** | **±10** | **14** | **12†** | 3.2 | 4.8 | 4.8 | 4.8 | 4.8 | 7.3 | 7.3 | **6.5** | **8.1** | **8.1** |
| 12 | 110 | ±10 | 15 | | 3.5 | 5.3 | 5.3 | 5.3 | 5.3 | 8.0 | 8.0 | 7.1 | 8.9 | 8.9 |
| 13 | 150 | ±10 | 18 | | 4.2 | 6.3 | 6.3 | 6.3 | 6.3 | 9.4 | 9.4 | 8.4 | 10.5 | 10.5 |
| **14** | **185** | **±10** | **20** | **12** | **4.9** | **7.4** | **7.4** | **7.4** | **7.4** | **11.1** | **11.1** | 9.9 | 12.3 | 12.3 |
| 15 | 220 | ±10 | 22 | | 5.1 | 7.6 | 7.6 | 7.6 | 7.6 | 11.5 | 11.5 | 10.2 | 12.7 | 12.7 |
| 16 | 280 | ±10 | 25 | | 5.9 | 8.9 | 8.9 | 8.9 | 8.9 | 13.4 | 13.4 | 11.9 | 14.8 | 14.8 |
| 17 | 325 | ±10 | 27 | | 6.2 | 9.2 | 9.2 | 9.2 | 9.2 | 13.8 | 13.8 | 12.3 | 15.4 | 15.4 |
| **18** | **430** | **±10** | **31** | **24†** | 7.0 | 10.5 | 10.5 | 10.5 | 10.5 | 15.8 | 15.8 | **14.1** | **17.5** | **17.5** |
| 19 | 530 | ±10 | 34 | | 8.0 | 12.1 | 12.1 | 12.1 | 12.1 | 18.1 | 18.1 | 16.1 | 20 | 20 |
| **20** | **700** | **±10** | **39** | **24** | **9.8** | **14.7** | **14.7** | **14.7** | **14.7** | **22** | **22** | 19.5 | 24 | 24 |
| 21 | 890 | ±10 | 44 | | 10.7 | 16.1 | 16.1 | 16.1 | 16.1 | 24 | 24 | 21 | 26 | 26 |
| **22** | **1250** | **±10** | **52** | **36** | **12.9** | **19.4** | **19.4** | **19.4** | **19.4** | **29** | **29** | 26 | 32 | 32 |
| **23** | **1700** | **±10** | **61** | **48†** | 14.2 | 21 | 21 | 21 | 21 | 32 | 32 | **29** | **36** | **36** |
| **24** | **2500** | **±15** | **72** | **48** | **18.8** | **28** | **28** | **28** | **28** | **42** | **42** | 36 | 45 | 45 |
| 25 | 3300 | ±15 | 82 | | 20 | 30 | 30 | 30 | 30 | 45 | 45 | 40 | 50 | 50 |
| 26 | 5800 | ±15 | 109 | | 30 | 44 | 44 | 44 | 44 | 67 | 67 | 59 | 74 | 74 |
| 27 | 7600 | ±15 | 125 | | 33 | 50 | 50 | 50 | 50 | 75 | 75 | 67 | 83 | 83 |
| 28 | 15000 | ±15 | 175 | | 55 | 82 | 82 | 82 | 82 | 124 | 124 | 110 | 138 | 138 |
| 29 | 20900 | ±15 | 207 | | 58 | 87 | 87 | 87 | 87 | 131 | 131 | 117 | 146 | 146 |

| SENSITIVE DC VOLTAGE ADJUSTMENT | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **51** | **20** | **±10** | | **3†** | | | | | | | | 2.25 | | |
| **52** | **30** | **±10** | | **3** | | | | | 2.25 | | | | | |
| **53** | **50** | **±10** | | **3** | 2.25 | | | | | | | | | |
| **54** | **56** | **±10** | | **5** | | | | | | | | 3.75 | | |
| **55** | **80** | **±10** | | **5, 6†** | | | | | 3.75 | | | 4.5 | | |
| **56** | **110** | **±10** | | **6** | | | | | 4.5 | | | | | |
| **57** | **140** | **±10** | | **5** | 3.75 | | | | | | | | | |
| **58** | **200** | **±10** | | **6** | 4.5 | | | | | | | | | |
| **59** | **320** | **±10** | | **12†** | | | | | | | | 9.0 | | |
| **60** | **450** | **±10** | | **12** | | | | | 9.0 | | | | | |
| **61** | **800** | **±10** | | **12** | 9.0 | | | | | | | | | |
| **62** | **1200** | **±10** | | **24†** | | | | | | | | 18.0 | | |
| **63** | **1800** | **±10** | | **24** | | | | | 18.0 | | | | | |
| **64** | **3200** | **±10** | | **24** | 18.0 | | | | | | | | | |
| **65** | **5200** | **±10** | | **48†** | | | | | | | | 36.0 | | |
| **66** | **7500** | **±10** | | **48** | | | | | 36.0 | | | | | |
| **67** | **13000** | **±10** | | **48, 72†** | 36.0 | | | | | | | 54.0 | | |
| **68** | **16000** | **±10** | | **72** | | | | | 54.0 | | | | | |
| **69** | **28000** | **±10** | | **72** | 54.0 | | | | | | | | | |
| **70** | **30000** | **±10** | | **115†** | | | | | | | | 86.0 | | |
| **71** | **40000** | **±10** | | **115** | | | | | 86.0 | | | | | |

| SENSITIVE DC CURRENT ADJUSTMENT | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Coil Number | Coil Resistance | Tolerance (%) | Max. mA at 20°C | Nominal Voltage | Minimum Current at 20° (mA) | | | | | | | | | |
| **81** | **1000** | **±10** | **45.0** | **n.a.** | 8.5 | | | | 13.0 | | | 16.0 | | |
| **82** | **2500** | **±10** | **28.0** | **n.a.** | 5.8 | | | | 8.4 | | | 10.0 | | |
| **83** | **5000** | **±10** | **20.0** | **n.a.** | 4.1 | | | | 6.2 | | | 7.2 | | |
| **84** | **10000** | **±10** | **14.0** | **n.a.** | 3.1 | | | | 4.5 | | | 5.0 | | |
| **85** | **15000** | **±10** | **11.5** | **n.a.** | 2.6 | | | | 3.5 | | | 4.2 | | |
| **36** | **30000** | **±10** | **8.3** | **n.a.** | 1.7 | | | | 2.5 | | | 2.9 | | |

†6 changeover relays
Bold type — U.S. Industry standard coils

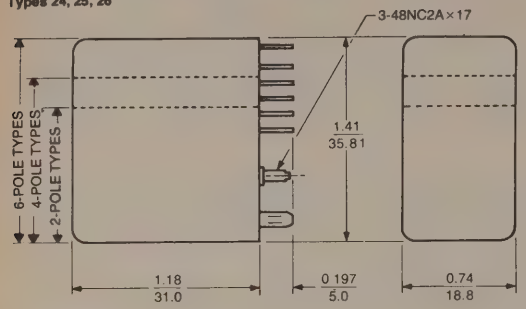
# MINIATURE RELAYS



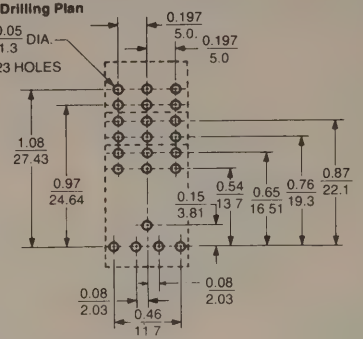
## Outline Dimensions

All dimensions in inches / mm

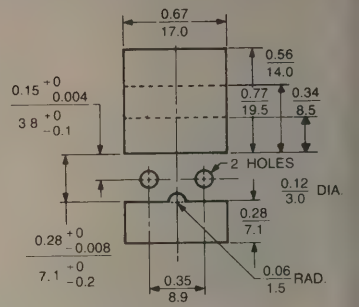
Types 24, 25, 26



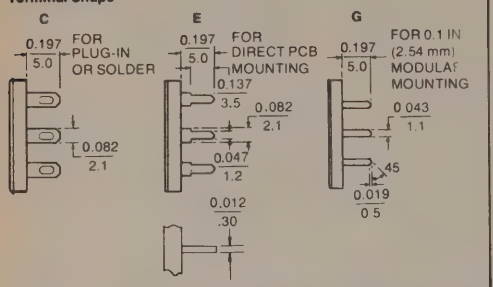

## Drilling Plan



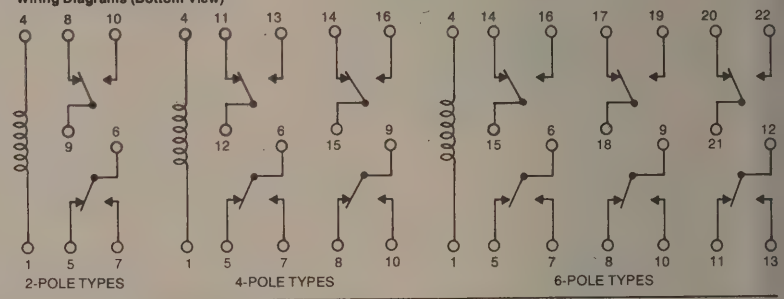

## Chassis Cut-Out




## Terminal Shape

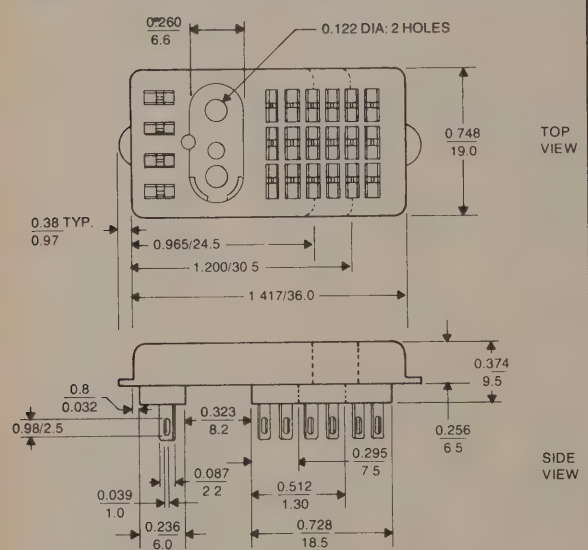


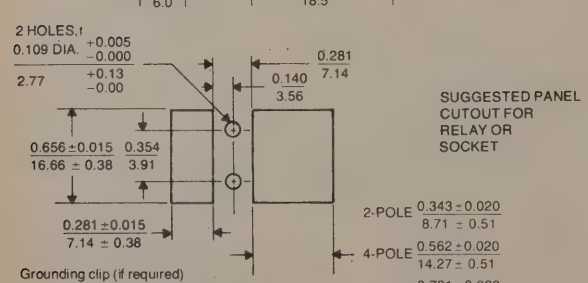

## Wiring Diagrams (Bottom View)




## Sockets

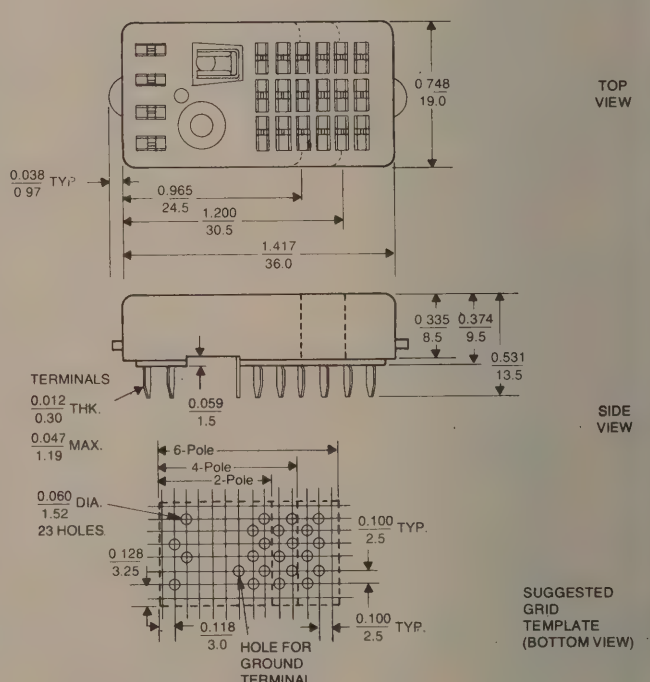
| Solder Terminal | 2-Pole, | 4-Pole, | 6-Pole |
|---|---|---|---|
| Standard | FO-10-2C-LUG | FO-16-4C-LUG | FO-22-6C-LUG |
| Wire Wrap | F-100-2C-WW | F-160-4C-WW | |




Grounding clip (if required) must be ordered separately—part no. EF-GC

| Printed-Circuit-Terminal | 2-Pole, | 4-Pole, | 6-Pole |
|---|---|---|---|
| Standard | FR-10-2C-PCB | FR-16-4C-PCB | FR-22-6C-PCB |
| No Ground Pin | FR-10 2C-PCNG | FR-16-4C-PCNG | FR-22-6C-PCNG |
| Gold Plated Pins | FR-100-2C-PCGP | FR-160-4C-PCGP | |




Weight, all sockets: ¼ ounce, approx.

Hold-down spring (if required) must be ordered separately — part no. HF-103-2C-CLIP; HF-163-4C-CLIP; HF-223-6C-CLIP.

ITT COMPONENTS GROUP • 1551E OSGOOD STREET • NORTH ANDOVER, MA 08145 • (617) 686-1110
A UNIT OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

Components ITT

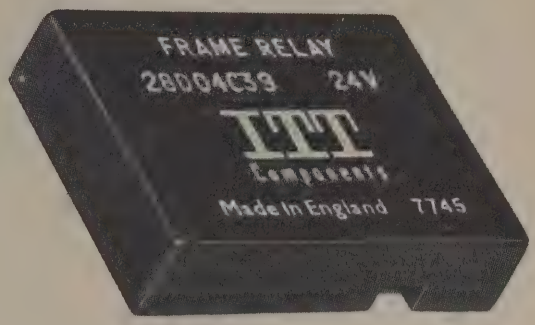


Add Dept. EM to address to tell them you saw it in eem

# LOW PROFILE FRAME RELAYS

# TYPE 28

- **ITT'S TYPE 28 'LO-PAC' FRAME RELAY — A NEW APPROACH TO LOW PROFILE PRINTED CIRCUIT RELAYS.**
- **Use of well proven springset from the ITT Cradle/25 relay gives an assurance of quality backed by years of user experience.**
- **A variety of contact materials available in Single, Twin and Heavy Duty types.**
- **Direct PC board mounting on 2.54mm spacing.**
- **Height above PC board of 10.5mm conforms to IEC recommendations and requirements.**




## CONTACT DATA / TABLE 1

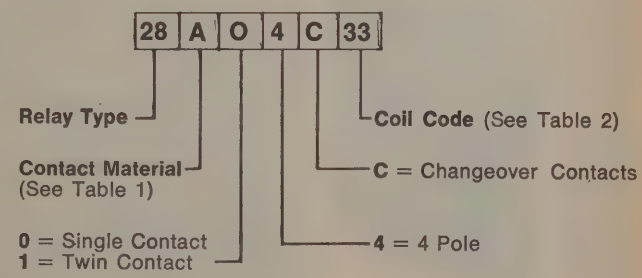
| Contact Material Code | A | B | C | D |
|---|---|---|---|---|
| Contact Material | Silver Light Duty | Gold/Nickel (95%/5%) Light Duty | Palladium/ Silver (60%/40%) Light Duty | Silver Heavy Duty |
| Contact Type | Single or Twin | Twin | Twin | Single |
| Maximum AC Rated Load (V A) | 60 | 40 | 100 | 250 |
| Maximum DC Rated Load (W) | 30 | 20 | 50 | 100 |
| Maximum Switched AC or DC Voltage (V) | 110 | 110 | 110 | 250 |
| Maximum Switched AC or DC Current (A) Up to $1 \times 10^6$ ops | 1 | 1 | 1 | 5 |

**Insulation Resistance:** 100 mΩ min at 500 VDC
**Voltage Proof:** 100V RMS at 50 Hz
**Mechanical Life (No Load):** $10^8$ operations
**Initial Contact Resistance (All Contact Codes):** 50 mΩ typical
**Operate Time (Including Bounce):** 10 mS. max (saturate coil voltage)
**Release Time (Including Bounce):** 10 mS. max (open circuited coil)
**Saturate Voltage (20°C):** 150% of nominal rated DC voltage
**'Must Operate' Voltage (20°C):** 75% of nominal rated DC voltage
**Insulation Resistance:** 100 mΩ min at 500 VDC
**Voltage Proof:** 1000V RMS at 50 Hz
**Relay Mass:** 24g max

## COIL DATA / TABLE 2

| Contact Type (See Table 1) | Nominal Rated DC Voltage | Operating Voltage Range (at 20°C) | Coil Resistance (at 20°C) | Nominal Power at "Must Operate" Voltage | Coil Code Number |
|---|---|---|---|---|---|
| | V | V | Ω±10% | mW | |
| Single Light Duty | 3 | 2.3 to 5 | 16.5 | 310 | 31 |
| | 6 | 4.5 to 10 | 65 | 310 | 32 |
| | 12 | 9 to 20 | 260 | 310 | 33 |
| | 24 | 18 to 40 | 1050 | 310 | 34 |
| | 48 | 36 to 80 | 4200 | 310 | 35 |
| Single Heavy Duty and Twin Light Duty | 3 | 2.3 to 4.5 | 12 | 425 | 36 |
| | 6 | 4.5 to 9 | 48 | 425 | 37 |
| | 12 | 9 to 18 | 190 | 425 | 38 |
| | 24 | 18 to 36 | 770 | 425 | 39 |
| | 48 | 36 to 72 | 3000 | 425 | 40 |

Relays are ordered by means of a picture code as follows:


28 A O 4 C 33
Relay Type
Contact Material (See Table 1)
0 = Single Contact
1 = Twin Contact
4 = 4 Pole
C = Changeover Contacts
Coil Code (See Table 2)

THE ABOVE EXAMPLE SHOWS A TYPE 28 RELAY WITH SINGLE LIGHT DUTY SILVER CONTACTS, 4 POLE CHANGEOVER, SUITABLE FOR A NOMINAL 12 VDC COIL OPERATION.

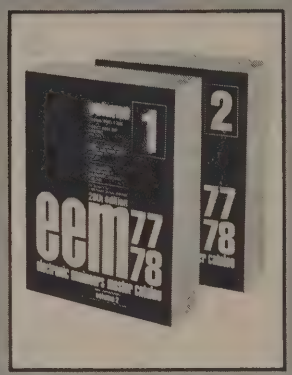
ITT COMPONENTS GROUP • 1551E OSGOOD STREET • NORTH ANDOVER, MA 08145 • (617) 686-1110
A UNIT OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

Components ITT

# WE KNOW OUR STUFF

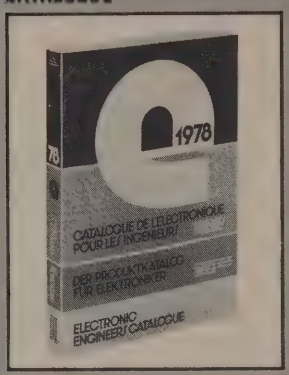
## 41 YEARS OF EXPERIENCE IN CATALOGING, 21 EDITIONS OF eem

### eem/ELECTRONIC ENGINEERS MASTER CATALOG —



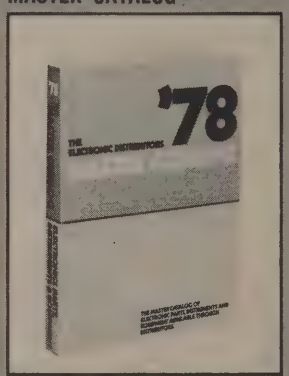

The "blue-ribbon" catalog/directory that has become "the standard of the industry" for electronic engineers, buyers and specifiers.

### ELECTRONIC ENGINEERS CATALOGUE



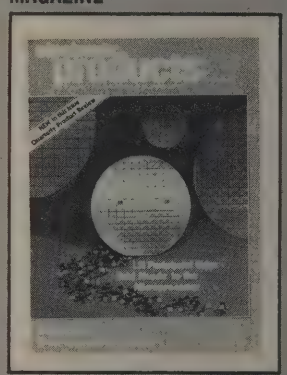

The new catalogue/directory of electronic products available to and from Western Europe and the United Kingdom. Designed especially for the European electronics engineer.

### ELECTRONIC DISTRIBUTORS MASTER CATALOG —



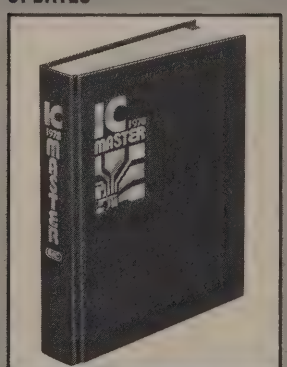

The only national catalog designed exclusively for distributors and their customers featuring electronic parts, instruments and equipment.

### ELECTRONIC PRODUCTS MAGAZINE —



The products magazine . . . A 100% product-oriented magazine including hundreds of new products and special features every month.

### IC MASTER AND THE UPDATES —




The only complete single-source directory including all IC devices manufactured in the United States. Updated three times yearly with accumulative supplements.

### eem FILE SYSTEM —

The only filing system designed especially for the electronics engineer. Instant retrieval and organization of data sheets and catalogs.

### UTP CUSTOM CATALOGS —

The Cadillac of individualized catalogs for the electronic parts distributor, featuring solely his lines and services.

### UNITED COST AND PRICING SERVICES —

The electronic distributors' proven method of being up to the minute on his cost and selling prices.

*United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Ave., Garden City, N.Y. 11530 / (516) 222-2500 TWX 510-222-1673*

# Let Kilovac® turn you on!

## Or off, as the case may be, KILOVAC relays offer the following outstanding features:

HC-1

KM-14

H-25

- Ratings to over 100 kV
- Long Life — one million plus operations
- Light Weight — as little as 1 oz.
- Non-oxidizing contacts
- Fast-Operate Time — 10 ms typical
- High Dielectric, smaller size per voltage/current rating

### 1. RELIABILITY

In the right application, with the KILOVAC relay selected to do a specific job, millions of cycles of mechanical life are possible with little or no degradation in performance specifications.

### 2. VACUUM IS THE OPTIMUM DIELECTRIC

It isolates approximately 2000 volts per .001 inch of contact gap. (A vacuum relay is a high voltage insulator and a low loss conductor). When breaking a load, vaporized metal from the contacts creates a high pressure area which rapidly expands the ionized metal vapor into the low pressure area surrounding the contacts. The result is a phenomenon termed "arc blowout." By this limit on arc time, contacts are subjected to less erosion and have longer life.

### 3. THE VACUUM "SELF-PUMPING" FEATURE

When the ionized metal vapor expands, as described above, it entraps gas molecules on the inner relay envelope, maintaining or even increasing the vacuum level.

### 4. LOW AND STABLE CONTACT RESISTANCE

This varies from cycle to cycle in conventional relays but remains stable over the life of a vacuum relay. This is due to: cleanliness of parts, lack of oxidation or contamination, and use of non-magnetic materials in the contact area. No contact maintenance required.

### 5. FAST OPERATE TIME

Short contact travel and low mass contacts mean faster operate time and a lower coil power drain.

### 6. SMALLER SIZE AND WEIGHT

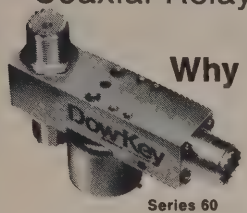
Due to small contact gap and short contact travel made possible by a vacuum dielectric, package size and weight are reduced.

### 7. SAFETY

Contacts are sealed within the vacuum envelope, switching in explosive atmospheres may be safely accomplished.

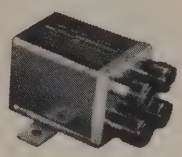
Kilovac® CORPORATION

## Coaxial Relays: Hz to GHz



Series 60

### Why Use Dow-Key?


Series 412

- Coaxial Relays
- Vacuum Coaxial Relays
- Microwave Coaxial Relays

In recent years coaxial relay and microwave switch applications have expanded in number and increased in operating frequency. For 30 years, Dow-Key has been a pioneer in these trends by introducing new higher frequency, higher power, more versatile devices while maintaining its recognized standards of quality and performance.

Dow-Key relays continue to provide high isolation, low VSWR and insertion loss, along with reliable operation over a wide range of severe environments and broad frequency ranges. Options are available to fit your system. You can select RF power capacity, operating voltage, failsafe or latching, and standard and special RF connectors.

You should also consider Dow-Key **vacuum** coaxial relays. They combine the unique high power/high voltage capability of a vacuum relay with the RF performance of a coaxial relay. Look to Dow-Key to fill your requirements for rapid, reliable, low loss coaxial switching in a wide range of applications including:

**COMMUNICATIONS**
- Satellite terminals.
- Transmit-receive switching to common antenna, grounding of receiver to protect against burn out, switching of one transmitter to one of many antennas.
- Manual and remote multi-antenna switching, many antennas to one transmitter.
- Insertion of amplifiers into circuit.
- Switching of broadband carriers from failed to standby circuits.
- Matrix switching of multiple receivers.
- Transmit power sampling.
- Transmitters to multiple antennas.
- Transfer-crossover of transmitter-antenna or receiver-antenna pairs.

**CATV/CCTV**
- Non-duplication switching RF head ends.
- Tone signal switching remote program control.
- Hospital video systems.
- Channel select, programming control.
- Closed circuit switching such as classroom TV teaching.
- Studio video signal switching.
- Switching of remote surveillance cameras to single monitor.

**LABORATORY**
- Switching between reference and unknown test circuits.
- Switching with high accuracy of fixed attenuators in and out of circuit.
- Multi-source monitor and test.

**TELEPHONE**
- Elimination of manual patch boards for carrier I.F. switching.
- Standby channel select (matrix type for complex routing).

Whether your need is for SPDT, transfer, or multiposition, whatever your actuator voltage, no matter what RF connector your system employs, Dow-Key has a standard relay or can adapt one in surprisingly short time.

Please call a Dow-Key applications engineer and let him lead you out of the coaxial relay wilderness.

P.O. Box 4422 / Santa Barbara, California 93103 Telephone (805) 684-4560 TWX 910-336-1141
**Kilovac** Vacuum Relays • **Dow-Key** Coaxial Relays

# Kilovac Vacuum Relays

**KILOVAC vacuum relays (ceramic or glass) are specified by design engineers for performance and reliability not available in conventional relays:**

- Ratings to over 100 kV
- Long Life — one million plus operations
- Light Weight — as little as 1 oz.
- Non-oxidizing contacts
- Fast-Operate Time — 10 ms typical
- High Dielectric, smaller size per voltage/current rating

## KILOVAC High Voltage/Medical Relays

Since 1964 Kilovac Corporation has delivered thousands of high voltage relays especially developed for heart defibrillators (both hospital and portable models). DPDT relays (P/N KM-15 and KM-14) are used as "patient" switches; SPST versions (P/N KM-6 and H-4), used for dump/abort safety discharge. Highly qualified application engineering assistance is at your disposal.

| KILOVAC TYPE | HC-1‡ | KC-2‡ | KC-3‡ | KM-14 | KC-10‡ | KC-20‡ | KM-15 | HVS-1 | KC-27‡ | H-4 | KM-6 | H-35 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Contact arrangement | SPDT | SPDT | SPDT ** | DPDT | SPDT | SPST, N.O. | DPDT | SPDT | SPST*** N.C. | SPDT | SPST, N.C. | SPDT |
| Rated operating voltage (kV dc or 60 Hz peak) | 2.5 | 15 | 8 | 7.5 | 15 | 28 | 8 | 17 | 120 | 5 | 10 | 35 |
| Test voltage (kVdc) | 5 | 18 | 11 | 14 | 20 | 30 | 18 | 22 | 140 | 7.5 | 12 | 40 |
| Continuous current, contacts closed, max. (amps dc or 60 Hz RMS) | 18 | 50 | 25 | 10 | 75 | 110 | 10 | 7 | 10 | 10 | 5 | 10 |
| Max. current at rated voltage switching under load (amps dc)* | 0.5 | 0.5 | 0.1 | 0.5 | 0.1 | 0.1 | 0.5 | 3.0 | N/A | 2.0 | 1.0 | 5.0 |
| Contact resistance, max. (ohms) | 0.010 | 0.012 | 0.015 | 0.500 | 0.012 | 0.005 | 0.500 | 0.015 | .250 | 0.02 | 0.035 | 0.015 |
| Operate time, max. (ms) | 6 | 18 | 18 | 20 | 35 | 30 | 25 | 25 | 30 | 10 | 10 | 30 |
| Coil resistance (ohms ±10% @ 25°C) | 335 | 250 | 220 | 12 | 225 | 120 | 65 | 128 | 24 | 250 | 100 | 50 |
| Coil voltage (Vdc, nominal) | 26.5 | 26.5 | 26.5 | 12 | 26.5 | 26.5 | 40 | 26.5 | 26.5 | 26.5 | 12 | 26.5 |
| Nominal dimensions (inches) | ¾D x 1½H | 1⅝D x 2⅜H | ¾D x 2¾H | 2D x 3H | 1⅝D x 4⅝H | 1⅝D x 3¾H | 2½D x 3⅝H | 4¾L x 5H | 1¼D x 6H | 1⅞L x ⅞H | 2¼L x 1 1/16H | 8¼L x 5¼H |
| Nominal weight (oz) | 1 | 3 | 2.5 | 10 | 16 | 10 | 12 | 15 | 9 | 1 | 3 | 15 |
| Mounting style† | thr'ded base | flange base† | flange base | foot bracket | flange base | thr'ded base | flanged base | foot bracket | thr'ded base | flange base | foot bracket | foot bracket |

## TYPICAL APPLICATIONS

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| General purpose high voltage | • | • | • | | • | • | | • | • | • | • | • |
| Communications | • | • | • | | • | • | | • | | • | | • |
| Radar/ECM/Avionics | • | • | • | | • | • | | • | • | • | • | • |
| Laser systems | • | • | • | | • | • | | • | • | | • | |
| * Medical: Heart defibrillators | | | | • | | | • | | | • | • | |

* All ratings are for pure resistive circuits. Contact factory for other circuits vs. ratings.
† Other styles available.
‡ Ceramic envelope.
**Also available in latching version
***Relay must completely be immersed in oil. Base must be grounded.

Kilovac® CORPORATION

P.O. Box 4422 / Santa Barbara, California 93103 Telephone (805) 684-4560 TWX 910-336-1141
**Kilovac** Vacuum Relays • **Dow-Key** Coaxial Relays

# . . . in ceramic or glass

## KILOVAC High Voltage Relays Mean . . .

**VACUUM RELAY RELIABILITY** means short contact travel, low contact mass, contacts free of oxides and pitting and minimum contact bounce. These long-life reliability features are made possible only because of operation in a high vacuum dielectric. Vacuum technology has made high reliability, long life high voltage switching practical, with considerable savings in space and weight. Developed for high voltage, high peak current applications, Kilovac relays are well suited and widely used in medical electronics, radar, communications, pulse forming networks, ECM, sonar, antenna switching and antenna couplers, microwave systems and switching in explosive atmospheres. Kilovac's broad line and "Quick Reaction Time" is geared to your most critical delivery schedule. We have the high vacuum experience, design and production capability to provide special modifications of our standard off-the-shelf designs in unbelievably short order.

**HIGH VOLTAGE ISOLATION:** 2000 volts per mil of contact gap with predictable, repeatable isolation well in excess of rated values.

**LOW AND STABLE CONTACT RESISTANCE:** 0.015 ohms typical with no contact oxidation or maintenance.

**FAST SWITCHING TIME:** 10 ms typical, due to small contact gap and short armature travel.

**LONG LIFE:** Millions of cycles with minimum degradation in electrical performance.

Any one of these standard features will justify your selection of KILOVAC vacuum relays. KILOVAC design and years of production experience permits immediate off-the-shelf delivery from a broad product line with voltages up to 100 kV. Special modifications quickly provided.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **KILOVAC TYPE** | **H-8** | **H-9** | **H-11/S2** | **H-12** | **H-14** | **H-16** | **H-17** | **H-18** | **H-19** | **H-23‡** | **H-25/S10** | **H-26** |
| Contact arrangement | SPDT | SPST, N.C. | SPST, N.O. | SPDT | DPDT | DPDT | SPDT | DPDT | DPDT | SPST, N.C. | SPDT | 4PDT |
| Rated operating voltage (KV dc or 60 Hz peak) | 15 | 15 | 9 | 8 | 12 | 12 | 25 | 8 | 20 | 30 | 50 | 15 |
| Test voltage (KV dc) | 20 | 20 | 12 | 12 | 15 | 15 | 30 | 10 | 25 | 35 | 60 | 17 |
| Continuous current, contacts closed, max. (amps dc or 60 Hz RMS) | 15 | 15 | 15 | 15 | 30 | 30 | 30 | 10 | 30 | 30 | 30 | 30 |
| Max. current at rated voltage switching under load (amps dc)* | 0.5 | 0.5 | 0.1 | 0.1 | 0.3 | 0.5 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Contact resistance, max. (ohms) | 0.015 | 0.015 | 0.015 | 0.015 | 0.015 | 0.030 | 0.015 | 0.020 | 0.015 | 0.015 | 0.015 | 0.020 |
| Operating time, max. (ms) | 15 | 15 | 18 | 18 | 20 | 20 | 25 | 15 | 30 | 30 | 60 | 30 |
| Coil resistance (ohms ±10% @ 25°C) | 265 | 265 | 250 | 250 | 120 | 120 | 120 | 265 | 225 | 120 | 120 | 120 |
| Coil voltage (Vdc, nominal) | 26.5 | 26.5 | 26.5 | 26.5 | 26.5 | 26.5 | 26.5 | 26.5 | 26.5 | 26.5 | 26.5 | 26.5 |
| Nominal dimensions (inches) | 1D x 3H | 1¼D x 2¾H | 1D x 1⅝H | 1D x 1¾H | 1¼D x 2¾H | 1D x 3¼H | 2D x 3½H | 1D x 2H | 2D x 3¼H | 2D x 3¾H | 3D x 7½H | 2D x 4H |
| Nominal weight (oz) | 3 | 3 | 2 | 2 | 8 | 5 | 5 | 4 | 7 | 7 | 30 | 16 |
| Mounting style | thr'ded base† | solder flange | thr'ded base† | thr'ded base | thr'ded base† | thr'ded base | flange base | thr'ded base | thr'ded base | thr'ded base† | thr'ded base | thr'ded base |

## TYPICAL APPLICATIONS

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| General purpose high voltage | • | • | • | • | • | • | • | • | • | • | • | • |
| Communications | • | • | • | • | • | • | • | • | • | • | • | • |
| Radar/ECM/Avionics | • | • | • | • | • | • | • | • | • | • | | • |
| Nuclear instrumentation | • | • | | | • | • | • | | • | • | • | |

* All ratings are for pure resistive circuits. Contact factory for other circuits vs. ratings.
† Other styles available.
‡ H-24, same spec as H-23, except H-24 is SPST, N.O.

Kilovac® CORPORATION

P.O. Box 4422 / Santa Barbara, California 93103 Telephone (805) 684-4560 TWX 910-336-1141
**Kilovac** Vacuum Relays • **Dow-Key** Coaxial Relays

# DowKey Coaxial Relays

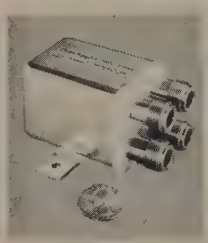
**Let Kilovac's Dow-Key Division solve your RF switching problems — whether simple or complex — at frequencies from Hz to GHz. Dow-Key coaxial relays provide low insertion loss, low VSWR, fast operating times, wide range of power capabilities, connector options and operating voltages. Write or call for your Dow-Key catalog today!**

| Product Class | Dow-Key Series | Application | | | Contacts | Connector | Features | Frequency | (2) Typical CW Power (in KW) |
|---|---|---|---|---|---|---|---|---|---|
| | | Comm. | ECM | CATV CCTV | | | | | |
| General Purpose RF Switching | 60 (4) | • | | • | SPDT Remote | N & UHF | Extremely Rugged | 450 MHz | 750 W |
| | 61 | • | | • | | BNC | Small Package | 450 MHz | 100 W |
| | 77 (4) | • | | • | | F & BNC | Low Cost | (3) | 150 W @ 50 MHz<br>75 W @ 1 GHz |
| | 163/164 | • | | • | | BNC | High Reliability | (3) | (3) |
| | 169 | • | | • | | F & BNC | Low Level | (3) | (3) |
| | 260 (4) | • | | • | DPDT Remote | UHF & BNC | Broad Power Range | 450 MHz | 1 |
| | 78 (4) | • | | • | Manual | UHF & BNC | Multi-position | 0 to 500 MHz | 1.5 kW @ 50 MHz<br>1 kW @ 100-400 MHz |
| | 71/72 (4) | • | | • | Multi-position Remote | UHF | High Power | Up to 500 MHz | 1 kW @ 200 MHz<br>750 W @ 500 MHz |
| | 74 | • | | • | | BNC, TNC, SMA | Multi-position | 2 GHz | |
| Vacuum Coaxial Relays | 196 | • | | | SPDT | SC, TNC | Bypass- (Vacuum) | 400 MHz | 1 |
| | 310 | • | | | SPDT | N<br>HN<br>C<br>SC<br>BNC<br>TNC | High Power Small Size | 60 MHz<br>400 MHz | 3<br>1 |
| | 311 | • | | | DPDT | | | 60 MHz<br>400 MHz | 3<br>1 |
| | 312 | • | | | Bypass | | | 60 MHz<br>400 MHz | 3<br>1 |
| | 313 | • | | | XFR | | | 60 MHz<br>400 MHz | 3<br>1 |
| | 220 | • | | | SPDT | UHF | Medium Power | 250 MHz | 1 |
| High Performance High Isolation Microwave Coaxial Relays (3) | 402 | • | • | • | SPDT | N | Broadband Microwave Performance (3) | dc-12 GHz | See Note (2) |
| | 411 | • | • | • | XFR | SMA | | | |
| | 412 | • | • | • | XFR | N | | | |
| Other Special Purpose RF Relays [Illustrative only; see (3)] | 150 | • | | | SPDT | (3) | (3) | 1120 MHz | (2) |
| | 186 | | • | | SPDT | 7/8 EIA | High Power | 400 MHz | 1 |
| | 223 | • | | | SPDT | N | Make Before Break Latching | 400 MHz | 120 W |
| | 324 | • | | | SPDT | N | 70,000 Ft. | 400 MHz | |

## Series 400 — REMOTE COAXIAL RELAYS

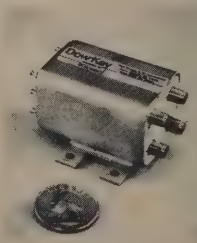
The Dow-Key Series 400 microwave coaxial relays are designed to meet all requirements for high reliability, high performance, broadband coaxial RF switching. These relays are designed for use with cable and connector sizes of your choice.

Series 400 coaxial relays provide excellent electrical characteristics over frequency ranges of dc to GHz and can be optimized for maximum performance at any narrower band of interest. The relays are designed to provide a wide variety of optional RF and power connectors.



Series 412

Series 402



Series 411

DowKey®
DIV. OF KILOVAC CORPORATION

P.O. Box 4422 / Santa Barbara, California 93103 Telephone (805) 684-4560 TWX 910-336-1141

**Kilovac** Vacuum Relays • **Dow-Key** Coaxial Relays

# ...Hz to GHz

**DOW-KEY coaxial relays may provide:**

- Excellent VSWR • Very low insertion loss
- Resistor terminated inputs (optional)
- Vacuum switch elements for high power capacity
- Special contact arrangements to meet isolation loss requirements.
- Auxiliary switches for associated circuit control
- Multitude of connectors and coil voltages

| VSWR Max. | Impedance Ohms | (1) Size (L x W x H) Inches | Approx. Weight (Oz.) |
|---|---|---|---|
| 1.1 | 50 | 3.65 x 1.16 x 2.5 | 10 |
| 1.05 | | 1.56 x .64 x 1.19 | 4.5 |
| (3) | 50/75 | 1.88 x .68 x 2.2 | 3 |
| (3) | 50 | 1.31 x 1.38 x 1.38 | 4 |
| (3) | 50/75 | 1.44 x .63 x 1.03 | 3.5 |
| 1.05 | 50 | 3.00 x 1.75 x 1.9 | 12 |
| 1.3 | | 3 Dia. x 1.0 | 10 |
| 1.06 @ 50 MHz<br>1.3 @ 500 MHz | | 71 = 5.75 Dia. x 2.75<br>72 = 4.0 x 2.62 x 3.5 | 71 = 48<br>72 = 24 |
| 1.3 | | 3 Dia. x 1.75 | 15 |
| 1.1 | 50 | | |
| (3) | 50 | 1.68 x 1.25 x 2 | 8 |
| (3) | | 3.36 x 1.25 x 2 | 12 |
| (3) | | 2.12 x 1.25 x 2 | 12 |
| (3) | | 1.73 x 1.25 x 2 | 12 |
| 1.15 | | | 4 |
| (3) | 50/75 | 2.65 x 1.09 x 2.07 | 4 |
| | 50 | 1.3 x 1.3 x 2 | 4.5 |
| | 50/75 | 1.75 x 1.75 x 2.6 | 8 |
| 1.25 | 50 | 1.63 x 1.42 x .53 | 6 |
| 1.13 | 50 | 7.0 x 1.75 x 3.62 | 5 Lbs. |
| 1.1 | 50 | 4.0 x 1.2 x 3.5 | (3) |
| 1.1 | 50 | 2.7 x 1.32 x 1.32 | (3) |

(1) Not including connectors.
(2) For max. power consult factory.
(3) Refer to general catalog or consult factory
(4) Refer to following page for additional details.

## HOW TO SELECT COAXIAL RELAYS

**DON'T** select precision connectors when the system and/or frequency does not require it.

**DO** specify nominal coil voltage and operating current.

**DO** specify basic function, i.e., SPDT, DPDT, etc., and whether or not external auxiliary contacts are required. If in doubt of function, supply a circuit diagram.

**DO** specify impedance. This is generally 50 ohms but many 50 ohm relays can be used in 75 ohm circuits with negligible discontinuity because electrical length of the relays is short at frequencies normally used at that impedance.

**DO** specify whether or not the unused part of the relay is shorted to ground, not shorted or resistor-terminated and the resistor values.

**DO** specify RF power requirements.

**DON'T** specify higher power than needed.

## WHAT DOW-KEY NEEDS TO KNOW FROM YOU

### CIRCUITS AND LOADS

Many times when relays fail to perform up to specification, it is due to lack of proper consideration of:

A. The VSWR of the load.
B. Required isolation between outputs and how it can be achieved.
C. Peak vs. average power and how phase affects max. voltage and current.
D. Ratings do not include hot switching.

The conditions listed above cannot be generalized, but must be considered unique to each application. It is therefore imperative that we be completely informed when selecting a relay for hot switching.

### OPERATE TIME

Operate time of the relay is primarily a function of the coil power, since it requires in excess of 50% of the total switching time to build up the coil field sufficiently to initiate relay operation. To reduce the relay operate time, various means are available:

A. Increase coil current (power).
B. Apply higher than normal voltage pulse to coil.
C. Lower voltage isolation requirements. (A smaller contact gap permits faster contact transfer time.)

With a combination of the above modifications operate times as fast as 500 microseconds are possible with specific types of relays.

### LIFE (MECHANICAL)

Relay life takes in all the foregoing considerations. It is necessary to define life, usually in terms of end-of-life set of performance parameters. Terms like "Mean Time Between Failure" are frequently meaningless unless failure points are defined, and unless conditions of load, rate of operation, duty cycle, coil power and other parameters are specified. Test data on file indicates typical mechanical life will range in excess of one million cycles of operations.

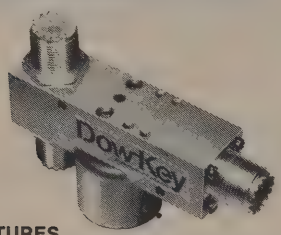
DowKey®
DIV. OF KILOVAC CORPORATION
P.O. Box 4422 / Santa Barbara, California 93103 Telephone (805) 684-4560 TWX 910-336-1141
**Kilovac** Vacuum Relays • **Dow-Key** Coaxial Relays

# Kilovac® / DowKey

CORPORATION — DIVISION OF KILOVAC CORPORATION

## SERIES 60 SPDT

### REMOTE COAXIAL RELAY




#### FEATURES

The Series 60 are remotely operated, ruggedly constructed, SPDT coaxial relays designed for operation to one kW. They are available with or without two Form C auxiliary contacts. For transmit-receive applications, they are available with a special high-isolation "G" connector at the NC or receive position. The G connector increases the isolation to greater than −100 dB at frequencies up to 500 MHz, but reduces the power rating of the normally-closed connector to 20 watts. G connectors will increase VSWR above 400 MHz. Data given for the Series 60 is applicable only when used in a 50-ohm transmission line. UHF connectors are not recommended above 400 MHz. Standard coils are 12 Vdc (48 ohms), 26 Vdc (245 ohms) and 115 Vac (5000 ohms). Other voltages are available on special order at a slight premium price or in minimum-order quantities.

#### SPECIFICATIONS

Operating Time ..... 25 ms. Max.
Auxiliary Contact Rating ..... 5 Amps., 115 Vac

#### MECHANICAL DATA

Life Expectancy ..... 1,000,000 cycles
Weight ..... 10 oz. Approx.
Finish: R.F. Contacts ..... Gold Plated Fine Silver
Auxiliary Contacts .. Gold Plated Fine Silver

#### CONNECTORS AND PART NUMBERS

| Connector Type | Std. SPDT | With Aux. Contacts | With NC "G" Conn. | With 2C Aux. & NC "G" |
|---|---|---|---|---|
| UHF | 60-XX04 | 60-XX0442 | 60-XX28 | 60-XX2842 |
| N | 60-XX01 | 60-XX0142 | 60-XX25 | 60-XX2542 |

In the above data, the "XX" following the hyphen represents the coil voltage. When ordering, replace the XX with the appropriate coil number, as follows:

22 = 12 Vdc  23 = 26 Vdc  26 = 115 Vac

## COAXIAL SWITCHES

### 78 SERIES MULTI-POSITION TYPES

Manually operated switches with true coaxial switching members (not wafer switches). Useful frequency range 0-500 MHz. RF power rating: 1.5 kW at 50 MHz, 1 kW at 100 through 400 MHz. Impedance: 50 ohms. Body size: 3″ dia. x 1″. Weight: 10 oz.

| Dow-Key Model | Conn. Type | Description |
|---|---|---|
| 78-0204 | UHF | SPDT |
| 78-0304 | UHF | SP 3-Pos. |
| 78-0404 | UHF | SP 4-Pos. |
| 78-0604 | UHF | SP 6-Pos. |
| 78-0302 | BNC | SP 3-Pos. |
| 78-0602 | BNC | SP 6-Pos. |
| 78-0702 | BNC | DPDT |

### 71/72 SERIES MULTI-POSITION TYPES

Weatherproofed high power switches for switching antennas, transmitters or receivers up to 500 MHz. Power rating: 1 kW at 200 MHz, 750 W at 500 MHz. VSWR: 1.06 at 50 MHz, 1.3 at 500 MHz. Impedance: 50 ohms. Body Size: 72 Series, 4″ x 3.5″ x 2.62″; 71 Series, 5.75″ dia. x 2.75″.

| Dow-Key Model | Conn. Type | Description | Coil Volt. |
|---|---|---|---|
| 71-220401 | UHF | 6-Pos. Shorting | 12 Vdc |
| 71-220402 | UHF | 6-Pos. Non-Shorting | 12 Vdc |
| 71-230401 | UHF | 6-Pos. Shorting | 26 Vdc |
| 71-230402 | UHF | 6-Pos. Non-Shorting | 26 Vdc |
| 71-260401 | UHF | 6-Pos. Shorting | 115 Vac |
| 71-260402 | UHF | 6-Pos. Non-Shorting | 115 Vac |
| 72-220401 | UHF | 3-Pos. Shorting | 12 Vdc |
| 72-220402 | UHF | 3-Pos. Non-Shorting | 12 Vdc |
| 72-230401 | UHF | 3-Pos. Shorting | 26 Vdc |
| 72-230402 | UHF | 3-Pos. Non-Shorting | 26 Vdc |
| 72-260401 | UHF | 3-Pos. Shorting | 115 Vac |
| 72-260402 | UHF | 3-Pos. Non-Shorting | 115 Vac |

## COAXIAL RELAYS

### 77 SERIES SPDT TYPES

Medium-size, light weight, low-priced coaxial relays for industrial and military uses. Available with or without one Form C auxiliary contacts. Power rating: 150 W at 50 MHz, 75 W at 1 GHz. Body size: 1.88″ x 0.75″. Weight: 3 oz.

| Dow-Key Model | Conn. Type | Coil Volt. | With 1 Form C Aux. Contacts |
|---|---|---|---|
| 77-2202 | BNC | 12 Vdc | No |
| 77-220232 | BNC | 12 Vdc | Yes |
| 77-2302 | BNC | 26 Vdc | No |
| 77-230232 | BNC | 26 Vdc | Yes |
| 77-2602 | BNC | 115 Vac | No |
| 77-260232 | BNC | 115 Vac | Yes |
| 77-2232 | F | 12 Vdc | No |
| 77-223232 | F | 12 Vdc | Yes |
| 77-2332 | F | 26 Vdc | No |
| 77-233232 | F | 26 Vdc | Yes |
| 77-2632 | F | 115 Vac | No |
| 77-263232 | F | 115 Vac | Yes |

### 260/260B SERIES DPDT TYPES

The 260 Series are standard DPDT relays with six terminals. The 260B Series are by-pass relays with an internal connection between the NC contacts, leaving only four terminals. RF ratings and specifications are the same as 60 Series. Body size: 3″ x 1.75″ x 0.88″. Weight: 12 oz.

| Dow-Key Model | Conn. Type | Coil Volt. | With 2 Form C Aux. Contacts |
|---|---|---|---|
| 260-2204 | UHF | 12 Vdc | No |
| 260-220442 | UHF | 12 Vdc | Yes |
| 260-2304 | UHF | 26 Vdc | No |
| 260-230442 | UHF | 26 Vdc | Yes |
| 260-2604 | UHF | 115 Vac | No |
| 260-260442 | UHF | 115 Vac | Yes |
| 260-2202 | BNC | 12 Vdc | No |
| 260-220242 | BNC | 12 Vdc | Yes |
| 260-2302 | BNC | 26 Vdc | No |
| 260-230242 | BNC | 26 Vdc | Yes |
| 269-2602 | BNC | 115 Vac | No |
| 260-260242 | BNC | 115 Vac | Yes |
| 260B-2304 | UHF | 26 Vdc | No |
| 260B-230442 | UHF | 26 Vdc | Yes |
| 260B-2604 | UHF | 115 Vac | No |
| 260B-260442 | UHF | 115 Vac | Yes |
| 260B-2302 | BNC | 26 Vdc | No |
| 260B-230242 | BNC | 26 Vdc | Yes |
| 260B-2602 | BNC | 115 Vac | No |
| 260B-260242 | BNC | 115 Vac | Yes |

Other coil voltages and connector types are available for Dow-Key relays; contact factory.

## Kilovac CORPORATION . . . small enough to be responsive, large enough to be responsible.

Kilovac Corporation, of which Dow-Key is a division, manufactures a broad line of high-voltage vacuum relays, with voltage ratings up to 100 kV, for use in radio frequency communications, medical instruments, industrial electronics, radar, sonar and space systems.

Kilovac's high vacuum technology has made possible smaller and lighter relays than previously available for high-voltage switching.

Designed for switching radio frequency circuits employing coaxial transmission lines, Dow-Key relays provide high efficiency with low SWR and excellent isolation. The relays are available in a variety of coil voltages and currents, power ratings, connector types and switching modes.

### SPECIALS

These pages cover only the standard, most popular Kilovac/Dow-Key relays. We manufacture many more products than shown, and invite your inquiries.

Kilovac/Dow-Key offers the original equipment manufacturer a diverse background of designing and producing special relays to exacting specifications.

Latching relays, hermetically sealed relays and a wide variety of switching arrangements, non-standard connectors, attached cables of various types (with or without connectors) and special coils are available.

Your inquiries regarding relays designed to your specifications will receive prompt attention from our Engineering and Marketing Departments.

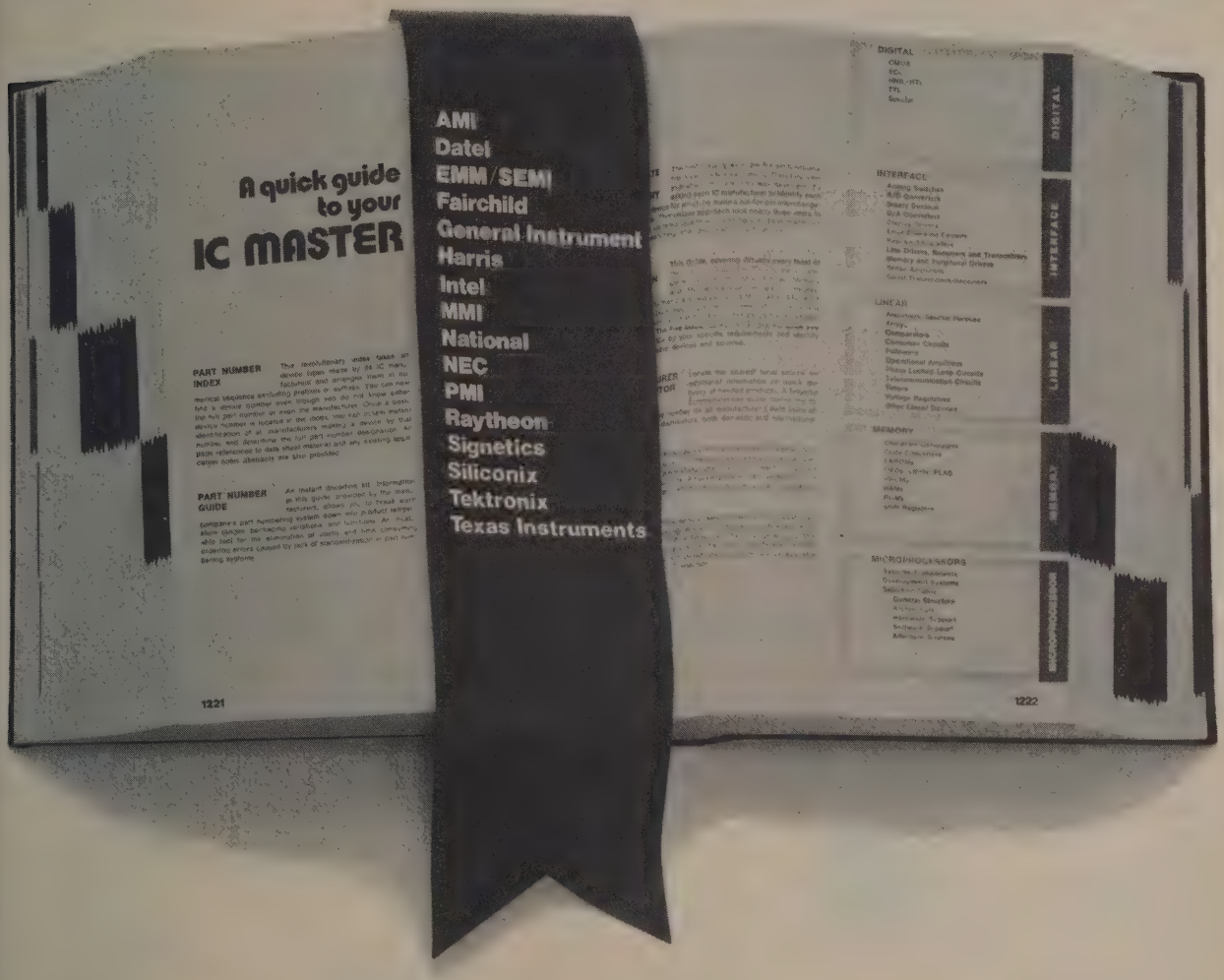
Kilovac® CORPORATION

P.O. Box 4422 / Santa Barbara, California 93103 Telephone (805) 684-4560 TWX 910-336-1141
**Kilovac** Vacuum Relays • **Dow-Key** Coaxial Relays



Add Dept. EM to address to tell them you saw it in eem

# A GOOD BOOK IS KNOWN BY THE COMPANIES IT KEEPS.




These manufacturers have invested in the IC MASTER to bring you the most complete information on their newest standard products.

HEN USING THE IC MASTER, REFER TO THESE MANUFACTURERS' COMPLETE DATA SHEETS TO HELP YOU IN YOUR IC SELECTION . . .

## THE WHOLE WORLD FOLLOWS THE MASTER.

**IC Master**
**1333 Lawrence Expressway, Suite 420**
**Santa Clara, CA 95051**
**(408) 248-8044**

***It's Faster With the Master***

# SUBMINIATURE RELAYS

Leach subminiature relays have set the industry standards for technology and reliability for decades. With their proven high performance in the most demanding applications, they are ideal for your critical subsea, shipboard, ground-based and aerospace applications.

Our Balanced Force™ subminiature relays are rugged, high-environment relays for applications where size, weight and reliability are important. For systems where size and weight are critical, our Series III subminiature relays are the smallest, lightest aircraft relays made with their contact ratings, and are 40% the size and weight of our J and K Series relays, yet offer the same high performance. Both relay types are available in a variety of termination, mounting and operating configurations.

**Subminiature Relays Dry Circuit to 10 Amps**

LEACH® RELAY DIVISION

5915 AVALON BLVD., LOS ANGELES, CA 90003
(213) 232-8221 TWX (910) 321-2303

| | Contact Rating (Amps) 28 VDC Resistive | Inductive | Motor | Lamp | 115, 400 Hz, 3Φ Resistive (Case Grounded) | Nominal Coil Voltage(s) | Coil Resistance(s)—(Ohms) | Operate Time, Maximum (MS) | Release Time, Maximum (MS) | Bounce Time, Maximum (MS) | Shock, Minimum, G | Sinusoidal Vibration, Minimum, G | Weight, Maximum, Oz. (Grams) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Low Level to 5A, 2PDT**<br>**Series X**<br>Series III design,<br>5 mounting & 3 terminal types.<br>0.810″x 0.410″x 0.640″.<br>Designed to MIL-R-6106.<br>Sockets available:<br>SO-1064-001 | 5 | 3 | 2 | 1 | Same as DC except inductive is 5A | 6.0<br>12.0<br>28.0<br>48.0<br>VDC | 30<br>125<br>500<br>1600 | 4 | 4 | 0.5 | 200† | 30† | .56 (16) |
| **Low Level to 5A, 4PDT**<br>**Series Y**<br>Series III design,<br>5 mounting & 3 terminal types.<br>0.810″x 0.810″x 0.640″.<br>Designed to MIL-R-6106.<br>Sockets available:<br>SO-1066-001 | 5 | 3 | 2 | 1 | Same as DC except inductive is 5A | 6.0<br>12.0<br>28.0<br>48.0<br>VDC | 25<br>100<br>400<br>1275 | 6 | 6 | 0.5 | 200† | 30† | .95 (27) |
| **Low Level to 10A, 3 PDT**<br>**Series YC**<br>Series III design,<br>5 mounting & 3 terminal types.<br>0.810″x 0.810″x 0.640″.<br>Designed to MIL-R-6106.<br>Sockets available:<br>SO-1065-001 | 10 | 6 | 4 | 2 | Same as DC except inductive is 8A | 6.0<br>12.0<br>28.0<br>48.0<br>VDC | 25<br>100<br>400<br>1275 | 6 | 6 | 1.0 | 200† | 30† | .99 (28) |

†At the time of publication, testing is being performed to establish higher ratings. Please contact factory.

# Subminiature Relays Dry Circuit to 25 Amps (Cont'd)

**LEACH®**
**RELAY DIVISION**

5915 AVALON BLVD., LOS ANGELES, CA 90003
(213) 232-8221 TWX (910) 321-2303

| | Contact Rating (Amps) 28 VDC Resistive | Inductive | Motor | Lamp | 115, 400 Hz, 3ϕ Resistive (Case Grounded) | Nominal Coil Voltage(s) | Coil Resistance(s)—(Ohms) | Operate Time, Maximum (MS) | Release Time, Maximum (MS) | Bounce Time, Maximum (MS) | Shock, Minimum, G | Sinusoidal Vibration, Minimum, G | Weight, Maximum, Oz. (Grams) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Low Level to 12A, 2PDT Non-Latch & Latch Series J, JA & JL**<br>Balanced Force* design,<br>4 mounting & 3 terminal types.<br>DC - 1.015"x 0.515"x 1.000"<br>AC - 1.015"x 0.515"x 1.125"<br>Non-Latch applicable to MS27401<br>Latch applicable to MS27744.<br>Sockets available: DC, Non-Latch SO-1049-8309(#16 Crimp)<br>SO-1049-8526(#20 Crimp)<br>AC-115VAC SO-1049-8772(#16 Crimp)<br>28VAC SO-1049-8774(#16 Crimp)<br>DC, Latch SO-1055-8690(#16 Crimp) | DC Coil 12 | 8 | 4 | 2 | Same as DC Rating | DC Non-Latch 6 12 28 | DC Non-Latch 20 80 320 | DC Non-Latch 10 | DC Non-Latch 10 | 1 | 200 | 200 | DC Coil 1.4 (40) |
| | AC Coil 10 | | | | | DC Latch 6 12 28 | DC Latch 38 150 600 | DC Latch 10 | DC Latch N/A | | | | |
| | | | | | | AC Coil (400 Hz) 115/28 (60 Hz) 115/28 | AC Coil I, Max .240 .040 100 .024 | AC Coil 15 | AC Coil 50 | | | | AC Coil 1.6 (46) |
| **Low Level to 12A, 4PDT Non-Latch & Latch Series K, KA & KL**<br>Balanced Force* design,<br>4 mounting & 3 terminal types.<br>1.015"x 1.015"x 1.000".<br>Non-Latch applicable to MS27400<br>Latch applicable to MS27745<br>Sockets available: DC, Non-Latch SO-1048-8308(#16 Crimp)<br>SO-1048-8518(#20 Crimp)<br>AC-115VAC SO-1048-8776(#16 Crimp)<br>28VAC SO-1048-8779(#16 Crimp)<br>DC, Latch SO-1056-8691(#16 Crimp) | DC Coil 12 | 8 | 4 | 2 | Same as DC Rating | DC Non-Latch 6 12 28 | DC Non-Latch 18 70 290 | DC Non-Latch 15 | DC Non-Latch 15 | | 200 | 30 | DC Coil 2.5 (71) |
| | AC Coil 10 | | | | | DC Latch 6 12 28 | DC Latch 28 112 450 | DC Latch 15 | DC Latch N/A | | | | |
| | | | | | | AC Coil (400 Hz) 115/28 (60 Hz) 115/28 | AC Coil I, Max .225 .040 .120 .028 | AC Coil 20 | AC Coil 50 | | | | AC Coil 2.7 (77) |
| **Low Level to 25A, 1 PDT Non-Latch & Latch Series JC, JCA & JCL** JS & JSA*****<br>Balanced Force* design,<br>50 ADC & 80A, 400 Hz overload capabilities.<br>JS Series 20A overload capabilities.<br>Special Models available.<br>3 mounting & 2 terminal types.<br>DC-1.015"x 0.515"x 1.000"<br>AC-1.015"x 0.515"x 1.125".<br>Applicable MS, MIL-R-6106.<br>Sockets available: DC, Non-Latch SO-1063-9033<br>AC SO-1063-9034<br>DC, Latch SO-1063-9036 | **JC, JCA & JCL | | | | | DC Non-Latch 6 12 28 | DC Non-Latch 20 80 320 | DC Non-Latch 10 | DC Non-Latch 10 | 1 | 200 | 30 | 1.7 (48) |
| | 25 | 12 | 10 | 5 | Same as DC Rating | | | | | | | | |
| | ***JS & JSA Series Only 115V, 60 Hz Case Grounded | | | | | DC Latch 6 12 28 | DC Latch 38 150 600 | DC Latch 10 | DC Latch N/A | | | | |
| | 10 | 10 | 8 | 4 | N/A | AC Coil (400 Hz) 115 (60 Hz) 115 | AC Coil I, Max .040 .024 | AC Coil 20 | AC Coil 50 | | | | |
| **Low Level to 25A, 3PDT Non-Latch & Latch Series KC, KCA & KCL**<br>Balanced Force* design.<br>50ADC & 80A, 400 Hz overload capabilities.<br>Special Models available.<br>3 mounting & 2 terminal types.<br>1.015"x 1.015"x 1.000".<br>DC, Non-Latch applicable to MS27743.<br>Latch applicable to MS27742.<br>Sockets available: DC, Non-Latch SO-1057-8912<br>AC SO-1062-8917<br>DC, Latch SO-1058-8913 | 25 | 12 | 10 | 5 | Same as DC except inductive 15A | DC Non-Latch 6 12 28 | DC Non-Latch 18 70 290 | DC Non-Latch 15 | DC Non-Latch 15 | 1 | 200 | 30 | 3.0 (85) |
| | | | | | | DC Latch 6 12 28 | DC Latch 28 112 450 | DC Latch 15 | DC Latch N/A | | | | |
| | | | | | | AC Coil (400 Hz) 115 (60 Hz) 115 | AC Coil I, Max .040 .028 | AC Coil 20 | AC Coil 50 | | | | |
| **Low Level to 25A 3PST/NO, 2A 1PDT Aux. Non-Latch & Latch Series KD, KDA & KDL**<br>Balanced Force* design. Same design as the Series KC with added auxiliary pole.<br>Special Models available.<br>3 mounting & 2 terminal types.<br>DC, Non-Latch applicable to MIL-R-6106/13.<br>Latch applicable to MIL-R-6106/12.<br>Sockets available: DC, Non-Latch SO-1059-8914<br>AC SO-1061-8916<br>DC, Latch SO-1060-8915 | 25 | 12 | 10 | 5 | Same as DC except inductive 15A | DC Non-Latch 6 12 28 | DC Non-Latch 18 70 290 | DC Non-Latch 15 | DC Non-Latch 15 | 1 Aux 4 | 200 | 30 | DC Coil 2.9 (82) |
| | Aux 2 | Aux 1 | | Aux 0.5 | | DC Latch 6 12 28 | DC Latch 28 112 450 | DC Latch 15 | DC Latch N/A | | | | |
| | | | | | | AC Coil (400 Hz) 115 (60 HZ) 115 | AC Coil I, Max .040 .028 | AC Coil 20 | AC Coil 50 | | | | AC Coil 3.0 (85) |

*Patented and T.M. Leach Corp.

# POWER AND CONTROL RELAYS

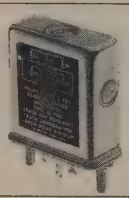
Leach power and control relays have been used for decades in commercial and military aircraft, trucks and buses, ships and tanks—any application that calls for proven durability, high performance and long life.

To ensure that you get the right relay for your application, our power and control relays are available in a broad range of configurations. You can choose from various terminal and mounting styles, dust and moisture resistant and hermetically-sealed enclosures, and a variety of operating ratings and characteristics.

## Power and Control Relays

LEACH® RELAY DIVISION

5915 AVALON BLVD., LOS ANGELES, CA 90003
(213) 232-8221 TWX (910) 321-2303

| | | Contact Rating (Amps) 28 VDC Resistive | Inductive | Motor | Lamp | Resistive 115/200VAC, 3φ (Case Grounded) | Contact Configuration | Resistance, Ohms ± 10% @ 25°C for 28 VDC | Nominal Coil Voltage(s) | Operate Time, Maximum (MS) | Release Time, Maximum (MS) | Bounce Time, Maximum (MS) | Sinusoidal Vibration, Minimum, G | Shock, Minimum, G | Weight, Maximum, Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **5 Amp, 2PDT**<br>**Series 9229**<br>**Series 9235; Magnetic Latch**<br>Contact rating @ 28 VDC or 115 VAC 400 Hz.<br>1.750″x 1.531″x .687″.<br>Applicable to MS25395 & MS25455 |  | 5 | 3 | 1.5 | .8 | N/A | — | 9229<br>248Ω | 28 VDC<br>115 VAC,<br>400 Hz,<br>60 Hz | AC Coils<br>.020 | AC Coils<br>.050<br>DC Coils<br>.020 | .002 | 10<br>55-<br>2000 | 25 | .18 |
| | | | | | | | | 9235<br>310Ω | | DC Coils<br>.020 | N.A. | | | | .20 |
| **5 Amp, 4PDT**<br>**Series 9220**<br>**Series 9228; Magnetic Latch**<br>Contact rating @ 28 VDC or 115 VAC 400 Hz.<br>1.750″x 1.531″x 1.032″.<br>Applicable to MS25267 & MS25467. | | 5 | 3 | 1.5 | .8 | N/A | — | 9220<br>248Ω | 28 VDC<br>115 VAC,<br>400 Hz,<br>60 Hz | AC Coils<br>.020 | AC Coils<br>.050<br>DC Coils<br>.020 | .002 | 10<br>55-<br>2000 | 25 | .30 |
| | | | | | | | | 9228<br>200Ω | | DC Coils<br>.020 | N.A. | | | | .30 |
| **5 Amp, 6PDT**<br>**Series 9226**<br>**Series 9223; Magnetic Latch**<br>Contact rating @ 28 VDC or 115 VAC, 400 Hz.<br>1.812″x 1.531″x 1.531″.<br>Applicable to MS25269 & MS25469. | | 5 | 3 | 1.5 | .8 | N/A | — | 9226<br>180Ω | 28 VDC<br>115 VAC,<br>400 Hz,<br>60 Hz | AC Coils<br>.020 | AC Coils<br>.050<br>DC Coils<br>.020 | .002 | 10<br>55-<br>2000 | 25 | .40 |
| | | | | | | | | 9223<br>200Ω | | DC Coils<br>.020 | N.A. | | | | .67 |

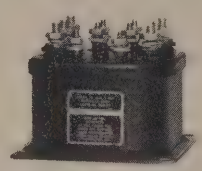
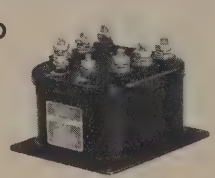
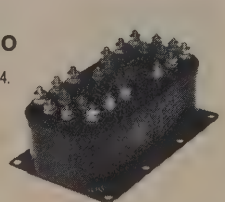
# Power and Control Relays

LEACH® RELAY DIVISION
5915 AVALON BLVD., LOS ANGELES, CA 90003
(213) 232-8221 TWX (910) 321-2303

| | Contact Rating (Amps) 28 VDC Resistive | Inductive | Motor | Lamp | Resistive 115/200VAC, 3Φ (Case Grounded) | Contact Configuration | Resistance, Ohms ± 10% @ 25°C for 28 VDC | Nominal Coil Voltage(s) | Operate Time, Maximum (MS) | Release Time, Maximum (MS) | Bounce Time, Maximum (MS) | Sinusoidal Vibration, Minimum, G | Shock, Minimum, G | Weight, Maximum, Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **10 Amp, 2PDT<br>Series 9227<br>Series 9237; Magnetic Latch**<br>Contact rating @ 28 VDC or 3 phase 115/200 VAC, 400 Hz.<br>1.781″ x 1.531″ x 1.032″.<br>Applicable to MS25273 & MS25466. | 10 | 6 | 4 | 2 | Same as DC | — | 9227 175Ω<br>9237 200Ω | 28 VDC 115 VAC, 400 Hz, 60 Hz | AC Coils .020<br>DC Coils .020 | AC Coils .050<br>DC Coils .020<br>DC Coils .020 | AC Coils .050<br>DC Coils .020<br>N.A. | .002 | 10 55-2000 | 25 | .30<br>.30 |
| **10 Amp, 4PDT<br>Series 9224<br>Series 9225; Magnetic Latch**<br>Contact rating @ 28 VDC or 3 phase 115/200 VAC, 400 Hz.<br>1.812″ x 1.531″ x 1.531″.<br>Applicable to MS25271 & MS25461. | 10 | 6 | 4 | 2 | 10 Same as DC | — | 9224 110Ω<br>9225 200Ω | 28 VDC 115 VAC, 400 Hz, 60 Hz | AC Coils .020<br>DC Coils .020 | AC Coils .050<br>DC Coils .020<br>N.A. | .002 | 10 55-2000 | 25 | .43<br>.40 |
| **10 Amp, 2PDT<br>Series 9330**<br>Contact rating @ 28 VDC or 115 VAC, 400 Hz.<br>1.781″ x 1.531″ x 1.032″.<br>Applicable to MS24149 | 10 | 10 | 6 | 2 | 10 Same as DC | — | 160Ω | 28 VDC 115 VAC, 400 Hz, 60 Hz | AC Coils .020<br>DC Coils .020 | AC Coils .050<br>DC Coils .020 | .002 | 10 15-1500 | 25 | .30<br>.30 |
| **15 Amp, 4PDT<br>Series 9274**<br>Contact rating @ 28 VDC or 3 phase 115/200 VAC, 400 Hz.<br>1.80″ x 2.06″ x 2.06″<br>Applicable to MS24568. | 10 | 10 | 6 | 3 | 15 Same as DC | — | 92Ω | 28 VDC 115 VAC, 400 Hz, 60 Hz | AC Coils .025<br>DC Coils .025 | AC Coils .050<br>DC Coils .020 | N.O. .003<br>N.C. .005 | 10 1000-2000 | 50 | .73 |
| **20 Amp<br>Series 9324—3PST/NO**<br>12A, 115 VAC, 60 Hz.<br>1.47″ x 2.50″ x 2.40″.<br>Applicable to MS27418. | 20 | 15 | 20 | 10 | 20 | 3PST/NO | 160 | 28 VDC; 115 VAC, 400 Hz; 60 Hz | AC Coils .025<br>DC Coils .020 | AC Coils .050<br>DC Coils .010 | .002 | 10 55 1500 Hz | 25 | .60 |
| **20 Amp<br>Series 9325—3PDT/NO**<br>Mechanical interlock version of 9324.<br>3.71″ x 3.00″ x 3.20″.<br>Applicable to MS27706 | 20 | 20 | 20 | 10 | 20 | 3PDT/NO | 160 | 28 VDC; 115 VAC, 400 Hz; 60 Hz | AC Coils .025<br>DC Coils .020 | AC Coils .050<br>DC Coils .010 | .005 | 10 55 1500 Hz | 25 | 1.4 |

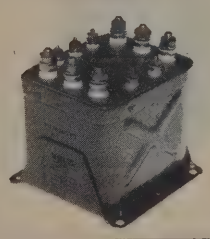
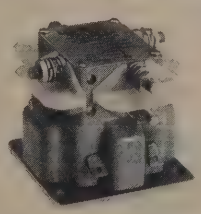
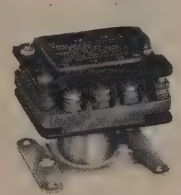
# Power and Control Relays

LEACH®
RELAY DIVISION
5915 AVALON BLVD., LOS ANGELES, CA 90003
(213) 232-8221 TWX (910) 321-2303

| | Contact Rating (Amps) 28 VDC Resistive | Inductive | Motor | Lamp | Resistive 115/200VAC, 3Φ (Case Grounded) | Contact Configuration | Resistance, Ohms ± 10% @ 25°C for 28 VDC | Nominal Coil Voltage(s) | Operate Time, Maximum (MS) | Release Time, Maximum (MS) | Bounce Time, Maximum (MS) | Sinusoidal Vibration, Minimum, G | Shock, Minimum, G | Weight, Maximum, Oz./Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **25 Amp Series 9123—3PST/NO**<br>50g shock, 15g vibration. Auxiliary 5 amp contacts available. 3.30″x 3.73″x 2.50″. Repairable models available. Applicable to MS27997.  | 25 | 25 | 25 | N/A | 25 | 3PST/NO | 50 | 28 VDC; 115 VAC, 400/60 Hz | .025 | AC Coils .050<br>DC Coils .010 | .002 | 15<br>55<br>1500 Hz | 50 | 1.25 |
| **50 Amp Series "H"**<br>Auxiliary contacts 5 amps. Repairable models available. Basic unit: 2.50″Dia.x 3.13″. Applicable to MS27751. | 25 | 15 | 15 | 10 | 50 | 3PDT<br>3PDT SPST/NO Aux.<br>3PST/NO SPST/NO SPST/NC Aux. | 6VDC 12Ω<br>12VDC, 50Ω<br>28 VDC, 200Ω 115 VAC, .09A | 6, 12, 28 VDC<br>115 VAC, 400 Hz<br>115 VAC, 60 Hz | .050 | .025 | .003 | 10<br>70<br>1000 Hz | 50 | 13.5 Oz. |
| **50 Amp Series "HC" Center-Off**<br>Repairable models available. Basic unit: 2.50″Dia.x 3.13″. Applicable to MS27750. | 25 | 15 | 15 | 10 | 50 | 3PDT | 6 VDC, 12Ω<br>12 VDC, 50Ω<br>28 VDC, 200Ω | 6, 12, 28 VDC | .035 | .025 | .003 | 10<br>70<br>1000 Hz | 50 | 14.0 Oz. |
| **50 Amp Series "HL" Magnetic Latch**<br>Repairable models available. Basic unit: 2.50″Dia.x 3.13″. Applicable to MS27749. | 25 | 15 | 15 | 10 | 50 | 3PDT | 6 VDC, 12Ω<br>12 VDC, 50Ω<br>28 VDC, 200Ω | 6, 12, 28 VDC | .035 | — | .003 | 10<br>70<br>1000 Hz | 50 | 14.0 Oz |
| **50 Amp Series 9124—3PST/NO**<br>50g shock, 15g vibration. Auxiliary 5 amp contacts available. Applicable to MS27222. 3.30″x 3.73″x 2.50″. Repairable models available.  | 50 | 50 | 50 | N/A | 50 | 3PST/NO | 50 | 28 VDC; 115 VAC, 400/60 Hz | .025 | AC Coils .050<br>DC Coils .010 | .002 | 15<br>55<br>1500 Hz | 50 | 1.25 |
| **50 Amp Series 9125—6PST/NO**<br>Mechanical interlock version of 9124. Design to MIL-R-6106. Aux. 5 amp contacts available. 6.21″x 3.80″x 2.70″.  | 50 | 50 | 50 | N/A | 50 | 6PST/NO | 50 | 28 VDC; 115 VAC, 400/60 Hz | .030 | AC Coils .050<br>DC Coils .010 | .002 | 10<br>70<br>1500 Hz | 50 | 2.90 |

# Power and Control Relays

LEACH® RELAY DIVISION
5915 AVALON BLVD., LOS ANGELES, CA 90003
(213) 232-8221 TWX (910) 321-2303

| | Contact Rating (Amps) 28 VDC Resistive | Inductive | Motor | Lamp | Resistive 115/200VAC, 3Φ (Case Grounded) | Contact Configuration | Resistance, Ohms ± 10% @ 25°C for 28 VDC | Nominal Coil Voltage(s) | Operate Time, Maximum (MS) | Release Time, Maximum (MS) | Bounce Time, Maximum (MS) | Sinusoidal Vibration, Minimum, G | Shock, Minimum, G | Weight, Maximum, Oz./Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **120 Amp Series "Z"**<br>Auxiliary contacts-5 amp. available in many models of contact. Configuration-consult factory. Available in repairable models. Design to MIL-R-6106. Basic unit: 3.65"Dia.x 4.28". | 50 | 30 | 30 | N/A | 120 | 3PDT<br>3PST/NO<br>3PST/NO SPST/NO SPST/NC Aux.<br>3PDT W/SPST/NO or SPST/NC Aux. | 6 VDC, 1.2 A<br>12 VDC, .6 A<br>28 VDC, .31 A<br>115 VAC, .12 A | 6, 12, 28 VDC<br>115 VAC 400 Hz<br>115 VAC 60 Hz | .060 | .040 | .004 | 10<br>70<br>1000 Hz | 15 | 2.0 lb. |
| **100 Amp Series "ZC" Center-Off**<br>Repairable models available. Design to MIL-R-6106. Basic unit: 3.65"Dia.x 4.28". | 50 | 30 | 30 | N/A | 100 | 3PDT<br>3PST | 6 VDC, .8 A<br>12 VDC, .4 A<br>28 VDC, .23 A<br>115 VAC, .09 A | 6, 12, 28 VDC<br>115 VAC 400 Hz<br>115 VAC 60 Hz | .060 | .040 | .004 | 10<br>70<br>1000 Hz | 15 | 2.0 lb. |
| **120 Amp Series "ZL" Magnetic Latch**<br>Repairable models available. Design to MIL-R-6106. Basic unit: 3.65"Dia.x 4.28". | 50 | 30 | 30 | N/A | 120 | 3PDT | 28 VDC, .215 A | 6, 12, 28 VDC<br>115 VAC 400 Hz<br>115 VAC 60 Hz | .060 | N/A | .004 | 10<br>70<br>1000 Hz | 15 | 2.0 lb. |
| **100 Amp Series 9213**<br>Sealed rotary, 1, 2, 3 and 4 pole. Auxiliary contacts form 5 amps. Design to MIL-R-6106".  | 100 | 100 | 100 | N/A | 100 | 3PST/NO 4PST/NO | 44.5 | 28 VDC;<br>115 VAC, 400 Hz;<br>115 VAC, 60 Hz | AC Coils .040<br>DC Coils .030 | AC Coils .060<br>DC Coils .020 | .010 | 10<br>55<br>1500 Hz | 25 | 2.7 |
| **25 to 100 Amp Series 9207**<br>Unsealed rotary, 1, 2, 3 and 4 pole. Auxiliary contacts from 5 amps. Design to MIL-R-6106.  | 100 | 100 | 100 | N/A | 100 | 3PST/NO 4PST/NO | 44.5 | 28 VDC;<br>115 VAC, 400 Hz<br>115 VAC; 60 Hz | .030 | AC Coils .050<br>DC Coils .020 | .010 | 10<br>55<br>500 Hz | 50 | 1.6 |
| **25 to 400 Amp Solenoid Type Power Contactors 1PST, 2PST**<br>Types shown: 3PST/NO, 25 amps. Design to MIL-R-6106.  | 7064:<br>25<br>50<br>7264:<br>200<br>7401:<br>400 | <br>25<br>50<br><br>100<br><br>100 | <br>25<br>50<br><br>200<br><br>400 | <br>N/A<br>25<br><br>N/A<br><br>N/A | <br>N/A<br>N/A<br><br>N/A<br><br>N/A | 3PST/NO 1PDT<br>1PST/NO<br>1PST/NO<br>1PST/NO | Varying | 28 VDC | .040 | .015 | N/A | 2<br>250<br>500 Hz | 25 | 2.6 |

# ELECTRONIC TIME DELAYS AND SENSORS

To simplify systems interfacing and integration, we have a complete custom facility for the design and production of timing and sensing systems.

They are available with Leach MIL-Standard relays or special solid state outputs, manufactured with discrete circuitry or thick film hybrids manufactured to MIL-STD-883, Class B requirements.

In addition to the standard products shown below, we can provide:

—Combinations of voltage, frequency and phase sequence detection with built-in time delays for systems monitoring.

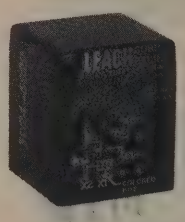
—Solid state relays with up to 3PNO contacts and ratings up to 25 amperes to MIL-STD-704 power requirements.

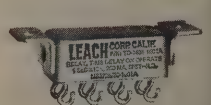
—Relay drivers for multiplex interface and isolation, conforming to MIL-R-28776.

—Solid state switching devices, ac and dc motor controllers, circuit breakers, current sensors and remote power controllers.

## Electronic Time Delays and Sensors

ENCLOSURE TYPES

| TYPE 10 1.5″x 1.5″x 1.8″ | TYPE 10 1.5″x 1.5″x 2.3″ | TYPE 20 1.2″x 1.0″x 1.8″ | TYPE 30 1.0″x 1.0″x 1.3″ | TYPE K |
|---|---|---|---|---|
| | | |  | |
| MATING SOCKET: SO-1021-7127 | MATING SOCKET: SO-1021-7127 (SENSORS) | MATING SOCKET: SO-1048-8308 | MATING SOCKET: SO-1048-8308 | MATING SOCKET: SO-1048-8308 |

| TYPE 40 1.0″x 0.5″x 1.1″ | TYPE 01 2.1″x 0.8″x 1.3″ | TYPE 02 2.1″x 1.0″x 1.0″ | TYPE 03 | TYPE E (HALF SIZE XTAL CAN) 0.8″x 0.4″x 0.4″ |
|---|---|---|---|---|
| | | | |  |
| MATING SOCKET: SO-1049-8309 | | | | |

# Electronic Time Delays and Sensors

LEACH® RELAY DIVISION
5915 AVALON BLVD., LOS ANGELES, CA 90003
(213) 232-8221 TWX (910) 321-2303

| | LEACH Series Number | Enclosure Types Available | Timing Range (1) | Accuracy (1) | Contact Configuration | Contact Ratings | Temperature Range | Input Voltage (MIL-STD-704A) | Applicable MIL-R-83726 Slash Sheet |
|---|---|---|---|---|---|---|---|---|---|
| **Time Delay Relays** | | | | | | | | | |
| Time Delay On Operate* | | | | | | | | | |
| Relay Output* | R300 | 10, 20, 30 | 0.1 SEC TO 300 SEC | ±2% TO ±10% | 2PDT 4PDT | 2 AND 10 AMP | −55°C TO +125°C | 18VDC TO 32VDC | 3, 14 |
| Solid State Output | S300 | 20, 30, 40 | | | SPNO | 0.25A | | | |
| Hybrid/Relay | TDH-8000 | K | .05-500 SEC | ± 10% | 2PDT | 10 AMP | | | |
| Time Delay On Release Positive Or Negative Control | | | | | | | | | |
| Relay Output* | R400 | 10, 20, 30 | 100MS TO 300 SEC | ± 2% TO ± 10% | 1PDT 3PDT | 2 AND 10 AMP | | | 4, 12 |
| Solid State Output | S400 | 20, 30 | | | SPNO | 0.25A | | | |
| Hybrid/Relay | TDH-8000 | K | .05-500 SEC | ± 10% | 2PDT | 10 AMP | | | |
| Hybrid Construction* | | | | | | | | | |
| Time Delay On Operate* | S5100 | 1/2 XTAL CAN | 50MS TO 500 SEC | | | | | | 20, 21 |
| Repeat Cycle Timer* | S5200 | | | | | | | | 22 |
| **Voltage, Frequency, and Phase Sensors** | | | | | | | | 18VDC TO 32VDC | |
| DC, Relay Output | V110 | | | | | | | | |
| AC Undervoltage, Relay Output | V210 | | | | | | | 90VAC TO 124VAC 400 Hz | |
| AC Overvoltage, Relay Output | V310 | 10 | N/A | ± 2% TO ± 10% | 2PDT AND 4PDT | 2 AND 10 AMP | −55°C TO +125°C | | N/A |
| AC Frequency, Relay Output | F410 | | | | | | | | |
| AC Phase Sequence, Relay Output | P510 | | | N/A | | | | | |
| **Proximity Sensors** | | | | | | | | | |
| Solid State Output (2) | PS100 | 01 02 03 | N/A | ± .03" | SPNO SPNC SPNO | 0.20A | −55°C TO +125°C | 18VDC TO 32VDC | N/A |

(1) EXTENDED TIMING RANGES AND GREATER ACCURACIES ARE AVAILABLE ON SPECIAL ORDER

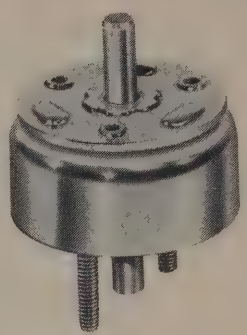
(2) AVAILABLE FOR BOTH FERROUS AND NON FERROUS TARGET SENSING
SHORT CIRCUIT PROTECTION AVAILABLE
PACKAGES FOR MULTIPLE SENSORS AND HIGHER OUTPUT RATINGS ON SPECIAL ORDER

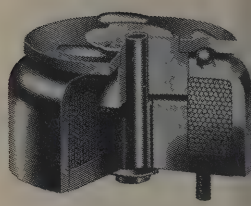
***TIME DELAY UNITS AVAILABLE QUALIFIED TO MIL-R-83726**

# ROTARY SOLENOIDS

Ledex Rotary Solenoids step, turn, pull, push, index, hammer, punch or trigger—whenever there is a need for fast and dependable direct rotary action. No complicated linkages or circuitry required. They're simple, have superior shock and vibration resistance, high torque over the full stroke. 250 standard models in stock for prototype work, ship in 48 hours. 117 to .09 lb.-in. torque range. Right or left hand strokes available in a variety of degrees.

Write for our complete catalog.





Gross Torque in Pound-Inches by duty cycle for standard rotary strokes

| Model | O.D. | Ht. in. | 25° cont. | 25° 1/20 | 35° cont. | 35° 1/20 | 45° cont. | 45° 1/20 | 67½° cont. | 67½° 1/20 | 95° cont. | 95° 1/2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1E | 1 | 5/8 | — | 1.1 | | | — | .62 | | | | |
| 2E | 1 1/8 | 21/32 | .2 | 1.7 | .15 | 1.3 | .10 | .89 | | | | |
| 3B | 1 5/16 | 7/8 | .35 | 3.2 | .25 | 2.3 | .15 | 1.7 | .09 | .80 | | |
| 3E | 1 5/16 | 51/64 | .35 | 3.2 | .25 | 2.3 | .15 | 1.8 | .09 | .89 | | |
| 4E | 1 5/16 | 61/64 | .9 | 5.2 | .6 | 3.5 | .4 | 3.1 | .2 | 1.9 | .15 | 1. |
| 5B | 1 7/8 | 1 13/64 | 1.8 | 10.0 | .9 | 8.3 | .7 | 6.0 | .5 | 4.0 | .19 | 1. |
| 5S | 1 7/8 | 1 3/64 | 1.9 | 13.2 | .9 | 9.2 | .7 | 6.9 | .5 | 4.9 | .2 | 2. |
| 6S | 2 1/4 | 1 27/64 | 4.6 | 30.6 | 3.4 | 20.5 | 1.7 | 12.1 | 1.6 | 9.7 | .9 | 5. |
| 7S | 2 3/4 | 1 55/64 | 11.0 | 46.6 | 6.0 | 42.0 | 5.0 | 32.8 | 2.5 | 19.3 | 1.5 | 11. |
| 8S | 3 3/8 | 2 5/16 | 16.0 | 117.0 | 12.0 | 77.0 | 10.0 | 65.0 | 4.2 | 35.0 | 3.5 | 20. |

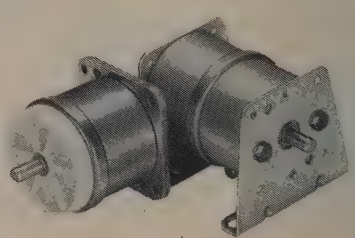
# CUSTOM DESIGNS

Design application assistance, and custom design rotary solenoids are always available from Ledex.

A few examples include:

Special shaft extensions
Special shaft configurations
Subminiature rotary solenoids
Special armature plate contours
Special finishes
Special mountings
Special rotary strokes
Zero axial stroke models
Two coil solenoids

# STEPPING MOTORS—SERIES 50



Extended life stepping motors have a 10 million cycle minimum life on unidirectional models, and in each direction on bidirectional models. 12, 18, 24, and 36 position designs, accurate to ±1° nonaccumulative. High torque-to-size ratios, with breakaway torques to 246 ounce-inches. The exclusive tooth clutch drive yields greater usable torque output, and acts as a built-in electromechanical clutch break for inertia loads. 64 stock models for quick prototype development.

Write for our complete catalog.

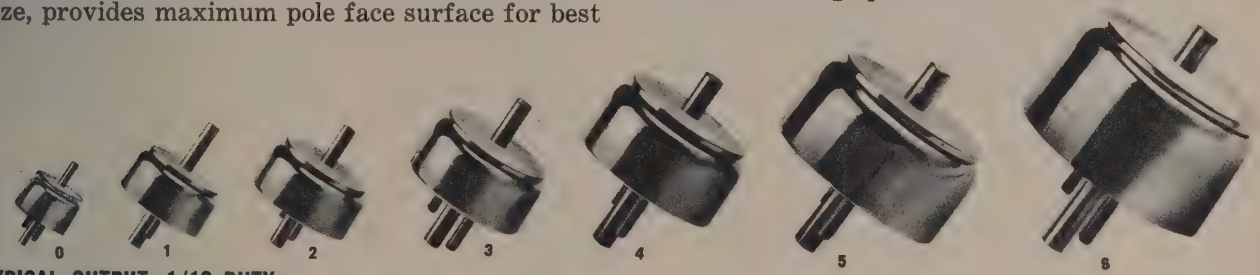
| Summary Specifications | Unidirectional | Bidirectional |
|---|---|---|
| Voltage | 6 to 220 VDC | 6 to 220 VDC |
| High temperature | +85°C | +85°C |
| Low temperature | −40°C | −40°C |
| Length | 1.9" | 2.8" |
| Height | 2¼" (sq. plate) | 2¼" |
| Weight | 14 oz. | 24 oz. |

126 Webster Street,
Dayton, Ohio 45401
Phone: (513) 224-9530

# PUSH & PULL SOLENOIDS

You name the job.
Short, medium or long stroke. High speed. Tight space. Unusual load. Ledex has the solenoid for you, usually on the shelf. Expert design assistance for your toughest custom requirements.

Pancake shaped Ledex push/pull solenoids are built for high force to size and fast response. Better than 10ms response. Form factor minimizes size, provides maximum pole face surface for best efficiency. Two types available. Flat face is for short stroke, rapid response. Conical face gives more mid-range punch.

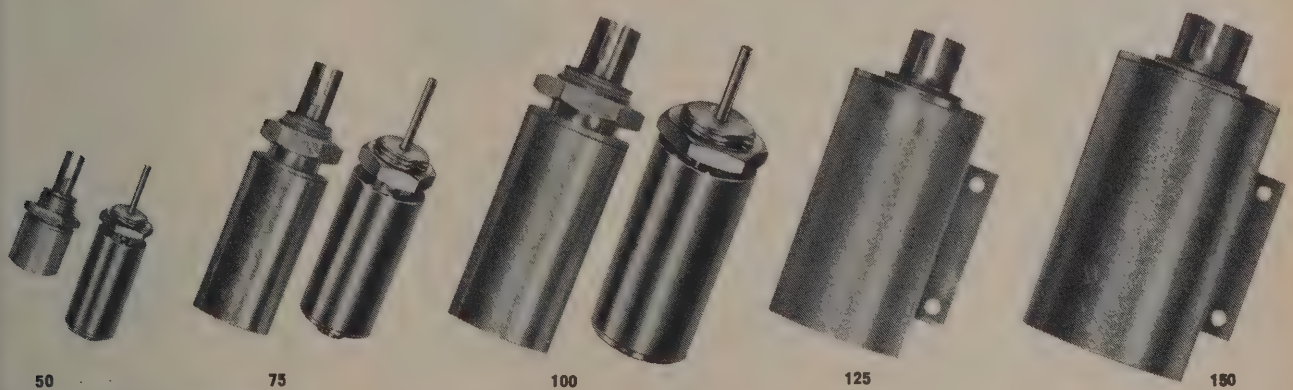



## TYPICAL OUTPUT, 1/10 DUTY

| Model | 0 | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size | .75"D x ½" | | 1"D x 17/32" | | 1.2"D x 23/64" | | 1.3"D x 11/16" | | 1.6"D x 55/64" | | 1.9"D x 1 1/64" | | 2.3"D x 1 23/64" | |
| | Conical Face | Flat Face | Conical Face | Flat Face | Conical Face | Flat Face | Conical Face | Flat Face | Conical Face | Flat Face | Conical Face | Flat Face | Conical Face | Flat Face |
| Stroke (In.) | .020 | — | .020 | .010 | .020 | .010 | .020 | .010 | .020 | .010 | .020 | .010 | .020 | — |
| Force (Lbs.) | 4.4 | — | 7.8 | 17 | 11 | 23 | 16 | 35 | 17 | 55 | 35 | 110 | 85 | — |
| Stroke (In.) | .120 | — | .120 | .060 | .120 | .060 | .120 | .060 | .200 | .100 | .250 | .100 | .250 | — |
| Force (Lbs.) | 1 | — | 2.4 | 3.3 | 3.3 | 4.5 | 8 | 10 | 6 | 12 | 16 | 20 | 52 | — |
| Weight | 1½ oz. | | 1½ oz. | | 2¼ oz. | | 3¾ oz. | | 6 oz. | | 10 oz. | | 1 lb. 5½ oz. | |

(For detail performance curves, write for our Catalog)

Quality engineered for efficiency and long term dependability, the Ledex long stroke solenoid has a built-in impact cushion pad to absorb energy at the end of the power stroke. For smooth travel and long wear, the solenoid plunger is electroless nickel plated. It rides in a smooth bushing track designed for positive alignment and low friction. Slotted and cross drilled plungers on all stock models simplify load attachment. Off-the-shelf models available for 12, 28 and 100 VDC operations.




## TYPICAL OUTPUT 1/10 DUTY

| Model | Size 50 | | Size 75 | Size 100 | Size 125 | Size 150 |
|---|---|---|---|---|---|---|
| Size | ½"D x ½" | ½"D x 1" | ¾"D x 1½" | 1"D x 2" | 1¼"D x 2¼" | 1½" x 2½" |
| Force, .050 Stroke | 4.5 oz. | 15 oz. | 3 lbs. | 7 lbs. | 11.5 lbs. | 16.5 lbs. |
| Force, .750 Stroke | — | — | .6 lbs. | 2 lbs. | 4 lbs. | 7 lbs. |
| Shaft Diameter, pull | .187" | .187" | .312" | .437" | .500" | .625" |
| Shaft Diameter, push | .062" | .062" | .094" | .125" | — | — |
| Mounting | Thr'd Bushing | Thr'd Bushing | Thr'd Bushing | Thr'd Bushing | Saddle | Saddle |
| Weight | 14 grams | 24 grams | 3 oz. | 6¾ oz. | 9 oz. | 1 lb. ½ oz. |

When it comes to actuating, Ledex has both the people and products to give you the quickest and best solution. There's a wide choice of stock models for a fast start on your prototype. And our expert application staff is always glad to custom engineer to your exact stroke, force, speed and size requirements. Other models (not shown) are available on made-to-order basis with force outputs in excess of 350 pounds. Write for our catalog.

LEDEX INC.
126 WEBSTER STREET, DAYTON, OHIO 45401
PHONE: (513) 224-9530

# Liberty Controls for Solenoids and

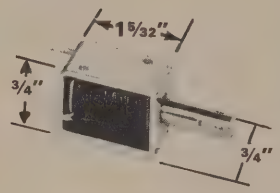
## SOLENOIDS

Liberty Controls Inc. has a full line of both C frame and solid frame solenoids which can be tailored to fit your needs. These shown below are some of the standard lines which cover a variety of applications. Each size is shown as pull solenoids and are complimented by a push type with similar force characteristics. Plungers and plunger stops are made from magnetic steels and annealed after machining for maximum efficiency.

The duty cycle ratings are very important in a solenoid application and continuous duty units should be used whenever possible for safest operation. When the force requirements exceed the capabilities of a continuous rated coil, it is essential to give us complete information regarding the intended duty cycle and power source limitations so that we can design and manufacture the best coil for your application. A good rule of thumb is that if the unit is going to be "on" for four (4) minutes or longer, a continuous duty coil should be used. Let us suggest the appropriate coil for duty cycles less than this four minutes.

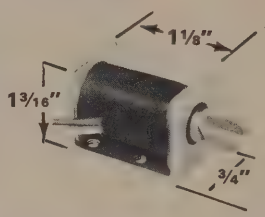
Remember, these solenoids shown are just a few examples of our line, and we encourage you to contact us about your specific requirements.

### TYPE 60



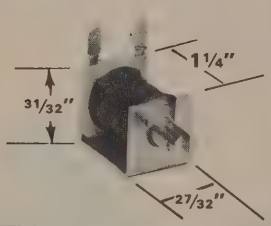

This solid frame solenoid has many light industrial and business machine applications. It is provided with solder, 3/16" quick connect terminals or leads. It has improved efficiency in this small size because it is a solid frame design.

### TYPE 61



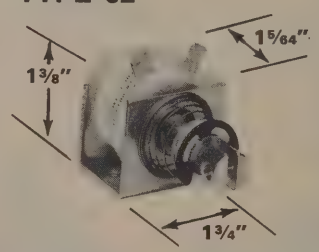

This C frame unit is designed for cost efficiency required in vending machines, slide projectors, automotive actuators and similar applications where volume is high and cost is a prime consideration. It is most often provided with ¼" quick connect terminals, but leads are available.

### TYPE L-24



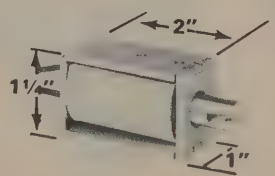

This C frame design is similar to the 61 but slightly larger and is designed for longer life. Its applications fall into the light industrial, business equipment, and calculator areas. It is readily interchangeable with other competitive solenoids and can be provided with several varieties of termination.

### TYPE 62



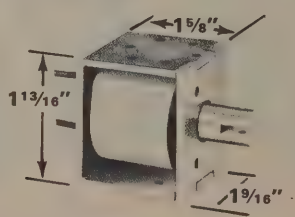

This C frame unit is larger than any of the above described C frames and is used widely in cash drawer applications where a large pull force is required on a pulse duty basis. It is compact and very efficient for this application. Again various terminations are available.

### TYPE 82



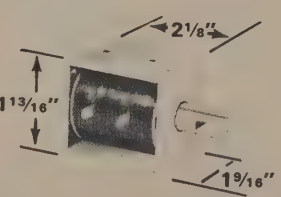

This solid frame solenoid is a medium force unit that has excellent magnetic circuit design. It is used in medium industrial applications where a longer stroke is required. It has been applied in door latch mechanisms and similar applications where side loading is a significant factor. Various terminations are available.

### TYPE 88



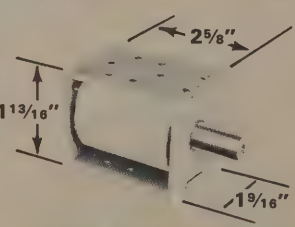

This solid frame unit is the smallest in a series of medium to heavy duty applications. It is used primarily in industrial applications where a short stroke is desired and space requirements are limited. These are used in computer peripheral devices for head loading, write disable indicator retractors, and other similar needs.

### TYPE 89




This solid frame unit is the next stop up from the 88 in longer stroke capabilities. Many of the same applications would apply here as in the 88, but generally the force is required over a slightly longer distance. This unit uses a brass plunger sleeve for longer life and better support in side loaded applications.

### TYPE 90




This solid frame solenoid is the largest of our standard line and is the longest in the 88, 89, 90 Series. As can be seen from the force characteristics curves on the adjacent page, this solenoid has the longest force distance ability. As with the whole series, the various terminations are available.

**Liberty Controls, Inc. 500 Brookforest Avenue, Shorewood, Illinois 60431 815/725-2241**

# General Purpose Relays you can rely on

## FORCE CHARACTERISTICS OF SOLENOIDS

Distance From Stop in Inches

| | 1/8 | | 1/4 | | 3/8 | | 1/2 | | 5/8 | |
|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | Cont. | Int. | Cont. | Int. | Cont. | Int. | Cont. | Int. | Cont. | Int. |
| 60 AC | *4 | 6 | 2 | 3.5 | 1 | 2 | .5 | 1 | — | — |
| DC | 4 | 6 | .5 | 2 | — | 1.5 | — | .5 | — | — |
| 61 AC | 6 | 14 | 4 | 8 | 3 | 6 | 2.5 | 5 | — | 3 |
| DC | 4 | 12 | 2 | 8 | 1 | 3 | — | 1 | — | — |
| L-24 AC | 7 | 11 | 5.5 | 8 | 5 | 7 | 3.5 | 6 | 2 | 3 |
| DC | 8 | 23 | 3 | 9 | 1.5 | 5 | 1 | 3 | — | — |
| 62 AC | 15 | 36 | 13 | 32 | 11 | 28 | 8 | 20 | 3 | 10 |
| DC | 15 | 45 | 9 | 27 | 6 | 18 | 3 | 9 | 1 | 3 |
| 82 AC | 13 | 21 | 6 | 12 | 3 | 9 | 1 | 7 | — | 6 |
| DC | 20 | 48 | 10 | 32 | 6 | 20 | 4 | 11 | 2 | 6 |
| 88 AC | 14 | 40 | 9 | 24 | 4 | 16 | 3 | 12 | — | 8 |
| DC | 40 | 140 | 14 | 100 | 7 | 40 | 3 | 20 | — | 10 |
| 89 AC | 14 | 40 | 9 | 28 | 5 | 24 | 4 | 20 | 2 | 18 |
| DC | 40 | 140 | 14 | 105 | 8 | 60 | 5 | 40 | 2 | 26 |
| 90 AC | 14 | 40 | 9 | 28 | 5 | 24 | 4 | 22 | 3 | 20 |
| DC | 64 | 140 | 27 | 107 | 12 | 70 | 6 | 50 | 3 | 35 |

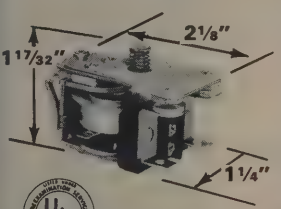
* Force in Ounces

## GENERAL PURPOSE TYPE RELAYS

Liberty Controls has an outstanding reputation for its line of General Purpose Relays. These relays perform dependably in many diverse applications including light to medium switching and plate circuit operations, in process controls and communication equipment. More recently many of these types of relays have been used as safety features on power equipment, such as, line monitoring for stray currents, discharging voltage on shutdown, and equipment shutdown through fault detection.

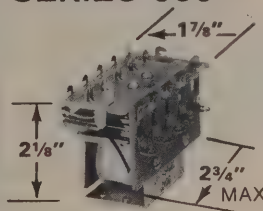
A wide variety of contact arrangements and ratings are available in our general purpose relay family. Minimum contact pressures of 25 grams are maintained on the smaller relays while the larger power relays perform at upwards of 200 grams contact pressure. Standard contacts are made of Silver Cadmium Oxide for low resistance qualities and then gold flashed to prevent corrosion and retard pitting which generally occurs with inductive loads.

### SERIES 250



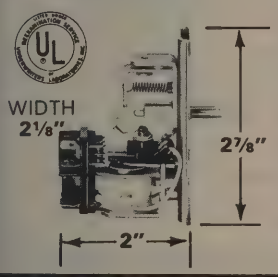

ELECTRICAL CHARACTERISTICS: CONTACTS: Rated at 25 amps @ 120-240 VAC resistive and 1 HP @ 120-240 VAC. ACTION: SPST Normally open, double break. OPERATING VOLTAGES: 6, 12, 24, 115, 203 VAC; 6, 12, 24, 110 VDC. TERMINALS: 1/4" quick connect for contacts, 3/16" quick connect for coil. MOUNTING: Frame drilled and tapped for one (1) 6-32 screw and locating tab. Optional with 5/16" X 6-32 stud and w/o locating tab. SPECIAL: Available with 5 amps SPDT auxiliary switch.

### SERIES 630



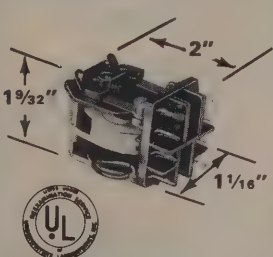

ELECTRICAL CHARACTERISTICS: CONTACTS: Rated at 15 amps. 120V 60 Hz. resistive using gold plated silver contacts as standard. ACTION: DPDT thru 5PDT. OPERATING VOLTAGES: 6, 12, 24, 48, 115, 230 VAC; 3, 6, 12, 24, 48, 110 VDC. TERMINALS: Solder or screw type. MOUNTING: Frame drilled and tapped for four (4) 6-32 screws. SPECIAL: Available in ST normally open or normally closed action. Also provided in 8, 12, and 18 pin Jones Plug or 8, 12 and 20 pin octal type plug.

### SERIES 218




ELECTRICAL CHARACTERISTICS: CONTACTS: Rated at 5 or 10 amps using silver cadmium oxide as standard. ACTION: SPST thru 3PDT. OPERATING VOLTAGES: 6, 12, 24, 115, 230 VAC; 5, 6, 24, 110 VDC. TERMINALS: Combination 3/16" quick connect, or solder, or printed circuit type. MOUNTING: 2 holes 10-32 tapped in front plate as shown or 6-32 tapped hole in base of relay. APPLICATION: This relay is typically used in safety circuits and unit shutdown circuits where a pulse to the coil will operate the relay and then the unit bar to be released manually through the reset button.

### SERIES 210



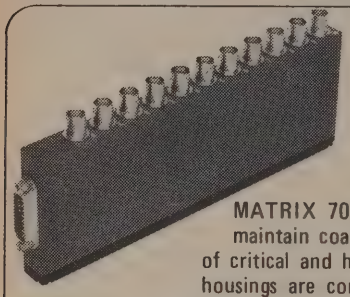

ELECTRICAL CHARACTERISTICS: CONTACTS: Rated at 5 or 10 amps using silver cadmium oxide as standard. U/L approved. ACTION: SPOT thru 3PDT. OPERATING VOLTAGES: 6, 12, 24, 115, 230 VAC; 6, 12, 24, 110 VDC. TERMINALS: Tab, solder, or printed circuit type. MOUNTING: Frame drilled and tapped for one (1) 6-32 screw and locating tab. Optional with 5/16" X 6-32 stud and w/o locating tab. SPECIAL: Available with SPST normally open or normally closed action. Also available as a manual reset or latching relay. Special plate circuit coils can be provided.

**Liberty Controls, Inc. 500 Brookforest Avenue, Shorewood, Illinois 60431 815/725-2241**

**MATRIX**
SYSTEMS CORPORATION
9411 Lurline Avenue • Chatsworth, California 91311
(213) 882-2008

SEE OUR OTHER PRODUCTS IN SECTION 3450 PAGE 2874

# COAXIAL SWITCH MODULE



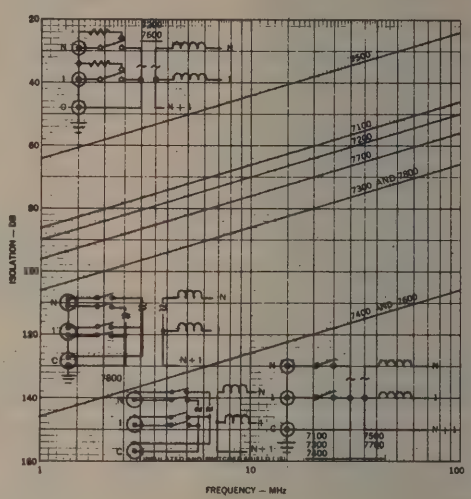
## FEATURES

- Two to twenty throws
- Continuous shield continuity
- Rugged machined aluminum housing
- Crosstalk always less than isolation
- Switchpoints individually field replaceable
- Extremely low EMI
- Low VSWR
- Matrix configuration easily assembled using 9000 series cross straps
- Signal circuits isolated from control circuitry

MATRIX 7000 Series Switch Modules are designed to maintain coaxial switching continuity over a wide range of critical and high environmental applications. The switch housings are constructed on precision machined aluminum alloy for structural integrity and hard anodized for durability. All signal shield paths are silver plated with covers gasketed for maximum EMI protection. The basic reed switch elements are hermetically sealed in nitrogen filled gas envelopes and employ rhodium plated contacts to insure non-stick operation. Applications for MATRIX 7000 Series include:

- R.F. and I.F. switching where a low VSWR is required.
- CCTV, base band video and pulse switching where low phase distortion and high pulse fidelity are required.
- Applications requiring a high degree of shielding integrity and low contact and induced noise such as pre amp input switching or the switching of high impedance operational amplifier inputs.

Matrix and hybrid switching systems are easily constructed by using Series 9000 (no output), 9100 (one output) or 9200 (two output) push-on cross straps which mate with the BNC connectors on the switch modules. The cross strap output connectors are BNC female type UG 1094/U. The model number of the cross strap is assigned by replacing the two zeros of the series number with the number of inputs desired. For example, a Model 9108 has eight inputs and one output.




## SERIES 7000

| | |
|---|---|
| 7100 – | Standard |
| 7200 – | Self-terminating |
| 7300 – | High isolation |
| 7400 – | Highest isolation |
| 7500 – | High power |
| 7600 – | Highest isolation self-terminating |
| 7700 – | Mercury wetted contacts |
| 7800 – | Twinax |

## MODEL NUMBER ASSIGNMENT

7 X XX – X

- Series
- Number of throws
- Coil suppression diodes – D
- TNC connectors – T
- Self-terminating resistance – ohms
- Insulated shield – I
- Insulated and switched shield – IS
- Expander output – E

Any of the above options may be combined

## SPECIFICATIONS

| | |
|---|---|
| FREQUENCY RANGE: | 0 - 300 MHz |
| CHARACTERISTIC IMPEDANCE: | 50 ohms - 75 ohm optional |
| SWITCHING CONFIGURATION: | Single or double pole, two thru twenty throws |
| SWITCHING SPEED: | Less than one millisecond |
| ISOLATION: | See graph |
| CONTROL - CONNECTOR: | 28 VDC, 30 MA D type - subminiature connector |
| SIGNAL CONNECTOR: | BNC - UG 1094/U, TNC optional |
| OPERATING TEMPERATURE AND HUMIDITY RANGE: | – 30°F to + 150°F, 0 to 98 percent R.H. |
| OPERATING SHOCK AND VIBRATION: | 50 G's - 1 MS, 2 G's p-p 20-2000 Hz |
| DIMENSIONS: | .625" W x 3.25" H x 1.44" + .625" x Number of throws |
| MOUNTING: | Three 6-32 tapped holes in base |

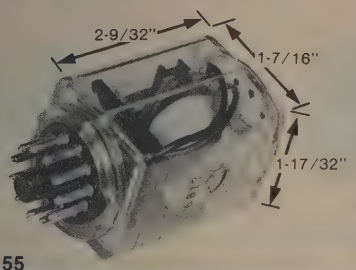
| | 7100 | 7200 | 7300 | 7400 | 7500 | 7600 | 7700 | 7800 |
|---|---|---|---|---|---|---|---|---|
| CONTACT RATING: | 100 vdc .250 amp 10 W | 28 vdc .250 amp 3W | 100 vdc .250 amp 10 W | 28 vdc .250 amp 3 W | 400 vdc 1 amp 15 W | 28 vdc .250 amp 3 W | 100 vdc 1.0 amp 28 W | 100 vdc .250 amp 10 W |
| CONTACT RESISTANCE: | .150ohm | .300ohm | .300ohm | .300ohm | .060ohm | .300ohm | .050ohm | .300ohm |

Matrix System Corporation manufactures a variety of Switching Devices. Whether you are Switching VHF, Video, Pulse or Audio or your control requirements are programmable or manual. Give us a call. We specialize in specials. (213) 882-2008

THE TOTAL RELAY COMPANY

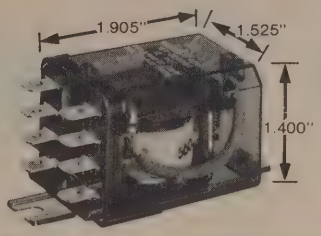
# MIDTEX INCORPORATED

Industrial Relays
Mercury-Wetted Relays
Time Delay Relays
Coaxial Relays
General Purpose Relays
Reed Relays
Solid State Relays
Microinterface Modules
Synchronous Motor Timers



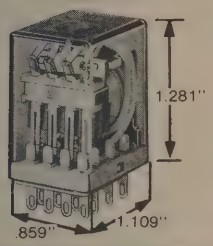

155

An octal plug-in relay available in SPDT, DPDT or 3 PDT with 5 and 10 amp contact ratings. Various coil voltages available also.



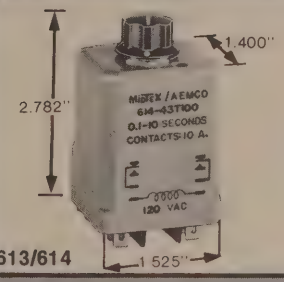

187

DPDT relay rated at 20 amps. Similar in size to the 157 and available with enclosed or open style stud mount. ¼" quick connects.



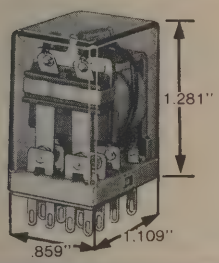

156

4 PDT relay available in 3 and 5 amp. contacts and various coil voltages. Also available in hermetically sealed version.



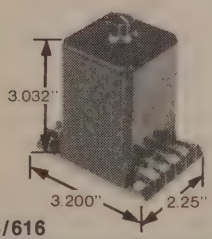

613/614

A DPDT time delay relay utilizing either the 157 or 187. Internal time delay available from 0.1 to 300 Sec.



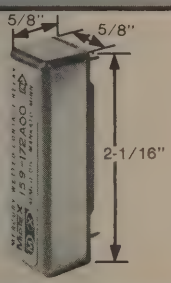

158

A miniature SPDT or DPDT relay available in 5 and 10 amp. contact ratings with various AC and DC coil voltages.



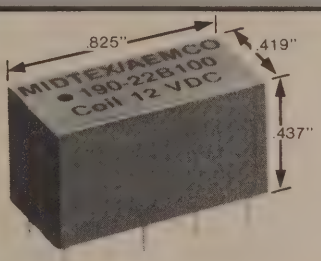

615/616

A DPDT or 3 PDT octal plug-in time delay relay. 10 amps contact rating. 1.0 to 300 Sec. delay of interval are standard options.



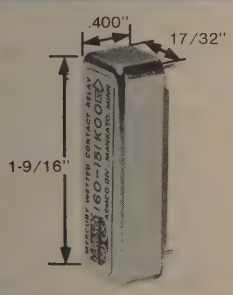

159

A mercury-wetted contact relay with extremely long life. Available with Form C or Form D contacts and various DC voltages.




190

Dual-in-Line Package Power Relay with 2 DPDT gold alloy contacts rated at 2 amps, 28 VDC, or 120 VAC, resistive. Excellent low level switching performance.




160

Similar to the 159 relay but smaller in size, this relay has extremely long life and is available with Form C or Form D contacts and various DC voltages.

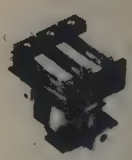
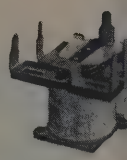
For further information or engineering assistance, call
507 625-6521

For a catalog with detailed specifications, please indicate below the one you wish to receive.

☐ Reed Catalog ☐ Mercury Catalog
☐ Industrial Relay Catalog

**MIDTEX, INC.**
**1650 TOWER BLVD. / NORTH MANKATO, MN 56001 / (507) 625-6521 / TWX 901-565-2244**

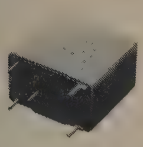
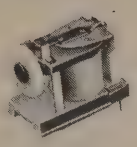
# GUIDE TO GENERAL PURPOSE

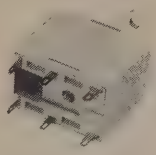



| SERIES | | | 10 | 12 | 13 | 14 | 19 |
|---|---|---|---|---|---|---|---|
| CONTACTS | | FORM<br>AMPS<br>VOLTS | SPDT<br>3<br>28DC | 1-3PDT<br>10<br>28DC/115AC | 1-3PDT<br>6 or 10<br>28DC/115AC | 1-3PDT<br>10<br>28DC/115AC | SPDT<br>10<br>28DC/115AC |
| NOMINAL OPERATING VOLTAGES & DC COIL RESISTANCE (ohms) (SPDT CONTACT ARRANGEMENT) | A C | 6<br>12<br>24<br>115<br>230 | N/A | 6<br>21<br>75<br>2250<br>9100 | 6<br>21<br>75<br>2250<br>9100 | 2.5<br>10<br>36<br>1000<br>4000 | N/A |
| | D C | 3<br>6<br>12<br>24<br>26.5<br>48<br>110 | 107<br>440<br>1760<br>7000<br>—<br>—<br>— | —<br>32<br>120<br>472<br>—<br>1800<br>10000 | —<br>32<br>120<br>472<br>—<br>1800<br>10000 | —<br>32<br>120<br>472<br>—<br>1800<br>10000 | 27<br>107<br>440<br>1760<br>—<br>—<br>— |
| TERMINALS | | SOLDER<br>PC<br>OCTAL PLUG | X<br>X<br>— | X<br>X<br>See Note | X<br>X<br>X | X<br>—<br>See Note | X<br>X<br>— |
| MAX. OPERATE TIME (ms) | | | 10 | 15 | 15 | 15 | 15 |
| MAX. RELEASE TIME (ms) | | | 5 | 10 | 10 | 10 | 5 |
| MINIMUM LIFE (Operations) | | | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 |
| DIELECTRIC STRENGTH (VRMS min.) | | | 1000 | 1250 | 1250 | 1250 | 1000 |
| TEMPERATURE RANGE | | | −55°C<br>TO<br>+85°C | −45°C<br>TO<br>+85°C | −45°C<br>TO<br>+85°C | −45°C<br>TO<br>+85°C | −55°C<br>TO<br>+85°C |
| WEIGHT (ozs.) | | WITH COVER<br>WITHOUT COVER | N/A<br>1 | 3.0<br>2.5 | 3.0<br>2.0 | N/A<br>2.5 | N/A<br>1.0 |
| HERMETICALLY SEALED | | | NO | NO | NO | NO | NO |
| PHYSICAL SIZE (inches) | | L<br>x<br>W<br>x<br>H | 1.031<br>X<br>1.062<br>X<br>.968 | 1.531<br>X<br>1.406<br>X<br>2.206 | 1.375<br>X<br>1.375<br>X<br>2.187 | 1.750<br>X<br>1.281<br>X<br>1.406 | 1.187<br>X<br>1.137<br>X<br>1.162 |
| U/L RECOGNIZED | | | YES | YES | YES | PENDING | NO |

NOTE: .1875" Faston Connector used in Series 12, 14 and 32
.110" x .025 Faston Connector (Contacts) — Series 39
.110" x .016 Faston Connector (Coils) — Series 39
Two #8-32 and two #6-32 Screw Terminals — Series 512
.250 x .032 and 2.187 x .032 Quick Connect Terminals — Series 513

# AND MILITARY RELAYS



| 27 | 28 | 29 | 38 | 39 | 54 | 57 | 07 |
|---|---|---|---|---|---|---|---|
| SPDT<br>3<br>28DC/115AC | SPDT<br>3 to 10<br>28DC/115AC | SP<br>3 or 10<br>28DC/115AC | DPDT<br>3<br>28DC/115AC | 2PNO<br>or DT<br>10<br>28DC/115AC | 2-4PDT<br>3 to 10<br>28DC<br>115/400AC | 2-4PDT<br>3-10<br>28DC<br>115/400AC | DPDT<br>10<br>28DC<br>115/400AC |
| N/A | N/A | N/A | N/A | N/A | N/A | N/A | —<br>—<br>—<br>1200<br>— |
| 13<br>50<br>200<br>800<br>—<br>—<br>— | 107<br>440<br>1760<br>7000<br>—<br>—<br>— | 27<br>107<br>440<br>1760<br>—<br>—<br>— | 26<br>102<br>410<br>1640<br>—<br>—<br>— | 11<br>44<br>175<br>700<br>—<br>—<br>— | —<br>27<br>108<br>—<br>430<br>1800<br>7200 | —<br>28<br>111<br>—<br>450<br>1750<br>9100 | —<br>19<br>75<br>—<br>300<br>1200<br>7600 @ 120VDC |
| —<br>X<br>— | —<br>X<br>— | —<br>X<br>— | —<br>X<br>— | X<br>—<br>See Note | X<br>X<br>— | X<br>—<br>X | X<br>X<br>— |
| 10 | 10 | 20 | 15 | 15 | 15 | 25 | 10 |
| 5 | 5 | 20 | 5 | 10 | 10 | 10 | 10 |
| 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 |
| 1000 | 1000 | 1000 | 500 | 1500 | 1000 | 1000 | 1000 |
| −45°C<br>TO<br>+85°C | −55°C<br>TO<br>+85°C | −55°C<br>TO<br>+85°C | −55°C<br>TO<br>+85°C | −45°C<br>TO<br>+85°C | −55°C<br>TO<br>+85°C | −55 C<br>TO<br>+85 C | −55°C<br>TO<br>+125°C |
| 0.5<br>N/A | 1.0<br>N/A | 1.2<br>N/A | 1.0<br>N/A | 2<br>N/A | 3.5<br>1.7 | 5<br>3 | 1.3<br>— |
| NO | NO | NO | NO | NO | YES | YES | YES |
| .97<br>X<br>.67<br>X<br>.81 | 1.219<br>X<br>.755<br>X<br>1.188 | 1.460<br>X<br>.785<br>X<br>1.188 | 1.219<br>X<br>.781<br>X<br>1.188 | 1.609<br>X<br>1.093<br>X<br>1.407 | 1.922<br>X<br>1.344<br>X<br>.953 | 1.438<br>X<br>1.656<br>X<br>2.984 | 1.010<br>X<br>1.015<br>X<br>.525 |
| YES | YES | YES | YES | SOME<br>MODELS | NO | NO | NO |

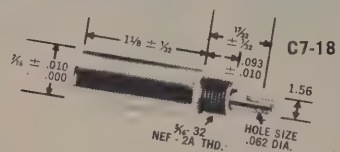
Additional data and literature on request. Write today.

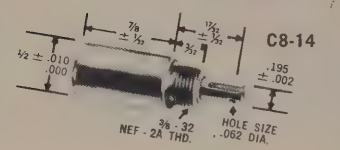
NORTH AMERICAN PHILIPS CONTROLS CORP.

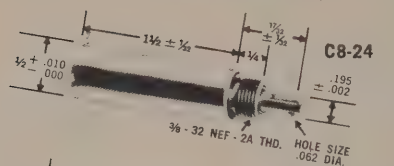
Frederick, Md. 21701 • (301) 663-5141

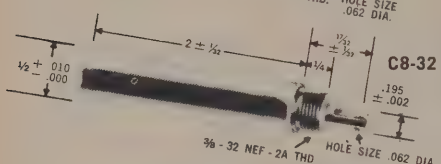
**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

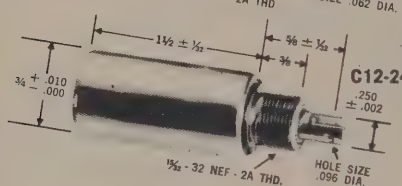
# TUBULAR SOLENOIDS

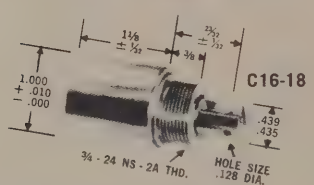


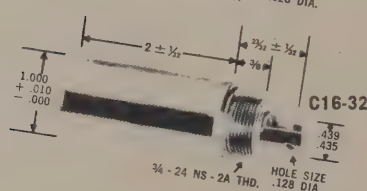



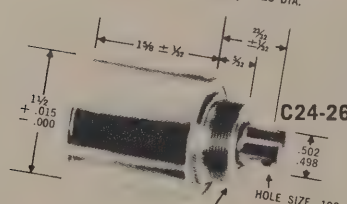



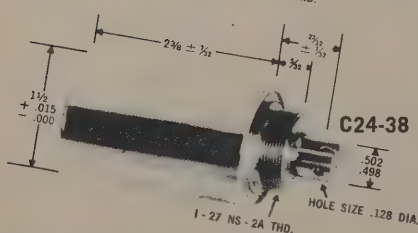




## NINE SIZES—PRECISION BUILT USING HIGH-GRADE STEEL IN ALL PARTS OF THE MAGNETIC CIRCUIT

They mount conveniently — only a single hole required. Complete with nut and lockwasher.

## DESIGNED FOR A VARIETY OF APPLICATIONS IN:

- Card-punch Machines
- Tape Recorders (Industrial Control)
- Impacting Devices
- Typesetting Machines
- Cash Registers
- Money Changer Machines
- Sorting Machines
- Reproduction (Copy Equipment)
- Phototype Machines
- Food, Materials Process Control
- Packaging Machines
- Data Processing and Peripheral equipment

| Part Number | Duty Cycle | Voltage | Resistance (ohms) | Coil Pwr. (W) | Pull in Ounces | | | | | | Wt. (oz.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Holding | 1/8" | 1/4" | 3/8" | 1/2" | 3/4" | |
| C7-18C24DC-AY | Cont. | 24 VDC | 241 | 2.5 | 17.5 | 1.25 | .375 | .125 | — | — | ½ |
| C7-181024DC-AY | 10% | 24 VDC | 20 | 25 | 26.5 | 6.75 | 4.25 | 3.5 | 2.25 | — | ½ |
| C8-14C24DC-AY | Cont. | 24 VDC | 205 | 2.8 | 21 | 1 | .125 | — | — | — | ¾ |
| C8-141024DC-AY | 10% | 24 VDC | 19 | 28 | 39.5 | 11.5 | 3.5 | 1 | — | — | ¾ |
| C8-24C24DC-AY | Cont. | 24 VDC | 205 | 2.8 | 24 | 1.5 | .625 | .5 | .25 | — | 1 |
| C8-241024DC-AY | 10% | 24 VDC | 21 | 28 | 37 | 8 | 4.5 | 4.5 | 4.5 | 2.25 | 1 |
| C8-32C24DC-AY | Cont. | 24 VDC | 126 | 4.4 | 23 | 2.125 | 1.25 | 1.125 | 1.125 | 1 | 1½ |
| C8-321024DC-AY | 10% | 24 VDC | 13.5 | 44 | 33 | 3.5 | 5.5 | 5.37 | 5.25 | 5.25 | 1½ |
| C12-24C24DC-AY | Cont. | 24 VDC | 186 | 3 | 44 | 3.75 | 1.25 | .5 | .375 | — | 2 |
| C12-241024DC-AY | 10% | 24 VDC | 20.5 | 30 | 62 | 20 | 13 | 11.5 | 8.5 | 3.5 | 2 |
| C16-18C24DC-AY | Cont. | 24 VDC | 117 | 5.3 | 93 | 9.5 | 3 | .625 | — | — | 3½ |
| C16-181024DC-AY | 10% | 24 VDC | 12 | 53 | 149 | 76 | 38 | 19 | 9 | 1 | 3½ |
| C16-32C24DC-AY | Cont. | 24 VDC | 79 | 7.2 | 99 | 20 | 9.25 | 4.75 | 3.5 | 15 | 5½ |
| C16-321024DC-AY | 10% | 24 VDC | 9 | 72 | 155 | 80 | 56 | 42.5 | 36.5 | 28.5 | 5½ |
| C24-26C24DC-AY | Cont. | 24 VDC | 76 | 8.2 | 197 | 33 | 13.5 | 7 | 2.75 | — | 10 |
| C24-261024DC-AY | 10% | 24 VDC | 7 | 82 | 260 | 177 | 128 | 80 | 49 | 18 | 10 |
| C24-38C24DC-AY | Cont. | 24 VDC | 58 | 10 | 188 | 69 | 32 | 19 | 12.5 | 6.5 | 15 |
| C24-381024DC-AY | 10% | 24 VDC | 5.4 | 100 | 254 | 190 | 150 | 119 | 96 | 72 | 15 |

NOTES:
1. Solenoids shown in energized position.
2. Push force approximately 90% of pull forces shown.

## SLOT SIZES

**C7-18**
.062 WIDE
¼ DEEP

**C8-14**
.062 WIDE
5/16 DEEP

**C8-24**
.062 WIDE
5/16 DEEP

**C8-32**
.062 WIDE
5/16 DEEP

**C12-24**
3/32 ± .010 WIDE
9/32 ± .010 DEEP

**C16-18**
.187 ± .010 WIDE
.468 ± .010 DEEP

**C16-32**
.187 ± .010 WIDE
.468 ± .010 DEEP

**C24-26**
.187 ± .010 WIDE
½ DEEP

**C24-38**
.187 ± .010 WIDE
½ DEEP

ALL SOLENOIDS SHOWN AVAILABLE IN PUSH TYPE.
CONTACT DISTRIBUTOR FOR AVAILABILITY OF STOCK.

# BOX FRAME SOLENOIDS

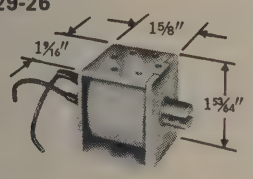
## 3/16" COIL TERMINALS STANDARD. LEADS AVAILABLE ON REQUEST

Oak box frame solenoids use high grade steel in all parts of the magnetic circuit. Carefully controlled annealing, after all machining operations are completed, assures maximum efficiency. The frame is dovetailed and staked to the end plate, adding mechanical strength and increasing the performance of the magnetic circuit. Plungers and plunger stops, which are made of annealed and specially processed steel, are available in three standard types for specific operating requirements.

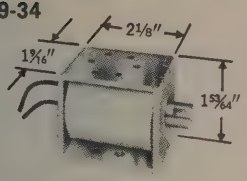
| TYPE (FORMERLY) | B-829-26 (38) | | | | B-829-34 (39) | | | | B-829-42 (40) | | | | B-720-20 (41) | | | | B-720-32 (42) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WEIGHT (oz.) | 12.5 | | 13 | | 16 | | 16.5 | | 20 | | 20 | | 4.5 | | 4.75 | | 6.5 | | 7 | |
| VOLTAGE | A.C. | | D.C. | | A.C. | | D.C. | | A.C. | | D.C. | | A.C. | | D.C. | | A.C. | | D.C. | |
| STANDARD PLUNGER | Style AX | | Style AY | | Style AX | | Style AY | | Style AX | | Style AY | | Style AX | | Style AU | | Style AX | | Style AU | |
| DUTY CYCLE | Cont. | 25% | Cont. | 25% | Cont. | 25% | Cont. | 25% | Cont. | 25% | Cont. | 25% | Cont. | 25% | Cont. | 25% | Cont. | 25% | Cont. | 25% |
| POWER DISSIPATION | 13 VA | 67 VA | 7.9 Watts | 31.5 Watts | 13 VA | 68.6 VA | 8.7 Watts | 34.8 Watts | 12 VA | 65.5 VA | 10.8 Watts | 43.2 Watts | 9.4 VA | 44.4 VA | 7.9 Watts | 31.5 Watts | 17.9 VA | 101 VA | 7.3 Watts | 29.4 Watts |
| HOLDING FORCE | 35 | 88 | 190 | 238 | 30 | 81 | 192 | 249 | 25 | 75 | 195 | 227 | 24 | 55 | 175 | 192 | 40 | 79.5 | 123 | 197 |
| PULL @ 1/8" | 24.5 | 75 | 56 | 154 | 18 | 67 | 73 | 159 | 12 | 52 | 80 | 150 | 12 | 45 | 19 | 62 | 24 | 70 | 26 | 70 |
| PULL @ 1/4" | 14.5 | 57 | 22 | 84 | 12.5 | 51 | 31.5 | 100 | 7 | 37.5 | 45 | 117 | 7 | 32 | 10 | 39 | 16 | 60 | 14 | 46 |
| PULL @ 3/8" | 11.5 | 45 | 11 | 45 | 11 | 44 | 17 | 64 | 6 | 29 | 24 | 82 | 4 | 21 | 4 | 23 | 13.5 | 45 | 8.5 | 31 |
| PULL @ 1/2" | 9 | 37 | 5 | 24 | 10 | 41 | 9.5 | 39 | 5.7 | 27.5 | 16 | 61 | 1.5 | 10 | 1.5 | 12 | 12 | 42 | 4 | 20 |
| PULL @ 3/4" | 1.5 | 10 | .5 | 6 | 9.5 | 39 | 4 | 20 | 5.5 | 26.5 | 7 | 36 | — | — | — | 1 | 7 | 30 | .5 | 7 |

ALL PULL FORCES IN (oz.)

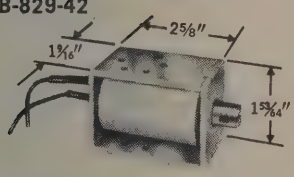
TYPE B-829-26



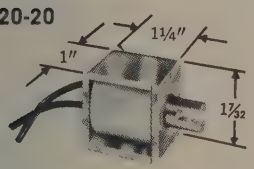

TYPE B-829-34



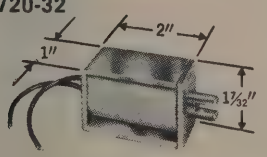

TYPE B-829-42



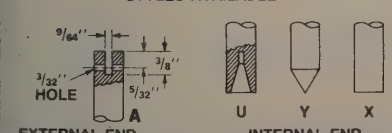

TYPE B-720-20




TYPE B-720-32




STANDARD PLUNGER STYLES AVAILABLE




### A.C. SOLENOIDS

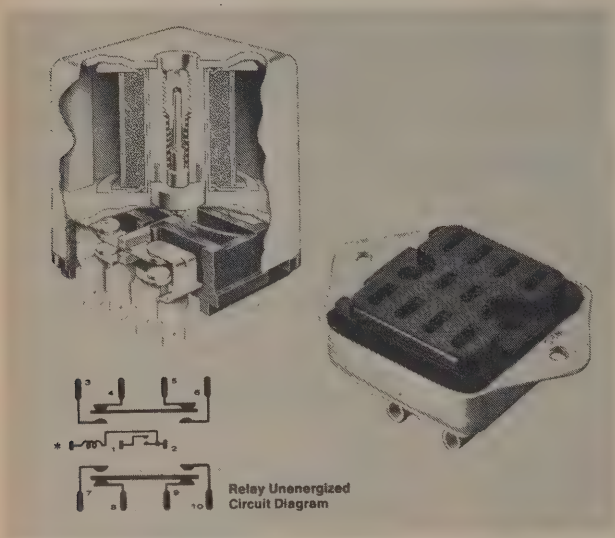
| Solenoid Part No. | Coil Resist. (ohms) | Duty Cycle/Voltage Cont. | Duty Cycle/Voltage 25% |
|---|---|---|---|
| **TYPE B-829-26 (Formerly Type 38)** | | | |
| B-829-26-17A-AX | .282 | 6 VAC | 12 VAC |
| B-829-26-20A-AX | 1.13 | 12 | 24 |
| B-829-26-23A-AX | 4.83 | 24 | 48 |
| B-829-26-26A-AX | 18.2 | 48 | 96 |
| B-829-26-30A-AX | 123 | 120 | 240 |
| **TYPE B-829-34 (Formerly Type 39)** | | | |
| B-829-34-16A-AX | .288 | 6 VAC | 12 VAC |
| B-829-34-19A-AX | 1.15 | 12 | 24 |
| B-829-34-22A-AX | 4.22 | 24 | 48 |
| B-829-34-25A-AX | 16.1 | 48 | 96 |
| B-829-34-29A-AX | 97.7 | 120 | 240 |
| **TYPE B-829-42 (Formerly Type 40)** | | | |
| B-829-42-15A-AX | .209 | 6 VAC | 12 VAC |
| B-829-42-18A-AX | .837 | 12 | 24 |
| B-829-42-21A-AX | 3.34 | 24 | 48 |
| B-829-42-24A-AX | 13.4 | 48 | 96 |
| B-829-42-28A-AX | 86.4 | 120 | 240 |
| **TYPE B-720-20 (Formerly Type 41)** | | | |
| B-720-20-23A-AX | 1.115 | 6 VAC | 12 VAC |
| B-720-20-26A-AX | 4.82 | 12 | 24 |
| B-720-20-29A-AX | 17.5 | 24 | 48 |
| B-720-20-32A-AX | 74.5 | 48 | 96 |
| B-720-20-36A-AX | 452 | 120 | 240 |
| **TYPE B-720-32 (Formerly Type 42)** | | | |
| B-720-32-19A-AX | .362 | 6 VAC | 12 VAC |
| B-720-32-22A-AX | 1.45 | 12 | 24 |
| B-720-32-25A-AX | 4.92 | 24 | 48 |
| B-720-32-28A-AX | 19.4 | 48 | 96 |
| B-720-32-32A-AX | 132 | 120 | 240 |

### D.C. SOLENOIDS

| Solenoid Part No. | Coil Resist. (ohms) | Duty Cycle/Voltage Cont. | Duty Cycle/Voltage 25% |
|---|---|---|---|
| B-829-26-23D-AY | 4.83 | 6 VDC | 12 VAC |
| B-829-26-26D-AY | 18.2 | 12 | 24 |
| B-829-26-29D-AY | 71.6 | 24 | 48 |
| B-829-26-32D-AY | 282 | 48 | 96 |
| B-829-26-36D-AY | 1908 | 120 | 240 |
| B-829-34-22D-AY | 4.22 | 6 VDC | 12 VDC |
| B-829-34-25D-AY | 16.1 | 12 | 24 |
| B-829-34-28D-AY | 67.3 | 24 | 48 |
| B-829-34-31D-AY | 261 | 48 | 96 |
| B-829-34-35D-AY | 1656 | 120 | 240 |
| B-829-42-21D-AY | 3.34 | 6 VDC | 12 VDC |
| B-829-42-24D-AY | 13.4 | 12 | 24 |
| B 829-42-27D-AY | 53 | 24 | 48 |
| B-829-42-30D-AY | 215 | 48 | 96 |
| B-829-42-34D-AY | 1321 | 120 | 240 |
| B-720-20-26D-AU | 4.82 | 6 VDC | 12 VDC |
| B-720-20-29D-AU | 17.5 | 12 | 24 |
| B-720-20-32D-AU | 74.5 | 24 | 48 |
| B-720-20-35D-AU | 286 | 48 | 96 |
| B-720-20-39D-AU | 1913 | 120 | 240 |
| B-720-32-25D-AU | 4.92 | 6 VDC | 12 VDC |
| B-720-32-28D-AU | 19.4 | 12 | 24 |
| B-720-32-31D-AU | 79 | 24 | 48 |
| B-720-32-34D-AU | 308 | 48 | 96 |
| B-720-32-38D-AU | 1995 | 120 | 240 |

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# TYPE W POWER/LOW LEVEL RELAYS




## GENERAL DESCRIPTION:

The Series W is patented, U.S. patent #2907848, and is available with socket for plug-in applications or for use without socket with standard quick-connect terminals for simplicity and ease in wiring. Rated for 1 and 2 HP motor loads, it offers high quality, dependable performance and long life. These relays are ideal for use in copy machines, appliances, automation equipment, motor starting and heater circuits, clock controlled systems, laundry equipment, vending machines, machine tools, furnace controls, panel boards and air conditioners. Not recommended for use in switching loads less than 10% of the A.C. contact rating. For applications below this level use low level contact or a combination of low and power contacts. (On combination low level and power contacts, low level contacts are numbered 3, 4, 5 and 6 on switch.)

## TO ORDER SHOW THE FOLLOWING:

W(H)* U L† 115 A 3 (R) ___

- W(H)* — Type
- U — UL Recognized
- L† — Low-Level Contact
- 115 — Nominal Voltage
- A — D-DC Volts or A-AC Volts
- 3 — Mounting Type (See Description below)
- (R) — Denotes Internal Rectification Option
- ___ — State Any Special Features Required

* Denotes holding circuit option
† Omit for Power Level Contacts

## SPECIFICATIONS

**CONTACT ARRANGEMENT:** 2 X's, 2 Y's, 2 Z's or 1 X, 1 Y, 1Z and combinations thereof

**CONTACT MATERIAL:** Silver (Standard) Silver Cadmium Oxide or Gold Plated (Optional)

**LIFE EXPECTANCY AND CONTACT RATING:** Based upon 10% duty cycle 1 Sec. ON, 9 Sec. OFF

**POWER LEVEL:** 10,000,000 Mechanical
100,000 Min. at the following electrical loads —
25 Amps Resistive at 120 VAC or 277 VAC
25 Amps Inductive at 120 VAC @ .75 P.F.
25 Amps Resistive at 28 VDC
12.5 Amps Inductive at 277 VAC @ .75 P.F.
1 H.P. 120 VAC (96 Amps Locked Rotor 60 Hz)
2 H.P. 277 VAC (72 Amps Locked Rotor 60 Hz)

**LOW LEVEL:** 10,000,000 Mechanical
1,000,000 —
7 Amps Resistive @ 120 VAC
5 Amps Resistive @ 24 VDC
500,000 —
10 Amps Resistive @ 120 VAC
7 Amps Resistive @ 24 VDC
3 Amps Inductive at 120 VAC @ .50 P.F.
100,000 Min. —
⅛ H.P. 120 VAC (22.8 Amps Locked Rotor 60 Hz)
⅛ H.P. 277 VAC (11.4) Amps Locked Rotor 60 Hz)
2,000,000 Min. —
10 Ma. @ 120 VAC
50 Ma @ 24 VDC

**AMBIENT TEMPERATURE:** −55°C to +40°C

**TERMINALS:** Spade type — ¼" x .032 standard

**MOUNTING:** Stud or panel

**DIELECTRIC STRENGTH:** 1500 Volts RMS

**INSULATION RESISTANCE:** 100 megohms minimum

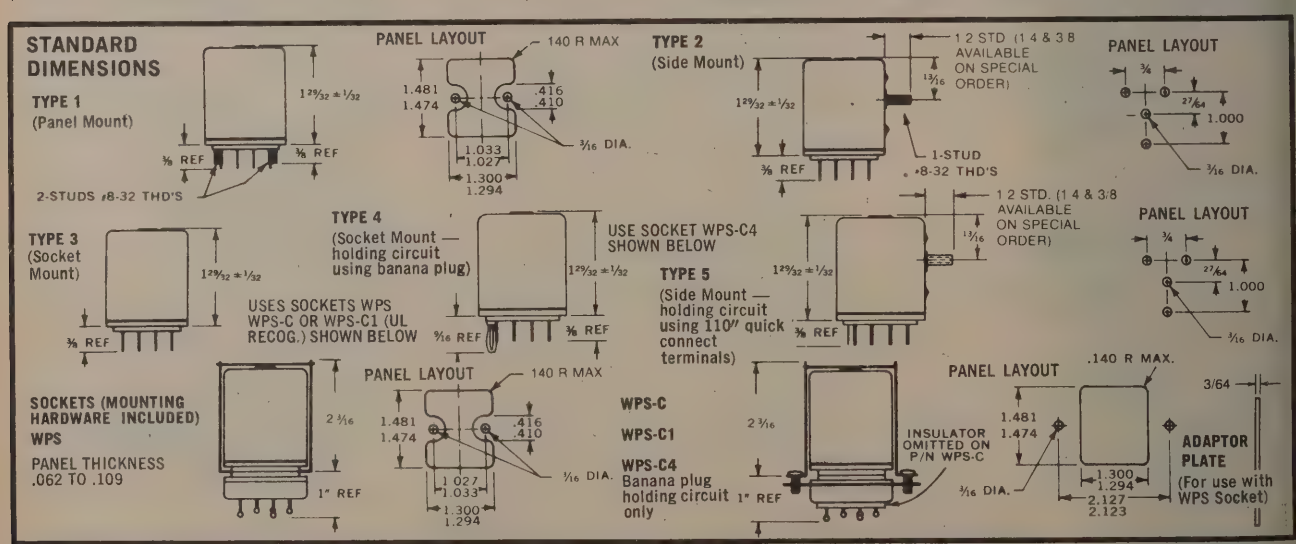
**OPERATING VOLTAGE:** (at 25 C) D.C. — 75% of Nominal; A.C. — 85% of Nominal

**OPERATE & RELEASE TIME:** 25 ms Nominal

**COIL DISSIPATION (APPROX.):** D.C. — 2.5W; A.C. — 7.5 VA (inrush 15 VA)

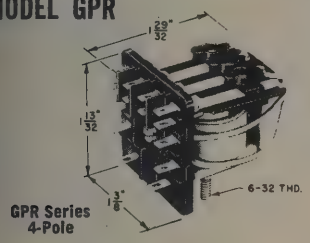
## STANDARD PART NUMBERS AVAILABLE THROUGH OAK DISTRIBUTORS

| Part No. | Coil Nominal Volts | Coil Ohms | Mounting | Socket Type |
|---|---|---|---|---|
| WU012D2-253 | 12 VDC | 50 | 2 | (Stud Mounted) |
| WU012D3-159 | 12 VDC | 50 | 3 | WPS-C1 |
| WU024D2-281 | 24 VDC | 200 | 2 | (Stud Mounted) |
| WU024D3-128 | 24 VDC | 200 | 3 | WPS-C1 |
| WU012A2-246 | 12 VAC | 4 | 2 | (Stud Mounted) |
| WU012A3-293 | 12 VAC | 4 | 3 | WPS-C1 |
| WU024A2-161 | 24 VAC | 14 | 2 | (Stud Mounted) |
| WU024A3-295 | 24 VAC | 14 | 3 | WPS-C1 |
| WU115A2-141 | 115 VAC | 250 | 2 | (Stud Mounted) |
| WU115A3-099 | 115 VAC | 250 | 3 | WPS-C1 |
| WU220A2-140 | 220 VAC | 1000 | 2 | (Stud Mounted) |
| WU220A3-108 | 220 VAC | 1000 | 3 | WPS-C1 |
| WHU115A4-367 | 115 VAC | 250 | 4 | WPS-C4 |
| WHU220A4-326 | 220 VAC | 1000 | 4 | WPS-C4 |


STANDARD DIMENSIONS
TYPE 1 (Panel Mount)
2-STUDS #8-32 THD'S
PANEL LAYOUT
140 R MAX
TYPE 2 (Side Mount)
1-STUD #8-32 THD'S
1 2 STD. (1 4 & 3 8 AVAILABLE ON SPECIAL ORDER)
TYPE 3 (Socket Mount)
TYPE 4 (Socket Mount — holding circuit using banana plug)
USE SOCKET WPS-C4 SHOWN BELOW
USES SOCKETS WPS WPS-C OR WPS-C1 (UL RECOG.) SHOWN BELOW
TYPE 5 (Side Mount — holding circuit using 110" quick connect terminals)
SOCKETS (MOUNTING HARDWARE INCLUDED)
WPS
PANEL THICKNESS .062 TO .109
WPS-C
WPS-C1
WPS-C4 Banana plug holding circuit only
INSULATOR OMITTED ON P/N WPS-C
.140 R MAX.
ADAPTOR PLATE (For use with WPS Socket)

# OHMITE® electro-mechanical relays

## MODEL GPR

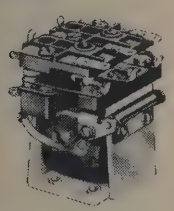


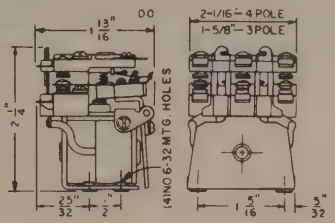
GPR Series 4-Pole

For Octal Plug GPR Series

Simple, rugged, low cost relays handling substantial power for small size. Uncomplicated design provides unusual flexibility for making and changing connection and mounting.

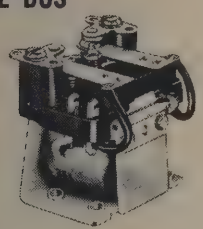
## MODEL DO

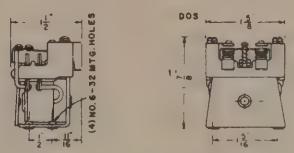





Particularly adaptable to aircraft and mobile equipment applications where severe shock and vibration are encountered. Design of molded parts around contact arms protects against mechanical injury. Stocked in 3-pole or 4-pole type, and also in hermetic enclosures and in latching types.

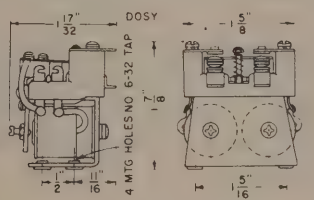
## MODEL DOS






Wide application, general purpose relay, compact and lightweight. Handles loads usually demanded of much larger relays. Meets rigorous aircraft relay standards.

## SENSITIVE MODEL DOSY




Similar in construction to Model DOS relay but equipped with twin coils for increased sensitivity. The DOSY relay is adaptable to a wide range of electronic control applications such as plate circuit controls, or as overload or underload controls in D.C. circuits to signal attainment of predetermined current levels.

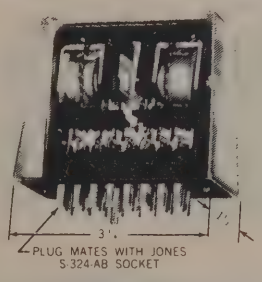
## SPECIFICATIONS

| Model | Coil Data | | | | |
|---|---|---|---|---|---|
| | GPR | DO | DOS | GPR Latching | DOSY |
| 6 VAC | .334-650 Amps | 2.33 Amps | .890 Amps | .650 Amps | |
| 12 VAC | .167-.309 Amps | 1.28 Amps | .460 Amps | .309 Amps | |
| 24 VAC | .084-.155 Amps | 5.7 Amps | .269 Amps | .155 Amps | |
| 115 VAC | .0174-.0325 Amps | 1.10 Amps | .043 Amps | .0325 Amps | Maximum Pull In Current = 5 MA to 11 MA |
| 230 VAC | .007-.0147 Amps | .070 Amps | .030 Amps | .0147 Amps | |
| 6 VDC | .230 Amps | .487 Amps | .450 Amps | .350 Amps | |
| 12 VDC | .114 Amps | .231 Amps | .210 Amps | .185 Amps | |
| 24 VDC | .060 Amps | .105 Amps | .105 Amps | .093 Amps | |
| 110 VDC | .011 Amps | .022 Amps | .022 Amps | .022 Amps | |
| 220 VDC | —— | .014 Amps | .013 Amps | —— | |
| Coil AC Wattage | 1.6-2.4 W. | 6 W. | 3 W. | 1.6-2.4 W. | 1 W. |
| DC | 1.4 W. | 3 W. | 2.5 W. | 2.4 W. | 1 W. |

| Maximum Contact Arrangement | 4PDT | 4PDT | DPDT | 6PDT | DPDT |
|---|---|---|---|---|---|
| Contact Rating | 5 Amp & 10 Amp | 10 Amp & 20 Amp | 15 Amp & 25 Amp | 5 Amp | 15 Amp |
| Weight (Unenclosed) | 2.5-3.5 oz. | 5-6 oz. | 4 oz. | 7 oz. | 4.5 oz. |
| Enclosures Available | Yes | Yes | Yes | Yes | No |

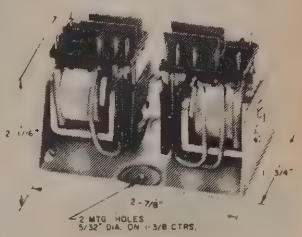
MANY MODELS ARE UL RECOGNIZED AND CSA LISTED

## MODEL GPR LATCHING RELAYS



Enclosed Latching Relay

Relay 6PDT Latching

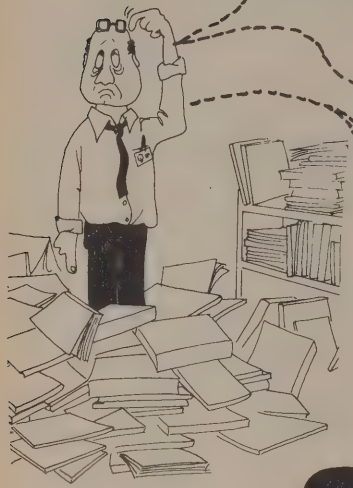



Latching relays consist of two GPR relays with armatures linked so that the n.o. contacts of one are mechanically latched in closed position when, and after, this relay is energized. When 2nd relay is energized, first relay restores and latches 2nd. Permits switching of twice the number of circuits and holding without coil current.

FOR STOCK ITEMS, CALL LOCAL REPRESENTATIVE LISTED IN INDEX

***What can I use to keep all the manufacturers' product data I receive in order?***

***What system makes filing or retrieving manufacturers' catalogs fast and easy?***



***Which file system have thousands of engineers purchased because they know it works?***

# eem FILE SYSTEM

## THE ONLY FILE SYSTEM DESIGNED SPECIALLY FOR THE ELECTRONIC ENGINEER!

The publishers of **eem** have put together a unique filing system for electronic product information. The complete system includes: a product index booklet which classifies electronic products into 3,000 listings both alphabetically and by product group, and 45 file folders imprinted with the **eem** product sections (extra gummed labels included for expanding the system.)

As you receive manufacturers' catalog data sheets, technical bulletins, or clip magazine articles, jot down the proper Product Section Numbers from the **eem** PRODUCT-TO-SECTION INDEX. Then simply file in order. When you require information on a specific product, refer to PRODUCT-TO-SECTION INDEX again to locate the correct file folder. It's simple, and you'll always have the necessary data to compare, specify and buy, right at your fingertips.

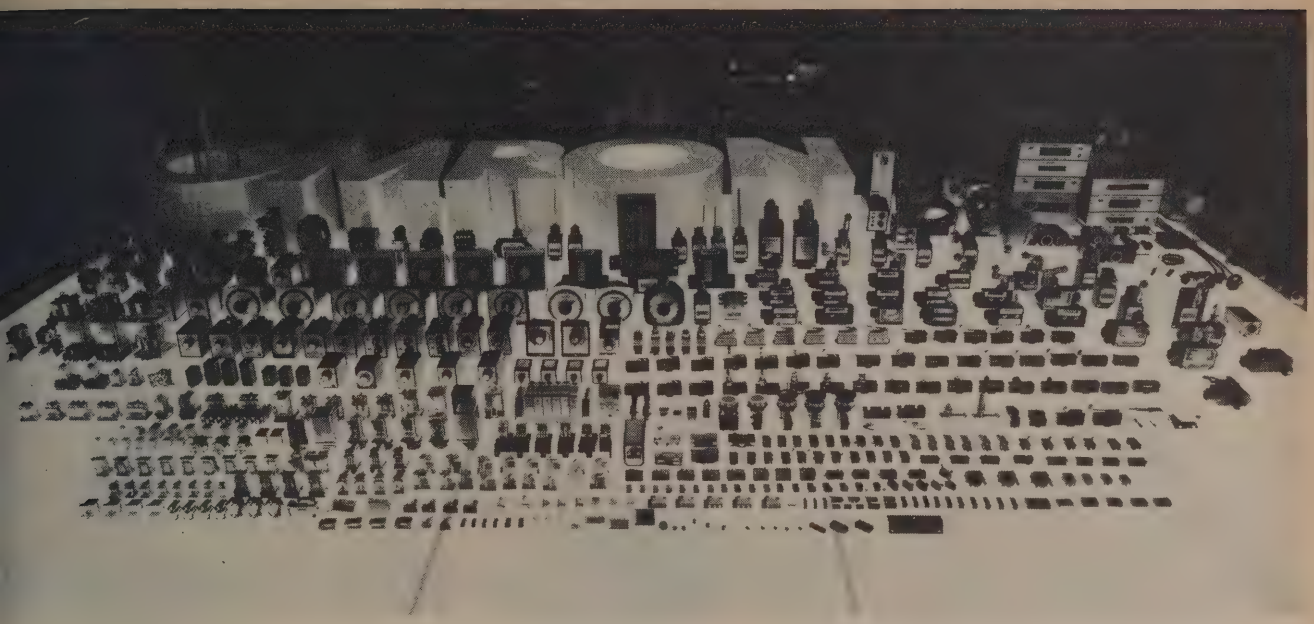
**Here's how to order your eem FILE SYSTEM:**

For the complete system send $10 (plus tax; N.Y., 8%, CA, 6½%) in check or money order to:

United Technical Publications, Inc.,
645 Stewart Avenue, Garden City, N.Y. 11530
Att: Circulation dept.

For an **eem FILE SYSTEM** without file folders send $7.50 (plus tax; N.Y. 8%; CA, 6½%).

*UNITED TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500*



Omron manufactures a broad line of quality control components and devices. Allow Omron to satisfy your needs.
Write for more information.

**Relays**

- General Purpose
- Hermetically Sealed
- Subminiature
- Power
- Reed
- Solid-State
- Special Purpose
  - Impulse
  - Stepping
  - Latching
  - Time Delay

**Switches**

- General Purpose Snap-action
- Miniature Snap-action
- Subminiature Snap-action
- Special Purpose Snap-action
- Diecast limit
- Enclosed limit
- Multiple limit
- Manual input devices

**Timers**

- Synchronous Motor
- Solid-State
- Pneumatic

See list of distributors under Manufacturers Listings.

OMRON

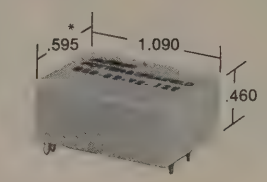
Omron Electronics Inc.
233 S. Wacker Drive
Chicago, Illinois 60606
Phone: (312) 876-0800

# The low cost R50 switches up to 5 amps, is immersion cleanable.

**R50-Y1 and Y2** relays seat .425" high for use on printed circuit boards spaced as close together as 0.6" center-to-center. Nominal pick-up power for R50-Y1 is 330 mW DC; for the R50S-Y1, 160 mW DC; for the R50-Y2, 410 mW DC; for the R50S-Y2, 290 mW DC; and for the R50-X1 from 450 to 562 mW DC. Pickup is approximately 75% of rated coil voltage. Dropout is 5% minimum. All models have gold-plated pc terminals spaced on a 0.1" grid. Contact life expectancy at rated load is 500,000 operations, minimum. All models are U/L recognized.

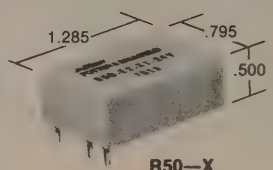
Contact rating: R50, 2 amps @ 28V DC or 1 amp @ 120 AC resistive. R50S, 1 amp @ 28V DC or 0.5 amp @ 120V AC resistive. R50-X1, 5 amps @ 28V DC or 2.5 amps @ 120V AC resistive. Approximate weight: R50-Y1, 0.3 oz.; R50-Y2 and R50-X1, 0.5 oz.

The polyester cover of the R50 is bonded to the relay base, but is not hermetically sealed. Therefore, if the board on which the relay is soldered is to be cleaned by immersion, cleaning time must not exceed two minutes. If fluorocarbons, chlorinated or hydrocarbon cleaning solutions are used, the temperature of the solution must not exceed 77° C. If aqueous-organic solutions are used, temperature must not exceed 82°C. After board cleaning, the knock-off nib on top of the case must be removed.

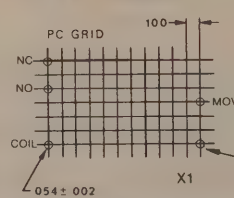


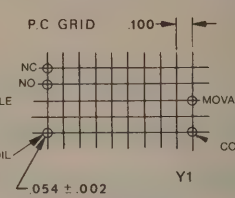

R50—Y

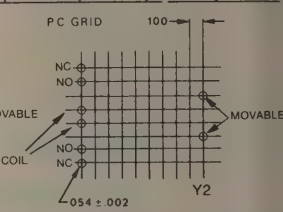
*.595 SPDT *.890 DPDT




R50—X




PC board bottom view

**GENERAL PURPOSE RELAYS**

| TYPE | COILS | | | CONTACTS | | SUGG. RE-SALE PRICE |
|---|---|---|---|---|---|---|
| | Input VDC | Res. in Ohms. | Nom. Power | Arrang. | Amps. Typ. | |
| R50-E2-Y1 | 5V | 43 | 580mW | SPDT | • 2 | $ 3.00 |
| | 6V | 47 | 770mW | | | 3.00 |
| | 12V | 200 | 720mW | | | 3.00 |
| | 24V | 950 | 610mW | | | 3.20 |
| | 48V | 3000 | 765mW | | | 3.70 |
| R50-E2-Y2 | 5V | 32 | 780mW | DPDT | • 2 | 4.00 |
| | 6V | 45 | 800mW | | | 4.00 |
| | 12V | 170 | 845mW | | | 4.00 |
| | 24V | 670 | 860mW | | | 4.10 |
| | 48V | 2500 | 920mW | | | 4.80 |
| R50-E2-X1 | 5V | 25 | 1.0W | SPDT | • 5 | 3.55 |
| | 6V | 37 | 1.0W | | | 3.55 |
| | 12V | 125 | 1.1W | | | 3.55 |
| | 24V | 440 | 1.3W | | | 3.75 |
| R50S-E2-Y1 | 5V | 64 | 390mW | SPDT | • 1 | 2.90 |
| | 6V | 66 | 545mW | | | 2.90 |
| | 12V | 330 | 435mW | | | 2.90 |
| | 24V | 950 | 600mW | | | 3.10 |
| R50S-E2-Y2 | 5V | 42 | 590mW | DPDT | • 1 | 3.80 |
| | 6V | 60 | 600mW | | | 3.80 |
| | 12V | 260 | 555mW | | | 3.80 |
| | 24V | 670 | 860mW | | | 3.90 |

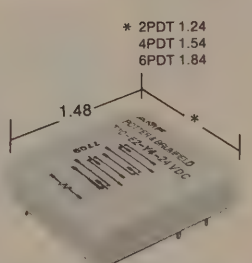
NEW

# Immersion cleanable T10 relays feature 3 amp permissive-make contacts. And they are TTL buffer compatible.

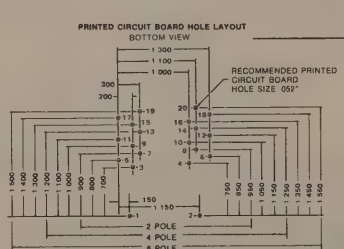
**T10** is a DC operated relay only .425" high, allowing printed circuit boards to be mounted on 0.6" centers. It has permissive-make contacts noted for low bounce and long life. Operate and release times are each 15 ms, including bounce. Suffix "Y" denotes gold-clad silver, single-button contacts rated to 3 amps @ 28V DC or 120V AC, resistive. Suffix "Z" denotes gold-clad silver, bifurcated contacts rated from low level to 1 amp @ 60V DC or 120V AC, resistive. A polyester cover snaps in place over the relay to keep out dust and other contaminates.

All models have UL Recognition under file 46750. Weight is approximately 1.06 oz.

The polyester cover of the T10 is bonded to the relay base, but is not hermetically sealed. Therefore, if the board on which the relay is soldered is to be cleaned by immersion, cleaning time must not exceed two minutes. If fluorocarbons, chlorinated or hydrocarbon cleaning solutions are used, the temperature of the solution must not exceed 77°C. If aqueous-organic solutions are used, temperature must not exceed 82°C. After board cleaning, the knock-off nib on top of the case must be removed.




SEATED HEIGHT .425 MAX.




**GENERAL PURPOSE RELAYS**

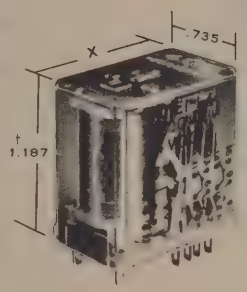
| TYPE | COILS | | | CONTACTS | | SUGG. RE-SALE PRICE |
|---|---|---|---|---|---|---|
| | Input VDC | Res. in Ohms. | Nom. Power | Arrang. | Amps. Typ. | |
| T10-E2-Y2 | 5 | 54 | 460mW | DPDT | 3• | $4.50 |
| | 6 | 77 | 470mW | | | 4.50 |
| | 12 | 310 | 465mW | | | 4.50 |
| | 24 | 1200 | 480mW | | | 4.50 |
| | 48 | 4800 | 480mW | | | 5.25 |
| T10-E2-Z2 | 5 | 54 | 460mW | DPDT | 1• | 5.00 |
| | 6 | 77 | 470mW | | | 5.00 |
| | 12 | 310 | 465mW | | | 5.00 |
| | 24 | 1200 | 480mW | | | 5.00 |
| | 48 | 4800 | 480mW | | | 5.75 |
| T10-E2-Y4 | 6 | 48 | 750mW | 4PDT | 3• | 5.15 |
| | 12 | 190 | 760mW | | | 5.15 |
| | 24 | 769 | 750mW | | | 5.15 |
| | 48 | 3050 | 755mW | | | 5.80 |
| T10-E2-Z4 | 6 | 48 | 750mW | 4PDT | 1• | 5.85 |
| | 12 | 190 | 760mW | | | 5.85 |
| | 24 | 769 | 750mW | | | 5.85 |
| | 48 | 3050 | 755mW | | | 6.50 |
| T10-E2-Y6 | 6 | 31 | 1.2W | 6PDT | 3 • | 6.95 |
| | 12 | 122 | 1.2W | | | 6.95 |
| | 24 | 480 | 1.2W | | | 6.95 |
| | 48 | 1900 | 1.2W | | | 8.50 |
| T10-E2-Z6 | 6 | 31 | 1.2W | 6PDT | 1 • | 7.85 |
| | 12 | 122 | 1.2W | | | 7.85 |
| | 24 | 480 | 1.2W | | | 7.85 |
| | 48 | 1900 | 1.2W | | | 9.40 |

• Denotes U/L

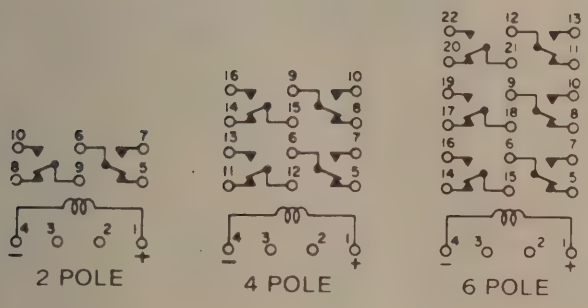
## POTTER & BRUMFIELD RELAYS

# The R10, our compact multi-purpose relay, is available to 8 poles from dry circuit to 10 amps. Many models Logic IC compatible.

**R10 SERIES** relays are UL recognized under File E42810 and E46750. Models to 6PDT have CSA recognition. Contact life expectancy for all series is 10 million operations, mechanical. Wiring connections should be made so that opposite polarity is not developed between adjacent contacts. Initial breakdown voltage of the gaps between contacts is 1,000 V rms; 500 V rms between "Z" (bifurcated) contacts. Contact ratings shown are for use at 28V DC or 115V AC, resistive. Maximum current is shown in parenthesis. "E1" relays have .012" x .080 x .210" long solder terminals with #3-48 mounting stud. "V" relays are DC voltage actuated. Pickup is approximately 75% of rated coil voltage. Dropout is 10% minimum. "J" relays are current actuated (DC). Maximum pickup is listed in "Input" column. "SS" relays are sensitive DC voltage actuated. Maximum pickup power of SPDT R10 — SS1.0K and — SS220 is 20 mW DC @ 25° C. Weight is 0.8 to 1.4 oz.




**R10-E1** X = .950 (2PDT) 1.165 (4PDT) †1.500 R10S




### GENERAL PURPOSE RELAYS

| TYPE | COILS | | | CONTACTS | | SUGG. RE-SALE PRICE |
|---|---|---|---|---|---|---|
| | Input | Res. in Ohms. | Nom. Power | Arrang. | Amps. Typ. (Max.) | |
| R10-E1-W4 | | | | | • 7.5 | |
| -V700 | 24VDC | 700 | 820mW | 4PDT | (10)* | $6.15 |
| R10-E1-Y1 | | | | | | |
| -SS1.0K | 6VDC | 1,000 | 36mW | SPDT | • 2 | 5.20 |
| -SS220 | 3VDC | 220 | 40mW | SPDT | (3)* | 5.20 |
| R10-E1-Y2 | | | | | | |
| -V28 | 5VDC | 28 | 900mW | | | 4.25 |
| -V52 | 6VDC | 52 | 690mW | | | 4.25 |
| -V185 | 12VDC | 185 | 770mW | | •* | 4.25 |
| -V700 | 24VDC | 700 | 820mW | 2PDT | 2 | 4.25 |
| -V2.5K | 48VDC | 2,500 | 920mW | | (3) | 4.25 |
| -V15.0K | 115VDC | 15,000 | 880mW | | | 6.70 |
| R10-E1-Y4 | | | | | | |
| -V52 | 6VDC | 52 | 690mW | | | 4.65 |
| -V185 | 12VDC | 185 | 770mW | | •* | 4.65 |
| -V700 | 24VDC | 700 | 802mW | 4PDT | 2 | 4.65 |
| -V2.5K | 48VDC | 2,500 | 920mW | | (3) | 4.65 |
| -V15.0K | 115VDC | 15,000 | 880mW | | | 7.10 |
| R10-E1-Y6 | | | | | | |
| -V25 | 6VDC | 25 | 1.4W | | | 6.10 |
| -V90 | 12VDC | 90 | 1.6W | | •* | 6.10 |
| -V430 | 24VDC | 430 | 1.3W | 6PDT | 2 | 6.10 |
| -V1.5K | 48VDC | 1,500 | 1.5W | | (3) | 6.10 |
| -V9.0K | 115VDC | 9,000 | 1.5W | | | 7.20 |
| R10-E1-X2 | | | | | | |
| -V28 | 5VDC | 28 | 900mW | | | 4.40 |
| -V52 | 6VDC | 52 | 690mW | | | 4.40 |
| -V185 | 12VDC | 185 | 770mW | | •* | 4.40 |
| -V700 | 24VDC | 700 | 802mW | 2PDT | 5 | 4.40 |
| -V2.5K | 48VDC | 2,500 | 920mW | | (7.5) | 4.40 |
| -V15.0K | 115VDC | 15,000 | 880mW | | | 6.85 |
| R10-E1-X4 | | | | | | |
| -V52 | 6VDC | 52 | 690mW | | | 4.95 |
| -V185 | 12VDC | 185 | 770mW | | •* | 4.95 |
| -V700 | 24VDC | 700 | 820mW | 4PDT | 5 | 4.95 |
| -V2.5K | 48VDC | 2,500 | 920mW | | (7.5) | 4.95 |
| -V15.0K | 115VDC | 15,000 | 880mW | | | 7.40 |
| R10-E1-X6 | | | | | | |
| -V25 | 6VDC | 25 | 1.4W | | | 6.55 |
| -V90 | 12VDC | 90 | 1.6W | | •* | 6.55 |
| -V430 | 24VDC | 430 | 1.3W | 6PDT | 5 | 6.55 |
| -V1.5K | 48VDC | 1,500 | 1.5W | | (7.5) | 6.55 |
| -V9.0K | 115VDC | 9,000 | 1.5W | | | 7.65 |
| R10-E1-W2 | | | | | •* | |
| -V185 | 12VDC | 185 | 770mW | 2PDT | 7.5 | 5.05 |
| -V700 | 24VDC | 700 | 820mW | | (10) | 5.05 |
| R10-E1-Z2 | | | | | | |
| -V52 | 6VDC | 52 | 690mW | | | 4.70 |
| -V185 | 12VDC | 185 | 770mW | | •* | 4.70 |
| -V700 | 24VDC | 700 | 820mW | 2PDT | 0.1 | 4.70 |
| -V2.5K | 48VDC | 2,500 | 920mW | | (2) | 4.70 |
| -V15.0K | 115VDC | 15,000 | 880mW | | | 7.15 |
| R10-E1-Z4 | | | | | | |
| -V52 | 6VDC | 52 | 690mW | | | 5.30 |
| -V185 | 12VDC | 185 | 770mW | | | 5.30 |
| -V700 | 24VDC | 700 | 820mW | 4PDT | •* | 5.30 |
| -V2.5K | 48VDC | 2,500 | 920mW | | 0.1 | 5.30 |
| -V15.0K | 115VDC | 15,000 | 880mW | | (2) | 7.75 |
| R10-E1-Z6 | | | | | | |
| -V25 | 6VDC | 25 | 1.4W | | | 6.95 |
| -V90 | 12VDC | 90 | 1.6W | | •* | 6.95 |
| -V430 | 24VDC | 430 | 1.3W | 6PDT | 0.1 | 6.95 |
| -V1.5K | 48VDC | 1,500 | 1.5W | | (2) | 6.95 |
| -V9.0K | 115VDC | 9,000 | 1.5W | | | 8.05 |

### R10 SERIES TYPICAL CONTACT LIFE FOR SWITCHING RESISTIVE LOADS AT 25°C

| Current | Voltage | Contacts | Adjustment | Life (Operations) |
|---|---|---|---|---|
| 10.0 Amp* | 115 vac. 60 Hz | W | V | $2.5 \times 10^4$ |
| 10.0 Amp | 28 vdc | W | V | $5 \times 10^4$ |
| 5.0 Amp* | 115 vac. 60 Hz | X | V | $5 \times 10^4$ |
| 5.0 Amp | 28 vdc | X | V | $5 \times 10^4$ |
| 2.0 Amp | 28 vdc | Y, Z | V | $1.5 \times 10^6$ |
| 2.0 Amp | 28 vdc | Y, Z | S, J | $6 \times 10^5$ |
| 1.0 Amp | 28 vdc | Y, Z | V, S, J | $12 \times 10^6$ |
| 100 ma | 28 vdc, 115 vac | Y, Z | V, S, J | $1 \times 10^8$ |
| 50 ma | 6 vdc | Z | V, J | $5 \times 10^7$ |

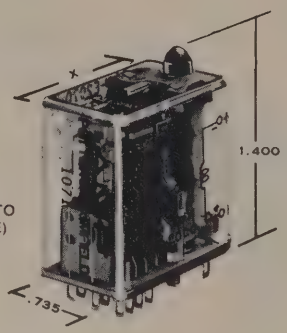
*Use ungrounded frame for AC loads 5 amps and above.

• Denotes U/L
* Denotes CSA

# POTTER & BRUMFIELD RELAYS

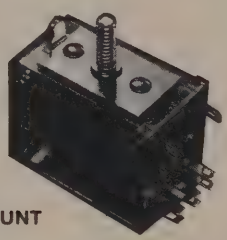
**R10L SERIES** Has a light emitting diode (LED) indicator. LED produces highly visible red light when relay coil is energized. Especially useful when troubleshooting an instrument, equipment, or system. LED has long operating life and high reliability. Other operating characteristics same as standard R10 Series relays. LED is available on relays with coils up to 48 volts DC. Relays fit standard R10 Series sockets.

Note: Observe polarity indicated when wiring R10L- with LED.



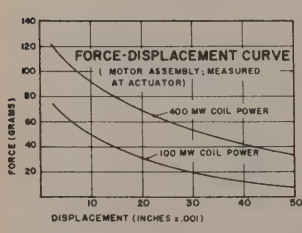

X = FROM .95 (2 POLE) TO 1.580 MAX. (8 POLE)

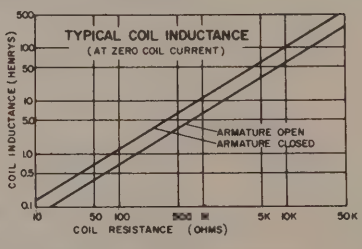
**R10-E6** is a standard R10-E1 (solder terminals) fitted with a bracket on the narrow side of its case for chassis mounting. The bracket has one #6-32 x .375" stud and one locating tab on .437" centers.

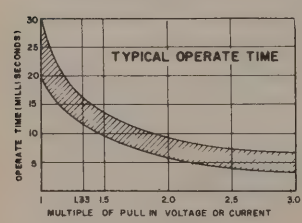


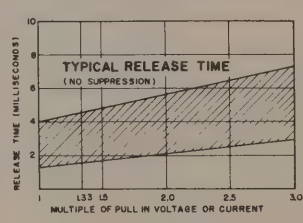
**R10 E6 BRACKET MOUNT**

## R10 PERFORMANCE GRAPHS




## GENERAL PURPOSE RELAYS

| TYPE | COILS | | | CONTACTS | | SUGG. RE-SALE PRICE |
|---|---|---|---|---|---|---|
| | Input | Res. in Ohms. | Nom. Power | Arrang. | Amps. Typ. (Max.) | |
| R10-E1-Y2 | | | | | | |
| -J2.5K | 5.8mA | 2,500 | 85mW | | | $ 4.60 |
| -J5.0K | 4.1mA | 5,000 | 84mW | 2PDT | 2 | 5.25 |
| -J10.0K | 3.1mA | 10,000 | 96mW | •* | (3) | 5.65 |
| R10-E1-Y4 | | | | | | |
| -J2.5K | 8.4mA | 2,500 | 176mW | | | 5.05 |
| -J5.0K | 6.2mA | 5,000 | 192mW | 4PDT | 2 | 5.70 |
| -J10.0K | 4.5mA | 10,000 | 200mW | •* | (3) | 6.15 |
| R10-E1-Z4 | | | | | | |
| -J1.0K | 13.0mA | 1,000 | 170mW | | | 5.70 |
| -J2.5K | 8.4mA | 2,500 | 176mW | 4PDT | 0.1 | 5.70 |
| -J5.0K | 6.2mA | 5,000 | 192mW | •* | (2) | 6.35 |
| R10-E1-X2 | 115VAC | (Diodes) | 3VA | 2PDT | 5 | |
| -115VAC | | (2)9.0K | | •* | (7.5) | 7.80 |
| R10-E1-X4 | 115VAC | (Diodes) | 3VA | 4PDT | 5 | |
| -115VAC | | (2)9.0K | | •* | (7.5) | 9.45 |
| R10-E1-X6 | 115VAC | (Diodes) | 3VA | 6PDT | 5 | |
| -115VAC | | (2)7.5K | | •* | (7.5) | 12.25 |
| R10-E1-X8 | 115VAC | (Diodes) | 3VA | 8PDT | 5 | |
| -115VAC | | (2)7.5K | | • | (7.5) | 14.75 |
| R10-E2 | | | | | | |
| -W2-V700 | 24VDC | 700 | 820mW | DPDT | 7.5 | |
| | | | | •* | (10) | 5.05 |
| -X2-V28 | 5VDC | 28 | 900mW | 2PDT | 5 | 4.40 |
| -X2-V700 | 24VDC | 700 | 820mW | •* | (7.5) | 4.40 |
| -Y2-V28 | 5VDC | 28 | 900mW | | | 4.25 |
| -Y2-V185 | 12VDC | 185 | 770mW | 2PDT | 2 | 4.25 |
| -Y2-V700 | 24VDC | 700 | 820mW | •* | (3) | 4.25 |
| -Y4-V185 | 12VDC | 185 | 770mW | 4PDT | 2 | 4.65 |
| -Y4-V700 | 24VDC | 700 | 820mW | •* | (3) | 4.65 |
| -Y6-V90 | 12VDC | 90 | 1.6W | | | 6.10 |
| -Y6-V430 | 24VDC | 430 | 1.3W | 6PDT | 2 | 6.10 |
| -Y6-V1.5K | 48VDC | 1500 | 1.5W | •* | (3) | 6.10 |
| -Z4-V185 | 12VDC | 185 | 770mW | 4PDT | 0.1 | 5.30 |
| -Z4-V700 | 24VDC | 700 | 820mW | •* | (2) | 5.30 |
| -Z4-J2.5K | 8.4mA | 2500 | 176mW | 4PDT | 0.1 | 5.70 |
| -Z4-J5.0K | 6.2mA | 5000 | 192mW | •* | (2) | 6.35 |
| -Z6-V90 | 12VDC | 90 | 1.6W | | | 6.95 |
| -Z6-V430 | 24VDC | 430 | 1.3W | 6PDT | 0.1 | 6.95 |
| -Z6-V1.5K | 48VDC | 1500 | 1.5W | •* | (2) | 6.95 |
| R10L-E1 | | | | | | |
| -X2-V185 | 12VDC | 185 | 770mW | 2PDT | 5 | 8.30 |
| -X2-V700 | 24VDC | 700 | 820mW | | (7.5) | 8.30 |
| -X4-V185 | 12VDC | 185 | 770mW | | | 8.85 |
| -X4-V700 | 24VDC | 700 | 820mW | 4PDT | 5 | 8.85 |
| -X4-V2.5K | 48VDC | 2500 | 920mW | | (7.5) | 8.85 |
| -X6-V430 | 24VDC | 430 | 1.3W | 6PDT | 5 (7.5) | 10.45 |
| -Y2-V52 | 6VDC | 52 | 690mW | | | 8.15 |
| -Y2-V185 | 12VDC | 185 | 770mW | 2PDT | 2 | 8.15 |
| -Y2-V700 | 24VDC | 700 | 820mW | | (3) | 8.15 |
| -Y2-V2.5K | 48VDC | 2500 | 920mW | | | 8.15 |
| -Y4-V52 | 6VDC | 52 | 690mW | | | 8.55 |
| -Y4-V185 | 12VDC | 185 | 770mW | 4PDT | 2 | 8.55 |
| -Y4-V700 | 24VDC | 700 | 820mW | | (3) | 8.55 |
| -Y6-V430 | 24VDC | 430 | 1.3W | 6PDT | 2 (3) | 10.00 |
| -Z4-V700 | 24VDC | 700 | 820mW | 4PDT | 0.1 (2) | 9.20 |
| R10L-E2 | | | | | | |
| -Y2-V185 | 12VDC | 185 | 770mW | 2PDT | 2 (3) | 8.15 |
| -Y4-V700 | 24VDC | 700 | 820mW | 4PDT | 2 (3) | 8.55 |
| R10-E6- | | | | | | |
| X2-V52 | 6VDC | 52 | 690mW | 2PDT | 5 (7.5) | 4.75 |
| -V185 | 12VDC | 185 | 770mW | 2PDT | 5 (7.5) | 4.75 |
| -V700 | 24VDC | 700 | 820mW | 2PDT | 5 (7.5) | 4.75 |
| -115V | 115VAC | 9.0 K | 3VA | 2PDT | 5 (7.5) | 8.15 |
| X4-V185 | 12VDC | 185 | 770mW | 4PDT | 5 (7.5) | 5.40 |
| -V700 | 24VDC | 700 | 820mW | 4PDT | 5 (7.5) | 5.40 |
| -115V | 115VAC | 9.0 K | 3VA | 4PDT | 5 (7.5) | 9.90 |
| Y2-V185 | 12VDC | 185 | 770mW | 2PDT | 2 (3) | 4.60 |
| -V700 | 24VDC | 700 | 820mW | 2PDT | 2 (3) | 4.60 |
| Y4-V185 | 12VDC | 185 | 770mW | 4PDT | 2 (3) | 5.10 |
| -V700 | 24VDC | 700 | 770mW | 4PDT | 2 (3) | 5.10 |

• Denotes U/L
* Denotes CSA

# POTTER & BRUMFIELD RELAYS

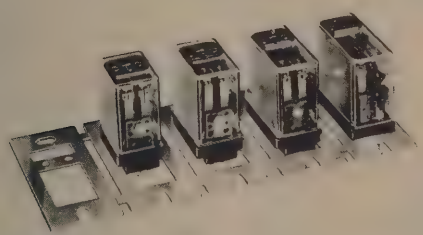
## R10 sockets for chassis, PC board, strip or panel mounting multiply your design options.

**MOUNTING STRIP FOR R10-R15 RELAYS**
Contains ten pre-punched break-away mounting plates stamped from .064" aluminum. Designed to simplify mounting one or more R10, R12, R13, R14, or R15 relays on chassis or racks. Each individual plat accepts a 2, 4, 6, or 8 pole solder terminal relay or socket.

When a socket is used, it is held in place by one #3-48 screw and nut in the hole provided. Or, the relay may be mounted without a socket by inserting its mounting stud through the hole in the plate and fastening a #3-48 nut on relay stud.

Single plates may be mounted over a rectangular hole measuring 1.62" x .750" maximum or a 1.62" round hole.

For rack or panel installation, the entire 10 piece strip (approx. 12" long) may be mounted.
Reinforcing of the strip may be required depending on the number of plates used and the particular mounting circumstances.



R10 Mounting Strip
**37D645** **LIST $1.43**

**SOCKETS FOR R10 SERIES**

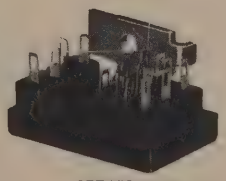
| Part No. | No. Of Poles | Terminal | Grounding Provision | Hold Down Spring* | List Price |
|---|---|---|---|---|---|
| 27E125 | 2 | Solder | Strip | 20C249 | $ .65 |
| 27E126 | 4 | Solder | Strip | 20C250 | .83 |
| 27E127 | 6 | Solder | Strip | 20C251 | 1.06 |
| 27E211 | 8 | Solder | Strip | 20C266 | 1.63 |
| 27E162 | 2 | Solder | None | 20C249 | .65 |
| 27E163 | 4 | Solder | None | 20C250 | .83 |
| 27E164 | 6 | Solder | None | 20C251 | 1.01 |
| 27E128 | 2 | P/C | Strip | 20C249 | .65 |
| 27E129 | 4 | P/C | Strip | 20C250 | .83 |
| 27E130 | 6 | P/C | Strip | 20C251 | 1.28 |
| 27E254 | 8 | P/C | Strip | 20C266 | 1.63 |
| 27E193 | 2 | P/C | Terminal | 20C249 | .65 |
| 27E194 | 4 | P/C | Terminal | 20C250 | .83 |
| 27E195 | 6 | P/C | Terminal | 20C251 | 1.28 |
| 27E215 | 2 | P/C Rt. Ang. | Yes | 20C249 | 4.41 |
| 27E216 | 4 | P/C Rt. Ang. | Yes | 20C250 | 4.90 |
| 27E212 | 2 | P/C | None | 20C249 | .67 |
| 27E213 | 4 | P/C | None | 20C251 | .83 |
| 27E271 | 6 | P/C | None | 20C251 | 1.39 |
| 27E152 | 4 | Solder/Bkt.Mt. | Strip | 20C250 | 1.17 |
| 27E317 | 2 | Solder Bkt. Mt. | Strip | 20C249 | 1.06 |
| 27E169 | 6 | Solder Bkt. Mt. | Strip | 20C251 | 1.55 |

| Part No. | No. of Poles | Description | List Price |
|---|---|---|---|
| 20C249 | 2 | Wire Hold Down Spring | .07 |
| 20C250 | 4 | Wire Hold Down Spring | .07 |
| 20C251 | 6 | Wire Hold Down Spring | .07 |
| 20C266 | 8 | Wire Hold Down Spring | .07 |
| 20C259 | All | Wire Hold Down Strap (P/C only) | .07 |
| 20C300 | 2 | Wire Hold Down Spring for 2 pole R10S only | .09 |
| 20C301 | 4 | Wire Hold Down Spring for 4 pole R10S only | .09 |

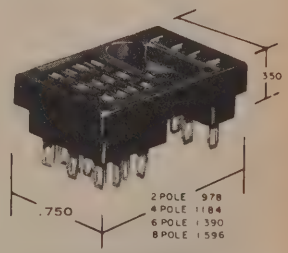
NOTE: Sockets with grounding provision not recommended for currents of 5 amps AC and above.

*Not included with socket.

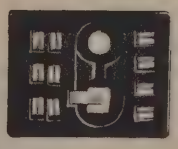
WIRE HOLD-DOWN SPRING



27E152




R10 RELAY SOCKET



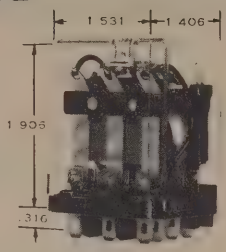
GROUNDING TERMINAL

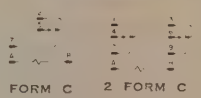
GROUNDING STRIP

# POTTER & BRUMFIELD RELAYS

## Switch loads to 10 amps, 150V DC or 15 amps, 277V AC

**KU series** relays are UL Recognized under File E22575 and CSA Listed (except KUE models) under File 15734. A "1" preceding the suffix, such as KUEP3D15, denotes a standard model. A "2" denotes a model having a push-to-test button for manually actuating the contacts to check the load circuit. A "3" denotes a highly visible neon lamp which indicates the presence of coil power. A "4" denotes both button and lamp. Models with a "5" have neither button nor lamp, and have two flanges as shown, right, for mounting. All models have .187" quick connect/solder terminals. Except for the flange-mount model, all may be mounted into the sockets below.



Contact life expectancy of all models is 10 million operations, mechanical, and 100,000 operations at full load. At loads of less than maximum rating, life expectancy rises accordingly.

### CONTACT RATINGS (UL)

**KUP Series, all models:** 5amps, 28V DC/240V AC, 80% PF. 1/10 HP, 120V AC; ¼ HP, 240V AC.

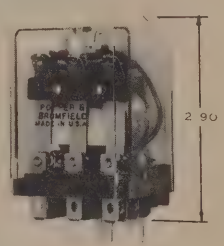
**KUP Series:**

**1 and 2 pole models:** 10 amps, 28V DC/240V AC, 80% PF. ¼ HP, 120V AC; ⅓ HP, 240V AC.

**3 pole models:** 10 amps, 120V AC, 80% PF. 6⅔ amps, 240V AC, 80% PF.

**KUMP Series, all models:** Same as above. Also, 15 amps, 277V AC, 80% PF.

**KUEP models:** 10 amps, 150V DC.




### SOCKETS FOR KUP-KUMP RELAYS

For mounting KUP-KUMP plain case, KUA, KUL, and KUR RELAYS; CL and CU time delays. All sockets are UL Recognized for 10 amps at 240V AC.

SPDT/DPDT/3PDT pierced solder terminal socket rated 10 amps. Molded nylon; has two .165" dia. mounting holes.

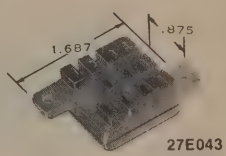
**27E043** **LIST $1.00**

SPDT/DPDT/3PDT printed circuit terminal, 10 amp socket accepts .187" relay terminals. Molded nylon; has two .165" dia. mounting holes.

**27E046** **LIST $1.17**

SPDT/DPDT/3PDT .187" quick-connect terminal socket rated 10 amps. Molded nylon; has two .187" dia. mounting holes.

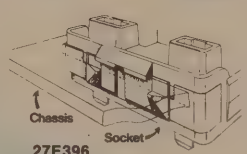
**27E067** **LIST $1.55**




**27E043**
**27E046**
**27E067**

Hold-down spring will accommodate machine screws or rivets.

**20C228** **LIST $ .22**

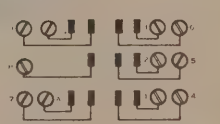



**27E396**
**27E400**

NEW

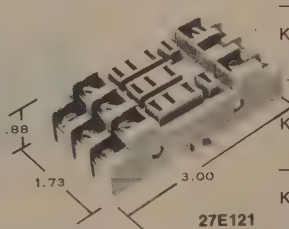
SPDT/DPDT/3PDT snap-in sockets require no mounting screws or retainer spring. 27E396 has .187" quick-connect termination; 27E400, solder-eyelet termination.

**27E396** **LIST $1.55**
**27E400** **LIST $1.00**



SPDT/DPDT/3PDT screw terminal socket rated 10 amps. Molded polycarbonate; accepts .187" relay terminals; mounting slots accept #6 screws. For track mount, see pg. 12.

**27E121** **LIST $4.95**




**27E121**

NEW

### MOUNTING STRIP

37D632 will mount 6 KU sockets (except 27E121) in aluminum strip 11.9" x 3.00" x .062".

**37D632** (not shown**) **LIST $1.09**

**GENERAL PURPOSE RELAYS**

| TYPE | COILS | | | CONTACTS | | SUGG. RESALE PRICE |
|---|---|---|---|---|---|---|
| | Input | Res. in Ohms. | Nom. Power | Arrang. | Amps. Rating | |
| KUEP3A15 | 120V | 2,250 | 2VA | SPST-NO-DM | 10 | $6.70 |
| KUEP3D15 | 24V | 472 | 1.2W | SPST-NO-DM | 10 | 6.45 |
| KUMP11A18 | 6V<br>12V<br>24V<br>120V<br>240V | 4.2<br>18<br>72<br>1,700<br>7,200 | 2.75 VA | DPDT | *•<br>15 | 7.45<br>7.45<br>7.45<br>7.45<br>8.15 |
| KUMP11D18 | 5V<br>6V<br>12V<br>24V<br>110V | 21<br>32.1<br>120<br>472<br>10,000 | 1.2W | DPDT | •*<br>15 | 6.80<br>6.80<br>6.80<br>6.80<br>7.60 |
| KUP5A15 | 6V<br>12V<br>24V<br>120V<br>240V | 6<br>24<br>85<br>2,250<br>9,110 | 2VA | SPDT | •*<br>10 | 5.55<br>5.55<br>5.55<br>5.55<br>6.25 |
| KUP5D15 | 5V<br>6V<br>12V<br>24V<br>110V | 21<br>32.1<br>120<br>472<br>10,000 | 1.2W | SPDT | •*<br>10 | 5.35<br>5.35<br>5.35<br>5.35<br>6.15 |
| KUP11A11 | 120V | 2,250 | 2VA | DPDT | *<br>•5 | 6.50 |
| KUP11D11 | 24V | 472 | 1.2W | DPDT | *<br>•5 | 5.90 |
| KUP11A15 | 6V<br>12V<br>24V<br>120V<br>240V | 6<br>24<br>85<br>2,250<br>9,110 | 2VA | DPDT | •*<br>10 | 6.60<br>6.60<br>6.60<br>6.60<br>7.30 |
| KUP11D15 | 5V<br>6V<br>12V<br>24V<br>110V | 21<br>32.1<br>120<br>472<br>10,000 | 1.2W | DPDT | •*<br>10 | 6.00<br>6.00<br>6.00<br>6.00<br>6.80 |
| KUP11A35 | 6V<br>12V<br>24V<br>120V | 6<br>24<br>85<br>2,250 | 2VA | DPDT | 10*• | 8.55<br>8.55<br>8.55<br>7.75 |
| KUP11D35 | 12V<br>24V<br>110V | 120<br>472<br>10,000 | 1.2W | DPDT | 10*• | 7.95<br>7.95<br>7.95 |
| KUP14A11 | 120V | 2,250 | 2.75VA | 3PDT | *•<br>5 | 7.25 |
| KUP14A15 | 6V<br>12V<br>24V<br>120V<br>240V | 4.2<br>18<br>72<br>1,700<br>7,200 | 2.75VA | 3PDT | •*<br>10 | 7.35<br>7.35<br>7.35<br>7.35<br>8.05 |
| KUP14D15 | 6V<br>12V<br>24V<br>110V | 32.1<br>120<br>472<br>10,000 | 1.2W | 3PDT | •*<br>10 | 6.80<br>6.80<br>6.80<br>7.60 |
| KUP14A25 | 120V | 1,700 | 2.75VA | 3PDT | 10*• | 7.95 |
| KUP14A35 | 120V | 1,700 | 2.75VA | 3PDT | 10*• | 8.50 |
| KUP14A45 | 120V | 1,700 | 2.75VA | 3PDT | 10*• | 9.75 |
| KUP5A55 | 120V | 2,250 | 2VA | SPDT | *•10 | 5.65 |
| KUP5D55 | 24V | 472 | 1.2W | SPDT | *•10 | 5.45 |
| KUP11A55 | 24V<br>120V | 85<br>2,250 | 2VA | DPDT | *•10 | 6.70<br>6.70 |
| KUP11D55 | 6V<br>12V<br>24V<br>110V | 32.1<br>120<br>472<br>10,000 | 1.2W | DPDT | •*<br>10 | 6.10<br>6.10<br>6.10<br>6.90 |
| KUP14A55 | 6V<br>12V<br>24V<br>120V<br>240V | 4.2<br>18<br>72<br>1,700<br>7,200 | 2.75VA | 3PDT | •*<br>10 | 7.45<br>7.45<br>7.45<br>7.45<br>8.15 |
| KUP14D55 | 6V<br>12V<br>24V<br>110V | 32.1<br>120<br>472<br>10,000 | 1.2W | 3PDT | •*<br>10 | 6.90<br>6.90<br>6.90<br>7.70 |

• Denotes U/L
* Denotes CSA

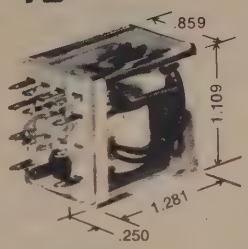
**Similar to 37D633 on page 9.

A—Alternating Current, e.g. PRD3A
D—Direct Current, e.g. PRD3D

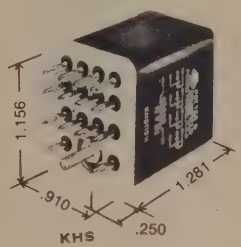
# KH series relays switch to eight circuits from low level to 3 amps in little more than one cubic inch.

**KHU/KHS SERIES** small, rugged 4PDT relays are available for AC or DC operation. KHU relays are recognized under the Component Program of UL and CSA. KHU has clear polycarbonate dust cover; KHS is hermetically sealed in metal enclosure. Relays are designed to meet exqcting requirements of data processing, computer and process control applications. Various contacts available: suffix "1" denotes gold-flashed silver rated 3 amps @ 30V DC or 120V AC, resistive; suffix "2" denotes silver-cadmium oxide rated 3 amperes; suffix "3" indicates gold alloy contacts for low level to 1.0 amp applications; suffix "6" indicates gold overlay on silver, bifuracted contacts rated 1 amp @ 30V DC, resistive, or 120V AC. Suffix "N" denotes a neon lamp in parallel with the coil to provide visual indication that power is reaching the coil. Mounting: Solder terminals with No. 3–48 stud .312" long. All relays fit sockets (below) with printed circuit or solder lug terminals. Weight without sockets: KHU 1.12 oz.; KHS 1.63 oz.

NOTE, KHS RELAYS SHOULD NOT HAVE FRAMES GROUNDED WITHOUT CONSULTING FACTORY FOR LOAD LEVELS.



KHU



KHS

**GENERAL PURPOSE RELAYS**

| TYPE | COILS | | | CONTACTS | | SUGG. RE-SALE PRICE |
|---|---|---|---|---|---|---|
| | Input | Res. in Ohms. | Nom. Power | Arrang. | Amps. Rating | |
| KHU17A11 | 6V<br>12V<br>24V<br>120V | 10.5<br>43<br>160<br>3,900 | 1.2VA | 4PDT | •*<br>3 | $ 8.20<br>8.20<br>8.20<br>8.40 |
| KHU17A11N | 120V | 3,900 | 1.2VA | 4PDT | *•3 | 10.65 |
| KHU17D11 | 5V<br>6V<br>12V<br>24V<br>48V<br>90V<br>110V | 28<br>40<br>160<br>650<br>2,600<br>9,000<br>11,000 | 900MW | 4PDT | •*<br>3 | 7.20<br>7.20<br>7.20<br>7.20<br>7.40<br>8.15<br>8.15 |
| KHU17D11N | 120V | 13,500 | 1.2VA | 4PDT | *•3 | 10.85 |
| KHU17A12 | 120V | 3,900 | 1.2VA | 4PDT | *•3 | 8.35 |
| KHU17D12 | 12V<br>24V<br>48V<br>110V | 160<br>650<br>2,600<br>11,000 | 900MW | 4PDT | 3* | 7.15<br>7.15<br>7.35<br>8.10 |
| KHU17A13 | 120V | 3,900 | 1.2VA | 4PDT | 1* | 20.90 |
| KHU17D13 | 24V<br>48V | 650<br>2,600 | 900MW | 4PDT | 1* | 19.70<br>19.90 |
| KHU17D16 | 12V<br>24V | 160<br>650 | 900MW | 4PDT | •*<br>1 | 9.85<br>9.85 |
| KHS17A11† | 6V<br>12V<br>24V<br>120V | 10.5<br>43<br>160<br>3,900 | 1.2VA | 4PDT | 3• | 13.85<br>13.85<br>13.85<br>14.05 |
| KHS17A12† | 120V | 3,900 | 1.2VA | 4PDT | 3• | 14.00 |
| KHS17A13† | 120V | 3,900 | 1.2VA | 4PDT | 3• | 24.95 |
| KHS17D11† | 6V<br>12V<br>24V<br>110V | 40<br>160<br>650<br>11,000 | 900MW | 4PDT | 3• | 12.85<br>12.85<br>12.85<br>13.80 |
| KHS17D12† | 24V<br>110V | 650<br>11,000 | 900MW<br>1.0W | 4PDT<br>4PDT | 3•<br>3• | 12.80<br>13.75 |
| KHS17D13† | 24V | 650 | 900mW | 4PDT | 2• | 23.75 |

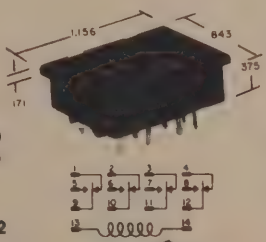
SPECIFY COIL VOLTAGE OR RESISTANCE WHEN ORDERING

### SOCKETS

KHS, KHU relays and CD-31 time delays

4PDT solder terminal sockets 27E006 and socket retainer 24A032.

**27E006** **LIST $ .79**
**24A032** **LIST $ .05**




4PDT printed circuit terminal socket.

**27E007** **LIST $ .82**

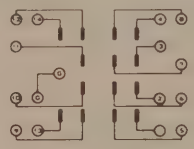


Hold-down spring.

**20C217** **LIST $ .15**

4PDT screw terminal socket rated 5 amperes. No hold-down spring required. For track mount, see pg. 12.

**27E166** **LIST $7.57**

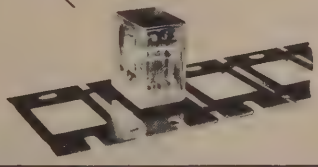


### MOUNTING STRIP

NEW

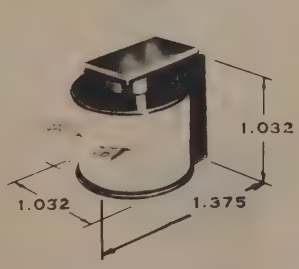
37D633 will mount 16 KH sockets (except 27E166) in two lengths of aluminum strip, each measuring 10.9" x 2.25" x .062.

**37D633** **LIST $ .93**



# BU buzzer provides dependable 120 Hz signal source.

**BU BUZZER** AC operated coil with a spring steel armature which buzzes when coil is energized. Used extensively in test equipment, laboratories and a host of other applications where a small light weight, dependable buzzer is required. Recognized under the Component Program of Underwriters' Laboratories Inc. File No. 51154 and CSA File No. 26606. Weight: 1⅝ ozs. Mounting: No. 6-32 tapped core.




**BUZZER**

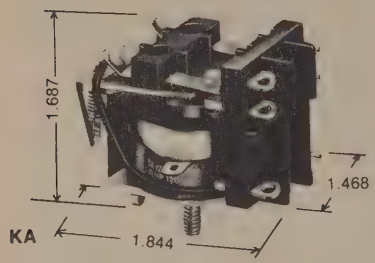
| TYPE | COILS | | | SUGG. RE-SALE PRICE |
|---|---|---|---|---|
| | Input | Res. in Ohms. | Nom. Power | |
| • *<br>BU | 6V<br>12V<br>24V<br>120V<br>240V | 2.7<br>13.2<br>50<br>1,250<br>4,600 | 4.6VA | $ 2.70<br>2.70<br>2.70<br>2.70<br>3.50 |

• Denotes U/L
* Denotes CSA

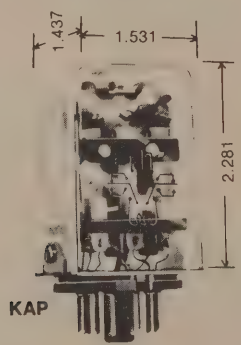
A—Alternating Current, e.g. PRD3A
D—Direct Current, e.g. PRD3D

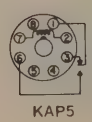
# POTTER & BRUMFIELD RELAYS

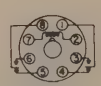
**KA and KAP SERIES** Small, low cost, highly efficient general purpose relays for handling light power loads such as small motors, solenoids and other relays, and general automation work. All KA and KAP relays have CSA listing (File No. LR-15734) and carry U/L component recognition (File No. E22575). Mechanical life expectancy: 10 million operations. Duty: Continuous. Contact rating: suffix AG and DG, 10 amps @ 120 VAC or 6 amps @ 240 VAC; suffix AY and DY, 5 amps @ 120 VAC or 3 amps @ 240 VAC. "G" suffix indicates silver-cadmium oxide.




The KA is the open version of this series. Mounting: One No. 6–32 threaded stud and locating tab on .438 centers. Wt: 2 ozs. The KAP is the enclosed model and is protected by a clear polycarbonate dust cover. Terminals: 8 or 11-pin plug. Weight: 3 ozs.





KAP5


KAP11

KAP14

**KAP HOLD-DOWN SPRING**
Hold-down spring will accommodate machine screws or rivets.
**20C206** **LIST $ .20**

**GENERAL PURPOSE RELAYS**

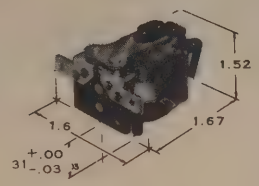
| TYPE | COILS | | | CONTACTS | | SUGG. RE-SALE PRICE |
|---|---|---|---|---|---|---|
| | Input | Res. In Ohms. | Nom. Power | Arrang. | Amps. Rating | |
| KA5AY | 6V | 6 | 2VA | SPDT | •* | $4.95 |
| | 12V | 24 | | | | 4.95 |
| | 24V | 85 | | | 5 | 4.95 |
| | 120V | 2,250 | | | | 4.95 |
| | 240V | 9,110 | | | | 5.60 |
| KA5AG | 6V | 6 | 2VA | SPDT | •* | 5.00 |
| | 12V | 24 | | | | 5.00 |
| | 24V | 85 | | | 10 | 5.00 |
| | 120V | 2,250 | | | | 5.00 |
| | 240V | 9,110 | | | | 5.65 |
| KA5DY | 6V | 32.1 | 1.2W | SPDT | •* | 4.80 |
| | 12V | 120 | | | | 4.80 |
| | 24V | 472 | | | 5 | 4.80 |
| | 110V | 10,000 | | | | 5.65 |
| KA5DG | 6V | 32.1 | 1.2W | SPDT | •* | 4.85 |
| | 12V | 120 | | | | 4.85 |
| | 24V | 472 | | | 10 | 4.85 |
| | 110V | 10,000 | | | | 5.70 |
| KA11AY | 6V | 6 | 2VA | DPDT | •* | 6.00 |
| | 12V | 24 | | | | 6.00 |
| | 24V | 85 | | | 5 | 6.00 |
| | 120V | 2,250 | | | | 6.00 |
| | 240V | 9,110 | | | | 6.50 |
| KA11AG | 6V | 6 | 2VA | DPDT | •* | 6.10 |
| | 12V | 24 | | | | 6.10 |
| | 24V | 85 | | | 10 | 6.10 |
| | 120V | 2,250 | | | | 6.10 |
| | 240V | 9,110 | | | | 6.60 |
| KA11DY | 6V | 32.1 | 1.2W | DPDT | •* | 5.25 |
| | 12V | 120 | | | | 5.25 |
| | 24V | 472 | | | 5 | 5.25 |
| | 48V | 1,800 | | | | 5.65 |
| | 110V | 10,000 | | | | 6.15 |
| KA11DG | 6V | 32.1 | 1.2W | DPDT | •* | 5.45 |
| | 12V | 120 | | | | 5.45 |
| | 24V | 472 | | | 10 | 5.45 |
| | 110V | 10,000 | | | | 6.35 |
| KA14AY | 6V | 6 | 2VA | 3PDT | •* | 6.70 |
| | 12V | 24 | | | | 6.70 |
| | 24V | 85 | | | 5 | 6.70 |
| | 120V | 2,250 | | | | 6.70 |
| | 240V | 9,110 | | | | 7.30 |
| KA14AG | 6V | 6 | 2VA | 3PDT | •* | 6.75 |
| | 12V | 24 | | | | 6.75 |
| | 24V | 85 | | | 10 | 6.75 |
| | 120V | 2,250 | | | | 6.75 |
| | 240V | 9,110 | | | | 7.45 |
| KA14DY | 6V | 32.1 | 1.2W | 3PDT | •* | 6.80 |
| | 12V | 120 | | | | 6.80 |
| | 24V | 472 | | | 5 | 6.80 |
| | 110V | 10,000 | | | | 7.20 |
| KA14DG | 6V | 32.1 | 1.2W | 3PDT | •* | 6.60 |
| | 12V | 120 | | | | 6.60 |
| | 24V | 472 | | | 10 | 6.60 |
| | 110V | 10,000 | | | | 7.35 |
| KAP5AG | 24V | 85 | 2VA | SPDT | •* | 8.50 |
| | 120V | 2,250 | | | 10 | 8.50 |
| KAP5DG | 24V | 472 | 1.2W | SPDT | •* | 8.25 |
| | 110V | 10,000 | | | 10 | 9.35 |
| KAP11AY | 24V | 85 | 2VA | DPDT | •* | 9.35 |
| | 120V | 2,250 | | | 5 | 9.35 |
| | 240V | 9,110 | | | | 9.85 |
| KAP11AG | 6V | 6 | 2VA | DPDT | •* | 9.50 |
| | 24V | 85 | | | 10 | 9.50 |
| | 120V | 2,250 | | | | 9.50 |
| KAP11DG | 24V | 472 | 1.2W | DPDT | •* | 9.45 |
| | 110V | 10,000 | | | 10 | 10.35 |
| KAP11DY | 12V | 120 | 1.2W | DPDT | •* | 9.30 |
| | 24V | 472 | | | 5 | 9.30 |
| | 110V | 10,000 | | | | 10.20 |
| KAP14AY | 24V | 85 | 2VA | 3PDT | •* | 11.55 |
| | 120V | 2,250 | | | 5 | 11.55 |
| | 240V | 9,110 | | | | 12.00 |
| KAP14AG | 24V | 85 | 1.2W | 3PDT | •* | 11.70 |
| | 120V | 2,250 | | | 10 | 11.70 |
| KAP14DG | 24V | 472 | 1.2W | 3PDT | •* | 11.65 |
| | 110V | 10,000 | | | 10 | 12.55 |
| KAP14DY | 12V | 120 | 1.2W | 3PDT | •* | 11.45 |
| | 24V | 472 | | | 5 | 11.45 |
| | 110V | 10,000 | | | | 12.25 |

• Denotes U/L
* Denotes CSA

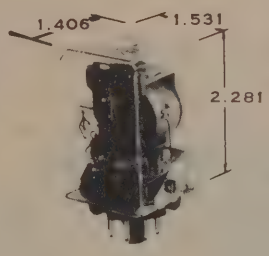
A—Alternating Current, e.g. PRD3**A**
D—Direct Current, e.g. PRD3**D**

# POTTER & BRUMFIELD RELAYS

**KR3-H SERIES** Ruggedly constructed but of small size, KR3-H is a heavy duty relay especially designed for applications where limited space is a factor. Its heavy duty copper-alloy movable contact carrier has twin silver-cadmium oxide contacts rated 20 amps @ 120V AC 60 Hz, resistive, or 28V DC; 1 HP 120/240V 60 Hz. Contact arrangement is 1 Form X (SPST-NO-DM) only. Terminals: suitable for .250" quick connect, also solder; for contacts: solder only for coil. Size: 1.6" x 1.671" x 1.52". Seated height: 1.21". Mounting: One No. 6-32 stud and locating tab on .437" center. Weight: 2 ozs.

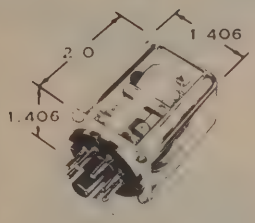



**KRP3-H SERIES** All electrical specifications listed above for the KR3-H series relays apply to the KRP3-H. However, the KRP3-H is enclosed in a clear polycarbonate dust cover and features an octal plug-in base. Weight: Approximately 3 ozs.

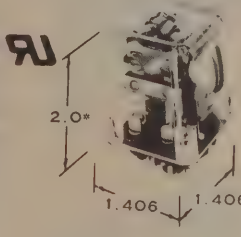



**KRP3-H Hold-Down Spring**
Hold-down spring will accommodate machine screws or rivets.
**20C206** **LIST $ .20**

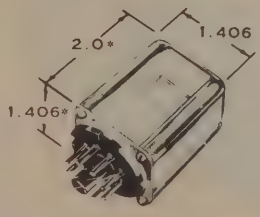
**KR11-E and KR14-E SERIES** Hermetically sealed in a metal can. Has octal-type plug and gold-flashed silver contacts rated 5 amps @ 120V AC, 80% P.F., or 28V DC, resistive. Suffix "G" denotes silver cadmium oxide contacts rated 10 amps @ 120V AC, 80% P.F., or 28V DC, resistive.




**KRP SERIES** Versatile, multi-contact arrangement. Enclosed in a clear polycarbonate dust cover. Standard 8-pin octal-type plug for KRP5 and KRP11, 11-pin for KRP-14. Weight: Approx. 3 ozs. Contacts: 5 amp, Gold flashed silver, 10 amp silver-cadmium oxide. See KCP-KRP hold-down spring for special mounting applications. See KRP-N indicator lamp relay for current monitoring applications.




**KRP-N** INDICATOR
**LAMP RELAY** A general purpose relay incorporating a lamp to indicate current or voltage availability in power circuit. Contacts: Silver-cadmium oxide rated 10 amps. Enclosures: Clear, polycarbonate dust cover. Mounting: Standard octal plug.
Weight: Approximately 3 ozs.
Hold-down spring (Please see Page 9).

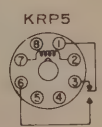



**"P" Case** is a clear polycarbonate case for mounting rectifiers, capacitors, resistors or other components. Octal type termination. 8 pin, 35D070. 11 pin, 35D072. Comes with four screws. Weight: 0.5 oz.
**35D070** **LIST $.88**
**35D072** **LIST $1.06**

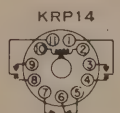
Hold-down spring for "P" Case, and KRP series relays will accommodate machine screws or rivets.
**20C176** **LIST $.22**

KRP3AH

KRP5



KRP14



KRP11

## GENERAL PURPOSE RELAYS

| TYPE | COILS | | | CONTACTS | | SUGG. RE-SALE PRICE |
|---|---|---|---|---|---|---|
| | Input | Res. in Ohms. | Nom. Power | Arrang. | Amps. Rating | |
| KR3AH | 12V<br>24V<br>120V | 24<br>85<br>2,250 | 2VA | SPST-NO-DM | 20 | $ 6.85<br>6.85<br>6.85 |
| KR3DH | 12V<br>24V<br>110V | 120<br>472<br>10,000 | 1.2W | SPST-NO-DM | 20 | 6.55<br>6.55<br>7.30 |
| KR11AE | 120V | 2,250 | 2VA | DPDT | 5 | 21.05 |
| KR11AGE† | 120V | 2,250 | 2VA | DPDT | 10 | 21.25 |
| KR11DE† | 24V | 472 | 1.2W | DPDT | 5 | 20.50 |
| KR11DGE† | 24V | 472 | 1.2W | DPDT | 10 | 20.80 |
| KR14AGE† | 120V | 2,250 | 2VA | 3PDT | 10 | 28.45 |
| KRP3AH | 12V<br>24V<br>120V | 24<br>85<br>2,250 | 2VA | SPST-NO-DM | 20 | 9.90<br>9.90<br>9.90 |
| KRP3DH | 12V<br>24V<br>110V | 120<br>472<br>10,000 | 1.2W | SPST-NO-DM | 20 | 9.65<br>9.65<br>10.60 |
| KRP5A | 6V<br>12V<br>24V<br>120V | 6<br>24<br>85<br>2,250 | 2VA | SPDT | •5 | 8.45<br>8.45<br>8.45<br>8.45 |
| KRP5AG | 6V<br>12V<br>24V<br>120V | 6<br>24<br>85<br>2,250 | 2VA | SPDT | •10 | 8.80<br>8.80<br>8.80<br>8.80 |
| KRP5D | 6V<br>12V<br>24V<br>110V | 32.1<br>120<br>472<br>10,000 | 1.2W | SPDT | •5 | 8.40<br>8.40<br>8.40<br>9.45 |
| KRP5DG | 6V<br>12V<br>24V<br>110V | 32.1<br>120<br>472<br>10,000 | 1.2W | SPDT | •10 | 8.70<br>8.70<br>8.70<br>9.65 |
| KRP11A | 6V<br>12V<br>24V<br>120V<br>240V | 6<br>24<br>85<br>2,250<br>9,110 | 2VA | DPDT | •5 | 9.50<br>9.50<br>9.50<br>9.50<br>10.10 |
| KRP11AG | 6V<br>12V<br>24V<br>120V<br>240V | 6<br>24<br>85<br>2,250<br>9,110 | 2VA | DPDT | •10 | 9.80<br>9.80<br>9.80<br>9.80<br>10.45 |
| KRP11D | 6V<br>12V<br>24V<br>48V<br>110V | 32.1<br>120<br>472<br>1,800<br>10,000 | 1.2W | DPDT | •5 | 9.45<br>9.45<br>9.45<br>9.90<br>10.40 |
| KRP11DG | 6V<br>12V<br>24V<br>48V<br>110V | 32.1<br>120<br>472<br>1,800<br>10,000 | 1.2W | DPDT | •10 | 9.75<br>9.75<br>9.75<br>10.35<br>10.70 |
| KRP14A | 6V<br>12V<br>24V<br>120V<br>240V | 6<br>24<br>85<br>2,250<br>9,110 | 2VA | 3PDT | •5 | 11.80<br>11.80<br>11.80<br>11.80<br>12.35 |
| KRP14AG | 6V<br>12V<br>24V<br>120V<br>240V | 6<br>24<br>85<br>2,250<br>9,110 | 2VA | 3PDT | •10 | 12.20<br>12.20<br>12.20<br>12.20<br>12.85 |
| KRP14D | 6V<br>12V<br>24V<br>48V<br>110V | 32.1<br>120<br>472<br>1,800<br>10,000 | 1.2W | 3PDT | •5 | 11.70<br>11.70<br>11.70<br>12.15<br>12.55 |
| KRP14DG | 6V<br>12V<br>24V<br>48V<br>110V | 32.1<br>120<br>472<br>1,800<br>10,000 | 1.2W | 3PDT | •10 | 12.10<br>12.10<br>12.10<br>12.65<br>13.00 |

(KRP Cont. next page)

• Denotes U/L

*Seated Height

A—Alternating Current, e.g. PRD3A
D—Direct Current, e.g. PRD3D

# POTTER & BRUMFIELD RELAYS

## A screwdriver is all you need for quick mounting of many P&B relays with our screw terminal sockets and track mounting system.

### OCTAL-STYLE SOCKETS

For KRP, KRP3-H, KAP, KBP, KCP, EBT, and EBA relays; CD-21, CD-38, CH, CK, and CR time delays; and CS sensor.

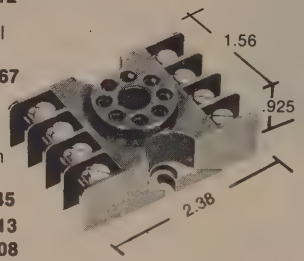
Molded polycarbonate, 8-pin screw terminal socket, rated 10 amperes.
**27E122** **LIST $3.12**

Molded polycarbonate, 11-pin screw terminal socket, rated 10 amperes.
**27E123** **LIST $4.67**

### TRACK MOUNT SYSTEM FOR SOCKETS

Extruded aluminum, three-foot section with slotted holes on 6″ centers for #8 screws.

**24A064** **NET $2.45**
**24A072** **NET $ .13**
**24A071** **NET $ .08**
**24A067** **NET $ .12**
**20C253** **NET $ .11**

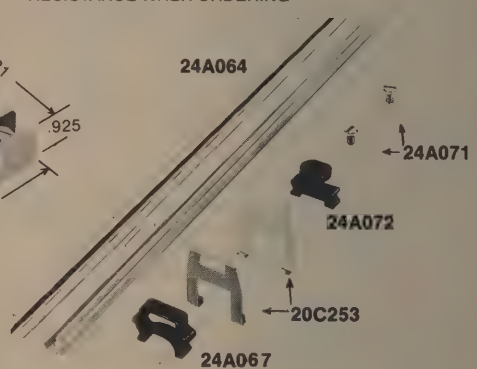



| To Mount This Socket | To This Track | Use This Clip |
|---|---|---|
| 27E121 (pg. 8) | 24A064 | Terminate large end of socket with 24A071 and a 13/32″ x 6-40 screw. |
| 27E122 | 24A064 | Between sockets use 24A072. Terminate end sockets with 24A071. |
| 27E123 | 24A064 | Between sockets use 24A072. Terminate end sockets with 24A067. |
| 27E166 (pg. 9) | 24A064 | 24A071 (2 required) |

**GENERAL PURPOSE RELAYS**

| TYPE | COILS | | | CONTACTS | | SUGG. RE-SALE PRICE |
|---|---|---|---|---|---|---|
| | Input | Res. in Ohms. | Nom. Power | Arrang. | Amps. Rating | |
| KRP11AN | 6V | 6 | 2VA | DPDT | •10 | $11.25 |
| | 12V | 24 | | | | 11.25 |
| | 24V | 85 | | | | 11.25 |
| | 120V | 2,250 | | | | 11.25 |
| | 240V | 9,110 | | | | 11.85 |
| KRP11DN | 6V | 32.1 | 1.2W | DPDT | •10 | 11.10 |
| | 12V | 120 | | | | 11.10 |
| | 24V | 472 | | | | 11.10 |
| | 110V | 10,000 | | | | 12.10 |
| KRP14AN | 6V | 6 | 2VA | 3PDT | •10 | 13.65 |
| | 12V | 24 | | | | 13.65 |
| | 24V | 85 | | | | 13.65 |
| | 120V | 2.250 | | | | 13.65 |
| | 240V | 9,110 | | | | 14.30 |
| KRP14DN | 24V | 472 | 1.2W | 3PDT | •10 | 13.50 |

SPECIFY COIL VOLTAGE OR RESISTANCE WHEN ORDERING



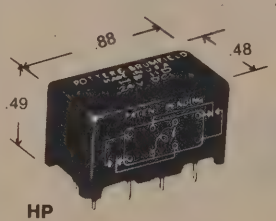

TRACK MOUNT SYSTEM

**HP SERIES** is recommended for applications such as TV cameras, dictating machines, desk top computers, copying machines, etc. Contacts are rated 0.3–2 amps @ 28 VDC, resistive; 0.1–0.5 amp @ 120 VAC @ 25°C. Circuit board or socket mounting. Encased in a nylon heat-sealed (non-hermetic) cover. Terminals on a .2″ grid. Weight: .25 oz.

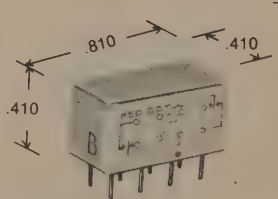
**HPS SERIES** Hermetically sealed HP above. HPS is designed for reliable performance in logic circuits or where prolonged submersion of pc boards in cleaning solvents may be required. Recommended for use in applications requiring more critical specifications than HP relay provides. HP socket may be used for mounting. Sealed metal enclosed relay weighs .25 oz.

### HP SERIES SOCKETS

(For HP, HPS and HCM relays)
DPDT solder terminal sockets 27E062 and socket retainer 24A051.
**27E062** **LIST $1.06**
**24A051** **LIST $ .17**



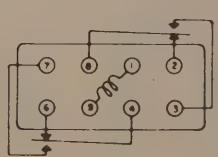

HP

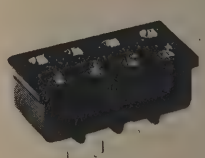



HPS

**GENERAL PURPOSE RELAYS**

| TYPE | COILS | | | CONTACTS | | SUGG. RE-SALE PRICE |
|---|---|---|---|---|---|---|
| | Input | Res. In Ohms. | Nom. Power | Arrang. | Amps. Rating | |
| HP11D | 5V | 39 | .662W | DPDT | 2 | $12.05 |
| | 6V | 55 | | | | 12.05 |
| | 12V | 218 | | | | 12.05 |
| | 24V | 870 | | | | 12.05 |
| | 48V | 3,480 | | | | 12.65 |
| HPS11D | 12V | 218 | .662W | DPDT | 2 | 13.90 |
| | 24V | 870 | | | | 13.90 |



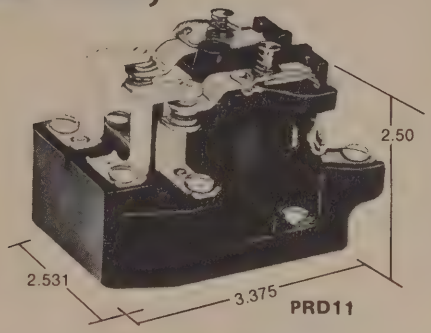


● Denotes U/L

A—Alternating Current, e.g. PRD3A
D—Direct Current, e.g. PRD3D

## POTTER & BRUMFIELD RELAYS

# America's most popular 30-amp relay improved three ways! Supported terminals, enclosed coil, tough phenolic base.




### Direct replacement for famous PR Series

The PRD is a UL-CSA listed, heavy duty power relay designed for high inrush current applications such as motor starting and incandescent lamp loads. This relay is an improved design of our PR Series. It has reinforced screw terminals which virtually eliminates the risk of terminal breakage when the relay is installed. Also, the coil of the PRD is housed in a protective plastic enclosure to minimize the possibility of damage to the coil.

Model for model, PRD is directly interchangeable with the PR. For example, a PRD7AYO replaces a PR7AYO; same size, mounting holes, and electrical characteristics. PRD has a life expectancy of 100,000 operations at full load. Contact life increases when operated at reduced loads or with appropriate arc suppression. The floating movable contact carrier provides excellent pressure and wipe between contact surfaces, thus keeping voltage drop to a minimum between mating contacts.

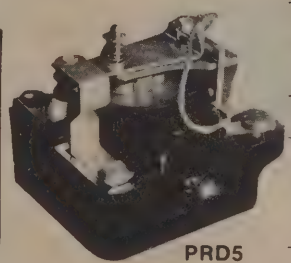
**Model PRDA11AYA** has a miniature snap-action switch with SPDT contacts rated 5 amps at 120V AC. All models mount using two .188" dia. holes on 1.875" centers.

Weight is 11 oz. maximum. For relay enclosure, see PRD Dust Cover on next page.

### UL and CSA Listed

**UL File E22575**
**CSA File 15734**

PRD3



PRD5

**PRD IS IC LOGIC COMPATIBLE**
PRD relays with 12V DC or 24V DC coils are compatible with IC drivers used to terminate logic boards. The 12V DC coil requires 170 mA; the 24V DC coil, just 84mA. When being driven directly by an IC such as TTL or CMOS with driver, the coil of the PRD must be paralleled with signal diode to allow coil back-emf to recirculate through the coil.

**PRD RELAYS LISTED BY UL AND CSA**

| Type | Suffix | | Contact Rating |
|---|---|---|---|
| | AC | DC | |
| PRD 1, 3, or 5 | AY | DY | 25 amps @ 277 V AC, resistive, 1 hp @ 120/240 V AC |
| PRD 7 or 11 | AY | DY | 25 amps @ 240 V AC, 20 amps @ 277 V AC, resistive, 1 hp @ 120/240 V AC. |
| PRD 7 or 11 | AG | | 30 amps @ 240 V AC, 20 amps @ 277 V AC, resistive, 1 hp @ 120/240 V AC, 10 amps @ 600 V AC, resistive. |

**POWER RELAYS**

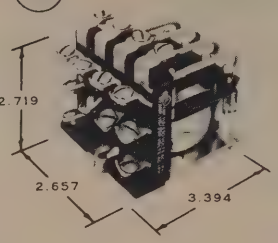
| TYPE | COILS | | | CONTACTS | | SUGG. RE-SALE PRICE |
|---|---|---|---|---|---|---|
| | Input | Res. in Ohms. | Nom. Power | Arrang. | Amps. Rating | |
| PRD1AYO | 24V | 12 | 9.8VA | SPST-NO | *• | $ 6.05 |
| | 120V | 290 | | | 25 | 6.05 |
| PRD3AYO | 6V | .86 | 9.8VA | SPST-NO-DM | *• | 6.25 |
| | 12V | 3.2 | | | | 6.25 |
| | 24V | 12 | | | 25 | 6.25 |
| | 120V | 290 | | | | 6.25 |
| | 208V | 850 | | | | 6.45 |
| | 240V | 1,200 | | | | 6.45 |
| PRD3DYO | 5V | 12.5 | 2W | SPST-NO-DM | *• | 6.45 |
| | 6V | 18 | | | | 6.00 |
| | 12V | 71 | | | 25 | 6.00 |
| | 24V | 288 | | | | 6.00 |
| | 110V | 6,050 | | | | 6.85 |
| PRD5AYO | 6V | .86 | 9.8VA | SPDT | *• | 6.95 |
| | 12V | 3.2 | | | | 6.95 |
| | 24V | 12 | | | 25 | 6.95 |
| | 120V | 290 | | | | 6.95 |
| | 208V | 850 | | | | 7.15 |
| | 240V | 1,200 | | | | 7.15 |
| PRD5DYO | 5V | 12.5 | 2W | SPDT | *• | 6.95 |
| | 6V | 18 | | | | 6.50 |
| | 12V | 71 | | | | 6.50 |
| | 24V | 288 | | | 25 | 6.50 |
| | 110V | 6,050 | | | | 7.35 |
| PRD7AGO | 120V | 290 | 9.8VA | DPST-NO | 30•* | 7.90 |
| PRD7AYO | 6V | .86 | 9.8VA | DPST-NO | *• | 7.65 |
| | 12V | 3.2 | | | | 7.65 |
| | 24V | 12 | | | 25 | 7.65 |
| | 120V | 290 | | | | 7.65 |
| | 208V | 850 | | | | 7.85 |
| | 240V | 1,200 | | | | 7.85 |
| PRD7DYO | 5V | 12.5 | 2W | DPST-NO | *• | 7.85 |
| | 6V | 18 | | | | 7.40 |
| | 12V | 71 | | | 25 | 7.40 |
| | 24V | 288 | | | | 7.40 |
| | 110V | 6,050 | | | | 8.25 |
| PRD11AGO | 120V | 290 | 9.8VA | DPDT | 30•* | 10.20 |
| PRD11AYO | 6V | .86 | 9.8VA | DPDT | *• | 9.25 |
| | 12V | 3.2 | | | | 9.25 |
| | 24V | 12 | | | | 9.25 |
| | 120V | 290 | | | 25 | 9.25 |
| | 208V | 850 | | | | 9.45 |
| | 240V | 1,200 | | | | 9.45 |
| | 480V | 4,500 | | | | 12.55 |
| PRDA11AYA | 12V | 3.2 | 9.8VA | DPDT & SPDT | *• | 13.95 |
| | 24V | 12 | | | 25 | 13.95 |
| | 120V | 290 | | | | 13.95 |
| | 240V | 1,200 | | | | 14.15 |
| PRD11DYO | 5V | 12.5 | 2W | DPDT | *• | 9.45 |
| | 6V | 18 | | | | 9.00 |
| | 12V | 71 | | | 25 | 9.00 |
| | 24V | 288 | | | | 9.00 |
| | 110V | 6,050 | | | | 9.85 |

• Denotes U/L
* Denotes CSA

A—Alternating Current, e.g. PRD3A
D—Direct Current, e.g. PRD3D

# POTTER & BRUMFIELD RELAYS

**PM SERIES** A compact 4PDT power relay for polyphase and heavy duty switching applications. Screw terminals. (PMT has .250" quick-connect terminals.) Has silver-cadmium oxide contacts rated at 25 amps at 240V, 50/60 Hz resistive AC, 1 HP per movable arm at 120V or 240V, AC single phase, U/L (File No. E22575) and CSA listed. Mounts by one front key-hole and two rear channel slots for 8-32 screws on 2" x 2.5" triangular centers. Weight: 14 ozs.

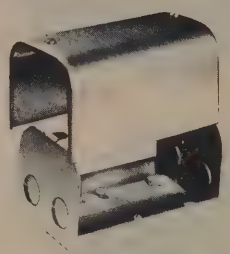



**POWER RELAYS**

| TYPE | COILS | | | CONTACTS | | SUGG. RE-SALE PRICE |
|---|---|---|---|---|---|---|
| | Input | Res. in Ohms. | Nom. Power | Arrang. | Amps. Rating | |
| PM17AY | 6V | .37 | 18VA | 4PDT | *• 25 | $20.05 |
| | 12V | 1.4 | | | | 20.05 |
| | 24V | 5 | | | | 20.05 |
| | 120V | 120 | | | | 20.05 |
| | 240V | 587 | | | | 20.15 |
| PM17AY | 480V | 1,790 | 18VA | 4PDT | •25 | 21.55 |
| PM17DY | 6V | 8.2 | 4.4W | 4PDT | *• 25 | 17.55 |
| | 12V | 33 | | | | 17.55 |
| | 24V | 132 | | | | 17.55 |
| | 110V | 2,760 | | | | 18.95 |
| PMT17AY | 24V | 5 | 18VA | 4PDT | *• 25 | 18.55 |
| | 120V | 120 | 18VA | | | 18.55 |

**PM SERIES ADAPTOR PLATE**
Adaptor plate for mounting PM on PRD mounting holes.
**37B370** **LIST $ .45**

**PM AND PRD DUST COVERS**
These dust covers have a sheet metal base with knockout for .5" dia. conduit and a cover fitted with two screws. Finished in gray. Mounting: three #10 holes on 1.875" x 4.125" centers. Approx. weight: 1 lb.



PM: 35D227
L: 5.313 MAX.
W: 3.812 MAX.
H: 3.812 MAX.

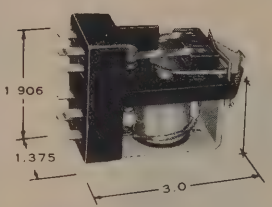
PR: 35D013
L: 5.312 MAX.
W: 3.375 MAX.
H: 3.125 MAX.

Metal dust cover for PM series only.
**35D227** **LIST $6.68**

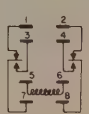
Plastic dust cover for PM series only.
**35D203** **LIST $1.17**

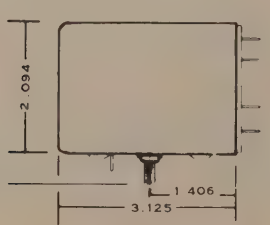
Metal dust cover for PRD series only.
**35D013** **LIST $5.51**

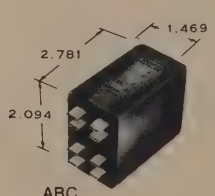
**AB and ABC SERIES** are UL/CSA recognized. For applications requiring long life and quiet operation. Available for AC and DC operation, these relays have a mechanical life expectancy in excess of three million operations. All models have silver contacts and .250" quick-connect terminals. Screw terminal adaptors are available. AB is open; ABC is enclosed in a non-hermetic, heavy metal dust cover. Contact rating: "H" style contacts, 15 amps @ 277 VAC, ¾ H.P., 120/250 VAC; "Y" style contacts, 10 amps @ 120 VAC, or 5 amps @ 240 VAC resistive. Mounting: AB, two 8-32 tapped holes on 1.250" centers. ABC, one ⅜" x 8-32 metal stud and locating tab on .562" centers. Approximate weight: AB, 5 oz.; ABC, 7 oz.



AB



ABC

**POWER RELAYS**

| TYPE | COILS | | | CONTACTS | | SUGG. RE-SALE PRICE |
|---|---|---|---|---|---|---|
| | Input | Res. in Ohms. | Nom. Power | Arrang. | Amps. Rating | |
| AB11AH | 6V | 1.3 | 6.4VA | DPDT | •* 15 | 9.90 |
| | 24V | 23 | | | | 9.90 |
| | 120V | 510 | | | | 9.90 |
| | 240V | 2,050 | | | | 10.55 |
| AB11AY | 24V | 23 | 6.4VA | DPDT | •* 10 | $10.05 |
| | 120V | 510 | | | | 10.05 |
| | 240V | 2,050 | | | | 10.60 |
| AB11DH | 12V | 72 | 2W | DPDT | •* 15 | 10.40 |
| | 24V | 288 | | | | 10.40 |
| | 110V | 6,050 | | | | 11.20 |
| AB11DY | 12V | 72 | 2W | DPDT | •* 10 | 10.65 |
| | 24V | 288 | | | | 10.65 |
| | 110V | 6,050 | | | | 11.15 |
| ABC11AH | 6V | 1.3 | 6.4VA | DPDT | •* 15 | 10.85 |
| | 24V | 23 | | | | 10.85 |
| | 120V | 510 | | | | 10.85 |
| | 240V | 2,050 | | | | 11.35 |
| ABC11AY | 24V | 23 | 6.4VA | DPDT | •* 10 | 11.05 |
| | 120V | 510 | | | | 11.05 |
| | 240V | 2,050 | | | | 11.60 |
| ABC11DH | 6V | 18 | 2W | DPDT | •* 15 | 11.35 |
| | 12V | 72 | | | | 11.35 |
| | 24V | 288 | | | | 11.35 |
| | 110V | 6 050 | | | | 12.10 |
| ABC11DY | 12V | 72 | 2W | DPDT | •* 10 | 11.65 |
| | 24V | 288 | | | | 11.65 |

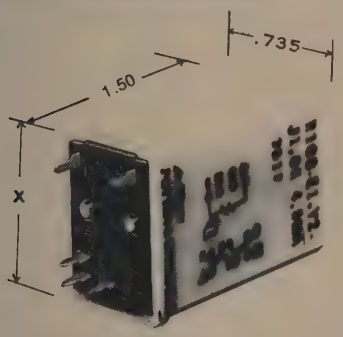
• Denotes U/L
* Denotes CSA

A—Alternating Current, e.g. PRD3**A**
D—Direct Current, e.g. PRD3**D**

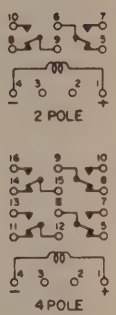
# The R10S is a 2 mA, sensitive, general purpose relay for direct drive from CMOS, TTL, $I^2L$, ECL and HTL.

**R10S SERIES** relays are very sensitive, current-actuated DC relays for direct drive by DTL, TTL, ECL, and HTL. UL and CSA are pending. Available in solder (E1), and pc board (E2) termination. Maximum pickup current is listed in "Input" column. Weight is 0.8 to 1.4 oz.

**See page 6 for Socket Information.**




X = .950 (2PDT)
1.165 (4PDT)




**SENSITIVE RELAYS**

| TYPE | COILS | | | CONTACTS | | SUGG. RE-SALE PRICE |
|---|---|---|---|---|---|---|
| | Input | Res. in Ohms. | Nom. Power | Arrang. | Amps. Typ. (Max.) | |
| R10S-E1-Y1 | | | | | | |
| -J1.0K | 3.2mA | 1,000 | 10mW | SPDT | 2 (3) | $ 4.80 |
| -J2.5K | 2.0mA | 2,500 | 10mW | SPDT | 2 (3) | 4.80 |
| -J5.0K | 1.4mA | 5,000 | 10mW | SPDT | 2 (3) | 5.90 |
| R10S-E1-Y2 | | | | | | |
| -J1.0K | 4.5mA | 1,000 | 20mW | 2PDT | 2 (3) | 5.60 |
| -J2.5K | 2.9mA | 2,500 | 20mW | 2PDT | 2 (3) | 5.60 |
| -J5.0K | 2.0mA | 5,000 | 20mW | 2PDT | 2 (3) | 6.70 |
| R10S-E1-Y4 | | | | | | |
| -J1.0K | 6.5mA | 1,000 | 40mW | 4PDT | 2 (3) | 6.00 |
| R10S-E2-Y1 | | | | | | |
| -J1.0K | 3.2mA | 1,000 | 10mW | SPDT | 2 (3) | 4.80 |
| -J2.5K | 2.0mA | 2,500 | 10mW | SPDT | 2 (3) | 4.80 |
| -J5.0K | 1.4mA | 5,000 | 10mW | SPDT | 2 (3) | 5.90 |
| R10S-E2-Y2 | | | | | | |
| -J2.5K | 2.9mA | 2,500 | 20mW | 2PDT | 2 (3) | 5.60 |
| R10S-E2-Y4 | | | | | | |
| -J1.0K | 6.5mA | 1,000 | 40mW | 4PDT | 2 (3) | 6.00 |

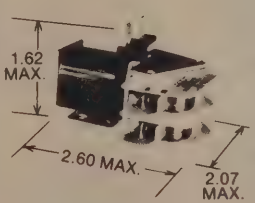
Other R10 relays on pages 4-5.

NEW

## Our Lowest Cost 20 Amp Power Relay

S87R is a low cost, UL Recognized relay for use in vending machines, washing machines, machine-tool control systems, heating and air conditioning systems, and automated conveyor systems. Its contacts are rated 20 amps, 277V AC; 60 LRA, 12 FLA, 1 HP @ 125V AC; 48 LRA, 8 FLA, 2 HP @ 250V AC; pilot duty, 360VA, 125/250V AC.

Life expectancy is 50,000 operations at full load; 1 million operations, mechanical. Operating temperature range is —45°C to +65°C. Mounting is by one .166" dia. mounting hole and .160" dia. boss. Termination is .250" quick-connect.

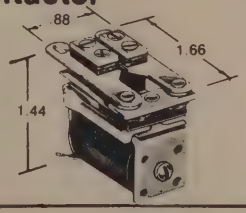



**POWER RELAYS**

| TYPE | COILS | | | CONTACTS | | SUGG. RE-SALE PRICE |
|---|---|---|---|---|---|---|
| | Input | Res. In Ohms | Nom. Power | Arrang. | Amps Rating | |
| S87R5A2B1D1 | 24V<br>120V<br>240V | 34<br>850<br>3400 | 5.4VA | SPDT | 20• | $4.45<br>4.45<br>4.95 |
| S87R11A2B1D1 | 24V<br>120V<br>240V | 34<br>850<br>3400 | 5.4VA | DPDT | 20• | 5.45<br>5.45<br>5.95 |
| S87R5D2B1D1 | 12V<br>24V | 50<br>200 | 2.9W | SPDT | 20• | 4.10<br>4.10 |
| S87R11D2B1D1 | 24V | 200 | 2.9W | DPDT | 20• | 5.10 |

## 60 Amp, Heavy Duty Contactor

**MB SERIES** Miniature DC contactor. Designed for very high current applications. Extra rugged construction ensures long life. Contact arms: Stationary, heavy brass, silver contacts pierced solder terminals. Movable, silver bar contact rated 60 amps @ 28V DC resistive. Mounting: Four No. 3-48 tapped holes on .375" x .375" centers. Weight: 2 oz.




**POWER RELAYS**

| TYPE | COILS | | | CONTACTS | | SUGG. RE-SALE PRICE |
|---|---|---|---|---|---|---|
| | Input | Res. In Ohms. | Nom. Power | Arrang. | Amps. Rating | |
| MB3D | 6V<br>12V<br>24V<br>110V | 13.3<br>62.3<br>245<br>5,000 | 2.7W | SPST-NO-DM | 60 | $12.30<br>12.30<br>12.30<br>13.20 |

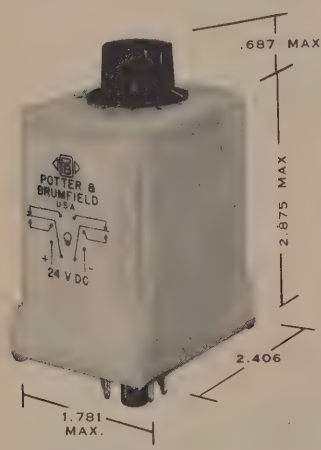
# The industry's broadest line of time delay relays and timing modules!

**THE CD SERIES** is available in delay on operate or release for use with an external relay. There are four cases styles: The CD-21 is designed for use with an external KRP relay. The CD-31 is designed for use with an external KHP relay. The CD-38 has an internal 10 amp DPDT relay and the CD-45 is designed for use with an external PRD relay.

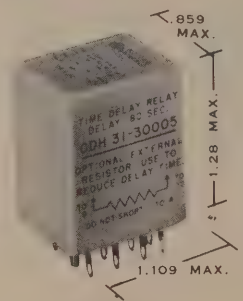
**Tolerance:** ± 5%. For Knob Adj. versions see Dial Scale. Res. Adj. (low end): Min. specified or less. (For AC units add ± ½ cycle 60 Hz.)
**Delta Time:** ± 5%. (For AC units add ± 1 cycle 60 Hz.)
**Repeatability:** ± 1% for 38 style. All others ± 2% (For AC units add ± 1 cycle 60 Hz.)
**Temperature Range:** Operating: — 40°C to + 55°C.
Storage: — 55°C to + 85°C.
**Dial Scale:** Time in seconds, calibrated:

| Setting | Tolerance* |
|---|---|
| Maximum | ± 5% of specified maximum |
| Minimum | Specified minimum or less |
| Other | ± 10% full scale |

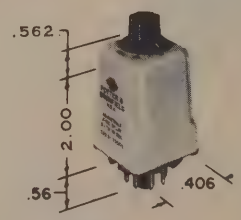
**Release Time:** 45 milliseconds typical; 60 milliseconds maximum.
**Recycle Time:** Less than 60 milliseconds for CD-38 units (internal shorting contact); 2.0 seconds for CD-21, CD-31, and CD-45 units (no shorting contact).
**Transient Protection:** 1000V, all 120V AC units except CD-31 style.
**Polarity Protection:** Yes.
**Timing Cycle Interrupt Transfer:** None.
**Weight:** CD-21, 4.3oz.; CD-31, 2oz.; CD-38, 8oz.; CD-45, 9oz.



CDD-38

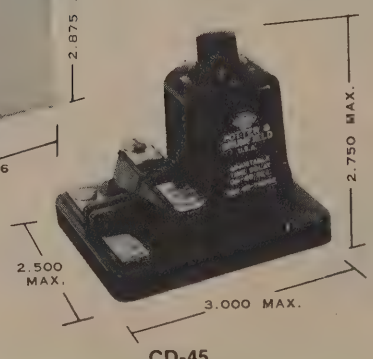


CD-31



CD-21

CDA-38



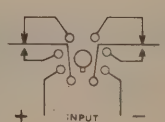
CD-45

## SOLID STATE/EMR TIME DELAY RELAYS

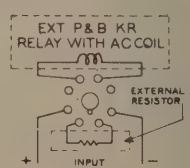
| TYPE | Time Delay in Seconds | Method of Control | Input Voltage | Dia. No. | Notes | SUGG. RE-SALE PRICE |
|---|---|---|---|---|---|---|
| **DELAY ON OPERATE** | | | | | | |
| CDA38-70012 | 1.0 | Fixed | 120 VAC | 1 | 1 | $51.60 |
| CDB21-70001 | 1.8-180 | Knob | 120 VAC | 4 | 2 | 50.50 |
| CDB21-70003 | 0.1-10 | Knob | 120 VAC | 4 | 2 | 50.50 |
| CDB38-30001 | 0.1-10 | Knob | 24 VAC | 1 | 1 | 57.10 |
| CDB38-30002 | 0.6-6 | Knob | 24 VAC | 1 | 1 | 57.10 |
| CDB38-70001 | 0.1-1 | Knob | 120 VAC | 1 | 1 | 57.10 |
| CDB38-70002 | 0.1-5 | Knob | 120 VAC | 1 | 1 | 57.10 |
| CDB38-70003 | 0.1-10 | Knob | 120 VAC | 1 | 1 | 57.10 |
| CDB38-70004 | 0.6-60 | Knob | 120 VAC | 1 | 1 | 57.10 |
| CDB38-70005 | 1.8-180 | Knob | 120 VAC | 1 | 1 | 57.10 |
| CDB38-70006 | 0.3-30 | Knob | 120 VAC | 1 | 1 | 57.10 |
| CDB45-70002 | 0.6-60 | Knob | 120 VAC | 7 | 6 | 48.40 |
| CDD21-30001 | 1.8-180 | Knob | 24 VDC | 3 | 3 | 50.10 |
| CDD21-30003 | 0.1-10 | Knob | 24 VDC | 3 | 3 | 50.10 |
| CDD38-30003 | 0.1-10 | Knob | 24 VDC | 1 | 1 | 54.20 |
| CDD38-30004 | 0.6-60 | Knob | 24 VDC | 1 | 1 | 54.20 |
| CDD38-30005 | 1.8-180 | Knob | 24 VDC | 1 | 1 | 54.20 |
| CDD38-40002 | 0.6-60 | Knob | 48 VDC | 1 | 1 | 54.20 |
| CDF31-70003 | 10 max. | Resistor | 120 VAC | 8 | 11 & 12* | 50.75 |
| CDF38-70001 | 1 max. | Resistor | 120 VAC | 2 | 1 & 9* | 53.15 |
| CDF38-70002 | 5 max. | Resistor | 120 VAC | 2 | 1 & 10* | 53.15 |
| CDF38-70003 | 10 max. | Resistor | 120 VAC | 2 | 1 & 12* | 53.15 |
| CDH31-30005 | 180 max. | Resistor | 24 VDC | 9 | 4 & 14 | 50.75 |
| **DELAY ON RELEASE** | | | | | | |
| CDB38-70012 | 0.6-60 | Knob | 120 VAC | 5 | 1 | 68.25 |
| CDB38-70014 | 0.1-10 | Knob | 120 VAC | 5 | 1 | 68.25 |
| CDB38-70015 | 1.8-180 | Knob | 120 VAC | 5 | 1 | 68.25 |
| CDD38-30008 | 1.8-180 | Knob | 24 VDC | 5 | 1 | 64.40 |
| CDD38-30012 | 0.6-60 | Knob | 24 VDC | 5 | 1 | 64.40 |
| CDD38-30014 | 0.1-10 | Knob | 24 VDC | 5 | 1 | 64.40 |

**NOTE: See page 38 for Socket Ordering Information and explanation of timing fuctions and notes**

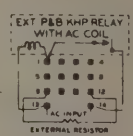
WIRING DIAGRAMS
(Disregard DC polarity for AC relays)



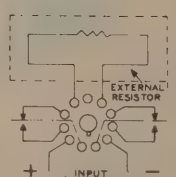
Dia. 1



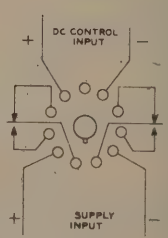
Dia. 4



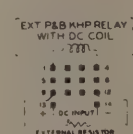
Dia. 8



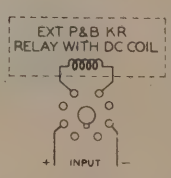
Dia. 2



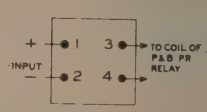
Dia. 5



Dia. 9



Dia. 3



Dia. 7

* External resistor (not furnished) for maximum time. Recommend ¼ watt minimum resistor.

# POTTER & BRUMFIELD RELAYS

## CG SERIES

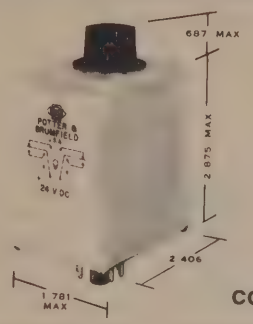
CG Series relays are available in time delay on operate, or interval on. They feature a C/MOS integrated circuit controlling a DPDT relay having contacts rated 10 amps @ 120V AC, or 5 amps @ 240V AC resistive. Repeatability, including first cycle of operation, is typically .01% for DC units, and 0.1% for AC units. The delay time provided by the IC network is not normally affected by voltage transients encountered in industrial applications. The relay contacts will not transfer if timing cycle is momentarily interrupted. Weight is approximately 8 ozs.

**Repeatability** (including first cycle of operation): AC: 0.1% typical, ±0.5% maximum, but not less than ±16 msec. DC: 0.05% typical; ±.1% maximum, but not less than ±3 msec.
**Tolerance:** +10% —0% of max. specified at high end. +0% —10% of min. specified at low end.
Not less than ±16 ms for AC units and ±10 ms for DC, all units.
**Dial Scale:** In seconds or minutes, reference only.
**Delta Time:** ±2% typical, ±5% max.
**Temperature Range:** Operating; —10°C to +55°C.
Storage; —40°C to +85°C.
**Release Time:** 30 ms typical, 45 ms maximum.
**Recycle Time:** AC: ms typical; 60 ms maximum.
DC: 30 ms typical; 45 ms maximum.
**Transient Protection:** 1,000V on all 120 & 240 VAC units
**Polarity Protection:** Yes.
**Timing Cycle Interrupt Transfer:** None.
**Weight:** Approximately 8 oz. (226.64 gm.)

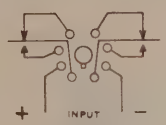
**NOTE: See page 38 for Socket Ordering Information and explanation of timing functions and notes**

## SOLID STATE/EMR TIME DELAY RELAYS

| TYPE | Time Delay In Seconds | Method of Control | Input Voltage | Dia. No. | Notes | SUGG. RE-SALE PRICE |
|---|---|---|---|---|---|---|
| **DELAY ON OPERATE** | | | | | | |
| CGB38-70010M | 1.0- 10 Min | Knob | 120 VAC | 1 | 1 | $64.35 |
| CGB38-70050M | 5.0- 50 Min | Knob | 120 VAC | 1 | 1 | 64.35 |
| CGB38-70100M | 10-100 Min | Knob | 120 VAC | 1 | 1 | 64.35 |
| CGD38-30010M | 1.0- 10 Min | Knob | 24 VDC | 1 | 1 | 61.05 |
| CGD38-30050M | 5.0- 50 Min | Knob | 24 VDC | 1 | 1 | 61.05 |
| CGD38-30100M | 10-100 Min | Knob | 24 VDC | 1 | 1 | 61.05 |
| **INTERVAL ON** | | | | | | |
| CGB38-79010M | 1.0- 10 Min | Knob | 120 VAC | 1 | 1 | 64.35 |
| CGB38-79050M | 5.0- 50 Min | Knob | 120 VAC | 1 | 1 | 64.35 |
| CGB38-79100M | 10-100 Min | Knob | 120 VAC | 1 | 1 | 64.35 |
| CGD38-39010M | 1.0- 10 Min | Knob | 24 VDC | 1 | 1 | 61.05 |
| CGD38-39050M | 5.0- 50 Min | Knob | 24 VDC | 1 | 1 | 61.05 |
| CGD38-39100M | 10-100 Min | Knob | 24 VDC | 1 | 1 | 61.05 |



CG-38

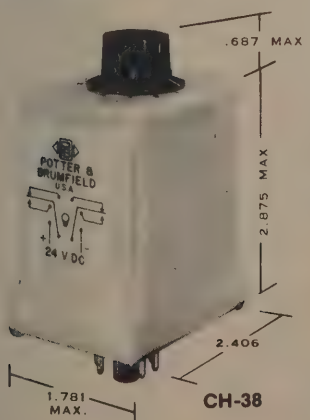


Dia. 1

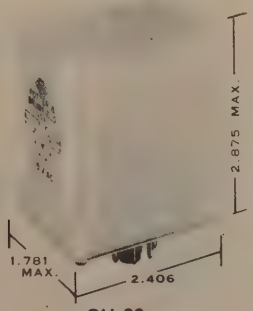
## CH SERIES

The CH series is intended for a wide range of industrial applications where economy is of greater interest than highly critical performance. It is available in two types: Knob-adjustable with the relay in the same enclosure as the solid state unit. The second type has a fixed time delay period that is set at the factory and cannot be modified; its case has no knob. The CH series is available for time delay on either operate or on release.

**Tolerance:**
Knob Adj. units: —0 +20% of maximum specified @ high end; minimum specified, or less, @ low end.
Others: ±5%.
(For AC units add ±½ cycle 60 Hz.)
**Delta Time:** ±10%. (For AC units add ±1 cycle 60 Hz.)
**Repeatability:** ±2%. (For AC units add ±1 cycle 60 Hz.)
**Temperature Range:** Operating: —10°C to +55°C.
Storage: —55°C to +85°C.
**Contact Rating:** DPDT 10 amps @ 120V AC 60 Hz.
**Dial Scale:** Reference only.
**Release Time:** 125 milliseconds typical: 200 milliseconds maximum.
**Recycle Time:** 125 milliseconds typical: 200 milliseconds maximum.
**Transient Protection:** 1000V, all 120V AC units.
**Polarity Protection:** Yes.
**Timing Cycle Interrupt Transfer:** Contacts may transfer momentarily if timing interval is interrupted.
**Weight:** Approx. 6oz.



CH-38



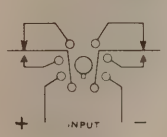
CH-38

## SOLID STATE/EMR TIME DELAY RELAYS

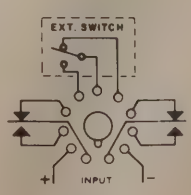
| TYPE | Time Delay In Seconds | Method of Control | Input Voltage | Dia. No. | Notes | SUGG. RE-SALE PRICE |
|---|---|---|---|---|---|---|
| **DELAY ON OPERATE** | | | | | | |
| CHA38-70001 | 10 | Fixed | 120 VAC** | 1 | 1 | $24.45 |
| CHB38-30001 | 1.0-10 | Knob | 24 VAC | 1 | 1 | 25.75 |
| CHB38-30003 | 1.0-180 | Knob | 24 VAC | 1 | 1 | 25.75 |
| CHB38-70001 | 1.0-10 | Knob | 120 VAC** | 1 | 1 | 25.75 |
| CHB38-70002 | 1.0-60 | Knob | 120 VAC** | 1 | 1 | 25.75 |
| CHB38-70003 | 1.8-180 | Knob | 120 VAC** | 1 | 1 | 25.75 |
| CHB38-80001 | 1.0-10 | Knob | **240 VAC | 1 | 1 | 27.20 |
| CHD38-30001 | 1.0-10 | Knob | 24 VDC | 1 | 1 | 24.50 |
| CHD38-30003 | 1.0-180 | Knob | 24 VDC | 1 | 1 | 24.50 |
| **DELAY ON RELEASE** | | | | | | |
| CHB38-30011 | 1.0-10 | Knob | 24 VAC | 6 | 1 & 13 | 33.85 |
| CHB38-70011 | 1.0-10 | Knob | 120 VAC** | 6 | 1 & 13 | 32.15 |
| CHB38-70012 | 1.0-60 | Knob | 120 VAC** | 6 | 1 & 13 | 33.00 |
| CHB38-70013 | 1.0-180 | Knob | 120 VAC** | 6 | 1 & 13 | 32.50 |
| CHD38-30011 | 1.0-10 | Knob | 24 VDC | 6 | 1 & 13 | 33.75 |
| CHD38-30013 | 1.0-180 | Knob | 24 VDC | 6 | 1 & 13 | 33.00 |
| **INTERVAL ON** | | | | | | |
| CHB38-70021 | 1.0-10 | Knob | **120 VAC | 1 | 1 | 31.00 |
| CHB38-70022 | 1.0-60 | Knob | **120 VAC | 1 | 1 | 32.65 |
| CHB38-70023 | 1.0-180 | Knob | **120 VAC | 1 | 1 | 31.25 |
| CHD38-30021 | 1.0-10 | Knob | 24 VDC | 1 | 1 | 32.55 |

**NOTE: See page 38 for Socket Ordering Information and explanation of timing functions and notes**

WIRING DIAGRAMS
(Disregard DC polarity for AC relays)



Dia. 1



Dia. 6

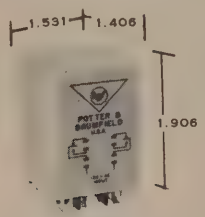
**Not recommended for continuous duty.

# POTTER & BRUMFIELD RELAYS

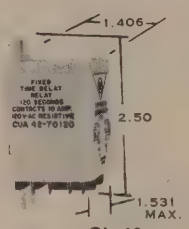
## CL SERIES

Designed for delay on operate the CL Series is similar to the CU with the exception that they don't have timing cycle interrupt transfer and will time to 0.1 second. These solid state time delays are ideal for AC or DC applications. A DPDT KU relay rated 10 amperes is mounted in the same enclosure, forming a compact assembly. CL relays are enclosed in yellow polycarbonate dust covers and are available in three types: fixed, resistor adjustable and knob adjustable. Plug-in/quick-connect terminals facilitate handling and hook-up.

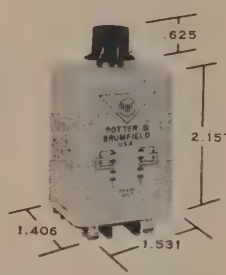
**Tolerance:**
Knob Adj. Types: —0 + 20% of maximum specified @ high end; minimum specified, or less, @ low end.
Res. Adj.: ± 10% high end; min. spec. or less at low end.
Fixed: ± 5%.
(For AC units add ± ½ cycle 60 Hz.)
**Repeatability:** ± 3%. (For AC units add ± 1 cycle 60 Hz.)
**Temperature Range:** Operating: —10°C to + 40°C.
Storage: —55°C to + 85°C.
**Contact Rating:** DPDT 10 amps @ 120V AC 60 Hz.
**Dial Scale:** Reference only.
**Release Time:** 100 milliseconds typical; 150 milliseconds maximum.
**Recycle Time:** 100 milliseconds typical; 150 milliseconds maximum.
**Transient Protection:** 1,000V on all 120V AC units.
**Polarity Protection:** Yes.
**Timing Cycle Interrupt Transfer:** None.
**Weight:** Approx. 3.5oz.



CL-41



CL-42



CL-51

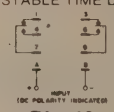
## SOLID STATE/EMR TIME DELAY RELAYS

| TYPE | Time Delay in Seconds | Method of Control | Input Voltage | Dia. No. | Notes | SUGG. RE-SALE PRICE |
|---|---|---|---|---|---|---|
| **DELAY ON OPERATE** | | | | | | |
| CLA41-70010 | 10 | Fixed | 120 VAC | 10 | 1• | $22.40 |
| CLB51-30010 | 0.1-10 | Knob | 24 VAC | 10 | 1• | 27.05 |
| CLB51-70010 | 0.1-10 | Knob | 120 VAC | 10 | 1• | 26.50 |
| CLB51-70120 | 1.2-120 | Knob | 120 VAC | 10 | 1• | 27.50 |
| CLF41-70010 | 0.1-10 | Resistor | 120 VAC | 11 | 200K*• | 24.40 |
| CLF42-70010 | 0.1-10 | Resistor | 120 VAC | 11 | 200K* | 24.40 |
| CLH41-30010 | 0.1-10 | Resistor | 24 VDC | 11 | 160K*• | 24.40 |

NOTE: See page 38 for Socket Ordering Information and explanation of timing functions and notes

WIRING DIAGRAMS
(Disregard DC polarity for AC relays)

FIXED AND KNOB ADJUSTABLE TIME DELAY



Dia. 10

Dia. 11

## CU SERIES

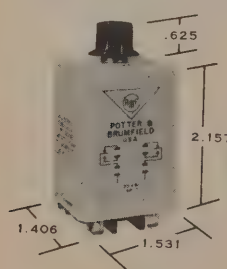
CU Series relays are available in three types: Fixed time delay, adjustable with an external resistor, and knob adjustable with a reference scale. For minimum time (on external resistor types) terminals 2 and 5 must be shorted together . For maximum time, the listed resistor must be connected between terminals 2 and 5. For intermediate values, a lesser value resistor or a potentiometer is used. Either fixed or resistor adjustable models can be furnished in two types of enclosures with the relay mounted in the same case as the solid state circuit. All CU Series contain DPDT relay of the KUP series listed on Page 8.

**Tolerance:**
Knob Adj. Types: —0 + 20% of maximum specified @ high end; minimum specified, or less, @ low end.
Adj. types: ± 10% high end; min. specified or less at low end.
(For AC units add ± ½ cycle 60 Hz.)
Fixed: ± 5%
**Repeatability:** ± 3%. (For AC units add + 1 cycle 60 Hz.)
**Temperature Range:** Operating: —10°C + 40°C.
Storage: —55°C to + 85°C.
**Contact Rating:** DPDT 10 amps @ 28V DC resistive or 120V AC 60 Hz, 80% PF.
**Dial Scale:** Reference only.
**Release Time:** 150 milliseconds typical; 225 milliseconds maximum.
**Recycle Time:** 150 milliseconds typical; 225 milliseconds maximum.
**Transient Protection:** 1,000V on all 120V AC units.
**Polarity Protection:** Yes.
**Timing Cycle Interrupt Transfer:** Contacts may transfer momentarily if timing cycle is interrupted.
**Weight:** Approx. 3.5oz.

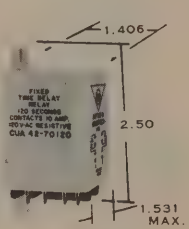
NOTE: See page 38 for Socket Ordering Information and explanation of timing functions and notes

## SOLID STATE/EMR TIME DELAY RELAYS

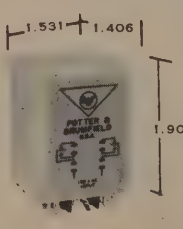
| TYPE | Time Delay In Seconds | Method of Control | Input Voltage | Dia. No. | Notes | SUGG. RE-SALE PRICE |
|---|---|---|---|---|---|---|
| **DELAY ON OPERATE** | | | | | | |
| CUA41-30010 | 10 | Fixed | 24 VAC | 10 | 1• | $18.45 |
| CUA41-70001 | 1.0 | Fixed | 120 VAC | 10 | 1• | 18.45 |
| CUA41-70005 | 5 | Fixed | 120 VAC | 10 | 1 | 18.45 |
| CUA41-70010 | 10 | Fixed | 120 VAC | 10 | 1• | 18.45 |
| CUA41-70120 | 120 | Fixed | 120 VAC | 10 | 1• | 20.40 |
| CUA42-30010 | 10 | Fixed | 24 VAC | 10 | 1• | 18.45 |
| CUA42-70010 | 10 | Fixed | 120 VAC | 10 | 1• | 18.45 |
| CUA42-70120 | 120 | Fixed | 120 VAC | 10 | 1• | 20.40 |
| CUB51-70010 | 1.0-10 | Knob | 120 VAC | 10 | 1• | 22.25 |
| CUB51-70120 | 1.0-120 | Knob | 120 VAC | 10 | 1 | 23.10 |
| CUC41-30010 | 10 | Fixed | 24 VDC | 10 | 1• | 18.45 |
| CUC41-30120 | 120 | Fixed | 24 VDC | 10 | 1• | 20.40 |
| CUC42-30010 | 10 | Fixed | 24 VDC | 10 | 1• | 18.45 |
| CUC42-30120 | 120 | Fixed | 24 VDC | 10 | 1• | 20.40 |
| CUF41-30010 | 1.0-10 | Resistor | 24 VAC | 11 | 200K*• | 19.45 |
| CUF41-70010 | 1.0-10 | Resistor | 120 VAC | 11 | 200K*• | 19.45 |
| CUF41-70030 | 1.0-30 | Resistor | 120 VAC | 11 | 600K*• | 20.05 |
| CUF41-70120 | 1.0-120 | Resistor | 120 VAC | 11 | 2.4Meg*• | 21.10 |
| CUF42-30010 | 1.0-10 | Resistor | 24 VAC | 11 | 200K*• | 19.45 |
| CUF42-70010 | 1.0-10 | Resistor | 120 VAC | 11 | 200K*• | 19.45 |
| CUF42-70120 | 1.0-120 | Resistor | 120 VAC | 11 | 2.4Meg*• | 21.10 |
| CUH41-30010 | 1.0-10 | Resistor | 24 VDC | 11 | 160K*• | 19.45 |
| CUH41-30120 | 1.0-120 | Resistor | 24 VDC | 11 | 2Meg*• | 21.10 |
| CUH42-30010 | 1.0-10 | Resistor | 24 VDC | 11 | 160K*• | 19.45 |
| CUH42-30120 | 1.0-120 | Resistor | 24 VDC | 11 | 2Meg*• | 21.10 |



CU-51



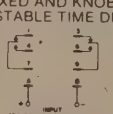
CU-42



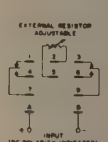
CU-41

WIRING DIAGRAMS
(Disregard DC polarity for AC relays)

FIXED AND KNOB ADJUSTABLE TIME DELAY



Dia. 10



Dia. 11

• Denotes U/L

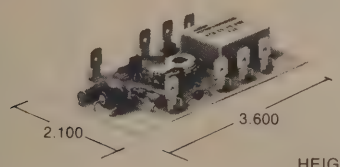
* External resistor (not furnished) for maximum time. Recommend ¼ watt minimum resistor.

# POTTER & BRUMFIELD RELAYS

## R16—our lowest cost time delay relay assembly.

R16 time delay on operate is available in the timing range of 2.0 to 30 seconds. A potentiometer is used to set the timing values. All components are mounted on a .062" G10 glass/epoxy printed circuit board having .250" quick-connect termination. Contacts have a life expectancy in excess of 10 million operations, mechanical, and at least 100,000 operations at full load @ 28V DC. The relay has a polyester cover ultrasonically welded to its base to keep out dust and contaminates. Cleaning by immersion is not recommended. The board mounts with #6 screws. Relay contacts will not transfer if timing cycle is interrupted.

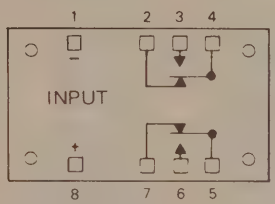
**Tolerance:** Potentiometer adjust—set to any range, within specified range.
**Delta Time:** ± 10%.
**Recycle Time:** 100 ms for 95% recovery.
**Timing Cycle Interrupt Transfer:** For AC inputs—momentary.
**Temperature:**
Operating; —10°C to + 55°C.
Storage; —40°C to + 85°C.
**Mounting:** Four clearance holes for # 6 screws.
**Weight:** 1.5 oz. approximately.
**Transient Protection:** 100V for 100 μsec.
**Repeatability:** ± 3% max.
**Polarity Protection:** Yes.




HEIGHT .500

SOLID STATE/EMR TIME ASSEMBLY

| TYPE | Time Delay in Seconds | CONTACTS | | | Diagram Number | SUGG. RE-SALE PRICE |
|---|---|---|---|---|---|---|
| | | Input Voltage | Arrange. | Amps. Typ. (Max.) | | |
| **DELAY ON OPERATE** | | | | | | |
| R16-30A-24A -Y2 | 2.0-30 | 24 VAC | DPDT | 2 (3) | 19 | $12.20 |
| R16-30A-120A -Y2 | 2.0-30 | 120 VAC | DPDT | 2 (3) | 19 | 13.25 |




**Dia. 19**
No socket used.

## Time Delay Relay Socket Ordering Information

Diagrams 1–6 incl: Use any standard octal-style socket. For screw terminal sockets, see page 12.

Diagram 7: No socket used.

Diagrams 8–9: Use any KH Series socket listed on page 9

Diagrams 10–11: Use any KU Series socket listed on page 8.

Diagrams 12–14 incl: PC board termination.

Diagrams 15–18 incl: See R12–R15 Sockets in this section.

Diagram 19: No socket used.

Diagram 21: PC board termination.

**POTTER & BRUMFIELD offers you a choice from 1000 Standard Relays or, we'll make a SPECIAL for you.**

Our list of over 1000 standard relays provides a type for nearly any application. And if a standard model won't meet your requirements, we'll make one that will. You can order any of the standard relays from leading electronic parts distributors, too. They will give you fast, economical, off-the-shelf service.

Next time you need relays, call your local P&B sales engineer or Potter & Brumfield Division of AMF Incorporated, Princeton, Indiana 47671. Our telephone number is (812) 386-1000.

P&B Relays are available from your local electronic parts distributor.

## Timing functions and notes

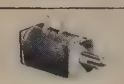
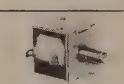
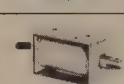
**DELAY ON OPERATE** — The delay period begins when input voltage is applied. The relay will remain de-energized until the end of the delay period, at which time it energizes and operates the output contacts. Reset is accomplished by removal of the input voltage.

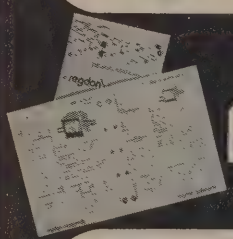
**INTERVAL ON** — The relay operates immediately upon application of input voltage. At the end of the adjustable, predetermined interval the relay drops out, even though input voltage may still be applied. It will remain dropped out until re-application of input voltage. Reset is accomplished by removal of input voltage.

**DELAY ON RELEASE** — The relay operates immediately upon application of input voltage. When input voltage is removed, the relay remains energized until the end of the delay period.

**NOTES: 1.** Has internal relay with DPDT contacts rated at 10 amperes, 120V AC; except CU Series, 10 amps @ 250V AC. **2.** Use with Potter & Brumfield relay KRP5AG-120V AC, KRP11AG-120V AC or KRP14AG-120V AC. **3.** Use with KRP5DG-24V DC, KRP11DG-24V DC, or KRP14DG-24V DC relay. **4.** Use with Potter & Brumfield KHP17D11-24V DC relay. **5.** Resistor shown in diagrams 12, 13 and 14 applies to CJH series only. **6.** Use w/Potter & Brumfield PRD11AY-120V AC relay. **7.** Internal relay contacts rated at 10 VA. **8.** Use 750K resistor for maximum time. **9.** Use 33K resistor for ½ maximum time. **10.** Use 200K resistor for ½ maximum time. **11.** Use with Potter & Brumfield KHP17A11-120V AC relay. **12.** Use 400K resistor for ½ maximum time. **14.** Use 1.6 meg. resistor for ½ maximum time.

## BOX-FRAME SOLENOIDS

| | TYPE | VOLTS | DUTY | OHMS | FORCES AND STROKES ounces @ inches (min.) | (max.) | BODY inches H x L x W | PRICE 1-24 |
|---|---|---|---|---|---|---|---|---|
| | 312-6005 | 24VDC | Cont. | 144 | 22 @ 1/32" | 2 @ 1/4" | 3/4 x 1 5/32 x 3/4 | $3.50 |
| | 312-6006 | 24VDC | Int. | 60 | 28 @ 1/32" | 4 @ 1/4" | 3/4 x 1 5/32 x 3/4 | 3.50 |
| | 312-6011 | 120VAC | Cont. | 390 | 12 @ 1/32" | 2.5 @ 1/4" | 3/4 x 1 5/32 x 3/4 | 3.85 |
| | 312-6012 | 120VAC | Int. | 100 | 20 @ 1/32" | 4 @ 1/4" | 3/4 x 1 5/32 x 3/4 | 3.85 |
| | 5U5-6053 | 24VDC | Cont. | 114 | 14 @ 1/16" | 2.5 @ 3/8" | 15/16 x 1 1/4 x 27/32 | 4.00 |
| | 5U5-6054 | 24VDC | Int. | 52 | 27 @ 1/16" | 5 @ 3/8" | 15/16 x 1 1/4 x 27/32 | 4.00 |
| | 5U5-6059 | 120VAC | Cont. | 500 | 10 @ 1/16" | 4.5 @ 3/8" | 15/16 x 1 1/4 x 27/32 | 4.00 |
| | 5U5-6060 | 120VAC | Int. | 310 | 17 @ 1/16" | 8.5 @ 3/8" | 15/16 x 1 1/4 x 27/32 | 4.00 |
|  | 5U7-6065 | 24VDC | Cont. | 85 | 15 @ 1/8" | 3 @ 1/2" | 15/16 x 1 3/4 x 27/32 | 4.50 |
| | 5U7-6066 | 24VDC | Int. | 33 | 32 @ 1/8" | 7 @ 1/2" | 15/16 x 1 3/4 x 27/32 | 4.50 |
| | 5U7-6071 | 120VAC | Cont. | 250 | 11 @ 1/8" | 7.5 @ 1/2" | 15/16 x 1 3/4 x 27/32 | 4.70 |
| | 5U7-6072 | 120VAC | Int. | 140 | 18 @ 1/8" | 12 @ 1/2" | 15/16 x 1 3/4 x 27/32 | 4.70 |
|  | 809-6101 | 24VDC | Cont. | 104 | 12 @ 1/8" | 2 @ 1/2" | 1 3/16 x 1 1/8 x 15/16 | 4.25 |
| | 809-6102 | 24VDC | Int. | 50 | 22 @ 1/8" | 3 @ 1/2" | 1 3/16 x 1 1/8 x 15/16 | 4.25 |
| | 809-6107 | 120VAC | Cont. | 400 | 12 @ 1/8" | 5 @ 1/2" | 1 3/16 x 1 1/8 x 15/16 | 4.35 |
| | 809-6108 | 120VAC | Int. | 220 | 24 @ 1/8" | 7 @ 1/2" | 1 3/16 x 1 1/8 x 15/16 | 4.35 |
|  | 827-6113 | 24VDC | Cont. | 72 | 24 @ 1/8" | 4 @ 5/8" | 1 3/16 x 1 7/8 x 15/16 | 4.55 |
| | 827-6114 | 24VDC | Int. | 32 | 40 @ 1/8" | 8 @ 5/8" | 1 3/16 x 1 7/8 x 15/16 | 4.55 |
| | 827-6119 | 120VAC | Cont. | 200 | 12 @ 1/8" | 6 @ 5/8" | 1 3/16 x 1 7/8 x 15/16 | 4.60 |
| | 827-6120 | 120VAC | Int. | 85 | 20 @ 1/8" | 13 @ 5/8" | 1 3/16 x 1 7/8 x 15/16 | 4.60 |
| | 930-6125 | 24VDC | Cont. | 54 | 63 @ 1/8" | 7 @ 3/4" | 1 5/8 x 2 x 1 7/16 | 7.40 |
| | 930-6126 | 24VDC | Int. | 15 | 113 @ 1/8" | 25 @ 3/4" | 1 5/8 x 2 x 1 7/16 | 7.40 |
| | 630-6131 | 120VAC | Cont. | 133 | 8 @ 1/8" | 7 @ 3/4" | 1 5/8 x 2 x 1 7/16 | 7.50 |
| | 930-6132 | 120VAC | Int. | 37 | 36 @ 1/8" | 26 @ 3/4" | 1 5/8 x 2 x 1 7/16 | 7.50 |
| | 940-6137 | 24VDC | Cont. | 50 | 78 @ 1/8" | 8 @ 3/4" | 1 5/8 x 2 3/16 x 1 7/16 | 7.60 |
| | 940-6138 | 24VDC | Int. | 15 | 140 @ 1/8" | 18 @ 3/4" | 1 5/8 x 2 3/16 x 1 7/16 | 7.60 |
| | 940-6143 | 120VAC | Cont. | 53 | 24 @ 1/8" | 15 @ 3/4" | 1 5/8 x 2 3/16 x 1 7/16 | 8.00 |
| | 940-6144 | 120VAC | Int. | 15 | 100 @ 1/8" | 65 @ 3/4" | 1 5/8 x 2 3/16 x 1 7/16 | 8.00 |
| | 960-6149 | 24VDC | Cont. | 58 | 50 @ 1/8" | 8 @ 1/2" | 1 5/8 x 1 9/16 x 1 7/16 | 6.00 |
| | 960-6150 | 24VDC | Int. | 21 | 100 @ 1/8" | 18 @ 1/2" | 1 5/8 x 1 9/16 x 1 7/16 | 6.00 |
| | 960-6155 | 120VAC | Cont. | 166 | 14 @ 1/8" | 10 @ 1/2" | 1 5/8 x 1 9/16 x 1 7/16 | 6.25 |
| | 960-6156 | 120VAC | Int. | 60 | 45 @ 1/8" | 30 @ 1/2" | 1 5/8 x 1 9/16 x 1 7/16 | 6.25 |
| | 970-6161 | 24VDC | Cont. | 58 | 65 @ 1/8" | 9 @ 1/2" | 1 5/8 x 1 23/32 x 1 7/16 | 6.75 |
| | 970-6162 | 24VDC | Int. | 20 | 120 @ 1/8" | 24 @ 1/2" | 1 5/8 x 1 23/32 x 1 7/16 | 6.75 |
| | 970-6167 | 120VAC | Cont. | 100 | 22 @ 1/8" | 16 @ 1/2" | 1 5/8 x 1 23/32 x 1 7/16 | 7.00 |
| | 970-6168 | 120VAC | Int. | 125 | 85 @ 1/8" | 58 @ 1/2" | 1 5/8 x 1 23/32 x 1 7/16 | 7.00 |

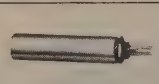
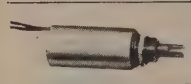
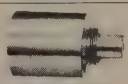
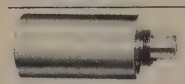


Specifications on request. Sales Representatives in major cities.

# regdon CORPORATION solenoids

3715 GRAND BLVD / BROOKFIELD IL 60513 / 312/485-5152

## TUBULAR SOLENOIDS

| | TYPE | VOLTS | DUTY | OHMS | FORCES AND STROKES ounces @ inches (min.) | (max.) | BODY inches Length x Dia. | PRICE 1-24 |
|---|---|---|---|---|---|---|---|---|
| | R7X9-6171 | 12VDC | Cont. | 80 | 5 @ 1/32" | 1.2 @ 5/32" | 1 1/8 x 7/16 | $5.40 |
| | R7X9-6172 | 12VDC | Int. | 14 | 9 @ 1/32" | 2.5 @ 5/32" | 1 1/8 x 7/16 | 5.40 |
| | R7X9-6173 | 24VDC | Cont. | 260 | 5 @ 1/32" | 1.2 @ 5/32" | 1 1/8 x 7/16 | 5.40 |
| | R7X9-6174 | 24VDC | Int. | 57 | 9 @ 1/32" | 2.5 @ 5/32" | 1 1/8 x 7/16 | 5.40 |
| | R8X7-6181 | 12VDC | Cont. | 55 | 2.5 @ 1/16" | 1 @ 3/16" | 7/8 x 1/2 | 5.50 |
| | R8X7-6182 | 12VDC | Int. | 20 | 6 @ 1/16" | 1.5 @ 3/16" | 7/8 x 1/2 | 5.50 |
| | R8X7-6183 | 24VDC | Cont. | 240 | 2.5 @ 1/16" | 1 @ 3/16" | 7/8 x 1/2 | 5.50 |
| | R8X7-6184 | 24VDC | Int. | 80 | 6 @ 1/16" | 1.5 @ 3/16" | 7/8 x 1/2 | 5.50 |
|  | R8X12-6191 | 12VDC | Cont. | 40 | 7 @ 1/32" | 1.5 @ 1/4" | 1 1/2 x 1/2 | 5.75 |
| | R8X12-6192 | 12VDC | Int. | 10 | 14 @ 1/32" | 4 @ 1/4" | 1 1/2 x 1/2 | 5.75 |
| | R8X12-6193 | 24VDC | Cont. | 160 | 7 @ 1/32" | 1.5 @ 1/4" | 1 1/2 x 1/2 | 5.75 |
| | R8X12-6194 | 24VDC | Int. | 38 | 14 @ 1/32" | 4 @ 1/4" | 1 1/2 x 1/2 | 5.75 |
| | R8X16-6203 | 24VDC | Cont. | 145 | 2.8 @ 1/8" | 1.5 @ 3/4" | 2 x 1/2 | 6.20 |
| | R8X16-6204 | 24VDC | Int. | 24 | 7 @ 1/8" | 4 @ 3/4" | 2 x 1/2 | 6.20 |
|  | R12X12-6211 | 12VDC | Cont. | 41 | 6.5 @ 1/8" | 1.2 @ 5/8" | 1 1/2 x 3/4 | 6.00 |
| | R12X12-6212 | 12VDC | Int. | 6 | 20 @ 1/8" | 6 @ 5/8" | 1 1/2 x 3/4 | 6.00 |
| | R12X12-6213 | 24VDC | Cont. | 165 | 6.5 @ 1/8" | 1.2 @ 5/8" | 1 1/2 x 3/4 | 6.00 |
| | R12X12-6214 | 24VDC | Int. | 25 | 20 @ 1/8" | 6 @ 5/8" | 1 1/2 x 3/4 | 6.00 |
|  | R16X9-6221 | 12VDC | Cont. | 36 | 22 @ 1/16" | 2.5 @ 1/2" | 1 1/8 x 1 | 6.70 |
| | R16X9-6222 | 12VDC | Int. | 8 | 33 @ 1/16" | 4 @ 1/2" | 1 1/8 x 1 | 6.70 |
| | R16X9-6223 | 24VDC | Cont. | 145 | 22 @ 1/16" | 2.5 @ 1/2" | 1 1/8 x 1 | 6.70 |
| | R16X9-6224 | 24VDC | Int. | 30 | 33 @ 1/16" | 4 @ 1/2" | 1 1/8 x 1 | 6.70 |
|  | R16X16-6231 | 12VDC | Cont. | 26 | 21 @ 1/8" | 6.5 @ 5/8" | 2 x 1 | 7.25 |
| | R16X16-6232 | 12VDC | Int. | 3.8 | 56 @ 1/8" | 20 @ 5/8" | 2 x 1 | 7.25 |
| | R16X16-6233 | 24VDC | Cont. | 105 | 21 @ 1/8" | 6.5 @ 5/8" | 2 x 1 | 7.25 |
| | R16X16-6234 | 24VDC | Int. | 15 | 56 @ 1/8" | 20 @ 5/8" | 2 x 1 | 7.25 |
| | R24X13-6243 | 24VDC | Cont. | 85 | 50 @ 1/8" | 5 @ 5/8" | 1 5/8 x 1 1/2 | 9.80 |
| | R24X13-6243 | 24VDC | Int. | 14 | 150 @ 1/8" | 20 @ 5/8" | 1 5/8 x 1 1/2 | 9.80 |
| | R23X19-6253 | 24VDC | Cont. | 59 | 80 @ 1/8" | 8 @ 1" | 2 3/8 x 1 1/2 | 10.50 |
| | R24X19-6253 | 24VDC | Int. | 10 | 140 @ 1/8" | 32 @ 1" | 2 3/8 x 1 1/2 | 10.50 |

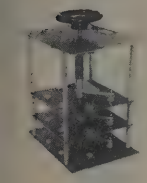
# HIGH VOLTAGE DEVICES

RELAYS
SWITCHES
MEASUREMENT
CONTROL UNITS

AC
DC
RF
PULSE

1 KV TO 600 KV
ENERGY STORAGE
ELECTRONIC AND POWER
SAFETY AND ACCESSORIES

## HV ROTARY SWITCHES



Ratings from 5 to 100 KV, 1 to 500 amps. Either manual or electrical operators, depending upon requirements. Position detents and interlocks to prevent opening under load.

## HIGH CURRENT SWITCHES

Models are available up to 20,000 amps continuous, and over 500,000 amps pulse, with voltage ratings of 6 volts to 300 KV peak test. Many are air cylinder or motor operated for high contact force.

## HV RELAYS

HV relays of the air insulated type both for low and high current. This series has ratings from 1 to 200 amps continuous, 100 to 100,000 amps momentary and capacitor discharge. Peak test voltages from 5 to 300 KV. Single or Multipole. NO, NC and DT. Auxiliary contacts optional on all types. Extended life and tungsten contacts also for high current closing.

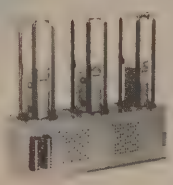
## HV-RF SWITCHES

For RF applications, low loss G-7 Silicone glass insulation and non-magnetic materials are used. Switches available up to 50 MHz. 1 to 50 KV, 1 to 800 amps. Air or hydraulic, and spring actuated.

## HV GROUNDING RELAYS

Extra high voltage low corona grounding relays of the air insulated type. Ratings up to 600 KV peak at 100 amps continuous. Solenoid, motor or air cylinder operated and spring or gravity return.

## VACUUM CONTACTORS CIRCUIT BREAKERS



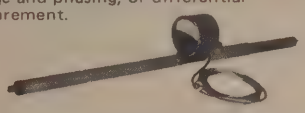
Vacuum switches, single phase, three phase, upright or low profile, for high reliability sealed arc interrupting or crobar shorting. 5 to 200 KV RMS operate. 50 to 4,000 amps continuous, 2,000 to 35,000 amps AC, 10 to 20,000 amps DC interrupt, 5,000 to 100,000 amps momentary and capacitor discharge.

## QUIET AC PRECISION SOLENOIDS

Class H coils with 180° C insulation. 1¼" stroke, or, with special stainless steel guides extendable to several inches. Corrosion resistant. Coil voltages offered are: 115 V, 208 V, 240 V, and 480 V, 60 Hz. 50 Hz optional. Other voltages and frequencies including DC available.

## Hi-Z T.M. HV VOLTMETERS SAFE POWER LINE USE AC - DC

Fully safe portable, all solid state, 2% to 5% accuracy. Taut band shielded high voltage measurement with minimum circuit loading. 0.0001 V to 240 KV AC and DC. Ideal for use with Elbow capacitance tap voltage test points. For cable test point or direct line voltage and phasing, or differential measurement.



## SOLENOID DRIVERS ENERGY STORAGE UNITS

For high speed or loss of power automatic circuit breaker trip and for high speed activation of contactor or circuit breaker solenoids. Energy storage up to 400 joules or more at 150 to 700 volts or more, 100 to 4,000 microfarad or more. Instantaneous SCR control available.

## TOROIDS, SPHERES, CORONA SHIELDS

Geometrically designed to avoid excessive voltage gradients at connecting points and other areas needing shielding or balancing of electrostatic fields to increase withstand voltage and minimize corona. Diameters are to international standard metric sizes.

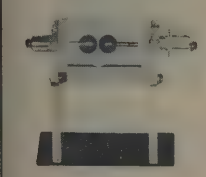
## HV DIGITAL MEMORY MULTIMETERS

Easy to read, 4½-digit display; 0.05% basic accuracy. 0.0001 volt to 900 KV. Battery/AC with charger. Recorder and scope outputs. DC, AC PK, AC RMS average, AC RMS true, RF to 250 MHz, ohms, megohms, AC and DC current, Peak Memory.

## HV VOLTAGE DIVIDERS

Precision compensated resistance-capacitance voltage dividers for 20 KV to 900 KV, DC to 10 MHz or to 0.2 USEC rise time pulse. 1,000/1 ratio matched to 1 megohm, 20 to 50 pf display or recorder, or as required. Accuracy and stability 0.1% to 3%.

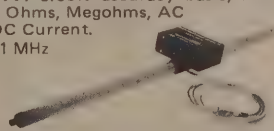
## HV ADJUSTABLE SPARK GAPS



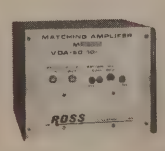
Non-melting carbon spheres, 1 cm to 10 cm and heavy wall aluminum spheres, 10 cm and above. Dust tight transparent covers used 1 KV to 88 KV. Open style to 670 KV. Direct reading micrometer type calibrating device.

## HV DIGITAL PROBES

HV Safety Probes for any Digital Display or VTVM. Also available complete with large 4½ - digit display 0.1% to 5% AC/DC accuracy, safety handle digital voltmeter. Battery/AC with charger. Removable Digital Display or Multimeter. Shielded. 0.0001 V to 200 KV. 0.05% accuracy basic, with DCV, ACV, Ohms, Megohms, AC and DC Current.
DC to 1 MHz



## WIDE BAND MATCHING AMPLIFIER




Rechargeable battery/AC operated. DC to 1 MHz. 1 megohm or higher input to 50 ohm load. Cable driver has maximum output to 10 V PK (20 V PK to PK) and maximum input of 10 V to 1,000 V PK direct from signal source. With Ross wide band HV dividers useful 0.1 V to over 900 KV.

ROSS ENGINEERING CORP.
559 WESTCHESTER DRIVE CAMPBELL, CALIF. 95008
PHONE (408) 377-4621
24 HR. (408) 253-1572

WRITE FOR CATALOG

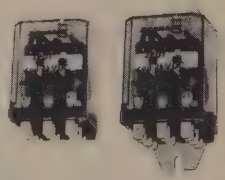
# SCHRACK RELAYS

**low cost • immediate delivery • highest quality**

## GENERAL PURPOSE RELAYS — INDUSTRIAL

**CA**—A dependable, robust unit, similar to CAD series except open frame. Supplied with pierced .110 faston terminals for soldering or quick connect-disconnect. P.C. terminals optional. Coil voltage from 6—230 VAC. 50/60 cycle. 6—110 VDC.

**CAD**—A compact, plug-in relay with dust cover. Available with 1, 2, or 3PDT contacts rated at 5 or 10 amps. The 8 or 11 pin base mates with any standard tube socket. Coil voltage from 6-230 VAC. 50/60 cycle, and 6—110 VDC.



**RM**—A small, low cost relay supplied with pierced .187 faston terminals for plug-in, soldering, or quick connect-disconnect application. Dust cover, plain style, for socket applications, or with slotted flanges on both ends of dust cover to permit bracket mounting directly to chassis. Sockets, neon lamps, test button available. U.L. recognized. File # E38891. **DPDT unit for 15 amp use.** 3PDT unit for 10 amps.

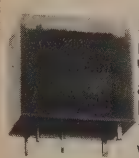
**ZKU**—A dependable miniature general purpose relay for control circuits, automatic control systems and electronic devices requiring compact relay design and high reliability. Available with plug-in, solder or PCB terminals and 2, 4, or 6 Form C fine silver (gold flashed) contacts rated at 3 amps. Contact size: .078 O.D. Coil voltages from 6-110 VDC. Enclosed in dust cover, and can be mounted in any position.

**ZLU**—Same as above, only sil-cad. oxide contacts rated at 5 amps. Contact size: .100 O.D.

## MINIATURE RELAYS

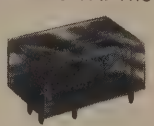
**RA**—A 4 PDT, U.L. recognized, miniature general purpose relay with gold flashed 3 amp contacts. Coil voltage from 6-220 VAC and 6-110 VDC. Available as plug-in unit to any one of 3 different socket types, with solder lugs or standard P.C. terminals. Enclosed in dust cover. Various contact materials available.

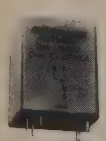
**RAX**—Same as above except U.L. recognized for opposite polarity voltages.



**RU101**—A SPDT low cost miniature relay built to meet stringent automotive Q.C. specifications. Widely used in office machines, alarm systems and appliances. Available for PCB mounting with Form C fine silver (gold diffused) contacts rated at 10 amps. Coil voltages from 3-110 VDC. Enclosed with snap-on nylon dust cover.

**RU115**—A miniature low profile relay with an unusually high rated breaking capacity of 10 amps at 2200 VA. The 1 Form C relay contact is rated @ 6 amps, 250 VAC continuous duty. Can be mounted in any position. Coil voltages from 5-110 VDC. Dimensions: 1⅛" long x ¾" wide x ½" high, in clear dust cover for PCB mounting.





**ZL880**—A smaller relay than the RU101, available for PCB mounting. 1 Form C fine silver (gold flashed) contacts, rated at 6 amps at 250 VAC. Relay requires less power consumption than our RU115. Coil voltages from 3-110 VDC. Can be supplied with 2 coils - bifiliar winding; 2 coils - different coil resistances; or 2 coils - equal coil resistances. Low cost.

## MAGNETIC LATCHING

**CRD/CRF**—A single coil magnetic latching relay similar in base design to the CAD or CAF series, CRD has octal or 11 pin base CRF pierced .110 faston terminals for soldering or quick connect-disconnect applications P.C. terminals can be furnished. Since no parts are subject to wear or friction, longer life is obtainable than with the mechanical latching relay. DPDT and 3PDT available at 10 amps. Enclosed in dust cover; aluminum dust cover optional with CRF type.

**RR**—Miniature version of the above, but furnished as 4PDT with 3 amp contact rating. Same physical size as RA relay. Enclosed in dust cover.

## SENSITIVE RELAYS

**CSD/CMD**—Mechanical construction similar to CA or CAD types but with sensitivity ranging from 40-300 MW and 250 MVA. Max. 3PDT. Coil voltage from 5-200 VAC and 4.9-100 VDC.

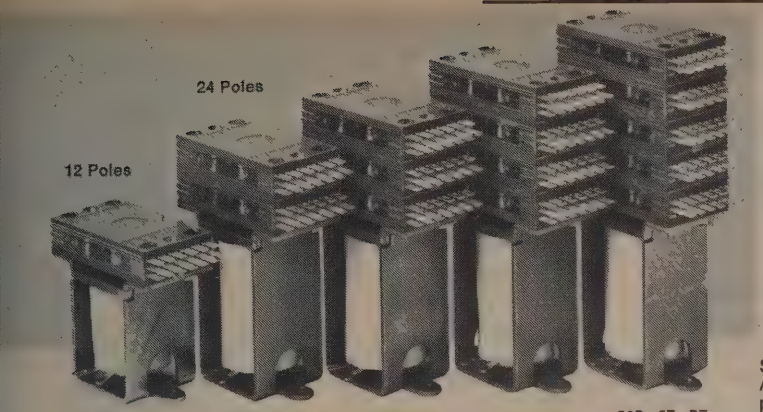
## STEPPING SWITCHES

**RTM**—A miniature plug-in, high speed stepping switch ideal for use where economy of space and price is important. 2 pole 10 or 2 pole 12 position, gold plated contacts mate with socket which terminates on printed circuit spacing. Coil voltage from 12 to 110 VDC. Enclosed in dust cover. Dimensions: 1 5/8" L x 13/16" W x 15/16" H.

***A complete variety of relay dust covers, plugs and sockets.***

*Write for catalogs and discount schedules.*

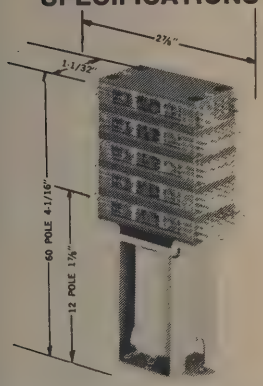
**SCHRACK ELECTRICAL SALES CORPORATION** 1140 BROADWAY, NEW YORK, N.Y. 10001




# T-bar RELAYS for Multipole High Density Switching

Switch from 4 to 60 circuits with only one T-Bar Relay. Available in configurations of 4, 8, 12, 24, 36, 48 and 52 poles with "A" or "C" contacts and 60 poles with "A" form contacts. For low level applications specify the 901 Series. For general purpose applications specify the 801 Series.

## SPECIFICATIONS




**Contacts:** Series 800—general purpose gold plated
Series 900—low-level bifurcated gold plated

**Contact Rating:** Series 800—5 amps max. resistive to 150 watts
Series 900—1 amp max. resistive to 50 watts

**Life Expectancy: at 20 CPM** Series 800—30,000,000 mechanical (latching limited to 1,000,000)
20,000,000 @ 100 mw
100,000 @ 5 amps 28 VDC
Series 900—30,000,000 mechanical
20,000,000 @ 100 mw
100,000 @ 1 amp at 28 VDC

**Contact Resistance:** 20 milliohms typical

**Ambient Temperatures:** —55° to plus 85°C

**Terminals:** Mate with T-Bar Connectors

**Dielectric Strength:** 1000 VRMS @ 60 cycles/sec. (higher available)

**Insulation Resistance:** 5000 megohms min. (higher available)

**Power @ 25°C:**

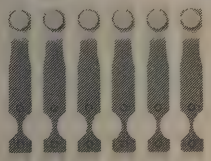
| Poles | Form | Watts |
|---|---|---|
| 4, 8 or 12 | A, B or C | 3 |
| 24 | A, B or C | 3.4 |
| 36 | A, B or C | 5.2 |
| 48 | A | 5.2 |
| 48 | B or C | 6.5 |
| 52 | A, B or C | 6.5 |
| 60 | A | 6.5 |
| 4, 8 or 12 | D | 3.4 |
| 24 | D | 5.2 |
| 36 | D | 6.5 |

NOTE: On all latching standard pulse coil power is 6 watts, except on bifilar coils, which is 10 watts.

**Operate and Release Time Typical (at nominal voltage 25°C):**
**Operate** (Refer to factory for faster operation):
4, 8 or 12 poles: 15 MS max.
24 poles: 25 MS max.
36 poles: 30 MX max.
48 poles: 35 MX max.
52 or 60 poles: 45 MS max.
For latching types: latch and unlatch times are 15 MS typical, all sizes.
**Release:** 5 MS typical
**Contact Bounce:**
2 MS typical N.O. contacts
6 MS typical N.C. contacts
4 MS typical for latching units (both ways)

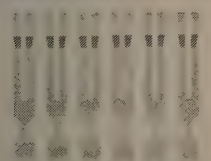
## Take your choice of 2 contacts!

**800 SERIES**
**for reliable General Purpose Switching**



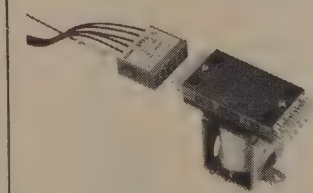
The 800 Series contact is a highly reliable gold-plated button contact. With its high contact pressure and positive wiping action, it is used in control type applications and in general purpose switching, such as relays, valves, lamps, etc. Contact Rating: up to 5 AMPS max.

**900 SERIES**
**for reliable Low Level Switching**



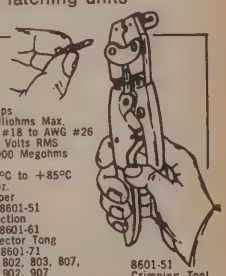
The 900 Series DATA-RITE™ contact has the reliability of a bifurcated contact with the added feature of two degrees of wiping action. The unique EDGE-TO-DOME contact guarantees a clean surface, which is critical for low level signals. The 900 Series is typically used in computer I/O signals; voice and data-grade communications; thermocouple and strain gauge outputs; all low level switching, whenever reliability is a premium, or whenever slight variations in contact resistance cannot be tolerated. Contact Rating: Microvolts up to 1 AMP max.

## T-BAR CONNECTORS



The T-Bar Series 88601 Connector has been specifically designed for use with T-Bar switches and relays. The connector contacts are crimp type which are snapped into a plastic insulator block. After installation, connectors are held in place against shock and vibration by use of a retaining clip.

| | |
|---|---|
| Current Carrying Capacity | 5 Amps |
| Contact Resistance | 5 Milliohms Max. |
| Wire Accommodated | AWG #18 to AWG #26 |
| Dielectric Strength | 1000 Volts RMS |
| Insulation Resistance | 100,000 Megohms Min. |
| Ambient Temperature | —55°C to +85°C |
| Weight | 0.3 Oz. |
| Recommended Tools | Crimper P/N 8601-51 Extraction P/N 8601-61 Connector Tong P/N 8601-71 |
| Use 88601 With | 801, 802, 803, 807, 901, 902, 907 |




## HOW TO ORDER

**1.** Specify Series **2.** Specify Number of Poles and Contact Form **3.** If A Relay, Specify Coil Voltage

Don't forget to order the mating T-Bar Series 88601 Connector! One for each 6 poles.

**901 — 12 C — 24**

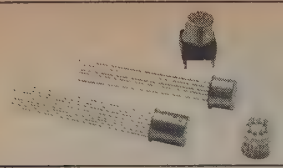
| SERIES | Application | No. of Poles | Contact Form* | Actuating Mechanism | Coil Voltage |
|---|---|---|---|---|---|
| 801 | General Purpose | 4 to 52 60 Pole Unit "A" Form Only | "A" or "C" | CONTINUOUS DUTY COIL | 6, 12, 24, 28, 48, 110 VDC 115 VAC |
| 901 | Low Level | | | | |
| 807 | General Purpose | 12 to 52 | "C" | MAGNETIC LATCHING COIL (Pulse to latch, pulse in opposite polarity to unlatch.) | 6, 12, 24, 28, 48, 110 VDC |
| 907 | Low Level | | | | |

*Form "A"— normally open contacts. Form "C"— double throw, break-before-make.

Manufactured under 1 or more of the following patents: 3206990, 3226508, 3689856.
®"T-Bar"—Reg. T.M.

T-bar INCORPORATED
SWITCHING COMPONENTS DIV.
141 Danbury Road, Wilton, Conn. 06897 • (203) 762-8351

Bob Paul 4944



# TELEDYNE RELAYS

## Military TO-5 Relays

The most versatile line of subminiature relays in the industry. Featuring all welded construction, hermetic sealing, and high force/mass ratios for excellent resistance to environmental extremes. Gold plated precious metal contacts assure reliable switching of loads from dry circuit to 1 ampere. Contact geometry and low inter-contact capacitance provide RF switching capability up to 500 MHZ. Most models qualified to MIL-R-39016, levels "L", "M", and "P" or MIL-R-28776.

**Available in following versions:**

- **SPDT & DPDT**, with optional internal suppression and/or steering diodes
- **SPDT & DPDT Sensitive,** with optional internal suppression and/or steering diodes
- **SPDT & DPDT Hybrid** (both standard and sensitive coil versions) with internal transistor driver and suppression diode
- **SPDT, DPDT, & 4PST Magnetic Latching,** with optional internal suppression and/or steering diodes
- **SPDT & DPDT Bifilar**
- **Special packages available upon request.**

| SERIES* | | CONTACT DATA | | COIL DATA | | | APPLICABLE MIL. SPEC. SHEET |
|---|---|---|---|---|---|---|---|
| | | ARRANGEMENT | MAX. RATING** (AMPS @ 28 VDC) | NOMINAL VOLTAGE (VDC) | NOMINAL RESISTANCE (Ω) | MUST-OPERATE POWER (MW) | |
| 411 | | 1 FORM C | 1 | 5, 6, 9, 12, 18, 26.5 | 63, 125, 280, 500, 1130, 2000 | 100 | M39016/7 |
| 411D | | 1 FORM C | 1 | 5, 6, 9, 12, 18, 26.5 | 63, 125, 280, 500, 1130, 2000 | 100 | M39016/23 |
| 411DD | | 1 FORM C | 1 | 5, 6, 9, 12, 18, 26.5 | 50, 98, 280, 500, 1130, 2000 | 100 | M39016/24 |
| 411T | | 1 FORM C | 1 | 5, 6, 9, 12, 18, 26.5 | 63, 125, 280, 500, 1130, 2000 | 100 | M28776/5 |
| 412 | | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5 | 50, 98, 220, 390, 880, 1560 | 130 | M39016/9 |
| 412D | | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5 | 50, 98, 220, 390, 880, 1560 | 130 | M39016/15 |
| 412DD | | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5 | 39, 78, 220, 390, 880, 1560 | 130 | M39016/20 |
| 412T | | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5 | 50, 98, 220, 390, 880, 1560 | 130 | M28776/1 |
| 431 | SENSITIVE | 1 FORM C | 1 | 5, 6, 9, 12, 18, 26.5, 32, 40 | 125, 255, 630, 1025, 2300, 4000, 6500, 11000 | 40 | M39016/10 |
| 431D | SENSITIVE | 1 FORM C | 1 | 5, 6, 9, 12, 18, 26.5, 32, 40 | 125, 255, 630, 1025, 2300, 4000, 6500, 11000 | 40 | M39016/25 |
| 431DD | SENSITIVE | 1 FORM C | 1 | 5, 6, 9, 12, 18, 26.5, 32, 40 | 100, 200, 630, 1025, 2300, 4000, 6500, 11000 | 40 | M39016/26 |
| 431T | SENSITIVE | 1 FORM C | 1 | 5, 6, 9, 12, 18, 26.5, 32, 40 | 125, 255, 630, 1025, 2300, 4000, 6500, 11000 | 40 | M28776/4 |
| 432 | SENSITIVE | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5, 36, 48 | 100, 200, 400, 850, 1600, 3300, 6500, 11000 | 60 | M39016/11 |
| 432D | SENSITIVE | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5, 36, 48 | 100, 200, 400, 850, 1600, 3300, 6500, 11000 | 60 | M39016/16 |
| 432DD | SENSITIVE | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5, 36, 48 | 64, 125, 400, 850, 1600, 3300, 6500, 11000 | 60 | M39016/21 |
| 432T | SENSITIVE | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5, 36, 48 | 100, 200, 400, 850, 1600, 3300, 6500, 11000 | 60 | M28776/3 |
| 421 | MAGNETIC LATCHING | 1 FORM C | 0.5 | 5, 6, 9, 12, 18, 26.5 | 61, 120, 280, 500, 1130, 2000 | 100 | M39016/8 |
| 421D | MAGNETIC LATCHING | 1 FORM C | 0.5 | 5, 6, 9, 12, 18, 26.5 | 61, 120, 280, 500, 1130, 2000 | 100 | M39016/27 |
| 421DD | MAGNETIC LATCHING | 1 FORM C | 0.5 | 5, 6, 9, 12, 18, 26.5 | 48, 97, 280, 500, 1130, 2000 | 100 | M39016/28 |
| 420/422 | MAGNETIC LATCHING | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5 | 61, 120, 280, 500, 1130, 2000 | 100 | M39016/12 |
| 420D/422D | MAGNETIC LATCHING | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5 | 61, 120, 280, 500, 1130, 2000 | 100 | M39016/29 |
| 420DD/422DD | MAGNETIC LATCHING | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5 | 48, 97, 280, 500, 1130, 2000 | 100 | M39016/30 |
| 424A | MAGNETIC LATCHING | 4 FORM A | 0.5 | 5, 6, 9, 12, 18, 26.5 | 61, 120, 280, 500, 1130, 2000 | 125 | NA |
| 424AD | MAGNETIC LATCHING | 4 FORM A | 0.5 | 5, 6, 9, 12, 18, 26.5 | 61, 120, 280, 500, 1130, 2000 | 125 | NA |
| 441 | BI-FILAR | 1 FORM C | 1 | 6, 12, 26.5 | 90, 360, 1450 | 145 | NA |
| 442 | BI-FILAR | 2 FORM C | 1 | 6, 12, 26.5 | 90, 360, 1450 | 145 | NA |

**General Specifications:**

Contact Resistance: 0.1Ω max. initial/0.2Ω max. after life at max. load
Life: 100,000 operations @ max. rated contact load (life expectancy $10^7$ operations at low level)
Temperature: −65°C to +125°C
Vibration: 30 g's to 3000 Hz.
Shock: 80 g's for 11 ms. (some maglatch models higher)

**Terminal and Spreader Pad Options:**

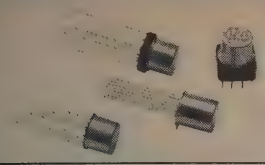
1. Standard terminal lengths: 1.5" (38.10 mm) wire leads or .187" (4.75 mm) pins (pin versions designed for use with plug-in sockets)
2. All models except 411 & 431 series (including D & DD versions) and 441 series can be supplied with spreader pads installed and cemented in place. Spreader pad P/N 192-10 for direct mounting on PC boards; P/N 192-59 designed for use with standard DIP sockets.

*Suffix D denotes internal suppression diode, DD suppression & steering diodes, and T transistor driver & suppression diode.
**Ratings for AC, Lamp, Inductive and Capacitive Loads also specified.

TELEDYNE RELAYS

3155 West El Segundo Boulevard, Hawthorne, California 90250 • Telephone (213) 973-4545

Detailed specifications on any of our products or a complete catalog are available on request.



# TELEDYNE RELAYS

## Commercial/Industrial TO-5 Relays

Low cost versions of DPDT MIL qualified TO-5 relays. Hermetic sealing, all welded construction, and gold plated precious metal contacts assure reliable switching of loads from dry circuit to 1 ampere. Contact geometry and low intercontact capacitance provide RF switching capability up to 500 MHz.

**Available in following versions:**

- **DPDT,** with optional internal suppression diode
- **DPDT Sensitive,** with optional internal suppression diode
- **DPDT Hybrid** (both standard and sensitive coil versions) with internal transistor driver and suppression diode
- **DPDT Magnetic Latching,** with optional internal suppression diodes

**Special packages available on request.**

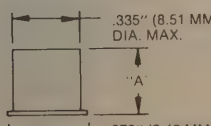
| SERIES | CONTACT DATA | | | COIL DATA | |
|---|---|---|---|---|---|
| | ARRANGEMENT | MAX. RATING (AMPS @ 28 VDC) | NOMINAL VOLTAGE (VDC) | NOMINAL RESISTANCE (Ω) | MUST-OPERATE POWER (MW) |
| 712 | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5 | 50, 100, 220, 390, 880, 1560 | 185 |
| 712D | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5 | 50, 100, 220, 390, 880, 1560 | 185 |
| 712TN | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5 | 50, 100, 220, 390, 880, 1560 | 185 |
| 732 | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5 | 100, 200, 400, 850, 1600, 3300 | 90 |
| 732D | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5 | 100, 200, 400, 850, 1600, 3300 | 90 |
| 732TN | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5 | 100, 200, 400, 850, 1600, 3300 | 90 |
| 732-1000* | 2 FORM C | 1 | 12 | 940 | 60 |
| 732D-1000* | 2 FORM C | 1 | 12 | 940 | 60 |
| 720/722 | 2 FORM C MAGLATCH | 1 | 5, 6, 9, 12, 18, 26.5 | 61, 120, 280, 500, 1130, 2000 | 125 |
| 720D/722D | 2 FORM C MAGLATCH | 1 | 5, 6, 9, 12, 18, 26.5 | 61, 120, 280, 500, 1130, 2000 | 125 |

**Spreader Pad Options:**
All models can be supplied with spreader pad mounted and cemented in place. Spreader pad P/N 192-10 for direct mounting on PC boards; P/N 192-59 designed for use with standard DIP sockets.

*Ultra-sensitive 732-1000 series designed specifically for use in battery-operated radio transceivers.
**Ratings for AC, Lamp, Inductive and Capacitive Loads also specified.

**General Specifications:**
Contact Resistance: .100Ω initial/.200Ω max. after life at max. load
Life: 100,000 operations at max. rated load (life expectancy $10^7$ operations at low level loads)
Temperature: −55°C to +71°C (operating)

## TO-5 Relay Case Dimensions




| RELAY SERIES | "A" DIM | |
|---|---|---|
| | INCHES | MM |
| 411<br>412 | 265 | 6 74 |
| 421<br>420/422<br>712<br>720/722 | 275 | 6 99 |
| 424A | 325 | 8 26 |
| 431<br>432<br>441<br>442<br>732 | 375 | 9 53 |

## Spreader Pads for TO-5 Relays

Preform and spread leads to grid patterns compatible with printed circuit board layouts and DIP sockets, with minimum additional profile height.

**P/N 192-10**
- Preforms and spreads leads to .200" X .300" grid at .100" spacing
- Serves as spacer and insulator for printed circuit board applications
- Simplifies insertion of leads into printed circuit boards
- Reduces stress on glass seals
- Aids visual inspection of solder flow
- Fits all TO-5 relays except 411, 424A, and 431 series (including D and DD versions) and 441 series. (See Note 2)

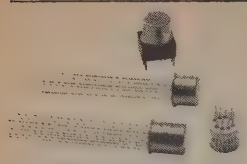
**P/N 192-59**
- Preforms and spreads leads to .300" grid at .100" spacing
- Designed for use with standard DIP sockets
- Fits the following TO-5 relay series: 412, 421, and 432 (including D and DD versions), 712 and 732 (including D versions), 411T, 431T, and 442 (See Notes 3 and 5)

**P/N 192-67**
- Preforms and spreads leads to .200" X .300" grid at .100" spacing
- Fits the following TO-5 relay series: 411 and 431 (including D and DD versions), 441 and 424A (See Note 4)

**Notes:**
1. Relays can be supplied with spreader pads installed and cemented in place.
2. To order relays with 192-10 spreader pads installed, add M to part number (for example: 412D-26 with 192-10 pad installed is 412DM-26).
3. To order relays with 192-59 spreader pads installed, add M2 to part number (for example: 412D-26 with 192-59 pad installed is 412DM2-26). Leads are trimmed to .130" below pad for plugging directly into DIP sockets.
4. To order relays with 192-67 spreader pads installed, add M3 to part number (for example: 412D-26 with 192-67 pad installed is 412DM3-26).
5. Relays with 9 or 10 pins may be mounted on 192-59 spreader pad, but will not plug into standard DIP sockets.
6. Material: Diallyl Phthalate.

TELEDYNE RELAYS
3155 West El Segundo Boulevard, Hawthorne, California 90250 • Telephone (213) 973-4545

Detailed specifications on any of our products or a complete catalog are available on request.



# TELEDYNE RELAYS

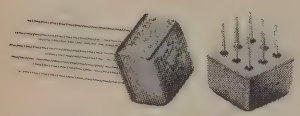
## High Environmental Military TO-5 Relays

Designed to withstand severe environmental conditions of shock, vibration, or elevated temperature in excess of normal military specification levels. The following versions are available, all of which meet other requirements of MIL-R-39016:

| SERIES | CONTACT DATA | | COIL DATA | | |
|---|---|---|---|---|---|
| | ARRANGEMENT | MAX. RATING (AMPS @ 28 VDC) | NOMINAL VOLTAGE (VDC) | NOMINAL RESISTANCE (Ω) | MUST-OPERATE POWER (MW) |
| 412H | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26, 5 | 50, 98, 220, 390, 880, 1560 | 130 |
| 412K | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26, 5 | 50, 80, 160, 300, 600, 1350 | 250 |
| 412V | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26, 5 | 50, 70, 155, 235, 610, 1130 | 170 |

**412H Series – High Temperature (200°C)**
**412K Series – High Shock (4000 g's/0.5ms)**
**412V Series – High Vibration (250 g's)**

Notes
1. Unless otherwise specified relays are supplied with 1.500" (38.10 mm) leads. For .187" (4.75 mm) pin versions, add "S" to part number (i.e. 412H-26 becomes 412HS-26).
2. All series can be supplied with spreader pads installed and cemented in place. Spreader pad P/N 192-10 for direct mounting on PC boards: P/N 192-59 designed for use with standard DIP sockets.
3. Screened hi-rel versions of TO-5 relays are available on special order and can be supplied to meet the requirements of NASA MSF C Spec. 40M 37496 and NASA GSF C Spec. S-311-P-2(06), in addition to specific customer applications.



## Centigrid® Military Relays

The smallest subminiature, hermetically sealed relay available. Low profile, .230" (5.84mm) high by .370" (9.40mm) square, with .100" grid spaced terminals. Sensitive version, 132 Series, is .350" (8.9mm) high and features ultra-low coil power dissipation. All-welded construction, hermetic sealing, and high force/mass ratios for excellent resistance to environmental extremes. Gold plated precious metal contacts assure reliable switching of loads from dry circuit to 1 ampere. Contact geometry and low inter-contact capacitance provide RF switching capability up to 500 MHz. Teledyne 112 Series qualified to L, M, and P levels of MIL-R-39016.

| SERIES* | CONTACT DATA | | COIL DATA | | | APPLICABLE MIL. SPEC. |
|---|---|---|---|---|---|---|
| | ARRANGEMENT | MAX. RATING (AMPS @ 28 VDC) | NOMINAL VOLTAGE | NOMINAL RESISTANCE | MUST-OPERATE POWER (MW) | |
| 112 | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5 | 50, 98, 220, 390, 880, 1560 | 130 | M39016/17 |
| 112D | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5 | 50, 98, 220, 390, 880, 1560 | 130 | M39016/18 |
| 112DD | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5 | 39, 78, 220, 390, 880, 1560 | 130 | M39016/19 |
| 132 | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5, 36, 40 | 100, 200, 400, 800, 1600, 3200, 6500, 11000 | 60 | M39016/41 |
| 132D | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5, 36, 40 | 100, 200, 400, 800, 1600, 3200, 6500, 11000 | 60 | M39016/42 |
| 132DD | 2 FORM C | 1 | 5, 6, 9, 12, 18, 26.5 36, 40 | 100, 200, 400, 800, 1600, 3200, 6500, 11000 | 60 | M39016/43 |

**General Specifications:**
Contact Resistance: 0.1Ω max. initial; 0.2 Ω max. after life at max. load.
Life: 100,000 operations @ max. rated contact load (life expectancy $10^7$ operations at low level)
Temperature: −65°C to +125°C
Vibration: 30 g's to 3000 Hz.
Shock: 75 g's for 6 msec. min.

*NOTE: Suffix D denotes internal suppression diode, suffix DD suppression and steering diodes.

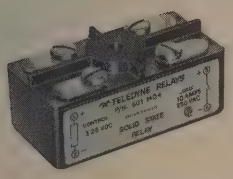
TELEDYNE RELAYS
3155 West El Segundo Boulevard, Hawthorne, California 90250 • Telephone (213) 973-4545

Detailed specifications on any of our products or a complete catalog are available on request.

# TELEDYNE RELAYS

# Solid State AC Relays

## 601-1400 Series — Optically Isolated 5 and 10 Amps



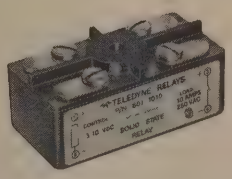
**UL Recognized — File #59547**

**CSA Certified — File #31043**

Solid state AC relays featuring LED optical isolation and synchronous/zero voltage turn-on. Available in 5 or 10 Amp steady state current ratings for 120 or 250 Volt loads (with peak ratings up to 600V). SPST, normally open. Choice of logic compatible 3-28 VDC or 90-250 VAC input. The versatile package design of the 601-1400 series provides choice of screw or quick-disconnect terminals for chassis or panel mounting, or solder pins for direct PC board applications. 1" (25.4mm) × 2" (50.8mm) × .9" (22.9mm) package size makes it the smallest 10 Amp solid state relay available.

| INPUT (CONTROL) VOLTAGE | OUTPUT VOLTAGE RATING | | OUTPUT (LOAD) CURRENT RATING & PART NUMBERS | |
|---|---|---|---|---|
| | CONTINUOUS VAC (RMS) | TRANSIENT VAC (PEAK) | 5 AMP | 10 AMP |
| 3-28 VDC | 140 | 200 | 601-1401 | 601-1402 |
| | 250 | 400 | 601-1403 | 601-1404 |
| | 250 | 600 | 601-1403H | 601-1404H |
| 90-250 VAC | 140 | 200 | 601-1411 | 601-1412 |
| | 250 | 400 | 601-1413 | 601-1414 |

## 601-1000 Series — Transformer Isolated



Transformer isolated version of the 601-1400 Series. High input/output isolation ($1500V/10^9$ Ohms) achieved through magnetic coupling. Asynchronous turn-on; zero current turn-off. SPST, available in 3 and 10 Amp ratings for 120 or 250 Volt loads. Features "adaptive" package design, providing choice of either screw or quick-disconnect terminals for chassis or panel mounting, or solder pins for direct PC board mounting.

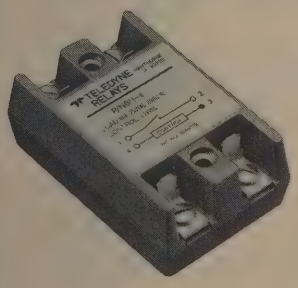
**UL Recognized — File #E47991**

**CSA Certified — File #31043**

| INPUT (CONTROL) VOLTAGE RANGE | OUTPUT CURRENT RATING AND PART NUMBERS | |
|---|---|---|
| | 3 AMP | 10 AMP |
| 3-10 VDC | 601-1007 | 601-1010 |
| 6-32 VDC | 601-1017 | 601-1020 |
| 60-140 VAC | 601-1027 | 601-1030 |

Basic part number provides screw terminals
Add suffix "P" for PC board pins, "Q" for quick disconnect terminals

## 611 Series — Optically Isolated — 10 to 40 Amps



High power solid state AC relays, available in 10, 15, 25 and 40 Amp ratings, for 120 and 250 Volt loads (with peak ratings up to 600V). Features LED optical isolation and synchronous/zero voltage switching. High output dv/dt immunity -200 Volts/ μsec. typical. Choice of logic compatible 3-28 VDC or 90-250 VAC input. Provided with multipurpose screw and quick-disconnect terminals.

| INPUT (CONTROL) VOLTAGE | OUTPUT VOLTAGE RATING | | OUTPUT CURRENT RATING AND PART NUMBERS | | | |
|---|---|---|---|---|---|---|
| | CONTINUOUS (RMS) | TRANSIENT (PEAK) | 10 AMP | 15 AMP | 25 AMP | 40 AMP |
| 3-28 VDC | 140 | 200 | 611-7 | 611-3 | 611-1 | 611-5 |
| | 250 | 400 | 611-8 | 611-4 | 611-2 | 611-6 |
| | 250 | 600 | 611-8H | 611-4H | 611-2H | 611-6H |
| 90-250 VAC | 140 | 200 | 611-17 | 611-13 | 611-11 | 611-15 |
| | 250 | 400 | 611-18 | 611-14 | 611-12 | 611-16 |
| | 250 | 600 | 611-18H | 611-14H | 611-12H | 611-16H |

**UL Recognized — File #E55197**

**CSA Certified — File #31043**

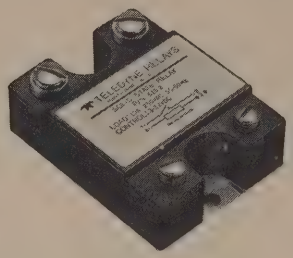
TELEDYNE RELAYS

3155 West El Segundo Boulevard, Hawthorne, California 90250 · Telephone (213) 973-4545

Detailed specifications on any of our products or a complete catalog are available on request.

# TELEDYNE RELAYS

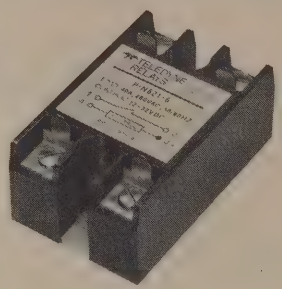
## Solid State AC Relays



### 615 Series - Optically Isolated 10, 25, and 40 Amps

High power solid state AC relays in 10, 25, and 40 Amp ratings for 125 and 250VRMS loads (with peak transient ratings up to 600V). Features 1500VRMS input/output isolation, synchronous zero-voltage switching, and high output transient immunity. Use of custom ICs in lieu of conventional discrete circuitry results in 40% reduction in component count for higher reliability and lower cost. Input voltage range of 3-32 VDC with constant current input circuit provides low and high level logic compatibility.

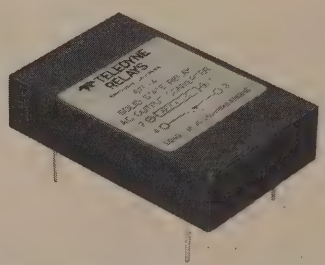
| OUTPUT (LOAD) CURRENT RATING & PART NUMBER | | | OUTPUT VOLTAGE RATING (VAC) | |
|---|---|---|---|---|
| 10 AMP | 25 AMP | 40 AMP | Continuous (RMS) | Transient (PEAK) |
| 615-1 | 615-3 | 615-5 | 140 | 200 |
| 615-2 | 615-4 | 615-6 | 250 | 400 |
| 615-2H | 615-4H | 615-6H | 250 | 600 |



### 621 Series — High Voltage, Optically Isolated

Solid State AC Relays featuring 3750VRMS optical isolation and synchronous/zero voltage turn-on. Available in 15, 25, and 40 Amp steady state current ratings for 480 Volt loads (with peak ratings of 800V). SPST, normally open. Choice of logic compatible 3-14 or 12-32 VDC input. Package design provides multi-purpose screw and quick-disconnect terminals. Designed to meet safety requirements of UL, CSA, VDE and IEC.

| INPUT VOLTAGE RANGE | OUTPUT (LOAD) CURRENT RATING & PART NUMBERS | | |
|---|---|---|---|
| | 15 AMP | 25 AMP | 40 AMP |
| 3-14 VDC | 621-1 | 621-3 | 621-5 |
| 12-32 VDC | 621-2 | 621-4 | 621-6 |



### 675 Series — Low Profile PC Board Relays

Optically isolated solid state AC relays featuring low profile package for PC board mounting. Maximum steady state load rating 3A/250VRMS. SPST, normally open. Control inputs are compatible with both low and high level logic systems.

| INPUT VOLTAGE RANGE | PART NUMBER | OUTPUT VOLTAGE RATING | |
|---|---|---|---|
| | | CONTINUOUS (RMS) | TRANSIENT PEAK |
| 4-10 VDC | 675-4 | 250 VAC | 400 VAC |
| | 675-4H | | 600 VAC |
| 10-32 VDC | 675-5 | | 400 VAC |
| | 675-5H | | 600 VAC |

**UL Recognized — File #E55197**
**CSA Certified - File #LR31043-5**


TELEDYNE RELAYS

3155 West El Segundo Boulevard, Hawthorne, California 90250 · Telephone (213) 973-4545


Detailed specifications on any of our products or a complete catalog are available on request.

TELEDYNE RELAYS

# SERENDIP® Commercial/Industrial DIP Solid State Relays

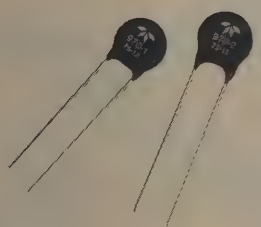
Subminiature solid state relays in standard TO-116 DIP packages. Featuring all solid state circuitry with hybrid microcircuit construction, and high input/output isolation (up to 2500 volts/$10^9$ Ohms). Six models available providing choice of output: bipolar (AC or DC), AC (triac), and DC (transistor). Bipolar (640/644 series) and DC (643 series) are direct pin-for-pin replacements for standard DIP reed relays.

| | INPUT DATA | | OUTPUT (LOAD) RATINGS | | | |
|---|---|---|---|---|---|---|
| | | | | CURRENT | | |
| PART NUMBER | VOLTAGE (VDC) | MAX. CURRENT (MADC @ 5V) | AC/DC | @ 10V INPUT | @ 5V INPUT | VOLTAGE |
| 640-1 | 3.8-10 | 22 | BIPOLAR (AC or DC) | ±80 mA | ±40 mA | ±50 V PEAK |
| 641-1* | 4-10 | 15 | AC | 0.5 A (Note 1) | 0.5 A (Note 1) | 150 VRMS |
| 641-2* | 4-10 | 15 | AC | 0.5 A (Note 1) | 0.5 A (Note 1) | 250 VRMS |
| 643-1 | 3.8-10 | 15 | DC | 400 mA | 200 mA | 60 VDC |
| 643-2 | 3.8-10 | 15 | DC | 100 mA | 50 mA | 250 VDC |
| 643-3 | 3.8-10 | 15 | DC | 400 mA | 200 mA | 135 VDC |
| 644-1 | 3.8-6 | 18 | BIPOLAR (AC or DC) (Note 2) | ±5 mA | ±5 mA | ±5 V PEAK |

**Notes:**
1. 1 Amp with standard DIP heat sink (Thermalloy P/N 6007A, or equivalent).
2. Features low offset voltage (100 microvolts typical).

***UL Recognized — File #E55197**

# Metal Oxide Varistors (MOV)



MOV SYMBOL

## 970 Series

| PART NUMBER | TRANSIENT (PEAK) RATING OF RELAY | MAXIMUM CONTINUOUS LINE VOLTAGE (RMS) |
|---|---|---|
| 970-1 | 400 VAC | 140 VAC |
| 970-2 | 600 VAC | 250 VAC |

Teledyne 970 Series Metal Oxide Varistors (MOVs) are characterized specifically for use with Teledyne solid state AC relays and I/O converter modules for protection against high voltage transients that are prevalent on AC lines. MOVs are bi-directional voltage sensitive devices that assume a low impedance state when their design voltage threshold is exceeded. As such, they perform a transient voltage clipping or suppression function on the AC line similar to back-to-back zener diodes and are ideal for circuit protection use from the standpoint of performance, economy and ease of installation.

(Consult factory for information regarding MOVs with higher ratings.)

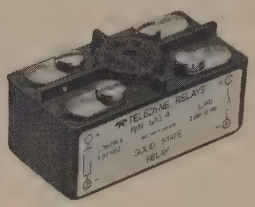
TELEDYNE RELAYS

3155 West El Segundo Boulevard, Hawthorne, California 90250 · Telephone (213) 973-4545

Detailed specifications on any of our products or a complete catalog are available on request.

# TELEDYNE RELAYS
# Solid State DC Relays

## 603 Series — Optically Isolated



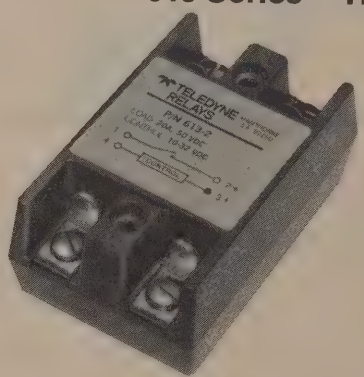
Solid state DC relays featuring LED optical isolation. SPST, normally open. Available in 2 and 5 Amp steady state current ratings, up to 250 VDC. DC control inputs are compatible with both low and high level logic systems. As an added option, controlled rise and fall time is offered to limit in-rush currents for lamp loads and switching transients for inductive loads. Package configuration provides either screw or quick-disconnect terminals for chassis or panel mounting, or solder pins for direct PC board mounting.

Size: 1″ (25.4mm) X 2″ (50.8mm) X .9″ (22.9mm).

| INPUT VOLTAGE RANGE | OUTPUT (LOAD) VOLTAGE RATING (VDC) | OUTPUT CURRENT RATING AND PART NUMBERS | |
|---|---|---|---|
| | | 2 Amp | 5 Amp |
| 3-32 VDC | 50 | 603-1 | 603-2 |
| 4-10 VDC | 250 | | 603-3 |
| 10-32 VDC | 250 | | 603-4 |
| 90-250 VAC | 50 | 603-11 | 603-12 |
| 3-32 VDC | 50 | 603-21 | 603-22 |
| | | WITH CONTROLLED RISE AND FALL TIME | |

**Notes:**
1. 603-3 and -4 utilize transformer isolation.
2. Basic P/N provides screw terminals. Add suffix "P" for PC board solder pins, suffix "Q" for quick disconnect terminals.

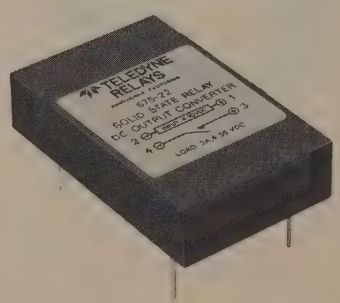
## 613 Series — High Current, Transformer Isolated



High current solid state DC relays featuring transformer isolation for low off-state leakage. SPST, normally open. 20A/50VDC maximum steady state load rating. Control inputs are compatible with both low and high level logic systems. Package design provides multipurpose screw and quick-disconnect terminals.

| INPUT VOLTAGE RANGE | PART NUMBERS |
|---|---|
| 4-10 VDC | 613-1 |
| 10-32 VDC | 613-2 |

## 675 Series — Low Profile PC Board Relays



Optically isolated solid state DC relays featuring low profile package for PC board mounting. 3A/55VDC maximum steady state load rating. SPST, normally open. Control inputs are compatible with both low and high level logic systems.

| INPUT VOLTAGE RANGE | PART NUMBERS |
|---|---|
| 4-10 VDC | 675-22 |
| 10-32 VDC | 675-23 |

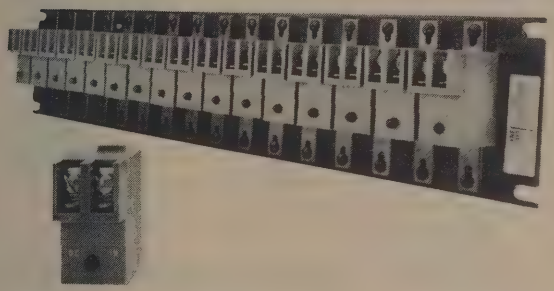
TELEDYNE RELAYS

3155 West El Segundo Boulevard, Hawthorne, California 90250 · Telephone (213) 973-4545

Detailed specifications on any of our products or a complete catalog are available on request.

# TELEDYNE RELAYS
# Solid State AC & DC I/O Converters

## 673 Series — Panel Mounted
### Optically Isolated



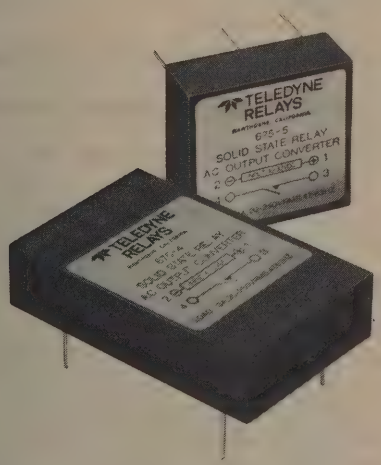
Designed for use in programmable controllers, computerized process control systems, machine tool controls, etc. All solid state circuitry — optically isolated — with high transient and noise immunity to withstand severe industrial environments without false triggering. Unique single circuit modular package design with logic terminals physically isolated from power wiring and high barriered power terminals providing for side by side panel mounting, thus eliminating the need for additional interconnecting terminal strips. This modular I/O interface concept facilitates installation and maintenance and offers substantially greater system flexibility when compared to conventional multicircuit PC card systems. Integral LED status indicators are included for easy troubleshooting. There are 11 different converter modules in the series as shown on the table.

| P/N | DESCRIPTION | RATINGS |
|---|---|---|
| 673-1 | AC Input Converter | 95-132 VAC Input |
| 673-11 | AC Input Converter | 187-250 VAC Input |
| 673-4 | AC Output Converter (400V Peak Output Rating) | 4-10 VDC Input 3 amps/132 VAC Output |
| 673-4H | AC Output Converter (600V Peak Output Rating) | 4-10 VDC Input 3 amps/250 VAC Output |
| 673-5 | AC Output Converter (400V Peak Output Rating) | 10-32 VDC Input 3 amps/132 VAC Output |
| 673-5H | AC Output Converter (600V Peak Output Rating) | 10-32 VDC Input 3 amps/250 VAC Output |
| 673-21 | DC Input Converter | 10-55 VDC Input |
| 673-31 | DC Input Converter | 95-132 VDC Input |
| 673-41 | DC Input Converter | 187-250 VDC Input |
| 673-22 | DC Output Converter | 4-10 VDC Input 3 amps/55 VDC Output |
| 673-23 | DC Output Converter | 10-32 VDC Input 3 amps/55 VDC Output |

**Notes:**

1. AC Converters are color-coded Blue; DC Converters are color-coded Red.
2. For additional information on Series 671P Mounting Panel, see page 11.
3. Mounting hardware kit for 32 modules available, P/N 9-369.

## 675 Series — PC Board Mounted
### Optically Isolated




Functionally identical to 673 Series but featuring low profile PC board compatible potted module construction for greater packaging density and close card spacing. Designed to replace discrete I/O interface circuitry, this modular PC board concept facilitates installation and maintenance. Utilizes all solid state circuitry — optically isolated — with high transient and noise immunity. There are 9 different converter modules in the series as shown on the table.

| P/N | DESCRIPTION | RATINGS |
|---|---|---|
| 675-1 | AC Input Converter | 130 VAC Input |
| 675-11 | AC Input Converter | 250 VAC Input |
| 675-4 | AC Output Converter (400V Peak Output Rating) | 4-10 VDC Input 3 amps/250 VAC Output |
| 675-4H | AC Output Converter (600V Peak Output Rating) | 4-10 VDC Input 3 amps/250 VAC Output |
| 675-5 | AC Output Converter (400V Peak Output Rating) | 10-32 VDC Input 3 amps/250 VAC Output |
| 675-5H | AC Output Converter (600V Peak Output Rating) | 10-32 VDC Input 3 amps/250 VAC Output |
| 675-21 | DC Input Converter | 10-32 VDC Input |
| 675-22 | DC Output Converter | 4-10 VDC Input 3 amps/55 VDC Output |
| 675-23 | DC Output Converter | 10-32 VDC Input 3 amps/55 VDC Output |

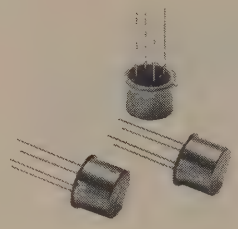
TELEDYNE RELAYS

3155 West El Segundo Boulevard, Hawthorne, California 90250 · Telephone (213) 973-4545

# TELEDYNE RELAYS

# Military Solid State Relays

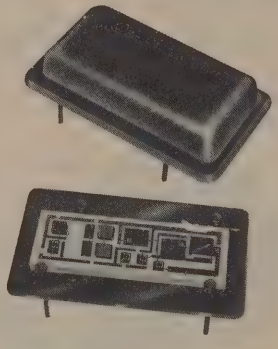
## M640 Series Solid State TO-5 Relays



Hermetically sealed subminiature solid state relays in TO-5 package. SPST, normally open. Features all solid state circuitry utilizing hybrid microcircuit techniques, with high input/output isolation (1000 V/$10^9$ Ohms). Available with bipolar output for AC or DC loads up to 40V/60mA or DC output for loads up to 40VDC/300mA or 250VDC/100mA. Mil-qualified to MIL-R-28750/5, 6, and /7.

| MILITARY PART NUMBER | TELEDYNE PART NUMBER | OUTPUT RATING |
|---|---|---|
| M28750/5 | M640-1W | 40 V/60 MA (bipolar, AC or DC) |
| M28750/6 | M643-1W | 40 VDC/300 MA |
| M28750/7 | M643-2W | 250 VDC/100 MA |

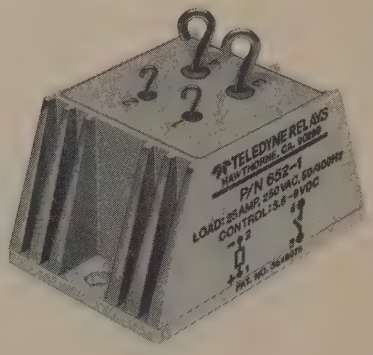
## 680 Series - AC and DC Solid State DIP Relays – Optically Isolated



Hermetically sealed in low profile metal DIP enclosures to withstand military and aerospace environments. Utilize thick film hybrid microcircuit construction techniques. Series includes Model 682-1 for AC loads up to 1A/250VRMS, and Model 683-1 for DC loads up to 600 mA/50VDC. Low level constant current input circuit minimizes power dissipation and provides logic compatibility. SPST, normally open.

| PART NUMBER | INPUT VOLTAGE RANGE | OUTPUT RATING | APPLICABLE MIL SPEC |
|---|---|---|---|
| 682-1 | 3-16 VDC | 1A/250VAC (45-440Hz) | MIL-R-28750/9 |
| 683-1 | 3-15 VDC | 600mA/50VDC | MIL-R-28750/8 |

## 652 Series - 25 Amp/250 VAC Solid State Relays – Optically Isolated




Hermetically sealed in a thermally efficient aluminium case to withstand Military and Aerospace environments. SPST, normally open. Features output switching by means of inverse/parallel SCRs for reliable operation over frequency range of 45-440Hz. Logic compatible drive circuit precludes need for external relay drivers. Synchronous/zero voltage turn-on to minimize RFI. Meets the requirements of MIL-R-28750, and is designed to operate within all categories of MIL-STD-704A Aircraft Power Limits.

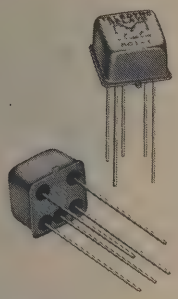
| INPUT VOLTAGE RANGE | PART NUMBERS |
|---|---|
| 3.8- 9 VDC | 652-1 |
| 9-32 VDC | 652-3 |

TELEDYNE RELAYS
3155 West El Segundo Boulevard, Hawthorne, California 90250 · Telephone (213) 973-4545

Detailed specifications on any of our products or a complete catalog are available on request.

# TELEDYNE RELAYS

## Military Opto-Coupler

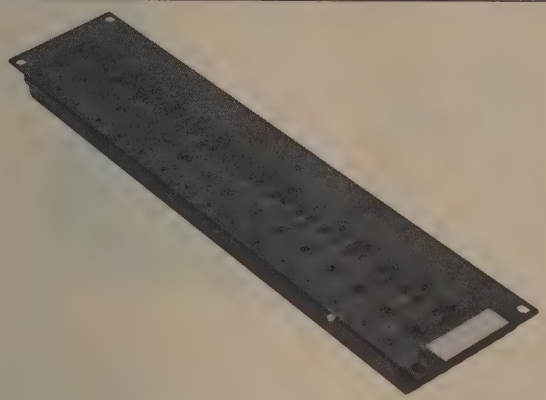


### 801-1 Iso-Cube™
### Military Optically Coupled Isolator

Packaged in a low profile hermetically sealed case, .225" (5.72mm) high by .370" (9.4mm) square, with pin-out on .100" grid centers for ease of pc board layout. Employing unique construction techniques developed for Teledyne hybrid SSRs, the miniature Iso-Cube provides the highest input/output isolation available in a military style coupler.

| PERFORMANCE FEATURES | |
|---|---|
| Isolation | 1500 VRMS |
| Transfer Ratio | 140% |
| Output Voltage | 40V min. |

## Mounting Panel For 671 and 673 Series I/O Converters

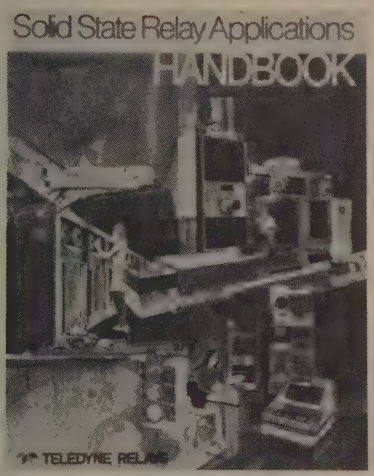


Custom designed mounting panel for Teledyne 671 and 673 Series Solid State I/O Converter Modules. Fits standard 19" rack and accepts up to 16 modules. Panel contains integral interconnect wiring for logic circuitry.

(See Solid State AC & DC I/O Converters section for description of 673 Series I/O Converter Modules)

PART NUMBERING

- 671P-2 Rear mounted connector
- 671P-4 Top mounted connector
- 671P-7 Rear mounted connectors (2) (For Multiplexing)




### SSR APPLICATIONS HANDBOOK

A comprehensive 24-page engineering guide to the selection and application of solid state relays. Available on request from Teledyne Relays.

# TELEDYNE RELAYS

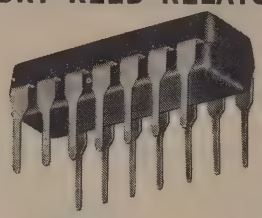
3155 West El Segundo Boulevard, Hawthorne, California 90250 · Telephone (213) 973-4545

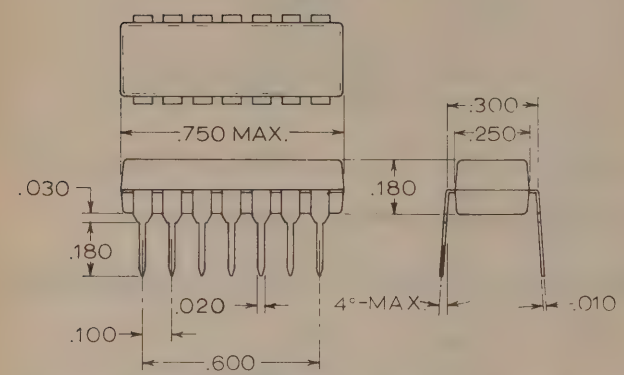
Detailed specifications on any of our products or a complete catalog are available on request.

**wabash**
Dept. EM, First and Webster Streets / Wabash, Indiana 46992 / (219) 563-2191 / TWX 810-290-2722
WABASH RELAY & ELECTRONICS DIVISION

# DIP PACKAGE DRY REED RELAYS

## 814 SERIES





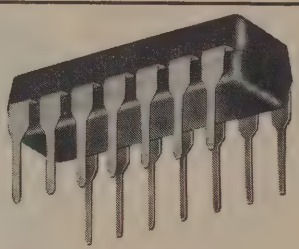

The 814 Series offers dry reed reliability and total isolation in a low profile IC type package, with DTL/TTL compatible coil drive available in most configurations.

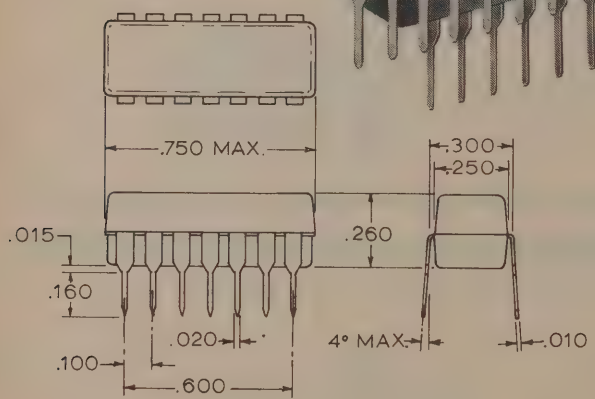
**SPECIFICATIONS — Contact Rating:** 28 VDC or 0.110 Amps (switching); 3 watts; 200 milliohms max. initial contact resistance; 200 Volt pk. bkdn. **Temperature:** −55°C to +105°C. **Shock:** 100G max., 8±1 mSec. ½ wave. **Vibration:** 20G @ 10-5000 Hz. **Insulation Resistance:** $10^{10}$ Ohms min. **Capacitance:** 0.2 pf. **Operate Time (Typical):** to 0.5 mSec. **Release Time (Typical):** 0.1 mSec. **Life Expectancy:** 50 x $10^6$ operations at signal level; 1 x $10^6$ operations at rated load.

| Contact Form | Nom. Voltage | Max. Voltage | Coil Resistance ±10% ▲ | Part Number |
|---|---|---|---|---|
| 1A | 5 | 16 | 365 | 814-101 |
| | 5 | 19 | 500 | 814-102 |
| | 6 | 19 | 500 | 814-103 |
| | 12 | 24 | 800 | 814-104 |
| | 24 | 30 | 1,250 | 814-105 |

▲Measured at 25°C.

## 815 SERIES

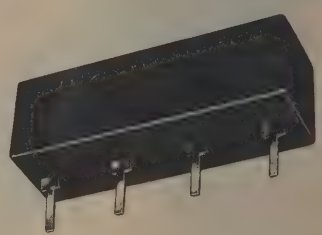


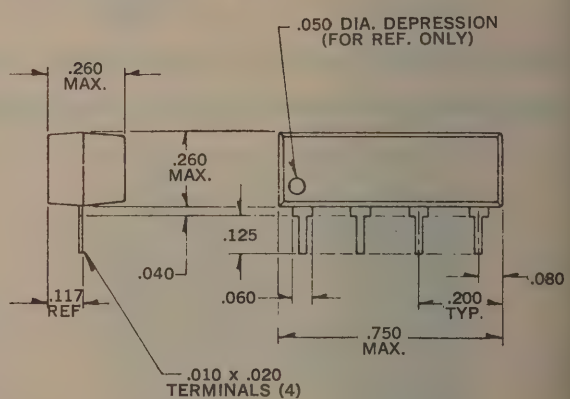



The 815 Series, with a profile slightly higher than the 814, offers increased versatility while maintaining the DIP package approach to hi-density printed circuit applications. Standard part numbers listed are subject to specifications shown for the 814 Series, however, the 815 has the capacity to offer dry reed switches to ½ Amp rating plus up to a 100 VDC max. switching voltage. Optional features include diode suppression, magnetic shielding and electrostatic shielding.

| Contact Form | Nom. Voltage | Max. Voltage | Coil Ohms ±10%▲ | Part Number |
|---|---|---|---|---|
| 1A | 5 | 14.1 | 200 | 815-101 |
| | 5 | 19 | 500 | 815-102 |
| | 12 | 19 | 500 | 815-103 |
| | 24 | 40 | 2,150 | 815-104 |
| 2A | 5 | 14.1 | 200 | 815-201 |
| | 12 | 19 | 500 | 815-202 |
| | 24 | 38 | 2,000 | 815-203 |
| 1B | 5 | 14.1 | 200 | 815-221 |
| | 12 | 16 | 500 | 815-222 |
| | 24 | 32 | 2,000 | 815-223 |
| 1C | 5 | 7.75 | 80 | 815-241 |
| | 12 | 19 | 500 | 815-242 |
| | 24 | 38 | 2,000 | 815-243 |

## 816 SERIES





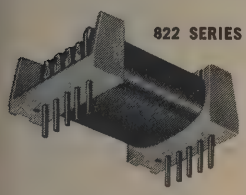

The 816 Series SIP (Single Inline Package) provides the power handling capabilities of the 815 DIP while taking up less printed circuit board space. Standard part numbers listed are subject to specifications shown for the 814 Series; however, the 816 has the capacity to offer dry reed switches with ratings to 0.5 amps and 100 VDC. Optional features include diode suppression and magnetic shielding.

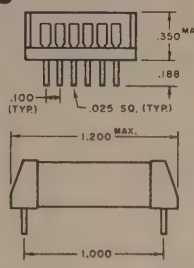
| Contact Form | Nom. Voltage | Max. Voltage | Coil Resistance ±10%▲ | Part Number |
|---|---|---|---|---|
| 1A SPST NO | 5 | 14.1 | 200 | 816-101 |
| | 5 | 19 | 500 | 816-102 |
| | 12 | 19 | 500 | 816-103 |
| | 24 | 40 | 2,150 | 816-104 |
| 1B SPST NC | 5 | 7 | 200 | 816-221 |
| | 12 | 16 | 500 | 816-222 |
| | 24 | 32 | 2,000 | 816-223 |

**wabash**
WABASH RELAY & ELECTRONICS DIVISION
Dept. EM, First and Webster Streets / Wabash, Indiana 46992 / (219) 563-2191 / TWX 810-290-2722

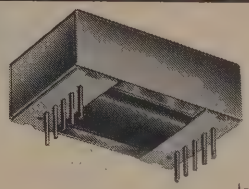
# MINIATURE DRY REED RELAYS
## 822 / 823 SERIES

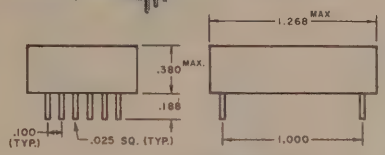
822 SERIES






823 SERIES






**SPECIFICATIONS — Contact Ratings:** (max.) 200 VDC, 150 VAC, 0.5 Amp (switching), 3 Amp (Carry), 10 Watts DC, 25 V-A (AC suppressed), 300 Volts peak breakdown, 200 milliohms max. initial contact resistance. **Temperature:** −55°C to +105°C. **Shock:** 200 G max., 11±1 mSec. **Vibration:** 30 G max. @ 0 to 1700 Hz. **Insulation Resistance:** $10^9$ Ohms min. **Capacitance:** 0.5 pf. **Life Expectancy:** 100 x $10^6$ ops @ dry ckt.; 50 x $10^6$ ops @ signal levels; 20 x $10^6$ ops @ rated load.

### 822 SERIES

| Contact Form | Nom. Voltage | Max. Voltage | Coil Resistance ±10% ▲ | Part Number |
|---|---|---|---|---|
| 1A | 6 | 16 | 200 | 822-102 |
| | 12 | 33 | 800 | 822-103 |
| | 24 | 67 | 3,200 | 822-104 |
| | 5 | 26 | 500 | 822-110 |
| 2A | 6 | 16 | 200 | 822-202 |
| | 12 | 33 | 800 | 822-203 |
| | 24 | 67 | 3,200 | 822-204 |
| 3A | 6 | 10 | 75 | 822-302 |
| | 12 | 21 | 300 | 822-303 |
| | 24 | 42 | 1,200 | 822-304 |
| 4A | 6 | 10 | 75 | 822-402 |
| | 12 | 21 | 300 | 822-403 |
| | 24 | 42 | 1,200 | 822-404 |
| 1B† | 6 | 8 | 200 | 822-211 |
| | 12 | 16 | 800 | 822-212 |
| | 24 | 32 | 3,200 | 822-213 |
| 2B† | 6 | 8 | 200 | 822-311 |
| | 12 | 16 | 800 | 822-312 |
| | 24 | 32 | 3,200 | 822-313 |
| 1A1B† | 6 | 9 | 60 | 822-324 |
| | 12 | 18 | 240 | 822-325 |
| | 24 | 36 | 960 | 822-326 |
| 1C† (1A1B guarantee break-before-make) | 6 | 8 | 60 | 822-316 |
| | 12 | 16 | 240 | 822-317 |
| | 24 | 32 | 960 | 822-318 |
| 1A‡ (magnetic latch) | 6 | 12 | 300 | 822-222 |
| | 6 | 12 | 300 | |
| | 12 | 24 | 1,200 | 822-223 |
| | 12 | 24 | 1,200 | |
| | 24 | 48 | 4,800 | 822-224 |
| | 24 | 48 | 4,800 | |
| 2A‡ (magnetic latch) | 6 | 12 | 300 | 822-332 |
| | 6 | 12 | 300 | |
| | 12 | 24 | 1,200 | 822-333 |
| | 12 | 24 | 1,200 | |
| | 24 | 48 | 4,000 | 822-334 |
| | 24 | 48 | 4,000 | |

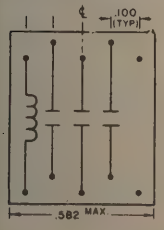
**Note:** Complete electrical data available on request.
822 Series relays can be provided that are recognized under the Component Program of Underwriters Laboratories, Inc. Please consult factory for more information.
Special Coil Terminations available — consult factory.

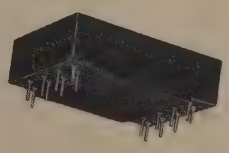
### 823 SERIES

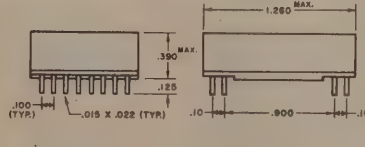
| Contact Form | Nom. Voltage | Max. Voltage | Coil Resistance ±10% ▲ | Part Number |
|---|---|---|---|---|
| 1A | 6 | 16 | 200 | 823-102 |
| | 12 | 33 | 800 | 823-103 |
| | 24 | 67 | 3,200 | 823-104 |
| | 5 | 26 | 500 | 823-110 |
| 2A | 6 | 16 | 200 | 823-202 |
| | 12 | 33 | 800 | 823-203 |
| | 24 | 67 | 3,200 | 823-204 |
| 3A | 6 | 10 | 75 | 823-302 |
| | 12 | 21 | 300 | 823-303 |
| | 24 | 42 | 1,200 | 823-304 |
| 4A | 6 | 10 | 75 | 823-402 |
| | 12 | 21 | 300 | 823-403 |
| | 24 | 42 | 1,200 | 823-404 |
| 1B† | 6 | 8 | 200 | 823-211 |
| | 12 | 16 | 800 | 823-212 |
| | 24 | 32 | 3,200 | 823-213 |
| 2B† | 6 | 8 | 200 | 823-311 |
| | 12 | 16 | 800 | 823-312 |
| | 24 | 32 | 3,200 | 823-313 |
| 1A1B† | 6 | 9 | 60 | 823-324 |
| | 12 | 18 | 240 | 823-325 |
| | 24 | 36 | 960 | 823-326 |
| 1C† (1A1B guarantee break-before-make) | 6 | 8 | 60 | 823-316 |
| | 12 | 16 | 240 | 823-317 |
| | 24 | 32 | 960 | 823-318 |
| 1A‡ (magnetic latch) | 6 | 12 | 300 | 823-222 |
| | 6 | 12 | 300 | |
| | 12 | 24 | 1,200 | 823-223 |
| | 12 | 24 | 1,200 | |
| | 24 | 48 | 4,800 | 823-224 |
| | 24 | 48 | 4,800 | |
| 2A‡ (magnetic latch) | 6 | 12 | 300 | 823-332 |
| | 6 | 12 | 300 | |
| | 12 | 24 | 1,200 | 823-333 |
| | 12 | 24 | 1,200 | |
| | 24 | 48 | 4,000 | 823-334 |
| | 24 | 48 | 4,000 | |

▲ Measured at 25°C.
† All relays containing magnets for Form B operation (including the break-before-make 1C) are polarity sensitive and correct polarity must be observed. Dot on relays indicates positive terminal.
‡ A positive voltage must be applied to either dot terminal to close the contact(s) of a latch relay.
A negative voltage must be applied to either dot terminal to open the contact(s) of a latch relay.

# 824 SERIES RR



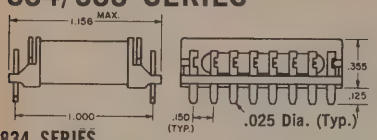


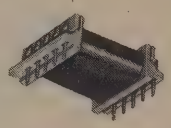

The 824 Series miniature reed relay is available in 1 pole through 6 pole standard configurations of forms A, B, or C, offering staggered pin spacing to minimize PC board space required. (3A pinout illustrated.) Call Wabash Relay for complete details.

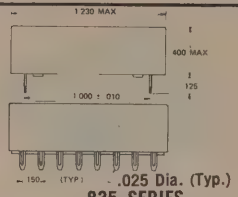
**SPECIFICATIONS — Contact Ratings:** (max.) 200 VDC, 150 VAC, 0.5 Amp (switching), 3 Amp (Carry), 10 Watts DC, 25 V-A (AC suppressed), 300 Volts peak breakdown, 200 milliohms max. initial contact resistance. **Temperature:** −55°C to +105°C. **Shock:** 200 G max., 11±1 mSec. **Vibration:** 30 G max. @ 0 to 1700 Hz. **Insulation Resistance:** $10^9$ Ohms min. **Capacitance:** 0.5 pf. **Life Expectancy:** 100 x $10^6$ ops @ dry ckt.; 50 x $10^6$ ops @ signal levels; 20 x $10^6$ ops @ rated load.

**wabash**
Dept. EM, First and Webster Streets / Wabash, Indiana 46992 / (219) 563-2191 / TWX 810-290-2722
WABASH RELAY & ELECTRONICS DIVISION

# MINIATURE DRY REED RELAYS 834/835 SERIES*






**SPECIFICATIONS — Contact Ratings:** (max.) 200 VDC, 150 VAC, 0.5 Amp (switching), 3 Amp (Carry), 10 Watts DC, 25 V-A (AC suppressed), 300 Volts peak breakdown, 200 milliohms max. initial contact resistance. **Temperature:** −55°C to +105°C. **Shock:** 200 G max., 11±1 mSec. **Vibration:** 30 G max. @ 0 to 1700 Hz. **Insulation Resistance:** $10^9$ Ohms min. **Capacitance:** 0.5 pf. **Life Expectancy:** 100 x $10^6$ ops @ dry ckt.; 50 x $10^6$ ops @ signal levels; 20 x $10^6$ ops @ rated load.

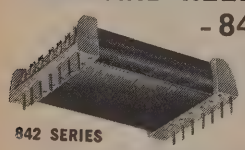
## 834 SERIES

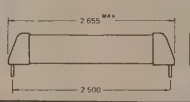
| Contact Form | Nom. Voltage | Max. Voltage | Coil Resistance ±10% ▲ | Part Number |
|---|---|---|---|---|
| 1A | 6 | 16 | 200 | 834-102 |
| | 12 | 33 | 800 | 834-103 |
| | 24 | 67 | 3,200 | 834-104 |
| | 5 | 26 | 500 | 834-106 |
| 2A | 6 | 16 | 200 | 834-202 |
| | 12 | 33 | 800 | 834-203 |
| | 24 | 67 | 3,200 | 834-204 |
| 3A | 6 | 10 | 75 | 834-302 |
| | 12 | 21 | 300 | 834-303 |
| | 24 | 42 | 1,200 | 834-304 |
| 4A | 6 | 10 | 75 | 834-402 |
| | 12 | 21 | 300 | 834-403 |
| | 24 | 42 | 1,200 | 834-404 |
| 5A | 6 | 10 | 75 | 834-502 |
| | 12 | 21 | 300 | 834-503 |
| | 24 | 42 | 1,200 | 834-504 |
| 6A | 6 | 10 | 75 | 834-602 |
| | 12 | 21 | 300 | 834-603 |
| | 24 | 42 | 1,200 | 834-604 |
| 1B† | 6 | 8 | 200 | 834-212 |
| | 12 | 16 | 800 | 834-213 |
| | 24 | 32 | 3,200 | 834-214 |
| 2B† | 6 | 8 | 200 | 834-222 |
| | 12 | 16 | 800 | 834-223 |
| | 24 | 32 | 3,200 | 834-224 |
| 1A1B† | 6 | 8 | 60 | 834-332 |
| | 12 | 16 | 240 | 834-333 |
| | 24 | 32 | 960 | 834-334 |
| 1C† (1A1B guarantee break-before-make) | 6 | 8 | 60 | 834-342 |
| | 12 | 16 | 240 | 834-343 |
| | 24 | 32 | 960 | 834-344 |
| 1A‡ (magnetic latch) | 6 | 12 | 300 | 834-272 |
| | 6 | 12 | 300 | |
| | 12 | 24 | 1,200 | 834-273 |
| | 12 | 24 | 1,200 | |
| | 24 | 48 | 4,800 | 834-274 |
| | 24 | 48 | 4,800 | |
| 2A‡ (magnetic latch) | 6 | 12 | 300 | 834-382 |
| | 6 | 12 | 300 | |
| | 12 | 24 | 1,200 | 834-383 |
| | 12 | 24 | 1,200 | |
| | 24 | 48 | 4,800 | 834-384 |
| | 24 | 48 | 4,800 | |

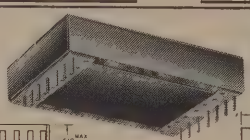
## 835 SERIES

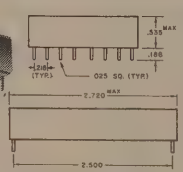
| Contact Form | Nom. Voltage | Max. Voltage | Coil Resistance ±10% ▲ | Part Number |
|---|---|---|---|---|
| 1A | 6 | 16 | 200 | 835-102 |
| | 12 | 33 | 800 | 835-103 |
| | 24 | 67 | 3,200 | 835-104 |
| | 5 | 26 | 500 | 835-106 |
| 2A | 6 | 16 | 200 | 835-202 |
| | 12 | 33 | 800 | 835-203 |
| | 24 | 67 | 3,200 | 835-204 |
| 3A | 6 | 10 | 75 | 835-302 |
| | 12 | 21 | 300 | 835-303 |
| | 24 | 42 | 1,200 | 835-304 |
| 4A | 6 | 10 | 75 | 835-402 |
| | 12 | 21 | 300 | 835-403 |
| | 24 | 42 | 1,200 | 835-404 |
| 5A | 6 | 10 | 75 | 835-502 |
| | 12 | 21 | 300 | 835-503 |
| | 24 | 42 | 1,200 | 835-504 |
| 6A | 6 | 10 | 75 | 835-602 |
| | 12 | 21 | 300 | 835-603 |
| | 24 | 42 | 1,200 | 835-604 |
| 1B† | 6 | 8 | 200 | 835-212 |
| | 12 | 16 | 800 | 835-213 |
| | 24 | 32 | 3,200 | 835-214 |
| 2B† | 6 | 8 | 200 | 835-222 |
| | 12 | 16 | 800 | 835-223 |
| | 24 | 32 | 3,200 | 835-224 |
| 1A1B† | 6 | 8 | 60 | 835-332 |
| | 12 | 16 | 240 | 835-333 |
| | 24 | 32 | 960 | 835-334 |
| 1C† (1A1B guarantee break-before-make) | 6 | 8 | 60 | 835-342 |
| | 12 | 16 | 240 | 835-343 |
| | 24 | 32 | 960 | 835-344 |
| 1A‡ (magnetic latch) | 6 | 12 | 300 | 835-272 |
| | 6 | 12 | 300 | |
| | 12 | 24 | 1,200 | 835-273 |
| | 12 | 24 | 1,200 | |
| | 24 | 48 | 4,800 | 835-274 |
| | 24 | 48 | 4,800 | |
| 2A‡ (magnetic latch) | 6 | 12 | 300 | 835-382 |
| | 6 | 12 | 300 | |
| | 12 | 24 | 1,200 | 835-383 |
| | 12 | 24 | 1,200 | |
| | 24 | 48 | 4,800 | 835-384 |
| | 24 | 48 | 4,800 | |

# STANDARD REED RELAYS -842/843 SERIES


842 SERIES





843 SERIES

**SPECIFICATIONS — Contact Ratings:** 150 VDC, 250 VAC, 1.5 Amp (switching) 6 Amp (carry), 25 Watts, 40 V-A (AC suppressed) 50 milliohm max. initial contact resistance 500 volts peak breakdown. **Temperature:** −55°C to +105°C. **Shock:** 100 G max., 11±1 mSec. **Vibration:** 30 G max. @ 0-1700 Hz. **Insulation Resistance:** $10^9$ Ohms min. **Capacitance:** 1.5 pf. **Life Expectancy:** Dry ckt., 100 x $10^6$ ops; signal level, 50 x $10^6$ ops; rated power, 20 x $10^6$ ops. Available to 12 form A. True form C also available.

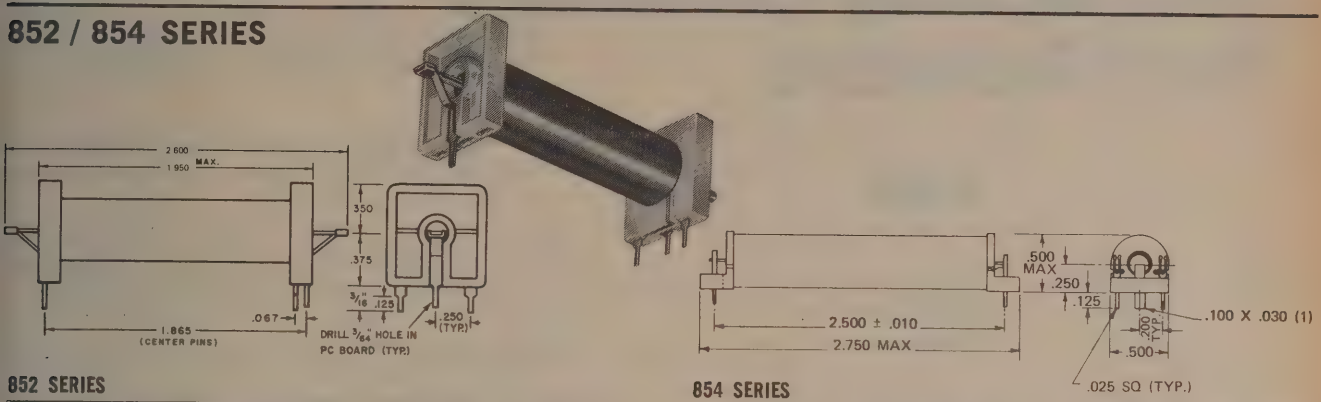
| Contact Form | Nom. Voltage | Max. Voltage | Coil Resistance ±10% ▲ | Part Number |
|---|---|---|---|---|
| 1A | 6 | 22 | 150 | 842/843-101 |
| | 12 | 45 | 600 | 842/843-102 |
| | 24 | 90 | 2,400 | 842/843-103 |
| | 48 | 175 | 9,000 | 842/843-104 |
| 2A | 6 | 20 | 100 | 842/843-201 |
| | 12 | 41 | 400 | 842/843-202 |
| | 24 | 82 | 1,600 | 842/843-203 |
| | 48 | 165 | 6,400 | 842/843-204 |
| 3A | 6 | 15 | 50 | 842/843-301 |
| | 12 | 30 | 200 | 842/843-302 |
| | 24 | 60 | 800 | 842/843-303 |
| | 48 | 121 | 3,200 | 842/843-304 |
| 4A | 6 | 16 | 50 | 842/843-401 |
| | 12 | 33 | 200 | 842/843-402 |
| | 24 | 66 | 800 | 842/843-403 |
| | 48 | 132 | 3,200 | 842/843-404 |
| 5A | 6 | 12 | 25 | 842/843-501 |
| | 12 | 24 | 100 | 842/843-502 |
| | 24 | 48 | 400 | 842/843-503 |
| | 48 | 97 | 1,600 | 842/843-504 |
| 6A | 6 | 14 | 25 | 842/843-601 |
| | 12 | 28 | 100 | 842/843-602 |
| | 24 | 56 | 400 | 842/843-603 |
| | 48 | 112 | 1,600 | 842/843-604 |
| 1B† | 6 | 9 | 100 | 842/843-209 |
| | 12 | 18 | 400 | 842/843-211 |
| | 24 | 36 | 1,600 | 842/843-213 |
| | 48 | 72 | 6,400 | 842/843-215 |
| 2B† | 6 | 9 | 100 | 842/843-309 |
| | 12 | 18 | 400 | 842/843-313 |
| | 24 | 36 | 1,600 | 842/843-317 |
| | 48 | 72 | 6,400 | 842/843-321 |
| 1C† (1A1B guarantee break-before-make) | 6 | 9 | 100 | 842/843-311 |
| | 12 | 18 | 400 | 842/843-315 |
| | 24 | 36 | 1,600 | 842/843-319 |
| | 48 | 72 | 6,400 | 842/843-323 |
| 1A‡ (magnetic latch) | 6 | 9 | 200 | 842/843-221 |
| | 6 | 9 | 200 | |
| | 12 | 18 | 800 | 842/843-222 |
| | 12 | 18 | 800 | |
| | 24 | 36 | 3,200 | 842/843-223 |
| | 24 | 36 | 3,200 | |
| | 48 | 72 | 4,500 | 842/843-224 |
| | 48 | 72 | 4,500 | |

▲Measured at 25°C.
†All relays containing magnets for Form B operation (including the break-before-make 1C) are polarity sensitive and correct polarity must be observed. Dot on relays indicates positive terminal.

‡A positive voltage must be applied to either dot terminal to close the contact(s) of a latch relay.
A negative voltage must be applied to either dot terminal to open the contact(s) of a latch relay.

**wabash**
WABASH RELAY & ELECTRONICS DIVISION
Dept. EM, First and Webster Streets / Wabash, Indiana 46992 / (219) 563-2191 / TWX 810-290-2722

## 852 / 854 SERIES




### 852 SERIES

| Contact Form | Nom. Voltage | Max. Voltage | Coil Resistance ±10% ▲ | Part Number |
|---|---|---|---|---|
| 1A | 6 | 8 | 74 | 852-306 |
| | 12 | 16 | 290 | 852-312 |
| | 24 | 33 | 1,200 | 852-324 |

▲ Measured at 25°C.

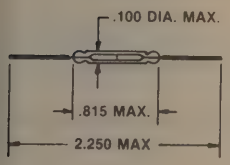
### 854 SERIES

| Contact Form | Nom. Voltage | Max. Voltage | Coil Resistance ±10% ▲ | Part Number |
|---|---|---|---|---|
| 1A | 6 | 18 | 100 | 854-101 |
| | 12 | 36 | 415 | 854-102 |
| | 24 | 72 | 1,700 | 854-103 |

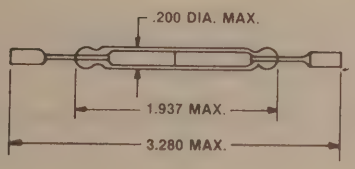
▲ Measured at 25°C.

## DRY REED SWITCHES / FORM A / (SPST-NO)

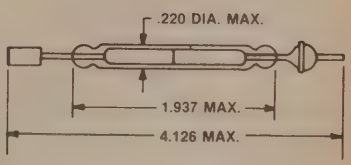
**69-2421**
**69-2721**




**69-4321**
**69-4621**

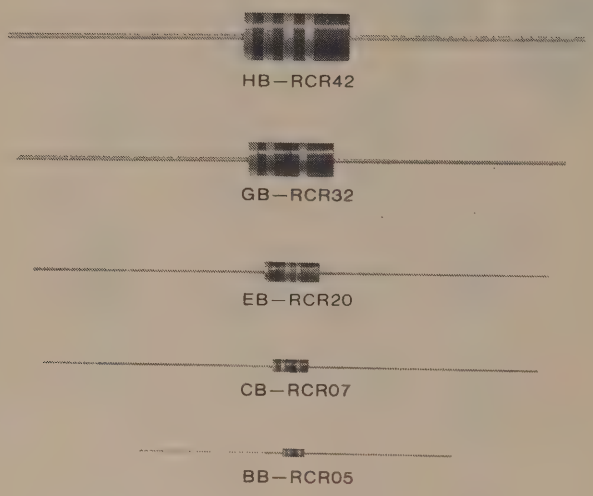



**69-4721**




| | 69-2421 Miniature | 69-4321 Standard | 69-2721 Min. R.F. | 69-4621 Std. R.F. | 69-4721 High Voltage R.F. |
|---|---|---|---|---|---|
| Voltage (Switching) Volts — D.C. Max. | 200 | 400 | 100 | 150 | 150 |
| Current (Switching) Amps — D.C. Max. | .5 | 1.5 | .1 | .5 | .5 |
| Current (Carry) Amps — D.C. Max. | 3 | 6 | 3 | 5 | 5 |
| Voltage x Current (Switching) Comb. — D.C. — Max. | 10 | 25 | 5 | 12 | 12 |
| Resistance (Contact) Milliohms — Max. — initial | 200 | 50 | 200 | 75 | 75 |
| Voltage (Breakdown) Volts — D.C. — Min. | 300 | 500 | 300 | 600 | 5000 |
| Resistance (Insulation) Ohms — Min. | $10^{10}$ | $10^{9}$ | $10^{10}$ | $10^{9}$ | $10^{9}$ |
| Pick-up (Available) Ampere Turns — Specify Range | 20-50 | 40-100 | 20-50 | 80-120 | 120-180 |

# Allen-Bradley Hot-Molded Fixed Resistors




Allen-Bradley hot-molded composition resistors are high quality units intended for general purpose use in the electronics industry.

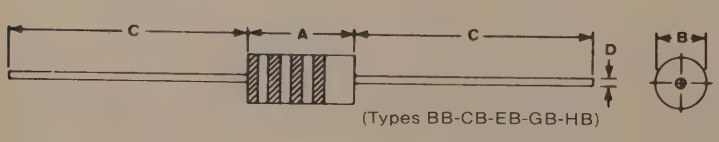
Allen-Bradley Style RCR resistors not only meet al requirements of MIL-R-39008 but also exceed the S level (best level) of Established Reliability of 0.001% failure rate per 1000 hours. And only Allen-Bradley resistors are available in S level reliability in all five wattage sizes over the entire resistance range. The S reliability level is indicated by a yello 5th color band on the resistor body.

Metal-clad hot-molded resistors (Types GM and HM are fitted with metal clamps which surround the major portion of the resistor. The metal clamps provide rigid mounting and efficient heat transfer from the resistors to the metal chassis or panels on which they are mounted.

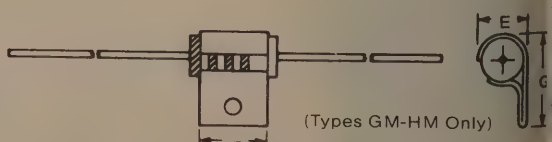
**For more information request Publication EC21.**

## SPECIFICATIONS

| Type | Power at 70°C | Resistance Range | Tolerance | Voltage Rating (RMS) | Maximum Ambient Temperature | Dimensions in Inches (millimeters) A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BB RCR05 | ⅛ watt | 2.7 Ohms to 100 Megohms<br>2.7 Ohms to 22 Megohms | ±5, 10, 20%<br>±5, 10% | 150V | +130°C | 0.145 (3,68) | 0.062 (1,59) | 1.000 (25,40) | 0.015 (0,38) | | | |
| CB RCR07 | ¼ watt | 2.7 Ohms to 100 Megohms<br>2.7 Ohms to 22 Megohms | ±5, 10, 20%<br>±5, 10% | 250V | | 0.250 (6,35) | 0.090 (2,29) | 1.500 (38,10) | 0.025 (0,64) | | | |
| EB RCR20 | ½ watt | 1.0 Ohm to 100 Megohms<br>1.0 Ohm to 22 Megohms | ±5, 10, 20%<br>±5, 10% | 350V | | 0.375 (9,52) | 0.140 (3,56) | 1.500 (38,10) | 0.033 (0,84) | | | |
| GB RCR32 | 1 watt | 2.7 Ohms to 100 Megohms<br>2.7 Ohms to 22 Megohms | ±5, 10, 20%<br>±5, 10% | 500V | | 0.562 (14,29) | 0.225 (5,72) | 1.500 (38,10) | 0.041 (1,04) | | | |
| HB RCR42 | 2 watts | 10 Ohms to 100 Megohms<br>10 Ohms to 22 Megohms | ±5, 10, 20%<br>±5, 10% | 750V<br>500V | | 0.688 (17,46) | 0.312 (7,94) | 1.500 (38,10) | 0.045 (1,14) | | | |
| GM | 3 watts | 2.7 Ohms to 22 Megohms | ±5%<br>±10% | 500V | | 0.562 (14,29) | 0.225 (5,72) | 1.500 (38,10) | 0.041 (1,04) | 0.305 (7,75) | 0.438 (11,11) | 0.656 (16,67) |
| HM | 4 watts | 10 Ohms to 22 Megohms | | 750V | | 0.688 (17,46) | 0.312 (7,94) | 1.500 (38,10) | 0.045 (1,14) | 0.391 (9,92) | 0.562 (14,29) | 0.766 (19,45) |



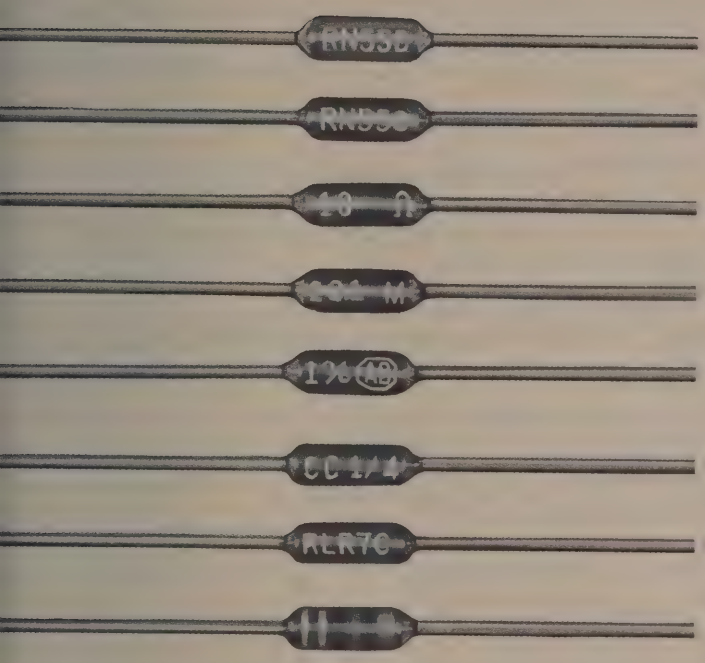
(Types BB-CB-EB-GB-HB)



(Types GM-HM Only)

# Allen-Bradley Cermet Film Fixed Resistors

## TYPE CC



**Capless** design provides a reliable termination that does away with problems associated with end cap construction.

**Leads** are designed for both soldering and welding to give you freedom of choice about attachment, and long term storage capability.

**Cores** are high purity alumina with outstanding physical and thermal properties to reduce the incidence of fractures.

**Coating** is specially formulated to maintain outstanding insulation properties throughout environmental exposures.

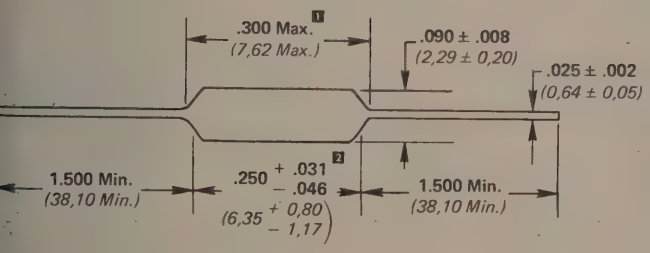
**Markings** are clear, crisp and precise; dual resistance marking for easy identification, and durable to withstand production handling.

**For more information request Publication EC33.**

## This one resistor can shrink your inventory costs

### DIMENSIONS

**Basic dimensions in inches. Dimensions shown in *ITALICS* are in millimeters.**



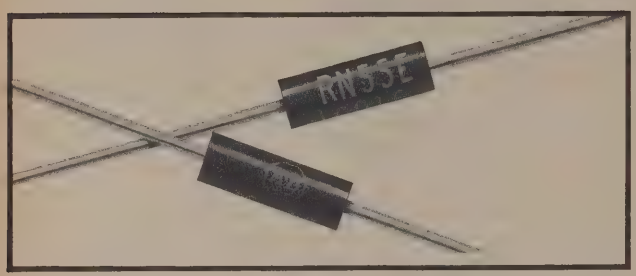

[1] Maximum length is "clean lead" to "clean lead"
[2] The end of the body is that point at which the body diameter equals .038 *(0,97)*

### SPECIFICATIONS

| | |
|---|---|
| Resistance Range | 10 Ohms to 22.1 Megohms |
| Power Rating | 0.125 watt @ 125°C<br>0.25 watt @ 70°C<br>0.5 watt @ 70°C (250V Max.) |
| TCR | ±50 PPM/°C and ±100 PPM/°C |
| Tolerance | ±0.5% and ±1% |
| Approved | RN55C 0.5%, 1% MIL-R-10509F<br>RN55D 1%, MIL-R-10509F<br>RLR07 1%, 2% MIL-R-39017C |

# Allen-Bradley Precision Metal Film Fixed Resistors

## TYPE FM




- Precision characteristics
- Uniform molded body
- Low temperature coefficient
- Tight tolerance

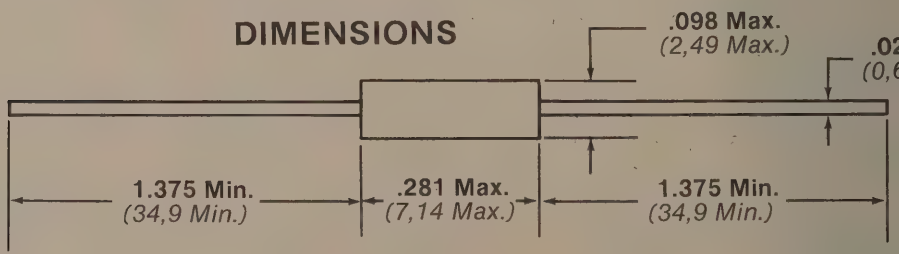
The Type FM, featuring the accuracy and stability of metal film technology, provides the tight tolerances, low temperature coefficients, minimal voltage coefficient, low noise, and stable performance that may be required for precision applications.

### SPECIFICATIONS

| | |
|---|---|
| Resistance Range | 20 Ohms to 357K Ohms [1] |
| Power Rating | 0.25 watt at 70°C<br>0.1 watt at 125°C |
| TCR | ±25, ±15, ±10 PPM/°C |
| Tolerance | ±1%, ±0.5%, ±0.25%, ±0.1%, ±0.05% |
| Approved | RN55E per MIL-R-10509F<br>Characteristic E (25 PPM/°C)<br>Tolerance B, C, D, F (0.1, 0.25, 0.5, 1%)<br>Resistance values 49.9 Ohms to 100K |

[1] For available resistance range and TCR combinations, see Publication EC54.

### DIMENSIONS

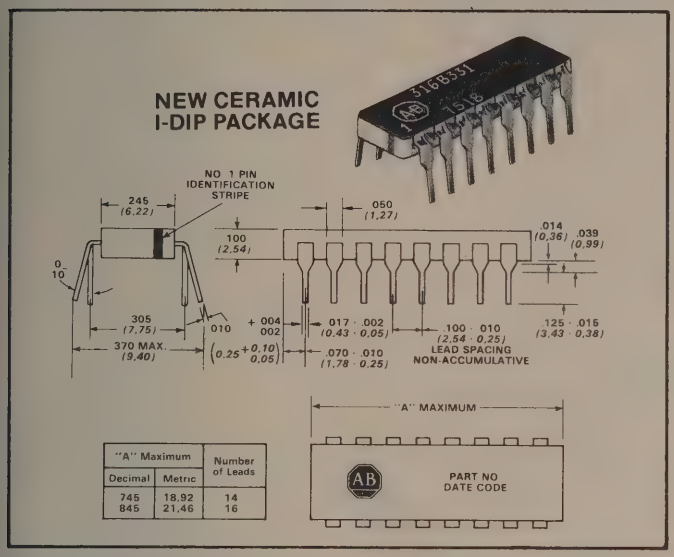



Basic dimensions in inches. Dimensions shown in *ITALICS* are in millimeters.

For more information request Publication EC54

# Allen-Bradley Resistor Networks

## CERMET DIP RESISTOR NETWORKS

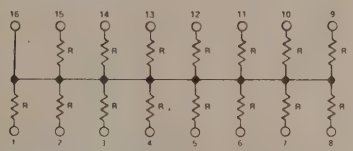



| "A" Maximum | | Number of Leads |
|---|---|---|
| Decimal | Metric | |
| .745 | 18,92 | 14 |
| .845 | 21,46 | 16 |

## STANDARD NETWORKS • PULL-UP PULL-DOWN • TERMINATION

### APPLICATIONS:

- Pull-up array for unused TTL gates
- Parallel high speed circuitry
- Wired OR configurations
- Pull-down applications
- TTL-MOS interfacing
- Digital pulse squaring



**314A — 14 pin DIP, 13 resistors**
**316A — 16 pin DIP, 15 resistors**

### APPLICATIONS:

- Transmission line termination
- Power gate pull-up
- Current limiting
- Logic level translation

**314B — 14 pin DIP, 7 resistors**
**316B — 16 pin DIP, 8 resistors**

## STANDARD RESISTANCE VALUES— SERIES 314A, 314B, 316A, 316B

| R (OHMS), ±2% TOLERANCE | | | | | | |
|---|---|---|---|---|---|---|
| 22 | 91 | 390 | 1600 | 6200 | 27K | 120K |
| 24 | 100* | 430 | 1800 | 6800* | 30K | 150K* |
| 27 | 110 | 470* | 2000 | 7500 | 33K* | 180K |
| 30 | 120 | 510 | 2200* | 8200 | 36K | 220K* |
| 33 | 130 | 560 | 2400 | 9100 | 39K | 270K |
| 36 | 150* | 620 | 2700 | 10K* | 43K | 330K* |
| 39 | 160 | 680* | 3000 | 11K | 47K* | 390K |
| 43 | 180 | 750 | 3300* | 12K | 51K | 470K* |
| 47 | 200 | 820 | 3600 | 13K | 56K | 560K |
| 51 | 220* | 910 | 3900 | 15K* | 62K | 680K* |
| 56 | 240 | 1000* | 4300 | 16K | 68K* | 1M* |
| 62 | 270 | 1100 | 4700* | 18K | 75K | |
| 68 | 300 | 1200 | 5100 | 20K | 82K | |
| 75 | 330* | 1300 | 5600 | 22K* | 91K | |
| 82 | 360 | 1500* | 6000 | 24K | 100K* | |

### HOW TO ORDER

Example: Require Series 314A with resistance value=1000Ω.
Order part #314A102.

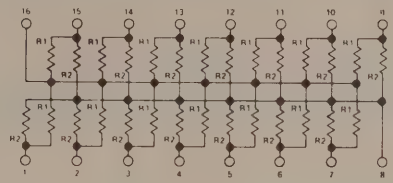
### ± 1% TOLERANCE

The values marked with an asterisk of Series 314A, 314B, 316A and 316B in the table above are available with ±1% tolerance. Add the letter "F" on the end of the part number to indicate the optional ±1% tolerance.

## STANDARD NETWORKS • PARALLEL • TERMINATION

### APPLICATIONS:

Series 314E and 316E networks are used in digital IC logic circuits and are especially suited for ECL and TTL applications. For ECL applications the network's circuit configuration serves a dual purpose. The R2 resistors are pull-down resistors and are normally tied to the most negative supply voltage. The R1 resistors, in parallel with the R2 resistors, provide the characteristic impedance for proper transmission line matching. In TTL logic the networks are used in pulse squaring applications.



**314E—14 pin DIP, 24 resistors**
**316E—16 pin DIP, 28 resistors**

## STANDARD RESISTANCE VALUES— SERIES 314E and 316E

| R1/R2 | Characteristic Impedance $Z_o$ | R1/R2 | Characteristic Impedance $Z_o$ |
|---|---|---|---|
| 81/130 | 50 | 220/330 | 132 |
| 120/200 | 75 | 330/390 | 179 |
| 90/660 | 80 | 330/470 | 194 |
| 130/210 | 80 | 330/680 | 222 |
| 160/260 | 100 | 1.5K/3.3K | 1.03K |
| 220/270 | 121 | 3K/6.2K | 2.02K |
| 180/390 | 123 | | |

### HOW TO ORDER

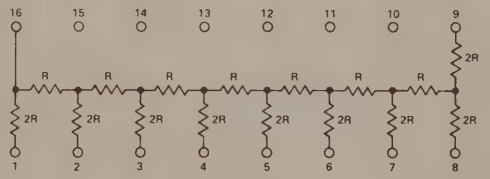
Example: Require Series 316E with characteristic impedance=50Ω.
Order part #316E810131.

## 8 BIT R/2R LADDER NETWORKS

### APPLICATIONS:

- Designed for use with D/A and A/D convertors with bipolar or CMOS switches.

| Part No. | R Value |
|---|---|
| 316L08253 | 25K |
| 316L08503 | 50K |
| 316L08104 | 100K |



**316L08**

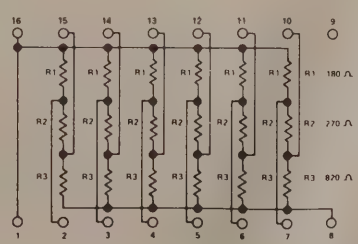
### HOW TO ORDER

Example: Require Series 316L08 with 100K ladder impedance.
Order part #316L08104.

## STANDARD TTL TO ECL TRANSLATOR NETWORK

### APPLICATIONS:

- Series 316T110 provides TTL to ECL translation.
- Contains six TTL to ECL translators.



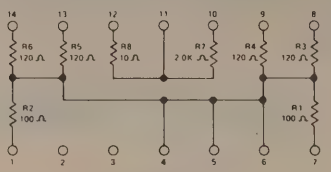

**316T110**

# STANDARD NETWORKS • SENSE AMP • INTERFACE

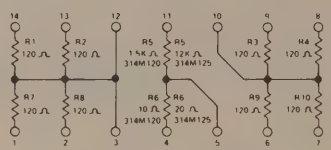
## APPLICATIONS:

- Designed for use with 7520 series core memory sense amplifiers
- Series 314M110 combines a threshold setting divider with balanced sense line termination and far end termination of two sense lines
- Series 314M120 and 314M125 combine threshold setting dividers with four sense line termination Following resistor values provide different threshold setting

| Resistor | 314M120 | 314M125 |
|---|---|---|
| R5 | 1.5KΩ | 12KΩ |
| R6 | 10Ω | 20Ω |



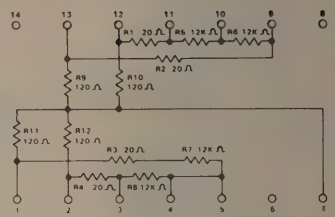
314M110



314M120 or 314M125

## APPLICATIONS:

- Series 314M130 designed for use with μA711 dual voltage comparator in core memory sense amplifier applications
- Combines four threshold dividers with balanced termination of two lines



314M130

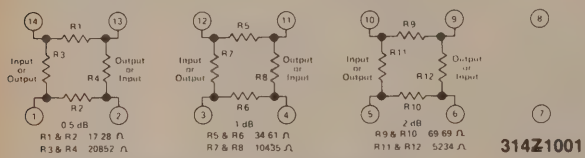
# STANDARD "O" PAD (BALANCED π) ATTENUATORS

## APPLICATIONS:

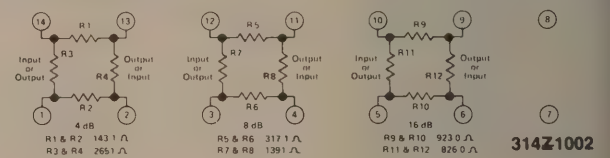
These networks are used primarily in the communications industry where a fixed voltage attenuation is required with impedance matching. Voltage attenuation in steps of 0.5 dB from 0.5 dB to 31.5 dB can be obtained from the Series 314Z networks by the use of one "O" pad, or by placing two or more in series. For example, 20 dB is obtained by placing the 4 dB and 16 dB sections in series.

## SPECIFICATIONS:

| | |
|---|---|
| Characteristic Impedance | 600 ohms |
| Attenuation Tolerance (dB) | ±1% |
| Attenuation Change Due to Temperature | ±1% Additional |
| Resistor Tolerance | ±1% |
| Temperature Coefficient of Resistance | ±200 ppm/°C |
| Power Dissipation Rating at 40°C | 150 mw per Attenuator |
| Frequency Response | Flat to 1 MHz |
| Operating Temperature | 0°C to +70°C |




314Z1001




314Z1002

# INTERCONNECT NETWORKS

## APPLICATIONS:

- Shorting
- Matrix interconnections

314X101—14 pin DIP

- Also available in 16 pin DIP as 316X101
- Other interconnect network configurations available

# STANDARD NETWORK SPECIFICATIONS

| Standard Network | Resistor Tolerance | Temp. Coefficient of resistance (ppm/°C) | Power Dissipation Rating (Up to 70°C Ambient) [1] | Operating Temperature Range | Resistance Ratios |
|---|---|---|---|---|---|
| 314A | ±2% ±1% also available for certain values | ±100 | 125 mw/resistor 1.6 watt/package [2] | −55°C to +125°C | — — — — — |
| 314B | | | 250 mw/resistor 1.6 watt/package [3] | | |
| 316A | | | 125 mw/resistor 1.8 watt/package [2] | | |
| 316B | | | 250 mw/resistor 1.8 watt/package [3] | | |
| 314E | ±2% | +100 | 125 mw/resistor 1.6 watt/package | −55°C to +125°C | — — — — — — |
| 316E | | | 125 mw/resistor 1.8 watt/package | | |
| 316L08 | +2% | +100 | 50 mw/resistor 1.8 watt/package | 0°C to +70°C | ±½ LSB from 0°C to +70°C |
| 314M110 | ±2% +5% (R8 only) | ±200 | 500 mw/resistor (R1 & R2) 100 mw/resistor (R3 through R8) | 0°C to +70°C | R3/R4 ±1.5% R5/R6 ±1.5% R7/R8 ±2% |
| 314M120 | ±2% +5% (R6 only) | +100 | 100 mw/resistor | 0°C to +70°C | R1/R2, R3/R4, R5/R6, R7/R8, R9/R10 ±1.5% |
| 314M125 | | | | | |
| 314M130 | +2% | +200 | 100 mw/resistor | 0°C to +70°C | — — — — — — |
| 316T110 | ±2% | ±200 | 125 mw/resistor | 0°C to +70°C | — — — — — |
| 314X101 | Resistance Value = 1 ohm Maximum | — — — | — — — | −55°C to + 125°C | — — — |
| 316X101 | | | | | |

[1] At 70° power derates linearly from full rated power to 0 wattage at 130°C

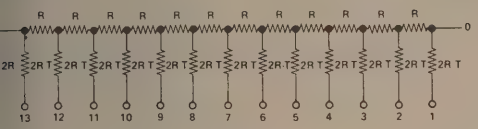
[2] Rated continuous working voltage (RCWV), based on nominal resistance (R) in ohms, is $\sqrt{125xR}$ or 150 volts, whichever is less

[3] Rated continuous working voltage (RCWV), based on nominal resistance (R) in ohms, is $\sqrt{25xR}$ or 350 volts, whichever is less

# PRECISION THIN FILM NETWORKS

## R/2R BINARY CODE LADDER NETWORKS

Ladder networks with fewer bits using the basic schematic of the FN132 are FN114, FN123, FN125, FN131, and FN160.

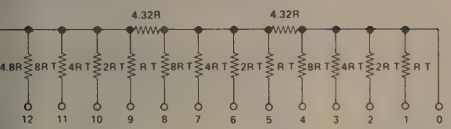


FN132

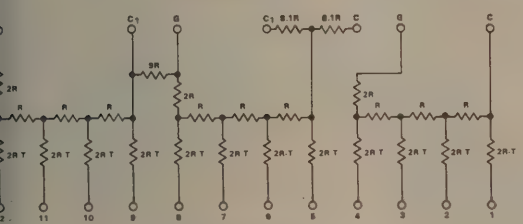
| Part Number | FN114 (1) | FN123 (1) | FN125 (2) | FN131 | FN132 | FN160 |
|---|---|---|---|---|---|---|
| Number of Bits | 12 | 10 | 10 | 10 | 13 | 10 |
| Ladder Resistance Value (R) | R=200K<br>$T_{1\ 2}$=500Ω<br>$T_{3\ 12}$=550Ω | R=50K<br>$T_{1\text{-}2}$=500Ω<br>$T_{3\text{-}10}$=550Ω | R=50K<br>$T_{1\ 2}$=200Ω<br>$T_{3\ 10}$=550Ω | R=10K<br>T=0 | R=5K<br>T=0 | R=5K<br>T=0 |
| Ladder Resistance Tolerance | ±10% | ±10% | ±10% | ±10% | ±10% | ±10% |
| Network Full Scale Accuracy | ±½ LSB | ±½ LSB | ±½ LSB | ±½ LSB | ±½ LSB | ±½ LSB |
| Operating Temperature Range | −55°C to +125°C | −55°C to +125°C | −55°C to +125°C | −55°C to +125°C | −55°C to +125°C | −55°C to +125°C |
| Storage Temperature Range | −65°C to +175°C | −65°C to +175°C | −65°C to +175°C | −65°C to +175°C | −65°C to +175°C | −65°C to +175°C |
| Operating Voltage Range | ±100V Maximum | ±70V Maximum | ±70V Maximum | ±30V Maximum | ±20V Maximum | ±20V Maximum |

(1) May be used with Fairchild 3750/3751 IC
(2) May be used with Fairchild 3750 IC

## 1-2-4-8 BCD CODE LADDER NETWORKS



FN130



FN128 and FN129

### APPLICATIONS:

- All ladders—A/D and D/A conversion.

| Part Number | FN128 (1) | FN129 (1) | FN130 |
|---|---|---|---|
| Number of Bits | 12 | 12 | 12 |
| Ladder Resistance Value (R) | R=50K<br>$T_{1\text{-}2}$=500Ω<br>$T_{3\text{-}12}$=500Ω | R=100K<br>$T_{1\text{-}2}$=500Ω<br>$T_{3\ 12}$=550Ω | R=10K<br>T=0 |
| Ladder Resistance Tolerance | ±10% | ±10% | ±10% |
| Network Full Scale Accuracy | ±½ LSB | ±½ LSB | ±½ LSB |
| Operating Temperature Range | −55°C to +125°C | −55°C to +125°C | −55°C to +125°C |
| Storage Temperature Range | −65°C to +175°C | −65°C to +175°C | −65°C to +175°C |
| Operating Voltage Range | ±100V Maximum | ±140V Maximum | ±20V Maximum |

(1) May be used with Fairchild 3750/3751 IC

## VOLTAGE DIVIDER NETWORK

(Decade Attenuator)

### APPLICATIONS:

FN207—Input attenuation and range selection in digital instrumentation, particularly in digital voltmeters and multimeters.

Resistance Tolerance on Total Resistance ($R_T$) at +25°C
$R_T = R_1 + R_2 + R_3 + R_4 + R_5$=10 Megohms ±0.05%.

Ratio Tolerance at +25°C and from 0 to 1000 volts.

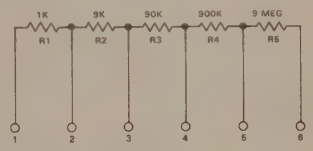
$$\frac{R_1 + R_2 + R_3 + R_4}{R_T} = \frac{1\ \text{Megohm}}{10\ \text{Megohms}} = 0.1\ \pm 0.03\%$$

$$\frac{R_1 + R_2 + R_3}{R_T} = \frac{100\ \text{K ohms}}{10\ \text{Megohms}} = 0.01\ \pm 0.03\%$$

$$\frac{R_1 + R_2}{R_T} = \frac{10\ \text{K ohms}}{10\ \text{Megohms}} = 0.001\ \pm 0.03\%$$

$$\frac{R_1}{R_T} = \frac{1\ \text{K ohm}}{10\ \text{Megohms}} = 0.0001\ \pm 0.03\%$$

| | |
|---|---|
| Temperature Coefficient of Resistance | ±25 ppm/°C |
| TCR Tracking | ±5 ppm/°C |
| Operating Voltage (between pins 1 & 6) | 1000 volts max. |
| Operating Temperature | 0°C to +70°C |
| Storage Temperature | −65°C to +175°C |



FN207

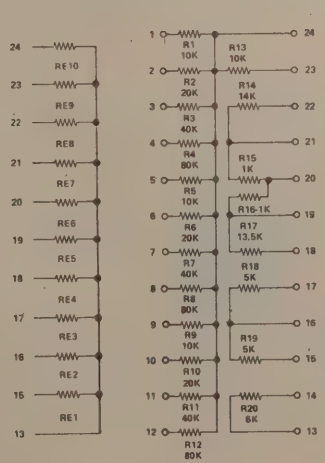
## CURRENT SUMMING NETWORKS PRECISION RESISTOR ARRAYS

### APPLICATIONS:

- A/D and D/A conversion.
- FN111*—10 bit binary operation.
- FN112*—3 place BCD operation (0 to 399).
- FN215—12 bit conversion—designed for use with Fairchild μA9650 IC.
- FN226**
- FN227**

*Both designed for use with Fairchild μA722 IC.

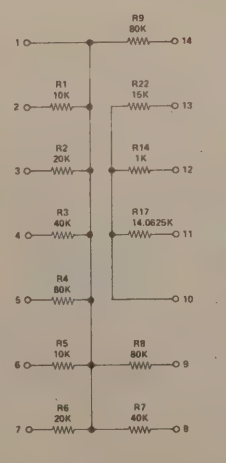
**Both designed for use with Intersil ICL 8018, 8019, 8020 IC's. FN226 gives 8 bit conversion. FN226 plus FN227 gives 12 bit conversion.



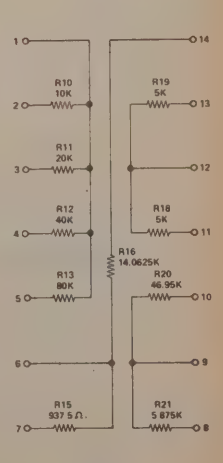
FN111 and FN112



FN215



FN226



FN227

## CURRENT SUMMING NETWORKS

| Part Number | | FN111 | | | | FN112 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Terminal Number | Resistor Number (Rej) | Nominal Resistance (K ohm) | Nominal Ratio (Rej/Rei) | Max. Ratio Tolerance % At 25°C | Max. Ratio Temp. Coeff. (PPM/°C) | Nominal Resistance (K ohm) | Nominal Ratio (Rej/Rei) | Max. Ratio Tolerance % At 25°C | Max. Ratio Temp. Coeff. (PPM/°C) |
| 15 | RE1 | 2.547 | 1.000 | ±10% Absolute | ±5.0 | 2.547 | 1.000 | ±10% Absolute | ±20 |
| 16 | RE2 | 5.094 | 2.000 | ±0.02 | ±5.0 | 5.094 | 2.000 | ±0.02 | ±5.0 |
| 17 | RE3 | 10.245 | 4 022 | ±0.05 | ±10 | 6.379 | 2.5045 | ±0 02 | ±5.0 |
| 18 | RE4 | 20.60 | 8.088 | ±0.10 | ±20 | 12.83 | 5.036 | ±0.05 | ±10 |
| 19 | RE5 | 41.43 | 16.265 | ±0.20 | ±20 | 25.80 | 10.13 | ±0.10 | ±20 |
| 20 | RE6 | 81.93 | 32.17 | ±0.20 | ±50 | 51.03 | 20.03 | ±0.20 | ±50 |
| 21 | RE7 | 163.4 | 64.16 | ±0.50 | ±100 | 63.36 | 24.88 | ±0.50 | ±100 |
| 22 | RE8 | 325.7 | 127.9 | ±1.0 | ±200 | 126.3 | 49.57 | ±1.0 | ±200 |
| 23 | RE9 | 644.9 | 253.2 | ±2.0 | ±500 | 250 1 | 98.17 | ±1.0 | ±200 |
| 24 | RE10 | 1275.0 | 500.8 | ±2.0 | ±500 | 495.0 | 194 3 | ±2.0 | ±500 |

## PRECISION RESISTOR ARRAYS

| Part Number | FN215 | FN226 | FN227 |
|---|---|---|---|
| **Tolerance** Resistance matching or ratio | R2/R1 = ±0.005%<br>R3/R1 = ±0.01%<br>R4/R1 = ±0.02%<br>R5/R1 = ±1.0%<br>R6/R5 = ±0.05%<br>R7/R5 = ±0.1%<br>R8/R5 = ±0.02%<br>R9/R1 = ±1.0%<br>R10/R9 = ±0.5%<br>R11/R9 = ±1.0%<br>R12/R9 = ±2.0%<br>R13/R1 = ±0.2% | R2/R1 = ±0.0122%<br>R3/R1 = ±0.0244%<br>R4/R1 = ±0.0488%<br>R5/R1 = ±0.096%<br>R6/R1 = ±0.195%<br>R7/R1 = ±0.391%<br>R8/R1 = ±0.781%<br>R9/R1 = ±0.1%<br>R17/R14 = ±0.1%<br>R22/R14 = ±0.5% | R11/R10 = ±1.0%<br>R12/R10 = ±1.0%<br>R13/R10 = ±1.0%<br>R16/R15 = ±1.0%<br>R19/R18 = ±0.1%<br>R21/R20 = ±0.1% |
| **Tolerance** Absolute | R14&R17 = ±0.5%<br>R15&R16 = ±1.0%<br>R18&R19 = ±0.1%<br>R20 = ±1.0% | R1 = ±0.1%<br>R14 = ±1.0% | R10 = ±0.5%<br>R15 = ±1.0%<br>R18 = ±0.5%<br>R20 = ±0.5% |
| Temperature coefficient of resistance | ±25 PPM/°C | ±25 PPM/°C | ±25 PPM/°C |
| Temperature coefficient of resistance tracking | ±5 PPM/°C | ±5 PPM/°C | ±5 PPM/°C |
| Power rating each resistor up to +125°C | 50MW | 50MW | 50MW |
| Operating temperature range | −55°C to +125°C | 0°C to +70°C | 0°C to +70°C |
| Storage temperature range | −65°C to +175°C | −65°C to +175°C | −65°C to +175°C |

## CUSTOM RESISTOR NETWORKS

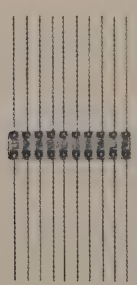
In addition to the standard cermet and precision thin film resistor networks listed on these pages, custom networks can be designed to meet a specific need. For more information on custom resistor network capabilities ask for these publications:

Cermet resistor networks—
A-B Publication 5840.

Thin film resistor networks—
A-B Publication 5800.

## PACKAGES

- Modified flat pack (Diallyl phthalate epoxy material)
- Conformal coated
- Chip



Resistor Networks

A-B QUALITY

# ALLEN-BRADLEY

1201 South Second Street
Milwaukee, Wisconsin 53204

# CATALOGUE DE L'ELECTRONIQUE POUR LES INGENIEURS
# DER PRODUKTKATALOG FÜR ELEKTRONIKER
# ELECTRONIC ENGINEERS CATALOGUE

**The 1978 edition is out...and the response is in...**
**IMMEDIATE AND OVERWHELMING**

**ACCEPTANCE**

The ELECTRONIC ENGINEERS CATALOGUE is the only comprehensive, trilingual catalogue/source-directory of electronic products available to—and from—Western Europe.

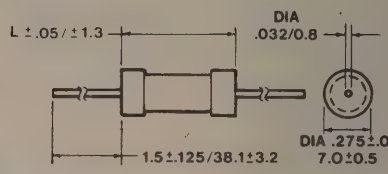
It is divided into three distinct sections: 1. **The Product Index and Directory,** which lists more than 3,000 product headings & cross-references alphabetically in English with their French and German equivalents. 2. **The Manufacturers' Catalogue Section,** which is a compilation of Manufacturers' Catalogues in alphabetical order. 3. **The Manufacturers' Sales Offices and Trade Marks Directory,** which alphabetically includes country, address, telex or TWX numbers of the Manufacturers' main and local sales offices and/or agents.

The ELECTRONIC ENGINEERS CATALOGUE offers U.S. manufacturers the most cost-efficient method of distributing their catalogue data to **25,000** electronic engineers and buyers throughout Western Europe. It represents the carefully conceived application of the time-proven **eem** "cataloging" concept to the elusive European marketplace.

nited Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Avenue, Garden City, New York 11530 / 516 222-2500

# ACI CARBON FILM HIGH VOLTAGE RESISTORS

## T SERIES / CARBON FILM HIGH VOLTAGE RESISTORS




### Features

- Low cost, cap and lead type
- Ratings to 3 w, 15 kV, ±5%

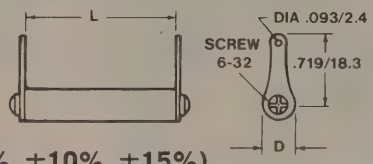
### General Purpose Types (±5%, ±10%, ±15%, ±20%)

| ACI Type | Power (watts) @ 25°C | Voltage Rating (kV) | Resistance (ohms) Min. | Resistance (ohms) Max. | Dimensions L in | Dimensions L mm | Dimensions D in | Dimensions D mm |
|---|---|---|---|---|---|---|---|---|
| TAEW | 0.5 | 3.0 | 1M | 1G | 0.80 | 20.3 | 0.275 | 7.0 |
| TAFW | 1.0 | 5.0 | 1M | 1G | 1.05 | 26.7 | 0.275 | 7.0 |
| TAKW | 1.5 | 7.5 | 1M | 1G | 1.55 | 39.4 | 0.275 | 7.0 |
| TAOW | 2.0 | 10.0 | 1M | 1G | 2.05 | 52.1 | 0.275 | 7.0 |
| TAQW | 2.5 | 12.5 | 1M | 1G | 2.55 | 64.8 | 0.275 | 7.0 |
| TARW | 3.0 | 15.0 | 1M | 1G | 3.05 | 77.5 | 0.275 | 7.0 |

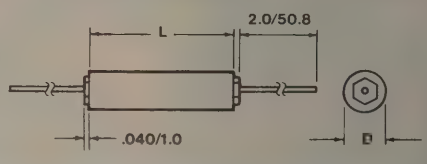
Note: T Series is supplied with .002" (.05mm) thick mylar protective sleeve.

## B SERIES / CARBON FILM HIGH VOLTAGE RESISTORS

Style A (Dimensions — in/mm)




Style B (Dimensions — in/mm)




### Features

- Single units to 10 w, 40 kV, ±3%
- Matched pairs to 20 w, 80 kV, ±1%
- Radial lug or axial lead

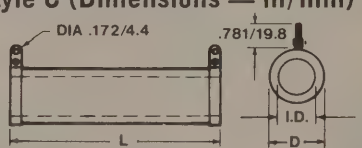
### General Purpose Types (±3%, ±5%, ±10%, ±15%)

| ACI Type | Power (watts) @ 25°C | Voltage Rating (kV) | Resistance (ohms) Min. | Resistance (ohms) Max. | Dwg. Style | Dimensions L in | Dimensions L mm | Dimensions D in | Dimensions D mm |
|---|---|---|---|---|---|---|---|---|---|
| BAEW | 0.5 | 2.5 | 10K | 1G | B | 0.75 | 19.1 | 0.250 | 6.4 |
| BAKW | 1.0 | 5.0 | 20K | 2G | B | 1.50 | 38.1 | 0.250 | 6.4 |
| BBF | 1.0 | 3.5 | 10K | 10G | A | 1.00 | 25.4 | 0.313 | 8.0 |
| BBFW | 1.0 | 3.5 | 10K | 10G | B | 1.00 | 25.4 | 0.313 | 8.0 |
| BBM | 2.0 | 7.5 | 10K | 25G | A | 1.75 | 44.5 | 0.313 | 8.0 |
| BBMW | 2.0 | 7.5 | 10K | 25G | B | 1.75 | 44.5 | 0.313 | 8.0 |
| BBR | 3.0 | 15.0 | 20K | 25G | A | 3.00 | 76.2 | 0.313 | 8.0 |
| BBRW | 3.0 | 15.0 | 20K | 25G | B | 3.00 | 76.2 | 0.313 | 8.0 |
| BBV | 5.0 | 30.0 | 40K | 25G | A | 5.50 | 139.7 | 0.313 | 8.0 |
| BFQ | 4.0 | 15.0 | 20K | 25G | A | 2.50 | 63.5 | 0.563 | 14.3 |
| BFT | 6.0 | 25.0 | 40K | 25G | A | 4.00 | 101.6 | 0.563 | 14.3 |
| BFW | 10.0 | 40.0 | 70K | 25G | A | 6.50 | 165.1 | 0.563 | 14.3 |

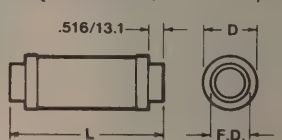
Notes: Both Style A and Style B are supplied with .002" (.05mm) thick Mylar protective sleeve.
Style B axial leads are #20 AWG tinned copper. Dimensional tolerances are ±.016"/.4mm or ±1%, whichever is greater

## D SERIES / CARBON FILM HIGH VOLTAGE RESISTORS

Style C (Dimensions — in/mm)




Style D (Dimensions — in/mm)




### Features

- Ratings to 100 w, 125 kV, ±3%
- Radial bands or ferrule terminals

### General Purpose Types (±3%, ±5%, ±10%, ±15%)

| ACI Type | Power (watts) @ 25°C | Voltage Rating (kV) | Resistance (ohms) Min. | Resistance (ohms) Max. | Dwg. Style | Dimensions L in | Dimensions L mm | Dimensions D in | Dimensions D mm | Dimensions I.D. in | Dimensions I.D. mm | Dimensions F.D. in | Dimensions F.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DJU | 10 | 25 | 50K | 100G | C | 4.500 | 114.3 | 0.750 | 19.1 | 0.500 | 12.7 | N/A | — |
| DPW | 20 | 35 | 100K | 100G | C | 6.500 | 165.1 | 1.125 | 28.6 | 0.750 | 19.1 | N/A | — |
| DPW-1 | 20 | 35 | 100K | 100G | D | 7.687 | 195.2 | 1.125 | 28.6 | N/A | — | 0.812 | 20.6 |
| DPX | 30 | 65 | 200K | 100G | C | 10.500 | 266.7 | 1.125 | 28.6 | 0.750 | 19.1 | N/A | — |
| DPX-1 | 30 | 65 | 200K | 100G | D | 11.687 | 296.8 | 1.125 | 28.6 | N/A | — | 0.812 | 20.6 |
| DVY | 60 | 90 | 400K | 100G | C | 14.500 | 368.3 | 1.500 | 38.1 | 1.250 | 28.6 | N/A | — |
| DVY-1 | 60 | 90 | 400K | 100G | D | 15.687 | 398.4 | 1.500 | 38.1 | N/A | — | 1.141 | 29.0 |
| DZW | 35 | 40 | 300K | 100G | C | 6.500 | 165.1 | 2.000 | 50.8 | 1.563 | 39.7 | N/A | — |
| DZW-1 | 35 | 40 | 300K | 100G | D | 7.687 | 195.2 | 2.000 | 50.8 | N/A | — | 1.141 | 29.0 |
| DZZ | 100 | 125 | 700K | 100G | C | 18.500 | 469.9 | 2.000 | 50.8 | 1.563 | 39.7 | N/A | — |
| DZZ-1 | 100 | 125 | 700K | 100G | D | 19.687 | 500.0 | 2.000 | 50.8 | N/A | — | 1.141 | 29.0 |

Note: Style C and D are normally supplied without protective sleeves; an .055" (1.4mm) thick vinyl sleeve is available upon request.
Dimensional tolerances are ±.016"/.4mm or ±1%, whichever is greater
Above are shown the most popular series but many other standard series are available. They include BP (Matched Pairs), E (Encapsulated), F&G (High Frequency), H (High Megohm) and HS (Sealed High Megohm). Contact the factory for additional information.

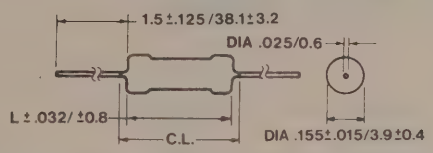
AMERICAN COMPONENTS INC. SUBSIDIARY OF insl-x
DEPT. EM, 8th AVENUE AT HARRY ST. / P.O. BOX 152 / CONSHOHOCKEN, PA 19428
TELEPHONE (215) 825-6200 / TWX 510-660-9268

# ACI METAL OXIDE HIGH VOLTAGE RESISTORS

## RNX SERIES / METAL OXIDE HIGH VOLTAGE RESISTORS

### Features
- Silicone or epoxy coating
- Ratings to 2 w, 6 kV, ±1%

### Dimensions — in/mm




### Precision Types (±1%, ±2%, ±5%, ±10%)

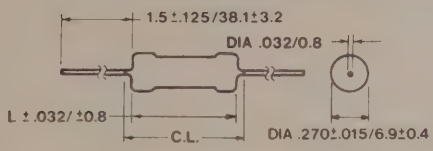
| ACI Type* | Power (watts) @ 125°C Silicone | Power (watts) @ 125°C Epoxy | Voltage Rating (kV) | Resistance (ohms) Min. | Resistance (ohms) Max. | TCR (ppm/°C) vs. Range ±100 | ±200 | ±400 | Dimensions L Max. in | L Max. mm | CL Max. in | CL Max. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RNX-⅜ | 0.5 | 0.2 | 1.5 | 1K | 500M | 1K- 50M | 51M-500M | — | 0.400 | 10.2 | 0.470 | 11.9 |
| RNX-½ | 0.6 | 0.25 | 1.5 | 1K | 1.5G | 1K- 60M | 61M-600M | 601M-1.5G | 0.525 | 13.3 | 0.595 | 15.1 |
| RNX-¾ | 1.0 | 0.4 | 2.0 | 1.2K | 2.5G | 1.2K-100M | 101M-1G | 1.01G-2.5G | 0.775 | 19.7 | 0.845 | 21.5 |
| RNX-1 | 1.25 | 0.5 | 4.0 | 1.5K | 3.0G | 1.5K-125M | 126M-1.25G | 1.26G-3.0G | 1.025 | 26.0 | 1.095 | 27.8 |
| RNX-1¼ | 1.5 | 0.6 | 5.0 | 1.7K | 4.0G | 1.7K-150M | 151M-1.5G | 1.51G-4.0G | 1.275 | 32.4 | 1.345 | 34.2 |
| RNX-1½ | 2.0 | 0.8 | 6.0 | 2.0K | 5.0G | 2.0K-175M | 176M-2.0G | 2.01G-5.0G | 1.525 | 38.7 | 1.595 | 40.5 |

*Add the suffix -E to ACI Type when specifying epoxy coating. Leads are OFHC tinned copper.

## ROX SERIES / METAL OXIDE HIGH VOLTAGE RESISTORS

### Features
- Silicone or epoxy coating
- Ratings to 10 w, 45 kV, ±1%

### Dimensions — in/mm




### Precision Types (±1%, ±2%, ±5%, ±10%)

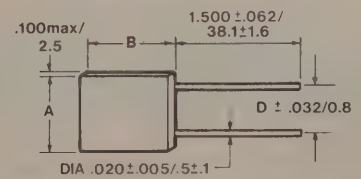
| ACI Type* | Power (watts) @ 125°C Silicone | Power (watts) @ 125°C Epoxy | Voltage Rating (kV) | Resistance (ohms) Min. | Resistance (ohms) Max. | TCR (ppm/°C) vs. Range ±100 | ±200 | ±400 | Dimensions L Max. in | L Max. mm | CL Max. in | CL Max. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ROX-¾ | 1.5 | .75 | 5.0 | 1K | 4G | 1K-200M | 201M- 1.5G | 1.6G-4G | 0.800 | 20.3 | 0.884 | 22.5 |
| ROX-1 | 2.0 | 1.0 | 7.5 | 1K | 5G | 1K-300M | 301M- 2.0G | 2.1G-5G | 1.050 | 26.7 | 1.134 | 28.8 |
| ROX-1½ | 2.5 | 1.5 | 11.0 | 1.5K | 7.5G | 1.5K-400M | 401M- 3.0G | 3.1G-7.5G | 1.550 | 39.4 | 1.634 | 41.5 |
| ROX-2 | 3.0 | 2.0 | 15.0 | 2K | 10G | 2K-500M | 501M- 4.0G | 4.1G-10G | 2.050 | 52.1 | 2.134 | 54.2 |
| ROX-3 | 5.0 | 3.0 | 22.5 | 3K | 15G | 3K-750M | 751M- 6.0G | 6.1G-15G | 3.050 | 77.5 | 3.134 | 79.6 |
| ROX-4 | 6.0 | 4.0 | 30.0 | 4K | 20G | 4K-1.00G | 1.01G- 8.0G | 8.1G-20G | 4.050 | 102.9 | 4.134 | 105.0 |
| ROX-5 | 8.0 | 5.0 | 37.5 | 5K | 25G | 5K-1.25G | 1.26G-10.0G | 10.1G-25G | 5.050 | 128.3 | 5.134 | 130.4 |
| ROX-6 | 10.0 | 6.0 | 45.0 | 6K | 30G | 6K-1.50G | 1.51G-12.0G | 12.1G-30G | 6.050 | 153.7 | 6.134 | 155.8 |

*Add the suffix -E to ACI Type when specifying epoxy coating. Leads are OFHC tinned copper.

## FLAT STYLE / METAL OXIDE HIGH VOLTAGE RESISTORS

### Features
- Silicone or epoxy coating
- Ratings to 4 w, 15 kV, ±1%

### Dimensions — in/mm




### Precision Types (±1%, ±2%, ±5%, ±10%)

| ACI Type* | Power (watts) @ 25°C Silicone | Power (watts) @ 25°C Epoxy | Voltage Rating (kV) | Resistance (ohms) Min. | Resistance (ohms) Max. | TCR (ppm/°C) vs. Range ±200 | ±250 | Dimensions A Max. in | A Max. mm | B Max. in | B Max. mm | D in | D mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FHV-1 | N/A | 1.6 | 3.5 | 10K | 2G | 10K-2G | — | 0.520 | 13.2 | 0.520 | 13.2 | 0.360 | 9.1 |
| FHV-2 | N/A | 4.0 | 7.5 | 20K | 10G | 10K-2G | 2.1G-10G | 1.020 | 25.9 | 0.520 | 13.2 | 0.860 | 21.8 |
| RCX-½ | 0.5 | 0.25 | 3.75 | 100 | 10G | 100-10G | — | 0.570 | 14.5 | 0.210 | 5.3 | 0.415 | 10.5 |
| REX-1 | 1.6 | 0.8 | 7.5 | 100 | 2G | 100-2G | — | 1.070 | 27.2 | 0.280 | 7.1 | 0.890 | 22.6 |
| RFX-1½ | 3.0 | 1.5 | 11.25 | 100 | 5G | 100-2G | 2.1G-5G | 1.570 | 39.9 | 0.330 | 8.4 | 1.390 | 35.3 |
| RFX-2 | 4.0 | 2.0 | 15.0 | 100 | 8G | 100-2G | 2.1G-8G | 2.070 | 52.6 | 0.330 | 8.4 | 1.880 | 47.8 |

*Add the suffix -E to ACI Type when specifying epoxy coating. Leads are OFHC tinned copper.

AMERICAN COMPONENTS INC. SUBSIDIARY OF insilco DEPT. EM 8th AVENUE AT HARRY ST. / P.O. BOX 152 / CONSHOHOCKEN, PA 19428 TELEPHONE (215) 825-6200 / TWX 510-660-9268

# ACI SPECIAL PRECISION METAL FILM RESISTORS

## UAR* PRECISION METAL FILM RESISTORS

### Features

- Temperature Coefficients of 0 ±5 ppm Standard
- Tolerances to ±0.1%
- Range from 20 Ohm to 1 Megohm
- Operating Temp. Range −20°C to +85°C
- Temperature Coefficient and Tolerance Matching
- Replacements for Precision Wirewounds

*Ultra Accurate Resistors

### Typical Performance

| | |
|---|---|
| Load Life: 1000 hrs. @ 85°C | .03% △R |
| Temperature Cycle: −55°C to +85°C | .02% △R |
| Humidity: MIL Std. 202, Method 106 | .02% △R |
| Noise Index | <.05 μv/v |
| Voltage Coefficient | .02 ppm/volt |
| Short Term Overload: 2.5x Rated Volt, 5 Sec. | .05% △R |
| Low Temp. Operation: −65°C @ Rated Load | .02% △R |

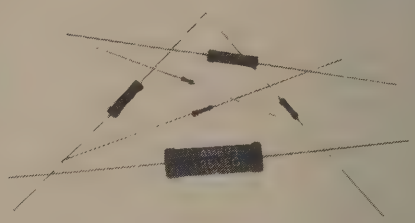
### Characteristics

| ACI Type | Resistance Range (ohms) | Temperature Coefficients −20°C to +85°C (±ppm/°C) | Tolerances % | Power Rating @ 85°C (watts) | Voltage Rating (volts) | Dimensions in Inches | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Body Length (L) | Body Diameter (D) | Lead Gage (A) |
| UAR-1/20 | 20 to 100K | (C-5) 15 ppm/°C<br>(C-6) 10 ppm/°C<br>(C-7) 5 ppm/°C | 1.0<br>0.5<br>0.25<br>0.1 | 1/20 | 200 | 0.150 ±.010 | 0.065 ±.005 | **26 AWG 0.016 |
| UAR-1/10 | 20 to 250K | | | 1/10 | 250 | 0.270 ±.010 | 0.095 ±.005 | 22 AWG 0.025 |
| UAR-1/8 | 20 to 500K | | | 1/8 | 300 | 0.398 ±.015 | 0.128 ±.010 | 22 AWG 0.025 |
| UAR-1/4 | 20 to 1.0M | | | 1/4 | 500 | 0.588 ±.015 | 0.203 ±.010 | 22 AWG 0.025 |

Leads are OFHC tinned copper.
Consult factory for alternate material.

**Lead Length 1.00 ±.062.

## AME HIGH RANGE CONFORMAL COATED METAL FILM RESISTORS



### Features

- Ranges to 30 Megohm
- Tolerances to ±0.1%, with ±1.0% Standard
- Shelf Life Aging of Less than 0.1% per Year Typical
- Noble-Met® Film with Inherently Low Noise
- Sizes from 1/20 Watt to 1.0 Watt
- Meet or Exceed Requirements of MIL-R-10509 and MIL-R-55182
- Temperature Coefficient to 0 ±25 ppm, with 0 ±100 ppm Standard

### Characteristics

| ACI Type | *MIL-R-10509 & *MIL-R-55182 | Power Rating (watts) Mil. | Power Rating (watts) Commercial | Resistance Range (ohms) | Voltage Rating (volts) | Dimensions in Inches | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Body Length (L) | Body Diameter (D) | Clean Lead Length (C.L.) Standard | Clean Lead Length (C.L.) Special | Lead Gage (A) |
| AME50 | RN50 RNC50 | 1/20 | 1/8 | 201K to 1.0M | 200 | 0.150 ±.010 | 0.060 ±.010 | 0.200 | 0.172 | **26 AWG .016 |
| AME55 | RN55 RNC55 | 1/10 | 1/6 | 619K to 3.0M | 250 | 0.250 ±.031 | 0.080 ±.015 | 0.360 | 0.281 | 22 AWG .025 |
| AME60 | RN60 RNC60 | 1/8 | 1/4 | 1.02M-7.5M | 300 | 0.390 ±.031 | 0.105 ±.015 | 0.475 | 0.406 | 22 AWG .025 |
| AME65 | RN65 RNC65 | 1/4 | 1/2 | 3.01M to 15.0M | 400 | 0.580 ±.031 | 0.156 ±.015 | 0.650 | 0.600 | 22 AWG .025 |
| AME70 | RN70 RNC70 | 1/2 | 1/2 | 4.12M to 20.0M | 700 | 0.730 ±.031 | 0.230 ±.015 | 0.830 | 0.730 | 20 AWG .032 |
| AME75 | RN75 | 1.0 | 1.0 | 49 to 30.0M | 1000 | 1.050 ±.031 | 0.350 ±.015 | 1.165 | — | 20 AWG .032 |

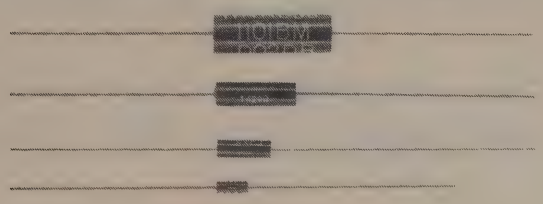
Tolerances: Standard is 1.0%. Tolerances to 0.5%, 0.25% and 0.10% available depending on range.
Leads: Tinned copper is standard. Weldable leads available. Consult factory.

*Dimensions conform to MIL Styles.
**Lead length 1.00 ±.062.

AMERICAN COMPONENTS INC. SUBSIDIARY OF Insl-x
DEPT. EM, 8th AVENUE AT HARRY ST. / P.O. BOX 152 / CONSHOHOCKEN PA. 19428
TELEPHONE (215) 825-6200 / TWX 510 660 9765

# ACI PRECISION METAL FILM RESISTORS

## ESTABLISHED RELIABILITY PRECISION METAL FILM RESISTORS — TO MIL-R-55182 RNC, RNR, RNN SERIES



### Features

- Tolerances of ±1%, ±.5%, ±.1%
- S Failure Rate Level
- Extended Resistance Ranges
- Molded for Optimum Environmental Performance
- Solid Core Construction for Extreme Sheer Strength

| MIL-R-55182 Tolerance | Temperature Coefficient | | |
|---|---|---|---|
| | MIL Code | ACI Code | TC Value |
| B = ±0.1% | J | C-3 | 0 ± 25 ppm/°C |
| D = ±0.5% | H | C-2 | 0 ± 50 ppm/°C |
| F = ±1.0% | K | C-1 | 0 ±100 ppm/°C |

### Characteristics

| Mil Type | ACI Type | Mil Approved T.C. Char. | Mil Approved Resistance Range (ohms) | Mil Power Rating (watts) @ 125°C | Mil Voltage Rating (volts) | Dimensions in Inches | | | | Wire Gage |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Body Length (L) | Body Dia. (D) | Lead Length (C) | Lead Dia. (A) | |
| RNC 50 RNN 50 | EE-1/20 | H, J, K | 10 to 604K | 1/20 | 200 | 0.150 ±.010 | 0.065 ±.005 | 1.00 ±.062 | 0.016 ±.0015 | 26 AWG .016 |
| RNC 55 RNN 55 | EE-1/10 | H, J, K | 10 to 1.21M | 1/10 | 200 | 0.270 ±.010 | 0.095 ±.005 | 1.50 ±.125 | 0.025 ±.002 | 22 AWG .025 |
| RNC 60 RNN 60 | EE-1/8 | H, J, K | 10 to 3.01M | 1/8 | 250 | 0.398 ±.015 | 0.128 ±.010 | 1.50 ±.125 | 0.025 ±.002 | 22 AWG .025 |
| RNC 65 RNN 65 | EE-1/4 | H, J, K | 1 to 6.26M | 1/4 | 300 | 0.588 ±.015 | 0.203 ±.010 | 1.50 ±.125 | 0.025 ±.002 | 22 AWG .025 |
| RNC 70 RNN 70 | EE-1/2 | H, J, K | 1 to 15M | 1/2 | 350 | 0.718 ±.015 | 0.258 ±.010 | 1.50 ±.125 | 0.032 ±.002 | 20 AWG .032 |
| RNC 75 RNN 75 | EE-1 | J | 10 to 5.0 | 1.0 | 750 | 1.098 ±.015 | 0.393 ±.010 | 1.50 ±.125 | 0.032 ±.002 | 20 AWG .032 |

Leads are OFHC copper. Nickel and gold plated dumet leads available. Consult factory.

## HERMETICALLY SEALED* PRECISION METAL FILM RESISTORS — TO MIL-R-55182

### Features

- Tolerances of ±1%, ±.5%, ±.1%
- S Failure Rate Level
- Special Dielectric Coating
- Ceramic Sleeve Construction

*Patent Pending

| MIL-R-55182 Tolerance | Temperature Coefficient | | |
|---|---|---|---|
| | MIL Code | ACI Code | TC Value |
| B = ±0.1% | E | C-3 | 0 ±25 ppm/°C |
| D = ±0.5% | C | C-2 | 0 ±50 ppm/°C |
| F = ±1.0% | | | |

### Characteristics

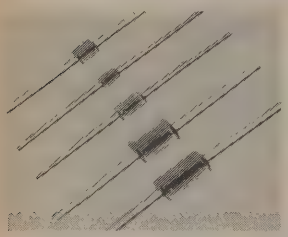
| Mil Type | ACI Type | Mil Approved T.C. Char. | Mil Approved Resistance Range (ohms) | Mil Power Rating (watts) @ 125°C | Mil Voltage Rating (volts) | Dimensions in Inches | | | | Lead Gage |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Body Length (L) | Body Dia. (D) | Max. Clean Lead Length C.L. | Lead Length | |
| RNC 50 | SE-1/20 | C, E | 10 to 100K | 1/20 | 200 | 0.180 ±.020 | 0.070 ±.010 | 0.225 | .984 ±1.125 | 26 AWG .016 |
| RNC 55 | SE-1/10 | C, E | 24.9 to 200K | 1/10 | 200 | 0.265 +.020 −.010 | 0.130 +.010 −.005 | 0.345 | 1.50 ±.125 | 22 AWG .025 |
| RNC 60 | SE-1/8 | C, E | 24.9 to 499K | 1/8 | 250 | 0.315 +.020 −.002 | 0.150 +.010 −.005 | 0.395 | 1.50 ±.125 | 22 AWG .025 |
| RNC 65 | SE-1/4 | C, E | 24.9 to 1.0M | 1/4 | 300 | 0.540 +.020 −.004 | 0.215 +.010 −.005 | 0.620 | 1.50 ±.125 | 22 AWG .025 |
| RNC 70 | SE-1/2 | C, E | 24.9 to 1.5M | 1/2 | 350 | 0.800 ±.020 | 0.300 ±.015 | 0.925 | 1.50 ±.125 | 20 AWG .032 |

Leads are OFHC tinned copper.

AMERICAN COMPONENTS INC. insl-co DEPT. EM 8th AVENUE AT HARRY ST / P.O. BOX 152 / CONSHOHOCKEN, PA 19428
TELEPHONE (215) 825-6200 / TWX 510-660-9268

# PRECISION METAL FILM RESISTORS

## Hermetically Sealed per MIL-R-55182 Characteristics C and E
## Hermetic Glass-to-Metal Seal — Failure Rates M (1%) thru S (0.001%)



### FEATURES

- High stability
- Hermetic enclosure
- Inert gas environment
- In accordance with MIL-R-55182, Styles RNR and RNN
- Extended life and reliability
- 1/10, 1/8, 1/4, 1/2 watt sizes (5 case sizes)

### APPLICATIONS

Aerospace, military, oceanography . . . wherever the application or environment demands the ultimate in resistor reliability, Angstrohm's hermetically sealed metal film resistors are unquestionably first-choice. The HN glass-to-metal hermetic seal protects the resistance element from virtually any adverse environmental influence, and will withstand in excess of 3,000 p.s.i. external pressure without leakage.

### SPECIFICATIONS

**MIL-Specifications:** RNR/RNN style resistors are designed to exceed the requirements of MIL-R-55182 for characteristics C and E.

**Power Rating:** All RNR/RNN resistors are based on full rated load at an ambient of 125°C.

**Resistance Tolerances:** The standard resistance tolerances are ±1.0% (F), ±.5% (D), and ±.1% (B) per Q.P.L. 55182. Consult factory for tighter tolerances and special matching.

**Resistance Values:** See Table 1 for range of resistance values. Standard values can be obtained from the resistance decade shown in Table. 2.

**Derating:** For ambients above 125°C, see Derating Curve.

Applied voltage shall not exceed $\sqrt{PR}$. See Table 1.

### RATINGS AND DIMENSIONS

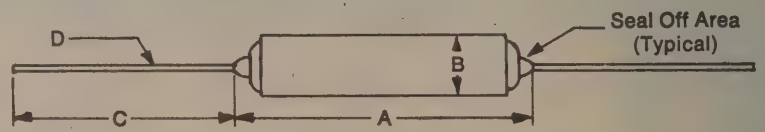
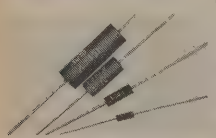



TABLE 1

| Designations | | Watt Rating @125°C | Volts Max. | Resistance Range in Ohms† | | Approx. Dimensions (in inches) | | | | Weight GMS (approx.) |
|---|---|---|---|---|---|---|---|---|---|---|
| MIL-55182 Style* | Angstrohm Style | | | Min. | Max. | A Max. | B Dia. Max. | C Nom. | D AWG | |
| RNR/RNN55 | HN55 | 1/10 | 200 | 10 | 1.21 Meg. | .281 | .112 | 1.50 | #22 | .314 |
| RNR/RNN57 | HN57 | 1/8 | 200 | 49.9 | 200K | .325 | .150 | 1.25 | #24 | .317 |
| RNR/RNN60 | HN60 | 1/8 | 250 | 10 | 2.49 Meg. | .437 | .150 | 1.50 | #22 | .485 |
| RNR/RNN65 | HN65 | 1/4 | 300 | 24.9 | 4.99 Meg. | .655 | .250 | 1.50 | #22 | .950 |
| RNR/RNN70 | HN70 | 1/2 | 350 | 49.9 | 7.50 Meg. | .796 | .250 | 1.50 | #20 | 1.300 |

*See Lead options under "Characteristics" below.
† Consult Factory for extended ranges.

## series SAR* precision metal film resistors

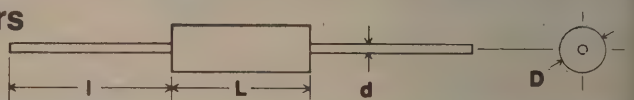


Angstrohm "SAR" thin metal film resistors are designed for hi-reliability, hi-precision, and long life applications and exceed the specifications and performance requirements of MIL-R-55182 and MIL-R-10509. The latest state-of-the-art materials and methods are utilized in their manufacture including improved metal film deposition technology, laser helixing, special moisture resistant undercoatings and flame retardent vacuum transfer molding.

The "SAR" resistor is ideal for high frequency and pulse applications requiring low reactance, low noise (−40 db typical) and low voltage coefficients (.02PPM/volt typical). "SAR" resistors are also capable of withstanding pulse overloads of up to fifty times rated power for 500 msec.

* Super Accurate Resistor

### SPECIFICATIONS




| Type | TC Code T-XX | Temperature Coefficient | TC Temp. Span | Power Rating @ 125° | Max. Voltage Rating | Resistance Range Min.-Max. | Tolerances Avail.±% | Dimensions |
|---|---|---|---|---|---|---|---|---|
| SAR25 | 9 | ±25PPM/°C | −55°C to 165°C | 1/20W | 200V | 49.9-150K | .01 thru 1.0 | L=.160±.010 D=.065±.005 l=1.0±.062 d=.016 #26 AWG |
| | 10 | ±15PPM/°C | −20°C to 85°C | | | 49.9-100K | | |
| | 13 | ±10PPM/°C | −20°C to 85°C | | | 49.9-100K | | |
| | 16 | ± 5PPM/°C | −20°C to 85°C | | | 49.9-49.9K | | |
| SAR51 | 9 | ±25PPM/°C | −55°C to 165°C | 1/10W | 250V | 49.9-402K | .01 thru 1.0 | L=.270±.010 D=.097±.005 l=1.50±.125 d=.025 #22 AWG |
| | 10 | ±15PPM/°C | −20°C to 85°C | | | 49.9-301K | | |
| | 13 | ±10PPM/°C | −20°C to 85°C | | | 49.9-249K | | |
| | 16 | ± 5PPM/°C | −20°C to 85°C | | | 49.9-150K | | |
| SAR60 | 9 | ±25PPM/°C | −55°C to 165°C | 1/8W | 300V | 49.9-1.21 Meg. | .01 thru 1.0 | L=.375±.010 D=.155±.005 l=1.50±.125 d=.025 #22 AWG |
| | 10 | ±15PPM/°C | −20°C to 85°C | | | 49.9-1.0 Meg. | | |
| | 13 | ±10PPM/°C | −20°C to 85°C | | | 49.9-750K | | |
| | 16 | ± 5PPM/°C | −20°C to 85°C | | | 49.9-499K | | |
| SAR65 | 9 | ±25PPM/°C | −55°C to 165°C | 1/4W | 500V | 49.9-2.5 Meg. | .01 thru 1.0 | L=.645±.010 D=.220±.005 l=1.50±.125 d=.025 #22 AWG |
| | 10 | ±15PPM/°C | −20°C to 85°C | | | 49.9-2.0 Meg. | | |
| | 13 | ±10PPM/°C | −20°C to 85°C | | | 49.9-1.0 Meg. | | |
| | 16 | ± 5PPM/°C | −20°C to 85°C | | | 49.9-1.0 Meg. | | |

Tolerance matching to .001% and TC matching to 5PPM/°C are also available.

angstrohm precision, inc.
p.o. box 1827
one precision place/hagerstown, maryland 21740
telephone: 301-739-8722 twx: 710-853-6834

# RESISTOR NETWORKS

**Index — DIP and SIP Networks**

Environmental and Physical Specifications ..... Page 3639
Isolated and Bussed Resistor Circuits ..... Page 3640
Special Purpose Circuits ..... Page 3642
SIP Networks ..... Page 3644

**Electrical**

Resistance Range
- Standard ..... 33Ω to 220KΩ
- Special ..... 10Ω to 1 MegΩ

Resistance Temperature Coefficient ..... ±250 ppm/°C (except as noted)
(−55°C to +125°C)

Short Time Overload
(2.5 × Rated Voltage, 5 sec) ..... ±0.25% Max. ΔR

**Environmental/Performance**

| Test (Per MIL-R-83401 except as noted) ..... | Max. ΔR |
|---|---|
| Load-Life ..... | ±1.0% |
| Mechanical Shock ..... | ±0.25% |
| Moisture Resistance ..... | ±0/25% (41xx series)<br>±0.50% (43xx series) |
| Resistance to Soldering Heat ..... (MIL-STD-202E, Meth. 210A, Cond. C, Proc. 2) | ±0.25% |
| Terminal Strength ..... | ±0.25% |
| Terminal Shock ..... | ±0.25% (41xx series)<br>±0.50% (43xx series) |
| Vibration ..... | ±0.25% |
| Insulation Resistance ..... | 10,000 MegΩ Minimum |
| Dielectric Withstanding Voltage ..... | Meets Requirements of MIL-R-83401 |
| Lead Solderability ..... | |
| Solvent Resistance ..... | |

For combined resistor/trimmer applications, refer to MFT™ Multi Function Trimmer specifications on page 3791.

BOURNS INC
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5415

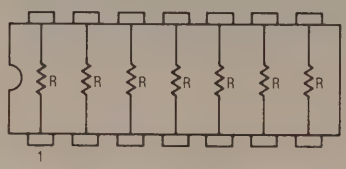
# DIP RESISTOR NETWORKS

Isolated and Bussed Resistor Circuits

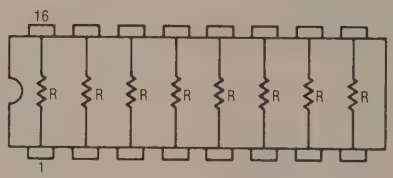
FEATURES

- Reduces P.C. board space
- Reduces total assembly costs
- Standard DIP package is compatible with automatic insertion equipment
- Krimp-Joint™ construction for extra reliability

## 7 ISOLATED RESISTORS
## 14 PIN DUAL-IN-LINE PACKAGE
## MODEL 4114R-001




## 8 ISOLATED RESISTORS
## 16 PIN DUAL-IN-LINE PACKAGE
## MODEL 4116R-001




Typical applications include power gate pull-up, impedance balancing, current limiting, line termination and ECL output pull-down.

The model 4114R-001 replaces the Allen-Bradley 314B, Beckman 899-3, CTS 760-3 and Sprague 914C-SR. The model 4116R-001 replaces the Allen-Bradley 316B, Beckman 898-3, CTS 761-3 and Sprague 916C-SR.

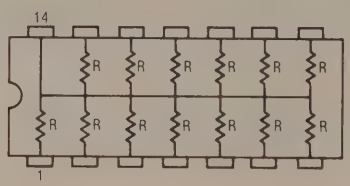
**Electrical Specifications**

Resistance Tolerance . . . . . ±2%
(100Ω to 220 KΩ)
±2Ω (<100Ω)
±5% (≥220 KΩ)

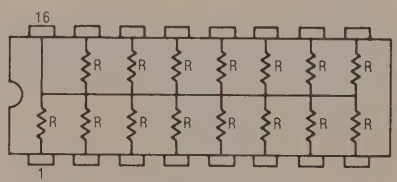
Power Rating @ 25°C
(See Derating Curve)
Total Package . (14 Pin) 2.0 watts
(16 Pin) 2.25 watts
Single Resistor . . . . . 0.25 watt

Resistance Temperature Coefficient
(−55°C to +125°C). ±100 PPM/°C Max.)

## 13 RESISTORS, PIN 14 COMMON
## 14 PIN DUAL-IN-LINE PACKAGE
## MODEL 4114R-002




## 15 RESISTORS, PIN 16 COMMON
## 16 PIN DUAL-IN-LINE PACKAGE
## MODEL 4116R-002




Typical applications include open collector pull-up, parallel pull-up, wired OR pull-up, TTL input pull-down, MOS memory pull-up and pull-down, unused gate pull-up, power driver pull-up.

The model 4114R-002 replaces the Allen-Bradley 314A, Beckman 899-1, CTS 760-1 and Sprague 914C-PE. The model 4116R-002 replaces the Allen-Bradley 316A, Beckman 898-1, CTS 761-1 and Sprague 916C-PE.

**Electrical Specifications**

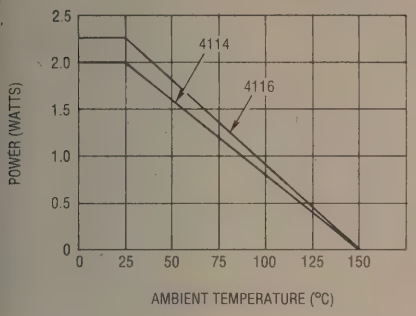
Resistance Tolerance . . . . . ±2%
(100Ω to 220 KΩ)
±2Ω (<100Ω)
±5% (≥220 KΩ)

Power Rating @ 25°C
(See Derating Curve)
Total Package . (14 Pin) 2.0 watts
(16 Pin) 2.25 watts
Single Resistor . . . . . 0.125 watt

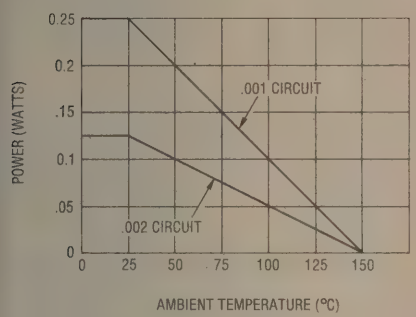
Resistance Temperature Coefficient
(−55°C to +125°C). ±100 PPM/°C Max.)

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5415

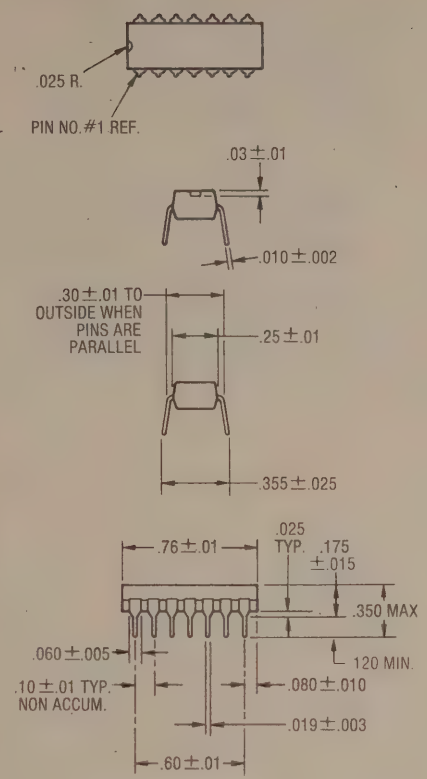
## PACKAGE POWER-TEMPERATURE DERATING CURVE



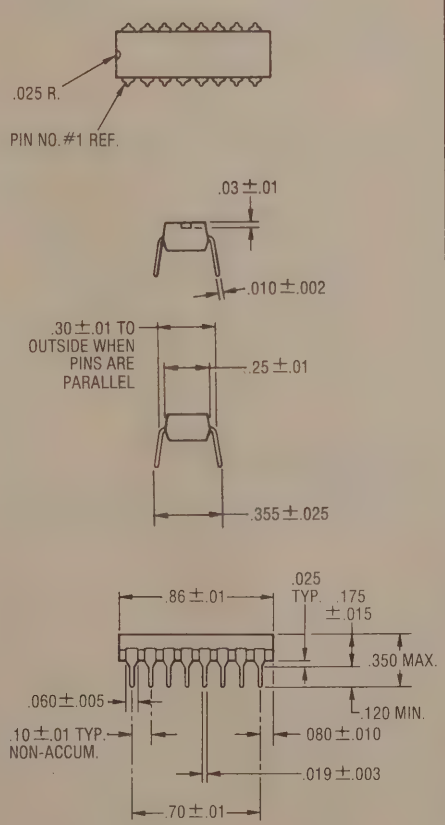

## SINGLE RESISTOR POWER-TEMPERATURE DERATING CURVE




## 4114 OUTLINE




## 4116 OUTLINE




Specifications are subject to change without notice.

## HOW TO ORDER

Example — A 16-pin, 15-resistor DIP network, 22K ohms per resistor is Model 4116R-002-223. The last three digits are the code for the resistance value — the first two digits designate the significant numbers (22), and the last digit gives the number of zeros that follow (3). So, -223 translates to 22,000 ohms.

## STANDARD RESISTANCES

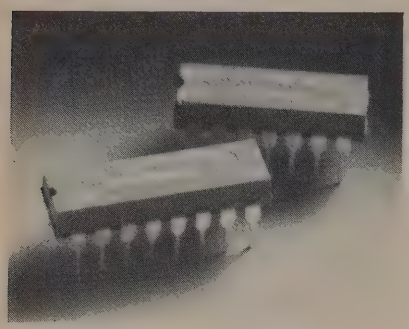
| Resistance (Ohms) | Resistance Code |
|---|---|
| 33 | -330 |
| 39 | -390 |
| 47 | -470 |
| 56 | -560 |
| 68 | -680 |
| 82 | -820 |
| 100 | -101 |
| 120 | -121 |
| 150 | -151 |
| 180 | -181 |
| 220 | -221 |
| 270 | -271 |
| 330 | -331 |
| 390 | -391 |
| 470 | -471 |
| 560 | -561 |
| 680 | -681 |
| 820 | -821 |
| 1000 | -102 |
| 1200 | -122 |
| 1500 | -152 |
| 1800 | -182 |
| 2000 | -202 |
| 2200 | -222 |
| 2700 | -272 |
| 3300 | -332 |
| 3900 | -392 |
| 4700 | -472 |
| 5600 | -562 |
| 6800 | -682 |
| 8200 | -822 |
| 10000 | -103 |
| 12000 | -123 |
| 15000 | -153 |
| 18000 | -183 |
| 22000 | -223 |
| 27000 | -273 |
| 33000 | -333 |
| 39000 | -393 |
| 47000 | -473 |
| 56000 | -563 |
| 68000 | -683 |
| 82000 | -823 |
| 100000 | -104 |
| 120000 | -124 |
| 150000 | -154 |
| 180000 | -184 |
| 220000 | -224 |

Standard Resistance Tolerance is ±2% or 2Ω, Whichever Is Larger
Other resistance values are available.

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5415

# DIP RESISTOR NETWORKS

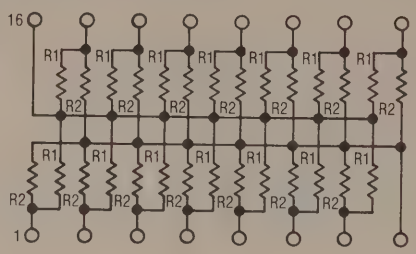
Special Purpose Circuits



FEATURES

- Reduces P.C. board space
- Reduces total assembly costs
- Standard DIP package is compatible with automatic insertion equipment
- Krimp-Joint™ construction for extra reliability

## DUAL LINE TERMINATOR 14/16 PIN DUAL-IN-LINE PACKAGE MODEL 4114R-003 MODEL 4116R-003




**Standard Resistances**

| Resistance (Ohms) | | Part Number | No. Pins |
|---|---|---|---|
| $R_1$ | $R_2$ | | |
| 220 | 270 | 4114R-003-221/271 | 14 Pin |
| | | 4116R-003-221/271 | 16 Pin |
| 220 | 330 | 4114R-003-221/331 | 14 Pin |
| | | 4116R-003-221/331 | 16 Pin |
| 180 | 390 | 4114R-003-181/391 | 14 Pin |
| | | 4116R-003-181/391 | 16 Pin |

Other resistor values available.

The BOURNS® Models 4114R-003 and 4116R-003 Resistor Networks are designed for TTL dual line termination. These models improve noise immunity where capacitive effects are excessive. The 4114R-003 network is a standard 14 pin DIP configuration and terminates 12 lines. The 4116R-003 is a 16 pin DIP configuration and terminates 14 lines.

The dual terminators consist of 24 (4114R-) or 28 (4116R-) thick film resistors. Pins 7 (or 8) and 14 (or 16) are common for ground and power respectively. Each series-pair of resistors is connected between the common lines. The center of these resistor pairs are connected to input terminals. Replaces the Beckman 899/898-5, the CTS 760/761-5, the Sprague 914/916C-5TR networks, and the Allen-Bradley 34E/36E networks.

**Electrical Specifications**

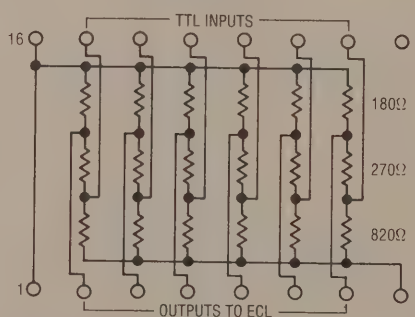
Resistance Tolerance ..... ±5%

Power Rating @ 25°C (See Derating Curve) .... 4114R-003 4116R-003

Package .. 2.0 watts 2.25 watts

Single Resistance . 0.125 watt 0.125 watt

## TTL TO ECL TRANSLATOR 16 PIN DUAL-IN-LINE PACKAGE MODEL 4116R-008




| Standard Resistances Resistance (Ohms) | | | Part Number |
|---|---|---|---|
| $R_1$ | $R_2$ | $R_3$ | |
| 180 | 270 | 820 | 4116R-008-001 |

The BOURNS® Model 4116R-008 Resistor Network provides translation from TTL to ECL integrated circuit logic. It is packaged in a standard 16 pin DIP configuration, with 18 thick film resistors interconnected as illustrated.

The translator design assumes both TTL and ECL are operating between a +5 volt power supply and ground. Six line capacity is provided in the 16 pin configuration. Replaces the Beckman 898-45 and the CTS 761-45.

**Electrical Specifications**

Resistance Tolerance ..... ±2%

Power Rating @ 25°C (See Derating Curve)

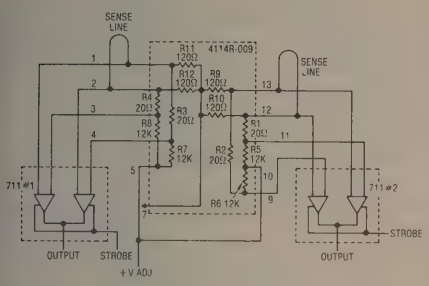
Package ..... 2.0 watts

Single Resistor ..... 0.125 watt

BOURNS INC

TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5415

## 711 DUAL COMPARATOR TERMINATOR 14 PIN DUAL-IN-LINE PACKAGE MODEL 4114R-009




BOURNS® Model 4114R-009 Resistor Network is designed to provide threshold reference settings and balanced sense line termination for two 711 dual comparators . . . in core memory sense amplifier applications. The 4114R-009 is packaged in a compact 14 pin DIP configuration, utilizing Bourns ultra-reliable Krimp-Joint™ termination design.

In use, threshold voltage settings are established by the voltage drop across the 20 ohm resistors (20mv. at + V adj. of 12.14 volts). Sense line termination is 120 ohms. Replaces the Beckman 889-19 and the CTS 760-19.

**Electrical Specifications**

Resistance Tolerance . . Pins 7 to 10 and 5 to 7 = 6.07K ±2%

Threshold Voltage . . . . 20 ±1.0 MV Pin 7 at 0V; Pins 5 and 10 at 12.14V ±10 MV

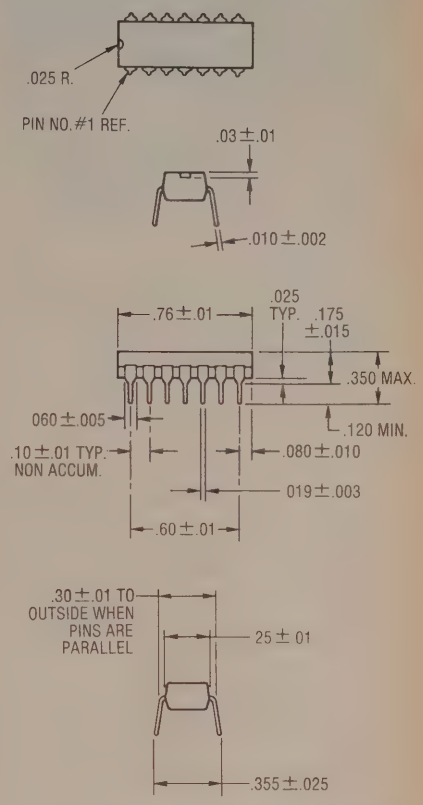
+V Adj. . . . . 20V maximum

Power Rating @ 25°C

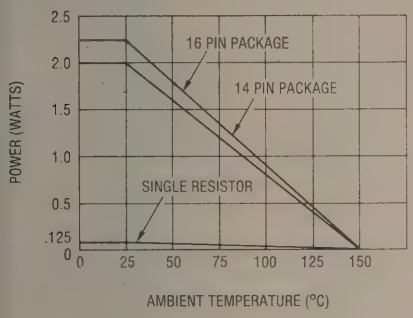
Package . . . . . 1.00 watt

Single Resistor . . . . . 0.080 watt

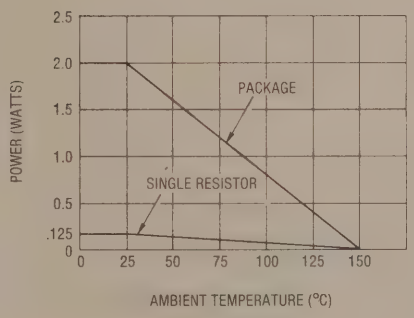
## 4114 OUTLINE



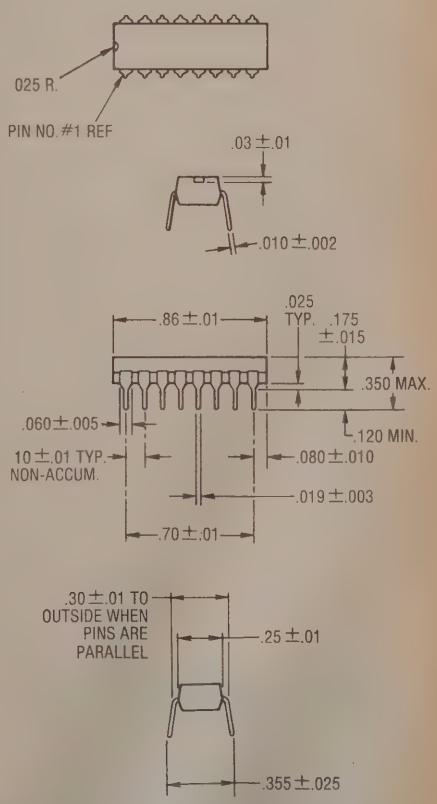

## MODEL 4116R-003 AND MODEL 4114R-003 POWER-TEMPERATURE DERATING CURVE



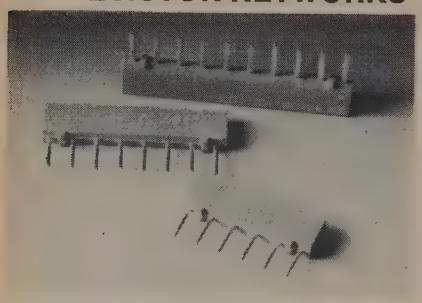

## MODEL 4116R-008 POWER-TEMPERATURE DERATING CURVE




## 4116 OUTLINE



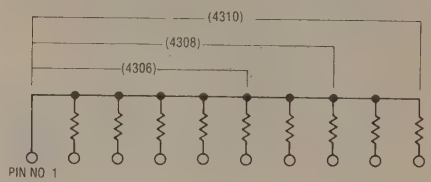
# SIP RESISTOR NETWORKS



## FEATURES

- Low profile compatible with DIPS
- Reduces PC board space
- Reduces total assembly costs
- Proven automatic insertion capability

## PIN 1 COMMON, 5, 7, OR 9 RESISTORS
## 6, 8, OR 10 PIN SINGLE-IN-LINE PACKAGE
## MODEL 4306R-101 (6 PIN)
## MODEL 4308R-101 (8 PIN)
## MODEL 4310R-101 (10 PIN)




These models incorporate 5, 7, or 9 thick-film resistors (respectively) of equal value, each connected between a common bus (pin 1) and a discrete PC board pin.

Typical applications include open collector pull-up, wired OR pull-up, TTL input pull-down, MOS memory pull-up and down, unused gate pull-up, power driver pull-up.

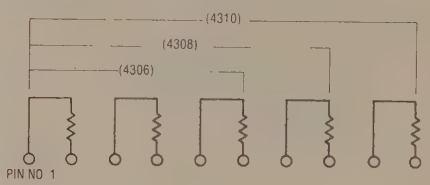
**Electrical Specifications**

Resistance
Tolerance . ±2% (100Ω to 220KΩ)
±2Ω (< 100Ω)
±5% (> 220KΩ)

Power Rating @ 25°C

| | 6 Pin watt | 8 Pin watt | 10 Pin watt |
|---|---|---|---|
| Package ..... | 0.75 | 1.0 | 1.25 |
| Single Resistor @ 25°C | 0.2 | 0.2 | 0.2 |

## 3, 4, OR 5 ISOLATED RESISTORS
## 6, 8, OR 10 PIN SINGLE-IN-LINE PACKAGE
## MODEL 4306R-102 (6 PIN)
## MODEL 4308R-102 (8 PIN)
## MODEL 4310R-102 (10 PIN)




These models incorporate 3, 4, or 5 isolated thick-film resistors (respectively) of equal value, each connected between two discrete PC board pins.

Typical applications include power gate pull-up, impedance balancing, current limiting, line termination and ECL output pull-down.

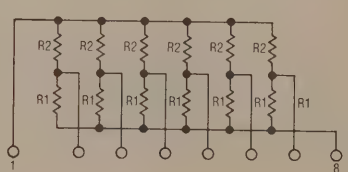
**Electrical Specifications**

Resistance
Tolerance . ±2% (100Ω to 220KΩ)
±2Ω (< 100Ω)
±5% (> 220KΩ)

Power Rating @ 25°C

| | 6 Pin watt | 8 Pin watt | 10 Pin watt |
|---|---|---|---|
| Package ..... | 0.75 | 1.0 | 1.25 |
| Single Resistor @ 25°C | 0.3 | 0.3 | 0.3 |

## 12 RESISTOR DUAL TERMINATOR
## 8 PIN SINGLE-IN-LINE PACKAGE
## MODEL 4308R-103




**Standard Resistances**

| Resistance | | |
|---|---|---|
| $R_1$ | $R_2$ | Part Number |
| 180 | 390 | 4308R-103-181/391 |
| 220 | 270 | 4308R-103-221/271 |
| 220 | 330 | 4308R-103-221/331 |

Other resistance values are available.

NOTE:

Also available in 6 and 10 pin configurations, consult with factory.

The Model 4308R-103 Molded Resistor Network is a unique offering from Bourns®. It provides TTL dual line termination in a low-cost epoxy molded SIP configuration. Dual terminators improve noise immunity where capacitive effects are excessive.

The 4308R-103 is an 8 pin configuration and terminates 6 lines. Pins 1 and 8 are common for ground and power, respectively. Twelve thick film resistors are paired in series between the common lines (pin 1 and 8). The center points of these resistor pairs are connected to input terminals (pin 2 through 7) Dual terminators are also available in standard 14 pin and 16 pin DIP models from Bourns®.

**Electrical Specifications**

Resistance Tolerance ..... ±5%
Power Rating @ 25°C
Package ..... 1.0 watt
Resistor Pair ..... 0.25 watt

BOURNS INC

TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5415

## HOW TO ORDER

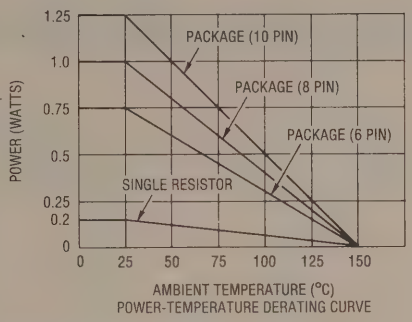
Example — An 8-pin, 12-resistor SIP Dual Terminator, with 220 ohms and 330 ohms values would be designed as: Model 4308R-103-221/331. The set(s) of 3 digits following the model number are the codes for resistance value — the first two digits designate the significant numbers (22) and (33) respectively, and the last digit gives the number of zeroes that follow (1). So, -221 translates to 220 ohms and 331 to 330 ohms.

### Standard Resistances

| Resistance (Ohms) | Resistance Code |
|---|---|
| 33 | -330 |
| 39 | -390 |
| 47 | -470 |
| 56 | -560 |
| 68 | -680 |
| 82 | -820 |
| 100 | -101 |
| 120 | -121 |
| 150 | -151 |
| 180 | -181 |
| 220 | -221 |
| 270 | -271 |
| 330 | -331 |
| 390 | -391 |
| 470 | -471 |
| 560 | -561 |
| 680 | -681 |
| 820 | -821 |
| 1000 | -102 |
| 1200 | -122 |
| 1500 | -152 |
| 1800 | -182 |
| 2000 | -202 |
| 2200 | -222 |
| 2700 | -272 |
| 3300 | -332 |
| 3900 | -392 |
| 4700 | -472 |
| 5600 | -562 |
| 6800 | -682 |
| 8200 | -822 |
| 10000 | -103 |
| 12000 | -123 |
| 15000 | -153 |
| 18000 | -183 |
| 22000 | -223 |
| 27000 | -273 |
| 33000 | -333 |
| 39000 | -393 |
| 47000 | -473 |
| 56000 | -563 |
| 68000 | -683 |
| 82000 | -823 |
| 100000 | -104 |
| 120000 | -124 |
| 150000 | -154 |
| 180000 | -184 |
| 220000 | -224 |

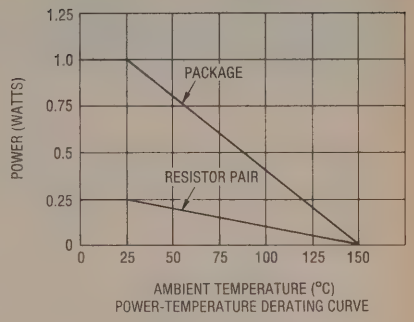
Other resistances are available.

## MODELS 4306R-101 4308R-101/431R-101



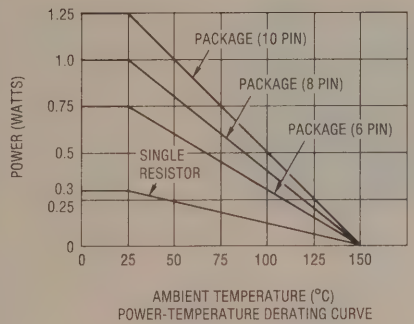
POWER-TEMPERATURE DERATING CURVE

## MODEL 4308R-103

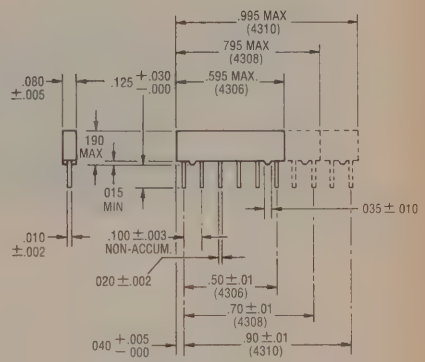


POWER-TEMPERATURE DERATING CURVE

## MODELS 4306R-102 4308R-102/4310R-102



POWER-TEMPERATURE DERATING CURVE




Specifications are subject to change without notice.

BOURNS INC
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5415

BECKMAN

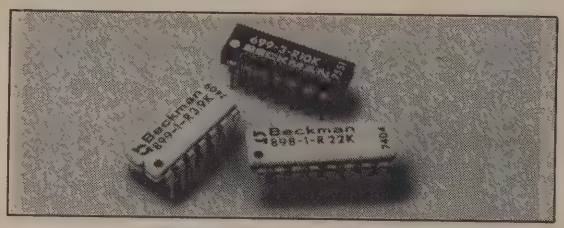
## Save Time, space and money with . . . RESNET™

# THICK and THIN FILM RESISTOR NETWORKS

Beckman RESNET™ thick or thin film dual in-line, thick film single in-line, flatpack and custom resistor networks consist of various resistor configurations packaged in standard 14- and 16-pin DIPs, 6-, 8- and 10-pin SIPs. All offer:

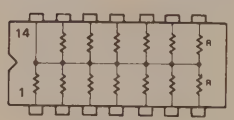
- Significant reduction of "on the board" costs
- Space savings over individual resistors
- Significant reduction of procurement, inventory and quality control costs.
- Compatibility with automatic insertion equipment

## DIP RESISTOR NETWORKS

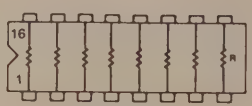


**Thick Film Series 899/898**

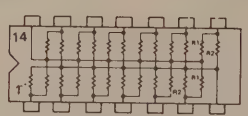
- 14-pin (899) and 16-pin (898) configurations
- Automatic insertion compatible
- Thick film reliability and performance
- ±2% (or ±2 ohms) resistance tolerance
- 0.15W (898/899-1, -5) or 0.250W (898/899-3) resistor power rating (+25°C)



**899-1-R**
13 resistors



**898-3-R**
8 resistors



**899-5-R/R**
Line Terminators

**Series 898-1, 898-3 & 899-1, 899-3 Stock Resistance Values (ohms)**

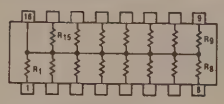
| | | | | |
|---|---|---|---|---|
| 22* | 91* | 300‡* | 2.0K†°* | 15K |
| 33* | 100 | 330†°* | 2.2K | 20K* |
| 36* | 110* | 390†°* | 3.0K° | 22K |
| 39* | 120* | 470 | 3.3K | 33K‡* |
| 47* | 150 | 510* | 4.7K | 47K |
| 51 | 180 | 620* | 5.1K* | 68K‡ |
| 56†° | 200* | 680 | 6.0K° | 100K |
| 62†‡* | 220 | 750* | 6.8K | 220K†‡* |
| 68†‡* | 240* | 1.0K | 8.2K* | 470K‡ |
| 82* | 270* | 1.5K | 10K | |

†898-1 only
‡898-3 only
°899-1 only
*899-3 only

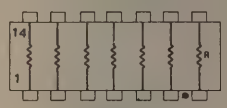
**Precision Thin Film Series 698/699**

If your application requirements call for greater circuit stability than unmatched individual discrete resistors and tighter accuracy tolerances than thick film resistor networks, consider our precision film resistor networks. Series 698 and 699 feature:

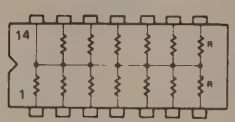
- Low cost—from 65¢ at 1,000 piece price
- ±5 ppm/°C tracking
- Absolute resistance tolerance options from ±0.1% to ±1.0%
- ±50 ppm/°C tempco
- −40dB max. noise
- Negligible resistance voltco



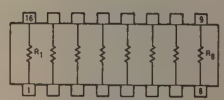
**698-1-R-X**
15 resistors



**699-3-R-X**
7 resistors

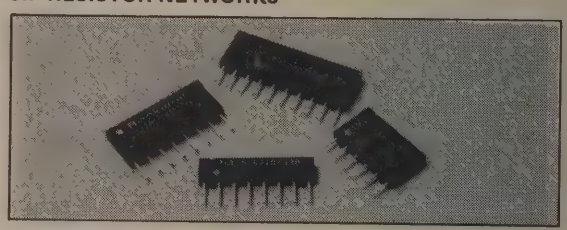


**699-1-R-X**
13 resistors



**698-3-R-X**
8 resistors

## SIP RESISTOR NETWORKS



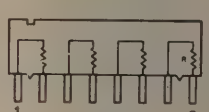
**High Power Series 783/784/785**

- 8-pin and new 6- and 10-pin configurations
- Automatic insertion compatible
- ±2% (or ±2 ohms) resistance tolerance
- 0.17W to 0.5W resistor power rating (+25°C)

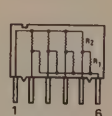
**Low-Profile Series 764**

- 8-pin low-profile package – 0.200" (5,08mm) max. height
- Automatic insertion compatible
- ±2% (or ±2 ohms) resistance tolerance
- 0.180W (764-1), 0.200W (764-3), 0.125W (764-5) resistor power rating (+25°C)

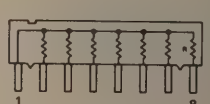
**785-1-R**
9 resistors



**784-3-R**
4 resistors



**783-5-R/R**
Line Terminators



**764-1-R**
7 resistors

BECKMAN INSTRUMENTS, INC. HELIPOT DIVISION
2500 Harbor Boulevard, Fullerton, California 92634
(714) 871-4848 · TWX No. 910-592-1260

BECKMAN

RESNET™

# THICK and THIN FILM RESISTOR NETWORKS

**Series 764-1 & 764-3 Stock Resistance Values (ohms)**

| | | | |
|---|---|---|---|
| 33‡ | 180 | 1.0K | 6.8K |
| 47 | 220 | 1.2K† | 10K† |
| 50† | 270† | 1.5K | 22K† |
| 56† | 330 | 1.8K† | 33K† |
| 100 | 470 | 2.2K | 47K† |
| 120 | 510† | 3.0K† | 100K† |
| 150 | 560† | 3.3K | |
| 160† | 680 | 4.7K | |

†764-1 only
‡764-3 only

**Series 783-1 & 783-3 Stock Resistance Values (ohms)**

| | | | |
|---|---|---|---|
| 22‡ | 100 | 470 | 2.0K† |
| 33‡ | 120 | 500 | 2.2K |
| 39‡ | 150 | 510 | 2.7K† |
| 47‡ | 160 | 560 | 3.3K |
| 50‡ | 180 | 680 | 4.7K |
| 56 | 220 | 1.0K | 5.6K† |
| 62 | 270 | 1.2K† | 6.8K |
| 68 | 330 | 1.5K | |
| 82† | 390 | 1.8K† | |

†783-1 only
‡783-3 only

**Series 784-1 & 784-3 Stock Resistance Values (ohms)**

| | | | |
|---|---|---|---|
| 22‡ | 150 | 680† | 6.8K |
| 33‡ | 160 | 1.0K | 10K† |
| 47‡ | 220 | 1.5K | 15K† |
| 56† | 270 | 2.0K† | 22K† |
| 62‡ | 330† | 2.2K | 100K |
| 68‡ | 390† | 2.7K† | |
| 100 | 470 | 3.3K | |
| 120 | 510† | 4.7K | |

†784-1 only
‡784-3 only

**Series 785-1 & 785-3 Stock Resistance Values (ohms)**

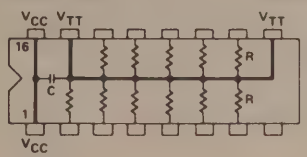
| | | | |
|---|---|---|---|
| 22‡ | 150‡ | 680 | 10K† |
| 33‡ | 160 | 1.0K | 12K† |
| 39‡ | 180‡ | 1.2K† | 15K† |
| 47 | 220 | 1.5K | 16K† |
| 50 | 270 | 2.0K† | 18K† |
| 56‡ | 330 | 2.2K | 22K† |
| 62‡ | 390 | 3.3K | 47K† |
| 68‡ | 470 | 4.7K | 56K† |
| 100 | 510† | 5.6K† | 100K† |
| 120‡ | 560† | 6.8K | |

†785-1 only
‡785-3 only

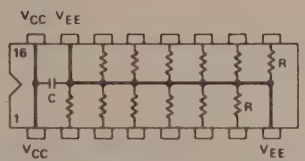
## STANDARD ECL TERMINATORS

**Series 898 16-Pin ECL Terminator DIPs**

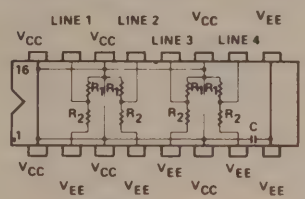
- Resistance tolerance: ±2% (or ± 2Ω)
- Resistor power rating: operation at $T_A$ = 85°C without heat/sinking
- Capacitor tolerance: +40%, −20%
- Capacitor voltage rating: 25V
- Temperature range: −30°C to +85°C




**898-41**
−20 Volt Terminators
R= 50Ω, 68Ω, 75Ω, and 100Ω




**898-42**
−5.2 Volt Terminators
R= 510Ω



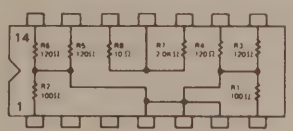

**898-43**
Thevenin Equivalent Terminators

| Model | R1 | R2 |
|---|---|---|
| 898-43-250 | 81 Ω | 130 Ω |
| 898-43-275 | 121 Ω | 195 Ω |
| 898-43-2100 | 162 Ω | 260 Ω |

## STANDARD DIP INTERFACE NETWORKS

**Model 899-17 14-Pin Sense Amp Terminator**

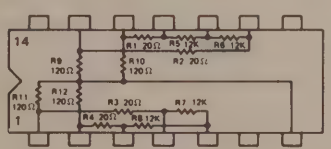
- Designed for 7520 series sense amps
- Resistor tempco: ±300 p/$10^6$ per °C
- Temperature range: 0°C to + 70°C




**899-17**
Sense Line Terminator
For 7520 Series Sense AMP

**Model 899-19 14-Pin Sense Amp Terminator**

- Designed for use in 711 dual comparator sense amp configuration
- Resistance tolerance: ±2%
- Threshold voltage: 2mV ±1mV
- +$V_{ADJ}$: 20V max.
- Temperature range: 0°C to +70°C




**899-19**
Sense Line Terminator
For μA711

## CUSTOM NETWORKS

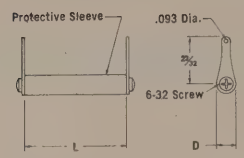
Our large staff of applications/design specialists — all heavy in experience — can mix resistance values on the same substrate. Or give you capacitor networks, diode networks, resistor/capacitor or resistor/diode combinations. Even shorting bars.

To order, or for more information and free evaluation samples, call your nearest Beckman/Helipot distributor. Or phone (714) 871-4848, Ext. 1776.

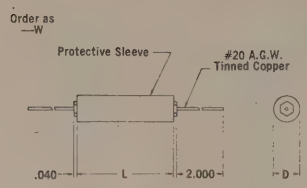
Prices and specifications subject to change without notice.

BECKMAN INSTRUMENTS, INC. HELIPOT DIVISION
2500 Harbor Boulevard, Fullerton, California 92634
(714) 871-4848 · TWX No. 910-592-1260

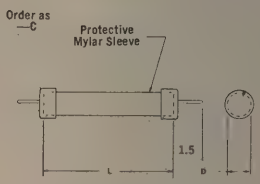
**BEMAN MFG., INC.** Dept. EM, P.O. Box 370, New Cumberland, Pennsylvania 17070 Phone: (717) 938-1451




RADIAL LUG
**FIG. 1**




THREADED AXIAL WIRE LEAD
**FIG. 2**




CAPPED AXIAL WIRE LEAD
**FIG. 3**

## HIGH VOLTAGE CARBON FILM RESISTORS

| Type | Volts Max. | Watts Max. | Dimensions — Inches | | | | Ohms | | Available In Fig. No.'s |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | D | ID | FD | Min. | Max. | |
| CFA | 2,500 | .5 | ¾ | ¼ | | | 10K | 1G | 2 |
| CFB | 5,000 | 1 | 1½ | ¼ | | | 20K | 2G | 2 |
| CFC | 3,500 | 1 | 1 | 5/16 | | | 10K | 10G | 1, 2, 4 |
| CFD | 10,000 | 2 | 1¾ | 5/16 | | | 10K | 25G | 1, 2, 4 |
| CFE | 15,000 | 3 | 3 | 5/16 | NA | NA | 20K | 25G | 1, 2, 4 |
| CFF | 30,000 | 5 | 5½ | 5/16 | | | 40K | 25G | 1, 2, 4 |
| CFG | 15,000 | 4 | 2½ | 9/16 | | | 20K | 25G | 1, 2 |
| CFH | 25,000 | 6 | 4 | 9/16 | | | 40K | 25G | 1, 2 |
| CFJ | 40,000 | 10 | 6½ | 9/16 | | | 70K | 25G | 1, 2 |
| NFA | 2,500 | .5 | ¾ | ¼ | | | 10K | 1G | 3 |
| NFB | 5,000 | 1 | 1½ | ¼ | | | 20K | 2G | 3 |
| NFC | 3,500 | 1 | 1 | 5/16 | NA | NA | 10K | 10G | 3 |
| NFD | 10,000 | 2 | 1¾ | 5/16 | | | 10K | 25G | 3 |
| NFE | 15,000 | 3 | 3 | 5/16 | | | 20K | 25G | 3 |
| *CJA | 25 KV | 10 | 4½ | ¾ | ½ | — | 50K | 100G | 5 |
| *CJB | 35 KV | 20 | 6½ | 1⅛ | ¾ | 13/16 | 100K | 100G | 5, 6 |
| *CJC | 65 KV | 30 | 10½ | 1⅛ | ¾ | 13/16 | 200K | 100G | 5, 6 |
| *CJD | 90 KV | 60 | 14½ | 1½ | 1⅛ | 1 9/64 | 400K | 100G | 5, 6 |
| *CJE | 40 KV | 35 | 6½ | 2 | 1 5/16 | 1 9/64 | 300K | 100G | 5, 6 |
| *CJF | 125 KV | 100 | 18½ | 2 | 1 5/16 | 1 9/64 | 700K | 100G | 5, 6 |

*Sleeving available on request.

Standard Tolerances are 15%, 10%, 5% and 3%.

## PRECISION TOLERANCE RESISTORS

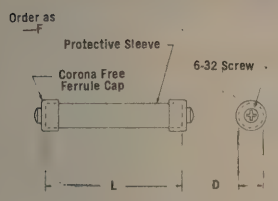
| Type | Volts Max. | Watts Max. | Dimensions — Inches | | Resistance Value (Max.) | | Available In Fig. No.'s |
|---|---|---|---|---|---|---|---|
| | | | L | D | ±2% | ±1% | |
| MP-1 | 5 KV | 1 | 1½ | ¼ | 2G | 1G | 2 |
| MP-2 | 10 KV | 2 | 2 | 5/16 | 20G | 5G | 1, 2, 4 |
| MP-4 | 20 KV | 4 | 3½ | 5/16 | 50G | 10G | 1, 2, 4 |
| MP-6 | 30 KV | 6 | 6 | 5/16 | 50G | 10G | 1, 2, 4 |
| MP-8 | 30 KV | 8 | 5 | 9/16 | 50G | 10G | 1, 2 |
| MP-10 | 60 KV | 10 | 11 | 5/16 | 50G | 10G | 1, 2, 4 |
| MP-12 | 50 KV | 12 | 8 | 9/16 | 50G | 10G | 1, 2 |
| MP-20 | 80 KV | 20 | 13 | 9/16 | 50G | 10G | 1, 2 |
| SP-1 | 5 KV | 1 | 1½ | ¼ | 100G | 25G | 2 |
| SP-2 | 10 KV | 2 | 2 | 5/16 | 100G | 25G | 1, 2, 4 |
| SP-4 | 20 KV | 4 | 3½ | 5/16 | 100G | 25G | 1, 2, 4 |
| SP-6 | 30 KV | 6 | 6 | 5/16 | 100G | 25G | 1, 2, 4 |
| SP-8 | 30 KV | 8 | 5 | 9/16 | 100G | 25G | 1, 2 |
| SP-10 | 60 KV | 10 | 11 | 5/16 | 100G | 25G | 1, 2, 4 |
| SP-12 | 50 KV | 12 | 8 | 9/16 | 100G | 25G | 1, 2 |
| SP-20 | 80 KV | 20 | 13 | 9/16 | 100G | 25G | 1, 2 |

NOTE: Megohm equals $10^6$, Gigohm equals $10^9$, Teraohm equals $10^{12}$.

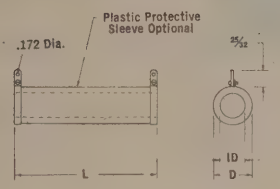
**BEMAN MANUFACTURING, INC. • Dept. EM, Fairview Industrial Park • Rt. 83 • Etters, Pennsylvania 17319**

# CARBON FILM RESISTORS

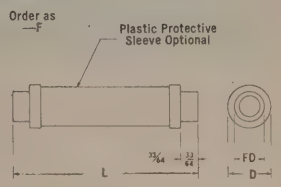
## HI-VOLTAGE HI-FREQUENCY HI-MEGOHM




FERRULE CAP
**FIG. 4**




RADIAL BAND
**FIG. 5**




FERRULED ENDS
**FIG. 6**

## HIGH FREQUENCY RESISTORS

| Type | Volts Max. | Watts Max. | Dimensions — Inches | | | | Ohms | | Available In Fig. No.'s |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | D | ID | FD | Min. | Max. | |
| SFA | 400 | .5 | ¾ | ¼ | | | 20 | 20M | 2 |
| SFB | 800 | 1 | 1½ | ¼ | | | 25 | 40M | 2 |
| SFC | 500 | 1 | 1 | 5/16 | | | 20 | 25M | 1, 2, 4 |
| SFD | 1,000 | 2 | 1¾ | 5/16 | | | 25 | 50M | 1, 2, 4 |
| SFE | 2,000 | 3 | 3 | 5/16 | NA | NA | 35 | 100M | 1, 2, 4 |
| SFF | 3,700 | 5 | 5½ | 5/16 | | | 60 | 100M | 1, 2, 4 |
| SFG | 1,500 | 4 | 2½ | 9/16 | | | 20 | 50M | 1, 2 |
| SFH | 2,800 | 6 | 4 | 9/16 | | | 25 | 75M | 1, 2 |
| SFJ | 4,500 | 10 | 6½ | 9/16 | | | 40 | 100M | 1, 2 |
| *SJA | 3,000 | 10 | 4½ | ¾ | ½ | — | 20 | 50M | 5 |
| *SJB | 4,000 | 20 | 6½ | 1⅛ | ¾ | 13/16 | 20 | 50M | 5, 6 |
| *SJC | 7,000 | 30 | 10½ | 1⅛ | ¾ | 13/16 | 30 | 100M | 5, 6 |
| *SJD | 10,000 | 60 | 14½ | 1½ | 1⅛ | 1 7/64 | 35 | 100M | 5, 6 |
| *SJE | 4,500 | 35 | 6½ | 2 | 1 5/16 | 1 7/64 | 20 | 35M | 5, 6 |
| *SJF | 12,500 | 100 | 18½ | 2 | 1 5/16 | 1 7/64 | 30 | 100M | 5, 6 |

*Sleeving available on request.

## HIGH MEGOHM RESISTORS

| Type | Volts Max. | Watts Max. | Dimensions — Inches | | Ohms | | Available In Fig. No.'s |
|---|---|---|---|---|---|---|---|
| | | | L | D | Min. | Max. | |
| HFA | 2,500 | .5 | ¾ | ¼ | 1M | 1T | 2 |
| HFB | 5,000 | 1 | 1½ | ¼ | 1M | 5T | 2 |
| HFC | 3,500 | 1 | 1 | 5/16 | 1M | 25T | 1, 2, 4 |
| HFD | 10,000 | 2 | 1¾ | 5/16 | 1M | 50T | 1, 2, 4 |
| HFE | 15,000 | 3 | 3 | 5/16 | 1M | 100T | 1, 2, 4 |
| HFF | 30,000 | 5 | 5½ | 5/16 | 1M | 100T | 1, 2, 4 |
| HFG | 15,000 | 4 | 2½ | 9/16 | 1M | 100T | 1, 2 |
| HFH | 25,000 | 6 | 4 | 9/16 | 1M | 100T | 1, 2 |
| HFJ | 40,000 | 10 | 6½ | 9/16 | 1M | 100T | 1, 2 |

Standard Tolerances are 20%, 15%, 10% and 5% for the SF and SJ Series and 10%, 5% and 3% for the HF Series.

Resistors of greater than 10G, are provided with special coating to minimize effects of handling and humidity, no change in diameter.

All Dimensional Tolerances ±1/64 or 1% whichever is greater.

If units are to be operated near maximum limits, at elevated ambient, or in a coolant, order resistors without sleeving.

Special values or configurations are available upon request from Beman Manufacturing, Inc.

Special coatings available upon request.

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

# High Performance Power Film Resistors

In 1962 Caddock Electronics introduced their axial lead resistors constructed with Micronox® resistance films. This advanced resistor technology has produced an extensive line of precision resistors with a combination of performance advantages:

- **Higher Power Ratings** — up to five times higher than other resistor technologies.
- **Higher Operating Temperatures** — up to +275°C.
- **Higher Resistance Values** — up to 10 times higher than other types of high precision resistors with matched temperature coefficients and standard configurations.
- **Exceptional Extended-Life Stability** — typically better than 0.01% per 1000 hours in extended life.
- **Improved Temperature Characteristics and Stability** — with lower temperature coefficients and closer TC matching.
- **Non-Inductive Design for Wide-Band, High Frequency Applications.**

Caddock's Exclusive Non-Inductive Design is also available in most models of Micronox® resistors. This special serpentine pattern provides for neighboring lines to carry currents in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor.

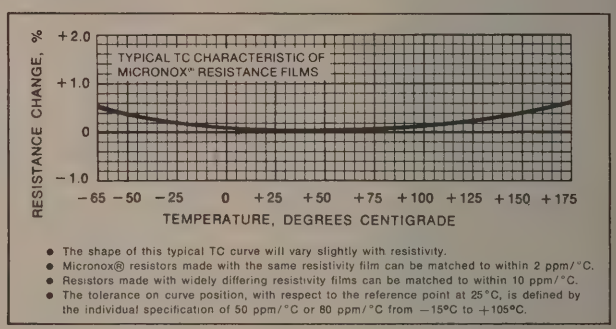
The result is a truly non-inductive resistor that is about as inductive as a straight piece of wire the length of the resistor body. This efficient design means faster settling times and minimum distortion in all types of high frequency circuits.

To achieve these many performance advantages, special complex-oxide film resistance materials have been developed by Caddock that include resistivities as low as 35 ohms/square and as high as 400,000 ohms/square to provide resistors that cover an exceptionally wide range of values, sizes and power ratings.

The unique structure of these materials also provides excellent long-term stability and exceptional insensitivity to high temperature and thermal shock.

### Micronox® Film Resistors Include Special TC Characteristics for Improved Circuit Temperature Stability.

Inherent in the parabolic shape of the Micronox® TC curve is a temperature 'band' where the TC slope is effectively 'zero.' This unique 'zero TC' characteristic can provide an immediate improvement in circuit stability in many applications.



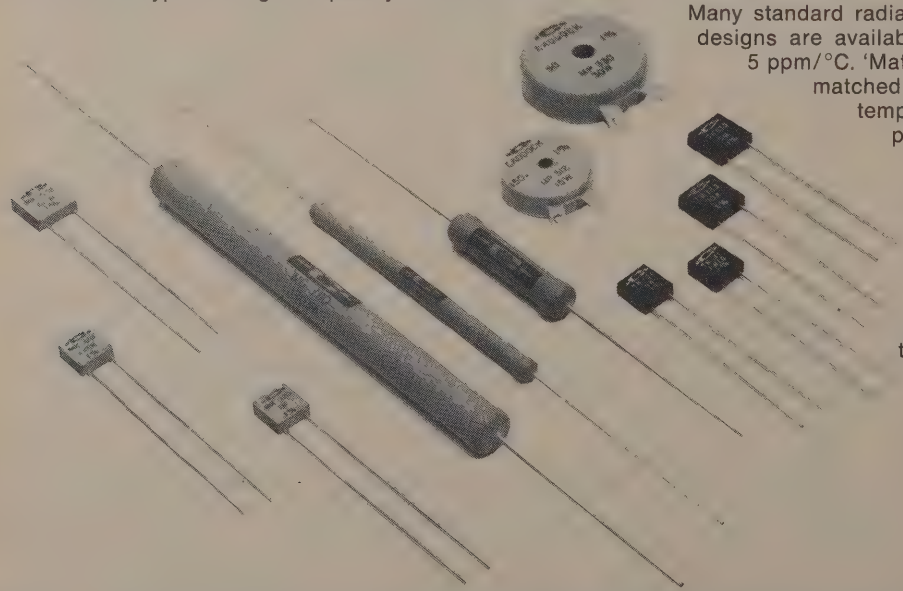

- The shape of this typical TC curve will vary slightly with resistivity.
- Micronox® resistors made with the same resistivity film can be matched to within 2 ppm/°C.
- Resistors made with widely differing resistivity films can be matched to within 10 ppm/°C.
- The tolerance on curve position, with respect to the reference point at 25°C, is defined by the individual specification of 50 ppm/°C or 80 ppm/°C from −15°C to +105°C.

### Tetrinox™ Film Resistors Provide Outstanding Load-Life Stability and TCs Lower Than 5 PPM/°C.

Caddock Electronics has recently introduced an advanced resistive system designated as the T-System™. Resistors using this highly stable, ultra-low TC resistance film are being widely used in advanced instrumentation, control, communication and computer systems.

Many standard radial-lead and single-in-line resistor designs are available with TCs of 10 ppm/°C and 5 ppm/°C. 'Matched-pair' resistor sets with TCs matched to within 1 ppm/°C over wide temperature limits are also being produced in large quantities using Tetrinox™ resistance films.

To completely describe the advantages of each of the various types of resistors listed in this catalog, we have provided an introduction to the two basic types of Caddock resistance films used in these resistors. The accompanying index will assist you in locating the model that is right for your application.



# High Performance Power Film Resistors

**CADDOCK**
HIGH PERFORMANCE FILM RESISTORS

## Two complex-oxide resistance films provide this high performance.

### Micronox® Resistance Films

Caddock Micronox® resistance films are unsurpassed in the production of precision resistors that combine —

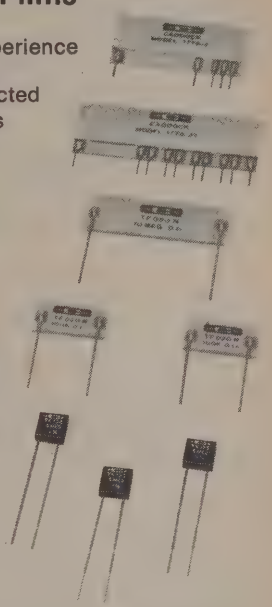
- **High Power Ratings** — to 30 watts.
- **High Voltage Ratings** — to 30,000 volts.
- **High Stability** — as close as 0.01% per 1000 hours in extended life.
- **High Operating Temperatures** — up to +275°C.
- **A Wide Range of Resistance Values In Many Sizes** — from .5 ohms to 2000 Megohms.

These performance advantages make Caddock Micronox® film resistors ideal for use in many types of electronic circuitry, including —

- **Voltage Reference Circuits**
- **High Power Density Packaging**
- **Precision Feedback Circuits**
- **Matched TC Resistor Pairs**
- **High Current Summing Circuits**

### Tetrinox™ Resistance Films

Building on 15 years of experience with our unique complete-oxide technology, Caddock has perfected the T-System™ resistance films that combine these special advantages:



- **Ultra-Low Temperature Coefficient** — standard to less than 10 PPM/°C, and specials to less than 5 PPM/°C.
- **Ultra-Precision** — with tolerances as tight as 0.05%.
- **High Resistance Range** — with values to 10 Megohms in a miniature package.
- **Ultra-Stable in Loadlife** — stability to within ±0.05% per 2000 hours.

This special combination of advantages make Caddock Tetrinox™ film resistors the optimum choice in many high stability applications —

- **Input Voltage Dividers in Precision Instrumentation**
- **Precision Voltage Reference Circuits.**
- **Decade Resistance Networks.**
- **Ultra-Low Power Precision Circuitry.**
- **Ultra-Stable Voltage Dividers.**

### Index to Caddock Micronox® Film Resistors

Performance specifications and detailed dimensional information on the many types of Caddock Micronox® film resistors are included on the following pages:


**Type MG and MH Precision High-Voltage Resistors** ..... Pages 3652 and 3653
**Type MS and MR Power Film Resistors** ..... Pages 3654 and 3655
**Type ML and MM Precision Film Resistors** ..... Page 3656
**Type MP Chassis Mounted Power Film Resistors** ..... Page 3657
**Type MV Low-R Power Film Resistors** ..... Page 3658
**Custom Resistive Devices** ..... Page 3659
**Type MK Low Cost Precision Film Resistors** ..... Pages 3660 and 3661


### Index to Caddock Tetrinox™ Film Resistors

Technical descriptions and specifications on Caddock Tetrinox™ film resistors are included on these pages:


**Type TK Temp-Stable Precision Film Resistors** ..... Pages 3662 and 3663
**Type TF Low TC Ultra-Precision Film Resistors.** ..... Page 3664
**Type 1776 Precision Decade Resistor Voltage Dividers** ..... Page 3665


If you should need additional information on any type of Caddock resistor, please call or write to our engineering and manufacturing offices in Riverside, California.


**CADDOCK**
ELECTRONICS, INCORPORATED
3127 CHICAGO AVENUE, RIVERSIDE, CALIFORNIA 92507 PHONE: (714) 683-5361 • TWX: 910-332-6108

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

# Type MG & MH Precision High-Voltage Resistors

Type MG and MH Precision High Voltage Resistors have been proven through many years of use in critical applications in airborne computers, manned space vehicles, geophysical instruments, and medical electronics where long term reliability and stability are of utmost importance.

With values as high as 2000 Megohms in a single resistor, operation at very high voltages can now be accomplished without the need for expensive, space-consuming multiple resistor 'strings.'

Matched resistor sets are available over a wide range of ratios, and the ratio TC can be matched as close as 2 PPM/°C when required. These resistor sets are ideal for use as control voltage feedback divider networks in precision high voltage supplies.

### Special High-Voltage and High-Voltage Pulse Performance

All power ratings and maximum working voltage ratings are for continuous duty. These ratings are based on pre-stress voltage levels applied during the manufacturing process to provide for stable resistor performance even under momentary overload conditions.

These resistors can be factory-conditioned to withstand up to 60% higher maximum working voltage, provided power ratings are not exceeded. (For this higher rating specify —15, example: MG750N—15. Overload and overvoltage ratings do not apply to —15 resistors.)

Type MG and MH resistors have also found wide use in pulse and current limiting applications where high voltage levels are encountered. To meet these special conditions, Caddock has facilities for pre-stressing resistors to several times rated working voltage as a means of establishing actual operating performance.

### Non-Inductive Performance

Caddock's patented Exclusive Non-Inductive Design uses a serpentine resistive pattern that provides for neighboring lines to carry currents in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor.

This efficient non-inductive construction is accomplished without derating of any performance advantages, and is especially valuable in pulse applications where wide bandwidths and excellent pulse fidelity must be maintained.

| Model No. | Wattage | Max. Continuous Oper. Volt | Oper. Temp. (Max.) | Dielect. Str'gth | TC ppm/°C† | Resistance Min. | Resistance Max. | Dimensions A | Dimensions B | Dimensions C | Encapsulation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MG650 | .5 | 600 | 225°C | 750 | 80 | 200Ω | 5 Meg | .313 ±.020 | .094 ±.015 | .025 ±.002 | Silicone Conformal |
| MG655 | .5 | 600 | 225°C | 750 | 80 | 200Ω | 8 Meg | .313 ±.030 | .109 ±.015 | .025 ±.002 | Silicone Conformal |
| MG660 | .6 | 1,000 | 225°C | 750 | 80 | 400Ω | 10 Meg | .500 ±.030 | .094 ±.015 | .025 ±.002 | Silicone Conformal |
| MG680 | .8 | 2,000 | 225°C | 750 | 80 | 600Ω | 20 Meg | .750 ±.030 | .094 ±.015 | .025 ±.002 | Silicone Conformal |
| MG710 | 1.0 | 4,000 | 225°C | 750 | 80 | 800Ω | 50 Meg | 1.000 ±.040 | .094 ±.015 | .025 ±.002 | Silicone Conformal |
| MG712 | .6 | 1,000 | 225°C | 750 | 80 | 800Ω | 20 Meg | .400 ±.060 | .140 ±.030 | .025 ±.002 | Silicone Conformal |
| MG714 | 1.0 | 1,000 | 225°C | 750 | 80 | 200Ω | 20 Meg | .562 ±.060 | .150 ±.030 | .032 ±.002 | Silicone Conformal |
| MG715 | 1.0 | 2,000 | 225°C | 750 | 80 | 400Ω | 50 Meg | .750 ±.060 | .140 ±.030 | .025 ±.002 | Silicone Conformal |
| MG716 | 1.5 | 4,000 | 225°C | 750 | 80 | 600Ω | 75 Meg | 1.000 ±.060 | .140 ±.030 | .025 ±.002 | Silicone Conformal |
| MG717 | 1.5 | 2,000 | 225°C | 750 | 80 | 600Ω | 75 Meg | .710 ±.050 | .240 ±.015 | .040 ±.002 | Silicone Conformal |
| MG720 | 2.0 | 6,000 | 225°C | 750 | 80 | 1K | 150 Meg | 1.500 ±.080 | .140 ±.030 | .025 ±.002 | Silicone Conformal |
| MG721 | 2.0 | 4,000 | 225°C | 750 | 80 | 200Ω | 100 Meg | 1.000 ±.050 | .240 ±.030 | .040 ±.002 | Silicone Conformal |
| MG725 | 2.5 | 10,000 | 225°C | 750 | 80 | 1.5K | 200 Meg | 2.000 ±.080 | .140 ±.030 | .025 ±.002 | Silicone Conformal |
| MG730 | 3.0 | 6,000 | 225°C | 1000 | 80 | 500Ω | 250 Meg | 1.500 ±.080 | .240 ±.030 | .040 ±.002 | Silicone Conformal |
| MG735 | 3.6 | 10,000 | 225°C | 1000 | 80 | 750Ω | 300 Meg | 2.000 ±.080 | .240 ±.030 | .040 ±.002 | Silicone Conformal |
| MG745 | 5.0 | 15,000 | 225°C | 1000 | 80 | 1K | 500 Meg | 3.000 ±.100 | .240 ±.030 | .040 ±.002 | Silicone Conformal |
| MG750 | 5.0 | 10,000 | 225°C | 1000 | 80 | 400Ω | 500 Meg | 2.125 ±.060 | .315 ±.030 | .040 ±.002 | Silicone Conformal |
| MG780 | 7.5 | 15,000 | 225°C | 1000 | 80 | 600Ω | 750 Meg | 3.125 ±.060 | .315 ±.030 | .040 ±.002 | Silicone Conformal |
| MG785 | 8.0 | 20,000 | 225°C | 1000 | 80 | 800Ω | 1000 Meg | 4.000 ±.120 | .315 ±.030 | .040 ±.002 | Silicone Conformal |
| MG810 | 10.0 | 25,000 | 225°C | 1000 | 80 | 1K | 1250 Meg | 5.000 ±.120 | .315 ±.030 | .040 ±.002 | Silicone Conformal |
| MG812 | 12.5 | 30,000 | 225°C | 1000 | 80 | 1.2K | 1500 Meg | 6.000 ±.120 | .315 ±.030 | .040 ±.002 | Silicone Conformal |
| MG815 | 15.0 | 30,000 | 225°C | 1000 | 80 | 1K | 2000 Meg | 6.000 ±.120 | .350 ±.040 | .040 ±.002 | Silicone Conformal |
| MH651 | .5 | 600 | 225°C | 750 | 80 | 200Ω | 5 Meg | .313 ±.020 | .094 ±.006 | .025 ±.002 | Black Molded |
| MH661 | .6 | 1,000 | 225°C | 2000 | 80 | 400Ω | 10 Meg | .500 ±.030 | .114 ±.010 | .025 ±.002 | Black Molded |
| MH681 | .8 | 2,000 | 225°C | 2000 | 80 | 600Ω | 20 Meg | .750 ±.030 | .114 ±.010 | .025 ±.002 | Black Molded |
| MH682 | .8 | 800 | 225°C | 1000 | 80 | 200Ω | 20 Meg | .400 ±.020 | .150 ±.010 | .025 ±.002 | Black Molded |
| MH713 | 1.0 | 4,000 | 225°C | 2000 | 80 | 800Ω | 50 Meg | 1.000 ±.030 | .114 ±.010 | .025 ±.002 | Black Molded |
| Type MH with special shielding, designed to eliminate degradation due to corona. | | | | | | | | | | | |
| MH711 | 1.0 | 2,000 | 225°C | 2000 | 80 | 800Ω | 50 Meg | 1.200 ±.040 | .220 ±.015 | .025 ±.002 | Black Molded |

†Temperature Coefficient: Referenced to 25°C, ΔR taken at —15°C and +105°C

## SPECIFICATIONS

**Resistance Tolerance:** ±1% (tolerances to .1% on special order).

**Insulation Resistance:** 100 megohms, minimum.

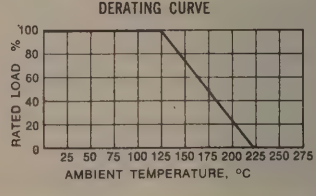
**Overvoltage:** 1.5 times working voltage for 5 seconds, R shift .8% max.

**Thermal Shock:** MIL - STD - 202, method 107, cond. C, R shift .5% max.

**Moisture Resistance:** MIL-STD-202, method 106, R shift .8% max.

**Loadlife:** 1000 hours at rated power, R shift .8% max.

**Standard Lead Material:** Gold Plated Dumet

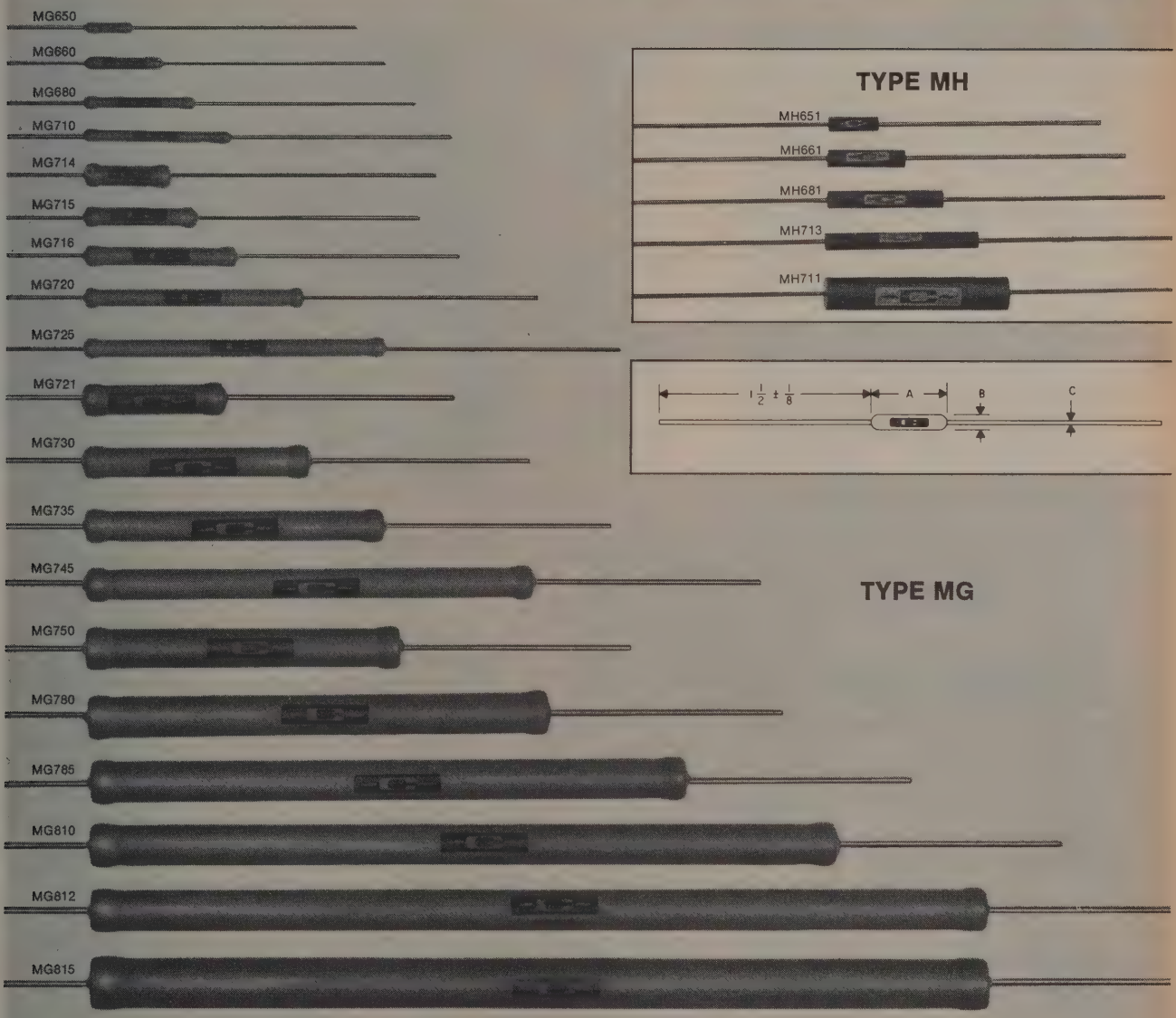


*Non-Inductive construction available in most models. Specify with N suffix on Model No.*

CADDOCK
ELECTRONICS, INCORPORATED
3127 CHICAGO AVENUE, RIVERSIDE, CALIFORNIA 92507 PHONE: (714) 683-5361 • TWX: 910-332-6108

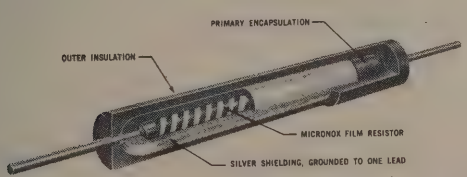
# Type MG & MH Precision High-Voltage Resistors

**CADDOCK**
HIGH PERFORMANCE FILM RESISTORS




## Exclusive Shielded Resistor

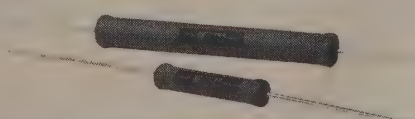
Model MH711, designed for extremely high voltage applications in very high resistance strings. This resistor remains exceptionally stable since shielding prevents film degradation from the corona developed in high voltage fields.




## Matched Resistor Sets with Tight Ratio Tolerances and TC Tracking.

Sets of Matched Type MG and MH resistors are available with ratios held as close as 0.05% over the range of ratios from 1:1 to 1:100,000 for use in voltage dividers, reference networks, feedback networks, and current summing networks.

The ratio TC of these matched resistor sets can be held as close as 2 ppm/°C over the temperature range from −15°C to +105°C.



**CADDOCK**
ELECTRONICS, INCORPORATED
3127 CHICAGO AVENUE, RIVERSIDE, CALIFORNIA 92507 PHONE: (714) 683-5361 • TWX: 910-332-6108

# CADDOCK
HIGH PERFORMANCE FILM RESISTORS

# Type MR & MS Power Film Resistors

Here are the power film resistors that overcome the design limitations of wire-wound resistors! Caddock Power Film Resistors provide power ratings to 12.5 watts at 6000 volts in a single axial lead resistor. By extending both the resistance range and maximum voltage ratings, Type MS Power Film Resistors simplify circuit design and reduce equipment complexity and cost.

## All These Features in One Resistor

- Full power and voltage ratings, without derating —
  — for non-inductive performance
  — for high resistance values that extend the critical resistance value up to 10 times.
- Higher voltage ratings without the limitations of minimum wire size and spacing.
- Excellent long-term stability.
  Tests demonstrate typical stability of 0.05% per 1000 hours over extended life.

## MICRONOX® Resistance Films

Type MS performance begins with Micronox® resistance films, the basic element in every Caddock resistor. Produced exclusively by Caddock Electronics, these proven complex oxide films have been used reliably for 15 years in Caddock's precision power resistor products.

Micronox® resistance films are fired directly onto a ceramic core, in air, at 1400°F. These resistance films have demonstrated outstanding stability when exposed to a high ambient temperature, thermal shock and high power densities.

This totally new approach to precision power resistors opens new design possibilities because of the wider resistance range, precise temperature characteristics, and higher temperature and power handling capability.

## There's no derating of performance when you specify Caddock's Exclusive Non-Inductive Design.

When non-inductive performance is specified, we produce these power film resistors with a serpentine resistive pattern that provides for neighboring lines to carry currents in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor.

The result is a truly non-inductive resistor that is about as inductive as a straight piece of wire the length of the resistor body. This efficient design means faster settling times and minimum distortion in all types of high frequency circuits.

## Type MS Power Film Resistors are produced under carefully controlled manufacturing and test procedures.

### Manufacturing Control

Type MS Resistors are produced under strict manufacturing controls with processes which include power conditioning, overvoltage conditioning and maximum temperature conditioning.

### Quality Control

Type MS Resistors receive quality surveillance which reaches from incoming raw materials to your packaged resistors in the shipping area. And our QC system has been approved for conformance to the requirements of NASA NHB5300.4(1C) and MIL-I-45208 in many recent surveys.

### Reliability Verification

Type MS Resistors are included in the Caddock Reliability Testing Program. Conformance to specification parameters including Extended Life, Shock, Vibration and Humidity are verified on a periodic basis. Data from MS resistors can be compared by similarity to other Caddock resistor types, since Type ML, MM, MS, MP, MG, MH and MK represent an identical combination of materials — aluminum oxide substrate, Micronox® resistance film and silicone insulating coating.

CADDOCK
ELECTRONICS, INCORPORATED
3127 CHICAGO AVENUE, RIVERSIDE, CALIFORNIA 92507 PHONE: (714) 683-5361 • TWX: 910-332-6108

# Type MS & MR Power Film Resistors

**CADDOCK**
HIGH PERFORMANCE FILM RESISTORS

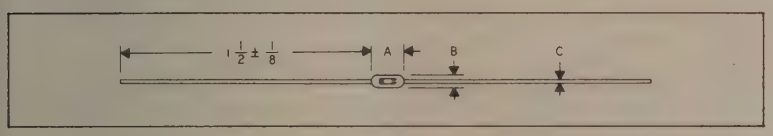
Type MS High Performance Power Film Resistors have a proven performance history in industrial, computer, military and space applications. This unique line now includes higher power ratings — up to 15 watts — and resistance values to 30 Megohms.

These exceptional resistors also provide outstanding extended life stability. In annual reliability tests where 2000 hour load-life stability data has been established, Type MS Power Film Resistors have demonstrated typical stability well within 0.1% per 1000 hours and extended life stability of 0.05% per 1000 hours.

Temperature coefficients are also low, with the standard TC of 50 PPM/°C available in all models of the Type MS Power Film Resistor. They can also be supplied on special order in matched resistor sets that provide ratio tracking with varying temperature to within 2 PPM/°C.

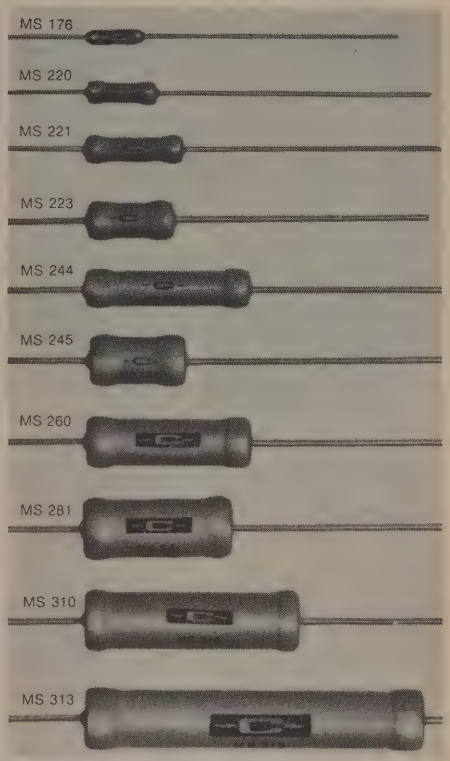
All of the Type MS Power Film Resistors are constructed with Micronox* resistance films bonded to a high strength solid ceramic core. Nickel alloy end caps and gold plated dumet axial leads complete the assembly. Encapsulation is provided by a silicone conformal coating.

Non-inductive construction is available in most models. Specify by adding "N" suffix to Model Number.




| Model No. | Wattage | Max. Voltage | Oper. Temp. (Max.) | Dielect. Str'gth | TC ppm/°C† | Resistance Min. | Resistance Max. | Dimensions A | Dimensions B | Dimensions C | Encapsulation | Leadwire |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MR 129 | .25 | 200 | 275°C | 500 | 150 | 10Ω | 500 K | .188 ±.020 | .070 ±.015 | .020 ±.002 | Silicone Conformal | Nickel |
| MR 154 | .40 | 300 | 275°C | 750 | 150 | 10Ω | 1 Meg | .250 ±.020 | .094 ±.015 | .025 ±.002 | Silicone Conformal | Nickel |
| MR 178 | .60 | 500 | 275°C | 750 | 150 | 20Ω | 3 Meg | .313 ±.020 | .094 ±.015 | .025 ±.002 | Silicone Conformal | Nickel |
| MS 126 | .25 | 200 | 275°C | 500 | 50 | 10Ω | 1 Meg | .188 ±.020 | .070 ±.015 | .020 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MS 150 | .5 | — | 275°C | 500 | 50 | 10Ω | 2 M | .188 ±.020 | .070 ±.015 | .020 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MS 151 | .5 | 300 | 275°C | 750 | 50 | 10Ω | 2 Meg | .250 ±.020 | .094 ±.015 | .025 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MS 175 | .75 | — | 275°C | 750 | 50 | 10Ω | 2 K | .250 ±.020 | .094 ±.015 | .025 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MS 176 | .75 | 500 | 275°C | 750 | 50 | 20Ω | 5 Meg | .313 ±.020 | .094 ±.015 | .025 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MS 210 | 1.0 | — | 275°C | 750 | 50 | 20Ω | 3 K | .313 ±.020 | .094 ±.015 | .025 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MS 214 | 1.0 | 500 | 275°C | 750 | 50 | 20Ω | 5 Meg | .313 ±.030 | .109 ±.015 | .025 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MS 220 | 2.0 | 1000 | 275°C | 800 | 50 | 20Ω | 10 Meg | .400 ±.060 | .140 ±.030 | .025 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MS 221 | 3.0 | 1000 | 275°C | 800 | 50 | 30Ω | 10 Meg | .575 ±.050 | .165 ±.030 | .030 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MS 223 | 3.0 | 800 | 275°C | 1000 | 50 | 10Ω | 4 Meg | .480 ±.060 | .230 ±.030 | .040 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MS 244 | 4.0 | 2000 | 275°C | 1000 | 50 | 30Ω | 15 Meg | .950 ±.060 | .230 ±.030 | .040 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MS 245 | 4.0 | 800 | 275°C | 1000 | 50 | 10Ω | 6 Meg | .570 ±.060 | .300 ±.030 | .040 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MS 260 | 6.0 | 2000 | 275°C | 1000 | 50 | 20Ω | 15 Meg | .970 ±.060 | .300 ±.030 | .040 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MS 281 | 8.0 | 2000 | 275°C | 1000 | 50 | 10Ω | 8 Meg | .910 ±.060 | .350 ±.040 | .040 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MS 310 | 10.0 | 4500 | 275°C | 1000 | 50 | 30Ω | 20 Meg | 1.25 ±.070 | .350 ±.040 | .040 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MS 313 | 12.5 | 6000 | 275°C | 1000 | 50 | 50Ω | 30 Meg | 2.00 ±.080 | .350 ±.040 | .040 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MS 315 | 15.0 | — | 275°C | 1000 | 50 | 50Ω | 1 Meg | 2.00 ±.080 | .350 ±.040 | .040 ±.002 | Silicone Conformal | Gold Plated Dumet |

†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C




## SPECIFICATIONS

**Resistance Tolerance:** ±1% (tolerances to .1% on special order).

**Insulation Resistance:** 100 megohms, minimum.

**Overload:** 5 times rated power for 5 seconds, R shift .5% max., or .5 ohms max., whichever is greater.

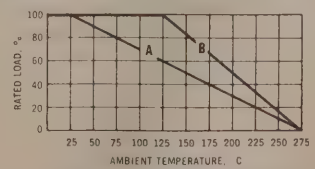
**Overvoltage:** 1.5 times max. voltage for 5 seconds, R shift .5% max., or .5 ohms max., whichever is greater.

**Thermal Shock:** MIL-STD-202, method 107, cond. C, R shift .5% max., or .5 ohms max., whichever is greater.

**Moisture Resistance:** MIL-STD-202, method 106, R shift .5% max., or .5 ohms max., whichever is greater.

**Loadlife:** 1000 hours at rated power, R shift .5% max., or .5 ohms max., whichever is greater.

DERATING CURVE




A—all MS models except MS126, MS151, MS176
B—all MR models, and MS126, MS151, MS176

**CADDOCK**
ELECTRONICS, INCORPORATED
3127 CHICAGO AVENUE, RIVERSIDE, CALIFORNIA 92507 PHONE: (714) 683-5361 • TWX: 910-332-6108

# CADDOCK
HIGH PERFORMANCE FILM RESISTORS

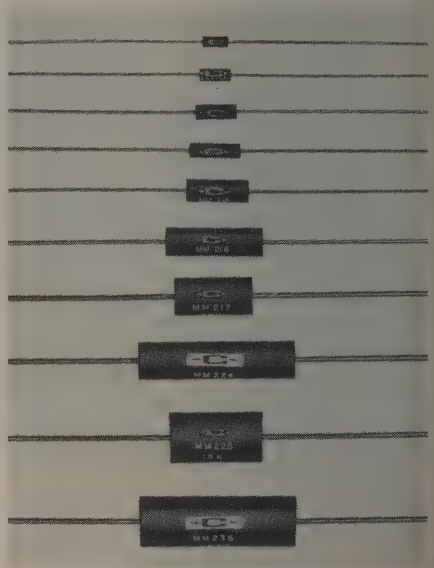
# Type ML & MM Precision Film Resistors

Type ML and MM resistors have a proven performance history in industrial, computer, military and space applications. With power ratings up to 3 watts and resistance values to 15 megohms, these outstanding resistors are ideal for applications requiring tolerances as close as 0.1% and extended life stability of 0.1% per 1000 hours.

The Type MM Precision Film Resistors provide a maximum operating temperature range of +275°C and both the Type ML and the Type MM have temperature coefficients of only 50 PPM/°C over the range from −15°C to +105°C.

Construction includes Micronox* resistance films fired onto a high strength solid ceramic core. End cap construction and a molded case completes the resistor assembly and provides increased resistance to abrasion and solvents.

Caddock's Exclusive Non-Inductive Performance can also be specified for any of these resistors by adding the "N" suffix to the model number.



| Model No. | Wattage | Max. Voltage | Oper. Temp. (Max.) | Dielect. Str'gth | TC ppm/°C† | Resistance | | Dimensions | | | | Encapsulation | Leadwire |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Min. | Max. | A | B | C | D | | |
| ML 103 | .06 | — | 175°C | 300 | 50 | 10Ω | 250 K | .110 ±.005 | .050 ±.005 | .016 ±.001 | 1.00 ±.12 | Transfer Molded Type | Gold Plated Dumet |
| ML 104 | .08 | 200 | 175°C | 400 | 50 | 50Ω | 300 K | .160 ±.010 | .065 ±.010 | .016 ±.002 | 1.50 ±.12 | Transfer Molded Type | Gold Plated Dumet |
| ML 114 | .15 | 200 | 175°C | 500 | 50 | 50Ω | 500 K | .188 ±.020 | .070 ±.015 | .020 ±.002 | 1.50 ±.12 | Transfer Molded Type | Gold Plated Dumet |
| ML 124 | .25 | 300 | 175°C | 750 | 50 | 50Ω | 600 K | .250 ±.020 | .094 ±.006 | .025 ±.002 | 1.50 ±.12 | Transfer Molded Type | Gold Plated Dumet |
| ML 131 | .4 | 500 | 175°C | 750 | 50 | 5Ω | 1 Meg | .313 ±.020 | .094 ±.006 | .025 ±.002 | 1.50 ±.12 | Transfer Molded Type | Gold Plated Dumet |
| ML 181 | .6 | 600 | 175°C | 750 | 50 | 50Ω | 5 Meg | .400 ±.020 | .150 ±.010 | .025 ±.002 | 1.50 ±.12 | Transfer Molded Type | Gold Plated Dumet |
| ML 212 | 1.0 | 1000 | 175°C | 1000 | 50 | 30Ω | 10 Meg | .625 ±.030 | .190 ±.020 | .030 ±.002 | 1.50 ±.12 | Transfer Molded Type | Gold Plated Dumet |
| ML 213 | 1.0 | 800 | 175°C | 1500 | 50 | 10Ω | 4 Meg | .500 ±.030 | .250 ±.020 | .040 ±.002 | 1.50 ±.12 | Transfer Molded Type | Gold Plated Dumet |
| ML 218 | 1.25 | 2000 | 175°C | 1500 | 50 | 30Ω | 15 Meg | 1.00 ±.030 | .250 ±.020 | .040 ±.002 | 1.50 ±.12 | Transfer Molded Type | Gold Plated Dumet |
| ML 219 | 1.25 | 800 | 175°C | 2000 | 50 | 10Ω | 6 Meg | .600 ±.030 | .330 ±.020 | .040 ±.002 | 1.50 ±.12 | Transfer Molded Type | Gold Plated Dumet |
| ML 226 | 2.0 | 2000 | 175°C | 2000 | 50 | 20Ω | 15 Meg | 1.00 ±.030 | .330 ±.020 | .040 ±.002 | 1.50 ±.12 | Transfer Molded Type | Gold Plated Dumet |
| MM 112 | .12 | 200 | 275°C | 400 | 50 | 10Ω | 500 K | .160 ±.010 | .065 ±.010 | .016 ±.002 | 1.50 ±.12 | Black Molded Type | Gold Plated Dumet |
| MM 125 | .25 | 200 | 275°C | 500 | 50 | 10Ω | 1 Meg | .188 ±.020 | .070 ±.015 | .020 ±.002 | 1.50 ±.12 | Black Molded Type | Gold Plated Dumet |
| MM 152 | .4 | 300 | 275°C | 750 | 50 | 10Ω | 2 Meg | .250 ±.020 | .094 ±.006 | .025 ±.002 | 1.50 ±.12 | Black Molded Type | Gold Plated Dumet |
| MM 177 | .6 | 500 | 275°C | 750 | 50 | 20Ω | 5 Meg | .313 ±.020 | .094 ±.006 | .025 ±.002 | 1.50 ±.12 | Black Molded Type | Gold Plated Dumet |
| MM 215 | 1.0 | 800 | 275°C | 1000 | 50 | 10Ω | 10 Meg | .400 ±.020 | .150 ±.010 | .025 ±.002 | 1.50 ±.12 | Black Molded Type | Gold Plated Dumet |
| MM 216 | 1.5 | 1000 | 275°C | 1000 | 50 | 30Ω | 10 Meg | .625 ±.030 | .190 ±.020 | .030 ±.002 | 1.50 ±.12 | Black Molded Type | Gold Plated Dumet |
| MM 217 | 1.5 | 800 | 275°C | 1500 | 50 | 10Ω | 4 Meg | .500 ±.030 | .250 ±.020 | .040 ±.002 | 1.50 ±.12 | Black Molded Type | Gold Plated Dumet |
| MM 224 | 2.0 | 2000 | 275°C | 1500 | 50 | 30Ω | 15 Meg | 1.00 ±.030 | .250 ±.020 | .040 ±.002 | 1.50 ±.12 | Black Molded Type | Gold Plated Dumet |
| MM 225 | 2.0 | 800 | 275°C | 2000 | 50 | 10Ω | 6 Meg | .600 ±.030 | .330 ±.020 | .040 ±.002 | 1.50 ±.12 | Black Molded Type | Gold Plated Dumet |
| MM 236 | 3.0 | 2000 | 275°C | 2000 | 50 | 20Ω | 15 Meg | 1.00 ±.030 | .330 ±.020 | .040 ±.002 | 1.50 ±.12 | Black Molded Type | Gold Plated Dumet |

†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C

*Micronox is a registered trademark of Caddock Electronics, Inc.

## SPECIFICATIONS

**Resistance Tolerance:** ±1% (tolerances to .1% on special order).

**Insulation Resistance:** 100 megohms, minimum.

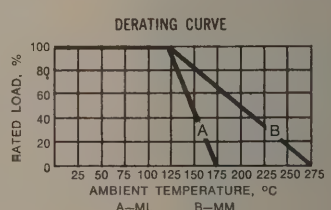
**Overload:** 5 times rated power for 5 seconds, R shift .5% max., or .5 ohms max., whichever is greater.

**Overvoltage:** 1.5 times max. voltage for .5 seconds, R shift .5% max., or .5 ohms max., whichever is greater.

**Thermal Shock:** MIL-STD-202, method 107, cond. B, R shift .2% max., or .5 ohms max., whichever is greater.

**Moisture Resistance:** MIL-STD-202, method 106, R shift .5% max., or .5 ohms max., whichever is greater.

**Loadlife:** 1000 hours at rated power, R shift .5% max., or .5 ohms, whichever is greater.



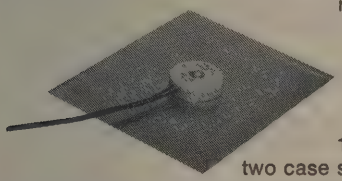

CADDOCK
ELECTRONICS, INCORPORATED
3127 CHICAGO AVENUE, RIVERSIDE, CALIFORNIA 92507 PHONE: (714) 683-5361 • TWX: 910-332-6108

# Type MP Chassis Mounted Power Film Resistors

**CADDOCK**
HIGH PERFORMANCE FILM RESISTORS

## With Non-Inductive Performance.

Type MP Chassis Mounted Power Film Resistors are made with Micronox® resistance films fired onto a ceramic substrate which is thermally bonded to an anodized aluminum base. By mounting this assembly directly to a metal surface for improved heat transfer, these unique resistors provide increased packaging densities in many types of electronic equipment.



15 and 30 watt ratings are available in two case sizes that permit through-bolt attachment to the chassis or other heat conducting surface. The molded silicone case encapsulates the resistor assembly to meet the requirements of the most stringent environmental specifications.

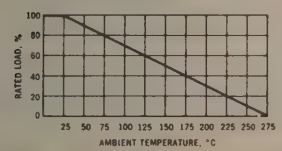
The outstanding stability of the Type MP Power Film Resistors has been demonstrated in a 5½ year, 50,000 hour program of continuous load-life testing. Extended life stability during these full-power tests was better than 0.01% per 1000 hours!

| Model No. | Power Rating† | Max. Voltage | Diel. Str. | High Temp. TC‡ | Resistance Range | | Dimensions | | | | Terminals |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Min. | Max. | A | B | C | D | |
| MP311 | 15 Watts | 300 | 600 | 50 | 50Ω | 200 K | .600 | .188 | — | .092 | 12" Min Teflon Leads 26AWG 7x34 |
| MP312 | 15 Watts | 300 | 600 | 50 | 10Ω | 200 K | .600 | .188 | .185 | .092 | Gold Plated Solder Lugs |
| MP329 | 30 Watts | 450 | 1000 | 50 | 50Ω | 200 K | .850 | .250 | — | .142 | 12" Min Teflon Leads 22AWG 7x30 |
| MP330 | 30 Watts | 450 | 1000 | 50 | 10Ω | 200 K | .850 | .250 | .250 | .142 | Gold Plated Solder Lugs |

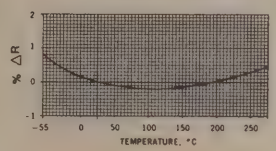
† Power rating based on chassis mounting with MP 311 and MP 312 on a 6" x 4" x 2" x .040" aluminum chassis and the MP 329 and MP 330 on a 5" x 7" x 2" x .040" aluminum chassis.

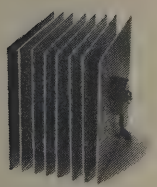
‡ TC: 50 ppm referenced to 25°C, ΔR taken at +150°C and +275°C. (Low temp. TC will be nominally −85 ppm/°C at −55°C. See typical R-T curve.)

DERATING CURVE




TYPICAL R-T CURVE

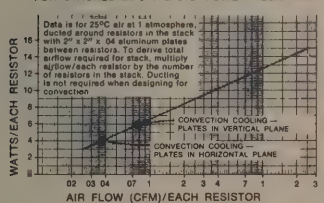


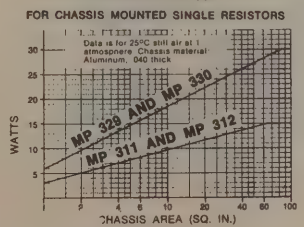
Stacked Type MP assemblies — constructed by bolting resistors between aluminum heat dissipating plates — provide a simple means of further improving packaging densities.

These charts of power ratings versus ambient temperature and chassis area show the high power levels that can be achieved with forced air cooling and with convection cooling in either vertical or horizontal orientation.

POWER RATING
FOR STACKED MP311 & 312 POWER RESISTORS


Data is for 25°C air at 1 atmosphere, ducted around resistors in the stack with 2" x 2" x .04 aluminum plates between resistors. To derive total airflow required for stack, multiply airflow/each resistor by the number of resistors in the stack. Ducting is not required when designing for convection
CONVECTION COOLING — PLATES IN VERTICAL PLANE
CONVECTION COOLING — PLATES IN HORIZONTAL PLANE
WATTS/EACH RESISTOR
16
14
12
10
8
6
4
2
0
02 03 04 07 1 2 3 4 7 1 2 3
AIR FLOW (CFM)/EACH RESISTOR

POWER RATING
FOR CHASSIS MOUNTED SINGLE RESISTORS




U.S. Patent No's 3,636,493 and 3,649,944 Other patents pending.

## SPECIFICATIONS

**Resistance Tolerance:** ±1% standard (Other tolerances on special order.)

**Insulation Resistance:** 10,000 Megohms, dry. Method — Mil-R-18546D, para. 4.6.8.

**Solderability:** Per Mil-R-18546D, para. 3.7, para. 4.6.4.

**Terminal Strength:** Per Mil-Std-202, Method 211, Cond. A (Pull Test), 5 lbs., and Cond. B (Bend Test). Max. ΔR, .2% or .2Ω, whichever is greater.

**Thermal Shock:** Per Mil-R-18546D, para. 4.6.9, max. ΔR, .5% or .2Ω, whichever is greater.

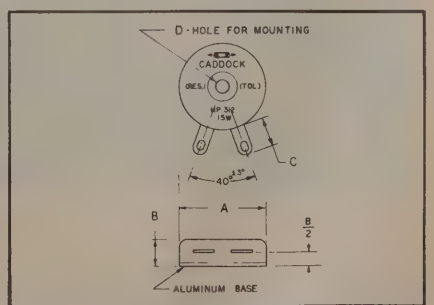
**Momentary Overload:** 2 times rated power or 1.5 times max. allowable working voltage, whichever gives the lower power, for 5 seconds. Max. ΔR, .5% or .2Ω, whichever is greater.

**Moisture Resistance:** Mil-Std-202, Method 106B, less steps 7a and 7b, max. ΔR, .5% or .2Ω, whichever is greater.

**Life:** Per Mil-R-18546D, para. 4.6.12, 1,000 hrs., Max. ΔR, 1% or .2Ω, whichever is greater.

**Shock, Medium Impact:** 50G, per Mil-Std-202, Method 205, Cond. C.

**Vibration, High Frequency:** Per Mil-Std-202, Method 204, Cond. B, Max. ΔR .2% or .2Ω, whichever is greater, through shock and vibration sequence.




**CADDOCK**
ELECTRONICS, INCORPORATED
3127 CHICAGO AVENUE, RIVERSIDE, CALIFORNIA 92507 PHONE: (714) 683-5361 • TWX: 910-332-6108

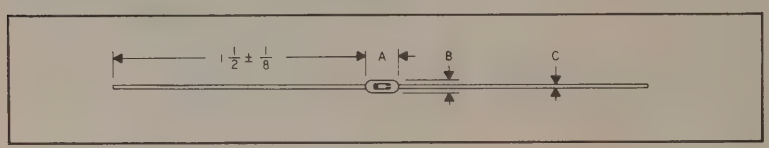
# CADDOCK
HIGH PERFORMANCE FILM RESISTORS

# Type MV
# Low-R Power Film Resistors

Type MV resistors extend the advantages of Caddock Micronox* resistance films to values as low as 0.5 ohms in a unique non-inductive design. The multiple-path resistance pattern distributes the currents evenly throughout the resistor and reduces the inductance to an absolute minimum.

The exceptional stability of Caddock Micronox* resistors — produced by firing these complex oxide films onto solid ceramic substrates — provides power ratings as high as 10 watts in a compact axial lead configuration that features excellent overload ratings.

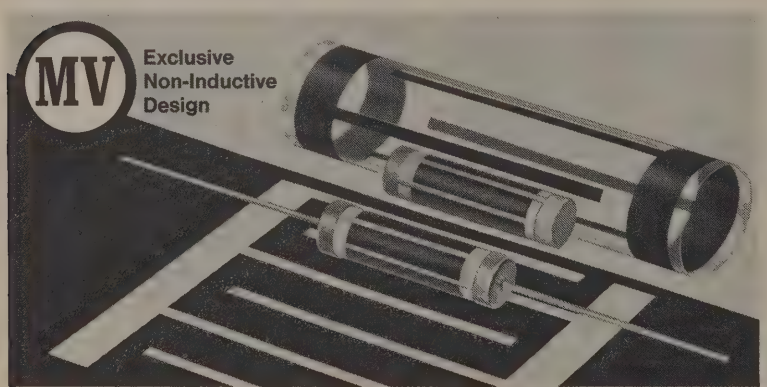
Type MV resistors are ideal for use in high frequency circuits where close resistance tolerances and excellent long-term stability are required.

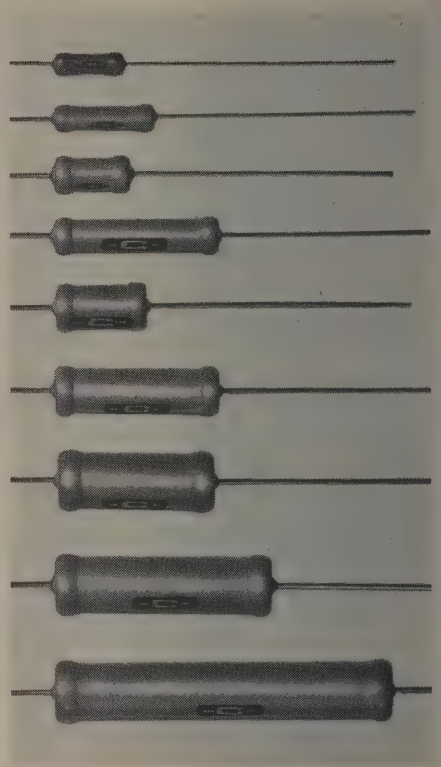



*Micronox is a registered trademark of Caddock Electronics, Inc.

| Model No. | Watt-age | Oper. Temp. (Max.) | Dielect. Str'gth | TC ppm/°C† | Resistance | | Dimensions | | | Encap-sulation | Leadwire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Min. | Max. | A | B | C | | |
| MV217 | 1.5 | 275°C | 800 | 100 | 5Ω | 100Ω | .400 ±.060 | .140 ±.030 | .025 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MV227 | 2.0 | 275°C | 800 | 100 | 5Ω | 100Ω | .575 ±.050 | .165 ±.030 | .030 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MV228 | 2.0 | 275°C | 1000 | 100 | 3Ω | 100Ω | .480 ±.060 | .230 ±.030 | .040 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MV233 | 3.0 | 275°C | 1000 | 100 | 2Ω | 100Ω | .950 ±.060 | .230 ±.030 | .040 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MV234 | 3.0 | 275°C | 1000 | 100 | 3Ω | 100Ω | .570 ±.060 | .300 ±.030 | .040 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MV251 | 4.0 | 275°C | 1000 | 100 | 1Ω | 100Ω | .970 ±.060 | .300 ±.030 | .040 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MV261 | 6.0 | 275°C | 1000 | 100 | 1Ω | 100Ω | .910 ±.060 | .350 ±.030 | .040 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MV280 | 8.0 | 275°C | 1000 | 100 | 1Ω | 100Ω | 1.25 ±.070 | .350 ±.040 | .040 ±.002 | Silicone Conformal | Gold Plated Dumet |
| MV311 | 10.0 | 275°C | 1000 | 100 | .5Ω | 100Ω | 2.00 ±.080 | .350 ±.040 | .040 ±.002 | Silicone Conformal | Gold Plated Dumet |

†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C



## SPECIFICATIONS

**Resistance Tolerance:** ±1%.

**Insulation Resistance:** 100 megohms, minimum.

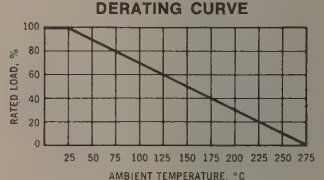
**Overload:** 5 times rated power for 5 seconds, R shift 1% max.

**Thermal Shock:** MIL-STD-202, method 107, cond. C, R shift 1% max.

**Moisture Resistance:** MIL-STD-202, method 106, R shift 1% max.

**Loadlife:** 1000 hours at rated power, R shift 1% max.

**DERATING CURVE**




CADDOCK
ELECTRONICS, INCORPORATED
3127 CHICAGO AVENUE, RIVERSIDE, CALIFORNIA 92507 PHONE: (714) 683-5361 • TWX: 910-332-6108

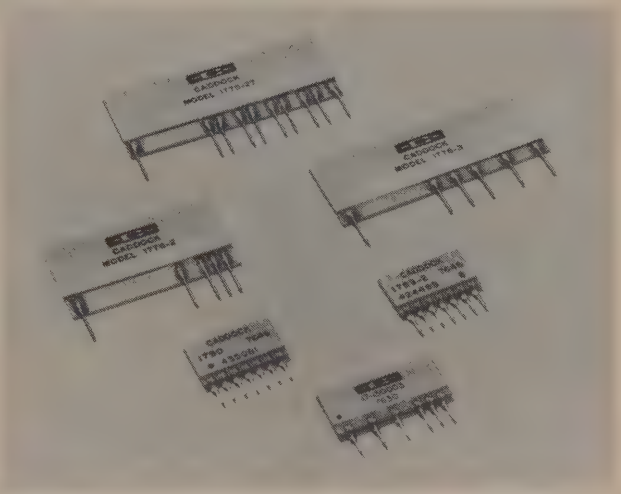
# Custom Resistive Devices

**CADDOCK**
**HIGH PERFORMANCE FILM RESISTORS**

For the ultimate in resistor network performance, Caddock produces many types of custom resistive networks with an unsurpassed combination of advantages:

- **High Resistance Ratios** — from 1-to-1 up to 1,000,000-to-1!
- **High Transient Handling Capability** — up to 100 times higher than the rated power level!
- **Extended Resistance Range** — from 1 ohm to 5000 Megohms.
- **Tight Resistance Tolerances** — to 0.05%.
- **Tight Ratio Tolerances** — to 0.025%.
- **Close Ratio Tracking** — to 5 PPM/°C from −15°C to +105°C.
- **Exceptional Resistor Stability** — as close as 0.01% per 1000 hours in extended life.

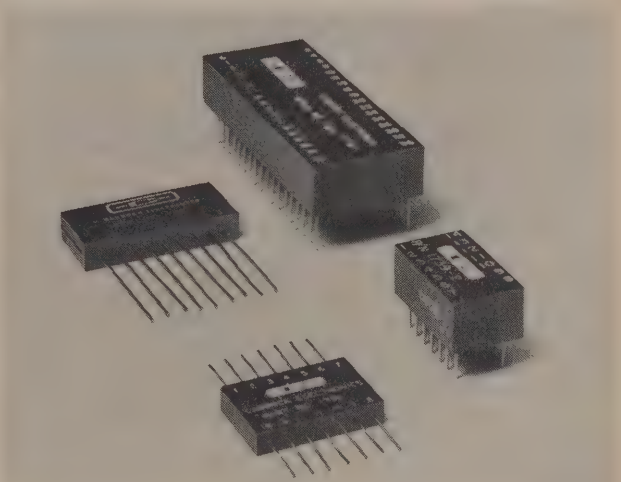
This combination of advantages in one resistor network often provides a practical — **and immediate** — means for improving the performance and specifications of electronic circuitry and equipment without any changes in the design!



## Special Multi-Lead Encapsulated Packaging for Complex Resistor Networks.

When circuit requirements make multi-resistor packaging necessary, Caddock can produce specially configured resistor networks with custom lead arrangements.

These custom resistor networks are completely encapsulated to withstand extreme environmental conditions, including shock, vibration, thermal shock and temperatures in the range from −65°C to +275°C.

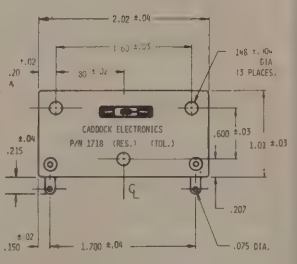


## Model 1718 Multi-Megohm Film Resistors With Exclusive Modular Stacking Design.

This Multi-Megohms Resistor is designed to provide a low profile non-inductive high resistance value with precise resistance-temperature characteristics. These are especially useful in high resistance voltage dividers where fast response is important.

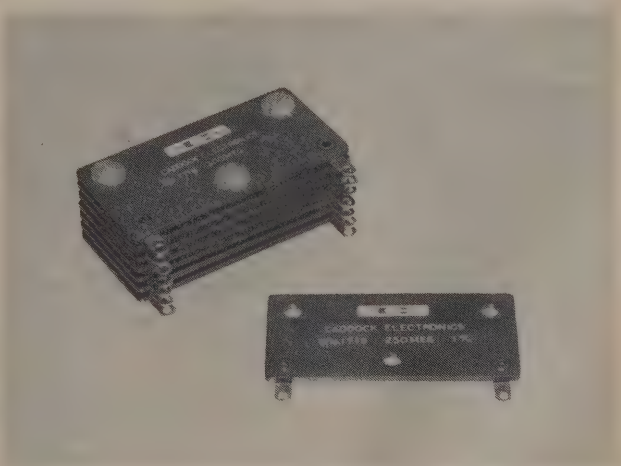
## SPECIFICATIONS

**Resistance Range:** 1 meg-333 meg
**Power Rating:** 3 Watts @ 25°C
**Max. Working Voltage:** 12000 Volts
**Resistance Tolerance:** ±1% (Tolerances 0.2% on special order)
**Terminal Material:** Gold Plated Copper
**Encapsulation:** Conformal Coating
**Insulation Resistance:** 100,000 Megs, Min. when mounted
**Temperature Coefficient:** ±80 PPM/°C Referenced to 25°C, △R taken at −15°C and +105°C
**Thermal Shock:** Mil-Std 202, Method 107 R shift .5% Max.
**Loadlife:** 1000 hours at rated power R shift 8% Max.
**Mounting:** Three 6-32 Nylon Screws with Standoff Spacers, .050 Thick, Supplied with unit
**Operating Temperature:** −55°C to +125°C




Substrate .054± .01 Thick.

.09± .01 Thick Including Lug.



**CADDOCK**
ELECTRONICS, INCORPORATED
3127 CHICAGO AVENUE, RIVERSIDE, CALIFORNIA 92507 PHONE: (714) 683-5361 • TWX: 910-332-6108

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

# Type MK Low Cost Precision Film Resistors

## With Resistance Range Extended to 100 Megohms.

Here are the low cost precision resistors that provide high density packaging in large volume printed circuit applications. Available in two miniature rectangular package configurations with standard lead spacings, Type MK Precision Film Resistors now cover the entire resistance range from 10 ohms to 100 Megohms.

Constructed with Caddock Micronox® resistance films fired onto a solid ceramic substrate, Type MK Precision Film Resistors combine all of these outstanding advantages:

- ±1% resistance tolerance is standard and tolerances to ±0.1% are available on special order.
- Operating temperatures are from −55°C to +175°C.
- Full power rating at +125°C.
- Temperature Coefficient is only 50 PPM/°C up to 10 Megohms and 80 PPM/°C up to 100 Megohms, referenced to 25°C with the ΔR taken at −15°C and +105°C.
- Extended life stability is typically better than 0.1% per 1000 hours.
- Caddock's non-inductive performance provides greater pulse fidelity and wider bandwidths in high frequency circuits.

This combination of performance advantages in a small, standardized case can simplify many engineering and production problems:

**One size of Type MK resistors can replace many sizes of radial lead resistors.**

This table of "RN" style axial lead resistors shows the many sizes and power ratings that can be replaced with either of the two models of Type MK Precision Film Resistors within the maximum allowable voltage ratings.

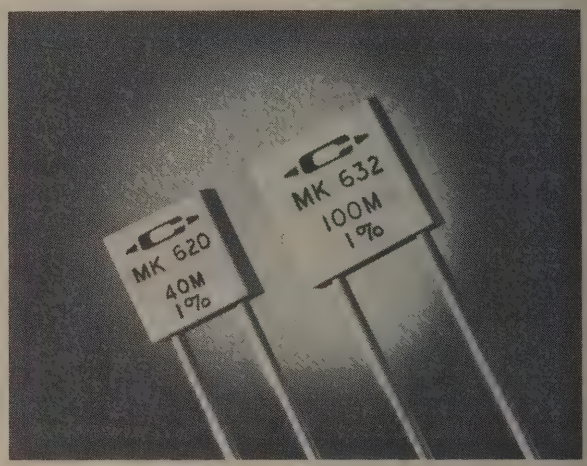
**Comparison of Type MK and "RN" Ratings and Dimensions**

| Resistor Type | Power Rating | Maximum Resistance | Mounting Hole Spacing | |
|---|---|---|---|---|
| MK 120 or MK 620 | .50 WT. | 40 Megohms | .150 | Even the smallest Type MK resistor can replace all of these RN type resistors. |
| MK 132 or MK 632 | .75 WT. | 100 Megohms | .200 | |
| RN50 | .05 WT | 1 Megohm | .400 | RN 50 |
| RN 55 | .10 WT | 5 Megohms | .500 | RN 55 |
| RN60 | .125 WT | 10 Megohms | .625 | RN 60 |
| RN65 | .25 WT | 20 Megohms | .875 | RN 65 |
| RN70 | .50 WT | 40 Megohms | 1.000 | RN 70 |

All outline drawings full size — dimensions in inches.

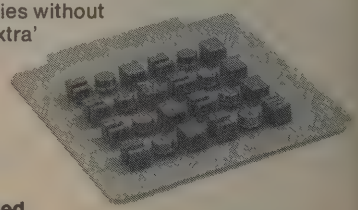
The largest Type MK — rated at .75 watt — requires less board space than even the 1/20th watt RN 50.

The smallest Type MK — rated at .5 watt — provides power dissipation **equal** to the RN 70 resistor. The RN 70 resistor requires a mounting hole spacing of 1" and a side-to-side spacing of .250 inches, resulting in a total mounting area of .25 square inches — **10 times the area required for a .75 watt Type MK resistor!**




**One standard resistor configuration can simplify board layouts.**

With the exceptionally wide range of resistances that are available in each model of Type MK Precision Film Resistors, circuits can now be designed for maximum packaging densities without the need for leaving 'extra' space where resistor value changes can require larger resistors or non-uniform lead spacings.



**Standardization of resistor size can speed assembly procedures and reduce procurement costs.**

The standardization of resistor size can pay additional dividends by simplifying assembly procedures. The radial leads do not require additional bending prior to insertion, and the standard lead spacing can reduce the time required for assembly.

The combination of higher power rating and smaller size can also lower procurement costs. By reducing the wide variety of sizes and types of axial lead resistors to a single, 'standardized' resistor type, unit prices can be lowered and inventory problems simplified.

### Low Quantity Prices — Fast Delivery

Quantity prices for Type MK Precision Film Resistors are low, with many values priced under 30 cents each in medium-to-large production orders.

Type MK Precision Film Resistors can be delivered in large quantities with normal delivery schedules of 4 to 6 weeks ARO, and prototype quantities can usually be delivered from stock.

A pricing schedule for all values and models of Type MK Precision Film Resistors is available upon request. For specific price and delivery information call or write to the main offices of Caddock Electronics in Riverside, California.

CADDOCK
ELECTRONICS, INCORPORATED
3127 CHICAGO AVENUE, RIVERSIDE, CALIFORNIA 92507 PHONE: (714) 683-5361 • TWX: 910-332-6108

# Type MK Low Cost Precision Film Resistors

**CADDOCK**
HIGH PERFORMANCE FILM RESISTORS

## Type MK Precision Film Resistors — Standard Resistance Range

| Model No. | Wattage | Max. Voltage | Oper. Temp. (Max.) | Dielect. Str'gth | TC ppm/°C† | Resistance Min. | Resistance Max. | Dimensions | Encapsulation | Leadwire |
|---|---|---|---|---|---|---|---|---|---|---|
| MK 120 | .5 | 200 | 175°C | 300 | 50 | 30 Ω | 2 Meg. | Ref. Case "A" Dwg. | Transfer Molded Type | Tinned Copper |
| MK 132 | .75 | 400 | 175 C | 400 | 50 | 10 Ω | 5 Meg. | Ref. Case "B" Dwg. | Transfer Molded Type | Tinned Copper |

**Resistance Tolerance:** ±1% (tolerance to ±.1% on special order).
**Operating Temperature:** −55°C to 175°C.
**Overload:** 5 times rated power for 5 seconds, R shift .15% max., or .2 ohms max., whichever is greater.
**Overvoltage:** 1.5 times max. voltage for 5 seconds, R shift .15% max., or .2 ohms max., whichever is greater.
**Thermal Shock:** Mil-Std-202, Method 107, Cond. B, shift .2% max., or .2 ohms, max., whichever is greater.
**Moisture Resistance:** Mil-Std-202, Method 106, R shift .5% max., or .2 ohms, whichever is greater.
**Loadlife:** 1000 hours at rated power, R shift .4% max., or .2 ohms, whichever is greater.
**Insulation Resistance:** 10,000 Megohms, minimum.

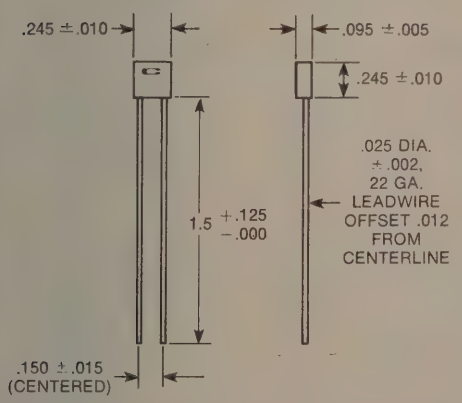
## Type MK Precision Film Resistors — Extended Resistance Range

| Model No. | Wattage | Max. Voltage | Oper. Temp. (Max.) | Dielect. Str'gth | TC ppm/°C† | Resistance Min. | Resistance Max. | Dimensions | Encapsulation | Leadwire |
|---|---|---|---|---|---|---|---|---|---|---|
| MK 620 | .5 | 200 | 175°C | 300 | 80 | 2 Meg. | 40 Meg. | Ref. Case "A" Dwg. | Transfer Molded Type | Tinned Copper |
| MK 632 | .75 | 400 | 175 C | 400 | 80 | 5 1 Meg | 100 Meg | Ref. Case "B" Dwg. | Transfer Molded Type | Tinned Copper |

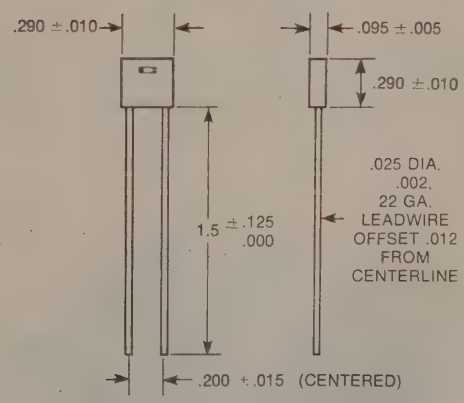
**Resistance Tolerance:** ±1% (consult factory for tighter tolerances).
**Operating Temperature:** −55°C to 175°C.
**Overvoltage:** 1.5 times max. voltage for 5 seconds, R shift .5% max.
**Thermal Shock:** Mil-Std-202, Method 107, Cond. B, R shift .5% max.
**Moisture Resistance:** Mil-Std-202, Method 106, R shift .5% max.
**Loadlife:** 1000 hours at rated power, R shift .5% max.
**Insulation Resistance:** 10,000 Megohms, minimum.

†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C

**Case "A"**
Model MK 120 and MK 620

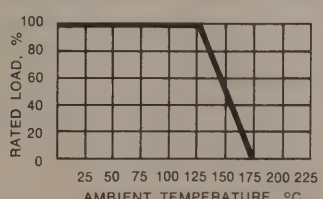



**Case "B"**
Model MK 132 and MK 632




ALL DIMENSIONS IN INCHES

**DERATING CURVE**




CADDOCK
ELECTRONICS, INCORPORATED
3127 CHICAGO AVENUE, RIVERSIDE, CALIFORNIA 92507 PHONE: (714) 683-5361 • TWX: 910-332-6108

**CADDOCK**
HIGH PERFORMANCE FILM RESISTORS

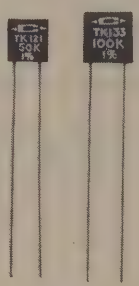
# Type TK Temp-Stable Precision Film Resistors

## With Temperature Coefficients of Less Than 10 PPM/°C.

Caddock introduces a new design element for precision electronic circuitry — an advanced technology breakthrough that solves many critical circuit stability problems — the **Type TK Temp-Stable Precision Film Resistors with the Tetrinox™ resistance system.**

Type TK Temp-Stable Precision Film Resistors provide a combination of performance advantages never before available in a resistive component:

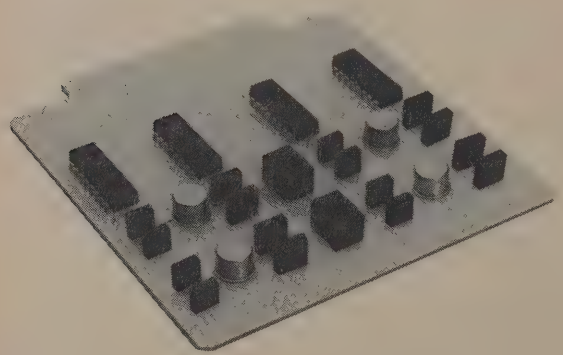
- **Temperature Stability** — better than 10 PPM/°C over the entire temperature range from −55°C to +125°C!
- **Long-Term Absolute Stability** — better than ±0.05% per 2000 hours of operation.
- **Extended Resistance Range** — from 1000 ohms to 10 Megohms.
- **Precision Tolerances** — ±1% is standard, and tolerances as close as ±0.05% are available.
- **Wide Operating Temperature Range**—from −55°C to +175°C.
- **Small Size** — with two miniature rectangular cases for maximum packaging density and minimum mounting area.
- **High Power Density** — with power ratings of .2 watt and .3 watt in molded cases, the largest of which is a standard CK 06 package.

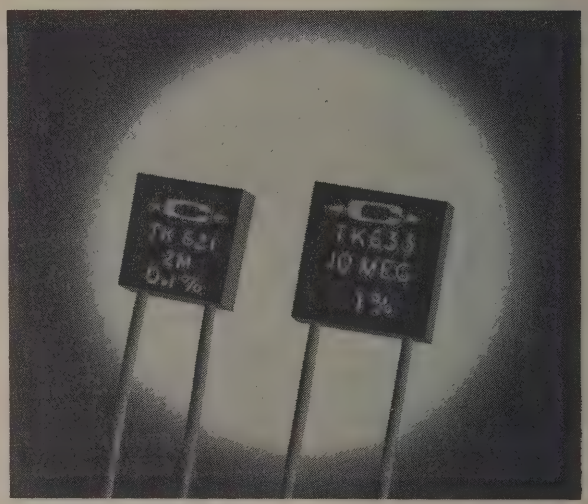



(Photos show resistors full size)

- **Highest Performance-to-Cost Ratio** — with many values priced below $1.50 each in 100 lot quantities.

Building on 15 years of experience with our unique complex-oxide technology, Caddock has perfected the Tetrinox™ resistance system — the first high resistance system to provide a TC that is well within 10 PPM/°C and that is also essentially linear over the entire temperature range from −55°C to +125°C.






The exceptional performance of Type TK resistors can achieve improvements in many circuit applications:

**Low TC "Matched-Pair" Voltage Dividers Can be Assembled Without Pre-Selection of Resistors.**

An important application for Type TK resistors is in "matched-pair" voltage dividers where the low 10 PPM/°C temperature coefficient provides ratio tracking of less than 20 PPM/°C without resistor pre-selection or special testing.

With factory selection, Type TK resistor pairs can be matched to within 1 PPM/°C.

**Extended Resistance Range Reduces Power Requirements**

Because the Type TK resistors provide resistance values as high as 10 Megohms — values that are up to 100 times higher than other types of ultra-low TC resistors — engineers can now design precision circuits with lower current drain and lower power requirements.

**High Density Packaging**

The radial lead mounting and small rectangular case of Type TK resistors permits high packaging densities in low profile electronic circuitry. And because both models of Type TK resistors are available in an exceptionally wide range of resistances, lead spacing and mounting space can be standardized.

For additional information on the Type TK resistors for your high stability circuits, contact the engineering staff of Caddock Electronics in Riverside, California. They can assist you in determining the exact temperature coefficient and tolerances your application requires, and will provide both evaluation and production quantities of these new resistors on fast-delivery schedules.

**CADDOCK**
ELECTRONICS, INCORPORATED
3127 CHICAGO AVENUE, RIVERSIDE, CALIFORNIA 92507 PHONE: (714) 683-5361 • TWX: 910-332-6108

# Type TK Temp-Stable Precision Film Resistors

**CADDOCK**
HIGH PERFORMANCE FILM RESISTORS

## Type TK Temp-Stable Precision Film Resistors — Standard Resistance Range

| Model No. | Temperature Coefficient ppm/°C † | Resistance | | Wattage @ +125°C | Max. Working Voltage | Dielect. Str'gth | Dimensions | Encap-sulation | Leadwire |
|---|---|---|---|---|---|---|---|---|---|
| | | Min. | Max. | | | | | | |
| TK121 | 5, 10 or 20 | 1K | 500K | .2 | 200 | 300 | Ref. Case "A" Dwg. | Transfer Molded Type | Tinned Copper |
| TK133 | 5, 10 or 20 | 1K | 1.5 Meg. | .3 | 300 | 400 | Ref. Case "B" Dwg. | Transfer Molded Type | Tinned Copper |
| TK139 | 5, 10 or 20 | 1K | 1.5 Meg. | .3 | 300 | 400 | Ref. Case "C" Dwg. | Transfer Molded Type | Tinned Copper |

† Specify TC when ordering. 10 PPM/°C is standard.

**Resistance Tolerance:** ±1% Standard. (Tolerances to ±0.05% on special order.)

**Operating Temperature:** −55°C to +175°C.

**TC Temperature Range:** −55°C to +125°C.

**Overload:*** 6.25 times rated power for 5 seconds at voltages not to exceed 1.5 times maximum rated working voltage, R shift less than 0.05%.

**Thermal Shock:** Mil-Std-202, Method 107, Condition B, R shift less than 0.05%.

**Low Temperature Operation:*** R shift less than 0.02%.

**Dielectric Withstanding Voltage:*** R shift less than 0.02%.

**Moisture Resistance:*** Mil-Std-202, Method 106, R shift less than 0.02%.

**Load Life:*** 2000 hours at +125°C, R shift less than 0.05%.

**Shelf Life (Typical):** 25 ppm/year.

**Insulation Resistance:** 10,000 Megohms.

**Vibration:*** R shift less than 0.01%.

**Shock:*** R shift less than 0.02%.

*Test methods per specifications and procedures of Mil-R-55182/9.

## Type TK Temp-Stable Precision Film Resistors — Extended Resistance Range

| Model No. | Temperature Coefficient ppm/°C † | Resistance | | Wattage @ +125°C | Max. Working Voltage | Dielect. Str'gth | Dimensions | Encap-sulation | Leadwire |
|---|---|---|---|---|---|---|---|---|---|
| | | Min. | Max. | | | | | | |
| TK621 | 5, 10 or 20 | 501K | 2 Meg | Limited by Maximum Working Voltage | 200 | 300 | Ref. Case "A" Dwg. | Transfer Molded Type | Tinned Copper |
| TK633 | 5, 10 or 20 | 1.51 Meg. | 10 Meg. | | 300 | 400 | Ref. Case "B" Dwg. | Transfer Molded Type | Tinned Copper |
| TK639 | 5, 10 or 20 | 1.51 Meg. | 10 Meg. | | 300 | 400 | Ref. Case "C" Dwg. | Transfer Molded Type | Tinned Copper |

† Specify TC when ordering. 10 PPM/°C is standard.

**Resistance Tolerance:** ±1% Standard. (Tolerances to ±0.05% on special order.)

**Operating Temperature:** −55°C to +175°C.

**TC Temperature Range:** −55°C to +105°C.

**Overload:*** 1.5 times maximum rated working voltage for 5 seconds, R shift less than 0.2%.

**Thermal Shock:** Mil-Std-202, Method 107, Condition B, R shift less than 0.1%.

**Low Temperature Operation:*** R shift less than 0.05%.

**Dielectric Withstanding Voltage:*** R shift less than 0.05%.

**Moisture Resistance:*** Mil-Std-202, Method 106, R shift less than 0.05%.

**Load Life:*** 2000 hours at +125°C, R shift less than 0.2%.

**Shelf Life (Typical):** 200 ppm/year.

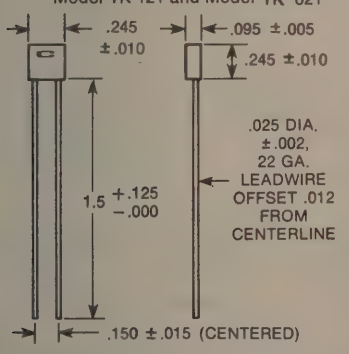
**Insulation Resistance:** 10,000 Megohms.

**Vibration:*** R shift less than 0.05%.

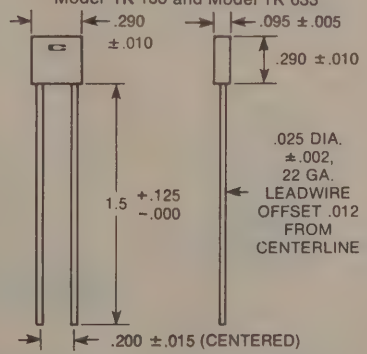
**Shock:*** R shift less than 0.05%.

*Test methods per specifications and procedures of Mil-R-55182/9.

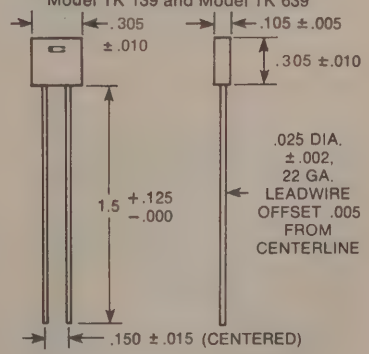
**Case "A"**
Model TK 121 and Model TK 621



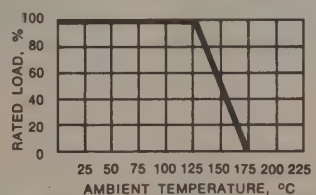

**Case "B"**
Model TK 133 and Model TK 633




**Case "C"**
Model TK 139 and Model TK 639




**DERATING CURVE**




APPLIES TO ALL MODELS OF TYPE TK RESISTORS

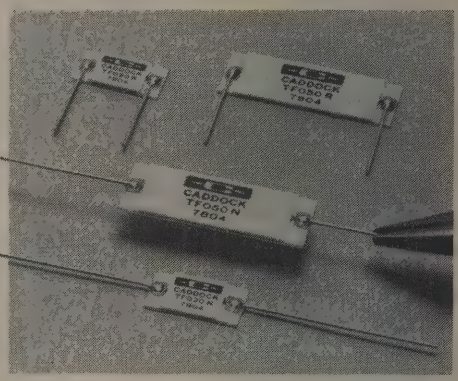
**CADDOCK**
ELECTRONICS, INCORPORATED
3127 CHICAGO AVENUE, RIVERSIDE, CALIFORNIA 92507 PHONE: (714) 683-5361 • TWX: 910-332-6108

# CADDOCK
HIGH PERFORMANCE FILM RESISTORS

# Type TF Low TC Ultra-Precision Film Resistors

## A cost-effective replacement for precision wire-wound resistors.

- **Ultra-Precision** — Resistance tolerance of ±0.1% is standard. Tolerances to ±0.01% are available.
- **Resistance Values** — 1 kohm to 10 Megohms.
- **Low Temperature Coefficient** — Less than 15 ppm/°C.
- **Non-Inductive Performance** — For greater pulse fidelity and wider bandwidths.



Type TF precision resistors employ the new Caddock Tetrinox™ resistance films — the resistance system that sets a new standard for high value, ultra-stable precision resistors.

A whole new approach to quantity production of ultra-precision resistors is the result of combining our unique complex-oxide technology with an advanced high thru-put laser manufacturing capability.

The result: You receive resistors with the highest performance — in quantity — at the lowest cost!

## Standard Type TF Resistors

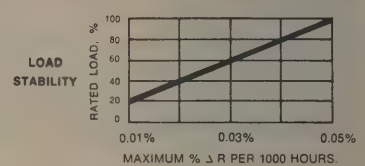
| Model Number | | Wattage @ +70°C. | Maximum Continuous Oper. Voltage | TC ppm/°C | Resistance | | Dimensions | | Leadwire |
|---|---|---|---|---|---|---|---|---|---|
| Axial Leads | Radial Leads | | | | Min. | Max. | A | B | |
| TF 020 N | TF 020 R | .33 | 300 | 15 | 1 K | 2 Meg | .75 ±.020 | .375 ±.020 | Tinned Copper |
| TF 050 N | TF 050 R | .75 | 1400 | 15 | 10 K | 10 Meg | 1.5 ±.020 | .50 ±.020 | Tinned Copper |

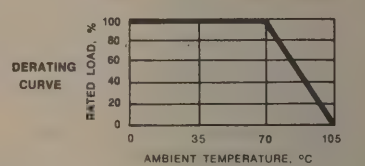
**Absolute Temperature Coefficient:** ±15 PPM/°C from −55°C to +105°C., referenced to +25°C.

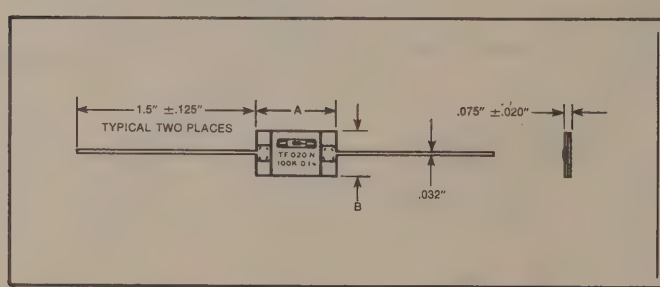
**Resistance Tolerance:** ±0.1% standard. Tolerances to ±0.01% on special order.

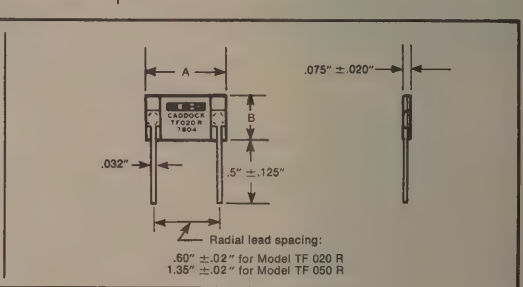
**Storage Temperature:** −55°C to +105°C.

**Shelf Life:** Typically 0.005% per year.



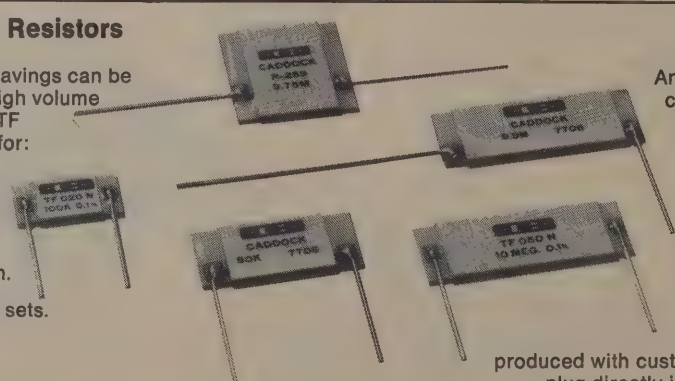




## Custom Type TF Resistors

Additional cost savings can be realized when your high volume ultra-precision Type TF resistor is optimized for:

- Voltage rating.
- Power rating.
- Mechanical configuration.
- Ratio matched sets.



And for special requirements, custom Type TF resistors are available with:

- Resistance values to 25 Megohms.
- TCs of 5 ppm/°C, 10 ppm/°C 15 ppm/°C or 25 ppm/°C.
- Shelf stability of 0.0025% per year.

Type TF resistors can also be produced with custom-spaced radial leads that will plug directly into your existing circuit layouts.

CADDOCK
ELECTRONICS, INCORPORATED
3127 CHICAGO AVENUE, RIVERSIDE, CALIFORNIA 92507 PHONE: (714) 683-5361 • TWX: 910-332-6108

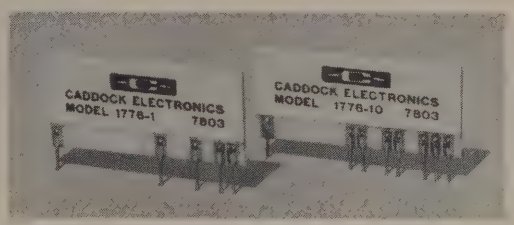
# Type 1776 Precision Decade Resistor Voltage Dividers

**CADDOCK**
HIGH PERFORMANCE FILM RESISTORS

## Input Voltage Dividers for Digital Multimeters and Range-Switching Instruments.

This new edge mount precision decade resistor voltage divider takes less board space and offers more performance than selected discrete resistor sets and thin film networks:

- **Voltage Division Ratios of 10:1, 100:1, 1000:1 and 10,000:1.**
- **Voltage Ratings of 1,200 volts continuous and 2,000 volts overvoltage.**
- **Utilizes Tetrinox™ Temp-Stable Resistance Film.**




| Model No. | Resistance Values | | | | | Fig. | Absolute Tolerance % | Ratio Tolerance % ① | Absolute TC ppm/°C | Ratio TC ppm/°C ② | Voltage Coefficient of Ratio ppm/volt ③ | Ratio Stability % Change in Ratio | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $R_1$ | $R_2$ | $R_3$ | $R_4$ | $R_5$ | | | | | | | Load Life ④ | Shelf Life ⑤ | Over-voltage ⑥ |
| 1776 – 9 | 9.9 Meg | 90 K | 10 K | N/A | N/A | 1 | 0.25 | 0.1 | 30 | 10 | 0.02 | 0.01 | 0.005 | 0.01 |
| 1776 – 91 | 9.9 Meg | 90 K | 10 K | N/A | N/A | 1 | 0.25 | 0.05 | 30 | 10 | 0.02 | 0.01 | 0.005 | 0.01 |
| 1776 – 912 | 9.9 Meg | 90 K | 10 K | N/A | N/A | 1 | 0.25 | 0.02 | 30 | 5 | 0.02 | 0.01 | 0.005 | 0.01 |
| 1776 – 8 | 9.9 Meg | 90 K | 10 K | N/A | N/A | 1 | 0.25 | 0.1 | 30 | 25 | 0.2 | 0.02 | 0.01 | 0.02 |
| 1776 – 81 | 9.9 Meg | 90 K | 10 K | N/A | N/A | 1 | 0.25 | 0.05 | 30 | 25 | 0.2 | 0.02 | 0.01 | 0.02 |
| 1776 – 1 | 9 Meg | 900 K | 90 K | 10 K | N/A | 2 | 0.25 | 0.05 | 30 | 10 | 0.02 | 0.01 | 0.005 | 0.01 |
| 1776 – 14 | 9 Meg | 900 K | 90 K | 10 K | N/A | 2 | 0.25 | 0.1 | 30 | 10 | 0.02 | 0.01 | 0.005 | 0.01 |
| 1776 – 7 | 9 Meg | 900 K | 90 K | 10 K | N/A | 2 | 0.25 | 0.05 | 30 | 25 | 0.2 | 0.02 | 0.01 | 0.02 |
| 1776 – 71 | 9 Meg | 900 K | 90 K | 10 K | N/A | 2 | 0.25 | 0.1 | 30 | 25 | 0.2 | 0.02 | 0.01 | 0.02 |
| 1776 – 23 | 9 Meg | 900 K | 90 K | 9 K | 900 | 3 | 0.1 | 0.1 | 50 | 50 | 0.2 | 0.02 | 0.01 | 0.02 |
| 1776 – 231 | 9 Meg | 900 K | 90 K | 9 K | 900 | 3 | 0.1 | 0.05 | 50 | 50 | 0.2 | 0.02 | 0.01 | 0.02 |
| 1776 – 24 | 9 Meg | 900 K | 90 K | 9 K | 1 K | 3 | 0.25 | 0.1 | 50 | 50 | 0.2 | 0.02 | 0.01 | 0.02 |
| 1776 – 241 | 9 Meg | 900 K | 90 K | 9 K | 1 K | 3 | 0.25 | 0.05 | 50 | 50 | 0.2 | 0.02 | 0.01 | 0.02 |
| 1776 – 10* | 9 Meg | 900 K | 90 K | 10 K | N/A | 4 | +0, −0.5 | 0.1 | 30 | 10 | 0.02 | 0.01 | 0.005 | 0.01 |

*Resistors Isolated

① **Ratio Tolerance:** Maximum ratio difference between any two resistors in the network.

② **Ratio Temperature Coefficient:** Ratio track between any two resistors in the network from 0°C to +70°C.

③ **Voltage Coefficient of Ratio (ppm/volt):** $R_1$ in series with any combination of $R_2$, $R_3$, $R_4$ and $R_5$, 100 volts to 1200 volts.

④ **Load Life:** Ratio stability of resistance under full load. 1200 volts DC applied to all resistors in series for 2000 hours at +70°C.

⑤ **Shelf Stability of Ratio:** Six months at shelf conditions.

⑥ **Overvoltage:** 2000 VDC or Peak AC. $R_1$ and any combination of $R_2$, $R_3$, $R_4$ and $R_5$ in series with $R_1$ for 10 seconds.

**Voltage Rating:** 1200 volts DC or 1000 volts rms AC applied to all resistors in series.

**Storage Temperature:** −55°C to +105°C.

**Figure 1**

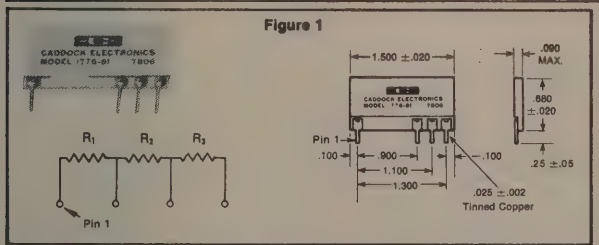



**Figure 2**

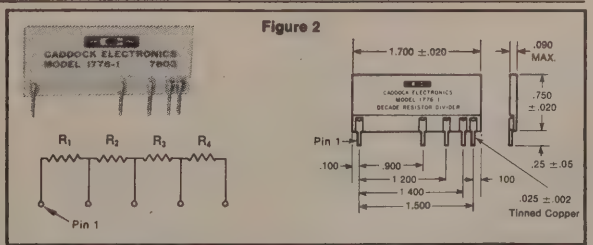



**Figure 3**

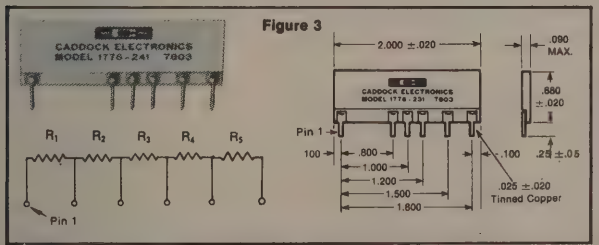
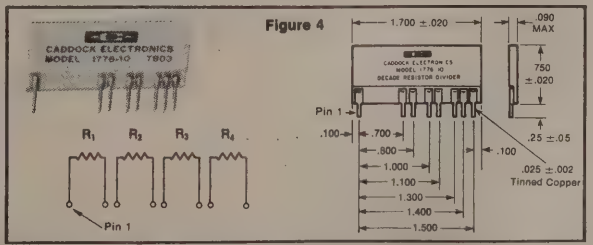



**Figure 4**




**CADDOCK**
ELECTRONICS, INCORPORATED
3127 CHICAGO AVENUE, RIVERSIDE, CALIFORNIA 92507 PHONE: (714) 683-5361 • TWX: 910-332-6108

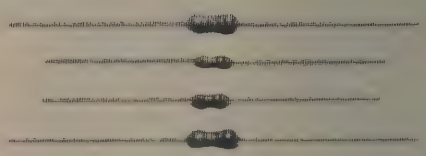
CAPAR COMPONENTS CORPORATION
303 Crossways Park Drive / Woodbury, New York 11797
Telephone: (516) 364-2610
Toll Free: 800-645-7474 / Telex: 144678

RESISTORS

# CMR SERIES
## METAL FILM FIXED RESISTORS

## INTRODUCTION

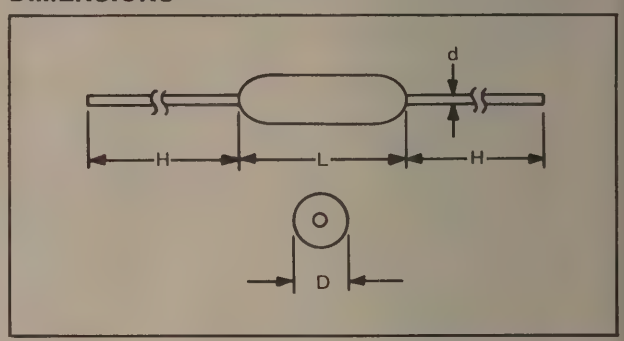
CAPAR's CMR Series Metal Film Resistors are the result of years of research and the utilization of the highest technology available in today's electronic industry. Manufactured to meet or exceed MIL specifications, these resistors are of the highest quality and economical pricing in the resistor market today. Comprised of a specific Nickel-Chrome Alloy deposited by a high vacuum evaporation technique, the resistors feature a controlled temperature coefficient and a low current noise. The resistors are also protected by a multi-layered, heat resistant epoxy resin coating to insure high stability against surrounding conditions.



## PERFORMANCE CHARACTERISTICS & FEATURES

1. MIL Style:
   (a) MIL-R-22684, RL07, RL20.
   (b) MIL-R-10509F, RN55, RN60.
2. Resistance Tolerance: ±2% (G), ±1% (F) available on special order ±0.5% (D), ±0.25% (C), ±0.1% (B).
3. Temperature Coefficient: ±200 ppm/°C (W), ±100 ppm/°C (X) available on special order ±50 ppm/°C (Y), ±25 ppm/°C (Z).
4. Conformal Multi-Coating.
5. Standard EIA Color Coding.

## DIMENSIONS




| Type | Equivalent Type No. | | Body Dimension | | Wire Termination | | Net Weight per 100 pieces |
|---|---|---|---|---|---|---|---|
| | MIL-R-22684 | MIL-R-10509 | Diameter (D) | Length (L) | Diameter (d) | Length (H) | |
| CMR25 | RL07 | RN55 | .093 ±.005 (2.5 Max.) | .250 ±.020 (6.8 Max.) | .024 ±.002 (0.65) | 1.417 ±.118 (36 ±3) | .064 lb. (29g) |
| CMR50 | RL20 | RN60 | .114 ±.015 (3.3 Max.) | .350 ±.025 (9.5 Max.) | .024 ±.002 (0.65) | 1.417 ±.118 (36 ±3) | .119 lb. (54g) |

MILLIMETERS IN ( )

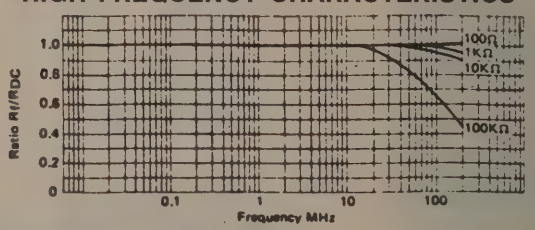
## GENERAL SPECIFICATIONS

| Type | Equivalent Type No. | | Rating Wattage | | Maximum Working Voltage | Maximum Overloading Voltage | Dielectric Withstanding Voltage | Resistance Tolerance | Temperature Coefficient |
|---|---|---|---|---|---|---|---|---|---|
| | MIL-R-22684 | MIL-R-10509 | at 70°C | at 110°C | | | | | |
| CMR25 | RL07 | RN55 | ¼W | ⅛W | 250V | 500V | 900V | 2%(G) | 200ppm/°C (W) |
| CMR50 | RL20 | RN60 | ½W | ¼W | 350V | 700V | 1000V | 1%(F) | 100ppm/°C (X) |
| | | | | | | | | SPECIAL ORDER<br>0.5% (D)<br>0.25% (C)<br>0.1% (B) | SPECIAL ORDER<br>50ppm/°C (Y)<br>25ppm/°C (Z) |

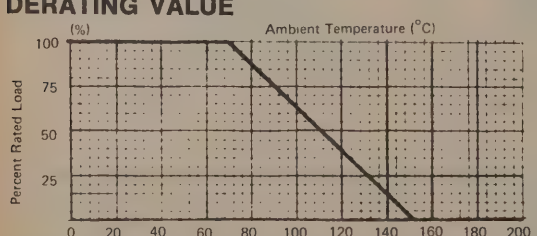
## STANDARD RESISTANCE VALUE RANGE

| Type | Equivalent Type No. | | Resistance Tolerance | |
|---|---|---|---|---|
| | | | 2% (G) | 1% (F) |
| | MIL-R-22684 | MIL-R-10509 | Temperature Coefficient | |
| | | | (E48 Series) | (E96 Series) |
| CMR25 | RL07 | RN55 | 10 ohm to 301K ohm | 49.9 ohm to 301K ohm<br>1 ohm to 1.2 megohm - commercial grade |
| CMR50 | RL20 | RN60 | 10 ohm to 680K ohm | 49.9 ohm to 301K ohm<br>1 ohm to 1.2 megohm - commercial grade |

## HIGH FREQUENCY CHARACTERISTICS

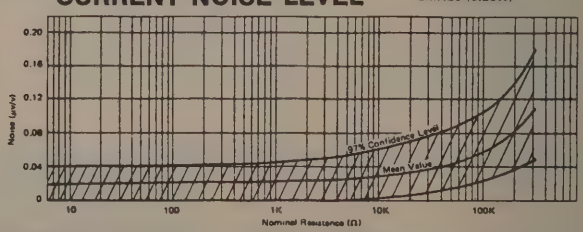



## DERATING VALUE




## CURRENT NOISE LEVEL

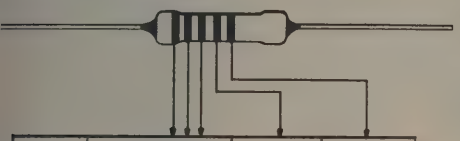
CMR25 (0.25W)



CAPAR COMPONENTS CORPORATION
303 Crossways Park Drive / Woodbury, New York 11797
Telephone: (516) 364-2610
Toll Free: 800-645-7474 / Telex: 144678

# RESISTORS
# CMR SERIES
## METAL FILM FIXED RESISTORS

## COLOR CODING



| Color | 1st, 2nd, 3rd Significant Figure | Multiplier | Tolerance |
|---|---|---|---|
| Black | 0 | 1 | — |
| Brown | 1 | 10 | 1% |
| Red | 2 | $10^2$ | 2% |
| Orange | 3 | $10^3$ | — |
| Yellow | 4 | $10^4$ | — |
| Green | 5 | $10^5$ | 0.5% |
| Blue | 6 | $10^6$ | — |
| Violet | 7 | $10^7$ | — |
| Grey | 8 | $10^8$ | — |
| White | 9 | $10^9$ | — |
| Gold | — | $10^{-1}$ | 5% |
| Silver | — | $10^{-2}$ | — |

1st band: digit
2nd band: digit
3rd band: digit
4th band: multiplier
5th band: tolerance

## STANDARD RESISTANCE DECADE VALUE

| E 48 (±2%) | E 96 (±1%) | E 48 (±2%) | E 96 (±1%) | E 24 (±5%) |
|---|---|---|---|---|
| 1.00 | 1.00 | 3.16 | 3.16 | 1.0 |
| | 1.02 | | 3.24 | |
| 1.05 | 1.05 | 3.32 | 3.32 | 1.1 |
| | 1.07 | | 3.40 | |
| 1.10 | 1.10 | 3.48 | 3.48 | 1.2 |
| | 1.13 | | 3.57 | |
| 1.15 | 1.15 | 3.65 | 3.65 | 1.3 |
| | 1.18 | | 3.74 | |
| 1.21 | 1.21 | 3.83 | 3.83 | 1.5 |
| | 1.24 | | 3.92 | |
| 1.27 | 1.27 | 4.02 | 4.02 | 1.6 |
| | 1.30 | | 4.12 | |
| 1.33 | 1.33 | 2.37 | 4.22 | 1.8 |
| | 1.37 | | 4.32 | |
| 1.40 | 1.40 | 4.42 | 4.42 | 2.0 |
| | 1.43 | | 4.53 | |
| 1.47 | 1.47 | 4.64 | 4.64 | 2.2 |
| | 1.50 | | 4.75 | |
| 1.54 | 1.54 | 4.87 | 4.87 | 2.4 |
| | 1.58 | | 4.99 | |
| 1.62 | 1.62 | 5.11 | 5.11 | 2.7 |
| | 1.65 | | 5.23 | |
| 1.69 | 1.69 | 5.36 | 5.36 | 3.0 |
| | 1.74 | | 5.49 | |
| 1.78 | 1.78 | 5.62 | 5.62 | 3.3 |
| | 1.82 | | 5.76 | |
| 1.87 | 1.87 | 5.96 | 5.96 | 3.6 |
| | 1.91 | | 6.04 | |
| 1.96 | 1.96 | 6.19 | 6.19 | 3.9 |
| | 2.00 | | 6.34 | |
| 2.05 | 2.05 | 6.49 | 6.49 | 4.3 |
| | 2.10 | | 6.65 | |
| 2.15 | 2.15 | 6.81 | 6.81 | 4.7 |
| | 2.21 | | 6.98 | |
| 2.26 | 2.26 | 7.15 | 7.15 | 5.1 |
| | 2.32 | | 7.32 | |
| 1.33 | 2.37 | 7.50 | 7.50 | 5.6 |
| | 2.43 | | 7.68 | |
| 2.49 | 2.49 | 7.87 | 7.87 | 6.2 |
| | 2.55 | | 8.06 | |
| 2.61 | 2.61 | 8.25 | 8.25 | 6.8 |
| | 2.67 | | 8.45 | |
| 2.74 | 2.74 | 8.66 | 8.66 | 7.5 |
| | 2.80 | | 8.87 | |
| 2.87 | 2.87 | 9.09 | 9.09 | 8.2 |
| | 2.94 | | 9.31 | |
| 3.01 | 3.01 | 9.53 | 9.53 | 9.1 |
| | 3.00 | | 9.76 | |

E 192 (±0.5%) Values on request

## CAPAR CMR SERIES AND MILITARY PERFORMANCE CHARACTERISTIC OUTLINE

| Performance Characteristic and Test | CAPAR CMR Series | MIL-R-22684B | MIL-R-10509F | Test Methods |
|---|---|---|---|---|
| EQUIVALENT TYPE NO. (STYLE) | CMR25<br>CMR50 | RL07<br>RL20 | RN55<br>RN60 | |
| INSULATION RESISTANCE | 10,000 M ohm | 10,000 M ohm | 10,000 M ohm | Resistors shall be clamped in the trough of a 90° metallic V-block and shall be measured at DC 500V |
| DIELECTRIC WITHSTANDING VOLTAGE ΔR* | 0.25% | 0.5% | 0.5% | Resistors shall be clamped in the trough of a 90° metallic V-block and shall be tested at AC potential respectively specified in the above list for a second |
| MOISTURE RESISTANCE ΔR* | 1.5% | 1.5% | 1.5% | Temporary resistance change after continuous 10 cycles for duty cycle specified per MIL-STD-202 Method 106 |
| TEMPERATURE CYCLING ΔR* | 0.35% | 1.0% | 0.5% | Resistance change after continuous five cycles for duty specified below<br>Step — Temperature — Time<br>1 — −65°C — 30 minutes<br>2 — 25°C — 10-15 minutes<br>3 — 150°C — 30 minutes<br>4 — 25°C — 10-15 minutes |
| SHORT TIME OVERLOAD ΔR* | 0.25% | 0.5% | 0.5% | Permanent resistance change after the application operating at RCWV or max. RCWV, whichever is less overload voltage respectively specified in the above list, whichever less for 5 seconds |
| LOAD LIFE ΔR* | 1.0% | 1.5% | 1.5% | Permanent resistance change after 1,000 hours operating at RCWV or max RCWV, whichever less with duty cycle of 1.5 hours "on", 0.5 hour "off" at 70 ±2°C ambient |
| RESISTANCE TO SOLDERING HEAT ΔR* | .3% | 0.5% | 0.5% | Permanent resistance chance when leads immersed to 3.17-4.76mm (.125-.187 inch) from the body in 350 ±10°C solder for 3 ±0.5 seconds |
| LOW TEMPERATURE OPERATION ΔR* | .35% | 0.5% | 0.5% | Resistor shall be placed in a cold chamber at room temperature, the temperature shall be gradually decreased to −65° +0°C, −5°C<br>After 1 hour of stabilization at this temperature, RCWV or max. RCWV, whichever less shall be applied for 45 minutes, return to room temperature, resistance change measured 24 hours after the test |
| RESISTANCE TO SOLVENT | Permanent and legible marking MIL-STD-202 Method 215 | Permanent and legible marking MIL-STD-202 Method 215 | Permanent and legible marking MIL-STD-202 Method 215 | Per MIL-STD-202 Method 215 solvent solutions<br>: trichloroethylene<br>: trichlorotrifluoroethane (Freon TMC)<br>: trichloroethane |
| CURRENT NOISE | −14db (0.2/ v/v) | | | The inherent current noise measured utilizing Quan-Tech Lab's Resistor Noise Set (Model 315) per MIL-STD-202 Method 308 IEC-PUB-115-114 |
| TERMINAL STRENGTH ΔR* | .2% | 0.5% | 0.5% | Direct Load:<br>Resistance to a 2.2kg (5 lbs.) direct load for 5 seconds in the direction of the longitudinal axis of the terminal leads<br>Twist Test:<br>Terminal leads shall be bent through 90° at a point of 6.35mm (.25 inch) from the body of resistor and shall be rotated through 360° about the original axis of the bent terminal in alternating direction for a total of 3 rotations |
| POWER CONDITIONING ΔR* | 1.0% | N.A. | N.A. | Resistance change after 24 hours operating at 1.5 times rated power, or max. RCWV, whichever less at 25°C ambient |
| HIGH TEMPERATURE EXPOSURE ΔR* | 1.5% | N.A. | N.A. | Resistance change after 2000 hours exposure at 150°C ambient with no load |
| DAMP HEAT (STEADY STATE) ΔR* | .5% | 0.5% | 0.5% | Resistance change after 56 days (1344 hours) operating at one-tenth RCWV, but not exceeding one-tenth max. RCWV in a humidity chamber, controlled at 40°C ±2°C and 90 to 95% RH per IEC-68-2-3 Condition Ca. |
| CLIMATIC SEQUENCE IEC-PUB-115-1 clause 23 ΔR* | .5% | .5% | .5% | Resistance change after following sequence<br>1. Dry Heat: exposure at 155°C for 16 hours<br>2. Damp Heat (accelerated) first cycle: 1 cycle specified per IEC-68-2-4 Test D<br>3. Cold: exposure at −55°C for 2 hours<br>4. Low Air Pressure: exposure at air-pressure of 85m bar. for 1 hour<br>5. Damp Heat (accelerated) remaining cycles: 5 cycles specified per IEC-68-2-4 Test D |
| SHELF LIFE ΔR* | 0.2% | 0.2% | N.A. | Temporary resistance change due mainly to high humidity during storage at natural room conditions/Year |

* Total resistance chance ± ( % +0.05 ohm)

SIZES ARE SUBJECT TO CHANGE WITHOUT NOTICE

CAPAR COMPONENTS CORPORATION
303 Crossways Park Drive / Woodbury, New York 11797
Telephone: (516) 364-2610
Toll Free: 800-645-7474 / Telex: 144678

RESISTORS

# CCF SERIES
## CARBON FILM FIXED RESISTORS

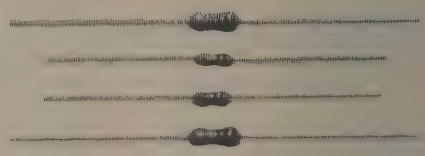
## INTRODUCTION

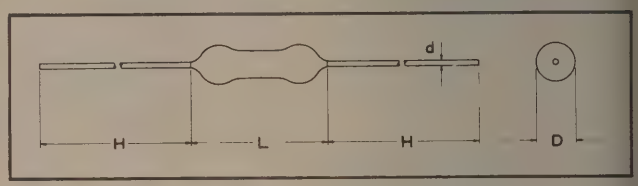
The CCF Series are low cost, high performance and highly reliable carbon film resistors.

They have been designed for miniature circuits that require resistors with greater stability and reliability than carbon composition types.

These resistors feature welded cap and lead construction, color coding resistant to all major cleaning solvents, uniform body sizing and special solder coated leads for easy soldering. The resistors exceed performance characteristics of MIL-R-11f.

The resistors are available card packed (50 to a sleeve, 1,000 to a box), taped and reeled, and cut and formed to customer specifications. New expanded resistance range 1 ohm through 10 megohm.





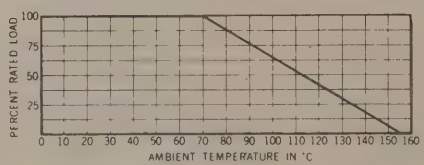

## SPECIFICATIONS — INCHES & (MILLIMETERS)

| Type | Body | | Leadwire | |
|---|---|---|---|---|
| | Length (L) | Diameter (D) | Length (L) | Diameter (D) |
| CCF 25 | .263 ±.012 (6.7 ±0.3) | .095 ±.008 (2.4 ±0.2) | 1.1 ±0.1 (28.0 max.) | .024 ±.001 (0.6 ±0.02) |
| CCF 50 | .374 ±.02 (9.5 ±0.5) | .146 ±.008 (3.7 ±0.2) | 1.2 ±.12 (38.0 ±3.0) | .031 ±.001 (0.8 ±0.03) |

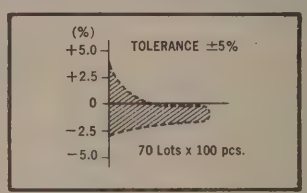
## RATING

| Style | Power Rating | Max. Working V. | Max. Overload V. | Rating Amb. Temp. | Resistance Range ±5% (J) |
|---|---|---|---|---|---|
| CCF 25 ¼W | 0.25W | 300V | 600V | 70°C | 1.0Ω≈10MΩ |
| CCF 50 ½W | 0.50W | 350V | 700V | 70°C | 1.0Ω≈10MΩ |

## DERATING CURVES



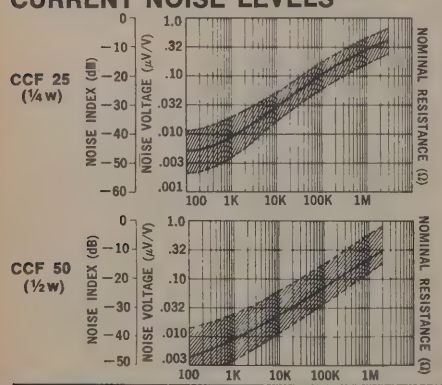

## RESISTANCE DISTRIBUTION



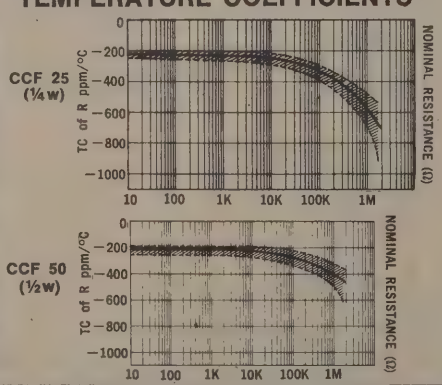

## CHARACTERISTICS

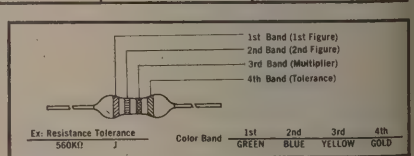
| Requirements | | Characteristics | | | | | Test Method JIS C 6402 | Test Method EIA RS-196A |
|---|---|---|---|---|---|---|---|---|
| Operating Temp. Range | | −25 ≈ 125°C | | | | | | |
| Temp. Coefficient (ppm/°C) | Style T.C.R. | 0≈−350 | 0≈−500 | 0≈−700 | 0≈−1,000 | 0≈−1,200 | 3.2 | 5.2.4 |
| | CCF 25 | 2.2Ω≈100KΩ | 110KΩ≈470KΩ | 510KΩ≈1MΩ | 1.1MΩ≈1.5MΩ | 1.6MΩ≈10MΩ | | |
| | CCF 50 | 2.2Ω≈100KΩ | 110KΩ≈680KΩ | 750KΩ≈1.5MΩ | 1.6MΩ≈2.2MΩ | 2.4MΩ≈10MΩ | | |
| Noise (μ v/v) | Style Noise | 0.1 | 0.3 | 0.6 | 1.0 | | RESISTOR NOISE TEST SET MODEL PA-103B NATIONAL JIS C 5202 5.9 TEST METHOD II | |
| | CCF 25 | 2.2Ω≈22KΩ | 24KΩ≈330KΩ | 360KΩ≈1.5MΩ | 1.6MΩ≈10MΩ | | | |
| | CCF 50 | 2.2Ω≈22KΩ | 24KΩ≈560KΩ | 620KΩ≈3.9MΩ | 4.7MΩ≈10MΩ | | | |
| Dielectric Withstanding Voltage | | No evidence of flashover, breakdown | | | | | (Resistance body; M. W. V. 5 sec. V Block) (Lead wire insulated part; 100 V 5 sec.) | |
| MAX. RESISTANCE CHANGES | Short Time Overload | ±(1% +0.05Ω) | | | | | 3.3 | 5.2.5 |
| | Vibration | ±2% | | | | | 3.9 | (MIL-STD-202 201A) |
| | Temp. Cycling | ±2% | | | | | 3.8 | 5.2.3 |
| | Effect of Soldering | ±(1% +0.05Ω) | | | | | 3.7 | (MIL-R-22684 4.6.9) |
| | Moisture Resistance | ±5% | | | | | 3.4 | 5.2.8 |
| | Load Life | ±3% | | | | | 3.6 | 5.2.9 |

## CURRENT NOISE LEVELS




## TEMPERATURE COEFFICIENTS




## COLOR CODE

| Color | 1st & 2nd Bands | 3rd Band | 4th Band | Color | 1st & 2nd Bands | 3rd Band | 4th Band |
|---|---|---|---|---|---|---|---|
| Black | 0 | $10^0$ | — | Violet | 7 | $10^7$ | — |
| Brown | 1 | $10^1$ | ±1% (F) | Gray | 8 | $10^8$ | — |
| | | | | White | 9 | $10^9$ | — |
| Red | 2 | $10^2$ | ±2% (G) | Gold | — | $10^{-1}$ | ±5% (J) |
| Orange | 3 | $10^3$ | — | Silver | — | $10^{-2}$ | ±10% (K) |
| Yellow | 4 | $10^4$ | — | | | | |
| Green | 5 | $10^5$ | — | Plain | — | — | — |
| Blue | 6 | $10^6$ | — | | | | |

SIZES ARE SUBJECT TO CHANGE WITHOUT NOTICE

# CORNING® RESISTORS

CORNING GLASS WORKS, CORNING ELECTRONICS
HOUGHTON PARK, A2, CORNING, NEW YORK 14830

## DISTRICT SALES OFFICES

| Littleton, MA | Raleigh, NC | Chicago, IL | Orange, CA |
|---|---|---|---|
| 617-486-3125 | 919-876-1100 | 312-693-6830 | 714-771-0260 |

## OEM CUSTOMER SERVICE AND PRODUCT ENGINEERING

| FP Series | Other Resistor Products | Product Engineering |
|---|---|---|
| Wilmington, NC, 919-791-5040 | Bradford, PA, 814-362-5571 | Bradford, PA, 814-362-5571 |

## RESISTORS FROM CORNING

**Precision Metal Film**

| | |
|---|---|
| RN, E Series (± 25 ppm/°C.) | MIL-R-10509 |
| RN, C Series (± 50 ppm/°C.) | MIL-R-10509 |
| RN, D Series (± 100 ppm/°C.) | MIL-R-10509 |

**Established Reliability Metal Film**

| | |
|---|---|
| RNC Series (± 25, ± 50, ± 100 ppm/°C.) | MIL-R-55182 |
| RLR Series (± 100 ppm/°C.) | MIL-R-39017 |

**Semi-precision Metal Film**

| | |
|---|---|
| RL Series (± 100, ± 200 ppm/°C.) | MIL-R-22684 |
| C Series (± 100, ± 200 ppm/°C) | COMMERCIAL |

**Flameproof Metal Film**

| | |
|---|---|
| FP Series | COMMERCIAL |

**Low-OHM Metal Film**

| | |
|---|---|
| FL and LO Series | COMMERCIAL |
| Minichip MK | |

## LOCAL SALES, SERVICE AND INVENTORY FROM THESE CORNING FRANCHISED DISTRIBUTORS

| | | |
|---|---|---|
| AZ Phoenix, Liberty Electronics | 602-249-2232 | |
| CA Sunnyvale, Bell Industries | 408-734-8570 | |
| CA Gardena, Bell Industries | 213-515-1800 | |
| CA Mountain View, Elmar Electron. | 415-961-3611 | |
| CA San Diego, Liberty Electronics | 714-565-9171 | |
| CA El Segundo, Liberty Electron. | 213-322-8100 | |
| CO Denver, Cramer/Denver | 303-758-2100 | |
| CO Commerce City, Elmar Electron. | 303-287-9611 | |
| CT North Haven, Cramer/Connecticut | 203-239-5641 | |
| FL Hollywood, Cramer/Hollywood | 305-921-7878 | |
| FL Orlando, Cramer/Orlando | 305-894-1511 | |
| FL Ft. Lauderdale, Hamilton/Avnet | 305-971-3491 | |
| GA Norcross, Cramer/Atlanta | 404-448-9050 | |
| IL Chicago, Bell Industries | 312-982-9210 | |
| IN Indianapolis, Pioneer/Indiana | 317-849-7300 | |
| KS Overland Pk., Hamilton/Avnet | 913-888-8900 | |
| MD Gaithersburg, Cramer/Washington | 301-948-0110 | |
| MD Lanham, Milgray/Washington | 301-459-2222 | |
| MD Baltimore, RESCO/Baltimore | 301-823-0070 | |
| MA Newton Centre, Cramer Electron. | 617-969-7700 | |
| MA Billerica, Kierulff Electronics | 617-667-8331 | |
| MA Watertown, Sterling Electronics | 617-894-6200 | |
| MI Livonia, Pioneer/Michigan | 313-525-1800 | |
| MN St. Paul, Ragon Electronics | 612-488-0201 | |
| NJ Cherry Hill, Cramer/Penn | 609-424-5993 | |
| NJ Somerset, Schweber Electronics | 201-469-6008 | |
| NM Albuquerque, Cramer/New Mexico | 505-243-4566 | |
| NY Farmingdale, Arrow Electronics | 516-694-6800 | |
| NY Hauppauge, Cramer/Long Island | 516-231-5600 | |
| NY Rochester, Cramer/Rochester | 716-275-0300 | |
| NY East Syracuse, Cramer/Syracuse | 315-437-6671 | |
| NY Freeport, Milgray Electronics | 516-546-6000 | |
| NY Westbury, Schwebber Electron. | 516-334-7474 | |
| NC Winston-Salem, Cramer/ Winston-Salem | 919-725-8711 | |
| NC Raleigh, RESCO/Raleigh | 919-781-5700 | |
| OH Columbus, Hughes-Peters | 614-294-5351 | |
| OH Cleveland, Pioneer/Cleveland | 216-587-3600 | |
| OH Dayton, Pioneer/Dayton | 513-236-9900 | |
| OH Cincinnati, Sheridan Sales | 513-761-5432 | |
| OH Dayton, Sheridan Assoc. | 513-223-3332 | |
| PA Philadelphia, Almo Electronics | 215-698-4000 | |
| PA Pittsburgh, Pioneer/Pittsburgh | 412-782-2300 | |
| TX Dallas, Hamilton/Avnet | 214-661-8661 | |
| TX Houston, Hamilton/Avnet | 713-780-1771 | |
| TX Dallas, Solid State Electronics | 214-352-2601 | |
| WA Bellevue, Liberty Electronics/NW | 206-453-8300 | |
| Can. Montreal, Cesco Electron. Ltd. | 514-735-5511 | |
| Can. Toronto, Cesco Electron. Ltd. | 416-661-0220 | |

CORNING

# CARBORUNDUM NON-INDUCTIVE POWER RESISTORS

**Choose Type SP** for great A-C power handling capability, whether it be at power frequency or many megahertz.

**Choose Type A** when high resistance is required in a high power non-inductive resistor.

**Choose Type AS** for its ability to absorb huge amounts of energy and for its non-inductive property at high voltage.

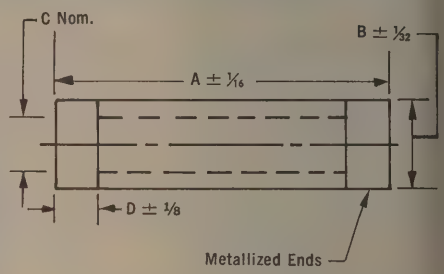
| CHARACTERISTICS | Type SP | Type AS | Type A |
|---|---|---|---|
| Maximum Operating Temperature: °C | 350 | 230<br>150* | 230 |
| Temperature Coefficient: Percent per degree C, −55°C to maximum rated temperature | 0.075 | 0.075 | 0.10 |
| Voltage Coefficient: Maximum percent per kilovolt per inch active length (overall length less termination) | 1.0 | 1.0 | — |
| Short Time Overload: Maximum percent change after 5 cycles 10 times rated power, 5 seconds on, 90 seconds off | 2.0 | 2.0 | — |
| Moisture Resistance: Maximum percent change when tested per MIL-STD-202 method 103 | 2.5 | 2.5 | 2.5 |

*with mylar insulation

## STANDARD SIZES

(Special sizes are also available: consult factory.)

| Type | A | B | C (SP & AS) | C (A) | D |
|---|---|---|---|---|---|
| 884 SP | 2.0 | 0.50 | 0.22 | — | 0.25 |
| 885 SP, AS, & A | 2.5 | 0.75 | 0.50 | 0 | 0.50 |
| 886 SP, AS, & A | 5.0 | 0.75 | 0.50 | 0 | 0.62 |
| 887 SP, AS, & A | 6.0 | 1.00 | 0.75 | 0.5 | 0.50 |
| 888 SP, AS, & A | 8.0 | 1.00 | 0.75 | 0.5 | 0.88 |
| 889 SP, AS, & A | 12.0 | 1.00 | 0.75 | 0.5 | 0.88 |
| 890 SP, AS, & A | 18.0 | 1.00 | 0.75 | 0.5 | 0.88 |
| 891 SP | 18.0 | 2.00 | 1.50 | — | 1.00 |
| 892 SP | 24.0 | 2.00 | 1.50 | — | 1.00 |




## ELECTRICAL SPECIFICATIONS

| Size and Type | Resistance Available (ohms) Premium to | Standard to | Premium to | Average Power @ 40°C (watts) | Peak Energy (joules) | Peak Voltage (volts) |
|---|---|---|---|---|---|---|
| **2" long x ½" diameter** | | | | | | |
| 884SP | 1.0 | 5.0 | 100 | 200 | 22.5 | 250 | 1,000 |
| **2½" long x ¾" diameter** | | | | | | |
| 885SP | 1.0 | 5.0 | 82.0 | 130 | 45 | 250 | 1,000 |
| 885AS | 6.0 | 100 | 1000 | 1200 | 15 | 2,500 | 4,000 |
| 885AS..M | 6.0 | 100 | 1000 | 1200 | 10 | 2,500 | 8,000* |
| 885A | | 1500 | 220K | 2.2M | 15 | 750 | 3,750 |
| **5" long x ¾" diameter** | | | | | | |
| 886SP | 1.0 | 5.0 | 180 | 330 | 90 | 500 | 4,000 |
| 886AS | 15.0 | 220 | 2200 | 3300 | 30 | 5,000 | 10,000 |
| 886AS..M | 15.0 | 220 | 2200 | 3300 | 19.5 | 5,000 | 20,000* |
| 886A | | 3900 | 390K | 3.9M | 30 | 1,500 | 10,000 |
| **6" long x 1" diameter** | | | | | | |
| 887SP | 1.0 | 5.0 | 82.0 | 330 | 150 | 1,600 | 4,000 |
| 887AS | 12.0 | 100 | 2200 | 3300 | 50 | 15,000 | 15,000 |
| 887AS..M | 12.0 | 100 | 2200 | 3300 | 32.5 | 15,000 | 30,000* |
| 887A | | 3900 | 390K | 3.9M | 50 | 6,000 | 12,000 |
| **8" long x 1" diameter** | | | | | | |
| 888SP | 1.0 | 5.0 | 120 | 390 | 190 | 2,100 | 6,000 |
| 888AS | 15.0 | 150 | 2700 | 3900 | 75 | 20,000 | 22,500 |
| 888AS..M | 15.0 | 150 | 2700 | 3900 | 49 | 20,000 | 45,000* |
| 888A | | 4700 | 470K | 4.7M | 60 | 7,500 | 15,000 |
| **12" long x 1" diameter** | | | | | | |
| 889SP | 1.0 | 10.0 | 180 | 680 | 275 | 3,200 | 10,000 |
| 889AS | 25.0 | 220 | 5000 | 6800 | 100 | 35,000 | 37,500 |
| 889AS..M | 25.0 | 220 | 5000 | 6800 | 65 | 35,000 | 75,000* |
| 889A | | 8200 | 680K | 6.8M | 90 | 12,500 | 25,000 |
| **18" long x 1" diameter** | | | | | | |
| 890SP | 1.0 | 10.0 | 270 | 1000 | 375 | 4,200 | 16,000 |
| 890AS | 40.0 | 330 | 8500 | 10K | 150 | 50,000 | 60,000 |
| 890AS..M | 40.0 | 330 | 7500 | 10K | 98 | 50,000 | 120,000* |
| 890A | | 12K | 750K | 10Meg | 125 | 20,000 | 40,000 |
| **18" long x 2" diameter** | | | | | | |
| 891SP | 1.0 | 10.0 | 75.0 | 450 | 750 | 15,000 | 16,000 |
| **24" long x 2" diameter** | | | | | | |
| 892SP | 1.0 | 10.0 | 100 | 600 | 1000 | 17,500 | 22,000 |

*Type AS with mylar: Add "M" as last character in part number.

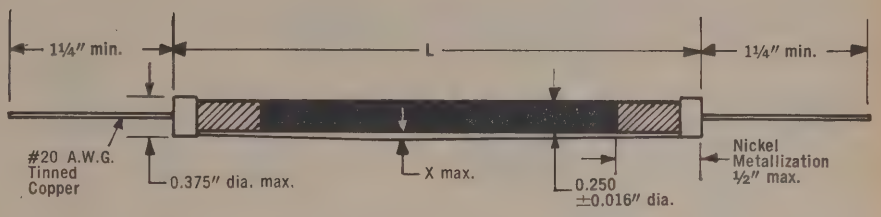
The Carborundum Company, Graphite Products Division, Post Office Box 339, Niagara Falls, N.Y. 14302 Tel: (716) 278-2521 Telex: 91-555 (CARBO GLO NGF)

CARBORUNDUM

# CARBORUNDUM NON-INDUCTIVE POWER RESISTORS FOR SPECIAL PROBLEM SOLUTIONS

## TYPE AS "PENCIL-SHAPED" STYLE

The high-energy absorbing characteristic of the Carborundum type AS material is available in these pencil-shaped resistors to offer the unique non-inductive high-voltage properties in a compact easily wired configuration.



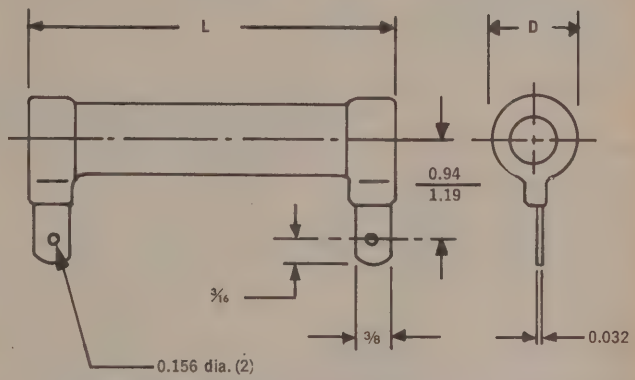

| Type No. | L +0.25 −0 | X | Resistance Available (ohms) Premium to | Standard to | Premium to | | Average Power @ 40°C (watts) | Peak Energy (joules) | Peak Voltage (volts) |
|---|---|---|---|---|---|---|---|---|---|
| 104 AS | 4 | 0.08 | 55 | 420 | 9,000 | 13,500 | 9 | 1,200 | 9,000 |
| 106 AS | 6 | 0.12 | 90 | 700 | 15,000 | 22,000 | 13 | 1,900 | 15,000 |
| 109 AS | 9 | 0.16 | 150 | 1,150 | 25,000 | 36,000 | 20 | 3,000 | 25,000 |

## TYPE AS EPOXY COATED STYLE

Carborundum Type AS High-Energy Ceramic Resistors are available with an epoxy coating which protects the resistors body from contaminants. It is especially useful where the resistor is employed in an application where it is not protected from a dirty ambient atmosphere or where it is immersed in a cooling or dielectric fluid.

In air the coated resistor can safely dissipate 75% of the power dissipated by an uncoated part.

The overall length, L, of the coated resistor is approximately 0.25" longer than the uncoated part; the diameter, D, is approximately 0.30" greater.




## TYPE AS DISC AND WASHER STYLES

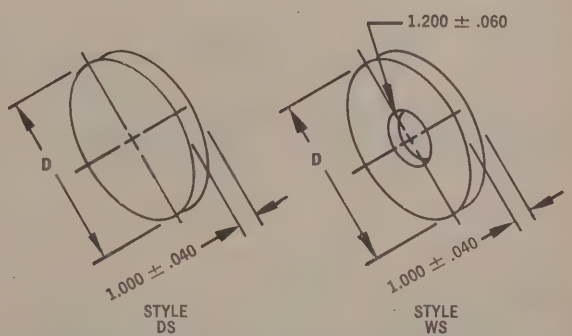
Carborundum Type AS Disc and Washer Ceramic Resistors are a bulk-type low resistance element, and therefore have the ability to absorb instantaneously great surges of energy with virtually zero inductance.

Maximum Peak Voltage: 5000 volts.

Maximum Temperature: 230°C.

Power Rating: In free air, parts will safely dissipate 2.5 watts per square inch of surface area at 40°C.

Temperature Coefficient of Resistance: −0.1%/°C to 0.0%/°C.




| Style | | Diameter "D" (inches) | Peak Energy (joules) | Available Resistances Minimum | Maximum |
|---|---|---|---|---|---|
| 911DS | Solid Disc | 1.60 ± 0.06 | 9,000 | 1.6 | 800 |
| 912DS | Solid Disc | 2.37 ± 0.06 | 21,000 | 0.7 | 90 |
| 913DS | Solid Disc | 3.00 ± 0.08 | 33,000 | 0.5 | 56 |
| 914DS | Solid Disc | 3.75 ± 0.08 | 52,500 | 0.3 | 36 |
| 913WS | Washer | 3.00 ± 0.08 | 27,600 | 0.5 | 78 |
| 914WS | Washer | 3.75 ± 0.08 | 47,000 | 0.3 | 40 |
| 915WS | Washer | 4.37 ± 0.08 | 65,500 | 0.2 | 28 |
| 916WS | Washer | 4.75 ± 0.08 | 79,500 | 0.2 | 24 |

The Carborundum Company, Graphite Products Division, Post Office Box 339, Niagara Falls, N.Y. 14302 Tel: (716) 278-2521 Telex: 91-555 (CARBO GLO NGF)

CARBORUNDUM

# CARBORUNDUM NON-INDUCTIVE POWER RESISTORS FOR SPECIAL PROBLEM SOLUTIONS

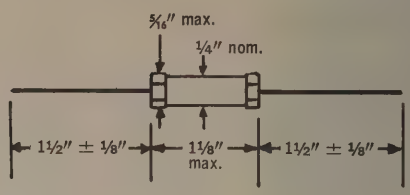
## TYPE 234SP RESISTORS

Carborundum's Type 234SP Resistor is offered in a small size, ¼ inch diameter by 1 inch long, capable of dissipating a full 10 watts of power at 40°C. It also offers these advantages:

### SPECIFICATIONS

Resistance: 1-330 ohms ±5% ±10% ±20%
Maximum Peak Voltage: 500 volts
Maximum Power at 40°C: 10.0 watts
Derate Linearly to 0 watts at 350°C
Maximum Operating Temperature: 350°C
Maximum Peak Energy: 30 joules

- **Non-Inductive**
  The Type 234SP is a bulk resistor. There are no spirals, no windings.
- **Surge Capability**
  The bulk of the body can absorb a surge of several seconds duration far better than a wire or film.
- **High Power Capability**
  The Type 234SP Resistor can glow dull red for short periods and return to near original resistance.




### CHARACTERISTICS

Short Time Overload (Max. change in resistance after 10 cycles at 1000% rated power, 5 seconds on, 90 seconds off: 10%

Life (Maximum change in resistance after 1000 hours at rated power): 5%

Note: The above characteristics are for parts 100 ohms and less. Power for tests is alternating current. If DC power is applied to resistor, changes in resistances may be substantially greater.

Temperature Coefficient of Resistance 0°C to 350°C (Maximum change*): ±.075%/°C

*Generally highest resistances have a negative TCR and lower resistances have a positive TCR.

# CARBORUNDUM® VARISTORS

Standard varistors described below have a 10% tolerance on voltage. Also available: leadless discs and rods, voltages specified at intermediate values or at other currents, and voltage tolerances of ±15% and ±20%. Available at extra cost: voltage tolerances of ±5% and ±7%, color coding, and special coatings.

Standard rod varistors have a blue epoxy coating. Available at extra cost: formed leads for printed circuit board insertion.

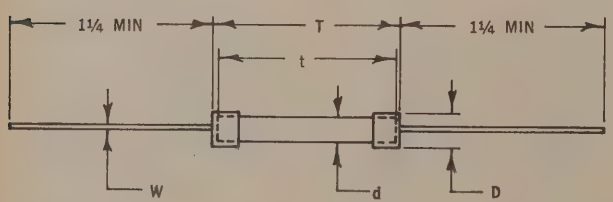



Figure 1

Standard disc varistors have a black flame-retardant PVC coating. Also available: Glyptal coating and kinked leads for printed circuit board insertion.

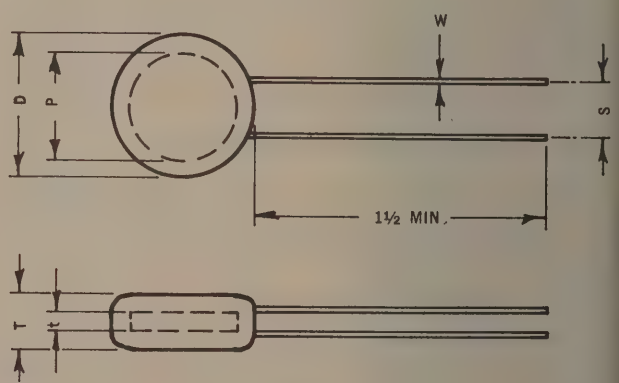



Figure 2

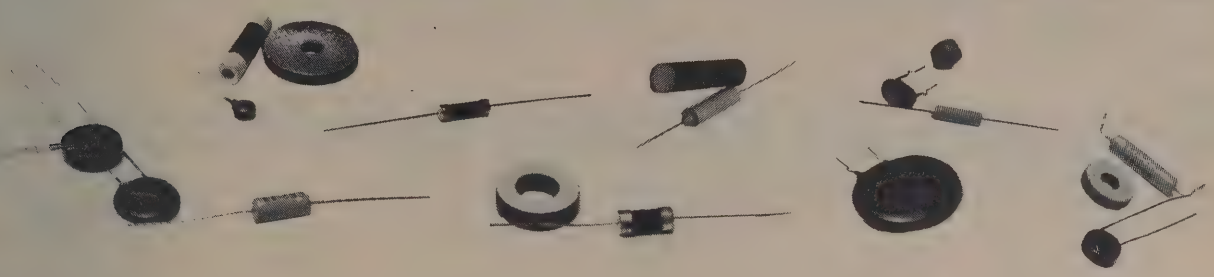
### VOLTAGES AVAILABLE

| | Carborundum Style Number | Volts ±10% at 1.0 MA | Volts at 1.0 MA Volts at .1 MA | Peak Voltage | Power Watts | d ±.030 | t ±.030 | D max. | T max. | w nom. | s nom. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ROD STYLES (Figure 1) | 231BNR4- | 100-750 | 2.1-1.7 | 800 | 0.750 | 0.156 | 0.625 | 0.250 | 0.812 | 0.032 | — |
| | 233BNR4- | 68-710 | 2.1-1.7 | 800 | 1.000 | 0.250 | 0.625 | 0.375 | 0.812 | 0.032 | — |
| | 234BNR4- | 135-1050 | 2.2-1.7 | 1500 | 1.500 | 0.250 | 1.000 | 0.375 | 1.188 | 0.032 | — |
| | **Carborundum Style Number** | **Volts ±10% at 1.0 MA** | **Volts at 1.0 MA Volts at .1 MA** | **Peak Voltage** | **Power Watts** | **d ±.030** | **t ±.030** | **D max.** | **T max.** | **w nom.** | **s nom.** |
| DISC STYLES (Figure 2) | 551BNR2- | 9-88 | 2.4-1.8 | 100 | 0.250 | 0.250 | 0.062 | 0.400 | 0.350 | 0.020 | 0.125 |
| | 432BNR2- | 6-90 | 2.9-1.7 | 100 | 0.500 | 0.500 | 0.062 | 0.650 | 0.350 | 0.032 | 0.250 |
| | 379BNR2- | 12-180 | 2.9-1.7 | 200 | 0.500 | 0.500 | 0.125 | 0.650 | 0.400 | 0.032 | 0.250 |
| | 328BNR2- | 2-80 | 3.0-1.7 | 100 | 0.750 | 0.750 | 0.062 | 0.900 | 0.350 | 0.032 | 0.375 |
| | 925BNR2- | 12-160 | 2.4-1.7 | 150 | 0.750 | 0.750 | 0.100 | 0.900 | 0.380 | 0.032 | 0.375 |
| | **Carborundum Style Number** | **Volts ±10% at 5.0 MA** | **Volts at 5.0 MA Volts at .5 MA** | **Peak Voltage** | **Power Watts** | **d ±.030** | **t ±.030** | **D max.** | **T max.** | **w nom.** | **s nom.** |
| | 923BNR2- | 13-150 | 2.2-1.7 | 150 | 1.500 | 1.000 | 0.100 | 1.150 | 0.380 | 0.040 | 0.375 |
| | 463BNR2- | 10-190 | 2.2-1.7 | 200 | 1.500 | 1.000 | 0.125 | 1.150 | 0.400 | 0.040 | 0.375 |
| | 927BNR2- | 9-140 | 2.7-1.9 | 150 | 2.250 | 1.250 | 0.100 | 1.400 | 0.380 | 0.040 | 0.375 |

The Carborundum Company, Graphite Products Division, Post Office Box 339, Niagara Falls, N.Y. 14302 Tel: (716) 278-2521 Telex: 91-555 (CARBO GLO NGF)

CARBORUNDUM

# CARBORUNDUM® VARISTORS



Carborundum silicon carbide varistors are voltage-dependent resistors which are offered in a wide variety of configurations, including discs, rods, and washers. In addition to the sizes shown on these pages, rods are available up to 18 inches in length, washers are available up to 3½ inches in diameter. Typical uses include limitation of peak discharges, spike suppression, stabilization of voltages, and generation of nonlinear functions.

Varistors are specified by the voltage measured across them, suitably toleranced, at some constant current. The slope of the voltage-current characteristic is most often given by the maximum voltage ratio for two specified currents.

In general the characteristic for a varistor may be approximated by the equation:

$$i = Ke^n$$

where i and e are instantaneous current and voltage respectively, K is a proportionality constant, and n is an exponent applicable in the range in which the varistor is used: most often it is between 3 and 5.

The silicon carbide varistor is a "forgiving" component. When hit by a voltage surge, the energy is absorbed throughout its body, not at a junction. A voltage surge beyond the design level causes substantial increase in current and energy absorption, but not a catastrophic failure.

## SMALL DISC VARISTORS

| Carborundum Part Number | Volts ±10% @ 1.0 ma. | Volts @ 1.0 ma. ÷ Volts @ 0.1 ma. (maximum) |
|---|---|---|
| 432BNR2-406 | 6.8 | 2.70 |
| 432BNR2-407 | 8.2 | 2.60 |
| 432BNR2-408 | 10.0 | 2.50 |
| 432BNR2-409 | 12.0 | 2.35 |
| 432BNR2-410 | 15.0 | 2.20 |
| 432BNR2-411 | 18.0 | 2.10 |
| 432BNR2-412 | 22.0 | 2.00 |
| 432BNR2-413 | 27.0 | 1.90 |
| 432BNR2-414 | 33.0 | 1.84 |
| 432BNR2-416 | 47.0 | 1.80 |
| 432BNR2-418 | 68.0 | 1.76 |
| 432BNR2-420 | 100.0 | 1.72 |
| 379BNR2-410 | 15.0 | 2.50 |
| 379BNR2-412 | 22.0 | 2.40 |
| 379BNR2-414 | 33.0 | 2.30 |
| 379BNR2-415 | 39.0 | 2.20 |
| 379BNR2-416 | 47.0 | 2.10 |
| 379BNR2-417 | 56.0 | 2.00 |
| 379BNR2-418 | 68.0 | 1.95 |
| 379BNR2-419 | 82.0 | 1.90 |
| 379BNR2-420 | 100.0 | 1.84 |
| 379BNR2-421 | 120.0 | 1.78 |
| 379BNR2-422 | 150.0 | 1.74 |
| 379BNR2-423 | 180.0 | 1.70 |
| 328BNR2-400 | 2.2 | 3.60 |
| 328BNR2-401 | 2.7 | 3.40 |
| 328BNR2-402 | 3.3 | 3.20 |
| 328BNR2-403 | 3.9 | 3.00 |
| 328BNR2-404 | 4.7 | 2.80 |
| 328BNR2-405 | 5.6 | 2.60 |
| 328BNR2-406 | 6.8 | 2.50 |
| 328BNR2-407 | 8.2 | 2.40 |
| 328BNR2-408 | 10.0 | 2.30 |
| 328BNR2-409 | 12.0 | 2.20 |
| 328BNR2-410 | 15.0 | 2.10 |
| 328BNR2-411 | 18.0 | 2.00 |
| 328BNR2-412 | 22.0 | 1.95 |
| 328BNR2-413 | 27.0 | 1.90 |
| 328BNR2-414 | 33.0 | 1.85 |
| 328BNR2-416 | 47.0 | 1.76 |

## LARGE DISC VARISTORS

| Carborundum Part Number | Volts ±10% @ 5.0 ma. | Volts @ 5.0 ma. ÷ Volts @ 0.5 ma. (maximum) |
|---|---|---|
| 463BNR2-410 | 15.0 | 2.40 |
| 463BNR2-412 | 22.0 | 2.20 |
| 463BNR2-414 | 33.0 | 2.10 |
| 463BNR2-415 | 39.0 | 2.02 |
| 463BNR2-416 | 47.0 | 1.98 |
| 463BNR2-417 | 56.0 | 1.94 |
| 463BNR2-418 | 68.0 | 1.90 |
| 463BNR2-419 | 82.0 | 1.86 |
| 463BNR2-420 | 100.0 | 1.82 |
| 463BNR2-421 | 120.0 | 1.78 |
| 463BNR2-422 | 150.0 | 1.74 |
| 463BNR2-423 | 180.0 | 1.70 |
| 927BNR2-408 | 10.0 | 2.90 |
| 927BNR2-409 | 12.0 | 2.80 |
| 927BNR2-410 | 15.0 | 2.70 |
| 927BNR2-411 | 18.0 | 2.60 |
| 927BNR2-412 | 22.0 | 2.50 |
| 927BNR2-413 | 27.0 | 2.40 |
| 927BNR2-414 | 33.0 | 2.30 |
| 927BNR2-416 | 47.0 | 2.20 |

## ROD VARISTORS

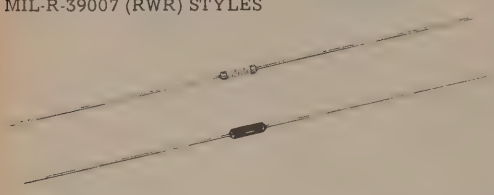
| Carborundum Part Number | Volts ±10% @ 1.0 ma. | Volts @ 1.0 ma. ÷ Volts @ 0.1 ma. (maximum) |
|---|---|---|
| 233BNR4-417 | 56.0 | 2.50 |
| 233BNR4-418 | 68.0 | 2.40 |
| 233BNR4-419 | 82.0 | 2.30 |
| 233BNR4-420 | 100.0 | 2.20 |
| 233BNR4-421 | 120.0 | 2.10 |
| 233BNR4-422 | 150.0 | 2.00 |
| 233BNR4-423 | 180.0 | 1.90 |
| 233BNR4-424 | 220.0 | 1.82 |
| 233BNR4-425 | 270.0 | 1.78 |
| 233BNR4-426 | 330.0 | 1.76 |
| 233BNR4-428 | 470.0 | 1.74 |
| 233BNR4-430 | 680.0 | 1.70 |
| 234BNR4-426 | 330.0 | 2.00 |
| 234BNR4-427 | 390.0 | 1.90 |
| 234BNR4-428 | 470.0 | 1.80 |
| 234BNR4-429 | 560.0 | 1.77 |
| 234BNR4-430 | 680.0 | 1.74 |
| 234BNR4-431 | 820.0 | 1.70 |
| 234BNR4-432 | 1000.0 | 1.68 |

The Carborundum Company, Graphite Products Division, Post Office Box 339, Niagara Falls, N.Y. 14302 Tel: (716) 278-2521 Telex: 91-555 (CARBO GLO NGF)

CARBORUNDUM

# Shallcross Resistor Specifications

## POWER (ER) RESISTORS
## MIL-R-39007 (RWR) STYLES



FEATURES:

Established reliability — documented failure rate — 100% screening.

Miniature size vs high power.

All MIL-R-39007 styles available.

Exceptional stability — controlled minimal stress windings using premium grade selected wires. Additional stabilization is afforded by an extensive accelerated aging program.

High thermal conductivity, centerless ground cores for maximum heat distribution and dissipation.

Resistance element is coated with a high temperature silicone material.

All welded construction.

Weldable and solderable leads.

Non-inductive windings available.

## POWER RESISTORS
## MIL-R-26 (RW) STYLES &
## COMMERCIAL INDUSTRIAL
## (LA) STYLES

FEATURES:

Miniature size vs high power levels.

22 styles to choose from — ranging from .4 watts to 18 watts.

MIL-R-26 styles available.

High thermal conductivity utilizing Beryllia, Alumina or Steatite cores.

All welded construction.

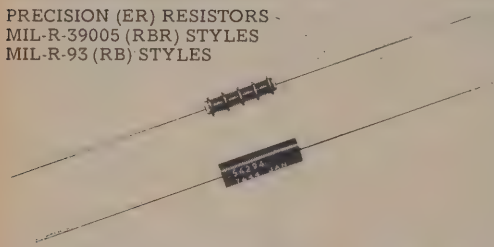
Resistance wires are "sandwich-welded" to the end caps.

Weldable and solderable leads.

Non inductive windings available.

Resistance element is coated with a high temperature silicone material.

## PRECISION (ER) RESISTORS
## MIL-R-39005 (RBR) STYLES
## MIL-R-93 (RB) STYLES



FEATURES:

Off-the-Lead welded terminations on all styles larger than .100" diameter.

Unique cap and lead construction isolates termination from external stresses.

Double splined knurl leads are welded to the cap and firmly anchored inside the bobbin with a special high temperature adhesive.

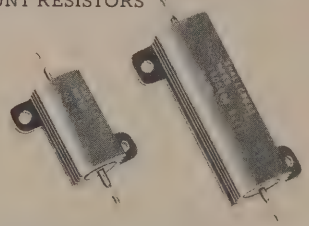
Epoxy sealed dry air chamber completely isolates windings from external stresses.

Thick layer of encapsulant supplies additional environmental and mechanical protection.

Resilient inner coating permeates and coats the windings for increased moisture, vibration, and shock protection without stress introduction.

Controlled minimal stress windings using premium grade selected wire.

## CHASSIS MOUNT RESISTORS



FEATURES

Four popular sizes — 5 watts to 50 watts.

High heat conductivity aluminum housing.

Screw mounts on chassis for heat sink effect.

Top surface marking for ease of identification after mounting.

Completely environmentally protected.

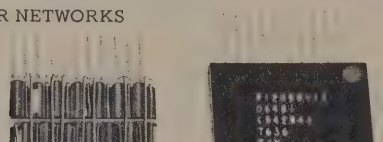
All welded terminations.

High temperature molded construction.

Copperweld terminals hot tin dipped for improved solderability.

Wound with premium grade resistance wire for maximum stability at conventional power ratings.

## RESISTOR NETWORKS



Network quality is determined by the qualities of its individual resistors plus packaging and mounting techniques. Shallcross offers a unique background of experience, reliability, data, manufacturing and testing skills for wirewound resistor networks. For a sample of this ability, submit your next network requirement for evaluation by Shallcross engineers.

PARAMETERS:

Resistance ratios to .001%

Resistor tolerances to ± .005% (at ambient)

Ratio tolerances as close as .01% (over a range of temperatures).

Stability to ±.001% per year.

**CUTLER-HAMMER/*shallcross***
Smithfield, North Carolina 27107
Telephone: (919) 934-5181

For complete specifications, see your authorized Shallcross distributor or write Cutler-Hammer/ Shallcross.

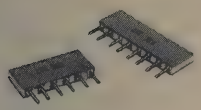
# CTS OF BERNE, INC.

SUBSIDIARY OF CTS CORPORATION, ELKHART, INDIANA

**WORLD LEADER IN CERMET RESISTOR TECHNOLOGY**

# SINGLE-IN-LINE CERMET RESISTOR NETWORKS

## 750 SERIES SINGLE-IN-LINE CERMET RESISTOR NETWORKS

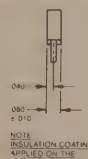


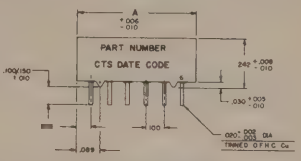
- 6, 8 and 10-pin modules on .100" lead centers
- Resistance: 33Ω - 510 KΩ* ±2% (for 750-85 Series, see table below schematic)
- Power ratings @ 70°C per module: 6 pin .9 watt; 8 pin 1.1 watt; 10 pin 1.5 watt
- Standard TC: ±250 ppm°C
- TC Tracking: 50 ppm°C

**FEATURES:**

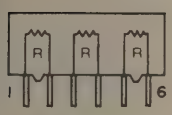
- Low profile construction
- High reliability
- Alumina substrate
- Low cost automatic insertion and handling

| No. of Pins | A |
|---|---|
| 6 | .578 |
| 8 | .778 |
| 10 | .987 |

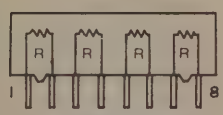


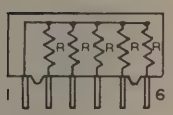

GENERAL TOLERANCES: Decimal dimensions ±.005"



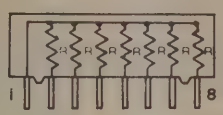
6 PIN — 3 RESISTORS
PART NUMBER
750-63-R (VALUE)



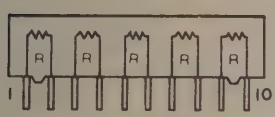
8 PIN — 4 RESISTORS
PART NUMBER
750-83-R-(VALUE)



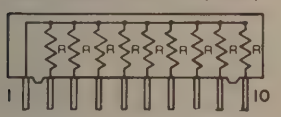
6 PIN — 5 RESISTORS
PART NUMBER
750-61-R (VALUE)



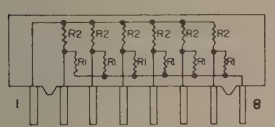
8 PIN — 7 RESISTORS
PART NUMBER
750-81-R (VALUE)



10 PIN — 5 RESISTORS
PART NUMBER 750-103-R (VALUE)



10 PIN — 9 RESISTORS
PART NUMBER 750-101-R (VALUE)



8 PIN — 12 RESISTORS
PART NUMBER 750-85 — 750-85-R (R1/R2)

| R1/R2 Ohms | Thevenin Impedance |
|---|---|
| 81/230 | 50Ω |
| 121/195 | 75Ω |
| 162/260 | 100Ω |
| 180/390 | 123Ω |
| 220/330 | 132Ω |
| 330/390 | 180Ω |
| 330/470 | 195Ω |

### STANDARD "OFF THE SHELF" PART NUMBERS*

| Resistance Value, Tolerance | 6 Pin 3 Resistor | 6 Pin 5 Resistor | 8 Pin 4 Resistor | 8 Pin 7 Resistor | 10 Pin 5 Resistor | 10 Pin 9 Resistor |
|---|---|---|---|---|---|---|
| 33Ω ±2% | 750-63-R33Ω | 750-61-R33Ω | 750-83-R33Ω | 750-81-R33Ω | — | — |
| 39Ω ±2% | 750-63-R39Ω | 750-61-R39Ω | — | 750-81-R39Ω | — | — |
| 47Ω ±2% | — | — | 750-83-R47Ω | — | — | 750-101-R47Ω |
| 51Ω ±2% | — | 750-61-R51Ω | — | 750-81-R51Ω | — | — |
| 56Ω ±2% | — | — | — | — | — | — |
| 68Ω ±2% | 750-63-R68Ω | — | 750-83-R68Ω | 750-81-R68Ω | — | — |
| 75Ω ±2% | — | — | 750-83-R75Ω | — | — | — |
| 82Ω ±2% | — | 750-61-R82Ω | 750-83-R82Ω | 750-81-R82Ω | — | — |
| 91Ω ±2% | — | 750-61-R91Ω | 750-83-R91Ω | 750-81-R91Ω | — | — |
| 100Ω ±2% | 750-63-R100Ω | 750-61-R100Ω | 750-83-R100Ω | 750-81-R100Ω | 750-103-R100Ω | 750-101-R100Ω |
| 110Ω ±2% | — | 750-61-A110Ω | — | 750-81-R110Ω | — | — |
| 120Ω ±2% | — | 750-61-R120Ω | 750-83-R120Ω | — | — | — |
| 130Ω ±2% | — | 750-61-R130Ω | — | — | — | — |
| 150Ω ±2% | 750-63-R150Ω | 750-61-R150Ω | 750-83-R150Ω | 750-81-R150Ω | — | — |
| 160Ω ±2% | — | 750-61-R160Ω | — | 750-81-R160Ω | — | — |
| 180Ω ±2% | — | 750-61-R180Ω | 750-83-R180Ω | 750-81-R180Ω | — | — |
| 200Ω ±2% | — | 750-61-R200Ω | — | 750-81-R200Ω | — | — |
| 220Ω ±2% | 750-63-R220Ω | 750-61-R220Ω | 750-83-R220Ω | 750-81-R220Ω | 750-103-R220Ω | 750-101-R220Ω |
| 240Ω ±2% | — | 750-61-R240Ω | — | — | — | — |
| 260Ω ±2% | — | 750-61-R260Ω | — | — | — | — |
| 270Ω ±2% | — | 750-61-R270Ω | 750-83-R270Ω | 750-81-R270Ω | — | — |
| 300Ω ±2% | — | — | — | 750-81-R300Ω | — | — |
| 330Ω ±2% | 750-63-R330Ω | 750-61-R330Ω | 750-83-R330Ω | 750-81-R330Ω | 750-103-R330Ω | 750-101-R330Ω |
| 360Ω ±2% | — | 750-61-R360Ω | — | — | — | — |
| 390Ω ±2% | — | 750-61-R390Ω | — | 750-81-R390Ω | — | — |
| 430Ω ±2% | — | — | — | 750-81-R430Ω | — | — |
| 470Ω ±2% | 750-63-R470Ω | 750-61-R470Ω | 750-83-R470Ω | 750-81-R470Ω | 750-103-R470Ω | 750-101-R470Ω |
| 500Ω ±2% | — | 750-61-R500Ω | — | 750-81-R500Ω | — | — |
| 510Ω ±2% | — | 750-61-R510Ω | 750-83-R510Ω | 750-81-R510Ω | — | — |
| 560Ω ±2% | — | — | — | 750-81-R560Ω | — | — |
| 680Ω ±2% | 750-63-R680Ω | 750-61-R680Ω | 750-83-R680Ω | 750-81-R680Ω | 750-103-R680Ω | 750-101-R680Ω |
| 820Ω ±2% | — | — | 750-83-R820Ω | 750-81-R820Ω | — | 750-101-R820Ω |
| 910Ω ±2% | — | — | — | 750-81-R910Ω | — | — |
| 1KΩ ±2% | 750-63-R1KΩ | 750-61-R1KΩ | 750-83-R1KΩ | 750-81-R1KΩ | 750-103-R1KΩ | 750-101-R1KΩ |
| 1.1KΩ ±2% | — | — | 750-83-R1.1KΩ | — | — | 750-101-R1.1KΩ |
| 1.2KΩ ±2% | — | — | 750-83-R1.2KΩ | 750-81-R1.2KΩ | — | — |
| 1.33KΩ ±2% | — | 750-61-R1.33KΩ | — | — | — | — |
| 1.5KΩ ±2% | 750-63-R1.5KΩ | 750-61-R1.5KΩ | 750-83-R1.5KΩ | 750-81-R1.5KΩ | — | — |
| 1.8KΩ ±2% | — | — | 750-83-R1.8KΩ | — | — | — |
| 2KΩ ±2% | 760-63-R2KΩ | 750-61-R2KΩ | 750-83-R2KΩ | 750-81-R2KΩ | — | — |
| 2.2KΩ ±2% | 750-63-R2.2KΩ | 750-61-R2.2KΩ | 750-83-R2.2KΩ | 750-81-R2.2KΩ | 750-103-R2.2KΩ | 750-101-R2.2KΩ |
| 2.7KΩ ±2% | — | 750-61-R2.7KΩ | — | 750-81-R2.7KΩ | — | — |
| 3KΩ ±2% | — | 750-61-R3KΩ | 750-83-R3KΩ | 750-81-R3KΩ | — | — |
| 3.3KΩ ±2% | 750-63-R3.3KΩ | 750-61-R3.3KΩ | 750-83-R3.3KΩ | 750-81-R3.3KΩ | 750-103-R3.3KΩ | 750-101-R3.3KΩ |
| 3.9KΩ ±2% | — | — | — | 750-81-R3.9KΩ | — | — |
| 4.7KΩ ±2% | 750-63-R4.7KΩ | 750-61-R4.7KΩ | 750-83-R4.7KΩ | 750-81-R4.7KΩ | 750-103-R4.7KΩ | 750-101-R4.7KΩ |
| 5.1KΩ ±2% | — | — | 750-83-R5.1KΩ | — | — | — |
| 5.6KΩ ±2% | — | — | 750-83-R5.6KΩ | 750-81-R5.6KΩ | — | 750-101-R5.6KΩ |
| 6.2KΩ ±2% | — | — | 750-83-R6.2KΩ | — | — | — |
| 6.8KΩ ±2% | 750-63-R6.8KΩ | 750-61-R6.8KΩ | 750-83-R6.8KΩ | 750-81-R6.8KΩ | 750-103-R6.8KΩ | 750-101-R6.8KΩ |
| 10KΩ ±2% | 750-63-R10KΩ | 750-61-R10KΩ | 750-83-R10KΩ | 750-81-R10KΩ | 750-103-R10KΩ | 750-101-R10KΩ |
| 12KΩ ±2% | — | 750-61-R12KΩ | — | — | — | 750-101-R12KΩ |
| 13KΩ ±2% | — | — | — | 750-81-R13KΩ | — | — |
| 15KΩ ±2% | 750-63-R15KΩ | 750-61-R15KΩ | 750-83-R15KΩ | 750-81-R15KΩ | — | — |
| 18KΩ ±2% | — | — | 750-83-R18KΩ | — | — | — |
| 20KΩ ±2% | — | — | 750-83-R20KΩ | — | — | — |
| 22KΩ ±2% | 750-63-R22KΩ | 750-61-R22KΩ | 750-83-R22KΩ | 750-81-R22KΩ | 750-103-R22KΩ | 750-101-R22KΩ |
| 27KΩ ±2% | — | — | 750-83-R27KΩ | — | — | — |
| 33KΩ ±2% | 750-63-R33KΩ | 750-61-R33KΩ | 750-83-R33KΩ | 750-81-R33KΩ | 750-103-R33KΩ | — |
| 47KΩ ±2% | 750-63-R47KΩ | 750-61-R47KΩ | 750-83-R47KΩ | 750-81-R47KΩ | 750-103-R47KΩ | 750-101-R47KΩ |
| 68KΩ ±2% | 750-63-R68KΩ | 750-61-R68KΩ | 750-83-R68KΩ | 750-81-R68KΩ | — | — |
| 75KΩ ±2% | — | — | — | 750-81-R75KΩ | — | — |
| 100KΩ ±2% | 750-63-R100KΩ | 750-61-R100KΩ | 750-83-R100KΩ | 750-81-R100KΩ | 750-103-R100KΩ | 750-101-R100KΩ |
| 120KΩ ±2% | — | — | 750-83-R120KΩ | — | — | — |
| 150KΩ ±2% | 750-63-R150KΩ | — | 750-83-R150KΩ | 750-81-R150KΩ | — | — |
| 180KΩ ±2% | — | — | 750-83-R180KΩ | — | — | — |
| 220KΩ ±2% | 750-63-R220KΩ | 750-61-R220KΩ | 750-83-R220KΩ | 750-81-R220KΩ | — | — |
| 240KΩ ±2% | — | — | 750-83-R240KΩ | — | — | — |
| 270KΩ ±2% | — | — | 750-83-R270KΩ | — | — | — |
| 470KΩ ±2% | 750-63-R470KΩ | 750-61-R470KΩ | 750-83-R470KΩ | 750-81-R470KΩ | — | — |
| 510KΩ ±2% | — | — | 750-83-R510KΩ | — | — | — |

***NOTE:** **Additional resistance values are constantly being added.** Please contact your local CTS Industrial Distributor to check availability of values not shown above.

ORDERING INFORMATION: Place orders using the following address: CTS OF BERNE, INC., 406E Parr Road, Berne, Indiana 46711 • Call and ask for John Henry at (219) 589-3111 • TWX 810-323-1580

# CTS OF BERNE, INC.

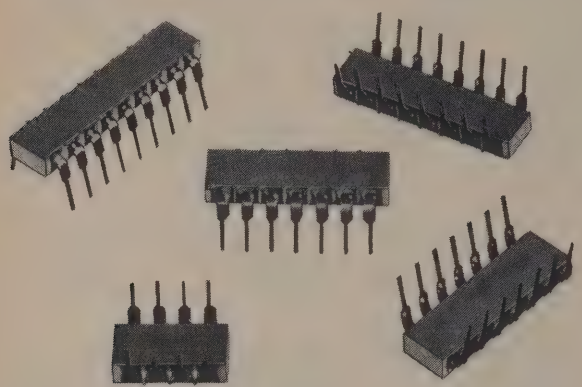
SUBSIDIARY OF CTS CORPORATION, ELKHART, INDIANA

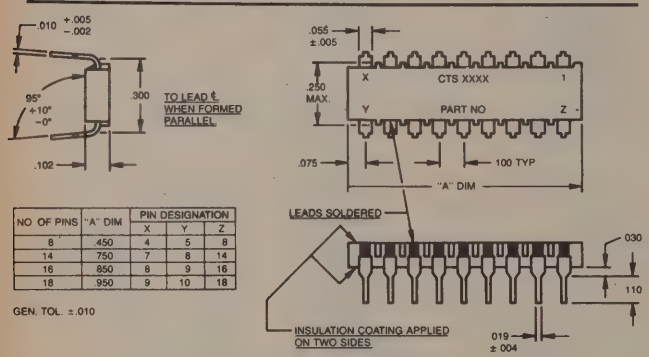
**WORLD LEADER IN CERMET RESISTOR TECHNOLOGY**

# DUAL-IN-LINE CERMET RESISTOR NETWORKS

***CERMET RESISTOR NETWORKS (Available with capacitor chips and/or active devices*)***

CTS Series 760 Dual-In-Line cermet resistor networks are available in 8, 14, 16, and 18 lead styles. CTS now offers you a choice of four popular space-saver packages. All are designed to simplify automatic insertion along with IC's and other DIP products for reduced costs. Easy to hand mount, too. Available without cover coat, so you can trim for circuit balance in your own plant. Choose from standard circuits available off-the-shelf for immediate delivery or custom designed to your specifications.






| NO. OF PINS | "A" DIM | PIN DESIGNATION X | Y | Z |
|---|---|---|---|---|
| 8 | .450 | 4 | 5 | 8 |
| 14 | .750 | 7 | 8 | 14 |
| 16 | .850 | 8 | 9 | 16 |
| 18 | .950 | 9 | 10 | 18 |

GEN. TOL. ±.010

## Environmental Performance Characteristics

| Test | Allowable Resistance Change CTS Max△ R | CTS Avg. △ R |
|---|---|---|
| Load Life: 1,000 hrs., 0.1 watt per resistor at 70°C | ±0.50% | ±0.20% |
| Moisture Resistance: 0.1 rated wattage at 70°C, 90-98% humidity, 1,000 hrs. | ±0.50% | ±0.20% |
| Insulation Resistance: Measured wet after moisture resistance test, 200 VDC | Greater than 1000 megohms | |
| Low Temperature Exposure: −63°C, 4 hrs. | ±0.25% | ±0.10% |
| Thermal Shock: 5 cycles, −63°C to +125°C, no load | ±0.25% | ±0.10% |
| Short Time Overload: 2.5 times rated voltage, 5 sec. | ±0.25% | ±0.05% |
| Terminal Strength: 5 lb. tensile & compression, 30 sec. | ±0.25% | ±0.03% |
| Effect of Soldering: 60/40 solder, 246°C, 2 sec. | ±0.25% | ±0.05% |

***FEATURES:***

- Low height profile
- .100" lead spacing
- High overload capabilities
- 8, 14, 16 & 18 pin constructions
- Compatible with automatic insertion equipment
- 2 watt power capabilities
- Reduced insertion time
- Available with capacitors and/or active devices*

***ELECTRICAL AND MECHANICAL SPECIFICATIONS:***

**Description:** 8, 14, 16, and 18 pin dual-in-line modules on .100" lead centers.

**Standard Resistance Range:** 22Ω through 1 MegΩ.

**Special Resistance Range:** Below 22Ω and above 1 MegΩ.

**Resistance Matching (2 like resistors):**
50Ω to 30KΩ — 0.5%
30KΩ to 250KΩ — 1%
250KΩ to 3 MegΩ — 2.5%

**Ratio Matching:**
50Ω to 30KΩ — ±1%
30KΩ to 250KΩ — ±2%
250KΩ to 3 MegΩ — ±5%

**Wattage Rating @ 70°C per module:** 8 pin - .75 watt; 14 pin - 1.5 watts; 16 pin - 1.75 watts; 18 pin - 2.0 watts.

**Standard Temperature Coefficient:** ±300 ppm/°C.

**Special Temperature Coefficient:** to ±100 ppm/°C.

**Temperature Coefficient Tracking:** Available to 50 ppm/°C.

**Standard Resistance Tolerance:** ±5%.

**Special Resistance Tolerance:** ±1% or ½Ω (whichever is greater).

**Substrate Material:** Alumina.

**Resistor Material:** Cermet - thick film.

**Insulation Coating:** Organic - epoxy phenolic.

**Lead Material:** Solder coated copper.

**Solder:** 60/40 Tin/Lead.

**Lead Strength:** 5# pull.

* Active devices added by CTS Microelectronics, Inc., Lafayette, Indiana.

ORDERING INFORMATION: Place orders using following address: CTS OF BERNE, INC., 406 Parr Rd., Berne, Ind. 46711 • (219) 589-8220 • TWX 810-323-1580

# CTS OF BERNE, INC.

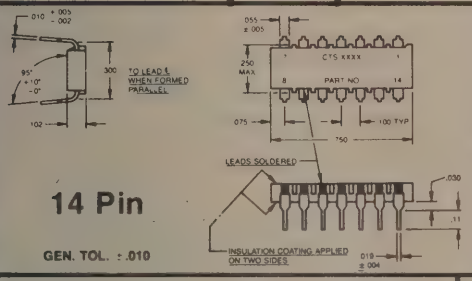
SUBSIDIARY OF CTS CORPORATION, ELKHART INDIANA

**WORLD LEADER IN CERMET RESISTOR TECHNOLOGY**

***760 SERIES 14/16 LEAD DUAL-IN-LINE CERMET RESISTOR NETWORKS***

# DUAL-IN-LINE CERMET RESISTOR NETWORKS

| CTS Series | Description | Element Type | Resistance Range & Tol. | Power Rating (Watts) | Standard TC | TC Tracking | Prices 1-99 | 100-499 | 500-999 |
|---|---|---|---|---|---|---|---|---|---|
| 760-3 | 14 Pin Module on .100" x .300" DIP Centers | Cermet | 22Ω-220KΩ*±2% | 1.5 @ 70°C per module | ±300 ppm/°C | 50 ppm/°C | $1.15 | $ .93 | $ .66 |
| 760-1 | | | | | | | 1.20 | .95 | .68 |
| 760-5 | | | | | | | 2.15 | 1.75 | 1.25 |
| 760-19 | | | | | | | 2.20 | 1.78 | 1.43 |
| 761-3 | 16 Pin Module on .100" x .300" DIP Centers | Cermet | 68Ω-470KΩ*±2% | 1.75 @ 70°C per module | ±300 ppm/°C | 50 ppm/°C | $1.20 | $ .95 | $ .68 |
| 761-1 | | | | | | | 1.25 | .98 | .70 |
| 761-5 | | | | | | | 2.30 | 1.88 | 1.34 |
| 761-45 | | | | | | | 2.40 | 1.90 | 1.65 |

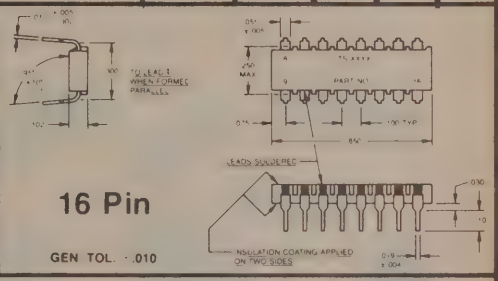



**14 Pin**

GEN. TOL. ± .010

**FEATURES:**

- **Low cost automatic insertion and handling**
- **High overload capabilities**
- **Low height profile**
- **Package compatibility with monolithic packages**
- **.100" lead spacing**




**16 Pin**

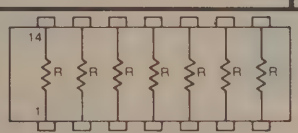
GEN. TOL. ± .010

## STANDARD "OFF THE SHELF" PART NUMBERS

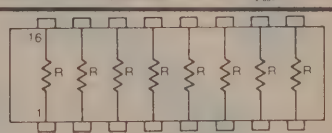
| Resistance Value, Tolerance | 14 Pin 7 Resistor | 14 Pin 13 Resistor |
|---|---|---|
| 22Ω ±2% | 760-3-R22Ω | |
| 39Ω ±2% | 760-3-R39Ω | |
| 68Ω ±2% | 760-3-R68Ω | 760-1-R68Ω |
| 75Ω ±2% | | 760-1-R75Ω |
| 100Ω ±2% | 760-3-R100Ω | 760-1-R100Ω |
| 110Ω ±2% | 760-3-R110Ω | |
| 150Ω ±2% | 760-3-R150Ω | 760-1-R150Ω |
| 220Ω ±2% | 760-3-R220Ω | 760-1-R220Ω |
| 330Ω ±2% | 760-3-R330Ω | 760-1-R330Ω |
| 390Ω ±2% | | 760-1-R390Ω |
| 470Ω ±2% | 760-3-R470Ω | 760-1-R470Ω |
| 500Ω ±2% | 760-3-R500Ω | 760-1-R500Ω |
| 680Ω ±2% | 760-3-R680Ω | 760-1-R680Ω |
| 1KΩ ±2% | 760-3-R1KΩ | 760-1-R1KΩ |
| 1.5KΩ ±2% | 760-3-R1.5KΩ | 760-1-R1.5KΩ |
| 1.8KΩ ±2% | 760-3-R1.8KΩ | |
| 2KΩ ±2% | | 760-1-R2KΩ |
| 2.2KΩ ±2% | 760-3-R2.2KΩ | 760-1-R2.2KΩ |
| 2.4KΩ ±2% | | 760-1-R2.4KΩ |
| 3KΩ ±2% | | 760-1-R3KΩ |
| 3.3KΩ ±2% | 760-3-R3.3KΩ | 760-1-R3.3KΩ |
| 4.7KΩ ±2% | 760-3-R4.7KΩ | 760-1-R4.7KΩ |
| 5KΩ ±2% | | 760-1-R5KΩ |
| 5.6KΩ ±2% | | 760-1-R5.6KΩ |
| 6KΩ ±2% | 760-3-R6KΩ | 760-1-R6KΩ |
| 6.8KΩ ±2% | 760-3-R6.8KΩ | 760-1-R6.8KΩ |
| 7.5KΩ ±2% | | 760-1-R7.5KΩ |
| 9.1KΩ ±2% | | 760-1-R9.1KΩ |
| 10KΩ ±2% | 760-3-R10KΩ | 760-1-R10KΩ |
| 12KΩ ±2% | | 760-1-R12KΩ |
| 15KΩ ±2% | 760-3-R15KΩ | 760-1-R15KΩ |
| 22KΩ ±2% | 760-3-R22KΩ | 760-1-R22KΩ |
| 33KΩ ±2% | 760-3-R33KΩ | 760-1-R33KΩ |
| 47KΩ ±2% | 760-3-R47KΩ | 760-1-R47KΩ |
| 68KΩ ±2% | 760-3-R68KΩ | 760-1-R68KΩ |
| 75KΩ ±2% | 760-3-R75KΩ | |
| 100KΩ ±2% | 760-3-R100KΩ | 760-1-R100KΩ |
| 150KΩ ±2% | 760-3-R150KΩ | 760-1-R150KΩ |
| 180KΩ ±2% | | 760-1-R180KΩ |
| 220KΩ ±2% | 760-3-R220KΩ | 760-1-R220KΩ |

| Resistance Value, Tolerance | 16 Pin 8 Resistor | 16 Pin 15 Resistor |
|---|---|---|
| 68Ω ±2% | 761-3-R68Ω | 761-1-R68Ω |
| 87.5Ω ±2% | 761-3-R87.5Ω | |
| 100Ω ±2% | 761-3-R100Ω | 761-1-R100Ω |
| 110Ω ±2% | 761-3-R110Ω | |
| 150Ω ±2% | 761-3-R150Ω | 761-1-R150Ω |
| 220Ω ±2% | 761-3-R220Ω | 761-1-R220Ω |
| 330Ω ±2% | 761-3-R330Ω | 761-1-R330Ω |
| 470Ω ±2% | 761-3-R470Ω | 761-1-R470Ω |
| 500Ω ±2% | | 761-1-R500Ω |
| 680Ω ±2% | 761-3-R680Ω | 761-1-R680Ω |
| 1KΩ ±2% | 761-3-R1KΩ | 761-1-R1KΩ |
| 1.5KΩ ±2% | 761-3-R1.5KΩ | 761-1-R1.5KΩ |
| 2KΩ ±2% | 761-3-R2KΩ | 761-1-R2KΩ |
| 2.2KΩ ±2% | 761-3-R2.2KΩ | 761-1-R2.2KΩ |
| 3.3KΩ ±2% | 761-3-R3.3KΩ | 761-1-R3.3KΩ |
| 4.7KΩ ±2% | 761-3-R4.7KΩ | 761-1-R4.7KΩ |
| 5.6KΩ ±2% | | 761-1-R5.6KΩ |
| 6KΩ ±2% | | 761-1-R6KΩ |
| 6.8KΩ ±2% | 761-3-R6.8KΩ | 761-1-R6.8KΩ |
| 10KΩ ±2% | 761-3-R10KΩ | 761-1-R10KΩ |
| 15KΩ ±2% | 761-3-R15KΩ | 761-1-R15KΩ |
| 22KΩ ±2% | 761-3-R22KΩ | 761-1-R22KΩ |
| 33KΩ ±2% | 761-3-R33KΩ | 761-1-R33KΩ |
| 47KΩ ±2% | 761-3-R47KΩ | 761-1-R47KΩ |
| 50KΩ ±2% | 761-3-R50KΩ | 761-1-R50KΩ |
| 68KΩ ±2% | 761-3-R68KΩ | 761-1-R68KΩ |
| 100KΩ ±2% | 761-3-R100KΩ | 761-1-R100KΩ |
| 150KΩ ±2% | 761-3-R150KΩ | 761-1-R150KΩ |
| 220KΩ ±2% | 761-3-R220KΩ | 761-1-R220KΩ |
| 470KΩ ±2% | 761-3-R470KΩ | |

*NOTE: Additional resistance values are constantly being added. Please contact your local CTS Industrial Distributor to check availability of values not shown above.

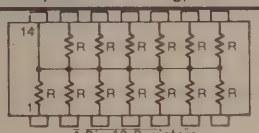



14 Pin-7 Resistors
Part Number 760-3-R-+value




16 Pin-8 Resistors
Part Number 761-3-R-+value

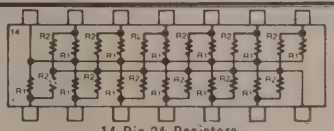
APPLICATIONS: "Wired OR" pull-up; Power driver pull-up; Power gate pull-up; Line termination; Long-line impedance balancing; LED current limiting; ECL output pull-down resistors; TTL input pull-down.



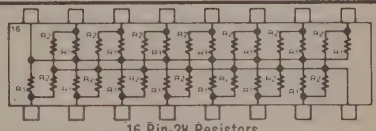

14 Pin-13 Resistors
Part Number 760-1-R-+value

16 Pin-15 Resistors
Part Number 761-1-R-+value

APPLICATIONS: MOS/ROM pull-up/pull-down; Open collector pull-up; "Wired OR" pull-up; Power driver pull-up; High speed parallel pull-up; TTL unused gate pull-up; TTL input pull-down; Digital pulse squaring.




14 Pin-24 Resistors
Part Number 760-5-R-+values




16 Pin-28 Resistors
Part Number 761-5-R-+values

| Resistance Values R1/R2 | Part Numbers | |
|---|---|---|
| 220Ω/270Ω | 760-5-R220/270 | 761-5-R220/270 |
| 220Ω/330Ω | 760-5-R220/330 | 761-5-R220/330 |
| 1.5K/3.3K | 760-5-R1.5/3.3K | 761-5-R1.5K/3.3K |

Other combinations available upon request

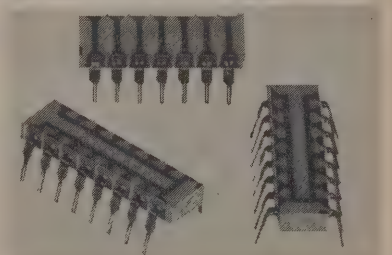
**Pulse Squaring TTL Terminators**

CTS 760-5 networks consist of two resistor pairs of the above value combinations. The resistors are connected together in series with a common line for power and a common line for ground. The junction of each pair is brought out to a separate terminal.

## *CONDUCTOR MODULES*

**Eliminate time consuming installation of jumper wires.**

**Density of Jumpers:**
Depending on number of pins, screened on both sides of substrate. Built to customer specifications and requirements.



ORDERING INFORMATION: Place orders using following address: CTS OF BERNE, INC., 406 Parr Rd., Berne, Ind. 46711 • (219) 589-8220 • TWX 810-323-1580

# CTS OF BERNE, INC.

SUBSIDIARY OF CTS CORPORATION, ELKHART, INDIANA

**WORLD LEADER IN CERMET RESISTOR TECHNOLOGY**

# SINGLE-IN-LINE CERMET RESISTOR NETWORKS

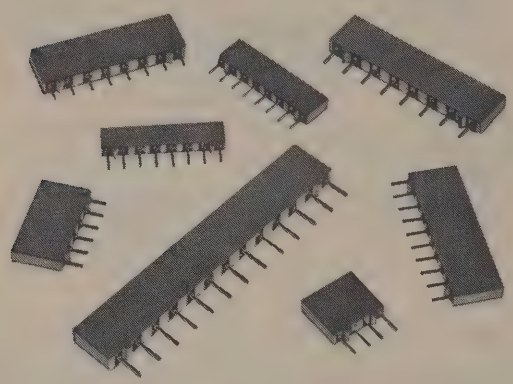
## *CERMET RESISTOR NETWORKS (Available with capacitor chips and/or active devices*)*

CTS . . . Leader in the field of **Low Profile** space-saving Cermet Resistor Modules. Readily recognizable because of the familiar CTS Blue.

As is well illustrated, these modules have been specifically designed to save space.

So if you want to reduce the size of your design or add more complex circuitry without increasing size, CTS rates top consideration.

Most appealing is the fact that "The Little Blue Brick" is an extensive "Off The Shelf" item with CTS.



750 Series

### *FEATURES:*

- Compact edge mount modules
- Ultra high stability and reliability
- Automatic insertion capabilities
- Reduced insertion time
- Fewer items to inventory
- Space savings over individual resistors
- Available with capacitors and/or active devices*
- Available with .100", .125" and .150" lead centers

### *ELECTRICAL AND MECHANICAL SPECIFICATIONS:*

**Description:** Cermet thick film single-in-line resistor networks.

**Standard Resistance Range:** 33Ω through 1 MegΩ.

**Special Resistance Range:** Below 33Ω and above 1 MegΩ.

**Resistance Matching (2 like resistors):**
50Ω to 30KΩ — 0.5%
30KΩ to 250KΩ — 1%
250KΩ to 3 MegΩ —2.5%

**Ratio Matching:**
50Ω to 30KΩ — ±1%
30KΩ to 250KΩ — ±2%
250KΩ to 3 MegΩ —±5%

**Standard Temperature Coefficient:** ±250 ppm/°C.

**Special Temperature Coefficient:** ±100 ppm/°C.

**Temperature Coefficient Tracking:** Available to 50 ppm/°C.

**Standard Resistance Tolerance:** ±5%.

**Special Resistance Tolerance:** to ±0.5% or ½Ω (whichever is greater).

**Substrate Material:** Alumina.

**Resistor Material:** Cermet - thick film.

**Insulation Coating:** Organic - epoxy phenolic.

**Lead Material:** Solder coated copper.

**Solder:** 60/40 Tin/Lead.

**Lead Strength:** 5# pull.

**Wattage Rating @ 70°C** (see chart below).

| Environmental Performance Characteristics | | |
|---|---|---|
| For units less than .340" high, refer to page 8 for performance characteristics. **Test** | **Allowable Resistance Change** CTS Max △ R | CTS Avg. △ R |
| Load Life: 1,000 hrs., 0.1 watt per resistor at 70°C | ±0.40% | ±0.20% |
| Moisture Resistance: 0.1 rated wattage at 70°C, 90-98% humidity, 1,000 hrs. | ±0.50% | ±0.20% |
| Insulation Resistance: Measured wet after moisture resistance test, 200 VDC | Greater than 1000 megohms | |
| Low Temperature Exposure: −63°C, 4 hrs. | ±0.10% | ±0.04% |
| Thermal Shock: 5 cycles, −63°C to +125°C, no load | ±0.10% | ±0.03% |
| Short Time Overload: 2.5 times rated voltage, 5 sec. | ±0.25% | ±0.05% |
| Terminal Strength: 5 lb. tensile & compression, 30 sec. | ±0.10% | ±0.03% |
| Effect of Soldering: 60/40 solder, 246°C, 2 sec. | ±0.10% | ±0.05% |

| Lead Centers | Ht. of Module (Max.) | Number of Pins | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| .100 | (.187) | .25 | — | — | — | .7 | .8 | — | — | — | — | — |
| .100 | (.250) | — | — | — | .9 | — | 1.1 | — | 1.5 | — | — | — |
| .100 | (.350) | — | .7 | — | 1.0 | — | 1.3 | — | 2.0 | 2.3 | — | — |
| .125 | (.187) | — | — | .6 | — | — | 1.0 | — | — | — | — | — |
| .125 | (.350) | .5 | 1.0 | — | 1.5 | — | 2.0 | — | 2.5 | — | 3.0 | — |
| .150 | (.340) | — | 1.3 | 1.7 | 2.0 | 2.3 | 2.6 | 3.0 | 3.3 | 3.6 | 4.0 | 4.3 |

* Active devices added by CTS Microelectronics, Inc., Lafayette, Indiana.

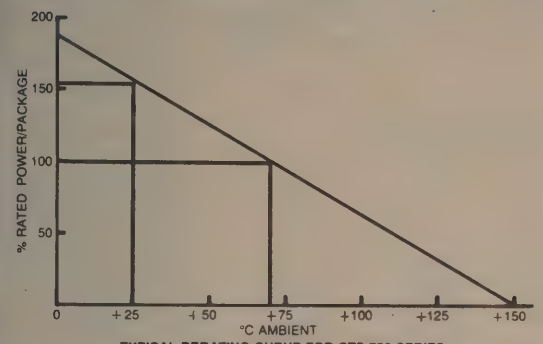
ORDERING INFORMATION: Place orders using following address: CTS OF BERNE, INC., 406 Parr Rd., Berne, Ind. 46711 • (219) 589-8220 • TWX 810-323-1580

# CTS OF BERNE, INC.

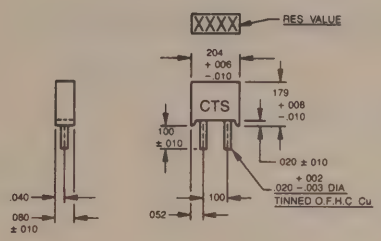
SUBSIDIARY OF CTS CORPORATION, ELKHART, INDIANA

**WORLD LEADER IN CERMET RESISTOR TECHNOLOGY**

# SINGLE-IN-LINE CERMET RESISTOR NETWORKS

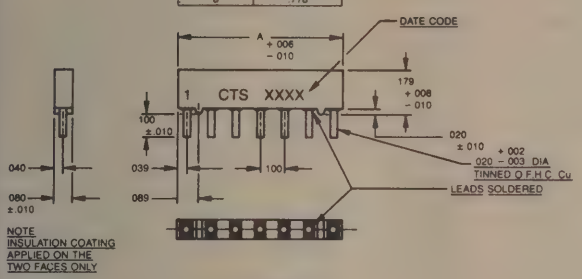



TYPICAL DERATING CURVE FOR CTS 750 SERIES



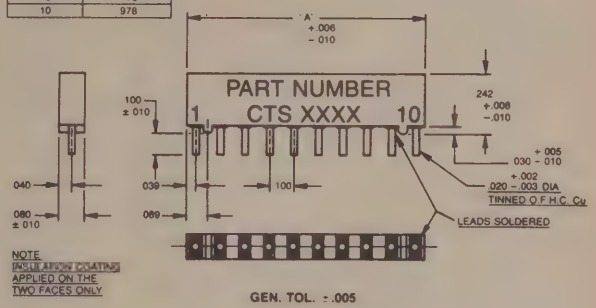

GEN. TOL. ±.005

| NO. OF PINS | "A" DIMENSION |
|---|---|
| 7 | 678 |
| 8 | 778 |



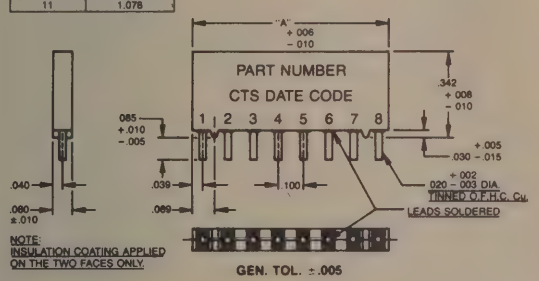

GEN. TOL. ±.005

| NO. OF PINS | "A" DIMENSION |
|---|---|
| 6 | 578 |
| 8 | 778 |
| 10 | 978 |



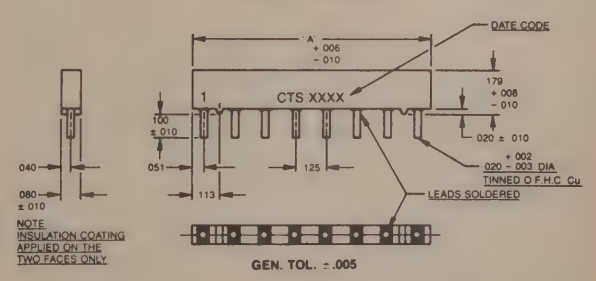

GEN. TOL. ±.005

| NO. OF PINS | A DIMENSION |
|---|---|
| 4 | 378 |
| 6 | 578 |
| 8 | 778 |
| 10 | .978 |
| 11 | 1.078 |



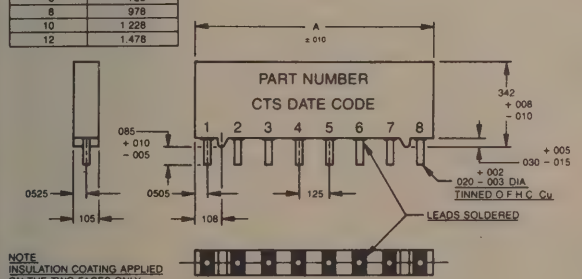

GEN. TOL. ±.005

| NO. OF PINS | A DIMENSION |
|---|---|
| 5 | 603 |
| 8 | 978 |



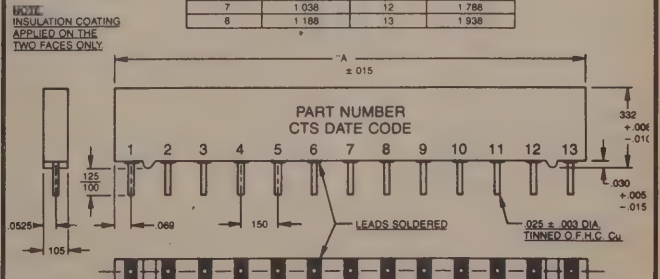

GEN. TOL. ±.005

| NO. OF PINS | "A" DIMENSION |
|---|---|
| 2 | 228 |
| 4 | 478 |
| 6 | 728 |
| 8 | 978 |
| 10 | 1.228 |
| 12 | 1.478 |




GEN. TOL. ±.005

| NO. OF PINS | A DIMENSION | NO. OF PINS | A DIMENSION |
|---|---|---|---|
| 4 | 588 | 9 | 1.338 |
| 5 | 738 | 10 | 1.488 |
| 6 | 888 | 11 | 1.638 |
| 7 | 1.038 | 12 | 1.788 |
| 8 | 1.188 | 13 | 1.938 |




GEN. TOL. ±.005

ORDERING INFORMATION: Place orders using following address: CTS OF BERNE, INC., 406 Parr Rd., Berne, Ind. 46711 • (219) 589-8220 • TWX 810-323-1580

DALE®

# MIL-R-26, TYPE RW

## DALE TYPE RS WIREWOUND RESISTOR

Silicone Coated and Molded

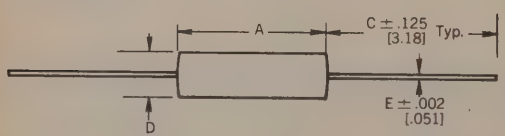
### STANDARD ELECTRICAL SPECIFICATIONS

| DALE TYPE | MIL-R-26 TYPE | DALE RATING U .05% thru 5% | DALE RATING V 3% & 5% | RESISTANCE RANGE (Ohms) MIL. Range shown in bold face .05% | .1% | .25% | .5%, 1%, 3%, 5% | MAX. WORKING VOLTAGE U | MAX. WORKING VOLTAGE V | MAX. WT. GRAMS |
|---|---|---|---|---|---|---|---|---|---|---|
| RS-1/8 | — | .25 W | — | — | — | — | 1-950 | 8.5 | — | .15 |
| RS-1/4 | — | .4 W | — | 1-950 | .499-950 | .499-3.4K | .1-3.4K | 20 | — | .21 |
| RS-1/2 | — | .75 W | — | 1-1.3K | .499-1.3K | .499-4.9K | .1-4.9K | 29 | — | .23 |
| RS-1A | **RW-70** | 1.0 W | — | 1-2.7K | .499-2.7K **.1-2.74K** | .499-10.4K **.1-2.74K** | .1-10.4K **.1-2.74K** | 52 | — | .34 |
| RS-1B | — | 1.1 W | — | 1-4.0K | .499-4K | .499-15K | .1-15K | 62 | — | .40 |
| RS-2 | — | 4.0 W | 5.5 W | .499-12.7K | .499-12.7K | .1-47.1K | .1-47.1K | 210 | 250 | 2.1 |
| RS-2A | — | 3.25 W | 4.75 W | .499-11.4K | .499-11.4K | .1-42.1K | .1-42.1K | 185 | 220 | .90 |
| RS-2B | **RW-79** | 3.0 W | 3.75 W | .499-6.5K | .499-6.5K **.1-6.49K** | .1-24.5K **.1-6.49K** | .1-24.5K **.1-6.49K** | 140 | 157 | .70 |
| RS-2C | — | 2.5 W | 3.25 W | .499-8.6K | .499-8.6K | .1-32.3K | .1-32.3K | 138 | 157 | 1.6 |
| RS-2C-23 | — | 2.5 W | 3.25 W | .499-8.6K | .499-8.6K | .1-32.3K | .1-32.3K | 138 | 157 | 1.6 |
| RS-5 | — | 5.0 W | 6.5 W | .499-25.7K | .499-25.7K | .1-95.2K | .1-95.2K | 360 | 410 | 4.2 |
| RS-5-69 | **RW-74** | 5.0 W | 6.5 W | .499-24.5K | .499-24.5K **.1-24.3K** | .1-91.0K **.1-24.3K** | .1-91.0K **.1-24.3K** | 350 | 400 | 4.2 |
| RS-5-70 | — | 5.0 W | 6.5 W | .499-25.7K | .499-25.7K | .1-95.2K | .1-95.2K | 360 | 410 | 4.2 |
| RS-7 | — | 7.0 W | 9.0 W | .499-41.4K | .499-41.4K | .1-154K | .1-154K | 504 | 576 | 4.7 |
| RS-10 | — | 10 W | 13 W | .499-73.4K | .499-73.4K | .1-273K | .1-273K | 858 | 978 | 9.0 |
| RS-10-38 | **RW-78** | 10 W | 13 W | .499-71.5K | .499-71.5K **.1-71.5K** | .1-265K **.1-71.5K** | .1-265K **.1-71.5K** | 846 | 966 | 9.0 |
| RS-10-39 | — | 10 W | 13 W | .499-73.4K | .499-73.4K | .1-273K | .1-273K | 858 | 978 | 9.0 |

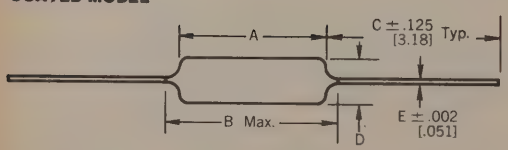
**NOTE:** All resistance ranges shown conform to military specifications unless otherwise indicated. [Numbers in brackets indicate millimeters]

### PHYSICAL CONFIGURATIONS

**MOLDED MODEL**




**COATED MODEL**




| | TYPE | DIM. A | DIM. B | DIM. C | DIM. D | DIM. E |
|---|---|---|---|---|---|---|
| MOLDED MODELS | RS-1/8 | .155 ± .015 [3.94 ± .381] | — | 1.500 [38.1] | .065 ± .015 [1.65 ± .381] | .016 [.406] |
| | RS-1/4 | .250 ± .015 [6.35 ± .381] | — | 1.500 [38.1] | .078 ± .015 [1.98 ± .381] | .020 [.508] |
| | RS-1/2 | .312 ± .015 [7.92 ± .381] | — | 1.500 [38.1] | .078 ± .015 [1.98 ± .381] | .020 [.508] |
| | RS-1A | .422 ± .015 [10.72 ± .381] | — | 1.500 [38.1] | .110 ± .015 [2.79 ± .381] | .020 [.508] |
| COATED MODELS | RS-1B | .575 ± .015 [14.61 ± .381] | — | 1.500 [38.1] | .110 ± .015 [2.79 ± .381] | .020 [.508] |
| | RS-2 | .625 ± .062 [15.88 ± 1.58] | .765 [19.43] | 2.000 [50.8] | .250 ± .031 [6.35 ± .787] | .040 [1.02] |
| | RS-2A | .812 ± .062 [20.62 ± 1.58] | .890 [22.61] | 1.500 [38.1] | .187 ± .031 [4.75 ± .787] | .032 [.813] |
| | RS-2B | .560 ± .062 [14.22 ± 1.58] | .622 [15.80] | 1.500 [38.1] | .187 ± .031 [4.75 ± .787] | .032 [.813] |
| | RS-2C | .500 ± .062 [12.7 ± 1.58] | .593 [15.06] | 1.500 [38.1] | .218 ± .031 [5.54 ± .787] | .040 [1.02] |
| | RS-2C-23 | .500 ± .062 [12.7 ± 1.58] | .593 [15.06] | 1.500 [38.1] | .218 ± .031 [5.54 ± .787] | .032 [.813] |
| | RS-5 | .875 ± .062 [22.23 ± 1.58] | 1.000 [25.4] | 2.000 [50.8] | .312 ± .031 [7.92 ± .787] | .040 [1.02] |
| | RS-5-69 | .875 ± .062 [22.23 ± 1.58] | .937 [23.80] | 2.000 [50.8] | .312 ± .031 [7.92 ± .787] | .040 [1.02] |
| | RS-5-70 | .875 ± .062 [22.23 ± 1.58] | 1.000 [25.4] | 1.500 [38.1] | .312 ± .031 [7.92 ± .787] | .032 [.813] |
| | RS-7 | 1.218 ± .062 [30.94 ± 1.58] | 1.281 [30.94] | 2.000 [50.8] | .312 ± .031 [7.92 ± .787] | .040 [1.02] |
| | RS-10 | 1.780 ± .062 [45.21 ± 1.58] | 1.875 [47.63] | 2.000 [50.8] | .375 ± .031 [9.53 ± .78] | .040 [1.02] |
| | RS-10-38 | 1.780 ± .062 [45.21 ± 1.58] | 1.842 [46.79] | 2.000 [50.8] | .375 ± .031 [9.53 ± .78] | .040 [1.02] |
| | RS-10-39 | 1.780 ± .062 [45.21 ± 1.58] | 1.875 [47.63] | 1.500 [38.1] | .375 ± .031 [9.53 ± .78] | .032 [.813] |

*For complete information, write or phone*

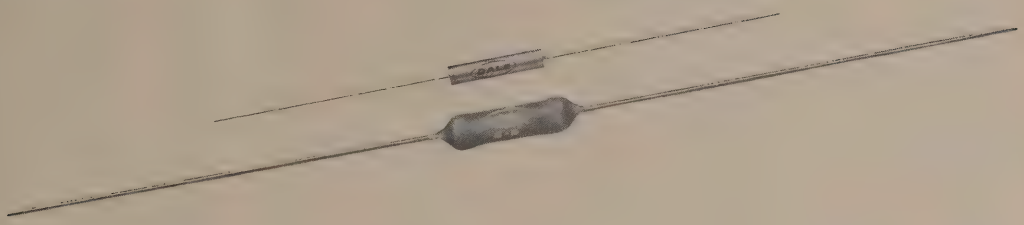
**DALE ELECTRONICS, INC.**, Box 609, Columbus, Nebraska 68601. Phone 402-564-3131

DALE®

# MIL-R-26E, TYPE RW

## DALE TYPE G WIREWOUND RESISTOR

Silicone Coated and Molded
Beryllium Oxide Core



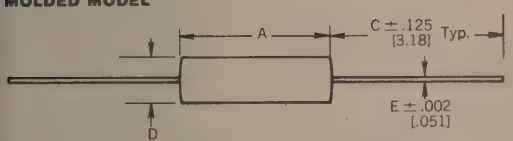
### STANDARD ELECTRICAL SPECIFICATIONS

| DALE TYPE | MIL-R-26 TYPE | DALE RATING U .05% thru 5% | DALE RATING V 3% & 5% | RESISTANCE RANGE (Ohms) MIL. Range shown in bold face .05% | .1% | .25% | .5%, 1%, 3%, 5% | MAX. WORKING VOLTAGE U | MAX. WORKING VOLTAGE V | MAX. WT. GRAMS |
|---|---|---|---|---|---|---|---|---|---|---|
| G-1 | **RW-81** | 1.0 W | — | 1-950 | .499-950 **.1-1K** | .499-3.4K **.1-1K** | .1-3.4K **.1-1K** | 33 | — | .20 |
| G-2 | — | 1.5 W | — | 1-1.3K | .499-1.3K | .499-4.9K | .1-4.9K | 42 | — | .21 |
| G-3 | **RW-80** | 2.25 W | — | 1-2.7K | .499-2.7K **.1-2.74K** | .499-10.4K **.1-2.74K** | .1-10.4K **.1-2.74K** | 80 | — | .34 |
| G-5 | — | 4.0 W | 5 W | .499-6.5K | .499-6.5K | .1-24.5K | .1-24.5K | 162 | 184 | .80 |
| G-5A | — | 4.5 W | 6.5 W | .499-11.4K | .499-11.4K | .1-42.1K | .1-42.1K | 214 | 257 | .95 |
| G-5C | — | 5 W | 7 W | .499-8.6K | .499-8.6K | .1-32.3K | .1-32.3K | 194 | 230 | 1.2 |
| G-6 | — | 6 W | 8 W | .499-12.7K | .499-12.7K | .1-47.1K | .1-47.1K | 258 | 298 | 2.0 |
| G-10 | — | 7 W | 10 W | .499-25.7K | .499-25.7K | .1-95.2K | .1-95.2K | 425 | 508 | 3.6 |
| G-12 | — | 10 W | 12 W | .499-41.4K | .499-41.4K | .1-154K | .1-154K | 607 | 665 | 4.2 |
| G-15 | — | 15 W | 18 W | .499-73.4K | .499-73.4K | .1-273K | .1-273K | 1050 | 1150 | 7.6 |

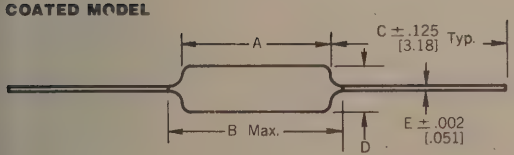
### PHYSICAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]

**MOLDED MODEL**




**COATED MODEL**




| | TYPE | DIM. A | DIM. B | DIM. C | DIM. D | DIM. E |
|---|---|---|---|---|---|---|
| MOLDED MODELS | G-1 | .250 ± .015 [6.35 ± .381] | — | 1.500 [38.1] | .078 ± .015 [1.98 ± .381] | .020 [.508] |
| | G-2 | .312 ± .015 [7.92 ± .381] | — | 1.500 [38.1] | .078 ± .015 [1.98 ± .381] | .020 [.508] |
| | G-3 | .422 ± .015 [10.72 ± .381] | — | 1.500 [38.1] | .110 ± .015 [2.79 ± .381] | .020 [.508] |
| COATED MODELS | G-5 | .562 ± .062 [14.27 ± 1.58] | .640 [16.26] | 1.500 [38.1] | .188 ± .032 [4.78 ± .813] | .032 [.813] |
| | G-5A | .812 ± .062 [20.62 ± 1.58] | .890 [22.61] | 1.500 [38.1] | .188 ± .032 [4.78 ± .813] | .032 [.813] |
| | G-5C | .500 ± .062 [12.7 ± 1.58] | .593 [15.06] | 1.500 [38.1] | .218 ± .032 [5.54 ± .813] | .040 [1.02] |
| | G-6 | .625 ± .062 [15.88 ± 1.58] | .765 [19.43] | 2.000 [50.8] | .250 ± .032 [6.35 ± .813] | .040 [1.02] |
| | G-10 | .875 ± .062 [22.23 ± 1.58] | 1.000 [25.4] | 2.000 [50.8] | .312 ± .032 [7.92 ± .813] | .040 [1.02] |
| | G-12 | 1.218 ± .062 [30.94 ± 1.58] | 1.281 [32.54] | 2.000 [50.8] | .312 ± .032 [7.92 ± .813] | .040 [1.02] |
| | G-15 | 1.780 ± .062 [45.21 ± 1.58] | 1.875 [47.63] | 2.000 [50.8] | .375 ± .032 [9.53 ± .813] | .040 [1.02] |

**NOTE:** All resistance ranges shown conform to military specifications unless otherwise indicated

*For complete information, write or phone*
**DALE ELECTRONICS, INC.,** Box 609, Columbus, Nebraska 68601. Phone 402-564-3131

DALE®

# MIL-R-26E, TYPE RW

## DALE TYPE CW WIREWOUND RESISTOR

### STANDARD ELECTRICAL SPECIFICATIONS

[Numbers in brackets indicate millimeters]

| DALE TYPE | MIL. TYPE | POWER RATING (Max. Hot Spot) 275 C | 350 C | MIL. | RESISTANCE* RANGE (MIL. Range shown in bold face) | BODY LENGTH ±.062 [1.57] | BODY DIA. ±.032 [.81] | LEAD LENGTH ±.125 [3.18] | LEAD DIA. | MAX. WT. (Grams) |
|---|---|---|---|---|---|---|---|---|---|---|
| CW-2 | – | 4.0 | 5.5 | – | .1Ω to 22K | .625 [15.88] | .250 [6.35] | 2.000 [50.80] | .040 [1.02] | 2.1 |
| CW-2A | – | 3.25 | 4.75 | – | .1Ω to 20K | .812 [20.62] | .188 [4.78] | 1.500 [38.10] | .032 [.81] | 1.0 |
| CW-2B | – | 3.0 | 3.75 | – | .1Ω to 11K | .562 [14.27] | .188 [4.78] | 1.500 [38.10] | .032 [.81] | .70 |
| CW-2C | – | 2.5 | 3.25 | – | .1Ω to 15K | .500 [12.70] | .218 [5.54] | 1.500 [38.10] | .040 [1.02] | 1.6 |
| CW-2C-1 | **RW-69** | 2.5 | 3.25 | 3.0 | .1Ω to 15K **.1Ω to 2K** | .500 [12.70] | .218 [5.54] | 1.500 [38.10] | .032 [.81] | 1.6 |
| CW-5 | – | 5.0 | 6.5 | – | .1Ω to 45K | .875 [22.22] | .312 [7.92] | 2.000 [50.80] | .040 [1.02] | 4.2 |
| CW-5-2 | – | 4.0 | 5.0 | – | .1Ω to 30K | .875 [22.22] | .250 [6.35] | 1.500 [38.10] | .032 [.81] | 4.2 |
| CW-5-5 | **RW-67** | 5.0 | 6.5 | 6.5 | .1Ω to 45K **.1Ω to 8.2K** | .875 [22.22] | .312 [7.92] | 1.500 [38.10] | .032 [.81] | 4.2 |
| CW-7 | – | 7.0 | 9.0 | – | .1Ω to 75K | 1.218 [30.94] | .312 [7.92] | 2.000 [50.80] | .040 [1.02] | 4.7 |
| CW-10 | – | 10.0 | 13.0 | – | .1Ω to 130K | 1.781 [45.24] | .375 [9.52] | 2.000 [50.80] | .040 [1.02] | 9.0 |
| CW-10-4 | **RW-68** | 10.0 | 13.0 | 11.0 | .1Ω to 130K **.1Ω to 20K** | 1.781 [45.24] | .375 [9.52] | 1.500 [38.10] | .032 [.81] | 9.0 |

*Consult factory for resistance values higher than those shown above.

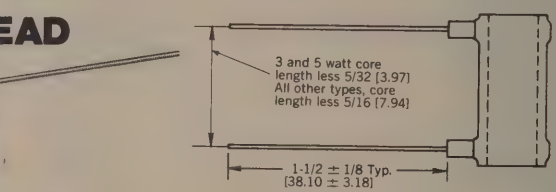
**Tolerance:** Standard tolerance is ±3% and ±5% 1 ohm and above; ±10% below 1 ohm.

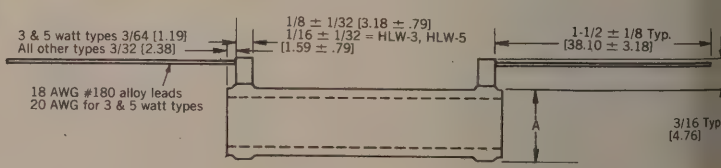
**Temperature Coefficient:** ±50 PPM/°C except on low values.

**Lead Material:** Standard material is tinned copperweld.

## DALE TYPE HLW TUBULAR LEAD

### Power Wirewound Resistors




With 18 AWG or 20 AWG #180 alloy lug-attached leads to facilitate direct electrical connection by soldering or welding. Not covered by MIL-R-26 but meets all electrical and mechanical requirements.

### STANDARD ELECTRICAL SPECIFICATIONS

| DALE TYPE | WATTAGE RATING | MAX. RESISTANCE* | LENGTH ±1/16 [1.59] | CORE O.D. | CORE I.D. ± 1/32 [.79] | A (Max.) | AXIAL TERMINAL STD. | AXIAL TERMINAL OPT. | RADIAL TERMINAL STD. | RADIAL TERMINAL OPT. | MOUNTING HARDWARE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HLW-3 | 3 | 6K | 7/16 [11.11] | 13/64 [5.16] | 1/8 [3.18] | 19/64 [7.54] | A2 | A1 | R2 | R1 | – |
| HLW-5 | 5-1/4 | 15K | 5/8 [15.88] | 1/4 [6.35] | 1/8 [3.18] | 11/32 [8.73] | A2 | A1 | R2 | R1 | – |
| HLW-6 | 8 | 25K | 1 [25.40] | 5/16 [7.94] | 3/16 [4.76] | 13/32 [10.32] | A1 | A2 | R1 | R2 | 101, 204, 207, 301 |
| HLW-10 | 10 | 33K | 1 [25.40] | 7/16 [11.11] | 5/16 [7.94] | 9/16 [14.29] | A1 | A2 | R1 | R2 | 101, 203, 208, 301 |
| HLW-12 | 12 | 70K | 1-3/4 [44.45] | 5/16 [7.94] | 3/16 [4.76] | 13/32 [10.32] | A1 | A2 | R1 | R2 | 101, 204, 207, 301 |
| HLW-15 | 15 | 78K | 1-1/2 [38.10] | 7/16 [11.11] | 5/16 [7.94] | 9/16 [14.29] | A1 | A2 | R1 | R2 | 101, 203, 208, 301 |
| HLW-20 | 20 | 120K | 2 [50.80] | 7/16 [11.11] | 5/16 [7.94] | 9/16 [14.29] | A1 | A2 | R1 | R2 | 101, 203, 208, 301 |

*Minimum resistance is .1 ohm for all models. Consult factory for higher values.

**NOTE:** All resistance ranges shown conform to military specifications unless otherwise indicated.

*For complete information, write or phone*
DALE ELECTRONICS, INC., Box 609, Columbus, Nebraska 68601. Phone 402-564-3131

DALE®

# MIL-R-26E, TYPE RW

## DALE TYPE HL TUBULAR

### Power Wirewound Resistors

**STANDARD ELECTRICAL SPECIFICATIONS**

[Numbers in brackets indicate millimeters]

| DALE | | | | MIL-R-26 | | | CORE DIMENSIONS | | | TERMINALS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | WATTAGE RATING | MAX.* RESISTANCE | MAX. WORKING† VOLTAGE | STYLE | V RATING | MAX. RESISTANCE | LENGTH ±1/16 [1.59] | O.D. | I.D. ± 1/32 [.79] | STD. | OPT. | MOUNTING HARDWARE |
| HL-5 | 5 | 25K | 230 | – | – | – | 1 [25.40] | 1/4 [6.35] | 5/32 [3.97] | 01 | 05 | ——— |
| HL-6 | 6 | 25K | 250 | – | – | – | 1 [25.40] | 5/16 [7.94] | 3/16 [4.76] | 02 | 05, 06, 14 | 101, 204, 207, 301 |
| HL-10 | 10 | 33K | 400 | RW-30 | 11W | 2.7K | 1 [25.40] | 7/16 [11.11] | 5/16 [7.94] | 02 | 05, 06, 14 | 101, 203, 208, 301 |
| HL-11 | 11 | 85K | 600 | RW-29 | 11W | 5.6K | 1-3/4 [44.45] | 3/8 [9.52] | 3/16 [4.76] | 02 | 05, 14 | 101, 204, 207, 301 |
| HL-12 | 12 | 70K | 500 | – | – | – | 1-3/4 [44.45] | 5/16 [7.94] | 3/16 [4.76] | 02 | 05, 06, 14 | 101, 204, 207, 301 |
| HL-15 | 15 | 78K | 650 | RW-31 | 14W | 6.8K | 1-1/2 [38.10] | 7/16 [11.11] | 5/16 [7.94] | 02 | 05, 06, 14 | 101, 203, 208, 301 |
| HL-20 | 20 | 120K | 880 | RW-32 | 17W | 10K | 2 [50.80] | 7/16 [11.11] | 5/16 [7.94] | 02 | 05, 06, 14 | 101, 203, 208, 301 |
| HL-25 | 25 | 155K | 1.3K | – | – | – | 2 [50.80] | 9/16 [14.29] | 5/16 [7.94] | 02 | 06, 14, 15, 17 | 101, 203, 208, 301 |
| HL-26 | 26 | 210K | 1.4K | RW-33 | 26W | 18K | 3 [76.20] | 7/16 [11.11] | 5/16 [7.94] | 02 | 05, 06, 14 | 101, 203, 208, 301 |
| HL-50 | 50 | 385K | 1.9K | – | – | – | 4 [101.60] | 9/16 [14.29] | 5/16 [7.94] | 02 | 06, 14, 15, 17 | 101, 203, 208, 301 |
| HL-51 | 51 | 410K | 2K | – | – | – | 3-1/2 [88.90] | 3/4 [19.05] | 1/2 [12.70] | 03 | 06, 14, 15, 17 | 102, 202, 206, 302, 303 |
| HL-60 | 60 | 485K | 2.1K | RW-35 | 55W | 43K | 4 [101.60] | 3/4 [19.05] | 1/2 [12.70] | 03 | 06, 14, 15, 17 | 102, 202, 206, 302, 303 |
| HL-65 | 65 | 560K | 2.4K | – | – | – | 4-1/2 [114.30] | 3/4 [19.05] | 1/2 [12.70] | 03 | 06, 14, 15, 17 | 102, 202, 206, 302, 303 |
| HL-80 | 80 | 685K | 2.4K | RW-36 | 78W | 56K | 4 [101.60] | 1-1/8 [28.58] | 3/4 [19.05] | 04 | 06, 07, 14, 15, 17, 19 | 103, 201, 205, 302, 303 |
| HL-100 | 100 | 870K | 2.5K | – | – | – | 6-1/2 [165.10] | 3/4 [19.05] | 1/2 [12.70] | 03 | 06, 14, 15, 17 | 102, 202, 206, 302, 303 |
| HL-120 | 120 | 1.15 Meg. | 3.2K | RW-37 | 113W | 91K | 6 [152.40] | 1-1/8 [28.58] | 3/4 [19.05] | 04 | 06, 07, 14, 15, 17, 19 | 103, 201, 205, 302, 303 |
| HL-130 | 130 | 1.25 Meg. | 4.1K | – | – | – | 6-1/2 [165.10] | 1-1/8 [28.58] | 3/4 [19.05] | 04 | 06, 07, 14, 15, 17, 19 | 103, 201, 205, 302, 303 |
| HL-160 | 160 | 1.6 Meg. | 4.8K | RW-38 | 159W | 150K | 8 [203.20] | 1-1/8 [28.58] | 3/4 [19.05] | 04 | 06, 07, 14, 15, 17, 19 | 103, 201, 205, 302, 303 |
| HL-175 | 175 | 1.7 Meg. | 5.2K | – | – | – | 8-1/2 [215.90] | 1-1/8 [28.58] | 3/4 [19.05] | 04 | 06, 07, 14, 15, 17, 19 | 103, 201, 205, 302, 303 |
| HL-225 | 225 | 2.1 Meg. | 6.1K | RW-47 | 210W | 160K | 10-1/2 [266.70] | 1-1/8 [28.58] | 3/4 [19.05] | 04 | 06, 07, 14, 15, 17, 19 | 103, 201, 205, 302, 303 |

*Minimum resistance is .1 ohm for all models. Consult factory for resistance values higher than those shown above.
†Supplementary insulation to be provided when potential to ground is greater than 500 V.

**NOTE:** All resistance ranges shown conform to military specifications unless otherwise indicated.

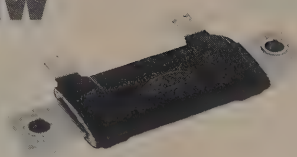
*For complete information, write or phone*
**DALE ELECTRONICS, INC.**, Box 609, Columbus, Nebraska 68601. Phone 402-564-3131

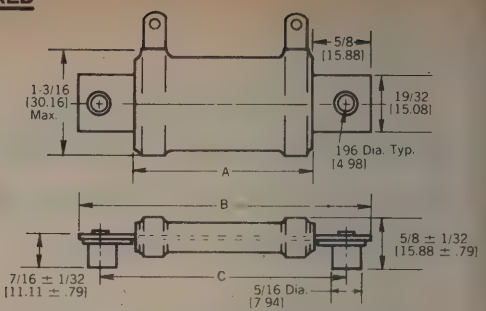
DALE®

# MIL-R-26, TYPE RW

## DALE TYPE HL FLAT

Power Wirewound Resistor






### STANDARD SIZE

[Numbers in brackets indicate millimeters]

| TYPE | DALE WATTAGE RATING | DALE MAX.* RESISTANCE | DALE MAX.† WORKING VOLTAGE | MIL-R-26 STYLE | MIL-R-26 V RATING | MIL-R-26 MAX. RESISTANCE | DIMENSIONS A ±1/16 [1.59] | DIMENSIONS B ±1/16 [1.59] | DIMENSIONS C ±1/32 [.79] | TERMINALS STD. | TERMINALS OPT. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HL-24 | 30 | 55K | 800 | **RW-20** | 21 W | **8.2K** | 1-1/4 [31.75] | 2-1/2 [63.50] | 2 [50.80] | 08 | 09, 16, 18 |
| HL-35 | 40 | 135K | 1.4KV | **RW-21** | 31 W | **16K** | 2 [50.80] | 3-1/4 [82.55] | 2-3/4 [69.85] | 08 | 09, 16, 18 |
| HL-55 | 55 | 300K | 1.8KV | **RW-22** | 53 W | **36K** | 3-1/2 [88.90] | 4-3/4 [120.65] | 4-1/4 [107.95] | 08 | 09, 16, 18 |
| HL-70 | 70 | 430K | 2.2KV | **RW-23** | 68 W | **51K** | 4-3/4 [120.65] | 6 [152.40] | 5-1/2 [139.70] | 08 | 09, 16, 18 |
| HL-95 | 95 | 560K | 2.6KV | **RW-24** | 91 W | **75K** | 6 [152.40] | 7-1/4 [184.15] | 6-3/4 [171.45] | 08 | 09, 16, 18 |

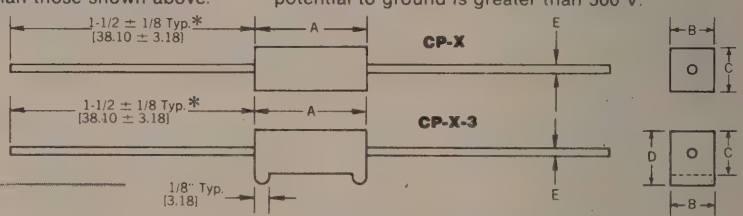
*Minimum resistance is .1 ohm for all models. Consult factory for non-inductive windings or resistance values higher than those shown above.

†Supplementary insulation to be provided when potential to ground is greater than 500 V.

# EIA RS 344

## DALE TYPE CP

Power Wirewound Resistor




*1-3/8 ± 1/8 [34.92 ± 3.18] for CP-20, CP-20-3, CP-22, CP-22-3.

### STANDARD SIZE

| DALE TYPE | WATTAGE RATING | EIA STANDARD RS-344 TYPE | RESISTANCE | MAX. WORKING VOLTAGE | DIMENSIONS A ± 1/32 [.79] | DIMENSIONS B ± 1/32 [.79] | DIMENSIONS C ± 1/32 [.79] | DIMENSIONS D ± 1/32 [.79] | DIMENSIONS E ± .001 [.02] |
|---|---|---|---|---|---|---|---|---|---|
| CP-2 | 2 | CRU2A | .1 to 2.4K | 65 | 11/16 [17.46] | 1/4 [6.35] | 1/4 [6.35] | — | .032 [.81] |
| CP-2-3 | 2 | — | .1 to 2.4K | 65 | 11/16 [17.46] | 1/4 [6.35] | 1/4 [6.35] | 5/16 [7.94] | .032 [.81] |
| CP-3 | 3 | CRU3 | .1 to 7.5K | 150 | 7/8 [22.22] | 5/16 [7.94] | 5/16 [7.94] | — | .036 [.91] |
| CP-3-3 | 3 | — | .1 to 7.5K | 150 | 7/8 [22.22] | 5/16 [7.94] | 5/16 [7.94] | 3/8 [9.52] | .036 [.91] |
| CP-5 | 5 | CRU5 | .1 to 8.5K | 200 | 7/8 [22.22] | 3/8 [9.52] | 11/32 [8.73] | — | .036 [.91] |
| CP-5-3 | 5 | — | .1 to 8.5K | 200 | 7/8 [22.22] | 3/8 [9.52] | 11/32 [8.73] | 13/32 [10.32] | .036 [.91] |
| CP-7 | 7 | CRU7 | .12 to 18K | 350 | 1-25/64 [35.32] | 3/8 [9.52] | 11/32 [8.73] | — | .036 [.91] |
| CP-7-3 | 7 | — | .12 to 18K | 350 | 1-25/64 [35.32] | 3.8 [9.52] | 11/32 [8.73] | 15/32 [11.91] | .036 [.91] |
| CP-10 | 10 | CRU10 | .18 to 30K | 540 | 1-7/8 [47.62] | 3/8 [9.52] | 11/32 [8.73] | — | .036 [.91] |
| CP-10-3 | 10 | — | .18 to 30K | 540 | 1-7/8 [47.62] | 3/8 [9.52] | 11/32 [8.73] | 15/32 [11.91] | .036 [.91] |
| CP-15 | 15 | CRU15 | .18 to 30K | 670 | 1-7/8 [47.62] | 1/2 [12.70] | 1/2 [12.70] | — | .036 [.91] |
| CP-15-3 | 15 | — | .18 to 30K | 670 | 1-7/8 [47.62] | 1/2 [12.70] | 1/2 [12.70] | 5/8 [15.88] | .036 [.91] |
| CP-20 | 20 | — | .29 to 30K | 770 | 2-1/2 [63.50] | 1/2 [12.70] | 1/2 [12.70] | — | .036 [.91] |
| CP-20-3 | 20 | — | .29 to 30K | 770 | 2-1/2 [63.50] | 1/2 [12.70] | 1/2 [12.70] | 5/8 [15.88] | .036 [.91] |
| CP-22 | 22 | — | .52 to 30K | 815 | 2-1/2 [63.50] | 1/2 [12.70] | 1/2 [12.70] | — | .036 [.91] |
| CP-22-3 | 22 | — | .52 to 30K | 815 | 2-1/2 [63.50] | 1/2 [12.70] | 1/2 [12.70] | 5/8 [15.88] | .036 [.91] |
| CP-25 | 25 | — | .58 to 30K | 860 | 2-1/2 [63.50] | 5/8 [15.88] | 5/8 [15.88] | — | .036 [.91] |

*For complete information, write or phone*

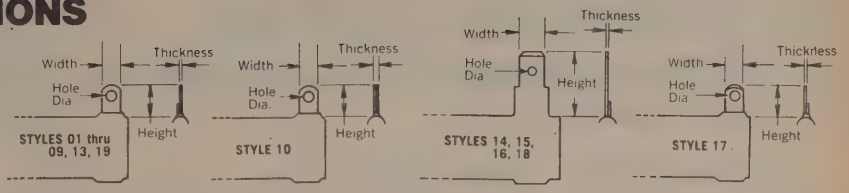
**DALE ELECTRONICS, INC.**, Box 609, Columbus, Nebraska 68601. Phone 402-564-3131

DALE®

[Numbers in brackets indicate millimeters]

# TERMINAL SPECIFICATIONS

## Standard and Optional Lug Terminals for HL and HLM Power Wirewound Resistors




### TERMINAL DIMENSIONS

| HL STYLES | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | A1 | A2 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WIDTH | 1/8 [3.18] | 3/16 [4.76] | 1/4 [6.35] | 1/4 [6.35] | 3/16 [4.76] | 1/4 [6.35] | 3/8 [9.52] | 1/4 [6.35] | 3/16 [4.76] | 1/8 [3.18] | 1-1/2" [38.10] 18 AWG Lead | 1-1/2" [38.10] 20 AWG Lead | 3/16 [4.76] | 3/16 [4.76] | 1/4 [6.35] | 3/16 [4.76] | 1/4 [6.35] | 1/4 [6.35] | 1/2 [12.70] |
| HEIGHT | 1/4 [6.35] | 13/32 [10.32] | 7/16 [11.11] | 9/16 [14.29] | 7/16 [11.11] | 9/16 [14.29] | 5/8 [15.88] | 1/2 [12.70] | 1/2 [12.70] | 3/16 [4.76] | | | 7/16 [11.11] | 9/16 [14.29] | 19/32 [15.08] | 9/16 [14.29] | 9/16 [14.29] | 9/16 [14.29] | 3/4 [19.05] |
| HOLE DIA. | .062 [1.57] | .093 [2.36] | .125 [3.18] | .125 [3.18] | .104 [2.64] | .166 [4.22] | .173 [4.39] | .125 [3.18] | .104 [2.64] | .063 [1.60] | | | .106 [2.69] | .050 [1.27] | .065 [1.65] | .050 [1.27] | .150 [3.81] | .065 [1.65] | .201 [5.10] |
| THICKNESS | .020 [.51] | .020 [.51] | .020 [.51] | .020 [.51] | .020 [.51] | .020 [.51] | .020 [.51] | .020 [.51] | .020 [.51] | .030 [.76] | | | .015 [.38] | .020 [.51] | .031 [.79] | .020 [.51] | .031 [.79] | .031 [.79] | .020 [.51] |

### TERMINAL AVAILABILITY

| CORE O.D. | RESISTOR TYPE | TERMINAL STYLE STANDARD | TERMINAL STYLE OPTIONAL | SETBACK |
|---|---|---|---|---|
| 1/4 [6.35] | HL-5 | 01 | 05 | 5/64 [1.98] |
| 5/16 [7.94] | HL-6, 12 | 02 | 05, 06, 14 | 3/32 [2.38] |
| 3/8 [28.58] | HL-11 | 02 | 05, 14 | 3/32 [2.38] |
| 7/16 [11.11] | HL-10, 15, 20, 26 | 02 | 05, 06, 14 | 3/32 [2.38] |
| 9/16 [14.29] | HL-25, 50 | 02 | 06, 14, 15, 17 | 3/32 [2.38] |
| 3/4 [19.05] | HL-51, 60, 65, 100 | 03 | 06, 14, 15, 17 | 1/8 [3.18] |
| 1-1/8 [28.58] | HL-80, 120, 130, 160, 175, 225 | 04 | 06, 07, 14, 15, 17, 19 | 7/32 [5.56] |
| FLAT | ALL STYLES | 08 | 09, 16, 18 | 5/64 [1.98] |
| MIN. FLAT | ALL STYLES | 10 | 13 | 3/64 [1.19] |

**STANDARD TERMINAL** will be supplied unless optional terminal is specified.

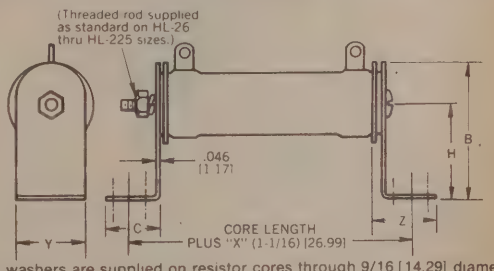
**OPTIONAL TERMINAL** available on request.

**TERMINAL FINISH** – Finish for terminal styles 14, 15, 16, 17 and 18 is limited to nickel plated steel (N). All other terminals will be supplied in tinned finish (Z) unless otherwise specified. Optional finishes are nickel plated (N) for HL's, bare alloy 180 (W) for HLW lead styles. Specify proper suffix in part number designation when ordering.

# MOUNTING SPECIFICATIONS

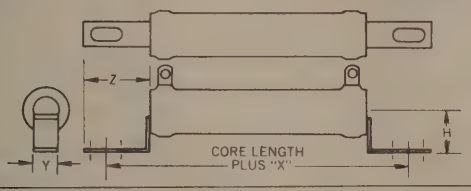
## HORIZONTAL THRU-BOLT

| BRACKET TYPE | X | Y | Z | H | MOUNTING SLOT | C | B |
|---|---|---|---|---|---|---|---|
| 101 | 1-1/16 [26.99] | 1/2 [12.70] | 55/64 [21.83] | 1 [25.40] | 7/32 x 7/16 [5.56 x 11.11] | 3/4 [19.05] | 1-3/8 [34.92] |
| 102 | 1-1/16 [26.99] | 3/4 [19.05] | 55/64 [21.83] | 1-1/4 [31.75] | 7/32 x 7/16 [5.56 x 11.11] | 3/4 [19.05] | 1-3/4 [44.45] |
| 103 | 1-1/16 [26.99] | 1-1/4 [31.75] | 1 [25.40] | 1-1/2 [38.10] | 9/32 x 9/16 [7.14 x 14.29] | 7/8 [22.22] | 2-1/8 [53.98] |



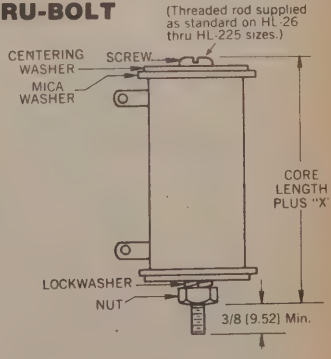

**Note:** Flat washers are supplied on resistor cores through 9/16 [14.29] diameter.

## PUSH-IN




| BRACKET TYPE | X | H | Y | Z | HOLE |
|---|---|---|---|---|---|
| 201 | 13/16 [20.64] | 1-25/64 [35.32] | 1/2 [12.70] | 11/16 [17.46] | .188 x .250 [4.78 x 6.35] |
| 202 | 11/16 [17.46] | 31/32 [24.61] | 3/8 [9.52] | 5/8 [15.88] | .175 x .359 [4.44 x 9.12] |
| 203 | 5/8 [15.88] | 43/64 [17.06] | 1/4 [6.35] | 15/32 [11.91] | .161 Dia. [4.09] |
| 204 | 3/8 [9.52] | 9/32 [7.14] | 1/4 [6.35] | 11/32 [8.73] | .144 Dia. [3.66] |
| 205 | 13/16 [20.64] | 1-25/64 [35.32] | 1/2 [12.70] | 11/16 [17.46] | .196 x .260 [4.98 x 6.60] |
| 206 | 23/32 [18.26] | 31/32 [24.61] | 3/8 [9.52] | 5/8 [15.88] | .196 x .375 [4.98 x 9.52] |
| 207 | 15/32 [11.91] | 9/32 [7.14] | 5/16 [7.94] | 7/16 [11.11] | .173 x .266 [4.39 x 6.76] |
| 208 | 5/8 [15.88] | 43/64 [17.06] | 5/16 [7.94] | 17/32 [13.49] | .173 x .296 [4.39 x 7.52] |

## VERTICAL THRU-BOLT




**Note:** Flat washers are supplied on resistor cores through 9/16 [14.29] diameter.

| BRACKET TYPE | X (Approximate) | THREAD |
|---|---|---|
| 301 | 7/16 [11.11] | 8-32 |
| 302 | 1/4 [6.35] | 8-32 |
| 303 | 1/4 [6.35] | 10-32 |

*For complete information, write or phone*

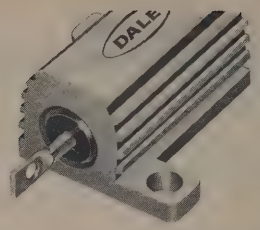
**DALE ELECTRONICS, INC.**, Box 609, Columbus, Nebraska 68601. Phone 402-564-3131

DALE®

# MIL-R-18546D, TYPE RE

## DALE TYPE RH WIREWOUND RESISTOR

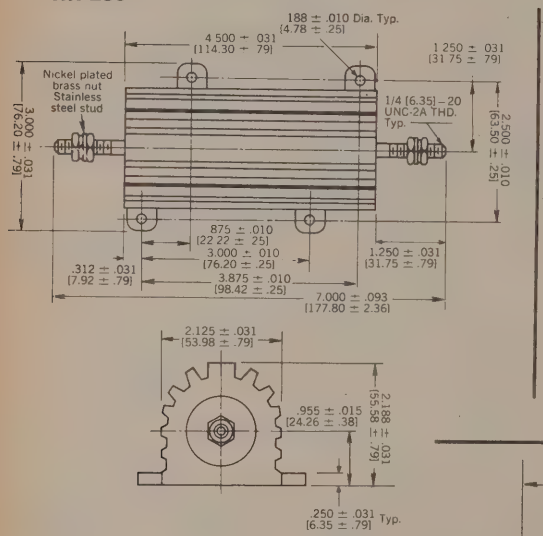
### Aluminum Housed




### STANDARD ELECTRICAL SPECIFICATIONS

| DALE TYPE | MIL-R-18546 TYPE | POWER RATING (Watts) | | RESISTANCE RANGE (Ohms) MIL. Range shown in bold face | | MAX. WORKING VOLTAGE | MAX. WEIGHT (Grams) | STANDARD TEMPERATURE COEFFICIENT VALUE RANGES (Ohms)† | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | DALE* | MIL | .05%, .1%, .25% | .5%, 1%, 3% | | | ±50 PPM | ±30 PPM | ±20 PPM |
| RH-5 | **RE-60G** | 7.5 (5) | 5 | 1 to 6.5K | .1 to 24.5K<br>**.1 to 3.32K** | 160 | 3 | 1 to 9.9 | 10 to 49 | 50 to 24.5K |
| RH-10 | **RE-65G** | 12.5 (10) | 10 | 1 to 12.7K | .008 to 47.1K<br>**.1 to 5.62K** | 265 | 6 | 1 to 9.9 | 10 to 79 | 80 to 47.1K |
| RH-25 | **RE-70G** | 25 | 20 | .5 to 25.7K | .01 to 95.2K<br>**.1 to 12.1K** | 550 | 13 | 1 to 9.9 | 10 to 169 | 170 to 95.2K |
| RH-50 | **RE-75G** | 50 | 30 | .5 to 73.4K | .01 to 273K<br>**.1 to 39.2K** | 1250 | 28 | 1 to 9.9 | 10 to 469 | 470 to 273K |
| RH-100 | **RE-77G** | 100 | 75 | .3 to 50K | .05 to 50K<br>**.05 to 29.4K** | 1900 | 400 | 1 to 99 | 100 to 949 | 950 to 50K |
| RH-250 | **RE-80G** | 250 | 120 | .3 to 75K | .1 to 75K<br>**.1 to 35.7K** | 2300 | 800 | 1 to 99 | 100 to 999 | 1K to 75K |

**RH-250**

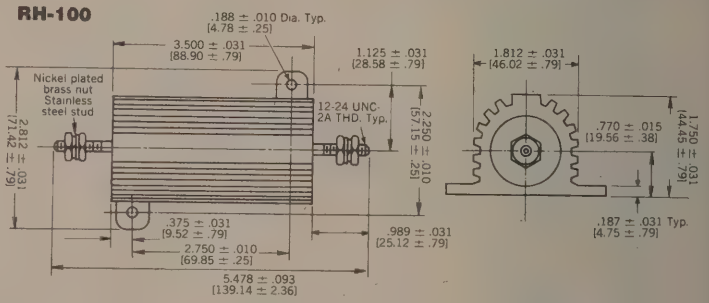


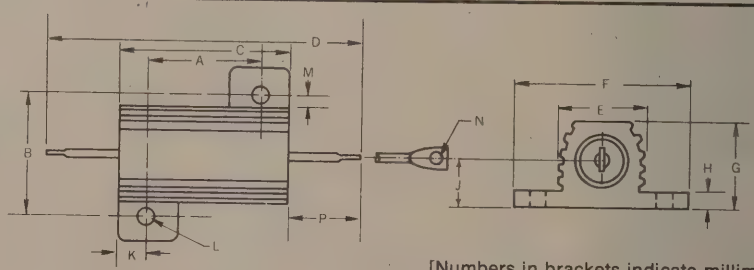

*NOTE: Figures in parentheses on RH-5 and RH-10 indicate wattage printed on these resistors. New construction allows them to be rated at 7.5 and 12.5 watts—but they will be printed with these higher ratings ***only*** upon customer request.

These resistors are also available in non-inductive NH styles.

NOTE: All resistance ranges shown conform to military specifications unless otherwise indicated.

**RH-100**




**RH-5 thru RH-50**

### DIMENSIONS

[Numbers in brackets indicate millimeters]

| TYPE | A | B | C | D | E | F | G | H | J | K | L | M | N | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RH-5 | .444<br>± .005<br>[11.28<br>± .127] | .490<br>± .005<br>[12.45<br>± .127] | .600<br>± .031<br>[15.24<br>± .787] | 1.125<br>± .062<br>[28.58<br>±1.575] | .334<br>± .015<br>[8.48<br>± .381] | .646<br>± .015<br>[16.41<br>± .381] | .320<br>± .015<br>[8.13<br>± .381] | .065<br>± .010<br>[1.65<br>± .254] | .133<br>± .010<br>[3.38<br>± .254] | .078<br>± .010<br>[1.98<br>± .254] | .093<br>± .005<br>[2.36<br>± .127] | .078<br>± .015<br>[1.98<br>± .381] | .050<br>± .005<br>[1.27<br>± .127] | .262<br>± .062<br>[6.65<br>±1.575] |
| RH-10 | .562<br>± .005<br>[14.27<br>± .127] | .625<br>± .005<br>[15.88<br>± .127] | .750<br>± .031<br>[19.05<br>± .787] | 1.375<br>± .062<br>[34.93<br>± 1.58] | .420<br>± .015<br>[10.67<br>± .381] | .800<br>± .015<br>[20.32<br>± .381] | .390<br>± .015<br>[9.91<br>± .381] | .075<br>± .010<br>[1.90<br>± .254] | .165<br>± .010<br>[4.19<br>± .254] | .093<br>± .010<br>[2.36<br>± .254] | .093<br>± .005<br>[2.36<br>± .127] | .102<br>± .015<br>[2.59<br>± .381] | .086<br>± .005<br>[2.18<br>± .127] | .312<br>± .062<br>[7.92<br>± 1.58] |
| RH-25 | .719<br>± .005<br>[18.26<br>± .127] | .781<br>± .005<br>[19.84<br>± .127] | 1.062<br>± .031<br>[26.97<br>± .787] | 1.938<br>± .062<br>[49.23<br>± 1.58] | .550<br>± .015<br>[13.97<br>± .381] | 1.080<br>± .015<br>[27.43<br>± .381] | .546<br>± .015<br>[13.87<br>± .381] | .088<br>± .010<br>[2.24<br>± .254] | .231<br>± .010<br>[5.87<br>± .254] | .172<br>± .010<br>[4.37<br>± .254] | .125<br>± .005<br>[3.18<br>± .127] | .115<br>± .015<br>[2.92<br>± .381] | .086<br>± .005<br>[2.18<br>± .127] | .438<br>± .062<br>[11.13<br>± 1.58] |
| RH-50 | 1.563<br>± .005<br>[39.70<br>± .127] | .844<br>± .005<br>[21.44<br>± .127] | 1.968<br>± .031<br>[49.99<br>± .787] | 2.781<br>± .062<br>[70.64<br>± 1.58] | .630<br>± .015<br>[16.00<br>± .381] | 1.140<br>± .015<br>[28.96<br>± .381] | .610<br>± .015<br>[15.49<br>± .381] | .088<br>± .010<br>[2.24<br>± .254] | .260<br>± .010<br>[6.60<br>± .254] | .196<br>± .010<br>[4.98<br>± .254] | .125<br>± .005<br>[3.18<br>± .127] | .107<br>± .015<br>[2.72<br>± .381] | .086<br>± .005<br>[2.18<br>± .127] | .406<br>± .062<br>[10.31<br>± 1.58] |

*For complete information, write or phone*
**DALE ELECTRONICS, INC.**, Box 609, Columbus, Nebraska 68601. Phone 402-564-3131

# DALE® MIL-R-39007, TYPE RWR, R LEVEL

## DALE TYPE ARS & AGS
### Established Reliability Molded and Silicone Coated with Teflon Sleeving

| DALE TYPE | MIL-R-39007 TYPE | POWER RATING (Watts) | MILITARY RANGE 1% Tolerance MINIMUM* RESISTANCE (Ohms) | MILITARY RANGE 1% Tolerance MAXIMUM* RESISTANCE (Ohms) |
|---|---|---|---|---|
| **AGS-1 | RWR-81 | 1 | 0.1 | 1.0K |
| AGS-2 | RWR-82 | 1.5 | 0.1 | 1.3K |
| **AGS-3 | RWR-80 | 2.25 | 0.1 | 3.16K |
| AGS-5 | RWR-89 | 4 | 0.1 | 4.12K |
| AGS-10 | RWR-84 | 7 | 0.1 | 12.4K |
| ARS-2 | RWR-71 | 2 | 0.1 | 12.1K |
| ARS-5 | RWR-74 | 5 | 0.1 | 12.1K |
| ARS-10 | RWR-78 | 10 | 0.1 | 39.2K |
| **AGS-1-118 | RWR-81N | 1 | 10.0 | 499 |
| AGS-2-118 | N.A. | 1.5 | 10.0 | 650 |
| **AGS-3-118 | RWR-80N | 2.25 | 10.0 | 1.58K |
| AGS-5-118 | RWR-89N | 4 | 10.0 | 2.05K |
| AGS-10-118 | RWR-84N | 7 | 10.0 | 6.19K |
| ARS-2-118 | RWR-71N | 2 | 10.0 | 8.06K |
| ARS-5-118 | RWR-74N | 5 | 10.0 | 6.04K |
| ARS-10-118 | RWR-78N | 10 | 10.0 | 19.6K |

*Consult factory for extended values.
**Molded model.

## DALE TYPE ESS, ESW, EGS, EGW, ESN & EGN
### Silicone Coated and Molded

| DALE TYPE | MIL-R-39007 TYPE | POWER RATING (Watts) | MILITARY RANGE .1% | MILITARY RANGE .5 & 1% |
|---|---|---|---|---|
| EGS-1* | RWR-81S | 1 | .499-1000 | .1-1000 |
| EGW-1* | RWR-81W | 1 | .499-1000 | .1-1000 |
| EGN-1* | RWR-81N | 1 | 10-499 | 10-499 |
| EGS-2* | RWR-82S | 1.5 | .499-1300 | .1-1300 |
| EGW-2* | RWR-82W | 1.5 | .499-1300 | .1-1300 |
| EGS-3* | RWR-80S | 2 | .499-3160 | .1-3160 |
| EGW-3* | RWR-80W | 2 | .499-3160 | .1-3160 |
| EGN-3* | RWR-80N | 2 | 10-1580 | 10-1580 |
| ESS-2B | RWR-89S | 3 | .499-4120 | .1-4120 |
| ESW-2B | RWR-89W | 3 | .499-4120 | .1-4120 |
| ESN-2B | RWR-89N | 3 | 10-2050 | 10-2050 |
| ESS-5 | RWR-74S | 5 | .499-12,100 | .1-12,100 |
| ESW-5 | RWR-74W | 5 | .499-12,100 | .1-12,100 |
| ESN-5 | RWR-74N | 5 | 10-6040 | 10-6040 |
| EGS-10 | RWR-84S | 7 | .499-12,400 | .1-12,400 |
| EGN-10 | RWR-84N | 7 | 10-6190 | 10-6190 |
| EGW-10 | RWR-84W | 7 | .499-12,400 | .1-12,400 |
| ESS-10 | RWR-78S | 10 | .499-39,200 | .1-39,200 |
| ESW-10 | RWR-78W | 10 | .499-39,200 | .1-39,200 |
| ESN-10 | RWR-78N | 10 | 10-19,600 | 10-19,600 |

*Molded models. All others have conformal coating.
**Available in non-mil models with broader resistance range and tolerance to .05%.

# DALE® MIL-R-39009B, TYPE RER

## DALE TYPE ARH Aluminum Housed Established Reliability

**STANDARD ELECTRICAL SPECIFICATIONS**

| DALE TYPE | MIL-R-39009B TYPE* | POWER RATING (Watts) MOUNTED | POWER RATING (Watts) FREE AIR | MILITARY RESISTANCE RANGE (Ohms)** MIN. | MILITARY RESISTANCE RANGE (Ohms)** MAX. | MAX. WORKING VOLTAGE | MAX. WEIGHT (Grams) | STANDARD TEMPERATURE COEFFICIENT VALUE RANGES (Ohms) ±100 PPM | ±50 PPM | ±30 PPM |
|---|---|---|---|---|---|---|---|---|---|---|
| ARH-5 | RER-60 | 5 | 3 | .1 | 3.32K | 128.9 | 3 | .1 to .99 | 1 to 19.9 | 20 to 4.12K |
| ARH-10 | RER-65 | 10 | 6 | .1 | 5.62K | 237.1 | 8 | .1 to .99 | 1 to 19.9 | 20 to 5.62K |
| ARH-25 | RER-70 | 20 | 8 | .1 | 12.1K | 491.9 | 15 | .1 to .99 | 1 to 19.9 | 20 to 12.1K |
| ARH-50 | RER-75 | 30 | 10 | .1 | 39.2K | 1085 | 32 | .1 to .99 | 1 to 19.9 | 20 to 39.2K |

*Also available in non-inductive styles RER-40, RER-45, RER-50 and RER-55. **Consult factory for extended values.

**Tolerance:** All established reliability resistors have a standard resistance tolerance of 1%.

**Standard Terminals:** Tinned copperweld for all models.

## DALE TYPE ERH & ENH Aluminum Housed Established Reliability

**STANDARD ELECTRICAL SPECIFICATIONS**

| DALE TYPE | MIL-R-39009 TYPE | POWER RATING (Watts) MOUNTED | POWER RATING (Watts) FREE AIR | MILITARY RESISTANCE RANGE (Ohms) 1% | MAX. WORKING VOLTAGE | MAX. WEIGHT (Grams) | STANDARD TEMPERATURE COEFFICIENT VALUE RANGES (Ohms) ±50PPM | ±30PPM | ±20PPM |
|---|---|---|---|---|---|---|---|---|---|
| ENH-5 | RER-40 | 5 | 3 | 1 to 1.65K | 91 | 3.3 | 1 to 9.9 | 10 to 25 | 26 to 1.65K |
| ENH-10 | RER-45 | 10 | 6 | 1 to 2.8K | 167 | 8.8 | 1 to 9.9 | 10 to 40 | 41 to 2.8K |
| ENH-25 | RER-50 | 20 | 8 | 1 to 6.04K | 348 | 16.5 | 1 to 9.9 | 10 to 85 | 86 to 6.04K |
| ENH-50 | RER-55 | 30 | 10 | 1 to 19.6K | 767 | 35.0 | 1 to 9.9 | 10 to 235 | 236 to 19.6K |
| ERH-5 | RER-60 | 5 | 3 | 0.10 to 3.32K | 129 | 3 | 1 to 9.9 | 10 to 49 | 50 to 3.32K |
| ERH-10 | RER-65 | 10 | 6 | 0.10 to 5.62K | 237 | 6 | 1 to 9.9 | 10 to 79 | 80 to 5.62K |
| ERH-25 | RER-70 | 20 | 8 | 0.10 to 12.1K | 492 | 13 | 1 to 9.9 | 10 to 169 | 170 to 12.1K |
| ERH-50 | RER-75 | 30 | 10 | 0.10 to 39.2K | 1084 | 28 | 1 to 9.9 | 10 to 469 | 470 to 39.2K |

**Standard Terminals:** Tinned copperweld for all models.

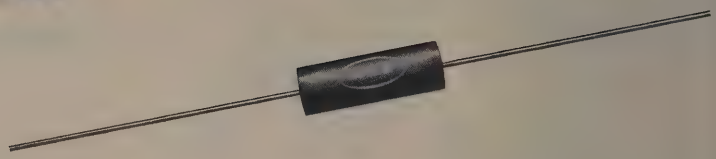
*For complete information, write or phone*
**DALE ELECTRONICS, INC.**, Box 609, Columbus, Nebraska 68601. Phone 402-564-3131

DALE®

# MIL-R-10509F, TYPE RN

## DALE TYPE MF

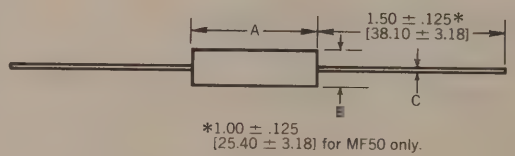
### Molded Metal Film Resistor



### STANDARD ELECTRICAL SPECIFICATIONS

| DALE TYPE | MIL TYPE | 125°C RATING (Char. C & E) | 70°C RATING (Char. D) | MAX. WT. (Grams) | MAX. WORKING VOLTAGE | RESISTANCE RANGE (Ohms) Mil. Range shown in bold face | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | T-00 | .5%, 1% T-0 (D) | .5%, 1% T-1 (D) | .1%, .25%, .5%, 1% T-2 (C) | .1%, .25%, .5%, 1% T-9 (E) |
| MF50 | **RN-50** | 1/20w | — | .11 | 200 | | 24.9-700K | 49.9-700K | 100-500K **10-100K** | 100-200K **10-100K** |
| MF-1/10 | **RN-55** | 1/10w | 1/8w | .35 | 200 | | 1-3 Meg. | 5-3 Meg. **10-301K** | 10-2 Meg. **49.9-100K** | 30.1-500K **49.9-100K** |
| MF-1/8 | **RN-60** | 1/8w | 1/4w | .45 | 300 | | 1-5 Meg. | 5-5 Meg. **10-1 Meg.** | 10-3 Meg. **49.9-499K** | 30.1-1 Meg. **49.9-499K** |
| MF-1/4 | **RN-65** | 1/4w | 1/2w | .84 | 350 | | 1-12 Meg. | 5-12 Meg. **10-2 Meg.** | 10-10 Meg. **49.9-1 Meg.** | 30.1-2 Meg. **49.9-1 Meg.** |
| MFS-1/2 | **RN-70** | 1/2w | 3/4w | 1.6 | 500 | | 1-20 Meg. | 5-20 Meg. **10-2.49 Meg.** | 10-15 Meg. **24.9-1 Meg.** | 24.9-3 Meg. **24.9-1 Meg.** |
| MF-1 | **RN-75** | — | 1w | 4.4 | 500 | **10-5.11 Meg.** | 10-20 Meg. | 24.9-20 Meg. | 49.9-20 Meg. | 49.9-5 Meg. |
| MF-2 | | — | 2w | 7.9 | 750 | | 30.1-10 Meg. | 100-8 Meg. | 100-6 Meg. | 200-5.11 Meg. |

**NOTE:** All resistance ranges shown conform to military specifications unless otherwise indicated.




*1.00 ± .125
[25.40 ± 3.18] for MF50 only.

### PHYSICAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]

| TYPE | DIM. A | DIM. B | DIM. C |
|---|---|---|---|
| MF50 | .150 ± .020 [3.81 ± .51] | .065 ± .015 [1.65 ± .38] | .016 [.41] Dia. |
| MF-1/10 | .260 ± .010 [6.60 ± .25] | .095 ± .005 [2.41 ± .13] | .025 [.64] Dia. |
| MF-1/8 | .406 ± .015 [10.31 ± .38] | .135 ± .010 [3.43 ± .25] | .025 [.64] Dia. |
| MF-1/4 | .593 ± .015 [15.06 ± .38] | .203 ± .015 [5.16 ± .38] | .025 [.64] Dia. |
| MFS-1/2 | .730 ± .020 [18.54 ± .51] | .250 ± .015 [6.35 ± .38] | .032 [.81] Dia. |
| MF-1 | 1.093 ± .020 [27.76 ± .51] | .375 ± .015 [9.52 ± .38] | .032 [.81] Dia. |
| MF-2 | 2.188 ± .020 [55.58 ± .51] | .375 ± .015 [3.52 ± .38] | .032 [.81] Dia. |

*For complete information, write or phone*
**DALE ELECTRONICS, INC.**, Box 74, Norfolk, Nebraska 68701, Phone 402-371-0080

DALE®

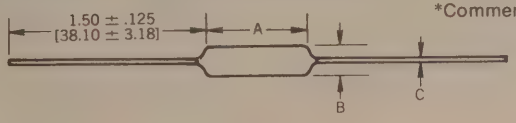
# MIL-R-10509F, TYPE RN

## DALE TYPE CMF COATED METAL FILM

### STANDARD ELECTRICAL SPECIFICATIONS

| DALE COMMERCIAL TYPE | DALE MIL. TYPE | RESISTANCE RANGE (Ohms) MIL. Range Shown in bold face T-00 .5%, 1% | T-1 (D) .10%, .25% .5%, 1% | T-2 (C) .10%, .25% .5%, 1% | T-9 (E) .10%, .25%, .5%, 1% | 125°C RATING (Char. C & E) | 70°C RATING | MAX. WEIGHT (Grams) | MAX. WORKING VOLTAGE |
|---|---|---|---|---|---|---|---|---|---|
| CMF-1/10 | **CMF-55 RN-55** | 1-3 Meg. | 5-3 Meg. **10-301K** | 10-2 Meg. **49.9-100K** | 30.1-500K **49.9-100K** | 1/10 w | 1/4 w* | .30 | 200 |
| CMF-1/8 | **CMF-60 RN-60** | 1-5 Meg. | 5-5 Meg. **10-1 Meg.** | 10-3 Meg. **49.9-499K** | 30.1-1 Meg. **49.9-499K** | 1/8 w | 1/2 w* | .55 | 300 |
| CMF-1/4 | **CMF-65 RN-65** | 1-1 Meg. | 5-12 Meg. **10-2 Meg.** | 10-10 Meg. **49.9-1 Meg.** | 24.9-2 Meg. **49.9-1 Meg.** | 1/4 w | 1/2 w | 1.00 | 350 |

*Commercial rating to requirements of MIL-R-22684.




### TEMPERATURE COEFFICIENT CODE

| T.C. CODE | MIL. CHAR. | TEMPERATURE COEFFICIENT | TEMPERATURE RANGE |
|---|---|---|---|
| T-00 | | 0±200 PPM/°C | −55°C to +175°C |
| T-0 | D | 0±150 PPM/°C | −55°C to +175°C |
| T-1 | D | 0±100 PPM/°C | −55°C to +175°C |
| T-2 | C | 0±50 PPM/°C | −55°C to +175°C |
| T-9 | E | 0±25 PPM/°C | −55°C to +175°C |

### PHYSICAL CONFIGURATIONS

| DALE TYPE | DIM. A | DIM. B | DIM. C |
|---|---|---|---|
| CMF-55 | .250 ± .031 [ 6.35 ± .787] | .095 ± .010 [2.41 ± .254] | .025 ± .002 [.635 ± .051] |
| CMF-60 | .390 ± .031 [ 9.91 ± .787] | .145 ± .015 [3.70 ± .381] | .025 ± .002 [.635 ± .051] |
| CMF-65 | .562 ± .031 [14.27 ± .787] | .190 ± .015 [4.83 ± .381] | .025 ± .002 [.635 ± .051] |

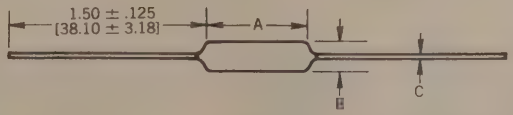
**NOTE:** All resistance ranges shown conform to military specifications unless otherwise indicated.

# MIL-R-22684B, TYPE RL

## DALE TYPE CMF COATED METAL FILM

### STANDARD ELECTRICAL SPECIFICATIONS

| DALE TYPE | MIL. TYPE | RESISTANCE RANGE (Ohms) Tolerance 2%, 5% MIL. RANGE T-00 | 70°C RATING | MAX. WEIGHT (Grams) | MAX. WORKING VOLTAGE |
|---|---|---|---|---|---|
| CMF-07 | RL07 | 51-150K | 1/4 w | .30 | 250 |
| CMF-20 | RL20 | 4.3-470K | 1/2 w | .55 | 350 |




### TEMPERATURE COEFFICIENT CODE

| T.C. CODE | MIL. CHAR. | TEMPERATURE COEFFICIENT |
|---|---|---|
| T-00 | MIL-R-22684 | 0 ± 200 PPM |

### PHYSICAL CONFIGURATIONS

| DALE TYPE | DIM. A | DIM. B | DIM. C |
|---|---|---|---|
| CMF-07 | .249 ± .031 [6.32 ± .787] | .090 ± .008 [2.29 ± .203] | .025 ± .002 [.635 ± .051] |
| CMF-20 | .385 ± .031 [9.78 ± .787] | .145 ± .015 [3.68 ± .381] | .032 ± .002 [.813 ± .051] |

[Numbers in brackets indicate millimeters]

*For complete information, write or phone*
**DALE ELECTRONICS, INC.**, Box 74, Norfolk, Nebraska 68701. Phone 402-371-0080

DALE®

# MIL-R-55182, TYPE RNC

## DALE TYPE EMF

### Molded Metal Film Established Reliability

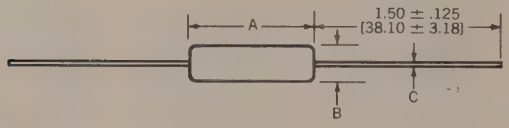
**STANDARD ELECTRICAL SPECIFICATIONS RNC Types in stock (S Level)**

| DALE TYPE | MIL. TYPE* | 70°C RATING | 125°C RATING | MAX. WT. (Grams) | MAX. WORKING VOLTAGE | RESISTANCE RANGE (Ohms)** Mil. Range shown in bold face T-1 (K) | T-2 (H) | T-9 (J) |
|---|---|---|---|---|---|---|---|---|
| EMF 50 | **RNC50** | 1/10 W | 1/20 W | .11 | 200 | 10-700K **10-796K** | 10-500K **10-796K** | 10-200K **10-796K** |
| EMF 55 | **RNC55** | 1/8 W | 1/10 W | .35 | 200 | 10-2.49 Meg. **10-1.21 Meg.** | 10-2 Meg **10-1.21 Meg.** | 10-500K **10-1.21 Meg.** |
| EMF 60 | **RNC60** | 1/4 W | 1/8 W | .45 | 250 | 10-3.01 Meg. **10-1 Meg.** | 10-3.01 Meg. **10-1 Meg.** | 10-1 Meg. **10-1 Meg.** |
| EMF 65 | **RNC65** | 1/2 W | 1/4 W | .84 | 300 | 10-6.26 Meg. **30.1-1 Meg.** | 10-6.26 Meg. **49.9-1 Meg.** | 10-2 Meg. **49.9-1 Meg.** |
| EMF 70 | **RNC70** | 3/4 W | 1/2 W | 1.6 | 350 | 10-15 Meg. **49.9-2.49 Meg.** | 10-15 Meg. **49.9-2.49 Meg.** | 10-3 Meg. **49.9-2.49 Meg.** |
| EMF 75 | — | — | 1 W | 4.4 | 500 | 24.9-4.07 Meg. | 24.9-4.07 Meg. | 24.9-4.07 Meg. |

*EMF also includes RNR and RNN Types. Consult factory.

**Consult factory for values on QPL.

**Standard Resistance Tolerances:** .1% (B), .25%, .5% (D) and 1% (F).




**TERMINAL TYPES:**
RNR = Solderable
RNC = Solderable/Weldable (Type C of MIL-STD-1276)
RNN = Weldable (Type N-2 of MIL-STD-1276)

**PHYSICAL CONFIGURATIONS**

| TYPE | DIM. A | DIM. B | DIM. C |
|---|---|---|---|
| EMF 50 | .150 ± .020 [3.81 ± .508] | .070 ± .010 [1.78 ± .254] | .016 Dia. [.406] |
| EMF 55 | .260 ± .010 [6.60 ± .254] | .094 ± .006 [2.39 ± .152] | .025 Dia. [.635] |
| EMF 60 | .406 ± .015 [10.31 ± .381] | .135 ± .010 [3.43 ± .254] | .025 Dia. [.635] |
| EMF 65 | .593 ± .015 [15.06 ± .381] | .203 ± .015 [5.16 ± .381] | .025 Dia. [.635] |
| EMF 70 | .730 ± .020 [18.54 ± .508] | .250 ± .015 [6.35 ± .381] | .032 Dia. [.813] |
| EMF 75 | 1.093 ± .020 [27.76 ± .508] | .375 ± .015 [9.52 ± .381] | .032 Dia. [.813] |

[Numbers in brackets indicate millimeters]

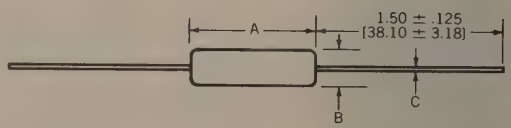
**NOTE:** All resistance ranges shown conform to military specifications unless otherwise indicated.

# MIL-R-39017, TYPE RLR

# R LEVEL

## DALE TYPE EMF

### Metal Film Established Reliability




**STANDARD ELECTRICAL SPECIFICATIONS**

| DALE TYPE | MIL. TYPE | 70°C RATING | MAX. WEIGHT (Grams) | MAX. WORKING VOLTAGE | MILITARY RES. RANGE* T-1 (100 PPM) |
|---|---|---|---|---|---|
| EMF 50-10 | RLR-05 | 1/8 W | .11 | 200 | 10 to 300K |
| ERL-07 | RLR-07 | 1/4 W | .35 | 250 | 10 to 2.49 Meg. |
| ERL-20 | RLR-20 | 1/2 W | .75 | 350 | 4.3 to1.00 Meg. |

*Consult factory for values on QPL.
Standard Resistance Tolerances: 1% (F), 2% (G).

**PHYSICAL CONFIGURATIONS**

| TYPE | DIM. A | DIM. B | DIM. C |
|---|---|---|---|
| EMF 50-10 | .150 ± .020 [3.81 ± .508] | .066 ± .008 [1.674 ± .203] | .016 Dia. [.406] |
| ERL-07 | .250 ± .031 [6.35 ± .787] | .090 ± .008 [2.29 ± .203] | .025 Dia. [.635] |
| ERL-20 | .375 ± .041 [9.52 ± 1.04] | .138 ± .023 [3.50 ± .584] | .032 Dia. [.813] |

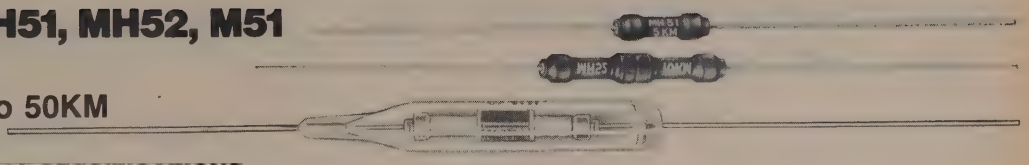
**Termination:** Standard lead material is solder-coated copper. (Solderable and weldable per MIL-STD-1276, Type C.)

*For complete information, write or phone*
**DALE ELECTRONICS, INC.,** Box 74, Norfolk, Nebraska 68701. Phone 402-371-0080

DALE®

# DALE TYPE MH51, MH52, M51 METAL FILM

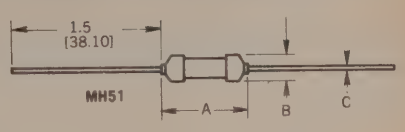
## Ultra High Value to 50KM



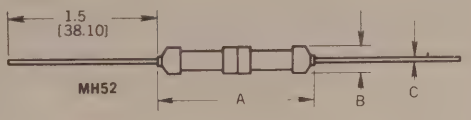
### STANDARD ELECTRICAL SPECIFICATIONS

| DALE TYPE | WATTS @ 40°C | MAX. VOLT. | DIMENSIONS A | B | C | RESISTANCE RANGE |
|---|---|---|---|---|---|---|
| MH52 | 1/2 | 3000 | .95 [24.13] | .140 ± .020 [3.57 ± .508] | .025 [.635] | 60M-50KM |
| *MH51 | 1/4 | 1500 | .55 [13.97] | .140 ± .010 [3.57 ± .254] | .025 [.635] | 30M-50KM |
| **M51 | 1/2 | 500 | 1.88 [47.75] | .216 ± .006 [5.49 ± .152] | .020 [.508] | 10M-1000KM |

[Numbers in brackets indicate millimeters]




*Type M51 available to 10,000 KM on special order.
**Type M51S at 1.69 [49.93] length also available on special order.

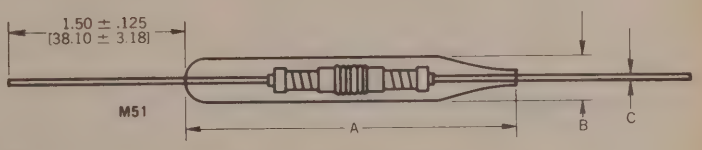



### SPECIFICATIONS

#### ELECTRICAL

**Tolerance:** M51 = 1%, 2%, 5%, 10%. MH51 = 5%, 10%, 20%. MH52 = 1%, 2%, 5%, 10%.

**Temperature Coefficient:** $10^{7}$-$10^{9}$ = 1200 PPM/°C; Over $10^{9}$-$10^{11}$ = 1500 PPM/°C; Over $10^{11}$-$10^{10}$ = 1800 PPM/°C. (TCs are typical only, and are ALWAYS NEGATIVE.)




# DALE TYPE F43, F435, F44 METAL FILM

## (Pulse Loading – Surge Discharge)

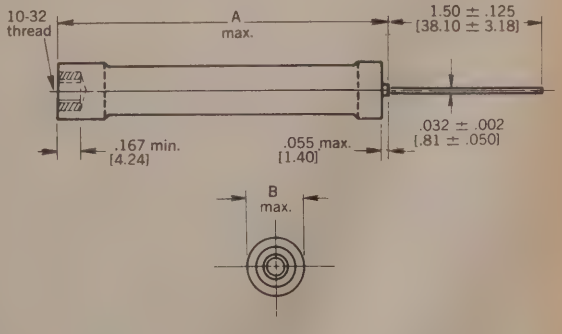
### STANDARD ELECTRICAL SPECIFICATIONS

| DALE TYPE | 40°C WATTAGE RATING | WORKING VOLTAGE | PULSE VOLTAGE | TEMP. RISE | TOLERANCE | RESISTANCE RANGE (Ohms) Min. | Max. |
|---|---|---|---|---|---|---|---|
| F43D | 1/2 | 4KV | 15KV | 26°C | ±2% | 2 Meg. | 3KM |
| F43KU | 1/2 | 4KV | 15KV | 26°C | ±5% | 2 Meg. | 50KM |
| F43TU | 1/2 | 4KV | 15KV | 26°C | ±10% | | |
| F435D | 3/4 | 8KV | 28KV | 32°C | ±2% | 2 Meg. | 7KM |
| F435KU | 3/4 | 8KV | 28KV | 32°C | ±5% | 2 Meg. | 100KM |
| F435TU | 3/4 | 8KV | 28KV | 32°C | ±10% | | |
| F44D | 1 | 14KV | 50KV | 36°C | ±2% | 2 Meg. | 10KM |
| F44KU | 1 | 14KV | 50KV | 36°C | ±5% | 2 Meg. | 150KM |
| F44TU | 1 | 14KV | 50KV | 36°C | ±10% | | |

*Working Voltage: F43-4KV at 32 Megohms and over. F44-14KV at 200 Megohms and over. Resistors may be operated at double wattage rating at 55°C ambient but with maximum voltage limitation of 3KV (F43) and 10KV (F44).

### PHYSICAL CONFIGURATIONS

| TYPE | TERMINATION | DIMENSIONS A | B |
|---|---|---|---|
| F43D | Standard Wire Leads | 1.094 [27.79] | .312 [7.92] |
| F43KU | Comb. Lead/Threaded Cap | 1.188 [30.18] | .312 [7.92] |
| *F43TU | Threaded Caps, both ends | 1.280 [32.51] | .312 [7.92] |
| F435D | Standard Wire Leads | 1.550 [39.37] | .312 [7.92] |
| F435KU | Comb. Lead/Threaded Cap | 1.640 [41.66] | .312 [7.92] |
| F435TU | Threaded Caps, both ends | 1.730 [43.94] | .312 [7.92] |
| F44D | Standard Wire Leads | 2.000 [50.80] | .312 [7.92] |
| F44KU | Comb. Lead/Threaded Cap | 2.094 [53.19] | .312 [7.92] |
| *F44TU | Threaded Caps, both ends | 2.187 [55.55] | .312 [7.92] |



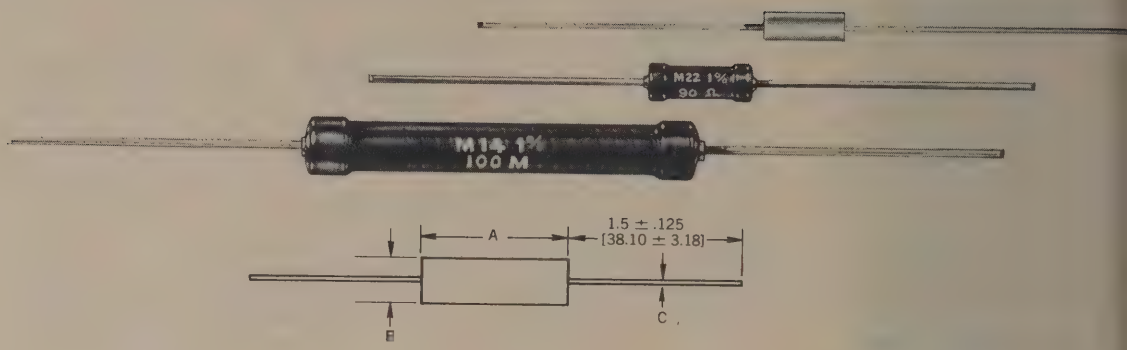

*10-32 x 5/16 [7.92] Coupling Stud supplied with each unit.

*For complete information, write or phone*
**DALE ELECTRONICS, INC.**, Box 74, Norfolk, Nebraska 68701. Phone 402-371-0080

DALE®

# DALE TYPE M METAL FILM

## High Value to 100 Meg.




### STANDARD ELECTRICAL SPECIFICATIONS

[Numbers in brackets indicate millimeters]

| DALE TYPE* | WATTAGE 70°C | RATING 125°C | MAX. WORKING VOLTAGE | SURF. TEMP. RISE °C | DIMENSIONS A | B | C | T.C. in PPM | RESISTANCE RANGE |
|---|---|---|---|---|---|---|---|---|---|
| **M20D | 0.25 | 0.125 | 250 | 30 | .375 ± .025 [9.52 ± .635] | .145 ± .010 [3.68 ± .254] | .032 ± .002 [.812 ± .050] | 100 | 10Ω to 500K |
| M22D | 0.5 | 0.25 | 350 | 35 | .575 ± .015 [14.60 ± .381] | .205 ± .010 [5.21 ± .254] | .032 ± .002 [.812 ± .050] | 100 | 10Ω to 2.5 Meg. |
| M22H | | | | | | | | 150 | High Value 2.51 Meg. to 10 Meg. |
| M13D | 1.0 | — | 500 | 50 | .840 ± .025 [21.34 ± .635] | .285 ± .010 [7.24 ± .254] | .032 ± .002 [.812 ± .050] | 100 | 10Ω to 10 Meg. |
| M13H | | | | | | | | 150 | High Value 10.1 Meg. to 30 Meg. |
| M14D | 2.0 | — | 1600 | 60 | 2.000 ± .060 [50.80 ± 1.52] | .285 ± .010 [7.24 ± .254] | .032 ± .002 [.812 ± .050] | 100 | 10Ω to 20 Meg. |
| M14H | | | | | | | | 150 | High Value 20.1 Meg. to 100 Meg. |

*Types M22, M13 and M14 are available with heat shrunk sleeve to double maximum working voltage. Sleeving adds approximately .025 [.635] to diameters shown above.
**Molded construction.

*For complete information, write or phone*
**DALE ELECTRONICS, INC.**, Box 74, Norfolk, Nebraska 68701. Phone 402-371-0080

DALE®

# MIL-R-83401B, STYLE RZ

## SERIES SDM

### Thick Film DIP Resistor Network

## SPECIFICATIONS

### ELECTRICAL

**Resistance Range:** 10Ω to 1 Megohm standard.

**Resistance Tolerances:** ±1%, ±2%, ±5%

**Temperature Coefficient:** "M" = ±300 PPM/°C; "K" = ±100 PPM/°C over the temperature range of −55°C to +125°C (+25°C reference).

**Terminals:** Tin-plated Alloy 42 or equivalent.

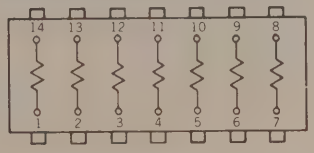
**NOTE:** All resistance ranges shown conform to military specifications unless otherwise indicated.

| MIL PIN | MIL. STYLE | DALE TYPE | MILITARY RES. RANGE TOLERANCE ±1%, ±2%, ±5% |
|---|---|---|---|
| M8340101 M XXXXX A | RZ010 | SDM14-01 | 10Ω-1 Meg. |
| M8340101 K XXXXX A | RZ010 | SDM14-01 | 10Ω-1 Meg. |
| M8340101 M XXXXX B | RZ010 | SDM14-02 | 10Ω-1 Meg. |
| M8340101 K XXXXX B | RZ010 | SDM14-02 | 10Ω-1 Meg. |
| M8340102 M XXXXX A | RZ020 | SDM16-01 | 10Ω-1 Meg. |
| M8340102 K XXXXX A | RZ020 | SDM16-01 | 10Ω-1 Meg. |
| M8340102 M XXXXX B | RZ020 | SDM16-02 | 10Ω-1 Meg. |
| M8340102 K XXXXX B | RZ020 | SDM16-02 | 10Ω-1 Meg. |

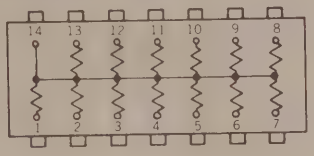
### STANDARD CONFIGURATION

**Also available in 16 pin models**

**M8340101-A, SDM14-01**



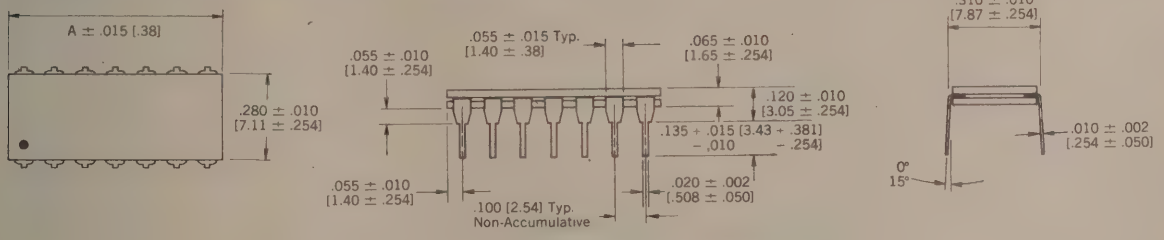

**M8340101-B, SDM14-02**




| NO. OF PINS | A |
|---|---|
| 14 | .710 [18.0] |
| 16 | .810 [20.6] |

### DIMENSIONAL AND TERMINAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]




### STOCK VALUES

Available from stock in these standard values (±2% tolerance A and B schematic) Characteristic "M" (±300 PPM/°C) or Characteristic "K" (±100 PPM/°C):

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 100Ω | 330Ω | 510Ω | 1KΩ | 2KΩ | 3KΩ | 4.7KΩ | 6.8KΩ | 22KΩ |
| 200Ω | 470Ω | 680Ω | 1.5KΩ | 2.2KΩ | 3.3KΩ | 5.1KΩ | 10KΩ | 100KΩ |

### HOW TO ORDER—Military Part Number

| M8340101 | M | 1003 | F | A |
|---|---|---|---|---|
| 1. DETAIL SPEC. NO. | 2. CHARACTERISTIC | 3. RESISTANCE VALUE | 4. TOLERANCE | 5. SCHEMATIC |

**1. Detail Spec. No.:** M8340101 = 14 pin DIP, RZ010; M8340102 = 16 pin DIP, RZ020.

**2. Characteristic:** "M" = ±300 PPM/°C. "K" = ±100 PPM/°C.

**3. Resistance Value:** The first three digits are significant figures and the last digit specifies the number of zeroes to follow.

**4. Tolerance:** F = ±1%, G = ±2%, J = ±5%.

**5. Schematic:** See above examples.

**Example:**

**M8340101 M 1003 F A** = A dual in-line resistor network with 14 pins, with a TC of R of ±300 PPM/°C. Resistance value of 100K ohms, tolerance of ±1% and to Schematic "A" above. All parts have been 100% Screen Tested per MIL-R-83401.

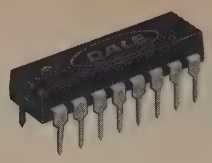
*For complete information, write or phone*

**DALE ELECTRONICS, INC.,** Box 74, Norfolk, Nebraska 68701. Phone 402-371-0080

DALE®

# SERIES MDP

## Thick Film DIP Resistor Network



### SPECIFICATIONS

**ELECTRICAL**

**Resistance Range:** 10Ω to 1 Meg.

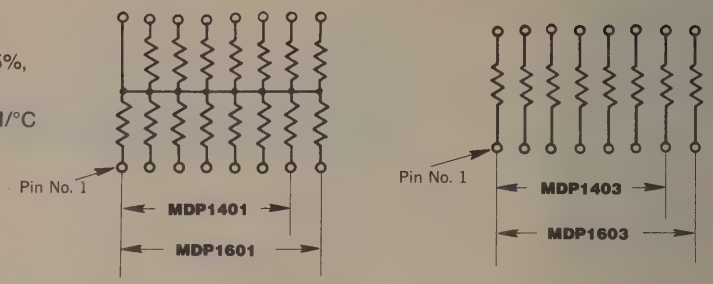
**Resistance Tolerance:** ±2% standard. ±1%, ±5%, ±10%, ±20% available.

**Resistance Temperature Coefficient:** ±100 PPM/°C (−55°C to +125°C) standard

**Terminals:** Tin plated copper alloy

**Body:** Molded epoxy

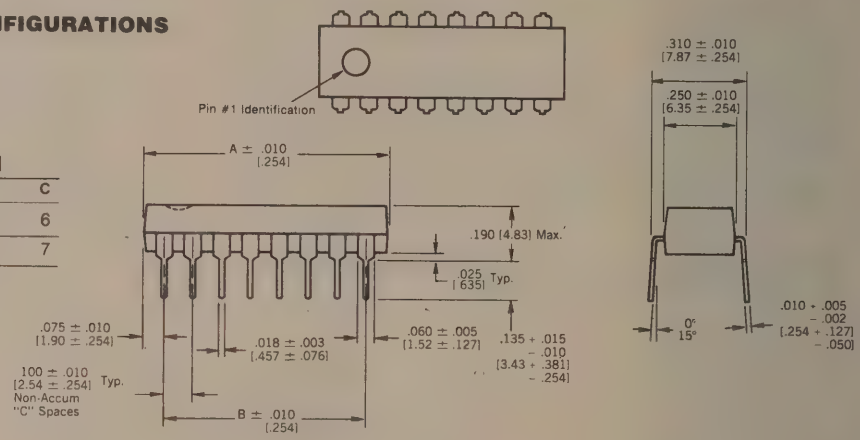
### STANDARD SCHEMATICS




### DIMENSIONS AND TERMINAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]

| TYPE | A | B | C |
|---|---|---|---|
| MDP14 | .750 [19.05] | .600 [15.24] | 6 |
| MDP16 | .850 [21.59] | .700 [17.78] | 7 |




### STOCKED RESISTANCE VALUES IN OHMS ("G" Tolerance)

Other Values from 10Ω to 1 Megohm Available

**MODEL MDP1401 and MDP1403**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 22 | 51 | 120 | *300 | 680 | 1.6K | 3.9K | 8.2K | 20K | 100K |
| *24 | 56 | 130 | 330 | *750 | 1.8K | *4.3K | 9.1K | 22K | 120K |
| 27 | *62 | 150 | *360 | 820 | 2.0K | 4.7K | 10K | 27K | 150K |
| *30 | 68 | 160 | 390 | *910 | 2.2K | 5.1K | 11K | 33K | 180K |
| 33 | 75 | 180 | *430 | 1K | 2.4K | 5.6K | 12K | 39K | 220K |
| *36 | 82 | 200 | 470 | *1.1K | 2.7K | 6.0K | *13K | 47K | 330K |
| 39 | 91 | 220 | 510 | 1.2K | 3.0K | *6.2K | 15K | 56K | 470K |
| *43 | 100 | 240 | 560 | 1.3K | 3.3K | 6.8K | *16K | 68K | 1 Meg. |
| 47 | *110 | 270 | 620 | 1.5K | *3.6K | 7.5K | 18K | 82K | |

*MDP1403 only.

**MODEL MDP1601 and MDP1603**

| | | | | | |
|---|---|---|---|---|---|
| | | †510 | 2.2K | 12K | 82K |
| 22 | 110 | 560 | 2.7K | 15K | 100K |
| 33 | 120 | 680 | 3.3K | 18K | 120K |
| 39 | 150 | 820 | 3.9K | 22K | 150K |
| 47 | 180 | 1K | 4.7K | 27K | 180K |
| 56 | 220 | 1.2K | 5.6K | 33K | 220K |
| *62 | 270 | 1.5K | 6.0K | 39K | 330K |
| 68 | 330 | 1.8K | 6.8K | 47K | 470K |
| 82 | 390 | 2.0K | 8.2K | 56K | *680K |
| 100 | 470 | | 10K | 68K | 1 Meg. |

*MDP1603 only. †MDP1601 only.

### HOW TO ORDER

| MDP | 14 | 03 | −101 | G |
|---|---|---|---|---|
| SERIES | NUMBER OF PINS | SCHEMATIC | RESISTANCE VALUE | TOLERANCE |

First 2 digits (3 for "F" tolerance) are significant figures, last digit specifies number of zeros to follow.

F = ±1% K = ±10%
G = ±2% M = ±20%
J = ±5%

**EXAMPLE:**

**MDP1403-101G** = A dual-in-line thick film resistor network with 14 pins on .100 [2.54] centers, 03 schematic, resistance of 100 ohms and tolerance of ±2%.

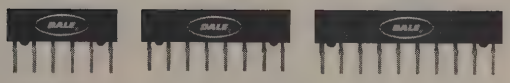
*For complete information, write or phone*

**DALE ELECTRONICS, INC.**, Box 74, Norfolk, Nebraska 68701. Phone 402-371-0080

DALE®

# DALE SERIES MSP

## Thick Film SIP Resistor Network



**MSPXXA**, .195" [4.95] above board

**MSPXXC**, .350" [8.89] above board

**MIL-R-83401 models available with 3 or 4 isolated resistors or 6 or 7 resistors with pin 1 common. Dimensions conform to MSPXXC models shown here.**

### SPECIFICATIONS

#### ELECTRICAL

**Resistance Range:** 10Ω to 1 Megohm

**Resistance Tolerances:** ±2% standard. ±1%, ±5%, ±10%, ±20% available.

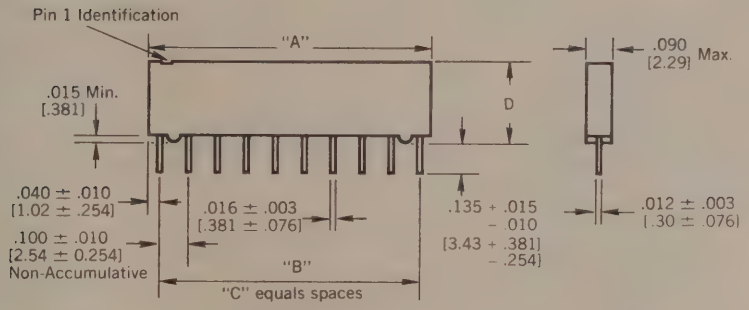
**Temperature Coefficient:** ±100 PPM/°C (−55°C to +125°C) standard

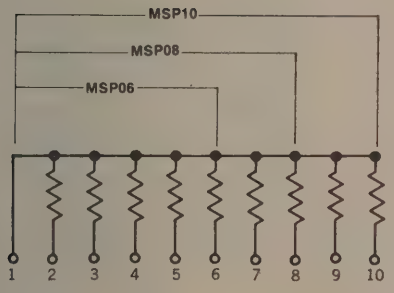
**Terminals:** Tin plated copper alloy

### DIMENSIONAL AND TERMINAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]

| TYPE | A (Max.) | B | C | D |
|---|---|---|---|---|
| MSP06C | .590 [14.99] | .500 [12.70] | 5 | .195" [4.95] for MSPXXA<br>.350" [8.89] for MSPXXC |
| MSP08C | .790 [20.07] | .700 [17.78] | 7 | |
| MSP10C | .990 [25.15] | .900 [22.86] | 9 | |




### STOCK VALUES

**(2% tolerance)**

| | | | | | |
|---|---|---|---|---|---|
| 22Ω | 120Ω | 560Ω | 2.7KΩ | 12KΩ | 68KΩ |
| 33Ω | 150Ω | 680Ω | 3.3KΩ | 15KΩ | 82KΩ |
| 39Ω | 180Ω | 820Ω | 3.9KΩ | 18KΩ | 100KΩ |
| 47Ω | 220Ω | 1KΩ | 4.7KΩ | 22KΩ | 120KΩ |
| 56Ω | 270Ω | 1.2KΩ | 5.6KΩ | 27KΩ | 150KΩ |
| 68Ω | 330Ω | 1.5KΩ | 6.0KΩ | 33KΩ | 180KΩ |
| 82Ω | 390Ω | 1.8KΩ | 6.8KΩ | 39KΩ | 220KΩ |
| 100Ω | 470Ω | 2.0KΩ | 8.2KΩ | 47KΩ | 330KΩ |
| 110Ω | 510Ω | 2.2KΩ | 10KΩ | 56KΩ | 470KΩ |

1 Meg.

**NOTE: MSPXXA and MSPXXC models also available from stock with 3, 4 or 5 isolated resistors.**

### HOW TO ORDER

| MSP | 06 | C | 01 | −100* | G |
|---|---|---|---|---|---|
| SERIES | NO. OF LEADS | ABOVE BOARD HEIGHT | SCHEMATIC | RESISTANCE VALUE | TOLERANCE |

*F = 4 digit code
G, J, K, M = 3 digit code

F = ±1%
G = ±2%
J = ±5%
K = ±10%
M = ±20%

*For complete information, write or phone*
**DALE ELECTRONICS, INC.**, Box 74, Norfolk, Nebraska 68701. Phone 402-371-0080

# for prompt service and "off-the-shelf" availability, call... DIPLOMAT

FOR OUR COMPLETE COMPREHENSIVE INVENTORY SELECTION

### SEMICONDUCTORS AND IC's
Alpha (Microwave)
AmPower
Carter Semiconductor
CDI Compensated Devices
Computer Diode
Crystalonics/Teledyne
Delco
EDI
Exar
General Instrument
General Semiconductor
ITT
Intersil
Kertron Semiconductor
Microsemiconductor Corp.
Microwave Associates
Monolithic Memories
Mostek
NAE North American Electronics
NEC Microcomputer Inc.
Optron
Semicon
Semtech
Sensitron
Signetics
Silicon General
Silicon Transistor Corp.
Solid Power Corp.
Solid State Devices
Solid State Scientific
Solitron Devices
SMC Microsystems Corp.
Syntron
Teledyne
Texas Instruments
Western Digital
Xciton

### CAPACITORS AND FILTERS
ARCO
Capar
CAL-R
Cornel Dubilier
ITT
Johanson
Mallory
NCI
San Fernando/Westcap
Sangamo

### CONNECTORS AND SOCKETS
Amphenol
Cinch
Robinson Nugent
Sullins
Texas Instruments

### CONTROLS AND SWITCHES
Alco Switch
Cherry
CTS
Hamlin
Mallory
Omron

### FANS & BLOWERS
Howard Industries

### FUSES AND HOLDERS
Bussman
Littelfuse

### HARDWARE AND CABINETS
Bud Radio
Hammond
H.H. Smith
Hollingsworth
Ungar

### METERS OF TEST EQUIPMENT
Simpson
Triplett

### OPTOELECTRONICS
Chicago Miniature
General Electric
Monsanto
Optron
Xciton

### POTENTIOMETERS AND TRIMMERS
Clarostat
CTS
Spectrol
Weston/Sangamo
VRN (IRC)

### RELAYS
Allied Controls
Deltrol
Electrol
Guardian
Hamlin
IDEC
Potter & Brumfield
Omron

### RESISTORS
American Corp.
CAL-R
Capar
Clarostat
Mallory
Memcor
RCL
Shallcross
Stackpole
Ward-Leonard

### R.F. CHOKES
J.W. Miller

### THERMISTORS AND RF FILTERS
CORCOM
Fenwal
Gulton Industries

### TRANSFORMERS AND POWERSTATS
Chicago Stancor

### TUBES
Amperex

### WIRE, CABLE, INSULATION PRODUCTS
Alpha
Belden
Cable-Tech
Cimco
Coleflex
Columbia
Dearborn
DeWire
Electronized Chemical Corp.
Harbor Industries
Hi Temp
Insultab
ITT
Manhattan
Norflex
Rainbow

**Each of the Above Listed Lines are Franchised at one or more of the Following Locations.**

DIPLOMAT

**DIPLOMAT ELECTRONICS, INC.**
Woodbury, N.Y.
(516) 921-9373

**DIPLOMAT ELECTRONICS, INC.**
Farmington, Mich.
(313) 477-3200

**DIPLOMAT ELECTRONICS, INC.**
Totowa, N.J.
(201) 785-1830

**DIPLOMAT ELECTRONICS, INC.**
Elk Grove Village, Ill.
(312) 595-1000

**DIPLOMAT ELECTRONICS, INC.**
Chicopee Falls, Mass.
(413) 592-9441

**DIPLOMAT ELECTRONICS, INC.**
Minneapolis, Minn.
(612) 788-8601

**DIPLOMAT ELECTRONICS, INC.**
Mt. Laurel, N.J.
(609) 234-8080

**DIPLOMAT ELECTRONICS, INC.**
Salt Lake City, Utah
(801) 486-4134

**DIPLOMAT ELECTRONICS, INC.**
St. Louis, Mo.
(314) 645-8550

**DIPLOMAT ELECTRONICS, INC.**
Holliston, Mass.
(617) 429-4120

**DIPLOMAT ELECTRONICS, INC.**
Sunnyvale, Calif.
(408) 734-1900

**DIPLOMAT ELECTRONICS, INC.**
Clearwater, Fla.
(813) 443-4514

**DIPLOMAT ELECTRONICS, INC.**
Ft. Lauderdale, Fla.
(305) 771-0440

**DIPLOMAT ELECTRONICS, INC.**
Woodbury, N.Y.
(516) 921-7920

**E-SYSTEMS**
Memcor Division

# WIRE WOUND RESISTORS

| TYPE | Power Rating (Watts) | Max. Res. (Ohms) | Core Size (Inch.) |
|---|---|---|---|
| **FR** VITREOUS ENAMEL FIXED TUBULAR WITH TABS | 5 | 25K | 1 x 5/16 |
| | 10 | 50K | 1¾ x 5/16 |
| | 20 | 100K | 2 x 7/16 |
| | 25 | 100K | 2 x 9/16 |
| | 50 | 250K | 4 x 9/16 |
| | 100 | 100K | 6½ x ¾ |
| | 160 | 100K | 8½ x 1⅛ |
| | 200 | 100K | 10½ x 1⅛ |
| **AR** VITREOUS ENAMEL ADJUSTABLE TUBULAR WITH TABS | 10 | 10K | 1¾ x 5/16 |
| | 25 | 25K | 2 x 9/16 |
| | 50 | 50K | 4 x 9/16 |
| | 75 | 50K | 6 x 9/16 |
| | 100 | 100K | 6½ x ¾ |
| | 160 | 100K | 8½ x 1⅛ |
| | 200 | 100K | 10½ x 1⅛ |
| **VL** VITREOUS ENAMEL AXIAL LEADS | 3 | 10K | 7/32 x 17/32 |
| | 5 | 25K | 5/16 x 1 1/64 |
| | 10 | 50K | ⅜ x 1 25/32 |
| **ML** MOLDED SILICONE AXIAL LEADS | 1 | 2500 | .125 x .437 |
| | 2 | 3500 | .205 x .590 |
| | 3 | 10K | .242 x .525 |
| | 6.5 | 80.6K | .375 x .917 |
| | 11 | 200K | .375 x 1.828 |

| TYPE | Power Rating (Watts) | Max. Res. (Ohms) | Core Size (Inch.) |
|---|---|---|---|
| **FR** w/LEADS VITREOUS ENAMEL FIXED TUBULAR | 5-8 | 25K | 1 x 5/16 |
| | 10-12 | 50K | 1¾ x 5/16 |
| | 20 | 100K | 2 x 7/16 |
| **MZ** VITREOUS ENAMEL MIDGET OVALS WITH TABS | 10 | 5000 | ⅜ x 5/32 |
| | 20 | 25K | ⅜ x 5/32 |
| **ZR** VITREOUS ENAMEL OVALS TAB TERMINAL | 30 | 10K | 5/16 x 1 |
| | 40 | 15K | 5/16 x 1 |
| | 55 | 25K | 5/16 x 1 |
| **RR** VITREOUS ENAMEL EDGEWOUND WITH TABS | 40 | 1.8 | 2 x 9/16 |
| | 90 | 3 | 4 x 9/16 |
| | 100 | 2.5 | 3½ x ¾ |
| | 160 | 5.5 | 6 x ¾ |
| | 150 | 6.0 | 5 x 1 |
| | 300 | 13 | 8½ x 1⅛ |
| | 500 | 36 | 10½ x 1⅝ |
| | 750 | 40 | 12 x 2½ |
| | 1500 | 100 | 20 x 2½ |

MEMCOR Components represent the cumulative design and production knowledge gained during 30 years experience in the industry.

Let MEMCOR sales engineers aid you with your special design and application requirements.

For price, quality, and delivery look to MEMCOR Components. Immediate delivery on stock value resistors. Typical 3-5 week delivery on other standard values and special requirements. These products are available from MEMCOR's Nationwide Authorized Distributor Network.

Write for FREE Catalog.

**E-SYSTEMS**
Memcor Division

DEPT. EM
1320 FLAXMILL ROAD
HUNTINGTON, INDIANA 46750
Telephone: (219) 356-4300
TWX: 810-333-1530

Charles T. Gamble Industries
605 PERKINS LANE • DELANCO, NEW JERSEY 08075 • (609) 461-1900

# CTG PRECISION WIRE WOUND RESISTORS & NETWORKS

Charles T. Gamble Industries has engineered and designed non inductive precision wire wound resistors to meet and exceed the requirements of MIL-R-93. These resistors are completely sealed against the effects of high humidity and salt water immersion cycling. The material used in the manufacture of our resistors has a very high dielectric strength. The bobbin material used in winding the resistors is one and the same as the encapsulating material. All resistors use resistance wire with very low thermal E.M.F. to the copper leads. Where thermal effects can be disregarded, welded construction with nickel alloy leads may be specified.

- Temperature Coefficient: Standard is ±10PPM/°C. T.C.'s as low as ±2PPM and as high as 6000PPM/°C can be supplied
- Tolerance available: from ±1.0% to ±0.001%

**NETWORKS: RC NETWORKS, LADDER NETWORKS, VOLTAGE DIVIDERS, BINARY NETWORKS**

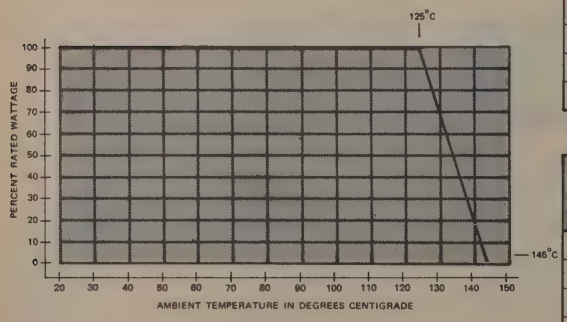
**Standard Axial Lead Precision Resistors** have been designed and engineered to offer high reliability and stability throughout a wide range of environmental factors.

**Subminiature Axial Lead Precision Resistors** have been designed for applications where space is a prime factor

**Printed Circuit Resistors** are designed for printed circuit board application, where space is a factor.

**Radial Lug Resistors** are supplied with a thru hole for mounting to the chassis by means of a #6 thru bolt.

**Power Rating —**
Maximum wattage ratings at 25°C through 125°C derated to 145°C at zero voltage




## STANDARD AXIAL LEAD PRECISION RESISTORS

| Type | Military Specs. New | Military Specs. Old | Commercial Wattage Rating | Max. Resist. Based on .0007 E Alloy | Military Wattage Rating | Max. Volts | Size Length | Size Dia. |
|---|---|---|---|---|---|---|---|---|
| 0808AL | | | .125W | 300K | | 200V | 1/4" | 1/4" |
| 1108AL | RB56 | | .125W | 350K | .125W | 250V | 11/32" | 1/4" |
| 1208AL | | | .200W | 350K | .250W | 225V | 3/8" | 1/4" |
| 1212AL | | | .250W | 1 meg. | | 225V | 3/8" | 3/8" |
| 1608AL | RB55 | AFRT 10 | .250W | 400K | .15 W | 184V | 1/2" | 1/4" |
| 1612AL | | | .400W | .500 meg. | | 300V | 1/2" | 3/8" |
| 1616AL | | | .500W | 1.3 meg. | | 300V | 1/2" | 1/2" |
| 2008AL | | | .500W | .425 meg. | | 300V | 5/8" | 1/4" |
| 2012AL | | | .750W | .600 meg. | | 600V | 5/8" | 3/8" |
| 2016AL | | | .750W | 2 meg. | | 600V | 5/8" | 1/2" |
| 2408AL | RB54 | AFRT 11 | .333W | 1 meg. | .250W | 300V | 3/4" | 1/4" |
| 2412AL | RB53 | AFRT 12 | .500W | 1.2 meg. | .333W | 300V | 3/4" | 3/8" |
| 3208AL | | | .500W | 1.1 meg. | | 300V | 1" | 1/4" |
| 3212AL | RB52 | AFRT 13 | 1.000W | 2 meg. | .400W | 600V | 1" | 3/8" |
| 3216AL | RB57 | AFRT 14 | 1.000W | 3 meg. | .750W | 600V | 1" | 1/2" |
| 4816AL | RB58 | AFRT 15 | 2.000W | 6 meg. | 1.000W | 900V | 1 1/2" | 1/2" |
| 6416AL | RB59 | AFRT 16 | 2.500W | 10 meg. | 1.250W | 1200V | 2" | 1/2" |

## SUB-MINIATURE AXIAL LEAD PRECISION RESISTORS

| Type | Commercial Wattage Rating | Maximum Resistance based on .0007 E Alloy | Maximum Voltage | Size Length | Size Dia. |
|---|---|---|---|---|---|
| 250109AL | .120W | 25K | 50 Volts | 1/4" | 7/64" |
| 375093AL | .1W | 20K | 55 Volts | 3/8" | 3/32" |
| 375109AL | .120W | 30K | 55 Volts | 3/8" | 7/64" |
| 375125AL | .125W | 50K | 72 Volts | 3/8" | 1/8" |
| 375187AL | .1W | 40K | 65 Volts | 3/8" | 3/16" |
| 500156AL | .1W | 70K | 85 Volts | 1/2" | 5/32" |
| 625156AL | .15W | 100K | 125 Volts | 5/8" | 5/32" |

## PRINTED CIRCUIT PRECISION RESISTORS

| Type | Military Specs. | Commercial Wattage | Military Wattage | Max. Volts | Max. Resist. Based on .0007 | Sizes Length | Sizes Dia. | Lead Spacing | Lead Length |
|---|---|---|---|---|---|---|---|---|---|
| 0808PC | | .125W | | 90V | 70K | 1/4" | 1/4" | .100 | 1" |
| 1008PC | RB71 | .250W | .125W | 240V | 250K | 5/16" | 1/4" | .200 | 1" |
| 1208PC | | .200W | | 200V | 200K | 3/8" | 1/4" | .100 | 1" |
| 1608PC | | .250W | | 184V | 400K | 1/2" | 1/4" | .100 | 1" |
| 1612PC | RB70 | .500W | .250W | 150V | .301 meg. | 1/2" | 3/8" | .200 | 1" |
| 2408PC | | .333W | | 300V | 1 meg. | 3/4" | 1/4" | .100 | 1" |
| 3208PC | | .500W | | 750V | 1.1 meg. | 1" | 1/4" | .100 | 1" |
| 3212PC | | 1.000W | | 1350V | 1.75 meg. | 1" | 3/8" | .250 | 1" |
| 3216PC | | 1.250W | | 1700V | 2.50 meg. | 1" | 1/2" | .250 | 1" |

## RADIAL LUG PRECISION RESISTORS

| Type | Military Specs. New | Military Specs. Old | Commercial Wattage | Military Wattage Rating | Maximum Voltage | Max. Resist. Based on .0007 | Size Length | Size Dia. |
|---|---|---|---|---|---|---|---|---|
| 1616RLU | RB08 | AFRT 17 | .500W | 1/4W | 300V | 885K | 1/2" | 1/2" |
| 2020RLU | RB16 | AFRT 18 | .666W | 1/3W | 300V | 1 meg. | 5/8" | 5/8" |
| 3220RLU | RB17 | AFRT 19 | 1.000W | 1/2W | 600V | 2.5 meg. | 1" | 5/8" |
| 4024RLU | RB18 | | 1.500W | 3/4W | 600V | 6.5 meg. | 1 1/4" | 3/4" |
| 6828RLU | RB19 | | 2.000W | 1W | 900V | 12 meg. | 2 1/8" | 7/8" |

Charles T. Gamble Industries
605 PERKINS LANE • DELANCO, NEW JERSEY 08075 • (609) 461-1900

# AXIAL LEAD POWER WIRE WOUND SILICONE COATED RESISTORS

## GENERAL SPECIFICATIONS

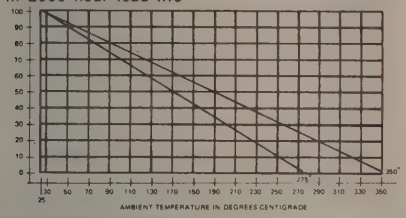
- Designed to meet the requirements of MIL-R-26
- Standard temperature coefficient ±20PPM additional TC's available from 5PPM/°C to 5500/°C
- Tolerance: ±1.0% standard. Available to ±.01%
- Wattage: ½ watt to 20 watts
- Coating — High temperature silicone, withstands moisture, salt water immersion, and cleaning solutions
- Leads: Tinned copperweld standard, other alloys available

**Power Ratings:**

Ratings are based on a 25°C ambient and either a 275°C (max.) or 350°C (max.) hotspot temperature

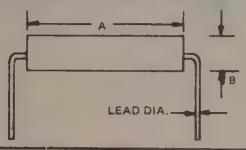
Characteristic U: Will result in .5% max. △R in 2000 hour load life

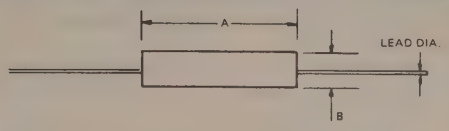
Characteristic V: Will result in a 3% max. △R in 2000 hour load life




**Non-Inductive Winding:**

- For non-inductivxe winding add prefix N
- Divide maximum resistance values by two
- Multiply maximum working voltage by .707




| CTG Type | MIL-R-26 Type | CTG Power Rating 275°C | CTG Power Rating 350°C | Nominal Dimensions Length "A" | Nominal Dimensions Diameter "B" | Maximum Resistance | Maximum Cont. Working Voltage | Lead Diam. |
|---|---|---|---|---|---|---|---|---|
| CG ½A | — | .4 | .52 | .250 ±.031 | .085 ±.020 | 3.0K | 25V | .020 |
| CG 1 | — | .75 | 1 | .312 ±.032 | .085 ±.020 | 5.0K | 35V | .020 |
| CG 2 | RW 70 | 1 | 1.5 | .406 ±.031 | .094 ±.031 | 8.0K | 50V | .020 |
| CG 3 | — | 1.0 | 1.1 | .531 ±.063 | .094 ±.031 | 9.0K | 50V | .020 |
| CG 4 | — | 2.5 | 3 | .812 ±.063 | .188 ±.031 | 20K | 135V | .032 |
| CG 5 | RW 69 | 2.5 | 3 | .500 ±.063 | .188 ±.063 | 20K | 130V | .032 |
| CG 5S | — | 2 | — | .500 ±.063 | .156 ±.031 | 10K | 130V | .032 |
| CG 6 | RW 79 | 3 | — | .560 ±.062 | .187 ±.031 | 20K | 135V | .032 |
| CG 7 | — | 4 | 5 | .625 ±.062 | .250 ±.062 | 35K | 175V | .040 |
| CG 8 | RW 74 | 5 | — | .875 ±.062 | .312 ±.031 | 70K | 300V | .040 |
| CG 8A | — | 5 | — | .785 ±.062 | .220 ±.031 | 50K | 300V | .032 |
| CG 8B | — | 5 | — | .835 ±.062 | .187 ±.031 | 47K | 300V | .032 |
| CG 9 | — | 7 | 8 | 1.218 ±.062 | .312 ±.031 | 100K | 450V | .040 |
| CG 10 | RW 78 | 10 | — | 1.78 ±.062 | .375 ±.031 | 200K | 720V | .040 |
| CG 10A | RW 68 | 10 | 11 | $1.875^{+.063}_{-.125}$ | .344 ±.094 | 200K | 720V | .032 |
| CG 10B | — | 10 | — | 1.75 ±.062 | .312 ±.031 | 200K | 720V | .040 |
| CG 11 | RW 56 | 10 | 14 | 2.00 ±.094 | .469 ±.094 | 210K | 800V | .032 |
| CG 12 | — | 1.5 | 1.7 | .406 ±.031 | .156 ±.063 | 12K | 70V | .020 |
| CG 13 | RW 67 | 5 | 6.5 | 1.00 ±.094 | .313 ±.063 | 70K | 300V | .032 |
| CG 14 | — | 1.5 | 1.7 | .375 ±.031 | .188 ±.063 | 12K | 40V | .020 |
| CG 15 | RW 55 | 5 | 7 | 1.375 ±.094 | .469 ±.094 | 120K | 500V | .032 |
| CG 18 | — | 2 | — | .375 ±.063 | .156 ±.031 | 10K | 120V | .020 |
| CG 33 | — | 15 | 20 | 2.875 ±.094 | .500 ±.094 | 275K | 1000V | .040 |

Non-Inductive styles are ordered as CGN. Specify Axial or Radial Lead when ordering!

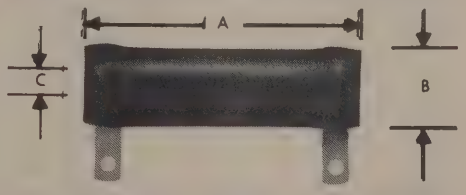
# VITEROUS FIXED AND ADJUSTABLE RESISTORS

## FIXED AND ADJUSTABLE TYPES

Tubular ceramic power resistors are wound with NiCr or CuNi resistance wire alloys. A military grade of ceramic tube coated with a high temperature vitreous enamel is used. This design meets the requirements of MIL-R-26C. Positive center of winding pitch and tension eliminates any possibility of hot spots.

- Wattage rating from 5 watts: 250 watts.
- Standard tolerance: ±5%.

Ayrton-Perry winding techniques may be employed to minimize inductance.




| Type | Military Spec. | Dimensions A | Dimensions B | Dimensions C | Max. Resist. | Comm. Watt | MIL Watts |
|---|---|---|---|---|---|---|---|
| 5A | — | 5/8 | 1/4 | 3/32 | 5K | 5 | — |
| 5B | — | 1 | 5/16 | 3/16 | 5K | 5 | — |
| 10B | RW-29 | 1¾ | 5/16 | 3/16 | 5.6K | 12 | 11 |
| 10C | RW-30 | 1 | 7/16 | 5/16 | 2.7K | 11 | 11 |
| 15C | RW-31 | 1½ | 7/16 | 5/16 | 6.8K | 15 | 14 |
| 20C | RW-32 | 2 | 7/16 | 5/16 | 10K | 20 | 17 |
| 25E | — | 2 | 9/16 | 25/64 | 50K | 25 | — |
| 50E | — | 4 | 9/16 | 25/64 | 100K | 50 | — |
| 25F | — | 2 | 5/8 | 29/64 | 50K | 25 | — |
| 35G | — | 3 | ¾ | ½ | 100K | 35 | — |
| 60G | RW-35 | 4 | ¾ | ½ | 43K | 60 | 55 |
| 70G | — | 4½ | ¾ | 35/64 | 100K | 70 | — |
| 100G | — | 6½ | ¾ | 35/64 | 75K | 100 | — |
| 60H | — | 4 | 15/16 | 9/16 | 50K | 60 | — |
| 90H | — | 6 | 15/16 | 9/16 | 75K | 90 | — |
| 100H | — | 6½ | 15/16 | 41/64 | 100K | 100 | — |
| 80L | RW-36 | 4 | 1⅛ | ¾ | 56K | 80 | 78 |
| 110L | RW-37 | 6 | 1⅛ | ¾ | 100K | 110 | 113 |
| 120L | — | 6½ | 1⅛ | ¾ | 100K | 120 | — |
| 175L | — | 8½ | 1⅛ | ¾ | 100K | 175 | — |
| 225L | RW-47 | 10½ | 1⅛ | ¾ | 100K | 225 | 210 |
| 250L | — | 12 | 1⅛ | ¾ | 100K | 250 | — |

NOTE: Add F or A to end of type number to specify fixed or adjustable type.

INTERNATIONAL MANUFACTURING SERVICES

IMS, INC

# THICK FILM CHIP RESISTORS

**International Manufacturing Services Inc.**

50 Schoolhouse Lane ● Portsmouth, R. I. 02871 ● (401) 683-9700

● ● ● **Delivery** ● ● ● **over 1,500,000 pcs in stock** ● **Consistent High Quality** ● **Low Cost** ● **Samples Available on Request Delivery to suit your needs**

## FEATURES

- Low profile for hybrid packaging
- Precision Geometries by Laser
- Passivation Coating
  Protective Glass over resistor
- 96% Alumina substrates
- **Resistance Range**:
  10 ohms to 25 megohms Standard
  .5 ohms to 2000 megohms Available
  Tolerance to Customer Spec.
  Designed to meet Mil-R-55342

## OPTIONS

- **Terminations**
  Gold
  Platinum Gold
  Platinum Silver
  Palladium Silver
  Solder tinning available
- **Leads Attached**
  (see Standard & Hi-Powered Resistors)
- **T.C.R.** (Varies by size & value)
  ±250ppm/°C measured from -55°C to 125°C with 25°C as reference
  Custom Orders to ±50ppm/°C
- **Color Coding**
  On back indicates value and termination direction
- **Back Side Metalization**
  For Heat Sink or Attachment to Circuit

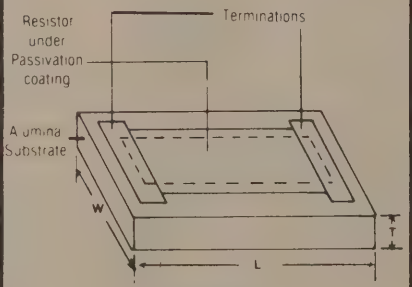
## STANDARD RESISTORS

| IMS # | Power Dissipation Rating 25 C Free Air | LENGTH (L) IN. | LENGTH (L) M.M. | WIDTH (W) IN. | WIDTH (W) M.M. |
|---|---|---|---|---|---|
| 0 | 60 mw (35V) | .045 | 1.14 | .030 | .76 |
| 1 | 125mw (50V) | .050 | 1.27 | .050 | 1.27 |
| 2 | 175mw (110V) | .075 | 1.90 | .050 | 1.27 |
| 3 | 250mw (125V) | .100 | 2.54 | .050 | 1.27 |
| 4 | 350mw (250V) | .150 | 3.81 | .050 | 1.27 |
| 5 | 500mw (125V) | .100 | 2.54 | .100 | 2.54 |
| 6 | 75mw (30V) | .040 | 1.02 | 040 | 1.02 |

● Thickness (T)

| Typical IN | Typical M.M. | Max IN | Max M.M. |
|---|---|---|---|
| .013 | .016 | .33 | .41 |

Standard




**For Wire Bonding**
Chip is attached face up as shown above

**For Solder Bonding or Conductive Epoxy Bonding**
Chip is flipped over (face down) for attachment

## HI-POWERED RESISTORS

| IMS # | Power Dissipation Rating 25° C Free Air | LENGTH (L) IN. | LENGTH (L) M.M. | WIDTH (W) IN. | WIDTH (W) M.M. |
|---|---|---|---|---|---|
| 24 | 1w | .240 | 6.10 | .120 | 3.05 |
| 26 | 1w | .120 | 3.05 | .240 | 6.10 |
| 28 | 3w | .320 | 8.13 | .230 | 5.84 |
| 29 | 2w | .220 | 5.59 | .245 | 6.22 |
| 102 | 4w | 320 | 8.13 | .320 | 8.13 |
| 349 | 6w | .620 | 15.75 | .270 | 6.86 |
| 639 | 10w | .720 | 18.30 | .350 | 8.89 |

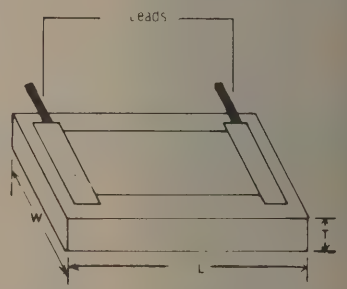
● Thickness (T)

| Typical IN | Typical M.M. | Max IN | Max M.M. |
|---|---|---|---|
| .029 | .035 | .74 | .89 |

Standard

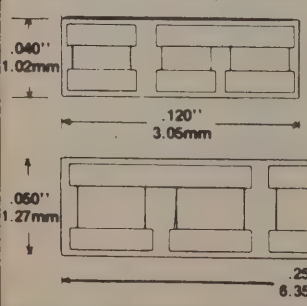
| | | | |
|---|---|---|---|
| .013 | .016 | .33 | .41 |

Available




**Leads** – Available as option on Hi-power Chips and Standard Resistors #1-5 (Attached with either 62/32/6 or 10/90 Hi-Temp Solder)

## ADDITIONAL PRODUCT LINES




**CHIP RESISTOR STRIPS**

**Typical Configurations**

**PLUS**

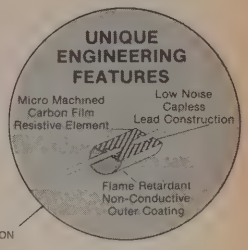
- Custom Resistor Networks
- Custom Thick Film Hybrid Circuit Boards
  For your own component assembly
- Design, Development, and Assembly of Custom Hybrid Circuits
  (Prototypes or full Production)

# ISKRA

• Ceramic Caps, Discs, Feed Thru • Ferrites • Meters • Motors, fractional H.P. • Semiconductors • Switches • Speakers • Trimmer Pots

## 5%, 2% AND 1% CARBON FILM RESISTORS

FUSE ACTION — NON-FLAMMABLE

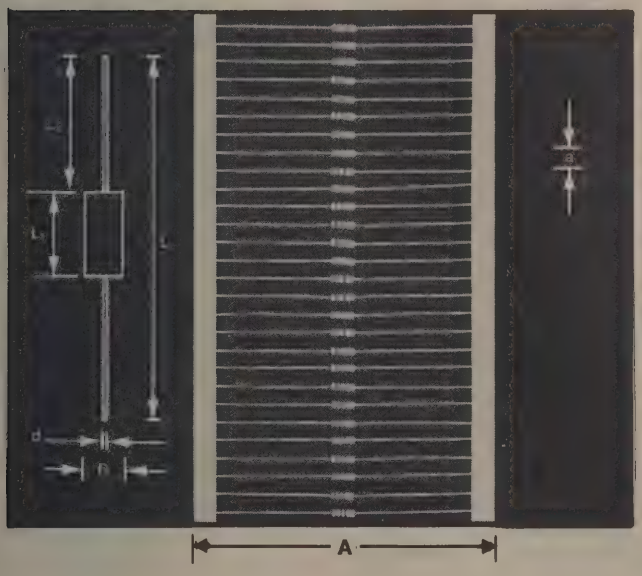

UNIQUE ENGINEERING FEATURES
Micro Machined Carbon Film Resistive Element
Low Noise Capless Lead Construction
Flame Retardant Non-Conductive Outer Coating
CAPLESS CONSTRUCTION ideally suited to HI DENSITY board population Permits close to the shoulder bends

### FEATURES

- △ High Stability
- △ Lowest Noise
- △ Smallest Dimensions
- △ Capless Design
- △ Meets MIL Specifications
- △ Extremely Long Life
- △ Produced And Checked By Automatic Equipment
- △ Failure Rate Less Than $10^{8}$/Hour (MTTF More Than $10^{8}$)
- △ Solderability as per MIL-STD-202
- △ Insulation Resistance Higher Than $10^{9}$ Ohms
- △ Terminal Strength > 8 Lbs.
- △ Equivalents: MIL R-10509, MIL R-39, MIL R-11
- △ Color Code: MIL-STD-129
- △ Available With Weldable Leads
- △ Available in Bulk Pack or Taped and Reeled

### SPECIFICATIONS

| TYPE | A | b | a | $L_1$ | $L_4$ | d | D | L |
|---|---|---|---|---|---|---|---|---|
| UPM ¼ W (INCHES) | 3.35/2.55 | 0.236 | 0.197 ± 0.08 | 0.236 + 0.039 | 1.457 ± 0.039 | 0.024 | 0.091 ± 0.08 | $3.15 \begin{smallmatrix}+0.118\\-0.079\end{smallmatrix}$ |
| UPM ¼ W (MM) | 85/65 | 6 | 5 ± 0.2 | 6 + 1 | 37 ± 1 | 0.6 | 2.3 ± 0.2 | $80 \begin{smallmatrix}+3\\-2\end{smallmatrix}$ |
| UPM ½ W (INCHES) | 3.35/2.55 | 0.236 | 0.197 ± 0.08 | 0.315 + 0.039 | 1.457 ± 0.039 | 0.027 | 0.111 ± 0.08 | $3.15 \begin{smallmatrix}+0.118\\-0.079\end{smallmatrix}$ |
| UPM ½ W (MM) | 85/65 | 6 | 5 ± 0.2 | 8 + 1 | 36 ± 1 | 0.7 | 2.8 ± 0.2 | $80 \begin{smallmatrix}+3\\-2\end{smallmatrix}$ |




### INCLUDE RESISTANCE RANGES

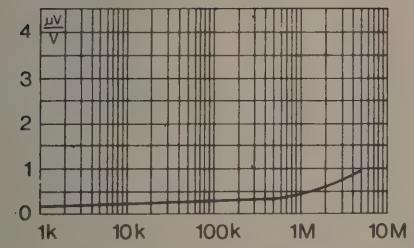
| Wattage | Tolerance | Range | Reel Qtys. |
|---|---|---|---|
| ¼ | 5% | 4.7Ω — 1 MegΩ | 4000/RL |
| | 2% | 10Ω — 300KΩ | |
| ½ | 5% | 4.7Ω — 4.7 MegΩ | 3000/RL |
| | 2% | 10Ω — 1 MegΩ | |

OTHERS ON SPECIAL REQUEST

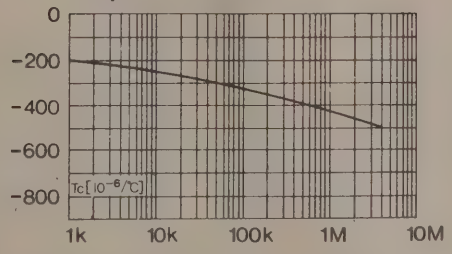
| MIL R-11 EQUIVALENT | MIL R-10509 EQUIVALENT |
|---|---|
| RC 07 and RC 12 | RN 65 cat. b,d |
| RC 20 and RC 22 | RN 70 cat. b,d |

| | MAX. Δ RES. |
|---|---|
| Humidity (Steady State) | ± 1.00% |
| Life | ± 1.00 |
| Short Time Overload | ± 0.50 |
| After Soldering | ± 0.25 |
| Thermal Shock | ± 0.25 |
| Twist | ± 0.25 |
| Vibration | ± 0.25 |

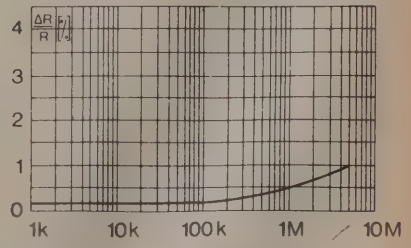
**Current noise**




**Temperature coefficient**



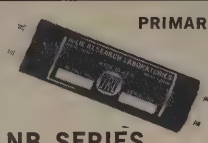

**Humidity**




**ISL PRODUCTS LTD.**
50 WERMAN COURT / PLAINVIEW, NEW YORK 11803 / (516) 694-2686

# JULIE RESEARCH LABORATORIES INCORPORATED

# PRECISION WIREWOUND RESISTORS



**PRIMARY RESISTANCE AND RATIO STANDARDS**

These ultra-stable oil-immersed resistors provide absolute accuracy and stability heretofore unattainable in conventional precision components. (See JRL Bulletins B-5 and B-6).

**NB SERIES**

## PRECISION RESISTORS FOR EVERY APPLICATION

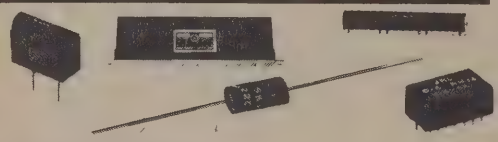
Precision Resistors for every application imaginable; high quality, low priced precision resistors are available for your every design need and at delivery schedules (1-2 weeks) even distributors can't beat!! JULIE RESEARCH resistors are guaranteed for a lifetime performance in almost every value, tolerance and stability.

Available as individual, ratio or network assemblies, these expertly manufactured and trimmed resistors assist you in eliminating countless hours of Production Test time from your design. In addition, the use of these very stable resistors contribute to reliable design and reduced component count. Specify a Julie Resistor. Better yet, call us and we will assist in helping you get the best price-performance unit your application and budget will allow.

## JUST A FEW OF THE PROVEN APPLICATIONS FOR THESE LOW REACTANCE HIGH PERFORMANCE RESISTORS ARE:

- Transducer Calibrating Networks
- Current Metering
- Gyro Torquing
- AC and DC Precision Bridge Elements
- Amplifier Summing Elements
- D/A Converters
- Reference Divider
- Precision Multiplier
- Resistive Divider Networks
- Shunting
- AC or DC Ratio
- High Performance MIL Spec
- Zener Trimming Networks

## RESISTOR STYLES



### SPECIFICATIONS

**Range:** Individual Resistors, 0.1 ohm to 5 megohms. Ratio Sets, 1:1 to $10^6$:1 depending on total resistance required.
**Accuracy:** Standard accuracy of resistors, 0.005% for values from 1000 ohms to 5 megohm. Standard accuracy of ratio sets, 0.0025% for ratios near 1:1. Accuracies from 0.002% to 0.1% are available (at corresponding prices) on special order.
**Stability:** Resistors, 0.002% per year for standard ranges.
**Accuracy Over Military Temperature Range:** ±0.02% from −45°C to +85°C.
**Matching Over Military Temperature Range:** ±0.005% from −45°C to +85°C.
**Retrace Over Military Environmental Conditions:** 0.002%.
**Temperature Coefficient:** Resistors, 5 ppm/°C standard. (Available as low as 1.0 ppm/°C). Ratio sets, 2.5 ppm/°C standard. (Available as low as 0.7 ppm/°C).
Note: Temperature Coefficient can be altered, in manufacture, over wide ranges.
**Thermal Transients:** All thermal-induced transient effects, e.g.: self-heating, Seebeck and Peltier effects, are less than 0.0015% at rated power dissipation. Self-heating and time constants of thermal transients are reduced to 10% of normal values in air.
**Current Capability:** To 2 Amperes.
**Voltage:** Between Terminals, 300 volts maximum. Terminals to Case, 500 volts maximum.

### SPECIFICATIONS

**Range:** Individual Resistors, 1 ohm to 10 megohms. Ratios, 1:1 to $10^6$:1, depending on total resistance required.
**Accuracy:** Standard accuracy of resistors, 0.01%, for values from 100 ohms to 5 megohm. Standard accuracy of ratios, 0.005%, for ratios near 1:1. Intermediate accuracies of 0.05% and up and higher accuracies to .0025% are available on special order.
**Stability:** Resistors 0.003% per year for standard ranges.
**Accuracy Over Military Temperature Range:** 0.02% from −30°C to +85°C.
**Matching Over Military Temperature Range:** to 0.005% from −45°C to −85°C.
**Retrace Over Military Environmental Conditions:** 0.003%.
**Temperature Coefficient:** Resistors, 5 ppm/°C standard, (available as low as 1.0 ppm/°C). Ratios, 2.5 ppm/°C standard, (available as low as 0.7 ppm/°C).
Note: Temperature Coefficient can be altered, in manufacture, over wide ranges.

### SPECIFICATIONS

**Range:** Individual Resistors, .1 ohm to 100 ohms.
**Accuracy:** Standard accuracy of resistors, 0.01%, for values from 1.0 ohm to 100 ohms. ($R_1$xG)±.005% (CH).
**Stability:** Resistors 0.003% per year for standard ranges.
**Accuracy Over Military Temperature Range:** 0.02% from −30°C to +85°C
**Retrace Over Military Environmental Conditions:** 0.003%.
**Temperature Coefficient:** Resistors, 5 ppm/°C standard, (available as low as 2.5 ppm/°C).
Note: Temperature Coefficient can be altered, in manufacture, over wide ranges.
**Voltage and Power Ratings:** See chart.
**Construction:** See charts.
**Group Encapsulation:** Special techniques permit group encapsulation of high-accuracy units on a high-yield basis, enabling better accuracies at competitive costs. (See JRL Bulletin B-11.)

### SPECIFICATIONS

The DIP resistor is available with 7 resistance values in a 14 pin DIP or 8 resistance values in a 16 pin DIP.
**Resistance Range:** 100Ω to 100KΩ **Ratio Accuracy:** Up to .003% **Dimensions:**
**Absolute Acc:** .01% **Accuracy Over MIL Environmental** ¾" x ½" x 5/16"
**Tc:** 5 PPM/°C **Conditions:** .005% ABS .002% Ratio **Delivery:** 3-4 weeks

## LOWEST, LOW REACTANCE OIL FILLED AND ENCAPSULATED THA-H, CH, HCH, RESISTORS AXIAL WIRE LEAD CONSTRUCTION

| Style | Size | AWG Leads | Max. Res. | Volt | Power | MIL R-93 |
|---|---|---|---|---|---|---|
| H32 | ⅜ x ½ | 20 | 250 K | 250 | ½ W | — |
| H33 | ⅜ x ¾ | 20 | 350 K | 450 | ⅓ W | RB 53 |
| H34 | ⅜ x 1 | 20 | 500 K | 500 | ½ W | RB 52 |
| H42 | ½ x ½ | 18 | 750 K | 250 | ½ W | — |
| H44 | ½ x 1 | 18 | 2 Meg | 500 | 1 W | RB 57 |
| H46 | ½ x 1½ | 18 | 3 Meg | 750 | 1½ | RB 58 |
| H48 | ½ x 2 | 18 | 5 Meg | 1000 | 2 W | RB 59 |
| HCH32 | ⅜ x ½ | 20 | 150 K | — | ¾ W* | — |
| HCH33 | ⅜ x ¾ | 20 | 250 K | — | 1 W* | — |
| HCH34 | ⅜ x 1 | 20 | 350 K | — | 1.5 W* | — |
| HCH35 | ⅜ x 1¼ | 20 | 500 K | — | 1.8 W* | — |
| HCH42 | ½ x ½ | 18 | 375 K | — | 1.5 W* | — |
| HCH44 | ½ x 1 | 18 | 750 K | — | 3 W* | — |
| HCH46 | ½ x 1½ | 18 | 1 M | — | 4.5W* | — |
| HCH48 | ½ x 2 | 18 | 1.5 M | — | 6 W* | — |
| CH-32 | ⅜ x ½ | 20 | 300 K | — | ¾* | — |
| CH-33 | ⅜ x ¾ | 20 | 500 K | — | 1 W* | — |
| CH-34 | ⅜ x 1 | 20 | 700 K | — | 1.5* | — |
| CH-35 | ⅜ x 1¼ | 20 | 1 Meg | — | 1.8* | — |
| CH-42 | ½ x ½ | 18 | 750 K | — | 1.5* | — |
| CH-44 | ½ x 1 | 18 | 1.5 M | — | 3.0* | — |
| CH-46 | ½ x 1½ | 18 | 2 M | — | 4.5* | — |
| CH-48 | ½ x 2 | 18 | 5 M | — | 6 W* | — |
| THA-36 | ⅜ x ½ | 18 | 1 M | 100 | — | RB 53 |
| THA-38 | ⅜ x ¾ | 18 | 1 M | 100 | — | RB 53 |

*When mounted on heat sink.

## SUPER ACCURATE, SUPER STABLE ENCAPSULATED, MINIATURE PRECISION R, XG, RS, L, GL RESISTORS

| | | | | | | |
|---|---|---|---|---|---|---|
| **TYPE R-AXIAL WIRE LEAD-CONSTRUCTION** | | | | | | |
| R-22 | ¼ x 9/16 | 22 | 500 K | 125 | ⅛ W | — |
| R-23 | ¼ x ¾ | 22 | 750 K | 125 | ¼ W | RB 54 |
| R-24 | 5/16 x 1 | 22 | 1 Meg | 350 | ¼ W | — |
| R-32 | ⅜ x ½ | 22 | 750 K | 125 | ¼ W | — |
| R-33 | ⅜ x ¾ | 20 | 1 Meg | 125 | ⅓ W | RB 53 |
| R-34 | ⅜ x 1 | 20 | 1.5 Meg | 250 | ½ W | RB 52 |
| R-35 | ⅜ x 1¼ | 20 | 2 Meg | 250 | ⅝ W | — |
| R-42 | ½ x ½ | 18 | 1.5 Meg | 125 | ½ W | — |
| R-44 | ½ x 1 | 18 | 4 Meg | 250 | 1 W | RB 57 |
| R-46 | ½ x 1½ | 18 | 7.5 Meg | 250 | 1½ W | RB 58 |
| R-48 | ½ x 2 | 18 | 10 Meg | 250 | 2 W | RB 59 |
| **TYPE L AND RB-RADIAL LUG CONSTRUCTION** | | | | | | |
| L-10A | ⅝ x 9/16 | Solder Lug | 1.5 Meg | 125 | ½ W | RB 16 |
| L-HB | ⅝ x 1¼ | Solder Lug | 4 Meg | 250 | 1 W | RB 18 |
| RB 19 | 1 x 2 1/32 | Solder Lug | 10 Meg | 300 | 2 W | RB 19 |
| RB 17 | ½ x 1 | Solder Lug | 1.5 Meg | 125 | ¾ W | RB 17 |
| **TYPE XG-RADIAL WIRE LEAD CONSTRUCTION** | | | | | | |
| R-32 XG | ⅜ x 9/16 | 22 | 500 K | 125 | ¼ W | — |
| R-42 XG | ½ x 9/16 | 20 | 1 Meg | 125 | ½ W | — |
| R-44 XG | ½ x 1 3/32 | 20 | 3.5 Meg | 250 | 1 W | — |
| R-46 XG | ½ x 1⅜ | 20 | 5 Meg | 250 | 1½ W | — |
| R-48 XG | ½ x 2 1/16 | 20 | 10 Meg | 250 | 2 W | — |
| R-52 XG | ⅝ x 1 9/32 | 20 | 1 Meg | 125 | ¾ W | — |
| **TYPE RS-TOP HAT CONSTRUCTION** | | | | | | |
| RS-36 | 13/32 x ½ | 22 | 750 K | 125 | ¼ W | — |
| RS-26 | 9/32 x ½ | 22 | 250 K | 125 | ⅛ W | — |

## LOW OHM, LONG TERM STABILITY, OIL FILLED AND ENCAPSULATED 4-TERMINAL CH46-T4, R-46-T4, R46xG-T4 AXIAL AND RADIAL CONSTRUCTION

| Style | Size | AWG Leads | Max. Res. | Current | Power |
|---|---|---|---|---|---|
| R-46-T4 | ½ x 1½ | 18 | 100 Ohms | 2 Amps | 1½ W |
| R-46xG-T4 | ½ x 1½ | 20 | 100 Ohms | 2 Amps | 1½ W |
| CH46-T4 | ½ x 1½ | 18 | 100 Ohms | 2 Amps | 3 W* |

*When mounted on heat sink.

**JULIE RESEARCH LABORATORIES, INC.** • 211 W. 61 ST., NEW YORK, N.Y. 10023 • (212) 245-2727 • TWX: 710-581-5138

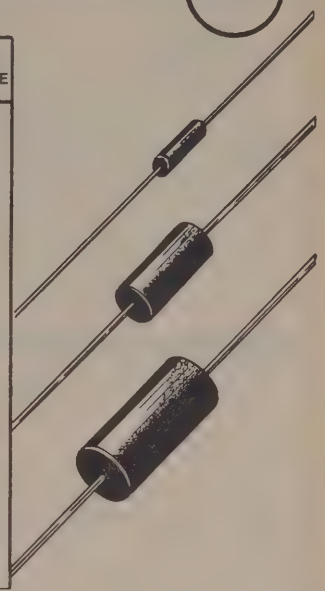
**KRL electronics, inc.**

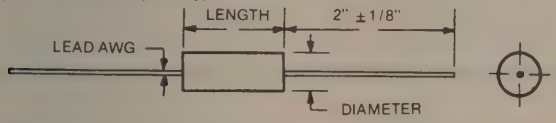
28 Bridge Street • Manchester, New Hampshire 03101
Tel. (603) 668-3210 • TWX (710) 220-1662

## KRL Precision Wire Wound . . . Axial Lead Resistors — 500 SERIES

| KRL STYLE | MIL-R-93 | MIL-R-39005 | DIMENSIONS | | | POWER in WATTS | | MAXIMUM VOLTAGE | MAXIMUM RESISTANCE |
|---|---|---|---|---|---|---|---|---|---|
| | | | LENGTH ±.015 | DIAMETER ±.015 | LEAD AWG | MIL 125°C | COMM 125°C | | |
| 532 | | | .200 | .100 | 24 | .025 | .050 | 100 | 100K |
| †533 | | | .260 | .100 | 24 | .050 | .100 | 100 | 150K |
| †534 | | | .300 | .100 | 22 | .050 | .100 | 100 | 150K |
| †535 | | | .250 | .125 | 22 | .065 | .125 | 150 | 300K |
| 536 | | | .312 | .125 | 22 | .075 | .150 | 200 | 400K |
| 537 | | | .375 | .125 | 22 | .100 | .200 | 200 | 500K |
| †538 | | | .375 | .187 | 22 | .125 | .250 | 300 | 600K |
| †540 | | RBR-74 | .500 | .187 | 22 | .175 | .350 | 300 | 1Meg |
| 550 | | RBR-75 | .295 | .250 | 22 | .125 | .250 | 200 | 900K |
| 555 | RB-56 | RBR-56 | .375 | .250 | 20 | .175 | .350 | 300 | 1Meg |
| †560 | RB-55 | RBR-55 | .500 | .250 | 20 | .250 | .500 | 400 | 2Meg |
| †565 | RB-54 | RBR-54 | .750 | .250 | 20 | .375 | .750 | 500 | 3.5Meg |
| 570 | RB-53 | RBR-53 | .750 | .375 | 20 | .450 | .900 | 600 | 4Meg |
| 575 | RB-52 | RBR-52 | 1.00 | .375 | 20 | .750 | 1.50 | 750 | 5Meg |
| 578 | | | .500 | .500 | 20 | .330 | .660 | 400 | 2Meg |
| 580 | RB-57 | RBR-57 | 1.00 | .500 | 20 | .850 | 1.75 | 850 | 10Meg |
| 585 | RB-58 | | 1.50 | .500 | 20 | 1.00 | 2.00 | 1.5KV | 15Meg |

†Indicates Most Popular Types.






**TOLERANCES AVAILABLE:**

Absolute accuracy for— 1. Precision Resistors from ±5% to ±.0025%
2. Power Resistors from ±10% to ±.01%
Ratio Matching in resistor sets available as close as ±.001%

**TEMPERATURE COEFFICIENTS:**

1. Standard temperature coefficient is ±10PPM/°C, slightly higher for low ohmic values.
2. Temperature coefficients are avialable as low as ±1PPM/°C, over a limited range.
3. T.C. Matching available as close as ±0.5PPM/°C at +25°C for matched sets.
4. T.C. TRACKING available as close as ±1PPM/°C over a limited range.
5. Special temperature coefficients available from +80PPM/°C to +6000PPM/°C.

**STABILITY:**

Precision Resistors— 0.001% for the first year, 0.0025% over a three year period.
Power Resistors— 0.003% for the first year, 0.005% over a three year period.

**ENVIRONMENTAL REQUIREMENTS:**

All KRL wire wound resistors meet or exceed the requirements of—
1. MIL-R-93 and MIL-R-39005 for Precision Resistors
2. MIL-R-26, MIL-R-39007 and MIL-R-18546 for Power Resistors.

## KRL Economy Line Resistors — EC SERIES

| KRL STYLE | DIMENSIONS | | | POWER in WATTS COMM | MAXIMUM VOLTAGE | MAXIMUM RESISTANCE |
|---|---|---|---|---|---|---|
| | LENGTH ±.062 | DIAMETER ±.032 | LEAD AWG‡ | | | |
| EC-10 | .390 | .100 | 24 | .50 | 150 | 100K |
| EC-12 | .530 | .100 | 24 | .50 | 150 | 120K |
| †EC-20 | .390 | .140 | 20 | 1.0 | 200 | 100K |
| †EC-22 | .530 | .140 | 20 | 1.2 | 200 | 120K |
| †EC-30 | .390 | .187 | 20 | 1.5 | 250 | 100K |
| †EC-32 | .530 | .187 | 20 | 1.7 | 250 | 150K |
| †EC-34 | .560 | .187 | 20 | 1.8 | 250 | 150K |
| EC-36 | .812 | .187 | 20 | 2.0 | 300 | 240K |
| †EC-40 | .500 | .250 | 20 | 2.0 | 300 | 200K |
| EC-42 | .625 | .250 | 20 | 2.5 | 300 | 220K |
| EC-45 | .812 | .250 | 20 | 2.7 | 350 | 250K |
| EC-50 | .875 | .312 | 18 | 2.8 | 350 | 300K |
| EC-55 | 1.00 | .312 | 18 | 3.0 | 350 | 500K |

†Indicates Most Popular Types

‡Lead diameter may vary by one gauge, depending on requirement.

## KRL WIRE WOUND POWER RESISTORS: — P SERIES

| KRL STYLE | MIL-R-26 | MIL-R-39007 | WATTAGE RATING | | MAX. WORKING VOLTAGE(2) | | MAXIMUM RESISTANCE IN OHMS(3) | DIMENSIONS | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | U | V | U | V | | LENGTH ±.062 | DIAMETER ±.032 | LEAD AWG(1) |
| P-½A | | | .5 | 1.0 | 18 | 20 | 3.4K | .250 | .094 | 24 |
| P-½ | | | .75 | 1.2 | 30 | 35 | 4.5K | .280 | .094 | 24 |
| P-1A | RW-70 | | 1.0 | 1.5 | 50 | 55 | 10K | .406 | .094 | 24 |
| P-1B | | | 1.1 | 1.6 | 62 | 67 | 12K | .530 | .094 | 24 |
| P-1C | | | 1.0 | 1.5 | 28 | 33 | 5K | .330 | .094 | 24 |
| †P-2 | | | 1.5 | 2.0 | 72 | 79 | 10K | .385 | .187 | 20 |
| †P-2A | RW-79 | | 3.0 | 3.75 | 135 | 148 | 22K | .560 | .187 | 20 |
| P-2B | | RWR-71 | 3.25 | 4.75 | 185 | 220 | 42K | .812 | .187 | 20 |
| †P-2C | | | 3.0 | 3.5 | 138 | 157 | 32K | .500 | .250 | 20 |
| †P-2D | RW-69 | | 2.5 | 3.0 | 135 | 148 | 20K | .500 | .187 | 20 |
| †P-3 | | | 4.0 | 5.5 | 210 | 250 | 45K | .625 | .250 | 20 |
| †P-5 | RW-74 | RWR-74 | 5.0 | 6.0 | 325 | 375 | 90K | .875 ± .094 | .312 ± .062 | 18 |
| P-6 | RW-67 | | 6.0 | 6.5 | 360 | 400 | 95K | 1.000 ± .094 | .312 ± .062 | 18 |
| P-7 | | | 7.0 | 8.0 | 360 | 400 | 100K | 1.200 ± .094 | .312 ± .062 | 18 |
| P-7A | RW-55 | | 7.5 | 9.0 | 510 | 580 | 150K | 1.375 ± .094 | .375 ± .062 | 18 |
| †P-10 | | | 10.0 | 13.0 | 800 | 930 | 250K | 1.815 ± .094 | .375 ± .062 | 18 |
| P-10A | RW-78 | RWR-78 | 10.0 | 12.0 | 800 | 930 | 240K | 1.780 ± .094 | .375 ± .062 | 18 |
| †P-10B | RW-68 | | 10.5 | 14.0 | 800 | 930 | 275K | 1.875 ± .094 | .375 ± .062 | 18 |

†Indicates Most Popular Types.

**CHARACTERISTIC V:** Coated resistors are available in 3% and 5% tolerance only.

**CHARACTERISTIC U:** Coated or Molded resistors are available in any tolerance.

# KELVIN

## Precision Wire-wound Resistors, Power Resistors & Resistor Networks

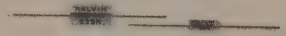
Kelvin is a pioneer in the field of very high stability, close tolerance, precision wire-wound resistors. Resistors shown represent only part of the broad Kelvin line. Complete catalog data is available on request.

## HIGH RELIABILITY "HRL" SERIES

Kelvin's "HRL" Series was generated after years of experience on the Polaris, Gemini, Apollo and other important high reliability missile and space programs. Kelvin has combined the many and varied parameters of these programs into a single resistor series, designed to meet the stringent high reliability requirements of many of today's military and commercial systems.

Kelvin's reliability goal, through the design and controls of the "HRL" Series resistor and the use of acceptance inspection procedures, was to produce precision wire-wound resistors having failure rates better than .0005%/1000 hours at a 90% confidence level. Present level is .00064%/1000 hours at a 60% confidence level.

All "HRL" resistors have a documented history. This includes traceability from the spool analysis of the resistance wire, through each phase of the production operation to the finished product. Each resistor is screened to eliminate INFANT MORTALITY. This consists of a 100 hour burn in at full rated power at 125°C and a short time overload at twice the rated power. Other tests are conducted as outlined in Bulletin HR 02449, which presents the complete procedure and methods approach for production of "HRL" resistors.



| KELVIN TYPE | WATTAGE* | RESISTANCE MAXIMUM** | DIA. ± .015 | LENGTH ± .032 | MAXIMUM VOLTS | LEAD DIA. | MIL-R-39005 |
|---|---|---|---|---|---|---|---|
| HRL-20 | .08 | 25K | .187 | .375 | 150 V | #22 | |
| HRL-991 | .125 | 150K | .250 | .312 | 150 V | #22 | RBR-71 |
| HRL-1009 | .125 | 316K | .250 | .295 | 150 V | #22 | RBR-75 |
| HRL-1097 | .125 | 90K | .193† | .500 | 150 V | #22 | RBR-74 |
| HRL-417 | .125 | 220K | .250 | .343 | 150 V | #20 | RBR-56 |
| HRL-467 | .150 | 332K | .250 | .500 | 200 V | #20 | RBR-55 |
| HRL-334 | .200 | 500K | .375 | .500 | 300 V | #20 | |
| HRL-812 | .250 | 562K | .250 | .750 | 300 V | #20 | RBR-54 |
| HRL-815 | .333 | 1.1 meg | .375 | 750 | 300 V | #20 | RBR-53 |
| HRL-1100 | .500 | 600K | .312 | .812 | 300 V | #20 | RBR-76 |
| HRL-254 | .500 | 1.21 meg | .375 | 1.000 | 600 V | #20 | RBR-52 |
| HRL-27 | .750 | 6.42 meg | .500 | 1.000 | 600 V | #20 | RBR-57 |

† ± .010 Tolerance

## SUB-MINIATURE TYPES

TOLERANCES: 1% through .005% available on most types and resistance values.

TEMPERATURE COEFFICIENT: ±20 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.

### COMBINATION AXIAL-RADIAL LEAD

| KELVIN TYPE | COMMERCIAL WATTAGE* | RESISTANCE MAX.** | DIA. ± 1/64 | LENGTH ± 1/32 | MAX. VOLTS | LEAD DIA. |
|---|---|---|---|---|---|---|
| 315-PAR | .05 | 100K | .080 | 375 | 100 | #24 |
| 303-PAR | .05 | 100K | .125 | 250 | 100 | #24 |
| 162-PAR | .10 | 200K | .125 | 375 | 100 | #22 |
| 158-PAR | 15 | 700K | .187 | 375 | 100 | #22 |

### AXIAL LEAD

| KELVIN TYPE | COMMERCIAL WATTAGE* | RESISTANCE MAX.** | DIA. ± 1/64 | LENGTH ± 1/32 | MAX. VOLTS | LEAD DIA. |
|---|---|---|---|---|---|---|
| EP-00 | .05 | 100K | .080 | .375 | 100 | #24 |
| 1788-P | .04 | 50K | 100 | 225 | 75 | #24 |
| 460 P | .06 | 100K | .100 | .281 | 100 | #24 |
| 301 P | .05 | 175K | .125 | .250 | 100 | #24 |
| EP-01 | .10 | 200K | .125 | 375 | 100 | #22 |
| 470 P | .10 | 500K | 160 | .500 | 100 | #24 |
| EP-20 | .15 | 700K | 187 | .375 | 200 | #22 |
| 304-P | 15 | 500K | 250 | .250 | 100 | #22 |
| 430 P | .15 | 600K | 250 | 312 | 100 | #20 |
| 417 P | 20 | 700K | 250 | 343 | 100 | #20 |

## PRINTED CIRCUIT TYPES

TOLERANCES: 1% through .005% available on most types and resistance values.

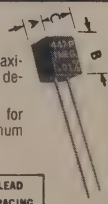
TEMPERATURE COEFFICIENT: ±20 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.



### HIGH DENSITY PACKAGING

| KELVIN TYPE | COMMERCIAL WATTAGE* | RESISTANCE MAX.** | SIZE ±.020 | | | MAX. VOLTS | LEAD DIA. | LEAD SPACING |
|---|---|---|---|---|---|---|---|---|
| | | | A | B | C | | | |
| 446-P | .250 | 2 Meg | 140" | .270" | .500" | 100 | #20 | .250 |
| 447-P | .125 | 1 Meg. | 140" | 270" | 250" | 100 | #20 | .125 |

### STANDARD PRINTED CIRCUIT

| KELVIN TYPE | COMMERCIAL WATTAGE* | RESISTANCE MAX.** | DIA. ±1/64 | LENGTH ±1/32 | MAX. VOLTS | LEAD DIA. | LEAD SPACING |
|---|---|---|---|---|---|---|---|
| 252-P | .15 | 375K | .250 | .250 | 100 | #22 | .150 |
| 176-P | .15 | 450K | .250 | .312 | 100 | #22 | .150 |
| 178-P | .20 | 650K | .250 | .400 | 200 | #22 | .150 |
| 277-P | .20 | 700K | .250 | .437 | 200 | #22 | .150 |
| 471-P | .25 | 750K | .250 | .500 | 300 | #22 | .150 |
| 177-P | .30 | 850K | .312 | .500 | 400 | #22 | .200 |
| 179-P | .30 | 1.1M | .375 | .500 | 400 | #22 | .200 |
| 155-P | .50 | 3.0M | .500 | .625 | 400 | #20 | .250 |

## HIGH STABILITY SERIES

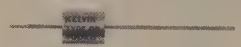
LONG TERM STABILITY: .003% resistance change per year maximum under conditions involving normal equipment and room temperature variations.

TOLERANCES: 1% through .005% available on most types and resistance values.

TEMPERATURE COEFFICIENT: ±10 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.



*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.

### AXIAL LEAD

| KELVIN TYPE | COMMERCIAL WATTAGE* | RESISTANCE MAX.** | DIA. ±1/64 | LENGTH ±1/32 | MAX. VOLTS | LEAD DIA. |
|---|---|---|---|---|---|---|
| OA | .15 | 560K | .187 | .375 | 300 | #22 |
| OB | .25 | 1.2 Meg. | .250 | .500 | 300 | #22 |
| OC | .33 | 2.2 Meg. | .250 | .750 | 400 | #22 |
| OD | .33 | 2.4 Meg. | .375 | .500 | 300 | #20 |
| OE | .50 | 3.6 Meg. | .375 | .828 | 400 | #20 |
| OF | .60 | 5.2 Meg. | .375 | 1.000 | 400 | #20 |
| OG | .50 | 4.0 Meg. | .500 | .500 | 400 | #20 |
| OH | 60 | 6.4 Meg. | 500 | .625 | 400 | #20 |
| OJ | 1.00 | 8.0 Meg. | .500 | 1.000 | 800 | #20 |
| OK | 1.50 | 10.0 Meg. | .500 | 1.500 | 900 | #20 |
| OL | 1.75 | 10.5 Meg. | .500 | 1.750 | 900 | #20 |
| OM | 2.00 | 13.0 Meg. | .500 | 2.000 | 1200 | #20 |

## STANDARD TYPES

TOLERANCES: 1% through .005% available on most types and resistance values.

TEMPERATURE COEFFICIENT: ±20 ppm/°C standard.

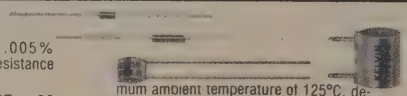
T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.

*All Lug Types available with #20 gauge radial leads (except EP-22) by specifying letter "R" after type number.



### LUG and RADIAL LEAD

| KELVIN TYPE | COMMERCIAL WATTAGE* | RESISTANCE MAX.** | DIA 1/32 | LENGTH 1/32 | MAX. VOLTS | TERMINAL TYPE* | MOUNTING HOLE |
|---|---|---|---|---|---|---|---|
| EP-22 | .10 | 350K | 312 | 250 | 100 | #24 x 2" (Wire Lead) | #2 |
| 346 P | .25 | 1.0M | 375 | 440 | 150 | Lug | #4 |
| 264-P | .33 | 1.5M | 375 | 500 | 300 | Lug | #4 |
| EP-09 | .50 | 4.0M | 500 | 500 | 400 | Lug | #6 |
| 263-P | .50 | 4.0M | 625 | 500 | 400 | Lug | #6 |
| EP-15 | .60 | 5.0M | 500 | 625 | 400 | Lug | #6 |
| EP-16 | 1.00 | 6.5M | 500 | 1.000 | 800 | Lug | #6 |
| EP-30 | 1.50 | 10.0M | 500 | 1.500 | 900 | Lug | #6 |

### AXIAL-WIRE LEAD

| KELVIN TYPE | COMMERCIAL WATTAGE* | RESISTANCE MAX.** | DIA. ± 1/64 | LENGTH ±1/32 | MAX. VOLTS | LEAD DIA. |
|---|---|---|---|---|---|---|
| EP-21 | .25 | 1.5 Meg. | .250 | .500 | 400 | #22 |
| 467-P | .25 | 1.5 Meg. | .250 | .500 | 400 | #20 |
| EP-23 | .33 | 2.75 Meg. | .250 | .750 | 400 | #22 |
| 812-P | .33 | 2.75 Meg. | .250 | .750 | 400 | #20 |
| 363-P | .40 | 3.0 Meg. | .250 | 1.000 | 400 | #22 |
| 334-P | .33 | 3.0 Meg. | .375 | .500 | 300 | #20 |
| 815-P | .50 | 4.5 Meg. | .375 | .750 | 600 | #20 |
| EP-24 | .50 | 4.5 Meg. | .375 | .828 | 600 | #20 |
| EP-25 | .50 | 5.0 Meg. | .500 | .500 | 400 | #20 |
| 254-P | .60 | 6.5 Meg. | .375 | 1.000 | 800 | #20 |
| EP-26 | .60 | 8.0 Meg. | .500 | .625 | 400 | #20 |
| EP-27 | 1.00 | 10.0 Meg. | .500 | 1.000 | 800 | #20 |
| EP-28 | 1.50 | 12.0 Meg. | .500 | 1.500 | 900 | #20 |
| 366-P | 1.75 | 13.0 Meg. | .500 | 1.750 | 900 | #20 |
| EP-29 | 2.00 | 15.0 Meg. | 500 | 2.000 | 1200 | #20 |

**CATALOG #763 COVERS ALL PRODUCTS SHOWN ON THIS PAGE**

KELVIN 5919 NOBLE AVENUE, VAN NUYS, CALIFORNIA 91411 TELEPHONE (213) 782-6662

## FAST RISE TIME APPLICATIONS

"RT" style resistors provide exceptionally high frequency performance, in addition to the other recognized advantages of wire-wound resistors. "RT" resistors can be supplied with rise times as low as 25 nanoseconds (from 10% to 90% of peak pulse amplitude at 100 KC), depending on resistance values and physical configurations. See Catalog #763

TOLERANCES: 1% through .005% available on most types and resistance values.

TEMPERATURE COEFFICIENT: ±20 ppm/°C standard.

T.C.s available to 1 ppm depending on size, value and temperature range.

WINDINGS: Non-inductive.

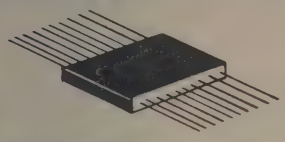
*WATTAGE RATINGS: Based on a maximum ambient temperature of 125°C, derated to zero watts at +145°C.

**RESISTANCE MAX.: Contact factory for availability of values above maximum shown.

AXIAL LEAD

| KELVIN TYPE | COMMERCIAL WATTAGE* | RESISTANCE MAX.** | DIA. ± 1/64 | LENGTH ± 1/32 | MAX. VOLTS | LEAD DIA. |
|---|---|---|---|---|---|---|
| RTA | 15 | 560 K | 187 | 375 | 300 | #22 |
| RTB | 25 | 1.2 Meg | 250 | 500 | 400 | #22 |
| RTC | 33 | 2.2 Meg | 250 | 750 | 400 | #22 |
| RTD | 33 | 2.4 Meg | 375 | 500 | 300 | #20 |
| RTE | 50 | 3.6 Meg | 375 | 828 | 400 | #20 |
| RTF | 60 | 5.2 Meg | 375 | 1.000 | 400 | #20 |
| RTG | 50 | 4.0 Meg | 500 | 500 | 400 | #20 |
| RTH | 60 | 6.4 Meg | 500 | 625 | 400 | #20 |
| RTJ | 100 | 8.0 Meg | 500 | 1.000 | 800 | #20 |
| RTK | 150 | 10.0 Meg | 500 | 1.500 | 900 | #20 |
| RTL | 175 | 10.5 Meg | 500 | 1.750 | 900 | #20 |
| RTM | 200 | 13.0 Meg | 500 | 2.000 | 1200 | #20 |

## RESISTOR NETWORKS



Kelvin develops and produces, to customer requirements, packaged resistor networks for use as voltage dividers, analog to digital converters, summing and integrator networks, binary resistive networks, R-2R ladders and special configurations.

Standard resistor networks in two series (R-2R and BCD) are available from catalog specifications. The potting, encapsulation and physical size flexibility of Kelvin resistors and case production techniques makes it possible to offer custome built units to exact customer requirements at reasonable prices. Our engineering department will review your requirements and submit price quotation and technical notes. 12 page Bulletin LN-37 available on request.

Electrical Characteristics Available: Nominal resistance ratio tolerance to ±.002% (DC). Resistance VDR ratio tolerances as close as .0005% (DC). Long term resistance ratio stabilities to ±.001% peryear. Low reactances to provide rise times as low as 25 nanoseconds. Temperature coefficients of resistors to track as close as 0.5 ppm/°C. from −55°C to +125°C

## SERIES KM MOLDED, POWER RESISTORS

Series KM are general purpose, reliable power resistors designed to be used where heat sinks are not available or not desired. These resistors are extremely stable for their size as compared to film types. Series KM are considered to have the lowest dollar per watt cost of precision resistors. Send for Bulletin K-1

**TOLERANCES:** 0.025% through 5.0%

**TEMPERATURE COEFFICIENT:**

±20 PPM/°C (170 ohms and above)
±30 PPM/°C (10 to 170 ohms)
±50 PPM/°C (1 to 9.99 ohms)
±90 PPM/°C (below 1 ohm)

T.C.s to 5 PPM/°C available depending on size and value.

**NON-INDUCTIVE STYLES:** Reduce resistance values by approximately 50%; derate maximum working voltage by 30%. Add "N" to part number. Example: KMN025.

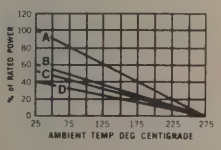
| KELVIN PART NUMBER | WATTAGE G & U 275°C | WATTAGE V 350°C | DC Working Voltage | Maximum Resistance | SIZE and TOLERANCES Length | Diameter | Lead Length (±0.125) | Lead Diameter (AWG) | Equivalent Military Styles MIL-R-26E |
|---|---|---|---|---|---|---|---|---|---|
| KM025 | 0.40 | 0.60 | 35 | 3.5K | 0.250± .015 | 0.078± .015 | 1.5 in | 24 | |
| KM050 | 0.75 | 1.0 | 50 | 7.0K | 0.312± .015 | 0.078± .015 | 1.5 in | 24 | |
| KM100 | 1.0 | 1.5 | 75 | 10.0K | 0.422± .015 | 0.093± .015 | 1.5 in. | 24 | RW70 |
| KM200 | 2.0 | 2.5 | 200 | 15.0K | 0.490± .015 | 0.150± .015 | 1.5 in | 22 | |
| KM250 | 2.5 | 3.0 | 200 | 30.0K | 0.500± .031 | 0.218± .015 | 1.5 in | 20 | RW69 |
| KM300 | 3.0 | 3.75 | 150 | 25.0K | 0.560± .031 | 0.187± .015 | 1.5 in | 20 | RW79 |
| KM301 | 3.3 | 4.8 | 200 | 42.0K | 0.812± .031 | 0.187± .015 | 1.5 in | 20 | |
| KM350 | 4.0 | 5.5 | 200 | 47.0K | 0.625± .031 | 0.250± .015 | 2.0 in | 18 | |
| KM500 | 5.0 | 6.5 | 400 | 95.0K | 0.875± .031 | 0.312± .031 | 2.0 in | 18 | RW67 RW74 |
| KM700 | 7.0 | 9.0 | 600 | 150K | 1.218± .031 | 0.312± .031 | 2.0 in | 18 | |
| KM1000 | 10.0 | 13.0 | 1000 | 275K | 1.780± .031 | 0.375± .031 | 2.0 in | 18 | RW68/RW78 |

## SERIES KC CHASSIS MOUNT POWER RESISTORS

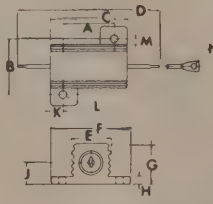
**DERATING CURVES**

Derating is required for reduced chassis mounting area and high ambient temperatures

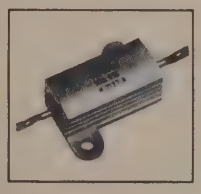
Curves.




A — When mounted on proper aluminum chassis.
48 sq. inches 0.040 aluminum for KC500 and KC1000
70 sq. inches 0.040 aluminum for KC2500
144 sq. inches 0.040 aluminum for KC5000




B — Unmounted KC500 and KC1000
C — Unmounted KC2500
D — Unmounted KC5000



Designed to provide maximum heat dissipation through heat sink and finned case configuration. Ideally suited where large amounts of power must be dissipated and small size is important. Capable of maintaining their precision tolerance in wattage ratings up to 50 watts. Send for Bulletin K-3

**TOLERANCES:** 0.05% through 5.0%

**TEMPERATURE COEFFICIENT:**

±20 PPM/°C (170 ohms and above)
±30 PPM/°C (10 to 170 ohms)
±50 PPM/°C (1 to 170 ohms)

T.C.s to 5 PPM/°C available depending on size and value

NON-INDUCTIVE STYLES: Reduce resistance values by approximately 50%; derate maximum working voltage by 30%. Add "N" to part number. Example: KCN500.

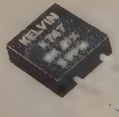
| KELVIN PART NUMBER | Watts | DC Working Voltage | Max Res | SIZE and TOLERANCES A ± .005 | B ± .005 | C ± .031 | D ± .062 | E ± .015 | F ± .015 | G ± .015 | H ± .010 | J ± .010 | K ± 0.10 | L ± .005 | M ± .015 | N ± .005 | Mtg. Screw Size | MIL-R-18546 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KC500 | 7.0 | 165 | 20K | 0.444 | 0.490 | 0.600 | 1.125 | 0.334 | 0.646 | 0.320 | 0.065 | 0.133 | 0.078 | 0.093 | 0.078 | 0.050 | #2 | RE60 |
| KC1000 | 12 | 275 | 30K | 0.562 | 0.625 | 0.750 | 1.375 | 0.425 | 0.812 | 0.400 | 0.075 | 0.190 | 0.093 | 0.093 | 0.093 | 0.086 | #2 | RE65 |
| KC2500 | 25 | 560 | 75K | 0.719 | 0.781 | 1.062 | 1.938 | 0.525 | 1.080 | 0.550 | 0.088 | 0.280 | 0.17* | 0.125 | 0.115 | 0.086 | #4 | RE70 |
| KC5000 | 50 | 1300 | 200K | 1.563 | 0.844 | 1.968 | 2.781 | 0.615 | 1.150 | 0.615 | 0.085 | 0.307 | 0.203 | 0.125 | 0.115 | 0.086 | #4 | RE75 |

## K747 WIRE WOUND RESISTOR

| | |
|---|---|
| Lead Size: | #22 (.025) solder coated brass |
| Lead Spacing ℄ to ℄: | .150" (±.010) |
| Wattage: | .3 watts |
| Voltage: | 200 volts |
| Resistance Range: | .5Ω to 400KΩ |
| Resistance Tolerance: | 1% thru .01% |
| Temperature Coefficient: | ±5 PPM standard (0-85°C) |
| TC Tracking: | Available to ±1 PPM/°C |
| Stability: | 25 PPM/year |
| Rise Time: | 25 nanoseconds (value dependent) |
| Noise: | Not measurable on commercially available equipment |
| Environmental: | Exceeds all requirements of MIL-R-39005 |

Designed specifically to interchange with film resistors of same physical configuration. Performance characteristics show the K747 series to be superior in almost all instances. Send for Bulletin K747.

For closer tolerances to .005% and temperature coefficients to 1 PPM (0 to 60°C referenced to 25°C) request Bulletin K746.




SIZE: 320± .020 H.
295± .010 L.
100± .015 W

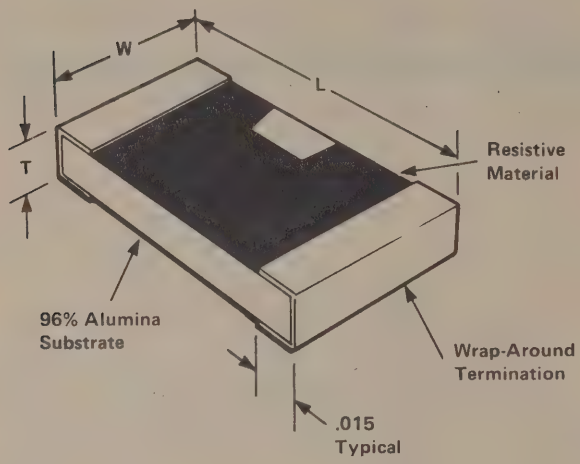
**Kelvin pioneered the close tolerance, close temperature coefficient and excellent long term stability wire-wound resistor. State-of-the-art manufacturing techniques and superior testing capabilities yield the ultimate in quality at a competitive price. Please contact your nearest Kelvin representative or the factory direct for further details.**

KELVIN 5919 NOBLE AVENUE, VAN NUYS, CALIFORNIA 91411 TELEPHONE (213) 782-6662

CALL
**(714) 979-8833**
**OR TWX**
**FOR PROMPT SERVICE**

## DIRECT SALES CATALOG

# PRECISION THICK FILM CHIP RESISTORS




Microplex chip resistors for thick and thin film hybrid circuits:

- Eliminates expensive multiple screenings
- Provides very low to very high resistance values in a small area
- Wrap-around terminations provide assembly ease with standard bonding techniques
- Allows high density packaging
- Offers uniform tolerances
- Reduces trimming needs

### GENERAL SPECIFICATIONS

Tolerance ±20%, ±10%, ±5%, ±1%, ±2% upon request

### MIL SPECIFICATIONS

Designed to meet applicable portions
MIL-R-55342
MIL-STD-202

### SPECIFICATIONS

| Style | Resistance Range* | Power Rating | Length (L) ±.005″ | Width (W) ±.005″ | Thickness (T) +.004″ −.002″ |
|---|---|---|---|---|---|
| Ec | 1Ω - 50 meg | 75 mw | .050 | .030 | .020 |
| A | 1Ω - 50 meg | 125 mw | .050 | .050 | .020 |
| B | 1Ω - 50 meg | 200 mw | .075 | .050 | .020 |
| C | 5Ω - 100 meg | 250 mw | .100 | .050 | .020 |
| D | 5Ω - 100 meg | 700 mw | .150 | .050 | .020 |
| E | 1Ω - 50 meg | 1 w | .100 | .100 | .020 |
| F | 5Ω - 100 meg | 2 w | .200 | .100 | .020 |

* Other values and sizes available on special orders.

FREE TYPICAL SAMPLER MAILED TO YOU BY RETURN MAIL FOR THE ASKING

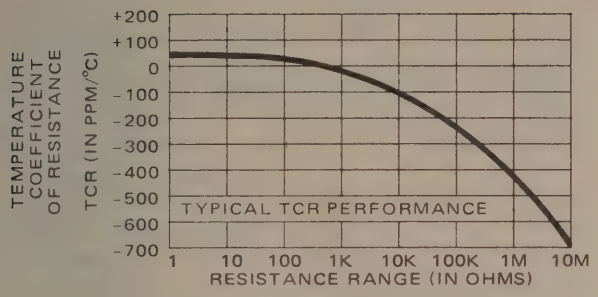
SCREENING AND TESTING AVAILABLE AT ADDITIONAL CHARGE

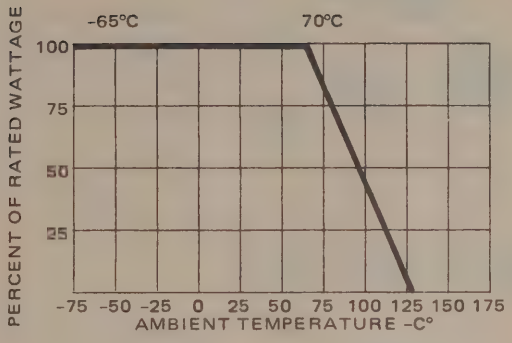
**CUSTOM RESISTOR NETWORKS AND METALLIZED CIRCUITS TO YOUR DESIGN AND SPECIFICATIONS**

**MICROPLEX, INC.**
2126 SOUTH LYON STREET / SANTA ANA, CALIFORNIA 92705 / (714) 979-8833, CALL COLLECT OR TELETYPE
PRECISION MICROELECTRONIC COMPONENTS SINCE 1970

CALL
(714) 979-8833
OR TWX
FOR PROMPT
SERVICE

## TYPICAL CHARACTERISTICS




## SPECIFICATIONS

Temperature Cycling: Mil-Std-202A, Method 102A, Condition C, Change is less than ±1%.

Life: Better than ±1% at 70°C for 1000 hours at the DC voltage required to dissipate full rated power.

Maximum Operating Voltage: 100 WVDC (not to exceed maximum power limitation).

Short Time Overload: 2.5 times maximum DC voltage required to dissipate full-rated power for 5 seconds at 25°C.

Power Rating: At 25°C in free air.

Termination Materials: Platinum Palladium Silver (Standard), Platinum Gold, Silver.

## HOW TO ORDER

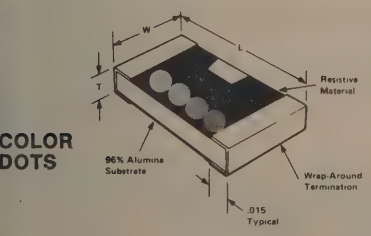
MCR A 21 2 J X Z

- MCR — MICROPLEX CHIP RESISTOR
- A — SIZE (see chart)
- 21 — RESISTANCE VALUES IN OHMS: significant figures
- 2 — RESISTANCE VALUES IN OHMS: number of zeros
- J — TOLERANCE (F = 1%, G = 2%, J = 5%, K = 10%, M = 20%)
- X — TERMINATION MATERIAL: X = Platinum gold, Y = Platinum palladium silver, S = Silver
- Z — SOLDER DIPPED With SN62 (available with X or Y terminates only)

Jumpers for Interconnections and Crossovers

| Style | Length (L) ±.005" | Width (W) ±.005" | Thickness (T) +.004" −.002" |
|---|---|---|---|
| JA | .050 | .030 | .020 |
| JB | .075 | .030 | .020 |

# COLOR CODE MARKED CHIP RESISTORS



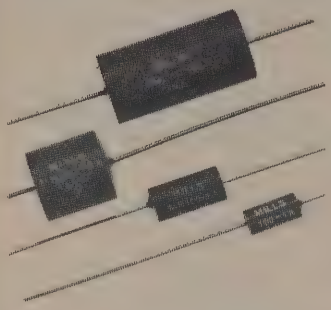

Custom color code marking of chip resistors in accordance with EIA standard Color Code for resistors or to your particular color code system. Ask for free samples.

Standard colors are used as specified in the GEN-101 RETMA chart supplied by the Electronic Industries Association. All color coded parts are marked with permanent marking ink which exceeds all the performance requirements of MIL-STD-202 for chemical resistance.

MICROPLEX, INC.
2126 SOUTH LYON STREET / SANTA ANA, CALIFORNIA 92705 / (714) 979-8833, CALL COLLECT OR TELETYPE
PRECISION MICROELECTRONIC COMPONENTS SINCE 1970

# MILLS PRECISION WIREWOUND RESISTORS

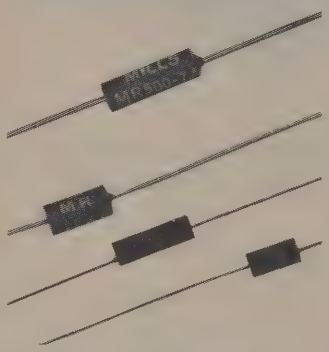
## STANDARDS



| Part No. | Watt | Max. R | Dia. | Length | Lead |
|---|---|---|---|---|---|
| MR100-1 | .15 | 700K | .187 | .375 | #22 |
| MR100-2 | .25 | 1.5M | .250 | .500 | #22 |
| MR100-3 | .30 | 2.75M | .250 | .750 | #22 |
| MR100-4 | .35 | 3.0M | .375 | .625 | #20 |
| MR100-5 | .50 | 4.0M | .375 | .828 | #20 |
| MR100-6 | .50 | 5.0M | .50 | .50 | #20 |

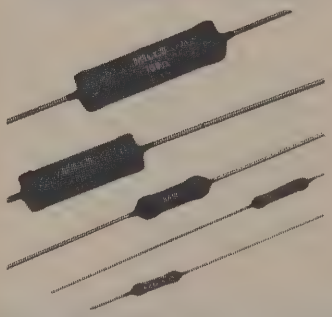
- Lead Configuration:
  "A" after Part No. for Axial Leads
  "R" for Radial Leads
  "L" for Lugs
- For high speed applications (minimum distributed L and C) specify MR200 Series.
- For high stability applications specify MR300 Series.
- Tolerance: .005% and up; to .002% in some cases.
- Metric sizes available, ask for our Metric Flyer.

## MINIATURE PARTS



| Part No. | Watt | Max. R | Dia. | Length | Lead |
|---|---|---|---|---|---|
| MR500-1 | .04 | 100K | .080 | .210 | #20 |
| MR500-2 | .05 | 125K | .080 | .375 | #24 |
| MR500-3 | .04 | 100K | .125 | .125 | #24 |
| MR500-4 | .05 | 125K | .100 | .210 | #24 |
| MR500-5 | .10 | 125K | .125 | .187 | #24 |
| MR500-6 | .10 | 125K | .125 | .250 | |

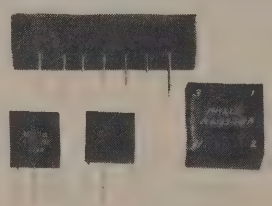
## PRECISION POWER WIREWOUND RESISTORS



| Part No. | Watt | Max. R | Dia. | Length | Lead |
|---|---|---|---|---|---|
| MRP-½-A | ½ | 4.9K | .093 | .343 | #24 |
| MRP-1-A | 1 | 10.4K | .093 | .406 | #24 |
| MRP-2-A | 2 | 25K | .187 | .500 | #20 |
| MRP-3-A | 3 | 47.1K | .187 | .562 | #20 |
| MRP-5-A | 5 | 90K | .250 | .812 | #18 |

- To 20 watts.
- Silicone covered for maximum heat transfer.
- Tolerance:
  1% is standard, available to .05%.
- Ask for our
  Precision Power Flyer.

## NETWORKS



- Any configuration you desire.
- Matched 2, 3 or 4 Network configurations available in standard sizes.
- Standard R, 2R, 4R types, etc. available.
- Tolerances: To .005%, closer in some cases;
  Temperature Coefficient tracking to 1 PPM; Ratio matches to .001%.
- Ask for our Network Flyer.

# MILLS RESISTOR COMPANY

DEPT. EM, 3840 CATALINA ST., LOS ALAMITOS, CA 90720 (213) 598-2454 (714) 827-2500

MINI-SYSTEMS, INC.
20 David Road, North Attleboro, MA 02761
TELEPHONE: (617) 695-0206 • TWX NO. 710-348-0564

# PRECISION THICK FILM CHIP RESISTORS

## HIGH RELIABILITY
### "QR" SERIES CHIP RESISTORS FOR ALL CRITICAL APPLICATIONS

MEET OR EXCEED **MIL-STD-55342B**, CHARACTERISTIC "M" SPECIFICATIONS AND PERFORMANCE

All parts manufactured with full traceability of materials and processing. 100% Group I (55342B) testing. Current generic type test data for Groups II and III testing will be supplied.

| MSI # | MIL # | SIZE | MSI POWER mW @ 70°C |
|---|---|---|---|
| QR-2 | RM0502 | .050 x .025 | 20 |
| QR-4 | RM0505 | .050 x .050 | 80 |
| QR-6 | RM0705 | .075 x .050 | 125 |
| QR-8 | RM1005 | .100 x .050 | 160 |
| QR-10 | RM1505 | .150 x .050 | 190 |
| QR-12 | — | .100 x .100 | 200 |
| QR-14 | RM2208 | .225 x .075 | 500 |
| QR-16 | — | .390 x .190 | 1250 |

IN DEPTH INVENTORY
NORMAL DELIVERY: 2 WEEKS OR SOONER

OPTIONS:

- Nickel plated for high temperature attachment and/or operation.
- Indium tinned for reflow to thin film gold.
- 100% Power burn-in with lot data or serialized with device data.
- 100% Short term overload testing.
- Tighter TCR (Absolute, Tracking, etc.).

## NEW LOW COST "JR" SERIES COMPUTER/INDUSTRIAL GRADE WRAP AROUND CHIP RESISTOR

Type #JR13—.075(L) x .050(W) x .017(T)

| QTY. | 25 | 100 | 1000 | 5000 | 10000 |
|---|---|---|---|---|---|
| *Price | $.50 | $.35 | $.25 | $.20 | $.15 |

* ±10% TOLERANCE

Tolerances Available: ±1%, 2%, 5%, 10%, 20%
Resistance Range: 10Ω to 10MΩ
PDIS Rating (25°C Free Air): 200 Milliwatts

Untinned for either epoxy or solder attachment.

IMMEDIATE DELIVERY FROM STOCK

## STANDARD "MSR" SERIES

All types available in the following sizes:

CHIP RESISTOR CHART

| SIZE (L x W) | PDIS RATING 25°C FREE AIR (MILLIWATTS) | OHMIC RANGE |
|---|---|---|
| .035 x .035 | 50 | 1Ω to 75MΩ |
| .050 x .040 | 100 | 1Ω to 100MΩ |
| .050 x .050 | 125 | 1Ω to 100MΩ |
| .100 x .025 | 100 | 10Ω to 1000MΩ |
| .075 x .050 | 200 | 1Ω to 100MΩ |
| .100 x .050 | 250 | 1Ω to 100MΩ |
| .100 x .100 | 500 | 1Ω to 100MΩ |
| .150 x .050 | 300 | 1Ω to 100MΩ |
| .244 x .125 | 2000 | 1Ω to 100MΩ |
| 1.000 x .100 | 4000 | 1Ω to 100MΩ |
| .393 x .192 | 2000 | 1Ω to 100MΩ |
| .496 x .100 | 2000 | 1Ω to 100MΩ |
| .494 x .243 | 4000 | 1Ω to 100MΩ |
| .661 x .326 | 8000 | 1Ω to 100MΩ |
| .661 x .494 | 12000 | 1Ω to 100MΩ |
| WRAP AROUNDS | | |
| .057 x .052 | 125 | 1Ω to 100MΩ |
| .083 x .052 | 200 | 1Ω to 100MΩ |
| .110 x .102 | 500 | 1Ω to 100MΩ |
| .110 x .052 | 250 | 1Ω to 100MΩ |
| .160 x .052 | 300 | 1Ω to 100MΩ |

- Tolerances Available: ±.25%, 1%, 2%, 5%, 10%, and 20% for most resistance values.
- All types are available in untinned versions for conductive epoxy attachment.
- Hi-Rel screening available on all resistor types.
- Backside metalization available upon request.
- "Flip-Chip" resistors are solder tinned (SN-62).
- Wire bond resistors have gold metalization optimized for wire bonding.

DELIVERY: STOCK TO 2 WEEKS

MINI-SYSTEMS pays consistent attention to:
QUALITY
CUSTOMER SERVICE
DELIVERY

MRC MILWAUKEE RESISTOR CORPORATION
700 WEST VIRGINIA STREET, MILWAUKEE, WI. 53204
Telephone: (414) 271-9900

# WIREWOUND POWER RESISTORS

## 8 to 2,000* Watts Vitreous Enamel, Silicone or Cement Coated

★ **STANDARD RESISTORS:** 8 THROUGH 225 WATTS . . . . . 8, 12, 20, 25, 50, 100 and 225 Watt, Vitreous Enamel in both FIXED and ADJUSTABLE (except 8 and 20 watt adjustable) are readily available. . . . . .

### CUSTOM RESISTORS

36 additional wattage ratings are available with different core diameters and lengths. Non-Inductive, Tapped, Live Bracket, Porcelain Bushings, Printed Circuit Board and other specialty items are also manufactured to customer specifications.

MILWAUKEE will satisfy your resistor requirements with custom values, tolerances , temp. coefficient, sizes and coatings easily with its engineering capabilities and production facilities.

### TERMINALS

All 8, 12 and 20 watt fixed resistors are standard with 1½" tinned leads. They are also available with conventional lug terminals. 12 watt adjustable and 25 watt through225 watt fixed and adjustable have lug type terminals. Single and double quick connect and many other special types of terminals are also available.

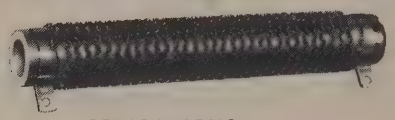
### MOUNTING

Spring clips, vertical through bolts and horizontal "L" brackets are available for all 8 through 225 watt sizes.

Ferrule mountings, special spring clips, mica washers, terminal hardware and other accessories are also available.

WRITE FOR OUR CATALOG WITH SPECIFICATIONS FOR VARIOUS MOUNTING OPTIONS

# RIBWOUND RESISTORS 40 – 2,000 WATTS



MILWAUKEE RIBWOUND RESISTORS ARE UNIQUE. . . . . The eveness of the crimping allows us to wind considerably higher ohmic values in any given wattage.....*If you have a particular problem or application - please contact our factory !*

### APPLICATIONS

Particularly useful where high energy is to be dissipated in the lower ohmic values†. With its ability to operate at about ½ the size of the equivalent round wire resistor. Mounting options are the same as for wirewound.

*† = MILWAUKEE'S EXCLUSIVE WINDING TECHNIQUES ALLOW AT LEAST 3 TIMES GREATER MAXIMUM OHMIC VALUES AS ARE NORMALLY COMPETITIVELY AVAILABLE !. . . . . .*

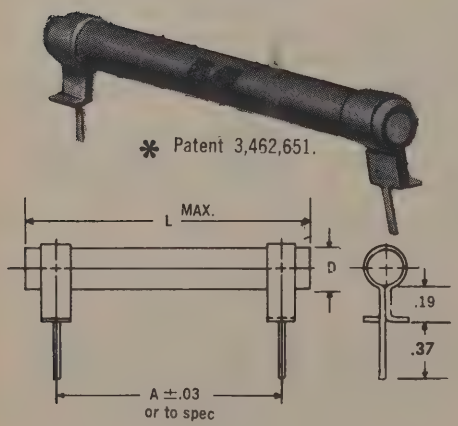
### COATINGS

MILWAUKEE'S variety of coatings is particularly convenient for the manufacture of resistors for use in special atmospheres. . . . . LET US KNOW OF YOUR SPECIAL REQUIREMENTS

### RIBWOUND CONSTRUCTION

Special resistance alloy ribbon is crimped and edgewound on the core. Depending on the particular alloy, the ribbon is spot-welded or silver soldered to the terminals. Ribwound resistors may be furnished in either fixed or adustable type and can be cement coated. Several 300 watt values are stocked. All other sizes are made to order.

# PCB PRINTED CIRCUIT BOARD RESISTORS*




**FIXED**

| WATTS | L | A | D | MAX. OHMS† |
|---|---|---|---|---|
| 3 | $1^{1}/_{32}$ | 0.6 | $^{5}/_{16}$ | 21,000 |
| 5 | $1^{5}/_{16}$ | 0.9 | $^{5}/_{16}$ | 39,000 |
| 7 | $1^{23}/_{32}$ | 1.3 | $^{5}/_{16}$ | 63,000 |
| 10 | $2^{1}/_{8}$ | 1.7 | $^{5}/_{16}$ | 86,000 |
| 15 | $2^{1}/_{8}$ | 1.7 | $^{13}/_{32}$ | 86,000 |
| 20 | $2^{5}/_{8}$ | 2.2 | $^{13}/_{32}$ | 114,000 |

**ADJUSTABLE**

| WATTS | L | A | D | MAX. OHMS† |
|---|---|---|---|---|
| 15 | $2^{1}/_{8}$ | 1.7 | $^{13}/_{32}$ | 20,000 |
| 20 | $2^{5}/_{8}$ | 2.2 | $^{13}/_{32}$ | 27,000 |

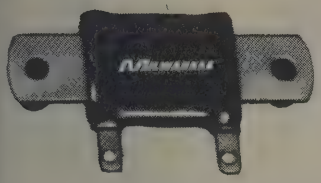
†=FOR HIGHER OHMS, CONSULT FACTORY

### FEATURES

- Built-in standoff keeps board cool.
- Mounting feet prevent rocking.
- Power ratings 3 to 20 watts.
- Complete OHM range.
- One-piece, welded terminals
- Rectangular leads .020 x .040 in.
- Silicon base coating. Vitreous enamel coating available.
- Standard tolerance ±5%.
- 20 PPM upon request.

MILWAUKEE RESISTOR CORPORATION
700 WEST VIRGINIA STREET, MILWAUKEE, WI. 53204
Telephone: (414) 271-9900

# OVALS

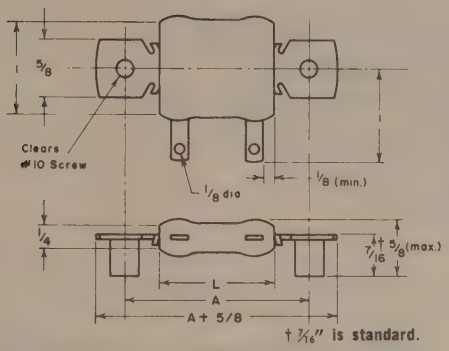


OVAL RESISTORS are for use where space saving is desired and where the use of the 'Heat Sink' function of the metal chassis, rack or panel may be employed. Resistance tolerance of ±5% is standard except on low resistance and multi-tapped units. COATINGS of vitreous enamel or silicone base are offered.

OVALS are available in regular or miniature sizes; an original development of MILWAUKEE Resistor.

Additional miniature oval core sizes are available increasing the possibility of taps and isolated sections. Other intermediate sizes are also available. Only regular ovals are available as adjustables.

## REGULAR

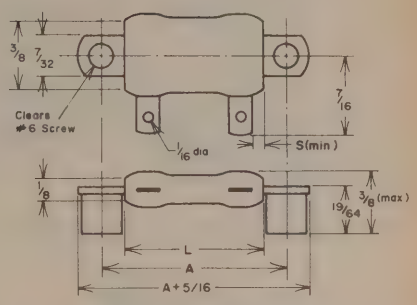



† 7/16" is standard.

| | | DIMENSIONS | |
|---|---|---|---|
| WATTS† | OHMS | A | L |
| 30 | 1.2 - 7,300 | 2" | 1 1/4" |
| 40 | .08 - 27,000 | 2 3/4" | 2" |
| 55 | .04 - 85,000 | 4 1/4" | 3 1/2" |
| 70 | .06 - 137,000 | 5 1/2" | 4 3/4" |
| 95 | .08 - 171,000 | 6 3/4" | 6" |

† = Rating based on mounting on steel panel 10" x 10" x .040".

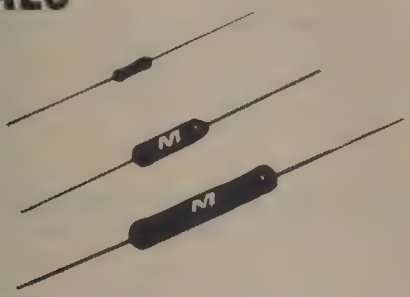
## MINIATURE




| | | DIMENSIONS | | |
|---|---|---|---|---|
| WATTS† | OHMS | A | L | S |
| 10 | .7 - 10,800 | 1" | 3/4" | 1/16" |
| 15 | .18 - 17,700 | 1 1/4" | 1" | 1/16" |
| 20 | .08 - 80,000 | 2 5/16" | 2" | 1/16" |

† = Rating based on mounting on steel panel 10" x 10" x .040".

# AXIALS

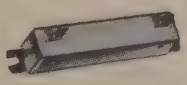


APPLICATIONS
- Electronic Circuitry
- Printed Circuits
- Radio, Television and Sound Reproduction
- Miniature Controls

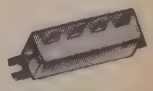
CONSTRUCTION
- Wire Wound on Ceramic Core
- All Welded
- Vitreous or Silicone Base Coating

FEATURES
- Rugged yet small.
- Highly stable.
- Matched expansion in core caps and coating for temperature stability.
- Standard 5% tolerance over 1 ohm, available in closer tolerances on request.
- Wattage ratings based on 325°C rise at 25°C ambient.
- Standard Sizes—3, 6.5, 11 watts.
- Leads Hot Tin Dipped.

# METAL CASE *



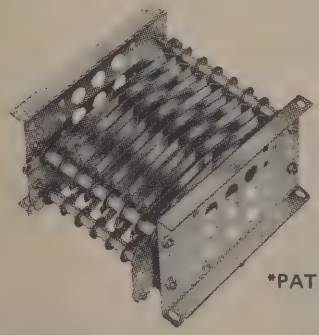
*PATENT 3,581,266



High Heat Sink—flush mounting dissipates heat.
20 to 100 Watts — higher on Specials
Quick Connect or Screw Terminals
Save: Space -First Cost- Assembly Cost

*WRITE FOR ADDITIONAL INFORMATION*

# GRIDS *



Stud or Deck Mounted, MILWAUKEE'S patented grid system assures maximum heat dissipation & cooling.

*PATENT 3,212,045

Pre-formed grid elements assure unidirectional stress motion. Custom design and construction features are most economical utilizing the exclusive MILWAUKEE patented grid system.

# stay up to date

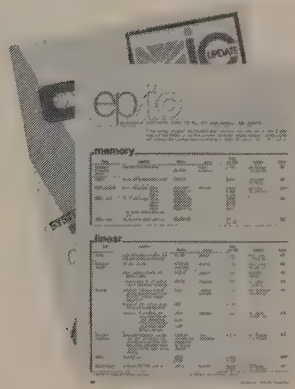
**SUBSCRIBE TO ELECTRONIC PRODUCTS MAGAZINE. IT'S YOUR *COMPLETE* GUIDE TO EVERYTHING THAT'S NEW IN THE FAST-CHANGING WORLD OF ELECTRONIC PRODUCTS AND SYSTEMS.**

**FEATURE STORIES** every month on electronic products, applications and availability.

**FORUMS**—Reports on meetings of manufacturers, users and distributors. Get the very latest news on a wide variety of products.

**NEW PRODUCT NEWS**—Hundreds of new products are introduced each month. You'll get the facts on not only what the new product is, but also where to get it, basic prices and current delivery.

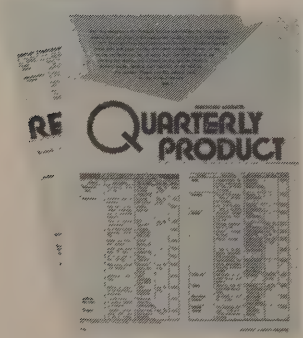
**EP/IC UPDATE**—Exclusive in ELECTRONIC PRODUCTS. A monthly report on *everything* that's new in the fast-moving world of integrated circuits.




**QUARTERLY PRODUCT REVIEW**—Another exclusive in ELECTRONIC PRODUCTS. A complete report of *every* new electronic product introduced in the previous quarter. This feature is in the January, April, July and October issues.

**QUARTERLY PRODUCT PLANNING DIRECTORY**—A compilation of the latest catalogs of a wide variety of electronic products and systems.

**OUTLOOK**—Important industry news affecting electronic products and systems.




**COMPONENT CAPERS**—A humorous look at the strange and wonderful world of electronics.

**MINI-GLOSSARIES,** Quizzes and more—Each and every month for over twenty years the readers of ELECTRONIC PRODUCTS learn something new about the products they work with and specify.

***If you are not now a subscriber, write to:***
***Dorothy Renoud, ELECTRONIC PRODUCTS MAGAZINE, 645 Stewart Avenue, Garden City, NY 11530.***
***Ask for a free qualification card.***

United Technical Publications, Inc., Div. of Cox Broadcasting Corp., 645 Stewart Ave., Garden City, NY 11530/(516) 222-2500

*Nytronics Components Group, Inc.*
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

**SAGE/NYTRONICS RESISTORS**

# INDUSTRY'S FINEST RESISTORS

MIL-R-39007
ESTABLISHED RELIABILITY
FAILURE RATES M, P, AND R .01%/1000 HRS.
RESISTANCE TOLERANCE ±1%
TEMPERATURE COEFFICIENT:
±20 PPM/°C MAX. 10Ω AND HIGHER
±50 PPM/°C MAX. 1Ω TO 10Ω
±90 PPM/°C MAX. .1Ω TO 1Ω

ALL STYLES AVAILABLE WITH SOLDERABLE (S) OR WELDABLE (W) TERMINALS
ALSO: NON-INDUCTIVELY WOUND (N)

## TYPE DESIGNATIONS

| MIL STYLE | DETAIL SPEC. NO. | SAGE STYLE | MIL WATTS @ 25°C | AVAILABLE RESISTANCE RANGE |
|---|---|---|---|---|
| RWR80S<br>RWR80W | /8E<br>/8E | 1009SM<br>1007SM | 2 | .10Ω to 2.67K |
| RWR81S<br>RWR81W | /9C<br>/9C | 259SM<br>257SM | 1 | .10Ω to 1.0K |
| RWR89S<br>RWR89W | /11C<br>/11C | 1249SM<br>1247SM | 3 | .10Ω to 4.12K |
| RWR84S<br>RWR84W | /10C<br>/10C | 1509SM<br>1507SM | 7 | .10Ω to 12.4K |
| RWR71S<br>RWR71W | /5D<br>/5D | 1259SP<br>1257SP | 2 | .10Ω to 16.2K |
| RWR74S<br>RWR74W | /6C<br>/6C | 1509SP<br>1507SP | 5 | .10Ω to 12.1K |
| RWR78S<br>RWR78W | /7C<br>/7C | 1709SP<br>1707SP | 10 | .10Ω to 39.2K |

## EXAMPLE PART DESIGNATION:

**RWR-74** — BODY STYLE

**S** — TERMINALS
S — SOLDERABLE
W — WELDABLE
N — NON-INDUCTIVE

**49R9** — NOMINAL RES., Ω. THREE SIGNIFICANT DIGITS PLUS FOURTH INDICATING NUMBER OF ZEROES. BELOW 100Ω, R-DECIMAL AND FOLLOWING DIGITS ARE SIGNIFICANT.

**F** — TOLERANCE ±1%

R — LIFE FAILURE RATE

*Nytronics Components Group, Inc.*
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

**SAGE/NYTRONICS RESISTORS**

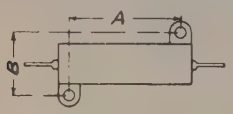
## INDUSTRY'S FINEST RESISTORS . . . Commercial, Military, High Reliability

# TYPE M METAL CLAD CHASSIS MOUNT RESISTORS

TYPE M CONSTRUCTION

Aluminum housed resistors for heat sink mounting. Meet or exceed requirements of MIL-R-18546D. Dielectric strength to 2500 volts rms.

All dimensions are inches nominal. Complete specifications available on request.




| STYLE | Rating Watts | A | B | Max. Resistance Ω | |
|---|---|---|---|---|---|
| | | | | Regular Winding | Non-Induct. |
| 3105M | 8 | .444 | .490 | 24,000 | 8,400 |
| 3010M | 14 | .562 | .625 | 30,000 | 10,500 |
| 3225M | 25 | .719 | .781 | 71,000 | 25,000 |
| 3550M | 50 | 1.562 | .844 | 230,000 | 80,000 |

M suffix designates regular single layer wind.
NM suffix designates non-inductive wind.

## TYPE MB HIGH WATTAGE
### BERYLLIUM OXIDE CORES

| STYLE | RATED WATTS 25°C ambient | |
|---|---|---|
| | chassis mounted | free air |
| 3105 MB/NMB | 15 | 6 |
| 3010 MB/NMB | 20 | 8 |
| 3225 MB/NMB | 35 | 14 |
| 3550 MB/NMB | 50 | 20 |

MB suffix designates regular single layer wind, NMB non-inductive wind.

## MIL-R-26E TYPE DESIGNATIONS

**EXAMPLE:** RW69 V 471

- RW69 — Body Style
- V — Characteristic, V only (350°C max.)
- 471 — Nominal resistance, Ω. Two significant digits plus third indicating number of zeros. Below 10ΩR = decimal and last digit is significant.

TOLERANCE: ±5% for values 1Ω and up; ±10% below 1Ω.
TC: ±260 ppm/°C 20Ω and up; 400 ppm/°C below 20Ω.

| MIL STYLE | SAGE STYLE | MIL WATTS | DEFINED OHMIC RANGE | |
|---|---|---|---|---|
| | | | (Single layer wound .00175 min. wire dia. | .001 Min. Wire Dia. |
| RW55V | 1900S | 7 | .1—5100 | |
| RW56V | 1950S | 14 | .1—9100 | |
| RW67V | 1550S | 6.5 | .1—3600 | .1—8200 |
| RW68V | 1700S | 11 | .1—8200 | .1—20K |
| RW69V | 1200S | 3 | .1—910 | .1—2K |

**EXAMPLE:** RW70 U 49R9 F

- RW70 — Body Style
- U — Characteristic, U only (275°C max.)
- 49R9 — Nominal resistance, Ω. Three significant digits plus fourth indicating number of zeros. Below 10ΩR = decimal and following digits are significant.
- F — Tolerance ± % B = .1% D = .5% F = 1.0%

TC: ±30 ppm/°C 10Ω and above
±50 ppm/°C 1Ω to 10Ω
±90 ppm/°C below 1Ω

| MIL STYLE | SAGE STYLE | MIL WATTS | VOLTAGE Max. | DEFINED OHMIC RANGE | | |
|---|---|---|---|---|---|---|
| | | | | Min. | Max. for .001" wire (Navy) | Max. for .0008" wire (all other) |
| RW70U | 1000S | 1 | — | .1 | 1210 | 3160 |
| RW74U | 1500S | 5 | 300 | .1 | 12100 | 38300 |
| RW78U | 1700S | 10 | 720 | .1 | 40200 | 90900 |
| RW79U | 1240S | 3 | 135 | .1 | 3570 | 10500 |
| RW80U | 1000SB | 2 | — | .1 | 1240 | 3160 |
| RW81U | 250SB | 1 | 25 | .1 | 649 | — |

## MIL-R-18546D TYPE DESIGNATIONS

*Example:* RE65 G 1001

- RE65 — Style
- G — Characteristic, 275°C Max. G for regular inductive winding N for non-inductive winding
- 1001 — Nominal resistance, Ω. ±1% only. Three significant digits plus fourth indicating number of zeros. Below 100Ω R = decimal and following digits are significant.

T.C. ±30 ppm/°C 2000Ω and above
±50 ppm/°C under 2000Ω

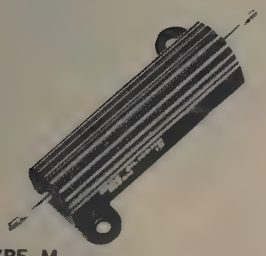
| MIL STYLE | SAGE STYLE | MIL WATTS | DEFINED OHMIC RANGE | |
|---|---|---|---|---|
| | | | Min. | Max. (.001 wire) |
| RE60G | 3105M | 5 | .1 | 3320 |
| RE60N | 3105NM | 5 | 1.0 | 1650 |
| RE65G | 3010M | 10 | .1 | 5620 |
| RE65N | 3010NM | 10 | 1.0 | 2800 |
| RE70G | 3225M | 20 | .1 | 12100 |
| RE70N | 3225NM | 20 | 1.0 | 6040 |
| RE75G | 3550M | 30 | .1 | 39200 |
| RE75N | 3550NM | 30 | 1.0 | 19600 |

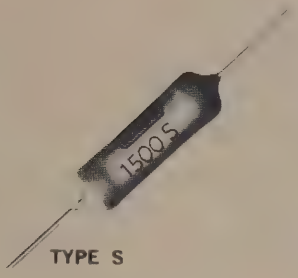
## CONSIDER THESE RESISTOR FEATURES

- Wattage Rating, ½ to 50 watts
- T.C. 20 ppm/°C or 10 ppm/°C
- 1000 volt rms body insulation
- Characteristic U or V wattage rating: to 275°C or 350°C
- Power load life stability <.5%/1000 hours
- Weldable leads when specified
- Non-inductive winding when specified

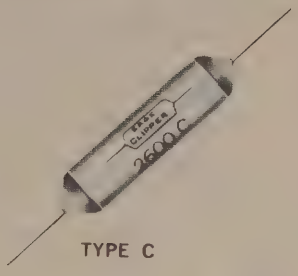
*Nytronics Components Group, Inc.*
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

# SAGE/NYTRONICS RESISTORS


TYPE M



TYPE S



TYPE C

## TYPC C CLIPPER METAL SHEATHED RESISTORS

Similar in all respects to Type S, fully insulated plus addition of metal sleeve for heat sink mounting in spring clip holders.
Full heat sink rating.

| STYLE | Rating Watts (Full heat sink rating) |
|---|---|
| 2200C | 6 |
| 2250C | 6 |
| 2550C | 11 |
| 2600C | 14 |

## TYPE S, NS SILICONE COATED POWER RESISTORS

Meet or exceed MIL-R-26E requirements. N designates non-inductive.

| | STYLE | Char. U Rating Watts | Nominal Size Length* | Nominal Size Dia.** | Lead Dia | Maximum Standard Range, Ω Regular Winding | Maximum Standard Range, Ω Non-Inductive | |
|---|---|---|---|---|---|---|---|---|
| | 100S | 1 | .400 | .094 | .020 | 8400 | 3000 | MINIATURE SERIES |
| | 200S | 2 | .400 | .125 | .020 | 11000 | 3900 | |
| | 300S | 3 | .400 | .187 | .020 | 15000 | 5300 | |
| | 250S | .5 | .250 | .078 | .020 | 3800 | 1350 | |
| | 500S | .8 | .312 | .078 | .020 | 5000 | 1750 | |
| | 750S | 1 | .531 | .094 | .020 | 12000 | 4200 | |
| | 1000S | 1 | .406 | 094 | .020 | 8400 | 3000 | |
| | 1100S | 2 | 500 | .125 | .032 | 15000 | 5500 | |
| → | 1200S | 3 | .500 | .187 | .032 | 20000 | 7000 | REGULAR S SERIES |
| | 1240S | 3 | .562 | .187 | .032 | 24000 | 8400 | |
| → | 1250S | 3 | .812 | .187 | .032 | 40000 | 14000 | |
| | 1300S | 3 | .625 | .250 | .040 | 30000 | 10500 | |
| | 1500S | 5 | .875 | .312 | .040 | 71000 | 25000 | |
| → | 1550S | 5 | 1.000 | .312 | .040 | 88000 | 31000 | |
| → | 1600S | 7 | 1.219 | .312 | .040 | 114000 | 40000 | |
| | 1700S | 10 | 1.781 | .375 | .040 | 230000 | 80000 | |
| | 1900S | 10 | 1.375 | .431 | .040 | 210000 | 73000 | |
| | 1950S | 11 | 2.000 | .431 | .040 | 314000 | 110000 | |

Min. Res. Tol. Available is ±1% on the NS Styles.

*On 100S, 200S and 300S L is max.
*On 250S, 500S and 750S L is ±.031.
*On all others L is ±.062.
*On 250S and 500S D is ±.016.
*On all others D is ±.031.
*For styles 1100S or smaller add .016 for non-inductive (NS) types or ohmic values less than 0.1 ohms.

SAGE SILICOHM® fixed wirewound units are not ordinary power resistors. They provide remarkable miniaturization vs required wattage performance. Sage has pioneered the area of power handling capacity combined with precision and stability features ordinarily associated with Mil-R-93 resistors.

## TYPE SB & NSB HIGH WATTAGE COMMERCIAL BERYLLIA CORE RESISTORS

| STANDARD SOLDERABLE LEADS | RATED WATTS G | RATED WATTS V | Approx Grams WEIGHT |
|---|---|---|---|
| 250SB | 1 | 1.5 | .18 |
| 500SB | 1.5 | 2 | .28 |
| 1000SB | 2.25 | 2.75 | .32 |
| 1200SB | 3.5 | 4.5 | 1.0 |
| 1240SB | 4 | 5 | 1.1 |
| 1250SB | 4.5 | 6 | 1.2 |
| 1300SB | 6 | 8 | 1.8 |
| 1500SB | 7 | 9 | 3.6 |
| 1600SB | 9 | 12 | 4.2 |
| 1700SB | 14 | 18 | 7.3 |

## TYPE S CONSTRUCTION

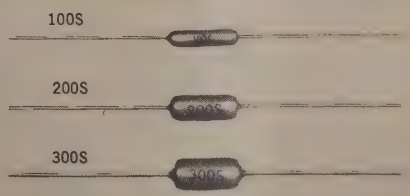
Showing ceramic core, spaced single layer winding, welded to stainless steel cap, and multiple layer coating.

Copperweld leads 60/40 Hot Solder Dip. Lead Length 2" ±1/16 * is supplied on all sizes unless otherwise specified on purchase order.

*Except 250S and 500S Styles, which are 1½" minimum.

## MINIATURE TYPE S "CORDWOOD" SERIES

1, 2, 3 watt .4 inch body length



# OHMITE® series 89 metal-mite® resistors

## FEATURES

- Molded construction
- Screw type mounting on housing
- Chassis design utilizes heat-sink effect
- Conventional power ratings produce high stability
- Housing surface allows for easy identification
- 5 through 50 watt models with standard or non-inductive winding

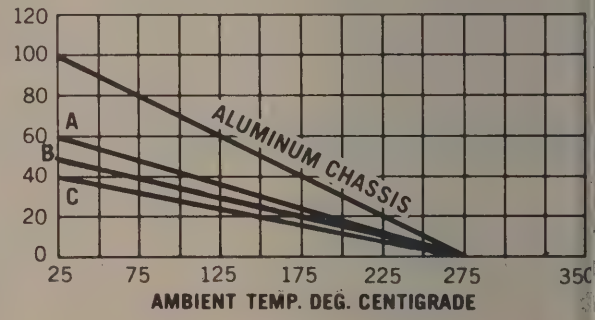
| OHMITE Type | MIL-R-18546 Type | Power Rating* Watts OHMITE** | MIL | Resistance Ranges (Ohms) 1% Tolerance | Standard Temperature Coefficient Value Ranges (Ohms) ±90 ppm | ±50 ppm | ±20 ppm |
|---|---|---|---|---|---|---|---|
| 8905S | RE60G | 7.5(5) | 5 | .1-24.9K | .1-.99 | 1-9.99 | 10-24.9K |
| 8910S | RE65G | 12.5(10) | 10 | .1-49.9K | .1-.99 | 1-9.99 | 10-49.9K |
| 8925S | RE70G | 25 | 20 | .1-100K | .1-.99 | 1-9.99 | 10-100K |
| 8950S | RE75G | 50 | 30 | .1-301K | .1-.99 | 1-9.99 | 10-301K |

*Rating is based on chassis mounting area and stability proper heat sink.
4 x 6 x 2 x .040 aluminum chassis for 5 and 10 watt units
5 x 7 x 2 x .040 aluminum chassis for 25 watt units
12 x 12 x .059 aluminum panel for 50 watt units
**Types 8905 and 8910 will be stamped with wattages shown in parentheses but will be stamped with higher ratings upon customer request.

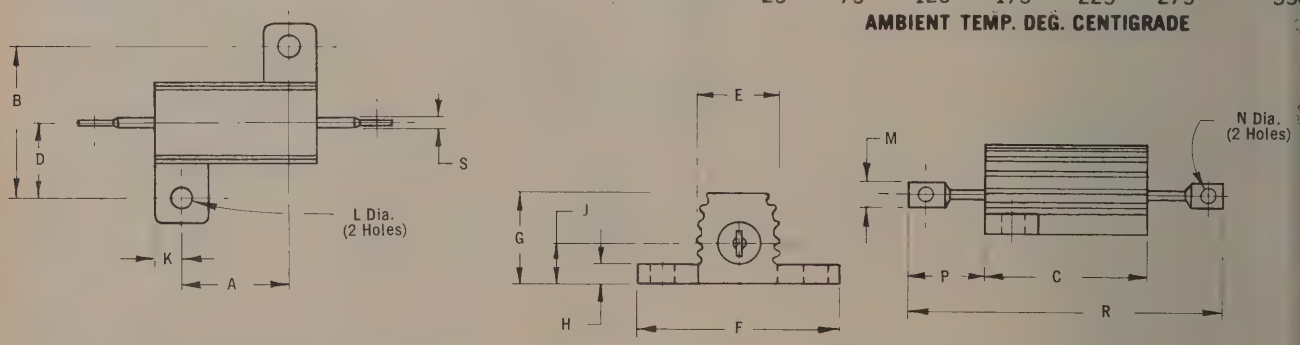
## DERATING

Series 89 resistors have an operating temperature range of −55°C to 275°C. Derating is required for reduced chassis mounting area and high ambient temperatures. The following curves apply to operation of unmounted resistors:

A = 5 and 10 watt units
B = 25 watt units
C = 50 watt units




## DIMENSIONS

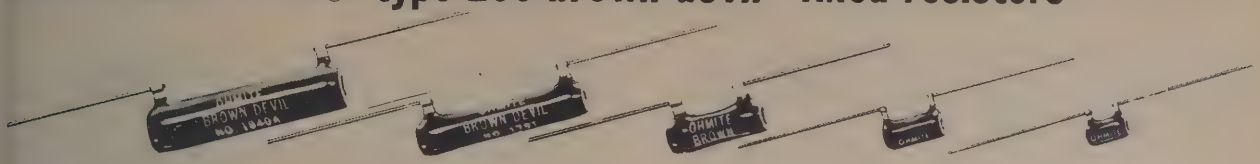



| OHMITE MIL | Watts† Watts | A ±.005 | B ±.005 | C ±.031 | D ±.0025 | E ±.015 | F ±.015 | G ±.015 | H ±.010 | J ±.015 | K ±.010 | L ±.005 | M Min. | N ±.005 | P ±.062 | R ±.062 | S Min. AWG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8950 RE75 | 50 30 | 1.563 | .844 | 1.968 | .422 | .630 | 1.140 | .610 | .088 | .260 | .196 | .125 | .140 | .086 | .438 | 2.781 | 12 |
| 8925 RE70 | 25 20 | .719 | .781 | 1.062 | .391 | .550 | 1.080 | .546 | .088 | .231 | .172 | .125 | .140 | .086 | .438 | 1.938 | 12 |
| 8910 RE65 | 12.5(10) 10 | .562 | .625 | .750 | .312 | .420 | .800 | .390 | .075 | .165 .183 | .093 | .093 | .140 | .086 | .312 | 1.375 | 12 |
| 8905 RE60 | 7.5(5) 5 | .444 | .490 | .600 | .245 | .334 | .646 | .320 | .065 | .133 .156 | .078 | .093 | .085 | .050 | .266 | 1.125 | 16 |

†Types 8905 and 8910 stamped with wattage shown in parenthesis.

OHMITE MFG. CO., a North AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, Illinois 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

# OHMITE® type 200 *brown devil* fixed resistors




BROWN DEVIL® (Type 200) resistors, are vitreous enameled, wirewound units long famous for ruggedness and durability in small power resistors. With the emphasis towards miniaturization and the current industry trend towards higher operating temperatures, Ohmite has been able to increase the ratings on two Brown Devil sizes. The 5 watt size is now rated **8 watts** and the 10 watt size is now rated **12 watts**. The 20 watt unit retains the same rating. The higher ratings may be confidently applied to any 5 or 10 watt unit now in the possession of users or distributors. At this time also, to meet the demand for lower wattage units, Ohmite introduces two, new, small stock sizes — 3 and 5¼ watts.

**Standard resistance tolerance** is ±5% for values 1 ohm or higher; ±10% for values below 1 ohm. Tinned leads 1½" long: 3 and 5¼ watt, 20 AWG; 8, 12 and 20 watt, 18 AWG.

## DIMENSIONS & WEIGHTS

| Rating | 3W | 5¼W | 8W | 12W | 20W |
|---|---|---|---|---|---|
| Core Dimen | 7/16"x.21D | 5/8"x1"D | 1"x3/8"D | 1¾"x3/4"D | 2"x7/8"D |
| Weight (lbs.) | .003 | .005 | .01 | .015 | .03 |

| Ohms | 3 WATT Cat. No.[1] | 3 WATT Amps. | 5¼ WATT Cat. No.[1] | 5¼ WATT Amps. | 8 WATT Cat. No.[1] | 8 WATT Amps. | 12 WATT Cat. No.[1] | 12 WATT Amps. | 20 WATT Cat. No.[1] | 20 WATT Amps. |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.5 | | | | | | | **1700A** | 4.90 | **1800A** | 6.32 |
| 1.0 | **2712** | 1.73 | **2822** | 2.29 | **1500** | 2.83 | **1701** | 3.46 | **1802A** | 4.47 |
| 1.1 | (2713) | 1.65 | (2823) | 2.19 | | | | | | |
| 1.2 | (2714) | 1.58 | (2824) | 2.09 | | | | | | |
| 1.3 | (2715) | 1.52 | (2825) | 2.01 | | | | | | |
| 1.5 | (2716) | 1.41 | 2826 | 1.87 | **1500B** | 2.30 | 1704 | 2.82 | | |
| 1.6 | (2717) | 1.37 | (2827) | 1.81 | | | | | | |
| 1.8 | (2718) | 1.29 | (2828) | 1.71 | | | | | | |
| 2.0 | 2719 | 1.22 | 2829 | 1.62 | **1501** | 2.00 | **1705** | 2.45 | **1802B** | 3.16 |
| 2.2 | **2720** | 1.17 | (2830) | 1.54 | | | | | | |
| 2.4 | (2721) | 1.12 | 2831 | 1.48 | | | | | | |
| 2.7 | (2722) | 1.05 | (2832) | 1.39 | | | | | | |
| 3.0 | (2723) | 1.00 | 2833 | 1.32 | **1502** | 1.63 | **1706** | 2.00 | **1802C** | 2.58 |
| 3.3 | 2724 | .95 | 2834 | 1.24 | | | | | | |
| 3.6 | (2725) | .91 | (2835) | 1.21 | | | | | | |
| 3.9 | (2726) | .88 | (2836) | 1.16 | | | | | | |
| 4.0 | | | | | 1503 | 1.41 | **1707** | 1.73 | 1802D | 2.24 |
| 4.3 | (2727) | .83 | (2837) | 1.10 | | | | | | |
| 4.7 | (2728) | .80 | (2838) | 1.06 | | | | | | |
| 5.0 | | | | | **1504** | 1.26 | **1708** | 1.54 | **1803** | 2.00 |
| 5.1 | (2729) | .77 | **2839** | 1.01 | | | | | | |
| 5.6 | (2730) | .73 | (2840) | .97 | | | | | | |
| 6.2 | (2731) | .69 | (2841) | .92 | | | | | | |
| 6.8 | (2732) | .66 | (2842) | .88 | | | | | | |
| 7.5 | (2733) | .63 | 2843 | .84 | **1505** | 1.00 | **1709** | 1.26 | | |
| 8.2 | (2734) | .60 | 2844 | .80 | | | | | | |
| 9.1 | (2735) | .57 | 2845 | .76 | | | | | | |
| 10 | (2736) | .55 | **2846** | .72 | **1506** | .89 | **1710** | 1.09 | **1804** | 1.41 |
| 11 | (2737) | .52 | (2847) | .69 | | | | | | |
| 12 | (2738) | .50 | 2848 | .66 | 1507 | .81 | **1711** | 1.00 | | |
| 13 | (2739) | .48 | (2849) | .64 | | | | | | |
| 15 | 2740 | .45 | 2850 | .59 | **1508** | .73 | **1712** | .89 | | |
| 16 | (2741) | .43 | (2851) | .57 | | | | | | |
| 18 | (2742) | .42 | (2852) | .54 | | | | | | |
| 20 | (2743) | .39 | (2853) | .51 | **1509** | .63 | **1713** | .77 | | |
| 22 | (2744) | .37 | (2854) | .49 | | | | | | |
| 24 | (2745) | .35 | 2855 | .47 | | | | | | |
| 25 | | | | | **1510** | .56 | **1714** | .69 | **1805** | .89 |
| 27 | (2746) | .33 | 2856 | .44 | | | | | | |
| 30 | (2747) | .32 | **2857** | .42 | **1511** | .51 | **1715** | .63 | | |
| 33 | (2748) | .30 | 2858 | .40 | | | | | | |
| 35 | | | | | 1512 | .47 | 1716 | .58 | | |
| 36 | (2749) | .29 | 2859 | .38 | | | | | | |
| 39 | (2750) | .28 | 2860 | .37 | | | | | | |
| 40 | | | | | 1513 | .44 | **1717** | .54 | | |
| 43 | (2751) | .26 | (2861) | .35 | | | | | | |
| 47 | **2752** | .25 | 2862 | .33 | | | | | | |
| 50 | | | | | **1514** | .40 | **1718** | .49 | **1806** | .63 |
| 51 | (2753) | .24 | 2863 | .32 | | | | | | |
| 56 | (2754) | .23 | (2864) | .31 | | | | | | |
| 62 | (2755) | .22 | (2865) | .29 | | | | | | |
| 68 | (2756) | .21 | (2866) | .28 | | | | | | |
| 75 | 2757 | .20 | 2867 | .27 | **1515** | .32 | **1719** | .40 | **1807** | .52 |
| 82 | (2758) | .19 | (2868) | .25 | | | | | | |
| 91 | (2759) | .18 | (2869) | .24 | | | | | | |
| 100 | 2760 | .17 | **2870** | .23 | **1516** | .28 | **1720** | .34 | **1808** | .45 |
| 110 | (2761) | .16 | (2871) | .22 | | | | | | |
| 120 | (2762) | .16 | 2872 | .21 | | | | | | |
| 125 | | | | | **1517** | .25 | **1721** | .31 | | |
| 130 | (2763) | .15 | (2873) | .20 | | | | | | |
| 150 | (2764) | .14 | **2874** | .19 | **1518** | .23 | **1722** | .28 | **1809** | .36 |
| 160 | (2765) | .14 | 2875 | .18 | | | | | | |
| 180 | (2766) | .13 | **2876** | .17 | | | | | | |
| 200 | 2767 | .12 | **2877** | .16 | **1519** | .20 | **1723** | .24 | **1810** | .32 |
| 220 | (2768) | .12 | 2878 | .16 | | | | | | |
| 225 | | | | | (1520) | .18 | 1724 | .23 | | |
| 240 | (2769) | .11 | 2879 | .15 | | | | | | |
| 250 | | | | | **1521** | .17 | **1725** | .22 | 1811 | .28 |
| 270 | (2770) | .11 | **2880** | .14 | | | | | | |
| 300 | (2771) | .10 | **2881** | .13 | **1522** | .16 | **1726** | .20 | **1812** | .26 |
| 330 | 2772 | .095 | **2882** | .12 | | | | | | |
| 350 | | | | | 1523 | .15 | 1727 | .18 | **1813** | .24 |
| 360 | (2773) | .091 | (2883) | .12 | | | | | | |
| 390 | (2774) | .088 | 2884 | .12 | | | | | | |
| 400 | | | | | **1524** | .14 | 1728 | .17 | 1814 | .22 |
| 430 | (2775) | .083 | 2885 | .11 | | | | | | |
| 450 | | | | | 1525 | .13 | **1729** | .16 | | |
| 470 | (2776) | .080 | 2886 | .11 | | | | | | |
| 500 | | | | | | | **1526** | .12 | **1730** | .15 | **1815** | .20 |
| 510 | (2777) | .077 | **2887** | .10 | | | | | | | | |
| 560 | 2778 | .073 | (2888) | .097 | | | | | | | | |
| 600 | | | | | | | 1527 | .11 | 1731 | .14 | | |
| 620 | (2779) | .070 | 2889 | .092 | | | | | | | | |
| 650 | | | | | | | | | | | **1816** | .18 |
| 680 | (2780) | .067 | 2890 | .088 | | | | | | | | |
| 700 | | | | | | | 1528 | .11 | 1732 | .13 | (1817) | .17 |
| 750 | 2781 | .063 | 2891 | .084 | | | (1529) | .10 | 1733 | .12 | **1818** | .16 |
| 800 | | | | | | | (1530) | .10 | 1734 | .12 | (1819) | .15 |
| 820 | (2782) | .060 | **2892** | .080 | | | | | | | | |
| 900 | | | | | | | 1531 | .094 | **1735** | .11 | (1820A) | .15 |
| 910 | (2783) | .057 | 2893 | .076 | | | | | | | | |
| 1000 | 2784 | .055 | **2894** | .072 | | | **1532** | .089 | **1736** | .11 | **1821** | .14 |
| 1100 | (2785) | .052 | 2895 | .069 | | | (1533) | .085 | (1737) | .10 | | |
| 1200 | (2786) | .050 | (2896) | .066 | | | **1534** | .081 | 1738 | .10 | **1822** | .13 |
| 1250 | | | | | | | 1535 | .080 | 1739 | .097 | 1823 | .12 |
| 1300 | (2787) | .048 | (2897) | .063 | | | | | | | | |
| 1500 | 2788 | .045 | **2898** | .059 | | | **1536** | .073 | **1740** | .089 | **1824** | .12 |
| 1600 | (2789) | .043 | (2899) | .057 | | | | | | | | |
| 1750 | | | | | | | 1537 | .067 | 1741 | .082 | **1825** | .11 |
| 1800 | 2790 | .042 | (2900) | .050 | | | | | | | | |
| 2000 | (2791) | .039 | 2901 | .047 | | | **1538** | .063 | **1742** | .077 | 1827 | .10 |
| 2200 | (2792) | .037 | 2902 | .045 | | | | | | | | |
| 2250 | | | | | | | 1539 | .059 | **1743** | .073 | (1828) | .094 |
| 2400 | (2793) | .035 | (2903) | .043 | | | | | | | | |
| 2500 | | | | | | | **1540** | .056 | **1744** | .069 | **1830** | .089 |
| 2700 | (2794) | .033 | 2904 | .041 | | | | | | | | |
| 2750 | | | | | | | | | | | 1831 | .085 |
| 3000 | (2795) | .032 | 2905 | .039 | | | **1541** | .046 | **1745** | .063 | 1832 | .081 |
| 3300 | (2796) | .030 | 2906 | .037 | | | | | | | | |
| 3500 | | | | | | | 1542 | .043 | **1746** | .058 | **1833** | .075 |
| 3600 | (2797) | .029 | 2907 | .035 | | | | | | | | |
| 3900 | 2798 | .028 | 2908 | .034 | | | | | | | | |
| 4000 | | | | | | | 1543 | .040 | **1747** | .054 | 1834 | .070 |
| 4300 | (2799) | .026 | (2909) | .032 | | | | | | | | |
| 4500 | | | | | | | **1544** | .038 | **1748** | .051 | (1835) | .066 |
| 4700 | (2800) | .025 | **2910** | .031 | | | | | | | | |
| 5000 | | | | | | | **1545** | .036 | **1749** | .049 | **1836** | .063 |
| 5100 | (2801) | .024 | **2911** | .030 | | | | | | | | |
| 5600 | (2802) | .023 | (2912) | .028 | | | | | | | | |
| 6000 | | | | | | | **1546** | .033 | **1750** | .044 | **1837** | .057 |
| 6200 | (2803) | .022 | (2913) | .027 | | | | | | | | |
| 6800 | (2804) | .021 | 2914 | .026 | | | | | | | | |
| 7000 | | | | | | | **1547** | .030 | 1751 | .041 | 1838 | .053 |
| 7500 | (2805) | .020 | 2915 | .025 | | | 1548 | .029 | **1752** | .036 | 1839 | .051 |
| 8000 | | | | | | | 1549 | .029 | **1753** | .035 | 1840 | .050 |
| 8200 | (2806) | .019 | 2916 | .023 | | | | | | | | |
| 8500 | | | | | | | | | (1754) | .034 | | |
| 9000 | | | | | | | 1550 | .027 | (1754A) | .033 | (1840A) | .047 |
| 9100 | (2807) | .018 | (2917) | .022 | | | | | | | | |
| 10K | **2808** | .016 | **2918** | .021 | | | **1551** | .026 | **1755** | .032 | **1841** | .043 |
| 11K | | | (2919) | .020 | | | | | (1756) | .030 | | |
| 12K | | | 2920 | .019 | | | | | (1757) | .029 | | |
| 12.5K | | | | | | | 1552 | .023 | (1758) | .028 | 1842 | .032 |
| 13K | | | 2921 | .019 | | | | | | | | |
| 13.5K | | | | | | | | | (1759) | .027 | | |
| 15K | | | **2922** | .017 | | | 1553 | .021 | **1761** | .026 | 1843 | .029 |
| 16K | | | (2923) | .017 | | | | | (1762) | .025 | | |
| 17.5K | | | | | | | (1554) | .019 | (1763) | .024 | | |
| 18K | | | 2924 | .016 | | | | | (1764) | .024 | | |
| 20K | | | **2925** | .014 | | | 1555 | .018 | **1765** | .022 | **1844** | .026 |
| 22.5K | | | | | | | (1556) | .017 | 1766 | .021 | | |
| 25K | | | | | | | **1557** | .015 | **1767** | .020 | 1845 | .023 |
| 30K | | | | | | | | | **1768** | .018 | (1846) | .021 |
| 35K | | | | | | | | | (1769) | .017 | (1847) | .019 |
| 40K | | | | | | | | | **1770** | .016 | (1848) | .018 |
| 45K | | | | | | | | | 1771 | .015 | (1849) | .017 |
| 50K | | | | | | | | | 1772 | .014 | 1850 | .016 |
| 55K | | | | | | | | | | | (1851) | .015 |
| 60K | | | | | | | | | | | (1852) | .015 |
| 65K | | | | | | | | | | | (1853) | .014 |
| 70K | | | | | | | | | | | (1854) | .014 |
| 75K | | | | | | | | | | | (1855) | .013 |
| 80K | | | | | | | | | | | (1856) | .013 |
| 85K | | | | | | | | | | | (1857) | .012 |
| 90K | | | | | | | | | | | (1858) | .012 |
| 95K | | | | | | | | | | | (1859) | .012 |
| 100K | | | | | | | | | | | **1860** | .011 |

[1]Popular items appear in BOLD print and are usually in stock at authorized Ohmite stocking distributors. Items appearing in LIGHT FACE print are available from stocking distributors but are not normally stocked in depth. Parentheses indicate non-stock standard items subject to a minimum handling charge per item.

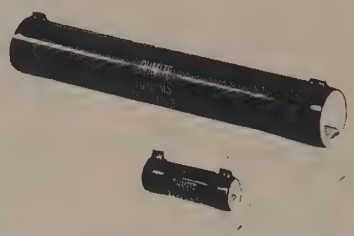
# OHMITE® type 270 vitreous enameled fixed resistors

These lug type resistors are wire-wound on high quality ceramic cores, protected and insulated by Ohmite vitreous enamel — the time-proved standard covering that is the best conductor of heat for a material which must also be a good electrical insulator.

Resistance tolerance is ±5% for values 1 ohm or higher; ±10% below 1 ohm.

Wattage ratings are for use in free air. When resistors are mounted in closed spaces or where the circulation of air is restricted, they should not be used at more than one-half rating. Currents and voltages for reduced ratings can be obtained by multiplying full rating by the following factors: 75% load = .86, 66% = .81, 50% = .71, 33% = .57, 25% = .50.

Mounting brackets are automatically supplied in individual unit packs; supplied only when specified in bulk pack orders. See page 15, "Mounting Brackets for Tubular Resistors" to specify other brackets.



| 12 WATT<br>Free air rating to 5600 Ohms<br>Core: 1¾" x 5/16"<br>Mtg. Ctr: 2 3/16"—Av. Wt. .02 lb.<br>Std. Mtg. Brkt.: Cat. No. 5 | | |
|---|---|---|
| Resist. Ohms. | Cat. No.[1] | Max. Amps. |
| .51 | **3723** | 4.86 |
| 1.0 | **3730** | 3.46 |
| 1.5 | 3734 | 2.83 |
| 2.2 | (3738) | 2.34 |
| 3.3 | 3742 | 1.91 |
| 4.7 | **3746** | 1.60 |
| 6.8 | 3750 | 1.33 |
| 10 | **3754** | 1.10 |
| 12 | 3756 | 1.00 |
| 15 | 3758 | .89 |
| 18 | (3760) | .82 |
| 22 | 3762 | .74 |
| 27 | 3764 | .67 |
| 33 | **3766** | .60 |
| 39 | (3768) | .55 |
| 47 | 3770 | .53 |
| 56 | (3772) | .46 |
| 68 | (3774) | .42 |
| 82 | 3776 | .38 |
| 100 | **3778** | .35 |
| 120 | (3780) | .32 |
| 150 | 3782 | .28 |
| 180 | **3784** | .26 |
| 220 | (3786) | .23 |
| 270 | 3788 | .21 |
| 330 | 3790 | .19 |
| 390 | 3792 | .18 |
| 470 | (3794) | .16 |
| 560 | 3796 | .15 |
| 680 | 3798 | .13 |
| 820 | (3800) | .12 |
| 1,000 | 3802 | .11 |
| 1,200 | 3804 | .10 |
| 1,500 | **3806** | .089 |
| 1,800 | (3808) | .082 |
| 2,200 | 3810 | .074 |
| 2,700 | 3812 | .067 |
| 3,300 | (3814) | .060 |
| 3,900 | 3816 | .055 |
| 4,700 | **3818** | .051 |
| 5,600 | (3820) | .046 |
| 6,800 | (3822) | .038 |
| 8,200 | (3824) | .035 |
| 10,000 | **3826** | .032 |
| 12,000 | (3828) | .029 |
| 15,000 | (3830) | .026 |
| 18,000 | (3832) | .024 |
| 22,000 | (3834) | .021 |
| 27,000 | (3836) | .019 |
| 33,000 | (3838) | .017 |
| 39,000 | (3840) | .016 |
| 47,000 | (3842) | .015 |
| 51,000 | (3843) | .014 |

| | 25 WATT<br>Free air rating to 12,000 Ohms.<br>Core: 2" x 9/16"<br>Mtg. Ctr: 2¾"—<br>Av. Wt. .05 lb.<br>Std. Mtg. Brkt.: No. 9 | | 50 WATT<br>Free air rating to 25,000 Ohms.<br>Core: 4" x 9/16"<br>Mtg. Ctr: 4¾"—<br>Av. Wt. .09 lb.<br>Std. Mtg. Brkt.: No. 9 | | 100 WATT<br>Free air rating to 60,000 Ohms.<br>Core: 6½" x ¾"<br>Mtg. Ctr: 7⅜"—<br>Av. Wt. .20 lb.<br>Std. Mtg. Brkt.: No. 12 | | 175 WATT<br>Free air rating for All Values<br>Core: 8½" x 1⅛"<br>Mtg. Ctr: 9⅜"—<br>Av. Wt. .50 lb.<br>Std. Mtg. Brkt.: No. 18 | | 225 WATT<br>Free air rating for All Values<br>Core: 10½" x 1⅛"<br>Mtg. Ctr: 11⅜"—<br>Av. Wt. .62 lb.<br>Std. Mtg. Brkt.: No. 18 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Ohms Res. | Catalog No.[1] | Max. Amps. | Catalog No.[1] | Max. Amps. | Catalog No.[1] | Max. Amps. | Catalog No.[1] | Max. Amps. | Catalog No.[1] | Max. Amps. |
| 1 | **0200J** | 5.00 | **0400J** | 7.07 | **0600C** | 10.00 | 0700C | 13.2 | **0900C** | 15.00 |
| 2 | **0200K** | 3.54 | **0400K** | 5.00 | **0600D** | 7.07 | 0700D | 9.35 | **0900D** | 10.60 |
| 2 | **0200L** | 2.88 | **0400L** | 4.07 | **0600E** | 5.77 | 0700E | 7.63 | **0900E** | 8.67 |
| 4 | **0200N** | 2.50 | **0400N** | 3.53 | **0600F** | 5.00 | (700F) | 6.6 | **0900F** | 7.50 |
| 5 | **0200A** | 2.24 | **0400A** | 3.16 | **0600A** | 4.47 | **0700A** | 5.92 | **0900A** | 6.72 |
| 10 | **0200B** | 1.58 | **0400B** | 2.23 | **0600B** | 3.16 | **0700B** | 4.18 | **0900B** | 4.74 |
| 15 | **0200R** | 1.29 | | | | | | | | |
| 25 | **0200C** | 1.00 | **0400C** | 1.41 | **0601** | 2.00 | **0701** | 2.64 | **0901** | 3.00 |
| 50 | **0200D** | .71 | **0400D** | 1.00 | **0602** | 1.41 | **0702** | 1.87 | **0902** | 2.12 |
| 75 | **0200E** | .58 | **0400E** | .82 | **0603** | 1.15 | 0703 | 1.52 | **0903** | 1.73 |
| 100 | **0200F** | .50 | **0440F** | .71 | **0604** | 1.00 | **0704** | 1.32 | **0904** | 1.50 |
| 125 | | | | | 0604B | .90 | 0704B | 1.18 | | |
| 150 | **0200G** | .41 | **0400G** | .58 | **0605** | .82 | 0705 | 1.08 | **0905** | 1.25 |
| 200 | **0200H** | .35 | **0400H** | .50 | | | | | | |
| 250 | **0201** | .32 | **0401** | .45 | **0606** | .63 | **0706** | .84 | **0906** | .95 |
| 500 | **0202** | .22 | **0402** | .32 | **0607** | .45 | **0707** | .59 | **0907** | .67 |
| 750 | **0203** | .18 | **0403** | .26 | **0608** | .37 | (0708) | .48 | 0908 | .55 |
| 800 | **0204** | .17 | (0404) | .25 | | | | | | |
| 1,000 | **0205** | .16 | **0405** | .22 | **0609** | .32 | **0709** | .42 | **0909** | .47 |
| 1,500 | **0206** | .13 | **0406** | .18 | **0610** | .26 | 0710 | .34 | **0910** | .39 |
| 2,000 | **0207** | .12 | **0407** | .16 | 0611 | .22 | 0711 | .30 | **0911** | .34 |
| 2,500 | **0208** | .10 | 0408 | .14 | **0612** | .20 | (0712) | .26 | 0912 | .30 |
| 3,000 | **0209** | .091 | **0409** | .13 | 0613 | .18 | 0713 | .24 | 0913 | .27 |
| 3,500 | (0210) | .084 | | | | | | | | |
| 4,000 | **0211** | .079 | 0410 | .11 | | | | | | |
| 5,000 | **0212** | .070 | **0411** | .10 | **0614** | .14 | (0714) | .19 | **0914** | .21 |
| 6,000 | **0213** | .064 | | | | | | | | |
| 7,500 | **0214** | .057 | **0412** | .081 | 0615 | .12 | (0715) | .15 | 0915 | .17 |
| 8,000 | | | 0413 | .079 | | | | | | |
| 10,000 | **0215** | .050 | **0414** | .071 | 0616 | .10 | 0716 | .13 | **0916** | .15 |
| 12,000 | **0216** | .045 | (0415) | .064 | | | | | | |
| 15,000 | **0217** | .036 | 0416 | .057 | 0617 | .081 | (0717) | .11 | 0917 | .13 |
| 20,000 | **0218** | .031 | 0417 | .050 | **0618** | .071 | (0718) | .094 | **0918** | .11 |
| 25,000 | **0219** | .028 | **0418** | .045 | (0619) | .063 | (0719) | .083 | 0919 | .095 |
| 30,000 | 0220 | .026 | | | 0620 | .058 | (0720) | .076 | 0920 | .087 |
| 35,000 | (0221) | .024 | (0419) | .032 | | | | | | |
| 40,000 | 0222 | .022 | | | (0621) | .050 | (0721) | .066 | 0921 | .075 |
| 50,000 | **0224** | .019 | **0420** | .026 | **0622** | .045 | (0722) | .059 | **0922** | .067 |
| 60,000 | (0225) | .016 | | | (0623) | .041 | (0723) | .054 | (0923) | .061 |
| 70,000 | (0226) | .013 | | | | | | | | |
| 75,000 | | | (0421) | .021 | (0624) | .032 | 0724 | .048 | (0924) | .055 |
| 80,000 | 0227 | .012 | | | | | | | | |
| 100,000 | **0229** | .0094 | **0422** | .018 | **0625** | .028 | **0725** | .042 | **0925** | .047 |
| 125,000 | | | (0423) | .017 | | | | | | |
| 150,000 | | | (0424) | .015 | | | | | | |
| 175,000 | | | (0425) | .014 | | | | | | |
| 200,000 | | | (0426) | .012 | | | | | | |
| 250,000 | | | 0428 | .010 | | | | | | |

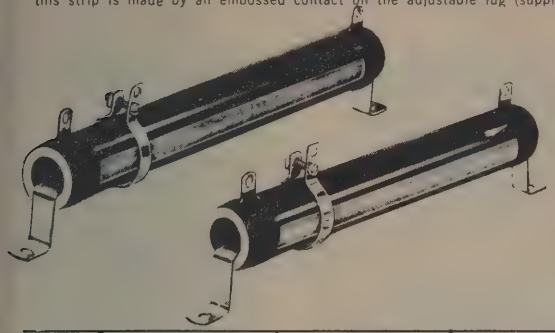
[1] Popular items appear in BOLD print and are usually in stock at authorized Ohmite stocking distributors. Items appearing in LIGHT FACE print are available from stocking distributors but are not normally stocked in depth. Parentheses indicate non-stock standard items subject to a minimum handling charge per item.

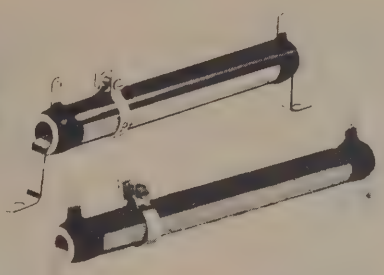
# OHMITE® dividohm® type 210 adjustable vitreous enameled resistors

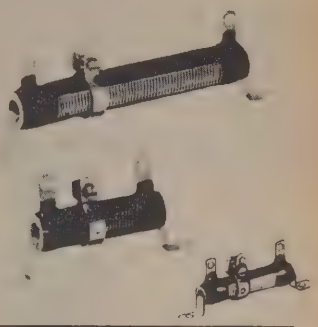
"Dividohm" resistors make ideal voltage dividers for original equipment and replacement in transmitters, rectifiers and other apparatus. Such tapped "bleeders" are made by using one or more adjustable lugs, as required. "Dividohms" are also handy for obtaining odd resistance values, for adjusting circuits, and for use on equipment which must be set to meet various line voltages.

"Dividohm" resistors are vitreous enameled resistors on which a narrow strip has been left uncovered to expose a portion of each turn. Contact to any wire in this strip is made by an embossed contact on the adjustable lug (supplied).

WATT RATING: **The stated wattage rating applies only when the entire resistance is in the circuit.** When the adjustable lug is set at an intermediate point, the wattage rating is reduced in approximately the same proportion, i.e., if the lug is set at half the resistance, the wattage is reduced by one-half. A safe rule to follow is to make sure that the maximum rated current is not exceeded. This should be carefully checked particularly if the resistor will be used as a voltage divider with several adjustable lugs. Resistance tolerance is ±10% for the total resistance value.







| | 12 WATT Core: 1¾" x 5/16" D. Mtg. Ctr: 2 3/16"— Av. Wt. .02 lb. Std. Mtg. Brkt.* No. 5 | | 25 WATT Core: 2" x 5/16" D. Mtg. Ctr: 2¾"— Av. Wt. .05 lb. Std. Mtg. Brkt.* No. 9 | | 50 WATT Core: 4" x 5/16" D. Mtg. Ctr: 4¾"— Av. Wt. .09 lb. Std. Mtg. Brkt.* No. 9 | | 75 WATT Core: 6" x 5/16" D. Mtg. Ctr: 6¾"— Av. Wt. .15 lb. Std. Mtg. Brkt.* No. 9 | | 100 WATT Core: 6½" x ¾" D. Mtg. Ctr: 7⅜"— Av. Wt. .20 lb. Std. Mtg. Brkt.* No. 12 | | 175 WATT Core: 8½" x 1⅛" D. Mtg. Ctr: 9⅜"— Av. Wt. .50 lb. Std. Mtg. Brkt.* No. 18 | | 225 WATT Core: 10½" x 1⅛" D. Mtg. Ctr: 11⅜"— Av. Wt. .62 lb. Std. Mtg. Brkt.* No. 18 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Resist. Ohms | Cat. No.[1] | Max. Amps. | Cat. No.[1] | Max. Amps. | Cat. No.[1] | Max. Amps. | Cat. No.[1] | Max. Amps. | Cat. No.[1] | Max. Amps. | Cat. No.[1] | Max. Amps. | Cat. No.[1] | Max. Amps. |
| 1 | **1001** | 3.46 | **0360** | 5.00 | **0560A** | 7.07 | 0769A | 8.66 | **0956A** | 10.0 | 1156A | 13.2 | **1356A** | 15.00 |
| 2 | **1002** | 2.45 | **0360B** | 3.54 | **0560B** | 5.00 | (0769B) | 6.12 | **0956B** | 7.07 | 1156B | 9.35 | **1356B** | 10.60 |
| 3 | 1003 | 2.00 | **0361** | 2.88 | **0560C** | 4.07 | **0769C** | 5.00 | **0956C** | 5.77 | 1156C | 7.63 | **1356C** | 8.67 |
| 4 | | | | | 0560D | 3.53 | (0769D) | 4.33 | **0956D** | 5.00 | (1156D) | 6.60 | **1356D** | 7.50 |
| 5 | **1004** | 1.54 | **0362** | 2.24 | **0560** | 3.16 | **0769** | 3.87 | **0956** | 4.47 | 1156 | 5.92 | **1356** | 6.72 |
| 7.5 | 1005 | 1.26 | **0362B** | 1.82 | | | | | | | | | | |
| 10 | **1006** | 1.09 | **0363** | 1.58 | **0561** | 2.23 | **0770** | 2.74 | **0957** | 3.16 | **1157** | 4.18 | **1357** | 4.74 |
| 15 | **1007** | .89 | **0364** | 1.29 | | | 0771 | 2.24 | | | | | | |
| 20 | **1008** | .77 | **0364B** | 1.12 | | | | | | | | | | |
| 25 | **1009** | .69 | **0365** | 1.00 | **0562** | 1.41 | 0772 | 1.73 | **0958** | 2.00 | **1158** | 2.64 | **1358** | 3.00 |
| 50 | **1010** | .49 | **0366** | .71 | **0563** | 1.00 | **0773** | 1.22 | **0959** | 1.41 | **1159** | 1.87 | **1359** | 2.12 |
| 75 | **1011** | .40 | **0367** | .58 | **0564** | .82 | | | | | | | | |
| 100 | **1012** | .34 | **0368** | .50 | **0565** | .71 | **0774** | .86 | **0960** | 1.00 | **1160** | 1.32 | **1360** | 1.50 |
| 150 | **1013** | .28 | **0369** | .41 | **0566** | .58 | | | | | | | | |
| 200 | **1014** | .24 | **0370** | .35 | **0567** | .50 | 0774B | .61 | | | | | | |
| 250 | **1015** | .22 | **0371** | .32 | **0568** | .45 | **0775** | .55 | **0960B** | .63 | **1160B** | .84 | **1360B** | .95 |
| 300 | **1016** | .20 | **0371B** | .29 | **0568B** | .41 | **0775B** | .50 | | | | | | |
| 350 | 1017 | .18 | | | | | | | | | | | | |
| 400 | 1018 | .17 | **0371C** | .25 | **0568C** | .35 | 0775C | .43 | | | | | | |
| 500 | **1019** | .15 | **0372** | .22 | **0569** | .32 | 0776 | .39 | **0961** | .45 | **1161** | .59 | **1361** | .67 |
| 600 | 1020 | .14 | | | | | | | | | | | | |
| 750 | **1021** | .13 | **0373** | .18 | **0570** | .26 | 0777 | .32 | | | | | | |
| 800 | (1022) | .12 | (0374) | .17 | (0571) | .25 | (0777B) | .30 | | | | | | |
| 1000 | **1023** | .11 | **0375** | .16 | **0572** | .22 | (0778) | .27 | **0962** | .32 | 1162 | .42 | **1362** | .47 |
| 1250 | (1024) | .098 | 0375B | .14 | (0572B) | .20 | (0778B) | .24 | | | | | | |
| 1500 | **1025** | .089 | 0376 | .13 | 0573 | .18 | (0779) | .22 | 0962B | .26 | (1162B) | .34 | **1362B** | .39 |
| 2000 | **1026** | .077 | **0377** | .12 | 0574 | .16 | (0780) | .19 | | | | | | |
| 2250 | (1027) | .073 | (0377B) | .11 | (0574B) | .15 | (0780B) | .18 | | | | | | |
| 2500 | 1028 | .069 | **0378** | .10 | 0575 | .14 | 0781 | .17 | **0963** | .20 | 1163 | .26 | **1363** | .30 |
| 3000 | **1029** | .063 | 0379 | .091 | 0576 | .13 | (0781B) | .16 | | | | | | |
| 3500 | **1030** | .058 | (0380) | .084 | (0576B) | .12 | (0782) | .15 | | | | | | |
| 4000 | 1031 | .055 | (0381) | .079 | (0577) | .11 | (0782B) | .14 | | | | | | |
| 4500 | (1032) | .052 | (0381B) | .074 | (0577B) | .10 | (0782C) | .13 | | | | | | |
| 5000 | **1033** | .049 | **0382** | .070 | **0578** | .10 | (0783) | .12 | 0964 | .14 | 1164 | .19 | **1364** | .21 |
| 6000 | (1034) | .045 | 0383 | .064 | (0578B) | .091 | (0783B) | .11 | | | | | | |
| 7000 | 1035 | .042 | 0383B | .060 | (0578C) | .084 | (0783C) | .10 | | | | | | |
| 7500 | 1036 | .040 | 0384 | .057 | (0579) | .081 | (0784) | .10 | | | | | | |
| 8000 | **1037** | .039 | (0384B) | .055 | 0580 | .079 | (0784B) | .096 | | | | | | |
| 8500 | (1038) | .037 | | | | | | | | | | | | |
| 9000 | (1039) | .036 | (0384C) | .052 | (0580B) | .074 | (0784C) | .091 | | | | | | |
| 10000 | **1040** | .035 | **0385** | .050 | 0581 | .071 | (0785) | .086 | **0965** | .10 | 1165 | .13 | **1365** | .15 |
| 12000 | | | (0386) | .042 | (0582) | .064 | (0785B) | .079 | | | | | | |
| 15000 | | | 0387 | .036 | 0583 | .057 | (0786) | .070 | (0966) | .081 | (1166) | .11 | (1366) | .13 |
| 20000 | | | 0388 | .031 | 0584 | .050 | 0787 | .061 | (0967) | .071 | (1167) | .094 | (1367) | .11 |
| 25000 | | | **0389** | .028 | (0585) | .045 | (0788) | .054 | (0968) | .063 | (1168) | .083 | 1368 | .095 |
| 30000 | | | | | (0586) | .036 | (0789) | .050 | (0969) | .058 | (1169) | .076 | (1369) | .087 |
| 35000 | | | | | | | (0790) | .046 | | | | | | |
| 40000 | | | | | 0587 | .029 | (0791) | .043 | (0970) | .050 | (1170) | .066 | (1370) | .075 |
| 45000 | | | | | | | (0792) | .035 | | | | | | |
| 50000 | | | | | 0588 | .026 | (0793) | .033 | (0971) | .045 | (1171) | .059 | (1371) | .067 |
| 60000 | | | | | (0589) | .024 | (0794) | .030 | | | | | | |
| 75000 | | | | | | | | | (0972) | .032 | (1172) | .048 | (1372) | .055 |
| 80000 | | | | | (0590) | .021 | (0795) | .026 | | | | | | |
| 100000 | | | | | 0591 | .018 | (0796) | .023 | 0973 | .028 | (1173) | .042 | (1373) | .047 |

[1]Popular items appear in **BOLD** print and are usually in stock at authorized Ohmite stocking distributors. Items appearing in LIGHT FACE print are available from stocking distributors but are not normally stocked in depth. Parentheses indicate non-stock standard items subject to a minimum handling charge per item.

*Mounting brackets are automatically supplied in individual unit packs; supplied only when specified in bulk packs.

## adjustable lugs

One "Screw Driver Type Adjustable Lug" is supplied with each unit. Lugs with a silver contact button can be ordered from the table shown below.

MOVING THE LUGS: Lugs always should be loosened completely before moving and not moved except while the current is off, in order to protect the exposed wire from mechanical or electrical injury and to protect the operator from dangerous voltages.

### STANDARD

| Core Diam. Inches | Screw Driver Type New Cat. No. | Screw Driver Type Old Cat. No. | Bakelite Knob Type New Cat. No. | Bakelite Knob Type Old Cat. No. |
|---|---|---|---|---|
| 5/16 | 2115 | 1058 | — | — |
| 7/16 | 2121 | 0358 | 2122 | 0359 |
| ¾ | 2125 | 1958 | 2126 | 1959 |
| 1⅛ | 2133 | 2158 | 2134 | 2159 |

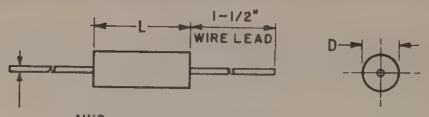
### With SILVER CONTACT BUTTONS

| Core Diam. Inches | Screw Driver Type New Cat. No. | Screw Driver Type Old Cat. No. | Bakelite Knob Type New Cat. No. | Bakelite Knob Type Old Cat. No. |
|---|---|---|---|---|
| 5/16 | 2116 | 2161 | — | — |
| 7/16 | 2123 | 2164 | 2124 | 2165 |
| ¾ | 2127 | 2166 | 2128 | 2167 |
| 1⅛ | 2135 | 2170 | 2136 | 2171 |

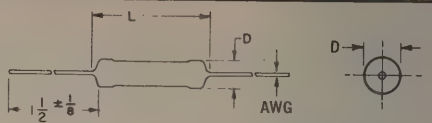
### DOUBLE THUMB SCREW ADJUSTABLE LUG

This adjustable lug, which is illustrated at left, features two advantages — ease of adjustment and less chance of damaging the resistance wire while moving lugs. Available for 1⅛" cores. Catalog No. **2160**

# OHMITE® wirewound resistors / axial lead and pc series




Series 88 & 99




Series 22, 44, 56 & 57

## OHMITE WIRE WOUND AXIAL LEAD RESISTORS

All of Ohmite's axial lead resistors feature a high quality resistance wire, single layer wound on a cylindrical ceramic core, and welded to metallic end caps. The leads are solder coated, weldable wire 1½" long. Specific mechanical and electrical parameters are listed in appropriate descriptions and tables for the individual Series below.

## AXIAL LEAD WIREWOUND RESISTOR SPECIFYING GUIDE

**VITREOUS ENAMEL — Molded — SERIES 99 — 5% Tolerance (1%-10% Available) — T.C. ±30 ppm/°C Typical**

| WATTS | Type | Res. Range | Maximum Length (″/mm) | Maximum Dia. (″/mm) | Leads 1.5″/38.1 mm Ga. |
|---|---|---|---|---|---|
| 1.5 | 995-1A | .1-6.65K | .437/11.1 | .140/3.6 | 24 |
| 2.25 | 995-2A | .1-6.49K | .390/9.9 | .219/5.6 | 20 |
| 3.25 | 995-3A | .1-22.1K | .562/14.3 | .234/5.9 | 20 |
| 5 | 995-5B | .1-53.6K | .953/24.2 | .234/5.9 | 20 |
| 6.5 | 995-5A | .1-80.6K | .937/23.8 | .343/8.7 | 20 |
| 9 | 995-7A | .1-118K | 1.233/31.3 | .343/8.7 | 20 |
| 11 | 995-10A | .1-187K | 1.796/45.6 | .343/8.7 | 20 |
| | | | | | |
| | | | | | |

**VITREOUS ENAMEL — Conformal — SERIES 22 — 5% Tolerance (1%-10% Available) — T.C. ±30 ppm/°C Typical**

| WATTS | Type | Res. Range | Maximum Length (″/mm) | Maximum Dia. (″/mm) | Leads 1.5″/38.1 mm Ga. |
|---|---|---|---|---|---|
| 1 | 221 | .1-2.5K | .406/10.3 | .156/4 | 22 |
| 2 | 222 | .1-3.9K | .406/10.3 | .219/5.6 | 20 |
| 3 | 223 | .1-10K | .562/14.3 | .250/6.4 | 20 |
| 5 | 225 | .1-30K | 1.000/25.4 | .250/6.4 | 20 |
| 6 | 226 | .1-35K | 1.031/26.2 | .343/8.7 | 20 |
| 7 | 227 | .1-40K | 1.250/31.8 | .343/8.7 | 20 |
| 10 | | | | | |
| 11 | 220P | .5-60K | 1.938/49.2 | .343/8.7 | |
| 15 | | | | | |

**FLAMEPROOF CERAMIC — Conformal — SERIES 57 CERON® — 5% Tolerance (1%-10% Available) — T.C. ±30 ppm/°C Typical**

| WATTS | Type | Res. Range | Maximum Length (″/mm) | Maximum Dia. (″/mm) | Leads 1.5″/38.1 mm Ga. |
|---|---|---|---|---|---|
| 1 | 571 | 1.0-3K | .406/10.3 | .156/4 | 22 |
| 2 | 572 | 1.0-4K | .406/10.3 | .219/5.6 | 20 |
| 3 | 573 | 1.0-12K | .562/14.3 | .234/5.9 | 20 |
| 5 | 575 | 1.0-30K | 1.000/25.4 | .234/5.9 | 20 |
| 6 | | | | | |
| 7 | 577 | 1.0-50K | 1.094/27.8 | .343/8.7 | 20 |
| 10 | 570 | 1.0-60K | 1.813/46.1 | .343/8.7 | 20 |
| 11 | | | | | |
| 15 | | | | | |

**SILICONE CERAMIC — Conformal — SERIES 44 OHMICONE® — 5% Tolerance (0.05%-10% Available) — T.C. ±20 ppm/°C Typical**

| WATTS | Type | Res. Range | Maximum Length (″/mm) | Maximum Dia. (″/mm) | Leads 1.5″/38.1 mm Ga. |
|---|---|---|---|---|---|
| 1 | 441 | .5-4K | .437/9.4 | .125/3.2 | 22 |
| 2 | 442 | .1-4K | .406/10.3 | .219/5.6 | 20 |
| 3 | 443 | .1-15K | .563/14.3 | .250/6.4 | 20 |
| 5 | 445 | .1-60K | .937/23.8 | .343/8.7 | 18 |
| 6 | | | | | |
| 7 | 447 | .1-80K | 1.250/31.8 | .343/8.7 | 18 |
| 10 | 440 | .1-150K | 1.843/46.8 | .406/10.3 | 18 |
| 11 | | | | | |
| 15 | | | | | |

**SILICONE CERAMIC — Conformal — SERIES 56 BERYLLIA-CORE ACRASIL® — 1% Tolerance (.05%-5% Available) — T.C. ±20 ppm/°C Typical**

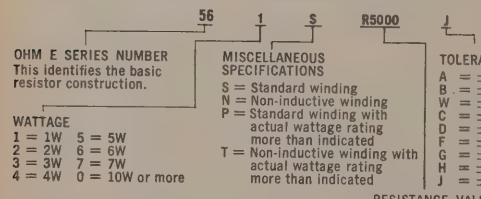
| WATTS | Type | Res. Range | Maximum Length (″/mm) | Maximum Dia. (″/mm) | Leads 1.5″/38.1 mm Ga. |
|---|---|---|---|---|---|
| 1 | 561 | .5-3K | .281/7.1 | .098/2.5 | 24 |
| 2 | 562 | .5-10K | .437/11.1 | .124/3.1 | 24 |
| 3 | | | | | |
| 5 | 565 | .1-25K | .624/15.8 | .218/5.5 | 20 |
| 6 | 566 | .1-35K | .687/17.4 | .281/7.1 | 18 |
| 7 | 567 | 1.0-75K | .937/23.8 | .343/8.7 | 18 |
| 10 | 560 | 1.0-125K | 1.280/32.5 | .343/8.7 | 18 |
| 11 | | | | | |
| 15 | 560P | 1.5-250K | 1.843/46.8 | .406/10.3 | 18 |

**SILICONE CERAMIC — Molded — SERIES 88 RITEOHM® — 1% Tolerance (.05%-10% Available) — T.C. ±20 ppm/°C Typical**

| WATTS | Type | Res. Range | Maximum Length (″/mm) | Maximum Dia. (″/mm) | Leads 1.5″/38.1 mm Ga. |
|---|---|---|---|---|---|
| 1 | 884-1A | .1-10K | .437/11.1 | .125/3.2 | 24 |
| 2 | 884-2 | .1-10K | .395/10 | .208/5.3 | 20 |
| 3 | 884-3 | .1-34K | .562/14.3 | .250/6.4 | 20 |
| 5 | 884-5 | .1-124K | .937/23.8 | .343/8.7 | 18 |
| 6 | | | | | |
| 7 | 884-7 | .1-178K | 1.238/31.4 | .343/8.7 | 18 |
| 10 | 884-10 | .1-301K | 1.843/46.8 | .363/9.2 | 18 |
| 11 | | | | | |
| 15 | | | | | |

## HOW TO ORDER

**MOLDED** — For Series 88 and 99, specify style, resistance and tolerance.
**CONFORMAL** — Specify these Product Numbers:




Resistance value is identified by four digits and one letter.
Resistance is expressed in ohms with the letter "R" signifying a decimal point. "R" is used in all resistance values lower than 1000 ohms. The letter "K" indicates multiples of 1000 ohms.

This chart provides all basic data needed to specify the right axial lead wirewound resistor for your circuit application. Refer to application guide to select the proper resistor based on your key specifying parameters.

### VITREOUS ENAMEL

**Series 99**
Hi-Heat Dissipation
Molded Construction
MIL-R-26

**Series 99 & 22**
Severe Humidity Protection
Resistant to All Solvents
Industrial Applications

### FLAMEPROOF CERAMIC

**Series 57**
Flameproof
Severe Environments
Immune to Fungus Growth
High Overland Design

### SILICONE CERAMIC

**Series 88**
Molded Construction

**Series 56**
MIL-R-39007

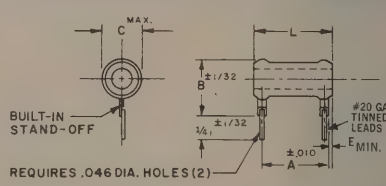
**Series 44, 88 & 56**
Low TC
Close Tolerance
High Heat Dissipation
Industrial Applications

**Series 88 & 56**
High Stability
Small Size/
High Heat Dissipation

Ohmite can supply resistors for applications requiring high reliability performance characteristics per MIL-R-39007.

- Meets MIL-R-26 Where Applicable
- Popular Values of Series 88, 99 and 44 Available from Stock
- Lead Taping Available
- Higher and Lower Resistance Values other Than Those Listed Above are Available. Consult Factory.

## RADIAL LEAD RESISTORS FOR P.C. BOARDS




**Resistance Element:** Resistance wire single layer wound on a tubular ceramic core and welded to lug bands.

**Terminals:** Radial, wire leads welded to lugs on centers to fit standard 0.1 inch matrix boards. Built-in standoff.

**Coating:** Vitreous enamel or Ohmicone (silicone-ceramic).

**Marking:** Ohmite code and resistance value (ohms) on top opposite leads.

**Tolerances:** Vitreous (Type 270) ±5%, 1 ohm and higher — ±10%, below 1 ohm. For closer tolerances, specify Type 474 (Ohmicone).

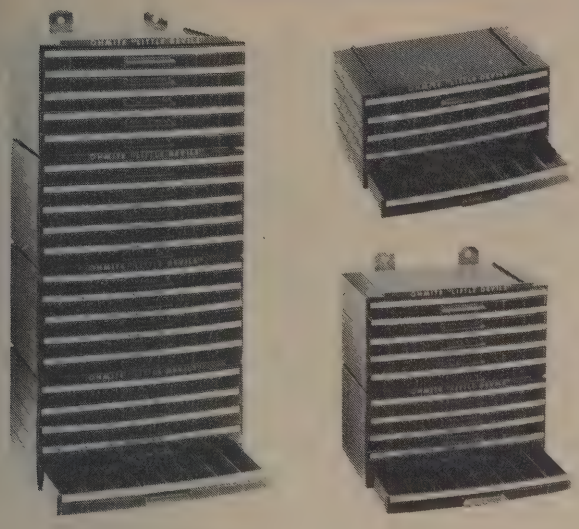
**Temperature Coefficient:** Less than 260 PPM/°C — Lower temperature coefficient available in Type 474 (Ohmicone).

| Rated Watts @ 25°C | Dimensions A ±.010 | B ±1/32 | C Max. | E Min. | L ±1/64 |
|---|---|---|---|---|---|
| 3 | .300 | .429 | 5/16 | 1/32 | 1/16 |
| 5¼ | .500 | .469 | 11/32 | 1/32 | 5/8 |

**OHMITE MFG. CO., a North AMERICAN PHILIPS company** / 3601 W. Howard St., Skokie, Illinois 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

# OHMITE® cabinet assortments/ohm-ranger®

## Little Devil® industrial and service resistor assortments



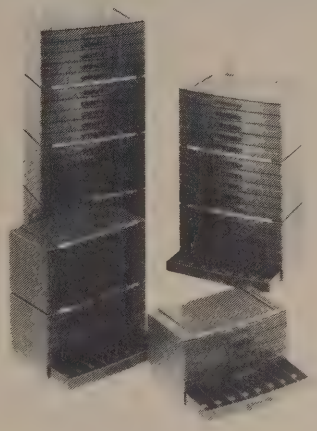
Select the composition resistor you need, right on the job from time-saving Little Devil® Assortments. Ohmite now offers **twelve industrial** assortments in addition to the four service assortments that have been so popular for many years. In this complete line, there is an assortment to fill every industrial and service need. An attractive plastic cabinet or cabinet assembly is furnished at no extra cost with each assortment. Each drawer of a single 5-drawer cabinet has eight compartments, all individually labeled. Dimensions of the single cabinet and 9″ long, 4¾″ high, 5¼″ deep. Dovetail tops and bottoms facilitate stacking. Cabinet assemblies for industrial assortments are riveted to metal strips which afford rigidity and permit hanging of the unit on the wall.

Cabinets are factory packed in accordance with the tables shown below.

### 12 ASSORTMENTS

| Type | Wattage | Cat. No. 1 | Tol. | Qty. | No. of Cabs | Resistance Range | No. of Values |
|---|---|---|---|---|---|---|---|
| LITTLE DEVILS CARBON COMP. | ⅛ | CAB-21 | 5% | 500 | 2 | 2.7Ω-22.0 Meg.Ω | 80 |
| | ⅛ | CAB-45 | 5% | 1000 | 4 | 2.7Ω-22.0 Meg.Ω | 160 |
| | ¼ | CAB-4 | 10% | 150 | 1 | 47Ω-10.0 Meg.Ω | 37 |
| | ¼ | CAB-25 | 10% | 1000 | 2 | 2.7Ω-22.0 Meg.Ω | 80 |
| | ¼ | CAB-46 | 5% | 1500 | 4 | 2.7Ω-22.0 Meg.Ω | 160 |
| | ½ | CAB-10 | 10% | 150 | 1 | 10Ω-10.0 Meg.Ω | 40 |
| | ½ | CAB-26 | 10% | 1000 | 2 | 2.7Ω-22.0 Meg.Ω | 80 |
| | ½ | CAB-47 | 5% | 1500 | 4 | 2.7Ω-22.0 Meg.Ω | 160 |
| | 1 | CAB-2 | 10% | 125 | 1 | 10Ω-10.0 Meg.Ω | 40 |
| | 1 | CAB-27 | 10% | 600 | 2 | 2.7Ω-22.0 Meg.Ω | 80 |
| | 1 | CAB-48 | 5% | 900 | 4 | 2.7Ω-22.0 Meg.Ω | 160 |
| | 2 | CAB-3 | 10% | 125 | 1 | 10Ω-10.0 Meg.Ω | 40 |

## Little Rebel® carbon and metal film resistor assortments



Always have the right resistor on hand and thwart Murphy's Law which states: "The resistance value needed will not be available." Ohmite Assortments of Little Rebel carbon film resistors come in Nine assortments and offer a wide selection of values in ⅛, ¼ and ½ watt sizes. "All values have been selected by popularity."

Ohmite Assortments of Metal Devil metal film resistors come in six assortments and offer a wide selection of values in ⅛ and ¼ watt sizes.

Each cabinet has five drawers and each drawer has eight compartments, all individually labeled.

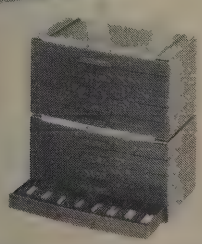
Dimensions of the single cabinet are 9″ long, 4¾″ high, 5¼″ deep. Dovetail tops and bottoms facilitate stacking. Assemblies of 2, 3 and 4 cabinets are riveted to metal strips for wall hanging.

### 15 ASSORTMENTS

| Type | Wattage | Cat. No. 1 | Tol. | Qty. | No. of Cabs | Resistance Range | No. of Values |
|---|---|---|---|---|---|---|---|
| LITTLE REBELS CARBON FILM | ⅛ | CAB-5F | 5% | 150 | 1 | 10Ω-.22 Meg.Ω | 31 |
| | ⅛ | CAB-22F | 5% | 500 | 2 | 10Ω-.22 Meg.Ω | 52 |
| | ⅛ | CAB-34F | 5% | 1000 | 3 | 10Ω-.22 Meg.Ω | 103 |
| | ¼ | CAB-6F | 5% | 150 | 1 | 1Ω-1.0 Meg.Ω | 36 |
| | ¼ | CAB-23F | 5% | 1000 | 2 | 1Ω-1.0 Meg.Ω | 75 |
| | ¼ | CAB-43F | 5% | 1500 | 4 | 1Ω-1.0 Meg.Ω | 136 |
| | ½ | CAB-7F | 5% | 150 | 1 | 1Ω-1.0 Meg.Ω | 36 |
| | ½ | CAB-24F | 5% | 1000 | 2 | 1Ω-1.0 Meg.Ω | 75 |
| | ½ | CAB-44F | 5% | 1500 | 4 | 1Ω-1.0 Meg.Ω | 136 |
| METAL DEVILS METAL FILM | ⅛ | CAB-8M | 1% | 250 | 1 | 10Ω-301KΩ | 40 |
| | ⅛ | CAB-28M | 1% | 500 | 2 | 10Ω-301KΩ | 80 |
| | ⅛ | CAB-31M | 1% | 1000 | 3 | 10Ω-301KΩ | 120 |
| | ¼ | CAB-9M | 1% | 250 | 1 | 10Ω-1.0 Meg.Ω | 40 |
| | ¼ | CAB-29M | 1% | 500 | 2 | 10Ω-1.0 Meg.Ω | 80 |
| | ¼ | CAB-32M | 1% | 1000 | 3 | 10Ω-1.0 Meg.Ω | 120 |

## resistor assortment

wire-wound/ axial lead molded vitreous enamel



Select the wire-wound resistor you need, right on the job. All the popular resistance values, as determined by national usage, are contained in these handy, compact assortments.

The attractive plastic cabinet is furnished at no extra cost with each assortment. Cabinets are factory packed in accordance with the table (shown below) which states the quantities of each resistance value per assortment. Each drawer segment is individually labeled. Dovetail tops and bottoms of cabinets facilitate stacking. Dimensions for single cabinets are 9″ long x 4¾″ high x 5¼″ deep; double cabinets are 10″ high, including wall hanging brackets.

- **Perfect for R & D and Prototype Labs.**
- **All popular values included.**
- **Resistors and handy cabinet for the price of the resistors alone.**
- **4 Wattage sizes to choose from.**
- **Contents clearly marked on front of each drawer segment.**

### SPECIFICATIONS

| Nominal Wattage Size | Catalog Number | No. of Res. Values | Quantity of Resistors |
|---|---|---|---|
| 1½ W. | CAB-91 | 40 | 167 |
| 3½ W. | CAB-93 | 71 | 325 |
| 5 W. | CAB-95 | 75 | 355 |
| 11 W. | CAB-99 | 40 | 185 |

## OHM-RANGER®

**economical, portable resistance selector**

- **Over 11 million ohms in one-ohm increments**
- **1% accuracy***
- **Easy slide switch operation**
- **Handy slimline size**
- **Rugged metal construction**

Catalog No. 3420

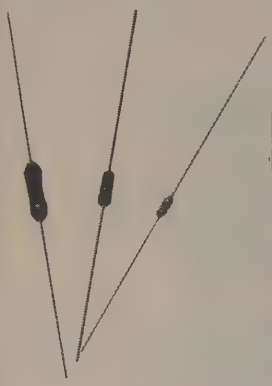
1 to 11,111,110 ohms, in one-ohm steps — with accuracy assured by half-watt 1% tolerance resistors! Has three binding posts, one to ground case. Small enough to take anywhere in your pocket, the handy easy-to-use OHM-RANGER is ideal for lab use, schools and service technicians. Dimensions 4″ x 6″ x 1″.

*10 ohms and above.

# Panasonic®

## FIXED RESISTORS

### TYPE ERD (⅛, ¼ & ½ W) CARBON FILM



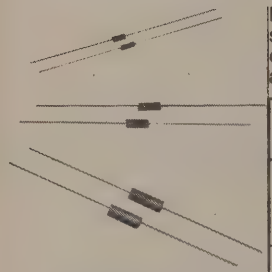
Panasonic has been producing the most reliable carbon film resistors for 45 years. This background, plus 20 years of modern mass producing experience in producing conventional standard types, has led to these new miniature standard carbon film resistors — which are unequalled for reliability and performance characteristics.

- Small size
- High stability
- High reliability
- Low noise
- Low temp. coefficient
- 1%, 2%, 5% tolerance

| Type No. (Feature) | Power Rating (W) @ 70°C | Max. RCWV (Note 1) | Max. Overload Voltage | Dielectric Withstanding Voltage | Res. Tol. (%) | Resistance Range (Ω) Min. | Resistance Range (Ω) Max. | Std. Res. Values | No. of Color Bands | Dimensions: mm (inch) L | Dimensions: mm (inch) D | Dimensions: mm (inch) d | Equivalent Type No. DIN 44051 | Equivalent Type No. MIL-R-11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ERD-10T (Standard) | 0.125 (⅛) | 150V | 300V | 300V AC | J (±5) | 4.7 | 150K | E-24 | 4 | 3.70 +0.40 −0.30 (.145 +.016 −.012) | 1.60±0.20 (.063±.008) | 0.40±0.05 (.016±.002) | 0204 | RC05 |
| ERD-25T (Standard) | 0.25 (¼) | 300V | 600V | 500V AC | J (±5) | 4.7 | 1.0M | E-24 | 4 | 6.35 +0.65 −0.38 | 2.30 +0.50 −0.30 | 0.60±0.05 | 0207 | RC07 |
| | | | | | G (±2) | 4.7 | 270K | E-48 | 5 | | | | | |
| ERD-25F (Flame Retardant) | 0.25 (¼) | 300V | 600V | 350V AC | J (±5) | 4.7 | 1.0M | E-24 | 4 | .250 +.025 −.015 | .090 +.020 −.012 | (.024±.002) | | |
| ERD-33T (Standard) | 0.33 (⅓) | 300V | 600V | 700V AC | J (±5) | 4.7 | 1.0M | E-24 | 4 | 9.00 +1.00 −0.50 | 2.80 +0.50 −0.30 | 0.65±0.05 | 0309 | |
| | | | | | G (±2) | 4.7 | 270K | E-48 | 5 | | | | | |
| ERD-33F (Flame Retardant) | 0.33 (⅓) | 300V | 600V | 500V AC | J (±5) | 4.7 | 1.0M | E-24 | 4 | .354 +.039 −.020 | .110 +.039 −.012 | (.026±.002) | | |
| ERD-50T (Standard) | 0.50 (½) | 350V | 700V | 700V AC | J (±5) | 4.7 | 1.0M | E-24 | 4 | 9.50±.050 | 3.50 +0.50 −0.30 | 0.60±0.05 | 0414 | RC20 |
| | | | | | G (±2) | 4.7 | 470K | E-48 | 5 | | | | | |
| ERD-50F (Flame Retardant) | 0.50 (½) | 350V | 700V | 500V AC | J (±5) | 4.7 | 1.0M | E-24 | 4 | (.375±.020) | .138 +.020 −.012 | (.024±.002) | | |

**Note 1:** Rated Continuous Working Voltage (RCWV) shall be determined from RCWV = √ Rated Power x Resistance Value, or Max. RCWV listed above, whichever less.

### TYPE ERC (⅛, ¼ & ½ W) CARBON COMPOSITION



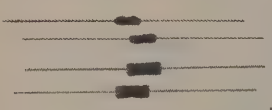
Panasonic has been producing carbon composition resistors for over 26 years. Our carbon composition types are now being produced by a hot-molding process on automatic machines recently developed and used only by Panasonic. These resistors, when used as specified, will not open-circuit nor exhibit erratic changes in value.

- Full range of standard values — from 2.2 ohms to 22 megohms
- Special high values on request
- High reliability
- Rugged construction
- Uniform quality

| Type No. | Power Rating (W) @ 70°C | Max. RCWV (Note 1) | Max. Overload Voltage | Dielectric Withstanding Voltage | Res. Tol. (%) | Resistance Range (Ω) Min. | Resistance Range (Ω) Max. | Std. Res. Values | Dimensions: mm (inch) L | Dimensions: mm (inch) D | Dimensions: mm (inch) d | Equivalent Type No. MIL-R-11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ERC-18G | ⅛ | 150V | 200V | 300 VAC @ Sea Level 200 VAC @ 87 mm Hg | J (±5) K (±10) M (±20) | 10Ω | 1MΩ | E-24 E-12 E-6 | 3.70±0.30 (.145±.015) | 1.57±0.10 (.062±.004) | 0.38±0.12 (.016±.005) | RC05 |
| ERC-14G | ¼ | 250V | 400V | 500 VAC @ Sea Level 325 VAC @ 87 mm Hg | J (±5) K (±10) M (±20) | 2.2Ω | 22MΩ | E-24 E-12 E-6 | 6.40±0.70 (.250±.031) | 2.29±0.20 (.090±.008) | 0.64±0.12 (.025±.005) | RC07 |
| ERC-12G | ½ | 350V | 700V | 700 VAC @ Sea Level 450 VAC @ 87 mm Hg | J (±5) K (±10) M (±20) | 2.2Ω | 22MΩ | E-24 E-12 E-6 | 9.50 +1.00 −0.80 (.375 +.041 −.031) | 3.50±0.30 (.138±.023) | 0.78±0.12 (.031±.005) | RC20 |

**Note 1:** Rated Continuous Working Voltage (RCWV) shall be determined from RCWV = √ Rated Power x Resistance Value, or Max. RCWV listed above, whichever less.

### TYPE ERO (¼ & ½ W) METAL FILM



With over 16 years of experience in mass producing metal film resistive elements and over 2 billion hours of component use, Panasonic has been able to lead the way in producing the new, small-size, standard metal film resistors essential for meeting MIL specs.

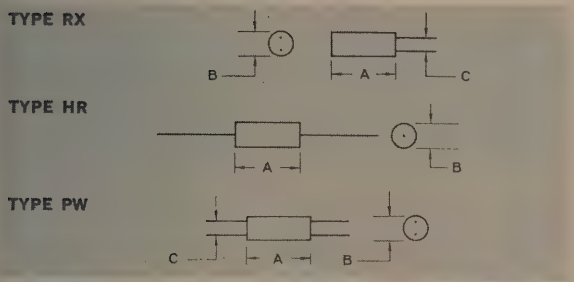
- Standard tolerance: 1%
- Temperature coefficient of 100 ppm (CKF Series) and 50 ppm (CHF Series)
- Meet standards of MIL-R-10509 (RN-60 and RN-65)
- Excellent humidity characteristics
- Solvent proof coating

| Type No. (Feature) | Power Rating (W) @ 70°C | Max. RCWV (Note 1) | Max. Overload Voltage | Dielectric Withstanding Voltage | TCR (ppm/°C) | Res. Tol. (%) | Resistance Range (Ω) Min. | Resistance Range (Ω) Max. | Std. Res. Values | Dimensions: mm (inch) L | Dimensions: mm (inch) D | Dimensions: mm (inch) d | Equivalent Type No. MIL-R-22684 | Equivalent Type No. MIL-R-10509 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ERO-25CK (Standard) | 0.25 (¼) | 250V | 500V | 500V | 100 | 1 | 10.0 | 562K | E-96 | 6.30±0.50 (.250±.020) | 2.30±0.50 (.090±.020) | 0.60±0.05 (0.24±.002) | RL07 | RN55 |
| | | | | | | 0.5 | 10.0 | 562K | E-96 | | | | | |
| ERO-25CH (Standard) | 0.25 (¼) | 250V | 500V | 500V | 50 | 1 | 49.9 | 301K | E-96 | | | | | |
| | | | | | | 0.5 | 49.9 | 301K | E-96 | | | | | |
| ERO-50CK (Standard) | 0.50 (½) | 350V | 700V | 700V | 100 | 1 | 20.0 | 2.00M | E-96 | 9.50±0.50 (.375±.020) | 3.50±0.50 (.138±.020) | 0.60±0.05 (.024±.002) | RL20 | RN60 |
| | | | | | | 0.5 | 20.0 | 2.00M | E-96 | | | | | |
| ERO-50CH (Standard) | 0.50 (½) | 350V | 700V | 700V | 50 | 1 | 49.9 | 1.00M | E-96 | | | | | |
| | | | | | | 0.5 | 49.9 | 1.00M | E-96 | | | | | |

**Note 1:** Rated Continuous Working Voltage (RCWV) shall be determined from RCWV = √ Rated Power x Resistance Value, or Max. RCWV listed above, whichever less.

# PRINTED CIRCUIT TYPE RX
# AXIAL LEAD TYPE HR
# 4-TERMINAL TYPE PW

# ULTRA HIGH PRECISION WIREWOUND RESISTORS




## DESCRIPTION AND APPLICATION:

**PRECISION'S** premier performance resistors represent nearly fifty years of specialization in the exclusive design and manufacture of precision resistance units. These ultra-high accuracy, ultra-time stability, low noise resistors are excellent for matched tolerances and TCR characteristics, as well as economical single or multiple secondary standards for critical commercial and military applications.

## ELECTRICAL AND PHYSICAL SPECIFICATIONS

| PRC Types | Marstan P/N* | MIL-Style (MIL-R-93) | Max. Watts 1% Res. Tol. | Max. Watts 0.01% Res. Tol. | Max. Volts | Body Dimensions Length (±.031″) A | Body Dimensions Diam. (±.031″) B | Standard Space C | Tinned Copper Leads Diam. (±.002″) | Tinned Copper Leads Length† (±.125″) | Resistance (Ohms) Min. | Resistance (Ohms) Max. Standard | Resistance (Ohms) Max. Special |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PRINTED CIRCUIT** | | | | | | | | | | | | | |
| RX378N | MPC-1A | RB70 | .5W | .25W | 200V | .500″ | .375″ | .200″ | .032″ | 1″ | 0.1 | 301K | 500K |
| RX255N | MPC-1B | RB71 | .25W | .125W | 100V | .312″ | .250″ | .200″ | .025″ | 1″ | 0.1 | 100K | 150K |
| RX258N | MPC-2 | — | .33W | .150W | 300V | .500″ | .250″ | .200″ | .025″ | 1″ | 0.1 | 250K | 350K |
| RX2512N | MPC-3 | — | .5W | .25W | 400V | .750″ | .250″ | .200″ | .032″ | 1″ | 0.1 | 500K | 1 MEG |
| **AXIAL LEAD** | | | | | | | | | | | | | |
| HR175N | MAW-1A | — | .2W | .100W | 100V | .312″ | .156″ | — | .020″ | 1.5″ | 0.1 | 80K | 100K |
| HR186N | MAW-2F | — | .2W | .100W | 150V | .375″ | .187″ | — | .025″ | 1.5″ | 0.1 | 100K | 150K |
| HR256N | MAW-4 | RB56 | .25W | .125W | 200V | .375″ | .250″ | — | .032″ | 1.5″ | 0.1 | 127K | 200K |
| HR258N | MAW-5 | RB55 | .33W | .150W | 300V | .500″ | .250″ | — | .032″ | 1.5″ | 0.1 | 226K | 500K |
| HR2512N | MAW-7 | RB54 | .5W | .25W | 300V | .750″ | .250″ | — | .032″ | 1.5″ | 0.1 | 511K | 1 MEG |
| HR3712N | MAW-8 | RB53 | .66W | .33W | 300V | .750″ | .375″ | — | .032″ | 1.5″ | 0.1 | 750K | 2 MEG |
| HR3716N | MAW-9 | RB52 | 1W | .5W | 600V | 1.000″ | .375″ | — | .032″ | 1.5″ | 0.1 | 1.5 MEG | 3 MEG |
| HR5016N | MAW-10 | RB57 | 1.5W | .75W | 600V | 1.000″ | .500″ | — | .032″ | 1.5″ | 0.1 | 2 MEG | 5 MEG |
| HR5024N | MAW-11 | RB58 | 2W | 1W | 900V | 1.500″ | .500″ | — | .032″ | 1.5″ | 0.1 | 3.01 MEG | 7.5 MEG |
| HR5032N | MAW-12 | RB59 | 2.5W | 1.25W | 1200V | 2.000″ | .500″ | — | .032″ | 1.5″ | 0.1 | 5.11 MEG | 10 MEG |
| **4-TERMINAL** | | | | | | | | | | | | | |
| PW½-AR | — | — | .5W | .25W | 500V | .625″ | .312″ | .110″ | .032″ | 1″ | .005 | 100 | 500K |
| PW-AR | — | — | 1W | .5W | 1000V | .750″ | .375″ | .200″ | .032″ | 1″ | .005 | 100 | 750K |
| PW2-AR | — | — | 2W | 1W | 1000V | 1.000″ | .375″ | .200″ | .032″ | 1″ | .01 | 100 | 1 MEG |

* The Balco/Marstan wirewound resistor line is now available directly from Precision Resistor Co., Inc.

† 2″ leads on MIL-Styles

## ENGINEERING DATA:

### 1 RESISTANCE RANGE AND TOLERANCE

**Standard:** Any ohmic value or decimal part of an ohm desired with tolerances to ±0.01%.

**Special:** Higher or lower values beyond the standard limits with tolerances to ±0.005%. (Allow approx. +.001 ohm/inch for lead resistance on low value two-terminal designs. Lead resistance adder may be eliminated by using a four-terminal configuration).

### 2 TEMPERATURE COEFFICIENT OF RESISTANCE (TCR)

**Standard:** Zero ±5 ppm/°C (100 ohms and above). Zero ±15 ppm/°C (values below 100 ohms).

**Special:** To ±1 ppm/°C. TCR matching to within 0.5 ppm/°C.

### 3 INDUCTANCE

**Standard:** Non-inductively wound with balanced reverse-pi winding.

### 4 STABILITY VS. TIME CHARACTERISTICS (No Load)

To ±0.001%/year at 25°C.

### 5 POWER RATINGS VS. AMBIENT TEMPERATURE

These resistors are designed for full load operation providing the ambient temperature plus the temperature rise due to power dissipation does not exceed +125°C. (Derated to zero power at +145°C.)

### 6 VOLTAGE RATINGS (D.C. Voltage or Peak Voltage)

To calculate the safe operating voltage for any resistance value below the maximum listed, apply the formula $E = \sqrt{PR}$.

### 7 THERMAL EMF (With respect to copper)

< +2 microvolts per °C (100 ohms and above). < −3 microvolts per °C (values below 100 ohms).

### 8 PROTECTIVE ENCAPSULATION

Hermetic - Epoxy - Seal.

### 9 MARKING (Identification)

**Standard:** PRC symbol, type, resistance value and tolerance.

**Special:** Military or custom marking.

### 10 SPECIAL TESTS

**Qualification testing:** Per MIL-Std-202 on a 100% or sample basis available.

PRC
PRECISION RESISTOR CO., INC.
109 U.S. HIGHWAY #22 • HILLSIDE, NEW JERSEY 07205 • PHONE: (201) 926-3036

# HIGH PRECISION WIREWOUND RESISTORS

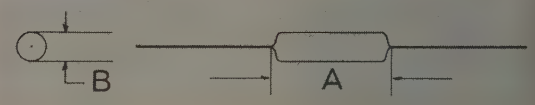
## TYPE SX (SILICONE PROTECTION)
## TYPE TX (ECONOMY LINE)

### DESCRIPTION AND APPLICATION:

**PRECISION** continues a tradition in wirewound resistors with . . .

- **BEST-SELLING HIGH PRECISION TYPE SX:** Silicone conformal coated types in any resistance value as well as higher or lower values and TCR characteristics beyond the MIL limits.
- **LOW-PRICED/SPACE-SAVER TYPE TX:** Hundreds of combinations and physical sizes for commercial/industrial applications in any ohmic value desired.

TYPE SX/TYPE TX




### FEATURES:

- Ideal for module designs
- Standard (Low) TCR char.
- Excellent long-term stability
- Wide selection to meet needs exactly
- Comply with MIL-Standards
- Competitively priced

### ELECTRICAL AND PHYSICAL SPECIFICATIONS

| PRC Types | | | | Max. Watts | Max. Volts | Body Dimensions (±.020″) | | Lead Diam. | Lead Length (±.125″) | Resistance (Ohms) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE SX | | TYPE TX | | | | Length A | Diam. B | | | Min. | Max. Standard | Max. Special* |
| Inductive | Non-Inductive | Inductive | Non-Inductive | | | | | | | | | |
| SX062 | SX062N | TX062 | TX062N | .04W | 35V | .270″ | .080″ | .020″ | 1.5″ | 1.0 | 17K | 30K |
| SX063 | SX063N | TX063 | TX063N | .05W | 50V | .332″ | .080″ | .020″ | 1.5″ | 0.1 | 20K | 50K |
| SX072 | SX072N | TX072 | TX072N | .06W | 45V | .270″ | .090″ | .020″ | 1.5″ | 0.1 | 25K | 35K |
| SX073 | SX073N | TX073 | TX073N | .07W | 65V | .332″ | .090″ | .020″ | 1.5″ | 0.1 | 30K | 65K |
| SX093 | SX093N | TX093 | TX093N | .1W | 85V | .332″ | .115″ | .025″ | 1.5″ | 0.1 | 35K | 75K |
| SX094 | SX094N | TX094 | TX094N | .1W | 100V | .395″ | .115″ | .025″ | 1.5″ | 0.1 | 50K | 100K |
| SX095 | SX095N | TX095 | TX095N | .125W | 125V | .457″ | .115″ | .025″ | 1.5″ | 0.1 | 60K | 180K |
| SX105 | SX105N | TX105 | TX105N | .166W | 165V | .457″ | .130″ | .025″ | 1.5″ | 0.1 | 75K | 210K |
| SX123 | SX123N | TX123 | TX123N | .166W | 165V | .332″ | .145″ | .025″ | 1.5″ | 0.1 | 40K | 120K |
| SX106 | SX106N | TX106 | TX106N | .2W | 200V | .520″ | .130″ | .025″ | 1.5″ | 0.1 | 100K | 280K |
| SX124 | SX124N | TX124 | TX124N | .2W | 200V | .395″ | .145″ | .025″ | 1.5″ | 0.1 | 50K | 160K |
| SX143 | SX143N | TX143 | TX143N | .2W | 200V | .332″ | .160″ | .028″ | 1.5″ | 0.1 | 50K | 130K |
| SX154 | SX154N | TX154 | TX154N | .25W | 250V | .395″ | .176″ | .028″ | 1.5″ | 0.1 | 100K | 200K |
| SX155 | SX155N | TX155 | TX155N | .25W | 250V | .457″ | .176″ | .028″ | 1.5″ | 0.1 | 100K | 300K |
| SX156 | SX156N | TX156 | TX156N | .33W | 330V | .520″ | .176″ | .028″ | 1.5″ | 0.1 | 140K | 400K |
| SX174 | SX174N | TX174 | TX174N | .33W | 330V | .395″ | .190″ | .028″ | 1.5″ | 0.1 | 130K | 220K |
| SX175 | SX175N | TX175 | TX175N | .33W | 330V | .457″ | .190″ | .028″ | 1.5″ | 0.1 | 135K | 350K |
| SX158 | SX158N | TX158 | TX158N | .5W | 500V | .645″ | .176″ | .028″ | 1.5″ | 0.1 | 450K | 600K |
| SX177 | SX177N | TX177 | TX177N | .5W | 500V | .582″ | .190″ | .028″ | 1.5″ | 0.1 | 400K | 540K |
| SX185 | SX185N | TX185 | TX185N | .5W | 500V | .457″ | .207″ | .028″ | 1.5″ | *0.01 | 135K | 360K |
| SX186 | SX186N | TX186 | TX186N | .5W | 500V | .520″ | .207″ | .028″ | 1.5″ | *0.01 | 150K | 480K |
| SX188 | SX188N | TX188 | TX188N | .6W | 600V | .645″ | .207″ | .028″ | 1.5″ | *0.01 | 450K | 720K |
| SX2210 | SX2210N | TX2210 | TX2210N | .8W | 800V | .770″ | .240″ | .032″ | 1.5″ | 0.1 | 511K | 1.1 MEG |
| SX3110 | SX3110N | TX3110 | TX3110N | 1W | 1000V | .770″ | .332″ | .032″ | 1.5″ | 0.1 | 750K | 1.6 MEG |
| SX2812 | SX2812N | TX2812 | TX2812N | 1.25W | 1000V | .895″ | .300″ | .032″ | 1.5″ | 0.1 | 1 MEG | 1.8 MEG |
| SX3114 | SX3114N | TX3114 | TX3114N | 1.33W | 1000V | 1.020″ | .332″ | .032″ | 1.5″ | 0.1 | 1.25 MEG | 2 MEG |
| SX3712 | SX3712N | TX3712 | TX3712N | 1.5W | 1000V | .895″ | .437″ | .032″ | 1.5″ | 0.25 | 1.5 MEG | 2.5 MEG |
| SX3716 | SX3716N | TX3716 | TX3716N | 2W | 1250V | 1.145″ | .437″ | .032″ | 1.5″ | 0.5 | 2 MEG | 3.5 MEG |
| SX3724 | SX3724N | TX3724 | TX3724N | 3W | 1250V | 1.645″ | .437″ | .032″ | 1.5″ | 0.5 | 3 MEG | 5 MEG |
| SX3730 | SX3730N | TX3730 | TX3730N | 5W | 1500V | 2.020″ | .437″ | .032″ | 1.5″ | 0.5 | 4 MEG | 6 MEG |

* 0.01 ohm to 0.1 ohm and maximum special resistance values available in non-standard physical sizes — 0 +.062″

TYPE SX/TYPE TX ENGINEERING DATA

PRC
PRECISION RESISTOR CO., INC.
109 U.S. HIGHWAY #22 • HILLSIDE, NEW JERSEY 07205 • PHONE: (201) 926-3036



Add Dept. EM to address to tell them you saw it in eem

# TYPE SX / TYPE TX HIGH PRECISION WIREWOUND RESISTORS

## ENGINEERING DATA:

### 1 RESISTANCE RANGE

**Standard:** Any specified ohmic value desired or decimal part of an ohm thereof.

**Special:** Higher or lower values beyond the standard limits.

### 2 RESISTANCE TOLERANCE

All calibrations and final measurements are made with temperature corrections to +25°C, unless otherwise specified.

| Military Symbol | Resistance Tolerance |
|---|---|
| A | ±0.05% |
| B | ±0.1% |
| C | ±0.25% |
| D | ±0.5% |
| F | ±1% |
| G | ±2% |
| H | ±3% |
| J | ±5% |
| Rough wound (one end terminated only) | +5% |

### 3 TEMPERATURE COEFFICIENT OF RESISTANCE (TCR)

**Standard:** Zero ±5 ppm/°C to Zero ±20 ppm/°C.

**Special:** To ±1 ppm/°C (±0.000001 ohm/ohm/°C).

### 4 INDUCTANCE

**Standard:** All high precision resistors are inductive wirewound resistors for DC circuits.

**Special:** High precision resistors with suffix letter "N" are non-inductively wound with balanced reversed turns to minimize the inductance and coupling effect with other components in critical or high density circuit designs.

### 5 STABILITY VS. TIME CHARACTERISTICS (No Load)

**Initial Resistance vs. Long Term Stability**

**Standard:** < ±0.01%/year at 25°C.

**Special:** < ±0.005%/year at 25°C.

### 6 POWER RATINGS VS. AMBIENT TEMPERATURE

All TYPE SX and TYPE TX resistors are designed for continuous full load operation providing the total operating temperature (the ambient temperature plus the temperature rise due to power dissipation) does not exceed:

+125°C (Char. C) TYPE SX.
+ 85°C (Char. A) TYPE TX.
See Derating Curve, Figure #1.

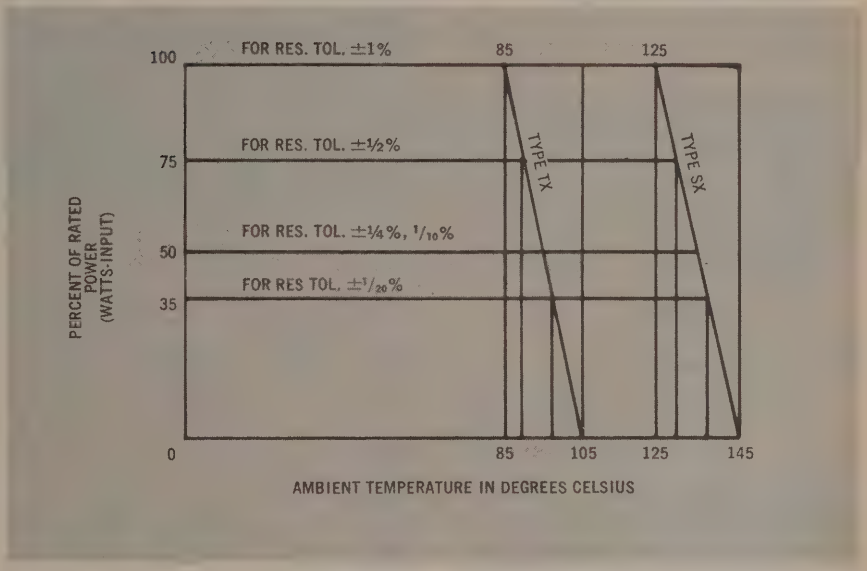



FIGURE #1 DERATING CURVE

### 7 POWER RATINGS VS. RESISTANCE TOLERANCE

Power ratings are based upon standard ±1% resistance tolerance. For closer tolerances refer to Derating Curve, Figure #1.

### 8 VOLTAGE RATINGS (D.C. Voltage or Peak Voltage)

To calculate the safe operating voltage for any resistance value below the maximum listed, apply the formula $E = \sqrt{PR}$.

### 9 TERMINALS

**Standard:** Solderable hot-tinned copper wire leads.

**Special:** Weldable leads available upon request.

### 10 PROTECTIVE COATINGS

**TYPE SX:** All TYPE SX resistors are encapsulated in a new solvent resistant silicone-epoxy-seal assuring excellent stability under severe environmental conditions — MIL-R-93 and MIL-R-39005.

**TYPE TX:** All TYPE TX resistors are sealed in a commercial plastic conformal coating assuring maximum protection against the effects of moisture.

### 11 MARKING

PRC symbol, type, resistance value and tolerance.

### 12 PURCHASING INFORMATION

When ordering high precision resistors, please specify: Quantity, Type, Resistance Value, Resistance Tolerance and Special Features which may apply.

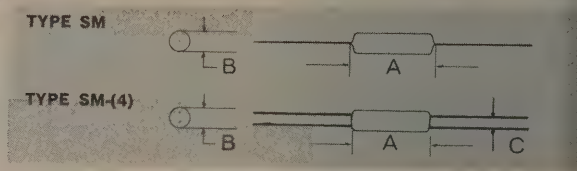
PRC PRECISION RESISTOR CO., INC.
109 U.S. HIGHWAY #22 • HILLSIDE, NEW JERSEY 07205 • PHONE: (201) 926-3036

# PRECISION POWER WIREWOUND RESISTORS

## TYPE SM AXIAL LEAD
## TYPE SM-(4) FOUR TERMINAL

### DESCRIPTION AND APPLICATION:

**PRECISION'S TYPE SM** sub-miniature precision power wirewound resistors are available in two and four terminal designs for commercial and military applications.




### ENGINEERING DATA:

**1 RESISTANCE RANGE**
Any ohmic value or decimal part of an ohm within range listed.

**2 RESISTANCE TOLERANCE**
**Standard:** ±1% (other tolerances available to ±0.05%).

**3 TEMPERATURE COEFFICIENT OF RESISTANCE (TCR)**
**Standard:** Zero ±5 ppm/°C to Zero ±20 ppm/°C.
**Special:** To ±2 ppm/°C.

**4 INDUCTANCE**
The basic TYPE SM resistors are inductively wound. Non-inductive resistors are available—add suffix letter "N" in part number.

**5 VOLTAGE RATINGS (D.C. Voltage or Peak Voltage)**
To calculate the safe operating voltage for any resistance value below the maximum listed, apply the formula $E = \sqrt{PR}$.

**6 POWER RATINGS**
All standard 1% tolerance TYPE SM resistors are designed for continuous full load operation at 25°C. Derate to zero power at +275°C.

**7 PROTECTIVE COATING**
All TYPE SM resistors are sealed in a tough solvent resistant — high temperature silicone coating.

**8 MARKING**
PRC symbol, type, ohmic value and tolerance or military and custom identification.

**9 FOUR TERMINAL DESIGN**
The four (4) terminal shunt/resistors are specifically designed and constructed for applications requiring precise measurement and sensing of current by the voltage drop methods or for use as precision voltage divider networks.

### ELECTRICAL AND PHYSICAL SPECIFICATIONS

#### TYPE SM

For higher resistance values (at max. rated voltage) decrease max. power rating ($P=E^2/R$)
For lower resistance values (at max. rated power) decrease max. voltage rating ($E=\sqrt{PR}$)

| PRC Type | Military Styles MIL-R-26 | Max. Power Rating (Watts) | *Min. Allowable Resist. (Ohms) | Resist. Values Based Upon Max. Power & Max. Voltage ($R=E^2/P$) | *Max. Allowable Resist. (Ohms) | Max. Voltage Rating | Body Dimensions A | Body Dimensions B (±.031") | Tinned Copper Terminals—Axial Length 1.750" ±.375" Gauge (AWG) | Tinned Copper Terminals—Axial Length 1.750" ±.375" Diam. Inches |
|---|---|---|---|---|---|---|---|---|---|---|
| SM062 | — | ¼W | 1.0 | 17K | 30K | 65V | .250" ±.031" | .080" | #24 | .020" |
| SM063 | — | ½W | 0.1 | 24K | 50K | 110V | .312" ±.031" | .080" | #24 | .020" |
| SM094 | RW70 | 1W | 0.1 | 40K | 80K | 200V | .406" ±.031" | .115" | #24 | .020" |
| SM076 | — | 1⅛W | 0.1 | 53K | 180K | 245V | .500" ±.031" | .090" | #24 | .020" |
| SM156 | — | 1½W | 0.1 | 90K | 400K | 375V | .531" ±.031" | .176" | #21 | .0285" |
| SM1711 | — | 2W | 0.1 | 225K | 900K | 670V | .812" ±.031" | .190" | #21 | .0285" |
| SM186 | RW69 | 3W | *0.025 | 80K | 480K | 500V | .500" ±.062" | .207" | #21 | .0285" |
| SM177 | RW79 | 3W | 0.1 | 80K | 540K | 500V | .562" ±.062" | .190" | #21 | .0285" |
| SM228 | — | 3W | *0.02 | 120K | 720K | 600V | .625" ±.062" | .240" | #20 | .032" |
| SM2812 | RW74 | 5W | *0.02 | 200K | 1 MEG | 1000V | .875" ±.062" | .312" | #20 | .032" |
| SM3114 | RW67 | 6½W | 0.1 | 154K | 1.5 MEG | 1000V | 1.000" ±.062" | .312" | #20 | .032" |
| SM3726 | RW78 | 10W | *0.07 | 156K | 4 MEG | 1250V | 1.780" ±.062" | .395" | #20 | .032" |

*0.02 ohm to 0.1 ohm and maximum resistance values available in non-standard physical sizes — 0+.062"

#### TYPE SM-(4)

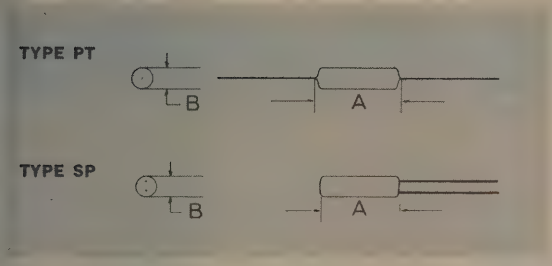
| PRC Type | Max. Power Rating | Body Dimensions Length (±.031") A | Body Dimensions Diam. (±.031") B | Std. Space C | Lead Diam. (±.001") | Lead Length (±.125") | Resistance (Ohms) Min. Max. Watts | Resistance (Ohms) Min. Derated Power | |
|---|---|---|---|---|---|---|---|---|---|
| SM186-4 | 2½W | .650" | .250" | .110" | .0285" | 1.500" | .025 @ 2½W | .005 @ .5W | 100 |
| SM228-4 | 3W | .775" | .280" | .110" | .0285" | 1.500" | .03 @ 3W | .005 @ .5W | 100 |
| SM2812-4 | 5W | 1.025" | .343" | .118" | .032" | 1.500" | .02 @ 5W | .005 @ 1.125W | 100 |
| SM3724-4 | 7½W | 1.800" | .437" | .243" | .032" | 1.500" | .03 @ 7½W | .005 @ 1.125W | 100 |

PRC PRECISION RESISTOR CO., INC.
109 U.S. HIGHWAY #22 • HILLSIDE, NEW JERSEY 07205 • PHONE: (201) 926-3036


Add Dept. EM to address to tell them you saw it in eem

# AXIAL LEAD TYPE PT
# PROBE DESIGN TYPE SP

# SPECIAL POSITIVE (+) TEMPERATURE COEFFICIENT WIREWOUND RESISTORS




## DESCRIPTION AND APPLICATION:

**PRECISION'S** linear (+) TCR thermal tracking resistors function as economical temperature sensing devices in bridge circuit applications for process control systems. These axial lead or probe design resistors are also used as compensators for voltage stabilization of components with negative (−) TCR drift.

## ELECTRICAL AND PHYSICAL SPECIFICATIONS

| PRC Types | | | Body Dimensions | | Lead Diam. Tinned Copper | Min. Res. (Ohms) | Maximum Resistance Values for Partial Listing of Popular +(TCR) Characteristics* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Axial Lead | Probe Design | Power Rating | Length A (±.032") | Diam. B (±.020") | | | 80 (.008%/°C) | 140 (.014%/°C) | 400 (.04%/°C) | 1400 (.14%/°C) | 3900 (.39%/°C) | 4500 (.45%/°C) | 6000 (.6%/°C) |
| PT073 | SP073 | 0—.05W | .332" | .100" | .020" | 1.0 | 3K | 3500 | 3K | 2500 | 50 | 600 | 200 |
| PT094 | SP094 | 0—.1W | .395" | .125" | .025" | 1.0 | 7500 | 8K | 7K | 6K | 100 | 1500 | 500 |
| PT156 | SP156 | 0—.25W | .520" | .187" | .028" | 1.0 | 30K | 30K | 27K | 20K | 500 | 5K | 2K |
| PT158 | SP158 | 0—.5W | .645" | .187" | .028" | 1.0 | 50K | 50K | 45K | 40K | 800 | 10K | 3500 |

* ΔR/°C = TCR x Ro (Above or below 25°C). Maximum Resistance values based upon .001" wire size.

## ENGINEERING DATA:

### 1 RESISTANCE RANGE AND TOLERANCE

**Standard:** 1 ohm through 50 Kilohms (±1% Tol.).

**Special:** 0.1 ohm through 300 Kilohms (to ±0.1% Tol.).

### 2 TEMPERATURE COEFFICIENT OF RESISTANCE (TCR)

The TCR characteristic is the change in resistance above or below the reference temperature (25°C).

Use formula:

$$TCR\,(\%) = \frac{\Delta R \times 100}{Ro \times \Delta t}$$

where:

Ro = Original resistance at reference temperature.

ΔR = Change in resistance at test temperature from resistance at reference temperature.

Δt = Difference between test and reference temperature in degrees.

**Standard:** +20 ppm/°C through +6000 ppm/°C. (See partial listing of popular TCR char. above.)

**Special:** Any non-standard (+) TCR with either available alloys or composite windings.

### 3 TOLERANCE ON (+) TCR

**Standard:** ±5% and ±10%.

**Special:** To ±1% or less. TCR matching < ±1% in a given lot.

### 4 STABILITY VS. TIME CHARACTERISTICS (No Load)

**Standard:** ±0.05%/year at 25°C.

**Special:** < ±0.01%/year at 25°C.

### 5 ZERO POWER RESISTANCE VS. EXTERNAL TEMPERATURE

Linear output < ±0.5% of the measured temperature over a wide measuring span (25 to 150°C) as well as smaller temperature changes for small spans (< 10°C).

### 6 THERMAL TIME CONSTANT

Time required for device to indicate 63.2% of a new impressed temperature - e.g. step change from +25°C to +100°C at 3FPS velocity to < 0.5 second.

### 7 WATTS - INPUT VS. AMBIENT TEMPERATURE

**Standard:** Devices listed are designed for continuous full load compensator applications at any ambient temperature up to and including +125°C (derated to zero power at +150°C).

**Special:** Hundreds of additional physical sizes and TCR combinations are available.

### 8 PROTECTIVE COATINGS

**Standard:** Conformal silicone/epoxy seal.

**Special:** Thermal conductive insulating coatings, uncoated or encapsulated into a metal sheath to meet needs exactly.

### 9 MARKING

PRC symbol, type, resistance value and tolerance. TCR char. — physical size permitting.

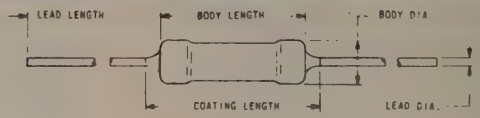
PRC
PRECISION RESISTOR CO., INC.
109 U.S. HIGHWAY #22 • HILLSIDE, NEW JERSEY 07205 • PHONE: (201) 926-3036

# SETTING NEW STANDARDS IN RELIABILITY

Here is a condensed version of Pyrofilm's product line. Should you desire detailed information, contact your Pyrofilm representative or the factory.

## METAL FILM RESISTORS

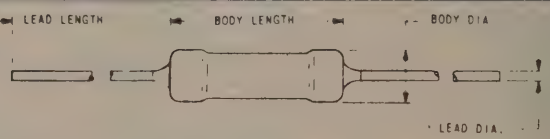
### CONFORMAL COATED




| PYRO-FILM | MIL-R-10509 | PHYSICAL AND ELECTRICAL CHARACTERISTICS | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RATING Watts | | RESISTANCE RANGE | | VOLTAGE to 1M | BODY DIMENSIONS Inches | | LEAD DIMENSIONS Inches | | | MAXIMUM COATING LENGTH Inches | |
| | | MIL | Com. | Min. | Max. | | Diameter | Length | Dia. | Length | AWG | Standard | Special |
| PME 45 | — | — | 1/20 | 25Ω | 200K | 200 | .047 ± .010 | 0.125 ± .020 | .010 | 1 | #30 | .160 | — |
| PME50 | RN50* | 1/20 | 1/8 | 10Ω | 1M | 200 | .060 ± .015 — .010 | .150 ± .020 | .016 | 1 | #26 | .200 | .172 |
| PME55 | RN55* | 1/10 | 1/8 | 10Ω | 4M | 250 | .095 ± .015 | .250 ± .031 | .025 | 1½ | #22 | .360 | .281 |
| PME60 | RN60* | 1/8 | 1/4 | 49Ω | 10M | 300 | .105 ± .015 | .390 ± .015 | .025 | 1½ | #22 | .475 | .406 |
| PME62 | — | — | 1/4 | 500Ω | 20M | 1,500 | .105 ± .015 | 0.510 ± .031 | .025 | 1½ | #22 | .600 | .530 |
| PME64 | — | — | 1/4 | 500Ω | 30M | 2,500 | .105 ± .015 | 0.970 ± .031 | .025 | 1½ | #22 | 1.070 | .985 |
| PME65 | RN65* | 1/4 | 1/2 | 49Ω | 20M | 400 | .156 ± .015 | .580 ± .031 | .025 | 1½ | #22 | .650 | .600 |
| PME70 | RN70* | 1/2 | 1 | 24Ω | 40M | 700 | .230 ± .015 | .730 ± .031 | .032 | 1½ | #20 | .830 | .730 |
| PME75 | RN75* | 1 | 2 | 49Ω | 50M | 1,000 | .365 ± .015 | 1.050 ± .031 | .032 | 1½ | #20 | 1.165 | 1.081 |
| PME80 | RN80 | 2 | 2 | 100Ω | 70M | 5,000 | .365 ± .015 | 2.175 ± .031 | .032 | 1½ | #20 | 2.290 | 2.206 |

## THICK FILM RESISTORS

### HIGH VOLTAGE CONFORMAL COATED




| PYROLFILM TYPE | WATTS MAX | VOLTAGE MAX | RESISTANCE RANGE* | BODY DIMENSIONS - INCHES | | LEAD DIAM INCHES |
|---|---|---|---|---|---|---|
| | | | | LENGTH | DIAMETER | |
| PVC55 | 1/8 | 250 | 10K - 50M | .250 ±.031 | .105 ±.015 | .025 |
| PVC60 | 1/4 | 500 | 10K - 100M | .375 ±.031 | .125 ±.020 | .025 |
| PVC62 | 1/4 | 500 | 10K - 200M | .510 ±.031 | .125 ±.020 | .025 |
| PVC64 | 1/4 | 1000 | 10K - 500M | .970 ±.031 | .125 ±.020 | .025 |
| PVC70 | 1 | 5KV | 10K - 500M | .750 ±.050 | .295 ±.025 | .032 |
| PVC100 | 1.5 | 10KV | 10K - 1000M | 1.040 ±.050 | .295 ±.025 | .032 |
| PVC175 | 3 | 17.5KV | 20K - 1000M | 1.800 ±.050 | .295 ±.025 | .032 |
| PVC200 | 3 | 20KV | 20K - 1000M | 2.050 ±.050 | .295 ±.025 | .032 |
| PVC300 | 3.75 | 30KV | 35K - 1000M | 3.050 ±.050 | .295 ±.025 | .032 |
| PVC400 | 5.25 | 40KV | 50K - 1000M | 3.980 ±.050 | .295 ±.025 | .032 |

*Extended values are available consult factory.

Also available in thick film — Chips, Radial Lead Flatso™, Networks

For **CUSTOM NETWORKS** consult Pyrofilm Application Engineers.

*Setting New Standards in Reliability*

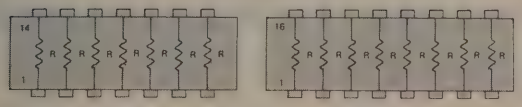
**PYROFILM**

**60 S. Jefferson Road • Whippany, N. J. 07981**
**(201) 887-8100 • TWX: 710-986-8220**

# SETTING NEW STANDARDS IN RELIABILITY

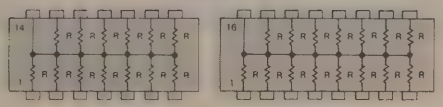
## DIP RESISTORS • 14 & 16 Pin

Schematic A



14 PIN 16 PIN

Schematic B



14 PIN 16 PIN

### PD 14 — A and PD 14 — B Standard Resistance Values

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 22 | 47 | 100 | 220 | 470 | 1.0K | 2.2K | 4.7K | 9.1K | 20K |
| 24 | 51 | 110 | 240 | 510 | 1.1K | 2.4K | 5.1K | 10K | 22K |
| 27 | 56 | 120 | 270 | 560 | 1.2K | 2.7K | 5.6K | 11K | 33K |
| 30 | 62 | 130 | 300 | 620 | 1.3K | 3.0K | 6.0K | 12K | 47K |
| 33 | 68 | 150 | 330 | 680 | 1.5K | 3.3K | 6.2K | 13K | 68K |
| 36 | 75 | 160 | 360 | 750 | 1.6K | 3.6K | 6.8K | 15K | 100K |
| 39 | 82 | 180 | 390 | 820 | 1.8K | 3.9K | 7.5K | 16K | |
| 43 | 91 | 200 | 430 | 910 | 2.0K | 4.3K | 8.2K | 18K | |

Standard Tolerance ±2% (<100Ω ±.5Ω)

### PD 16 — A and PD 16 — B Standard Resistance Values

| | | | | |
|---|---|---|---|---|
| 62 | 220 | 1.5K | 6.0K | 33.0K |
| 68 | 330 | 2.0K | 6.8K | 47.0K |
| 100 | 470 | 2.2K | 10.0K | 68.0K |
| 110 | 680 | 3.3K | 15.0K | 100.0K |
| 150 | 1.0K | 4.7K | 22.0K | |

Standard Tolerance ±2% (<100Ω ±.5Ω)

### STANDARD PRODUCT SPECIFICATIONS

Resistance Range ..... 10 ohms to 1 meg ohm

Tolerance ..... Letter designation for ordering
- Standard 2% ..... G
- Special 5% ..... J
- Special 1% ..... F
- Special .5% ..... D

Max. number of resistors per Dip available ..... 28

Power Rating ..... 1.75W Total per DIP at 70°C
Max. power per resistor .125W for standard circuits

Temperature Coefficient Track .... Typical 50 PPM/°C
Special 25 PPM/°C

Temperature Coefficient of resistance ..... Letter designation for ordering
- Standard — 0 ± 300PPM/°C ..... M
- Special — 0 ± 200PPM/°C ..... L
- Special — 0 ± 100PPM/°C ..... K

Tolerance Ratio Match ..... As low as .5%

Voltage Ratings ..... 100 V max. per resistor, 2000 V max. per DIP package for special circuits

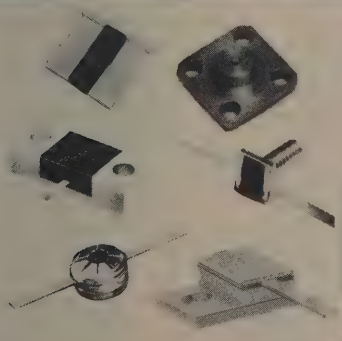
Operating Temperature Range ..... −55°C to +125°C

Encapsulation ..... epoxy transfer molded

### ORDERING INFORMATION

| Basic Model Number | Number of Pins | Temp. Coeff. | Resistance Value | Tolerance | Schematic |
|---|---|---|---|---|---|
| PD | 16 | M | 220Ω | G | A |

## RF COMPONENTS



- ATTENUATORS 2-20DB UP TO 50 WATTS
- TERMINATIONS, RESISTORS, & CAPACITORS UP TO 20 WATTS
- COAXIAL CONDUCTION COOLED LOADS UP TO 200 WATTS
- HIGH POWERED CHIP RESISTORS UP TO 1000 WATTS
- FLANGE MOUNTED TERMINATIONS & RESISTORS UP TO 800 WATTS

**Pyrofilm Also Makes . . .**
- Custom designed microwave and stripline components
- Thin film low power chips • Rods, discs and T pads
- High power rods, disc, and T pads

*Setting New Standards in Reliability*

**PYROFILM**

**60 S. Jefferson Road • Whippany, N. J. 07981**
**(201) 887-8100 • TWX: 710-986-8220**

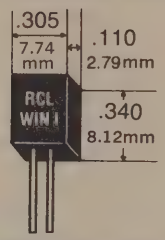
AMF
RESISTOR DIVISION
DEPT. EM, 195 McGREGOR STREET • MANCHESTER, NEW HAMPSHIRE 03102
TELEPHONE: (603) 627-3831 • TWX: 710-220-1876

# RCL Electronics

# *modular precision resistors*
## *Type* WIN

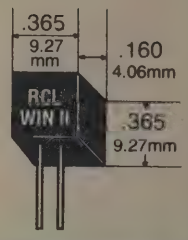
## THE WINNERS CHOICE!

FOR SIZE
**WIN I**

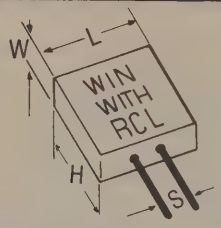



Approximated Actual Size

FOR COST & WIDE RANGE
**WIN II**




Approximated Actual Size




### Check These Standard Characteristics:

- △ **T.C.:** STD is ± 5 PPM — Available to 2 PPM (0 To + 85°C)
- △ **RANGE:** 0.1 Ω To 500K (See Table).
- △ **TOLERANCE:** .01% To 10% (See Table)
- △ **STABILITY:** .0025% MAX/Year.
- △ **T.C. TRACKING:** To 1 PPM.
- △ **RELIABILITY:** Built on the same lines as MIL-R-39005, demonstrating minimum reliability of .001%/1000 Hrs.

| | |
|---|---|
| **WATTAGE** | .3W AT 85°C |
| **VOLTAGE** | 200 VDC |
| **RESISTANCE RANGE** | WIN I 0.1 Ω To 125 K WIN II 0.1 Ω To 500 K |
| **TOLERANCE** | See Table II |
| **TEMPERATURE COEFF.** | See Table II |
| **T.C. TRACKING** | To ±1 PPM |
| **STABILITY** | 25 PPM/YEAR |
| **RISE TIME** | Up To 25 nSec. Available Consult Factory |
| **NOISE** | Not measurable on comm. equip. |
| **ENVIRONMENTAL** | Exceeds limits of MIL-R-39005 |
| **LEAD SPACING (S)*** | .150 ±.010 |
| **SIZE (MAXIMUM) WIN I** | H = .320 L = .305 W = .110 |
| **SIZE (MAXIMUM) WIN II** | H = .365 L = .365 W = .160 |

* Standard Leads are #22 (.025) Tinned Copperweld or Tinned Copper for both WIN I & II

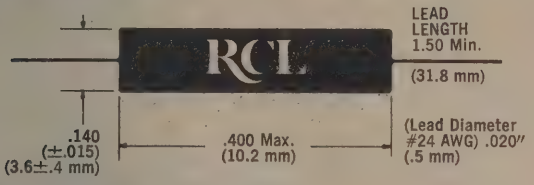
| RESISTANCE RANGE | CLOSEST TOLERANCE AVAIL. | | CLOSEST T.C. AVAIL. (0 To + 85°C) | |
|---|---|---|---|---|
| | WIN I | WIN II | WIN I | WIN II |
| 0.1 Ω To .99 Ω | N.A. | ± 10% | N.A. | ± 90 PPM |
| 1.0 Ω To 24.9 Ω | N.A. | ± 3% | N.A. | ± 30 PPM |
| 25 Ω To 99.9 Ω | ± 0.25% | ± 0.25% | ± 5 PPM | ± 5 PPM |
| 100 Ω To 199 Ω | ± 0.1% | ± 0.1% | ± 5 PPM | ± 5 PPM |
| 200 Ω To 499 Ω | ±0.1% | ± 0.05% | ± 3 PPM | ± 3 PPM |
| 500 Ω To 699 Ω | ±0.5% | ± 0.02% | ± 3 PPM | ± 3 PPM |
| 700 Ω To 999.9 Ω | ±0.02% | ± 0.01% | ± 3 PPM | ± 3 PPM |
| 1K To 125K | ±0.02% | ± 0.01% | ± 2 PPM | ±2 PPM |
| 125K To 500K | N.A. | ± 0.01% | N.A. | ±2 PPM |

AMF
RESISTOR DIVISION
DEPT. EM, 195 McGREGOR STREET • MANCHESTER, NEW HAMPSHIRE 03102
TELEPHONE: (603) 627-3831 • TWX: 710-220-1876

# RCL Electronics

## *precision wire-wound fuse resistors*

**NOW . . . a dual-purpose device that performs the functions of acting both as a precision wirewound resistor and a fuse. Precisely controlled characteristics . . . stable accurate resistance . . . allows precise control of fusing point and time lag.**




**GENERAL SPECIFICATIONS ON 500 SERIES**

**Resistance Range:** 0.2Ω-200Ω
**Resistance Tolerance:** 10%, Std, 5% and 2% available
**Blow Characteristics:** Consult factory
**Steady-State Conditions:** Consult factory
**Operating Temperature:** −55°C to +150°C
**Temperature Coefficient:** ±50 PPM/°C Max

**CONSTRUCTION FEATURES**

- Single Fusing Element — All Welded Connections
- Ceramic Shell — Air Encapsulation
- Meets or Exceeds MIL-R-26 Environmental Conditions-Specifications
- Intrinsically Safe — Ceramic Bobbin — Single Layer Wound

RCL designs and manufactures standard (F500 series) and special fuse-resistors to customer requirements. The fuse resistor acts both as a precision wirewound resistor and as a fusing element with precisely controlled characteristics.

- Affords protection for semiconductor devices
- Reduces the number of discrete components required
- Eliminates fire hazard and circuit board damage due to overheated components

**SPECIFICATION DEVELOPMENT**

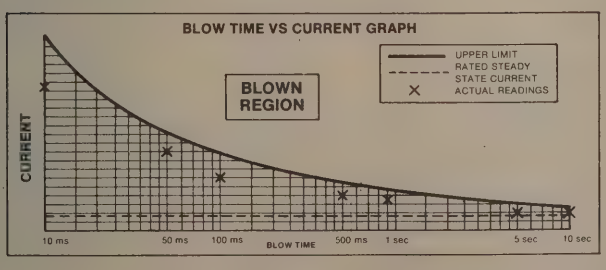
Because of the sometimes difficult task of determining the exact circuit conditions, it is often necessary to make refinements to the basic fuse resistor design after evaluating the operation in the circuit. The following general procedure has proven successful on past designs:

- Customer supplies detail requirements
- RCL engineering review and quotation
- Engineering prototypes are supplied
- Customer evaluates prototypes in circuit
- Specification refinements (if necessary) are made

**SPECIFICATION PROCEDURES**

When establishing a fuse resistor design, it is desirable to know the following:

- Normal operating current
- Desired total resistance and tolerance
- Current versus blowtime required (1 point definition minimum — 2 or more preferred)
- Operating temperature limits
- Description of transients — magnitude, duration, repetition
- Physical requirements — size and weight
- Normal ambient temperature
- Special environmental requirements




## *RCL wire-wound printed circuit resistors*

△ All welded construction.

△ All resistor wire terminations are made at the top of the resistor rather than at the bottom. This does the following:

a. protects the joints from damage when submerged in a solder bath.
b. by placing these joints as far away as possible from the solder bath, the body acts as a heat sink and thus these terminations are given additional protection.
c. this design generally applies to values of 2K and above.

△ Custom designs on special order.

△ Different lead spacing can be furnished on request.

△ Non-inductive winding available.

| RCL Type | MIL-R-93D Type | Dia. (± .025) | Length (± .032) | Max. Res. Using .001 (25.4μ) | Max. Res. Using .0006 (15.2μ) | Watt-age | Standard Lead Spacing (±.010) | Lead Diam. (AWG) |
|---|---|---|---|---|---|---|---|---|
| 4060 | RB-71 | .25 | .312 | 100K | 500K | .250 | .200 | #22 |
| 4061 | — | .25 | .375 | 160K | 800K | .250 | .200 | #22 |
| 4062 | — | .25 | .437 | 160K | 800K | .250 | .200 | #22 |
| 4063 | — | .375 | .375 | 185K | 1 Meg. | .333 | .200 | #20 |
| 4064 | — | .375 | .437 | 250K | 1.3 Meg. | .333 | .200 | #20 |
| 4065 | RB-70 | .375 | .5 | 301K | 1.5 Meg. | .333 | .200 | #20 |
| 4066 | — | .437 | .375 | 450K | 2 Meg. | .400 | .300 | #20 |
| 4067 | — | .437 | .437 | 600K | 3 Meg. | .400 | .300 | #20 |
| 4068 | — | .437 | .5 | 700K | 3.5 Meg. | .400 | .300 | #20 |

Lead Length 1¼" Minimum. Tinned, weldable leads.

## *special temperature coefficient wire wound resistors*

- Applications include transistor circuits, zener diode temperature compensation, temperature measuring devices.
- Available in a range of temperature coefficients from −50 PPM/°C. to +6,000 PPM/°C.
- Values range from 10 ohms to 5 megohms.
- All available with axial or printed circuit leads.
- Available in all physical sizes.
- All meet applicable paragraphs of Mil-R-93D.

**SPECIAL TEMPERATURE COEFFICIENTS AVAILABLE.**

| COLD RANGE | | HEAT RANGE | | R FACTOR |
|---|---|---|---|---|
| −55°C to +25°C | | +25°C to +105°C | | Multiply Max. R by |
| | | | | 1.00 |
| −30 | ±10 | −30 | ±10 | 1.00 |
| ±3 | | ±3 | | 1.00 |
| ±5 | | ±5 | | 1.00 |
| ±10 | | ±10 | | 1.00 |
| ±20 | | ±20 | | 1.00 |
| +95 | ±20 | +85 | ±20 | .80 |
| +110 | ±10 | +100 | ±10 | .80 |
| +120 | ±10 | +110 | ±10 | .75 |
| +150 | ±30 | +150 | ±30 * | .85 |
| +180 | ±20 | +180 | ±20 * | .80 |
| +280 | ±30 | +280 | ±30 * | .25 |
| +380 | ±40 | +400 | ±40 * | .70 |
| +700 | ±200 | +650 | ±200 * | .60 |
| +850 | ±80 | +850 | ±80 * | .60 |
| +1100 | ±100 | +1050 | ±100 * | .50 |
| +1250 | ±100 | +1150 | ±100 * | .50 |
| +1500 | ±200 | +1450 | ±200 | .55 |
| +2600 | ±200 | +2550 | ±200 | .50 |
| +3400 | ±300 | +3600 | ±300 | .36 |
| +4000 | ±400 | +4500 | ±400 | .10 |
| +5000 | ±300 | +6000 | ±300 | .05 |

* Consult factory for price and availability.

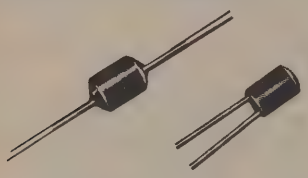
**Above TC's refer to .001 (25.4μ) minimum wire diameter. Some alloys available in sizes as low as .0007 (18μ)**

AMF
RCL Electronics

RESISTOR DIVISION
DEPT. EM, 195 McGREGOR STREET • MANCHESTER, NEW HAMPSHIRE 03102
TELEPHONE: (603) 627-3831 • TWX: 710-220-1876

# *established reliability wire-wound resistors*

## PRECISION RESISTORS / PER MIL R-39005



**Resistance Tolerances Available:** .01%, .02%, .05%, .10%, 1.0%.
If solderable leads are required use Suffix L.
If weldable leads are required use Suffix U.

| RCL Type No. | Mil-R-39005 Type | INCHES Diam. ±.015 | INCHES Length +.020 −.032 | Mil Watt | Max. Volts | Max. Mil Res. | MILLIMETERS Diam. ±0.4 | MILLIMETERS Length +0.5 −0.8 |
|---|---|---|---|---|---|---|---|---|
| 7009-ER | RBR 56 | .250 | .344 | 0.125 | 150 | 220K | 6.3 | 8.7 |
| 7010-ER | RBR 55 | .250 | .500 | 0.15 | 200 | 332K | 6.3 | 12.7 |
| 7020-ER | RBR 54 | .250 | .750 | 0.250 | 300 | 562K | 6.3 | 19.05 |
| 7030-ER | RBR 53 | .375 | .750 | 0.33 | 400 | 1.1 Meg. | 9.5 | 19.05 |
| 7040-ER | RBR 52 | .375 | 1.000 | 0.50 | 600 | 1.210 Meg. | 9.5 | 25.4 |

**Lead Length:** 1½" min. (38.1mm min.). **Lead Diameter:** #20 AWG .032" (0.8mm).

| RCL Type # | Mil-R-39005 Type | INCHES Diam. Max. | INCHES Length Max. | Mil Watts | Max. Volts | Max. Mil Res. | Standard Lead Spacing | MILLIMETERS Diam. Max. | MILLIMETERS Length Max. |
|---|---|---|---|---|---|---|---|---|---|
| 4060-ER | RBR 71 | .250 ±.031 | .312 ±.031 | 0.125 | 150 | 150K | .200 ±.010 | 6.35 ±7.87 | 7.93 ±7.87 |
| R2407-ER | RBR 80 | .160 | .325 | .1 | 100 | 120K | .225 ±.005 | 4.06 | 8.26 |
| R2408-ER | RBR 81 | .160 | .500 | .1 | 100 | 250K | .400 ±.005 | 4.06 | 12.70 |

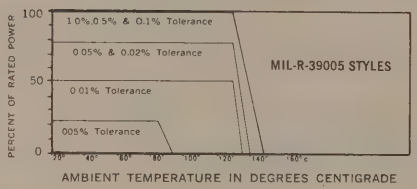
**Lead Length:** 1.0" min. **Lead Diameter:** #22 AWG for 4060-ER — #20 AWG for R2407-ER and R-2408-ER.
**Standard Temperature Coefficient:** ±20 PPM/°C.

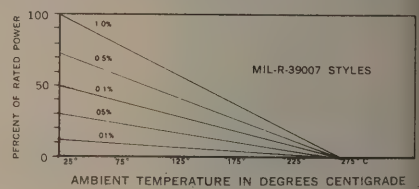
## POWER RESISTORS / PER MIL R-39007

**Resistance Tolerances Available:** .1%, .5%, 1.0%.
**Lead Length:** 1½" minimum.
**Standard Coefficient:** ±20 PPM/°C.
**Non Inductive Winding:** Add Suffix N. (divide maximum resistance values by 2)
If solderable leads are required use Suffix S.
If weldable leads are required use Suffix W.

A completely controlled process is used for the manufacture of established reliability units. Every unit is documented and traceable with quality control data. A 100 hour burn-in at rated wattage is performed. Failure rates test results are available.

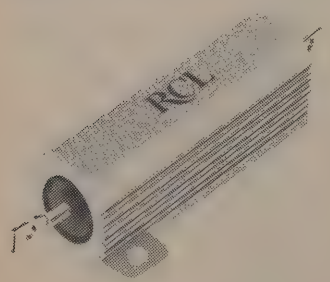
| RCL Type No. | MIL-R-39007 Type | INCHES Diam. ±.031 | INCHES Length ±.062 | Wattage Rating | Max. Resist. | Lead Diam. AWG | MILLIMETERS Diam. ±0.8 | MILLIMETERS Length ±1.6 |
|---|---|---|---|---|---|---|---|---|
| T-2B-71-ER | RWR 71 | .188 | .812 | 2.0 | 16.2K | #20 | 4.8 | 20.0 |
| T-5-74-ER | RWR 74 | .312 | .875 | 5.0 | 12.1K | #18 | 8.0 | 22.2 |
| B-1-ER | RWR 81 | .085 ±.020 | .250 ±.032 | 1.0 | 1K | #24 | 2.2 ±0.12 | 2.4 ±0.8 |
| B-3-ER | RWR 80 | .094 | .406 ±.032 | 2.0 | 2.67K | #24 | 2.4 | 11.5 ±0.8 |
| B-5-ER | RWR 89 | .187 | .560 | 3.0 | 4.12K | #20 | 4.8 | 14.2 |
| T10-78-ER | RWR 78 | .375 | 1.780 | 10 | 39.2K | .040 | 9.53 | 45.21 |
| B-2-ER | RWR 82 | .078 ±.016 | .312 ±.016 | 1.5 | 1.3K | .020 | 1.98 | 7.92 |
| B-10-ER | RWR 84 | .312 ±.031 | .875 ±.062 | 7 | 12.4K | .040 | 7.92 | 22.23 |

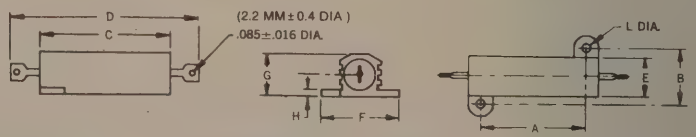



## POWER RESISTORS / MIL R-39009

### ESTABLISHED RELIABILITY ALUMINUM HOUSED POWER RESISTORS




| RCL Type No. | Mil-R-39009 Type No. | Power Rating* (Watts) RCL | Power Rating* (Watts) Mil | Min. Resistance | Max. Resistance | Max. Working Voltage | Max. Weight (Grams) |
|---|---|---|---|---|---|---|---|
| ALN5 ER | RER-40 | 7.5 | 5 | 1Ω | 16.5 K | 113.2 | 3.3 |
| AL5 ER | RER-60 | 7.5 | 5 | .1Ω | 33.2 K | 160.0 | 3.0 |
| ALN10 ER | RER-45 | 12.5 | 10 | 1Ω | 28 K | 187.3 | 8.8 |
| AL10 ER | RER-65 | 12.5 | 10 | .1Ω | 56.2 K | 265.0 | 8.0 |
| ALN25 ER | RER-65 | 25.0 | 20 | 1Ω | 60.4 K | 388.8 | 16.5 |
| AL25 ER | RER-70 | 25.0 | 20 | .1Ω | 121 K | 550.0 | 16.0 |
| ALN50 ER | RER-55 | 50.0 | 30 | 1Ω | 196 K | 883.7 | 35.5 |
| AL50 ER | RER-75 | 50.0 | 30 | .1Ω | 392 K | 1250.0 | 35.0 |

* Rating based on chassis mounting.

**APPLICABLE MIL-SPECIFICATIONS**
**MIL-R-39009:** Meets or exceeds military specifications covering aluminum housed, chassis-mounted resistors.

**Dielectric Strength:**
1000 Volts AC on AL-5 AL-10
2500 Volts AC on AL-25, AL-50

**Insulation Resistance:**
10,000 megohms minimum dry.

### DIMENSIONS IN INCHES

| RCL Type No. * | ** | A | B | C | D | E | F | G | H | L | Mil-R-39009 Type No. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tolerance | | ±.005 | ±.005 | ±.032 | ±.062 | ±.015 | ±.015 | ±.015 | ±.010 | ±.005 | |
| ALN5 ER | X | .445 | .490 | .600 | 1.125 | .335 | .645 | .321 | .065 | .094 | RER-40 |
| AL5 ER | X | | | | | | | | | | RER-60 |
| ALN10 ER | X | .562 | .625 | .750 | 1.375 | .420 | .795 | .400 | .074 | .094 | RER-45 |
| AL10 ER | X | | | | | | | | | | RER-65 |
| ALN25 ER | X | .720 | .780 | 1.060 | 1.940 | .530 | 1.075 | .560 | .087 | .125 | RER-50 |
| AL25 ER | X | | | | | | | | | | RER-70 |
| ALN50 ER | X | 1.562 | .845 | 1.970 | 2.780 | .615 | 1.135 | .615 | .087 | .125 | RER-55 |
| AL50 ER | X | | | | | | | | | | RER-75 |

* Indicates Non-Inductively Wound ** Indicates Inductively Wound

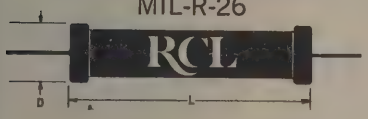
AMF
RESISTOR DIVISION
DEPT. EM, 195 McGREGOR STREET • MANCHESTER, NEW HAMPSHIRE 03102
TELEPHONE: (603) 627-3831 • TWX: 710-220-1876

# RCL Electronics
# SERIES T
# silicone coated axial power wire-wound resistors

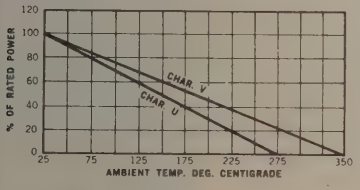
*General Specifications Available:*

- ☐ **Standard Temperature Coefficient:**
  Standard T.C.:
  ±20 PPM/°C. 500Ω up ±30 PPM/°C 10Ω to 499Ω
  ±50 PPM/°C 1Ω to 9.9Ω ±90 PPM/°C below 1Ω
  Lower ohmic values require higher T.C.'s, consult factory for information on specific applications.
  Consult factory for lower temperature coefficient requirements.
- ☐ **Tolerance:** ±1.0% is standard. Closer tolerances available. Closer tolerances may necessitate lowering maximum resistance; consult factory for specifics.
- ☐ **Wattage Range:** ½ watts to 14 watts.
- ☐ **Standard Resistance Values:** From 0.1 ohms to maximum values as stated in table. For values below 0.1 ohms consult factory.
- ☐ **Coating:** RCL's proprietary silicone coating withstands moisture, salt water immersion, and cleansing solutions. It will withstand continuous operation up to 400°C.
- ☐ **Leads:** Tinned copperweld is standard.
- ☐ **Dielectric Strength:** 500 VAC for T-½A through T-1C, 1000 VAC for all others.
- ☐ **Insulation Resistance:** 5000 Megohms minimum at 100 volts D.C.
- ☐ **Wide Temperature Range:** From −65°C to +275°C (Characteristic U) or +350° (Characteristic V).

MILITARY GRADE
MEETS OR EXCEEDS
MIL-R-26




**POWER RATINGS:**
The RCL "T" Series has two power ratings, depending on operating temperature and stability requirements:
**CHARACTERISTIC U:** 275°C maximum hot-spot temperature.
**CHARACTERISTIC V:** 350°C maximum hot-spot temperature.
**DERATING:**
RCL Series "T" resistors have an operating temperature range of −65°C to +275°C (Characteristic U), or to +350°C (Characteristic V).




**Ultra-fast delivery for prototypes and initial production needs.**

| RCL TYPE | MIL-R 26 E TYPE | WATTAGE RATING U | WATTAGE RATING V | DIMENSIONS DIA. ±.031* | DIMENSIONS LEN. ±.062* | MAX. RESISTANCE RCL MAX. | MAX. RESISTANCE MIL-R 26 E MAX. | LEAD DIAM. |
|---|---|---|---|---|---|---|---|---|
| T-½A | | .4 | | .078 | .220 | 2.5K | | #24 |
| T-½ | | .75 | | .078 | .330 | 7.5K | | #24 |
| T-1A | | 1.0 | 1.25 | .093 | .406 | 10K | | #24 |
| T-1A-70 | RW-70 | 1.0 | | .094 | .406 ±.031 | 10K | 3.16K | #24 |
| T-1B | | 1.1 | 1.30 | .093 | .530 | 12K | | #24 |
| T-1C | | 1.0 | | .093 | .280 | 5K | | #24 |
| T-2 | | 1.5 | | .156 | .343 | 10K | | #20 |
| T-2A | | 3.0 | 3.75 | .187 | .500 | 22K | | #20 |
| T-2A-69 | RW-69 | | 3.00 | .188 ±.063 | .500 ±.063 | 22K | 2.K | #20 |
| T-2B | | 3.0 | 3.75 | .188 | .812 | 40K | | #20 |
| T-2B-79 | RW-79 | 3.0 | | .187 | .560 | 22K | 10.5K | #20 |
| T-2C | | 3.0 | 3.25 | .250 | .500 | 40K | | #18 |
| T-3 | | 4.0 | 5.5 | .250 | .625 | 45K | | #18 |
| T-5 | | 5.0 | 6.5 | .312 | .875 | 91K | | #18 |
| T-5-74 | RW-74 | 5.0 | | .312 | .875 | 91K | 38.3K | #18 |
| T-6 | | 6.0 | 7.5 | .312 | 1.000 | 95K | | #18 |
| T-6-67 | RW-67 | | 6.5 | .313 ±.063 | 1.000 ±.094 | 95K | 8.2K | #20 |
| T-7 | | 7.0 | 9.00 | .312 | 1.185 | 100K | | #18 |
| T-7A | RW-55 | 7.0 | 9.00 | .375 | 1.375 | 150K | | #18 |
| T-10 | | 10.0 | 13.00 | .375 | 1.812 | 250K | | #18 |
| T-10-78 | RW-78 | 10.0 | | .375 | 1.780 | 260K | 90.9K | #18 |
| T-10-68 | RW-68 | | 11.00 | .344 ±.094 | 1.875 $^{+.063}_{-.125}$ | 265K | 20K | #20 |
| T-10-A-56 | RW-56 | | 14.00 | .469 ±.094 | 2.000 ±.094 | 275K | 9.1K | #20 |

Lead Length: 1¼" (32mm) minimum

* Tolerance applies to all types unless otherwise indicated.

## BERYLLIUM OXIDE CORE WIRE-WOUND RESISTORS

**For maximum heat dissipation . . . in smaller sizes. (All specifications same as above . . . Series T.)**

| RCL Type | MIL-R-26E | Rated Wattage U | Rated Wattage V | Diameter Inches ±.032 | Diameter mm ±.08 mm | Dimensions Length Inches ±.062 | Dimensions Length mm ±1.6 mm | Lead Diameter AWG | Lead Diameter mm | Max. Resistance MIL | Max. Resistance RCL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B-1 | RW-81 | 1 | — | .085 ±.020 | 2.2 ±0.5 | .250 ±.032 | 6.4 ±0.8 | #24 | 0.5 | 1K | 3.4K |
| B-2 | — | 1.5 | 2 | .078 | 2 | .312 | 7.9 | #24 | 0.5 | — | 7.5K |
| B-3 | RW-80 | 2 | — | .094 | 2.4 | .406 ±.032 | 10.3 ±0.8 | #24 | 0.5 | 3.16K | 10.0K |
| B-5 | — | 4 | 5 | .188 | 4.8 | .562 | 14.3 | #20 | 0.8 | — | 25K |
| B-5A | — | 4.5 | 6.5 | .188 | 4.8 | .812 | 20.6 | #20 | 0.8 | — | 42K |
| B-5C | — | 5 | 7 | .218 | 5.5 | .500 | 12.7 | #18 | 1 | — | 32K |
| B-6 | — | 6 | 8 | .250 | 6.4 | .625 | 15.9 | #18 | 1 | — | 50K |
| B-10 | — | 7 | 10 | .312 | 7.9 | .875 | 22.2 | #18 | 1 | — | 95K |
| B-12 | — | 10 | 12 | .312 | 7.9 | 1.218 | 31 | #18 | 1 | — | 154K |
| B-15 | — | 15 | 18 | .375 | 9.5 | 1.780 | 45.2 | #18 | 1 | — | 273K |

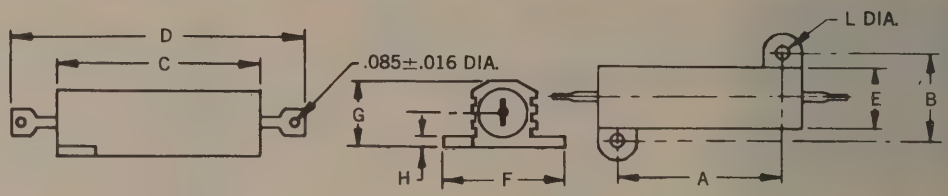
Lead length 1¼" (32mm) Minimum.

**NON-INDUCTIVE WINDING AVAILABLE FOR SERIES "T" OR "B"**

- ☐ For non-inductive winding add prefix "N".
1. Divide maximum resistance values by two.
2. Multiply maximum working voltage by .707.
3. Where possible, specify maximum inductance or capacitance allowable at a specific frequency.

AMF
RESISTOR DIVISION
DEPT. EM, 195 McGREGOR STREET • MANCHESTER, NEW HAMPSHIRE 03102
TELEPHONE: (603) 627-3831 • TWX: 710-220-1876

# RCL Electronics
# aluminum housed wire-wound power resistors




| TYPE | A | B | C | D | E | F | G | H | L | MIL-Type |
|---|---|---|---|---|---|---|---|---|---|---|
| Tol. | ±.005 | ±.005 | ±.032 | ±.062 | ±.015 | ±.015 | ±.015 | ±.010 | ±.005 | — |
| AL-5 | .445 | .490 | .600 | 1.125 | .335 | .645 | .323 | .065 | .093 | RE-60 |
| AL-10 | .562 | .625 | .750 | 1.375 | .423 | .800 | .400 | .074 | .093 | RE-65 |
| AL-25 | .719 | .781 | .062 | 1.942 | .531 | 1.075 | .562 | .087 | .125 | RE-70 |
| AL-50 | 1.562 | .845 | 1.970 | 2.780 | .616 | 1.135 | .616 | .087 | .125 | RE-75 |

## FEATURES

- Molded and welded construction
- Screw mounts on chassis
- Exceptionally high stability at all conventional power ratings
- Utilizes heat-sink effect of chassis
- Clearly marked on top surface of housing for ease of identification after mounting
- Exceeds MIL-R-18546
- Complete protection against environment

**NON INDUCTIVE STYLES: (Series "AL" and "ALB")** The same physical and electrical specifications are available with non-inductive winding. They are identified by adding the letter N after the AL identification.

| RCL TYPE | MIL-R-18546 TYPE | POWER RATING* (WATTS) RCL | POWER RATING* (WATTS) MIL | RESISTANCE RANGES (OHMS) | MAX. WORKING VOLTAGE | MAX. WT. GRAMS |
|---|---|---|---|---|---|---|
| AL-5 | RE-60G | 7.5 | 5 | .01 to 24.5K | 160 | 3 |
| AL-10 | RE-65G | 12.5 | 10 | .01 to 47.1K | 265 | 6 |
| AL-25 | RE-70G | 25 | 20 | .01 to 95.2K | 550 | 14 |
| AL-50 | RE-75G | 50 | 30 | .01 to 273K | 1250 | 29 |

* Rating based on chassis mounting.

## MATERIAL

**Core:** Steatite, or Alumina Ceramic.
**Resistance Wire:** Nichrome wire (800Ω/CMF) is standard; other alloys used when required.
**End Caps:** Stainless steel.
**Sealant:** Molded construction.
**Housing:** Anodized Aluminum.
**Terminals:** Tinned copperweld.
**Flame Retardant Construction:** Available on special order.

### BERYLLIUM OXIDE CORES FOR GREATER HEAT DISSIPATION

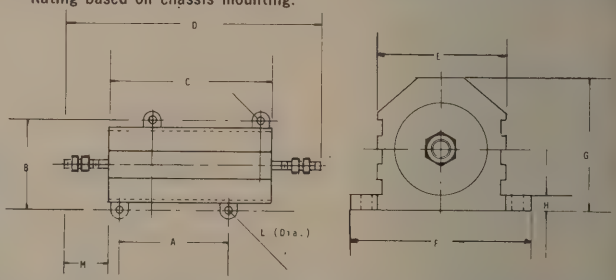
| RCL TYPE | MIL-R-18546 TYPE | POWER RATING* (WATTS) RCL | POWER RATING* (WATTS) MIL | RESISTANCE RANGES (OHMS) | MAX. WORKING VOLTAGE | MAX. WT. GRAMS |
|---|---|---|---|---|---|---|
| ALB-5 | RE-60 | 15 | 5 | .01 to 24.5K | 220 | 3 |
| ALB-10 | RE-65 | 20 | 10 | .01 to 47.1K | 340 | 6 |
| ALB-25 | RE-70 | 35 | 20 | .01 to 95.2K | 650 | 14 |
| ALB-50 | RE-75 | 50 | 30 | .01 to 273k | 1400 | 29 |

* Rating based on chassis mounting.

## POWER RATING

Both AL-100 and AL-250 Series ratings based on the following requirements:

**A.** 275°C maximum internal hotspot temperature.
**B.** 1% maximum △R in 1000 hour load life.
**C.** Proper heat sink: 12" x 12" x .125 Aluminum Panel.
**D. Derating:**
1. Operating temperature range of −55°C to +275°C.
2. Derating is required for reduced chassis mounting area and for high ambient temperatures.




## ELECTRICAL SPECIFICATIONS

**Tolerance:** ±1.0% is standard. Available to ±.05%. Closer tolerances may necessitate lowering maximum resistance. Consult RCL for specifics.

**Standard T.C.:**
±20 PPM/°C. 500Ω up
±30 PPM/°C. 10Ω to 499Ω
±50 PPM/°C 1Ω to 9.9Ω
±90 PPM/°C. below 1Ω

Lower ohmic values require higher T.C.'s. Consult factory for information on specific applications.

**Dielectric Strength:** 5500 VAC on AL-100 and AL-250.

**Insulation Resistance:** 10,000 megohms minimum dry.

### Dimensions

| TYPE | A | B | C | D | E | F | G | H | L | M | MIL TYPE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tol. | ±.010 | ±.010 | ±.031 | ±.093 | ±.031 | ±.031 | ±.031 | ±.031 | ±.010 | ±.031 | — |
| AL-100 | 2.750 | 2.250 | 3.500 | 5.478 | 1.812 | 2.812 | 1.750 | .187 | .188 (TYP) | .989 | RE77 |
| AL-250 | 3.000 | 2.500 | 4.500 | 7.000 | 2.125 | 3.000 | 2.188 | .250 | .188 (TYP) | 1.250 | RE80 |

| RCL TYPE | MIL-R-18546D TYPE | POWER RATING* (WATTS) RCL | POWER RATING* (WATTS) MIL | RESISTANCE RANGES (OHMS) | MAX. WORKING VOLTAGE | MAX. WT. GRAMS |
|---|---|---|---|---|---|---|
| AL-100 | RE-77G | 100 | 75 | .1 to 50K | 1900 | 400 |
| AL-250 | RE-80G | 250 | 120 | .1 to 75K | 2500 | 800 |

* Rate based on chassis mounting. See information on Power Rating below.

AMF
RESISTOR DIVISION
DEPT. EM, 195 McGREGOR STREET • MANCHESTER, NEW HAMPSHIRE 03102
TELEPHONE: (603) 627-3831 • TWX: 710-220-1876

# RCL Electronics
# *radial lead resistors*

**NON-INDUCTIVE WINDING**

| RCL Type | Diameter ±.010 | Length ±.010 | Standard Lead Spacing ±.010 | Lead Dia. AWG. |
|---|---|---|---|---|
| 7010R | .250 | .500 | .400 | #20 |
| 7020R | .250 | .750 | .650 | #20 |
| 7040R | .375 | 1.000 | .900 | #20 |

# *subminiature wire-wound resistors*

These extremely small, encapsulated resistors meet and exceed the specifications of MIL-R-93. Special RCL techniques also allow the production of custom sizes at minimal cost to the customer.

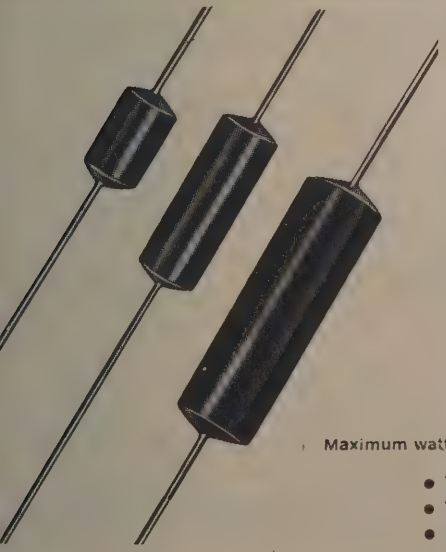
**Tolerances available:** from ±1.0% to ±0.001%.

**Temperature coefficient:** Standard is ±10 PPM/°C.
Temperature coefficients available as low as ±2 PPM/°C.

| RCL Type | Dia ±.016 Inches (±0.4mm) | Length ±.032 Inches (±0.8mm) | Max. Watts | Max. Volts | Max. Res. .001 Wire (25.4μ) | Max. Res. .0005 Wire (12.7μ) | Non-Inductive | Lead Diam. Length 1½" (38.1mm) Min. |
|---|---|---|---|---|---|---|---|---|
| 7001 | .100 (2.5) | .200 (5) | 0.05 | 75 | 10K | — | No | #26AWG (0.4mm) |
| 7002 | .110 (2.8) | .220 (5.6) | 0.1 | 100 | 10K | 100K | No | #24AWG (0.5mm) |
| 7003 | .100 (2.5) | .260 (6.6) | 0.05 | 100 | 10K | 150K | No | #24AWG (0.5mm) |
| 7004 | .100 (2.5) | .300 (7.6) | 0.05 | 100 | 10K | 250K | Yes | #24AWG (0.5mm) |
| 7005 | .125 (3.2) | .250 (6.3) | 0.1 | 100 | 10K | 300K | Yes | #22AWG (0.6mm) |
| 7006 | .125 (3.2) | .312 (7.9) | 0.1 | 100 | 16K | 350K | Yes | #22AWG (0.6mm) |
| 7007 | .1875 (4.8) | .375 (9.5) | 0.125 | 200 | 60K | 700K | Yes | #22AWG (0.6mm) |
| 7008 | .250 (6.3) | .250 (6.3) | 0.150 | 100 | 100K | 1 Meg. | Yes | #22AWG (0.6mm) |
| 7009 | .250 (6.3) | .343 (8.7) | 0.25 | 200 | 127K | 1.4 Meg. | Yes | #20AWG (0.8mm) |
| 7010 | .250 (6.3) | .500 (12.7) | 0.33 | 400 | 226K | 3 Meg. | Yes | #20AWG (0.8mm) |

Maximum wattage rating is at 25° C through 125° C

# *miniature axial lead w/w encapsulated resistors*



| Type | MIL-R-93 Type | Dia. ±.015 In. (±0.4mm) | Length ±.031 In. (±0.8mm) | Maximum Watts | MIL Wattage | Maximum Volts | Max. Res. .001 Wire |
|---|---|---|---|---|---|---|---|
| 7009 | RB-56 | .25 (6.3) | .343 (8.7) | 0.25 | 0.125 | 200 | 127K |
| 7010 | RB-55 | .25 (6.3) | .5 (12.7) | 0.33 | 0.15 | 400 | 226K |
| 7020 | RB-54 | .25 (6.3) | .75 (19) | 0.50 | 0.25 | 400 | 511K |
| 7030 | RB-53 | .375 (9.5) | .75 (19) | 0.60 | 0.33 | 400 | 750K |
| 7040 | RB-52 | .375 (9.5) | 1.0 (25.4) | 1.00 | 0.50 | 800 | 1.5 Meg. |
| 7044 | — | .5 (12.7) | .5 (12.7) | 0.50 | — | 400 | 1 Meg. |
| 7045 | — | .5 (12.7) | .625 (15.9) | 0.60 | — | 400 | 1 Meg. |
| 7045A | — | .437 (11.1) | .625 (15.9) | 0.60 | — | 400 | 650K |
| 7050 | RB-57 | .5 (12.7) | 1.0 (25.4) | 1.25 | 0.75 | 800 | 2 Meg. |
| 7050A | — | .437 (11.1) | 1.0 (25.4) | 1.25 | — | 800 | 1.5 Meg. |
| 7060 | RB-58 | .5 (12.7) | 1.5 (38.1) | 1.50 | 1.0 | 900 | 3 Meg. |
| 7070 | RB-59 | .5 (12.7) | 2 (50.8) | 2.00 | 1.25 | 1,200 | 5 Meg. |

Maximum wattage rating is from −55° C to +125° C.

**MILITARY SPECIFICATIONS**

- These standard sizes meet the physical dimensions of MIL-R-93.
- Test data and approval information available.
- All RCL types meet or exceed the electrical and environmental characteristics of this specification.

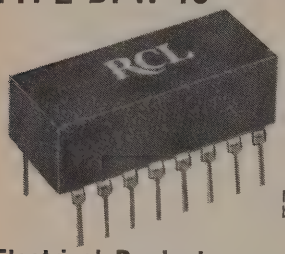
***INDUSTRY'S BEST DELIVERY***

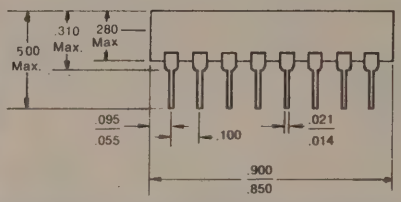
AMF
RESISTOR DIVISION
DEPT. EM, 195 McGREGOR STREET • MANCHESTER, NEW HAMPSHIRE 03102
TELEPHONE: (603) 627-3831 • TWX: 710-220-1876

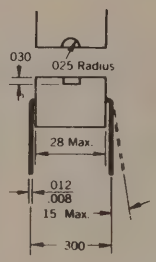
# RCL Electronics

# *wire-wound networks (dual-in line package)*

## TYPE DPW 16



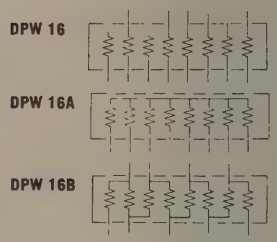




Note: Dimensions shown are typical for this type package but are flexible to meet specific customer requirements.

- Designed for automatic insertion
- Up to 8 resistors in a 16-pin package
- Optimum heat dissipation in small package
- High temperature stability
- Precision tolerance and T.C.

### TYPICAL SCHEMATICS




### Electrical Products

**Power Rating:** 4 watts (up to ½ watt/resistor)

**Resistance Range:** .05 ohm to 100K resistor

**Temperature Coefficient Match:** 10 PPM/°C Standard — Available to 2.5 PPM/°C

**Tolerance:** 1% Standard Available to .05%

**Temperature Coefficient:** 10 Ω to 10K Ω ±20 PPM/°C — .5 Ω to 9.9 Ω ±50 PPM/°C

**Tolerance Match:** .05%

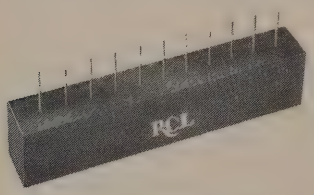
**Dielectric Strength:** 500 VAC

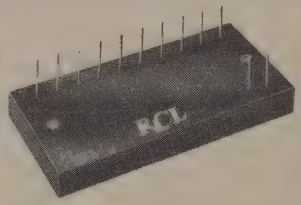
**Insulation Resistance:** 1000 Megohms minimum. 100 Megohms minimum after moisture test.

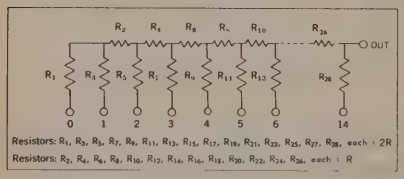
Also available in 14 pin standard DIP configuration (Up to 7 resistors). Specify DPW 14, DPW 14A, DPW 14B.

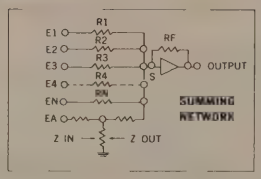
# *ladder and summing networks*

### RCL makes available ladder networks in both standard and miniaturized versions



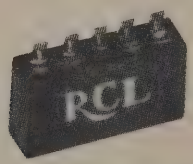



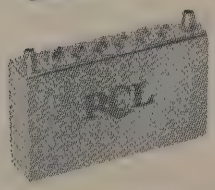

- Maximum total error less than ½ of the smallest word input combinations
- Modular construction
- Interchangeable sub-assemblies

### General Specifications Available:

- Ambient operating temperature range . . . −55° to +125°C
- Error . . . Under .50 of the least insignificant bit for every input combination
- Resistance Values . . . .05 ohms to 100K
- Output accuracy to ±.01% and ±2 PPM/°C
- Up to 14 bits available
- Wire Wound precision resistors of matched characteristics result in stability

# *precision resistance networks*




RCL designs, develops and produces packaged resistance networks to individual customer requirements.

A high degree of sophisticated packaging plus miniaturization techniques are available from RCL's network engineering specialists. Typical custom designed networks are shown here.

### General Specifications Available:

- Absolute resistor tolerances to ±.005%
- Ratio tolerances to ±.003%
- Temperature coefficient match and tracking between resistors within ±1 PPM°, from −0°C to +85°C
- Long term stability of .003% the first year and .005% over a three year period
- Low reactance and rise times as low as .02 microseconds
- AC resistance match at frequency determined by user.
- In AC converter networks, capacitance can be matched to 0.01 MMFD with a shielded network

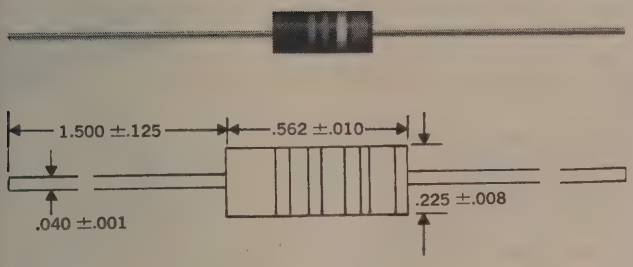
**If you have a network problem, send us your complete specifications for a prompt and detailed proposal.**

AMF
RESISTOR DIVISION
DEPT. EM, 195 McGREGOR STREET • MANCHESTER, NEW HAMPSHIRE 03102
TELEPHONE: (603) 627-3831 • TWX: 710-220-1876

## RCL Electronics

# *low cost 2 watt molded wire-wound resistors*

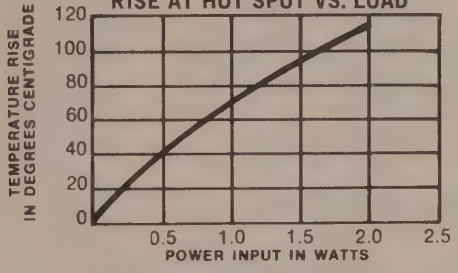
## TYPE BWR



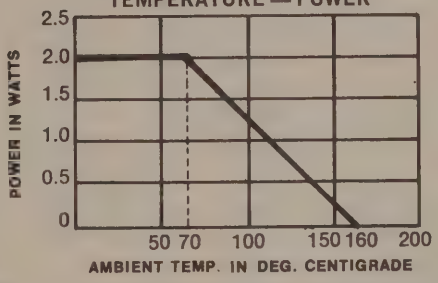

A general purpose, extremely economical wire wound resistor. Type BWR covers three different wattage requirements in one size resistor.

BWR resistors offer wire wound stability, negligible noise and no catastrophic failures for 2, 1 and ½ watt applications. Significant cost savings may be obtained over Fixed Compositions Resistors in the categories of 1 watt 5% tolerance, 2 watt 5% and 10% tolerances.

**SURFACE TEMPERATURE RISE AT HOT SPOT VS. LOAD**




**DERATING CURVE TEMPERATURE — POWER**




| PERFORMANCE CHARACTERISTICS | |
|---|---|
| **REQUIREMENT** | **MAXIMUM BWR △R** |
| Temperature Coefficient | |
| 0.1Ω - 0.16Ω | +0.1%/°C |
| 0.10Ω - 0.62Ω | +0.08%/°C |
| 0.68Ω - 1000Ω | ±0.04%/°C |
| Low Temperature Operation | ±3% |
| Temperature Cycling (−55°C to +125°C) | ±5% |
| Moisture Resistance | ±5% |
| Short Time Overload (8 watts) | ±4% |
| Load Life | ±10% |
| Terminal Strength | ±2% |
| Resistance to Soldering Heat | ±4% |
| Shock | ±2% |
| High Frequency Vibration | ±2% |

### PERFORMANCE CHARACTERISTICS

Type BWR resistors meet or exceed performance requirements of EIA RS-344.

### SPECIFICATIONS

| | |
|---|---|
| **MIL-R-11 Style Equivalent for physical size only** | RC32 |
| **Resistance, Standard** | 0.10Ω thru 1000Ω |
| **Resistance Tolerances, Standard** | ±5%; ±10% |
| **Power Rating** | 2 watts @ 70°C<br>1 watt @ 115°C<br>½ watt @ 137°C;<br>derating to 0 @ 160°C |
| **Maximum Continuous Working Voltage** | $\sqrt{PR}$ |
| **Minimum Insulation Resistance — Dry** | 10,000 Megohms |
| **Minimum Insulation Resistance — Wet** | 100 Megohms |
| **Minimum Dielectric Withstanding Voltage** | |
| **Atmospheric Pressure** | 1,000 Volts R.M.S. |
| **Reduced Pressure** | 625 Volts R.M.S. |
| **Hot Spot Temperature Rise at 2 Watts** | 115°C |
| **Current Noise** | Negligible |

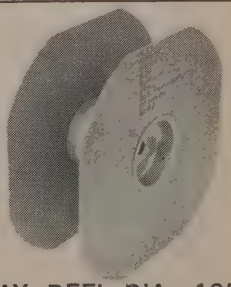
**Notes:**

1. Because of inaccuracies common in measuring low resistance values, an allowance of 0.01Ω should be added to the %△R limits.
2. Test conditions are as specified in MIL-R-11 and MIL-STD-202 except where shown in parenthesis.
3. For indication of approximate inductance values, consult factory.

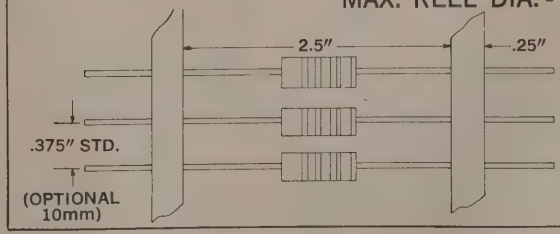
### PACKAGING

**STANDARD:**
BULK
1000 PCS/BOX

**OPTIONAL:**
LEAD TAPE
1000 PCS/REEL



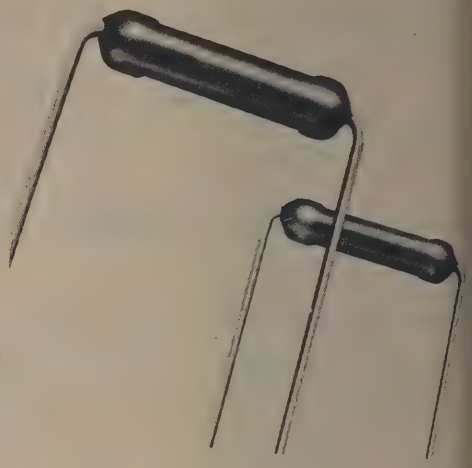
MAX. REEL DIA. - 12″



AMF
RCL Electronics
RESISTOR DIVISION
DEPT. EM, 195 McGREGOR STREET • MANCHESTER, NEW HAMPSHIRE 03102
TELEPHONE: (603) 627-3831 • TWX: 710-220-1876

# *silicone coated power resistors*

## *radial lead* TYPE TR



### SPECIFICALLY DESIGNED FOR PRINTED CIRCUIT BOARD MOUNTING

- Complete welded construction.
- Meets requirements of MIL-R-26.

### General Specifications Available:

**Standard T.C.:** ±20PPM/°C. 500 Ω up
±30PPM/°C. 10 Ω to 499 Ω
±50PPM/°C. 1 Ω to 9.9 Ω
±90PPM/°C. 0.1 Ω to 1 Ω

Lower ohmic values require higher T.C.'s; consult factory for information on specific applications, and for lower temperature coefficient requirements.

**Tolerance:** ±1.0% is standard. Closer tolerances are available. Consult RCL for specifics.

**Wattage Range:** ½ watt to 18 watts.

**Resistance Values:** From .01 ohms to 275K.

**Coating:** Silicone coating impervious to moisture, salt, water immersion and abrasion.

**Leads:** Tinned copperweld is standard.

**Dielectric Strength:** 1000 VAC "V" block test.

**Insulation Resistance:** 5000 Megohms minimum dry 100 volts D.C.

**Wide Temperature Range:** From −65°C to +275°C.

**Flame Resistant Construction:** Available on special order.

**Special Low Resistance Values:** Available to .001 ohms. For values below .01 ohms consult factory for practical tolerances.

METRIC DIMENSIONS

| RCL TYPE | RATED WATTAGE | | DIMENSIONS | | LEAD DIAMETER | MAX. RESISTANCE | STANDARD LEAD SPACE | DIMENSIONS | | LEAD DIA. | STANDARD LEAD SPACE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | U | V | DIAMETER ±.031 | LENGTH ±.062 | AWG | | ±.020 | DIA. ±0.8mm | LENGTH ±1.6mm | mm | ±0.5mm |
| TR-2A | 3 | 3.75 | .187 | .500 | #20 | 24K | .550 | 4.8 | 12.7 | .08 | 14 |
| TR-3 | 4 | 5.5 | .250 | .625 | #20 | 40K | .675 | 6.4 | 16.0 | 1.0 | 17 |
| TR-5 | 5 | 6.5 | .312 | .875 | #20 | 75K | .925 | 7.9 | 22.2 | 1.0 | 23.5 |
| TR-7 | 7 | .90 | .312 | 1.185 | #20 | 100K | 1.225 | 7.9 | 30.0 | 1.0 | 31 |
| TR-10 | 10 | 13 | .375 | 1.780 | #20 | 250K | 1.800 | 9.0 | 45.2 | 1.0 | 46 |

# *beryllium oxide core version*

## TYPE BR

- Beryllium oxide core.
- Optimum heat dissipation pattern.
- High temperature silicone coating.
- Up to 4 times higher power ratings than conventional resistors of equivalent size.
- General specifications of the "B" Series on page 30 are applicable to "BR" Series.

(Refer to heat dissipation curves on page 8)

METRIC DIMENSIONS

| RCL TYPE | RATED WATTAGE | | DIMENSIONS | | LEAD DIAMETER | MAX. RESISTANCE | STANDARD LEAD SPACE | DIMENSIONS | | LEAD DIA. | STANDARD LEAD SPACE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | U | V | DIAMETER ±.031 | LENGTH ±.062 | AWG | | ±.020 | DIAMETER ±0.8mm | LENGTH ±1.6mm | mm | ±0.5mm |
| BR-2 | 1.5 | 2.0 | .078 | .312 | #24 | 7.5K | .344 | 2 | 8.0 | 0.5 | 8.7 |
| BR-3 | 2.25 | 2.75 | .093 | .406 | #24 | 10K | .425 | 2.4 | 10.3 | 0.5 | 10.8 |
| BR-5 | 4.0 | 5 | .187 | .500 | #20 | 22K | .550 | 4.8 | 12.7 | 0.8 | 14 |
| BR-5A | 4.5 | 6.5 | .187 | .812 | #20 | 40K | .800 | 4.8 | 20.0 | 0.8 | 19.8 |
| BR-5C | 5 | 7 | .218 | .500 | #20 | 30K | .525 | 5.5 | 12.7 | 1.0 | 13.3 |
| BR-6 | 6 | 8 | .250 | .625 | #20 | 40K | .675 | 6.4 | 16.0 | 1.0 | 17 |
| BR-10 | 7 | 10 | .312 | .875 | #20 | 91K | .925 | 7.9 | 22.2 | 1.0 | 23.5 |
| BR-12 | 10 | 12 | .312 | 1.218 | #20 | 100K | 1.225 | 7.9 | 30.7 | 1.0 | 31 |
| BR-15 | 15 | 18 | .375 | 1.780 | #20 | 250K | 1.800 | 9.5 | 45.2 | 1.0 | 46 |

### SERIES TR — RADIAL LEAD NON-INDUCTIVE STYLES — SERIES BR

a) For Standard Core, Radial Lead Non-inductive Resistors may be specified by using suffix "N" (for example: TR-N-5).

b) For Beryllia or Beryllium Oxide Core, Radial lead Non-inductive Resistors may be specified by using suffix "N" (for example: BR-N-5). Maximum resistance for both non-inductive styles is ½ of that indicated in tables.

AMF
RESISTOR DIVISION
DEPT. EM, 195 McGREGOR STREET • MANCHESTER, NEW HAMPSHIRE 03102
TELEPHONE: (603) 627-3831 • TWX: 710-220-1876

RCL Electronics

# special products

RCL engineers have designed and produced thousands of unique products to meet special customer applications. Shown are a few typical examples. RCL has an application engineering group directed toward solving and producing unusual products to fit custom requirements. Our capabilities include extended resistance ranges, extremely low reactance, low thermal EMF and special configuration.

## computer resistors

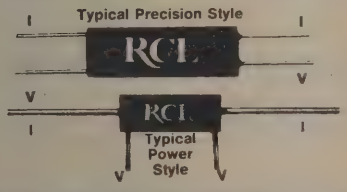
High-density power resistors specifically designed to meet demanding space requirements. Ideal for memory termination. Isolates line drive impulses and terminates lines. RCL engineers can meet all design requirements by adapting nearly any type of configuration.

Particularly suited to very low resistance requirements for interface with integrated circuitry.

POWER RATING: 23 WATTS WHEN MOUNTED ON HEAT SINK MAINTAINED AT 75°C.

**Resistance Range:** From 0.1Ω to 100Ω.
**Tolerances:** 5% standard. Closer tolerances available. Consult factory.
**Dimensions:** .5 x .5 x .062 (Millimeters: 12.7 x 12.7 x 1.6).
**Terminals:** Wire leads.
**T.C.:** ±100 PPM/°C. Closer telarnces available on request.
**Max. Temp.:** (on open side) 125°C.

## 4-terminal resistors



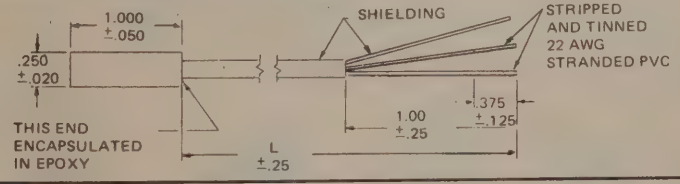

RCL manufactures 4-Terminal Resistor assemblies in both precision and power styles. They are used in current sensing circuits primarily with low resistance values to minimize the effects of lead resistance and lead temperature coefficient. This unique construction is essential for tight tolerance low value resistors where lead material characteristics are critical.

To order, specify "4-Terminal Construction" with any RCL Resistor Series 7000 (Precision Styles) or Series "T" (Power Styles). Consult factory for application details or special packaging configurations.

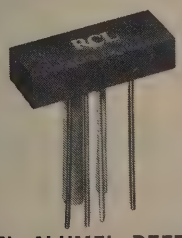
## molded temperature compensators

RCL offers a standard line of epoxy encapsulated sensing resistors for temperature compensating applications. The standard resistance tolerance ±5% with tighter tolerances available on special order. Cable lengths from 2.0" to 48.0" are available with 6.0" standard. Operating temperature range is −55°C to +125°C. Repeatability of temco within a given lot is ±100 PPM.

| RCL Style | Resistance Range | PPM/°C Average Tempco 0° - 100°C |
|---|---|---|
| TC35 | 10Ω - 50KΩ | 3500 ±350 |
| TC45 | 10Ω - 10KΩ | 4500 ±450 |
| TC55 | 10Ω - 5KΩ | 5500 ±550 |

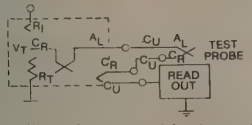



## thermocouple reference junctions



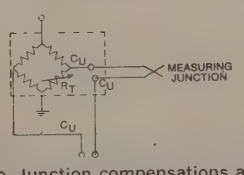

Reference junctions are necessary to make accurate temperature measurements with thermocouples. Ice baths or boiling water are most commonly used in laboratory tests. Since baths are inconvenient and impractical in equipment or field work, several alternate methods are used. RCL engineers and manufactures electronic reference junctions providing stable and accurate reference points for intricate temperature measuring systems.

### A. CHROMEL ALUMEL REFERENCE NETWORK




Configuration A: Typical of a reference junction network for chromel alumel thermocouple. $R_T$ is made with an alloy that varies the $V_T$ exactly opposite to the CR-AL junction establishing a zero voltage effect due to ambient conditions, so that the measuring junction reference is always the initial desired temperature. The read out voltage is proportional to test probe temperature. This eliminates the need of the ice bath reference. Use of copper leads with the network eliminates secondary thermal errors.

### B. BRIDGE REFERENCE JUNCTION




$R_T$ is selected to produce an equal and opposite voltage thermal error due to ambient to the reference junction temperature changes. Output is then proportional to the measuring junction temperature. Junction compensations are practical to .5°C. These methods allow compensation of most common thermocouple junctions.

AMF
RCL Electronics
RESISTOR DIVISION
DEPT. EM, 195 McGREGOR STREET • MANCHESTER, NEW HAMPSHIRE 03102
TELEPHONE: (603) 627-3831 • TWX: 710-220-1876

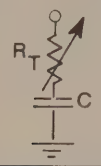
# special products

Included among the many types which have been developed and manufactured by RCL are sensors for use in fuel injection systems, gas turbines, jet engines and industrial air conditioning and heating, and for sensing control of solar energy systems. Shown on these pages are a few examples.

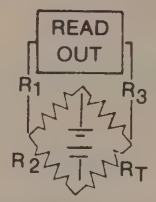
## temperature compensators

Often in sensitive circuits where coils and capacitors are used, the accuracy required is totally overwhelmed by temperature effects and variations. In other applications, temperature sensitive devices are required to measure the actual temperature for input data.

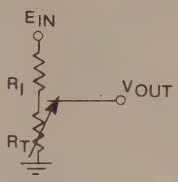
RCL engineers and manufactures temperature compensators to meet this need generally for specific user applications. A, B and C are some typical devices made to fulfill this need.




**B.** Where $R_T$ is selected to compensate for a negative capacitor change vs. temperature so that the Time Constant (RC product) remains the same regardless of ambient temperature. Size in this case is a function of RC value and working voltage.




**A.** Where $R_T$ is made with an alloy which has a specific controlled temperature coefficient to give the desired change in resistance per degree change in temperature. The bridge circuit in this case is supplied with 2 input supply terminals and 2 output or detector terminals in a module 3⁄8″T x 1″L x 1″W.

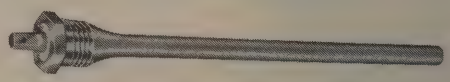



**C.** Where $R_I$ is selected to regulate current and $R_T$ is made with an alloy which will give the desired output level vs. ambient temperature. Size is governed by power dissipation requirements.

## automotive temperature sensor

A typical example of a highly specialized temperature sensor. Operating temperatures −55° to +150°C. TC range is available from 0 to +6000 PPM/°C. This construction is available using all of the special alloys described on page 8.

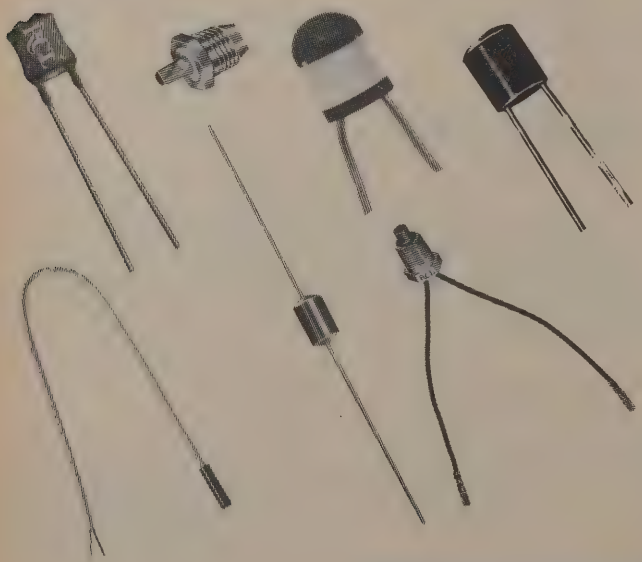
## special high temperature resistance probes



For use at extremely high temperatures and/or high altitudes. Unlimited number of commercial applications.

Maximum operating temperature: 1400°F. Various configurations available to fit specific applications.

## solar control sensors



RCL's "Special Products Division" manufactures a complete line of Temperature Control Sensors. These units have a wide variety of commercial applications, ranging from Solar Heating to Air Conditioning of industrial, commercial, and residential systems. RCL manufactures these Sensors in several configurations, some of which are illustrated below. Our staff of "Special Products" engineers are always available for consultation as to how these Sensors may best meet your specific requirements.

**STANDARD CONFIGURATIONS**

△ **AXIAL LEAD**

△ **PLUG-IN TYPES**
Specifically designed for thermostats and controllers.

△ **VARYING LEADS**
Available with leads from 6″ to 6′. Particularly adaptable for collection and dry storage chambers.

△ **METAL MOUNTED**
Sensors mounted in threaded brass or stainless steel housings. These are particularly adaptable to water storage and swimming pool systems.

**CONSULT FACTORY FOR YOUR SPECIFIC REQUIREMENTS**

# Over 30 Years' Buyer Preference Prove Our Ohmic Capability, Versatility

## AXIAL LEAD

| No. | Watts | Resistance Min. Max. | Dimensions O.D. x Lgth. |
|---|---|---|---|
| 3 AX | 3 | 0.1- 10,000 | ¼ max. x 9/16 |
| 5 AX | 5 | 0.1- 30,000 | 11/32 max. x 1 1/16 |
| 10 AX | 10 | 0.1- 50,000 | 13/32 max. x 1 5/16 |

## MIL-R-26 AXIAL LEAD

| | | | |
|---|---|---|---|
| RW67V | 6.5 | 0.10- 3,600 | 11/32 x 1 1/16 |
| RW68V | 11 | 0.10- 8,200 | 13/32 x 1 5/16 |
| RW69V | 3 | 0.10- 910 | ¼ x 9/16 |

Silicone-base coated, moisture-resistant.
TC = 0 ± 20 ppm/°C, 10 ohms and above.
Commercial equivalents available.

## FIXED LUG

| No. | Wattage | Resistance Min.-Max. | Max. Dimensions O.D. x Lgth. |
|---|---|---|---|
| 1 M | 5 | 0.1- 11,000 | 5/16 x 1 |
| 1¾ M | 10 | 0.1- 50,000 | 5/16 x 1¾ |
| 2 E | 20 | 0.25-100,000 | 7/16 x 2 |
| 2 B | 25 | 0.25-100,000 | 9/16 x 2 |
| 4 B | 50 | 0.5-175,000 | 9/16 x 4 |
| 6½ C | 100 | 1.0-300,000 | ¾ x 6½ |
| 8½ R | 160 | 1.0-300,000 | 1⅛ x 8½ |
| 10½ R | 200 | 1.0-400,000 | 1⅛ x 10½ |

## MIL-R-26 FIXED LUG

| | | | |
|---|---|---|---|
| RW29V | 11 | 0.10- 5,600 | 7/16 x 1¾ |
| RW30V | 11 | 0.10- 2,700 | 9/16 x 1 |
| RW31V | 14 | 0.10- 6,800 | 9/16 x 1½ |
| RW32V | 17 | 0.10-10,000 | 9/16 x 2 |
| RW33V | 26 | 0.10-18,000 | 9/16 x 3 |
| RW35V | 55 | 0.10-43,000 | 29/32 x 4 |

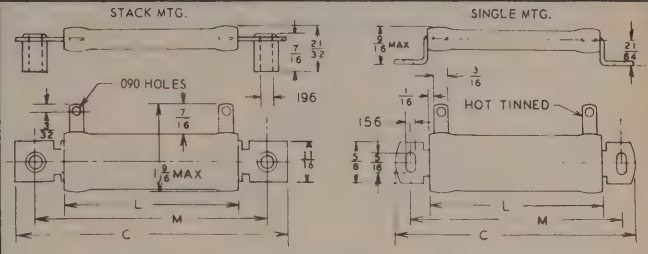
## ADJUSTABLE

| No. | Wattage | Resistance Min.-Max. | Max. Dimensions O.D. x Lgth. |
|---|---|---|---|
| 1¾ MA | 10 | 1.0- 10,000 | 5/16 x 1¾ |
| 2 BA | 25 | 1.0- 25,000 | 9/16 x 2 |
| 4 BA | 50 | 1.0-100,000 | 9/16 x 4 |
| 6 BA | 75 | 1.0-100,000 | 9/16 x 6 |
| 6½ CA | 100 | 1.0-100,000 | ¾ x 6½ |
| 8½ RA | 160 | 1.0-100,000 | 1⅛ x 8½ |
| 10½ RA | 200 | 1.0-100,000 | 1⅛ x 10½ |

## MIL-R-19365 ADJUSTABLE

| | | | |
|---|---|---|---|
| RX29V | 11 | 1- 470 | 7/16 x 1¾ |
| RX32V | 17 | 1- 910 | 9/16 x 2 |
| RX33V | 26 | 1-1,500 | 9/16 x 3 |
| RX35V | 55 | 1-3,600 | 29/32 x 4 |

## FLAT OVAL




| Watts* Free Air | Core—L | Min. Ohms | Max. Ohms | Mounting | C | M |
|---|---|---|---|---|---|---|
| 30 | 1¼ | 0.1 | 10K | Single<br>Stack | 2⅛<br>2½ | 1¾<br>2 |
| 40 | 2 | 0.2 | 30K | Single<br>Stack | 2⅞<br>3¼ | 2½<br>2¾ |
| 55 | 3½ | 0.3 | 60K | Single<br>Stack | 4⅜<br>4¾ | 4<br>4¼ |
| 65 | 4¾ | 0.4 | 85K | Single<br>Stack | 5⅝<br>6 | 5¼<br>5½ |
| 75 | 6 | 0.5 | 100K | Single<br>Stack | 6⅞<br>7¼ | 6½<br>6¾ |

## MINIATURE, FLAT OVAL

Construction similar to above large size resistors.

| WATTS* Free Air | Min. Ohms | Max. Ohms |
|---|---|---|
| 10 | 1.0 | 15 K |
| 15 | 1.0 | 25 K |
| 20 | 1.0 | 50 K |

Write for Bulletin RMF 5.0/1068

*Ratings of large and miniature, flat oval resistors based on mounting on steel panel 10" x 10" x .040". When mounted on non-metallic surface, reduce wattage approximately 15%.

## RIBBON-WOUND RESISTORS

| Watts | Core Size D | Core Size L | Ohms Min. Res. | Ohms Max. Res. | Watts | Core Size D | Core Size L | Ohms Min. Res. | Ohms Max. Res. |
|---|---|---|---|---|---|---|---|---|---|
| 400 | 1⅛ | 11¼ | 0.24 | 18.00 | 135 | ¾ | 5 | 0.06 | 4.25 |
| 375 | 1⅛ | 10½ | 0.22 | 16.50 | 105 | ¾ | 4 | 0.04 | 3.00 |
| 300 | 1⅛ | 8½ | 0.17 | 13.00 | 100 | ¾ | 3½ | 0.03 | 2.40 |
| 240 | 1⅛ | 6½ | 0.11 | 8.20 | 135 | 9/16 | 6 | 0.06 | 5.50 |
| 185 | 1⅛ | 5 | 0.09 | 6.40 | 105 | 9/16 | 5 | 0.05 | 3.65 |
| 180 | ¾ | 6½ | 0.08 | 6.00 | 90 | 9/16 | 4 | 0.04 | 2.75 |

Available with adjustable tap bands or with tapped windings.

**NON-INDUCTIVE RESISTORS:** for high frequency power circuits. Available in all fixed-lug types, 10 watts and larger. Standard tolerances: ±10%.

**RESISTANCE TOLERANCES:** Standard: ±5%, 1.0 ohm and over. Special: down to ±1%.

***Write For Complete Catalog***

# resistors, inc.

CUSTOM DESIGNING,
ENGINEERING, MANUFACTURING

5226 West 26th Street, Chicago, Illinois 60650
Area Code: 312 OLympic 2-7555

Since its inception in 1954, R-OHM Corporation has been dedicated to the task of improving and modernizing manufacturing techniques for metal and carbon film resistors and discrete semiconductors. Today, with specially designed, highly automated assembly lines, we are able to mass produce these products under exceptionally strict quality and reliability controls. Where applicable, devices are manufactured to meet or exceed military specifications. The R-OHM line is recognized throughout the industry for its high level of quality and reliability. Through efficient mass production techniques, we have earned an enviable reputation for service and on-time deliveries at competitive prices. We invite you to join our constantly expanding list of satisfied customers.

R.ohm
QUALITY · RELIABILITY

## CARBON FILM RESISTORS

| TYPE | RATING IN WATT 70° | MAX WORKING VOLTAGE (DC or AC RMS) | RESISTANCE TOLERANCE | RESISTANCE RANGE | GENERAL APPLICATIONS |
|---|---|---|---|---|---|
| R-10 | 0.125W | 200V | ±2%(G) ±5%(J) | 1Ω to 470kΩ (5%) (10Ω to 220kΩ 2%) | For use in general purpose low power equipment and for PC mountings. Very wide resistance values and extremely close tolerances are available. |
| R-25 | 0.025W | 250V | | .5Ω to 5.6 MΩ(5%) (10Ω to 1.5 MΩ 2%) | |
| R-50 | 0.050W | 350V | | .5Ω to 1.5 MΩ(5%) (10Ω to 3.3 MΩ 2%) | |

## METAL FILM RESISTORS (RL07—RL20 TYPE)

| TYPE | RATING IN WATT 70° | MAX WORKING VOLTAGE (DC or AC RMS) | RESISTANCE TOLERANCE | RESISTANCE RANGE | GENERAL APPLICATIONS |
|---|---|---|---|---|---|
| CRB1/4 | 0.25W | 250V | ±2%(G) ±1%(F) | 10Ω to 1.0 MΩ | Precision resistor, metal film coated type. Reliability exceeds all requirements of MIL-R-22684. Ideal for high quality level electronic equipment. |
| CRB1/2 | 0.50W | 350V | | 10Ω to 1.2 MΩ | |

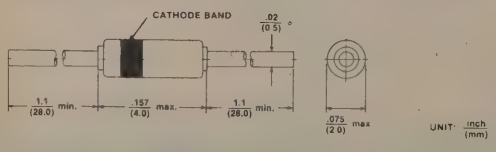
## METAL FILM RESISTORS (RN55—RN60 TYPE)

| TYPE | RATING IN WATT 70° | MAX WORKING VOLTAGE (DC or AC RMS) | RESISTANCE TOLERANCE | RESISTANCE RANGE | GENERAL APPLICATIONS |
|---|---|---|---|---|---|
| CRA1/8 | 0.125W | 200V | ±0.5%(D) ±1.0%(F) | 10Ω to 1.0 MΩ(1%) 49.9Ω to 100kΩ(.5%) | Precision resistor, metal film coated type. Reliability exceeds all requirements of MIL-R-10509F. Ideal for high quality level electronic equipment. |
| CRA1/4 | 0.25W | 300V | | 10Ω to 1.2 MΩ(1%) 49.9Ω to 301KΩ(.5%) | |

## DIODES-Silicon Switching

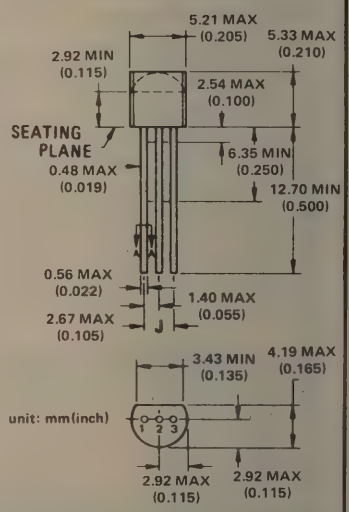
### Device Types (DO-35)

| | | | |
|---|---|---|---|
| 1N4148 | 1N4446 | 1N4606 | 1N3606 |
| 1N4149 | 1N4447 | 1N914 | 1N914A |
| 1N4150 | 1N4448 | 1N916 | 1N916A |
| 1N4151 | 1N4449 | 1N3600 | 1N914B |
| 1N4152 | 1N4450 | 1N3604 | 1N916B |
| 1N4153 | 1N4454 | 1N3605 | 1N3064 |
| 1N4154 | | | |




## SILICON SMALL SIGNAL TRANSISTORS NPN and PNP (Epoxy TO-92)

- General Purpose, Low Level, Low Noise, Amplifiers
- General Purpose, Low Noise Amplifiers
- General Purpose, Medium Power Amplifiers
- General Purpose Amplifiers & Switches, Audio to 500 MHz
- High Voltage Amplifiers & Switches
- Darlington Amplifiers
- General Purpose, High Voltage, Low Noise Amplifiers

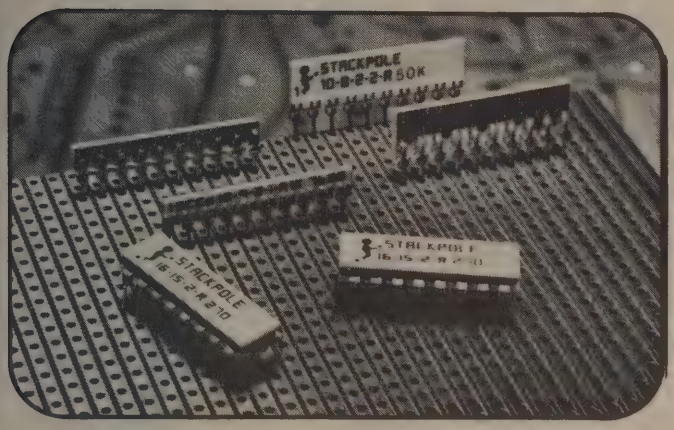



**For more detailed information, contact your local R-OHM sales office or R-OHM Corporation, 16931 Milliken Avenue, Irvine, CA 92716. (714) 546-7750 TWX: 910-595-1721**

# A CONSTANT FORCE IN A CHANGING WORLD

# STACKPOLE

## SIP & DIP Thick Film Resistor Networks



- High reliability thick film resistors
- Strong 96% alumina substrate
- .100″ and .125″ terminal spacing
- Wide selection of resistance values
- Fast delivery
- DIP and molded SIP packages compatible with standard IC automatic insertion equipment
- Meets or exceeds physical outline requirements of MIL-STD. 202E for resistor networks
- Standard SIPs .350″ high, Mini-SIPs™ .175″

## Performance Specifications

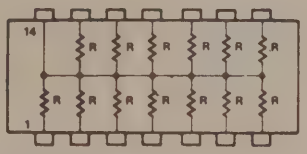
| | |
|---|---|
| Resistance Tolerance | ±2% |
| Resistance Temperature Coefficient | −55°C to 125°C <±100PPM/°C (±.01%/°C) |
| Resistance Voltage Coefficient | 0.02%/V Typ. |
| Power Rating | |
| Single Resistor (+70°C Case) | 0.250 W<br>0.125 W |
| Total Package (+70°C Case) | 14 lead 1.5 W<br>16 lead 1.75 W |
| Resistance Temperature Coefficient Tracking | <50ppm/°C max. (.005%/°C) |
| Operating Temperature Range | −55°C to +125°C |
| Storage Temperature Range | −65°C to +150°C |

Maximum rated voltage is 300.

## Mechanical Specifications

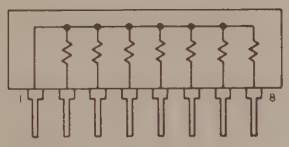
- Substrate Material — 96% Alumina Ceramic
- Lead Material — 60/40 Plating
- Conductive Material — Paladium Silver<br>Palladium Platinum Silver
- Resistive Material — Birox/Bismuth Ruthenate
- Lead Solderability — Meets Req. of MIL-STD. 202E and MIL-STD. 883, Method 2003

## Standard Configurations

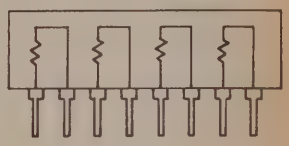



14 or 16 Lead DIPS

14 or 16 Lead DIPS




4 to 12 Lead SIPS



4 to 12 Lead SIPS

## Custom Networks

Special resistance values and combinations available for specific applications. Please contact factory for quotation.

## Distribution

Many standard values available from your local Stackpole Distributor for immediate delivery.

## Ordering Information

When ordering, please indicate whether DIP, SIP or Mini-SIP, number of leads, number of resistors and resistance value.

STACKPOLE
COMPONENTS COMPANY
DEPT. EM, P.O. BOX 14466, RALEIGH, N.C. 27610 • PHONE (919) 828-6201 • TWX 510-928-0520

# Stackpole Fixed-Composition Resistors

Since the earliest days of radio, Stackpole fixed-compositon resistors have been continually updated and improved. They are among the most reliable and widely used components available for commercial, industrial, and military applications.

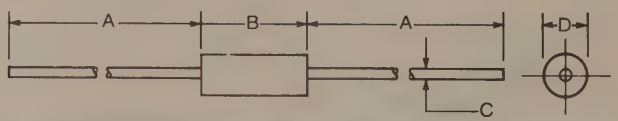
Stackpole's commercial-type resistors meet the requirements of MIL-STD-202, Method 208, and our military type far exceeds the stringent requirements of MIL-R-39008. We are qualified by the military to S level of established reliability, which specifies 0.001% failure rate per 1000 hours.

Stackpole resistors are 100% tested, which enables you to cut your inspection costs. Solderability, load life, and humidity-temperature characteristic checks insure constant control of quality. The result is uniformity, plus reliability.

To secure additional information, request Stackpole Bulletin 80-101. Stackpole Carbon Company, Electronic Components Division, Kane, Pa. 16735.
Or telephone: (814) 837-7000.
TWX: 510-695-8404.

## SPECIFICATIONS

| Type | Power at 70° C | Resistance Range | Tolerance | Voltage Rating (RMS) | Maximum Ambient Temperature | Dimensions in Inches (millimeters) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | A | B | C | D |
| RC05 | ⅛ watt | 2.2 ohms to 1 megohm | ±5, 10, 20% | 150V | +130° C | 0.984 (25,0) | 0.145 (3,68) | 0.016 (0,4) | 0.062 (1,57) |
| RC07 | ¼ watt | 2.2 ohms to 5.6 megohms | ±5, 10, 20% | 250 V | | 1.102 (28,0) | 0.248 (6,3) | 0.024 (0,6) | 0.094 (2,4) |
| RCR07 | | 10 ohms to 1 megohm | ±5, 10% | | | | | | |
| RC20 | ½ watt | 2.2 ohms to 22 megohms | ±5, 10, 20% | 350 V | | 1.417 (36,0) | 0.374 (9,5) | 0.0275 (0,7) | 0.142 (3,6) |
| RCR20 | | 10 ohms to 22 megohms | ±5, 10% | | | | | | |
| RC32 | 1 watt | 10 ohms to 100 megohms | ±5, 10, 20% | 500 V | +150° C | 1,500 (38,10) | 0.562 (14,29) | 0.040 (1,04) | 0.225 (5,72) |
| RCR32 | | 10 ohms to 22 megohms | ±5, 10% | | | | | | |
| RC42 | 2 watts | 10 ohms to 22 megohms | ±5, 10, 20% | 750 V | | 1.500 (38,10) | 0.688 (17,46) | 0.045 (1,14) | 0.318 (7,94) |
| RCR42 | | 10 ohms to 22 megohms | ±5, 10% | 500 V | | | | | |




# Carbon-Film Resistors

Stackpole carbon-film resistors offer reliable performance in both commercial and industrial applications where high stability and uniformity of characteristics are required. Interchangeable in size with composition resistors, they are compatible with commercially available automatic sequencing and insertion equipment.

Stackpole carbon-film resistors are available in bulk package, strip package, cut and formed, and lead reel tape. See our Bulletin 86-101.

To obtain additional information, write Stackpole Carbon Company, Electronic Components Division, Kane, Pa. 16735 • Telephone: (814) 837-7000. TWX: 510-695-8404.

## SPECIFICATIONS

| Max. Power Rating | Tolerance | Resistance Range | Voltage Rating | Operating Temp. Range | Maximum Dimensions in Inches (Millimeters) | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | A | B | C | D |
| ¼ watt | ±2, 5% | 4.7 ohms to 4.7 megohms | 250 V | -55° C to 150° C | 1.102 ± 0.039 (28 ± 1) | 0.250 ± 0.015 (6.35 ± 0.4) | 0.024 ± 0.001 (0.61 ± 0.03) | 0.091 ± 0.008 (2.3 ± 0.2) |

STACKPOLE®
the revolutionary resistor people.

# Stackpole Special Purpose Resistors...

Special purpose industrial resistors are used in many applications involving high voltage and/or high energy surges. Resistors spotted at high voltage load points, such as spark plugs, distributor points, or coil leads will limit spurious high frequency signals from being emitted or carried on transmission lines. And large resistors are the perfect answer for use in circuit breakers.

Ceramic resistors with wide ranges of resistance values can be specifically designed to withstand adverse temperature and atmospheric conditions. Where moving contact to the suppression resistor is needed, a carbon-graphite brush type resistor can be used. Electrical connection can be established by means of metallized faces.

Special purpose resistors consist of carbon particles dispersed in a ceramic matrix or thermally cured organic resins containing inert fillers.

**APPLICATIONS:** Circuit Breakers, RFI Suppression, Lightning Arrestors, Heaters, Thermostat Controls, High Power Resistors, RF Termination, Spark Plug, Distributor, Bleeder.

## DESIGN GUIDELINES

1. Submit sketch or drawing of part with space limitations.
2. Describe function of part with resistance required (ohms) and mechanical tolerances (±).
3. Physical size, O.D., I.D., and length with tolerances.
4. Volts, AC and DC; wattage; current.
5. Contacts: Copper, brass or monel metal spray, or attached leads.
6. Lead length and diameter.
7. Operating temperature and maximum temperature; in air, oil or other?
8. Is application steady state or pulse? If pulse, list duty cycle, peak voltage, and peak current.
9. Provide sample of resistor now being used, if any.
10. Describe other engineering parameters such as continuous or intermittent power level, operating temperature requirements, applied voltages or other ambient conditions.

## CERAMIC RESISTORS

Thermally stable, chemically inert, ceramic resistors are suitable for adverse conditions. They withstand high energy dissipation at high temperature and voltage levels such as encountered in high voltage surge equipment, dummy loads, high frequency radiation suppression and other high voltage-power applications.

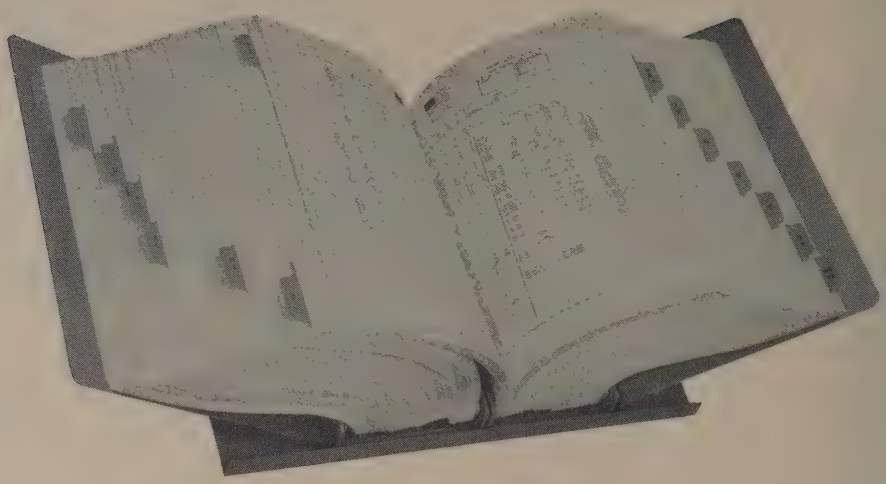
## ORGANIC RESISTORS

Organically bonded resistors are less expensive alternative for less stringent environments. They offer an inexpensive solution in applications requiring high resistance values where only medium steady state head dissipation is mandatory, or where high energy levels are momentary such as lightning arrestors.

**Specification Data**

| Characteristics | Ceramic Resistors | Organic Resistors |
|---|---|---|
| Maximum Steady State Power Density | 12 watts/in.$^3$ (.75w/cm$^3$) | 10 watts/in.$^3$ (.6w/cm$^3$) |
| Maximum Transient Energy Density | 400 Joules/cm$^3$) in Air or Inert Atmosphere | 100 Joules/in.$^3$) (10 J/cm$^3$) |
| Maximum Voltage Gradient | 10 Kilovolts/in. (4KV/cm) | 8 Kilovolts/in. (3KV/cm) |
| Resistivity Range | 2 ohm-cm. to 10,00 ohm-cm. | 2 ohm-cm. to 200 megohm-cm. |
| Maximum Operating Temperature | 250° C | 120° C |
| Voltage Coefficient | 0.003%/volt max. | .03%/volt max. |
| Temperature Coefficient | −0.13%/° C max. | ± .03%/° C max. |
| Size Range: up to 18" long (45 cm) up to 6" diameter (15 cm) | | |

STACKPOLE
ELECTRONIC COMPONENTS DIV.
ST. MARYS, PENNSYLVANIA 15857
Phone 814-781-1234 • TWX 510-693-4511



# UNITED PRICING REPORTS

## the single source that speeds up invoicing, pricing, quoting, purchasing and estimating

Electronic component prices change so fast, you'd need a team of people just to keep up.

United Pricing Reports is the better way. When you subscribe to Pricing Reports you receive 1500 pricing sheets (3000 pages) of the latest prices, as of the date we ship them to you.

This gives you, in a single source, up-to-the minute selling prices on more than 500,000 electronic components.

United Pricing Reports gives you accurate resale prices at the exact moment you need them. Not hours or days later. So it helps you eliminate frantic phone calls, letter writing and catalog scanning to check on prices when you write an invoice or type a purchase order.

## Twice weekly price updates.

One week after you receive your Pricing Reports source book (1500 pricing sheets) you begin receiving twice weekly price updates. You simply take these new price pages and replace the now obsolete pages with them.

The whole process is simple. All information is organized alphabetically by manufacturer. And each manufacturer's price schedule is listed by part number in numerical/alphabetical sequence.

One more thing. When we promise twice weekly updates, we deliver. 52 weeks a year, consistently. Not monthly or every other month. We have a tradition of delivery on our promises, and we're certainly not going to stop now.

*NITED TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500 TWX-510/222-16*

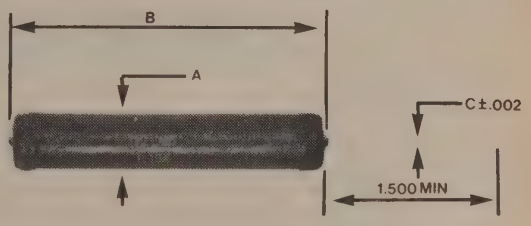
TEL ABS

POWERPOWERPOWERPOWERP

154 Harvey Road P.O. Box 375 Londonderry, N.H. 03053 TWX 710-220-1844 Tel. (603) 625-8994

# TYPE VR series

## vitreous power




An essential factor for reliable resistor performance is in the protection that the resistor's enclosure provides to its relatively fragile resistance element.

This protection must withstand the mechanical conditions of handling in use, the thermal effects of the resistor operation under adverse situations and the chemical environments imposed during assembly or life. Additionally, it functions as the medium through which the heat is extracted from the element and dissipated.

A ceramic enclosure affords the ultimate in this type of protection for a wirewound power resistor.

The hard, smooth vitreous surface resists the effects of severe abrasion and rough handling during circuit assembly and through-out life.

Overloads can be sustained without damage to the enclosure because the assembly has already been subjected to red-heat when this coating was applied. There is no attendant flame or burning on severe overload, since there is no organic material to burn.

Both this high temperature capability and the good thermal conductivity of the ceramic material combine to allow higher temperature operation and higher wattage ratings for resistors with this coating as an enclosure. The high heat conductivity of this ceramic in direct contact with the individual turns of the resistance wire provides an excellent transfer of the heat generated in the wire. There is no thermal insulation to cause hot spots.

The inert character of the ceramic coating provides the resistor with a resistance to chemical conditions, which avoids environmental corrosion, and affords solvent resistance during cleaning operations after circuit assembly. The resistor's marking is also an inert ceramic material so that identification is permanent under all conditions.

| Style | Watts @ 325°C Temp. Rise | DIMENSIONS | | RESISTANCE | | LEAD SIZE | |
|---|---|---|---|---|---|---|---|
| | | Diameter "A" | Length "B" | Min. | Max. | Length | Diameter |
| VR1 | 1.0 | .093" ± .031" 2.36mm ± .78 | .406" ± .031" 10.31mm ± .78 | 1.0Ω | 1.3KΩ | 1.5" 38.1mm | .020" .5mm |
| VR2 | 2.0 | .187" ± .031" 4.75mm ± .78 | .375" ± .062" 9.25mm ± 1.57 | 1.0Ω | 1.2KΩ | 1.5" 38.1mm | .032" .81mm |
| VR3 | 3.0 | .187" ± .031" 4.75mm ± .78 | .500" ± .062" 12.7mm ± 1.57 | 1.0Ω | 3KΩ | 1.5" 38.1mm | .032" .81mm |
| VR5 | 5.0 | .187" ± .031" 4.75mm ± .78 | .937" ± .062" 23.8mm ± 1.57 | 1.0Ω | 6KΩ | 1.5" 38.1mm | .032" .81mm |
| VR7 | 7.0 | .312" ± .062" 7.92mm ± 1.57 | 1.000" ± .062" 25.4mm ± 1.57 | 1.0Ω | 10KΩ | 1.5" 38.1mm | .032" .81mm |
| VR10 | 10.0 | .312" ± .062" 7.92mm ± 1.57 | 1.750" ± .062" 44.45mm ± 1.57 | 1.0Ω | 17.5K | 1.5" 38.1mm | .032" .81mm |
| VR12 | 12.5 | .375" ± .062" 9.52mm ± 1.57 | 1.750" ± .062" 44.45mm ± 1.57 | 1.0Ω | 43KΩ | 1.5" 38.1mm | .032" .81mm |

Tolerances: 5% for 1Ω and higher. 1% available on special request in most cases. 10% for values below 1Ω.

Temperature coefficient: 30PPM for 10Ω and higher. Below 10Ω, 90PPM. Special T.C.'s are available.

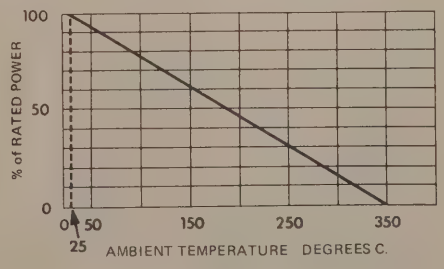
Dielectric strength: 1000 volts AC on 2 watt and higher. 500 volts AC on 1 watt.

Wattages: 1 watt to 12.5 watts @ 25°C ambient. Derated to 0 @ 375°C.

Inductance: Varies with each resistance value and size. Contact factory for information. Non-inductive resistors available.

Welded construction.

Meets or exceeds MIL-R-26




**We do just one thing, and one thing well!**

TEL LABS

# POWERPOWERPOWERPOWERF

154 Harvey Road P.O. Box 375 Londonderry, N.H. 03053 TWX 710-220-1844 Tel. (603) 625-8994

## Beryllium Oxide Core

Use of beryllium core allows greater power ratings than exhibited by conventional resistors of equal size.

| TEL LABS STYLE | MIL DESIG. (RW) | DIAMETER (A) | LENGTH (B) | LEAD SIZE (C) | Wattage Rating U 275° C | Wattage Rating V 350° C | Maximum Resistance MIL | Maximum Resistance TEL LABS |
|---|---|---|---|---|---|---|---|---|
| BL1 | RW81 | .078 ± .015 | .265 ± .015 | .020 | 1 | 1.5 | 649^ | 3.4K |
| BL2 | | .090 ± .031 | .395 ± .031 | .020 | 1.5 | 2 | – – – | 4.9K |
| BL3 | RW80 | .090 ± .031 | .395 ± .031 | .020 | 2.25 | 2.75 | 3.16K | 10.2K |
| BL4 | | .187 ± .031 | .625 ± .062 | .032 | 4 | 5 | – – – | 25.0K |
| BL4A | | .187 ± .031 | .825 ± .062 | .032 | 4.5 | 6.5 | – – – | 42.2K |
| BL5 | | .250 ± .031 | .500 ± .062 | .032 - .040 | 5 | 7 | – – – | 33.0K |
| BL6 | | .250 ± .031 | .625 ± .062 | .032 - .040 | 6 | 8 | – – – | 47.0K |
| BL7 | | .300 ± .062 | .950 ± .093 | .032 - .040 | 7 | 10 | – – – | 96.0K |
| BL10 | | .300 ± .062 | 1.218 ± .093 | .032 - .040 | 10 | 12 | – – – | 155.0K |
| BL10A | | .350 ± .062 | 1.815 ± .093 | .040 | 15 | 18 | – – – | 275.0K |

Same derating as shown on opposite page.

Units are manufactured using stainless steel end caps, all welded construction and high quality resistance wire.

Coating is of high quality silicone to withstand high temperature operation.

Standard tolerances and temperature coefficient as well as specials are available.

Units are supplied with axial leads.

Non-Inductive (Aryton-Perry) specify as "BLN". Maximum resistance (per chart below) would have to be divided by two.

## TYPE EH chassis mount aluminum housed

All welded construction

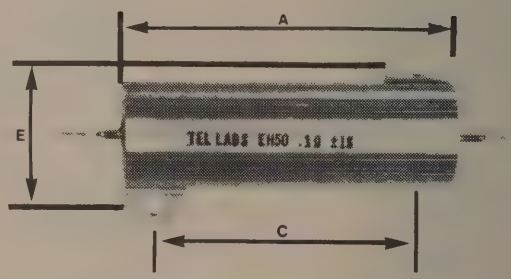
Special molding compound and process assures positive transfer of heat to the case and mounting chassis.

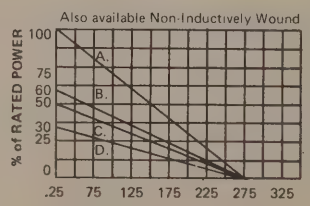
Resistance ranges — per chart below and lower values upon investigation.

Tolerances — .01% thru 5% — close tolerances on low ohms per application only.

For Non-Inductive, add "N" to style number. Maximum resistance value must be decreased by at least one half of maximum value listed in chart.

Units manufactured to meet or exceed the requirements of MIL-R-18546D.




EH5 3.0 GRAMS
EH10 5.6 GRAMS
EH25 11.7 GRAMS
EH50 25.0 GRAMS

A. EH5, 10, 25, 50 Mounted
B. EH10 Unmounted
C. EH5, 25 Unmounted
D. EH50 Unmounted

| TEL LABS STYLE | A ±.031 | C ±.005 | E ±.005 |
|---|---|---|---|
| EH5 | .600 | .444 | .490 |
| EH10 | .750 | .562 | .625 |
| EH25 | 1.062 | .718 | .781 |
| EH50 | 1.937 | 1.562 | .843 |

MOUNTING

EH25, 50 5x7x2 Aluminum Chassis
EH5, 10 4x6x2 Aluminum Chassis

| TEL LABS STYLE (Anodyzed) | WATTAGE Mounted | WATTAGE Unmounted | RESISTANCE RANGE 1% - 5% | TEMP. COEFFICIENT ±50 PPM | TEMP. COEFFICIENT ±20 PPM |
|---|---|---|---|---|---|
| EH5 | 8W | 4W | 0.1Ω to 22K | 0.1Ω to 30Ω | OVER 30Ω |
| EH10 | 10W | 6W | 0.1Ω to 40K | 0.1Ω to 50Ω | OVER 50Ω |
| EH25 | 25W | 10W | 0.1Ω to 70K | 0.1Ω to 100Ω | OVER 100Ω |
| EH50 | 50W | 12W | 0.1Ω to 250K | 0.1Ω to 300Ω | OVER 300Ω |

Meets or exceeds MIL R-18546D.

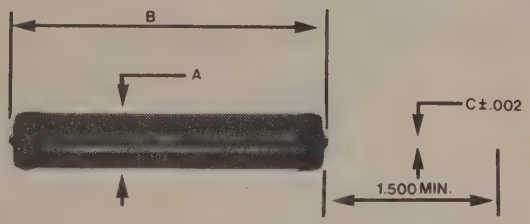
## We do just one thing, and one thing well!

TEL LABS

POWERPOWERPOWERPOWERP

154 Harvey Road P.O. Box 375 Londonderry, N.H. 03053 TWX 710-220-1844 Tel. (603) 625-8994

# TYPE EL silicone power




## MEET OR EXCEEDS MIL-R-26

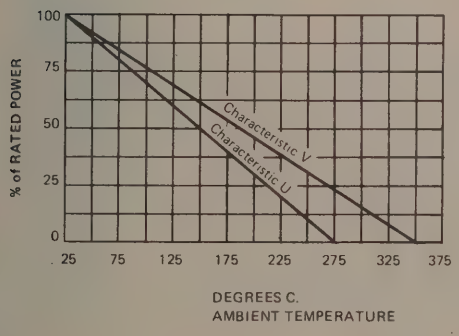
Silicone coated units with axial leads provide maximum power dissipation using the smallest package.

These may be made using standard inductive winding or non-inductive winding. Care must be taken when specifying non-inductive winding as it is possible to achieve only one half the resistance value specified for inductive winding.

A cost savings may be realized as compared to many other precision type units.

Resistance tolerances to 0.05% are available in this series.

| Tel Labs Style | Mil Desig. (RW) | Diameter (A) | Length (B) | Lead Size (C) | Wattage 275°C | Wattage 350°C | Radial Leads (special) | Radial Leads Size |
|---|---|---|---|---|---|---|---|---|
| EL¼ | | .090±.031 | .215±.031 | .020 | 0.5W | 1.0W | Yes | – |
| EL½ | | .090±.031 | .280±.031 | .020 | 0.5W | 1.0W | Yes | .020 |
| EL1A | RW70 | .090±.031 | .395±.031 | .020 | 1.0W | 1.25W | Yes | .020 |
| EL1B | | .090±.031 | .530±.031 | .020 | 1.0W | 1.25W | Yes | .020 |
| EL1C | | .135±.031 | .335±.031 | .025 | 1.0W | 2.0W | No | – |
| EL2 | | .250±.031 | .625±.062 | .032-.040 | 3.0W | 4.0W | Yes | .032 |
| EL2A | | .187±.031 | .825±.062 | .032 | 3.25W | 4.5W | Yes | .032 |
| EL2B | | .187±.031 | .625±.062 | .032 | 3.0W | 3.5W | Yes | .032 |
| EL2C | | .250±.031 | .562±.062 | .032-.040 | 3.0W | 4.0W | Yes | .032 |
| EL2D | | .250±.031 | .500±.062 | .032-.040 | 3.0W | 4.0W | Yes | .032 |
| EL2E | RW59, 69 | .195±.031 | .500±.062 | .025 | 2.5W | 3.5W | No | – |
| EL2F | | .187±.031 | .500±.062 | .032 | 2.5W | 3.0W | Yes | .032 |
| EL2G | | .187±.031 | .430±.062 | .032 | 2.5W | 3.0W | Yes | .032 |
| EL2H | | .187±.031 | .385±.062 | .032 | 2.5W | 3.0W | Yes | .032 |
| EL21 | RW79 | .195±.031 | .560±.062 | .032 | 3.0W | 3.5W | Yes | .032 |
| EL3 | | .295±.031 | .500±.062 | .032-.040 | 3.0W | 4.0W | Yes | .032 |
| EL5 | RW74 | .290±.062 | .925±.093 | .032-.040 | 5.0W | 6.0W | Yes | .032 |
| EL5A | RW57, 67 | .350±.062 | 1.000±.093 | .032-.040 | 5.0W | 6.5W | Yes | .032 |
| EL7 | | .290±.062 | 1.200±.093 | .032-.040 | 5.0W | 6.5W | Yes | .032 |
| EL7A | | .350±.062 | 1.360±.093 | .032-.040 | 5.0W | 7.0W | Yes | .032 |
| EL10A | RW58, 68 | .350±.062 | 1.815±.093 | .040 | 10.0W | 12.0W | Yes | .032 |




| STYLE | RESISTANCE 0.05% 0.1% 0.25% 0.5% | RESISTANCE 1% 2% 3% 5% | NORMAL TEMPERATURE COEFFICIENT ± 90 PPM | ± 50 PPM | ± 30 PPM | ± 20 PPM |
|---|---|---|---|---|---|---|
| EL¼ | 10^ - 950^ | 1^ - 3.4K | Below 1^ | 1^ to 6.9^ | 7^ to 999^ | 1K - 3.5K |
| EL½ | 10^ - 1K | 1^ - 7K | Below 1^ | 1^ to 9.9^ | 10^ to 799^ | 800^ - 7K |
| EL1A | 1^ - 2K | 1^ - 10K | Below 1^ | 1^ to 9.9^ | 10^ to 999^ | 1K - 10K |
| EL1B | 1^ - 4K | 1^ - 12K | Below 1^ | 1^ to 9.9^ | 10^ to 1.34K | 1.35K - 12K |
| EL1C | 1^ - 2K | 1^ - 10K | Below 1^ | 1^ to 9.9^ | 10^ to 999^ | 1K - 10K |
| EL2 | 1^ - 12K | 1^ - 40K | Below 1^ | 1^ to 9.9^ | 10^ to 4.69K | 4.7K - 40K |
| EL2A | 1^ - 10K | 1^ - 35K | Below 1^ | 1^ to 9.9^ | 10^ to 3.49K | 3.5K - 35K |
| EL2B | 1^ - 8K | 1^ - 30K | Below 1^ | 1^ to 9.9^ | 10^ to 2.99K | 3.0K - 30K |
| EL2C | 1^ - 8K | 1^ - 30K | Below 1^ | 1^ to 9.9^ | 10^ to 2.99K | 3.0K - 30K |
| EL2D | 1^ - 7.5K | 1^ - 27K | Below 1^ | 1^ to 9.9^ | 10^ to 2.49K | 2.5K - 27K |
| EL2E | 1^ - 8K | 1^ - 30K | Below 1^ | 1^ to 9.9^ | 10^ to 2.99K | 3.0K - 30K |
| EL2F | 1^ - 4K | 1^ - 20K | Below 1^ | 1^ to 9.9^ | 10^ to 2.99K | 3.0K - 20K |
| EL2G | 1^ - 2K | 1^ - 10K | Below 1^ | 1^ to 9.9^ | 10^ to 2.99K | 3.0K - 10K |
| EL2H | 1^ - 2K | 1^ - 9K | Below 1^ | 1^ to 9.9^ | 10^ to 2.99K | 3.0K - 9K |
| EL21 | 1^ - 8K | 1^ - 30K | Below 1^ | 1^ to 9.9^ | 10^ to 2.99K | 3.0K - 30K |
| EL3 | 1^ - 8.3K | 1^ - 30.5K | Below 1^ | 1^ to 9.9^ | 10^ to 2.99K | 3.0K - 30.5K |
| EL5 | .5^ - 22K | .1^ - 70K | Below 1^ | 1^ to 9.9^ | 10^ to 7.49K | 7.5K - 70K |
| EL5A | .5^ - 35K | .1^ - 90K | Below 1^ | 1^ to 9.9^ | 10^ to 8.39K | 8.4K - 90K |
| EL7 | .5^ - 35K | 1^ - 90K | Below 1^ | 1^ to 9.9^ | 10^ to 8.24K | 8.25K - 90K |
| EL7A | .5^ - 45K | .1^ - 100K | Below 1^ | 1^ to 9.9^ | 10^ to 9.99K | 10K - 100K |
| EL10A | .5^ - 75K | .1^ - 275K | Below 1^ | 1^ to 9.9^ | 10^ to 30.99K | 31K - 175K |

***We do just one thing, and one thing well!***

TEL LABS

# PRECISIONPRECISIONPRECISION

154 Harvey Road P.O. Box 375 Londonderry, N.H. 03053 TWX 710-220-1844 Tel. (603) 625-8994

## TYPE SL series

| MIL R 93D DESIG. | TEL LABS STYLE | A ±.015 | B ±.031 | MAX. VALUE MIL. | MAX. VALUE COMM. | WATTAGE MIL. | WATTAGE COMM. | MAX. V. MIL. | MAX. V. COMM. | HOLE CLEARANCE SCREW # |
|---|---|---|---|---|---|---|---|---|---|---|
| | SL21 | 500 | 500 | | 350K | 0 25W | 0 5W | 300 | 600 | 6 |
| RB16 | SL31 | 500 | 687 | 1 MEG | 1 5 MEG | 0 33W | 0 6W | | 600 | 6 |
| RB17 | SL50 | 562 | 1 000 | 2 MEG | 3 5 MEG | 0 5W | 1 0W | 600 | 1200 | 6 |
| RB18 | SL60 | 750 | 1 250 | 3 01 MEG | 4 25 MEG | 0 75W | 1 5W | 600 | 1200 | 6 |
| RB19 | SL70 | 906 | 2 125 | 6 03 MEG | 10 MEG | 1 0W | 2 0W | 900 | 2400 | 6 |

Conformal and Shell encapsulated

Excellent under critical environmental conditions Available with .032 Leads. Specify Letter "X" after style (SL21X)

Temperature Coefficients from 0±20 PPM°C to 0±5 PPM/°C

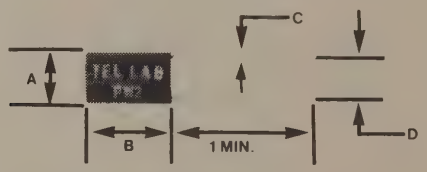
Matching in sets to 2 PPM

NonInductively Wound

Stabilities available on a production basis to 0.005%/year.

## TYPE PW series

Conformal and Shell Encapsulated. Designed Specifically for Printed Circuit Applications. Temperature coefficients from 0±20 PPM to 0±5 PPM Matching to 2 PPM. Inductive or Noninductive Winding. Stabilities available on a production basis to 0.005%/year.

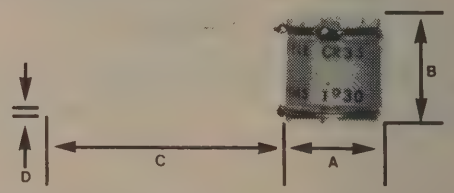



| Mil R 93D Desig. | Tel Labs Style | A ± .015 | B ± .032 | C | D ± .015 | MAX. VALUE Mil. | MAX. VALUE Comm. | WATTAGE Mil. | WATTAGE Comm. | MAX. V. Mil. | MAX. V. Comm. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RB71 | PW1 | .250 | .312 | .025 | .200 | 100K | 125K | .125W | .15W | | 300 |
| | PW2 | .250 | .406 | 025 | .200 | | 175K | | .2W | | 600 |
| RB70 | PW20 | .375 | .500 | .032 | .200, .250 | 301K | 375K | .250W | .33W | 150 | 600 |
| | PW40 | .468 | .625 | .032 | .250, .300 | | 500K | | .3W | | 600 |
| | PW31 | .500 | .625 | 032 | .250, .300 | | 1.75 Meg | | .6W | | 600 |
| | PW10 | .406 | 1.250 | .032 | .250, .300 | | 1.0 Meg | | 1.0W | | 1200 |
| | PW50 | .531 | 1.000 | .032 | .250, .300 | | 3.0 Meg | | 1.0W | | 1200 |

## TYPE CR CA CL series

CERAMIC CORE RESISTORS
"CR" Ceramic Radial Leads
"CA" Ceramic Axial Leads
"CL" Ceramic Lugs

Ceramic spool type unit. Windings sealed in varnish. Hole provided for screw mounting. Operate from -65°C to 105°C. Inherently good stability.
Excellent for use under laboratory conditions and most commercial applications.




| Style | Diameter A ±.015 | Length B ±.031 | Lead Diam. D | Max Value (.0005 Wire) | Wattage | Max. V | Hole (clearance) Screw # |
|---|---|---|---|---|---|---|---|
| CR16 | .250 | .250 | 0.20 | 100K | 0.1W | 200 | 0 |
| CR1 | .250 | .406 | .020-0.25 | 400K | 0.15W | 400 | 2 |
| CR23 | .281 | .343 | .020-.025 | 250K | 0.15W | 200 | 2 |
| CR18 | .343 | .312 | .020-.025 | 400K | 0.2W | 200 | 6 |
| CR2 | .250 | .687 | .020-.025 | 1.25 Meg. | 0.25W | 400 | 0 |
| CR20 | .375 | .437 | .020-.032 | 1.0 Meg. | 0.25W | 200 | 4 |
| CR25 | .500 | .437 | .025-.032 | 1.5 Meg. | 0.33W | 400 | 6 |
| CR27 | .375 | .656 | .025-.032 | 1.5 Meg. | 0.5W | 400 | 4 |
| CR31 | .500 | .625 | .025-.032 | 3.0 Meg. | 0.5W | 400 | 6 |
| CR35 | .500 | .562 | .025-.032 | 3.25 Meg. | 0.5W | 400 | 6 |
| CR53 | .500 | 1.000 | .025-.032 | 6.0 Meg. | 1.0W | 800 | 6 |
| CR60 | .750 | 1.250 | .025-.032 | 6.0 Meg. | 1.5W | 800 | 6 |
| CR71 | .812 | 2.093 | .025-.032 | 20.0 Meg. | 2.5W | 1600 | 6 |

1. All units above may be supplied with Axial Leads, specify "CA".
2. Lugs may be supplied on the following; CL25, CL31, CL35, CL53, CL60, CL71

**We do just one thing, and one thing well!**

TEL LABS

# PRECISIONPRECISIONPRECISION

154 Harvey Road P.O. Box 375 Londonderry, N.H. 03053 TWX 710-220-1844 Tel. (603) 625-8994

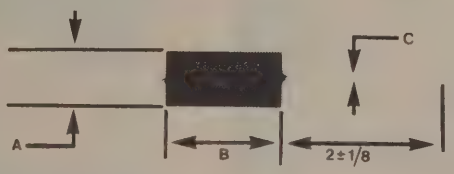
## TYPE SA epoxy

DESIGNED TO MEET OR EXCEED MILR93D

All units represented may be modified for minimum inductance and capacitive effects at frequencies above the audio range. Rise and decay time characteristics are measured from 10% to 90% of peak pulse amplitude with a 100 kilocycle pulse input.

Temperature coefficients are available to 0 ± 4PPM/°C. and T.C. matches are available to 2PPM/°C.

Stabilities of 0.005% per year are available on a production basis.



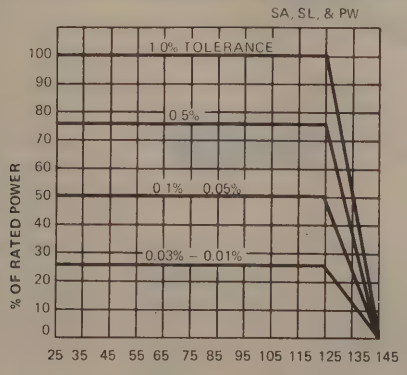

| Tel Labs Style | Mil R93D Desig. | Diam. A ± .015 | Length B ± .031 | Lead Diam. C. | MAX. VALUE Mil. | MAX. VALUE Comm. | WATTAGE Mil. | WATTAGE Comm. | MAX. VOLTAGE Mil. | MAX. VOLTAGE Comm. |
|---|---|---|---|---|---|---|---|---|---|---|
| SA1 | RB55 | .250 | .500 | .032 | 226 K | 1.1 Meg | .15W | .3W | 400 | 400 |
| SA2 | RB54 | 250 | .750 | .032 | 448 K | 2 Meg | .25W | .4W | 300 | 400 |
| SA3 | RB53 | .375 | .750 | .032 | 750 K | 8 Meg | .333W | .5W | 300 | 400 |
| SA4 | RB52 | 375 | 1 000 | 032 | 1 5 Meg | 10 Meg | 5W | 75W | 600 | 800 |
| SA5 | RB57 | .500 | 1.000 | .032 | 2 Meg | 16 Meg | 75W | 1 0W | 800 | 1000 |
| SA6 | RB58 | .500 | 1.531 | .032 | 3 Meg | 24 Meg | 1.0W | 1.5W | 900 | 1200 |
| SA7 | RB59 | .500 | 2.031 | .032 | 5 11 Meg | 24 Meg | 1 25W | 2 0W | 1200 | 1800 |
| SA11 | | .250 | .625 | .032 | | 400 K | | .33W | | 800 |
| SA13 | | .312 | .937 | .032 | | 1.2 Meg | | .5W | | 800 |
| SA16 | RB56 | .250 | .375 | .032 | 127 K | 205 K | 125W | .25W | 200 | 200 |
| SA19 | | 250 | .250 | .032 | | 500 K | | .2W | | 200 |
| SA18 | | .500 | .500 | .032 | | 3 Meg | | .5W | | .500 |

## subminiatures

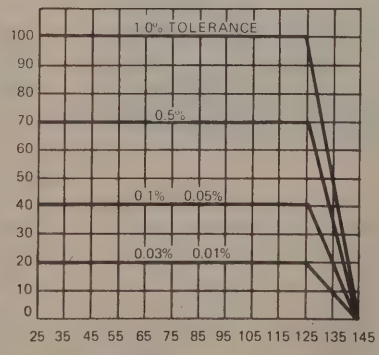
| Tel Labs Style | Diameter A ±.015 | Length B ±.031 | Lead Diam. C. | Maximum Value | Maximum Wattage | Maximum Voltage |
|---|---|---|---|---|---|---|
| SA9 | 135 | 312 | .025 | 400 K | 08W | 100 |
| SA10 | .185 | .500 | .025 | 500 K | .2W | 100 |
| SA17 | 109 | 270 | 020 | 200 K | 05W | 100 |
| SA20 | 165 | 500 | 025 | 400 K | 150W | 100, 200 |
| SA21 | 187 | 375 | 025 | 500 K | .125W | 100, 200 |
| SA22 | 150 | 400 | 025 | 190 K | .07W | 100 |
| SA24 | 125 | 250 | .020 | 75 K | .05W | 100 |
| SA25 | .110 | 300 | 020 | 85 K | .05W | 100 |
| SA26 | .125 | 375 | .025 | 140 K | 05W | 100 |
| SA29 | 100 | 300 | .025 | 80 K | 05W | 100 |
| SA30 | .200 | .405 | .025 | 550 K | .13W | 100 |
| SA31 | .100 | 220 | .020 | 70 K | .04W | 100 |

## Derating Charts

### standard series




### subminiatures

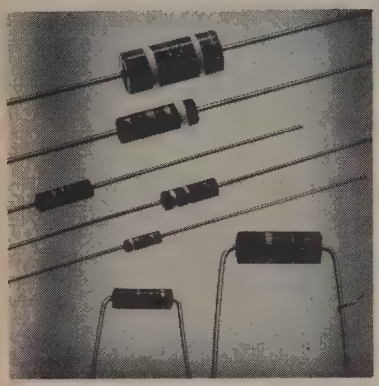



**We do just one thing, and one thing well!**

# TRW IRC RESISTORS

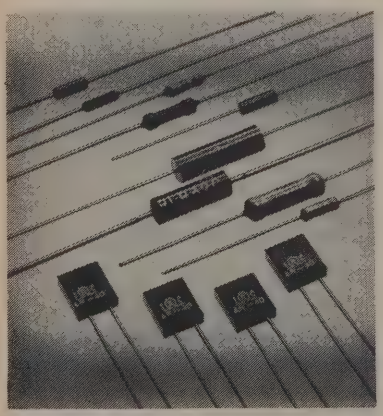
## You get exactly the resistor you need for *your* application.

## No compromises. No "favorites." Just quality.



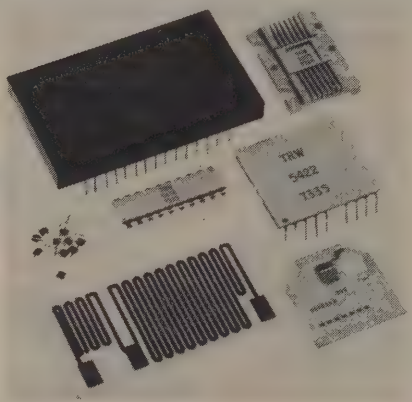
**Carbon comp.**

*Billions* used in consumer, industrial, military applications. TRW/IRC carbon comp. capability ranges from standard commercial types through established reliability RCR's, to ultra-high range ($10^{11}$ ohms). Where you're using carbon comp.'s in automated assembly, TRW/IRC packaging options can help cut the cost of interfacing with your machines. Card packs, lead tape reels, cut and formed leads...we'll be glad to explore the potential economies with you.



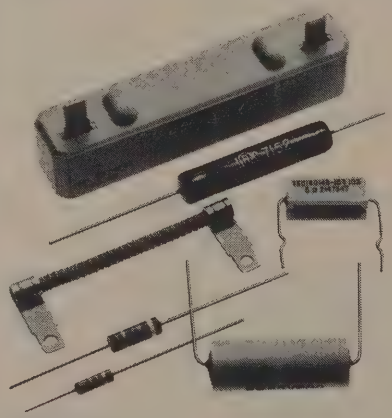
**Metal Film**

TRW/IRC has brought the state of the art in thin-film to a performance level equaling high-stability wirewounds. Capabilities include resistors with tolerances to ± 0.01% and ± 3 PPM T.C. ...high-rel units... precision subminiatures...and, of course the popular RN's. You can also look at alloy films offering high-temperature and high-voltage capability at low cost.



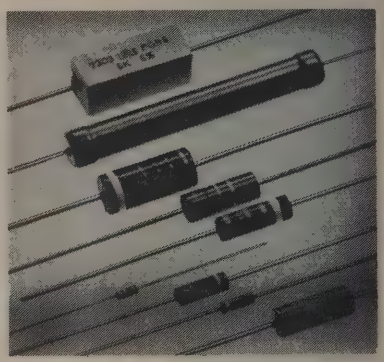
**Resistive Networks**

Advanced resistor technology here. These IC compatible, precision tantalum-film circuits provide inherent low noise, excellent stability, and hermetic performance without hermetic cost. Tolerances from 5% to 0.05% available in custom designs.
TRW/IRC also offers the industry's most complete line of discrete fixed resistors.



**Wirewound**

The line starts with molded wirewound resistors—"space-savers" that bridge the cost-performance gap between composition resistors and precision wirewounds.
It proceeds to standard, non-insulated types for appliance/automotive use...to precision subminiatures offering high power density... to low cost fusible, flameproof units for consumer and industrial applications... to tubular and flat power wirewounds with ratings to 250 W.



**Metal Glaze™**

This is TRW/IRC's thick-film technology—for all types of low power resistor applications. Metal Glaze is widely accepted for its built-in power handling reliability, resistance range, and cost effectiveness. Numerous standard and special designs—precision, semi-precision, flameproof, high-rel, high-voltage.

**All types...all technologies... one source**

To wrap it up, TRW/IRC offers you the most complete line of fixed resistors in the business, with many of the popular types available from one source— your local TRW/IRC distributor. Having a direct pipeline to each of our plants, he can give you fast delivery.

Contact your local TRW sales office for application assistance, custom designs, and special engineering help when you need it. TRW/IRC Resistors, an Electronic Components Division of TRW, Inc. Plants at Boone, N.C., Burlington, Iowa, Corpus Christi, Texas and Philadelphia, Pa. Write TRW/IRC Resistors, 401 N. Broad St., Philadelphia, Pa. 19108. Or call (215) 923-8230.

TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., 401 N. BROAD ST., PHILADELPHIA, PA. 19108 (215) 922-8900

# TRW IRC RESISTORS

TRW/IRC RESISTORS

## On the shelf... When you want them. Where you want them.

The TRW/IRC resistors listed in the table below are those usually carried in stock by our distributors. They're the resistors you're most likely to need, or at least, need in a hurry. When you do, chances are your nearby TRW/IRC distributor can fill your order from his shelves. Other parts and styles are available as well, although not always from stock. Ask your distributor, he'll be happy to discuss your special local stock needs with you.

### GENERAL PURPOSE RESISTOR

**Carbon Composition MIL-R-39008**

RCR07—¼ w
RCR20—½ w
RCR32—1w

**Molded Wirewound**

BWH—2w
BW-20—1w

### RN GENERAL PURPOSE SEMI PRECISION AND PRECISION METAL GLAZE™ RESISTORS

**MIL-R-22684 Type RL**

RL07—RG07
RL20—RG20
RL32—RG32
RL42—RG42

**MIL-R-10509 Type RN**

RN55D—T0-55
RN60D—T0-60
RN65D—T0-65
RN55C—T2-55
RN60C—T2-60
RN65C—T2-65

**MIL-R-39017 Type RLR***

RLR07—RGR07
RLR20—RGR20
RLR32—RGR32
RLR42—RGR42

**MIL-R-11 Style Equivalents**

RC05—RG-⅛
RC07—RG-¼

### M & C SERIES HIGH STABILITY METAL FILM RESISTORS

**MIL-R-10509 Style**

CCA-T0 (RN60D)
CCA-T2 (RN60C)
CCB-T0 (RN65D)
CCB-T2 (RN65C)
CEA-T0 (RN55D)
CEA-T2 (RN55C)
CEC-T0
CEC-T2
MMC-T0 (RN50D)
MMC-T2 (RN50C)

**Established Reliability— Metal Film Resistors MIL-R-55182**

RNC/RNR50K
RNC/RNR50H
RNC/RNR55K
RNC/RNR55H
RNC/RNR60K
RNC/RNR60H
RNC/RNR65K
RNC/RNR65H

*Including new Rev. C which specifies ±1% & 2% tol., ±100 ppm T.C.

DISTRIBUTOR OPERATION, TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW, INC., 401 N. BROAD ST., PHILA., PA. 19108 (215) 923-8230

# TRW IRC RESISTORS

## GENERAL PURPOSE MOLDED CARBON COMPOSITION RESISTORS (RC & RCR)

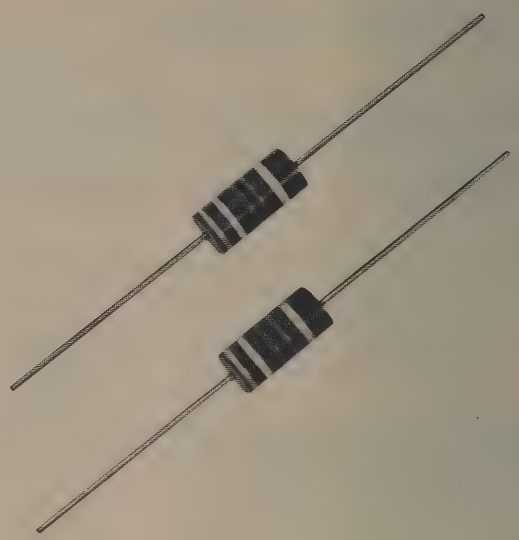
Performance advantages include **strong** lead assemblies. TRW's ribbed shoulder leads are **deeply** imbedded in the molding, defy twisting or pull-out.

TRW leads feature a uniform surface—thanks to an exclusive alloy electroplating process (no hot dipping). You'll find no lumps or voids to degrade solderability.

Moisture protection is another TRW feature. With the element thermally bonded to glass body and embedded in TRW's Selectrez™ mold jacket, you get a more than 50% boost in moisture protection.

TRW carbon comp.'s also offer outstanding high-temperature characteristics.This results from the resistance element's being bonded to the glass substrate at 500°C, plus the internal heat-sinking action of the talon lead construction.

Altogether, these features—plus superior high-frequency characteristics (see facing page)—mean a top quality resistor with outstanding reliability.



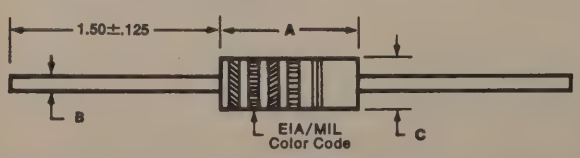
| TRW TYPE | GBT-¼ | GBT-½ | GBT-1 |
|---|---|---|---|
| MIL-R-11 Style | RCO7 | RC20 | RC32 |
| MIL-R-39008 Style | RCRO7 | RCR20 | RCR32 |
| MIL-R-39008 Failure Rate Level | S | S | S |
| Resistance, Standard | 2.7 ohms thru 22 Megohms | 2.7 ohms thru 22 Megohms | 2.7 ohms thru 22 Megohms |
| Resistance, Special (Non Mil) | | 24 Megohms thru 100 Gigaohms | — |
| Tolerances, Standard | ±5%, ±10%, ±20% | ±5%, ±10%, ±20% | ±5%, ±10%, ±20% |
| Power Rating | ¼-watt @ 70°C | ½-watt @ 70°C | 1-watt @ 70°C |
| Maximum Continuous Working Voltage | 250 Volts | 350 Volts | 500 Volts |
| Minimum Insulation Resistance—Dry | 10,000 Megohms | 10,000 Megohms | 10,000 Megohms |
| Wet | 100 Megohms | 100 Megohms | 100 Megohms |
| Minimum Dielectric Withstanding Voltage Atmospheric | 500 Volts, R.M.S. | 700 Volts, R.M.S. | 1000 Volts, R.M.S. |
| Reduced | 325 Volts, R.M.S. | 450 Volts, R.M.S. | 625 Volts, R.M.S. |
| Shunt Capacitance (Avg.) | 0.15 pF | 0.175 pF | 0.25 pF |
| Load Life-Typical △R Less Than* | ±4% | ±6% | ±6% |

| Resistance-Temperature Characteristic | Typical △R Less Than* From 25°C Reference | | | | | |
|---|---|---|---|---|---|---|
| Nominal Resistance (Ohms) | GBT¼ @ −55°C | GBT¼ @ +105°C | GBT-½ @ −55°C | GBT-½ @ +105°C | GBT-1 @ −55°C | GBT-1 @ +105°C |
| 1K and Under | ±2% | ±2% | ±4.5% | ±2.5% | ±5% | ±4% |
| 1.1K to 10K | +8% | ±3% | +7% | −2.5% | +8% | −4% |
| 11K to 100K | +9% | −4% | +9% | −3.5% | +9% | −4% |
| 110K to 1Meg | +10% | −5% | +10% | −3.5% | +11% | −4% |
| 1.1Meg to 10Meg | +11% | −5% | +11% | −3.5% | +11% | −4% |
| 11Meg to 22Meg | +11% | −5% | +11% | −3.5% | +11% | −4% |

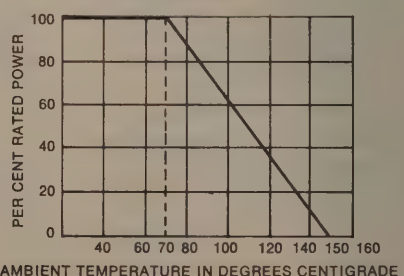
*"Typical △R Less than" is defined as the maximum △R to be expected in 95% of the population of △ distribution.

**DIMENSIONS**

| | A | B | C |
|---|---|---|---|
| GBT-¼ | .250±.015 | .025±.001 | .090±.008 |
| GBT-½ | .390±.010 | .031±.001 | .140±.008 |
| GBT-1 | .562±.010 | .040±.001 | .225±.008 |

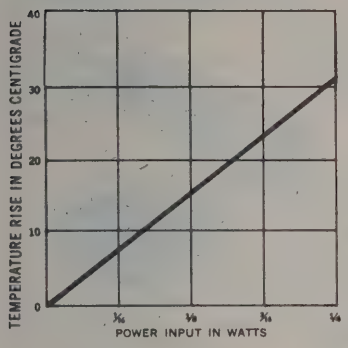



**DERATING CURVE**
**TEMPERATURE—POWER**

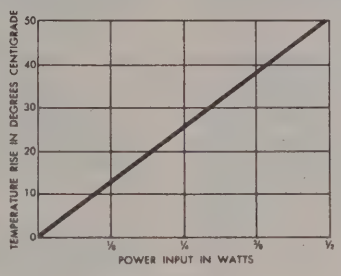


# TRW IRC RESISTORS

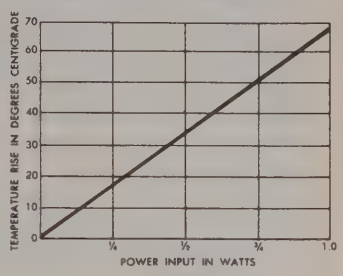
## SURFACE TEMPERATURE RISE AT HOT SPOT VS. LOAD




GBT¼




GBT½



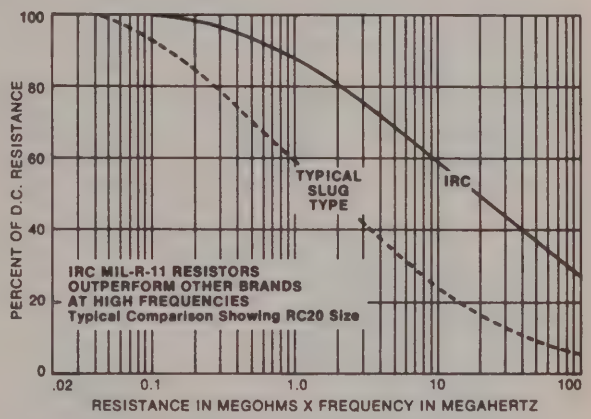

GBT1

**Superior high frequency characteristics**

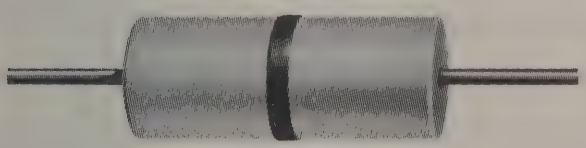
The best high frequency characteristics in a fixed composition resistor are achieved when the ratio of cross-sectional area to resistor length is minimized. TRW/IRC's element has the smallest cross section and fewest carbon binder contacts of any carbon composition resistors.

The low mass resistance element assures low shunt capacitance and superior performance at high frequencies. In high frequency equipment, this results in better pulse shaping with less broadening and truncation and faster response.

TRW/IRC resistors significantly outperform other brands, as shown on the chart.


PERCENT OF D.C. RESISTANCE
TYPICAL SLUG TYPE
IRC
IRC MIL-R-11 RESISTORS OUTPERFORM OTHER BRANDS AT HIGH FREQUENCIES
Typical Comparison Showing RC20 Size
RESISTANCE IN MEGOHMS X FREQUENCY IN MEGAHERTZ

## ZEROHM Molded Jumper Wires



Molded jumper wires or crossovers, as they are sometimes called, are basically interconnection devices between points on a P.C. Board.

Generally they are used for the following reasons:

—Inability to connect two points on a P.C. Board due to other circuit paths which must be crossed over.

—An after-the-fact design change that requires new point connections.

—Circuit tuning by changing point connections.

TRW's molded jumper wires offer a quick simple solution to these problems. They are especially suited for automatic machine insertion on lead tape or available in all packaging styles including pre-cut and formed for manual insertion.

**SPECIFICATIONS**

Maximum resistance .....0.01 Ω

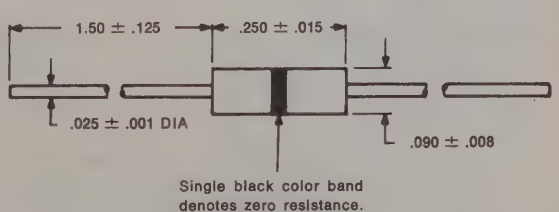
Lead material .....30/70 tin/lead solder-coated copper wire.

Body material .....Electrical grade, high performance, molding compound

Min. Insulation resistance—Dry .....10,000 meg Ω
Wet .....100 meg Ω

Min. Dielectric withstanding voltage
Atmospheric .....500V RMS
Reduced .....325V RMS

Insulation flammability .....Resistor insulation is self extinguishing within 10 seconds after externally applied flame is removed.

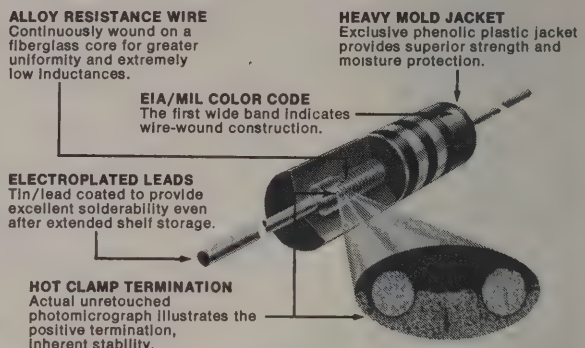


# TRW IRC RESISTORS

## GENERAL PURPOSE WIREWOUND MOLDED RESISTORS

**Type BW-20 (1 Watt) and BWH (2 Watt)**

The TRW/IRC Type BWH bridges the cost-performance gap between composition resistors and premium wirewounds. Its 2 watt rating in 1-watt size lets you replace 2 watt units and save space, or use it in 1 watt space with the advantages of a two-times safety factor and wirewound stability. BW-20s come in six types of packaging to cut assembly costs. They fit ½ watt inserting machines, and can be ordered with a wide variety of cut-and-formed lead configurations.


ALLOY RESISTANCE WIRE
Continuously wound on a fiberglass core for greater uniformity and extremely low inductances.
HEAVY MOLD JACKET
Exclusive phenolic plastic jacket provides superior strength and moisture protection.
EIA/MIL COLOR CODE
The first wide band indicates wire-wound construction.
ELECTROPLATED LEADS
Tin/lead coated to provide excellent solderability even after extended shelf storage.
HOT CLAMP TERMINATION
Actual unretouched photomicrograph illustrates the positive termination, inherent stability.

Patent No. 3,319,210

### GENERAL PURPOSE WIREWOUND MOLDED RESISTORS

| TRW TYPE | BW-20 | BWH |
|---|---|---|
| EIA RS-344 Style | CRU1 | CRU2 |
| MIL-R-11 Style Size Equivalent | RC20 | RC32 |
| Resistance, Standard | 0.24 Ohms thru 750 Ohms* | 0.10 Ohms thru 2400 Ohms* |
| Tolerance, Standard<br>Special | ±5%, ±10%<br>±2% | ±5%, ±10% |
| Power Rating | 1-watt 50°C<br>½-watt 100°C<br>¼-watt 125°C, derating to 0 @ 160°C | 2-watts @ 70°C<br>1-watt @ 115°C<br>½-watt @ 137°C, derating to 0 @ 160°C |
| Max. Continuous Working Voltage | ✓ PR | ✓ PR |
| Min. Insulation Resistance—Dry | 10,000 Megohms | 10,000 Megohms |
| Min. Insulation Resistance—Wet | 100 Megohms | 100 Megonms |
| Min. Dielectric Withstanding Voltage<br>Atmospheric Pressure<br>Reduced Pressure | <br>700 Volts, R.M.S.<br>450 Volts, R.M.S. | <br>1000 Volts, R.M.S.<br>625 Volts, R.M.S. |
| Hot Spot Temp. Rise at 1-Watt | 100°C | 115°C |
| Current Noise | Negligible | Negligible |
| Marking | Standard EIA/MIL Color Code (double width first band) | Standard EIA/MIL Color Code (double width first band) |

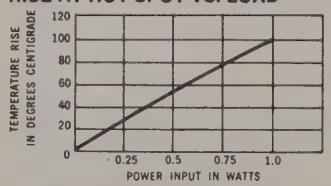
*See page 7 for decade values

See fusible, flameproof versions on next page

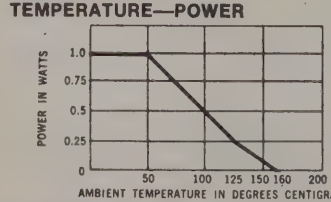
| | A | B | C |
|---|---|---|---|
| BW-20 | .390 ± .010 | .032 ± .001 | .140 ± .008 |
| BWH | .562 ± .010 | .040 ± .001 | .225 ± .008 |

**Typical BW-20 Δ R Less Than****

**SURFACE TEMPERATURE RISE AT HOT SPOT VS. LOAD**




**DERATING CURVE TEMPERATURE—POWER**



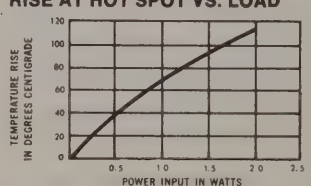

**Load Life (50°C) ±3%**

Temperature Coefficient†
0.24 Ohms-0.62 Ohms
0.68 Ohms-750 Ohms

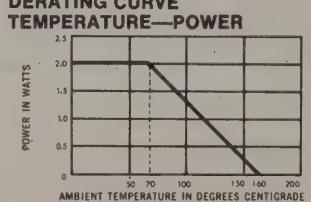
±0.025% / °C
±0.010% / °C
respectively

**Typical BWH Δ R Less Than****

**SURFACE TEMPERATURE RISE AT HOT SPOT VS. LOAD**




**DERATING CURVE TEMPERATURE—POWER**




**Load Life ±5%**

Temperature Coefficient†
0.1 Ohms-0.16 Ohms
0.18 Ohms-0.62 Ohms
0.68 Ohms-2400 Ohms

±0.08% / °C
±0.06% / °C
±0.02% / °C
respectively

**Typical Δ R Less Than is defined as the maximum ΔR to be expected in 95% of the population of a distribution. †Special TC available

# TRW IRC RESISTORS

## BWF FLAMEPROOF FUSIBLE WIREWOUND RESISTOR

The BWF is an economical fusible/flameproof resistor designed to handle ½, 1 and 2 watt applications where dependable circuit and equipment protection is essential.

The BWF has predictable overload *Fusing* Characteristics and is *Flameproof* under fault conditions up to 1000X rated power. (1000V maximum).

Rated at 2 watts and physically a 1 watt size, the BWF provides space savings and is suited for lead forming or automatic insertion equipment on reels of 2000 units. Other packaging styles are available.

Note: BW-20F now available. Rated at 1 watt in ½ watt package for failsafe applications requiring a smaller size than the BWF.

### TRW-BT348 FLAMEPROOF RESISTOR SPECIFICATION HIGHLIGHTS

1. INSTANTANEOUS OVERLOAD

   Overloads from 0 to 15 minutes duration. From 4X to 1000X rated power, (or 1000V, whichever is smaller)
   —No flaming of resistor
   —A paper tissue (Kimwipe #900-S) shall not ignite when resting across or beneath the unit.

2. DYNAMIC OVERLOAD

   Wattage increased at 100% increments of rated power every 2 seconds, (after a 1 minute warmup at rated power).
   —Same as 1 above.

3. CURRENT LIMITING

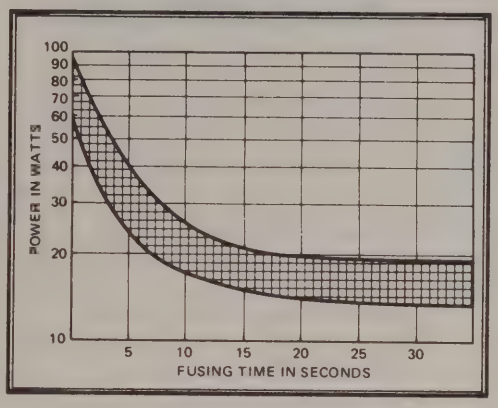
   Overload applied as in 1. Up to 1000X rated power (or 1000V).
   —Current shall limit to less than 1% of the ohms law value.

4. INSULATION FLAMMABILITY

   Resistor insulation is self extinguishing after externally applied flame is removed.
   —Extinguishes within 10 seconds.
   —Smoking is considered acceptable.

- Equiv. to E.I.A. RS-344 ..... CRU2
- Size Equiv. to MIL-R-11 ..... RC32
- Power Rating @ 70°C ..... 2 Watts
- Resistance Range Minimum ..... 0.10Ω
  Maximum ..... 100Ω
- Purchase Tolerance ..... 5%, 10%
- Maximum Continuous Voltage ..... $\sqrt{PR}$
- Loadlife: 2 watts @ 70°C .....Max. △R±10%
- Min. Dielectric Strength
  Atmospheric Pressure ..... 1000V RMS
  Reduced Pressure ..... 625V RMS
- Min. Insulation Resistance
  Dry ..... 10K MegΩ
  Wet ..... 100K MegΩ

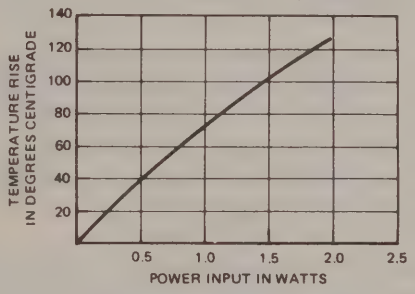
### Typical Fusing Characteristics



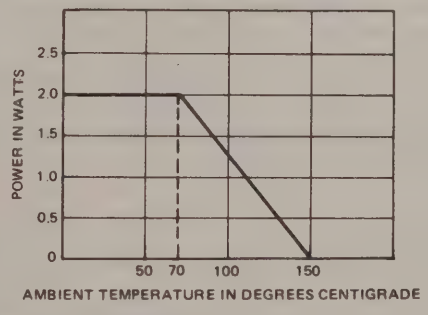

### TYPICAL TEMPERATURE COEFFICIENT or △R Less Than

0.1Ω — 0.16Ω ..... + 800 PPM/°C or + 0.08%/°C
0.18Ω — 0.68Ω ..... + 600 PPM/°C or + 0.06%/°C
0.75Ω — 100Ω ..... ± 200 PPM/°C or ± 0.02%/°C

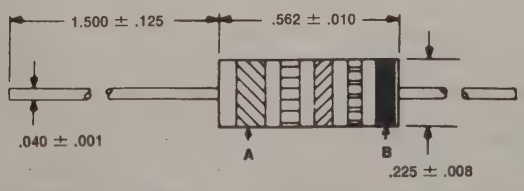
### SURFACE TEMPERATURE RISE AT HOT SPOT VS. LOAD




### TEMPERATURE CURVE RECOMMENDED POWER DERATING




### MARKING AND DIMENSIONS




**EIA/MIL COLOR CODE**

A = First significant figure is a double width band to designate wirewound

B = Flameproof designator—Blue marking

**TRW IRC RESISTORS**

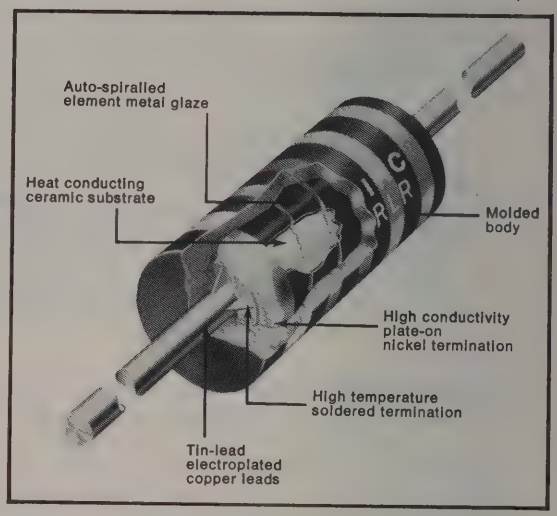
# RG GENERAL PURPOSE SEMI PRECISION AND PRECISION METAL GLAZE™ RESISTORS

Cost effective IRC molded thick film Metal Glaze resistors are designed to provide a combination of ruggedness and performance unmatched anywhere for the price.

The secret is in the proprietary glaze systems, the unique design, and automated production techniques.

Metal Glaze resistors by the billions are in use worldwide, in all types of applications from missile guidance computers to truck anti skid systems, from telephone receivers to process control instrumentation.

Metal Glaze resistors meet or far exceed such MIL specifications as MIL-R-22684(RL), 10509(RN), 39017(RLR), 55182(RNR). Power Load △R's are often less than ±1%, even after 10,000 hours—equivalent to years of equipment life. And these units remain within tolerances even after extended periods of shelf or equipment storage.

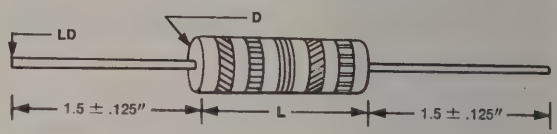



## PRODUCT FEATURES

- **Metal Glaze™ Thick Film Element**—Fused to core at 2000°F—extremely rugged and reliable system—up to 100 times thickness of oxide or evaporated films.
- **Solid Ceramic Substrate**—Provides optimum thermal conductivity—permits maximum power density, lowest T.C. △R's, overload protection, and freedom from mechanical breakage.
- **End-Plated and Soldered Terminals**—Prevents movement, provides excellent electrical and thermal contact. Withstands 20 lb. pull for 5 seconds.
- **Uniform Molded Body**—Best mechanical strength for automated lead forming and insertion equipment.
- **Stability**—Above built-in features provide design tolerances of as low as ±1.5% (depending on purchase tolerance, style, and T.C. selection—see design tolerance discussion, page 6).

**DIMENSIONS—See Table**

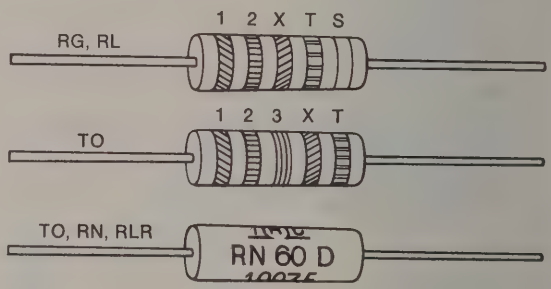
**Body Configuration—Molded**




## IDENTIFICATION

Metal Glaze resistors can be provided with color bands or alpha-numeric printing.

See Table next page for marking by style.




1, 2, 3 = Significant Figures
X = Multiplier
T = Tolerance
S = White Solderable Band (RL)

| | | |
|---|---|---|
| Black = 0 | Green = 5 | Brown = ±1% Tol. |
| Brown = 1 | Blue = 6 | Red = ±2% Tol. |
| Red = 2 | Violet = 7 | Gold = ±5% Tol. |
| Orange = 3 | Gray = 8 | Silver = ±10% Tol. |
| Yellow = 4 | White = 9 | |

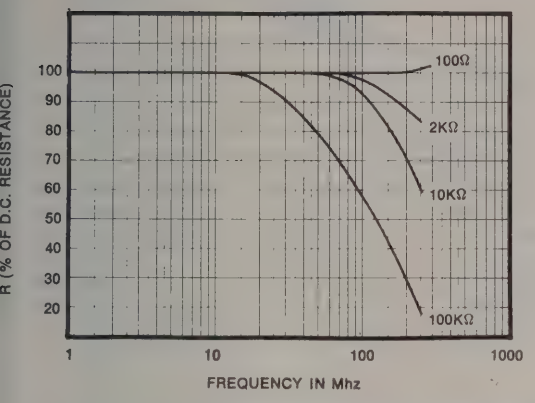
New! 3W molded, axial lead GS-3 in a 1W package. Replaces wirewound power resistors and offers low temp. rise, excellent frequency response in reliable metal glaze construction.

| | IRC TYPE | MIL STYLE | MIL RANGE | IRC RANGE | TOL % | TC | POWER RATING | VOLTAGE RATING | DIMENSIONS L | D | LD |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GS-3 | GS-3 | — | — | 10-2.1M | 1,2,5 | 50,100 | 1W@125°C, 3W@25°C | 1000V | .515±.01 | .225±.008 | .032±.002 |

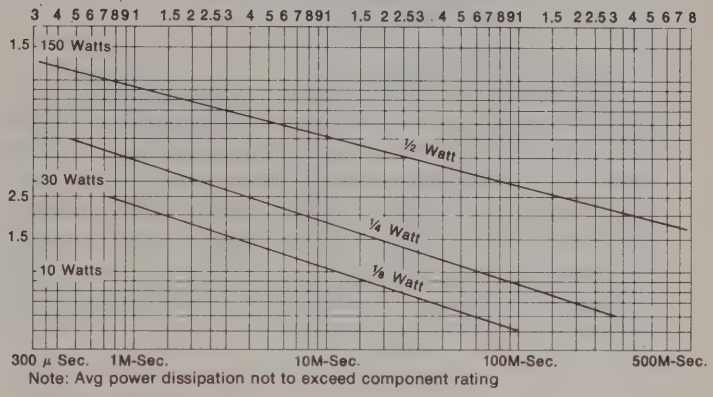
# TRW IRC RESISTORS

## HIGH FREQUENCY CHARACTERISTICS

RG ¼W SIZE



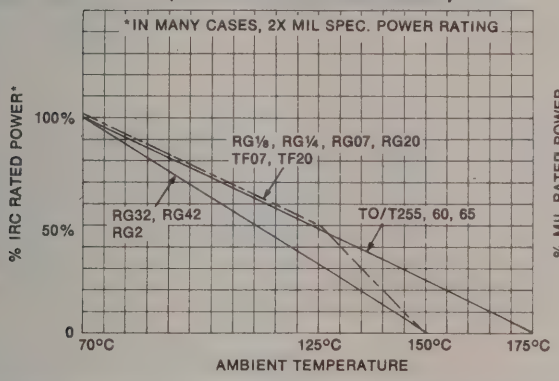

RG PULSE OR SURGE POWER RATING:
MAXIMUM APPLIED POWER/PULSE ON TIME



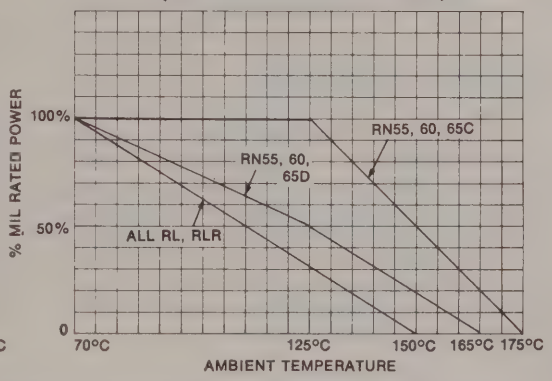

Note: Avg power dissipation not to exceed component rating

## SPECIFICATIONS

COMMERCIAL POWER DERATING—METAL GLAZE
(SEE SPECIFICATION TABLE BELOW)




MIL SPECIFICATION POWER DERATING
(SEE SPECIFICATION TABLE BELOW)




| CLASSIFICATION/ CONFIGURATION | IRC TYPE | MIL STYLE | MIL RANGE (Ω) | IRC RANGE (Ω) | TOL. ±% | T.C. (±ppm/°C) | POWER RATING[4] IRC | POWER RATING[4] MIL | VOLTAGE RATING (v) | DIMENSIONS L (in.) | DIMENSIONS D (in.) | DIMENSIONS LD (in.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GENERAL PURPOSE AND SEMI-PRECISION | RG⅛ | RC05[1] | — | 10 – 150K | 5 | 200 | ¼W @ 70°C | ⅛W @ 70°C | 200 | .150 ± .01 | .066 ± .008 | .016 ± .002[5] |
| | RG¼ | RC07[1] | — | 6.2 – 1M | 5 | 200 | ½W @ 70°C | ¼W @ 70°C | 250 | .250 ± .015 | .090 ± .008 | .025 ± .001 |
| | RG07 | RL07 | 51 – 150K | 10 – 620K | 2, 5 | 200 | ½W @ 70°C | ¼W @ 70°C | 250 | .250 ± .015 | .090 ± .008 | .025 ± .001 |
| | RG20 | RL20 | 4.3 – 470K | 4.3 – 1M | 2, 5 | 200 | 1W @ 70°C | ½W @ 70°C | 350 | .390 ± .010 | .140 ± .008 | .032 ± .002 |
| | RG32 | RL32 | 10 – 1M | 10 – 1M | 2, 5 | 200 | 1W @ 70°C | 1W @ 70°C | 500 | .562 ± .031 | .190 ± .008 | .040 ± .002 |
| | RG42 | RL42 | 10 – 1.5M | 10 – 1.5M | 2, 5 | 200 | 2W @ 70°C | 2W @ 70°C | 500 | .688 ± .040 | .318 ± .018 | .045 ± .002 |
| Color Banded | RG2 | RC42[1] | — | 10 – 1.5M | 5 | 200 | 2W @ 70°C | 2W @ 70°C | 500 | .688 ± .040 | .318 ± .018 | .045 ± .002 |
| TF07 | | | | | | | | | | | | |
| LOW RESISTANCE Banded or Stamped | TF07 | RL07[1] | — | 1 – 10 | 1, 2, 5 | 100 | ½W @ 70°C | ¼W @ 70°C | 250 | .250 ± .015 | .090 ± .008 | .025 ± .001 |
| | TF20 | RL20[1] | — | 1 – 10 | 1, 2, 5 | 100 | ¾W @ 70°C | ½W @ 70°C | 350 | .390 ± .010 | .140 ± .008 | .032 ± .002 |
| PRECISION | T055 | RN55D | 10 – 301K | 10 – 499K | 1[3] | 100[3] | ½W @ 70°C | ⅛W @ 70°C | 200 | .250 ± .015 | .090 ± .008 | .025 ± .001 |
| | T255 | RN55C | 49.9 – 100K | 10 – 499K | 1[3] | 50[3] | ¼W @ 70°C | 1/10W @ 125°C | 200 | .250 ± .015 | .090 ± .008 | .025 ± .001 |
| | T060 | RN60D | 10 – 1M | 10 – 1M | 1[3] | 100[3] | ¾W @ 70°C | ¼W @ 70°C | 300 | .390 ± .010 | .140 ± .008 | .025 ± .001 |
| TO55 | T260 | RN60C | 49.9 – 499K | 10 – 1M | 1[3] | 50[3] | ½W@70°C | ⅛W @ 125°C | 250 | .390 ± .010 | .140 ± .008 | .025 ± .001 |
| | T065 | RN65D | 10 – 1M | 10 – 1M | 1[3] | 100[3] | 1W@70°C | ½W @ 70°C | 350 | .562 ± .031 | .190 ± .008 | .025 ± .001 |
| Banded or Stamped | T265 | RN65C | 49.9 – 348K | 10 – 1M | 1[3] | 50[3] | ½W @ 70°C | ¼W @ 125°C | 300 | .562 ± .031 | .190 ± .008 | .025 ± .001 |
| | RGR07 | RLR07/R[2] | 10 – 470K | 10 – 470K | 1, 2 | 100 | ¼W @ 70°C | ¼W @ 70°C | 250 | .250 ± .015 | .090 ± .008 | .025 ± .001 |
| RLR20 | RGR20 | RLR20/R[2] | 4.3 – 1M | 4.3 – 1M | 1, 2 | 100 | ½W @ 70°C | ½W @ 70°C | 350 | .390 ± .010 | .140 ± .008 | .032 ± .002 |
| | RGR32 | RLR32/P[2] | 10 – 1M | 10 – 1M | 1, 2 | 100 | 1W @ 70°C | 1W @ 70°C | 500 | .562 ± .031 | .190 ± .008 | .040 ± .002 |
| ESTABLISHED RELIABILITY | RGR42 | RLR42/M[2] | 10 – 1.5M | 10 – 1.5M | 1, 2 | 100 | 2W @ 70°C | 2W @ 70°C | 500 | .688 ± .040 | .318 ± .018 | .045 ± .002 |

[1]Not QPL listed [2]Failure rate symbol [3]See pp. 9–10 for close tolerance & TC [4]See power derating curves above [5]1.00 ± .125 lead length

# TRW IRC RESISTORS

## MAR ULTRA PRECISION, NON-INDUCTIVE METAL FILM RESISTORS

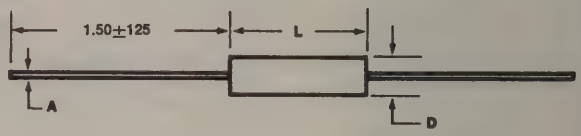
**"Where speed and precision count"**

MAR ultra-precision resistors have all of the advantages of evaporated metal film resistors and in addition, precision tolerances to .01% and temperature coefficients to 5 PPM/°C are standard. The inherent low inductance and low capacitance of this design make it ideally suited to high-speed applications requiring a high degree of stability. The rugged epoxy encapsulation provides excellent environmental protection.

Tailored TCs from —100 PPM/°C to +150 PPM/°C are available with TC tolerances to ± 5 PPM/°C.

**TYPICAL PERFORMANCE**

| | |
|---|---|
| Load Life 1000 hrs. @ 85°C | .01% ΔR |
| Temperature Cycle | .002% ΔR |
| Humidity | .02% ΔR |
| Noise Index | −40 db |
| Voltage Coefficient | .02ppm/volt |
| 1 year shelf life | ±15 ppm |



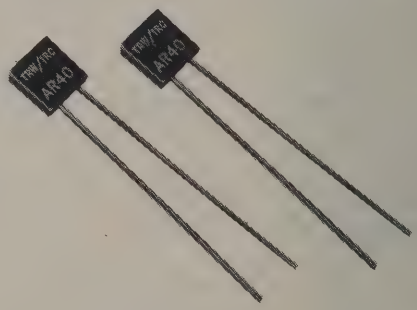

**PERFORMANCE AND DIMENSIONS**

| IRC TYPE | RESISTANCE RANGE* (Ohms) | TEMPERATURE COEFFICIENTS −20°C to +85°C (±ppm/°C) | TOLERANCES (±%) | POWER RATING** @ 85°C (Watts) | VOLTAGE RATINGS (Volts) | DIMENSIONS IN INCHES | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Body Length (L Max.) | Body Diameter (D Max.) | Lead Gage (A) |
| MAR3 | 20 — 100K | T10 = 15 | 1.00, 0.50, 0.25, 0.10, 0.05, 0.02, 0.01 | 1/20 | 200 | .191 | .082 | #26 .016† |
| MAR5 | 20 — 250K | T13 = 10 | | 1/10 | 250 | .281 | .102 | #22 .025 |
| MAR6 | 20 — 500K | T16 = 5 | | 1/8 | 300 | .425 | .155 | #22 .025 |
| MAR7 | 20 — 1 Meg | | | 1/4 | 500 | .650 | .195 | #22 .025 |

*Wider ranges available, contact factory.
**High power ratings available. Contact factory.
†Lead length 1.00 ± .062.

## AR40 ULTRA-PRECISION METAL FILM RESISTORS

The AR40 ultra-precision metal film resistor is designed to satisfy those critical design requirements where virtually zero temperature coefficient, stability and absolute accuracy are needed. Temperature coefficients of ± 5 PPM/°C and ± 2 PPM/°C are standard. Standard tolerances are available to .01%. The radial lead design and small case size require a minimum of printed circuit board space. Proven end cap termination assures essentially no degradation during normal circuit board insertion practices.




**PERFORMANCE AND DIMENSIONS**

| TCR CLASS. | STANDARD TEMP. COEFF. (°C) | RESISTANCE RANGE* (Ohms) | STANDARD TOLERANCE (±%) | WATTAGE 85°C | DIMENSIONS IN INCHES | |
|---|---|---|---|---|---|---|
| T-18 | 2 ppm 0 to 60°C<br>5 ppm −55 to 125°C | 20 to 100K | .01, .02, .05, .10, .25, .50, 1.00 | .3 watts | Height | .320 ± .020 |
| | | | | | Length | .295 ± .010 |
| | | | | | Width | .100 ± .010 |
| T-16 | 5ppm 0 to 60°C<br>10 ppm −55 to 125°C | | | | Lead spacing | .150 ± .010 |
| | | | | | Lead gage #22 | .0253** |

*Wider ranges available, contact factory.
**Lead Length 1.00 minimum

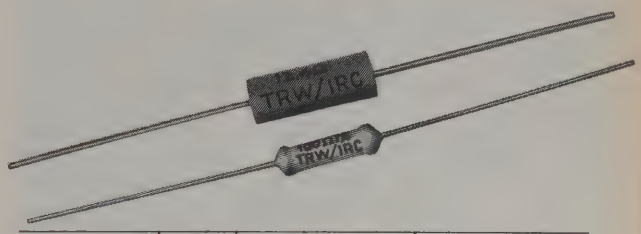
# TRW IRC RESISTORS

## M&C SERIES HIGH STABILITY METAL FILM RESISTORS

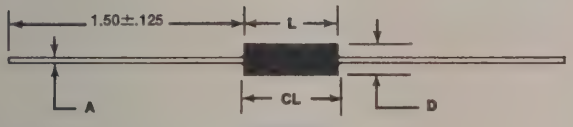
Evolved from the industry's original metal film process. These resistors are manufactured to the tightest controls for best performance with respect to low noise, high stability, and the ultimate in TCs and tolerances for precision applications. Standard tolerances and TCs are available to ± 0.1% and ±25 PPM°C respectively. Resistance values are to 100 megohms.

These evaporated metal film resistors will exceed all MIL-R-specification requirements, including the highest reliability level of MIL-R-55182. Voltage coefficient when measured between 1/10 and full rated voltage is typically less than 0.5 PPM/Volt for all values and essentially zero for low and medium values. Typical △ R for long term life is less than .04%.

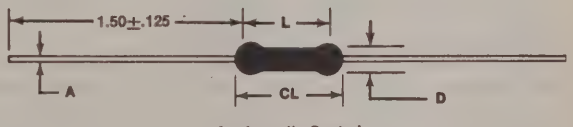
The design concept of these resistors offer high strength characteristics for potting applications and automatic insertion.




| MIL-R-55182 Char. | IRC T.C. Code | Temperature Coefficient | Temperature Span |
|---|---|---|---|
| K | T0 | 0±100PPM/°C | −55°C to +165°C |
| H | T2 | 0±50PPM/°C | −55°C to +175°C |
| J | T9 | 0±25PPM/°C | −55°C to +175°C |
| | T3 | 0 to +100PPM/°C | −55°C to +165°C |
| | T4 | 0 to −100PPM/°C | −55°C to +165°C |
| | T5 | 0±25PPM/°C | +25°C to +145°C |
| | T6 | 0 to +50PPM/°C | −55°C to +165°C |
| | T7 | 0 to −50PPM/°C | −55°C to +165°C |
| | T8 | 0±25PPM/°C | +25°C to +165°C |
| | | 0±35PPM/°C | −55°C to +25°C |
| | TR | 0 to +100PPM/°C<br>0 to −250PPM/°C | −55°C to +165°C |
| | TE | 0 to +100PPM/°C<br>0 to −500PPM/°C | −55°C to +165°C |




Molded
Style M




Conformally Coated
Style C

### PERFORMANCE AND DIMENSIONS

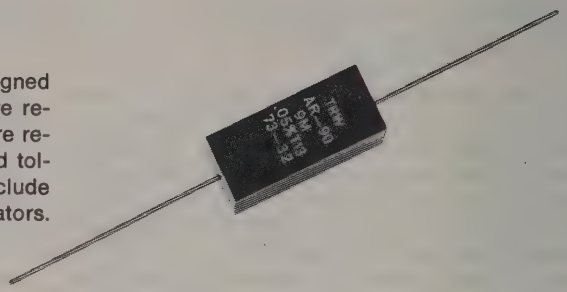
| IRC TYPE | MIL TYPE | RNR MIL CHAR | IRC T.C. CODE | MIL RESISTANCE RANGE (Ohms) | IRC RESISTANCE RANGE (Ohms) | MIL POWER RATING (Watts) 70°C | 125°C | MIL VOLTAGE RATING (Volts) | DIMENSION IN INCHES Body Length (L) | Body Diameter (D) | Max. Clean Lead Length (CL) | Lead Gage (A) | BODY STYLE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MMC | RNR50 | K | T0 | 10-100K | 10-3.2 MEG | 1/8 | 1/20 | 200 | .150±.020 | .065±.010 | .200 | #26** .016 | C |
| | RN50+ | H, J | T2, T9 | 49.9-100K | 49.9-1.1 MEG | | | | | | | | |
| CEA | RN55+ | — | T0 | — | 10-6.5 MEG | 1/8 | 1/10 | 200 | .250±.031 | .090±.010 | .325 | #22 .0253 | C |
| | | — | T2, T9 | — | 30.1-2.3 MEG | | | | | | | | |
| CCM | RNR55 | K | T0 | 20-200K | 20-6.3 MEG | 1/8 | 1/10 | 200 | .250±.031 | .088±.010 | .325 | #22 .0253 | C |
| | RN55+ | H, J | T2, T9 | 49.9-200K | 30.1-2.2 MEG | | | | | | | | |
| MCM | — | — | T0 | — | 20-301K | 1/8 | 1/10 | 200 | .250±.031 | .093±.005 | .310 | #22 .0253 | M |
| | | — | T2, T9 | — | 30.1-301K | | | | | | | | |
| CCA | RNR60 | K | T0 | 24.9-499K | 10-13 MEG | 1/4 | 1/8 | 250 | .400±.031 | .140±.020 | .540 | #22 .0253 | C |
| | RN60+ | H, J | T2, T9 | 49.9-499K | 49.9-4.5 MEG | | | | | | | | |
| MEA | RN60+ | — | T0 | — | 10-6.5 MEG | 1/4 | 1/8 | 250 | .406±.015 | .130±.010 | .545 | #22 .0253 | M |
| | | — | T2, T9 | — | 30.1-2.3 MEG | | | | | | | | |
| MEB | RN65+ | — | T0 | — | 10-13 MEG | 1/2 | 1/4 | 300 | .594±.015 | .203±.015 | .733 | #22 .0253 | M |
| | | — | T2, T9 | — | 49.9-4.5 MEG | | | | | | | | |
| CCB | RNR65 | K | T0 | 24.9-1 Meg | 10-24 MEG | 1/2 | 1/4 | 300 | .594±.031 | .180±.020 | .734 | #22 .0253 | C |
| | RN65+ | H, J | T2, T9 | 49.9-1 Meg | 49.9-8.4 MEG | | | | | | | | |
| MEC | RN70+ | — | T0 | — | 10-24 MEG | 3/4 | 1/2 | 350 | .719±.020 | .261±.020 | .863 | #20 .032 | M |
| | | — | T2, T9 | — | 24.9-8.4 MEG | | | | | | | | |
| CEC | — | — | T0 | — | 10-24 MEG | 1 | 1/2 | 350 | .594±.031 | .180±.020 | .734 | #20 .032 | C |
| | | — | T2, T9 | — | 49.9-8.4 MEG | | | | | | | | |
| MEF | RN75+ | — | T0 | — | 49.9-55.5 MEG | 1 | 1 | 500 | 1.105±.020 | .395±.020 | 1.253 | #20 .032 | M |
| | | — | T2, T9 | — | 49.9-19.5 MEG | | | | | | | | |
| MEH | RN80+ | — | T0 | — | 100-148 MEG | 2 | | 750 | 2.254±.020 | .395±.020 | 2.378 | #20. 032 | M |
| | | — | T2, T9 | — | 100-52 MEG | | | | | | | | |

*Gold plated Dumet leads. 100" ± .062" **Lead length, 1.00" ± .062"

**TRW IRC RESISTORS**

## AR 90 ULTRA-PRECISION HIGH RANGE RESISTORS

The AR90 ultra precision metal film resistor is designed to satisfy those critical design requirements where resistance values between 1 meg Ω and 10 meg Ω are required. Temperature coefficients to 5 PPM/°C and tolerances to .05% are standard. Applications include ultra precision voltage dividers and input attenuators.



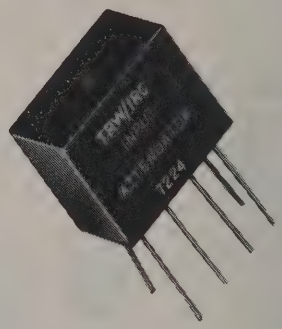
**PERFORMANCE AND DIMENSIONS**

| IRC TYPE | RESISTANCE RANGE* (ohms) | TEMPERATURE COEFFICIENTS −20°C to +85°C (± PPM/°C) | TOLERANCES | POWER RATING | VOLTAGE RATING | BODY DIMENSIONS (IN.) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | LENGTH | DEPTH | HEIGHT | LEAD |
| AR90 | 1M − 10M | T10 = 5<br>T13 = 10<br>T16 = 15 | 1.0, 0.5, 0.25, 0.1, 0.05 | .5W | 1000 | 1.0 | 0.4 | 0.4 | #22 |

*Wider ranges available. Contact factory.

## AR ULTRA-PRECISION RESISTOR NETWORKS

AR Resistor Networks provide the best performance and packaging density for a circuit requiring multiple, interdependent precision resistors. The rugged epoxy encapsulation provides maximum environmental protection. AR networks are designed to specific circuit requirements using one of the standard sizes available or special sizes where required.

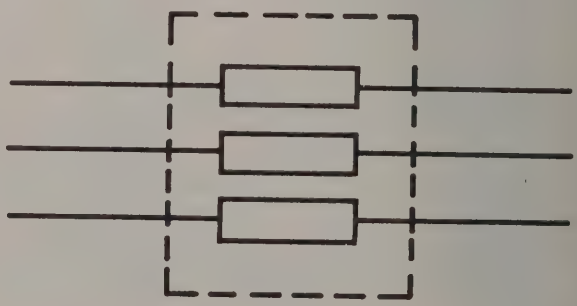


Features include:
- Lower Effective Cost
- High Density Packaging
- Ratio Matching to 0.005%
- Resistors thermally tied together
- Deliveries comparable to discretes
- All-welded construction
- TC Matching to ±1 PPM/°C

## AR MATCHED RESISTOR SETS

AR Matched Resistor Sets provide ultra-precision resistor performance at the lowest possible cost. Tolerance matching to 0.005% and TC matching to 1 PPM/°C can be specified.

Any TRW/IRC metal film resistors may be obtained as matched sets. The AR series, MAR and AR40 styles are recommended for the most precise tolerance and TC matching requirements.

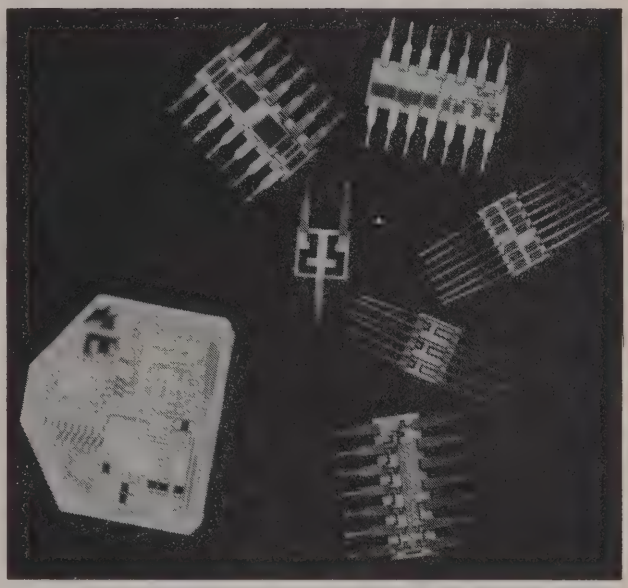


# TRW IRC RESISTORS

## TaNFilm™ PRECISION FILM RESISTOR NETWORKS

TRW/IRC TaNFilm precision subminiature resistor networks are made of sputtered tantalum nitride, using proprietary equipment and processes.

TaNFilm is inherently resistant to electrolytic attack, since each resistor is passivated with an anodized surface layer. The processes used in manufacture allow routine tolerances of 0.1% and make tolerances of 0.05% economically feasible. The continuous sputtering process makes TaNFilm very uniform, so resistors track over the full temperature range to a few parts per million. Many hours of test data allow accurate performance prediction. A variety of networks are available, and others can be fabricated to your packaging requirements. Standard configurations are the DIP sandwich pack shown on page 16, and TO-88 type flat packs.



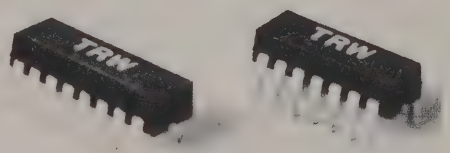
**TYPICAL TaNFilm Design CRITERIA[1]**

| | | | |
|---|---|---|---|
| Resistance Value | 50Ω to 100,000Ω | Drift | ≤0.25% per year |
| Tolerance | ±0.05% to ±1.0% | Noise | ≤−25dB |
| TCR | −100±25 ppm/°C | Voltage Coefficient | ≤5 ppm/V |
| TCR Tracking | to 5 ppm/°C | Series Inductance | ≤5 nH |
| Settling Time | to 20nSec. | Shunt Capacitance | ≤0.1 pF |

[1]These are not absolute units. Contact factory for your specific requirements.

## RESISTOR NETWORKS DUAL IN-LINE PACKAGE

TRW/IRC TaNFilm* resistor networks utilize a Tantalum Nitride resistor film deposited on a high alumina ceramic substrate. Units are molded in standard TO-116 DIP form-factor with 14 and 16 pin terminations.



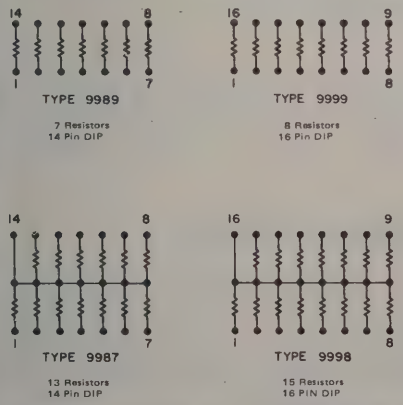

**Styles**

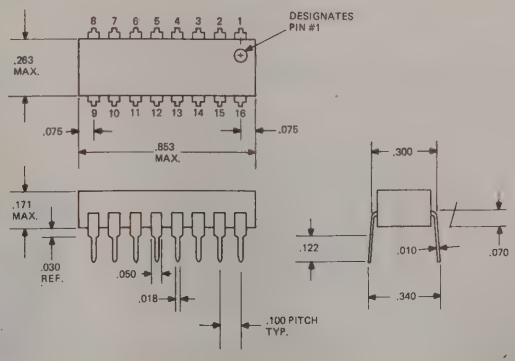
9989 = 7 resistors of equal value, 14 pin DIP
9999 = 8 resistors of equal value, 16 pin DIP
9987 = 13 resistors of equal value, 14 pin DIP
9998 = 15 resistors of equal value, 16 pin DIP

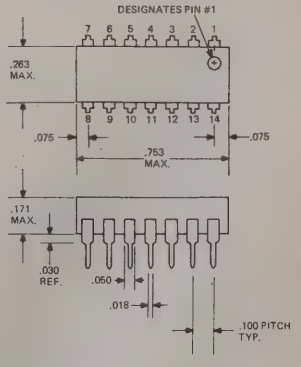
**Resistance Values**

Types 9987 and 9998
50Ω to 50KΩ

Types 9989 and 9999
50Ω to 100KΩ



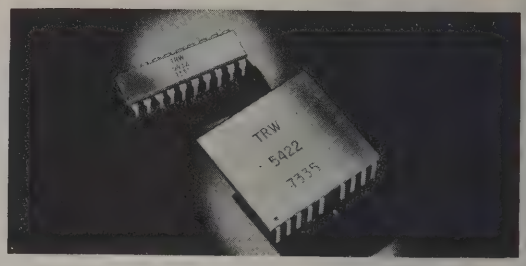




*Trademark of TRW INC. for its Tantalum Nitride Film.

**TRW IRC RESISTORS**

# TaNFilm© R-2R LADDERS

- 12 BIT RESOLUTION
- FULL MIL PERFORMANCE
- TWO PACKAGE STYLES
- FOUR RESISTANCE VALUES
- 12 BIT OR 10 BIT ACCURACY




## DESIGN

These 12 Bit R-2R Ladders feature the inherent passivation, low noise and premium performance of TaNFilm. They provide ±½ LSB accuracy over the full mil temperature range (−55 to +125°C) and retain this accuracy after long operating life in extreme environments. Unlike competitive devices this military grade performance demands no price premium. TaNFilm networks provide hermetic performance without the cost and disadvantages of hermetic sealing, because the tantalum nitride film is anodically passivated.

Resistors are sputtered tantalum nitride on 99.5% Alumina ceramic and are anodically passivated. Interconnections are 99.9% pure gold and the gold plated leads are welded to the interconnection film. Complete absence of silver and solder provides absolute insurance against silver and tin migration. The 5430 series features standard dual in-line packaging with rugged, gold plated, copper alloy, shouldered leads for ease of insertion. The 5420 series has two rows of leads .900" apart and is pin compatible with Beckman 811 series networks. The 5200 series are identical with the 5400 except for accuracy.

## CIRCUIT AND APPLICATION

The circuit and pinout diagram is shown on the right. The characteristic "R" value may be 5K, 10K, 20K or 25K. Other values may be provided on special order. Standard switch compensation of 5 ohms is built into the four most significant bits. This also may be changed on special order. Three extra application resistors are provided for bipolar operation, Op Amp feedback or output attenuation. Switch or offset compensation may be provided in these resistors if required.

## SPECIFICATIONS:

| | |
|---|---|
| Ladder Resistance Values (R) | 5K, 10K, 20K, 25K |
| Ladder Resistance Tolerance | ±1% |
| Maximum Input Voltage | 20V |
| Settling Time (to 0.1% of final value) | 100n sec. |
| External Switch Compensation (Note 1) | 5Ω |
| Temperature Range | −55° to 125°C |
| Ladder Voltage Accuracy | P/N 5200 is ±488 ppm; 5400 is ±122 ppm |
| Application Resistor Voltage Ratio | P/N 5200 is ±488 ppm; 5400 is ±122 ppm |
| Lead Material | Gold Plated Copper Alloy |

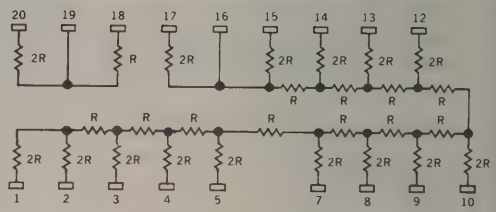
## STABILITY

TaNFilm 12 Bit Ladders Exhibit specified Maximum Voltage Ratio Error after the following tests:

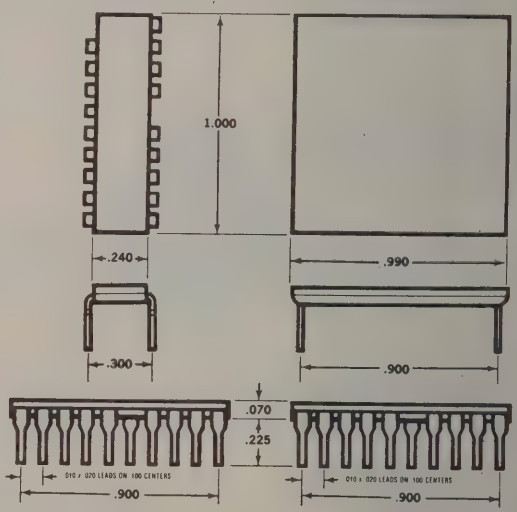
| | |
|---|---|
| Operating Life | 1000 Hrs. Full Load 100°C |
| Short Time Overload | 10 Seconds 2.5 x Rated Voltage |
| Thermal Shock | 10 Cycles −65°C to +150°C |
| Temperature Cycling | 10 Cycles −65°C to +150°C |
| Moisture Cycle - Load/Polar | 10 Days 90/98% R.H. Full Load (202-106) |
| Soldering Heat | 10 Seconds @ 260°C |
| Shock | 3000 g's for 0.2 Milliseconds |
| Vibration | 20 g's |
| Terminal Strength | Per Mil 202-211B |

**NOTE 1** — CONSULT FACTORY FOR OTHER SWITCH COMPENSATION

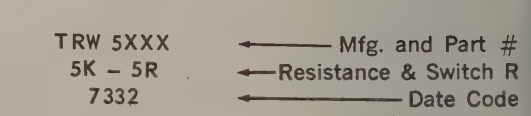
### CIRCUIT DIAGRAM




**5430 SERIES** **5420 SERIES**




### MARKING

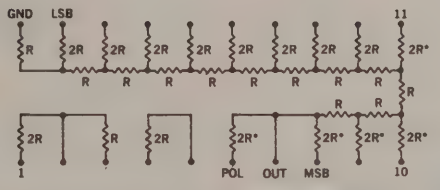
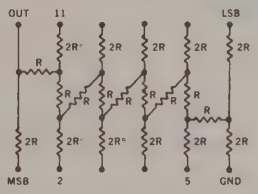
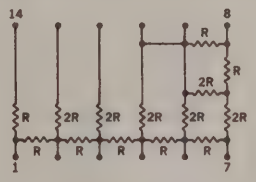
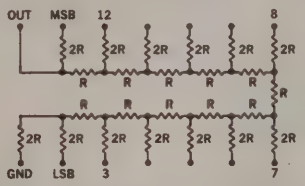
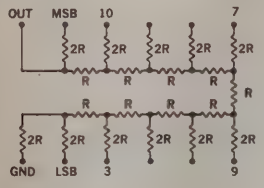
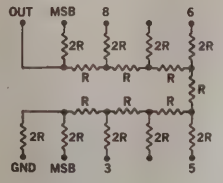



## ORDERING INFORMATION

| Style | Resistance | 5K | 10K | 20K | 25K |
|---|---|---|---|---|---|
| 5420 Series | Part # | 5421 | 5422 | 5423 | 5424 |
| 5430 Series | Part # | 5431 | 5432 | 5433 | 5434 |
| 5220 Series | Part # | 5221 | 5222 | 5223 | 5224 |
| 5230 Series | Part # | 5231 | 5232 | 5233 | 5234 |

**TRW** IRC RESISTORS

# TaNFilm® R-2R LADDERS

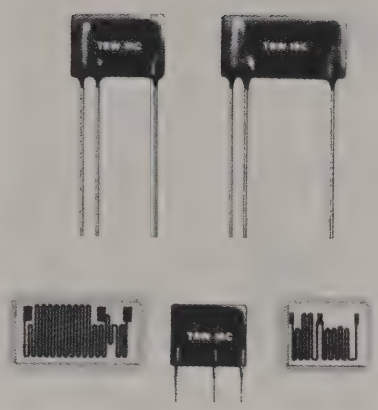
| PART & DESCRIPTION | CIRCUIT | PACKAGE |
|---|---|---|
| 5512 12 BIT R=10K<br>5516 12 BIT R=2K<br>Accuracy ½ LSB<br>*—15Ω SWITCH RESISTANCE |  | 20 PIN D.I.P. |
| 5445 10 BIT 1/8 LSB (12 BIT ACCURACY)<br>5245 10 BIT ½ LSB (10 BIT ACCURACY)<br>5045 10 BIT 2 LSB (8 BIT ACCURACY)<br>R=50K<br>*—150Ω SWITCH RESISTANCE |  | 12 PIN D.I.P. |
| 1045 8 BIT CURRENT SUMMING LADDER<br>R=500Ω<br>RATIO ACCURACY .25% BALANCED |  | 14 PIN D.I.P. |
| 12 BXXE* 12 BIT R=5K, 25K, 50K<br>ACCURACY ½ LSB<br>SWITCH COMPENSATION AVAILABLE |  | 14 PIN FLAT PACK .370" x .250" |
| 10 BXXE* 10 BIT R=5K, 25K, 50K<br>ACCURACY ½ LSB<br>SWITCH COMPENSATION AVAILABLE |  | 12 PIN FLAT PACK .320" x .250" |
| 8 BXXE* 8 BIT R=5K, 25K, 50K<br>ACCURACY ½ LSB |  | 10 PIN FLAT PACK .270" x .250" |

*XX INDICATES R VALUE — 05=5K, 25=25K, 50=50K
NOTE: D.I.P. LEADS ON .100 CENTERS, FLAT PACK RIBBON LEADS ON .050" CENTERS

TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., 4222 SOUTH STAPLES ST., CORPUS CHRISTI, TX 78411 (512) 854-4872

**TRW IRC RESISTORS**

# THICK FILM-HIGH VOLTAGE DIVIDERS

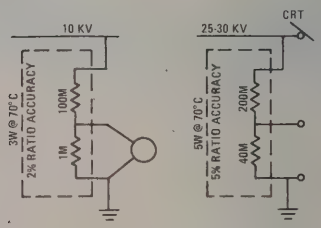


TRW-IRC "RD" series high voltage resistors feature voltage ratios, ratio tolerance and stability characteristics previously unavailable in high voltage resistors.

Resistance ratios to 10,000:1 and voltage ratings to 30 KV are now standard.

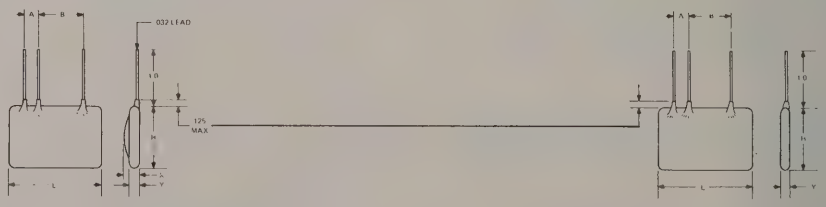
Typical Color tv application.

EXAMPLES:



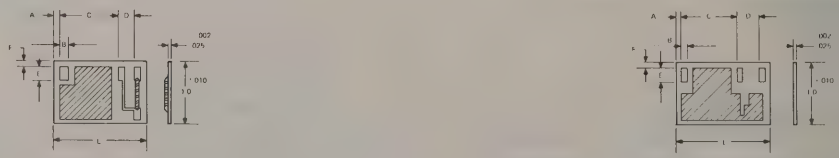

For CRT, high voltage power supply, electrostatic copiers and other high voltage applications, type "RD" resistors are available in ceramic substrate and encapsulated versions; the latter is P.C. board compatible.

| | RD2 | RD2A | RD3 | RD3A | RD5 | RD5A | XRD2 | XRD2A | XRD3 | XRD3A | XRD5 | XRD5A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Power Rating | 2W | 2W | 3W | 3W | 5W | 5W | 2W | 2W | 3W | 3W | 5W | 5W |
| Resistance Range (MΩ) | .5–500 | .5–200 | 1–300 | 1–750 | 1–1000 | 1–1000 | .5–200 | .5–200 | 1–300 | 1–750 | 1–1000 | 1–1000 |
| Resistance Tolerance | ±10, 20% | ±10, 20% | ±10, 20% | ±10, 20% | ±10, 20% | ±10, 20% | ±10, 20% | ±10, 20% | ±10, 20% | ±10, 20% | ±10, 20% | ±10, 20% |
| Ratios Available ($R_1/R_2$) | 1:1<br>10:1 | 25:1<br>10,000:1 | 2:1<br>25:1 | 25:1<br>10,000:1 | 2:1<br>25:1 | 25:1<br>10,000:1 | 1:1<br>10:1 | 25:1<br>10,000:1 | 2:1<br>25:1 | 25:1<br>10,000:1 | 2:1<br>25:1 | 25:1<br>10,000:1 |
| Ratio Tolerance | 5% | 5% | 5% | 2, 5% | 5% | 2, 5% | 5% | 5% | 2, 5% | 2, 5% | 5% | 2, 5% |
| TCR (PPM/°C) | ±400 | ±400 | ±400 | ±400 | ±400 | ±400 | ±400 | ±400 | ±400 | ±400 | ±400 | ±400 |
| Voltage Rating | 10 KV | 10 KV | 20 KV | 20 KV | 30 KV | 30 KV | 10 KV | 10 KV | 20 KV | 20 KV | 30 KV | 30 KV |
| 1000 Hour Load ΔR | ±3% | ±3% | ±3% | ±3% | ±3% | ±3% | ±3% | ±3% | ±3% | ±3% | ±3% | ±3% |



| | A | B | L | H | X | Y |
|---|---|---|---|---|---|---|
| RD2A* | .175 | .576 | 1.10 | 1.10 | .225 | .150 |
| RD3A | .232 | .935 | 1.60 | 1.10 | .225 | .150 |
| RD5A | .232 | 1.385 | 2.10 | 1.10 | .225 | .150 |

| | A | B | L | H | Y |
|---|---|---|---|---|---|
| RD2* | .201 | .549 | 1.10 | 1.10 | .150 |
| RD3 | .452 | .658 | 1.60 | 1.10 | .150 |
| RD5 | .424 | 1.186 | 1.20 | 1.10 | .150 |



| | A | B | C | D | E | F | L |
|---|---|---|---|---|---|---|---|
| XRD2A* | .062 | .125 | .576 | .175 | .250 | .062 | 1.000 |
| XRD3A | .100 | .125 | .935 | .232 | .250 | .062 | 1.500 |
| XRD5A | .125 | .125 | 1.385 | .232 | .250 | .062 | 2.000 |

| | A | B | C | D | E | F | L |
|---|---|---|---|---|---|---|---|
| XRD2* | .062 | .125 | .549 | .201 | .250 | .062 | 1.000 |
| XRD3 | .125 | .140 | .658 | .452 | .250 | .062 | 1.500 |
| XRD5 | .125 | .140 | 1.186 | .424 | .250 | .062 | 2.000 |

*ALL TOLERANCES ARE WITHIN ±.03125

# TRW IRC RESISTORS

## MV GENERAL PURPOSE HIGH VOLTAGE RESISTORS

MV resistors are designed for high voltage requirements where high resistance and power are needed. TRW/IRC's exclusive composition film type resistance coating is applied in helical form on a ceramic tube to provide a conducting tube of long effective length.

MV resistors are particularly suited for voltmeter multipliers, bleeders, electrostatic filters, X-ray equipment, probes, voltage dividers, TV high voltage circuits, and similar applications.

**WITH LUG TERMINALS, COLLOIDAL SILVER TERMINALS OR AXIAL LEADS**

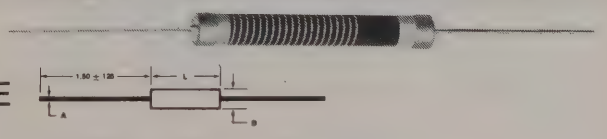
| IRC TYPE | TERMINAL TYPE | POWER RATING (Watts) | PEAK VOLTAGE RATING* (KV) | MINIMUM AVAILABLE RESISTANCE ±10% or ±20% Tolerance | MINIMUM AVAILABLE RESISTANCE ±5% Tolerance | MAXIMUM AVAILABLE RESISTANCE (Megs) | DIMENSIONS IN INCHES Resistor Body Length | Resistor Body Diameter | Ceramic Inside Diameter | Widths of Silver Bands #15 Term. |
|---|---|---|---|---|---|---|---|---|---|---|
| MVC-1 | ‡** | 1 | 3.5 | 10K | 100K | 1,000 | 1.00±.03 | .31±.03 | Thd. #6-32 | N/A |
| MVC-2 | ‡** | 2 | 7.5 | 25K | 100K | 1,000 | 1.75±.03 | .31±.03 | Thd. #6-32 | N/A |
| MVC-3 | ‡** | 3 | 15.0 | 100K | 100K | 1,000 | 3.00±.03 | .31±.03 | Thd. #6-32 | N/A |
| MVC-5 | ‡** | 5 | 30.0 | 100K | 200K | 1,000 | 5.50±.06 | .31±.03 | Thd. #6-32 | N/A |
| MVX-½ | Axial Leads | ½ | 1.5 | 100K | 100K | 250 | .69±.03 | .25±.03 | N/A | N/A |
| MVX-1 | Axial Leads | 1 | 3.5 | 100K | 100K | 1,000 | 1.00±.03 | .25±.03 | N/A | N/A |
| MVX-1½ | Axial Leads | 1.5 | 7.5 | 100K | 100K | 1,000 | 1.57±.03 | .25±.03 | N/A | N/A |
| MVX-2 | Axial Leads | 2 | 10.0 | 100K | 100K | 1,000 | 2.00±.03 | .25±.03 | N/A | N/A |
| MVX-3 | Axial Leads | 3 | 15.0 | 100K | 100K | 1,000 | 3.00±.06 | .25±.03 | N/A | N/A |
| MVH-2 | ‡ | 4 | 15.0 | 100K | 150K | 1,000 | 2.50±.06 | .56±.03 | Thd. #6-32 | N/A |
| MVH-4 | ‡ | 6 | 25.0 | 100K | 400K | 1,000 | 4.00±.06 | .56±.03 | Thd. #6-32 | N/A |
| MVF | 12, 15 | 2 | 5.0 | 25K | 100K | 1,000 | 1.75±.03 | .31±.03 | .19±.03 | .38±.03 |
| MVP | 12, 15, 16, 17 | 10 | 15.0 | 100K | 400K | 1,000 | 4.50±.06 | .75±.03 | .50±.03 | .56±.06 |
| MVA | 15, 16, 17 | 20 | 25.0 | 200K | 1.0meg | 1,000 | 3.50±.06 | 1.12±.03 | .75±.03 | .56±.06 |
| MVO | 15, 16, 17 | 30 | 50.0 | 400K | 2.0meg | 1,000 | 10.5±.06 | 1.12±.03 | .75±.03 | .56±.06 |
| MVQ | 15, 17 | 50 | 50.0 | 500K | 3.5meg | 1,000 | 10.5±.12 | 2.00±.05 | 1.56±.03 | .88±.06 |
| MVR | 15, 17 | 90 | 100.0 | 1meg | 7.0meg | 1,000 | 18.5±.12 | 2.00±.05 | 1.56±.03 | .88±.06 |

‡Solder lug or screw mounted
*Rated continuous working voltage determined by $E = \sqrt{PR}$
E should not exceed value listed in column above
**Also available with axial leads

E = Max. continuous votage
P = Power in watts
R = Resistance in ohms

TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., P.O. BOX 393, BOONE, N.C. 28607 (704) 264-8861

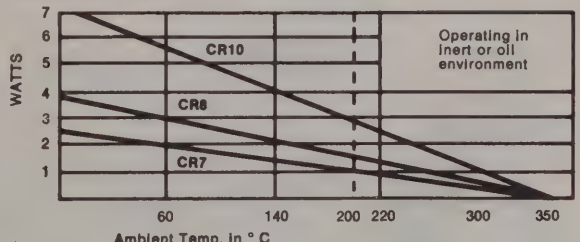
## CR SEMI-PRECISION CARBON ALLOY RESISTORS HIGH TEMPERATURE/HIGH VOLTAGE



CR resistors are economically priced, high-voltage/high-temperature resistors developed for ballast and bleeder applications. This resistor series was originally designed to operate in inert, vacuum, or oil environments. Construction is completely inorganic with no outgassing, and these uncoated carbon alloy resistors will withstand an open flame of 1600°F.

CR resistors are currently being manufactured in three sizes. Other sizes and protective coatings are available upon request.

**DERATING CURVE**




**PERFORMANCE AND DIMENSIONS**

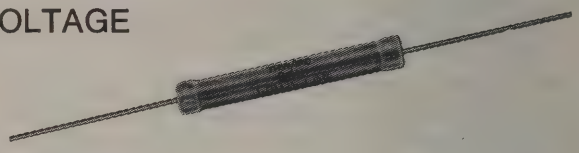
| IRC TYPE | RESISTANCE RANGE (Ohms) | TOLERANCE (±%) | OPERATING TEMPERATURE (°C) | POWER RATING @ 200°C* (Watts) | VOLTAGE RATING* (Volts) | DIMENSIONS IN INCHES Body Length (L Max.) | Body Diameter (D Max.) | Lead Gage (A) |
|---|---|---|---|---|---|---|---|---|
| CR6 | 1Ω—5 Meg | 2-5 | —65 to ±350 | .5 | 1,000 | .342 | .095 | #22 .025 |
| CR7 | 500—25 Meg | 5 | —65 to +350 | 1 | 8,000 | .580 | .157 | #20 .032 |
| CR8 | 1K—50 Meg | 5 | —65 to +350 | 1.5 | 12,500 | .938 | .157 | #20 .032 |
| CR9 | 2K—100 Meg | 5 | —65 to ±350 | 2 | 12,500 | .938 | .300 | #20 .032 |
| CR10 | 2K—200 Meg | 5 | —65 to +350 | 3 | 15,000 | 2.125 | .328 | #20 .032 |

*Voltage and wattage dependent on resistance, operating temperature and environment (i.e. Oil, Air, Vacuum, Inert, etc.)

TRW/IRC RESISTORS. AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., 4222 SOUTH STAPLES ST., CORPUS CHRISTI, TX 78411 (512) 854-4872

# TRW IRC RESISTORS

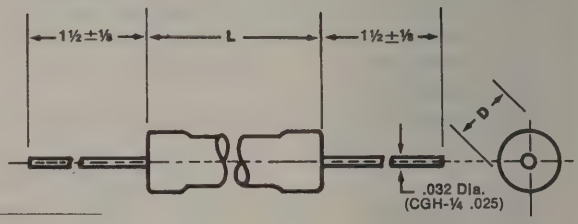
## CGH PRECISION HIGH RANGE, HIGH VOLTAGE METAL GLAZE RESISTORS



The CGH resistor uses the superior qualities of precision thick film, fired at high temperatures on an extremely stable ceramic substrate. This results in a resistor capable of operating in high ambient temperatures and with excellent high voltage load stability.

CGH resistors are particularly suited for precision high voltage and high impedance applications, such as voltage multipliers, X-ray equipment, and high voltage power supplies where precision tolerances and TCs are required.

**DIMENSIONS**:




**SPECIFICATIONS**

| TRW TYPE | Power Rating @ 110°C (Watts) | VOLTAGE RATING (Volts) | RESISTANCE RANGE (Ohms) | T.C.* |
|---|---|---|---|---|
| CGH-¼ | ¼ | 1,000 | 301K-20 Meg ohms | T0,T2 |
| CGH-½ | ½ | 1,500 | 500K-40 Meg ohms | T0,T2 |
| CGH-1 | 1 | 3,500 | 1 Meg-100 Meg ohms | T0,T2 |
| CGH-2 | 2 | 5,000 | 1 Meg-200 Meg ohms | T0,T2 |
| CGH-3 | 3 | 10,000 | 1 Meg-300 Meg ohms | T0,T2 |
| CGH-5 | 5 | 15,000 | 1 Meg-500 Meg ohms | T0,T2 |

*T0 = ±100 PPM, T2 = ±50 PPM. ±200 PPM also available.

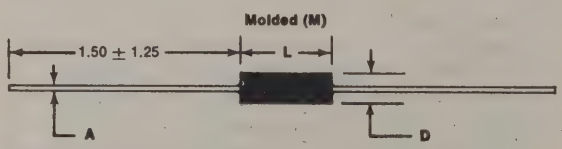
| TRW TYPE | Dimensions in Inches | |
|---|---|---|
| | Body Length* (L) | Body Diameter (D) |
| CGH-¼ | 0.250 ± .031 | 0.088 ± .010 |
| CGH-½ | 0.375 ± .031 | 0.138 ± .016 |
| CGH-1 | 0.690 ± .062 | 0.297 ± .031 |
| CGH-2 | 1.060 ± .062 | 0.297 ± .031 |
| CGH-3 | 2.062 ± .062 | 0.297 ± .031 |
| CGH-5 | 3.062 ± .062 | 0.297 ± .031 |

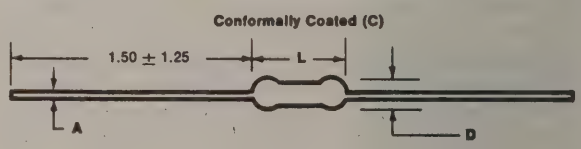
*Clean lead length, add .125" to max (L).

TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., P.O. BOX 393, BOONE, N.C. 28607 (704) 264-8861

## BR HIGH POWER DENSITY PRECISION THIN FILM RESISTORS

The BR series precision metal film power resistors offer an excellent power-to-size ratio, high frequency response, and exceptionally stable performance. They have power ratings 50% to 100% greater for a given size than formerly was available in metal films. This increased capability is obtained with no performance degradation.




**SPECIFICATIONS**

| IRC TYPE | RESISTANCE RANGE (Ohms) | TEMPERATURE COEFFICIENT (±ppm/°C) | TOLERANCE (±%) | POWER RATING @ 25°C* (Watts) See Note 4 | VOLTAGE RATING (Volts) | DIMENSIONS IN INCHES | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Body Length (L Max.) | Body Diameter (D Max.) | Lead Gage (A) |
| BR-3C | 10-25K | 25, 50, 100 | 1, 0.5, 0.25, 0.1 | 1 | 200 | .152±.020 | .065±.010 | #26 .016 |
| BR-4C | 20-100K | | | 1½ | 300 | .250±.031 | .088±.010 | #22 .0253 |
| BR-4M | 20-100K | | | 1½ | 300 | .250±.031 | .093±.005 | #22 .0253 |
| BR-5M | 10-500K | | | 2 | 300 | .406±.015 | .130±.010 | #22 .0253 |
| BR-7C | 10-1Meg | | | 3 | 525 | .594±.031 | .180±.020 | #20 .032 |
| BR-7M | 10-1Meg | | | 3 | 525 | .719±.020 | .261±.020 | #20 .032 |
| BR-9C | 10-5Meg | | | 5 | 750 | .960±.031 | .310±.020 | #20 .032 |
| BR-9M | 10-5Meg | | | 5 | 750 | 1.105±.020 | .395±.020 | #20 .032 |

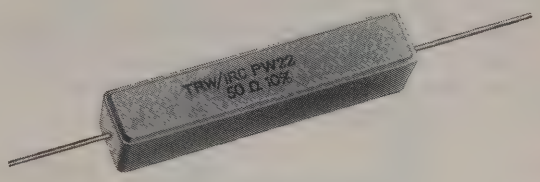
NOTES: 1. Derated power rating by 50% for ±0.1% tolerance. 2. BR-3C lead length 1.00±.062. 3. Molded units (M) are flame proof. 4. Power rating and derating is dependent on mounting conditions. Consult factory for mounting information.

TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., 4222 SOUTH STAPLES ST., CORPUS CHRISTI, TX 78411 (512) 854-4872

# TRW IRC RESISTORS

## PW GENERAL PURPOSE FIREPROOF POWER RESISTORS

**Type PW** resistors are available in eight ratings: 2, 3, 5, 7, 10, 15, 22 to 50 watts. All resistors are inorganically constructed and will not support combustion. Available in standard, fusible, and positive T.C. variations.



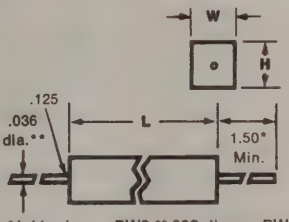

**SPECIFICATIONS**

| IRC TYPE | POWER RATING (Watts) | RESISTANCE Min.* (Ohms) | RESISTANCE Max. (Ohms) | STANDARD TEMPERATURE COEFFICIENT (−55°C to +275°C) 0.06%/°C (Ohms) | STANDARD TEMPERATURE COEFFICIENT (−55°C to +275°C) 0.03%/°C (Ohms) | SPECIAL TEMPERATURE COEFFICIENTS +0.55%/°C (Ohms) | SPECIAL TEMPERATURE COEFFICIENTS +0.45%/°C (Ohms) | SPECIAL TEMPERATURE COEFFICIENTS +0.26%/°C (Ohms) |
|---|---|---|---|---|---|---|---|---|
| PW1 | 1 | 0.18 | 2.2K | 0.18 to 0.56 | 0.62 to 2.2K | 0.1 to 27 | 0.24 to 120 | 0.82 to 110 |
| PW2 | 2 | 0.18 | 2.4K | 0.18 to 0.62 | 0.68 to 2.4K | 0.1 to 30 | 0.24 to 130 | 0.82 to 120 |
| PW3 | 3 | 0.1 | 7.5K | 0.1 to 0.27 | 0.3 to 7.5K | 0.1 to 56 | 01. to 270 | 0.20 to 270 |
| PW5 | 5 | 0.1 | 8.2K | 0.1 to 0.36 | 0.39 to 8.2K | 0.1 to 68 | 0.1 to 300 | 0.24 to 300 |
| PW7 | 7 | 0.1 | 18K | 0.1 to 0.56 | 0.62 to 18K | 0.1 to 150 | 0.15 to 680 | 0.51 to 670 |
| PW10 | 10 | 0.18 | 30K | 0.18 to 0.91 | 1.0 to 30K | 0.1 to 240 | 0.24 to 1100 | 0.82 to 1100 |
| PW15 | 15 | 0.18 | 30K | 0.18 to 0.91 | 1.0 to 30K | 0.1 to 240 | 0.24 to 1100 | 0.82 to 1100 |
| PW22 | 22 | 0.27 | 12K | 0.27 to 1.3 | 1.3 to 12K | 0.15 to 360 | 0.36 to 1800 | 1.25 to 1800 |

*Consult IRC for lower ranges
Tolerance: ±5% and ±10% (standard) tolerances on Standard Temperature Coefficient Resistors. Ranges below 1 ohm available in ±10% tolerance only. PW-1 ±10% tolerance only.

| Dimensions in Inches ±.03 | | | |
|---|---|---|---|
| Type | L | W | H |
| PW1 | .58 | .25 | .25 |
| PW2 | .69 | .25 | .25 |
| PW3 | .88 | .31 | .31 |
| PW5 | .88 | .38 | .35 |
| PW7 | 1.39 | .38 | .35 |
| PW10 | 1.88 | .38 | .35 |
| PW15 | 1.88 | .50 | .50 |
| PW22 | 2.50 | .50 | .50 |

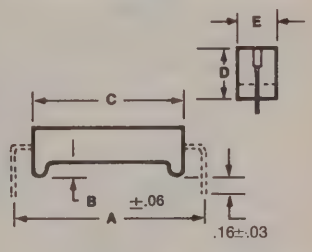
Note: Type PW-50 chassis mounted unit also available. Contact factory.




*1.44 min. on PW2 **.032 dia. on PW2
Add .125 for clean lead length
PW22 lead dia. = .040.

| Recommended Mtg. Dimensions | | | | | |
|---|---|---|---|---|---|
| Type | A | B | C | D | E |
| PW-2A | 1.00 | .06 | .69 | .31 | .25 |
| PW-3A | 1.25 | .06 | .88 | .38 | .31 |
| PW-5A | 1.25 | .06 | .88 | .41 | .38 |
| PW-7A | 1.75 | .12 | 1.39 | .47 | .38 |
| PW-10A | 2.25 | .12 | 1.88 | .47 | .38 |
| PW-15A | 2.25 | .12 | 1.88 | .63 | .50 |

Standard parts are supplied with straight axial leads. Consult factory for available configurations for printed circuit mounting.

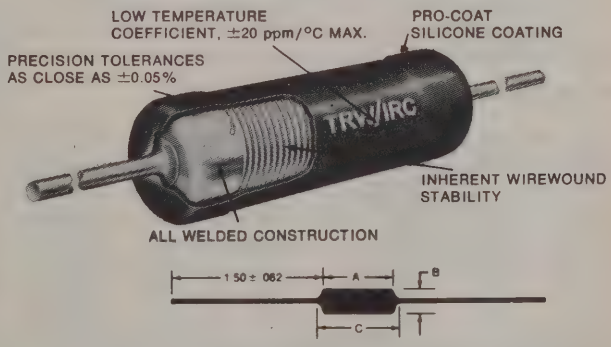



(PW-2A .18±.03)

## AS MINIATURE PRECISION POWER WIREWOUND RESISTORS

Type AS resistors expand circuit design limits significantly by carrying full power even at 125°C ambient. These resistors meet MIL Characteristic V (MIL-R-26) with an allowable 350°C hot spot.

Available in standard and non-inductive windings. Additional options include special stabilization, matching, varnish top-coat, hot tinned leads. Special AS resistors furnished as Hi-Rel functional fuses.




**SPECIFICATIONS**

| IRC TYPE | STYLES MIL-R-26 | IRC POWER RATING 350°C Max. HOT SPOT (Watts) 125°C | IRC POWER RATING 350°C Max. HOT SPOT (Watts) 25°C | COMMERCIAL RANGE (Ohms) Min. | COMMERCIAL RANGE (Ohms) Max. | VOLTAGE RATING (Volts) | NON-INDUCTIVE RANGE (Ohms) Min. | NON-INDUCTIVE RANGE (Ohms) Max. | DIMENSIONS IN INCHES DIM. A ±.032 | DIM. B ±.032 | DIM. C MAX. | LEAD DIA. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AS-¼ | | 0.25 | 0.5 | 1.0 | 3.4K | 70 | * | * | .250 | .062 | .312 | .020 |
| AS-½ | | 0.5 | 1 | 0.5 | 6K | 100 | * | * | .312 | .062 | .375 | .020 |
| AS-1 | | 1 | 2 | 0.1 | 7.5K | 130 | 0.1 | 3.8K | .375 | .093 | .450 | .020 |
| AS-2** | RW69V RW79U | 2 | 3 | 0.1 | 20K | 140 | 0.5 | 10K | .500 | .218 | .625 | .032 |
| AS-2A | | 2.5 | 4 | 0.1 | 42.1K | 300 | 0.5 | 21K | .812 | .187 | .937 | .032 |
| AS-2B | | 3 | 4 | 0.1 | 24K | 185 | 0.5 | 12K | .562 | .187 | .687 | .032 |
| AS-3 | | 3 | 5 | 0.1 | 30K | 200 | 0.5 | 15K | .687 | .250 | .812 | .040 |
| AS-5 | RW74U RW67V | 5 | 7 | 0.1 | 60K | 400 | 0.8 | 30K | .875 | .312 | 1.000 | .040 |
| AS-7 | | 7 | 9 | 0.1 | 90K | 600 | 1.0 | 45K | 1.250 | .312 | 1.375 | .040 |
| AS-10 | RW68V RW78U | 10 | 14 | 0.1 | 175K | 1000 | 3.0 | 50K | 1.812 | .375 | 1.937 | .040 |
| ASC-10 | RW55V | 7 | 10 | 0.1 | 90K | 600 | 1.0 | 45K | 1.375 | .468 | 1.468 | .040 |
| ASC-15 | RW56V | 10 | 15 | 0.1 | 175K | 1000 | 3.0 | 50K | 2.000 | .468 | 2.093 | .040 |

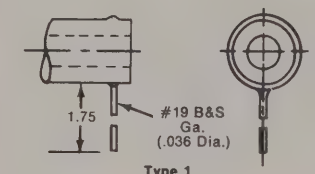
*Inductance on AS-¼ and AS-½ is less than 1μH at 1 MHz. Tolerance available, ±5, 3, 1, and >0.1%
**AS-2 also available in shorter AS2C version. (L=.469, D=.125, .032 lead dia.)

# TRW IRC RESISTORS

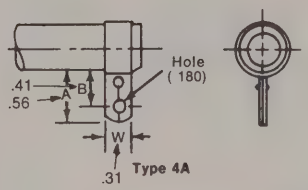
## POWER WIREWOUND RESISTORS

TRW/IRC Power Wirewound Resistors are designed to meet or exceed the requirements of MIL-R-26 and are available in a wide range of tubular, flat, ferrule and adjustable styles.

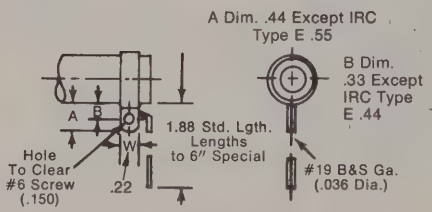
### LUG TYPE




Type 1




Type 4A


A Dim. .44 Except IRC Type E .55
B Dim. .33 Except IRC Type E .44
A
B
W
1.88 Std. Lgth. Lengths to 6" Special
Hole To Clear #6 Screw (.150)
.22
#19 B&S Ga. (.036 Dia.)

Type 12A (no lead) Type 13A (with lead)

NOTE: Non-inductive, tapped, and adjustable resistors also are available.

**PERFORMANCE AND SPECIFICATIONS**

| IRC WATTAGE | IRC TYPE | MIL Equiv. | CORE DIMENSION Length In Inches | CORE DIMENSION O.D. In Inches | CORE DIMENSION I.D. In Inches | TERMINALS Std. | TERMINALS Special | RESISTANCE RANGE (ohms) |
|---|---|---|---|---|---|---|---|---|
| 4 | ⅞A | | .88 | .31 | .19 | 12A | 1*, 13A | 0.10– 10K |
| 5 | 1A | | 1.00 | .31 | .19 | 13A | 1**, 12A | 0.10– 15K |
| 12 | 1¾A | RW29 | 1.75 | .31 | .19 | 13A† | 1, 12A | 0.10– 50K |
| 12 | 1C | RW30 | 1.00 | .44 | .27 | 12A | 1, 13A | 0.10– 20K |
| 15 | 1½C | RW31 | 1.50 | .44 | .27 | 12A | 1, 13A | 0.10– 50K |
| 20 | 2C | RW32 | 2.00 | .44 | .27 | 13A† | 1,12A | 0.10– 80K |
| 25 | 2D | | 2.00 | .56 | .38 | 12A | 1, 4A, 13A | 0.10–100K |
| 26 | 3C | RW33 | 3.00 | .44 | .27 | 12A | 1, 13A | 0.10–150K |
| 30 | 2½D | | 2.50 | .56 | .38 | 12A | 1,4A, 13A | 0.10–150K |
| 35 | 3D | | 3.00 | .56 | .38 | 12A | 1,4A, 13A | 0.10–200K |
| 45 | 3E | | 3.00 | .75 | .50 | 12A | 4A, 13A | 0.15–250K |
| 50 | 3½E | | 3.50 | .75 | .50 | 12A | 4A, 13A | 0.20–300K |
| 50 | 4D | | 4.00 | .56 | .38 | 12A | 1,4A, 13A | 0.20–300K |
| 60 | 4E | RW35 | 4.00 | .75 | .50 | 12A | 4A, 13A | 0.20–350K |
| 60 | 5D | | 5.00 | .56 | .38 | 12A | 1,4A, 13A | 0.25–400K |
| 65 | 4½E | | 4.50 | .75 | .50 | 12A | 4A, 13A | 0.25–400K |
| 75 | 5E | | 5.00 | .75 | .50 | 12A | 4A, 13A | 0.27–450K |
| 80 | 4H | RW36 | 4.00 | 1.12 | .75 | 4A | — | 0.30–525K |
| 100 | 6½E | | 6.50 | .75 | .50 | 12A | 4A, 13A | 0.36–600K |
| 120 | 6H | RW37 | 6.00 | 1.12 | .75 | 4A | — | 0.47–850K |
| 130 | 6½H | | 6.50 | 1.12 | .75 | 4A | — | 0.56–900K |
| 160 | 8H | RW38 | 8.00 | 1.12 | .75 | 4A | — | 0.68–1.15 Meg. |
| 175 | 8½H | | 8.50 | 1.12 | .75 | 4A | — | 0.75–1.25 Meg. |
| 225 | 10½H | RW47 | 10.50 | 1.12 | .75 | 4A | — | 0.91– 1.5 Meg. |
| 250 | 12H | | 12.00 | 1.12 | .75 | 4A | — | 1.00–1.75 Meg. |

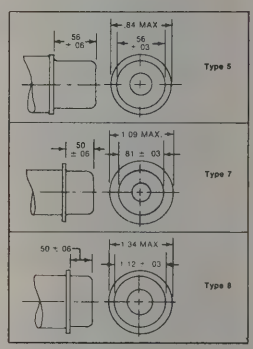
*6 Watts **8 Watts †12A std. on adjustable type

### FERRULE TYPE

**PERFORMANCE AND SPECIFICATIONS**

| IRC WATTAGE | IRC TYPE | OVERALL LENGTH ±.19 In Inches | BODY LENGTH ±.06 In Inches | MAX. SHOULDER DIAMETER* In Inches | FITS FORM #1 STD. FUSE CLIP | FERRULE TERMINALS | MIN. OHMS | MAX. OHMS (.00175 WIRE) | MAX. OHMS (.001 WIRE) |
|---|---|---|---|---|---|---|---|---|---|
| 20 | RW16 | 2.38 | 1.38 | .84 | 30A.250V. | 5 | 0.1 | 9K | 45K |
| 30 | RW15 | 2.94 | 1.94 | .84 | 30A.250V. | 5 | 0.1 | 16K | 78K |
| 60 | RW14 | 4.56 | 3.44 | 1.09 | 60A.250V. | 7 | 0.2 | 48K | 230K |
| 75 | RW13 | 5.12 | 4.12 | 1.09 | 60A.250V. | 7 | 0.2 | 60K | 290K |
| 130 | RW12 | 7.44 | 6.44 | 1.34 | 60A.600V. | 8 | 0.47 | 125K | 620K |
| 175 | RW11 | 9.63 | 8.63 | 1.34 | 60A.600V. | 8 | 0.75 | 175K | 850K |
| 215 | RW10 | 11.44 | 10.44 | 1.34 | 60A.600V. | 8 | 0.82 | 210K | 1050K |

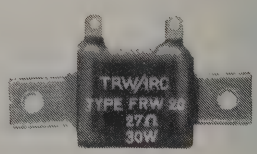
*Body diameter is always less than shoulder diameter.




### OVAL TYPE

**PERFORMANCE AND SPECIFICATIONS**

| IRC WATTAGE | IRC TYPE | POWER RATING MIL Equiv. | POWER RATING Watts | DIMENSIONS IN INCHES Mounting Centers | DIMENSIONS IN INCHES Core Length | RESISTANCE RANGE (ohms) | |
|---|---|---|---|---|---|---|---|
| 30 | FRW-20 | RW20 | 21 | 2.00 | 1.25 | 0.1 | 15K |
| 40 | FRW-21 | RW21 | 31 | 2.75 | 2.00 | 0.1 | 35K |
| 55 | FRW-22 | RW22 | 53 | 4.25 | 3.50 | 0.20 | 75K |
| 70 | FRW-23 | RW23 | 68 | 5.50 | 4.75 | 0.25 | 110K |
| 95 | FRW-24 | RW24 | 91 | 6.75 | 6.00 | 0.35 | 140K |




NOTE: Stack-mounted resistors must be derated to limit the hotspot of the hottest unit to 350°C. For more efficient ventilation, resistors should be mounted with their flat sides (short axis) on a vertical axis.

# TRW IRC RESISTORS

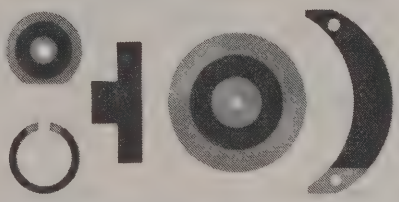
## AW COMMERCIAL WIREWOUND RESISTORS

**Type AW** resistors are available in a wide range of configurations to meet low-cost, high volume applications in the automotive and appliance fields. A range of terminal styles is available, and others can be made to user specifications at a nominal cost. Power ratings are 4.5 watts per inch between mounting centers on the standard AW, and 6 watts per inch between mounting centers on the Hi-Wattage AW resistor.

## CONCENTRIC DISCS and STRIPS

Concentric discs and strips are available in power ratings of up to 1 watt per square inch. These resistors are carbon composition film screen on various flat substrates. Available 20Ω-100KΩ/sq. Standard tolerances are ± 20%.

Disc resistors are die stamped from resistance strips. Inner and outer rings of colloidal silver are applied to provide contact with coaxial line fixtures. Special configurations and tolerances to ± 10% are available.



Applications are variable speed controls in automotive and appliance products, antenna rotor controls wherever a low cost special configuration pot element is required in quantity.

TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., P.O. BOX 393, BOONE, N.C. 28607 (704) 264-8861

## TRW/IRC APPLICATION/DESIGN CAPABILITY

It is impossible to describe in this catalog all the product variations available from TRW/IRC Resistors. Selected TC's, special tolerances, fixed rise times . . . the unique configurations variations are limited only by our mutual ability to work together.

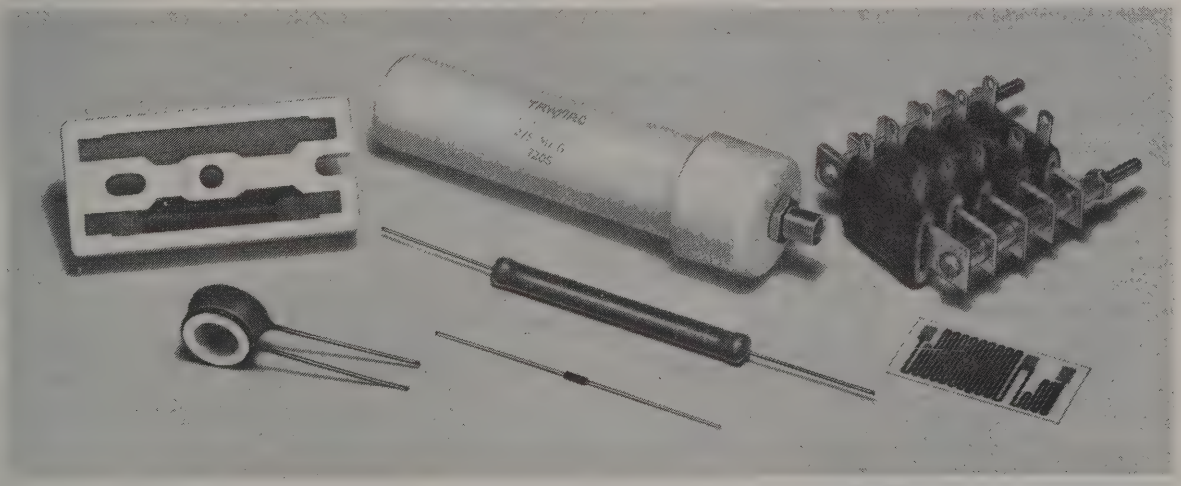
Beyond this, TRW also offers an application/design capability second to none in the industry—and ready to meet virtually any resistive need you might have.

This technology embraces both thin and thick metal film, networks, wirewounds, high-voltage and ultra-precision resistors. In thin-film, for example, it includes tolerance and TC matching down to .01% and 5 PPM/°C respectively. In thick-film, it includes design capabilities in subminiature, tubular substrates — for relays, LED's, and connector applications. In wirewound resistors and assemblies, it includes specialized TC's, fusible units, and custom configurations.

Too, TRW technology also takes in high-precision tantalum-nitride networks. Because of the high circuit density possible with tantalum units, this technology offers opportunities for extreme miniaturization.

* * *

The foregoing scarcely touches the highlights of TRW/IRC's application/design capability. But most important, whatever your performance, configuration or environmental problem, we urge that you let us work with you at the **design** stage. It's at this point, we believe, that we can offer the greatest help in application and cost effectiveness.



TRW/IRC RESISTORS, AN ELECTRONIC COMPONENTS DIVISION OF TRW INC., 401 N. BROAD ST., PHILADELPHIA, PA. 19108 (215) 922-8900

# TRW IRC RESISTORS

## MIL SPEC DEFINITIONS, TERMINOLOGY

**MIL—R—11 (RC) RC07GF153K**

| RC07 | GF | 153 | K |
|---|---|---|---|
| Style/Power (See Tables 1 and 2) | "G" = 70°C Max. ambient temperature for full load operation. "F" = Temperature Coefficient which varies (with resistance) from ±625 ppm/°C to ±3100 ppm/°C. | Resistance First 2 digits significant, 3rd digit "number of zeros." 153 = 15,000Ω | Tolerance (See Table 4) K = ± 10% |

**MIL—R—22684 (RL) RL07S153J**

| RL07 | S | 153 | J |
|---|---|---|---|
| Style/Power (See Tables 1 and 2) | Terminal (Lead) "S" = Solderable | Resistance First 2 digits significant, 3rd digit, "number of zeros." 153 = 15,000Ω | Tolerance (See Table 4) J = ±5% |

**MIL—R—10509 (RN) RN60D1003F**

| RN60 | D | 1003 | F |
|---|---|---|---|
| Style/Power (See Tables 1 and 2) | Characteristic (See Table 3) D = ±100 ppm/°C | Resistance First 3 digits significant, 4th digit "number of zeros." 1003 = 100,000Ω | Tolerance (See Table 4) F = ±1% |

**MIL—R—26 (RW)—Numbering System Complex (See MIL spec) RW55U49R9F**

| RW55 | U | 49R9 | F |
|---|---|---|---|
| Style/Power Size/ Construction | Max. "Hot Spot," derating temperature, insulation resistance and moisture resistance. "U" or "V" characteristic. | Resistance 3 or 4 digits depending on the TC, tolerance, etc. "U" char. has 4 "V" char. has 3 | Tolerance (See Table 4) Only applicable to "U" char. |

**MIL—R—39008 (RCR) RCR07G153JS**

| RCR07 | G | 153 | J | S |
|---|---|---|---|---|
| Style/Power (See Tables 1 and 2) | Characteristic "G" indicates a max. ambient temperature of 70°C for full load operation, and a TC which varies (with resistance) from ±625 ppm/°C to ±1900 ppm/°C. | Resistance First 2 digits significant, 3rd digit, "number of zeros." 153 = 15,000Ω | Tolerance (See Table 4) J = ±5% | Failure Rate (See Table 5) S = .001%/ 1000 hours |

**MIL—R—39017 (RLR) RLR07C153GR**

| RLR07 | C | 153 | G | R |
|---|---|---|---|---|
| Style/Power (See Tables 1 and 2) | Terminal (Lead) "C" = Solderable/Weldable | Resistance First 2 digits significant, 3rd digit, "number of zeros." 153 = 15,000Ω | Tolerance (See Table 4) G = ±2% | Failure Rate (See Table 5) R = ±0.1%/ 1000 hours |

**MIL—R—55182 (RNR) RNR60H1003FS**

| RNR60 | H | 1003 | F | S |
|---|---|---|---|---|
| Style, Terminal and Power (See Tables 1 and 2) RNR = Solderable Leads RNC = Solderable/Weldable Leads RNN = Nickel Leads | Characteristic (See Table 3) H = ±50 ppm/°C | Resistance First 3 digits significant, 4th digit "no. of zeros." 1003 = 100,000Ω | Tolerance (See Table 4) F = ±1% | Failure Rate (See Table 5) S = .001%/ 1000 hours |

**NOTE:** The Established Reliability specifications (i.e., MIL-R-39008, MIL-R-39017, and MIL-R-55182) supersede MIL-R-11, MIL-R-22684, and MIL-R-10509 respectively, for all *new* design. Resistors qualified to the three Established Reliability specifications may be substituted, without limitation, wherever the older MIL devices are specified.

**TABLE 1—Resistor Style**

| | |
|---|---|
| RC | Fixed Composition Resistor (MIL-R-11) |
| RCR | Fixed Composition Resistor, Established Reliability (MIL-R-39008) |
| RL | Fixed Film Resistor (MIL-R-22684) |
| RLR | Fixed Film Resistor, Established Reliability (MIL-R-39017) |
| RN | Fixed Resistor, High Stability (MIL-R-10509) |
| RNR | Fixed Film Resistor, Established Reliability (MIL-R-55182) |
| RW | Fixed Wirewound Resistor, Power Type (MIL-R-26) |

**TABLE 2—Size/Power @ 70° unless otherwise stated)**

| | |
|---|---|
| 05—⅛ watt | MIL-R-11 (RC) |
| 07—¼ watt | MIL-R-39008 (RCR) |
| 20—½ watt | MIL-R-22684 (RL) |
| 32—1 watt | MIL-R-39017 (RLR) |
| 42—2 watt | |
| 50—1/20 watt (@ 125°C) | MIL-R-10509 (RN) MIL-R-55182 (RNR) |
| 55—⅛ watt | |
| 60—¼ watt | |
| 65—½ watt | |
| 70—¾ watt | |
| 75—1 watt (@ 125°C) | |
| 80—2 watt (@ 125°C) | |

**TABLE 3—Characteristic**

| | |
|---|---|
| B = ±500 ppm/°C<br>C = ± 50 ppm/°C (T2)<br>D = ±200, 500 ppm/°C (T0)<br>E = ± 25 ppm/°C (T9)<br>F = ± 50 ppm/°C | MIL-R-10509 (RN) |
| H = ± 50 ppm/°C (T2)<br>J = ± 25 ppm/°C (T9)<br>K = ±100 ppm/°C (T0) | MIL-R-55182 (RNR) |

NOTE: RL and RLR resistors are ±200 ppm/°C. There is no temperature coefficient designation in the RL numbering system.

**TABLE 4—Tolerance**

| | |
|---|---|
| K = | ±10% |
| J = | ±5% |
| G = | ±2% |
| F = | ±1% |
| D = | ±0.5% |
| C = | ±0.25% |
| B = | ±0.10% |

**TABLE 5—Failure Rate 1000 Hours (60% Confidence)**

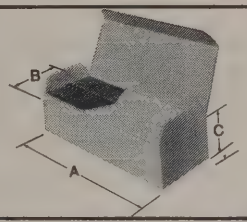
| | |
|---|---|
| M = | 1.0% |
| P = | 0.1% |
| R = | .01% |
| S = | .001% |

# TRW IRC RESISTORS

## PACKAGING STYLES

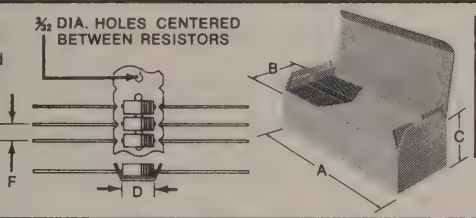
Consult factory for standard package available for the resistor of your choice.

**Oriented Bulk:** Preferred by manufacturers with their own feeding or taping arrangements. Resistors are axially oriented.



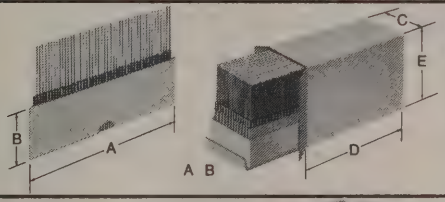

| Type | Wattage | Standard Quantity Per Box | A | B | C |
|---|---|---|---|---|---|
| GBT-¼ | ¼ | 2500 | 10¾" | 3 1/16" | 1¾" |
| GBT-½ | ½ | 2000 | 10¾" | 4 1/16" | 2 5/16" |
| GBT-½V | ½ | 2000 | 10¾" | 4 1/16" | 2 5/16" |
| GBT-1 | 1 | 1000 | 10¾" | 4 1/16" | 2 11/16" |
| BW-20 | 1 | 2000 | 10¾" | 4 1/16" | 2 5/16" |
| BWH | 2 | 1000 | 10 5/16" | 4¼" | 2 1/16" |

**Grip Strip®** A TRW exclusive. Resistors are held without adhesive in strips for ease of handling and counting.



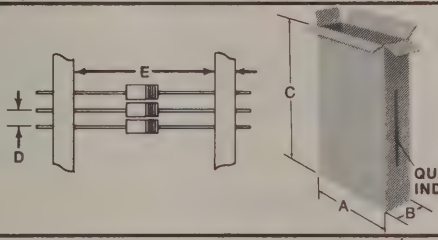

| Type | Wattage | Standard Per Box | Quantity Per Strip | A | B | | D | F |
|---|---|---|---|---|---|---|---|---|
| GBT-½ | ½ | 1000 | 50 | 10 7/16" | 4 1/16" | 2 5/16" | .182" | 7/16" |
| GBT-½V | ½ | 1000 | 50 | 10 7/16" | 4 1/16" | 2 5/16" | .182" | 7/16" |
| GBT-1 | 1 | 1000 | 40 | 12" | 4 5/16" | 4" | .260" | 9/16" |
| BW-20 | 1 | 1000 | 50 | 10 7/16" | 4 1/16" | 2 5/16" | .182" | 7/16" |
| BWH | 2 | 1000 | 40 | 12" | 4 5/16" | 4" | .260" | 9/16" |

**Corrugated Card Pack:** Resistors are inserted into the flutes of corrugated cards.




| Type | Wattage | Standard Quantity Per Box | Quantity Per Strip | A | B | C | D | E |
|---|---|---|---|---|---|---|---|---|
| GBT-¼ | ¼ | 1000 | 50 | 6 3/16" | 1 1/2" | 2 13/16" | 6 1/4" | 3 1/2" |
| GBT-½ | ½ | 1000 | 50 | 8 1/4" | 1 1/2" | 3 1/16" | 8 5/16" | 3 5/8" |
| BW-20 | 1 | 1000 | 50 | 8 1/2" | 1 1/2" | 3 1/16" | 8 5/8" | 3 5/8" |

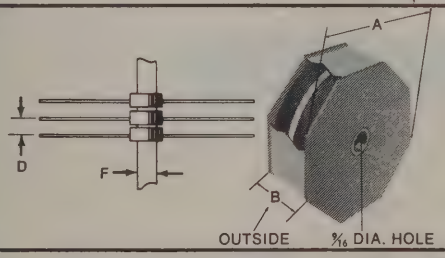
**Ammo-Pak®:** 10,000 resistor package is a continous lead tape belt. Each lead of the resistor is held between two sets of pressure sensitive tape.




| Type | Wattage | Standard Quantity Per Box | A* | B* | C** | D ±.015" | E ±1/16" | F |
|---|---|---|---|---|---|---|---|---|
| GBT-¼ | ½ | 10,000 | 10 3/16" | 3¾" | 9¾" | .200" | 2 1/16" | ¼" |
| GBT-½V | ½ | 10,000 | 12 1/2" | 4" | 19" | .200" | 2 1/16" | ¼" |
| GBT-½ | ½ | 10,000 | 12 1/2" | 4" | 19" | .200" | 2 1/16" | ¼" |
| BW-20 | 1 | 10,000 | 12½" | 4" | 19" | .200" | 2 1/16" | ¼" |

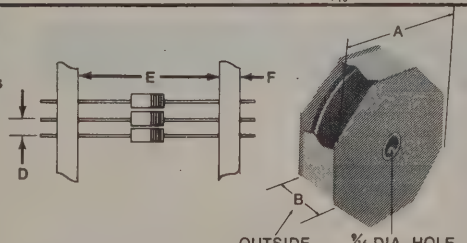
*Subtract ¼" (**subtract ½") for inside carton dimensions.

**Body Tape Reel:** Each resistor body is held by a pressure sensitve tape.




| Type | Wattage | Standard Quantity Per Reel | A (Across Corners) Max. | B Max. | D | F |
|---|---|---|---|---|---|---|
| GBT-¼ | ¼ | 2500 | 6½" | 3 5/8" | .105" | 3/16" |
| GBT-¼ | ¼ | 5000 | 9¾" | 3 5/8" | .105" | 3/16" |
| GBT-½ | ½ | 2500 | 9¾" | 3 13/16" | .158" | ¼" |
| GBT-½ | ½ | 5000 | 13½" | 3 13/16" | .158" | ¼" |
| GBT-½V | ½ | 2500 | 9¾" | 3 13/16" | .158" | ¼" |
| GBT-½V | ½ | 5000 | 13½" | 3 13/16" | .158" | ¼" |
| GBT1 | 1 | 2000 | 13½" | 3 13/16" | .260" | 5/8" |
| BW-20 | 1 | 2500 | 9¾" | 3 13/16" | .158" | ¼" |
| BW-20 | 1 | 5000 | 13½" | 3 13/16" | .158" | ¼" |
| BWH | 2 | 2000 | 13½" | 3 13/16" | .260" | 5/8" |

**Lead Tape Reel:** Each resistor lead is held between two sets of pressure sensitive tape.




| Type | Wattage | Standard Quantity Per Reel | A (Across Corners) Max. | B Max. | D ±.015" | E ±1/16" | F |
|---|---|---|---|---|---|---|---|
| GBT-¼ | ¼ | 2500 | 10 7/8" | 3 13/16" | .200" | 2 1/16" | ¼" |
| GBT-¼ | ¼ | 5000 | 13½" | 3 13/16" | .200" | 2 1/16" | ¼" |
| GBT-½ | ½ | 2500 | 10 7/8" | 3 13/16" | .200" | 2 1/16" | ¼" |
| GBT-½V | ½ | 2500 | 10 7/8" | 3 13/16" | .200" | 2 1/16" | ¼" |
| GBT-½ | ½ | 5000 | 13½" | 3 13/16" | .200" | 2 1/16" | ¼" |
| GBT-1 | 1 | 2000 | 13½" | 3 13/16" | .375" | 2 7/8" | ¼" |
| BW-20 | 1 | 2500 | 10 7/8" | 3 13/16" | .200" | 2 1/16" | ¼" |
| BW-20 | 1 | 5000 | 13½" | 3 13/16" | .200" | 2 1/16" | ¼" |
| BWH | 2 | 2000 | 13½" | 3 13/16" | .375" | 2 7/8" | ¼" |

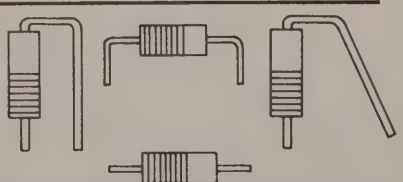
*Other spacing available.

**Cut and formed leads**

TRW/IRC offers the widest selection of pre-cut and formed units in the industry.

Purchasing of pre-cut units offers the user very significant savings in labor and assembly, as well as savings in valuable plant space, since units take only half the space of other packaging styles.

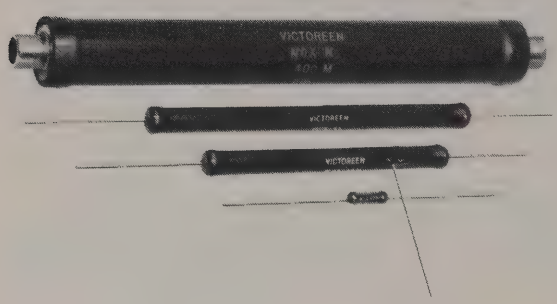
Drawings shown are for carbon composition types. These packaging styles are available for many wirewound and film resistors with some dimensional variations. Consult your sales representative or the factory for specifications, availability and costs.



CUT AND FORMED LEADS AVAILABLE
CONTACT FACTORY FOR DIMENSIONS

VICTOREEN

# TECHNICAL DATA COMPONENTS



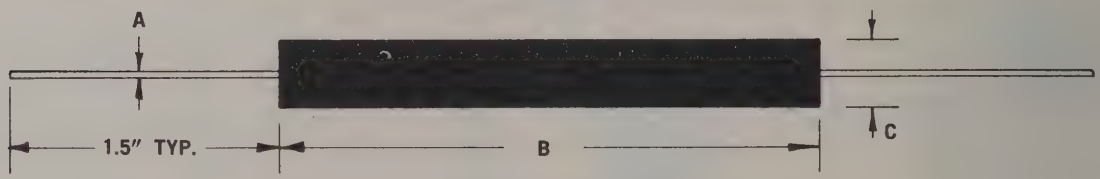
- Wide Resistance Range — 10K-10,000 Megohms
- Full Load Stability — Typically Better than ±1% for 1000 Hours at 70°C
- Power Rating — To 45 Watts
- Voltage Rating — To 45 KV
- Excellent High Voltage, High Temperature

# MOX RESISTORS

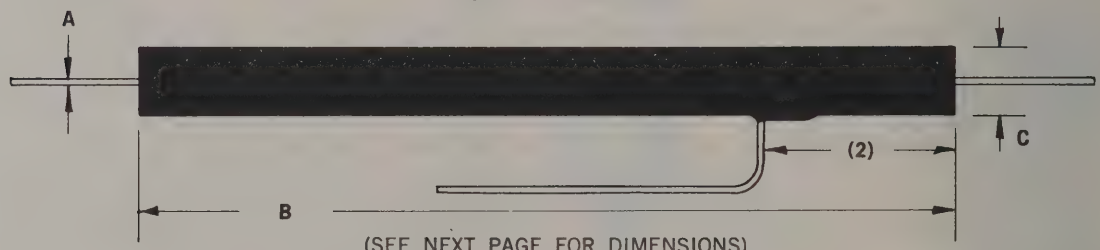
Victoreen's MOX series of cylindrical, high voltage, high resistance resistors has provided the marketplace with a dependable, high performance product for nearly ten years. The improvements presented here represent our response to the current needs of the high voltage design engineer. These changes reflect improvements in Temperature Coefficient, Voltage Coefficient, Power Rating, and available Tolerance, yet are only intended as guidelines to our capabilities.

For applications requiring specifications more stringent than those presented here, please contact the Applications Engineering Department at Victoreen.

STANDARD MOX SERIES




MOX RD SERIES




(SEE NEXT PAGE FOR DIMENSIONS)

**VICTOREEN, INC.** A Shelter Globe Corporation Subsidiary
10101 WOODLAND AVE • CLEVELAND, OHIO 44104
Phone (216) 795-8200 TWX: (810) 421-8287

VICTOREEN

# TECHNICAL DATA COMPONENTS

# MOX RESISTORS

| TYPE | RESISTANCE RANGE | POWER @ 70°C | VOLTAGE RATING | AVAIL. TOL. | MAX. SURF. TEMP. | A[1] | B | C |
|---|---|---|---|---|---|---|---|---|
| 400F | 100K-500M | 1.0W | 1000 | 1,2,5 | 350C | .020 D | .470 | .140 |
| 400A | 100K-2500M | .25W | 1000 | .5,1,2 | 180C | .020 D | .540 | .165 |
| 401 | 100K-1500M | .50W | 1500 | 1,2,5 | 220C | .032 C | .500 | .150 |
| 750A | 100K-5000M | .50W | 2000 | .5,1,2 | 180C | .020 D | .860 | .165 |
| 701 | 100K-2500M | 1.0W | 3000 | 1,2,5 | 220C | .032 C | .840 | .150 |
| 1125A | 100K-10KM | 1.0W | 5000 | .5,1,2 | 180C | .020 D | 1.250 | .165 |
| 1101 | 100K-2500M | 1.5W | 6000 | 1,2,5 | 220C | .032 C | 1.235 | .150 |
| 1 | 10K-1000M | 2.5W | 7500 | .5,1,2 | 220C | .032 C | 1.140 | .345 |
| 2 | 20K-2000M | 5.0W | 15000 | .5,1,2 | 220C | .032 C | 2.140 | .345 |
| 3 | 30K-3000M | 7.5W | 22500 | .5,1,2 | 220C | .032 C | 3.140 | .345 |
| 4 | 40K-4000M | 10.0W | 30000 | .5,1,2 | 220C | .032 C | 4.140 | .345 |
| 5 | 50K-5000M | 12.5W | 37500 | .5,1,2 | 220C | .032 C | 5.140 | .345 |
| 6 | 60K-6000M | 15.0W | 45000 | 1,2,5 | 220C | .032 C | 6.140 | .345 |
| F | 20K-3000M | 22.5W[2] | 20000 | 1,2,5 | 220C | Ferrule | 3.120 | .890 |
| G | 20K-5000M | 34.0W | 30000 | 1,2,5 | 220C | Ferrule | 4.620 | .890 |
| H | 20K-7000M | 45.0W | 45000 | 1,2,5 | 220C | Ferrule | 6.120 | .890 |

| TYPE | RESISTANCE RANGE | POWER @ 70°C | VOLTAGE RATING | MAX. RATIO | RATIO TOL. | A | B | C |
|---|---|---|---|---|---|---|---|---|
| 2RD | 20K-1500M | 2.5W | 7500 | 5000:1 | 1,2,3 | .032 C | 2.140 | .345 |
| 3RD | 30K-2250M | 5.0W | 15000 | 10K:1 | 1,2,3 | .032 C | 3.140 | .345 |
| 4RD | 40K-3000M | 7.5W | 22500 | 10K:1 | 1,2,3 | .032 C | 4.140 | .345 |
| 5RD | 50K-3500M | 10.0W | 30000 | 10K:1 | 1,2,3 | .032 C | 5.140 | .345 |
| 6RD | 60K-4500M | 12.5W | 37500 | 10K:1 | 1,2,3 | .032 C | 6.140 | .345 |
| FRD | 20K-2500M | 20.0W | 20000 | 5000:1 | 1,2,3 | Ferrule | 3.120 | .890 |
| GRD | 20K-4000M | 30.0W | 30000 | 5000:1 | 1,2,3 | Ferrule | 4.620 | .890 |
| HRD | 20K-6000M | 40.0W | 40000 | 5000:1 | 1,2,3 | Ferrule | 6.120 | .890 |

[1]D = Dumet, Tinned; C = Copper, Tinned; Ferrule = .400 O.D. Ferrule Cap
[2]Mox F, G, and H are Derated from an Ambient of 25°C

## MOX RD TAP SPACING (±.100)

| DIVIDER RATIO | MOX 2RD | MOX 3RD | MOX 4RD | MOX 5RD |
|---|---|---|---|---|
| 100-200 | 1.20 | 1.40 | | |
| 200-400 | 1.00 | 1.20 | 1.40 | 1.50 |
| 400-750 | .85 | 1.00 | 1.20 | 1.30 |
| 750-1000 | .80 | .90 | 1.00 | 1.05 |
| 1000-2000 | .70 | .80 | .90 | 1.00 |
| 2000-4000 | .65 | .70 | .75 | .80 |
| 4000-7500 | *.65 | .65 | .70 | .70 |
| 7500-10000 | | .65 | .65 | .65 |

*Ratio Limited to 5000
Consult Factory for Mox-6RD spacing

**VICTOREEN, INC.** A Sheller Globe Corporation Subsidiary
10101 WOODLAND AVE • CLEVELAND, OHIO 44104
Phone (216) 795-8200 TWX: (810) 421-8287

VICTOREEN

# TECHNICAL DATA COMPONENTS

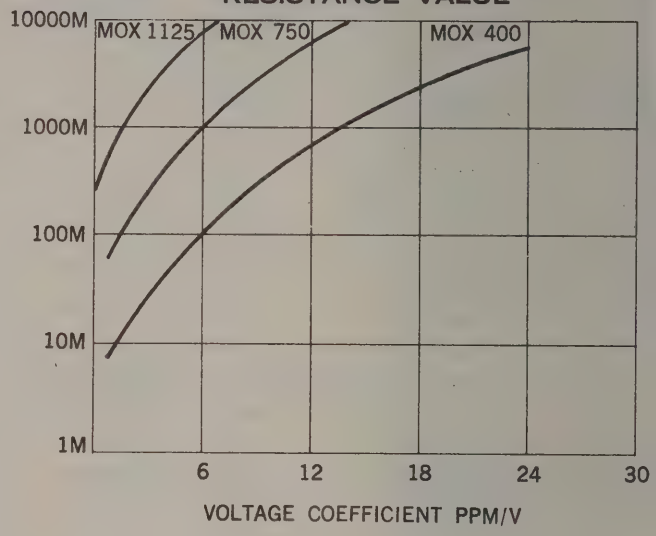
## TEMPERATURE COEFFICIENT AND DERATING INFORMATION

| STYLE | STANDARD 100PPM | STANDARD 250PPM | STANDARD 500PPM |
|---|---|---|---|
| 400F | 100K-10M | 10M-500M | N/A |
| 400A | 100K-500M | 500M-1000M | 1000M-2500M |
| 401 | 100K-200M | 200M-1000M | 1000M-1500M |
| 750A | 100K-1000M | 1000M-2000M | 2000M-5000M |
| 701 | 100K-400M | 400M-2000M | 2000M-2500M |
| 1125A | 100K-1500M | 1500M-3000M | 3000M-10KM |
| 1101 | 100K-600M | 600M-2500M | N/A |
| 1 | 10K-300M | 300M-1000M | N/A |
| 2 | 20K-600M | 600M-2000M | N/A |
| 3 | 30K-900M | 900M-3000M | N/A |
| 4 | 40K-1200M | 1200M-4000M | N/A |
| 5 | 50K-1500M | 1500M-5000M | N/A |
| 6 | 60K-1800M | 1800M-6000M | N/A |
| F | 20K-300M | 300M-3000M | N/A |
| G | 20K-500M | 500M-5000M | N/A |
| H | 20K-700M | 700M-7000M | N/A |

In addition to the above, a Special Temperature Coefficient of ±50PPM/C is available on the MOX-400A series up to 30M, on the 750A series up to 60M, and on the 1125A series up to 100M.

When determining the Temperature Coefficient of RD Series resistors, the above table applies to the total resistance part. The Temperature Coefficient of tracking between the two resistors will be better than ±25PPM/C.

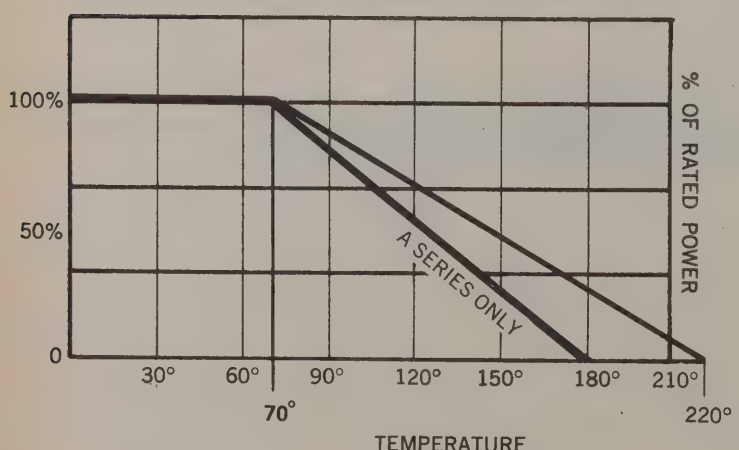
(TYPICAL) VOLTAGE COEFFICIENT vs. RESISTANCE VALUE



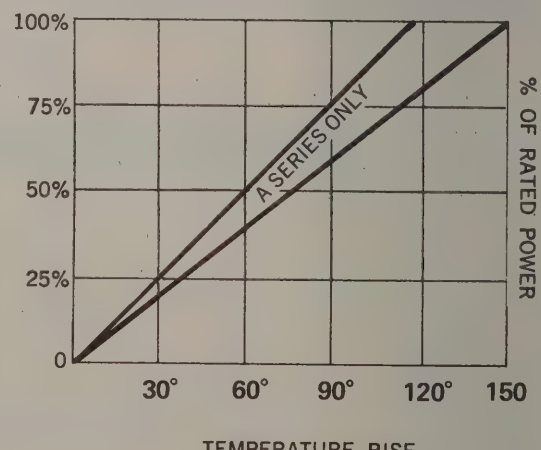

The above curves apply to Victoreen's MINI-MOX series resistors only. As an option, MINI-MOX resistors that have been screened for special low voltage coefficients are available.

As a rule, Victoreen's MAXI-MOX resistors exhibit far better Voltage Coefficients than the MINI-MOX resistors. Typically, these V.C.'s range from .5PPM/V on the larger sizes to 2PPM/V on the Mox 1 series.

CYLINDRICAL AND SLIM MOX
TEMPERATURE DERATING CURVE



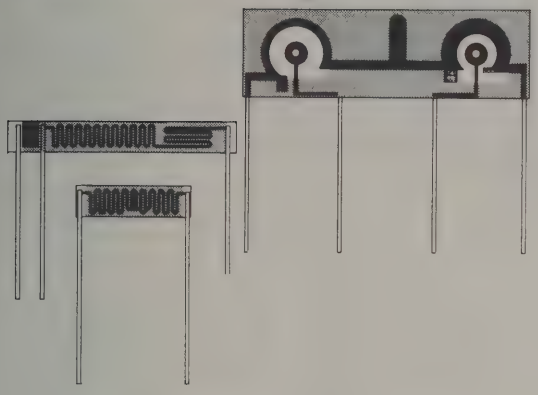

CYLINDRICAL AND SLIM MOX
TEMPERATURE RISE vs. % RATED POWER

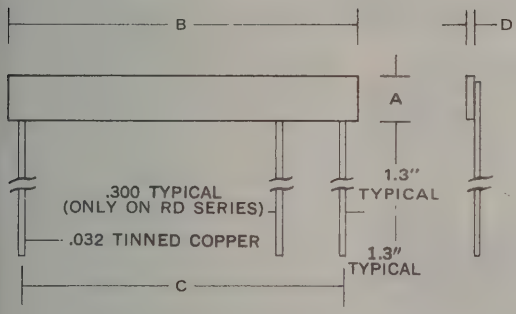



**VICTOREEN, INC.** A Shelter Globe Corporation Subsidiary
10101 WOODLAND AVE • CLEVELAND, OHIO 44104
Phone (216) 795-8200 TWX: (810) 421-8287

VICTOREEN

# TECHNICAL DATA COMPONENTS






- Wide Resistance Range — 1 to 5000 Megohms
- Full Load Stability — Typically Better than +1% for 1000 Hours at 70°C
- Power Rating — To 6 Watts
- Voltage Rating — 20 KV
- Excellent High Voltage, High Temperature
- Noninductive Design

Victoreen's "F" series Slim-Mox were initially conceived to provide drift protection against various potting compounds, when used under an epoxy conformal coating. Field experience has shown, however, that in these potted applications, or in applications requiring higher power dissipation, this special high temperature coating can stand on its own. For a versatile, small size, higher power resistor consider Victoreen's "F" series Slim-Mox. For applications requiring high stability and environmental protection Victoreen's conformal epoxy should be used. For other applications or information not presented here, contact the Applications Engineering Department at VICTOREEN.

## TABLE 2 — TEMPERATURE COEFFICIENT

| | 102 | 104<br>202 | 108<br>204 | 208<br>404 | 308<br>408 |
|---|---|---|---|---|---|
| ±100PPM | 250K-50M | 500K-100M | 1M-200M | 2M-400M | 5M-600M |
| ±250PPM | 50M-250M | 100M-1000M | 200M-1000M | 400M-2000M | 600M-3000M |
| ±500PPM | 250M-1500M | 500M-2500M | 1000M-5000M | 2000M-5000M | 3000M-5000M |

## TABLE 1

| TYPE | RESISTANCE RANGE | POWER @ 70°C | POTTED VOLTAGE RATING | UNPOTTED VOLTAGE RATING | AVAIL. TOL. | MAX. SURF. TEMP. | A | B | C | D |
|---|---|---|---|---|---|---|---|---|---|---|
| 102F | 250K-1500M | .5W | 2500 | 2500 | 1,5,15 | 220°C | .25 | .50 | .4 | .145 |
| 104F | 500K-2500M | 1.0W | 5000 | 5000 | 1,5,15 | 220°C | .25 | 1.00 | .9 | .145 |
| 108F | 1M-5000M | 2.0W | 10000 | 10000 | 1,5,15 | 220°C | .25 | 2.00 | 1.9 | .145 |
| 202F | 500K-2500M | 1.0W | 5000 | 5000 | 1,5,15 | 220°C | .50 | .50 | .4 | .145 |
| 204F | 1M-5000M | 2.0W | 10000 | 10000 | 1,5,15 | 220°C | .50 | 1.00 | .9 | .145 |
| 208F | 2M-5000M | 4.0W | 15000 | 10000 | 1,5,15 | 220°C | .50 | 2.00 | 1.9 | .145 |
| 308F | 5M-5000M | 5.0W | 18000 | 10000 | 1,5,15 | 220°C | .75 | 2.00 | 1.9 | .145 |
| 404F | 2M-5000M | 4.0W | 10000 | 10000 | 1,5,15 | 220°C | 1.00 | 1.00 | .9 | .145 |
| 408F | 5M-5000M | 6.0W | 20000 | 10000 | 1,5,15 | 220°C | 1.00 | 2.00 | 1.9 | .145 |

| TYPE | RESISTANCE RANGE | POWER @ 70°C | POTTED VOLTAGE RATING | UNPOTTED VOLTAGE RATING | MAX. RATIO | RATIO TOL. | A | B | C | D |
|---|---|---|---|---|---|---|---|---|---|---|
| 108RDF | 1M-3000M | 2.0W | 7500 | 7500 | 1000:1 | .5,1,3 | .25 | 2.00 | 1.9 | .145 |
| 204RDF | 1M-3000M | 2.0W | 7500 | 7500 | 1000:1 | .5,1,3 | .50 | 1.00 | .9 | .145 |
| 208RDF | 1M-5000M | 4.0W | 12000 | 10000 | 4000:1 | .5,1,3 | .50 | 2.00 | 1.9 | .145 |
| 308RDF | 2M-5000M | 5.0W | 15000 | 10000 | 4000:1 | .5,1,3 | .75 | 2.00 | 1.9 | .145 |
| 404RDF | 1M-5000M | 4.0W | 7500 | 7500 | 4000:1 | .5,1,3 | 1.00 | 1.00 | .9 | .145 |
| 408RDF | 5M-5000M | 6.0W | 20000 | 10000 | 5000:1 | .5,1,3 | 1.00 | 2.00 | 1.9 | .145 |

**VICTOREEN, INC.** A Sheller Globe Corporation Subsidiary
10101 WOODLAND AVE • CLEVELAND, OHIO 44104
Phone (216) 795-8200 TWX: (810) 421-8287

VICTOREEN

# TECHNICAL DATA COMPONENTS

## RX-I HI-MEG RESISTORS

VICTOREEN HI-MEG RESISTORS were originally designed for use in electrometer circuits where a high order of performance is required. HI-MEG resistors achieve a high degree of accuracy and stability, and operate at this high level for a long period of time. The HI-MEGS are manufactured in accordance with MIL-R-14293A, characteristic T, and therefore are measured at 20 volts ±1 volt. Reference to the average voltage coefficient curve below will indicate that deviations from the marked resistance value may be encountered when used at higher voltages. By special order, Victoreen can supply resistors with resistance measurements at specified voltages.

ELEMENT: The resistor element is a carbon coated glass rod, the ends of which are banded with silver to obtain the best electrical contact. Wire leads extend from the ends of the element.

GLASS SEAL: HI-MEGS are vacuum sealed in a glass envelope which is treated with a special silicone varnish which keeps the resistor relatively free from the effects of moisture. Care should be exercised however, to avoid contamination in handling, such as fingerprints, which might result in reduced effective resistance.

NOISE: The noise level is negligible for most uses.

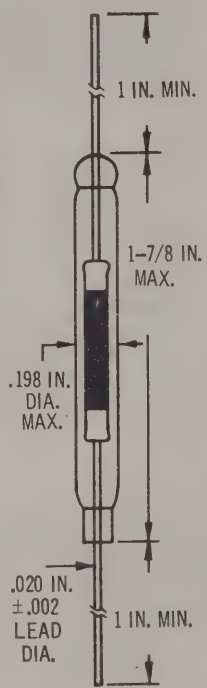
POWER RATING: The power rating for any HI-MEG resistor is equal to one divided by the resistance in megohms.

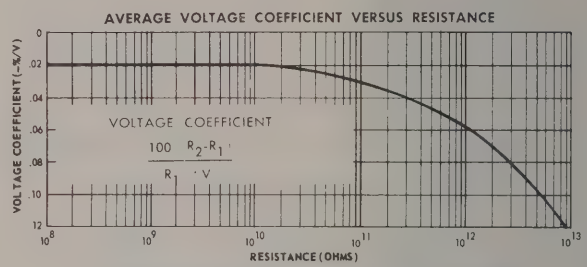
RESISTANCE: HI-MEG resistors available in values from $10^7$ to $10^{14}$ ohms.

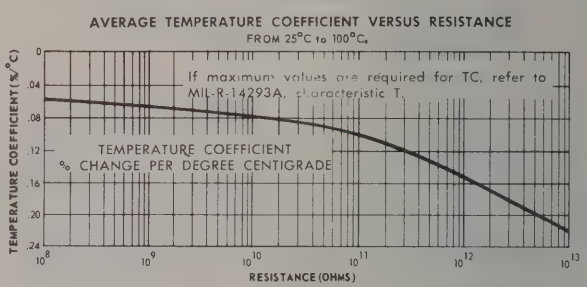
TOLERANCE: HI-MEG resistors can be supplied in the following tolerances: 1% below $10^{12}$ ohms, 2% and 5% below $10^{13}$ ohms, and 10% over the entire range. Refer to the price list for standard tolerance availability.

MAXIMUM WORKING VOLTAGE: 1000V.

MAXIMUM OPERATING AMBIENT TEMPERATURE: 100°C.





AVERAGE TEMPERATURE COEFFICIENT VERSUS RESISTANCE
FROM 25°C to 100°C.
TEMPERATURE COEFFICIENT (%/°C)
If maximum values are required for TC, refer to MIL-R-14293A, characteristic T.
TEMPERATURE COEFFICIENT
% CHANGE PER DEGREE CENTIGRADE
RESISTANCE (OHMS)

## GV3 HI-VOLTAGE REGULATING DIODE

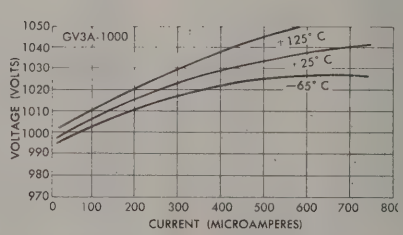
- Current capabilities to 700ua.
- Regulation of the order of 10 volts per 100 micro-amps.
- Designed to regulate high voltage power supplies for portable radiation detection instruments and photo-multiplier tubes, as DC coupling elements and for other high voltage-low current applications.
- Shock: 100g-11ms per Mil. Std. 202C method 202B.
- Vibration: 10-55cps-10g.

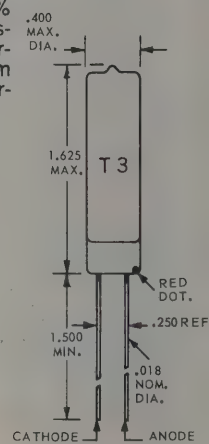
These Victoreen HV Regulators available in any desired nominal voltage ±2.5% from 400 volts to 2500 volts at the customary test point of 50ua. All characteristics such as maximum and minimum currents, regulation, etc., may be interpolated from the table below.

### COMMONLY USED TYPES

| TYPE | NOM. VOLTAGE @ 50ua TEST POINT | TOL. | CURRENT IN MICROAMPERES MIN. | MAX. | PEAK | REGULATION* (MAX.) | ALTITUDE |
|---|---|---|---|---|---|---|---|
| GV3B-400 | 400V | ±10V | 5 | 300 | 400 | 20V | 72,000 |
| GV3A-1000 | 1000V | ±15V | 10 | 500 | 750 | 40V | 65,000 |
| GV3A-2500 | 2500V | ±37V | 25 | 400 | 1400 | 85V | 50,000 |

*This regulation is the change in voltage over useful range of current from MIN. to MAX.




**VICTOREEN, INC.** A Sheller Globe Corporation Subsidiary
10101 WOODLAND AVE • CLEVELAND, OHIO 44104
Phone (216) 795-8200 TWX: (810) 421-8287

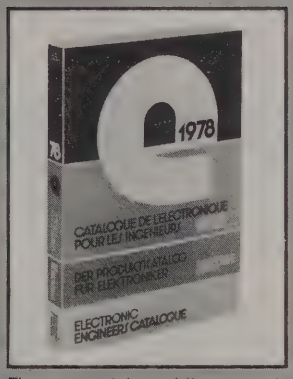
# WE KNOW OUR STUFF

## 41 YEARS OF EXPERIENCE IN CATALOGING, 21 EDITIONS OF eem

**eem/ELECTRONIC ENGINEERS MASTER CATALOG —**

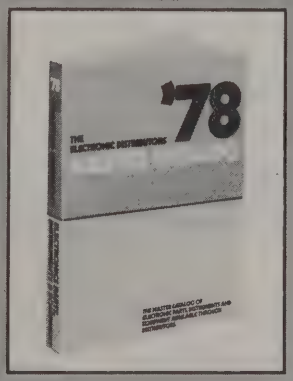
The "blue-ribbon" catalog/directory that has become "the standard of the industry" for electronic engineers, buyers and specifiers.

**ELECTRONIC ENGINEERS CATALOGUE**



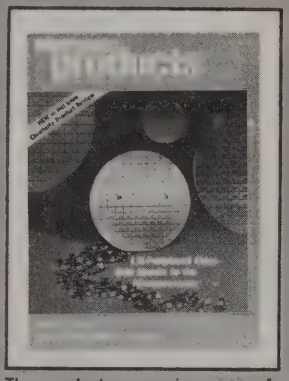

The new catalogue/directory of electronic products available to and from Western Europe and the United Kingdom. Designed especially for the European electronics engineer.

**ELECTRONIC DISTRIBUTORS MASTER CATALOG —**



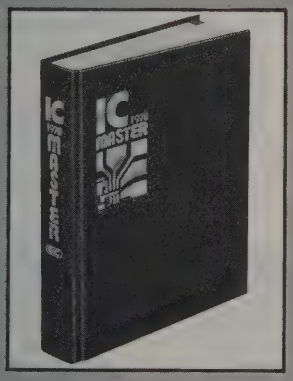

The only national catalog designed exclusively for distributors and their customers featuring electronic parts, instruments and equipment.

**ELECTRONIC PRODUCTS MAGAZINE —**



The products magazine . . . A 100% product-oriented magazine including hundreds of new products and special features every month.

**IC MASTER AND THE UPDATES —**




The only complete single-source directory including all IC devices manufactured in the United States. Updated three times yearly with accumulative supplements.

**eem FILE SYSTEM —**

The only filing system designed especially for the electronics engineer. Instant retrieval and organization of data sheets and catalogs.

**UTP CUSTOM CATALOGS —**

The Cadillac of individualized catalogs for the electronic parts distributor, featuring solely his lines and services.

**UNITED COST AND PRICING SERVICES —**

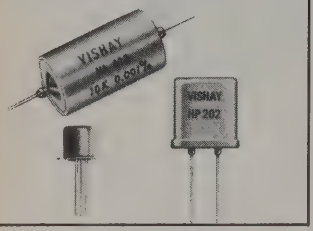
The electronic distributors' proven method of being up to the minute on his cost and selling prices.

*United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Ave., Garden City, N.Y. 11530 / (516) 222-2500 TWX 510-222-1673*

# Precision resistive components selection guide

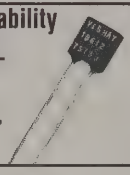
VISHAY RESISTIVE SYSTEMS GROUP • 63 LINCOLN HIGHWAY, MALVERN, PA 19355 • Phone (215) 644-1300 • TWX 510-668-8944

## Hermetically-sealed resistors, metrology and laboratory grade



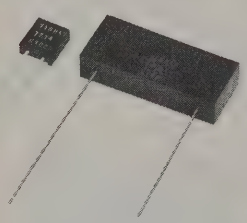

| MODEL NUMBER | RESISTANCE (OHMS) | TOLERANCE[1] | POWER @25°C | TCR[2] | TCR TRACKING[2] | DIMENSIONS (excluding leads) (inch) [mm] |
|---|---|---|---|---|---|---|
| HA412 | 5-100k | To ±0.001% | 0.30W | 1 ppm/°C | 3 ppm/°C max. | 0.625 (15.875) L x 0.375 (9.525) Dia. |
| HA414 | 5-200k | | 0.50W | | | 1.000 (25.400) L x 0.375 (9.525) Dia. |
| HA512 | 5-300k | | 0.75W | | | 0.625 (15.875) L x 0.500 (12.700) Dia. |
| HA516 | 5-600k | | 1.50W | | | 1.000 (25.400) L x 0.500 (12.700) Dia. |
| HA518 | 5-1M | | 2.50W | | | 1.500 (38.100) L x 0.500 (12.700) Dia. |
| HP202 | 5-100k | | 0.30W | | | 0.430 (10.922) x 0.435 (11.049) x 0.185 (4.699); lead spacing 0.150 (3.810) |
| VHM-1 | 50-20k | To ±0.02% | 0.05W @125°C | 2.5 ppm/°C | 5 ppm/°C max. | 0.210 (5.334) H x 0.230 (5.842) Dia. (std. T018 case) |

## Established-reliability resistors, ERMIL style RNC90Y (Mil-R-55182/9, Char. Y)



| MODEL NUMBER | RESISTANCE (OHMS) | TOLERANCE[1] | POWER @125°C | TCR[2] | TCR TRACKING[2] | DIMENSIONS (excluding leads) (inch) [mm] HxLxW |
|---|---|---|---|---|---|---|
| S444 | 1-100k | To ±0.005% | 0.30W | 2.5 ppm/°C | 5 ppm/°C max. | 0.350 (8.890) x 0.310 (7.874) x 0.110 (2.794); lead spacing 0.150 (3.810 |

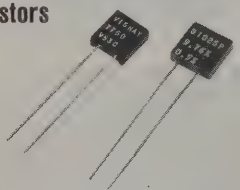
## Precision resistors, high-performance industrial and aerospace grade



| MODEL NUMBER | RESISTANCE (OHMS) | TOLERANCE[1] | POWER @125°C | TCR[2] | TCR TRACKING[2] | DIMENSIONS (excluding leads) (inch) [mm] HxLxW |
|---|---|---|---|---|---|---|
| S102C | 1-100k | To ±0.005% | 0.30W | 2.5 ppm/°C | 5 ppm/°C max.; 3 ppm/°C typical | 0.326 (8.280) x 0.302 (7.670) x 0.105 (2.667); lead spacing 0.150 (3.810) |
| S104 | 1-200k | | 0.50W | | | 0.520 (13.208) x 0.565 (14.351) x 0.150 (3.810); lead spacing 0.400 (10.160) |
| S105 | 1-300k | | 0.75W | | | 0.520 (13.208) x 0.810 (20.574) x 0.150 (3.810); lead spacing 0.650 (16.510) |
| S106C | 0.5-600k | | 1.00W | | | 0.520 (13.208) x 1.190 (30.226) x 0.245 (6.223); lead spacing 0.900 (22.860) |
| HS102C* (ruggedized) | 1-100k | | 0.30W | | | 0.430 (10.922) x 0.435 (11.049) x 0.185 (4.699); lead spacing 0.150 (3.810) |

*Shorter height dimensions available on special order.

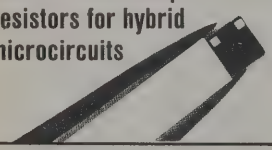
## Value-engineered and standard stock precision resistors



| MODEL NUMBER | RESISTANCE (OHMS) | TOLERANCE[1] | POWER @ 125°C | TCR[2] | TCR TRACKING[2] | DIMENSIONS (excluding leads) (inch) [mm] HxLxW |
|---|---|---|---|---|---|---|
| V53C | 1-100k | To ±0.02% | 0.30W | 10 ppm/°C | 10 ppm/°C typical | 0.326 (8.280) x 0.302 (7.670) x 0.105 (2.667); lead spacing 0.150 (3.810) |
| S102SP* | 10-100k* | ±0.5% (±1.0% EOL) | 0.30W | | – | 0.375 (9.525) x 0.320 (8.128) x 0.120 (3.048), lead spacing 0.150 (3.810) |

*Available only in standard values per E192 list (Table IV), Mil-R-55182.
For < +1% design-tolerance (end-of-life) applications.

## Micro and minichip resistors for hybrid microcircuits



| MODEL NUMBER | RESISTANCE (OHMS) | TOLERANCE[1] | POWER @70°C | TCR[2] | TCR TRACKING[2] | CHIP DIMENSIONS (inch) [mm] LxWxT |
|---|---|---|---|---|---|---|
| V5X5 | 5-5k | To ±0.005%* | 0.05W | 2.5 ppm/°C | 5 ppm/°C max. | 0.050 (1.270) x 0.050 (1.270) x 0.017 (0.432) |
| V15X5 | 50-25k | | 0.10W | | | 0.150 (3.810) x 0.050 (1.270) x 0.017 (0.432) |

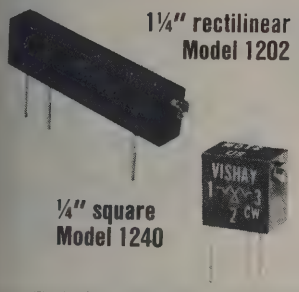
*User-calibratable to ±0.005%

## Hermetically-sealed precision power resistors

| MODEL NUMBER | RESISTANCE (OHMS) | TOLERANCE[1] | POWER @25°C | TCR[2] | TCR TRACKING[2] | DIMENSIONS (excluding leads) (inch) [mm] HxLxW |
|---|---|---|---|---|---|---|
| VHP-3 | 10-39.2k | To ±0.01% | 10W* | 2.5 ppm/°C | 5 ppm/°C max. | 0.346 (2.03) x 1.530 (38.86) x 1.00 (25.4); std T03 case |

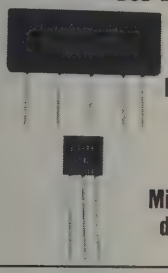
* 10W when chassis-mounted, 3W in free air.

## Precision trimming potentiometers




| MODEL NUMBER | RESISTANCE (OHMS) | POWER @85°C | TCR | NO. OF TURNS | DIMENSIONS (excluding leads) HxLxW (inch) (mm) AND TERMINATION STYLES |
|---|---|---|---|---|---|
| 1202<br>RJR12 style | 2, 5, 10, 20<br>50, 100, 200,<br>250, 500, 1k,<br>2k, 2.5k, 5k,<br>10k, 20k<br>All values<br>±5% or ±10% | 0.50W | +5 ±5 ppm/°C from −55°C to +25°C;<br>−5 ±5 ppm/°C from +25°C to +150°C | 25 ± 2 | 0.325 (8.255) x 1.250 (31.750) x 0.195 (4.953)<br>Type P: In-line pins<br>Type Y: Staggered pins<br>Type L: Flexible leads<br>Type LB: Panel-mount with flexible leads |
| 1240<br>RJR26 style | 5, 10, 20,<br>50, 100, 200,<br>500, 1k,<br>2k, 5k<br>All values<br>±5% | 0.25W | | 21 ± 2 | Type X: Edge-mount, side-adjust;<br>Type W: Edge-mount, top-adjust<br>0.250 (6.350) x 0.250 (6.350) x 0.175 (4.445)<br>Type P: Flat-mount, side-adjust<br>0.175 (4.445) x 0.250 (6.350) x 0.250 (6.350) |

## Standard unitized circuits




| MODEL NUMBER[1] | NO. OF RESISTORS | R VALUE OF EACH RESISTOR[2] | TOL. RATIO BETW. RESISTORS @25°C | TCR RATIO BETW. RESISTORS (−55°C to +125°C) | DIMENSIONS (excluding leads) HxLxW (inch) (mm) |
|---|---|---|---|---|---|
| 300190,1 | 2 | 100Ω-100kΩ | ±1.0%, ±0.5%, ±0.1%, ±0.05%, ±0.02%, ±0.01%, ±0.005% | 5 ppm/°C | 0.520 (13.208) x 0.565 (14.351) x 0.150 (3.810) |
| 300192, 3,4 | 3 | 100Ω-100kΩ | | 5 ppm/°C | 0.520 (13.208) x 0.810 (20.574) x 0.150 (3.810) |
| 300195,6, 7,8,9 | 4 | 100Ω-100kΩ | | 5 ppm/°C | 0.520 (13.208) x 1.190 (30.226) x 0.245 (6.223) |
| 300210 | 3 | 100Ω-100kΩ | | 5 ppm/°C | 0.520 (13.208) x 0.810 (20.574) x 0.150 (3.810) |
| 300211, 12 | 4 | 100Ω-100kΩ | | 5 ppm/°C | 0.520 (13.208) x 1.190 (30.226) x 0.245 (6.223) |
| 300144 | 2 (1 chip) | 100Ω-40kΩ[3] | | 1 ppm/°C | 0.320 (8.128) x 0.295 (7.493) x 0.100 (2.540) |
| 300145 | 4 (2 chips) | 100Ω-40kΩ[3] | | 1 ppm/°C,<br>5 ppm/°C[4] | 0.375 (9.525) x 0.375 (9.525) x 0.200 (5.080) |

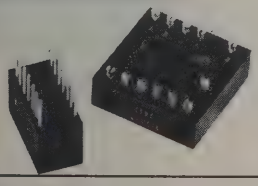
[1] Standardized circuits used throughout, with individual R values selected by user. For the 300144 and 300145 models, standard R ratio sets are available in addition to standard circuits. Consult factory for details.

[2] Resistance values below 100Ω are available. Consult factory.

[3] 40kΩ is the maximum resistance value per chip, and is divided between the two resistors on the chip.

[4] 1 ppm/°C between resistors R1 and R2 and between R3 and R4; 5 ppm/°C for all resistors as a set.

## Standard and custom resistance networks



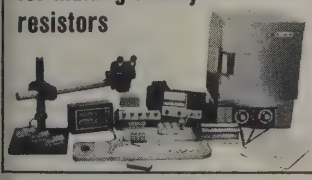
**CUSTOM AND STANDARD BINARY LADDER NETWORKS, BCD LADDERS, ETC.**

- Up to 16 bits
- ½ LSB to ±0.001 full-scale accuracy
- 25-ppm total impedance stability over 3 years

Besides designing completely custom precision networks to your most demanding specifications, Vishay offers standard binary R-2R ladder networks in 4-bit to 16-bit configurations (voltage-fed) with resistance values from 100 ohms to 50kΩ; 2R to 100kΩ.

Three basic package styles: **Profile 500,** 0.750" (19.05mm) W x 0.500" (12.70mm) H; **Profile 375,** 1.230" (31.242mm) W x 0.365" (9.271mm) H. Lengths dependent on number of bits: min. 0.700" (17.78mm) for 4-bit Profile 500 to 2.14" (54.356mm) for 16-bit ladder; min. 0.730" (18.542mm) for Profile 375 to 2.59" (65.786mm) for 15-bit package. **Profile 200,** 1.0" (25.4mm) W x 1.0" (25.4mm) L x 0.200" (5.08mm) H only.

## In-plant station for making Vishay resistors



**BENCHTOP STATION FOR CALIBRATING AND ENCAPSULATING VISHAY RESISTORS IN YOUR OWN PLANT**

**Model 290424** (115V 60Hz) or **Model 290425** (220V 50Hz) gives you a complete facility for obtaining custom resistors of Vishay quality within your own plant or laboratory. Ideal for breadboarding, prototype, and even for production runs.

Select a Vishay resistor chip of a resistance value closest to the final value you want. Then calibrate according to simple instructions provided, to tolerances as close as ±0.005%. Make resistors of any value from 2Ω to 100kΩ. Call for further information.

## 1. Standard Tolerances

| TOLERANCE | SERIES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | HA, HP | VHM-1 | S444 | S | V53C | S102SP | VHP-3 | V-Chip |
| ±0.001% | | | | | | | | |
| ±0.0025% | | | | | | | | |
| ±0.005% | | | | | | | | |
| ±0.01% | | | | | | | | |
| ±0.02% | | | | | | | | |
| ±0.05% | | | | | | | | |
| ±0.1% | | | | | | | | |
| ±0.25% | | | | | | | | |
| ±0.5% | | | | | | | | |
| ±1.0% | | | | | | | | |

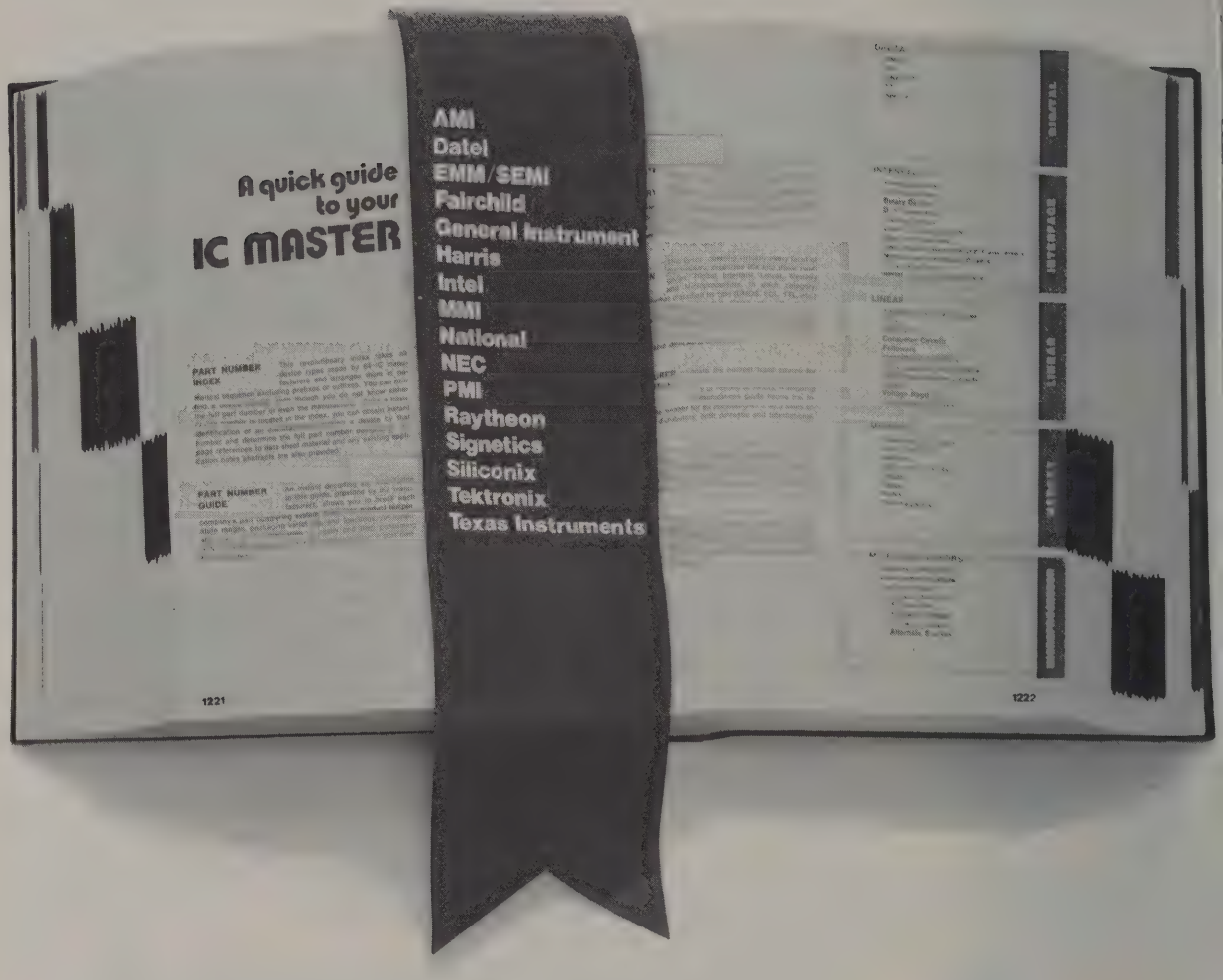
Recognized measurement limitations impose restrictions on practical tolerance attainable when selecting low-resistance-value resistors. Consult Applications Engineering Department for exact limits.

## 2. Standard TCR and TCR Tracking

| SERIES | TCR | TCR TRACKING |
|---|---|---|
| HA, HP | +1 ±1.5 ppm/°C from 0°C to +25°C;<br>−1 ±1.5 ppm/°C from +25°C to +60°C | 3 ppm/°C max. |
| VHM-1, S444, S, HS, VHP-3, V-Chip | +2.5 ±2.5 ppm/°C from −55°C to +25°C;<br>−2.5 ±2.5 ppm/°C from +25°C to +125°C | 5 ppm/°C max.,<br>3 ppm/°C typical |
| V53C | ±10 ppm/°C, ref.@ +25°C | 10ppm/°C typical |
| S102SP | | — |

TCR characteristics, including tracking, are standard down to:
100Ω —V-Chip, VHM-1, VHP-3
50Ω —S, HS, V53C, S102SP
40Ω —S444
Consult Applications Engineering Department for further details.

# A GOOD BOOK IS KNOWN BY THE COMPANIES IT KEEPS




These manufacturers have invested in the IC MASTER to bring you the most comple information on their newest standard products.

WHEN USING THE IC MASTER, REFER TO THESE MANUFACTURERS' COMPLE DATA SHEETS TO HELP YOU IN YOUR IC SELECTION . . .

## THE WHOLE WORLD FOLLOWS THE MASTER.

**IC Master**
**1333 Lawrence Expressway, Suite 420**
**Santa Clara, CA 95051**
**(408) 248-8044**

***It's Faster With the Master***

# Allen-Bradley Trimming Potentiometers

**TYPE E:**
Cermet, single turn, 0.5W at 70°C, 10 ohms to 2.5 megs, ±10%, pin terminals, 14 types, top and side adjustment, linear taper. TCR <±35 PPM/°C.

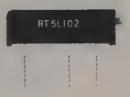
**TYPE D:**
Cermet, single turn, 0.5W at 70°C, 10 ohms to 2.5 megs, ±20%, pin terminals, 8 types, top and side adjustment, linear taper. TCR <±35 PPM/°C.

**TYPE 90:**
Cermet, single turn, 0.5W at 70°C, 1.0W at 40°C, 100 ohms to 2 megs, ±20%, pin terminals, top and side adjustment, linear taper. TCR ±100 PPM/°C.

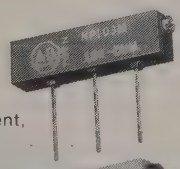
**TYPE S:**
Cermet, single turn, 0.5W at 85°C, 50 ohms to 1 meg, ±10%, pin terminals, top and side adjustment, linear taper. TCR <±35 PPM/°C.

**TYPE A:**
Cermet, single turn, 0.5W at 85°C, 10 ohms to 2.5 megs, ±10%, pin terminals, top and side adjustment, 6 types, linear taper. TCR <±35 PPM/°C.

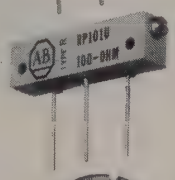
**TYPE MT:**
Cermet, 20 turns, 0.5W at 70°C, 10 ohms to 2.5 megs, ±10%, pin terminals, 7 types, top and side adjustment, linear taper. TCR <±35 PPM/°C.




**TYPE RT:**
Cermet, 20 turns, 1.0W at 40°C, 10 ohms to 2.5 megs, ±10%, pin terminals, 4 types, linear taper, .250 inch or .340 inch high types. Translucent housing also available in any of the lead configurations. TCR <±35 PPM/°C.



**TYPE N.**
Hot-molded composition, 25 turns, 0.33W at 50°C, 100 ohms to 2.5 megs, ±10% and ±20%, pin terminals, linear taper.



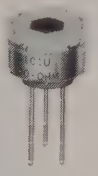

**TYPE R:**
Hot-molded composition, 25 turns, 0.25W at 70°C, 100 ohms to 2.5 megs, ±10% and ±20%, pin or solder lug terminals, linear taper

**TYPE F:**
Hot-molded composition, single turn, 0.25W at 70°C, 100 ohms to 5 megs, ±10% and ±20%, pin or solder lug terminals, top and side adjustment, 5 standard tapers.

**TYPE FD:**
Dual version of Type F; front section: solder lug only, rear section: pin or lug. Well suited for Bridged-T or L-pad attenuator applications.

**TYPE BT:**
An all plastic version of the Type FD for excellent performance at high frequencies. Two terminal configurations available. Also well suited for Bridged-T or L-pad attenuator applications

**TYPE O:**
Hot-molded composition, single turn, 0.4W at 70°C, 100 ohms to 5 megs, ±10% and ±20%, pin or solder lug terminals, 5 standard tapers



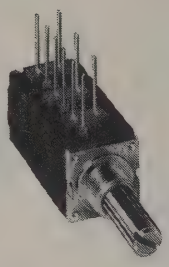
**TYPE Y:**
Hot-molded composition, single turn, 0.25W at 50°C, 100 ohms to 5 megs, ±10% and ±20%, pin or solder lug terminals, 5 types, top and side adjustment, 5 standard tapers

## SPECIFICATIONS

| Type | Publication Number | Resistance Element and Adjustment Turns | Resistance Range and Tolerance | Power Rating | Voltage Rating (RMS or DC) | Operating Temperature Range | Terminal Types | Case Dimensions in Inches (millimeters) | Enclosure |
|---|---|---|---|---|---|---|---|---|---|
| E | 5219A | Cermet Single Turn | 10 Ohms to 2.5 Megohms ±10% | 0.5 Watt @ 70°C | 300V | −55°C to +125°C | Pin | 0.375 (9,53) Square by 0.19 (4,83) Thick | Immersion Sealed |
| D | 5240 | | 10 Ohms to 2.5 Megohms ±20% | 0.5 Watt @ 70°C | | −55°C to +125°C | | 0.375 (9,52) Diameter | Dust Covered |
| 90 | 5242 | | 100 Ohms to 2 Megohms ±20% | 0.5 Watt @ 70°C 1.0 Watt @ 40°C | 200V | −55°C to +125°C | | L 0.466 (11,9) W 0.393 (10,0) D 0.228 (5,8) | Open Frame |
| S | 5208 | | 50 Ohms to 1 Megohm ±10% | 0.5 Watt @ 85°C | 300V | −65°C to +150°C | | 0.375 (9,52) Diameter by 0.375 (9,52) | Immersion Sealed |
| A | 5238 | | 10 Ohms to 2.5 Megohms ±10% | 0.5 Watt @ 85°C | | −55°C to +150°C | | 0.250 (6,35) Diameter by 0.125 (3,18) | |
| MT | 5241 | Cermet 20 Turn Nominal | 10 Ohms to 2.5 Megohms ±10% | 0.5W @ 70°C | | −55°C to +125°C | | 0.375 (9,53) Square by 0.218 (5,54) Thick | |
| RT | 5237A | | 10 Ohms to 2.5 Megohms ±10% | 1.0 Watt @ 40°C | | −55°C to +125°C | | L 0.750 (19,05) W 0.190 (4,83) H 0.250 (6,35) or H 0.340 (8,64) | |
| N | 5206 | Hot-Molded Composition 25 Turn | 100 Ohms to 2.5 Megohms ±10%, ±20% | 0.33 Watt @ 50°C | | −55°C to +100°C | Pin | L 1.250 (31,75) H 0.359 (9,13) W 0.250 (6,35) | |
| R | 5205 | | | 0.25 Watt @ 70°C | | −55°C to +125°C | Pin or Solder Lug | | |
| F | 5234 | Hot-Molded Composition Single Turn | 100 Ohms to 5 Megohms ±10%, ±20% | 0.25 Watt @ 70°C | 350V | −55°C to +120°C | Pin or Solder Lug | 0.500 (12,70) Diameter by 0.531 (13,49) | |
| FD | 5231 | | | | | | Front: Lug Rear: Lug or Pin | 0.500 (12,70) Diameter by 0.688 (17,46) | |
| BT | 5236 | | | Consult Factory | | −40°C to +120°C | Front: 3 Lugs Rear: 3 Pins or Front: 2 Pins Rear: 2 Pins | 0.500 (12,70) Diameter by 0.535 (13,59) | Dust and Splash Resistant |
| O | 5235 | | | 0.4 Watt @ 70°C | 350V | −55°C to +150°C | Pin or Solder Lug | 0.500 (12,70) Diameter by 0.531 (13,49) | Immersion Sealed |
| Y | 5209 | | | 0.25 Watt @ 50°C | | −55°C to +100°C | Pin or Solder Lug | 0.500 (12,70) Diameter by 0.359 (9,13) | Dust and Splash Resistant |

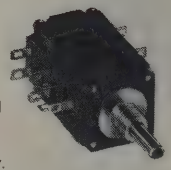
# Allen-Bradley Variable Resistors

**SERIES 70 MOD POT®:** Modular design innovated by Allen-Bradley offers almost unlimited combinations: single, dual, triple or quadruple sections. Options include PC or solder lug terminals, variety of switches, vernier drives, concentric shafts, hot-molded composition, cermet or conductive plastic resistance elements.



**SERIES 72 MOD POT®:** Similar to Series 70, except the bushing and shaft are non-metallic. Available in single or dual combination only.

**SERIES 73 MOD POT®:** Similar to Series 70, except the bushing is of a more economical design. Available in single or dual combination only.

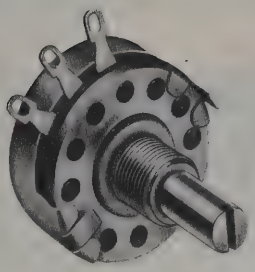


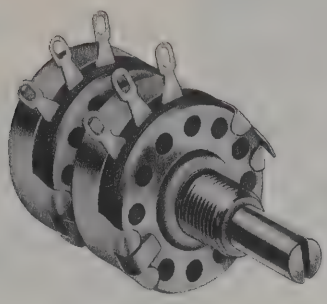
## SPECIFICATIONS

| Type | Publication Number | Resistance Element | Resistance Range and Tolerance | Power Rating (Linear Taper) | Voltage Rating (RMS or DC) | Operating Temperature Range | Number of Sections Available | Case Dimensions in Inches (millimeters) | Enclosure |
|---|---|---|---|---|---|---|---|---|---|
| Series 70 | 5217 | Cermet | 100 Ohms to 1 Megohm ±10% | 2.0 Watts @ 70°C | 350V | −55°C to +150°C | 1, 2, 3 or 4 | Lug terminal: 0.594 *(15.08)* Deep Pin terminal: 0.625 *(15.88)* Square (Single Section) | Dust and Splash Resistant |
| | | Hot-Molded Composition | 50 Ohms to 10 Megohms ±10%, ±20% | 1.0 Watt @ 70°C | | −55°C to +120°C | | | |
| | | Conductive Plastic | 100 Ohms to 1 Megohm ±10%, ±20% | 0.5 Watt @ 70°C | | | | | |
| Series 72 | 5217 | Cermet | 100 Ohms to 1 Megohm ±10% | 1.0 Watt @ 70°C | | −55°C to +100°C | 1 or 2 | | |
| | | Hot-Molded Composition | 50 Ohms to 10 Megohms ±10%, ±20% | 0.5 Watt @ 70°C | | | | | |
| | | Conductive Plastic | 100 Ohms to 1 Megohm ±10%, ±20% | 0.25 Watt @ 70°C | | | | | |
| Series 73 | 5217 | Cermet | 100 Ohms to 1 Megohm ±10% | 2.0 Watts @ 70°C | | −55°C to +120°C | | | |
| | | Hot-Molded Composition | 50 Ohms to 10 Megohms ±10%, ±20% | 0.75 Watt @ 70°C 1.0 Watt @ 40°C | | | | | |
| | | Conductive Plastic | 100 Ohms to 1 Megohm ±10%, ±20% | 0.5 Watt @ 70°C | | | | | |
| J(RV 4) | 5200 | Hot-Molded Composition | 50 Ohms to 5 Megohms ±10%, ±20% | 2.25 Watts @ 70°C | 500V | −55°C to +120°C | 1, 2 or 3 | 0.625 *(15.88)* Deep by 1.156 *(29.36)* Diameter (Single Section) [1] | |
| EJ | 5230 | | | 2.25 Watts @ 70°C | | | 1 or 2 | | |
| K | 5222 | | | 3.0 Watts @ 70°C | | −55°C to +150°C | 1, 2 or 3 | | |
| G(RV 6) | 5201 | | 100 Ohms to 5 Megohms ±10%, ±20% | 0.5 Watt @ 70°C | 350V | −55°C to +120°C | 1 | For G, L and W: 0.469 *(11.91)* Deep For GD: 0.547 *(13.89)* Deep For WR: 0.422 *(10.72)* Deep by 0.500 *(12.70)* Diameter Above dimensions for types G and WR do not include the available switch option [1] | Immersion Sealed |
| GD | 5213 | | | | | | 2 | | |
| L | 5233 | | | 0.8 Watt @ 70°C | | −55°C to +150°C | 1 | | |
| W(RV 6) | 5212 | | | 0.5 Watt @ 70°C | | −55°C to +120°C | | | |
| WR | 5220 | | | 0.5 Watt @ 70°C | | | | | Dust and Splash Resistant |
| SP | 5216 | Cermet | 50 Ohms to 1 Megohm ±10% (5% available) | 1.0 Watt @ 70°C | 300V | −65°C to +150°C | | 0.438 *(11.11)* Deep by 0.375 *(9.52)* Diameter | Immersion Sealed |
| M | 5239 | Conductive Plastic | 100 Ohms to 1 Megohm ±20% | 0.1 Watt @ 40°C | 90V | −25°C to +100°C | 1 or 2 | 0.394 *(10.0)* Cubed All Versions | Dust and Splash Resistant |

[1] All depth dimensions are maximum.

**TYPE J (RV4):**
Standard of the industry for quality. Hot-molded composition, 50 ohm to 5 megs, ±10% and ±20% (special values to 1000 megs available), 2.25W at 70°C, single, dual, triple sections available. Switch for single or dual sections.

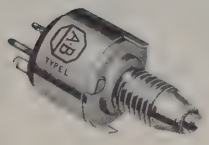




**TYPE EJ:**
Extra long life version of the Type J with rotational life exceeding one million rotations, single or dual configurations. Slip clutch available.

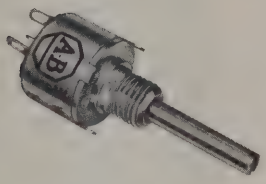
**TYPE K:**
A 3.0W at 70°C version of the popular Type J.

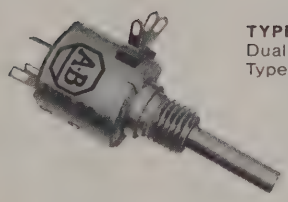
**TYPE G (RV6):**
Hot-molded composition, 100 ohms to 5 megs, ±10% and ±20%, 0.5W at 70°C, single section available with or without SPST switch.



**TYPE L:**
Hot-molded composition, 100 ohms to 5 megs, ±10% and ±20%, 0.8W at 70°C, single section.

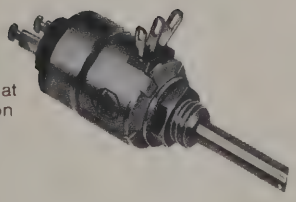
**TYPE W (RV6):**
Hot-molded composition, 100 ohms to 5 megs, ±10% and ±20%, 0.5W at 70°C, single section.



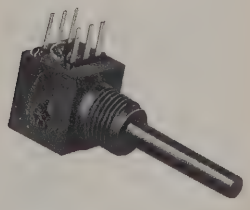


**TYPE GD:**
Dual section version of Type G

**TYPE WR:**
Radial-lead version of Type W. Available with or without switch. Switch versions offer contacts that close at start of clockwise rotation (TYPE WRS) or with switch with contacts that close at start of counter-clockwise rotation (TYPE WRH).



**TYPE M:**
Miniature conductive plastic, 100 ohms to 1 meg, ±20%, 0.1W at 40°C, single and dual sections available with or without SPDT switch. 5 terminal options. Non-metallic case, bushing and shaft.



**TYPE SP:**
Cermet, 50 ohms to 1 meg, ±10%, 1.0W at 70°C, single section. Only ⅜ inch diameter.

Standard options for most types include linear and non-linear tapers, a variety of shafts, bushings, shaft endings, shaft lengths, and hardware.

Types GD, J and the multi-section MOD POT® with composition tracks are well suited for attenuator applications.

BECKMAN®

## Military — Cermet HELITRIM®

# TRIMMING POTENTIOMETERS

| Beckman Model | Mounting Style | Dimensions - L x W x H inch (mm) | No. of Turns | Resistance Range | Resistance Tolerance | Power Rating | Temp. Range | Tempco (p/10$^6$/°C | Price 1-99 | Price 100-199 | Price 200-499 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 | Lead | 1 1/4 (31,8) x .297 (7,54) x 5/16 (7,95) high temp. | 32 | 10Ω-2 meg | ±10% <50Ω, ±20% | 1.5 watts at 125°C | -65° to 200°C | ±100 | $8.19 | $7.58 | $6.66 |
| 53 | Pins | 1 1/4 (31,8) x .292 (7,42) x 19/64 (7,54) high temp. | 32 | 10Ω-2 meg | ±10% <50Ω, ±20% | 1.5 watts at 125°C | -65° to 200°C | ±100 | 7.50 | 7.13 | 6.75 |
| 54 | Lug | 1 1/4 (31,8) x .292 (7,42) x 19/64 (7,54) high temp. | 32 | 10Ω-2 meg | ±10% <50Ω, ±20% | 1.5 watts at 125°C | -65° to 200°C | ±100 | 7.50 | 7.13 | 6.75 |
| 55L | Lead | 1 1/4 (31,8) x .290 (7,37) x 11/32 (8,74) | 22 | 10Ω-2 meg | ±10% <50Ω, ±20% | 1 watt at 85°C | -65° to 175°C | ±100 | 5.94 | 5.50 | 5.10 |
| 55P | Pins | 1 1/4 (31,8) x .290 (7,37) x 11/32 (8,74) | 22 | 10Ω-2 meg | ±10% <50Ω, ±20% | 1 watt at 85°C | -65° to 175°C | ±100 | 5.94 | 5.50 | 5.10 |
| 55S | Lug | 1 1/4 (31,8) x .290 (7,37) x 11/32 (8,74) | 22 | 10Ω-2 meg | ±10% <50Ω, ±20% | 1 watt at 85°C | -65° to 175°C | ±100 | 5.94 | 5.50 | 5.10 |
| 56L | Lead | 1 1/4 (31,8) x .195 (4,95) x .320 (8,13) RJ12 | 22 | 10Ω-2 meg | ±10% <50Ω, ±20% | 1 watt at 85°C | -65° to 175°C | ±100 | 5.94 | 5.50 | 5.10 |
| 56P | Pins | 1 1/4 (31,8) x .195 (4,95) x .320 (8,13) RJ12 | 22 | 10Ω-2 meg | ±10% <50Ω, ±20% | 1 watt at 85°C | -65° to 175°C | ±100 | 5.94 | 5.50 | 5.10 |
| 58P | Pins | 1 1/4 (31,8) x .195 (4,95) x .320 (8,13) RJ12Y | 22 | 10Ω-2 meg | ±10% <50Ω, ±20% | 1 watt at 85°C | -65° to 175°C | ±100 | 5.94 | 5.50 | 5.10 |
| 58S | Lug | 1 1/4 (31,8) x .195 (4,95) x .320 (8,13) RJ12Y | 22 | 10Ω-2 meg | ±10% <50Ω, ±20% | 1 watt at 85°C | -65° to 175°C | ±100 | 5.94 | 5.50 | 5.10 |
| 61P | Pins | 1/4 (6,35) Dia. x 1/4 (6,35) Top Adj RJ50 | 1 | 10Ω-1 meg | ±10% <100Ω, ±20% >500KΩ, ±20% | 0.5 watt at 85°C | -65° to 150°C | ±100 | 5.94 | 5.50 | 5.10 |
| 61PA | Pins (TO-5) | 9/32 (7,14) Sq. x 3/8 (9,53) Side Adjust | 1 | 10Ω-1 meg | ±10% <100Ω, ±20% >500KΩ, ±20% | 0.5 watt at 85°C | -65° to 150°C | ±100 | 7.50 | 7.13 | 6.75 |
| 61M | Pins (TO-5) | 3/8 (9,53) Sq. x .240 (6,10) Top Adjust | 1 | 10Ω-1 meg | ±10% <100Ω, ±20% >500KΩ, ±20% | 0.5 watt at 85°C | -65° to 150°C | ±100 | 7.50 | 7.13 | 6.75 |
| 63P | Pins (TO-5) | 3/8 (9,53) Sq. x 3/16 (4,76) Side Adj RJ24 | 20 | 10Ω-2 meg | ±10% <100Ω, ±20% >500KΩ, ±20% | 0.5 watt at 85°C | -65° to 150°C | ±100 | 7.27 | 6.74 | 6.25 |
| 63W | Edge Pins | 3/8 (9,53) x .240 (6,10) x .410 (10,4) Top Adj RJ24 | 20 | 10Ω-2 meg | ±10% <100Ω, +20% >500KΩ, +20% | 0.5 watt at 85°C | -65° to 150°C | ±100 | 7.27 | 6.74 | 6.25 |
| 63X | Edge Pins | 3/8 (9,53) x .240 (6,10) x .410 (10,4) Side Adj RJ24 | 20 | 10Ω-2 meg | ±10% <100Ω, ±20% >500KΩ, +20% | 0.5 watt at 85°C | -65° to 150°C | ±100 | 7.27 | 6.74 | 6.25 |
| 64P | Pins (TO-5) | 1/4 (6,35) Sq. x .170 (4,318) | 22 | 10Ω-1 meg | +10% | 0.25 watt at 85°C | -65° to 150°C | ±100 | 5.71 | 5.29 | 4.91 |

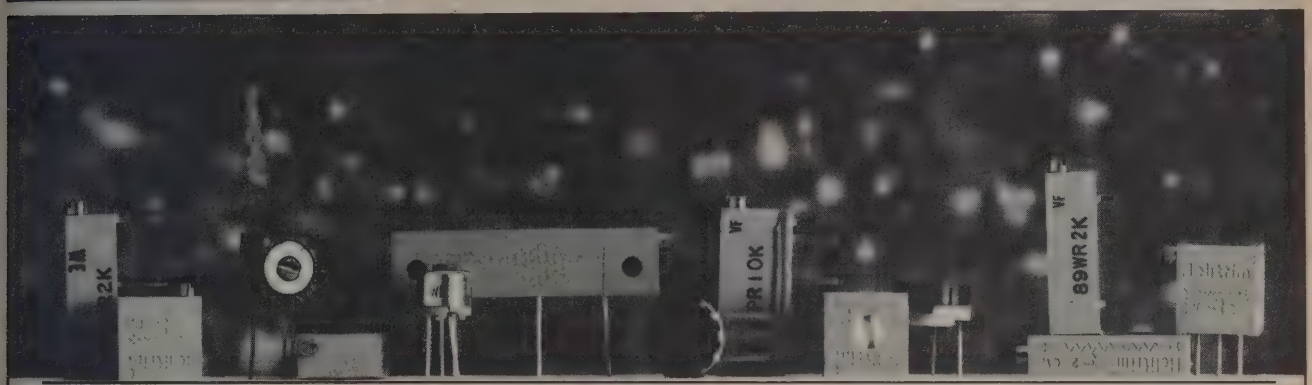
Notes:
1. Standard resistance values (ohms): 10, 20, 50, 100, 500, 1K, 5K, 10K, 20K, 25K, 50K, 100K, 200K, 250K, 500K, 1 meg, 2 meg.
2. All Helipot cermet trimming potentiometers have essentially infinite resolution.
3. Prices and specifications subject to change without notice.

BECKMAN INSTRUMENTS, INC. HELIPOT DIVISION
2500 Harbor Boulevard, Fullerton, California 92634
(714) 871-4848 • TWX No. 910-592-1260

BECKMAN®

## Industrial — Cermet HELITRIM®

# TRIMMING POTENTIOMETERS




| Beckman Model | Description (Adjustment — Pin Style) | Dimensions - L x W x H inch (mm) | No. of Turns | Resistance Range (Ω) | Rt Tol. (Note 1) | Power Rating (watts) | Max. Temp. (°C) | Tempco (p/10⁶/°C) | Prices 1-99 | 100-199 | 200-499 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 62P | Top adj; pins | 1/4 (6,35) Dia. x 1/4 (6,35) | 1 | 10-1 meg | ±10% | 0.5 at 70° C | 125 | ±100 | $2.27 | $1.83 | $1.65 |
| 62PA | Side adj; TO-5 pins | 9/32 (7,14) x .290 (7,37) x 3/8 (9,53) | 1 | 10-1 meg | ±10% | 0.5 at 70° C | 125 | ±100 | 3.38 | 2.73 | 2.46 |
| 62PH | Top thumbwheel adj-pins | 1/4 (6,35) Dia. x 5/16 (7,94) | 1 | 10-1 meg | ±10% | 0.5 at 70° C | 125 | ±100 | 3.38 | 2.73 | 2.46 |
| 62M | Top adj; TO-5 pins | 1/4 (6,35) Dia. x 1/4 (6,35) | 1 | 10-1 meg | ±10% | 0.5 at 70° C | 125 | ±100 | 2.27 | 1.83 | 1.65 |
| 66P | Side adj; TO-5 pins | 3/8 (9,53) Sq. x .200 (5,08) | 20 | 10-2 meg | ±10% | 0.5 at 25° C | 125 | ±100 | 3.82 | 3.54 | 3.28 |
| 66W | Top adj; edge pins | 3/8 (9,53) x .200 (5,08) x .41 (10,4) | 20 | 10-2 meg | ±10% | 0.5 at 25° C | 125 | ±100 | 3.82 | 3.54 | 3.28 |
| 66X | Side adj; edge pins | 3/8 (9,53) x .200 (5,08) x .41 (10,4) | 20 | 10-2 meg | ±10% | 0.5 at 25° C | 125 | ±100 | 3.82 | 3.54 | 3.28 |
| 68P | Side adj; TO-5 pins | 3/8 (9,53) Sq. x .245 | 18 | 10-2 meg | ±10% | 0.5 at 70° C | 125 | ±100 | 1.78 | 1.43 | 1.29 |
| 68X | Side adj; In-line pins | 3/8 (9,53) Sq. x .245 | 18 | 10-2 meg | ±10% | 0.5 at 70° C | 125 | ±100 | 1.78 | 1.43 | 1.29 |
| 68W | Top adj; In-line pins | 3/8 (9,53) Sq. x .245 | 18 | 10-2 meg | ±10% | 0.5 at 70° C | 125 | ±100 | 1.78 | 1.43 | 1.29 |
| 72P | Top adj; TO-5 pins | 3/8 (9,53) Sq. x 3/16 (4,76) | 1 | 10-2 meg | ±10% | 0.5 at 70° C | 125 | ±100 | .83 | .67 | .61 |
| 72PL | Top adj; In-line pins | 3/8 (9.53) Sq. x 3/16 (4,76) | 1 | 10-2 meg | ±10% | 0.5 at 70° C | 125 | ±100 | .83 | .67 | .61 |
| 72PX | Top adj; edge pins | 3/8 (9,53) Sq. x 3/16 (4,76) | 1 | 10-2 meg | ±10% | 0.5 at 70° C | 125 | ±100 | .83 | .67 | .61 |
| 72PM | Top adj; wide pins | 3/8 (9,53) Sq. x 3/16 (4,76) | 1 | 10-2 meg | ±10% | 0.5 at 70° C | 125 | ±100 | .83 | .67 | .61 |
| 72RPX* | Top adj; edge pins | 3/8 (9,53) Sq. x 3/16 (4,76) | 1 | 10-2 meg | ±10% | 0.5 at 70° C | 125 | ±100 | .83 | .67 | .61 |
| 72RX* | Side adj; TO-5 pins | 3/8 (9,53) x 3/16 (4,76) x 3/8 (9,53) | 1 | 10-2 meg | ±10% | 0.5 at 70° C | 125 | ±100 | .83 | .67 | .61 |
| 72RXL* | Side adj; In-line pins | 3/8 (9,53) x 3/16 (4,76) x 3/8 (9,53) | 1 | 10-2 meg | ±10% | 0.5 at 70° C | 125 | ±100 | .83 | .67 | .61 |
| 72RXW* | Top adj; In-line pins | 3/8 (9,53) Sq. x 3/16 (4,76) | 1 | 10-2 meg | ±10% | 0.5 at 70° C | 125 | ±100 | .83 | .67 | .61 |
| 72XW | Top adj; In-line pins | 3/8 (9,53) Sq. x 3/16 (4,76) | 1 | 10-2 meg | ±10% | 0.5 at 70° C | 125 | ±100 | .83 | .67 | .61 |
| 72XL | Side adj; In-line pins | 3/8 (9,53) x 3/16 (4,76) x 3/8 (9,53) | 1 | 10-2 meg | ±10% | 0.5 at 70° C | 125 | ±100 | .83 | .67 | .61 |
| 72X | Side adj; TO-5 pins | 3/8 (9,53) x 3/16 (4,76) x 3/8 (9,53) | 1 | 10-2 meg | ±10% | 0.5 at 70° C | 125 | ±100 | .83 | .67 | .61 |
| 76P | End adj; RJ11 pins | 3/4 (19,1) x .190 (4,83) x .340 (8,64) | 15 | 10-2 meg | ±10% | 0.75 at 25° C | 105 | ±100 | 3.20 | 2.58 | 2.33 |
| 77P | End adj; .2" (5,08) pin space | 3/4 (19,1) x .280 (7,11) x .360 (9,14) | 15 | 10-2 meg | ±10% | 0.75 at 25° C | 105 | ±100 | 3.20 | 2.58 | 2.33 |
| 78L | End adj; leads | 1-1/4 (31,8) x .195 (4,95) x .320 (8,13) | 22 | 10-2 meg | ±10% | 0.75 at 70° C | 125 | ±100 | 3.24 | 3.00 | 2.78 |
| 78P | End adj; .1" (2,54) pin space | 1-1/4 (31,8) x .195 (4,95) x .320 (8,13) | 22 | 10-2 meg | ±10% | 0.75 at 70° C | 125 | ±100 | 3.24 | 3.00 | 2.78 |
| 78S | End adj; .1" (2,54) pin space | 1-1/4 (31,8) x .195 (4,95) x .320 (8,13) | 22 | 10-2 meg | ±10% | 0.75 at 70° C | 125 | ±100 | 3.24 | 3.00 | 2.78 |
| 79P | End adj; .1" (2,54) pin space | 3/4 (19,1) x .190 (4,83) x .360 (9,14) | 15 | 10-2 meg | ±10% | 0.75 at 25° C | 105 | ±100 | 3.20 | 2.58 | 2.33 |
| 82P | Top adj; pins | 1/4 (6,35) Dia. x .150 (3,81) | 1 | 10-1 meg | ±10% | 0.5 at 70° C | 125 | ±100 | 1.73 | 1.39 | 1.26 |
| 82PA | Side adj; TO-5 | .280 x .185 x .360 | 1 | 10-1 meg | ±10% | 0.5 at 70° C | 125 | ±100 | 2.59 | 2.08 | 1.89 |
| 86P | End adj; TO-116 | 3/4 (19,05) x 1/4 (6,35) x .200 (5,08) | 18 | 10-2 meg | ±10% | 0.5 at 25° C | 105 | ±100 | 4.65 | 4.31 | 3.99 |
| 89P | End adj; .1" (2,54) pin space | 3/4 (19,05) x .190 (4,83) x 1/4 (6,35) | 15 | 10-2 meg | ±10% | 0.75 at 25° C | 125 | ±100 | 1.19 | .96 | .86 |
| 89PH† | End adj; .1" (2,54) pin space | 3/4 (19,05) x .190 (4,83) x 1/4 (6,35) | 15 | 10-2 meg | ±10% | 0.75 at 25° C | 105 | ±100 | 1.19 | .96 | .86 |
| 89W | End adj; .2" (5,08) pin space | 3/4 (19,05) x .190 (4,83) x 1/4 (6,35) | 15 | 10-2 meg | ±10% | 0.75 at 25° C | 125 | ±100 | 1.19 | .96 | .86 |
| 89WH† | End adj; .2" (5,08) pin space | 3/4 (19,05) x .190 (4,83) x 1/4 (6,35) | 15 | 10-2 meg | ±10% | 0.75 at 25° C | 105 | ±100 | 1.19 | .96 | .86 |
| 89X | End adj; RJ11 pins | 3/4 (19,05) x .190 (4,83) x 1/4 (6,35) | 15 | 10-2 meg | ±10% | 0.75 at 25° C | 125 | ±100 | 1.19 | .96 | .86 |
| 89XH† | End adj; RJ11 pins | 3/4 (19,05) x .190 (4,83) x 1/4 (6,35) | 15 | 10-2 meg | ±10% | 0.75 at 25° C | 105 | ±100 | 1.19 | .96 | .86 |
| 89Y | End adj; In-line | 3/4 (19,05) x .190 (4,83) x 1/4 (6,35) | 15 | 10-2 meg | ±10% | 0.75 at 25° C | 125 | ±100 | 1.19 | .96 | .86 |
| 91A | Top adj; In-line .1" (2,54) pins | 3/8 (9,53) Dia. x .200 (5,08) | 1 | 10-2 meg | ±20% | 0.5 at 40° C | 125 | ±100 | .58 | .46 | .42 |
| 91B | Top adj; TO-5 pins | 3/8 (9,53) Dia. x 1/4 (6,35) | 1 | 10-2 meg | ±20% | 0.5 at 40° C | 125 | ±100 | .58 | .46 | .42 |
| 91C | Top adj; .172" (4,36) x .156" (3,96) pin space | 3/8 (9,53) Dia. x 1/4 (6,35) | 1 | 10-2 meg | ±20% | 0.5 at 40° C | 125 | ±100 | .58 | .46 | .42 |
| 91D | Top adj; In-line .172" (4,36) pins | 3/8 (9,53) Dia. x 1/4 (6,35) | 1 | 10-2 meg | ±20% | 0.5 at 40° C | 125 | ±100 | .58 | .46 | .42 |
| 91E | Top adj; .4" (10,16) x .1" (2,54) pin space | 3/8 (9,53) Dia. x 1/4 (6,35) | 1 | 10-2 meg | ±20% | 0.5 at 40° C | 125 | ±100 | .58 | .46 | .42 |
| 91S | Side adj; .150" (3,81) pin space | 3/8 (9,53) x 1/4 (6,35) x .385 (9,78) | 1 | 10-2 meg | ±20% | 0.5 at 40° C | 125 | ±100 | .58 | .46 | .42 |
| 91T | Side adj; TO-5 pins | 3/8 (9,53) x .345 (8,76) x .385 (9,78) | 1 | 10-2 meg | ±20% | 0.5 at 40° C | 125 | ±100 | .58 | .46 | .42 |
| 91V | Side adj; .172" (4,36) x .156" (3,96) pin space | 3/8 (9,53) x .400 (10,2) x .385 (9,78) | 1 | 10-2 meg | ±20% | 0.5 at 40° C | 125 | ±100 | .58 | .46 | .42 |
| 91W | Side adj; In-line .1" (2,54) pins | 3/8 (9,53) x 1/4 (6,35) x .385 (9,78) | 1 | 10-2 meg | ±20% | 0.5 at 40° C | 125 | ±100 | .58 | .46 | .42 |
| 91X | Side adj; TO-5 pins | 3/8 (9,53) x .345 (8,76) x .385 (9,78) | 1 | 10-2 meg | ±20% | 0.5 at 40° C | 125 | ±100 | .58 | .46 | .42 |
| 91Y | Side adj; .172" (4,36) x .156" (3,96) pin space | 3/8 (9,53) x .400 (10,2) x .385 (9,78) | 1 | 10-2 meg | ±20% | 0.5 at 40° C | 125 | ±100 | .58 | .46 | .42 |
| 91Z | Side adj; In-line .172" (4,36) pins | 3/8 (9,53) x 1/4 (6,35) x .385 (9,78) | 1 | 10-2 meg | ±20% | 0.5 at 40° C | 125 | ±100 | .58 | .46 | .42 |
| 93P | Top adj; TO-5 pins | 1/2 (12,70) Dia. x 1/4 (6,35) | 1 | 20-2 meg | ±10% | 1.00 at 70° C | 125 | ±100 | 1.90 | 1.54 | 1.38 |

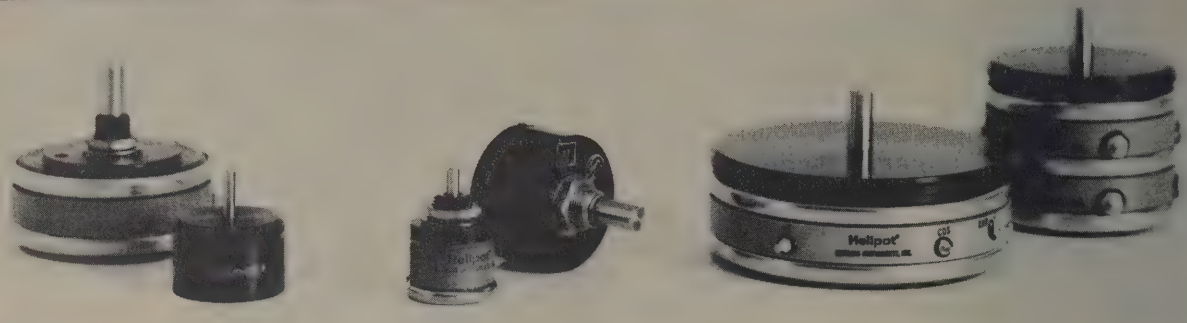
*Reverse rotation models.
†High profile models.

**Notes:**
1. Resistance tolerances shown as ±10% are for resistence values >100Ω and <500KΩ. Other values are ±20%.
2. All Helipot cermet trimming potentiometers have essentially infinite resolution.
3. Prices and specifications subject to change without notice.

BECKMAN INSTRUMENTS, INC. HELIPOT DIVISION
2500 Harbor Boulevard, Fullerton, California 92634
(714) 871-4848 · TWX No. 910-592-1260

BECKMAN

# Single-turn (wirewound cermet, conductive plastic & hybrid) HELIPOT®
# PRECISION POTENTIOMETERS




## Single-turn

| Housing Diameter | Resistance Element | Beckman Model Number | Mounting Type | Bearing Type | Range of Resistence Values (ohms) | Min. Practical Independent Linearity* (± %) | Power Rating (Watts at °C) | Starting Torque (max., oz.-in.) | Number of Cups | Ambient Temperature Range (°C) |
|---|---|---|---|---|---|---|---|---|---|---|
| 7/8" .875" (22,225mm) | Wire | TP | Bushing | Ball | 186-15K | 0.2 | 1.25-70 | 0.1 | 4 | −65 to 125 |
| | Wire | TSP | Servo | Ball | 186-15K | 0.2 | 1.25-70 | 0.1 | 4 | −65 to 125 |
| | Wire | 5101 | Bushing | Sleeve | 186-116K | 0.25 | 0.75-40 | 0.2 | 4 | −25 to 85 |
| | Wire | 5103 | Servo | Ball | 186-116K | 0.25 | 0.75-40 | 0.2 | 4 | −25 to 85 |
| | Cermet | 6103 | Servo | Ball | 150-1 meg | 0.3 | 3.0-85 | 0.5 | 4 | −65 to 150 |
| | C.P. | 6153 | Servo | Ball | 1K-50K | 0.15 | 1.0-70 | 0.5 | 4 | −65 to 125 |
| | C.P. | 6173 | Servo | Ball | 2K-200K | 0.15 | 4.0-70 | 0.5 | 4 | −65 to 125 |
| | C.P. | 6186 | Bushing | Sleeve | 1K-100K | 0.5 | 1.0-70 | 1.0 | 1 | −65 to 125 |
| | Hybrid | 8201 | Bushing | Sleeve | 500-10K | 0.50 | 0.75-40 | 0.2 | 2 | −25 to 85 |
| | Hybrid | 8203 | Servo | Ball | 500-10K | 0.50 | 0.75-40 | 0.2 | 2 | −25 to 85 |
| 1-1/16" 1.062" (26,988mm) | Wire | 5211 | Bushing | Sleeve | 25-25K | 0.15 | 1.0-40 | 0.4 | 4 | −25 to 85 |
| | Wire | 5212 | Servo | Sleeve | 25-25K | 0.15 | 1.0-40 | 0.4 | 4 | −25 to 85 |
| | Wire | 5213 | Servo | Ball | 25-25K | 0.15 | 1.0-40 | 0.3 | 4 | −25 to 85 |
| | Cermet | 6213 | Servo | Ball | 100-1 meg | 0.25 | 5.0-85 | 0.5 | 4 | −65 to 150 |
| | C.P. | 6263 | Servo | Ball | 1K-10K | 0.15 | 1.5-70 | 0.5 | 4 | −65 to 125 |
| | C.P. | 6273 | Servo | Ball | 2K-200K | 0.15 | 5.0-70 | 0.5 | 4 | −65 to 125 |
| 1-5/16" 1.312" (33,338mm) | Wire | 5311 | Bushing | Sleeve | 10-44.6K | 0.5 | 2.0-40 | 1.0 | 1 | −25 to 85 |
| | Cermet | 3301 | Bushing | Sleeve | 1K-1 meg | 0.3 | 0.75-65 | 1.0 | 1 | −25 to 105 |
| | Cermet | 6301 | Bushing | Ball | 250-1 meg | 0.25 | 6.0-85 | 0.7 | 1 | −65 to 150 |
| | Cermet | 6303 | Servo | Ball | 250-1 meg | 0.25 | 6.0-85 | 0.7 | 1 | −65 to 150 |
| | C.P. | 3351 | Bushing | Sleeve | 1K-10K | 0.25 | 0.75-65 | 1.0 | 1 | −25 to 105 |
| | C.P. | 3371 | Bushing | Sleeve | 2K-390K | 0.25 | 1.0-65 | 1.0 | 1 | −25 to 105 |
| | C.P. | 6351 | Bushing | Ball | 1K-10K | 0.1 | 2.0-70 | 0.7 | 1 | −65 to 125 |
| | C.P. | 6353 | Servo | Ball | 1K-10K | 0.1 | 2.0-70 | 0.7 | 1 | −65 to 125 |
| 1-7/16" 1.438" (36,512mm) | Wire | 5401 | Bushing | Sleeve | 25-50K | 0.15 | 2.0-40 | 1.6 | 4 | −65 to 125 |
| | Wire | 5402 | Servo | Sleeve | 25-50K | 0.15 | 2.0-70 | 1.6 | 4 | −65 to 125 |
| | Wire | 5403 | Servo | Ball | 25-50K | 0.15 | 2.0-70 | 0.6 | 4 | −65 to 125 |
| | Wire | 5404 | Pilot | Sleeve | 25-50K | 0.15 | 2.0-70 | 1.6 | 4 | −65 to 125 |
| | Wire | 5405 | Pilot | Ball | 25-50K | 0.15 | 2.0-70 | 0.6 | 4 | −65 to 125 |
| 2" 2.000" (50,800mm) | Wire | 5611 | Bushing | Sleeve | 15-80K | 0.10 | 3.5-70 | 1.5 | 4 | −65 to 125 |
| | Wire | 5612 | Servo | Sleeve | 15-80K | 0.10 | 3.5-70 | 1.5 | 4 | −65 to 125 |
| | Wire | 5613 | Servo | Ball | 15-80K | 0.10 | 3.5-70 | 0.8 | 4 | −65 to 125 |
| | Wire | 5614 | Pilot | Sleeve | 15-80K | 0.10 | 3.5-70 | 1.5 | 4 | −65 to 125 |
| | Wire | 5615 | Pilot | Ball | 15-80K | 0.10 | 3.5-70 | 0.8 | 4 | −65 to 125 |
| | Wire | 5616 | Pilot/Servo | Sleeve | 15-80K | 0.10 | 3.5-70 | 1.5 | 4 | −65 to 125 |
| | Wire | 5617 | Pilot/Servo | Ball | 15-80K | 0.10 | 3.5-70 | 0.8 | 4 | −65 to 125 |
| | Cermet | 6601 | Bushing | Ball | 250-1 meg | 0.15 | 10.0-85 | 1.5 | 4 | −65 to 150 |
| | Cermet | 6603 | Servo | Ball | 250-1 meg | 0.15 | 10.0-85 | 1.5 | 4 | −65 to 150 |
| | C.P. | 6651 | Bushing | Ball | 1K-10K | 0.1 | 2.5-70 | 1.5 | 4 | −65 to 125 |
| | C.P. | 6653 | Servo | Ball | 1K-10K | 0.1 | 2.5-70 | 1.5 | 4 | −65 to 125 |
| | C.P. | 6671 | Bushing | Ball | 2K-336K | 0.1 | 8.0-70 | 1.5 | 4 | −65 to 125 |
| | C.P. | 6673 | Servo | Ball | 2K-336K | 0.1 | 8.0-70 | 1.5 | 4 | −65 to 125 |
| 2" 2.000" (50,800mm) | Hybrid | 8211 | Bushing | Sleeve | 1K-25K | F.Q. | 3.5-70 | 1.5 | 2 | −65 to 125 |
| | Hybrid | 8212 | Servo | Sleeve | 1K-25K | F.Q. | 3.5-70 | 1.5 | 2 | −65 to 125 |
| | Hybrid | 8213 | Servo | Ball | 1K-25K | F.Q. | 3.5-70 | 0.8 | 2 | −65 to 125 |
| 3" 3.000" (76,200mm) | Wire | 5711 | Bushing | Sleeve | 25-145K | 0.075 | 5.0-40 | 1.5 | 4 | −65 to 85 |
| | Wire | 5712 | Servo | Sleeve | 25-145K | 0.075 | 5.0-40 | 1.5 | 4 | −65 to 85 |
| | Wire | 5713 | Servo | Ball | 25-145K | 0.075 | 5.0-40 | 1.3 | 4 | −65 to 85 |
| | Wire | 5714 | Pilot | Sleeve | 25-145K | 0.075 | 5.0-40 | 1.5 | 4 | −65 to 85 |
| | Wire | 5715 | Pilot | Ball | 25-145K | 0.075 | 5.0-40 | 1.3 | 4 | −65 to 85 |

*Values listed are available on special order. Standard Independent Linearity for all Helipot single-turn precision potentiometers is ±0.5%.
LEGEND TO ABBREVIATIONS: **C.P.**—Conductive Plastic. **Pilot**—3 hole/pilot mount. **Pilot/Servo**—Servo/3 hole pilot mount. **FQ**—Factory quote.
All specifications subject to change without notice.

BECKMAN INSTRUMENTS, INC. HELIPOT DIVISION
2500 Harbor Boulevard, Fullerton, California 92634
(714) 871-4848 • TWX No. 910-592-1260

BECKMAN

## Multi-turn (wirewound & hybrids) HELIPOT®

# PRECISION POTENTIOMETERS

### Multi-turn

| Housing Diameter | Number of Turns | Resistance Element | Beckman Model Number | Mounting Type | Bearing Type | Range of Resistance Values (ohms) | Standard Independent Linearity (± %) | Min. Practical Independent Linearity (± %) | Power Rating (watts at °C) | Starting Torque (max., oz.-in.) | Ambient Temperature Range (°C) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 7/8" .875" (22,225mm) | 3 | Wire | 7363 | Servo | Ball | 3-32.3K | 0.25 | 0.15 | 1.5 at 70 | 0.6 | −65 to 125 |
| | | Wire | 7366 | Bushing | Sleeve | 3-32.3K | 0.25 | 0.15 | 1.5 at 70 | 0.8 | −65 to 125 |
| | 5 | Wire | 7463 | Servo | Ball | 5-53.8K | 0.25 | 0.15 | 1.5 at 70 | 0.6 | −65 to 125 |
| | | Wire | 7466 | Bushing | Sleeve | 5-53.8K | 0.25 | 0.15 | 1.5 at 70 | 0.8 | −65 to 125 |
| | 10 | Wire | 7216 | Bushing | Sleeve | 10-125K | 0.25 | 0.05 | 1.5 at 40 | 0.6 | −65 to 85 |
| | | Wire | 7221 | Bushing | Sleeve | 10-125K | 0.25 | 0.05 | 2.0 at 25 | 0.6 | −65 to 85 |
| | | Wire | 7223 | Servo | Ball | 10-125K | 0.25 | 0.05 | 2.0 at 70 | 0.6 | −65 to 125 |
| | | Wire | 7246 | Bushing | Sleeve | 10-125K | 0.25 | F.Q. | 2.0 at 25 | 2.0 | −25 to 85 |
| | | Wire | 7263 | Servo | Ball | 10-107.8K | 0.20 | 0.05 | 2.0 at 70 | 0.6 | −65 to 125 |
| | | Wire | 7266 | Bushing | Sleeve | 10-107.8K | 0.20 | 0.05 | 2.0 at 70 | 0.8 | −65 to 125 |
| | | Wire | 7276 | Bushing | Sleeve | 100-100K | 0.25 | 0.075 | 2.0 at 25 | 1.5 | −25 to 105 |
| | | Wire | 7281 | Bushing | Sleeve | 100-100K | 0.25 | 0.075 | 2 at 70 | 0.8 | −55 to 125 |
| | | Wire | 7286 | Bushing | Sleeve | 100-100K | 0.25 | 0.075 | 2 at 70 | 0.8 | −55 to 125 |
| | | Hybrid | 8103 | Servo | Ball | 1K-100K | 0.25 | F.Q. | 2.0 at 70 | 0.6 | −65 to 125 |
| | | Hybrid | 8106 | Bushing | Sleeve | 1K-100K | 0.25 | F.Q. | 2.0 at 70 | 0.8 | −65 to 125 |
| | | Hybrid | 8136 | Bushing | Sleeve | 1K-100K | 0.25 | F.Q. | 2.0 at 25 | 1.5 | −25 to 105 |
| | | Hybrid | 8141 | Bushing | Sleeve | 1K-100K | 0.25 | F.Q. | 2 at 70 | 0.8 | −55 to 125 |
| | | Hybrid | 8146 | Bushing | Sleeve | 1K-100K | 0.25 | F.Q. | 2 at 70 | 0.8 | −55 to 125 |
| 1-13/16" 1.812" (46,038mm) | 3 | Wire | C | Bushing | Sleeve | 5-194.7K | 0.50 | 0.10 | 3.0 at 40 | 3.0 | −65 to 85 |
| | | Wire | 9301 | Bushing | Sleeve | 30-192.6K | 0.25 | 0.04 | 3.0 at 70 | 1.3 | −65 to 125 |
| | | Wire | 9303 | Servo | Ball | 30-192.6K | 0.25 | 0.04 | 3.0 at 70 | 1.3 | −65 to 125 |
| | 10 | Wire | A | Bushing | Sleeve | 10-648K | 0.25 | 0.05 | 5.0 at 40 | 3.0 | −65 to 85 |
| | | Wire | 7601 | Bushing | Sleeve | 100-650K | 0.15 | 0.025 | 5.0 at 70 | 1.3 | −65 to 125 |
| | | Wire | 7603 | Servo | Ball | 100-650K | 0.15 | 0.025 | 5.0 at 70 | 1.3 | −65 to 125 |
| 3-5/16" 3.312" (84,138mm) | 15 | Wire | B | Bushing | Sleeve | 40-2 meg | 0.5 | 0.035 | 10.0 at 40 | 2.7 | −65 to 85 |
| | | Wire | BS | Servo | Sleeve | 40-2 meg | 0.5 | 0.035 | 10.0 at 40 | 2.7 | −65 to 85 |
| | | Wire | BSP | Servo | Ball | 40-2 meg | 0.5 | 0.035 | 10.0 at 40 | 2.7 | −65 to 85 |
| | 25 | Wire | D | Bushing | Sleeve | 60-3.312 meg | 0.5 | 0.035 | 15.0 at 40 | 3.5 | −65 to 85 |
| | | Wire | DSP | Servo | Ball | 60-3.312 meg | 0.5 | 0.035 | 15.0 at 40 | 3.5 | −65 to 85 |
| | 40 | Wire | E | Bushing | Sleeve | 125-5.3 meg | 0.5 | 0.035 | 20.0 at 40 | 3.5 | −65 to 85 |
| | | Wire | ESP | Servo | Ball | 125-5.3 meg | 0.5 | 0.035 | 20.0 at 40 | 3.5 | −65 to 85 |

F.Q.—Factory Quote. All specifications subject to change without notice.

BECKMAN INSTRUMENTS, INC. HELIPOT DIVISION
2500 Harbor Boulevard, Fullerton, California 92634
(714) 871-4848 · TWX No. 910-592-1260

BECKMAN

# Duodial® & Digidial®
# TURNS-COUNTING DIALS

**RB SERIES**—1-13/16" (46,04mm) diameter dials finished in satin chrome with black-filled numerals and divisions (RBD has matte black finish and white-filled numerals and divisions). Built-in vibration-proof locking mechanism—knob and locking lever cap made of black nylon. Models can be used with most potentiometers, or other device, having from 1 to 15 mechanical turns.

**2600/2610 SERIES**—Miniature 7/8" (22,23mm) diameter versions of the RB Series. Ideally suited for applications where panel space is limited. Primarily for use with 7/8" (22,23mm) diameter multi-turn potentiometers but can be used with devices of any size having from 1 to 15 mechanical turns. All models have satin chrome finish, black-filled numerals and divisions, vibration-proof locking mechanism with black nylon cap, and black nylon knob. Series 2610 has 100 divisions.

**2620 SERIES**—Compact 1" (25,4mm) diameter provides panel space savings while retaining excellent readability. White numerals on black background for fiftieths of a turn, and black numerals on white background for full turns. May be used with devices with from 1 to 10 adjustment turns. Positive locking mechanism prevents accidental changes of setting, due to vibration or sudden shock. Rugged black housing and knob help assure long life and carefree operation. Model 2621 is designed for mounting on 1/8" (3,17mm) shafts, Models 2626 and 2627 mount on ¼" (6,35mm) shafts.

**900 SERIES**—Ideally suited to applications where precise settings and readability are required. 4¾" (12,07cm) diameter permits greater accuracy of setting. Outer dial is graduated in complete turns, inner vernier dial is graduated in hundredths. Settings can be made easily to three significant figures and estimated accurately to a fourth. For rapid changing of settings, an eccentric finger-hole is provided in the adjustment knob. The inner vernier dial and knob are made of plastic to eliminate body capacitance which might affect the setting. Since the knob is connected to the potentiometer shaft, backlash is thereby eliminated.

**BH SERIES** — Models BH462 and BH1462 offer quality appearance and reliable performance. High contrast black numerals on a clear anodized aluminum or grey plastic background allow ease of readability in either high or low ambient lighting. The primary dial is rigidly fixed to the shaft eliminating backlash. Ten complete turns of adjustment offer a full range of settings from 000 to 999. Combining precision features with attractive design are good reasons to use Beckman's Model BH462 and BH1462 on your next application.

**210 SERIES**—Miniature dials that have the same distinctive styling as the 205 Series, yet occupy less than 50% of the panel area. Their small size and excellent readability make them an ideal choice for use with potentiometers having a 1-13/16" (46,04mm) diameter or less. They have die cast zinc case finish with matte black enamel. Brushed aluminum locking lever prevents accidental movement and can be actuated without disturbing the setting.

Prices and specifications subject to change without notice.

| | DUODIAL® and BH MODELS | | | | | | | | | | | | DIGITAL® MODELS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RB RBC RBD | RBJ | 2611 2601 | 2606 2616 2607 2617 | 2621 | 2626 2627 | BH462 | BH1462 | 901 | 902 | 903 | 904 | 210 | 211 |
| Counting Capacity, max. turns | 15 | | | | 10 | | | | | 15 | 25 | 40 | 10 | |
| Diameter, nominal (Duodials) | 1 13/16" (46,04mm) | | 7/8" (22,23mm) | | 1" (25,4mm) | | | | 4 3/4" (12,07cm) | | | | Not Applicable | |
| Height (Digidials) | Not Applicable | | | | | | | | | | | | 1 21/32" (42,1mm) | |
| Width (Digidials) | Not Applicable | | | | | | | | | | | | 1 7/32" (31,0mm) | |
| Depth, from panel face | 1" (25,4mm) | | .791" (20,09mm) | 29/32" (23,01mm) | .938" (23,82mm) | | 1.000" (25,4mm) | 1.125" (28,6mm) | 1 1/32" (26,2mm) | | | | 1 9/32" (32,5mm) | |
| For Shaft diameter | 1/4" (6,35mm) | 1/8" (3,17mm) | | 1/4" (6,35mm) | 1/8" (3,17mm) | 1/4" (6,35mm) | | | | | | | 1/4" (6,35mm) | 1/8" (3,17mm) |
| Max. Shaft extension (from panel face) | 13/16" (20,63mm) | | 43/64" (17,06mm) | 25/32" (19,84mm) | .816" (20,72mm) | | .800" (20,32mm) | .875" (22,22mm) | 23/32" (18,25mm) | | | | 7/8" (22,22mm) | |
| Min. Shaft extension (from panel face) | 9/16" (14,28mm) | | 15/32" (11,90mm) | 37/64" (14,68mm) | .620" (15,74mm) | | .600" (15,24mm) | .675" (17,14mm) | 15/32" (11,90mm) | | | | 17/32" (13,49mm) | |
| Fore Bushing, thread | 3/8-32-NEF | 1/4-32-NEF | | 3/8-32-NEF | 1/4-32-NEF | 3/8-32-NEF | | | | 1/2-32-NS | | | 3/8-32-NEF | 1/4-32-NEF |
| Max. Bushing extension (from panel face) | 13/32" (10,31mm) | 19/64" (7,54mm) | .270" (6,85mm) | 19/64" (7,54mm) | .335" (8,50mm) | | .297" (7,54mm) | | 1/4" (6,35mm) | | | | 5/32" (3,96mm) | |
| Locking Mechanism | Positive Action | | | | | | Positive Detent | | Positive Action | | | | Friction Type | |
| Price (1-9 Qty.) | RB =$6.65<br>RBC, RBD =$10.00 | $41.00 | 2601= $8.00<br>2611= $6.95 | 2606=$7.75<br>2607=$8.25<br>2616=$6.75<br>2617=$7.20 | $5.00 | 2626= $4.75<br>2627= $5.25 | BH462=$8.66<br>BH1462=$7.02 | | $35.00 | | | | $15.75 | $15.75 |

BECKMAN INSTRUMENTS, INC. HELIPOT DIVISION
2500 Harbor Boulevard, Fullerton, California 92634
(714) 871-4848 · TWX No. 910-592-1260

# MFT™ THE MFT™ BREAKTHROUGH

BOURNS announces the Multi Function Trimmer . . .
. . . THE FUTURE IN TRIMMER/RESISTOR TECHNOLOGY.

Bourns has combined the world's best technologies used in producing cermet trimmers and cermet fixed resistor networks. The result is NINE new multiple trimmer and resistor network combinations. Revolutionary!

Packaged in the popular Dual In-Line Pin (DIP) configuration, the MFT trimmer truly marks the future in trimmer/resistor technology for the Analog World.

## SPECIFICATIONS

### GENERAL

**Electrical**

DC Resistance (±) any node to any other node ..... 20%
DC Resistance Ratio R1/R1 + R2 (±) ..... 2%
Rated Voltage .. $\sqrt{P \cdot R}$ P = Power, R = Resistance; Up to 400V Absolute Max.
Total Package Power @ 85°C ..... 1.00 Watt (Max.)
@ 125°C ..... 0.40 Watt (Max.)
Resistance Voltage Coefficient ..... 50ppm/V (Max.)
Dielectric Withstanding Voltage ..... 350 VRMS (Max.)
Insulation Resistance ..... 1,000MΩ (Min.)

**Environmental**

Temperature Range, Operational ..... −55°C to +125°C
Storage ..... −55°C to +150°C
Temperature Coefficient, −55°C to +125°C, R1 or R2 .....100ppm/°C (Max.) Temperature Coefficient, Tracking −55°C to +125°C, R1 with respect to R2 ..... 50ppm/°C (Max.)
Temperature Coefficient, Tracking, any ratio involving trimmer wiper ..... 100ppm/°C (Max.)
Terminal Strength, Pull .....4.5 lbs./30 sec. Bend ..... 8 ounces
Solderability ..... 80% coverage (Min.)
Resistance to Soldering Heat (TRS), 260° for 10 seconds ..... ±1.25%
Load Life 1,000 hours @ 85°C (TRS) ..... 3.0% (Max.)
Short Time Overload (TRS), 2.5 x RATED Voltage for 5 Seconds .. 0.25% (Max.)
Moisture Resistance ..... 1000MΩ (Min.)

**Physical**

Package Outline ..... JEDEC DIP
Flammability ..... UL 94V-1

### POTENTIOMETER

**Electrical**

Range of R1 + R2 ..... 500Ω, 1KΩ, 5KΩ, 10KΩ, 50KΩ, 100KΩ, 500KΩ
Total Power Dissipation @ 85°C ..... 0.25 Watt (Max.)
@ 125°C ..... 0.10 Watt (Max.)
Contact Resistance Variation (±) ..... 1%
Adjustability
(±) In-Circuit Resistance (Rheostat) ..... 0.10%
(±) Voltage Division (Divider) ..... 0.05%
Actual Electrical Travel (±15°) ..... 280°
End Resistance ..... 2Ω (Max.)

**Environmental**

Rotational Life ..... 200 Cycles (Min.)
Max. Resistance Shift @ 200 Cycles ..... 4% (Max.)
Vibration, 30G's, 45 Hz to 2Hz, Contact Bounce ..... 0.1 ms (Max.)
(±) TRS ..... 1%
Shock, 100G's, Contact Bounce ..... 0.1 ms (Max.)
(±) VRS ..... 1%
Low Temperature Exposure (TRS), 24 hours @ −55°C ..... 2.0% (Max.)
High Temperature Exposure (TRS), 24 hours @ +125°C ..... 3.0%
Humidity (TRS) ..... 2.0%

**Physical**

Adjustment Torque ..... 5 oz.-in. (Max.)
Mechanical Stops ..... Solid

### FIXED RESISTORS

**Electrical**

Resistance Ratio Range (R1/R1 + R2) ..... .1, .2, .3, .4, .5, .6, .7, .8, .9
Total Power Dissipation @ 85°C ..... 0.25 Watt (Max.)
@ 125°C ..... 0.10 Watt (Max.)

**Environmental**

Low Temperature Exposure (TRS), 24 hours @ −55°C ..... 0.25%
High Temperature Exposure (TRS), 24 hours @ +125°C ..... 0.50%
Humidity (TRS) ..... 0.25%

BOURNS NC

TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5204

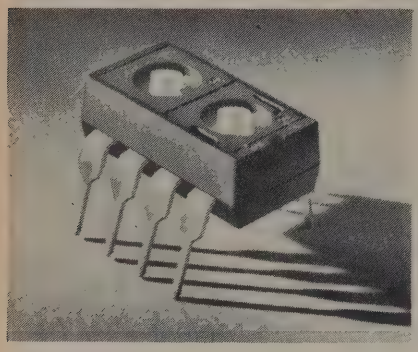
HOT LINE (714) 781-5204

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

MFT™

# MULTI FUNCTION TRIMMER/MODEL 7102B

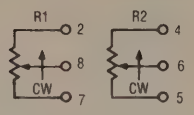
Two Single Turn Cermet Trimmers
In An 8-Pin DIP



## FEATURES

- Reduced total circuit manufacturing costs
- Reduced PC board space
- The first low cost, sealed trimmer compatible with auto-insertion equipment
- Better temperature tracking than discretes
- Improved circuit performance
- Reduced circuit design time
- Increased reliability
- Five Resistance Values for R1
  R1: 100Ω, 1KΩ, 10KΩ, 100KΩ, 500KΩ
- Five Resistance Ratios
  R2/R1: 1, 2, 10, 100, 1000

## SCHEMATIC



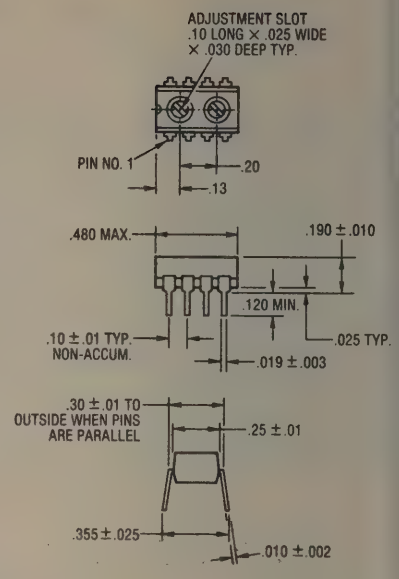

## PART NUMBER BUILD UP

7102B-XXX-XXX

From Ratio Matrix
I.E.-211 = R2/R1, 1:2

Standard Resistance Code For Value of R1
I.E.-102 = 1000Ω

## DIMENSIONS




## RATIO CODE MATRIX

| R1 \ R2/R1 | 1 | 2 | 10 | 100 | 1000 |
|---|---|---|---|---|---|
| -101 | -210 | -211 | -212 | -213 | -214 |
| -102 | -210 | -211 | -212 | -213 | |
| -103 | -210 | -211 | -212 | | |
| -104 | -210 | -211 | | | |
| -504 | -210 | | | | |

**These Part Numbers are available from stock or maximum of four (4) weeks lead time.**

For all other Part Numbers contact Bourns Product Management for Pricing and Delivery. (714) 781-5204.

**DETAIL** lists the resistance of each element in each part number.

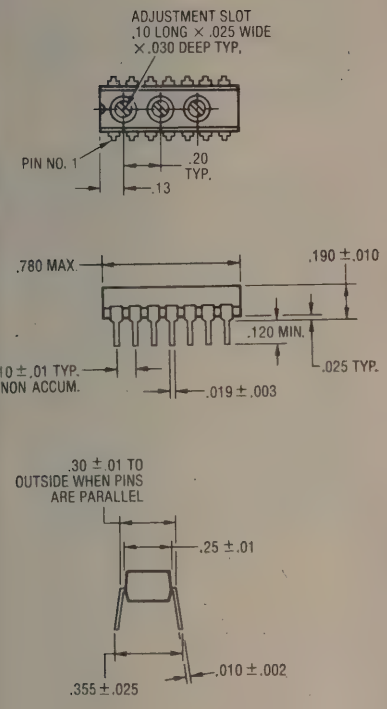
| Part Numbers | DETAIL R1 | DETAIL R2 |
|---|---|---|
| **7102B-210-101** | 101 | 101 |
| **7102B-210-102** | 102 | 102 |
| **7102B-210-103** | 103 | 103 |
| **7102B-210-104** | 104 | 104 |
| **7102B-210-504** | 504 | 504 |

| Part Numbers | DETAIL R1 | DETAIL R2 |
|---|---|---|
| **7102B-211-102** | 102 | 202 |
| **7102B-211-103** | 103 | 203 |
| **7102B-211-104** | 104 | 204 |
| **7102B-212-102** | 102 | 103 |
| **7102B-212-103** | 103 | 104 |

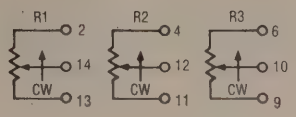
BOURNS INC

TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5204

## DIMENSIONS




## SCHEMATIC




## PART NUMBER BUILD UP

7103C-XXX-XXX

1st Selection From Ratio Code Matrix

2nd Selection From R Code Matrix

## R CODE MATRIX

| R1 / Ratio | 100Ω | 1KΩ | 10KΩ | 100KΩ | 500KΩ |
|---|---|---|---|---|---|
| -310 | -101 | -102 | -103 | -104 | -504 |
| -311 | -101 | -102 | -103 | -104 | |
| -312 | -101 | -102 | -103 | -104 | |
| -313 | -101 | -102 | -103 | | |
| -314 | -101 | -102 | -103 | | |
| -315 | -101 | -102 | -103 | | |
| -316 | -101 | -102 | | | |
| -317 | -101 | -102 | | | |
| -318 | -101 | -102 | | | |
| -319 | -101 | -102 | | | |
| -320 | -101 | | | | |
| -321 | -101 | | | | |
| -322 | -101 | | | | |
| -323 | -101 | | | | |
| -324 | -101 | | | | |

## RATIO CODE MATRIX

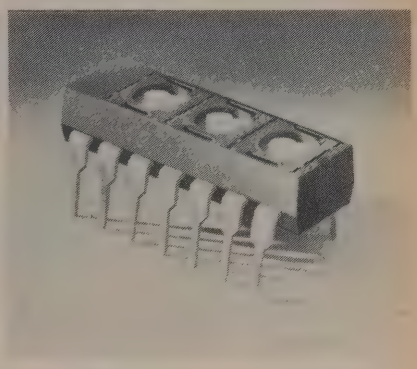
| R3/R1 \ R2/R1 | 1 | 2 | 10 | 100 | 1000 |
|---|---|---|---|---|---|
| 1 | -310 | -311 | -313 | -316 | -320 |
| 2 | | -312 | -314 | -317 | -321 |
| 10 | | | -315 | -318 | -322 |
| 100 | | | | -319 | -323 |
| 1000 | | | | | -324 |

Assign R1 as lowest R value, then calculate R2/R1; R3/R1.

# MFT™

# MULTI FUNCTION TRIMMER/MODEL 7103C

Three Single Turn Cermet Trimmers In A 14-Pin DIP



## FEATURES

- Reduced total circuit manufacturing costs
- Reduced PC board space
- The first low cost, sealed trimmer compatible with auto-insertion equipment
- Better temperature tracking than discretes
- Improved circuit performance
- Reduced circuit design time
- Increased reliability
- Compatible with auto-test equipment
- Five Resistance Values for R1
  R1: 100Ω, 1KΩ, 10KΩ, 100KΩ, 500KΩ
- Five Resistance Ratios
  R2/R1: 1, 2, 10, 100, 1000
  R3/R1: 1, 2, 10, 100, 1000

**These Part Numbers are available from stock or maximum of four (4) weeks lead time.**

For all other Part Numbers contact BOURNS Product Management for Pricing & Delivery. (714) 781-5204.

**DETAIL** lists the resistance of each part number.

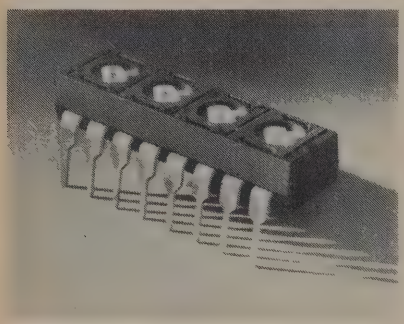
| Part Numbers | DETAIL R1 | R2 | R3 |
|---|---|---|---|
| **7103C-310-101** | 101 | 101 | 101 |
| **7103C-310-102** | 102 | 102 | 102 |
| **7103C-310-103** | 103 | 103 | 103 |
| **7103C-310-104** | 104 | 104 | 104 |
| **7103C-310-504** | 504 | 504 | 504 |
| **7103C-312-103** | 103 | 203 | 203 |
| **7103C-314-102** | 102 | 103 | 202 |
| **7103C-314-103** | 103 | 104 | 203 |
| **7103C-315-102** | 102 | 103 | 103 |
| **7103C-322-101** | 101 | 104 | 102 |

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5204

MFT™

# MULTI FUNCTION TRIMMER/MODEL 7104D

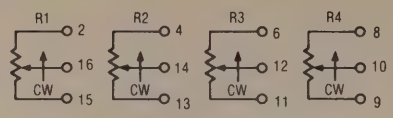
Four Single Turn Cermet Trimmers
In A 16-Pin DIP



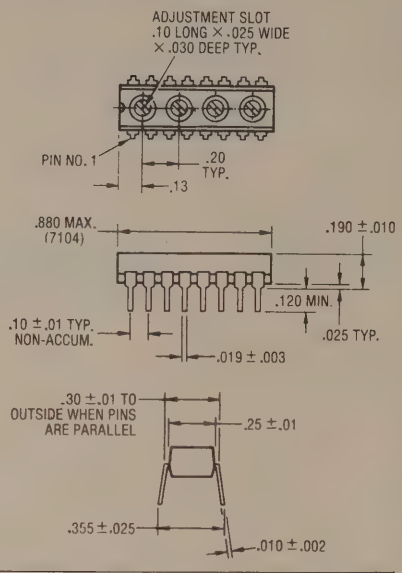
## FEATURES

- Reduced total circuit manufacturing costs
- Reduced PC board space
- The first low cost, sealed trimmer compatible with auto-insertion equipment
- Better temperature tracking than discretes
- Improved circuit performance
- Reduced circuit design time
- Increased reliability
- Compatible with auto-test equipment
- Five Resistance Values for R1
  R1: 100Ω, 1KΩ, 10KΩ, 100KΩ, 500KΩ
- Five Resistance Ratios
  R2/R1: 1, 2, 10, 100, 1000
  R3/R1: 1, 2, 10, 100, 1000
  R4/R1: 1, 2, 10, 100, 1000

## SCHEMATIC




## DIMENSIONS




## PART NUMBER BUILD UP

1. Determine required R values from circuit design.
2. Assign lowest R value the designation R1.
3. Rank remaining three R values in descending order of ratio with respect to R1.
4. Search ratio set chart top to bottom, left to right for appropriate ratio set dash number.
5. Use R code matrix to determine R code for appropriate R1 value vs ratio set dash number. R code matrix also determines R2, R3 and R4 value assignment (last three columns).

## EXAMPLE:

1. Required values are: 100K, 1K, 1K and 10K
2. Assign R1 = 1K
3. Rank remaining values: 1000 (100K), 10 (10K), 1 (1K)
4. Search ratio set chart, add ratio set dash number -424
5. Consult R code matrix column heading 1K (R1 value), -424 row. Resistance code is -102. Complete part number is 7104D-424-102 R code matrix, last 3 columns, gives: R2 = 100K R3 = 1K, R4 = 10K

7104D-XXX-XXX

1st Selection From Ratio Set Chart

2nd Selection From R Code Matrix

**These Part Numbers are available fro stock or maximum of four (4) weeks lead time.**

For all other Part Numbers contact BOURNS Product Management for Pricing & Delivery. (714) 781-5204.

**DETAIL** lists the resistance of each part number.

| Part Numbers | DETAIL R1 | R2 | R3 | R4 |
|---|---|---|---|---|
| **7104D-410-101** | 101 | 101 | 101 | 101 |
| **7104D-410-102** | 102 | 102 | 102 | 102 |
| **7104D-410-103** | 103 | 103 | 103 | 103 |
| **7104D-410-104** | 104 | 104 | 104 | 104 |
| **7104D-410-504** | 504 | 504 | 504 | 504 |
| **7104D-419-102** | 102 | 202 | 202 | 202 |
| **7104D-419-103** | 103 | 203 | 203 | 203 |
| **7104D-420-103** | 103 | 104 | 203 | 203 |
| **7104D-423-103** | 103 | 104 | 103 | 104 |
| **7104D-424-102** | 102 | 104 | 102 | 103 |
| **7104D-427-102** | 102 | 104 | 202 | 103 |
| **7104D-437-101** | 101 | 104 | 102 | 103 |

BOURNS INC.

TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5204

## R CODE MATRIX

| Ratio \ R1 | 100Ω | 1KΩ | 10KΩ | 100KΩ | 500KΩ | R2/R1 | R3/R1 | R4/R1 |
|---|---|---|---|---|---|---|---|---|
| -410 | -101 | -102 | -103 | -104 | -504 | 1 | 1 | 1 |
| -411 | -101 | -102 | -103 | -104 | | 2 | 1 | 1 |
| -412 | -101 | -102 | -103 | | | 10 | 1 | 1 |
| -413 | -101 | -102 | | | | 100 | 1 | 1 |
| -414 | -101 | | | | | 1000 | 1 | 1 |
| -415 | -101 | -102 | -103 | -104 | | 2 | 1 | 2 |
| -416 | -101 | -102 | -103 | | | 10 | 1 | 2 |
| -417 | -101 | -102 | | | | 100 | 1 | 2 |
| -418 | -101 | | | | | 1000 | 1 | 2 |
| -419 | -101 | -102 | -103 | -104 | | 2 | 2 | 2 |
| -420 | -101 | -102 | -103 | | | 10 | 2 | 2 |
| -421 | -101 | -102 | | | | 100 | 2 | 2 |
| -422 | -101 | | | | | 1000 | 2 | 2 |
| -423 | -101 | -102 | -103 | | | 10 | 1 | 10 |
| -424 | -101 | -102 | | | | 100 | 1 | 10 |
| -425 | -101 | | | | | 1000 | 1 | 10 |
| -426 | -101 | -102 | -103 | | | 10 | 2 | 10 |
| -427 | -101 | -102 | | | | 100 | 2 | 10 |
| -428 | -101 | | | | | 1000 | 2 | 10 |
| -429 | -101 | -102 | -103 | | | 10 | 10 | 10 |
| -430 | -101 | -102 | | | | 100 | 10 | 10 |
| -431 | -101 | | | | | 1000 | 10 | 10 |
| -432 | -101 | -102 | | | | 100 | 1 | 100 |
| -433 | -101 | | | | | 1000 | 1 | 100 |
| -434 | -101 | -102 | | | | 100 | 2 | 100 |
| -435 | -101 | | | | | 1000 | 2 | 100 |
| -436 | -101 | -102 | | | | 100 | 10 | 100 |
| -437 | -101 | | | | | 1000 | 10 | 100 |
| -438 | -101 | | | | | 100 | 100 | 100 |
| -439 | -101 | | | | | 1000 | 100 | 100 |
| -440 | -101 | | | | | 1000 | 1 | 1000 |
| -441 | -101 | | | | | 1000 | 2 | 1000 |
| -442 | -101 | | | | | 1000 | 10 | 1000 |
| -443 | -101 | | | | | 1000 | 100 | 1000 |
| -444 | -101 | | | | | 1000 | 1000 | 1000 |

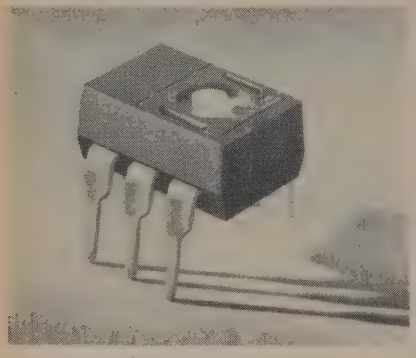
MFT™
**MULTI FUNCTION TRIMMER/MODEL 7104D**
Four Single Turn Cermet Trimmers In A 16-Pin DIP

BOURNS
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5204

MFT™

# MULTI FUNCTION TRIMMER/MODEL 7105A

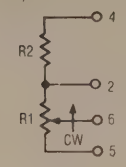
One Single Turn Cermet Trimmer With One Series Fixed Resistor In A 6-Pin DIP



## FEATURES

- Reduced total circuit manufacturing costs
- Reduced PC board space
- The first low cost, sealed trimmer compatible with auto-insertion equipment
- Better temperature tracking than discretes
- Improved circuit performance
- Reduced circuit design time
- Increased reliability
- Compatible with auto-test equipment
- Total Resistance = TR = R1+R2
- Seven Values
  R1+R2: 500Ω, 1KΩ, 5KΩ, 10KΩ, 50KΩ, 100KΩ, 500KΩ
- Nine Resistance Ratios
  $\frac{R1}{R1+R2}$: .1, .2, .3, .4, .5, .6, .7, .8, .9

## SCHEMATIC




## PART NUMBER BUILD UP

7105A-XXX-XXX

β From Ratio Chart
I.E. β = .4, -104

Standard R Code For TR
I.E. -102 = 1000Ω

## RATIO CHART

| β | Dash Number |
|---|---|
| .1 | -101 |
| .2 | -102 |
| .3 | -103 |
| .4 | -104 |
| .5 | -105 |
| .6 | -106 |
| .7 | -107 |
| .8 | -108 |
| .9 | -109 |

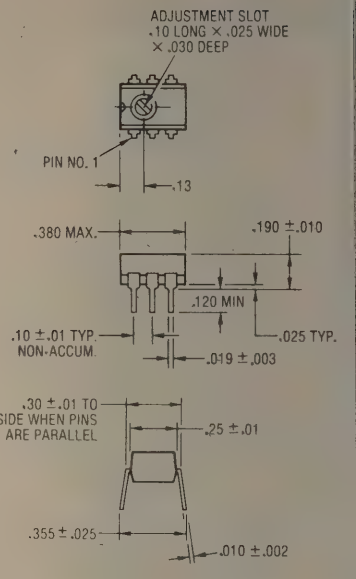
**These Part Numbers are available from stock or maximum of four (4) weeks lead time.**

For all other Part Numbers contact BOURNS Product Management for Pricing & Delivery. (714) 781-5204.

**DETAIL** lists the resistance of each part number.

| Part Numbers | DETAIL R1 | DETAIL R2 |
|---|---|---|
| **7105A-102-502** | 102 | 402 |
| **7105A-102-103** | 202 | 802 |
| **7105A-102-504** | 104 | 404 |
| **7105A-103-503** | 153 | 353 |
| **7105A-104-503** | 203 | 303 |
| **7105A-105-102** | 501 | 501 |
| **7105A-105-103** | 502 | 502 |
| **7105A-105-503** | 253 | 253 |
| **7105A-105-104** | 503 | 503 |
| **7105A-107-503** | 353 | 153 |
| **7105A-108-502** | 402 | 102 |
| **7105A-108-504** | 404 | 104 |
| **7105A-109-103** | 902 | 102 |
| **7105A-109-104** | 903 | 103 |

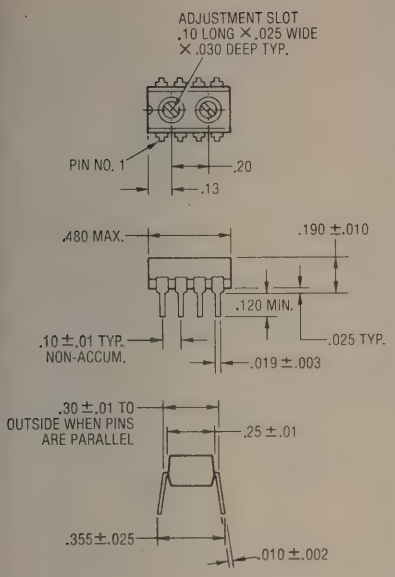
## DIMENSIONS



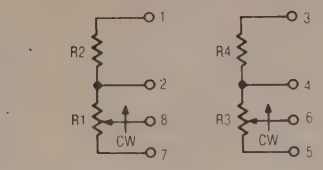

BOURNS NC

TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5204

## DIMENSIONS




## SCHEMATIC




## PART NUMBER BUILD UP

7125B-XXX-XXX

R1 / R1+R2
From Ratio Chart
I.E. -204 = .4

Standard R Code
For R1+R2
I.E. -102 = 1000Ω

## RATIO CHART

| $\frac{R1}{R1+R2}$ | Dash Number |
|---|---|
| .1 | -201* |
| .2 | -202 |
| .3 | -203 |
| .4 | -204 |
| .5 | -205 |
| .6 | -206 |
| .7 | -207 |
| .8 | -208 |
| .9 | -209 |

* Not available in R1+R2 = 500Ω

**These Part Numbers are available from stock or maximum of four (4) weeks lead time.**

For all other Part Numbers contact Bourns Product Management for Pricing and Delivery. (714) 781-5204.

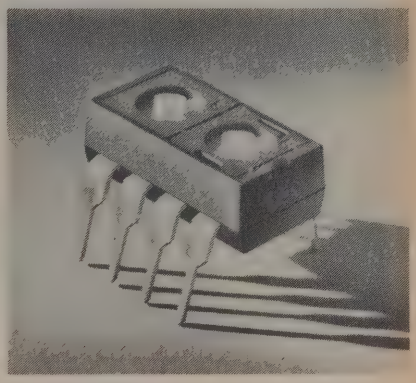
**DETAIL** lists the resistance of each element in each part number.

| Part Numbers | DETAIL | | | |
|---|---|---|---|---|
| | R1 | R2 | R3 | R4 |
| **7125B-201-102** | 101 | 901 | 101 | 901 |
| **7125B-201-502** | 501 | 452 | 501 | 452 |
| **7125B-201-503** | 502 | 453 | 502 | 453 |
| **7125B-202-103** | 202 | 802 | 102 | 802 |
| **7125B-203-503** | 153 | 353 | 153 | 353 |
| **7125B-207-502** | 352 | 152 | 352 | 152 |
| **7125B-207-103** | 702 | 302 | 702 | 302 |
| **7125B-207-503** | 353 | 153 | 353 | 153 |
| **7125B-209-104** | 903 | 103 | 903 | 103 |

MFT™

# MULTI FUNCTION TRIMMER/MODEL 7125B

Two Single Turn Cermet Trimmers
With Series Fixed Resistors,
Equivalent To Two Model 7105A
In A Single 8-Pin DIP



## FEATURES

- Reduced total circuit manufacturing costs
- Reduced PC board space
- The first low cost, sealed trimmer compatible with auto-insertion equipment
- Better temperature tracking than discretes
- Improved circuit performance
- Reduced circuit design time
- Increased reliability
- Compatible with auto-test equipment
- Total Resistance = TR = R1+R2
- Seven Values
  R1+R2: 500Ω, 1KΩ 5KΩ, 10KΩ, 50KΩ, 100KΩ, 500KΩ
- Nine Resistance Ratios
  $\frac{R1}{R1+R2}$: .1, .2, .3, .4, .5, .6, .7, .8, .9
- **R3 and R4 are Duplication of R1 and R2**

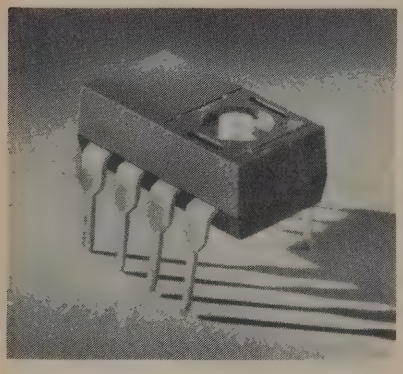
BOURNS NC

TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5204

# MFT™

## MULTI FUNCTION TRIMMER/MODEL 7106B

One Single Turn Cermet Trimmer With
Two Series Fixed Resistors
In An 8-Pin DIP



### FEATURES

- Reduced total circuit manufacturing costs
- Reduced PC board space
- The first low cost, sealed trimmer compatible with auto-insertion equipment
- Better temperature tracking than discretes
- Improved circuit performance
- Reduced circuit design time
- Increased reliability
- Compatible with auto-test equipment
- Seven Values for R1+R2+R3
  R1+R2+R3: 500Ω, 1KΩ, 5KΩ, 10KΩ, 50KΩ, 100KΩ, 500KΩ
- Eight Resistance Ratios
  $\frac{R3}{R1+R2+R3}$: .1, .2, .3, .4, .5, .6, .7, .8
  $\frac{R1+R3}{R1+R2+R3}$: .2, .3, .4, .5, .6, .7, .8, .9

### SCHEMATIC

### PART NUMBER BUILD UP

7106B-XXX-XXX

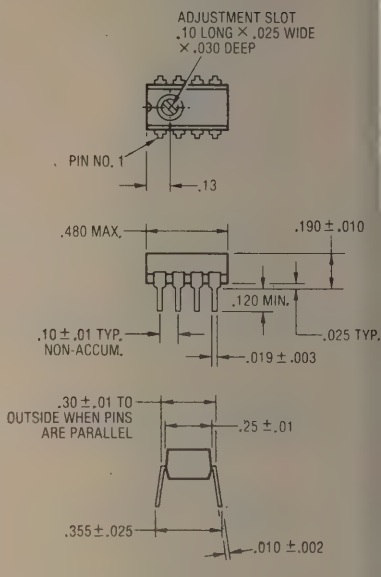
From Ratio Matrix

I.E. -137, $\frac{R3}{R1+R2+R3} = .3$

$\frac{R1+R3}{R1+R2+R3} = .7$

Standard R Code
For R1+R2+R3
I.E. -102 = 1000Ω

### DIMENSIONS




### RATIO MATRIX

| R1+R3 / R1+R2+R3 \ R3 / R1+R2+R3 | .1 | .2 | .3 | .4 | .5 | .6 | .7 | .8 |
|---|---|---|---|---|---|---|---|---|
| .9 | -119 | -129 | -139 | -149 | -159 | -169 | -179 | -189 |
| .8 | -118 | -128 | -138 | -148 | -158 | -168 | -178* | |
| .7 | -117 | -127 | -137 | -147 | -157 | -167* | | |
| .6 | -116 | -126 | -136 | -146 | -156* | | | |
| .5 | -115 | -125 | -135 | -145* | | | | |
| .4 | -114 | -124 | -134* | | | | | |
| .3 | -113 | -123* | | | | | | |
| .2 | -112* | | | | | | | |

* Not available for R1+R2+R3 = 500Ω

**These Part Numbers are available from stock or maximum of four (4) weeks lead tim**

For all other Part Numbers contact Bourns Product Management for Pricing an Delivery. (714) 781-5204.

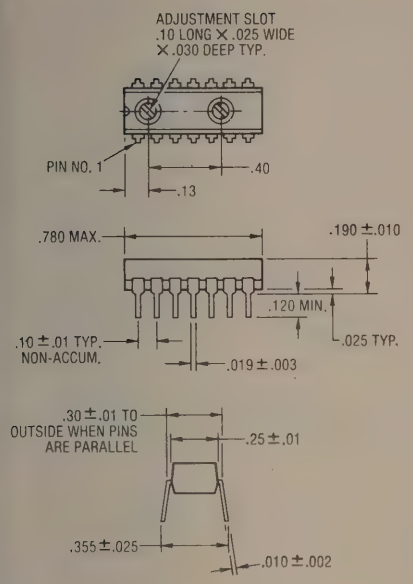
**DETAIL** lists the resistance of each element in each part number.

| Part Numbers | DETAIL R1 | R2 | R3 |
|---|---|---|---|
| **7106B-119-103** | 802 | 102 | 102 |
| **7106B-125-103** | 302 | 502 | 202 |
| **7106B-127-504** | 253 | 153 | 103 |
| **7106B-128-103** | 602 | 202 | 202 |
| **7106B-128-104** | 603 | 203 | 203 |
| **7106B-137-103** | 402 | 302 | 302 |
| **7106B-137-503** | 203 | 153 | 153 |
| **7106B-137-504** | 204 | 154 | 154 |

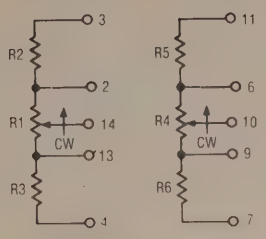
| Part Numbers | DETAIL R1 | R2 | R3 |
|---|---|---|---|
| **7106B-145-502** | 501 | 252 | 202 |
| **7106B-145-103** | 102 | 502 | 402 |
| **7106B-145-503** | 502 | 253 | 203 |
| **7106B-146-102** | 201 | 401 | 401 |
| **7106B-146-104** | 203 | 403 | 403 |
| **7106B-157-104** | 203 | 303 | 503 |
| **7106B-168-501** | 101 | 101 | 301 |

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5204

## DIMENSIONS




## SCHEMATIC




## PART NUMBER BUILD UP

7126C-XXX-XXX

From Ratio Matrix

I.E. -237, $\frac{R3}{R1+R2+R3} = .3$

$\frac{R1+R3}{R1+R2+R3} = .7$

Standard R Code For R1+R2+R3
I.E. -102 = 1000Ω

## RATIO MATRIX

| $\frac{R1+R3}{R1+R2+R3}$ \ $\frac{R3}{R1+R2+R3}$ | .1 | .2 | .3 | .4 | .5 | .6 | .7 | .8 |
|---|---|---|---|---|---|---|---|---|
| .9 | -219 | -229 | -239 | -249 | -259 | -269 | -279 | -289* |
| .8 | -218 | -228 | -238 | -248 | -258 | -268 | -278* | |
| .7 | -217 | -227 | -237 | -247 | -257 | -267* | | |
| .6 | -216 | -226 | -236 | -246 | -256* | | | |
| .5 | -215 | -225 | -235 | -245* | | | | |
| .4 | -214 | -224 | -234* | | | | | |
| .3 | -213 | -223* | | | | | | |
| .2 | -212* | | | | | | | |

* Not available for R1+R2+R3 = 500Ω

**These Part Numbers are available from stock or maximum of four (4) weeks lead time.**

For all other Part Numbers contact Bourns Product Management for Pricing and Delivery. (714) 781-5204.

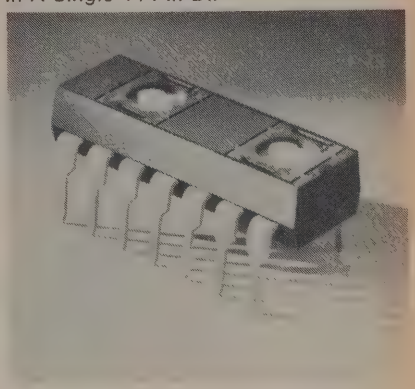
**DETAIL** lists the resistance of each element in each part number.

| Part Numbers | DETAIL | | | | | |
|---|---|---|---|---|---|---|
| | R1 | R2 | R3 | R4 | R5 | R6 |
| **7126C-228-103** | 602 | 202 | 202 | 602 | 202 | 202 |
| **7126C-237-503** | 203 | 153 | 153 | 203 | 153 | 153 |
| **7126C-245-103** | 102 | 502 | 402 | 102 | 502 | 402 |

MFT™

# MULTI FUNCTION TRIMMER/MODEL 7126C

Two Single Turn Cermet Trimmers With Two Series Fixed Resistors, Equivalent To Two Model 7106B In A Single 14-Pin DIP



## FEATURES

- Reduced total circuit manufacturing costs
- Reduced PC board space
- The first low cost, sealed trimmer compatible with auto-insertion equipment
- Better temperature tracking than discretes
- Improved circuit performance
- Reduced circuit design time
- Increased reliability
- Compatible with auto-test equipment
- Seven Values for R1+R2+R3
  R1+R2+R3: 500Ω, 1KΩ, 5KΩ, 10KΩ, 50KΩ, 100KΩ, 500KΩ
- Eight Resistance Ratios
  $\frac{R3}{R1+R2+R3}$: .1, .2, .3, .4, .5, .6, .7, .8
  $\frac{R1+R3}{R1+R2+R3}$: .2, .3, .4, .5, .6, .7, .8, .9
- **R4, R5 and R6 are Duplications R1, R2 and R3**

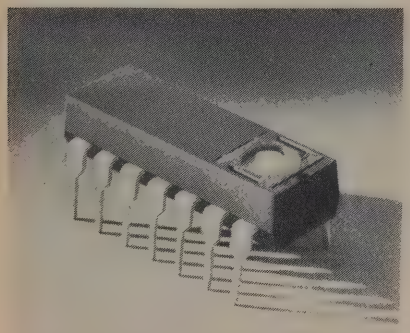
BOURNS INC

TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5204

MFT™

# MULTI FUNCTION TRIMMER/MODEL 7107C FOR OP-AMP GAIN TRIM APPLICATIONS

One Single Turn Cermet Trimmer With Two Series Fixed Resistors and One Discrete Fixed Resistor In A 14-Pin DIP

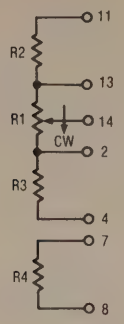


## FEATURES

- Reduced total circuit manufacturing costs
- Reduced PC board space
- The first low cost, sealed trimmer compatible with auto-insertion equipment
- Better temperature tracking than discretes
- Improved circuit performance
- Reduced circuit design time
- Increased reliability
- Compatible with auto-test equipment
- Five Values For R1+R2+R3 R1+R2+R3: 10KΩ, 20KΩ, 50KΩ 100KΩ, 500KΩ
- Eight Nominal Gain Ratios Gain = 1, 2, 3, 4, 5, 10, 100, 1000
- Variable From 90% to 110% of Nominal
- R4 Value For Maximum Temperature Stability

$$R4 = \frac{R2 \cdot R3}{R2+R3}$$

## SCHEMATIC




## PART NUMBER BUILD UP

7107C-XXX-XXX

From Gain Chart
I.E. -111, Gain = 10

Standard Resistance Code For R1+R2+R3
I.E. -103 = 10,000Ω

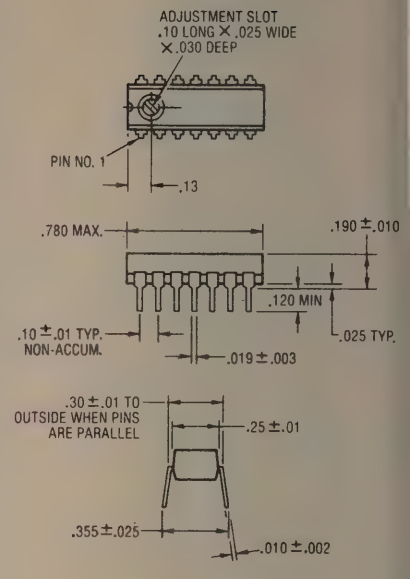
## GAIN CHART

| Gain | Dash Number |
|---|---|
| 1 | -101 |
| 2 | -102 |
| 3 | -103 |
| 4 | -104 |
| 5 | -105 |
| 10 | -111 |
| 100 | -112 |
| 1000 | -113 |

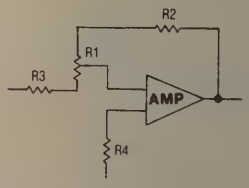
**These Part Numbers are available from stock or maximum of four (4) weeks lead time.**
For all other Part Numbers contact BOURNS Product Management for Pricing & Delivery. (714) 781-5204.

| Part Numbers |
|---|
| **7107C-101-203** |
| **7107C-101-503** |
| **7107C-111-104** |
| **7107C-112-104** |

## DIMENSIONS

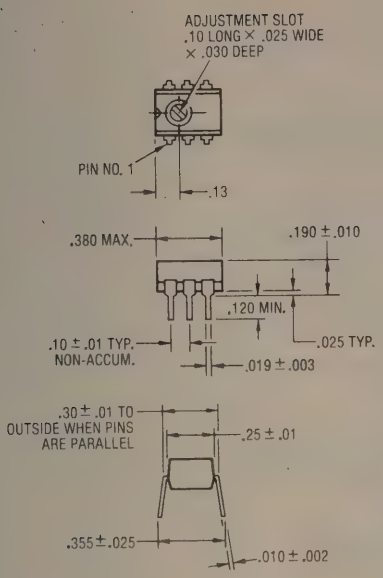



## APPLICATION

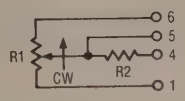



BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5204

## DIMENSIONS




## SCHEMATIC




## PART NUMBER BUILD UP

7108A-XXX-XXX

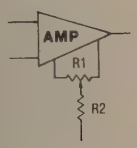
1st Selection
From Ratio Chart
I.E. -105 = R2/R1, 5

2nd Selection
R1 from R Code Matrix
I.E. 50KΩ = -503

## RATIO CHART

| R2/R1 | Dash Number |
|---|---|
| 1 | -101 |
| 5 | -105 |
| 10 | -111 |
| 100 | -112 |

## APPLICATION




## R CODE MATRIX

| Ratio \ R1 | 5KΩ | 10KΩ | 50KΩ | 100KΩ | 500KΩ |
|---|---|---|---|---|---|
| -101 | -502 | -103 | -503 | -104 | -504 |
| -105 | -502 | -103 | -503 | -104 | |
| -111 | -502 | -103 | -503 | | |
| -112 | -502 | | | | |

**These Part Numbers are available from stock or maximum of four (4) weeks lead time.**

For all other Part Numbers contact Bourns Product Management for Pricing and Delivery. (714) 781-5204.

**DETAIL** lists the resistance of each element in each part number.

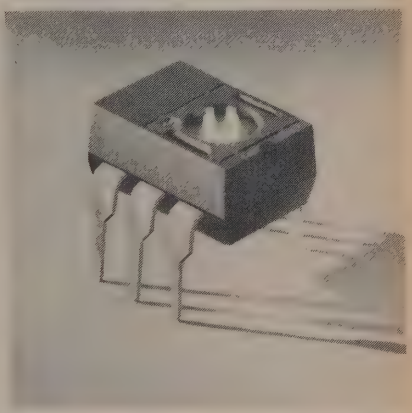
| Part Numbers | DETAIL R1 | DETAIL R2 |
|---|---|---|
| **7108A-101-103** | 103 | 103 |
| **7108A-101-104** | 104 | 104 |

| Part Numbers | DETAIL R1 | DETAIL R2 |
|---|---|---|
| **7108A-105-502** | 502 | 253 |
| **7108A-105-103** | 103 | 503 |

MFT™

# MULTI FUNCTION TRIMMER/MODEL 7108A FOR OP-AMP OFFSET ADJUSTMENT

One Single Turn Cermet Trimmer With One Fixed Resistor in Wiper Circuit In A 6-Pin DIP



## FEATURES

- Reduced total circuit manufacturing costs
- Reduced PC board space
- The first low cost, sealed trimmer compatible with auto-insertion equipment
- Better temperature tracking than discretes
- Improved circuit performance
- Reduced circuit design time
- Increased reliability
- Compatible with auto-test equipment
- Five Values For R1
  R1: 5KΩ, 10KΩ, 50KΩ, 100KΩ, 500KΩ
- Four Resistance Ratios
  $\frac{R2}{R1}$: 1, 5, 10, 100

BOURNS
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5204

# TRIMMING POTENTIOMETERS

## SELECTION GUIDE INDEX

For details on specific models look under the applicable element type, size to find models described on previous pages.

### RECTANGULAR MULTI-TURN

| Length | Commercial Model | Industrial Model | Mil-Spec Model |
|---|---|---|---|
| **Wirewound** | | | |
| 1¼″ | 271/3/5 | 200<br>260<br>3057 | RT12, RTR12 |
| 1″ | 3067 | 3070<br>220 | RT10 |
| ¾″ | 3005 | | |
| **Cermet** | | | |
| .785″ | | 20 | |
| 1¼″ | | 3059 | RJ12, RJR12 |
| ¾″ | 3006<br>3009<br>3069 | 3099(DIP) | RJR32 |
| ½″ | | 3082 | RJR28 |
| **Carbon** | | | |
| 1¼″ | 272/4/6 | | |

### SQUARE MULTI-TURN

| | | | |
|---|---|---|---|
| **Wirewound** | | | |
| ½″ | 3255 | 3250 | RT22, RTR22 |
| ⅜″ | | 3280<br>3290 | RT24, RTR24 |
| ¼″ | | 3260 | RT26 |
| **Cermet** | | | |
| ½″ | | 3252 | RJ22 |
| ⅜″ | 3299 | 3282, 3292 | RJ24, RJR24 |
| ¼″ | | 3262 | RJ26, RJR26 |

### SINGLE-TURN

| | | | |
|---|---|---|---|
| **Wirewound** | | | |
| ½″ | 3345 | | |
| 5/16″ | 3305 | 3300 | |
| **Cermet** | | | |
| ½″ | | 3359 | |
| ⅜″ | 3386 | 3352 | |
| 5/16″ | | 3339* | |
| ¼″ | 3329 | | |
| **Carbon** | | | |
| ½″ | 3355 | 3391/3392 | |

* 4 Turn Adjustment

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

## PART NUMBERING SYSTEM

3006 P - 1 - 102 M

- MODEL
- TERMINAL TYPE see key below
- CATALOG ITEM 2 or 3 digits indicate a special
- RESISTANCE CODE see below
- PANEL MOUNT if applicable

## KEY TO TERMINAL TYPES

| | | | |
|---|---|---|---|
| J | Solder Hook | W-66 or X | Printed Circuit Pins (edge mounting, side adjustment for worm gear units only) |
| L | Insulated Stranded Leads | H,S,W | Printed Circuit Pins (edge mounting) |
| S | Solder Hooks | P,R,T,K*,F* | Printed Circuit Pins (flat mounting)* |
| P,T,Y | Printed Circuit Pins (flat mounting) | D | Printed Circuit Pins (DIP socket spacing) |
| H | Printed Circuit Pins (see individual model catalog sheet for details) | | |
| W | Printed Circuit Pins (edge mounting) | | |

## RESISTANCES

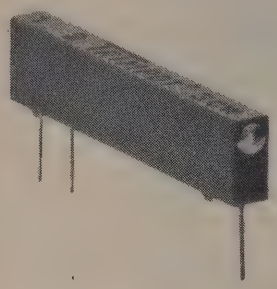
The following values are standard if they fall within limits listed for individual models. Other resistances available on special order.

| Wirewound | Cermet | Carbon | Code |
|---|---|---|---|
| 50 | 10 | | 100 |
| 20 | 20 | | 200 |
| 50 | 50 | | 500 |
| 100 | 100 | 100 | 101 |
| 200 | 200 | | 201 |
| | | 250 | 251 |
| 500 | 500 | 500 | 501 |
| 1K | 1K | 1K | 102 |
| 2K | 2K | | 202 |
| | | 2.5K | 252 |
| 5K | 5K | 5K | 502 |
| 10K | 10K | 10K | 103 |
| 20K | 20K | | 203 |
| 50K | | 25K | 253 |
| 100K | 50K | 50K | 503 |
| | 100K | 100K | 104 |
| | 200K | | 204 |
| | | 250K | 254 |
| | 500K | 500K | 504 |
| | 1 Meg. | 1 Meg. | 105 |
| | 2 Meg. | 2 Meg. | 205 |
| | | 2.5 Meg. | 255 |
| | 5 Meg. | 5 Meg. | 505 |

BOURNS INC
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

# MODEL 20

SIP Trimpot® Potentiometer
Cermet Element



## FEATURES

- Lower PC board profile, only .185″ off the board
- Machine insertable SIP design provides extra cost savings
- High density board spacing, fits on standard .100″ grid
- Stable cermet element offers continuous resolution
- High power rating: 0.50 watt at 70°C
- Low temperature coefficient: 100 ppm/°C over −55°C to +125°C temperature range
- Sealed to MIL-R-22097 (standard); withstands industrial cleaning processes
- Wiper assembly idles at both ends of travel, eliminating the possibility of travel from forced adjustment

BOURNS® Model 20 sealed SIP potentiometer offers a thin package width and machine insertability together with outstanding performance and quality.

## SPECIFICATIONS

**Electrical Characteristics**

Standard Resistance Range (see chart) . . 10 to 5,000,000 ohms
Resistance Tolerance . . . . . ±10% standard
Absolute Minimum Resistance . 3.0% or 1.0 ohm, whichever is greater
Continuity . . . . . Maintained for full mechanical range
Insulation Resistance: 500 volts DC . . . . . 100 megohms minimum
Contact Resistance Variation, Maximum . . . . . 3.0% or 1.0 ohm whichever is greater
Resolution . . . . . Infinite
Setability, Voltage Divider Mode . . . ±0.05% all resistances
Rheostat Mode . . . . . ±0.1% all resistances

**Environmental Characteristics**

Power Ratings:
25°C . . . . . 0.75 watt
70°C . . . . . 0.50 watt
125°C . . . . . 0 watt
Operating Temperature Range . . . . . −55°C to +125°C
Temperature Coefficient . . . ±100 ppm/°C, all resistances maximum
Humidity, MIL-STD-202, Method 106 . . . . . 20 megohms minimum insulation resistance after removal from chamber
Seal . Meets immersion requirements of MIL-R-22097
Vibration . . . . . 20Gs
Contact Bounce . . . 1 millisecond maximum
Wiper Shift, Maximum . . . . . 2.0%
Shock . . . . . 50Gs
Contact Bounce and Wiper Shift . Same as vibration
Load Life . . . . . 1000 hours 0.5 watt at 70°C
Mechanical Life . 200 cycles without discontinuity
Dielectric Strength
Room Conditions . . 1000 volts AC
80,000 ft. (0.8″ hg) . . 250 volts AC

Specifications are subject to change without notice

**Physical Characteristics**

Markings . . Manufacturer's name or symbol, wiring diagram, date code, resistance and manufacturer's part number (customer's part number optional)
Appearance . . Legible markings, no physical defects
Shaft Torque . . 5.0 oz.-in. maximum all resistances
Mechanical Adjustment . . . . . 15 turns ±3
Mechanical Stops . Wiper assembly idles
Weight . . . . . 0.40 grams maximum
Terminals . . . . . Solderable pins

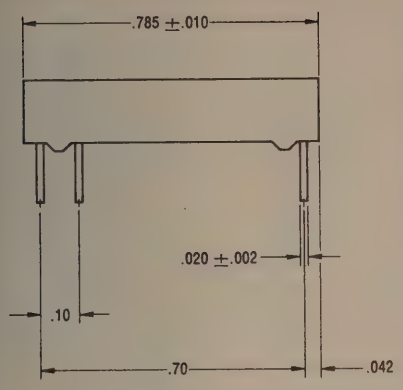
**Metric Conversion Chart**

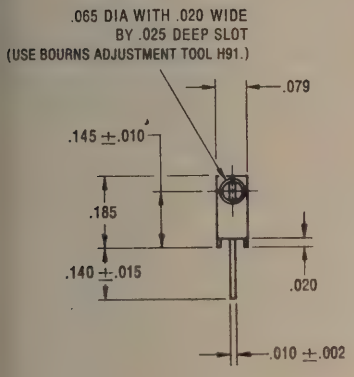
| Inch | mm | Inch | mm |
|---|---|---|---|
| .001 | .025 | .065 | 1.65 |
| .002 | .051 | .079 | 2.00 |
| .005 | .127 | .100 | 2.54 |
| .010 | .254 | .140 | 3.56 |
| .015 | .381 | .145 | 3.68 |
| .020 | .508 | .185 | 4.70 |
| .025 | .635 | .700 | 17.78 |
| .042 | 1.07 | .785 | 19.94 |

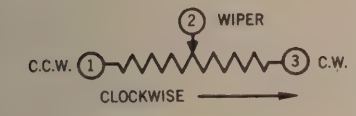
BOURNS

TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

## DIMENSIONS




TOLERANCES: EXCEPT WHERE NOTED
DECIMALS: .XX±.010, XXX±.005

## STANDARD RESISTANCES

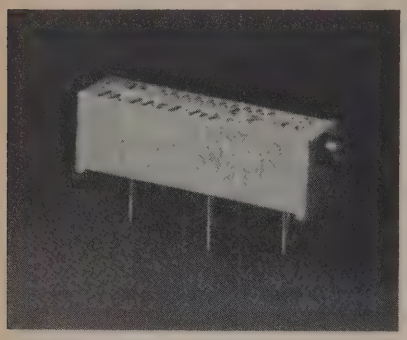
| Resistance (Ohms) | Part Number |
|---|---|
| 10 | 20P-1-100 |
| 20 | 20P-1-200 |
| 50 | 20P-1-500 |
| 100 | 20P-1-101 |
| 200 | 20P-1-201 |
| 500 | 20P-1-501 |
| 1,000 | 20P-1-102 |
| 2,000 | 20P-1-202 |
| 5,000 | 20P-1-502 |
| 10,000 | 20P-1-103 |
| 20,000 | 20P-1-203 |
| 50,000 | 20P-1-503 |
| 100,000 | 20P-1-104 |
| 200,000 | 20P-1-204 |
| 500,000 | 20P-1-504 |
| 1,000,000 | 20P-1-105 |
| 2,000,000 | 20P-1-205 |
| 5,000,000 | 20P-1-505 |

Special resistances available from 10 to 5,000,000 ohms

BOURNS INC
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

## MODEL 3006

Commercial Trimpot® Potentiometer
Cermet Element



### FEATURES

- Low cost
- Low PC board profile, only ¼" off the board
- Stable cermet element offers continuous resolution
- High power rating: 0.75 watt at 70°C
- Low temperature coefficient: 100 ppm/°C over −55° to +125°C temperature range
- Sealed to MIL-R-22097 standard; withstands industrial cleaning processes
- 16 independent wiper contacts assure excellent setability
- Wiper assembly idles at both ends of travel eliminating the possibility of damage from forced adjustment

### SPECIFICATIONS

**Electrical Characteristics**

Standard Resistance Range (see chart on front) . . . 10 to 2,000,000 ohms
Resistance Tolerance . . . . . ±10% standard, closer tolerances available
Absolute Minimum Resistance . 3.0% or 1.0 ohm, whichever is greater
Continuity . . . . . Maintained for full mechanical range
Insulation Resistance, 500 volts DC . . . . . 100 megohms minimum
Contact Resistance Variation, Maximum . . . . . 3 ohms or 3%, whichever is greater
Resolution . . . . . Infinite
Setability (Voltage Divider) . 0.02%

**Environmental Characteristics**

Power Ratings:
25°C . . . . . 1.25 watt
70°C . . . . . 0.75 watt
125°C . . . . . 0 watt
Operating Temperature Range . . . . . −55° to +125°C
Temperature Coefficient . . . . ±100 ppm/°C all resistances maximum
Humidity, MIL-STD-202, Method 106 . . . . . 20 megohms minimum insulation resistance after removal from chamber
Seal . . . . . Meets immersion requirements of MIL-R-22097
Vibration . . . . . 20Gs
Contact Bounce . 0.1 millisecond maximum
Wiper Shift, Maximum . . . . 2.0%
Shock . . . . . 50Gs
Contact Bounce and Wiper Shift . . Same as vibration
Load Life . . . . 1,000 hours 0.75 watt at 70°C
Mechanical Life . 200 cycles without discontinuity
Dielectric Strength
Room Conditions . 1000 volts AC
80,000 feet (0.8" hg) . 250 volts AC

**Physical Characteristics**

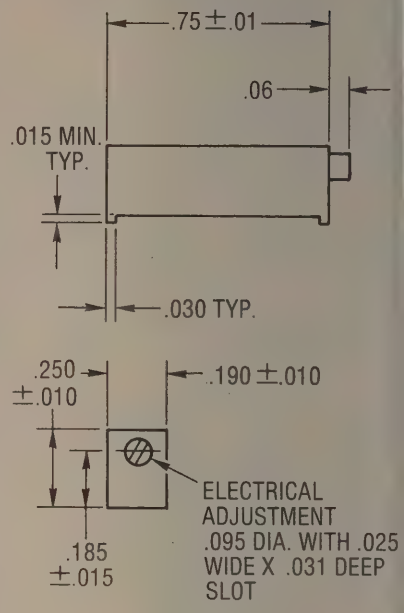
Shaft Torque . . 5.0 oz.-in maximum
Markings . Manufacturer's name or symbol, wiring diagram, date code, resistance and manufacturer's part number (customer's part number optional)
Appearance . . . . Legible markings, no physical defects
Mechanical Adjustment . . 15 turns nominal
Mechanical Stops . Wiper assembly idles
Weight . . . . Approximately 0.1 oz.
Terminals . . . . . Solderable pins

Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to change without notice.

### DIMENSIONS

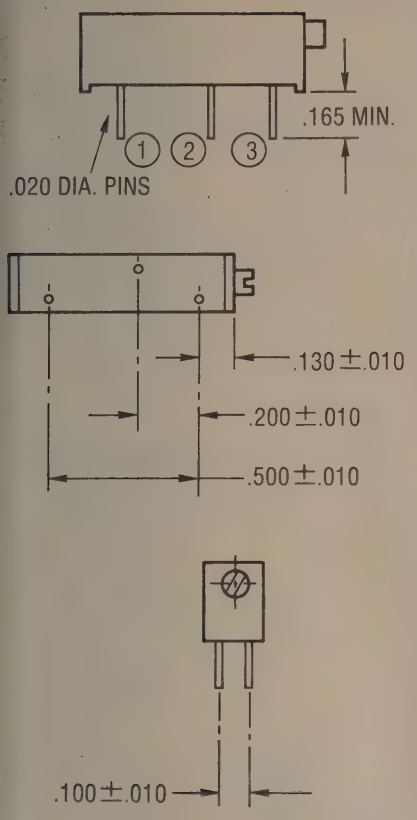
**3006 Basic Dimensions**



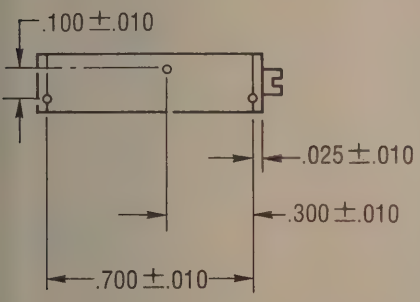

BOURNS
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

## DIMENSIONS

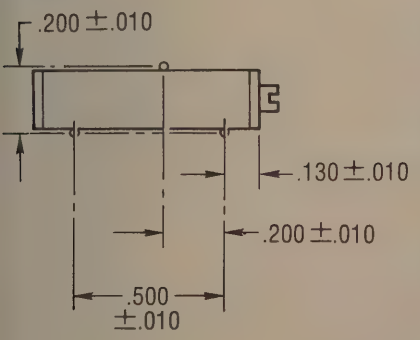
**3006P**




**3006W**




**3006Y**




## STANDARD RESISTANCES

| Resistance (Ohms) | Part Numbers* | | |
|---|---|---|---|
| | 3006P | Printed Circuit Pins 3006W | 3006Y |
| 10 | 3006P-1-100 | 3006W-1-100 | 3006Y-1-100 |
| 20 | 3006P-1-200 | 3006W-1-200 | 3006Y-1-200 |
| 50 | 3006P-1-500 | 3006W-1-500 | 3006Y-1-500 |
| 100 | 3006P-1-101 | 3006W-1-101 | 3006Y-1-101 |
| 200 | 3006P-1-201 | 3006W-1-201 | 3006Y-1-201 |
| 500 | 3006P-1-501 | 3006W-1-501 | 3006Y-1-501 |
| 1,000 | 3006P-1-102 | 3006W-1-102 | 3006Y-1-102 |
| 2,000 | 3006P-1-202 | 3006W-1-202 | 3006Y-1-202 |
| 5,000 | 3006P-1-502 | 3006W-1-502 | 3006Y-1-502 |
| 10,000 | 3006P-1-103 | 3006W-1-103 | 3006Y-1-103 |
| 20,000 | 3006P-1-203 | 3006W-1-203 | 3006Y-1-203 |
| 50,000 | 3006P-1-503 | 3006W-1-503 | 3006Y-1-503 |
| 100,000 | 3006P-1-104 | 3006W-1-104 | 3006Y-1-104 |
| 200,000 | 3006P-1-204 | 3006W-1-204 | 3006Y-1-204 |
| 500,000 | 3006P-1-504 | 3006W-1-504 | 3006Y-1-504 |
| 1,000,000 | 3006P-1-105 | 3006W-1-105 | 3006Y-1-105 |
| 2,000,000 | 3006P-1-205 | 3006W-1-205 | 3006Y-1-205 |

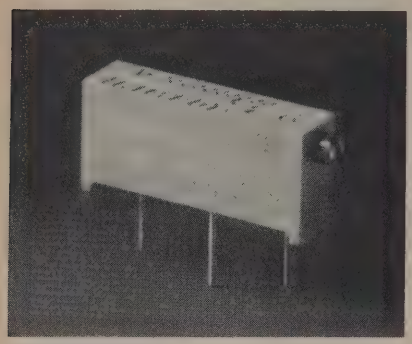
Special resistances available from 10 to 5,000,000 ohms.

* The last three digits of the part number represent the resistance in standard code.

BOURNS INC
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

# MODEL 3009

Commercial E-Z-Trim® Potentiometer
Cermet Element



## FEATURES

- Mil-Spec immersion seal gives trouble-free operation after P.C. board processes
- Low temperature coefficient: ±100 ppm/°C over entire resistance and temperature range
- Stable, infinite resolution PALIRIUM® Cermet element and outstanding ±0.05% setability
- Tinned pins for compatibility with automated and hand soldering methods
- .021 diameter pins alleviate complicated circuit board fabrication
- Space-saving size: .75″ x .19″ x .35″ with RJ11 pin configuration
- Date code traceability
- Wiper assembly idles at both ends of travel, preventing damage from forced adjustment

## SPECIFICATIONS

**Electrical Characteristics**

Standard Resistance Range . . . 10 ohms to 2 megohms

Resistance Tolerance . . . . . ±10% standard, closer tolerances available

Absolute Minimum Resistance* . . . 2.0% or 1.0 ohm, whichever is greater

Continuity* . . . . Maintained for full mechanical range

Insulation Resistance, 500 volts DC . . . . . 100 megohms minimum

Resolution . . . . . Infinite

**Environmental Characteristics**

Power Ratings:
25°C . . . . . 0.75 watt
125°C . . . . . 0 watt

Operating Temperature Range . . . . . −55° to +125°C

Temperature Coefficient . . . . ±100 ppm/°C all resistances maximum

Humidity, MIL-STD-202, Method 106 . . . . . 20 megohms minimum insulation resistance after removal from chamber

Seal* . . . . . Mil-Spec immersion

Vibration . . . . . 20Gs

Contact Bounce . 0.1 millisecond maximum

Wiper Shift, Maximum . . . . 2.0%

Shock . . . . . 50Gs

Load Life . . 1000 hours 0.75 watt at 25°C

Mechanical Life . 200 cycles without discontinuity

Dielectric Strength
Room Conditions . . 1000 volts AC
80,000 feet (0.8″ hg) . 250 volts AC

**Physical Characteristics**

Shaft Torque* . 5.0 oz-in. maximum

Markings* . . Manufacturer's name, wiring diagram, date code, resistance and manufacturer's part number (customer's part number optional)

Appearance* . Legible markings, no physical defects

Mechanical Adjustment* . . 20 turns nominal

Mechanical Stops* . . . . . Wiper assembly idles

Weight . . . . . Approximately 0.1 oz.

Terminals . . . . . Printed circuit pins

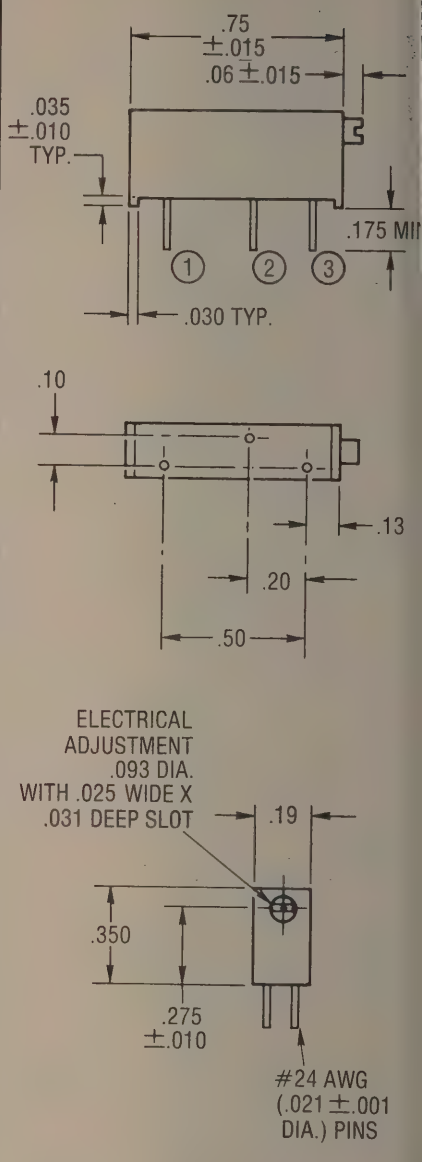
* Inspection Note: 100% or statistical sampling inspection performed to insure highest quality.

Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to change without notice.

## DIMENSIONS

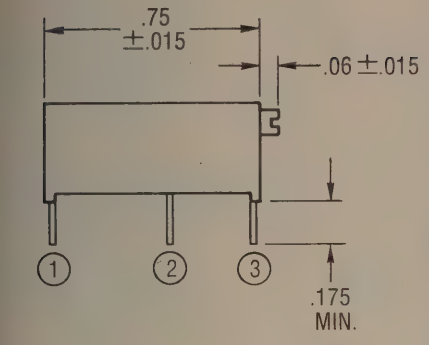
**3009P**

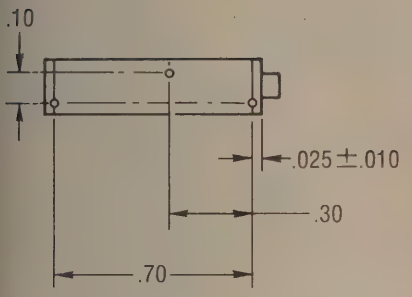


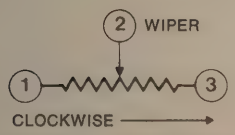

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

## DIMENSIONS

**3009Y**




## STANDARD RESISTANCES

| Resistance (Ohms) | Part Numbers* | |
|---|---|---|
| | 3009 Printed Circuit Pins | 3009Y Printed Circuit Pins |
| 10 | 3009P-1-100 | 3009Y-1-100 |
| 20 | 3009P-1-200 | 3009Y-1-200 |
| 50 | 3009P-1-500 | 3009Y-1-500 |
| 100 | 3009P-1-101 | 3009Y-1-101 |
| 200 | 3009P-1-201 | 3009Y-1-201 |
| 500 | 3009P-1-501 | 3009Y-1-501 |
| 1,000 | 3009P-1-102 | 3009Y-1-102 |
| 2,000 | 3009P-1-202 | 3009Y-1-202 |
| 5,000 | 3009P-1-502 | 3009Y-1-502 |
| 10,000 | 3009P-1-103 | 3009Y-1-103 |
| 20,000 | 3009P-1-203 | 3009Y-1-203 |
| 50,000 | 3009P-1-503 | 3009Y-1-503 |
| 100,000 | 3009P-1-104 | 3009Y-1-104 |
| 200,000 | 3009P-1-204 | 3009Y-1-204 |
| 500,000 | 3009P-1-504 | 3009Y-1-504 |
| 1,000,000 | 3009P-1-105 | 3009Y-1-105 |
| 2,000,000 | 3009P-1-205 | 3009Y-1-205 |

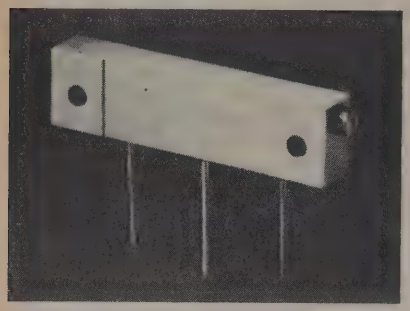
Special resistances available from 10 ohms to 2 megohm

* The last three digits of the part number represent the resistance in standard code.

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

## MODEL 3059

Potentiometer — 1¼″ Long
Industrial — Cermet



### FEATURES

- Meets or exceeds all requirements of MIL-R-22097, Characteristics C, F, Style RJ12 and MIL-R-39035, Style RJR12
- Complete resistance range: 10 ohms to 2 megohm
- High operating temperature (150°C)
- High power dissipation 1.0 watt at 70°C

### SPECIFICATIONS

**Electrical Characteristics**

Standard Resistance Range .... 10 ohms to 2 megohm
Resistance Tolerance ..... ±10% standard, closer tolerances available
Absolute Minimum Resistance ... 2 ohms maximum
Continuity ..... Maintained for full mechanical range
Insulation Resistance, 500 volts DC .... 1000 megohms minimum
Contact Resistance Variation, Maximum ..... 3 ohms or 3.0%, whichever is greater
Adjustability*
Voltage Ratio ..... ±0.05%
Resistance ..... ±0.10%

**Environmental Characteristics**

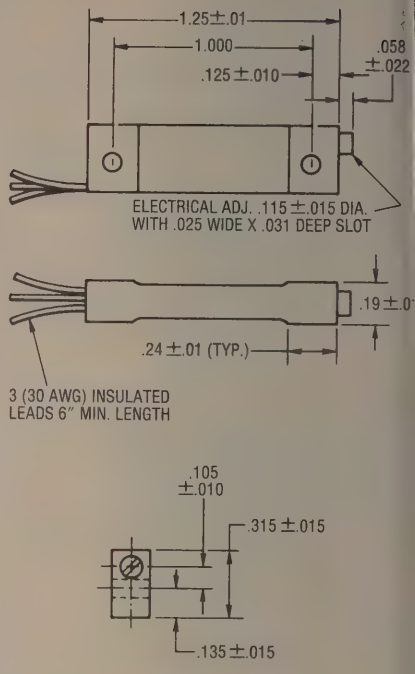
Power Ratings:
70°C ..... 1.0 watt or 400 volts maximum
150°C ..... 0 watt
Operating Temperature Range ..... −55° to +150°C
Temperature Coefficient .... ±100 ppm/°C all resistances maximum
Humidity, MIL-R-22097 ..... 100 megohms minimum insulation resistance after removal from chamber
Vibration ..... MIL-R-22097, 20Gs
Contact Bounce . 0.1 millisecond maximum
Wiper Shift, Maximum .... 1.0% voltage ratio
Shock ..... MIL-R-22097, 50Gs
Contact Bounce and Wiper Shift .. Same as vibration
Salt Spray .... Meets MIL-STD-202, Method 101A
Load Life ..... 1000 hours per MIL-R-22097
Resistance Shift, Maximum . 2.0%
Mechanical Life . 200 cycles without discontinuity
Dielectric Strength ... MIL-R-22097
Room Conditions .. 900 volts AC
70,000 feet ..... 350 volts AC

**Physical Characteristics**

Immersion Leak Test .... No leaks
Shaft Torque .. 5.0 oz.-in. maximum
Markings ... Manufacturer's name, wiring diagram, date code, resistance and manufacturer's part number (customer's part number optional)
Appearance .... Legible markings, no physical defects
Mechanical Stops . Wiper assembly idles
Weight ..... Approximately 0.1 oz.
Terminals:
L .... Teflon-insulated, standard leads, 30 AWG (0.024 O.D.) 7 strands/38 AWG
P, Y ..... Solderable circuit pins
J ..... Solderable solder lugs

### DIMENSIONS

**L**



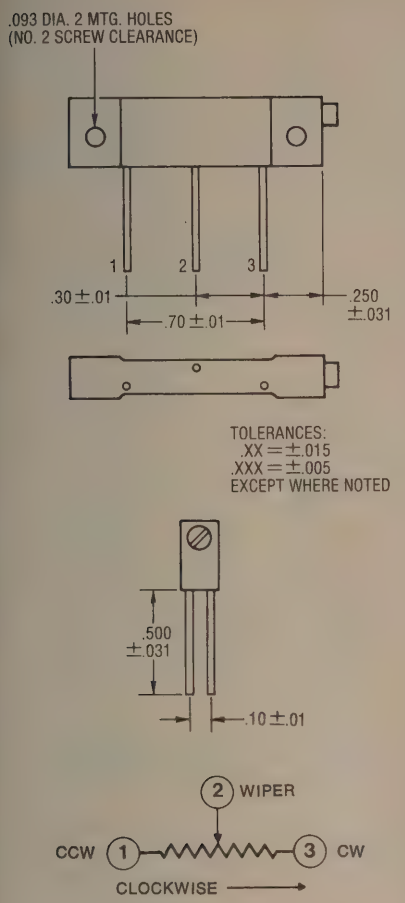

Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to change without notice.

* The precision with which the output voltage ratio or output resistance of a device can be set to the desired value.

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

## DIMENSIONS




## STANDARD RESISTANCES

| Resistance (Ohms) | Part Numbers* | | | |
|---|---|---|---|---|
| | 3059L Stranded Insulated Lead Wires | 3059P Printed Circuit Pins | 3059Y Printed Circuit Pins | 3059J Solder Lugs |
| 10 | 3059L-1-100 | 3059P-1-100 | 3059Y-1-100 | 3059J-1-100 |
| 20 | 3059L-1-200 | 3059P-1-200 | 3059Y-1-200 | 3059J-1-200 |
| 50 | 3059L-1-500 | 3059P-1-500 | 3059Y-1-500 | 3059J-1-500 |
| 100 | 3059L-1-101 | 3059P-1-101 | 3059Y-1-101 | 3059J-1-101 |
| 200 | 3059L-1-201 | 3059P-1-201 | 3059Y-1-201 | 3059J-1-201 |
| 500 | 3059L-1-501 | 3059P-1-501 | 3059Y-1-501 | 3059J-1-501 |
| 1,000 | 3059L-1-102 | 3059P-1-102 | 3059Y-1-102 | 3059J-1-102 |
| 2,000 | 3059L-1-202 | 3059P-1-202 | 3059Y-1-202 | 3059J-1-202 |
| 5,000 | 3059L-1-502 | 3059P-1-502 | 3059Y-1-502 | 3059J-1-502 |
| 10,000 | 3059L-1-103 | 3059P-1-103 | 3059Y-1-103 | 3059J-1-103 |
| 20,000 | 3059L-1-203 | 3059P-1-203 | 3059Y-1-203 | 3059J-1-203 |
| 50,000 | 3059L-1-503 | 3059P-1-503 | 3059Y-1-503 | 3059J-1-503 |
| 100,000 | 3059L-1-104 | 3059P-1-104 | 3059Y-1-104 | 3059J-1-104 |
| 200,000 | 3059L-1-204 | 3059P-1-204 | 3059Y-1-204 | 3059J-1-204 |
| 500,000 | 3059L-1-504 | 3059P-1-504 | 3059Y-1-504 | 3059J-1-504 |
| 750,000 | 3059L-1-754 | 3059P-1-754 | 3059Y-1-754 | 3059J-1-754 |
| 1,000,000 | 3059L-1-105 | 3059P-1-105 | 3059Y-1-105 | 3059J-1-105 |
| 2,000,000 | 3059L-1-205 | 3050P-1-205 | 3059Y-1-205 | 3059J-1-205 |

Special resistances available from 10 ohms to 2 megohm.

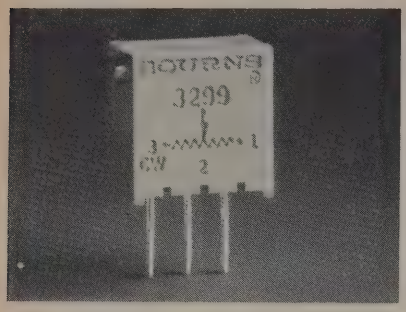
* The last three digits of the part number represent the resistance in standard code.

NOTE: Panel Mount Model 3059 available with leads or solder lugs. When ordering add "M" to part number. Example: 3059L-1-203M.

BOURNS
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

## MODEL 3299

Commercial Cermet Potentiometer
⅜" Square




### FEATURES

- Very low cost
- Typical CRV of 3% (1% available)
- High power rating: ½ watt @ 70°C
- Small size: .375" x .395" x .240" high
- Low T.C.: ±100 ppm/°C over entire temperature and resistance range
- Sealed to withstand wave-soldering and cleaning processes

## SPECIFICATIONS

**Electrical Characteristics**

Standard Resistance Range . 10 ohms to 1,000,000 ohms
Resistance Tolerance ..... ±10% standard, closer tolerances available
Absolute Minimum Resistance ..... 5 ohms, all resistances
Continuity ..... Maintained for full mechanical range
Insulation Resistance, 500 volts DC .... 1000 megohms minimum
Contact Resistance Variation Maximum ..... 3 ohms or 3%, whichever is greater. Consult factory for 1%

**Environmental Characteristics**

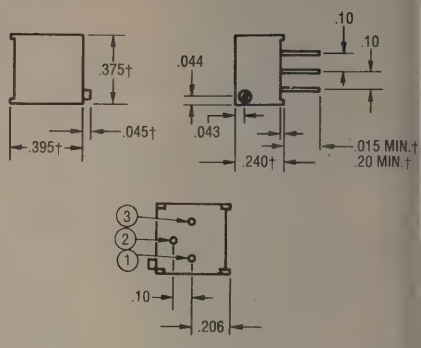
Power Ratings:
70°C ..... 0.5 watt or 300 volts maximum
125°C ..... 0 watt
Operating Temperature Range ..... −55° to +125°C
Temperature Coefficient per MIL-R-22097 .... ±100 ppm/°C all resistances maximum
Moisture Resistance, MIL-STD-202D, Method 103B . 10 megohms minimum insulation resistance after removal from chamber
Seal ..... Withstands industrial cleaning processes
Vibration ... Exceeds MIL-R-22097, 20Gs
Contact Bounce . 0.1 millisecond maximum
Wiper Shift, Maximum .... 1.0% voltage ratio
Shock ..... Exceeds MIL-R-22097, 100Gs
Contact Bounce and Wiper Shift .. Same as vibration
Salt Spray .... Meets MIL-R-22097
Load Life ..... 1000 hours per MIL-R-22097
Resistance Shift, maximum . 3%
Mechanical Life . 200 cycles without discontinuity
Dielectric Strength ... MIL-R-22097
Room Conditions .. 900 volts AC minimum
70,000 feet ..... 350 volts AC minimum

**Physical Characteristics**

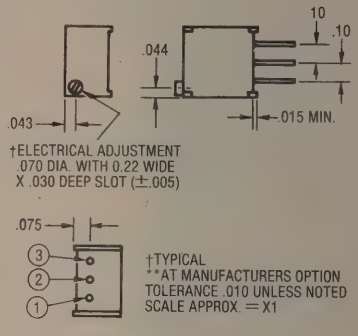
Shaft Torque ... 3 oz.-in. maximum
Markings ... Manufacturer's name, wiring diagram, date code, resistance and manufacturer's model number (customer's part number optional)
Mechanical Adjustment ..... 25 ±5 turns
Mechanical Stops . Wiper assembly idles
Weight ..... Approximately .04 oz.

## DIMENSIONS

**3299P**




**3299W**




Terminals
P, X, W ..... Solderable printed circuit pins
Mounting . Mount by printed circuit pins

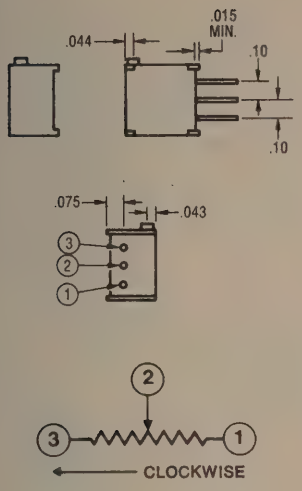
Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to change without notice.

BOURNS
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

## DIMENSIONS

**3299X**




## STANDARD RESISTANCES

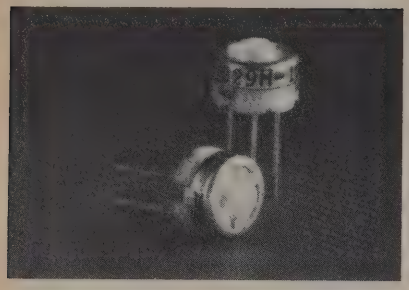
| Resistance (Ohms) | Part Numbers* | | |
|---|---|---|---|
| | 3299P Printed Circuit Pins | 3299W Printed Circuit Pins | 3299X Printed Circuit Pins |
| 10 | 3299P-1-100 | 3299W-1-100 | 3299X-1-100 |
| 20 | 3299P-1-200 | 3299W-1-200 | 3299X-1-200 |
| 50 | 3299P-1-500 | 3299W-1-500 | 3299X-1-500 |
| 100 | 3299P-1-101 | 3299W-1-101 | 3299X-1-101 |
| 200 | 3299P-1-201 | 3299W-1-201 | 3299X-1-201 |
| 500 | 3299P-1-501 | 3299W-1-501 | 3299X-1-501 |
| 1,000 | 3299P-1-102 | 3299W-1-102 | 3299X-1-102 |
| 2,000 | 3299P-1-202 | 3299W-1-202 | 3299X-1-202 |
| 5,000 | 3299P-1-502 | 3299W-1-502 | 3299X-1-502 |
| 10,000 | 3299P-1-103 | 3299W-1-103 | 3299X-1-103 |
| 20,000 | 3299P-1-203 | 3299W-1-203 | 3299X-1-203 |
| 50,000 | 3299P-1-503 | 3299W-1-503 | 3299X-1-503 |
| 100,000 | 3299P-1-104 | 3299W-1-104 | 3299X-1-104 |
| 200,000 | 3299P-1-204 | 3299W-1-204 | 3299X-1-204 |
| 500,000 | 3299P-1-504 | 3299W-1-504 | 3299X-1-504 |
| 1,000,000 | 3299P-1-105 | 3299W-1-105 | 3299X-1-105 |
| 2,000,000 | 3399P-1-205 | 3299W-1-205 | 3299X-1-205 |
| 5,000,000 | 3299P-1-505 | 3299W-1-505 | 3299X-1-505 |

* The last three digits of the part number represent the resistance in standard code.

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

## MODEL 3329

Single Turn, Commercial
Cermet Element




### FEATURES

- Low cost commercial Cermet single turn capable of meeting MIL-R-22097
- Space saving size: 0.25″ dia. x 0.18″ high
- Low temperature coefficient: ±100 ppm/°C over entire temperature and resistance range
- 0.5 watt power rating at 85°C
- Extended temperature range: −55° to +150°C
- Sealed to withstand any wave soldering and immersion cleaning process

### FEATURES

**Electrical Specifications**

Standard Resistance Range . . . 10 ohms to 1 megohm
Resistance Tolerance . . . . . 20% standard, closer tolerances available
Absolute Minimum Resistance . . . . . 2 ohms
Continuity . . . . . Maintained for full mechanical range
Contact Resistance Variation Maximum . . . . . 3 ohms or 3% whichever is greater
Insulation Resistance, 500 volts DC . . . . 1000 megohms minimum

**Environmental Specifications**

Power Ratings:
85°C . . . . . 0.5 watt
150°C . . . . . 0 watt
Operating Temperature Range . . . . . −55° to +150°C
Temperature Coefficient . . . . ±100 ppm/°C all resistances maximum
Humidity, MIL-STD-202, Method 103 . . . . . 10 megohms minimum insulation resistance after removal from chamber
Vibration . . . Exceeds MIL-R-22091, 30Gs
Contact Bounce . 0.1 millisecond maximum
Shock . Exceeds MIL-R-22097, 100Gs
Contact Bounce . . . . . Same as Vibration
Salt Spray . . . . Meets MIL-R-22097
Load Life . . . . . 1000 hours per MIL-R-22097
Mechanical Life . 200 cycles without discontinuity
Effective Electrical Rotation . . 240° nominal
Dielectric Strength . . . MIL-R-22097 Room Conditions . . . 500 volts AC minimum

**Physical Specifications**

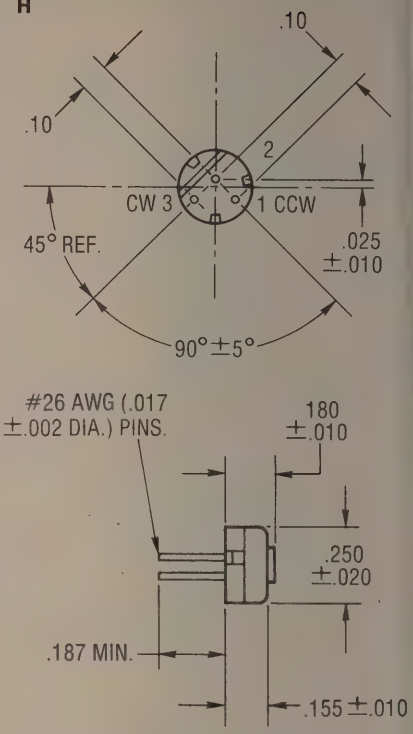
(85°C) Immersion Leak Test . . . . . No leaks
Markings . . . Date code, resistance, and manufacturer's model number
Appearance . . . . Legible markings, no physical defects
Mechanical Stops . . . . . Solid
Shaft Torque . . 5.0 oz.-in. maximum
Weight . . . . Approximately 0.08 oz.
Terminals H.P.W. . . . . Tinned pins

Specification Note: Closer performance tolerances can be supplied upon request.

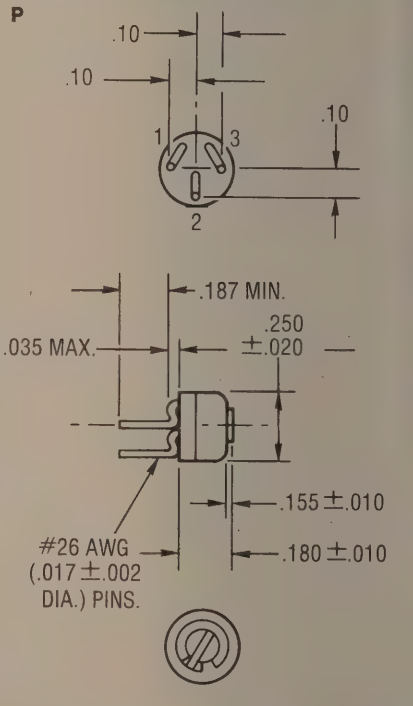
Specifications are subject to change without notice.

### DIMENSIONS

H



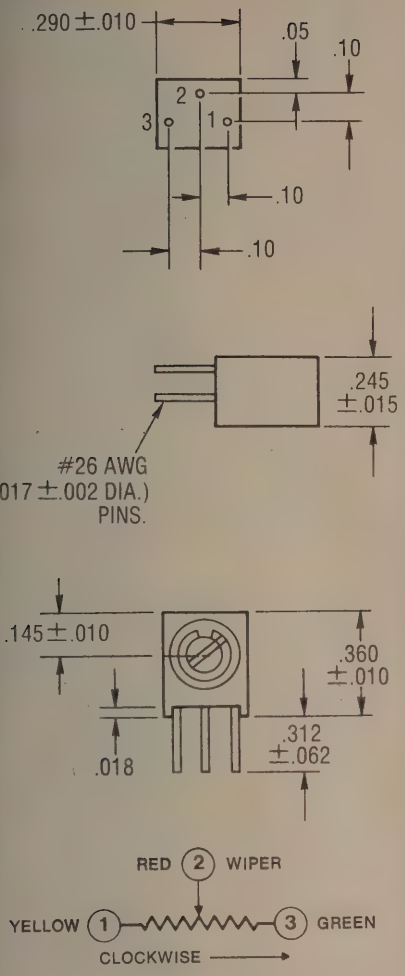

P




BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

## DIMENSIONS

**W**




## STANDARD RESISTANCES

| Resistance (Ohms) | Part Numbers* | | |
|---|---|---|---|
| 10 | 3329H-1-100 | 3329P-1-100 | 3329W-1-100 |
| 20 | 3329H-1-200 | 3329P-1-200 | 3329W-1-200 |
| 50 | 3329H-1-500 | 3329P-1-500 | 3329W-1-500 |
| 100 | 3329H-1-101 | 3329P-1-101 | 3329W-1-101 |
| 200 | 3329H-1-201 | 3329P-1-201 | 3339W-1-201 |
| 500 | 3329H-1-501 | 3329P-1-501 | 3329W-1-501 |
| 1K | 3329H-1-102 | 3329P-1-102 | 3329W-1-102 |
| 2K | 3329H-1-202 | 3329P-1-202 | 3329W-1-202 |
| 5K | 3329H-1-502 | 3329P-1-502 | 3329W-1-502 |
| 10K | 3329H-1-103 | 3329P-1-103 | 3329W-1-103 |
| 20K | 3329H-1-203 | 3329P-1-203 | 3329W-1-203 |
| 50K | 3329H-1-503 | 3329P-1-503 | 3329W-1-503 |
| 100K | 3329H-1-104 | 3329P-1-104 | 3329W-1-104 |
| 200K | 3329H-1-204 | 3329P-1-204 | 3329W-1-204 |
| 500K | 3329H-1-504 | 3329P-1-504 | 3329W-1-504 |
| 1 Meg | 3329H-1-105 | 3329P-1-105 | 3329W-1-105 |

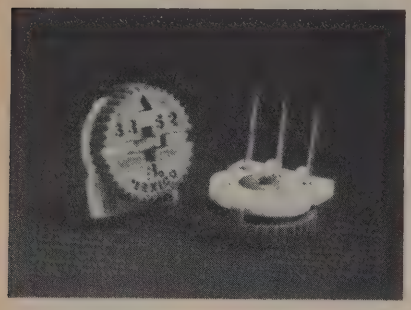
Special resistances available from 10 ohms to 2 megohms.

* The last three digits of the part number represent the resistance in standard code.

BOURNS INC
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

## MODEL 3352

Commercial, Cermet Variable Resistor
⅜″ Diameter



### FEATURES

- Adjustability of ±0.05% voltage ratio
- Low temperature coefficient of ±100 ppm/°C
- 0.75 watt power at 40°C
- CRV is 1% of 1 ohm
- Designed to withstand circuit board processes

### SPECIFICATIONS

**Electrical Characteristics**

Standard Resistance Range . . 10 to 5,000,000 ohms
Resistance Tolerance . . . . . ±20% standard, closer tolerances available
Absolute Minimum Resistance . . . 2 ohms maximum
Adjustability:*
Voltage Ratio . . . . . ±0.05%
Resistance . . . . . ±0.10%
Contact Resistance Variation . 1 ohm or 1%, whichever is greater
Insulation Resistance, 500 volts DC . . . . 1000 megohms minimum

**Physical Characteristics**

Markings . . . . Resistance value and manufacturer's model number
Mechanical Stops . . . . . Solid
Shaft Torque . . 5.0 oz.-in. maximum
Weight . . . . Approximately 0.01 oz.
Terminals . .020 in. Dia. Solderable Pins

**Environmental Characteristics**

Power Ratings:
40°C (250 volts AC Maximum . . . . . 0.75 watt
85°C . . . . . 0.50 watt
125°C . . . . . 0 watt
Operating Temperature Range . . . . . −55° to +125°C
Temperature Coefficient . . . . ±100 ppm/°C
Humidity, MIL-STD-202, Method 103 . . . . . 10 megohms minimum resistance after removal from chamber
Vibration . . . Exceeds MIL-R-22097, 30Gs
Contact Bounce . 0.1 millisecond maximum
Shock . Exceeds MIL-R-22097, 100Gs
Contact Bounce . 0.1 millisecond maximum
Load Life . . . . . 1000 hours per MIL-R-22097
Resistance Shift Maximum . . 3%
Mechanical Life . 200 cycles without discontinuity
Effective Electrical Rotation . . 205° ±10°
Dielectric Strength . . . MIL-R-22097
Sea Level . 500 volts AC minimum

* The precision with which the output voltage ratio or output resistance of a device can be set to the desired value.

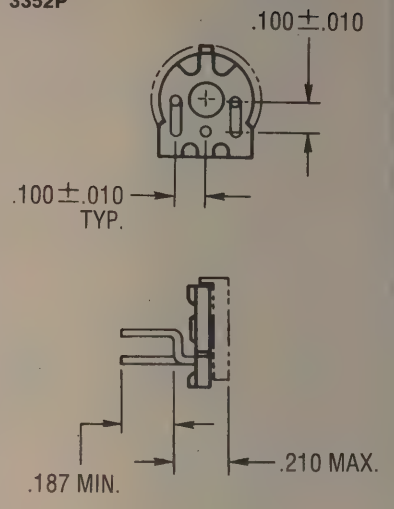
Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to change without notice.

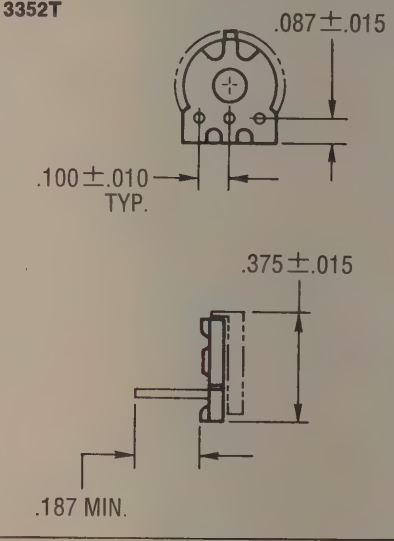
### DIMENSIONS

**Top Adjust**

**3352P**



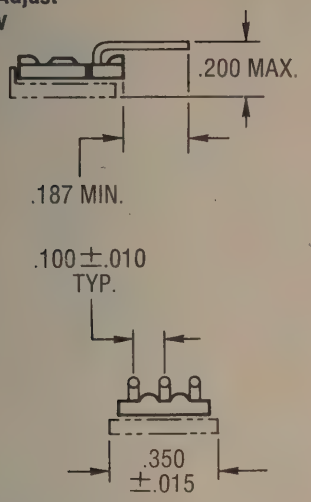

**3352T**



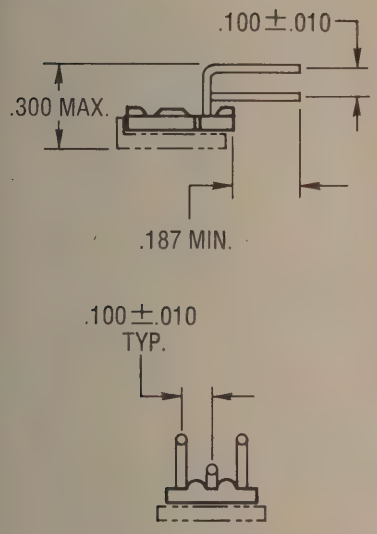

BOURNS
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

## DIMENSIONS

**Side Adjust**
**3352W**




**3352H**




## STANDARD RESISTANCES

| Resistance (Ohms) | Side Adjust Part Number* | | | |
|---|---|---|---|---|
| 10 | 3352H-1-100 | 3352K-1-100 | 3352V-1-100 | 3352W-1-100 |
| 20 | 3352H-1-200 | 3352K-1-200 | 3352V-1-200 | 3352W-1-200 |
| 50 | 3352H-1-500 | 3352K-1-500 | 3352V-1-500 | 3352W-1-500 |
| 100 | 3352H-1-101 | 3352K-1-101 | 3352V-1-101 | 3352W-1-101 |
| 200 | 3352H-1-201 | 3352K-1-201 | 3352V-1-201 | 3352W-1-201 |
| 500 | 3352H-1-501 | 3352K-1-501 | 3352V-1-501 | 3352W-1-501 |
| 1,000 | 3352H-1-102 | 3352K-1-102 | 3352V-1-102 | 3352W-1-102 |
| 2,000 | 3352H-1-202 | 3352K-1-202 | 3352V-1-202 | 3352W-1-202 |
| 5,000 | 3352H-1-502 | 3352K-1-502 | 3352V-1-502 | 3352W-1-502 |
| 10,000 | 3352H-1-103 | 3352K-1-103 | 3352V-1-103 | 3352W-1-103 |
| 20,000 | 3352H-1-203 | 3352K-1-203 | 3352V-1-203 | 3352W-1-203 |
| 25,000 | 3352H-1-253 | 3352K-1-253 | 3352V-1-253 | 3352W-1-253 |
| 50,000 | 3352H-1-503 | 3352K-1-503 | 3352V-1-503 | 3352W-1-503 |
| 100,000 | 3352H-1-104 | 3352K-1-104 | 3352V-1-104 | 3352W-1-104 |
| 200,000 | 3352H-1-204 | 3352K-1-204 | 3352V-1-204 | 3352W-1-204 |
| 250,000 | 3352H-1-254 | 3352K-1-254 | 3352V-1-254 | 3352W-1-254 |
| 500,000 | 3352H-1-504 | 3352K-1-504 | 3352V-1-504 | 3352W-1-504 |
| 1,000,000 | 3352H-1-105 | 3352K-1-105 | 3352V-1-105 | 3352W-1-105 |
| 2,000,000 | 3352H-1-205 | 3352K-1-205 | 3352V-1-205 | 3352W-1-205 |
| 5,000,000 | 3352H-1-505 | 3352K-1-505 | 3352V-1-505 | 3352W-1-505 |

| Resistance (Ohms) | Top Adjust Part Number* | | |
|---|---|---|---|
| 10 | 3352E-1-100 | 3352P-1-100 | 3352T-1-100 |
| 20 | 3352E-1-200 | 3352P-1-200 | 3352T-1-200 |
| 50 | 3352E-1-500 | 3352P-1-500 | 3352T-1-500 |
| 100 | 3352E-1-101 | 3352P-1-101 | 3352T-1-101 |
| 200 | 3352E-1-201 | 3352P-1-201 | 3352T-1-201 |
| 500 | 3352E-1-501 | 3352P-1-501 | 3352T-1-501 |
| 1,000 | 3352E-1-102 | 3352P-1-102 | 3352T-1-102 |
| 2,000 | 3352E-1-202 | 3352P-1-202 | 3352T-1-202 |
| 5,000 | 3352E-1-502 | 3352P-1-502 | 3352T-1-502 |
| 10,000 | 3352E-1-103 | 3352P-1-103 | 3352T-1-103 |
| 20,000 | 3352E-1-203 | 3352P-1-203 | 3352T-1-203 |
| 25,000 | 3352E-1-253 | 3352P-1-253 | 3352T-1-253 |
| 50,000 | 3352E-1-503 | 3352P-1-503 | 3352T-1-503 |
| 100,000 | 3352E-1-104 | 3352P-1-104 | 3352T-1-104 |
| 200,000 | 3352E-1-204 | 3352P-1-204 | 3352T-1-204 |
| 250,000 | 3352E-1-254 | 3352P-1-254 | 3352T-1-254 |
| 500,000 | 3352E-1-504 | 3352P-1-504 | 3352T-1-504 |
| 1,000,000 | 3352E-1-105 | 3352P-1-105 | 3352T-1-105 |
| 2,000,000 | 3352E-1-205 | 3352P-1-205 | 3352T-1-205 |
| 5,000,000 | 3352E-1-505 | 3352P-1-505 | 3352T-1-505 |

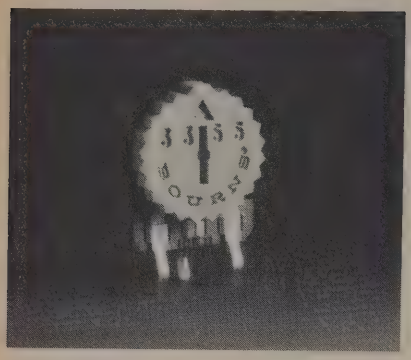
Special resistances available from 10 to 5,000,000 ohms.

* The last three digits of the part number represent the resistance in standard code.

BOURNS INC
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

## MODEL 3355

Single Turn Conductive Plastic Economy Trimmer



### FEATURES

- Available from 100 ohms to 5 megohms
- Resistance tolerance ±20-± 30%
- Rated 0.25 Watt maximum at 70°C
- Tempco less than ±500 ppm/°C
- Flame retardant construction meets UL94V-1
- Integral thumbwheel is standard
- Board wash capability
- Adjustability 0.1%

### SPECIFICATIONS

**Electrical Characteristics**

Standard Resistance Range . . 100 ohms to 5 megohms
Resistance Tolerance . . . . . ±20%
Adjustability:* (above 1 meg) ±30%
Voltage Ratio . ±0.1% maximum
Resistance . . . ±0.2% maximum
Contact Resistance Variation . . 1% maximum
Absolute Minimum Restistance . . . 2 ohms maximum
Effective Electrical Angle . . . . 240° ±10°
Voltage Coefficient . . . . . .08%/volt maximum

**Environmental Characteristics**

Power Ratings:
25°C . . . . . 0.50 watt
70°C . . . . . 0.25 watt
100°C . . . . . 0 watt
Operating Temperature Range . 0°C to 100°C
Temperature Coefficient . . . . . 500 ppm/°C maximum
Humidity, 24 hours at 95% RH . . . . . Resistance shift ±7.5 % maximum
Vibration . . . . . 30Gs
Contact Bounce . 0.1 millisecond maximum
Shock . . . . . 100Gs
Contact Bounce . 0.1 millisecond maximum
Load Life . 100 hours, 70°C, ¼ watt
Resistance Shift . ±5% maximum
Mechanical Life . 200 cycles without discontinuity
Flammability . . . . . Meets UL94V-1
Solvent Resistance . . . . Withstands most cleaning solvents and detergents
Resistance Shift . ±5% maximum

**Physical Characteristics**

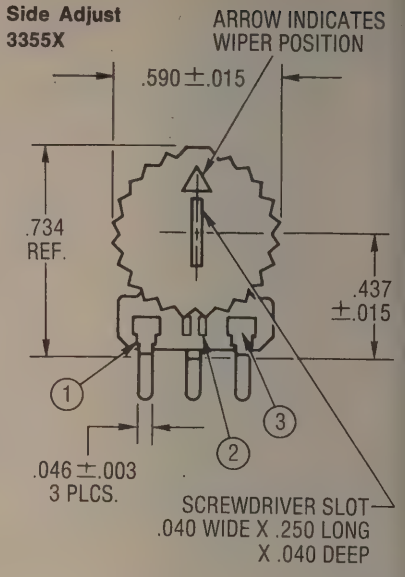
Mechanical Rotation . . . 260° ±10°
Markings . . . Manufacturer's name, model number, resistance value
Appearance . . . . Legible markings, no physical defects
Mechanical Stops . . . . . Solid
Adjustment Torque . . . . . 3 oz.-in. maximum
Weight . . Approximately 1.3 grams
Terminals . Solderable snap-in pins

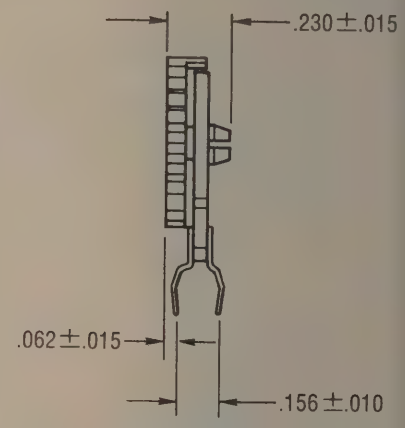
* The precision with which the output voltage ratio or output resistance of a device can be set to the desired value.

Blue is the standard color on all adjustment wheels. Optional colors (available only on the Standard Thumbwheel style) are: Black, White, Violet, Green, Yellow, Orange, Red and Brown. Consult the factory for ordering these optional colors.

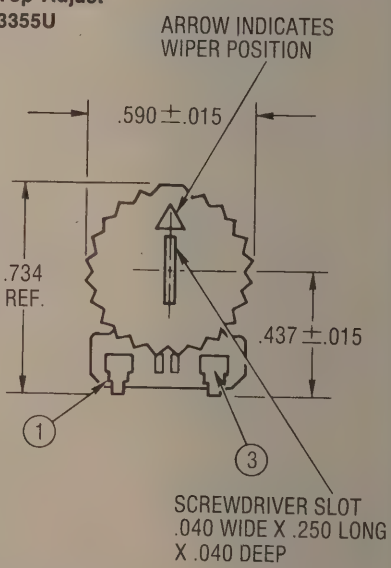
### DIMENSIONS

**Side Adjust**
**3355X**




**Top Adjust**
**3355U**



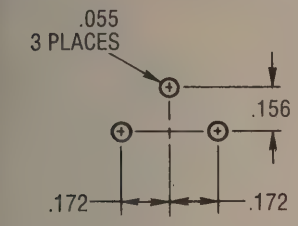

Specification Note: Closer performance tolerances can be supplied upon request.

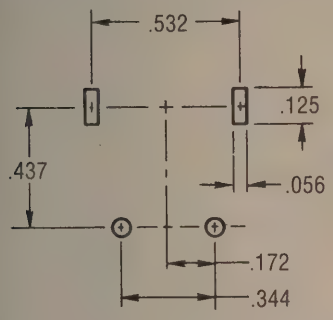
Specifications are subject to change without notice.

BOURNS
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

## DIMENSIONS

**Suggested Circuit Board Patterns**




## STANDARD RESISTANCES

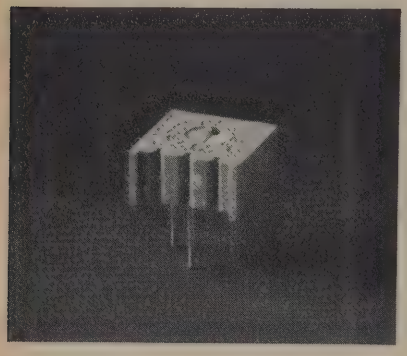
| Resistance (Ohms) | Top Adjustment Part Numbers | | |
|---|---|---|---|
| | Standard Thumbwheel | Optional Thumbwheel with Hex | Optional Smooth Wheel |
| 100 | 3355U-1-101 | 3355U-1-101TH | 3355U-1-101S |
| 250 | 3355U-1-251 | 3355U-1-251TH | 3355U-1-251S |
| 500 | 3355U-1-501 | 3355U-1-501TH | 3355U-1-501S |
| 1,000 | 3355U-1-102 | 3355U-1-102TH | 3355U-1-102S |
| 2,500 | 3355U-1-252 | 3355U-1-252TH | 3355U-1-252S |
| 5,000 | 3355U-1-502 | 3355U-1-502TH | 3355U-1-502S |
| 10,000 | 3355U-1-103 | 3355U-1-103TH | 3355U-1-103S |
| 25,000 | 3355U-1-253 | 3355U-1-253TH | 3355U-1-253S |
| 50,000 | 3355U-1-503 | 3355U-1-503TH | 3355U-1-503S |
| 100,000 | 3355U-1-104 | 3355U-1-104TH | 3355U-1-104S |
| 250,000 | 3355U-1-254 | 3355U-1-254TH | 3355U-1-254S |
| 500,000 | 3355U-1-504 | 3355U-1-504TH | 3355U-1-504S |
| 1,000,000 | 3355U-1-105 | 3355U-1-105TH | 3355U-1-105S |
| 2,500,000 | 3355U-1-255 | 3355U-1-255TH | 3355U-1-255S |
| 5,000,000 | 3355U-1-505 | 3355U-1-505TH | 3355U-1-505S |

| Resistance (Ohms) | Side Adjustment Part Numbers | | |
|---|---|---|---|
| | Standard Thumbwheel | Optional Thumbwheel with Hex | Optional Smooth Wheel |
| 100 | 3355X-1-101 | 3355X-1-101TH | 3355X-1-101S |
| 250 | 3355X-1-251 | 3355X-1-251TH | 3355X-1-251S |
| 500 | 3355X-1-501 | 3355X-1-501TH | 3355X-1-501S |
| 1,000 | 3355X-1-102 | 3355X-1-102TH | 3355X-1-102S |
| 2,500 | 3355X-1-252 | 3355X-1-252TH | 3355X-1-252S |
| 5,000 | 3355X-1-502 | 3355X-1-502TH | 3355X-1-502S |
| 10,000 | 3355X-1-103 | 3355X-1-103TH | 3355X-1-103S |
| 25,000 | 3355X-1-253 | 3355X-1-253TH | 3355X-1-253S |
| 50,000 | 3355X-1-503 | 3355X-1-503TH | 3355X-1-503S |
| 100,000 | 3355X-1-104 | 3355X-1-104TH | 3355X-1-104S |
| 250,000 | 3355X-1-254 | 3355X-1-254TH | 3355X-1-254S |
| 500,000 | 3355X-1-504 | 3355X-1-504TH | 3355X-1-504S |
| 1,000,000 | 3355X-1-105 | 3355X-1-105TH | 3355X-1-105S |
| 2,500,000 | 3355X-1-255 | 3355X-1-255TH | 3355X-1-255S |
| 5,000,000 | 3355X-1-505 | 3355X-1-505TH | 3355X-1-505S |

BOURNS
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

## MODEL 3386

Commercial, Cermet Potentiometer
3/8" Square



### FEATURES

- Low tempco of ±100 ppm/°C
- Extended temperature range: −55° to +125°C
- 0.5 watt power rating at 85°C
- Typical CRV of 1%
- Fourteen standard terminal styles
- Sealed to withstand immersion
- Adjustability of ±0.03% voltage ratio

### SPECIFICATIONS

**Electrical Characteristics**

Standard Resistance Range .... 10 to 2,000,000 ohms
Resistance Tolerance ..... 10% standard, closer tolerances available
Absolute Minimum Resistance .. 2 ohms maximum
Adjustability:*
Voltage Ratio ..... ±0.03%
Resistance ..... ±0.10%
Contact Resistance Variation ..... 1 ohm or 1% maximum whichever is greater
Insulation Resistance, 500 volts DC .... 1000 megohms minimum

**Physical Characteristics**

Seal ..... MIL-R-22097 immersion
Markings .. Date code, resistance value, and model number
Appearance .... Legible markings, no physical defects
Mechanical Stops ..... Solid
Shaft Torque . 5.0 oz.-in. maximum
Weight .... Approximately 0.03 oz.
Terminals . .020 in. Dia. Solderable Pins

**Environmental Characteristics**

Power Ratings:
85°C (300 volts AC Maximum) ..... 0.5 watt
125°C ..... 0 watt
Operating Temperature Range ..... −55° to +125°C
Temperature Coefficient .... ±100 ppm/°C
Humidity, MIL-STD-202, Method 103 ..... 10 megohms minimum insulation resistance after removal from chamber
Vibration ... Exceeds MIL-R-22097, 30Gs
Contact Bounce . 0.1 millisecond maximum
Shock . Exceeds MIL-R-22097, 100Gs
Contact Bounce . 0.1 millisecond maximum
Load Life ..... 1000 hours per MIL-R-22097
Resistance Shift Maximum .. 3%
Mechanical Life . 200 cycles without discontinuity
Effective Electrical Rotation .. 280° ±15°
Mechanical Rotation ... 310° ±15°
Dielectric Strength ... MIL-R-22097
Room Conditions .. 900 volts AC minimum

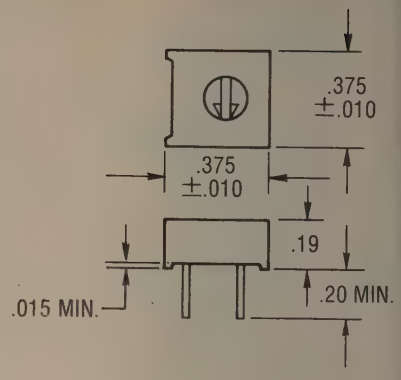
Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to change without notice.

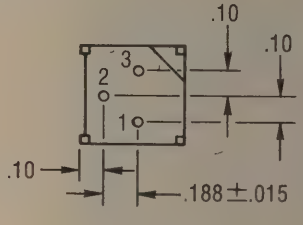
* The precision with which the output voltage ratio or output resistance of a device can be set to the desired value.

### DIMENSIONS

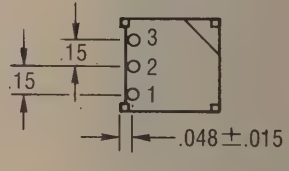
**Top Adjust**

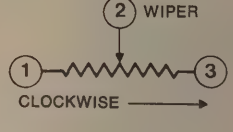



**3386P**




**3386R**

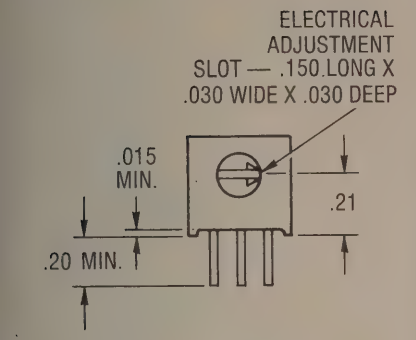


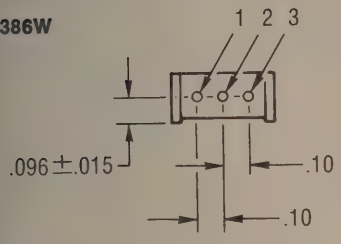

BOURNS INC
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

## DIMENSIONS

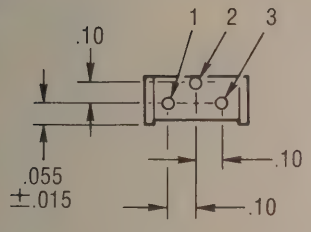
**Side Adjust**




**3386W**




**3386H**




## STANDARD RESISTANCES

| Resistance (Ohms) | Side Adjust Part Number* | | | | | | |
|---|---|---|---|---|---|---|---|
| | TO-5 | | .150″ In-Line | | | .100″ In-Line | |
| | 3386H- | 3386X- | 3386S- | 3386J- | 3386B- | 3386W- | 3386C- |
| 10 | -1-100 | -1-100 | -1-100 | -1-100 | -1-100 | -1-100 | -1-100 |
| 20 | -1-200 | -1-200 | -1-200 | -1-200 | -1-200 | -1-200 | -1-200 |
| 50 | -1-500 | -1-500 | -1-500 | -1-500 | -1-500 | -1-500 | -1-500 |
| 100 | -1-101 | -1-101 | -1-101 | -1-101 | -1-101 | -1-101 | -1-101 |
| 200 | -1-201 | -1-201 | -1-201 | -1-201 | -1-201 | -1-201 | -1-201 |
| 500 | -1-501 | -1-501 | -1-501 | -1-501 | -1-501 | -1-501 | -1-501 |
| 1,000 | -1-102 | -1-102 | -1-102 | -1-102 | -1-102 | -1-102 | -1-102 |
| 2,000 | -1-202 | -1-202 | -1-202 | -1-202 | -1-202 | -1-202 | -1-202 |
| 5,000 | -1-502 | -1-502 | -1-502 | -1-502 | -1-502 | -1-502 | -1-502 |
| 10,000 | -1-103 | -1-103 | -1-103 | -1-103 | -1-103 | -1-103 | -1-103 |
| 20,000 | -1-203 | -1-203 | -1-203 | -1-203 | -1-203 | -1-203 | -1-203 |
| 25,000 | -1-253 | -1-253 | -1-253 | -1-253 | -1-253 | -1-253 | -1-253 |
| 50,000 | -1-503 | -1-503 | -1-503 | -1-503 | -1-503 | -1-503 | -1-503 |
| 100,000 | -1-104 | -1-104 | -1-104 | -1-104 | -1-104 | -1-104 | -1-104 |
| 200,000 | -1-204 | -1-204 | -1-204 | -1-204 | -1-204 | -1-204 | -1-204 |
| 250,000 | -1-254 | -1-254 | -1-254 | -1-254 | -1-254 | -1-254 | -1-254 |
| 500,000 | -1-504 | -1-504 | -1-504 | -1-504 | -1-504 | -1-504 | -1-504 |
| 1,000,000 | -1-105 | -1-105 | -1-105 | -1-105 | -1-105 | -1-105 | -1-105 |
| 2,000,000 | -1-205 | -1-205 | -1-205 | -1-205 | -1-205 | -1-205 | -1-205 |

| Resistance (Ohms) | Top Adjust Part Number* | | | | | | |
|---|---|---|---|---|---|---|---|
| | .200″ Grid | | TO-5 | .150″ In-Line | | 100″ In-Line | Tri-angular |
| | 3386F- | 3386Y- | 3386P- | 3386R- | 3386M- | 3386T- | 3386K- |
| 10 | -1-100 | -1-100 | -1-100 | -1-100 | -1-100 | -1-100 | -1-100 |
| 20 | -1-200 | -1-200 | -1-200 | -1-200 | -1-200 | -1-200 | -1-200 |
| 50 | -1-500 | -1-500 | -1-500 | -1-500 | -1-500 | -1-500 | -1-500 |
| 100 | -1-101 | -1-101 | -1-101 | -1-101 | -1-101 | -1-101 | -1-101 |
| 200 | -1-201 | -1-201 | -1-201 | -1-201 | -1-201 | -1-201 | -1-201 |
| 500 | -1-501 | -1-501 | -1-501 | -1-501 | -1-501 | -1-501 | -1-501 |
| 1,000 | -1-102 | -1-102 | -1-102 | -1-102 | -1-102 | -1-102 | -1-102 |
| 2,000 | -1-202 | -1-202 | -1-202 | -1-202 | -1-202 | -1-202 | -1-202 |
| 5,000 | -1-502 | -1-502 | -1-502 | -1-502 | -1-502 | -1-502 | -1-502 |
| 10,000 | -1-103 | -1-103 | -1-103 | -1-103 | -1-103 | -1-103 | -1-103 |
| 20,000 | -1-203 | -1-203 | -1-203 | -1-203 | -1-203 | -1-203 | -1-203 |
| 25,000 | -1-253 | -1-253 | -1-253 | -1-503 | -1-503 | -1-503 | -1-503 |
| 50,000 | -1-503 | -1-503 | -1-503 | -1-104 | -1-104 | -1-104 | -1-104 |
| 100,000 | -1-104 | -1-104 | -1-104 | -1-204 | -1-204 | -1-204 | -1-204 |
| 250,000 | -1-254 | -1-254 | -1-254 | -1-254 | -1-254 | -1-254 | -1-254 |
| 500,000 | -1-504 | -1-504 | -1-504 | -1-504 | -1-504 | -1-504 | -1-504 |
| 1,000,000 | -1-105 | -1-105 | -1-105 | -1-105 | -1-105 | -1-105 | -1-105 |
| 2,000,000 | -1-205 | -1-205 | -1-205 | -1-205 | -1-205 | -1-205 | -1-205 |

Special resistances available from 10 to 2,000,000 ohms.

* The last three digits of the part number represent the resistance in standard code. Example: Complete Part Number: 3386H-1-101

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

## MODELS 3391, 3392

Single Turn Conductive Plastic Subminiature Potentiometer with Optional Switch

### FEATURES

- Conductive plastic elements for long life and stability
- O-ring for seal against dust and moisture
- Switch with detent
- Linear or non-linear tapers to amplifier circuits

BOURNS Models 3391 and 3392 are subminiature, single turn adjustment potentiometers specifically designed for applications requiring extremely compact, high density circuitry. Applications include hearing aid volume controls, subminiature paging systems, hand-held probes, other miniature equipment and hybrid circuits.

Options include: axial or radial leads, flat knob or dome cap, with or without switches, CW or CCW tapers plus six (6) color tones.

### SPECIFICATIONS

**Electrical Characteristics**

Resistance Range . 1K to 500 K ohms
Resistance Tolerance ..... 20% standard
Minimum End Resistance .. 5 ohms maximum
Contact Resistance Variation .. 3% maximum
Resistance Taper ... (See Figure 4)
Insulation Resistance ... 1 megohm minimum
Switch Resistance
  On Position .... 1 ohm maximum
  Off Position . 1 megohm minimum
Switch Current .. 100 ma maximum

**Environmental Characteristics**

Power Ratings:
  40°C (100 volts AV or 3 ma maximum) ..... 1/20 watt
Operating Temperature Range ..... −30°C to +70°C
Shock ..... 100Gs
  Total Resistance Shift .... ±2% maximum
Rotational Life
  (Without Switch) .. 50,000 cycles
  (With Switch) ..... 25,000 cycles
Load Life 1000 Hours
  Resistance Shift. ±15% maximum
Humidity, 24 hours @ 95%
  Resistance Shift After Removal From Chamber ..... ±10% maximum (±25% maximum above 50K ohm)

**Physical Characteristics**

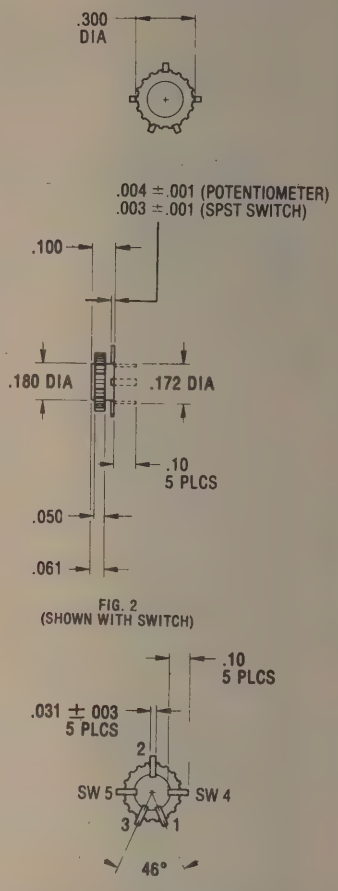
Mechanical Rotation .... 220° ±5°
Adjustment Torque ..... .5 oz.-in. maximum
Stop Strength ... 3 oz.-in. minimum
Terminals .... Solderable flat leads

Beige is the standard color on all adjustable caps and knobs. Optional colors are: Brown, Black, Tan, Tan/Pink and Pink.

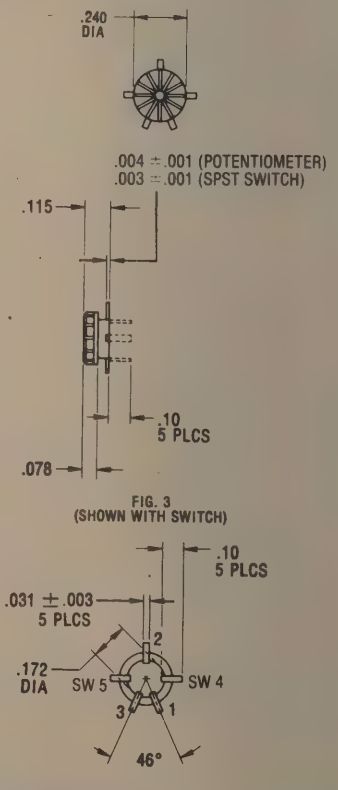
Specifications are subject to change without notice

### DIMENSIONS

#### 3391 FLAT KNOB STYLE

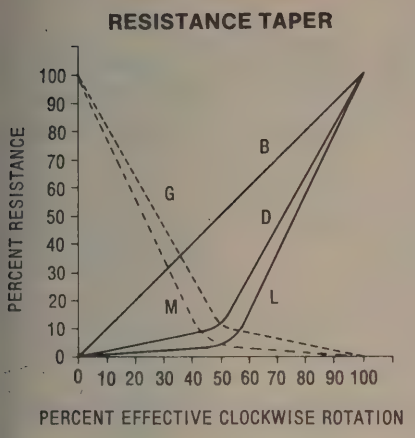



#### 3392 DOME CAP STYLE




BOURNS INC
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

## RESISTANCE TAPER




## PART NUMBERING INFORMATION

**3391 A — 1 — 102 D**

Model:
3391 — Flat Cap Model (Cap attached)
3392 — Dome Cap Model (Cap not included)*

* Part numbers for Standard Dome Caps
H160-1 Black H160-4 Tan
H160-2 Brown H160-5 Tan/Pink
H160-3 Beige H160-6 Pink

Terminal:
A — Axial
R — Radial

Special Types:

Model 3391 (Cap Attached)
1 — W/O Switch, Black
2 — W/O Switch, Brown
3 — W/O Switch, Beige
4 — W/O Switch, Tan
5 — W/O Switch, Tan/Pink
6 — W/O Switch, Pink
11 — With Switch, Black
12 — With Switch, Brown
13 — With Switch, Beige
14 — With Switch, Tan
15 — With Switch, Tan/Pink
16 — With Switch, Pink

Model 3392 (Cap ordered separately)*
1 — W/O Switch
11 — With Switch

Resistance Code: 1K Ohm

Taper:
B — Linear
D — CW, 10% Audio
G — CCW, 10% Audio
L — CW, 2% Audio Non-Standard
M — CCW, 2% Audio Non-Standard

## STANDARD RESISTANCES

**With Switch Linear Taper***

| Resistance (Ohms) | Part Numbers | | | |
|---|---|---|---|---|
| | Flat Cap | | Dome Cap | |
| | Axial Leads 3391A-13- | Radial Leads 3391R-13- | Axial Leads 3392A-13- | Radial Leads 3392R-13- |
| 1,000 | 102B | 102B | 102B | 102B |
| 2,500 | 252B | 252B | 252B | 252B |
| 5,000 | 502B | 502B | 502B | 502B |
| 10,000 | 103B | 103B | 103B | 103B |
| 25,000 | 253B | 253B | 253B | 253B |
| 50,000 | 503B | 503B | 503B | 503B |
| 100,000 | 104B | 104B | 104B | 104B |
| 250,000 | 254B | 254B | 254B | 254B |
| 500,000 | 504B | 504B | 504B | 504B |

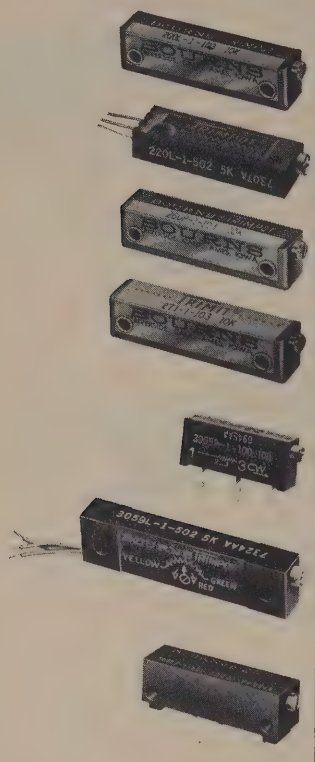
**Without Switch Linear Taper***

| Resistance (Ohms) | Part Numbers | | | |
|---|---|---|---|---|
| | Flat Cap | | Dome Cap | |
| | Axial Leads 3391A-3- | Radial Leads 3391R-3- | Axial Leads 3392A-3- | Radial Leads 3392R-3- |
| 1,000 | 102B | 102B | 102B | 102B |
| 2,500 | 252B | 252B | 252B | 252B |
| 5,000 | 502B | 502B | 502B | 502B |
| 10,000 | 103B | 103B | 103B | 103B |
| 25,000 | 253B | 253B | 253B | 253B |
| 50,000 | 503B | 503B | 503B | 503B |
| 100,000 | 104B | 104B | 104B | 104B |
| 250,000 | 254B | 254B | 254B | 254B |
| 500,000 | 504B | 504B | 504B | 504B |

* Taper Suffix Designations: B = Linear; D = CW, 10% Audio; G = CCW, 10% Audio; L = CW, 2% Audio (non-standard); M = CCW, 2% Audio (non-standard).

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

# WIREWOUND TRIMMING POTENTIOMETERS



Choose wirewound units for high power, stability and low temperature coefficient.

| | Description | Dimensions H x W x L | Terminals | Res. Tol. (%) | Power (Watt) at 70°C | Max. Temp. °C | Nom. Adj. Turns | Humidity Mil Spec | Standard Res. Ω |
|---|---|---|---|---|---|---|---|---|---|
| 200 | **Low Cost TRIMPOT® Potentiometer** | .32x.28x1.25 | L,S,P | ±10 | 0.5 | 105 | 25 | Steady State | 10-50K |
| 220 | **High Temperature (RT 10)** | .32x.18x1.00 | L,W,P | ±5 | 1.0 | 175 | 15 | Yes | 10-30K |
| 260 | **High Temperature** | .32x.28x1.25 | L,S,P | ±10 | 1.0 | 175 | 25 | Steady State | 10-50K |
| 271<br>273<br>275 | **Commercial TRIMIT® Potentiometer** | .32x.28x1.25 | L<br>S<br>P | ±10 | 0.50 at 25°C | 105 | 25 | Steady State | 10-50K |
| 3005 | **Sealed Commercial E-Z-TRIM® Potentiometer** | .31x.17x.75 | P | ±10 | 1.0 at 40°C | 125 | 20 | Steady State | 10-50K |
| 3057 | **High Temperature Humidity Proof (RT 12 level M, P, (RT 12)** | .32x.19x1.25 | L,P,Y,J | ±5 | 1.0 | 150 | 22 | Yes | 10-100K |
| 3067 | **Commercial E-Z-TRIM® Potentiometer** | .35x.28x1.00 | S,P | ±10 | 0.5 at 25°C | 85 | 15 | No | 50-20K |

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

Choose wirewound units for high power, stability and low temperature coefficient.

| | Description | Dimensions H x W x L | Terminals | Res. Tol. (%) | Power (Watt) at 70°C | Max. Temp. °C | Nom. Adj. Turns | Humidity Mil Spec | Standard Res. Ω |
|---|---|---|---|---|---|---|---|---|---|
| *3070 | **High Power Fine Resolution** | .31x.31x1.06<br>.36x.31x1.06 | L,S,H<br>P | ±5 | 1.5 | 175 | 10 | Yes | 100-50K |
| 3250 | **Humidity Proof High Temperature (RT 22)** | .19x.50x.50<br>.22x.50x.50 | L<br>P,W<br>W66 | ±5 | 1.0 | 175 | 25 | Yes | 10-50K |
| 3255 | **Commercial TRIMPOT® Potentiometer** | .19x.50x.50<br>.22x.50x.50 | L<br>P,W<br>W66 | ±5 | 1.0 at 50°C | 150 | 25 | Steady State | 10-50K |
| 3260 | **Humidity Proof High Temperature (RT 26)** | .25x.25x.17 | H,W | ±5 | 0.2 | 175 | 11 | Yes | 10-25K |
| 3290 | **Humidity Proof High Temperature (RT 24)** | .150x.375x.375 | L,W,H<br>P | ±5 | 1.0 | 175 | 25 | Yes | 10-50K |
| 3300 | **Humidity Proof Single-Turn High Temperature** | .37x.31x.25<br>.31 dia.x.18<br>.31 dia.x.46 | W<br>P<br>S | ±5 | 0.5 | 175 | 300° | Yes | 10-25K |
| 3305 | **Sealed Commercial TRIMIT® Potentiometer** | .375x.31x.26<br>.31 dia.x.19 | W<br>P | ±5 | 0.5 at 70°C | 125 | 280° | Steady State | 10-25K |
| 3345 | **Potentiometer Industrial TRIMPOT®** | .45 dia.x.235<br>.525x.45x.285 | P<br>W | ±5 | 1.0 | 150 | 1 | Yes | 10-50K |

* Not stocked by distributors

BOURNS NC

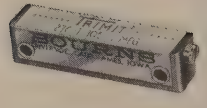
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

## CERMET TRIMMING POTENTIOMETERS

Choose cermet units for good adjustability, stability, resistance range and good high frequency performance.

| | Description | Dimensions H x W x L | Terminals | Res. Tol. (%) | Power (Watt) at 70°C | Max. Temp. °C | Nom. Adj. Turns | Humidity Mil Spec | Standard Res. Ω |
|---|---|---|---|---|---|---|---|---|---|
| 3069 | Commercial E-Z-TRIM® Potentiometer | .35x.25x.75 | P | ±10 | 0.75 at 25° | 125 | 20 | Yes | 10-2 Meg |
| 3082 | Humidity Proof Cermet | .10x.15x.50 | P | ±10 | 0.3 at 85°C | 150 | 10 | Yes | 10-2 Meg |
| 3099 | Dual In-Line Package | .25x.19x.75 | P | ±10 | 1.0 | 150 | 20 | Yes | 10-2 Meg |
| 3252 | High Performance Humidity Proof (RJ 22) (RJR 22) | .50x.50x.22 | L,P,W,X | ±10 | 1.0 | 150 | 22 | Yes | 10-2 Meg |
| 3262 | Humidity Proof High Temperature (RJ 26) (RJR 26) | .25x.25x.17 | P,W,X | ±10 | 0.25 at 85°C | 175 | 12 | Yes | 10-1 Meg |
| 3292 | Thin Line Cermet (RJ 24) | .375x.375x.15 | L,P,W,X | ±10 | 0.5 at 85°C | 175 | 22 | Yes | 10-1 Meg |
| 3339 | Four-Turn Adjustment | .300 dia.x.25 | P,H,W | ±10 | 0.5 at 85°C | 150 | 4 | Yes | 10-1 Meg |
| 3359 | Commercial Cermet | 7/16" dia. | P,W | ±20 | 0.5 | 125 | 270° | No | 100-2 Meg |

### Resiston® Carbon Trimming Potentiometers



| | Description | Dimensions H x W x L | Terminals | Res. Tol. (%) | Power (Watt) at 70°C | Max. Temp. °C | Nom. Adj. Turns | Humidity Mil Spec | Standard Res. Ω |
|---|---|---|---|---|---|---|---|---|---|
| 272<br>274<br>276 | Commercial TRIMIT® RESISTALOY® Element Potentiometer | .32x.28x1.25 | L<br>S<br>P | ±20 | 0.20 at 25°C | 105 | 25 | No | 5K-5 Meg |

BOURNS NC

TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

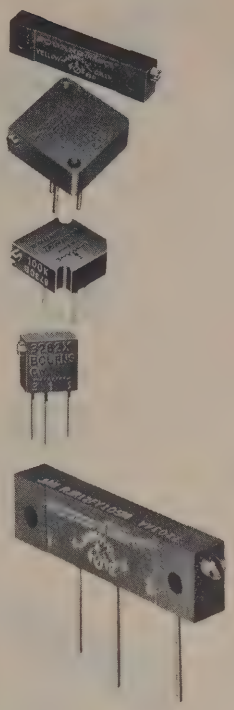
MIL-R-22097

| Qualified Styles | Qualified Terminals | Characteristics | Qualified Resistances Ω |
|---|---|---|---|
| RJ12 | L,P,Y | C,F | 10Ω-1 Meg. |
| RJ22 | L,P,W,X | C,F | 10Ω-1 Meg. |
| RJ24 | L,P,W,X | C,F | 10Ω-1 Meg. |
| RJ26 | P,W,X | C,F | 10Ω-1 Meg. |

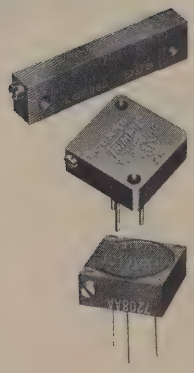
MIL-R-39035

| | | | |
|---|---|---|---|
| RJR12 | L,Y | C,F | 10Ω-1 Meg. |
| RJR24 | P,W,X | C,F | 10Ω-1 Meg. |
| RJR26 | P,W,X | F | 10Ω-1 Meg. |
| RJR28 | P | C,F | 10Ω-2 Meg. |
| RJR32 | D | C,F | 10Ω-2 Meg. |

## MIL-SPEC TRIMMERS



## MIL-SPEC TRIMMERS



MIL-R-27208

| Qualified Styles | Qualified Terminals | Characteristics | Qualified Resistances Ω |
|---|---|---|---|
| RT10 | L,P | C2 | 100Ω-10K |
| RT12 | L,P,Y | C2 | 10Ω-20K |
| RT22 | L | C2 | 50Ω-20K |
| | P,W,X | C2 | 50Ω-20K |
| RT24 | L,P,W,X | C2 | 10Ω-10K |
| RT26 | W,X | C2 | 10Ω-5K |

MIL-R-39015

| | | | |
|---|---|---|---|
| RTR12 | L,P,Y | D | 10Ω-20K |
| RTR22 | L,P,W,X | D | 500Ω-20K |
| RTR24 | P,W,X | D | 500Ω-10K |

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5320

# CONTROLS

## SELECTION GUIDE
## CONTROLS

| Element | Model No. | Diameter | Element | Model No. | Diameter |
|---|---|---|---|---|---|
| Cermet | 3852A | ¾″ | Conductive Plastic | 3851A | ¾″ |
| | 3852B | ¾″ | | 3851B | ¾″ |
| | 3852C | ¾″ | | 3851C | ¾″ |
| | 3852E | ¾″ | | 3851E | ¾″ |
| | 3856H | ¾″ | | 3858A | ¾″ |
| | 3859A | ¾″ | | 3858B | ¾″ |
| | 3859B | ¾″ | | | |
| | 3862C | ½″ | | | |
| | 3862E | ½″ | | | |

## MODEL 80 MODULAR POTENTIOMETERS

| Model No. | Description |
|---|---|
| 81/82 | Single/multiple ⅝″ square — bushing mount Cermet and conductive plastic elements |
| 83/84 | ⅝″ square — 10-turn wirewound |
| 85/86 | Same as 81/82 with rotary switch module |
| 87/88 | Semi-precision single/multiple ⅝″ square—bushing mount Cermet and conductive plastic elements |

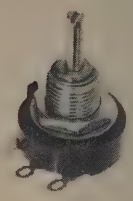
This family of ⅝″ square Bourns modular potentiometers combines the design versatility of advanced construction with factory assembled reliability and quality assurance. An exclusive shaft torque control feature provides a remarkably consistent feel unit to unit.

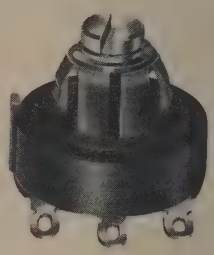
BOURNS
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5212

CERMET

| Significant Specifications | Description | Model |
|---|---|---|
| ¾" Diameter<br>Body Depth ..... ¼"<br>Standard Resistance Range:<br>(Tapers A and H) ..... 50 to 5,000,000 ohms<br>(Tapers C and F) ..... 1000 to 2,500,000 ohms<br>Resistance Tolerance ..... ±10% standard<br>Theoretical Electrical Travel (3852 & 3859) ..... 240° ±10°<br>Mechanical Angle:<br>(3852 & 3859) ..... 280° ± 5°<br>(3856 No stops) .... 1350° ±50°<br>Continuity ..... Maintained for full mechanical angle<br>Max. Contact Resistance Variation . ±3% of total resistance<br>Power Rating at 70°C:<br>(Tapers A and H) ..... 2 watts<br>(Tapers C and F) ..... 1 watt<br>Operating Temperature Range:<br>(3852 & 3856) .. −65° to +150°C<br>(3859) ..... −65° to +125°C<br>Temperature Coefficient ..... ±150 ppm/°C<br>Rotational Life ..... 50,000 cycles | ⅜" D. x ⅜" L. Bushing | 3852A |
| | ⅜" D. x ½" L. Locking Bushing | 3852B |
| | ¼" D. x ¼" L. Bushing | 3852C |
| | ¼" D. x ⅜" L. Locking Bushing | 3852E |
| | ⅜" D. x ⅜" L. Bushing<br>¼" Shaft Dia.<br>3¾ Turns | 3856A |
| | ⅜" D. x ⅜" L. Bushing<br>⅛" Shaft Dia.<br>3¾ Turns | 3856H |
| | ⅜" D. x ⅜" L. Plastic Bushing | 3859A |
| | ⅜" D. x ¼" L. Plastic Snap-in Bushing | 3859B |

## CONTROLS

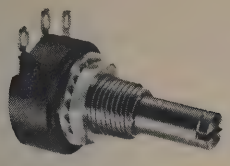


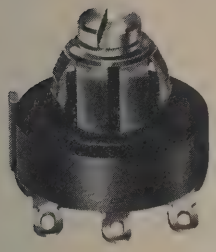


BOURNS NC

TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5212

## CONTROLS





### CONDUCTIVE PLASTIC

| Model | Description | Significant Specifications |
|---|---|---|
| 3851A | ⅜″ D. x ⅜″ L. Bushing | ¾″ Diameter<br>Body Depth . . . . . ¼″<br>Standard Resistance Range:<br>(Tapers B and E) . . . . . 1000 to 100,000 ohms<br>(Tapers D and G) . . . . . 2000 to 50,000 ohms<br>Resistance Tolerance . . . . . 20% standard<br>Theoretical Electrical Travel (3851 & 3858) . . . . . 240° ±10°<br>Mechanical Angle (3851 & 3858) . . . . . 280° ±5°<br>Continuity . . . . . Maintained for full mechanical angle<br>Max. Contact Resistance Variation . ±1% of total resistance<br>Power Rating at 70°C:<br>(Tapers B and E) . . . . . 1 watt<br>(Tapers D and G) . . . . . 0.5 watt<br>Operating Temperature Range . . . . . −65° to +125°C<br>Temperature Coefficient . . . . . ±1000 ppm/°C<br>Rotational Life . . . . . 100,000 cycles |
| 3851B | ⅜″ D. x ½″ L. Locking Bushing | |
| 3851C | ¼″ D. x ¼″ L. Bushing | |
| 3851E | ¼″ D. x ⅜″ L. Locking Bushing | |
| 3858A | ⅜″ D. x ⅜″ L. Plastic Bushing | |
| 3858B | ⅜″ D. x ¼″ L. Plastic Snap-in Bushing | |

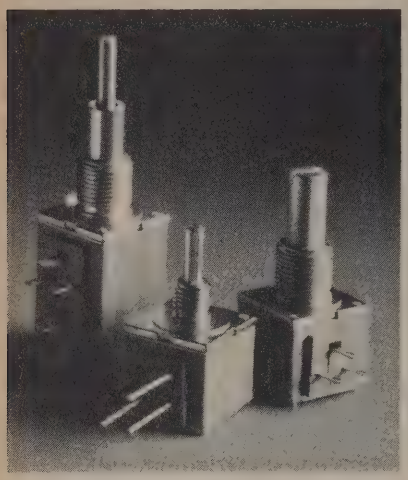
### CERMET

| | | |
|---|---|---|
| 3862C | ¼″ D. x ¼″ L. Bushing | ½″ Diameter<br>Body Depth . . . . . 453″ ±.016<br>Standard Resistance Range:<br>(Tapers A and H) . . . . . 100 to 5,000,000 ohms<br>(Tapers C and F) . . . . . 500 to 2,500,000 ohms<br>Resistance Tolerance . . . . . ±10% standard<br>Theoretical Electrical Travel . . . . . 260° ±10°<br>Mechanical Angle . . . . . 295° ±3°<br>Max. Contact Resistance Variation . ±3% of total resistance<br>Power Rating at 125°C:<br>(Tapers A and H) . . . . . 1 watt<br>(Tapers C and F) . . . . . 0.5 watt<br>Operating Temperature Range . . . . . −65° to +175°C<br>Temperature Coefficient . . . . . ±150 ppm/°C<br>Standard Resistance Range . . . . . 1000 ohms to 5,000,000 ohms<br>Resistance Tolerance . . . . . ±10% standard<br>Power Rating . .6 ½ watt at +125°C<br>Operating Temperature Range . . . . . −65° to +175°C |
| 3862E | ¼″ D. x ½″ L. Locking Bushing | |

BOURNS
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5212

# MODEL 81/82

Modular Potentiometer Single or Multiple ⅝" Square Sections Bushing Mount Cermet and/or Conductive Plastic Elements



BOURNS® Model 81/82 MODULAR potentiometer combines the design versatility of advanced modular construction with factory assembled reliability and quality assurance. The net result is a consistently high quality ⅝" square panel potentiometer that can be delivered in single or multiple section configurations to suit your specific applications . . . from off-the-shelf components . . . at low cost. The Model 81/82's unique shaft torque control feature provides a smooth, high quality feel that will enhance the "human engineering appeal" of your equipment. This feature enables Bourns to produce a panel potentiometer that has a remarkably consistent feel (torque range only .3 to 2.0 oz.-in.) from unit-to-unit . . . regardless of the number of modules ganged on a single shaft.

## SPECIFICATIONS

### Electrical Characteristics

| | Conductive Plastic | Cermet |
|---|---|---|
| Standard Resistance Range | | |
| (Tapers A, B, H & E) | (B & E) 250 to 5,000,000 ohms | (A & H) 50 to 5,000,000 ohms |
| (Tapers C, D, F & G) | (D & G) 1000 to 2,500,000 ohms | (C & F) 1000 to 2,500,000 ohms |
| Resistance Tolerance | ±20% standard (B, D & G tapers) ±10% available (E taper) | ±10% standard (A, C and F tapers) ±5% available (H taper) |
| Independent Linearity | (B & E tapers) ±5% | (A & H tapers) ±5% |
| Absolute Minimum Resistance | 2 ohms | 2 ohms |
| Continuity | Maintained for full mechanical angle | Maintained for full mechanical angle |
| Theoretical Electrical Travel | 240° ±5° | 240° ±6° |
| Maximum Contact Resistance Variation (Tapers A, B, H & E) | (B & E) ±1% or 3Ω, whichever is greater | (A & H) ±1% or 3Ω, whichever is greater |
| (Tapers C, D, F & G) | (D & G) ±2% | (C & F) ±2% |
| Resolution | Infinite | Infinite |
| Dielectric Strength | MIL-R-23285 | MIL-R-23285 |
| Sea Level | 1000 Volts RMS | 1000 Volts RMS |
| 70,000 Ft. | 500 Volts RMS | 500 Volts RMS |
| Insulation Resistance (500 Volts DC) | 1000 megohms | 1000 megohms |
| Power Rating at 70°C | | |
| Single Section | 1 Watt | 2 Watts |
| Multiple Section | .5 Watts/Section | 1 Watt/Section |
| Roll-on/Roll-off | .25% max. (B & E tapers) .1% max: CCW (D taper); CW (G taper) .5% max: CW (D taper); CCW (G taper) | .5% max. (A & H tapers) .1% max: CCW (C taper); CW (F taper) 1.0% max: CW (C taper); CCW (F taper) |

### Environmental Characteristics

| | Conductive Plastic | Cermet |
|---|---|---|
| Temperature Range | −65° to +125°C | −65° to +150°C |
| Temperature Coefficient Over Temperature Range | ±1000 ppm/°C | ±150 ppm/°C |
| Vibration, 15G's (Single Section) | MIL-R-23285 | MIL-R-23285 |
| Maximum Wiper Shift | 5% of total resistance | 5% of total resistance |
| Maximum Total Resistance Shift | ±2% | ±2% |
| Shock, 30G's (Single Section) | MIL-R-23285 | MIL-R-23285 |
| Maximum Wiper Shift | 5% of total resistance | 5% of total resistance |
| Maximum Total Resistance Shift | ±2% | ±2% |
| Load Life | 1000 Hrs. | 1000 Hrs. |
| Maximum Total Resistance Shift | ±10% | ±5% |
| Rotational Life | 100,000 Cycles | 100,000 Cycles |
| Maximum Total Resistance Shift | 10 ohms or ±12% | 10 ohms or ±12% |
| Moisture Resistance | | |
| Maximum Total Resistance Shift | ±10% | ±5% |

### Mechanical Characteristics

| | Conductive Plastic | Cermet |
|---|---|---|
| Shaft Torque | | |
| Single Section (A & B Bushing) | .5 to 1.5 oz.-in. | .5 to 1.5 oz.-in. |
| Single Section (C & E Bushing) | .3 to 1.5 oz.-in. | .3 to 1.5 oz.-in. |
| Dual Section (All Bushings) | .5 to 2.0 oz.-in. | .5 to 2.0 oz.-in. |
| Triple Section (All Bushings) | .5 to 2.0 oz.-in. | .5 to 2.0 oz.-in. |
| Quadruple Section (All Bushings) | .5 to 2.0 oz.-in. | .5 to 2.0 oz.-in. |
| Shaft Locking Torque with Locknut @ 10 lb. in. (B & E Bushing) | 20 oz.-in. | 20 oz.-in. |
| Stop Strength | ② 4 lbs.-in. | ② 4 lbs.-in. |
| Total Mechanical Travel | 300° ±5° | 300° ±5° |
| Weight (Single Section) | 21 Gms. max. | 21 Gms. max. |
| Each Additional Section | 6 Gms. max. | 6 Gms. max. |
| Terminals | ① Printed circuit terminals or solder lugs | |
| Markings | Manufacturer's symbol, wiring diagram, date code, resistance, manufacturer's P/N | |

① Model 81/82 performance not guaranteed after being subjected to printed circuit board cleaning procedures.

② Consult factory for dual concentric shafts.

BOURNS INC

TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5212

## PART NUMBERING SYSTEM

Features indicated by shaded areas are production standards and normally available for fast delivery.
Unshaded areas are available on special order and are not normally stocked.

**MODEL TYPE & TERMINAL STYLE**
- 81 Control, P.C.
- 82 Control, Lugs

**NO. OF SECTIONS**
- 1 Single Section
- 2 Dual Section
- 3 Triple Section
- 4 Quadruple

**ANTI-ROTATION LUG OPTIONS ④**
- A Sgl., .305 R., 90° CW
- D No Lug
- E Sgl., .531 R., 90° CW
- H Sgl., .437 R., 90° CW
- J Sgl., .375 R., 90° CW

**TYPE OF ELEMENT, TAPER & TOL. ④**
- A Linear, Cermet, ±10%
- B Linear, C-P, ±20%
- C CW Audio, Cermet, ±10%
- D CW Audio, C-P, ±20%
- S CW Audio, C-P, ±10%
- E Linear, C-P, ±10%
- F CCW Audio, Cermet, ±10%
- G CCW Audio, C-P, ±20%
- T CCW Audio, C-P, ±10%
- H Linear, Cermet, ±5%

EXAMPLE:

82 A 2 A B 28 A① 23 /① A② 15②

| BUSHING STYLE & SIZE | SHAFT TYPE & END STYLE ④ | SHAFT LENGTH FMS ③ | RESISTANCE CODE—VALUE ① |
|---|---|---|---|
| A Plain 3/8" D. x 3/8" L. | B Single, Slotted, 1/4" D. | 16, 20, 24, 28 | 03 — 50*, 05 — 100*, 07 — 250, 08 — 500, 10 — 1K, 12 — 2.5K, 13 — 5K, 15 — 10K, 17 — 25K, 18 — 50K, 20 — 100K, 22 — 250K, 23 — 500K, 25 — 1 Meg, 26 — 2.5 Meg, 27 — 5 Meg |
| | C Single, Flatted | 24 | |
| J Plain 3/8" D. x 1/4" L. | G Dual Concentric 1/4" D. Outer - 1st Sec. Plain End 1/8" D. Inner - Other Sec. | 36 | |
| B Locking 3/8" D. x 1/2" L. | B Single, Slotted, 1/4" D. | 20 | |
| C Plain 1/4" D. x 1/4" L. | E Single, Slotted, 1/8" D. | 12, 16, 20, 24, 28 | |
| N Plain 1/4" D. x 3/8" L. | F Single, Flatted | 24 | |
| | K Dual Concentric 1/8" D. Outer - 1st Sec. Plain End 3/64" D. Inner - Other Sec. | 32 | |
| E Locking 1/4" D. x 1/2" L. | E Single, Slotted, 1/8" D. | 20 | |

* Available in Cermet only. Audio tapers available from 1K ohm to 2.5 megohm only.

NOTES:
1. Taper and Resistance Code for 1st Section.
2. Taper and Resistance Code for 2nd Section.
3. Shaft length code is based on the number of 1/32" increments in the length from the mounting surface (FMS). Shaft lengths other than those listed are available on special order. Dual concentric shaft length code indicates length of inner shaft. Standard length of outer shaft is 3/8" less. Consult factory for non-standard concentric shaft lengths or module drive combinations.
4. Other anti-rotation lug options, resistance values, tapers and shaft end styles are available on special order. Consult factory for details.

## MOUNTING HARDWARE

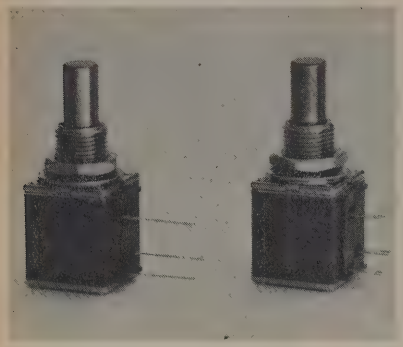
| Part No. and Description | Bushing Style A | B | C | E |
|---|---|---|---|---|
| H-36-1 Flat Washer | | | X | X |
| H-36-2 Flat Washer | X | X | | |
| H-37-1 Lockwasher | | | X | X |
| H-37-2 Lockwasher | X | X | | |
| H-38-1 Mounting Nut | | | X | X |
| H-38-2 Mounting Nut | X | X | | |
| H-38-3 Locknut | | | | X |
| H-38-4 Locknut | | X | | |

NOTE: Hardware indicated by shaded areas is normally supplied with unit. Other hardware may be ordered separately. Hardware bulk packaged with units.

BOURNS
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5212

# MODEL 83/84

Modular Potentiometer
⅝" Square 10-Turn, Wirewound



## SPECIFICATIONS

**Electrical Characteristics**

Resistance Range . 200 ohm to 100K
Resistance Tolerance ..... ±5%
Linearity (Independent) .. ±0.25% maximum
Effective Electrical Angle ... 3600° +10°/−0°
Absolute Minimum Resistance .... 1.0 ohm or 0.1%, whichever is greater
Noise .... 100 ohm ENR maximum
Power Rating:
25°C ..... 1.8 watts
70°C ..... 1.0 watt
125°C ..... 0 watt
Dielectric Strength @ Sea Level .... 1000 volts AC minimum
Insulation Resistance, 500 volts DC .... 1000 megohms minimum

**Environmental Characteristics**

Temperature Range ..... −55° to +125°C
Temperature Coefficient over Temperature Range . ±50 ppm/°C
Vibration ..... 15 Gs
Wiper Bounce .. 0.1 milliseconds maximum
Shock ..... 50Gs
Wiper Bounce .. 0.1 milliseconds maximum
Load Life ..... 1000 hours
Resistance Shift . 2.0% maximum

**Mechanical & Physical Characteristics**

Mechanical Rotation ..... 3600° +15°/−0°
Shaft Runout ..... .006 in. T.I.R.
Shaft End Play ..... .014 in. T.I.R.
Shaft Radial Play .... .005 in. T.I.R.
Rotational Life .... 1,000,000 Shaft Revolutions
Stop Strength . 48 oz.-in. minimum[1]
Torque (1 or 2 section) .... 0.25 to 2.0 oz.-in.
Weight .... Approximately 0.75 oz.
Marking . Manufacturer's name and part number, resistance value, wiring diagram & date code

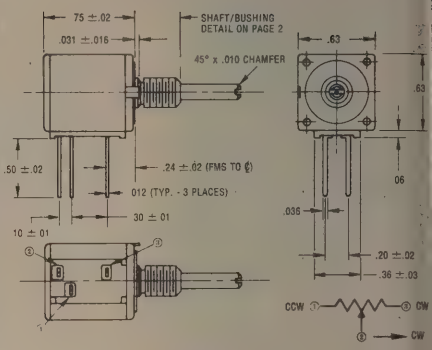
[1] Consult factory for dual concentrics

**Resolution Table**

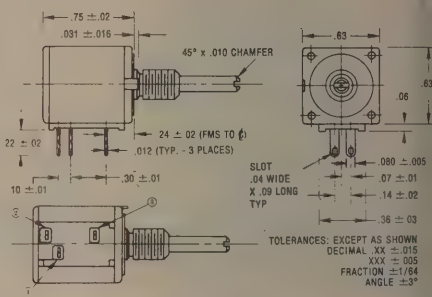
| Resistance (ohms) | Resolution (%) |
|---|---|
| 200 | .048 |
| 500 | .036 |
| 1K | .029 |
| 2K | .024 |
| 5K | .023 |
| 10K | .019 |
| 20K | .015 |
| 50K | .011 |
| 100K | .0095 |

## DIMENSIONS

**P.C. Pin Type 83**

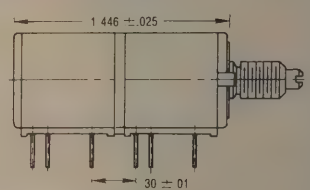



**Solder Lug Type 84**

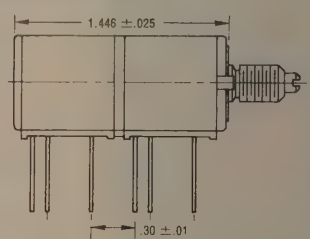



**Dual Section**

**Type 84 Solder Lugs**




**Type 83 P.C. Pins**




NOTE: Dimensions for dual section assembly are for either single or dual concentric shaft styles.

* BOURNS reserves the right to change specifications and prices without notice.

**Metric Conversion**

| Inch | mm | Inch | mm | Inch | mm | Inch | mm |
|---|---|---|---|---|---|---|---|
| .005 | 0,127 | .031 | 0,787 | .080 | 2,032 | .300 | 7,632 |
| .010 | 0,254 | .036 | 0,916 | .090 | 2,290 | .360 | 9,158 |
| .012 | 0,305 | .040 | 1,018 | .100 | 2,544 | .500 | 12,720 |
| .015 | 0,381 | .060 | 1,524 | .200 | 5,088 | .630 | 16,002 |
| .020 | 0,508 | .062 | 1,574 | .220 | 5,597 | .750 | 19,080 |
| .025 | 0,635 | .070 | 1,781 | .240 | 6,106 | 1.446 | 36,786 |

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5212

## PART NUMBERING SYSTEM

Features indicated by shaded areas are production standards and normally available for fast delivery.

Unshaded areas are available on special order and are not normally stocked.

**MODEL TYPE & TERMINAL STYLE**
- 83 Precision, P.C. Pins
- 84 Precision, Lugs

**NO. OF SECTIONS**
- 1 Single Section
- 2 Dual Section

**ANTI-ROTATION OPTIONS ④**
- A Sgl., .305 R., 90° CW
- C Sgl., .305 R., 270° CW
- D No Lug

**TYPE OF ELEMENT AND TOLERANCE ④**
- J Wirewound 10-Turn, ±5%

EXAMPLE:

| 84 | A | 2 | D | - | B | 28 | - | J | ① 10 | / | ② J | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

① ②

BUSHING STYLE & SIZE | SHAFT TYPE & END STYLE ④ | SHAFT LENGTH FMS ③ | RESISTANCE CODE—VALUE ④

**BUSHING STYLE & SIZE**

| | | | | |
|---|---|---|---|---|
| A | Plain 3/8" D. x 3/8" L. | B | Single, Slotted, 1/4" D. | 16, 20, 24, 28 |
| J | Plain 3/8" D. x 1/4" L. | G | Dual Concentric - Plain End 1/4" D. Outer, 1/8" D. Inner - Outer Operates Section No. 1 | 36 — 1 1/8" L.; 40 — 1 1/4" L. |
| B | Locking 3/8" D. x 1/2" L. | B | Single, Slotted, 1/4" D. | 20 |
| C | Plain 1/4" D. x 1/4" L. | E | Single, Slotted, 1/8" D. | 12, 16, 20, 24, 28 |
| N | Plain 1/4" D. x 3/8" L. | K | Dual Concentric - Plain End 1/8" D. Outer, 5/64" D. Inner - Outer Operates Section No. 1 | 32 — 1" L.; 36 — 1 1/8" L. |
| E | Locking 1/4" D. x 1/2" L. | E | Single, Slotted, 1/8" D. | 20 |

**RESISTANCE CODE—VALUE ④**

| | |
|---|---|
| 06 | — 200 |
| 08 | — 500 |
| 10 | — 1K |
| 11 | — 2K |
| 13 | — 5K |
| 15 | — 10K |
| 16 | — 20K |
| 18 | — 50K |
| 20 | — 100K |

NOTES:

1. Element Type and Resistance Code for 1st Section.
2. Element Type and Resistance Code for 2nd Section.
3. Shaft length code is based on the number of 1/32" increments in the length from the mounting surface (FMS). Shaft lengths other than those listed are available on special order. Dual concentric shaft length code indicates length of inner shaft. Standard length of outer shaft is 3/8" less. Consult factory for non-standard combinations.
4. Other anti-rotation lug options, resistance values, tolerance and shaft end styles are available on special order. Consult factory for details.

## MOUNTING HARDWARE

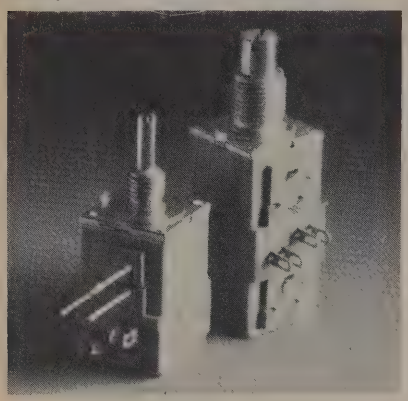
| Part No. and Description | Bushing Style A | B | C | E |
|---|---|---|---|---|
| H-36-1 Flat Washer | | | X | X |
| H-36-2 Flat Washer | X | X | | |
| H-37-1 Lockwasher | | | X | X |
| H-37-2 Lockwasher | X | X | | |
| H-38-1 Mounting Nut | | | X | X |
| H-38-2 Mounting Nut | X | X | | |
| H-38-3 Locknut | | | | X |
| H-38-4 Locknut | | X | | |

NOTE: Hardware indicated by shaded areas is normally supplied with unit. Other hardware may be ordered separately. Hardware bulk packaged with units.

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5212

## MODEL 85/86

Model 81/82 Modular Potentiometer with Rotary Switch Module (Pat. Pend.)



The BOURNS® Model 81/82 "Modular" Potentiometers are available with optional rotary switch modules for applications where integral "on-off" function control is desired. The combination is designated the Model 85/86.

Switch modules may be ganged behind a primary potentiometer module in any combination of up to three switches and/or secondary potentiometer modules.

A positive action "non-tease" detent design with low actuation torque, compliments the smooth feel of the Model 81/82 Potentiometer.

Contacts of fine silver with gold overlay provide exceptionally low contact resistance for reliable operation in low level analog or logic circuits.

## SPECIFICATIONS

**Electrical Characteristics**

Contacts:
DPST . . . 2 N.O. & N.O./N.C. Std.
DPDT . . . . . 2 Pr. Transfer-Std. (Break before make)
Power Rating (Resistive Load):
DPST . . 2 A. @ 125 VRMS-60 Hz. or 2 A. @ 28 V. DC, 1A @ 250 VRMS-60 Hz.
DPDT . . . 1A @ 125 VRMS-60 Hz. or 1A. @ 28V. DC
Dielectric Strength
Sea Level . 1000 VRMS minimum
Insulation
Resistance . . . . . 1000 megohms
Contact Resistance (.1 V. DC-10 ma.) . . 10 milliohms maximum
Contact Bounce . . . . 5 milliseconds maximum

**Mechanical Characteristics**

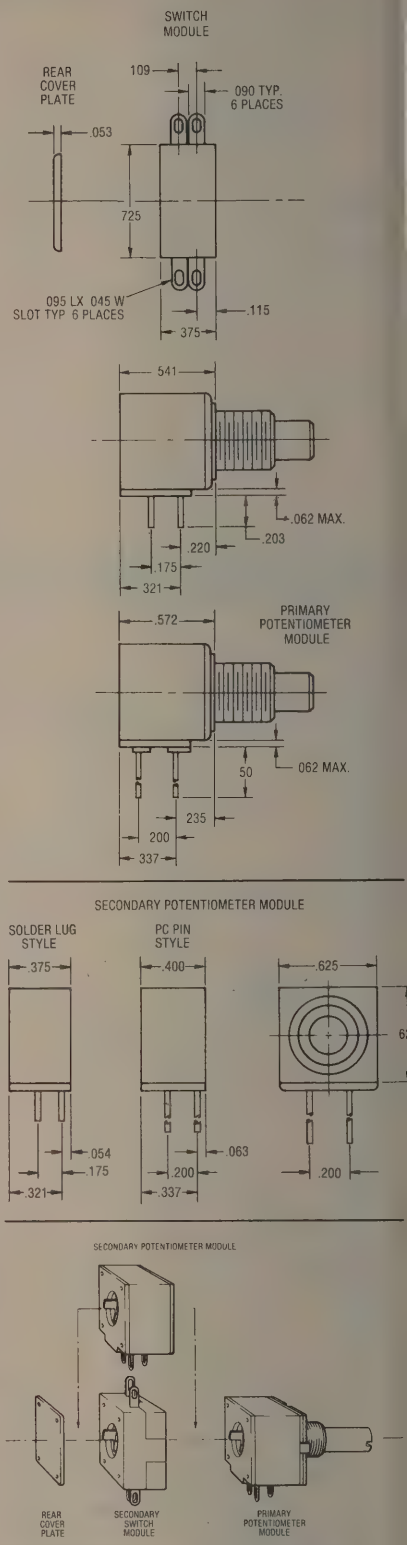
Detent Actuation Torque (Each Section-Switch Module only) . . . . . 3-7 oz.-in.
Shaft Torque (Out of Detent, 2-4 Module Assembly) . 0.5-2 oz.-in.
Detent . . . . . CW or CCW-Std.
Actuation Angle . . . . . 20° ±5°
Contacts . . . . . Fine Silver with Gold Overlay
Terminals . . . . . Solder Lug only
Standard Orientation . In-Line with Control Terminals
Optional . . . . . Rotated 90° CCW from Standard
Terminal Strength (Before and After Soldering Heat Exposure) . . . 2 lb. minimum

**Environmental Characteristics**

Operating Temperature Range . . . . . 0° to +70°C
Power Rating . . . . . As Specified
Contact Resistance . 10 milliohms maximum
Actuating Torque (SW. only) . . . . . 3-7 oz.-in.
Exposure Temperature Range . . . . . −65° to +125°C
Vibration 8Gs (Dual Section) . . . . . 44-2000 Hz.
Contact Resistance . 10 milliohms maximum
Contact Bounce . 0.1 millisecond maximum
Shock, 20Gs (Dual Section):
Contact Resistance . 10 milliohms maximum
Contact Bounce . 0.1 millisecond maximum
Rated Power Load . 25,000 Cycles
Rotational Life (50% Duty Cycle @ Actuating Torque (SW only) . . . . . 2-7 oz.-in.
Moisture Resistance . MIL-STD-202, Method 106
Contact Resistance . 10 milliohms maximum
Insulation Resistance (After 24 Hours @ Room Temperature) . 100 megohms minimum
Housing Material . . . . . High Temperature, Flame Retardant Thermosetting Plastic

Note: Refer to Model 81/82 for potentiometer specifications.

## DIMENSIONS




BOURNS INC

TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5212

## PART NUMBERING SYSTEM

Features indicated by shaded areas are production standards and normally available for fast delivery.

Unshaded areas are available on special order and are not normally stocked.

**NO. OF SECTIONS**
- 2 Dual Section
- 3 Triple Section
- 4 Quadruple

**MODEL TYPE & TERMINAL STYLE**
- 85 Control, P.C. Pins Switch, Lugs
- 86 Control, Lugs Switch, Lugs

**ANTI-ROTATION LUG OPTIONS ④**
- A Sgl., .305 R., 90° CW
- D No Lug
- E Sgl., .531 R., 90° CW
- H Sgl., .437 R., 90° CW
- J Sgl., .375 R., 90° CW

**TYPE OF ELEMENT, TAPER & TOL. ④**
- A Linear, Cermet, ±10%
- B Linear, C-P, ±20%
- C CW Audio, Cermet, ±10%
- D CW Audio, C-P. ±20%
- S CW Audio, C-P. ±10%
- E Linear, C-P. ±10%
- F CCW Audio, Cermet, ±10%
- G CCW Audio, C-P. ±20%
- T CCW Audio, C-P. ±10%
- H Linear, Cermet, ±5%

86 A 2 A B 28 A 22 / R50

### BUSHING STYLE & SIZE

- A Plain 3/8" D. x 3/8" L.
- J Plain 3/8" D. x 1/4" L.
- B Locking 3/8" D. x 1/2" L.
- C Plain 1/4" D. x 1/4" L.
- N Plain 1/4" D. x 3/8" L.
- E Locking 1/4" D. x 1/2" L.

### SHAFT TYPE AND END STYLE ④

- B Single, Slotted, 1/4" D.
- C Single, Flatted
- ③ G Dual Concentric - Plain End 1/4" D. Outer, 1/8" D. Inner - Outer Operates Section No. 1
- ③ L Dual Concentric - Plain End 1/4" D. Outer, 1/8" D. Inner - Outer Operates Section No. 1 & 2
- ③ N Dual Concentric - Plain End 1/4" D. Outer, 1/8" D. Inner - Outer Operates Section No. 1, 2, 3
- H Single, Slotted, 6mm D.
- B Single, Slotted, 1/4" D.
- E Single, Slotted, 1/8" D.
- F Single, Flatted
- ③ K Dual Concentric - Plain End 1/8" D. Outer, 5/64" D. Inner - Outer Operates Section No. 1
- ③ M Dual Concentric - Plain End 1/8" D. Outer, 5/64" D. Inner - Outer Operates Section No. 1 & 2
- ③ P Dual Concentric - Plain End 1/8" D. Outer, 5/64" D. Inner - Outer Operates Section No. 1, 2, 3
- E Single, Slotted, 1/8" D.

### SHAFT LENGTH FMS ③

| | |
|---|---|
| 16 | 1/2" L. |
| 20 | 5/8" L. |
| 24 | 3/4" L. |
| 28 | 3/8" L. |
| 24 | 3/4" L. |
| 36 | 1 1/8" L. |
| 40 | 1 1/4" L. |
| 25 | 25mm L. |
| 50 | 50mm L. |
| 20 | 5/8" L. |
| 12 | 3/8" L. |
| 16 | 1/2" L. |
| 20 | 5/8" L. |
| 24 | 3/4" L. |
| 28 | 7/8" L. |
| 24 | 3/4" L. |
| 32 | 1" L. |
| 36 | 1 1/8" L. |
| 20 | 5/8" L. |

### RESISTANCE CODE—VALUE ④

| | | | |
|---|---|---|---|
| 03 | — 50* | 20 | — 100K |
| 05 | — 100* | 22 | — 250K |
| 07 | — 250 | 23 | — 500K |
| 08 | — 500 | 25 | — 1 Meg |
| 10 | — 1K | 26 | — 2.5 Meg |
| 12 | — 2.5K | 27 | — 5 Meg |
| 13 | — 5K | | |
| 15 | — 10K | | |
| 17 | — 25K | | |
| 18 | — 50K | | |

* Available in Cermet only. Audio tapers available from 1K ohm to 2.5 megohm only.

### SWITCH CODE AND DESCRIPTION

| | |
|---|---|
| R50 | DPST, N.O./N.C., CW DETENT, IN-LINE TERM. |
| R51 | DPST, N.O./N.C., CCW DETENT, IN-LINE TERM. |
| R52 | DPST, N.O./N.O., CW DETENT, IN-LINE TERM. |
| R53 | DPST, N.O./N.O., CCW DETENT, IN-LINE TERM. |
| R54 | DPST, N.C./N.C., CW DETENT, IN-LINE TERM. |
| R55 | DPST, N.C./N.C., CCW DETENT, IN-LINE TERM. |
| R56 | DPST, N.O./N.C., CW DETENT, HOR. HERM. |
| R57 | DPST, N.O./N.C., CCW DETENT, HOR. TERM. |
| R58 | DPST, N.O./N.O., CW DETENT, HOR. TERM. |
| R59 | DPST, N.O./N.O., CCW DETENT, HOR. TERM. |
| R60 | DPST, N.C./N.C., CW DETENT, HOR. TERM. |
| R61 | DPST, N.C./N.C., CCW DETENT, HOR. TERM. |
| R70 | DPDT, CW DETENT, IN-LINE TERM. |
| R71 | DPDT, CCW DETENT, IN-LINE TERM. |
| R72 | DPDT, CW DETENT, HOR. TERM. |
| R73 | DPDT, CCW DETENT, HOR. TERM. |

## NOTES

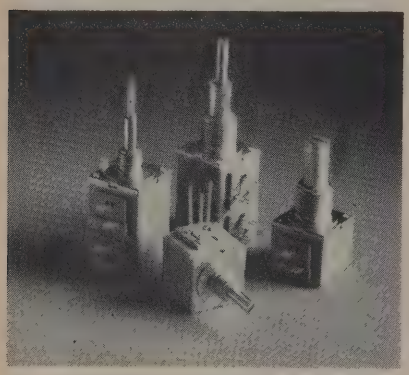
1. Taper and Resistance Code for 1st Section.
2. Switch Code for 2nd Section. See back page for Switch Code and description of switches available at special option.
3. Shaft length code is based on the number of 1/32" increments in the length from the mounting surface (FMS). Shaft lengths other than those listed are available on special order. Dual concentric shaft length code indicates length of inner shaft. Standard length of outer shaft is 3/8" less. Consult factory for non-standard concentric shaft lengths or module drive combinations.
4. Other anti-rotation lug options, resistance values, tapers and shaft end styles are on special order. Consult factory for details.

Specifications are subject to change without notice.

Specification Note: Closer performance tolerances can be supplied upon request.

# MODEL 87/88

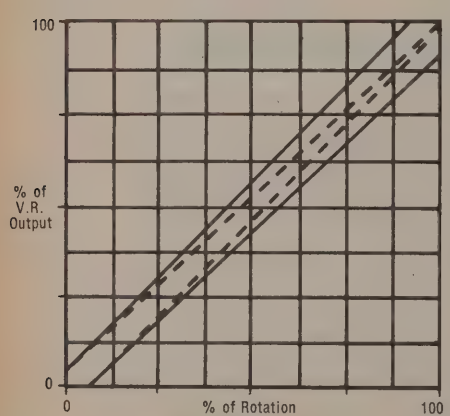
Semi-Precision/Modular Potentiometer/
Single or Multiple ⅝" Square Sections
Bushing Mount/Cermet and/ or
Conductive Plastic Elements



The BOURNS® Model 87/88 semi-precision modular potentiometer is a unique new control designed to fill the performance and price gap between low-cost industrial controls and single-turn precision potentiometers.

The 87/88 is available with either cermet or conductive plastic resistive elements with a zero-based linearity as low as 2% standard or 1% optional. This linearity will satisfy the more exacting requirements of applications where the output of the equipment must be related to a front panel control (dial) setting.

An exclusive shaft torque control feature provides a remarkably consistent feel (torque range of only .3 to 2.0 oz.-in.) from unit-to-unit, regardless of the number of modules ganged on a single shaft.




**ZERO BASE LINEARITY**

CCW end of overlay is fixed at the zero reference point. Only the CW end can be moved for best position.

BOURNS INC

TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5212

## SPECIFICATIONS

**Electrical Characteristics**

| | Conductive Plastic | Cermet |
|---|---|---|
| Standard Resistance Range | 250 to 2,500,000 ohms | 250 to 2,500,000 ohms |
| Resistance Tolerance | ±5% | ±3% |
| Zero Base Linearity | Standard ±2.0%<br>Optional ±1.0% | Standard ±2.5%<br>Optional ±1.5% |
| Absolute Minimum Resistance | 2 ohms | 2 ohms |
| Continuity | Maintained for full mechanical angle | Maintained for full mechanical angle |
| Theoretical Electrical Travel | 250° ±4° | 250° ±6° |
| Maximum Contact Resistance Variation | ±1% | ±1.5% |
| Resolution | Infinite | Infinite |
| Dielectric Strength | MIL-R-23285 | MIL-R-23285 |
| Sea Level | 1000 Volts RMS | 1000 Volts RMS |
| 70,000 Ft. | 500 Volts RMS | 500 Volts RMS |
| Insulation Resistance (500 Volts DC) | 1000 megohms | 1000 megohms |
| Power Rating at 70°C | | |
| Single Section | 1 Watt | 2 Watts |
| Multiple Section | .5 Watt/Section | 1 Watt/Section |
| Roll-on/Roll-off | .5% max. | .5% max. |

**Environmental Characteristics**

| | Conductive Plastic | Cermet |
|---|---|---|
| Temperature Range | −55° to +125°C | −65° to + 150°C |
| Temperature Coefficient Over Temperature Range | (250 to 750K) ±1000 ppm/°C<br>(1 meg to 2.5 meg) ±1200 ppm/°C | (All resistance) ±150 ppm/°C |
| Vibration, 15G's (Single Section) | MIL-R-23285 | MIL-R-23285 |
| Maximum Wiper Shift | 5% of total resistance | 5% of total resistance |
| Maximum Total Resistance Shift | ±2% | ±2% |
| Shock, 30G's (Single Section) | MIL-R-23285 | MIL-R-23285 |
| Maximum Wiper Shift | 5% of total resistance | 5% of total resistance |
| Maximum Total Resistance Shift | ±2% | ±2% |
| Load Life | 1000 Hrs. | 1000 Hrs. |
| Maximum Total Resistance Shift | ±10% | ±5% |
| Rotational Life | 100,000 Cycles | 100,000 Cycles |
| Maximum Total Resistance Shift | 10 ohms or ±12% | 10 ohms or ±10% |
| Moisture Resistance | | |
| Maximum Total Resistance Shift | ±10% | ±10% |

**Mechanical Characteristics**

| | Conductive Plastic | Cermet |
|---|---|---|
| Shaft Torque | | |
| Single or Dual Section (A & B Bushing) | .5 to 1.5 oz.-in. | .5 to 1.5 oz.-in. |
| Single or Dual Section (C & E Bushing) | .3 to 2.0 oz.-in. | .3 to 2.0 oz.-in. |
| Triple Section (All Bushings) | .5 to 2.0 oz.-in | .5 to 2.0 oz.-in |
| Quadruple Section (All Bushings) | .5 to 2.0 oz.-in | .5 to 2.0 oz.-in |
| Shaft Locking Torque with Locknut @ 10 lb. in. (B & E Bushing) | 20 oz.-in. | 20 oz.-in. |
| Stop Strength | ② 4 lbs.-in. | ② 4 lbs.-in. |
| Total Mechanical Travel | 300° ±5° | 300° ±5° |
| Weight (Single Section) | 21 Gms. max. | 21 Gms. max. |
| Each Additional Section | 6 Gms. max. | 6 Gms. max. |
| Terminals | ① Printed circuit terminals or solder lugs | |
| Markings | Manufacturer's symbol, wiring diagram, date code resistance, manufacturer's P/N | |

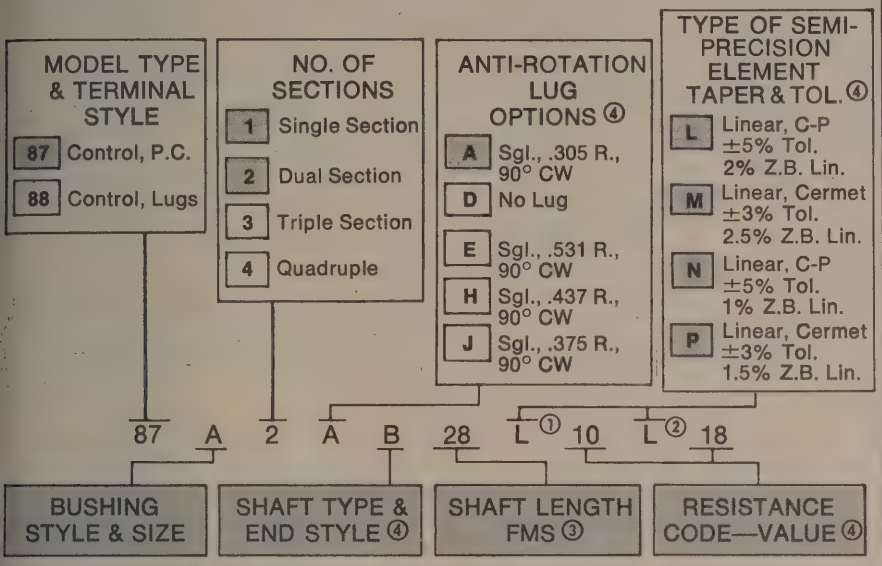
① Model 87/88 performance not guaranteed after being subjected to printed circuit board cleaning procedures.

② Consult factory for dual concentric shafts.

## PART NUMBERING SYSTEM

Features indicated by shaded areas are production standards and normally available for fast delivery.

Unshaded areas are available on special order and are not normally stocked.


MODEL TYPE & TERMINAL STYLE
87 Control, P.C.
88 Control, Lugs
NO. OF SECTIONS
1 Single Section
2 Dual Section
3 Triple Section
4 Quadruple
ANTI-ROTATION LUG OPTIONS ④
A Sgl., .305 R., 90° CW
D No Lug
E Sgl., .531 R., 90° CW
H Sgl., .437 R., 90° CW
J Sgl., .375 R., 90° CW
TYPE OF SEMI-PRECISION ELEMENT TAPER & TOL. ④
L Linear, C-P ±5% Tol. 2% Z.B. Lin.
M Linear, Cermet ±3% Tol. 2.5% Z.B. Lin.
N Linear, C-P ±5% Tol. 1% Z.B. Lin.
P Linear, Cermet ±3% Tol. 1.5% Z.B. Lin.
87 A 2 A B 28 L① 10 L② 18
BUSHING STYLE & SIZE
SHAFT TYPE & END STYLE ④
SHAFT LENGTH FMS ③
RESISTANCE CODE—VALUE ④

| | | | | | |
|---|---|---|---|---|---|
| A | Plain ⅜″ D. x ⅜″ L. | B | Single, Slotted, ¼″ D. | 16 | ½″ L. |
| | | | | 20 | ⅝″ L. |
| | | | | 24 | ¾″ L. |
| | | | | 28 | ⅞″ L. |
| | | C | Single, Flatted | 24 | ¾″ L. |
| | | G | Dual Concentric - Plain End ¼″ D. Outer, ⅛″ D. Inner | 36 | 1⅛″ L. |
| | | G | - Outer Operates Section No. 1 | 40 | 1¼″ L. |
| | | L | - Outer Operates Section No. 1 & 2 | | |
| | | N | - Outer Operates Section No. 1, 2, 3 | | |
| J | Plain ⅜″ D. x ¼″ L. | H | Single, Slotted, 6mm D. | 25 | 25mm L. |
| | | | | 50 | 50mm L. |
| B | Locking ⅜″ D. x ½″ L. | B | Single, Slotted, ¼″ D. | 20 | ⅝″ L. |
| C | Plain ¼″ D. x ¼″ L. | E | Single, Slotted, ⅛″ D. | 12 | ⅜″ L. |
| | | | | 16 | ½″ L. |
| | | | | 20 | ⅝″ L. |
| | | | | 24 | ¾″ L. |
| | | | | 28 | ⅞″ L. |
| | | F | Single, Flatted | 24 | ¾″ L. |
| | | K | Dual Concentric - Plain End ⅛″ D. Outer, 5/64″ D. Inner | 32 | 1″ L. |
| | | K | - Outer Operates Section No. 1 | 36 | 1⅛″ L. |
| | | M | - Outer Operates Section No. 1 & 2 | | |
| | | P | - Outer Operates Section No. 1, 2, 3 | | |
| N | Plain ¼″ D. x ⅜″ L. | | | | |
| E | Locking ¼″ D. x ½″ L. | E | Single, Slotted, ⅛″ D. | 20 | ⅝″ L. |

| | |
|---|---|
| 07 | — 250 |
| 08 | — 500 |
| 10 | — 1K |
| 12 | — 2.5K |
| 13 | — 5K |
| 15 | — 10K |
| 17 | — 25K |
| 18 | — 50K |
| 20 | — 100K |
| 22 | — 250K |
| 23 | — 500K |
| 25 | — 1 Meg |
| 26 | — 2.5 Meg |

## MOUNTING HARDWARE

| Part No. and Description | Bushing Style | | | |
|---|---|---|---|---|
| | A | B | C | E |
| H-36-1 Flat Washer | | | X | X |
| H-36-2 Flat Washer | X | X | | |
| H-37-1 Lockwasher | | | X | X |
| H-37-2 Lockwasher | X | X | | |
| H-38-1 Mounting Nut | | | X | X |
| H-38-2 Mounting Nut | X | X | | |
| H-38-3 Locknut | | | | X |
| H-38-4 Locknut | | X | | |

NOTE: Hardware indicated by shaded areas is normally supplied with unit. Other hardware may be ordered separately. Hardware bulk packaged with units.

NOTES:

1. Taper and Resistance Code for 1st Section.
2. Taper and Resistance Code for 2nd Section.
3. Shaft length code is based on the number of 1/32″ increments in the length from the mounting surface (FMS). Shaft lengths other than those listed are available on special order. Dual concentric shaft length code indicates length of inner shaft. Standard length of outer shaft is ⅜″ less. Consult factory for non-standard concentric shaft lengths or module drive combinations.
4. Other anti-rotation lug options, resistance values, tapers and shaft end styles are on special order. Consult factory for details.

Specifications are subject to change without notice.

Specification Note: Closer performance tolerances can be supplied upon request.

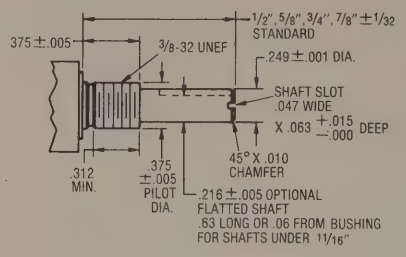
# MODEL 81/82, 83/84, 87/88

Single Turn Potentiometers with 1-4 Sections

## MECHANICAL DIMENSIONS

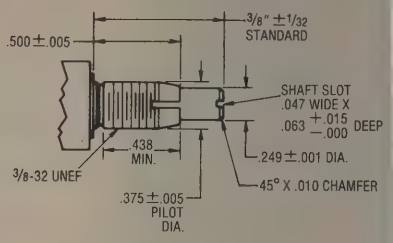
### "A" BUSHING

**⅜" Dia. Plain — Single Shaft**


1/2", 5/8", 3/4", 7/8" ±1/32 STANDARD
375 ±.005
3/8-32 UNEF
.249 ±.001 DIA.
SHAFT SLOT .047 WIDE X .063 +.015 −.000 DEEP
45° X .010 CHAMFER
.312 MIN.
.375 ±.005 PILOT DIA.
.216 ±.005 OPTIONAL FLATTED SHAFT .63 LONG OR .06 FROM BUSHING FOR SHAFTS UNDER 11/16"

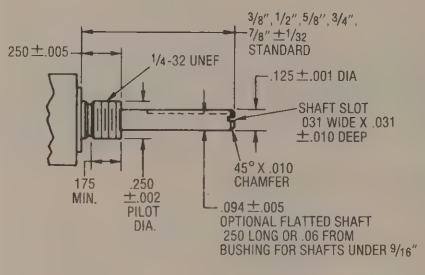
### "B" BUSHING

**⅜" Dia. Locking — Single Shaft**



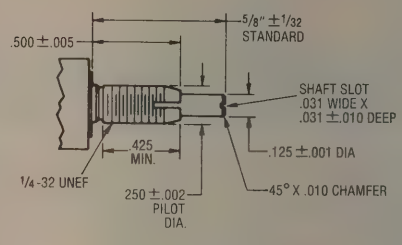

### "C" BUSHING

**¼" Dia. Plain — Single Shaft**


3/8", 1/2", 5/8", 3/4", 7/8" ±1/32 STANDARD
250 ±.005
1/4-32 UNEF
.125 ±.001 DIA
SHAFT SLOT .031 WIDE X .031 ±.010 DEEP
45° X .010 CHAMFER
175 MIN.
.250 ±.002 PILOT DIA.
.094 ±.005 OPTIONAL FLATTED SHAFT .250 LONG OR .06 FROM BUSHING FOR SHAFTS UNDER 9/16"

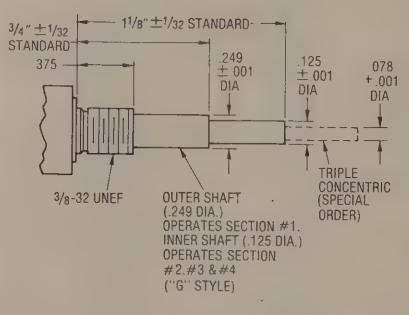
### "E" BUSHING

**¼" Dia. Locking — Single Shaft**



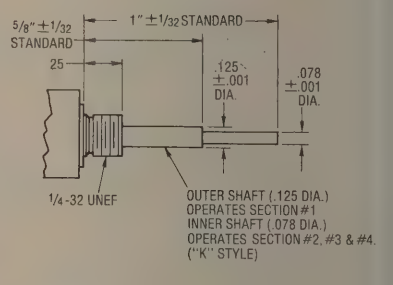

### "A" BUSHING

**⅜" Dia. Plain — Concentric Shaft**

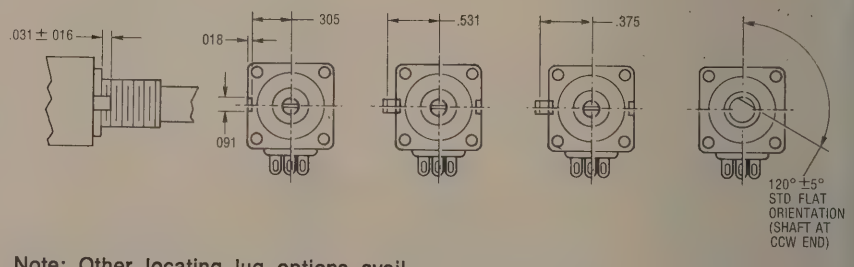

3/4" ±1/32 STANDARD
11/8" ±1/32 STANDARD
375
.249 ±.001 DIA
.125 ±.001 DIA
.078 +.001 DIA
3/8-32 UNEF
OUTER SHAFT (.249 DIA.) OPERATES SECTION #1. INNER SHAFT (.125 DIA.) OPERATES SECTION #2, #3 & #4. ("G" STYLE)
TRIPLE CONCENTRIC (SPECIAL ORDER)

### "C" BUSHING

**¼" Dia. Plain — Concentric Shaft**


5/8" ±1/32 STANDARD
1" ±1/32 STANDARD
25
.125 ±.001 DIA.
.078 ±.001 DIA.
1/4-32 UNEF
OUTER SHAFT (.125 DIA.) OPERATES SECTION #1 INNER SHAFT (.078 DIA.) OPERATES SECTION #2, #3 & #4. ("K" STYLE)

## LOCATING LUG OPTIONS

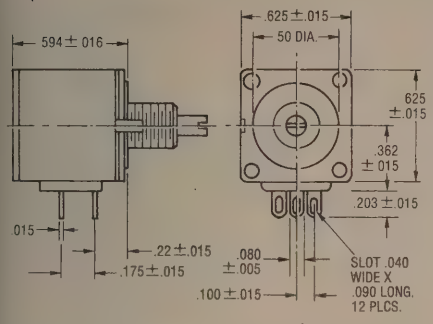



Note: Other locating lug options available. For details contact factory.

BOURNS
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5212

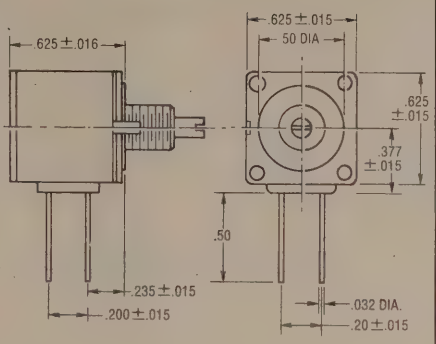
## SINGLE UNIT — LUGS

**Model 82**

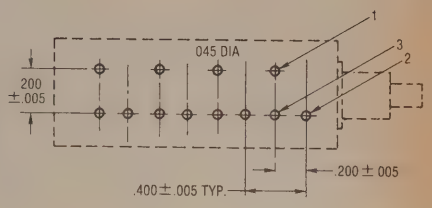



## SINGLE UNIT — PC PINS

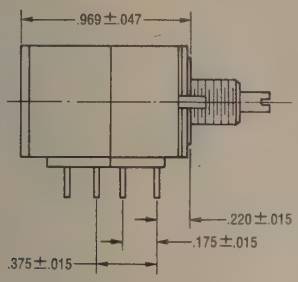
**Model 81**



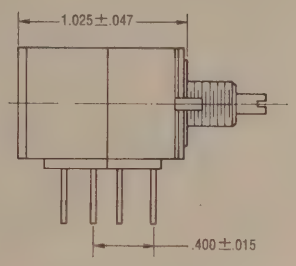

## SUGGESTED PC BOARD LAYOUT — PC PINS




## DUAL UNIT — LUGS

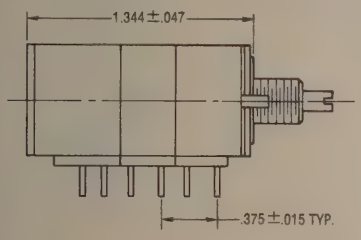



## DUAL UNIT — PC PINS

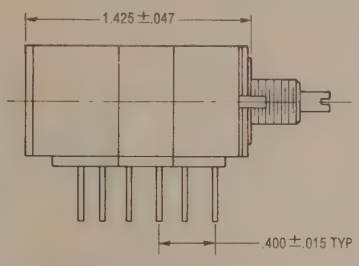



NOTE 1: For concentric shaft styles add .100 spacer between module(s) driven by inner shaft and those driven by outer shaft.

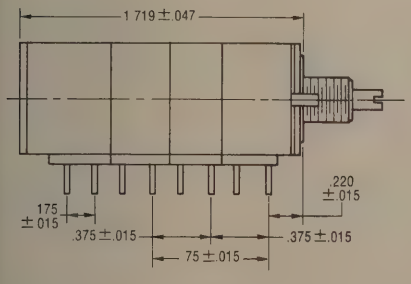
## TRIPLE UNIT — LUGS



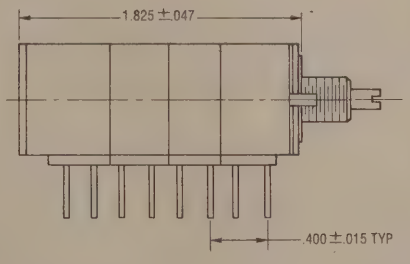

## TRIPLE UNIT — PC PINS




## QUAD UNIT — LUGS




## QUAD UNIT — PC PINS

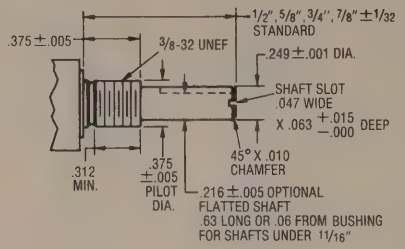



BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5212

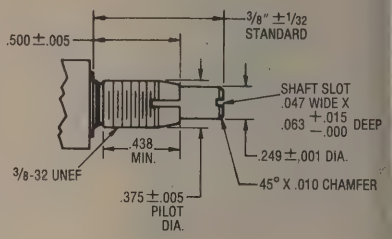
**MODEL 87/88**

## MECHANICAL DIMENSIONS

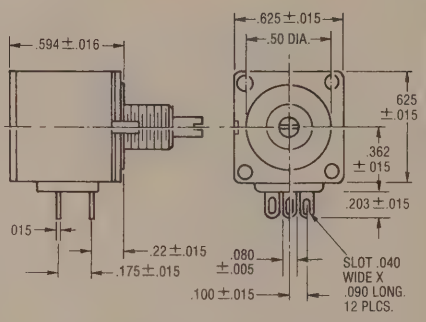
### "A" BUSHING
**⅜" Dia. Plain — Single Shaft**



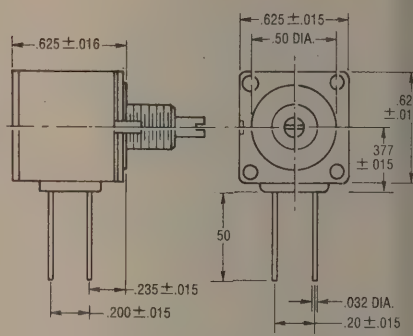

### "C" BUSHING
**¼" Dia. Plain — Single Shaft**



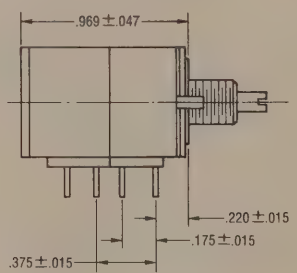

### SINGLE UNIT — LUGS
**Model 88**



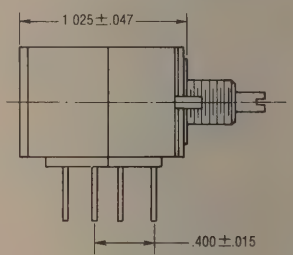

### SINGLE UNIT — PC PINS
**Model 87**



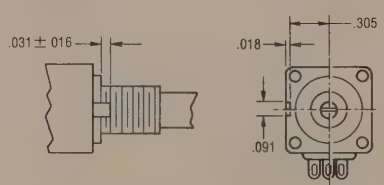

### DUAL UNIT — LUGS



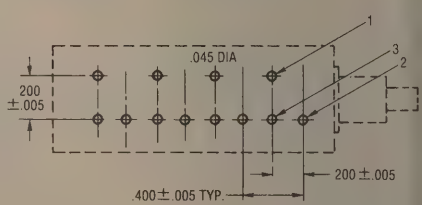

### DUAL UNIT — PC PINS




### LOCATING LUG DIMENSIONS
**A — SGL. .305R. 90° CW (STD.)**



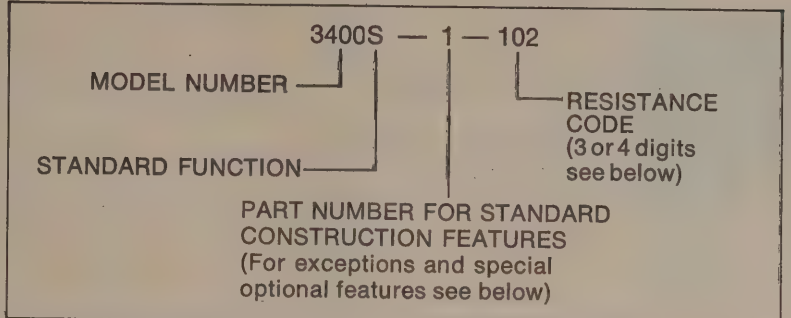

### SUGGESTED PC BOARD LAYOUT — PC PINS




BOURNS
NC
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5212

# STANDARD PRECISION POTENTIOMETERS

## PART NUMBERING SYSTEM


3400S — 1 — 102
MODEL NUMBER
STANDARD FUNCTION
RESISTANCE CODE (3 or 4 digits see below)
PART NUMBER FOR STANDARD CONSTRUCTION FEATURES (For exceptions and special optional features see below)

| Optional Features (Substitute for single digit part number) | Part No. | 3400S | 3500S-1 | 3509S | 3510S | 3520S | 3540S | 3541S | 3543S | 3545S | 3700S | 3501S | 3507S | 3707S | Standard Resistances (Refer to limits for each model) Ohms | Code |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High Torque Feature (2 to 8 oz.-in.) | 16 | X | X | X | X | X | X | X | X | X | | X | X | | 10 | 100 |
| TR Tolerance ±1.0% | 31 | X | | X | X | X | X | | X | X | X | | X | X | 25 | 250 |
| TR Tolerance ±1.0% | 32 | | X | | | | | | | | | | | | 50 | 500 |
| TR Tolerance ±5.0% | 36 | | | | | | | | | | | X | | | 100 | 101 |
| Linearity ±0.1% Min. Res. 300Ω | 40 | X | | X | X | X | X | | | X | | X | | | 200 | 201 |
| Linearity ±0.1% Min. Res. 300Ω | 42 | | X | | | | | | | | | | | | 500 | 501 |
| Linearity ±.05% Min. Res. 1KΩ | 41 | X | | | | | | | | | | | | | 1,000 | 102 |
| Linearity ±.05% Min. Res. 1KΩ | 43 | | X | | | | | | | | | | | | 2,000 | 202 |
| Linearity ±.25% | 45 | | | | X | X | | | | X | X | | X | | 5,000 | 502 |
| Center Tap | 50 | | | | | | | | | | | X | | | 10,000 | 103 |
| Center Tap | 51 | | X | | X | | | | | X | | | X | | 20,000 | 203 |
| Center Tap | 52 | X | | X | | X | X | X | X | X | | | X | | 50,000 | 503 |
| 1/8" Shaft, 1/4" Bushing | 70 | | X | | | X | X | X | X | X | | X | X | | 100,000 | 104 |
| 1/4" Shaft, 3/8" Bushing | 71 | | | | X | | | | | | | | | | 125,000 | 1253 |
| Split Lock Bushing | 72 | | | | X | | | | | X | | | X | | 150,000 | 154 |
| Split Lock Bushing | 77 | X | X | | | X | X | X | X | X | | X | X | | 200,000 | 204 |
| 7/8" Shaft Length Beyond Bushing | 73 | X | X | X | X | X | X | X | X | X | X | X | X | X | 250,000 | 254 |
| 5/8" Shaft Length Beyond Bushing | 74 | X | X | X | X | X | X | X | X | X | X | X | X | X | 500,000 | 504 |
| 3/4" Shaft Length Beyond Bushing | 75 | X | X | X | X | X | X | X | X | X | X | X | X | X | 1,000,000 | 105 |
| 1" Shaft Length Beyond Bushing | 76 | X | X | X | X | X | X | X | X | X | X | X | X | X | 2,000,000 | 205 |
| Shaft Flat | 80 | | X | | X | X | X | X | X | X | | X | X | | 5,000,000 | 505 |
| Non-Turn Pin | 90 | | X | | | | | | | | | | | | | |
| Non-Turn Pin | 91 | | | | X | X | X | X | X | X | | X | | | | |
| 2-Cup Assembly | 135 | X | X | | X | X | X | X | X | X | | X | | | | |

**EXCEPTIONS TO STANDARD CONSTRUCTION** 3509S-8-RC has stainless steel shaft, metal bushing. 3509S-7-RC has stainless steel shaft, plastic bushing. 3509S-9-RC has plastic shaft, metal bushing.

BOURNS INC
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5122

## MODEL 3500

⅞″ Diameter 10-Turn Bushing Mount Wirewound Element

### FEATURES

- 0.20% linearity — standard)
- 20% longer resistance element in a compact housing only 1.00″ long
- Extended temperature range −65° to +125°C
- Housing high temperature, moisture resistant thermosetting plastic
- SILVERWELD® termination eleminates vulnerable single wire termination
- Performance of Model 3500 is guaranteed by the Bourns Reliability Assurance Program which includes individual inspection to published electrical and physical characteristics
- Custom design capability is available to satisfy your most demanding and difficult special requirements

### SPECIFICATIONS

The specifications listed below are for the standard model. Modifications of all types (mechanical, electrical and environmental) can be custom engineered to your specific requirements.

**Electrical Characteristics**

Resistance Range ..... 50 ohms to 500K ohms
Resistance Tolerance ..... ±3%
Linearity (Independent) .. ±0.20%
Resolution ..... See standard resistance table
Effective Electrical Angle ... 3600° (+10°/−0°)
Absolute Minimum Resistance .... 1.0 ohm or 0.1%, whichever is greater
Noise ... 100 ohms ENR maximum
Power Ratings:
70°C ..... 2.0 watts
125°C ..... .0 watt
Dielectric Strength ... MIL-R-12934
Room Conditions . 1500 volts AC minimum
70,000 feet (0.8″ hg.) . 400 volts AC minimum
Insulation Resistance
500 volts DC .... 1000 megohms minimum

**Environmental Characteristics**

Temperature Range ..... −65° to +125°C
Temperature Coefficient of Wire[1] ..... 20 ppm/°C maximum
Humidity ... MIL-R-12934 humidity cycling
Vibration ..... MIL-R-12934, 20Gs
Wiper Bounce ... 0.1 millisecond maximum
Wiper Shift ..... 0.1% maximum
Shock ..... MIL-R-12934, 100Gs
Wiper Bounce and Wiper Shift . Same as Vibration
Load Life . MIL-R-12934, 1000 hours
Resistance Shift . 2.0% maximum
Sand and Dust ..... MIL-E-5272
Fungus ..... MIL-E-5272
Salt Spray ..... MIL-R-12934

**Mechanical and Physical Characteristics**

Mechanical Angle ..... 3600° (+10°/−0°)
Shaft Runout ..... .002 in. T.I.R.
Lateral Runout ..... .005 in. T.I.R.
Pilot Diameter Runout . .002 in. T.I.R.
Shaft End Play ..... .005 in. T.I.R.
Shaft Radial Play .... .003 in. T.I.R.
Rotational Life[1] .... 2,000,000 shaft revolutions
Stop Strength . 96 oz.-in. maximum
Ganging ..... 2 cups maximum
Torque ..... 0.6 oz.-in. maximum
Add 75% for additional cup
Weight ..... Approximately 1.0 oz.
Terminals . Gold-plated solder lugs
Markings . Manufacturer's name and part number, resistance value and tolerance, linearity tolerance, wiring diagram, and data code.

**Notes:**

[1] Consult manufacturer for complete specification details for resistance below 500 ohms.

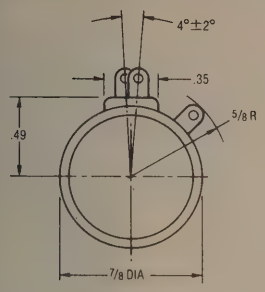
Specification Note: Closer performance tolerances can be supplied upon request.

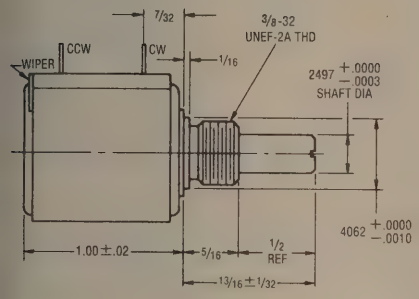
Specifications are subject to change without notice.

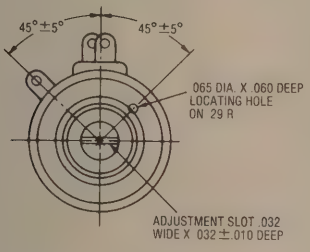
BOURNS

TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5122

## DIMENSIONS — 3500S-2*




*3500S-1 shaft length 1 1/16 ±1/32.

## STANDARD RESISTANCES

| Resistance (Ohms) | Part Number* | Resolution (percent) |
|---|---|---|
| 50 | 3500S-2-500 | .042 |
| 100 | 3500S-2-101 | .050 |
| 200 | 3500S-2-201 | .045 |
| 500 | 3500S-2-501 | .033 |
| 1,000 | 3500S-2-102 | .028 |
| 2,000 | 3500S-2-202 | .020 |
| 5,000 | 3500S-2-502 | .016 |
| 10,000 | 3500S-2-103 | .018 |
| 20,000 | 3500S-2-203 | .017 |
| 50,000 | 3500S-2-503 | .011 |
| 100,000 | 3500S-2-104 | .010 |
| 125,000 | 3500S-2-1253 | .009 |
| 200,000 | 3500S-2-204 | .007 |
| 500,000 | 3500S-2-504 | .005 |

* The last three or four digits of the part number represent the resistance in standard code.

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5122

## MODEL 3540

⅞″ Diameter 10-Turn Bushing Mount Wirewound Element

### FEATURES

- Small size: extends ¾″ behind panel
- High performance at low cost
- Unique, rugged, mechanically locked construction
- Direct terminal-to-element, SILVERWELD® bond eliminates vulnerable multi-joint connections
- Linearity: 0.25%
- Temperature Range: —55°C to +125°C
- Factory options available:
  - 2 section unit with single or concentric shafts
  - Anti Rotation Lug
  - High Shaft Torque
  - Tight Linearity
  - Tight Resistance Tolerance
  - Many Others

### SPECIFICATIONS

**Electrical Characteristics**

Resistance Range ... 100 ohms to 100K ohms
Resistance Tolerance ..... ±5%
Linearity (Independent) .. ±0.25%
Resolution ..... See standard resistance table
Effective Electrical Angle ... 3600° (+10°/—0°)
Absolute Minimum Resistance ... 1.0 ohm or 0.1%, whichever is greater
Noise ... 100 ohms ENR maximum
Power Ratings:
70°C ..... 2.0 watts
125°C ..... 0 watt
Second Section (-135 or -468) . 1.5 Watts at 70°C
Dielectric Strength ... MIL-R-12934
Sea Level ..... 1000 volts AC minimum
Insulation Resistance
500 volts DC .... 1000 megohms minimum

**Environmental Characteristics**

Temperature Range ..... —55° to +125°C
Temperature Coefficient of Wire[1] ..... 20 ppm/°C maximum
Vibration ..... MIL-R-12934, 15Gs
Wiper Bounce ... 0.1 millisecond maximum
Shock ..... MIL-R-12934, 50Gs
Wiper Bounce ... 0.1 millisecond maximum
Load Life . MIL-R-12934, 1000 hours
Resistance Shift . 2.0% maximum

**Mechanical and Physical Characteristics**

Mechanical Angle ..... 3600° (+10°/—0°)
Shaft Runout ..... .003 in. T.I.R
Lateral Runout ..... .005 in. T.I.R
Pilot Diameter Runout . .003 in. T.I.R
Shaft End Play ..... .010 in. T.I.R
Shaft Radial Play .... .003 in. T.I.R
Rotational Life[1] .... 1,000,000 shaft revolutions
Stop Strength .. 75 oz-in. minimum
Torque ..... 0.5 oz.-in. maximum
Weight ..... Approximately .75 oz
Terminals . Gold-plated solder lugs
Markings . Manufacturer's name and part number, resistance value and tolerance, linearity tolerance, wiring diagram, and date code

**Notes:**

[1] Consult manufacturer for complete specification details for resistance below 200 ohms.

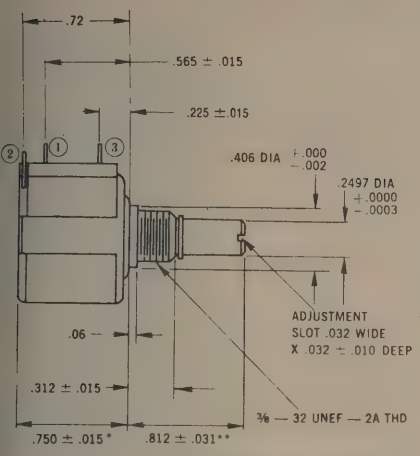
Specification Note: Closer performance tolerances can be supplied upon request.

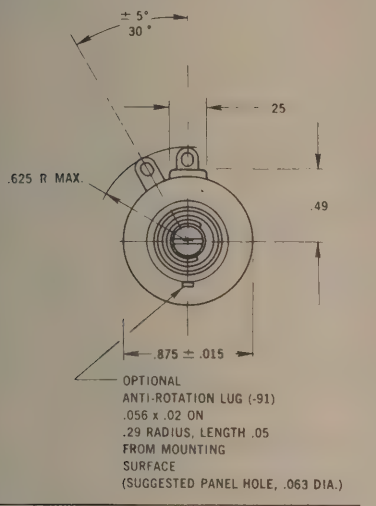
Specifications are subject to change without notice.

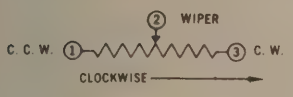
BOURNS NC

TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5122

## DIMENSIONS





± 5°
30°
.25
.625 R MAX.
.49
.875 ± .015
OPTIONAL ANTI-ROTATION LUG (-91) .056 x .02 ON .29 RADIUS, LENGTH .05 FROM MOUNTING SURFACE (SUGGESTED PANEL HOLE, .063 DIA.)




## STANDARD SPECIFICATIONS

| Resistance (Ohms) | Part Number* | Resolution (percent) |
|---|---|---|
| 100 | 3540S-1-101 | .061 |
| 200 | 3540S-1-201 | .038 |
| 500 | 3540S-1-501 | .031 |
| 1,000 | 3540S-1-102 | .025 |
| 2,000 | 3540S-1-202 | .022 |
| 5,000 | 3540S-1-502 | .017 |
| 10,000 | 3540S-1-103 | .018 |
| 20,000 | 3540S-1-203 | .016 |
| 50,000 | 3540S-1-503 | .010 |
| 100,000 | 3540S-1-104 | .009 |

* The last three or four digits of the part number represent the resistance in standard code

BOURNS
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5122

# MODEL 3541

10-Turn, HYBRITRON™ Potentiometer
⅞″ Diameter, Bushing Mount

## FEATURES

- HYBRITRON™ conductive plastic-on-wirewound element
- Compact size: ⅞″ diameter, ¾″ depth
- Rotational life: 5,000,000 shaft revolutions
- Rugged, mechanically locked construction
- Linearity: 0.25%
- Temperature range: —55°C to +125°C
- Options available include: 2 section unit with common or concentric shafts and anti-rotation lug
- Temperature coefficient ±100 ppm

Bourns has combined the best features of both wirewound and conductive plastic resistance elements in a new composite we call HYBRITRON™.
The result is a precision potentiometer with exceptionally long life and infinite resolution . . . PLUS a low temperature coefficient and good stability. This hybrid element is used in Bourns new Model 3541 10-turn unit.

The 3541 employs Bourns exclusive SILVERWELD® direct, terminal-to-element bond for the ultimate in reliability.

## SPECIFICATIONS

**Electrical Characteristics**

Resistance Range . . . . 1K ohms t 100K ohm
Resistance Tolerance . . . . ±10%
Linearity (Independent)[1] . ±0.25%
Resolution . . . . . Essentially infinit
Effective Electrical Angle . . . 3600 (+10°/—0°
Output Smoothness . . . . . 0.015% maximun
Power Ratings:
70°C . . . . . 2.0 watt
125°C . . . . . 0 wat
Second Section
(-135 or -468) . . 1.5 watts at 70°C
Dielectric Strength . . . MIL-R-39023
Sea Level . . . . . 1000 volts AC minimum
Insulation Resistance
500 volts DC . . . . 1000 megohms minimum

**Environmental Characteristics**

Temperature
Range . . . . . —55° to +125°C
Temperature Coefficient . . . . ±100 ppm/°C maximum
Vibration . . . . . MIL-R-39023 15Gs
Wiper Bounce . . . 0.1 millisecond maximum
Shock . . . . . MIL-R-39023, 50Gs
Wiper Bounce . . . 0.1 millisecond maximum
Load Life . MIL-R-39023, 1000 hours
Resistance Shift . 5.0% maximum

**Mechanical and Physical Characteristics**

Mechanical Angle . . . . . 3600° (+10°/—0°)
Shaft Runout . . . . . .003 in. T.I.R.
Lateral Runout . . . . . .005 in. T.I.R.
Pilot Diameter Runout . .003 in. T.I.R.
Shaft End Play . . . . . .010 in. T.I.R.
Shaft Radial Play . . . . .003 in. T.I.R.
Rotational Life[1] . . . . 5,000,000 shaft revolutions
Stop Strength . . 75 oz.-in. minimum
Torque[2] . . . . . 0.5 oz.-in. maximum
Weight[2] . . . . . Approximately .80 oz.
Terminals . . . . . Solder lugs
Markings . Manufacturer's name and part number, resistance value and tolerance, linearity tolerance, wiring diagram, and date code.

**Notes:**

[1] From 1% to 99% VR output.

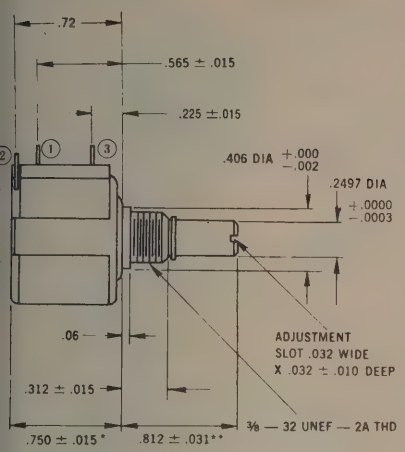
[2] Single Unit specification.

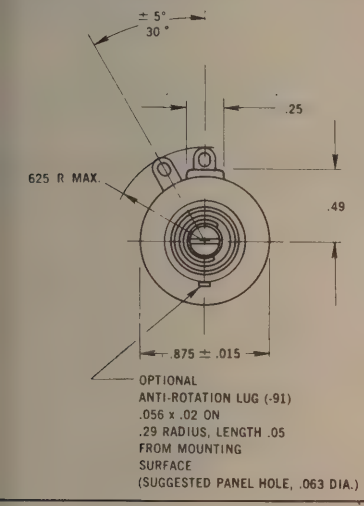
Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to change without notice.

BOURNS
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5122

## DIMENSIONS





± 5°
30°
.25
.625 R MAX.
.49
.875 ± .015
OPTIONAL ANTI-ROTATION LUG (-91) .056 x .02 ON .29 RADIUS, LENGTH .05 FROM MOUNTING SURFACE (SUGGESTED PANEL HOLE, .063 DIA.)

## STANDARD RESISTANCES

| Resistance (Ohms) | Part Number* |
|---|---|
| 1,000 | 3541S-1-102 |
| 2,000 | 3541S-1-202 |
| 5,000 | 3541S-1-502 |
| 10,000 | 3541S-1-103 |
| 20,000 | 3541S-1-203 |
| 50,000 | 3541S-1-503 |
| 100,000 | 3541S-1-104 |

* The last three or four digits of the part number represent the resistance in standard code

| **Common Modifications:** | **Order Part Number:** |
|---|---|
| Anti Rotation Lug | 3541S-91-RC |
| Two sections with common shaft | 3541S-1-135-RC/RC |
| Two sections with concentric shafts | 3541S-468-RC/RC |

BOURNS
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5122

## MODEL 3600

KNOBPOT® Potentiometer ¾" Diameter
10-Turn Bushing Mount
Wirewound Element

### FEATURES

- KNOBPOT® precision potentiometer and readout concept.* Potentiometer, knob, and readout dial in one package requiring less front panel space than most dials alone
- Readability, Repeatability, and Phasing. New clock face readout provides excellent readability and setting accuracy previously available only in larger diameter dials. (Repeatability, within 0.1% voltage ratio. Phasing of dial readout to potentiometer performed at factory within ±0.5%.)
- Mounting: Only two drill holes required. Simple installation — place unit in drilled panel and secure with locskwasher and nut
- Self-locking feature provides excellent stability during vibration and shock
- Customized Dial Face Capability — Special numeral and increment marking, special color combinations

### SPECIFICATIONS

**Electrical Characteristics**

Standard Resistance Range . 100 ohms to 250K ohms
Resistance Tolerance* ..... ±5%
Accuracy (correlation of dial reading to output) ..... ±0.5% voltage ratio
Repeatability of dial reading ..... 0.1% voltage ratio
Resolution ..... See standard resistance table
Effective Electrical Angle ... 3600° normal
Absolute Minimum Resistance* .... 1 ohm or 0.1%, whichever is greater
Noise During Adjustment* .... 100 ohms ENR maximum
Power Ratings:
25°C ..... 1.5 watts
85°C ..... 0 watt
Dielectric Strength .. MIL-STD-202
Room Conditions . 1000 volts AC
70,000 feet ..... 400 volts AC

**Environmental Characteristics**

Temperature Range ..... −65° to +85°C
Temperature Coefficient of Resistance Wire[1] ... 20 ppm/°C maximum
Humidity . MIL-STD-202, Method 103
Vibration ..... MIL-R-12934, 10Gs
Wiper Bounce ... 0.1 millisecond
Wiper Shift ..... 0.2% maximum
Shock ..... MIL-R-12934, 50Gs
Wiper Bounce and Wiper Shift . Same as Vibration
Load Life ..... 1000 hours
Resistance Shift . 2.0% maximum
Sand and Dust ..... MIL-E-5272
Salt Spray ..... MIL-R-12934
Fungus ..... MIL-E-5272

**Mechanical and Physical Characteristi**

Mechanical Angle ..... 360
(+20°/−0
Rotational Life[1] ..... 100,000 di
revolutio
Stop Strength ..... 20 in.-o
Torque, in.-oz. ..... 0.75 minimu
5.0 maximum (startin
5.0 maximum (runnin
Weight ..... 0.6 o
Marking* ... Manufacturer's nam
part number, resistance valu
and date coc

**Notes:**

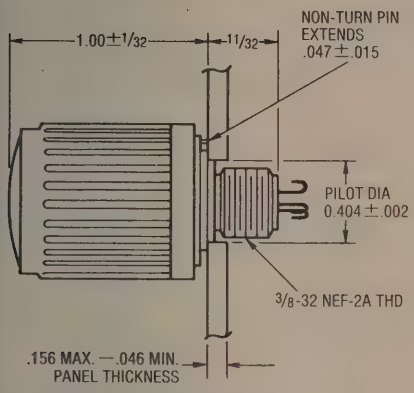
* Inspection Note: Applicable 100
or statistical sampling inspection
performed to insure highest qualit
[1] Consult manufacturer for comple
specification details for resistanc
below 1000 ohms and above 100K
ohms.

Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to chang
without notice.

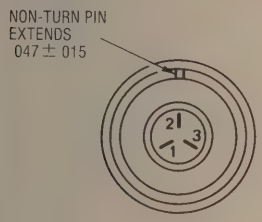
BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5122

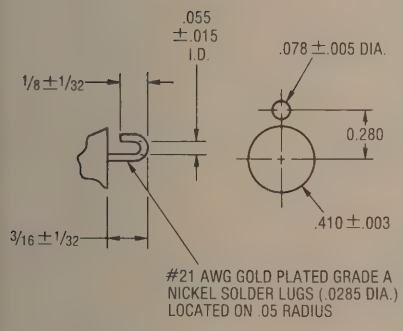
## DIMENSIONS




LOCKWASHER AND MOUNTING NUT
TO BE SUPPLIED WITH EACH UNIT

TOLERANCES: EXCEPT WHERE NOTED
DECIMALS: .XX±.010, .XXX±.005
FRACTIONS: ±1/64



## STANDARD RESISTANCES

| Resistance (Ohms) | Part Number* | Resolution (percent) |
|---|---|---|
| 100 | 3600S-1-101 | .046 |
| 200 | 3600S-1-201 | .043 |
| 500 | 3600S-1-501 | .037 |
| 1,000 | 3600S-1-102 | .035 |
| 2,000 | 3600S-1-202 | .029 |
| 5,000 | 3600S-1-502 | .029 |
| 10,000 | 3600S-1-103 | .025 |
| 20,000 | 3600S-1-203 | .023 |
| 50,000 | 3600S-1-503 | .015 |
| 100,000 | 3600S-1-104 | .011 |
| 250,000 | 3600S-1-254 | .008 |

* The last three digits of the part number represent the resistance in standard code.
Patent No. 3,069,646

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5122

## MODEL 3610

Digital KNOBPOT® Potentiometer
⅞" Diameter, 10-Turn,
Snap-in Mounting, Wirewound Element

### FEATURES

- Integral digital readout, knob and potentiometer
- The high accuracy of this model is enhanced by excellent visual readability. Numbers are as easy to read as those on much larger readout devices
- Saves space 2 ways: a small diameter of only ⅞", an extension behind the panel of less than ⅞"
- Guaranteed accuracy: a premounted, prephased assembly with maximum possible error between electrical output and dial reading specified at ±.5% for all resistances. This error is the combination of terminal base linearity and dial accuracy
- Simple to install: new snap-in mounting cup saves time and labor and provides a shock-resistant mounting
- Recessed lens offers protection from breakage, especially during installation
- Specials, such as custom knobs, readout faces, higher accuracies and a handy removal tool are readily available. Consult any Bourns sales office

### SPECIFICATIONS

**Electrical Characteristics**

Standard Resistance Range . 100 to 250,000 ohms
Resistance Tolerance ..... ±5%
Accuracy (correlation of dial reading to output) ..... ±0.5% voltage ratio
Repeatability of dial reading . 0.1% voltage ratio
Resolution ..... See standard resistance table
Effective Electrical Angle ... 3600° nominal
Absolute Minimum Resistance ..... 1 ohm or 0.1%, whichever is greater
Noise During Adjustment . 100 ohms ENR maximum
Power Ratings:
25°C ..... 1.5 watts
85°C ..... 0 watt
Dielectric Strength .. MIL-STD-202
Room Conditions .. 1000 volts AC
70,000 feet ..... 400 volts AC

**Environmental Characteristics**

Temperature Range ..... −25° to +85°C
Temperature Coefficient of Resistance Wire[1] .... 20 ppm/°C maximum
Humidity ..... MIL-STD-202, Method 103 B, Cond. B
Vibration ..... MIL-R-12934, 10Gs
Wiper Bounce ... 0.1 millisecond maximum
Wiper Shift ..... 0.2% maximum
Shock ..... MIL-R-12934, 50Gs
Wiper Bounce and Wiper Shift . Same as Vibration
Load Life ..... 1000 hours
Resistance Shift . 2.0% maximum

**Mechanical and Physical Characteristics**

Mechanical Angle ..... 3600° (+20°/−0°)
Rotational Life[1] ..... 50,000 dial revolutions
Stop Strength ..... 20 oz.-in.
Torque, oz.-in. ..... 1 minimum, 7 maximum (starting) 7 maximum (running)
Weight ..... 0.7 oz.
Marking .... Manufacturer's name, part number, resistance value and date code.

**Notes:**

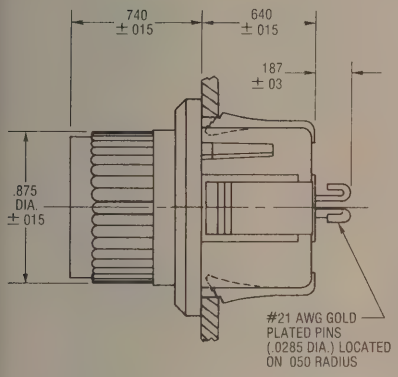
[1] Consult manufacturer for complete specification details, for resistance below 1000 ohms and above 100K ohms.

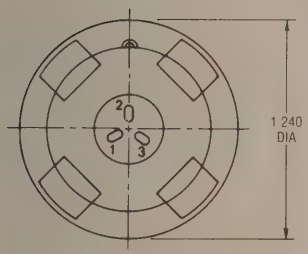
Specification Note: Closer performance tolerances can be supplied upon request.

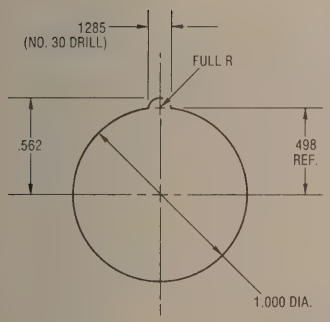
Specifications are subject to change without notice.

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5122

## DIMENSIONS



## STANDARD RESISTANCES

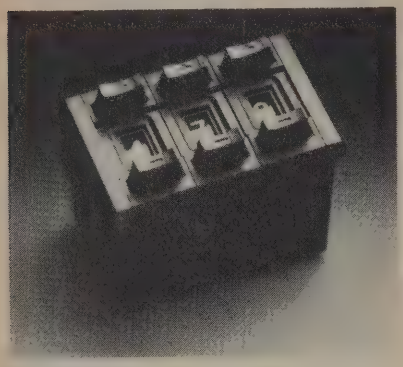
| Resistance (Ohms) | Part Number* | Resolution (percent) |
|---|---|---|
| 100 | 3610S-1-101 | .046 |
| 200 | 3610S-1-201 | .046 |
| 500 | 3610S-1-501 | .041 |
| 1,000 | 3610S-1-102 | .034 |
| 2,000 | 3610S-1-202 | .034 |
| 5,000 | 3610S-1-502 | .028 |
| 10,000 | 3610S-1-103 | .022 |
| 20,000 | 3610S-1-202 | .018 |
| 50,000 | 3610S-1-503 | .014 |
| 100,000 | 3610S-1-104 | .011 |
| 250,000 | 3610S-1-254 | .009 |

* The last three or four digits of the part number represent the resistance in standard code

BOURNS INC
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5122

## MODEL 3680

Digital Potentiometer Snap-in Mounting, Pushbutton Action, Cermet Elements.



### FEATURES

- 0% to 99% capability by 0.1% steps
- In-Line Digital readout
- Accuracy (Dial Reading to Output Ratio) ±0.5% full scale
- Convenient snap-in mounting with bezel
- Stable Bourns proprietary built-in Cermet Resistors
- Small panel space
- Rear solder lug terminals fit AMP series 110 receptacles (dual purpose solderable)
- 100 ppm/°C tempco
- 2 watts power rating
- 10 ohms-1 Megohm standard total resistance range
- Temperature range −25°C to +85°C
- Rectangular to match other panel components

### SPECIFICATIONS

**Electrical Characteristics**

Standard Resistance Range . . . 10 ohms to 1 megohm
Resistance Tolerance . . . . . ±1.0%
Absolute Minimum Resistance . 3 ohms or .2% of total resistance whichever is greater
Resolution . . 3681 =10%; 3682 = 1%; 3683 = .1%; 3684 = .01%; 3685 = .001%
Insulation Resistance @ 500 VDC . . . 1000 megohms min.
Power Ratings:
25°C . . . . . 2 watts
85°C . . . . . 0 watt
Dielectric Strength @ Sea Level . . . . . 1000 volts AC
Accuracy:
Dial Reading to Output Ratio . . . . . ±.5% full scale
Rheostat Mode . ±1% of indicated Tolerance
Repeatability of Dial Reading . . 0.1% of full scale

**Environmental Characteristics**

Temperature Range . . . . . −25° to +85°C
Vibration @ 10G Contact Bounce . 0.1 millisecond maximum
Wiper Shift . . . 0.2% voltage ratio
Shock @ 50G . . Same as Vibration
Load Life @ 1000 Hours Total Resistance Shift . . . ±2.0%
Temperature Coefficient . . . . . ±100ppm/°C

**Mechanical and Physical Characteristics**

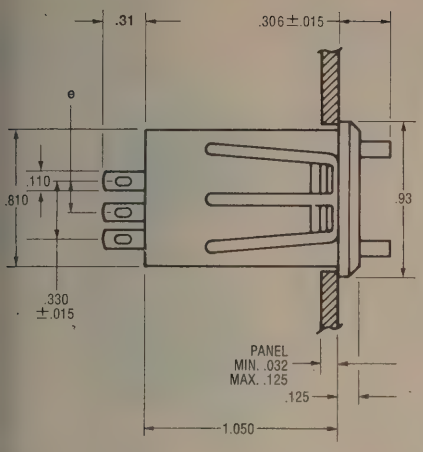
Expected Life . . . . . 100,000 button operations/decade
Weight . . . . . Approximately .78 oz
Terminals .11 wide x .016 thick . . . . Tinned solder lugs for 3 #20 AWG wires
Marking . . . . Manufacturer's name, wiring diagram, part number, resistance value, date code
Readout Marking . . . . . 10 positions

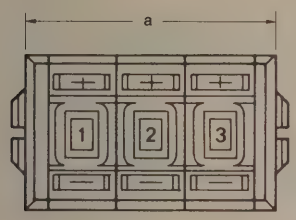
Specification Note: Closer performance tolerances can be supplied upon request.

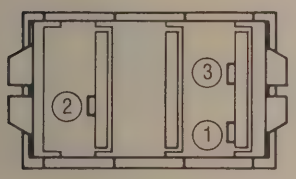
Specifications are subject to change without notice.

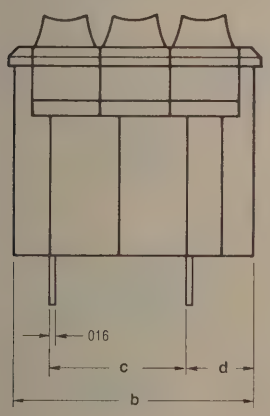
BOURNS
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5122

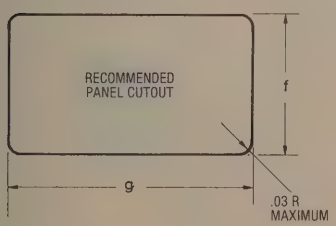
## DIMENSIONS

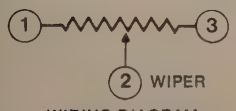



WIRING DIAGRAM

## STANDARD RESISTANCES
## TR VALUES

| Resistance (Ohms) | 3681 | 3682 | 3683 | 3684 | 3685 | Resistance (Ohms) | 3681 | 3682 | 3683 | 3684 | 3685 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | X | | | | | 5000 | X | X | X | | |
| 20 | X | | | | | 10K | X | X | X | X | |
| 50 | X | | | | | 20K | | X | X | X | |
| 100 | X | X | | | | 50K | | X | X | X | |
| 200 | X | X | | | | 100K | X | X | X | X | X |
| 500 | X | X | | | | 500K | | | X | X | X |
| 1000 | X | X | X | | | 1 Meg. | | X | X | X | X |
| 2000 | X | X | X | | | | | | | | |

If you're designing panels with precision data entry or setpoint controls, consider the BOURNS Model 3680 Digital Potentiometer . . . another innovative product from Bourns.

The 3680 integrates a precision incremental decade potentiometer with an easy-to-read digital display, AND a speedy pushbutton control action. It is handsome, accurate, and a "snap" to install.

Everything is INSIDE the Model 3680 . . . no resistors or mini-PC boards are required . . . nothing clutters the back of the unit to steal precious space.

## DECADE DIMENSION CHART

| Model | Dimensions a | b | c | d | Panel Cutout ±.015 e | ±.010 f | ±.010 g | Weight (approx.) oz | gms |
|---|---|---|---|---|---|---|---|---|---|
| 3681 | .650 | .590 | — | .39 | .165 | .830 | .620 | .336 | 9.53 |
| 3682 | 1.05 | .99 | .42 | .47 | .330 | .830 | 1.020 | .576 | 16.33 |
| 3683 | 1.46 | 1.39 | .73 | .47 | .165 | .830 | 1.420 | .824 | 23.36 |
| 3684 | 1.87 | 1.79 | 1.21 | .47 | .303 | .830 | 1.820 | 1.072 | 30.39 |
| 3685 | 2.270 | 2.19 | 1.540 | .47 | .165 | .830 | 2.220 | 1.320 | 37.42 |

NOTE: Tolerances except as shown: .XX ±.015
.XXX ±.005

BOURNS INC
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5122

## KNOBPOT® POTENTIOMETERS

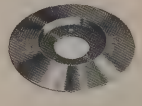
| Model | Resistance (Ohms) | Tolerance (%) | Dial Acc. % VR | Dial Repeatability % VR | Electrical Rotation | Mechanical Life (Rev.) | Watts Power at 25°C | Maximum Operating Temp. Range | Shock | Vibration | Length FMS | Length Overall |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3640 1 ¼" Dia., 10 Turn Digital Readout Wire-wound | 100Ω-500K | ±3% | ±0.1% to ±0.2% | ±0.05% | 3,600° Nominal | 100,000 | 2.5 | −65° to +85°C | 50Gs | 10Gs | 1½" | 2 3/32" |
| 3650 1 ¼" Dia., 10 Turn Digital Readout Wire-wound | 100Ω-100K | ±3% | ±0.1% to ±0.2% | ±0.05% | 3,600° Nominal | 100,000 | 2.5 | −25° to +85°C | 50Gs | 10Gs | 29/32" | 2 15/32" |

## ACCESSORIES FOR KNOBPOT® POTENTIOMETERS

H-361 (3610)
**Removal Tool**

H-97 (3640) H-103 (3600)
**Plastic Slip-Over Friction Brake**

H-93 (3600) H-99 (3640)
**Snap-On Color Rings***



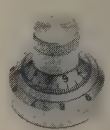
H-95 (3600) H-98 (3640)
**Stainless Steel Skirt**

H-105 (3640) H-107 (3600)
**Flat Face Recess Mounting Bracket**

H-106 (3640) H-108 (3600)
**Beveled Face Recess Mounting Bracket**

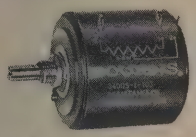
## TURNS-COUNTING DIALS

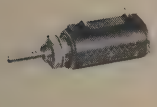
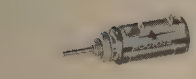
| | Part No. | Body Finish | Shaft Diameter (Inches) | Brake |
|---|---|---|---|---|
| H-400 SERIES **1" Diameter** | H-411 | Black | ¼ | No |
| | H-412 | Black | ¼ | Yes |
| | H-461 | Clear | ¼ | No |
| | H-462 | Clear | ¼ | Yes |
| | H-421 | Black | ⅛ | No |
| | H-422 | Black | ⅛ | Yes |
| | H-471 | Clear | ⅛ | No |
| | H-472 | Clear | ⅛ | Yes |
| H-490 SERIES **1" Diameter** | H-491-1 | Clear | 3/32 | No |
| | H-492-1 | Clear | 3/32 | Yes |
| | H-493-1 | Black | 3/32 | No |
| | H-494-1 | Black | 3/32 | Yes |
| | H-491-2 | Clear | ⅛ | No |
| | H-492-2 | Clear | ⅛ | Yes |
| | H-493-2 | Black | ⅛ | No |
| | H-494-2 | Black | ⅛ | Yes |
| | H-491-3 | Clear | ¼ | No |
| | H-492-3 | Clear | ¼ | Yes |
| | H-493-3 | Black | ¼ | No |
| | H-494-3 | Black | ¼ | Yes |
| H-510 SERIES **1⅜" Diameter** | H-510-1 | Clear | ⅛ | Yes |
| | H-510-2 | Clear | ¼ | Yes |

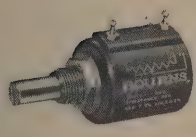


BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5122

## OTHER AVAILABLE PRECISION POTENTI-OMETERS





## WIREWOUND SPECIFICATIONS

| Model | Resistances | Resistance Tolerance | Linearity, Independent | Electrical and Mechanical Rotation | Mechanical Life[1] | Power | Maximum Temperature Range | Size (dia. x length) | Maximum Ganging | Shock | Vibration |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **3400** 1 13/16" Dia. 10 Turns | 100Ω-500K | ±3% | ±0.15% | 3600° (+4°/−0°) | 2,000,000 Rev. | 5W at 40°C | −65° to +105°C | 1 13/16" x 1¾" | 2 cups | 50Gs | 10Gs |
| **3509** ⅞" Dia. 10 Turns | 100Ω-100K | ±5% | ±0.25% | 3600° (+10°/−2°) | 20,000 Rev. | 2W at 25°C | −55° to +105°C | ⅞" x 1⅛" | NA | 50Gs | 10Gs |
| **3510** ⅞" Dia. 3 Turns | 50Ω-100K | ±3% | ±0.3% | 1080° (+10°/−0°) | 600,000 Rev. | 1W at 70°C | −65° to +125°C | ⅞" x 9/16" | 2 cups | 100Gs | 20Gs |
| **3520** ⅞" Dia. 5 Turns | 20Ω-75K | ±3% | ±0.3% | 1800° (+10°/−0°) | 1,000,000 Rev. | 1.5W at 70°C | −65° to +125°C | ⅞" x 11/16" | 2 cups | 100Gs | 20Gs |
| **3543** ⅞" Dia. 3 Turns | 20Ω-50K | ±5% | ±0.25% | 1080° (+10°/−0°) | 300,000 Rev. | 1W at 70°C | −55° to +125°C | ⅞" x ¾" | 2 cups | 50Gs | 15Gs |
| **3545** ⅞" Dia. 5 Turns | 50Ω-50K | ±5% | ±0.25% | 1800° (+10°/−0°) | 500,000 Rev. | 1:5W at 70°C | −55° to +125°C | ⅞" x ¾" | 2 cups | 50Gs | 15Gs |
| **3700** ½" Dia. 10 Turns | 100Ω-100K | ±5% | ±0.5% | 3600° (+50°/−0°) | 1,000,000 Rev. | 1W at 70°C | −65° to +125°C | ½" x 1" | NA | 100Gs | 20Gs |
| **3707** ½" Dia. 10 Turns | 100Ω-100K | ±5% | ±1.0% | 3600° (+10°/−0°) | 200,000 Rev. | 1W at 40°C | −55° to +105°C | ½" x 1" | NA | 50Gs | 10Gs |

## CONDUCTIVE PLASTIC SPECIFICATIONS



| Model | Resistances | Resistance Tolerance | Linearity, Independent | Electrical and Mechanical Rotation | Mechanical Life[1] | Power | Maximum Temperature Range | Size (dia. x length) | Maximum Ganging | Shock | Vibration |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **3501** ⅞" Dia. 10 Turns | 1K-500K 1, 2, 4 Meg | ±10% | ±0.5% | 3600° (+10°/−2°) | 4,000,000 Rev. Minimum | 2W at 70°C | −55° to +105°C | ⅞" 1" | 2 cups | 100Gs | 20Gs |

NOTES:

1 Consult manufacturer for complete specification details for resistance below 200 ohms and above 125K ohms.

BOURNS INC
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5122

## MODEL H-700

Turns Counting Dial
¾" Diameter, 10-Turn

### FEATURES

- Markings are machine engraved
- Cam detent for positive lock
- No extra panel drilling required
- Corrosion resistant, all-metal construction assures reliable performance in rugged environmental applications

The BOURNS® H-700 series vernier turns counting dials are precision machined of stainless steel and aluminum for accuracy, long life and superlative operating smoothness. These units have both the looks and feel of fine, high quality instruments.

A positive action transfer mechanism assures perfect indexing of the secondary scale. Transfer points are quiet and accurate.

### SPECIFICATIONS

**Mechanical and Physical Characteristics**

Number of Turns ..... 10
Dial Divisions ..... 50
Readability — Ten Turns .... 1 part in 500
Torque—Running, While Mounted ... 2.0 oz.-in. maximum
Markings ... H-721 White On Black Background
H-771 Black On Aluminum Background
Set Screw Tightening Torque .... 20 in. lbs. maximum

**Environmental Characteristics**

Operating Temperature Range ..... −15° to +85°C
Mechanical Life ..... 10,000 cycles
Humidity-No Damage .. 96 hours @ 95% RH

**Shaft and Bushing Requirements**

Shaft Extension Beyond Panel .... .600 minimum .800 maximum
Bushing Extension Beyond Panel .... .225 maximum (Including Shaft C Ring where applicable)

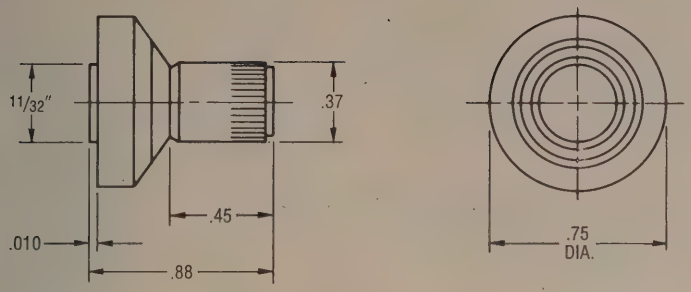
Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to change without notice.

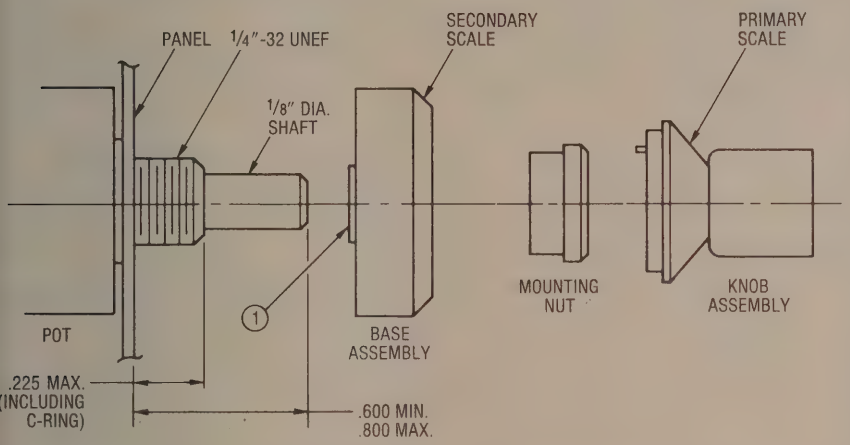
| Part No. | Body Finish | Brake | Shaft Dia. |
|---|---|---|---|
| H-721 | BLACK | NO | ⅛" |
| H-771 | CLEAR | NO | ⅛" |

BOURNS
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5122

## DIMENSIONS




Note: Dials also available on special order for 3/32" dia. shafts. They may be ordered in black or clear finish. Consult factory for details.




## MOUNTING REQUIREMENTS

Drill a hole in the panel to accommodate the potentiometer; nothing special is required for the dial. The unthreaded portion of the potentiometer bushing must not project through the panel. The shaft length, measured from the face of the panel, should be a minimum of .600 and a maximum of .800. The .600 dimension is an absolute minimum and in some cases optimum performance is not obtained.

[1] Notice that there is a short, 11/32" diameter, projection at the rear of the dial. This is required to hold the dial away from the panel to permit the turns-counting scale to turn freely. This dial will not function properly if this projection can fall through the panel. Suggested panel hole diameter is .281.

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5122

## MODEL H-1400

Turns Counting Dial
1″ Diameter, 10-Turn

### FEATURES

- Molded and filled markings
- Cam detent for positive lock
- No extra panel drilling required
- Corrosion resistant, plastic and metal construction
- Smooth, reliable performance in most severe environmental conditions
- Low cost

The BOURNS® H-1400 series of analog turns counting dials are precision engineered and manufactured of plastic and metal construction for best balance of quality/cost. The resultant product delivers exceptional smoothness, accuracy and long life at very low cost.

A positive action transfer mechanism assures perfect indexing of the secondary scale. Transfer points are quiet and accurate.

### STANDARD STYLES

| Part No. | Body Finish | Brake | Shaft Dia. |
|---|---|---|---|
| H-1411 | BLACK | NO | ¼″ |
| H-1412 | BLACK | YES | ¼″ |
| H-1461 | GRAY | NO | ¼″ |
| H-1462 | GRAY | YES | ¼″ |
| H-1421 | BLACK | NO | ⅛″ |
| H-1422 | BLACK | YES | ⅛″ |
| H-1471 | GRAY | NO | ⅛″ |
| H-1472 | GRAY | YES | ⅛″ |

### SPECIFICATIONS

**Mechanical and Physical Characteristics**

Number of Turns . . . . . 10
Dial Divisions . . . . . 50
Readability — Ten Turns . . . 2 parts in 1000
Torque—Running, While Mounted . . . 2.0 oz.-in. maximum
—With Brake Engaged . 5.0 oz.-in. minimum
Markings . . (H-1411, H-1412, H-1421 & H-1422) White on Black Background
(H-1461, H-1462, H-1471 & H-1472) Black on Gray Background
Set Screw Tightening Torque . . . . 20 in. lbs. maximum

**Environmental Characteristics**

Operating Temperature Range . . . . . −15° to +70°C
Mechanical Life . . . . 10,000 cycles
Humidity—No Damage . 96 hours @ 95% RH

**Shaft and Bushing Requirements**

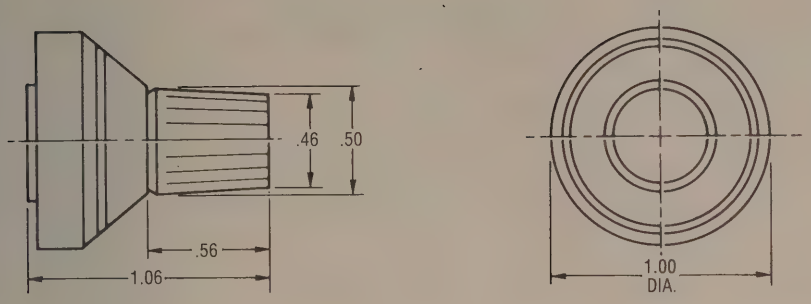
Shaft Extension Beyond Panel . . . . .675 minimum
.875 maximum
Bushing Extension Beyond Panel . . . . .297 maximum
(Including Shaft C Ring where applicable)

Specification Note: Closer performance tolerances can be supplied upon request.

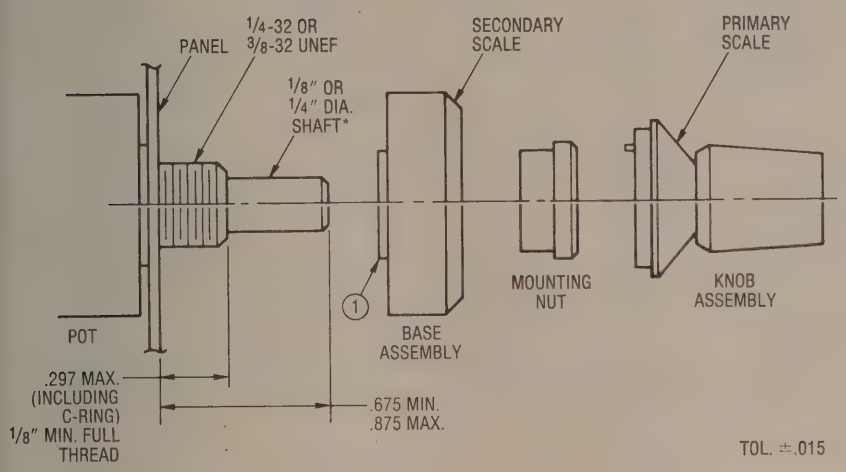
Specifications are subject to change without notice.

BOURNS
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5122

## DIMENSIONS




* Note: Dials also available on special order for 3/32" dia. shafts. They may be ordered in black or gray finish, with or without a brake. Consult factory for details.




## MOUNTING REQUIREMENTS

Drill a hole in the panel to accommodate the potentiometer; nothing special is required for the dial. The unthreaded portion of the potentiometer bushing must not project through the panel. The shaft length, measured from the face of the panel, should be a minimum of .600 and a maximum of 1.000. The .600 dimension is an absolute minimum and in some cases optimum performance is not obtained.

[1] Notice that there is a short, one half inch diameter, projection at the rear of the dial. This is required to hold the dial away from the panel to permit the turns-counting scale to turn freely. This dial will not function properly if this projection is recessed in the panel. Suggested panel hole diameter is 0.406 for 3/8" dia. bushings, and .281" diameter for 1/4" bushings.

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5122

# HIGH PRECISION POTENTIOMETERS

## CUSTOM PRECISION POTENTIOMETERS

BOURNS also produces a wide variety of precision potentiometers for exacting applications in industrial and military markets. These models are specifically designed for extensive custom modifications to fit a broad range of unique applications. They include:

1 B-LINE™ single-turn precision potentiometers with aluminum housing. Potentiometers in this series are in diameters of 7/8", 1 1/16" and 2", bushing or servo mount. Wirewound, and conductive plastic elements are available in each size — 12 standard models in all.

2 Single-turn precision potentiometers with plastic housing.

3 Servo-mount multi-turn potentiometers.

4 Non-linear function potentiometers, available in most models.

## SELECTION GUIDE

### HIGH PERFORMANCE PRECISION POTENTIOMETERS

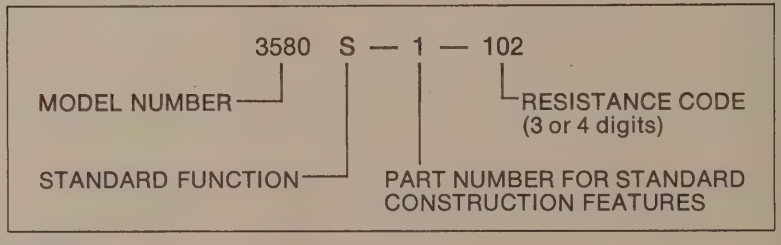
(suitable for special modification to meet exacting customer requirements)

| Number of Turns | Diameter | Wirewound Model No. | | Non-Wirewound Model No. | |
|---|---|---|---|---|---|
| | | Servo | Bushing | Conductive Plastic Servo | Conductive Plastic Bushing |
| 1 | 7/8" | 3580 (1)<br>3585 (1)<br>6530 | 3530 (1)<br>3535 (1)<br>6630 | 6534<br>6538 | 6634<br>6638 |
| 1 | 1 1/16" | 3485 (1)<br>6540 | 3435 (1)<br>6640 | 6544 | 6644 |
| 1 | 2" | 3465 (1)<br>6570 | 3415 (1)<br>6670 | 6574 | 6674 |
| 1 | 3" | 3495 | 3445 | | |
| 3 | 7/8" | 3560 | 3560S-93 | 3561 | 3561S-93 |
| 5 | 7/8" | 3570 | 3570S-93 | 3571 | 3571S-93 |
| 10 | 1/2"<br>7/8"<br>2" | 3750<br>3550<br>3450 | 3550S-93<br>3450S-93 | 3751<br>3551<br>3451 | 3551S-93<br>3451S-93 |

(1) QPL PER MIL-R-12934

See Detailed Specifications on following page

## PART NUMBERING SYSTEM




NOTE:

For precision modular potentiometer applications, refer to Model 83/84 specifications on pages 3832.

BOURNS INC

TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5200

# HIGH PRECISION POTENTIOMETERS

## SPECIAL FEATURES AVAILABLE

Other specifications and/or tighter tolerances available on request.

| Model Type | Single-Turn Wirewound | | | | Single-Turn Film | | | Multiturn Wirewound | | | | | Multiturn Film | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 10-turn | 3-turn | 5-turn | 10-turn | 10-turn | 10-turn | 3-turn | 5-turn | 10-turn | 10-turn |
| **Diameter** | ⅞″ | 1 1/16″ | 2″ | 3″ | ⅞″ | 1 1/16″ | 2″ | ½″ | ⅞″ | ⅞″ | ⅞″ | 2″ | ½″ | ⅞″ | ⅞″ | ⅞″ | 2″ |
| **TR Tolerance** | | | | | | | | | | | | | | | | | |
| ±1% | X | X | X | X | | | | X | X | X | X | X | | | | | |
| ±2% | X | X | X | X | | | | X | X | X | X | X | | | | | |
| ±5% | X | X | X | X | X | X | X | X | X | X | X | X | | X | X | X | X |
| **Linearity** | | | | | | | | | | | | | | | | | |
| ±0.1% | | | X | X | | | X | | | X | X | X | | | | | |
| ±0.2% | X | X | X | X | | X | X | X | X | X | X | X | | | | | |
| ±0.25% | X | X | X | X | X | X | X | X | X | X | X | X | | | | X | X |
| **Taps** | | | | | | | | | | | | | | | | | |
| Max. No. | AS REQUIRED | | | | | | | | | | | | | | | | |
| Std. Tol. ± | 2° | 2° | 1° | 1° | 1% VR | 1% VR | 1% VR | 2° | 2° | 2° | 2° | 1° | 5° | 3° | 3° | 3° | 2° |
| **Additional Cups** | AS REQUIRED | | | | | | | | | | | | | | | | |
| **Special Shafts** | | | | | | | | | | | | | | | | | |
| Front Ext. | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Rear Shaft | X | X | X | X | X | X | X | | X | X | X | X | | X | X | X | X |
| Screwdriver Slot | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Shaft Flats | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Stepped Shaft | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Splined Shaft | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| **Special Lids** | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| **Mechanical Stops** | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| **Anti-Rotation Pin** | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| **High Torque** | | | | | | | | | | | | | | | | | |
| 2-10 oz.-in. | X | X | X | X | X | X | X | | X | X | X | X | | X | X | X | X |
| **Mil Spec Runouts** | X | X | X | X | X | X | X | | X | X | X | X | | X | X | X | X |

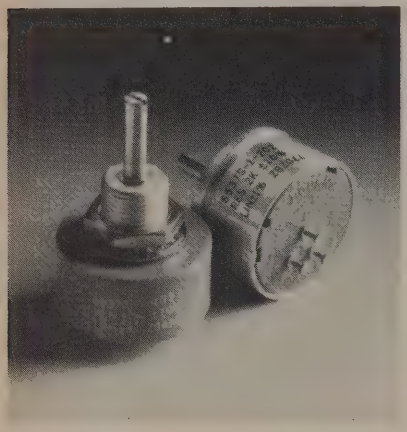
BOURNS INC

TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5200

## MODEL 6537
**SERVO MOUNT**

## MODEL 6637
**BUSHING MOUNT**

⅞" Diameter, Single-Turn Potentiometer
Conductive Plastic Element



### FEATURES

- Infinite resolution element
- Standard linearity: 1.0%; special linearities available
- Extended temperature range: −65°C to +125°C
- Output smoothness: 0.1% standard
- Custom design capability available
- Molded-in rear terminals
- Precious metal contact
- Fire retardant high temperature thermoset plastic housing (bushing)

### SPECIFICATIONS

**Electrical Characteristics**

Resistance Range ..... 1K ohm to 100K ohm
Resistance Tolerance ..... ±10%
Linearity (Independent)
Standard ..... ±1%
Resolution ..... Essentially Infinite
Effective Electrical Angle .... 340° ±3°
End Voltage ..... 0.5% maximum
Output Smoothness ..... 0.1%
Power Rating:
70°C ..... 1 watt
125°C ..... 0 watt
Dielectric Strength —
Sea Level .... 750 VAC minimum
Insulation Resistance,
500 VDC . 500 megohms minimum

**Environmental Characteristics**

Operating Temperature Range ..... −65° to +125°C
Vibration (Contact Bounce 0.1 millisecond maximum) . 15Gs
Shock (Contact Bounce 0.1 millisecond maximum) . 50Gs

**Mechanical and Physical Characteristics**

Mechanical Angle .... Continuous
Backlash ..... 0.1° maximum
Shaft Runout ..... 0.005 T.I.R.
Shaft End Play ..... 0.005 T.I.R.
Shaft Radial Play ..... 0.005 T.I.R.
Pilot Diameter Runout (Servo) ..... 0.0025 T.I.R.
Lateral Runout (Servo) . 0.003 T.I.R.
Rotational Life .... 10,000,000 shaft revolutions
Torque (Starting and Running) . 0.50 oz.-in. maximum
Terminals . Rear terminals turret type

Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to change without notice.

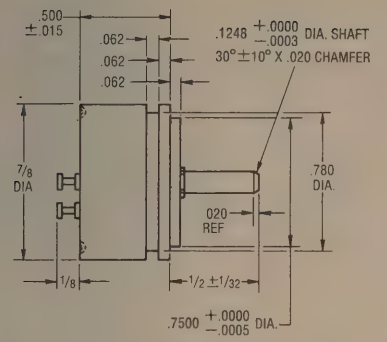
### STANDARD RESISTANCES

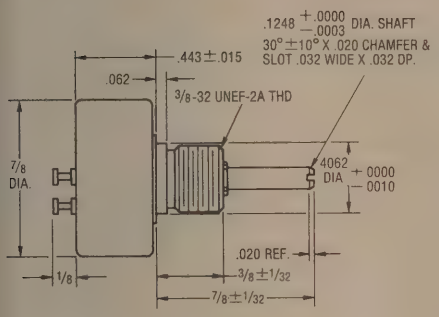
| Resistance (Ohms) | Servo Mount | Bushing Mount |
|---|---|---|
| 1K | 6537S-1-102 | 6637S-1-102 |
| 2K | 6537S-1-202 | 6637S-1-202 |
| 5K | 6537S-1-502 | 6637S-1-502 |
| 10K | 6537S-1-103 | 6637S-1-103 |
| 20K | 6537S-1-203 | 6637S-1-203 |
| 50K | 6537S-1-503 | 6637S-1-503 |
| 100K | 6537S-1-104 | 6637S-1-104 |

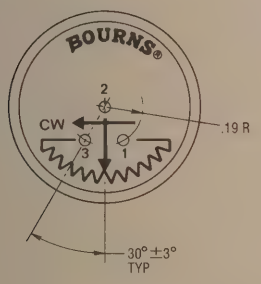
* The last three digits of the part number represent the resistance in standard code.

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5200

## DIMENSIONS



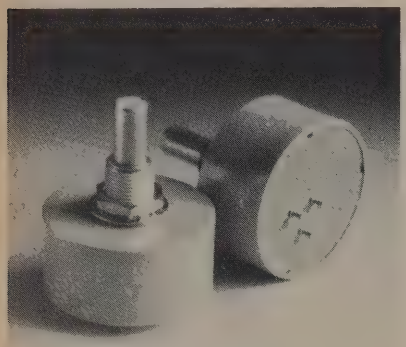

## OPTIONAL SPECIAL FEATURES

- Front shaft extensions
- Shaft flats, slots, grooves and special shaft diameter
- Special servo or bushing lids
- Sleeve bearings or ball bearing (servo)
- Mechanical stops
- High torque
- Low torque
- Anti-rotation pin
- Special electrical angles
- Special linearity tolerances
- Special resistances
- Special resistance tolerances
- Center tap
- Voltage or resistance shorts

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5200

## MODEL 6657
**BUSHING MOUNT**

1⅝" Diameter, Single-Turn Potentiometer
Conductive Plastic Element



### FEATURES

- Infinite resolution element
- Standard linearity: 1.0%; special linearities available
- Extended temperature range: −65°C to +125°C
- Output smoothness: 0.1% standard
- Custom design capability available
- Molded-in rear terminals

### SPECIFICATIONS

**Electrical Characteristics**

Resistance Range ..... 1K ohm to 100K ohm
Resistance Tolerance ..... ±10%
Linearity (Independent)
Standard ..... ±1%
Resolution ..... Essentially Infinite
Effective Electrical Angle .... 340° ±3°
End Voltage ..... 0.5% maximum
Output Smoothness ..... 0.1%
Power Rating:
70°C ..... 1.5 watts
125°C ..... 0 watt
Dielectric Strength —
Sea Level .... 750 VAC minimum
Insulation Resistance,
500 VDC ..... 1000 megohm minimum

**Environmental Characteristics**

Operating Temperature Range ..... −65° to +125°C
Vibration (Contact Bounce 0.1 millisecond maximum) . 15Gs
Shock (Contact Bounce 0.1 millisecond maximum) . 50Gs

**Mechanical and Physical Characteristics**

Mechanical Angle .... Continuous
Backlash ..... 0.1° maximum
Shaft Runout ..... 0.001 T.I.R.
Shaft End Play ..... 0.005 T.I.R.
Shaft Radial Play ..... 0.003 T.I.R.
Rotational Life .... 10,000,000 shaft revolutions
Torque (Starting and Running) .. 0.50 oz.-in. maximum
Terminals . Rear terminals turret type

Specification Note: Closer performance tolerances can be supplied upon request.

Specifications are subject to change without notice.

### STANDARD RESISTANCES

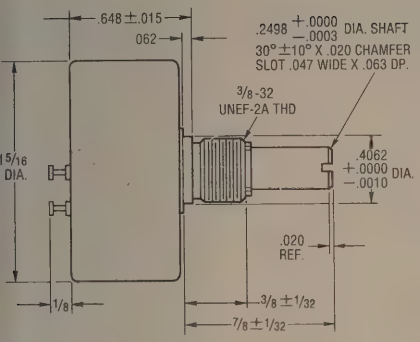
| Resistance (Ohms) | Part Number* Bushing Mount |
|---|---|
| 1K | 6657S-1-102 |
| 2K | 6657S-1-202 |
| 5K | 6657S-1-502 |
| 10K | 6657S-1-103 |
| 20K | 6657S-1-203 |
| 50K | 6657S-1-503 |
| 100K | 6657S-1-104 |

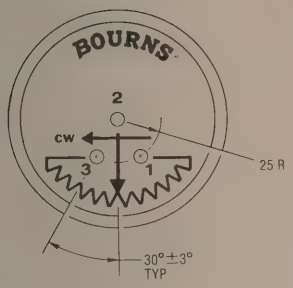
* The last three digits of the part number represent the resistance in standard code.

BOURNS INC

TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5122

## DIMENSIONS




## OPTIONAL SPECIAL FEATURES

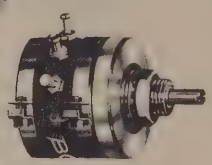
- Front and rear shaft extensions
- Shaft flats, slots, grooves and special shaft diameter
- Special bushing lids
- Mechanical stops
- High torque
- Low torque
- Anti-rotation pin
- Special electrical angles
- Special linearity tolerances
- Special resistances
- Special resistance tolerances
- Center tap (within linearity tolerance)
- Voltage or resistance shorts
- Nonlinear functions

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5122

## WIREWOUND HIGH PRECISION POTENTIOMETERS

3580

3530


3535

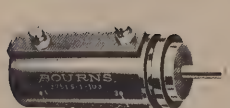
3465

⅔ ACTUAL SIZE

3495

6530
6534

6670
6674



3750
3751

3550
3551

BOURNS INC

TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5200

### SINGLE-TURN

| Model Number | Description Type of Mount | Nominal Diameter | Housing Length FMS | Bushing Dimension | Nom. Shaft Dia. x Length FMS | Length Added Each Extra Cup |
|---|---|---|---|---|---|---|
| 3580 | SERVO | ⅞″ | .606 | N/A | ⅛″ x ½″ | N/A |
| 3530 | BUSHING | ⅞″ | .487 | ⅜-32 | ⅛″ x ½″ | N/A |
| 3585 | SERVO | ⅞″ | .681 | N/A | ⅛″ x ½″ | .405 |
| 3535 | BUSHING | ⅞″ | .681 | ⅜-32 | ⅛″ x ½″ | .405 |
| 3485 | SERVO | 1 1/16″ | .681 | N/A | ⅛″ x ⅞″ | .405 |
| 3435 | BUSHING | 1 1/16″ | .681 | ½-32 | ⅛″ x ⅞″ | .405 |
| 3465 | SERVO | 2″ | .826 | N/A | ¼″ x ⅝″ | .500 |
| 3415 | BUSHING | 2″ | .846 | ⅜-32 | ¼″ x ⅞″ | .500 |
| 3495 | SERVO | 3″ | .826 | N/A | ¼″ x ⅝″ | .500 |
| 3445 | BUSHING | 3″ | .846 | ⅜-32 | ¼″ x ⅞″ | .500 |
| 6530 | SERVO | ⅞″ | .475 | N/A | ⅛″ x ½″ | .200 |
| 6630 | BUSHING | ⅞″ | .475 | ⅜-32 | ⅛″ x ½″ | .200 |
| 6540 | SERVO | 1 1/16″ | .475 | N/A | ⅛″ x ½″ | .200 |
| 6640 | BUSHING | 1 1/16″ | .475 | ⅜-32 | ⅛″ x 13/16″ | .200 |
| 6570 | SERVO | 2″ | .600 | N/A | ¼″ x ⅝″ | .200 |
| 6670 | BUSHING | 2″ | .600 | ⅜-32 | ¼″ x ⅞″ | .200 |

### MULTITURN

| | | | | | | |
|---|---|---|---|---|---|---|
| 3750 | SERVO | ½″ | 1.188 | N/A | 3/32″ x ⅜″ | N/A |
| 3550 | SERVO | ⅞″ | 1.580 | * | ⅛″ x ⅜″ | 1.23 |
| 3570 | SERVO | ⅞″ | 1.188 | * | ⅛″ x ⅜″ | .868 |
| 3560 | SERVO | ⅞″ | 1.047 | * | ⅛″ x ⅜″ | .725 |
| 3450 | SERVO | 2″ | 2.25 | * | ¼″ x ⅝″ | 1.75 |

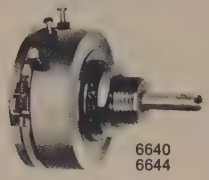
Note: Illustrations used above may apply to wirewound or non-wirewound models since they are often identical in outside appearance. The numbers beside them indicate the models that are applicable.

| Standard Resistance Range Ω | Resistance Tol. (%) | Independent Linearity (%) | Electrical Rotation (°)† | Mechanical Life in Shaft Rev. | Power in Watts at 70°C | Maximum Oper. Temp. Range | Prices 1-4 | Prices 25-49 | Model Number |
|---|---|---|---|---|---|---|---|---|---|
| 25-20K | ±3.0 | ±0.5 | 350 ±2 | 2,000,000 | 1.0 | −65° +125°C | $37.00 | $30.40 | 3580 |
| 25-20K | ±3.0 | ±0.5 | 350 ±2 | 1,000,000 | 1.0 | −65° +125°C | 35.20 | 28.80 | 3530 |
| 25-20K | ±3.0 | ±0.5 | 350 ±2 | 2,000,000 | 1.0 | −65° +125°C | 31.90 | 25.50 | 3585 |
| 25-20K | ±3.0 | ±0.5 | 350 ±2 | 2,000,000 | 1.0 | −65° +125°C | 26.00 | 23.70 | 3535 |
| 50-25K | ±3.0 | ±0.5 | 350 ±2 | 2,000,000 | 1.5 | −65° +125°C | 31.60 | 26.10 | 3485 |
| 50-25K | ±3.0 | ±0.5 | 350 ±2 | 2,000,000 | 1.5 | −65° +125°C | 30.70 | 25.10 | 3435 |
| 50-100K | ±3.0 | ±0.3 | 350 ±2 | 1,000,000 | 4.0 | −65° +125°C | 33.70 | 30.60 | 3465 |
| 50-100K | ±3.0 | ±0.3 | 350 ±2 | 1,000,000 | 4.0 | −65° +125°C | 32.30 | 29.20 | 3415 |
| 100-200K | ±3.0 | ±0.25 | 350 ±2 | 1,000,000 | 6.0 | −65° +125°C | 50.75 | 46.20 | 3495 |
| 100-200K | ±3.0 | ±0.25 | 350 ±2 | 1,000,000 | 6.0 | −65° +125°C | 50.75 | 46.20 | 3445 |
| 10-20K | ±3.0 | ±0.5 | 350 ±2 | 2,000,000 | 1.0 | −65° +150°C | 39.00 | 32.35 | 6530 |
| 10-20K | ±3.0 | ±0.5 | 350 ±2 | 2,000,000 | 1.0 | −65° +150°C | 39.00 | 32.35 | 6630 |
| 20-25K | ±3.0 | ±0.5 | 350 ±2 | 2,000,000 | 1.5 | −65° +150°C | 39.00 | 32.35 | 6540 |
| 20-25K | ±3.0 | ±0.5 | 350 ±2 | 2,000,000 | 1.5 | −65° +150°C | 39.00 | 32.35 | 6640 |
| 50-100K | ±3.0 | ±0.3 | 350 ±2 | 2,000,000 | 4.0 | −65° +150°C | 39.00 | 32.35 | 6570 |
| 50-100K | ±3.0 | ±0.3 | 350 ±2 | 2,000,000 | 4.0 | −65° +150°C | 39.00 | 32.35 | 6670 |
| 50-100K | ±5.0 | ±0.5 | 3600 +20 −0 | 1,000,000 | 1.0 | −65° +125°C | 38.95 | 31.00 | 3750 |
| 50-200K | ±3.0 | ±0.2 | 3600 +10 −0 | 2,000,000 | 2.5 | −65° +125°C | 34.40 | 30.55 | 3550 |
| 25-100K | ±3.0 | ±0.25 | 1800 +10 −0 | 1,000,000 | 2.0 | −65° +125°C | 34.40 | 30.55 | 3570 |
| 25-100K | ±3.0 | ±0.25 | 1080 +10 −0 | 600,000 | 1.5 | −65° +125°C | 34.40 | 30.55 | 3560 |
| 1K-500K | ±3.0 | ±0.15 | 3600 +3 −0 | 2,000,000 | 5.0 | −65° +125°C | 51.40 | 47.20 | 3450 |

* Bushing Mount available.
† All single turn models are continuous rotation. Mechanical stops available on request. Mechanical rotation on multiturn models is same as electrical rotation except for model 3450 which is 3600° +10/−0.

BOURNS
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5200

# NON-WIREWOUND HIGH PRECISION POTENTIOMETERS



6640
6644

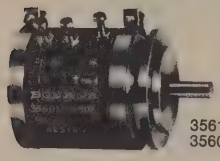
6540
6544

½ ACTUAL SIZE

6570
6574

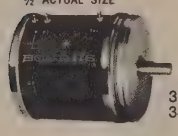
6630
6634

3571
3570



3561
3560

½ ACTUAL SIZE



3451
3450

## SINGLE-TURN

| Model Number | Description: Type of Mount | Description: Type of Element | Nominal Diameter | Housing Length FMS | Bushing Dimension | Nom. Shaft Dia. x Length FMS | Length Added Each Extra Cup |
|---|---|---|---|---|---|---|---|
| 6534 | SERVO | CONDUCTIVE PLASTIC | ⅞″ | .475 | N/A | ⅛″ x ½″ | .200 |
| 6634 | BUSHING | | ⅞″ | .475 | ⅜-32 | ⅛″ x ½″ | .200 |
| 6544 | SERVO | | 1 1/16″ | .475 | N/A | ⅛″ x ½″ | .200 |
| 6644 | BUSHING | | 1 1/16″ | .475 | ⅜-32 | ⅛″ x 13/16″ | .200 |
| 6574 | SERVO | | 2″ | .600 | N/A | ¼″ x ⅝″ | .200 |
| 6674 | BUSHING | | 2″ | .600 | ⅜-32 | ¼″ x ⅞″ | .200 |

## MULTITURN

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3751 | SERVO | CONDUCTIVE PLASTIC | ½″ | 1.188 | N/A | 3/32″ x ⅜″ | N/A |
| 3551 | SERVO | | ⅞″ | 1.580 | * | ⅛″ x ⅜″ | 1.23 |
| 3571 | SERVO | | ⅞″ | 1.188 | * | ⅛″ x ⅜″ | .868 |
| 3561 | SERVO | | ⅞″ | 1.047 | * | ⅛″ x ⅜″ | .725 |
| 3451 | SERVO | | 2″ | 2.25 | * | ¼″ x ⅝″ | 1.75 |

Note: Illustrations used above may apply to wirewound or non-wirewound models since they are often identical in outside appearance. The numbers beside them indicate the models that are applicable.

* Bushing Mount available.

BOURNS INC

TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5200

| Standard Resistance Range Ω | Resistance Tol. (%) | Independent Linearity (%) | Electrical Rotation (°)† | Mechanical Life in Shaft Rev. | Power in Watts at 70°C | Maximum Oper. Temp. Range | Prices 1-4 | Prices 25-49 | Model Number |
|---|---|---|---|---|---|---|---|---|---|
| 1K-100K | ±10 | ±0.5 | 320 ±3 | 25,000,000 | 1.0 | −65° +125°C | 43.10 | 36.60 | 6534 |
| 1K-100K | ±10 | ±0.5 | 320 ±3 | 25,000,000 | 1.0 | −65° +125°C | 43.10 | 36.60 | 6634 |
| 1K-100K | ±10 | ±0.5 | 340 ±3 | 25,000,000 | 1.25 | −65° +125°C | 43.10 | 36.60 | 6544 |
| 1K-100K | ±10 | ±0.5 | 340 ±3 | 25,000,000 | 1.25 | −65° +125°C | 43.10 | 36.60 | 6644 |
| 1K-100K | ±10 | ±0.25 | 350 ±2 | 25,000,000 | 2.0 | −65° +125°C | 44.55 | 37.85 | 6574 |
| 1K-100K | ±10 | ±0.25 | 350 ±2 | 25,000,000 | 2.0 | −65° +125°C | 44.55 | 37.85 | 6674 |
| 1K-500K | ±10 | ±0.5 | 3600 +20 −2 | 10,000,000 | 1.0 | −55° +105°C | 51.35 | 42.00 | 3751 |
| 1K-1 Meg | ±10 | ±0.5 | 3600 +10 −0 | 10,000,000 | 2.0 | −55° +105°C | 48.65 | 39.80 | 3551 |
| 500-500K | ±10 | ±0.5 | 1800 +10 −2 | 5,000,000 | 1.5 | −55° +105°C | 48.65 | 39.80 | 3571 |
| 500-200K | ±10 | ±0.5 | 1080 +10 −2 | 3,000,000 | 1.0 | −55° +105°C | 48.65 | 39.80 | 3561 |
| 2K-1 Meg | ±10 | ±0.5 | 3600 +5 −0 | 10,000,000 | 5.0 | −55° +105°C | 96.20 | 78.70 | 3451 |

† All single turn models are continuous rotation. Mechanical stops available on request. Mechanical rotation on multiturn models is same as electrical rotation except for model 3571, 3561, and 3451 which are 1800° +10/−0, 1080° +10/−0 and 3600° +10/−0 respectively.

BOURNS INC.
TRIMPOT PRODUCTS DIVISION
DEPT. EM 1200 COLUMBIA AVENUE
RIVERSIDE, CALIFORNIA 92507
PHONE (714) 781-5200

**Bowmar**
BOWMAR/TIC, Inc.
Dept. EM, 850 Lawrence Drive
Newbury Park, California 91320
Phone: (805) 498-2161/TWX 910-336-1265

# PRECISION POTENTIOMETERS

## SINGLE TURN WIREWOUND

SERVO POT (PVR11)

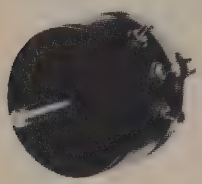
ROTARY TRIMMER (RV 1/2)

PANEL CONTROL (TP09)

MEETS MIL-R-12934 MEETS MIL-R-19

**Precision Servo Pots**
**Size:** 05, 09, 11, 15, 18, 20 & 30
**Standard Resistance Ranges:** 200 ohms to 250 K ohms
**Wattage Ratings:** 1, 1.5, 2, 3, and 4 watts (approx. 1 watt per inch of diameter)
**Rt TOL:** ±5% standard, ±1% special
**Linearity:** to ±0.25%

## SINGLE TURN CONDUCTIVE PLASTIC



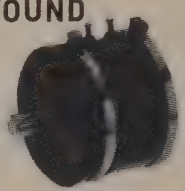
**Conductive Plastic Pots®**
**Size:** 09, 11, 15, 18, 20 & 30
**Rt TOL:** 10% standard, 4% special
**Life:** 50,000,000 revolutions
Taps located within ±2°, ±1° optional

**ALL MEET OR EXCEED MIL-R-39023**

Linear or special functions
Multiple ganging with independent phasing
**Standard Resistance Ranges:** 500 ohms to 250 K ohms
**Power Rating:** 1.0 watt to 2.5 watts @ 70°C
**Linearity:** ±0.5% to 0.03%
Res. Temp. Coefficient: 300 ppm/°C max.

## MULTI-TURN WIRE WOUND

09 Series
3, 5, 10 & 20 Turn



18 Series
3, 5, &10 Turn

20 Series
3, 5, & 10 Turn

**Sizes:** 09, 18, 20, —3, 5, 10, 20 Turn Potentiometers
Multiple-cup ganging with independent phasing
All welded internal connections
250 to 500 K ohms
**Rt TOL:** ±5% standard, ±1% optional
Multiple taps
Wattage up to 4 watts (approx. 1.5 watts per inch of diameter)
**Linearity:** to ±.015%
**Temperature Coefficient:** 0.002%/°C

**ALL MODELS TESTED TO MEET OR EXCEED ML-R-12934**

## CONCENTRIC SHAFTS 2 GANG MINIATURE

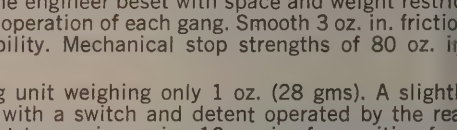
A new series of miniature 2-gang potentiometers with aerospace quality and performance ca pability, the Series PVR05, is now available to the engineer beset with space and weight restri tions. Dual concentric shafts allow independent operation of each gang. Smooth 3 oz. in. frictio torque on each shaft provides adjustment stability. Mechanical stop strengths of 80 oz. i prevents damage to the unit.

All this is available in a .625" dia. x 1.500" long unit weighing only 1 oz. (28 gms). A slight longer unit (1.750") weighing 1.16 oz. (33 gms) with a switch and detent operated by the re potentiometer shaft is also available. The detent torque is a crisp 10 oz. in. for positive fe

Price and delivery varies with the many design variations of the new series.

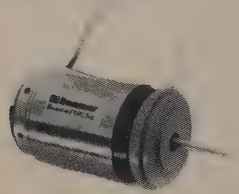
## VARI (F)UNCTION MODULES

Unitized Pot-Clutch Modules consisting of potentiometers, clutches, spring returns, synchro, brake combinations on an in line module.



MC 11-37 CONFIGURATIO

## DC TORQUER CP POTENTIOMETER COMBINATION



**DESIGNED TO MEET OR EXCEED ENVIRONMENT TESTS CONDUCTED IN ACCORDANC WITH MIL-R-5272**
**TYPICAL SPECIFICATIONS**

**Motor**
**Excitation:** 12 VDC max.
**Stall Current:** .57 amps
**Stall Power:** 6.9 watts
**Stall Torque:** 1.2 oz. in.
**Rotor Resistance:** 21.3Ω
**Torque/Amp:** 2.1 oz. in/amp

**Potentiometer**
**Total Resistance:** 500Ω-100KΩ
**Linearity:** .5% std, .1% special
**Electrical Angle:** 340°
**Resolution:** Essentially infinite
**Shaft Runout:** .003 TIR
**Radial Play:** .003 TIR
**End Play:** .005 Max.

**Motor-Pot Combination**
**Starting Voltage:** .5 volts max.
**No Load Speed:** 7200 RPM
**Inertia:** 2.2 GM-CM²
**Operating Temp. Range:** −55°C to +71°C
**Weight:** 2.1 oz. max.
**Winding Temp.:** 100°C max.

NOTES:
Motors with different torques, voltages, power requirement, etc., are available.
Special pot functions, conformities, taps, extra gangs, etc., are available.
Other size units with motors from .6" dia. to 1.35" dia. available.
Size 08, 09, 11, 15 mounting available.

## CUSTOM DESIGNED POTENTIOMETERS AND ROTATING COMPONENTS TO MEET SPECIAL REQUIREMENTS

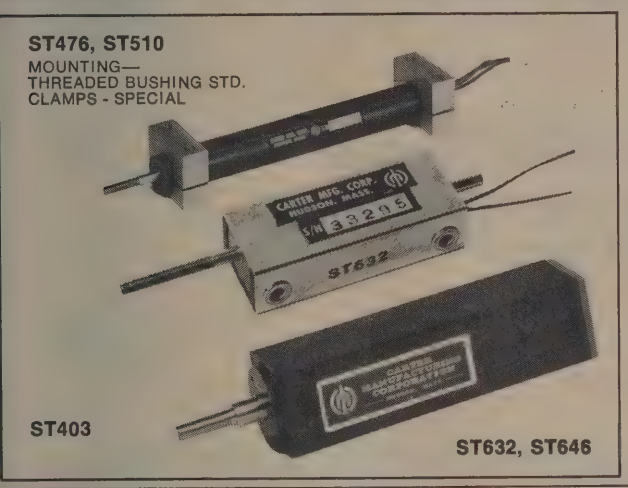
Non-linear and Special Functions
Hostile Environments
Extended Life
Miniaturization
Vari (f)unction Packages

# CARTER POTENTIOMETERS

## RECTILINEAR / WIRE WOUND / CONDUCTIVE PLASTIC

Carter Manufacturing Corp. is an organization of engineers and craftsmen specializing in the unusual in potentiometers and switch engineering and their manufacture. Since our founding in 1955 we have developed full capability in wire wound and conductive plastic potentiometers. We welcome the opportunity to work with you for your unique requirements as well as standard commercial or mil types.

## RECTILINEAR POTENTIOMETERS / WIRE OR CONDUCTIVE PLASTIC

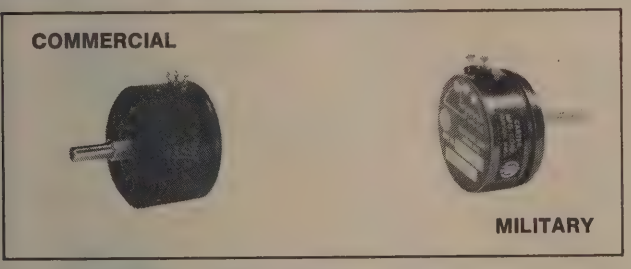



Carter manufactures many custom variations of rectilinear potentiometers. When requesting quotations please specify stroke, resistance, linearity, any taps, any switching, environmental requirements and quantity.

Wire wound and conductive plastic elements can also be furnished for special requirements.

| Type | Size | Stroke | Res.Ω | Std. Lin. | Spl. Lin. | Elements | Watts 125° |
|---|---|---|---|---|---|---|---|
| ST476 | ½" Dia. | To 8" | 50K/" Max. | 2% Stroke | .25% Stroke | 1 or 2 | 1 |
| ST510 | ¾" Dia. | To 12" | 100K/" Max. | 2% Stroke | .25% Stroke | 1 or 2 | 1.5 |
| ST403 | 1¼" x 1¼" | To 36" | 150K/" Max. | 2% Stroke | .25% Stroke | 1 or 2 | 2 |
| ST632 | 5/16" x ½" | To 4" | 60K/" Max. | 2% Stroke | .25% Stroke | 1 | .25 |
| ST646 | ½" x ½" | To 6" | 50K/" Max. | 2% Stroke | .25% Stroke | 1 or 2 | 1 |

## WIRE WOUND / CONDUCTIVE PLASTIC / SINGLE TURN POTENTIOMETERS MILITARY / COMMERCIAL




### GENERAL SPECIFICATIONS

**Resistance Tolerance:** WW ±5%, C/P ±10% Std. (Spl. avail.).
**Function Angles:** Spl. available.
**Rotation:** WW with stops, continuous available.
C/P continuous, stops available.
**Taps:** WW taps to single turn of wire with positive elimination of failure.
C/P taps of low resistance or zero width available.
**Power Rating:** To zero watts at 150°C.
**Ambient Temp.:** −65°C to +125°C std. (to 150°C available).

### MIL STANDARDS / WIRE WOUND

| Size | ½" | ⅞" | 1 1/16" | 1 7/16" | 1 5/8" | 1¾" | 2" | 3" |
|---|---|---|---|---|---|---|---|---|
| Type | 120 | 118 | 223 | 157 | 136 | 160 | 119 | 236 |
| Mil. Size | 05 | 09 | 11 | 15 | 17 | 18 | 20 | 30 |
| Function Angle | 320° | 320° | 320° | 320° | 320° | 320° | 350° | 350° |
| Std. Lin. | ±.5% | ±.4% | ±.3% | ±.25% | ±.2% | ±.18% | ±.15% | ±.1% |
| Spl. Lin. | ±.3% | ±.25% | ±.2% | ±.1% | ±.1% | ±.09% | ±.09% | ±.07% |
| Max. Res. | 75KΩ | 100KΩ | 100KΩ | 150KΩ | 150KΩ | 175KΩ | 200KΩ | 500KΩ |
| Watts | 2 | 3 | 3.5 | 4 | 4 | 4 | 4.5 | 5 |

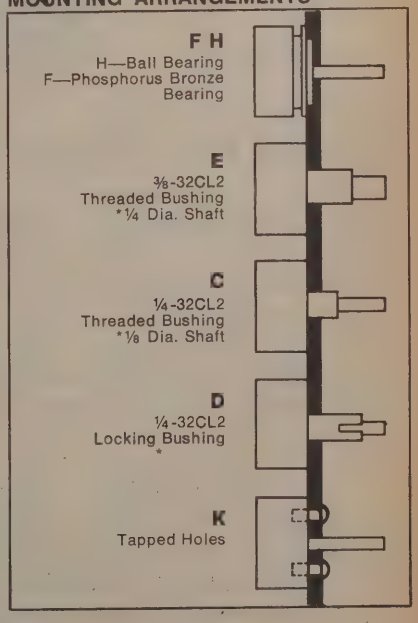
### MIL STANDARDS / CONDUCTIVE PLASTIC

| Size | ½" | ⅞" | 1 1/16" | 1 7/16" | 1 5/8" | 1¾" | 2" | 3" |
|---|---|---|---|---|---|---|---|---|
| Type | CP120 | CP118 | CP223 | CP157 | CP136 | CP160 | CP119 | CP236 |
| Mil. Size | 05 | 09 | 11 | 15 | 17 | 18 | 20 | 30 |
| Function Angle | 320° | 340° | 340° | 345° | 345° | 345° | 345° | 345° |
| Std. Lin. | ±.7% | ±.5% | ±.5% | ±.4% | ±.4% | ±.35% | ±.3% | ±.25% |
| Spl. Lin. | ±.3% | ±.15% | ±.15% | ±.1% | ±.1% | ±.07% | ±.06% | ±.03% |
| Max. Res. | 60KΩ | 100KΩ | 150KΩ | 150KΩ | 175KΩ | 200KΩ | 250KΩ | 400KΩ |
| Watts | 1 | 1.4 | 1.6 | 2 | 2.2 | 2.6 | 3 | 5 |

### COMMERCIAL PLASTIC HOUSING / WIRE WOUND — CONDUCTIVE PLASTIC

| Size | 2" | 3" | Size | 2" | 3" |
|---|---|---|---|---|---|
| Type | 508 | 511 | Type | CP508 | CP511 |
| Mil. Size | — | — | Mil. Size | — | — |
| Function Angle | 320° | 320° | Function Angle | 345° | 345° |
| Std. Lin. | ±.25% | ±.25% | Std. Lin. | ±1% | ±.7% |
| Spl. Lin. | ±.2% | ±.2% | Spl. Lin. | ±.5% | ±.25% |
| Max. Res. | 250KΩ | 500KΩ | Max. Res. | 250KΩ | 400KΩ |
| Watts | 3 | 5 | Watts | 3 | 5 |

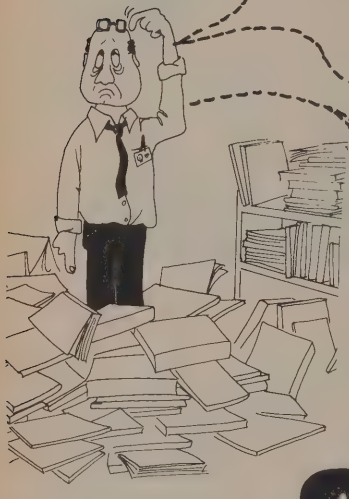
### MOUNTING ARRANGEMENTS




**CARTER MANUFACTURING CORPORATION**
DEPT. EM, SUGAR ROAD • BOLTON, MASSACHUSETTS 01740 • TELEPHONE (617) 779-5501

***What can I use to keep all the manufacturers' product data I receive in order?***

***What system makes filing or retrieving manufacturers' catalogs fast and easy?***



***Which file system have thousands of engineers purchased because they know it works?***

# eem FILE SYSTEM

## THE ONLY FILE SYSTEM DESIGNED SPECIALLY FOR THE ELECTRONIC ENGINEER!

The publishers of **eem** have put together a unique filing system for electronic product information. The complete system includes: a product index booklet which classifies electronic products into 3,000 listings both alphabetically and by product group, and 45 file folders imprinted with the **eem** product sections (extra gummed labels included for expanding the system.)

As you receive manufacturers' catalog data sheets, technical bulletins, or clip magazine articles, jot down the proper Product Section Numbers from the **eem** PRODUCT-TO-SECTION INDEX. Then simply file in order. When you require information on a specific product, refer to PRODUCT-TO-SECTION INDEX again to locate the correct file folder. It's simple, and you'll always have the necessary data to compare, specify and buy, right at your fingertips.

**Here's how to order your eem FILE SYSTEM:**

For the complete system send $10 (plus tax; N.Y., 8%, CA, 6½%) in check or money order to:
United Technical Publications, Inc.,
645 Stewart Avenue, Garden City, N.Y. 11530
Att: Circulation dept.

For an **eem FILE SYSTEM** without file folders send $7.50 (plus tax; N.Y. 8%; CA, 6½%).

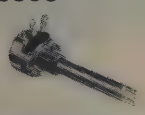
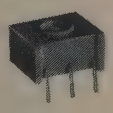
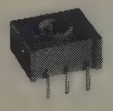
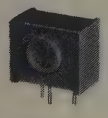
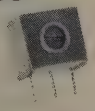
*UNITED TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500*

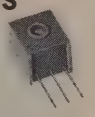
# CTS OF BERNE, INC.

SUBSIDIARY OF CTS CORPORATION, ELKHART, INDIANA

**WORLD LEADER IN CERMET RESISTOR TECHNOLOGY**

# INDUSTRIAL CERMET POTS & TRIMMERS

| CTS Series | Description | Data Sheet | Resistance Range |
|---|---|---|---|
| **550R** | Power: 2 @ 70°C<br>Max. Temp: 175°C<br>Resist. Tol: ±10%<br>Dim.: ¾″ dia.<br>Bushing: ⅜″ FMS<br>Shaft: ⅞″ FMS x .250″ dia., slotted | 3550 D | 50Ω-1 MEGΩ |
| **550S**  | Power: 2 @ 70°C<br>Max. Temp: 175°C<br>Resist. Tol: ±10%<br>Dim.: ¾″ Dia.<br>Bushing: ⅜″ FMS<br>Shaft: 2″ FMS x .250″ dia. | 3550 D | 50Ω-1 MEGΩ |
| **550LT** | Power: 2 @ 70°C<br>Max. Temp: 175°C<br>Resist. Tol: ±10%<br>Dim.: ¾″ dia.<br>Bushing: ½″ FMS, locking<br>Shaft: ⅝″ FMS x .250″ dia., slotted | 3550 D | 50Ω-1 MEGΩ |
| **345** | Power: ¾ @ 25°C<br>½ @ 85°C<br>Max. Temp: 150°C<br>Resist. Tol: ±20%<br>Dim.: .250″ dia. x .180″<br>No. of Turns: 1 | 3345 | 50Ω-500 KΩ |
| **363**  | Power: 1 @ 25°C<br>½ @ 85°C<br>Max. Temp: 125°C<br>Resist. Tol: ±20%<br>Dim.: .434″ x .360″ x .255″<br>No. of Turns: 1<br>.150″ lead spacing<br>Side or top adjust terminal form | 3360 H | 50Ω-1 MEGΩ |
| **364**  | Power: 1 @ 25°C<br>½ @ 85°C<br>Max. Temp: 125°C<br>Resist. Tol: ±20%<br>Dim.: .434″ x .360″ x .230″<br>No. of Turns: 1<br>.125″ lead spacing<br>Side or top adjust terminal form | 3360 H | 50Ω-1 MEGΩ |
| **365**  | Power: 1 @ 25°C<br>½ @ 85°C<br>Max. Temp: 125°C<br>Resist. Tol: ±20%<br>Dim.: .434″ x .360″ x .255″<br>No. of Turns: 1<br>.100″ lead spacing<br>Terminals S, T, X, Y & U available | 3360 H | 50Ω-1 MEGΩ |
| **360S**  | Power: ½ @ 85°C<br>Max. Temp: 125°C<br>Resist. Tol: ±20%<br>Dim.: .434″ x .360″ x .298″<br>No. of Turns: 1<br>.150″ lead spacing | 3360 G | 50Ω-1 MEGΩ |
| **360T** | Power: ½ @ 85°C<br>Max. Temp: 125°C<br>Resist. Tol: ±20%<br>Dim.: .434″ x .360″ x .298″<br>No. of Turns: 1<br>.150″ lead spacing | 3360 G | 50Ω-1 MEGΩ |

| CTS Series | Description | Data Sheet | Resistance Range |
|---|---|---|---|
| **362S**  | Power: ½ @ 85°C<br>Max. Temp: 150°C<br>Resist. Tol: ±20%<br>Dim.: .312″ x .355″ x .300″<br>No. of Turns: 1<br>.100″ lead spacing | 3360 G | 50Ω-1 MEGΩ |
| **362T** | Power: ½ @ 85°C<br>Max. Temp: 150°C<br>Resist. Tol: ±20%<br>Dim.: .312″ x .355″ x .300″<br>No. of Turns: 1<br>.100″ lead spacing | 3360 G | 50Ω-1 MEGΩ |
| **362X** | Power: ½ @ 85°C<br>Max. Temp: 150°C<br>Resist. Tol: ±20%<br>Dim.: .312″ x .355″ x .300″<br>No. of Turns: 1<br>TO-5 lead spacing | 3360 G | 50Ω-1 MEGΩ |
| **362Y** | Power: ½ @ 85°C<br>Max. Temp: 150°C<br>Resist. Tol: ±20%<br>Dim.: .312″ x .355″ x .300″<br>No. of Turns: 1<br>TO-5 lead spacing | 3360 G | 50Ω-1 MEGΩ |
| **362U** | Power: ½ @ 85°C<br>Max. Temp: 150°C<br>Resist. Tol: ±20%<br>Dim.: .312″ x .355″ x .300″<br>No. of Turns: 1<br>.200″ lead spacing | 3360 G | 50Ω-1 MEGΩ |
| **375E** | Power: ½ @ 70°C<br>Max. Temp: 125°C<br>Resist. Tol: ±20%<br>Dim.: .370″ Dia. x .150″<br>.100″ lead spacing<br>Cent. Term.: .400″ | 3375 | 50Ω-1 MEGΩ |
| **375V** | Power: ½ @ 70°C<br>Max. Temp: 125°C<br>Resist. Tol: ±20%<br>Dim.: .370″ dia. x .150″<br>.172″ lead spacing<br>Cent. Term.: .156″ | 3375 | 50Ω-1 MEGΩ |
| **375S** | Power: ½ @ 70°C<br>Max. Temp: 125°C<br>Resist. Tol: ±20%<br>Dim.: .370″ dia. x .150″<br>.100″ lead spacing | 3375 | 50Ω-1 MEGΩ |
| **375T** | Power: ½ @ 70°C<br>Max. Temp: 125°C<br>Resist. Tol: ±20%<br>Dim.: .370″ dia. x .150″<br>.100″ lead spacing | 3375 | 50Ω-1 MEGΩ |
| **375X** | Power: ½ @ 70°C<br>Max. Temp: 125°C<br>Resist. Tol: ±20%<br>Dim.: .370″ dia. x .150″<br>.100″ lead spacing<br>TO-5 lead spacing | 3375 | 50Ω-1 MEGΩ |
| **375Y** | Power: ½ @ 70°C<br>Max. Temp: 125°C<br>Resist. Tol: ±20%<br>Dim.: .370″ dia. x .150″<br>.100″ lead spacing<br>TO-5 lead spacing | 3375 | 50Ω-1 MEGΩ |

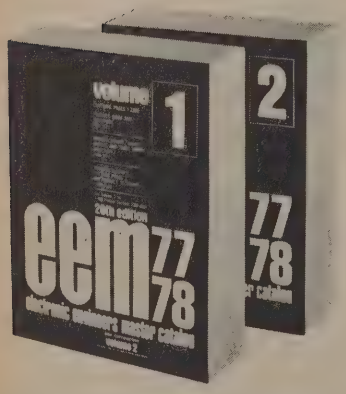
ORDERING INFORMATION: Place orders using following address: CTS OF BERNE, INC., 406 Parr Rd., Berne, Ind. 46711 • (219) 589-8220 • TWX 810-323-1580

# we know

## 41 years of experience in

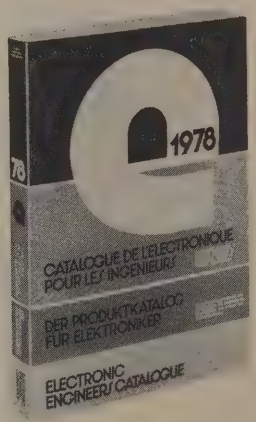
## United

## Electronics Division



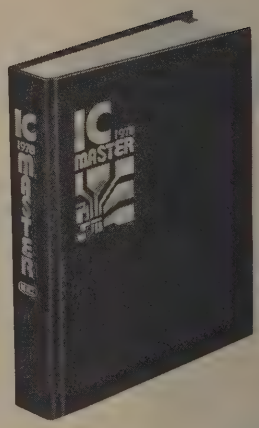

**eem/ELECTRONIC ENGINEERS MASTER CATALOG —**

The "blue-ribbon" catalog/directory that has become "the standard of the industry" for electronic engineers, buyers and specifiers.




**ELECTRONIC ENGINEERS CATALOGUE —**

The new catalogue/directory of electronic products available to and from Western Europe and the United Kingdom. Designed especially for the European electronics engineer.



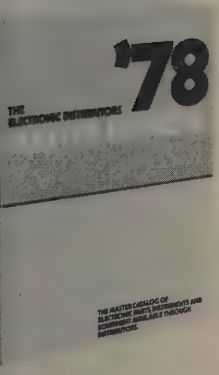

**IC MASTER AND THE UPDATES —**

The only complete single-source directory including all IC devices manufactured in the United States. Updated three times yearly with accumulative supplements.

# our stuff...

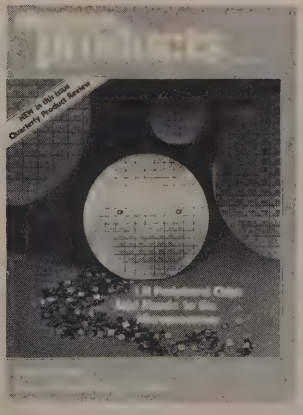
## cataloging, 21 editions of eem

## Technical Publications




**ronic Distributors**
**TER CATALOG —**

nly national catalog designed ively for distributors and their ners featuring electronic parts, ments and equipment.



**ELECTRONIC PRODUCTS MAGAZINE —**

The products magazine . . . A 100% product-oriented magazine including hundreds of new products and special features every month.

**eem FILE SYSTEM —**

The only filing system designed especially for the electronics engineer. Instant retrieval and organization of data sheets and catalogs.

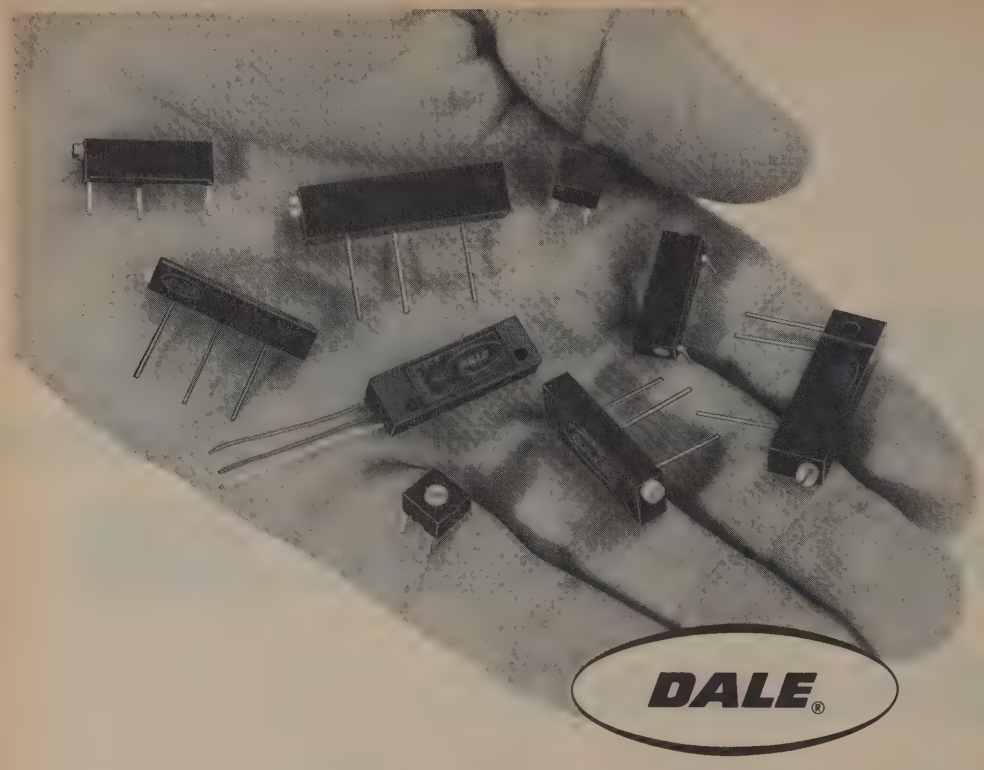
**UNITED COST AND PRICING SERVICES —**

The electronic distributors' proven method of being up to the minute on his cost and selling prices.

**UTP CUSTOM CATALOGS —**

The Cadillac of individualized catalogs for the electronic parts distributor, featuring solely his lines and services.

ed Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Avenue, Garden City, New York 11530 / 516 222-2500




# T-POT QUICK REFERENCE GUIDE

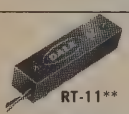
- New space-saving low profile models with cermet and wirewound elements
- Mil models including E-Rel
- Panel mount models available in most series

*For complete information, write or phone:*

**DALE ELECTRONICS, INC.,**
Box 609, Columbus, NE 68601 • Phone: 402-564-3131

## MILITARY GRADE TRIMMER POTENTIOMETERS

**(High Temperature, Precision)**

| ILLUSTRATION | MODEL | SEAL† TYPE | CONFIGURATION | STANDARD RESISTANCE & TOLERANCE | POWER RATING | OPERATING TEMP. RANGE | ADJUSTMENT TURNS | HEIGHT | WIDTH | LENGTH |
|---|---|---|---|---|---|---|---|---|---|---|
| RT-10** | 691 | 1 | • Alternate position Printed Circuit Pins 22 AWG | 10 ohms to 100K ohms ±5% | 1 watt at 70° C, derated to 0 at 175° C | –65° C to 175° C | 15±2 | .18 | .32 | 1.00 |
| | 680 | 1 | • Printed Circuit Pins 22 AWG | | | | | | | |
| | 697* | 2 | • 28 AWG Stranded Teflon Leads | | | | | | | |
| | 692* | 2 | • 26 AWG Solid Leads | | | | | | | |
|  RT-11** | 1287 | 1 | • Printed Circuit Pins 21 AWG | 10 ohms to 100K ohms ±5% | 1 watt at 70° C, derated to 0 at 175° C | –65° C to 175° C | 25±2 | .28 | .31 | 1.25 |
| | 1288* | 2 | • Stranded Teflon Leads 28 AWG | | | | | | | |
| | 1299* | 1 | • Spade Type Solder Lug | | | | | | | |
| RT-12** | 1680 | 1 | • Printed Circuit Pins 21 AWG | 10 ohms to 100K ohms ±5% | 1 watt at 70° C, derated to 0 at 175° C | –65° C to 175° C | 22±3 | .19 | .32 | 1.25 |
| | 1697* | 2 | • Stranded Teflon Leads 28 AWG | | | | | | | |
| | 1692* | 2 | • 22 AWG Solid Wire | | | | | | | |
| | 1690* | 2 | • Solder Lug | | | | | | | |
| RTR-12 | 1880 | 3 | • Printed Circuit Pins, Gold Plated Nickel | 10 ohms to 20K ohms ±5% | .75 watt at 85° C, derated to 0 at 150° C | –65° C to 150° C | 22±3 | .19 | .32 | 1.25 |
| | 1897 | 3 | • 28 AWG Stranded Teflon Insulated Leads | | | | | | | |

**†SEAL TYPE IDENTIFICATION**

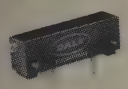
1. Immersion proof per MIL-R-27208
2. Humidity proof per MIL-STD-202, Method 106
3. Sealed per MIL-R-39015
4. Humidity proof per MIL-STD-202, Method 103, Condition B
5. Immersion proof – sealed for board washing, leak tested in 70° C water
6. Immersion proof per MIL-R-22097

*Indicates model is also available in Panel Mount version.

**10 ohms to 20K ohms.

# COMMERCIAL/INDUSTRIAL GRADE POTENTIOMETERS

## WIREWOUND ELEMENT

| ILLUSTRATION | MODEL | SEAL TYPE | CONFIGURATION | STANDARD RESISTANCE & TOLERANCE | POWER RATING | OPERATING TEMP. RANGE | ADJUSTMENT TURNS | HEIGHT | WIDTH | LENGTH |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2187<br>2188*<br>2199* | 4<br>4<br>4 | • Printed Circuit Pins 21 AWG<br>• Stranded Vinyl Leads 28 AWG<br>• Spade Type Solder Lug | 10 ohms to 100K ohms ±10% | 1 watt at 70° C, derated to 0 at 125° C | −65° C to 125° C | 25±2 | .31 | .28 | 1.25 |
|  | 2387<br>2317<br>2389<br>2319 | 4<br>5<br>4<br>5 | Printed Circuit Terminals<br>Hook-type Solder Lugs | 10 ohms to 50K ohms ±10% | 0.5 watt at 25° C, derated to 0 at 105° C | −55° C to 105° C | 15 turns nominal | .36 | .28 | 1.00 |
| | 2487<br>2417 | 4<br>5 | Printed Circuit Terminals | 10 ohms to 50K ohms ±10% | 1 watt at 40° C, derated to 0 at 125° C | −55° C to 125° C | 20 turns nominal | .31 | .16 | .75 |
| | 721<br>*723<br>724 | 5<br>5<br>5 | Printed Circuit Terminals | 10 ohms to 50K ohms ±10% | 1.0 watt at 70° C, derated to 0 at 150° C | −65° C to 150° C | 25 turns nominal | .25 | .165 | .75 |
| | 727<br>729 | 5<br>5 | Printed Circuit Terminals, machine insertable<br>Printed Circuit Terminals, hand insertable | 10 ohms to 50K ohms ±10% | 1 watt at 70° C, derated to 0 at 150° C | −65° C to 150°C | 25 turns nominal | .19 | .25 | .75 |

## CERMET ELEMENT

| ILLUSTRATION | MODEL | SEAL TYPE | CONFIGURATION | STANDARD RESISTANCE & TOLERANCE | POWER RATING | OPERATING TEMP. RANGE | ADJUSTMENT TURNS | HEIGHT | WIDTH | LENGTH |
|---|---|---|---|---|---|---|---|---|---|---|
| | 781<br>*783<br>784<br>785 | 5<br>5<br>5<br>5 | Printed Circuit Terminals | 10 ohms to 2 Megohms ±10% | 1 watt at 70° C, derated to 0 at 125° C | −55° C to 125° C | 25 turns nominal | .25 | .165 | .75 |
| | 787<br>789 | 5<br>5 | Printed Circuit Terminals, machine insertable<br>Printed Circuit Terminals, hand insertable | 10 ohms to 2 Megohms ±10% | 1 watt at 70° C, derated to 0 at 125° C | −55° C to 125° C | 25 turns nominal | .19 | .25 | .75 |
| | 8487<br>8417 | 4<br>5 | Printed Circuit Terminals | 10 ohms to 2 Megohms ±10% 100Ω thru 500K ±20% all other values | .75 watt at 25° C, derated to 0 at 125° C | −55° C to 125° C | 20 turns nominal | .31 | .16 | .75 |
| | 817 | 6 | • Printed Circuit Pins 26 AWG | 10 ohms to 2 Megohms ±10% 100Ω thru 500K ±20% all other values | .3 watt at 85° C, derated to 0 at 150° C | −65° C to 150° C | 10 turns nominal | .15 | .10 | .50 |
| | 85<br>85A | 5<br>5 | • Printed Circuit Terminals, machine insertable<br>• Printed Circuit Terminals, hand insertable | 10 ohms to 1 Megohm ±20% | .5 watt at 25° C, derated to 0 at 125° C | −55° C to 125° C | 12 turns nominal | .19 | .265 | .28 |
| | 87<br>87A | 5<br>5 | • Printed Circuit Terminals, machine insertable<br>• Printed Circuit Terminals, hand insertable | 10 ohms to 1 Megohm ±20% | .5 watt at 25° C, derated to 0 at 125° C | −55° C to 125° C | Single turn | .19 | .265 | .28 |
| | 101T<br>102T<br>150TX<br>150SX<br>101SX<br>100SX | 5 | • Printed Circuit Terminals for top and side adjustment | 10 ohms to 2 Megohms ±10% | .5 watt at 85°C, derated to 0 at 125°C | −55°C to 125°C | Single Turn | .19 | .375 | .375 |

**DUNCAN ELECTRONICS**
SUBSIDIARY
SYSTRON DONNER

Model # Wirewound: 3200 7/8" dia.(3) | 3500 1 7/16" dia. | 3700 2" dia. | 3230 7/8" dia. | 3250 7/8" dia. | 3600 1 3/4" dia
Model # Hybrid: 4200 | 4500 | 4700 | 4230 | 4250 | 4600

# DUNCAN precision wirewound 10-turn potentiometers

| | MILITARY | | | COMMERCIAL | | |
|---|---|---|---|---|---|---|
| **ELECTRICAL** | 3200 | 3500 | 3700 | 3230 | 3250 | 3600 |
| Electrical Travel | 3600° +4° /-0° | 3600° +1° /-0° | 3600° +1° /-0° | 3600° +10° /-0° | 3600° +10° /-0° | 3600° +4° /-0° |
| Normal Resistance Range (Ohms) | 100-100K | 100-200K | 100-300K | 100-100K | 100-100K | 100-300K |
| Resistance Tolerance: Std. | ±3% | ±3% | 3±% | ±3% | ±5% | ±3% |
| Power Rating (Watts) | 2.5 | 5 | 7 | 2.5 | 2 | 7 |
| Linearity: Std. | ±0.25% | ±0.15% | ±0.1% | ±0.25% | ±.25% | ±0.25% |
| Noise, ENR Max. (Ohms) | 100 | 100 | 100 | 100 | 100 | 100 |
| Insulation Resistance (Meg. Ohms) | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| Tempco of Pot, Maximum | ±.007%/°C | ±.007%/°C | ±.007%/°C | ±.007%/°C | ±.007%/°C | ±.007%/°C |
| **MECHANICAL** | | | | | | |
| Mechanical Travel Turns | 10(1) | 10(1) | 10(2) | 10 | 10(1) | 10(2) |
| Mechanical Life, Revolutions | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 500,000 | 2,000,000 |
| Ganged Cups, Maximum | 2 | 2 | 2 | N/A | N/A | 2 |
| Taps, Maximum Number | 46 | 110 | 135 | 46 | N/A | 135 |
| Weight (oz): Single Cup | 1.3 | 4.0 | 4.5 | 1.3 | 0.5 | 3.7 |
| Max. Torque: Start/Run Bushing | 0.5/0.5 | N/A | 1.5/1.2 | 0.6/0.5 | 1.0/1.0 | 1.5/1.2 |
| (oz-in) Start/Run Servo | 0.5/0.4 | 1.0/0.8 | 1.2/0.8 | N/A | N/A | N/A |
| **ENVIRONMENTAL** | | | | | | |
| Temperature Range (°C), Std. | -65 to +125 | -65 to +125 | -65 to +125 | -55 to + 105 | -25 to + 85 | -55 to + 105 |
| Meets MIL-R-12934 For: Shock | Yes | Yes | Yes | N/A (4) | N/A | N/A (4) |
| Humidity | Yes | Yes | Yes | N/A (4) | N/A | N/A (4) |
| Vibration | Yes | Yes | Yes | N/A (4) | N/A | N/A (4) |

# DUNCAN precision hybrid 10-turn potentiometers

| | MILITARY | | | COMMERCIAL | | |
|---|---|---|---|---|---|---|
| **ELECTRICAL** | 4200 | 4500 | 4700 | 4230 | 4250 | 4600 |
| Electrical Travel | 3600° +4° /-0° | 3600° +1° /-0° | 3600° +1° /-0° | 3600° +10° /-0° | 3600° +10° /-0° | 3600° +4° /-0° |
| Normal Resistance Range (Ohms) | 1K-100K | 3K-200K | 5K-250K | 1K-100K | 1K-100K | 5K-250K |
| Resistance Tolerance: Std. | ±3% | ±3% | 3±% | ±3% | ±5% | ±3% |
| Power Rating (Watts) | 2.5 | 5 | 7 | 2.5 | 2 | 7 |
| Linearity: Std. | ±0.25% | ±0.15% | ±0.1% | ±0.25% | ±.25% | ±0.25% |
| Output Smoothness | .015 | .01 | .008 | .10 | .015 | .008 |
| Insulation Resistance (Meg. Ohms) | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| Tempco of Pot, Maximum | ±.007%/°C | ±.007%/°C | ±.007%/°C | ±.007%/°C | ±.0150%/°C | ±.007%/°C |
| **MECHANICAL** | | | | | | |
| Mechanical Travel Turns | 10(1) | 10(1) | 10(2) | 10 | 10(1) | 10(2) |
| Mechanical Life, Revolutions | 5,000,000 | 5,000,000 | 5,000,000 | 5,000,000 | 2,000,000 | 5,000,000 |
| Ganged Cups, Maximum | 2 | 2 | 2 | N/A | N/A | 2 |
| Taps, Maximum Number | 46 | 110 | 135 | 46 | N/A | 135 |
| Weight (oz): Single Cup | 1.3 | 4.0 | 4.5 | 1.3 | 0.5 | 3.7 |
| Max. Torque: Start/Run Bushing | 0.5/0.5 | N/A | 1.5/1.2 | 0.6/0.5 | 1.0/1.0 | 1.5/1.2 |
| (oz-in) Start/Run Servo | 0.5/0.4 | 1.0/0.8 | 1.2/0.8 | N/A | N/A | N/A |
| **ENVIRONMENTAL** | | | | | | |
| Temperature Range (°C), Std. | -65 to +125 | -65 to +125 | -65 to +125 | -55 to + 105 | -25 to + 85 | -55 to + 105 |
| Meets MIL-R- 39023 For: Shock | Yes | Yes | Yes | N/A (4) | N/A | N/A (4) |
| Humidity | Yes | Yes | Yes | N/A (4) | N/A | N/A (4) |
| Vibration | Yes | Yes | Yes | N/A (4) | N/A | N/A (4) |

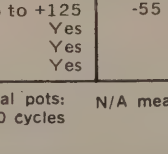
(1) Also available in 3- & 5-turn rotation.
(2) Also available in 3-turn rotation.
(3) Also available in ¾" diameter.
(4) Environmental specs for commercial pots: enclosed construction, 10G at 2,000 cycles vibration, 50G shock.

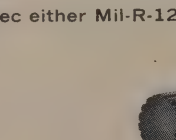
N/A means not applicable.

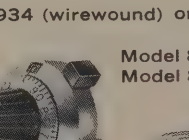
All Military styles are fully qualified to the applicable Mil-Spec either Mil-R-12934 (wirewound) or Mil-R-39023 (non-wirewound)

# MINIATURE TURNS—COUNTING DIALS

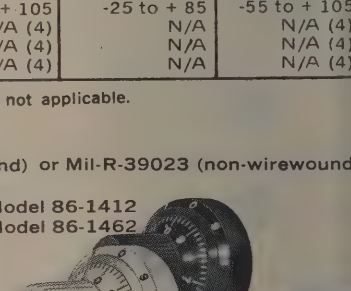
These dials enable the accurate positioning of multi-turn devices. Each was specially designed to complement the Duncan line of precision multi-turn potentiometers. Despite their compact size, all dials afford the optimum in readability — precise readings can be made at a glance, and from any angle. Convenient and economical, they require only the minimum in panel drilling and mounting hardware. Six models in all, four are offered for use with standard ¼-inch shafts, while two are available for use with ⅛-inch shafts. All dials feature a positive-action lock.


Model 61


Model 71


Model 76

Model 86-1412
Model 86-1462


Model 86-412
Model 86-462

**DUNCAN ELECTRONICS** 2865 FAIRVIEW ROAD, COSTA MESA, CALIFORNIA 92626 (714) 545-8261 • TWX: 910-595-112

200 2200 ⅞" dia. | 1300 2300 1⅛" dia. | 1500 2500 1⅛" dia. | 1600 2600 1¾" dia. | 1700 2700 2" dia. | 1800 2800 3" dia. | 1230 2230 ⅞" dia. | 1630 2630 1¾" dia.

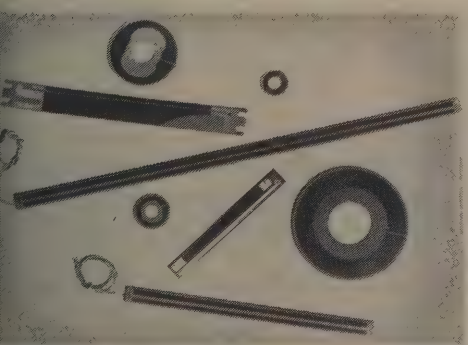
# DUNCAN precision wirewound single-turn potentiometers

| | MILITARY | | | | | COMMERCIAL | |
|---|---|---|---|---|---|---|---|
| 1200 | 1300 | 1500 | 1600 | 1700 | 1800 | 1230 | 1630 |
| 354° ±2° | 354° ±2° | 354° ±2° | 354° ±1° | 356° ±1° | 358° ±1° | 354° ±2° | 354° ±2° |
| 100-20K | 100-30K | 100-50K | 100-50K | 100-60K | 100-100K | 100-20K | 100-50K |
| +5% | ±5% | ±3% | ±3% | ±3% | ±3% | ±5% | ±5% |
| 1.25 | 2 | 3 | 4 | 5 | 7 | 1.25 | 4 |
| ±0.5% | ±0.5% | ±0.5% | ±0.5% | ±0.5% | ±0.5% | ±0.5% | ±0.5% |
| 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| ±.007%/°C | ±.007%/°C | ±.007%/°C | ±.007%/°C | ±.007%/°C | ±.007%/°C | ±.007%/°C | ±.007%/°C |
| | | | | | | | |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 |
| 6 | 6 | 8 | 8 | 8 | 8 | 6 | 6 |
| 9 | 9 | 19 | 24 | 26 | 41 | 9 | 24 |
| 0.6 | 0.8 | 2.2 | 2.8 | 3.3 | 6.5 | 0.6 | 3.0 |
| 0.2/0.2 | 0.2/0.2 | 1.3/0.9 | 1.4/1.0 | 1.5/1.1 | 1.7/1.3 | 0.3/0.3 | 2.0/1.5 |
| 0.1/0.1 | 0.15/0.15 | 0.6/0.4 | 0.7/0.5 | 0.8/0.6 | 1.0/0.8 | N/A | N/A |
| | | | | | | | |
| —65 to + 125 | —65 to + 125 | —65 to + 125 | —65 to + 125 | —65 to + 125 | —65 to + 125 | —55 to + 105 | —55 to + 105 |
| Yes | Yes | Yes | Yes | Yes | Yes | N/A (4) | N/A (4) |
| Yes | Yes | Yes | Yes | Yes | Yes | N/A (4) | N/A (4) |
| Yes | Yes | Yes | Yes | Yes | Yes | N/A (4) | N/A (4) |

Note: Lockwasher & Hex Nut supplied with all Bushing Models.

# DUNCAN precision hybrid single-turn potentiometers

| | MILITARY | | | | | COMMERCIAL | |
|---|---|---|---|---|---|---|---|
| 2200 | 2300 | 2500 | 2600 | 2700 | 2800 | 2230 | 2630 |
| 354° ±2° | 354° ±2° | 354° ±2° | 354° ±1° | 356° ±1° | 358° ±1° | 354° ±2° | 354° ±2° |
| 200-10K | 200-15K | 500-20K | 500-25K | 500-30K | 750-50K | 200-10K | 500-25K |
| +5% | ±5% | ±3% | ±3% | ±3% | ±3% | ±5% | ±5% |
| 1.25 | 2 | 3 | 4 | 5 | 7 | 1.25 | 4 |
| ±0.5% | ±0.5% | ±0.5% | ±0.5% | ±0.5% | ±0.5% | ±0.5% | ±0.5% |
| .10 | .09 | .08 | .07 | .06 | .05 | .10 | .07 |
| 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| ±.007%/°C | ±.007%/°C | ±.007%/°C | ±.007%/°C | ±.007%/°C | ±.007%/°C | ±.007%/°C | ±.007%/°C |
| | | | | | | | |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 | 10,000,000 |
| 6 | 6 | 8 | 8 | 8 | 8 | 6 | 6 |
| 9 | 9 | 19 | 24 | 26 | 41 | 9 | 24 |
| 0.6 | 0.8 | 2.2 | 2.8 | 3.3 | 6.5 | 0.6 | 3.0 |
| 0.2/0.2 | 0.2/0.2 | 1.3/0.9 | 1.4/1.0 | 1.5/1.1 | 1.7/1.3 | 0.3/0.3 | 2.0/1.5 |
| 0.1/0.1 | 0.15/0.15 | 0.6/0.4 | 0.7/0.5 | 0.8/0.6 | 1.0/0.8 | N/A | N/A |
| | | | | | | | |
| —65 to + 125 | —65 to + 125 | —65 to + 125 | —65 to + 125 | —65 to + 125 | —65 to + 125 | —55 to + 105 | —55 to + 105 |
| Yes | Yes | Yes | Yes | Yes | Yes | N/A (4) | N/A (4) |
| Yes | Yes | Yes | Yes | Yes | Yes | N/A (4) | N/A (4) |
| Yes | Yes | Yes | Yes | Yes | Yes | N/A (4) | N/A (4) |



## ELEMENTS: AN INDIVIDUALIZED APPROACH TO YOUR POTENTIOMETER REQUIREMENTS

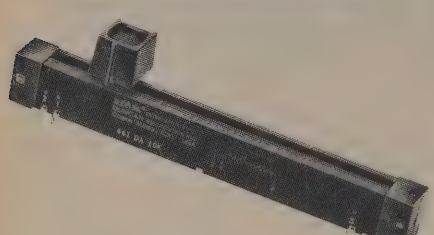
Many applications indicate the use of a conductive plastic element combined with a wiper arm instead of a complete potentiometer assembly. This approach may result in reduced space requirements, lower cost and a reduction in driving torque. Duncan RESOLON® lends itself to this approach because it can be co-molded with a substrate of virtually any configuration.

The selection of the wiper to be used with a RESOLON element is quite critical and can radically affect contact resistance, output smoothness and operating life. Wherever possible we should be permitted to design and supply the wiper assembly for most effective "mating" with the element.

Elements in any configuration can be produced with single or multiple tracks or with low resistance conductive plastic collector bars.

# DUNCAN CONDUCTIVE PLASTIC SLIDELINE CONTROLS

## SERIES 400
## METRIC SERIES M400



In addition to broadcast and recording, Series 400 is ideally suited to a great number of instrumentation applications. In transportation as throttle controls for rapid transit and people-moving equipment . . . pollution monitoring equipment, solar energy instrumentation and tone/speed controls for copying machines.

Available in 2¾" and 4¼" stroke lengths with single or dual elements. Offered with either printed circuit pins or solder type flat terminals which accept quick-connect receptacles. Special features include center taps and either SPST or DPST switches with gold-plated contacts at no increase in package size.

**KNOBS AVAILABLE**

### PERFORMANCE SPECIFICATIONS

L = LINEAR  A = AUDIO

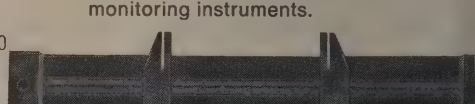
| ELECTRICAL | L | A |
|---|---|---|
| 1. Resistance Range (Ohms) | 1K to 250K | 600 to 25K |
| 2. Standard Resistance Values* (Ohms) | 1K<br>2K<br>5K<br>10K<br>20K<br>50K<br>100K | 600<br>1K<br>5K<br>10K |
| 3. Resistance Tolerance** % | ±20 | ±20 |
| 4. Linearity Tolerance, (%) | ±2.0 | NA |
| 5. Taper Conformity (dB) | NA | 0-20dB: ±2<br>20-50dB: ±4 |
| 6. Tracking (Dual Channel Only) (dB) | 2% | 0-20dB:2<br>>20-50dB:4 |
| 7. End Voltage (%) | 0.5 | NA |
| 8. Insertion Loss (dB) | NA | 0.1 |
| 9. Maximum Attenuation (dB) (Three-Terminal Device) | NA | 90 |
| 10. Resolution | INFINITE | |
| 11. Power Rating at 70°C. (Watts) | | |
| Model 421/422 | 2.5 | .25 |
| Model 441/442 | 4.0 | .40 |

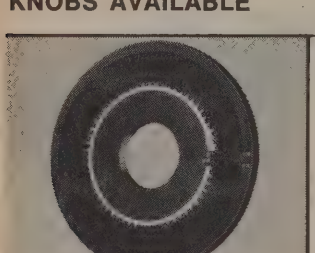
| MECHANICAL | L | A |
|---|---|---|
| 1. Travel (Inches MM) | Model 421/422 | 2¾ |
| | Model 441/442 | 4¼ |
| 2. Actuating Force, Max. | (Oz. gm) | 3 |
| 3. Stop Strength | (Lbs. Kg) | 10 |
| 4. Number of Channels | | Single or Dual in One Housing |
| 5. Terminals | Model 421/441 | Solder Type P Lugs (Accep Quick Conne Receptacles |
| | Model 422/442 | Printed Circ Pins |

| GENERAL | | |
|---|---|---|
| 1. Ambient Temperature | | —55°C. to+12 |
| 2. Taps | | Center Tap Av able on Linear |
| 3. Life | Traverses | 5 Million |

*Other values available as special.
**Tighter tolerances available as special.

Special units are available with two ind vidual wipers generating independent ou puts for establishing high/low limits monitoring instruments.





1220 ⅞" dia. | 1320 1⅛" dia. | 1520 1⅞" dia. | 1620 1¾" dia. | 1720 2" dia. | 1820 3" dia.

## RESOLON® conductive plastic single-turn potentiometers
## MILITARY

| ELECTRICAL | 1220 | 1320 | 1520 | 1620 | 1720 | 1820 |
|---|---|---|---|---|---|---|
| Theoretical Electrical Travel (1) | 320° | 320° | 340° | 340° | 350° | 350 |
| Normal Resistance Range (Ohms) | 1K-20K | 1K-30K | 1K-50K | 1K-75K | 1K-100K | 1K-125 |
| Extended Resistance Range (Ohms) | 500-75K | 500-100K | 500-125K | 750-135K | 750-150K | 1K-250 |
| Resistance Tolerance: Standard | 10% | 10% | 10% | 10% | 10% | 10% |
| Best Practical | 2% | 2% | 2% | 2% | 2% | 2% |
| Power Rating (Watts) (2) | 0.5 | 0.75 | 1.0 | 1.5 | 2.0 | 3. |
| Linearity: Standard | ±0.5% | ±0.5% | ±0.5% | ±0.5% | ±0.5% | ±0.5% |
| Best Practical | ±0.2% | ±0.15% | ±0.10% | ±.075% | ±.05% | ±.04% |
| Output Smoothness | 0.1% of Total Applied Voltage | | | | | |
| Insulation Resistance (Meg Ohms) | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,00 |
| Dielectric, Volts RMS | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,00 |
| Voltage Across Terminals, Max., DC | 400 | 400 | 400 | 400 | 400 | 40 |
| Tempco of Pot, Maximum | —.03%/°C | —.03%/°C | —.03%/°C | —.03%/°C | —.03%/°C | —.03%/° |
| **MECHANICAL** | | | | | | |
| Mechanical Travel | 360° Continuous | | | | | |
| Mechanical Life, Revolutions | 20,000,000 | 20,000,000 | 20,000,000 | 20,000,000 | 20,000,000 | 20,000,00 |
| Ganged Cups, Maximum | 6 | 6 | 8 | 8 | 8 | |
| Taps, Maximum Number | 9 | 9 | 19 | 24 | 26 | 4 |
| Moment of Inertia (gm-cm2) | 0.2 | 0.2 | 4.0 | 4.5 | 5.0 | 8.5 |
| Weight (oz): Single Cup | 0.6 | 0.8 | 2.2 | 2.8 | 3.3 | 6.5 |
| Each Additional Cup | 0.2 | 0.5 | 0.7 | 0.7 | 1.0 | 1.4 |
| Stop Strength (oz-in) | N/A | N/A | N/A | N/A | N/A | N/A |
| Max. Torque (oz-in): Starting, Servo | 0.1 | 0.15 | 0.6 | 0.7 | 0.8 | 1.0 |
| Running, Servo | 0.1 | 0.15 | 0.4 | 0.5 | 0.6 | 0.8 |
| **ENVIRONMENTAL** | | | | | | |
| Temperature Range (°C) Standard | —65 to + 125 | —65 to + 125 | —65 to + 125 | —65 to + 125 | —65 to + 125 | —65 to + 125 |
| Meets MIL-R-39023 for: Humidity | Yes | Yes | Yes | Yes | Yes | Ye |
| Vibration | Yes | Yes | Yes | Yes | Yes | Ye |
| Shock | Yes | Yes | Yes | Yes | Yes | Ye |

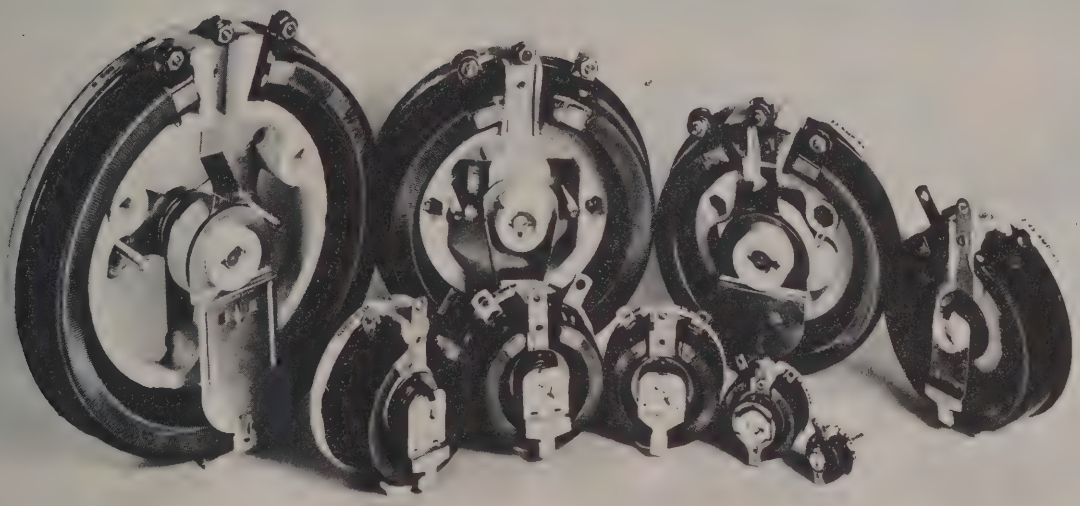
(1) Greater angles available.
(2) Rated at 60°C. Derated linearly to zero at 125°C.

**DUNCAN ELECTRONICS** 2865 FAIRVIEW ROAD, COSTA MESA, CALIFORNIA 92626 (714) 545-8261 • TWX: 910-595-112

E-SYSTEMS
Memcor Division

# POWER RHEOSTATS

## MEET THE MEMCOR FAMILY OF HIGH QUALITY WIRE-WOUND POWER RHEOSTATS



All MEMCOR Power Rheostats are vitreous enamel coated. The core and base are bonded together with vitreous enamel, thereby contributing markedly to the heat dissipation.

Standard tolerance: ±10%, ±5% available as a special.

| TYPE | POWER (Watts) | RESISTANCE RANGE | DIAMETER | WEIGHT |
|---|---|---|---|---|
| R12½ | 12½ Watt | 1 - 5000 Ohms | 7/8" | .035 Lbs. |
| R25 | 25 Watt | 1 - 5000 Ohms | 1 1/16" | 0.23 Lbs. |
| R50 | 50 Watt | 0.5 - 10,000 Ohms | 2 15/16" | 0.45 Lbs. |
| R75 | 75 Watt | 0.5 - 10,000 Ohms | 2¾" | 0.60 Lbs. |
| R100 | 100 Watt | 0.5 - 10,000 Ohms | 3⅛" | 0.72 Lbs. |
| R150 | 150 Watt | 0.5 - 10,000 Ohms | 4" | 1.50 Lbs. |
| R225 | 225 Watt | 1 - 2500 Ohms | 5" | 2.18 Lbs. |
| R300 | 300 Watt | 1 - 2500 Ohms | 6" | 3.0 Lbs. |
| R500 | 500 Watt | 1 - 2500 Ohms | 8" | 3.75 Lbs. |
| R1000 | 1000 Watt | 1 - 2000 Ohms | 12" | 10.0 Lbs. |

Special Rheostats with Tapered Sections, Locking Devices, Off Positions, Tandem Mountings, Special Shafts on Bushing, and many other variations can be supplied.

Write for FREE Catalog.

E-SYSTEMS
Memcor Division
DEPT. EM
1320 FLAXMILL ROAD
HUNTINGTON, INDIANA 46750
Telephone: (219) 356-4300
TWX: 810-333-1530

# for prompt service and "off-the-shelf" availability, call... DIPLOMAT

FOR OUR COMPLETE COMPREHENSIVE INVENTORY SELECTION

### SEMICONDUCTORS AND IC's
Alpha (Microwave)
AmPower
Carter Semiconductor
CDI Compensated Devices
Computer Diode
Crystalonics/Teledyne
Delco
EDI
Exar
General Instrument
General Semiconductor
ITT
Intersil
Kertron Semiconductor
Microsemiconductor Corp.
Microwave Associates
Monolithic Memories
Mostek
NAE North American Electronics
NEC Microcomputer Inc.
Optron
Semicon
Semtech
Sensitron
Signetics
Silicon General
Silicon Transistor Corp.
Solid Power Corp.
Solid State Devices
Solid State Scientific
Solitron Devices
SMC Microsystems Corp.
Syntron
Teledyne
Texas Instruments
Western Digital
Xciton

### CAPACITORS AND FILTERS
ARCO
Capar
CAL-R
Cornel Dubilier
ITT
Johanson
Mallory
NCI
San Fernando/Westcap
Sangamo

### CONNECTORS AND SOCKETS
Amphenol
Cinch
Robinson Nugent
Sullins
Texas Instruments

### CONTROLS AND SWITCHES
Alco Switch
Cherry
CTS
Hamlin
Mallory
Omron

### FANS & BLOWERS
Howard Industries

### FUSES AND HOLDERS
Bussman
Littelfuse

### HARDWARE AND CABINETS
Bud Radio
Hammond
H.H. Smith
Hollingsworth
Ungar

### METERS OF TEST EQUIPMENT
Simpson
Triplett

### OPTOELECTRONICS
Chicago Miniature
General Electric
Monsanto
Optron
Xciton

### POTENTIOMETERS AND TRIMMERS
Clarostat
CTS
Spectrol
Weston/Sangamo
VRN (IRC)

### RELAYS
Allied Controls
Deltrol
Electrol
Guardian
Hamlin
IDEC
Potter & Brumfield
Omron

### RESISTORS
American Corp.
CAL-R
Capar
Clarostat
Mallory
Memcor
RCL
Shallcross
Stackpole
Ward-Leonard

### R.F. CHOKES
J.W. Miller

### THERMISTORS AND RF FILTERS
CORCOM
Fenwal
Gulton Industries

### TRANSFORMERS AND POWERSTATS
Chicago Stancor

### TUBES
Amperex

### WIRE, CABLE, INSULATION PRODUCTS
Alpha
Belden
Cable-Tech
Cimco
Coleflex
Columbia
Dearborn
DeWire
Electronized Chemical Corp.
Harbor Industries
Hi Temp
Insultab
ITT
Manhattan
Norflex
Rainbow

**Each of the Above Listed Lines are Franchised at one or more of the Following Locations.**

DIPLOMAT

**DIPLOMAT ELECTRONICS, INC.**
Woodbury, N.Y.
(516) 921-9373

**DIPLOMAT ELECTRONICS, INC.**
Farmington, Mich.
(313) 477-3200

**DIPLOMAT ELECTRONICS, INC.**
Totowa, N.J.
(201) 785-1830

**DIPLOMAT ELECTRONICS, INC.**
Elk Grove Village, Ill.
(312) 595-1000

**DIPLOMAT ELECTRONICS, INC.**
Chicopee Falls, Mass.
(413) 592-9441

**DIPLOMAT ELECTRONICS, INC.**
Minneapolis, Minn.
(612) 788-8601

**DIPLOMAT ELECTRONICS, INC.**
Mt. Laurel, N.J.
(609) 234-8080

**DIPLOMAT ELECTRONICS, INC.**
Salt Lake City, Utah
(801) 486-4134

**DIPLOMAT ELECTRONICS, INC.**
St. Louis, Mo.
(314) 645-8550

**DIPLOMAT ELECTRONICS, INC.**
Holliston, Mass.
(617) 429-4120

**DIPLOMAT ELECTRONICS, INC.**
Sunnyvale, Calif.
(408) 734-1900

**DIPLOMAT ELECTRONICS, INC.**
Clearwater, Fla.
(813) 443-4514

**DIPLOMAT ELECTRONICS, INC.**
Ft. Lauderdale, Fla.
(305) 771-0440

**DIPLOMAT ELECTRONICS, INC.**
Woodbury, N.Y.
(516) 921-7920

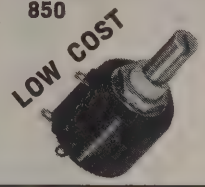
# POTENTIOMETERS-DIALS-COMBOS®

MULTI-TURN POTENTIOMETERS

## 850 SERIES — Wirewound

Precision, low-cost, designed for versatility and reliability. Available in dual gangs, dual concentric, high torque, slip clutch, with mounted switches, and many specialized applications, including servo mount with ball bearings.

850




850D

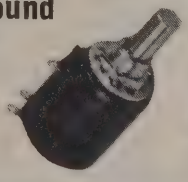
850 SPECIAL VERSIONS

| Model | No. of Turns | Resistance[1] Range (Ohms) | Resistance[2] Tolerance | Max. Power Rating Watts | Independent[2] Linearity | Mech. Life (Shaft Revolutions) | Nom. Size in Inches (Dia. x Length) | 50 Piece[6] Unit Price |
|---|---|---|---|---|---|---|---|---|
| 850 | 10 | 100-100K | ±5% | 2 Watts | ±0.25% | 1,000,000 | .875 x .750 | $4.28 |
| 851 | 1 | 10-10K | ±5% | 1 Watt | ±0.75% | 1,000,000 | .875 x .750 | 4.71 |
| 853, 855 | 3-5 | 10-50K | ±5% | 2 Watts | ±0.5% | 1,000,000 | .875 x .750 | 4.71 |
| 850D | 3, 5, 10[3] | 25-100K | ±5% | 2 Watts | ±0.5% | 1,000,000 | .875 x 1.50 | 12.31 |

## MW & MR SERIES — Wirewound
## MH SERIES — Hybrid

Highest quality precision multi-turns for long life and reliability. New Hybrid MH Series offers best features of wirewound and conductive plastic for extended life.

MW20



MW46-10 TURN

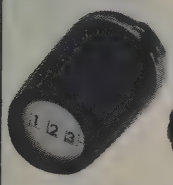
MR46-3 TURN

MH-12 (HYBRID)

| Model | No. of[3] Turns | Resistance[1,4] Range (Ohms) | Resistance[2] Tolerance | Max. Power Rating Watts | Independent[2,3] Linearity | Mech. Life (Shaft Revolutions) | Nom. Size in Inches[3,5] (Dia. x Length) | 50 Piece[2,4] Unit Price |
|---|---|---|---|---|---|---|---|---|
| MW-12 | 10 | 20-100K | ±3% | 1 Watt | ±0.5% | 1,000,000 | .500 x 1.00 | $11.16 |
| MH-12 (Hybrid) | 10 | 1K-50K | ±10% | 1 Watt | ±0.5% | 5,000,000 | .500 x 1.00 | 17.35 |
| MW20 | 5, 10 | 10-150K | ±3% | 2, 3 Watts | ±0.25% | 2,000,000 | .812 x 1.00 | 9.30 |
| MW46 | 3, 5, 10, 20 | 10Ω-1 meg | ±3% | 3, 5, 10, 20 Watts | ±0.25% | 2,000,000 | 1.812 x 2.00 | 12.74 |
| MR46 | 3, 5, 10, 20 | .5-1 meg | ±5% | 3, 5, 10, 20 Watts | ±0.25% | 2,000,000 | 1.812 x 2.25 | 9.17 |

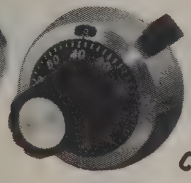
DIALS

1" DIA.



DA-10

⅞" DIA.




MF-20

1 3/16" DIA.

MD-30

1 13/16" DIA.

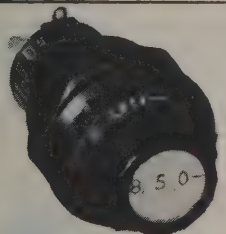
MF-46

¾" x ⅝"

MF-10

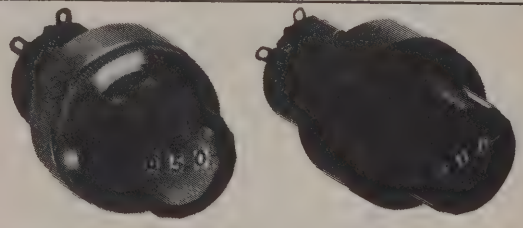
| 50 PIECE UNIT PRICE | |
|---|---|
| DA-10 | $9.48 |
| MF-20 | 6.83 |
| MD-30 | 4.60 |
| MF-46 | 7.85 |
| MF-10 | 9.25 |

POT/DIAL COMBINATIONS



## COMBO® 1 — WITH LOCK

Model DA850 or DA20.
Combines a DA-10 digital dial with a Model 850 or MW20 multi-turn pot. Potentiometers available in 3, 5 or 10 turns.
Mounts in 1.25" dia. panel hole.
50 pc. price, $16.69



## COMBO® 3 — WITHOUT LOCK

Model DA850NL or DA20NL.
Combines DA-10 dial with choice of seven multi-turn pots. Dials available with black or white faces and numbers. Adaptors available in clear or black anodize.
Mounts in 1.187" dia. panel hole.
50 pc. price, $16.69

1. Extended resistance range available.
2. Tighter tolerances available.
3. 3, 5, 20 turns not specified here.
4. Model MR46, from .5Ω to 20Ω is slide-wire.
5. All units available in metric sizes.
6. Some resistance values priced higher.

No minimum order required.
Terms: 1%-10 — Net 30.
FOB: Oceanside, Calif.

**ELECTRO TECHNIQUES, INC.**
215 VIA DEL NORTE, OCEANSIDE, CA 92054
(POLARIS INDUSTRIAL ENTERPRISES, INC.)
TEL: (714) 757-7770
TWX: 910-322-1396

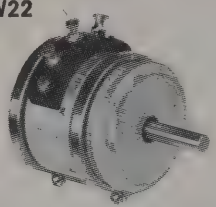
# PRECISION POTENTIOMETERS

## SINGLE TURN — WIREWOUND

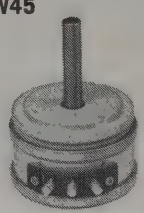
SW22C

LOW COST

SW22



SW45

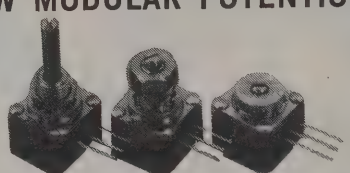


**ASK FACTORY ABOUT OUR LINE OF CONDUCTIVE PLASTIC SINGLE TURN POTENTIOMETERS**

| Model[1] No. | Nom. Dia.[2] Inches | Resistance[3] Range-Ohms | Resistance Tolerance (Standard) | Independent Linearity (Standard) | Max. Power Rating-Watts | Electrical Angle | Mechanical[4] Angle | Starting Torque Max. | 50 Piece Unit Price |
|---|---|---|---|---|---|---|---|---|---|
| SW22C | .866 | 10-20K | ±3% | ±.5% | 1 Watt | 320° | Contin. | .7 oz. in. | $7.62 |
| SW22 | .866 | 10-20K | ±3% | ±.5% | 1 Watt | 350° | Contin. | .3 oz. in. | 18.60 |
| SW30 | 1.140 | 10-40K | ±3% | ±.5% | 1 Watt | 350° | Contin. | .4 oz. in. | 22.32 |
| SW45 | 1.614 | 10-60K | ±3% | <5K = ±.5%<br>>5K = ±.4% | 2 Watts | 350° | Contin. | .8 oz. in. | 23.25 |
| SW50 | 1.968 | 10-80K | ±3% | <5K = ±.5%<br>>5K = ±.4% | 2.5 Watts | 350° | Contin. | 1.111 oz. in. | 25.11 |

## SINGLE TURN MODULAR POTS

### NEW MODULAR POTENTIOMETERS — SP12 (Conductive Plastic) SC12 (Cermet)



-1 -2 -3

**WHEN ORDERING SPECIFY:**

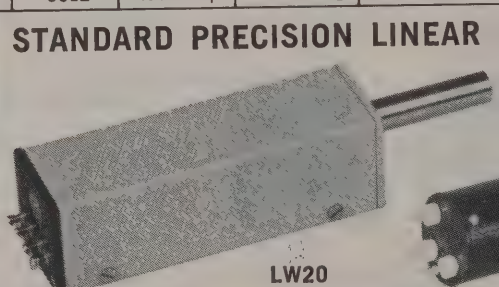
| S | P or C | 12 | -1, -2, -3 | RT |
|---|---|---|---|---|
| Single Turn | Conductive Plastic or Cermet | Size (.5″) | -1 Bushing Plain<br>-2 Lock Bushing<br>-3 Plain | |

**EXAMPLE:**
**SC12-2-10K IS:** CERMET, LOCK BUSHING, 10K OHM ELEMENT

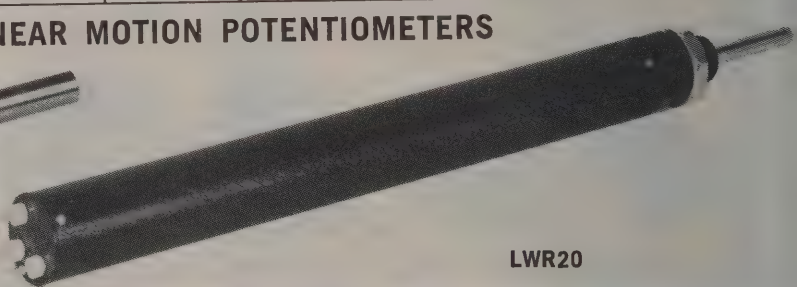
| Model No. | Nom. Dia. Inches | Resistance Range-Ohms | Resistance Tolerance (Standard) | Independent Linearity (Standard) | Max. Power Rating-Watts | Electrical Angle | Mechanical Angle | Starting Torque Max. | 50 Piece Unit Price |
|---|---|---|---|---|---|---|---|---|---|
| SP12 | .500″ Sq. | 100-5 meg | +10%<br>+20%>500K | ±.5% | .5 Watt | 295° | 295° | .5 oz. in. | $2.60 |
| SC12 | .500″ Sq. | 10-2 meg | ±10% | ±.5% | 1 Watt | 295° | 295° | .5 oz. in. | 3.00 |

## LINEAR MOTION — WIREWOUND

### STANDARD PRECISION LINEAR MOTION POTENTIOMETERS



LW20



LWR20

| Model No. | Resistance (Ohms) | Linearity | Mechanical Stroke (Inches) | Electrical Stroke (Inches) | Shaft Dia. (Inches) | Size (Inches) | 1-9 Price |
|---|---|---|---|---|---|---|---|
| LWR10-30 | 15 to 10K | ±.7% | 1.260 | 1.181 | .118 | ½ Dia. x 3⅜ Lg. | $46.00 |
| LWR10-50 | 50 to 20K | ±.7% | 2.047 | 1.968 | .118 | ½ Dia. x 4⅜ Lg. | 49.50 |
| LWR10-100 | 50 to 40K | ±.5% | 4.015 | 3.937 | .118 | ½ Dia. x 6⅛ Lg. | 52.75 |
| LW20-15 | 8 to 50K | ±2.0% | .590 | .590 | 3/16 | .790 Sq. x 2 Lg. | 30.00 |
| LW20-30 | 15 to 10K | ±1.5% | 1.180 | 1.180 | 3/16 | .790 Sq. x 2⅝ Lg. | 35.00 |
| LW20-50 | 25 to 15K | ±1.0% | 1.968 | 1.968 | 3/16 | .790 Sq. x 3⅜ Lg. | 43.00 |
| LW20-100 | 50 to 30K | ±.7% | 3.937 | 3.937 | 3/16 | .790 Sq. x 5⅛ Lg. | 52.75 |
| LWR20-50 | 25 to 20K | ±.4% | 2.087 | 1.968 | 3/16 | .790 Dia. x 3⅜ Lg. | 49.50 |
| LWR20-100 | 50 to 40K | ±.4% | 4.055 | 3.937 | 3/16 | .790 Dia. x 5⅛ Lg. | 52.75 |
| LWR20-200 | 100 to 80K | ±.4% | 7.992 | 7.874 | 3/16 | .790 Dia. x 11¼ Lg. | 98.60 |
| LW30-50 | 25 to 20K | ±.4% | 1.968 | 1.968 | 3/16 | 1¼ Sq. x 4¾ Lg. | 56.00 |
| LW30-100 | 50 to 40K | ±.4% | 3.937 | 3.937 | 3/16 | 1¼ Sq. x 6¾ Lg. | 65.70 |
| LW50-300 | 200 to 50K | ±.4% | 11.812 | 11.812 | .315 | 2 Sq. x 15¾ Lg. | 200.00 |
| LW50-500 | 500 to 150K | ±.4% | 19.687 | 19.687 | .315 | 2 Sq. x 23⅝ Lg. | 325.00 |
| LW50-1000 | 500 to 300K | ±.4% | 39.375 | 39.375 | .315 | 2 Sq. x 47¼ Lg. | 600.00 |

1. All available in conductive plastic, contact factory.
2. Metric sizes and mountings available.
3. Extended resistance range available.
4. Stops available.
5. Some resistance values higher.

No minimum order required.
Terms: 1%-10 — Net 30.
FOB: Oceanside, Calif.

**ELECTRO TECHNIQUES, INC.**

**NON-LINEAR FUNCTIONS AVAILABLE — LOW-TORQUE SINGLE TURNS AVAILABLE**

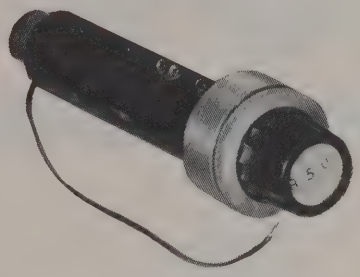
215 VIA DEL NORTE, OCEANSIDE, CA 92054 TEL: (714) 757-777
(POLARIS INDUSTRIAL ENTERPRISES, INC.) TWX: 910-322-1396

# MOTORIZED POTS-OIL-FILLED POTS

## MOTOR-CONTROLLED POTENTIOMETERS

### (MULTI-TURN AND SINGLE-TURN)

ELECTRO TECHNIQUES offers for the first time a complete line of motor-controlled potentiometers with motor operating currents low enough to respond accurately from operational amplifier outputs. All Electro Techniques Rotary Potentiometers can be motorized for your applications.



### MC20-1

**MOTORS AVAILABLE**

DC VOLTAGES: 1½, 2, 3, 6, 12,
Larger Motor Pot Avail., 24 VDC
RPM: 6000 to 20,000
GEAR RATIOS: 3.1/1 to 980,000 to 1
TORQUE: Up to 85 oz. inches

### MC20-1 WITH DIGITAL DIAL

**EXAMPLE:**

MODEL MC20-1 with 6 volt DC motor (19000 RPM) with 1670/1 gear ratio. Gear train operates at approximately 11 ma current, and clutches at approx. 20 ma. Potentiometer turns at 10 RPM. Size: ⅞" dia. x 3½" long.

NOTES: Model MC20-1 shown above includes motor, gear train, clutching coupler, and potentiometer assembled by Electro Techniques.

### FEATURES:

HIGH SPEED DC MOTOR allows voltage pulsing to advance pot in constant increments.

LOW CURRENT OPERATION allows max. performance with less bulky power supplies and components.

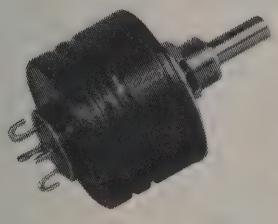
MAY BE OPERATED from op amp types such as 301, 741, 748 or dual 1458. Operating current approx. 12 ma and clutching current approx. 20 ma.

DOUBLE BALL JOINT adjustable mechanical slip clutch and alignment coupler maintains smooth and consistent turning of potentiometer without damage.

MOUNTING CLAMPS may be rotated or laterally moved for chassis mounting, or clamps may be removed and unit panel mounted. Motorpot will work in conjunction with any Electro Techniques turns counting dials.

PANEL MOUNTING allows manual adjustment during off Voltage periods.

MOST COMMON SLEW RATES are: 1, 3, 5, 10 and 30 RPM at the potentiometer.

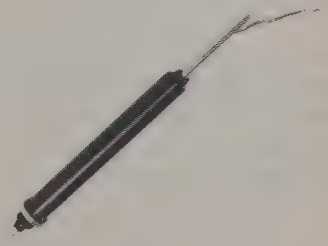


SO-30

## OIL-FILLED POTENTIOMETERS (WIREWOUND AND FILM)

Electro-Techniques offers a complete line of **standard** oil-filled potentiometers for applications in corrosive and contaminated atmospheres requiring long load life.

Consult our factory for the type of oil filled potentiometer required for upgrading your reliability.



LO-10

**ELECTRO TECHNIQUES, INC.**
215 VIA DEL NORTE, OCEANSIDE, CA 92054
(POLARIS INDUSTRIAL ENTERPRISES, INC.)
TEL: (714) 757-7770
TWX: 910-322-1396

# PRECISION POTENTIOMETERS

**THE LEADING MANUFACTURER OFFERING MOLDED CONDUCTIVE PLASTIC, WIREWOUND, CONDUCTIVE PLASTIC FILM, & HYBRID TECHNOLOGIES**

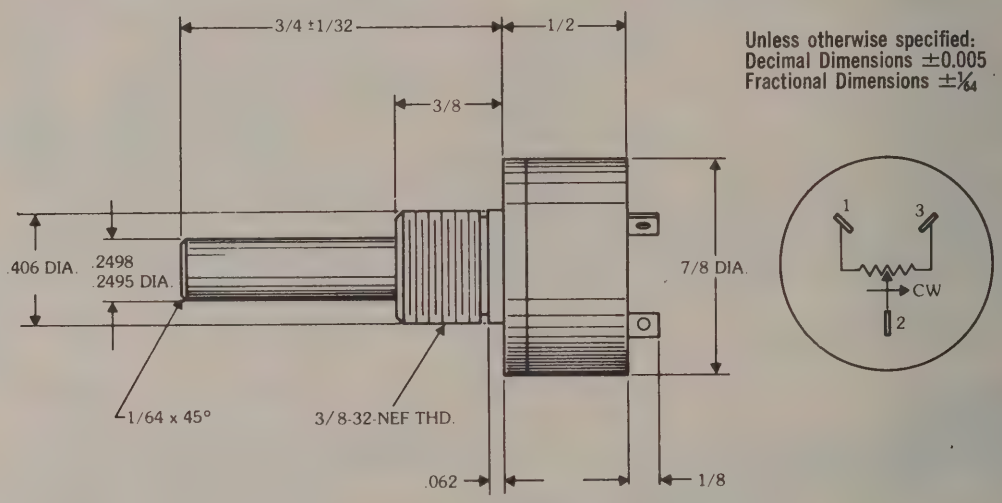
## IMPORTANT NOTES ON FACTORY STOCK & VOLUME PRODUCTION CAPABILITIES

The products shown on these first four NEI pages are low cost precision conductive plastic potentiometers which are available from factory stock. These products are **not** sold through distributors. Deliveries range from a few days to a few weeks.

The last two NEI pages show our custom design capabilities in wirewound and conductive plastic. In both custom and standard products, NEI has volume production facilities in five plants capable of producing millions of units.

## ECONOPOT® MKIII LOW COST RESISTOFILM™ CONDUCTIVE PLASTIC POTENTIOMETERS

(Priced from $1.95 to $4.95. No pot in its price range approaches MKIII.)




### ELECTRICAL DATA

**Standard Resistance Range:** 1K ohms to 100K ohms
**Standard Resistance Tolerance:** ±20%
**Electrical Travel, Theoretical:** 270°
**Standard Linearity:** ±1.0%
**Power Rating:** 70°C, 1 Watt
125°C, 0 Watt
**Output Smoothness:** ±0.25%
**Resistance Temperature Characteristic:** ±5%
**Temperature Coefficient:** ±400 ppm/°C
**Dielectric Strength:** 1000 Vrms
**Resolution:** Virtually Infinite

### MECHANICAL DATA

**Shaft Torque:** 1.0 oz.-in. max.
**Mechanical Travel:** 300° ±5°
**Shaft:** Stainless Steel
**Contacts:** Precious Metal
**Stop Strength:** 5 in.-lbs. nominal

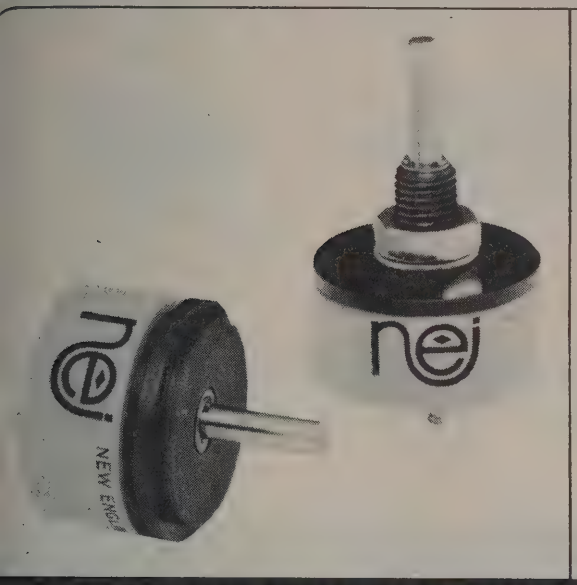
### ENVIRONMENTAL DATA

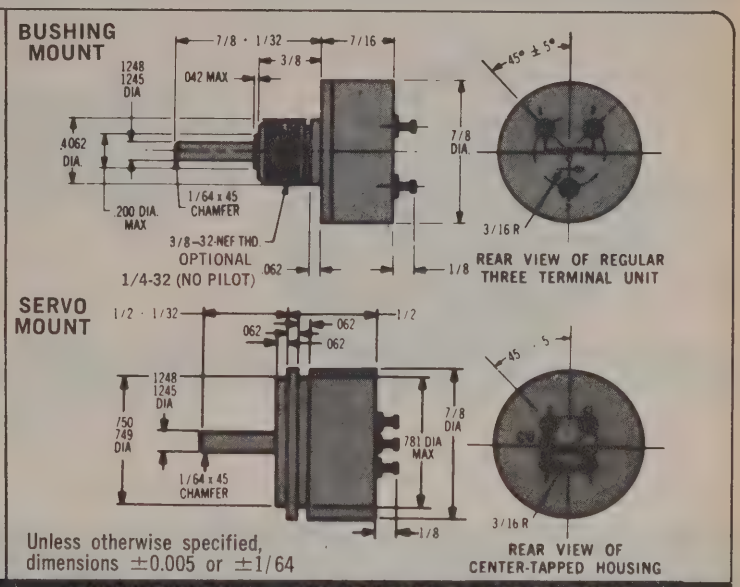
**Rotational Life:** 5 Million Cycles (less than 5% resistance shift)
**Load Life:** 1000 Hours (less than 5% resistance shift)
**Shock (20 G's):** Per MIL-R-23825
**Vibration (20 G's):** Per MIL-R-23825
**Operating Temperature:** −65°C to +125°C

**new england instrument company**
KENDALL LANE • NATICK, MASS. 01760 • (617) 873-9711 • TWX: 710-360-0398

# PRECISION POTENTIOMETERS

## ECONOPOT® STANDARD CONDUCTIVE PLASTIC MODELS
## 7/8" DIAMETER • LOW COST • FROM FACTORY STOCK




Unless otherwise specified, dimensions ±0.005 or ±1/64

## ORIGINAL HIGH RELIABILITY ECONOPOT®

5 MILLION CYCLE LIFE • ±10% RESISTANCE • −65°C TO +125°C
PRECISION BALL BEARINGS (SERVO MODELS)

| MODEL NUMBER | OUTPUT SMOOTHNESS | INDEPENDENT LINEARITY (STANDARD) | TOTAL RESISTANCE ±10% | PRICE (500 PCS. OR MORE) |
|---|---|---|---|---|
| **SERVO MODELS** | | | | |
| 78ESA102 | 0.5% | 1% | 1K | $13.60 |
| 78ESA502 | 0.5% | 1% | 5K | 13.60 |
| 78ESA103 | 0.5% | 1% | 10K | 13.60 |
| 78ESB102 | 0.25% | 0.5% | 1K | 16.45 |
| 78ESB502 | 0.25% | 0.5% | 5K | 16.45 |
| 78ESB103 | 0.25% | 0.5% | 10K | 16.45 |
| 78ESC102 | 0.15% | 0.25% | 1K | 19.55 |
| 78ESC502 | 0.15% | 0.25% | 5K | 19.55 |
| 78ESC103 | 0.15% | 0.25% | 10K | 19.55 |
| **BUSHING MODELS** | | | | |
| 78EBA102 | 0.5% | 1% | 1K | 11.55 |
| 78EBA502 | 0.5% | 1% | 5K | 11.55 |
| 78EBA103 | 0.5% | 1% | 10K | 11.55 |
| 78EBB102 | 0.25% | 0.5% | 1K | 14.40 |
| 78EBB502 | 0.25% | 0.5% | 5K | 14.40 |
| 78EBB103 | 0.25% | 0.5% | 10K | 14.40 |
| 78EBC102 | 0.15% | 0.25% | 1K | 17.50 |
| 78EBC502 | 0.15% | 0.25% | 5K | 17.50 |
| 78EBC103 | 0.15% | 0.25% | 10K | 17.50 |

### CHARACTERISTICS — ALL MODELS

**Terms, definitions and test methods per VRCI standards unless otherwise specified.**

| PARAMETER | VALUE |
|---|---|
| Standard Total Resistance Values | 1K, 5K, & 10K per table |
| Standard Independent Linearity | 1%, 0.5% & 0.25% per table |
| Theoretical Electrical Travel | 340° |
| Standard Output Smoothness | 0.5%, 0.25% & 0.15% per table |
| Standard Life Expectancy | 5,000,000 revolutions |
| Resolution | Essentially infinite |
| Standard End Voltage | 1% maximum |
| Standard Power Rating | 1 watt @ 70°C, derated linearly to 0 @ 125°C |
| Insulation Resistance | 1000 Megohms min. @ 500 VDC |
| Dielectric Withstanding Voltage | 750 volts rms |
| Standard Torque | 1.0 oz.-in. max. — bushing |
| Weight | 16 grams max. — servo |
| Shock | Per MIL-STD-202, Method 205, condition C |
| Vibration | Per MIL-STD-202, Method 205, condition C |
| Operating Temperature | −65°C to +125°C |

## INDUSTRIAL ECONOPOT® MODEL C

2 MILLION CYCLE LIFE • ±20% RESISTANCE • OILITE BEARINGS (SERVO MODELS)

| MODEL NUMBER | OUTPUT SMOOTHNESS | INDEPENDENT LINEARITY (STANDARD) | TOTAL RESISTANCE ±20% | PRICE (500 PCS. OR MORE) |
|---|---|---|---|---|
| **BUSHING MODELS** | | | | |
| 78CBA102 | 0.5% | 1% | 1K | $5.99 |
| 78CBA502 | 0.5% | 1% | 5K | 5.99 |
| 78CBA103 | 0.5% | 1% | 10K | 5.99 |
| 78CBB102 | 0.25% | 0.5% | 1K | 8.95 |
| 78CBB502 | 0.25% | 0.5% | 5K | 8.95 |
| 78CBB103 | 0.25% | 0.5% | 10K | 8.95 |
| **SERVO MODELS** | | | | |
| 78CSA102 | 0.5% | 1% | 1K | 7.95 |
| 78CSA502 | 0.5% | 1% | 5K | 7.95 |
| 78CSA103 | 0.5% | 1% | 10K | 7.95 |
| 78CSB102 | 0.25% | 0.5% | 1K | 10.20 |
| 78CSB502 | 0.25% | 0.5% | 5K | 10.20 |
| 78CSB103 | 0.25% | 0.5% | 10K | 10.20 |
| 78CSC102 | 0.15% | 0.25% | 1K | 12.85 |
| 78CSC502 | 0.15% | 0.25% | 5K | 12.85 |
| 78CSC103 | 0.15% | 0.25% | 10K | 12.85 |

### CHARACTERISTICS — ALL MODELS

**Terms, definitions and test methods per VRCI standards unless otherwise specified.**

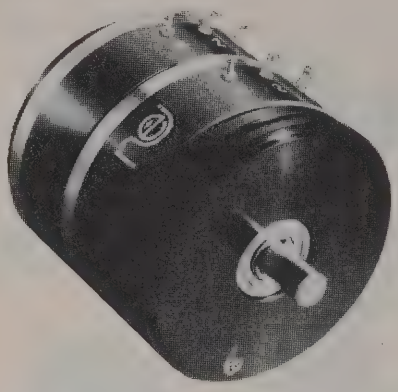
| PARAMETER | VALUE |
|---|---|
| Resistance Tolerance | ±20% |
| Standard Life Expectancy | 2,000,000 revolutions |
| Dielectric Withstanding Voltage | 500 volts rms |
| Bearings (Servo models) | Oilite |

ALL OTHER SPECIFICATIONS ARE AS SHOWN FOR THE ORIGINAL HIGH RELIABILITY ECONOPOT® (SEE ABOVE).

nej new england instrument company
KENDALL LANE · NATICK, MASS. 01760 · (617) 873-9711 · TWX: 710-360-0398

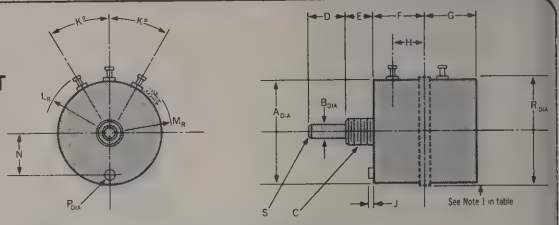
# PRECISION POTENTIOMETERS

## ECONOPOT® MKII STANDARD CONDUCTIVE PLASTIC MODELS
## 6 DIAMETERS • GANGABLE • LOW COST • FROM FACTORY STOCK

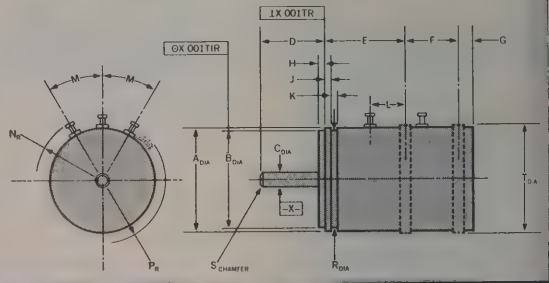


ALL MODELS FEATURE NEI's RESISTOFILM™ (PATENT #3,457,537)

BUSHING MOUNT MODELS (MOUNTING HARDWARE SUPPLIED)




SERVO MOUNT MODELS (PRECISION BALL BEARINGS)




| HOUSING DIAMETER (INCHES) | MODEL NUMBER | MOUNTING TYPE | RANGE OF RESISTANCE ±10% | STANDARD INDEPENDENT LINEARITY (±%) | POWER RATING (WATTS) |
|---|---|---|---|---|---|
| 0.500 | 50 BF | Bushing | 1K-20K | 1 and 0.5 | 0.5 |
| 0.500 | 50 SF | Servo | 1K-20K | 1 and 0.5 | 0.5 |
| 0.750 | 34 BF | Bushing | 1K-50K | 1 and 0.5 | 0.7 |
| 0.750 | 34 SF | Servo | 1K-50K | 1 and 0.5 | 0.7 |
| 0.875 | 78 BF | Bushing | 1K-50K | 1, 0.5, 0.25 | 1.0 |
| 0.875 | 78 SF | Servo | 1K-50K | 1, 0.5, 0.25 | 1.0 |
| 1.062 | 116 SF | Servo | 1K-50K | 1, 0.5, 0.25 | 1.0 |
| 1.250 | 114 BF | Bushing | 1K-50K | 1, 0.5, 0.25 | 1.0 |
| 1.437 | 176 SF | Servo | 1K-100K | 1, 0.5, 0.25 | 2.0 |
| 2.000 | 200 BF | Bushing | 1K-100K | 1, 0.5, 0.25 | 2.0 |
| 2.000 | 200 SF | Servo | 1K-100K | 1, 0.5, 0.25 | 2.0 |

| GENERAL SPECIFICATIONS PARAMETER | VALUE |
|---|---|
| Theoretical Travel | 340° |
| Electrical Overtravel | 5° min. each end |
| End Voltage | 1.5% max. |
| Dielectric Withstanding Voltage | 1000 V rms |
| Travel Resolution | virtually infinite |
| Output Smoothness | 0.125% (MIL-R-39023) |
| Standard Life Expectancy | 10 Million Revolutions |
| Mechanical Travel | 360° continuous |
| Starting Torque (servo models) | 1st cup-0.5 oz.-in. max. Ea. add'l cup-0.3 oz.-in. max. |

## DIMENSIONS — BUSHING MODELS

| TYPE | A ±.005 | B +.0000 −.0003 | C CL2 THD. | D ±.030 | E ±.015 | F MAX. | G MAX. | H ±.005 | J MAX. | K ±2° | L MAX. | M MAX. | N ±.005 | P ±.003 | **R MAX. | S CHAMFER ±.010 ±5° |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 | .500 | .1248 | ¼x32 | ⅜ | ⅜ | .562 | .510 | .250 | .062 | 30° | .550 | .530 | .281 | .062 | .770 | ¼₄x45° |
| 34 | .750 | .1248 | ¼x32 | ⅜ | ⅜ | .562 | .510 | .250 | .062 | 30° | .550 | .530 | .281 | .062 | .770 | ¼₄x45° |
| 78 | .875 | .1248 | ¼x32 | ⅜ | ⅜ | .727 | .510 | .355 | .062 | 30° | .605 | .605 | .312 | .062 | .900 | ¼₄x45° |
| 114 | 1.250 | .2498 | ⅜x32 | ⅜ | ⅜ | .855 | .800 | .500 | .062 | 30° | .818 | .850 | .531 | .093 | 1.320 | ½₂x45° |
| 200 | 2.000 | .2498 | ⅜x32 | ⅜ | ⅜ | 1.000 | .960 | .685 | .067 | 25° | 1.165 | 1.152 | .531 | .125 | 2.000 | ½₂x45° |

## DIMENSIONS — SERVO MODELS

| TYPE | A ±.005 | B +.0000 −.0005 | C +.0000 −.0003 | D ±.030 | E MAX. | F MAX. | *G MAX. | H ±.005 | J ±.005 | K MIN. | L ±.015 | M ±2° | N MAX. | P MAX. | R MAX. | S ±.010 ±5° | **T MAX. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 | .500 | .4375 | .1248 | .500 | .500 | .500 | .145 | .062 | .062 | .007 | .250 | 30° | .550 | .530 | .630 | .015x45° | .770 |
| 34 | .750 | .625 .624 | .1248 | .500 | .625 | .505 | .145 | .062 | .062 | .007 | .250 | 30° | .550 | .530 | .630 | .015x45° | .770 |
| 78 | .875 | .750 .749 | .1248 | .625 | .790 | .505 | .145 | .062 | .062 | .057 | .355 | 30° | .605 | .605 | .781 | .015x45° | .900 |
| 116 | 1.062 | .9688 | .1248 | .625 | .790 | .505 | .145 | .062 | .062 | .057 | .355 | 25° | .680 | .680 | .975 | .015x45° | 1.090 |
| 176 | 1.437 | 1.3125 | .2498 | .625 | .910 | .505 | .201 | .062 | .062 | .088 | .355 | 20° | .910 | .910 | 1.312 | .030x45° | 1.472 |
| 200 | 2.000 | 1.8750 | .2498 | .625 | .910 | .505 | .201 | .062 | .093 | .088 | .355 | 15° | 1.170 | 1.152 | 1.875 | .030x45° | 2.000 |

### ORDERING INFORMATION

TYPE NO. — MODEL — RESISTOFILM — NO. OF CUPS — LIN. TOL. — RESISTANCE

78 — S — F — 1 — B — 103

Type shown would be a ⅞" servo mount single cup with 0.5 linearity having a resistance value of 10,000Ω.

116 = 1⅛"
176 = 1¾"

S = SERVO
B = BUSHING

A = ±1%
B = ±0.5%
C = ±0.25%

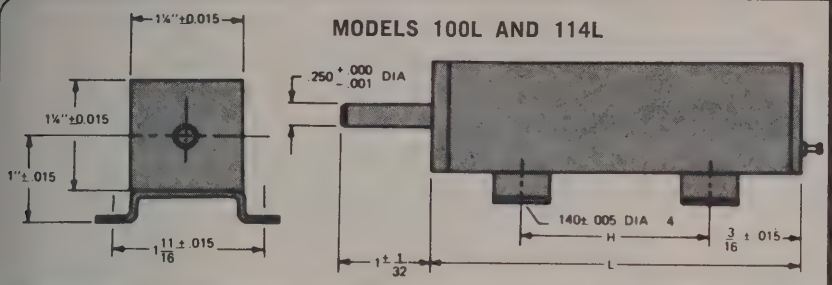
Resistance (Ohms)
1,000 = 102
5,000 = 502
10,000 = 103
25,000 = 253
50,000 = 503
100,000 = 104

new england instrument company
KENDALL LANE • NATICK, MASS. 01760 • (617) 873-9711 • TWX: 710-360-0398

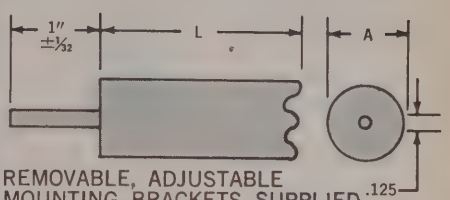
# PRECISION POTENTIOMETERS

## ECONOPOT® STANDARD LINEAR MOTION MODELS
## CONDUCTIVE PLASTIC UNITS FEATURING NEI's RESISTOFILM™

### MODELS 100L AND 114L




### MODEL 50LMF




REMOVABLE, ADJUSTABLE MOUNTING BRACKETS SUPPLIED WITH ROUND CROSS-SECTION UNITS

| MODEL | ELECTRICAL STROKE, E | MECHANICAL STROKE, M | A | B | C | H | L |
|---|---|---|---|---|---|---|---|
| 100L | SPECIFY (UP TO 30") | E + 3/32" | 1" | 7/8" | 1 7/16" | E + 1" | E + 3" |
| 114L | SPECIFY (UP TO 30") | E + 3/32" | 1 1/4" | 1" | 1 7/16" | E + 1" | E + 3" |
| 50LMF | SPECIFY (UP TO 6") | E + 3/32" | 1/2" | N.A. | N.A. | N.A. | E + 2" |

## SPECIFICATIONS

### ELECTRICAL

**Resistance per inch of stroke length:** 50K ohms per inch maximum
**Stroke length, Standard:** up to 30"
**Special:** up to 100"
**Number of Elements:** single or dual
**Total Resistance Tolerance:** ±10%
**Independent Linearity, Standard:** ±1%
**Special:** ±0.1% (for stroke lengths over 4")
**Power Rating:** 0.5 watts per inch stroke at 25°C
**Resolution:** essentially infinite
**Insulation Resistance:** 1000 megohms minimum

### MECHANICAL

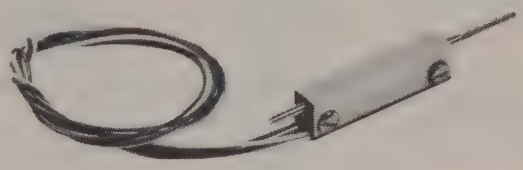
**Case Width, Standard:** 1" or 1¼" square & ½" O.D. round
**Starting Torque:** 4 oz.-in.
**Taps:** available (specify location & type i.e.: current or voltage)
**Mounting:** flanges or brackets available
**Connectors:** available

**Note:** The shaft can be rotated without detrimental effect to the unit.

## OTHER LINEAR MOTION DESIGNS AVAILABLE

### HIGH RELIABILITY DUAL-ELEMENT UNITS

Originally designed to be a rocket propellant valve position monitor, this unit has two potentiometer elements (one for control and one for telemetry), plus a single-pole double-throw switch. Linearity tolerance is only ±0.001" and position reference must be maintained after repeated linear shaft accelerations of 3000 G's. 24 were used in each rocket.

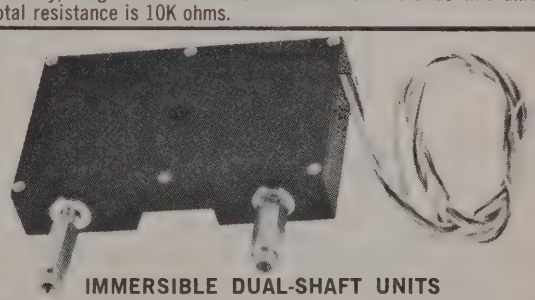


### MINIATURE DOUBLE-ENDED UNITS

**LMFL-101** Dimensions: ¼"W x 5/16"D x 1¼"L. This conductive plastic design features a double-ended shaft extension and can be actuated from either end, sensing a stroke length of 0.18". High accuracy, long life and infinite resolution characterize this unit. Total resistance is 10K ohms.

### WIREWOUND ROUND CROSS-SECTION UNITS

**LMWS-205** This wirewound unit is typical of linear motion units designed to meet specific configuration requirements. It features a precisely located center tap, a resistance of 2K ohms ±5%, 0.1% resolution, and an absolute linearity of 0.5%. Mechanical stroke length is 2".



### IMMERSIBLE DUAL-SHAFT UNITS

**LMFT-121** Dimensions: 1¾"L x 2⅞"W x ½"D. This unique package was designed specifically for total immersion in water. It features two separate elements independently actuated. Both are center tapped, with leads provided. Total resistance is 5K ohms with 1% accuracy and ¾" stroke length.

**new england instrument company**
KENDALL LANE • NATICK, MASS. 01760 • (617) 873-9711 • TWX: 710-360-0398

# PRECISION POTENTIOMETERS

## CUSTOM DESIGNS
## SINGLE-TURN PRECISION CONDUCTIVE PLASTIC

½" DIAMETER 55FT SERIES

¾" DIAMETER 34FT SERIES

⅞" DIAMETER 78FT SERIES

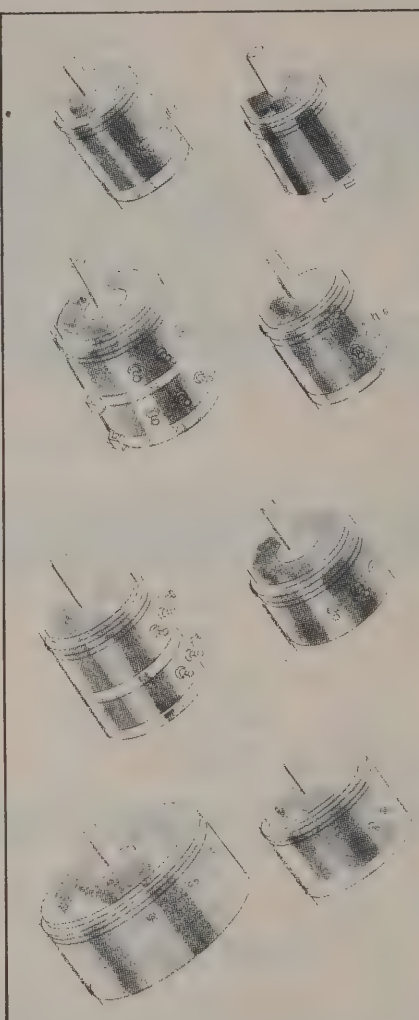
1 1/16" DIAMETER 116FT SERIES

1 7/16" DIAMETER 176FT SERIES

1⅝" DIAMETER 158FT SERIES

2" DIAMETER 200FT SERIES

3" DIAMETER 300FT SERIES



- LINEAR OR NONLINEAR FUNCTIONS
- MULTIPLE TAPS AVAILABLE
- SINGLE OR MULTI-CUP UNITS
- SERVO OR BUSHING MOUNTS
- AVAILABLE WITH SPRING RETURNS, STOPS, SWITCHES, MOTORS, ETC. DESIGNED IN

### GENERAL SPECIFICATIONS — CONDUCTIVE PLASTIC

**Resistance Tolerance**
Standard: ±10%

**Theoretical Electrical Travel**
Standard: 340°

**Ambient Temperature Range**
Standard: −55°C to +150°C

**Travel Resolution**
Essentially infinite

**Bearings**
Stainless steel ball bearings are standard.

**Mechanical Rotation**
Normally continuous; however, stops are available.

**Life**
50 million revolutions

| SERIES | DIAMETER | NOMINAL RESISTANCE RANGE | NOMINAL POWER RATING | MAXIMUM STARTING TORQUE | NOMINAL ACCURACY |
|---|---|---|---|---|---|
| 55 FT | ½" | 1K to 10K | 0.5W @ 25°C | 0.35 oz.-in. | ±1.0% |
| 34 FT | ¾" | 1K to 20K | 1.0W @ 25°C | 0.35 oz.-in. | ±0.75% |
| 78 FT | ⅞" | 1K to 25K | 1.0W @ 25°C | 0.35 oz.-in. | ±0.75% |
| 116 FT | 1 1/16" | 1K to 50K | 1.0W @ 25°C | 0.35 oz.-in. | ±0.5% |
| 176 FT | 1 7/16" | 1K to 75K | 1.5W @ 25°C | 0.50 oz.-in. | ±0.5% |
| 158 FT | 1⅝" | 1K to 75K | 2.0W @ 25°C | 0.50 oz.-in. | ±0.5% |
| 200 FT | 2" | 1K to 100K | 3.0W @ 25°C | 0.75 oz.-in. | ±0.3% |
| 300 FT | 3" | 1K to 100K | 5.0W @ 25°C | 1.0 oz.-in. | ±0.25% |

VALUES SHOWN ABOVE ARE NOMINAL. FOR SPECIFIC REQUIREMENTS, REFER TO NEI'S COMPLETE CATALOG OR CONTACT OUR APPLICATIONS ENGINEERING DEPARTMENT.

## WAFERPOT™ SINGLE-TURN PRECISION CONDUCTIVE PLASTIC POTENTIOMETERS

(LINEAR & NONLINEAR FUNCTION POTENTIOMETERS SPECIFICALLY DESIGNED FOR HIGH-DENSITY PACKAGING)

| | | MODEL 116 FT | MODEL 176 FT | MODEL 200 FT |
|---|---|---|---|---|
| MECHANICAL | Body Diameter | 1 1/16" | 1 7/16" | 2" |
| | Length (single cup only) | .680 | .680 | .680 |
| | Length each additional cup | .200 | .200 | .200 |
| | Starting Torque | .35 oz.-in. max. | .50 oz.-in. max. | .75 oz.-in. max. |
| | (per cup, additional) | .25 oz.-in. max. | .35 oz.-in. max. | .50 oz.-in. max. |
| TYPICAL SPECIFICATIONS | Standard Resistance Values | 1 K to 50K | 1K to 75K | 1K to 100K |
| | Standard Resistance Tolerance | ±10% | ±10% | ±10% |
| | Standard Accuracy | ±0.5% | ±0.5% | ±0.3% |
| ELECTRICAL | Travel Resolution (essentially infinite for all models) | | | |
| | Electrical Function Angle | 340° ±5° | 340° ±5° | 340° ±5° |
| | Power Rating @ 25°C (derates linearly to 0 watts @ 125°C) | 1.0 watt | 1.5 watts | 3.0 watts |

**new england instrument company**
KENDALL LANE • NATICK, MASS. 01760 • (617) 873-9711 • TWX: 710-360-0398

# PRECISION POTENTIOMETERS

## CUSTOM DESIGNS
## SINGLE-TURN PRECISION WIREWOUND TYPES

### RELATIVE MERITS OF CONDUCTIVE PLASTIC AND WIREWOUND

The major advantages of conductive plastic potentiometers over wirewounds are infinite resolution and longer life. In most other respects, the two types are comparable. NEI has made it a strong point over the years to maintain **balanced** capability in conductive plastic and wirewound potentiometers. Each has its advantages in given applications, and NEI is the **only** company that can objectively recommend and supply either type.

### GENERAL SPECIFICATIONS — WIREWOUND

**Resistance Tolerance**
Standard: ±5%

**Theoretical Electrical Travel**
Standard: 340°

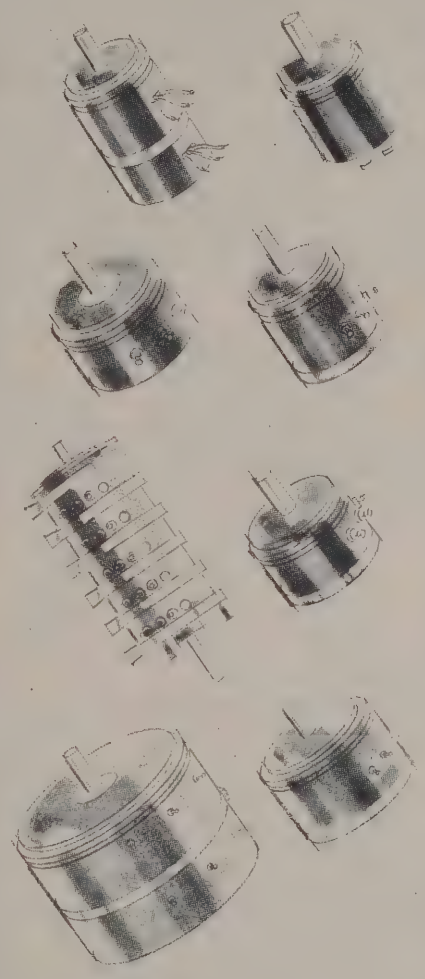
**Ambient Temperature Range**
Standard: −55°C to +125°C
Special: −55°C to +150°C

**Bearings**
Stainless steel ball-bearings are standard.

**Mechanical Rotation**
Normally continuous; however, stops are available.

| SERIES | DIAMETER | NOMINAL RESISTANCE RANGE | NOMINAL POWER RATING | MAXIMUM STARTING TORQUE | NOMINAL ACCURACY |
|---|---|---|---|---|---|
| 55W | ½″ | 100Ω to 50K | 2W @ 25°C | 0.5 oz.-in. | ±3.0% |
| 34W | ¾″ | 100Ω to 100K | 2W @ 25°C | 0.45 oz.-in. | ±2.0% |
| 78W | ⅞″ | 100Ω to 150K | 2.5W @ 25°C | 0.4 oz.-in. | ±1.0% |
| 116W | 1 1/16″ | 100Ω to 150K | 3W @ 25°C | 0.4 oz.-in. | ±0.75% |
| 176W | 1 7/16″ | 100Ω to 250K | 3W @ 25°C | 0.5 oz.-in. | ±0.5% |
| 158W | 1⅝″ | 500Ω to 350K | 3.5W @ 25°C | 0.65 oz.-in. | ±0.5% |
| 200W | 2″ | 500Ω to 500K | 4W @ 25°C | 0.80 oz.-in. | ±0.40% |
| 300W | 3″ | 500Ω to 750K | 6W @ 25°C | 1.0 oz.-in. | ±0.25% |

VALUES SHOWN ABOVE ARE NOMINAL. FOR SPECIFIC REQUIREMENTS, REFER TO NEI'S COMPLETE CATALOG OR CONTACT OUR APPLICATIONS ENGINEERING DEPARTMENT.



½″ DIAMETER 55W SERIES

¾″ DIAMETER 34W SERIES

⅞″ DIAMETER 78W SERIES

1 1/16″ DIAMETER 116W SERIES

1 7/16″ DIAMETER 176W SERIES

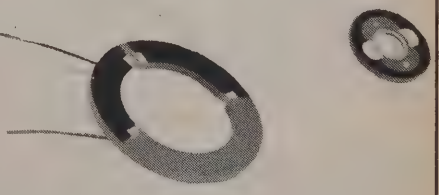
1⅝″ DIAMETER 158W SERIES

2″ DIAMETER 200W SERIES

3″ DIAMETER 300W SERIES

### WIREWOUND & CONDUCTIVE PLASTIC ELEMENTS & ASSEMBLIES

- LINEAR MOTION
- ROTARY MOTION
- LINEAR FUNCTIONS
- NONLINEAR FUNCTIONS
- SECTOR OR FULL 360°
- ELEMENTS INSTALLED IN YOUR SPECIAL ASSEMBLIES & FULLY TESTED IN OUR ENVIRONMENTAL LABORATORY



**new england instrument company**
KENDALL LANE • NATICK, MASS. 01760 • (617) 873-9711 • TWX: 710-360-0398

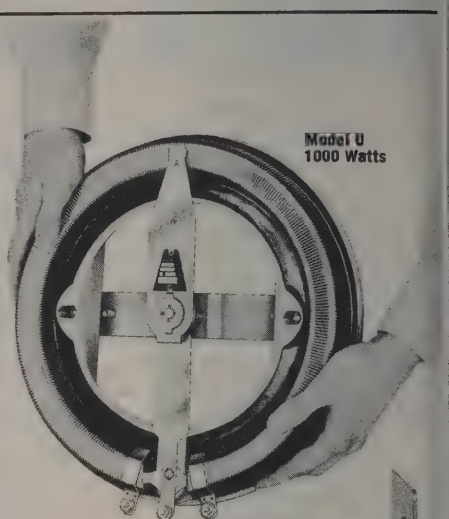
# OHMITE® vitreous enameled rheostats (potentiometers)

Now, Ohmite offers TWELVE sizes in its line of famous rheostats.

In all Ohmite rheostats, the resistance wire is wound on a solid ceramic core. The turns are locked in place with tough, protective vitreous enamel or Ohmicone® silicone ceramic. Pivoted, universal action mounting of the brush, assures perfect contact. Metal-graphite contact brushes, varied to fit current and resistance, insure good contact with negligible wear of the wire. Terminals at each end of the winding permit connection of the unit as a potentiometer.

**NOW, FOR ITS RATING, INDUSTRY'S SMALLEST RHEOSTAT!**

Model C
7½ Watts

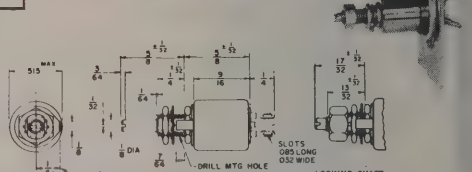


Model U
1000 Watts

| Dimensions and Other Parameters | Mod. C Encl. | Model E Unencl. | Model E Encl. | Model H | Model J | Model G | Model K | Model L | Model P | Model N | Model R | Model T | Model U |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rated Watts | 7½ | 12½ | | 25 | 50 | 75 | 100 | 150 | 225 | 300 | 500 | 750 | 1000 |
| Resistance Range - Ohms | 10 to 5,000 | 1 to 15,000 | | 1 to 25,000 | 0.5 to 50,000 | 0.5 to 50,000 | 0.5 to 50,000 | 0.5 to 50,000 | 1 to 30,000 | 1 to 50,000 | 1 to 20,000 | 1 to 15,000 | 1 to 20,000 |
| Overall Diameter | .515 | ⅞ | 1¾₆₄ | 1¹⁵⁄₁₆ | 2⁵⁄₁₆ | 2¾ | 3⅛ | 4 | 5 | 6 | 8 | 10 | 12 |
| Overall Depth Behind Panel | ⅞ | 1¹⁄₁₆ | 1³¹⁄₃₂ | 1⅜ | 1⅜ | 1¾ | 1¾ | 2 | 2⅛ | 2⅜ | 2⅛ | 3 | 3 |
| Weight - Lbs. | .017 | .037 | .053 | 0.19 | 0.32 | 0.52 | 0.64 | 1.1 | 2 | 2.6 | 4 | 7.6 | 10 |
| Mtg. Centers (Dimension "M") | (Single-Hole Mounting) | | | | | | | | ⅞ | 1¹⁵⁄₁₆ | 1½ | 1⅞ | 3 |

## MODEL "C" — 7½ WATT* — STANDARD & LOCKING SHAFT

| Ohms | Amps | Standard Shaft Catalog No.[1] | Locking Shaft Catalog No.[1] |
|---|---|---|---|
| 10 | .86 | 4908 | 4948 |
| 15 | .71 | 4909 | (4949) |
| 25 | .55 | 4910 | (4950) |
| 35 | .46 | (4911) | (4951) |
| 50 | .39 | 4912 | (4952) |
| 75 | .32 | (4913) | (4953) |
| 100 | .27 | 4914 | 4954 |
| 150 | .22 | (4915) | (4955) |
| 200 | .19 | 4916 | (4956) |
| 250 | .17 | 4917 | (4957) |
| 350 | .15 | 4918 | 4958 |
| 500 | .12 | 4919 | (4959) |
| 750 | .10 | (4920) | (4960) |
| 1000 | .086 | 4921 | 4961 |
| 1500 | .071 | (4922) | (4962) |
| 2500 | .055 | (4923) | 4963 |
| 3500 | .046 | (4924) | (4964) |
| 5000 | .039 | 4925 | 4965 |

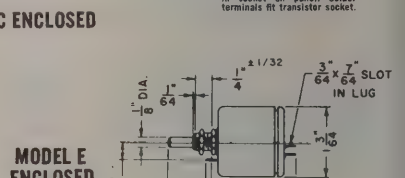

DRILL 1/8 HOLE IN PANEL
STANDARD SHAFT
DRILL MTG HOLE FOR 1/4-32 THD BUSHING 1/16 THK HEX NUT
LOCKING SHAFT
SLOTS .085 LONG .032 WIDE
Locking-type Model C mounted in socket on panel. Solder terminals fit transistor socket.

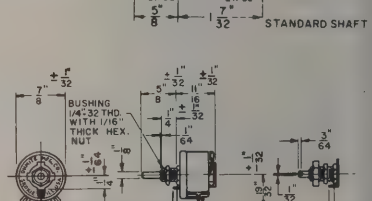
MODEL C ENCLOSED

*Rating on metal panel — unit is silicone-ceramic coated.

## MODEL "E" — 12½ WATT* — UNENCLOSED & ENCLOSED

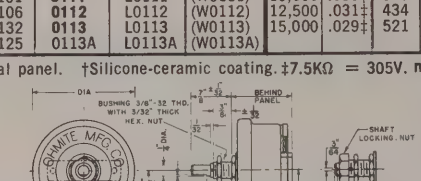
| Total Ohms | Max. Amps | Steps Appr. | Unenclosed Standard Shaft Cat. No.[1] | Unenclosed Locking Shaft Cat. No.[1] | Enclosed Std. Shaft Cat. No. | Total Ohms | Max. Amps | Steps Appr. | Unenclosed Standard Shaft Cat. No.[1] | Unenclosed Locking Shaft Cat. No.[1] | Enclosed Std. Shaft Cat. No. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.53 | 32 | **0101** | L0101 | (W0101) | 175 | .27 | 146 | **0114** | L0114 | (W0114) |
| 2 | 2.50 | 28 | **0102** | L0102 | (W0102 | 200 | .25 | 132 | 0114A | L0114A | (W0114A) |
| 2.5 | 2.24 | 31 | (0102A) | (L0102A) | (W0102A) | 250 | .22 | 128 | **0115** | L0115 | (W0115) |
| 3 | 2.04 | 33 | 0103 | L0103 | (W0103) | 350 | .19 | 149 | **0116** | L0116 | (W0116) |
| 5 | 1.58 | 61 | 0103A | L0103A | (W0103A) | 500 | .16 | 213 | **0117** | L0117 | (W0117) |
| 6 | 1.44 | 58 | **0104** | L0104 | (W0104) | 750 | .13 | 193 | **0118** | L0118 | (W0118) |
| 8 | 1.25 | 61 | **0105** | L0105 | (W0105) | 1,000 | .11 | 257 | **0119** | L0119 | (W0119) |
| 10 | 1.12 | 76 | **0106** | L0106 | (W0106) | 1,500 | .091 | 255 | **0120** | L0120 | (W0120) |
| 15 | .91 | 64 | 0107 | L0107 | (W0107) | 2,500 | .071 | 277 | **0121** | L0121 | (W0121) |
| 25 | .71 | 67 | **0108** | L0108 | (W0108) | 3,500 | .060 | 313 | **0122**† | L0122† | (W0122)† |
| 35 | .60 | 73 | **0109** | L0109 | (W0109) | 5,000 | .050 | 355 | **0123**† | L0123† | (W0123)† |
| 50 | .50 | 83 | **0110** | L0110 | (W0110) | 7,500 | .041‡ | 299 | 4190† | L4190† | (W4190)† |
| 75 | .41 | 101 | **0111** | L0111 | (W0111) | 10,000 | .035‡ | 398 | **4191**† | L4191† | (W4191)† |
| 100 | .35 | 106 | **0112** | L0112 | (W0112) | 12,500 | .031‡ | 434 | (4192)† | (L4192)† | (W4192)† |
| 125 | .32 | 132 | **0113** | L0113 | (W0113) | 15,000 | .029‡ | 521 | 4193† | L4193† | (W4193)† |
| 150 | .29 | 125 | 0113A | L0113A | (W0113A) | | | | | | |



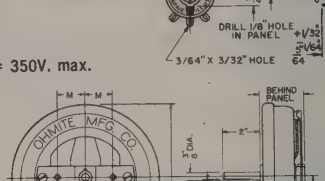

*Rating on metal panel. †Silicone-ceramic coating. ‡7.5KΩ = 305V. max; 10KΩ, 12.5KΩ, and 15KΩ = 350V. max.

**MODELS H, J, G, K, L***


OHMITE MFG. CO.
BUSHING 3/8"-32 THD. WITH 3/32" THICK HEX. NUT
BEHIND PANEL
SHAFT LOCKING NUT
DRILL 3/16" HOLE IN PANEL
HOLES FOR NO. 2 SCREWS. MOD. N
HOLES FOR NO. 8 SCREWS MODELS H, J, G, K, L
STANDARD SHAFT MODELS H, J, G, K, L
LOCKING SHAFT MODEL H, U, G, K

* NO NON-TURN ON MODEL L

**MODELS P, N, R, T, U**




### 25 WATT MODEL "H" — UL Listed

| Locking Shaft | Std. Shaft | Total Ohms | Max. Amps | Steps Approx. |
|---|---|---|---|---|
| L0140 | **0140** | 1 | 5.000 | 30 |
| L0141 | **0141** | 2 | 3.540 | 30 |
| L0142 | **0142** | 3 | 2.880 | 31 |
| L0143 | **0143** | 6 | 2.040 | 50 |
| L0144 | **0144** | 8 | 1.770 | 53 |
| L0145 | **0145** | 10 | 1.580 | 52 |
| L0146 | **0146** | 15 | 1.290 | 67 |
| L0147 | **0147** | 25 | 1.000 | 89 |
| L0148 | **0148** | 35 | .845 | 98 |
| L0149 | **0149** | 50 | .707 | 80 |
| L0150 | **0150** | 75 | .575 | 107 |
| L0151 | **0151** | 100 | .500 | 142 |

### 50 WATT MODEL "J" — UL Listed

| Catalog No.[1] | Total Ohms | Max. Amps | Steps Approx. |
|---|---|---|---|
| **0308** | 0.5 | 10.000 | 24 |
| **0309** | 1 | 7.070 | 44 |
| **0310** | 2 | 5.000 | 43 |
| **0311** | 4 | 3.530 | 42 |
| **0312** | 6 | 2.880 | 45 |
| **0313** | 8 | 2.500 | 43 |
| **0314** | 12 | 2.040 | 86 |
| **0315** | 16 | 1.760 | 91 |
| **0316** | 22 | 1.500 | 100 |
| **0317** | 35 | 1.190 | 125 |
| **0318** | 50 | 1.000 | 112 |
| **0319** | 80 | .790 | 143 |
| **0320** | 125 | .630 | 176 |

### 75 WATT MODEL "G" — UL Listed

| Catalog No.[1] | Total Ohms | Max. Amps | Steps Approx. |
|---|---|---|---|
| 1100 | 0.5 | 12.300 | 27 |
| (1101) | 1 | 8.660 | 27 |
| 1102 | 2 | 6.120 | 30 |
| 1103 | 3 | 5.000 | 28 |
| 1104 | 5 | 3.880 | 53 |
| 1105 | 7.5 | 3.160 | 50 |
| 1106 | 10 | 2.740 | 53 |
| 1107 | 16 | 2.170 | 91 |
| 1108 | 25 | 1.730 | 113 |
| 1109 | 50 | 1.230 | 142 |

### 100 WATT MODEL "K" — UL Listed

| Catalog No.[1] | Total Ohms | Max. Amps | Steps Approx. |
|---|---|---|---|
| **0440** | 0.5 | 14.100 | 33 |
| **0441** | 1 | 10.000 | 33 |
| 0442 | 2 | 7.070 | 32 |
| 0443 | 3 | 5.750 | 39 |
| **0444** | 5 | 4.470 | 57 |
| **0445** | 7.5 | 3.650 | 60 |
| **0446** | 10 | 3.160 | 57 |
| **0447** | 16 | 2.500 | 88 |
| **0448** | 25 | 2.000 | 109 |
| **0449** | 50 | 1.410 | 137 |

### 150 WATT MODEL "L" — UL Listed

| Catalog No.[1] | Total Ohms | Max. Amps | Steps Approx. |
|---|---|---|---|
| 0524 | 0.5 | 17.300 | 29 |
| 0525 | 1 | 12.300 | 41 |
| 0526 | 2 | 8.650 | 40 |
| 0527 | 3 | 7.070 | 42 |
| 0528 | 5 | 5.480 | 44 |
| 0529 | 7.5 | 4.470 | 75 |
| **0530** | 10 | 3.880 | 79 |
| **0531** | 15 | 3.163 | 75 |
| **0532** | 25 | 2.450 | 120 |
| 0533 | 35 | 2.070 | 133 |
| **0534** | 50 | 1.735 | 151 |

Continued on next page

# OHMITE® vitreous enameled rheostats (potentiometers)

### 25 WATT MODEL "H" — UL Listed

| Locking Shaft | Std. Shaft | Total Ohms | Max. Amps | Steps Approx. |
|---|---|---|---|---|
| L0152 | **0152** | 125 | .445 | 139 |
| L0153 | **0153** | 175 | .373 | 154 |
| L0154 | **0154** | 250 | .316 | 177 |
| L0155 | **0155** | 350 | .267 | 197 |
| L0156 | **0156** | 500 | .222 | 220 |
| L0157 | **0157** | 750 | .182 | 261 |
| L0158 | **0158** | 1,000 | .155 | 278 |
| L0159 | **0159** | 1,500 | .129 | 267 |
| L0160 | **0160** | 2,500 | .100 | 341 |
| L0161 | **0161** | 3,500 | .084 | 315 |
| L0162 | **0162** | 5,000 | .070 | 355 |
| L4200 | 4200† | 7,500 | .058 | 439 |
| L4201† | **4201†** | 10,000 | .050 | 476 |
| L4202† | 4202† | 15,000 | .041 | 431 |
| L4203† | **4203†** | 20,000 | .035 | 422 |
| L4204† | **4204†** | 25,000 | .032 | 527 |

†Silicone-ceramic coating, 500V max. for 10KΩ and above. Not UL listed.

### 50 WATT MODEL "J" — UL Listed

| Catalog No.[1] | Total Ohms | Max. Amps | Steps Approx. |
|---|---|---|---|
| **0321** | 150 | .575 | 170 |
| **0322** | 225 | .470 | 199 |
| **0323** | 300 | .408 | 211 |
| **0324** | 500 | .316 | 284 |
| **0325** | 800 | .250 | 282 |
| **0326** | 1,000 | .224 | 352 |
| **0327** | 1,600 | .176 | 355 |
| **0328** | 2,500 | .141 | 449 |
| **0329** | 3,500 | .119 | 496 |
| **0330** | 5,000 | .100 | 459 |
| 0331 | 8,000 | .079 | 576 |
| **0332** | 10,000 | .070 | 565 |
| 4210† | 15,000 | .058 | 568 |
| 4211† | 20,000 | .050 | 599 |
| 4212† | 25,000 | .045 | 573 |
| 4213† | 30,000 | .041 | 688 |
| (4214†) | 40,000 | .035 | 673 |
| **4215†** | 50,000 | .032 | 842 |

†Silicone-ceramic coating. 750V max. for 15KΩ and above. Not UL listed.

### 75 WATT MODEL "G" — UL Listed

| Catalog No.[1] | Total Ohms | Max. Amps | Steps Approx. |
|---|---|---|---|
| 1110 | 75 | 1.000 | 134 |
| 1111 | 100 | .866 | 178 |
| 1112 | 200 | .612 | 180 |
| 1113 | 300 | .500 | 211 |
| 1114 | 400 | .433 | 223 |
| 1115 | 500 | .388 | 279 |
| (1116) | 750 | .316 | 338 |
| 1117 | 1,000 | .274 | 356 |
| (1118) | 1,500 | .224 | 420 |
| 1119 | 2,000 | .194 | 443 |
| (1120) | 2,500 | .173 | 441 |
| (1121) | 5,000 | .123 | 564 |
| (1122) | 7,500 | .100 | 547 |
| 1123 | 10,000 | .087 | 572 |

### 100 WATT MODEL "K" — UL Listed

| Catalog No.[1] | Total Ohms | Max. Amps | Steps Approx. |
|---|---|---|---|
| **0450** | 75 | 1.150 | 163 |
| **0451** | 100 | 1.000 | 172 |
| **0452** | 200 | .707 | 216 |
| **0453** | 300 | .575 | 261 |
| 0454 | 400 | .500 | 272 |
| **0455** | 500 | .447 | 269 |
| 0456 | 750 | .365 | 326 |
| **0457** | 1,000 | .316 | 343 |
| 0458 | 1,500 | .258 | 404 |
| 0459 | 2,000 | .224 | 426 |
| 0460 | 2,500 | .200 | 426 |
| 0461 | 5,000 | .141 | 543 |
| 0462 | 7,500 | .115 | 528 |
| 0463 | 10,000 | .100 | 704 |

### 150 WATT MODEL "L" — UL Listed

| Catalog No.[1] | Total Ohms | Max. Amps | Steps Approx. |
|---|---|---|---|
| **0535** | 75 | 1.415 | 179 |
| **0536** | 100 | 1.225 | 190 |
| **0537** | 150 | 1.000 | 225 |
| **0538** | 200 | .865 | 239 |
| 0539 | 250 | .775 | 236 |
| 0540 | 350 | .655 | 265 |
| **0541** | 500 | .548 | 296 |
| 0542 | 750 | .447 | 352 |
| **0543** | 1,250 | .346 | 473 |
| 0544 | 1,800 | .288 | 537 |
| 0545 | 2,250 | .259 | 529 |
| 0546 | 3,000 | .224 | 558 |
| 0547 | 4,500 | .182 | 667 |
| 0548 | 7,500 | .141 | 714 |
| **0549** | 10,000 | .122 | 952 |

### 225 WATT MODEL "P" — UL Listed

| Catalog No.[1] | Total Ohms | Max. Amps | Steps Approx. |
|---|---|---|---|
| (1250) | 1.0 | 15.000 | 42 |
| 1251 | 2.0 | 10.600 | 41 |
| **1252** | 3.0 | 8.660 | 61 |
| (1253) | 4.0 | 7.500 | 58 |
| 1254 | 5.0 | 6.710 | 57 |
| (1255) | 7.5 | 5.490 | 60 |
| **1256** | 10.0 | 4.740 | 115 |
| 1257 | 15.0 | 3.870 | 108 |
| 1258 | 25.0 | 3.000 | 114 |
| 1259 | 50.0 | 2.120 | 218 |
| 1260 | 75.0 | 1.730 | 206 |
| 1261 | 100 | 1.500 | 275 |
| 1262 | 150 | 1.220 | 259 |
| **1263** | 200 | 1.060 | 345 |
| 1264 | 300 | .866 | 326 |
| 1265 | 400 | .750 | 342 |
| 1266 | 700 | .567 | 483 |
| 1267 | 900 | .500 | 484 |
| 1268 | 1,200 | .433 | 513 |
| 1269 | 1,500 | .387 | 641 |
| 1270) | 1,750 | .358 | 603 |
| 1270A) | 2,000 | .336 | 690 |
| 1271 | 2,500 | .300 | 679 |

### 300 WATT MODEL "N" — UL Listed

| Catalog No.[1] | Total Ohms | Max. Amps | Steps Approx. |
|---|---|---|---|
| **0650** | 1.0 | 17.320 | 56 |
| 0651 | 2.0 | 12.240 | 51 |
| 0652 | 3.0 | 10.000 | 51 |
| 0653 | 4.0 | 8.660 | 77 |
| 0654 | 5.0 | 7.750 | 76 |
| 0655 | 7.5 | 6.320 | 72 |
| **0656** | 10.0 | 5.480 | 76 |
| **0657** | 15.0 | 4.470 | 144 |
| **0658** | 25.0 | 3.460 | 134 |
| **0659** | 50.0 | 2.450 | 230 |
| **0660** | 75.0 | 2.000 | 275 |
| **0661** | 100 | 1.730 | 288 |
| 0662 | 150 | 1.410 | 345 |
| 0663 | 200 | 1.220 | 364 |
| 0664 | 300 | 1.000 | 433 |
| **0665** | 400 | .866 | 456 |
| 0666 | 700 | .655 | 500 |
| 0667 | 900 | .578 | 517 |
| 0668 | 1,200 | .500 | 541 |
| 0669 | 1,500 | .447 | 676 |
| (0670) | 1,750 | .414 | 625 |
| (0670A) | 2,000 | .387 | 714 |
| 0671 | 2,500 | .346 | 720 |

### 500 WATT MODEL "R"

| Catalog No.[1] | Total Ohms | Max. Amps | Steps Approx. |
|---|---|---|---|
| 0849 | 1.0 | 22.300 | 56 |
| 0850 | 1.5 | 18.200 | 71 |
| (0851) | 2.0 | 15.800 | 75 |
| (0852) | 2.5 | 14.100 | 78 |
| 0853 | 3.0 | 12.900 | 79 |
| 0854 | 4.0 | 11.200 | 74 |
| 0855 | 5.0 | 10.000 | 104 |
| 0856 | 8.0 | 7.900 | 104 |
| 0857 | 12.5 | 6.300 | 115 |
| 0858 | 16.0 | 5.600 | 186 |
| **0859** | 25.0 | 4.470 | 205 |
| 0860 | 40.0 | 3.540 | 206 |
| 0872 | 50.0 | 3.160 | 205 |
| 0861 | 80.0 | 2.520 | 316 |
| 0862 | 125 | 2.000 | 388 |
| 0863 | 175 | 1.690 | 434 |
| 0864 | 250 | 1.410 | 490 |
| 0865 | 325 | 1.240 | 505 |
| **0866** | 500 | 1.000 | 614 |
| 0867 | 750 | .817 | 735 |
| 0868 | 1,000 | .707 | 769 |
| 0869 | 1,500 | .577 | 932 |
| (0870) | 2,000 | .500 | 971 |
| 0871 | 2,500 | .447 | 962 |

### 750 WATT MODEL "T"

| Catalog No.[1] | Total Ohms | Max. Amps | Steps Approx. |
|---|---|---|---|
| 1300 | 1.0 | 27.400 | 72 |
| (1301) | 1.5 | 22.300 | 72 |
| (1302) | 2.0 | 19.400 | 96 |
| (1303) | 2.5 | 17.300 | 101 |
| (1304) | 3.0 | 15.800 | 96 |
| (1305) | 4.0 | 13.600 | 94 |
| 1306 | 5.0 | 12.200 | 104 |
| 1307 | 8.0 | 9.650 | 100 |
| (1308) | 10.0 | 8.650 | 139 |
| (1309) | 12.5 | 7.750 | 138 |
| 1310 | 16.0 | 6.820 | 139 |
| 1311 | 25.0 | 5.470 | 137 |
| 1312 | 50.0 | 3.870 | 246 |
| (1313) | 80.0 | 3.060 | 381 |
| 1314 | 100 | 2.740 | 376 |
| 1315 | 160 | 2.170 | 476 |
| 1316 | 200 | 1.940 | 469 |
| 1317 | 300 | 1.580 | 562 |
| 1318 | 400 | 1.370 | 593 |
| 1319 | 600 | 1.117 | 705 |
| 1320 | 750 | 1.000 | 694 |
| 1321 | 1,200 | .791 | 889 |
| (1322) | 1,800 | .646 | 1,050 |
| (1322A) | 2,000 | .610 | 935 |
| (1323) | 2,500 | .547 | 1,170 |

### 1000 WATT MODEL "U"

| Catalog No.[1] | Total Ohms | Max Amps | Steps Approx. |
|---|---|---|---|
| **1450** | 1.0 | 31.600 | 91 |
| 1451 | 1.5 | 25.800 | 90 |
| 1452 | 2.0 | 22.400 | 90 |
| 1453 | 2.5 | 20.000 | 127 |
| 1454 | 3.0 | 18.300 | 114 |
| 1455 | 4.0 | 15.800 | 120 |
| **1456** | 5.0 | 14.100 | 124 |
| 1457 | 8.0 | 11.200 | 118 |
| 1458 | 10.0 | 10.000 | 117 |
| (1459) | 12.5 | 8.950 | 163 |
| 1460 | 16.0 | 7.900 | 166 |
| 1461 | 25.0 | 6.330 | 162 |
| 1462 | 50.0 | 4.470 | 327 |
| 1463 | 75.0 | 3.650 | 307 |
| 1464 | 100 | 3.160 | 446 |
| 1465 | 175 | 2.390 | 490 |
| 1466 | 225 | 2.110 | 630 |
| 1467 | 300 | 1.830 | 661 |
| 1468 | 400 | 1.580 | 704 |
| 1469 | 500 | 1.410 | 695 |
| 1470 | 750 | 1.150 | 828 |
| 1471 | 1,000 | 1.000 | 870 |
| 1472 | 1,500 | .816 | 1,040 |
| 1473 | 2,500 | .633 | 1,100 |

**Popular items appear in BOLD print and are usually in stock at authorized Ohmite stocking distributors. Items in LIGHT FACE print are available from stocking distributors but are not normally stocked in depth. Parentheses indicate non-stock standard items subject to a minimum handling charge per item.**

# OHMITE® molded composition potentiometers

STYLE CMU
MIL STYLE
RV4N

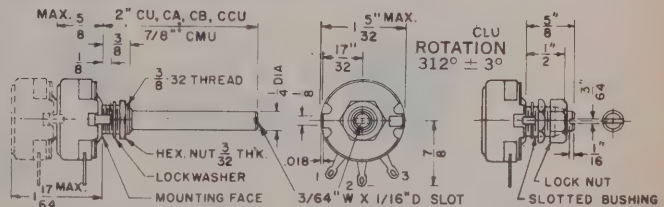
Ohmite molded composition potentiometers (Type AB) provide high quality and dependable performance.

Because the resistance element is a thick, solid-molded ring, longer life and smoother operation are obtained. This is due also to the molded composition contact. Units are dust and splash proof, fungus and corrosion resistant and meet the requirements of military specification MIL-R-94.

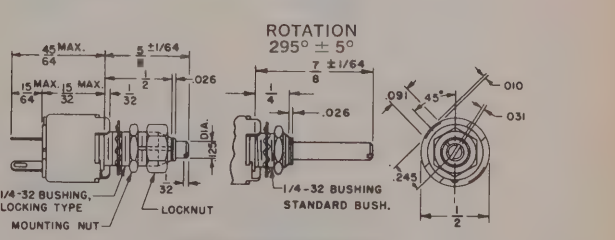
**STOCK "POTS" — MIL Units are stamped with MIL and Commercial Designations.**

| | Type AB (1 3/32" Dia.) Rated 2 Watts | | | | | | Type AS (½" Dia.) Rated ½ Watt | |
|---|---|---|---|---|---|---|---|---|
| | Single Unit ⅞" Shaft | Single Unit 2" Shaft | | | Locking | Dual | Miniature Locking | Miniature ⅞" Shaft |
| Resist. | Style CMU (Linear) Comm. & MIL | Style CU (Linear) | Style CA (CW log) | Style CB (CCW log) | Style CLU (Linear) Comm. & MIL | Style CCU (Linear) | Style AS (Linear) Comm. & MIL | Style ASM (Linear) Comm. & MIL |
| Range or Limited Ohmic Values | 50 to 5.0 Meg. | 50 to 5.0 Meg. | 0.1 Meg. .25 Meg. .5 Meg. 1.0 Meg. 2.5 Meg. | 10,000 25,000 50,000 | 50 to 5.0 Meg. | 10,000 25,000 50,000 1.0 Meg. .25 Meg. .5 Meg. 1.0 Meg. | 50 to 5.0 Meg. | 50 to 5.0 Meg. |
| Weight | .064 lb. | .084 lb. | | | .070 lb. | .123 lb. | .017 lb. | .017 lb. |

**FOR STOCK ITEMS, CALL LOCAL REPRESENTATIVE LISTED IN INDEX**




**TYPE AB POTENTIOMETERS**




**TYPE AS POTENTIOMETERS**

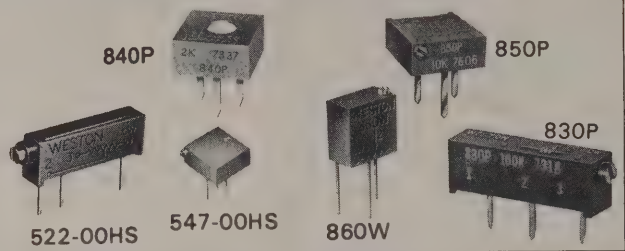
# WESTON

SANGAMO WESTON
Schlumberger

WESTON COMPONENTS & CONTROLS
A Division of Sangamo Weston, Inc.
Archbald, Pa. 18403
Tel. (717) 876-1500
TWX 510 656-2902
Telex 83-1873

## GENERAL PURPOSE CERMET

**Square, rectangular, and round**

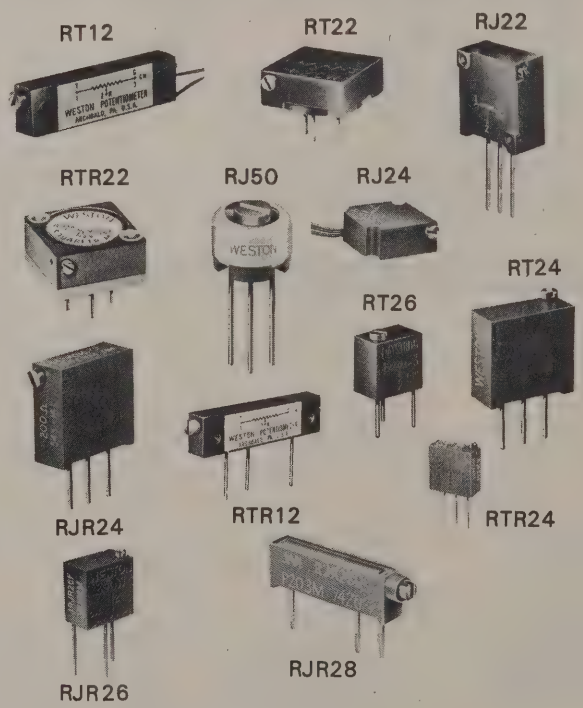



## GENERAL PURPOSE WIREWOUND

**Square, rectangular, and round**

## MILITARY GRADE

**All styles qualified to military specifications**




NOTES: • All units are humidity resistant per MIL-STD-202, Method 106.

• Model 1000 & 567-105HS contain solid stops. All other units are manufactured with slip clutch (wiper idles) for mechanical protection.

| DESCRIPTION | MODEL | TERM. |
|---|---|---|
| ¾" Rect. Comm | 830P† | P |
| ⅜" Sq. Comm. | 840P† | P |
| ⅜" Sq. Comm. | 850P† | P |
| ¼" Sq. Comm. | 860 | W<br>X |
| ½" Rect | 522-00HS | P |
| ⅜" Sq. | 546-00HS<br>547-00HS<br>548-00HS<br>548-72HS | L<br>P<br>W<br>X |
| ½" Sq | 558-00HS<br>558-72HS | W<br>X |
| ½" Round | 1000-00HS | P |
| ½" Round | 1000-67HS | P |
| ⅜" Sq. | 543-00HS<br>544-00HS<br>545-00HS<br>545-72HS | L<br>P<br>W<br>X |
| ½" Sq. | 553-00HS<br>555-00HS<br>555-72HS | L<br>W<br>X |
| ¼" Sq. | 561-00HS<br>562-00HS<br>562-72HS | P<br>W<br>X |
| ½" Sq. | 701-00HS | P |
| 5/16" Sq. | 501-00HS | P |
| | 502-00HS<br>502-72HS | W<br>X |
| MIL-R-27208/8<br>1¼" Rect | 534-118HS<br>535-105HS<br>539-105HS | L<br>P<br>Y |
| MIL-R-27208/9<br>⅜" Sq. | 543-118HS<br>544-105HS<br>545-101HS<br>545-102HS | L<br>P<br>W<br>X |
| MIL-R-27208/4<br>½" Sq. | 553-118HS<br>555-101HS<br>555-102HS<br>701-105HS | L<br>W<br>X<br>P |
| MIL-R-27208/10<br>¼" Sq. | 561-105HS<br>562-101HS<br>562-102HS | P<br>W<br>X |
| MIL-R-22097/4<br>Char. "F"<br>⅜" Sq. | 546-118HS<br>547-105HS<br>548-101HS<br>548-102HS<br>'C' Characteristic also available | L<br>P<br>W<br>X |
| MIL — R-22097/5<br>Char. F<br>¼" Sq. | 860-101HS<br>860-102HS | W<br>X |
| MIL-R-22097/3<br>Char. "C"<br>½" Sq. | 558-101HS<br>558-102HS | W<br>X |
| MIL-R-22097/6<br>¼" Round Char. "C" | 567-105HS | P |
| MIL-R-39015/1<br>1¼" Rect. | 534-160HS<br>535-160HS<br>539-160HS | L<br>P<br>Y |
| MIL-R-39015/2<br>½" Sq. | 313-160HS<br>318-160HS | L<br>P |
| | 701-160HS<br>553-160HS | P<br>L |
| | 555-160HS<br>555-161HS | W<br>X |
| MIL-R-39015/3<br>⅜" Sq. | 543-160HS<br>544-160HS<br>545-160HS<br>545-161HS | L<br>P<br>W<br>X |
| MIL-R-39035/2<br>⅜" Sq. | 547-160HS<br>548-160HS<br>548-161HS | P<br>W<br>X |
| MIL— R-39035/3<br>Char. F.<br>¼" Sq. | 860-160HS<br>860-161HS | W<br>X |
| MIL — R-39035/5<br>Char. C<br>¼" Rect. | 522-160HS | P |

Prices and specifications subject to change without notice.

SANGAMO WESTON
Schlumberger

WESTON COMPONENTS & CONTROLS
A Division of Sangamo Weston, Inc
Archbald, Pa. 18403
Tel. (717) 876-1500
TWX 510 656-2902
Telex 83-1873

# WESTON

| MILIT. DESIG. | TURNS | SIZES L W T | POWER RATING (W) | T.C. + PPM/°C | RES. TOL. % | RES. RANGE (OHMS) | 1-9 | PRICES 10-24 | 25-49 |
|---|---|---|---|---|---|---|---|---|---|
| N.A. | 15 | .75 x 25 x .19 | .75 @ 70°C | 100 | 10% | 10 - 2 Meg. | 1.35 | 1.28 | 1.21 |
| † Other Models available. | | Consult Factory | | | | | | | |
| N.A. | 1 | .375 x .375 x 188 | 5 @ 70°C | 100 | 10% | 10 - 2 Meg | 75 | 69 | 64 |
| † Other Models available. | | Consult Factory | | | | | | | |
| N.A. | 22 | 375 x 375 x 187 | 5 @ 70°C | 100 | 10% | 10 - 2 Meg | 1.49 | 1.44 | 1.34 |
| † Other Models available | | Consult Factory | | | | | | | |
| N.A. | 16 | .250 x .250 x .175 | .25 @ 85°C | 100 | 10% | 100 - 1 meg | 2.25 | 2.10 | 2.00 |
| | 10 | .50 x .17 x 10 | .3 @ 85°C | 100 | 10% | 100 - 1 Meg | 3.63 | 3.48 | 3.22 |
| N.A. | 25 | .375 x .375 x 150<br>.375 x .375 x 170<br>.417 x .375 x 170<br>.417 x .375 x 170 | 5 @ 85°C | 100 | 10% | 10 - 1 Meg | 5.25 | 5.02 | 4.77 |
| N.A. | 35 | .535 x .500 x .220<br>.535 x .500 x .220 | .5 @ 85°C | 100 | 10% | 50 - 1 Meg | 5.05 | 4.72 | 4.32 |
| N.A. | 1 | 50 Diam x 310 | 1 @ 70°C | 50 | 5% | 10 - 15K<br>20K - 35K<br>50K | 2.60<br>2.86<br>5.15 | 2.30<br>2.53<br>4.78 | 2.09<br>2.30<br>4.53 |
| N.A. | 1 | 500 Diam. x 240 | 1 @ 70°C | 50 | 5% | 10 - 15K<br>20K - 35K<br>50K | 2.50<br>2.75<br>5.03 | 2.20<br>2.42<br>4.66 | 1.99<br>2.19<br>4.41 |
| N.A. | 25 | .375 x .375 x 150<br>.375 x .375 x .170<br>.417 x .375 x .170<br>.417 x .375 x .170 | 1 @ 70°C | 50 | 5% | 10 - 10K<br>20K<br>50K | 5.25<br>5.75<br>6.25 | 5.02<br>5.52<br>6.02 | 4.77<br>5.27<br>5.77 |
| N.A. | 35 | .500 x .500 x .187<br>.535 x .500 x .220<br>.535 x .500 x .220 | 1 @ 70°C | 50 | 5% | 10 - 15K<br>20K - 25K<br>50K | 5.48<br>5.67<br>5.85 | 5.10<br>5.29<br>5.48 | 4.73<br>4.92<br>5.10 |
| N.A. | 13 | .250 x .250 x .170 | .25 @ 70°C | 50 | 5% | 10 - 5K<br>10K - 20K<br>25K | 6.50<br>7.50<br>8.50 | 6.18<br>7.18<br>8.18 | 5.85<br>6.85<br>7.85 |
| N.A. | 37 | .500 x .500 x .230 | 1 @ 70°C | 50 | 5% | 10 - 15K<br>20K | 5.48<br>5.67 | 5.10<br>5.29 | 4.73<br>4.92 |
| N.A. | 15 | .312 x .312 x .175 | 6 @ 70°C | 70 | 5% | 10 - 10K<br>20K | 6.08<br>6.93 | 5.44<br>6.31 | 4.83<br>5.70 |
| | | .312 x .312 x .200<br>.312 x .312 x .190 | | | | 10 - 10K<br>20K | 3.62<br>4.15 | 3.26<br>3.78 | 2.89<br>3.41 |
| RT12C2L<br>RT12C2P<br>RT12C2Y | 24 | 1.25 x .315 x .190<br>1.25 x .315 x .190<br>1.25 x .325 x .195 | .75 @ 85°C | 50 | 5% | 10 - 10K<br>20K<br>50K* | 6.21<br>6.54<br>7.48 | 5.50<br>6.06<br>6.90 | 5.14<br>5.68<br>6.45 |
| RT24C2L<br>RT24C2P<br>RT24C2W<br>RT24C2X | 25 | .375 x .375 x .150<br>.375 x .375 x .170<br>.417 x .375 x .170<br>.417 x .375 x .170 | .75 @ 85°C | 50 | 5% | 10 - 10K<br>20K* - 25K*<br>10 - 10K<br>20K* - 25K* | 7.36<br>8.05<br>6.40<br>7.00 | 6.69<br>7.27<br>5.82<br>6.32 | 6.19<br>6.76<br>5.38<br>5.88 |
| RT22C2L | 35 | 500 x .500 x .187 | .75 @ 85°C | 50 | 5% | 50 - 10K<br>20K | 5.41<br>5.95 | 5.11<br>5.62 | 4.84<br>5.34 |
| RT22C2W<br>RT22C2X<br>RT22C2P | 35<br>35<br>37 | .535 x .500 x .220<br>.535 x .500 x .220<br>.500 x .500 x .230 | | | | 50 - 10K<br>20K | 4.70<br>5.17 | 4.44<br>4.89 | 4.21<br>4.64 |
| RT26C2P<br>RT26C2W<br>RT26C2X | 13 | .250 x .250 x .170<br>.250 x .250 x .170<br>.250 x .250 x .170 | .25 @ 85°C | 50 | 5% | 10 - 5K<br>10K* - 20K*<br>25K* | 6.60<br>7.60<br>8.60 | 6.28<br>7.28<br>8.28 | 5.95<br>6.95<br>7.95 |
| RJ24FL<br>RJ24FP<br>RJ24FW<br>RJ24FX | 25 | .375 x .375 x .150<br>.375 x .375 x .170<br>.417 x .375 x .170<br>.417 x .375 x .170 | 50 @ 85°C | 100 | 10% | 50 - 1 Meg | 6.15 | 5.89 | 5.60 |
| RJ26FW<br>RJ26FX | 16 | .250 x .250 x .175 | .25 @ 85°C | 100 | 10% | 1K — 100K | 4.40 | 4.25 | 4.15 |
| RJ22CW<br>RJ22CX | 35 | .535 x .500 x .220<br>.535 x .500 x .220 | .5 @ 85°C | 100 | 10% | 200 - 1 Meg. | 5.59 | 5.23 | 4.81 |
| RJ50CP | 1 | .260 Diam x .210 | .25 @ 85°C | 250 | 10% | 10 - 1 Meg. | 5.39 | 4.95 | 4.62 |
| RTR12DL<br>RTR12DP<br>RTR12DY | 24 | 1.25 x .315 x .190<br>1.25 x .315 x .190<br>1.25 x .325 x .195 | .75 @ 85°C | 50 | 5% | 100 - 20K<br>50K* | 13.75<br>14.85 | 12.65<br>13.75 | 11.55<br>12.65 |
| | | | | RTR12DL-M & P Level Failure Rate; RTR12DP & RTR12DY-M Level Failure Rate | | | | | |
| RTR22DL<br>RTR22DP | 45 | .500 x .500 x .187<br>.500 x .500 x .255 | .75 @ 85°C | 50 | 5% | 200 - 10K<br>20K<br>M, P Level Failure Rate | 10.24<br>11.29 | 9.71<br>10.76 | 9.19<br>10.24 |
| | | | | | | 200 - 10K<br>20K<br>R Level Failure Rate | 14.03<br>15.13 | 12.93<br>14.03 | 11.83<br>12.93 |
| RTR22DP<br>RTR22DL | 37<br>35 | .500 x .500 x .230<br>.500 x .500 x .187 | .75 @ 85°C | 50 | 5% | 10 - 10K<br>20K | 10.24<br>11.29 | 9.71<br>10.76 | 9.19<br>10.24 |
| | | | | RTR22DP — M P Level Failure Rate; RTR22DL — M Level Failure Rate | | | | | |
| RTR22DW<br>RTR22DX | 35<br>35 | .535 x .500 x .220<br>.535 x .500 x .220 | .75 @ 85°C | 50 | 5% | 100 - 10K<br>20K<br>M, P Level Failure Rate | 10.24<br>11.29 | 9.71<br>10.76 | 9.19<br>10.24 |
| RTR24DL<br>RTR24DP<br>RTR24DW<br>RTR24DX | 25 | .375 x .375 x .150<br>.375 x .375 x .170<br>.417 x .375 x .170<br>.417 x .375 x .170 | .75 @ 85°C | 50 | 5% | 10 - 100**<br>200 - 10K<br>20K* - 25K*<br>50K* | 8.20<br>8.20<br>9.84<br>11.48 | 7.50<br>7.50<br>9.00<br>10.50 | 6.70<br>6.70<br>8.04<br>9.38 |
| | | | | RTR24DP - M & P Level Failure Rate, RTR24DL, RTR24DW, RTR24DX - M Level Failure Rate | | | | | |
| RJR24CP<br>RJR24CW<br>RJR24CX | 25 | .375 x .375 x .170<br>.417 x .375 x .170<br>.417 x .375 x .170 | .5W @ 85°C | 250 | 10% | 10 - 1 Meg. | 11.30 | 10.50 | 10.00 |
| | | | | (Char. "C" - 10 ohms thru 1 Meg.) (Char. "F" 100 ohms thru 100K) - M & P Level Failure Rate | | | | | |
| RJR26FW<br>RJR26FX | 16 | .250 x .250 x .175 | .25 @ 85°C | 100 | 10% | 1K — 100K | 12.75 | 11.85 | 11.10 |
| RJR28CP | 10 | .50 x .17 x .10 | .3 @ 85°C | 150 | 10% | 10 — 1 meg. | 13.20 | 12.54 | 11.88 |

*Non-Standard military value

**Non-QPL Resistance values

# WESTON SQUARETRIM®
## ¼" LOW COST CERMET
## POTENTIOMETERS

WESTON
SQUARETRIM
POTENTIOMETERS
¼" LOW COST CERMET

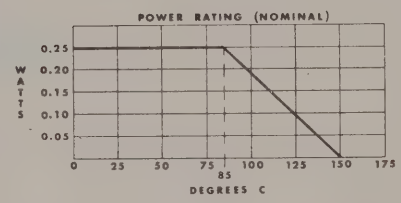
860W

860X

- Sealed to guard against contaminants: Sealed to withstand "Flow" Soldering and Industrial type immersion cleaning
- Wide resistance range, 100 ohms to 1 megohm
- WESTON Hi-Stability cermet element
- Mechanical protection, stop and clutches
- Resolution, essentially infinite
- Adjustments ratio 16 to 1

| SERIES 860 | SPECIFICATIONS | | WP-160 FEB. 1978 |
|---|---|---|---|
| | DESCRIPTION | VALUE | |
| ELECTRICAL | Standard resistance range | 100 ohms to 1 megohm | |
| | Resistance tolerance | ± 10% | |
| | End resistance | 2 ohms or .1% whichever is greater | |
| | Contact resistance variation | 3% or 3 ohms, whichever is greater | |
| | Temperature coefficient | ± 100 P.P.M./°C max. | |
| | Power rating | 0.25 watt (in still air) at 85°C | |
| | Insulation resistance | 1000 megohms minimum (500 V.D.C.) | |
| | Dielectric strength | 600 V.A.C. room conditions | |
| | Maximum working voltage | 200 V.D.C. (RMS) or within power rating, whichever is less | |
| | Continuity | Maintained for full mechanical range | |
| | Resolution | Essentially infinite | |
| MECHANICAL | Mechanical protection | Slip clutch, wiper idles | |
| | Mechanical adjustment | 16 turns nominal | |
| | Rotational life | 200 cycles min. with no discontinuity | |
| | Torque | 3 oz. in. maximum | |
| | Weight | .5 gram maximum | |
| ENVIRONMENTAL | Operating temperature range | -55°C to +150°C | |
| | Moisture resistance | MIL-R-22097, MIL-STD-202, Method 106 | |
| | Shock | 100 G's per MIL-R-22097 | |
| | Vibration | 20 G's 10 to 2000 cycles per MIL-R-22097, Test Condition D | |
| | Load life | 1000 hrs. @ rated power per MIL-R-22097 | |
| | High temperature exposure | MIL-R-22097 | |
| | Low temperature operation | MIL-R-22097 | |

### WESTON SQUARETRIM® ¼" LOW COST CERMET




METRIC CONVERSIONS

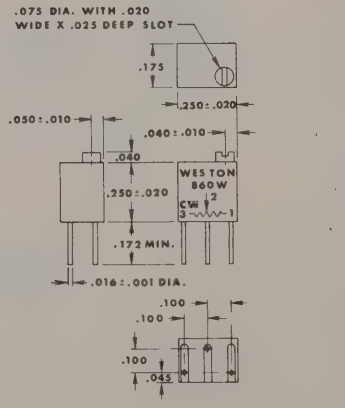
| IN | M.M | IN. | M.M. |
|---|---|---|---|
| .001 | .025 | .045 | 1.143 |
| .005 | .127 | .050 | 1.270 |
| .010 | .254 | .075 | 1.905 |
| .016 | .406 | .100 | 2.540 |
| .020 | .508 | .172 | 4.369 |
| .025 | .635 | .175 | 4.445 |
| .040 | 1.016 | .250 | 6.350 |

RESISTANCE OHMS

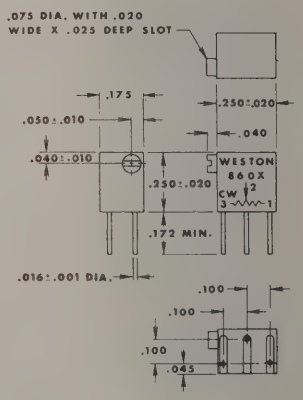
| | | |
|---|---|---|
| 100 | 5K | 200K |
| 200 | 10K | 250K |
| 500 | 20K | 500K |
| 1K | 50K | 1 Meg |
| 2K | 100K | |

Decimal Tolerance unless otherwise specified
.XXX ± .005
.XX ± .010
Fraction ± 1/64

860W




860X




SANGAMO WESTON
Schlumberger
WESTON COMPONENTS & CONTROLS
ARCHBALD, PENNSYLVANIA 18403
TEL (717) 876-1500
TWX 510 656-2902
TELEX 83-1873

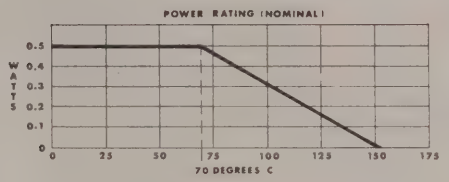
# WESTON SQUARETRIM
## 3/8" LOW COST CERMET POTENTIOMETERS

| SERIES 850 | SPECIFICATIONS | | WP-157C JAN. 1978 |
|---|---|---|---|
| | DESCRIPTION | VALUE | |
| ELECTRICAL | Standard resistance range | 10 ohms to 2 megohms | |
| | Resistance tolerance | ±10% | |
| | End resistance | 2 ohms maximum | |
| | Contact resistance variation | 3% or 5 ohms, whichever is greater | |
| | Temperature coefficient | ±100 P.P.M./°C max. | |
| | Power rating | 0.5 watt (in still air) at 70°C | |
| | Insulation resistance | 1000 megohms minimum (500 V.D.C.) | |
| | Dielectric strength | 900 V.A.C. room conditions | |
| | Maximum working voltage | 300 V.D.C. (RMS) or within power rating, whichever is less | |
| | Continuity | Maintained for full mechanical range | |
| | Resolution | Essentially infinite | |
| MECHANICAL | Decimal tolerance | .XX = ±.010 | |
| | Unless otherwise specified | .XXX = ±.005 | |
| | Mechanical protection | Slip clutch, wiper idles | |
| | Mechanical adjustment | 22 turns nominal | |
| | Rotational life | 200 cycles min. with no discontinuity | |
| | Torque | 5 oz. in. maximum | |
| | Weight | 1 gram maximum | |
| ENVIRONMENTAL | Operating temperature range | -55°C to +150°C | ALLOWABLE RESISTANCE CHANGE |
| | Moisture resistance | MIL-R-22097, MIL-STD-202, Method 106 | 2% |
| | Shock | 100 G's per MIL-R-22097 | 1% |
| | Vibration | 20 G's 10 to 2000 cycles per MIL-R-22097, Test Condition D | 1% |
| | Load life | 1000 hrs. @ rated power per MIL-R-22097 | 3% |
| | High temperature exposure | MIL-R-22097, except 150°C | 3% |
| | Low temperature operation | MIL-R-22097 | 2% |

### 3/8" LOW COST CERMET

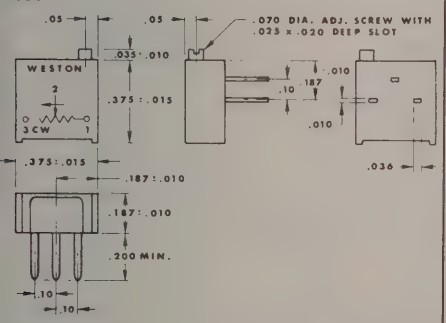
**RESISTANCE OHMS**

| | | |
|---|---|---|
| 10 | 1K | 50K |
| 20 | 2K | 100K |
| 50 | 5K | 200K |
| 100 | 10K | 250K |
| 200 | 20K | 500K |
| 500 | 25K | 1 MEG. |




**Tolerance unless otherwise specified**
.XX = ±.010
.XXX = ±.005

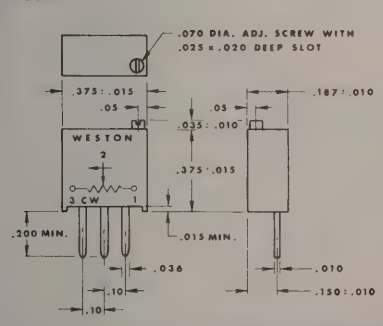
**850P**



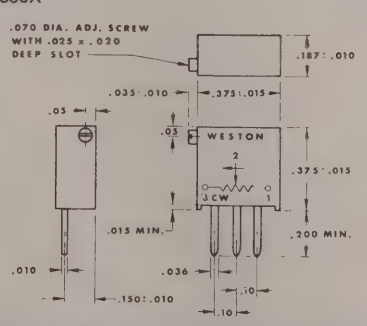

**METRIC CONVERSION**

| IN. | M.M. | IN. | M M | IN | M M. |
|---|---|---|---|---|---|
| .010 | 0.254 | .036 | 0.914 | .150 | 3.810 |
| .015 | 0.381 | .040 | 1.016 | .187 | 4 750 |
| .020 | 0.508 | .050 | 1.270 | .200 | 5 080 |
| .025 | 0.635 | .070 | 1.778 | .375 | 9 525 |
| .035 | 0.889 | .100 | 2.540 | | |

**850W**



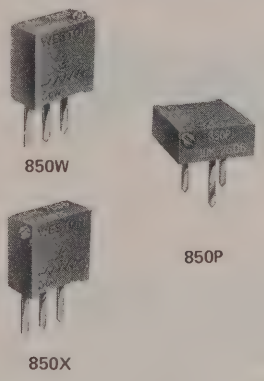

**850X**




SANGAMO WESTON
Schlumberger

WESTON COMPONENTS & CONTROLS
ARCHBALD, PENNSYLVANIA 18403
TEL (717) 876-1500
TWX 510 656-2902
TELEX 83-1873

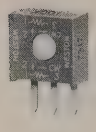
WESTON SQUARETRIM POTENTIOMETERS 3/8" LOW COST CERMET




- Sealed to guard against contaminants; Sealed to withstand "Flow" Soldering and Industrial type immersion cleaning.
- Weston hi-stability cermet element
- Wide resistance range, 10 ohms to 2 megohm
- Resistance tolerance ± 10%
- Resolution, essentially infinite
- Adjustability — 22 turns nominal
- High power — 0.5 watt at 70°C
- Wide operating temperature range -55°C to +150°C
- Temperature coefficient ± 100 PPM/°C max.

# WESTON SQUARETRIM
## 3/8" LOW COST CERMET
## POTENTIOMETERS

WESTON
SQUARETRIM
POTENTIOMETERS
3/8" LOW COST CERMET


840X

840P

- Sealed to guard against contaminants: Sealed to withstand "Flow" Soldering and Industrial type immersion cleaning.
- Weston hi-stability cermet element
- Wide resistance range, 10 ohms to 2 megohm
- Resistance tolerance ±10%
- Resolution, essentially infinite
- Adjustability — single turn
- High power — 0.5 watt at 70°C
- Wide operating temperature range -55°C to +125°C
- Temperature coefficient ±100 PPM/°C max.
- Weldable and solderable terminal pins
- Wide variety of lead configurations available

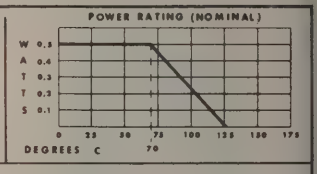
| SERIES 840 | SPECIFICATIONS | | WP-156E JAN. 1978 |
|---|---|---|---|
| | DESCRIPTION | VALUE | |
| ELECTRICAL | Standard resistance range | 10 ohms to 2 megohms | |
| | Resistance tolerance | ± 10% | |
| | End resistance | 2 ohms maximum | |
| | Contact resistance variation | 3% or 5 ohms, whichever is greater | |
| | Temperature coefficient | ± 100 P.P.M./°C max. | |
| | Power rating | 0.5 watt (in still air) at 70°C | |
| | Insulation resistance | 1000 megohms minimum (500 V.D.C.) | |
| | Dielectric strength | 900 V.A.C. room conditions | |
| | Maximum working voltage | 300 V.D.C. (RMS) or within power rating, whichever is less | |
| | Continuity | Maintained for full mechanical range | |
| | Resolution | Essentially infinite | |
| MECHANICAL | Decimal tolerance | .XX = ± .010 | |
| | Unless otherwise specified | .XXX = ± .005 | |
| | Stop strength | Solid -.15 oz. in. min. | |
| | Mechanical adjustment | 290° nominal | |
| | Rotational life | 200 cycles min. with no discontinuity | |
| | Torque | 5 oz. in. maximum | |
| | Weight | 1 gram maximum | |
| ENVIRONMENTAL | Operating temperature range | -55°C to +125°C | ALLOWABLE RESISTANCE CHANGE |
| | Moisture resistance | MIL-R-22097, MIL-STD-202, Method 106 | 2% |
| | Shock | 100 G's per MIL-R-22097 | 1% |
| | Vibration | 20 G's 10 to 2000 cycles per MIL-R-22097, Test Condition D | 1% |
| | Load life | 1000 hrs. @ rated power per MIL-R-22097 | 3% |
| | High temperature exposure | MIL-R-22097, except 125°C | 3% |
| | Low temperature operation | MIL-R-22097 | 2% |

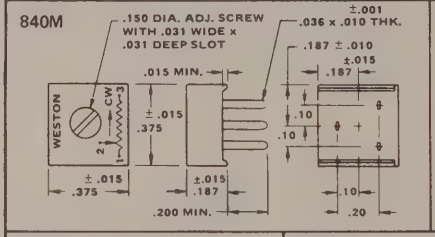
### 3/8" LOW COST CERMET

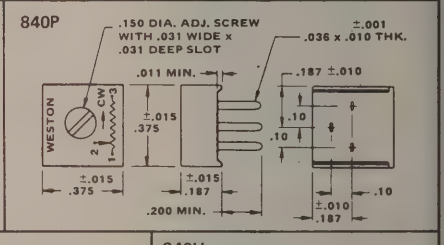
| RESISTANCE OHMS | | |
|---|---|---|
| 10 | 1K | 50K |
| 20 | 2K | 100K |
| 50 | 5K | 200K |
| 100 | 10K | 250K |
| 200 | 20K | 500K |
| 500 | 25K | 1 MEG. |
| | | 2 MEG* |

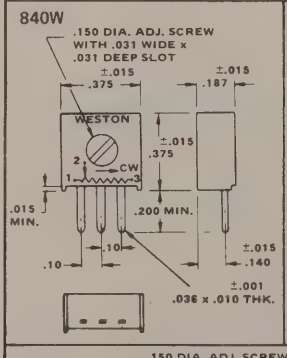
*Factory Quote

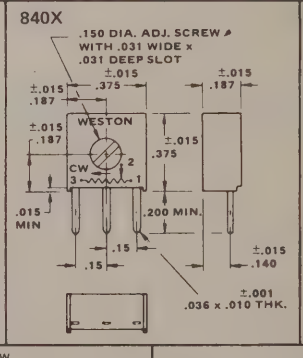
| METRIC CONVERSION | | | | | |
|---|---|---|---|---|---|
| IN. | M.M. | IN. | M.M. | IN. | M.M |
| .001 | 0.025 | .036 | 0.914 | .187 | 4.750 |
| .010 | 0.254 | .100 | 2.540 | .200 | 5.080 |
| .011 | 0.279 | .125 | 3.175 | .375 | 9.525 |
| .015 | 0.381 | .140 | 3.556 | | |
| .031 | 0.787 | .150 | 3.810 | | |

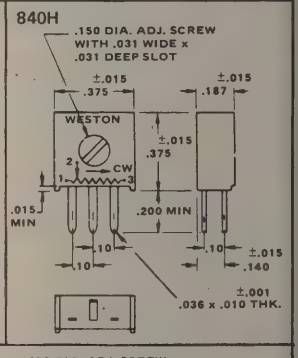


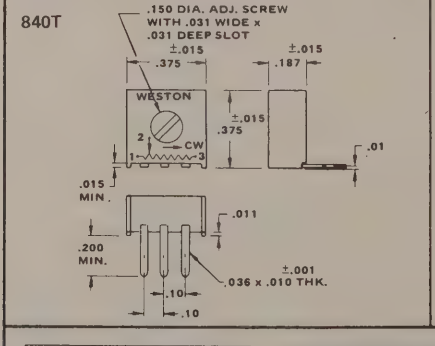



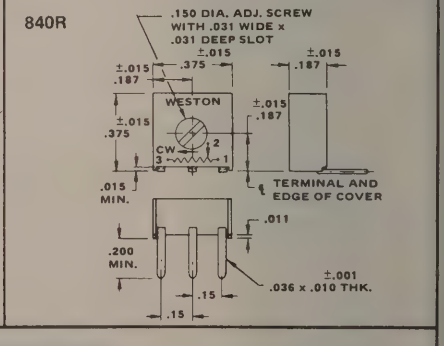



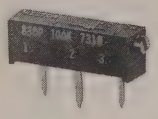

SANGAMO WESTON
Schlumberger

WESTON COMPONENTS & CONTROLS
ARCHBALD, PENNSYLVANIA 18403
TEL (717) 876-1500
TWX 510 656-2902
TELEX 83-1873

| SERIES 830 | SPECIFICATIONS | | WP-155E JAN. 1978 |
|---|---|---|---|
| | DESCRIPTION | VALUE | |
| ELECTRICAL | Standard resistance range | 10 ohms to 2 megohm | |
| | Resistance tolerance | ±10% | |
| | End resistance | 2 ohms maximum | |
| | Contact resistance variation | 3% or 5 ohms, whichever is greater | |
| | Temperature coefficient | ±100 PPM/°C max. | |
| | Power rating | 0.75 watt (in still air) at 70°C | |
| | Insulation resistance | 1000 megohms minimum (500 V.D.C.) | |
| | Dielectric strength | 900 V.A.C., Room conditions | |
| | Maximum working voltage | 300 V.D.C. (RMS) or within power rating, whichever is less | |
| | Continuity | Maintained for full mechanical range | |
| | Resolution | Essentially infinite | |
| MECHANICAL | Decimal tolerance | .XX = ±.010 | |
| | Unless otherwise specified | .XXX = ±.005 | |
| | Mechanical protection | Stops, wiper idles | |
| | Mechanical adjustment | 15 turns nominal | |
| | Rotational life | 200 cycles min. with no discontinuity | |
| | Torque | 5 oz. in. maximum | |
| | Weight | 1 gram maximum | |
| ENVIRONMENTAL | Operating temperature range | -55° to +125°C | ALLOWABLE RESISTANCE CHANGE |
| | Moisture resistance | MIL-R-22097, MIL-STD-202, Method 106 | 2% |
| | Shock | 100 G's per MIL-R-22097 | 1% |
| | Vibration | 20 G's 10 to 2000 cycles per MIL-R-22097, Test Condition D | 1% |
| | Load life | 1000 hrs. @ rated power per MIL-R-22097 | 3% |
| | High temperature exposure | MIL-R-22097, except 125°C | 3% |
| | Low temperature operation | MIL-R-22097 | 2% |

# WESTON RECTILINEAR
## 3/4" LOW PROFILE CERMET
# POTENTIOMETERS

WESTON
SQUARETRIM
POTENTIOMETERS
¾" LOW PROFILE CERMET



830P

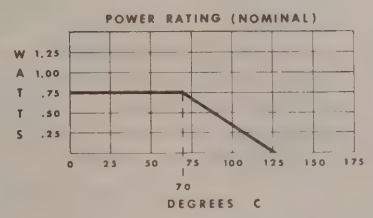
- Sealed to guard against contaminants: Sealed to withstand "Flow" Soldering and Industrial type immersion cleaning.
- Weston hi-stability cermet element
- Wide resistance range, 10 ohms to 2 megohm
- Resistance tolerance ± 10%
- Resolution, essentially infinite
- Adjustability — 15 turns of adjustment screw
- Mechanical protection — stops and slip clutch
- High power — 0.75 watt at 70°C
- Wide operating temperature -55°C to +125°C
- Temperature coefficient ±100 PPM/°C max.
- Weldable and solderable terminal pins
- Wide variety of lead configurations available

## 3/4" LOW PROFILE CERMET RECTILINEAR

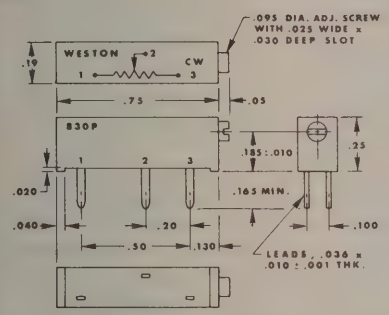
### RESISTANCE OHMS

| | |
|---|---|
| 10 | 10K |
| 20 | 20K |
| 50 | 25K |
| 100 | 50K |
| 200 | 100K |
| 500 | 200K |
| 1K | 250K |
| 2K | 500K |
| 5K | 1 MEG |
| | 2 MEG* |

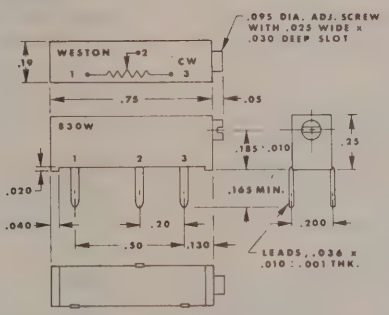
*Factory Quote



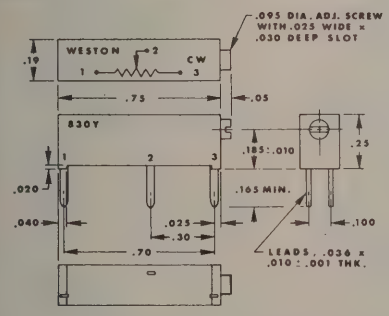

### 830P




### 830W




### 830Y




### METRIC CONVERSION

| IN. | M.M. | IN. | M.M. |
|---|---|---|---|
| .001 | .025 | .125 | 3.175 |
| .005 | .127 | .130 | 3.302 |
| .010 | .254 | .165 | 4.191 |
| 020 | .508 | .185 | 4.699 |
| .025 | .635 | .190 | 4.826 |
| .030 | .762 | .200 | 5.060 |
| 036 | .914 | .250 | 6.350 |
| .040 | 1.016 | .300 | 7.620 |
| .050 | 1.270 | .500 | 12.700 |
| .095 | 2.413 | .700 | 17.780 |
| .100 | 2.540 | .750 | 19.050 |

SANGAMO WESTON
Schlumberger

WESTON COMPONENTS & CONTROLS
ARCHBALD, PENNSYLVANIA 18403
TEL (717) 876-1500
TWX 510 656-2902
TELEX 83-1873

# WESTON

SANGAMO WESTON
Schlumberger

WESTON COMPONENTS & CONTR
A Division of Sangamo Weston, Inc.
Archbald, Pa. 18403
Tel. (717) 876-1500
TWX 510 656-2902
Telex 83-1873

## SALES REPRESENTATIVES

**ARIZONA**
Piper Sales Co.
P.O. Box 1648
Scottsdale, Arizona 85252
Phone: 602 949-8424
946-4437

**CALIFORNIA**
Nova-Tronix
2585 Scott Boulevard
Santa Clara, Calif. 95050
Phone: 408 243-9530

WES-K Associates
13123 Via Del Valedor
San Diego, Calif. 92129
Phone: 714 271-5048

WES-K Associates
5917 Noble Avenue
Van Nuys, Calif. 91401
Phone: 213 989-3070

**COLORADO**
Piper Sales Co.
8041 West Interstate 70
North Frontage Road
Arvada, Colorado 80002
Phone: 303 420-4646

**CONNECTICUT**
Impact Electronics, Inc.
60 Connolly Parkway, Bldg. 1
Hamden, Conn. 06514
Phone: 203 281-1331

**FLORIDA**
Perrott Associates, Inc.
P.O. Box 6399
Clearwater, Fla. 33518
Phone: 813 585-3327

Perrott Associates, Inc.
P.O. Box 15067
Ft. Lauderdale, Florida 33318
Phone: 305 792-2211

Perrott Associates, Inc.
1607 Forsyth Rd.
Orlando, Florida 32807
Phone: 305 275-1132

**ILLINOIS**
Marcon Associates, Inc.
4836 Main St.
Skokie, Illinois 60076
Phone: 312 675-6450

**IOWA**
Marcon Associates, Inc.
4836 Main St.
Skokie, Illinois 60076
Phone: 312 675-6450

**KANSAS**
ENSCO-REP, Inc.
7939 Floyd, Suite L-12
Overland Park, Kansas 66204
Phone: 913 381-7557

**MARYLAND**
Bernard White & Co., Inc.
7 Church Lane
Baltimore, Maryland 21208
Phone: 301 484-5400

**MASSACHUSETTS**
Impact Electronics, Inc.
66 Needham Street
Newton, Mass. 02161
Phone: 617 964-7740

**MICHIGAN**
J.C. Hofstetter Co.
610 North Woodward Ave.
Birmingham, Mich. 48011
Phone: 313 646-3635

**MINNESOTA**
R.G. Ragon, Inc.
1136 W. Larpenteur Ave.
St. Paul, Minnesota 55113
Phone: 612 488-0201

**MISSOURI**
ENSCO-REP, Inc.
11714 Lackland Industrial Drive
St. Louis, Mo. 63141
Phone: 314 567-3935

**NEW JERSEY (Northern)**
ADDEM
P.O. Box 583
West Caldwell, New Jersey 07006
Phone: 516 752-9303

ADDEM
P.O. Box 231
Keasbey, N.J. 08832
Phone: 516 752-9303

**NEW JERSEY (Southern)**
Electro-Comp Sales
21 Bala Avenue
Bala-Cynwyd, Pa. 19004
Phone: 215 667-9360

**NEW MEXICO**
Piper Sales Co.
P.O. Box 14894
Albuquerque, New Mexico 87111
Phone: 505 294-1436

**NEW YORK (Northern)**
Reagan/Compar, Albany, Inc.
6 Highland Avenue
Albany, New York 12205
Phone: 518 489-4777

Reagan/Compar
530 Verna Drive
Endwell, N.Y. 13760
Phone: 607 723-8743

Reagan/Compar
42 Winding Brook Drive
Fairport, N.Y. 14450
Phone: 716 271-2230

Reagan/Compar
41 Woodberry Rd.
New Hartford, N.Y. 13413
Phone: 315 732-3775

**NEW YORK (Southern)**
ADDEM
12 Commerce Drive
Farmingdale, New York 11735
Phone: 516 752-9303

**OHIO**
J.C. Hofstetter Co.
3300 S. Dixie Drive
Dayton, Ohio 45439
Phone: 513 296-1010

J.C. Hofstetter Co.
7014 River Styx Road
Medina, Ohio 44256
Phone: 216 241-4880
725-4477

**OKLAHOMA**
Vista Associates
725 South Central Expressway
Suite A-9
Richardson, Texas 75080
Phone: 214 235-4547

**OREGON**
Comtec
1715 114th Ave., S.E.
Suite 116
Bellevue, Wash. 98004
Phone: 206 453-1188

**PENNSYLVANIA (Eastern)**
Electro-Comp Sales
21 Bala Avenue
Bala-Cynwyd, Pa. 19004
Phone: 215 667-9360

**PENNSYLVANIA (Western)**
J.C. Hofstetter Co.
7014 River Styx Road
Medina, Ohio 44256
Phone: 216 241-4880
725-4477

**TEXAS**
Delta Components
11457 Harry Hines Blvd.
Dallas, Texas 75229
Phone: 214 241-4914

**WASHINGTON**
Comtec
1715 114th Ave., S.E.
Suite 116
Bellevue, Wash. 98004
Phone: 206 453-1188

**CANADA**
Cartwright Southall Assoc., Inc.
Suite 906, 15 King Street West
Hamilton 10, Ontario
Phone: 416 528-0294

McIntyre Agencies
3600 Barclay Avenue
Suite 340
Montreal 251, Quebec
Phone: 514 731-9617
731-9618

**EUROPE**
Eurofarad
93 Rue Oberkampf
Paris XI, France
Phone: 355.39.13

Marco Marketing
396 Bath Road
Slough, Bucks, England
Phone: Slough (0753) 35444

Telion
232, Albisriederstrasse
Zurich, Switzerland
Phone: 051 54 99 11

Eurelettronica
Via Mascheroni 19
20145 Milano, Italy
Phone: 498 18 51

Sotronic
Rue Pere De Deken, 14
Pater De Dekenstraat 14
1040 Brussels, Belgium
Phone: 02/736/1007

SOMV Schlumberger
Schlumberger Division Components
Ingolstaedterstr. 67A
8000 Munich 46, Germany
Phone: 089 317031

Magnetic AB Stockholm
P.O. Box 20036
16120 Bromma 20, Sweden
Phone: 29 04 60

GDS-HENCKELAPS
Fyrrevangen 4
DK-4622 Havdrup, Denmark
Phone: (03) 38 57 16

GDS-HENCKELAPS
Heerloekka 14
1440 Droebak, Norway

INDE Associates
P.O. Box 133
Cemetry Road
Ludhiana 141 008, India.
Phone: 23860

STG International Ltd.
52, Nachlat Benyamin St.
P.O.B. 1276
Tel-Aviv, Israel
Phone: 53459

Impectron (Pty.) Ltd.
P.O. Box 10262
Johannesburg 2000
South Africa
Phone: 725-3350

Primotec AG
CH-5400 Baden
Wettingerstrasse 23
Switzerland
Phone: 056 26 52 62

AB Gosta Backstrom
Alstromergatan 22
Box 12009
S-102 21 Stockholm 12
Sweden
Phone: 08/54 10 80

SANGAMO WESTON
Schlumberger

WESTON COMPONENTS & CONTROLS
A Division of Sangamo Weston, Inc.
Archbald, Pa. 18403
Tel. (717) 876-1500
TWX 510 656-2902
Telex 83-1873

# WESTON

## DISTRIBUTORS

**ARIZONA**

Mirco Electronic Distributor, Inc.
2005 W. Peoria Avenue
Phoenix, Arizona 85029
Phone: 602 997-6194

**CALIFORNIA**

Arndt
P.O. Box 132
Belmont, California 94002
Phone: 415 592-6718

Bell Industries
306 E. Alondra Boulevard
Gardena, California 90248
Phone: 213 321-5802

Components Center Inc.
1240 "E" Logan Avenue
Costa Mesa, California 92626
Phone: 714 979-0433
213 620-0311

Hi Rel Distributor Sales, Inc.
20507 Belshaw
Carson, California 90746
Phone: 213 774-8200

JACO
21201 Oxnard Street
Woodland Hills, California 91364
Phone: 213 887-6400

Pyramid Electronics
586 Weddell Drive
Sunnyvale, California 94086
Phone: 408 744-1900

Ratel Electronics
1741 Reynolds Avenue
Irvine, California 92714
Phone: 714 549-8611

Frank Shelley Electronics, Inc.
1040 Pico Blvd.
Santa Monica, California 90405
Phone: 213 392-3913

Shelley Neumann, Inc.
4040 Sorrento Valley Blvd.
Suite L
San Diego, California 92121
Phone: 714 453-7133

Terminal Electronics
880 Maude Avenue
Mountain View, California 94043
Phone: 415 969-9240

**COLORADO**

Integrated Electronics
436 East 58th Avenue
Denver, Colorado 80216
Phone: 303 534-6121

Ratel/Denver
47 South Federal Avenue
Denver, Colorado 80219
Phone: 303 934-5813

**CONNECTICUT**

Impact Electronics
66 Needham Street
Newton, Massachusetts 02161
Phone: 617 964-7740

**FLORIDA**

Impala Electronics, Inc.
6022 Benjamin Road
Tampa, Florida 33614
Phone: 813 885-4747

**ILLINOIS**

Bell Industries
2422 West Touchy Avenue
Chicago, Illinois 60645
Phone: 312 982-9210

GBL Electronics
75 Gaylord Street
Elk Grove Village, Illinois 60007
Phone: 312 593-3220

**INDIANA**

Graham Electronics, Inc.
133 S. Pennsylvania Street
Indianapolis, Indiana 46204
Phone: 317 634-8202

**KANSAS**

Milgray/Kansas City
6901 West 63rd Street
Overland Park, Kansas 66202
Phone: 913 236-8800

**MARYLAND**

EDJE Electronics
2520 Glencoe Road
Baltimore, Maryland 21234
Phone: 301 444-6982

Radio Electric Service Co. of Baltimore, Inc.
1026 Cromwell Bridge Road
Baltimore, Maryland 21204
Phone: 301 823-0070

**MASSACHUSETTS**

Impact Electronics
66 Needham Street
Newton, Massachusetts 02161
Phone: 617 964-7740

**MICHIGAN**

Reptron Electronics, Inc.
31199 Schoolcraft Road
Livonia, Michigan 48150
Phone: 313 525-2700

RM Electronics Co., Inc.
4860 South Division
Kentwood, Michigan 49508
Phone: 616 531-9300

**MINNESOTA**

Ragon Electronics, Inc.
1136 W. Larpenteur Avenue
St. Paul, Minnesota 55113
Phone: 612 488-0201

**MISSOURI**

Olive Electronics, Inc.
9910 Page Blvd.
St. Louis, Mo. 63132
Phone: 314 426-4500

**MONTANA**

Flamand Electronic Supply
9 North Broadway
Belgrade, Montana 59714
Phone: 406 388-6606

**NEW JERSEY**

Mid-Atlantic
Kor-Center East H-1
Interstate Industrial Park
Bellmawr, New Jersey 08030
Phone: 609 931-5303

State Electronics Parts, Corp.
36 Route 10
Hanover, New Jersey 07936
Phone: 201 887-2550

**NEW MEXICO**

Electronic Devices Co.
3301 Juan Tabo NE
Bldg. 201
Albuquerque, New Mexico 87111
Phone: 505 293-1935

**NEW YORK**

ACI Electronics Corp.
28 South Mall
Plainview, New York 11803
Phone: 516 293-6630

Bomark Electronics Inc.
145 Sycanne Ave.
Central Islip, N.Y. 11722
Phone: 516 234-7300

Command Electronics Corp.
114 Allen Blvd.
Farmingdale, New York 11735
Phone: 516 293-1212

Delmar Electronics Inc.
101 Eads Street
West Babylon, New York 11704
Phone: 516 420-1234

Fairmont Electronic Sales Corp.
35 South Service Road
Plainview, New York 11803
Phone: 516 694-8200

Harrison Electronics Corp.
20th Smith Street
Farmingdale, L.I., New York 11735
Phone: 516 293-7990

Iris Electronics Co., Inc.
20 Dubon Court
Farmingdale, L.I., New York 11735
Phone: 516 420-8400

JACO
145 Oser Avenue
Hauppauge, L.I., New York 11787
Phone: 516 273-5500

L & S Electronics Inc.
139 North Central Avenue
Valley Stream, N.Y. 11580
Phone: 516 561-2474

Milgray Electronics, Inc.
191 Hanse Avenue
Freeport, New York 11520
Phone: 516 546-6000

SAI
87 Gazza Boulevard
Farmingdale, New York 11735
Phone: 516 293-2710

Summit Distributors
916 Main Street
Buffalo, New York 14202
Phone: 716 884-3450

**OHIO**

DAY-CAP Electronics, Inc.
540 South Street
Piqua, Ohio 45356
Phone: 513 773-4750

Milgray/Cleveland, Inc.
1821 E. 40th Street
Cleveland, Ohio 44103
Phone: 216 881-8800

REH Electronics
6459 S.O.M. Center Road
Solon, Ohio 44139
Phone: 216 248-1636

Repco
6835 Cochran Road
Solon, Ohio 44139
Phone: 216 248-8900

Stotts Friedman Co.
2600 East River Road
Dayton, Ohio 45439
Phone: 513 298-5555

**OKLAHOMA**

Radio Inc.
1000 S. Main
Tulsa, Oklahoma 74119
Phone: 918 587-9123

**OREGON**

Zepher Electronic Sales
647 Industry Drive
Seattle, Washington 98188
Phone: 206 575-0922

**PENNSYLVANIA**

Advacom, Inc.
1968 Buffalo Road
Erie, Pa. 16510
Phone: 814 455-8110

Cumberland Electronics, Inc.
642 South 20th Street
Harrisburg, Pa. 17104
Phone: 717 232-9715

Henwarr, Inc.
Huntingdon Valley Industrial Park
1957 Pioneer Road, Bldg. H
Huntingdon Valley, Pa. 19006
Phone: 215 675-4104

Herbach & Rademan
401 East Erie Avenue
Philadelphia, Pa. 19134
Phone: 215 426-1700

Peak Electronics
354-356 Lancaster Ave.
P.O. Box 533
Wayne, Penna. 19087
Phone: 215 293-9000

Philadelphia Electronics Inc.
112 N. 12th Street
Philadelphia, Pa. 19107
Phone: 215 568-7400

Pyttronic Industries, Inc.
P.O. Box 433
Stump Road
Montgomeryville, Pa. 18936
Phone: 215 643-2850

Shap Electronics
421-E Pike Road
Huntingdon Valley, Pa. 19006
Phone: 215 698-9550

**TEXAS**

KA Electronic Sales
1220 Majesty Drive
Dallas, Texas 75247
Phone: 214 634-7870

Solid State Electronics
P.O. Box 20299
Dallas, Texas 75220
Phone: 214 352-2601

Southwest Electronics Inc.
12725 Royal Drive
Stafford, Texas 77477
Phone: 713 494-6021

TTI
1108 East Lancaster
Fort Worth, Texas 76102
Phone: 817 335-8111

**VIRGINIA**

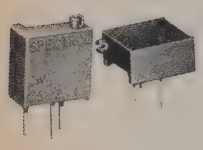
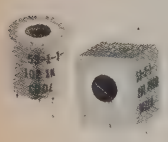
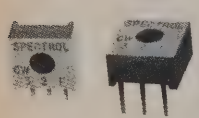
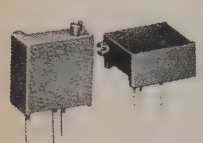
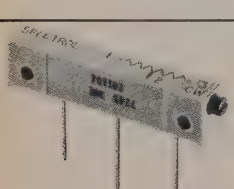
Virginia Radio
715 Henry Avenue
Charlottesville, Va. 22902
Phone: 804 296-4184

**WASHINGTON**

Zepher Electronic Sales
647 Industry Drive
Seattle, Washington 98188
Phone: 206 575-0922

Spectrol

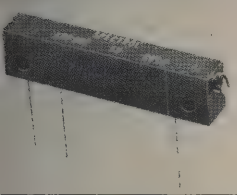
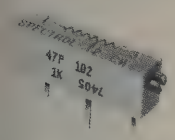
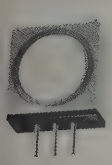
# CERMET TRIMMING POTENTIOMETERS

| Actual size | MODEL NO. | NOMINAL SIZE (INCHES) | NOM. ADJ. TURNS | TERMINAL[1] STYLE | RESISTANCE TOLERANCE | MAXIMUM POWER RATING (WATTS) | TEMPCO (PPM/° C) | STANDARD RESISTANCE RANGE (OHMS) | U.S. 50 PC. UNIT PRICE |
|---|---|---|---|---|---|---|---|---|---|
| | ▶43 (Clear Lid & Panel Mount Available) | 0.75 Long | 20 | PC | ±10% | 0.75 @ 25° C | ±100 (100Ω–2 Meg)<br>+200<br>−100<br>(10, 20 & 50Ω) | 10Ω–2 Meg. | 1.15 |
|  | ▶52 | 0.38 Square | 25 | PC | ±5% | 0.5 @ 85° C | ±100 (100Ω–2 Meg)<br>0 to +250<br>(10, 20, 50Ω) | 10Ω–2 Meg. | 3.10 |
|  | ▶53 | 0.34 Dia. Top Adjust<br>0.31 x 0.36 Side Adjust | 280° | PC | ±20% (±10% Available) | 0.5 @ 85° C | ±100 (100Ω–1 Meg)<br>0 to +450<br>(10, 20 & 50Ω) | 10Ω–1 Meg. | 1.59<br>1.65 |
| | ▶62 | 0.25 Dia. Top Adjust<br>.025 Square Side Adjust | 270° | PC | ±20% (±10% Available) | 0.75 @ 25° C | ±100 (100Ω–1 Meg)<br>0 to +450<br>(10, 20 & 50Ω) | 10Ω–1 Meg. | 1.45<br>1.50 |
|  | ▶63 | 0.38 Square | 300° | PC | ±20% (±10% Available) | 0.5 @ 70° C | ±100 (100Ω–2 Meg)<br>0 to +250<br>(10, 20, 50Ω) | 10Ω–2 Meg. | 0.70 |
|  | ▶64 | 0.38 Square | 25 | PC | ±10% | 0.5 @ 70° C | ±100 (100Ω–2 Meg)<br>0 to +250<br>(10, 20, 50Ω) | 10Ω–2 Meg. | 1.46 |
| | ▶65 | 0.25 Dia. Top Adjust<br>0.25 x 0.32 Side Adjust | 270° | PC | ±20% (±10% Available) | 0.5 @ 70% C | ±100 (100Ω–1 Meg)<br>0 to +200<br>(10,20,50Ω) | 10Ω–2 Meg. | 1.24<br>1.68 |
|  | ▶70 | 1.25 Long | 20 | L, PC, SH | ±10% | 1.0 @ 85° C | ±100 (100Ω–2 Meg)<br>0 to +450<br>(10, 20 & 50Ω) | 10Ω-2 Meg. | 1.79 |

▶ DISTRIBUTOR AUTHORIZED STOCKING ITEM

Spectrol

# WIREWOUND TRIMMING POTENTIOMETERS

| Actual size / MODEL NO. | NOMINAL SIZE (INCHES) | NOM. ADJ. TURNS | TERMINAL STYLE | RESISTANCE TOLERANCE | MAXIMUM POWER RATING (WATTS) | TEMPCO (PPM/° C) | STANDARD RESISTANCE RANGE (OHMS) | U.S. 50 PC. UNIT PRICE |
|---|---|---|---|---|---|---|---|---|
|  ▶ **40** (RT 12 Available) | 1.25 Long | 22 | L,PC,SH | ±5% | 1.0 @ 70° C | ±50 | 10Ω–10K<br>20K<br>50K<br>100K | 3.88<br>4.74<br>6.39<br>7.09 |
|  ▶ **47** (Clear Lid & Panel Mount Available) | 0.75 Long | 20 | PC | ±10% | 1.0 @ 40° C | ±50 | 10Ω-10K<br>20K | 1.39<br>1.67 |
| ▶ **50** (RT 24 Available) | 0.38 Square | 23 | L,PC | ±5% | 0.75 @ 85° C | ±50 | 10Ω–10K<br>20K<br>50K | 5.60<br>6.32<br>6.75 |
|  ▶ **55** (RT 22 Available) | 0.50 Square | 23 | L,PC | ±5% | 1.5 @ 70° C | ±50 | 10Ω–10K<br>20K<br>50K | 5.60<br>6.32<br>6.75 |
| **80** | 0.35 Dia. | 320° | PC | 5% | 1.0 @ 50° C | ±50 | 10Ω–10K<br>20K<br>50K | 4.39<br>5.17<br>6.18 |
| ▶ **84** | 0.50 Dia. (Base) | 320° | PC,SH | ±5% | 1.5 @ 70° C | ±50 | Screw Driver 10Ω–10K<br>20K<br>Knob 10Ω–10K<br>20K<br>Panel Mt. 10Ω–10K<br>20K | 2.94<br>3.30<br>3.59<br>4.01<br>4.66<br>5.17 |
| **85** | 0.55 x 0.54 Side Adjust | 320° | PC | ±5% | 1.5 @ 70° C | ±50 | Screw Driver 10Ω–10K<br>20K | 5.15<br>5.93 |
| TRIMMER ADJUSTMENT TOOL ½ actual size ▶ **8** | 5.0 Long | This Adjustment Tool is designed to adjust trimmers of all sizes and has an extended as well as recessed blade for critical adjustments. | | | | | | .80 |

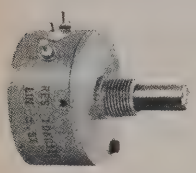
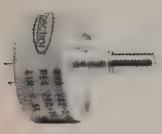
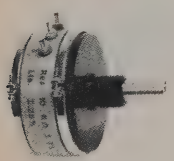
[1]TERMINATIONS: L – COLOR CODED LEAD WIRES, SH – SOLDER HOOKS, PC – PRINTED CIRCUIT PINS.

▶ DISTRIBUTOR AUTHORIZED STOCKING ITEM

Spectrol

# SINGLE-TURN WIREWOUND PRECISION POTENTIOMETERS

All units shown ½ actual size

| | MODEL NO. | NOMINAL DIA.[2] (INCHES) | RESISTANCE RANGE (OHMS) | STANDARD RESISTANCE TOLERANCE | LINEARITY TOLERANCE STANDARD | LINEARITY TOLERANCE BEST PRACTICAL[1] | MAXIMUM POWER RATING (WATTS) | MOUNTING AVAILABLE | U.S. 50 PC. UNIT PRICE |
|---|---|---|---|---|---|---|---|---|---|
|  | **100** | 1.312 | 5 to 35K | ± 3% (± 5% below 50Ω) | 5Ω to 100Ω ±1.0%<br>100Ω to 35KΩ ± 0.5% | ±.15% | 2.75 @ 40° C | Bushing<br>Servo | 15.95<br>20.05 |
| | **122**<br>(Style RR 1100 Available) | 1.062 | 5 to 20K | ± 3% (±5% below 20Ω) | 5Ω to 200Ω ±1.0%<br>200Ω to 20KΩ ± 0.5% | ±.20% | 1.5 @ 70° C | Bushing<br>Servo | 15.60<br>18.00 |
|  | ▶ **132** | 1.312 | 5 to 35K | ± 3% (± 5% below 50Ω) | 5Ω to 200Ω ± 1.0%<br>200Ω to 35KΩ ± 0.5% | ±.20% | 2.75 @ 40° C | Bushing | 6.65 |
| | ▶ **140** | .500 | 50 to 50K | ± 5% | ± 1.0% | ±.50% | 2.0 @ 40° C | Bushing | 5.80 |
| | **142** | .500 | 50 to 50K | ±5% | ±1.0% | ±.50% | 2.0 @ 40°C | Servo | 17.34 |
| | **152** | .875 | 5 to 40K | ± 3% (±5% below 50Ω) | 5Ω to 500Ω ±1.0%<br>500Ω and above ±0.5% | ±.35% | 2.0 @ 40° C | Bushing<br>Servo | 6.00<br>10.20 |
|  | **172**<br>(Style RR1300 Available) | 1.438 | 5 to 50K | ±3% (±5% below 50Ω) | 5Ω to 200Ω ±1.00%<br>200Ω to 2KΩ ± 0.5%<br>2K to 50KΩ ±.25% | ±.15% | 2.0 @ 70°C | Bushing<br>Servo | 26.82<br>32.10 |
| | **182** | .750 | 5 to 30K | ±3% (±5% below 20Ω) | 5Ω to 2KΩ ±1.0%<br>2KΩ to 30KΩ ±0.5% | ±.25% | 1.5 @ 70°C | Servo | Contact Factory |
| | **202** | 1.750 | 5 to 60K | ± 3% (± 5% below 50Ω) | 5Ω to 50Ω ± 1.0%<br>50Ω to 500Ω ±0.5%<br>500Ω to 60KΩ ±.25% | ±.15% | 3.5 @ 70° C | Bushing<br>Servo | 18.20<br>21.00 |

[1] BEST PRACTICAL LINEARITY FIGURES SHOWN FOR THE VARIOUS MODELS APPLY TO HIGHER RESISTANCE UNITS. CONSULT FACTORY WITH SPECIFIC REQUIREMENTS.

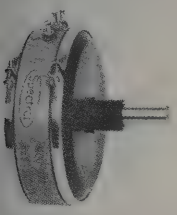
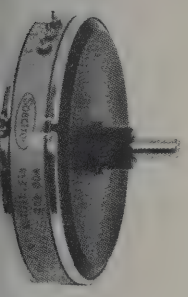
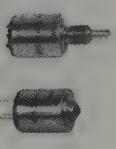
▶ DISTRIBUTOR AUTHORIZED STOCKING ITEM

[2] SIZES SHOWN ARE FOR THE BUSHING MOUNT VERSIONS. SHAFT DIA. .125" FOR MODELS 122, 140, 142, 502, 552, 702, AND CW05; .094" FOR MODELS 162 AND 164; .250" FOR ALL OTHER MODELS.

Spectrol

# SINGLE-TURN WIREWOUND PRECISION POTENTIOMETERS

All units shown ½ actual size

| MODEL NO. | NOMINAL DIA.[2] (INCHES) | RESISTANCE RANGE (OHMS) | STANDARD RESISTANCE TOLERANCE | LINEARITY TOLERANCE STANDARD | LINEARITY TOLERANCE BEST PRACTICAL | MAXIMUM POWER RATING (WATTS) | MOUNTING AVAILABLE | U.S. 50 PC. UNIT PRICE |
|---|---|---|---|---|---|---|---|---|
|  **302** (Style RR 2000 Available) | 2.000 | 5 to 80K | ±3% (±5% below 50Ω) | 5Ω to 50Ω ±1.0%<br>50Ω to 200Ω ±0.5%<br>200Ω to 80KΩ ±.25% | ±.10% | 4.0 @ 70° C | Bushing<br>Servo | 21.75<br>24.40 |
|  **402** (Style RR 3000 Available) | 3.000 | 10 to 150K | ±3% (±5% below 100Ω) | 10Ω to 200Ω ±0.5%<br>200Ω to 150KΩ ±.25% | ±.075% | 6.0 @ 70° C | Bushing<br>Servo | 28.30<br>29.75 |
| **452** SIN-COS | 3.000 | 250 to 25K per quad | ±3% | 250Ω to 2.5KΩ ±0.5% (PK To PK)<br>2.5KΩ and above ±0.3% (PK To PK) | ±.20% | 6.0 @ 70°C | Servo | 90.60 |
| **702** (Style RR 2100 Available) | .875 | 5 to 20K | ±3% (±5% below 20Ω) | 5Ω to 500Ω ±1.0%<br>500Ω to 20KΩ ±0.5% | ±.25% | 1.25 @ 70° C | Bushing<br>Servo | 14.70<br>16.80 |
|  **CW05** **CW06** (Contact Factory) | .505 | 10 to 50K | ±10% | ±5% | 1% | .75 @ 40°C | Bushing<br>PCB Mount | 3.48<br>3.48 |
| **MW** | .905 | 5 to 50K | ±10% | ±5% | ±2% | 1 @ 20°C | Bushing | 1.80 |

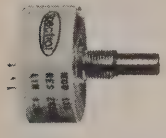
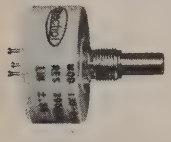
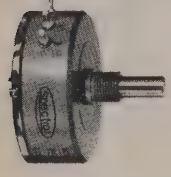
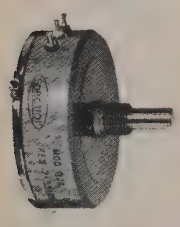
[1]BEST PRACTICAL LINEARITY FIGURES SHOWN FOR THE VARIOUS MODELS APPLY TO HIGHER RESISTANCE UNITS. CONSULT FACTORY WITH SPECIFIC REQUIREMENTS.

[2]SIZES SHOWN ARE FOR THE BUSHING MOUNT VERSIONS. SHAFT DIA. .125" FOR MODELS 122, 140, 142, 502, 552, 702, AND CW05; .094" FOR MODELS 162 AND 164; .250" FOR ALL OTHER MODELS.

Spectrol

# SINGLE-TURN CONDUCTIVE PLASTIC AND CERMET POTENTIOMETERS

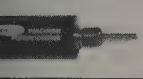
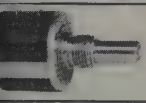
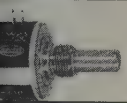
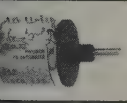
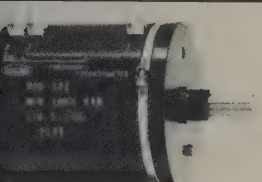
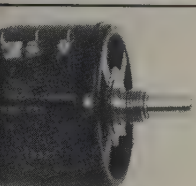
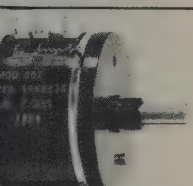
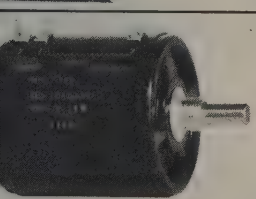
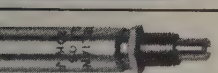
All units shown ½ actual size

| MODEL NO. | NOMINAL DIA. (INCHES) | RESISTANCE RANGE (OHMS) | RESISTANCE TOLERANCE | LINEARITY | MAXIMUM POWER RATING (WATTS) | OUTPUT SMOOTHNESS | TEMPCO (PPM/° C) | MOUNTING AVAILABLE | U.S. 50 PC. UNIT PRICE |
|---|---|---|---|---|---|---|---|---|---|
| **126** (Conductive Plastic) | 1.062 | 500 to 50K | ±10% (Special to ±5%) | ±0.5% (Special to ±.15%) | 0.6 @ 70° C | 0.1% Max. | ±400 | Servo | Contact Factory |
| **128** (Conductive Plastic) | 1.062 | 500 to 50K | ±10% (Special to ±5%) | ±0.5% (Special to ±.15%) | 1.25 @ 70° C | 0.1% Max. | ±400 | Bushing Servo | 23.10 27.40 |
|  **138** (Conductive Plastic) | 1.312 | 500 to 100K | ±10% (Special to ±5%) | ±0.5% (Special to ±.25%) | 2.0 @ 40° C | 0.1% Max. | ±500 | Bushing | 9.80 |
|  **139** (Cermet) | 1.312 | 500 to 2 Meg. | ±10% (Special to ±5%) | ±0.5% (Special to ±.25%) | 5.0 @ 40° C | 0.1% Max. | ±100 | Bushing | 13.00 |
| **158** (Conductive Plastic) | .875 | 500 to 50K | ±10% (Special to ±5%) | ±0.5% (Special to ±.25%) | 1.0 @ 40° C | 0.1% Max. | ±400 | Bushing* Servo | 10.55* 15.95 |
| **159** (Cermet) | .875 | 500 to 2 Meg. | ±10% (Special to ±5%) | ±0.5% (Special to ±.25%) | 3.5 @ 40° C | 0.1% Max. | ±100 | Bushing Servo | 12.00 16.20 |
|  **208** (Conductive Plastic) | 1.750 | 500 to 50K | ±10% (Special to ±5%) | ±0.3% (Special to ±.12%) | 1.75 @ 70° C | 0.1% Max. | ±400 | Bushing Servo | 29.20 32.30 |
|  **308** (Conductive Plastic) | 2.000 | 1K to 100K | ±10% (Special to ±5%) | ±.25% (Special to ±.05%) | 2.0 @ 70° C | 0.1% Max. | ±400 | Bushing Servo | 31.05 34.15 |
| **708** (Conductive Plastic) | .875 | 500 to 50K | ±10% (Special to ±5%) | ±0.5% (Special to ±0.2%) | 1.0 @ 70° C | 0.1% Max. | ±400 | Bushing Servo | 22.75 26.95 |

*CONSULT FACTORY FOR NEW LOW-COST VERSION

Spectrol

# MULTI-TURN WIREWOUND PRECISION POTENTIOMETERS

| All units shown ½ actual size | MODEL NO. | NOMINAL DIA.[2] (INCHES) | RESISTANCE RANGE (OHMS) | STANDARD RESISTANCE TOLERANCE | LINEARITY TOLERANCE STANDARD | LINEARITY TOLERANCE BEST PRACTICAL[1] | MAXIMUM POWER RATING (WATTS) | MOUNTING AVAILABLE | U.S. 50 PC. UNIT PRICE |
|---|---|---|---|---|---|---|---|---|---|
|  | ▶ 162/164 (10 Turn) | .500 | 100 to 100K | ±5% | ±.30% | ±.15% | 2.0 @ 40° C | 162 Bushing<br>164 Servo | 10.20<br>13.20 |
| | 502 (10 Turn)<br>(Style RR 1000 Available) | .875 | 15 to 100K | ±3%<br>(±5% below 100Ω) | ±.25% | ±.05% | 2.0 @ 70° C | Bushing<br>Servo | 16.35<br>18.95 |
|  | ▶ 533 (3 Turn) | .875 | 5 to 60K | ±5% | ±.25% | ±.15% | 1.0 @ 70° C | Bushing<br>Servo | 5.80<br>11.60 |
| | ▶ 534 (10 Turn) | .875 | 10 to 200K | ±5% | ±.25% | ±.075% | 2.0 @ 70° C | Bushing<br>Servo | 5.05<br>10.55 |
| | ▶ 535 (5 Turn) | .875 | 5 to 100K | ±5% | ±.25% | ±.10% | 1.5 @ 70° C | Bushing<br>Servo | 5.80<br>11.60 |
|  | 537 (3 Turn) | .875<br>(.590 Length) | 5 to 60K | ±5% | ±.25% | ±.10% | 1.5 @ 70° C | Bushing | 8.00<br>11.55 |
|  | 552 (3 Turn) | .875 | 5 to 45K | ±3%<br>(±5% below 50Ω) | ±.25% | ±.125% | 1.0 @ 70° C | Bushing<br>Servo | 16.35<br>18.95 |
|  | 802 (10 Turn)<br>(Style RR 2100 Available) | 1.812 | 20 to 500K | ±3%<br>(±5% below 200Ω) | ±.25% | ±.025% | 5.0 @ 70° C | Bushing<br>Servo | 18.00<br>21.55 |
|  | ▶ 830 (3 Turn) | 1.812 | 15 to 150K | ±3%<br>(±5% below 100Ω) | ±.25% | ±.05% | 3.0 @ 40° C | Bushing | 9.20 |
|  | 852 (3 Turn) | 1.812 | 15 to 150K | ±3%<br>(±5% below 100Ω) | ±.25% | ±.05% | 2.0 @ 70° C | Bushing<br>Servo | 18.00<br>21.55 |
|  | ▶ 860 (10 Turn) | 1.812 | 20 to 500K | ±3%<br>(±5% below 200Ω) | ±.25% | ±.025% | 8.0 @ 40° C | Bushing | 9.20 |
|  | HEL 05 (10 Turn) | .500 | 50 to 100K | ±5%<br>(±10% below 100Ω) | ±1.0% | ±.25% | 1.5 @ 40° C | Bushing | 7.05 |

▶ DISTRIBUTOR AUTHORIZED STOCKING ITEM

Spectrol

# SWITCHES AND MULTIDIALS

## SUBMINIATURE SWITCHES

All units shown actual size

| | MODEL NO. | NOMINAL DIA. (INCHES) | SWITCH ACTION | CONTACT CURRENT RATING | LIFE AT RATED CURRENT | CONTACT RESISTANCE (OHMS) | DESCRIPTION | U.S. 50 PC. UNIT PRICE* |
|---|---|---|---|---|---|---|---|---|
| | ▶ 87-11-XX† | .500 | Positive Detent, 36° Indexing, Stops | 250MA @ 28VDC | 4,000 Switching Operations, Per Position | .05 Maximum | Screwdriver Adjust | 3.25 |
| | ▶ 87-21-XX† | .550 | Positive Detent, 36° Indexing, Stops | 250MA @ 28VDC | 4,000 Switching Operations, Per Position | .05 Maximum | Knob Adjust | 3.80 |
| | ▶ 87-31-XX† | .500 | Positive Detent, 36° Indexing, Stops | 250MA @ 28 VDC | 4,000 Switching Operations, Per Position | .05 Maximum | Bushing Panel Mounting | 4.20 |

### NUMBER OF POLES AND ACTIVE POSITIONS

| NUMBER OF POLES | ACTIVE POSITIONS | ACTIVE TERMINAL PIN NUMBERS | BASIC PART NUMBER |
|---|---|---|---|
| SINGLE POLE | 1 | 1 (ON–OFF) | 87-XX-11 |
| | 2 | 1 and 2 | 87-XX-12 |
| | 3 | 1 thru 3 | 87-XX-13 |
| | 4 | 1 thru 4 | 87-XX-14 |
| | 5 | 1 thru 5 | 87-XX-15 |
| | 6 | 1 thru 6 | 87-XX-16 |
| | 7 | 1 thru 7 | 87-XX-17 |
| | 8 | 1 thru 8 | 87-XX-18 |
| | 9 | 1 thru 9 | 87-XX-19 |
| | 10 | 1 thru 10 | 87-XX-10 |

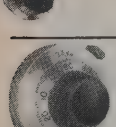
| NUMBER OF POLES | ACTIVE POSITIONS | ACTIVE TERMINAL PIN NUMBERS | BASIC PART NUMBER |
|---|---|---|---|
| TWO POLE | 1 | 3 and 8 (ON–OFF) | 87-XX-21 |
| | 2 | 2, 3, 7, and 8 | 87-XX-22 |
| | 3 | 2, 3, 4, 7, 8, and 9 | 87-XX-23 |
| | 4 | 1 thru 4, 6 thru 9 | 87-XX-24 |
| | 5 | 1 thru 10 | 87-XX-25 |
| THREE POLE | 1 | 1, 4, and 8 (ON OFF) | 87 XX 31 |
| | 2 | 1, 2, 4, 5, 8, and 9 | 87-XX-32 |
| | 3 | 1 thru 6, 8 thru 10 | 87-XX-33 |

### TYPICAL SWITCH APPLICATIONS

● Logic switching. ● Internal switching device for optional equipment add-ons. ● Test point switching. ● Adapting main-frame computers to peripheral equipment. ● Standardizing printed circuit boards. ● Selecting operational voltages. ● Selecting calibration resistors.

## MULTIDIALS

All units shown 1/3 actual size.

| | MODEL NO. | NOMINAL DIA. (INCHES) | NUMBER OF TURNS | MINOR SCALE DIVISION | SHAFT BORE ■ (INCHES) | FINISH ■ | U.S. 50 PC. UNIT PRICE |
|---|---|---|---|---|---|---|---|
| | ▶ 11-1-11 | 1.000 | 11 | 1/50 Turn | .250 | Satin Chrome | 7.30 |
| | ▶ 15-1-11<br>▶ 18-1-11 | H 1.750<br>W 1.000 | 10<br>(3 Digit) | 1/500 Turn | .250 | Satin Chrome | 10.20 |
| | ▶ 15-2-11 | H 1.750<br>W 1.000 | 100<br>(4 Digit) | 1/500 Turn | .250 | Satin Chrome | 12.00 |
| | ▶ 16-1-11 | .875 | 15 | 1/50 Turn | .250 | Clear Anodized | 6.15 |
|  | ▶ 21-1-11 | 1.812 | 15 | 1/100 Turn | .250 | Satin Chrome | 7.05 |

† LAST TWO DIGITS DENOTE POLE/POSITION, E.G., SINGLE POLE UP TO 10 POSITIONS, 2 POLE UP TO 5 POSITIONS, AND 3 POLE UP TO 3 POSITIONS.

*PRICES SHOWN FOR SINGLE POLE VERSIONS ONLY.

■ OTHER SHAFT BORE SIZES AND FINISHES AVAILABLE

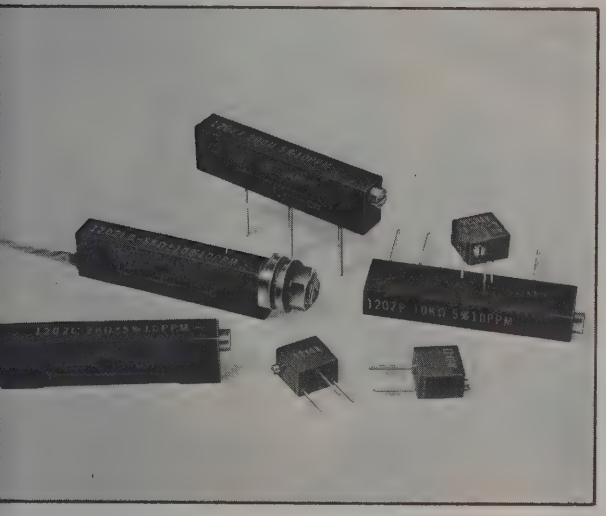
▶ *DISTRIBUTOR AUTHORIZED STOCKING ITEM

**UNITED STATES Spectrol Electronics Corporation** P.O. Box 1220, City of Industry, Calif. 91745, U.S.A. • (213) 964-6565 • TWX (910) 584-1314
**UNITED KINGDOM Spectrol Reliance Ltd.** Drakes Way, Swindon, Wiltshire, England • Swindon 21351 • TELEX: 44692
**ITALY SP Elettronica SpA** Via Carlo Piscane 7, 20016 Pero (Milan) Italy • 35 30 241 • TELEX: 36091
**GERMANY Spectrol Electronics GmbH** Sales Office, Oberauerstrasse 15, 8000 Munich 70 West Germany • (089) 7145096 • TELEX: 05-213014

VISHAY RESISTIVE SYSTEMS GROUP

# Precision Bulk Metal® trimming potentiometers

VISHAY RESISTIVE SYSTEMS GROUP • 63 Lincoln Highway, Malvern, PA 19355 • Phone (215) 644-1300 • TWX 510-668-8944



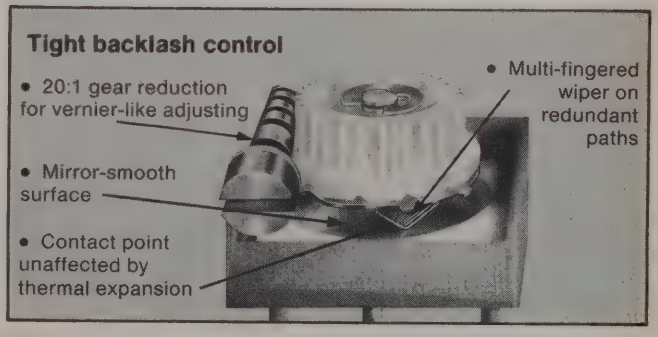
- **Settability** to 0.01% typical (Model 1240), 0.05% max (all models).
- **Setting stability** 0.5% max ΔR after shock and vibration.
- **Load-life stability** 1.0% max ΔR (Model 1240), 2.0% max ΔR (Model 1202) after 10,000 hr at full power and 85°C.
- **TCR** 10 ppm/°C (end-to-end) over full Mil range (−55°C to +150°C).
- **Pin configurations** for ¼" sq, ⅜" sq, ⅜" rd, ¾" rect, 1¼" rect.
- **Unmeasurable hop-off.**

shay RJR12-style (Model 1202 1¼" rectangular) and JR26-style (Model 1240 ¼" square) precision trimming otentiometers are designed and manufactured to meet exceed the Characteristic H requirements of Mil-R-9035, the most demanding specification yet issued for mmers.

The unique Vishay Bulk Metal®resistive element sed in these trimmers presents a mirror-smooth planar sistance surface to a multi-fingered wiper. his combination, operating over redundant current aths, virtually eliminates the possibility of catastrophic ilure.

The bulk-metal element makes possible additional portant advantages over other precision trimmer chnologies: The substantially thick (>2.5μm) metal mina, bonded to a ceramic substrate, is kept in its rgin state, unstressed through manufacturing, ndling, and storage—not subjected to bending, abra-on, and subsequent stress relief as is wire wound on a obbin or mandrel—a definite advantage for low TCR. flat monolithic surface has no hills and valleys as do rns of wire which cause stepwise resolution as the per slides over them. Being a solid layer of a special etal alloy, it does not suffer the haphazard dispersion of resistive particles characteristic of cermet elements—another advantage in tight settability and sure setting stability. Finally, it enjoys the long-term electrical stability that only a solid piece of metal can provide—its very hard surface won't wear from wiper travel, and won't experience chemical etch in corrosive environments.

Complete information on Vishay trimmers is available in Bulletin TR-600. For information on Vishay precision fixed resistors, see our selection guide in EEM (Resistors, Fixed) and send for specific literature.


Tight backlash control
• 20:1 gear reduction for vernier-like adjusting
• Mirror-smooth surface
• Contact point unaffected by thermal expansion
• Multi-fingered wiper on redundant paths

| ODEL UMBER | RESISTANCE (OHMS) | POWER @85°C | TCR | NO. OF TURNS | DIMENSIONS (excluding leads) HxLxW (inch) (mm) AND TERMINATION STYLES |
|---|---|---|---|---|---|
| 202 JR12 tyle | 2, 5, 10, 20 50, 100, 200, 250, 500, 1k, 2k, 2.5k, 5k, 10k, 20k All values ±5% or ±10% | 0.50W | ±5 ppm/°C from −55°C to +25°C; −5 ±5 ppm/°C from +25°C to +150°C | 25±2 | 0.325 (8.255) x 1.250 (31.750) x 0.195 (4.953) Type P: In-line pins Type Y: Staggered pins Type L: Flexible leads Type LB: Panel-mount with flexible leads |
| 240 JR26 tyle | 5, 10, 20, 50, 100, 200, 500, 1k, 2k, 5k All values ±5% | 0.25W | | 21±2 | Type X: Edge-mount, side-adjust; Type W: Edge-mount, top-adjust 0.250 (6.350) x 0.250 (6.350) x 0.175 (4.445) Type P: Flat-mount, side-adjust 0.175 (4.445) x 0.250 (6.350) x 0.250 (6.350) |

VISHAY RESISTIVE SYSTEMS GROUP

63 Lincoln Highway
Malvern, PA 19355
(215) 644-1300
TWX 510-668-8944

# CATALOGUE DE L'ELECTRONIQUE POUR LES INGENIEURS
# DER PRODUKTKATALOG FÜR ELEKTRONIKER
# ELECTRONIC ENGINEERS CATALOGUE

**The 1978 edition is out...and the response is in...**
**IMMEDIATE AND OVERWHELMING**

**ACCEPTANCE**

The ELECTRONIC ENGINEERS CATALOGUE is the only comprehensive, trilingual catalogue/source-directory of electronic products available to—and from—Western Europe.

It is divided into three distinct sections: 1. **The Product Index and Directory,** which lists more than 3,000 product headings & cross-references alphabetically in English with their French and German equivalents. 2. **The Manufacturers' Catalogue Section,** which is a compilation of Manufacturers' Catalogues in alphabetical order. 3. **The Manufacturers' Sales Offices and Trade Marks Directory,** which alphabetically includes country, address, telex or TWX numbers of the Manufacturers' main and local sales offices and/or agents.

The ELECTRONIC ENGINEERS CATALOGUE offers U.S. manufacturers the most cost-efficient method of distributing their catalogue data to **25,000** electronic engineers and buyers throughout Western Europe. It represents the carefully conceived application of the time-proven **eem** "cataloging" concept to the elusive European marketplace.

United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Avenue, Garden City, New York 11530 / 516 222-2500

VRN
ST. PETERSBURG
a Division of Vernitron Corp.

100% Tested
*Manufacturers of precision potentiometers, trimmers and dip switches*

# COMPLETE POTENTIOMETER CHOICE FOR ALL APPLICATIONS

VRN
ST. PETERSBURG
a Division of Vernitron Corp.

100% Tested
*Manufacturers of precision potentiometers, trimmers and dip switches*

2801 72nd ST. NORTH ST. PETERSBURG, FLORIDA 33710 U.S.A. TELEPHONE: (813) 347-2181 TELEX: 540149
P.O. BOX 44000 ST. PETERSBURG, FLORIDA 33743 U.S.A. TWX: (810) 863-0357

VRN
ST. PETERSBURG a Division of Vernitron Corp.

# CIRCUITRIM® RECTANGULAR TRIMMER POTENTIOMETERS

## CERMET (Non-wirewound) or Wirewound provide the widest choice for military, industrial and commercial applications.

Available from VRN Distributors

## CERMET (Non-wirewound)

| Illus. | Package L x W x H | VRN | Military Style or Designation | Resistance Ranges ±10% Std. MIL-Qual. | Resistance Ranges ±10% Std. VRN | Terminals | Adjust Turns (Nom) | Power (Watts) |
|---|---|---|---|---|---|---|---|---|
| 3 | 1.25 x .19 x .32 | 450-00 | RJ12L | 10Ω-1 MegΩ | 10Ω-1 MegΩ | Leads | 22 | .75 @ 85°C |
| 4 | 1.25 x .19 x .32 | 450-10 | RJ12P | 10Ω-1 MegΩ | 10Ω-1 MegΩ | P.C. Pins | 22 | .75 @ 85°C |
| 5 | 1.25 x .19 x .32 | 450-20 | RJ12Y | 10Ω-1 MegΩ | 10Ω-1 MegΩ | P.C. Pins | 22 | .75 @ 85°C |
| 3 | 1.25 x .19 x .34 | 45-00 | — | — | 100Ω-1 MegΩ ±20% | Leads | 22 | .75 @ 70°C |
| 4 | 1.25 x .19 x .34 | 45-10 | — | — | 100Ω-1 MegΩ ±20% | P.C. Pins | 22 | .75 @ 70°C |
| 5 | 1.25 x .19 x .34 | 45-20 | — | — | 100Ω-1 MegΩ ±20% | P.C. Pins | 22 | .75 @ 70°C |
| 6 | .75 x .16 x .31 | 960-20 | — | — | 10Ω-1 MegΩ | P.C. Pins | 20 | .75 @ 25°C |
| 7 | .75 x .27 x .35 | 980-20 | — | — | 10Ω-1 MegΩ | P.C. Pins | 20 | .75 @ 25°C |
| 9 | .75 x .16 x .31 | 989-20 | (RJ11P Pin Placement) | — | 10Ω-1 MegΩ | P.C. Pins | 20 | .75 @ 25°C |

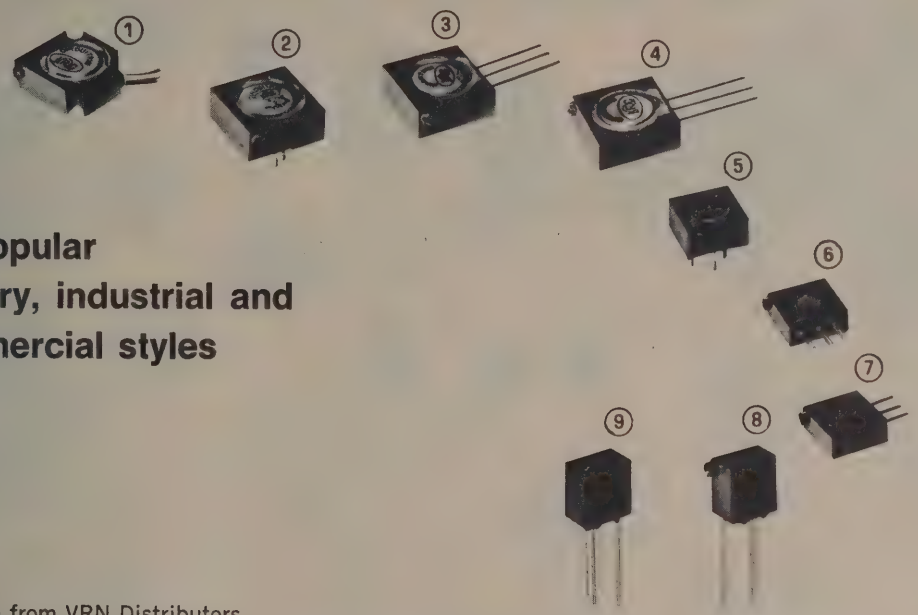
## WIREWOUND

| Illus. | Package L x W x H | VRN | Military Style or Designation | Resistance Ranges MIL-Qual. | Resistance Ranges VRN | Terminals | Adjust Turns (Nom) | Power (Watts) |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.25 x .28 x .32 | 60-00 | RT11CL | — | 10Ω-50K ±10% | Leads | 22 | 1.0 @ 70°C |
| 2 | 1.25 x .28 x .32 | 60-20 | RT11CP | — | 10Ω-50K ±10% | P.C. Pins | 22 | 1.0 @ 70°C |
| 3 | 1.25 x .19 x .32 | 400-00 | RT12C2L | 100Ω-20K | 10Ω-50K ±5% | Leads | 22 | .75 @ 85°C |
| 4 | 1.25 x .19 x .32 | 400-10 | RT12C2P | 100Ω-20K | 10Ω-50K ±5% | P.C. Pins | 22 | .75 @ 85°C |
| 5 | 1.25 x .19 x .32 | 400-20 | RT12C2Y | 100Ω-20K | 10Ω-50K ±5% | P.C. Pins | 22 | .75 @ 85°C |
| 3 | 1.25 x .19 x .34 | 40-00 | — | — | 10Ω-50KΩ ±10% | Leads | 22 | 1.0 @ 50°C |
| 4 | 1.25 x .19 x .34 | 40-10 | — | — | 10Ω-50KΩ ±10% | P.C. Pins | 22 | 1.0 @ 50°C |
| 5 | 1.25 x .19 x .34 | 40-20 | — | — | 10Ω-50KΩ ±10% | P.C. Pins | 22 | 1.0 @ 50°C |
| 1 | 1.25 x .28 x .32 | 600-00 | RT11CP | — | 10Ω-50K ±5% | Leads | 22 | 1.0 @ 70°C |
| 2 | 1.25 x .28 x .32 | 600-20 | RT11CP | — | 10Ω-50K ±5% | P.C. Pins | 22 | 1.0 @ 70°C |
| 1 | 1.25 x .19 x .32 | 60-00 | — | — | 10Ω-50KΩ ±10% | Leads | 22 | 1.0 @ 70°C |
| 2 | 1.25 x .19 x .32 | 60-10 | — | — | 10Ω-50KΩ ±10% | P.C. Pins | 22 | 1.0 @ 70°C |
| — | 1.25 x .19 x .32 | 60-201 | — | — | 10Ω-50KΩ ±10% | Hook Pins | 22 | 1.0 @ 70°C |
| 8 | 1" x .31 x .16 | 901-20 | RT11P-RT12Y | — | 10Ω-50K ±5% | P.C. Pins | 28 | 1.0 @ 70°C |
| 6 | .75 x .16 x .31 | 910-20 | — | — | 10Ω-20K ±10% | P.C. Pins | 20 | 1.0 @ 40°C |
| 7 | .75 x .27 x .35 | 930-20 | — | — | 10Ω-20K ±10% | P.C. Pins | 20 | 1.0 @ 40°C |

NOTES: RT11 and RJ11 Mil. Type Trimmers have been removed from Gov't and Mil. Procurement Lists. Future Procurement should call for RT12 and RJ12 Types. Trimmer Type 989-20 has .7 x .1 Pin Spacing.

VRN
ST. PETERSBURG a Division of Vernitron Corp.

# CIRCUITRIM® SQUARE AND CUBE MULTI-TURN TRIMMERS




**All popular military, industrial and commercial styles**

Available from VRN Distributors

## CERMET (Non-wirewound)

| Illus. | Package L x W x H | VRN | Military Style or Designation | Resistance Ranges ±10%*** MIL-Qual. | Resistance Ranges ±10%*** VRN | Terminals | Adjust Turns (Nom) | Power (Watts) |
|---|---|---|---|---|---|---|---|---|
| 1 | .5 x .5 x .19 | 255-00 | RJ22CL | 10Ω-1 MegΩ | 10Ω-1 MegΩ | Leads | 25 | .75 @ 70°C |
| 2 | ½" .5 x .5 x .22 | 255-10 | RJ22CP | 10Ω-1 MegΩ | 10Ω-1 MegΩ | P.C. Pins Bottom | 25 | .75 @ 70°C |
| 3 | .5 x .5 x .19 | 255-207* | RJ22CX | 10Ω-1 MegΩ | 10Ω-1 MegΩ | P.C. Pins Edge | 25 | .75 @ 70°C |
| 4 | .5 x .5 x .19 | 255-208* | RJ22CW | 10Ω-1 MegΩ | 10Ω-1 MegΩ | P.C. Pins Edge | 25 | .75 @ 70°C |
| 1 | .5 x .5 x .19 | 25-00 | — | — | 100Ω-1 MegΩ ±20% | Leads | 25 | .75 @ 70°C |
| 2 | ½" .5 x .5 x .22 | 25-10 | — | — | 100Ω-1 MegΩ ±20% | P.C. Pins Bottom | 25 | .75 @ 70°C |
| 3 | .5 x .5 x .19 | 25-207* | — | — | 100Ω-1 MegΩ ±20% | P.C. Pins Edge | 25 | .75 @ 70°C |
| 4 | .5 x .5 x .19 | 25-208* | — | — | 100Ω-1 MegΩ ±20% | P.C. Pins Edge | 25 | .75 @ 70°C |
| 5 | .375 x .375 x .195 | 750-10 | RJ24CP | 10Ω-1 MegΩ | 10Ω-1 MegΩ | P.C. Pins Bottom | 19 | .5 @ 70°C |
| 6 | ⅜" .375 x .375 x .21 | 750-207* | RJ24X | — | 10Ω-1 MegΩ | P.C. Pins Edge | 19 | .5 @ 70°C |
| 7 | .375 x .375 x .21 | 750-208* | RJ24W | — | 10Ω-1 MegΩ | P.C. Pins Edge | 19 | .5 @ 70°C |
| 5 | .375 x .375 x .195 | 75-10 | — | — | 100-1 MegΩ | P.C. Pins Bottom | 19 | .5 @ 70°C |
| 6 | ⅜" .375 x .375 x .21 | 75-207* | — | — | 100-1 MegΩ | P.C. Pins Edge | 19 | .5 @ 70°C |
| 7 | .375 x .375 x .21 | 75-208* | — | — | 100-1 MegΩ | P.C. Pins Edge | 19 | .5 @ 70°C |
| 8 | 5/16" .312 x .312 x .19 | 850-20 | — | — | 10Ω-1 MegΩ | P.C. Pins Edge | 13 | .3 @ 70°C |
| 9 | .312 x .312 x .19 | 850-208 | — | — | 10Ω-1 MegΩ | P.C. Pins Edge | 13 | .3 @ 70°C |

## WIREWOUND

| Illus. | Package L x W x H | VRN | Military Style or Designation | Resistance Ranges ±5% Std. MIL-Qual. | Resistance Ranges ±5% Std. VRN | Terminals | Adjust Turns (Nom) | Power (Watts) |
|---|---|---|---|---|---|---|---|---|
| 1 | .5 x .5 x .19 | 205-00 | RT22C2L | 50Ω-20K | 10Ω-50K | Leads | 25 | 1.0 @ 70°C |
| 2 | ½" .5 x .5 x .22 | 205-10 | RT22C2P | 50Ω-20K | 10Ω-50K | P.C. Pins Bottom | 25 | 1.0 @ 70°C |
| 3 | .5 x .5 x .19 | 205-207* | RT22C2X | 50Ω-20K | 10Ω-50K | P.C. Pins Edge | 25 | 1.0 @ 70°C |
| 4 | .5 x .5 x .19 | 205-208* | RT22C2W | 50Ω-20K | 10Ω-50K | P.C. Pins Edge | 25 | 1.0 @ 70°C |
| 1 | .5 x .5 x .19 | 20-00 | — | — | 50Ω-20KΩ ±10% | Leads | 25 | 1.0 @ 50°C |
| 2 | ½" .5 x .5 x .22 | 20-10 | — | — | 50Ω-20KΩ ±10% | P.C. Pins Bottom | 25 | 1.0 @ 50°C |
| 3 | .5 x .5 x .19 | 20-207* | — | — | 50Ω-20KΩ ±10% | P.C. Pins Edge | 25 | 1.0 @ 50°C |
| 4 | .5 x .5 x .19 | 20-208* | — | — | 50Ω-20KΩ ±10% | P.C. Pins Edge | 25 | 1.0 @ 50°C |
| 5 | .375 x .375 x .195 | 700-10 | RT22C2P | 10Ω-10K | 10Ω-20K | P.C. Pins Bottom | 21 | .75 @ 70°C |
| 6 | ⅜" .375 x .375 x .21 | 700-207* | RT22X | — | 10Ω-20K | P.C. Pins Edge | 21 | .75 @ 70°C |
| 7 | .375 x .375 x .21 | 700-208* | RT22W | — | 10Ω-20K | P.C. Pins Edge | 21 | .75 @ 70°C |
| 5 | .375 x .375 x .195 | 70-10 | — | — | 50Ω-20KΩ ±10% | P.C. Pins Bottom | 21 | .75 @ 70°C |
| 6 | ⅜" .375 x .375 x .21 | 70-207* | — | — | 50Ω-20KΩ ±10% | P.C. Pins Edge | 21 | .75 @ 70°C |
| 7 | .375 x .375 x .21 | 70-208* | — | — | 50Ω-20KΩ ±10% | P.C. Pins Edge | 21 | .75 @ 70°C |
| 8 | .312 x .312 x .19 | 800-20 | — | — | 10Ω-20K | P.C. Pins Edge | 15 | .6 @ 70°C |
| 9 | 5/16" .312 x .312 x .19 | 800-208* | — | — | 10Ω-20K | P.C. Pins Edge | 15 | .6 @ 70°C |

*Suffix 207 denotes Lead Screw Location 90° from Pins.
Suffix 208 denotes Lead Screw Location 180° from Pins.

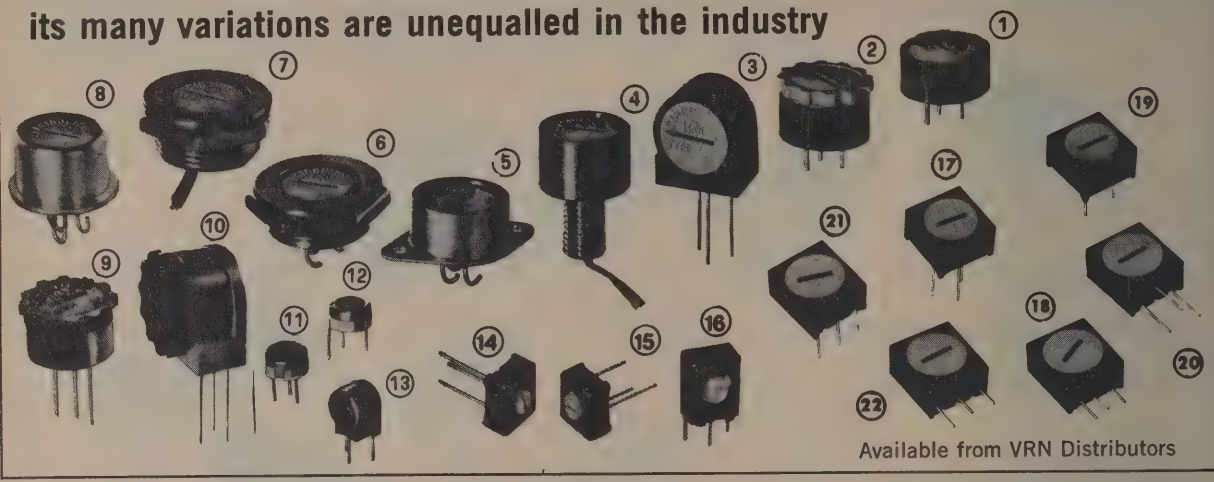
***Unless otherwise indicated.

RN/St. Petersburg
DIVISION OF VERNITRON CORPORATION

VRN
ST. PETERSBURG a Division of Vernitron Corp.

# CIRCUITRIM® 100 — The World's most experienced — Most versatile ¼″ and ½″ SINGLE TURN TRIMMERS

## its many variations are unequalled in the industry




Available from VRN Distributors

| Illus. | VRN Type*** | Description | Pin Spacing & Mounting | Adjustment Control | Resistance Range & Tolerance | Power (Watts) |
|---|---|---|---|---|---|---|
| **SINGLE TURN — WIREWOUND** | | | | | | |
| 1 | 100* | ½″ Round x .235 High | .1″ Radius, Flat | Top S.D. Slot | 10Ω-50K ±5% | 1.0 @ 70°C |
| 2 | 110 | ½″ Round x .325 High | .1″ Radius, Flat | Top S.D. & Knob | 10Ω-50K ±5% | 1.0 @ 70°C |
| 3 | 106-2 | ½″ Wide x .56 High | .1″ Radius, Vertical | Side S.D. Slot | 10Ω-50K ±5% | 1.0 @ 70°C |
| 4 | 108-4 | ½″ Wide x .56 High | .1″ Radius, Vertical | Side S.D. & Knob | 10Ω-50K ±5% | 1.0 @ 70°C |
| 5 | 101-5 | ½″ Round x .265 High | .1″ Radius, Flange | Top S.D. Slot | 10Ω-50K ±5% | 1.0 @ 70°C |
| 6 | 102-5 | ¾″ Round x .250 Deep | .1″ Radius, Flush | Top S.D. Slot | 10Ω-50K ±5% | 1.0 @ 70°C |
| 7 | 103-6 | ¾″ Round x .315 Deep | 10″ Leads, Flush | Top S.D. Slot | 10Ω-50K ±5% | 1.0 @ 70°C |
| 8 | 118-7 | ½″ Round x .312 High | 10″ Leads, Flat | Top S.D. Slot | 10Ω-50K ±5% | 1.0 @ 70°C |
| 9 | 500 | ½″ Round x .325 High | .1″ Radius, Flat | Top S.D. & Knob | 10Ω-50K ±5% | 1.0 @ 70°C |
| 10 | 506 | ½″ Wide x .56 High | .1″ Radius, Vertical | Top S.D. & Knob | 10Ω-50K ±5% | 1.0 @ 70°C |
| **SINGLE TURN — CERMET** | | | | | | |
| 1 | 150* | ½″ Round x .235 High | .1″ Radius, Flat | Top S.D. Slot | 10Ω-2 MegΩ ±10% | .75 @ 70°C |
| 2 | 160 | ½″ Round x .325 High | .1″ Radius, Flat | Top S.D. & Knob | 10Ω-2 MegΩ ±10% | .75 @ 70°C |
| 3 | 156-2 | ½″ Wide x .56 High | .1″ Radius, Vertical | Side S.D. Slot | 10Ω-2 MegΩ ±10% | .75 @ 70°C |
| 4 | 158-4 | ½″ Wide x .56 High | .1″ Radius, Vertical | Side S.D. & Knob | 10Ω-2 MegΩ ±10% | .75 @ 70°C |
| 5 | 151-5 | ½″ Round x .265 High | .1″ Radius, Flange | Top S.D. Slot | 10Ω-2 MegΩ ±10% | .75 @ 70°C |
| 6 | 152-5 | ¾″ Round x .250 Deep | .1″ Radius, Flush | Top S.D. Slot | 10Ω-2 MegΩ ±10% | .75 @ 70°C |
| 7 | 103-6 | ¾″ Round x .315 Deep | 10″ Leads, Flush | Top S.D. Slot | 10Ω-2 MegΩ ±10% | .75 @ 70°C |
| 8 | 118-7 | ½″ Round x .312 High | 10″ Leads, Flat | Top S.D. Slot | 10Ω-2 MegΩ ±10% | .75 @ 70°C |
| 9 | 550 | ½″ Round x .235 High | .1″ Radius, Flat | Top S.D. & Knob | 10Ω-2 MegΩ ±30% | .75 @ 70°C |
| 10 | 556 | ½″ Wide x .56 High | .1″ Radius, Vertical | Side S.D. & Knob | 10Ω-2 MegΩ ±30% | .75 @ 70°C |
| 17 | 76-10 | ⅜″ Square x .28 High | .1″ Radius, Flat | Top S.D. Slot | 100Ω-1 MegΩ ±10% | .5 @ 70°C |
| 18 | 76-30 | ⅜″ Square x .28 High | .2″ Radius, Flat | Top S.D. Slot | 100Ω-1 MegΩ ±10% | .5 @ 70°C |
| 19 | 76-50** | ⅜″ Square x .28 High | .15 Inline, Flat | Top S.D. Slot | 100Ω-1 MegΩ ±10% | .5 @ 70°C |
| 20 | 76-20** | .2 x .37 x .42 High | .10 Inline, Vertical | Side S.D. Slot | 100Ω-1 MegΩ ±10% | .5 @ 70°C |
| 21 | 76-40** | .2 x .37 x .42 High | .10 Radius, Vertical | Side S.D. Slot | 100Ω-1 MegΩ ±10% | .5 @ 70°C |
| 22 | 76-70** | .2 x .37 x .42 High | .15 Inline, Vertical | Side S.D. Slot | 100Ω-1 MegΩ ±10% | .5 @ 70°C |

**Also available with C.W. rotation.
***Available with 0.5W @ 85°C rating, testing to MIL-R-22097, as 760 Series, all styles.

### ¼″ SINGLE TURN — CERMET

| | | | | | | |
|---|---|---|---|---|---|---|
| 11 | 170* | ¼″ Round x .17 High | .1″ Radius, Flat | Top S.D. Slot | 10Ω-1 MegΩ ±20% | .5 @ 85°C |
| 12 | 171 | ¼″ Round x .18 High | .1″ Radius, Flat | Top S.D. Slot | 10Ω-1 MegΩ ±20% | .5 @ 85°C |
| 13 | 172 | ¼″ Wide x .31 High | .1″ Radius, Vertical | Side S.D. Slot | 10Ω-1 MegΩ ±20% | .5 @ 85°C |
| 14 | 180 | ¼″ Square x .18 High | .1″ Radius Flat | Top S.D. Slot | 100Ω-1 MegΩ | .5 @ 70°C |
| 15 | 181 | ¼″ Square x .18 High | .1″ Centers Flat | Top S.D. Slot | 100Ω-1 MegΩ | .5 @ 70°C |
| 16 | 182 | ¼″ Square x .312 High | .1″ Centers Flat | Side S.D. Slot | 100Ω-1 MegΩ | .5 @ 70°C |

*Basic Mechanical/Electrical Components for these respective series. Mounting variations and type and location of adjustment controls provide versatility and change in model numbering.

VRN/St. Petersburg
A DIVISION OF VERNITRON CORPORATION

VRN
ST. PETERSBURG a Division of Vernitron Corp.

# PRECISION SINGLE TURN and MULTI-TURN POTENTIOMETERS

## Wirewound, bushing-mounted, metal or plastic case

Many feature VRN's exclusive metal to metal stop system and rear terminals for close packaging.
3 to 30 turns available.

Available from VRN Distributors

| Specifications | Type 5000 ½" Dia. Metal Case | Type 5001 ½" Dia. Metal Case | Type 7400 ¾" Dia. Metal Case | Type 7405 ¾" Dia. Metal Case | Type 7500 ¾" Dia. Metal Case |
|---|---|---|---|---|---|
| **Electrical** | | | | | |
| Resistance Range & Tol. | 25Ω-100K ±5% | 10Ω-50K ±5% | 100Ω-100K ±5% | 100Ω-50K ±5% | 50Ω-250K ±5% |
| Power Rating | 1.5W @ 40°C | 2.0W @ 40°C | 3.0W @ 40°C | 2.0W @ 40°C | 3.0W @ 40°C |
| Operating Temp. Range | −55°C to +125°C | −65°C to +150°C | −65°C to +125°C | −65°C to +125°C | −55°C to +125°C |
| Linearity (Indep., Std.) | ±5% | ±5% | ±0.25% | ±0.5% | ±.25% |
| Rotation | 3600° +4° −0° | 320° ±5° | 3600° +6° −0° | 1800° +6° −0° | 3600° +4° −0° |
| **Mechanical** | | | | | |
| Dimensions (Dia. x L.B.P.) | ½" x 1 3/64" | ½" x ½" | ¾" x 1¼" | ¾" x 13/16" | ¾" x 1 21/32" |
| Bushing (Dia. x L.) | ⅜" x ½" | ¼" x ⅜" | ⅜" x 7/16" | ⅜" x 7/16" | ⅜" x ½" |
| Shaft (Dia. x L.) | ¼" x ½" | ⅛" x ⅛" | ¼" x ½" | ¼" x ½" | ¼" x ½" |
| Rotation | 3600° +4° −0° | 320° ±5° | 3600° +6° −0° | 1800° +6° −0° | 3600° +4° −0° |

| Specifications | Type 7501 ¾" Dia. Metal Case | Type 1000 1" Dia. Metal Case | Type 6800 ⅞" Dia. Phenolic Case | Type HD-150 1½" Dia. Phenolic Case | Type 151 1½" Dia. Metal Case |
|---|---|---|---|---|---|
| **Electrical** | | | | | |
| Resistance Range & Tol. | 50Ω-75K ±5% | 500Ω-200K ±5% | 100Ω-100KΩ ±5% | 500Ω-600K ±5% | 100Ω-100K ±5% |
| Power Rating | 2.25W @ 40°C | 3.0W @ 40°C | 2.0W @ 70°C | 5.0W @ 40°C | 3.5W @ 40°C |
| Operating Temp. Range | −65°C to +150°C | −55°C to +125°C | −55°C to +125°C | −55°C to +100°C | −65°C to +150°C |
| Linearity (Indep., Std.) | ±1% | ±0.5% | ±.25% | ±3% | ±0.5% |
| Rotation | 345° ±5° | 3600° +4° −0° | 3600° +10° −0° | 3600° +4° −0° | 350° ±5° |
| **Mechanical** | | | | | |
| Dimensions (Dia. x L.B.P.) | ¾" x ⅜" | 1" x 1 1/32" | ⅞" x 1/16" | 1½" x 2.0" | 1½" x ½" |
| Bushing (Dia. x L.) | ¼" x ⅜" | ⅜" x ½" | 4/10" x 3/10" | ⅜" x 5/16" | ⅜" x ½" |
| Shaft (Dia. x L.) | ¼" x ½" | ¼" x ½" | ¼" x ½" | ¼" x ½" | ¼" x ½" |
| Rotation | Cont. | 3600° +4° −0° Available in 2 to 15 Turns | 3600° +10° −0° | 3600° +4° −0° Also Avail. in 3 & 5 Turns | Cont. |

Note: Consult factory for Shaft and Bushing Modifications, Center Taps, Intermediate Turns, best Practical Resistance and Linearity Tolerances and Moisture or Hermetic Sealing.

## TURNS COUNTING DIALS

**Eliminate reading errors.**

RD-400 Series
1" Dia. 10 Turns

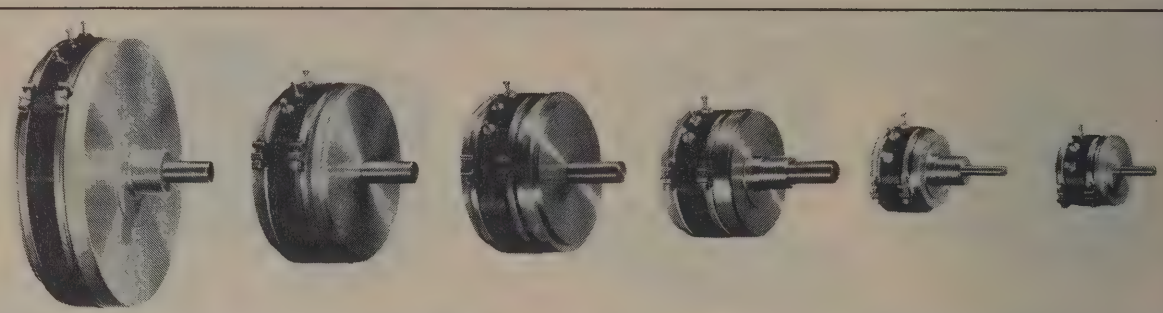
RDK-400 Series
1" Dia. 15 Turns

Dials are adaptable to all VRN Precision Potentiometers without need for extra panel holes. Life tested for one quarter million cycles. Available in black or clear anodized finish, with or without lock.

N/St. Petersburg
DIVISION OF VERNITRON CORPORATION

VRN
ST. PETERSBURG a Division of Vernitron Corp.

# PRECISION POTENTIOMETERS
## 7/8″ to 3″ Diameter 1 to 6 Watts



These high performance devices will equal or exceed the appropriate military specifications, as well as those of competitive devices.

Factory services will supply a wide range of mechanical, electrical and environmental modifications. Standard options include special shafts, shaft seals, stops, anti-rotation pins . . . multicup assembly, voltage taps, 1% T.R. tolerance and independent linearity as low as 0.1%.

## SPECIFICATIONS

| Mfr's Model | Size | Mounting | Linearity* | Power | Torque Starting/ Running | Weight Oz. (gm) | Resistance Range |
|---|---|---|---|---|---|---|---|
| 0871-0001 | .875 Dia. x .620 | Servo ⅛ Shaft | ±.5 | 1W @ 70°C | 0.15 | 0.6 | 50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K, 50K |
| 0871-0002 | .875 Dia. x .645 | Bushing ⅛ Shaft | ±.5 | 1W @ 70°C | 0.15 | 0.6 | |
| 1061-0001 | 1.062 Dia. x .67 | Servo ⅛ Shaft | ±.5 | 1.5W @ 70°C | 0.15 | 0.8 | 50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K, 50K |
| 1061-0002 | 1.062 Dia. x .645 | Bushing ⅛ Shaft | ±.5 | 1.5W @ 70°C | 0.15 | 0.8 | |
| 1441-0001 | 1.437 Dia. x .800 | Servo ¼ Shaft | ±.5 | 2W @ 70°C | 0.5 | 1.7 | 50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K, 50K |
| 1441-0002 | 1.437 Dia. x .850 | Bushing ¼ Shaft | ±.5 | 2W @ 70°C | 0.5 | 1.7 | |
| 1751-0001 | 1.750 Dia. x .800 | Servo ¼ Shaft | ±.25 | 2.5W @ 70°C | 0.5 | 2.2 | 50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K, 50K |
| 1751-0002 | 1.750 Dia. x .850 | Bushing ¼ Shaft | ±.25 | 2.5W @ 70°C | 0.5 | 2.3 | |
| 2001-0001 | 2.00 Dia. x .800 | Servo ¼ Shaft | ±.25 | 4W @ 70°C | 0.5 | 3 | 50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K, 50K |
| 2001-0002 | 2.00 Dia. x .850 | Bushing ¼ Shaft | ±.25 | 4W @ 70°C | 0.5 | 3 | |
| 3001-0001 | 3.00 Dia. x .800 | Servo ¼ Shaft | ±.25 | 6W @ 70°C | 0.5 | 5.5 | 50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K, 50K |
| 3001-0002 | 3.00 Dia. x .850 | Bushing ¼ Shaft | ±.25 | 6W @ 70°C | 0.5 | 5.3 | |

## % RESOLUTION

| Model | 50Ω | 100Ω | 200Ω | 500Ω | 1KΩ | 2KΩ | 5KΩ | 10KΩ | 20KΩ | 50KΩ | 100KΩ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0871 | .361 | .292 | .233 | .173 | .152 | .149 | .107 | .090 | .070 | .059 | — |
| 1061 | .301 | .231 | .188 | .140 | .115 | .131 | .106 | .085 | .067 | .052 | — |
| 1441 | .253 | .201 | .172 | .143 | .106 | .087 | .093 | .072 | .058 | .044 | — |
| 1751 | .228 | .179 | .137 | .113 | .097 | .076 | .081 | .071 | .047 | .039 | — |
| 2001 | — | .177 | .138 | .111 | .089 | .066 | .071 | .065 | .044 | .033 | .027 |
| 3001 | — | .125 | .099 | .076 | .062 | .050 | .038 | .041 | .033 | .027 | .025 |

### ELECTRICAL CHARACTERISTICS

**Resistance Tolerance:** ±3%
**Effective Electrical Angle:** 350° ±2°
**End Settings:** 1Ω or 0.1% whichever is greater
**Noise Ohms ENR:** 100 maximum
**Dielectric Strength:** MIL-R-12934
**Sea Level:** 1,000 volts AC minimum
**Insulation Resistance, 500 volts DC:** 1,000 megohms min.

### MECHANICAL & PHYSICAL CHARACTERISTICS

**Mechanical Angle:** Continuous
**Shaft Runout:** .001 in. (.025mm) T.I.R.
**Shaft End Play:** .005 in. (.127mm) T.I.R.
**Shaft Radial Play:** .002 in. (.051mm) T.I.R.
**Pilot Surface Runout:** .0015 in. (.0381mm) T.I.R.
**Lateral Runout:** .002 in. (.051mm) T.I.R.
**Rotational Life:** 1,000,000 shaft revolutions

### MECHANICAL & PHYSICAL CHARACTERISTICS (Cont'd)

**Moment of Inertia:** 16.0 gm cm²
**Ganging:** 15 cups maximum
**Terminals:** Gold plated turrets

### ENVIRONMENTAL CHARACTERISTICS

**Operating Temperature Range:** −65°C to 125°C
**Temperature Coefficient of Wire:** 20 ppm/°C maximum
**Humidity:** MIL-R-12934, humidity cycling
**Vibration:** MIL-R-12934, high frequency
**Wiper Bounce:** 0.1 millisecond maximum
**Shock:** MIL-R-12934, 100G
**Wiper Bounce and Wiper Shift:** Same as vibration
**Rotational Load Life:** MIL-R-12934 par. 4.6.20.2, 1,000 hrs.
**Resistance Shift:** 5.0% maximum
**Salt Spray:** MIL-R-12934

VRN/St. Petersburg
A DIVISION OF VERNITRON CORPORATION

# HEATSINKS

AAVID ENGINEERING, INC.
30 COOK COURT, LACONIA, NEW HAMPSHIRE 03246 — TEL. (603) 524-4443

**OVER 260 SHAPES** Largest selection of extruded heatsinks. Write or call for Catalog #77

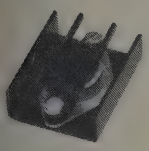


FIG. A

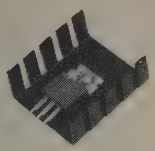


FIG. B

FIG. C

FIG. D

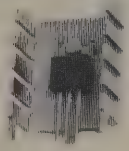


FIG. E

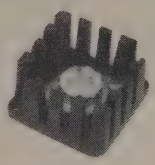


FIG. F

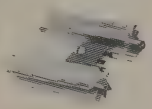


FIG. G

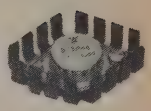


FIG. H

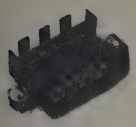


FIG. I

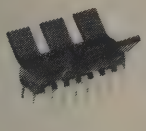


FIG. J

FIG. K

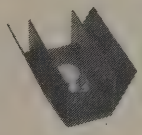


FIG. L

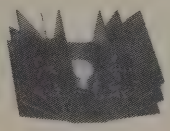


FIG. M

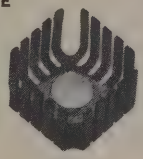


FIG. N

FIG. O

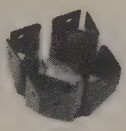


FIG. P

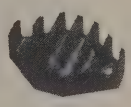


FIG. Q

FIG. R

**SERIES 5100** Popular 2 piece heat sink designed for circuit board mounting. The top and the base may be ordered separately.

| Part Number | Figure | For Case Style | Size, Inches L | W | H | TR °C/W |
|---|---|---|---|---|---|---|
| 5166B | A | TO-66 | 1.32 | .89 | .609 | 14 |
| 5166C | A | TO-66 | 1.32 | .89 | .609 | 14 |
| 5166B (Base) | A | TO-66 | 1.32 | .89 | .609 | 16 |

**SERIES 5200** Designed to maximize heat transfer unitizing a 2 piece heat sink. Black anodized base may be ordered with a gold chromate uninsulated top where electrical contact is needed.

| | | | | | | |
|---|---|---|---|---|---|---|
| 5203B | A | TO-3 | 1.53 | 1.25 | .515 | 12 |
| 5203C | A | TO-3 | 1.53 | 1.25 | .515 | 12 |
| 5203B (Case) | A | TO-3 | 1.53 | 1.25 | .515 | 14 |

**SERIES 5300** Lightweight heat sink for plastic power semiconductors. The 5307 accommodates one device, and the 5306 accommodates one or two devices. Excellent for circuit board applications.

| | | | | | | |
|---|---|---|---|---|---|---|
| 5306B | B | Blank | 1.18 | 1.00 | 0.50 | 19 |
| 5306B-13 | B | Two Holes (Plastic Power) | 1.18 | 1.00 | 0.50 | 19 |
| 5307B | B | Blank | 0.71 | 1.00 | 0.50 | 25 |
| 5307B-14 | B | Two Holes (Plastic Power) | 0.71 | 1.00 | 0.50 | 25 |

**SERIES 5425 & 5632** Low cost — space saving, vertically mounted heat sink for plastic power semiconductors. Nickel plated units are available where soldering of mounting tabs are desired.

| | | | | | | |
|---|---|---|---|---|---|---|
| 5425B | C | Plastic Power | 1.41 | 0.88 | 0.25 | 22.0 |
| 5425C | C | Plastic Power | 1.41 | 0.88 | 0.25 | 25.0 |
| 5425D | C | Plastic Power | 1.41 | 0.88 | 0.25 | 31.0 |
| 5632B | C | Plastic Power | 2.19 | 1.38 | 0.50 | 8.8 |
| 5632D | C | Plastic Power | 2.19 | 1.38 | 0.50 | 9.7 |
| 5634B | C | Plastic Power | 2.19 | 1.38 | 0.50 | 8.8 |
| 5634D | C | Plastic Power | 2.19 | 1.38 | 0.50 | 9.7 |

**SERIES 5500** Low cost cooling for TO-3 or TO-66 case styles.

| | | | | | | |
|---|---|---|---|---|---|---|
| 5531B-3 | D | TO-3 | 1.00 | 1.63 | 1.0 | 13 |
| 5531C-3 | D | TO-3 | 1.00 | 1.63 | 1.0 | 13 |
| 5531B-66 | D | TO-66 | 1.00 | 1.63 | 1.0 | 13 |
| 5531C-66 | D | TO-66 | 1.00 | 1.63 | 1.0 | 13 |

**SERIES 5600** Vertically mounted — low cost — heat sink for plastic power transistors, Triacs, and SCR's. Mounting tabs designed for either soldering (nickel finish) or bending.

| | | | | | | |
|---|---|---|---|---|---|---|
| 5630B | E | Plastic Power (One Slot) | 1.38 | 1.00 | 0.500 | 10 |
| 5630C | E | Plastic Power (One Slot) | 1.38 | 1.00 | 0.500 | 11 |
| 5630D | E | Plastic Power (One Slot) | 1.38 | 1.00 | 0.500 | 14 |

**SERIES 5000** Series 5000 is ideal for circuit board applications where space is a premium. It provides free circulation of air from all sides and accepts all popular semiconductors case styles.

| | | | | | | |
|---|---|---|---|---|---|---|
| 5000-005-TO-3 | F | TO-3 | 1.81 | 1.81 | 0.50 | 7.3 |
| 5000-0075-TO-3 | F | TO-3 | 1.81 | 1.81 | 0.75 | 6.1 |
| 5000-010-TO-3 | F | TO-3 | 1.81 | 1.81 | 1.00 | 5.4 |
| 5000-0125-TO-3 | F | TO-3 | 1.81 | 1.81 | 1.25 | 5.0 |

**SERIES 60130** The new Series 60130 heat sink was specifically designed for the tab mount plastic case type semiconductor. Available with pins for circuit board solder mount or without pins for a self-threading screw mount. Longer lengths available upon request.

| | | | | | | |
|---|---|---|---|---|---|---|
| 60130-010 | G | Plastic Power (3 Holes) | 1.0 | 1.38 | 0.50 | 13.6 |
| 60130-010-P | G | Plastic Power (3 Holes) | 1.0 | 1.38 | 0.50 | 13.6 |
| 60130-015 | G | Plastic Power (3 Holes) | 1.5 | 1.38 | 0.50 | 12.0 |
| 60130-015-P | G | Plastic Power (3 Holes) | 1.5 | 1.38 | 0.50 | 12.0 |

**SERIES 5013** Minimum amount of board space required and at a very low cost.

| | | | | | | |
|---|---|---|---|---|---|---|
| 5013B | H | TO-3 | 1.88 | 1.40 | 0.50 | 14.0 |
| 5014B | H | TO-3 | 1.88 | 1.40 | 0.75 | 12.0 |
| 5015B | H | TO-3 | 1.88 | 1.40 | 1.00 | 10.0 |
| 5016B | H | TO-3 | 1.88 | 1.40 | 1.25 | 8.0 |

**SERIES 5007** Two piece interated circuit package heat sink removes heat from both top and bottom. Designed for 14 and 16 pin dual in line up to 0.82" in length.

| Part Number | Figure | For Case Style | Size, Inches L | W | H | TR °C/W |
|---|---|---|---|---|---|---|
| 5007A | I | IC's 14 and 16 Pins | 1.24 | 0.75 | | 28 |

**SERIES 5010** One piece heat sink for 14 and 16 pin integrated circuit package. Bonded with AAVID's Ther-O-Bond 1500 for maximum thermal efficiency.

| | | | | | | |
|---|---|---|---|---|---|---|
| 5010B | J | IC's 14 and 16 Pins | 0.75 | 0.604 | .177 | 35 |
| 5010C | J | IC's 14 and 16 Pins | 0.75 | 0.604 | .177 | 38 |

**SERIES 3225** Low cost heat sink that is easy to install.

| Part Number | Figure | For Case Style | Size, Inches Dia. | H | TR °C/W |
|---|---|---|---|---|---|
| 3225B | K | TO-5 | 0.75 | 0.40 | 50 |
| 3225C | K | TO-5 | 0.75 | 0.40 | |
| 3226B | K | TO-5 | 0.75 | 0.40 | 60 |
| 3226C | K | TO-5 | 0.75 | 0.40 | |

**SERIES 60495R & 60150R** Extruded heat sink designed for minimum amount of mounting space. The Model 60150R incorporates the highly efficient radial fin design.

| | | | | | | |
|---|---|---|---|---|---|---|
| 60495R-3B | L | Blank | 3.0 | 1.39 | 1.50 | 2.8 |
| 60495R-3B-H1 | L | TO-3 | 3.0 | 1.39 (Base) | 1.50 | 2.8 |
| 60150R-3B | M | Blank | 3.0 | 3.96 | 1.60 | 1.7 |
| 60150R-3B-H1 | M | TO-3 | 3.0 | 3.96 | 1.60 | 1.7 |

**SERIES 5051** High performance — economical 5051 thru 5059. One piece heat sink for TO-3 and TO-66 devices, saves additional labor and cost by allowing device and sink to be mounted with same hardware.

| | | | | | | |
|---|---|---|---|---|---|---|
| 5051B | N | TO-3 | 1.78 | 1.78 | 0.50 | 6.9 |
| 5052B | N | TO-3 | 1.78 | 1.78 | 0.75 | 6.3 |
| 5053B | N | TO-3 | 1.78 | 1.78 | 1.00 | 5.7 |
| 5054B | N | TO-3 | 1.78 | 1.78 | 1.25 | 5.3 |
| 5056B | N | TO-66 | 1.78 | 1.78 | 0.50 | 6.9 |
| 5057B | N | TO-66 | 1.78 | 1.78 | 0.75 | 6.3 |
| 5058B | N | TO-66 | 1.78 | 1.78 | 1.00 | 5.7 |
| 5059B | N | TO-66 | 1.78 | 1.78 | 1.25 | 5.3 |

**SERIES 3230-5** The 3230-5 heat sink provides extra surface area for cooling. May be secured using boss which clears a 4-40 screw.

| Part Number | Figure | For Case Style | Size, Inches Dia. | H | TR °C/W |
|---|---|---|---|---|---|
| 3230B-5 | O | TO-5 | 0.75 | 0.25 | 43 |
| 3230C-5 | O | TO-5 | 0.75 | 0.25 | |

**SERIES 5690** Highest power dissipation per unit cost.

| | | | | | | |
|---|---|---|---|---|---|---|
| 5690B-3 | P | TO-3 | 1.83 | 1.83 | 1.31 | 4.5 |
| 5690B-66 | P | TO-66 | 1.83 | 1.83 | 1.31 | 4.5 |

**SERIES 5423** Space saving — clamps over the TO-3 case using virtually no additional board space.

| | | | | | | |
|---|---|---|---|---|---|---|
| 5423 | Q | TO-3 | 1.56 | 1.06 | 0.50 | 85 |
| 5425 | Q | TO-3 | 1.56 | 1.06 | 0.75 | 63 |
| 5427 | Q | TO-3 | 1.56 | 1.06 | 1.00 | |

**SERIES 3201** Low cost TO-5 heat sink provides a very high ratio of heat dissipation to volume occupied. Ideal for components card applications.

| Part Number | Figure | For Case Style | Size, Inches Dia. | H | TR °C/W |
|---|---|---|---|---|---|
| 3201B | R | TO-5 | 0.50 | 0.25 | 65 |

# AEG-TELEFUNKEN CORPORATION

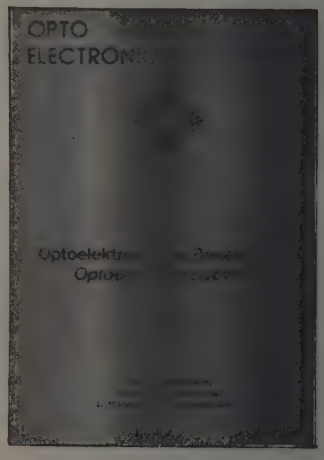
## ELECTRONIC COMPONENTS

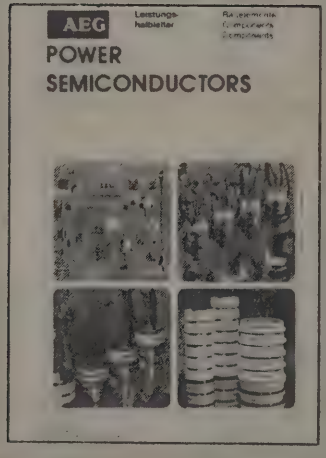
### SEMICONDUCTORS

Silicon and Germanium Transistors
RF Input Transistors
High Voltage Transistors
Darlington Power Transistors
Switching and Power Transistors
Silicon, Germanium Diodes
Switching Diodes
Avalanche Diodes
Diode Quads
Zener Diodes
Varactor Diodes
Integrated Circuits
PMOS
MOS-LSI

### OPTO-ELECTRONICS

Infra-Red Emitting Diodes
Light Emitting Diodes
LED Displays
Emitter and Detector Arrays
Photo Transistors
Photo Diodes
Photo Switches
Photo Cells
Opto-Couplers




### POWER SEMICONDUCTORS

High Voltage Diodes
Silicon Rectifiers
Triacs
Thyristors (SCR)
High Current Assemblies
Selenium Rectifiers
Selenium Plates
Selenium Assemblies

# AEG-TELEFUNKEN

**570 Sylvan Avenue, Englewood Cliffs, New Jersey 07632 (201) 568-8570 Telex 135497**
Canada: Bayly Engineering (416) 683-8200

For detailed product specifications contact AEG-TELEFUNKEN

# $CS_{dc}$ Semiconductor Modules

## FEATURING

State of the art semiconductors by —

## GENERAL ELECTRIC

Replacement types for many discontinued assemblies formerly manufactured by G.E.
High and low voltage silicon rectifier modules
(up to 60,000 volts; up to 10 Amps)
Solid state thyratron replacements
Control switch/triac modules
dc to dc low voltage to high voltage converters
Custom design and engineering services
All products 'MADE IN USA'

FOR MORE INFORMATION CONTACT:

**CONDITIONING SEMICONDUCTOR DEVICES CORP.**

Post Office Box No. 816, Wayne, New Jersey 07470 Telephone: (201) 335-6723

# for prompt service and "off-the-shelf" availability, call... DIPLOMAT

FOR OUR COMPLETE COMPREHENSIVE INVENTORY SELECTION

## SEMICONDUCTORS AND IC's
Alpha (Microwave)
AmPower
Carter Semiconductor
CDI Compensated Devices
Computer Diode
Crystalonics/Teledyne
Delco
EDI
Exar
General Instrument
General Semiconductor
ITT
Intersil
Kertron Semiconductor
Microsemiconductor Corp.
Microwave Associates
Monolithic Memories
Mostek
NAE North American Electronics
NEC Microcomputer Inc.
Optron
Semicon
Semtech
Sensitron
Signetics
Silicon General
Silicon Transistor Corp.
Solid Power Corp.
Solid State Devices
Solid State Scientific
Solitron Devices
SMC Microsystems Corp.
Syntron
Teledyne
Texas Instruments
Western Digital
Xciton

## CAPACITORS AND FILTERS
ARCO
Capar
CAL-R
Cornel Dubilier
ITT
Johanson
Mallory
NCI
San Fernando/Westcap
Sangamo

## CONNECTORS AND SOCKETS
Amphenol
Cinch
Robinson Nugent
Sullins
Texas Instruments

## CONTROLS AND SWITCHES
Alco Switch
Cherry
CTS
Hamlin
Mallory
Omron

## FANS & BLOWERS
Howard Industries

## FUSES AND HOLDERS
Bussman
Littelfuse

## HARDWARE AND CABINETS
Bud Radio
Hammond
H.H. Smith
Hollingsworth
Ungar

## METERS OF TEST EQUIPMENT
Simpson
Triplett

## OPTOELECTRONICS
Chicago Miniature
General Electric
Monsanto
Optron
Xciton

## POTENTIOMETERS AND TRIMMERS
Clarostat
CTS
Spectrol
Weston/Sangamo
VRN (IRC)

## RELAYS
Allied Controls
Deltrol
Electrol
Guardian
Hamlin
IDEC
Potter & Brumfield
Omron

## RESISTORS
American Corp.
CAL-R
Capar
Clarostat
Mallory
Memcor
RCL
Shallcross
Stackpole
Ward-Leonard

## R.F. CHOKES
J.W. Miller

## THERMISTORS AND RF FILTERS
CORCOM
Fenwal
Gulton Industries

## TRANSFORMERS AND POWERSTATS
Chicago Stancor

## TUBES
Amperex

## WIRE, CABLE, INSULATION PRODUCTS
Alpha
Belden
Cable-Tech
Cimco
Coleflex
Columbia
Dearborn
DeWire
Electronized Chemical Corp.
Harbor Industries
Hi Temp
Insultab
ITT
Manhattan
Norflex
Rainbow

**Each of the Above Listed Lines are Franchised at one or more of the Following Locations.**

DIPLOMAT

**DIPLOMAT ELECTRONICS, INC.**
Woodbury, N.Y.
(516) 921-9373

**DIPLOMAT ELECTRONICS, INC.**
Farmington, Mich.
(313) 477-3200

**DIPLOMAT ELECTRONICS, INC.**
Totowa, N.J.
(201) 785-1830

**DIPLOMAT ELECTRONICS, INC.**
Elk Grove Village, Ill.
(312) 595-1000

**DIPLOMAT ELECTRONICS, INC.**
Chicopee Falls, Mass.
(413) 592-9441

**DIPLOMAT ELECTRONICS, INC.**
Minneapolis, Minn.
(612) 788-8601

**DIPLOMAT ELECTRONICS, INC.**
Mt. Laurel, N.J.
(609) 234-8080

**DIPLOMAT ELECTRONICS, INC.**
Salt Lake City, Utah
(801) 486-4134

**DIPLOMAT ELECTRONICS, INC.**
St. Louis, Mo.
(314) 645-8550

**DIPLOMAT ELECTRONICS, INC.**
Holliston, Mass.
(617) 429-4120

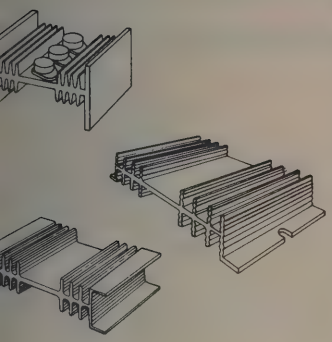
**DIPLOMAT ELECTRONICS, INC.**
Sunnyvale, Calif.
(408) 734-1900

**DIPLOMAT ELECTRONICS, INC.**
Clearwater, Fla.
(813) 443-4514

**DIPLOMAT ELECTRONICS, INC.**
Ft. Lauderdale, Fla.
(305) 771-0440

**DIPLOMAT ELECTRONICS, INC.**
Woodbury, N.Y.
(516) 921-7920

**e DELBERT BLINN COMPANY has for many years designed, fabricated and supplied specialty hardware items r the rapidly changing and expanding electronics industry. Our vast experience in plastic and metal fabrica- on guarantees you the best possible service for your particular needs regardless of quantity.**



## HEAT SINK DISSIPATORS

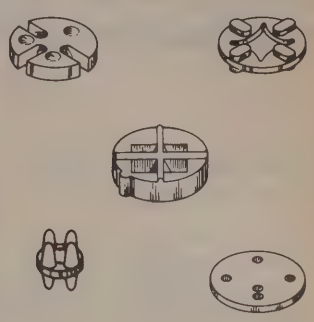
Efficiency, light weight and economy are incorporated in a complete line of professionally engineered heat sinks available in a variety of sizes and shapes. Material: Aluminum 6063-T5 alloy, mill finish. Lengths to 5 ft. available. (Serrations--U.S. Pat. No. 3163207). Can be cut, drilled, anodized or painted to your specifications.

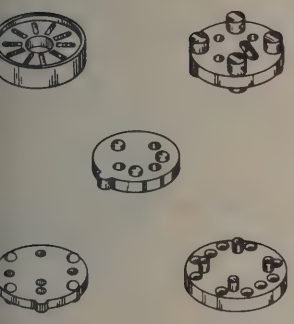
CATALOG SERIES — AHS

## NYLON TRANSISTOR PADS

Precision molded from Zytel 101 (MIL-P-20693), these pads provide an economical insulator and thermal barrier with high dielectric strength. Resist continuous exposure to 135° C.

CATALOG SERIES — TPN





## DIALLYL PHTHALATE TRANSISTOR PADS

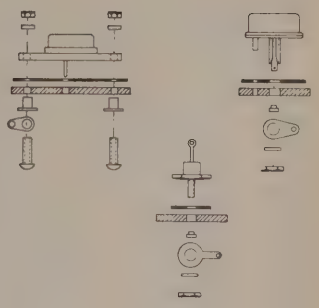
Available with and without stand-offs in configurations for all applications, these pads are molded of glass-filled Diallyl Phthalate (Mil-M-14F SDG) and provide an excellent mounting base. They resist continuous exposure to 400° F. and offer very high dielectric strength.

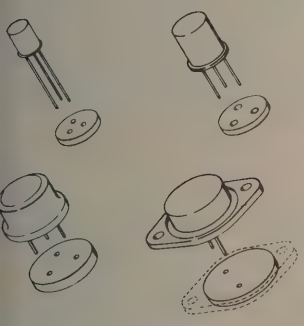
CATALOG SERIES — TPD

## MOUNTING KITS

These and other standard kits incorporating mica, beryllium oxide or anodized aluminum insulators provide the parts necessary to mount all semi-conductors. Special materials and configurations can also be furnished to your specifications.

CATALOG SERIES — MK





## BERYLLIUM OXIDE TRANSISTOR HEAT SINKS

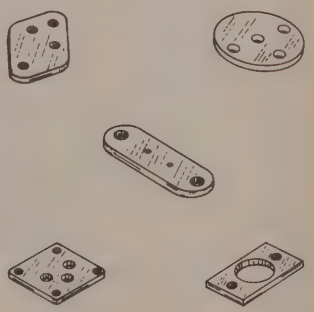
Made of high purity (99+%) sintered BeO, these sinks provide a satisfactory solution to the design engineer where electronic applications require both dielectric insulation and high heat transfer.

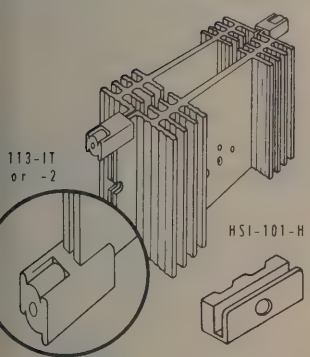
CATALOG SERIES — BOS

## MICA INSULATORS

Delbert Blinn mica insulators are precision stamped from quality controlled stock and will withstand temperatures to 1000° F. with negligible dehydration. Standard thickness is .002 ± .001. Other designs, shapes, thicknesses or tolerances are available on special order.

CATALOG SERIES — MI






## HEAT SINK MOUNTING INSULATOR

Delbert Blinn mounting insulators are precision molded of Micralon "202" and provide a practical, compact and economical method for mounting and insulating all standard heat sinks.

These insulators are capable of continuous operation to 175° C. and have a dielectric strength of 340 V/MIL.

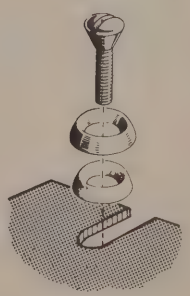
CATALOG SERIES — HSM

## NYLON CUP WASHER FILLERS

Employed as insurance against damage, these quality fillers are molded from high strength Polyamide (nylon) and guarantee chip and crack free panel installation.

Available in Nos. 6, 8, 10 and 12 screw sizes.

CATALOG SERIES — NWF



**any other heat sink, trans- or pad and specialty items t shown above are avail- le.**

**rite for additional informa- n.**

When custom designs or modifications of standard electronic hardware parts are needed, our years of experience in the molding, extruding, stamping and fabrication of metal and plastic parts enables us to supply you with parts unsurpassable in quality.

We can help you successfully meet competition in today's highly competitive market.

**IONE (714) 623-1257**
**or (213) 628-8794**

**Delbert Blinn**

***ELECTRONIC SPECIALTIES***

**P. O. BOX 2007 • POMONA, CALIFORNIA 91766**

# DELCO POWER SEMICONDUCTORS

## silicon npn high energy power transistors

**1.0 to 10 ampere** **TO-3**

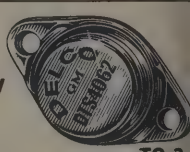
| Type | Ic Max Amps | VCEO (sus) @ Ic Volts @ mA | | VCEO @ ICEO Volts @ mA | | hFE @ Ic Amps | | VCE (sat) @ Ic Volts @ Amps | |
|---|---|---|---|---|---|---|---|---|---|
| DTS401 | 2.0 | 300 | 100 | 400 | 0.50 | 20/100 | 0.5 | 0.8 | 0.5 |
| DTS402 | 3.5 | 325 | 100 | 400 | 0.50 | — | — | 2.0 | 3.0 |
| DTS403 | 3.5 | 325 | 100 | 400 | 0.25 | — | — | 2.0 | 3.5 |
| DTS409 | 3.5 | 325 | 100 | 400 | 0.25 | 15/ | 1.0 | 1.2 | 1.0 |
| DTS410 | 3.5 | 200 | 100 | 200 | 0.25 | 30/90 | 1.0 | 0.8 | 1.0 |
| DTS411 | 3.5 | 300 | 100 | 300 | 0.25 | 30/90 | 1.0 | 0.8 | 1.0 |
| DTS413 | 2.0 | 325 | 100 | 400 | 0.25 | 20/80 | 0.5 | 0.8 | 0.5 |
| DTS423 | 3.5 | 325 | 100 | 400 | 0.25 | 30/90 | 1.0 | 0.8 | 1.0 |
| DTS424 | 3.5 | 350 | 100 | 500 | 0.25 | 30/90 | 1.0 | 0.8 | 1.0 |
| DTS425 | 3.5 | 400 | 100 | 500 | 0.25 | 30/90 | 1.0 | 0.8 | 1.0 |
| DTS430 | 5.0 | 300 | 100 | 400 | 2.50 | 15/45 | 2.5 | 0.9 | 2.5 |
| DTS431 | 5.0 | 325 | 100 | 400 | 2.50 | 15/35 | 2.5 | 0.7 | 2.5 |
| DTS515 | 10.0 | 250 | 100 | 250 | 0.5 | 15/80 | 3.0 | 1.8 | 3.0 |
| DTS516 | 10.0 | 250 | 100 | 250 | 0.5 | 20/80 | 3.0 | 1.5 | 3.0 |
| DTS517 | 10.0 | 250 | 100 | 250 | 0.5 | 20/80 | 3.0 | 1.2 | 3.0 |
| DTS518 | 10.0 | 270 | 100 | 275 | 0.5 | 25/75 | 3.0 | 1.0 | 3.0 |
| DTS519 | 10.0 | 300 | 100 | 300 | 0.5 | 25/75 | 3.0 | 1.0 | 3.0 |
| DTS520 | 10.0 | 350 | 100 | 350 | 0.5 | 20/80 | 3.0 | 1.5 | 3.0 |
| DTS520MX | 10.0 | 350 | 100 | 700[1] | 0.5 | 20/80 | 3.0 | 1.5 | 3.0 |
| DTS701 | 1.0 | 600 | 100 | 800 | 0.50 | 20/ | 0.15 | — | — |
| DTS702 | 3.0 | 750 | 500 | 1000 | 0.50 | 2.5/ | 2.0 | — | — |
| DTS704 | 3.0 | 800 | 500 | 1000 | 0.50 | 2.5/ | 2.0 | — | — |
| DTS708 | 3.0 | 600 | 500 | 900 | 0.25 | — | — | 2.0 | 1.0 |
| DTS709 | 3.0 | 600 | 500 | 900 | 0.25 | — | — | 1.0 | 2.0 |
| DTS710 | 3.0 | 600 | 500 | 900 | 0.25 | 10/50 | 0.15 | — | — |
| DTS712 | 3.0 | 700 | 500 | 900 | 0.50 | 2.5/ | 2.0 | — | — |
| DTS714 | 3.0 | 700 | 500 | 900 | 0.50 | 2.5/ | 2.0 | — | — |
| DTS720 | 3.0 | 750 | 500 | 1000 | 0.25 | 18/54 | 0.15 | — | — |
| DTS723 | 3.0 | 750 | 500 | 1000 | 0.25 | 10/ | 0.5 | 0.8 | 1.0 |
| DTS801 | 2.0 | 700 | 100 | 800 | 0.50 | 20/ | 0.2 | — | — |
| DTS802 | 5.0 | 750 | 500 | 1000 | 0.50 | 2.2/ | 3.5 | — | — |
| DTS804 | 5.0 | 800 | 500 | 1000 | 0.50 | 2.2/ | 3.5 | — | — |
| DTS812 | 5.0 | 700 | 500 | 900 | 0.50 | 2.2/ | 3.5 | — | — |
| DTS812MX | 5.0 | 700 | 500 | 900 | 0.50 | 6/24 | 1.0 | 1.0 | 1.0 |
| DTS814 | 5.0 | 700 | 500 | 900 | 0.50 | 2.2/ | 3.5 | — | — |
| 2N3902 | 3.5 | 325 | 100 | 400 | 0.25 | 30/90 | 1.0 | 0.8 | 1.0 |
| JAN2N3902* | 3.5 | 325 | 100 | 400 | 0.25 | 30/90 | 1.0 | 0.8 | 1.0 |
| 2N5157 | 3.5 | 400 | 100 | 500 | 0.25 | 30/90 | 1.0 | 0.8 | 1.0 |
| JAN2N5157* | 3.5 | 400 | 100 | 500 | 0.25 | 30/90 | 1.0 | 0.8 | 1.0 |
| 2N5241 | 5.0 | 325 | 100 | 400 | 2.50 | 15/35 | 2.5 | 0.7 | 2.5 |
| JAN2N5241* | 5.0 | 325 | 100 | 400 | 0.5 | 15/35 | 2.5 | 0.7 | 2.5 |
| 2N6573 | 10.0 | 250 | 100 | — | — | 15/60 | 3.0 | 1.2 | 3.0 |
| 2N6574 | 10.0 | 275 | 100 | — | — | 20/60 | 3.0 | 1.0 | 3.0 |
| 2N6575 | 10.0 | 300 | 100 | — | — | 20/60 | 3.0 | 1.0 | 3.0 |

*JANTX versions also available [1] ICBO @ 25°C

## silicon npn high energy power transistors

**10 ampere** **TO-36**

| Type | Ic Max Amps | VCEO (sus) @ Ic Volts @ mA | | VCBO @ ICBO Volts @ mA | | hFE @ Ic Amps | | VCE (sat) @ Ic Volts @ Amps | |
|---|---|---|---|---|---|---|---|---|---|
| 2N2580 | 10.0 | 325 | 100 | 400 | 5.0 | 10/40<br>4 min. | 5.0<br>10.0 | 0.7 | 5.0 |
| 2N2581 | 10.0 | 325 | 100 | 400 | 5.0 | 25/65<br>10 min. | 5.0<br>10.0 | 1.0 | 10.0 |
| 2N2582 | 10.0 | 325 | 100 | 500 | 5.0 | 10/40<br>4 min. | 5.0<br>10.0 | 0.7 | 5.0 |
| 2N2583 | 10.0 | 325 | 100 | 500 | 5.0 | 25/65<br>10 min. | 5.0<br>10.0 | 1.0 | 10.0 |
| 2N3079 | 10.0 | 200 | 100 | 200 | 5.0 | 10/50 | 5.0 | 0.7 | 5.0 |
| 2N3080 | 10.0 | 300 | 100 | 300 | 5.0 | 10/50 | 5.0 | 0.7 | 5.0 |




## silicon npn high energy darlingtons

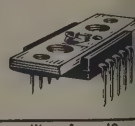
**10 to 15 ampere** **TO-3**

| Type | Ic Cont. Amps | VCEO (sus) @ Ic Volts @ mA | | VCEO @ ICEO Volts @ mA | | hFE @ Ic Amps | | VCE (sat) @ Ic Volts @ Amps | |
|---|---|---|---|---|---|---|---|---|---|
| DTS4062 | 20.0 | 350 | 1000 | 600 | 0.25 | 75/ | 10.0 | 2.0 | 20.0 |
| DTS4066 | 20.0 | 350 | 1000 | 600 | 0.25 | 75/ | 10.0 | 3.5 | 20.0 |
| DTS4067 | 20.0 | 350 | 1000 | 600 | 0.25 | 150/ | 10.0 | 2.0 | 20.0 |
| DTS4072 | 20.0 | 350 | 1000 | 600 | 0.25 | 75/ | 10.0 | 3.5 | 20.0 |
| DTS4074 | 20.0 | 350 | 1000 | 600 | 0.25 | 75/ | 10.0 | 3.5 | 20.0 |
| DTS4075 | 20.0 | 350 | 1000 | 600 | 0.25 | 150/ | 10.0 | 2.0 | 20.0 |

## silicon rectifiers

**button diodes**

| Type | Maximum Forward Current IF(AV) | Peak Reverse Voltage | Reverse Current IRM(Max.) @ TJ = 25°C | Forward Voltage Drop @ IFM = 100A TJ = 175°C VFM(Max.) |
|---|---|---|---|---|
| DBD101 | 2A-22A Δ | 100V | 100μA | 1.25V |
| DBD102 | 2A-22A Δ | 200V | 100μA | 1.25V |
| DBD104 | 2A-22A Δ | 400V | 100μA | 1.25V |



## monolithic amplifier module

| Type | VCC Max | Ic Max | I idle [1] | Input bias I[1] | A VOL | W OUT [2] | JC |
|---|---|---|---|---|---|---|---|
| DA101 | 16V | 3.0A | 40mA | .80μA | 90dB | 6W | 4°C/W |

## monolithic voltage regulator

| Type | Vin Max Volts | Vin Typical Volts | Vo Typical Volts | ΔVo With Load Variation mA | | ΔVo With Load Variation mA | | Ic Max A | Iq Quiescent mA | Z Output Imp. mΩ |
|---|---|---|---|---|---|---|---|---|---|---|
| DVR-8 | 25 | 10.5-16 | 8.0 | 50 | 50-100 | 50 | 10.5-16 | 0.2 | 10 | 80 |

Δ Depends on mounting. See data sheet [1] Typical [2] Bridge VCC = 14V

# AND WHERE TO GET THEM.

## NOW AVAILABLE FROM THESE DISTRIBUTORS IN PRODUCTION QUANTITIES.

### LABAMA

UNTSVILLE
owell Electronics
205) 539-2731

### RIZONA

HOENIX
terling Electronics, Inc.
602) 258-4531

### ALIFORNIA

ARDENA
ell Industries
lectronics Distributors Div.
213) 321-5802
OLETA
.P.S. Electronics, Inc.
805) 964-6823
OS ANGELES
ierulff Electronics, Inc.
213) 725-0325
.P.S. Electronics, Inc.
213) 748-1271
ALO ALTO
ierulff Electronics, Inc.
315) 968-6292
AN DIEGO
ierulff Electronics, Inc.
714) 278-2112
.P.S. Electronics, Inc.
714) 292-5611
UNNYVALE
ell Industries
408) 734-8570

### COLORADO

DENVER
Kierulff Electronics, Inc.
(303) 371-6500

### CONNECTICUT

NORWALK
Harvey Electronics
(203) 853-1515

### FLORIDA

CLEARWATER
Diplomat/Southland
(813) 443-4514
MIAMI SPRINGS
Powell Electronics/Florida
(305) 592-3260

### ILLINOIS

CHICAGO
Bell Industries
Electronics Distributors Div.
(312) 982-9210
ELK GROVE VILLAGE
Kierulff Electronics, Inc.
(312) 640-0200

### INDIANA

INDIANAPOLIS
Graham Electronics Supply, Inc.
(317) 634-8202

### MARYLAND

BALTIMORE
RESCO/Baltimore
(301) 823-0070

### MASSACHUSETTS

BILLERICA
Kierulff Electronics, Inc.
(617) 935-5134
(617) 667-8331
NEWTON
The Greene-Shaw Co., Inc.
(617) 969-8900

### MICHIGAN

LIVONIA
Pioneer/Michigan
(313) 525-1800

### MINNESOTA

MINNEAPOLIS
Stark Electronics Supply Co.
(612) 332-1325

### MISSOURI

KANSAS CITY
Walters Radio Supply, Inc.
(816) 531-7015
ST. LOUIS
LCOMP-St. Louis
(314) 291-6200

### NEW JERSEY

CINNAMINSON
Wilshire Electronics/Philadelphia
(609) 786-8990
(215) 627-1920
CLIFTON
Wilshire Electronics/New Jersey
(201) 340-1900
(212) 244-8930

### NEW MEXICO

ALBUQUERQUE
Sterling Electronics
(505) 345-6601

### NEW YORK

BINGHAMTON
Harvey Electronics
(607) 748-8211
BUFFALO
Summit Distributors, Inc.
(716) 884-3450
FARMINGDALE
Wilshire Electronics/Long Island
(516) 293-5775
FREEPORT
Milgray/New York
(516) 546-6000
WOODBURY
Harvey Electronics
(516) 921-8700
(212) 895-9260

### OHIO

CINCINNATI
United Radio, Inc.
(513) 761-4030
CLEVELAND
Pattison Supply Co.
Industrial Electronics Div.
(216) 441-3000
DAYTON
Pioneer/Dayton
(513) 236-9900

### PENNSYLVANIA

PHILADELPHIA
Almo Electronics
(215) 698-4000
PITTSBURGH
CAM/RPC Electronics
(412) 782-3770

### SOUTH CAROLINA

COLUMBIA
Dixie Radio Electronics Co., Inc.
(803) 779-5333

### TEXAS

DALLAS
Sterling Electronics
(214) 357-9131
HOUSTON
Harrison Equipment Co., Inc.
(713) 652-4700
Sterling Electronics
(713) 627-9800

### WASHINGTON

SEATTLE
Kierulff Electronics, Inc.
(206) 575-4420

### IN CANADA:

Zentronics Ltd.
Toronto (416) 635-2822
Ottawa (613) 238-6411
Montreal (514) 735-5361

### OVERSEAS: EUROPEAN INQUIRIES:

European Parts & Accessories Marketing Group
General Motors Continental
Plant 2, Noorderlaan, Postbus 9
B-2030, Antwerp, Belgium

### ALL OTHER OVERSEAS INQUIRIES:

General Motors Overseas Operations
Parts & Accessories Dept.
767 Fifth Avenue
New York, NY 10022
(212) 486-4412

### DELCO ELECTRONICS REGIONAL SALES OFFICES

Hawthorne, CA 90250
P.O. Box 426
(213) 675-4401

Kokomo, IN 46901
700 E. Firmin St.
(371) 459-1277

Delco Electronics

Delco Electronics Division
General Motors Corporation

# INTERNATIONAL RECTIFIER IOR

Semiconductor Division • 233 Kansas St., El Segundo, California 90245 • Telex 66-4464 • Phone: (213) 322-3331

## SILICON CONTROLLED RECTIFIERS — 4 to 470 Amps (RMS)

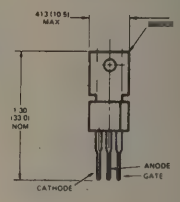
| $I_{T(RMS)}$ (A) | 4.0 | 8.0 | 25 | 25 | 35 | 35 | 35 | 80 | 110 | 110 | 110 | 235 | 470 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $I_{T(AV)}$ (A) @ Max. $T_C$ = (°C) | 2.55 @ 30° | 5.1 @ 85° | 16 @ 95° | 16 @ 95° | 22 @ 85° | 22 @ 85° | 22.3 @ 35° | 50 @ 87° | 70 @ 62° | 70 @ 62° | 70 @ 80° | 150 @ 85° | 300 @ 75° |
| $I_{TSM}$ (A) | 25 | 80 | 250 | 250 | 350 | 350 | 300 | 1,200 | 1,000 | 1,200 | 1,600 | 4,250 | 8,000 |
| Max. $I_{GT}$ @ 25°C (mA) | 0.2 | 25 | 25 | 25 | 40 | 40 | 40 | 110 | 70 | 70 | 150 | 150 | 150 |
| dv/dt (V/μs) | 8 typ. | 50 min. | 20 typ. | 20 | 50 min. | 50 min. | 10 min. | 25 min. | 20 | 20 | 200 min. | 200 min. | 100 min. |
| Case Style | A-2 (1) | TO-220AB | TO-203AA | A-8A | A17 | TO-48 | TO-48 | TO-65 | TO-94 | A-14 | TO-94 | TO-93 | TO-118 |
| **PRV** | | | | | | | | | | | | | |
| 15 Volts | IR106Q1 | — | — | — | — | — | — | — | — | — | — | — | — |
| 25 Volts | — | — | IR32U | IR30U | — | — | — | — | — | — | — | — | — |
| 30 Volts | IR106U1 | — | — | — | — | — | — | — | — | — | — | — | — |
| 50 Volts | IR105F1 | IR122F1 | IR32F | IR30F | 20RA5 | 22RA5 | — | — | — | — | — | — | — |
| 100 Volts | IR106A1 | IR122A1 | IR32A | IR30A | 20RA10 | 22RA10 | 16RC10A | 50RCS10 | — | — | — | — | — |
| 200 Volts | IR106B1 | IR122B1 | IR32B | IR30F | 20RA20 | 22RA20 | 16RC20A | — | — | — | — | 151RA20 | — |
| 300 Volts | IR106C1 | IR122C1 | IR32C | IR30C | 20RA30 | 22RA30 | 16RC30A | — | 71RC30AS60 | 72RC30AS60 | 71RA30 | 151RA30 | 300RA30 |
| 400 Volts | IR106D1 | IR122D1 | IR32D | IR30D | 20RA40 | 22RA40 | 16RC40A | 50RCS40 | — | — | — | 151RA40 | — |
| 500 Volts | IR106E1 | IR122E1 | IR32E | IR30E | 20RA50 | 22RA50 | — | — | — | — | — | — | — |
| 600 Volts | — | IR122M1 | IR32M | IR30M | 20RA60 | 22RA60 | 16RC60A | 50RCS60 | 71RC60AS50 | 72RC60AS50 | 71RA60 | 151RA60 | 300RA60 |
| 700 Volts | — | — | — | — | — | — | — | — | 71RC80AS50 | 72RC80AS50 | — | — | — |
| 800 Volts | — | — | — | — | 20RA80 | 22RA80 | 16RC80A | — | — | — | — | — | — |
| 900 Volts | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 1000 Volts | — | — | — | — | — | — | 16RC100A | 50RCS100 | — | — | 71RA100 | 151RA100 | — |
| 1200 Volts | — | — | — | — | — | — | 16RC120A | 50RCS120 | — | — | 71RA120 | 151RA120 | 300RA120 |
| 1600 Volts | — | — | — | — | — | — | — | — | — | — | 71RA160 | — | 300RA160 |

(1) Available in 8 case styles. See data sheet PD-3.001.

## SILICON RECTIFIERS — 1 to 300 Amps (AV)

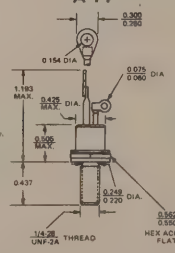
| $I_{F(AV)}$ (A) @ Max. $T_C$ (°C) | 1 @ 75° | 1 @ 75° | 1.5 @ 40° | 2 @ 100° | 3 @ 125° | 6 @ 95° | 16 | 40 @ 140° | 70 @ 125° | 150 @ 150° | 300 @ 120° |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $I_{FSM}$ — (A) Surge | 30 | 50 | 50 | 50 | 150 | 400 | 300 | 500 | 1,200 | 3,000 | 5,000 |
| Case Style | DO-41 | DO-39 | DO-39 | DO-39 | C-12 | C-15 | DO-4 | DO-5 | DO-5 | DO-8 | DO-9 |
| **PRV** | | | | | | | | | | | |
| 50 Volts | 1N4001 | — | 1N4816 | 20D05 | 30S05 | 60S05 | — | 40HF5 | — | — | — |
| 100 Volts | 1N4002 | 10D1 | 1N4817 | 20D1 | 30S1 | 60S1 | 16F10 | 40HF10 | 70H10A | — | 300U10A |
| 200 Volts | 1N4003 | 10D2 | 1N4818 | 20D2 | 30S2 | 60S2 | 16F20 | 40HF20 | 70H20A | 150K20A | 300U20A |
| 300 Volts | — | 10D3 | 1N4819 | 20D3 | 30S3 | 60S3 | 16F30 | 40HF30 | 70H30A | 150K30A | 300U30A |
| 400 Volts | 1N4004 | 10D4 | 1N4820 | 20D4 | 30S4 | 60S4 | 16F40 | 40HF40 | 70H40A | 150K40A | 300U40A |
| 500 Volts | — | 10D5 | 1N4821 | 20D5 | 30S5 | 60S5 | — | 40HF50 | — | — | — |
| 600 Volts | 1N4005 | 10D6 | 1N4822 | 20D6 | 30S6 | 60S6 | 16F60 | 40HF60 | 70H60A | 150K60A | 300U60A |
| 700 Volts | — | — | — | — | — | — | — | — | 70H70A | — | — |
| 800 Volts | 1N4006 | 10D8 | 1N5053 | 20D8 | 30S8 | 60S8 | — | 40HF80 | 70H80A | 150K80A | 300U80A |
| 900 Volts | — | — | — | — | — | — | — | 40HF90 | 70H90A | — | — |
| 1000 Volts | 1N4007 | 10D10 | 1N5054 | 20D10 | 30S10 | 60S10 | 16F100 | 40HF100 | 70H100A | 150K100A | 300U100A |
| 1200 Volts | — | — | — | — | — | — | — | — | 70H120A | 150K120A | 300U120A |

A-2(1)

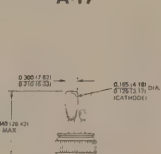



A-8A

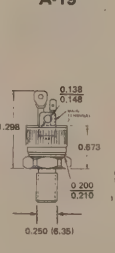
A-14



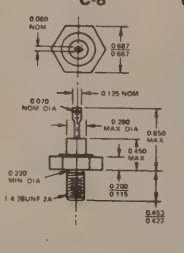

A-17



A-19

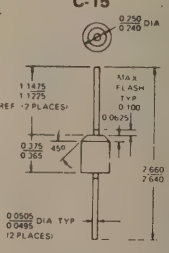



C-8

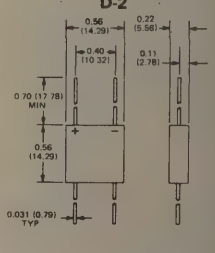



C-12

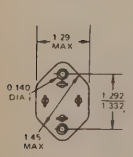
C-15



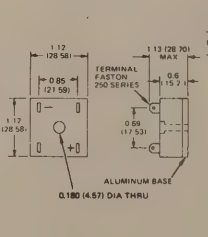

D-2



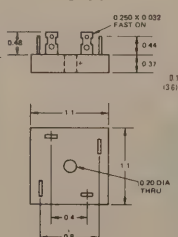

D-14



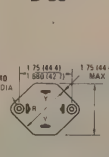

D-17A



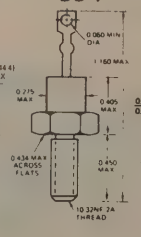

D-31



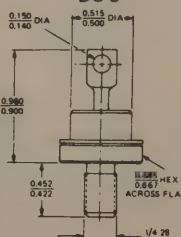

D-35



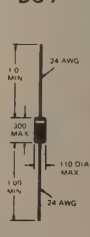

DO-4



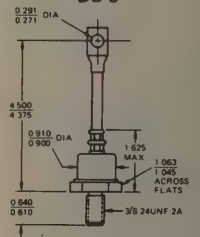

DO-5




DO-7




DO-8

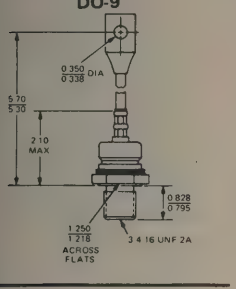


## ZENER VOLTAGE REGULATORS

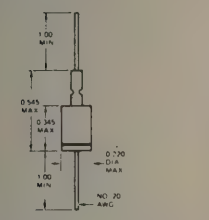
| Power Rating | 400mW 50°C $T_A$ | | 400mW 25°C $T_A$ | | 500mW 75°C $T_A$ | | 1W 25°C $T_A$ | | 1W 50°C $T_A$ | | 5W 50°C $T_L$ | | 10W 75°C $T_C$ | | 50W 75°C $T_C$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Case Style | DO-7 ① | | DO-7 ② | | DO-7 ② | | DO-13 ② | | DO-41 ① | | C-12 ② | | DO-4 ②③ | | C-8 ②③ | |
| $V_Z$ ④ | Part No. | $I_{ZT}$ (mA) | Part No. | $I_{ZT}$ (mA) | Part No. | $I_{ZT}$ (mA) | Part No. | $I_{ZT}$ (mA) | Part No. | $I_{ZT}$ (mA) | Part No. | $I_{ZT}$ (mA) | Part No. | $I_{ZT}$ (mA) | Part No. | $I_{ZT}$ (mA) |
| 3.3 | 1N746A | 20 | – | – | 1N5226B | 20 | – | – | | | | | | | | |
| 3.6 | 1N747A | 20 | – | – | 1N5227B | 20 | – | – | | | | | | | | |
| 3.9 | 1N748A | 20 | – | – | 1N5228B | 20 | – | – | | | | | | | | |
| 4.3 | 1N749A | 20 | – | – | 1N5229B | 20 | – | – | | | | | | | | |
| 4.7 | 1N750A | 20 | – | – | 1N5230B | 20 | – | – | 1N4732A | 53 | 1N5337B | 260 | – | – | 1N4551B | 2650 |
| 5.1 | 1N751A | 20 | – | – | 1N5231B | 20 | – | – | 1N4733A | 49 | 1N5338B | 240 | – | – | 1N4552B | 2450 |
| 5.6 | 1N752A | 20 | – | – | 1N5232B | 20 | – | – | 1N4734A | 45 | 1N5339B | 220 | – | – | 1N4553B | 2250 |
| (6.0) | – | – | – | – | 1N5233B | 20 | – | – | – | – | 1N5340B | 200 | – | – | – | – |
| 6.2 | 1N753A | 20 | – | – | 1N5234B | 20 | – | – | 1N4735A | 41 | 1N5341B | 200 | – | – | 1N4554B | 2000 |
| 6.8 ⑤ | 1N754A | 20 | 1N957B | 18.5 | 1N5235B | 20 | 1N3016B | 37 | 1N4736A | 37 | 1N5342B | 175 | 1N2970B | 370 | 1N3305B | 1850 |
| 6.8 | – | – | – | – | – | – | – | – | – | – | – | – | – | – | 1N4555B | 1850 |
| 7.5 ⑥ | 1N755A | 20 | 1N958B | 16.5 | 1N5236B | 20 | 1N3017B | 34 | 1N4737A | 34 | 1N5343B | 175 | 1N2971B | 335 | 1N3306B | 1700 |
| 7.5 | – | – | – | – | – | – | – | – | – | – | – | – | – | – | 1N4556B | 1650 |
| 8.2 | 1N756A | 20 | 1N959B | 15.0 | 1N5237B | 20 | 1N3018B | 31 | 1N4738A | 31 | 1N5344B | 150 | 1N2972B | 305 | 1N3307B | 1500 |
| (8.7) | – | – | – | – | 1N5238B | 20 | – | – | – | – | 1N5345B | 150 | – | – | – | – |
| 9.1 | 1N757A | 20 | 1N960B | 14.0 | 1N5239B | 20 | 1N3019B | 28 | 1N4739A | 28 | 1N5346B | 150 | 1N2973B | 275 | 1N3308B | 1370 |
| 10 | 1N758A | 20 | 1N961B | 12.5 | 1N5240B | 20 | 1N3020B | 25 | 1N4740A | 25 | 1N5347B | 125 | 1N2974B | 250 | 1N3309B | 1200 |
| 11 | – | – | 1N962B | 11.5 | 1N5241B | 20 | 1N3021B | 23 | 1N4741A | 23 | 1N5348B | 125 | 1N2975B | 230 | 1N3310B | 1100 |
| 12 | 1N759A | 20 | 1N963B | 10.5 | 1N5242B | 20 | 1N3022B | 21 | 1N4742A | 21 | 1N5349B | 100 | 1N2976B | 210 | 1N3311B | 1000 |
| 13 | – | – | 1N964B | 9.5 | 1N5243B | 9.5 | 1N3023B | 19 | 1N4743A | 19 | 1N5350B | 100 | 1N2977B | 190 | 1N3312B | 960 |
| (14) | – | – | – | – | 1N5244B | 9.0 | – | – | – | – | 1N5351B | 100 | 1N2978B | 180 | 1N3313B | 890 |
| 15 | – | – | 1N965B | 8.5 | 1N5245B | 8.5 | 1N3024B | 17 | 1N4744A | 17 | 1N5352B | 75 | 1N2979B | 170 | 1N3314B | 830 |
| 16 | – | – | 1N966B | 7.8 | 1N5246B | 7.8 | 1N3025B | 15.5 | 1N4745A | 15.5 | 1N5353B | 75 | 1N2980B | 155 | 1N3315B | 780 |
| (17) | – | – | – | – | 1N5247B | 7.4 | – | – | – | – | 1N5354B | 70 | 1N2981B | 145 | 1N3316B | 740 |
| 18 | – | – | 1N967B | 7.0 | 1N5248B | 7.0 | 1N3026B | 14.0 | 1N4746A | 14.0 | 1N5355B | 65 | 1N2982B | 140 | 1N3317B | 700 |
| (19) | – | – | – | – | 1N5249B | 6.6 | – | – | – | – | 1N5356B | 65 | 1N2983B | 130 | 1N3318B | 660 |
| 20 | – | – | 1N968B | 6.2 | 1N5250B | 6.2 | 1N3027B | 12.5 | 1N4747A | 12.5 | 1N5357B | 65 | 1N2984B | 125 | 1N3319B | 630 |
| 22 | – | – | 1N969B | 5.6 | 1N5251B | 5.6 | 1N3028B | 11.5 | 1N4748A | 11.5 | 1N5358B | 50 | 1N2985B | 115 | 1N3320B | 570 |
| 24 | – | – | 1N970B | 5.2 | 1N5252B | 5.2 | 1N3029B | 10.5 | 1N4749A | 10.5 | 1N5359B | 50 | 1N2986B | 105 | 1N3321B | 520 |
| (25) | – | – | – | – | 1N5253B | 5.0 | – | – | – | – | 1N5360B | 50 | 1N2987B | 100 | 1N3322B | 500 |
| 27 | – | – | 1N971B | 4.6 | 1N5254B | 4.6 | 1N3030B | 9.5 | 1N4750A | 9.5 | 1N5361B | 50 | 1N2988B | 95 | 1N3323B | 460 |
| (28) | – | – | – | – | 1N5255B | 4.5 | – | – | – | – | 1N5362B | 50 | – | – | – | – |
| 30 | – | – | 1N972B | 4.2 | 1N5256B | 4.2 | 1N3031B | 8.5 | 1N4751A | 8.5 | 1N5363B | 40 | 1N2989B | 85 | 1N3324B | 420 |
| 33 | – | – | 1N973B | 3.8 | 1N5257B | 3.8 | 1N3032B | 7.5 | 1N4752A | 7.5 | 1N5364B | 40 | 1N2990B | 85 | 1N3325B | 380 |
| 36 | – | – | 1N974B | 3.4 | 1N5258B | 3.4 | 1N3033B | 7.0 | 1N4753A | 7.0 | 1N5365B | 30 | 1N2991B | 70 | 1N3326B | 350 |
| 39 | – | – | 1N975B | 3.2 | 1N5259B | 3.2 | 1N3034B | 6.5 | 1N4754A | 6.5 | 1N5366B | 30 | 1N2992B | 65 | 1N3327B | 320 |
| 43 | – | – | 1N976B | 3.0 | 1N5260B | 3.0 | 1N3035B | 6.0 | 1N4755A | 6.0 | 1N5367B | 30 | 1N2993B | 60 | 1N3328B | 290 |
| 47 | – | – | 1N977B | 2.7 | 1N5261B | 2.7 | 1N3036B | 5.5 | 1N4756A | 5.5 | 1N5368B | 25 | 1N2995B | 55 | 1N3330B | 270 |
| 51 | – | – | 1N978B | 2.5 | 1N5262B | 2.5 | 1N3037B | 5.0 | 1N4757A | 5.0 | 1N5369B | 25 | 1N2997B | 50 | 1N3332B | 245 |
| 56 | – | – | 1N979B | 2.2 | 1N5263B | 2.2 | 1N3038B | 4.5 | 1N4758A | 4.5 | 1N5370B | 20 | 1N2999B | 45 | 1N3334B | 220 |
| 62 | – | – | 1N980B | 2.0 | 1N5265B | 2.0 | 1N3039B | 4.0 | 1N4759A | 4.0 | 1N5372B | 20 | 1N3000B | 40 | 1N3335B | 200 |
| 68 | – | – | 1N981B | 1.8 | 1N5266B | 1.8 | 1N3040B | 3.7 | 1N4760A | 3.7 | 1N5373B | 20 | 1N3001B | 37 | 1N3336B | 180 |
| 75 | – | – | – | – | – | – | 1N3041B | 3.3 | 1N4761A | 3.3 | 1N5374B | 20 | 1N3002B | 33 | 1N3337B | 170 |
| 82 | – | – | – | – | – | – | 1N3042B | 3.0 | 1N4762A | 3.0 | 1N5375B | 15 | 1N3003B | 30 | 1N3338B | 150 |
| (87) | – | – | – | – | – | – | – | – | – | – | 1N5376B | 15 | – | – | – | – |
| 91 | – | – | – | – | – | – | 1N3043B | 2.8 | 1N4763A | 2.8 | 1N5377B | 15 | 1N3004B | 28 | 1N3339B | 140 |

① Basic = 10%, "A" = 5% ② Basic = 20%, "A" = 10%, "B" = 5% ③ "R" = Cathode to stud. ④ Contact factory for other available voltages. ⑤ Also available, 50W 1N4555. ⑥ Also available, 50W 1N4456.

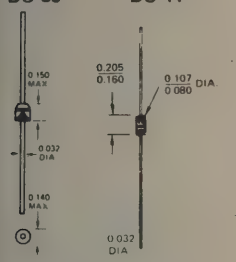
### DO-9




### DO-13




### DO-39 DO-41




## TEMPERATURE COMPENSATED VOLTAGE REFERENCES

| Power Rating (mW) | $V_Z$ – Zener Voltage (V) | $I_{ZT}$ – Test Current (mA) | $Z_Z$ Zener Impedance (Ω) @ $I_{ZT}$ | Case Style | Temp Coefficient (%/°C) | IR Part No. |
|---|---|---|---|---|---|---|
| 400 | 5.9-6.5 | 7.5 | – | DO-7 | – | – |
| | | | 10 | | 0.01 | 1N821A |
| | | | – | | – | – |
| | | | 10 | | 0.05 | 1N823A |
| | | | – | | – | – |
| 400 | 5.9-6.5 | 7.5 | 10 | DO-7 | 0.002 | 1N825A |
| | | | – | | – | – |
| | | | 10 | | 0.001 | 1N827A |
| | | | – | | – | – |
| | | | 10 | | 0.0005 | 1N829A |
| 500 | 8.55-9.45 | 7.5 | 20 | DO-7 | 0.01 | 1N935B |
| | | | | | 0.005 | 1N936B |
| | | | | | 0.002 | 1N937B |
| | | | | | 0.001 | 1N938B |
| | | | | | 0.0005 | 1N939B |

① Based on average current.

## SINGLE PHASE BRIDGES

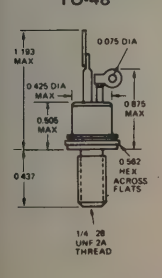
| DC Output Current (A) | 1.8 | 2.2 | 6 | 7.5 | 10 | 15 | 25 | 25 | 35 | 40 | 50 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| @ °C | $T_A$ 50°C | $T_A$ 50°C | $T_C$ 50°C | $T_C$ 75°C | $T_C$ 75°C | $T_C$ 75°C | $T_C$ 75°C | $T_C$ 75°C | $T_C$ 75°C | $T_C$ 50°C | $T_C$ 50°C |
| $I_{FSM}$ (A) | 50 | 50 | 150 | 75 | 100 | 150 | 300 | 300 | 350 | 500 | 600 |
| Case Style | D-2 | D-2 | D-14 | D-31 | D-31 | D-31 | D-31 | D-35 | D-31 | D-17A | D-17A |
| $V_{RRM}$ (V) | | | | † | † | † | † | | † | | |
| 50 | – | – | – | 75JB05L | 100JB05L | – | 250JB05L | – | – | – | – |
| 100 | – | – | – | 75JB1L | 100JB1L | – | 250JB1L | – | – | 400JB1L | 500JB1L |
| 200 | 18DB2A | 22DB2A | 60FB2L | 75JB2L | 100JB2L | 150JB2L | 250JB2L | – | 300JB2L | 400JB2L | 500JB2L |
| 300 | 18DB3A | – | – | 75JB3L | 100JB3L | – | 250JB3L | – | – | – | – |
| 400 | 18DB4A | 22DB4A | 60FB4L | 75JB4L | 100JB4L | 150JB4L | 250JB4L | 250MDA4R | 300JB4L | 400JB4L | 500JB4L |
| 500 | 18DB5A | – | – | 75JB5L | – | – | – | – | – | – | – |
| 600 | 18DB6A | 22DB6A | 60FB6L | 75JB6L | 100JB6L | 150JB6L | 250JB6L | – | 300JB6L | 400JB6L | 500JB6L |
| 700 | 18DB7A | – | – | – | – | – | – | – | – | – | – |
| 800 | 18DB8A | – | – | – | – | – | – | – | – | – | – |
| 1000 | 18DB10A | 22DB10A | – | – | – | – | – | – | – | – | – |

†U.L. Recognized

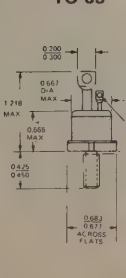
## KLIP-SELS — Transient Voltage Suppressors

| Device Voltage Rating (V) | Transient Voltage Rating (V) | Max. Rated RMS Operating Voltage (V) | For Individual Rectifier ① Rated Thru 3 Amp | For Individual Rectifier ① Rated Thru 16 Amp | For Individual Rectifier ① Rated Thru 60 Amp | For Individual Rectifier ① Rated Thru 250 Amp |
|---|---|---|---|---|---|---|
| 100 | 150 | 60 | KV2DTM | KZ2DTM | – | – |
| 100 | 150 | 52 | KV2DTF | KZ2DTF | KSA2DAF | KSL2DAF |
| 150 | 250 | 90 | KV3DTM | – | – | – |
| 150 | 250 | 78 | KV3DTF | KZ3DTF | KSA3DAF | – |
| 300 | 360 | 120 | KV4DTM | KZ4DTM | – | – |
| 300 | 360 | 150 | KV5DTM | KZ5DTM | – | – |
| 300 | 360 | 130 | KV5DTF | KZ5DTF | KSA5DAF | KSL5DAF |
| 500 | 650 | 234 | KV9DTF | KZ9DTF | KSA9DBF | KSL9DBF |
| 600 | 650 | 240 | KV8DTM | KZ8DTM | – | – |
| 600 | 800 | 260 | KV10DTF | KZ10DTF | KSA10DBF | KSL10DBF |
| 800 | 1000 | 364 | KV14DTF | KZ14DTF | – | – |
| 1000 | 1200 | 442 | KV17DTF | KZ17DTF | – | – |
| 1200 | 1600 | 520 | – | – | – | – |
| 1200 | 1600 | 520 | KV20DTF | KZ20DTF | KSA20DBF | KSL20DBF |

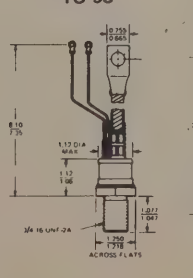
### TO-48



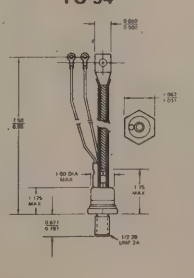

### TO-65



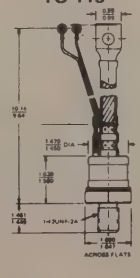

### TO-93



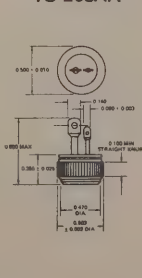

### TO-94



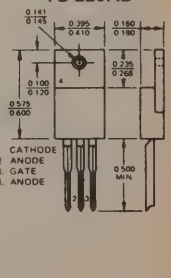

### TO-118




### TO-203AA



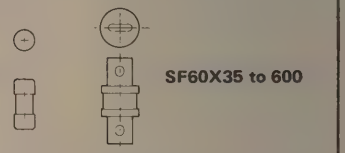

### TO-220AB



# INTERNATIONAL RECTIFIER IOR

## SEMICONDUCTOR PROTECTIVE FUSES

| Max. RMS Voltage | 130 | 250 | 500 | 600 | 700 | Max. RMS Voltage | 130 | 250 | 500 | 600 | 700 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Max DC Voltage | 130 | 210 | 450 | 550 | 700 | Max DC Voltage | 130 | 210 | 450 | 550 | 700 |
| Max. Arc Voltage | 220 | 410 | 850 | 1,050 | 1,200 | Max. Arc Voltage | 220 | 410 | 850 | 1,050 | 1,200 |
| RMS Current (A) | | | | | | RMS Current (A) | | | | | |
| 5 | SF13X5 | SF25X5 | – | SF60C5 | – | 125 | SF13X125 | SF25X125 | SF50P125 | SF60C125 | SF70P125 |
| 10 | SF13X10 | SF25X10 | – | SF60C10 | SF70P10 | 150 | SF13X150 | SF25X150 | SF50P150 | SF60C150 | SF70P150 |
| 15 | SF13X15 | SF25X15 | – | SF60C15 | SF70P15 | 175 | – | SF25X175 | SF50P175 | SF60C175 | SF70P175 |
| 20 | SF13X20 | SF25X20 | – | SF60C20 | SF70P20 | 200 | SF13X200 | SF25X200 | SF50P200 | SF60C200 | SF70P200 |
| 25 | SF13X25 | SF25X25 | – | SF60C25 | SF70P25 | 225 | – | SF25X225 | – | SF60C225 | – |
| 30 | SF13X30 | SF25X30 | – | SF60C30 | SF70P30 | 250 | SF13X250 | SF25X250 | SF50P250 | SF60C250 | SF70P250 |
| 35 | SF13X35 | – | SF50P35 | SF60C35 | SF70P35 | 300 | SF13X300 | SF25X300 | SF50P300 | SF60C300 | SF70P300 |
| 40 | SF13X40 | SF25X40 | SF50P40 | SF60C40 | SF70P40 | 350 | SF13X350 | SF25X350 | SF50P350 | SF60C350 | – |
| 45 | – | – | SF50P45 | SF60C45 | – | 400 | SF13X400 | SF25X400 | SF50P400 | SF60C400 | SF70P400 |
| 50 | SF13X50 | SF25X50 | SF50P50 | SF60C50 | SF70P50 | 450 | – | SF25X450 | SF50P450 | SF60C450 | – |
| 60 | SF13X60 | SF25X60 | SF50P60 | SF60C60 | SF70P60 | 500 | SF13X500 | SF25X500 | SF50P500 | SF60C500 | SF70P500 |
| 70 | SF13X70 | SF25X70 | SF50P70 | SF60C70 | SF70P70 | 550 | – | – | SF50P550 | – | – |
| 80 | SF13X80 | SF25X80 | SF50P80 | SF60C80 | SF70P80 | 600 | SF13X600 | SF25X600 | SF50P600 | SF60C600 | SF70P600 |
| 90 | – | – | SF50P90 | SF60C90 | SF70P90 | 700 | – | – | SF50P700 | SF60C700 | – |
| 100 | SF13X100 | SF25X100 | SF50P100 | SF60C100 | SF70P100 | 800 | SF13X800 | – | SF50P800 | SF60C800 | – |




## POWER TRANSISTORS

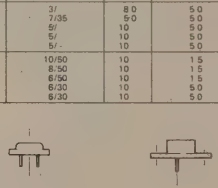
### HIGH VOLTAGE

### NPN High Gain Power Transistors

| Part No | $I_C$ Peak (A) | $V_{CEO(sus)}$ Min (V) | $H_{FE}$ (Min /Max ) | @ $I_C$ (A) | $V_{CE(sat)}$ Max (V) | @ $I_B$ (A) | $P_d$ (W) |
|---|---|---|---|---|---|---|---|
| IR701 | 4.0 | 600 | 20/ | 0.15 | – | - | 50 |
| IR801 | 5.0 | 700 | 20/– | 0.2 | – | - | 100 |
| 2N5838 | 5.0 | 250 | 8/– | 3.0 | 1.0 | 3.0 | 100 |
| 2N5839 | 5.0 | 275 | 10/ | 2.0 | 1.5 | 2.0 | 100 |
| 2N5840 | 5.0 | 350 | 10/ - | 2.0 | 1.5 | 2.0 | 100 |
| IR708 | 7.0 | 600 | – | | 2.0 | 1.0 | 50 |
| IR709 | 7.0 | 600 | – | – | 1.0 | 2.0 | 50 |
| IR710 | 7.0 | 600 | 7/– | 1.0 | – | – | 50 |
| IR721 | – | 800 | 20/60 | 0.15 | – | – | 50 |
| *IR660 | 10 | 200 | 30/90 | 1.0 | 0.8 | 1.0 | 60 |
| *IR663 | 10 | 325 | 30/90 | 1.0 | 0.8 | 1.0 | 60 |
| *IR665 | 10 | 400 | 30/90 | 1.0 | 0.8 | 1.0 | 60 |
| 2N3902 | 10 | 325 | 30/90 | 1.0 | 0.8 | 1.0 | 100 |
| 2N5157 | 10 | 400 | 30/90 | 1.0 | 0.8 | 1.0 | 100 |
| IR401 | 10 | 200 | 20-100 | 0.5 | 0.8 | 0.5 | 100 |
| IR413 | 7.0 | 325 | 20/80 | 0.5 | 0.8 | 0.5 | 100 |
| 2N5804 | 15 | 225 | 10/100 | 5.0 | 2.0 | 5.0 | 110 |
| 2N5805 | 15 | 300 | 10/100 | 5.0 | 2.0 | 5.0 | 110 |
| 2N5241 | 10 | 325 | 15/35 | 2.5 | 0.7 | 2.5 | 125 |
| IR410 | 10 | 200 | 20/100 | 1.0 | 0.8 | 1.0 | 100 |
| IR411 | 10 | 300 | 30/90 | 1.0 | 0.8 | 1.0 | 100 |
| IR430 | 10* | 300 | 15/45 | 2.5 | 0.9 | 2.5 | 125 |
| IR431 | 10 | 325 | 15/35 | 2.5 | 0.7 | 2.5 | 125 |
| IR409 | 10 | 325 | 15/ | 1.0 | 1.2 | 1.0 | 125 |
| IR423 | 10 | 325 | 30/90 | 1.0 | 0.8 | 1.0 | 125 |
| IR403 | 10 | 325 | – | | 1.1 | 3.5 | 125 |
| IR402 | 10 | 325 | – | - | 2.0 | 3.0 | 125 |
| IR424 | 10 | 350 | 30/90 | 1.0 | 0.8 | 1.0 | 125 |
| IR425 | 10 | 400 | 30/90 | 1.0 | 0.8 | 1.0 | 125 |
| IR515 | 15 | 250 | 3.5/ - | 10 | 1.8 | 3.0 | 125 |
| IR516 | 15 | 250 | 4/ | 10 | 1.9 | 7.0 | 125 |
| IR517 | 15 | 250 | 5/ | 10 | 1.6 | 7.0 | 125 |
| IR518 | 15 | 275 | 5/ | 10 | 1.4 | 7.0 | 125 |
| IR519 | 15 | 300 | 5/ | 10 | 1.4 | 7.0 | 125 |

### NPN Fast Switching Power Transistors

| Part No | $I_C$ Peak (A) | $V_{CEO(sus)}$ Min. (V) | $h_{FE}$ (Min /Max ) | @ $I_C$ (A) | $V_{CE(sat)}$ Max (V) | @ $I_C$ (A) | $P_d$ (W) | $t_r$ $t_s$ $t_f$ Max ($\mu s$) |
|---|---|---|---|---|---|---|---|---|
| 2N6542 | 10 | 300 | 7/35 | 3.0 | 5.0 | 5.0 | 100 | 7.4.0/.8 |
| 2N6543 | 10 | 400 | 7/35 | 3.0 | 5.0 | 5.0 | 100 | 7.4.0/.8 |
| 2N6306 | 16 | 250 | 4/ | 8.0 | 5.0 | 8.0 | 125 | 6.1.6 .4 |
| 2N6307 | 16 | 300 | 4/ | 8.0 | 5.0 | 8.0 | 125 | 6.1.6 .4 |
| 2N6544 | 16 | 300 | 7/35 | 5.0 | 5.0 | 8.0 | 125 | 1.4.0.1 |
| 2N6308 | 16 | 350 | 3/ | 8.0 | 5.0 | 8.0 | 125 | 6.1.6 .4 |
| 2N6545 | 16 | 400 | 7/35 | 5.0 | 5.0 | 8.0 | 125 | 1.4.0.1 |
| 2N6573 | 15 | 250 | 5/ | 10 | 5.0 | 10 | 125 | 9.2.5/.7 |
| 2N6574 | 15 | 275 | 5/ | 10 | 5.0 | 10 | 125 | 9.2.5/.7 |
| 2N6575 | 15 | 300 | 5/ - | 10 | 5.0 | 10 | 125 | 9.2.5/.7 |
| 2N6249 | 30 | 200 | 10/50 | 10 | 1.5 | 10 | 175 | 2/3.5/1 |
| 2N6250 | 30 | 275 | 8/50 | 10 | 1.5 | 10 | 175 | 1/3.5/1 |
| 2N6251 | 30 | 350 | 6/50 | 10 | 1.5 | 10 | 175 | 2/3.5/1 |
| 2N6548 | 30 | 300 | 6/30 | 10 | 5.0 | 15 | 175 | 7.4.0/.8 |
| 2N6547 | 30 | 400 | 6/30 | 10 | 5.0 | 15 | 175 | 7.4.0/.8 |




CASE STYLES. All power transistors are TO-3 case except. * = TO66, ** = H 1 case

### NPN High Gain Darlingtons

| Part No. | $I_C$ Peak (A) | $V_{CEO(sus)}$ Min. (V) | $H_{FE}$ (Min /Max.) | @ $I_C$ (A) | $V_{CE(sat)}$ Max. (V) | @ $I_C$ (A) | $P_d$ (W) |
|---|---|---|---|---|---|---|---|
| IR1010 | 15 | 80 | 200/– | 10 | 1.8 | 5.0 | 100 |
| IR1020 | 15 | 80 | 500/– | 10 | 1.5 | 5.0 | 100 |
| *IR5251 | 15 | 350 | 10/– | 10 | 2.0 | 10 | 100 |
| *IR5252 | 15 | 400 | 10/– | 10 | 2.0 | 10 | 100 |
| *IR5253 | 15 | 450 | 10/– | 10 | 2.0 | 10 | 100 |
| IR4039 | 20 | 300 | 5/– | 15 | 5.0 | 15 | 100 |
| IR4041 | 20 | 300 | 8/– | 15 | 2.2 | 15 | 100 |
| *IR5000 | 20 | 300 | 15/– | 15 | 1.8 | 15 | 125 |
| IR4040 | 20 | 325 | 8/– | 15 | 2.0 | 15 | 125 |
| IR4045 | 20 | 325 | 15/ - | 15 | 1.2 | 5.0 | 125 |
| *IR5001 | 20 | 350 | 15/– | 15 | 1.8 | 15 | 125 |
| IR4050 | 20 | 350 | 8/– | 15 | 2.0 | 15 | 125 |
| IR4055 | 20 | 350 | 15/– | 15 | 1.8 | 15 | 125 |
| IR4059 | 20 | 350 | 5/– | 15 | 5.0 | 15 | 100 |
| IR4061 | 20 | 350 | 8/– | 15 | 2.2 | 15 | 100 |
| *IR5002 | 20 | 400 | 15/– | 15 | 1.8 | 15 | 125 |
| IR4060 | 20 | 400 | 8/– | 15 | 2.0 | 15 | 125 |
| IR4065 | 20 | 400 | 15/– | 15 | 1.8 | 15 | 125 |
| *IR5063 | 20 | 500 | 8/– | 20 | 2.0 | 15 | 125 |
| *IR5064 | 20 | 600 | 8/– | 15 | 2.0 | 10 | 125 |
| *IR5065 | 20 | 750 | 4/– | 15 | 2.0 | 10 | 125 |
| *IR5066 | 20 | 900 | 5/– | 12 | 2.0 | 10 | 125 |
| *IR5060 | 25 | 300 | 40/– | 15 | 2.0 | 20 | 125 |
| *IR5061 | 25 | 350 | 40/– | 15 | 2.0 | 20 | 125 |
| *IR5062 | 25 | 400 | 40/– | 15 | 2.0 | 20 | 125 |

### NPN Fast Switching Darlingtons

| Part No. | $I_C$ Peak (A) | $V_{CEO(sus)}$ Min. (V) | $h_{FE}$ (Min./Max.) | @ $I_C$ (A) | $V_{CE(sat)}$ Max. (V) | @ $I_C$ (A) | $P_d$ (W) | $t_r/t_s/t_f$ Max. ($\mu s$) |
|---|---|---|---|---|---|---|---|---|
| IR6251 | 15 | 350 | 100/– | 5.0 | 2.0 | 10 | 100 | 25/2.5/1 |
| IR6252 | 15 | 400 | 100/– | 5.0 | 2.0 | 10 | 100 | 25/2.5/1 |
| IR6253 | 15 | 450 | 100/– | 5.0 | 2.0 | 10 | 100 | 25/2.5/1 |
| IR6000 | 20 | 300 | 60/– | 10 | 1.8 | 15 | 125 | 4/2.5/1 |
| IR6001 | 20 | 350 | 60/– | 10 | 1.8 | 15 | 125 | 4/2.5/1 |
| IR6002 | 20 | 400 | 60/– | 10 | 1.8 | 15 | 125 | 4/2.5/1 |
| IR6060 | 25 | 300 | 40/– | 15 | 2.0 | 20 | 125 | 4/2.5/1 |
| IR6061 | 25 | 350 | 40/– | 15 | 2.0 | 20 | 125 | 4/2.5/1 |
| IR6062 | 25 | 400 | 40/– | 15 | 2.0 | 20 | 125 | 4/2.5/1 |

## EPITAXIAL BASE

### NPN/PNP Discrete Power Transistors

| Types | Polarity | $I_C$ Peak (A) | $V_{CEO(sus)}$ Vmin | $h_{FE}$ Min | @ $I_C$ (A) | @ $V_{CE}$ (V) | $t_r$ $\mu$sec. | $t_s$ $\mu$sec. | $t_f$ $\mu$sec. | $P_d$ (W) | IR Data Sheet |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2N3055 | NPN | 15 | 60 | 5 | 10 | 1.1 | – | – | – | 115 | 9 039 |
| 2N3713 | NPN | 10 | 60 | 15 | 3 | 4 | 0.7 | 1.0 | 0.8 | 150 | 9 040 |
| 2N3714 | NPN | 10 | 80 | 15 | 3 | 4 | 0.7 | 1.0 | 0.8 | 150 | 9 040 |
| 2N3715 | NPN | 10 | 60 | 30 | 3 | 4 | 0.7 | 1.0 | 0.8 | 150 | 9 040 |
| 2N3716 | NPN | 10 | 80 | 30 | 3 | 4 | 0.7 | 1.0 | 0.8 | 150 | 9 040 |
| 2N3771 | NPN | 60 | 40 | 5 | 30 | 4 | 0.7 | 1.0 | 0.8 | 200 | 9 055 |
| 2N3772 | NPN | 50 | 60 | 5 | 20 | 3 | 0.7 | 1.0 | 0.8 | 200 | 9 055 |
| 2N3773 | NPN | 30 | 140 | 15 | 8 | 4 | 0.7 | 1.0 | 0.8 | 150 | 9 057 |
| 2N3789 | PNP | 10 | 60 | 15 | 3 | 4 | 0.7 | 1.0 | 0.8 | 150 | 9 040 |
| 2N3790 | PNP | 10 | 80 | 15 | 3 | 4 | 0.7 | 1.0 | 0.8 | 150 | 9 040 |
| 2N3791 | PNP | 10 | 60 | 30 | 3 | 4 | 0.7 | 1.0 | 0.8 | 150 | 9 040 |
| 2N3792 | PNP | 10 | 80 | 30 | 3 | 4 | 0.7 | 1.0 | 0.8 | 150 | 9 040 |
| 2N4398 | PNP | 50 | 40 | 5 | 30 | 4 | 0.4 | 1.5 | 0.6 | 200 | 9 033 |
| 2N4399 | PNP | 50 | 60 | 5 | 30 | 4 | 0.4 | 1.5 | 0.6 | 200 | 9 033 |
| 2N5301 | NPN | 50 | 40 | 5 | 30 | 3 | 1.0 | 2.0 | 1.0 | 200 | 9 033 |
| 2N5302 | NPN | 50 | 60 | 5 | 30 | 3 | 1.0 | 2.0 | 1.0 | 200 | 9 033 |
| 2N5303 | NPN | 50 | 80 | 5 | 20 | 2 | 1.0 | 2.0 | 1.0 | 200 | 9 033 |
| 2N5629 | NPN | 20 | 100 | 4 | 16 | 2 | – | – | – | 200 | 9 037 |
| 2N5630 | NPN | 20 | 120 | 4 | 16 | 2 | – | – | – | 200 | 9 037 |
| 2N5631 | NPN | 20 | 140 | 4 | 16 | 2 | – | – | – | 200 | 9 037 |
| 2N5632 | NPN | 15 | 100 | 5 | 10 | 1.0 | – | – | – | 150 | 9 045 |
| 2N5633 | NPN | 15 | 120 | 5 | 10 | 1.0 | – | – | – | 150 | 9 045 |
| 2N5634 | NPN | 15 | 140 | 5 | 10 | 1.0 | – | – | – | 150 | 9 045 |
| **2N5683 | PNP | 70 | 60 | 5 | 50 | 5 | – | – | – | 300 | 9 056 |
| **2N5684 | PNP | 70 | 80 | 5 | 50 | 5 | – | – | – | 300 | 9 056 |
| **2N5685 | NPN | 70 | 60 | 5 | 50 | 5 | – | – | – | 300 | 9 056 |
| **2N5686 | NPN | 70 | 80 | 5 | 50 | 5 | – | – | – | 300 | 9 056 |
| 2N5745 | PNP | 50 | 80 | 20 | 2 | 1.0 | 2.0 | 1.0 | | 200 | 9 033 |
| 2N5758 | NPN | 10 | 100 | 25 | 3 | 1.0 | – | – | – | 150 | 9 042 |
| 2N5759 | NPN | 10 | 120 | 20 | 3 | 1.0 | – | – | – | 150 | 9 042 |
| 2N5760 | NPN | 10 | 140 | 15 | 3 | 1.0 | – | – | – | 150 | 9 042 |
| 2N5875 | PNP | 20 | 60 | 4 | 10 | 1.0 | 0.7 | 1.0 | 0.8 | 150 | 9 043 |
| 2N5876 | PNP | 20 | 80 | 4 | 10 | 1.0 | 0.7 | 1.0 | 0.8 | 150 | 9 043 |
| 2N5877 | NPN | 20 | 60 | 4 | 10 | 1.0 | 0.7 | 1.0 | 0.8 | 150 | 9 043 |
| 2N5878 | NPN | 20 | 80 | 4 | 10 | 1.0 | 0.7 | 1.0 | 0.8 | 150 | 9 043 |
| 2N5879 | PNP | 30 | 60 | 4 | 15 | 1.0 | 0.7 | 1.0 | 0.8 | 160 | 9 044 |
| 2N5880 | PNP | 30 | 80 | 4 | 15 | 1.0 | 0.7 | 1.0 | 0.8 | 160 | 9 044 |
| 2N5881 | NPN | 30 | 60 | 4 | 15 | 1.0 | 0.7 | 1.0 | 0.8 | 160 | 9 044 |
| 2N5882 | NPN | 30 | 80 | 4 | 15 | 1.0 | 0.7 | 1.0 | 0.8 | 160 | 9 044 |
| 2N5883 | PNP | 50 | 60 | 4 | 25 | 4 | 0.7 | 1.0 | 0.8 | 200 | 9 032 |
| 2N5884 | PNP | 50 | 80 | 4 | 25 | 4 | 0.7 | 1.0 | 0.8 | 200 | 9 032 |
| 2N5885 | NPN | 50 | 60 | 4 | 25 | 4 | 0.7 | 1.0 | 0.8 | 200 | 9 032 |
| 2N5886 | NPN | 50 | 80 | 4 | 25 | 4 | 0.7 | 1.0 | 0.8 | 200 | 9 032 |
| 2N6029 | PNP | 20 | 100 | 4 | 16 | 2 | – | – | – | 200 | 9 037 |
| 2N6030 | PNP | 20 | 120 | 4 | 16 | 2 | – | – | – | 200 | 9 037 |
| 2N6031 | PNP | 20 | 140 | 4 | 16 | 2 | – | – | – | 200 | 9 037 |
| 2N6226 | PNP | 10 | 100 | 25 | 3 | 1.0 | – | – | – | 150 | 9 042 |
| 2N6227 | PNP | 10 | 130 | 20 | 3 | 1.0 | – | – | – | 150 | 9 042 |
| 2N6228 | PNP | 10 | 140 | 15 | 3 | 1.0 | – | – | – | 150 | 9 042 |
| 2N6229 | PNP | 15 | 100 | 15 | 3 | 1.0 | – | – | – | 150 | 9 045 |
| 2N6230 | PNP | 15 | 120 | 15 | 3 | 1.0 | – | – | – | 150 | 9 045 |
| 2N6231 | PNP | 15 | 140 | 15 | 3 | 1.0 | – | – | – | 150 | 9 045 |
| 2N6246 | PNP | 20 | 80 | 60 | 5 | 15 | – | – | – | 125 | 9 041 |
| 2N6247 | PNP | 20 | 80 | 80 | 5 | 15 | – | – | – | 125 | 9 041 |
| 2N6248 | PNP | 15 | 100 | 100 | 5 | 10 | – | – | – | 125 | 9 041 |
| 2N6469 | PNP | 20 | 40 | 5 | 15 | 1.3 | – | – | – | 125 | 9.041 |
| 2N6470 | NPN | 20 | 40 | 5 | 15 | 1.3 | – | – | – | 125 | 9.041 |
| 2N6471 | NPN | 20 | 60 | 5 | 15 | 1.3 | – | – | – | 125 | 9.041 |
| 2N6472 | NPN | 20 | 80 | 5 | 15 | 1.3 | – | – | – | 125 | 9.041 |
| 2N6609 | PNP | 50 | 140 | 15 | 8 | 4 | – | – | – | 200 | 9 057 |
| IR802 | NPN | 30 | 90 | 10 | 15 | 0.8 | – | – | – | 200 | 9.034 |
| IR3771 | NPN | 60 | 40 | 5 | 30 | 4 | 0.7 | 1.0 | 0.8 | 200 | 9 035 |
| IR3772 | NPN | 50 | 60 | 5 | 20 | 3 | 0.7 | 1.0 | 0.8 | 200 | 9 035 |
| IR3773 | NPN | 50 | 140 | 5 | 16 | 2 | 1.5 | 2.0 | 1.8 | 200 | 9 036 |
| IR4502 | PNP | 30 | 90 | 10 | 15 | 0.8 | – | – | – | 200 | 9 034 |
| IR8302 | PNP | 30 | 120 | 5 | 16 | 2 | 1.5 | 2.0 | 1.8 | 200 | 9 036 |

### NPN/PNP Discrete Power Darlingtons

| Types | Polarity | $I_C$ Peak (A) | $V_{CEO(sus)}$ Vmin | $h_{FE}$ Min. | @ $I_C$ (A) | @ $V_{CE}$ (V) | $P_d$ (W) | IR Data Sheet |
|---|---|---|---|---|---|---|---|---|
| IR640 | NPN | 15 | 60 | 500 | 10 | 4 | 175 | 9.051 |
| IR641 | NPN | 15 | 80 | 500 | 10 | 4 | 175 | 9.051 |
| IR642 | NPN | 15 | 100 | 500 | 10 | 4 | 175 | 9.051 |
| IR645 | PNP | 15 | 60 | 500 | 10 | 4 | 175 | 9.051 |
| IR646 | PNP | 15 | 80 | 500 | 10 | 4 | 175 | 9.051 |
| IR647 | PNP | 15 | 100 | 500 | 10 | 4 | 175 | 9.051 |
| IR900 | PNP | 10 | 60 | 1000 | 3 | 3 | 90 | 9.054 |
| IR901 | PNP | 10 | 80 | 1000 | 3 | 3 | 90 | 9.054 |
| IR1000 | NPN | 10 | 80 | 1000 | 3 | 3 | 90 | 9.054 |
| IR1001 | NPN | 10 | 80 | 1000 | 3 | 3 | 90 | 9.054 |
| IR1010 | NPN | 15 | 80 | 200 | 10 | 5 | 100 | 9.018 |
| IR1020 | NPN | 15 | 80 | 500 | 10 | 5 | 100 | 9.018 |
| IR2500 | PNP | 15 | 60 | 1000 | 5 | 3 | 150 | 9.060 |
| IR2501 | PNP | 15 | 80 | 1000 | 5 | 3 | 150 | 9.060 |
| IR3000 | NPN | 15 | 60 | 1000 | 5 | 3 | 150 | 9.060 |
| IR3001 | NPN | 15 | 80 | 1000 | 5 | 3 | 150 | 9.060 |
| 2N6050 | PNP | 20 | 60 | 750 | 6 | 3 | 150 | 9.049 |
| 2N6051 | PNP | 20 | 80 | 750 | 6 | 3 | 150 | 9.049 |
| 2N6052 | PNP | 20 | 100 | 750 | 6 | 3 | 150 | 9.049 |
| 2N6053 | PNP | 16 | 80 | 750 | 4 | 3 | 100 | 9.053 |
| 2N6054 | PNP | 16 | 80 | 750 | 4 | 3 | 100 | 9.053 |
| 2N6055 | NPN | 16 | 60 | 750 | 4 | 3 | 100 | 9.053 |
| 2N6056 | NPN | 16 | 80 | 750 | 4 | 3 | 100 | 9.053 |
| 2N6057 | NPN | 20 | 80 | 750 | 6 | 3 | 150 | 9.049 |
| 2N6058 | NPN | 20 | ■ | 750 | 6 | 3 | 150 | 9.049 |
| 2N6059 | NPN | 20 | 100 | 750 | 6 | 3 | 150 | 9.049 |
| 2N6282 | NPN | 40 | 60 | 750 | 10 | 3 | 180 | 9.048 |
| 2N6283 | NPN | 40 | 80 | 750 | 10 | 3 | 180 | 9.048 |
| 2N6284 | NPN | 40 | 100 | 750 | 10 | 3 | 180 | 9.048 |
| 2N6285 | PNP | 40 | 60 | 750 | 10 | 3 | 180 | 9.048 |
| 2N6286 | PNP | 40 | 80 | 750 | 10 | 3 | 180 | 9.048 |
| 2N6287 | PNP | 40 | 100 | 750 | 10 | 3 | 180 | 9.048 |
| 2N6383 | NPN | 16 | 40 | 1000 | 5 | 3 | 100 | 9.052 |
| 2N6384 | NPN | 16 | 60 | 1000 | 5 | 3 | 100 | 9.052 |
| 2N6385 | NPN | 16 | 80 | 1000 | 5 | 3 | 100 | 9.052 |
| *2N6534 | NPN | 16 | 80 | 100 | 8 | 3 | 36 | 9.059 |
| *2N6535 | NPN | 16 | 100 | 100 | 8 | 3 | 36 | 9.059 |
| *2N6536 | NPN | 16 | 100 | 100 | 8 | 3 | 36 | 9.059 |
| *2N6537 | NPN | 16 | 120 | 100 | 8 | 3 | 36 | 9.059 |

SPA 1004B

**ISKRA**

• Ceramic Caps, Discs, Feed Thru • Ferrites • Meters • Motors, fractional H.P. • Semiconductors • Switches • Speakers • Trimmer Pots

# SEMICONDUCTORS

## BRIDGES, DIODES, HIGH VOLTAGE, HIGH CURRENT DEVICES

## 1N4000 SERIES SILICON RECTIFIER DIODES 1 AMP, 50-1000V

△ Plastic Rectifiers
△ Subminiature Size Axial Lead Mounted Rectifiers for General Purpose Low-Power Applications
△ Silicone Passivated, JEDEC Numbered
△ Available Bulk or Taped and Reeled

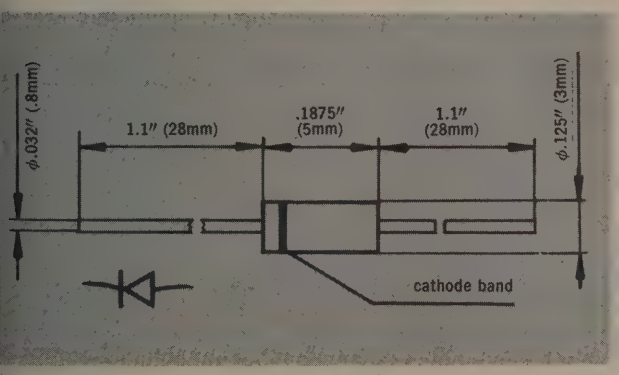
### MAXIMUM RATINGS

| Rating | Symbol | Unit | 1N4001 | 1N4002 | 1N4003 | 1N4004 | 1N4005 | 1N4006 | 1N4007 |
|---|---|---|---|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $U_{RRM}$<br>$U_{RM}$<br>$U_R$ | V | 50 | 100 | 200 | 400 | 600 | 800 | 1000 |
| Non-Repetitive Peak Reverse Voltage 10 ms (Halfwave, Single Phase 50 Hz Peak) | $U_{RSM}$ | V | (100)*<br>60 | (150)*<br>120 | (300)*<br>240 | (600)*<br>480 | (900)*<br>720 | (1200)*<br>1000 | (1500)*<br>1200 |
| RMS Voltage | $U_{RMS}$ | V | 35 | 70 | 140 | 280 | 420 | 560 | 700 |
| Average Rectified Forward Current (Single Phase, Resistive Load 50 Hz) | $I_O$ | A | 1.0 | | | | | | |
| Non-Repetitive Peak Current (Surge Current, 1 Cycle for 10 ms) | $I_{FSM}$ | A | 50 | | | | | | |
| Operating Temperature | $T_{op}$ | °C | −65 to +175 | | | | | | |
| Storage Temperature | $T_{STG}$ | °C | −65 to +175 | | | | | | |

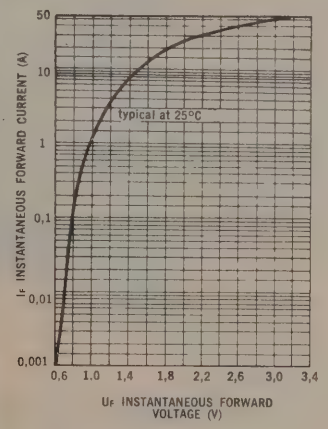
*Available on special request*

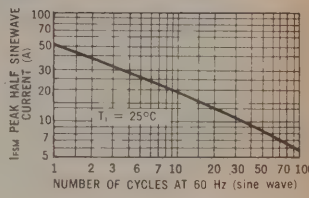
### ELECTRICAL CHARACTERISTICS

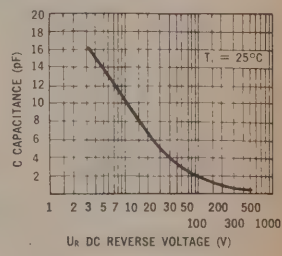
| Characteristics and Conditions | Symbol | Unit | Head |
|---|---|---|---|
| Max. Instantaneous Forward Voltage Drop ($I_F$ = 1,0A $T_j$ = 25°C) | $U_{FWD}$ | V | 1.1 |
| Max. Reverse Current at $U_{RRM}$ ($T_j$ = 25°C) | $I_R$ | μA | 10 |
| Max. Reverse Current at $U_{RRM}$ ($T_j$ = 100°C) | $I_R$ | μA | 50 |
| Typical Thermal Resistance Junction to Ambient (Mounting Method A) | $R_{TH}$ | °C/W | 85 |

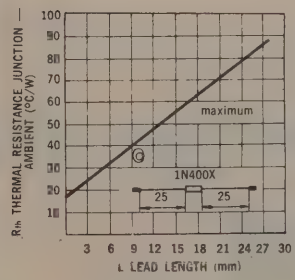


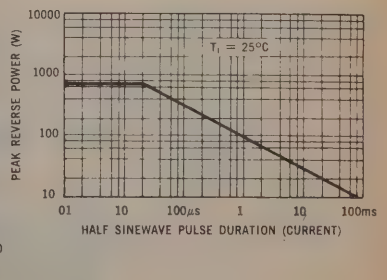

### CHARACTERISTIC CURVES



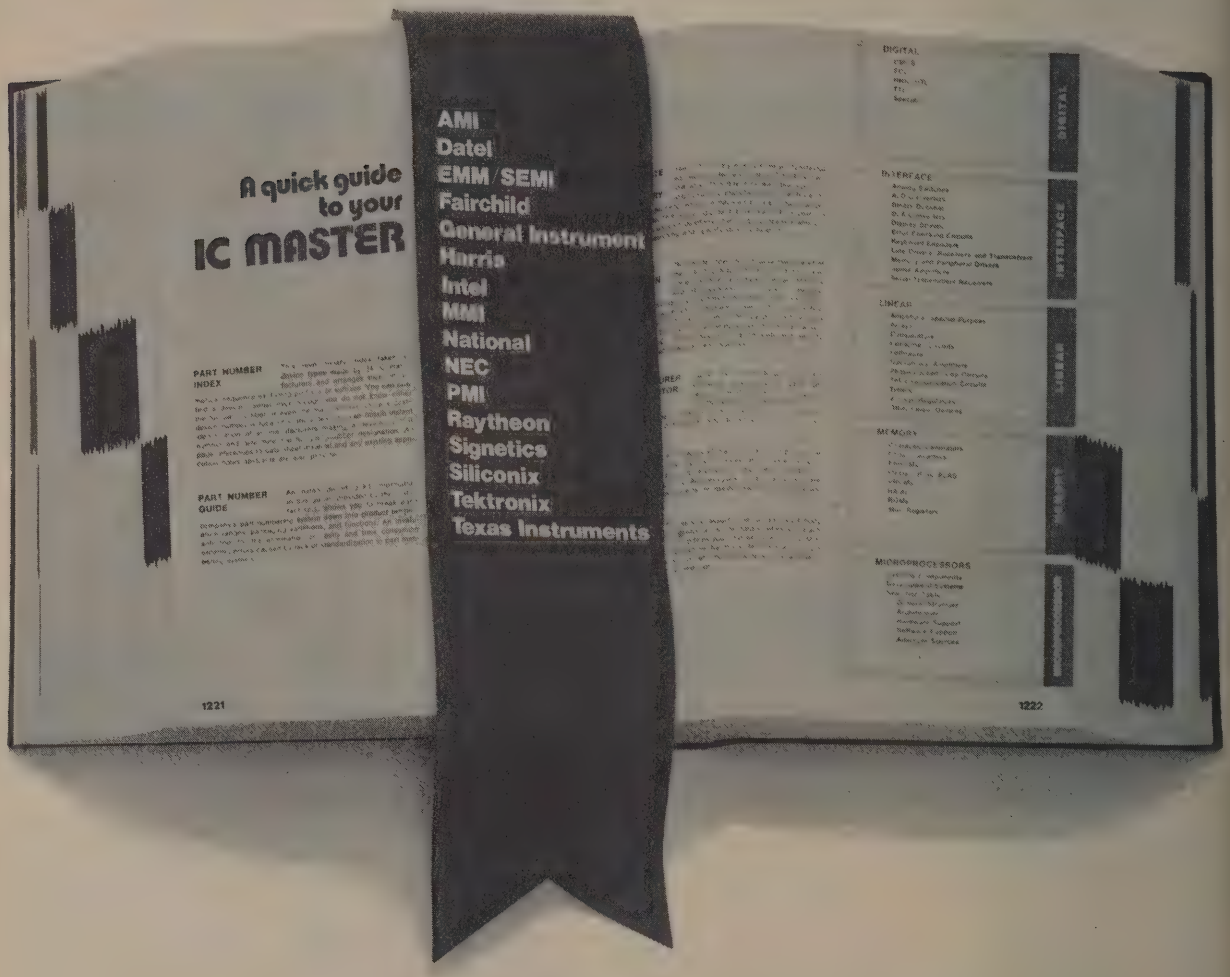




**ISL PRODUCTS LTD.**
50 WERMAN COURT / PLAINVIEW, NEW YORK 11803 / (516) 694-2686

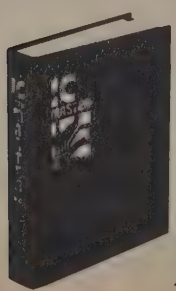
# A GOOD BOOK IS KNOWN BY THE COMPANIES IT KEEPS




These manufacturers have invested in the IC MASTER to bring you the most complet information on their newest standard products.

WHEN USING THE IC MASTER, REFER TO THESE MANUFACTURERS' COMPLET DATA SHEETS TO HELP YOU IN YOUR IC SELECTION . . .

**THE WHOLE WORLD FOLLOWS THE MASTER.**



**IC Master**
**1333 Lawrence Expressway, Suite 420**
**Santa Clara, CA 95051**
**(408) 248-8044**

***It's Faster With the Master***

Panasonic

# ZNR TRANSIENT/SURGE ABSORBERS

Panasonic ZNRs are zinc oxide nonlinear resistors whose resistance changes as a function of the applied voltage. The ZNR has a bilateral and symmetrical V-I characteristic curve. Gives your circuit clamping protection in either direction. The ZNR thus provides a highly reliable and economical way to protect against repeated high voltage transients and surges such as those produced by lighting, switching surges and noise spikes.

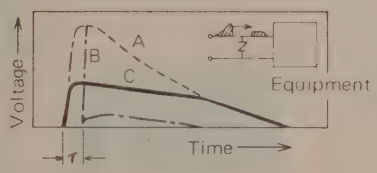
## FEATURES

- Excellent clamping voltage characteristic and fast response time (<50 nsec.) when subjected to impulse surges. Eliminates the discharge lag that is indicative of gap-type arrestors.
- Bilateral and symmetrical V-1 characteristic curve. The ZNR can, therefore, be used both in AC and DC circuits, for protection of either positive or negative transients.

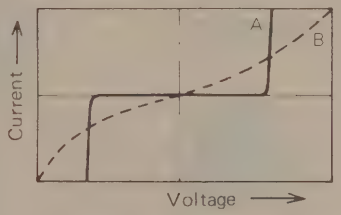
**IMMEDIATELY AVAILABLE FROM STOCK**

## STANDARD VOLT RANGE

| Part Number | Varistor Voltage $V_1$ mA (V) | Maximum Allowable Voltage AC rms (V) | DC (V) |
|---|---|---|---|
| ERZ-C--DK220 | 22 (20-24) | 14 | 18 |
| ERZ-C--DK270 | 27 (24-30) | 17 | 22 |
| ERZ-C--DK330 | 33 (30-36) | 20 | 26 |
| ERZ-C--DK390 | 39 (35-43) | 25 | 31 |
| ERZ-C--DK470 | 47 (42-52) | 30 | 38 |
| ERZ-C--DK560 | 56 (50-62) | 35 | 45 |
| ERZ-C--DK680 | 68 (61-75) | 40 | 56 |
| ERZ-C--DK820 | 82 (74-90) | 50 | 65 |
| ERZ-C--DK101 | 100 (90-110) | 60 | 85 |
| ERZ-C--DK121 | 120 (108-132) | 75 | 100 |
| ERZ-C--DK151 | 150 (135-165) | 95 | 125 |
| ERZ-C--DK201 | 200 (185-225) | 130 | 170 |
| ERZ-C--DK221 | 220 (198-242) | 140 | 180 |
| ERZ-C--DK241 | 240 (216-264) | 150 | 200 |
| ERZ-C--DK271 | 270 (247-303) | 175 | 225 |
| ERZ-C--DK361 | 360 (324-396) | 230 | 300 |
| ERZ-C--DK391 | 390 (351-429) | 250 | 320 |
| ERZ-C--DK431 | 430 (387-473) | 275 | 350 |
| ERZ-C--DK471 | 470 (423-517) | 300 | 385 |
| ERZ-C--DK621 | 620 (558-682) | 385 | 505 |
| ERZ-C--DK681 | 680 (612-748) | 420 | 560 |
| ERZ-C--DK751 | 750 (675-825) | 460 | 615 |
| ERZ-C--DK781 | 780 (702-858) | 485 | 640 |
| ERZ-C--DK821 | 820 (738-902) | 510 | 670 |
| ERZ-C--DK911 | 910 (819-1001) | 550 | 745 |
| ERZ-C--DK102 | 1000 (900-1100) | 625 | 825 |
| ERZ-C--DK112 | 1100 (990-1210) | 680 | 895 |
| ERZ-C--DK182 | 1800 (1620-1980) | 1000 | 1465 |




A: Original surge wave form
B: Clamping voltage using gap type arrestor
C: Clamping voltage using ZNR
τ: Discharge lag




A: ZNR
B: SiC varistor

| Part No. Prefix + Disc Size mm | Volt Range V 1mA | Energy J | Withstanding Surge (8 x 20 μsec) Current (A) | Dia. |
|---|---|---|---|---|
| ERZ-C05 | 100-470 | 1-2.5 | 100 | .265-.295 |
| ERZ-C07 | 100-470 | 2-5 | 250 | .335-.374 |
| ERZ-C10 | 22-1100 | 2-20 | 250-500 | .492-.551 |
| ERZ-C14 | 22-1800 | 1.6-80 | 500-1000 | .630-.768 |
| ERZ-C20 | 100-1800 | 15-160 | 2000 | .906-1.004 |

## HIGH VOLTAGE "ZNR®" SURGE ABSORBER

### PRIMARY AND SECONDARY PROTECTION

## PART NUMBER CODE

| E | R | Z | – | C | 0 | 7 | D | K | 2 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Common Code | | | | | Element Size | | Type | Tolerance | V 1mA | | |

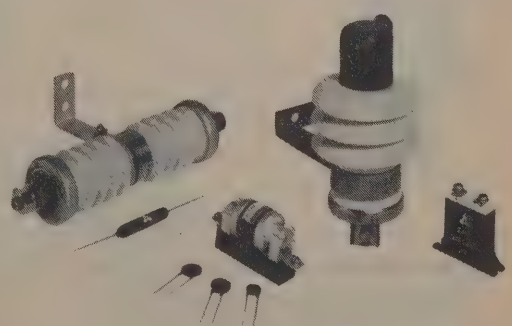
ZNR A/C SERIES

| | |
|---|---|
| D | Disc |
| E | Molded |

| | |
|---|---|
| J | ±5% |
| K | ±10% |
| L | ±15% |

| | |
|---|---|
| 05 | 5mm (.197) |
| 07 | 7mm (.276) |
| 10 | 10mm (.394) |
| 14 | 14mm (.551) |
| 20 | 20mm (.787) |
| 25 | 25mm (.984) |
| 32 | 32mm (1.260) |

The first two digits are significant figures of voltage and the third one denotes number of zeros following.



**Panasonic /** ELECTRONIC COMPONENTS DIVISION
ONE PANASONIC WAY / SECAUCUS, NEW JERSEY 07094 / (201) 348-7000

JUST SLIGHTLY AHEAD OF OUR TIME

# High Current Silicon

## POWERBLOCK POWER SYSTEMS
## POWER TRANSISTORS

### POWERBLOCK POWER SYSTEMS

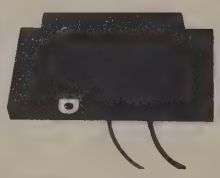
| 1200A |
|---|
| 80V* |
| 18.7 cu. in. |

PACKAGE NO. PPS-1200
Size 3⅞" x 3⅞" x 1¼"

| 500A |
|---|
| 80V* |
| 11 cu. in. |

PACKAGE NO. PPS-500 (Not Shown)
Size 2¾" x 3¼" x 1¼"

| 250A |
|---|
| 80V* |
| 5.6 cu. in. |



PACKAGE NO. PPS-250
Size 3" x 1½" x 1¼"

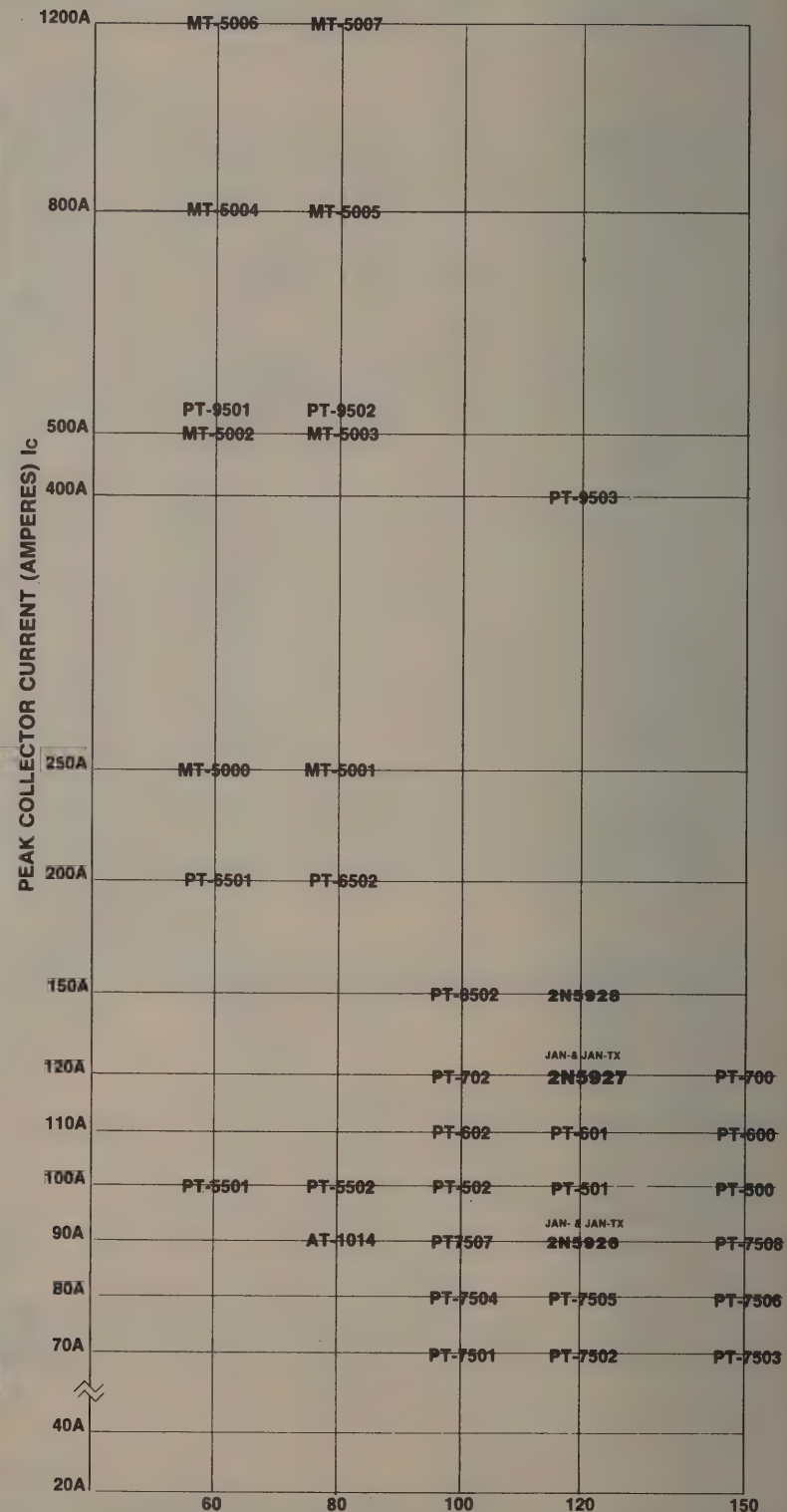
*High Voltage Powerblock Power Systems available — consult factory

### POWER TRANSISTORS

PACKAGE NO. PB-500
Size 1½" x 1½" x 1⅛"

JEDEC TO-114

JEDEC TO-63




**PowerTech, Inc.**

"BIG IDEAS IN BIG POWER"

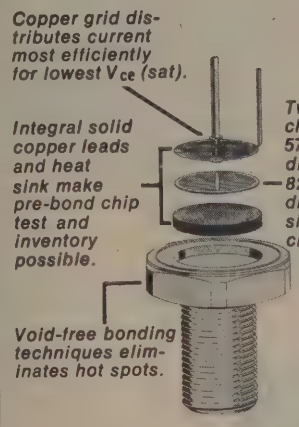
0-02 Fair Lawn Ave. · Fair Lawn, N. J. 07410 · 201-791-5050

**TRANSISTOR FEATURES**

High Current Gains: 10 min. @ 300A
High Collector Voltage: to 650V
Low Saturation Voltage: 0.5V max. @ $I_C = 300A$
Second Breakdown Resistant: $E_{s/b} = 6$ Joules, $I_{s/b}$ — SOAR Specified
Manufactured to MIL Specs: MIL-S-19500
Power Dissipation Ratings: to 625 Watts

**POWERBLOCK POWER SYSTEM FEATURES**

High KVA Product
High Current Gains
Savings in Space & Weight
Savings in Ckt. Assembly Costs
Customized Options Available
Power Dissipation Ratings: to 1200 Watts


Copper grid distributes current most efficiently for lowest $V_{ce}$ (sat).
Integral solid copper leads and heat sink make pre-bond chip test and inventory possible.
Two choices: 570 mil diam. or 820 mil diam. single chips!
Void-free bonding techniques eliminates hot spots.

| | $I_C = 500A$ | $I_C = 800A$ | |
|---|---|---|---|
| $h_{FE}$* | 500 | 100 | min. |
| $V_{CE(sat)}$ | 2.0V | 3.0V | max. |
| $V_{BE}$ | 2.5V | 3.5V | max. |

PPS-1200

| | $I_C = 750A$ | $I_C = 1200A$ | |
|---|---|---|---|
| $h_{FE}$* | 500 | 100 | min. |
| $V_{CE(sat)}$ | 2.0V | 2.5V | max. |
| $V_{BE}$ | 2.5V | 3.5V | max. |

PPS-1200

| | $I_C = 250A$ | $I_C = 500A$ | |
|---|---|---|---|
| $h_{FE}$* | 500 | 100 | min. |
| $V_{CE(sat)}$ | 2.0V | 2.5V | max. |
| $V_{BE}$ | 2.5V | 3.5V | max. |

PPS-500

| | $I_C = 300A$ | |
|---|---|---|
| $h_{FE}$ | 10 | min. |
| $V_{CE(sat)}$ | 0.5V | max. |

PB-500

| | $I_C = 200A$ | |
|---|---|---|
| $h_{FE}$ | 10 | min. |
| $V_{CE(sat)}$ | 0.35V | max. |

PB-500

| | $I_C = 125A$ | $I_C = 250A$ | |
|---|---|---|---|
| $h_{FE}$* | 450 | 175 | min. |
| $V_{CE(sat)}$ | 1.5V | 2.5V | max. |
| $V_{BE}$ | 2.5V | 3.0V | max. |

*DARLINGTON CONNECTED

OPTIONAL PACKAGES

POWERBLOCK

JEDEC TO-68

MODULE

HIGH VOLTAGE FAST SWITCHING

PT-4500
PT-700
PT-600 PT-4502 PT-4503
PT-500
PT-7508 PT-7511 PT-3522 PT-3523
PT-7506 PT-7510
PT-7503 PT-7509 PT-3512 PT-3513
PT-3526
PT-3516

150 200 325 400 500 600 650

| | $I_C = 100A$ | |
|---|---|---|
| $h_{FE}$ | 15 | min. |
| $V_{CE(sat)}$ | 0.75V | max. |

TO-114

| | $I_C = 100A$ | |
|---|---|---|
| $h_{FE}$ | 10 | min. |
| $V_{CE(sat)}$ | 1.0V | max. |

TO-114

| | $I_C = 70A$ | |
|---|---|---|
| $h_{FE}$ | 10 | min. |
| $V_{CE(sat)}$ | 0.6V | max. |

TO-114

| | $I_C = 60A$ | |
|---|---|---|
| $h_{FE}$ | 10 | min. |
| $V_{CE(sat)}$ | 0.6V | max. |

TO-114

| | $I_C = 50A$ | |
|---|---|---|
| $h_{FE}$ | 10 | min. |
| $V_{CE(sat)}$ | 0.6V | max. |

TO-114

| | $I_C = 50A$ | |
|---|---|---|
| $h_{FE}$ | 10 | min. |
| $V_{CE(sat)}$ | 0.6V | max. |

TO-63

| | $I_C = 40A$ | |
|---|---|---|
| $h_{FE}$ | 10 | min. |
| $V_{CE(sat)}$ | 0.6V | max. |

TO-63

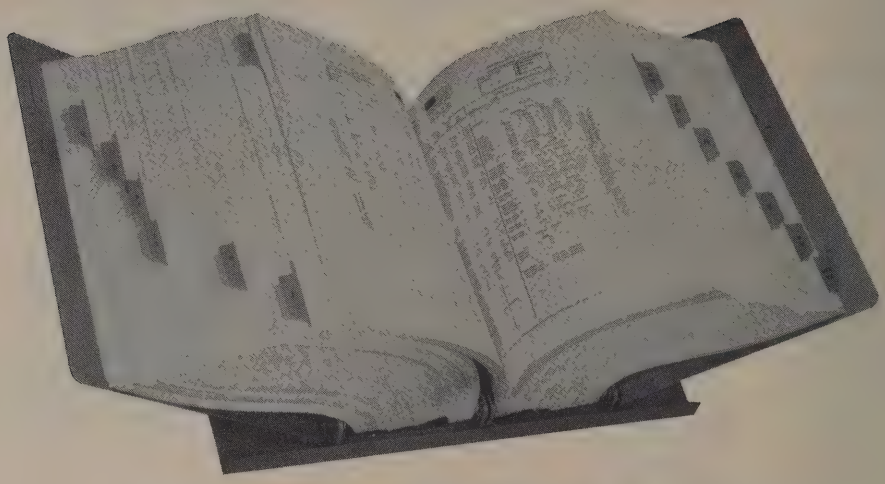
| | $I_C = 30A$ | |
|---|---|---|
| $h_{FE}$ | 10 | min. |
| $V_{CE(sat)}$ | 0.6V | max. |

TO-63

| | $I_C = 20A$ | |
|---|---|---|
| $h_{FE}$ | 10 | min. |
| $V_{CE(sat)}$ | 0.5V | max. |

| | $I_C = 10A$ | |
|---|---|---|
| $h_{FE}$ | 10 | min. |
| $V_{CE(sat)}$ | 0.5V | max. |

**PowerTech, Inc.**
"BIG IDEAS IN BIG POWER"
0-02 Fair Lawn Ave. • Fair Lawn, N. J. 07410 • 201-791-5050



# UNITED PRICING REPORTS

## the single source that speeds up invoicing, pricing, quoting, purchasing and estimating

Electronic component prices change so fast, you'd need a team of people just to keep up.

United Pricing Reports is the better way. When you subscribe to Pricing Reports you receive 1500 pricing sheets (3000 pages) of the latest prices, as of the date we ship them to you.

This gives you, in a single source, up-to-the minute selling prices on more than 500,000 electronic components.

United Pricing Reports gives you accurate resale prices at the exact moment you need them. Not hours or days later. So it helps you eliminate frantic phone calls, letter writing and catalog scanning to check on prices when you write an invoice or type a purchase order.

## Twice weekly price updates.

One week after you receive your Pricing Reports source book (1500 pricing sheets) you begin receiving twice weekly price updates. You simply take these new price pages and replace the now obsolete pages with them.

The whole process is simple. All information is organized alphabetically by manufacturer. And each manufacturer's price schedule is listed by part number in numerical/alphabetical sequence.

One more thing. When we promise twice weekly updates, we deliver. 52 weeks a year, consistently. Not monthly or every other month. We have a tradition of delivery on our promises, and we're certainly not going to stop now.

*UNITED TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500 TWX-510/222*

# DIRECTRON INDUSTRIAL SELENIUM RECTIFIERS

**Selenium Surge Suppressors Polarized (DC) Non Polarized (AC) Max. DC Volts 25-750 Max. Clamping Volts 16-1800 Peak Current Rating 3A-270A**

## DIRECTION ELEVATOR CONTROL RECTIFIERS

| Part No. | AC Input Volts Up To | Phase | Amps | Units Required | List Price Unit | List Price Set |
|---|---|---|---|---|---|---|
| CD260 | 260 | 1φ | 1.5 | 2 | $13.85 | $27.70 |
| | | 3φ | 2.2 | 3 | 13.85 | 41.55 |
| DD260 | 260 | 1φ | 2.2 | 2 | 16.15 | 32.50 |
| | | 3φ | 3.3 | 3 | 16.15 | 48.45 |
| ED260 | 260 | 1φ | 3.4 | 2 | 19.65 | 39.30 |
| | | 3φ | 5.1 | 3 | 19.65 | 58.95 |
| FD260 | 260 | 1φ | 6.6 | 2 | 24.25 | 48.50 |
| | | 3φ | 10. | 3 | 24.25 | 72.75 |
| GD260 | 260 | 1φ | 10. | 2 | 42.00 | 84.00 |
| | | 3φ | 15. | 3 | 42.00 | 126.00 |
| COMPACT UNIT (Double Decker) | | | | | | |
| 3D260 | 260 | 3φ | 3. | 1 | 43.90 | — |

| | Otis Part No. | List Price |
|---|---|---|
| CENTER TAP | 230AV1 | $23.00 |
| | 230AS1 | 23.00 |
| HALF WAVE (blocking) | 230AR1 | 7.00 |
| | 230AR3 | 7.00 |
| | 230AZ1 | 13.85 |
| | 230AZ2 | 13.85 |
| 1φ FWB | 230AY3 | 31.50 |
| | 230AY1 | 47.25 |
| 3φ FWB | 230AL1 | 68.25 |
| | 230AL2 | 23.00 |
| | 230AL3 | 138.60 |
| | 230AG1 | 104.00 |
| | 230AJ1 | 115.50 |
| | 230AW1 | 34.65 |
| | 230BA1 | 141.75 |
| | 230BJ3 | 68.25 |
| | 230BJ4 | 141.75 |
| | 230BJ5 | 138.60 |

**FAST QUOTATIONS**
24 HOUR SERVICE ON CUSTOM BUILT RECTIFIERS.
SEND US YOUR SAMPLES.

**IN STOCK**
RECTIFIER TRANSFORMERS, HIGH CURRENT CHOKES, INVERTERS;
DC POWER SUPPLIES:
115V-220V Input 0-48VDC Output Current: 0-500 Amps

Complete Secondary Facilities for Specialized Equipment.
Custom Built Transformers and Chokes. Power Supplies to Your Specifications.

## FULL WAVE BRIDGE RECTIFIERS, SINGLE PHASE, RESISTIVE-INDUCTIVE LOADS

| Max. Amps | 18V In — 14V Out No. | Price | 36V In — 628V Out No. | Price | 54V In — 42V Out No. | Price | 130V In — 100V Out No. | Price | 160V In — 130V Out No. | Price | 260V In — 200V Out No. | Price |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ½ | A18 | $1.75 | A36 | $2.60 | A54 | $4.05 | A130 | $8.70 | A160 | $12.70 | A260 | $14.15 |
| 1 | B18 | 2.05 | B36 | 3.75 | B54 | 5.20 | B130 | 14.15 | B160 | 21.10 | B260 | 22.55 |
| 2 | C18 | 3.75 | C36 | 5.20 | C54 | 7.25 | C130 | 17.00 | C160 | 25.40 | C260 | 28.00 |
| 3 | D18 | 4.65 | D36 | 7.25 | D54 | 9.80 | D130 | 22.50 | D160 | 33.80 | D260 | 39.50 |
| 4 | E18 | 5.75 | E36 | 11.55 | E54 | 15.30 | E130 | 34.90 | E160 | 52.85 | E260 | 67.60 |
| 6 | F18 | 8.35 | F36 | 16.50 | F54 | 19.65 | F130 | 47.60 | F160 | 71.35 | F260 | 75.65 |
| 10 | G18 | 11.55 | G36 | 21.10 | G54 | 28.00 | G130 | 56.00 | G160 | 84.05 | G260 | 95.30 |
| 12 | H18 | 14.10 | H36 | 25.40 | H54 | 33.80 | H130 | 65.00 | H160 | * | H260 | 109.50 |
| 15 | J18 | 17.35 | J36 | 31.75 | J54 | 35.75 | J130 | 77.65 | J160 | * | J260 | 138.60 |
| 20 | K18 | 21.10 | K36 | 42.15 | K54 | 54.00 | K130 | 112.00 | K160 | * | K260 | 202.00 |
| 24 | L18 | 23.70 | L36 | 48.50 | L54 | 65.00 | L130 | 119.50 | L160 | * | L260 | 219.50 |
| 30 | M18 | 30.60 | M36 | 58.65 | M54 | 84.00 | M130 | * | M160 | 252.00 | M260 | * |
| 36 | P18 | 37.00 | P36 | 72.50 | P54 | * | P130 | * | P160 | * | P260 | * |
| 50 | R18 | 46.00 | R36 | 90.00 | R54 | * | R130 | 228.70 | R160 | * | R260 | * |

220V Single Phase available . . . up to 1000 amps.
HALF-WAVE, CENTER-TAP, DOUBLER, TRIPLER or 3-PHASE — Quotations on request.
Minimum Order — $25.00. *Prices on Request — Quantity Discount — Prices Subject to Change.

# HY-A-SIL HIGH-AMPERE SILICON RECTIFIERS

## FEATURES

- High Operating Temperature, 190°C (Up to 120°C ambient)
- High Operating Voltage (Up to 600 p.i.v.)
- High Efficiency (99% compared to about 75% for selenium)
- Excellent Regulation (4% compared to about 15% for selenium)

SL–PH–F

SL–BR–F

## CENTER-TAP

| Stock No. | AC Input Volts Up To | DC Output Volts Up To | Max. Amps Self Cooled | Max. Amps Fan Cooled | User Net Price |
|---|---|---|---|---|---|
| SI-CT-A | 18-0-18 | 16 | 40 | 80 | $19.70 |
| SI-CT-B | 36-0-36 | 32 | 40 | 80 | 25.50 |
| SL-CT-A | 18-0-18 | 16 | 50 | 100 | 23.10 |
| SL-CT-B | 36-0-36 | 32 | 50 | 100 | 28.90 |
| SL-CT-D | 72-0-72 | 64 | 50 | 100 | 46.20 |
| SL-CT-F | 140-0-140 | 125 | 50 | 100 | 56.70 |
| SK-CT-A | 18-0-18 | 16 | 100 | 200 | 38.35 |
| SK-CT-B | 36-0-36 | 32 | 100 | 200 | 44.10 |
| SK-CT-D | 72-0-72 | 64 | 100 | 200 | 47.50 |
| SK-CT-F | 140-0-140 | 125 | 100 | 200 | 61.50 |
| SM-CT-A | 18-0-18 | 16 | 200 | 400 | 57.75 |
| SM-CT-B | 36-0-36 | 32 | 200 | 400 | 76.40 |
| SM-CT-D | 72-0-72 | 64 | 200 | 400 | 79.80 |
| SM-CT-F | 140-0-140 | 125 | 200 | 400 | 97.15 |
| SO-CT-B | 36-0-36 | 32 | 400 | 800 | 127.00 |

## 3φ BRIDGE

| Stock No. | AC Input Volts Up To | DC Output Volts Up To | Max. Amps Self Cooled | Max. Amps Fan Cooled | User Net Price |
|---|---|---|---|---|---|
| SL-PH-A | 36 | 48 | 75 | 150 | $76.40 |
| SL-PH-B | 72 | 96 | 75 | 150 | 108.65 |
| SL-PH-C | 105 | 144 | 75 | 150 | 153.85 |
| SL-PH-D | 140 | 188 | 75 | 150 | 231.00 |
| SL-PH-E | 220 | 290 | 75 | 150 | 277.20 |
| SK-PH-E | 220 | 290 | 100 | 200 | 315.00 |
| SM-PH-E | 220 | 290 | 200 | 400 | 383.25 |
| SO-PH-E | 220 | 290 | 400 | 800 | 472.50 |

## 1φ BRIDGE

| Stock No | AC Input Volts Up To | DC Output Volts Up To | Max. Amps Self Cooled | Max. Amps Fan Cooled | User Net Price |
|---|---|---|---|---|---|
| SA-BR-D | 140 | 125 | 1 | * | $11.55 |
| SA-BR-F | 280 | 250 | 1 | * | 13.95 |
| SC-BR-D | 140 | 125 | 2 | * | 13.95 |
| SC-BR-F | 280 | 250 | 2 | * | 16.30 |
| SD-BR-A | 36 | 32 | 6 | 12 | 23.10 |
| SD-BR-D | 140 | 125 | 6 | 12 | 38.35 |
| SD-BR-F | 280 | 250 | 6 | 12 | 49.90 |
| SE-BR-A | 36 | 32 | 10 | 20 | 27.85 |
| SE-BR-D | 140 | 125 | 10 | 20 | 46.20 |
| SE-BR-F | 280 | 250 | 10 | 20 | 56.70 |
| SF-BR-A | 36 | 32 | 20 | 40 | 31.25 |
| SF-BR-D | 140 | 125 | 20 | 40 | 50.95 |
| SF-BR-F | 280 | 250 | 20 | 40 | 61.45 |
| SI-BR-A | 36 | 32 | 40 | 80 | 38.35 |
| SI-BR-B | 72 | 64 | 40 | 80 | 46.20 |
| SI-BR-C | 105 | 90 | 40 | 80 | 76.40 |
| SI-BR-D | 140 | 125 | 40 | 80 | 80.85 |
| SI-BR-F | 280 | 250 | 40 | 80 | 121.30 |
| SL-BR-A | 36 | 32 | 50 | 100 | 42.80 |
| SL-BR-B | 72 | 64 | 50 | 100 | 49.90 |
| SL-BR-D | 140 | 125 | 50 | 100 | 89.00 |
| SL-BR-F | 280 | 250 | 50 | 100 | 139.65 |
| SG-BR-A | 36 | 32 | 70 | 140 | 50.95 |
| SG-BR-B | 72 | 64 | 70 | 140 | 63.50 |
| SG-BR-D | 140 | 125 | 70 | 140 | 101.85 |
| SG-BR-F | 280 | 250 | 70 | 140 | 165.40 |
| SK-BR-A | 36 | 32 | 100 | 200 | 76.40 |
| SK-BR-B | 72 | 64 | 100 | 200 | 86.60 |
| SK-BR-D | 140 | 125 | 100 | 200 | 115.50 |
| SK-BR-F | 280 | 250 | 100 | 200 | 191.10 |
| SM-BR-A | 36 | 32 | 200 | 400 | 127.00 |
| SM-BR-B | 72 | 64 | 200 | 400 | 152.75 |
| SM-BR-D | 140 | 125 | 200 | 400 | 231.00 |
| SM-BR-F | 280 | 250 | 200 | 400 | 329.15 |
| SO-BR-B | 72 | 64 | 400 | 800 | 346.50 |
| SO-BR-F | 280 | 250 | 400 | 800 | 609.00 |

All above ratings based on 30°C ambient. Fan-cooled ratings based on air velocity of 1000 linear ft/minute. For resistive or inductive loads, as rated. For capacitive or battery loads, derate amperage 20%. Doublers, triplers, 3 phase half wave and 3 phase center-tap also available. Custom-built stacks, 24 hour service.

**MANUFACTURED BY**

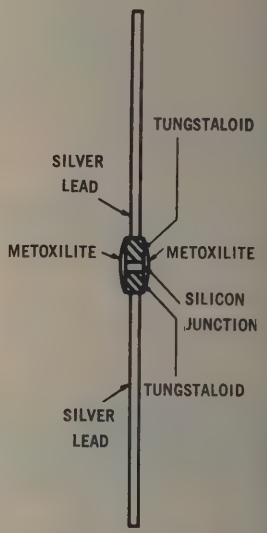
## SANFORD-MILLER CORP.

**DEPT. C78, 8 JOHN STREET**
**LYNBROOK, NEW YORK 11563**
**TELEPHONE: (516) 593-2025**

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

# METOXILITE LO-$V_F$ SUPER-FAST RECOVERY SILICON RECTIFIERS

A high efficiency fast recovery axial lead silicon rectifier for high frequency applications. Ideally suited as core drivers and design of high frequency converters. The Semtech Metoxilite case provides the ultimate in hermeticity and ruggedness. The metal oxides which form the outer case material are fused directly to the high temperature bonded tungstaloid pin junction assembly. The Super Fast Metoxilite is suitable for use in consumer, industrial, military and space programs.



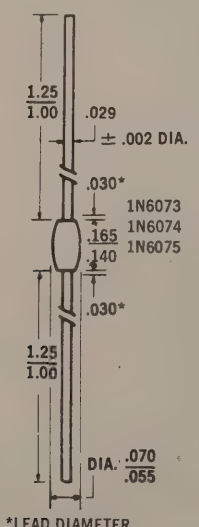

## *JEDEC (EIA) REGISTERED INFORMATION
## JAN, JANTX AND JTXV TO MIL-S-19500/503 (EL) ALSO AVAILABLE

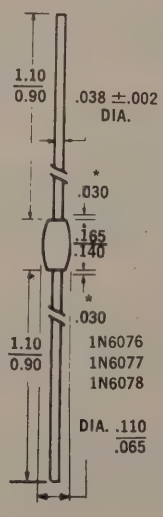
| Device Type | * Reverse Voltage | | Forward Current (1) | * Forward Current (2) | * Reverse Current (Max.) | | Instantaneous Forward Voltage (4) | * Instantaneous Forward Voltage (4) | * Capacitance @ 12V DC | * 1 Cycle Surge Current tp= 8.3 ms | * Reverse Recovery Time (3) | * Max. Thermal Impedance(5) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | $I_R$ | | $V_F$ @ $I_F$ =1.5 Adc | $V_F$ @ $I_F$ =9.4 A(pk) | | | $T_{rr}$ | $\theta_{J-L}$ | |
| | $V_R$ | $V_{RM}$ (WKg) | | | UAdc | | | | Pico-farads | A(pk) | ns | °C/Watt | |
| | Vdc | V(pk) | A | A | 25°C | 100°C | Vdc (Max.) | V(pk) Max. | Max. | $I_F$(Surge) | Max. | d=0 | d=.375 |
| 1N6073 | 50 | 50 | 1.5 | 3.0 | 1.0 | 50 | 1.2 | 2.04 | 24 | 35 | 30 | 13 | 46 |
| 1N6074 | 100 | 100 | 1.5 | 3.0 | 1.0 | 50 | 1.2 | 2.04 | 24 | 35 | 30 | 13 | 46 |
| 1N6075 | 150 | 150 | 1.5 | 3.0 | 1.0 | 50 | 1.2 | 2.04 | 24 | 35 | 30 | 13 | 46 |
| | | | | | | | 3.0 Adc | 18.8 A(pk) | | | | TECHNICAL BULLETIN R111 | |
| 1N6076 | 50 | 50 | 3.0 | 6.0 | 5.0 | 100 | 1.2 | 1.76 | 58 | 75 | 30 | 8.5 | 25 |
| 1N6077 | 100 | 100 | 3.0 | 6.0 | 5.0 | 100 | 1.2 | 1.76 | 58 | 75 | 30 | 8.5 | 25 |
| 1N6078 | 150 | 150 | 3.0 | 6.0 | 5.0 | 100 | 1.2 | 1.76 | 58 | 75 | 30 | 8.5 | 25 |
| | | | | | | | 5.0 Adc | 37.7 A(pk) | | | | TECHNICAL BULLETIN R112 | |
| 1N6079 | 50 | 50 | 5.0 | 12.0 | 10 | 500 | 0.97 | 1.5 | 230 | 175 | 30 | 5 | 23.5 |
| 1N6080 | 100 | 100 | 5.0 | 12.0 | 10 | 500 | 0.97 | 1.5 | 230 | 175 | 30 | 5 | 23.5 |
| 1N6081 | 150 | 150 | 5.0 | 12.0 | 10 | 500 | 0.97 | 1.5 | 230 | 175 | 30 | 5 | 23.5 |
| | | | | | | | | | | | | TECHNICAL BULLETIN R116 | |

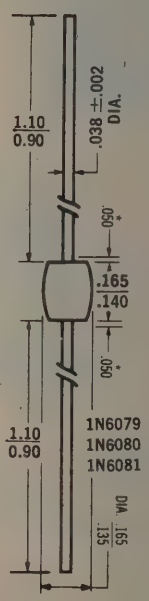
All temperatures are local ambient, 25°C unless otherwise specified.

NOTES: (1) At $T_L$ = 25°C, .375 inches from diode body.
(2) At $T_L$ = 70°C, 0 inches from diode body.
(3) Recovery Conditions: 0.5 amp forward current to 1.0 amp reverse current. Recovery time measured when rectifier recovers to 0.25 amp. See applications note AE103 and test info sheet 900132 (B).
(4) $V_F$ is measured at pulse $I_F$ duration — 8.0 milliseconds max.
(5) See back side of data sheet for max. power derating curves and $\theta_{J-L}$ information.

Operating and Storage Temperature −65°C to +150°C.



SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

# METOXILITE LO-CURRENT SILICON RECTIFIERS

Metoxilite is Semtech's new multipurpose high current axial lead silicon rectifier, ideally suited for small electronic package design. Through utilization of new design and manufacturing techniques, the Metoxilite device provides the ultimate in hermeticity and ruggedness. The metal oxides which form the outer case material are fused directly to the high temperature metallurgically bonded assembly. The Metoxilite device exceeds environmental requirements of current military and space program specifications. A general purpose rectifier suitable for all applications.

LEAD MATERIAL: 99.9% PURE SILVER IN ACCORDANCE WITH MIL-S-13282A, GRADE A

## MEDIUM RECOVERY ($t_{rr}$) 2 MICROSECONDS

| Device Type | Reverse Voltage | | Forward Current | Reverse Current (Max.) | | Instantaneous Forward Voltage | Repetitive Surge Current | 1 Cycle Surge Current tp = 8.3 ms | Reverse Recovery Time 1 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Free Air | $I_R$ | | $V_F$ @ $I_F$ = | | | Trr | |
| | $V_R$ | $V_{RM}$(wkg) | 55°C | UA dc | | 0.5 Adc | | A (pk) | μs | |
| | Vdc | V (pk) | A | 25°C | 100°C | Vdc | A (pk) | $I_F$(Surge) | Max. | Typ. |
| M2 | 200 | 200 | 0.5 | .200 | 15 | 1.1 | 5 | 25 | 2 | 1 |
| M4 | 400 | 400 | 0.5 | .200 | 15 | 1.1 | 5 | 25 | 2 | 1 |
| M6 | 600 | 600 | 0.5 | .200 | 15 | 1.1 | 5 | 25 | 2 | 1 |
| M8 | 800 | 800 | 0.5 | .200 | 15 | 1.1 | 5 | 25 | 2 | 1 |
| M0 | 1000 | 1000 | 0.5 | .200 | 15 | 1.1 | 5 | 25 | 2 | 1 |

TECHNICAL BULLETIN R99

## FAST RECOVERY

| Device Type | Reverse Voltage | | Forward Current | Reverse Current (Max.) | | Instantaneous Forward Voltage | Repetitive Surge Current | 1 Cycle Surge Current tp = 8.3 ms | Reverse Recovery Time 1 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Free Air | $I_R$ | | $V_F$ @ $I_F$ = | | | Trr | |
| | $V_R$ | $V_{RM}$(wkg) | 55°C | UA dc | | 0.5 Adc | | A (pk) | ns | |
| | Vdc | V (pk) | A | 25°C | 100°C | Vdc | A (pk) | $I_F$(Surge) | Max. | Typ. |
| F1 | 100 | 100 | 0.5 | .250 | 15 | 1.2 | 3 | 12.5 | 150 | 100 |
| F2 | 200 | 200 | 0.5 | .250 | 15 | 1.2 | 3 | 12.5 | 150 | 100 |
| F4 | 400 | 400 | 0.5 | .250 | 15 | 1.2 | 3 | 12.5 | 150 | 100 |
| F5 | 500 | 500 | 0.5 | .250 | 15 | 1.2 | 3 | 12.5 | 150 | 100 |

TECHNICAL BULLETIN R100

## VERY FAST RECOVERY

| Device Type | Reverse Voltage | | Forward Current | Reverse Current (Max.) | | Instantaneous Forward Voltage | Repetitive Surge Current | 1 Cycle Surge Current tp = 8.3 ms | Reverse Recovery Time 1 |
|---|---|---|---|---|---|---|---|---|---|
| | | | Free Air | $I_R$ | | $V_F$ @ $I_F$ = | | | $T_{rr}$ |
| | $V_R$ | $V_{RM}$(wkg) | 55°C | μA DC | | 0.5 Adc | | A(pk) | ns |
| | Vdc | V (pk) | A | 25°C | 100°C | Vdc Max. | A (pk) | $I_F$(Surge) | Max. |
| T1 | 100 | 100 | 0.5 | .250 | 15 | 1.2 | 3 | 12.5 | 100 |
| T2 | 200 | 200 | 0.5 | .250 | 15 | 1.2 | 3 | 12.5 | 100 |
| T3 | 300 | 300 | 0.5 | .250 | 15 | 1.2 | 3 | 12.5 | 100 |
| T4 | 400 | 400 | 0.5 | .250 | 15 | 1.2 | 3 | 12.5 | 100 |

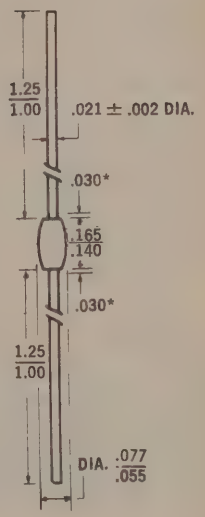
TECHNICAL BULLETIN R107

## (1N) TYPE

| Device Type | Reverse Voltage | | Forward Current | Reverse Current (Max.) | | Instantaneous Forward Voltage | Repetitive Surge Current | 1 Cycle Surge Current tp = 8.3 ms | Reverse Recovery Time 1 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Free Air | $I_R$ | | $V_F$ @ $I_F$ = | | | Trr | |
| | $V_R$ | $V_{RM}$(wkg) | 55°C | UA dc | | 0.4 Adc | | A (pk) | μs | |
| | Vdc | V (pk) | A | 25°C | 100°C | Vdc | A (pk) | $I_F$(Surge) | Max. | Typ. |
| 1N645 | 225 | 275 | 0.5 | 0.2 | 15 | 1.0 | 5 | 25 | 2 | 1 |
| 1N646 | 300 | 360 | 0.5 | 0.2 | 15 | 1.0 | 5 | 25 | 2 | 1 |
| 1N647 | 400 | 480 | 0.5 | 0.2 | 20 | 1.0 | 5 | 25 | 2 | 1 |
| 1N648 | 500 | 600 | 0.5 | 0.2 | 20 | 1.0 | 5 | 25 | 2 | 1 |
| 1N649 | 600 | 720 | 0.5 | 0.2 | 25 | 1.0 | 5 | 25 | 2 | 1 |

Available in JAN, JTX and JTXV 1N645-1, 1N647-1 and 1N649-1.

TECHNICAL BULLETIN R101




*Lead diameter uncontrolled in this area.

All temperatures are local ambient, 25°C unless otherwise specified.

NOTES: 1 Recovery Conditions: 0.5 amp forward current to −1.0 amp reverse current. Recovery time measured when rectifier recovers to −.25 amp. See Semtech Applications note and test procedure for details.

Operating and Storage Temperature −65°C to +175°C.

Semtech reserves the right to change specifications without notice.

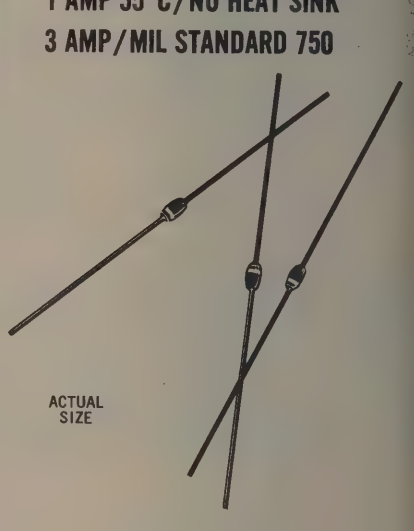
SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

# METOXILITE SILICON RECTIFIERS — ALSO AVAILABLE TO NEW MSFC/NASA AND MILITARY SPECIFICATIONS (JAN, JTX AND JTXV)

**200 TO 1000 VOLTS**
**LOW REVERSE LEAKAGE**
**SOLID INTERNAL CONSTRUCTION**
**SUPERIOR THERMAL SHOCK RESISTANCE**
**FOR NEW PACKAGING DESIGN**

A multi-purpose, high current axial lead silicon rectifier, ideally suited to maximize small electronic package designs. Metoxilite (fused metal oxides) is fused to the metallurgically bonded junction/tungsten-pin assembly forming a "tough" subminiature package. Hermetically sealed and designed to meet stringent temperature cycling, humidity and other environmental requirements per MIL-STD-750A. A general purpose rectifier for use in military, space, industrial and consumer product applications, such as: power supplies, AC to DC converters and control circuits.

**1 AMP 55°C/NO HEAT SINK**
**3 AMP/MIL STANDARD 750**




| Type No. | Peak Inverse Voltage | RMS Voltage | DC Blocking Voltage | Average Rectified Current | | Max. Static Forward Volt @ 1A | Max. Static Reverse Current | | Recurrent Surge | One Cycle Surge | Recovery Time ① | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 55°C | 100°C | 25°C | 25°C | 100°C | | | Max. | Typ. |
| | Volts | Volts | Volts | MA | MA | Volts | UA | UA | Amps | Amps | Usec | Usec |
| **MEDIUM RECOVERY ($t_{rr}$) 2 MICROSECONDS** | | | | | | | | | | | | |
| S2M | 200 | 140 | 200 | 1000 | 750 | 1.2 | 1 | 25 | 10 | 50 | 2 | 1 |
| S4M | 400 | 280 | 400 | 1000 | 750 | 1.2 | 1 | 25 | 10 | 50 | 2 | 1 |
| S6M | 600 | 420 | 600 | 1000 | 750 | 1.2 | 1 | 25 | 10 | 50 | 2 | 1 |
| S8M | 800 | 560 | 800 | 1000 | 750 | 1.2 | 1 | 25 | 10 | 50 | 2 | 1 |
| S0M | 1000 | 700 | 1000 | 1000 | 750 | 1.2 | 1 | 25 | 10 | 50 | 2 | 1 |
| **FAST RECOVERY NANOSECOND REVERSE RECOVERY** | | | | | | | | | | | | |
| S2F | 200 | 140 | 200 | 1000 | 750 | 1.2 | 1 | 25 | 6 | 25 | .150 | .100 |
| S4F | 400 | 280 | 400 | 1000 | 750 | 1.2 | 1 | 25 | 6 | 25 | .150 | .100 |
| S6F | 600 | 420 | 600 | 1000 | 750 | 1.2 | 1 | 25 | 6 | 25 | .250 | .175 |
| S8F | 800 | 560 | 800 | 1000 | 750 | 1.2 | 1 | 25 | 6 | 25 | .300 | .200 |
| S0F | 1000 | 700 | 1000 | 1000 | 750 | 1.2 | 1 | 25 | 6 | 25 | .500 | .250 |

TECHNICAL BULLETIN R69

TECHNICAL BULLETIN R68

Operating and storage temperature —193.8°C to +200°C

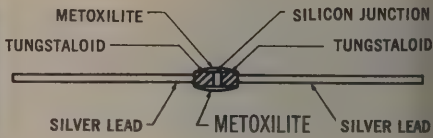
① Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current. Recovery time measured when rectifier recovers to.25 amp.

## (1N) TYPE

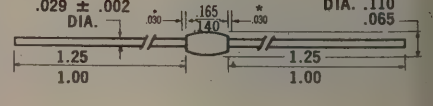
| Device Type ① | Reverse Voltage | | Forward Current ② Free Air | Reverse Current (Max.) $I_R$ | | Instantaneous Forward Voltage $V_F$ @ $I_F$= | Repetitive Surge Current | 1 Cycle Surge Current tp=8.3m Sec. | Reverse Recovery Time ③ Trr | | Thermal Impedance θJ—L | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_R$ | $V_{RM}$(wkg) | 55°C | UAdc | | 1.0Adc | | A(pk) | μSec | | °C/Watt | |
| | Vdc | V(pk) | A | 25°C | 100°C | Vdc | A(pk) | $I_F$(surge) | Max. | Typ. | d=0 | d=.375 |
| **MEDIUM RECOVERY ($t_{rr}$) 2 MICROSECONDS** | | | | | | | | | | | | |
| 1N5614 | 200 | 200 | 1.0 | 0.5 | 25 | 1.2 | 10 | 50 | 2 | 1 | 7 | 33 |
| 1N5616 | 400 | 400 | 1.0 | 0.5 | 25 | 1.2 | 10 | 50 | 2 | 1 | 7 | 33 |
| 1N5618 | 600 | 600 | 1.0 | 0.5 | 25 | 1.2 | 10 | 50 | 2 | 1 | 7 | 33 |
| 1N5620 | 800 | 800 | 1.0 | 0.5 | 25 | 1.2 | 10 | 50 | 2 | 1 | 7 | 33 |
| 1N5622 | 1000 | 1000 | 1.0 | 0.5 | 25 | 1.2 | 10 | 50 | 2 | 1 | 7 | 33 |
| **FAST RECOVERY NANOSECOND REVERSE RECOVERY** | | | | | | | | | | | | |
| 1N5615 | 200 | 200 | 1.0 | 0.5 | 25 | 1.2 | 6 | 25 | .150 | .100 | 7 | 33 |
| 1N5617 | 400 | 400 | 1.0 | 0.5 | 25 | 1.2 | 6 | 25 | .150 | .100 | 7 | 33 |
| 1N5619 | 600 | 600 | 1.0 | 0.5 | 25 | 1.2 | 6 | 25 | .250 | .175 | 7 | 33 |
| 1N5621 | 800 | 800 | 1.0 | 0.5 | 25 | 1.2 | 6 | 25 | .300 | .200 | 7 | 33 |
| 1N5623 | 1000 | 1000 | 1.0 | 0.5 | 25 | 1.2 | 6 | 25 | .500 | .250 | 7 | 33 |

TECHNICAL BULLETIN R76

TECHNICAL BULLETIN R77




LEAD MATERIAL: 99.9% PURE SILVER
IN ACCORDANCE WITH MIL-S-13282A, GRADE A




*LEAD DIAMETER UNCONTROLLED IN THIS AREA

All temperatures are local ambient, 25°C unless otherwise specified.

NOTES: ① Types 1N5614, 16, 18, 20, 22 available in accordance with MIL-S-19500/427. Types 1N5615, 17, 19, 21, 23 available in accordance with MIL-S-19500/429.

② The 1.0 amp rating @ 55°C requires no heat sinking, special mounting, or forced air across the body of the device.

③ Recovery conditions: 0.5 amp forward current to —1.0 amp reverse current recovery time measured when rectifier recovers to —.25 amp. See Semtech Applications note and test procedure for details.

Operating and Storage Temperature —193.8°C to +200°C

For all types on this page: THERMAL RESISTANCE from junction to heat sink θJL = 33°C/W with (d) length of lead from body to heat sink .375 inches.

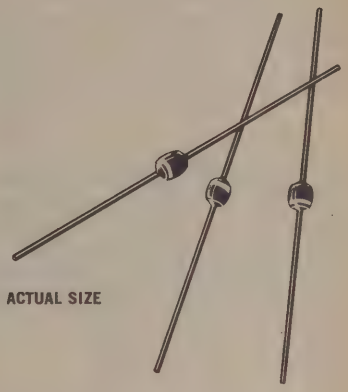
Semtech reserves the right to change specifications without notice.

**SEMTECH**
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

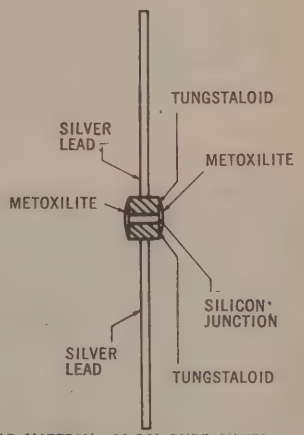
# METOXILITE SILICON RECTIFIERS

## HIGH CURRENT AXIAL LEADS

3 AMP 55°C/NO HEAT SINK
6 AMP/MIL STANDARD 750


ACTUAL SIZE

| Type ① | Peak Inverse Voltage | RMS Voltage | DC Blocking Voltage | Average Rectified Current | | Max. Static Forward Volt @ 3A | Max. Static Reverse Current | | Recurrent Surge | One Cycle Surge | Recovery Time ② | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 55°C | 100°C | 25°C | 25°C | 100°C | | | Max. | Typ. |
| | Volts | Volts | Volts | Amps | Amps | Volts | μA | μA | Amps | Amps | μsec | μsec |
| **MEDIUM RECOVERY ($t_{rr}$) 2 MICROSECONDS** | | | | | | | | | | | | |
| 3SM2 | 200 | 140 | 200 | 3 | 2 | 1.0 | 1 | 20 | 25 | 150 | 2 | 1 |
| 3SM4 | 400 | 280 | 400 | 3 | 2 | 1.0 | 1 | 20 | 25 | 150 | 2 | 1 |
| 3SM6 | 600 | 420 | 600 | 3 | 2 | 1.0 | 1 | 20 | 25 | 150 | 2 | 1 |
| 3SM8 | 800 | 560 | 800 | 3 | 2 | 1.1 | 1 | 20 | 25 | 150 | 2 | 1 |
| 3SM0 | 1000 | 700 | 1000 | 3 | 2 | 1.1 | 1 | 20 | 25 | 150 | 2 | 1 |
| TECHNICAL BULLETIN R67 | | | | | | | | | | | | |
| **FAST RECOVERY NANOSECOND REVERSE RECOVERY** | | | | | | | | | | | | |
| 3SF1 | 100 | 70 | 100 | 3 | 2 | 1.1 | 1 | 20 | 25 | 150 | .150 | .100 |
| 3SF2 | 200 | 140 | 200 | 3 | 2 | 1.1 | 1 | 20 | 25 | 150 | .150 | .100 |
| 3SF4 | 400 | 280 | 400 | 3 | 2 | 1.1 | 1 | 20 | 25 | 150 | .150 | .100 |
| TECHNICAL BULLETIN R66 | | | | | | | | | | | | |
| **LO-VF FAST RECOVERY ($t_{rr}$) 100 NANOSECONDS** | | | | | | | | | | | | |
| 3L03 | 30 | 28 | 30 | 3 | 2 | 0.9 | 1 | 20 | 25 | 150 | .100 | .080 |
| 3L05 | 50 | 35 | 50 | 3 | 2 | 0.9 | 1 | 20 | 25 | 150 | .100 | .080 |
| TECHNICAL BULLETIN R93 | | | | | | | | | | | | |

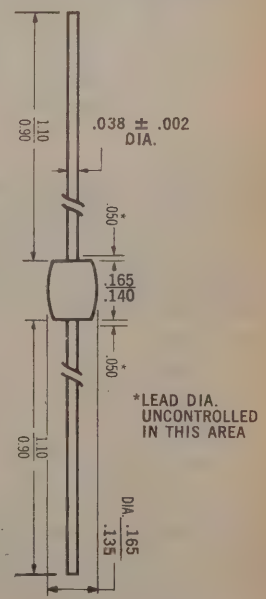



LEAD MATERIAL: 99.9% PURE SILVER IN ACCORDANCE WITH MIL-S-13282A, GRADE A

For all types on this page: THERMAL RESISTANCE from junction to heat sink $\theta JL$ = 20°C/W with (d) length of lead from body to heat sink .375 inches.

## (1N) TYPE

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MEDIUM RECOVERY ($t_{rr}$) 2 MICROSECONDS** | | | | | | | | | | | | |
| 1N5550 | 200 | 140 | 200 | 3 | 2 | 1.0 | 1 | 20 | 25 | 150 | 2 | 1 |
| 1N5551 | 400 | 280 | 400 | 3 | 2 | 1.0 | 1 | 20 | 25 | 150 | 2 | 1 |
| 1N5552 | 600 | 420 | 600 | 3 | 2 | 1.0 | 1 | 20 | 25 | 150 | 2 | 1 |
| 1N5553 | 800 | 560 | 800 | 3 | 2 | 1.1 | 1 | 20 | 25 | 150 | 2 | 1 |
| 1N5554 | 1000 | 700 | 1000 | 3 | 2 | 1.1 | 1 | 20 | 25 | 150 | 2 | 1 |
| TECHNICAL BULLETIN R78 | | | | | | | | | | | | |
| **FAST RECOVERY NANOSECOND REVERSE RECOVERY** | | | | | | | | | | | | |
| 1N5415 | 50 | 35 | 50 | 3 | 2 | 1.1 | 1 | 20 | 25 | 150 | .150 | .100 |
| 1N5416 | 100 | 70 | 100 | 3 | 2 | 1.1 | 1 | 20 | 25 | 150 | .150 | .100 |
| 1N5417 | 200 | 140 | 200 | 3 | 2 | 1.1 | 1 | 20 | 25 | 150 | .150 | .100 |
| 1N5418 | 400 | 280 | 400 | 3 | 2 | 1.1 | 1 | 20 | 25 | 150 | .150 | .100 |
| 1N5419 | 500 | 350 | 500 | 3 | 2 | 1.1 | 1 | 20 | 25 | 150 | .250 | .200 |
| TECHNICAL BULLETIN R79 | | | | | | | | | | | | |
| **LO-VF FAST RECOVERY** | | | | | | | | | | | | |
| 1N5835 | 30 | 28 | 30 | 3 | 2 | 0.9 | 1 | 20 | 25 | 150 | .100 | .080 |
| 1N5836 | 50 | 35 | 50 | 3 | 2 | 0.9 | 1 | 20 | 25 | 150 | .100 | .080 |
| TECHNICAL BULLETIN R104 | | | | | | | | | | | | |




*LEAD DIA. UNCONTROLLED IN THIS AREA

All temperatures are local ambient, 25°C unless otherwise specified.

NOTES: ① Types 1N5550-54 available in accordance with MIL-S-19500/420.
Types 1N5415-19 available in accordance with MIL-S-19500/411.
Types 1N5835-36 available in accordance with MIL-S-19500/484 (EL).

② Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current.
Recovery time measured when rectifier recovers to .25 amp.

The 3 amp rating @ 55°C requires no heat sinking, special mounting, or forced air across the body of the device.

Operating and storage temperature −193.8°C to +200°C.

Semtech reserves the right to change specifications without notice.

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

# OTHER JAN TYPE SILICON RECTIFIERS

Semtech Corporation provides a multipurpose Hermetic Seal Silicon Rectifier incorporating advance design and engineering techniques never before available to the electronics industry at a nominal cost. This new rectifier utilizes solid internal construction with a package combining high mechanical strength, superior thermal shock resistance, rugged hermetic seal, high dielectric strength and excellent thermal conductivity properties.

REFER TO INFORMATION ON METOXILITE SILICON RECTIFIERS FOR DEVICES THAT ARE AVAILABLE TO NEW MSFC/NASA AND MILITARY SPECIFICATIONS.

## GENERAL PURPOSE MIL-S-19500/286C including JAN, TX and TXV

NOTE: 1 $T_{rr}$ 2 μsec.

| Device Type | Reverse Voltage | | Forward Current ① | Reverse Current Max. | | Instantaneous Forward Voltage | Repetitive Surge Current | 1 Cycle Surge Current tp = 8.3 ms | Reverse Recovery Time ② | | Typ. Thermal Impedance ③ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_R$ | $V_{RM}$ (Wkg) | Free Air 55° | $I_R$ UAdc | | $V_F$ @ $I_F$ = 1.0 Adc | | A (pk) | $T_{rr}$ μs | | $\theta_{j-L}$ °C/Watt | |
| | Vdc | V (pk) | A | 25°C | 100°C | Vdc | A (pk) | $I_F$ (Surge) | Max. | Typ. | d=0 | d=.375 |
| 1N4245 | 200 | 200 | 1.0 | 1.0 | 25 | 1.2 | 10 | 50 | 2 | 1 | 7 | 33 |
| 1N4246 | 400 | 400 | 1.0 | 1.0 | 25 | 1.2 | 10 | 50 | 2 | 1 | 7 | 33 |
| 1N4247 | 600 | 600 | 1.0 | 1.0 | 25 | 1.2 | 10 | 50 | 2 | 1 | 7 | 33 |
| 1N4248 | 800 | 800 | 1.0 | 1.0 | 25 | 1.2 | 10 | 50 | 2 | 1 | 7 | 33 |
| 1N4249 | 1000 | 1000 | 1.0 | 1.0 | 25 | 1.2 | 10 | 50 | 2 | 1 | 7 | 33 |

All temperatures are local ambient, 25°C unless otherwise specified.

TECHNICAL BULLETIN R90

NOTES: ① The 1.0 amp rating @ 55°C requires no heat sinking, special mounting, or forced air across the body of the device.
② Recovery Conditions: 0.5 amp forward current to −1.0 amp reverse current. Recovery time measured when rectifier recovers to −.25 amp. See Semtech Applications note and test procedure for details.
③ See back side of data sheet for maximum power derating curves and $\theta_{j-L}$ information.
Operating Temperature −193.8°C to +175°C.
Storage Temperature −193.8°C to +200°C.

## FAST RECOVERY MIL-S-19500/359B (USAF) including JAN, TX and TXV

| Device Type | Reverse Voltage | | Forward Current ① | Reverse Current Max. | | Forward Voltage | Repetitive Surge Current | 1 Cycle Surge Current tp = 8.3 ms | Reverse Recovery Time ② | | Typ. Thermal Impedance ③ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_R$ | $V_{RM}$ (Wkg) | Free Air 55° | $I_R$ UAdc | | $V_F$ @ $I_F$ = 1.0 Adc | | A (pk) | $T_{rr}$ ns | | $\theta_{j-L}$ °C/Watt | |
| | Vdc | V (pk) | A | 25°C | 100°C | Vdc | A (pk) | $I_F$ (Surge) | Max. | Typ. | d=0 | d=.375 |
| *1N4942 | 200 | 200 | 1.0 | 1.0 | 25 | 1.2 | 6 | 25 | 150 | 100 | 7 | 33 |
| 1N4943 | 300 | 300 | 1.0 | 1.0 | 25 | 1.2 | 6 | 25 | 150 | 100 | 7 | 33 |
| *1N4944 | 400 | 400 | 1.0 | 1.0 | 25 | 1.2 | 6 | 25 | 150 | 100 | 7 | 33 |
| 1N4945 | 500 | 500 | 1.0 | 1.0 | 25 | 1.2 | 6 | 25 | 250 | 175 | 7 | 33 |
| *1N4946 | 600 | 600 | 1.0 | 1.0 | 25 | 1.2 | 6 | 25 | 250 | 175 | 7 | 33 |
| *1N4947 | 800 | 800 | 1.0 | 1.0 | 25 | 1.2 | 6 | 25 | 300 | 200 | 7 | 33 |
| *1N4948 | 1000 | 1000 | 1.0 | 1.0 | 25 | 1.2 | 6 | 25 | 500 | 250 | 7 | 33 |

* Supplied as JAN or JAN-TX.

All temperatures are local ambient, 25°C unless otherwise specified.

TECHNICAL BULLETIN R89

NOTES: ① The 1.0 amp rating @ 55°C requires no heat sinking, special mounting, or forced air across the body of the device.
② Recovery Conditions: 0.5 amp forward current to −1.0 amp reverse current. Recovery time measured when rectifier recovers to −.25 amp. See Semtech Applications note and test procedure for details.
③ See back side of data sheet for maximum power derating curves and $\theta_{j-L}$ information.
Operating Temperature −193.8°C to +175°C.
Storage Temperature −193.8°C to +200°C.

## supplied to MIL-S-19500/228E including JAN AND TX

| Type No. | $V_r$ Peak Inverse Voltage | $V_{RM}$ (Wkg.) | Average Rectified Current | | Forward Voltage @ 1A | Max. Static Reverse Current @ PIV | | *if (surge) (at:1/120 sec.) |
|---|---|---|---|---|---|---|---|---|
| | | | $T_A$ = 100°C | $T_A$ = 150°C | (pk) | 25°C | 150°C | |
| | V (pk) | V (pk) | MA | MA | Volts | μA | μA | Amps |
| 1N3611 | 240 | 200 | 1000 | 300 | 1.1 | 1 | 300 | 20 |
| 1N3612 | 480 | 400 | 1000 | 300 | 1.1 | 1 | 300 | 20 |
| 1N3613 | 720 | 600 | 1000 | 300 | 1.1 | 1 | 300 | 20 |
| 1N3614 | 920 | 800 | 1000 | 300 | 1.1 | 1 | 300 | 20 |
| 1N3957 | 1150 | 1000 | 1000 | 300 | 1.1 | 1 | 300 | 20 |

All temperatures are local ambient, 25°C unless otherwise specified.

TECHNICAL BULLETIN R40

Operating Ambient Temperature −65°C to +175°C

Storage Temperature −65°C to +200°C

Barometric Pressure, Reduced 8 mm Hg — 1N3611, 1N3612 and 1N3613; 54 mm Hg — 1N3614; 87 mm Hg — 1N3957.

*$T_A$ = +150°C if (surge = 30 Adc) 10 surges of 8.0 msec duration each, at intervals of 1 minute. $I_O$ = 300 mAdc.

Semtech reserves the right to change specifications without notice.

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

## MINI-METOXILITE HIGH VOLTAGE SILICON RECTIFIERS

Semtech offers "Ministac" a sub-miniature multipurpose high voltage silicon rectifier. Better electrical characteristics obtained by Semtech's unique construction. Hermetically sealed and designed to meet requirements of military, industrial and consumer-product applications. Ideally suited for low current high voltage applications and multiplier circuits.

** OUTLINE 01 * "A" SUFFIX PARTS .270 / .180

LEAD MATERIAL: 99.9% PURE SILVER IN ACCORDANCE WITH MIL-S-13282A, GRADE A

| Type No. | Peak Inverse Voltage | Max. Static Forward Voltage | Average Rectified Current (Milliamps) 55°C | 100°C | 150°C | Max. Static Reverse Current @ PIV 25°C µAdc | 100°C µAdc | One Cycle Surge Amps | Recurrent Surge Amps | Max. Recovery Time ① trr Nsec. | Max. Junction Capacitance @ 100 Volts Picofarads |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **METOXILITE MEDIUM RECOVERY (OUTLINE 01)**** | | | | | | | | | | | |
| | | @ 125 MA | | | | | | | | | |
| M20 | 2000 | 5 | 125 | 67 | 10 | .100 | 7.0 | 7 | 1.25 | 2000 | 2.0 |
| M30 | 3000 | 5 | 125 | 67 | 10 | .100 | 7.0 | 7 | 1.25 | 2000 | 2.0 |
| M40 | 4000 | 5 | 125 | 67 | 10 | .100 | 7.0 | 7 | 1.25 | 2000 | 2.0 |
| | | @ 50 MA | | | | | | | | | |
| M50A** | 5000 | 6 | 50 | 25 | 5 | .250 | 10.0 | 5 | 1.00 | 5000 | 2.0 |
| M60A** | 6000 | 6 | 50 | 25 | 5 | .250 | 10.0 | 5 | 1.00 | 5000 | 2.0 |
| **METOXILITE FAST RECOVERY NANOSECOND REVERSE RECOVERY (OUTLINE 01)**** | | | | | | | | | | | |
| | | @ 100 MA | | | | | | | | | |
| F15 | 1500 | 5 | 100 | 50 | 5 | .100 | 7.0 | 5 | 1.25 | 250 | 2.0 |
| F20 | 2000 | 5 | 100 | 50 | 5 | .100 | 7.0 | 5 | 1.25 | 250 | 2.0 |
| F25 | 2500 | 5 | 100 | 50 | 5 | .100 | 7.0 | 5 | 1.25 | 250 | 2.0 |
| F30 | 3000 | 5 | 100 | 50 | 5 | .250 | 10.0 | 5 | 1.25 | 250 | 2.0 |
| | | @ 50 MA | | | | | | | | | |
| F40A ** | 4000 | 8 | 50 | 25 | 2.5 | .250 | 10.0 | 2.5 | .75 | 300 | 2.0 |
| F50A ** | 5000 | 8 | 50 | 25 | 2.5 | .250 | 10.0 | 2.5 | .75 | 300 | 2.0 |
| F60A ** | 6000 | 8 | 50 | 25 | 2.5 | .250 | 10.0 | 2.5 | .75 | 300 | 2.0 |

TECHNICAL BULLETIN R96

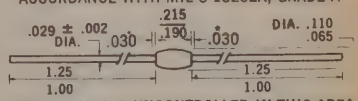
TECHNICAL BULLETIN R97

① Recovery conditions: 50 MA forward current to 100 MA reverse current.
Recovery time measured when rectifier recovers to 25 MA.
Operating and Storage Temperature −193.8°C to +200°C.

## SEMTECH METOXILITE SUB-MINIATURE HIGH VOLTAGE SILICON RECTIFIERS

Available in Metoxilite, Semtech's new sub-miniature multipurpose high voltage axial lead silicon rectifier, ideally suited for small electronic package design. The Metoxilite device exceeds environmental requirements of current military and space program specifications.

LEAD MATERIAL: 99.9% PURE SILVER IN ACCORDANCE WITH MIL-S-13282A, GRADE A




*LEAD DIAMETER UNCONTROLLED IN THIS AREA

| Type No. | Peak Inverse Voltage | RMS (Sine Wave) Voltage | DC Blocking Voltage | Average Rectified Current 55°C MA | 100°C MA | 150°C MA | Maximum Static Forward Voltage 100 MA 25°C Volts | Maximum Static Reverse Current @ PIV 25°C µA | 100°C µA | Recurrent Surge Amps | One Cycle Surge Amps | *Reverse Recovery Time Trr Max. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MEDIUM RECOVERY** | | | | | | | | | | | | |
| SM20 | 2000 | 1400 | 2000 | 250 | 150 | 50 | 4.0 | 1 | 25 | 2.5 | 10 | |
| SM25 | 2500 | 1750 | 2500 | 250 | 150 | 50 | 4.0 | 1 | 25 | 2.5 | 10 | |
| SM30 | 3000 | 2100 | 3000 | 250 | 150 | 50 | 4.0 | 1 | 25 | 2.5 | 10 | |
| **FAST RECOVERY** | | | | | | | | | | | | |
| S15F | 1500 | 1050 | 1500 | 250 | 150 | 50 | 4.0 | 1 | 25 | 2.5 | 10 | 300 ns |
| S20F | 2000 | 1400 | 2000 | 250 | 150 | 50 | 4.0 | 1 | 25 | 2.5 | 10 | 300 ns |
| S25F | 2500 | 1750 | 2500 | 250 | 150 | 50 | 4.0 | 1 | 25 | 2.5 | 10 | 300 ns |
| **JAN and TX can be supplied to meet MIL-S-19500/279A** | | | | | | | | | | | | |
| 1N3643 | 1000 | 700 | 1000 | 250 | 150 | — | 3.5 | 1 | 20 | 2.5 | 14 | — |
| 1N3644 | 1500 | 1050 | 1500 | 250 | 150 | — | 3.5 | 1 | 20 | 2.5 | 14 | — |
| 1N3645 | 2000 | 1400 | 2000 | 250 | 150 | — | 3.5 | 1 | 20 | 2.5 | 14 | — |
| 1N3646 | 2500 | 1750 | 2500 | 250 | 150 | — | 3.5 | 1 | 20 | 2.5 | 14 | — |
| 1N3647 | 3000 | 2100 | 3000 | 250 | 150 | — | 3.5 | 1 | 20 | 2.5 | 14 | — |

TECHNICAL BULLETIN R94

TECHNICAL BULLETIN R95

TECHNICAL BULLETIN R55

*Reverse Recovery (Trr) Conditions.
50 MA forward current to 100 MA reverse current.
Recovery time measured when rectifier recovers to 25 MA.
Operating Temperature −65°C to +175°C
Storage Temperature −65°C to +200°C

Operating Temperature −65°C to +175°C
Storage Temperature −193.8°C to +200°C
Altitude Operation (Barometric Pressure Reduced) 40,000 ft.

Semtech reserves the right to change specifications without notice.

**SEMTECH**
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

# METOXILITE "MINISTIC" HIGH VOLTAGE SILICON RECTIFIERS — FAST RECOVERY

Semtech Corporation introduces a new Sub-Sub-Miniature High Voltage Metoxilite Rectifier. Ideally suited for low current high voltage applications and multiplier circuits. Improved reverse leakage and reverse recovery parameters at elevated temperatures. A silicon multi-junction device utilizing a high temperature tungsten pin bonded construction with expansion coefficients matched. The void-free, solid monolithic technology results in corona-free operation. The Metoxilite hermetic seal meets or exceeds stringent temperature cycling and humidity requirements of military, space, industrial and consumer-product applications.

| Type No. | Peak Inverse Voltage | Max. Static FWD. Voltage @ 10 mA | Average Rectified Current 25°C | ① Max. Static Rev. Current @ PIV 25°C | ① Max. Static Rev. Current @ 2/3 PIV 100°C | ② One Cycle Surge | ③ Recovery Time | Max. Junction Cap. at 100V |
|---|---|---|---|---|---|---|---|---|
| | Volts | Volts | mA | μA | μA | Amps | NS | PF |
| FM50 | 5,000 | 10 | 25 | 1.0 | 10 | 2 | 300 | 2.0 |
| FM75 | 7,500 | 10 | 25 | 1.0 | 10 | 2 | 300 | 2.0 |
| FM100 | 10,000 | 20 | 10 | 1.0 | 10 | 2 | 300 | 1.0 |
| FM150 | 15,000 | 20 | 10 | 1.0 | 10 | 2 | 300 | 1.0 |

TECHNICAL BULLETIN R125

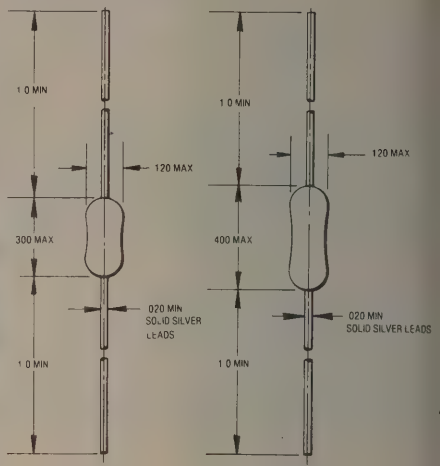
Operating Junction Temperature range: −65°C to +150°C. Storage Temperature range: −65°C to +175°C.

① At typical room lighting (50 to 75 foot candles, fluorescent type)

② $I_{fsm}$ @ 8.3 ms ½ sine wave

③ Recovery conditions: 5 MA forward current to 10 MA reverse current. Recovery time measured when rectifier recovers to 2.5 MA.

NOTE: When utilized at maximum PIV ratings subminiature high voltage rectifiers should be used in oil environment or encapsulated in epoxy or other types of conformal coatings.




FM50 FM75 FM100 FM150

# GENERAL PURPOSE

| Type No. | Peak Inverse Voltage | D.C. Blocking Voltage | Avg. Rectified Current in Oil For "A" Mounting | Maximum Static Forward Voltage @ 100 mA | ① Typ. Static Reverse Current @ PIV | | ② One Cycle Surge | Typ. Cap. @ 100 V. 1 MHz |
|---|---|---|---|---|---|---|---|---|
| | 25°C | 25°C | 55°C (oil) | 25°C | 25°C | 100°C | 25°C | 25°C |
| | Volts | Volts | mA | Volts | μA | μA | Amps | pF |
| SH75 | 7,500 | 7,500 | 200 | 12 | 1.0 | 15 | 25 | 0.75 |
| SH100 | 10,000 | 10,000 | 200 | 12 | 1.0 | 15 | 25 | 0.75 |

TECHNICAL BULLETIN R124

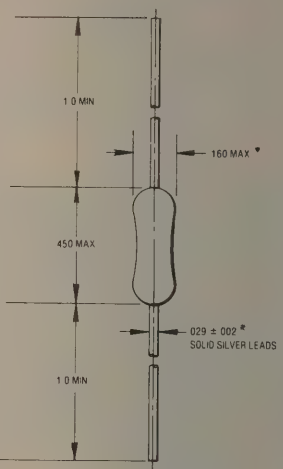
Operating Junction Temperature range: −65°C to +150°C. Storage Temperature range: −65°C to +175°C.

① At typical room lighting (50 to 75 foot candles, fluorescent type)

② $I_{fsm}$ @ 8.3 ms ½ sine wave

③ Avalanche test 100 μA for 100 millisec. @ 25°C.

NOTE: When utilized at maximum PIV ratings sub-miniature high voltage rectifiers should be used in oil environment or encapsulated in epoxy or other types of conformal coatings.
Above available in fast recovery with TRR 300 nsec as Types SH75F and SH100F.




SH75 SH100

# "MINISTIC" FAST RECOVERY HIGH VOLTAGE ASSEMBLIES

Semtech Corporation offers "MINISTIC" Sub-miniature multipurpose high voltage silicon rectifier assemblies; Cylindrical in design with insulated case for simple handling and installation. Better electrical characteristics obtained by Semtech's unique construction. Hermetically sealed and designed to meet requirements of industrial and consumer product applications. Ideally suited for low current high voltage applications and multiplier circuits.

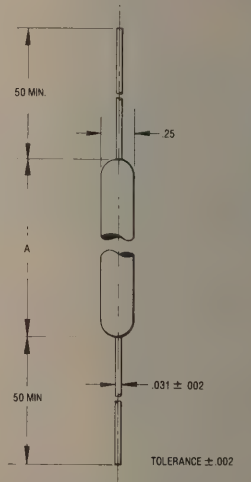
| Type No. | Peak Inverse Voltage | Average Rectified Current 55°C | Average Rectified Current 100°C | One Cycle Surge Current 25°C | Reverse Current @ PIV 25°C | Reverse Current @ 2/3 PIV 100°C | Max. Forward @ 10 MA 25°C | ① Reverse Recovery Time Max. | Case Length Inches |
|---|---|---|---|---|---|---|---|---|---|
| | Volts | MA | MA | Amps | UA | UA | Volts | Nsec. | A |
| SMFR20K | 20,000 | 20 | 10 | 2.0 | 1.0 | 10 | 40 | 300 | 1.375 |
| SMFR30K | 30,000 | 20 | 10 | 2.0 | 1.0 | 10 | 60 | 300 | 2.0 |

TECHNICAL BULLETIN H72

Storage Temperature: −55°C to +150°C.
Operating Temperature: −55°C to +150°C.

① Recovery conditions: 5 MA forward current to 10 MA reverse current. Recovery time measured when rectifier recovers to 2.5 MA.

NOTE: When utilized at maximum PIV ratings subminiature high voltage rectifiers should be used in oil environment or encapsulated in epoxy or other types of conformal coatings.
Above available with Io of 50 MA at 55°C as Types SMHF20K and SMHF30K




SMFR20K SMFR30K

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

# BI-POLARITY SILICON TRANSIENT SUPPRESSORS

This new series of silicon bi-polarity transient suppressors is unique in that a single device will provide voltage transient protection symetrically (i.e., provide protection for A.C. signals in addition to D.C.). This new series of devices has peak pulse power ratings of 500 or 1500 watts for 1 millisecond and its response time is effectively instantaneous (less than 1 x $10^{-12}$ sec.). Therefore, these versatile devices have many protection applications where large voltage transients can permanently damage voltage-sensitive components. Its response time affords protection for integrated circuits, MOS devices, hybrids, and many other voltage-sensitive components. The devices are encased in Semtech's Metoxilite, fused directly to the high temperature metallurgically bonded assembly. For use in commercial, industrial, military and space programs.

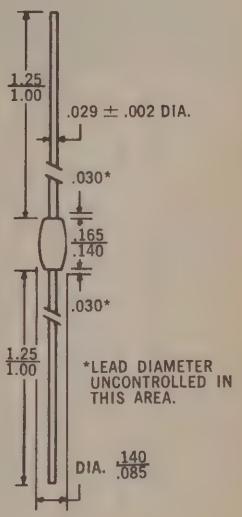
**Characteristics @ 25°C applies in either direction.**

**Can be supplied as JAN, JANTX, or JANTXV to MIL-S-19500/516 (EL).**

## 500 WATT PEAK PULSE POWER

| Series Type | Breakdown Voltage $V_{(BR)}$ | | Test Current $I_T$ | Working Peak Voltage $V_M$ (wkg) | Maximum Leakage Current $I_L$ | Maximum Peak Surge Voltage $V_{SM}$ | Maximum Peak Surge Current $I_{SM}$ | Maximum Temp. Coeff. of $V_{(BR)}$ |
|---|---|---|---|---|---|---|---|---|
| 500W | Vdc Min. | Vdc Max. | mAdc | Vdc | μAdc | V(pk) | A(pk) | %/°C |
| 1N6102 | 6.12 | 7.48 | 175 | 5.2 | 100 | 11.0 | 45.4 | .05 |
| 1N6103 | 6.75 | 8.25 | 175 | 5.7 | 50 | 11.8 | 42.4 | .06 |
| 1N6104 | 7.38 | 9.02 | 150 | 6.2 | 20 | 12.7 | 39.4 | .06 |
| 1N6105 | 8.19 | 10.01 | 150 | 6.9 | 20 | 14.0 | 35.7 | .06 |
| 1N6106 | 9.00 | 11.00 | 125 | 7.6 | 20 | 15.2 | 32.9 | .07 |
| 1N6107 | 9.90 | 12.10 | 125 | 8.4 | 20 | 16.3 | 30.7 | .07 |
| 1N6108 | 10.80 | 13.20 | 100 | 9.1 | 20 | 17.7 | 28.2 | .07 |
| 1N6109 | 11.70 | 14.30 | 100 | 9.9 | 20 | 19.0 | 26.3 | .08 |
| 1N6110 | 13.50 | 16.50 | 75 | 11.4 | 20 | 21.9 | 22.8 | .08 |
| 1N6111 | 14.40 | 17.60 | 75 | 12.2 | 20 | 23.4 | 21.4 | .08 |
| 1N6112 | 16.20 | 19.80 | 65 | 13.7 | 1 | 26.3 | 19.0 | .085 |
| 1N6113 | 18.0 | 22.0 | 65 | 15.2 | 1 | 29.0 | 17.2 | .085 |
| 1N6114 | 19.8 | 24.2 | 50 | 16.7 | 1 | 31.9 | 15.7 | .085 |
| 1N6115 | 21.6 | 26.4 | 50 | 18.2 | 1 | 34.8 | 14.4 | .09 |
| 1N6116 | 24.3 | 29.7 | 50 | 20.6 | 1 | 39.2 | 12.8 | .09 |
| 1N6117 | 27.0 | 33.0 | 40 | 22.8 | 1 | 43.6 | 11.5 | .09 |
| 1N6118 | 29.7 | 36.3 | 40 | 25.1 | 1 | 47.9 | 10.4 | .095 |
| 1N6119 | 32.4 | 39.6 | 30 | 27.4 | 1 | 52.3 | 9.6 | .095 |
| 1N6120 | 35.1 | 42.9 | 30 | 29.7 | 1 | 56.2 | 8.9 | .095 |
| 1N6121 | 38.7 | 47.3 | 30 | 32.7 | 1 | 62.0 | 8.1 | .095 |
| 1N6122 | 42.3 | 51.7 | 25 | 35.8 | 1 | 67.7 | 7.4 | .095 |
| 1N6123 | 45.9 | 56.1 | 25 | 38.8 | 1 | 73.5 | 6.8 | .095 |
| 1N6124 | 50.4 | 61.6 | 20 | 42.6 | 1 | 80.7 | 6.2 | .095 |
| 1N6125 | 55.8 | 68.2 | 20 | 47.1 | 1 | 89.3 | 5.6 | .100 |
| 1N6126 | 61.2 | 74.8 | 20 | 51.7 | 1 | 98.0 | 5.1 | .100 |
| 1N6127 | 67.5 | 82.5 | 20 | 56.0 | 1 | 108.1 | 4.6 | .100 |
| 1N6128 | 73.8 | 90.2 | 15 | 62.2 | 1 | 118.2 | 4.2 | .100 |
| 1N6129 | 81.9 | 100.1 | 15 | 69.2 | 1 | 131.1 | 3.8 | .100 |
| 1N6130 | 90.0 | 110.0 | 12 | 76.0 | 1 | 144.1 | 3.5 | .100 |
| 1N6131 | 99.0 | 121.0 | 12 | 83.6 | 1 | 158.5 | 3.2 | .100 |
| 1N6132 | 108.0 | 132.0 | 10 | 91.2 | 1 | 172.9 | 2.9 | .100 |
| 1N6133 | 117.0 | 143.0 | 10 | 98.8 | 1 | 187.3 | 2.7 | .105 |
| 1N6134 | 135.0 | 165.0 | 8 | 114.0 | 1 | 216.2 | 2.3 | .105 |
| 1N6135 | 144.0 | 176.0 | 8 | 121.6 | 1 | 228.8 | 2.2 | .105 |
| 1N6136 | 162.0 | 198.0 | 5 | 136.8 | 1 | 257.4 | 1.9 | .110 |
| 1N6137 | 180.0 | 220.0 | 5 | 152.0 | 1 | 286.0 | 1.7 | .110 |

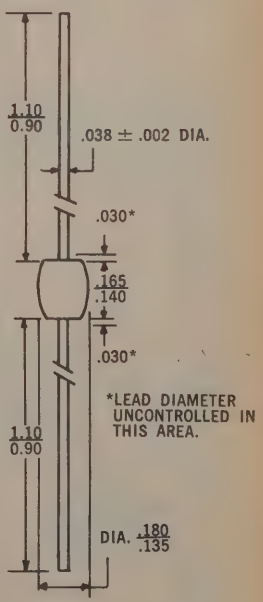
TECH BULLETIN X7




## 1500 WATT PEAK PULSE POWER

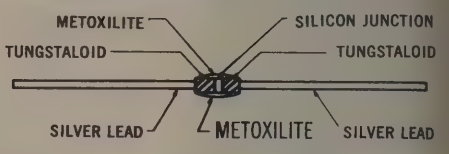
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1N6138 | 6.12 | 7.48 | 175 | 5.2 | 500 | 11.0 | 136.4 | .05 |
| 1N6139 | 6.75 | 8.25 | 175 | 5.7 | 300 | 11.8 | 127.1 | .06 |
| 1N6140 | 7.38 | 9.02 | 150 | 6.2 | 100 | 12.7 | 118.1 | .06 |
| 1N6141 | 8.19 | 10.01 | 150 | 6.9 | 100 | 14.0 | 107.1 | .06 |
| 1N6142 | 9.00 | 11.00 | 125 | 7.6 | 100 | 15.2 | 98.7 | .07 |
| 1N6143 | 9.90 | 12.10 | 125 | 8.4 | 20 | 16.3 | 92.0 | .07 |
| 1N6144 | 10.80 | 13.20 | 100 | 9.1 | 20 | 17.7 | 84.7 | .07 |
| 1N6145 | 11.70 | 14.30 | 100 | 9.9 | 20 | 19.0 | 78.9 | .08 |
| 1N6146 | 13.50 | 16.50 | 75 | 11.4 | 20 | 21.9 | 68.5 | .08 |
| 1N6147 | 14.40 | 17.60 | 75 | 12.2 | 20 | 23.4 | 64.1 | .08 |
| 1N6148 | 16.20 | 19.80 | 65 | 13.7 | 10 | 26.3 | 57.0 | .085 |
| 1N6149 | 18.0 | 22.0 | 65 | 15.2 | 5 | 29.0 | 51.7 | .085 |
| 1N6150 | 19.8 | 24.2 | 50 | 16.7 | 5 | 31.9 | 47.0 | .085 |
| 1N6151 | 21.6 | 26.4 | 50 | 18.2 | 5 | 34.8 | 43.1 | .09 |
| 1N6152 | 24.3 | 29.7 | 50 | 20.6 | 5 | 39.2 | 38.3 | .09 |
| 1N6153 | 27.0 | 33.0 | 40 | 22.8 | 5 | 43.6 | 34.4 | .09 |
| 1N6154 | 29.7 | 36.3 | 40 | 25.1 | 5 | 47.9 | 31.3 | .095 |
| 1N6155 | 32.4 | 39.6 | 30 | 27.4 | 5 | 52.3 | 28.7 | .095 |
| 1N6156 | 35.1 | 42.9 | 30 | 29.7 | 5 | 56.2 | 26.7 | .095 |
| 1N6157 | 38.7 | 47.3 | 30 | 32.7 | 5 | 62.0 | 24.2 | .095 |
| 1N6158 | 42.3 | 51.7 | 25 | 35.8 | 5 | 67.7 | 22.2 | .095 |
| 1N6159 | 45.9 | 56.1 | 25 | 38.8 | 5 | 73.5 | 20.4 | .095 |
| 1N6160 | 50.4 | 61.6 | 20 | 42.6 | 5 | 80.7 | 18.6 | .095 |
| 1N6161 | 55.8 | 68.2 | 20 | 47.1 | 5 | 89.3 | 16.8 | .100 |
| 1N6162 | 61.2 | 74.8 | 20 | 51.7 | 5 | 98.0 | 15.3 | .100 |
| 1N6163 | 67.5 | 82.5 | 20 | 56.0 | 5 | 108.1 | 13.9 | .100 |
| 1N6164 | 73.8 | 90.2 | 15 | 62.2 | 5 | 118.2 | 12.7 | .100 |
| 1N6165 | 81.9 | 100.1 | 15 | 69.2 | 5 | 131.1 | 11.4 | .100 |
| 1N6166 | 90.0 | 110.0 | 12 | 76.0 | 5 | 144.1 | 10.4 | .100 |
| 1N6167 | 99.0 | 121.0 | 12 | 83.6 | 5 | 158.5 | 9.5 | .100 |
| 1N6168 | 108.0 | 132.0 | 10 | 91.2 | 5 | 172.9 | 8.7 | .100 |
| 1N6169 | 117.0 | 143.0 | 10 | 98.8 | 5 | 187.3 | 8.0 | .105 |
| 1N6170 | 135.0 | 165.0 | 8 | 114.0 | 5 | 216.2 | 6.9 | .105 |
| 1N6171 | 144.0 | 176.0 | 8 | 121.6 | 5 | 228.8 | 6.6 | .105 |
| 1N6172 | 162.0 | 198.0 | 5 | 136.8 | 5 | 257.4 | 5.8 | .110 |
| 1N6173 | 180.0 | 220.0 | 5 | 152.0 | 5 | 286.0 | 5.2 | .110 |

TECH BULLETIN X8



SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

# METOXILITE LOW DYNAMIC IMPEDANCE SILICON VOLTAGE REGULATORS



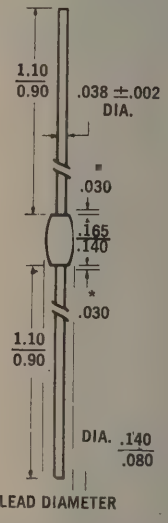

This new series of devices offers significantly lower dynamic impedance when compared at the same operating current to those presently available. For a given dynamic impedance requirement, these regulator diodes can be operated at a lower bias current. Regulation, ripple reduction and efficiency will be improved when these devices are used as regulators.

Cased in Metoxilite, they provide the ultimate in hermeticity and ruggedness. The metal oxides which form the outer case are fused directly to the high temperature metallurgically bonded assembly. This Metoxilite device exceeds requirements of current military and space program specifications.

| Type No. | Nominal Voltage | 5 Watt Min. Breakdown | 5 Watt Max. Voltage | 5 Watt $I_R$ Test | 5 Watt $Z_R$ | Reverse Leakage $V_R$ Test | Reverse Leakage $I_S$ | * TCBV | $I_R$ Max. |
|---|---|---|---|---|---|---|---|---|---|
| | V | V | V | MA | Ohms | V | uA | %°C | MA |
| SX6.8 | 6.8 | 6.46 | 7.14 | 175 | .75 | 5.2 | 150 | .05 | 700 |
| SX7.5 | 7.5 | 7.13 | 7.87 | 175 | .75 | 5.7 | 100 | .06 | 630 |
| SX8.2 | 8.2 | 7.79 | 8.61 | 150 | .75 | 6.2 | 50 | .06 | 580 |
| SX9.1 | 9.1 | 8.65 | 9.55 | 150 | 1.0 | 6.9 | 25 | .06 | 520 |
| SX10 | 10 | 9.50 | 10.50 | 125 | 1.5 | 7.6 | 25 | .07 | 475 |
| SX11 | 11 | 10.45 | 11.55 | 125 | 1.5 | 8.4 | 10 | .07 | 430 |
| SX12 | 12 | 11.40 | 12.60 | 100 | 1.5 | 9.1 | 10 | .07 | 395 |
| SX13 | 13 | 12.35 | 13.65 | 100 | 2.0 | 9.9 | 10 | .08 | 365 |
| SX15 | 15 | 14.25 | 15.75 | 75 | 2.5 | 11.4 | 5 | .08 | 315 |
| SX16 | 16 | 15.20 | 16.80 | 75 | 2.5 | 12.2 | 5 | .08 | 294 |
| SX18 | 18 | 17.10 | 18.90 | 65 | 2.5 | 13.7 | 5 | .085 | 264 |
| SX20 | 20 | 19.0 | 21.0 | 65 | 2.5 | 15.2 | 2 | .085 | 237 |
| SX22 | 22 | 20.9 | 23.1 | 50 | 2.5 | 16.7 | 2 | .085 | 216 |
| SX24 | 24 | 22.8 | 25.2 | 50 | 3.0 | 18.2 | 2 | .09 | 198 |
| SX27 | 27 | 25.7 | 28.3 | 50 | 3.0 | 20.6 | 2 | .09 | 176 |
| SX30 | 30 | 28.5 | 31.5 | 40 | 3 | 22.8 | 2 | .09 | 158 |
| SX33 | 33 | 31.4 | 34.6 | 40 | 4 | 25.1 | 2 | .035 | 144 |
| SX36 | 36 | 34.2 | 37.8 | 30 | 5 | 27.4 | 2 | .095 | 132 |
| SX39 | 39 | 37.1 | 40.9 | 30 | 5 | 29.7 | 2 | .095 | 132 |
| SX43 | 43 | 40.9 | 45.1 | 30 | 6 | 32.7 | 2 | .095 | 110 |
| SX47 | 47 | 44.7 | 49.3 | 25 | 7 | 35.8 | 2 | .095 | 100 |
| SX51 | 51 | 48.5 | 53.5 | 25 | 8 | 38.8 | 2 | .095 | 92 |
| SX56 | 56 | 53.2 | 58.8 | 20 | 9 | 42.6 | 2 | .095 | 84 |
| SX62 | 62 | 58.9 | 65.1 | 20 | 10 | 47.1 | 2 | .100 | 76 |
| SX68 | 68 | 64.6 | 71.4 | 20 | 15 | 51.7 | 2 | .100 | 70 |
| SX75 | 75 | 71.3 | 78.7 | 20 | 20 | 56.0 | 2 | .100 | 63 |
| SX82 | 82 | 77.9 | 86.1 | 15 | 30 | 62.2 | 2 | .100 | 58 |
| SX91 | 91 | 86.5 | 95.5 | 15 | 35 | 69.2 | 2 | .100 | 52.5 |
| SX100 | 100 | 95.0 | 105.0 | 12 | 40 | 76.0 | 2 | .100 | 47.5 |
| SX110 | 110 | 104.5 | 115.0 | 12 | 55 | 83.6 | 2 | .100 | 43 |
| SX120 | 120 | 114.0 | 126.0 | 10 | 70 | 91.2 | 2 | .100 | 39.5 |

TECHNICAL BULLETIN X1

LEAD MATERIAL: 99.9% PURE SILVER IN ACCORDANCE WITH MIL-S-13282A, GRADE A.




UNCONTROLLED IN THIS AREA

| Type No. | Nominal Voltage. | Breakdown Min. | Max. Voltage | $I_R$ Test | $Z_R$ | Reverse Leakage $V_R$ Test | Reverse Leakage $I_S$ | TCBV* | $I_R$ Max. |
|---|---|---|---|---|---|---|---|---|---|
| | V | V | V | MA | Ohms | V | UA | %/°C | MA |
| 1N4954 | 6.8 | 6.46 | 7.14 | 175 | 1 | 5.2 | 300 | .05 | 600 |
| 1N4955 | 7.5 | 7.13 | 7.87 | 175 | 1.5 | 5.7 | 200 | .06 | 600 |
| 1N4956 | 8.2 | 7.79 | 8.61 | 150 | 1.5 | 6.2 | 100 | .06 | 550 |
| 1N4957 | 9.1 | 8.65 | 9.55 | 150 | 2 | 6.9 | 50 | .06 | 495 |
| 1N4958 | 10 | 9.50 | 10.50 | 125 | 2 | 7.6 | 25 | .07 | 450 |
| 1N4959 | 11 | 10.45 | 11.55 | 125 | 2.5 | 8.4 | 15 | .07 | 410 |
| 1N4960 | 12 | 11.40 | 12.60 | 100 | 2.5 | 9.1 | 10 | .07 | 375 |
| 1N4961 | 13 | 12.35 | 13.65 | 100 | 3 | 9.9 | 10 | .08 | 345 |
| 1N4962 | 15 | 14.25 | 15.75 | 75 | 3.5 | 11.4 | 5 | .08 | 300 |
| 1N4963 | 16 | 15.20 | 16.80 | 75 | 3.5 | 12.2 | 5 | .08 | 280 |
| 1N4964 | 18 | 17.10 | 18.90 | 65 | 4 | 13.7 | 5 | .085 | 250 |
| 1N4965 | 20 | 19.0 | 21.0 | 65 | 4.5 | 15.2 | 1 | .085 | 225 |
| 1N4966 | 22 | 20.9 | 23.1 | 50 | 5 | 16.7 | 1 | .085 | 205 |
| 1N4967 | 24 | 22.8 | 25.2 | 50 | 5 | 18.2 | 1 | .09 | 186 |
| 1N4968 | 27 | 25.7 | 28.3 | 50 | 6 | 20.6 | 1 | .09 | 167 |
| 1N4969 | 30 | 28.5 | 31.5 | 40 | 8 | 22.8 | 1 | .09 | 150 |
| 1N4970 | 33 | 31.4 | 34.6 | 40 | 10 | 25.1 | 1 | .095 | 136 |
| 1N4971 | 36 | 34.2 | 37.8 | 30 | 11 | 27.4 | 1 | .095 | 126 |
| 1N4972 | 39 | 37.1 | 40.9 | 30 | 14 | 29.7 | 1 | .095 | 115 |
| 1N4973 | 43 | 40.9 | 45.1 | 30 | 20 | 32.7 | 1 | .095 | 105 |
| 1N4974 | 47 | 44.7 | 49.3 | 25 | 25 | 35.8 | 1 | .095 | 96 |
| 1N4975 | 51 | 48.5 | 53.5 | 25 | 27 | 38.8 | 1 | .095 | 88 |
| 1N4976 | 56 | 53.2 | 58.8 | 20 | 35 | 42.6 | 1 | .095 | 80 |
| 1N4977 | 62 | 58.9 | 65.1 | 20 | 42 | 47.1 | 1 | .100 | 73 |
| 1N4978 | 68 | 64.6 | 71.4 | 20 | 44 | 51.7 | 1 | .100 | 67 |
| 1N4979 | 75 | 71.3 | 78.7 | 20 | 45 | 56.0 | 1 | .100 | 60 |
| 1N4980 | 82 | 77.9 | 86.1 | 15 | 65 | 62.2 | 1 | .100 | 55 |
| 1N4981 | 91 | 86.5 | 95.5 | 15 | 75 | 69.2 | 1 | .100 | 50 |
| 1N4982 | 100 | 95.0 | 105.0 | 12 | 90 | 76.0 | 1 | .100 | 45 |
| 1N4983 | 110 | 104.5 | 115.5 | 12 | 125 | 83.6 | 1 | .100 | 41 |
| 1N4984 | 120 | 114.0 | 126.0 | 10 | 170 | 91.2 | 1 | .100 | 37.5 |

Operating and Storage Temperature −195°C to +175°C.
* Temperature coefficient of breakdown voltage

TECHNICAL BULLETIN X3

Semtech reserves the right to change specifications without notice.

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

# METOXILITE LOW DYNAMIC IMPEDANCE SILICON VOLTAGE REGULATORS

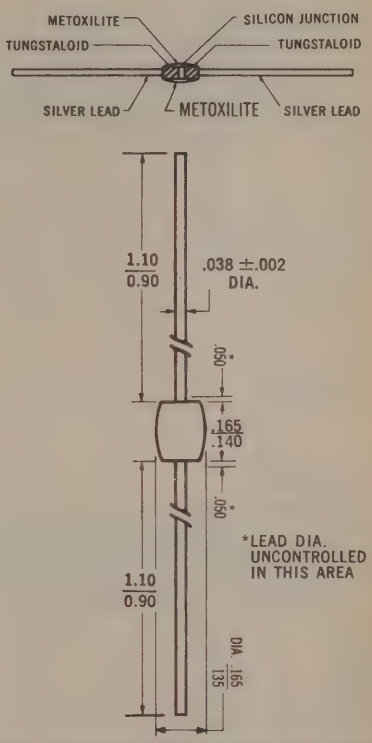
This new series of devices offers significantly lower dynamic impedance when compared at the same operating current to those presently available. For a given dynamic impedance requirement, these regulator diodes can be operated at a lower bias current. Regulation, ripple reduction and efficiency will be improved when these devices are used as regulators.

Cased in Metoxilite, they provide the ultimate in hermeticity and ruggedness. The metal oxides which form the outer case are fused directly to the high temperature metallurgically bonded assembly. This Metoxilite device exceeds requirements of current military and space program specifications.

| Type No. | Nominal Voltage | Min. Breakdown | Max. Voltage | $I_R$ Test | $Z_R$ | Reverse Leakage $V_R$ Test | Reverse Leakage $I_S$ | * TCBV | $I_R$ Max. |
|---|---|---|---|---|---|---|---|---|---|
| | V | V | V | MA | Ohms | V | UA | %/°C | A |
| SY6.8 | 6.8 | 6.46 | 7.14 | 500 | .4 | 5.2 | 600 | .05 | 2.10 |
| SY7.5 | 7.5 | 7.13 | 7.87 | 500 | .4 | 5.7 | 400 | .06 | 1.8 |
| SY8.2 | 8.2 | 7.79 | 8.61 | 450 | .4 | 6.2 | 200 | .06 | 1.7 |
| SY9.1 | 9.1 | 8.65 | 9.55 | 450 | .5 | 6.9 | 100 | .06 | 1.5 |
| SY10 | 10 | 9.50 | 10.50 | 375 | .7 | 7.6 | 100 | .07 | 1.4 |
| SY11 | 11 | 10.45 | 11.55 | 375 | .7 | 8.4 | 50 | .07 | 1.2 |
| SY12 | 12 | 11.40 | 12.60 | 300 | .7 | 9.1 | 50 | .07 | 1.1 |
| SY13 | 13 | 12.35 | 13.65 | 300 | 1.0 | 9.9 | 50 | .08 | 1.0 |
| SY15 | 15 | 14.25 | 15.75 | 225 | 1.0 | 11.4 | 25 | .08 | 0.90 |
| SY16 | 16 | 15.20 | 16.80 | 225 | 1.5 | 12.2 | 25 | .08 | 0.80 |
| SY18 | 18 | 17.10 | 18.90 | 195 | 1.5 | 13.7 | 25 | .085 | 0.70 |
| SY20 | 20 | 19.0 | 21.0 | 195 | 1.6 | 15.2 | 10 | .085 | 0.69 |
| SY22 | 22 | 20.9 | 23.1 | 150 | 1.7 | 16.7 | 10 | .085 | 0.63 |
| SY24 | 24 | 22.8 | 25.2 | 150 | 1.7 | 18.2 | 10 | .09 | 0.59 |
| SY27 | 27 | 25.7 | 28.3 | 150 | 1.8 | 20.6 | 10 | .09 | 0.52 |
| SY30 | 30 | 28.5 | 31.5 | 120 | 1.9 | 22.8 | 10 | ,09 | 0.47 |
| SY33 | 33 | 31.4 | 34.6 | 120 | 2 | 25.1 | 10 | .095 | 0.43 |
| SY36 | 36 | 34.2 | 37.8 | 90 | 2.5 | 27.4 | 10 | .095 | 0.39 |
| SY39 | 39 | 37.1 | 40.9 | 90 | 2.5 | 29.7 | 10 | .095 | 0.36 |
| SY43 | 43 | 40.9 | 45.1 | 90 | 3 | 32.7 | 10 | .095 | .033 |
| SY47 | 47 | 44.7 | 49.3 | 75 | 3.5 | 35.8 | 10 | .095 | .030 |
| SY51 | 51 | 48.5 | 53.5 | 75 | 4 | 38.8 | 10 | .095 | 0.27 |
| SY56 | 56 | 53.2 | 58.8 | 60 | 4.5 | 42.6 | 10 | .095 | 0.25 |
| SY62 | 62 | 58.9 | 65.1 | 60 | 5 | 47.1 | 10 | .100 | 0.22 |
| SY68 | 68 | 64.6 | 74.1 | 60 | 7 | 51.7 | 10 | .100 | 0.21 |
| SY75 | 75 | 71.3 | 78.7 | 60 | 10 | 56.0 | 10 | .100 | 0.18 |
| SY82 | 82 | 77.9 | 86.1 | 45 | 15 | 62.2 | 10 | .100 | 0.17 |
| SY91 | 91 | 86.5 | 95.5 | 45 | 17 | 69.2 | 10 | .100 | 0.15 |
| SY100 | 100 | 95.0 | 105.0 | 36 | 20 | 76.0 | 10 | .100 | 0.14 |
| SY110 | 110 | 104.5 | 115.5 | 36 | 22 | 83.6 | 10 | .100 | 0.12 |
| SY120 | 120 | 114.0 | 126.0 | 30 | 35 | 91.2 | 10 | .100 | 0.11 |

Operating and Storage Temperature −195°C to +175°C.
* Temperature coefficient of breakdown voltage.

TECHNICAL BULLETIN X5




# HIGH VOLTAGE MONOLITHIC CERAMIC CAPACITORS

## IDEAL FOR HIGH VOLTAGE HIGH DENSITY POWER SUPPLIES

We have a high density high voltage monolithic capacitor that meets present day equipment design criteria. Offering higher volumetric efficiencies and voltage stability over wide temperature ranges.

### HIGHER CURRENT CAPABILITIES

In addition to high voltage the inherent design offers higher current carrying capabilities than previously available in ceramic monolithic capacitors of similar size.

### "GOLD CAP" RADIALS

Construction: Monolithic radial leaded and dip coated
Voltage: 1, 2, 3, 4 & 5 KV
Capacitance: 18 pF to .39 μFd.
Dimensions: (Body) From .40″L x .35″H x .25″T to .80″L x .75″H x .35″T

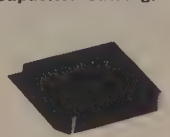
### "MONO" CHIPS

Construction: Monolithic with end terminations
Voltage: 1, 2, 3, 4 & 5 KV
Capacitance: 18 pF to .39 μFd.
Dimensions: (Body) From .25″L x .20″W x .15″T to .65″L x .60″W x .25″T

"GOLD CAP"

Semtech capacitors are now available in quantity from stock at pricing low enough for use in commercial applications.

**Contact your nearest Semtech office for our new High Voltage Capacitor Catalog.**



"MONO"

## TWO DIELECTRIC TYPES

| DIELECTRIC | NPO | X7R |
|---|---|---|
| Temperature Coefficient (T.C.) | Less than 30 ppm/°C; −55°C to +125°C | ±15% −55°C to +125°C |
| Dissipation Factor (D.F.) | Less than .0015 (.15%) at 1 kHz, 1 VAC, 25°C | 2.5% max 1 kHz, 1 VAC, 25°C |
| Insulation Resistance (I.R.) | 100K megΩ or 1000 megΩ microfarads, whichever is less (25°C, 500 VDC) | 100K megΩ or 1000 megΩ microfarads, whichever is less (25°C, 500 VDC) |
| Aging | 0 | 1% per decade |
| Dielectric Withstanding Voltage | 1.2 Times Rated Voltage*, at 25°C | 1.2 Times Rated Voltage*, at 25°C |
| Dimensional Tolerance | ±.010 or ±5%, whichever is greater | ±.010 or ±5%, whichever is greater |

*Dielectric Withstanding Voltage Tests are conducted with changing current limited to 10 mA and the discharge current limited to 5A.

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

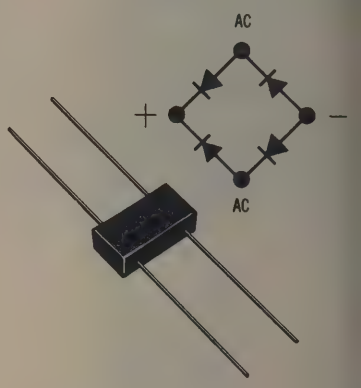
# "COMPAC" BRIDGE RECTIFIERS

## MULTI-PURPOSE

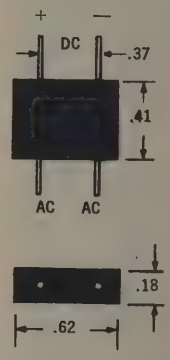
**SOLID SILVER LEADS: DIAMETER .031 ±.002"; LENGTH ⅞" MINIMUM**
**OPERATING AND STORAGE TEMPERATURE −55°C TO +150°C**

Sub-miniature, rugged, highly-reliable and economical, are the only adjectives necessary to describe Semtech's "Compac" silicon bridge rectifiers. Incorporating Semtech's Supratxial silicon junctions, solid silver leads and high-temperature molding compounds, the units provide maximum mechanical, thermal and electrical reliability. These silicon bridge rectifiers will meet stringent requirements of military, industrial and consumer products applications.

SINGLE PHASE FULL WAVE BRIDGE




| Type No. | Peak Inverse Voltage | Average Rectified Current | | Max. Reverse Current @ PIV | | Max. Fwd. Volts/Leg @ 1A DC (**100 mA DC) | Recurrent Surge | Data Sheet No. |
|---|---|---|---|---|---|---|---|---|
| | | 55°C | 100°C | 25°C | 100°C | 25°C | 25°C | |
| | Volts | Amps | Amps | μA | μA | Volts | Amps | |
| SBR2 | 200 | 1.5 | 1.00 | 2 | 40 | 1.2 | 10 | MB8 |
| SBR4 | 400 | 1.5 | 1.00 | 2 | 40 | 1.2 | 10 | MB8 |
| SBR6 | 600 | 1.5 | 1.00 | 2 | 40 | 1.2 | 10 | MB8 |
| SBR8 | 800 | 1.5 | 1.00 | 2 | 40 | 1.2 | 10 | MB8 |
| SBR10 | 1000 | 1.5 | 1.00 | 2 | 40 | 1.2 | 10 | MB8 |
| SBR15 | 1500 | .36 | .24 | 2 | 40 | **3.5 | 2.5 | MB8 |
| SBR20 | 2000 | .36 | .24 | 2 | 40 | **3.5 | 2.5 | MB8 |
| SBR25 | 2500 | .36 | .24 | 2 | 40 | **3.5 | 2.5 | MB8 |
| SBR30 | 3000 | .36 | .24 | 2 | 40 | **3.5 | 2.5 | MB8 |



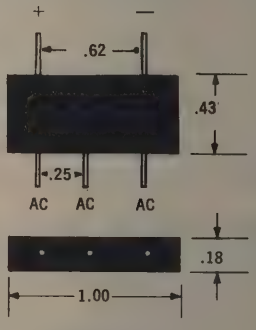

Tolerance ±.030
Lead Spacing Measured Center to Center

## FAST RECOVERY

| Type No. | Peak Inverse Voltage | Average Rectified Current | | Max. Reverse Current @ PIV | | Max. Fwd. Volts/Leg @ 1A DC | Recurrent Surge | *Reverse Recovery | Data Sheet No. |
|---|---|---|---|---|---|---|---|---|---|
| | | 55°C | 100°C | 25°C | 100°C | 25°C | 25°C | trr | |
| | Volts | Amps | Amps | μA | μA | Volts | Amps | μ sec | |
| SBR05F | 50 | 1.0 | 0.65 | 2 | 40 | 1.3 | 6 | .150 | MB9 |
| SBR1F | 100 | 1.0 | 0.65 | 2 | 40 | 1.3 | 6 | .150 | MB9 |
| SBR2F | 200 | 1.0 | 0.65 | 2 | 40 | 1.3 | 6 | .150 | MB9 |
| SBR4F | 400 | 1.0 | 0.65 | 2 | 40 | 1.3 | 6 | .150 | MB9 |
| SBR6F | 600 | 1.0 | 0.65 | 2 | 40 | 1.3 | 6 | .250 | MB9 |
| SBR8F | 800 | 1.0 | 0.65 | 2 | 40 | 1.3 | 6 | .300 | MB9 |
| SBR10F | 1000 | 1.0 | 0.65 | 2 | 40 | 1.3 | 6 | .500 | MB9 |

Reverse Recovery time is measured on each junction prior to manufacture of assembly.
*Recovery Conditions: 0.5 amp forward current to 1.0 amp reverse current. Recovery time is measured when rectifier recovers to .25 Amps.

THREE PHASE BRIDGE




Tolerance ±.03
Lead Spacing Measured Center to Center

## "COMPAC-3" SILICON 3 PHASE

Semtech now offers a line of "Compac" sub-miniature medium power, 3-phase full wave bridge rectifiers. These units utilize Semtech's unique Supratxial silicon junctions. Sub-miniature size makes these bridge rectifiers easy to package. Use of high temperature compounds provides excellent mechanical, thermal and electrical reliability. These silicon bridge rectifiers easily satisfy the stringent requirements of military and industrial as well as consumer applications.

| Type No. | Peak Inverse Voltage | Average Rectified Current | | Max. Reverse Current @ PIV | | Max. Fwd. Volts/Leg @ 1A DC (**100 mA DC) | Recurrent Surge | Data Sheet No. |
|---|---|---|---|---|---|---|---|---|
| | | 55°C | 100°C | 25°C | 100°C | 25°C | 25°C | |
| | Volts | Amps | Amps | μA | μA | Volts | Amps | |
| S3BR2 | 200 | 2.0 | 1.2 | 3 | 60 | 1.2 | 10 | MB11 |
| S3BR4 | 400 | 2.0 | 1.2 | 3 | 60 | 1.2 | 10 | MB11 |
| S3BR6 | 600 | 2.0 | 1.2 | 3 | 60 | 1.2 | 10 | MB11 |
| S3BR8 | 800 | 2.0 | 1.2 | 3 | 60 | 1.2 | 10 | MB11 |
| S3BR10 | 1000 | 2.0 | 1.2 | 3 | 60 | 1.2 | 10 | MB11 |
| S3BR15 | 1500 | 0.5 | 0.3 | 3 | 60 | **3.5 | 2.5 | MB11 |
| S3BR20 | 2000 | 0.5 | 0.3 | 3 | 60 | **3.5 | 2.5 | MB11 |
| S3BR25 | 2500 | 0.5 | 0.3 | 3 | 60 | **3.5 | 2.5 | MB11 |
| S3BR30 | 3000 | 0.5 | 0.3 | 3 | 60 | **3.5 | 2.5 | MB11 |

Can also be obtained with "Medium" and "Fast" reverse recovery characteristics up to 1000 volts. Add Suffix "M" or "F"

Semtech reserves the right to change specifications without notice.

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

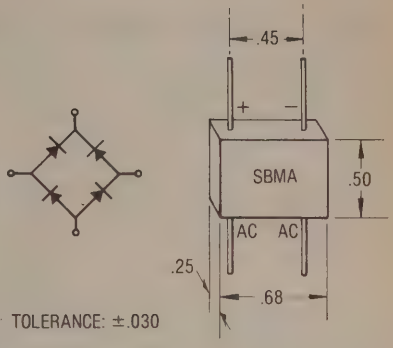
# "PCB" SILICON BRIDGE RECTIFIERS

Semtech Corporation introduces a new series of silicon rectifier bridges designed for circuit board mounting. Features include an all-welded internal assembly with Metoxilite rectifiers encapsulated to provide dependable electrical, thermal and mechanical reliability. Bridges are designed for commercial, industrial and military applications.

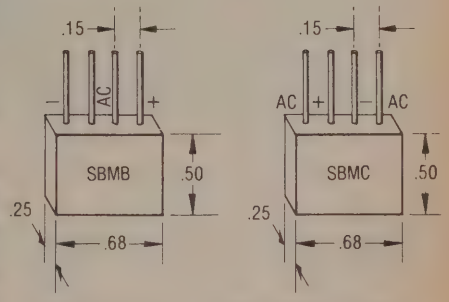
| Type No. | Peak Inverse Voltage | Type No. | Peak Inverse Voltage | SPECIFICATIONS | |
|---|---|---|---|---|---|
| SBMA2 | 200 | SBMC6 | 600 | MAXIMUM FORWARD VOLTS/LEG @ 1A DC, 25°C | 1.2 VOLTS |
| SBMB2 | 200 | SBMA8 | 800 | AVERAGE RECTIFIED CURRENT @ 25°C | 1.5 AMPS |
| SBMC2 | 200 | SBMB8 | 800 | @ 100°C | 1 AMP |
| SBMA4 | 400 | SBMC8 | 800 | | |
| SBMB4 | 400 | SBMA0 | 1000 | MAXIMUM REVERSE CURRENT @ PIV @ 25°C | 2 μA |
| SBMC4 | 400 | SBMB0 | 1000 | @ 100°C | 50 μA |
| | | SBMC0 | 1000 | | |
| SBMA6 | 600 | | | RECURRENT SURGE @ 25°C | 10 AMPS |
| SBMB6 | 600 | | | SINGLE CYCLE SURGE @ 25°C | 50 AMPS |

Operating and storage temperature −55°C to +150°C

TECHNICAL BULLETIN B45




TOLERANCE: ±.030




LEADS: DIAMETER .031 ±.002, LENGTH 1.0 MIN.

# "PCB" FAST RECOVERY

| Type No. | Peak Inverse Voltage | SPECIFICATIONS | |
|---|---|---|---|
| SBMA05F | 50 | REVERSE RECOVERY (trr) | 150 NSEC |
| SBMB05F | 50 | | *250 NSEC |
| SBMC05F | 50 | | |
| SBMA1F | 100 | AVERAGE RECTIFIED CURRENT @ 25°C | 1.5 AMPS |
| SBMB1F | 100 | @ 100°C | 1 AMP |
| SBMC1F | 100 | | |
| SBMA2F | 200 | MAXIMUM REVERSE CURRENT @ PIV @ 25°C | 2 μA |
| SBMB2F | 200 | @ 100°C | 50 μA |
| SBMC2F | 200 | | |
| SBMA4F | 400 | MAXIMUM FORWARD VOLTS/LEG @ 1A DC, 25°C | 1.2 VOLTS |
| SBMB4F | 400 | | |
| SBMC4F | 400 | RECURRENT SURGE @ 25°C | 10 AMPS |
| *SBMA6F | 600 | | |
| *SBMB6F | 600 | SINGLE CYCLE SURGE @ 25°C | 25 AMPS |
| *SBMC6F | 600 | | |

Operating and storage temperature −55°C to +150°C

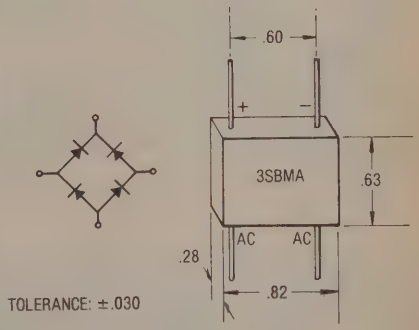
TECHNICAL BULLETIN B50

# "PCB" 3 AMP

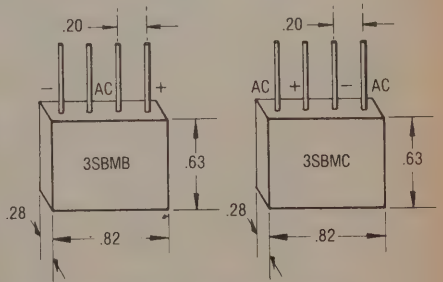
| Type No. | Peak Inverse Voltage | SPECIFICATIONS | |
|---|---|---|---|
| 3SBMA2 | 200 | AVERAGE RECTIFIED CURRENT @ 25°C | 3 AMPS |
| 3SBMB2 | 200 | @ 100°C | 1.5 AMPS |
| 3SBMC2 | 200 | | |
| 3SBMA4 | 400 | MAXIMUM REVERSE CURRENT @ PIV @ 25°C | 10 μA |
| 3SBMB4 | 400 | @ 100°C | 100 μA |
| 3SBMC4 | 400 | | |
| 3SBMA6 | 600 | MAXIMUM FORWARD VOLTS/LEG @ 3A DC, 25°C | 1.0 VOLTS |
| 3SBMB6 | 600 | 800 VOLT DEVICES @ 3A DC, 25°C | 1.1 VOLTS |
| 3SBMC6 | 600 | | |
| 3SBMA8 | 800 | RECURRENT SURGE @ 25°C | 25 AMPS |
| 3SBMB8 | 800 | | |
| 3SBMC8 | 800 | SINGLE CYCLE SURGE @ 25°C | 150 AMPS |

Operating and storage temperature −55°C to +150°C

TECHNICAL BULLETIN B48




TOLERANCE: ±.030




LEADS: DIAMETER .040 ±.002, LENGTH .5 MIN.

# "PCB" 3 AMP FAST RECOVERY

| Type No. | Peak Inverse Voltage | SPECIFICATIONS | |
|---|---|---|---|
| 3SBMA05F | 50 | REVERSE RECOVERY (trr) | 150 NSEC |
| 3SBMB05F | 50 | AVERAGE RECTIFIED CURRENT @ 25°C | 3 AMPS |
| 3SBMC05F | 50 | @ 100°C | 1.5 AMPS |
| 3SBMA1F | 100 | | |
| 3SBMB1F | 100 | MAXIMUM REVERSE CURRENT @ PIV @ 25°C | 10 μA |
| 3SBMC1F | 100 | @ 100°C | 100 μA |
| 3SBMA2F | 200 | | |
| 3SBMB2F | 200 | MAXIMUM FORWARD VOLTS/LEG @ 3A DC, 25°C | 1.1 VOLTS |
| 3SBMC2F | 200 | | |
| 3SBMA4F | 400 | RECURRENT SURGE @ 25°C | 25 AMPS |
| 3SBMB4F | 400 | | |
| 3SBMC4F | 400 | SINGLE CYCLE SURGE @ 25°C | 150 AMPS |

Operating and storage temperature −55°C to +150°C

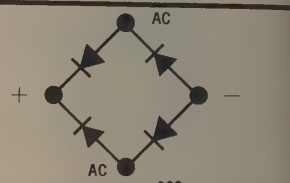
TECHNICAL BULLETIN B49

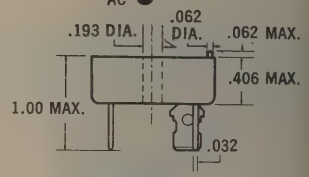
SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

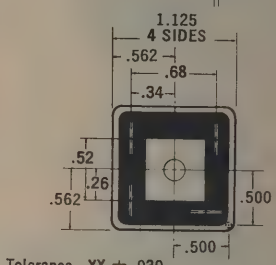
# "ALPAC"® SILICON BRIDGE RECTIFIERS

Semtech Corporation introduces "ALPAC" a complete line of Single Phase Silicon Bridge Rectifier circuits. Designed in Aluminum Cases to provide maximum thermal conductivity and simple installation. "ALPAC" universal terminals, insulated from case, provide a 3 way electrical connection: fast disconnect, wire wrap around and hole wire insert for soldering.

Internally the device utilizes the Semtech high performance solid double heat sink junctions designed for mechanical strength and eliminating the use of solders for improved reliability. The bridges are designed for utilization in power supplies, AC to DC converters and motor control circuits.



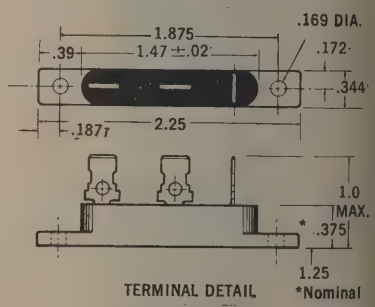




Tolerance .XX ± .030
.XXX ± .020

| Type No. | PIV Per Leg | Sine Wave RMS Input Voltage Max. | Average DC Output Amps TC = Case Temp. (°C) | | | Average DC Output/Leg TA = Ambinet Temp. (No Heat Sink) (°C) | | | Peak 1 Cycle Fwd. Surge | Peak Recurrent Fwd. | VF Max. Per Leg @ 3A DC | Reverse Current ($I_R$ Max. @ PIV) (°C) | | Data Sheet No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 55 | 100 | 125 | 25 | 55 | 100 | | | 25°C | 25 | 100 | |
| | Volts | Volts | Amps | Amps | Amps | Amps | Amps | Amps | Amps | Amps | Volts | μA | μA | |
| SCBA2 | 200 | 140 | 17.5 | 12.5 | 9.0 | 6.0 | 5.0 | 3.0 | 150 | 75 | 1.0 | 5 | 100 | MB3 |
| SCBA4 | 400 | 280 | 17.5 | 12.5 | 9.0 | 6.0 | 5.0 | 3.0 | 150 | 75 | 1.0 | 5 | 100 | MB3 |
| SCBA6 | 600 | 420 | 17.5 | 12.5 | 9.0 | 6.0 | 5.0 | 3.0 | 150 | 75 | 1.0 | 5 | 100 | MB3 |

Maximum thermal impedance junction to mounting surface 2.0°C/Watt.
Maximum operating and storage temperature —55°C to +150°C.

**ALSO AVAILABLE IN FAST RECOVERY**
TECH BULLETIN MB15



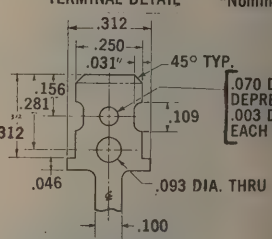

TERMINAL DETAIL

# "ALPAC" DOUBLERS AND CENTER TAPS

**AVAILABLE IN FAST RECOVERY**
TECH BULLETIN MB17 & 18

Semtech Corporation introduces "Alpac," a series of Doublers and Center taps, Rectifier circuits. Designed in Aluminum Cases to provide maximum thermal conductivity and simple installation. "Alpac" terminals are insulated from case. The Universal Terminals provide a 3 way electrical connection: fast disconnect, wire wrap around and hole wire insert for soldering. Internally the device utilizes the Semtech high performance solid double heat sink junctions.

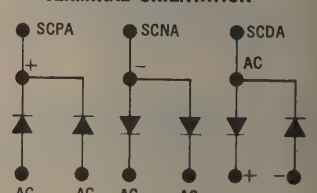
The devices are designed to replace stud rectifiers and provide simple, economical and reliable packaging.

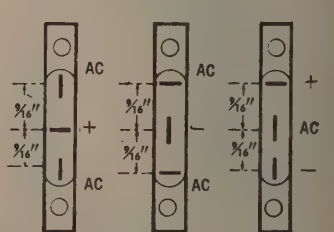



| Type No. | PIV Per Leg | Sine Wave RMS Input Voltage Max. | Average DC Output/Leg TC = Case Temp. (°C) | | | Average DC Output/Leg TA = Ambient Temp. (No Heat Sink) (°C) | | | Peak 1 Cycle Fwd. Surge | Peak Recurrent Fwd. | VF Max. Per Leg @ 3A DC | $I_R$ Max. Per Leg @ PIV (°C) | | Data Sheet No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 55 | 100 | 125 | 25 | 55 | 100 | | | 25°C | 25 | 100 | |
| | Volts | Volts | Amps | Amps | Amps | Amps | Amps | Amps | Amps | Amps | Volts | μA | μA | |
| SCDA2 | 200 | 140 | 8.5 | 6 | 4.5 | 3 | 2.75 | 2 | 150 | 75 | 1.0 | 5 | 100 | MB4 |
| SCPA2 | 200 | 140 | 8.5 | 6 | 4.5 | 3 | 2.75 | 2 | 150 | 75 | 1.0 | 5 | 100 | MB4 |
| SCNA2 | 200 | 140 | 8.5 | 6 | 4.5 | 3 | 2.75 | 2 | 150 | 75 | 1.0 | 5 | 100 | MB4 |
| SCDA4 | 400 | 280 | 8.5 | 6 | 4.5 | 3 | 2.75 | 2 | 150 | 75 | 1.0 | 5 | 100 | MB4 |
| SCPA4 | 400 | 280 | 8.5 | 6 | 4.5 | 3 | 2.75 | 2 | 150 | 75 | 1.0 | 5 | 100 | MB4 |
| SCNA4 | 400 | 280 | 8.5 | 6 | 4.5 | 3 | 2.75 | 2 | 150 | 75 | 1.0 | 5 | 100 | MB4 |
| SCDA6 | 600 | 420 | 8.5 | 6 | 4.5 | 3 | 2.75 | 2 | 150 | 75 | 1.0 | 5 | 100 | MB4 |
| SCPA6 | 600 | 420 | 8.5 | 6 | 4.5 | 3 | 2.75 | 2 | 150 | 75 | 1.0 | 5 | 100 | MB4 |
| SCNA6 | 600 | 420 | 8.5 | 6 | 4.5 | 3 | 2.75 | 2 | 150 | 75 | 1.0 | 5 | 100 | MB4 |

Maximum thermal impedance junction to mounting surface 4.0°C/Watt.
Maximum operating and storage temperature —55°C to +150°C.

TERMINAL ORIENTATION



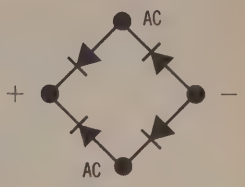




Semtech reserves the right to change specifications without notice.

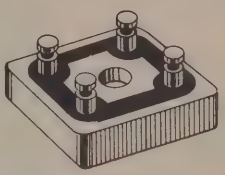
SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

# "ALPAC® JR." SILICON BRIDGE RECTIFIERS

Semtech offers "Alpac Jr." Designed in aluminum cases (turret terminals, insulated from case) to provide maximum thermal conductivity and simple installation. Internally the "Alpac Jr." utilizes the Semtech high performance solid double heat sink junctions. The bridges are designed for utilization in power supplies, AC to DC converters, motor control circuits, etc.



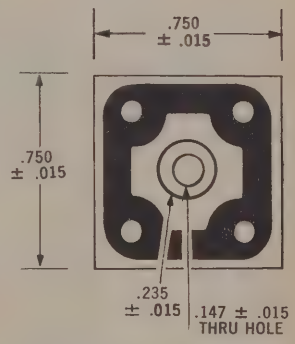

| Type | PIV per leg | Sine Wave RMS input Volt. Max. | Average DC Output Amps TC = (case temp.) (°C) | | Average DC Output Amps TA = Amb. Temp. (No Heat Sink) (°C) | | | Peak 1 Cycle Forward Surge | Peak DC Output (1 sec. max.) | Peak Recurrent Surge | VF Max. per leg. @ 1ADC | Reverse Current ($I_R$ Max. @PIV) | | Recovery Time ① | Data Sheet No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 55 | 100 | 25 | 55 | 100 | | 55°C | | 25°C | 25°C | 100°C | trr | |
| | Volts | Volts | Amps | Amps | Amps | Amps | Amps | Amps | Amps | Amps | Volts | μA | μA | μ sec. | |
| **5 AMP MULTI-PURPOSE** | | | | | | | | | | | | | | | |
| SCAJ2 | 200 | 140 | 5.5 | 4.0 | 2.0 | 1.5 | 1.05 | 5 0 | 10 | 15 | 1.2 | 2 | 5 0 | | MB12 |
| SCAJ4 | 400 | 280 | 5.5 | 4.0 | 2.0 | 1.5 | 1.05 | 5 0 | 10 | 15 | 1.2 | 2 | 5 0 | | MB12 |
| SCAJ6 | 600 | 420 | 5.5 | 4.0 | 2.0 | 1.5 | 1.05 | 5 0 | 10 | 15 | 1.2 | 2 | 5 0 | | MB12 |
| **FAST RECOVERY ($t_{rr}$) 150 NANOSECONDS (EXCEPT SCAJ6F)** | | | | | | | | | | | | | | | |
| SCAJ05F | 50 | 35 | 5.0 | 3.5 | 1.5 | 1.05 | .7 | 2 5 | | 9 | 1.3 | 2 | 5 0 | .150 | MB14 |
| SCAJ1F | 100 | 70 | 5.0 | 3.5 | 1.5 | 1.05 | .7 | 2 5 | | 9 | 1.3 | 2 | 5 0 | .150 | MB14 |
| SCAJ2F | 200 | 140 | 5.0 | 3.5 | 1.5 | 1.05 | .7 | 2 5 | | 9 | 1.3 | 2 | 5 0 | .150 | MB14 |
| SCAJ3F | 300 | 210 | 5.0 | 3.5 | 1.5 | 1.05 | .7 | 2 5 | | 9 | 1.3 | 2 | 5 0 | .150 | MB14 |
| SCAJ4F | 400 | 280 | 5.0 | 3.5 | 1.5 | 1.05 | .7 | 2 5 | | 9 | 1.3 | 2 | 5 0 | .150 | MB14 |
| SCAJ6F | 600 | 420 | 5.0 | 3.5 | 1.5 | 1.05 | .7 | 2 5 | | 9 | 1.3 | 2 | 5 0 | .250 | MB14 |



① Recovery Conditions: 0.5 amp forward current to 1.0 amp reverse current. Recovery time is measured when rectifier recovers to .25 Amps.

Operating and Storage Temperature, —55°C to +150°.

Maximum THERMAL IMPEDANCE junction to mounting surface 5°C/Watt.

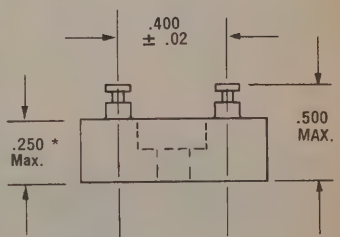



# "ALPAC-T"® SILICON BRIDGE RECTIFIERS

"ALPAC-T" is a packaging concept designed to replace discrete and stud rectifier arrays offering increased reliability and lower production costs for the customer. "ALPAC-T" utilizes the Metoxilite hermetically sealed rectifier — NASA and MIL approved rectifiers available. Internal components are supported in a low thermal impedance, epoxy thermoset-filled high alumina ceramic.

| Type | PIV Per Leg | Sine Wave RMS Input Voltage Max. | Average DC Output Amps TC = Case Temp. | | Average DC Output Amps TA = Ambient Temp. (No Heat Sink) | | | Peak 1 Cycle Forward Surge | Peak Recurrent Forward Surge | $V_F$ Max. Per Leg @ 3ADC | Reverse Current ($I_R$ Max. Per Leg @ PIV) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 55°C | 100° | 25°C | 55°C | 100° | | | 25°C | 25°C | 100°C |
| | Volts | Volts | Amps | Amps | Amps | Amps | Amps | Amps | Amps | Volts | μA | μA |
| SCBH2 | 200 | 140 | 12 | 9 | 4.0 | 3.0 | 1.7 | 125 | 60 | 1.0 | 2 | 50 |
| SCBH4 | 400 | 280 | 12 | 9 | 4.0 | 3.0 | 1.7 | 125 | 60 | 1.0 | 2 | 50 |
| SCBH6 | 600 | 420 | 12 | 9 | 4.0 | 3.0 | 1.7 | 125 | 60 | 1.0 | 2 | 50 |

TECHNICAL BULLETIN MB-43




* SCAJ ONLY
SCBH .300 MAX.

## "ALPAC-T" FAST RECOVERY ($t_{rr}$) 250 NANOSECONDS

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SCBH05F | 50 | 35 | 10 | 7.5 | 4.0 | 3.0 | 1.7 | 125 | 60 | 1.1 | 2 | 50 |
| SCBH1F | 100 | 70 | 10 | 7.5 | 4.0 | 3.0 | 1.7 | 125 | 60 | 1.1 | 2 | 50 |
| SCBH2F | 200 | 140 | 10 | 7.5 | 4.0 | 3.0 | 1.7 | 125 | 60 | 1.1 | 2 | 50 |
| SCBH4F | 400 | 280 | 10 | 7.5 | 4.0 | 3.0 | 1.7 | 125 | 60 | 1.1 | 2 | 50 |

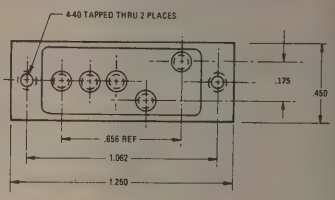
Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current.
Recovery time is measured when rectifier recovers to .25 amp.
Maximum Operating and Storage Temperature —55°C to +150°C.

TECHNICAL BULLETIN MB-44

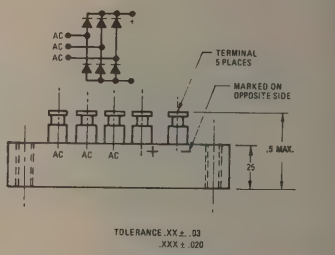
**SEMTECH**
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

## "ALPAC® JR. - 3" 3 PHASE SILICON BRIDGE RECTIFIERS

"ALPAC JR. - 3" is a packaging concept designed to replace discrete and stud rectifier arrays offering increased reliability and lower production costs for the customer. "ALPAC JR. - 3" utilizes the Metoxilite hermetically sealed rectifier — NASA and MIL approved rectifiers available. Internal components are supported in a low thermal impedance, epoxy thermoset-filled high alumina ceramic. "ALPAC JR. - 3" is designed for utilization in power supplies, AC to DC converters, motor control circuits, etc.



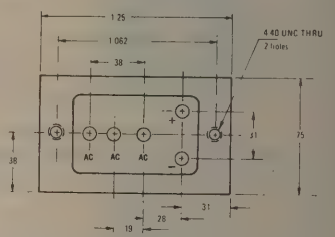

| Type | PIV Per Leg | Sine Wave RMS Input Volt. Max. | Average DC Output Amps TC = (case temp. 55°C | 100°C | Average DC Output Amps TA = Ambient Temp. (No Heat Sink) 25°C | 55°C | 100°C | Peak 1 Cycle Surge | Peak Recurrent Surge | VF Max. Per Leg @ 1 ADC 25°C | Reverse Current (IR Max. @ PIV) 25°C | 100°C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Volts | Volts | Amps | Amps | Amps | Amps | Amps | Amps | Amps | Volts | uA | uA |
| SC3BJ2 | 200 | 140 | 5.5 | 4 | 2.0 | 1.5 | 1.05 | 50 | 15 | 1.2 | 3 | 75 |
| SC3BJ4 | 400 | 280 | 5.5 | 4 | 2.0 | 1.5 | 1.05 | 50 | 15 | 1.2 | 3 | 75 |
| SC3BJ6 | 600 | 420 | 5.5 | 4 | 2.0 | 1.5 | 1.05 | 50 | 15 | 1.2 | 3 | 75 |




TECHNICAL BULLETIN MB35

### FAST RECOVERY ($t_{rr}$) 150 NANOSECONDS, SC3BJ6F ($T_{rr}$) 250 NANOSECONDS

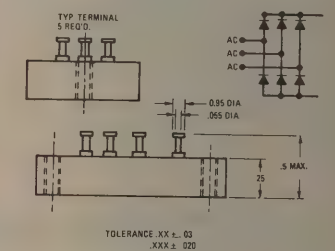
| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SC3BJ05F | 50 | 35 | 5 | 3.5 | 1.5 | 1.05 | .7 | 25 | 9 | 1.3 | 3 | 75 |
| SC3BJ1F | 100 | 70 | 5 | 3.5 | 1.5 | 1.05 | .7 | 25 | 9 | 1.3 | 3 | 75 |
| SC3BJ2F | 200 | 140 | 5 | 3.5 | 1.5 | 1.05 | .7 | 25 | 9 | 1.3 | 3 | 75 |
| SC3BJ4F | 400 | 280 | 5 | 3.5 | 1.5 | 1.05 | .7 | 25 | 9 | 1.3 | 3 | 75 |
| SC3BJ6F | 600 | 420 | 5 | 3.5 | 1.5 | 1.05 | .7 | 25 | 9 | 1.3 | 3 | 75 |




TECHNICAL BULLETIN MB36

## "ALPAC® - 3T" 3 PHASE SILICON BRIDGE RECTIFIERS

| Type | PIV Per Leg | Sine Wave Volt. Input Max. | Average DC Output Amps TC = Case Temp. 55°C | 100°C | 125°C | Average DC Output Amps TA = Ambient Temp. (No Heat Sink) 25°C | 55°C | 100°C | Peak 1 Cycle Forward Surge | Peak Recurrent Forward Surge | VF Max. Per Leg @ 3 ADC 25°C | Reverse Current (IR Max. Per Leg @ PIV) 25°C | 100°C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Volts | Volts | Amps | Amps | Amps | Amps | Amps | Amps | Amps | Amps | Volts | μA | μA |
| SC3BH2 | 200 | 140 | 11 | 8 | 5.5 | 4.0 | 3.0 | 1.7 | 125 | 60 | 1.0 | 5 | 100 |
| SC3BH4 | 400 | 280 | 11 | 8 | 5.5 | 4.0 | 3.0 | 1.7 | 125 | 60 | 1.0 | 5 | 100 |
| SC3BH6 | 600 | 420 | 11 | 8 | 5.5 | 4.0 | 3.0 | 1.7 | 125 | 60 | 1.0 | 5 | 100 |

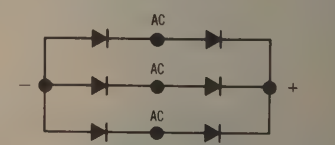



TECHNICAL BULLETIN MB37

### FAST RECOVERY ($t_{rr}$) 250 NANOSECONDS

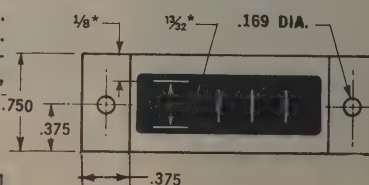
| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SC3BH05F | 50 | 35 | 9.5 | 7 | 5.0 | 3.0 | 2.2 | 1.2 | 125 | 50 | 1.1 | 5 | 100 |
| SC3BH1F | 100 | 70 | 9.5 | 7 | 5.0 | 3.0 | 2.2 | 1.2 | 125 | 50 | 1.1 | 5 | 100 |
| SC3BH2F | 200 | 140 | 9.5 | 7 | 5.0 | 3.0 | 2.2 | 1.2 | 125 | 50 | 1.1 | 5 | 100 |
| SC3BH4F | 400 | 280 | 9.5 | 7 | 5.0 | 3.0 | 2.2 | 1.2 | 125 | 50 | 1.1 | 5 | 100 |
| | | | | | | | 2.2 | 1.2 | 125 | 50 | 1.1 | 5 | 100 |

Reverse Recovery Time is measured on each junction prior to manufacture of assembly. TECHNICAL BULLETIN MB38
Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current. Recovery time is measured when rectifier recovers to .25 amp.
Maximum Operating and Storage Temperature −55°C to +150°C.

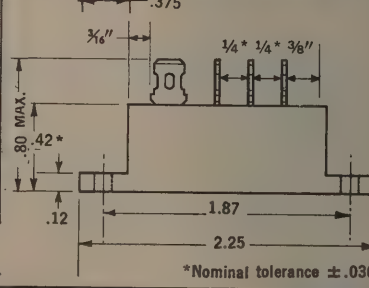



## "ALPAC® - 3" 3 PHASE SILICON BRIDGE RECTIFIERS

"Alpac-3," 3-phase silicon bridge rectifiers incorporates much of the original "Alpac"... aluminum case for maximum thermal conductivity, light weight, and simple installation. Internally, "Alpac-3" utilizes the Semtech high-performance silicon junctions bonded between solid double tungstaloid pins. "Alpac-3" is well suited for utilization in power supplies, AC to DC converters and motor control circuits. Also available in Fast Recovery.




| Type | PIV per leg | Sine Wave RMS input Volt. Max. | Average DC Output Amps TC = (case temp.) (°C) 55 | 100 | 125 | Average DC Output Amps TA = (Amb. Temp.) (No heat Sink) (°C) 25 | 55 | 100 | Peak 1 Cycle Forward Surge | Peak Recurrent Forward Surge | VF Max. per leg @ 3ADC 25°C | Reverse Current (IR Max. @ PIV) 25°C | 100°C | Data Sheet No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Volts | Volts | Amps | Amps | Amps | Amps | Amps | Amps | Amps | Amps | Volts | μA | μA | |
| SC3BA2 | 200 | 140 | 16.5 | 12 | 8.5 | 6.0 | 5.0 | 3.0 | 150 | 75 | 1.0 | 5 | 100 | MB7 |
| SC3BA4 | 400 | 280 | 16.5 | 12 | 8.5 | 6.0 | 5.0 | 3.0 | 150 | 75 | 1.0 | 5 | 100 | MB7 |
| SC3BA6 | 600 | 420 | 16.5 | 12 | 8.5 | 6.0 | 5.0 | 3.0 | 150 | 75 | 1.0 | 5 | 100 | MB7 |

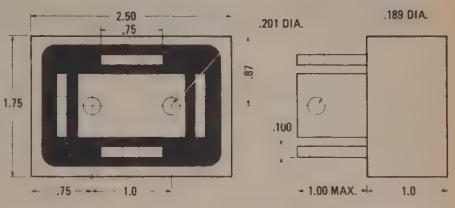



Operating and Storage temperature, —55°C to +150°C. Maximum thermal impedance junction to mounting surface 2.5°C/WATT
Semtech reserves the right to change specifications without notice.

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

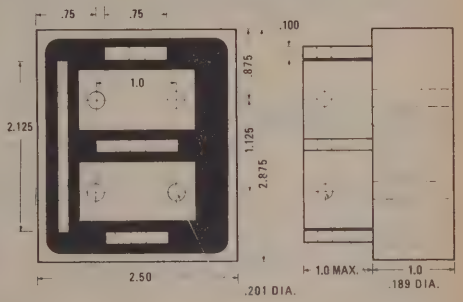
# "ALPAC® SR." SILICON BRIDGE RECTIFIERS

Semtech offers a wide choice of high current silicon bridge rectifiers for military and industrial applications. Leading the "Alpac Sr." family of heavy-duty products, these bridge rectifiers incorporate high-performance, solid, double tungstaloid pin, silicon junctions, insulated terminals, and light weight, easy-to-mount aluminum cases. Aluminum cases also provide maximum thermal conductivity. "Alpac Sr." bridges are designed for utilization in power supplies, AC to DC converters and motor control circuits.

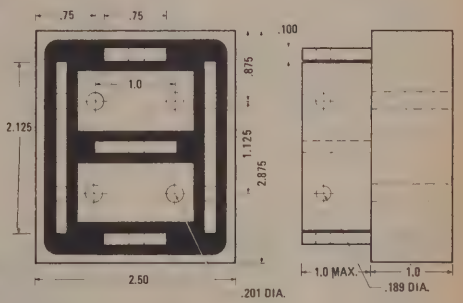



## HIGH CURRENT

| Type No. | Peak Inverse Voltage Per Leg | RMS Voltage Per Leg | Average Rectified Current | | Reverse Current Per Leg @ PIV | | One Cycle Surge | Data Sheet No. |
|---|---|---|---|---|---|---|---|---|
| | Volts | Volts | Amps | Amps | μA | μA | Amps | |
| | 25°C | 25°C | 55°C† | 100°C† | 25°C | 100°C | 25°C | |
| 1φFWB | | | | | | | | |
| SCAS2A | 200 | 140 | 150 | 80 | 20 | 300 | 750 | MB5 |
| SCAS4A | 400 | 280 | 150 | 80 | 20 | 300 | 750 | MB5 |
| SCAS6A | 600 | 420 | 150 | 80 | 20 | 300 | 750 | MB5 |
| 3φ½WB | | | | | | | | |
| SC3HAS2A* | 200 | 140 | 250 | 130 | 10 | 150 | 750 | MB5 |
| SC3HAS4A* | 400 | 280 | 250 | 130 | 10 | 150 | 750 | MB5 |
| SC3HAS6A* | 600 | 420 | 250 | 130 | 10 | 150 | 750 | MB5 |
| 3φFWB | | | | | | | | |
| SC3AS2A | 200 | 140 | 125 | 90 | 30 | 450 | 750 | MB5 |
| SC3AS4A | 400 | 280 | 125 | 90 | 30 | 450 | 750 | MB5 |
| SC3AS6A | 600 | 420 | 125 | 90 | 30 | 450 | 750 | MB5 |



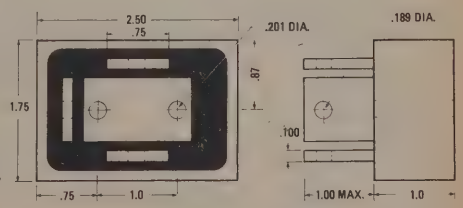

* Indicate polarity when ordering. † Case Temperature. ALSO AVAILABLE IN FAST RECOVERY
P — Positive Output.
N — Negative Output
Operating and Storage Temperature −55°C to +150°C.




## DOUBLERS AND CENTER TAPS

"Alpac Sr." doublers and center taps offer an integrated circuits approach to using high power rectifiers. Designed to replace stud rectifiers and provide simple, economical and reliable packaging.

| Type No. | Peak Inverse Voltage Per Leg | RMS Voltage Per Leg | Average Rectified Current | | Reverse Current Per Leg @ PIV | | One Cycle Surge | Data Sheet No. |
|---|---|---|---|---|---|---|---|---|
| | Volts | Volts | Amps | Amps | μA | μA | Amps | |
| | 25°C | 25°C | 55°C † | 100°C† | 25°C | 100°C | 25°C | |
| SCDAS2A | 200 | 140 | 200 | 105 | 10 | 150 | 750 | .1B6 |
| SCPAS2A | 200 | 140 | 200 | 105 | 10 | 150 | 750 | MB6 |
| SCNAS2A | 200 | 140 | 200 | 105 | 10 | 150 | 750 | MB6 |
| SCDAS4A | 400 | 280 | 200 | 105 | 10 | 150 | 750 | MB6 |
| SCPAS4A | 400 | 280 | 200 | 105 | 10 | 150 | 750 | MB6 |
| SCNAS4A | 400 | 280 | 200 | 105 | 10 | 150 | 750 | MB6 |
| SCDAS6A | 600 | 420 | 200 | 105 | 10 | 150 | 750 | MB6 |
| SCPAS6A | 600 | 420 | 200 | 105 | 10 | 150 | 750 | MB6 |
| SCNAS6A | 600 | 420 | 200 | 105 | 10 | 150 | 750 | MB6 |




† Case Temperature ALSO AVAILABLE IN FAST RECOVERY
Operating and Storage Temperature −55°C to +150°C.
Maximum Thermal Impedance, junction to mounting surface, 0.2°C/watt.
Semtech reserves the right to change specifications without notice.

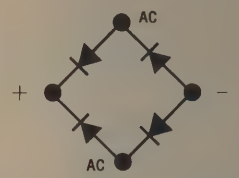
**SEMTECH**
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

# "ALPAC-50" SILICON BRIDGE RECTIFIERS

Semtech Corporation introduces "ALPAC-50", a complete line of Single Phase, Silicon Bridge, Rectifier Circuits. Designed in Aluminum Cases to provide maximum thermal conductivity and simple installation.

"ALPAC-50" terminals are insulated from case. Internally the device utilizes the Semtech high performance Metoxilite rectifiers. The bridges are designed for utilization in power supplies, AC to DC converters and motor control circuits.

| Type No. | Peak Inverse Voltage Per Leg | RMS Voltage Per Leg | Average Rectified Current | | Max. Forward Voltage @ 10A/Leg | Reverse Current Per Leg @ PIV | | One Cycle Surge Current |
|---|---|---|---|---|---|---|---|---|
| | Volts | Volts | Amps | | Volts | μA | | Amps |
| | 25°C | 25°C | 75°C† | 100°C† | 25°C | 25°C | 100°C | 25°C |

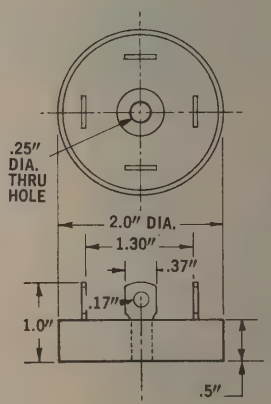



## BRIDGE RECTIFIERS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SCBAR2 | 200 | 140 | 50 | 33 | 1.1 | 4 | 80 | 375 |
| SCBAR4 | 400 | 280 | 50 | 33 | 1.1 | 4 | 80 | 375 |
| SCBAR6 | 600 | 420 | 50 | 33 | 1.1 | 4 | 80 | 375 |
| SCBAR8 | 800 | 560 | 50 | 33 | 1.1 | 4 | 80 | 375 |
| SCBAR10 | 1000 | 700 | 50 | 33 | 1.1 | 4 | 80 | 375 |

Max. Thermal Resistance 0.5°C/Watt
Operating and Storage Temperature −55°C to +150°C
†Case Temperature

TECHNICAL BULLETIN MB20




## FAST RECOVERY BRIDGE RECTIFIERS (trr) 200 NANOSECONDS

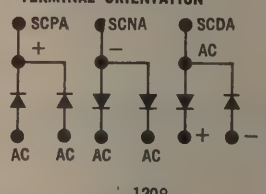
Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current. Recovery time measured when rectifier recovers to .25 amp.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SCBAR05F | 50 | 35 | 50 | 33 | 1.2 | 4 | 80 | 375 |
| SCBAR1F | 100 | 70 | 50 | 33 | 1.2 | 4 | 80 | 375 |
| SCBAR2F | 200 | 140 | 50 | 33 | 1.2 | 4 | 80 | 375 |
| SCBAR4F | 400 | 280 | 50 | 33 | 1.2 | 4 | 80 | 375 |

Max. Thermal Resistance 0.5°C/Watt
Operating and Storage Temperature −55°C to +150°C
†Case Temperature

TECHNICAL BULLETIN MB28

TERMINAL ORIENTATION

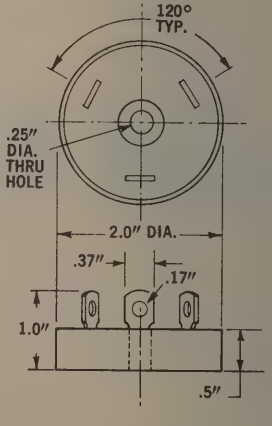



## DOUBLERS AND CENTER TAPS *See Note

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SCDAR2 | 200 | 140 | 25 | 16.5 | 1.1 | 4 | 80 | 375 |
| SCDAR4 | 400 | 280 | 25 | 16.5 | 1.1 | 4 | 80 | 375 |
| SCDAR6 | 600 | 420 | 25 | 16.5 | 1.1 | 4 | 80 | 375 |
| SCDAR8 | 800 | 560 | 25 | 16.5 | 1.1 | 4 | 80 | 375 |
| SCDAR10 | 1000 | 700 | 25 | 16.5 | 1.1 | 4 | 80 | 375 |

TECHNICAL BULLETIN MB29

*NOTE: Part numbers noted are doublers. For center taps, substitute P for positive and N for negative in place of letter D.
Max. Thermal Resistance 0.5°C/Watt
Operating and Storage Temperature −55°C to +150°C
†Case Temperature




## FAST RECOVERY DOUBLERS AND CENTER TAPS (trr) 200 NANOSECONDS

Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current. Recovery time measured when rectifier recovers to .25 amp.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SCDAR05F | 50 | 35 | 25 | 16.5 | 1.2 | 4 | 80 | 375 |
| SCDAR1F | 100 | 70 | 25 | 16.5 | 1.2 | 4 | 80 | 375 |
| SCDAR2F | 200 | 140 | 25 | 16.5 | 1.2 | 4 | 80 | 375 |
| SCDAR4F | 400 | 280 | 25 | 16.5 | 1.2 | 4 | 80 | 375 |

TECHNICAL BULLETIN MB30

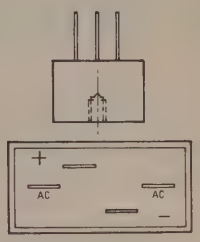
*NOTE: Part numbers noted are doublers. For center taps, substitute P for positive and N for negative in place of letter D.
Max. Thermal Resistance 0.5°C/Watt
Operating and Storage Temperature −55°C to +150°C
†Case Temperature

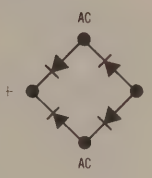
Semtech reserves the right to change specifications without notice.

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

# "ALPAC® - R50" SILICON BRIDGE RECTIFIERS

"ALPAC-R50" is a packaging concept designed to replace discrete and stud rectifier arrays offering increased reliability and lower production costs for the customer. "ALPAC-R50" utilizes the Metoxilite hermetically sealed rectifier — NASA and MIL approved rectifiers available. Internal components are supported in a low thermal impedance, epoxy thermoset-filled high alumina ceramic. This construction firmly secures and insulates the internal components to temperatures above 300°C. "ALPAC-R50" is designed for utilization in power supplies, AC to DC converters, motor control circuits, etc.

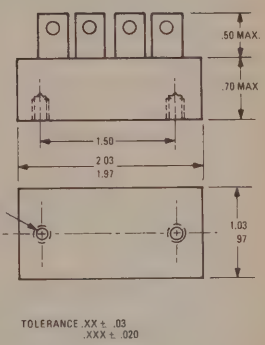



## BRIDGE RECTIFIERS

| Type No. | Peak Inverse Voltage Per Leg | RMS Voltage Per Leg | Average Rectified Current | | Maximum Forward Voltage @ 10A/Leg | Reverse Current Per Leg @ PIV | | One Cycle Surge Current |
|---|---|---|---|---|---|---|---|---|
| | Volts | Volts | Amps | Amps | Volts | μA | μA | Amps |
| | 25°C | 25°C | 55°C* | 100°C* | 25°C | 25°C | 100°C | 25°C |
| SCBK2 | 200 | 140 | 50 | 33 | 1.1 | 8 | 160 | 375 |
| SCBK4 | 400 | 280 | 50 | 33 | 1.1 | 8 | 160 | 375 |
| SCBK6 | 600 | 420 | 50 | 33 | 1.1 | 8 | 160 | 375 |

TECHNICAL BULLETIN MB39




## FAST RECOVERY BRIDGE RECTIFIERS ($t_{rr}$) 250 NANOSECONDS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SCBK05F | 50 | 35 | 50 | 33 | 1.2 | 8 | 160 | 375 |
| SCBK1F | 100 | 70 | 50 | 33 | 1.2 | 8 | 160 | 375 |
| SCBK2F | 200 | 140 | 50 | 33 | 1.2 | 8 | 160 | 375 |
| SCBK4F | 400 | 280 | 50 | 33 | 1.2 | 8 | 160 | 375 |

Maximum Thermal Resistance 0.6°C/Watt.

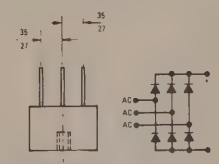
TECHNICAL BULLETIN MB40

* Case Temperature.

Operating and Storage Temperature −55°C to +150°C.

Reverse Recovery Time is measured on each junction prior to manufacture of assembly.

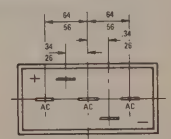
Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current. Recovery time is measured when rectifier recovers to .25 amp.

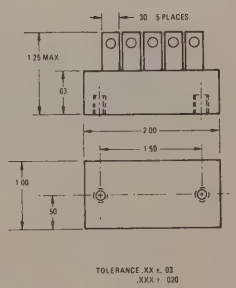



## 3-PHASE BRIDGE RECTIFIERS

| Type No. | Peak Inverse Voltage Per Leg | RMS Voltage Per Leg | Average Rectified Current | | Maximum Forward Voltage @ 10A/Leg | Reverse Current Per Leg @ PIV | | One Cycle Surge Current |
|---|---|---|---|---|---|---|---|---|
| | Volts | Volts | Amps | Amps | Volts | μA | μA | Amps |
| | 25°C | 25°C | 55°C* | 100°C* | 25°C | 25°C | 100°C | 25°C |
| SC3BK2 | 200 | 140 | 50 | 33 | 1.1 | 9 | 180 | 375 |
| SC3BK4 | 400 | 280 | 50 | 33 | 1.1 | 9 | 180 | 375 |
| SC3BK6 | 600 | 420 | 50 | 33 | 1.1 | 9 | 180 | 375 |

TECHNICAL BULLETIN MB41




## FAST RECOVERY 3-PHASE BRIDGE RECTIFIERS ($t_{rr}$) 200 NANOSECONDS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SC3BK05F | 50 | 35 | 50 | 33 | 1.2 | 9 | 180 | 375 |
| SC3BK1F | 100 | 70 | 50 | 33 | 1.2 | 9 | 180 | 375 |
| SC3BK2F | 200 | 140 | 50 | 33 | 1.2 | 9 | 180 | 375 |
| SC3BK4F | 400 | 280 | 50 | 33 | 1.2 | 9 | 180 | 375 |

* Case Temperature.

TECHNICAL BULLETIN MB42

Operating and Storage Temperature −55°C to +150°C.

Reverse Recovery Time is measured on each junction prior to manufacture of assembly.

Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current. Recovery time is measured when rectifier recovers to .25 amp.

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

# SUPER FAST RECOVERY SILICON POWER RECTIFIERS

A high efficiency fast recovery silicon power stud rectifier for high frequency applications. Ideally suited for designing high frequency switching regulators and power converters. The Super-Fast stud rectifier is suitable for use in consumer, industrial, military and space programs.

## DO-4 "STUD" 30 NANOSECONDS REVERSE RECOVERY

| Device Type * | Reverse Voltage | | Forward Current | Reverse Current (Max.) | | Instantaneous Forward Voltage (1) | | 1 Cycle Surge Current tp= 8.3 ms | Reverse Recovery Time | Max. Thermal Imped. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $I_R$ | | $V_F$ @ 10 Adc | | | | |
| | $V_R$ | $V_{RM}$ (WKg) | $T_C$=25°C $I_O$ | UA dc | | | | A(pk) | $T_{rr}$ ns | θJC |
| | Vdc | V | A | 25°C | 100°C | 25°C | 100°C | $I_F$(Surge) | Max. | °C/ Watt |
| SFF05 | 50 | 35 | 12 | 10 | 500 | 1.1 | 1.0 | 175 | 30 | 6 |
| SFF10 | 100 | 70 | 12 | 10 | 500 | 1.1 | 1.0 | 175 | 30 | 6 |
| SFF15 | 150 | 105 | 12 | 10 | 500 | 1.1 | 1.0 | 175 | 30 | 6 |
| | | | | | | $V_F$ @ 20 Adc | | | | |
| 2SFF05 | 50 | 35 | 20 | 20 | 1000 | 1.1 | 1.0 | 300 | 30 | 3 |
| 2SFF10 | 100 | 70 | 20 | 20 | 1000 | 1.1 | 1.0 | 300 | 30 | 3 |
| 2SFF15 | 150 | 105 | 20 | 20 | 1000 | 1.1 | 1.0 | 300 | 30 | 3 |

TECHNICAL BULLETIN MB49 REV A

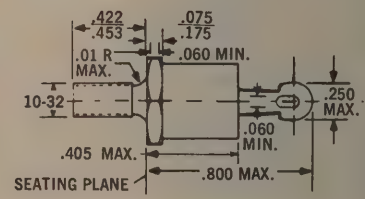
Max. Operating and Storage Temperature Range −55°C to +150°C.
Mounting Torque 15-20 Inch Lbs.
(1) $V_F$ is measured at pulse $I_F$ duration = 8 milliseconds max.
* For Reverse Polarity add "R" after type number.
Standard: Cathode to Base

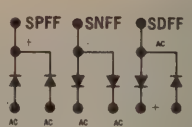
## DO-4T DOUBLERS AND CENTER TAPS
### 30 NANOSECONDS REVERSE RECOVERY

| Device Type | Reverse Voltage | | Forward Current | Reverse Current Max.-leg | | Instantaneous Forward Voltage (1) | | 1 Cycle Surge Current tp=8.3 ms | Reverse Recovery Time |
|---|---|---|---|---|---|---|---|---|---|
| | | | $T_C$=25°C | $I_R$ | | | | | $T_{rr}$ |
| | $V_R$ | $V_{RM}$(WKg) | $I_O$ | UA dc | | $V_F$ @ 10 Amps | | A(pk) | ns |
| | Vdc | V | A | 25°C | 100°C | 25°C | 100°C | $I_F$(Surge) | Max. |
| SNFF05 | 50 | 35 | 20 | 10 | 500 | 1.1 | 1.0 | 125 | 30 |
| SNFF10 | 100 | 70 | 20 | 10 | 500 | 1.1 | 1.0 | 125 | 30 |
| SNFF15 | 150 | 105 | 20 | 10 | 500 | 1.1 | 1.0 | 125 | 30 |
| SPFF05 | 50 | 35 | 20 | 10 | 500 | 1.1 | 1.0 | 125 | 30 |
| SPFF10 | 100 | 70 | 20 | 10 | 500 | 1.1 | 1.0 | 125 | 30 |
| SPFF15 | 150 | 105 | 20 | 10 | 500 | 1.1 | 1.0 | 125 | 30 |
| SDFF05 | 50 | 35 | 20 | 10 | 500 | 1.1 | 1.0 | 125 | 30 |
| SDFF10 | 100 | 70 | 20 | 10 | 500 | 1.1 | 1.0 | 125 | 30 |
| SDFF15 | 150 | 105 | 20 | 10 | 500 | 1.1 | 1.0 | 125 | 30 |

TECHNICAL BULLETIN MB50 REV A

Max. Operating and Storage Temperature Range −55°C to +150°C.
Mounting Torque 15-20 Inch Lbs.
Maximum thermal impedance junction to Case 3.0°C/W.
(1) $V_F$ is measured at pulse $I_F$ duration = 8 milliseconds max.



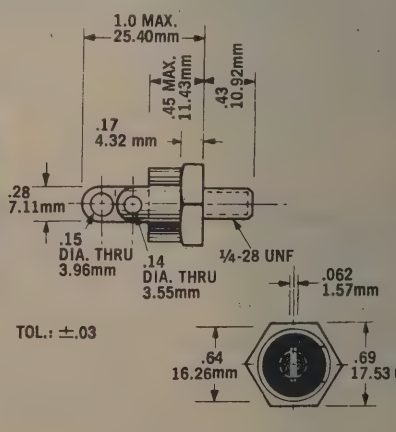



## DO-5L "STUD" 40 NANOSECONDS REVERSE RECOVERY

| Type No. * | PIV | $I_R$ @ PIV | | Max. $V_F$ @ 10 Amps (1) | | | Max. $V_F$ @ 30 Amps (1) | | | Max. $V_F$ @ 50 Amps (1) | | | Reverse Recovery |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Volt | Milliamps | | Volt | | | Volt | | | Volt | | | NSec |
| | | 25°C | 100°C | 25°C | 100°C | 150°C | 25°C | 100°C | 150°C | 25°C | 100°C | 150°C | Max. |
| STFF05 | 50 | .1 | 3 | .84 | .70 | .63 | .96 | .85 | .78 | 1.05 | .93 | .90 | 40 |
| STFF10 | 100 | .1 | 3 | .84 | .70 | .63 | .96 | .85 | .78 | 1.05 | .93 | .90 | 40 |
| STFF15 | 150 | .1 | 3 | .84 | .70 | .63 | .96 | .85 | .78 | 1.05 | .93 | .90 | 40 |

TECHNICAL BULLETIN MB46 REV C

Maximum Operating and Storage Temperature −55°C to +150°C.
Mounting Torque 35-40 Inch Lbs.
$T_{rr}$ Reverse Recovery is measured on each junction prior to manufacture of assembly.
Maximum thermal impedance junction to Case 1.0°C/W.
(1) $V_F$ is measured at pulse $I_F$ duration = 8 milliseconds max.
* For Reverse Polarity add "R" after type number. Standard: Cathode to Base
Metric equivalents are given for general information only and are based upon one inch = 25.4MM.



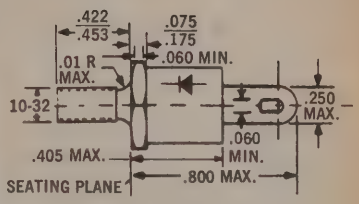

Semtech reserves the right to change specifications without notice.

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

# FAST RECOVERY SILICON POWER RECTIFIERS

## DO-4 "STUD" 150 NANOSECONDS REVERSE RECOVERY

A high efficiency fast recovery silicon power stud rectifier for high frequency applications. Ideally suited for designing high frequency switching regulators and power converters. The Fast stud rectifier is suitable for use in consumer, industrial, military and space programs.



| Device Type* | Reverse Voltage | | Forward Current | Reverse Current (Max.) | | Instantaneous Forward Voltage (1) | | 1 Cycle Surge Current tp=8.3 ms | Reverse Recovery Time | Max. Thermal Imped. |
|---|---|---|---|---|---|---|---|---|---|---|
| | $V_R$ | $V_{RM}$(WKg) | $T_C$=55°C $I_O$ | $I_R$ UA dc | | $V_F$ @ 8 Adc | | A (pk) | $T_{rr}$ ns | θJC |
| | Vdc | V | A | 25°C | 100°C | 25°C | 100°C | $I_F$ (Surge) | Max. | °C/Watt |
| 1SF1 | 100 | 70 | 8 | 1.0 | 20 | 1.40 | 1.35 | 125 | 150 | 6 |
| 1SF2 | 200 | 140 | 8 | 1.0 | 20 | 1.40 | 1.35 | 125 | 150 | 6 |
| 1SF4 | 400 | 280 | 8 | 1.0 | 20 | 1.40 | 1.35 | 125 | 150 | 6 |
| | | | | | | $V_F$ @ 16 Adc | | | | |
| 2SF1 | 100 | 70 | 16 | 2.0 | 40 | 1.40 | 1.35 | 250 | 150 | 3 |
| 2SF2 | 200 | 140 | 16 | 2.0 | 40 | 1.40 | 1.35 | 250 | 150 | 3 |
| 2SF4 | 400 | 280 | 16 | 2.0 | 40 | 1.40 | 1.35 | 250 | 150 | 3 |

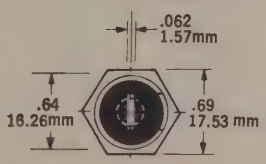
TECHNICAL BULLETIN

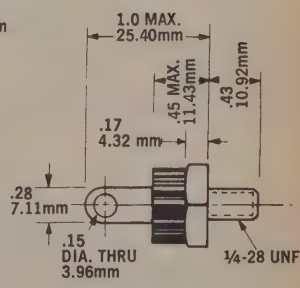
Max. Operating and Storage Temperature −55°C to +150°C.
Mounting Torque 15-20 Lbs.
(1) $V_F$ is measured at pulse $I_F$ duration = 8 milliseconds max.
* For Reverse Polarity add "R" after type number.
Standard: Cathode to Base

# DO-5 "STUD" SILICON POWER RECTIFIERS

Semtech Corporation introduces a new series of high current silicon stud rectifiers with fast recovery characteristics.

This series has been specifically designed for high frequency, high power industrial, military and space applications. Designed with Metoxilite rectifiers in a DO-5 base and easy-to-solder terminal.




TOL.: ±.03

### MEDIUM RECOVERY ($t_{rr}$) 2 MICROSECONDS

| Type No. * | PIV | $I_R$ @ PIV Per Leg | | Reverse Recovery | ① $V_F$ @ 50 Amps | |
|---|---|---|---|---|---|---|
| | | 25°C | 100°C | Max. | 25°C | 100°C |
| | V | μA | μA | μsec | Max. | Max. |
| ST2M | 200 | 13 | 500 | 2.0 | 1.22 | 1.17 |
| ST3M | 300 | 13 | 500 | 2.0 | 1.22 | 1.17 |
| ST4M | 400 | 13 | 500 | 2.0 | 1.22 | 1.17 |
| ST6M | 600 | 13 | 500 | 2.0 | 1.22 | 1.17 |

TECHNICAL BULLETIN MB45

### FAST RECOVERY ($t_{rr}$) 150 NANOSECONDS

| Type No. * | PIV | $I_R$ @ PIV Per Leg | | Reverse Recovery | ① $V_F$ @ 50 Amps | |
|---|---|---|---|---|---|---|
| | | 25°C | 100°C | Max. | 25°C | 100°C |
| | V | μA | μA | Nsec | Max. | Max. |
| STF1 | 100 | 13 | 500 | 150 | 1.40 | 1.35 |
| STF2 | 200 | 13 | 500 | 150 | 1.40 | 1.35 |
| STF3 | 300 | 13 | 500 | 150 | 1.40 | 1.35 |
| STF4 | 400 | 13 | 500 | 150 | 1.40 | 1.35 |

TECHNICAL BULLETIN MB45

## LO-VF "STUD"

| Type No. | PIV | $I_R$ @ PIV | | Reverse Recovery | | ① $V_F$ @ 10 Amps | | | | | | ① $V_F$ @ 30 Amps | | | | | | ① $V_F$ @ 50 Amps | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 25°C | 100°C | Typ | Max. | 25°C | | 100°C | | 150°C | | 25°C | | 100°C | | 150°C | | 25°C | | 100°C | | 150°C | |
| | V | μA | μA | Nsec | Nsec | Typ | Max. | Typ | Max. | Typ | Max. | Typ | Max. | Typ | Max. | Typ | Max. | Typ | Max. | Typ | Max. | Typ | Max. |
| STL03* | 30 | 13 | 500 | 85 | 100 | .86 | .88 | .77 | .78 | .72 | .74 | .95 | .97 | .88 | .91 | .85 | .88 | 1.02 | 1.05 | .97 | 1.00 | .93 | .98 |
| STL05* | 50 | 13 | 500 | 85 | 100 | .86 | .88 | .77 | .78 | .72 | .74 | .95 | .97 | .88 | .91 | .85 | .88 | 1.02 | 1.05 | .97 | 1.00 | .93 | .98 |

TECH. BULL. MB32

* For Reverse Polarity, Add "R" After Type No. Standard: Cathode to Base
Maximum Operating & Storage Temperature −55°C to +150°C — Mounting Torque 35-40 Inch Lbs.
Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current.
Recovery time is measured when rectifier recovers to .25 amp.
$T_{rr}$ Reverse Recovery is measured on each junction prior to manufacture of assembly.
Maximum thermal impedance junction to case 1.0°C/Watt.
① $V_F$ is measured at pulse $I_F$ duration = 1.0 millisecond.

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

# CUPAC 150, LO-V FAST RECOVERY SILICON POWER RECTIFIERS

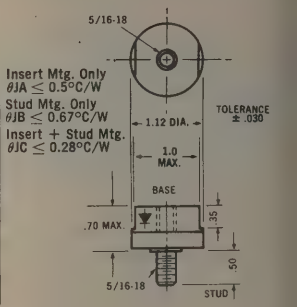
Semtech Corporation introduces "CuPac" 150, a new series of high current silicon rectifiers with fast recovery characteristics. OFHC† insert base and stud allow the internal Metoxilite rectifiers to be heat sunk from cathode, anode or both.

This series has been specifically designed for high frequency, high power industrial, military and space applications.

## ½ WAVE RECTIFIER

| Type No. 1 | PIV | $I_R$ @ PIV Per Leg | | Reverse Recovery | | * $V_F$ @ 20 Amps | | | | | | * $V_F$ @ 60 Amps | | | | | | * $V_F$ @ 100 Amps | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 25°C | 100°C | Typ. | Max. | 25°C | | 100°C | | 150°C | | 25°C | | 100°C | | 150°C | | 25°C | | 100°C | | 150°C | |
| | V | μA | MA | Nsec | Nsec | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | Max. |
| SCSL03 | 30 | 25 | 1 | 85 | 100 | .86 | .88 | .77 | .78 | .72 | .74 | .95 | .97 | .88 | .91 | .85 | .88 | 1.02 | 1.05 | .97 | 1.00 | .93 | .98 |
| SCCL05 | 50 | 25 | 1 | 85 | 100 | .86 | .88 | .77 | .78 | .72 | .74 | .95 | .97 | .88 | .91 | .85 | .88 | 1.02 | 1.05 | .97 | 1.00 | .93 | .98 |

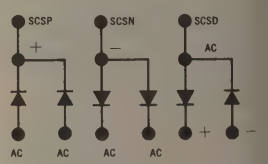
TECHNICAL BULLETIN MB31

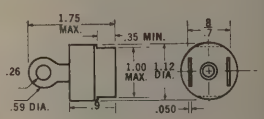



## DOUBLERS AND CENTER TAPS

| Type No. 2 | PIV | $I_R$ @ PIV Per Leg | | Reverse Recovery | | * $V_F$ @ 10 Amps | | | | | | * $V_F$ @ 30 Amps | | | | | | * $V_F$ @ 50 Amps | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 25°C | 100°C | Typ. | Max. | 25°C | | 100°C | | 150°C | | 25°C | | 100°C | | 150°C | | 25°C | | 100°C | | 150°C | |
| | V | μA | μA | Nsec | Nsec | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | Max. |
| SCSDL03 | 30 | 13 | 500 | 85 | 100 | .86 | .88 | .77 | .78 | .72 | .74 | .95 | .97 | .88 | .91 | .85 | .88 | 1.02 | 1.05 | .97 | 1.00 | .93 | .98 |
| SCSPL03 | 30 | 13 | 500 | 85 | 100 | .86 | .88 | .77 | .78 | .72 | .74 | .95 | .97 | .88 | .91 | .85 | .88 | 1.02 | 1.05 | .97 | 1.00 | .93 | .98 |
| SCSNL03 | 30 | 13 | 500 | 85 | 100 | .86 | .88 | .77 | .78 | .72 | .74 | .95 | .97 | .88 | .91 | .85 | .88 | 1.02 | 1.05 | .97 | 1.00 | .93 | .98 |
| SCSDL05 | 50 | 13 | 500 | 85 | 100 | .86 | .88 | .77 | .78 | .72 | .74 | .95 | .97 | .88 | .91 | .85 | .88 | 1.02 | 1.05 | .97 | 1.00 | .93 | .98 |
| SCSPL05 | 50 | 13 | 500 | 85 | 100 | .86 | .88 | .77 | .78 | .72 | .74 | .95 | .97 | .88 | .91 | .85 | .88 | 1.02 | 1.05 | .97 | 1.00 | .93 | .98 |
| SCSNL05 | 50 | 13 | 500 | 85 | 100 | .86 | .88 | .77 | .78 | .72 | .74 | .95 | .97 | .88 | .91 | .85 | .88 | 1.02 | 1.05 | .97 | 1.00 | .93 | .98 |

TECHNICAL BULLETIN MB31

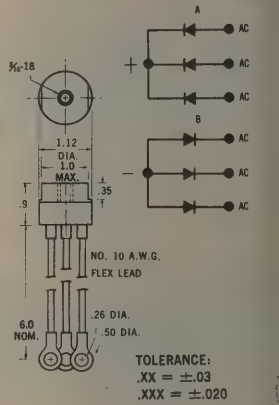



## 3-PHASE ½ WAVE BRIDGE

| Type No. 3 | PIV | $I_R$ @ PIV Per Leg | | Reverse Recovery | | * $V_F$ @ 5 Amps | | | | | | * $V_F$ @ 15 Amps | | | | | | * $V_F$ @ 25 Amps | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 25°C | 100°C | Typ. | Max. | 25°C | | 100°C | | 150°C | | 25°C | | 100°C | | 150°C | | 25°C | | 100°C | | 150°C | |
| | V | μA | μA | Nsec | Nsec | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | Max. | Typ. | Max. |
| SCSHL03 | 30 | 10 | 350 | 85 | 100 | .86 | .88 | .77 | .78 | .72 | .74 | .95 | .97 | .88 | .91 | .85 | .88 | 1.02 | 1.05 | .97 | 1.00 | .93 | .98 |
| SCSHL05 | 50 | 10 | 350 | 85 | 100 | .86 | .88 | .77 | .78 | .72 | .74 | .95 | .97 | .88 | .91 | .85 | .88 | 1.02 | 1.05 | .97 | 1.00 | .93 | .98 |

TECHNICAL BULLETIN MB31




Maximum Operating & Storage Temperature −55°C to +150°C — Mounting Torque 35 - 40 Inch Lbs.

Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current.

Recovery time measured when rectifier recovers to .25 amp measured on individual rectifiers prior to assembly.

†OFHC — Oxygen Free High Conductivity

1 For Reverse Polarity, Add "R" After Type No.

2 STANDARD PART COMES WITH NO. 8 A.W.G. — FLEX LEADS, ADD LETTER W AFTER TYPE NO. — ADD LETTER L AFTER TYPE NUMBER TO SPECIFY LUG TYPE.

3 For Negative Polarity, Add "N" After Type No.

*$V_F$ is measured at pulse $I_F$ duration = 1.0 millisecond.

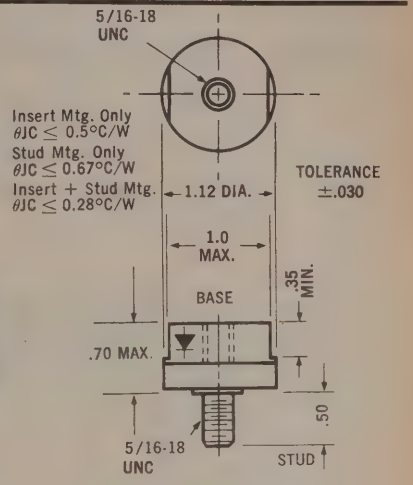
Semtech reserves the right to change specifications without notice.

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

# "CUPAC" 150 SILICON POWER RECTIFIERS

Semtech Corporation introduces "CuPac" 150, a new series of high current silicon rectifiers with fast recovery characteristics. OFHC** insert base and stud allow the internal Metoxilite rectifiers to be heat sunk from cathode, anode or both. The secondary epoxy case provides a long external leakage path necessary for P.I.V. to 600 volts.

This series has been specifically designed for high frequency, high power industrial, military and space applications.




### FAST RECOVERY ($t_{rr}$) 200 NANOSECONDS

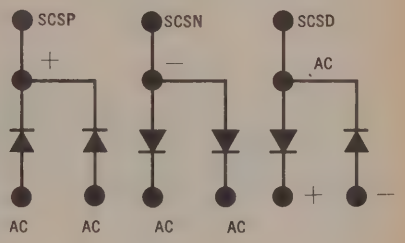
| Type No. | Peak Inverse Voltage | Max. * $V_F$ @ 100A $T_J$ 25°C | Max. * $V_F$ @ 100A $T_J$ 100°C | Max. Static Rev. Current @ PIV 25°C | Max. Static Rev. Current @ PIV 100°C |
|---|---|---|---|---|---|
| | Volts | Volts | Volts | μA | MA |
| SCSF05 | 50 | 1.4 | 1.35 | 25 | 1 |
| SCSF1 | 100 | 1.4 | 1.35 | 25 | 1 |
| SCSF2 | 200 | 1.4 | 1.35 | 25 | 1 |
| SCSF4 | 400 | 1.4 | 1.35 | 25 | 1 |

### MEDIUM RECOVERY ($t_{rr}$) 2 MICROSECONDS

| Type No. | Peak Inverse Voltage | Max. * $V_F$ @ 100A $T_J$ 25°C | Max. * $V_F$ @ 100A $T_J$ 100°C | Max. Static Rev. Current @ PIV 25°C | Max. Static Rev. Current @ PIV 100°C |
|---|---|---|---|---|---|
| | Volts | Volts | Volts | μA | MA |
| SCSM2 | 200 | 1.22 | 1.17 | 25 | 1 |
| SCSM4 | 400 | 1.22 | 1.17 | 25 | 1 |
| SCSM6 | 600 | 1.22 | 1.17 | 25 | 1 |

TECHNICAL BULLETIN R75

For reverse polarity, add "R" after Type No.
"CUPAC" also available in DOUBLERS and CENTER TAPS, 3-PHASE ½ WAVE BRIDGE
* $V_F$ is measured at pulse $I_F$ duration = 1.0 millisecond.




## DOUBLERS AND CENTER TAPS

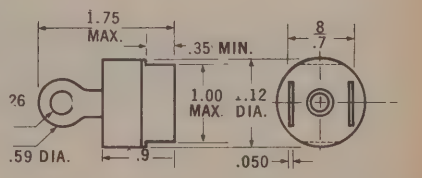
### FAST RECOVERY ($t_{rr}$) 200 NANOSECONDS

| Type No. | Peak Inverse Voltage Per Leg 25°C | Max. * $V_F$ @ 50A $T_J$ 25°C | Max. * $V_F$ @ 50A $T_J$ 100°C | Max. Reverse Current Per Leg 25°C | Max. Reverse Current Per Leg 100°C |
|---|---|---|---|---|---|
| | Volts | Volts | Volts | μA | μA |
| SCSDF05 | 50 | 1.4 | 1.35 | 13 | 500 |
| SCSPF05 | 50 | 1.4 | 1.35 | 13 | 500 |
| SCSNF05 | 50 | 1.4 | 1.35 | 13 | 500 |
| SCSDF1 | 100 | 1.4 | 1.35 | 13 | 500 |
| SCSPF1 | 100 | 1.4 | 1.35 | 13 | 500 |
| SCSNF1 | 100 | 1.4 | 1.35 | 13 | 500 |
| SCSDF2 | 200 | 1.4 | 1.35 | 13 | 500 |
| SCSPF2 | 200 | 1.4 | 1.35 | 13 | 500 |
| SCSNF2 | 200 | 1.4 | 1.35 | 13 | 500 |
| SCSDF4 | 400 | 1.4 | 1.35 | 13 | 500 |
| SCSPF4 | 400 | 1.4 | 1.35 | 13 | 500 |
| SCSNF4 | 400 | 1.4 | 1.35 | 13 | 500 |

### MEDIUM RECOVERY ($t_{rr}$) 2 MICROSECONDS

| Type No. | Peak Inverse Voltage Per Leg 25°C | Max. * $V_F$ @ 50A $T_J$ 25°C | Max. * $V_F$ @ 50A $T_J$ 100°C | Max. Reverse Current Per Leg 25°C | Max. Reverse Current Per Leg 100°C |
|---|---|---|---|---|---|
| | Volts | Volts | Volts | μA | μA |
| SCSDM2 | 200 | 1.22 | 1.17 | 13 | 500 |
| SCSPM2 | 200 | 1.22 | 1.17 | 13 | 500 |
| SCSNM2 | 200 | 1.22 | 1.17 | 13 | 500 |
| SCSDM4 | 400 | 1.22 | 1.17 | 13 | 500 |
| SCSPM4 | 400 | 1.22 | 1.17 | 13 | 500 |
| SCSNM4 | 400 | 1.22 | 1.17 | 13 | 500 |
| SCSDM6 | 600 | 1.22 | 1.17 | 13 | 500 |
| SCSPM6 | 600 | 1.22 | 1.17 | 13 | 500 |
| SCSNM6 | 600 | 1.22 | 1.17 | 13 | 500 |

TECHNICAL BULLETIN MB25

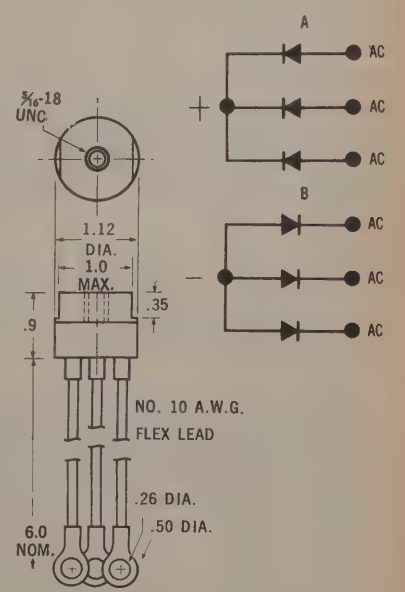



Maximum Operating & Storage Temperature —55°C to +150°C.
Mounting Torque 35-40 Inch Lbs.
**OFHC—Oxygen Free High Conductivity,
* $V_F$ is measured at pulse $I_F$ duration = 1.0 millisecond.

Standard part comes with No. 8 A.W.G. Flex Leads
Add letter W after Type No.
—Add Letter L after type number to specify lug type.
Recovery conditions: 0.5 amp forward current to 1.0 amp reverse current. Recovery time measured when rectifier recovers to .25 amp and performed on each diode prior to assembly.

## 3-PHASE ½ WAVE BRIDGE

Semtech Corporation introduces a new series of "CuPac" 150 high current silicon 3 phase ½ wave bridges with fast recovery characteristics. OFHC** insert base allows the internal Metoxilite rectifiers to be heat sunk. The secondary epoxy case provides a long external leakage path necessary for P.I.V. to 600 volts.




### FAST RECOVERY ($t_{rr}$) 200 NANOSECONDS

| Type No. | Peak Inverse Voltage Per Leg 25°C | Max. * $V_F$ @ 33A $T_J$ 25°C | Max. * $V_F$ @ 33A $T_J$ 100°C | Reverse Current Per Leg @ PIV 25°C | Reverse Current Per Leg @ PIV 100°C |
|---|---|---|---|---|---|
| | Volts | Volts | Volts | μA | μA |
| SCSHF05 | 50 | 1.4 | 1.35 | 10 | 350 |
| SCSHF1 | 100 | 1.4 | 1.35 | 10 | 350 |
| SCSHF2 | 200 | 1.4 | 1.35 | 10 | 350 |
| SCSHF4 | 400 | 1.4 | 1.35 | 10 | 350 |

### MEDIUM RECOVERY ($t_{rr}$) 2 MICROSECONDS

| Type No. | Peak Inverse Voltage Per Leg 25°C | Max. * $V_E$ @ 33A $T_J$ 25°C | Max. * $V_E$ @ 33A $T_J$ 100°C | Reverse Current Per Leg @ PIV 25°C | Reverse Current Per Leg @ PIV 100°C |
|---|---|---|---|---|---|
| | Volts | Volts | Volts | μA | μA |
| SCSHM2 | 200 | 1.22 | 1.17 | 10 | 350 |
| SCSHM4 | 400 | 1.22 | 1.17 | 10 | 350 |
| SCSHM6 | 600 | 1.22 | 1.17 | 10 | 350 |

TECHNICAL BULLETIN MB26

For Negative Polarity, Add "N" After Type No.
*$V_F$ is measured at pulse $I_F$ duration = 1.0 millisecond.

Semtech reserves the right to change specifications without notice.

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

# "SLIMPAC" HIGH VOLTAGE-HIGH CURRENT SILICON RECTIFIERS

The Semtech's "Slimpac" is a new high density high voltage high current silicon rectifier for use in industrial and military applications which require small, lightweight rectifiers without compromise on the required high reliability criteria. Designed and tooled to be efficiently mass produced, "Slimpac" can be used economically in existing applications. The rectifier can be utilized in all standard, single and polyphase rectifier circuits. Designed to be corona free, the unit is capable of meeting stringent electrical, mechanical, and environmental specifications.

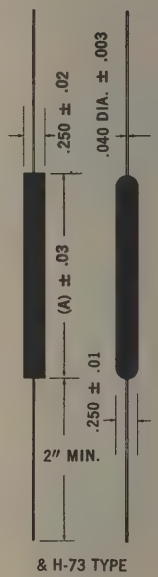
## "SLIMPAC JR."

| Type No. | Peak Inverse Voltage | Average Rectified Current 55°C | Average Rectified Current 100°C | One Cycle Surge Current | Reverse Current @ PIV 25°C | Reverse Current @ PIV 100°C | Max. Forward Voltage | Max. Case Size (A) | Data Sheet No. |
|---|---|---|---|---|---|---|---|---|---|
| | Volts | Amps | Amps | Amps | μA | μA | 50 MA | Inches | |
| SCHJ15K | 15000 | .050 | .030 | 20 | 1.0 | 25 | 20 | 1.5 | H49 |
| SCHJ22.5K | 22500 | .050 | .030 | 20 | 1.0 | 25 | 30 | 2 | H49 |
| SCHJ30K | 30000 | .050 | .030 | 20 | 1.0 | 25 | 40 | 2.5 | H49 |
| SCHJ37.5K | 37500 | .050 | .030 | 20 | 1.0 | 25 | 50 | 3 | H49 |
| SCHJ45K | 45000 | .050 | .030 | 20 | 1.0 | 25 | 60 | 3.5 | H49 |

Operating and Storage Ambient Temperature −55°C to +150°C.
Maximum Junction Temperature +175°C.
Semtech reserves the right to change specifications without notice.

## "SLIMPAC JR." FAST RECOVERY ($T_{rr}$) 200 NANOSECONDS

| Type No. | Peak Inverse Voltage | Average Rectified Current 55°C | Average Rectified Current 100°C | One Cycle Surge Current | Reverse Current @ PIV 25°C | Reverse Current @ PIV 100°C | Max. Forward Voltage | Max. Case Size (A) | Data Sheet No. |
|---|---|---|---|---|---|---|---|---|---|
| | Volts | Amps | Amps | Amps | μA | μA | 50 MA | Inches | |
| SCHJ15KF | 15000 | .050 | .030 | 20 | 1.0 | 25 | 20 | 1.5 | H73 |
| SCHJ22.5KF | 22500 | .050 | .030 | 20 | 1.0 | 25 | 30 | 2 | H73 |
| SCHJ30KF | 30000 | .050 | .030 | 20 | 1.0 | 25 | 40 | 2.5 | H73 |
| SCHJ37.5KF | 37500 | .050 | .030 | 20 | 1.0 | 25 | 50 | 3 | H73 |
| SCHJ45KF | 45000 | .050 | .030 | 20 | 1.0 | 25 | 60 | 3.5 | H73 |



& H-73 TYPE

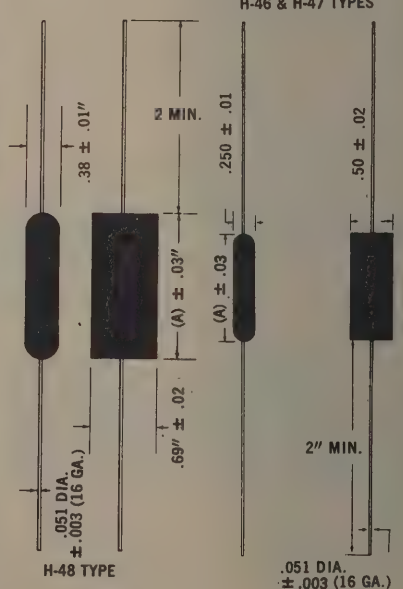
| Type No. | Peak Inverse Voltage | Average Rectified Current 55°C | Average Rectified Current 100°C | One Cycle Surge Current | Reverse Current @ PIV 25°C | Reverse Current @ PIV 100°C | Max. Forward Voltage | Max. Case Size (A) | Data Sheet No. |
|---|---|---|---|---|---|---|---|---|---|
| | Volts | Amps | Amps | Amps | μA | μA | 500 MA | Inches | |
| SCH5000 | 5000 | .5 | .33 | 50 | 0.1 | 15 | 7 | 1.125 | H46 |
| SCH7500 | 7500 | .5 | .33 | 50 | 0.1 | 15 | 10 | 1.625 | H46 |
| SCH10000 | 10000 | .5 | .33 | 50 | 0.1 | 15 | 14 | 2.000 | H46 |
| SCH12500 | 12500 | .5 | .33 | 50 | 0.1 | 15 | 17 | 2.375 | H46 |
| SCH15000 | 15000 | .5 | .33 | 50 | 0.1 | 15 | 20 | 2.750 | H46 |
| SCH20000 | 20000 | .5 | .33 | 50 | 0.1 | 15 | 27 | 3.500 | H46 |
| SCH25000 | 25000 | .5 | .33 | 50 | 0.1 | 15 | 33 | 4.250 | H46 |

H-46 & H-47 TYPES

## FAST RECOVERY **($t_{rr}$) 200 NANOSECONDS

| Type No. | Peak Inverse Voltage | Average Rectified Current 55°C | Average Rectified Current 100°C | One Cycle Surge Current | Reverse Current @ PIV 25°C | Reverse Current @ PIV 100°C | Max. Forward Voltage | Max. Case Size (A) | Data Sheet No. |
|---|---|---|---|---|---|---|---|---|---|
| | Volts | Amps | Amps | Amps | μA | μA | 500 MA | Inches | |
| SCF2500 | 2500 | .5 | .33 | 25 | 1.0 | 25 | 6 | 1.125 | H47 |
| SCF5000 | 5000 | .5 | .33 | 25 | 1.0 | 25 | 12 | 2.000 | H47 |
| SCF7500 | 7500 | .5 | .33 | 25 | 1.0 | 25 | 18 | 2.750 | H47 |
| SCF10000 | 10000 | .5 | .33 | 25 | 1.0 | 25 | 24 | 3.500 | H47 |
| SCF12500 | 12500 | .5 | .33 | 25 | 1.0 | 25 | 30 | 4.250 | H47 |

**$T_{RR}$ Reverse Recovery is measured on each junction prior to manufacture of assembly.
0.5 Amp forward current to 1.0 Amp reverse current. Recovery time measured when rectifier recovers to .25 Amp.
Operating and Storage Ambient Temperature −55°C to +150°C.
Maximum Junction Temperature +175°C.



H-48 TYPE

## "SLIMPAC SR."

ALSO AVAILABLE IN FAST RECOVERY

| Type No. | Peak Inverse Voltage | Average Rectified Current 55°C | Average Rectified Current 100°C | One Cycle Surge Current | Reverse Current @ PIV 25°C | Reverse Current @ PIV 100°C | Max. Forward Voltage | Max. Case Size (A) | Data Sheet No. |
|---|---|---|---|---|---|---|---|---|---|
| | Volts | Amps | Amps | Amps | μA | μA | 1.0 AMP | Inches | |
| SCHS2500 | 2500 | 2 | 1.2 | 150 | 10 | 120 | 5 | 1.5 | H48 |
| SCHS5000 | 5000 | 2 | 1.2 | 150 | 10 | 120 | 10 | 2.5 | H48 |
| SCHS7500 | 7500 | 2 | 1.2 | 150 | 10 | 120 | 15 | 3.5 | H48 |
| SCHS10000 | 10000 | 2 | 1.2 | 150 | 10 | 120 | 20 | 4.5 | H48 |
| SCHS12500 | 12500 | 2 | 1.2 | 150 | 10 | 120 | 25 | 5.5 | H48 |
| SCHS15000 | 15000 | 2 | 1.2 | 150 | 10 | 120 | 30 | 6.5 | H48 |

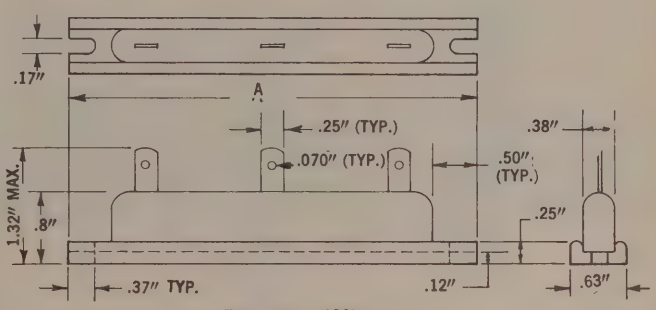
Operating and Storage Ambient Temperature −55°C to +150°C.
Maximum Junction Temperature +175°C.

SEMTECH
CORPORATION . 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

# "KV-PAC" HIGH VOLTAGE SILICON RECTIFIERS, DOUBLERS AND CENTER TAPS

New high voltage silicon rectifier assemblies in a rugged, functional design. "KV-PAC" has easy-to-use mounting slots and universal 3-way electrical connections. Designed to operate at 0.6 Amp when utilized as a half-wave rectifier, doubler and 1.2 Amps in a center-tap, or bridge circuit application. Economical, for usage in commercial and industrial applications such as power supplies for the microwave ovens.

| Type No. | Peak Inverse Voltage Per Leg | Avg. Rect. Curr. 55°C | Max. Forward Voltage @ 250 MA/Leg | One Cycle Surge Current | Reverse Current @ PIV | Case Length |
|---|---|---|---|---|---|---|
| | 55°C | Mtg. | 25°C | 55°C | 25°C | (A) |
| | Volts | Amps | Volts | Amps | μA | Inches |
| SDH10K | 10KV | 0.6 | 14 | 35 | 10 | 3.36 |
| SDH15K | 15KV | 0.6 | 21 | 35 | 10 | 4.04 |
| SDHC5K | 5KV | 1.2 | 7 | 35 | 10 | 3.36 |
| SDHD5K | 5KV | 0.6 | 7 | 35 | 10 | 3.36 |
| SDHC10K | 10KV | 1.2 | 14 | 35 | 10 | 4.72 |
| SDHD10K | 10KV | 0.6 | 14 | 35 | 10 | 4.72 |
| SDHC15K | 15KV | 1.2 | 21 | 35 | 10 | 6.09 |
| SDHD15K | 15KV | 0.6 | 21 | 35 | 10 | 6.09 |



Tolerance ±.030"

TECHNICAL BULLETIN MB27

On Center Tap Add Suffix P for Positive Output, N for Negative Output.
Operating and Storage Temperature −55°C to +150°C.

# "KV-PAC" PLUS HIGH VOLTAGE SILICON RECTIFIERS, DOUBLERS AND CENTER TAPS

NOTE: UNITS SHOULD BE MOUNTED WITH SUITABLE GREASE.

"KV-PAC" PLUS is designed to operate at 1.0 Amp when utilized as a half-wave rectifier, doubler and 2.0 Amps in a center-tap, or bridge circuit application. Economical, for usage in commercial, industrial and military applications.

| Type No. | Peak Inverse Voltage Per Leg | Average Rectified Current | Maximum Forward Voltage @ 500 MA/Leg | One Cycle Surge Current | Reverse Current @ PIV | Case Length |
|---|---|---|---|---|---|---|
| | 55°C | 55°C Mtg. | 25°C | 55°C | 25°C | A |
| | Volts | Amps | Volts | Amps | μA | Inches |
| SDH5KM | 5KV | 1.0 | 7 | 50 | 1.0 | 3.36 |
| SDH10KM | 10KV | 1.0 | 14 | 50 | 1.0 | 3.36 |
| SDH15KM | 15KV | 1.0 | 20 | 50 | 1.0 | 4.04 |
| SDHC5KM | 5KV | 2.0 | 7 | 50 | 1.0 | 4.72 |
| SDHD5KM | 5KV | 1.0 | 7 | 50 | 1.0 | 4.72 |
| SDHC10KM | 10KV | 2.0 | 14 | 50 | 1.0 | 4.72 |
| SDHD10KM | 10KV | 1.0 | 14 | 50 | 1.0 | 4.72 |
| SDHC15KM | 15KV | 2.0 | 20 | 50 | 1.0 | 6.09 |
| SDHD15KM | 15KV | 1.0 | 20 | 50 | 1.0 | 6.09 |

NOTE: SDH WITHOUT CENTER TERMINAL.

On Center Tap Add Suffix P for Positive Output, N for Negative Output.
Operating and Storage Temperature −55°C to +150°C.

TECHNICAL BULLETIN MB34

# "KV-PAC" SR. HIGH VOLTAGE SILICON RECTIFIERS, DOUBLERS AND CENTER TAPS

"KV-PAC" SR, is designed to operate at 2.5 Amp when utilized as a half-wave rectifier, doubler and 5 Amps in a center-tap, or bridge circuit application. Economical, for usage in commercial industrial and military applications.

| Type No. | Peak Inverse Voltage Per Leg | Average Rectified Current | Maximum Forward Voltage @ 1 Amp/ Leg | One Cycle Surge Current | Reverse Current @ PIV | Case Length |
|---|---|---|---|---|---|---|
| | 55°C | 55°C Mtg. | 25°C | 55°C | 25°C | A |
| | Volts | Amps | Volts | Amps | μA | Inches |
| SDH5KS | 5KV | 2.5 | 7 | 150 | 1.0 | 3.36 |
| SDH10KS | 10KV | 2.5 | 14 | 150 | 1.0 | 4.04 |
| SDHC5KS | 5KV | 5.0 | 7 | 150 | 1.0 | 4.72 |
| SDHD5KS | 5KV | 2.5 | 7 | 150 | 1.0 | 4.72 |
| SDHC10KS | 10KV | 5.0 | 14 | 150 | 1.0 | 6.09 |
| SDHD10KS | 10KV | 2.5 | 14 | 150 | 1.0 | 6.09 |

On Center Tap Add Suffix P for Positive Output, N for Negative Output.
Operating and Storage Temperature −55°C to +150°C.

TECHNICAL BULLETIN MB33

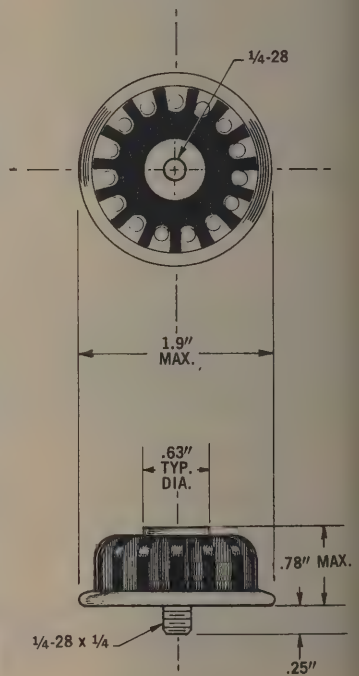
SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

# HIGH VOLTAGE MODULES

High voltage modules ("HVM"), a new building block approach for high voltage requirements. The devices can be stacked to provide either higher voltage assemblies or other circuit configurations such as doublers, center taps and bridges. "HVM" completely eliminates all external component parts and solder joints usually found in devices of this type. All components are encapsulated and connected to metal discs that, in turn, serve as compensation, cooling fins and corona protection. Internally, "HVM" utilizes the Semtech Metoxilite silicon rectifiers. Easy to assemble and mount, simple to screw together; meets the various circuit configurations and equipment mounting requirements.

| | PIV | Average Rectified Current (Amps) | | | Single Cycle Surge Current | Rev. Current @ PIV | | Max. Forward Voltage |
|---|---|---|---|---|---|---|---|---|
| Type No. | KV | Air | @ 55°C Oil | With Heat Sink | Amps @ 25°C | μA @ 25°C | μA @ 100°C | Volts |
| | | | | | | | | @ 100 mA |
| SHVM15 | 15 | 0.5 | 0.5 | 0.5 | 10 | 1.0 | 25 | 24 |
| SHVM12.5 | 12.5 | 0.5 | 0.5 | 0.5 | 10 | 1.0 | 25 | 20 |
| SHVM10 | 10 | 0.5 | 0.5 | 0.5 | 10 | 1.0 | 25 | 16 |
| SHVM7.5 | 7.5 | 0.5 | 0.5 | 0.5 | 10 | 1.0 | 25 | 12 |
| SHVM5 | 5 | 0.5 | 0.5 | 0.5 | 10 | 1.0 | 25 | 8 |
| SHVM2.5 | 2.5 | 0.5 | 0.5 | 0.5 | 10 | 1.0 | 25 | 4 |
| | | | | | | | | @ 1A |
| S2HVM15 | 15 | 0.8 | 2.0 | 1.5 | 50 | 1.0 | 25 | 17 |
| S2HVM12.5 | 12.5 | 1.0 | 2.0 | 2.0 | 50 | 1.0 | 25 | 15 |
| S2HVM10 | 10 | 1.2 | 2.0 | 2.0 | 50 | 1.0 | 25 | 12 |
| S2HVM7.5 | 7.5 | 2.0 | 2.0 | 2.0 | 50 | 1.0 | 25 | 9 |
| S2HVM5 | 5 | 2.0 | 2.0 | 2.0 | 50 | 1.0 | 25 | 6 |
| S2HVM2.5 | 2.5 | 2.0 | 2.0 | 2.0 | 50 | 1.0 | 25 | 4 |
| | | | | | | | | @ 3A |
| S3HVM10 | 10 | 1.2 | 3.0 | 2.5 | 150 | 1.0 | 25 | 10 |
| S3HVM7.5 | 7.5 | 1.5 | 3.0 | 3.0 | 150 | 1.0 | 25 | 8 |
| S3HVM5 | 5 | 2.4 | 3.0 | 3.0 | 150 | 1.0 | 25 | 5 |
| S3HVM2.5 | 2.5 | 3.0 | 3.0 | 3.0 | 150 | 1.0 | 25 | 3 |
| | | | | | | | | @ 3A |
| S6HVM5 | 5 | 2.4 | 6.0 | 6.0 | 250 | 2.0 | 50 | 5 |
| S6HVM2.5 | 2.5 | 4.0 | 6.0 | 6.0 | 250 | 2.0 | 50 | 3 |
| | | | | | | | | @ 3A |
| S9HVM2.5 | 2.5 | 4.0 | 10.0 | 7.5 | 350 | 3.0 | 75 | 3 |

TECH BULLETIN H58




| | PIV | Average Rectified Current (Amps) | | | Single Cycle Surge Current | Rev. Current @ PIV | | Max. Forward Voltage | * Trr |
|---|---|---|---|---|---|---|---|---|---|
| Type No. | KV | Air | @ 55°C Oil | With Heat Sink | Amps @ 25° | μA @ 25°C | μA @ 100°C | Volts | n. sec |
| | | | | | | | | @ 100mA | |
| SHVM15F | 15 | .350 | .350 | .350 | 6 | 1.0 | 25 | 30 | 250 |
| SHVM12.5F | 12.5 | .350 | .350 | .350 | 6 | 1.0 | 25 | 25 | 250 |
| SHVM10F | 10 | .350 | .350 | .350 | 6 | 1.0 | 25 | 20 | 250 |
| SHVM7.5F | 7.5 | .350 | .350 | .350 | 6 | 1.0 | 25 | 15 | 250 |
| SHVM5F | 5 | .350 | .350 | .350 | 6 | 1.0 | 25 | 10 | 250 |
| SHVM2.5F | 2.5 | .350 | .350 | .350 | 6 | 1.0 | 25 | 5 | 250 |
| | | | | | | | | @ 1A | |
| S2HVM7.5F | 7.5 | 0.8 | 2.0 | 1.5 | 25 | 1.0 | 25 | 18 | 250 |
| S2HVM5F | 5 | 1.2 | 2.0 | 2.0 | 25 | 1.0 | 25 | 12 | 250 |
| S2HVM2.5F | 2.5 | 2.0 | 2.0 | 2.0 | 25 | 1.0 | 25 | 6 | 250 |
| | | | | | | | | @ 3A | |
| S3HVM5F | 5 | 1.2 | 3.0 | 2.5 | 125 | 1.0 | 25 | 12 | 250 |
| S3HVM2.5F | 2.5 | 2.4 | 3.0 | 3.0 | 125 | 1.0 | 25 | 6 | 250 |
| | | | | | | | | @ 3A | |
| S6HVM2.5F | 2.5 | 2.4 | 6.0 | 5.0 | 200 | 2.0 | 50 | 12 | 250 |

*$T_{rr}$ Rev. Recovery is measured on each junction prior to mfg. of ass'y.

TECH BULLETIN H58

Semtech reserves the right to change specifications without notice.

**SEMTECH**
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

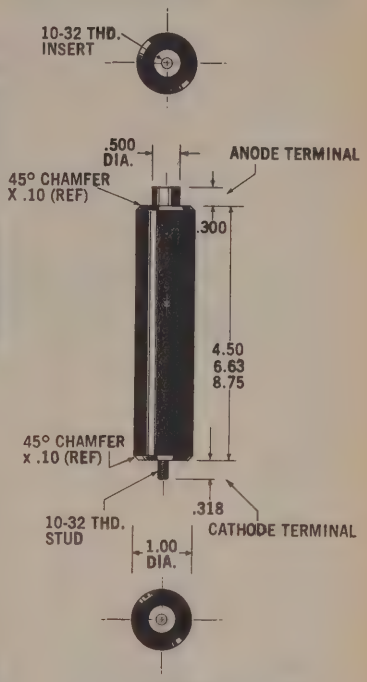
# "KILOVOLT-STAC" HIGH VOLTAGE SILICON RECTIFIERS

The Semtech "KILOVOLT-STAC" is a new high density, high voltage, silicon rectifier for use in commercial, industrial and military applications. Designed and tooled to be efficiently mass produced, "KILOVOLT-STAC" can be used economically in existing applications. The rectifier can be utilized in all standard, single and polyphase rectifier circuits and is specifically adaptable for use in power supplies for X-ray equipment. These devices are cylindrical in shape and thereby provide easy mounting in either air or oil. Designed to be corona-free, "KILOVOLT-STAC" rectifiers are capable of meeting stringent electrical, mechanical and environmental specifications.

| Type No. | Peak Inverse Voltage | Dynamic Reverse Current @ PIV | | Average Rectified Current Amps | | | Forward Voltage $V_F$ | One Cycle Surge | Dimensions Inches |
|---|---|---|---|---|---|---|---|---|---|
| | | μA | μA | Free Air* | 600 CFM Forced Air* | Oil | Volts | tp=8.3 ms | 1.0 Dia. |
| | KV | 25°C | 100°C | 25°C | 25°C | 55°C | 25°C | Amps | Length |
| | | | | | | | @ 100 MA | | |
| SCKV100K3 | 100 | 1 | 25 | 0.1 | 0.2 | 0.3 | 168 | 7.5 | 4.50 |
| SCKV150K3 | 150 | 1 | 25 | 0.1 | 0.2 | 0.3 | 252 | 7.5 | 6.63 |
| SCKV200K3 | 200 | 1 | 25 | 0.1 | 0.2 | 0.3 | 336 | 7.5 | 8.75 |
| | | | | | | | @ 100 MA | | |
| SCKV50K6 | 50 | 1 | 25 | 0.2 | 0.4 | 0.6 | 84 | 15 | 4.50 |
| SCKV75K6 | 75 | 1 | 25 | 0.2 | 0.4 | 0.6 | 126 | 15 | 6.63 |
| SCKV100K6 | 100 | 1 | 25 | 0.2 | 0.4 | 0.6 | 168 | 15 | 8.75 |
| | | | | | | | @ 100 MA | | |
| SCKV33K12 | 33 | 1 | 25 | 0.3 | 0.6 | 1.2 | 56 | 20 | 4.50 |
| SCKV45K12 | 45 | 1 | 25 | 0.3 | 0.6 | 1.2 | 84 | 20 | 6.63 |
| SCKV66K12 | 66 | 1 | 25 | 0.3 | 0.6 | 1.2 | 112 | 20 | 8.75 |
| | | | | | | | @ 500 MA | | |
| SCKV12.5K30 | 12.5 | 1 | 25 | 1.0 | 2.0 | 3.0 | 14 | 50 | 4.50 |
| SCKV18K30 | 18 | 1 | 25 | 1.0 | 2.0 | 3.0 | 21 | 50 | 6.63 |
| SCKV25K30 | 25 | 1 | 25 | 1.0 | 2.0 | 3.0 | 28 | 50 | 8.75 |
| | | | | | | | @ 1 AMP | | |
| SCKV12.5K40 | 12.5 | 1 | 25 | 1.0 | 2.0 | 4.0 | 14 | 150 | 4.50 |
| SCKV18K40 | 18 | 1 | 25 | 1.0 | 2.0 | 4.0 | 21 | 150 | 6.63 |
| SCKV25K40 | 25 | 1 | 25 | 1.0 | 2.0 | 4.0 | 28 | 150 | 8.75 |

Operating and Storage Temperature —55°C to +150°C.
Atmosphere and operating voltage must be consistent with length of stack.

TECHNICAL BULLETIN H60

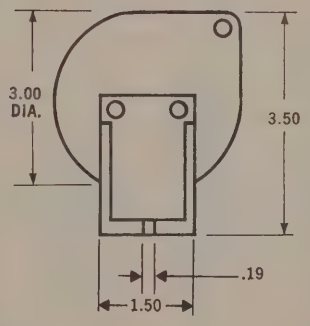


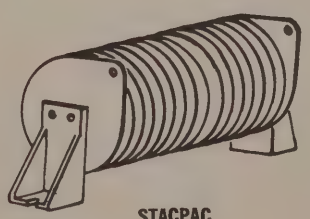

TOLERANCE .XX ±.03
.XXX ±.020
FRACTIONAL = NOMINAL DIMENSION

# "STACPAC"

"Stacpac", a new concept in power rectifier stacks for use in high voltage, high current applications. Unique in design, "Stacpac" completely eliminates all the external component parts and solder joints usually found in devices of this type. All components are encapsulated and connected to aluminum discs, that in turn serve as compensation, cooling fins and corona protection. Internally, "Stacpac" utilizes the Semtech solid construction, double tungstaloid, silicon rectifiers. "Stacpac" was designed specifically to streamline packaging, replace multiple stud rectifiers and auxiliary compensation in high voltage, high current applications.

| Type No. | Peak Inverse Voltage | RMS Voltage | Average Rectified Current | | Reverse Current @ PIV | | One Cycle Surge Current | Max. Fwd. Voltage @ 3 ADC | Max. Length[1] of Ass'y. | Data Sheet No. |
|---|---|---|---|---|---|---|---|---|---|---|
| | KV | KV | Amps | | μA | | Amps | Volts | | |
| | 25°C | 25°C | 55°C | 100°C | 25°C | 100°C | 25°C | 25°C | Inches | |
| **HIGH POWER SILICON RECTIFIERS** | | | | | | | | | | |
| SCPH2 | 1.0 | 0.7 | 5.5 | 3.0 | 110 | 200 | 150 | 2 | 2.74 | H50 |
| SCPH4 | 2.0 | 1.4 | 5.5 | 3.0 | 110 | 200 | 150 | 4 | 3.40 | H50 |
| SCPH6 | 3.0 | 2.10 | 5.5 | 3.0 | 110 | 200 | 150 | 6 | 4.07 | H50 |
| SCPH8 | 4.0 | 2.80 | 5.5 | 3.0 | 110 | 200 | 150 | 8 | 4.73 | H50 |
| SCPH10 | 5.0 | 3.50 | 5.5 | 3.0 | 110 | 200 | 150 | 10 | 5.39 | H50 |
| SCPH12 | 6.0 | 4.20 | 5.5 | 3.0 | 110 | 200 | 150 | 12 | 6.05 | H50 |
| SCPH14 | 7.0 | 4.90 | 5.5 | 3.0 | 110 | 200 | 150 | 14 | 6.71 | H50 |
| SCPH16 | 8.0 | 5.60 | 5.5 | 3.0 | 110 | 200 | 150 | 16 | 7.38 | H50 |
| SCPH18 | 9.0 | 6.30 | 5.5 | 3.0 | 110 | 200 | 150 | 18 | 8.04 | H50 |
| SCPH20 | 10.0 | 7.00 | 5.5 | 3.0 | 110 | 200 | 150 | 20 | 8.70 | H50 |
| SCPH22 | 11.0 | 7.70 | 5.5 | 3.0 | 110 | 200 | 150 | 22 | 9.36 | H50 |
| SCPH24 | 12.0 | 8.40 | 5.5 | 3.0 | 110 | 200 | 150 | 24 | 10.03 | H50 |
| SCPH26 | 13.0 | 9.10 | 5.5 | 3.0 | 110 | 200 | 150 | 26 | 10.69 | H50 |
| SCPH28 | 14.0 | 9.80 | 5.5 | 3.0 | 110 | 200 | 150 | 28 | 11.35 | H50 |
| SCPH30 | 15.0 | 10.50 | 5.5 | 3.0 | 110 | 200 | 150 | 30 | 12.01 | H50 |
| SCPH32 | 16.0 | 11.20 | 5.5 | 3.0 | 110 | 200 | 150 | 32 | 12.67 | H50 |
| SCPH34 | 17.0 | 11.90 | 5.5 | 3.0 | 110 | 200 | 150 | 34 | 13.33 | H50 |
| SCPH36 | 18.0 | 12.60 | 5.5 | 3.0 | 110 | 200 | 150 | 36 | 14.00 | H50 |
| SCPH38 | 19.0 | 13.30 | 5.5 | 3.0 | 110 | 200 | 150 | 38 | 14.66 | H50 |
| SCPH40 | 20.0 | 14.00 | 5.5 | 3.0 | 110 | 200 | 150 | 40 | 15.32 | H50 |
| SCPH42 | 21.0 | 14.70 | 5.5 | 3.0 | 110 | 200 | 150 | 42 | 15.98 | H50 |
| SCPH44 | 22.0 | 15.40 | 5.5 | 3.0 | 110 | 200 | 150 | 44 | 16.64 | H50 |
| SCPH46 | 23.0 | 16.10 | 5.5 | 3.0 | 110 | 200 | 150 | 46 | 17.31 | H50 |
| SCPH48 | 24.0 | 16.80 | 5.5 | 3.0 | 110 | 200 | 150 | 48 | 17.97 | H50 |
| SCPH50 | 25.0 | 17.50 | 5.5 | 3.0 | 110 | 200 | 150 | 50 | 18.63 | H50 |



STACPAC

Mechanical Dimensions:
Width, 3 inches;
[1] length includes two insulated mounting legs.
Operating and Storage Temperature, —55°C to +150°C
Note: Although mounting brackets are insulated, care must be taken to assure proper distance to ground planes.

Semtech reserves the right to change specifications without notice.

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1

# "KW-PAC" HIGH VOLTAGE CENTER TAPS - DOUBLERS

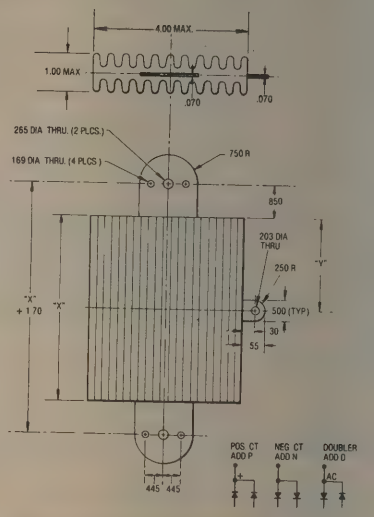
The Semtech "KW-PAC" is a new high density, high current, silicon rectifier for use in commercial, industrial and military applications. Designed and tooled to be efficiently mass produced, "KW-PAC" can be used economically in existing applications. The rectifier can be utilized in all standard, single and polyphase rectifier circuits and is specifically adaptable for use in power supplies. These devices are rectangular in shape and thereby provide easy mounting in either air or oil.

"KW-PAC" rectifiers are capable of meeting stringent electrical, mechanical and environmental specifications.

| Type No. | PIVkv | Is* 1Cycle Surge Amps | Vf @ If* 25°C Volts | Vf @ If* 25°C Amps | Io NC† Amps | FA† Io @ 55°C Amps | Oil Amps | Case DR No. |
|---|---|---|---|---|---|---|---|---|
| S4KW1.5C-1 | 1.5 | 600 | 2.2 | 12 | 8 | 16 | 20 | C-1 |
| S2KW3C-1 | 3 | 300 | 4.4 | 6 | 4 | 8 | 10 | C-1 |
| S1KW6C-1 | 6 | 150 | 8.8 | 3 | 2 | 4 | 5 | C-1 |
| S4KW3C-2 | 3 | 600 | 4.4 | 12 | 6 | 12 | 15 | C-2 |
| S2KW6C-2 | 6 | 300 | 8.8 | 6 | 3 | 6 | 7.5 | C-2 |
| S1KW12C-2 | 12 | 150 | 17.6 | 3 | 1.5 | 3 | 3.8 | C-2 |
| S4KW4.5C-3 | 4.5 | 600 | 6.6 | 12 | 6 | 12 | 15 | C-3 |
| S2KW9C-3 | 9 | 300 | 13.2 | 6 | 3 | 6 | 7.5 | C-3 |
| S1KW18C-3 | 18 | 150 | 26.4 | 3 | 1.5 | 3 | 3.8 | C-3 |
| S4KW6C-4 | 6 | 600 | 8.8 | 12 | 6 | 12 | 15 | C-4 |
| S2KW12C-4 | 12 | 300 | 17.6 | 6 | 3 | 6 | 7.5 | C-4 |
| S1KW24C-4 | 24 | 150 | 35.2 | 3 | 1.5 | 3 | 3.8 | C-4 |
| S4KW7.5C-5 | 7.5 | 600 | 11 | 12 | 6 | 12 | 15 | C-5 |
| S2KW15C-5 | 15 | 300 | 22 | 6 | 3 | 6 | 7.5 | C-5 |
| S1KW30C-5 | 30 | 150 | 44 | 3 | 1.5 | 3 | 3.8 | C-5 |
| S4KW9C-6 | 9 | 600 | 13.2 | 12 | 6 | 12 | 15 | C-6 |
| S2KW18C-6 | 18 | 300 | 26.4 | 6 | 3 | 6 | 7.5 | C-6 |
| S1KW36C-6 | 36 | 150 | 52.8 | 3 | 1.5 | 3 | 3.8 | C-6 |

Example of Neg CT Type No. S4KW3C-2N
Legend for: Neg CT Add N
Pos CT Add P
Doubler Add D

* tp = 8.3 ms
† NC Natural Convection
FA Forced Air




| Case | "X" | "Y" |
|---|---|---|
| C-1 | 4.780 | 2.390 |
| C-2 | 7.980 | 3.990 |
| C-3 | 11.180 | 5.590 |
| C-4 | 14.380 | 7.190 |
| C-5 | 17.380 | 8.790 |
| C-6 | 20.780 | 10.390 |

# "KW-PAC" HIGH VOLTAGE SILICON BRIDGE RECTIFIERS

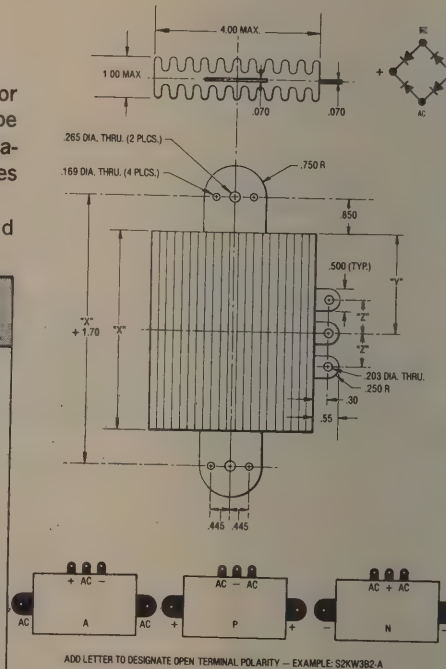
The Semtech "KW-PAC" is a new high density, high voltage, silicon bridge rectifier for use in commercial, industrial and military specifications. Designed and tooled to be efficiently mass produced, "KW-PAC" can be used economically in existing applications. The rectifier is specifically adaptable for use in power supplies. These devices are rectangle in shape and thereby provide easy mounting in either air or oil.

"KW-PAC" rectifiers are capable of meeting stringent electrical, mechanical and environmental specifications.

| Type No. | PIVkv | Is* 1Cycle Surge Amps | Vf leg @ If* 25°C Volts | Vf leg @ If* 25°C Amps | Io NC† Amps | FA† Io @ 55°C Amps | Oil Amps | Case DR No. |
|---|---|---|---|---|---|---|---|---|
| S4KW.75B-1 | .75 | 600 | 1.1 | 12 | 15 | 30 | 40 | B-1 |
| S2KW1.5B-1 | 1.5 | 300 | 2.2 | 6 | 7.5 | 15 | 20 | B-1 |
| S1KW3B-1 | 3 | 150 | 4.4 | 3 | 3.8 | 7.5 | 10 | B-1 |
| S4KW1.5B-2 | 1.5 | 600 | 2.2 | 12 | 12 | 24 | 32 | B-2 |
| S2KW3B-2 | 3 | 300 | 4.4 | 6 | 6 | 12 | 16 | B-2 |
| S1KW6B-2 | 6 | 150 | 8.8 | 3 | 3 | 6 | 8 | B-2 |
| S4KW2.25B-3 | 2.25 | 600 | 3.3 | 12 | 12 | 24 | 32 | B-3 |
| S2KW4.5B-3 | 4.5 | 300 | 6.6 | 6 | 6 | 12 | 16 | B-3 |
| S1KW9B-3 | 9 | 150 | 13.2 | 3 | 3 | 6 | 8 | B-3 |
| S4KW3B-4 | 3 | 600 | 4.4 | 12 | 12 | 24 | 32 | B-4 |
| S2KW6B-4 | 6 | 300 | 8.8 | 6 | 6 | 12 | 16 | B-4 |
| S1KW12B-4 | 12 | 150 | 17.6 | 3 | 3 | 6 | 8 | B-4 |
| S4KW3.75B-5 | 3.75 | 600 | 5.5 | 12 | 12 | 24 | 32 | B-5 |
| S2KW7.5B-5 | 7.5 | 300 | 11.0 | 6 | 6 | 12 | 16 | B-5 |
| S1KW15B-5 | 15 | 150 | 22.0 | 3 | 3 | 6 | 8 | B-5 |
| S4KW4.5B-6 | 4.5 | 600 | 6.6 | 12 | 12 | 24 | 32 | B-6 |
| S2KW9B-6 | 9 | 300 | 13.2 | 6 | 6 | 12 | 16 | B-6 |
| S1KW18B-6 | 18 | 150 | 26.4 | 3 | 3 | 6 | 8 | B-6 |

* tp = 8.3 ms
† NC Natural Convection
FA Forced Air

Add letter to designate open terminal polarity — example S2KW3B2-A




ADD LETTER TO DESIGNATE OPEN TERMINAL POLARITY – EXAMPLE: S2KW3B2-A

| Case | "X" | "Y" | "Z" |
|---|---|---|---|
| B-1 | 4.780 | 2.390 | .800 |
| B-2 | 7.980 | 3.990 | 1.600 |
| B-3 | 11.180 | 5.590 | 2.400 |
| B-4 | 14.380 | 7.190 | 3.200 |
| B-5 | 17.580 | 8.790 | 4.000 |
| B-6 | 20.780 | 10.390 | 4.800 |

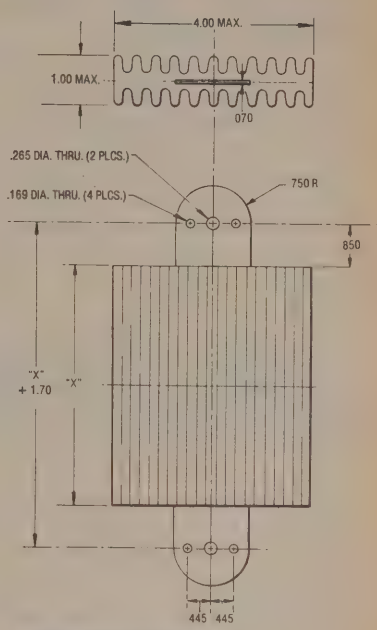
SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

## KW-PAC" HIGH VOLTAGE SILICON RECTIFIERS

he Semtech "KW-PAC" is a new high density, high current, silicon rectifier for use in ommercial, industrial and military applications. Designed and tooled to be efficiently ass produced, "KW-PAC" can be used economically in existing applications. The ectifier can be utilized in all standard, single and polyphase rectifier circuits and is pecifically adaptable for use in power supplies. These devices are rectangular in shape and thereby provide easy mounting in either air or oil.
KW-PAC" rectifiers are capable of meeting stringent electrical, mechanical and nvironmental specifications.

| Type No. | PIVkv | Is* 1 Cycle Surge Amps | VF leg @ IF* 25°C Volts | VF leg @ IF* 25°C Amps | Io NC Amps | FA Io @ 55°C Amps | Io Oil Amps | Case DR No. |
|---|---|---|---|---|---|---|---|---|
| S4KW3KA-1 | 3 | 600 | 4.4 | 12 | 8 | 16 | 20 | A-1 |
| S2KW6KA-1 | 6 | 300 | 8.8 | 6 | 4 | 8 | 10 | A-1 |
| S1KW12KA-1 | 12 | 150 | 17.6 | 3 | 2 | 4 | 5 | A-1 |
| S4KW6KA-2 | 6 | 600 | 8.8 | 12 | 6 | 12 | 15 | A-2 |
| S2KW12KA-2 | 12 | 300 | 17.6 | 6 | 3 | 6 | 7.5 | A-2 |
| S1KW24KA-2 | 24 | 150 | 35.2 | 3 | 1.5 | 3 | 3.8 | A-2 |
| S4KW9KA-3 | 9 | 600 | 13.2 | 12 | 6 | 12 | 15 | A-3 |
| S2KW18KA-3 | 18 | 300 | 26.4 | 6 | 3 | 6 | 7.5 | A-3 |
| S1KW36KA-3 | 36 | 150 | 52.8 | 3 | 1.5 | 3 | 3.8 | A-3 |
| S4KW12KA-4 | 12 | 600 | 17.6 | 12 | 6 | 12 | 15 | A-4 |
| S2KW24KA-4 | 24 | 300 | 35.2 | 6 | 3 | 6 | 7.5 | A-4 |
| S1KW48KA-4 | 48 | 150 | 70.4 | 3 | 1.5 | 3 | 3.8 | A-4 |
| S4KW15KA-5 | 15 | 600 | 22 | 12 | 6 | 12 | 15 | A-5 |
| S2KW30KA-5 | 30 | 300 | 44 | 6 | 3 | 6 | 7.5 | A-5 |
| S1KW60KA-5 | 60 | 150 | 88 | 3 | 1.5 | 3 | 3.8 | A-5 |
| S4KW18KA-6 | 18 | 600 | 26.4 | 12 | 6 | 12 | 15 | A-6 |
| S2KW36KA-6 | 36 | 300 | 52.8 | 6 | 3 | 6 | 7.5 | A-6 |
| S1KW72KA-6 | 72 | 150 | 105.6 | 3 | 1.5 | 3 | 3.8 | A-6 |

GEND: NC Natural Convection
FA Forced Air
* tp = 8.3 ms

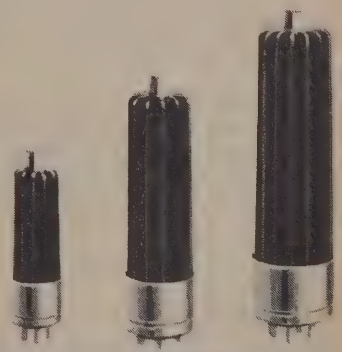



| Case | "X" |
|---|---|
| A-1 | 4.780 |
| A-2 | 7.980 |
| A-3 | 11.180 |
| A-4 | 14.380 |
| A-5 | 17.580 |
| A-6 | 20.780 |

## TUBE-PAC" HIGH VOLTAGE SILICON RECTIFIERS

UBE-PAC" is Semtech's new line of silicon, high-voltage rectifiers intended as a direct plug- replacement part for most popular mercury-vapor and vacuum glass tube-type rectifiers.

signed to last the life of the equipment, Semtech's "TUBE-PAC" are smaller, corona-free, ssipate heat more effectively and eliminate filament power. No special adaptors are re- ired to use Semtech's "TUBE-PAC."



R (SEMTECH TUBE REPLACEMENT PRECEEDS STANDARD EIA TUBE TYPE NUMBER).

### S TUBE REPLACEMENTS

| Type | PIV - KV | Io Amp | Cathode Connection |
|---|---|---|---|
| STR3B25 | 4.5 | 0.5 | 1 |
| STR3B28 | 10 | 0.5 | 1 |
| STR4B32 | 10 | 1.25 | 2 |
| STR249C | 10 | 0.5 | 1 |
| STR575A | 15 | 2.5 | 2 |
| STR576A | 25 | 0.5 | 2 |
| STR250R | 60 | 0.25 | 2 |
| STR253 | 15 | 0.35 | 2 |
| STR577 | 25 | 0.3 | 2 |
| STR593 | 25 | 0.3 | 1 |
| STR615 | 2 | 2.5 | 1 |
| STR635 | 1 | 6.4 | 3 |
| STR672A | 2.5 | 3.2 | 2 |

| Type | PIV - KV | Io Amp | Cathode Connection |
|---|---|---|---|
| STR816 | 7.5 | .13 | 2 |
| STR866A | 10 | 0.5 | 1 |
| STR872A | 10 | 1.25 | 2 |
| STR5544 | 1.5 | 3.2 | 2 |
| STR5560 | 1.5 | 2.5 | 4 |
| STR5720 | 1.0 | 2.5 | 4 |
| STR6587 | 16 | 0.23 | 2 |
| STR6693 | 15 | 5 | 2 |
| STR6807 | 1.5 | 6.4 | 2 |
| STR6808 | 1.5 | 6.4 | 2 |
| STR6894 | 20 | 2.5 | 2 |

| Type | PIV - KV | Io Amp | Cathode Connection |
|---|---|---|---|
| STR6895 | 20 | 2.5 | 2 |
| STR7018 | 2 | 2.5 | 1 |
| STR7019 | 1 | 6.4 | 2 |
| STR7454 | 25 | 6.5 | 1 |
| STR7789 | 15 | 0.4 | 2 |
| STR7790 | 20 | 1.0 | 2 |
| STR7792 | 25 | 2.0 | 2 |
| STR8008 | 10 | 1.25 | 2 |
| STR8080 | 25 | 2.5 | 2 |
| STR8253 | 20 | 0.25 | 2 |
| STR8434 | 20 | 1.8 | 2 |
| STR8435 | 20 | 1.8 | 2 |

OULD YOU REQUIRE A VACUUM TUBE RECTIFIER REPLACEMENT NOT LISTED, PLEASE CONTACT OUR LOCAL REPRESENTATIVE.

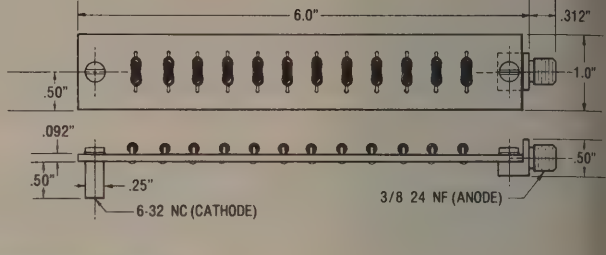
TECHNICAL BULLETIN H57

Semtech reserves the right to change specifications without notice.

SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

# "X-WAY STIC" HIGH VOLTAGE SILICON RECTIFIERS

The Semtech "X-Way Stic" is a new high voltage, silicon rectifier for use in commercial and industrial applications. The rectifier can be utilized in all standard, single and poly-phase rectifier circuits and is specifically adaptable for use in power supplies for X-ray equipment. The "X-Way Stic" utilizes hermetically sealed Metoxilite multi-chip rectifiers on a fiber glass strip. The Metoxilite rectifier techniques were initially developed for high reliability aerospace programs. Now this technology is available at low pricing for use in consumer equipment.




| Type* | Peak Reverse Voltage Operating KV | Peak Reverse Voltage Test KV | Reverse Current At PRV uA | Average Rectified Current @ 55°C Oil mA | Recurrent Surge 10 Cycles @ 60 Cycles Amps | Single Cycle Surge @ 8.3 mS Amps | Forward Voltage @ 50mm Volts |
|---|---|---|---|---|---|---|---|
| X100KS | 100 | 125 | 1.0 | 150 | 7.5 | 25 | 160 |
| X125KS | 125 | 150 | 1.0 | 150 | 7.5 | 25 | 190 |
| X150KS | 150 | 175 | 1.0 | 150 | 7.5 | 25 | 220 |

* "X-Way Stic" can also be supplied without termination hardware, standoff (cathode) and 3/8 stud (anode), add letter "W" after type number.

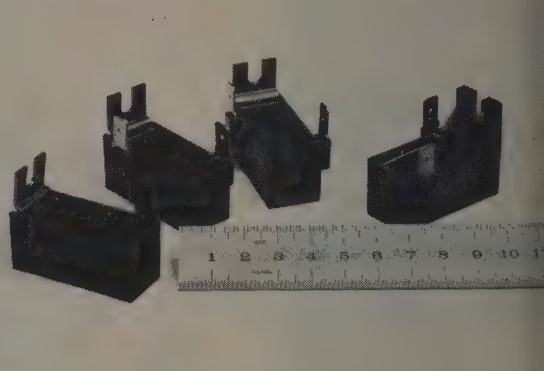
Operating and storage temperature: −55°C to +150°C.

Derate current linearly from 150 mA at 55°C to zero at 150°C.
All specifications are at 25°C unless otherwise noted.

NOTE: In order to achieve rated voltage and current, the rectifiers should be submerged in Shell Diala Oil AZ or equivalent electrical insulating oil.

# "MOR-PAC II" HIGH VOLTAGE SILICON RECTIFIERS FOR MICROWAVE OVENS

The MOR-PAC (Microwave Oven Rectifier Pac) silicon rectifier was designed specifically for use in Microwave ovens. Parameters are specified to meet the unique characteristics of the Magnetron power supply. A high voltage Metoxilite multi-chip silicon rectifier encapsulated to provide better heat dissipation and simple mounting.



## SPECIFICATIONS

Types: SCMW 10, 11, 12, 13, 20 & 22

Voltage Breakdown ($V_B$) @ 100 UA (Per *) — 12 KV Min.

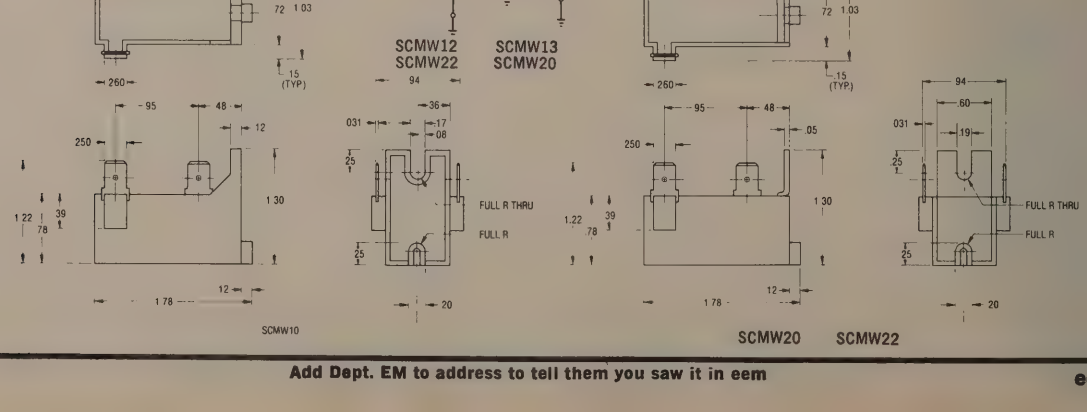
Maximum Reverse Operating Voltage (Ep) — 5 KV

Average Rectified Current ($I_o$) @ 55°C $T_c$

| | |
|---|---|
| SCMW-10 | 350 MA |
| SCMW-11 | 400 MA |
| SCMW-12 | 400 MA |
| SCMW-13 | 400 MA |
| SCMW-20 | 700 MA |
| SCMW-22 | 750 MA |

Operating and Storage Temperature — −55°C to +150°C

* Transient rating — one millisec. pulse non-recurrent



SEMTECH
CORPORATION 652 Mitchell Road, Newbury Park, California 91320 (805) 498-2111, (213) 628-5392 / TWX: 910-336-1264

# N-CHANNEL ENHANCEMENT-MODE VMOS POWER FETS

- **High Speed Switching**
- **CMOS to High Current Interface**
- **TTL to High Current Interface**
- **High Frequency Linear Amplifiers**
- **Line Drivers**
- **DC to DC Converters**
- **Switching Power Supplies**

## BENEFITS

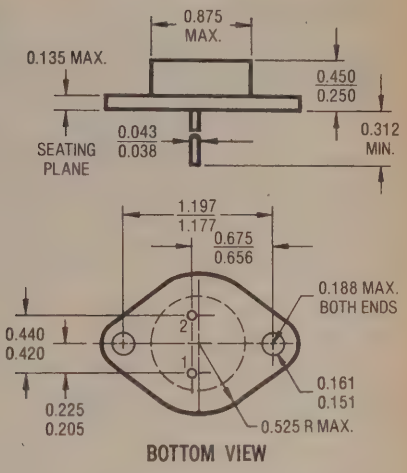
- Directly Interfaces to CMOS, TTL, DTL and MOS Logic Families
  Low Drive Current ($I_{GSS}$ <10 μA)
- Permits More Efficient and Compact Switching Designs
  Typical $T_{ON}$ and $T_{OFF}$ <5 nsec
- Minimizes Component Count and Design Time/Effort
  Drives Inductive Loads Directly
  Fan Out from a CMOS Logic Gate >100
  Easily Paralleled with Inherent Current Sharing Capability
  High Gain
- Improves Reliability
  Free from Secondary Breakdown
  Voltage Derating
  Inherently Reduces Output Current as Temperature Increases
  Input Protected from Static Discharge

## ABSOLUTE MAXIMUM RATINGS

| | |
|---|---|
| *Maximum Drain-Source Voltage | |
| 2N6656 & 2N6659 | 35V |
| 2N6657 & 2N6660 | 60V |
| 2N6658 & 2N6661 | 90V |
| *Maximum Drain-Gate Voltage | |
| 2N6656 & 2N6659 | 35V |
| 2N6657 & 2N6660 | 60V |
| 2N6658 & 2N6661 | 90V |
| *Maximum Continuous Drain Current | 2.0A |
| Maximum Pulsed Drain Current | 3.0A |
| *Maximum Continuous Forward Gate Current | 2.0 mA[1] |
| *Maximum Pulsed Forward Gate Current | 100 mA |
| *Maximum Continuous Reverse Gate Current | 100 mA |
| *Maximum Forward Gate-Source (Zener) Voltage | 15V |
| *Maximum Reverse Gate-Source Voltage | 0.3V |
| *Maximum Dissipation at 25°C Case Temperature | |
| 2N6656, 7 & 8 | .25W |
| 2N6659, 60 & 61 | 6.25W |
| *Linear Derating Factor | |
| 2N6656, 57 & 58 | 200 mW/°C |
| *Temperature (Operating and Storage) | −55°C to +150°C |
| *Lead Temperature (1/16" from case for 10 sec) | 300°C |

*Indicates JEDEC registered data

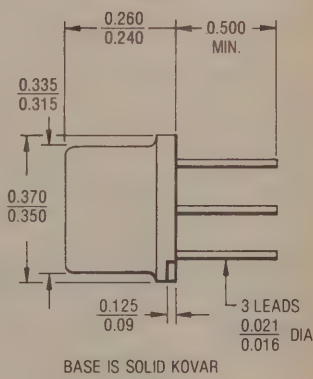
2N6656, 57 and 58
TO-3

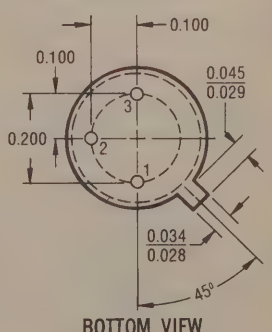



ALL DIMENSIONS IN INCHES

| Pin | Out |
|---|---|
| 1 | G |
| 2 | S |
| Case | Drain |

2N6659, 60 and 61
TO-39




ALL DIMENSIONS IN INCHES

| Pin | Out |
|---|---|
| 1 | S |
| 2 | G |
| 3 | Drain & Case |

**Thermalloy, Inc.**
Post Office Box 34829 • 2021 West Valley View Lane
Dallas, TX 75234 • (214) 243-4321 • TWX: 910-860-5542
NUMBER ONE IN SEMICONDUCTOR ACCESSORIES

# Heat Sinks and Semiconductor Accessories

## Heat Sinks ①

DIP HEAT SINKS One piece heat sinks for 14 and 16 pin integrated circuits. 6020A clips securely into place requiring no mounting hardware or epoxy. Other styles bond to DIP with epoxy, require no extra board space, and may be added after assembly.

| PART NO. | FIG. | CASE STYLE | NOMINAL SIZE LENGTH | WIDTH | HEIGHT | TR② °C/W |
|---|---|---|---|---|---|---|
| 6010B | A | DIP | .750 | .604 | .212 | 55 |
| 6011B | B | DIP | .750 | .250 | .190 | 65 |
| 6012B | B | DIP | .730 | .250 | .190 | 65 |
| 6020A | C | DIP | 1.000 | .725 | .500 | 40 |

TO-5 ENCAPSULATING HEAT SINKS Two piece heat sinks for positive retention under shock and vibration. Top and body grip transistor flange for maximum heat transfer.

| | | | | | |
|---|---|---|---|---|---|
| 1101A | D | TO-5 | .500 HEX | .390 | 10 |
| 2205B | E | TO-5 | .812 DIA | .340 | 41 |
| 2211B | E | TO-5 | .625 DIA | .310 | 49 |
| 2215B | E | TO-5 | .750 DIA | .350 | 37 |

TO-5 ECONOMY PRESS-ON HEAT SINKS One piece light weight coolers. May be installed with no special tools after board assembly.

| | | | | | |
|---|---|---|---|---|---|
| 1115B | F | TO-5 | .375 DIA | .400 | 68 |
| 1116B | F | TO-5 | .351 DIA | .370 | 18* |
| 1134B | G | TO-5 | .750 SQ. | .187 | 38 |
| 1136B | G | TO-5 | .750 SQ. | .375 | 27 |
| 2225B | H | TO-5 | .750 DIA | .400 | 46 |
| 2226B | H | TO-5 | .750 DIA | .250 | 54 |
| 2227B | H | TO-5 | 1.250 DIA | .400 | 21 |
| 2228B | H | TO-5 | .875 DIA | .531 | 35 |
| 2230B-5 | I | TO-5 | .750 DIA | .250 | 48 |
| 2257R | I | TO-5 | .500 DIA | .375 | 62 |

*Mounted on a 6" x 6" x .062 thk plate

TO-3 and TO-66 TWO PIECE CIRCUIT BOARD HEAT SINKS Top piece contacts upper surface of transistor for positive retention and optimum heat transfer. Top and base may be ordered separately, both insulated and uninsulated.

| | | | | | | |
|---|---|---|---|---|---|---|
| 6103B | J | TO-3 | 1.531 | 1.250 | .515 | 11 |
| 6166B | J | TO-66 | 1.531 | 1.250 | .609 | 14.5 |

TO-3 and TO-66 CIRCUIT BOARD HEAT SINKS High performance one piece coolers in a variety of styles to meet your thermal and packaging requirements.

| | | | | | | |
|---|---|---|---|---|---|---|
| 6001B-2 | K | TO-3 | 1.810 | 1.810 | .500 | 7.2 |
| 6013B | L | TO-3 | 1.880 | 1.400 | .500 | 9.7 |
| 6017B | L | TO-66 | 1.550 | 1.040 | .500 | 12.7 |
| 6051B | M | TO-3 | 1.780 | 1.780 | .500 | 7.4 |
| 6056B | M | TO-66 | 1.780 | 1.780 | .500 | 7.4 |
| 6060B & 6061B | P | TO-3 & TO-66 | 2.000 | 1.750 | .375 | 6.5 |
| | P | | 2.000 | 2.250 | .375 | 5.9 |

PLASTIC POWER HEAT SINKS Performance and design for every plastic power requirement in both vertical and horizontal mount economy coolers. Vertical style available with tinned tabs and/or nickel plate. May be soldered directly to the board.

| | | | | | | |
|---|---|---|---|---|---|---|
| 6025B | N | PL PWR | .875 | .250 | 1 250 | 19 |
| 6030B | Q | PL PWR | 1.000 | .500 | 1 180 | 12 |
| *6038B | Q | PL PWR | 1.000 | .500 | 1 180 | 18 |
| 6070B | R | PL PWR | 1.750 | .700 | 375 | 16 |
| 6073B | S | PL PWR | .750 | .750 | 375 | 21 |
| 6106B-13 | S | PL PWR | 1.180 | 1.000 | 500 | 17 |
| 6107B-14 | S | PL PWR | .710 | 1.000 | 500 | 20 |

*6038 Has clip

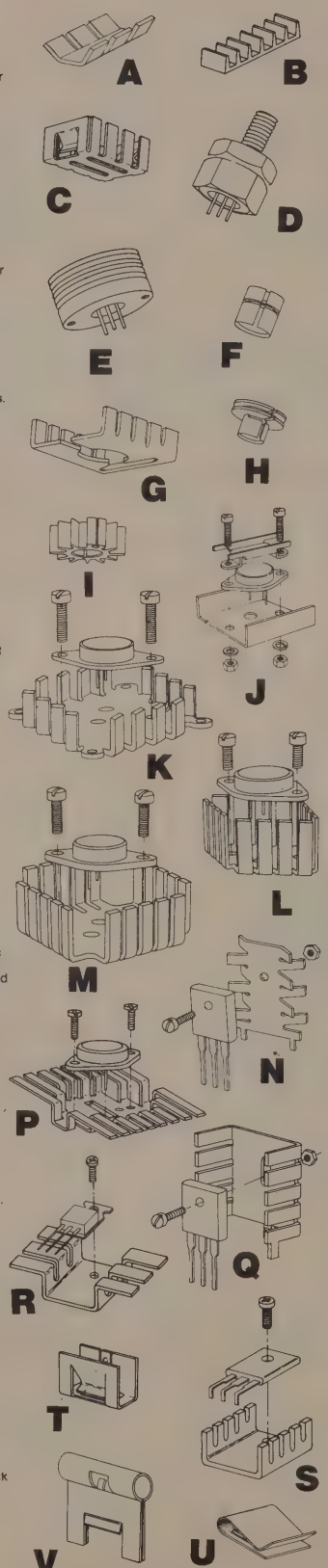
PLASTIC POWER CLIP SINKS Light weight, low cost clip-on heat sinks require no mounting hardware or special tools for assembly. These may be attached to device after board assembly and require minimum board space. Pre-black anodized.

| | | | | | | |
|---|---|---|---|---|---|---|
| *6041PB | U | TO-126 Case 77 | .800 | .268 | .800 | 47 |
| *6042PB | U | Case 90 Case 199 | 1.000 | .268 | .800 | 31 |
| *6043PB | U | TO-220 | 1.000 | .268 | .800 | 35 |
| 6045B | T | TO-220 | 1.000 | .350 | .750 | 26 |
| *6046PB | V | TO-202 | .800 | .300 | .850 | 25 |
| 6047PB | V | TO-202 | .800 | .300 | .850 | 26 |

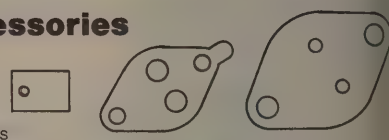
*Has Locking Tab

NOTES:
① Dimensions given are nominal sizes for reference only. Consult Thermalloy catalog for tolerances.
② Thermal resistance values are for natural convection.
3. Finish prefixes; "A" Hard Anodize; "B" Black Anodize; "PB" Pre-black Anodize; ("C" Gold chromate available).

**Contact factory for latest issue of Thermalloy, Inc. catalog of heat sinks and accessories.**




## Accessories



INSULATORS

| CASE STYLE | MATERIAL/PART NUMBERS THERMALFILM | HD ANOD ALUM | BeO |
|---|---|---|---|
| TO-3 | 43-03-1 & -2<br>43-03-3 & -4 | 4726A<br>4703A | 4003 |
| TO-5 | 43-05-1 | | 4005 |
| TO-66 | 43-66-1 & -2 | 4766A | 4066 |
| PLASTIC POWER | 43-77-1 & -2<br>43-77-9 | 4777A<br>4778A | |
| WASHERS | 43-02-10<br>43-02-25<br>43-02-95 | | B375-120-62<br>B470-235-40<br>B510-200-40 |

Consult Thermalloy catalog for dimensions. MIL SPEC parts available.

INSUL-COTE Insul-Cote is a neatly packaged Thermalfilm or mica insulator PRE-COATED with Thermalcote thermal grease. Available in individual packets or high volume "Ammo Pack" for use with Thermalloy's Insul-Cote dispenser. Below is a partial listing of Insul-Cote Insulators. For case style consult table above.

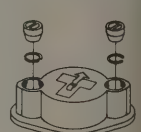
| INSUL-COTE WITH THERMALFILM I | | INSUL-COTE WITH .002/.003 MICA |
|---|---|---|
| 43-03-1AP | 43-66-1AP | 56-03-2AP |
| 43-03-2AP | 43-66-2AP | 56-66-2AP |
| 43-03-3AP | 43-77-2AP | 56-77-2AP |
| 43-03-4AP | 43-77-9AP | |

For other INSUL-COTE pre-coated insulators, individual packets, or production dispenser, consult factory.

MOUNTING PADS Prevent heat damage during soldering, facillitate board clean-up, prevent solder bridges, assure uniform device height, and simplify board repair. Designate material and color as suffix to part no. Materials: (-N) Nylon, or (-DAP) Diallyl Phthalate. Example: 7717-N RED

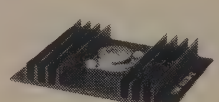
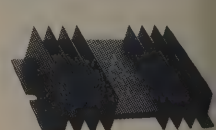
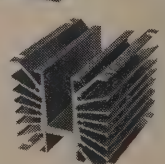
| CASE STYLE | PART NO. | LEADS | O.D. | THK |
|---|---|---|---|---|
| TO-5 | 7717-4 | 4 | .375 | .075 |
| | 7717-5 | 4 | .350 | .125 |
| TO-18 | 7717-7 | 4 | .250 | 125 |
| | 7717-18 | 4 | .200 | .100 |
| | 7717-152 | 3-4 | .200 | .045 |
| TO-18 LEAD CONVERSION to TO-5 | 7717-44 | 4 | .305 | .125 |
| to .150 Dia Cir | 7717-93 | 4 | .230 | .055 |
| IC LEAD | 7717-107 | 8 | .430 | .130 |
| IC LEAD CONVERSION .250 to .350 | 7717-222 | 8 | .365 | .070 |
| .200 to .400 | 7717-19 | 8 | .500 | .275 |
| EPOXY .05 in-line to TO-5 | 7717-2 | 3 | .305 | 125 |

TO-3 COVER Insulating cover for TO-3 transistor includes lock washers for electrical connection of mounting screws to collector, test probe hole, and screw covers. Available in white glass filled nylon, Part No. 8903NW, or 94V-0 UL APVD BLACK THERMOPLASTIC POLYESTER, Part No. 8903VB.



THERMALCOTE — a superior thermal point compound. Improves heat transfer across interface.
1 oz. tube . . . . . Part No. 249
2 oz. jar . . . . . Part No. 250
1 lb. . . . . Part No. 251

CUSTOM FABRICATED EXTRUDED HEAT SINKS Industry standard extrusion profiles are immediately available from Thermalloy stock. Many additional shapes are available at no tooling charge on a minimum order basis.

# TRW CAPACITORS

## SOLID STATE OPERATION

### TRW Molded Diodes

GENERAL CHARACTERISTICS

- Molded Encasement
- Uniform Sizes—Ideal for Auto-insertion
- Available in 1.0, 1.5, 2.5, 5.0 Watt Ratings

JEDEC types 1N4728 thru 1N4764

1N5923 thru 1N5956

1N5018 thru 1N5051

1N5344 thru 1N5388

TRW zeners are designed to operate in applications where high steady state power dissipation and or large zener surge currents may be encountered. They provide an economical and reliable solution to circuit problems where stud-mounted devices have previously been used.

### TRW Transient Voltage Suppressor

GENERAL CHARACTERISTICS

- Molded Encasement
- Full Voltage Range
- Storage Temp. Range . . . —65°C to 175°C.
- t clamping (0 volts to BV min) . . . 1 x $10^{-12}$ sec.
- 8.2 V thru 200 Volts
- Available in Three Ratings
  - 500 watts (0.5 Joules)
  - 1000 watts (1.0 Joules)
  - 1500 watts (1.5 Joules)

The TRW Transient Voltage Suppressor is an extension of the TRW Zener technology. It utilizes the devices' capability to rapidly change impedance value from a very high standby value to a very low conducting value when subjected to high energy transients. The Transient Voltage Suppressor effectively shunts potentially damaging effects to sensitive systems, equipment or components by clamping the voltage at some predetermined level.

## TRW HIGH POWER NPN SILICON TRANSISTOR

Available in Std. Types Like . . .

| | |
|---|---|
| 2N3771 | 2N6258 |
| 2N3772 | 2N6570 |
| 2N3773 | 2N6571 |
| 2N6259 | |

TRW BRT-60 (60 Amp.)

A high current, high power mesa transistor made by the single diffusion process. Extremely rugged and capable of handling large amounts of current, it is designed to be used in applications requiring high power dissipations.

The device is supplied in the TO-3 case. Typical applications are shunt regulators, high power amplifiers, power switching circuits, AC-DC converters, hammer drivers and various other applications.

# TRW RF SEMICONDUCTORS

## TRW HAS THE INDUSTRY'S BROADEST LINE OF RF TRANSISTORS AND HYBRIDS

- Linear Microwave Transistors
- Linear Broadband Amplifiers
- Linear HF/SSB Power Transistors
- Broadband Microwave Transistors
- Discrete Microwave Transistors
- Navigation Band Pulse Transistors
- UHF Discrete Power Transistors
- VHF Power Transistors
- VHF Aircraft Radio Transistors (AM Service)
- UHF Broadband JO* Transistors
- CATV Hybrid Amplifiers
- CATV Discrete Transistors
- M.I.C Power Amplifiers
- Low Voltage Power Transistors
- Mobile Radio Transistors

## SELECT THE FREQUENCY YOU NEED.

* Registered trademark TRW, INC. U.S. Pat. 3. 713. 006

| PART NUMBER | MAX RATED FREQ. MHz | POWER OUTPUT W | GAIN dB | $V_{CC}$ VOLTS | PACKAGE |
|---|---|---|---|---|---|
| PT8551 | 28 | 1.0 | 13 | 28.0 | TO-39 |
| PT5701 | 28 | 1.5 | 15 | 12.5 | TO-39 |
| PT8549 | 28 | 5.0 | 15 | 12.5 | .380 SOE |
| PT9787[2] | 28 | 8.0 | 14 | 28.0 | .380 SOE F |
| PT9795[2] | 28 | 15 | 15 | 12.5 | .380 SOE F |
| PT9788[2] | 28 | 20 | 14 | 28.0 | .380 SOE F |
| PT9796[2] | 28 | 30 | 15 | 12.5 | .380 SOE F |
| PT9797[2] | 28 | 50 | 15 | 12.5 | .380 SOE F |
| PT9783[2] | 28 | 50 | 14 | 28.0 | .380 SOE F |
| PT9776[2] | 28 | 75 | 13 | 12.5 | .380 SOE F |
| PT9784[2] | 28 | 75 | 15 | 12.5 | .380 SOE F |
| PT9798[2] | 28 | 75 | 15 | 50.0 | .380 SOE F |
| PT9847 | 28 | 100 | 15 | 12.5 | .380 SOE F |
| PT9785 | 28 | 100 | 13 | 12.5 | .500 SOE F |
| PT9780 | 28 | 100 | 14 | 28.0 | .500 SOE F |
| PT9849 | 28 | 150 | 13 | 12.5 | .500 SOE F |
| PT9790 | 28 | 150 | 14 | 50.0 | .500 SOE F |
| 2N5070[1] | 30 | 25 | 15 | 28.0 | TO-60 |
| 2N5687 | 50 | 1.5 | 17 | 12.5 | TO-39 |
| PT8850[2] | 50 | 5.0 | 13 | 12.5 | .380 SOE F |
| PT8851[2] | 50 | 10 | 12 | 12.5 | .380 SOE F |
| PT8852[2] | 50 | 20 | 11 | 12.5 | .380 SOE F |
| PT8853[2] | 50 | 35 | 10 | 12.5 | .380 SOE F |
| PT8854[2] | 50 | 70 | 9 | 12.5 | .380 SOE F |
| 2N5071[1] | 76 | 24 | 9 | 24.0 | TO-60 |
| PT8860 | 88 | 1.8 | 14 | 12.5 | TO-39 |
| PT8861[2] | 88 | 5.0 | 13 | 12.5 | .380 SOE F |
| PT8862[2] | 88 | 12 | 12 | 12.5 | .380 SOE F |
| PT8863[2] | 88 | 20 | 11 | 12.5 | .380 SOE F |
| ML20[7] | 88 | 20 | 20 | 12.5 | MVM |
| PT8864[2] | 88 | 35 | 9 | 12.5 | .380 SOE F |
| PT8865[2] | 88 | 70 | 8 | 12.5 | .380 SOE F |
| CA2875[4] | 110 | 0.6 | 17.5 | 24.0 | CA |
| CA416[4] | 120 | 54dBmV | 16.5 | 24.0 | CA |
| CA418[4] | 120 | 54dBmV | 18.5 | 24.0 | CA |
| 2N5102[1] | 136 | 15 | 4 | 24.0 | TO-60 |
| CA2830[4] | 150 | 0.6 | 34 | 24.0 | CA |
| PT9730[3] | 150 | 2.5 | 11 | 13.5 | .380 SOE |
| PT9732[3] | 150 | 3.0 | 10 | 13.5 | .380 SOE |
| PT9734[3] | 150 | 6.0 | 8 | 13.5 | .380 SOE |
| PT9731[3] | 150 | 10 | 6 | 13.5 | .380 SOE |
| PT9733[3] | 150 | 15 | 6 | 13.5 | .380 SOE |
| PT9782[2,3] | 150 | 25 | 4.5 | 13.5 | .380 SOE |
| MV30[7] | 160 | 30 | 22 | 12.5 | MVM |
| 2N4427 | 175 | 1.0 | 10 | 12.5 | TO-39 |
| 2N3866 | 175 | 1.0 | 11 | 28.0 | TO-39 |
| 2N5913 | 175 | 1.2 | 12.4 | 12.5 | TO-39 |
| PT8870[2] | 175 | 2.5 | 10 | 12.5 | .380 SOE F |
| PT8871[2] | 175 | 2.5 | 14 | 12.5 | .280 SOE S |
| 2N5589 | 175 | 3.0 | 8.2 | 12.5 | .380 SOE |
| 2N6080 | 175 | 4.0 | 12 | 12.5 | .380 SOE |
| PT9730 | 175 | 4.0 | 13 | 28.0 | .380 SOE |
| 2N5641[1] | 175 | 7.0 | 8.4 | 28.0 | .380 SOE |
| PT9732 | 175 | 8.0 | 12 | 28.0 | .380 SOE |
| 2N5590 | 175 | 10 | 5.2 | 12.5 | .380 SOE |
| PT8872[2] | 175 | 12 | 11.3 | 12.5 | .380 SOE F |
| 2N3632[1] | 175 | 13 | 6 | 28.0 | TO-60 |
| 2N6081 | 175 | 15 | 6.4 | 12.5 | .380 SOE |
| PT8848 | 175 | 15 | 6.4 | 12.5 | .380 SOE F |
| PT8873 | 175 | 15 | 7.8 | 12.5 | .380 SOE F |
| PT8837 | 175 | 15 | 7.8 | 12.5 | .380 SOE |
| PT9734 | 175 | 15 | 11.5 | 28.0 | .380 SOE |
| 2N5642[1] | 175 | 20 | 8.2 | 28.0 | .380 SOE |
| MV20[7] | 175 | 20 | 20 | 12.5 | MVM |
| 2N5591 | 175 | 25 | 4.4 | 12.5 | .380 SOE |
| 2N6082 | 175 | 25 | 6.2 | 12.5 | .380 SOE |
| PT9731 | 175 | 25 | 10 | 28.0 | .380 SOE |
| JO4028 | 175 | 28 | 8.5 | 12.5 | .500 J Zero |
| 2N6083 | 175 | 30 | 5.7 | 12.5 | .380 SOE |
| PT8875 | 175 | 30 | 5.7 | 12.5 | .380 SOE F |
| JO4036 | 175 | 35 | 7.5 | 12.5 | .500 J Zero |
| PT8874 | 175 | 40 | 4.5 | 12.5 | .380 SOE F |
| PT8838 | 175 | 40 | 4.5 | 12.5 | .380 SOE |
| 2N5643[1] | 175 | 40 | 7.6 | 28.0 | .380 SOE |
| JO4045 | 175 | 45 | 6.5 | 12.5 | .500 J Zero |
| PT9733 | 175 | 50 | 7.9 | 28.0 | .380 SOE |
| JO4070 | 175 | 70 | 5.9 | 12.5 | .500 J Zero |
| JO4075 | 175 | 75 | 6.2 | 12.5 | .500 J Zero |
| JO1006 | 175 | 100 | 7.0 | 28.0 | .500 J Zero |
| PT4578[5] | 200 | 45dBmV | 3.0dB NF | 12.0 | TO-39 |
| LT1001A[5] | 200 | 45dBmV | 2.0dB NF | 14.0 | TO-39 |
| CA2818[4] | 200 | 0.5 | 18 | 24.0 | CA |
| TPV366[6] | 225 | 0.5 | 16 | 24.0 | .280 SOE |
| TPV394[6] | 225 | 5.0 | 15 | 24.0 | .280 SOE |
| TPV364[6] | 225 | 10 | 9 | 24.0 | .280 SOE |
| TPV375[6] | 225 | 14 | 8 | 24.0 | .500 SOE |
| PT4574[5] | 300 | 45dBmV | 4.0dB NF | 14.0 | TO-117 |
| LT2001[5] | 300 | 45dBmV | 3.0db NF | 18.0 | TO-117 |
| CA601BU[4] | 300 | 49dBmV | 31 | 24.0 | CA |
| CA100[4] | 300 | 52dBmV | 16.3 | 24.0 | CA |
| CA2100[4] | 300 | 52dBmV | 17 | 24.0 | CA |
| CA2300[4] | 300 | 52dbmV | 22 | 24.0 | CA |
| CA2600[4] | 300 | 53.5dBmV | 33.5 | 24.0 | CA |
| CA200[4] | 300 | 54.5dBmV | 16.3 | 24.0 | CA |
| CA2200[4] | 300 | 54.5dBmV | 17 | 24.0 | CA |
| CA2301[4] | 300 | 54.5dBmV | 22 | 24.0 | CA |
| CA2840[4] | 300 | 0.5 | 22 | 24.0 | CA |
| CA3800[4] | 300 | 1.0 | 22 | 24.0 | CA |
| CA2810[4] | 350 | 0.5 | 33 | 24.0 | CA |
| CA2800[4] | 400 | 0.5 | 18 | 24.0 | CA |
| CA2870[4] | 400 | 0.5 | 33 | 24.0 | CA |
| 2N3866 | 400 | 1.0 | 11.2 | 28.0 | TO-39 |
| 2N5090[1] | 400 | 1.2 | 8 | 28.0 | TO-60 |
| PT9700 | 400 | 1.5 | 11 | 28.0 | .280 SOE |
| PT9705 | 400 | 2.0 | 10 | 28.0 | .280 SOE |
| 2N3375[1] | 400 | 3.0 | 5 | 28.0 | TO-60 |
| PT9701 | 400 | 4.0 | 10 | 28.0 | .280 SOE |
| PT9703 | 400 | 10 | 10 | 28.0 | .280 SOE |
| 2N3733[1] | 400 | 10 | 4 | 28.0 | TO-60 |
| 2N5016[1] | 400 | 15 | 4.7 | 28.0 | TO-60 |
| PT9702 | 400 | 20 | 7.0 | 28.0 | .280 SOE |
| 2N5637[1] | 400 | 20 | 4.6 | 28.0 | .280 SOE |
| PT9704 | 400 | 30 | 6.3 | 28.0 | .280 SOE |
| PT9704A | 400 | 30 | 7.8 | 28.0 | .280 SOE |
| JO2014 | 400 | 40 | 8.6 | 28.0 | .500 J Zero |

TRW RF SEMICONDUCTORS
AN ELECTRONIC COMPONENT DIVISION OF TRW INC. 14520 AVIATION BOULEVARD, LAWNDALE, CALIFORNIA 90260 • (213) 679-4561 • TWX: 910-325-6206 • TELEX: 67-7148

# TRW RF SEMICONDUCTORS

| PART NUMBER | MAX RATED FREQ. MHz | POWER OUTPUT W | GAIN dB | $V_{CC}$ VOLTS | PACKAGE |
|---|---|---|---|---|---|
| J02015 | 400 | 70 | 7.0 | 28.0 | .500 J Zero |
| J02015A | 400 | 70 | 8.4 | 28.0 | .500 J Zero |
| PT8880 | 470 | 0.2 | 9.0 | 12.5 | TO-39 |
| PT8881[2] | 470 | 1.5 | 10 | 12.5 | .280 SOE S |
| 2N5944 | 470 | 2.0 | 9.0 | 12.5 | .280 SOE |
| PT8809[2] | 470 | 2.0 | 10 | 12.5 | .280 SOE |
| 2N5945 | 470 | 4.0 | 8.0 | 12.5 | .280 SOE |
| PT8810 | 470 | 5.0 | 8.6 | 12.5 | .280 SOE |
| PT8811 | 470 | 10 | 6.0 | 12.5 | .280 SOE |
| 2N5946 | 470 | 10 | 6.0 | 12.5 | .280 SOE |
| J03015 | 470 | 15 | 7.7 | 12.5 | .500 J Zero |
| MX15[7] | 470 | 15 | 19 | 12.5 | MXM |
| J03020 | 470 | 20 | 7.5 | 12.5 | .500 J Zero |
| J03028 | 470 | 28 | 6.0 | 12.5 | .500 J Zero |
| J03035 | 470 | 35 | 4.6 | 12.5 | .500 J Zero |
| J03045 | 470 | 45 | 5.0 | 12.5 | .500 J Zero |
| J03055 | 470 | 55 | 4.4 | 12.5 | .500 J Zero |
| J03060 | 470 | 60 | 3.8 | 12.5 | .500 J Zero |
| LT3005[5] | 500 | 45dbmV | 45dB NF | 18.0 | .200 SOE |
| TP491[5] | 500 | 45 dBmV | 1.6dB NF | 10.0 | T-PACK |
| LT3047[5] | 500 | 45 dBmV | 1.6dB NF | 10.0 | TO-46 |
| CA2820[4] | 500 | 0.5 | 30 | 24.0 | CA |
| 2N5177[1] | 500 | 25 | 5 | 28.0 | DIA-2L |
| MX7.5[7] | 512 | 7.5 | 18 | 12.5 | MXM |
| MX12[7] | 512 | 12 | 19 | 12.5 | MXM |
| TPV596[6] | 860 | 0.5 | 12 | 24.0 | .280 SOE |
| TPV597[6] | 860 | 1.0 | 11 | 24.0 | .280 SOE |
| J03301[2] | 866 | 4.5 | 6.5 | 12.5 | MRB |
| J03401[2] | 866 | 6.0 | 7.8 | 12.5 | MRB |
| J03302[2] | 866 | 15 | 5.7 | 12.5 | MRB |
| J03402[2] | 866 | 15 | 7.0 | 12.5 | MRB |
| J03303[2] | 866 | 22 | 5.0 | 12.5 | MRB |
| J03403[2] | 866 | 22 | 6.4 | 12.5 | MRB |
| J03304[2] | 866 | 30 | 4.8 | 12.5 | MRB |
| J03404[2] | 866 | 30 | 5.7 | 12.5 | MRB |
| J03405[2] | 866 | 35 | 5.4 | 12.5 | MRB |
| J03406[2] | 866 | 40 | 5.2 | 12.5 | MRB |
| J03305[2] | 866 | 42 | 4.5 | 12.5 | MRB |
| 2N4429[1] | 1000 | 1.0 | 5.0 | 28.0 | TO-117 |
| PT8651[1] | 1000 | 1.0 | 5.0 | 28.0 | RT-3 |
| 2N4430[1] | 1000 | 2.5 | 5.0 | 28.0 | TO-129 |
| 2N5764[1] | 1000 | 3.0 | 6.0 | 28.0 | RT-3 |
| MRA0610-3 | 1000 | 3.0 | 7.8 | 28.0 | MRA |
| 2N4431[1] | 1000 | 5.0 | 5.0 | 28.0 | TO-129 |
| 2N5765[1] | 1000 | 5.0 | 6.0 | 28.0 | RT-3 |
| MRA0610-9 | 1000 | 9.0 | 7.8 | 28.0 | MRA |
| MRA0610-18 | 1000 | 18 | 7.8 | 28.0 | MRA |
| MRA0610-40 | 1000 | 40 | 8.0 | 28.0 | MRA |
| MRP0912-25[9] | 1215 | 25 | 8.0 | 40.0 | MRA |
| MRP0912-50 | 1215 | 50 | 7.0 | 50V | MRA |
| MRP0912-75[9] | 1215 | 75 | 7.0 | 50.0 | MRA |
| MRP0912-150[9] | 1215 | 150 | 7.0 | 50.0 | MRP |
| MRP0912-250[9] | 1215 | 250 | 6.0 | 50.0 | MRP |
| MRA1014-2 | 1400 | 2.0 | 8.2 | 28.0 | MRA |
| MRA1014-6 | 1400 | 6.0 | 7.4 | 28.0 | MRA |

| PART NUMBER | MAX RATED FREQ. MHz | POWER OUTPUT W | GAIN dB | $V_{CC}$ VOLTS | PACKAGE |
|---|---|---|---|---|---|
| MRA1014-12 | 1400 | 12 | 7.8 | 28.0 | MRA |
| MRA1014-35 | 1400 | 35 | 7.0 | 28.0 | MRA |
| MRA1417-2 | 1700 | 2 | 8.0 | 28.0 | MRA |
| MRA1417-6 | 1700 | 6 | 7.4 | 28.0 | MRA |
| MRA1417-11 | 1700 | 11 | 7.4 | 28.0 | MRA |
| MRA1417-25 | 1700 | 25 | 7.0 | 28.0 | MRA |
| 2N5481[1] | 2000 | 1.0 | 6.0 | 28.0 | RT-3 |
| 2N5766[1] | 2000 | 1.0 | 8.0 | 28.0 | RT-3 |
| TRW2001 | 2000 | 1.0 | 9.0 | 28.0 | HLP-8 |
| TRW52001[2,6] | 2000 | 1.8 | 6.0 | 20.0 | TW200 |
| MRA1720-2 | 2000 | 2.0 | 7.6 | 28.0 | MRA |
| 2N5482[1] | 2000 | 2.5 | 5.0 | 28.0 | RT-3 |
| 2N5767[1] | 2000 | 2.5 | 8.0 | 28.0 | RT-3 |
| TRW2003 | 2000 | 3.0 | 8.0 | 28.0 | HLP-8 |
| TRW52602[2,6] | 2000 | 3.6 | 6.0 | 20.0 | HLP-8 |
| 2N5483[1] | 2000 | 5.0 | 4.0 | 28.0 | RT-3 |
| MRA1720-5 | 2000 | 5.0 | 6.6 | 28.0 | MRA |
| 2N5768[1] | 2000 | 5.0 | 7.0 | 28.0 | RT-3 |
| TRW2005 | 2000 | 5.0 | 8.0 | 28.0 | HLP-8 |
| TRW52604[2,6] | 2000 | 7.2 | 5.0 | 20.0 | HLP-8 |
| MRA1720-9 | 2000 | 9.0 | 6.5 | 28.0 | MRA |
| TRW2010 | 2000 | 10 | 7.0 | 28.0 | HLP-8 |
| TRW2015 | 2000 | 15 | 6.0 | 28.0 | HLP-11 |
| TRW2020 | 2000 | 20 | 5.2 | 28.0 | HLP-11 |
| MRA1720-20 | 2000 | 20 | 6.0 | 28.0 | MRA |
| TRW2301 | 2300 | 1.0 | 8.0 | 20.0 | HLP-8 |
| MRA2023-1.5[2,8] | 2300 | 1.5 | 8.0 | 28.0 | MRA |
| MRA2023-3[2,8] | 2300 | 3.0 | 8.0 | 28.0 | MRA |
| TRW2304 | 2300 | 4.0 | 8.0 | 20.0 | HLP-8 |
| MRA2023-6[2,8] | 2300 | 6.0 | 7.0 | 28.0 | MRA |
| TRW2307 | 2300 | 7.0 | 8.5 | 20.0 | HLP-8 |
| MRA2023-12[2,8] | 2300 | 12 | 7.0 | 28.0 | MRA |
| TRW53601[2,6] | 3000 | 0.8 | 6.0 | 20.0 | HLP-8 |
| TRW3001 | 3000 | 1.0 | 7.0 | 28.0 | HLP-8 |
| TRW53602[2,6] | 3000 | 1.6 | 5.0 | 20.0 | HLP-8 |
| TRW3003 | 3000 | 3.0 | 6.0 | 28.0 | HLP-8 |
| TRW3005 | 3000 | 5.0 | 5.0 | 28.0 | HLP-8 |
| TRW54601[2,6] | 4000 | 0.5 | 6.0 | 20.0 | HLP-8 |
| TRW4001 | 4000 | 1.0 | 6.0 | 28.0 | HLP-8 |
| TRW4003 | 4000 | 3.0 | 6.0 | 28.0 | HLP-8 |

## NOTES

[1] Available but not recommended for use in new design.
[2] Package options are available.
[3] Rated for AM service.
[4] Linear Hybrid Amplifier.
[5] Low Noise Transistor.
[6] Linear Class A Transistor.
[7] Mobile Radio Hybrid Amplifier.
[8] 22V operation also available.
[9] Rated for Pulsed Power Operation.


AN ELECTRONIC COMPONENT DIVISION OF TRW INC. 14520 AVIATION BOULEVARD, LAWNDALE, CALIFORNIA 90260 • (213) 679-4561 • TWX: 910-325-6206 • TELEX: 67-7148

vemaline products
487 Jefferson Blvd., Warwick, R.I. 02886
(401) 739-7600 TELEX-927573
A Division of Ostby and Barton

# HIGH POWER HEAT SINKS (Extruded)

## HOW TO ORDER

### SELECT STYLE:

From Performance Table and Profile Illustrations select Style to meet requirements.

### SELECT FINISH:

#1 Unfinished Aluminum
#2 Chromate Conversion (MIL-C-5541) Irridite
#3 Dull Black Anodize (MIL-A-8625a)—Standard Finish

### DETERMINE HOLE PATTERN:‡ (See Figs.)

0 = Blank (No holes)
A = TO-3 Pattern
C thru C7 = SCR mtg.
F = TO-3 Pattern
G thru G8 = SCR mtg.
H thru H5 = SCR mtg. (Threaded)
T = TO-66 Pattern

### DETERMINE LENGTH:

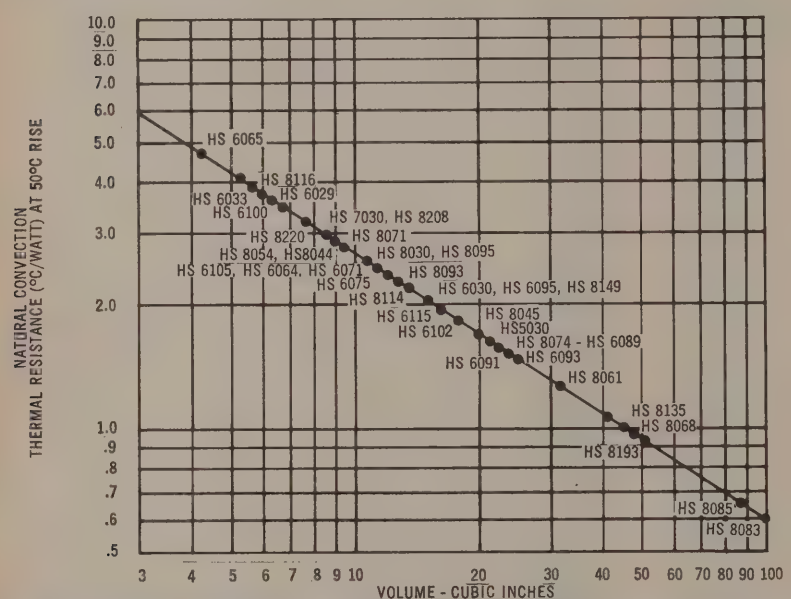
2 = 2″ 4 = 4″ 6 = 6″
3† = 3″ 5 = 5″

### EXAMPLE:

HS 7030 - 3 - B - 3
STYLE — FINISH — HOLES — LENGTH

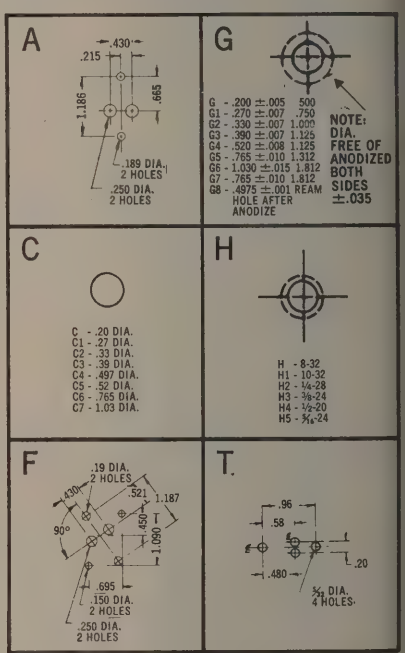
NOTES:
1- * Indicates that sink utilizes serrated fins to achieve greater surface area.
2- Dimensions given are for reference only.
3- Material: Aluminum 6063-T5.
4- Tolerances: Standard mil tolerances.
5- T.R. - Thermal Resistance - Value indicated is based on a 3 inch length of sink.
6- † Industry standard length.
7- ‡ To order heatsinks with mounting holds only, use hole pattern #MH. Example HS6071-3-0-3-MH.

## SELECTION GUIDE

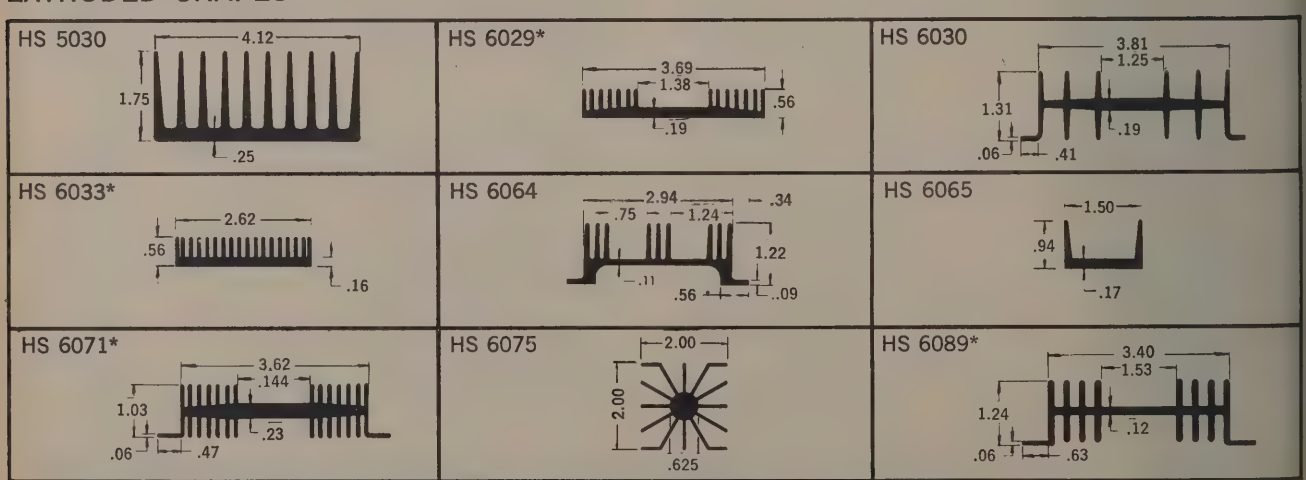



The curve, a straight line plot on log paper shows the natural convection thermal resistance (°C/watt) at a 50°C rise of the heat sink mounting surface above ambient, versus the volume occupied by the heat sink. The volume is based on a 3 inch length of each sink.

## HOLE PATTERNS




## EXTRUDED SHAPES



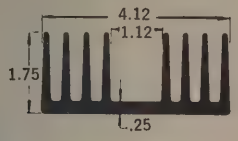

ALL SPECIFICATIONS FOR REFERENCE ONLY, AND ARE SUBJECT TO MODIFICATION.

vemaline products
487 Jefferson Blvd., Warwick, R.I. 02886
(401) 739-7600 TELEX-927573
A Division of Ostby and Barton

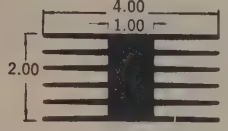
# HIGH POWER HEAT SINKS (Extruded)

## EXTRUDED SHAPES/CONTINUED

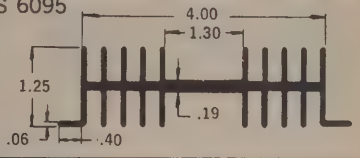
HS 6091



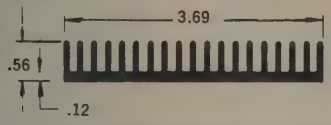

HS 6093



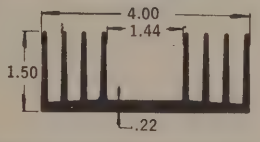

HS 6095



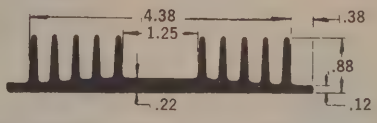

HS 6100*



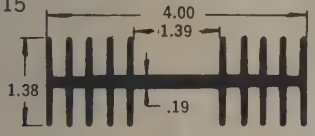

HS 6102*



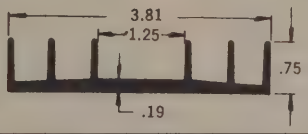

HS 6105*



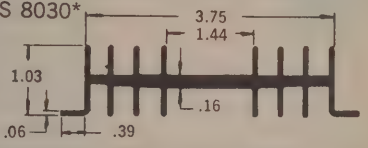

HS 6115



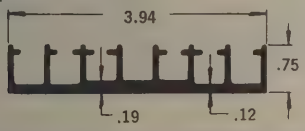

HS 7030



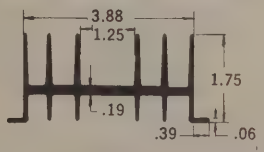

HS 8030*



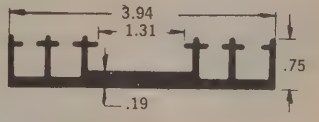

HS 8044*



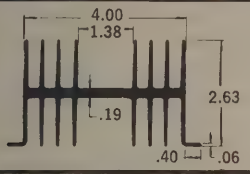

HS 8045




HS 8054*

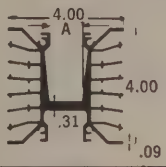



HS 8061*

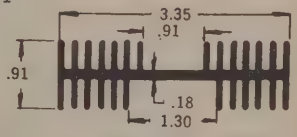



HS 8068*

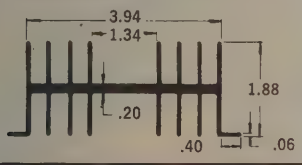
A = 1.12




HS 8071

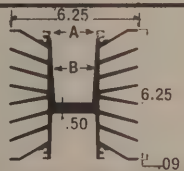



HS 8074



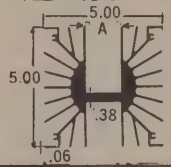

HS 8083*

A = 2.25
B = 1.81

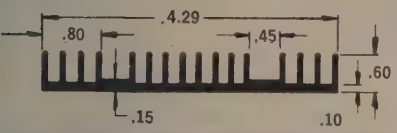



HS 8085

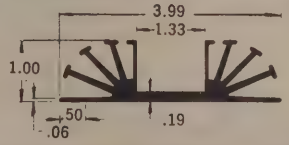
A = 1.50



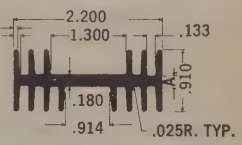

HS 8093*




HS 8095

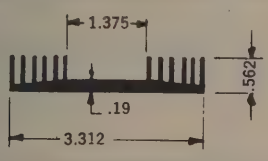



HS 8114

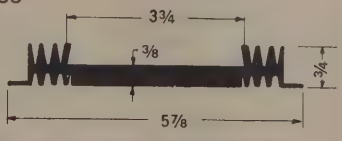



A = 1.40

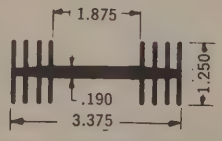
HS 8116*



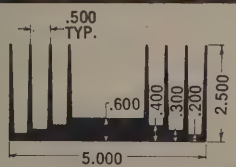

HS 8135



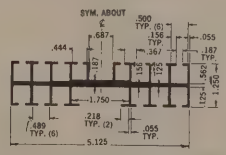

HS 8149



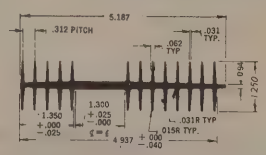

HS 8193




HS 8208




HS 8220

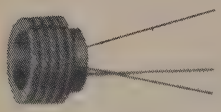



ALL SPECIFICATIONS FOR REFERENCE ONLY, AND ARE SUBJECT TO MODIFICATION.

vemaline products
487 Jefferson Blvd., Warwick, R.I. 02886
(401) 739-7600 TELEX-927573
A Division of Ostby and Barton

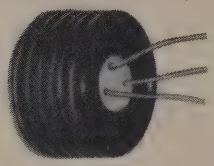
# MEDIUM POWER HEAT SINKS

FOR E. I. A. JEDEC OUTLINES: TO-1, TO-5, TO-7, TO-8, TO-9, TO-11, TO-12, TO-16, TO-18, TO-24, TO-25, TO-28, TO-29, TO-33, TO-39, TO-40, TO-42, TO-43, TO-44, TO-45, TO-46.



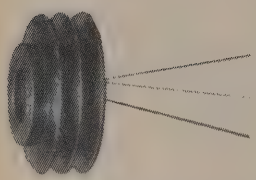
## 6025

**Weight:** .06 oz.
**Finish:** Irridite, unless otherwise specified
**Dia.:** ½" **Lgth.:** ¼"



## 8039

**Weight:** .145 oz.
**Finish:** Dull Black Anodize (MIL-A-8625a) unless otherwise specified
**Dia.:** ¾" **Lgth.:** 11/32"



## S8020

**Weight:** .148 oz.
**Finish:** Dull Black Anodize (MIL-A-8625a) unless otherwise specified
**Dia.:** 1" **Lgth.:** 13/32"

## HOW TO ORDER

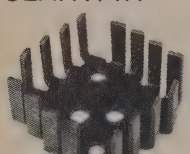
FINISH:
Dull Black Anodize (per MIL-A-8625a) standard finish.

Irridite Finish (per MIL-C-5541)

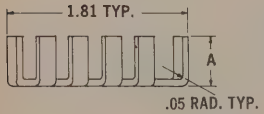
SUFFIX:
Determine the exact diameter of the type semiconductor to be used, since there is a large variation in semiconductor case diameters. Select appropriate suffix from table.

| Applies to: | Suffix | Semiconductor Mtg. Hole Dia. (inches) ±.003" |
|---|---|---|
| S8020 | P | .518 |
| | N | .498 |
| | M | .480 |
| | L | .397 |
| | K | .370 |
| | J | .353 |
| All Models | H | .335 |
| | G | .330 |
| | F | .318 |
| | E | .314 |
| | D | .294 |
| All Models | C | .271 |
| | B | .245 |
| | A | .177 |

## SLANTFIN



Here's a new line of heat sinks designed with slanted vane fins to utilize air flow in multiple directions for superior heat dissipation.
The high thermal efficiency of these lightweight heat sinks enables them to dissipate as much heat as heavier and more costly impact extruded and cast heat sinks.
Ready for immediate delivery, these new vemaline SlantFin heat sinks are designed to accommodate plastic power packs and can be easily mounted to printed circuit boards.




| Part No. | Dim. A |
|---|---|
| 6045 | .50 |
| 6046 | .75 |
| 6047 | 1.00 |
| 6048 | 1.25 |

### ORDERING INFORMATION

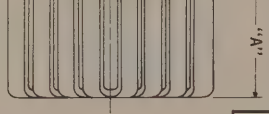
Example: **6045-3-A** unit is ½" high, with a Black Anodized finish and has a TO-3 hole pattern.

| Model No. | Hole Pattern Suffix TO-3 | TO-66 |
|---|---|---|
| 6045 | -A | -T |
| 6046 | -A | -T |
| 6047 | -A | -T |
| 6048 | -A | -T |

| Finish |
|---|
| 1 - NO FINISH |
| 2 - YELLOW IRRIDITE |
| 3 - BLACK ANODIZE |

## DIAMOND-SHAPED

Vemaline's unique and economical Diamond-Shaped heat sink is the perfect space-saving cooler for high heat dissipation efficiency.
Made to accommodate plastic power packs, this lightweight heat sink conforms to TO-3 and TO-66 hole patterns for easy circuit-board mounting, as well.
Ready for immediate delivery, Vermaline's low-priced Diamond-Shaped heat sink delivers quality performance.




| Part No. | Dim. A |
|---|---|
| 6148 | .500 |
| 6149 | .750 |
| 6150 | 1.00 |
| 6151 | 1.25 |

| Model No. | Hole Pattern Suffix TO-3 | TO-6 |
|---|---|---|
| 6148 | -A | -T |
| 6149 | -A | -T |
| 6150 | -A | -T |
| 6151 | -A | -T |

### ORDERING INFORMATION

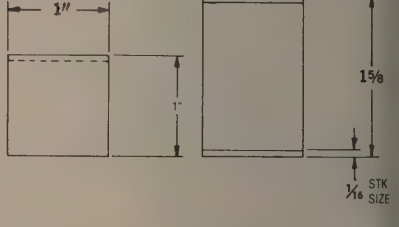
Example: **6148-3-A** unit is ½" high, with a Black Anodized finish and has a TO-3 hole pattern.

| Code | Hole Pattern For | Code |
|---|---|---|
| 3 | TO-3 | -A |
| 0 | TO-66 | -T |
| 2 | — | — |

| | Finish |
|---|---|
| 3 | BLACK ANODIZE |
| 0 | NO FINISH |
| 2 | YELLOW IRRIDITE |

## MAXIFIN

A new high efficiency component, the Vemaline MaxiFin heat sink is specifically made to reduce heat build-up while it keeps costs down.
Designed for 10 watt and under power heat dissipation, the lightweight MaxiFin circulates air to provide maximum cooling for power packs. Easily mounted on printed circuit boards, it comes in two models to fit TO-3 and TO-66 patterns.
Ready for immediate delivery, the Vemaline MaxiFin heat sink has a one inch fin height and can meet diverse heat reduction requirements.




### ORDERING INFORMATION

Example: **6147-3-7** unit is 1" high, has a gold Irridite finish, and a TO-66 hole pattern.

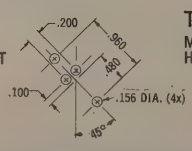
| Part No. | Hole Pattern |
|---|---|
| 6147-A | TO-3 |
| 6147-T | TO-66 |

| Finish |
|---|
| -1 NO FINISH |
| -2 BLACK ANODIZE |
| -3 GOLD IRRIDITE |

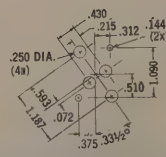
**ALL SPECIFICATIONS FOR REFERENCE ONLY, AND ARE SUBJECT TO MODIFICATION.**

## HOLE PATTERNS

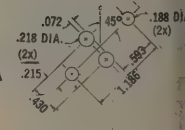
TO-66
ALL SHAPES
HOLE PATTERN T




TO-3
MaxiFin
HOLE PATTERN A




TO-3
SlantFin and Diamond
HOLE PATTERN A





Add Dept. EM to address to tell them you saw it in eem

# Everything you ever wanted to know about Power Semiconductors but were reluctant to ask!

**U.S.**
**$6.50 each**

**Elsewhere**
**$7.50 each**

(Book Rate Postage Included)

**deal for all users of**
**Power Semiconductors**
**egardless of job function,**
**echnical background,**
**nd experience level.**

**Two books in one**
**8 x 10½ Format • Easy-to-read**
**Fully indexed • 432 pages**

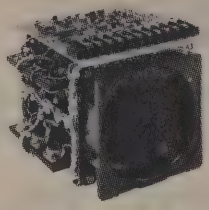
This valuable reference book will save you time and money when specifying, buying, installing, testing, maintaining, troubleshooting, servicing, identifying, and replacing power semiconductors—Order your copy today. Send check or money order (payable in U.S. funds) to:

Westinghouse Electric Corporation
Book Order (ER)
Semiconductor Division
Youngwood, Pa. 15697

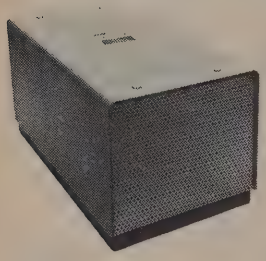
# BULOVA®

# LINEAR D.C. SERVO AMPLIFIERS

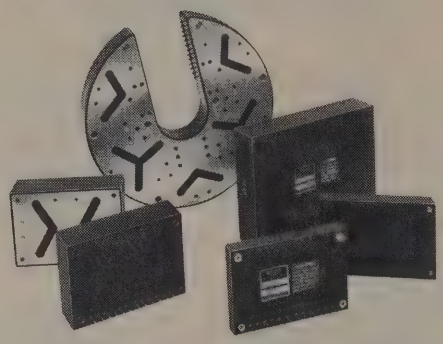
**25 to 1000 Watts**



**FAN COOLED, 500, 750 and 1000 Watts**



The Bulova Series DCA/FC Servo Amplifiers are all forced air cooled. Heat sinks and fans are integral in all units.



**EPOXY ENCAPSULATED, 25 to 600 Watts**

## Features

- Dual Usage—Current or Voltage Amplifier
- Wide Bandwith—10kHz Small Signal, 1kHz Full Power
- Adjustable Gain
- Adjustable Current Limit
- Current or Voltage Feedback
- Integral Heat Sink
- Continuous 100% Dissipation (Fan Cooled Units)

## Typical Applications

- DC Servo Motors
- DC Torque Motors
- Servo Valves
- Low Inertia Motors
- Deflection Coils

| Model No. | OUTPUT AT NOMINAL SUPPLY: Output Current, Amp. Cont. | Limit Adjust. Range, Amp. | Peak Voltage | Peak Current, Amperes | SUPPLY: Supply, V d.c. | Supply Bias, V d.c. (20mA) | GAIN: V/V Gain | A/V Gain | FREQ. RESPONSE: Small Signal, kHz | Full output, kHz | INTERNAL DISSIPATION: Continuous, W @ 25°C | Derating, W/°C | Full Power Rating, W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **EPOXY ENCAPSULATED 25 TO 600 WATTS** | | | | | | | | | | | | | |
| DCA25 | ±1.25 | 0.4 to 1.25 | ±20 | ±1.25 | + 28 ±3 | −15 ±2 | 20 | 0.5 | 10 | 1 | 12.5 | .075 | 25 |
| DCA25/60 | ±0.50 | 0.2 to 0.50 | ±50 | ±0.50 | + 60 ±5 | −15 ±2 | 20 | 0.5 | 10 | 1 | 12.5 | .075 | 25 |
| DCA50/60 | ±1 | 0.2 to 1 | ±50 | ±1 | + 60 ±5 | −15 ±2 | 20 | 0.5 | 10 | 1 | 25 | .15 | 50 |
| DCA200 | ±5 | 0.4 to 10 | ±20 | ±10 | + 28 ±3 | −15 ±2 | 20 | 0.5 | 10 | 1 | 100 | .75 | 200 |
| DCA300 | ±6 | 0.4 to 15 | ±20 | ±15 | + 28 ±3 | −15 ±2 | 20 | 0.5 | 10 | 1 | 150 | 1.00 | 300 |
| DCA300/60 | ±6 | 0.2 to 6 | ±50 | ± 6 | + 28 ±3 | −15 ±2 | 20 | 0.5 | 10 | 1 | 150 | .875 | 300 |
| DCA600/60 | ±6 | 0.2 to 12 | ±50 | ±12 | + 60 ±5 | −15 ±2 | 20 | 0.5 | 10 | 1 | 300 | 2.00 | 600 |
| DCA600/100 | ±6 | 1.0 to 6.7 | ±90 | ±6.7 | +100 ±5 | −15 ±2 | 20 | 0.5 | 10 | 1 | 300 | 2.00 | 600 |
| **FAN COOLED 500, 750 AND 1000 WATTS** | | | | | | | | | | | | | |
| DCA500FC-1 | ±10 | 1 to 10 | ±50 | ±10 | ± 60 ±5 | not req. | 10 | 2.5 | 5 | 1 | 500 | 10 | 500 |
| DCA500FC-2 | ±10 | 1 to 10 | ±50 | ±10 | + 60 ±5 | −15 ±2 | 10 | 2.5 | 5 | 1 | 500 | 10 | 500 |
| DCA500FC-3 | ±10 | 1 to 10 | ±50 | ±10 | + 60 ±5 | not req. | 10 | 2.5 | 5 | 1 | 500 | 10 | 500 |
| DCA750FC-1 | ±15 | 1.5 to 15 | ±50 | ±15 | ± 60 ±5 | not req. | 10 | 2.5 | 5 | 1 | 750 | 15 | 750 |
| DCA750FC-2 | ±15 | 1.5 to 15 | ±50 | ±15 | + 60 ±5 | −15 ±2 | 10 | 2.5 | 5 | 1 | 750 | 15 | 750 |
| DCA750FC-3 | ±15 | 1.5 to 15 | ±50 | ±15 | + 60 ±5 | not req. | 10 | 2.5 | 5 | 1 | 750 | 15 | 750 |
| DCA1000FC-1 | ±20 | 2 to 20 | ±50 | ±20 | ± 60 ±5 | not req. | 10 | 2.5 | 5 | 1 | 1000 | 20 | 1000 |
| DCA1000FC-2 | ±20 | 2 to 20 | ±50 | ±20 | + 60 ±5 | −15 ±2 | 10 | 2.5 | 5 | 1 | 1000 | 20 | 1000 |
| DCA1000FC-3 | ±20 | 2 to 20 | ±50 | ±20 | + 60 ±5 | not req. | 10 | 2.5 | 5 | 1 | 1000 | 20 | 1000 |

**BULOVA®**

ELECTRONICS DIVISION
OF BULOVA WATCH COMPANY, INC.
61-20 WOODSIDE AVENUE
WOODSIDE, N. Y. 11377 • 212 335-6000

SERVO PRODUCTS

**NEED MORE INFO?**
*Call or Write for Full Spec Bulletin*

# SERVO ELECTRONICS

STANDARD AND CUSTOMIZED DESIGN

## DIGITAL & ANALOGUE ELECTRONICS FOR CONTROL SYSTEMS

- Standard units available which will meet applicable MIL Specifications.
- Power output ranges from 1 Watt to 2.5 KW.
- Units for industrial applications available.
- SPECIAL electronics designed to your detailed specification.

200 HP

141

140

416-3

916 (Flat Pack)

980-1

**LOGIC CIRCUITRY FOR MODE CONTROL**

**AMPLIFIERS FOR AC SERVO MOTORS**

**AMPLIFIERS FOR DC TORQUERS AND DC MOTORS**

**AMPLIFIERS FOR SERVO VALVES AND CLUTCHES**

**MODULATORS AND DEMODULATORS**

**RESOLVER BOOSTERS AND ISOLATION AMPLIFIERS**

**TEMPERATURE CONTROLLERS**

## DIGITAL • ANALOGUE CONTROL SYSTEMS

STANDARD AND CUSTOMIZED DESIGN

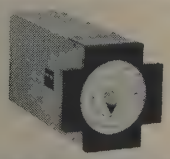
| | | | |
|---|---|---|---|
| Servo Indicators | Two Speed Servos | Computer Interface Systems | |
| Servo Actuators | Servo Computers | Nuclear Control Rod Indicators | Special Control Systems |
| Servo Repeaters | Data Transmission Systems | Analogue to Digital Converters | Process Controllers |

- Units available which will meet applicable MIL Specifications.
- Devices designed to operate with A.C., D.C., synchro or resolver command signals.
- All units feature self-contained transistorized high reliability electronics and power supplies.
- Units now in use on numerous systems involving:

| | | |
|---|---|---|
| SIMULATORS | Missile Tracking | Aircraft Instrumentation |
| Fire Control | Ground Support | Missile Instrumentation |
| ASW | High Accuracy Positioning | Stable Platforms |

- Special systems can be designed in accordance to your detailed specifications. CTC will also design **"Interface"** equipment to integrate major control systems.

## INDICATORS

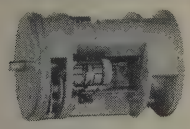

CS-109 Dual Pointer Indicator

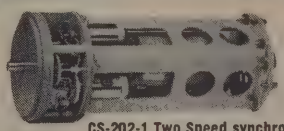
Bearing Indicator

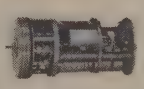
Simulated Altimeter

Although CTC is best known for its system engineering, a most significant part of the company is in the field of CUSTOMIZING of electronics and electromechanical assemblies for control systems applications. By using off-the-shelf modules we can accomplish such MODIFICATIONS in a short time and in most cases without extra cost.

## ACTUATORS

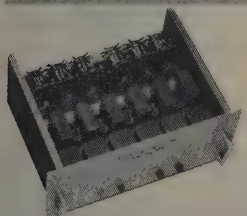

CS-202-2 300 lb. in. actuator


CS-202-1 Two Speed synchro high accuracy actuator


CS-198 250 oz. in. 0.1% accuracy actuator

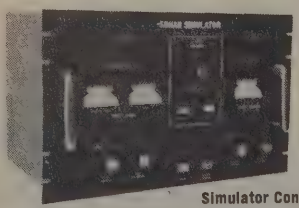
Custom Servo Actuator

## SPECIAL SYSTEMS


Control System used in ASW

Digital Control System

Dual Channel Resolver Angle Computer


Simulator Control Systems

CONTROL TECHNOLOGY CO., Inc., 41-16 29TH STREET, LONG ISLAND CITY, N. Y. 11101 • (212) EMpire 1-2133

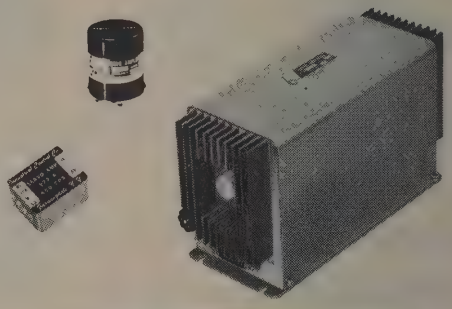
# SERVO COMPONENTS

## INSTRUMENTS, AMPLIFIERS and ACCESSORIES

***FOR MILITARY AND INDUSTRIAL CONTROL SYSTEMS***

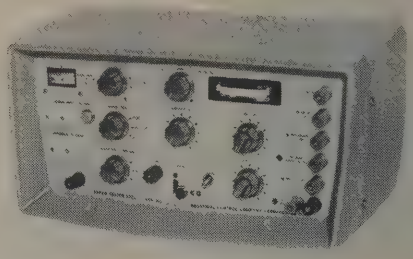
### SERVO AMPLIFIERS

- DC, pot and synchro inputs
- 60 and 400 ~ outputs
- 972A (.5 cu in, 9 watts), to 1078A (1 KW DC)
- Solid-state and magnetic amplifiers



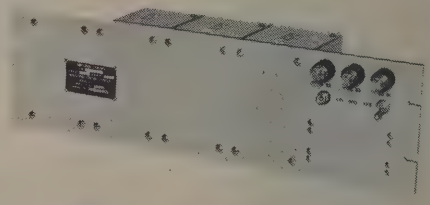
### SERVO TESTERS

- 100C, general purpose use
- 103A, prod and field test
- Frequency and transient response
- For DC and AC servos



### SYNCHRO AMPLIFIERS and FREQUENCY CHANGERS

- 929R, 90V./line, 400 ~ stators
- 820C, 90V./line, 60 ~ stators
- Buffer CX's from CT and TR loads
- Electromechanical and solid-state

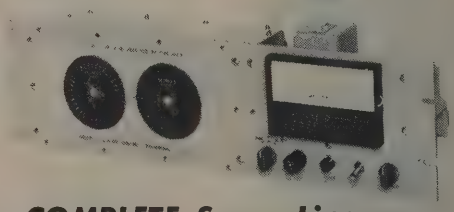


### SERVO DEMONSTRATORS

- Laboratory experiments
- Industrial training
- Synchro and pot data
- 60 and 400 ~ models

### SYNCHRO DIRECTORS

- Generate 1 and 36 speed stator voltages
- Constant velocity and harmonic motion modes
- Computer programmed
- 60 and 400 ~ stator outputs



***Write for Catalog of our COMPLETE Servo Line.***

# INDUSTRIAL CONTROL COMPANY

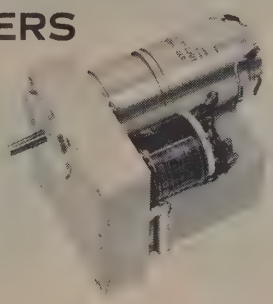
CENTRAL AVENUE AT PINELAWN • FARMINGDALE, L.I., N.Y. 11735 • 516-694-3000

# SERVO SYSTEMS

## STANDARD MODULES or SPECIALS

***MIL-GRADE AND FAST DELIVERY***

### High Torque SYNCHRO REPEATERS



- 770 Series for 400 ~
- 847 Series for 60 ~
- 8′ error
- 300 oz in shaft torque
- 117V. line power

### Two Speed SYNCHRO REPEATERS

- 1038 Series for 400 ~
- 921 Series for 60 ~
- 16, 25 and 36 speed
- Shafts at high and lo speed
- 117V. line power

### DC and AC POT FOLLOWERS

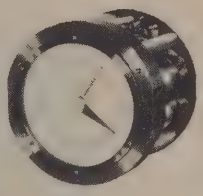
- 900 Series
- DC, 60 or 400 ~ inputs
- 1, 3 or 10 turn pots
- Torques to 300 oz in
- 117V. 60 or 400 ~ power

### Precision DC VELOCITY SERVOS

- 982 Series for 60 ~
- 983 Series for 400 ~
- ±10V. DC command
- 117V. line power
- Wide range of torques and speed

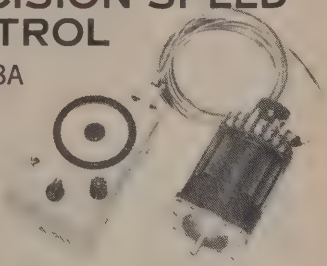
### 3 Axis SERVO INDICATOR

- type 909A



### Bi-Directional PRECISION SPEED CONTROL

- type 923A

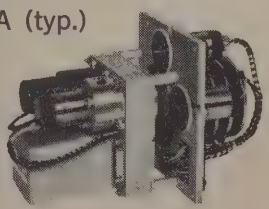


### Process Control DELAYED SIGNAL GENERATOR

- type 849B

### Custom Assemblies TO CUSTOMER SPECS.

- type 869A (typ.)



***Modifications from Standards readily available.***

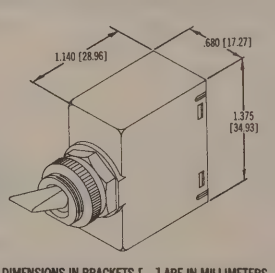
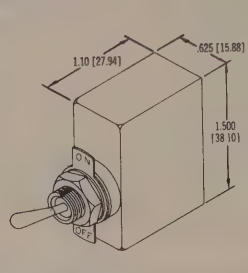
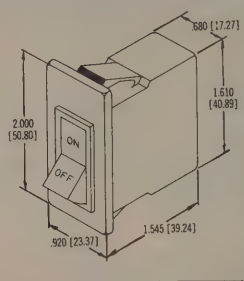
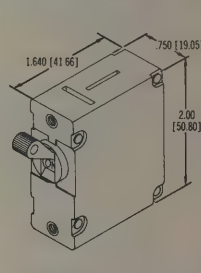
**INDUSTRIAL CONTROL COMPANY**

CENTRAL AVENUE AT PINELAWN • FARMINGDALE, L.I., N.Y. 11735 • 516-694-3000

# AIRPAX™ MAGNETIC CIRCUIT

A North American Philips Company

■ Airpax magnetic circuit breakers have been used for many years to solve the protection problems inherent with fuses and thermal breakers. Magnetic breakers are the acknowledged standard in military equipment, computer systems, ground fault personnel protection systems, and other industrial equipment. Airpax magnetic breakers eliminate the replacement problem inherent with fuses. The minimum trip current is not affected by temperature extremes, as in the case with fuses and thermal breakers. Precise protection is provided.

| Model Designation | T11 | AP/UP | 203 | APG/UPG |
|---|---|---|---|---|
| | | | | |
| DIMENSIONS |  DIMENSIONS IN BRACKETS [ ] ARE IN MILLIMETERS. |  |  |  |
| GENERAL DESCRIPTION AND APPLICATIONS | The T11 is a single pole, single throw, series trip magnetic breaker that combines power switching and reliable protection in one tiny, aesthetically pleasing package. It can be operated at either dc or 50/60Hz, eliminating the need to specify and stock separate units. The T11 offers a choice of six attractive handle colors plus a variety of mounting hardware. The patented snap-action mechanism increases operational life of up to five times that previously available. It also eliminates possible operator "teasing" of the contacts and minimizes arcing. For more information, request Bulletin 2014. | Types AP and UP are sealed electromagnetic circuit protectors qualified to the requirements of specification MIL-C-39019. AP and UP protectors will withstand up to 100G shock applied repeatedly in any plane, as well as 10G vibration from 10 to 2000 Hz under full load, which makes their use practical in mobile equipment. All will operate at rated value between —40°C and +100°C. For more information, request Bulletin 2001. | Combines over-current protection with ON-OFF switch and pilot light functions, for use in high quality industrial, medical, and military equipment where reliable protection and attractive appearance are demanded. Optional colors, plus a single rocker actuator for multipole assemblies, provide ease of operation and panel uniformity. An optional illuminated handle can be used to indicate circuit condition. Snap-in front panel mounting provides economy and simplifies installation. Optional flush mounting also available. For more information, request Bulletin 2009. | APG/UPG circuit breakers are suitable for use in any situation where low cost precision operation is required. Multipole assemblies have a single toggle handle — a unique feature which simplifies mounting (handle per pole, optional). Also available with a rocker arm actuator for improved panel appearance, as well as a panel seal toggle version for marine or military environments. For more information, request Bulletin 2003. |
| Number of Poles | 1 | 1, 2, 3 | 1, 2, 3 | 1, 2, 3, 4 |
| Current and Voltage Ratings | 0.10 to 20 amperes at 32V dc;<br>0.10 to 15 amperes at 120V ac;<br>0.10 to 7.5 amperes at 50V dc and 250V ac | 0.05-20 amperes, 240V ac, 50V dc | 0.05-10 amperes, 250V ac, 50V dc<br>10.1-20 amperes, 120V ac, 32V dc | 0.05-30 amperes, 277V ac, 65V dc<br>31-50 amperes, 50V dc |
| Interrupting Capacity | 1000 amperes at 120V ac, 250V ac, 32V dc, and 50V dc. | 1000 amperes | 1000 amperes | 1000 amperes at 277V ac, 65V dc<br>5000 amperes:<br>(30 A max. rating at 120V ac)<br>(20 A max. rating at 250V ac)<br>(10 A max. rating at 277V ac) |
| UL/CSA Recognized/ Listed | Recognized | Recognized<br>(UP, single pole, series only) | Recognized | Recognized (UPG) |

**AIRPAX ELECTRONICS • CAMBRIDGE DIVISION • CAMBRIDGE, MARYLAND 21613**
Phone: (301) 228-4600 Telex: 8-7715 TWX: 710-865-9655

# BREAKERS

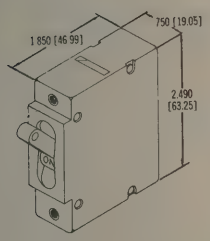
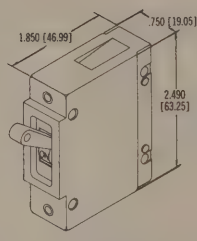
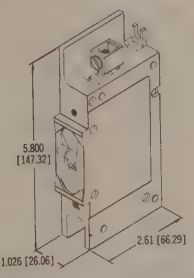
Airpax circuit breakers, with the exception of the T11, are available in many mechanical and electrical configurations to provide maximum versatility for the designer. The following internal circuits are available and can be combined in multipole units.

**SERIES TRIP**
A SPST two-terminal device with the sensing coil and contacts in series with the load being protected.

**SERIES TRIP PLUS AUXILIARY SWITCH**
A SPDT auxiliary switch is added to the series trip unit to provide auxiliary switching functions.

**SHUNT TRIP**
A connection is brought our from the internal coil-contact junction to a third terminal, permitting a shunt across the trip coil.

**RELAY TRIP**
Coil and contact leads are brought out to separate pairs of terminals. This configuration permits the overload sensing coil to be placed in a circuit which is electrically isolated from the trip contacts.

| APL/UPL | 205 | 209 |
|---|---|---|
| | | |
|   |   |   |
| APL/UPL circuit protectors are ruggedly constructed to provide dependable protection under the most severe conditions of use in industrial, military (QPL to MIL-C-55629), marine, or any application where precision protection is required. The versatility of the APL line makes it ideal for special purpose applications. For more information, request Bulletin 2002. | The 205 provides improved electrical performance plus a dust-proof enclosure. All openings in the case (including arc blowout vent and handle) have been sealed with resilient rubber and mylar. Case sections are of tongue and groove construction to provide an overlapping closure. Ideal for application in extremely harsh environments. For more information, request Bulletin 2002. | 209 molded case circuit breakers present to electrical contractors, O.E.M.'s, and panel and equipment builders a more compact, competitive unit. Front or back connected terminal styles. Readily mounted in switch boards, panel enclosures, panel boards, or junction boxes. Family consists of the 209, a labeled circuit breaker; 219 manual motor controller; and 229 appliance controller. For more information, request Bulletin 2012 |
| 1, 2, 3, 4, 5, 6, 7, 8, 9 | 1, 2, 3, 4, 5, 6 | 1, 2, 3, 4, 5, 6 |
| 0.05-20 amperes, 277V ac<br>0.05-20 amperes, 20V ac, 65V dc<br>51-100 amperes, 32V dc | 0.05-20 amperes, 480V ac<br>0.05-20 amperes, 250V ac, 65V dc<br>51-100 amperes, 32V dc | 0.10-100 amperes, 125V dc<br>0.10-75 amperes, 600V ac<br>0.10-100 amperes, 120, 240, 277, 480V ac |
| 1000 amperes, 277V ac, 65V dc<br>2000 amperes, 32V dc<br>5000 amperes, 120V ac (50 A max. rating)<br>5000 amperes, 277V ac (20 A max. rating) | 1000 amperes, 250V ac, 65V dc<br>2000 amperes, 32V dc<br>5000 amperes, 120V ac (50 A max. rating)<br>5000 amperes, 480V ac (20 A max. rating) | 5000 amperes |
| Recognized (UPL) | Recognized | Recognized/Listed |

## GENERAL CHARACTERISTICS

**Trip Free**
Airpax circuit protectors and circuit breakers will trip open on overload, even when forcibly held on. This prevents the operator from damaging the equipment by restraining the handle in the ON position.

**Trip Indication**
The operating handle moves forcibly and positively to the OFF position on overload.

**Shock**
Protectors will withstand shocks of 100G without tripping, while carrying full rated current, when tested per MIL-STD-202C, Method 213, Test Condition 1.

**Vibration**
Protectors will withstand 10G without tripping, while carrying full rated current, when tested per MIL-STD-202C, Method 201A.

**Ambient Operation**
—40°C to +85°C.

**Insulation Resistance**
100 megohms minimum at 500V dc.

**Dielectric Strength**
1500 ac at 60Hz.

**Endurance**
When the protector is operated as a switch carrying full rated current, at a maximum rate of 6 operations per minute, the operating life will exceed 10,000 operations.

AIRPAX™
A North American Philips Company

AIRPAX ELECTRONICS • CAMBRIDGE DIVISION • CAMBRIDGE, MARYLAND 21613
Phone (301) 228-4600 Telex 8-7715 TWX 710-865-9655

# ALCOSWITCH

**World's smallest toggle switches with most-asked-for features. Our submini size means greater space savings and fulfills critical applications. Uniform 0.1" spacing between all terminals and anchor pins conforms with today's PCB standards. High torque bushings and anti-push-in toggle captivation prevents damage. Flame retardant glass filled diallyl phthalate (DAP) is used on all models to prevent damage during soldering and offers high dielectric. Gold on terminals provides ease in soldering and extends shelf life.**

## DISCOUNT SCHEDULE

**X-FACTOR**
For quantities under 100.

| | | |
|---|---|---|
| **1-24** | Multiply by | 1.59 |
| **25-49** | Multiply by | 1.15 |
| **50-99** | Multiply by | 1.08 |

250-Over, Quoted on Request.

## ACTUATORS & BUSHINGS

Color choices available for types 6, 7, 8, 10 and 11 shown at right. Specify: **(0)**-Black, **(2)**-Red, **(6)**-Blue.

**BUSHING SIZE:**

**10-48** Types 1, 4, 5, 6, 9, 10.
**.176 Dia.** Types 3 and 7.
**1/4-40** Types 2, 8, 11, 12.

## RATINGS

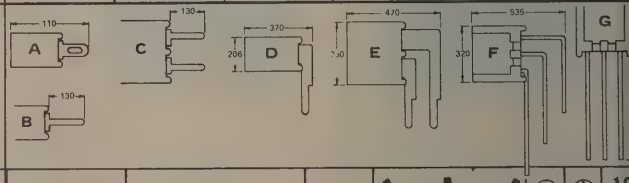
Easily identified by 2nd digit in model number.

1. Gold: 0.4VA max. @ 20 VDC.
3. Silver: 3A @ 125 VAC.

Example: TT13A-2T.

## TERMINAL TYPES

A Wired, silver.
B Single pole PC, gold.
C Double pole PC, gold.
D Single pole RA, gold.
E Double pole, RA, gold.
F Vertical RA, gold.
G Extended PC, gold.




| Illustration | Model | Type | ↘ | ⊥ | ↙ | ▣ | ▲ | 100-Lot |
|---|---|---|---|---|---|---|---|---|
| | TT13A-2T | SPST | On | None | Off | 4 | A | $1.04 |
| | TT13D-2T | SPDT | On | None | On | 4 | A | 1.04 |
| | TT13E-2T | SPDT | On | Off | On | 4 | A | 1.23 |
| | TT23K-2T | DPST | On | None | Off | 4 | A | 1.48 |
| | TT23N-2T | DPDT | On | None | On | 4 | A | 1.48 |
| | TT23P-2T | DPDT | On | Off | On | 4 | A | 1.67 |
| | TTE13A-3T | SPST | On | None | Off | 1 | A | $1.45 |
| | TTE13D-3T | SPDT | On | None | On | 1 | A | 1.45 |
| | TTE13E-3T | SPDT | On | Off | On | 1 | A | 1.64 |
| | TTE23K-3T | DPST | On | None | Off | 1 | A | 1.89 |
| | TTE23N-3T | DPDT | On | None | On | 1 | A | 1.89 |
| | TTE23P-3T | DPDT | On | Off | On | 1 | A | 2.08 |
| | TT13A-3T | SPST | On | None | Off | 5 | A | $1.04 |
| | TT13D-3T | SPDT | On | None | On | 5 | A | 1.04 |
| | TT13E-3T | SPDT | On | Off | On | 5 | A | 1.23 |
| | TT23K-3T | DPST | On | None | Off | 5 | A | 1.48 |
| | TT23N-3T | DPDT | On | None | On | 5 | A | 1.48 |
| | TT23P-3T | DPDT | On | Off | On | 5 | A | 1.67 |
| | TT23PA-3T | DPDT | On | On | On | 5 | A | 1.86 |
| | TT13A-4T(*) | SPST | On | None | Off | 6 | A | $1.07 |
| | TT13D-4T(*) | SPDT | On | None | On | 6 | A | 1.07 |
| | TT13E-4T(*) | SPDT | On | Off | On | 6 | A | 1.26 |
| | TT23K-4T(*) | DPST | On | None | Off | 6 | A | 1.51 |
| | TT23N-4T(*) | DPDT | On | None | On | 6 | A | 1.51 |
| | TT23P-4T(*) | DPDT | On | Off | On | 6 | A | 1.70 |
| | TT23PA-4T(*) | DPDT | On | On | On | 6 | A | 1.89 |
| | TT13A-4T¼(*) | SPST | On | None | Off | 8 | A | $1.13 |
| | TT13D-4T¼(*) | SPDT | On | None | On | 8 | A | 1.13 |
| | TT13E-4T¼(*) | SPDT | On | Off | On | 8 | A | 1.32 |
| | TT23K-4T¼(*) | DPST | On | None | Off | 8 | A | 1.58 |
| | TT23N-4T¼(*) | DPDT | On | None | On | 8 | A | 1.58 |
| | TT23P-4T¼(*) | DPDT | On | Off | On | 8 | A | 1.76 |
| | TT13A-5T | SPST | On | None | Off | 9 | A | $1.07 |
| | TT13D-5T | SPDT | On | None | On | 9 | A | 1.07 |
| | TT13E-5T | SPDT | On | Off | On | 9 | A | 1.26 |
| | TT23K-5T | DPST | On | None | Off | 9 | A | 1.51 |
| | TT23N-5T | DPDT | On | None | On | 9 | A | 1.51 |
| | TT23P-5T | DPDT | On | Off | On | 9 | A | 1.70 |
| | TT13A-6T(*) | SPST | On | None | Off | 10 | A | $1.10 |
| | TT13D-6T(*) | SPDT | On | None | On | 10 | A | 1.10 |
| | TT13E-6T(*) | SPDT | On | Off | On | 10 | A | 1.29 |
| | TT23K-6T(*) | DPST | On | None | Off | 10 | A | 1.54 |
| | TT23N-6T(*) | DPDT | On | None | On | 10 | A | 1.54 |
| | TT23P-6T(*) | DPDT | On | Off | On | 10 | A | 1.73 |
| | TT23PA-6T(*) | DPDT | On | On | On | 10 | A | 1.92 |
| | TT13A-6T¼(*) | SPST | On | None | Off | 11 | A | $1.17 |
| | TT13D-6T¼(*) | SPDT | On | None | On | 11 | A | 1.17 |
| | TT13E-6T¼(*) | SPDT | On | Off | On | 11 | A | 1.35 |
| | TT23K-6T¼(*) | DPST | On | None | Off | 11 | A | 1.61 |
| | TT23N-6T¼(*) | DPDT | On | None | On | 11 | A | 1.61 |
| | TT23P-6T¼(*) | DPDT | On | Off | On | 11 | A | 1.80 |
| | TT23PA-6T¼(*) | DPDT | On | On | On | 11 | A | 1.98 |
| | TTE13A-9T¼ | SPST | On | None | Off | 2 | A | $1.51 |
| | TTE13D-9T¼ | SPDT | On | None | On | 2 | A | 1.51 |
| | TTE13E-9T¼ | SPDT | On | Off | On | 2 | A | 1.70 |
| | TTE23K-9T¼ | DPST | On | None | Off | 2 | A | 1.95 |
| | TTE23N-9T¼ | DPDT | On | None | On | 2 | A | 1.95 |
| | TTE23P-9T¼ | DPDT | On | Off | On | 2 | A | 2.14 |

| Illustration | Model | Type | ↘ | ⊥ | ↙ | ▣ | ▲ | 10 Lo |
|---|---|---|---|---|---|---|---|---|
| | TT13A-9T¼ | SPST | On | None | Off | 12 | A | $1. |
| | TT13D-9T¼ | SPDT | On | None | On | 12 | A | 1. |
| | TT13E-9T¼ | SPDT | On | Off | On | 12 | A | 1. |
| | TT23K-9T¼ | DPST | On | None | Off | 12 | A | 1. |
| | TT23N-9T¼ | DPDT | On | None | On | 12 | A | 1. |
| | TT23P-9T¼ | DPDT | On | Off | On | 12 | A | 1. |
| | TT23PA-9T¼ | DPDT | On | On | On | 12 | A | 1. |
| | TT11AG-PC-1 | SPST | On | None | Off | 3 | B | $1. |
| | TT11DG-PC-1 | SPDT | On | None | On | 3 | B | 1. |
| | TT11EG PC-1 | SPDT | On | Off | On | 3 | B | 1. |
| | TT21KG-PC-1 | DPST | On | None | Off | 3 | C | 1. |
| | TT21NG-PC-1 | DPDT | On | None | On | 3 | C | 1. |
| | TT21PG-PC-1 | DPDT | On | Off | On | 3 | C | 1. |
| | TT21PAG-PC-1 | DPDT | On | On | On | 3 | C | 1. |
| | TT11AG-PC-4(*) | SPST | On | None | Off | 7 | B | $1. |
| | TT11DG-PC-4(*) | SPDT | On | None | On | 7 | B | 1. |
| | TT11EG-PC-4(*) | SPDT | On | Off | On | 7 | B | 1. |
| | TT21KG-PC-4(*) | DPST | On | None | Off | 7 | C | 1. |
| | TT21NG-PC-4(*) | DPDT | On | None | On | 7 | C | 1. |
| | TT21PG-PC-4(*) | DPDT | On | Off | On | 7 | C | 1. |
| | TT11AG-PC-9T¼ | SPST | On | None | Off | 12 | B | $1. |
| | TT11DG-PC-9T¼ | SPDT | On | None | On | 12 | B | 1. |
| | TT11EG-PC-9T¼ | SPDT | On | Off | On | 12 | B | 1. |
| | TT21KG-PC-9T¼ | DPST | On | None | Off | 12 | C | 1. |
| | TT21NG-PC-9T¼ | DPDT | On | None | On | 12 | C | 1. |
| | TT21PG-PC-9T¼ | DPDT | On | Off | On | 12 | C | 1. |
| | TT21PAG-PC-9T¼ | DPDT | On | On | On | 12 | C | 2. |
| | TT11DG-WW-2T | SPDT | On | None | On | 4 | G | $1. |
| | TT11EG-WW-2T | SPDT | On | Off | On | 4 | G | 1. |
| | TT21NG-WW-2T | DPDT | On | None | On | 4 | G | 1. |
| | TT21PG-WW-2T | DPDT | On | Off | On | 4 | G | 2. |
| | TT11DG-RA-1 | SPDT | On | None | On | 3 | D | $1. |
| | TT11EG-RA-1 | SPDT | On | Off | On | 3 | D | 1. |
| | TT21NG-RA-1 | DPDT | On | None | On | 3 | E | 1. |
| | TT21PG-RA-1 | DPDT | On | Off | On | 3 | E | 2. |
| | TT21PAG-RA-1 | DPDT | On | On | On | 3 | E | 2. |
| | TT11DG-RA-4(*) | SPDT | On | None | On | 7 | D | $1. |
| | TT11EG-RA-4(*) | SPDT | On | Off | On | 7 | D | 1. |
| | TT21NG-RA-4(*) | DPDT | On | None | On | 7 | E | 1. |
| | TT21PG-RA-4(*) | DPDT | On | Off | On | 7 | E | 2. |
| | TT11DG-RA-9T¼ | SPDT | On | None | On | 12 | D | $1. |
| | TT11EG-RA-9T¼ | SPDT | On | Off | On | 12 | D | 1. |
| | TT21NG-RA-9T¼ | DPDT | On | None | On | 12 | E | 1. |
| | TT21PG-RA-9T¼ | DPDT | On | Off | On | 12 | E | 2. |
| | TT21PAG-RA-9T¼ | DPDT | On | On | On | 12 | E | 2. |
| | TT11DG-VRA-1 | SPDT | On | None | On | 7 | F | $1. |
| | TT11EG-VRA-1 | SPDT | On | Off | On | 7 | F | 1. |
| | TT21NG-VRA-1 | DPDT | On | None | On | 7 | F | 1. |
| | TT21PG-VRA-1 | DPDT | On | Off | On | 7 | F | 2. |

Prices and specifications subject to change without no

ALCO® ELECTRONIC PRODUCTS, INC.
1551 Osgood Street, North Andover, Ma. 01845 U.S.A.
Tel: (617) 685-4371 TWX: 710 342-0552

# ALCOSWITCH

e ALCO TP Series Pushbutton
vitches find applicational uses
instrumentation, telecom sys-
ns, computers, etc. The PC
rsions feature 4 stabilizing
ounts and gold plated contacts/
rminals for dependable intermit-
nt use and good solderability.
ght angle models are most use-
for edge PCB mounting. Dual
tuators conserve space. A vari-
y of actuator types and bushing
tions allows greater versatility.
our choice of normally open or
PDT momentary types.

## DISCOUNT SCHEDULE

X-FACTOR
For quantities under 100.

| | | |
|---|---|---|
| 1-24 | Multiply by | 1.59 |
| 25-49 | Multiply by | 1.15 |
| 50-99 | Multiply by | 1.08 |

250-Over, Quoted on Request.

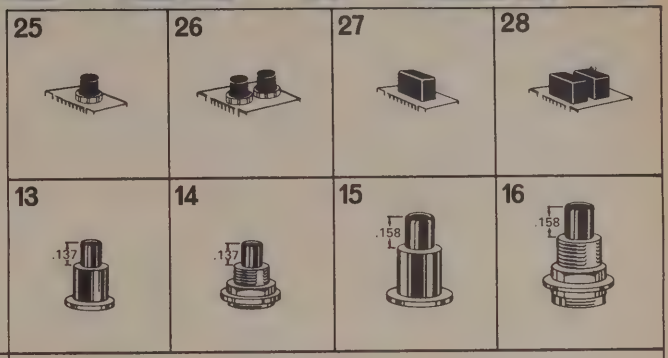
## ▣ ACTUATORS & BUSHINGS

Color choices available for types 25, 26, 27, 28, 13, 14, 15 and 16 shown at right. Specify:

**(0)**-Black, **(2)**-Red, **(6)**-Blue.

**BUSHING SIZE:**

| | |
|---|---|
| None | Types 25 thru 28. |
| .176 Dia. | Type 13. |
| 10-48 | Type 14. |
| .250 Dia. | Type 15. |
| 1/4-40 | Type 16. |




## ◆ RATINGS

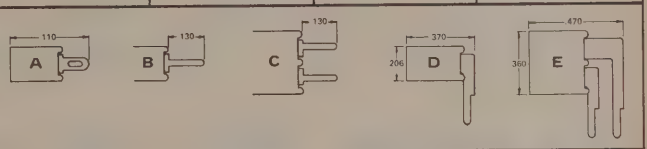
Easily identified by 2nd digit in model number.

1. Gold: 0.4VA max. @ 20 VDC.
3. Silver: 3A @ 125 VAC.

Example: TP1**1**CG-PC.

## ▲ TERMINAL TYPES

A Wired, silver.
B Single pole PC, gold.
C Double pole PC, gold.
D Single pole RA, gold.
E Double pole RA, gold.




| Illustration | Model | Type | Action | ▣ | ▲ | 100-Lot |
|---|---|---|---|---|---|---|
| | TP11CG-PC(*)<br>TP11FG-PC(*) | SPST<br>SPDT | Normally Open<br>Momentary | 27<br>27 | B<br>B | $ .85<br>1.04 |
| | TP21CCG-PC(*)<br>TP21FFG-PC(*) | 2xSPST<br>2XSPDT | Normally Open<br>Momentary | 28<br>28 | C<br>C | $1.42<br>1.61 |
| | TPA11CG-PC(*)<br>TPA11FG-PC(*)<br>TPA21MG-PC(*) | SPST<br>SPDT<br>DPDT | Normally Open<br>Momentary<br>Normally Open | 25<br>25<br>25 | B<br>B<br>C | $ .85<br>1.04<br>1.42 |
| | TPA21CCG-PC(*)<br>TPA21FFG-PC(*) | 2xSPST<br>2xSPDT | Normally Open<br>Momentary | 26<br>26 | C<br>C | $1.42<br>1.61 |
| | TP11CG-RA(*)<br>TP11FG-RA(*) | SPST<br>SPDT | Normally Open<br>Momentary | 27<br>27 | D<br>D | $1.01<br>1.20 |
| | TP21CCG-RA(*)<br>TP21FFG-RA(*) | 2xSPST<br>2xSPDT | Normally Open<br>Momentary | 28<br>28 | E<br>E | $1.73<br>1.92 |
| | TPA11CG-RA(*)<br>TPA11FG-RA(*)<br>TPA21MG-RA(*) | SPST<br>SPDT<br>DPDT | Normally Open<br>Momentary<br>Normally Open | 25<br>25<br>25 | D<br>D<br>E | $1.01<br>1.20<br>1.73 |
| | TPA21CCG-RA(*)<br>TPA21FFG-RA(*) | 2xSPST<br>2xSPDT | Normally Open<br>Momentary | 26<br>26 | E<br>E | $1.73<br>1.92 |
| | TPB11CG-PC(*)<br>TPB11FG-PC(*)<br>TPB21MG-PC(*)<br>TPB21RG-PC(*) | SPST<br>SPDT<br>DPST<br>DPDT | Normally Open<br>Momentary<br>Normally Open<br>Momentary | 13<br>13<br>13<br>13 | B<br>B<br>C<br>C | $ .91<br>1.10<br>1.42<br>1.61 |

| Illustration | Model | Type | Action | ▣ | ▲ | 100-Lot |
|---|---|---|---|---|---|---|
| | TPC11CG-PC(*)<br>TPC11FG-PC(*)<br>TPC21MG-PC(*)<br>TPC21RG-PC(*) | SPST<br>SPDT<br>DPST<br>DPDT | Normally Open<br>Momentary<br>Normally Open<br>Momentary | 14<br>14<br>14<br>14 | B<br>B<br>C<br>C | $ .95<br>1.13<br>1.45<br>1.64 |
| | TPB11CG-RA(*)<br>TPB11FG-RA(*)<br>TPB21MG-RA(*)<br>TPB21RG-RA(*) | SPST<br>SPDT<br>DPST<br>DPDT | Normally Open<br>Momentary<br>Normally Open<br>Momentary | 13<br>13<br>13<br>13 | D<br>D<br>E<br>E | $1.07<br>1.26<br>1.73<br>1.92 |
| | TPC11CG-RA(*)<br>TPC11FG-RA(*)<br>TPC21MG-RA(*)<br>TPC21RG-RA(*) | SPST<br>SPDT<br>DPST<br>DPDT | Normally Open<br>Momentary<br>Normally Open<br>Momentary | 14<br>14<br>14<br>14 | D<br>D<br>E<br>E | $1.10<br>1.29<br>1.76<br>1.95 |
| | TPD11CG-PC(*)<br>TPD11FG-PC(*)<br>TPD21MG-PC(*)<br>TPD21RG-PC(*) | SPST<br>SPDT<br>DPST<br>DPDT | Normally Open<br>Momentary<br>Normally Open<br>Momentary | 15<br>15<br>15<br>15 | B<br>B<br>C<br>C | $ .95<br>1.13<br>1.45<br>1.64 |
| | TPF11CG-PC(*)<br>TPF11FG-PC(*)<br>TPF21MG-PC(*)<br>TPF21RG-PC(*) | SPST<br>SPDT<br>DPST<br>DPDT | Normally Open<br>Momentary<br>Normally Open<br>Momentary | 16<br>16<br>16<br>16 | B<br>B<br>C<br>C | $1.01<br>1.20<br>1.51<br>1.70 |
| | TPD11CG-RA(*)<br>TPD11FG-RA(*)<br>TPD21MG-RA(*)<br>TPD21RG-RA(*) | SPST<br>SPDT<br>DPST<br>DPDT | Normally Open<br>Momentary<br>Normally Open<br>Momentary | 15<br>15<br>15<br>15 | D<br>D<br>E<br>E | $1.10<br>1.29<br>1.76<br>1.95 |
| | TPF11CG-RA(*)<br>TPF11FG-RA(*)<br>TPF21MG-RA(*)<br>TPF21RG-RA(*) | SPST<br>SPST<br>DPST<br>DPDT | Normally Open<br>Momentary<br>Normally Open<br>Momentary | 16<br>16<br>16<br>16 | D<br>D<br>E<br>E | $1.17<br>1.36<br>1.83<br>2.02 |
| | TPC13C(*)<br>TPC13F(*)<br>TPC23M(*)<br>TPC23R(*) | SPST<br>SPDT<br>DPST<br>DPDT | Normally Open<br>Momentary<br>Normally Open<br>Momentary | 14<br>14<br>14<br>14 | A<br>A<br>A<br>A | $ .88<br>1.07<br>1.32<br>1.51 |
| | TPF13C(*)<br>TPF13F(*)<br>TPF23M(*)<br>TPF23R(*) | SPST<br>SPDT<br>DPST<br>DPDT | Normally Open<br>Momentary<br>Normally Open<br>Momentary | 16<br>16<br>16<br>16 | A<br>A<br>A<br>A | $ .95<br>1.13<br>1.39<br>1.58 |

Prices and specifications subject to change without notice.

ALCO® ELECTRONIC PRODUCTS, INC.
1551 Osgood Street, North Andover, Ma. 01845 U.S.A.
Tel: (617) 685-4371 TWX: 710 342-0552

# ALCOSWITCH

Environmental seals completely encapsulate the case and frame of our standard TT and TP Series. Despite use of a dual case and seal, these switches are much smaller and fully compatible with traditional miniatures. Disposable protective boots are provided to seal the actuator during the PCB cleaning process. This latest technology absolutely solves all of your PC application problems at a reasonable cost.

Our TSS Slide Switch Series utilizes the same basic contact assembly as used in our dependable TT Toggle Switches. Designed for compact PC applications in computers, instrumentation and telephone apparatus. Contacts/Terminals are gold plated for dependable occasional use and good solderability. Dual actuators conserve space when used as program switches. Gold plating is standard.

## DISCOUNT SCHEDULE

**X-FACTOR**
For quantities under 100.

| | | |
|---|---|---|
| **1-24** | Multiply by | 1.59 |
| **25-49** | Multiply by | 1.15 |
| **50-99** | Multiply by | 1.08 |

250-Over, Quoted on Request.

## ACTUATORS & BUSHINGS

Color choices available for types 13 thru 16 shown at right. Specify: **(0)**-Black, **(2)**-Red, **(6)**-Blue.

**BUSHING SIZE:**
**.176 Dia.** Types 3 and 13.
**10-48** Types 1 and 14.
**.250 Dia.** Type 15.
**1/4-40** Types 12, 2 and 16.

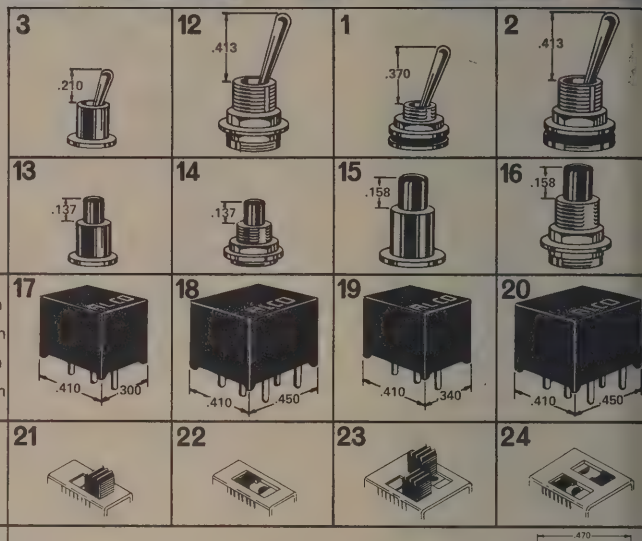
## RATINGS

Easily identified by 2nd digit in model number.
**1.** Gold: 0.4VA max. @ 20 VDC.

Example: TSS11AG-PC.

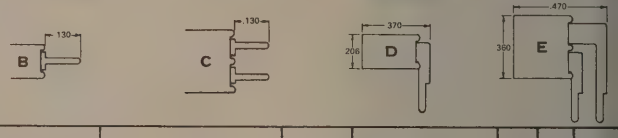
**ENVIRONMENTALLY SEALED**
**Type 17 (ES1)** For SP switches with .176 Dia. or 10-48 bushings.
**Type 18 (ES3)** For DP switches with .176 Dia. or 10-48 bushings.
**Type 19 (ES2)** For SP switches with .250 Dia. or 1/4-40 bushings.
**Type 20 (ES4)** For DP switches with .250 Dia. or 1/4-40 bushings.

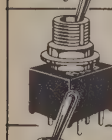
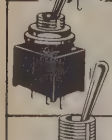
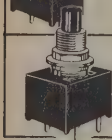
**SLIDE ACTUATORS:**
**Types 21 & 23** Extended .110".
**Types 22 & 24** Flush.




## TERMINAL TYPES

B Single pole PC, gold.
C Double pole PC, gold.
D Single pole RA, gold.
E Double pole RA, gold.




| Illustration | Model (PC terminals only) | Type | ↘ | ⊥ | ↙ | ▣ | 100-Lot |
|---|---|---|---|---|---|---|---|
| | TT11AG-PC-1-ES1 | SPST | On | None | Off | 3 | $1.51 |
| | TT11DG-PC-1-ES1 | SPDT | On | None | On | 3 | 1.51 |
| | TT11EG-PC-1-ES1 | SPDT | On | Off | On | 3 | 1.70 |
| | TT21KG-PC-1-ES3 | DPST | On | None | Off | 3 | 2.14 |
| | TT21NG-PC-1-ES3 | DPDT | On | None | On | 3 | 2.14 |
| | TT21PG-PC-1-ES3 | DPDT | On | Off | On | 3 | 2.33 |
|  | TT11AG-PC-9T¼-ES2 | SPST | On | None | Off | 12 | $1.61 |
| | TT11DG-PC-9T¼-ES2 | SPDT | On | None | On | 12 | 1.61 |
| | TT11EG-PC-9T¼-ES2 | SPDT | On | Off | On | 12 | 1.80 |
| | TT21KG-PC-9T¼-ES4 | DPST | On | None | Off | 12 | 2.21 |
| | TT21NG-PC-9T¼-ES4 | DPDT | On | None | On | 12 | 2.21 |
| | TT21PG-PC-9T¼-ES4 | DPDT | On | Off | On | 12 | 2.39 |
| | TT21PAG-PC-9T¼-ES4 | DPDT | On | On | On | 12 | 2.58 |
|  | TTE11AG-PC-3T-ES1 | SPST | On | None | Off | 1 | $1.92 |
| | TTE11DG-PC-3T-ES1 | SPDT | On | None | On | 1 | 1.92 |
| | TTE11EG-PC-3T-ES1 | SPDT | On | Off | On | 1 | 2.11 |
| | TTE21KG-PC-3T-ES3 | DPST | On | None | Off | 1 | 2.55 |
| | TTE21NG-PC-3T-ES3 | DPDT | On | None | On | 1 | 2.55 |
| | TTE21PG-PC-3T-ES3 | DPDT | On | Off | On | 1 | 2.74 |
| | TTE11AG-PC-9T¼-ES2 | SPST | On | None | Off | 2 | $2.02 |
| | TTE11DG-PC-9T¼-ES2 | SPDT | On | None | On | 2 | 2.02 |
| | TTE11EG-PC-9T¼-ES2 | SPDT | On | Off | On | 2 | 2.21 |
| | TTE21KG-PC-9T¼-ES4 | DPST | On | None | Off | 2 | 2.61 |
| | TTE21NG-PC-9T¼-ES4 | DPDT | On | None | On | 2 | 2.61 |
| | TTE21PG-PC-9T¼-ES4 | DPDT | On | Off | On | 2 | 2.80 |
| | TTE21PAG-PC-9T¼-ES4 | DPDT | On | On | On | 2 | 2.99 |
| | TPB11CG-PC-ES(*) | SPST | Normally Open | | | 13 | $1.32 |
| | TPB11FG-PC-ES(*) | SPDT | Momentary | | | 13 | 1.51 |
| | TPB21MG-PC-ES(*) | DPST | Normally Open | | | 13 | 1.95 |
| | TPB21RG-PC-ES(*) | DPDT | Momentary | | | 13 | 2.14 |
| | TPC11CG-PC-ES(*) | SPST | Normally Open | | | 14 | $1.35 |
| | TPC11FG-PC-ES(*) | SPDT | Momentary | | | 14 | 1.54 |
| | TPC21MG-PC-ES(*) | DPST | Normally Open | | | 14 | 1.98 |
| | TPC21RG-PC-ES(*) | DPDT | Momentary | | | 14 | 2.17 |
|  | TPD11CG-PC-ES(*) | SPST | Normally Open | | | 15 | $1.39 |
| | TPD11FG-PC-ES(*) | SPDT | Momentary | | | 15 | 1.58 |
| | TPD21MG-PC-ES(*) | DPST | Normally Open | | | 15 | 1.98 |
| | TPD21RG-PC-ES(*) | DPDT | Momentary | | | 15 | 2.17 |
| | TPF11CG-PC-ES(*) | SPST | Normally Open | | | 16 | $1.45 |
| | TPF11FG-PC-ES(*) | SPDT | Momentary | | | 16 | 1.64 |
| | TPF21MG-PC-ES(*) | DPST | Normally Open | | | 16 | 2.05 |
| | TPF21RG-PC-ES(*) | DPDT | Momentary | | | 16 | 2.24 |

| Illustration | Model | Type | ▙ | ▟ | ▟ | ▣ | ▲ | 100-Lot |
|---|---|---|---|---|---|---|---|---|
| | TSS11AG-PC | SPST | On | None | Off | 21 | B | $1.04 |
| | TSS11DG-PC | SPDT | On | None | On | 21 | B | 1.04 |
| | TSS11EG-PC | SPDT | On | Off | On | 21 | B | 1.21 |
| | TSS21KG-PC | DPST | On | None | Off | 21 | C | 1.61 |
| | TSS21NG-PC | DPDT | On | None | On | 21 | C | 1.61 |
| | TSS21PG-PC | DPDT | On | Off | On | 21 | C | 1.84 |
| | TSS21PAG-PC | DPDT | On | On | On | 21 | C | 1.83 |
| | TSS11AG-1-PC | SPST | On | None | Off | 22 | B | $1.04 |
| | TSS11DG-1-PC | SPDT | On | None | On | 22 | B | 1.04 |
| | TSS11EG-1-PC | SPDT | On | Off | On | 22 | B | 1.21 |
| | TSS21KG-1-PC | DPST | On | None | Off | 22 | C | 1.61 |
| | TSS21NG-1-PC | DPDT | On | None | On | 22 | C | 1.61 |
| | TSS21PG-1-PC | DPDT | On | Off | On | 22 | C | 1.84 |
| | TSS21PAG-1-PC | DPDT | On | On | On | 22 | C | 1.83 |
| | TSD21AAG-PC | 2xSPST | On | None | Off | 23 | C | $1.61 |
| | TSD21DDG-PC | 2xSPDT | On | None | On | 23 | C | 1.61 |
| | TSD21EEG-PC | 2xSPDT | On | Off | On | 23 | C | 1.84 |
| | TSD21AAG-1-PC | 2xSPST | On | None | Off | 24 | C | $1.61 |
| | TSD21DDG-1-PC | 2xSPDT | On | None | On | 24 | C | 1.61 |
| | TSD21EEG-1-PC | 2xSPDT | On | Off | On | 24 | C | 1.84 |
| | TSS11DG-RA | SPDT | On | None | On | 21 | D | $1.21 |
| | TSS11EG-RA | SPDT | On | Off | On | 21 | D | 1.41 |
| | TSS21NG-RA | DPDT | On | None | On | 21 | E | 1.91 |
| | TSS21PG-RA | DPDT | On | Off | On | 21 | E | 2.11 |
| | TSS21PAG-RA | DPDT | On | On | On | 21 | E | 2.11 |
| | TSS11DG-1-RA | SPDT | On | None | On | 22 | D | $1.21 |
| | TSS11EG-1-RA | SPDT | On | Off | On | 22 | D | 1.41 |
| | TSS21NG-1-RA | DPDT | On | None | On | 22 | E | 1.91 |
| | TSS21PG-1-RA | DPDT | On | Off | On | 22 | E | 2.11 |
| | TSS21PAG-1-RA | DPDT | On | On | On | 22 | E | 2.11 |
| | TSD21DDG-RA | 2xSPDT | On | None | On | 23 | E | $1.91 |
| | TSD21EEG-RA | 2xSPDT | On | Off | On | 23 | E | 2.11 |
| | TSD21DDG-1-RA | 2xSPDT | On | None | On | 24 | E | $1.91 |
| | TSD21EEG-1-RA | 2xSPDT | On | Off | On | 24 | E | 2.11 |

ALCO® ELECTRONIC PRODUCTS, INC.
1551 Osgood Street, North Andover, Ma. 01845 U.S.A.
Tel: (617) 685-4371 TWX: 710 342-0552

Prices and specifications subject to change without noti

# ALCOSWITCH

**S-4 SERIES:** Instrument Grade Slide Switches most useful for gramming applications. Fully ulated, low profile DAP cases vide high impact and low loss. minals are epoxy sealed to pre- t contamination by flux and ning agents. Gold plated types recommended for low level tching. PC pins fall into tradi- nal 0.1" grids.

**SA SERIES:** Unique switching ngement allows long life and contact resistance. All models identical in body size and minal placement. Difference in unting and level height. Con- s and terminals are fully gold ed.

**SERIES:** A diverse selection offered to meet any applica- al need. Offering the highest ee of reliability at a reason- cost. Designed for soldering o PC boards or optionally used h standard DIP sockets. Term- s and contacts are of beryllium per, heavy gold plate over nick- o assure dependable service for level use. All models have er molded-in terminals or xy sealed bases.

## DISCOUNT SCHEDULE

Quantities of 25 and over, quoted upon request.

### ACTUATORS

Identified by code column in listings below and as pictured at right.

1. .100" high
2. Flush
3. .095" high

### RATINGS — MSS Series

G - Gold: 0.4VA @ 20V max. (AC or DC). Plating Thickness - .00005".
4 - Silver: 4 amps @ 115 VAC. 2 amps @ 230 VAC.

### ACTUATOR HEIGHT

4. .140" w/tabs
5. .140" w/o tabs
6. .195" w/tabs
7. .195" w/o tabs

### RATINGS — MSSA Series

G - Gold: 0.4VA @ 20V max. (AC or DC). Plating Thickness - .00005".
4 - Silver: 300ma @ 125 VAC.

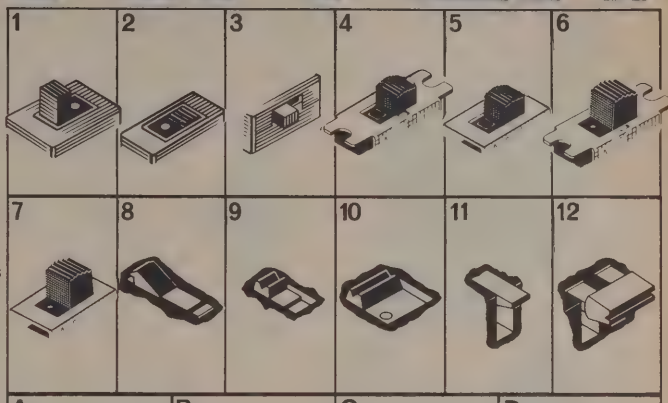
### ACTUATORS

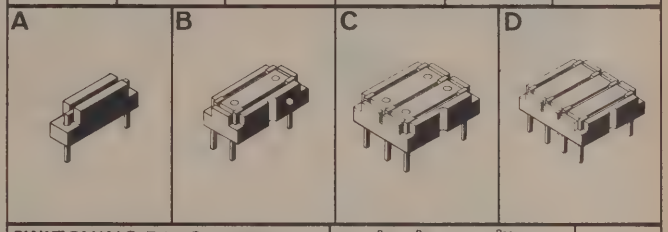
8. Rocker
9. Slide
10. Double Slide
11. Piano
12. Double Piano

### RATINGS — DIP Series

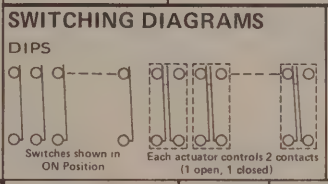
Non-Switching: 50 VDC @ 100 ma.
Switching: 5 VDC @ 100 ma (typ.). 24 VDC @ 25 ma (max.).
Plating Thickness - .00003".

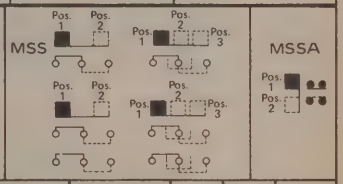
**PJ SERIES:** Programming Jumpers span standard DIP sockets .300" on centers connecting opposing contacts in IC patterns. No more poor intermittent contact problems. Easily installed. Body is made of SE-0 glass-filled thermoplastic. Pins are phosphor bronze and gold plated.

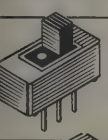
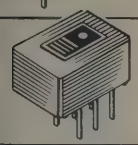
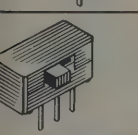
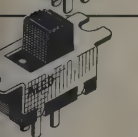
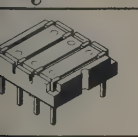


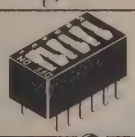
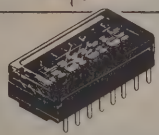
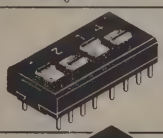
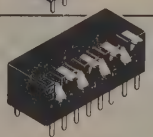
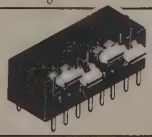




### SWITCHING DIAGRAMS




| Illustration | Model | Type | ▣ | Action | ◭ | One-24 |
|---|---|---|---|---|---|---|
|  | MSS-104D | SPDT | 1 | On None On | 4 | $1.55 |
| | MSS-104DG | SPDT | 1 | On None On | G | 1.75 |
| | MSS-104E | SPDT | 1 | On Off On | 4 | 1.85 |
| | MSS-204N | DPDT | 1 | On None On | 4 | 2.15 |
| | MSS-204NG | DPDT | 1 | On None On | G | 2.65 |
| | MSS-204P | DPDT | 1 | On Off On | 4 | 2.65 |
|  | MSS-104D-1 | SPDT | 2 | On None On | 4 | $1.55 |
| | MSS-104DG-1 | SPDT | 2 | On None On | G | 1.75 |
| | MSS-204N-1 | DPDT | 2 | On None On | 4 | 2.15 |
| | MSS-204NG-1 | DPDT | 2 | On None On | G | 2.65 |
|  | MSS-104D-RA | SPDT | 3 | On None On | 4 | $1.70 |
| | MSS-104DG-RA | SPDT | 3 | On None On | G | 1.95 |
| | MSS-204N-RA | DPDT | 3 | On None On | 4 | 2.55 |
| | MSS-204NG-RA | DPDT | 3 | On None On | G | 3.05 |
| | MSSA-22 | 2 Ckt. | 4 | N.O.-N.C. | 4 | $1.65 |
| | MSSA-22G | 2 Ckt. | 4 | N.O.-N.C. | G | 1.65 |
| | MSSA-22-1 | 2 Ckt. | 5 | N.O.-N.C. | 4 | 1.65 |
| | MSSA-22G-1 | 2 Ckt. | 5 | N.O.-N.C. | G | 1.65 |
|  | MSSA-22-2 | 2 Ckt. | 6 | N.O.-N.C. | 4 | $1.65 |
| | MSSA-22G-2 | 2 Ckt. | 6 | N.O.-N.C. | G | 1.65 |
| | MSSA-22-3 | 2 Ckt. | 7 | N.O.-N.C. | 4 | 1.65 |
| | MSSA-22G-3 | 2 Ckt. | 7 | N.O.-N.C. | G | 1.65 |
|  | PJ-1 | 1 Ckt. | A | | G | $ .30 |
| | PJ-2 | 2 Ckt. | B | | G | .32 |
| | PJ-3 | 3 Ckt. | C | | G | .35 |
| | PJ-4 | 4 Ckt. | D | | G | .41 |

| Illustration | Model | Type | Markings | ▣ | ◭ | One-24 |
|---|---|---|---|---|---|---|
| | DSS-4 | 4PST | 1 thru 4 | 8 | G | $3.05 |
| | DSS-6 | 6PST | 1 thru 6 | 8 | G | 3.45 |
| | DSS-7 | 7PST | 1 thru 7 | 8 | G | 3.65 |
| | DSS-8 | 8PST | 1 thru 8 | 8 | G | 3.85 |
| | DSS-10 | 10PST | 1 thru 10 | 8 | G | 4.25 |
|  | DBS-5 | 5PST | 1, 2, 4, 8, 16 | 8 | G | $3.25 |
| | DBS-6 | 6PST | 1, 2, 4, 8, 16, 32 | 8 | G | 3.45 |
|  | DLS-4 | 4PST | 1 thru 4 | 9 | G | $3.20 |
| | DLS-6 | 6PST | 1 thru 6 | 9 | G | 3.60 |
| | DLS-8 | 8PST | 1 thru 8 | 9 | G | 4.00 |
| | DLS-10 | 10PST | 1 thru 10 | 9 | G | 4.40 |
|  | DLS-2SD | (2) N.O.-N.C. | 1 thru 2 | 10 | G | $3.20 |
| | DLS-3SD | (3) N.O.-N.C. | 1 thru 3 | 10 | G | 3.60 |
| | DLS-4SD | (4) N.O.-N.C. | 1 thru 4 | 10 | G | 4.00 |
| | DLS-5SD | (5) N.O.-N.C. | 1 thru 5 | 10 | G | 4.40 |
|  | DYS-4 | 4PST | 1 thru 4 | 11 | G | $4.00 |
| | DYS-6 | 6PST | 1 thru 6 | 11 | G | 4.20 |
| | DYS-8 | 8PST | 1 thru 8 | 11 | G | 4.40 |
| | DYS-10 | 10PST | 1 thru 10 | 11 | G | 4.60 |
|  | DYS-2SD | (2) N.O.-N.C. | 1 thru 2 | 12 | G | $4.00 |
| | DYS-3SD | (3) N.O.-N.C. | 1 thru 3 | 12 | G | 4.20 |
| | DYS-4SD | (4) N.O.-N.C. | 1 thru 4 | 12 | G | 4.40 |
| | DYS-5SD | (5) N.O.-N.C. | 1 thru 5 | 12 | G | 4.60 |

Prices and specifications subject to change without notice.

ALCO® ELECTRONIC PRODUCTS, INC.
1551 Osgood Street, North Andover, Ma. 01845 U.S.A.
Tel: (617) 685-4371 TWX: 710 342-0552

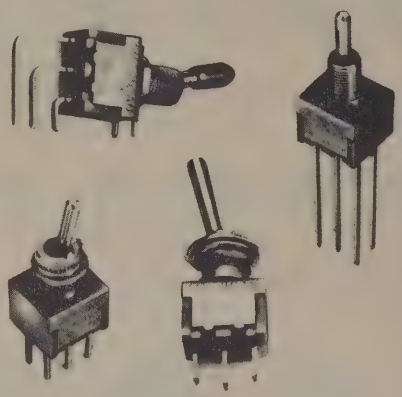
# AMERICAN SWITCH CORP.

AREA (617) 246-1007

134 WATER STREET, WAKEFIELD, MASS. 01880

## Your Primary Source for highest quality and fastest deliveries the world over.

### SUBMINIATURE TOGGLE AND PUSHBUTTON SWITCHES



| Model No. | SWITCHING FUNCTION Key Way | Key Way | Key Way | U.L. Model No. |
|---|---|---|---|---|
| ST1-1 | ON | NONE | ON | UL11 |
| ST1-2 | ON | OFF | ON | UL12 |
| ST1-3 | (ON) | OFF | (ON) | UL13 |
| ST1-4 | ON | OFF | (ON) | UL14 |
| ST1-5 | ON | NONE | (ON) | UL15 |
| ST2-1 | ON | NONE | ON | UL21 |
| ST2-2 | ON | OFF | ON | UL22 |
| ST2-3 | (ON) | OFF | (ON) | UL23 |
| ST2-4 | ON | OFF | (ON) | — |
| ST2-5 | ON | NONE | (ON) | UL25 |
| ST2-6 Term. Conn. | ON 1-2 4-5 | ON 1-2 5-6 | ON 2-3 5-6 | UL26 Term. Conn. |

Note: Parenthesis indicates momentary action.

**ELECTRICAL SPECIFICATIONS**
(Compare with what you are now using)

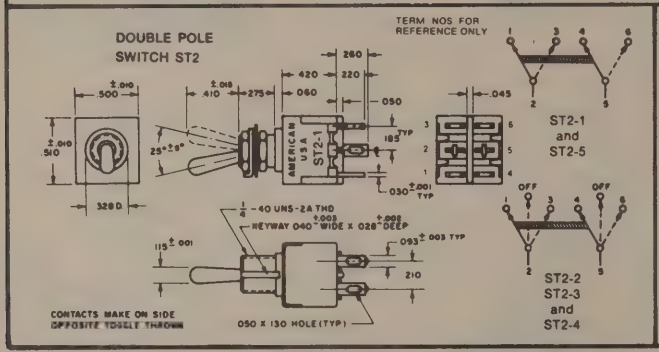
**Contact ratings:**
6 amperes at 125 VAC (resistive load)
3 amperes at 250 VAC (resistive load)
7 amperes at 30 VDC (resistive load)

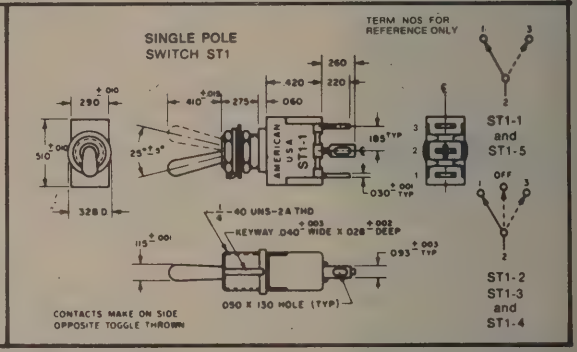
**Electrical Life:**
250,000 cycles minimum at rated load
(ST1-1 and ST2-1 only-other models 60,000 cycles minimum)

**Initial Contact Resistance:**
3 milliohms maximum at 3 VDC, 0.1 Amp

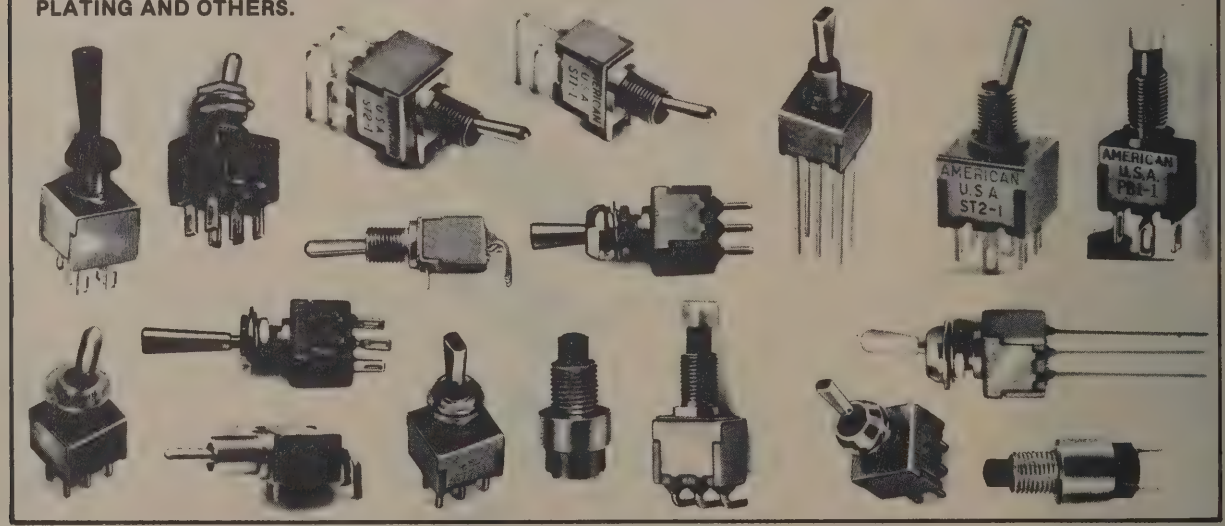
**Insulation Resistance:**
Greater than 2,000,000 meg ohms between terminals and case ground

**Dielectric Strength:**
Greater than 2500 VAC for 1 minute between terminals and case ground (at sea level)


DOUBLE POLE
SWITCH ST2
TERM NOS FOR REFERENCE ONLY
ST2-1 and ST2-5
ST2-2 ST2-3 and ST2-4
CONTACTS MAKE ON SIDE OPPOSITE TOGGLE THROWN
.050 X .130 HOLE (TYP)


SINGLE POLE
SWITCH ST1
TERM NOS FOR REFERENCE ONLY
ST1-1 and ST1-5
ST1-2 ST1-3 and ST1-4
CONTACTS MAKE ON SIDE OPPOSITE TOGGLE THROWN
.050 X .130 HOLE (TYP)

**A FULL RANGE OF STANDARD CONFIGURATIONS AND OPTIONS ARE AVAILABLE INCLUDING RIGHT ANGLE PRINTED CURCUIT MOUNTINGS, STRAIGHT PRINTED CIRCUIT MOUNTINGS, EPOXY TERMINAL SEALING, SELECTIONS OF ROUND HANDLES, FLATTED HANDLES, BUSHINGS, CONTACT MATERIAL, PLATING AND OTHERS.**




**A FULL RANGE OF ACCESSORIES ARE AVAILABLE INCLUDING COLOR CAPS, DECORATIVE NUTS, KNURLED NUTS, KEYING WASHERS AND OTHERS.**

**CONTACT US FOR A CURRENT CATALOG AND FAST RESPONSE.**

QUALITY ENGINEERED, MADE-IN-AMERICA PRODUCTS

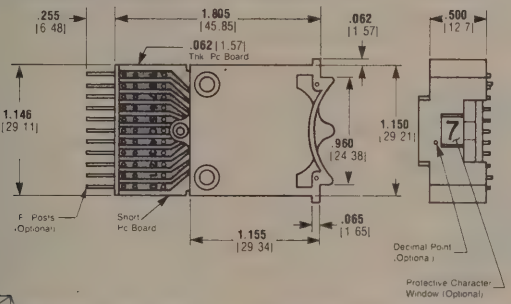
# THUMBWHEEL SWITCHES

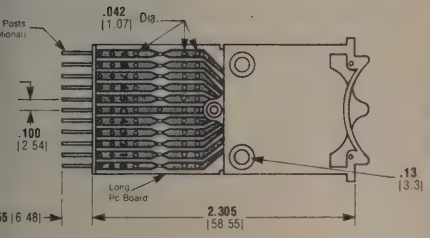
AMP

## INTRODUCTION

AMP thumbwheel switches provide a simple, highly reliable means of manually programming various types of electrical/electronic equipment. These miniature switches are designed for front and rear panel mounting and can be used singly or "stacked" for either individual or matrix output applications. They are ideally suited for use in machine tool and process control systems as well as test equipment, aircraft, various instruments and input data terminals. For more details, ask for AMP Catalog No.73-143.

## .500 [12.7] STANDARD SPECIFICATIONS




**ELECTRICAL**

**Outputs:** Decimal, BCD and BCO. Other codes also available.
**Contact Resistance (pad-to-pad):** .1 ohm (max.).
**Current Rating:** 3 amperes (continuous); .125 ampere (switching).
**Insulation Resistance (74°F [23.3°C], sea level):** 1 x $10^9$ ohms (min.).
**Dielectric Withstanding Voltage:** 500 VDC (min.).
**Capacitance (between any two conductors):** 5 pf (max.).

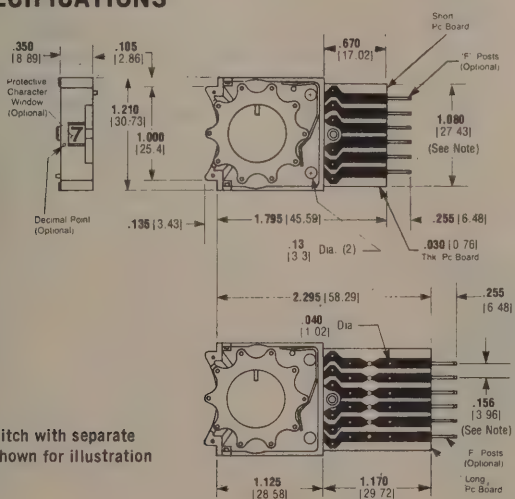
**MECHANICAL**

**Wheel/Dial Positions:** 8 and 10, standard.
**Wheel/Dial Characters:** White, gothic style, .18" [4.57 mm] high (max.).
**Operating Force:** .4 to 1.25 lb. [1.78 to 5.56 N].
**Structural Plastic:** Black, polycarbonate (glossy finish) or polyester (matte finish).
**Protective Character Window:** Clear polycarbonate.
**Printed Circuit Boards:** Flame retardant, glass epoxy laminate.
**Contacts:** Gold-over-nickel plated phosphor bronze.
**Detent Spring:** Phosphor bronze.
**Life:** 1,000,000 detent operations (min.).

**ENVIRONMENTAL (MIL-STD-202)**

**Temperature:** —40°F to + 190°F [—40°C to + 87.7°C].
**Shock:** 25 G in all planes.
**Vibration:** 10-2000 Hz (Method 204B, Condition B).

## .350 [8.89] SPECIFICATIONS




**Note:** 10 position BCD switch with separate common to complement shown for illustration purposes only.

**ELECTRICAL**

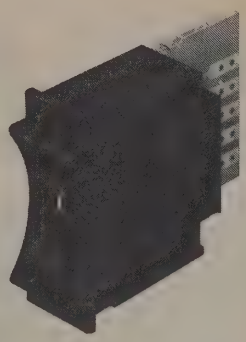
**Outputs:** Decimal and BCD. Other codes also available.
**Contact Resistance (pad-to-pad):** .1 ohm (max.)
**Current Rating:** 3 amperes (continuous); .125 ampere (switching).
**Insulation Resistance (74°F [23.3°C], sea level):** 1 x $10^9$ ohms (min.)
**Dielectric Withstanding Voltage:** 500 VCD (min.)
**Capacitance (between any two conductors):** 5 pf (max.)

**MECHANICAL**

**Wheel/Dial Positions:** 10, standard. Other variations available.
**Wheel/Dial Characters:** White, gothic style, .18" [4.57 mm] high (max.)
**Operating Force:** .4 to 1.25 [1.78 to 5.56 N]
**Structural Plastic:** Black, polycarbonate (glossy finish) or NORYL† (matte finish)
**Protective Character Window:** Clear polycarbonate
**Printed Circuit Boards:** Flame retardant, glass epoxy laminate
**Contacts:** Gold-over-nickel plated phosphor bronze
**Detent Spring:** Phosphor bronze
**Life:** 1,000,000 detent operations (min.)

**ENVIRONMENTAL (MIL-STD-202)**

**Temperature:** —40°F to +190°F [—40°C to +87.7°C]
**Shock:** 25 G in all planes
**Vibration:** 10-2000 Hz (Method 204B, Condition B)



### .500 [12.7] STANDARD

AMP .500 (12.7) standard thumbwheel switches are available as 8 or 10 position switches with outputs in decimal, BCD or BCO. They can be supplied with short or long boards and for mother/daughter board, pc connector, solderless wire or soldered wire connection. Standard housings with a glossy or fine matte finish incorporate a mounting flange to facilitate front or rear panel mounting.

### .350 [8.89]

AMP .350 [8.89] thumbwheel switches are furnished with most of the same capabilities as the .500 [12.7] standard switch, but are intended for use where horizontal mounting space is limited or where a wider switch is unnecessary. Available outputs and options also include the same broad range as the wider switch.

**AMP**
**INCORPORATED**
DEPT. EM, HARRISBURG, PA 17105
PHONE: 717-564-0100 TWX: 510-657-4110

AMP

# THUMBWHEEL SWITCHES

## .300 [7.62] BOARD MOUNT MINIATURE THUMBWHEEL SWITCH

### SPECIFICATIONS

#### STACKABLE

**ELECTRICAL**

**Outputs:** BCD. Certain other codes also available.
**Contact Resistance** (pad-to-pad): .1 ohm (max.).
**Current Rating:** 1.5 amperes (non-switching); .125 ampere (switching).
**Insulation Resistance (74°F [23.3°C], sea level):** 1 x $10^9$ ohms (min.).
**Dielectric Withstanding Voltage:** 500 VDC (min.).
**Capacitance (between any two conductors):** 5 pf (max.).

**MECHANICAL**

**Wheel/Dial Positions:** 10, standard*. Certain other variations also available.
**Wheel/Dial Characters:** White, gothic style, .15" [3.8 mm] high (max.).
**Operating Force:** 10 to 14 oz. [2.8 to 3.9 N].
**Structural Plastic (wheel and housing with integral detent spring):** Black, acetal (semi-gloss finish).
**Contacts:** Gold-over-nickel plated phosphor bronze.
**Printed Circuit Boards:** Flame retardant, glass epoxy laminate.
**Life:** 250,000 detent operations (min.).

**ENVIRONMENTAL** (MIL-STD-202)

**Temperature:** −40°F to +190°F [−40°C to +87.7°C].
**Shock:** 25 G in all planes.
**Vibration:** 10-2000 Hz (Method 204B, Condition B).

*A stop pin **(1-22973-0)** can be installed to limit wheel rotation and must be ordered separately. One stop pin allows wheel rotation to all 10 readout positions; two stop pins limit wheel rotation to nine or less readout positions.

#### BOARD MOUNT

**ELECTRICAL**

**Outputs:** Decimal, BCD and BCD 9's complement. Certain other codes also available.
**Contact Resistance (pad-to-pad):** .1 ohm (max.).
**Current Rating:** 1.5 amperes (non-switching); .12 ampere (switching).
**Insulation Resistance (74°F [23.3°C], sea level** 1 x $10^9$ ohms (min.).
**Dielectric Withstanding Voltage:** 500 VDC (min.).
**Capacitance (between any two conductors):** 5 p (max.).

**MECHANICAL**

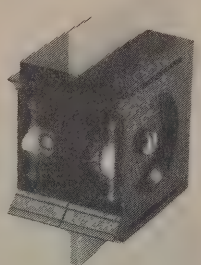
**Wheel/Dial Position:** 10 standard*. Certain othe variations also available.
**Wheel/Dial Characters:** Black on white or white o black, gothic style, .15" [3.8 mm] high (max.)
**Operating Force:** 10 to 14 oz. [2.8 to 3.9 N].
**Structural Plastic (wheel and housing with integra detent spring):** Acetal (semi-gloss finish). Refer t the charts on page 20-48C for available colors.
**Contacts:** Gold-over-nickel plated phosphor bronze.
**Life:** 250,000 detent operation (min.).

**ENVIRONMENTAL** (MIL-STD-202)

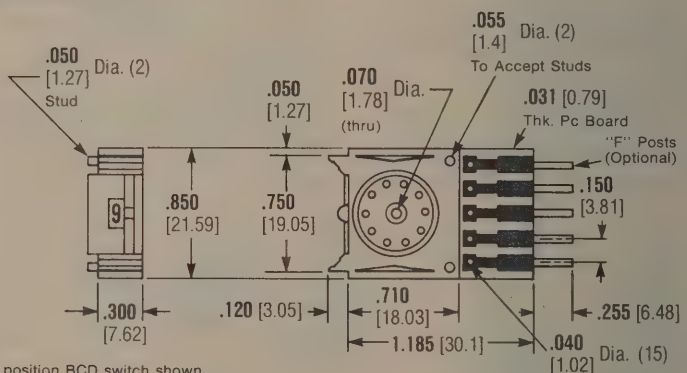
**Temperature:** −40°F to +190°F [−40°C t +87.7°C].
**Shock:** 25 G in all planes.
**Vibration:** 10-2000 Hz (Method 204B, Condition B).

STACKABLE

BOARD MOUNT

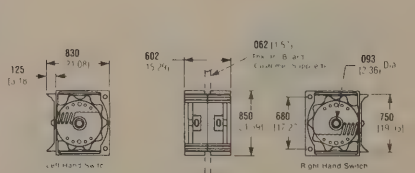


### STACKABLE

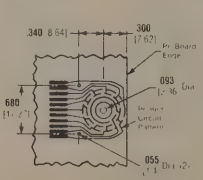


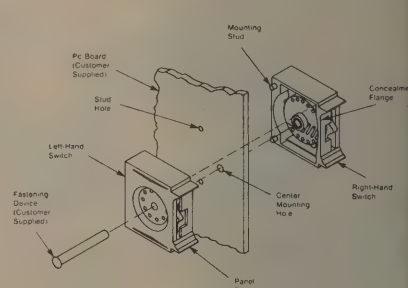

**Note:** 10 position BCD switch shown.

### BOARD MOUNT



Note: 10 position decimal switches and related artwork shown for illustration purposes only. Dimensions are also typical for BCD and BCD 9's complement switches.






Note: The pc board is .062 [1.57] thick. Any suitable fastening device (= 2 screw and nut, rivet, eyelet, etc.) that is comparable to the .093 [2.36] dia. mounting hole and the .602 [15.29] overall width of a left- and right-hand switch assembly may be used for mounting the switches to a pc board.

AMP
INCORPORATED
DEPT. EM, HARRISBURG, PA 17105
PHONE: 717-564-0100 TWX: 510-657-4110

# THUMBWHEEL SWITCHES

AMP

## TRUTH TABLES

**Table 1**
**10 Pos. Decimal**

| Dial Position | Common to: 0 1 2 3 4 5 6 7 8 9 |
|---|---|
| 0 | ● |
| 1 | ● ● |
| 2 | ● ● |
| 3 | ● ● |
| 4 | ● ● |
| 5 | ● ● |
| 6 | ● ● |
| 7 | ● ● |
| 8 | ● ● |
| 9 | ● ● |

**Table 2**
8 Pos. Decimal
**8 Pos. Decimal**

| Dial Position | Common to: 0 1 2 3 4 5 6 7 |
|---|---|
| 0 | ● |
| 1 | ● ● |
| 2 | ● ● |
| 3 | ● ● |
| 4 | ● ● |
| 5 | ● ● |
| 6 | ● ● |
| 7 | ● ● |

**Table 3**
**10 Pos. BCD**

| Dial Position | Common to: 1 2 4 8 |
|---|---|
| 0 | |
| 1 | ● |
| 2 | ● |
| 3 | ● ● |
| 4 | ● |
| 5 | ● ● |
| 6 | ● ● |
| 7 | ● ● ● |
| 8 | ● |
| 9 | ● ● |

**Table 4**
**10 Pos. BCD Complement**

| Dial Position | Common to: 1 2 4 8 |
|---|---|
| 0 | ● ● ● ● |
| 1 | ● ● ● |
| 2 | ● ● ● |
| 3 | ● ● ● |
| 4 | ● ● ● |
| 5 | ● ● |
| 6 | ● ● |
| 7 | ● |
| 8 | ● ● ● |
| 9 | ● ● |

**Table 5**
**10 Pos. BCD w/Complement**

| Dial Position | Common to: 1 2 4 8 1 2 4 8 |
|---|---|
| 0 | ● ● ● ● |
| 1 | ● ● ● ● |
| 2 | ● ● ● ● |
| 3 | ● ● ● ● |
| 4 | ● ● ● ● |
| 5 | ● ● ● ● |
| 6 | ● ● ● ● |
| 7 | ● ● ● ● |
| 8 | ● ● ● ● |
| 9 | ● ● ● ● |

**Table 6**
**10 Pos. BCD w/Separate Common to Complement**
**Common X to ●**
**Common Y to ○**

| Dial Position | Common to: 1 2 4 8 |
|---|---|
| 0 | ○ ○ ○ ○ |
| 1 | ● ○ ○ ○ |
| 2 | ○ ● ○ ○ |
| 3 | ● ● ○ ○ |
| 4 | ○ ○ ● ○ |
| 5 | ● ○ ● ○ |
| 6 | ○ ● ● ○ |
| 7 | ● ● ● ○ |
| 8 | ○ ○ ○ ● |
| 9 | ● ○ ○ ● |

**Table 7**
**10 Pos. BCD 9's Complement**

| Dial Position | Common to: 1 2 4 8 |
|---|---|
| 0 | ● ● |
| 1 | ● |
| 2 | ● ● ● |
| 3 | ● ● |
| 4 | ● ● |
| 5 | ● |
| 6 | ● ● |
| 7 | ● |
| 8 | ● |
| 9 | |

**Table 8**
**10 Pos. BCD 9's Complement w/Complement**

| Dial Position | Common to: 1 2 4 8 1 2 4 8 |
|---|---|
| 0 | ● ● ● ● |
| 1 | ● ● ● ● |
| 2 | ● ● ● ● |
| 3 | ● ● ● ● |
| 4 | ● ● ● ● |
| 5 | ● ● ● ● |
| 6 | ● ● ● ● |
| 7 | ● ● ● ● |
| 8 | ● ● ● ● |
| 9 | ● ● ● ● |

**Table 9**
**8 Pos. BCD**

| Dial Position | Common to: 1 2 4 |
|---|---|
| 0 | |
| 1 | ● |
| 2 | ● |
| 3 | ● ● |
| 4 | ● |
| 5 | ● ● |
| 6 | ● ● |
| 7 | ● ● ● |

**Table 10**
**8 Pos. BCD Complement**

| Dial Position | Common to: 1 2 4 |
|---|---|
| 0 | ● ● ● |
| 1 | ● ● |
| 2 | ● ● |
| 3 | ● |
| 4 | ● ● |
| 5 | ● |
| 6 | ● |
| 7 | |

**Table 11**
**8 Pos. BCD w/Complement**

| Dial Position | Common to: 1 2 4 1 2 4 |
|---|---|
| 0 | ● ● ● |
| 1 | ● ● ● |
| 2 | ● ● ● |
| 3 | ● ● ● |
| 4 | ● ● ● |
| 5 | ● ● ● |
| 6 | ● ● ● |
| 7 | ● ● ● |

**Table 12**
**8 Pos. BCD w/Separate Common to Complement**
**Common X to ●**
**Common Y to ○**

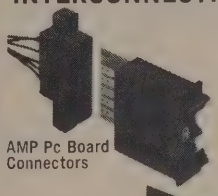
| Dial Position | Common to: 1 2 4 |
|---|---|
| 0 | ○ ○ ○ |
| 1 | ● ○ ○ |
| 2 | ○ ● ○ |
| 3 | ● ● ○ |
| 4 | ○ ○ ● |
| 5 | ● ○ ● |
| 6 | ○ ● ● |
| 7 | ● ● ● |

**Table 13**
**10 Pos. + and −, Repeating (DPDT)**
**Common X to ●**
**Common Y to ○**

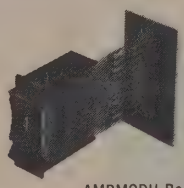
| Dial Position | Common to: + − + − |
|---|---|
| + | ○ ● |
| − | ○ ● |
| + | ○ ● |
| − | ○ ● |
| + | ○ ● |
| − | ○ ● |
| + | ○ ● |
| − | ○ ● |
| + | ○ ● |
| − | ○ ● |

## OPTIONS

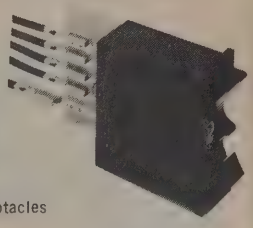
### INTERCONNECTION METHODS



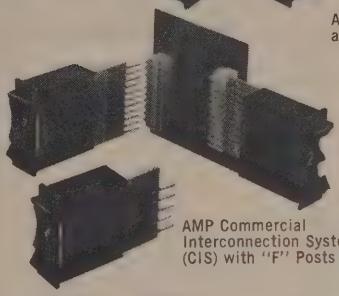
AMP Pc Board Connectors



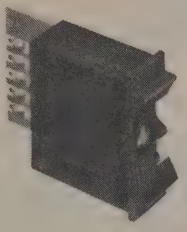
AMPMODU Receptacles and Posts



AMP EDGE Terminals



AMP Commercial Interconnection System (CIS) with "F" Posts



Soldered Wire Terminations

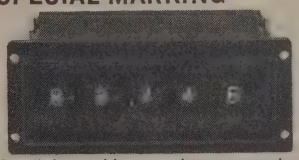
### BOARD LENGTHS

Input/output boards on all AMP switches may be supplied in two lengths. A long board is used where components such as diodes and resistors are required in the switching function and are to be mounted directly onto the board. The short board is used where no such components are needed. All interconnection methods may be used with either board length.

### PROTECTIVE CHARACTER WINDOWS

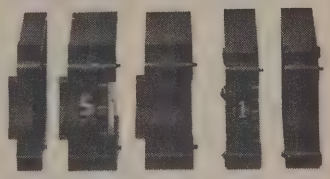
Transparent plastic windows are available on .500 [12.7] and .350 [8.89] switches. They provide protection for the wheel characters against dirt, dust and other contaminants. They are ideally suited for use in industrial environments.

### SPECIAL MARKING



Special marking such as punctuation, abbreviations and symbols can be supplied on switch modules and spacers. These markings are in addition to the special markings which may be obtained on the switch wheels.

### SPACERS



Spacers are available for custom stacking or assembling switch modules. They are supplied with glossy or fine matte finishes. Material construction of the spacers is black polycarbonate (glossy finish) or black thermoplastic (matte finish).

Figure 1. Spacers for .500 [12.7] Standard & Message Wheel Switches.

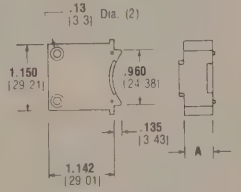
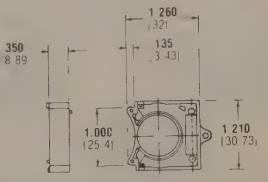



Figure 2. Spacer for .350 [8.89] Switches.



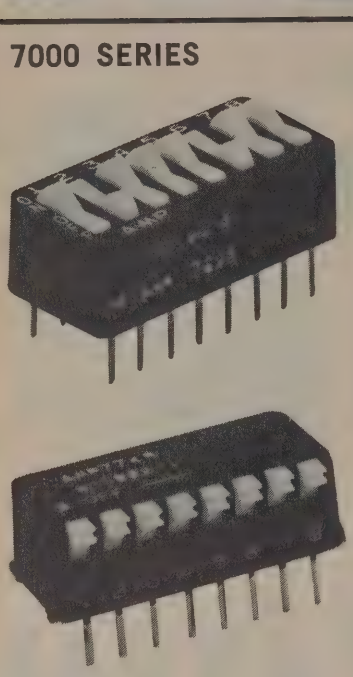

**ASSEMBLY HARDWARE**

When switches are purchased as individual modules, assembly hardware must be ordered separately.

**AMP INCORPORATED**
HARRISBURG, PENNSYLVANIA 17105
Phone: 717-564-0100 TWX: 510-657-4110

**AMP**

## 7000 SERIES





### FEATURES

- High Density—Low profile, compact design requires a minimum of pc board area.
- Available in standard or right angle versions.
- Simple Operation — Rocker actuators instantly change program.
- Easy Mounting—Switches can be flow-soldered directly to pc board or simply inserted into DIP headers or IC packaging receptacles.
- Economical—Board mounted switches eliminate the need for interconnection wiring to perform switching functions.
- High Reliability—Fully enclosed design protects contact surfaces from environmental hazards. Optional transparent cover is also available.
- Versatile Application — Switches furnished in various sizes, ranging from 1 to 12 positions.

**AMP**
INCORPORATED
DEPT. EM, HARRISBURG, PA 17105
PHONE: 717-564-0100 TWX: 510-657-4110

# DUAL-IN-LINE PACKAGE SWITCHES

The AMP Dual In-Line Package Switch provides a highly reliable, low cost means of manually programming various types of electrical/electronic equipment. This unique device is essentially a multiplicity of rocker actuated, single-pole, single-throw switches packaged in a housing with input/output leads on .100" x .300" centers and is specifically designed to be mounted on a printed circuit board. It features a very low profile, and is ideally suited for programming logic functions in computers, test equipment, telephone equipment, process control equipment, etc.

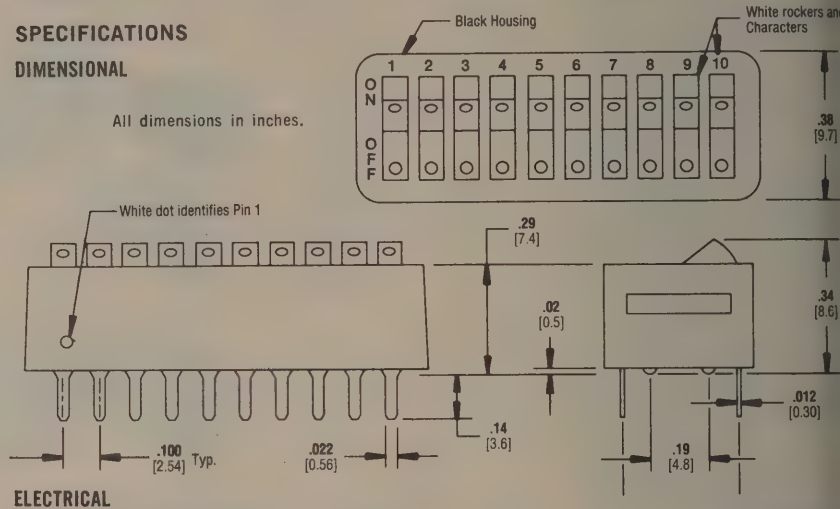
The Dual In-Line Package Switch requires no hardware for mounting and can be either flow-soldered directly to a pc board or simply inserted into AMP's DIP headers or IC packaging receptacles.

The AMP Dual In-Line Package Switch can be supplied in a wide range of sizes, from 1 to 12 positions.

### SPECIFICATIONS

#### DIMENSIONAL

All dimensions in inches.




#### ELECTRICAL

Circuit Current/Voltage Ratings: Nonswitching ..... 1.5A @ 50 VDC
Switching ..... 100 ma @ 5 VDC
25 ma @ 24 VDC

Contact Resistance (50 MV open-circuit, 10 ma) ..... 100 Milliohms (Max.)

Insulation Resistance (@ 100 VDC) Between adjacent open or closed switches:
Initial ..... $1 \times 10^{11}$ Ohms (Min.)
After environmental exposure ..... $1 \times 10^{9}$ Ohms (Min.)

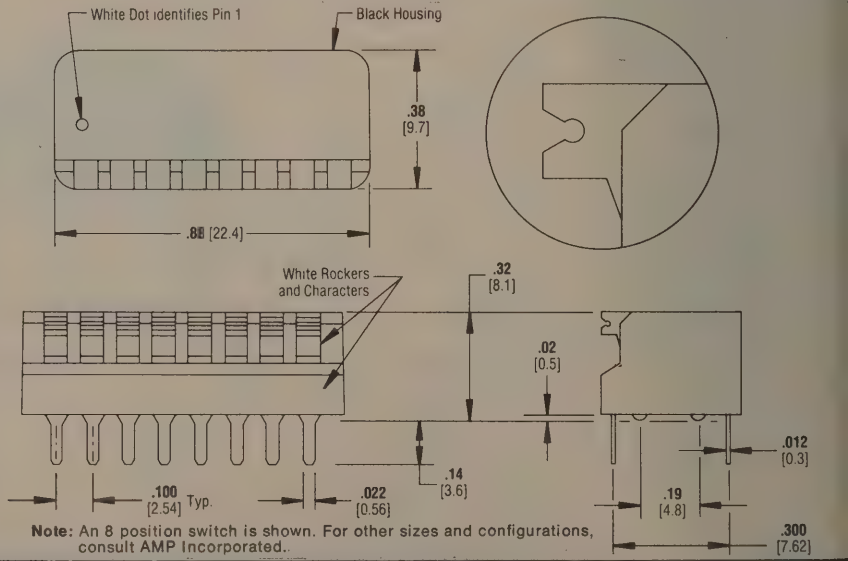
Dielectric Breakdown Voltage ..... 500 VDC (Min.)

Circuit Capacitance (between adjacent switches) ..... 5 Picofarads (Max.)

Shock: Discontinuity shall not exceed 1.0 microseconds when shocked 3 times in each of 6 directions for a combined total of 18 shocks. Shock wave parameters are 20g level, 11 millisecond duration, half sine pulse shape.

Vibration: Discontinuity shall not exceed 1.0 microseconds when tested in accordance with MIL-STD-202 D Method 204, Condition C.

**MATERIAL** Housing ..... Glass-filled polyester
Actuators ..... Polyester
Contacts ..... Beryllium copper, gold-over-nickel plated




**Note:** An 8 position switch is shown. For other sizes and configurations, consult AMP Incorporated.

# DUAL-IN-LINE PACKAGE SWITCHES

## AMP 7030 SERIES RECESSED CAM DIP SWITCHES

### FEATURES

Low Profile above P.C. Board.

Design prevents accidental change of rocker position.

Easy to apply tape processing seal available for top of switch.

Epoxy seal on bottom combined with tape seal on top inhibit contamination of contacts during processing.

94V-0 Rated Material.

Marking on rockers provides excellent legibility for program setting and identification.

### MATERIALS

Switch housing and base are 94V-0 Rated Glass Filled Polyester—color is black with white markings.

Rockers are 94V-0 Rated Unfilled Polyester — color is white with optional red markings.

Contacts are Beryllium Copper with gold over nickel plating.

Sealing Material is epoxy.

### ELECTRICAL & MECHANICAL RATINGS

Contact Resistance . . . . 100 milliohms max.
Ins. Resistance . . . . . $1 \times 10^{11}$ ohms
Dielectric Strength . . . . 500 VDC
Cycle Life . . . . . 7000 Cycles/Pole min.
Capacitance . . . . . 5 picofarads
Operating Temp . . . . . 0°F to 190°F

Current/Voltage Rating . . . . . 24 volts @ 25 ma max. switching

## AMP 7100 AND 7130 SERIES ECONOMY DIP SWITCHES

### FEATURES

Economical substitute where cycle life is not critical.

94V-0 Rated Material.

Low Profile (on 7130 Series).

Marking on rockers provides excellent legibility for program setting (on 7130 Series).

Design prevents accidental change of rocker position (on 7130 Series).

### MATERIALS

Switch housing and base are 94V-0 Rated Glass Filled Polyester—color is blue with white markings.

Rockers are 94V-0 Rated Unfilled Polyester— color is white with optional red markings.

Contacts are copper alloy with gold plate on contact surfaces.

### ELECTRICAL & MECHANICAL RATINGS

Contact Resistance . . . . 100 milliohms max.
Ins. Resistance . . . . . $1 \times 10^{11}$ ohms
Dielectric Strength . . . . 500 VDC
Cycle Life . . . . . 2000 cycles/pole
Capacitance . . . . . 5 picofarads
Operating Temp . . . . . 0°F thru 190°F

Current/Voltage Rating . . . . . 24 volt @ 25 ma max. (switching)

## AMP 7200 AND 7040 SERIES LED DIP SWITCHES AND MOMENTARY CAM DIP SWITCHES

### FEATURES

Momentary or detented rockers available.

Switch leads and LED leads independently terminated for circuit connection versatility.

Permits rapid circuit test or fault indication.

Permits rapid program verification.

Permits Dual-In-Line Packaging of LED's.

94V-0 Rated Materials (Except Diodes).

### MATERIALS

Switch housing and base are 94V-0 Rated Glass Filled Polyester—color is black with white markings.

Rockers are Unfilled Polyester—color is white.

Contacts are Beryllium Copper with gold over nickel plating.

LEDS are epoxy encapsulated GaAsp or GaP Diodes—color is red.

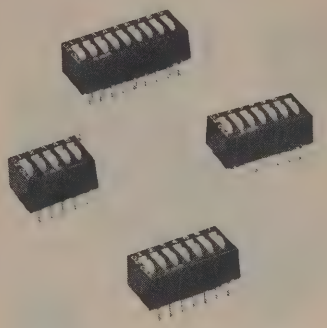
### ELECTRICAL & MECHANICAL RATINGS

Contact Resistance . . . . 100 milliohms max.
Ins. Resistance . . . . . $1 \times 10^{11}$ ohms
Dielectric Strength . . . . 500 VDC
Cycle Life . . . . . 7000 Cycles/Pole min.
Capacitance . . . . . 5 picofarads
Operating Temp . . . . . 0°F to 190°F

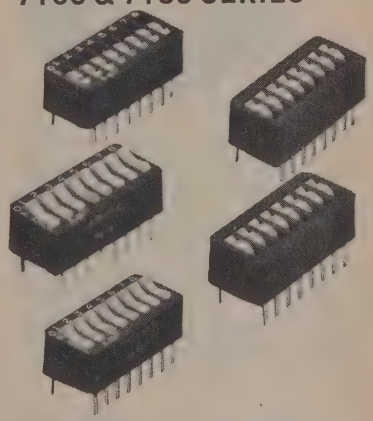
Current/Voltage Rating . . . . . .
Contacts
24 volts @ 25 ma
LED's
Operating Voltage—2.0 V max. @ 20 ma
Reverse Voltage—5.0 V max. @ 100 microamps
Power Dissipation—230 mw max. @ 25°C
Lumination—0.4 millicandella min. @ 20 ma

AMP

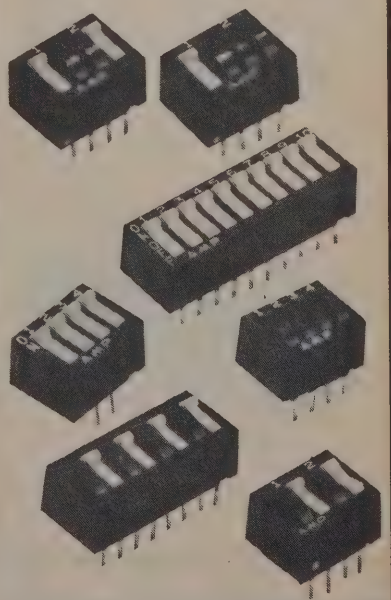
7030 SERIES



7100 & 7130 SERIES



7200 & 7040 SERIES

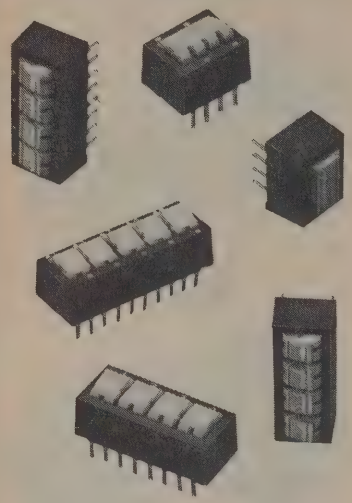


AMP INCORPORATED
DEPT. EM, HARRISBURG, PA 17105
PHONE: 717-564-0100 TWX: 510-657-4110

AMP

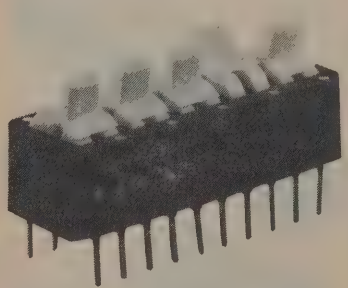
# MULTIPOLE SWITCHES (DUAL-IN-LINE)

## 7010 & 7020 SERIES



The AMP Dual-in-Line Package Multipole switch provides a means of manually programming various types of electrical/electronic equipment. The multipole switch is essentially a multiplicity of single pole switches mechanically coupled to provide switching of various poles simultaneously. The switch is packaged in a housing with input/output leads on .100" x .300" centers and is specifically designed to be mounted on a printed circuit board.

The AMP Multipole Switch can be supplied in a wide range of sizes—from 4 to 10 single pole single throw switches—with the capability of mechanically coupling a maximum of 6 poles within one switch package. These switches can also be furnished with 2 to 5 single pole double throw switches or 1 or 2 double pole double throw switches.



**LEVER ACTUATED SWITCH**

### ELECTRICAL SPECIFICATIONS

SPDT or DPDT Switching—Make before break—Circuit Current/Voltage Ratings

Non-switching
1.5A @ 50 VDC

Switching
100 ma @ 5 VDC
25 ma @ 24 VDC

Contact Resistance (50 MV open-circuit, 2 MA) 100 Milliohms (Max.)

Insulation Resistance (@ 100 VDC)
between adjacent closed switches—
1 x $10^{11}$ Ohm (Initial)
1 x $10^{9}$ after environmental tests
between adjacent open switches—
1 x $10^{11}$ Ohm (Initial)
1 x $10^{9}$ after environmental tests

Dielectric Breakdown Voltage—500 VDC (Min.)

Circuit Capacitance (between adjacent switches) —5 pfd

### MECHANICAL SPECIFICATIONS

Operating Temperature — 0°F thru 190°F

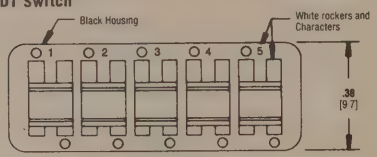
Shock: Discontinuity shall not exceed 1.0 microseconds when shocked 3 times in each of 6 directions for a combined total of 18 shocks. Shock wave parameters are 20g level, 11 millisecond duration, half sine pulse shape.

**Note:** All dimensions in inches unless indicated otherwise.

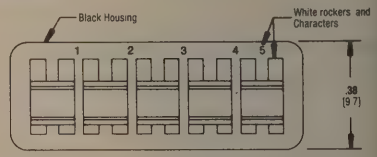
**Specifications subject to change. Consult AMP Incorporated for latest design specifications.**

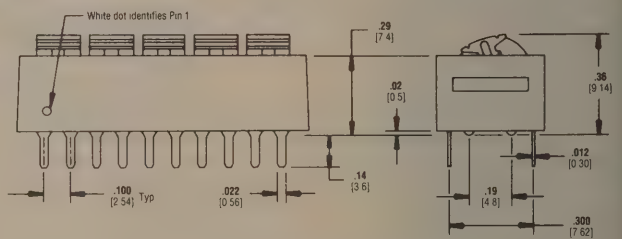
**Specifications**

**SPDT Switch**

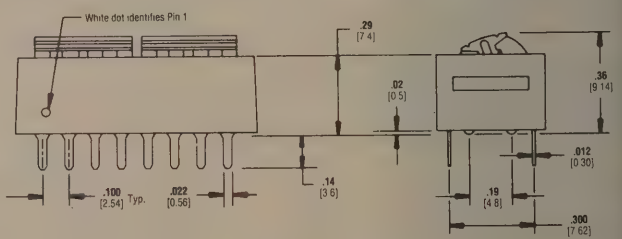



**DPST Switch**

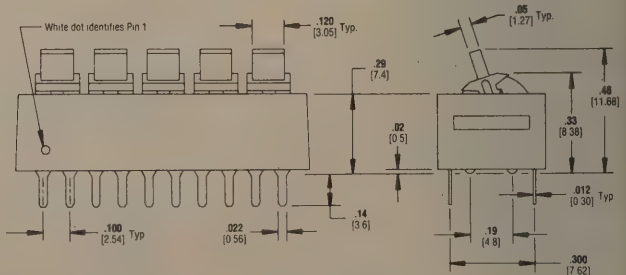



**DPDT Switch**

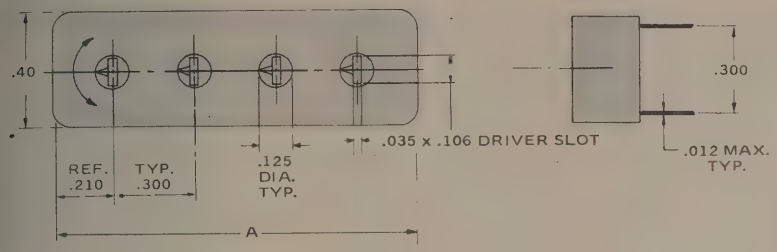


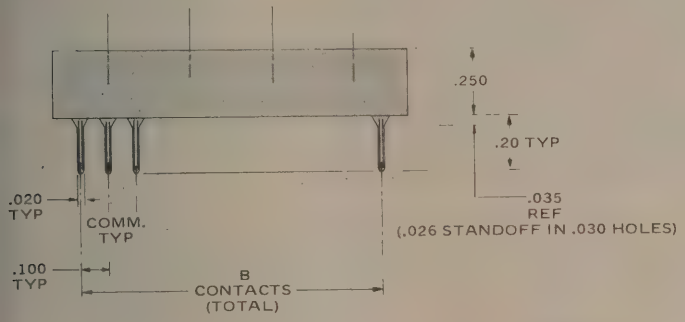

**Lever Actuated Dimensions**

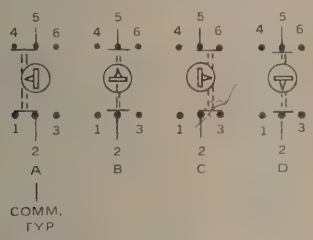


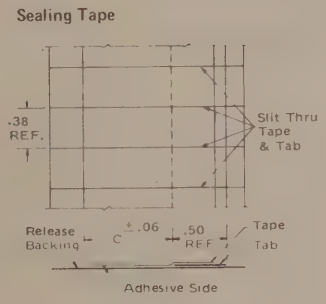

AMP
INCORPORATED
DEPT. EM, HARRISBURG, PA 17105
PHONE: 717-564-0100 TWX: 510-657-4110

# MINIATURE Double Pole, Double Throw Switch




## SPECIFICATIONS

### Electrical

Circuit Current/Voltage Rating:
Non-switching — 1.0A max. @ 50 VDC
Switching — 100 ma @ 5 VDC 25 ma @ 24 VDC
Contact Resistance — 50 Milliohms (Max.) @ 50 Millivolts open circuit voltage at 10 Milliamps current

Insulation Resistance:
between adjacent closed switches — 1 x $10^9$ ohms (Min.) at 100 VDC
between adjacent open switches — 1 x $10^9$ ohms (Min.) at 100 VDC
Dielectric Breakdown Voltage — 500 VDC (Min.)

### Mechanical

Operating Temperature — 0°F thru 190°F

Life Cycle — 2,000 switch operations (Min.)

### Materials

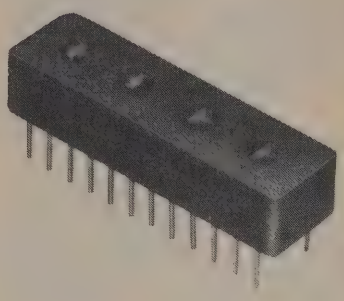
Housing and Actuator — U.L. recognized, 94V-0 rated polyester.
Contacts — Gold-plated copper-nickel alloy.

### Dimensional

All dimensions are in inches unless otherwise noted.

AMP

## 7400 SERIES



The AMP miniature double pole, double throw switch in one to 5 position configurations is a high density, low profile, p.c. board mountable switch suitable for a wide range of logic level switching operation. A small screwdriver is used to position the actuator which is bidirectional and continuously rotatable. Each position has built-in detented action for positive positioning. All switches mounted directly to your board on a .100 Grid pattern can be either flow soldered or inserted into AMP DIP receptacles.

### FEATURES

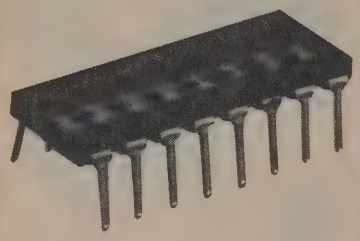
- High density, low profile (only .250" high)
- Housings made of U.L. recognized, 94V-0 rated polyester material
- Simple operation — screwdriver actuated
- Positive detented action
- Positive control — alternate "off" position rotates in either direction
- Economical — mounts directly to p.c. board eliminating need for costly interconnect wiring
- Choice of sizes from 1 to 5 positions (Four position presently available. Other sizes will be proposed upon request.)

AMP
INCORPORATED
DEPT. EM, HARRISBURG, PA 17105
PHONE: 717-564-0100 TWX: 510-657-4110

AMP

# PROGRAMMABLE DUAL-IN-LINE (DIP) SHUNT

## 7600 SERIES



### FEATURES

- Very low profile — .077" [1.96 mm] above board
- Low cost tamper-proof programming
- Housings made of UL recognized, 94V-0 rated, glass-filled thermoplastic polyester
- Large current capacity — 5 amperes (one conductor)
- Excellent strap visibility for determining state of operation
- Cut straps can be reconnected: by solder bridging, then re-opened; by use of solder wick
- Suitable for DIP handling techniques
- No extra space required for end-to-end mounting
- No loose pieces
- Ideal for volume requirements of similar programs
- Can be supplied pre-programmed
- Variety of marking and color coding possibilities

Dimensioning:
All dimensions in inches and millimeters. Values in brackets are metric equivalents.

Specifications subject to change. Consult AMP Incorporated for latest design specifications.

AMP's programmable DIP shunt provides a means of manually programming various types of electrical/electronic equipment. This unique device is basically a multiplicity of electrically conductive straps packaged in a housing with input/output leads on .100" x .300" [2.54 mm x 7.62 mm] centers. The straps can be retained intact or cut to produce the desired "closed-circuit" and "open-circuit" conditions. The DIP shunt is specifically designed to be mounted on a pc board and is ideally suited for achieving circuit crossovers on single-sided pc boards and can be used for addressing computer terminals.

The AMP programmable DIP shunt is currently available in 2 thru 12-positions, but other sizes can be supplied upon request. A hand tool is available for strap cutting.

### ELECTRICAL

Current Rating — 5 A for 20° Rise Above Ambient (one conductor per shunt)

Insulation Resistance — 1 x $10^{11}$ Ohms (min.) @ 100 VDC

Dielectric Withstanding Voltage — 1000 VDC (min.)

Capacitance:
(Between Adjacent Straps) — 2 pf.
(Across Cut Strap) — 5 pf.

### PHYSICAL AND ENVIRONMENTAL

Temperature — MIL-STD-202, Method 102A, Test Condition D [—65°C thru +125°C]

Moisture Resistance — MIL-STD-202, Method 106D

Terminal Strength (Bend Test) — MIL-STD-202, Method 211A, Test Condition B (5 bending operations)

Solderability* — AMP Specification No. 209-11

Resistance to Soldering Heat* — MIL-STD-202, Method 210A, Test Condition E, Procedure 2

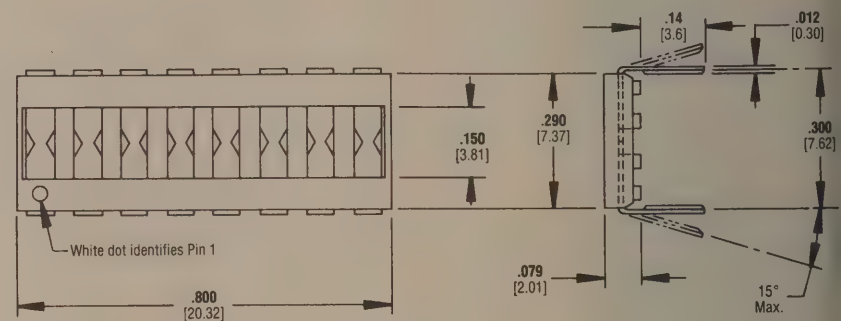
* Cut straps can be reconnected by solder bridging. Solder bridging recommendations are:
—Use low temperature solder.
—Use solder tip approximately 1/32" [0.79 mm] dia.
—Do not let solder tip come in contact with plastic material.

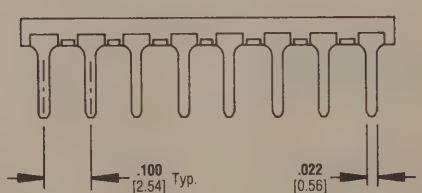
### MATERIALS

Housing — UL Recognized 94V-0 Rated, Glass-Filled Thermoplastic Polyester; Color, Black (other colors available)

Metal Parts — Brass with Electroplated Tin Finish (gold plated I/O legs are optional)

### DIMENSIONAL

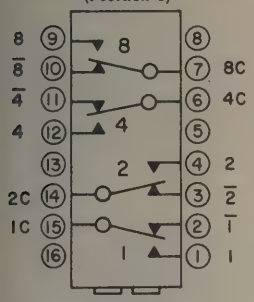



AMP
INCORPORATED
DEPT. EM, HARRISBURG, PA 17105
PHONE: 717-564-0100 TWX: 510-657-4110

# ROTARY PRINTED CIRCUIT BOARD (PCB) Switches

**Pin Configuration Schematic (Position 0)**



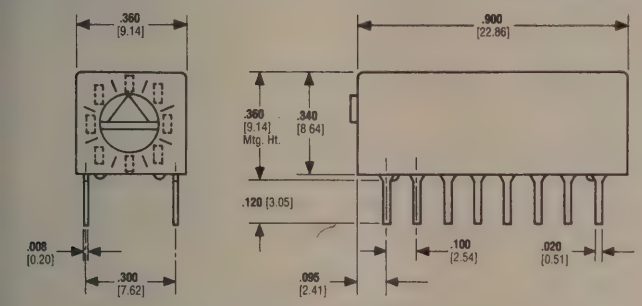

Binary Weights 8-4-2-1

**Truth Table (BCD and BCD Complement)**

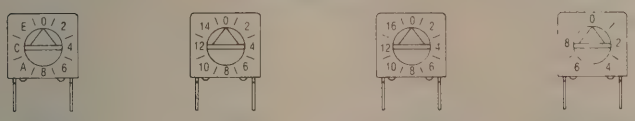
| Pole Pos. | 8 | 4 | 2 | 1 | $\overline{8}$ | $\overline{4}$ | $\overline{2}$ | $\overline{1}$ |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | ● | ● | ● | ● |
| 1 | | | | ● | ● | ● | ● | |
| 2 | | | ● | | ● | ● | | ● |
| 3 | | | ● | ● | ● | ● | | |
| 4 | | ● | | | ● | | ● | ● |
| 5 | | ● | | ● | ● | | ● | |
| 6 | | ● | ● | | ● | | | ● |
| 7 | | ● | ● | ● | ● | | | |
| 8 | ● | | | | | ● | ● | ● |
| 9 | ● | | | ● | | ● | ● | |
| 10 or A | ● | | ● | | | ● | | ● |
| 11 or B | ● | | ● | ● | | ● | | |
| 12 or C | ● | ● | | | | | ● | ● |
| 13 or D | ● | ● | | ● | | | ● | |
| 14 or E | ● | ● | ● | | | | | ● |
| 15 or F | ● | ● | ● | ● | | | | |

● = CONNECTION

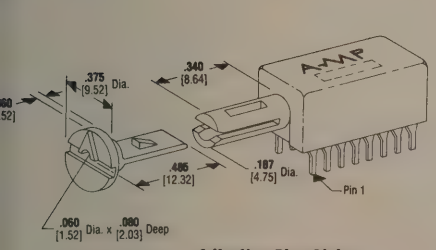
**ypical Body Dimensions**



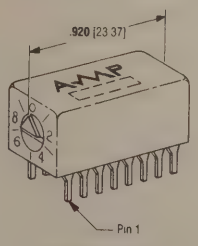

**Stamping Details**



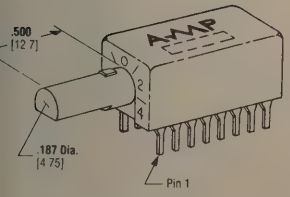
Style I | Style II | Style III | Style IV



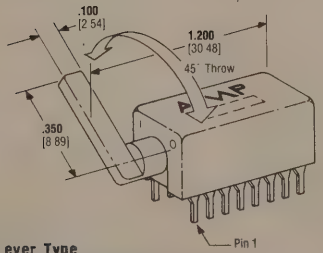

Adjusting Plug Style




Screwdriver Slot

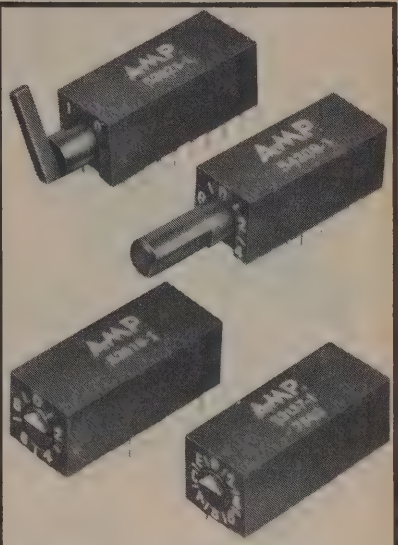



Extended Shaft




**Lever Type**
2 Position (Position 1 is same as pole position "F" on truth table)

AMP



The AMP Printed Circuit Board Rotary Switches are 16 pin DIP packages with 4 P.D.T. switches which are operated by encoded cams. A shaft with screwdriver slot, lever, or extension turns the cam in either direction to the desired "positive detent" setting. The setting may be outwardly indicated by a pointer. The switches are especially designed for printed circuit board mounting and are completely compatible with the latest packaging techniques. Input/output pins are spaced on .100" x .300" centers, allowing them to be mounted in a board by the normal methods used for 16-lead IC's.

## FEATURES

- 16 Pin DIP
- 8421 Encoding with Complement
- 4 Pole Double Throw
- Positive Detent
- PC Mounted with Edge Actuation
- Optional Actuation Methods

## ELECTRICAL SPECIFICATIONS

Voltage Rating — 120 volts RMS (max.)
Current Rating — 1.0 Ampere (max.)
Contact Resistance — 100 Milliohms (max.)
Dielectric Strength — 300 VAC 60 Hz
Dc Insulation Resistance — 1,000 Megohms

## MECHANICAL SPECIFICATIONS

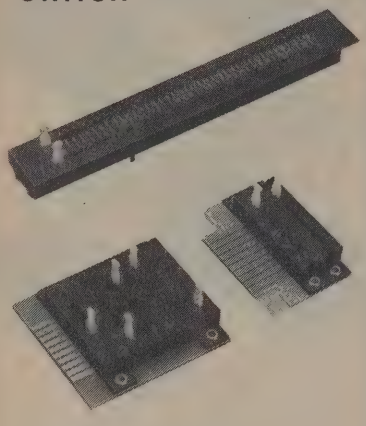
Contact Material — Phosophor Bronze, Gold-over-Nickel Plated
Detent Release Torque — 1 Oz.-In. (Min.)
Life Expectancy (min.) 2,000 Revolutions

AMP INCORPORATED
DEPT. EM, HARRISBURG, PA 17105
PHONE: 717-564-0100 TWX: 510-657-4110

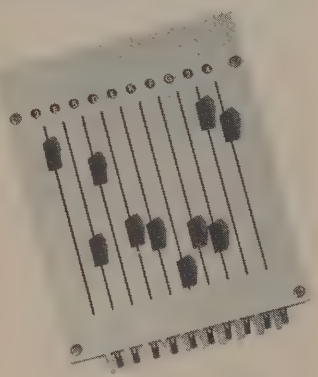
AMP

# PULL TO SET SWITCHES/MATRIX SLIDE SWITCHES/ELECTROMECHANICAL RELAYS

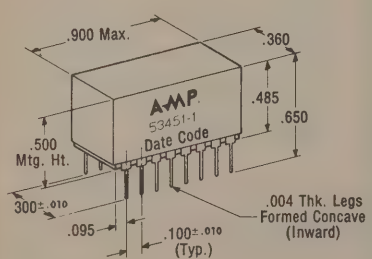
PULL-TO-SET SWITCH



MATRIX SLIDE SWITCHES



RELAY




All dimensions in inches.

## PULL-TO-SET SWITCH

### FEATURES

- Economical low cost switching.
- Modular design for maximum flexibility.
- Choice of board mount assemblies or individual switches to mount on your board.
- Sturdy construction.
- Long life — 25,000 cross-point switching.
- High pressure, positive contact.
- Single pole, ten throw functions.
- Available in 1 x 10, 5 x 10, and 2 x 40 position modules.

## MATRIX SLIDE SWITCHES

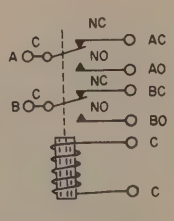
### FEATURES

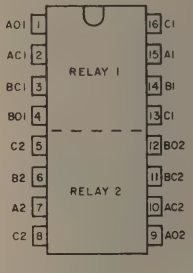
- Contact lifting principle employing detent channel and ball assures longer life by eliminating abrasion and preventing metal smear between pc board conductors.
- Standard switch sizes include 5 x 10, 10 x 10, 5 x 16 and 10 x 16 slide/position configurations.
- Flexible modular design permits various combinations of non-standard switch configurations.
- Standard sizes available with or without visual display.
  Standard visual readouts are legible .125" high white characters on black background.
- Standard readout characters are "0 thru 9" followed by letters "A thru F" on switches having more than 10 slide positions.
- Visual readout characters other than standard characters are available.
- Small physical switch size is due to unique roll-up design of visual display indicators.
- Interchangeable contact finger grips — standard color is black; other colors also available.
- Brushed stainless steel face plate is designed for easy, attractive flush mounting to front panel.
- Gold or nickel plated contacts.
- Slide output tabs mate with AMP "110" Series FASTON Receptacles; pc board connections accept DUO-TYNE Flag One-Piece Pc Edge Connector or various AMP-UNYT Pc Connectors with crimp snap-in contacts.
- High speed machine-applied terminations assure top quality, low cost connections.

## ELECTROMECHANICAL RELAY TWO DPDT (2 FORM C) PART NO. 53451-1

### FEATURES

- Two independent relays per unit.
- 16-pin. DIP-type device compatible with present packaging techniques for IC's.
- DPDT (2 Form C) switch configuration (per relay).
- 4.5 volt relay designed to be IC controlled.
- Also available in 6.0 volt (part no. 1-53451-1)
- Low resistance gold contacts.
- Electromechanical relay with true circuit isolation.
- Correct installation assured by symmetrical package design.
- High sensitivity.
- Fast, reliable, economical switching.



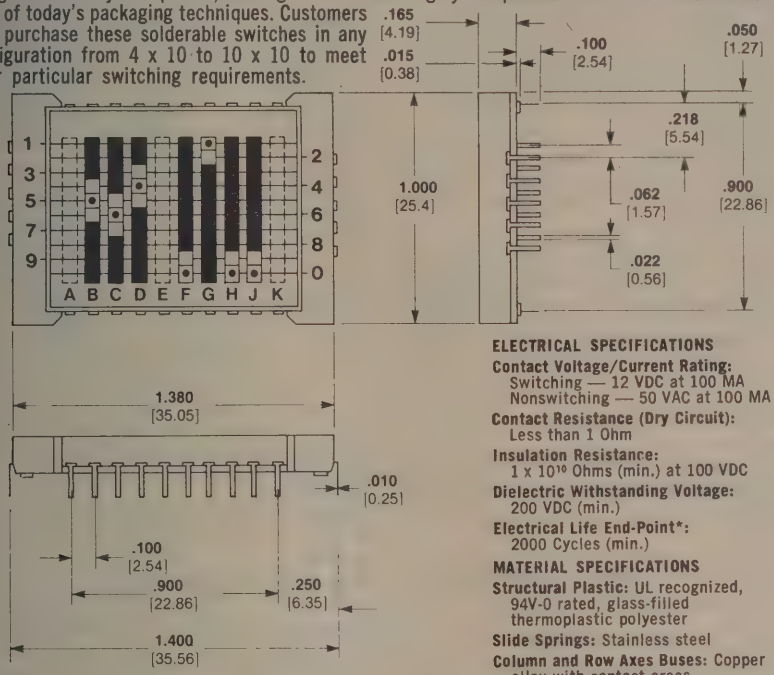




AMP
INCORPORATED
DEPT. EM, HARRISBURG, PA 17105
PHONE: 717-564-0100 TWX: 510-657-4110

# MINI-MATRIX SLIDE SWITCH / 3510 SERIES ROTARY SWITCH

## INTRODUCTION

AMP Mini-Matrix Slide switches provide a highly reliable, low cost means of manually programming various types of electrical/electronic equipment. These unique devices are basically a multiplicity of manually operated slides which select cross-points in a matrix. They feature an extremely compact design and a very low profile, making the switches highly compatible with the miniaturization standards of today's packaging techniques. Customers may purchase these solderable switches in any configuration from 4 x 10 to 10 x 10 to meet their particular switching requirements.




**ELECTRICAL SPECIFICATIONS**

**Contact Voltage/Current Rating:** Switching — 12 VDC at 100 MA Nonswitching — 50 VAC at 100 MA

**Contact Resistance (Dry Circuit):** Less than 1 Ohm

**Insulation Resistance:** 1 x $10^{10}$ Ohms (min.) at 100 VDC

**Dielectric Withstanding Voltage:** 200 VDC (min.)

**Electrical Life End-Point*:** 2000 Cycles (min.)

**MATERIAL SPECIFICATIONS**

**Structural Plastic:** UL recognized, 94V-0 rated, glass-filled thermoplastic polyester

**Slide Springs:** Stainless steel

**Column and Row Axes Buses:** Copper alloy with contact areas electroplated gold

**Contact Surfaces:** Electroplated gold

* Electrical life end-point is defined as a contact resistance greater than 1 ohm.

## INTRODUCTION FEATURES

AMP 3510 Rotary Switches are designed to meet the programming needs of today's electronic industry. AMP 3510 series switches are specially designed to provide phase locked loop coding, seven segment coding, binary and BCD coding, as well as many other complex custom codes used in communications, entertainment, video games and machine control equipment. Any even number of detent positions, from 18 to 50, can be furnished in the same switch package height and width dimensions. Also, as many as seven layers can be stacked to provide up to 70 output functions per detent position.

Each switch features a bidirectional rotating pc board with fixed, insert molded cantilever brush contacts. Insert molding of the contacts insures accurate positioning as well as closely controlled contact forces. The detent is accomplished by spring loaded stainless steel balls in a molded detent housing. This design assures a positive snap and eliminates hang-up between switching positions. On custom designs, actuator rotation can be limited to less than 360° with the use of stops.

**ELECTRICAL SPECIFICATIONS**

**Circuit Current Rating (at 24 VDC):** Nonswitching — 2.5 amperes (max.); Switching — 125 ma (max.).

**Contact Resistance (at 6 VDC, 40 ma):** 1 ohm.

**Insulation Resistance (at 100 VDC):** 1 x $10^{8}$ ohms (min.).

**Dielectric Withstanding Voltage:** 250 VDC (min.).

**Capacitance:** 5 picofarads (max.).

**MECHANICAL & ENVIRONMENTAL SPECIFICATIONS**

**Contact Life Expectancy:** 25,000 bidirectional rotations at rated load.

**Initial Operating Force:** 0.5 to 2 in.-lb. [2.2 to 8.9 N].

**Temperature:** Operating — −20°F to +190°F [28.8°C to +87.7°C]; Nonoperating — −100°F to +275°F [−73.3°C to +135°C].

**MATERIAL SPECIFICATIONS**

**Housing, Front & Rear Covers:** 94V-0 rated black thermoplastic.

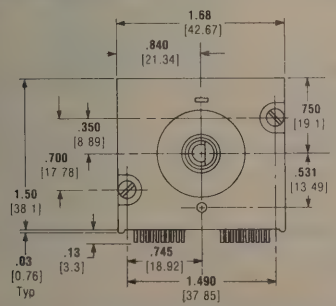
**Operating Shaft:** Zinc alloy or aluminum.

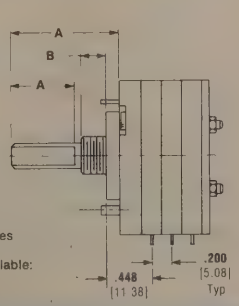
**Connecting Hardware:** Brass or corrosion resistant steel.

**Printed Circuit Boards:** 1 oz. [0.028 kg] copper clad laminate with precious metal plated circuits.

**Contacts:** Copper alloy, precious metal plated.

**Detent Wheel:** Acetal.



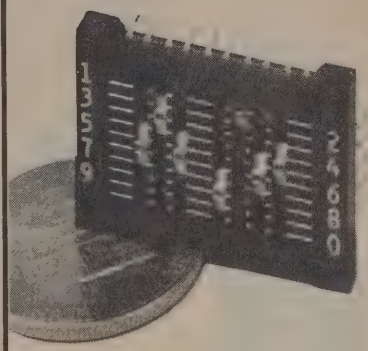




A — Custom shaft configurations and sizes can be provided.

B — Three standard bushing lengths available: .250 [6.35], .375 [9.53] and .500 [12.7].

AMP

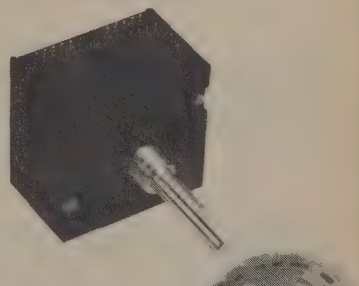
## MINI-MATRIX SLIDE SWITCH



### FEATURES

- 10 x 10 switch occupies only 1" x 1.38" (25.4 mm x 35.05 mm) of area on a pc board
- Very low profile — extends only .165" (4.19 mm) above pc board
- Can be soldered to a pc board with other components
- Plastic parts made of UL recognized, 94V-0 rated thermoplastic polyester
- Customer selects the exact configuration — from 4 x 10 to 10 x 10 — to meet his particular switching requirements

## ROTARY SWITCHES 3510 SERIES



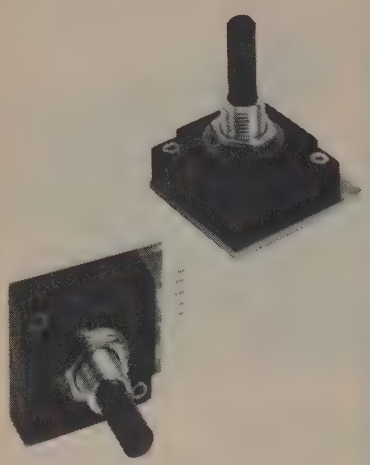
### FEATURES

- Wide choice of sizes
- Code flexibility
- Modular stacking
- Optimum reliability
- Insert molded cantilever brush contacts
- Positive switching
- Compact design
- Enclosed contacts
- Available options

AMP INCORPORATED
DEPT. EM, HARRISBURG, PA 17105
PHONE: 717-564-0100 TWX: 510-657-4110

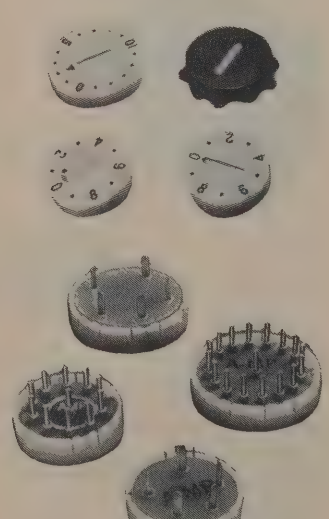
# MULTI-LAYER ROTARY SWITCHES
# PRINTED CIRCUIT BOARD ROTARY SWITCHES

## 3100 SERIES



The AMP Multi-Layer Rotary Switch is specifically designed for logic level circuitry but is capable of controlling electrical circuits that operate at current ratings of 2 amperes, 115 volts ac (nonswitching) and up to 125 milliamperes, 115 volts ac (switching).

## 6000 SERIES



## MULTI-LAYER ROTARY SWITCH 3100 SERIES

### FEATURES

- Code Flexibility — Switch output capabilities include hexadecimal, hexadecimal complement and BCD, plus various other codes re-requiring a maximum of 13 contacts per switch layer.
- Modular Stacking — Switch layers can be stacked for multi-layer operation by a single actuator — without increasing mounting surface dimensions.
- Optimum Reliability — Ruggedly constructed switches consist of molded thermoplastic layers, stainless steel ball and spring detent, brass or corrosion resistant steel hardware, and phosphor bronze contacts with gold-over-nickel plating.
- Positive Switching — Positive detent action of detent wheel assures error-free operation. operation.
- Compact Design — Switches require a minimum of front- or behind-panel mounting space.
- Enclosed Contacts — Contact surfaces are fully protected against dirt, dust and other environmental hazards.

**Note:** All dimensions in inches unless indicated otherwise.

**Specifications subject to change. Consult AMP Incorporated for latest design specifications.**

### SPECIFICATIONS

**ELECTRICAL**

**Circuit Current Rating:**
**Nonswitching** — 2A @ 115 VAC
**Switching** (Resistive Load) — 125 MA @ 115 VAC (Max.)

**Initial Contact Resistance** (Measured from input terminal, thru contact to output terminal) — 100 Milliohms (Max.)

**Insulation Resistance** (@ 250 VDC) — 1 x $10^8$ Ohms (Min.)

**Dielectric Breakdown Voltage** — 300 VDC (Min.)

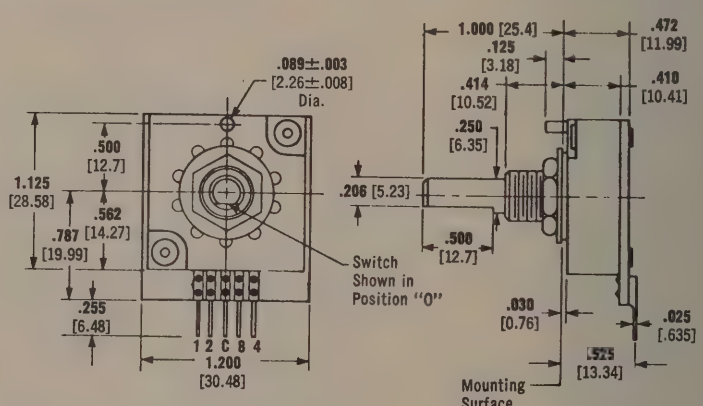
**DIMENSIONAL**

**PHYSICAL AND ENVIRONMENTAL**

**Contact Life Expectancy** — 25,000 Rotations @ Rated Load
**Initial Operating Force** — 1 to 2 Inch/Lbs.
**Operating Temperature** — —40°F to +190°F

**MATERIAL**

**Structural Parts (Switch Layers)** — Glass filled nylon 94-V2
**Operating Shaft and Detent** — Thermoplastic polyester 94-V-O
**Printed Circuit Boards** — Glass epoxy, copper clad
**Contacts** — Phosphor bronze, gold-over-nickel plated
**Hardware** — Brass or corrosion resistant steel




**NOTES:**
1. Knobs for operating switches are to be supplied by the customer.
2. Stops for limiting switch rotation to less than 360° can be provided upon request.

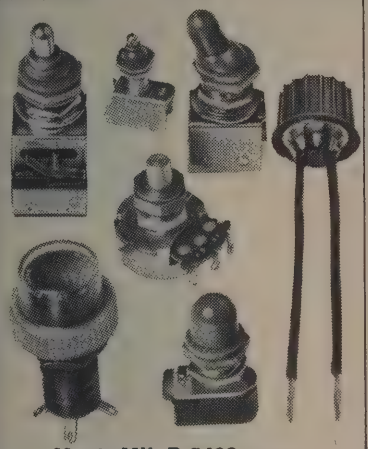
## PRINTED CIRCUIT BOARD ROTARY SWITCHES 6000 SERIES

### FEATURES

- **COMPACT DESIGN** — Small diameter, low profile switches are ideal for pc board mounting.
- **WIDE CHOICE OF OUTPUTS**—8-position binary coded octal, 10-position binary coded decimal, 16-position hexadecimal and 8-, 10- or 16-position single pole.
- **VERSATILE APPLICATION** — Available styles include slotted version for screwdriver or coin actuation, plus bar-type knob and thumbwheel versions for hand rotation.
- **ECONOMICAL** — Board mounting eliminates need for input/output wiring to perform switching functions.
- **POSITIVE SWITCHING** — Contacts have positive detent action; all switch positions easily identified by large readable numerals.
- **OPTIMUM RELIABILITY** — Fully enclosed design protects contact surfaces from dust, dirt and other environmental contaminants.

**AMP**
INCORPORATED
DEPT. EM, HARRISBURG, PA 17105
PHONE: 717-564-0100 TWX: 510-657-4110

# SWITCH ENVIRONMENTAL SEALING
## Toggle, pushbutton and rotary switch seals



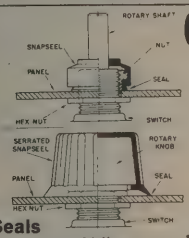
**Meets MIL-B-5423 specs; EMI/RFI-shielded versions available.**

## MIL AND INDUSTRIAL VERSION: HEXSEALS®

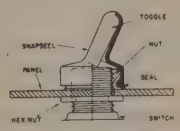
Provide positive high-pressure environmental sealing for all standard switches and rotary shafts with one-piece silicone boots incorporating a molded-in hex nut for water-tight, dust-tight protection. Replacing regular mounting hardware, vibration-resistant Hexseals fit snugly around the switch neck to seal both the panel mounting hole and the switch—even against a 30 foot head of water or gas. Flexible Hexseals allow free motion of shaft or lever. A variety of boot height, diameter and thread sizes are available. Ask for Bulletin HEX-72

| | |
|---|---|
| Material: | Boot: Silicone rubber unless otherwise specified. Silicone rubber conforms to ZZ-R-765-Class III, Gr. 50. Other elastomers available on special order. |
| | Nut: Brass, nickel plated |
| Temp. Range: | —160°F TO +500°F (—106°C TO +260°C) |
| Pressure Range: | Exceeds 15 psi internal and external |
| Shelf Life: | Excess of 25 years |
| Resistant to: | Salt spray, weather, sunlight, ozone, and most acids, |
| Stock Colors: | grey, transparent (Clear); Other colors available on special order. |

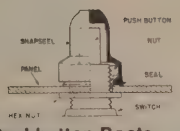
## COMMERCIAL VERSION: SNAPSEALS T.M.




**Rotary Shaft Seals**
Shaft diameter: ¼″ nom.; bushing diameter: ⅜″. For Ratchet Knob Type: knob height: ½″ approx.; knob diameter: ⅝″ approx.




**Toggle Switch Boots**
Bat handle height from panel: ⅞″; bat handle diameter: up to ¼″; bushing diameter: ½″ max.

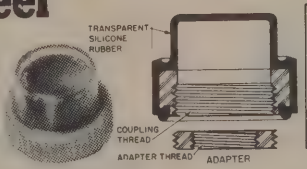



**Pushbutton Boots**
Pushbutton height from panel: up to 9/16″; pushbutton diameter: up to ¼″; bushing diameter: ⅜″ or 15/32″.

Low-cost, easy-to-install Snapseels slip easily over standard pushbutton, toggle or rotary switches to provide double insulation while sealing against moisture, dirt and dust, solvents, most acids and external pressures of 10 psi. Many sizes. SPECIFICATIONS: Material: black neoprene (other materials and colors available); Operating temperatures: -65°F to +300°F; Shelf Life: 2 years; Mounting nut: nickel-plated brass.
Ask for Bulletin SNP-72

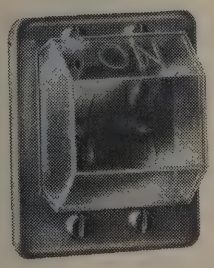
## INDICATOR LIGHT SEALS: RubRglas®-Seel

Transparent and flexible pressure switch boots of glass-clear silicone rubber allow complete visibility of the completely enclosed and sealed lamp filament and "press-to-test" markings. Molded to a corrosion-resistant aluminum nut with an integral gasket rib for firm seating against any panel surface. Wide range of thread sizes available.
Ask for Bulletin HEX-72A




| Coupling Thread |
|---|
| 13/16-32NS-2B |
| 11/16-32NS-2B |
| 7/8-32NS-2B |
| 11/16-32NS-2B |
| .850-24NS-2B |

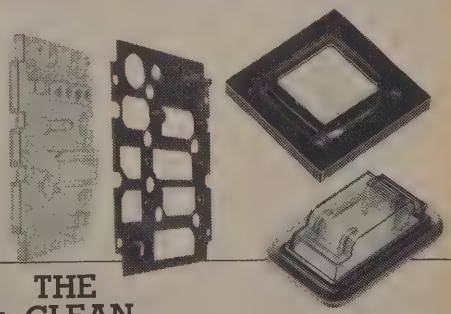
## CIRCUIT BREAKER BOOTS
### Protective RubRglas®-Seals



Shield exposed panel openings and circuit breakers with single, double or triple pole switch handles against weather, salt water, acids and dirt without redesigning equipment or hindering operation. Tough but flexible wide-angle boots made of glass-clear silicone rubber keep switch handles visible and accessible for easy manual operation. Boot assemblies consist of RubRglas shield, cadmium-plated steel frame, self-sealing stainless steel screws (Seelskrews®). Over 25-year shelf life.
Ask for Bulletin No. CB-72

## EXOTIC ELASTOMERS

Extreme precision tolerances in all types of miniature elastomer molding. Cut waste to a minimum by getting the best performance out of vitons, silicones and other hard working materials.



**APM-HEXSEAL**
DIVISION OF APM CORPORATION
44 HONECK ST., ENGLEWOOD, N.J. 07631
THE CLEAN FIGHTERS
TELEPHONE (201) 569-5700 • APM HEXSL EGW • TELEX 13-3403

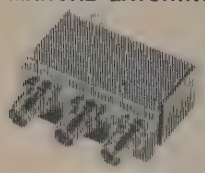
# AMPHENOL® SWITCHES

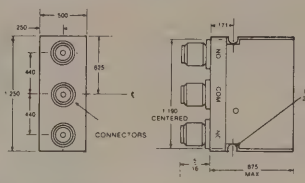
BUNKER RAMO

AMPHENOL NORTH AMERICA
Bunker Ramo Corporation

## MINIform SERIES 303

**1P2T SUBMINIATURE. REMOTE FAILSAFE OR MANUAL LATCHING**



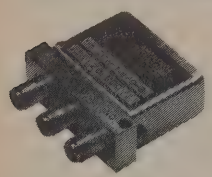


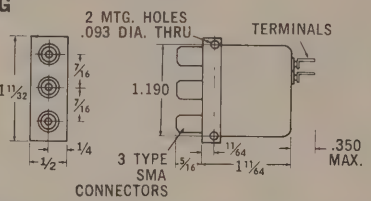

**ELECTRICAL CHARACTERISTICS**

| Frequency GHz | | 0-2 | 2-4 | 4-6 | 0-1 | 1-3 | 3-6 |
|---|---|---|---|---|---|---|---|
| Conn. | Term. | VSWR (maximum) | | | ISOLATION (minimum)-dB | | |
| SMA | NS | 1.1 | 1.2 | 1.3 | 80 | 70 | 60 |
| SUB 27 | NS | 1.1 | 1.2 | 1.35 | 80 | 70 | 60 |
| PC PINS | NS | Dependent upon application | | | 80 | 70 | 60 |

## MINIATURE SERIES 303

**1P2T AND TRANSFER. REMOTE FAILSAFE OR MANUAL LATCHING**



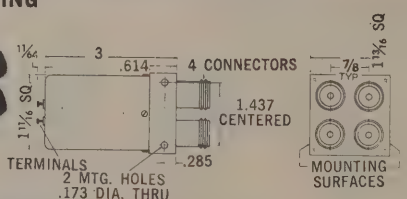



**ELECTRICAL CHARACTERISTICS**

| Frequency GHz | | 0-3 | 3-8 | 8-12.4 | 12.4-18 | 0.3 | 3-8 | 8-12.4 | 12.4-18 |
|---|---|---|---|---|---|---|---|---|---|
| Conn. | Term. | VSWR (maximum | | | | ISOLATION (minimum) —dB | | | |
| SMA | NS | 1.2 | 1.3 | 1.4 | 1.5 | 90 | 80 | 70 | 60 |

## STANDARD SIZE SERIES 303

**1P1T, 1P2T AND TRANSFER. REMOTE FAILSAFE OR MANUAL LATCHING**

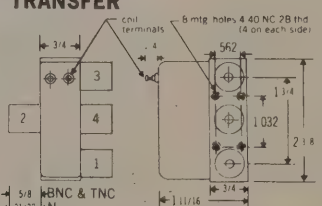



**ELECTRICAL CHARACTERISTICS**

| Frequency GHz | | 0-3 | 3-6 | 6-10 | 10-12.4 | 0-3 | 3-6 | 6-10 | 10-12.4 |
|---|---|---|---|---|---|---|---|---|---|
| Conn. | Term. | VSWR (maximum) | | | | ISOLATION (minimum) —dB | | | |
| SMA TNC N | NS | 1.3 | 1.4 | 1.5 | 1.5 | 80 | 75 | 65 | 60 |

## DYNAform SERIES 360

**CIRCUIT INSERTION, AND TRANSFER**

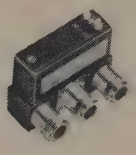


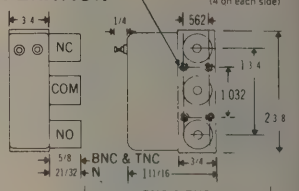

**ELECTRICAL CHARACTERISTICS**

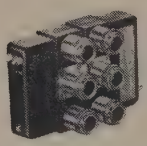
| Frequency GHz | .03 | 0.1 | 0.2 | 0.4 | 0.7 | 1.0 | 1.5 | 2.0 |
|---|---|---|---|---|---|---|---|---|
| Function | VSWR (maximum) | | | | | | | |
| Transfer/ Insertion | 1.05 | 1.06 | 1.10 | 1.15 | 1.20 | 1.25 | 1.35 | 1.50 |
| Function | ISOLATION (minimum) —dB | | | | | | | |
| Transfer/ Insertion | 45 | 43 | 38 | 33 | 29 | 22 | 20 | 16 |

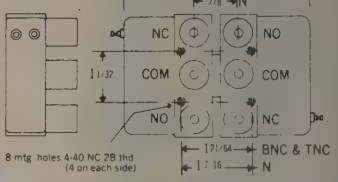
## DYNAform SERIES 360

**1P2T AND 2P2T REMOTE OPERATION**





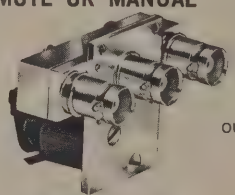


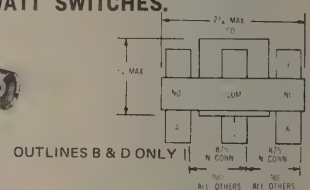

**ELECTRICAL CHARACTERISTICS**

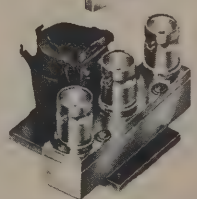
| Frequency GHz | | .03 | 0.1 | 0.2 | 0.4 | 1.0 | 2.0 | 4.0 | 6.0 |
|---|---|---|---|---|---|---|---|---|---|
| Conn. | Term. | VSWR (maximum) | | | | | | | |
| BNC | SH | 1.05 | 1.05 | 1.06 | 1.08 | 1.15 | 1.20 | 1.25 | 1.40 |
| TNC | NS | 1.05 | 1.05 | 1.06 | 1.08 | 1.15 | 1.20 | 1.25 | 1.50 |
| N | RT | 1.05 | 1.05 | 1.06 | 1.08 | 1.20 | 1.25 | 1.50 | — |
| Conn. | Term. | ISOLATION (minimum) —dB | | | | | | | |
| BNC | SH | 70 | 66 | 63 | 60 | 53 | 42 | 30 | 20 |
| TNC | NS | 50 | 48 | 42 | 38 | 27 | 24 | 21 | 18 |
| N | RT | 40 | 38 | 35 | 31 | 24 | 17 | 14 | — |

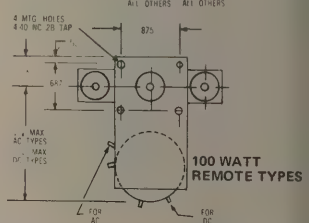
## BLADED DESIGNS SERIES 314, 316, 317, 318

**1P2T. 100 AND 500 WATT SWITCHES. REMOTE OR MANUAL**








**100 WATT SWITCHES. ELECTRICAL CHARACTERISTICS**

| Frequency GHz | | .06 | 0.1 | 0.2 | 0.4 | 0.7 | 1.0 | 2.0 | 3.0 |
|---|---|---|---|---|---|---|---|---|---|
| Conn. | Term. | VSWR (maximum) | | | | | | | |
| BNC TNC N | SH | 1.05 | 1.06 | 1.07 | 1.10 | 1.15 | 1.20 | 1.25 | 1.40 |
| | NS/ RT | 1.55 | 1.06 | 1.07 | 1.15 | 1.20 | 1.20 | 1.25 | — |
| Conn. | Term. | ISOLATION (minimum) —dB | | | | | | | |
| BNC TNC N | SH | 75 | 70 | 64 | 60 | 55 | 50 | 40 | 30 |
| | NS/ RT | 55 | 50 | 42 | 38 | 35 | 24 | 20 | — |

**500 WATT SWITCHES. ELECTRICAL CHARACTERISTICS**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| N | SH | 1.04 | 1.05 | 1.06 | 1.08 | 1.10 | 1.12 | 1.25 | 1.50 |
| C | NS | 1.04 | 1.05 | 1.06 | 1.08 | 1.10 | 1.12 | 1.30 | 1.60 |
| UHF | SH | 1.06 | 1.10 | 1.20 | 1.40 | — | — | — | — |
| | NS | 1.06 | 1.10 | 1.20 | 1.40 | — | — | — | — |
| N | SH | 75 | 70 | 65 | 55 | 45 | 40 | 35 | 30 |
| C | NS | 50 | 45 | 40 | 35 | 30 | 25 | 20 | 15 |
| UHF | SH | 72 | 67 | 62 | 55 | — | — | — | — |
| | NS | 45 | 42 | 40 | 33 | — | — | — | — |

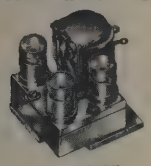
BUNKER RAMO

AMPHENOL NORTH AMERICA
Bunker Ramo Corporation

# AMPHENOL® SWITCHES

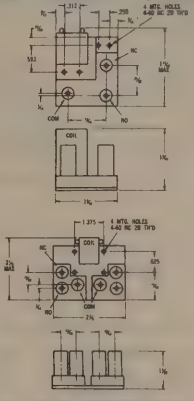
## BLADED DESIGNS SERIES 315, 321

### 1P2T AND 2P2T FLAT-MOUNTING. REMOTE OR MANUAL



1P2T

2P2T

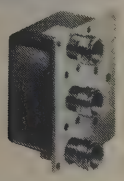


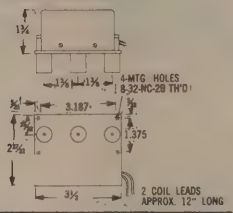
**ELECTRICAL CHARACTERISTICS**

| Frequency GHz | .03 | .06 | 0.1 | 0.2 | 0.4 | 0.7 | 1.0 | 1.5 |
|---|---|---|---|---|---|---|---|---|
| Connector | VSWR (maximum) | | | | | | | |
| BNC/TNC SUB 27 | 1.04 | 1.05 | 1.05 | 1.09 | 1.18 | 1.25 | 1.30 | 1.40 |
| Connector | ISOLATION (minimum) —dB | | | | | | | |
| BNC/TNC SUB 27 | 55 | 50 | 45 | 40 | 35 | 30 | 25 | 20 |

## BLADED DESIGNS SERIES 320

### 1P2T HIGH POWER WITH DUST COVER. REMOTE



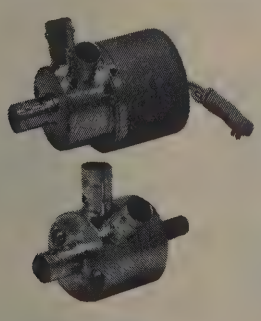


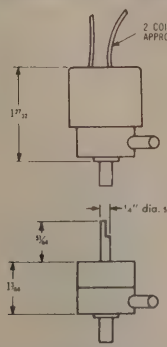

**ELECTRICAL CHARACTERISTICS**

| Frequency GHz | .06 | 0.1 | 0.2 | 0.4 | 0.7 | 1.0 | 2.0 | 3.0 |
|---|---|---|---|---|---|---|---|---|
| Connector | VSWR (maximum) | | | | | | | |
| N | 1.04 | 1.05 | 1.06 | 1.08 | 1.10 | 1.12 | 1.32 | 1.45 |
| HN | 1.04 | 1.05 | 1.07 | 1.12 | 1.15 | 1.25 | 1.35 | 1.55 |
| Connector | ISOLATION (minimum) —dB | | | | | | | |
| N | 100 | 100 | 98 | 95 | 92 | 90 | 65 | 50 |
| HN | 100 | 100 | 98 | 92 | 90 | 85 | 60 | 48 |

## BLADED DESIGNS SERIES 319

### 1P2T. SMALL CIRCULAR SWITCHES. REMOTE OR MANUAL



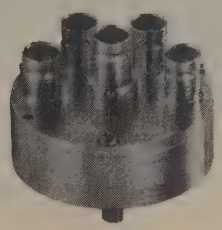


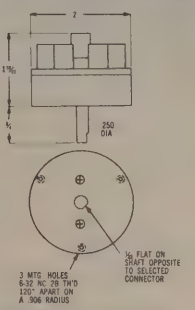

**ELECTRICAL CHARACTERISTICS**

| Frequency GHz | 0.1 | 0.2 | 0.4 | 1.0 | 2.0 | 3.0 | 4.0 |
|---|---|---|---|---|---|---|---|
| Connector | VSWR (maximum) | | | | | | |
| BNC | 1.05 | 1.05 | 1.05 | 1.10 | 1.25 | — | — |
| TNC/N | 1.05 | 1.05 | 1.05 | 1.10 | 1.20 | 1.35 | 1.40 |
| Connector | ISOLATION (minimum) —dB | | | | | | |
| BNC | 85 | 80 | 75 | 70 | 60 | — | — |
| TNC/N | 85 | 80 | 75 | 70 | 60 | 55 | 50 |

## BLADED DESIGNS SERIES 322

### 1P3T, 4T, 5T, 6T CIRCULAR SWITCHES. MANUAL



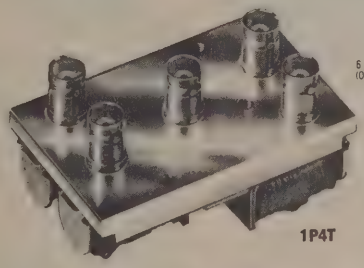



**ELECTRICAL CHARACTERISTICS**

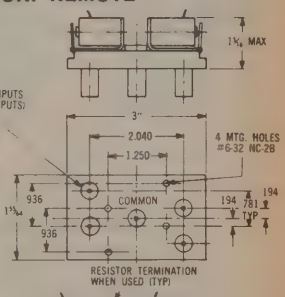
| Frequency GHz | 0.1 | 0.2 | 0.4 | 0.7 | 1.0 | 2.0 | 3.0 |
|---|---|---|---|---|---|---|---|
| Connector | VSWR (maximum) | | | | | | |
| BNC/TNC | 1.06 | 1.10 | 1.12 | 1.12 | 1.13 | 1.20 | 1.25 |
| MB | 1.10 | 1.15 | 1.20 | 1.25 | 1.30 | — | — |
| Connector | ISOLATION (minimum) —dB | | | | | | |
| BNC/TNC | 100 | 90 | 65 | 60 | 60 | 55 | 45 |
| MB | 90 | 80 | 60 | 52 | 45 | — | — |

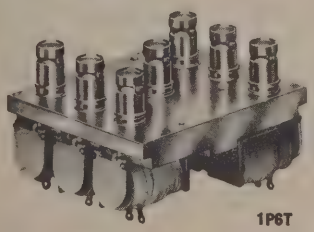
## BLADED DESIGNS SERIES 323, 325, 326, 329

### 1P4T, 6T, 8T, 12T. MULTI-POSITION. REMOTE

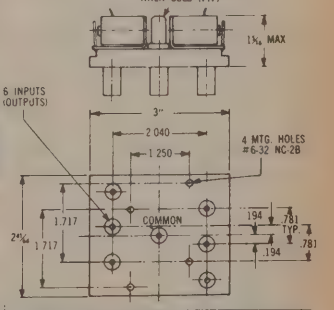


1P4T



1P6T




**ELECTRICAL CHARACTERISTICS**

| Frequency GHz | | | .03 | .06 | 0.1 | 0.2 | 0.4 | 0.7 | 1.0 |
|---|---|---|---|---|---|---|---|---|---|
| Func. | Conn. | Term. | VSWR (maximum) | | | | | | |
| 1P4T | BNC TNC | SH | 1.05 | 1.05 | 1.05 | 1.06 | 1.10 | 1.15 | 1.36 |
| | | NS & RT | 1.05 | 1.05 | 1.05 | 1.06 | 1.10 | 1.16 | 1.38 |
| 1P6T | BNC TNC | SH | 1.05 | 1.05 | 1.06 | 1.10 | 1.28 | 1.65 | 2.00 |
| | | NS & RT | 1.05 | 1.05 | 1.06 | 1.10 | 1.28 | 1.65 | 2.00 |
| 1P8T | BNC TNC | SH | 1.05 | 1.10 | 1.20 | 1.35 | 1.60 | 2.00 | — |
| | | NS & RT | 1.05 | 1.10 | 1.20 | 1.35 | 1.60 | 2.00 | — |
| 1P12T | BNC TNC | SH | 1.06 | 1.15 | 1.20 | 1.50 | 2.00 | — | — |
| | | NS & RT | 1.06 | 1.15 | 1.20 | 1.50 | 2.00 | — | — |
| Func. | Conn. | Term. | ISOLATION (minimum) —dB | | | | | | |
| 1P4T | BNC TNC | SH | 90 | 80 | 75 | 60 | 50 | 42 | 35 |
| | | NS & RT | 60 | 58 | 55 | 45 | 35 | 30 | 27 |
| 1P6T | BNC TNC | SH | 90 | 80 | 75 | 65 | 50 | 40 | 30 |
| | | NS & RT | 60 | 58 | 50 | 40 | 35 | 30 | 25 |
| 1P8T | BNC TNC | SH | 85 | 80 | 75 | 65 | 50 | 45 | — |
| | | NS & RT | 60 | 58 | 50 | 40 | 35 | 30 | — |
| 1P12T | BNC TNC | SH | 80 | 70 | 65 | 55 | 45 | — | — |
| | | NS & RT | 60 | 50 | 42 | 37 | 30 | — | — |

INDUSTRY ORIENTED
ELECTRONIC DISTRIBUTO

# BARBEY ELECTRONICS

PHONE: (215) 376-611(
333 N. FOURTH ST./READING, PA. 1960

**BRANCH STORES**

622 Columbia Avenue
Lancaster, Pa. 17603
Tel. (717) 393-5637

157 N. York Street
Pottstown, Pa. 19464
Tel. (215) 326-0702

821 Quentin Road
Lebanon, Pa. 17042
Tel. (717) 273-1679

**COMMERCIAL SOUND DIVISION**

333 N. 4th St.
Reading, PA 19603
Tel. (215) 376-7451

## LINE CARD-COMPONENTS FOR INDUSTRY

**AMPROBE**
RECORDING, CLAMP-ON METERS

**B&K DYNASCAN**
TEST INSTRUMENTS

**BELDEN**
WIRE, CABLE, CORDS

**BUD**
CABINETS, CHASSIS

**BUSSMAN**
FUSES, HOLDERS, BLOCKS

**CHICAGO MINIATURE**
PILOT LAMPS AND NEON

**CINCH (TRW)**
TERMINALS, PLUGS, SOCKETS

**CLAROSTAT**
POWER RESISTORS, CONTROLS

**COLUMBIA CABLE**
WIRE AND CABLE

**CUTLER-HAMMER**
LEVER, PUSH SWITCHES

**DIALCO**
PILOT LIGHTS, LEDS, SWITCHES

**EVEREADY**
BATTERIES, FLASHLIGHTS

**GRAYHILL**
SWITCHES, SOCKETS

**GUARDIAN**
RELAYS, SOLENOIDS

**HECON**
ELECTRIC, ELECTRONIC COUNTERS

**IMC MAGNETICS**
FANS, BLOWERS

**INTERNATIONAL RECT.**
DIODES, SCR's, BRIDGES

**KEPRO**
P.C. KITS, BOARDS, CHEMICALS

**KESTER**
SOLDER AND FLUXES

**LEECRAFT**
INDICATOR LIGHTS, SOCKETS

**MALLORY**
CAPACITORS, BATTERIES

**MICRO SWITCH**
BASIC AND HEAVY DUTY SWITCHES,
PHOTO ELECTRIC CONTROLS
PROXIMITY, SOLID STATE CONTROLS

**POTTER & BRUMFIELD**
RELAYS, CIRCUIT BREAKERS

**PREMIER**
CABINETS, CHASSIS

**RCA**
INDUSTRIAL TUBES

**SAMS, HOWARD W.**
TECHNICAL PUBLICATIONS

**SIMPSON**
TEST INSTRUMENTS, METERS

**SOLA**
REGULATED POWER SUPPLIES

**SPRAGUE**
CAPACITORS

**STANCOR**
TRANSFORMERS, RELAYS

**SUPERIOR ELECTRIC**
STEPPING MOTORS, POWERSTATS

**SWITCHCRAFT**
PLUGS, JACKS, SWITCHES

**SYLVANIA (GTE)**
SEMI COND. PILOT LIGHTS

**TRIPLETT**
TEST INSTRUMENTS, METERS

**UNGAR**
SOLDERING TOOLS

**VACO**
TERMINALS, TOOLS

**WELLER**
SOLDERING TOOLS

**XCELITE**
TOOLS

**ALTEC**
SOUND EQUIPMENT

**BOGEN**
PA EQUIPMENT

**SHURE**
MICROPHONES

**TALK-A-PHONE**
INTERCOM SYSTEMS

**UNIVERSITY**
PA SPEAKERS

**Space does not permit listing all lines. Send for our FREE industrial catalog.**

# ARCOLECTRIC CORPORATION

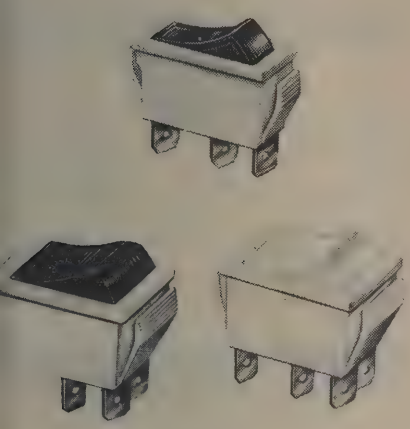
Dept. EM, P.O. Box 348 • 11120 Chandler Blvd. • North Hollywood, California 91603

TEL: 213-985-3130 TEL: 213-877-6969 TELEX: 65-1349


# SWITCHES

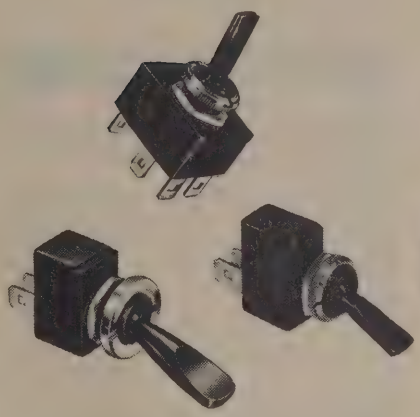
### ROCKER

400 SERIES LIGHTED & UNLIGHTED. SP & DP. 10A UL CSA VDE



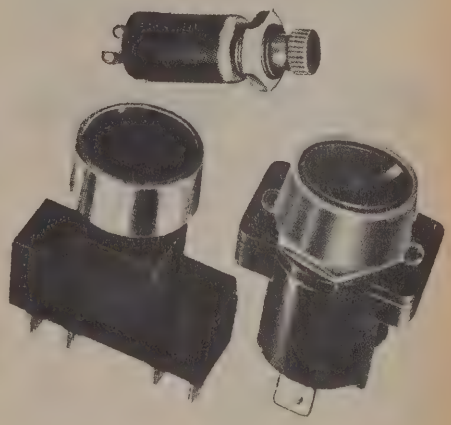
### LEVER

600 & 800 SERIES 3A & 10A SP & DP. UL/CSA



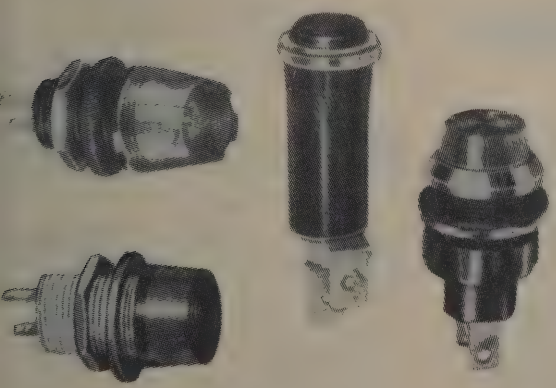
### PUSHBUTTON

900 RANGE MOMENTARY ONLY SP & TWO CIRCUIT



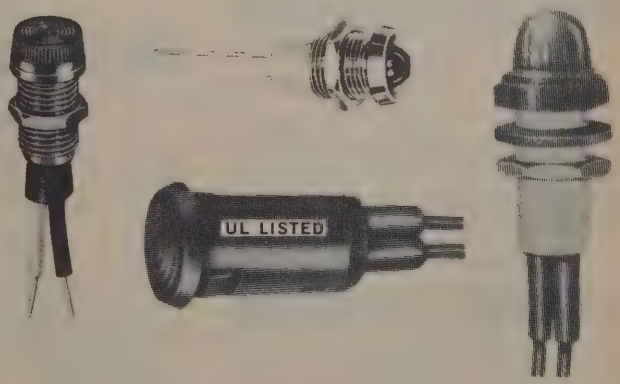
# LAMPHOLDERS

AVAILABLE FOR LAMPS:
T1¼ MIDGET SCREW BASE
T1¾ FLANGE BASE
T3¼ MIN. BAY. BASE



# INDICATOR LIGHTS

AVAILABLE FOR 125V NEON UL/CSA. LED HOLDER WITH & WITHOUT LED'S.

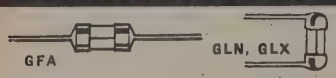



**SEND FOR COMPLETE CATALOG**

# fuses and holders

**bussmann manufacturing division**
**McGraw Edison Company**
**DEPT. EM 502 Earth City Plaza**
**P.O. Box 14460**
**St. Louis, Mo. 63178, (314) 739-9600**

## TRON® SUBMINIATURE PIG-TAIL FUSES




Glass-tube construction with 1-1/2" leads of #24 tinned copper for 1/100-5 amp ratings, #18 tinned copper for 7-15 amp ratings. Hermetically sealed. Color coded to indicate amp ratings. For circuits with fault current of 50 amps or less (1/100-5 amps for 125 V or less, 7-15 amps for 32 V or less). GLN, GLX body size, .140" x .3"; GFA body size, .145" x .3".

| Buss No. | Amperes | Net Price For Ten | Net Price For 100 |
|---|---|---|---|
| GLN | 1/100 | $21.30 | $177.00 |
| GLN | 1/32, 1/20, 1/16, 1/10, 1/8, 3/10, 4/10, 7, 8, 15 | 17.70 | 148.00 |
| GLX | 15/100, 2/10, 1/4, 1/2, 6/10, 3/4, 1, 1-1/2, 2, 3, 4, 5 | 25.60 | 213.00 |
| GFA | 1/100, 1/32, 1/20, 1/16, 1/10, 1/8, 15/100, 2/10, 1/4, 3/10, 4/10, 1/2, 6/10 | 8.50 | 71.00 |
| GFA | 3/4, 1, 1-1/2, 2, 3, 4, 5, 7, 8, 15 | 7.60 | 64.00 |

## SUBMINIATURE PRONG TYPE UNIT

Rated 125 V or less, fault current not over 300 amps; open at 200% within 10 sec or less. Use AF knob for waterproof. Size, .270" dia., .250" lg. (body).

| Buss No. | Amperes | Net Price For Ten | Net Price For 100 |
|---|---|---|---|
| GMW | 1/200, 1/100, 1/64, 1/32, 1/16 | $14.00 | $117.00 |
| GMW | 1/10, 2/10, 1/4, 3/10, 4/10, 1/2, 6/10, 3/4, 1, 1-1/2, 2, 3, 4, 5 | 10.70 | 89.00 |
| HWA* | Holder, fits all GMW | 13.60 | 113.00 |
| HWA† | Holder, fits all GMW | 12.20 | 101.00 |
| AF | Knob only, fits HWA | 1.80 | 15.00 |

*With AF knob. †Without AF knob.

## 13/64 x 45/64 inch FUSES

(5mm x 20mm)

Protection of miniaturized circuits — commonly used in foreign equipment. Carry 100%, open at 200% in 10 sec.

| Buss No. | Amperes | Volts | Net Price For Five | Net Price For 100 |
|---|---|---|---|---|
| GMA | 1/8 | 125 | $2.90 | $48.00 |
| GMA | 1/4, 1/2, 7/10 | 125 | 2.25 | 38.00 |
| GMA | 1, 1-2/10, 1-1/2, 2, 3, 4, 5, 6, 10 | 125 | 1.95 | 33.00 |

## 1/4 x 5/8 inch FUSES

FAST ACTING FUSE

Glass tube, 1/4" x 5/8". Carry 110%, open at 135% in 1 hour.

| Buss No. | Amperes | Volts | Net Price For Five | Net Price For 100 |
|---|---|---|---|---|
| AGA | 1, 1-1/2, 2, 2-1/2 | 32 | $0.75 | $13.00 |
| AGA | 3 | 32 | .75 | 13.00 |
| AGA | 5, 6, 7-1/2, 10, 15, 20 | 32 | .55 | 8.60 |
| AGA | 25, 30 | 32 | .55 | 8.60 |

## 1/4 x 7/8 inch FUSES

FAST ACTING FUSE

Glass tube, carry 110%, open at 135% in 1 hour.

| Buss No. | Amperes | Volts | Net Price For Five | Net Price For 100 |
|---|---|---|---|---|
| AGW | 1, 2-1/2, 3, 4 | 32 | $0.75 | $13.00 |
| AGW | 5, 6, 7-1/2, 15, 20, 30 | 32 | .55 | 9.00 |

## 1/4 x 1 inch FUSES

FAST ACTING FUSES

Glass tube, 1/4" x 1". Carry 100%, open at 200% in 5 seconds. 1/500 to 1/32 amp sizes have bridge construction; all others straight-through element. U/L Approved.

| Buss No. | Amperes | Volts | Net Price For Five | Net Price For 100 |
|---|---|---|---|---|
| AGX | 1/500 | 250 | $11.05 | $184.00 |
| AGX | 1/200 | 250 | 4.85 | 81.00 |
| AGX | 1/100 | 250 | 4.15 | 69.00 |
| AGX | 1/32 | 250 | 3.60 | 60.00 |
| AGX | 1/16 | 250 | 2.25 | 38.00 |
| AGX | 1/10, 1/8, 3/16, 2/10 | 250 | 1.85 | 31.00 |
| AGX | 1/4, 3/8, 4/10, 1/2, 3/4 | 250 | 1.00 | 17.00 |
| AGX | 1, 1-1/2, 2, 3, 4 | 125* | .75 | 13.00 |
| AGX | 5, 8, 10, 15, 20 | 32† | .55 | 8.60 |
| AGX | 10, 15, 20, 25, 30 | 32 | .53 | 8.20 |

*1 A, 250. †5 A, 125.

## 1/4 x 1-1/4 inch FUSES

FAST ACTING FUSES

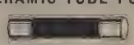
Glass tube, 1/4" x 1-1/4". Carry 110%, open at 135% in 1 hour or less. 1/500 to 2 amp sizes will open at 200% in 5 seconds or less. 1/500 to 1/32 amp have bridge construction; all others straight-through element. U/L Approved.

| Buss No. | Amperes | Volts | Net Price For Five | Net Price For 100 |
|---|---|---|---|---|
| AGC | 1/500 | 250 | $11.05 | $184.00 |
| AGC | 1/200 | 250 | 4.85 | 81.00 |
| AGC | 1/100 | 250 | 4.15 | 69.00 |
| AGC | 1/32 | 250 | 3.60 | 60.00 |
| AGC | 1/16, 1/8, 15/100, 175/1000, 3/16, 1/10, 2/10 | 250 | 1.85 | 31.00 |
| AGC | 1/4, 3/10, 3/8, 45/100, 1/2, 6/10, 3/4 | 250 | 1.00 | 17.00 |
| AGC | 1, 1-1/4, 1-1/2, 1-6/10, 2 | 250 | .75 | 13.00 |
| AGC | 2-1/2, 3, 4 | 250 | | |
| AGC | | 32‡ | | |
| MTH | 4, 5, 6 | 250 | .90 | 15.00 |
| AGC | 5, 6, 7-1/2, 8 | 32‡ | .55 | 9.00 |
| AGC | 10,15 | 32‡ | .55 | 8.30 |
| AGC | 25 | 32‡ | .55 | 9.00 |
| AGC | 30 | | .55 | 8.30 |

‡Not U/L listed.

## 1/4 x 1-1/4 inch FUSES

CERAMIC TUBE FUSES

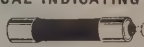


High interrupting capacity for use on circuit delivering as high as 25,000 amps at 125 V, or 10,000 amps at 250 V. 1/4" x 1-1/4". Carry 110%, open at 135% in 1 hour. Up to 15 amp size U/L Approved.

| Buss No. | Amperes | Volts | Net Price For Five | Net Price For 100 |
|---|---|---|---|---|
| ABC | 1/4 | 250 | $1.55 | $26.00 |
| ABC | 1, 2, 3 | 250 | 1.55 | 26.00 |
| ABC | 5, 6, 8, 10 | 250 | 1.35 | 22.00 |
| ABC | 12, 15, 20 | 250 | 1.35 | 22.00 |
| ABC | 25, 30 | 125 | 1.95 | 33.00 |

## 1/4 x 1-1/4 inch FUSES

VISUAL INDICATING FUSES



For use with HLD fuseholder. Bright red dot on indicating pin extends from end of fuse when fuse is open even after power is off. Rated 125 V or less, carries 110%, opens at 135% in 1 hour or less. Only 1/4" x 1-1/4".

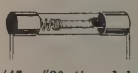
| Buss No. | Amperes | Net Price For Five | Net Price For 100 |
|---|---|---|---|
| GBA | 3/4 | $4.95 | $83.00 |
| GBA | 1, 1-1/2, 2, 3, 4, 5 | 3.70 | 62.00 |

Fiber tube with silver plated indicating pin which extends when fuse is blown. May be used to actuate a signal when used in HKA fuseholder or Signal Fuse Block. Dual tube construction in sizes larger than 5 amps (cannot be used in HKA fuseholder). Voltage, 125 volts, except 8 amp and over which are 32 volts. Size, 1/4" x 1-1/4".

| Buss No. | Amperes | Net Price For Five | Net Price For 100 |
|---|---|---|---|
| GLD | 3/4 | $4.45 | $74.00 |
| GLD | 1, 1-1/2, 2, 3, 4, 5 | 3.50 | 58.00 |
| GLD | 6, 8, 10, 12, 15, 20 | 4.85 | 81.00 |

## 1/4 x 1-1/4 inch FUSES

FUSETRON PIG-TAIL FUSES



Body 1/4" x 1-1/4", #20 tinned leads, 1-1/4". 1/100 to 2-8/10 same as MDL type; 3 to 7 amps same as MDX type. U/L Approved.

| Buss No. | Amperes | Volts | Net Price For Five | Net Price For 100 |
|---|---|---|---|---|
| MDV | 1/100, 1/32 | 250 | $3.70 | $62.00 |
| MDV | 1/16, 1/10, 1/8, 15/100, 175/1000, 3/16, 2/10, 1/4, 3/10, 3/8, 4/10, 1/2, 6/10, 3/4, 8/10, 1 | 250 | 2.80 | 46.00 |
| MDV | 1-1/4, 1-1/2, 1-6/10, 2 | 125 | 2.70 | 45.00 |
| MDV | 2-1/2, 2-8/10, 3, 3-2/10, 4, 5, 6-1/4, 7 | 125 | 2.25 | 38.00 |

FAST ACTING FUSE

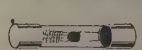
PIG-TAIL FUSES

Glass tube 1/4" x 1-1/4" with 1-1/4" leads of #20 tinned wire. Carry 110%, open 135% in 1 hour. 250 V. U/L Approved.

| Buss No. | Amperes | Net Price For Five | Net Price For 100 |
|---|---|---|---|
| GJV | 1/16 | $2.65 | $44.00 |
| GJV | 1/8 | 2.65 | 44.00 |
| GJV | 1/4, 3/10, 3/8, 1/2, 3/4 | 1.75 | 30.00 |
| GJV | 1, 1-1/2, 2, 3 | 1.40 | 23.00 |
| GJV | 4, 5, 6 | 1.50 | 25.00 |

## 1/4 x 1-1/4 inch FUSES

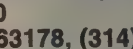
FUSETRON GLASS TUBE FUSES



Dual-element slow-blowing type, 1/4" x 1-1/4". Fuse link operates only on very high overloads or short-circuits; thermal cutout functions on low overloads (cannot operate quickly on any load, thus providing long time-lag). Carry 110%, open at 135% in 1 hour. MDL 1/100 to 2-8/10 amp and MDX 3 to 7 amp sizes. U/L Approved. MDL type has longer time-lag than MDX type.

| Buss No. | Amperes | Volts | Net Price For Five | Net Price For 100 |
|---|---|---|---|---|
| MDL | 1/100, 1/32 | 250 | $3.00 | $50.00 |
| MDL | 1/16, 1/10, 1/8, 15/100, 175/1000, 3/16, 2/10, 1/4, 3/10, 3/8, 4/10, 1/2, 6/10, 7/10, 3/4, 8/10, 1 | | 2.25 | 38.00 |
| MDX | 1-1/4, 1-1/2, 1-6/10, 2 | 250 | 2.40 | 40.00 |
| MDL | 1-2/10, 1-1/4, 1-1/2, 1-6/10, 2 | 125 | 2.15 | 36.00 |
| MDL | 2-1/2, 2-8/10 | 125 | 1.85 | 31.00 |
| MDX | 3, 3-2/10, 4, 5 | 125 | 1.85 | 31.00 |
| MDX | 6-1/4, 7 | 125 | 2.05 | 34.00 |
| MDL | 3, 3-2/10, 4, 5, 6-1/4, 8, 10, 15, 20, 25, 30 | 32 | 1.85 | 31.00 |

## 1/4 x 1-1/4 inch FUSES



Fusetron dual-element fuse, slow-blowing type, ceramic tube. Carry 110%, open at 135% in 1 hour.

| Buss No. | Amperes | Volts | Net Price For Five | Net Price For 100 |
|---|---|---|---|---|
| MDA | 1/100, 1/32 | 250 | $3.90 | $65.00 |
| MDA | 1/16, 1/10, 1/8, 15/100, 175/1000, 3/16, 2/10, 1/4, 3/10, 3/8, 4/10, 1/2, 6/10, 3/4, 8/10, 1, 1-1/4, 1-1/2, 1-6/10, 2 | 250 | 3.20 | 53.00 |
| MDA | 2-1/2, 2-8/10, 3, 3-2/10, 4, 5, 6-1/4, 7, 8, 10, 15, 20 | 250 | 3.15 | 52.00 |
| MDA | 25, 30 | 125 | 2.25 | 37.00 |
| | | | 2.25 | 37.00 |

bussmann manufacturing division
McGraw Edison Company
DEPT. EM 502 Earth City Plaza
P.O. Box 14460
St. Louis, Mo. 63178, (314) 739-9600

# fuses and holders

## 9/32 x 1-1/4 inch FUSES

### AGS GLASS TUBE FUSES

Test specification; carry, 110%, open at 135% within 1 hour except 35 and 40 amp units which open at 300% in 2 to 4 seconds when tested in standard 30-amp test circuit. Note: These units in sizes larger than 30 amps are not recommended for use in fuse clips or fuseholders as clips will not carry the high currents.

| Buss No. | Amperes | Volts | Net Price For Five | 100 |
|---|---|---|---|---|
| AGS | 1/16 | 250 | $3.85 | $64.00 |
| AGS | 1/8 | 250 | 2.70 | 45.00 |
| AGS | 1/4, 1/2 | 250 | 1.45 | 24.00 |
| AGS | 1, 2, 2-1/2, 3 | 250 | 1.45 | 24.00 |
| AGS | 5, 10, 15, 20 ,25, 30 | 32 | 1.05 | 18.00 |
| AGS | 20, 25, 30 | 32 | 1.00 | 16.00 |
| AGS | 35, 40, 50 | | 1.25 | 21.00 |

## 9/32 x 1-1/4 inch FUSES

### CERAMIC TUBE FUSES

Carrry 110%, at 135% in 1 hour. 35 and 40 amp. open at 300% in 2 to 4 seconds when tested in a standard 30 amp. test circuit.

| Buss No. | Amperes | Volts | Net Price For Five | 100 |
|---|---|---|---|---|
| ABS | 1, 2, 3 | 250 | $2.35 | $40.00 |
| ABS | 5, 8, 10, 15, 20 | 250 | 2.25 | 38.00 |
| ABS | 25, 30 | 125 | 2.25 | 38.00 |
| ABS | 35, 40 | 32 | 2.35 | 40.00 |

## 9/32 x 1-1/4 inch FUSES

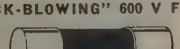
### FUSETRON DUAL-ELEMENT FUSES

Glass tube, slow-blowing. Avoid needless blows from starting currents or surges, yet provides protection against short-circuits or continuous overloads. Carry 110%, open at 135% in 1 hour. Approximate blowing time: at 200% load, 25 seconds; at 300% load, 8 seconds; at 500% load, 3 seconds.

| Buss No. | Amperes | Volts | Net Price For Five | 100 |
|---|---|---|---|---|
| MDM | 1/10, 15/100, 2/10, 1/4, 3/10, 4/10, 1/2, 6/10, 3/4, 8/10, 1 | 250 | $3.00 | $50.00 |
| MDM | 1-1/4, 1-6/10, 2 | 125 | 3.00 | 50.00 |
| MDM | 2-1/2, 2-8/10, 3 | 125 | 2.40 | 40.00 |
| MDM | 3-2/10, 4, 5, 6-1/4, 8, 10, 10, 15, 20, 25, 30, 35, 40 | 32 | 2.40 | 40.00 |

## 13/32 x 1-3/8 inch FUSES

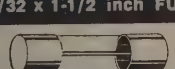
### "QUICK-BLOWING" 600 V FUSES



Designed to protect control circuits, fluorescent lighting circuits or similar uses where quick-blowing characteristics are desired. Use HPC-L fuseholder or 3845 fuse block. U/L Approved. Fiber tube 13/32" x 1-3/8".

| Buss No. | Amperes | Net Price For Ten | 100 |
|---|---|---|---|
| BBS | 4/10, 3/4, 8/10 | $5.10 | $42.00 |
| BBS | 1, 2, 3, 4, 5 | 4.90 | 40.00 |

## 13/32 x 1-1/2 inch FUSES



Glass tube, carry 110%, open at 135% in 1 hour. 3 amp. and smaller sizes U/L listed.

| Buss No. | Amperes | Volts | Net Price For Ten | 100 |
|---|---|---|---|---|
| AGU | 1, 2, 3, 4, 5, 10, 15 | 250 | $3.20 | $26.00 |
| AGU | 20, 25, 30 | 32 | 2.90 | 24.00 |

## 13/32 x 1-1/2 inch FUSES

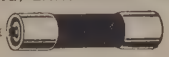
### MIDGET TYPE FUSES

Up to 15 amp size U/L Approved.

| Buss No. | Amperes | Volts | Net Price For Ten | 100 |
|---|---|---|---|---|
| BAF | 1, 3, 5, 6, 10 | 250 | $2.70 | $22.00 |
| BAF | 15, 20, 25, 30 | 125 | 2.70 | 22.00 |

## 13/32 x 1-1/2 inch FUSES

### INDICATING, LAMINATED TUBE FUSES



Red button on indicating pin extends from end of fuse when fuse is blown. Units are built in accordance with Navy Specifications. These units may be used in Buss HPC-C fuseholders. Voltage, (1-15 amps), 250, others, 125 V.

| Buss No. | Amperes | Net Price For Ten | 100 |
|---|---|---|---|
| MIN | 1, 2, 3, 5, 10, 15, 20, 25, 30 | $7.60 | $64.00 |

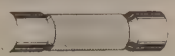
### SIGNAL OR VISUAL INDICATING FUSES

MIC fuses have silver-plated indicating pin. Pin may be used as visual indicator or may be used to actuate a signal. MIJ fuses are similar to MIC types except they have been specially designed for complex circuitry as in computers. Voltage, 250 except 20 amps and over which are 32 V.

| Buss No. | Amperes | Net Price For Ten | 100 |
|---|---|---|---|
| MIC | 1, 2, 3, 5, 10, 15, 20, 25, 30 | $8.50 | $71.00 |
| MIJ | 1, 2, 3, 5, 10, 15, 20, 25, 30 | 9.90 | 83.00 |

## 13/32 x 1-1/2 inch FUSES

### HIGH INTERRUPTING CAPACITY FUSES



Type KTK — For use on circuits as high as 100,000 amps and sand filler surrounding a silver fuse at 600 volts or less, AC only. Glass fiber melamine tubes element. Amperes: 1/10, 1/8, 2/10, 1/4, 3/10, 1/2, 3/4, 1, 1-1/2, 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 25, 30. Lot of 10, Net $18.40. Lot of 100, Net $153.00.

## 13/32 x 1-1/2 inch FUSES

### FUSETRON FIBER TUBE FUSES

Dual-element slow-blowing type, 13/32" x 1-1/2" overall. Fuse link operates only on very high overloads or short circuits; thermal cutout functions on low overloads (cannot operate quickly on any overload, thus providing longer time lag). Carry 110%, open at 135% in 1 hour. 125 and 250 volt sizes U/L Approved.

| Buss No. | Amperes | Volts | Net Price For Ten | 100 |
|---|---|---|---|---|
| FNM | 1/10, 15/100, 2/10, 3/10, 4/10, 1/2, 6/10, 8/10, 1, 1-1/8, 1-1/4, 1-4/10, 1-6/10, 1-8/10, 2, 2-1/4, 2-1/2, 2-8/10, 3-2/10, 3-1/2, 4, 4-1/2, 5, 5-6/10, 6-1/4, 7, 8, 9, 10 | 250 | $7.20 | $60.00 |
| FNM | 12, 15 | 125 | 7.10 | 59.00 |
| FNM | 20, 25, 30 | 32 | 7.10 | 59.00 |

Same as series FNM above, except glass tube instead of fibre tube.

| Buss No. | Amperes | Volts | Net Price For Ten | 100 |
|---|---|---|---|---|
| MDR | 1/10, 15/100, 2/10, 3/10, 4/10, 1/2, 6/10, 8/10 | 250 | $7.20 | $60.00 |
| MDR | 1, 1/2, 1-6/10 | 125 | 7.20 | 60.00 |
| MDR | 2-1/2, 3, 3-2/10, 4, 5, 6-1/4, 8, 10, 15, 20 | 32 | 5.80 | 48.00 |
| MDR | 25, 30, 35, 40 | 32 | 6.40 | 53.00 |

## 13/32 x 1-1/2 inch FUSES

### INDICATING FUSETRON FUSES

Similar to FNM types. Indicating pin extends from fuse when fuse blows. Use in signal fuse block or HPC-C fuseholder (larger than 10 amps units cannot be used in HPC-C). U/L Approved in 0-15 amp sizes.

| Buss No. | Amperes | Net Price For Ten | 100 |
|---|---|---|---|
| FNA | 1/10, 15/100, 2/10, 3/10, 4/10, 1/2, 6/10, 8/10, 1, 1-1/8, 1-1/4,1-4/10, 1-6/10, 1-8/10, 2, 2-1/4, 2-1/2, 2-8/10, 3, 3-2/10, 3-1/2, 4, 4-1/2, 5, 5-6/10, 6, 6-1/4, 7, 8, 10 | $13.40 | $111.00 |
| FNA | 12, 15, 20, 25, 30 | 15.00 | 124.00 |

## TYPE C AND N FUSES, HOLDERS

C. N HC, HN

Matched glass fuses and fuseholders for specific size ranges. Type N fuses are dual-element time-delay or slow-blowing type. 0 to 1-1/4 amp sizes, 1/4" x 1-1/4"; 1-3/10 to 7 amp sizes, 1/4" x 1-7/16". Type C fuses are single-element quick-blowing type. 0 to 3-1/2 amp sizes, 1/4" x 1-1/16"; 3-6/10 to 10 amp sizes, 1/4" x 1-1/4". Holders rated at 250 volts.

### TYPE N FUSES

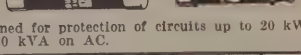
| Amperes | Holder No. HN- | Volts | Net Price For Five | 100 |
|---|---|---|---|---|
| 1/100, 1/32 | 0 to 3/10 | 250 | $1.75 | $29.00 |
| 1/16, 1/10, 15/100, 2/10, 1/4, 3/10 | 0 to 3/10 | 250 | 1.75 | 29.00 |
| 4/10 | 3/10 to 1/2 | 250 | 1.75 | 29.00 |
| 1/2 | 3/10 to 1/2 | 250 | 1.75 | 29.00 |
| 6/10 | 1/2 to 3/4 | 250 | 1.75 | 29.00 |
| 7/10, 3/4 | 1/2 to 3/4 | 250 | 1.75 | 29.00 |
| 8/10, 1 | 3/4 to 1-1/4 | 250 | 1.75 | 29.00 |
| 1-1/4 | 3/4 to 1-1/4 | 250 | 1.75 | 29.00 |
| 1-6/10 | 1-3/10 to | 125 | 1.75 | 29.00 |
| 1-3/4 | 1-3/4 | 125 | 1.75 | 29.00 |
| 2 | 1-3/4 to 2-1/2 | 125 | 1.75 | 29.00 |
| 2-1/2 | 1-3/4 to 2-1/2 | 125 | 1.75 | 29.00 |
| 2-8/10 | 2-1/2 to 3-1/2 | 125 | 1.75 | 29.00 |
| 3-2/10 | 2-1/2 to 3-1/2 | 125 | 1.75 | 29.00 |
| 3-1/2 | 2-1/2 to 3-1/2 | 125 | 1.75 | 29.00 |
| 4 | 3-1/2 to 5 | 125 | 1.75 | 29.00 |
| 5 | 3-1/2 to 5 | 125 | 1.75 | 29.00 |
| 6-1/4 | 5 to 7 | 125 | 1.75 | 29.00 |
| 7 | 5 to 7 | 125 | 1.75 | 29.00 |

### TYPE C FUSES

| Amperes | Holder No. HC- | Volts | Net Price For Five | 100 |
|---|---|---|---|---|
| 1/32 | 0 to 3/10 | 250 | $4.00 | $66.00 |
| 1/16 | 0 to 3/10 | 250 | 2.60 | 43.00 |
| 1/8, 3/16 | 0 to 3/10 | 250 | 2.10 | 35.00 |
| 1/4 | 0 to 3/10 | 250 | 1.65 | 27.00 |
| 3/10 | 0 to 3/10 | 250 | 1.65 | 27.00 |
| 3/ | 3/10 to 1/2 | 250 | 1.65 | 27.00 |
| 1/2 | 3/10 to 1/2 | 250 | 1.65 | 27.00 |
| 3/4 | 1/2 to 3/4 | 250 | 1.65 | 27.00 |
| 1 | 3/4 to 1-1/4 | 250 | 1.00 | 16.00 |
| 1-1/4 | 3/4 to 1-1/4 | 250 | 1.00 | 16.00 |
| 1-1/2 | 1-1/4 to 1-3/4 | 250 | 1.00 | 16.00 |
| 1-3/4 | 1-1/4 to 1-3/4 | 250 | 1.00 | 16.00 |
| 2 | 1-3/4 to 2-1/2 | 250 | 1.00 | 16.00 |
| 2-1/2 | 1-3/4 to 2-1/2 | 250 | 1.00 | 16.00 |
| 3 | 2-1/2 to 3-1/2 | 250 | 1.00 | 16.00 |
| 3-1/2 | 2-1/2 to 3-1/2 | 250 | 1.00 | 17.00 |
| 4 | 3-6/10 to 5 | 250 | 1.00 | 17.00 |
| 5 | 3-6/10 to 5 | 250 | 1.00 | 17.00 |
| 6 | 5 to 7 | 250 | 1.00 | 17.00 |
| 7 | 5 to 7 | 250 | 1.00 | 17.00 |
| 8 | 7 to 10 | 250 | 1.75 | 29.00 |
| 10 | 7 to 10 | 250 | 1.75 | 29.00 |

Type HC and Type HN Fuseholders — All sizes (specify). Net for 10 $3.80. Net for 100 $32.00.

## HIGH VOLTAGE FUSES



Designed for protection of circuits up to 20 kW on DC and 30 kVA on AC.

| Buss No. | Amperes | Volts | Net Price For Ten | 100 |
|---|---|---|---|---|
| HVA | 3/8, 1/2, 3/4, 1, 1-1/2, 2 | 1000 | $5.80 | $48.00 |
| HVB | 1/2, 3/4, 1, 1-1/2, 2 | 2500 | 8.00 | 67.00 |
| HVJ | 1/16, 1/8, 1/4, 3/8, 1/2, 3/4, 1, 1-1/2, 2 | 5000 | 14.90 | 124.00 |
| HVL | 1/16, 1/8, 1/4, 3/8, 1/2, 3/4, 1, 1-1/2, 2 | 10K | 28.40 | 235.00 |

# fuses and holders

**bussmann manufacturing division**
**McGraw Edison Company**
**DEPT. EM 502 Earth City Plaza**
**P.O. Box 14460**
**St. Louis, Mo. 63178, (314) 739-9600**

## SFE STANDARD FUSES

Different amperages are different lengths, making it impossible to over-fuse. Glass tube, 1/4" dia. Carry 110%, open at 135% in 1 hour. Made to SAE specifications and U/L Approved. 32 volts or less.

| Buss No. | Amperes | Length In. | Net Price For Five | Net Price For 100 |
|---|---|---|---|---|
| SFE | 4 | 5/8 | $0.49 | $8.10 |
| SFE | 6 | 3/4 | .49 | 8.10 |
| SFE | 7-1/2, 9 | 7/8 | .49 | 8.10 |
| SFE | 14 | 1-1/16 | .47 | 7.80 |
| SFE | 20 | 1-1/4 | .47 | 7.80 |
| SFE | 30 | 1-7/16 | .65 | 11.00 |

## SIGNAL-INDICATING ALARM ACTIVATING TYPE UNIT

Takes only 1/4" x 1-15/32" space. Color indicator. Rated 300 V or less; 100% for 10 min.; open at 150% within 5 min.

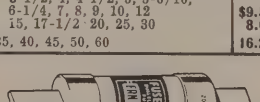
| Buss No. | Amperes and Color of Indicator | Net Price For Ten | Net Price For 100 |
|---|---|---|---|
| GMT | 18/100*, 1/4†, 1/2‡, 35/100§, 3/4#, 1●, 1-1/3△, 2□, 3◀, 5∞, 7-1/2♦, 10** | $8.40 | $70.00 |
| HLT | Holder, fits all GMT | 8.80 | 74.00 |

**Color of Indicator:** *Yellow; †violet; ‡red; §black; #brown; •gray; △white; □orange; ◀blue; ∞green; ♦black-white; **red-white.

## FUSETRON DUAL-ELEMENT FUSES

Long time-lag prevents useless shut-downs caused by ordinary fuses opening on starting currents or other harmless overloads, yet protects against short-circuits. On normal installations will guard motors against burnout from overloads or single phasing. U/L Listed for motor running and circuit protection up to 250 volts.

| Buss No. | Amperes | Net Price For Ten | Net Price For 100 |
|---|---|---|---|
| FRN | 1/10, 15/100, 2/10, 3/10, 4/10, 1/2, 6/10, 8/10, 1, 1-1/8, 1-1/4, 1-4/10, 1-6/10, 1-8/10, 2, 2-1/4, 2-1/2, 2-8/10, 3-2/10, 3-1/2, 4, 4-1/2, 5, 5-6/10, 6-1/4, 7, 8, 9, 10, 12 | $9.50 | $79.00 |
| FRN | 15, 17-1/2, 20, 25, 30 | 8.60 | 72.00 |
| FRN | 35, 40, 45, 50, 60 | 16.20 | 134.00 |



| | | | |
|---|---|---|---|
| FRN | 70, 80, 90, 100 | $36.30 | $301.00 |

## BUSS ONE-TIME FUSES

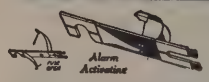
FAST ACTING FUSE

Get same care in engineering and manufacture as other BUSS products. Each can be depended upon to operate as intended under all service conditions. Carry U/L label. For voltage up to 250.

| Buss No. | Amperes | Net Price For Ten | Net Price For 100 |
|---|---|---|---|
| NON | 1, 3, 6, 10, 15, 20, 25, 30 | $2.60 | $21.00 |
| NON | 15, 20, 25, 30 | 2.70 | 22.00 |
| | 35, 40, 45, 50, 60 | 4.60 | 38.00 |

| | | | |
|---|---|---|---|
| NON | 70, 80, 90, 100 | $19.80 | $164.00 |

## GRASSHOPPER FUSES




Alarm activating and signal indicating. Length: 1-43/64", except 35D (1-5/8"), 35E (1-63/64").

| Buss No. | Amperes | Blowing Time Amp | Blowing Time Sec. | Net Price For Ten | Net Price For 100 |
|---|---|---|---|---|---|
| 35A* | 1-1/3# | 2 | 90 | $6.00 | $50.00 |
| 35B* | 1-1/3** | 2 | 90 | 6.00 | 50.00 |
| 35B* | 2** | 3 | 180 | 6.00 | 50.00 |
| 35C* | 2# | 3 | 180 | 6.00 | 50.00 |
| 35D* | 1-1/3** | 2 | 90 | 11.20 | 94.00 |
| 35E | 3** | 4 | 300 | 6.00 | 50.00 |
| 35F* | 1/2# | 3/4 | 9 | 6.00 | 50.00 |
| 35G* | 3** | 4-1/2 | 300 | 6.00 | 50.00 |
| 35H* | 5** | 6-1/2 | 300 | 6.00 | 50.00 |
| 35J† | 1/2# | 3/4 | 90 | 8.40 | 70.00 |
| 35K† | 1-1/3# | 2 | 180 | 11.20 | 94.00 |
| 35L† | 2# | 3 | 180 | 11.20 | 94.00 |
| 35M† | 3** | 4-1/2 | 300 | 10.40 | 86.00 |
| 35N† | 5** | 6-1/2 | 300 | 10.40 | 86.00 |
| 35P† | 3/4# | 1-1/8 | 90 | 8.00 | 67.00 |
| 35R* | 18/100# | .270 | 90 | 8.00 | 67.00 |
| 35S† | 1/4# | .375 | 90 | 8.40 | 70.00 |
| 35T* | 65/100# | 1.1 | 180 | 8.40 | 70.00 |

Volts: *90 or less. †160 or less. Mounting Screw: #No. 10. **No. 6.

## TRON RECTIFIER FUSES

**For Protection of Semiconductor Rectifiers and Similar Applications**

Especially designed for protection of semiconductor rectifiers, thyristors and other solid state devices. High interrupting capacity and very fast clearing to restrict let-through current and energy to very low values. Give safe short-circuit protection for systems with fault current to 200 kA at 600 volts or less. Carry 100%, open at 1000 secs between 150% and 180% of rating; open within 1 sec at 250% of rating.

### GBB SERIES

Size, 1-1/4" length x 1/4" diameter.

| Buss No. | Amperes | Max. Volts | Net Each |
|---|---|---|---|
| GBB | 1, 1-1/4, 2, 3, 4, 5, 6, 7, 8, 9, 10 | 130 | $1.26 |
| GBB | 12, 15, 20, 25, 30 | 65 | 1.26 |

### KAA SERIES

Size, 1-1/2" length x 13/32" diameter. Also available up to 1000 amps; prices on request.

| | | | |
|---|---|---|---|
| KAA | 1/2, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 20, 25, 30 | 130 | $1.67 |

### KAW SERIES

Size, 1-1/2" length x 13/32" diameter.

| | | | |
|---|---|---|---|
| KAW | 1, 2, 3, 4, 5, 7, 8, 10, 12, 15, 20, 25, 30 | 130 | $1.71 |

### KAB SERIES

Size, 9/16" diameter x 2" length, values to 30 amps; 1-7/32" diameter x 3-1/8" length, 70 amps to 200 amps. Also available up to 800 amps; prices on request.

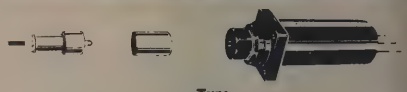
| | | | |
|---|---|---|---|
| KAB | 1/2, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 17-1/2, 20, 25, 30 | 250 | $1.90 |
| KAB | 70, 80, 90, 100, 150, 200 | 250 | 8.53 |

### KAC SERIES

Size, 2-7/8" length x 9/16" diameter. Also available up to 800 amps; prices on request.

| | | | |
|---|---|---|---|
| KAC | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 17-1/2, 20, 25, 30 | 600 | $2.80 |

## SERIES 70 FUSE



Type HWG*

**SIGNAL-INDICATING • ALARM-ACTIVATING**

For use in telephone and similar applications. Color code indicating pin extends from end when fuse opens. Glass tube construction. Rated 300V.

| Buss No. | Amperes | Net Price For Ten | Net Price For 100 |
|---|---|---|---|
| 70E | 18/100 | $13.60 | $113.00 |
| 70X | 2/10 | 13.60 | 113.00 |
| 70F | 1/4 | 10.80 | 90.00 |
| 70K | 1/4 | 13.60 | 113.00 |
| 70G | 1/2 | 10.80 | 90.00 |
| 70H | 3/4 | 10.80 | 90.00 |
| 70J | 3-1/3 | 10.80 | 90.00 |
| GKB | 1 | 14.20 | 118.00 |
| 70A | 1-1/3 | 10.80 | 90.00 |
| 70B | 2 | 10.80 | 90.00 |
| 70C | 3 | 10.80 | 90.00 |
| 70D | 5 | 10.80 | 90.00 |
| 71A | 6 | 10.80 | 90.00 |
| 70M | 8 | 12.40 | 103.00 |
| GKB | 10 | 12.40 | 103.00 |

*HWG holder fits all Series 70 fuses. Rated 15A, 300V. Net Each .... $1.92

## BLOCKS FOR TRON RECTIFIER FUSES

| Buss No. | No. Poles | For Fuse* Symbol | Amp. | Base Size In. | Net Each |
|---|---|---|---|---|---|
| 4515 | 1 | KAA | | 3/4 x 2-9/16 | $1.07 |
| 4525 | 2 | or | 1 to 30 | 1-5/16 x 2-9/16 | 2.08 |
| 4535 | 3 | KAW | | 2-1/16 x 2-9/16 | 3.05 |
| 4386 | 1 | | | 3/4 x 3-1/4 | 1.59 |
| 4287 | 2 | KAB | 1 to 30 | 2 x 3-1/2 | 3.05 |
| 3959 | 3 | | | 3 x 3-1/2 | 4.79 |
| 3556 | 1 | KAB | 70 to 100 | 1-1/2 x 3-1/8 | 3.47 |
| 3521 | 3 | | | 5-23/32 x 3-1/8 | 10.40 |
| 3595 | 1 | | | 1-1/4 x 3-1/2 | 2.56 |
| 3528 | 2 | KAC | 1 to 30 | 2-1/2 x 3-1/2 | 5.05 |
| 2795 | 3 | | | 3-1/2 x 3-1/2 | 7.59 |

*GBB series — use any BUSS block for 1/4" x 1-1/4" fuse.

## BLOCKS FOR 1/4 x 1 inch FUSES

**No. 4520** — 1 pole, small bakelite base, solder terminals. Spring bronze albaloy plated clips. Base dimensions, .500 x 1.375 inches. Net Each .... $0.39

**No. 3992** — 1 pole, small bakelite base, one piece solder terminals and spring bronze albaloy plated clips. Base dimensions, .500 x 1.375 inches. Net Each .... $0.47

**No. 2698** — 1 pole, small bakelite base, ¼ in. quick-connect terminals, spring bronze albaloy plated clips. Base dimensions, .500 x 1.375 inches. Net Each .... $0.49

**No. 4399** — 1 pole, small bakelite base, screw terminals. Spring bronze albaloy plated clips. Base dimensions, .500 x 1.375 inches. Net Each .... $0.58

**bussmann manufacturing division**
**McGraw Edison Company**
**DEPT. EM 502 Earth City Plaza**
**P.O. Box 14460**
**St. Louis, Mo. 63178, (314) 739-9600**

# fuses and holders

## BLOCKS FOR 1/4 x 1-1/4 inch FUSES (cont'd)

**No. 4405** — 1 pole, small bakelite base, solder terminals. Spring bronze albaloy plated clips. Base dimensions, .500 x 1.625 inches. Net Each ... **$0.39**

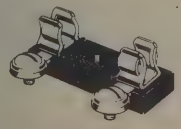
**No. 4406** — 1 pole, small bakelite base, side solder terminals. Spring bronze albaloy plated clips. Base dimensions, .500 x 1.625 inches. Net Each .. **$0.39**

**No. 4408** — 2 pole, small bakelite base, solder terminals. Spring bronze albaloy plated clips. Base dimensions, 1.000 x 1.625 inches. Net Each .... **$0.68**

**No. 2799** — 1 pole, small bakelite base, 3/16 in. quick-connect terminals. Beryllium copper albaloy plated clips. Base dimensions, .500 x 1.625 inches. Net Each .... **$0.75**

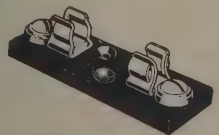
**No. 2841** — 1 pole, small bakelite base, 1/4 in. quick-connect terminals. Spring bronze albaloy plated clips. Base dimensions, .500 x 1.625 inches. Net Each .... **$0.49**

**No. 2839** — 1 pole, small bakelite base, 1/4 in. quick-connect terminals. Spring bronze albaloy plated clips. Base dimensions, .500 x 1.625 inches. Net Each .... **$0.49**



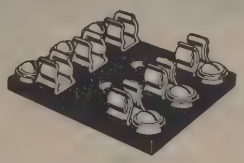
**No. 2958** — 1 pole, small bakelite base, screw side terminals. Spring bronze albaloy plated clips. Base dimensions, .500 x 1.625 inches. Net Each .... **$0.61**

**No. 4407** — 1 pole, small bakelite base, screw terminals. Spring bronze albaloy plated clips. Base dimensions, .500 x 1.652 inches. Net Each ... **$0.58**

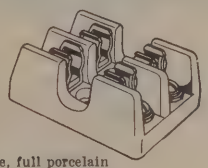


**No. 4512** — 1 pole, full bakelite base, screw terminals. Spring bronze albaloy plated clips. Base dimensions, .750 x 2.1875 inches. Net Each .... **$0.72**

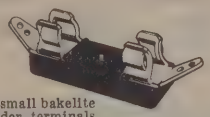
## BLOCKS FOR 1/4 x 1-1/4 inch FUSES (cont'd)



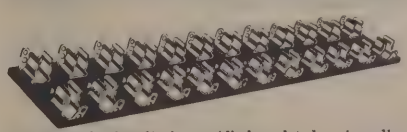
**No. 4532** — 3 pole, full bakelite base, screw terminals. Spring bronze albaloy plated clips. Base dimensions, 1.6875 x 2.1875 inches. Net Each .... **$2.13**



**No. 4161** — 2 pole, full porcelain base with side barriers, screw terminals. Spring bronze albaloy plated clips. Base dimensions, 1.3125 x 2.2500 inches. Net Each ... **$1.65**



**No. 3998** — 1 pole, small bakelite base, one piece solder terminals and suring bronze albaloy plated clips. Base dimensions, .500 x 1.625 inches. Net Each .... **$0.39**

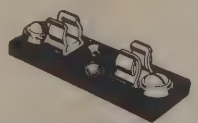


Molded black phenolic base; Albaloy plated spring clips for strong grip, high corrosion resistance. * x 1-5/8", 3823 Series.

| Buss No. | No. Poles | Base Size* In. | Net Each |
|---|---|---|---|
| 3823-1 | 1 | 1/2 | $0.37 |
| 3823-2 | 2 | 1-1/8 | .60 |
| 3823-3 | 3 | 1-3/4 | .99 |
| 3823-4 | 4 | 2-3/8 | 1.22 |
| 3823-5 | 5 | 3 | 1.51 |
| 3823-6 | 6 | 3-5/8 | 1.77 |
| 3823-7 | 7 | 4-1/4 | 2.00 |
| 3823-8 | 8 | 4-7/8 | 2.27 |
| 3823-9 | 9 | 5-1/2 | 2.58 |
| 3823-10 | 10 | 6-1/8 | 2.85 |
| 3823-11 | 11 | 6-3/4 | 3.14 |
| 3823-12 | 12 | 7-3/8 | 3.45 |

## BLOCKS FOR 13/32 x 1-1/2 inch FUSES

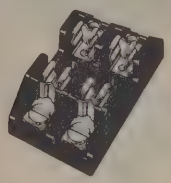
**No. 4421** — 1 pole, small bakelite base, solder terminals. Beryllium copper silver plated clips. Base dimensions, .6250 x 2.3125 inches. Net Each .... **$0.83**



**No. 4515** — 1 pole, full bakelite base, screw terminals. Beryllium copper silver plated clips. Base dimensions, .7500 x 2.5625 inches. Net Each .... **$1.07**

**No. 2807** — 1 pole, molded phenolic base with side barriers, screw terminals. Spring bronze albaloy plated clips. Base dimensions, .859 x 3.000 inches. Net Each .... **$1.09**

## BLOCKS FOR 13/32 x 1-1/2 inch FUSES (cont'd)



**No. 2808** — 2 pole, molded phenolic base with side barriers, screw terminals. Spring bronze albaloy plated clips. Base Dimensions, 1.625 x 3.000 inches. Net Each .. **$1.77**

**Add-On Fuse Block** — Each pole locks into each other. New poles can be added at any time, each has end barrier. Net Each .... **$0.25**
**No. 3742** Specify End Barrier Only. Net Each .... **$1.65**
**No. 3743** Specify One-Pole Only — Base dimensions, .787 x2.562 inches. Marking strip in 50 inch lengths. 3723 marking strip. Net Each .... **$0.76**

## TRON FUSE CLIPS FOR P.C. BOARDS

For ¼" diameter fuses — offer economical way to mount fuses on printed circuit boards. Clips with two tabs, especially bowed that snap in P.C. board to hold clip firmly while being wane soldered, eliminates riveting. Clips available with end stops and single tabs.

| BUSS No. | No. Tabs | Clip Material | Clip Finish | Net Each |
|---|---|---|---|---|
| IA1310-05 | 1 | Beryllium Copper | Tin | $0.187 |
| IA0581-01 | 1 | Spring Bronze | Albaloy | .187 |
| IA0581-05 | 1 | Beryllium Copper | Tin | .187 |
| IA1119-05 | 2 | Beryllium Copper | Silver | .14 |
| IA1119-10 | 2 | Spring Bronze | Albaloy | .081 |
| IA1120-05 | 2 | Beryllium Copper | Silver | .14 |
| IA1120-10 | 2 | Spring Bronze | Albaloy | .13 |

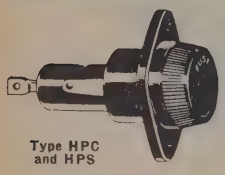
## BUSS FUSE CLIPS

| Buss No. | Description | For Dia Fuse In. | Net Each |
|---|---|---|---|
| 3434 | Insulated Twin Clip | 1/4 | $0.31 |
| 5681-15 | Clip | 1/4 | .056 |
| 5678-14 | Clip and Terminal | 1/4 | .07 |
| 4431 | Clip Assembly | 1/4 | .17 |
| 4432 | Clip Assembly | 1/4 | .21 |
| 5682-01 | Clip | 1/4 | .10 |
| 5682-41 | Clip | 1/4 | .052 |
| 5682-44 | Clip | 1/4 | .052 |
| 4567 | Clip Assembly | 1/4 | .17 |
| 4583 | Clip Assembly | 1/4 | .20 |
| 5682-02 | Clip | 1/4 | .10 |
| 5672-11 | Clip | 9/32 | .086 |
| 5674-41 | Clip | 9/32 | .086 |
| 4560 | Clip Assembly | 9/32 | .29 |
| 4585 | Clip Assembly | 9/32 | .39 |
| 5674-01 | Clip | 9/32 | .17 |
| 5956-16 | Clip | 13/32 | .086 |
| 5960-61 | Clip | 13/32 | .11 |
| 5960-07 | Clip | 13/32 | .28 |
| 5960-63 | Clip | 13/32 | .11 |
| 4561 | Clip Assembly | 13/32 | .29 |
| 4586 | Clip Assembly | 13/32 | .48 |
| 5960-09 | Clip | 13/32 | .28 |

**bussmann manufacturing division**
**McGraw Edison Company**
**DEPT. EM 502 Earth City Plaza**
**P.O. Box 14460**
**St. Louis, Mo. 63178, (314) 739-9600**

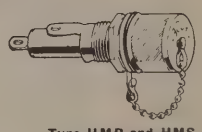
# BUSS FUSEHOLDERS

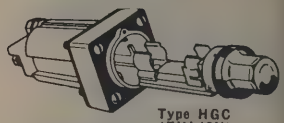
Carton Quantity 10 on all Fuseholders

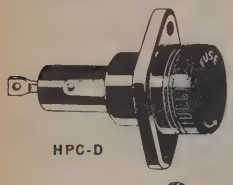

Type HPC and HPS

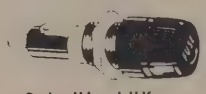
Type HC and HN

Type HKL

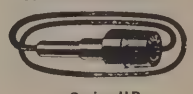

Type HMR and HMS

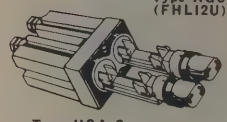

Type HGC (FHLI2U)

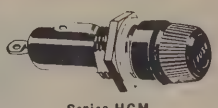

HPC-D


Series HJ and HK

Type HKA


Series HR

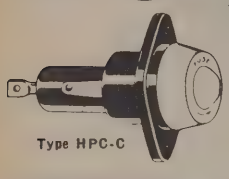

Type HGA-C (FHLI0U)

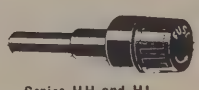

Series HCM

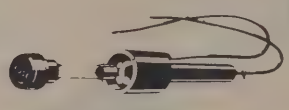
Type HLD No. 5487

Type HTA

Type HPG and HPL-B


Type HPC-C


Series HH and HI


Type HLQ and HLR

*VOLTAGE: On lamp indicating holders shows operating range for lamp indication. On non-indicating holders shows maximum voltage of fuses commercially available that will fit holders.

## NON-INDICATING FOR 1/4 x 1 inch FUSES

| Buss No. | Type Mounting | *Fuse Voltage | Current Capacity | Net Each |
|---|---|---|---|---|
| HDI-A or -B | In-line | 250 or less | 15A | $0.31 |
| HHI-A or -B | In-line | 250 or less | 15A | .45 |
| HJM | Panel | 125 or less | 30A | .72 |
| HJM-CC | Panel | 125 or less | 30A | .72 |
| HJM-H | Panel | 125 or less | 30A | .80 |
| 9969 | Spring nut for panel mounting in-line holder | | | .058 |

## LAMP-INDICATING FOR 1/4 x 1 inch FUSES

| Buss No. | Type Mounting | *Fuse Voltage | Current Capacity | Net Each |
|---|---|---|---|---|
| HJL | Panel | 100 to 250 | 20A | $3.26 |

## SHIELDED NON-INDICATING FOR 1/4 x 1 inch FUSES

| Buss No. | Type Mounting | *Fuse Voltage | Current Capacity | Net Each |
|---|---|---|---|---|
| HMS | Panel | 250 or less | 30A | $8.48 |

## SHIELDED NON-INDICATING FOR 1/4 x 1-1/4 INCH FUSES

| Buss No. | Type Mounting | *Fuse Voltage | Current Capacity | Net Each |
|---|---|---|---|---|
| HMR | Panel | 250 or less | 30A | $8.48 |

## SIGNAL ACTIVATING-LAMP INDICATING FOR 1/4 x 1-1/4 inch INDICATING FUSES

| Buss No. | Type Mounting | *Fuse Voltage | Current Capacity | Net Each |
|---|---|---|---|---|
| HKA | Panel | 125 or less | 5A | $7.05 |

## LAMP INDICATING FOR 1/4 x 1-1/4 inch FUSES

| Buss No. | Type Mounting | *Fuse Voltage | Current Capacity | Net Each |
|---|---|---|---|---|
| HGA | Panel | 100 to 250 | 30A | $9.16 |
| HGA-C | Panel | 100 to 250 | 30A | 10.11 |
| HGB | Panel | 100 to 250 | 30A | 7.73 |
| HGB-C | Panel | 100 to 250 | 30A | 8.50 |
| HKL | Panel | 100 to 250 | 20A | 3.16 |
| HKL-X | Panel | 100 to 250 | 20A | 3.16 |
| HKR | Panel | 24 to 32 | 20A | 5.10 |
| HKT | Panel | 10 to 14 | 20A | 5.10 |
| HKU | Panel | 4 to 6 | 20A | 5.10 |
| HKX | Panel | 24 to 32 | 20A | 5.10 |

## VISUAL INDICATING FOR 1/4 x 1-1/4 inch FUSES

| Buss No. | Type Mounting | *Fuse Voltage | Current Capacity | Net Each |
|---|---|---|---|---|
| HLD | Panel | 125 or less | 30A | $0.85 |
| 5487 | Knob assembly for HLD holder | | | .43 |

## NON-INDICATING FOR 1/4 x 1-1/4 inch FUSES

| Buss No. | Type Mounting | *Fuse Voltage | Current Capacity | Net Each |
|---|---|---|---|---|
| HCM | Panel | 250 or less | 18A | $1.11 |
| HCM-H | Panel | 250 or less | 18A | 1.17 |
| HDJ-A or -B | In-line | 250 or less | 15A | .31 |
| HHJ-A or -B | In-line | 250 or less | 15A | .45 |
| HKP | Panel | 250 or less | 30A | .72 |
| HKP-CC | Panel | 250 or less | 30A | .72 |
| HKP-H | Panel | 250 or less | 30A | .78 |
| HKP-HH | HKP 1-4 in quick-connect term | | | .85 |
| HLF | Panel | 250 or less | 30A | .72 |
| HMB | Panel | 250 or less | 30A | .72 |
| HMJ | HDJ holder w/SFE 20 fuse & wire leads | | | .58 |
| HRJ | HHJ holder w/SFE 20 fuse & wire leads | | | .74 |
| HTA | Panel | 250 or less | 15A | .72 |
| HTA-DD | HTA w/3/16 in. quick-connect term. | | | .85 |
| HTA-HH | HTA w/1/4 in. quick-connect term. | | | .85 |
| 9969 | Spring nut for panel mounting in-line holders | | | .058 |

## NON-INDICATING FOR 9/32 x 1-1/4 inch FUSES

| Buss No. | Type Mounting | *Fuse Voltage | Current Capacity | Net Each |
|---|---|---|---|---|
| HCM | Panel | 250 or less | 18A | $1.11 |
| HCM-H | Panel | 250 or less | 18A | 1.17 |

## NON-INDICATING FOR 13/32 x 1-3/8 inch FUSES

| Buss No. | Type Mounting | *Fuse Voltage | Current Capacity | Net Each |
|---|---|---|---|---|
| HPC-L | Panel | 600 or less | 5A | $1.22 |

## NON-INDICATING FOR 13/32 x 1-1/2 inch FUSES

| Buss No. | Type Mounting | *Fuse Voltage | Current Capacity | Net Each |
|---|---|---|---|---|
| HPC | Panel | 250 or less | 30A | $1.22 |
| HPC-D | Panel | 250 or less | 30A | 2.46 |
| HPG | Panel | 600 or less | 30A | 1.28 |
| HPL-B | Panel | 600 or less | 30A | 3.47 |
| HPS | Panel | 600 or less | 30A | 1.22 |

## VISUAL INDICATING FOR 13/32 x 1-1/2 inch FUSES

| Buss No. | Type Mounting | *Fuse Voltage | Current Capacity | Net Each |
|---|---|---|---|---|
| HPC-C | Panel | 250 or less | 30A | $1.51 |

## LAMP INDICATING FOR 13/32 x 1-1/2 inch FUSES

| Buss No. | Type Mounting | *Fuse Voltage | Current Capacity | Net Each |
|---|---|---|---|---|
| HGC | Panel | 200 to 500 | 30A | $9.72 |

### OTHER STANDARD AND SPECIAL FUSES, BLOCKS AND HOLDERS

If the fuses, fuse blocks and holders shown do not fit your requirements ask for information on other types. Fuses and fuse mountings to meet JAN and Military specifications also available. If you have a special problem in protection, send description or sketch giving number of circuits, type of fuse, terminals, etc., desired. We welcome such inquiries.

bussmann manufacturing division
McGraw Edison Company
DEPT. EM 502 Earth City Plaza
P.O. Box 14460
St. Louis, Mo. 63178, (314) 739-9600

# military fuses and holders

| Military Type Designation | Nearest Buss Equiv. | Price Each |
|---|---|---|
| F01A250V1/500A S | AGX1/500 | $2.21* |
| F01A250V1/200A-S | AGX1/200 | .97* |
| F01A250V1/100A-S | AGX1/100 | .83* |
| F01A250V1/32A-S | AGX1/32 | .72* |
| F01A250V1/16A-S | AGX1/16 | .45* |
| F01A250V1/8A-S | AGX1/8 | .37* |
| F01A250V1/4A-S | AGX1/4 | .20* |
| F01A250V3/8A-S | AGX3/8 | .20* |
| F01A250V1/2A-S | AGX1/2 | .20* |
| F01A125V3/4A-S | AGX3/4 | .20* |
| F01A125V1A-S | AGX1 | .15* |
| F01A125V1-1/2A-S | AGX1-1/2 | .15* |
| F01A125V2A-S | AGX2 | .15* |
| F02A250V1/100A-S | AGC1/100 | .83* |
| F02A250V1/32A-S | AGC1/32 | .72* |
| F02A250V1/16A-S | AGC1/16 | .37* |
| F02A250V | AGC1/8 | .37* |
| F02A250V1/4A-S | AGC1/4 | .20* |
| F02A250V3/8A-S | AGC3/8 | .20* |
| F02A250V1/2A-S | AGC1/2 | .20* |
| F02A250V3/4A-S | AGC3/4 | .20* |
| F02A250V1A-S | AGC1 | .15* |
| F02A250V1-1/2A-S | AGC1-1/2 | .15* |
| F02A250V2A-S | AGC2 | .15* |
| F02A250V3A-S | AGC3 | .15* |
| F02A250V4A-S | MTH4 | .18* |
| F02A250V5A-S | MTH5 | .18* |
| F02A250V6A-S | MTH6 | .18* |
| F02A125V10A-S | GLH10 | .26* |
| F02A32V15A-S | AGC15 | .11* |
| F02A32V20A-S | AGC20 | .11* |
| F02B250V1/100A-S | MDL1/100 | .60* |
| F02B250V1/32A-S | MDL1/32 | .60* |
| F02B250V1/16A-S | MDL1/16 | .45* |
| F02B250V1/8A-S | MDL1/8 | .45* |
| F02B250V1/4A-S | MDL1/4 | .45* |
| F02B250V3/8A-S | MDL3/8 | .45* |
| F02B250V1/2A-S | MDL1/2 | .45* |
| F02B250V3/4A-S | MDL3/4 | .45* |
| F02B250V1A-S | MDL1 | .45* |
| F02B250V1-1/2A-S | MDX1-1/2 | .48* |
| F02B250V2A-S | MDX2 | .48* |
| F02B125V3A-S | MDX3 | .37* |
| F02B125V5A-S | MDX5 | .37* |
| F02B32V8A-S | MDL8 | .37* |
| F02B32V10A-S | MDL10 | .37* |
| F02B32V15A-S | MDL15 | .37* |
| F02B32V20A-S | MDL20 | .37* |
| F03A250V1A-S | ABC1 | .31* |
| F03A250V3A-S | ABC3 | .31* |
| F03A250V5A-S | ABC5 | .27* |
| F03A250V8A-S | ABC8 | .27* |
| F03A250V10A-S | ABC10 | .27* |
| F03A250V12A-S | ABC12 | .27* |
| F03A250V15A-S | ABC15 | .27* |
| F03A125V20A-S | ABC20 | .27* |
| F03A125V30A-S | ABC30 | .39* |
| F03B250V1/100A-S | MDA1/100 | .78* |
| F03B250V1/32A-S | MDA1/32 | .78 |
| F03B250V1/16A-S | MDA1/16 | .64* |
| F03B250V1/8A-S | MDA1/8 | .64* |
| F03B250V15/100A-S | MDA15/100 | .64* |
| F03B250V3/16A-S | MDA3/16 | .64* |
| F03B250V1/4A-S | MDA1/4 | $0.64* |
| F03B250V3/8A-S | MDA3/8 | .64* |
| F03B250V1/2A-S | MDA1/2 | .64* |
| F03B250V3/4A-S | MDA3/4 | .64* |
| F03B250V1A-S | MDA1 | .63* |
| F03B125V3A-S | MDA3 | .45* |
| F03B125V5A-S | MDA5 | .45* |
| F03B125V8A-S | MDA8 | .45* |
| F03B125V10A-S | MDA10 | .45* |
| F03B125V12A-S | MDA12 | .45* |
| F03B125V15A-S | MDA15 | .45* |
| F03B125V20A-S | MDA20 | .45* |
| F03B125V30A-S | MDA30 | .45* |
| F05A32V10A-S | AGS10 | .21* |
| F05A32V15A-S | AGS15 | .21* |
| F05A32V20A-S | AGS20 | .20* |
| F05A32V25A-S | AGS25 | .20* |
| F05A32V30A-S | AGS30 | .20* |
| F05B32V10A-S | MDM10 | .48* |
| F05B32V15A-S | MDM15 | .48* |
| F05B32V20A-S | MDM20 | .48* |
| F05B32V25A-S | MDM25 | .48* |
| F05B32V30A-S | MDM30 | .48* |
| F06A250V1A-S | ABS1 | .47* |
| F06A250V2A-S | ABS2 | .47* |
| F06A250V3A-S | ABS3 | .47* |
| F06A250V5A-S | ABS5 | .45* |
| F06A250V10A-S | ABS10 | .45* |
| F06A250V15A-S | ABS15 | .45* |
| F07A250V1A-S | AGU1 | .32* |
| F07A250V2A-S | AGU2 | .32* |
| F07A250V3A-S | AGU3 | .32* |
| F07A32V5A-S | AGU5 | .32* |
| F07A32V10A-S | AGU10 | .32* |
| F07A32V15A-S | AGU15 | .32* |
| F07A32V20A-S | AGU20 | .29* |
| F07A32V30A-S | AGU30 | 29* |
| F07B125V1A-S | MDR1 | .72* |
| F07B125V2A-S | MDR2 | .72* |
| F07B125V3A-S | MDR3 | .58* |
| F07B32V5A-S | MDR5 | .58* |
| F07B32V10A-S | MDR10 | .58* |
| F07B32V15A-S | MDR15 | .58* |
| F07B32V20A-S | MDR20 | .58* |
| F07B32V30A-S | MDR30 | .64* |
| F09A250V1A-S | BAN1 | .30 |
| F09A250V2A-S | BAN2 | .30 |
| F09A250V3A-S | BAN3 | .30 |
| F09A250V3-1/2A-S | BAN3-1/2 | .30 |
| F09A250V5A-S | BAN5 | .30 |
| F09A250V6A-S | BAN6 | .30 |
| F09A250V6-1/4A-S | BAN6-1/4 | .30 |
| F09A250V7A-S | BAN7 | .30 |
| F09A250V8A-S | BAN8 | .30 |
| F09A250V10A-S | BAN10 | .30 |
| F09A250V10A-S | BAN15 | .30 |
| F09A250V20A-S | BAN20 | .30 |
| F09A250V25A-S | BAN25 | .30 |
| F09A250V30A-S | BAN30 | .30 |
| F09B250V1/10A-S | FNM1/10 | .72 |
| F09B250V15/100A-S | FNM15/100 | .72 |
| F09B250V2/10A-S | FNM2/10 | .72 |
| F09B250V3/10A-S | FNM3/10 | .72 |

## BUSS FUSES LISTED UNDER MIL-F-15160D

Suffix S on Military type designation (e.g., F01A250V1/500A-S) indicates silver plating; if silver plating is not required, omit (e.g., F01A250V1/500A).

| Military Type Designation | Nearest Buss Equiv. | Price Each |
|---|---|---|
| F09B250V4/10A-S | FNM4/10 | $0.72 |
| F09B250V1/2A-S | FNM1/2 | .72 |
| F09B250V6/10A-S | FNM6/10 | .72 |
| F09B250V8/10A-S | FNM8/10 | .72 |
| F09B250V1A-S | FNM1 | .71 |
| F09B250V1-1/4A-S | FNM1-1/4 | .71 |
| F09B250V1-6/10A-S | FNM1-6/10 | .71 |
| F09B250V2A-S | FNM2 | .71 |
| F09B250V2-1/2A-S | FNM2-1/2 | .71 |
| F09B250V3-2/10A-S | FNM3-2/10 | .71 |
| F09B250V4A-S | FNM4 | .71 |
| F09B250V5A-S | FNM5 | 71 |
| F09B250V6-1/4A-S | FNM6-1/4 | .71 |
| F09B250V8A-S | FNM8 | .71 |
| F09B250V10A-S | FNM10 | .71 |
| F09B125V15A-S | FNM15 | .71 |
| F09B32V20A-S | FNM20 | .71 |
| F09B32V25A-S | FNM25 | .71 |
| F09B32V30A-S | FNM30 | .71 |
| F15A250V1A-S | NFA1 | .34 |
| F15A250V3A-S | NFA3 | .34 |
| F15A250V6A-S | NFA6 | .34 |
| F15A250V10A-S | NFA10 | .34 |
| F15A250V15A-S | NFA15 | .34 |
| F15A250V20A-S | NFA20 | .34 |
| F15A250V25A-S | NFA25 | .34 |
| F15A250V30A-S | NFA30 | .34 |
| F15B250V1A-S | FRN1 | .95 |
| F15B250V1-1/10A-S | FRN1-6/10 | .95 |
| F15B250V2A-S | FRN2 | .95 |
| F15B250V2-1/2A-S | FRN2-1/2 | .95 |
| F15B250V1-6/10A-S | FRN3-2/10 | .95 |
| F15B250V4A-S | FRN4 | .95 |
| F15B250V5A-S | FRN5 | 95 |
| F15B250V6-1/4A-S | FRN6-1/4 | .95 |
| F15B250V8A-S | FRN8 | .95 |
| F15B250V10A-S | FRN10 | .95 |
| F15B250V12A-S | FRN12 | .95 |
| F15B250V15A-S | FRN15 | .86 |
| F15B250V20A-S | FRN20 | .86 |
| F15B250V25A-S | FRN25 | .86 |
| F15B250V30A-S | FRN30 | .86 |
| F60C500V1/8A-S | KLM1/8 | 1.91 |
| F60C500V1/4A-S | KLM1/4 | 1.91 |
| F60C500V3/8A-S | KLM3/8 | 1.91 |
| F60C500V1/2A-S | KLM1/2 | 1.91 |
| F60C500V3/4A-S | KLM3/4 | 1.91 |
| F60C500V1A-S | KLM1 | 1.91 |
| F60C500V3A-S | KLM3 | 1.91 |
| F60C500V6A-S | KLM6 | 1.91 |
| F60C500V8A-S | KLM8 | 1.91 |
| F60C500V10A-S | KLM10 | 1.91 |
| F60C500V15A-S | KLM15 | 1.91 |
| F60C500V20A-S | KLM20 | 1.91 |
| F60C500V25A-S | KLM25 | 1.91 |
| F60C500V30A-S | KLM30 | 1.91 |

*Add $9.00 Stamping Charge and a minimum $10.00 per thousand Silver Plating Charge per item.

## INSTRUMENT TYPE FUSES LISTED UNDER MIL-F-23419A, DATED 19 DEC. 1966

| Part No. | Type Designation | Nearest Buss Equivalent | Price Each |
|---|---|---|---|
| M23419/1-001 | FM01 1/200A | GMU 1/200A | $1.54 |
| M23419/1-002 | FM01 1/100A | GMU 1/100A | 1.54 |
| M23419/1-003 | FM01 1/64A | GBU 1/64A | 1.54 |
| M23419/1-004 | FM01 1/32A | GMU 1/32A | 1.54 |
| M23419/1-005 | FM01 1/16A | GMU 1/16A | 1.54 |
| M23419 1-006 | FM01 1/10A | GMU 1/10A | 1.19 |
| M23419/1-007 | FM01 1/8A | GMU 1/8A | 1.19 |
| M23419/1-008 | FM01 2/10A | GMU 2/10A | 1.19 |
| M23419/1-009 | FM01 1/4A | GMU 1/4A | 1.19 |
| M23419/1-010 | FM01 3/10A | GMU 3/10A | 1.19 |
| M23419/1-011 | FM01 4/10A | GMU 4/10A | 1.19 |
| M23419/1-012 | FM01 1/2A | GMU 1/2A | 1.19 |
| M23419/1-013 | FM01 6/10A | GMU 6/10A | 1.19 |
| M23419/1-014 | FM01 3/4A | GMU 3/4A | 1.19 |
| M23419/1-015 | FM01 1A | GMU 1A | 1.19 |
| M23419/1-016 | FM01 1-1/2A | GMU 1-1/2A | 1.19 |
| M23419/1-017 | FM01 2A | GMU 2A | 1.19 |
| M23419/1-018 | FM01 3A | GMU 3A | 1.19 |
| M23419/1-019 | FM01 4A | GMU 4A | 1.19 |
| M23419/1-020 | FM01 5A | GMU 5A | 1.19 |
| M23419/1-021 | FM03 1/100 | — | 1.21 |
| M23419/1-022 | FM03 1/32 | — | 1.12 |
| M23419/1-023 | FM03 1/16 | — | .715 |
| M23419/1-024 | FM03 1/8 | — | .715 |
| M23419/1-024 | FM03 1/4 | — | .583 |
| M23419/1-025 | FM03 3/8 | — | .583 |
| M23419/1-026 | FM03 1/2 | — | .583 |
| M23419/1-027 | FM03 3/4 | — | .583 |
| M23419/1-028 | FM03 1 | — | .429 |
| M23419/1-029 | FM03 1-1/2 | — | .429 |
| M23419/1-030 | FM03 2 | — | .429 |
| M23419/1-031 | FM03 3 | — | .429 |
| M23419/1-032 | FM03 4 | — | .429 |
| M23419/1-033 | FM03 5 | — | .429 |
| M23419/1-034 | FM03 6 | — | .429 |
| M23419/1-035 | FM03 8 | — | .429 |
| M23419/1-036 | FM03 10 | — | .429 |
| M23419/1-037 | FM03 12 | — | .429 |
| M23419/1-038 | FM03 15 | — | .429 |
| M23419/1-039 | FM03 20 | — | .429 |
| M23419/1-040 | FM03 25 | — | .451 |

FM03 listed under MIL-F-23419B, 1/100 to 25 amps.

## OTHER BUSS MIL FUSES AND BLOCKS

Fuses to MIL-F-15160D also available in styles:

F10A, F11A, F14A, F14B, F15B, F16A, F16B, F19A, F19B, F20A, F20B, F21A, F21B, F22A, F22B, F27A, F28A, F29A, F30A, F36A, F36B, F37A, F37B, F38A, F39A, F39B, F40A, F40B, F50A, F61C, F62C, F63C, F64C, F65C, F66C, F77A.

Fuse Blocks to MIL-F-21346, Aircraft Limiters to MIL-F-5372C and Aircraft Blocks to MIL-F-5372C are also available.

## FUSE CLIPS LISTED MIL-F-21346 DATED 24 APRIL 1958

| | | |
|---|---|---|
| FC21AN | 5682-11 | $0.10 |
| FC21BN | 5674-10 | .17 |
| FC21CN | 5960-23 | .28 |
| FC22AN | 5678-05 | .17 |
| FC22CN | 5623-11 | .26 |

## BUSS FUSEHOLDERS LISTED UNDER MIL-F-19207B, DATED 31 AUG. 1966

Extractor post, blown fuse indicating and non-indicating types.

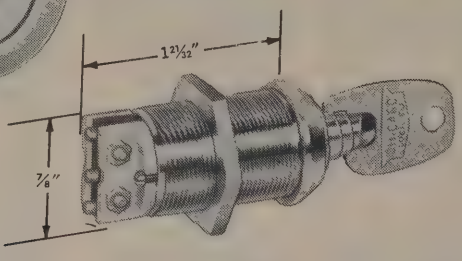
| Buss and Military Type Designation | Electrical Rating | Price Each, Lots of 1-99 | 100-499 | 500-999 |
|---|---|---|---|---|
| FHLI0U | 30A, 90-250V | $6.55 | $5.71 | — |
| FHLI1U | 30A, 90-250V | 5.28 | 4.39 | — |
| FHLI2U | 30A, 90-500V | 5.98 | 5.20 | — |
| FHLI7GI | 20A, 90-250V | 5.82 | 3.18 | $2.54 |
| FHLI8GI-1 | 20A, 12-22V | 5.95 | 4.96 | 3.97 |
| FHLI8GI-2 | 20A, 23-33V | 5.95 | 4.96 | 3.97 |
| FHLI8GI-3 | 20A, 34-45V | 5.95 | 4.96 | 3.97 |
| FHLI8GI-4 | 20A, 46-60V | 5.95 | 4.96 | 3.97 |
| FHLI8GI-5 | 20A, 61-80V | 5.95 | 4.96 | 3.97 |
| FHLI8GI-6 | 20A, 81-90V | 5.95 | 4.96 | 3.97 |
| FHLI8GI-7 | 20A, 2.5-4V | 5.95 | 4.96 | 3.97 |
| FHLI8GI-8 | 20A, 5-7V | 5.95 | 4.96 | 3.97 |
| FHLI8GI-9 | 20A, 8-12V | 5.95 | 4.96 | 3.97 |
| FHNI9G | 15A, 250V | 1.84 | 1.54 | 1.23 |
| FHN20G | | 2.08 | 1.74 | 1.39 |
| FHL22W | 20A, 250V | 2.71 | 2.26 | 1.80 |
| FHN23W | 30A, 250V | 3.16 | 2.64 | 2.11 |
| FHN26GI | 30A, 250V | 1.45 | 1.21 | .968 |
| FHL29G-1 | 30A, 12-22V | 8.61 | 7.47 | — |
| FHL29G-2 | 30A, 23-33V | 8.61 | 7.47 | — |
| FHL29G-3 | 30A, 34-45V | 8.61 | 7.47 | — |
| FHL29G-4 | 30A, 46-60V | 8.61 | 7.47 | — |
| FHL29G-5 | 30A, 61-80V | 8.61 | 7.47 | — |
| FHL29G-6 | 30A, 81-90V | 8.61 | 7.47 | — |
| FHL30G-1 | 30A, 12-22V | 8.86 | 7.39 | — |
| FHL30G-2 | 30A, 23-33V | 8.86 | 7.39 | — |
| FHL30G-3 | 30A, 34-45V | 8.86 | 7.39 | — |
| FHL30G-4 | 30A, 46-60V | 8.86 | 7.39 | — |
| FHL30G-5 | 30A, 61-80V | 8.86 | 7.39 | — |
| FHL30G-6 | 30A, 81-90V | 8.86 | 7.39 | — |
| FHN31GI | 5A, 250V | 1.65 | 1.38 | 1.10 |
| FHN42W | 5A, 125V | 1.72 | 1.43 | 1.14 |

†Lots 100 Up.

# Maximum Security Switch Locks for every application!

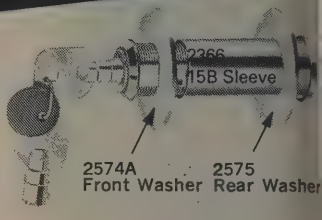
## ACE Switch Locks

**4900 Series** **Ace Locks**
**Underwriter's Listed** **20 tumblers**

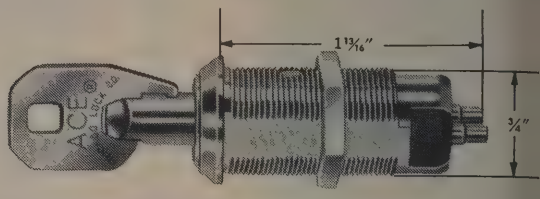



**No. 4902** — SPDT switch lock. Hardened steel cylinder mounted in a brass barrel 7/8" diameter; solder terminals, polished chrome finish. Furnished with micro-switch No. 11SM1.

**No. 4901—(not shown)** Same specs as 4902, except with adjustable sleeve and washers. Adjustable 1-7/8" to 3-3/4" thickness.

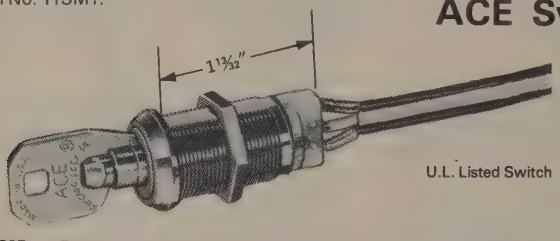



**No. 3039**—SPST switch with adjustable sleeve and washers; dependable wiping contacts. Solder terminals. Lock all brass construction, polished chrome finish. Key removable "off," "on" or "off-on." Also available in die cast outer barrel.



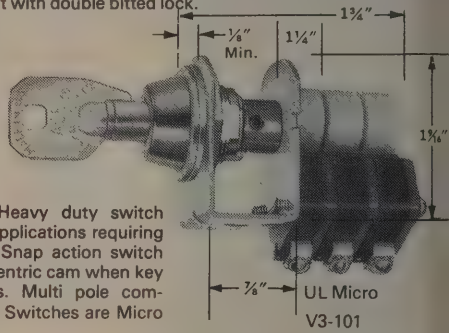

**No. 4073**—Maintaining contact switch. Key removable "off," "on" or "off-on". Also available as 4073-70 with momentary contact switch. All brass construction. Also offered with die cast outer barrel. No. 2274-80 same as 4073 except with double bitted lock.

## ACE Switch Locks




U.L. Listed Switch

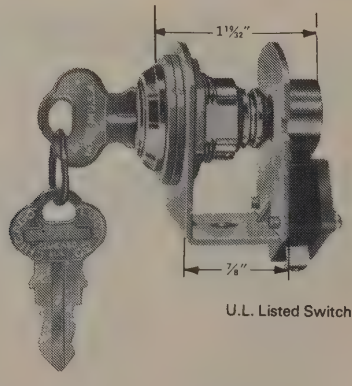
**No. 4235** — Easy to mount, UL Listed switch SPDT, available with silver plated contacts and 10" wire leads. Offered without 10" leads at reduced cost. Furnished with micro-switch 1SX1-H58.




U.L. Listed Switch

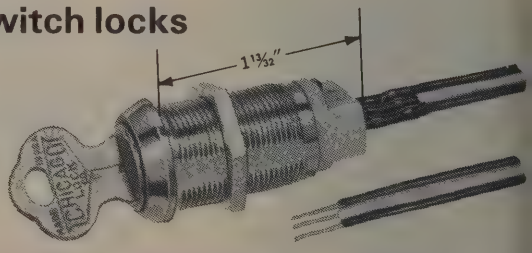
**No. EXA-112-3**—Heavy duty switch lock designed for applications requiring UL Listed switch. Snap action switch actuated by an eccentric cam when key turned 90 degrees. Multi pole combinations available. Switches are Micro No. V3-101.

## Chicago double bitted switch locks




**No. EXD-98**
Same as EXA-112, except with double bitted cylinder. Designed for high current applications. Multiple pole combinations available. Furnished with micro-switch V3-101.

U.L. Listed Switch




**No. 3535** — UL Listed switch, SPDT. Furnished with silver plated contacts and 10" wire leads. Same as 4235 except has double bitted cylinder. Available without 10" leads at reduced cost. Furnished with micro-switch 1SX1-H58.

**Current Ratings**
*125-250VAC, 5 AMP; 30 VDC, 3 AMP
*125-250VAC, 7 AMP; 28 VDC, 7 AMP
110-120VAC, 10 AMP; 10 VDC, 10 AMP

125 VDC, ½ AMP
125-250 VAC, 10 AMP
125-250 VAC — Over 10 AMP

**Lock Numbers**
4901, 4902
3535, 4235
2174, 2174-70,
3039, 4073,
4073-70

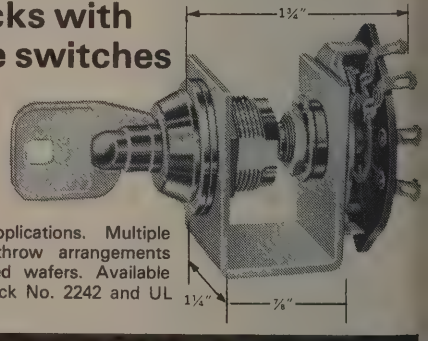
EXD-98, EXA-112†
EXD-98-25
EXD-112-25

**†When ordering, specify if for appliances requiring T.V. approved switches. Only available on EXD-98 or EXA-112 series.**

| CURRENT RATINGS for 4188, 2242 and 4903 | Voltage | AC amps Resistive | DC amps Resistive |
|---|---|---|---|
| | 6V | 5.5 | 5.5 |
| | 12V | 3.5 | 3.5 |
| | 24V | 1.75 | 1.55 |
| | 48V | .8 | .65 |
| | 115V | .23 | .21 |

***Silver plated contacts.**
**Also suited for low energy circuits.**

## Switch locks with wafer type switches




**No. 4188** — Key operated with bracket mounting and Ace cylinder. Switch designed for low voltage applications. Multiple poles and various throw arrangements available with stacked wafers. Available with double bitted lock No. 2242 and UL lock 4903.

CHICAGO LOCK CO.
4311 West Belmont Ave., Chicago, Illinois 60641
Phone 312-282-7177

# CARLINGSWITCH

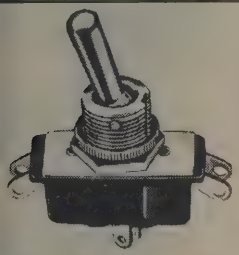
THE BIGGEST SINGLE NAME IN SWITCHES

## SINGLE POLE

Screw Terminals 15/32". Threaded Bushing, 15/32". Dia. Ball Toggle 3/8" long. Bat Toggle 11/16" long. U.L. Appd. Rubber toggle boots may be supplied on all toggle switches.

| Catalog No. | Rating | Toggle |
|---|---|---|
| 110-S-73 | 6A.-125V. | Bat |
| 110-S-23 | 6A.-125V. | Ball |
| 160-S-73 | 10A.-125V. | Bat |
| WIRE LEADS | | |
| 111-16-73 | 6A.-125V. | Bat |

6" Leads Stripped 1/2" 105C. TFF. Wire.

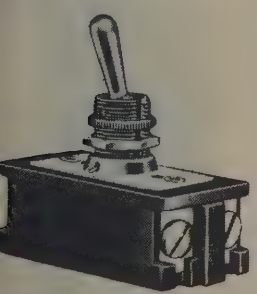


## SINGLE POLE — DOUBLE POLE

SOLDER LUGS 15/32"

Threaded Bushing 15/32" Dia. Bat Toggle 11/16" long. U.L. Appd. All Have 250V. Ratings.

| Catalog No. | Action | Rating |
|---|---|---|
| 110-73 | SP - ST | 6A.-125V. |
| 112-73 | SP - DT | 3A.-125V. |
| 216-73 | DP - ST | 3A.-125V. |
| 316-73 | DP - DT | 3A.-125V. |
| 2BB62-73 | SP - DT | 6A.-125V. |
| 2BK62-73 | DP - ST | 6A.-125V. |
| 2BL62-73 | DP - DT | 6A.-125V. |
| 160-73 | SP - ST | 10A.-125V. |



## SINGLE POLE DOUBLE POLE

Heavy Duty AC-DC Type. 15/32" Bushing. 11/16" Bat Toggle. All Have Horsepower Ratings.

| Catalog No. | RATINGS 125V. | RATINGS 250V. | Action |
|---|---|---|---|
| DA284* | 16A. | 8A. | DP - ST |
| DK284* | 16A. | 8A. | DP - ST |
| EA204† | 20A. | 10A. | SP - ST |
| EK204† | 20A. | 10A. | DP - ST |

* 1 HP 125-250V. rating.
† 1½ HP 125-250V. rating.

## SINGLE POLE

SCREW TERMINALS OR SOLDER LUGS.

Rated 15 Amps.* 125V. 10 Amps. 250VAC. 3/4 HP. 125-250V. AC. except SPST is 1 HP. Rated 15/32" Dia. Threaded Bushing 15/32" long. 11/16" Bat Toggle. U.L. Appd. Heavy Duty.

* Applicable to low voltage DC requirements.

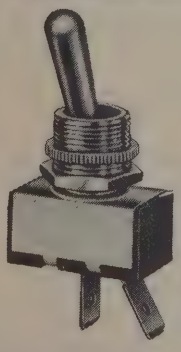
| Catalog No. | Terminals | Action |
|---|---|---|
| 2FA54-73 | Screw | SP - ST |
| 2FB54-73 | Screw | SP - DT |
| 2FC54-73 | Screw | SP - DT, Center Off |
| 2FA53-73 | Lugs | SP - ST |
| 2FB53-73 | Lugs | SP - DT |
| 2FC53-73 | Lugs | SP - DT, Center Off |

## MOMENTARY ACTION

SAME Specifications as above Except SPST. 3/4 HP. Rated.

SCREW TERMINALS

| Catalog No. | ACTION Up | ACTION Center | ACTION Down |
|---|---|---|---|
| SINGLE POLE SINGLE THROW | | | |
| 6FA54-73 | Off | None | Mom. On |
| 6FA58-73 | On | None | Mom. Off |
| SINGLE POLE DOUBLE THROW | | | |
| 6FB54-73 | On | None | Mom. On |
| 6FC54-73 | Mom. On | Off | Mom. On |
| 6FC58-73 | On | Off | Mom. On |



## SINGLE POLE

**20 AMP.**

20 Amp. 125 VAC
10 Amp. 250 VAC
1½ HP 125-250 VAC

| Catalog No. | Terminals | Toggle |
|---|---|---|
| CA204 | Screw | Nickel-Bat |

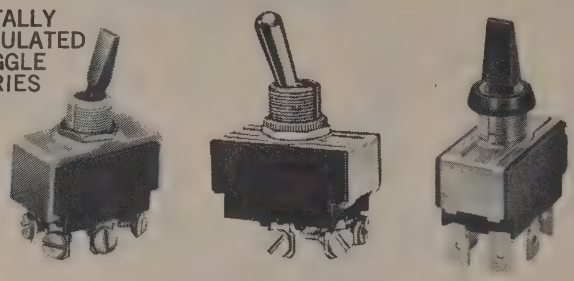
Also available SP - DT (ON-ON).
Optional Terminals: Solder Lug, .250 Spade, Wire Leads.

# CARLINGSWITCH

THE BIGGEST SINGLE NAME IN SWITCHES

## DOUBLE POLE

TOTALLY INSULATED TOGGLE SERIES



SCREW TERMINALS OR SOLDER LUGS

Rated 15 Amps.* 125V 10 Amps. 250V. AC. ¾ HP. 125-250V. AC. Threaded Bushing 15/32" Dia. Threaded Bushing 15/32" long. 11/16" Bat Toggle. U.L. Appd. Heavy Duty. New one piece decorator series nylon toggle available on single and double pole "G" Series switches. Consult factory for colors and toggle styles available on totally insulated series switches.

* Applicable to low voltage DC requirements.

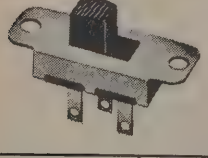
| Catalog No. | Terminals | Action |
|---|---|---|
| 2GK54-73 | Screw | DP - ST |
| 2GL54-73 | Screw | DP - DT |
| 2GM54-73 | Screw | DP - DT, Center Off |
| 2GK50-73 | Lugs | DP - ST |
| 2GL50-73 | Lugs | DP - DT |
| 2GM50-73 | Lugs | DP - DT, Center Off |

## MOMENTARY ACTION

Same Specifications As Above.

SCREW TERMINALS

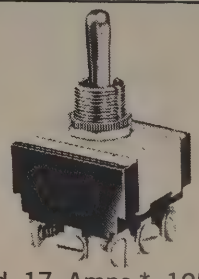
| Catalog No. | ACTION | | |
|---|---|---|---|
| | Up | Center | Down |
| DOUBLE POLE SINGLE THROW | | | |
| 6GK5E-73 | Off | None | Mom. On |
| 6GK5S-73 | On | None | Mom. Off |
| DOUBLE POLE DOUBLE THROW | | | |
| 6GL5E-73 | On | None | Mom. On |
| 6GM5S-73 | Mom. On | Off | Mom. On |
| 6GM5E-73 | On | Off | Mom. On |



## SLIDE SWITCHES

1⅛" Mounting Centers Single Poles Rated 4A 125V. AC.

| Catalog No. | Action | Terminals |
|---|---|---|
| S60A-BL | SP - ST | Solder Lugs 13/64" long |
| S60B-BL | SP - DT | Solder Lugs 13/64" long |



## THREE POLE SCREW TERMINALS

Rated 17 Amps.* 125V. AC. 12 Amps. 250V. AC. 1 HP. 1-2-3 Phase 120-600V. AC. 15/32" Dia. Bushing 15/32" long. 11/16" Bat Toggle.

* Applicable to low voltage DC requirements.

| Catalog No. | Action |
|---|---|
| HK274-73 | 3P - ST |
| HL274-73 | 3P - DT |
| HM274-73 | 3P - DT, Center Off |

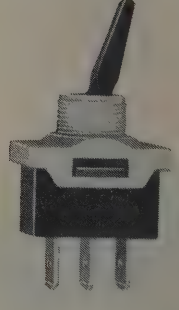
## FOUR POLE SCREW TERMINALS

The Four Pole Switch has the same physical appearance as the Three Pole Switch pictured above. Only dimensional difference is in the width when the Fourth pole is added.

Rating 15A. 125V. 10A. 250V. AC. 15/32" Dia. Bushing. 15/32" long. 11/16" Bat Toggle. Heavy Duty.

| Catalog No. | Action |
|---|---|
| 1K254-73 | 4P - ST |
| 1L254-73 | 4P - DT |
| 1M254-73 | 4P - DT, Center Off |

## TOTALLY INSULATED TOGGLE SERIES



Double-insulated nylon toggle series features patented wiping action contact assembly. Specify solder lugs, .250" tabs or wire leads.

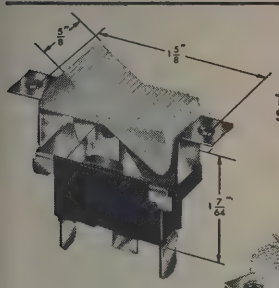
| Catalog No. | Circuit | Rating |
|---|---|---|
| DA 101-PB-B | SP-ST .250 Tabs | 10A 125V. AC<br>5A 250V. AC |
| DA 105-PB-B | SP-ST Wire Leads | 1½ H.P. 125-250V. AC |

Also available with SP-DT (ON-ON, ON-OFF-ON) and ratings of 20A 125V. AC, 10A 250V. AC, 1½ H.P. 125-250V. AC.

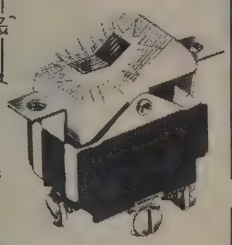
**CARLINGSWITCH, INC.** • 505 NEW PARK AVE. • WEST HARTFORD, CT. 06110 • TEL. (203) 233-5551

# CARLINGSWITCH

THE BIGGEST SINGLE NAME IN SWITCHES



TIL Series



LTIL Series

LTIL Series with snap-in bracket

Silicone seal available

## SWITCHES - TIPPETTE* LIGHTED - TIPPETTE

* Tippette is a Carling Trademark

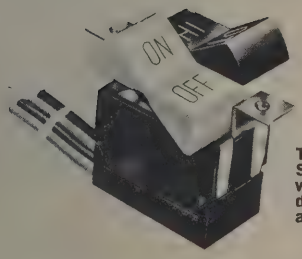
### TIL Series

| RATING 15A.-125V. AC† 10A.-250V. AC ¾ HP 125-250V. AC | | | | | | OPERATION AND CIRCUIT CHARACTERISTICS | | |
|---|---|---|---|---|---|---|---|---|
| SOLDER LUGS | .250 SPADE TERM. | .205 SPADE TERM. | .187 SPADE TERM. | SCREW TERM. | WIRE LEADS | Pos. #1 | Pos. #2 (Center) | Pos. #3 |
| | | | | | | SINGLE POLE SINGLE THROW | | |
| TILA50 | TILA51 | TILA52 | TILA53 | TILA54 | TILA55 | On | None | Off |
| TILA5A | TILA5B | TILA5C | TILA5D | TILA5E | TILA5F | Off | None | Mom. On |
| TILA5L | TILA5M | TILA5Q | TILA5R | TILA5S | TILA5T | On | None | Mom. Off |
| | | | | | | SINGLE POLE DOUBLE THROW | | |
| TILB50 | TILB51 | TILB52 | TILB53 | TILB54 | TILB55 | On | None | On |
| TILB5A | TILB5B | TILB5C | TILB5D | TILB5E | TILB5F | On | None | Mom. On |
| TILC50 | TILC51 | TILC52 | TILC53 | TILC54 | TILC55 | On | Off | On |
| TILC5A | TILC5B | TILC5C | TILC5D | TILC5E | TILC5F | On | Off | Mom. On |
| TILC5L | TILC5M | TILC5Q | TILC5R | TILC5S | TILC5T | Mom. On | Off | Mom. On |

### TIG Series (With ONE Tippette Lever)

| RATING 15A.-125V. AC† 10A.-250V. AC ¾ HP 125-250V. AC | | | | | | OPERATION AND CIRCUIT CHARACTERISTICS | | |
|---|---|---|---|---|---|---|---|---|
| SOLDER LUGS | .250 SPADE TERM. | .205 SPADE TERM. | .187 SPADE TERM. | SCREW TERM. | WIRE LEADS | Pos. #1 | Pos. #2 (Center) | Pos. #3 |
| | | | | | | DOUBLE POLE SINGLE THROW | | |
| TIGK50 | TIGK51 | TIGK52 | TIGK53 | TIGK54 | TIGK55 | On | None | Off |
| TIGK5A | TIGK5B | TIGK5C | TIGK5D | TIGK5E | TIGK5F | Off | None | Mom. On |
| TIGK5L | TIGK5M | TIGK5Q | TIGK5R | TIGK5S | TIGK5T | On | None | Mom. Off |
| | | | | | | DOUBLE POLE DOUBLE THROW | | |
| TIGL50 | TIGL51 | TIGL52 | TIGL53 | TIGL54 | TIGL55 | On | None | On |
| TIGL5A | TIGL5B | TIGL5C | TIGL5D | TIGL5E | TIGL5F | On | None | Mom. On |
| TIGM50 | TIGM51 | TIGM52 | TIGM53 | TIGM54 | TIGM55 | On | Off | On |
| TIGM5A | TIGM5B | TIGM5C | TIGM5D | TIGM5E | TIGM5F | On | Off | Mom. On |
| TIGM5L | TIGM5M | TIGM5Q | TIGM5R | TIGM5S | TIGM5T | Mom. On | Off | Mom. On |

* These switches are applicable to low voltage DC requirements.
Available in 3 and 4 Pole Series. For Lighted Tippette add Prefix "L" to above numbers.




TIG Series with double actuators

Standard Colors are WHITE, -WH and BLACK, -BL. Other colors available upon request.

Imprinting on Actuators may be had upon request.

**Brackets** — In addition to the illustrations shown, we offer a variety of brackets — offset, flat, angled, open ear, snap-in, etc. Specials can be made upon request. Snap-in style is designed for panel thickness of approximately .040″ to .100″. For mounting information and dimensions consult distributor. This model bracket is available on single, double and three pole Tippettes — Single and double pole lighted Tippettes. Narrow or wide bezels.

**LIGHTED TIPPETTE FEATURES**

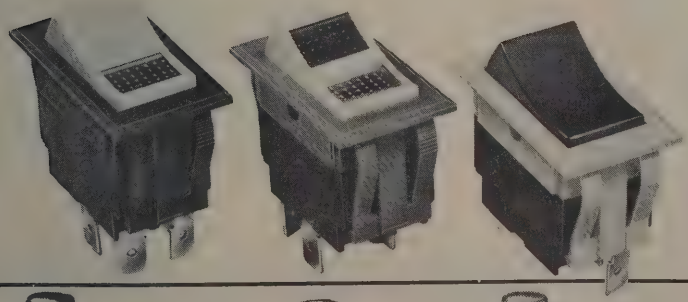
**Actuators, Brackets & Accessories** — Available in the same styles as listed in the Tippette Series. Lenses are Red, Amber, Clear and White. Special variations and colors available.

**Lamp Characteristics**

Neon (Standard)
120*-240 Volts .002 Amps.

Incandescent
6 Volts .20 Amps.
12 Volts .08 Amps.
24-28 Volts .04 Amps.

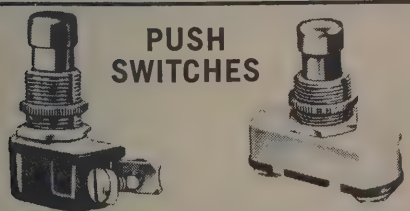
*Available with "High Brightness" in 120.



## CURVED ROCKER TIPPETTES

Insulated all-nylon bracket/bezel and rocker may be molded in any color combination of available Zytel 101 colors. Switch snap-mounts into conventional opening in panel from .030″ to .250″ thick. Available with ratings and circuit characteristics for single and double pole Tippettes and lighted Tippettes listed above. U/L and C.S.A. listings. Rocker may be ordered smooth (no light), or with one or two large-lens indicator lights as illustrated. Legend imprinting may be specified.

## PUSH SWITCHES



Type: PP - Push, On - Push, Off. Maintained. NO Normally Open. Momentary NC Normally Closed. Momentary. All Have 15/32″ Dia. Bushing. Push buttons with color coded caps available.
* Screw Terminals. Others Have Solder Lugs.
† Ratings up to 2 HP available.

PA300 Series

MAINTAINED OR MOMENTARY CONTACTS

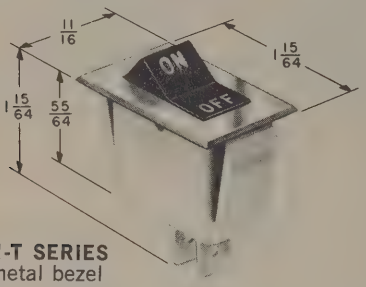
| Catalog No. | Rating | Type |
|---|---|---|
| 110-SP* | 6A.-125V. | P.P. |
| PA354† | 15A.-125V. | P.P. |
| 110-PM-OFF | 6A.-125V. | N.O. |
| 172* | 10A.-250V. | N.O. |
| 170 | 10A.-250V. | N.C. |
| 16-3P-OFF | 3A.-125V. | N.O. |
| 16-3P-ON | 3A.-125V. | N.C. |

# CARLINGSWITCH

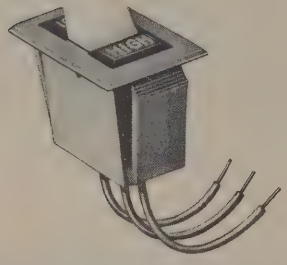
THE BIGGEST SINGLE NAME IN SWITCHES

## MINI TIPPETTE SERIES — SINGLE AND DOUBLE POLE

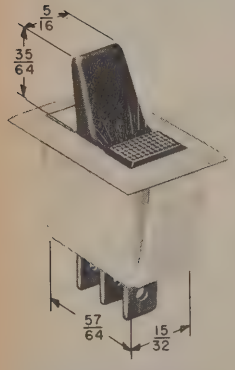
Insulated all nylon bracket/bezel and rocker may be molded in any available DuPont Zytel color. Snap-in mounting. Lighted and unlighted versions. Imprinting available on bezel, lens or rocker. New, patented wiping action contact arrangement has been tested to withstand in excess of 100,000 cycles at fully rated inductive load. Excellent for low voltage, very low current applications. UL and CSA listed.



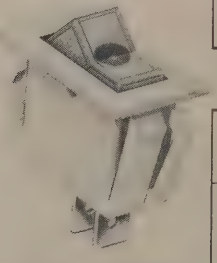

**TA201-T SERIES**
with metal bezel




**TB105-P SERIES**
Featuring wire leads and imprinting




**LTA201-P SERIES**



**LTA210-R SERIES**

### MINI TIPPETTE SERIES

| OPERATION AND CIRCUIT CHARACTERISTICS | NOMINAL RATINGS** 15A.-125V. AC 10A.-250V. AC ¾ HP 125-250V. AC | | | 10A.-125V. AC 5A.-250V. AC ½ HP 125-250V. AC | | |
|---|---|---|---|---|---|---|
| SINGLE POLE-SINGLE THROW | SOLDER LUGS | .250 TABS | WIRE LEADS | SOLDER LUGS | .250 TABS | WIRE LEADS |
| On-None-Off<br>Off-None-Mom. On<br>On-None-Mom. Off | TA200-T | TA201-T | TA205-T | TA100-T<br>TA10A-T<br>TA10L-T | TA101-T<br>TA10B-T<br>TA10M-T | TA105-T<br>TA10F-T<br>TA10T-T |
| SINGLE POLE-DOUBLE THROW<br>On-None-On<br>On-None-Mom. On<br>On-Off-On | TB200-T | TB201-T | TB205-T | TB100-T<br>TB10A-T<br>TC100-T | TB101-T<br>TB10B-T<br>TC101-T | TB105-T<br>TB10F-T<br>TC105-T |

### PADDLE TOGGLE SERIES

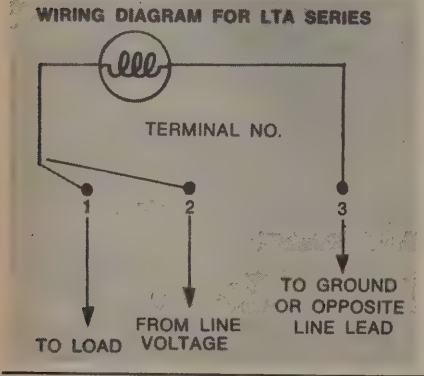
| OPERATION AND CIRCUIT CHARACTERISTICS | NOMINAL RATINGS** 15A.-125V. AC 10A.-250V. AC ¾ HP 125-250V. AC | | | 10A.-125V. AC 5A.-250V. AC ½ HP 125-250V. AC | | |
|---|---|---|---|---|---|---|
| SINGLE POLE-SINGLE THROW | SOLDER LUGS | .250 TABS | WIRE LEADS | SOLDER LUGS | .250 TABS | WIRE LEADS |
| On-None-Off<br>Off-None-Mom. On<br>On-None-Mom. Off | TA200-P | TA201-P | TA205-P | TA100-P<br>TA10A-P<br>TA10L-P | TA101-P<br>TA10B-P<br>TA10M-P | TA105-P<br>TA10F-P<br>TA10T-P |
| SINGLE POLE-DOUBLE THROW<br>On-None-On<br>On-None-Mom. On<br>On-Off-On | TB200-P | TB201-P | TB205-P | TB100-P<br>TB10A-P<br>TC100-P | TB101-P<br>TB10B-P<br>TC101-P | TB105-P<br>TB10F-P<br>TC105-P |

### LIGHTED SERIES

| OPERATION AND CIRCUIT CHARACTERISTICS | NOMINAL RATINGS* 15A.-125V. AC 10A.-250V. AC | | | 10A.-125V. AC 5A.-250V. AC | | |
|---|---|---|---|---|---|---|
| SINGLE POLE-SINGLE THROW | SOLDER LUGS | .250 TABS | WIRE LEADS | SOLDER LUGS | .250 TABS | WIRE LEADS |
| On-None-Off | LTA210-P<br>LTA210-R | LTA211-P<br>LTA211-R | LTA215-P<br>LTA215-R | LTA110-P<br>LTA110-R | LTA111-P<br>LTA111-R | LTA115-P<br>LTA115-R |

Mounting Hole: .550 x 1.125
Panel Thickness: .202-.250

* Also Available with Horsepower Rating
** L Rating available.




*Black - B and White - W, standard colors. Additional colors available upon request. If additional features are desired, please specify this information with basic number when ordering, such as metal bezel, imprinting or lamp voltages, 120 VAC std. 250 VAC, 6 VDC, 12 VDC and 28 VDC available.

When ordering metal bezel, stainless steel is standard. Consult factory for other finishes. Specify if for low energy, dry circuit applications. For information regarding double pole Mini Tippettes, please consult factory.

HOW TO ORDER (EXAMPLE):

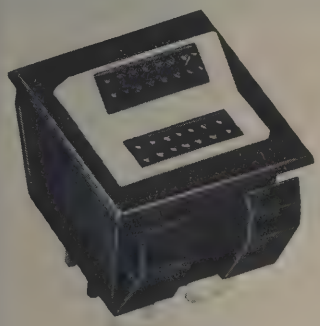
**LTA201-P** — Basic No. | **B** — Actuator Color* | **W** — Base Color* | **R** — Lens Color

**CARLINGSWITCH, INC.** • 505 NEW PARK AVE. • WEST HARTFORD, CT. 06110 • TEL. (203) 233-5551

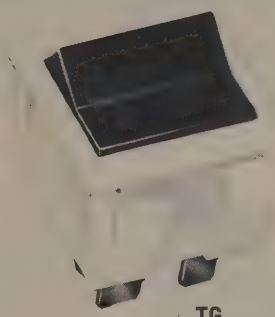
# CARLINGSWITCH

THE BIGGEST SINGLE NAME IN SWITCHES

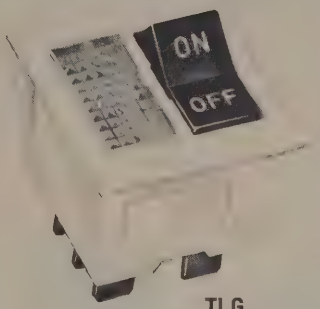
## DOUBLE POLE MINI TIPPETTE SERIES



LTG Series



TG Series




TLG Series

Recommended mounting hole: 1.00″ x 1.125″ Panel thickness: .030″ to .250″

Double pole Mini Tippettes may be ordered in a variety of circuits and styles; lighted and unlighted. Consult your Carlingswitch distributor.

## CARLING'S NEW SUBMINIATURE TIPPETTES

### 10 AMPS 125 VAC

FOR SMALL CHANGE!

SIZE — just .750″ (behind panel) with .750″ x .590″ bezel. Snaps into conventional .515″ x .625″ cutout in panel up to .156″ thick. RATING — 10 amps at 125 VAC, 5 amps at 250 VAC, inductive, UL listed. All SP and DP circuit variations available. ECONOMY — about ½ the price of competitive units. RELIABILITY — patented wiping action contact arrangement. Suited for low voltage, low amperage applications. Fully insulated Zytel 101 body and actuator, in any of Zytel colors. Legend imprinting available.

| OPERATION AND CIRCUIT CHARACTERISTICS | NOMINAL RATINGS | CATALOG NUMBERS | | OPERATION AND CIRCUIT CHARACTERISTICS | NOMINAL RATINGS | CATALOG NUMBERS | |
|---|---|---|---|---|---|---|---|
| Single Pole, Double Throw | | Solder Lugs | Printed Circuit Terminals | Double Pole, Double Throw | | Solder Lugs | Printed Circuit Terminals |
| On-None-On | 10A, 125VAC 5A, 250VAC | SGB0410 | SGB0411 | On-None-On | 10A, 125VAC 5A, 250VAC | SGD0410 | SGD0411 |
| On-None-Mom. On | | SCG041A | SGB041B | On-None-Mom. On | | SGD041A | SGD041B |
| On-Off-On | | SGBC410 | SGBC411 | On-Off-On | | SGDC410 | SGDC411 |
| Mom. On-Off-On | | SGBC41A | SGBC41B | Mom. On-Off-On | | SGDC41A | SGDC41B |
| Mom. On-Off-Mom. On | | SGBC41L | SGBC41M | Mom. On-Off-Mom. On | | SGDC41L | SGDC41M |

| Example | SGB0410 | TB | W |
|---|---|---|---|
| For tippette actuator add -T paddle actuator add -P | Basic No. | Actuator & Color | Base Color |

**CARLINGSWITCH, INC.** • 505 NEW PARK AVE. • WEST HARTFORD, CT. 06110 • TEL. (203) 233-5551

# KEYBOARDS and KEYBOARD SWITCHES

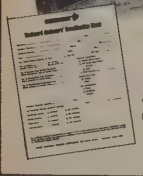
Straightforward electronics adapt readily to your specifications. Many standard keyboards stocked for immediate, "off-the-shelf" delivery. Custom designs available on volume applications with modest engineering, tooling and art work charges.

## KEYBOARD SWITCHES

Gold "crosspoint" contact key design provides high force per unit for contact area and virtually eliminates contact closure interference by contaminates. Choice of types with straight or angled stems.

## TWO VALUABLE DESIGN AIDS YOURS FOR THE ASKING

**84 page catalog and guide** to Cherry keyboards, keyboard switches and the complete line of Cherry snap-action switches.

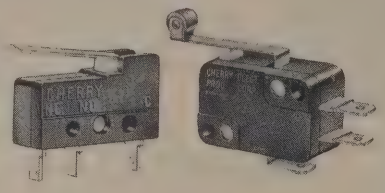


**Six-page Keyboard Designers' Specification Sheet.** Makes it easy for you to spec and order any keyboard design.

# LOW ENERGY

## gold crosspoint contact snap action switches

For positive switching of low energy solid state circuits. Cherry "crosspoint" contact configuration—two gold contact prisms at right angles to each other—provides maximum contact pressure, minimum hazard of contact closure interference.



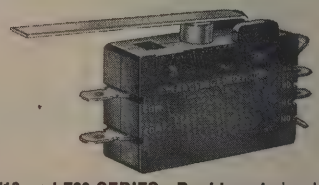
Available in virtually every snap action switch type in the comprehensive Cherry line: general purpose, panel mount pushbutton, light force, miniature, subminiature, weatherproof and open designs.

# GENERAL PURPOSE

## snap action switches

Rugged, compact switches with large overtravel, wear-resistant nylon button, many integral hinged actuator variations.

**E13 and E14 SERIES—Single pole** in choice of 15 and 25 amp electrical ratings.
Switch body: 1-13/16" x 41/64" x 41/64".



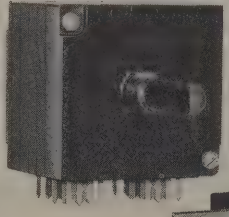
**E19 and E20 SERIES—Double pole** in choice of 15 and 20 amp electrical ratings.
Switch body: 1-13/16" x 1-1/8" x 41/64".

# ROTOCODE

## the new Rotary Switch with Coded Electrical Output

**Combines the coded electrical output of a thumbwheel switch . . . with the shaft actuation of a rotary switch!**

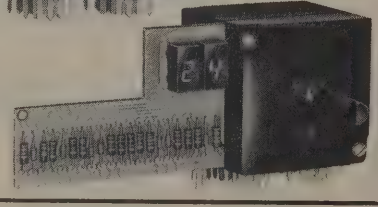
Provides high switching density. Designed for easier, faster, flow-solder installation. High reliability. Readily expandable. Custom designs available.



**All at low, affordable cost!**

BASIC ROTOCODE

LED READOUT ROTOCODE



# PANEL MOUNT

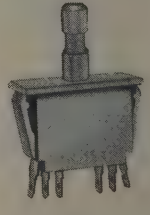
## pushbutton switches

Snap-in mounting in choice of momentary contact action, push-pull (reset), momentary "cheat" interlock, push-push (alternate action). White nylon case.

**E69 SERIES**

**Single pole** with 10 amp electrical rating. Switch body: 1-1/2" x 1" x 11/16".

**E79 SERIES**



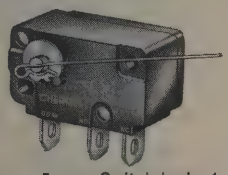
**Double pole** controls two circuits from single actuator.
Electrical rating: 10 amp.
Switch body: 1-1/2" x 1" x 11/16".

# CHERRY

**CHERRY ELECTRICAL PRODUCTS CORP.**
3623 Sunset Avenue, Waukegan, Illinois 60085
PHONE: 312/689-7700—TWX: 910/235-1572

# LIGHT FORCE MINIATURE
## snap action switches

Compact switches with long-life coil spring mechanism. Added internal actuator increases life, decreases operating force while maintaining high contact pressure.



**E51 SERIES**
**Low torque**
Rotary action with feather-light operation. Clockwise or counter clockwise action. Electrical rating: 5 amp. Switch body: 1-1/2" x 1" x 11/16".

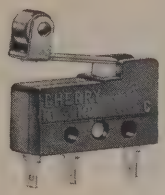
**E22/E23/E33/E34 SERIES**
Operating force as low as 2 grams. Choice of 3, 5, 10 and 15 amp electrical ratings. Switch body: 13/32" x 5/8" x 1-3/32".

# SUBMINIATURE
## snap action switches

Subminiature switches with large overtravel, integral hinged actuators, choice of terminal types with two force and rating ranges and many hinged actuator variations.

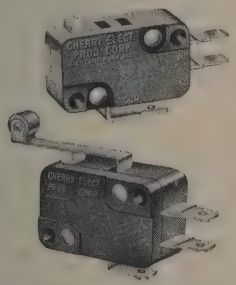
**E61 SERIES**
**Light force** with 5 amp electrical rating.
Switch body: 25/32" x 23/64" x 1/4".

**E62 SERIES**
**Standard force** with 10.1 amp electrical rating. Switch body: 25/32" x 23/64" x 1/4".



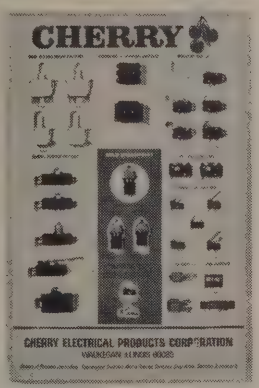
# MINIATURE
## snap action switches

Compact miniature switches with long-life coil spring mechanism, integral hinged actuators, choice of terminal types and four force rating ranges.



**E22/E23/E33/E34 SERIES**—Choice of 3, 5, 10 and 15 amp electrical ratings, operating forces from 15 to 100 grams. Switch body: 13/32" x 5/8" x 13/32".

# $89 DESIGNER'S PROTOTYPE KIT
## for switch users
## ...ONLY $29



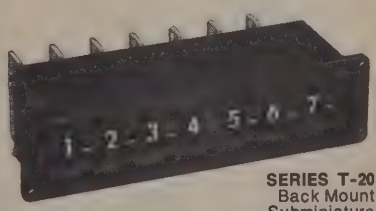

**Get this handy switch kit containing 32 Cherry switches** worth $89.04 in handy display to stand on desk or hang on wall. **All for just $29** . . . postage paid.
Enclose check with order or call 312 689-7702.

# THUMBWHEEL and LEVERWHEEL SWITCHES

Avaiable in 18 basic configurations ☐ in a full range of alphanumeric readouts ☐ and output codes ☐ individual digits or ☐ in assemblies of several digits mounted side-by-side ☐ complete with end caps ☐ with many available features and options ☐ in gloss or matte finish.

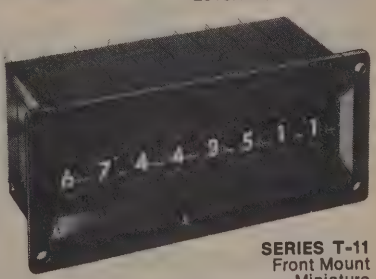
**SERIES T-50**
Back Mount
Sub-Miniature Thumbwheel Switches

**SERIES T-35**
Back Mount
Subminiature Thumbwheel Switches Just .350" Wide



**SERIES T-20**
Back Mount
Subminiature
Thumbwheel Switches

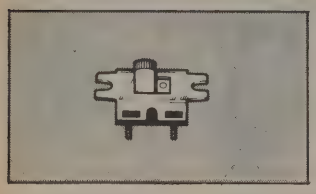
**SERIES L-10**
Back Mount
Leverwheel Switches



**SERIES T-11**
Front Mount
Miniature
Thumbwheel Switches

**SWITCHES and KEYBOARDS**

**Available locally from authorized distributors.**

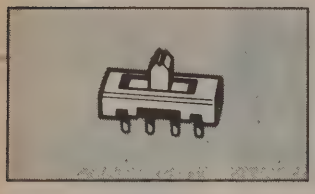


## MINI MIKE SLIDE SWITCHES

Our standard line of high quality miniature slide and snap action switches. Available in SPST, SPDT, DPDT and Form Z" circuit configurations. Low energy switches with contacts of hard gold over barrier. Standard P.C. mounting. Other terminal variations offered.

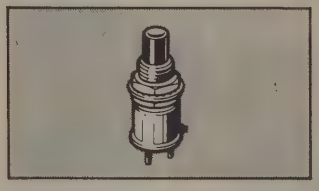
## TAPIT KEYBOARD PUSHBUTTON SWITCHES

A 4 terminal momentary printed circuit switch. SPST — normally closed, Form "Z" alternate circuits available. Contacts of silver. Low energy contacts of hard gold over barrier. Life expectancy: 10,000 actuations. Optional mounting tabs available.



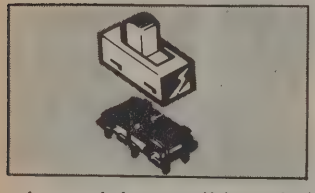
## ECONOMITE SLIDE SWITCHES

Save on cost without sacrificing quality. Our line of low cost miniature slide switches, available in SPDT SP3Position, DPDT and DP4Position circuits. Panel and P.C. mounting available. Black button in various heights. Nominal rating — 300 milliamps 125VAC for 10,000 actuations. Silver plated contacts.



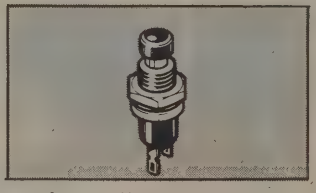
## TO-5 PUSHBUTTON SPASAVER SWITCH

Where space is a consideration, this SPST normally open, momentary switch is extremely useful. Contacts of silver, low energy versions of hard gold over barrier. Printed circuit applications. Available with or without bushing.



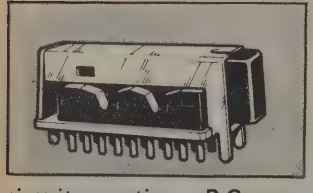
## MR. CLEAN WAVE SOLDERABLE MINIATURE SLIDE SWITCHES

Our new line of wave solderable, anti-contamination, miniature slide switches. Features a unique (patents pending) 2-piece assembly designed to alleviate problems due to contamination by flux and cleaning solvents. Available in SPST, SPDT, DPDT and Form "Z" circuits. Over center snap action mechanism, low energy gold contacts, 50,000 actuations at 10 ma @ 6VDC resistive End of Life Criteria: 100 milliohms. Now available with stand off bases.



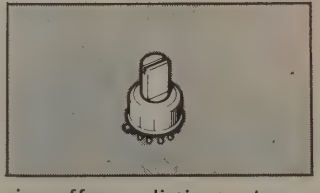
## ECONOMITE MINIATURE PUSHBUTTON SWITCHES

Attractive miniature pushbutton switches, ideal for use in applications requiring a SPST momentary action circuit. Where space, weight and low cost are of importance these switches offer many advantages. Contacts of silver. Low energy versions with gold contacts. These reliable switches are available in a variety of pushbutton colors and include necessary panel mounting hardware.



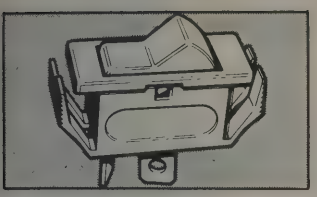
## MODULE SERIES

This line of subminiature slide switches offers a greater number of switching capabilities. SPDT, DPDT, 4PDT and 6PDT circuitry options. P.C. mounting. Momentary and alternate action actuation modes available. Silver contacts. Low energy versions with contacts of hard gold over barrier. Life expectancy 150,000 actuations for SPDT and DPDT versions. 4PDT and 6PDT life expectancy of 10 000 actuations; 250,000 actuations for low energy models.



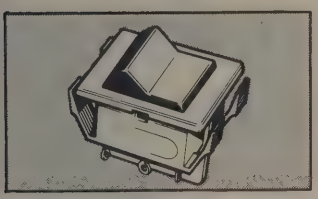
## TO-5 ROTARY SPASAVER SWITCH

This wave solderable subminiature rotary switch gets up to 8 positions into a TO-5 can. The compact size offers a distinct advantage, in view of the increasing cost of P.C. board real estate and the premium on front or rear panel space. P.C., panel and board socket mounting with optional bushing. Actuator moves through 360 degrees in detented steps of 45 degrees. Available with stops as required from 2 to 8 positions. Low energy contacts of hard gold over barrier. Also available in DPDT circuitry. Life expectancy: 10,000 actuations.



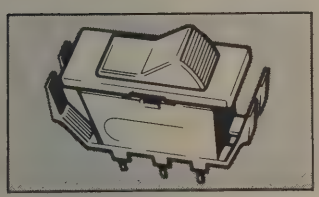
## 26 SERIES SINGLE POLE ROCKER AND PADDLE SWITCHES

Variety enhances the desirability of these switches. Modern styling with a wide range of actuator and case color choices. Solder, screw or slip-on terminals available. U.L. and CSA listings, with ratings up to 10 amps. SPST, SPDT circuits available. Matching panel lights and lighted versions. Special colors, hot stamping and metal bezels optional. Standard silver-cadmium contacts. Heavy duty versions available. Two switches in one case or a switch plus a lens in one case on request. Standard snap-in panel mounting.



## 27 SERIES DOUBLE POLE ROCKER AND PADDLE SWITCHES

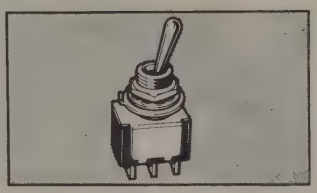
U.L. and CSA listings with ratings up to 10 amps. Compact switches with attractive styling and easy snap-in installation. SPST, SPDT, DPST, and DPDT versions are available. Choice of solder, screw or slip-on terminals. Switches come in a variety of case and actuator colors. Special colors, hot stamping and metal bezels are available on request. Standard silver-cadmium contacts. Lighted versions and matching panel lights are also offered.



## 38 SERIES DOUBLE POLE ROCKER – SINGLE POLE SIZE

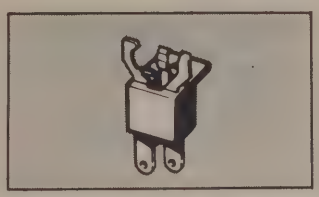
This switch, U.L. listed 6 amps at 125VAC inductive is a DPDT rocker switch in a package no larger than our single pole package. Features modern styling with a snap-in installation. Available in versions of SPST, SPDT, DPST, and DPDT. Solder or slip-on terminals. Heavy duty, low energy and dry circuit versions offered. Black, white, grey color combinations. Matching panel lights and lighted single pole versions available. Special colors, hot stamping and metal bezels optional. Low cost, high quality.

**CALL OR SEND FOR OUR INFORMATIVE 24 PAGE CATALOG WHICH INCLUDES PHOTOS, LINE DRAWINGS, SPECIFICATIONS AND ORDERING INFORMATION ON OUR COMPLETE LINE OF SWITCHES AND INDICATORS.**



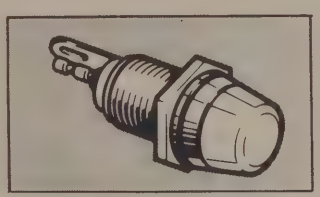
## MINIATURE TOGGLE SWITCHES

Small switches, big in quality and long life. U.L. listed at 5 amps inductive 120VAC. SPDT and DPDT circuits available with solder or P.C. terminals. Life expectancy: 100,000 actuations at rated load for ON-ON versions. All others, 40,000 actuations. Panel or printed circuit mounting make for easy installation where speed, size and cost are at a premium. Includes mounting hardware. Other versions available on request.



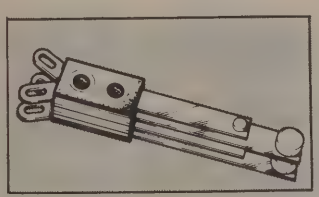
## KLIPSOCKET

For all T-1 ¾ Midget Flange Based Incandescent and Neon Lamps. Bulb engages with nickel - silver contact/terminals which are molded in the glass filled nylon base. Terminals are designed for soldering or slip-on connectors.



## PANEL INDICATOR LIGHTS

Three series of panel indicators to satisify your lighting requirements. Long life and high brilliance. Neon and incandescent versions available. Relampable indicators to fit T-1 ¾ midget flange based lamps. Wide range of color, terminal and lens choices offered. Nylon body mounts, snap-in, snap-out lenses. U.L. listed versions. Watertight models. Chrome bezel option.



## LEAF SWITCHES

Low cost, long life leaf switching, custom designed to fit your application without costly tooling or special designing. Because of our engineering, production, design facilities, and tooling versatility, you can get the exact switch to meet your requirements. Wide variety of actuators, contacts, lifters and blades.

CHICAGO SWITCH, INC. / 1714 N. DAMEN AVE. / CHICAGO, ILL. 60647 / (312) 489-5500

# for prompt service and "off-the-shelf" availability, call... DIPLOMAT

FOR OUR COMPLETE COMPREHENSIVE INVENTORY SELECTION

## SEMICONDUCTORS AND IC's
Alpha (Microwave)
AmPower
Carter Semiconductor
CDI Compensated Devices
Computer Diode
Crystalonics/Teledyne
Delco
EDI
Exar
General Instrument
General Semiconductor
ITT
Intersil
Kertron Semiconductor
Microsemiconductor Corp.
Microwave Associates
Monolithic Memories
Mostek
NAE North American Electronics
NEC Microcomputer Inc.
Optron
Semicon
Semtech
Sensitron
Signetics
Silicon General
Silicon Transistor Corp.
Solid Power Corp.
Solid State Devices
Solid State Scientific
Solitron Devices
SMC Microsystems Corp.
Syntron
Teledyne
Texas Instruments
Western Digital
Xciton

## CAPACITORS AND FILTERS
ARCO
Capar
CAL-R
Cornel Dubilier
ITT
Johanson
Mallory
NCI
San Fernando/Westcap
Sangamo

## CONNECTORS AND SOCKETS
Amphenol
Cinch
Robinson Nugent
Sullins
Texas Instruments

## CONTROLS AND SWITCHES
Alco Switch
Cherry
CTS
Hamlin
Mallory
Omron

## FANS & BLOWERS
Howard Industries

## FUSES AND HOLDERS
Bussman
Littelfuse

## HARDWARE AND CABINETS
Bud Radio
Hammond
H.H. Smith
Hollingsworth
Ungar

## METERS OF TEST EQUIPMENT
Simpson
Triplett

## OPTOELECTRONICS
Chicago Miniature
General Electric
Monsanto
Optron
Xciton

## POTENTIOMETERS AND TRIMMERS
Clarostat
CTS
Spectrol
Weston/Sangamo
VRN (IRC)

## RELAYS
Allied Controls
Deltrol
Electrol
Guardian
Hamlin
IDEC
Potter & Brumfield
Omron

## RESISTORS
American Corp.
CAL-R
Capar
Clarostat
Mallory
Memcor
RCL
Shallcross
Stackpole
Ward-Leonard

## R.F. CHOKES
J.W. Miller

## THERMISTORS AND RF FILTERS
CORCOM
Fenwal
Gulton Industries

## TRANSFORMERS AND POWERSTATS
Chicago Stancor

## TUBES
Amperex

## WIRE, CABLE, INSULATION PRODUCTS
Alpha
Belden
Cable-Tech
Cimco
Coleflex
Columbia
Dearborn
DeWire
Electronized Chemical Corp.
Harbor Industries
Hi Temp
Insultab
ITT
Manhattan
Norflex
Rainbow

**Each of the Above Listed Lines are Franchised at one or more of the Following Locations.**

DIPLOMAT

**DIPLOMAT ELECTRONICS, INC.**
Woodbury, N.Y.
(516) 921-9373

**DIPLOMAT ELECTRONICS, INC.**
Farmington, Mich.
(313) 477-3200

**DIPLOMAT ELECTRONICS, INC.**
Totowa, N.J.
(201) 785-1830

**DIPLOMAT ELECTRONICS, INC.**
Elk Grove Village, Ill.
(312) 595-1000

**DIPLOMAT ELECTRONICS, INC.**
Chicopee Falls, Mass.
(413) 592-9441

**DIPLOMAT ELECTRONICS, INC.**
Minneapolis, Minn.
(612) 788-8601

**DIPLOMAT ELECTRONICS, INC.**
Mt. Laurel, N.J.
(609) 234-8080

**DIPLOMAT ELECTRONICS, INC.**
Salt Lake City, Utah
(801) 486-4134

**DIPLOMAT ELECTRONICS, INC.**
St. Louis, Mo.
(314) 645-8550

**DIPLOMAT ELECTRONICS, INC.**
Holliston, Mass.
(617) 429-4120

**DIPLOMAT ELECTRONICS, INC.**
Sunnyvale, Calif.
(408) 734-1900

**DIPLOMAT ELECTRONICS, INC.**
Clearwater, Fla.
(813) 443-4514

**DIPLOMAT ELECTRONICS, INC.**
Ft. Lauderdale, Fla.
(305) 771-0440

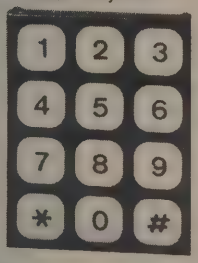
**DIPLOMAT ELECTRONICS, INC.**
Woodbury, N.Y.
(516) 921-7920

# CHOMERICS KEYBOARDS

## QUICKEY™ FLAT OR TACTILE MODELS

• More Than 10 Million Operations • Low Profile • Simple Concealed Mounting • Very Low Cost
• Dust And Moisture Resistant • Pins Or Flextail Output • Large Arrays Possible From Std. Units

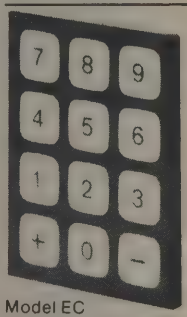
Model ER Tactile Keyboard



Model EF Flat Keyboard

| Standard EF Models — 0.005" Key Travel | | Standard ER Models — 0.035" Key Travel | | | | | |
|---|---|---|---|---|---|---|---|
| ½ in. Centers Part No. | ¾ in. Centers Part No. | ½ in. Centers Part No. | ¾ in. Centers Part No. | Legend Format | Encoding** | Termination | No. of Keys |
| EF21280 | EF20457 | ER21622 | ER21605 | Touch Tone* | Single-pole | Pins | 12 |
| EF21289 | EF20071 | ER21623 | ER21606 | Touch Tone | Matrix-1 | Pins | 12 |
| | EF20070 | | ER21607 | Calculator | Single-pole | Pins | 12 |
| | EF21314 | | ER21782 | Blank | Single-pole | Pins | 12 |
| | EF22811 | | ER22809 | Blank | Matrix-1 | Pins | 12 |
| EF22838 | EF22854 | ER22846 | ER22862 | Touch Tone | Single-pole | Tail | 12 |
| EF22839 | EF22855 | ER22847 | ER22863 | Touch Tone | Matrix-0 | Tail | 12 |
| EF22840 | EF22856 | ER22848 | ER22864 | Touch Tone | Matrix-1 | Tail | 12 |
| EF22841 | EF22357 | ER22849 | ER22865 | Touch Tone | Matrix-2 | Tail | 12 |
| EF22842 | EF22858 | ER22850 | ER22866 | Blank | Single-pole | Tail | 12 |
| EF22843 | EF22859 | ER22851 | ER22867 | Blank | Matrix-0 | Tail | 12 |
| EF22844 | EF22860 | ER22852 | ER22868 | Blank | Matrix-1 | Tail | 12 |
| EF22845 | EF22861 | ER22853 | ER22869 | Blank | Matrix-2 | Tail | 12 |
| EF21261 | EF20597 | ER21625 | ER21609 | Calculator | Single-pole | Pins | 16 |
| | EF20092 | | ER21610 | Touch Tone | Single-pole | Pins | 16 |
| EF22090 | EF20458 | ER22092 | ER21611 | Touch Tone | Matrix-1 | Pins | 16 |
| EF22641 | EF22495 | ER22476 | ER22496 | Hexadecimal | Single-pole | Pins | 16 |
| | EF22278 | | ER21783 | Blank | Single-pole | Pins | 16 |
| | EF22745 | | | Hexadecimal | Matrix-1 | Pins | 16 |
| | EF22812 | | ER22810 | Blank | Matrix-1 | Pins | 16 |

Ask for Technical Bulletins 967 (ER) and 969 (EF).



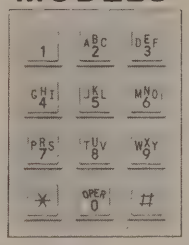
Model EC Environmentally-Sealed Tactile Keyboard

## SEALED MODELS

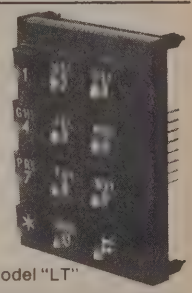
| Part No. | Encoding** | Legend Format | No. of Keys |
|---|---|---|---|
| EC22206 | Single-pole | Calculator | 12 |
| EC22207 | Matrix-1 | Touch Tone | 12 |
| EC22208 | Single-pole | Touch Tone | 12 |
| EC22210 | Single-pole | Touch Tone | 16 |
| EC22211 | Matrix-1 | Touch Tone | 16 |
| EC22212 | Single-pole | Calculator | 16 |

Ask for Technical Bulletin 973.

## TELEPHONE MODELS



Model "ET"



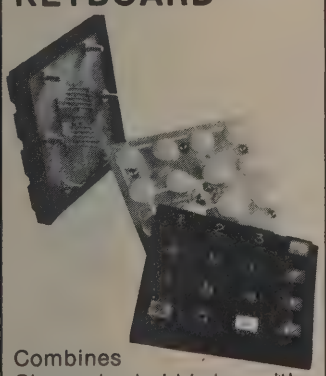
Model "LT"

| Part No. | Encoding | No. Pins |
|---|---|---|
| ET22763 | Single-pole | 13 |
| ET22770 | Touch Tone-2 commons | 9 |
| ET22771 | Touch Tone-1 common | 8 |
| ET22772 | Touch Tone-no common | 7 |

Telephone styles match AT&T standards. Ask for Technical Bulletins 979 (ET) and 983 (LT).

| Part No. | Encoding** | Termination |
|---|---|---|
| LT23345 | Single-pole | Flexible Tail |
| LT23346 | Matrix-0 | Flexible Tail |
| LT23347 | Matrix-1 | Flexible Tail |
| LT23348 | Matrix-2 | Flexible Tail |
| LT23295 | Single-pole | Pins |
| LT23297 | Matrix-0 | Pins |
| LT23296 | Matrix-1 | Pins |
| LT23298 | Matrix-2 | Pins |

## MILITARY SPEC KEYBOARD



Combines Chomerics bubble key with MIL PC board and rubber boot type keytops. Meets MIL STDS. 202, 810 and P-11268. Ask for Technical Bulletin 977.

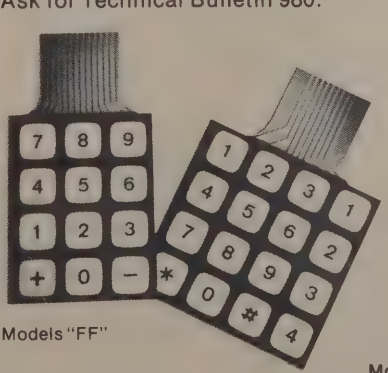
## CUSTOM KEYBOARD CIRCUITS

Mylar Circuit with Molded Bubbles

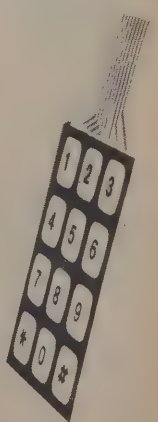
Folded mylar circuits with molded bubbles provide tactile feel. Designed for easy integration with customer's housing and keytops. Ask for Technical Bulletin 976.

## ULTRA LOW PROFILE KEYBOARDS

Type FF and FR Keyboards provide lowest possible profile and are available with standard or custom legend artwork. Ask for Technical Bulletin 980.



Models "FF"



Model "FR"

*Touch Tone is a registered trademark of AT&T.
**-0 = no common -1 = 1 common -2 = 2 commons.

CHOMERICS
77 Dragon Court
Woburn, Massachusetts 01801
Tel. (617) 935-4850/TWX 710-393-0173

# C&K Components Inc.

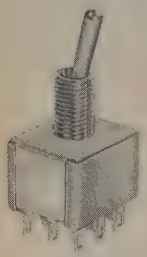
103 E Morse Street, Watertown, Mass. 02172

The Primary Source Worldwide

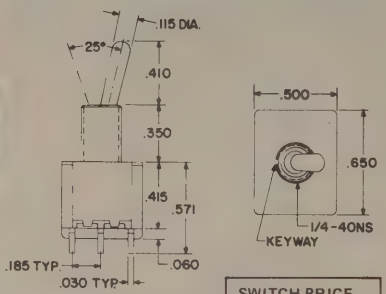
(617) 926-0800 TWX: 710-327-0460 TELEX: 92-2546


**Request our free catalog of Toggles, Rockers, PC Mounts, Pushbuttons, Illuminated Switches, Slides, Microminiature Switches and Thumbwheels.**

## Toggle Switches

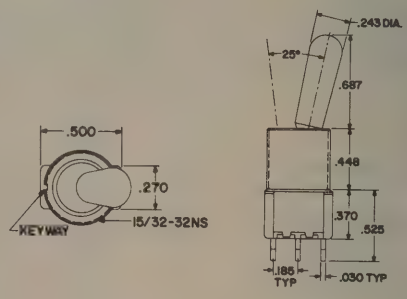


3PDT




| MODEL NUMBER | SWITCH FUNCTION | | | SWITCH PRICE 1-24 | 25-99 | 100-499 |
|---|---|---|---|---|---|---|
| 7301 S YZQ | ON | NONE | ON | 4.05 | 3.38 | 2.91 |
| 7303 S YZQ | ON | OFF | ON | 4.35 | 3.62 | 3.12 |
| 7305 S YZQ | (ON) | OFF | (ON) | 4.35 | 3.62 | 3.12 |
| 7307 S YZQ | ON | OFF | (ON) | 4.35 | 3.62 | 3.12 |
| 7308 S YZQ | ON | NONE | (ON) | 4.35 | 3.62 | 3.12 |
| 7309 S YZQ | NONE | ON | (ON) | 4.35 | 3.62 | 3.12 |

Also available in SPDT, DPDT, and 4PDT.
Consult factory for prices.



SPDT

| MODEL NUMBER | SWITCH FUNCTION | | | SWITCH PRICE 1-24 | 25-99 | 100-499 |
|---|---|---|---|---|---|---|
| 7101 T ZQ | ON | NONE | ON | 2.50 | 2.19 | 1.99 |
| 7103 T ZQ | ON | OFF | ON | 2.80 | 2.43 | 2.20 |
| 7105 T ZQ | (ON) | OFF | (ON) | 2.80 | 2.43 | 2.20 |
| 7107 T ZQ | ON | OFF | (ON) | 2.80 | 2.43 | 2.20 |
| 7108 T ZQ | ON | NONE | (ON) | 2.80 | 2.43 | 2.20 |
| 7109 T ZQ | NONE | ON | (ON) | 2.80 | 2.43 | 2.20 |

Also available in DPDT, 3PDT, and 4PDT.
Consult factory for prices.

### TOGGLE AND ROCKER SPECIFICATIONS

**CONTACT RATING** – 5 amps with resistive load @ 120 VAC or 28 VDC; 2 amps with resistive load @ 250 VAC.

**ELECTRICAL LIFE** – 100,000 make-and-break cycles at full load on all models ending in 01. All other models 40,000 cycles.

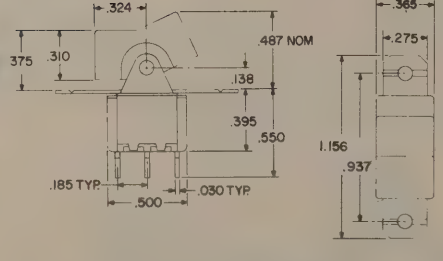
**CONTACT RESISTANCE** – 10 milliohms max. initial @ 2-4 VDC. 100 milliamps for coin silver contacts.

**INSULATION RESISTANCE** – 1,000 megohms min.

**DIELECTRIC STRENGTH** – 1,000 volts RMS @ sea level.

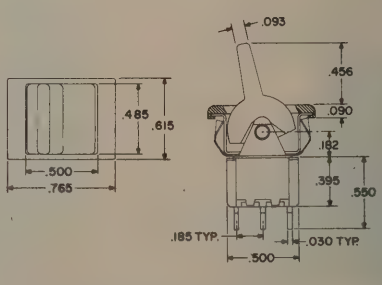
## Rocker Switches

SPDT




| MODEL NUMBER | SWITCH FUNCTION | | | SWITCH PRICE 1-24 | 25-99 | 100-499 |
|---|---|---|---|---|---|---|
| 7101 J1 ZQ | ON | NONE | ON | 2.10 | 1.79 | 1.59 |
| 7103 J1 ZQ | ON | OFF | ON | 2.40 | 2.03 | 1.80 |
| 7105 J1 ZQ | (ON) | OFF | (ON) | 2.40 | 2.03 | 1.80 |
| 7107 J1 ZQ | ON | OFF | (ON) | 2.40 | 2.03 | 1.80 |
| 7108 J1 ZQ | ON | NONE | (ON) | 2.40 | 2.03 | 1.80 |
| 7109 J1 ZQ | NONE | ON | (ON) | 2.40 | 2.03 | 1.80 |

Also available in DPDT, 3PDT, and 4PDT.
Consult factory for prices.



SPDT

| MODEL NUMBER | SWITCH FUNCTION | | | SWITCH PRICE 1-24 | 25-99 | 100-499 |
|---|---|---|---|---|---|---|
| 7101 J61 ZQ | ON | NONE | ON | 2.15 | 1.84 | 1.64 |
| 7103 J61 ZQ | ON | OFF | ON | 2.45 | 2.08 | 1.85 |
| 7105 J61 ZQ | (ON) | OFF | (ON) | 2.45 | 2.08 | 1.85 |
| 7107 J61 ZQ | ON | OFF | (ON) | 2.45 | 2.08 | 1.85 |
| 7108 J61 ZQ | ON | NONE | (ON) | 2.45 | 2.08 | 1.85 |
| 7109 J61 ZQ | NONE | ON | (ON) | 2.45 | 2.08 | 1.85 |

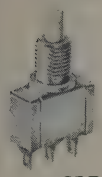
Also available in DPDT, 3PDT, and 4PDT.
Consult factory for prices.
Consult factory for further dimensional requirements.

**C&K Components Inc.**
103 E Morse Street, Watertown, Mass. 02172
(617) 926-0800 TWX: 710-327-0460 TELEX: 92-2546

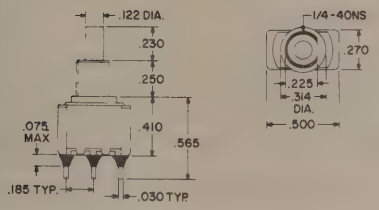
The Primary Source Worldwide

**Request our free catalog of Toggles, Rockers, PC Mounts, Pushbuttons, Illuminated Switches, Slides, Microminiature Switches and Thumbwheels.**

## Snap-Acting Momentary Pushbutton Switches

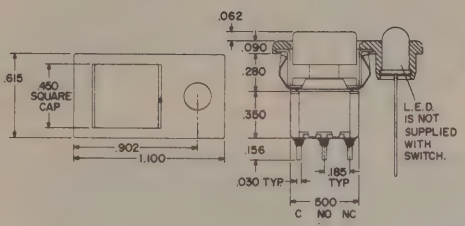


SPDT




| MODEL NUMBER | SWITCH RATING | SWITCH PRICE 1-24 | 25-99 | 100-499 |
|---|---|---|---|---|
| 8121 Z | *1 amp @ 120 VAC | 3.31 | 2.65 | 2.24 |
| 8125 Z | *0.4 volt amps @ 20V (AC or DC) | 2.10 | 1.68 | 1.49 |

Also available 2-4 poles. Consult factory for prices.



SPDT

| MODEL NUMBER | SWITCH RATING | SWITCH PRICE 1-24 | 25-99 | 100-499 |
|---|---|---|---|---|
| 8121 J82 Z | *1 amp @ 120 VAC | 3.76 | 3.10 | 2.69 |
| 8125 J82 Z | *0.4 volt amps @ 20V (AC or DC) | 2.55 | 2.13 | 1.94 |

Also available in DPDT. Consult factory for prices.

**SNAP-ACTING PUSHBUTTON SPECIFICATIONS**

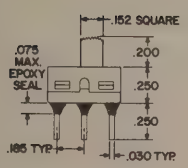
**CONTACT RATING** – *8121: 1 amp resistive @ 120 VAC or 28 VDC. *8125: 0.4 volt amps (VA) max. @ 20V max. (AC or DC)
**CONTACT RESISTANCE** – 50 milliohms maximum.
**INSULATION RESISTANCE** – 1,000 megohms minimum.
**DIELECTRIC STRENGTH** – 1,000 volts RMS minimum at sea level.
**ELECTRICAL LIFE** – 60,000 cycles minimum at full load.
Maximum allowable installation force to secure cap to plunger.
Multi-pole contacts do not make & break simultaneously.

**SLIDE SPECIFICATIONS**

**CONTACT RATING** – 6 amps with resistive load @ 120 VAC or 28 VDC. 3 amps with resistive load @ 250 VAC.
**CONTACT RESISTANCE** – 10 milliohms max. initially.
**ELECTRIC LIFE** – 40,000 actuations at full load.
**MECHANICAL LIFE** – 250,000 actuations (low energy).
**INSULATION RESISTANCE** – 100,000 megohms minimum.
**DIELECTRIC STRENGTH** – 1,000 volts RMS @ sea level.
**ACTUATION FORCE** – 150-350 grains initially.

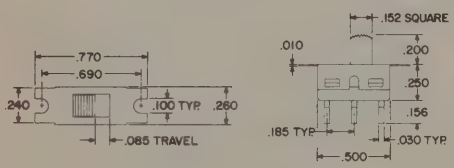
## Slide Switches

SPDT




| MODEL NUMBER | SWITCH FUNCTION | | | SWITCH PRICE 1-24 | 25-99 | 100-499 |
|---|---|---|---|---|---|---|
| *1101 M2 CBE | ON | NONE | ON | 1.42 | 1.19 | 1.06 |

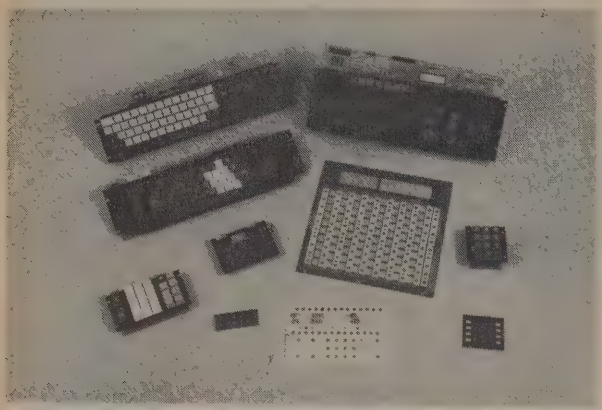
*Rated at 0.4 volt amps (VA) max. @ 20V max. (AC or DC).



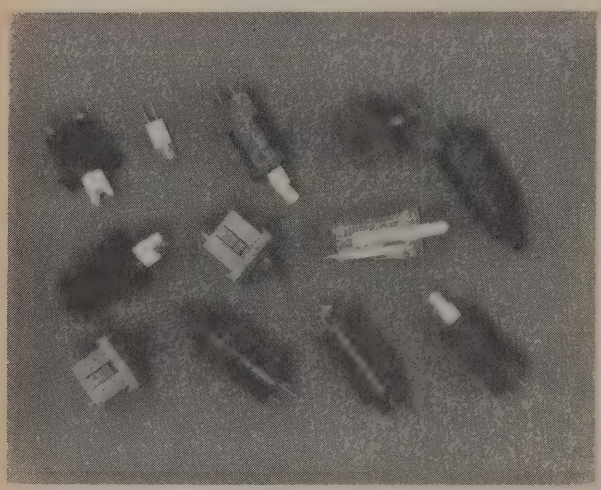
SPDT

| MODEL NUMBER | SWITCH FUNCTION | | | SWITCH PRICE 1-24 | 25-99 | 100-499 |
|---|---|---|---|---|---|---|
| 1101 M1 ZQ | ON | NONE | ON | 1.17 | .94 | .81 |

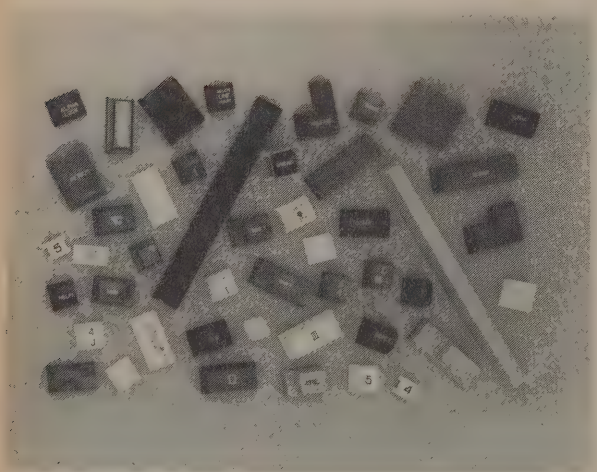
# C. P. CLARE KEYBOARDS AND KEYSWITCHES



STANDARD AND CUSTOM KEYBOARD ARRAYS FOR ANY APPLICATION.



INDUSTRY'S LARGEST SELECTION OF KEYBOARD SWITCH TECHNOLOGIES.



WIDE RANGE OF KEYTOP SIZES, LEGENDS AND COLORS.

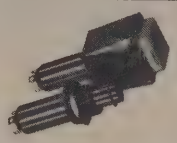
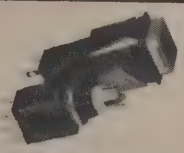
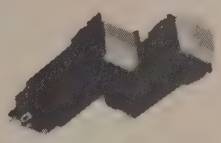
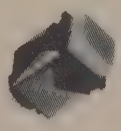
## KEYBOARDS AND KEYSWITCHES

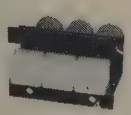
Clare has the product selection, low applied cost, service, and quality to solve your keyboard requirements. Here are just a few of the reasons we are a major worldwide keyboard supplier:

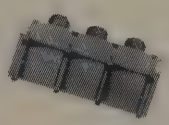
- Pushbutton switches have been our specialty for over a decade.
- Standard communications, word processing, and numeric layouts available.
- Direct sales offices and representatives worldwide.
- Complete keyboard layout flexibility.
- Seven quality keyswitch products from which to choose.
  - — S820, S830, and low-profile S880 reedswitches
  - — S870 gold-crossbar switch
  - — S890 solid-state switch
  - — Slimtac and Softac micromotion pads
- Applications consulting to assist in cost effective design.
  - — Dozens of popular shapes with two-shot legends
  - — Over 5,000 tooled two-shot legends including Kata Kana, French, Spanish, German and Russian
  - — Sculptured typewriter shapes.
  - — Matte finish to reduce glare
  - — Changeable legend, lighted, and three-shot legend keytops.
  - — In-house tooling and molding.
- High quality standards to assure product uniformity.
- Complete electronic design capability including TTL, LSI, and microprocessor encoding.
- Lighted and alternate-action keyswitches available for special human factor considerations.
- Extensive engineering support to provide quick phototype efforts on volume programs.
- Continuing R & D to keep designs up-to-date and competitive.

C. P. CLARE & COMPANY
GENERAL INSTRUMENT CORPORATION
3101 W. Pratt Avenue • Chicago, Illinois 60645 • (312) 262-7700

# C. P. CLARE SWITCHLIGHTS

| SWITCH ACTION | CIRCUITS | CONTACT RATING 28VDC/125VAC RESISTIVE LOAD | DESCRIPTION | PRODUCT |
|---|---|---|---|---|
| MOMENTARY OR ALTERNATE (REMAIN-IN) | 2 N.O. —OR— 1 N.O. & 1 N.C. | 2 AMPERES | ILLUMINATED FRONT PANEL SNAP-IN OR REAR MOUNTABLE CHOICE OF LENS SHAPES AND SIZES |  S180 SERIES |
| INDICATOR | | | ILLUMINATED FRONT PANEL SNAP IN OR REAR MOUNTING. CHOICE OF LENS SHAPES AND SIZES. |  S190 SERIES |
| MOMENTARY OR ALTERNATE | 2 FORM C | 2 AMPERES | | |
| MOMENTARY OR ALTERNATE (REMAIN-IN) | 6 N.O. —OR— 3 N.O. & 3 N.C. | 2 AMPERES | ILLUMINATED FRONT PANEL SNAP-IN OR REAR MOUNTING. CHOICE OF LENS SHAPES AND SIZES. | S220 SERIES |
| INDICATOR | | | FRONT PANEL SNAP-IN SINGLE OR DUAL LIGHT AND SPLIT SCREENS |  (MONOFORM) S410 SERIES |
| MOMENTARY OR ALTERNATE | 2 N.O. —OR— 1 N.O. & 1 N.C. | 2 AMPERES | | |
| MOMENTARY OR ALTERNATE (REMAIN-IN) | 2 FORM C | 10 AMPERES | | |
| INDICATOR | | | FRONT PANEL SNAP-IN SINGLE LIGHT |  S490 SERIES |
| MOMENTARY | 2 N.O. —OR— 1 N.O. & 1 N.C. | 1 AMPERE | | |
| MOMENTARY | 1 N.O. | 1 AMPERE | SUBMINIATURE SWITCHLIGHT. | S510 SERIES (UNLIGHTED) S520 SERIES (LIGHTED) |
| MOMENTARY OR ALTERNATE (REMAIN-IN) | 2 FORM C —OR— 4 FORM C | 2 AMPERES | ILLUMINATED FRONT PANEL SNAP-IN OR REAR MOUNTING. CHOICE OF LENS SHAPES AND SIZES. | S570 SERIES |
| MOMENTARY OR ALTERNATE (REMAIN-IN) | 2 N.O. & 2 N.C. | 10 AMPERES | ILLUMINATED FRONT PANEL SNAP-IN OR REAR MOUNTING. CHOICE OF LENS SHAPES AND SIZES. | S610 SERIES |

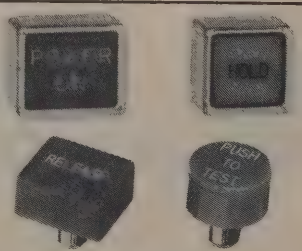




**ILLUMINATED GANGSWITCHES**

FRONT AND REAR PANEL MOUNTING FRAMES

LAMPS AND TOOLS



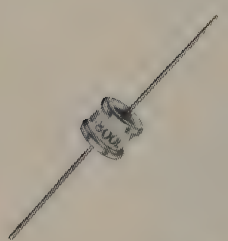

LENS CAPS

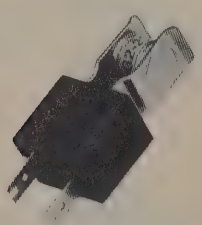
C. P. CLARE & COMPANY
GENERAL INSTRUMENT CORPORATION
3101 W. Pratt Avenue • Chicago, Illinois 60645 • (312) 262-7700

# C. P. CLARE CIRCUIT PROTECTION

## SURGE ARRESTER SELECTION GUIDE

| Product | Voltage Range | Approx. Size & Mounting Method | Physical Construction | Special Features |
|---|---|---|---|---|
| Comm Gap (CG) | 75V-1000V DC | .265″ L x .380″ Dia. Solder Leads .892″ L | Ceramic/Metal | Small Size |
| | | P/C Mtg. | | Rugged Ceramic Construction |
| | | Mtg. Clips for Units w/o Leads | | Low Capacitance < 1.5 pF |
| | | | | High Peak Current Capability > 10 kA |
| Uni-Imp® (UBD, UGT, UBT) | 550V-20kV DC | 2.20″ L x .560″ Dia. | Glass/Metal | Ultra Fast Protection |
| | | Solder Lugs | | No Overshoot (DC to 200kV/μs) |
| | | | | Life Thousands of Operations |
| Spark Gaps (SB & SG) | 400V-40kV DC | 3.562″ L x 1.202″ Dia. | Glass/Metal | Sub-Microsecond Response Time |
| | | Solder Lugs | | Electrical Energy Transfer |
| | | Ferruled Ends for Clip Mtg. | | DC Overvoltage Protection |
| Triggered Spark Gaps (TA & TB) | 1.0kV-25kV DC | ¾″ H x 21/32″ Dia. | Ceramic/Metal | Command Energy Switching |
| | | Solder Lugs | | DC Overvoltage Protection |
| | | 2.10″ H x 2.82″ Dia. | | Rugged Construction |
| | | Stud Screw Mtg. | | |





## CG SERIES SURGE ARRESTERS

The GC/CG2 series of Comgaps are surge arresters designed to protect sensitive electronic equipment from damage due to excessive voltages or currents generated by transient phenomena. Their most common application is in the protection of equipment connected to signal lines such as those found in telecommunications, data communications, security, and traffic control systems.

The CG/CG2 series surge arresters are constructed of two metal electrodes hermetically sealed in a gas filled, rugged ceramic cylinder. They perform as voltage dependent switches which can reliably and repeatedly carry large currents for brief periods of time. In operation, application of a sufficient voltage across the Comgap causes an arc to form between the electrodes changing its impedance from greater than 10,000 megohms to a few milliohms in a time period of less than 100 nanoseconds. While conducting in the arc mode the voltage across the surge arrester is less than 30 volts.

CG devices offer low dc breakdown ratings, good performance and extremely low arc voltages. They are recommended for energy transfer applications such as capacitive discharge systems and applications where minimum cost is required.

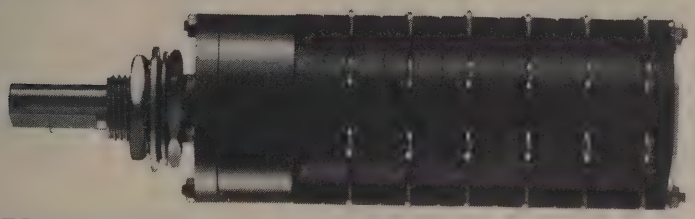
Life of the CG/CG2 series is a function of the surge current amplitude and duration to which the device is subjected. Transients are by their very nature unpredictable in magnitude and energy content. Life may be in the order of millions of operations, depending on surge current wave shape. Typical end of life is not catastrophic failure but rather a gradual shift of breakdown voltage and lowering of insulation resistance. Life characteristics shown in the data are for the surge current wave shapes based on most commonly occurring transients induced by lightning discharges. End of life is considered to occur when the voltage breakdown varies more than 20% from minimum or maximum rated breakdown voltage.

CG devices offer fast response time, high holdover voltage and high follow-on current capability. The CG2-350 and CG2-350L are REA approved for standard duty protector applications. Both CG and CG2 products are available with or without leads. A companion holder, the CGH-1, permits the mounting of unleaded devices to printed circuit boards where snap-in replacement of the surge arrester is desired.

CG surge arresters are available with DC breakdown ratings from 75 volts through 1000 volts. CG2 surge arresters are available with DC breakdown ratings from 145 volts through 1000 volts.

# COLE INSTRUMENT
# THAT'S A SWITCH

ACTUAL SIZE



## 3600 SERIES Miniature Enclosed Rotary Switches

A new custom quality rotary switch. The 1-inch 3600 series enclosed miniature; meets MIL-S-3786. A 6 amp. switch for high-rel use in aircraft controls, electronic test equipment in harsh environments.

Quality? Roller bearing silver contacts. Custom quality? Up to 12 decks, 1 to 6 poles per deck; 30, 36, 45 deg. (8, 10 or 12 position). Options like hermetic enclosure; pre-wired to connector.

### TECHNICAL DATA

**Specifications**

Meets or exceeds applicable requirements of MIL-S-3786D. Style SR04
Certified test reports available

**Electrical**

Contact Rating

Current carrying: 10 amps @ 28 VDC
Make & Break: 6 amp resistive @ 115 VAC
6 amp resistive @ 28 VDC
3 amp inductive @ 28 VDC
Dielectric Strength: 1500V RMS
Contact Resistance:
Initial .005 ohms max.
Insulation Resistance:
$10^5$ meg ohms min.

**Mechanical**

Rotational Torque: 5 in. lbs. max.
Weight: 1.7 ounces + .3 ounces/deck
Life: 100,000 cycles min. mechanical
25,000 cycle min. switching 5 amps @ 120 VAC

### ORDERING INFORMATION SAMPLE CODE

36 45-204-3S

- 36 — Cole Basic Switch and Drawing No.
- 45 — Degrees Between Positions
- 2 — Number of Poles
- 04 — Number of Positions
- 3 — Number of Decks
- S — Shorting Decks (Omit for Non-shorting)

## MARK C SERIES PRECISION SWITCHES

### SPECIFICATIONS

**ELECTRICAL**

CURRENT RATING

15 AMPS Continuous Load — Static. Non-Switching
5 AMPS Resistive Load Switching at 115 Volts AC
3 AMPS inductive Load Switching at 115 Volts AC

Voltage Breakdown—1500 volts RMS 60 Hz minimum.

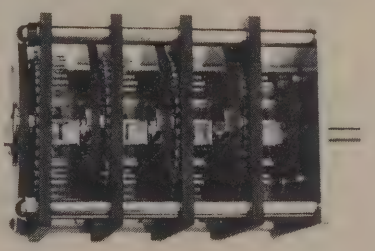
Insulation Resistance—Will Meet Requirements of MIL P 18177 Type GEE and Type GEB As Applicable.

**MECHANICAL**

Unitized deck construction—ease and economy—removed and replaced individually. No excess torque build-up in large multi deck units—no backlash.

Life expectancy—1,000,000 cycles or more, with consistent cleaning and lubrication programs.

Designed and Manufactured—To Meet Applicable Sections of MIL S 3786, MIL STD 202, MIL T 945, MIL A 8625, QQ-P416, MIL STD 167, MIL S 13282 and all design specs.



| Series | Size Sq. |
|---|---|
| 14 | 1-½" |
| 16 | 1-¾" |
| 20 | 2-000" |
| 22 | 2-¼" |
| 26 | 2-¾" |

Numbers are actual degrees desired, dropping fractions
exceptions:
56 for 5⅝
72 for 7.2
75 for 7½

Positions per pole
Number of positions required—available within size and pole configurations

0 0 0 0 0 0 0 0 0

| | | |
|---|---|---|
| Last number (S) Poles per deck | 1 = Non-shorting<br>2 = Shorting | Number of decks<br>No deck length limit |

**EXAMPLE**

2 2 2 2 1 1 3 1 3

| | | | | | |
|---|---|---|---|---|---|
| Series 22 2¼" sq. | 2 poles per dk. | Shorting type | 11¼ detent | 31 posit per pole | 3 deck length |

**THIS EXAMPLE WOULD BE WRITTEN AS COLE 222-211-313**

## MINI DRUM PROGRAMMERS

Thrifty, reliable alternative way to program up to 24 steps, control 20 or more 5 amp. circuits (motors, valves, lights, heaters, actuators, etc.) in business machines, test instrumentation, process control, e.g. Fingertip programming (no tools) of tabs that actuate SPDT switch for each modular drum. Tap switches for position sensing and control. Runs, indexes and homes on 115 VAC, 6 RPM motor, standard. OPTIONS: Manual, AC or DC solenoid drives, bi-directional and more.

***See our rep and distributor listings.***

***For fast quotes call Phil Hanson at***

*King of Quality Rotary Switches*

**COLE**
INSTRUMENT CORP.

*2650 S. Croddy Way Santa Ana, CA 92704*

**(714) 556-3100**

# Specialty Switches

## Arrow Hart Division

## SPECIFICATIONS

All Arrow-Hart specialty switches are covered by a limited warranty as stated in the company's Conditions and Terms of Sales which are available on request.

All Arrow-Hart switches, except as noted in specific sections, are UL Listed File E1148 Guide WOYR. Many switches are CSA Listed. Contact factory for specific information. The 1600/2600 Series Rocker Switches are UL Listed File E24354 Guide WOYR. In addition, these switches have international listing as follows: CSA (Canada), SEMKO (Sweden), SF (Finland), BS (Great Britain), VDE (Germany), DEMKO (Denmark) and UTE (France). Other approvals are pending.

All dimensions are approximate and for reference only. If specific dimensions are necessary contact factory.

## INDEX


**TOGGLE SWITCHES**
- GENERAL PURPOSE ..... p 1-4
- POWER ..... p 3-5
- SUBMINIATURE ..... p 9
- MIL-APPROVED ..... p 10

**ROCKER SWITCHES**
- LIGHTED & NON-LIGHTED .... p 13-14

**PUSHBUTTON SWITCHES**
- GENERAL PURPOSE ..... p 7-8
- POWER ..... p 8
- LIGHTED (ADAPT-A-SWITCH) ..... p 6
- SUBMINIATURE ..... p 9

**ROTARY SWITCHES**
- GENERAL PURPOSE & HEAVY DUTY ..... p 12
- LOCKING, GENERAL PURPOSE ..... p 11
- LOCKING, HIGH SECURITY .... p 11
- LOCKING, HEAVY DUTY ..... p 11

**HARDWARE** ..... p 4, 10

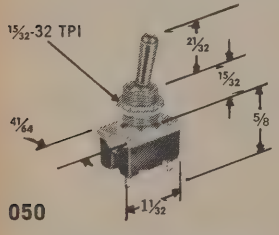

# TOGGLE SWITCHES

## 3 AMP WIPING-ACTION CONTACTS

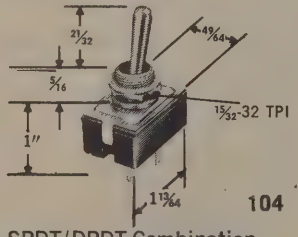
**TWO-POSITION — 050 SERIES**
**THREE-POSITION — 104 SERIES**

### SPECIFICATIONS

**Exposed metal parts** ..... Bright nickel
**Dielectric breakdown** ..... Exceeds 1000 V rms
**Contact material** ..... Bronze silver plated
**Terminal material** ..... Bronze silver plated
**Standard hardware** ..... 1 hex nut, 1 knurled nut (unassembled)
**Rating** ..... UL Listed 3 amp 125 V AC/DC, 1 amp 250 V AC/DC
**Terminals** ..... Solder lug 050 Series. Quick-connect/solder lug 104 Series.




SP and DP Bat lever. Shown **83050.**




SPDT/DPDT Combination Solder lug, Quick Connect. Shown **84104.**

**OPTIONAL LEVERS**

**COLORED BATON**

**MOLDED TAPER**

**METAL PADDLE**

These small space saving switches have a "quick make/break" wiping action. This knife type contact mechanism meets the rigid reliability standards required by the Data Processing, Communication, and Instrumentation industries. These switches are the designers choice for low-level switching. Standard models have silver plated bronze contacts. Solder lug termination except for 104 Series which has combination solder lug quick connect terminals. UL Listed at 3 amp 125 V, 1 amp 250 V AC/DC.

| Circuit | Action | Lever‡ | Slotted Sleeve Length | Catalog Number |
|---|---|---|---|---|
| **TWO-POSITION 050 SERIES** | | | | |
| SPST | off-on | Bat | 15/32" | 83050 |
| SPST | off-on | Black Baton | 15/32" | 83050CL1 |
| SPST | off-on | White Baton | 15/32" | 83050CL2 |
| SPST | off-on | Red Baton | 15/32" | 83050CL3 |
| SPST | off-on | *Molded Taper | 15/32" | 83050SB |
| SPDT | on-on | Bat | 15/32" | 83052 |
| SPDT | on-on | *Metal Paddle | 15/32" | 83052CG |
| SPDT | on-on | *Molded Taper | 15/32" | 83052SG |
| DPST | off-on | Bat | 15/32" | 83053 |
| DPST | off-on | Black Baton | 15/32" | 83053CL1 |
| DPST | off-on | White Baton | 15/32" | 83053CL2 |
| DPST | off-on | Red Baton | 15/32" | 83053CL3 |
| DPST | off-on | *Metal Paddle | 15/32" | 83053CG |
| DPST | off-on | *Molded Taper | 15/32" | 83053SG |
| DPDT | on-on | Bat | 15/32" | 83054 |
| DPDT | on-on | Black Baton | 15/32" | 83054CL1 |
| DPDT | on-on | White Baton | 15/32" | 83054CL2 |
| DPDT | on-on | Red Baton | 15/32" | 83054CL3 |
| DPDT | on-on | *Metal Paddle | 15/32" | 83054CG |
| DPDT | on-on | *Molded Taper | 15/32" | 83054SG |
| **THREE-POSITION 104 SERIES** | | | | |
| SPDT | on-off-on | Bat | 5/16" | 84105 |
| DPDT | on-off-on | Bat | 5/16" | 84104 |

* Hardware supplied: 1 hex nut, 1 dress nut unassembled.
‡ Black, white, and red baton levers are stocked. Other colors available on request. Contact factory.

# Specialty Switches

## Arrow Hart Division

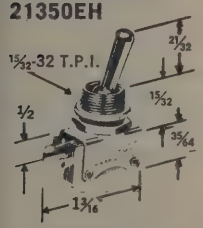
## 3 AMP ROLLER-BUTT CONTACTS

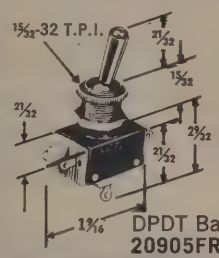
**TWO-POSITION — CANOPY SERIES**

### SPECIFICATIONS

**Exposed metal parts** ..... Bright nickel
**Dielectric breakdown** ..... Exceeds 1000 V rms
**Contact material** ..... Bronze silver plated
**Solder lug terminal material** ..... Bronze silver plated
**Standard hardware** ..... 1 hex nut, 1 knurled nut (unassembled)
**Rating** ..... See description

SPDT Bat lever.
**21350EH**




DPDT Bat lever.
**20905FR**

**OPTIONAL LEVER**

**BALL**

This unique quick-make quick-break design offers a full selection of circuits on a small base. The dependable roller-action mechanism provides long life. Ideally suited for small motor applications the Canopy Series is UL Listed at 3 amp 125 V, 1 amp 250 V AC/DC.

| Circuit | Action | Lever | Slotted Sleeve Length | Catalog Number |
|---|---|---|---|---|
| SPDT | on-on | Ball | 15/32" | 21350BF |
| SPDT | on-on | Bat | 15/32" | 21350EH |
| SPDT | on-on | Bat | 1" | 21661BE |
| SPDT | on-mom. on | Bat | 15/32" | 21827GA |
| DPST | off-on | Ball | 15/32" | 20902N |
| DPST | off-on | Bat | 15/32" | 20902CX |
| DPDT | on-on | Ball | 15/32" | 20905BX |
| DPDT | on-on | Bat | 15/32" | 20905FR |
| DPDT | on-on | Ball | 1" | 20905C |
| DPDT | on-on | Bat | 1" | 20905KA |
| DPDT | on-mom. on | Bat | 15/32" | 21858BX |

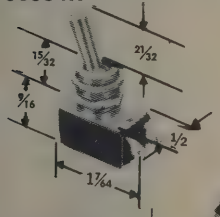
## 6 AMP WIPING-ACTION CONTACTS

**TWO-POSITION — 591 SERIES, 015 SERIES**
**THREE-POSITION — 024 SERIES**

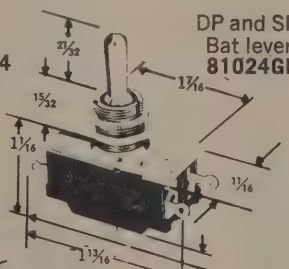
### SPECIFICATIONS

**Exposed metal parts** ..... Bright nickel
**Dielectric breakdown** ..... Exceeds 1000 V rms
**Contact material** ..... Bronze silver plated
**Terminal material** ..... Bronze silver plated
**Standard hardware** ..... 1 hex nut, 1 knurled nut (unassembled)
**Rating** ..... See description below
**Terminals** ..... Solder lug, screw, or wire lead, see Table

SPST Solder lug. **591**
**86994N**

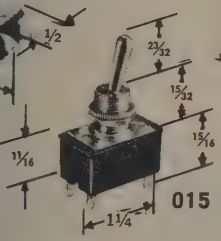



**024**




DP and SP Bat lever.
**81024GB**

SP and DP Bat lever.
**82024HD**




**015**

**OPTIONAL LEVER**

**(591 & 015 Series)**

### 591 SERIES

The 591 Series offers a selection of medium current (6 amps) switches in a small molded base. Quick-make quick-break wiping mechanism. UL Listed at 6 amp 125 V, 3 amp 250 V AC/DC.

### 015 AND 024 SERIES

The 015 and the 024 Series are deluxe switches. They give maximum reliability in both low-level and rated power (6 amps) applications. These switches are the "classic" choice in many applications. UL Listed at 6 amp 125 V, 3 amp 250 V AC/DC (except model 81021AV which is listed at 6 amp 125 V, 1 amp 250 V AC/DC).

| Circuit | Action | Lever‡ | Termination | *Slotted Sleeve Length | Catalog Number |
|---|---|---|---|---|---|
| **TWO-POSITION 591 SERIES** | | | | | |
| SPST | off-on | Bat | Wire Lead | 15/32" | 86599QE |
| SPST | off-on | Bat | Screw | 15/32" | 86964E |
| SPST | off-on | Black Baton | Solder Lug | 15/32" | 86994CL1 |
| SPST | off-on | White Baton | Solder Lug | 15/32" | 86994CL2 |
| SPST | off-on | Red Baton | Solder Lug | 15/32" | 86994CL3 |
| SPST | off-on | Bat | Solder Lug | 15/32" | 86994N |
| **TWO-POSITION 015 SERIES** | | | | | |
| SPST | off-on | Bat | Solder Lug | 15/32" | 81015AW |
| SPST | off-on | Black Baton | Solder Lug | 15/32" | 81015CL1 |
| SPST | off-on | White Baton | Solder Lug | 15/32" | 81015CL2 |
| SPST | off-on | Red Baton | Solder Lug | 15/32" | 81015CL3 |
| SPST | off-mom. on | Bat | Solder Lug | 15/32" | 81045-FB |
| SPDT | on-on | Bat | Solder Lug | 15/32" | 81021AV |
| SPDT | on-on | Black Baton | Solder Lug | 15/32" | 81021CL1 |
| SPDT | on-on | White Baton | Solder Lug | 15/32" | 81021CL2 |
| SPDT | on-on | Red Baton | Solder Lug | 15/32" | 81021CL3 |
| SPDT | on-mom. on | Bat | Solder Lug | 15/32" | 81051G |
| DPST | off-on | Bat | Solder Lug | 15/32" | 81024GB |
| DPST | off-on | Black Baton | Solder Lug | 15/32" | 81024GBCL1 |
| DPST | off-on | White Baton | Solder Lug | 15/32" | 81024GBCL2 |
| DPST | off-on | Red Baton | Solder Lug | 15/32" | 81024GBCL3 |
| DPST | off-on | Bat | Solder Lug | 15/32" | 81024KB† |
| DPDT | on-on | Bat | Solder Lug | 15/32" | 81027-CB† |
| DPDT | on-on | Bat | Solder Lug | 15/32" | 81027CE |
| DPDT | on-on | Black Baton | Solder Lug | 15/32" | 81027CL1 |
| DPDT | on-on | White Baton | Solder Lug | 15/32" | 81027CL2 |
| DPDT | on-on | Red Baton | Solder Lug | 15/32" | 81027CL3 |
| DPDT | on-mom. on | Bat | Solder Lug | 15/32" | 81057N |
| **THREE-POSITION 024 SERIES** | | | | | |
| SPDT | on-off-on | Bat | Solder Lug | 15/32" | 82022HD |
| DPDT | on-off-on | Bat | Solder Lug | 15/32" | 82024HD |

† End-connected solder lugs.
‡ Black, white, and red baton levers are stocked. Other colors available on request. Contact factory.
* sleeve dia. 15/32-32 TPI

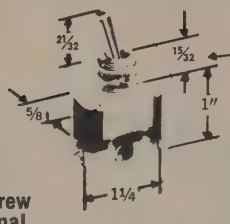
CROUSE-HINDS®

# Specialty Switches

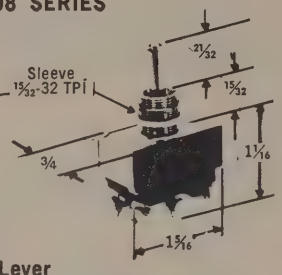
## Arrow Hart Division

## 15 AMP AC ONLY

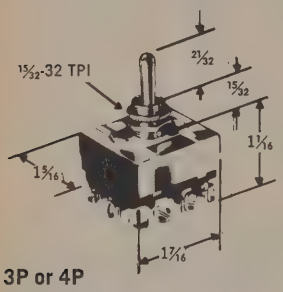
### TWO AND THREE POSITION — 608 SERIES




**SP Screw Terminal**
Depth with QC termination is 1 3/32", with solder lug is 1 5/16




**DP Bat Lever**
Depth with QC termination is 1 3/16", with solder lug is 1"




**3P or 4P**
Depth with QC termination is 1 3/16" with solder lug is 1"

**OPTIONAL LEVER**

**COLORED BATON**

### SPECIFICATIONS

**Exposed metal parts** ..... Bright nickel
**Dielectric breakdown** .... Exceeds 1000 V rms
**Contact material** ..... Silver Cadmium Oxide
**Rating** ..... UL Listed 15 amp, ¾ HP, 125 V AC; 10 amp, ¾ HP, 250 V AC
**Terminals** ..... Screw, solder lug, quick connect, see Table
**Standard hardware** ..... 1 hex nut, 1 knurled nut (unassembled)

The 608 Series is designed to offer high capacity (AC only) on a small size phenolic base butt type (silver cad-oxide buttons) contacts and ball-joint lever construction for long life expectancy. Available in 2- or 3-position and momentary contact at one or both sides of the center position. Rated at 15 amp, ¾ HP, 125 V AC, 10 amp, ¾ HP, 250 V AC.

| Circuit | Action | Lever‡ | Termination | Slotted Sleeve Length | Catalog Number |
|---|---|---|---|---|---|
| SPST | off-on | Bat | Screw | 15/32" | 82600 |
| SPST | off-on | Black Baton | Screw | 15/32" | 82600CL1 |
| SPST | off-on | White Baton | Screw | 15/32" | 82600CL2 |
| SPST | off-on | Red Baton | Screw | 15/32" | 82600CL3 |
| SPST | off-on | Bat | Solder Lug | 15/32" | 82601 |
| SPST | off-on | Black Baton | Solder Lug | 15/32" | 82601CL1 |
| SPST | off-on | White Baton | Solder Lug | 15/32" | 82601CL2 |
| SPST | off-on | Red Baton | Solder Lug | 15/32" | 82601CL3 |
| SPST | off-on | Bat | Quick Connect | 15/32" | 82601P |
| SPST | off-on | Black Baton | Quick Connect | 15/32" | 82601PCL1 |
| SPST | off-on | White Baton | Quick Connect | 15/32" | 82601PCL2 |
| SPST | off-on | Red Baton | Quick Connect | 15/32" | 82601PCL3 |
| SPST | off-on | Bat | Screw | 15/32" | 82779SA* |
| SPDT | on-on | Bat | Screw | 15/32" | 82604 |
| SPDT | on-on | Black Baton | Screw | 15/32" | 82604CL1 |
| SPDT | on-on | White Baton | Screw | 15/32" | 82604CL2 |
| SPDT | on-on | Red Baton | Screw | 15/32" | 82604CL3 |
| SPDT | on-on | Bat | Solder Lug | 15/32" | 82605 |
| SPDT | on-on | Bat | Quick Connect | 15/32" | 82605P |
| SPDT | on-off-on | Bat | Screw | 15/32" | 82602 |
| SPDT | on-off-on | Black Baton | Screw | 15/32" | 82602CL1 |
| SPDT | on-off-on | White Baton | Screw | 15/32" | 82602CL2 |
| SPDT | on-off-on | Red Baton | Screw | 15/32" | 82602CL3 |
| SPDT | on-off-on | Bat | Screw | 15/32" | 82603 |
| SPDT | on-off-on | Bat | Quick Connect | 15/32" | 82603P |
| SPDT | on-off-on | Black Baton | Quick Connect | 15/32" | 82603PCL1 |
| SPDT | on-off-on | White Baton | Quick Connect | 15/32" | 82603PCL2 |
| SPDT | on-off-on | Red Baton | Quick Connect | 15/32" | 82603PCL3 |
| SPDT | mom.-off-mom. | Bat | Screw | 15/32" | 82726 |
| DPST | off-on | Bat | Screw | 15/32" | 82606 |
| DPST | off-on | Black Baton | Screw | 15/32" | 82606CL1 |
| DPST | off-on | White Baton | Screw | 15/32" | 82606CL2 |

| Circuit | Action | Lever‡ | Termination | Slotted Sleeve Length | Catalog Number |
|---|---|---|---|---|---|
| DPST | off-on | Red Baton | Screw | 15/32" | 82606CL3 |
| DPST | off-on | Bat | Solder Lug | 15/32" | 82607 |
| DPST | off-on | Black Baton | Solder Lug | 15/32" | 82607CL1 |
| DPST | off-on | White Baton | Solder Lug | 15/32" | 82607CL2 |
| DPST | off-on | Red Baton | Solder Lug | 15/32" | 82607CL3 |
| DPST | off-on | Black Baton | Quick Connect | 15/32" | 82607PCL1 |
| DPST | off-on | White Baton | Quick Connect | 15/32" | 82607PCL2 |
| DPST | off-on | Red Baton | Quick Connect | 15/32" | 82607PCL3 |
| DPDT | on-on | Bat | Screw | 15/32" | 82610 |
| DPDT | on-on | Black Baton | Screw | 15/32" | 82610CL1 |
| DPDT | on-on | White Baton | Screw | 15/32" | 82610CL2 |
| DPDT | on-on | Red Baton | Screw | 15/32" | 82610CL3 |
| DPDT | on-on | Bat | Solder Lug | 15/32" | 82611 |
| DPDT | on-off-on | Bat | Screw | 15/32" | 82608 |
| DPDT | on-off-on | Black Baton | Screw | 15/32" | 82608CL1 |
| DPDT | on-off-on | White Baton | Screw | 15/32" | 82608CL2 |
| DPDT | on-off-on | Red Baton | Screw | 15/32" | 82608CL3 |
| DPDT | on-off-on | Bat | Solder Lug | 15/32" | 82609 |
| DPDT | on-off-on | Bat | Quick Connect | 15/32" | 82609P |
| DPDT | on-off-on | Black Baton | Quick Connect | 15/32" | 82609CL1 |
| DPDT | on-off-on | White Baton | Quick Connect | 15/32" | 82609CL2 |
| DPDT | on-off-on | Red Baton | Quick Connect | 15/32" | 82609CL3 |
| DPDT | mom.-off-mom. | Bat | Screw | 15/32" | 82736 |
| 3PST | off-on | Bat | Screw | 15/32" | 82612 |
| 3PDT | on-on | Bat | Screw | 15/32" | 82616 |
| 3PDT | on-on | Bat | Solder Lug | 15/32" | 82617 |
| 3PDT | on-off-on | Bat | Screw | 15/32" | 82614 |
| 3PDT | on-off-on | Bat | Solder Lug | 15/32" | 82615 |
| 4PDT | on-on | Bat | Screw | 15/32" | 82635 |
| 4PDT | on-on | Bat | Solder Lug | 15/32" | 82636 |
| 4PDT | on-off-on | Bat | Screw | 15/32" | 82633 |
| 4PDT | on-off-on | Bat | Solder Lug | 15/32" | 82634 |

* Rating is 20 amp, 1 HP, 125 V AC, 10 amp, 1 HP, 250 V AC.
‡ Black, white, and red baton levers are stocked. Other colors available on request. Contact factory.

# Specialty Switches

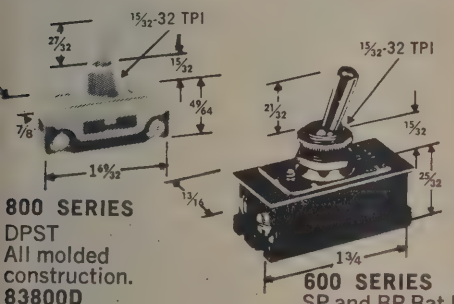
## Arrow Hart Division

## 16 AMP

**TWO-POSITION — 800 SERIES (For double insulation use)**
**TWO-POSITION — 600 SERIES**

### SPECIFICATIONS

**Exposed metal parts** ..... Bright nickel
**Dielectric breakdown** .... Exceeds 1000 V rms
**Contact material** ..... Bronze silver plated
**Terminal material** ..... Bronze silver plated
**Rating 800 Series** ..... UL Listed 16 amp, 1 HP, 125 V AC/DC; 8 amp, 1 HP, 250 V AC/DC
**Rating 600 Series** ..... SPST models UL Listed 12 amp, 125 V AC/DC, 6 amp, 250 V AC/DC DPST models UL Listed 16 amp, 1 HP, 125 V AC/DC, 8 amp, 1 HP, 250 V AC/DC.
**Termination** ..... Screw
**Standard hardware** ..... 1 hex nut, 1 knurled nut (unassembled)




**800 SERIES**
DPST
All molded construction.
**83800D**

**600 SERIES**
SP and BP Bat lever
**80600BJ.**

**OPTIONAL LEVERS**

COLORED BATON

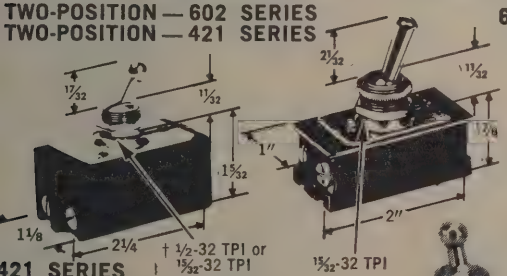
BALL

**DOUBLE INSULATION — 800 SERIES**
The all-molded construction of the 800 Series of medium duty switches allows them to be applied where double insulation is desirable — or mandatory. Screw termination.

**600 SERIES**
The 600 Series of medium duty switches are primarily designed for small motor applications, both AC and DC. Screw termination.

## 20 AMP WIPING-ACTION CONTACTS

**TWO-POSITION — 602 SERIES**
**TWO-POSITION — 421 SERIES**




**602 SERIES**
SP and DP Bat lever.
**80421**

**421 SERIES**
DPST Ball lever. **80602CA**

**OPTIONAL LEVERS**

BALL

COLORED BATON

**421 SERIES**
The 421 Series of quick-make quick-break AC/DC switches are built to handle rugged applications up to 20 amp and 2 HP at 250 V. Widely used in industrial power tools and floor cleaning and polishing equipment. Screw termination.

**602 SERIES**
The 602 Series of heavy duty switches are designed for higher power applications than the 600 Series, above. Screw termination.

## ADDITIONAL MOUNTING HARDWARE FOR TOGGLE SWITCHES

All sleeve mounted switches are furnished with two mounting nuts. One nut goes behind panel to prevent the bushing or sleeve being distorted by overtightening the front panel nut. Arrow-Hart accepts no responsibility for damage to switches that are mounted without the backup nuts.

### STANDARD MOUNTING HARDWARE

| Catalog Number | Description | Thread or I.D. | Material | Finish |
|---|---|---|---|---|
| 8947-151AS | St Hex | 15/32"-32 | Brass | Tin Dip |
| 8947-232AH | Std. Hex | 15/32"-32 | Steel | Chromate |
| 1561-521AZ | Thick Hex | 15/32"-32 | Brass | Nickel |
| 8991-3SA | Std. Knurled | 15/32"-32 | Brass | Tin Dip |
| 8991-35AZ | Dress Knurled | 15/32"-32 | Brass | Nickel |
| 1561-238AZ | Top Nut | 15/32"-32 | Brass | Nickel |
| 83050-62 | Dress Nut | 15/32"-32 | Brass | Satin Chrome |
| 8991-1378 | Std. Lockwasher | 15/32" | Bronze | Tin Dip |
| 20590-174AS | Std. Locating Ring | 15/32" | Brass | Tin Dip |
| 20590-1AS | On-off Dial | 15/32" | Brass | Tin Dip |
| 21172-AS | Hi-Lo Dial | 15/32" | Brass | Tin Dip |

| Circuit | Action | Lever‡ | Slotted Sleeve Length | Catalog Number |
|---|---|---|---|---|
| **800 SERIES** | | | | |
| DPST | off-on | Molded Bat | 15/32" | 83800D |
| **600 SERIES** | | | | |
| DPST | off-on | Ball | 5/16" | 80600 |
| DPST | off-on | Ball | 15/32" | 80600B |
| DPST | off-on | Bat | 15/32" | 80600BJ |
| DPST | off-on | Black Baton | 15/32" | 80600CL1 |
| DPST | off-on | White Baton | 15/32" | 80600CL2 |
| DPST | off-on | Red Baton | 15/32" | 80600CL3 |
| SPST | off-on | Bat | 15/32" | 80607BJ |
| SPDT | off-on | Bat | 15/32" | 80618K |

‡ Black, white, and red baton levers are stocked. Other colors available on request. Contact factory.

| Circuit | Action | Lever‡ | Slotted Sleeve Length | Catalog Number |
|---|---|---|---|---|
| **421 SERIES** | | | | |
| DPST | off-on | Ball | 11/32" lg.† | 80421 |
| DPST | off-on | Bat | 15/32" lg.† | 80421U |
| **602 SERIES** | | | | |
| SPST | off-on | Bat | 15/32" lg. | 80601BD |
| SPDT | on-on | Bat | 15/32" lg. | 80609CA |
| DPST | off-on | Ball | 15/32" lg. | 80602C |
| DPST | off-on | Bat | 15/32" lg. | 80602CA |
| DPST | off-on | Black Baton | 15/32" lg. | 80602CL1 |
| DPST | off-on | White Baton | 15/32" lg. | 80602CL2 |
| DPST | off-on | Red Baton | 15/32" lg. | 80602CL3 |

‡ Black, white, and red baton levers are stocked. Other colors available on request. Contact factory.
† 80421 sleeve dia. 1/2", 80421U dia. 15/32

CROUSE-HINDS®

# Specialty Switches

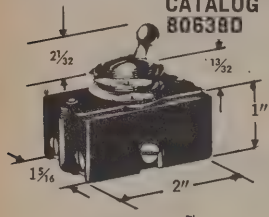
**Arrow Hart Division**

## HEAVY DUTY TOGGLE SWITCHES

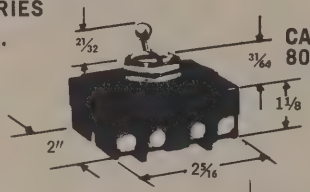
### 10-30 AMP (POSITIVE CENTER OFF)

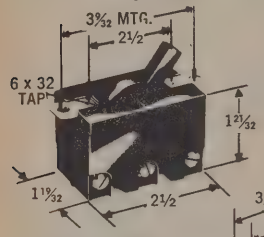
**THREE-POSITION — 638 SERIES**

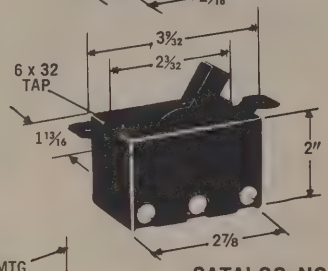
CATALOG NO. 80638D




CATALOG NO.'s 80983 or 80985

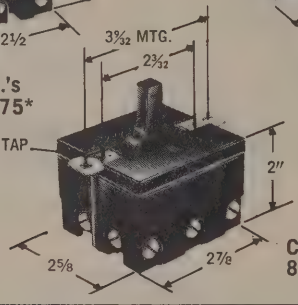



CATALOG NO. 80988

CATALOG NO.'s 80634 or 80975*




CATALOG NO.'s 80898 or 80899

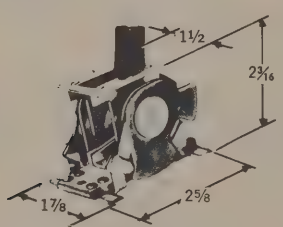
The 3-position, positive center-off feature assures that the lever cannot be moved from one side through the center position without stopping. This unique feature makes these switches ideal for motor reversing applications. Sleeve and flush mounting models. Can be provided without center stop (consult factory). Screw termination. Bushing mounted units have a ¾" dia. 32 TPI keyed bushing.

| Circuit | Action | UL Listed AC/DC 125 V Amp | UL Listed AC/DC 250 V Amp | Lever | Slotted Sleeve Length | Catalog Number |
|---|---|---|---|---|---|---|
| DPDT | on-off-on | 10 | 5 | Ball | 13/32" | 80638D |
| 3PDT | on-off-on | 10 | 5 | Ball | 13/32" | 80983 |
| | | ½-HP-125-230 | | | | |
| 4PDT | on-off-on | 10 | 5 | Ball | 13/32" | 80985 |
| | | ½-HP-125-230 | | | | |
| DPDT | on-off-on | 20 | 10† | Square | | 80634 |
| DPDT | on-on* | 20 | 10† | Square | | 80975* |
| DPDT | on-off-on | 30 | 20 | Square | Two hole mounted | 80988 |
| 3PDT | on-off-on | 30 | 20 | Square | | 80898 |
| 4PDT | on-off-on | 30 | 20 | Square | | 80899 |
| 3 Circuit | on-on-on | 30 | 20 | Square | | 82347 |

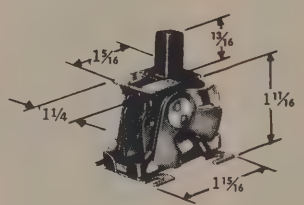
† 1½ HP, 250 V AC; 2 HP, 230 V AC. * 80975 is a 2-position switch.

## EXTRA HEAVY DUTY TOGGLE SWITCHES

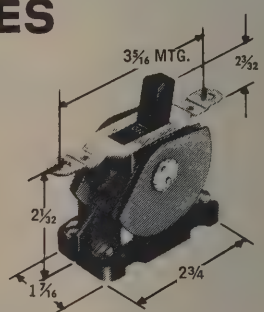
**(UL FILE E1148 GUIDE WOYR)**



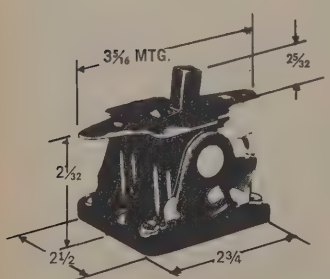

**CATALOG NO. 7828B**
DPST — 60 amp 250 V, 25 Amp 600 V AC/DC.



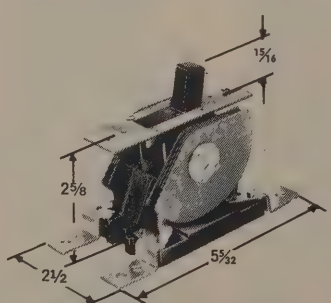

**CATALOG NO. 8686U**
DPST — 30 amp 250 V AC/DC



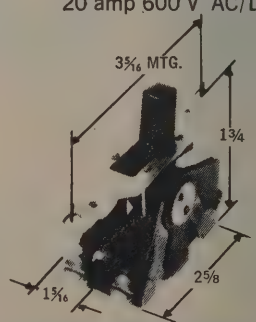

**CATALOG NO. 80093**
DPST — 30 amp 250 V, 20 amp 600 V AC/DC.




**CATALOG NO. 80404**
3PST — 30 amp 250 V, 20 amp 600 V AC/DC.




**CATALOG NO. 80770K**
DPST — 60 amp 250 V, 2 HP 250 V AC/DC.




**CATALOG NO. 100006**
DPST — 30 amp 250 V AC/DC

CROUSE-HINDS®

# Specialty Switches

## Arrow Hart Division

# LIGHTED PUSHBUTTON SWITCHES ADAPT-A-SWITCH

**31 STOCK COMPONENTS BUILD 25,334 DIFFERENT VARIATIONS**

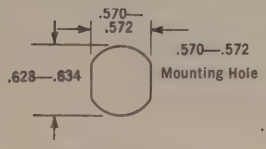
LENS

LAMP*

ACTUATOR-INDICATOR

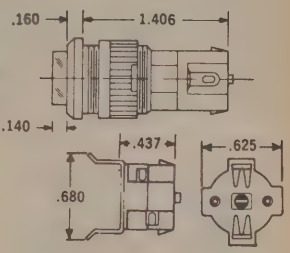
MOUNTING NUT

FINGER SNAP-ON CONTACT BLOCKS

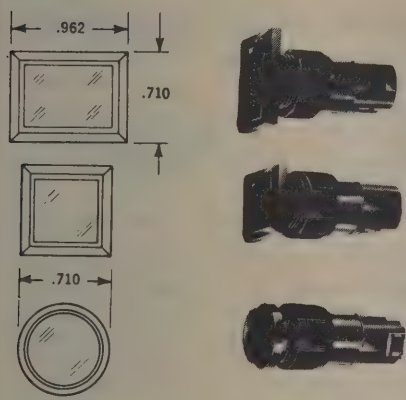



Dimensions same for all actuator shapes.

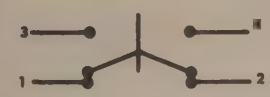
* Lamp not supplied




## 3 LENS / ACTUATOR SHAPES




## 1 FORM Z CIRCUIT




## 2 SWITCHING ACTIONS

**MOMENTARY ACTION**
Use with 1-4 contact blocks

**ALTERNATE ACTION**
Use with 1-3 contact blocks

## 7 LENS COLORS

| | |
|---|---|
| White | Yellow |
| Red | Amber |
| Green | Black (opaque)† |
| Blue | |

† Order black opaque lens when no illumination is required.

## 4 CONTACT BLOCK ASSEMBLIES

NOTE: Each block assembly adds .437" to length of switch. Allow an additional ⅛" behind switch for actuator rod travel clearance.

## LAMP AND WRENCH

Lamps not supplied — use standard T1¾ incandescent groove base. (6 Volts #337; 14 Volts #336; 28 Volts #334.)

Mounting wrench Cat. No. 83500-45.

## GENERAL SPECIFICATIONS

**ACTUATOR —**
Terminals: Tin plated solder type accepts #18 wire. Weight: 8 grms. Plunger Travel: .094 inches.

**CONTACT BLOCK —**
Terminals: Solid fine silver solder type. Accepts #18 wire. Weight: 4 grms. Contacts: Positive snap, wiping action.

**CONTACT RATINGS —**
Standard Duty (Fine Silver): 5 amp, 125 V AC Resistive — 2 amp, 250 V AC Resistive — 5 amp, 28 V DC Resistive.
Low Energy (Gold Plated): Minimum rating for dry circuit application is 10 Micro Amp, 50 MV. Gold Plated Contacts are for applications under 100 milliwatts.

**LIFE —**
Mechanical and Electrical at full ratings: 100,000 cycles minimum.

**MAX. OPERATING FORCE —**

| Poles | Momentary Oz. | Momentary Gms. | Alternate Action Oz. | Alternate Action Gms. |
|---|---|---|---|---|
| 1 | 12 | 341. | 16 | 454. |
| 2 | 24 | 662. | 32 | 909. |
| 3 | 36 | 1022. | 43 | 1362. |
| 4 | 48 | 1363. | * | |

* Do not use.

## UL LISTING

These swiches are not currently UL Listed. Consult factory for applications requiring UL Listing.

## CATALOG NUMBERS

### LENSES

| Color | Rectangular | Square | Round |
|---|---|---|---|
| White | 83500-70 | 83500-80 | 83500-90 |
| Red | 83500-71 | 83500-81 | 83500-91 |
| Green | 83500-72 | 83500-82 | 83500-92 |
| Blue | 83500-73 | 83500-83 | 83500-93 |
| Yellow | 83500-74 | 83500-84 | 83500-94 |
| Amber | 83500-75 | 83500-85 | 83500-95 |
| Black | 83500-76 | 83500-86 | 83500-96 |

## MIX AND MATCH

### INDICATORS FOR MATCHING ILLUMINATED SWITCHES

Indicators are available that are identical in appearance to the illuminated switches featured here. Same lens shapes and colors, same body styles and dimensions. To order an indicator specify catalog number for indicator body and shape and color for lens (see lens catalog number for switches).

SNAP-ON CLIP INDICATOR

| Indicator Bodies | Catalog Number |
|---|---|
| Rectangular | 83507 |
| Square | 83508 |
| Round | 83509 |

An actuator can become an indicator only with this clip.

### ACTUATORS

| Momentary | Rectangular | Square | Round |
|---|---|---|---|
| Alternate Action | 83501<br>83504 | 83502<br>83505 | 83503<br>83506 |

### CONTACT BLOCKS

| Type | Low Leved | Standard |
|---|---|---|
| Single | 83600-30 | 83500-30 |
| Double | Consult Factory | 83500-230 |
| Triple | Consult Factory | 83500-330 |
| Quad | Consult Factory | 83500-430 |

## HOW TO ORDER

1. Determine lens shape and color. Specify Catalog Number.
2. Determine shape and action of actuator required. Specify Catalog Number.
3. Determine number of poles required. Select either standard duty or low energy. Specify Catalog Number.
4. Determine additions or modifications. Specify Catalog Number.

### HOW TO ORDER EXAMPLE

REQUIRED

| | | |
|---|---|---|
| Round Green Lens | Round Lighted Momentary Cont. Actuator | 3 Pole Form Z Contacts |

PARTS
1 pc. 83500-92 1 pc. 83503 3 pcs. 83500-30

ORDER READS
1 pc. - 83500-92 round green lens
1 pc. - 83503 round actuator momentary action
3 pcs. - 83500-30 standard duty contact block

CROUSE-HINDS®

# Specialty Switches

**Arrow Hart Division**

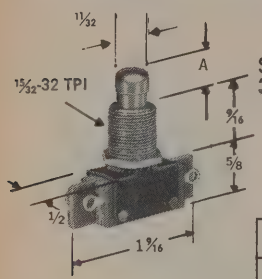
# GENERAL PURPOSE PUSHBUTTON SWITCHES

## GENERAL SPECIFICATIONS FOR PUSHBUTTON SWITCHES

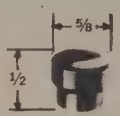
**Exposed metal parts** ..... Bright nickel (except 511 Series which is Aluminum)
**Dielectric breakdown** ..... Exceeds 1,000 V rms
**Contact material** ..... Bronze silver plated
**Terminal material** ..... Bronze silver plated
**Standard hardware** ..... 1 hex nut, 1 knurled nut (unassembled)
**Snap-on buttons** ..... Red and black buttons are available separately for grooved switches

## 1 AMP AC ONLY
### LOW OPERATING PRESSURE — CANOPY SERIES

'A' = 11/32 for standard button
'A' = 21/32 with snap-on button in place on grooved shaft




Standard button
**3392**




| Catalog Number | Button Size | Description |
|---|---|---|
| 3391-194 | 5/8" dia. | Black Molded |
| 3391-372 | 5/8" dia. | Red Molded |

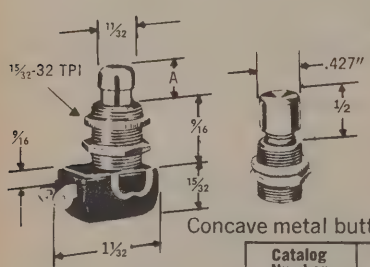
These AC only butt type contact switches feature low operating pressure. They are available with a snap-on button, a standard metal button, or a grooved shaft to accept a snap-on button. Order snap-on button separately for grooved switches. Solder lug terminations. Slotted sleeve: 15/32" dia., 9/16" lg. UL Listed at 1 amp 125 V AC.

| Circuit | Action | Button Style | Catalog Number |
|---|---|---|---|
| Z Circuit | 1 NO-1 NC | Standard* | 3392 |
| Z Circuit | 1 NO-1 NC | Black | 3392AE |
| Z Circuit | 1 NO-1 NC | Red | 3392AER |
| Z Circuit | 1 NO-1 NC | Grooved* | 3392AEB |

* For user-assembled snap-on buttons "grooved" switch style must be ordered.

## 3 AMP AC ONLY
### LOW OPERATING PRESSURE — 511 SERIES

'A' = 11/32 for standard button
'A' = 21/32 with snap-on button in place on grooved shaft




Concave metal button.

| Catalog Number | Button Size | Description |
|---|---|---|
| 3391-194 | 5/8" dia. | Black Molded |
| 3391-372 | 5/8" dia. | Red Molded |

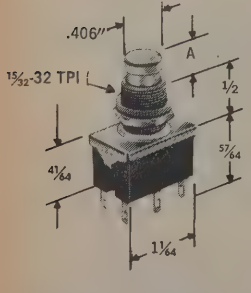
SPST standard metal button.
**80511**

Similar to the Canopy series these AC only butt type contact switches have a molded bakelite base. Available with snap-on, standard metal, grooved, or concave buttons. Concave button is brass with bright nickel finish. Order button separately for grooved switches. Solder lug termination. Slotted sleeve: 15/32" dia., 9/16" lg. UL Listed at 3 amp 125 V, 1 amp 250 V AC.

| Circuit | Action | Button Style | Catalog Number |
|---|---|---|---|
| SPST | on-mom. off | Standard* | 80511 |
| SPST | on-mom. off | Black | 80541 |
| SPST | on-mom. off | Red | 80541R |
| SPST | on-mom. off | Grooved* | 80541L |
| SPST | on-mom. off | Concave | 80511C |
| SPST | off-mom. on | Standard* | 80511E |
| SPST | off-mom. on | Black | 80541E |
| SPST | off-mom. on | Red | 80541ER |
| SPST | off-mom. on | Grooved* | 80541EL |
| SPST | off-mom. on | Concave | 80511CE |

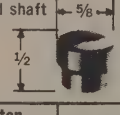
* For user-assembled snap-on buttons "grooved" switch style must be ordered.

## 3 AMP WIPING-ACTION CONTACTS
### SPACE SAVING — 094 SERIES




**Single and Double Pole**
Standard metal button. **83090.**

'A' = 1 3/4 for standard button
'A' = 3/4 with snap-on button in place on grooved shaft




| Catalog Number | Button Size | Description |
|---|---|---|
| 3391-194 | 5/8" dia. | Black Molded |
| 3391-372 | 5/8" dia. | Red Molded |

This space saving switch with quick-make quick-break wiping contacts is ideal for low level AC/DC switching. Silver plated bronze contacts. Solder lug termination. Slotted sleeve: 15/32" dia., 1/2" lg. Standard metal button or grooved shaft to accept snap-on button. Order button separately. UL Listed at 3 amp 125, 1 amp 250 V AC/DC.

| Circuit | Action | Button Style | Catalog Number |
|---|---|---|---|
| SPST | off-mom. on | Standard* | 83090 |
| SPST | off-mom. on | Grooved* | 83090C |
| DPST | off-mom. on | Grooved* | 83093C |
| DPDT | on-mom. on | Grooved* | 83094C |

* For user-assembled snap-on buttons "grooved" switch style must be ordered.

CROUSE HINDS®

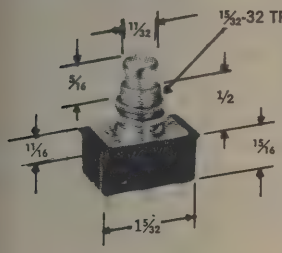
# Specialty Switches

**Arrow Hart Division**

## GENERAL PURPOSE PUSHBUTTON SWITCHES CONTINUED

### 6 AMP WIPING-ACTION CONTACTS

**CLASSIC — 087 SERIES**



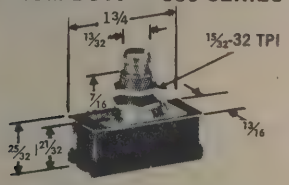

**SINGLE OR DOUBLE POLE**
Standard metal button.
**81087J**

This series is the pushbutton equivalent of the 015 Series of toggle switches. Gives maximum reliability in both power and low-level circuits. Solder lug terminations. Slotted sleeve: 15/32" dia., 13/32" lg. Metal button. UL Listed at 6 amp 125 V, 3 amp 250 V AC/DC (except for 81084G which is UL Listed at 6 amp 125 V, 1 amp 250 V AC/DC.)

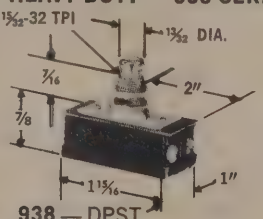
| Circuit | Action | Button Style | Catalog Number |
|---|---|---|---|
| SPST | off-mom. on | Standard | 81075BV |
| SPDT | on-mom. on | Standard | 81081G |
| DPST | off-mom. on | Standard | 81084G |
| DPDT | on-mom. on | Standard | 81087J |

### 16-20 AMP

**MEDIUM DUTY — 630 SERIES / HEAVY DUTY — 938 SERIES**




**630** — SPST/DPST — Standard metal button. Shown **80631.**




**938** — DPST
Standard metal button.

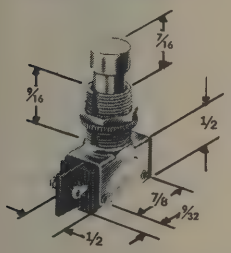
These medium and heavy duty switches are good general purpose controls. Wiping action. Slotted sleeve: 15/32" dia., 7/16" lg. Screw terminations. Metal button.

| Series | Circuit | Action | AC/DC 125 V Amp | AC/DC 250 V Amp | Button Style | Catalog Number |
|---|---|---|---|---|---|---|
| 630 | SPST | off-mom. on | 16<br>1 HP | 8<br>1 HP | Standard | 80631 |
| | DPST | off-mom. on | 16<br>1 HP | 8<br>1 HP | Standard | 80630 |
| 938 | DPST | off-mom. on | 20<br>1½ HP | 10<br>1½ HP | Standard | 80938 |

## DOUBLE ACTION PUSH-PUSH SWITCHES

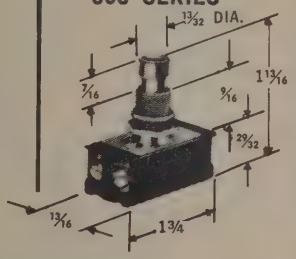
### 3 AMP

**CANOPY SERIES**



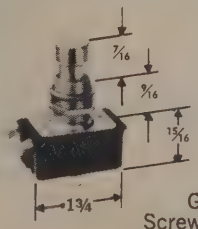

### 16-20 AMP

**863 SERIES**



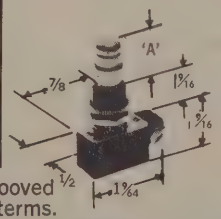

### 6 AMP

**DOUBLE POLE**
**117 SERIES**

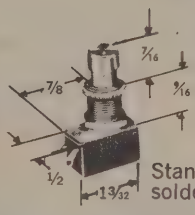



### 6 AMP

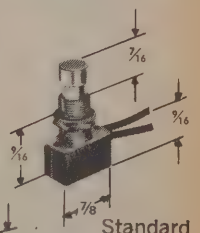
**SINGLE POLE**
**403 SERIES**




Grooved
Screw terms.

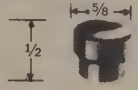



Standard solder lug.




Standard wire leads.

These switches are similar in construction to the toggle switches except they have a push-push action. Slotted sleeve: 15/32" dia., 9/16" lg.




| Catalog Number | Button Size | Description |
|---|---|---|
| 3391-194 | 5/8" dia. | Black Molded |
| 3391-372 | 5/8" dia. | Red Molded |

| Series | Circuit | Action | AC/DC 125 V Amp | AC/DC 250 V Amp | Button Style | Termination | Catalog Number |
|---|---|---|---|---|---|---|---|
| Canopy | SPDT | on-on | 3 | 1 | Standard | Solder | 80711 |
| | DPDT | on-on | 3 | 1 | Standard | Solder | 80714 |
| 403 | SPST | off-on | 6 | 3 | Standard* | Solder | 82403 |
| | SPST | off-on | 6 | 3 | Grooved* | Solder | 82403CL |
| | SPST | off-on | 6 | 3 | Standard* | 6" Wire | 82404 |
| | SPST | off-on | 6 | 3 | Standard* | Screw | 82405 |
| | SPST | off-on | 6 | 3 | Grooved* | Screw | 82405CL |
| 117 | DPDT | on-on | 6 | 3 | Standard | Solder | 81117 |
| 863 | DPST | off-on | 16 A 1 HP | 8 A 1 HP | Standard | Screw | 80863 |
| | DPST | off-on | 20 A 1½ HP | 10 A 1½ HP | Standard | Screw | 80951 |

* For user-assembled snap-on buttons "grooved" switch style must be ordered. Note 'A' dimension with button in place is 13/64. Without button dimension 'A' is 9/16.

CROUSE-HINDS®

# Specialty Switches

**Arrow Hart Division**

## SUBMINIATURE SWITCHES

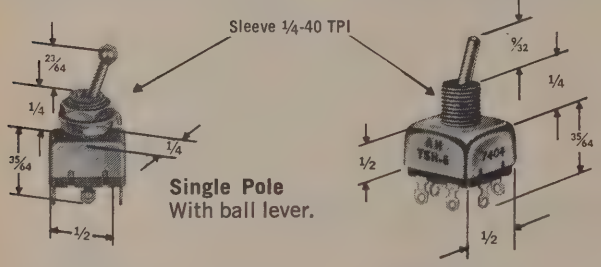
These quality grade subminiature toggle and momentary push-button switches are ideally suited for applications requiring the highest quality standards. The gold plated conatcts permit dependable use in low level circuits, especially where long shelf life is critical. Not currently UL Listed. Consult factory for applications requiring UL Listing.

### GENERAL SPECIFICATIONS

**Exposed metal parts** ..... Gold anodized aluminum
**Dielectric breakdown** ..... Exceeds 1000 V rms
**Contact material** ..... Gold-plated silver buttons
**Movable contact arm** ..... Rhodium-plated silver
**Terminals** ..... Gold plate
**Standard hardware** ..... 2 gold-anodized hex nuts, 1 lockwasher, 2 locating rings (unassembled)
**Additional hardware** ..... Available, see opposite page

**Base** ..... Molded diallyl phthalate
**Contact mechanisms** ..... TS type — knee action. TC, TE, TG, TM type — Rocker action. PM type — Leaf blade with wiping action. PMQ type—Snap acting butt type.
**Toggle rating** ..... 5 amp, 125 V AC—5 amp 29 V DC
**Pushbutton rating** ..... 1 amp 115 V AC, 2 amp 29 V DC (except PMQ3 rated at 7 amp 125 V AC, 5 amp 250 V AC, 5 amp 29 V DC)
**Termination** ..... Solder lug. P.C. Termination available
**Slotted sleeve** ..... ¼" dia., ¼" long
**Colored lever adapters** ..... Available
**Colored pushbuttons** ..... Available

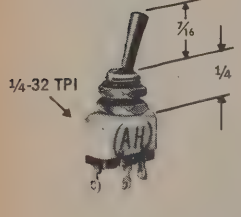
## TOGGLE SWITCHES / SMT SERIES SINGLE AND DOUBLE POLE




**Single Pole**
With ball lever.

**SP** width ¼"
**DP** width ½"

**Double Pole**
With lever to accept colored bat lever adapter.

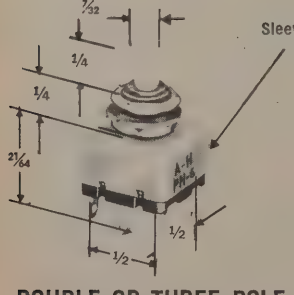



Color lever adapter assembled. For Single or Double Pole Switches. See opposite page for ordering information.

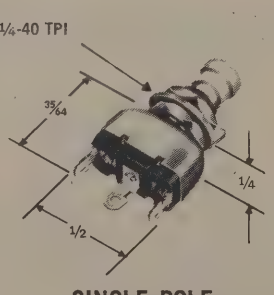
| Circuit | Action | Lever | Catalog Number |
|---|---|---|---|
| SPDT | on-on | Straight* | TSH3 |
| SPDT | on-on | Ball† | TS3 |
| SPDT | on-off-on | Straight* | TCH3 |
| SPDT | on-off-on | Ball† | TC3 |
| SPDT | mom. on-off-maint. on | Straight* | TEH3 |
| SPDT | mom. on-off-maint. on | Ball† | TE3 |
| SPDT | mom. on-off-mom. on | Straight* | TGH3 |
| SPDT | mom. on-off-mom. on | Ball† | TG3 |
| SPDT | mom. on-maint. on | Straight* | TMH3 |
| SPDT | mom. on-maint. on | Ball† | TM3 |
| DPST | off-on | Straight | TSH2 |
| DPST | off-on | Ball † | TS2 |
| DPDT | on-on | Straight | TSH6 |
| DPDT | on-on | Ball † | TS6 |
| DPDT | on-off-on | Straight | TCH6 |
| DPDT | on-off-on | Ball † | TC6 |
| DPDT | mom. on-off-maint. on | Straight | TEH6 |
| DPDT | mom. on-off-maint. on | Ball † | TE6 |
| DPDT | mom. on-off-mom. on | Straight | TGH6 |
| DPDT | mom. on-off-mom. on | Ball † | TG6 |
| DPDT | mom. on-maint. on | Straight | TMH6 |
| DPDT | mom. on-maint. on | Ball † | TM6 |

* See Double Pole switch illustration for lever style.
† See Single Pole switch illustration for lever style.

## PUSHBUTTON SWITCHES / SMP SERIES SINGLE, DOUBLE AND THREE POLE




DOUBLE OR THREE POLE




SINGLE POLE

| Circuit | Action | Catalog Number |
|---|---|---|
| SPDT | on-mom. on | PM3 |
| DPDT | on-mom. on | PM6 |
| 3PDT | off-mom. on | PM7 |
| 3PDT | on-mom. on | PM8 |
| SPDT | on-mom. off | PMQ3 |

Colored pushbutton caps are available. Standard color supplied is white. Two cap sizes are available .218" dia. and ⅜" dia. See opposite page. .218" cap is supplied as standard.

CROUSE HINDS®

# Specialty Switches

**Arrow Hart Division**

## SUBMINIATURE SWITCHES CONTINUED

### MOUNTING HARDWARE, LEVER ADAPTERS, AND PUSHBUTTON CAPS

#### MOUNTING HARDWARE

All sleeve mounted switches are furnished with two mounting nuts. One nut goes behind panel to prevent the bushing or sleeve being distorted by overtightening the front panel nut. Arrow-Hart accepts no responsibility for damage to switches that are mounted without the backup nuts.

| Catalog Number | Description | Thread or I.D. | Material | Finish |
|---|---|---|---|---|
| 81019 1AZ | Std. Hex | ¼"-40 | Brass | Nickel |
| 81099 1BF | Std. Hex | ¼"-40 | Alum. | Gold Anodized |
| 81099 1BE | Std. Hex | ¼"-40 | Alum. | Clear Anodized |
| 18569 1BF | Std. Knurled | ¼"-40 | Alum. | Gold Anodized |
| 18569 1BE | Std. Knurled | ¼"-40 | Alum. | Clear Anodized |
| 18569 1 | Dress Nut | ¼"-40 | Stain. | Steel |
| 18569 2BF | Dress Nut | ¼"-40 | Alum. | Gold Anodized |
| 18569 2BE | Dress Nut | ¼"-40 | Alum. | Clear Anodized |
| 95091 111 | Internal Tooth Lockwasher | ¼" | Steel | Zinc |
| 18533 1 | Locking Ring Short Tab | ¼" | Steel | Zinc |
| 18533 4 | Locking Ring Long Tab | ¼" | Steel | Zinc |

#### MOUNTING HARDWARE

STANDARD HEX | STANDARD KNURLED | DRESS NUT | INTERNAL TOOTH LOCKWASHER | LOCKING RING WITH TAB

.215" dia. | ⅜" dia.

#### PUSHBUTTON CAPS

#### LEVER ADAPTERS

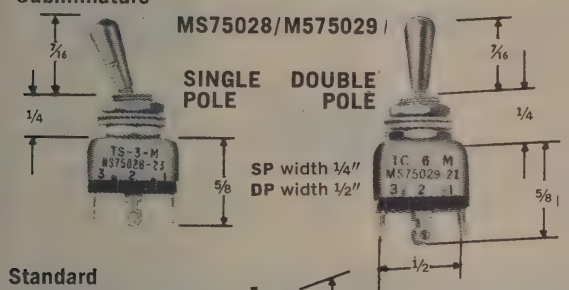
| Catalog Number | Description |
|---|---|
| 18500-11 | White |
| 18500-13 | Blue |
| 18500-14 | Red |
| 18500-15 | Yellow |
| 18500-16 | Green |
| 18500-17 | Brown |
| 18500-18 | Black |
| 18500-22BE | Anodized Alum. |

#### PUSHBUTTON CAPS

| Colors | .218" Dia. | ⅜" Dia. |
|---|---|---|
| White (Nat.) | 18567-61 | 18567-71 |
| Black | 18567-62 | 18567-72 |
| Blue | 18567-63 | 18567-73 |
| Red | 18567-64 | 18567-74 |
| Yellow | 18567-65 | 18567-75 |
| Green | 18567-66 | 18567-76 |
| Brown | 18567-67 | 18567-77 |

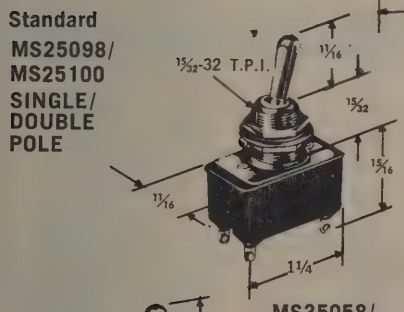
## MILITARY SWITCHES SUBMINIATURE AND STANDARD

**Subminiature**

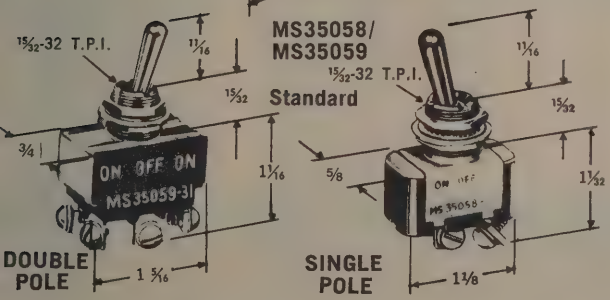



**Standard**

**MS25098/ MS25100 SINGLE/ DOUBLE POLE**




**MS35058/ MS35059**




These toggle switches are manufactured in accordance with MIL spec MIL-S-83731. Switches supplied with two hex nuts, one locating ring and one shakeproof lockwasher assembled.

**SUBMINIATURE**

| Action | Circuit: Single Pole Cat. No. | Single Pole MS Part No. | Double Pole Cat. No. | Double Pole MS Part No. |
|---|---|---|---|---|
| on-none-on | TS1M | MS-75028-22 | TS2M | MS-75029-22 |
| on-off-on | TC3M | MS-75028-21 | TC6M | MS-75029-21 |
| mom. on-off-maint. on | TE3M | MS-75028-31 | TE6M | MS-75029-31 |
| mom. on-off-mom. on | TG3M | MS-75028-27 | TG6M | MS-75029-27 |
| mom. on-none-on | TM3M | MS-75028-26 | TM6M | MS-75029-26 |
| on-none-on | TS3M | MS-75028-23 | TS6M | MS-75029-23 |

**STANDARD**

| Action | Circuit: Single Pole Cat. No. | Single Pole MS Part No. | Double Pole Cat. No. | Double Pole MS Part No. |
|---|---|---|---|---|
| on-none-off | 25098AM | MS-25098-22 | 25100AM | MS-25100-22 |
| on-none-mom. off | 25098BM | MS-25098-29 | 25100BM | MS-25100-29 |
| off-none-mom. on | 25098CM | MS-25098-30 | 25100CM | MS-25100-30 |
| on-none-on | 25098DM | MS-25098-23 | 25100DM | MS-25100-23 |
| on-off-on | 35058EM | MS-35058-21 | 35059EM | MS-35059-21 |
| on-none-off | 35058WM | MS-35058-22 | 35059WM | MS-35059-22 |
| on-none-on | 35058DM | MS-35058-23 | 35059DM | MS-35059-23 |
| on-off-none | 35058AM | MS-35058-24 | 35059AM | MS-35059-24 |
| on-mom. off-none | 35058CM | MS-35058-25 | 35059CM | MS-35059-25 |
| on-none-mom. on | 35058FM | MS-35058-26 | 35059FM | MS-35059-26 |
| mom. on-off-mom. on | 35058GM | MS-35058-27 | 35059GM | MS-35059-27 |
| none-off-mom. on | 35058BM | MS-35058-28 | 35059BM | MS-35059-28 |
| on-none-mom. off | 35058XM | MS-35058-29 | 35059XM | MS-35059-29 |
| off-none-mom. on | 35058YM | MS-35058-30 | 35059YM | MS-35059-30 |
| on-off-mom. on | 35058HM | MS-35058-31 | 35059HM | MS-35059-31 |

Screw terminals are assembled.

CROUSE-HINDS®

# Specialty Switches

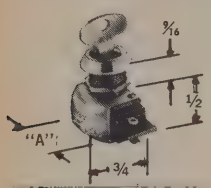
## Arrow Hart Division

# LOCKING SWITCHES ROTARY KEYLOCK SWITCHES AND BRACKETS

## CANOPY SERIES 3 AMP AC/DC

These power switches offer all the features of the non locking canopy series, with the addition of a locking mechanism for circuit security applications. They can be used for controlled access of a wide variety of electrical equipment.

- Silver Plated Brass Movable (Roller) and Stationary Contacts
- Laminated Bakelite Base Construction
- Tin Dipped Brass Slotted Sleeve
- Zinc Chromate Plated Steel Frame
- One Nickel Plated Steel Key



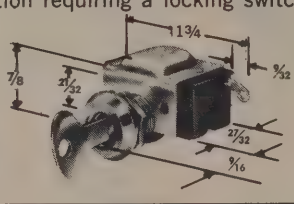

**STANDARD SECURITY**

| | "A" Dim. |
|---|---|
| SPST SPDT | 1 3/16" |
| DPST DPDT | 1 3/16" |

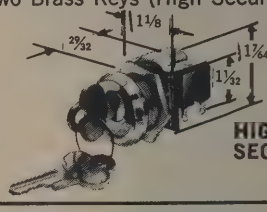
## INTERMEDIATE SERIES / 715L SERIES 6 AMP AC/DC

This series of power switches is an extension of the canopy line and features higher ratings and wiping contacts. The Standard Security Level versions are used to prevent unauthorized actuation of computers, data processing equipment, and electronic instrumentation. The High Security Level tumbler lock switches are widely used in hospital, business machine, banking, stationary power tool, and alarm system applications. Both versions are ideally suited for any application requiring a locking switch capable of handling either power or low energy loads.

- Wiping Blade Contact Mechanism
- Stationary Contact Silver Plated Brass
- Movable Contact Silver Plated Bronze
- Bakelite Base Construction
- Tin Dipped Brass Slotted Sleeve
- Brass Nickel Plated Dress Nut
- Zinc Chromate Plated Steel Frame
- One Nickel Plated Steel Key (Standard Security Level)
- Two Brass Keys (High Security Level)



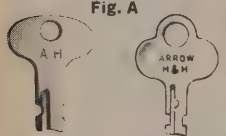

**STANDARD SECURITY**




**HIGH SECURITY**

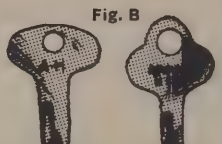
## KEY STYLES

Fig. A



1561-488 1561-1488

Fig. B



1561-487 1561-1487

Fig. C 81715-41
Fig. D 81715-61

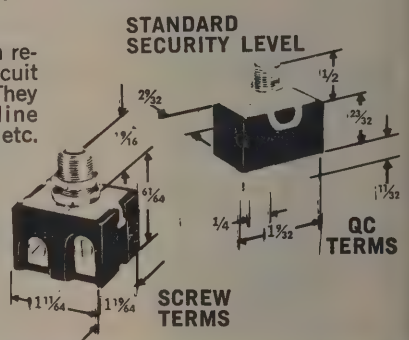
Fig.E 82787-10

## HEAVY DUTY SERIES / 702L SERIES 20 AMP 120-240 VAC

Our heavy duty series combines high reliability switching, heavy duty circuit protection and maximum economy. They have found application in gasoline pumps, heating and cooling systems, etc.

- Slow Make and Break Contacts
- Butt Type Silver Contacts
- 2-4 Positions
- H. P. Rating
- Bakelite Base
- Tin Dipped Brass Sleeve

**STANDARD SECURITY LEVEL**




## LOCKING SWITCH SELECTION GUIDE

| Series | Security Level | Circuit | Action | AC/DC 125 V Amp | AC/DC 250 V Amp | Slotted Sleeve Length | Sleeve (Dia.) 32 TPI | Key Removal Positions | Key Style Fig. | Catalog Number |
|---|---|---|---|---|---|---|---|---|---|---|
| ** Canopy 2-pos. | S | SPST | off-on | 3 | 1 | 9/16" | 15/32" | Off | A | 1561L |
| | S | SPST | off-on | 3 | 1 | 9/16" | 15/32" | Both | B | 1561LE |
| | S | SPDT | on-on | 3 | 1 | 9/16" | 15/32" | Both | B | 1565L |
| | S | DPST | off-on | 3 | 1 | 9/16" | 15/32" | Off | A | 1572L |
| | S | DPDT | on-on | 3 | 1 | 9/16" | 15/32" | Both | B | 1575L |
| ** Intermediate 715L 2-pos. | S | SPST | off-on | 6 | 3 | 9/16" | 15/32" | Off | A | 81715L |
| | S | SPST | off-on | 6 | 3 | 9/16" | 15/32" | Both | B | 81715LE |
| | HS | SPST | off-on | 6 | 3 | 45/64" | 7/8" | Off | D | 81715LQ61 |
| | HS | SPST | off-on | 6 | 3 | 45/64" | 7/8" | Both | C | 81715LQ41 |
| | S | SPDT | on-on | 6 | 3 | 9/16" | 15/32" | Both | A | 81721L |
| | HS | SPDT | on-on | 6 | 3 | 45/64" | 7/8" | CC on | D | 81721LQ61 |
| | HS | SPDT | on-on | 6 | 3 | 9/16" | 15/32" | Both | C | 81721LQ41 |
| | S | DPST | off-on | 6 | 3 | 9/16" | 15/32" | Off | A | 81724L |
| | S | DPST | off-on | 6 | 3 | 9/16" | 15/32" | Both | B | 81724LC |
| | HS | DPST | off-on | 6 | 3 | 45/64" | 7/8" | Off | D | 81724LQ61 |
| | HS | DPST | off-on | 6 | 3 | 45/64" | 7/8" | Both | C | 81724LQ41 |
| | S | DPDT | on-on | 6 | 3 | 9/16" | 15/32" | Both | A | 81727L |
| | HS | DPDT | on-on | 6 | 3 | 45/64" | 7/8" | CC on | D | 81727LQ61 |
| | HS | DPDT | on-on | 6 | 3 | 45/64" | 7/8" | Both | C | 81727LQ41 |

| Series | Security Level | Circuit | Action | AC Only 125 V AC | AC Only 240 V AC | Slotted Sleeve Length | Sleeve (Dia.) 32 TPI | Key Removal Positions | Key Style Fig. | Catalog Number |
|---|---|---|---|---|---|---|---|---|---|---|
| Heavy Duty 702L 2 & 4-pos. | S | DPST | off-on-off-on | 20 A 1½ HP | 20 A 2 HP | 15/32" | 15/32" | Off | E | 82787B† |
| | S | DPST | off-on | 20 A 1½ HP | 20 A 2 HP | 9/16" | 15/32" | Off | A | 70307LA* |

*Termination is screw. † Termination is quick-connect. **Termination is solder lug

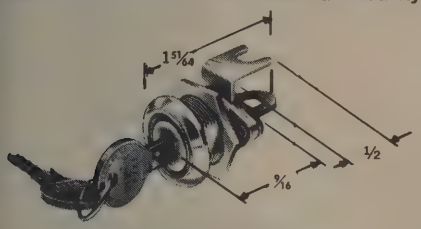
# Specialty Switches

## Arrow Hart Division

# LOCKING SWITCHES CONTINUED

## LOCKING BRACKETS FOR TOGGLE SWITCHES

Locking brackets provide a flexible way to convert toggle switches to rotary lock switches. In addition, we can offer economy priced brackets which deliver Standard Security Level or High Security Level locking mechanisms.



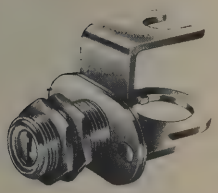

HIGH SECURITY LEVEL

Replacement key is stock item.
82787-55

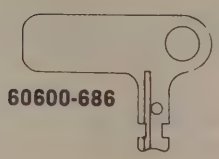
### HIGH SECURITY LEVEL

- Tin Dipped Brass Sleeve (7/8" diameter 24 T.P.I.)
- Supplied with Nickel Plated Brass Dress and Hex Nut
- Two Keys Supplied with Each Bracket (82787-55)

| Cat. No. | Description |
|---|---|
| 8947-400 | Key Removable in Counter-Clockwise position |
| 8947-401 | Key Removable in Center position |
| 8947-404 | Key Removable in either extreme position |
| 8947-405 | Key Removable in Clockwise position |
| 8047-406 | Key Removable in Counter-Clockwise position when using AC only momentary single throw switch. |
| 8947-407 | Key Removable in any one of 3 positions |



STANDARD SECURITY LEVEL




### STANDARD SECURITY LEVEL

- Tin Dipped Steel Construction • 15/32 dia. 32 TPI Bushing
- One Nickel Plated Key (80600-686)

| Cat. No. | Description |
|---|---|
| 80600-1027 | Key Removable in all positions. Key way not slotted |
| 80600-1037 | Key Removable in Vertical position. Key way slotted opposite yoke |

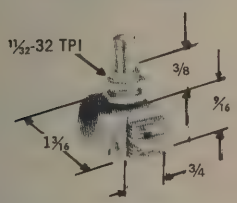
# ROTARY SWITCHES

These time proven 2-position through 4-position rotary switches are suitable for a wide range of applications from low-level up to 2 HP at 240 volts.

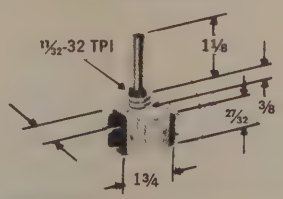
## GENERAL SPECIFICATIONS FOR ROTARY SWITCHES

**Exposed metal parts** ..... Bright nickel
**Dielectric breakdown** ..... Exceeds 1,000 V rms
**Standard hardware** ..... 2 hex nuts (unassembled)

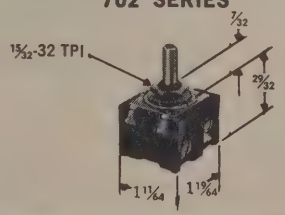
CANOPY SERIES




715 SERIES




702 SERIES




| Series | Circuit | Action | AC/DC 125 V Amp | AC/DC 250 V Amp | 11/32" Dia. Unslotted Sleeve Length | Shaft Dia. | Shaft Length | Termination | Catalog Number |
|---|---|---|---|---|---|---|---|---|---|
| Canopy 2-pos. | SPST | off-on | 3 | 1 | 3/8" | 1/4" | 3/8" | Solder | 1561B |
| | SPST | off-on | 3 | 1 | 3/8" | 1/4" | 1 1/8" | Solder | 1561BS |
| | SPST | on-on | 3 | 1 | 1" | 1/4" | 1/2" | Solder | 1575VA |
| 715 2-pos. | SPST | off-on | 6 | 1 | 3/8" | 1/4" | 3/8" | Solder | 81715 |
| | SPST | off-on | 6 | 1 | 3/8" | 1/4" | 1 1/8" | Solder | 81715J |
| | SPDT | on-on | 6 | 1 | 3/8" | 1/4" | 3/8" | Solder | 81721 |
| | SPDT | on-on | 6 | 1 | 3/8" | 1/4" | 1 1/8" | Solder | 81721J |
| | DPDT | on-on | 6 | 1 | 3/8" | 1/4" | 3/8" | Solder | 81727 |
| | DPDT | on-on | 6 | 1 | 3/8" | 1/4" | 1 1/8" | Solder | 81727J |

| Series | Circuit | Action | AC Only 120 V | AC Only 240 V | 15/32" Dia. Unslotted Sleeve Length | Shaft Dia. | Shaft Length | Termination | Catalog Number |
|---|---|---|---|---|---|---|---|---|---|
| 702 2-pos. | DPST | off-on | 20 A 1 HP 5L | 20 A 2 HP | 7/32" | 1/4" | 11/16" | Screw | 70302A |

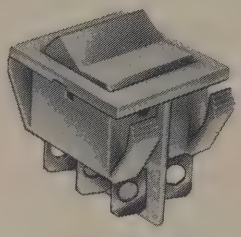
CROUSE-HINDS®

# Specialty Switches

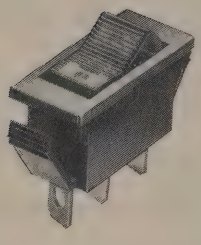
Arrow Hart Division

## SNAP-IN ROCKER SWITCHES LIGHTED AND NON-LIGHTED

SINGLE POLE
2-POSITION
(non-lighted)

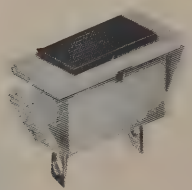


DOUBLE POLE
2-POSITION
(non-lighted)



SINGLE POLE
2-POSITION
(lighted)

DOUBLE POLE
2-POSITION
(lighted)



INDICATOR

- **Economical**
- **Compact design with popular snap-in mounting**
- **Choice of color**
- **Matching indicator lights**
- **Slow, make and break action**
- **Choice of single pole 1600 Series or double pole 2600 Series**
- **Complete European approvals**

Compact design with popular snap-in mounting. UL, CSA, UTE, BS, VDE, SEMKO, SF and DEMKO listed at 16 amp 250 Vac.

Specified in electronic instrumentation and on medical, data processing, telecommunications and duplicating equipment — the same switch can be used for both domestic and foreign markets.

Offered in a choice of colors. A wide circuit variety for designers and engineers. Lighted and unlighted styles.

### SPECIFICATIONS

| | |
|---|---|
| **Operation** | Rocker lever action, slow make-break, 2 and 3 position maintained 2 position momentary, with and without illumination |
| **Function** | 1600 Series single pole, single throw (SPST) and single pole double throw (SPDT). 2600 Series double pole, single throw (DPST) and double pole, double throw (DPDT) |
| **Mounting method** | Through rectangular aperture by fixing legs on switch which gives a "snap-in" feature |
| **Base** | High grade Nylon 66 |
| **Actuator** | High grade Nylon 66 |
| **Weight** | 1600 Series — 6 grams approx. 2600 Series — 12 grams approx. |
| **Contact rating** | 16A, 250 Vac |
| **Dielectric voltage** | 1000 volts R.M.S. (across contacts) |
| **Insulation resistance** | 50 megohms |
| **Electrical life** | 10,000 cycles minimum at maximum rated voltage and current |
| **Mechanical life** | 50,000 cycles minimum |
| **Lamp specification** | Average life — 25,000 hours for neons (110 volts) and 50,000 hours for filament (6 volts). Wattage: 6 Volts, 0.9 Watts |
| **Temperature range** | −40°C to +85°C |
| **Angular movement** | 2 position 36°, 3 position 18° each side of center |
| **Maximum Panel Thickness** | .118 for both 1600 and 2600 |

### SPECIAL OPTIONS — CONTACT FACTORY

- **Special voltage bulbs**
- **Hot stamp legends**
- **Special color bezel and actuators**
- **Wire leads**
- **Solder lugs**

CROUSE-HINDS®

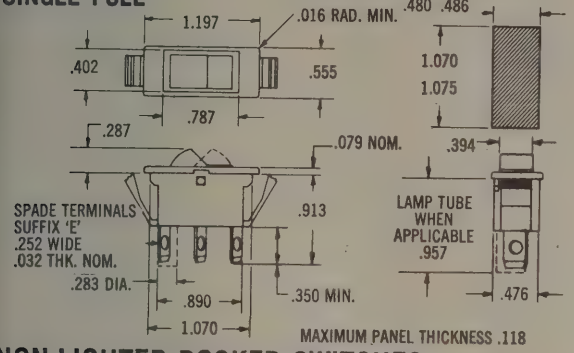
# Specialty Switches

Arrow Hart Division

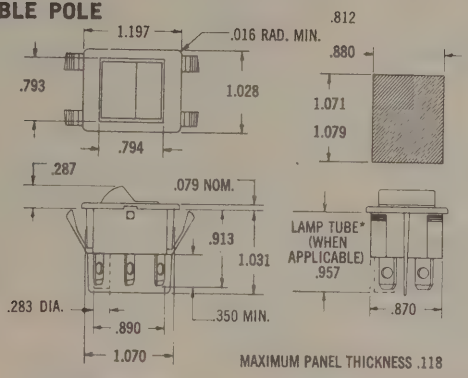
## SNAP-IN ROCKER SWITCHES LIGHTED AND NON-LIGHTED CONTINUED

### DIMENSIONS/LIGHTED AND NON-LIGHTED

#### SINGLE POLE




#### DOUBLE POLE




* Consult factory

### NON-LIGHTED ROCKER SWITCHES

#### SINGLE POLE

| Circuit | Action | Basic Catalog Number |
|---|---|---|
| SPST | off-on | 1600 |
| SPST | off-(on) | 1601 |
| SPDT | on-on | 1602 |
| SPDT | on-(on) | 1603 |
| SPDT | on-off-on | 1604 |

| Bezel Color Code | Actuator Color Code | Termination .250" QC |
|---|---|---|
| 1 = Black<br>2 = White<br>3 = Red | 1 = Black<br>2 = White<br>3 = Red | E |

#### DOUBLE POLE

| Circuit | Action | Basic Catalog Number |
|---|---|---|
| DPST | off-on | 2600 |
| DPST | off-(on) | 2601 |
| DPDT | on-on | 2602 |
| DPDT | on-(on) | 2603 |
| DPDT | on-off-on | 2604 |

| Bezel Color Code | Actuator Color Code | Termination .250" QC |
|---|---|---|
| 1 = Black<br>2 = White<br>3 = Red | 1 = Black<br>2 = White<br>3 = Red | E |

### LIGHTED ROCKER SWITCHES

#### SINGLE POLE

| Circuit | Action | Basic Catalog Number Neon | Filament |
|---|---|---|---|
| SPST | off-on | 1600 | 1620* |
| SPST | off-(on) | 1601 | 1621* |
| SPDT | on-off-on | 1624* | 1624* |

| Translucent Actuator Color | Bulb Voltage Code | Bezel Color Code | Termination .250" QC |
|---|---|---|---|
| A = Amber<br>G† = Green<br>R = Red<br>W = Clear | 1 = 110V (Neon)<br>4 = 6V (Filament) | 1 = Black<br>2 = White<br>3 = Red | E |

#### DOUBLE POLE

| Circuit | Action | Basic Catalog Number |
|---|---|---|
| DPST | off-on | 2600 |
| DPST | off-(on) | 2601 |
| DPST | on-(off) | 2605 |

| Translucent Actuator Color | Bulb Voltage Code | Bezel Color Code | Termination .250" QC |
|---|---|---|---|
| A = Amber<br>G = Green<br>R = Red<br>W = Clear | 1 = 110V (Neon)<br>4 = 6V (Filament) | 1 = Black<br>2 = White<br>3 = Red | E |

* On two pole base

( ) Momentary Circuit

† All SPST switches ordered with a translucent green actuator are supplied on a single pole base with lamp tube. Catalog numbers supplied are 1600TG. for off-on and 1601TG for off-(on) action.

### LIGHTED INDICATOR

| Basic Catalog Number | Translucent Lens Color Code | Lamp Voltage | Bezel Color | Termination .250" QC |
|---|---|---|---|---|
| 1609 | A = Amber<br>R = Red | 1 = 110V (Neon) | 1 = Black | E |

### HOW TO ORDER

**NON-LIGHTED:**
Select basic catalog number after determining desired circuit. Then add suffixes for bezel color, actuator color, and termination.

**EXAMPLE NON-LIGHTED:**
1600 (SPST) + 1 (Black Bezel) + 1 (Black Actuator) + E (.250 QC Terminals).
The correct catalog number is 160011E.

**LIGHTED:**
Select basic catalog number after determining desired circuit (and lamp type and actuator color for SPST models). Add suffixes for actuator color, bulb voltage, bezel color and termination.

**EXAMPLE LIGHTED:**
1600 (SPST) + R (Red Actuator) + 1 (110 V Neon) + 1 (Black Bezel) + E (.250 QC Terminals).
The correct catalog number is 1600R11E.

# CW INDUSTRIES SWITCHES

## MICRO-MINIATURE SLIDE SWITCHES

GS-115
Top Actuated

GI-116
Side Actuated

**Circuitry:** SPDT and DPDT with detent.

**Actuation:** Top and side.

**Rating:** From 0.5A to 1.0A at 125V.

The smallest switches made by CW -- occupy less than 1/5 the volume and 1/4 the cross-sectional mounting surface area of standard size slide switches of similar circuitry.

## MINIATURE SLIDE SWITCHES

GF-124
Top Actuated

GI-154 PC
Side Actuated

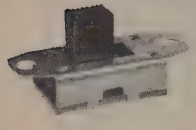
**Circuitry:** Available as single, double, and three pole and 2, 3 or 4 positions, with detent or spring return.

**Actuation:** Top and side (a momentary contact pushbutton switch is also available in this size).

**Rating:** From 0.5A to 8.5A at 125V.

Sized between micro miniature and standard sized switches. More moderately priced than the micro-miniature Switch.

## STANDARD SLIDE SWITCHES



GF-324
Top Actuated

GG-351 PC
Side Actuated

**Circuitry:** Available as single, double, three and four pole and 2, 3 or 4 positions with detent or spring return.

**Actuation:** Top, side, push-pull or toggle.

**Rating:** From 3A to 13A AC; 0.5A DC at 125V; and 8A DC at 12V.

Most moderately priced of all CW switches. Available in a wide variety of mounting options, terminal choices and supplemental features.

## BIFURCATED SWITCHES

GMB-126

GMB-127S

**Circuitry:** SPDT, DPDT, SP 3 Position, and DP 3 Position; break before make and make before break.

**Actuation:** Top.

**Rating:** 0.5A AC-DC at 125V.

These miniature bifurcated switches provide redundant high contact pressure as required in some low current, low voltage applications.

## MINIATURE TOGGLE SWITCHES*

GT-124

**Circuitry:** SPDT and DPDT with detent.

**Actuation:** Toggle.

**Rating:** From 0.5A to 6A at 125V.

Switch mechanism is virtually tease-proof, providing a true 2-position on-off action. Ideal for use in the instrument, appliance, industiral control and communications industries.

*Patented

## DIP SWITCHES

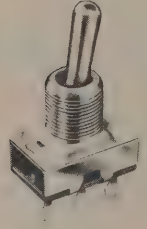
**Circuitry:** SPST in 4 to 10 stations.

**Actuation:** Top.

**Rating:** 100mA at 50V DC non-switching and 100mA at 5V DC switching.

For high density, PC board applications that require multi-station/manual selection on-off switching.

## TOGGLE, ROCKER AND ROTARY SUPERSTRUCTURES FOR STANDARD SLIDE SWITCHES



GT-324

GR1-326

GA-324

CW Industries demonstrates its switch flexibility by offering a simple superstructure that enables the user to easily change many basic switch types into toggle, rocker or rotary switch types. Over 20 versions of each basic switch are possible. Types vary in their mounting bracket, actuating knob or both. This versatility enables users to purchase highly reliable CW switches, with a variety of actuators, at prices far less than switches of similar circuitry.

*CW Engineers are always available to help solve unique switch problems and, if necessary, to work with customers in the development of new switches for new applications.*

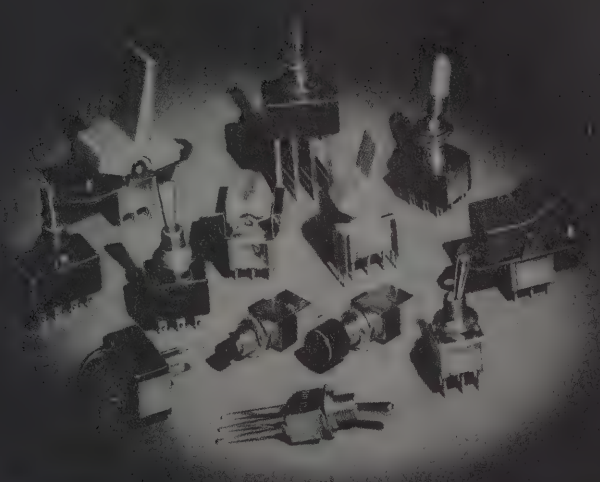
For additional information, request CW Switch Catalog 2100-77

CW INDUSTRIES
550 DAVISVILLE ROAD, WARMINSTER PENNSYLVANIA 18974
PHONE 215-355-7080 • Telex 83-1470 • Cable—CWIND
Quality products through creative engineering

CONTROL

J-B-T SWITCHES

- Lever Lock
- Toggles
- Pushbuttons
- Rockers
- Paddles
- Direct Panel Mount
- Printed Circuit Board Mount
- Wire Wrap
- Right Angle
- Lever and Bushing Options
- Special Options



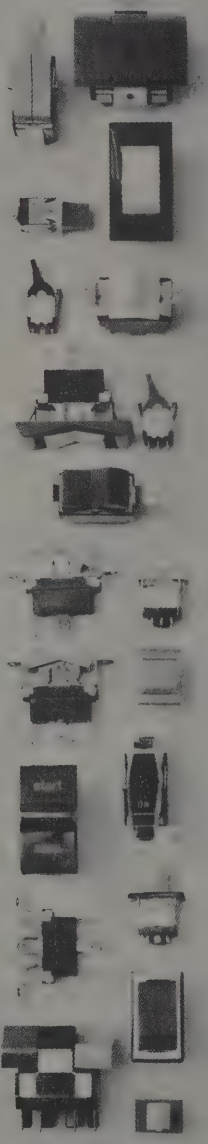
J-B-T SUB-MINIATURE SWITCHES

Send for complete catalog: Cutler-Hammer J.B.T. Switches 424 Chapel Street
Box 1904 New Haven, CT 06509 Telephone: (203) 772-2220 TWX 710 465 3165

# some special

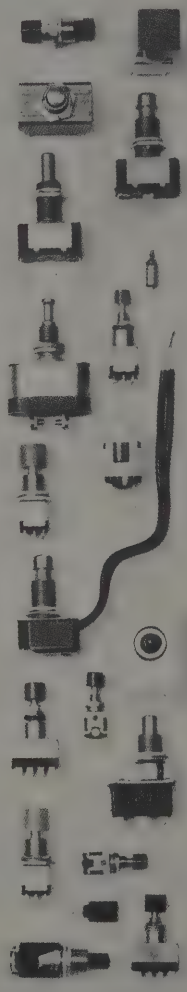
**Toggle Switches**
Bat, lever lock. Designer Line, sealed. Big, broad choice.

**Rocker Switches**
Singles and multiples. Wide, colorful selection range. Legends, too.

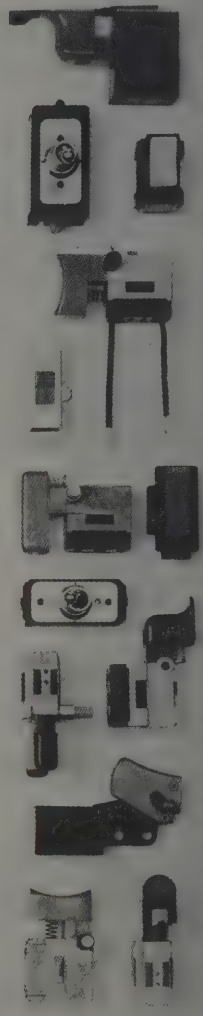


From Cutler-Hammer. The broadest line. Styled to meet today's and tomorrow's requirements. They're solid quality, look great, work long and hard. Carried in stock for local availability by Switch Distributors. Backed by Cutler-Hammer sales engineers who can deliver innovative design help for

**Pusbutton Switches**
Choice of sizes, colors, circuits, ratings. Styled to "turn you on".



**Tool Handle & Slide Switches**
Variable speed, reversing. Double insulated.



CUTLER • HAMMER
Specialty Products Group
Milwaukee, WI 53216
414-442-7800

CONTROL

# reminders

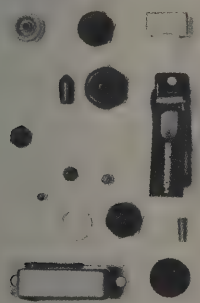
the exact switch or relay you need — when you need it.

It's no wonder so many designers specify Cutler-Hammer. For quality, reliability, availability, and style. For commercial, industrial, and military applications.

We simply offer more — of everything!

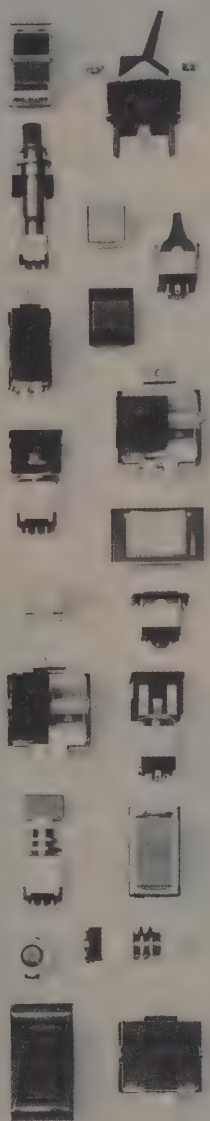
**Snap Switches**
Lever, roller, leaf, and pushbutton actuators. Four terminal styles.

**Switch Accessories**
Guards. Boots. Seals. Caps. Decorator facenuts. And much more to protect, code or customize.

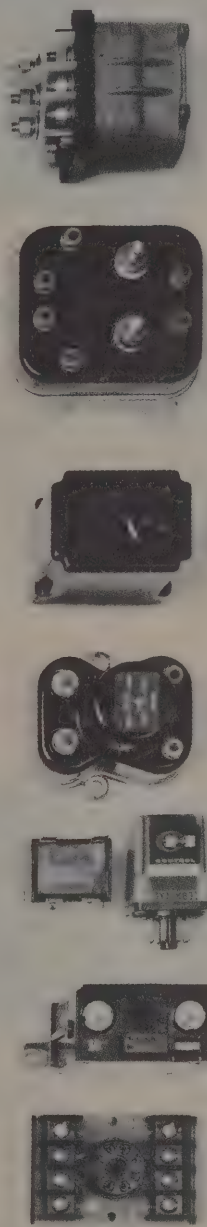


**Rotary Switches**
Precision and general purpose. Single and multiple wafer.

**Illuminated Switches**
Rockers, paddles, pushbuttons, indicators. Snap-in and bushing.



**Relays**
Hermetics, non-sealed, potted. Power, latching, and timing functions.



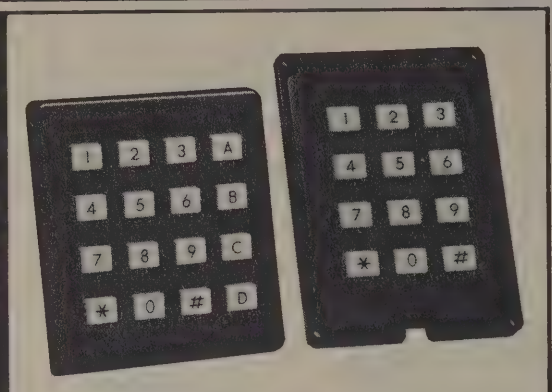
**p.s.**

For complete full-line catalog, write on your letterhead to Cutler-Hammer Specialty Products Group, 4201 North 27th Street, Milwaukee, Wisconsin 53216. Or check with your nearest Cutler-Hammer sales office for our '77/'78 Order-Log.

# DIGITRAN

# Digital Switches and Keyboards

Series KL




Terminal KEYBOARDS

## Low Profile MINIKEY™

A handsome, miniature keyboard with the real tactile response previously available only in full size, full stroke keyboards. Fast, positive contact closures assure swift, comfortable, positive keyboard operation.

- 12 key and 16 key arrays
- Rear-panel or front-panel mounting
- Excellent tactile characteristics
- Interface with all digital logic circuitry
- Matrix, single-pole and TOUCH TONE* operation

*Touch Tone is a registered trademark of A.T. & T.

## Solid State KEYBOARDS

Custom-designed for the volume OEM user, Digitran's solid state keyboards offer superior technical features and are highly cost-effective. They are the *only* capacitive keyboards with a unitized frame and with a single moving-plate capacitive switching element, for vastly improved switching characteristics.

- Patented noise-rejection technique
- All electronics on printed circuit board
- Drip-proof and debris-proof
- Low profile, exceptionally clean appearance
- High reliability, in excess of 100 million MCBF

**THE COMPANY BEHIND THE PRODUCT:** Digitran is a major manufacturer of special-feature miniature and terminal keyboards for a wide variety of data entry applications. In addition, we are the world's largest manufacturer of thumbwheel switches, which we invented in 1959. **SALES NETWORK:** Our network of more than 450 technical representatives and stocking distributors covers all major Free World markets. **INFORMATION ANYTIME, ANYWHERE:** For detailed information and pricing on any of our commercial/industrial switches, contact your nearest Digitran distributor. For information and pricing on our keyboards and sealed Q.P.L. switches, contact your nearest Digitran technical representative. Locations of all Digitran distributors and representatives are listed in this EEM directory. Or you may directly contact:

THE DIGITRAN COMPANY

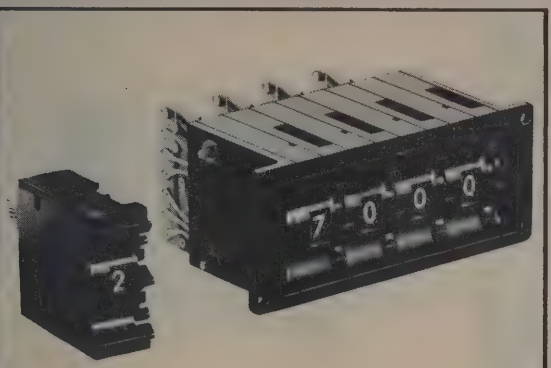
A division of Becton, Dickinson and Company B-D

855 South Arroyo Parkway • Pasadena, California 91105 • Phone: (213) 449-3110 • TWX 910-588-3794.

# Digital Switches and Keyboards

# DIGITRAN

Series 200/700



## MINISWITCH®

Small switches for hostile environments, virtually impervious to sand, dust, oils, salt spray, high humidity and temperature, and explosive atmospheres. Identical products except that the Series 200 has potted wire leads and the Series 700 has a potted printed circuit board. Switch width, .500" and cutout height, .980". Q.P.L. approved to MIL-S-22710/15 and MIL-S-22710/20.

- 8, 10, 12 or 16 dial positions
- .250" spacers
- R.F.I. shielding available
- Optional, replaceable Mil-spec lighting
- Active elements enclosed in sealed chamber

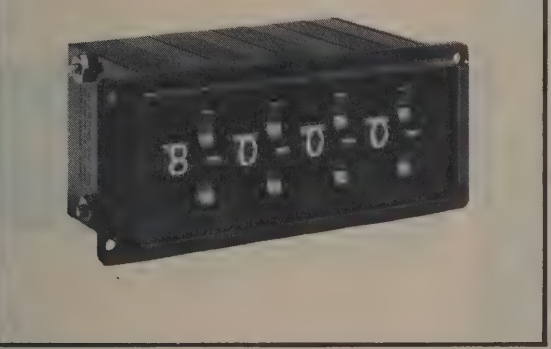
Series 300/13000

## General Purpose DIGISWITCH®

One of the most widely used thumbwheel switches, with more available options, output codes and special termination features than any other switch. Switch width for both products is .500". Cutout height for the rear-mounted 300 is 1.380"; for the front-mounted 13000, it is 2.000".

- 8, 10, 12 or 16 dial positions, with optional stops to limit rotation
- .500" spacers (plus .250" for the 300)
- Message units, for longer legends
- R.F.I. shielding
- Special dial characters

Series 8000

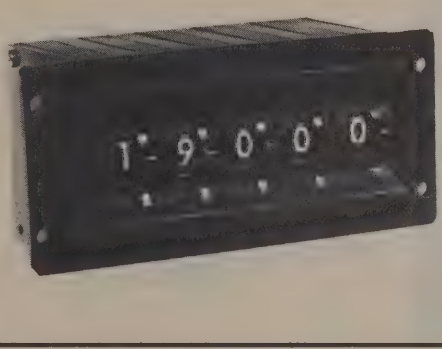


## General Purpose MINISWITCH®

A miniaturized version of the Series 300 DIGISWITCH, with the same high quality, capabilities and special features. Positive detent action. Switch width, .500" and cutout height only .980". Rear-mounted.

- 8, 10 or 16 dial positions, with optional stops to limit rotation
- .250" or .500" spacers
- Special case, spacer and dial marking options
- R.F.I. shielding
- Easy-to-replace lighting, plus lighted decimals

Series 9000/19000



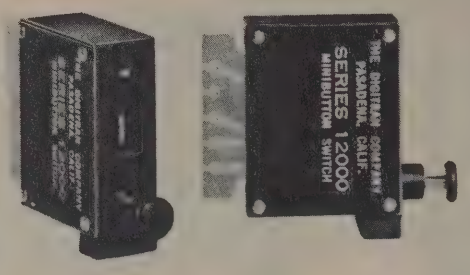
## DIGISWITCH®

Series 9000 features all the attributes of the Series 300 line, with the added benefit of being sealed against hostile environments. Qualified to MIL-S-22710/12. Wide choice of options, output codes and termination features. Switch width, .600", with cutout height of 1.375". Series 19000 is a dust-proof unsealed version of the 9000.

- 8, 10, 12 or 16 dial positions, or with dial stops to limit rotation
- .200" and .400" spacers with or without special markings
- R.F.I. shielding available
- Easy in-line readability from any angle
- Optional, replaceable Mil-spec lighting

# DIGITRAN Digital Switches and Keyboards

Series 12000




## MINIBUTTON®

A reliable, contamination-proof pushbutton-actuated switch for applications requiring panel sealing per MIL-S-22710 Method I and II, such as military communications equipment, and for severe industrial environments. Rear-mounted. No supplemental panel covers, boots or other enclosures required for sealing. Switch width, .500″ and overall height, 1.31″. Qualified to MIL-S-22710/17.

- 8 or 10 dial positions
- Individually mounted switches
- Metal case — no R.F.I. shielding required
- Optional, replaceable Mil-spec lighting
- Glass window that seals switch interior

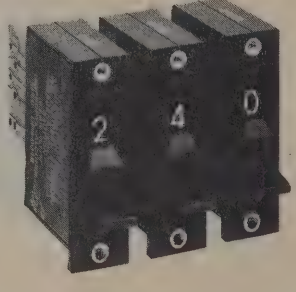
Series 23000

## "Snap-In" SLIMSWITCH

For applications where economy is a primary consideration, and where maximum panel density, good reliability and error-proof positive setting action are required. Large (.170″ high) in-line characters. Switch width only .315″ with cutout height of 1.221″.

- 10 or 11 dial positions, with optional stops to limit rotation
- Snap-in, front mounting, no tools required
- Slim design
- Economically priced
- Self-locking stainless steel snap-on assembly strap

Series 24000

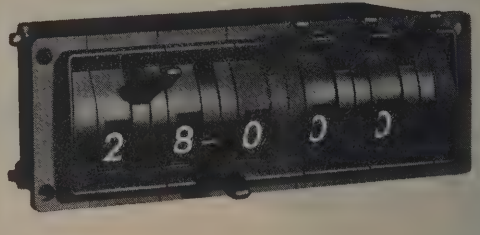



## DIGILEVER®

Modular, bi-directional lever-actuated switches built to perform in any hostile or inert environment and with any type of equipment. Sealed from the front to prevent contamination. Switch width, .480″, overall height, 1.610″. Q.P.L. approved to MIL-S-22710/24.

- 10 dial positions
- Wide viewing angle, with large characters
- Optional, replaceable Mil-spec lighting
- Fast operation, with excellent tactile feel
- Panel sealing is standard

Series 28000




## MINILEVER® Switch

A lever-operated digital switch that can be actuated in either direction. Instantly resets, with a sweep of the hand, all levers in an assembly up or down. Especially advantageous in applications requiring frequent and rapid switch settings. Switch width is .500″ and cutout height is .980″. Rear-mounted.

- 8, 10 or 12 dial positions
- 90° full lever travel
- Broad output code capability
- "Upper" or "lower" window locations
- Positive detent action

# Digital Switches and Keyboards

# DIGITRAN

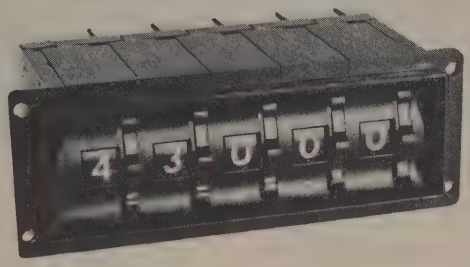
Series 29000

## "Economy" MINISWITCH®

An economical MINISWITCH with traditional Digitran quality. Rear-mounted, with extra-large in-line character readout, plus protection against normal exposure to semi-hostile environments. Switch width, .350" and cutout height, 1.020".

- 10, 11, 12 or 16 dial positions, with optional stops to limit rotation
- Broad output code and configuration availability
- Slim design for high package density
- Dust-proof switching chamber
- Economically priced

Series 43000

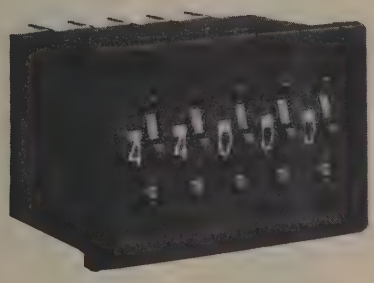



## Low Cost MINISWITCH®

A high-performance digital MINISWITCH at half the list price of comparable switches, featuring optional LED lighting and snap-together assembly for mix-and-match versatility. Rear-mounted. Available with pin or solder terminations. Switch width is .500", cutout height, .980".

- 10 dial positions, with optional stops to limit rotation
- Optional LED lighting
- Snap-together assembly, no tools or hardware required
- Interchangeable with most .500" wide digital switches
- Available in most popular codes

Series 44000

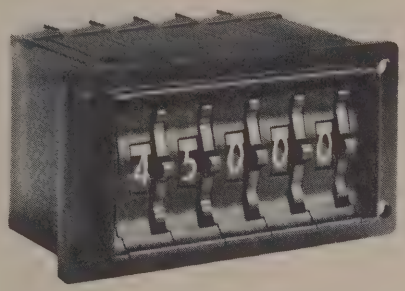



## Low Cost MINISWITCH®

The same quality, performance, options and low price as the Series 43000 MINISWITCH, including snap-together assembly. Designed for front-mounting installations, with switch width of .315" and cutout height of 1.220".

- 10 dial positions, with optional stops to limit rotation
- Optional LED lighting
- No mounting hardware required
- Interchangeable with most .315" (8 mm) wide front-mounted digital switches
- Available in most popular codes

Series 45000




## Low Cost MINISWITCH®

A rear-mounted version of the Series 44000 MINISWITCH with less front surface showing in the panel and more panel space for engraving. Switch width is also .315" and cutout height is .961".

- 10 dial positions, with optional stops to limit rotation
- Optional LED lighting
- Snap-together assembly, no tools or hardware required
- Interchangeable with most .315" wide digital switches
- Available in most popular codes

# DIGITRAN Digital Switches and Keyboards

## Digital Switch Features and Options

### Commercial/Industrial

| OPTION DESCRIPTION DESIGNATION | | SWITCH SERIES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 300 | 8000 | 13000 | 23000 | 28000 | 29000 | 43000 | 44000 | 45000 |
| Dial Positions (without stops) | 8 | ● | ● | ● | – | – | – | – | – | – |
| | 10 | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | 12 | ● | – | ● | – | ● | ● | – | – | – |
| | 16 | ● | ● | ● | – | – | ● | – | – | – |
| | Specials available | ● | ● | ● | ● | ● | ● | – | – | – |
| Dial stops to limit dial positions | | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Assembly spacers | .250" wide | ● | ● | ● | – | ● | – | ● | – | – |
| | .315" wide | – | – | – | ● | – | – | – | ● | ● |
| | .350" wide | – | – | – | – | – | ● | – | – | – |
| | .500" wide | ● | ● | ● | – | ● | – | ● | – | – |
| Message units | 1.0" wide | ● | ● | ● | – | ● | – | – | – | – |
| | 1.75" wide | ● | – | – | – | – | – | – | – | – |
| | 1.050" wide | – | – | – | – | – | ● | – | – | – |
| Special markings on spacers & switches | | ● | ● | ● | ● | ● | ● | ✲ | ✲ | ✲ |
| Special dial characters | | ● | ● | ● | ● | ● | ● | ✲ | ✲ | ✲ |
| RFI shielding | | ● | ● | ● | – | ● | – | – | – | – |
| Double modules (one actuator) | | ● | – | ● | – | ● | – | – | – | – |
| Replaceable lighting | | ● | ● | – | – | – | – | ● | ● | ● |
| Lighted decimal point on case | | ● | ● | ● | – | – | – | – | – | – |
| Lighted decimal point on spacer | | ● | ● | ● | ● | ● | ● | – | – | – |
| Provision for mounting components on output terminals or special P C boards | | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Wire wrap terminals | | ● | ● | ● | ● | ● | ● | – | – | – |
| Pin terminals | | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Special terminations | | ● | ● | ● | ● | ● | ● | – | – | – |
| Back mounting (with hardware) | | ● | ● | – | – | ● | ● | ● | – | ● |
| Snap-in mounting (without hardware) | | – | – | – | ● | – | – | – | ● | – |
| Assembled together by studs | | ● | ● | ● | – | ● | – | – | – | – |
| Assembled together with assembly straps | | – | – | – | ● | – | ● | – | – | – |
| Snap-together assembly | | – | – | – | – | – | – | ● | ● | ● |
| Panel mounting hardware included | | ● | ● | ● | – | ● | ● | ● | – | ● |

✲ Consult factory

# Digital Switches and Keyboards

# DIGITRAN

## Digital Switch Features and Options

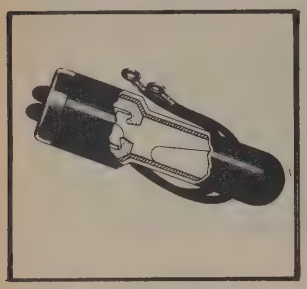
### Sealed, QPL and General Purpose

| OPTION DESCRIPTION DESIGNATION | | SWITCH SERIES | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 200 | 300 | 700 | 9000 | 12000 | 13000 | 19000 | 24000 |
| Dial positions (without stops) | 8 | ● | ● | ● | ● | ● | ● | ● | – |
| | 10 | ● | ● | ● | ● | ● | ● | ● | ● |
| | 12 | ● | ● | ● | ● | – | ● | ● | – |
| | 16 | ● | ● | ● | ● | – | ● | ● | – |
| | Specials available | ● | ● | ● | ● | ● | ● | ● | ● |
| | Dial stops to limit dial positions | ● | ● | ● | ● | – | ● | ● | ● |
| Assembly spacers | .250" wide | ● | ● | ● | – | – | ● | – | – |
| | .200" and .400" | – | – | – | ● | – | – | ● | – |
| | .500" wide | – | ● | – | ● | – | ● | ● | – |
| Message units | .75" wide | ● | – | ● | – | – | – | – | – |
| | 1.0" wide | ● | ● | ● | ● | – | ● | ● | – |
| | 1.75" wide | – | ● | – | – | – | – | – | – |
| | Special markings on spacers & switches | ● | ● | ● | ● | – | ● | ● | – |
| | Special dial characters | ● | ● | ● | ● | ● | ● | ● | ● |
| Sealing capability | Fully sealed switch chamber | ● | – | ● | ● | ● | – | – | – |
| | Dust sealed switch chamber | ● | – | ● | – | ● | – | ● | ● |
| | Panel sealing | ● | – | ● | ● | ● | – | – | ● |
| | RFI shielding | ● | ● | ● | ● | ● | ● | ● | ● |
| | Double modules (one actuator) | ● | ● | ● | – | – | ● | – | – |
| | Replaceable lighting | ● | ● | ● | ● | ● | – | ● | ● |
| | Lighted decimal point on case | – | ● | – | – | – | ● | – | – |
| | Lighted decimal point on spacer | ● | ● | ● | ● | – | ● | ● | – |
| | Provision for mounting components on output terminals on special P.C. boards | – | ● | ● | ● | ● | ● | ● | ● |
| | Wire wrap terminals | – | ● | ● | ● | ● | ● | ● | ● |
| | Pin terminals | – | ● | ● | ● | ● | ● | ● | ● |
| | Special terminations | – | ● | ● | ● | ● | ● | ● | ● |
| | Back mounting (w/hardware) | ● | ● | ● | ● | ● | – | ● | ● |
| | Front mounting (w/hardware) | – | – | – | – | – | ● | – | – |
| | Assembled together by studs | ● | ● | ● | ● | – | ● | ● | – |
| | Panel mounting hardware included | ● | ● | ● | ● | ● | ● | ● | ● |
| | QPL approved | ● | ● | ● | ● | ● | ● | – | ● |

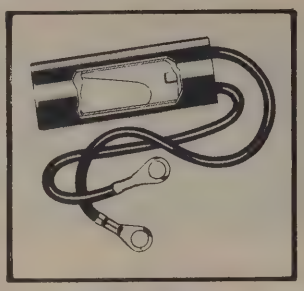
THE DIGITRAN COMPANY
A division of Becton, Dickinson and Company B-D
855 South Arroyo Parkway • Pasadena, California 91105 • Phone: (213) 449-3110 • TWX 910-588-3794.

# durakool®

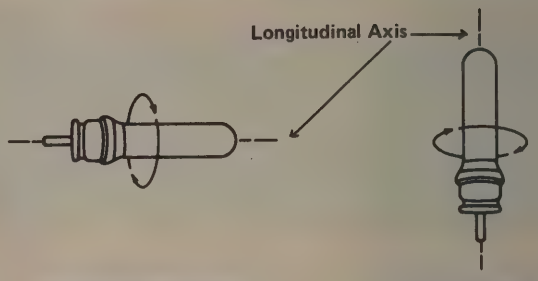
## TILT & TIP OVER SWITCHES



**Mercury-to-Mercury**
Contacts are made and broken through two pools of mercury; clean snap-action, no chatter, little erosion. (G-Series)



**Mercury-to-Metal**
Contacts are made and broken between a pool of mercury and a metal electrode. (A-Series)




**Tilt Switch Mounting**
Tilt switches mount horizontally. Rotation around the longitudinal axis does not affect operation.

**Tip Switch Mounting**
Tip switches mount vertically. Rotation around the longitudinal axis does not affect operation.

All Durakool switch products are of all-steel construction providing compact size and high structural strength. Contact areas are confined within an arc suppressing gas in the hermetically sealed switch body. The absence of moving mechanical parts virtually eliminates wear and contact degradation, assuring long life and consistent switching functions.

In addition to the standard tilt and tip over switches listed, Durakool manufactures thousands of custom switches for specific OEM applications. Special angle, make and break requirements and leaded types are available on special factory order.

### UNINSULATED TILT SWITCHES — A AND G SERIES

ELECTRICAL RATINGS AND OPERATING ANGLES | PHYSICAL DIMENSIONS

| CATALOG DESIGNATION | AMPERES AC (60 Hz) 120V | AC (60 Hz) 240V | AC (60 Hz) 480V | DC 120V | DC 240V | TUNGSTEN LAMP LOADS AT 120V 60 Hz | MOTOR RATINGS HP AC (60 Hz) 120-480V | MOTOR RATINGS HP DC 120-240V | *MINIMUM RECOMMENDED OPERATING ANGLE | LENGTH | LARGEST DIAMETER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A½ (3677) | 1 | .4 | — | .5 | .4 | 60W | — | — | 20° | 3/8 | .235 |
| AIS | (1 Ampere 6V—24 VAC/DC) | | | | | 75W | — | — | 20° | 3/64 | 13/32 |
| AIN (2622) | 1 | .7 | — | .5 | .4 | 100W | — | — | 16° | 1 1/64 | 13/32 |
| G5N (3822) | 5 | 4 | — | 3 | 2 | 400W | ¼ | ⅛ | 16° | 1 33/64 | 27/64 |
| G8N (3825) | 10 | 8 | 5 | 5 | 4 | 800W | ⅓ | ⅙ | 14° | 1 55/64 | ½ |
| G10N (3765) | 20 | 16 | 10 | 10 | 8 | 1600W | ¾ | ⅓ | 13° | 2 3/64 | 39/64 |
| G20N (3769) | 35 | 28 | 18 | 18 | 14 | 2800W | 1½ | ¾ | 9° | 2 53/64 | 25/64 |
| G20SN(3830) | 35 | 28 | 18 | 18 | 14 | 2800W | 1½ | ¾ | 12° | 2 5/16 | 49/64 |
| G35N (3829) | 65 | 52 | 33 | 33 | 26 | 5200W | 3 | 1½ | 9° | 3 7/16 | 63/64 |

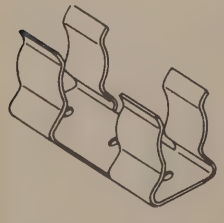
*Includes a safety factor in degrees to insure a "make" and "break" of the mercury contacts.

### INSULATED TILT SWITCHES — A AND G SERIES

ELECTRICAL RATINGS AND OPERATING ANGLES | PHYSICAL DIMENSIONS

| *CATALOG DESIGNATION | AMPERES AC (60 Hz) 120V | AC (60 Hz) 240V | AC (60 Hz) 480V | DC 120V | DC 240V | TUNGSTEN LAMP LOADS AT 120V 60 Hz | MOTOR RATINGS HP AC (60 Hz) 120-480V | MOTOR RATINGS HP DC 120-240V | **MINIMUM RECOMMENDED OPERATING ANGLE | LENGTH | LARGEST DIAMETER | TERMINAL DATA SCREW SIZE | TERMINAL DATA HOLE SIZE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A½ | 1 | .4 | — | .5 | .4 | 60W | | | 16° | 1 1/16 | 31/32 | | |
| A1 | 1 | .7 | — | .5 | .4 | 100W | — | — | 16° | 1 21/64 | ½ | #8 | .170 |
| G5Z | 5 | 4 | — | 3 | 2 | 400W | — | — | 16° | 1 49/64 | 27/32 | #8 | .170 |
| G8Z | 10 | 8 | 5 | 5 | 4 | 800W | ¼ | ⅛ | 14° | 2 1/32 | ¾ | #10 | .203 |
| G10Z | 20 | 16 | 10 | 10 | 8 | 1600W | ⅓ | ⅙ | 13° | 2 3/8 | 27/32 | #10 | .203 |
| G20Z | 35 | 28 | 18 | 18 | 14 | 2800W | ¾ | ⅓ | 9° | 3 7/32 | 1 1/32 | #10 | .203 |
| G20SZ | 35 | 28 | 18 | 18 | 14 | 2800W | 1½ | ¾ | 12° | 2 23/32 | 1 1/32 | #10 | .203 |
| G35Z | 65 | 52 | 33 | 33 | 26 | 5200W | 3 | 1½ | 9° | 3 3/4 | 1 1/4 | ¼ | .265 |

* For cotton leads add "-1", neoprene rubber add "-2" and "-3" for silicone rubber leads.
** Includes a safety factor in degrees to insure a "make" and "break" of the mercury contacts.



### DOUBLE CLIPS

| Switch Model | Clip # | Switch Model | Clip # |
|---|---|---|---|
| A½ | — | G20Z | 2009 |
| A1 | — | G20Y | 2009 |
| G5Z | 2023 | G20SZ | 2009 |
| G8Z | 2008 | G20SY | 2009 |
| G8Y | 1997 | G35Z | 2010 |
| G10Z | 2009 | G35Y | 2010 |
| G10Y | 2008 | | |

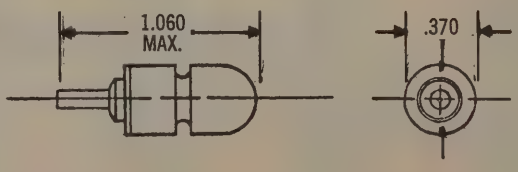
### SINGLE CLIP

| Switch Model | Clip # |
|---|---|
| A1 | 122 |
| G5Z | 122 or 164 |
| G8Z | 122 |
| G10Z | 122 |

### DURAKOOL SCHEDULE E SWITCHES

### WIDE ANGLE TILT SWITCH — 1 AMP

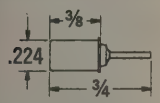
UNINSULATED SWITCH #4289
INSULATED SWITCH #A1-141
1 AMP @ 120° VAC
OPERATING ANGLE 25° TO 45°



# durakool®

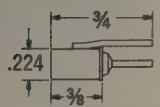
## DURAKOOL SCHEDULE E SWITCHES

### A½ Mini Tilt Switch



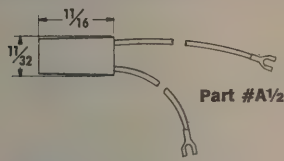

Part #3677
Uninsulated

ACTUAL SIZE




Part #3954
Leaded/Uninsulated

### Insulated A½ Tilt Switch




Part #A½-1 #26AWG Super Flex Leads

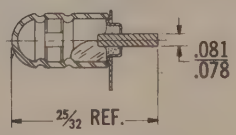
| VOLTAGE | LOAD TYPE | WATTAGE | CURRENT |
|---|---|---|---|
| 120 VAC | TUNGSTEN | 60W | ½A |
| 120 VAC | INDUCTIVE RESISTIVE | 120W | 1A |
| 240 VAC | INDUCTIVE RESISTIVE | 100W | .4A |
| 12 DC | TUNGSTEN RESISTIVE | 12W | 1A |
| 240 VDC | RESISTIVE | 120W | ½A |

Typical Included Angle 10°
Minimum Recommended Angle 20°

## ANTI-VIBRATION TILT SWITCH / UNINSULATED

**Part No. 3018**

CONTACT RATINGS:
1 Amp @ 120 VAC
0.7 Amp @ 240 VAC
0.5 Amp @ 120 VDC
0.4 Amp @ 240 VDC
0.8 Amp @ 120 VAC (Tungsten)




## WIDE ANGLE G5 SWITCH/UNINSULATED

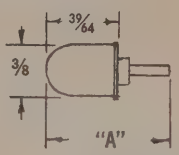
**Part No. 3843**

ELECTRICAL RATINGS AND OPERATING ANGLES

| AMPERES | | | | | TUNGSTEN LAMP LOADS AT 120V 60 Hz | MOTOR RATINGS HP | | OPERATING ANGLE TYPICAL |
|---|---|---|---|---|---|---|---|---|
| AC (60 Hz) | | | DC | | | AC (60 Hz) 120-480V | DC 120-240V | |
| 120V | 240V | 480V | 120V | 240V | | | | |
| 5 | 4 | — | 3 | 2 | 400W | ¼ | ⅓ | 35° |

## AIS/Extended Electrode Uninsulated Switches

| Part Number | "A" Dim. |
|---|---|
| 3996 | 23/32 |
| 4251 | 3/4 |
| 3510 | 27/32 |
| 4116 | 7/8 |



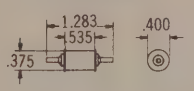

| VOLTAGE | LOAD TYPE | WATTAGE | CURRENT |
|---|---|---|---|
| 120 VAC | TUNGSTEN | 60W | ½A |
| 120 VAC | INDUCTIVE RESISTIVE | 120W | 1A |
| 240 VAC | INDUCTIVE RESISTIVE | 100W | .4A |
| 12 DC | TUNGSTEN RESISTIVE | 12W | 1A |
| 240 VDC | RESISTIVE | 120W | ½A |

Typical Included Angle 16°
Minimum Recommended Angle 20°

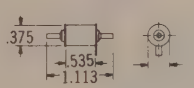
## DOUBLE ENDED SPDT A1 TILT SWITCHES

### Uninsulated SPDT

Part #3573

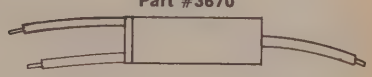



Part #3619




### Insulated SPDT

Part #3670



| AC (60 Hz) | | | DC | | Tungsten Lamp Loads at 120V 60Hz | *Minimum Recom. Operating Angle |
|---|---|---|---|---|---|---|
| 120V | 240V | 480V | 120V | 240V | | |
| 1 | .7 | — | .5 | .4 | 100W | 15° |

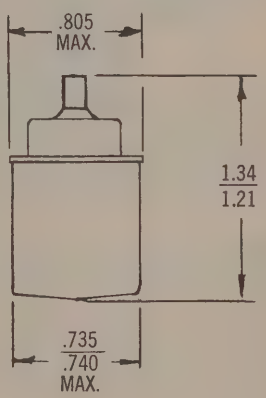
## PROXIMITY SWITCH

**Part No. 3943**

| General Purpose N.O. Contacts | |
|---|---|
| Volts AC | Amps |
| 120 | 20 |
| 240 | 15 |
| 480 | 10 |
| 120 VAC | ½ HP |

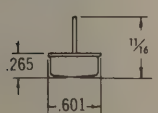
Magnet not supplied by Durakool

Commercially available 1200 Gauss Ceramic Magnets are commonly used.




## TO8 SERIES TIP OVER SWITCH

Durakool TO8 Series mercury Tip Over Switches are of the normally closed contact configuration and are omnidirectional.




TYPE A

TYPE B

TYPE C

TYPE D

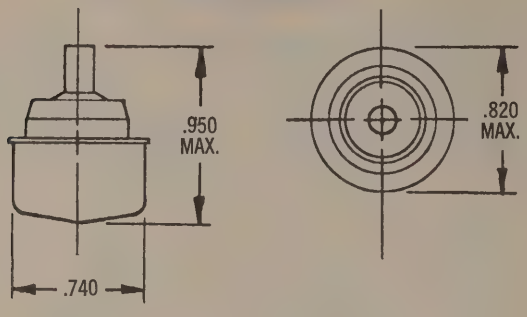
| TYPE | PART # | ANGLE | CONTACT RATING VOLTS/AC | CONTACT RATING AMPS |
|---|---|---|---|---|
| A | TO8-1001 | 17-27° | 120 | 1.7 |
| D | TO8-1002 | 15-35° | 120 | 1.7 |
| C | TO8-1003 | 15-35° | 120 | 1.7 |
| A | TO8-1004 | 10-30° | 120 | 1.7 |
| B | TO8-1005 | 10-30° | 120 | 1.7 |
| A | TO8-1006 | 15-35° | 120 | 1.7 |

Any of the above types can be provided in angle specifications shown. Special vibration dampening types are also available. Consult the factory with your specific requirements for availability.

durakool®

## SAFETY TIP OVER SWITCH/20 AMPS

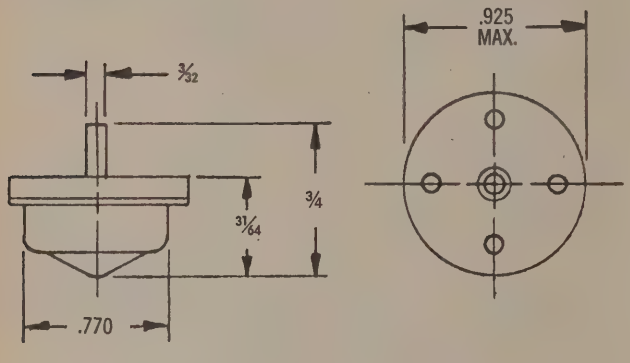
**Part #4282**




N.C. Contacts — 20 Amps @ 120 VAC Resistive
20 Amps @ 24 VDC Inductive
Break Angle — Can be supplied in range of 30° — 70° from vertical + − 15°
Construction — Stainless steel, all welded, hermetically sealed contacts
Long Life — Ideal for kill switch applications
Terminations — Faston tabs or wire leads

## TO3 — TIP OVER SWITCH/15 AMPS

**Part #TO3-1002**

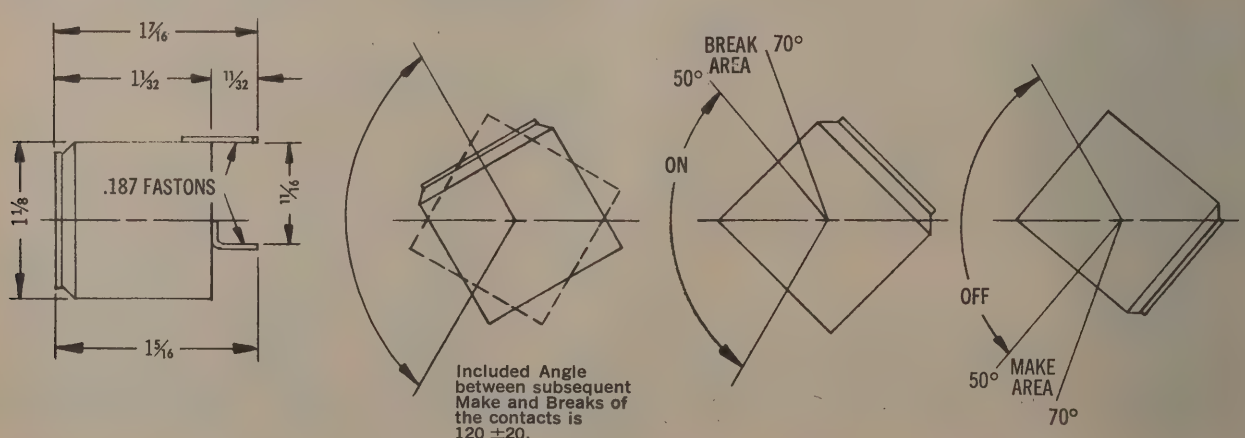



N.C. Contacts — 15 Amp @ 120 VAC Resistive
Break Angle — 30° ±10° from vertical
Construction — All steel, all welded, hermetically sealed contacts
Long Life — Mercury to metal contacts
Terminations — Faston tabs or wire leads

## WIDE ANGLE SWITCH 20 AMP/120° OPERATING ANGLE

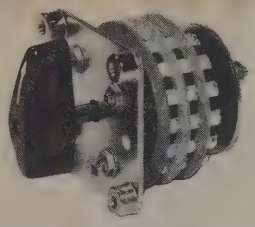
20 Amp general purpose load — ½ H.P. @ 120 VAC
All steel, hermetically sealed construction, long life
Ideal for sump pump and all other liquid level controls & floats

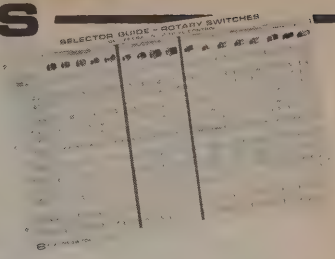
**Part #4236**
**Includes .187 Tab Faston Terminations**



# ROTARY SWITCHES

## DETENT ACTION — for ECONOMY and COMPACTNESS in MULTI-POSITION APPLICATIONS






10 to 30 amp . . . Standard and Miniaturized versions . . . up to 600V , . . up to 75 poles . . . 2 to 16 positions. Excellent for selection and control circuits. Most have UL & CSA approvals . . . military equivalents.

## SNAP-ACTION — for BEST DIRECT CURRENT (DC) SWITCHING CAPABILITY

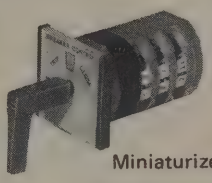
20 to 200 amp . . . Standard and Miniaturized versions . . . up to 600V . . . up to 12 poles . . . 2 to 4 positions. Excellent for switching D. C. Most have UL & CSA approvals . . . military equivalents.

## CAM-ACTUATED — for DIRECT MOTOR CONTROL and COMPACTNESS

6 to 125 amp is Standard and Miniaturized versions . . . up to 600V . . . up to 24 poles . . . 2 to 12 positions. Excellent for motor control applications. Unusually large range of options including indicator lights, spring-return, removeable handles, many handle styles, etc.

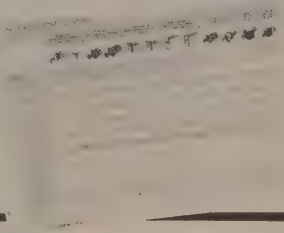
# INSTRUMENT and CONTROL SWITCHES

Standard



Miniaturized

10 to 40 amps . . . up to 600V. Standard & miniaturized versions. Complete line of Voltmeter, Ammeter, Wattmeter, Breaker Control, Synchroscope applications. Special lighted versions.



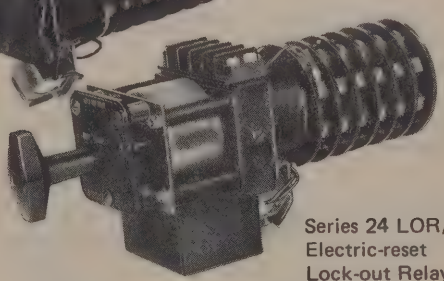
# RELAY DEVICES

## A HIGH SPEED MULTI-CONTACT LOCK-OUT RELAY FOR POWER INDUSTRY APPLICATIONS

- HIGH-SPEED . . . total response time less than 8 milliseconds . . . available for LOR and LOR/ER.
- MULTI-CONTACT . . . up to 40 contacts (20 N/C . . . 20 N/O)
- RATING: 600V . . . 20A Interrupt.
- SEISMIC . . . completely tested to latest seismic specs.

These auxiliary relays are remote-TRIP manual or remote RESET control relays for the purpose of tripping and locking out circuit breakers or other devices automatically when a fault or other predetermined condition exists. Generally used in conjunction with differential relays to protect transformers, buses, rotating machinery, etc.

Series 24 LOR
Manual-reset
Lock-out Relay



Series 24 LOR/ER
Electric-reset
Lock-out Relay

## REMOTE OPERATED CONTROL SWITCH RELAY FOR BOTH MANUAL AND REMOTE SUPERVISORY CONTROL OF POWER CIRCUIT BREAKERS

- Combines the features of manually-operated switch with remote-operated relay
- For all Instrument & Control Applications
- Bi-directional service for breaker control . . . automatic synchroscope timing
- Continuous rating: 30A/600V

Series 24 CSR
Control Switch Relay

Combines present control switches with a remote-controlled solenoid. Manual and supervisory control function in the operational control of power circuit breakers. Eliminates the need for substation redesign with redundant, separate relays when manual substations convert to supervisory control.

## A NEW ROTARY LATCHING SWITCH RELAY

- High-Speed: Less than one cycle total response time
- Multi-contact: 16 NO plus 16 NC
- Compact Size
- Specification: IEEE STD 313
- Seismic Shockproof: IEEE STD 344
- Available with manual override

Series 31 LSR
Latching Switch Relay

Controls up to sixteen NO and sixteen NC contacts in a single device. Provides a compact solution to a variety of relay applications — as a latching relay, a programming relay, a reclosing relay, a seal-in relay, etc. Can also satisfy many switching applications as a manual switch combined with remote-operation like a relay.

ELECTROSWITCH
ELECTRO SWITCH CORP. • Weymouth, Massachusetts 02188 • Telephone: 617/335/5200 • TWX: 710/388/0377

# electro-mech

# LIGHTED PUSH-BUTTON SWITCHES

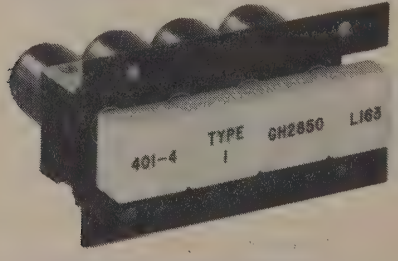
ELECTRO-MECH provides a perfect blend of quality standard products with in-depth experience in answering unique requirements. Proven engineering designs are illustrated by the excellent performance characteristics of each ELECTRO-MECH lighted push-button switch, indicator, and display assembly. Low-bounce, long-life contacts, new innovations in legends, displays, field-service, packaging — all standard features. Whatever your applications, ELECTRO-MECH is prepared to answer your specific needs. Choose from any of the most popular models.

How to fit a square button in a round hole.
SPST-DPDT. High density mountability on less than ¾" centers, the design benefits of ½" square and ½" x ¾" low-profile buttons that just drop in a round hole and secure with a nut from behind the panel.
Momentary or alternate action, reliable circuitry, low bounce, low-profile, unitized housing. All together in the Series 20. Find out about it.
LIGHTED PUSH BUTTON SERIES 20
ELECTRO MECH

## INTERLOCKING SWITCH ASSEMBLIES

*SERIES 500*

Added beauty and long-lasting appearance with handsome chrome barriers between each switch or indicator. Independent or interlocking action. Ten types of tracking action and switching sequences. Up to 12 switches in single or dual row, ⅞" or 1" centers.



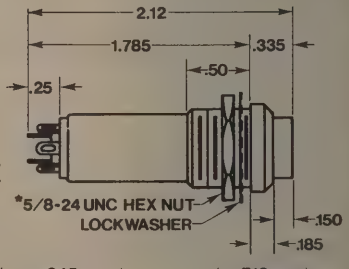

## MULTI-STATION SUB-PANEL ASSEMBLIES

*SERIES 400*

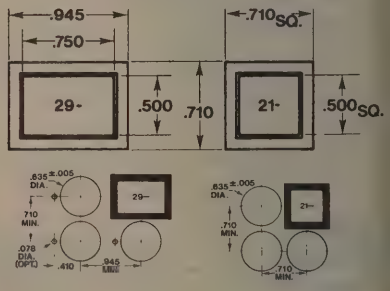
Multi-station switch assemblies designed for sub-panel mounting by means of a flanged "U" channel. All standard ELECTRO-MECH switches can be incorporated with several types of mechanical interlocking/lockout actions between stations. Up to 12 stations in one or two row configurations.

## *SERIES 20* SWITCHES

- MOUNTS IN A 5/8" DIA. ROUND HOLE
- HIGH DENSITY MOUNTING ABILITY —LESS THAN 3/4" CENTERS
- LOW PROFILE APPEARANCE IN ONE UNITIZED HOUSING




| Switch Functions | SPST N.O. | SPST N.C. | DPST N.O. | DPST N.C. | DPST 1N.O., 1N.C. | SPDT | DPDT |
|---|---|---|---|---|---|---|---|
| MOMENTARY | 21-128 | 21-129 | 21-130 | 21-131 | 21-132 | 21-149 | 21-150 |
| PUSH-ON PUSH-OFF | 21-228 | 21-229 | 21-230 | 21-231 | 21-232 | 21-249 | 21-250 |
| PUSH-ON REMAIN-IN PUSH-OFF | 21-828 | 21-829 | 21-830 | 21-831 | 21-832 | 21-849 | 21-850 |
| N.O. POS | 2-5 | | 1-2,4-5 | | 3-6 | 1-2 | 1-2, 4-5 |
| N.C. POS | | 2-5 | | 2-3,5-6 | 1-4 | 2-3 | 2-3, 5-6 |
| COMMON POS | | | 2,5 | 2,5 | | 2 | 2,5 |




ELECTRO-MECH COMPONENTS, INC. • 1826 NORTH FLORADALE AVE. • SO. EL MONTE, CALIF. 91733 • (213) 442-7180

# electro-mech

**COMMUNICATIONS ■ INDUSTRIAL CONTROLS ■ DISPLAYS**
**■ COMPUTER/PERIPHERALS ■ INSTRUMENTATION**

## LIGHTED PUSH-BUTTON SWITCH PRODUCTS

### GENERAL SWITCH SPECIFICATIONS:

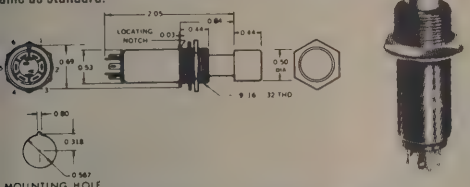
Technical specifications apply to all Electro-Mech Switch models unless otherwise specified:

**Ratings:** 30 Volts DC or 15 Volts AC; 2 amps resistive; 1 amp inductive
**Weight:** 0.8 oz. (approx.)
**Operating Pressure:** 2 lbs. +1 lb.
**Plunger Travel:** 3/16" (approx.)
**Actuations:** 100,000
Accommodates all **"switchlines"** standard lenses. Uses one T1-3/4, AN3140-327, 328, 330 bulb or neon lamp. 3 actuation modes standard also in 2, 3, 4 and 6-pole configuration.

### SWITCHLINE *and* SLIMLINE SWITCHES

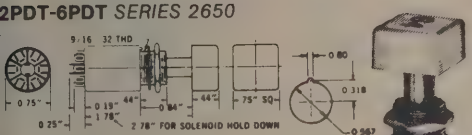
**1PST-2PDT** *SERIES 2150*

A new 2100 Series Slimline version of our standard Illuminated Pushbutton Switch featuring silver slide bar action. Add BR after part number for mounting on 5/8" centers. Utilizes AN3140-T 1-3/4 or ALC-100 bulb. All other specifications same as standard.



| | 1PST | | 2PST | | 1 N.O. 1 N.C. | 1PDT | 2PDT |
|---|---|---|---|---|---|---|---|
| | N.O. | N.C. | 2 N.O. | 2 N.C. | | | |
| Momentary Push-on/ Push-off | 2128 | 2129 | 2130 | 2131 | 2132 | 2149 | 2150 |
| | 2228 | 2229 | 2230 | 2231 | 2232 | 2249 | 2250 |

**2PDT-6PDT** *SERIES 2650*



ILLUMINATED

| | Mom. | Push-on Push-off | Push-on Remain In Push-off | Snap Feel Mom. |
|---|---|---|---|---|
| 2PDT | 2650 | 2750 | 2850 | 2550 |
| 3PDT | 2651 | 2751 | 2851 | 2551 |
| 4PDT | 2652 | 2752 | 2852 | 2552 |
| 5PDT | 2653 | 2753 | 2853 | 2553 |
| 6PDT | 2654 | 2754 | 2854 | 2554 |

### SOLENOID HOLD-DOWN

*SERIES 3054*

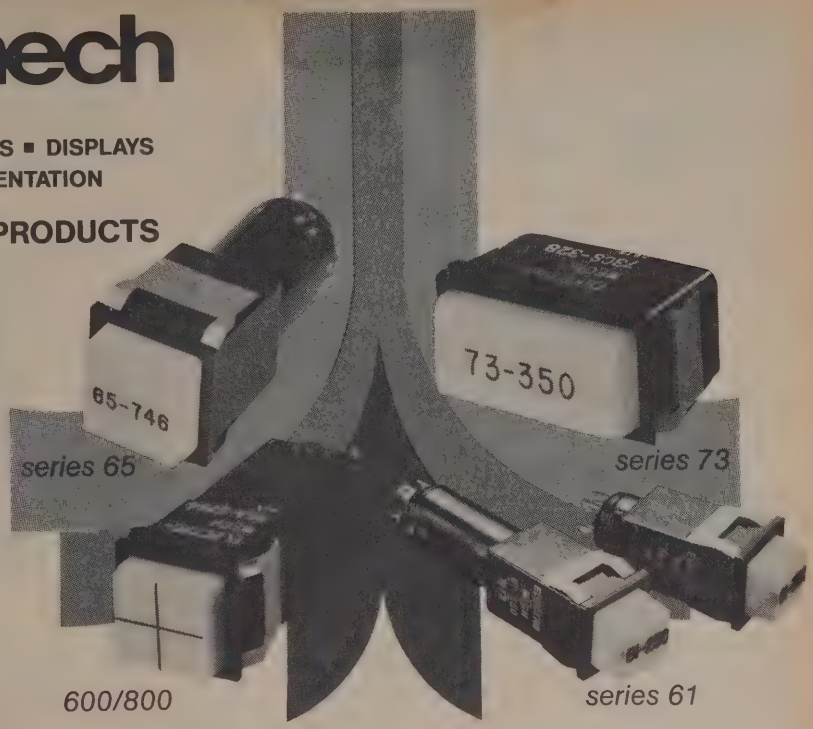
Switchline Illuminated Pushbutton switches with an integral hold-down coil which is activated with switch. Holds the push-button in the depressed position until coil is de-energized returning it to relaxed position. Available in all circuit configurations up to 6PDT. Same specifications as standard model.

### MINIATURE FRONT PANEL MOUNT MOMENTARY SWITCHES

*SERIES 5000*

An exceptionally short momentary switch available in circuit configurations up to 2PDT. Clear anodized case. All specifications same as standard model except plunger travel which is 3/32".

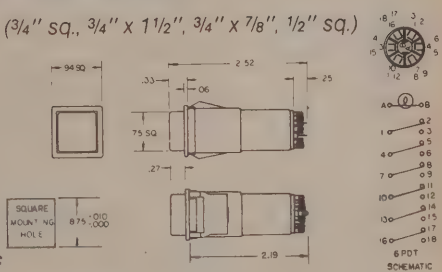
| | 1PST | | 2PST | | 1 N.O. 1 N.C. | 1PDT | 2PDT |
|---|---|---|---|---|---|---|---|
| | N.O. | N.C. | 2 N.O. | 2 N.C. | | | |
| Momentary | 5128 | 5129 | 5130 | 5131 | 5132 | 5149 | 5150 |




## designer group switches

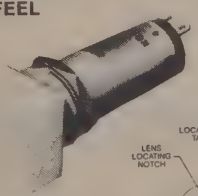
These Electro-Mech Standards feature typical switch functions and mounting options for design flexibility. A choice of dual/quad display units are also available.

*(3/4" sq., 3/4" x 1 1/2", 3/4" x 7/8", 1/2" sq.)*



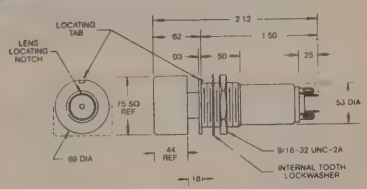

***All Designer Group units feature:***

- **1PST TO 6PDT**
- **MOMENTARY; ALTERNATE ACTION; PUSH-ON REMAIN-IN; PUSH-ON, PUSH-OFF *and* MOMENTARY SNAP-FEEL**



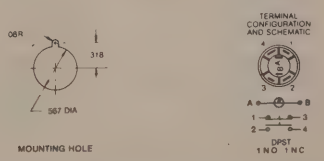
### SHORT HOUSING

*SERIES 6100*
*(3/4" sq.)*




High-density packaging requirements are answered with this shorter, front panel mount, providing the same quality design as standard Electro-Mech model sizes.

- **INDUSTRY'S SHORTEST ALTERNATE-ACTION DESIGN**
- **REQUIRES ONLY 1½" BEHIND PANEL**

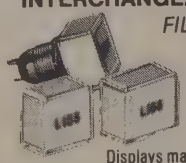



### 10 AMP *Series 4000* DPST-2 N.O.

*for U.L. Applications*

Low profile matches standard industry models. Momentary or Alternate Action design takes any standard lens size. 30 VDC or 115 VAC, 10 A Resistive, 5 A Inductive.

### INTERCHANGEABLE LENSES/ *FILTERS*



*Series 150*

Displays may be changed or buttons replaced. Non-wearing, clear-acrylic lens and filter buttons. Available in standard, Opaque or Contour.

ELECTRO-MECH COMPONENTS, INC. • 1826 NORTH FLORADALE AVE. • SO. EL MONTE. CALIF. 91733 • (213) 442-7180

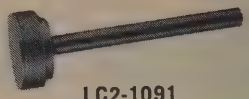
# MERCURY FILM SWITCHES

- **LONG LIFE**
  Self healing mercury contacts are coupled with an almost foolproof energizing mechanism to eliminate contact and frictional wear.
- **HIGH RELIABILITY**
  Operation joins two mercury films. There are no contact interfaces to impede signal passage. Over 2 Billion Cycle MCBF.
- **NO CONTACT BOUNCE**
  Mercury contacts are joined without bounce or noise in a perfect electrical closure.
- **OPERATION IN ANY POSITION**
  A patented design uses strong surface tension forces to hold mercury films securely to wetted surfaces regardless of position.
- **LOW AND STABLE CONTACT RESISTANCE**
  Mercury contacts are renewed with every operation. Contact resistance is low, stable, and independent of load being switched.
- **HIGH STAND-OFF VOLTAGE**
  Large contacts gaps provide 1250 VAC breakdown ratings. A near perfect hermetic seal assures that it will last the life of the switch.
- **RUGGED CONSTRUCTION**
  Perhaps the strongest switching capsule ever made. A sample has literally been hammered into a wooden plank without structural damage. Danger from mercury leakage is eliminated.
- **PERMANENT MAGNET OR COIL ACTUATION**
  Versatile design permits updating all applications where dry reed, or mercury wetted reed, switches have been used in the past.
- **LOW IN COST**
  Priced to serve almost any application LC2 now allows the use of high reliability switching in cost conscious circuits.

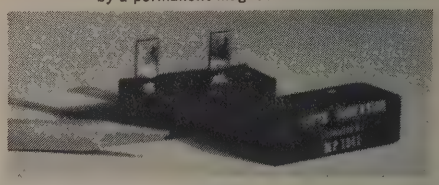
## SPECIFICATIONS

| | |
|---|---|
| Contact Form | Form 'A' SPST-NO(1) |
| Life | Indefinite |
| Reliability (MCBF) | $> 2 \times 10^9$ (2) |
| Rated Contact Load (DC) | 5V, 2 amps<br>24V, 1 amp<br>200V, 0.1amps |
| Contact Resistance | 0.15 ohms |
| Contact Resistance Stability | ‡0.015 ohms |
| Contact Breakdown | 1250 VRMS |
| Contact Bounce | None |

NOTES: (1) Contact factory for Form B; Form C; and latching models.
(2) Based upon tests conducted on over 100 units tested to over $3.4 \times 10^{10}$ operations.
(3) Contact factory for higher voltage models.

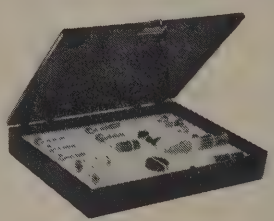


**LC2-1091**
The basic mercury film switch. It may be operated by a permanent magnet or a coil.



**IS1841**
A mercury film equipment interlock switch with actuating permanent magnet assembly.

**LC2P1839**
A rugged bulkhead mounted LC2 switch with mounting hardware.



**ENGINEERING DESIGN KITS**

**DK1-2328** — Contains samples of varying mechanical configurations of the LC2 switch. Mounting hardware, typical permanent drive magnets and complete documentation are included. **Price: $49.00**

**DK2-2329** — Demonstrates the range of ampere turn sensitivities normal to the production output of the switch. A test coil is provided. This kit is helpful in order to determine if selected switch sensitivities are required to serve your application. Complete documentation is included. **Price: $49.00**

# OMNIDIRECTIONAL TILT SWITCHES

| TILT SWITCH SPECIFICATIONS | | |
|---|---|---|
| **Switch Number** | **TS7** | **TS7B** |
| Contact Form (Switch Vertical) | Open | Closed |
| Nominal Operate Angle (from Horizontal) | 75° | 45° |
| Operate Angle Tolerance | ±10° | ±10° |
| Typical Angular Hysteresis | 10° | 15° |
| Contact Material | Mercury | Mercury |
| Contact Resistance (Typical) (Ohms) | 1.0 | 1.0 |
| Contact Load Limit | | |
| Amperes at 12V DC | 1.0 | 1.0 |
| Amperes at 115V AC | 0.5 | 0.5 |

**Note: #1.** The TS3 and TS6 are intended for non-critical attitude determination. They should not be used in applications where tight angular tolerances or close repeatability are required.
**#2.** PATENTS APPLIED FOR.
**#3.** Contact Factory for other Nominal Operate Angles and other Angle tolerances.

- **Ultra Miniature**
- **Hermetically Sealed**
- **Rugged Steel Case**
- **360° Sensitivity**
- **Low Cost**
- **Convenient Mounting Packages**
- **Normally Open or Closed Contacts**

**Applications:**
- Fall Down Switches
- Automotive
- Medical Electronics
- Appliances
- TV Games
- Digital Watches
- Ordnance Fuses
- Industrial Control
- Interlocks
- Marine Products

**Illustrated is the TS3 Switch. It was designed for the digital watch industry. It is one of the smallest tilt switches in industry.**

**FIFTH DIMENSION INC.**
5-D
707 ALEXANDER ROAD • PRINCETON, NEW JERSEY 08540
TELEPHONE: (609) 452-1200 • TWX: 510-685-2387

# TOP ACCESS ROCKER DIP SWITCHES

Grayhill

## SPECIFICATIONS

**Mechanical Life:** 50,000 Operations per Rocker.

**Make and Break Current Rating:** 35,000 Operations at 50 MA, 30 VDC; 25,000 Operations at 125 MA, 30 VDC.

**Contact Resistance:** 100 Milliohms Maximum after life (30 Milliohms initially), measured at 2MA DC and 50 MV (open circuit).

**Insulation Resistance** (at 100 VDC): Between Adjacent Open or Closed Contacts: 50,000 Megohms after life, (100,000 Megohms initially).

**Dielectric Strength:** Between Adjacent Open or Closed Contacts: 500 VAC after life (750 VAC initially).

**Current Carry Rating:** 5 Amps with a maximum contact temperature rise of 20° C.

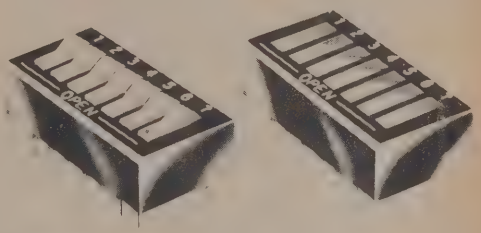
## MATERIALS AND FINISHES

**Switch Cover, Rocker and Base:** Polyester.

**Shorting Bar:** Brass, Gold plated .00001" minimum over Nickel plated .00005" minimum.

**Base Contacts including Terminals:** Brass, Gold plated .00001" minimum.

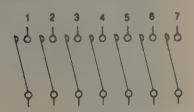
**Protective Cover:** Zytel.



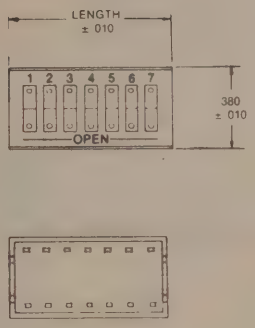
# SPST ROCKER DIP SWITCHES 2 THRU 10 STATIONS

**NOW QUALIFIED TO MIL-S-83504**

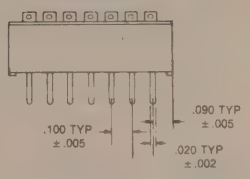
TYPICAL CIRCUIT DIAGRAM
(SHOWN IN OPEN POSITION FOR A SWITCH WITH SEVEN ROCKERS)

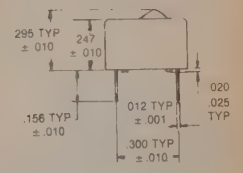



| No. Of Rockers | Length | Uses Cover |
|---|---|---|
| 2 | 0.280 | 76P02 |
| 3 | 0.380 | 76P03 |
| 4 | 0.480 | 76P04 |
| 5 | 0.580 | 76P05 |
| 6 | 0.680 | 76P06 |
| 7 | 0.780 | 76P07 |
| 8 | 0.880 | 76P08 |
| 9 | 0.980 | 76P09 |
| 10 | 1.080 | 76P10 |

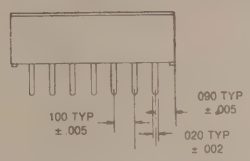


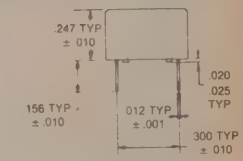

**STANDARD**




**RECESSED**



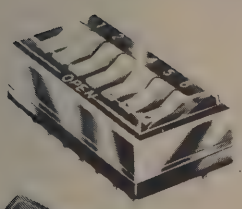

TOP TAPE SEAL FOR RECESSED ROCKERS — CONTACT GRAYHILL

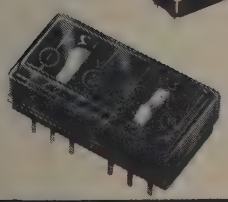
## ORDERING INFORMATION

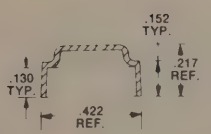
| Standard | | | | Military Qualified | | | |
|---|---|---|---|---|---|---|---|
| No. of Rockers | Part Nos. Raised Rocker | Recessed Rocker | Unit Price | No. of Rockers | Part Nos. Raised Rocker | Recessed Rocker | Unit Price |
| 2 | 76B02 | 76RB02 | $3 05 | 2 | 76MB02 | 76MRB02 | $3 35 |
| 3 | 76B03 | 76RB03 | 3 10 | 3 | 76MB03 | 76MRB02 | 3 40 |
| 4 | 76B04 | 76RB04 | 3 15 | 4 | 76MB04 | 76MRB04 | 3 45 |
| 5 | 76B05 | 76RB05 | 3 20 | 5 | 76MB05 | 76MRB05 | 3 50 |
| 6 | 76B06 | 76RB06 | 3 30 | 6 | 76MB06 | 76MRB06 | 3 60 |
| 7 | 76B07 | 76RB07 | 3.35 | 7 | 76MB07 | 76MRB07 | 3 65 |
| 8 | 76B08 | 76RB08 | 3 45 | 8 | 76MB08 | 76MRB08 | 3 75 |
| 9 | 76B09 | 76RB09 | 3 55 | 9 | 76MB09 | 76MRB09 | 3 85 |
| 10 | 76B10 | 76RB10 | 3.60 | 10 | 76MB10 | 76MRB10 | 3.90 |

SEE DISCOUNT SCHEDULE ON FOLLOWING PAGE.

## PROTECTIVE COVERS FOR THE TOP ACCESS SWITCHES







## ORDERING INFORMATION:

| PROTECTIVE COVER | | | PROTECTIVE COVER | | |
|---|---|---|---|---|---|
| Dim. A | Part Number | Unit Price | Dim. A | Part Number | Unit Price |
| 0.322 | 76P02 | 15¢ | 0 822 | 76P07 | 15¢ |
| 0.422 | 76P03 | 15¢ | 0 922 | 76P08 | 15¢ |
| 0.522 | 76P04 | 15¢ | 1 022 | 76P09 | 15¢ |
| 0.622 | 76P05 | 15¢ | 1 122 | 76P10 | 15¢ |
| 0.722 | 76P06 | 15¢ | | | |

SEE DISCOUNT SCHEDULE ON FOLLOWING PAGE.

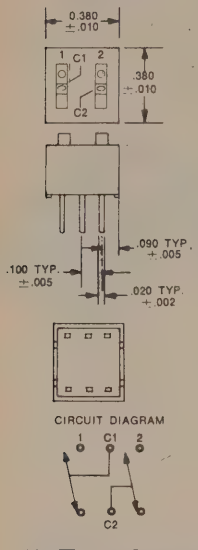
**Available Locally Through Your Grayhill Distributor**

Grayhill

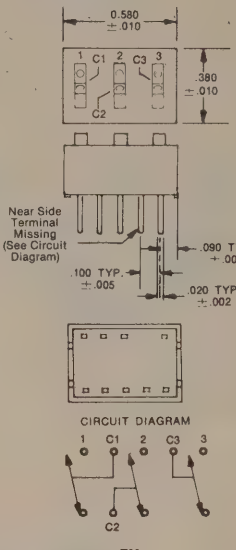
# TOP ACCESS ROCKER DIP SWITCHES

## THE DIP-C™ SINGLE POLE/DOUBLE THROW CIRCUITRY

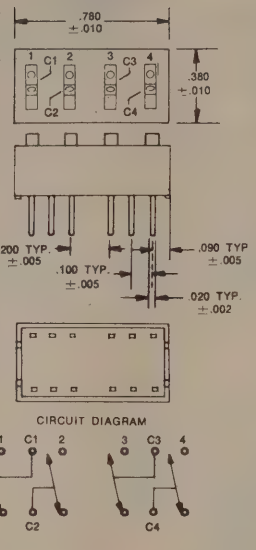
2 ROCKER




3 ROCKER




4 ROCKER



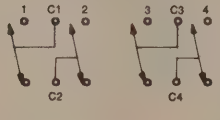

CIRCUIT DIAGRAM

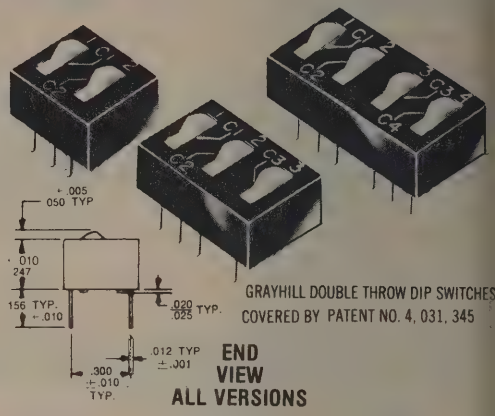



CIRCUIT DIAGRAM




CIRCUIT DIAGRAM




END VIEW ALL VERSIONS

GRAYHILL DOUBLE THROW DIP SWITCHES COVERED BY PATENT NO. 4, 031, 345

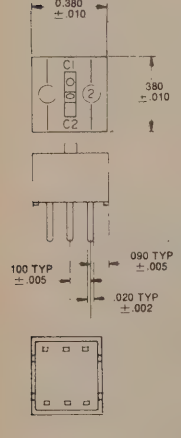
### ORDERING INFORMATION:

| SPDT ROCKER DIP SWITCHES | | | |
|---|---|---|---|
| Number of Rockers | Part Number | Unit Price | Uses Cover |
| 2 | 76C02 | $3.40 | 76P03 |
| 3 | 76C03 | 3.65 | 76P05 |
| 4 | 76C04 | 3.90 | 76P07 |

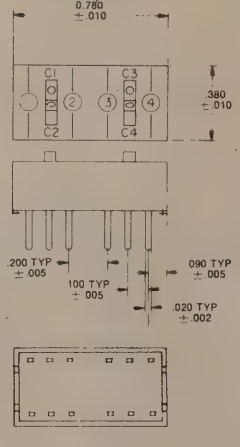
SEE DISCOUNT SCHEDULE BELOW

## THE DOUBLE-DIP™ DOUBLE POLE/DOUBLE THROW CIRCUITRY

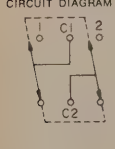
1 ROCKER



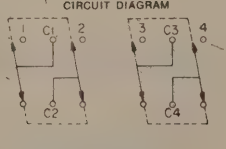

2 ROCKER



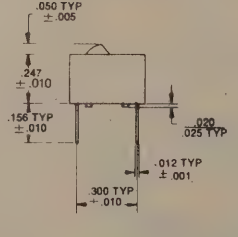

CIRCUIT DIAGRAM

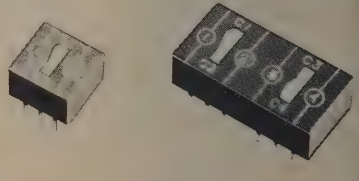



CIRCUIT DIAGRAM




END VIEW ALL VERSIONS



GRAYHILL DOUBLE THROW DIP SWITCHES COVERED BY PATENT NO. 4, 031, 345

### ORDERING INFORMATION:

| DPDT ROCKER DIP SWITCHES | | | |
|---|---|---|---|
| Number of Rockers | Part Number | Unit Price | Uses Cover |
| 1 | 76D01 | $3.50 | 76P03 |
| 2 | 76D02 | 4.00 | 76P07 |

SEE DISCOUNT SCHEDULE BELOW

| DISCOUNT SCHEDULE | |
|---|---|
| 1- 9 UNIT PRICE | PART NOS. 76C, 76D, 76P |
| 10- 24 LESS 8% | 500-999 LESS 35% |
| 25- 49 LESS 16% | PART NOS. 76B, 76RB, 76MB, 76MRB |
| 50- 99 LESS 21% | 500-999 LESS 40% |
| 100-499 LESS 30% | 1000 UP-CONTACT GRAYHILL |

PRICES AND DISCOUNTS SUBJECT TO CHANGE WITHOUT NOTICE.

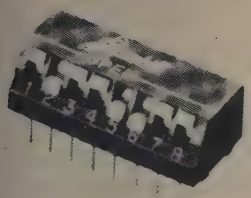
Grayhill, Inc. / 569 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040 / TWX: 910-683-1850

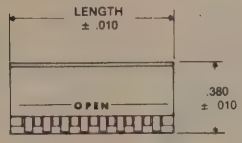
# SIDE ACTUATED AND FRONT PANEL MOUNT

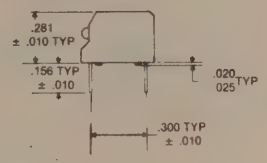
Grayhill

## THE PIANO-DIP™

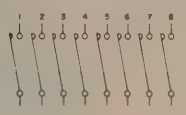
### SPST — SIDE ACTUATED 4 THRU 10 STATIONS

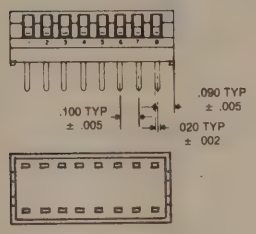





TYPICAL CIRCUIT DIAGRAM
(SHOWN IN OPEN POSITION FOR A SWITCH WITH EIGHT ROCKERS)

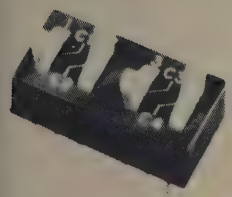



### ORDERING INFORMATION:

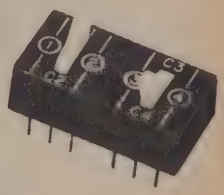
| SPST PIANO DIP SWITCHES | | | | SPST PIANO DIP SWITCHES | | | |
|---|---|---|---|---|---|---|---|
| Number of Rockers | Length | Part Number | Unit Price | Number of Rockers | Length | Part Number | Unit Price |
| 4 | 0.480 | 76PB04 | 4.65 | 8 | 0.880 | 76PB08 | 5.05 |
| 5 | 0.580 | 76BP05 | 4.75 | 9 | 0.980 | 76PB09 | 5.15 |
| 6 | 0.680 | 76PB06 | 4.85 | 10 | 1.080 | 76PB10 | 5.25 |
| 7 | 0.780 | 76BP07 | 4.95 | | | | |

SEE DISCOUNT SCHEDULE BELOW

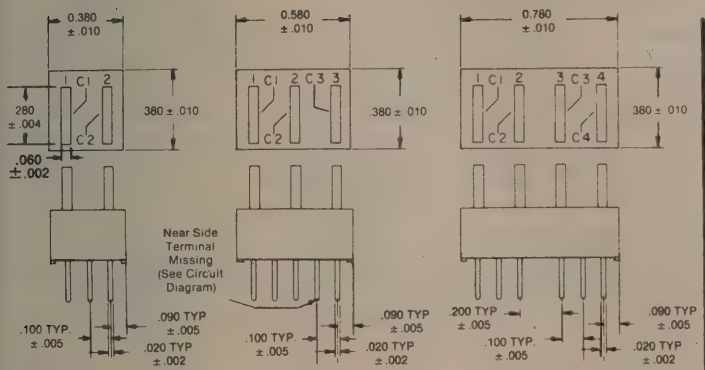


## THE TOGGLE-DIP™

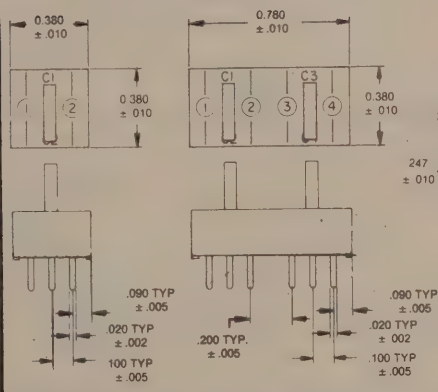
### FRONT PANEL PROGRAMMING SWITCHES

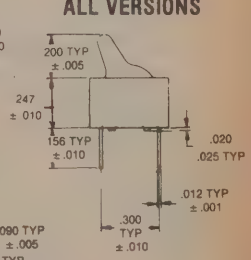


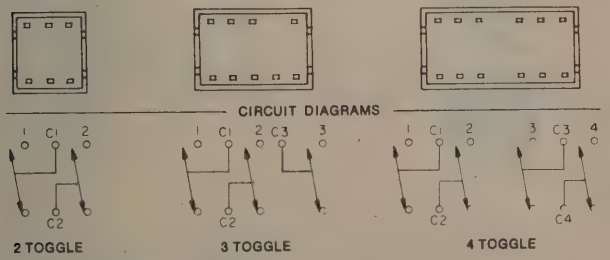

### SPDT

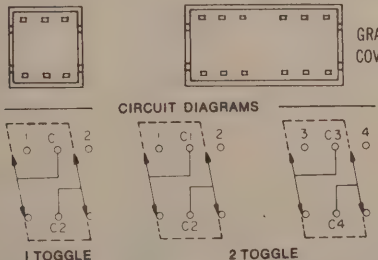



### DPDT




GRAYHILL DOUBLE THROW DIP SWITCHES COVERED BY PATENT NO. 4, 031, 345

### ORDERING INFORMATION:

| SPDT TOGGLE DIP SWITCHES | | |
|---|---|---|
| Number of Rockers | Part Number | Unit Price |
| 2 | 76TC02 | $3.40 |
| 3 | 76TC03 | 3.65 |
| 4 | 76TC04 | 3.90 |

| DPDT TOGGLE DIP SWITCHES | | |
|---|---|---|
| Number of Rockers | Part Number | Unit Price |
| 1 | 76TD01 | $3.50 |
| 2 | 76TD02 | 4.00 |

| DISCOUNT SCHEDULE | |
|---|---|
| 1- 9 UNIT PRICE | PART NOS. 76TC, 76TD |
| 10- 24 LESS 8% | 500-999 LESS 35% |
| 25- 49 LESS 16% | PART NO. 76PB |
| 50- 99 LESS 21% | 500-999 LESS 40% |
| 100-499 LESS 30% | 1000 UP - CONTACT GRAYHILL |

PRICES AND DISCOUNTS SUBJECT TO CHANGE WITHOUT NOTICE.

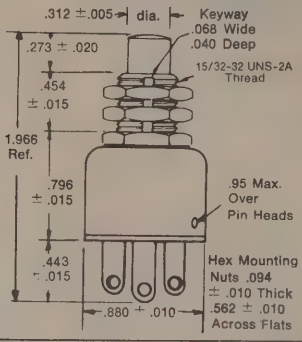
**Available Locally Through Your Grayhill Distributor**

# SNAP ACTION AND WIPING CONTACT PUSHBUTTON SWITCHES

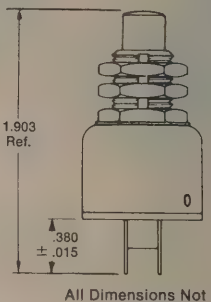
**RATING CRITERIA FOR ALL SWITCHES ON THIS PAGE** — **Contact Resistance:** 25 milliohms maximum on a new switch. **Voltage Breakdown:** 1,000 VAC between mutually insulated parts. **Insulation Resistance:** 1,000 megohms minimum.

## SNAP ACTION, 10 AMP RATING, AUDIBLE FEEDBACK

7-26—SPDT
Break Before Make



2201, 7-7—SPST—N.O
2202, 7-8—SPST—N.C.




All Dimensions Not Shown, Same As SPDT

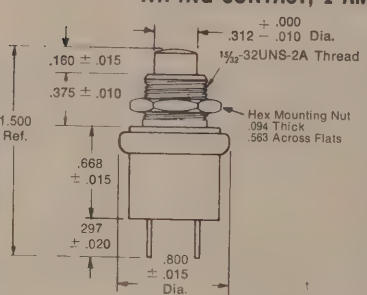
| Circuitry | Action | Total Travel | Actuating Force (Oz.) | Mtg. Hole |
|---|---|---|---|---|
| SPST | Momentary | ≧ .065" | ≧ 36 | 31/64" |

| Circuitry | Rating At 115VAC Resistive | Operations At Rated Load | Part No. | Button Color | Unit Price | 50-99 Pieces | 100-499 Pieces |
|---|---|---|---|---|---|---|---|
| SPDT | 10 Amps | 25,000 | 7-26R | Red | $5.70 | $4.85 | 3.99 |
| SPDT | | | 7-26B | Black | 5.70 | 4.85 | 3.99 |
| SPST-N.O. | | | 2201 | Red | 4.40 | 3.74 | 3.08 |
| SPST-N.O. | | | 7-7 | Black | 4.40 | 3.74 | 3.08 |
| SPST-N.C. | | | 7-8 | Red | 4.40 | 3.74 | 3.08 |
| SPST-N.C. | | | 2202 | Black | 4.40 | 3.74 | 3.08 |

Also available with Faston terminals. Button caps, button guards, decorative hardware and pendant housing also available. See GRAYHILL Pushbutton Catalog

## WIPING CONTACT, 1 AMP RATING, UL LISTED AT 3 AMPS

4001 10-9 SPST-N.O.
4002 10-10 SPST-N.C.



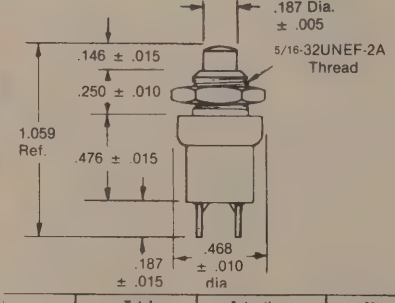

| Circuitry | Action | Total Travel | Actuating Force (Oz.) | Mtg. Hole |
|---|---|---|---|---|
| SPST-N.O. | Momentary | .140" ± .032" | 22 ± 8 | 31/64" |
| SPST-N.C. | | .110" ± .020" − .010" | | |

| Circuitry | Rating At 115VAC Resistive | Operations At Rated Load | Part No. | Button Color | Unit Price | 50-99 Pieces | 100-499 Pieces |
|---|---|---|---|---|---|---|---|
| SPST-N.O. | 1 Amp | 100,000 | 4001* | Red | $1.65 | $1.40 | $1.16 |
| SPST-N.O. | 3 Amp | 6,000 | 10-9* | Black | 1.65 | 1.40 | 1.16 |
| SPST-N.C. | To UL | To UL | 10-10* | Red | 1.65 | 1.40 | 1.16 |
| SPST-N.C. | Criteria | Criteria | 4002* | Black | 1.65 | 1.40 | 1.16 |

*Add UL to Part No. for UL Listed Switches. Also available in positive feel version. Button guard, decorative hardware and pendant housing also available. See GRAYHILL Pushbutton Catalog.

## WIPING CONTACT, MINIATURE SIZE

23-1 SPST-N.O.



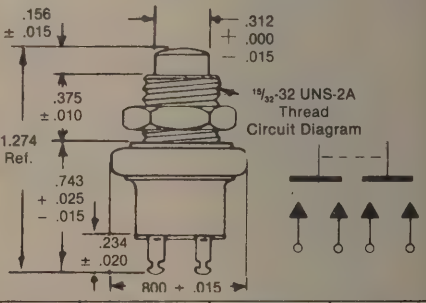

| Circuitry | Action | Total Travel | Actuating Force (Oz.) | Mtg. Hole |
|---|---|---|---|---|
| SPST-N.O. | Momentary | .095" ± .010" | 16 ± 4 | 21/64" |

| Rating At 115VAC Resistive | Operations At Rated Load | Part No. | Button Color | Unit Price | 50-99 Pieces | 100-499 Pieces |
|---|---|---|---|---|---|---|
| ¼ Amp | 100,000 | 23-1 | Red | $1.90 | $1.62 | $1.33 |
| | | 23-4 | Black | 1.90 | 1.62 | 1.33 |

Decorative Hardware Also Available. See GRAYHILL Pushbutton Catalog.

## WIPING CONTACT, DPST

35-1 DPST-N.C.




| Circuitry | Action | Total Travel | Actuating Force (Oz.) | Mtg. Hole |
|---|---|---|---|---|
| DPST-N.O. | Momentary | .062" ± .015" | 20 ± 8 | 31/64" |

| Rating At 115VAC Resistive | Operations At Rated Load | Part No. | Button Color | Unit Price | 50-99 Pieces | 100-499 Pieces |
|---|---|---|---|---|---|---|
| ½ Amp | 100,000 | 35-1 | Red | $2.30 | $1.96 | $1.61 |
| | | 35-3 | Black | 2.30 | 1.96 | 1.61 |

Button Guard and Decorative Hardware Also Available. See GRAYHILL Pushbutton Catalog.

PRICES AND DISCOUNTS SUBJECT TO CHANGE WITHOUT NOTICE.

Grayhill, Inc. / 569 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040 / TWX: 910-683-1850

# 1 AMP, BUTT CONTACT PUSHBUTTON SWITCHES

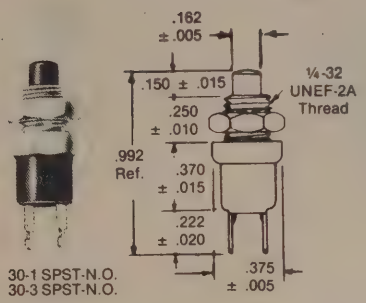
## HIGH CURRENT SWITCHING CAPABILITY IN A MINIATURE SWITCH
## UL LISTED AT 5 AMPS

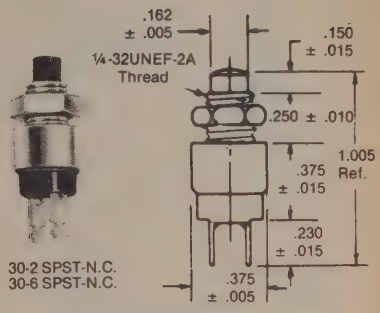
**RATING CRITERIA:**

**Contact Resistance:** 25 milliohms maximum on a new switch.

**Voltage Breakdown:** 1,000 VAC between mutually insulated parts.

**Insulation Resistance:** 1,000 megohms minimum.




| Circuitry | Rating 115 VAC Resistive | Operations at Rated Load | Action | Total Travel | Actuating Force (Oz.) | Mtg. Hole | Part No. | Button Color | Unit Price | 50-99 Pieces | 100-499 Pieces |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SPST-N.O. | 1 Amp | 1,000,000 | Momentary | .062" ± .010" | 10 ± 4 | 17/64 | 30-1* | Red | $1.25 | $1.06 | $0.88 |
| | | | | | | | 30-3* | Black | 1.25 | 1.06 | 0.88 |
| SPST-N.C. | 5 AMP to UL Criteria | 6,000 to UL Criteria | | .065" $^{+\ .010"}_{-\ .015"}$ | 8 ± 4 | | 30-2* | Black | 1.25 | 1.06 | 0.88 |
| | | | | | | | 30-6* | Red | 1.25 | 1.06 | 0.88 |

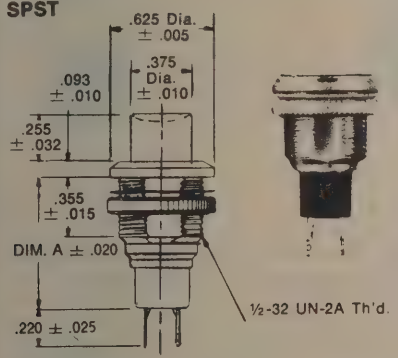
*Add UL To Part No. For UL Listed Switches.

Also Available in SPST-N.O. With Overtravel, Positive Feel Versions and Watertight Panel Seal. Button Caps and Decorative Hardware Also Available.

## DECORATIVE MOUNTING
## MOMENTARY CONTACT

### FRONT PANEL MOUNTING
### ROUND BEZEL

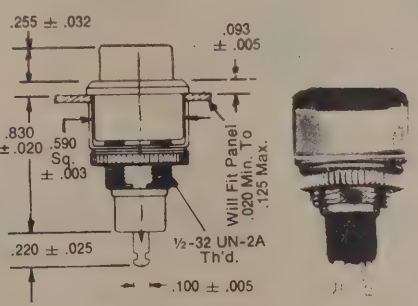
**SPST**




| Circuit | Dim. A |
|---|---|
| N.O. | .710 |
| N.C. | .690 |

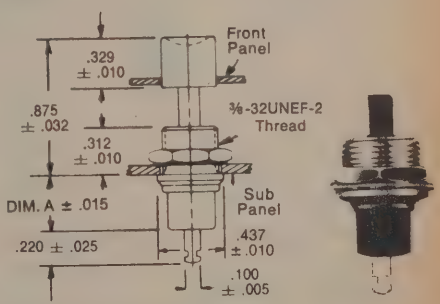
### FRONT PANEL MOUNTING
### SQUARE BEZEL

**SPST**




### SUB-PANEL MOUNTING
### ROUND (.375 DIA.) OR SQUARE (.485) BUTTONS

**SPST**




| Circuit | Dim. A |
|---|---|
| N.O. | .710 |
| N.C. | .690 |

MOUNTING HARDWARE:
FRONT PANEL MOUNT – 1 INTERNAL TOOTH LOCKWASHER, 1 KNURLED RING NUT .640 DIA.
SUB PANEL MOUNT – 1 INTERNAL TOOTH LOCKWASHER,
1 MOUNTING NUT .500 ACROSS FLATS BY .093 THICK

## ELECTRICAL RATINGS SAME AS ABOVE

| Circuitry | Mounting | Part No. | Unit Price | 50-99 Pieces | 100-499 Pieces |
|---|---|---|---|---|---|
| SPST-N.O. | Round Bezel | 30-05-01* | $2.70 | $2.30 | $1.89 |
| SPST-N.C. | Round Bezel | 30-05-02* | 2.95 | 2.51 | 2.07 |
| SPST-N.O. | Square Bezel | 30-01-01* | 3.10 | 2.64 | 2.17 |
| SPST-N.C. | Square Bezel | 30-01-02* | 3.35 | 2.85 | 2.35 |
| SPST-N.O. | Sub Panel | 30-03-01* | 1.70 | 1.45 | 1.19 |
| SPST-N.C. | Sub Panel | 30-03-02* | 2.00 | 1.70 | 1.40 |

*Button Color Number Suffix Must Be Added. -0101 (White); -0303 (Red); -0404 (Green); -0505 (Blue); -0606 (Yellow); -0707 (Black)

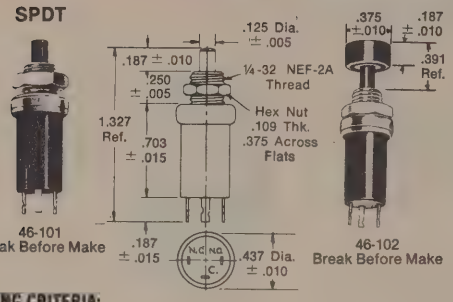
Also Available in SPST-N.O. With Overtravel and Positive Feel Versions. See GRAYHILL Pushbutton Catalog.

**Available Locally Through Your Grayhill Distributor**

# MULTI CIRCUIT, ¼ AMP, WIPING CONTACT PUSHBUTTON SWITCHES

## HIGH RELIABILITY — LONG WIPE CONTACT INSURES OPERATION

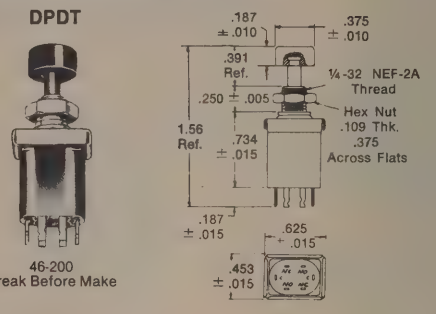
SPDT




46-101 Break Before Make

46-102 Break Before Make

DPDT




46-200 Break Before Make

**RATING CRITERIA:**

**Contact Resistance:** 25 milliohms maximum on a new switch.

**Voltage Breakdown:** 1,000 VAC between mutually insulated parts.

**Insulation Resistance:** 1,000 megohms minimum.

| Action | Total Travel | Acutating Force (Oz.) | Mtg. Hole |
|---|---|---|---|
| Momentary | .180" Min. | 17 ± 5, SPDT<br>35 ± 9, DPDT | 17/64" |

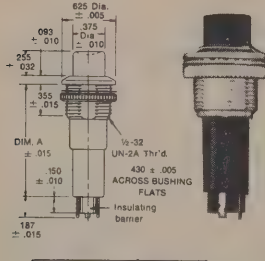
| Rating 115 VAC Resistive | Operations at Rated Load | Part No. | Button Or Cap Color | Unit Price | 50-99 Pieces | 100-499 Pieces |
|---|---|---|---|---|---|---|
| ¼ Amp | 250,000 | 46-101 RED | Red | $1.90 | $1.62 | $1.33 |
| | | 46-101 BLK | Black | 1.90 | 1.62 | 1.33 |
| | | 46-102 RED | Red | 2.00 | 1.70 | 1.40 |
| | | 46-102 BLK | Black | 2.00 | 1.70 | 1.40 |
| | | 46-200 RED | Red | 4.05 | 3.44 | 2.84 |
| | | 46-200 BLK | Black | 4.05 | 3.44 | 2.84 |

Also Available With Make Before Break Contacts, Watertight Panel Seal, Environmental Seal. See GRAYHILL Pushbutton Catalog.

## DECORATIVE MOUNTING MOMENTARY OR ALTERNATE ACTION

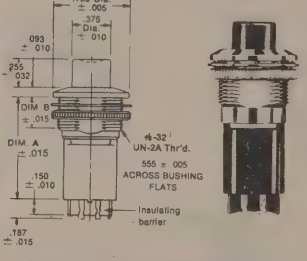
### FRONT PANEL MOUNTING — ROUND BEZEL

SPDT




| Action | Dim. A |
|---|---|
| Momentary | 0.992 |
| Alternate | 1.278 |

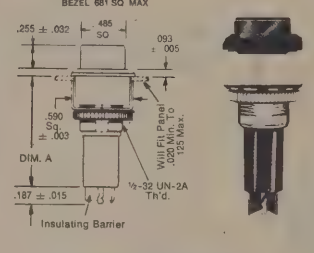
DPDT




| Action | Dim. A | Dim. B |
|---|---|---|
| Momentary | 1.001 | .314 |
| Alternate | 1.130 | .355 |

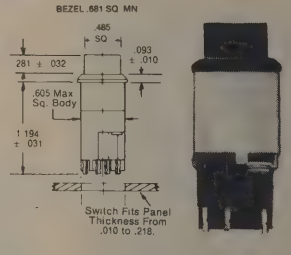
### FRONT PANEL MOUNTING — SQUARE BEZEL

SPDT




| Action | Dim. A |
|---|---|
| Momentary | 1.174 |
| Alternate | 1.264 |

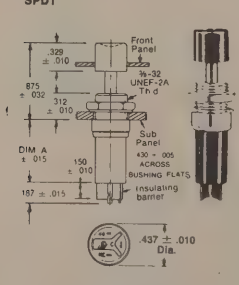
DPDT




**MOUNTING HARDWARE:** Internal Tooth Lockwasher, 1 Knurled Ring Nut (.640 Dia. SPDT; .765 Dia. DPDT) Except Mounting Sleeve and Mounting Screws Supplied with DPDT Square Bezel.

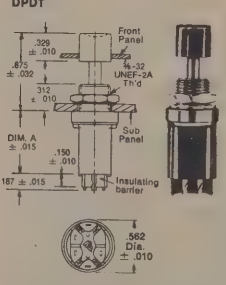
### SUB-PANEL MOUNTING ROUND (.375 DIA.) OR SQUARE (.485) BUTTONS

SPDT




| Action | Dim. A |
|---|---|
| Momentary | .703 |
| Alternate | .750 |

DPDT




| Action | Dim. A |
|---|---|
| Momentary | .701 |
| Alternate | .750 |

**MOUNTING HARDWARE:** 1 Internal Tooth Lockwasher,
1 Mounting Nut .500 across Flats by .093 Thick

### ELECTRICAL RATINGS SAME AS LISTED ABOVE

| Circuitry | Mounting | Action | Part No. | Unit Price | 50-99 Pieces | 100-499 Pieces |
|---|---|---|---|---|---|---|
| SPDT | Rnd. Bezel | Mom. | 46-05-05* | $2.80 | $2.38 | $1.96 |
| SPDT | Rnd. Bezel | Alt. | 46-05-07* | 4.40 | 3.74 | 3.08 |
| DPDT | Rnd. Bezel | Mom. | 46-05-08* | 3.90 | 3.32 | 2.73 |
| DPDT | Rnd. Bezel | Alt. | 46-05-09* | 5.40 | 4.59 | 3.78 |
| SPDT | Sq. Bezel | Mom. | 46-01-05* | 3.40 | 2.89 | 2.38 |
| SPDT | Sq. Bezel | Alt. | 46-01-07* | 5.00 | 4.25 | 3.50 |
| DPDT | Sq. Bezel | Mom. | 46-01-08* | 4.50 | 3.83 | 3.15 |
| DPDT | Sq. Bezel | Alt. | 46-01-09* | 6.00 | 5.10 | 4.10 |
| SPDT | Sub Panel | Mom. | 46-03-05* | 2.40 | 2.04 | 1.68 |
| SPDT | Sub Panel | Alt. | 46-03-07* | 4.00 | 3.40 | 2.80 |
| DPDT | Sub Panel | Mom. | 46-03-08* | 3.60 | 3.06 | 2.52 |
| DPDT | Sub Panel | Alt. | 46-03-09* | 4.75 | 4.04 | 3.33 |

*Button Color Number Suffix Must Be Added. -0101 (White); -0303 (Red); -0404 (Green); -0505 (Blue); -0606 (Yellow); -0707 (Black).

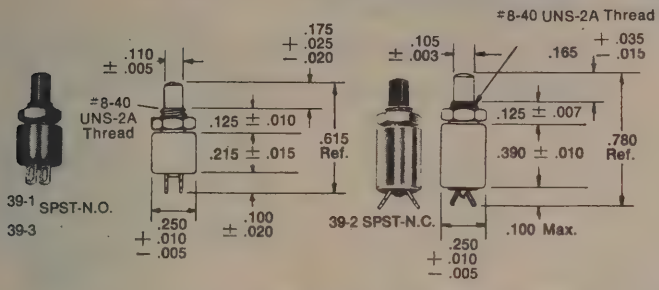
PRICES AND DISCOUNTS SUBJECT TO CHANGE WITHOUT NOTICE.

Grayhill, Inc. / 569 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040 / TWX: 910-683-1850

# MINIATURE BUTT CONTACT PUSHBUTTON SWITCHES

Grayhill

## SPACE PROBLEM SOLVER — 0.2500″ DIAMETER; 0.315″ BEHIND PANEL




### RATING CRITERIA FOR ALL SWITCHES ON THIS PAGE

**Contact Resistance:** 25 milliohms maximum on a new switch.

**Voltage Breakdown:** 1,000 VAC between mutually insulated parts.

**Insulation Resistance:** 1,000 megohms minimum.

| Circuitry | Action | Total Travel | Actuating Force (Oz.) | Mtg. Hole |
|---|---|---|---|---|
| SPST-N.O. | Momentary | .035″ ± .015″ | 4 +4 −2 | 11/64″ |
| SPST-N.C. | | .042″ ± .010″ | 4 ± 2 | |

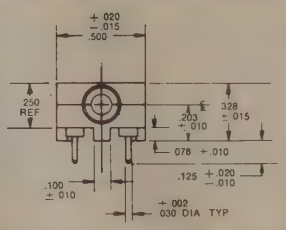
| Circuitry | Rating at 115 VAC, Resistive | Operations at Rated Load | Part No. | Button Color | Unit Price | 50-99 Pieces | 100-499 Pieces |
|---|---|---|---|---|---|---|---|
| SPST-N.O. | ½ Amp | 1,000,000 | 39-1<br>39-3 | Red<br>Black | $1.70<br>1.70 | $1.45<br>1.45 | $1.19<br>1.19 |
| SPST-N.C. | ¼ Amp | 250,000 | 39-2 | Black | 2.30 | 1.96 | 1.61 |

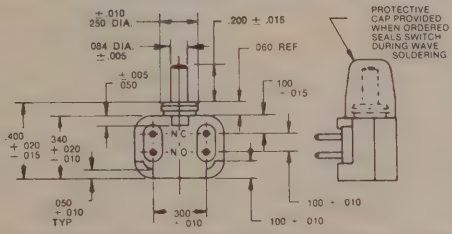
Also Available in SPST-N.O. With Overtravel and Threaded Body for Limit Switch Applications.
Button Caps for SPST-N.O. Types Also Available. See GRAYHILL Pushbutton Catalog.

## PC MOUNT VERSION, FULLY PROTECTED DURING FLUX CLEANING OPERATION

39-251
SPDT

39-250
SPDT



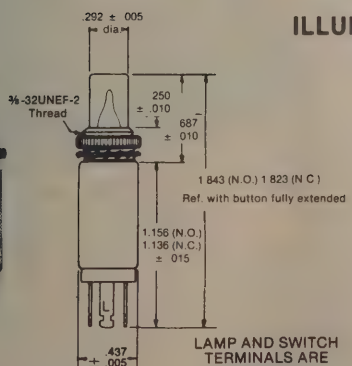

| Rating at 115 VAC, Resistive | Operations at Rated Load | Part No. | Button Color | Description | Unit Price | 50-99 Pieces | 100-499 Pieces |
|---|---|---|---|---|---|---|---|
| ¼ Amp | 500,000 | 39-251 RED<br>39-251 BLK | RED<br>BLACK | WITHOUT CAP | $0.95<br>0.95 | $0.81<br>0.81 | $0.67<br>0.67 |
| | | 39-250 RED<br>39-250 BLK | RED<br>BLACK | WITH CAP | 1.15<br>1.15 | 0.98<br>0.98 | 0.81<br>0.81 |

Circuitry

SPDT
2 Circuits

| Action | Total Travel | Actuating Force (Oz.) |
|---|---|---|
| Momentary | .090 +.010″ −.015″ | 7 ± 3 |

## ILLUMINATED AND MINIATURE SIZE




| Circuitry | Action | Total Travel | Actuating Force (Oz.) | Mtg. Hole |
|---|---|---|---|---|
| SPST-N.O. | Momentary | .062″ ± .010″ | 16 + 8, − 4 | 25/64″ |
| SPST-N.C. | | .050″ ± .015″ | 7 ± 3 | |

NEON
40-1 SPST-N.O.
40-2 SPST-N.C.

INCANDESCENT
40-100 SPST-N.O.
40-102 SPST-N.C.

LED
40-200 SPST-N.O.
40-202 SPST-N.C.

| Rating At 115 VAC Resistive | Operations At Rated Load | Part No. (See Above) | Unit Price | 50-99 Pieces | 100-499 Pieces |
|---|---|---|---|---|---|
| 1 AMP | 500,000 | 40-1* | $3.65 | $3.10 | $2.56 |
| | | 40-2* | 3.95 | 3.36 | 2.77 |
| | | 40-100** | 4.00 | 3.40 | 2.80 |
| | | 40-102** | 4.30 | 3.66 | 3.01 |
| | | 40-200 RED | 3.95 | 3.36 | 2.77 |
| | | 40-202 RED | 3.95 | 3.36 | 2.77 |

*ADD CLR (CLEAR), AMB TR (AMBER TRANSPARENT), RED TR (RED TRANS.), WHT FR (WHITE FROSTED)
**ADD GRN TR (GREEN TRANSPARENT), RED FR (RED FROSTED), YEL FR (YELLOW FROSTED) OR ANY OF THE CHOICES LISTED ABOVE.

**MOUNTING HARDWARE:** 1 Internal Tooth Lockwasher, 1 Knurled Ring Nut .500 Dia. by .094

**Lamp Information** — Lamps are non-replaceable — Neon, 105-125V. Operation; Surge Res. Not Supplied. Incandescent, Rated At 28 V., 20V Supply Recommended. LED, 10 MA to 100 MA Operation; External Res. Required; Cathode Term Is Gold Plated, Anode Is Tin Plated.

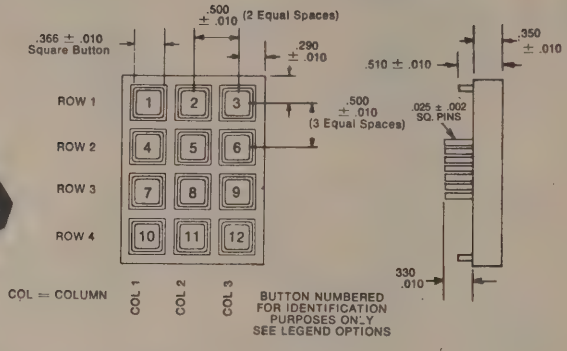
PRICES AND DISCOUNTS SUBJECT TO CHANGE WITHOUT NOTICE.

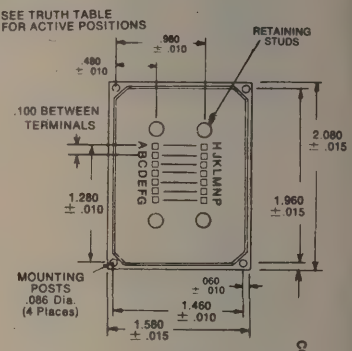
**Available Locally Through Your Grayhill Distributor**

Grayhill

# 3″ X 4″ KEYBOARDS

- POSITIVE TACTILE AND AUDIO FEEDBACK
- RECESSED BUTTONS
- STANDARD MOUNTING DIMENSIONS
- LOW PROFILE
- TOPSIDE OR SUB-PANEL MOUNTING

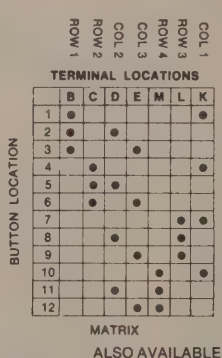


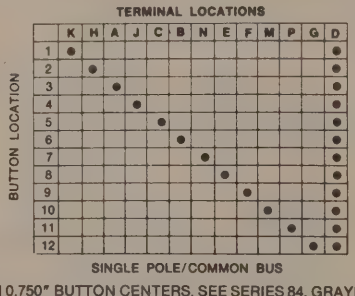



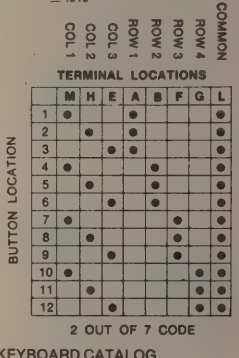

## SERIES 83 POST MOUNTING

### CODES AND TRUTH TABLES

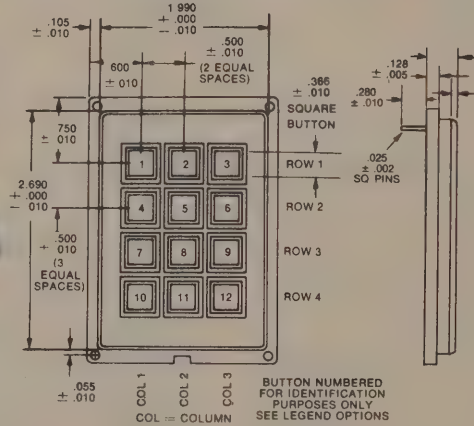
ONLY TERMINALS INDICATED IN THE TRUTH TABLES ARE SUPPLIED WITH KEYBOARDS. TERMINALS LABELED FOR IDENTIFICATION ONLY AND NOT LETTERED ON PRODUCT.

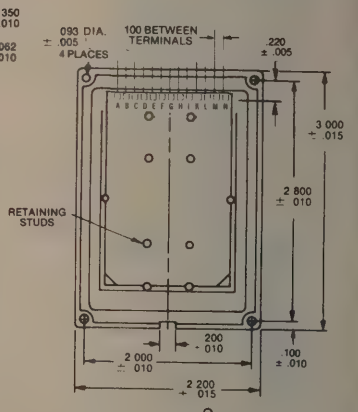



ALSO AVAILABLE WITH 0.750″ BUTTON CENTERS. SEE SERIES 84, GRAYHILL KEYBOARD CATALOG.

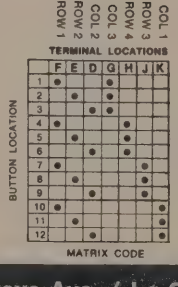


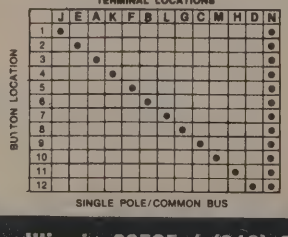



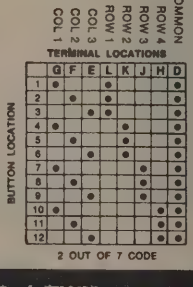

## SERIES 86 FLANGE MOUNTING

### CODES AND TRUTH TABLES

ONLY TERMINALS INDICATED IN THE TRUTH TABLES ARE SUPPLIED WITH KEYBOARDS. TERMINALS LABELED FOR IDENTIFICATION ONLY AND NOT LETTERED ON PRODUCT.



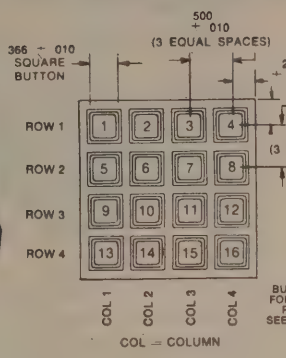



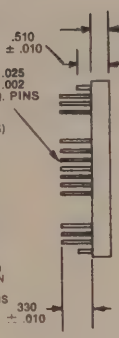

Grayhill, Inc. / 569 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040 / TWX: 910-683-1850

# 4" X 4" KEYBOARDS

Grayhill

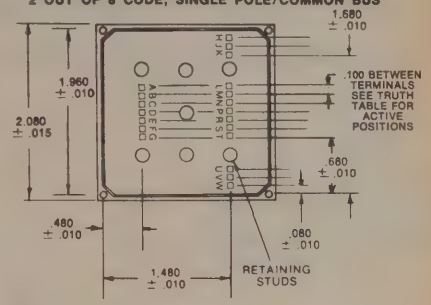
**SERIES 83**
**POST MOUNTING**



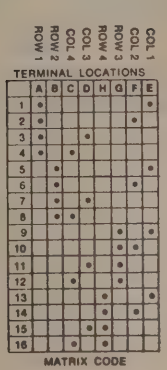

**TERMINAL LOCATIONS**

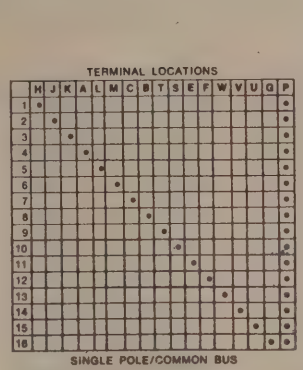
**2 OUT OF 8 CODE; SINGLE POLE/COMMON BUS**

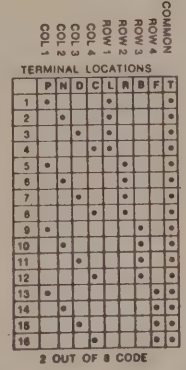



**CODES AND TRUTH TABLES**

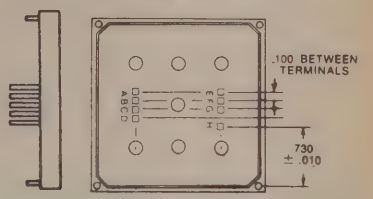
ONLY TERMINALS INDICATED IN THE TRUTH TABLES ARE SUPPLIED WITH KEYBOARDS. TERMINALS LABELED FOR IDENTIFICATION ONLY AND NOT LETTERED ON PRODUCT



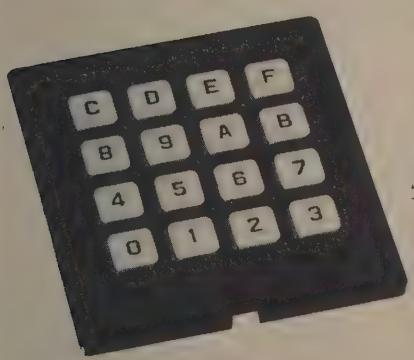




**TERMINAL LOCATION — MATRIX CODE ALL OTHER DIMENSIONS SAME AS ABOVE**

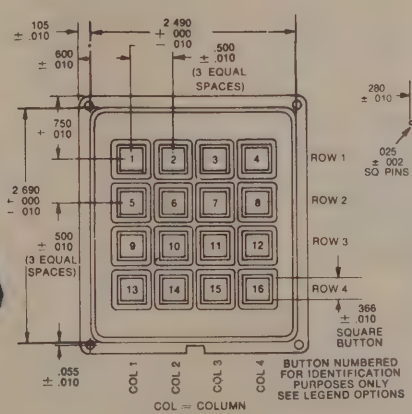


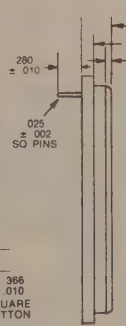

ALSO AVAILABLE WITH 0.750" BUTTON CENTERS. SEE SERIES 84, GRAYHILL KEYBOARD CATALOG.

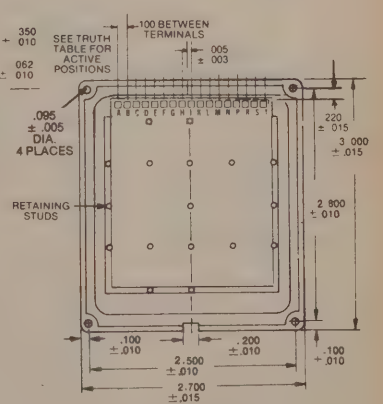
---




**SERIES 86**
**FLANGE MOUNTING**

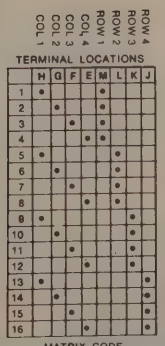


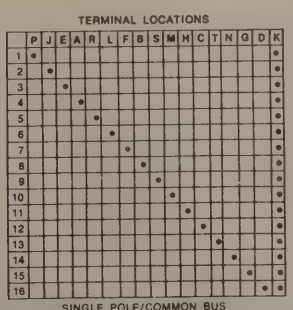



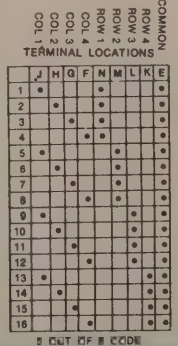




**CODES AND TRUTH TABLES**

ONLY TERMINALS INDICATED IN THE TRUTH TABLES ARE SUPPLIED WITH KEYBOARDS. TERMINALS LABELED FOR IDENTIFICATION ONLY AND NOT LETTERED ON PRODUCT.



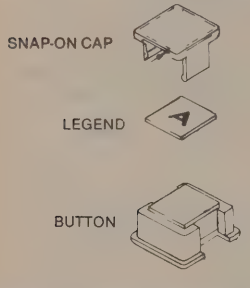

**Available Locally Through Your Grayhill Distributor**

# KEYBOARDS

- LONG LIFE — RATED TO 3,000,000 OPERATIONS
- READILY INTERFACED WITH LOGIC CIRCUITRY WITH STANDARD BUFFERING TECHNIQUES
- DURABLE — MOLDED OF TOUGH ABS PLASTIC
- STANDARD BUTTON OPTIONS - SELF LEGENDING - MOLDED IN LEGEND
- SPECIAL BUTTON OPTIONS
  - HOT STAMPED LEGENDS
  - BLACK BUTTON, WHITE LEGEND
  - DIFFERENT COLORS

## LEGENDS:

**SNAP-ON CAP** Clear snap-on cap removes easily to allow for self legending of prototypes. Legend card is available with most of the popular legends. Legend peels off of card and is adhesive backed to hold firmly in place. Snap-on cap versions project approx. 0.015" above surface of keyboard.



LEGEND CARD
PART NO. 87AC2046

**MOLDED-IN** All legend configurations listed below (with the exception of the self legend style) are permanent molded-in type. Any of the following formats are available as standards in the appropriate keyboard configuration (See Ordering Information).

### 3X4 LEGEND CHOICES

—101

SELF LEGEND
SNAP-ON CAPS

—102

| | | |
|---|---|---|
| 1 | 2 | 3 |
| 4 | 5 | 6 |
| 7 | 8 | 9 |
| * | 0 | # |

—103

| | | |
|---|---|---|
| 1 | ABC 2 | DEF 3 |
| GHI 4 | JKL 5 | MNO 6 |
| PRS 7 | TUV 8 | WXY 9 |
| * | OPER 0 | # |

TWO SHOT MOLDED BUTTONS
BLACK LEGEND ON WHITE

### 4X4 LEGEND CHOICES

—001

SELF LEGEND
SNAP-ON CAPS

—002

| | | | |
|---|---|---|---|
| 0 | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 |
| 8 | 9 | A | B |
| C | D | E | F |

—003

| | | | |
|---|---|---|---|
| C | D | E | F |
| 8 | 9 | A | B |
| 4 | 5 | 6 | 7 |
| 0 | 1 | 2 | 3 |

TWO SHOT MOLDED BUTTONS
BLACK LEGEND ON WHITE

—004

| | | | |
|---|---|---|---|
| 1 | 2 | 3 | C |
| 4 | 5 | 6 | D |
| 7 | 8 | 9 | E |
| A | 0 | B | F |

—005

| | | | |
|---|---|---|---|
| 1 | 2 | 3 | F |
| 4 | 5 | 6 | E |
| 7 | 8 | 9 | D |
| A | 0 | B | C |

—006

| | | | |
|---|---|---|---|
| 1 | ABC 2 | DEF 3 | A |
| GHI 4 | JKL 5 | MNO 6 | B |
| PRS 7 | TUV 8 | WXY 9 | C |
| * | OPER 0 | # | D |

TWO SHOT MOLDED BUTTONS BLACK LEGEND ON WHITE

PRICES AND DISCOUNTS SUBJECT TO CHANGE WITHOUT NOTICE.

## RATING:

**Rating At 24 VDC:** 10 milliamps, resistive.

**Contact Resistance:** Compatible with MOS, TTL and DTL.

**Voltage Breakdown:** 250 VAC between mutually insulated parts.

**Life Expectancy:** 3,000,000 operations per button.

**Contact Bounce:** Less than 4 milliseconds at make, 10 milliseconds at break.

## NOTE:

The 2 of 7 (or 8) "Telephone Code" was developed primarily for audio tone generation. For more critical data input applications, please consult Grayhill for Mean Cycle Before Failure (MCBF) data.

## MATERIALS AND FINISHES:

**Housing:** ABS Plastic (Black).

**Button:** ABS Plastic (White with Molded-in Black Legend).

**Terminals:** Copper Alloy, CDA No. 725.

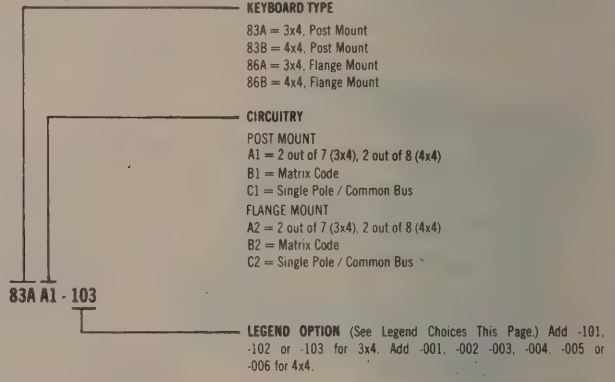
## OPERATING FEATURES:

**Button Travel:** 0.015" nominal, total travel.

**Operating Force:** 220 ± 40 grams.

## ORDERING INFORMATION:

Part number is descriptive and formed in the following manner.


KEYBOARD TYPE
83A = 3x4, Post Mount
83B = 4x4, Post Mount
86A = 3x4, Flange Mount
86B = 4x4, Flange Mount
CIRCUITRY
POST MOUNT
A1 = 2 out of 7 (3x4), 2 out of 8 (4x4)
B1 = Matrix Code
C1 = Single Pole / Common Bus
FLANGE MOUNT
A2 = 2 out of 7 (3x4), 2 out of 8 (4x4)
B2 = Matrix Code
C2 = Single Pole / Common Bus
83A A1 - 103
LEGEND OPTION (See Legend Choices This Page.) Add -101, -102 or -103 for 3x4. Add -001, -002 -003, -004, -005 or -006 for 4x4.

Sample part number orders a 3x4 Post Mount, 2 out of 7 code with a standard telephone legend.

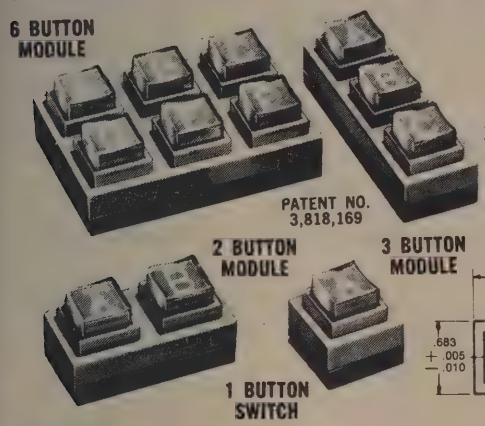
## PRICES

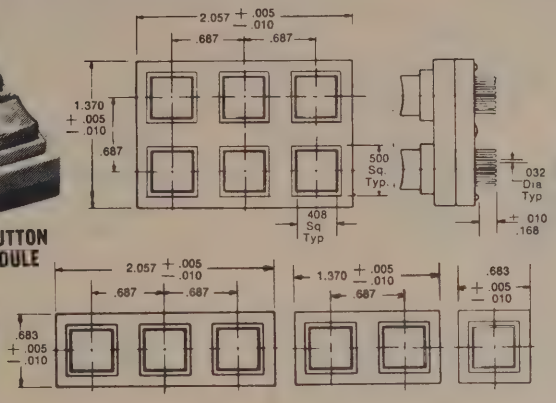
| No. of Buttons | Keyboard Type | Circuit Code | Unit Price | 50-99 Pieces | 100-499 Pieces |
|---|---|---|---|---|---|
| 3x4 | 83A | A1 | $10.00 | $8.50 | $7.00 |
| | | B1 | 9.00 | 7.65 | 6.30 |
| | | C1 | 9.50 | 8.08 | 6.65 |
| | 86A | A2 | $10.00 | $8.50 | $7.00 |
| | | B2 | 9.00 | 7.65 | 6.30 |
| | | C2 | 9.50 | 8.08 | 6.65 |
| 4x4 | 83B | A1 | $11.00 | $9.35 | $7.70 |
| | | B1 | 10.00 | 8.50 | 7.00 |
| | | C1 | 10.50 | 8.93 | 7.35 |
| | 86B | A2 | $11.00 | $9.35 | $7.70 |
| | | B2 | 10.00 | 8.50 | 7.00 |
| | | C2 | 10.50 | 8.93 | 7.35 |
| INSERTABLE LEGEND CARD PART NO. 87AC2046 | | | $ 1.00 | $0.85 | $0.70 |

# PUSHBUTTON SWITCH MODULES PC MOUNTABLE—SERIES 82

Grayhill

## SELF-GENERATED LOGIC, 1 TO 4 POLES PER BUTTON, WIDE CHOICE OF CIRCUITRY STACK IN ANY ARRAY, CHOICE OF COLORS, CHOICE OF LEGENDS



**RATING:**
**Rating at 5 VDC:** 100 milliamps. **Life Expectancy:** 1,500,000 operations.
**Contact Resistance:** 25 milliohms or less on a new switch.
**Voltage Breakdown:** 250 VAC between mutually insulated parts.
**Insulation Resistance:** 1,000 megohms minimum.

**OPERATING FEATURES:**
**Button Travel:** 0.130" total travel. **Overtravel:** 0.080".
**Operating Force:** 4-7 ounces (dependent on number of poles).

**MOUNTING:**
Modules are designed to plug into any printed circuit board from $^{1}/_{16}$" to $^{1}/_{8}$" thick. Modules can be stacked horizontally or vertically for any combination of button array and still maintain $^{11}/_{16}$" button centers.

**7-WIRE CODE CAPABILITY UNDER EACH BUTTON**
The GRAYHILL Series 82 Pushbutton Modules represent the most versatile switches now available to generate coded outputs for control systems of all kind: The capabilities are practically endless since any code up to 7-wire can be accomplished right in the switches. CONTACT FACTORY.

**LEGENDS:**
Hot stamped, two-shot molded, or field-legendable with easy slip-ins. Standard telephone legend configuration and many other typical legends readily available.

**ORDERING INFORMATION:**
For hot stamped or two shot molded button.
To order a Series 82 pushbutton module, there are five areas in which information is required:

1. Type of Module: 1-, 2-, 3-, or 6-button.
2. Type of Mounting: Either horizontal or vertical.
3. Circuitry required for each button (A=SPST; B=2PST; C=3PST, etc.)
4. Color for each internal button (GRAY is standard; other available colors are WHITE, RED, GREEN, and BLACK. Colors can be intermixed. For example, Buttons A thru E are GRAY and F is WHITE.)
5. Legending required on button (Button A legend #1, Button B legend #2, etc.)

Upon receipt of your order, a part number will be assigned to facilitate future identification of this part. These numbers are sequentially assigned as the need arises and are non-descriptive.

For prototypes 4PST circuitry can be ordered and pins can be clipped to provide desired circuitry. Coded circuitry cannot be achieved in this manner. These modules are gray in color and are quickly available through your local GRAYHILL distributor.

**PRICES:** With hot stamped or Two shot molded buttons, contact GRAYHILL.

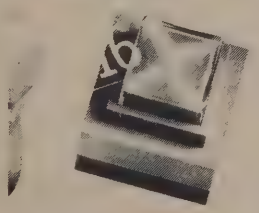
**STANDARD TELEPHONE LEGEND (Reference Picture Above)**
**TWO SHOT MOLDED BUTTONS**

| TOP SIX BUTTONS | | | |
|---|---|---|---|
| Part Number | Circuitry Each Button | Unit Price | 50-99 Pieces |
| 82-601-85 | SPST | $6 70 | $5 69 |
| 82-601-86 | 2PST | 7 30 | 6 20 |
| 82-601-87 | 3PST | 7 90 | 6 71 |
| 82-601-88 | 4PST | 8 50 | 7 22 |

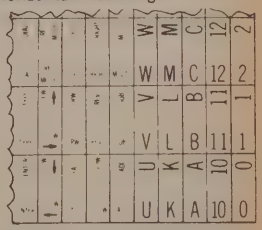
| BOTTOM SIX BUTTONS | | | |
|---|---|---|---|
| 82-601-89 | SPST | $6 70 | $5 69 |
| 82-601-90 | 2PST | 7 30 | 6 20 |
| 82-601-91 | 3PST | 7 90 | 6.71 |
| 82-601-92 | 4PST | 3 50 | 7 22 |

Also available in 2 out of 7 code output — Contact GRAYHILL

## SERIES 82 PUSH BUTTON MODULES WITH INSERTABLE LEGENDS



For prototype and small quantity usage. Switches are available with clear protective cap slotted on one side to allow the insertion of a clear plastic tab imprinted with the legend. A legend sheet is available with all normally required legends for both vertical and horizontal mounting.




Legend sheet is sold separately, GRAYHILL Part No. 82-AC-2017. Contains white legends 0-19, A-Z, and all other normally used symbols and word groups. Simply cut out and insert in slotted button.

**INSERTABLE LEGEND MODULES**

| Part Number | Number of Buttons | Circuitry | Unit Price | 50-99 Pieces |
|---|---|---|---|---|
| 82-101-71 | 1 | SPST | $1.70 | $1.44 |
| 82-101-74 | 1 | 4PST | 2.00 | 1.70 |
| 82-201-41 | 2 | SPST | 2.85 | 2.42 |
| 82-201-44 | 2 | 4PST | 3.45 | 2.93 |
| 82-301-61 | 3 | SPST | 4.00 | 3.40 |
| 82-301-64 | 3 | 4SPT | 4.90 | 4.16 |
| 82-601-81 | 6 | SPST | 7.50 | 6.37 |
| 82-601-84 | 6 | 4PST | 9.30 | 7.90 |
| ACCESSORY | | | | |
| 82AC2017 | Legend Sheet for Above Modules | | $1.00 | $0.85 |

**Available Locally Through Your Grayhill Distributor**

Grayhill

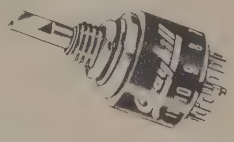
# 1/2" DIAMETER, SINGLE DECK ROTARY SWITCHES—SERIES 50, 51

## OUTSTANDING CIRCUIT VERSATILITY AND A WIDE RANGE OF OPTIONS

AVAILABLE IN STANDARD OR MILITARY STYLES

ADJUSTABLE STOPS PROVIDE IMMEDIATE PROTOTYPES

22½°, 30°, 36°, 45°, 60°, OR 90° ANGLES OF THROW



## OTHER OPTIONS INCLUDE:

- 1 THRU 4 POLES • SEALED OR UNSEALED
- SOLDER LUG OR PC TERMINALS
- FIXED OR ADJUSTABLE STOPS

The most popular Series 50 and 51 rotary switches are fixed stop, with or without panel seals, solder lug or PC terminals. The following drawings (Figures 1 thru 4) show these combinations. The chart at the right lists the switch style that describes the combination and the appropriate drawing that illustrates the combination. The Series 50 is 36° angle of throw and 0 500" diameter. The Series 51 is 22½° or 30° angle of throw and 0.562" diameter. Many other options are available, see following page.

| Type | Terminal | Switch Style | Applicable Figures |
|---|---|---|---|
| Unsealed | Solder Lug | A | 1, 3 |
| Fixed Stop | PC Terminal | P | 1, 4 |
| Sealed | Solder Lug | S | 2, 3 |
| Fixed Stop | PC Terminal | SP | 2, 4 |

## UNSEALED — FIXED STOPS

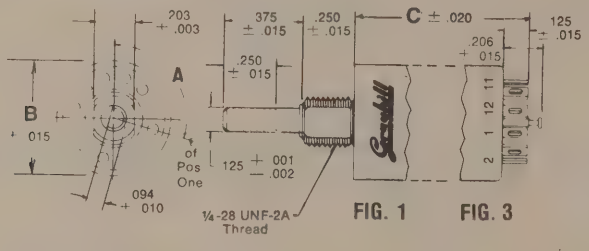
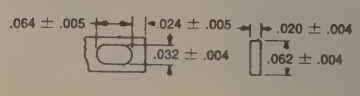


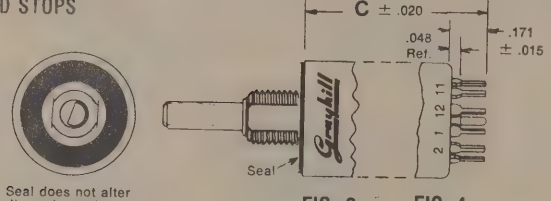

FIG. 1 FIG. 3

| SERIES | 51 | 51 | 50 |
|---|---|---|---|
| Angle of Throw | 22½° | 30° | 36° |
| Angle A | 101°20" | 105° | 108° |
| Dimension B | .562 | .562 | .500 |

## SOLDER LUG TERMINAL DETAIL



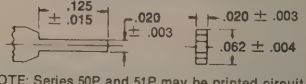

## SEALED — FIXED STOPS




Seal does not alter dimensions when mounted

FIG. 2 FIG. 4

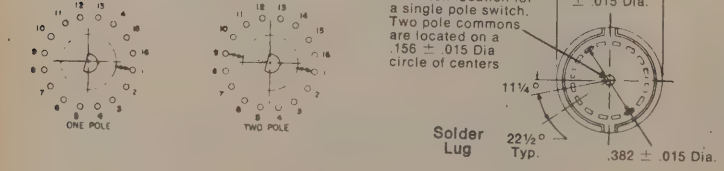
## PC TERMINAL DETAIL



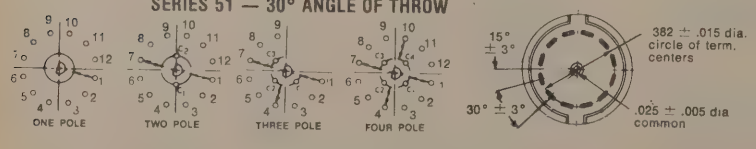

NOTE: Series 50P and 51P may be printed circuit mounted on a .025 grid. Contact GRAYHILL for P.C. board drilling information.

## CIRCUIT DIAGRAMS Switches are viewed from shaft end and shown in position 1

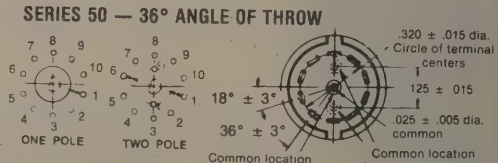
### SERIES 51 — 22½° ANGLE OF THROW


ONE POLE
TWO POLE
Common location for a single pole switch. Two pole commons are located on a .156 ± .015 Dia circle of centers
.562 ± .015 Dia.
11¼°
Solder Lug
22½° Typ.
.382 ± .015 Dia.
Side View
.171 ± .015
.125 Ref.
± .015 500 Dia. Circle of centers
Terminal Is .016 ± .003 Sq.
.156 ± .015
11° 15'
22° 30'
Common location for two pole sw.
PC Mount
Common location for one pole sw. .025 ± .005 Dia. common

### SERIES 51 — 30° ANGLE OF THROW




### SERIES 50 — 36° ANGLE OF THROW


ONE POLE
TWO POLE
.320 ± .015 dia. Circle of terminal centers
125 ± 015
18° ± 3°
36° ± 3°
.025 ± .005 dia. common
Common location for a single pole switch
Common location for a two pole switch

Common location for a single pole switch. Two pole commons are located as shown in circuit diagram on a .156 ± .015 dia. Circle of centers; four pole commons are located as shown in circuit diagram on a .175 ± .015 dia circle of centers

Grayhill, Inc. / 569 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040 / TWX: 910-683-1850

# 1/2" DIAMETER, SINGLE DECK ROTARY SWITCHES—SERIES 50, 51

Grayhill

**RATING:**

Rated to make and break 200MA for 10,000 cycles of operation or 50MA for 25,000 cycles of operation, resistive load, 115VAC or 30VDC.
For complete load life information, see GRAYHILL Rotary Switch catalog.

**CONTACT RESISTANCE:**

50 milliohms maximum (10 milliohms initially).

**INSULATION RESISTANCE:**

10,000 megohms minimum between mutually insulated parts (50,000 megohms initially).

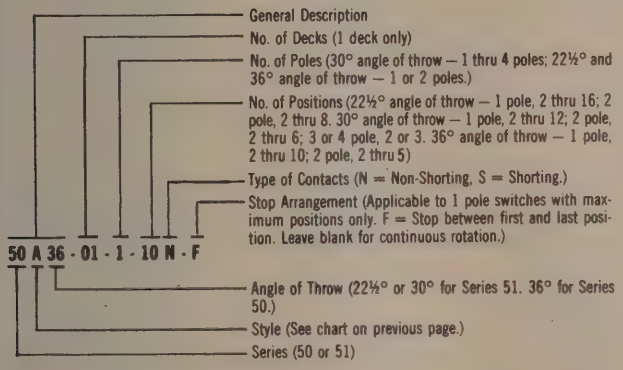
**VOLTAGE BREAKDOWN:**

500VAC between mutually insulated parts.

**CARRY CURRENT:**

6 amperes with a maximum contact temperature rise of 20°C.

**HOW TO ORDER:**


50 A 36 - 01 - 1 - 10 N - F
General Description
No. of Decks (1 deck only)
No. of Poles (30° angle of throw — 1 thru 4 poles; 22½° and 36° angle of throw — 1 or 2 poles.)
No. of Positions (22½° angle of throw — 1 pole, 2 thru 16; 2 pole, 2 thru 8. 30° angle of throw — 1 pole, 2 thru 12; 2 pole, 2 thru 6; 3 or 4 pole, 2 or 3. 36° angle of throw — 1 pole, 2 thru 10; 2 pole, 2 thru 5)
Type of Contacts (N = Non-Shorting, S = Shorting.)
Stop Arrangement (Applicable to 1 pole switches with maximum positions only. F = Stop between first and last position. Leave blank for continuous rotation.)
Angle of Throw (22½° or 30° for Series 51. 36° for Series 50.)
Style (See chart on previous page.)
Series (50 or 51)

**UNIT PRICE**
**Styles A and P**

| No. of Poles | Non-Shorting | | | Shorting | | |
|---|---|---|---|---|---|---|
| | Series 50 36° | Series 51 22½°* | Series 51 30° | Series 50 36° | Series 51 22½°* | Series 51 30° |
| 1 | $8.45 | $12.45 | $9.10 | $8.75 | $12.75 | $9.40 |
| 2 | 11.60 | 14.95 | 12.25 | 12.30 | 15.55 | 12.90 |
| 3 | — | — | 14.15 | — | — | 15.25 |
| 4 | — | — | 16.25 | — | — | 17.65 |

**Styles S and SP**

| No. of Poles | Non-Shorting | | | Shorting | | |
|---|---|---|---|---|---|---|
| | Series 50 36° | Series 51 22½°* | Series 51 30° | Series 50 36° | Series 51 22½°* | Series 51 30° |
| 1 | $8.85 | $12.85 | $9.45 | $9.20 | $13.15 | $9.80 |
| 2 | 11.95 | 15.35 | 12.65 | 12.70 | 15.95 | 13.35 |
| 3 | — | — | 14.60 | — | — | 15.65 |
| 4 | — | — | 16.65 | — | — | 18.05 |

*22½° Price For Styles A And S Only. Contact GRAYHILL For Prices Of 22½°, Styles P And SP

QUANTITY DISCOUNTS APPLY
PRICES SUBJECT TO CHANGE WITHOUT NOTICE

**ADJUSTABLE STOPS**

Adjustable stop versions of the Series 50 and 51 Rotary Switches are readily available from local distributor stock. The adjustable stop versions are form, fit and function equivalents to their fixed stop counterparts. Adjustable stop Series 50 and 51 Rotary Switches can be provided in all angles of throw and with or without shaft and panel seal. Contact your local distributor or GRAYHILL for cross reference information between fixed and adjustable stop switches.

**45°, 60° OR 90° ANGLES OF THROW**

The Series 50 Rotary Switch is also available with 45° (8 position), 60° (6 position) or 90° (4 position) angles of throw. These angles of throw are available with 1 or 2 poles per deck, solder lug or PC mount terminals, with or without shaft and panel seal, fixed or adjustable stops and in standard or military types.

**MILITARY STYLE ROTARY SWITCHES**

The Series 50 and 51 Rotary Switches are also available with military type switch materials. Many types of the Series 50 are fully qualified to MIL-S-3786/20. Many types of the Series 51 are fully qualified to MIL-S-3786/35. These documents as well as the QPL (Qualified Products List) should be consulted for complete specification and ordering information. Contact GRAYHILL for additional assistance in specifying military styles Series 50 and 51 Rotary Switches.

**ADDITIONAL STANDARD FEATURES OR OPTIONS**

—Screwdriver Slotted Shafts
—Coded Versions
—Spring Return (Momentary Positions)
—Push-To-Turn or Pull-To-Turn†
—Keylock (Key Operated)
—RFI Grounding†
—Electrostatic or Electromagnetic Shielding†
—Intermix of Shorting and Non-Shorting Contacts†
Complete description in GRAYHILL Engineering Catalog

†Indicates not available through distributors

**Available Locally Through Your Grayhill Distributor**

# 1/2" DIAMETER, 1/4 AMP, MULTI-DECK ROTARY SWITCHES—SERIES 71

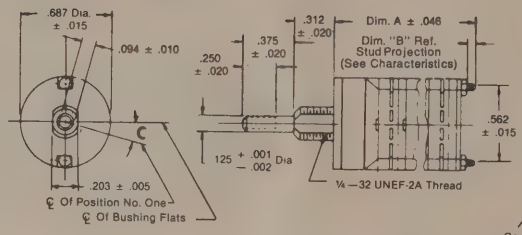
**VALUE ENGINEERED TO COMPETE IN PRICE AND OUT PERFORM OPEN-WAFERS**

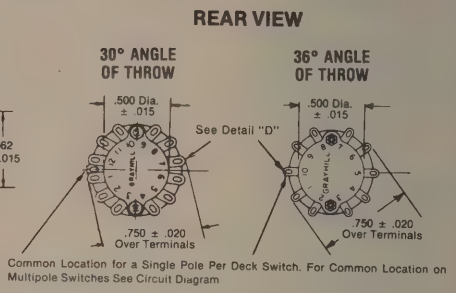
**ADJUSTABLE STOPS PROVIDE IMMEDIATE PROTOTYPES**

**VERSATILITY — CHOICE OF**

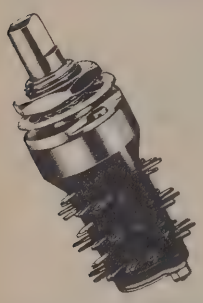
- 30° OR 36° ANGLE OF THROW
- 1 TO 6 POLES, PER DECK
- 1 THRU 12 DECKS
- .125" OR .250" DIA. SHAFT
- PC MOUNTABLE TERMINALS
- SINGLE OR CONCENTRIC SHAFTS

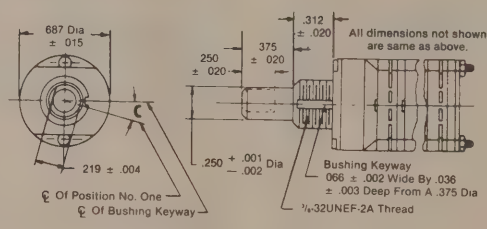
## STYLE A — SOLDER LUG .125" DIA. SHAFT

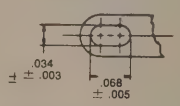




REAR VIEW
30° ANGLE OF THROW
36° ANGLE OF THROW
.500 Dia. ± .015
See Detail "D"
.750 ± .020 Over Terminals
Common Location for a Single Pole Per Deck Switch. For Common Location on Multipole Switches See Circuit Diagram

## STYLE B — SOLDER LUG .250" DIA. SHAFT



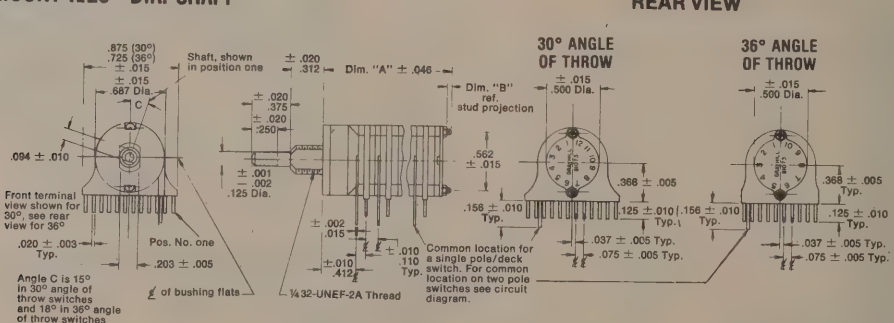

.687 Dia ± .015
C
219 ± .004
℄ Of Position No. One
℄ Of Bushing Keyway
.312 ± .020
All dimensions not shown are same as above.
.375 ± .020
.250 ± .020
.250 + .001 − .002 Dia
Bushing Keyway .066 ± .002 Wide By .036 ± .003 Deep From A .375 Dia
¼-32UNEF-2A Thread



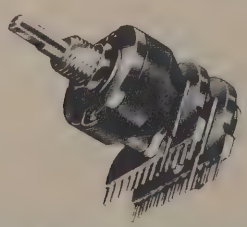

| Angle of Throw | Angle C |
|---|---|
| 30° | 15° |
| 36° | 36° |

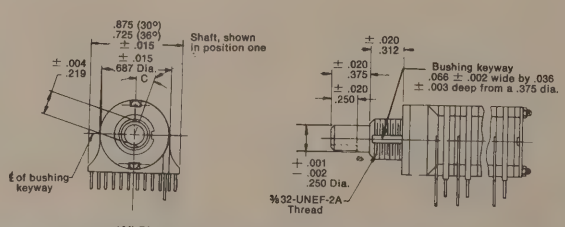
| No. of Decks | Dim. A | Dim. B |
|---|---|---|
| 1 | .761 | .031 |
| 2 | .979 | .031 |
| 3 | 1.197 | .031 |
| 4 | 1.415 | .031 |
| 5 | 1.633 | .031 |
| 6 | 2.131 | .312 |
| 7 | 2.349 | .312 |
| 8 | 2.567 | .312 |
| 9 | 2.785 | .312 |
| 10 | 3.003 | .312 |
| 11 | 3.221 | .312 |
| 12 | 3.439 | .312 |

## STYLE AF — PC MOUNT .125" DIA. SHAFT


REAR VIEW
.875 (30°) .725 (36°) ± .015
.687 Dia. ± .015
C
.094 ± .010
Front terminal view shown for 30°, see rear view for 36°
.020 ± .003 Typ.
Pos. No. one
.203 ± .005
Angle C is 15° in 30° angle of throw switches and 18° in 36° angle of throw switches
℄ of bushing flats
Shaft, shown in position one
± .020 .312
Dim. "A" ± .046
± .020 .375 ± .020 .250
± .001 − .002 .125 Dia.
± .002 .015
± .010 .412
± .010 .110 Typ.
¼32-UNEF-2A Thread
Common location for a single pole/deck switch. For common location on two pole switches see circuit diagram.
Dim. "B" ref. stud projection
.562 ± .015
.156 ± .010 Typ.
30° ANGLE OF THROW
± .015 .500 Dia.
.368 ± .005
.125 ± .010 Typ.
.037 ± .005 Typ.
.075 ± .005 Typ.
36° ANGLE OF THROW
.368 ± .005 Typ.
.125 ± .010 Typ.
.037 ± .005 Typ.
.075 ± .005 Typ.

## STYLE BF — PC MOUNT .250" DIA. SHAFT




.875 (30°) .725 (36°) ± .015
.687 Dia. ± .015
C
Shaft, shown in position one
± .004 .219
℄ of bushing keyway
± .020 .312
± .020 .375 ± .020 .250
Bushing keyway .066 ± .002 wide by .036 ± .003 deep from a .375 dia.
± .001 − .002 .250 Dia.
⅜32-UNEF-2A Thread

(All Dimensions And Views Not Shown, Same As Above)

Grayhill, Inc. / 569 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040 / TWX: 910-683-1850

# 1/2" DIAMETER, 1/4 AMP, MULTI-DECK ROTARY SWITCHES—SERIES 71

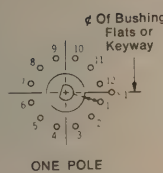
Grayhill

## CIRCUIT DIAGRAMS

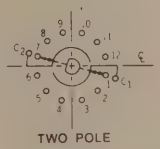
(Switch is viewed from Shaft End and shown in Position No. 1)
NOTE: All Common Terminals are located above Base Terminals as shown

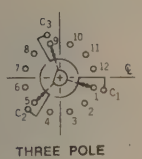
### SOLDER LUG TERMINALS

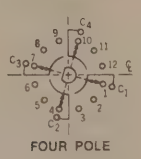
#### 30° ANGLE OF THROW

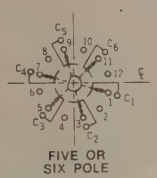


ONE POLE

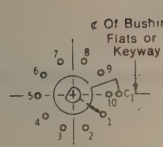

TWO POLE


THREE POLE


FOUR POLE


FIVE OR SIX POLE

#### 36° ANGLE OF THROW

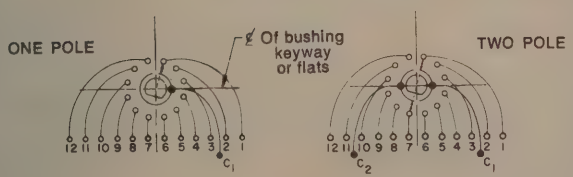


ONE POLE

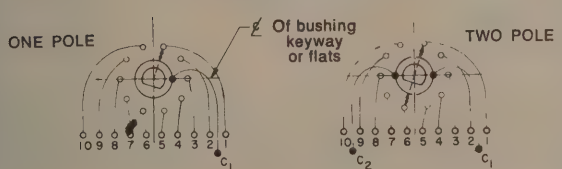
TWO POLE

### PC MOUNT

#### 30° ANGLE OF THROW




#### 36° ANGLE OF THROW




**RATING:**

Rated to make and break 400MA for 10,000 cycles of operation or 200... for 25,000 cycles of operation, resistive load, 115VAC or 30VDC. Rated to make and break 250MA for 10,000 cycles of operation or 100MA for 25,000 cycles of operation, inductive load (250 Millihenries), 30VDC.

For complete load life information, see GRAYHILL Rotary Switch catalog.

**CONTACT RESISTANCE:**

50 milliohms maximum (10 milliohms initially).

**INSULATION RESISTANCE:**

10,000 megohms minimum between mutually insulated parts (50,000 megohms initially).

**VOLTAGE BREAKDOWN:**

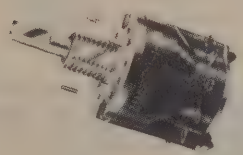
500 VAC minimum between mutually insulated parts.

**CARRY CURRENT:**

4 amperes with a maximum contact temperature rise of 20°C.

### ADJUSTABLE STOPS
### AVAILABLE FROM LOCAL DISTRIBUTOR STOCK

Number of positions per pole can be changed by removing and relocating stop pins in holes in the switch front plate. Available in the single shaft versions with either .125" or .250" diameter; 30° or 36° angle of throw; and solder lug terminals or PC mount.



| Non Adjustable Style From Previous Page | With Adjustable Stops Style Becomes |
|---|---|
| A | AD |
| B | BD |
| AF | ADF |
| BF | BDF |

### SHAFT AND PANEL SEAL

Shaft is sealed by "O" ring inside bushing. Panel is sealed by "O" ring at base of bushing. Seals do not alter dimensions as shown in the drawings when switch is mounted. Panel seal is silicone rubber. Shaft seal is an "O" ring per MIL-P-5516B.

| Non Sealed Style From Previous Page | With Seals Style Becomes |
|---|---|
| A | AS |
| B | BS |
| AF | ASF |
| BF | BSF |

### CONCENTRIC SHAFT SWITCHES

**STYLE C**

Concentric shaft version of Series 71. Available with solder lug or PC mount termination with 30° or 36° angles of throw. Poles per deck limitations are the same as the single shaft versions. Limited to three decks per each section and to a maximum of six poles per section. Contact GRAYHILL for complete ordering and pricing information.

**HOW TO ORDER AND PRICES:** See next page.

**Available Locally Through Your Grayhill Distributor**

# 1/2" DIAMETER, 1/4 AMP, MULTI-DECK ROTARY SWITCHES—SERIES 71

**HOW TO ORDER:**

71 A 30 - 02 - 1 - 12N - C

- 71 — Series
- A — Style (See previous pages)
- 30 — Angle of Throw (30° or 36°)
- 02 — No. of Decks (12 decks max.; also see poles per deck limitation in price table.)
- 1 — No. of Poles per Deck (See circuit diagram for style and angle of throw limitations. Also limited to a maximum of 16 total poles per switch.)
- 12 — No. of Positions (30° angle of throw solder lug — 1 pole, 2 thru 12; 2 pole, 2 thru 6; 3 pole, 2 thru 4, 4 pole, 2 or 3; 5 or 6 pole, 2 only. 30° angle of throw PC mount — 1 pole, 2 thru 12; 2 pole, 2 thru 6. 36° angle of throw — 1 pole, 2 thru 10; 2 pole, 2 thru 5.)
- N — Type of Contacts (N = Non-Shorting, S = Shorting)
- C — Stop Arrangement (Applicable to 1 pole switches with maximum positions only. C = Continuous, F = Stop between first and last position.)

**71A 30, 71B 30, 71A 36 AND 71B 36**

POLES/DECK AND POSITIONS/POLE

| Number of Decks | 30° and 36° Angle of Throw | | 30° Angle of Throw | | | |
|---|---|---|---|---|---|---|
| | 1 (2-12) | 2 (2-6) | 3 (2-4) | 4 (2-3) | 5 (2) | 6 (2) |
| 1 | $6.75 | $7.10 | $7.45 | $7.80 | $8.15 | $8.50 |
| 2 | 9.50 | 10.20 | 10.90 | 11.60 | 12.30 | 13.00 |
| 3 | 12.25 | 13.30 | 14.35 | 15.40 | 16.45 | N.A. |
| 4 | 15.00 | 16.40 | 17.80 | 19.20 | N.A. | N.A. |
| 5 | 17.75 | 19.50 | 21.25 | N.A. | N.A. | N.A. |
| 6 | 20.50 | 22.60 | N.A. | N.A. | N.A. | N.A. |
| 7 | 23.25 | 25.70 | N.A. | N.A. | N.A. | N.A. |
| 8 | 26.00 | 28.80 | N.A. | N.A. | N.A. | N.A. |
| 9 | 28.75 | N.A. | N.A. | N.A. | N.A. | N.A. |
| 10 | 31.50 | N.A. | N.A. | N.A. | N.A. | N.A. |
| 11 | 34.25 | N.A. | N.A. | N.A. | N.A. | N.A. |
| 12 | 37.00 | N.A. | N.A. | N.A. | N.A. | N.A. |

NOTE: Number of Positions does not affect price

**71AF 30, 71BF 30, 71AF 36 AND 71BF 36**

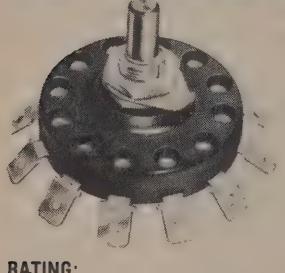
POLES/DECK AND POSITIONS/POLE

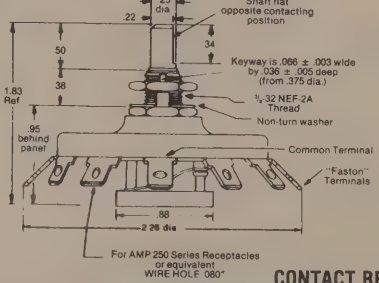
| Number of Decks | 30° or 36° Angle of Throw | | Number of Decks | 30° or 36° Angle of Throw | |
|---|---|---|---|---|---|
| | 1 (2-12) | 2 (2-6) | | 1 (2-12) | 2 (2-6) |
| 1 | $7.65 | $8.00 | 7 | $29.85 | $32.30 |
| 2 | 11.35 | 12.05 | 8 | 33.55 | 36.35 |
| 3 | 15.05 | 16.10 | 9 | 37.25 | N.A. |
| 4 | 18.75 | 20.15 | 10 | 40.95 | N.A. |
| 5 | 22.45 | 24.20 | 11 | 44.65 | N.A. |
| 6 | 26.15 | 28.25 | 12 | 48.35 | N.A. |

For Adjustable Stop switches, add $0.50 to price of comparable listed style and configuration.
For Sealed switches, add $1.00 to price of comparable listed style and configuration.

QUANTITY DISCOUNTS APPLY
PRICES SUBJECT TO CHANGE WITHOUT NOTICE

# 15 AMP, UL LISTED ROTARY SWITCHES — 30° ANGLE OF THROW 1 POLE, 2 TO 11 POSITIONS 'FASTON' TERMINALS





CIRCUIT DIAGRAM
Drawings and Spec. For Ref. Only

**RATING:**

Series 19 switches are UL listed at:
15 amps, 120 VAC, non-inductive load. 1 amp, 120 VDC, non-inductive load.
This rating is based on the following criteria:
Overload — 50 operations at 125% rated AC load and 150% rated DC load.
Endurance — 6000 operations at rated load with 900 VAC dielectric strength before and after test.
Temperature Rise — Not to exceed 30°C when carrying rated AC load after endurance test.
Contacts will carry 20 amps at 115 volts AC with 30°C maximum temperature rise.

**CONTACT RESISTANCE:** (Measured at 2 VDC and approximately 100 MA) for new switch approximately 10 milliohms.

**INSULATION RESISTANCE:** Approximately 100,000 meghoms. Between mutually insulated parts.

**VOLTAGE BREAKDOWN:** Approximately 2500 VAC. Between mutually insulated parts.

**HOW TO ORDER:**

Part Number 19101-* UL.

*(Indicate number of positions — 2, 3, 4, etc.)

| Number of Positions | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| PRICES | $8.35 | $8.60 | $8.85 | $9.10 | $9.35 | $9.60 | $9.85 | $10.10 | $10.35 | $10.60 |

ALL PRICES SUBJECT TO QUANTITY DISCOUNT.
For example, quantities of 100 switches of a single part number are discounted 50% from the above prices.

**Grayhill, Inc. / 569 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040 / TWX: 910-683-1850**

# 0.3" DIAMETER ROTARY SWITCHES 10 POSITIONS, 1 OR 2 POLES—SERIES 75

Grayhill

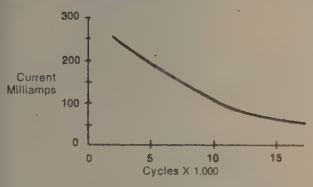
**DESIGNED AS THE WORLD'S SMALLEST ROTARY SWITCH**

**RATED TO MAKE AND BREAK LOGIC LOADS FOR A MINIMUM OF 15,000 CYCLES OF OPERATION**

**NON-SHORTING WIPING CONTACTS**

**RATING:**

**Life Expectancy:**




**CIRCUIT DIAGRAM**

(Switch is viewed from shaft end and shown in position 1.)

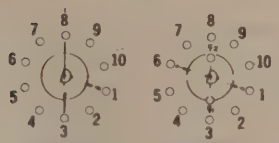



**Chart shown for non-shorting contacts (break before make).**

One cycle is 360° rotation and a return through all switch positions to the starting position. The data for the above curve was measured at sea level, 25°C. and 68% relative humidity with the following life limiting criteria.

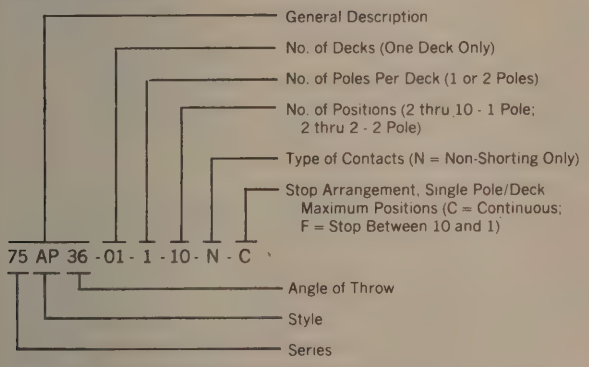
**Voltage:** 115 VAC or 30 VDC, resistive load.

**Contact Resistance:** 50 milliohms maximum. (15 milliohms initially).

**Insulation Resistance:** 10,000 megohms minimum between mutually insulated parts. (50,000 megohms initially.)

**Voltage Breakdown:** 500 VAC minimum between mutually insulated parts.

**HOW TO ORDER:**


General Description
No. of Decks (One Deck Only)
No. of Poles Per Deck (1 or 2 Poles)
No. of Positions (2 thru 10 - 1 Pole; 2 thru 2 - 2 Pole)
Type of Contacts (N = Non-Shorting Only)
Stop Arrangement, Single Pole/Deck Maximum Positions (C = Continuous; F = Stop Between 10 and 1)
75 AP 36 - 01 - 1 - 10 - N - C
Angle of Throw
Style
Series

**PRICES:**

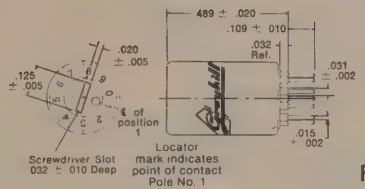
| Style | Unit Price | |
|---|---|---|
| | 1 Pole/Deck | 2 Pole/Deck |
| AF or CF | $8.30 | $10.65 |
| AP or CP | 8.00 | 9.85 |
| BF | 9.65 | 12.00 |
| BP | 9.35 | 11.20 |

ALL PRICES SUBJECT TO QUANTITY DISCOUNT.

For example, quantities of 100 switches of a single part number are discounted 50% from the above prices.

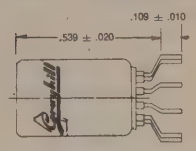
**SCREWDRIVER ACTUATED**

**Style AP**




**Style AF**

All Dimensions Not Shown and Front View Same as Style AP

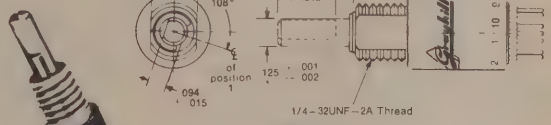



**REAR VIEWS SHOWN BELOW**

**SHAFT ACTUATED**

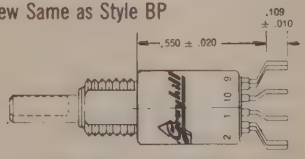
**Style BP**

See Style AP for Terminal Dimensions



**Style BF**

All Dimensions Not Shown and Front View Same as Style BP




**SERIES 75 COVERED BY PATENT NO. 3,803,370**

**REAR VIEWS SHOWN BELOW**

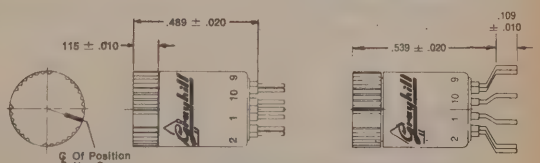
**INTEGRAL KNOB ACTUATED**

**Style CP**

See Style AP for Terminal Dimensions

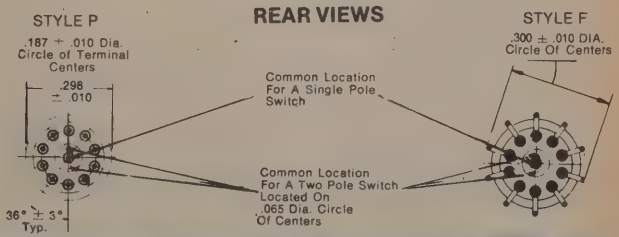
**Style CF**

All Dimensions Not Shown and Front View Same as Style CP




**REAR VIEWS SHOWN BELOW**

**REAR VIEWS**


STYLE P
.187 + .010 Dia. Circle of Terminal Centers
.298 ± .010
36° ± 5° Typ.
Common Location For A Single Pole Switch
Common Location For A Two Pole Switch Located On .065 Dia. Circle Of Centers
STYLE F
.300 ± .010 DIA. Circle Of Centers

**Available Locally Through Your Grayhill Distributor**

Grayhill

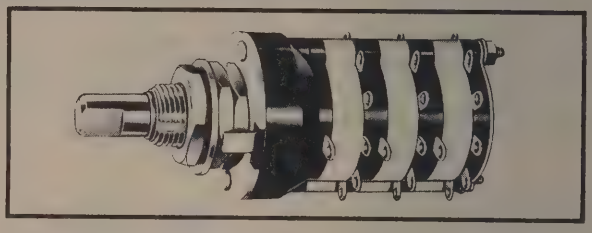
# UL LISTED
# 1 INCH, 1 AMP, ROTARY SWITCHES

## OUR MOST POPULAR ROTARY SWITCH FAMILY AVAILABLE IN STANDARD AND MILITARY STYLES SINGLE OR CONCENTRIC SHAFTS AND A WIDE RANGE OF VARIATIONS AND OPTIONS

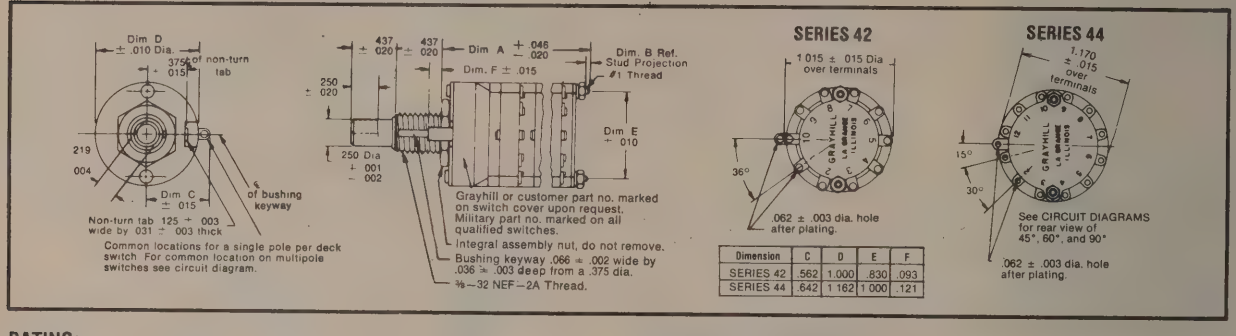
**INCLUDING**

- 30°, 36°, 45°, OR 90° ANGLES TO THROW
- 1 THRU 6 POLES/DECK
- 1 THRU 12 DECKS
- NON-SHORTING OR SHORTING CONTACTS
- ADJUSTABLE STOPS
- SHAFT AND PANEL SEALS
- PC MOUNTING
- ADD-A-POTS
- ADJUSTABLE STOPS PROVIDE IMMEDIATE PROTOTYPES

## SINGLE SHAFT STYLES A AND D



Military styles (style M (85°C)), style H and HS (125°C), are qualified to MIL-S-3786/4-1. Patent No. 3,297,836.


Dim D
± .010 Dia.
.375 of non-turn tab
+ .015
219
004
Dim C
± .015
of bushing keyway
Non-turn tab .125 + .003 wide by .031 ± .003 thick
Common locations for a single pole per deck switch. For common location on multipole switches see circuit diagram.
.437 ± .020
.437 ± .020
Dim A ± .046 .020
Dim. B Ref. Stud Projection #1 Thread
Dim. F ± .015
.250 ± .020
Dim E ± .010
.250 Dia + .001 − .002
Grayhill or customer part no. marked on switch cover upon request. Military part no. marked on all qualified switches.
Integral assembly nut, do not remove.
Bushing keyway .066 ± .002 wide by .036 ± .003 deep from a .375 dia.
⅜—32 NEF—2A Thread.
SERIES 42
1.015 ± .015 Dia over terminals
36°
.062 ± .003 dia. hole after plating.
SERIES 44
1.170 ± .015 over terminals
15°
30°
See CIRCUIT DIAGRAMS for rear view of 45°, 60°, and 90°
.062 ± .003 dia. hole after plating.

| Dimension | C | D | E | F |
|---|---|---|---|---|
| SERIES 42 | .562 | 1.000 | .830 | .093 |
| SERIES 44 | .642 | 1.162 | 1.000 | .121 |

### RATING:

**Rated:** To make and break the following loads with 30° or 36° angle of throw: 1 amp., 115VAC resistive; 1 amp., 6 to 28 VDC resistive; 0.25 amp., 115 VAC inductive; 0.02 amp., 115 VDC inductive; 0.10 amp., 6 to 28 VDC inductive; 0.10 amp., 115 VDC resistive. To carry 10 amps continuously.

**Contact Resistance:** .010 ohms initial. After 25,000 cycles of operation .020 ohms maximum.

**Insulation Resistance:** 50,000 megohms minimum (initially).

**Voltage Breakdown:** 1,000 VAC initially (500 VAC or better after most environmental tests).

**Life Expectancy:** 100,000 mechanical cycles of operation.

**Stop Strength:** 15 pound-inches minimum.

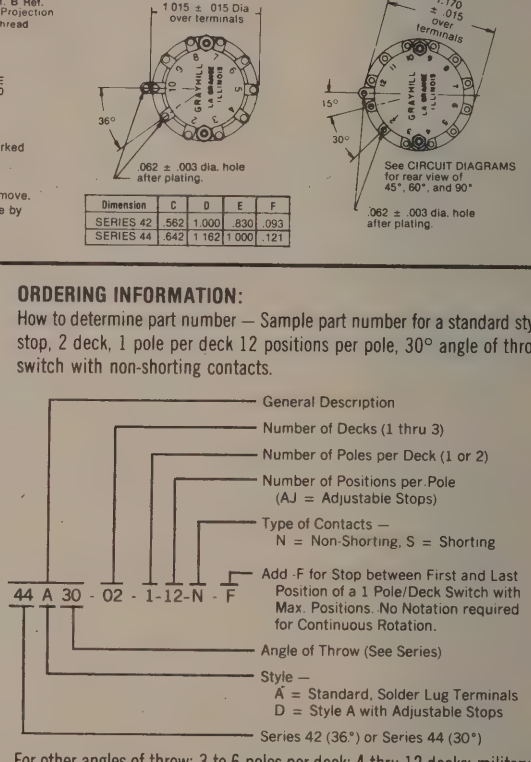
**Rotational Torque:** 20-96 ounce-inches, depending on the number of poles per deck and the number of decks.

**Contacts:** Shorting or non-shorting wiping contacts with over 150 grams contact force.

**Shaft Flat Orientation:** Flat opposite contacting position of pole number one. (See circuit diagram.)

### ORDERING INFORMATION:

How to determine part number — Sample part number for a standard style, fixed stop, 2 deck, 1 pole per deck 12 positions per pole, 30° angle of throw rotary switch with non-shorting contacts.


44 A 30 - 02 - 1-12-N - F
General Description
Number of Decks (1 thru 3)
Number of Poles per Deck (1 or 2)
Number of Positions per Pole (AJ = Adjustable Stops)
Type of Contacts — N = Non-Shorting, S = Shorting
Add -F for Stop between First and Last Position of a 1 Pole/Deck Switch with Max. Positions. No Notation required for Continuous Rotation.
Angle of Throw (See Series)
Style — A = Standard, Solder Lug Terminals D = Style A with Adjustable Stops
Series 42 (36°) or Series 44 (30°)

For other angles of throw; 3 to 6 poles per deck; 4 thru 12 decks; military, sealed, UL listed, or PC mountable styles, contact factory.

| ONE POLE PER DECK | | | | | | | | | | | | | TWO POLES PER DECK | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SERIES 42A 36 AND 44A 30 (FIXED STOPS) | | | | | | | | | | | | SERIES 44A 30 | SERIES 42A 36 AND 44A 30 (FIXED STOPS) | | | | | SERIES 44A 30 |
| No. of Decks | Dim. A | Number of Positions | | | | | | | | | | | No. of Decks | Number of Positions | | | | |
| | | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | 2 | 3 | 4 | 5 | 6 |
| 1 | 1.025 | $12.15 | $12.30 | $12.45 | $12.60 | $12.75 | $12.90 | $13.05 | $13.20 | $13.35 | $13.50 | $13.65 | 1 | $13.25 | $13.55 | $13.85 | $14.15 | $14.45 |
| 2 | 1.375 | 13.95 | 14.25 | 14.55 | 14.85 | 15.15 | 15.45 | 15.75 | 16.05 | 16.35 | 16.65 | 16.95 | 2 | 16.25 | 16.85 | 17.45 | 18.05 | 18.65 |
| 3 | 1.717 | 15.75 | 16.20 | 16.65 | 17.10 | 17.55 | 18.00 | 18.45 | 18.90 | 19.35 | 19.80 | 20.25 | 3 | 19.25 | 20.15 | 21.05 | 21.95 | 22.85 |

| SERIES 42D36 (ADJ. STOPS) | | | | SERIES 44D30 (ADJ. STOPS) | | | |
|---|---|---|---|---|---|---|---|
| No. of Decks | Dim. A | No. of Positions | | No. of Decks | Dim. A | No. of Positions | |
| | | 2-10 1 Pole | 2-5 2 Pole | | | 2-12 1 Pole | 2-6 2 Pole |
| 1 | 1.025 | $13.35 | $14.15 | 1 | 1.025 | $13.65 | $14.45 |
| 2 | 1.375 | 16.35 | 18.05 | 2 | 1.375 | 16.95 | 18.65 |
| 3 | 1.717 | 19.35 | 21.95 | 3 | 1.717 | 20.25 | 22.85 |

**QUANTITY DISCOUNTS APPLY.** For example 100 pieces of one part number carry a 50% discount from list prices shown.
DISCOUNTS AND PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

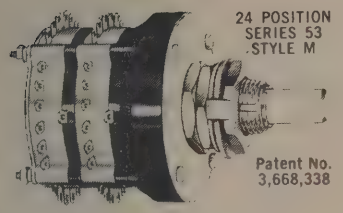
**Grayhill, Inc. / 569 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040 / TWX: 910-683-1850**

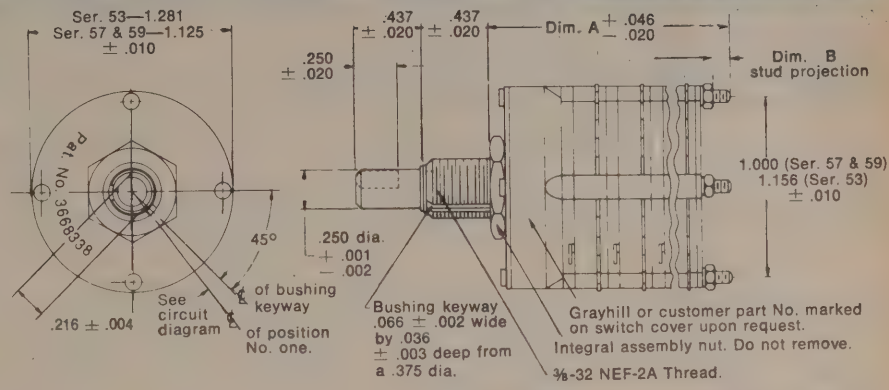
# 16, 20 AND 24 POSITION ROTARY SWITCHES SERIES 53, 57, 59

Grayhill

## MAKE AND BREAK MORE CIRCUITS IN LESS SPACE

## LOGIC LEVEL TO 1/2 AMP



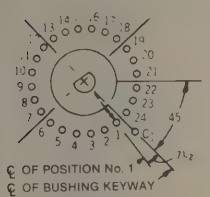


Ser. 53—1.281
Ser. 57 & 59—1.125
± .010
Pat. No. 3668338
45°
.216 ± .004
See circuit diagram
of bushing keyway
of position No. one.
.437 ± .020
.437 ± .020
Dim. A + .046 − .020
Dim. B stud projection
.250 ± .020
.250 dia. + .001 − .002
1.000 (Ser. 57 & 59)
1.156 (Ser. 53)
± .010
Bushing keyway .066 ± .002 wide by .036 ± .003 deep from a .375 dia.
Grayhill or customer part No. marked on switch cover upon request.
Integral assembly nut. Do not remove.
⅜-32 NEF-2A Thread.

Mounting Hardware:
Two mounting nuts, one internal tooth lockwasher and one non-turn washer.

| Series | Diameter | |
|---|---|---|
| | Front Plate | Terminals |
| 53 | 1.281 ± .010 | 1.350 ± .015 |
| 57 or 59 | 1.125 ± .010 | 1.190 ± .015 |

## CIRCUIT DIAGRAMS

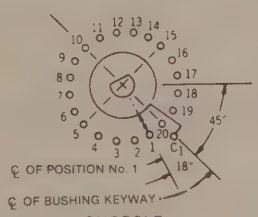
### SERIES 53 — 15° ANGLE OF THROW (24 POSITIONS)



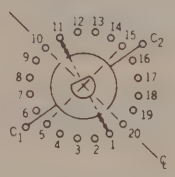

ONE POLE

TWO POLE

### SERIES 59 — 18° ANGLE OF THROW (20 POSITIONS)

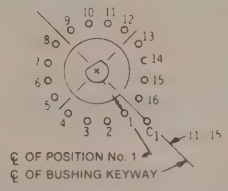



ONE POLE

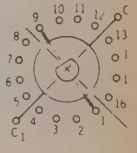


TWO POLE

### SERIES 57 — 22½° ANGLE OF THROW (16 POSITIONS)



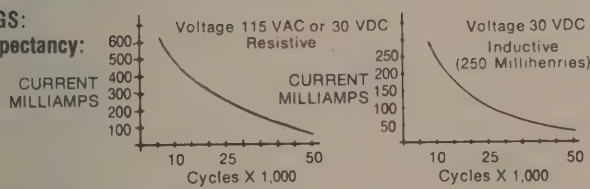

ONE POLE



TWO POLE

## RATINGS:

**Life Expectancy:**




Switch rating for break before make contacts.

Curve data based on test data conducted at sea level, 25°C, and 68% relative humidity.

Cycle equals 360° rotation and return.

Cycling rate is 10 cycles per minute.

Life limiting or failure criteria for these curves are:

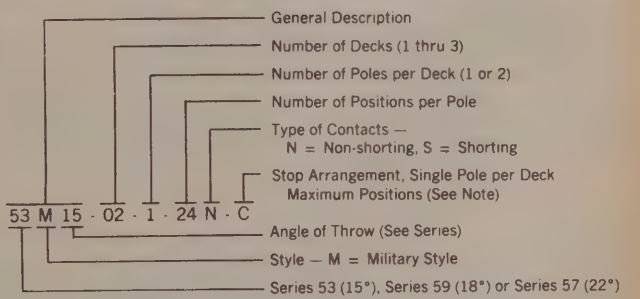
**Contact Resistance:** 50 milliohms maximum (15 milliohms initially).

**Insulation Resistance:** 10,000 megohms minimum between mutually insulated parts. (50,000 megohms initially.)

**Voltage Breakdown:** 500 VAC minimum between mutually insulated parts. These switches will carry 4 amperes with a maximum contact temperature rise of 20°C.

## ORDERING INFORMATION AND PRICES:

How to determine part number: Suffix "C" or "F" is required for a complete part number when ordering single pole/deck switches with maximum number of positions. Sample part number for a 2 deck, 1 pole/deck, 24 position, Style M, 15° angle of throw, non-shorting contact switch without stops:


General Description
Number of Decks (1 thru 3)
Number of Poles per Deck (1 or 2)
Number of Positions per Pole
Type of Contacts —
N = Non-shorting, S = Shorting
Stop Arrangement, Single Pole per Deck
Maximum Positions (See Note)
53 M 15 - 02 - 1 - 24 N - C
Angle of Throw (See Series)
Style — M = Military Style
Series 53 (15°), Series 59 (18°) or Series 57 (22°)

For 3 to 12 poles per deck; 4 thru 12 decks; military qualified, sealed styles, contact factory

## SERIES 53, 57, AND 59 PRICES

| Number of Decks | Dim. A | Poles/Deck and Positions/Pole | | |
|---|---|---|---|---|
| | | 1 Pole | | 2 Pole |
| | | 2-24 | SERIES 53 | 2-12 |
| | | 2-20 | SERIES 59 | 2-10 |
| | | 2-16 | SERIES 57 | 2-8 |
| 1 | .916 | $19 90 | | $20 90 |
| 2 | 1.249 | 27 70 | | 29 70 |
| 3 | 1.582 | 35 50 | | 38 50 |

ALL PRICES SUBJECT TO QUANTITY DISCOUNT. For example, quantities of 100 switches of a single part number are discounted 50% from the above prices.

DISCOUNTS AND PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

**Available Locally Through Your Grayhill Distributor**

# GORDOS

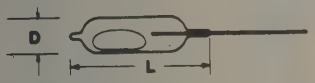
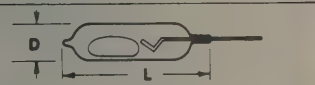
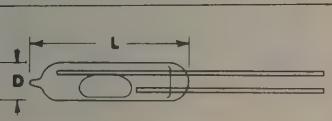
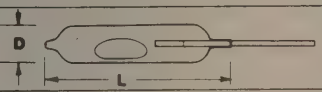
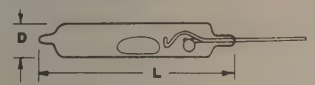
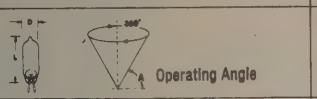
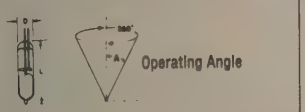
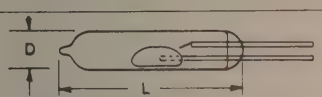
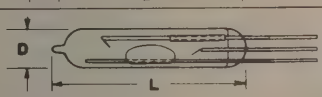
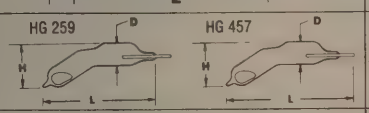
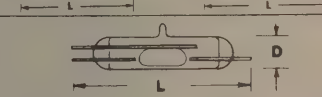
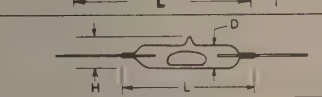
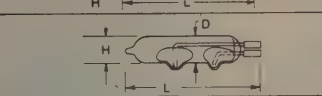
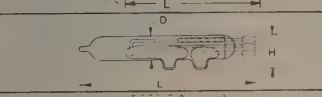
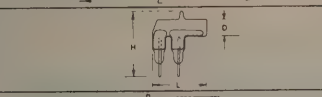
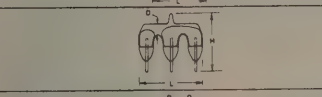
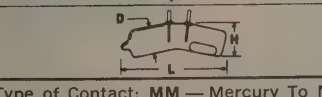
# REED SWITCHES

| | Maximum Glass Diameter Inches (mm) | Maximum Glass Length Inches (mm) | Nominal Uncut Switch Length Inches (mm) | Minimum Trim Length Inches (mm) | Maximum Switching Current (Amps) | Maximum Switching Voltage (VDC) | D.C. Contact Rating (Watts) | Minimum Break-down Voltage (VRMS) | Maximum Initial Contact Resistance (Ohms) | Stock Ampere Turn Range | 1-24 pc. (Stock A.T. Range) Price |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **DRY SUB-MINIATURE SPST/FORM A** OFFSET GAP | | | | | | | | | | | |
| MR-456 | .090 (2.28) | .560( 14.22) | .190 (48.26) | .690 (17.52) | .250 | 100 | 7 | 250 | .150 | 15/45 | $ .87 |
| CENTER GAP | | | | | | | | | | | |
| MR-0780 | .074 (1.87) | .470 (11.93) | 1.98 (50.29) | .600 (15.24) | .250 | 28 | 3 | 200 | .200 | 15/45 | 1.10 |
| MR-4590 | .090 (2.28) | .560 (14.22) | 1.98 (50.29) | .690 (17.52) | .250 | 28 | 3 | 200 | .200 | 15/45 | .95 |
| **DRY MINIATURE SPST/FORM A** CENTER GAP | | | | | | | | | | | |
| MR-108 | .105 (2.66) | .785 (19.93) | 2.10 (53.34) | 1.03 (26.16) | .500 | 200 | 10 | 250 | .100 | 15/45 | .87 |
| MR-138 | .105 (2.66) | .815 (20.70) | 2.10 (53.34) | 1.25 (31.75) | .500 | 1000 | 10 | 1200 | .100 | 15/45 | 3.00 |
| MR-5830 | .105 (2.66) | .845 (21.46) | 2.10 (53.34) | 1.09 (27.68) | .500 | 200 | 10 | 250 | .100 | 28/42 | 1.40 |
| MR-1031 | .105 (2.66) | .785 (19.93) | 2.10 (53.34) | 1.03 (26.16) | 1.0 | 200 | 50 | 250 | .500 | 40/70 | 1.15 |
| **DRY MINIATURE SPDT/FORM C** | | | | | | | | | | | |
| MR-5204 | .125 (3.17) | .600 (15.24) | 2.125 (53.97) | .850 (21.59) | .300 | 28 | 3 | 200 | .150 | 15/45 | 3.25 |
| MR-7604 | .125 (3.17) | .585 (14.85) | 2.07 (52.57) | .785 (19.39) | .300 | 100 | 4 | 250 | .200 | 15/45 | 3.25 |
| **MERCURY WETTED SUB-MINIATURE SPST/FORM A** OFFSET GAP | | | | | | | | | | | |
| WR-125-1 | .100 (2.54) | .500 (12.70) | 1.62 (41.14) | .750 (19.05) | 1.0 | 500 | 50 | 1500 | .050 | 40/80 | 3.50 |
| (MOUNTING POSITION — WITHIN 30° OF VERTICAL) | | | | | | | | | | | |
| **MERCURY WETTED MINIATURE SPST/FORM A** OFFSET GAP | | | | | | | | | | | |
| WR-127-1 | .125 (3.17) | .690 (17.52) | 162 (41.14) | 1.90 (48.26) | 1.0 | 500 | 50 | 1500 | .050 | 40/80 | 3.15 |
| (MOUNTING POSITION — WITHIN 30° OF VERTICAL) | | | | | | | | | | | |
| **MERCURY WETTED MINIATURE SPDT/FORM C** | | | | | | | | | | | |
| WR-1201-1 | .125 (3.17) | .630 (16.00) | 1.57 (39.87) | .850 (21.59) | 1.0 | 500 | 50 | 1500 | .050 | 40/80 | 8.50 |
| (MOUNTING POSITION — WITHIN 30° OF VERTICAL) | | | | | | | | | | | |
| **MERCURY WETTED COMPACT SPST/FORM A** OFFSET GAP | | | | | | | | | | | |
| WR-1300-1 | .190 (4.82) | 1.05 (26.67) | .320 (81.28) | 1.35 (34.29) | 3.0 | 500 | 60 | 1000 | .060 | 40/140 | 3.75 |
| (MOUNTING POSITION — WITHIN 30° OF VERTICAL) | | | | | | | | | | | |
| **DRY COMPACT SPST/FORM A** OFFSET GAP | | | | | | | | | | | |
| MR-608 | .190 (4.82) | 1.45 (36.83) | 3.20 (81.28) | 1.70 (43.18) | 1.0 | 250 | 15 | 300 | .050 | 30/80 | 1.10 |
| **DRY STANDARD SPST/FORM A** CENTER GAP | | | | | | | | | | | |
| MR-708 | .190 (4.82) | 1.65 (41.91) | 3.40 (86.36) | 1.90 (48.26) | 1.0 | 250 | 15 | 300 | .050 | 30/80 | 1.10 |
| **DRY STANDARD SPST/FORM A** OFFSET GAP | | | | | | | | | | | |
| MR-8901 | .190 (4.82) | 1.70 (43.18) | 3.20 (81.28) | 1.95 (49.53) | 3.0 | 250 | 100 | 400 | .500 | 60/100 | 2.50 |
| MR-893 | .190 (4.82) | 1.70 (43.18) | 3.20 (81.28) | 2.50 (63.50) | 3.0 | 1500 | 100 | 2000 | .500 | 60/100 | 4.00 |
| **DRY STANDARD SPDT/FORM C** | | | | | | | | | | | |
| MR-201 | .190 (4.82) | 1.20 (30.48) | 3.15 (80.01) | 1.45 (36.83) | .250 | 100 | 10 | 250 | .200 | 30/70 | 2.50 |
| MR-200-2 | .190 (4.82) | 1.20 (30.48) | 3.15 (80.01) | 1.45 (36.83) | .250 | 100 | 10 | 250 | .200 | 20/40 | 3.25 |
| (MAGNET BIASED-LATCHING) | | | | | | | | | | | |
| **DRY LARGE SPST/FORM A** CENTER GAP | | | | | | | | | | | |
| MR-908 | .207 (5.25) | 2.07 (52.57) | 3.20 (81.28) | 2.32 (58.92) | 1.0 | 250 | 10 | 500 | .050 | 40/100 | 1.10 |
| MR-988 | .195 (4.95) | 2.07 (52.57) | 3.20 (81.28) | 2.50 (63.50) | 1.0 | 1200 | 25 | 1400 | .050 | 40/100 | 3.25 |
| MR-990 | .207 (5.25) | 2.07 (52.57) | 3.20 (81.28) | 2.32 (58.92) | 3.0 | 250 | 100 | 300 | .050 | 40/100 | 3.50 |

**GORDOS CORPORATION**, 250 GLENWOOD AVE., BLOOMFIELD, NJ 07003, U.S.A./TELEPHONE (201) 743-6800/TWX: 710-994-4787

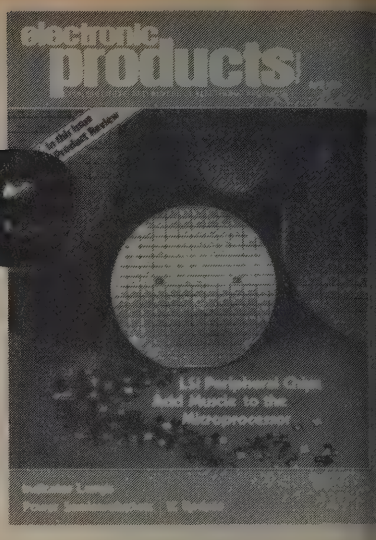
# GORDOS

## MERCURY SWITCHES

| | Switch Part No. | Contact Arrangement | Current Ratings AC Resistive 30 115 220 | Differential Angle Degrees Max. | Min. | Inches (Millimeters) D | L | H | Type of Contact* | Standard Mounting Clip Part No. | Req. | Remarks | Prices 1-49 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | HG 252 LO | SPST | 4 2 1 | 14° | — | .325 (8.26 | 1″ 25.40 | — — ) | MWM | M-514 | 1 | General Purpose Switch | $1.00 |
| | HG 455 LO | SPST | 15 10 4 | 5° | — | .435 (11.05 | 1 11/16″ 42.86 | — — ) | MDM | M-59 | 1 | Small 10A Switch | 3.75 |
|  | HG 433 LO | SPST | 8 5 2 | 5° | — | .495 (12.57 | 1¾″ 44.45 | — — ) | MDM | M-511 | 1 | Industry Standard | 3.00 |
|  | HG 216 LO | SPST | MA MA MA | 10° | — | .070 (1.778 | .400 10.16 | — — ) | MDM | — | — | Microminiature | 5.00 |
| | HG 219 LO | SPST | 3 1 .5 | 5° | — | .175 (4.45 | ¾″ 19.05 | — — ) | MDM | M-539 | 1 | General Purpose Miniature | 1.75 |
| | HG 520 LO | SPST | 25 .1 .05 | 10° | — | .155 (3.94 | ½″ 12.70 | — — ) | MDM | M-539 | 1 | Precision Switch Subminiature | 2.00 |
|  | HG 217 LO | SPST | 6 3 2 | 10° | — | .325 (8.26 | 1⅜″ 34.93 | — — ) | MDM | M-514 | 1 | | 1.45 |
|  | HG 452 LO | SPST | 20 10 5 | 3° | — | .600 (15.24 | 2⅝″ 66.68 | — — ) | MDM | M-512 | 1 | Industry Standard | 3.75 |
| | HG 454 LO | SPST | 20 10 5 | 5° | — | .600 (15.24 | 2¼″ 57.15 | — — ) | MDM | M-512 | 1 | Industry Standard | 3.65 |
|   | HG 242 LO | SPST | .2 .1 MA | 25° | 15° | .275 (6.99 | ⅞″ 22.23 | — — ) | MDM | M-570 | 1 | Normally Closed Conical Tipover Series. Angles are measured. | 5.30 |
|   | HG 244 LO | SPST | 2 1 .5 | 30° | ±5° | .495 (12.57 | 1¼″ 31.75 | — — ) | MDM | M-511 | 1 | Normally Open Conical Tipover Series. Angles are measured from vertical. Consult factory for other angles. | 7.75 |
|  | HG 803 LO | SPST | 1 .2 .1 | 1.4° | — | .325 (8.26 | 1⅜″ 34.93 | — — ) | MWM | M-514 | 1 | Platinum Tipped Electrodes Thermostat Control Switch | 1.40 |
|  | HG 804 LO | SPDT | 1 .2 .1 | 2° | — | .350 (8.89 | 1 1/16″ 39.69 | — — ) | MWM | M-514 | 1 | Platinum Tipped Electrodes Thermostat Control Switch | 2.50 |
|   | HG 259 LO | SPST | 4 2 1 | 35° | 25° | .325 (8.26 | 1.187 30.1 | .500 12.7 ) | MDM | M-514 | 1 | High differential angle made to customer specifications | 2.50 |
| | HG 457 LO | SPST | 20 10 5 | 32.5° | 27.5° | .446 (11.30 | 2.25 57.15 | .875 22.23) | MDM | M-56 | 1 | | 4.00 |
|  | HG 621 LO | SPDT | 12 8 3 | 7° | — | .435 (11.05 | 2¼″ 57.15 | — — ) | MDM | M-59 | 1 | Break Before Make | 5.75 |
|  | HG 209 LO | TWO CKT | 3 1 .5 | 6° | — | .230 (5.84 | 1″ 25.40 | ⅜″ 9.53 ) | MDM | M-570 | 1 | | 4.10 |
|  | HG 412 LO | SPST | 25 15 7 | 8° | — | .520 (13.21 | 2¼″ 57.15 | ⅝″ 15.88) | MM | M-511 | 1 | | 5.25 |
|  | HG 420 LO | SPDT | 25 15 8 | 10° | — | .520 (13.21 | 2″ 50.8 | ⅝″ 15.88) | MM - MDM | M-511 | 1 | Make Before Break | 6.75 |
|  | HG 421 LO | SPST | 30 20 10 | 10° | — | .450 (11.43 | 1⅜″ 34.93 | 1½″ 38.10) | MM | M-56 | 2 | | 7.00 |
|  | HG 461 LO | SPDT | 30 20 10 | 14° | 9° | .450 (11.43 | 1⅜″ 34.93 | 1½″ 38.10) | MM | M-56 | 2 | Momentary Make Before Break | 10.40 |
|  | HG 702 LO | PULSE | 4 3 1 | 20° | 15° | .495 (12.57 | 1½″ 38.10 | ⅝″ 15.88) | MDM | M-56 | 2 | Momentary Pulse Length 30 to 70 Ms. | 5.00 |

* Type of Contact: **MM** — Mercury To Mercury; **MWM** — Mercury To Wet Metal; **MDM** — Mercury To Dry Metal

# stay up to date



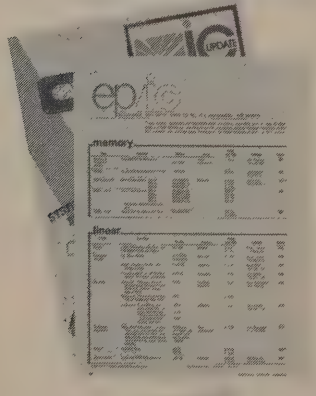

**SUBSCRIBE TO ELECTRONIC PRODUCTS MAGAZINE. IT'S YOUR *COMPLETE* GUIDE TO EVERYTHING THAT'S NEW IN THE FAST-CHANGING WORLD OF ELECTRONIC PRODUCTS AND SYSTEMS.**

**FEATURE STORIES** every month on electronic products, applications and availability.

**FORUMS**—Reports on meetings of manufacturers, users and distributors. Get the very latest news on a wide variety of products.

**NEW PRODUCT NEWS**—Hundreds of new products are introduced each month. You'll get the facts on not only what the new product is, but also where to get it, basic prices and current delivery.

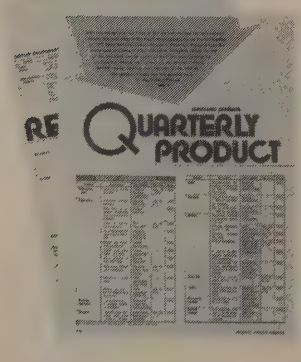
**EP/IC UPDATE**—Exclusive in ELECTRONIC PRODUCTS. A monthly report on *everything* that's new in the fast-moving world of integrated circuits.



**QUARTERLY PRODUCT REVIEW**—Another exclusive in ELECTRONIC PRODUCTS. A complete report of *every* new electronic product introduced in the previous quarter. This feature is in the January, April, July and October issues.

**QUARTERLY PRODUCT PLANNING DIRECTORY**—A compilation of the latest catalogs of a wide variety of electronic products and systems.

**OUTLOOK**—Important industry news affecting electronic products and systems.



**COMPONENT CAPERS**—A humorous look at the strange and wonderful world of electronics.

**MINI-GLOSSARIES,** Quizzes and more—Each and every month for over twenty years the readers of ELECTRONIC PRODUCTS learn something new about the products they work with and specify.

***If you are not now a subscriber, write to:***
***Dorothy Renoud, ELECTRONIC PRODUCTS MAGAZINE, 645 Stewart Avenue, Garden City, NY 11530.***
***Ask for a free qualification card.***

United Technical Publications, Inc., Div. of Cox Broadcasting Corp., 645 Stewart Ave., Garden City, NY 11530/(516) 222-2500

HAMLIN INC

DEPT. EM, 628 LAKE STREET • LAKE MILLS, WISCONSIN 53551
PHONE: SALES (414) 648-2361 • TWX 910-260-3740

REED SWITCHES / INDUSTRIAL SENSORS / LIQUID CRYSTAL DISPLAYS

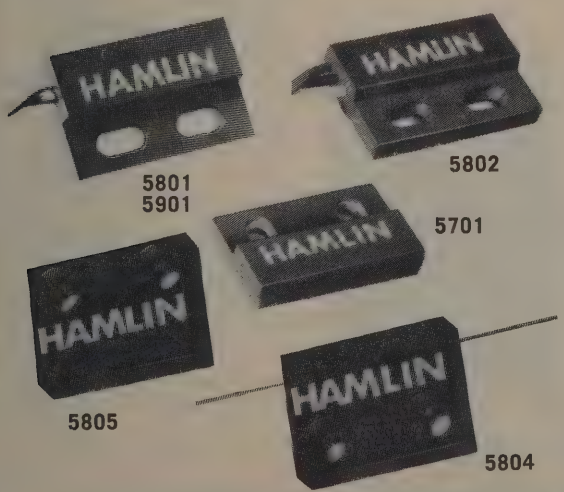
# MAGNETIC REED SWITCHES

Micro-miniature • Tiny • Sub-miniature • Compact • Mercury-wetted • High voltage • High current

| Switch Model No. | Form | Max. DC Contact Rating | Max. Amps | Max. DC Volts | Stock Ampere Turn Pull-In Range | Normal Stocking Tolerance A.T. | Overall Length Nominal Inches | Glass Length Max. Inches | Glass Diameter Max. Inches | Magnet | Special Features | List Price 500's |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **HAMLIN DRY REED FORM C MAGNETIC REED SWITCHES** | | | | | | | | | | | | |
| MDRR-DT | C | 3W | .240 | 28 | 20-50 | ±7.5 | 2.076 | .562 | .105 | H-33 | 3W Low Profile Form C | $2.30 |
| MRH-DT | C | 3W | .250 | 28 | 20-60 | ±7.5 | 2.124 | .610 | .130 | H-33 | Instrument Grade Form C | 2.40 |
| MRG-DT | C | 3W | .250 | 28 | 20-60 | ±7.5 | 2.125 | .610 | .130 | H-33 | Mod. Current & Voltage | 2.06 |
| MLC-DT | C | 3W | .110 | 28 | 27.5, 32.5, & 37.5 | ±10 | 2.125 | .610 | .130 | H-33 | Economy Form C - Sub-Miniature | 1.45 |
| DLC-DT | C | 10W | .500 | 200 | 50-115 | ±15 | 3.375 | 1.562 | .218 | H-32 | Economy Form C - Standard | 1.10 |
| DRR-DTH | C | 10W | .500 | 250 | 50-115 | ±7.5 | 3.375 | 1.562 | .218 | H-34 | High Breakdown Form C | 1.35 |
| DRT-DTH | C | 20W | 1.500 | 500 | 60-115 | ±7.5 | 3.375 | 1.562 | .218 | H-34 | Inductive Loads | 2.94 |
| **HAMLIN DRY REED FORM A MAGNETIC REED SWITCHES** | | | | | | | | | | | | |
| MMRR-2 | A | .3W | .010 | 28 | 17.5-52.5 | ±7.5 | 2.000 | .375 | .090 | H-31 | "Grain of Wheat" Size | 1.35 |
| MSRF-2 | A | .3W | .010 | 28 | 27.5-52.5 | ±10 | 2.230 | .830 | .102 | H-33 | Low R.F. Losses | 1.05 |
| MINI-2S | A | 3W | .110 | 28 | 7.5-32.5 | ±7.5 | 1.235 | .500 | .070 | H-31 | The Mini-Reed | .87 |
| MDRR-4 | A | 10W | .500 | 100 | 12.5-52.5 | ±7.5 | 1.235 | .600 | .105 | H-33 | Low Profile Form A | .64 |
| MSRR-2 | A | 10W | .500 | 200 | 17.5-52.5 | ±7.5 | 2.250 | .800 | .090 | H-33 | Mod. Current & Voltage | .72 |
| MRR-2 | A | 10W | .500 | 200 | 17.5-52.5 | ±7.5 | 2.230 | .800 | .130 | H-33 | Mod. Current & Voltage | .72 |
| MRR-5 | A | 10W | .500 | 500 | 27.5-62.5 | ±7.5 | 2.230 | .800 | .130 | H-33 | Breakdown Voltage to 1000 VDC | 1.65 |
| MDSR-4 | A | 10W | .500 | 100 | 12.5-52.5 | ±7.5 | 1.590 | .600 | .090 | H-33 | .090 Dia. Low Profile | .64 |
| MARR-2 | A | 10W | .500 | 100 | 17.5-52.5 | ±7.5 | 2.230 | .800 | .105 | H-33 | .105 Dia. High Reliability | .68 |
| MARC-2 | A | 10W | .500 | 100 | 30.35 +40 | ±10 | 2.230 | .800 | .105 | H-33 | Economy Form A | .55 |
| MARH-2 | A | 10W | .500 | 200 | 17.5-52.5 | ±7.5 | 2.230 | .800 | .105 | H-33 | Instrument Grade - Prem. Per. | .87 |
| MARR-5 | A | 10W | .500 | 500 | 17.5-52.5 | ±7.5 | 1.775 | .750 | .105 | H-33 | Breakdown Voltage to 1000 VDC | 1.65 |
| SRR-2 | A | 15W | 1.000 | 400 | 35-115 | ±7.5 | 3.375 | 1.425 | .195 | H-32 | Mod. Current & Voltage | 1.10 |
| DRR-1 | A | 15W | 1.000 | 400 | 42.5-132.5 | ±7.5 | 3.250 | 2.100 | .207 | H-34 | Mod. Current & Voltage | .84 |
| DRR-5 | A | 25W | 1.000 | 1000 | 52.5-132.5 | ±7.5 | 3.250 | 2.100 | .207 | H-34 | Breakdown Voltage to 1500 VDC | 1.58 |
| DRT-5 | A | 50W | 3.000 | 1000 | 57.5-132.5 | ±7.5 | 3.250 | 2.100 | .207 | H-34 | Inductive Load Type Contact | 2.88 |
| **HAMLIN MERCURY-WETTED MAGNETIC REED SWITCHES** | | | | | | | | | | | | |
| MDC-1 | A | 50W | 2.000 | 100 | 40-80 | ±10 | 2.250 | .610 | .130 | H-33 | Tiny Size, Mercury Wetted | 2.25 |
| MDC-DT | C | 14W | .500 | 28 | 70 | ±15 | 1.600 | .600 | .132 | H-32 | Form C, Mercury Wetted | 5.62 |
| MTHG-2 | A | 3W | .100 | 28 | 40 | ±15 | 1.590 | .560 | .090 | H-33 | All Position Mercury Wetted | 3.00 |
| **HAMLIN "SPECIAL" MAGNETIC REED SWITCHES** | | | | | | | | | | | | |
| MSLS-2 | A | 10W | .100 | 100 | — | — | 1.784 | .800 | .105 | — | Latching Reed Switch | 1.95 |
| **HAMLIN HIGH VOLTAGE MAGNETIC REED SWITCHES** | | | | | | | | | | | | |
| DRVT-5 | A | 50W | .004 | 3500 | 90-150 | ±10 | 3.250 | 1.950 | .218 | H-34 | Breakdown Voltage to 5,000 VDC | 2.75 |
| DRVT-10 | A | 50W | 3.000 | 7500 | 100-150 | ±10 | 3.250 | 1.950 | .218 | H-34 | Breakdown Voltage to 10,000 VDC | 3.50 |
| **HAMLIN HIGH CURRENT MAGNETIC REED SWITCHES** | | | | | | | | | | | | |
| SRT-2 | A | 110VA | 1.000 | 28VDC 110 VAC | 57.5-132.5 | ±7.5 | 3.375 | 1.610 | .195 | H-32 | High Power Inductive Loads | 1.99 |
| DRR-129 | A | 100W | 3.000 | 250 | 42.5-132.5 | ±7.5 | 3.250 | 1.950 | .207 | H-34 | Ideal High Current Loads | 1.56 |

## MAGNETICALLY ACTUATED REED PROXIMITY SENSORS

High Reliability and Long Life • Hermetically Sealed




### ORDERING/PRICING INFORMATION

| Mfr.'s Type | Form | AC & DC OPERATION Contact Rating Watts | Switching Voltage | Current Amps | Breakdown Voltage | List Price |
|---|---|---|---|---|---|---|
| 5801 | A | 10 | 200 VDC 240 VAC | .500 | 400 VDC | $3.75 |
| 5802 | C | 3 | 100 VDC 120 VAC | .250 | 200 VDC | 7.75 |
| 5804 | A | 10 | 100 VDC 120 VAC | .500 | 250 VDC | 1.45 |

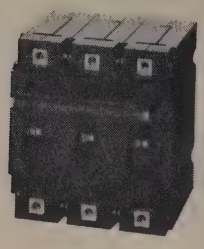
| Mfr's. Type | Form | 1½ AMP AC ONLY Current Rating | Voltage Rating | Blocking Voltage | | |
|---|---|---|---|---|---|---|
| 5901 | A | 1½ Amps | 120-240 VAC 50-60 Hz | 400V Peak | | 7.75 |

| Mfr's. Type | Use With | MAGNETIC ACTUATORS Operating Distance | Differential | Release Distance | | |
|---|---|---|---|---|---|---|
| 5701 | 5801 5901 | To 5/8" | 1/8"-1/4" | 5/16"-13/16" | | 2.00 |
| 5805 | 5802 5804 | To 29/32" | 1/32"-7/16" | 3/64"-1" | | 1.20 |

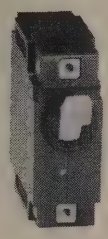
# HEINEMANN

## HYDRAULIC-MAGNETIC CIRCUIT PROTECTORS

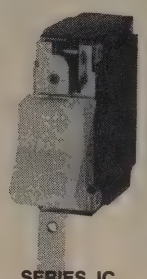
E-FRAME



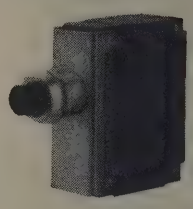
SERIES AM1



SERIES JA



SERIES JC



SERIES JD

With the widest range of styles and electrical ratings in the industry, Heinemann circuit breakers offer almost unlimited options: integral or fractional must-hold ratings from 0.010 to 100A, and in steps to 225A; single- and multipole models; breakers for 50/60Hz, 400Hz, or dc service; breakers qualified under Mil Specs; and breakers in any series which include special internal circuits such as high-inrush capability, relay-trip, auxiliary switches, dual rating, DuCon® construction for both current and voltage sensing, and other optional circuits for sophisticated control functions.

Hydraulic-magnetic actuation (a Heinemann invention) assures that must-hold and must-trip points are unaffected by ambient temperature fluctuations. Very precise control within a narrow current band is thus possible. In addition, a wide selection of time-delay characteristics permits close match of breaker to equipment requirements, allowing high temporary overloads to prevent nuisance tripping or tripping instantaneously according to the particular design need.

Contact your nearby Heinemann representative for complete technical assistance. Individual product-line bulletins listed below.

**E-FRAME:** Smaller than other E-Frame breakers, competitively priced. Approx. 5¾h x 2w x 2⅝d (2-pole). Available in 1 to 6 poles.

**SERIES AM1:** 1 to 4 poles. UL-component-recognized. Special circuits available. Approx. 2.5h x 2.5d, .75w per pole.

**SERIES JA:** Compact OEM breaker. Only 2.5 oz/pole. 1 to 4 poles. Approx. 2h x 1.875d, .75w per pole.

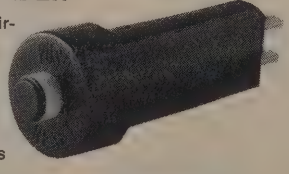
**JA VARIANTS.** Snap-In JB (1 to 4 poles) installs in rectangular panel cutout without screws. JC (1 to 4 poles—single-pole shown) has white or gray rocker handle. JD has round button for push-push operation. JE has moisture-sealed bat-type toggle for marine applications.

### CONDENSED GUIDE TO HEINEMANN CIRCUIT BREAKERS

| Type | Series | Bulletin | Poles | Maximum* Voltages | Interrupting Cap. (amp) | Current (amp) |
|---|---|---|---|---|---|---|
| PANEL MOUNTING | E-Frame | CF-3104 | 1,2,3,4,5,6 | 240 AC<br>480 AC<br>240 AC (400~)<br>125 DC | 5,000<br>5,000<br>5,000<br>5,000 | 0.01 to 100<br>0.01 to 100<br>0.15 to 100<br>0.05 to 50 |
| | EH-Frame | GH-3442 | 3 | 480 AC | 10,000 | 0.5 to 100 |
| | CJ | 3111 | 2 | 120/240AC | 10,000 | 125 to 200 |
| | | | 3 | 240 AC | 10,000 | 100 to 225 |
| GENERAL PURPOSE | 1163 | 3412 | 1,2,3 | 250 AC<br>125 DC | 5,000<br>5,000 | 0.01 to 100<br>0.016 to 100 |
| AUXILIARY | 0111 | 3201 | 1 | 250 AC | 1,500 | 0.01 to 50 |
| AM SERIES | AM1 | AM-3306 | 1,2,3,4 | 250 AC<br>250 AC (400~)<br>65 DC | 1,000<br>1,000<br>1,000 | 0.02 to 60<br>0.02 to 60<br>0.02 to 60 |
| | AM1000 | 3305 | 1,2,3 | 250 AC<br>250 AC (400~)<br>125 DC | 1,500<br>1,500<br>2,000 | 0.01 to 70<br>0.15 to 65<br>0.015 to 100 |
| MINIATURE | JA, JB, JC, JD, JE | J-3333 | 1,2,3,4 | 250 AC<br>250 AC (400~)<br>65 DC | 1,000<br>1,000<br>1,000 | 0.020 to 30<br>0.100 to 30<br>0.020 to 20 |

*AC voltages are 60 Hz unless marked with (400~).

### LOW-COST RESETTABLE PUSHBUTTON PROTECTOR, DIRECT REPLACEMENT FOR FUSE AND CYLINDRICAL FUSEHOLDER



The brand-new Heinemann Re-Cirk-It® circuit protector is resettable with just a light finger touch on the pushbutton, and fits a ⅝" circular panel hole to directly replace a glass fuse and fuseholder. Presently available in a choice of current ratings from 0.25 through 10A at 240V ac or 32V dc. Time delay prevents nuisance tripping.

Protector trips only on overcurrent conditions, cannot be turned off manually. Also cannot be held on against a fault. ¼" quick-on terminals are standard. UL-recognized and CSA-accepted as component—appliance control.

Priced as low as a fuse and fuseholder in OEM quantities. Ready for immediate delivery. Alternate button styles available on special order. Bulletin KD-4001.

### THE HEINEMANN SERIES GH3—a new low-cost fully-magnetic EH-Frame breaker

Now you can afford a completely magnetic three-pole three-phase branch-circuit protector at a price lower than you are accustomed to pay for an ordinary thermal unit.

The new Heinemann GH3 is UL-listed for short-circuit interrupting capacity of 10,000 amp at 480V 60Hz three-phase at 45% to 50%power factor. Wide range of standard off-the-shelf continuous current ratings from 15 to 100 amp. Already proven in such heavy-duty applications as computer main frames, air conditioning, machine tools.

6" high, 4.125" wide, 3.375" deep—fits standard EH-Frame panel cutout. Wgt. 3.3 lb. Ask for Bulletin 3442.

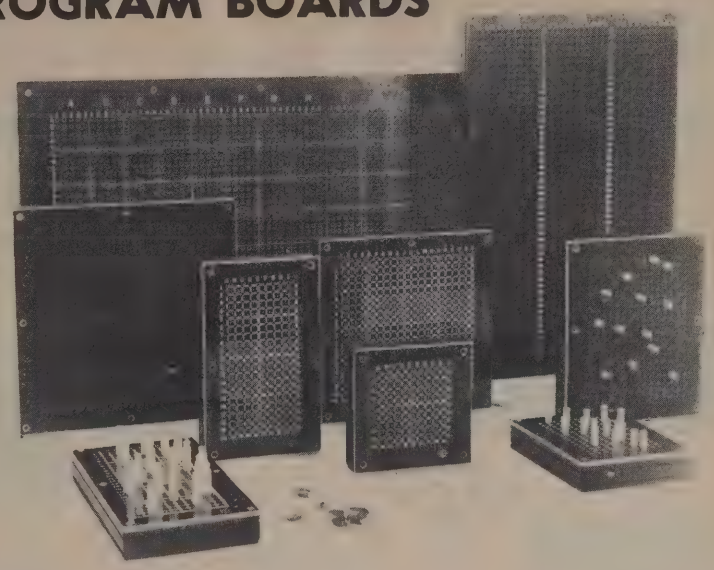
**HEINEMANN ELECTRIC COMPANY** Trenton, N.J. 08650

7088

# MATRIX PROGRAM BOARDS

## GENERAL:

As the result of over ten years experience, INFO-LITE has developed a most convenient, compact and economical system for reliable programming and switching • The Matrix Program Board allows a wide variety of switching/programming functions to be performed by simply inserting programming pins (shorting or diode type) into a 2 to10 deck contact matrix • No accessories such as "read" "write" equipment are required • Matrix Board features have lead them to be favored over such devices as patchboards, card readers, toggle and thumbwheel switches, mag/punched tape and electronic memories • The two basic uses for Matrix Program Boards are: (1) Cordless patching (input-output switching), using shorting pins; (2) Programmable diode matrices (logic memories), using diode pins • A two deck (X-Y) contact matrix is comprised of a set of contact busses (inputs) running at 90° to a second set of busses (outputs) • These two contact levels are isolated except at those crosspoints where programming pins are inserted • Terminals (solder/solderless) are provided on the rear surface for each contact buss • INFO-LITE offers two crosspoint grids: the 2000 Series with .250" grid and the 1000 Series with .130" grid • Panels with 5 x 5 to 100 x 100 crosspoints and up to10 contact decks can be supplied to economically meet your requirements, whether for prototype or production quantities.



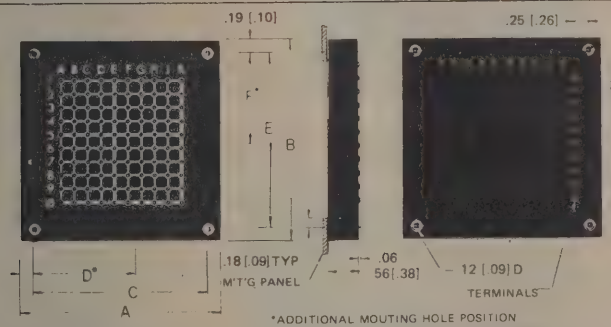
## FEATURES

- Reliable closed entry contacts
- Rugged programming pins that will not bend
- Rapid & convenient method of programming/switching
- Permits insertion of components into network without soldering
- Replaces costly complex switching hardware
- Attractive and compact package
- Low capacitance for high frequency applications
- Ease of visual program checking

## TYPICAL APPLICATIONS

Numeric Controlled Equipment
Logic Memories
Power Distributors
Circuit/Component Test Programmers
Lighting Systems
Code Generators
Programmable Diode Matrices
Communications Distributors
Status Indicators
Data Logging
Vending Machine Control
Thermo-Couple Selectors
Batching Programmers
Function Generators
Sequence Programmers
Pulse Code Programmers

## STANDARD SPECIFICATIONS & STOCK MATRICES FOR 1000 & 2000 SERIES




| Matrix Size | Dash # | 2000 Series — 250" GRID | | | | | | 1000 Series — .130" Grid | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | A | B | C | D | E | F |
| 10 x 10 | -1 | 3.63 | 3 63 | 3.25 | — | 3.25 | — | 2.02 | 2.02 | 1.82 | — | 1.82 | — |
| 10 x 20 | -3 | 3.63 | 6.12 | 3.25 | — | 5.75 | 2.75 | 2.02 | 3.32 | 1.82 | — | 3.12 | — |
| 10 x 25 | -4 | 3.63 | 7.38 | 3.25 | — | 7.00 | 3.50 | 2.02 | 3.97 | 1.82 | — | 3.77 | 1.82 |
| 10 x 50 | -5 | 3.63 | 13.62 | 3.25 | — | 13.25 | 4.50 8.75 | 2.02 | 7.22 | 1.82 | — | 7.02 | 3.51 |
| 20 x 20 | -8 | 6.12 | 6.12 | 5.75 | 2.75 | 5.75 | 2.75 | 3.32 | 3.32 | 3.12 | — | 3.12 | — |
| 25 x 25 | -9 | 7.38 | 7.38 | 7.00 | 3.50 | 7.00 | 3.50 | 3.97 | 3.97 | 3.77 | 1.82 | 3.77 | 1.82 |

To obtain A or B sizes of special matrix, use: For 1000 Series - L = .13 x (6 + N); For 2000 Series - L = .25 x (5 + N); N - Number of crosspoints.

### STANDARD SPECIFICATIONS

1 — Contact Type: Closed Entry
2 — Contact Material: Be-Cu, Alloy 25
3 — Contact Finish: a - .0002" Ag over Cu Flash
b - .00002" Min. Au over Ni Flash
4 — Contact Support Material: Silicone Rubber
5 — Contact Resistance: .040 Ohm, typ.
6 — Contact Capacitance: 1 uuf [2 uuf]/in. at 1 MHz, typ.
7 — Bussing: 1st (top) Deck Vert.; 2nd Deck Horiz.
8 — Breakdown Voltage: 1000 VRMS
9 — Current Rating: 5 [2] Amps std; 10 [4] Amps available
10 — Terminals: Combination Taper Pin Socket/Solder Cup [Solder Cup]
11 — Panel Material: Black XXX Grade Phenolic
12 — Panel Marking: Alpha-Numeric/Grid, White Epoxy Ink Screened

NOTE: Values in brackets [ ] are for 1000 Series if two values are given.

### SPECIFYING PART NUMBERS

X000-X-XX

.130" GRID 1
.250" GRID 2

MATRIX SIZE (SEE TABLE)

S SILVER CONTACT FINISH
G GOLD CONTACT FINISH

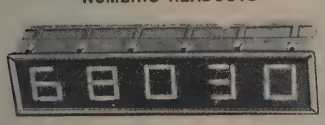
A SCREENED FRONT PANEL
B BLANK FRONT PANEL

EXAMPLE: A 20 x 20, .250" grid matrix with silver contacts & blank front panel would have Pt. No. 2000-8-BS.

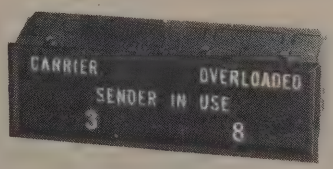
U.S. Patent No. 3,631,374

## OTHER INFO-LITE PRODUCTS

NUMERIC READOUTS




LIGHTED INDICATORS




## STANDARD PROGRAMMING PINS

| | |
|---|---|
| 1000 SERIES 2-D SHORTING PIN — No. 1010X | 2000 SERIES 2-D SHORTING PIN — No. 2010X |
| 1000 SERIES 2-D DIODE PIN — No. 1020X-CSXXXX | 2000 SERIES 2-D DIODE PIN — No. 2020X-CSXXXX |

SEE OUR LIGHTED DISPLAY AND READOUT PRODUCTS IN SECTION 2450.

"LINKS BETWEEN MAN AND MACHINE"

INFO-LITE CORPORATION

46-10 104th STREET • CORONA, N. Y. 11368

For more information or engineering assistance, contact your local representative or call us direct at

(212) 476-1287

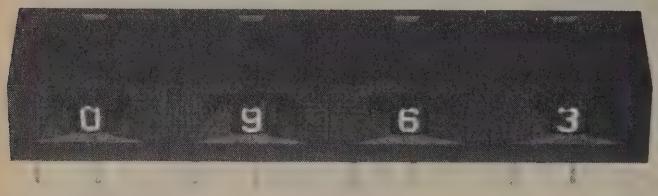
# Switches

INTERSWITCH

ONE OF THE PURDY GROUP OF COMPANIES

770 AIRPORT BOULEVARD, BURLINGAME, CALIFORNIA 94010 • TEL (415) 347-8217 • TWX 910-374-2353

## GWS Thumbwheel Switches



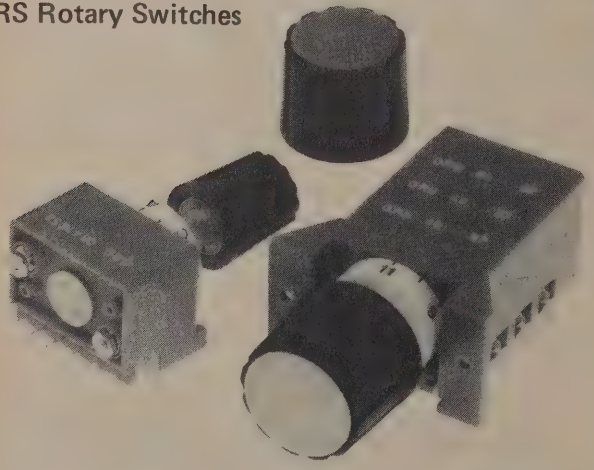

The INTERSWITCH GWS Thumbwheel Switch has been designed for those applications which require adjustment of values or selection of functions other than from the front panel of your instrument or equipment.

These switches are intended for printed circuit board mounting and are available with your choice of four wheel marking orientations along the periphery of the wheel, plus marking on the flat side in any of the four choices. You also have a choice of two standard wheel colors of either ten or sixteen position, and there are several output codes to choose from.

### Specifications

| | |
|---|---|
| **Electrical** | |
| Rated Voltage | 50 V |
| Test Voltage | 1000 V |
| Rated Thermal Current | 3 A |
| Overall Resistance terminal-to-terminal through contacts | <100 milliohms |
| Insulation Resistance | >10 megohms |
| **Mechanical** | |
| Contact Force | >30 gm |
| Actuating Torque | 100 - 150 cm-gm |
| Lifetime | One million detent operations |
| **Environmental** | |
| Temperature Range | -20° C to +60° C |
| Maximum allowable solder temperature: | |
| By Hand | 340° C for five seconds |
| Solder Bath | 250° C for four seconds |
| **Materials** | |
| Au on PCB | 5 microns |
| Sliding Contacts | Ag/Pd 30 |
| Housing Color | Black |

## GRS Rotary Switches



The INTERSWITCH GRS Rotary Switch was designed for PCB mounting. Two models are available for mounting to vertical PCB's and two models for mounting to horizontal PCB's.

These switches are available with either decimal outputs or binary coded outputs and with the following detent angles:

- 15° (24 position)
- 22.5° (16 position)
- 30° (12 position)
- 36° (10 position)

Stops may be ordered to limit the number of positions to something less if desired.

Switches may be ordered with shorting or non-shorting contacts. In addition, special output codes can be designed to fit your particular needs.

The GRS1 and GRS3 Rotary Switches may be ordered with up to four sections. Alternate mounting methods of the GRS2 and GRS4 give you greater freedom for your designs. In addition, some special shaft options are also available.

### Specifications

| | |
|---|---|
| **Electrical** | |
| Rated Voltage | 50 V |
| Test Voltage | 500 V |
| Rated Thermal Current | 1 A |
| Overall Resistance terminal-to-terminal through contacts | <90 milliohms |
| Insulation Resistance | $10^4$ meghoms |
| Capacitance between 2 adjacent contacts | 0.87 pF (approx.) |
| **Mechanical** | |
| Inputs 1 or 2 per plane | 1 or 2 per plane |
| Outputs | Max. 12 per plane |
| Actuating torque | |
| 30° or 36° detent angle | 0.6 cm-kg (approx.) |
| 15° or 22.5° detent angle | 0.9 cm-kg (approx.) |
| Lifetime | 100,000 detent operations |
| **Environmental** | |
| Temperature Range | -25° C to +70° C |
| **Materials** | |
| Au on PCB | 2 microns |
| Au on Sliding Contacts | 20 microns |
| Insulating Material | Polycarbonate, red |

# Thumbwheel Switches

INTERSWITCH
ONE OF THE PURDY GROUP OF COMPANIES

770 AIRPORT BOULEVARD, BURLINGAME, CALIFORNIA 94010 • TEL (415) 347-8217 • TWX 910-374-2353

## Type A

10, 11, 12, 16 positions

Rear mounted

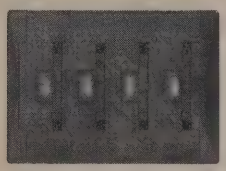
Black or grey housing

11 mm wide x 53 mm high x 54 mm deep

Contact Ratings:
Resistive switching: .25A
Max. non-switching: 2A

Working voltage: 50V

Contact resistance: .070Ω



½ Scale (approx.)

## Type B

10, 11, 12, 16 positions

Front mounted

Black or tan housing

12.5 mm wide x 58 mm high x 57 mm deep

Contact ratings:
Resistive switching: .25A
Max. non-switching: 2A

Working voltage: 50V

Contact resistance: .070Ω

½ Scale (approx.)

## Type G (world's largest)

10 positions only

Front mounted

Black or tan housing

20 mm wide x 76 mm high x 79 mm deep

Contact ratings:
Resistive switching: .5A
Max. non-switching: 4A

Working voltage: 250V

Contact resistance: .060Ω

½ Scale (approx.)

## Type H (std.), Type R (message), Type S (sealed)

Types R, S - 10 position only

Type H - 10, 11, 16 positions

Front mounted

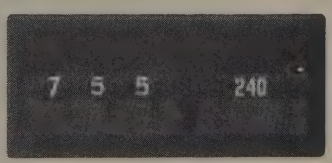
Type R - 20 mm wide x 33 mm high x 38 mm deep (Black housing only)

Type H, S - 10 mm wide x 33 mm high x 38 mm deep (Black or tan housing)

Contact ratings:
Resistive switching: .1A
Max. non-switching: 1A

Working voltage: 50V

Contact resistance: .070Ω



½ Scale (approx.)

## Types E, L, N

10 positions only

Rear mounted

Black or tan housing

Type E - 16 mm wide x 24 mm high x 35 mm deep

Type L - 8 mm wide x 24 mm high x 35 mm deep

Type N - 7 mm wide x 24 mm high x 35 mm deep

Contact ratings:
Resistive switching: .075A
Max. non-switching: 1A

Working voltage: 50V

Contact resistance: .070Ω

Types E & L

Type N

½ Scale (approx.)

## Type M

10, 11, 16 positions

Front mounted

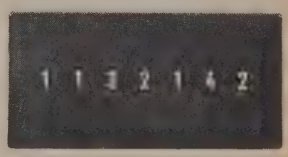
Black or tan housing

8 mm wide x 33 mm high x 38 mm deep

Contact ratings:
Resistive switching: 0.1A
Max. non-switching: 1A

Working voltage: 50V

Contact resistance: .070Ω



½ Scale (approx.)

## Type P

10, 11, 16 positions

Rear mounted

Black or tan housing

10 mm wide x 30.5 mm high x 41 mm deep

Contact ratings:
Resistive switching: 0.1A
Max. non-switching: 1A

Working voltage: 50V

Contact resistance: .070Ω

½ Scale (approx.)

## Type V

10 positions only

Front mounted

Black or tan housing

8 mm wide x 26.5 mm high x 35 mm deep

Contact ratings:
Resistive switching: .075A
Max. non-switching: 1A

Working voltage: 50V

Contact resistance: .070Ω

½ Scale (approx.)

# Matrix Boards

INTERSWITCH
ONE OF THE PURDY GROUP OF COMPANIES

770 AIRPORT BOULEVARD, BURLINGAME, CALIFORNIA 94010 • TEL (415) 347-8217 • TWX 910-374-2353

## The simple straight-forward method of programming.

## There are a number of standard 2-layer matrix boards available, but,

## We specialize in custom 2, 3, 4 & 6 layer matrix boards.

## Features

- ☐ Models rated at 2, 6 and 16 amps.
- ☐ All contact materials gold plated.
- ☐ Silk-screened inscriptions protected by a clear melamine layer.
- ☐ Spacing between rows and between columns .1", 3 and 6 mm.
- ☐ Protected and supported bus bar pairs.
- ☐ Shorting pins, diode pins and cable pins available.

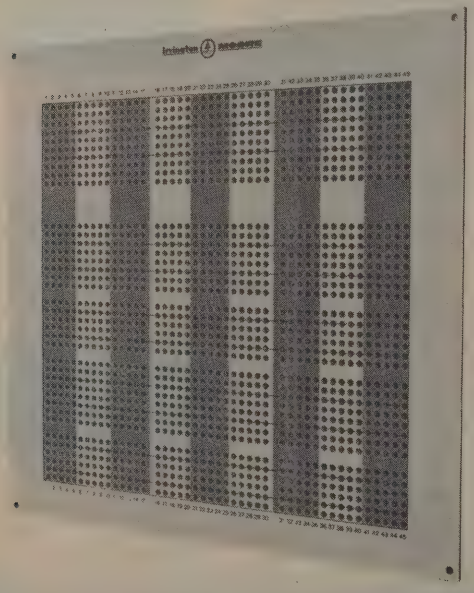
## Applications

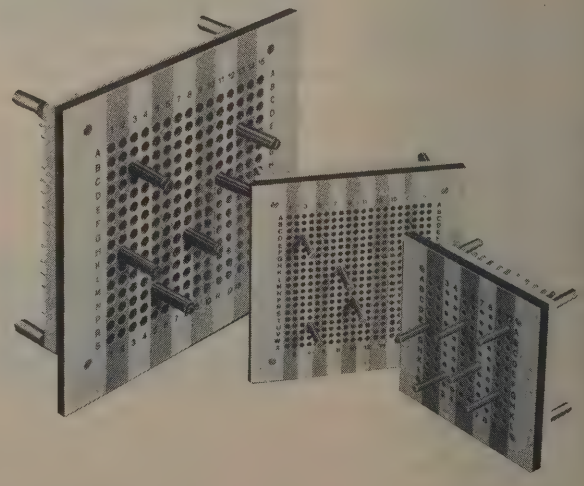
- ☐ Circuit test programmers.
- ☐ Reprogrammable diode matrix memories.
- ☐ Traffic controllers.
- ☐ Program variables for N-C machine tools.
- ☐ Memories for computers.
- ☐ Program variables for process controls.
- ☐ Power distribution systems.
- ☐ Lighting systems.
- ☐ Sound systems.

A matrix board is a manual programming device for electronic equipment. It is designed for situations where flexibility, economy and programming ease must be maximized. The inscribed face provides visual definition of each instruction, simplifying programming. Once programmed, circuits can be left indefinitely or changed as needed. Typical applications include the governing of batch processing, supervising of automatic machines and coordinating test equipment.

A matrix board is mechanically and electrically reliable, and comes in a variety of standard sizes. Custom boards can also be built to customer specifications in varying sizes and hole patterns.

The matrix is built around perpendicular rows of conductors, or bus bars contained in two or more layers. Those running vertically are called columns, those running horizontally are called rows. Where these conductors cross - the X, Y junction - a hole through the face of the matrix board allows a shorting pin to be inserted. A pin placed at that point connects one row to one column and closes the circuit between the two bus bars. Thus the basic function of the matrix board is that of a switch. Its advantage is the combination of switching actions that can be accomplished, and the ability to change, or reprogram the board quickly.





# Data Modules

INTERSWITCH

ONE OF THE PURDY GROUP OF COMPANIES

770 AIRPORT BOULEVARD, BURLINGAME, CALIFORNIA 94010 • TEL (415) 347-8217 • TWX 910-374-2353

## A Unique Way of Programming

## Features

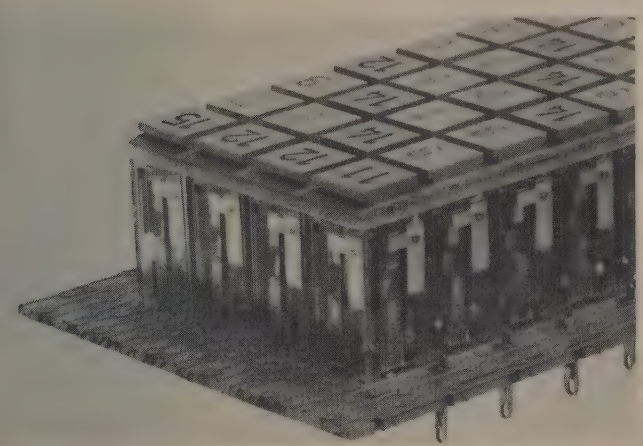
- ☐ 4 switches per module.
- ☐ Compact size.
- ☐ Large visual display.
- ☐ Quick program change.
- ☐ Equal to a 1 x 4 matrix.
- ☐ Available with diodes.
- ☐ Available with right angle mounting.
- ☐ Available with changeover contacts.

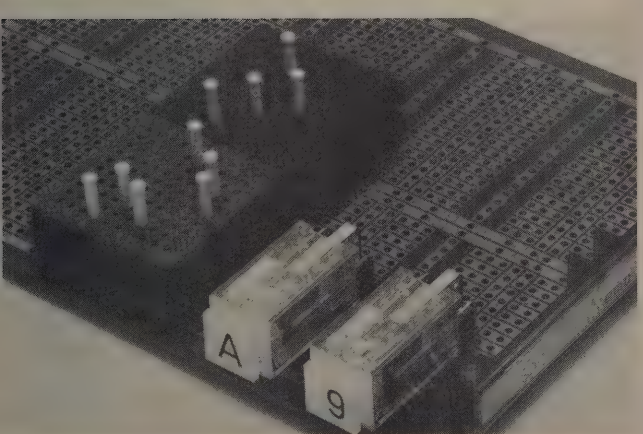
## Applications

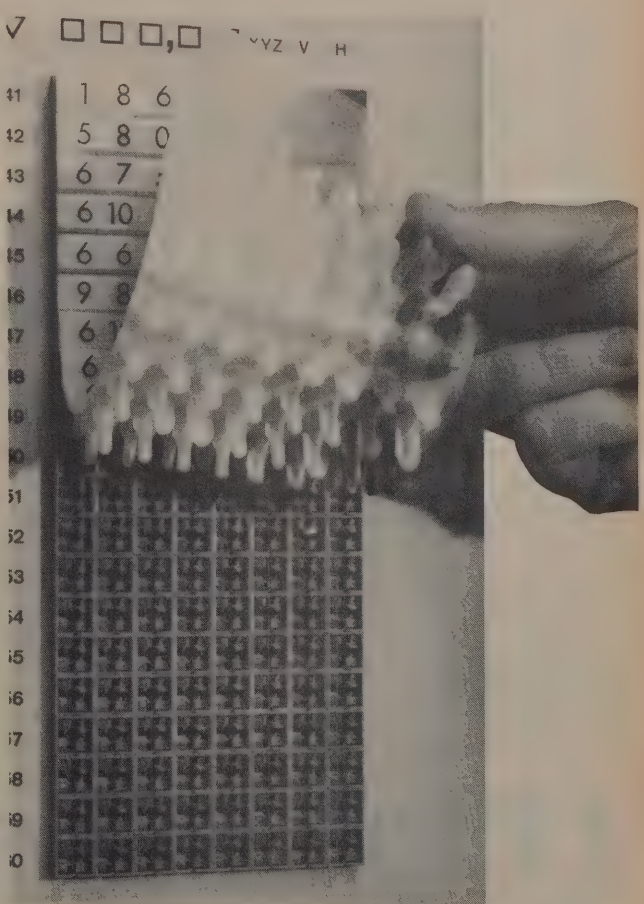
- ☐ Program variables for process controls for:
  - Plastic molding equipment.
  - Chemical formulating.
  - Soap and cosmetic production.
  - Paper products processing.
- ☐ Program variables for N-C machine tools.
- ☐ Program variables for:
  - Computers and peripherals.
  - Automatic typewriters.
  - Automatic sprinklers.

The Series 300 and 400 Data Modules are 5-terminal miniature coding devices with 1-2-4-8 binary outputs. The output code selection is obtained by inserting one of the 16 different plastic programming keys. The keys selectively close from none to all four of the contacts housed within the Data Module. These units are available with or without diodes in series with the outputs.

The Series 200 Data Modules have four changeover contacts (9 terminals) thereby providing both the binary and complementary outputs.





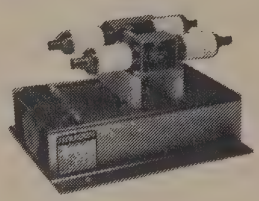
# vacuum contactors

Vacuum Contactors are used to control large amounts of DC power and RF currents with ratings up to 50 kv and currents up to 900 Amperes continuous. These contactors are recommended wherever high voltage capability, small size, and high speed operation with a long and low maintenance life are important. Applications include primary control of power supplies, industrial motors, and induction heating equipment, RF system tap changing, and fault protection of high power transmitters. The 12 page catalog provides complete specifications with a variety of specific applications for 3-pole, high voltage AC and DC, RF contactors and overcurrent relays actuated by solenoid, air or motor drives.

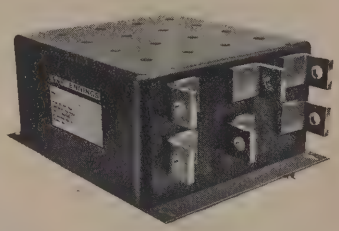
*This 12-page catalog provides complete specifications on 3-pole vacuum contactors, high voltage AC and DC contactors, high voltage overcurrent relays and high voltage RF contactors actuated by solenoid, air or motor drives. Engineering notes are included that relate ratings to a variety of specific applications.*

RP101-103

RP900-901



RT22



RP151

RP157

| Model Number | Test Voltage (Pk KV) | Operate Voltage (Pk KV) | Continuous Current (Amps) | Max. Interrupt AC Current (Amps RMS) | Max. Interrupt DC Power (KW) | Capacitor Discharge Decaying to 0 in 200 $\mu$s | Contact Arrangement | Actuator Voltage (Volts) | Time to Close (Ms) | Break Time (Ms) | Weight (Lbs.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RP101F4903D21B20<br>RP101F4904D21B20 | 30 | 25 | 200<br>DC | N/A | 500<br>(10 A Max.) | N/A | N/O<br>N/C | 115<br>60 Hz | 60 | 50 | 8¾ |
| RP101F4304D26B20 | 30 | 25 | 200<br>DC | N/A | 500<br>(10 A Max.) | N/A | N/C | 100<br>DC | 55 | 42 | 8¾ |
| RP103F4903D21B20<br>RP103F4904D21B20 | 36 | 15.5 | 200<br>RMS | 2000 | N/A | 50<br>K Amps | N/O<br>N/C | 115<br>60 Hz | 60<br>30 | 50<br>60 | 8¾ |
| RP103F4304D26B20 | 36 | 15.5 | 200<br>RMS | 2000 | N/A | 50<br>K Amps | N/C | 100<br>DC | 55 | 42 | 8¾ |
| RP901K4903D21B30<br>RP901K4904D21B30 | 70 | 50 | 400<br>DC | N/A | 500<br>(10 A Max.) | N/A | N/O<br>N/C | 115<br>60 Hz | 60<br>30 | 50<br>60 | 15 |
| RP901K4601D26B30<br>RP901K4602D26B30 | 70 | 50 | 400<br>DC | N/A | 500<br>(10 A Max.) | N/A | N/O<br>N/C | 100<br>DC | 34<br>60 | 11<br>25 | 15 |
| RP900K4903D21B30<br>RP900K4904D21B30 | 70 | 50 | 400<br>RMS | 4000 | N/A | 100<br>K Amps | N/O<br>N/C | 115<br>60 Hz | 60<br>30 | 50<br>60 | 15 |
| RP900K4601D26B30<br>RP900K4602D26B30 | 70 | 50 | 400<br>RMS | 4000 at<br>13 KV RMS | N/A | 100<br>K Amps | N/O<br>N/C | 100<br>DC | 34<br>60 | 11<br>25 | 15 |

| Unit | Pk. Operate Voltage 32 MHz | Contact Current 32 MHz RMS | Contact Resistance Ohms Max. | Contact Capacitance pF | Contact Inductance Nh | Contact Arrangement | Open Time | Close Time | Pull-in Current RMS | Hold Current RMS | Hold Power Watts | Actuating Voltage or Air Pressure | Approx. Weight | Life | Auxiliary Contacts Ratings Volt RMS Current RMS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RP233X4513006M00<br>(Solenoid Operated) | 25 | 35 | .0005 | 2 | 25 | N/O | 17 Ms. | 7.5 Ms. | .7 | .09 | 10 | 100<br>VDC | 3 lbs. | $1x10^5$ | Form C<br>230/7 |
| RT224070A31NB<br>(Solenoid Operated) | 5* | 25 | .0005 | 2.5 | n/a | Latching | <300<br>Ms. | <300<br>Ms. | .3 | n/a | n/a | 230<br>VAC | 12 lbs. | $2.5x10^5$ | Form C<br>230/15 |
| RP233D1585<br>(Air Operated) | 25 | 35 | .0005 | 2 | 25 | N/O | <200<br>Ms. | n/a | n/a | n/a | n/a | 40 ±5<br>psig | 12 oz. | $1x10^5$ | n/a |
| RF20B1586<br>(Air Operated) | 20 | 135 | .0004 | 10 | 2.5 | N/O | <200<br>Ms. | n/a | n/a | n/a | n/a | 35 ±5<br>psig | 2 lbs.<br>12 oz. | $1x10^6$ | n/a |

*Higher voltage ratings available at lower frequencies.

| Model Number | Operate Voltage V (RMS) | Continuous Current 60 Hz | Interrupt Current Amps RMS | Mechanical Life (Min.) | Actuator Voltage | Approx. Pull-in Current Amps Max. | Approx. Hold Current Amps Max. | Interrupt Time | Auxiliary Contacts | Approx. Weight |
|---|---|---|---|---|---|---|---|---|---|---|
| RP151B4541X44R20 | 600 | 200 | 2000 | $3x10^5$ | 26.5 VDC | 2.8 | .4 | Less than<br>2 Cycles | 2 SPDT<br>230 VAC/10A | 16 lbs. |
| RP157B4549X41TX0 (60 Hz)<br>RP157B4549X4KTX0 (50 Hz) | 1500 | 300 | 3000 | $1x10^6$ | 115 VAC | 15 | 1.5 | Less than<br>2 Cycles | 4 PDT<br>230 VAC/5A | 25 lbs. |
| RP1574544X44TX0<br>RP1574544X45TX0<br>RP1574544X46TX0 | 1500 | 300 | 3000 | $1x10^6$ | 26.5 VDC<br>48 VDC<br>100 VDC | 19.1<br>9.5<br>4.9 | .25<br>.117<br>.059 | Less than<br>2 Cycles | 115 VAC/5A | 25 lbs. |

ITT JENNINGS Dept. EM, 970 McLaughlin Ave. • San Jose, CA 95122 • (408) 292-4025

DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

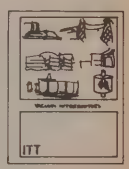
# vacuum interrupters

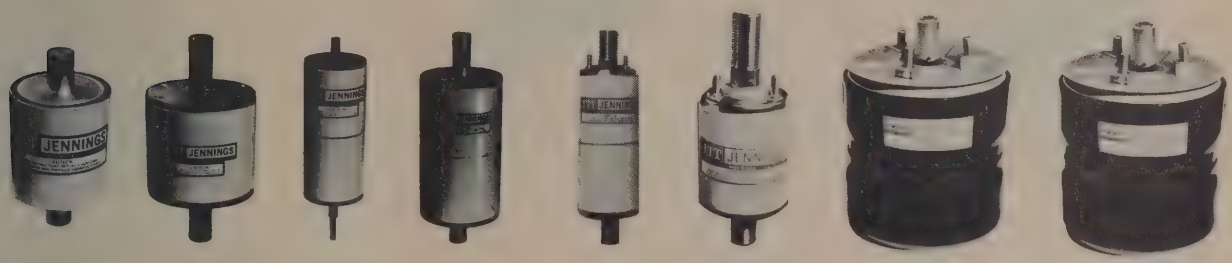
ITT Jennings offers a line of Vacuum Interrupters for use in power generation and distribution systems. Their high dependability compared with other types of interrupters has been proven in over 20 years of in-field service. In fact, the first commercial vacuum interrupter supplied by ITT Jennings, installed as a line-and-load dropping switch on a 138 kv transmission line, is still going strong. Vacuum Interrupters are simple in principle. They require that only two contacts be separated in a vacuum environment. ITT Jennings builds them with heavy metal alloy construction combined with ceramic envelopes. This inherently high dielectric device provides numerous advantages such as:

- Short actuator stroke, which simplifies operation
- High interrupting and operating speed.
- Rapid dielectric recovery, which minimizes restrikes.
- Very high 60 cps and Impulse Withstand Voltages.
- Extremely small and lightweight for their capacity.
- Quiet operation.
- Long, maintenance-free life.
- Using no oil, they are non-flammable, non-toxic, and non-explosive.

ITT Jennings Vacuum Interrupters are found in applications such as line and load dropping switches on 230 kv lines, and for switching large capacitor banks (usually at 15.5 kv, but they have been used in systems up to 345 kv). They are also used to interrupt transformer magnetizing currents up to 230 kv, for fault interruption up to 115 kv, and to control arc furnaces and other mining equipment at supply voltages up to 24.5 kv.

*Twelve-page catalog provides engineering information on the selection and use of vacuum interrupters in various general purpose, utility and industrial applications. Contains complete specifications on vacuum interrupters and special vacuum interrupter switches for RF applications.*





RP157 RP951B RP103C1 RP909 RP603B RP602B RP720 RP723/ RP728

| ELECTRICAL | | | | | | | MECHANICAL | | | | | RELIABILITY | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number | *Line-to-Line Voltage, Rated Max. KV (RMS) | Low Frequency Withstand Voltage KV (RMS) | Basic Impulse Level KV (Crest) | Continuous Current A (RMS) | Interrupting Ability, Max. @ Rated Voltage AC (RMS) | Momentary Current A (RMS) | Contact Stroke INCH | Contact Opening & Closing Velocity FT/SEC. | Contact Opening Force Max. Lbs. | Approx. Weight Lbs. | Moving Contact Weight Lbs. | Mechanical Life Operations @ Rated Current | Typical Operations Life/ Operations @ Max. Interrupting Current |
| RP157B | 5 | 11 | 45 | 300 | 2000 | 20,000 | 3/16 | 2 | 10 | 1.5 | 0.8 | 500,000 | 50 |
| RP951B | 5 | 27 | 60 | 600 | 4000 | 30,000 | 1/4 | 2 | 32 | 7 | 1½ | 500,000 | 100 |
| RP103C1 | 15.5 | 36 | 95 | 200 | 2000 | 20,000 | 5/32 | 1 | 8 | 2¼ | 1/4 | 250,000 | 100 |
| RP602B | 15.5 | 36 | 95 | 600 | 2000 | 20,000 | 1/4 | 2¾ | 10 | 1.8 | 0.8 | 20,000 (in oil) | 50 |
| RP603B | 38 | 80 | 150 | 600 | 2000 | 20,000 | 3/8 | 3 | 10 | 2.5 | 1.0 | 20,000 (in oil) | 50 |
| RP909 | 15.5 | 50 | 110 | 600 | 12,000 | 20,000 | 3/8 | 4/3 | 15 | 10 | 2 | 10,000 | 12 |
| RP720 | 15.5 | 50 | 110 | 1200 | 20,000 | 32,000 | 5/8 | 6/3 | 45 | 13 | 2.4 | 10,000 | 4 |
| RP723 | 15.5 | 50 | 110 | 2000 | 23,000 | 60,000 | 3/4 | 7/2¾ | 45 | 24 | 3.70 | 10,000 | 4 |
| RP728 | 15.5 | 50 | 110 | 2000 | 33,000 | 69,000 | 3/4 | 7/3¼ | 45 | 24 | 3.70 | 10,000 | 4 |

* Higher voltages available on some models

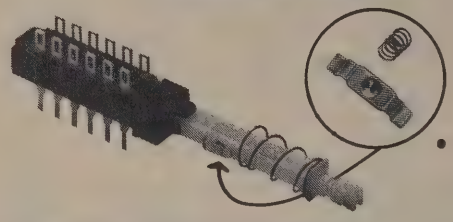
ITT JENNINGS Dept. EM, 970 McLaughlin Ave. • San Jose, CA 95122 • (408) 292-4025
DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

# MODULAR PUSH BUTTON SWITCHES

**"Creative Switchmakers" for Home Entertainment Products and Test Equipment**

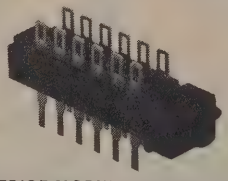
***If it's a better switch you need . . . better switch to Schadow!***

## better switch... here's why...



### HAND WIRING AND FLO-SOLDERING CONNECTIONS ARE STANDARD

- Solder lugs on top for hand wiring
- PC spikes at bottom for flo-soldering



### SUPERIOR MODULAR CONSTRUCTION

- Ease of maintenance . . . switch plunger with sliding contacts is removable from the front without disturbing electrical connections

### INDIVIDUAL COIL SPRING LOADED MOVING CONTACTS

- The coil spring-loaded contoured moving contacts have been designed to provide balanced contact pressure for optimum surface to surface interface with the fixed contacts . . . assuring reliable performance in low voltage (dry circuit) applications
- Long term low contact resistance
- Constant coil spring tension at the contact points provides positive self-cleaning action

### MODULE ADVANTAGES

- Enclosed housing protects inner contact area from dust and foreign intrusions
- Fixed terminals are "staked" in position, providing an extra seal to help prevent wicking of solder or flux
- Molded PC Board Standoffs, front and back, on bottom side, assure parallel mounting

**TECHNICAL DATA**

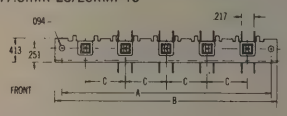
| | |
|---|---|
| Contact Resistance | 4-6 mOhms |
| after 25,000 cycles | 6-20 mOhms |
| Lifetime Expectation Interlocked (50,000) Momentary, Push Push (100,000) cycles | |
| Material of Construction | |
| Fixed contact. Brass/Silver Plated | .0002" |
| Moving contact | Bimetal Brass/Silver .0004" |
| Plunger Material | Polycarbonate V-0 rated or Delrin |
| Contacts | Non-shorting |
| Housing Material | Polycarbonate V-0 rated or Glass Reinforced Nylon |
| Terminal Board Material | High Grade Paper Phenolic or V-0 rated material. Series F |
| Key pressure with 2PDT | 28 oz. |
| Key pressure with 4PDT | 32 oz. |
| Key pressure with 6PDT | 35 oz. |
| Key pressure with 8PDT | 42 oz. |
| Key pressure with 10PDT | 46 oz. |
| Key pressure with Power Switch | 42 oz. |

**NOTE:** Lighter key pressures available, contact factory for details.

**NOTE:** For switching applications requiring flame retardant materials, contact factory.

### CHASSIS DIMENSIONS FOR SERIES F & SERIES G SWITCHES

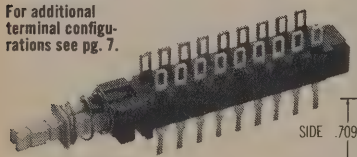
NOTE: Maximum stations to be grouped in one interlocking action. 10mm-10/12.5mm-23/15mm-23/17.5mm-23/20mm-19



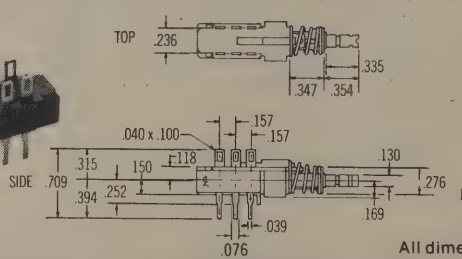

| No. of Stations | C Dim. 10mm (.3941) A MTG. | C Dim. 10mm (.3941) B MTG. | C Dim. 12.5mm (.4921) A MTG. | C Dim. 12.5mm (.4921) B MTG. | C Dim. 15mm (.5906) A MTG. | C Dim. 15mm (.5906) B MTG. | C Dim. 17.5mm (.6890) A MTG. | C Dim. 17.5mm (.6890) B MTG. | C Dim. 20mm (.7874) A MTG. | C Dim. 20mm (.7874) B MTG. |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 1.417 | 1.811 | 1.437 | 1.831 | 1.614 | 2.008 | 1.713 | 2.402 | 1.811 | 2.598 |
| 3 | 1.811 | 2.205 | 1.929 | 2.413 | 2.205 | 2.795 | 2.165 | 2.854 | 2.402 | 3.091 |
| 4 | 2.205 | 2.598 | 2.185 | 2.913 | 2.795 | 3.386 | 2.854 | 3.543 | 3.091 | 3.780 |
| 5 | 2.598 | 2.992 | 2.677 | 3.406 | 3.386 | 3.976 | 3.543 | 4.232 | 3.780 | 4.468 |
| 6 | 2.992 | 3.386 | 3.169 | 3.898 | 3.976 | 4.567 | 4.232 | 4.921 | 4.468 | 5.157 |
| 7 | 3.386 | 3.780 | 3.661 | 4.390 | 4.567 | 5.157 | 4.921 | 5.610 | 5.157 | 5.846 |
| 8 | 3.780 | 4.173 | 4.154 | 4.882 | 5.157 | 5.748 | 5.610 | 6.299 | 5.846 | 6.535 |
| 9 | 4.173 | 4.567 | 4.646 | 5.374 | 5.748 | 6.339 | 6.299 | 6.988 | 6.535 | 7.224 |
| 10 | 4.567 | 4.961 | 5.138 | 5.866 | 6.339 | 6.929 | 6.988 | 7.677 | 7.224 | 7.913 |
| 11 | 4.961 | 5.354 | 5.630 | 6.358 | 6.929 | 7.520 | 7.677 | 8.366 | 7.913 | 8.602 |
| 12 | 5.354 | 5.748 | 6.122 | 6.850 | 7.520 | 8.110 | 8.366 | 9.055 | 8.602 | 9.291 |
| 13 | 5.748 | 6.142 | 6.614 | 7.343 | 8.110 | 8.701 | 9.055 | 9.744 | 9.291 | 9.980 |
| 14 | 6.142 | 6.535 | 7.106 | 7.835 | 8.701 | 9.291 | 9.744 | 10.433 | 9.980 | 10.668 |
| 15 | 6.535 | 6.929 | 7.598 | 8.327 | 9.291 | 9.882 | 10.433 | 11.122 | 10.668 | 11.358 |
| 16 | 6.929 | 7.323 | 8.091 | 8.819 | 9.882 | 10.472 | 11.122 | 11.811 | 11.358 | 12.047 |
| 17 | 7.323 | 7.717 | 8.583 | 9.311 | 10.472 | 11.063 | 11.811 | 12.500 | 12.047 | 12.736 |
| 18 | 7.717 | 8.110 | 9.075 | 9.803 | 11.063 | 11.654 | 12.500 | 13.189 | 12.736 | 13.425 |
| 19 | 8.110 | 8.504 | 9.567 | 10.295 | 11.654 | 12.244 | 13.189 | 13.878 | 13.425 | 14.114 |
| 20 | 8.504 | 8.898 | 10.059 | 10.787 | 12.244 | 12.835 | 13.878 | 14.567 | 14.114 | 14.803 |
| 21 | 8.898 | 9.291 | 10.551 | 11.280 | 12.835 | 13.425 | 14.567 | 15.256 | 14.803 | 15.492 |
| 22 | 9.291 | 9.685 | 11.043 | 11.772 | 13.425 | 14.016 | 15.256 | 15.945 | 15.492 | 16.181 |
| 23 | 9.685 | 10.079 | 11.535 | 12.264 | 14.016 | 14.606 | 15.945 | 16.634 | 16.181 | 16.870 |
| 24 | 10.079 | 10.472 | 12.028 | 12.756 | 14.606 | 15.197 | 16.634 | 17.323 | 16.870 | 17.559 |
| 25 | 10.472 | 10.866 | 12.520 | 13.248 | 15.197 | 15.787 | 17.323 | | 17.559 | |
| 26 | 10.866 | 11.260 | 13.012 | 13.740 | 15.787 | 16.378 | | | | |
| 27 | 11.260 | 11.654 | 13.504 | 14.232 | 16.378 | 16.968 | | | | |
| 28 | 11.654 | 12.047 | 13.996 | 14.724 | 16.968 | 17.559 | | | | |
| 29 | 12.047 | 12.441 | 14.488 | 15.215 | | | | | | |
| 30 | 12.441 | 12.835 | 14.980 | 15.707 | | | | | | |
| 31 | 12.835 | 13.228 | 15.472 | 16.199 | | | | | | |
| 32 | 13.228 | 13.622 | 15.965 | 16.693 | | | | | | |
| 33 | 13.622 | 14.016 | 16.457 | 17.185 | | | | | | |
| 34 | 14.016 | 14.409 | 16.949 | | | | | | | |
| 35 | 14.409 | 14.803 | | | | | | | | |
| 36 | 14.803 | 15.197 | | | | | | | | |
| 37 | 15.197 | 15.591 | | | | | | | | |
| 38 | 15.591 | 15.984 | | | | | | | | |
| 39 | 15.984 | 16.378 | | | | | | | | |
| 40 | 16.378 | 16.772 | | | | | | | | |
| 41 | 16.772 | 17.165 | | | | | | | | |
| 42 | 17.165 | 17.559 | | | | | | | | |
| 43 | 17.559 | | | | | | | | | |

## F SERIES

For additional terminal configurations see pg. 7.



F-6U
6P DT

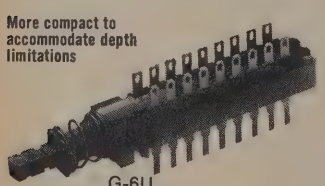



| MODULE DIMENSIONS | X | Y |
|---|---|---|
| 2PDT | .827 | 1.670 |
| 4PDT | 1.300 | 2.143 |
| 6PDT | 1.772 | 2.615 |
| 8PDT | 2.244 | 3.087 |
| 10PDT | 2.716 | 3.559 |
| 16PDT | | |

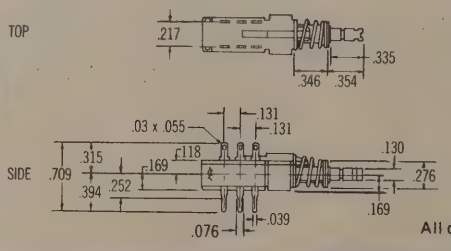
All dimensions in inches

## G SERIES

More compact to accommodate depth limitations



G-6U
6P DT




| MODULE DIMENSIONS | X | Y |
|---|---|---|
| 2PDT | .705 | 1.548 |
| 4PDT | 1.098 | 1.941 |
| 6PDT | 1.492 | 2.335 |
| 8PDT | 1.895 | 2.705 |

All dimensions in inches

ITT ITT Schadow inc

8081 Wallace Road, Eden Prairie, MN 55344 • 612/944-1820 • TWX 910-576-2469 • TELEX: 29-0556

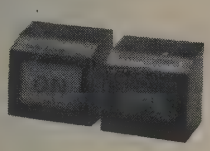
Manufacturing facilities in Minneapolis, Minnesota; Einbeck, W. Germany; W. Berlin and Dole, France

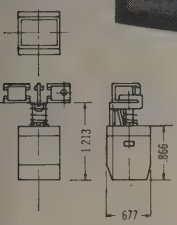
In Canada: ITT Components, 4001 Chesswood Drive, Downsview, Ontario M3J2R8 • 416/630-7971 • TELEX: 06-22703

## MECHANICAL REFLECTING INDICATOR BUTTONS FOR F & G SERIES

- Uses no energy. Needs no lamp, lamp/holder, power supply, switch contact or wiring.
- Works on the principle of reflecting ambient light through a clear plastic lens.
- Generates no heat and eliminates costly lamp replacement.

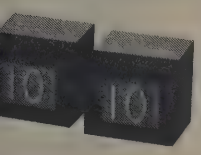
**FA 110 DUAL LEGEND INDICATOR BUTTON**





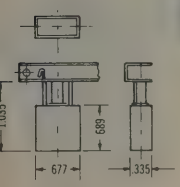

Legend and color change when button is depressed. (Legend is on indicator surface.)

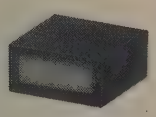
Button Shell Colors: Black, white, grey
Indicators: Black, green, orange, white, grey, yellow, blue



Legend remains the same, but indicator color changes when the button is depressed. (Legend is on rear side of clear lens cap.)

**FA 100**



Button Shell Colors: Chrome, black, white, grey, nickel

Indicators: Blue, orange, yellow, green, amber, white

# right on the button . . .

## standard buttons for Series F and G Switches

Rectangular buttons also can be snapped on vertically to provide more selection of larger buttons on smaller chassis spacing. Standard colors shown . . . other colors to match or contrast with your equipment available on special order.

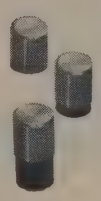
Rectangular buttons also can be snapped on vertically to provide more selection of larger buttons on smaller chassis spacing. Standard colors shown . . . other colors to match or contrast with your equipment available on special order.

**FG**
Diameter: .346"
Length: .413"
Standard Minimum Spacing: 10mm
Colors: Black, White, Grey, Red, Green, Chrome

**F-200**
Diameter: .394"
Length: .433"
Standard Minimum Spacing: 12.5mm
Colors: Chrome/Black, Black/Black

**FZ**
Diameter: .394"
Length: .642"
Standard Minimum Spacing: 12.5mm
Colors: Black/Black, White/Black, White/Red, Red/Black, Red/Grey

**F1.12 - H-3**
**F1.15 - H-3**
**F1.21 - H-3**
Diameters: .433", .433", .433"
Lengths: .472", .591", .827"
Cap Depth: .472"
Standard Minimum Spacing: 12.5mm
Colors: Black/Metal Cap

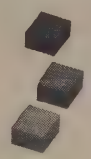


**F1.12 - H-4**
**F1.15 - H-4**
**F1.21 - H-4**
Diameters: .394", .394", .394"
Lengths: .472", .591", .827"
Cap Depth: .079" Standard Minimum Spacing: 12.5mm
Colors: Black/Metal Cap

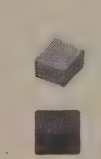
**F1.12 - H-5**
**F1.15 - H-5**
**F1.21 - H-5**
Diameters: .480", .480", .480"
Lengths: .571", .689", .925"
Cap Depth: .571"
Standard Minimum Spacing: 12.5mm
Colors: Black/Chrome

**FGK**
Diameter: .473"
Length: .492"
Standard Minimum Spacing: 12.5mm
Colors: Red, White, Black, Grey, Green

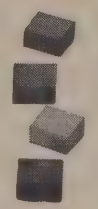
**FSC**
Width: .386"
Height: .217"
Length: .441"
Standard Minimum Spacing: 10mm
Colors: White, Black, Grey



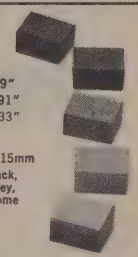
**FSD**
Width: .484"
Height: .276"
Length: .413"
Standard Minimum Spacing: 12.5mm
Colors: Black, White, Grey



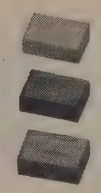
**FU12**
Width: .470"
Height: .216"
Length: .440"
Standard Minimum Spacing: 12.5mm
Colors: Black, White, Grey, Red



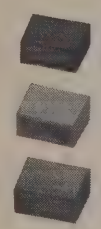
**FSB**
Width: .579"
Height: .291"
Length: .433"
Standard Minimum Spacing: 15mm
Colors: Black, White, Grey, Red, Chrome



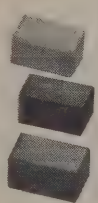
**FE**
Width: .681"
Height: .236"
Length: .472"
Standard Minimum Spacing: 17.5mm
Colors: Black, White, Grey.



**FSA**
Width: .677"
Height: .315"
Length: .512"
Standard Minimum Spacing: 17.5mm
Colors: Black, White, Grey
Inserts: Silver or Gold

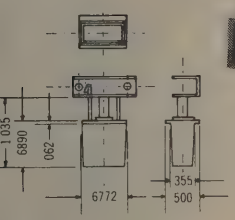


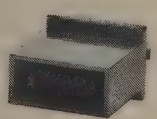
**FA**
Width: .772"
Height: .394"
Length: .453"
Standard Minimum Spacing: 20mm
Colors: Black, White, Grey,



**04-7060-00**
Width: .487"
Height: .487"
Length: .590"
Cap Depth: .480"
Standard Minimum Spacing: 12.5mm
Colors: Spun-Finish Chrome

**FA 106**

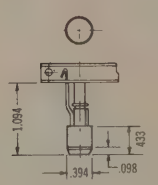


Button Shell Colors: Chrome, black, white, grey, nickel

Indicators: Blue, orange, yellow, green, amber, white

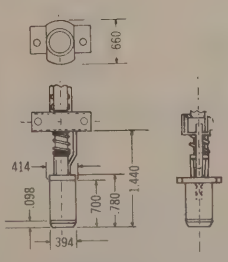
**FA 201**



Button Shell Colors: Chrome, black, white, grey, nickel

Indicators: Blue, amber, orange, yellow, green, white

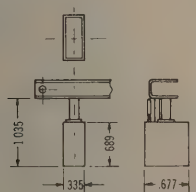
**FA 207**



Button Shell Colors: Chrome, nickel, black, white

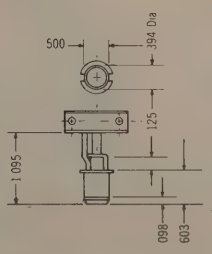
Indicators: Blue, orange, yellow, amber, green, white

**FA 101**



Button Shell Colors: Chrome, black, white, grey, nickel
Indicators: Orange, yellow, green, amber, blue, white

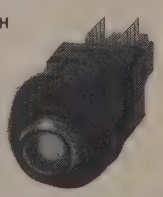
**FA 206**



Button Shell Colors: Chrome, black, nickel

Indicators: Blue, orange, yellow, amber, green, white

**ZF THREADED BUSHING MOUNT WITH FA 200 BUTTON**

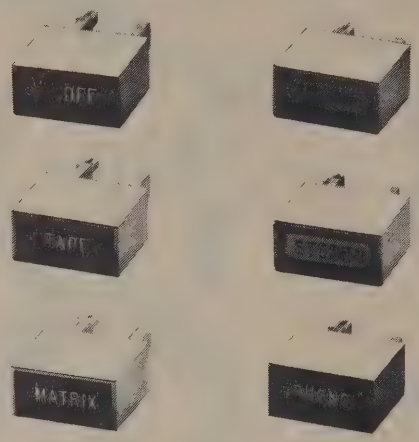


Button Shell Colors: Chrome, black, nickel, white, grey
Indicators: Blue, orange, yellow, green, amber, white
Choice of black, chrome or grey front mounting nut.

# ITT ITT Schadow inc

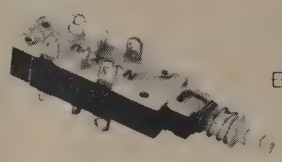
## NEED GRAPHICS?

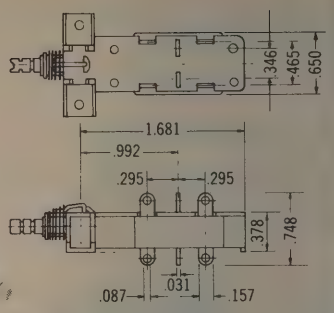
Several examples are shown below. Your specific requirements quoted on request. (Graphics pictured on FA 100 push buttons)



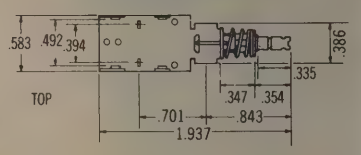

## N30 TV-5 rated power switches

(Also available with 2PDT low voltage auxiliary contacts) UL, CSA, VDE Approved.

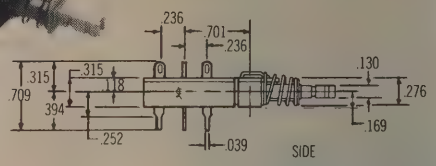





## Series NE 15/F line switches




(Also available with 2PDT low voltage auxiliary contacts) UL, CSA, VDE Approved, 4 AMP 250 VAC.




## CA-110 SERIES

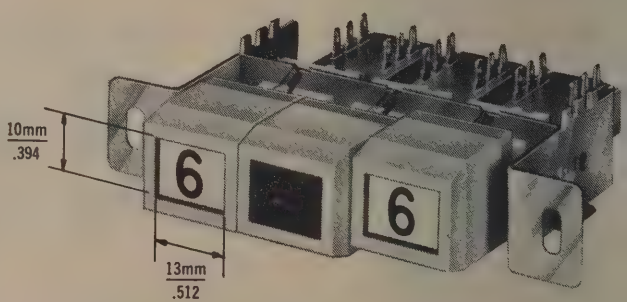
Schadow, the creative switchmaker, has developed a "lampless" push button switch, with bright color indicators — with or without graphics — to mechanically indicate changing functions.

This innovative push-button switch, Series CA 110, is for use in high quality commercial applications. The sophistication of the series in terms of electrical construction (bifurcated contacts — coil spring loaded) and mechanical actions available, will satisfy the most demanding switching requirements.

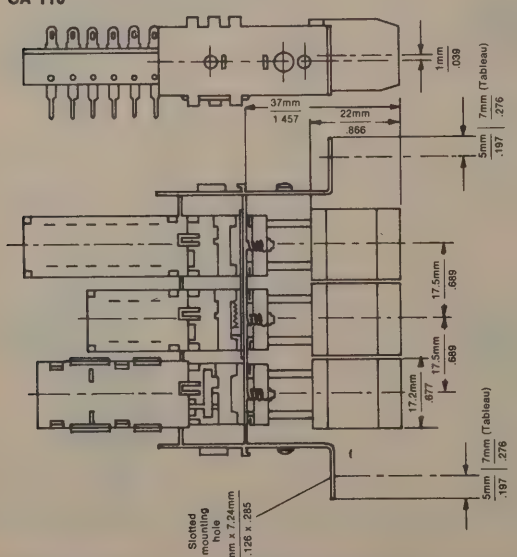
Tableau or stacked switches are available in Series CA 110, 15 switches wide x 10 high per chassis.

Because a lamp and socket assembly is omitted, economies in manufacture permit a lower pricing schedule, and the elimination of another drain on electrical power sources.

If it's a better switch you need . . . better switch to Schadow.




**CA 110**




Legend and color change when button is depressed. (Legend is on indicator surface.)

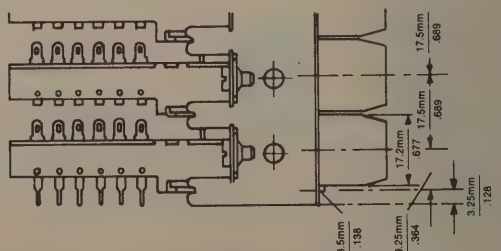
DT

Legend remains the same, but indicator color changes when the button is depressed. (Legend is on rear side of clear lens cap.)

| STANDARD COLORS | | |
|---|---|---|
| BUTTON SHELL | INDICATOR OFF | INDICATOR ON |
| White | White | White |
| Gray | Gray | Gray |
| Black | Black | Black |
| | Yellow | Yellow |
| | Green | Green |
| | Orange | Orange |
| | Blue | Blue |

For custom legend applications contact factory.

**CA 110 TABLEAU**

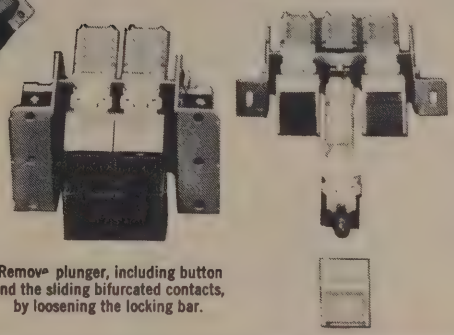


SCHADOW

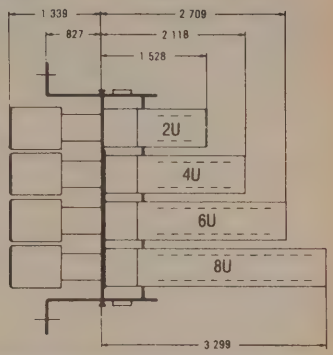
# High quality Series CL illuminated and Series C non-illuminated push button switches

This push-button switch is for use in high quality commercial applications. The sophistication of the Series "CL" & "C" in terms of electrical construction (bifurcated contacts — coil spring loaded) and mechanical actions available will satisfy the most demanding switching requirements.

Tableau or stacked switches available either "CL" or "C" Series, 15 switches wide x 10 high per chassis. With the designation Series "CL" this switch is available with slip-on lamp holder. Use Type 5522 lamp. Button spacing is 17.5mm (.689").



Remove plunger, including button and the sliding bifurcated contacts, by loosening the locking bar.




## SPECIFICATIONS: SERIES CL and C PUSH BUTTON SWITCHES

### MECHANICAL DATA

Key travel = .315" Contact travel = .197"
Life 300,000 cycles depending upon load.
Key pressure — 2 & 4PDT = 35 oz.; 6 & 8PDT = 49 oz.

### MECHANICAL ACTIONS AVAILABLE

[Gr] = Interlocking.

[$Gr_1$, $Gr_2$] = Two independent interlocking groups.

[o.A.] = Momentary.

[A.o.R.] = Momentary release button for interlocking.

[EE] = Push-push.

[Z] = Central release for individual latching.

[Sp] = Blocking action only one key down. Switching is delayed to increase margin of safety.

[Gr + Sp] = Interlocking with blocking. Maximum 15 button (stations) in one row.

[$Gr_1$, + Sp / $Gr_2$, + Sp] = Two groups of interlocking with blocking. (Group 1 can be blocked independent of Group 2.)

[o.A. + VSp] = Momentary action with blocking.

[EE + VSp] = Push to engage, push again to release — with blocking. The depressed button must first be released before another button can be depressed.

[Gr + VSp + A.o.R.] = Interlocking with blocking and locking of button with one central momentary release button. The depressed button must first be released by central release button or solenoid remote release, before another one button can be depressed.

[Gr + RSp + A.o.R.] = Locked — Interlocking with blocking. A central release button must first be depressed before any of one interlocked buttons can be depressed; this button remains latched after release button is allowed to return. The main circuit can be interrupted, if necessary, through the release button contacts. In this way, a 4 amp. circuit can be switched, without current, through standard C-Module switch contacts.

### CHASSIS AND STATION DATA

Model Number ..... 17.5
Center to center spacing ..... 0.689"
Number of stations ..... 1-15
Standard Buttons-Series "C" (Non-illuminated) CSX
Standard Buttons-Series "CL" (Illuminated) CRS, CRV

### CONTACT TYPES

Standard: Non-shorting — Solder Terminals Top, PC Terminals Bottom.

[Shorting: ks] Short PC top, Standard PC bottom: SI
Short PC terminals both sides: SC
Special cut off terminals either side .036" long.

### INSULATION MATERIAL

Contact Plate: Phenolic 20.62.8 Kl.IV
Module: Polycarbonate (Makrolon)
Contact Plunger 2u, 4u: Polycarbonate (Makrolon)
Contact Plunger 6u, 8u: Polyamid
Outer Plunger: Azetalharz

### ELECTRICAL DATA

Voltage Max.: 1000 volts.
Current Max.: 2 amps $\cos_\phi = 1$.
Load Max.: 100 watts ac.
Load Max.: 25 watts dc.
Test Voltages: Contact to ground 300 volts ac.
Terminal to terminal: 2000 volts ac.
Auxiliary terminals to outer-terminals: 1000 volts ac.
Lamp holder contacts to ground: 1500 volts ac.
Insulation Resistance: $10^{12}$ Ω after 96 hours storage in 95-100% humidity.
Contact Resistance: 5 milli Ω.
Contact Resistance: After 25,000 switching cycles — about 15 milli Ω (depends on load).
Dielectric loss, tgδ $4x10^{3}$ (300 kHz).

### POWER SWITCH NC17 (UL, CSA and VDE Approved)

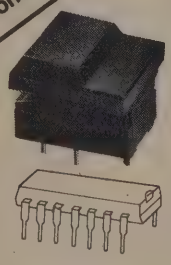
Max. Voltage — 250 ac.
Max. Current — 6A (Cos $\phi$ = 0.75)
Max. Current — 3A (Inductive load)
Max. Voltage — 250 dc.
Max. Current — 2A dc.
Test voltage between terminals & chassis: 3000V ac.
Test voltage between terminals & contacts: 2000V ac.
Contact Resistance: 50 milli Ω (With rated load).

digitast
modular electronic switch input component

**digitast**

SR 12.3mm wide x 17.1mm

ST 17.3mm wide x 17.1mm (pictured)

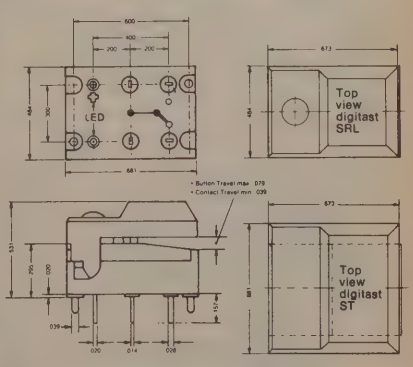


**digitast**

SRL (LED factory or customer installed) 12.3mm wide x 17.1mm (pictured)

STL (LED factory or customer installed) 17.3mm wide x 17.1mm

Digitast for use with DIP packages, consistent tactile feel, SPDT momentary spring loaded contact, less than 1 ms contact bounce, 24v 10ma or 60v 100ma ratings. Mechanical life greater than 1 million operations. Available with built in LED. PCB mounting. Hot stamped graphics available.




ITT ITT Schadow inc

8081 Wallace Road, Eden Prairie, MN 55344 • 612/944-1820 • TWX 910-576-2469 • TELEX: 29-0556
Manufacturing facilities in Minneapolis, Minnesota; Einbeck, W. Germany; W. Berlin and Dole, France
In Canada: ITT Components, 4001 Chesswood Drive, Downsview, Ontario M3J2R8 • 416/630-7971 • TELEX: 06-22703

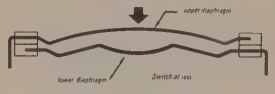
low cost
3 point contact
totally sealed
highest integrity

# disc switch

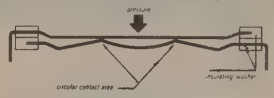
modular electronic components

**TOTAL SEALING**

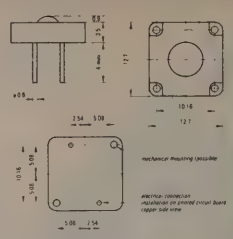
The Disc switch is totally sealed through insert moulding and ultra-sonic welding.

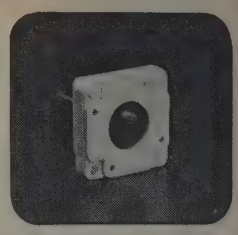



The Disc switch is built around two contact diaphragms separated by an insulating material. The profile of each of these two diaphragms is such that, under the action of applied pressure on the upper dome, it is momentarily collapsed, making instant positive, 3 point contact with the lower diaphragm.

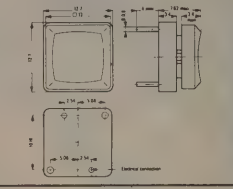


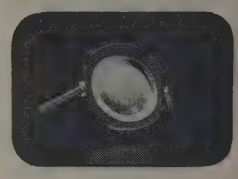

- High Reliability...10 X $10^6$
- Self Cleaning
- Broad Range of Switching Power...from a few milliwatts to 30 watts.
- Low Bounce (less than 100 microseconds)



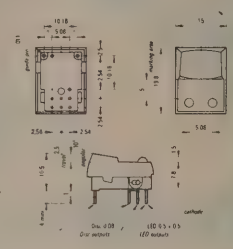


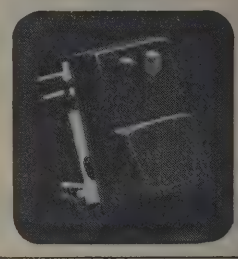
**MD** Disc module: Extra-flat momentary contact module. Shorter stroke configuration installable directly on printed circuit board. Enables you to design your own keyboard adapted to your own specific needs.



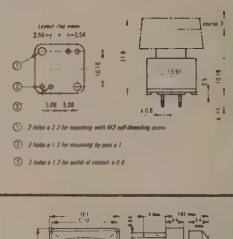


**MDP** Push button switch assembly with a momentary action contact and incorporating the unique design disc switch. The switch is designed for direct insertion into printed circuit boards. Two principal advantages of the MDP switch are the short stroke (only 0.5 mm) and the crisp tactile feel.

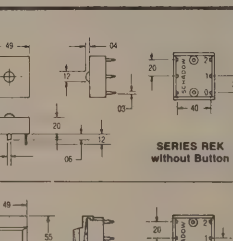


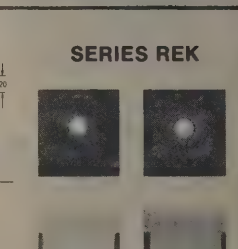


**DMB** Modular Rocker Disc Switch: Momentary contact for use on printed circuit board. Customer design and installation from bread board through production. Can be mounted in line on 15.24 MM/.600" centers or in a matrix (.600" x .800"). Available with one or two L.E.D.'s (red, green or yellow). Engraving or hotstamped graphics available.



**TFD** Alpha-numeric data entry keyboard style switch: Size, stroke and touch approximate industry standard for data entry switches. Low profile.





**MDP** Push button switch assembly with a momentary action contact and incorporating the unique design disc switch. The switch is designed for direct insertion into printed circuit boards. Two principal advantages of the MDP switch are the short stroke (only 0.5mm) and the crisp tactile feel. Contact arrangement: single, normally open contact with momentary action. TERMINALS: tinned terminals — 0.8mm dia. x 4mm long. SOLDERING: since the disc switch is completely sealed, it can be flow soldered. PUSH BUTTONS AND KEYS: dimensions (mm) 12.7 x 12.7 x 3.4 (7.62 with key). STANDARD COLORS: red, blue, light grey, dark grey.

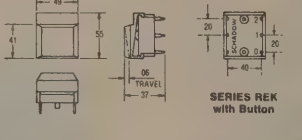
unique
versatile

# series "R"

electronic switch input components

Series R is the economical answer for an electronic switch input component to use with standard dual-in-line packages (DIP's), ideally designed for incorporation into a broad variety of electronic devices including advanced microprocessor controlled equipment. Series R is compatible with TTL, CMOS Logic. Redundant contacts insure required reliability.




**SERIES REK**



**SPECIFICATIONS:**

- Available in SPST and SPDT
- Extremely compact design
- Crisp, consistent tactile feel
- Installable on customer-designed printed circuit boards (edge connections or pin connections)
- Graphics available upon request
- Actuating method can be custom designed or use a choice of standard button colors: black, white, red, blue, green, orange, grey and yellow.

| | |
|---|---|
| Wattage Capacity | 250mW (Series REK) |
| Voltage | 25 V. (Series REK) |
| Current | 20mAdc |
| Contacts | Silver or Gold |
| Contact Resistance | ⩽ 100m (Series REK) |

| | |
|---|---|
| Contact Bounce | .1 Millisec. Max. |
| Operating Force | 100 Grams |
| Travel | .03 in. |
| Life | $10^6$ Cycles @ 10mA |
| Temperature Range | −20°C to +70°C |
| Total Button Travel | 0.8 mm |
| Pre-travel | 0.4mm |

Due to continuing research and product technology, specifications are subject to change without notice.

ITT ITT Schadow inc

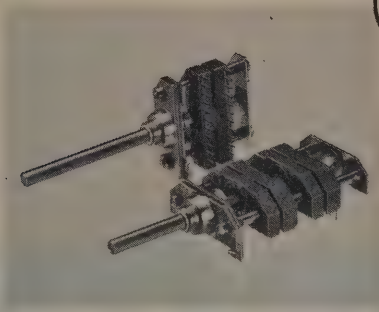
**8081 Wallace Road, Eden Prairie, MN 55344 • 612/944-1820 • TWX 910-576-2469 • TELEX: 29-0556**

Manufacturing facilities in Minneapolis, Minnesota; Einbeck, W. Germany; W. Berlin and Dole, France

In Canada: ITT Components, 4001 Chesswood Drive, Downsview, Ontario M3J2R8 • 416/630-7971 • Telex 06-22703

# The Flat Switch SBL11

SCHADOW™



A low profile multiposition switch specially designed for printed circuit applications

Specially constructed to enable direct soldering into printed circuit boards

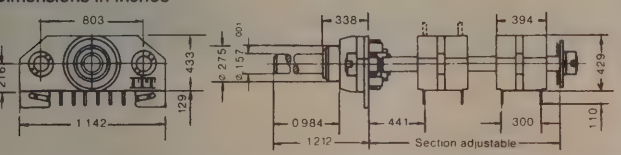
Movable sections allow flexibility in circuit layout and overcome PC-tolerances

Insert moulding provides an effective seal against flux

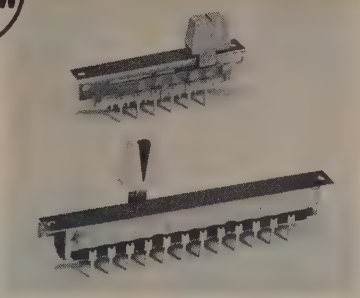
Available from 1-6 poles in combinations up to 5 adjustable sections

- Low profile switch, less than .045" high, especially suitable for plug-in units
- Compatible with IC's in pin configuration
- High quality materials ensure a long mechanical life
- Stable contact resistance with silver (standard) or gold alloy contacts
- Shorting and non-shorting versions available

Dimensions in inches




# Slide Switch CL Series



Multiposition slide switches with 3 frame sizes for maximum of either 6, 12 or 24 contact positions.

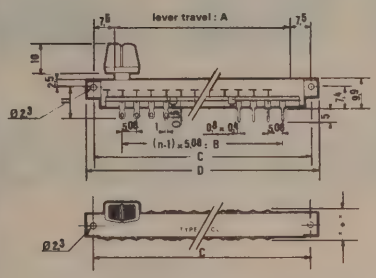
- Terminations for wiring or Printed Circuit Board mounting.
- Semi-Professional Silver Plated Brass Contacts. Life Expectancy: 15,000 operations.
- Professional 3 µ Gold Colbalt Contacts. Life Expectancy: 50,000 operations.

2 to 6 positions:
1 to 3 circuits

2 to 12 positions:
1 to 6 circuits

2 to 24 positions:
1 to 12 circuits (only PCB)

Dimensions in mm's

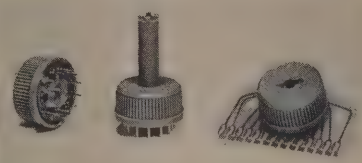


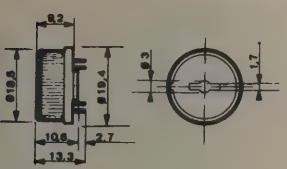

| | A | B | C | D |
|---|---|---|---|---|
| CL 6 | 30,5 | 25,4 | 45,5 | 50 |
| CL 12 | 61 | 55,88 | 76 | 80,5 |
| CL 24 | 121,9 | 116,84 | 136,9 | 141,5 |

# Rotary Switches RBP 12 Series

A miniature printed circuit board mounting rotary switch with index and contacts contained within a single moulded plastic case.

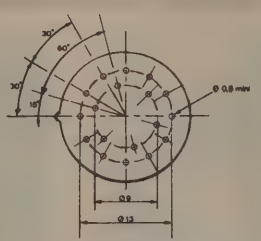
P.C. board is available permitting connection to mother board.



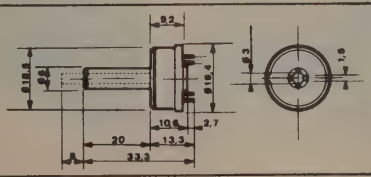


**RBP 12 F**

For manual operation adjusted with screwdriver.



**Pin configuration**



**RBP 12 AD**

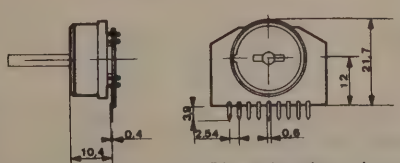
Hollow shaft Ø6 mm to accept Ø3 mm inner shaft.

**RBP 12...P**

P.C. board is available permitting connection to mother board on RBP 12 F, AD.

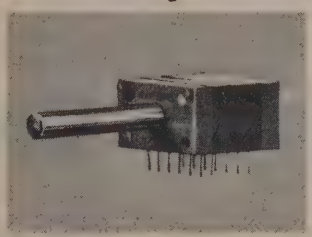
Example: 1 RBP 12 FAP.

Several other variations available.



Dimensions in mm's

# Rotary Switches MIL Series



The MIL is a rotary modular switch designed for printed circuit boards. As easy to connect as any other PCB mounting component.

The placing of your switch can be decided to exactly match the available space on your printed circuit board independent of the position of the control knob.

**Modular**

Through the choice of assembly of basic switch modules:

— either in line,
— or in L formation (5 modules max.),
— or with modules fixed or sliding on the shaft,
— or with spaced out modules linked by the control shaft which passes above other components on the board.

**Miniaturization**

The very reduced dimensions (17,78 x 17,78 x 10,5 mm) enable it to be mounted on closely spaced printed circuits in racks leaving space for other components.

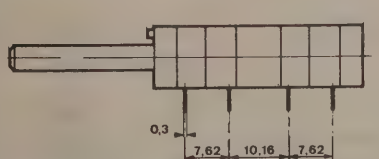
**Sealed construction**

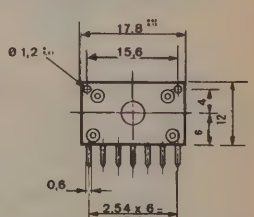
Designed for use on printed circuit boards, the MIL is totally sealed. After mounting it can be subjected to the cleaning of the PCB in a freon bath with ultrasonic vibration, it will withstand 21 days under humidity test and will resist corrosive environments.

**Reliability**

The mobile double contact, together with exceptional sealing, guarantees excellent performance as well as very high reliability.

Dimensions in mm's



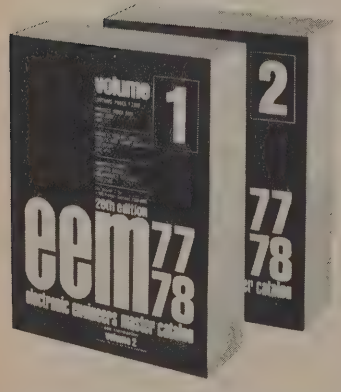

ITT ITT Schadow inc
8081 Wallace Road, Eden Prairie, MN 55344 • 612/944-1820 • TWX 910-576-2469 • TELEX: 29-0556
Manufacturing facilities in Minneapolis, Minnesota; Einbeck, W. Germany; W. Berlin and Dole, France
In Canada: ITT Components, 4001 Chesswood Drive, Downsview, Ontario M3J2R8 • 416/630-7971 • TELEX: 06-22703

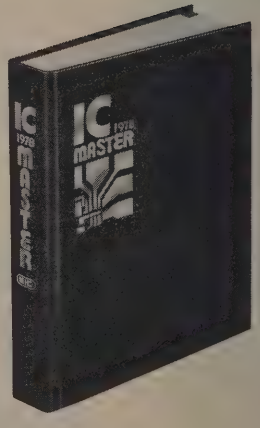
# we know

## 41 years of experience in

## United

## Electronics Division






**eem/ELECTRONIC ENGINEERS MASTER CATALOG —**

The "blue-ribbon" catalog/directory that has become "the standard of the industry" for electronic engineers, buyers and specifiers.

**ELECTRONIC ENGINEERS CATALOGUE —**

The new catalogue/directory of electronic products available to and from Western Europe and the United Kingdom. Designed especially for the European electronics engineer.

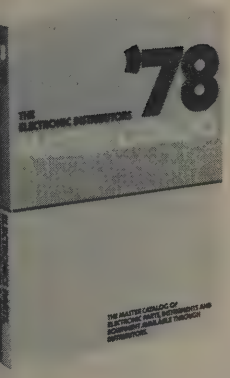
**IC MASTER AND THE UPDATES —**

The only complete single-source directory including all IC devices manufactured in the United States. Updated three times yearly with accumulative supplements.

# our stuff...

## cataloging, 21 editions of eem

## Technical Publications




**tronic Distributors**
**TER CATALOG —**

nly national catalog designed sively for distributors and their mers featuring electronic parts, uments and equipment.

**ELECTRONIC PRODUCTS MAGAZINE —**

The products magazine . . . A 100% product-oriented magazine including hundreds of new products and special features every month.

**eem FILE SYSTEM —**

The only filing system designed especially for the electronics engineer. Instant retrieval and organization of data sheets and catalogs.

**UNITED COST AND PRICING SERVICES —**

The electronic distributors' proven method of being up to the minute on his cost and selling prices.

**UTP CUSTOM CATALOGS —**

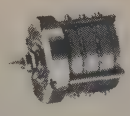
The Cadillac of individualized catalogs for the electronic parts distributor, featuring solely his lines and services.

ited Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Avenue, Garden City, New York 11530 / 516 222-2500

# JANCO CORPORATION

## Series "A" MINIATURE ROTARY SELECTOR SWITCHES

**Series A-15** — 15°

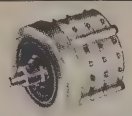


ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

Max. Positions: 24
Body Diameter: 2″

6-1900 Series 1 pole/deck
6-1912 Series 2 pole/deck
6-1980 Series 3 pole/deck
6-1914 Series 4 pole/deck
6-1913 Series 6 pole/deck

**Series A-20** — 20°

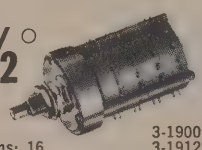


ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

Max. Positions: 18
Body Diameter: 2″

Available only in single pole per deck construction.

**Series A-22** — 22½°

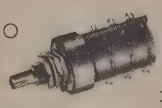


ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

Max. Positions: 16
Body Diameter: 1.5″

3-1900 Series 1 pole/deck
3-1912 Series 2 pole/deck
3-1914 Series 4 pole/deck

**Series A-30** — 30°



ELECTRICAL RATING:
2 amps 115 v ac Res.
1 amp 28 v dc Res.
0.5 amp 28 v dc Ind.

Max. Positions: 12
Body Diameter: 1.036″

1905 Series 1 pole/deck
1-1909 Series 2 pole/deck
4-1900 Series 3 pole/deck
67-1940 Series 4 pole/deck
67-1900 Series 6 pole/deck

**Series A-36** — 36°

ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

Max. Positions: 10
Body Diameter: 1.036″

1900 Series 1 pole/deck
1960 Series 2 pole/deck

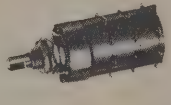
**Series A-45** — 45°

ELECTRICAL RATING:
5 amps 115 v ac Res.
5 amps 28 v dc Res.
2.5 amps 28 v dc Ind.

Max. Positions: 8
Body Diameter: 1.036″

1906 Series 1 pole/deck
1-1910 Series 2 pole/deck

**Series A-60** — 60°

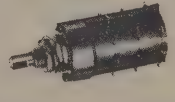


ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

Max. Positions: 6
Body Diameter: 1.036″

Available only in single pole per deck construction.

**Series A-90** — 90°



ELECTRICAL RATING:
5 amps 115 v ac Res.
5 amps 28 v dc Res.
2.5 amps 28 v dc Ind.

Max. Positions: 4
Body Diameter: 1.036″

Available only in single pole per deck construction.

## Series "B" MICRO-MINIATURE ROTARY SELECTOR SWITCHES

• TOTALLY ENCLOSED • EXPLOSION PROOF
• UNITIZED CONSTRUCTION

All switches offer maximum protection against radio frequency interference.

Body Diameter: .623″

Electrical Rating Continuous:
8 amps at 28 v dc

Switching Rate:
0 to 0.25 amp resistive
0 to 28 v dc
0 to 0.25 amp resistive
0 to 115 v ac
0 to 0.12 amp inductive
0 to 28 v dc

Torque: 5 to 9″ ounces

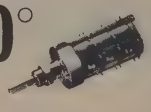
Contact Resistance:
.005 ohms average

Insulation Resistance:
100,000 megohms minimum at 100 volts

10,000 megohms minimum at 500 volts

Designed and Built to meet the environmental and functional requirements of MIL-S-3786

**Series B-30** — 30°



Max. Positions: 12

2500 Series 1 pole/deck
2530 Series 2 pole/deck
2531 Series 3 pole/deck

"M" SERIES

2500M Series 1 pole/deck
2530M Series 2 pole/deck
2531M Series 3 pole/deck

**Series B-36** — 36°

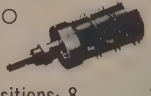
Max. Positions: 10

1-2500 Series 1 pole/deck
1-2530 Series 2 pole/deck

"M" SERIES

1-2500M Series 1 pole/deck
1-2530M Series 2 pole/deck

**Series B-45** — 45°



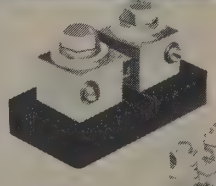
Max. Positions: 8

2-2500 Series 1 pole/deck
2-2530 Series 2 pole/deck

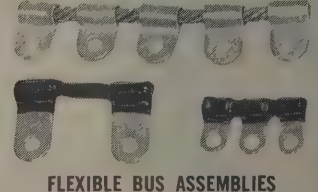
"M" SERIES

2-2500M Series 1 pole/deck
2-2530M Series 2 pole/deck

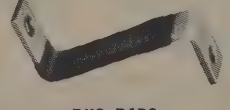
## ELECTRICAL HARDWARE PRODUCTS FOR AIRCRAFT



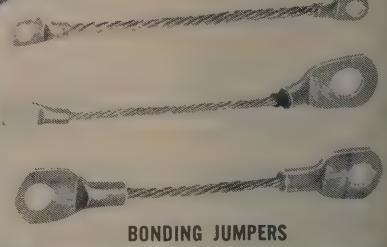
EXTERNAL AMMETER SHUNTS MIL-S-61-B



FLEXIBLE BUS ASSEMBLIES



BUS BARS



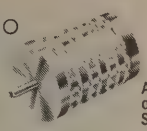
BONDING JUMPERS

**JANCO CORPORATION**

Box 3038 • Burbank, CA 91504 • 3111 Winona Avenue • (213) 849-2107 • (213) 845-7473 • TWX 910-498-2701

# Series "C" ROTARY SELECTOR SWITCHES

**Series C-22** — 22½°



Max. Positions: 16
Body Diameter: 3″

**ELECTRICAL RATING:**
10 amps 115 v ac Res.
10 amps 28 v dc Res.
6 amps 28 v dc Ind.

Available only in single pole per deck construction.
Screw terminals only.

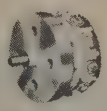
**Series C-30** — 30°

Max. Positions: 11 plus off
Body Diameter: 2.180″

**ELECTRICAL RATING:**
10 amps 115 v ac Res.
10 amps 28 v dc Res.
5 amps 28 v dc Ind.

Available in 1 and 3 poles per deck construction.
Screw terminals only.

**Series C-36** — 36°

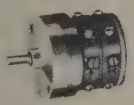


Max. Positions: 9 plus off
Body Diameter: 2.375″

**ELECTRICAL RATING:**
10 amps 115 v ac Res.
10 amps 28 v dc Res.
5 amps 28 v dc Ind.

Available only in single pole per deck construction.
Screw terminals only.

**Series C-45** — 45°



Max. Positions: 7 plus off
Body Diameter: 1.93″

**ELECTRICAL RATING:**
10 amps 115 v ac Res.
10 amps 28 v dc Res.
5 amps 28 v dc Ind.

Available in 1 and 2 poles per deck construction.
Screw terminals only.

**Series C-90** — 90°

Max. Positions: 4
Body Diameter: 2.12″

Screw terminals only.

**ELECTRICAL RATING:**
**1 pole construction**
15 amps Res. 115 v ac
15 amps Res. 28 v dc
10 amps Ind. 28 v dc
**2 pole construction**
7.5 amps Res. 115 v ac
7.5 amps Res. 28 v dc
5 amps Ind. 28 v dc

## GENERAL SPECIFICATIONS

**All switches offer maximum protection against radio frequency interference.**

**ELECTRICAL RATING:**
Carry 10 amps continuous.
Make and Break — see individual switch data.

**VOLTAGE DROP:**
0.1 volt or less at rated amperage.
Initial Contact Resistance: .003 ohm.

**LIFE:**
10,000 double cycles make and break rated amperage.

**TORQUE:**
1 to 3 inch lbs.

**SWITCHES DESIGNED AND BUILT IN ACCORDANCE WITH THE FOLLOWING SPECS.:**
MIL-S-6807 (rotary switches enclosed)
MIL-S-3786 (rotary switches)
MIL-E-5272 (environmental testing)

**ON MOST OF THE SWITCHES LISTED, THE FOLLOWING FEATURES ARE AVAILABLE:**

- O-ring Shaft and Panel Seal
- Combination of Decks
- Bridging contacts
- Momentary positions
- Isolated positions
- Adjustable stops
- Solenoid driven
- Keylock
- Gang switches
- Concentric shaft switches

# JANCO CORPORATION

# Series "D" PUSHBUTTON ROTARY SWITCHES

**FEATURES:** • Totally enclosed, explosion proof. • Printed-circuit construction. • Black or white numbers on black or white background indicate switch positions (black numbers on white background for lighted switches). • All standard codes available. Available in 8, 10, 12 or 16 positions. • Plastic covered buttons, available in black, red, green, yellow, white or blue.

### BI-DIRECTIONAL

| Index | Series | No. of Positions |
|---|---|---|
| 45° | D45B | 8 |
| 36° | D36B | 10 |
| 30° | D30B | 12 |
| 22½° | D22B | 16 |

SERIES 2800 QPL to MIL-S-22710/18

### UNI-DIRECTIONAL

| Index | Series | No. of Positions |
|---|---|---|
| 45° | D45U | 8 |
| 36° | D36U | 10 |
| 30° | D30U | 12 |
| 22½° | D22U | 16 |

SERIES 2900M QPL to MIL-S-22710/23

### PERFORMANCE DATA:

**ELECTRICAL RATING CONTINUOUS:**
3 amps

**MAKE AND BREAK**
.125 amp res. at 28 v dc and 115 v ac
.05 amp ind. at 28 v dc

**PUSH FORCE:**
55 oz. max.

**CONTACT RESISTANCE:**
Initial .100 ohms
After life .160 ohms

**LIFE:**
50,000 cycles
Cycle consists of 720° rotation

**INSULATION RESISTANCE:**
5,000 megohms

**ALTITUDE:**
70,000 ft.

**TEMPERATURE RANGE:**
−65°C to +85°C

**PLUNGER TRAVEL:**
.180 approx.

**DIELECTRIC STRENGTH:**
750 volts RMS

**WEIGHT:**
½ oz. approx.

**Designed to meet the requirements of MIL-S-22710**

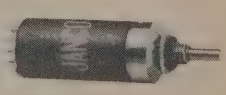
## TYPICAL UNIQUE APPLICATIONS OF JANCO ROTARY SWITCHES

**MINIATURE PIN-TYPE ROTARY SWITCHES**
For printed circuit boards and front panel mounting. Various numbers of positions and poles.

**MINI CODE SWITCHES**
Intended to be used with card racks on ½″ centers, the unit measures ⅜″ high. Can be lighted.

**SINCE 1947 . . . JANCO has solved thousands of switching problems! For a quick solution to your specific problem — call JANCO direct.**

**FOR "DRY" CIRCUIT SWITCHING**
To interface with low level and "dry" logic circuits. Available in a variety of detent angles and output codes.



**MASTER COMMUNICATIONS SELECTOR SWITCH**
Provides standard coded outputs and offers unique switching functions. Only .675″ in diameter.

**JANCO CORPORATION**
Box 3038 • Burbank, CA 91504 • 3111 Winona Avenue • (213) 849-2107 • (213) 845-7473 • TWX 910-498-2701

# LEDEX PUSH BUTTON CONTROLS

When your product demands the best switch the industry has to offer, examine the good looks and fine touch of a long lasting Ledex push button switch.

You can combine logic level switching (10 mA/5VDC) and high current switching (6A/250VAC) on one ganged switch.

You can get more interrelated options than any other similar switch available today—momentary, push/push, reciprocal release, master release, interlock, and emergency "all off" as required.

You can also get the most reliable delivery scheduling in the industry.

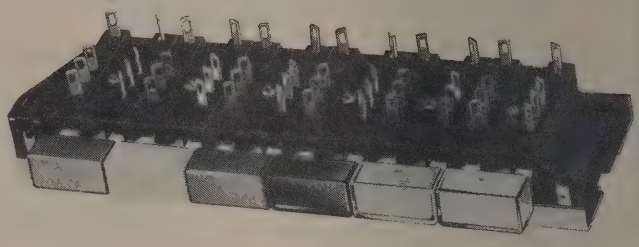
Test a pre-production prototype. Ask for our Push-Button catalogs.

SPECIFICATIONS

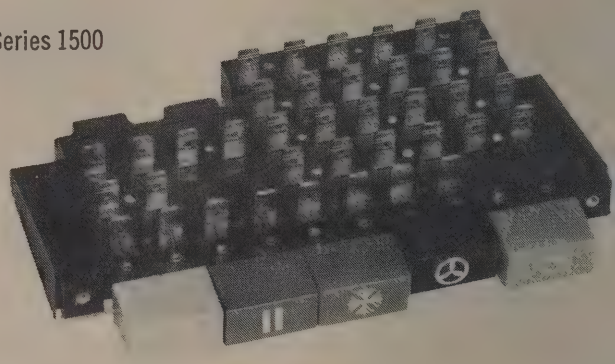
| Series | 1400 | 1500 | 1700 | 1800 |
|---|---|---|---|---|
| Module Capacity | 1-20 per frame | 1-15 per frame | Single Unit | 1-20 per frame |
| Rating | 4A/125VAC<br>2A/250VAC | 16A/250VAC | 4A/250VAC | 10mA/5VDC<br>6A/250VAC |
| Contact material | Silver (STD.)<br>Gold (Optional) | Silver plated brass | Copper/Silver alloy | Silver plated brass |
| Terminals | Solder or P.C. | Spade | Solder | Solder or P.C. |
| Illumination | 6, 12, 24V lamps | Nonilluminated | 6, 12, 24V lamps | 2, 12, 24V lamps<br>Single or dual |
| Cap size | ⅜" x ¾"<br>¾" x ¾" | .49" x .97" | .709" dia.<br>.709" x .709"<br>.709" x .945" | ⅜" x ¾"<br>7/16" x ¾"<br>¾" x ¾" |
| Cap Colors | Red, Yellow<br>Green, Blue<br>Black, Grey<br>White, Clear | Red, Yellow<br>Green, Blue<br>Black, White<br>Light & Dark Grey | Red, Yellow<br>Green, Blue<br>Clear | Red, Yellow<br>Green, Blue<br>Black, Grey<br>White, Clear,<br>split screens |
| Legends | Hot stamp<br>Engraved<br>Film inserts | Hot stamp<br>Engraved | Film insert | Hot stamp<br>Engraved<br>Film inserts |
| Function | Momentary<br>Push/push<br>Reciprocal release<br>Master release<br>Reciprocal + Master release<br>Interlock | Momentary<br>Push/push<br>Reciprocal release<br>Master release<br>Reciprocal + Master release<br>Interlock | Momentary<br>Push/push<br>Keylock | Momentary<br>Push/push<br>Reciprocal release<br>Master release<br>Reciprocal + Master release<br>Interlock |
| Switching per module | 2P2T<br>Non-shorting | 1NO 3NC thru 4NO 1NC<br>Non-shorting | 1P2T thru 3P2T<br>Non-shorting | Lo-level to 4P2T<br>Hi-level to 1NO 2NC |

License rights by RAFI of West Germany

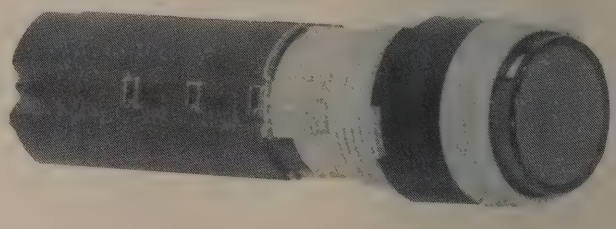
Series 1400



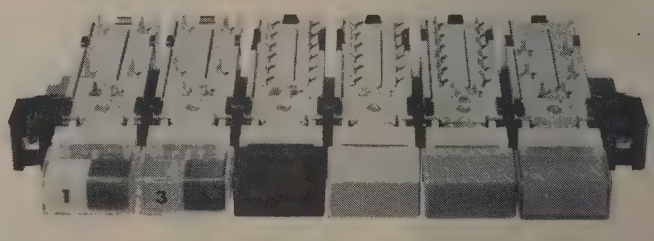
Series 1500



Series 1700

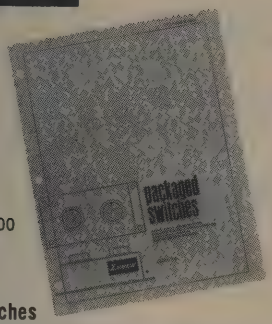


Series 1800



LEDEX
126 Webster Street,
Dayton, Ohio 45401
Phone: (513) 224-9530

# STEPPING SWITCHES/CIRCUIT SELECTORS

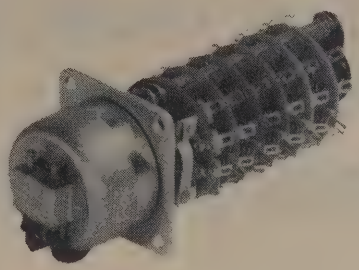



Catalog B-3200

**Packaged Switches**
Catalog B-3200 provides design guidelines for specifying and using hermetically sealed switches where high reliability requirements or harsh environmental conditions are factors that the designer must consider in the application.

Several stock models, including compact 5 pole 2 throw, 49 pole 2 throw, and 39 pole 3 throw switches, are available for immediate delivery. Circuit diagrams and various switch control methods are given for each of the ten stock models shown.

Custom engineered programmers, variable intervalometers, controllers and management systems are provided as examples of how packaged switches can be tailored to meet a wide range of exacting requirements.



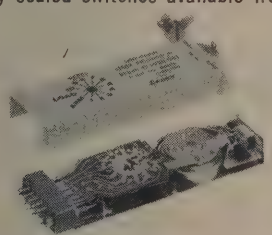
**Ledex Stepping Switches**
Used for relays, transfer switching, remote control of predetermined circuit patterns, remote sequencing of complex switching arrangements, or in programming checkout and sequential operations. They are known best for their ability to perform multiple switching functions reliably, in limited space, and under severe operating and environmental conditions. Available in open construction, prewired modules or as packaged control solutions.

**Ledex Hermetically Sealed Switches**
Engineered to withstand severe shock and vibration, such as encountered in aircraft, missile and military applications, and to provide added switching reliability in adverse environments. Used extensively in aerospace and underwater guidance controls, as mode selectors, in rocket firing devices, and in a variety of military control functions that demand a high degree of reliability. There are 13 models available from the shelf.

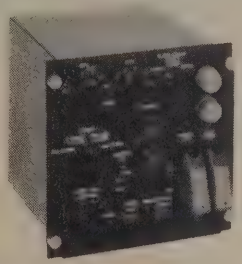
## LEDEX PACKAGED CONTROL SOLUTIONS

Here are examples of Ledex Stepping Switches designed into compact, reliable control packages that combine the best characteristics of solid state and electromechanical technologies.

Whether your problem involves armament controls or commercial control functions, there's a good chance Ledex has already solved a similar problem. Our Packaged Switches Catalog, B-3200, shows several more detailed examples and also includes specifications for 13 hermetically sealed switches available from the shelf.



**Miniaturized Armament Control Intervalometer**
Flat, compact, 12-position stepping switch measures only ½" x 1¼" x 4¼", fires 19 rockets, sequentially in pairs. It includes a Ledex pulser to control time intervals over mil-spec. temperature and voltage ranges.



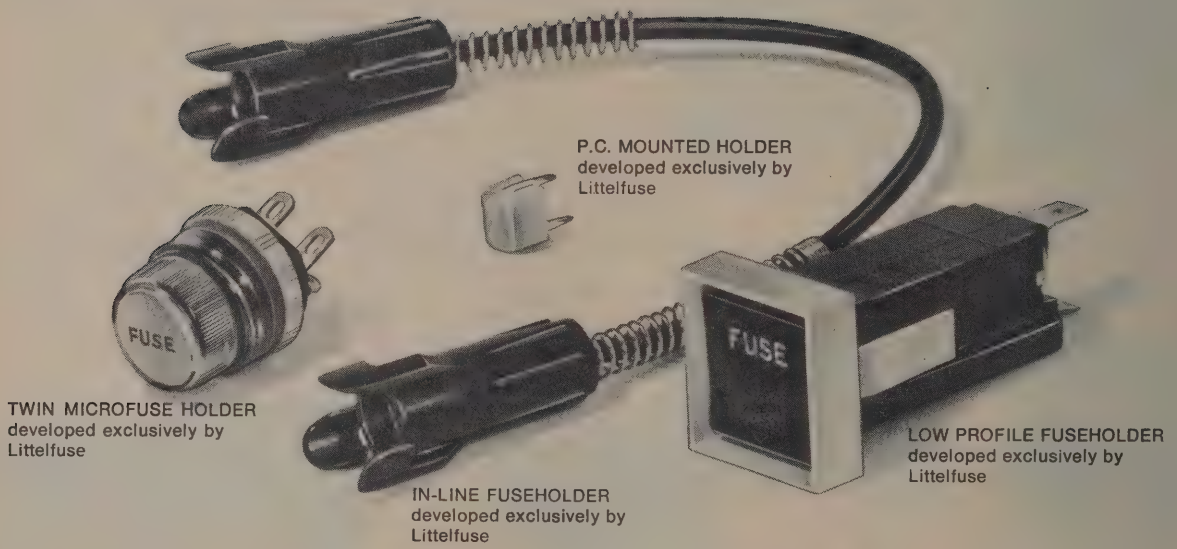
**Dual Channel Flare/Chaff Dispenser Programmer**
An all electronic dispenser, except for mechanical counters, allows programming of rate and quantity for flare or chaff dispensing by independent or simultaneous channel operation. Output pulses of up to 10 amperes per channel drive the electromechanical distributor switches located elsewhere in the aircraft. This state of the art experience can also be put to use in commercial applications as well as military. Let us interface your requirements with a "black box" solution.

**Universal Stores Dispenser Intervals Variable on Digital Basis**
All solid state and among the most flexible of Ledex intervalometer designs, this one permits the pilot to vary release intervals to any rate ranging from 30 ms to 9.99 seconds in increments of 10 ms. It includes a stepping switch to distribute sequential fire commands. Timing tolerance is ±10% over a voltage range of 22 to 32 volts and temperature to −55°C to +85°C. The package includes built-in suppression to protect solid state circuitry when switching inductive loads.

For engineering assistance and technical literature, write or phone:

**LEDEX INC.**
126 WEBSTER STREET, DAYTON, OHIO 45401
PHONE: (513) 224-9530

# At Littelfuse we don't just meet your Circuit Protection needs –we anticipate them.




P.C. MOUNTED HOLDER
developed exclusively by Littelfuse

TWIN MICROFUSE HOLDER
developed exclusively by Littelfuse

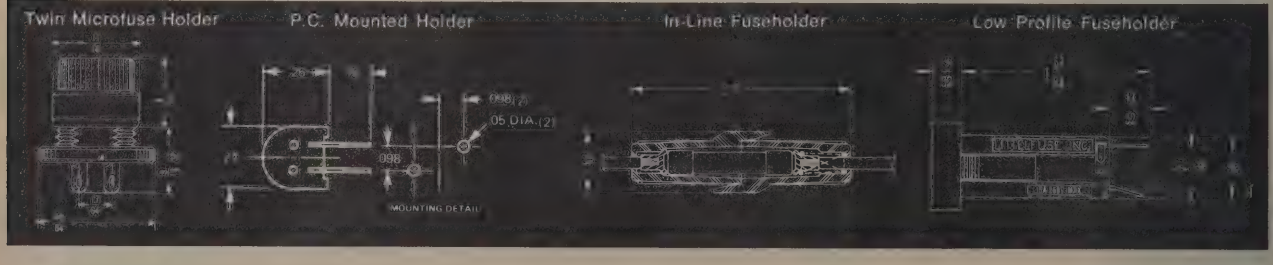
IN-LINE FUSEHOLDER
developed exclusively by Littelfuse

LOW PROFILE FUSEHOLDER
developed exclusively by Littelfuse

But that should come as no surprise. Since 1927, Littelfuse has provided the electronic industry with a complete line of fuses, fuseholders, circuit breakers, switches, and relays. Whatever a customer's need, we have a quality product to satisfy it.

But Littelfuse has to do more than keep up with the industry—we have to stay ahead of it. Our research and development engineers are constantly designing and testing to create tomorrow's products—more advanced, more streamlined, more versatile. Low-Profile Snap Mount fuseholders, P.C. Board fuseholders, Twin Microfuse holders, "Twist-Lock" In-Line fuseholders—these are just a few of the products developed exclusively by Littelfuse.

For detailed information on the complete line of Littelfuse products, write for Catalog #19. Or contact our representative or authorized Littelfuse distributor in your area. He will be glad to help you determine your immediate needs—and to help you plan for tomorrow's.



# Littelfuse– *first in design and innovation*

**P.C. Mounted Holder — 281007**
A low-profile, plug-in fuseholder accommodating Littelfuse picofuses and microfuses. Edge-mounted, the holder permits easy and rapid fuse removal and replacement. Rated at 5 amps to 125 volts.

**Twin Microfuse Holder — 280021**
A versatile twin or single circuit holder for space-tight applications. Accepts two microfuses or a combination of micro and picofuse. Rated at 5 amps to 125 volts.

**In-Line Fuseholder — 155100**
A low-cost holder with "twist lock" allowing easy fuse extraction and replacement. Accepts all ¼" x 1¼" fuses and SFE fuses to 20 amps. Available in black, transparent or six other standard colors.

**Low Profile Fuseholder**
Square cap fuseholder snaps into chassis, eliminating need for mounting hardware. The cap snaps open for quick and easy fuse insertion and removal. Aesthetically styled to complement modern instrument panels, the holder is available in several color combinations.

**HOW TO ORDER LOW PROFILE FUSEHOLDERS**
Six digit number is a coded description of fuseholder

| 348 | 6 | 4 | 5 |
|---|---|---|---|
| A | B | C | D |

A Series Number **348** for 3AG Standard fuses.

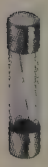
B Terminal Style: **6,** 3/16" w. quick-connect and solder type; **8,** ¼" w. quick-connect and solder type.

C Bezel Color: Specify **1,** red; **2,** green; **3,** yellow; **4,** blue; **5,** white; **7,** black; **9,** gray.

D Cap Color: Specify **1,** red; **2,** green; **3,** yellow; **4,** blue; **5,** white; **7,** black; **9,** gray.

**NOTE:** To order a cap assembly **only,** use **348** series number and insert a **0** in the terminal style and bezel color locations (**348 001**). To order a body assembly **only,** use 348 and insert a **0** in the cap color location (**348 850**).

## Littelfuse offers more than 6,000 kinds of fuses, fuseholders, circuit breakers, switches, and relays, including the following:



¼" dia. x 1¼" long 3AG fuses for electronic circuit protection applications.

**311 Series**
Glass tube. Medium-acting for automobiles, radios, amplifiers, etc. 4-30 amps.

**312 Series**
Glass tube. Fast-acting for general fuse protection. 1/100-10 amps.

**313 Series**
Glass tube. Slo-Blo. Designed to withstand momentary high-current surges but to open quickly on sustained overloads. 1/100-30 amps.

**314 Series**
Ceramic tube. High interrupting capacity up to 10,000 amps at 250 volts. 1/8-30 amps.

All fuses shown above can be supplied with pigtail leads for "Soldered In" applications. Similar electrical performance also available in 9/32" x 1-1/4" and 13/32" x 1-1/2" Fuses.

**342 (000) Series**
3AG Miniature, Space-saving Panel Fuseholder. Rated at 20 amperes to 250 volts.

**341 (000) Series**
3AG Panel Fuseholder with screw driver slot knob. Rated at 15 amperes to 250 volts.

**342006**
3AG Watertight Panel Fuseholder. Rated at 20 amperes to 250 volts.

**344 (000) Series**
3AG Indicating Fuseholder for visual display of blown fuse. Two lens styles available. Rated at 20 amperes to 250 volts.

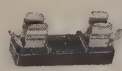
**340251**
3AG Shielded Fuseholder. Eliminates radio frequency interference. Rated at 30 amperes to 250 volts.

**Subminiature Picofuse**
9/32" long x 3/32" dia. Axial leads—275 (000) Series. Radial leads—276 (000) Series. 1/16-15 amps to 125 volts.

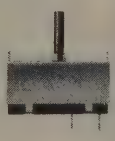
**Subminiature Microfuse**
Plug-in or pigtail types with transparent or metal caps. 10,000 amp short circuit capacity. 1/500-5 amps to 125 volts.

**Subminiature Fuseholder**
For picofuse and microfuse. Available in standard, indicating, or R.F. shielded types.

**Fuse Clips**
Available with solder lugs, with and without fuse stops and for printed circuit board mounting.



**Fuse Blocks**
Open fuse mountings with solder, screw or quick connect terminals. 1-12 poles.



**Circuit Breakers**
Manual reset breakers. Rated currents 4/10-4.1 amps to 250 volts.

**Switches**
Momentary action SPST switches. Rated at 5 amps-125 volts or 2.5 amps-250 volts.

**Relays**
Low voltage power relays for automotive, marine and recreational vehicle applications.

LF

LITTELFUSE® SUBSIDIARY OF Tracor

800 EAST NORTHWEST HIGHWAY • DES PLAINES, ILLINOIS 60016 • PHONE: (312) 824-1188

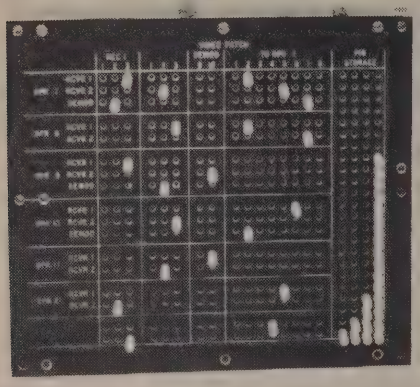
# LVC INDUSTRIES INC.

CO-ORD SWITCH · BLOC-LITE DIVISIONS

135-25 37th AVE • FLUSHING, NEW YORK 11354 • (212) 939-9777

MATRIX BOARDS
SLIDE SWITCHES
LIGHT INDICATORS

# MATRIX PROGRAM BOARDS



CO-ORD Matrix Program Boards are composed of 2 to 10 decks of contacts that are bussed on .250 centers. The contact rows of one deck are usually oriented perpendicular to the rows of adjacent deck(s) so as to obtain switching crosspoints. Electrical connections of the bussed contact rows are effected by inserting shorting pins at the desired crosspoints; "CO-AX", phone plug type pins are available for networks which require component insertion (Diodes, resistors, etc.). Single board matrices of up to 11,000 crosspoints are available in standard or special arrangements. Bussed and isolated contacts can be had alone or in combination. Panels may be screened, engraved, or fitted with pre-punched templates for rapid program changing.

U. S. Patent No. 3,349,361

## APPLICATIONS

- Computer memories
- Cordless patch panels
- Function generators (Analog/Digital)
- Power distributors
- Thermocouple signal selectors
- Circuit/Component test programmers
- Lighting systems (Special effects)
- Variable sequence selectors
- Variable diode matrices
- Code generators
- Traffic control panels
- Decade switches
- Vending machine control
- Numeric controlled machinery
- Data channeling and logging
- Communications distributors

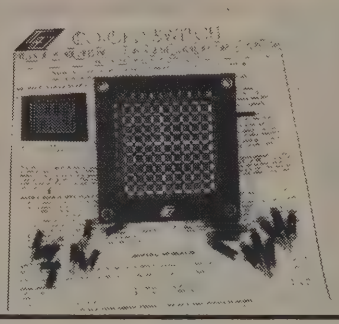
## FEATURES

- Closed entry contacts
- High mechanical environment capacity
- Low interlead capacitance
- Attractive and uncluttered
- Compact package
- Standard sizes available
- Permits insertion of components into network without soldering
- Wide variety of switching combinations

## SPECIFICATIONS

- Contact Resistance
  - a Total Pin Resistance: .004 OHM MAX.
  - b Volume Resistivity of Strip: .003 OHM/IN
- Breakdown Voltage: 1000 VRMS MIN.
- Current Capacity: 5 AMPS Continuous (up to 100 amps on special application)
- Materials:
  - a Plastic Parts: Black Phenolic XXX
  - b Flexible Contacts: Heat Treated Beryllium Copper
  - c Terminals: Brass
  - d Finishes: Gold, Silver or Nickel

## PROGRAM BOARD KITS



KIT BPS-1 consists of a 10 x 10 matrix board similar to #63014-1, below. 10 shorting pins and 10 "CO-AX" diode pins with 1N4148's installed ..... **$30.00**

KIT BPS-2 is the same as BPS-1 but without diodes ..... **$25.25**

10 x 10 matrix board ..... **$20.00 ea.**

Shorting pin ..... .22 ea.

Diode pin w/1N4148 ..... 1.10 ea.

Diode pin w/o diode ..... .56 ea.

AVAILABLE FROM STOCK

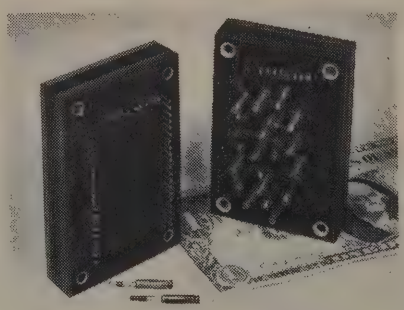
### STANDARD MATRIX BOARDS — SERIES 63014

| DASH | -1 | -2 | -3 | -4 | -5 | -6 | -7 | -8 | -9 |
|---|---|---|---|---|---|---|---|---|---|
| MATRIX | 10 x 10 | 10 x 15 | 10 x 20 | 10 x 25 | 15 x 20 | 15 x 25 | 20 x 20 | 10 x 50 | 25 x 25 |

AVAILABLE FROM STOCK. ADD DASH NO. (1 Thru 9) MATRIX SIZE.

## MINIATURE PROGRAM BOARD

.100 and .125 inch Center Line



TENTH INCH MATRIX
AT $.08 PER POINT

These Matrix Program Boards are designed to meet the increased technological requirements for miniaturization in electronic systems and equipment. They have all the same features of the larger matrices and can be supplied in from 2 to 4 decks of bussed contacts. Single matrix boards of up to 2500 crosspoints can be furnished in one solid unit, with rugged Shorting and CO-AX (diode) pins available for programming functions. A standard 2 deck matrix measures .315 inches thick from the front to rear panel; program pins are .280 inches long by .063 inches in diameter. Termination of the bussed contacts are to .040 diameter pin terminals, which allow the matrix to be plugged into mating female receptacles or connected to directly by wave, dip, or hard soldering. Contact resistance is only .005 ohms per crosspoint; breakdown voltage 600 VRMS; current capacity 3 amps continuous.

WRITE FOR YOUR NEW PRODUCT CATALOGUE

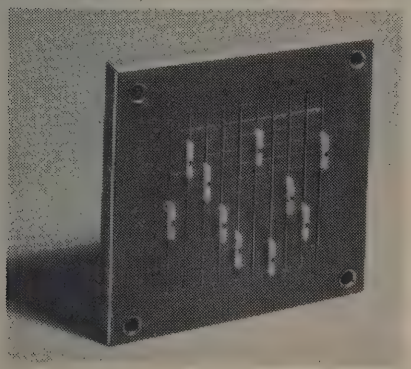
# LVC INDUSTRIES INC.

CO-ORD SWITCH · BLOC-LITE DIVISIONS

135-25 37th AVE. • FLUSHING, NEW YORK 11354 • (212) 939-9777

MATRIX BOARDS
SLIDE SWITCHES
LIGHT INDICATORS

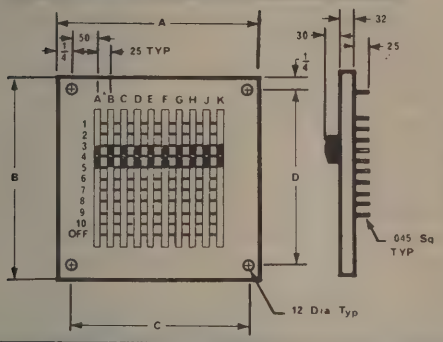
## MATRIX SLIDE SWITCHES



CO-ORD Matrix Slide Switches are designed to provide reliable, low cost matrix switching for applications requiring manual data entry operations. These simplified, versatile switches are available in various ranges of standard sizes, with capacities including up to 25 outputs per switching line. Each output is controlled by a separate contact slider which in turn can provide as many as 25 positions (variations). Special designed Matrix Slide Switches can be supplied with as many as 5000 switching positions.

Switching quality and reliability is achieved through such advanced designed features as; positive detent positioning resulting from the unique individual GSD (Guide-Slide-Detent) Housing, panoramic viewing of the switching functions facilitating rapid circuit selection and minimizing data entry error, rugged solid block closed construction containing each contact and slider in a basic unitized assembly, electrical and mechanical integrity assured through the use of only the highest quality materials.

Write for Bulletin 1474

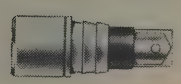



MATRIX SLIDE SWITCH — Series No. 85000-

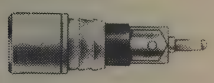
| DASH NUMBER | MATRIX SIZE | NUMBER OF SLIDERS | NUMBER OF POSITIONS | DIMENSIONS | | | |
|---|---|---|---|---|---|---|---|
| | | | | A | B | C | D |
| 1 | 10 X 10 | 10 | 10 | 3.75 | 3.75 | 3.25 | 3.25 |
| 2 | 10 X 20 | 10 | 20 | 3.75 | 5.75 | 3.25 | 5.25 |
| 3 | 20 X 10 | 20 | 10 | 6.25 | 3.75 | 5.75 | 3.25 |
| 4 | 20 X 20 | 20 | 20 | 6.25 | 5.75 | 5.75 | 5.25 |
| 5 | 25 X 25 | 25 | 25 | 7.50 | 6.75 | 7.00 | 6.25 |

NO. 85000-1 (10 x 10) 1 - 9 PIECES $28.00 EA.

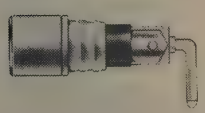
# MINI-BRITE "simplicity" in subminiature indicator lights



MINI-BRITE 75001 Panel Mount



MINI-BRITE 75002 Panel/Printed Circuit Mount



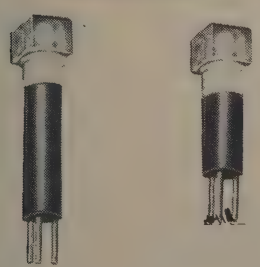
MINI-BRITE 75003 Printed Corcuit Mount

**MINI-BRITE** subminiature indicators have been engineered and are manufactured with the idea of achieving the ultimate in simplicity, standardization, reliability and cost reduction . . . this has been accomplished by the design of a unique housing and contact arrangement centered on the use of standard, wire terminal lamps . . . which provides light intensity comparable to units five times their size.
Conforms to MS90308. U. S. Patent #3,559,153

Write for Bulletin 1470

- **FRONT RELAMPABLE** just remove the snap on cap
- **STANDARD LAMPS** any T-1 lamp, wire lead type
- **EASY INSTALLATION** press housing into hole
- **WIRING OPTIONS** combination solder/female terminal
- **MOUNTING OPTIONS** panel mounted, panel/printed circuit
- **HIGH DENSITY PACKAGING** mount on .250 centers.

STANDARD OR SPECIAL CONFIGURATIONS



## MINI-TRANS subminiature Transistorized indicator lights

The MINI-TRANS series incorporates a silicon planar transistor, either NPN or PNP, which will turn on the indicator and provide an extremely bright indication from signal levels as low as 0.30 mA. In addition to standard circuits, specially designed physical and electrical configurations can be furnished to customer specifications. Units can be supplied with a built-in resistor of any standard value. This unique transistorized design capability is ideally suited when extremely low level signals are used for front panel indications, assuring long life and maximum brightness. A wide range of standard incandescent lamps are available to meet your requirements. Except for the increased length of the housing, these indicators are compatible and have all the features of the MINI-BRITE series.

Write for Bulletin No. 1470T

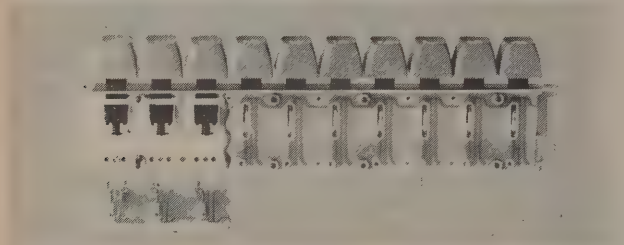
BLOC-LITE Lighting Devices • ANNUNCIATORS • LIGHT MATRICES • SPECIAL INDICATORS • DISPLAY PANELS • EDGE-LIGHTED PANELS

# Maxi-SWITCH KEYSTRIPS AND KEYBOARDS

The Maxi-Switch Company is a leading producer of pushbutton switch components and switch assemblies for the computer, photo-copy, business machine, automation and peripheral equipment industries.

The Maxi-Switch Keystrip construction technique facilitates the design and production of custom keyboards. Individual pushbutton stations may be purchased singly, in Keystrips, numeric blocks, or as completed Keyboards, with or without encoding circuitry. The wide range of features, options and accessories complement Keyboard adaptability.

## 1600 & 1800 KEYSTRIPS



**1600 KEYSTRIP**

Maxi-Switch Keystrips present a unique approach to switch construction. These modular units offer long mechanical life and high quality in readily available, off-the-shelf assemblies. Combinations of different contact types, contact forms and plunger actions may be used within a single Keystrip. Up to 20 or more stations may be accommodated per Keystrip with standard spacing of ⅝″ or ¾″ between stations. Other spacings are optionally available.

Standard Series 1600 and Series 1800 switches are equipped with glass reed contacts, and differ only in frame height and available options (1600—1.5″ high, 1800—1.1″ high). Contact options (1600 only) include cross-bar palladium leaf contacts and 15 ampere snap-action power contacts. Reset and lockout solenoids may also be used with Series 1600 Keystrips.

Individual reeds may be tied to a common bus on one side, or brought out to separate terminals, depending on the requirements of the application. The common bus feature saves component and mother-board space, and requires fewer solder connections.

## SPECIFICATIONS

### BUTTONS:

A variety of lighted and unlighted buttons available in several colors. Ask for Maxi-Switch Bulletin MS 2500 for information on buttons and Keystrip/Keyboard illumination.

### TERMINALS:

Printed circuit, pierced solder lug, plug-in male/female contacts, wire-wrap, .110 quick connect.

### CONTACTS:

Glass Reed, Form A or B, 28 VDC @ 250 Ma.

Cross-Bar Palladium leaf contacts, Form A, B or C (1600 only). 3 Ampere @ 28 VDC, 3 Ampere @ 115 VAC.

Snap Action Power Contacts (1600 only). 10 Ampere @ 250 VAC, ½ Ampere @ 125 VDC; or 15 Ampere @ 250 VAC, ½ Ampere @ 125 VDC.

### PLUNGER ACTIONS:

Momentary Contact (standard)
Interlatch and Lockout
Alternate Action (push-push)
Lockout Only
Key Motion Sensing
Cross-Bank Interlatch and Lockout

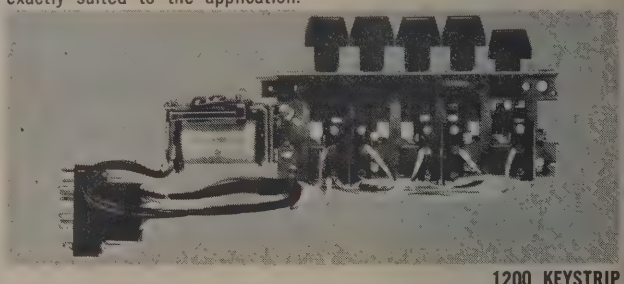
## 1200 & 1400 KEYSTRIPS

Series 1200 and 1400 Keystrips feature two-piece steel frames as the basic structure, with pushbutton components mounted between two frame halves.

Series 1200 and 1400 Keystrips may be lighted with one or two lamps per switch station (Form A lamp contact not available on 1400 switches with more than 3 bits). Midget groove T-1¾ bulbs are used. Lamp sockets may be furnished with solder lugs, AMP 78 Series taper tabs, 3″ pigtail lead wires, or with common bussing.

Series 1200 Keystrips provide circuit switching of up to 20 positions per keystrip. Many action options are available, and variations of standard design may be quickly accomplished using basic shelf stock for fast prototype and production service.

The range of available contact forms (A, AA, B, C or F), plunger actions, terminals and buttons allow the designer to specify switches which are exactly suited to the application.



**1200 KEYSTRIP**

Maxi-Switch offers the newest concept in binary coded decimal switching. Series 1400 switches represent a significant advancement in the development of simplified mechanical encoding techniques, eliminating the maze of contacts, diodes, and interconnections normally associated with switch encoding.

The Maxi Binary Switch will provide 3, 4, 5 or 6-bit binary output through snap-action contacts rated at 3 amperes, 300 watts, Form "A" (SPST/NO) or Form "C" (SPDT).

## KEYBOARDS

Maxi-Switch is one of the major suppliers of encoded keyboards for data terminals and other alpha/numeric data entry applications. Users may choose from a wide range of standard off-the-shelf versions such as ASR-33, ASR-37, APL 3270 and ANSI Standard. Smaller styles such as the popular 16-key encoded hex pad or 12-key, wired-only pad are also available at attractive prices.

Chances are Maxi-Switch can supply your keyboard need with a standard product, and that means a savings of both time and money. For specific information, ask your local Maxi-Switch representative for a standard keyboard catalog, or contact the factory directly. Maxi-Switch invests as much in good customer service as in innovative keyboard design. We try hard to do business on your schedule. If that sounds like a refreshing change, give Maxi-Switch a try.

The Maxi **standard** keyboard line includes several series, with many variations available within each.
Keyboard encoding may be standard USASCII or EBCDIC, or special codes as required. Standard data levels are provided. Keytops are available in a variety of sizes, styles, colors and languages. Custom legends supplied on request.

- **2900 Series:** Modular reed switch keyboards. Reeds are replaceable from the back of the circuit board should it ever be necessary. Modules in 1 through 6 stations. Proven to 100,000,000 operations.
- **4000 Series:** Low cost/high reliability solid-state keyboards with capacitive coupled switches. Latest breakthrough in keyboard technology. Long life, environmental resistance, and large capacitance change during switching to produce reliable switching.
- **6000 Series:** Low-cost mechanical switches with gold contacts. Cruciform keytop mounting. Low profile design.

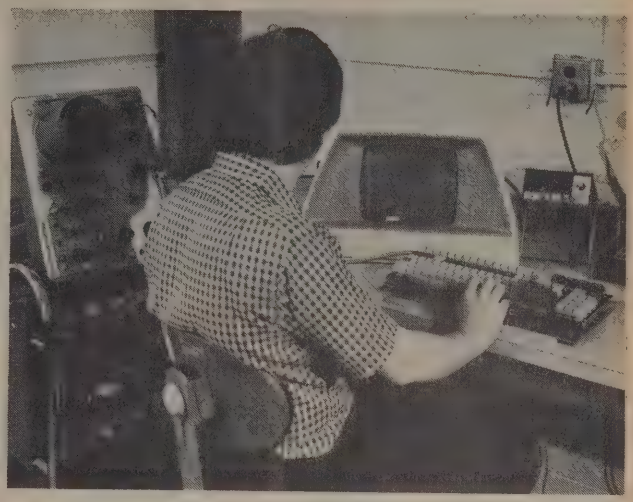
Maxi provides a **custom** keyboard design service. Using keyboard design kits available from local representatives (see index, back of this catalog for addresses) or direct from the factory, users may specify all keyboard parameters, including types and location of key switches, operating force, type of logic, code, button styles, colors and legends.

# SPECIFICATIONS

- **2900 Series** (sold only as part of a keyboard assembly)
  Ht. — 1.54″, including keytop
  Total Travel — .175″, ±.010″
  Operating Life — 100 million (typical load)
- **4000 Series** (sold as complete keyboard only)
  Ht. — 1.45″, including keytop
  Total Travel — .165″, ±.010″
- **6000 Series**
  Ht. — 1.220″ including keytop
  Total Travel — .120″, ±.027″
  Operating Life — 10 million (typical load)

# PRODUCT DEVELOPMENT

Maxi engineers are devoted to an on-going program of innovation in keyboard design. For example, Maxi is currently the only major keyboard manufacturer to offer mechanical, reed and solid-state keyboards. New products are continuously introduced to help the company stay abreast of rapidly expanding needs in the information processing industry. Watch for regular product announcements resulting from this developmental commitment.



# ENGINEERING/QC

Maxi-Switch engineers have extensive experience in the design and development of custom keyboards for special applications. Their logic and keyswitch designs are subject to rugged life tests, and finished keyboards must pass rigid quality control procedures at several stages of production. Final keyboard checkout insures that each unit performs under load and is thoroughly tested to meet customer specifications.

# MANUFACTURING

All Maxi-Switch keyboard and keystrip products are manufactured in a new and modern facility in suburban Minneapolis. In-house capabilities include keyboard design and layout, automatic soldering, keyswitch molding, metal stamping and automated assembly. Skilled technicians man the production assembly lines, using only the best in components and materials.

THE Maxi-SWITCH CO.
DEPT. EM, 9697 EAST RIVER RD. • MINNEAPOLIS, MN 55433
(612) 755-7660

# CIRCUIT PROTECTION

**LIGHTNING / TRANSIENT SURGE / PROTECTION**

## AC POWER LINE PROTECTION: EQUIPMENT AND FACILITY PROTECTION

CATALOG 700

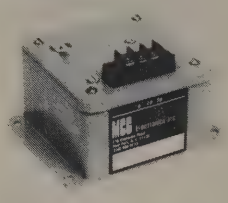
### AC POWER LINE PROTECTION

**for 120, 240, 277, 380 & 480VAC line 1φ, 3φ Delta, wye 50/60/400Hz service**

**PROTECTION FOR**

- **Computers**
- **Instrumentation & Control**
- **Communications Equipment**
- **Switching & Signalling**

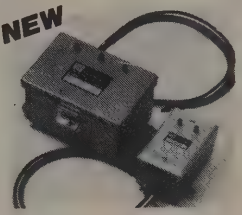
### SERIES P



The Series P operates rapidly to prevent damage to equipment operating on the AC power lines, by switching rapidly to a clamping state whenever a transient exceed the clamping threshold. The units operate on overvoltages of either polarity, on 1φ and 3φ lines and recover automatically when the transient expires. Severe transient conditions cause the protector to switch to a crowbar mode and cause an external fuse or circuit breaker to operate. Available for 120, 240, 380 & 440VAC lines. 1φ and 3φ service.

### MCG SERIES

NEW



MCG series of AC line Protectors is designed to rapidly clamp (in nanoseconds) substantial transients of either polarity to safe levels. Energy handling capabilities range from 160 joules to 480 joules and is available for use on 120, 240, 277, 380 & 480VAC RMS lines in 1φ and 3φ service. LED's indicate line status and integrity of internal fusing.

### FACILITY PROTECTION

NEW

The 2000 series of AC Power Line Protectors are designed to protect 120/240/380/480VAC, 1φ and 3φ power systems from electrical transients caused by lightning, induction and switching surges. Operating in nanoseconds, the protectors will clamp vigorously whenever the threshold level is exceeded and recover automatically when the transient expires. Provides protection for computer systems, traffic and railroad signal systems, automatic controls, broadcasting and communication areas, etc.

### AC LINE MONITOR

NEW

The P1213 unit is designed monitor the normal 120VAC 60/400Hz and to disconnect load from the line when the put AC voltage level (RMS) ri to 130VAC and above. When AC line drops below the 130 threshold, the P1213 immedia and automatically reapplies power to the load. The P121 rugged constructed to switch to 25 amps and yet use milliwatts of power in the st by mode.

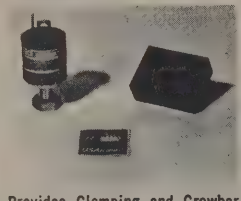
## PROTECTION COMPONENTS: AC/DC CIRCUIT LEVEL PROTECTION

CATALOG 830

### LVC-1

The LVC-1's are overvoltage protectors that sense when a DC overvoltage is occuring and switch rapidly from an "open" to a virtual "short" circuit within microseconds. Any potentially destructive energy from transients, maladjustments, series regulator faults, etc. is now provided with a very low resistance path around sensitive components, such as IC's, transistors, etc. TRIP voltages from 5.2V-600V @ 3A to 470A current levels are available.

### LVC-10

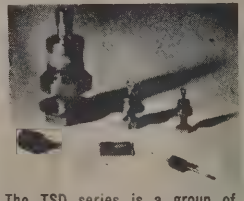


Provides Clamping and Crowbar Protection in a single package. The initial transient is zener clamped for a fixed interval (adjustable) and then the LVC-10 switches to a "brute force" crowbar (short circuit) mode, if the transient persists. Avoids NUISANCE tripping in electrically "noisy" areas. The LVC-10's are available with clamping voltages ranging from 4.7 to 100V at currents from 3A to 235A.

### CCB-10

Series CCB Clamping Crowbars determine automatically on an energy basis whether a clamping or a crowbar type of protection is required. For low energy transients, the CCB merely clamps the transient to safe levels. For large energy transients, the CCB will switch to a crowbar (shorting) mode to provide brute force protection. Clamping voltages, from 5.3V to 200V at current levels of 3A to 235A are available.

### TSD

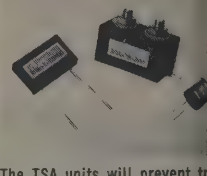


The TSD series is a group of easy-to-use transient suppressors that are well suited to protect a wide variety of electronic equipments from failure due to high voltage transients.

These units will rapidly clamp, by zener action, an incoming voltage transient to a selected voltage level by diverting the transient energy through itself for the duration of the overvoltage. Recovery is automatic when the transient expires.

Clamping voltages from 4.7V to 800V are available with energy levels from .1 to 30 joules.

### TSA



The TSA units will prevent t sient damage by rapidly swit ing from an open circuit t clamping state whenever a t sient voltage exceeds the cla ing threshold. These units o ate on overvoltages of eit polarity and recover autom cally when the transient dis pears. The TSA-1.7's and TS units are especially suited connection across the AC l Voltage clamping from 4.7V 400V peak.

## SIGNAL/DATA/TELEPHONE LINE PROTECTION: INSTRUMENTATION AND SYSTEMS

CATALOG 310

### INTERFACE PROTECTION

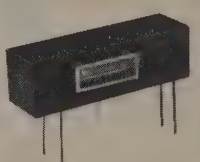
"Interface Protection" is a comprehensive 10 page brochure on the use of signal line protectors to protect signal/data/telephone lines from transient overvoltages caused by lightning, heavy machinery etc.

Standard transient test waveforms are reviewed and MCG units to meet these specifications are recommended. Detailed model descriptions and a selection guide are included to assist the engineer in protecting his sensitive semiconductor devices.

### SLP-2, 3

The SLP-2 and -3 protectors were expressly designed to protect signal/data/telephone lines from transient overvoltages (ANSI C37.90A) caused by lightning, heavy machinery, elevator motors, generators, etc. The SLP interfaces between the signal line and the sensitive circuit to provide a sophisticated blend of high speed (nanoseconds) voltage limiting and brute force protection. The SLP's recover automatically to standby when the need for protection has passed. Protection levels range from ±6 to ±200V.

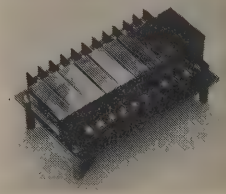
### SLP-4, 6



The SLP-4, -6 protectors are dual versions of the SLP-3 protectors and are designed to protect both the input and return circuit lines of a single circuit from the effects of transient overvoltages. (ANSI C37.90A) Protection levels range from ±6V to ±200V.

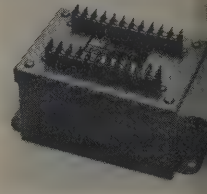
The new SLP units interface between the signal lines and the sensitive circuit to provide low cost, high speed protection.

### MULTIPLE SLP



Up to 10 SLP-2, -3, -5 or 4 SLP-4, -6 modules can be mounted on a heavy duty printed circuit board. Fitted with input and output terminal strips to facilitate ease of installing or retrofitting. The assembly can be mounted flush with a chassis or supported ¼" or more above the chassis. With a full complement of SLP's, the board and components will fit in a 5¼" x 3" x 1½" (L x W x H) area.

### ENCLOSED SLP



SLP units are incorporated i heavy duty steel enclosure provide an easy method of ins lation in the field. Up to 20 units can be accommodated input and output terminal connections provided at the of the box. Installation is e Bolt down the box and then sert signal inputs and outp under the appropriate term strip screw and tighten.

MCG

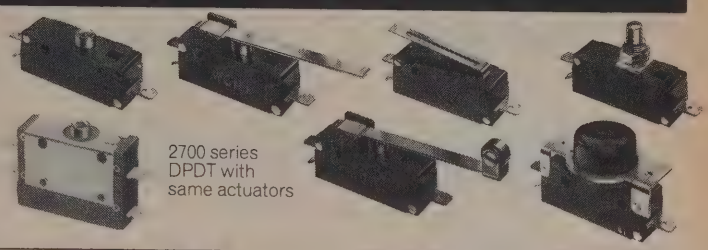
For immediate answers: **CALL MIKE COYLE (516) 586-5125 — EXT. 250**

**MCG ELECTRONICS INC.** • 160 BROOK AVE. • DEER PARK, N. Y. 11729 • 516-586-5125

# think quality specify McGill switches

## snap-action

High reliability through design simplicity. Fewer parts to wear—minimum spring flexing increases life. No coil springs. Less than .005" differential travel. SPDT, SPST. **2600 Series**—20 A, 125-250 V AC; 1 HP 125 V AC; 2 HP 250 V AC; 50/60 Hz. **2650 Series**—25 A 125-250 V AC; 1½ HP 125 V AC; 2 HP 250 V AC. Operating force: 20 oz. max. **1600 Series**—Light operating force—10 oz. max. 15 A 125-250 V AC; ¾ HP 125 V AC; 1½ HP 250 V AC. Also available as **2700 Series** in DPDT models with same actuators and rated: 20 A, 125-250 V AC, 2 HP 250 V AC, 50/60 Hz. U.L. Listed. C.S.A. Approved.



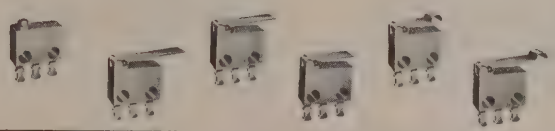
2700 series DPDT with same actuators

## miniature snap-action

1 3/32" x 5/8" x 13/32" case. Oversize silver contacts. Excellent wiping action and low contact bounce. SPDT, SPST. **4600 Series**—6—14 oz. max. operating force. 15A, ½ HP 125-250 V AC; ½ A 125 V DC; ¼ A 250 V DC; 4 A "L" 125 V AC. **4700 Series**—Light operating force—8 oz. and 75 gram max. 10 A, ⅓ HP, 125-250 V AC; 4 A "L" 125 V AC. U.L. Listed. C.S.A. Approved. **4613 Series** meets requirements for TV fire protection.

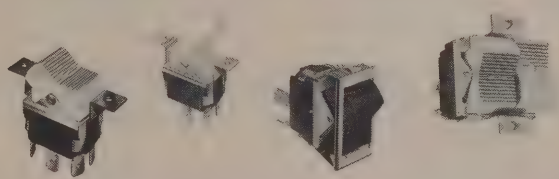
## sub-miniature snap-action

**4900 Series**—smallest precision snap-action switches available. Case dimensions less than .250" x .300" x .100". Choice of contacts, terminals and actuators. SPDT. 2 A 125-250 V AC; 2 A (Res.) 30 V DC; 1 A (Ind.) 30 V DC. Meet MIL-S-8805 specifications. Temp. range —100° F to +185° F. Up to 250° F continuous duty temp. ratings available.



## rocker and paddle

Your choice of actuator color, style. Proven reliable detent mechanism. Snap-in mounting optional. Variety of SP and DP, 3-pole, 4-pole and 2-circuit models. **0801 SP and 0811 DP Series** — 20 A 277 V AC; 1½ HP 125-250 V AC. **1801 SP and 1811 DP Series**—6 A 125 V AC; 3 A 250 V AC; ¼ HP 125-250 V AC. **0840 3-pole and 4-pole series** — 17 A 277 V AC; 6 A 600 V AC; 1 HP 125 V AC; 2 HP 250-480-600 V AC; 1, 2 or 3 phase. U.L. Listed. C.S.A. Approved.



## miniature rocker and paddle

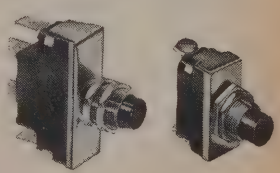
High rating reliability. Choice of standard or specially styled actuators terminals, circuitry to meet your needs. Optional snap-in mounting. **0805 Series**—12 A 125 V AC; 6 A 250 V AC; ½ HP 125-250 V AC and 15 A 125-277 V AC, ¾ HP 125-250 V AC. **1805 Series** 8 A 128 V AC; 4 A 250 V AC; ⅓ HP 125-250 V AC. Also available with 6 A "L" 125-250 V AC rating. **0806 Series**—features neon indicator light. Same ratings as 12 A 0805 series switches. U.L. Listed. C.S.A. Approved.

## toggle

Reliable proven positive detent mechanisms. Wide variety of circuitry in 6 A to 20 A ratings. SP, DP, 3-pole and 4-pole models. Choice of spade, screw or solder terminals. U.L. Listed.

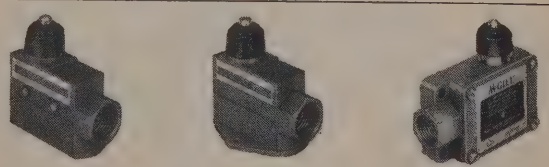
## push button

Momentary and maintained contact push-button switches up to 30 A. Variety of mechanisms, including snap-action, SPST, SPDT, 2-circuit. U.L. Listed.



## precision metal-cased

Applicable for limit, safety and automatic control uses. In die-cast housings with variety of direct action and adjustable level actuators. **1502 Series** 20 A, 125-250, 480 V AC, ½ A 125 V DC, ¼ A 250 V DC. **1503 Series** same rating with added 10 A, 125 V AC Lamp Load and 1 HP 125 V AC, 2 HP 250 V AC. U.L. Listed.



## specially-engineered

Modifications of basic switches to meet application requirements. Special actuator designs and colors, mounting hardware and attachments to provide more design latitude, style-appeal and functional reliability. Complete application engineering abilities and facilities to develop the best answer to your special switch problems.

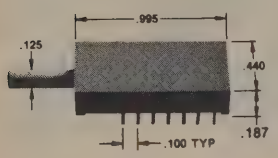
*Request Catalog 89 for complete specifications.*

McGILL MANUFACTURING CO., INC., ELECTRICAL DIVISION, VALPARAISO, INDIANA 46383. Phone: (219) 464-4911

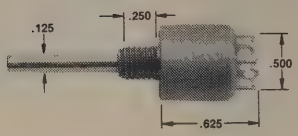
# COMPONENT PRODUCTS GROUP

# DAVEN SWITCHES

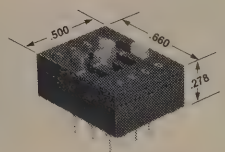
### Dipswitch



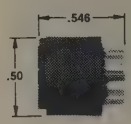

### G/K Series




### Center-Off Dipswitch




### P Series




### SPECIFICATIONS

Switching Capacity 1/8 amp.
**Up to 3 Non-shorting closures per position.**
**Up to 5 Shorting closures per position.**
Six Positions Max. 60°
Contact Resistance .050 ohms max.
Dielectric 500 VAC
Insulation 10,000 Megohms
**External Stop option**
(Up to 30 ounce inches)

### SPECIFICATIONS

Switching Capacity 1 amp.
**1 pole, 12 position to 4 pole, 3 position**
Shorting or Non-shorting
Indexing—30°, 36°, 45°, 60°
QPL per MIL-S-3786/20E
Explosion Levels "E" + "F"
Dielectric 1000 VRMS
Insulation 50,000 Megohms
Contact Resistance—.020 ohms max.
**P/C and Solder Terminals**
Mounting Hardware Supplied

### SPECIFICATIONS

Switching capacity up to .250 Ma. Four electrically isolated, 3-position center-off switches in one DIP configuration.
Contact resistance — .050 ohm max. Life — 2000 cycles min. Operating temp.: – 40 to + 85°C.

### SPECIFICATIONS

Switching Capacity ½ amp.
**1 pole, 10 position**
**2 pole, 5 position**
Indexing 36°
Shorting & non-shorting
Screw driver operated
Printed Circuit Terminals
Dielectric 1000 VRMS
Insulation 50,000 Megohms
**Stop strength 24 inch ounces.**
Contact Resistance .030 ohms max.

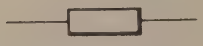
**COMPLETE CATALOG RS-77**

# DAVEN PRECISION WIREWOUND RESISTORS

### Miniature Axial

.100—.187 diameter
.235—.500 Long
Resistance to 1 Megohm Max.
**T.C. to ±3 PPM/°C**
Standard ±10 PPM/°C
**Tolerances .02—0.1%**
Wattage .03—.125W
Operating Temp.
-55 to +145°C

### Standard Axial



.250—.500 diameter
.343—2.00 Long
Resistance to 24 Megohms Max.
T.C. to ±2 PPM/°C
Standard ±10 PPM/°C
**Tolerances .005—0.1%**
Wattage—.125—2.0W
Operating Temp.
-55 to ±145°C

### Printed Circuit

.281—.500 diameter
.312—.500 high
Resistance to 2.6 Megohms Max.
T.C. to ±2 PPM/°C
Standard ±10 PPM/°C
**Tolerances .01—0.1%**
Wattage .250—.500W
Lead spacing .200—.300

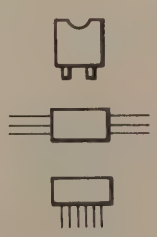
### Lug Type

.437—.937 diameter
.500—2.0 Long
**Center Tap lugs and radial leads**
Lugs accommodate #6 screws.
Resistance to 19 megohms.
T.C. to ±3 PPM/°C
Standard ±20 PPM/°C
Tolerances .01—0.1%

# FUSE RESISTORS

**TWO for the price of ONE...**
Precision resistor and fuse...
.140—.200 diameter
.400—.500 long
.01 ohms to 2.5k resistance.
Tolerances ±.02—±5%
**Fusing time 5μs—3 minutes**
Tradeoffs on the above required.

# NETWORKS



CUSTOM for your convenience
**Resistors matched to .005%**
T.C.'s matched to .5 PPM
Matched reactive components.
CR, RC, C, L, R combinations
Cold Junction Reference
Environmental and Hermetic Seals.
Ladders; R-2R BCD, mix radix
Bipolar, Binary bipolar, shift binary, summing

**COMPLETE CATALOG WW-75**

## McGRAW-EDISON / Edison Electronics

Grenier Field Municipal Airport, Manchester, N.H. 03103 (603) 669-0940 • TWX 710-220-1747

# MICRO SWITCH

## TABLE OF CONTENTS

The products described in the following pages are representative of the thousands of position sensing and manual control products manufactured and distributed worldwide by MICRO SWITCH. For comprehensive catalogs write MICRO SWITCH, Freeport, Illinois 61032, Dept. 720E. Or, call (815) 235-6600. For application assistance, contact a nearby MICRO SWITCH Branch Office. See listing in this Directory. For off-the-shelf products, see your local MICRO SWITCH Authorized Distributor listed on pages 49 & 50.


### MANUALLY OPERATED SWITCHES

#### PUSHBUTTONS

**AML p. 2**
Wide choice of visual display with power, electronic or solid state switching. Single level termination with all common types. Choice of snap in front mount or strip and matrix mount.

**Series 2 p. 14**
Individual or strip, snap in mount. 1 to 4 section buttons for many display possibilities. Widest choice of switch modules, plus coil operation.

**Series 3 p. 18**
Matrix, individual or strip mount. 1 or 2 section. 5 amp rating. Various button styles and visual display.

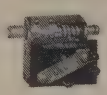
**Series 4 p. 21**
Snap in front mount with easy wiring for low installed cost. Single section. Electrical ratings from 10 amps to gold contacts to solid state switching.

**Unlighted Pushbuttons p. 24**
Bushing mounted. Wide choice of circuitry or ratings.

**SN/SD p. 25**
Hall effect, solid state switching. Wide selection of buttons and legends. Snap in or P.C. board mount in standard or low profile modules.

### SPECIAL PURPOSE

**Type AC p. 26**
Door interlock switches for use in hazardous electronic equipment. Variety of precision snap-acting switches.



### TOGGLE SWITCHES

**Series 8 p. 27**
Complete miniature manual line. 6 amp rating. 1 to 4 poles. Variety of actuators, contacts and termination. Use where low cost and small size are critical requirements.

**Type TS p. 29**
Standard size toggles, 1 or 2 pole. Various actions, circuitry and termination. Use where a lower cost standard size toggle is required.

**Type TL-TP p. 30**
Sealed toggle and rocker toggle series. Standard size. 1, 2 and 4 poles. Various actuators, termination, and circuitry. Has both mil. listings and UL listings.

**Type AT p. 32**
Toggle switch assemblies using basic switches. Wide variety of ratings, contacts, actuators, terminals, and sealing. Mil. listings available.

### POSITION SENSING SWITCHES

#### BASIC SWITCHES

**Type SX p. 35**
Smallest snap-action switches from MICRO SWITCH. Rated to 7 amperes. Choice of actuators and terminal styles. Use where the smallest and least weight, snap acting switch is essential.

**Type SM p. 36**
Slightly larger than SX switches. Rated to 11 amperes. Choice of contacts, actuators and terminal styles. Use for communications/office equipment and other smaller application needs.

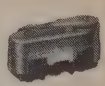
**Type V3 p. 37**
**Type XL p. 38**
Standard or low operating forces. Rated to 15 amperes. Use for appliance-vending machine and similar applications. XL Solid state Hall effect integrated circuit in a V3 package.

**Type Z & A p. 39**
Standard size switches. Ratings to 25 amps. High precision — long life. Wide choice of actuators and terminals. Use for general purpose applications.

**Type SE/XE p. 42**
Sealed, environment-proof switches. Rated to 7 amperes. Choice of auxiliary actuators and terminal styles. Use where a sealed SM or a sealed SX is needed. Mil. listings.

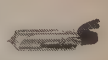
**Type HM p. 43**
Hermetically-sealed switches. Rated 5 amperes, 28 VDC and 125 VAC, 400 hertz. High temperature version to 500°F (260°C). The ultimate in sealing, plus small size. Mil. listings.

**Type HS p. 44**
Hermetically sealed switch. Rated to 25 amperes, 28 VDC. High temperature version to 300°F (149°C). Choice of integral levers and terminals. Standard size switch with the best seal. Mil. listings.



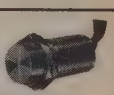
**Type HT p. 44**
High temperature switch (up to +1000°F 538°C). Side and panel mount. Rated 3 amperes 125 VAC. Use for oven/furnace applications.

**Mercury Switch p. 45**
Low cost hermetically-sealed switches. Easy installation and low force operation. Tilt (position-sensitive) switches are actuated by the normal movements of machine parts.



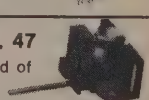
### SOLID STATE NO TOUCH SENSORS

**103SR/400SR p. 46**
Magnetically operated Hall effect sensors. May be directly interfaced with most electronic circuits.



**XK p. 46**
Eddy current, ferromagnetic operated sensor. Rugged plastic package and direct interface with logic devices.

**AV p. 47**
Vane operated Hall effect sensor. 0 to 100 KHz, speed of operation.



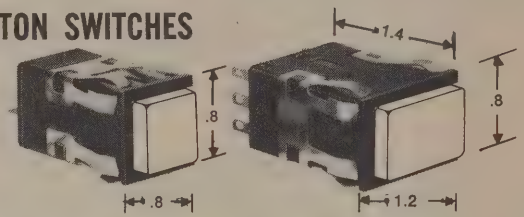
**FW p. 47**
Choice of ferromagnetic or all metals sensing proximity switches. Protected from RFI effects. Environment sealed. Direct interface with logic devices.

**MICRO SWITCH** A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

# AML ADVANCED MANUAL LINE

- **Wide selection of pushbutton, rocker, and paddle (toggle type) switches accommodates different functions and promotes operator efficiency.**
- **Solid state, electronic, and power duty control.**
- **Full or split screen incandescent display of vivid transmitted color, projected color (for neutral display when unlit), and dead front (hidden color).**
- **Wide-angle visibility LED's and line voltage neon display (for power switches).**
- **Switches and indicators terminate at the same shallow depth (1.4 inches) for convenient wiring.**
- **Snap-in surface mount or sub-panel (hidden bezel) mount with mounting bracket assemblies.**
- **Designed to meet UL, CSA, CEE24 and IEC standards.**
- **Choice of 7/64, 9/64, 13/64 and 5/16-inch hot stamped legend.**

## PUSHBUTTON SWITCHES




AML pushbutton switches are available in square and rectangular housings for solid state or electronic control, and in rectangular housings for power duty applications.

**BUTTONS (pages 5, 6) AND INCANDESCENT LAMPS (page 13) ARE ORDERED SEPARATELY**

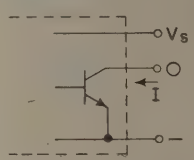
## AML11 SOLID STATE PUSHBUTTON SWITCHES . . . INCANDESCENT DISPLAY

AML11 switches provide low voltage signals that interface with nearly all DC logic level loads. The contactless switching mechanism combines the performance-proven MICRO SWITCH Hall effect generator, a trigger circuit and amplifier on a silicon chip. The TTL compatible output "snaps" from high to low (low to high) as the permanent magnet plunger moves adjacent to it.

### ELECTRICAL SPECIFICATIONS — SOLID STATE SWITCHES

| Electrical Characteristics | | | | | | Absolute Maximum Rating | | | |
|---|---|---|---|---|---|---|---|---|---|
| Integrated Circuit Function | Supply Current (Max.) | Output Voltage (Operated) | Output Leakage Current Max. (Released) | Switching Time Max. Rise 10% to 90% | Switching Time Max. Fall 90% to 10% | Supply Voltage (Vs) | Voltage Externally Applied to Output | Loads to Output | Storage Temperature |
| 5 VDC Sinking[1] | 3.5 mA (Released) 6.5 mA (Operated —no load) | +.4 Volt (Sinking 8 mA) | 2.0 μA | 1.0 μsec (Sinking 8 mA) | 1.0 μsec (Sinking 8 mA) | −.5 to +7.0 VDC 0° to +65°C (+32° to +149°F) | −.5 Volt min. +15 Volts max. (Off condition) | 20 mA (Sinking) | −40° to +65°C (−40° to +149°F) |
| 6-16 VDC Sinking[2] | 6.5 mA @ 6 VDC 10.0 mA @ 16 VDC (Plus load current)[3] | +.4 Volt (Sinking 20 mA max.) | 20 μA | 1.5 μsec (Sinking 20 mA) | 0.5 μsec (Sinking 20 mA) | −1.2 to +20 VDC | +20 VDC max. in Off condition only −.5 VDC min. in Off or On condition | 40 mA | −40° to +65°C (−40° to +149°F) |

CURRENT SINKING OUTPUT




1 Over temperature range of °C to +55°C (+32° to +131°F) and supply voltage of 4.5 to 5.5 VDC.
2 Over temperature range of 0°C to +55°C (+32° to +131°F) and supply voltage of 6 to 16 VDC.
3 At 24°C (+75°F)

### ORDER GUIDE — Solid State Pushbutton Switches/Incandescent Display

**AML11 C B A 2 AA**

| HOUSING TYPE | BEZEL COLOR | LAMP TYPE | TERMINAL TYPE | CIRCUITRY CODES |
|---|---|---|---|---|
| **B** Square Non-Lighted<br>**C** Square 1 Lamp Ckt.<br>**E** Rectangular Non-Lighted<br>**F** Rectangular 1 Lamp Ckt. | **B** Black | **A** No Lamp Installed | **2** .110 x .020 (Solder or Quick-Connect)<br>**3** (Printed Circuit, .025 x .025 Wire-Wrap, or Push-On) | Momentary Action:<br>**AA** 5 VDC Sinking<br>**BA** 6-16 VDC Sinking |

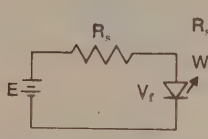
ADDITIONAL AML11 OPTIONS: raised bezel housings, two-level alternate-action, non-lighted versions, and rectangular housings with two lamp circuits. Refer to Product Brochure AML.

## AML12 SOLID STATE PUSHBUTTON SWITCHES . . . LED DISPLAY

AML12 switches combine Hall effect switching reliability with LED display to provide a completely solid state device. Electrical specifications are the same as shown on the facing page.

### LED APPLICATION INFORMATION

Internal resistors control the LED current to a nominal 20 mA on 5 VDC devices. For those devices without internal current limiting resistors, suitable external control of the LED current must be provided. It is recommended that a minimum of 5 VDC open circuit voltage with an appropriate series resistance be used to drive LED devices. This minimizes the effect of temperature (current variation) on forward voltage of the LED. Refer to equations.




$$R_s = \frac{E - V_f}{I_f}$$

WHERE: $R_s$ = Series Resistance
E = Supply Voltage
$V_f$ = Forward Voltage of LED
$I_f$ = Circuit Current

If a diode is added in series for reverse polarity protection then:

$$R_s = \frac{E - V_f - V_{PD}}{I_f}$$

WHERE: $V_{PD}$ = Forward Voltage of Protection Diode

### ORDER GUIDE — Solid State Pushbutton Switches/LED Display

**AML12 C B B 2 AA**

| HOUSING TYPE | BEZEL COLOR | LED COLOR/ VOLTAGE | TERMINAL TYPE DIODE PROTECTION | CIRCUITRY CODES |
|---|---|---|---|---|
| **C** Square 1 LED | **B** Black | Red **B** *V, **C** 5 V<br>Yellow **H** *V, **J** 5 V<br>Green **R** *V, **S** 5 V | **2** .110 x .020 (Solder or Quick-Connect)<br>**3** .025 x .025 (Printed Circuit, Wire-Wrap, or Push-on) | Momentary Action:<br>**AA** 5 VDC Sinking<br>**BA** 6-16 VDC Sinking |

* See LED application information for devices without current-limiting resistor.

ADDITIONAL AML12 OPTIONS: integral diode LED protection, 15 V LED voltage, and two level alternate-action. Refer to Product Brochure AML.

## AML21 ELECTRONIC CONTROL PUSHBUTTON SWITCHES . . . INCANDESCENT DISPLAY

AML21 switches provide electronic control capability (up to 3 amps, 125 VAC). There is a choice of fine silver or gold contacts; momentary or two-level alternate-action (push-on push-off).

### ELECTRICAL SPECIFICATIONS

| Contacts | Voltage | Current | Load Type |
|---|---|---|---|
| Silver | 250 VAC | 2 Amps | 75% Power Factor |
| | 125 VAC | 3 Amps | 75% Power Factor |
| | 24 VDC | 2 Amps | Resistive |
| Gold | 24 VDC | 100 mA | Resistive |
| | 5 VDC | 10 mA | Resistive |
| | .5 VDC | 1 mA | Resistive |

### ORDER GUIDE — Electronic Control Pushbutton Switches/Incand. Display

**AML21 B B A 2 AA**

| HOUSING TYPE | BEZEL COLOR | LAMP TYPE | TERMINAL TYPE | CIRCUITRY CODES (Each pole has double-throw) | | |
|---|---|---|---|---|---|---|
| **B** Square, Non-lighted<br>**C** Square, 1 Lamp Ckt.<br>**E** Rectangular, Non-lighted<br>**F** Rectangular 1 Lamp Ckt. | **B** Black | **A** No Lamp Installed | **2** .110 x .020 (Solder or Quick-Connect)<br>**3** .025 x .025 (Printed Ckt., Wire Wrap or Push-On) | Silver Contacts | Mom. Action | **AA** 1-Pole, **AC** 2-Pole |
| | | | | | Alt. Action | **AB** 1-Pole, **AD** 2-Pole |
| | | | | Gold Contacts | Mom. Action | **BA** 1-Pole, **BC** 2-Pole |
| | | | | | Alt. Action | **BB** 1-Pole, **BD** 2-Pole |

Contact arrangement: 1, 2, or 4 poles: Form C

ADDITIONAL AML21 OPTIONS: 4 poles, non-lighted versions, and rectangular housings with two lamp circuits. Refer to Product Brochure AML.

**MICRO SWITCH** A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

## AML22 ELECTRONIC CONTROL PUSHBUTTON SWITCHES . . . LED DISPLAY

AML22 switches are identical to the AML21 series, except they are furnished with LED display. Refer to page 3 for LED application information.

### ORDER GUIDE — Electronic Control Pushbutton Switches/LED Display

**AML22 C B B 2 AA**

| HOUSING TYPE | BEZEL COLOR | LED COLOR/ VOLTAGE | | TERMINAL TYPE | CIRCUITRY CODES (Each pole has double-throw) | | |
|---|---|---|---|---|---|---|---|
| **C** Square 1 LED | **B** Black | Red | **B** *V<br>**C** 5 V | **2** .110 x .020 (Solder or Quick-Connect) | Silver Contacts | Mom. Action | **AA** 1-Pole<br>**AC** 2-Pole |
| | | Yellow | **H** *V<br>**J** 5 V | **3** .025 x .025 (Printed Ckt., Wire Wrap or Push-On) | | Alt. Action | **AB** 1-Pole<br>**AD** 2-Pole |
| | | Green | **R** *V<br>**S** 5 V | | Gold Contacts | Mom. Action | **BA** 1-Pole<br>**BC** 2-Pole |
| | | | | | | Alt. Action | **BB** 1-Pole<br>**BD** 2-Pole |

Contact arrangement: 1, 2, or 4 poles: Form C

* See LED application information for devices without current-limiting resistor, page 3.

ADDITIONAL AML22 OPTIONS: Integral diode protection for the LED, 15 V LED voltage, and 4 poles. Refer to Product Brochure AML.

## AML31/32 POWER DUTY PUSHBUTTON SWITCHES . . . INCANDESCENT/LED DISPLAY

AML31 (incandescent display) and AML32 (neon display) switches are for use in power line — disconnect applications.

### ELECTRICAL SPECIFICATIONS

| Voltage | Current | Load Type |
|---|---|---|
| 125 VAC | 10 Amps | 60% Power Factor |
| 250 VAC | 10 Amps | 60% Power Factor |

10 amps, ⅓ hp.

### ORDER GUIDE — Power Duty Pushbutton Switches/Incandescent Display

**AML31 F B A 4 AD**

| HOUSING TYPE | BEZEL COLOR | LAMP TYPE | TERMINAL TYPE | CIRCUITRY CODES |
|---|---|---|---|---|
| **E** Rectangular Non-Lighted<br>**F** Rectangular 1 Lamp Ckt. | **B** Black | **A** No Lamp Installed | **4** .187 x .020 (Solder or Quick-Connect) | 2-Pole, Single-Throw Normally-Open, Form X:<br>**AD** Alternate Action |

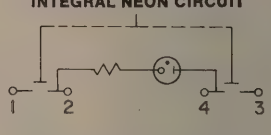
Contact arrangement: 2 pole: Form X

### ORDER GUIDE — Power Duty Pushbutton Switches/Neon Display

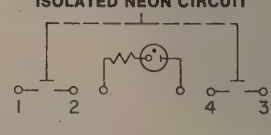
**AML32 F B C 7 AD**

| HOUSING TYPE | BEZEL COLOR | LAMP VOLTAGE/COLOR | | TERMINAL TYPE/ LAMP CIRCUIT | CIRCUITRY CODES |
|---|---|---|---|---|---|
| **F** Rectangular 1 Lamp Ckt. | **B** Black | Red | **B** 125 VAC<br>**C** 250 VAC | **4** .187 x .020 (Solder or Quick-Connect) with isolated lamp circuit | 2-Pole, Single-Throw Normally-Open, Form X:<br>**AD** Alternate Action |
| | | Clear | **K** 125 VAC<br>**L** 250 VAC | **7** .187 x .020 with integral lamp circuit | |

INTEGRAL NEON CIRCUIT




ISOLATED NEON CIRCUIT



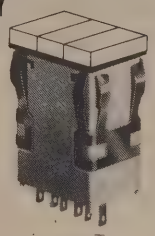

ADDITIONAL OPTIONS: AML31/32 — momentary action; AML31 — non-lighted versions. Refer to Product Brochure AML.

# AML41/42 INDICATORS . . . INCANDESCENT/LED DISPLAY

## ORDER GUIDE — Indicators/Incandescent Display

**AML41 C B A 2**

| HOUSING TYPE | BEZEL COLOR | LAMP TYPE | TERMINAL TYPE |
|---|---|---|---|
| **Pushbutton Style:**<br>**C** Square 1 Lamp Ckt.<br>**D** Square 2 Lamp Ckts.<br>**F** Rectangular 1 Lamp Ckt.<br>**G** Rectangular 2 Lamp Ckts.<br>**Lens Style:**<br>**J** Rectangular 1 Lamp Ckt.<br>**K** Rectangular 2 Lamp Ckts.<br>**L** Rectangular 3 Lamp Ckts. | **B** Black | **A** No Lamp Installed | **2** .110 x .020 (Solder or Quick-Connect)<br>**3** .025 x .025 (Printed Circuit, Wire-Wrap or Push-On) |


LENS STYLE

COMPACT LED

PUSHBUTTON STYLE

**BUTTONS (pages 5, 6) AND INCANDESCENT LAMPS (page 13) ARE ORDERED SEPARATELY**

**Pushbutton style** indicators have the same panel appearance as square and rectangular pushbutton switches and use the same buttons.

**Lens style** indicators use a special button which snaps over the bezel, providing a larger display area than rectangular pushbuttons.

## ORDER GUIDE — Indicators/LED Display

**AML42 S B C 2**

| HOUSING TYPE | BEZEL COLOR | LED COLOR/VOLTAGE | | | TERMINAL TYPE/ DIODE PROTECTION |
|---|---|---|---|---|---|
| **C** Square 1 LED<br>**S** Compact Rectangular 1 LED | **B** Black | Red | **B** **C** | 5 *V | **2** .110 x .020 (Solder or Quick Connect)<br>**3** .025 x .025 (Printed Circuit, Wire-Wrap or Push-On) |
| | | Yellow | **H** **J** | 5 *V | |
| | | Green | **S** **R** | 5 *V | |

* See LED Application information for devices without current-limiting resistor, page 3.

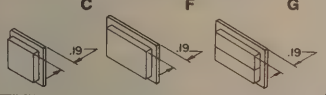
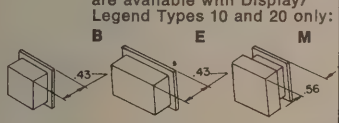
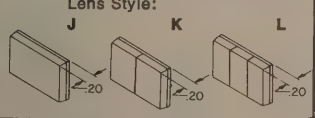
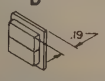
LED indicators are available in a square pushbutton housing and in a compact .80″ x .30″ rectangular device.

ADDITIONAL AML42 OPTIONS: integral diode protection for the LED and 15 V LED voltage.

# AML51 BUTTONS/LENSES FOR INCANDESCENT DISPLAY

## ORDER GUIDE — Buttons and Lenses/Incandescent Display

**AML51 C 10 R — —**

| BUTTON TYPE | DISPLAY/LEGEND TYPE | FULL COLOR | 2-SPLIT COLOR | 3-SPLIT COLOR |
|---|---|---|---|---|
| **FOR PUSHBUTTONS OR INDICATORS**<br>**C** **F** **G**<br>  | Transmitted Color<br>**10** No legend<br>**20** With Legend | **R** Red<br>**Y** Yellow<br>**G** Green<br>**B** Blue<br>**W** White<br>**A*** Amber<br>**C*** Light Green | **R** Red<br>**Y** Yellow<br>**G** Green<br>**B** Blue<br>**W** White<br>**A*** Amber<br>**C*** Light Green | **R** Red<br>**Y** Yellow<br>**G** Green<br>**B** Blue<br>**W** White<br>**A*** Amber<br>**C*** Light Green |
| **Button Types B, E, and M are available with Display/ Legend Types 10 and 20 only:**<br>**B** **E** **M**<br>  | Clear Cap and Transmitted Color Insert<br>**11** No Legend<br>**21** With Legend | | | |
| **FOR INDICATORS ONLY**<br>**Lens Style:**<br>**J** **K** **L**<br>  | Dead Front Cap and Transmitted Color Insert<br>**30** No Legend<br>**40** With Legend | | | |
| **Pushbutton Style:**<br>**D**<br>  | Projected Color with White Translucent Cap and Transparent Color Insert<br>**50** No Legend<br>**60** With Legend | | | |

Note: Dimensions include the .060 in. bezel.

TRANSMITTED COLOR: Display color can be distinguished whether lighted or unlighted.

PROJECTED COLOR: Display is white when unlighted and colored when lighted.

DEAD FRONT: Display appears black when unlighted. Hidden legend/ color appear when lighted.

* Amber and light green are not available with Display/Legend Types 50 and 60.

Split colors for Display/Legend Types 10, 11, 20, and 21 are visible whether lighted or unlighted. On all other types, split colors are only visible when lighted.

ADDITIONAL AML51 OPTIONS: other extended height buttons, and black and gray button colors for non-lighted applications. Refer to Product Brochure AML.

**MICRO SWITCH** A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

## AML52 BUTTONS FOR LED/NEON DISPLAY

### ORDER GUIDE

**AML52 N 10 R**

| BUTTON TYPE | DISPLAY/ LEGEND TYPE | BUTTON COLOR |
|---|---|---|
| C — .19 — For LED Devices | Transmitted Color | R Red |
| N — .19 — For Neon Devices | 10 No Legend | Y Yellow |
| | 20 With Legend | G Green |
| | | B Blue |
| | | W White |
| | | K Black |

Note: Dimensions include the .060 in. bezel.

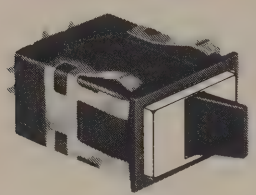
ADDITIONAL AML52 OPTIONS: amber, gray and light green buttons. Refer to Product Brochure AML.

AML52 buttons have a window which allows an LED or neon bulb lens to extend flush with the top of the button surface.

### BUTTON LEGENDING

To specify hot stamp legends, request the following legend order sheets: AML51 pushbuttons, FO-63394; AML51 lens, FO-63395; AML52 pushbuttons, FO-63504.

## PADDLE SWITCHES



**SWITCH COVERS (page 9) AND INCANDESCENT LAMPS (page 13) ARE ORDERED SEPARATELY.**

Paddle switch operators are permanently installed in rectangular housings. Colored covers (ordered separately) snap into the top of the housings to provide an attractive, uniform color display. Solid state, electronic control, and power duty switching.

### OPERATING ACTION OPTIONS

| 2-POSITION | | 3-POSITION | | |
|---|---|---|---|---|
| Maint. | Maint. | Maint. | Maint. | Maint. |
| Mom. | Maint. | Mom. | Maint. | Mom. |
| Maint. | Mom. | Maint. | Maint. | Mom. |
| | | Mom. | Maint. | Maint. |

Note: Power duty switches have 2-position, maintained action only.

## AML13 SOLID STATE PADDLE SWITCHES/INCANDESCENT DISPLAY

AML13 switches provide low voltage signals that interface with nearly all DC logic level loads. As a permanent magnet plunger moves adjacent to the MICRO SWITCH Hall effect integrated circuit, the TTL compatible output "snaps" from high to low (low to high).

### ELECTRICAL SPECIFICATIONS

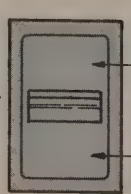
Refer to page 2.

### ORDER GUIDE — Solid State Paddle Switches/Incandescent Display

**AML13 E B A 2 AA 01**

| HOUSING TYPE | OPER./BEZEL COLOR | LAMP TYPE | TERMINAL TYPE | CIRCUITRY CODE |
|---|---|---|---|---|
| E Rectangular Non-Lighted | B Black | A No Lamp Installed | 2 .110 x .020 (Solder or Quick-Connect) | One IC (Ckt. A): AA 5 V Sinking |
| F Rectangular 1 Lamp Ckt. (A) | | | | BA 6-16 V Sinking |
| | | | | Two IC's (Ckts. A & B): AC 5 V Sinking |

⚠ The "MICRO SWITCH" identification is shown on this side of the switch housing.




| OPERATING ACTION | | |
|---|---|---|
| | 2-POSITION | |
| Circuit Output States | 01 Maint. | Maint. |
| Ckt. A | Low (operated) | High |
| Ckt. B | High | Low (operated) |

ADDITIONAL AML13 OPTIONS: two lamp circuits; other two-position and three-position operating actions; .025 x .025 printed circuit, wire-wrap, or push-on terminals; and two 6-16 V sinking IC's.

## AML15 SOLID STATE PADDLE SWITCHES . . . LED DISPLAY

AML15 switches combine Hall effect switching reliability with LED display to provide a completely solid state device.

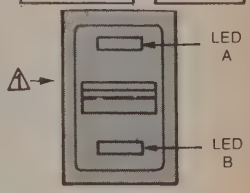
**ELECTRICAL SPECIFICATIONS**
Refer to page 2.

### ORDER GUIDE — Solid State Paddle Switches/LED Display

**AML15 F B B 2 AA 01 R X**

| HOUSING TYPE | OPR./ BEZEL COLOR | LED VOLTAGE | TERMINAL TYPE | CIRCUITRY CODE | OPERATING ACTION | LED COLOR (LED A) | LED COLOR (LED B) |
|---|---|---|---|---|---|---|---|
| F Rectangular 1 LED | B Black | B Non-Resistor* C 5 V | 2 .110 x .020 (Solder or Quick-Connect) | One IC (Ckt. A): AA 5 V Sinking BA 6-16 V Sinking Two IC's (Ckts. A & B): AC 5 V Sinking BC 6-16 V Sinking | 01 | R Red Y Yellow G Green | X No LED |

| Circuit Output States | 01 Maint. | 01 Maint. |
|---|---|---|
| Ckt. A | Low (operated) | High |
| Ckt. B | High | Low (operated) |




* See LED application information for devices without current-limiting resistor, page 3.

ADDITIONAL AML15 OPTIONS: two LED's, integral diode LED protection; 15 V LED voltage; .025 x .025 printed circuits, wire-wrap, or push-on termination; other two-position and three-position operating actions. Refer to Product Brochure AML.

## AML23 ELECTRONIC CONTROL PADDLE SWITCHES/INCANDESCENT DISPLAY

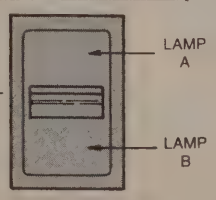
AML23 switches provide electronic control capability (up to 3 amps, 125 VAC). There is a choice of fine silver or gold contacts; two or three-position operating action.

**ELECTRICAL SPECIFICATIONS**
Refer to page 4.

### ORDER GUIDE — Electronic Control Paddle Switches/Incandescent Display

**AML23 E B A 2 AA 01**

| HOUSING TYPE | OPERATOR/ BEZEL COLOR | LAMP TYPE | TERMINAL TYPE | CIRCUITRY CODES | OPERATING ACTION |
|---|---|---|---|---|---|
| E Rectangular Non-Lighted F Rectangular 1 Lamp Ckt. (A) | B Black/Black | A No Lamp Installed | 2 .110 x .020 (Solder or Quick-Connect) | Insert Code letters as shown in Circuitry Chart below. | Insert code numbers from Operating Action Chart below. |




ADDITIONAL AML23 OPTIONS: two lamp circuits, .025 x .025 printed circuit, wire-wrap or push-on terminals, other two and three-position operating actions, and additional circuitry. Refer to Product Brochure AML.

| OPERATING ACTION | | |
|---|---|---|
| Maint. | 01 None | Maint. |
| Maint. | 04 Maint. | Maint. |

| CIRCUITRY CODES | | CIRCUITRY | |
|---|---|---|---|
| Silver Contacts | Gold Contacts | 2-POSITION | 3-POSITION |
| AA | BA | 3 2 1 / 3 2 1 | 3 2 1 / 3 2 1 / 3 2 1 |
| AC ⚠2 | BC ⚠2 | 3 2 1 / 3 2 1 / 6 5 4 / 6 5 4 | 3 2 1 / 3 2 1 / 3 2 1 / 6 5 4 / 6 5 4 / 6 5 4 |

⚠1 The "MICRO SWITCH" identification is shown on this side of the switch housings.
⚠2 For non-illuminated switches only.

**MICRO SWITCH** A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

## AML25 ELECTRONIC CONTROL PADDLE SWITCHES . . . LED DISPLAY

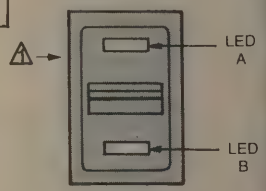
AML25 switches are identical to AML23 series, except they are furnished with LED display. Refer to page 3 for LED application information.

### ORDER GUIDE — Electronic Control Paddle Switches/LED Display

| AML25 | F | B | B | 2 | AA | 01 | R | X |
|---|---|---|---|---|---|---|---|---|
| HOUSING TYPE | OPERATOR/ BEZEL COLOR | LED VOLTAGE | TERMINAL TYPE | CIRCUITRY CODES | OPERATING CODE | LED COLOR (LED A) | LED COLOR (LED B) |
| F Rectangular 1 LED | B Black/Black | B Non-Resistor* C 5.0 V | 2 .110 x .020 (Solder or Quick-Connect) | Insert code letters as shown in Circuitry Chart on page 7 | Insert code numbers from Operating Action Chart on page 7 | R Red Y Yellow G Green | X No LED |

* See LED application information for devices without current-limiting resistor, page 3.

ADDITIONAL AML25 OPTIONS: two LED's; 15 V LED voltage; .025 x .025 printed circuit, wire-wrap, or push-on termination; other two and three-position operating actions; and additional circuitry. Refer to Product Brochure AML.




## AML33/35 POWER DUTY PADDLE SWITCHES . . . INCANDESCENT/NEON DISPLAY

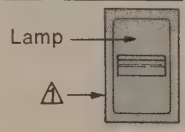
AML33 (incandescent display) and AML35 (neon display switches) are for use in power line-disconnect applications.

### ELECTRICAL SPECIFICATIONS

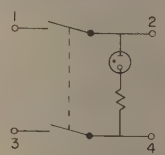
| Voltage | Current | Load Type |
|---|---|---|
| 125 VAC | 15 Amps | 60% Power Factor |
| 240 VAC | 15 Amps | 60% Power Factor |

### ORDER GUIDE — Power Duty Paddle Switches/Incandescent Display

| AML33 | E | B | A | 4 | AA | 01 |
|---|---|---|---|---|---|---|
| HOUSING TYPE | OPERATOR/ BEZEL COLOR | LAMP TYPE | TERMINAL TYPE | CIRCUITRY CODES | OPERATING ACTION |
| E Rectangular Non-Illum. F Rectangular 1 Lamp Ckt. | B Black/Black | A No Lamp Installed | 4 .187 x .020 (Solder or Quick-Connect) | Silver Contacts: AA 1-Pole (One Form A Single-Throw, Normally-Open) AC 2-Pole (Two Form A) | 01 Maint. ON Maint. OFF |

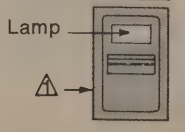



INTEGRAL NEON CIRCUIT

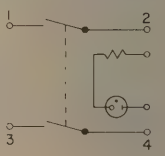



### ORDER GUIDE — Power Duty Paddle Switches/Neon Display

| AML35 | F | B | B | A | AA | 01 |
|---|---|---|---|---|---|---|
| HOUSING TYPE | OPERATOR/ BEZEL COLOR | LAMP VOLTAGE | TERMINAL TYPE/ LAMP CIRCUIT | CIRCUITRY CODES | OPERATING ACTION |
| F Rectangular 1 Lamp Ckt. | B Black/Black | B 120 VAC C 250 VAC | 4 .187 x .020 (Solder or Quick-Connect) With Isolated Lamp Circuit 7 .187 x .020 With Integral Lamp Circuit (Available with 2-Pole devices only) | Silver Contacts: AA (One Form A Single-Throw) Available only with isolated lamp circuit, term. type 4. AC 2-Pole (Two Form A) | 01 Maint. ON Maint. OFF |




ISOLATED NEON CIRCUIT




⚠ The "MICRO SWITCH" identification is shown on this side of the switch housing.

# PADDLE SWITCH COVERS

## AML53/55 COVERS FOR PADDLE SWITCHES

Paddle switch covers are furnished in the same attractive colors as the buttons used in AML push-button switches and indicators. They provide an attractive, uniform color display, whether lighted or non-lighted.

AML53 covers are for non-lighted or incandescent display.

AML55 covers are used with LED and neon display paddle switches. The LED version has a "window" which allows the LED to be flush with the top surface of the cover. The neon type has a colored lens which extends over the neon bulb.

### ORDER GUIDE — Covers/Incandescent Display

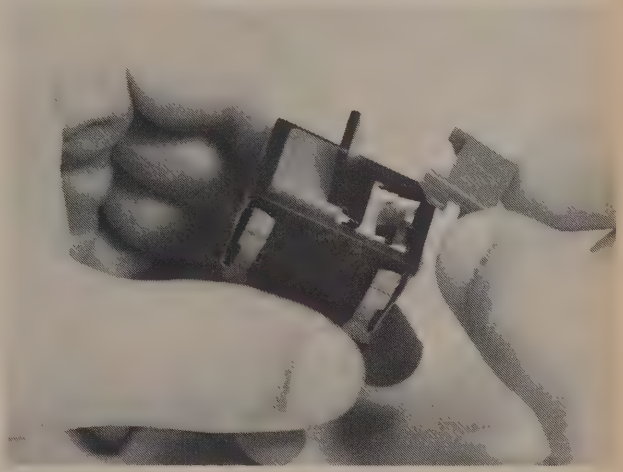
(for AML13, 23, and 33 paddle switches)

**AML53 E 10 R**

| PADDLE COVER TYPE | DISPLAY/LEGEND TYPE | COVER COLOR |
|---|---|---|
| **E** ½ Cover | Transmitted Color<br>**10** No Legend<br>**20** With Legend | **R** Red<br>**Y** Yellow<br>**G** Green<br>**B** Blue<br>**W** White<br>***K** Black |

* Not recommended for lighted display.

ADDITIONAL AML53 OPTIONS: dead front and projected color display; gray, amber, and light green covers. Refer to Product Brochure AML.



Colored covers simply snap onto the top of the paddle switch housings.

### ORDER GUIDE — Covers/LED Display

(for AML15 and 25 paddle switches)

**AML55 E 10 Y**

| PADDLE COVER TYPE | DISPLAY/LEGEND TYPE | COVER COLOR |
|---|---|---|
| **E** ½ cover For One LED† | Transmitted Color<br>**10** No Legend<br>**20** With Legend | **R** Red<br>**Y** Yellow<br>**G** Green<br>**B** Blue<br>**W** White<br>**K** Black |

† NOTE: To order a ½-cover without the LED window, specify an AML53-E listing.

ADDITIONAL AML55 OPTIONS: two-piece covers and gray, amber, and light-green cover colors. Refer to Product Brochure AML.

### COVER LEGENDING

To specify hot stamp legends, request the following legend order sheets: AML53 covers, FO-63567; and AML55 covers, FO-63565.

### ORDER GUIDE — Covers/Neon Display

(for AML35 paddle switches)

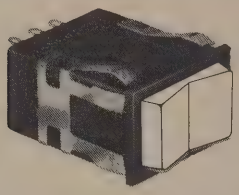
**AML55 N 10 R Y**

| PADDLE COVER TYPE | DISPLAY/LEGEND TYPE | LENS COLOR | COVER COLOR |
|---|---|---|---|
| **N** Full Neon Cover, with Colored Lens | Transmitted Color<br>**10** No Legend<br>**20** With Legend | **T** Clear<br>**R** Red | **R** Red<br>**K** Black<br>**L** Gray |

ADDITIONAL AML55 OPTIONS: yellow, green, blue, white, amber, and light green covers. Refer to Product Brochure AML.

**MICRO SWITCH** A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

# ROCKER SWITCHES



ROCKERS (page 12, 13) AND INCANDESCENT LAMPS (page 13) **ARE ORDERED SEPARATELY.**

Rocker switches combine the low-profile appearance of pushbutton switches with toggle-action operation. Solid state, electronic control, and power duty versions are offered.

## OPERATING ACTION OPTIONS

| 2-POSITION | | 3-POSITION | | |
|---|---|---|---|---|
| Maint. | Maint. | Maint. | Maint. | Maint. |
| Mom. | Maint. | Mom. | Maint. | Mom. |
| Maint. | Mom. | Maint. | Maint. | Mom. |
| | | Mom. | Maint. | Maint. |

Note: Power duty switches have 2-position, maintained action only.

# AML14 SOLID STATE ROCKER SWITCHES... INCANDESCENT DISPLAY

AML14 switches provide low voltage signals that interface with nearly all DC logic level loads. As a permanent magnet plunger moves adjacent to the MICRO SWITCH Hall effect integrated circuit, the TTL compatible output snaps from high to low (low to high).

## ELECTRICAL SPECIFICATIONS

Refer to page 2.

ADDITIONAL AML14 OPTIONS: two lamp circuits; other two-position and three-position operating actions; .025 x .025 printed circuit, wire-wrap, or push-on terminals; and two 6-16 V sinking IC's. Refer to Product Brochure AML.

## ORDER GUIDE — Solid State Rocker Switches/Incandescent Display

**AML14 E B A 2 AA 01**

**HOUSING TYPE**
- **E** Rectangular Non-Lighted
- **F** Rectangular 1 Lamp Ckt. (A)

**BEZEL COLOR**
- **B** Black

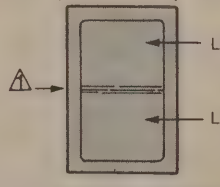
**LAMP TYPE**
- **A** No Lamp Installed

**TERMINAL TYPE**
- **2** .110 x .020 (Solder or Quick-Connect)

**CIRCUITRY CODE**
- **One IC (Ckt. A): AA** 5 V Sinking
- **BA** 6-16 V Sinking
- **Two IC's (Ckts. A & B): AC** 5 V Sinking

**OPERATING ACTION**

| Circuit Output States | 01 Maint. | Maint. |
|---|---|---|
| Ckt. A | Low (operated) | High |
| Ckt. B | High | Low (operated) |




# AML16 SOLID STATE ROCKER SWITCHES... LED DISPLAY

AML16 switches combine Hall effect switching reliability with LED display to provide a completely solid state device. Refer to page 3 for LED application information.

## ELECTRICAL SPECIFICATIONS

Refer to page 2.

## ORDER GUIDE — Solid State Rocker Switches/LED Display

**AML16 F B B 2 AA R X 01**

**HOUSING TYPE**
- **F** Rectangular 1 LED

**BEZEL COLOR**
- **B** Black

**LED VOLTAGE**
- **B** Non-Resistor*
- **C** 5 V

**TERMINAL TYPE**
- **2** .110 x .020 (Solder or Quick-Connect)

**CIRCUITRY CODE**
- **One IC (Ckt. A): AA** 5 V Sinking
- **BA** 6-16 V Sinking
- **Two IC's (Ckts. A & B): AC** 5 V Sinking
- **BC** 6-16 V Sinking

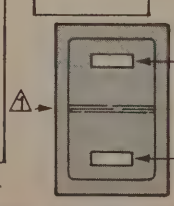
**LED COLOR (LED A)**
- **R** Red
- **Y** Yellow
- **G** Green

**LED COLOR (LED B)**
- **X** No LED

**OPERATING ACTION**

| Circuit Output States | 01 Maint. | Maint. |
|---|---|---|
| Ckt. A | Low (operated) | High |
| Ckt. B | High | Low (operated) |

* See LED application information for devices without current-limiting resistor, page 3.




⚠ The "MICRO SWITCH" identification is shown on this side of the switch housings.

ADDITIONAL AML16 OPTIONS: integral diode LED protection; two LED's, 15 V LED voltage; .025 x .025 printed circuit, wire-wrap, or push-on termination; other two-position and three-position operating actions. Refer to Product Brochure AML.

## AML24 ELECTRONIC CONTROL ROCKER SWITCHES . . . INCANDESCENT DISPLAY

AML24 switches provide electronic control capability (up to 3 amps, 125 VAC). There is a choice of fine silver or gold contacts; two or three-position operating action.

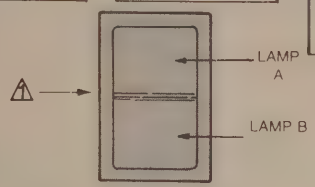
**ELECTRICAL SPECIFICATIONS**
See page 4.

### ORDER GUIDE — Electronic Control Rocker Switches/Incandescent Display

**AML24**

| E | B | A | 2 | AA | 01 |
|---|---|---|---|---|---|
| HOUSING TYPE | BEZEL COLOR | LAMP TYPE | TERMINAL TYPE | CIRCUITRY CODES | OPERATING ACTION |
| **E** Rectangular Non-Lighted<br>**F** Rectangular 1 Lamp Ckt. | **B** Black | **A** No Lamp Installed | **2** .110 x .020 (Solder or Quick-Connect) | Insert Code letters as shown in Circuitry Chart below. | Insert code numbers from Operating Action Chart below |

ADDITIONAL AML24 OPTIONS: two lamp circuits; .025 x .025 printed circuit, wire-wrap, or push-on terminals; other two and three-position operating actions; and additional circuitry. Refer to Product Brochure AML.




## AML26 ELECTRONIC CONTROL ROCKER SWITCHES . . . LED DISPLAY

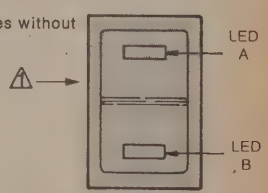
AML26 switches are identical to AML24 series, except they are furnished with LED display.

### ORDER GUIDE — Electronic Control Rocker Switches/LED Display

**AML26**

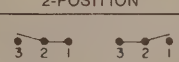
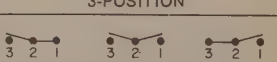
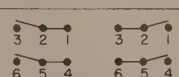
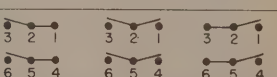
| F | B | B | 2 | AA | 01 | R | X |
|---|---|---|---|---|---|---|---|
| HOUSING TYPE | BEZEL COLOR | LED VOLTAGE | TERMINAL TYPE | CIRCUITRY CODES | OPERATING ACTION | LED COLOR (LED A) | LED COLOR (LED B) |
| **F** 1 LED | **B** Black | **B** Non-Resistor*<br>**C** 5 V | **2** .110 x .020 (Solder or Quick-Connect) | Insert Code letters as shown in Circuitry Chart below. | Insert code numbers from Operating Action Chart below | **R** Red<br>**Y** Yellow<br>**G** Green | **X** No LED |

* See LED application information for devices without current-limiting resistor, page 3.




ADDITIONAL AML26 OPTIONS: two LED's; 15 V LED voltage; .025 x .025 printed circuit wire-wrap, or push-on terminals; other two and three-position operating actions; and additional circuitry. Refer to Product Brochure AML.

| OPERATING ACTION | | |
|---|---|---|
| | | |
| Maint. | **01** None | Maint. |
| Maint. | **04** Maint. | Maint. |

| CIRCUITRY CODES | | CIRCUITRY | |
|---|---|---|---|
| Silver Contacts | Gold Contacts | 2-POSITION | 3-POSITION |
| **AA** | **BA** |  |  |
| **AC** 2 | **BC** 2 |  |  |

1 The "MICRO SWITCH" identification is shown on this side of the switch housings.
2 For non-illuminated swtches only.

**MICRO SWITCH** A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

# AML34/36 POWER DUTY ROCKER SWITCHES . . . INCANDESCENT/NEON DISPLAY

AML34 (incandescent display) and AML36 (neon display) switches are for use in power line-disconnect applications.

## ELECTRICAL SPECIFICATIONS

| Voltage | Current | Load Type |
|---|---|---|
| 125 VAC | 15 Amps | 60% Power Factor |
| 240 VAC | 15 Amps | 60% Power Factor |

## ORDER GUIDE — Power Duty Rocker Switches/Incandescent Display

**AML34 E B A 4 AA 01**

**HOUSING TYPE**
- **E** Rectangular Non-Illum.
- **F** Rectangular 1 Lamp Ckt.

**BEZEL COLOR**
- **B** Black

**LAMP TYPE**
- **A** No Lamp Installed

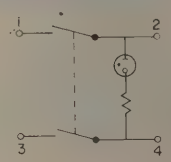
**TERMINAL TYPE**
- **4** .187 x .020 (Solder or Quick-Connect) With Isolated Lamp Circuit

**CIRCUITRY CODES**
- **Silver Contacts: AA** 1-Pole (One Form A Single-Throw)
- **AC** 2-Pole (Two Form A)

**OPERATING ACTION**

**01** Maint. ON / Maint. OFF

**INTEGRAL NEON CIRCUIT**



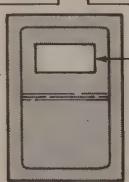

## ORDER GUIDE — Power Duty Rocker Switches/Neon Display

**AML36 F B B 4 AA 01**

**HOUSING TYPE**
- **F** Rectangular 1 Lamp Ckt.

**BEZEL COLOR**
- **B** Black

**LAMP VOLTAGE**
- **B** 125 VAC
- **C** 250 VAC



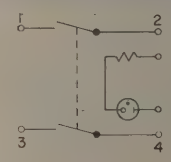

**TERMINAL TYPE/ LAMP CIRCUIT**
- **4** .187 x .020 (Solder or Quick-Connect) With Isolated Lamp Circuit
- **7** .187 x .020 With Integral Lamp Circuit (Available with 2-Pole devices only)

**CIRCUITRY CODES**
- **Silver Contacts: AA** (One Form A Single-Throw) Available only with isolated lamp circuit, terminal type 4
- **AC** 2-Pole (Two Form A)

**OPERATING ACTION**

**01** Maint. ON / Maint. OFF

**ISOLATED NEON CIRCUIT**




⚠1 The "MICRO SWITCH" identification is shown on this side of the switch housing.

# AML54/56 ROCKER OPERATORS

Rocker operators are furnished in the same attractive colors as the buttons used in AML pushbutton switches and indicators. They provide an attractive, uniform color display, whether lighted or unlighted.

AML54 rockers are for non-lighted or incandescent display.

AML56 rockers are used with LED and neon display rocker switches. The LED version has a "window" which allows the LED to be flush with the top surface of the rocker. The neon type has a colored lens which extends over the neon bulb.

## ORDER GUIDE — Rockers/Neon Display

(for AML36 switches)

**AML56 N 10 R K**

**ROCKER OPERATOR TYPE**
- **N**

Full Rocker with Colored Lens

**DISPLAY/LEGEND TYPE**
- Transmitted Color
- **10** No Legend
- **20** With Legend

**LENS COLOR**
- **T** Clear
- **R** Red

**ROCKER COLOR**
- **R** Red
- **K** Black

ADDITIONAL AML56 OPTIONS: yellow, green, blue, white, amber and light green rockers. Refer to Product Brochure AML.

Rocker operators are assembled to the switches by simply snapping them into recesses in the switch operator sockets.

# MOUNTING BRACKETS/LAMPS/BARRIERS

## ROCKER OPERATORS (CONT.)

### ORDER GUIDE — Rockers/Incandescent Display
(for AML14, 24, and 34)

**AML54 F 10 R**

| OPERATOR TYPE ROCKER | DISPLAY/LEGEND TYPE | ROCKER COLOR |
|---|---|---|
| **F** Full Rocker | Transmitted Color | **R** Red |
| **E** ½ Rocker | **10** No Legend | **Y** Yellow |
| | **20** With Legend | **G** Green |
| | | **B** Blue |
| | | **W** White |
| | | ***K** Black |

* Not recommended for lighted display.

ADDITIONAL AML54 OPTIONS: dead front and projected color display; gray, amber, and light green rockers. Refer to Product Brochure AML.

### ORDER GUIDE — Rockers/LED Display
(for AML16 and 26)

**AML56 E 10 R**

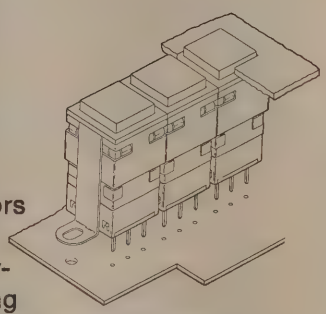
| ROCKER OPERATOR TYPE | DISPLAY/LEGEND TYPE | ROCKER COLOR |
|---|---|---|
| **E** ½ Rocker* | Transmitted Color | **R** Red |
| | **10** No Legend | **Y** Yellow |
| | **20** With Legend | **G** Green |
| | | **B** Blue |
| | | **W** White |
| | | **K** Black |

* NOTE: To order a ½-rocker without the LED "window," specify an AML54-E listing.

ADDITIONAL AML56 OPTIONS: gray, amber and light green rockers. Refer to Product Brochure AML.

## AML61 MOUNTING BRACKET ASSEMBLIES

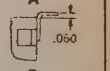
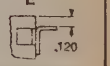
This strip utilizes type F mounting brackets for printed circuit board mounting. Matrix mount also available.



AML switches and indicators can be subpanel mounted (hidden bezel) with factory-assembled AML61 mounting bracket assemblies and extended buttons, in a single panel cutout. Both square and rectangular housings can be accommodated. Refer to Product Brochure AML for more information.

### ORDER GUIDE — Strip Mounting Assembly

**AML61 B A 5 A**

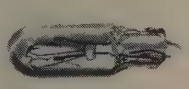
| HOUSING TYPE | MOUNTING BRACKET ORIENTATION | NUMBER OF STATIONS | MOUNTING BRACKET LOCATION |
|---|---|---|---|
| **B** Square | **A** | **1** | **A**  .060 |
| **E** Rectangular | **B** | **2** | **B** BRACKET FLUSH TO TOP OF CAN |
| | | **3** | |
| | | **4** | |
| | | **5** | |
| | | **6** | **E**  .120 |

ADDITIONAL AML61 OPTIONS: up to 12 stations per row, and other mounting bracket locations. Refer to Product Brochure AML.

## AML91 INCANDESCENT LAMPS

### ORDER GUIDE

**AML91 L A 86**

| DEVICE | TYPE | CONSTRUCTION (Industry Lamp No.) |
|---|---|---|
| **L** Lamp  | **A** Wedge Base T-1¾ | **86** 6.3 Volts |
| | | **73** 14.0 Volts |
| | | **85** 28.0 Volts |

## AML71 BARRIERS

Barriers separate switches and indicators (not for use with AML61).

### ORDER GUIDE

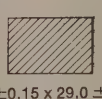
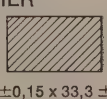
**AML71 S C B**

| LENGTH | TYPE | COLOR |
|---|---|---|
| **S** Short (For use with square devices and short side of rectangular device.) | **C** Center | **B** Black |
| **L** Long (For use with long side of rectangular device.) | **E** End | |

Key: 0,00 — mm / 0.00 — inches

## PANEL CUTOUTS FOR SINGLE SWITCHES/INDICATORS

For complete mounting dimensions refer to Product Brochure AML.

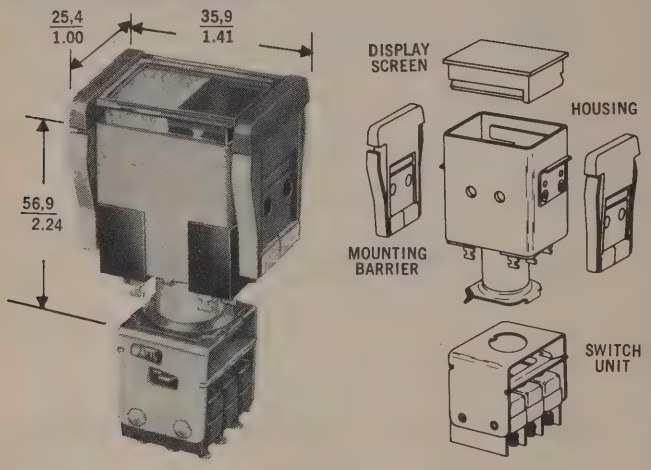
| WITHOUT BARRIERS | | | SHORT BARRIER | | LONG BARRIER |
|---|---|---|---|---|---|
| | |  | |  | |
| 19,0 ±0,15 x 6,35 ±0,15<br>.750 ±.005 x .250 ±.005 | 19,0 ±0,15<br>.750 ±.005 SQUARE | 19,0 ±0,15 x 29,0 ±0.15<br>.750 ±.005 x 1.141 ±.005 | 19,0 ±0,15 x 23,25 ±0,15<br>.750 ±.005 x .915 ±.005 | 19,0 ±0,15 x 33,3 ±0.15<br>.750 ±.005 x 1.310 ±.005 | 23,25 ±0,15 x 29,0 ±0.15<br>.915 ±.005 x 1.141 ±.005 |

**MICRO SWITCH** A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

# SERIES 2 RECTANGULAR DISPLAY MODULAR LIGHTED PUSHBUTTON SWITCHES
## BARRIER MOUNT MODULES

### Operator-Indicator Housing Modules

### SHORT BARRIER MOUNT




**Catalog Listings**

| Short Barrier Operator-Indicator Housing Type | No. of Sockets | Type 2C | Hand Relampable Type 2C200 |
|---|---|---|---|
| No Coil | 2 (A & C) | 2C1† | 2C201† |
| | 4 (A, B, C, & D) | 2C3† | 2C203† |
| 6 vdc Hold-in Coil | 2 (A & C) | 2C13 | 2C213 |
| | 4 (A, B, C, & D) | 2C15 | 2C215 |
| 28 vdc Hold-in Coil | 2 (A & C) | 2C25 | 2C225 |
| | 4 (A, B, C, & D) | 2C27 | 2C227 |
| 48 vdc Hold-in Coil | 2 (A & C) | 2C37 | 2C237 |
| | 4 (A, B, C, & D) | 2C39 | 2C239 |

### INDICATOR HOUSING MODULES

Indicators match their respective operator-indicator counterparts in panel appearance, but have no provision for attaching switch units. They utilize the same barriers for panel mounting.

### MOUNTING BARRIERS

Molded color barriers are available in two panel thickness ranges (.19″ panels require the .06″ to .19″ type). For strip-mounted units, specify one more barrier than the number of units in the group.

### HOLD-IN COIL ELECTRICAL DATA

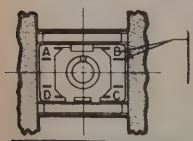
(also available in Flange mount)

Hold-in coil equipped operator-indicator housings enable electromagnetic maintained and released contact. When energized, the coil holds the device in the operated condition, after the screen has been manually depressed.

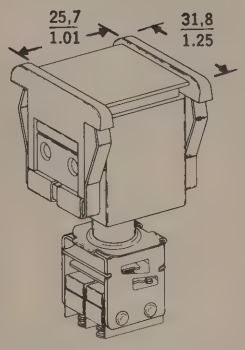
Approximate coil power ratings are 1.3 watts, 6 vdc coil and 1.7 watts, 28 or 48 vdc coil.

### ELECTRICAL BAIL

The circuit at right shows a means of operating any number of hold-in coil units, one-by-one, in situations that require only one switch to be operated at a time. A cancel switch can be installed at either or both points "A" and "B" to perform clearing of all switches.




LAMP TERMINAL DESIGNATION, 2 TERMINALS FOR EACH LAMP, PLATED FOR SOLDERING




### LONG BARRIER MOUNT

These housings are assembled to panels with mounting barriers attached to the longer sides.*

**Catalog Listings**

| Long Barrier Operator-Indicator Housing Type | No. of Sockets | Type 2C | Hand Relampable Type 2C200 |
|---|---|---|---|
| No Coil | 2 (A & C) | 2C7† | 2C207† |
| | 4 (A, B, C, & D) | 2C9† | 2C209† |
| 6 vdc Hold-in Coil | 2 (A & C) | 2C19 | 2C219 |
| | 4 (A, B, C, & D) | 2C21 | 2C221 |
| 28 vdc Hold-in Coil | 2 (A & C) | 2C31 | 2C231 |
| | 4 (A, B, C, & D) | 2C33 | 2C233 |
| 48 vdc Hold-in Coil | 2 (A & C) | 2C43 | 2C243 |
| | 4 (A, B, C, & D) | 2C45 | 2C245 |

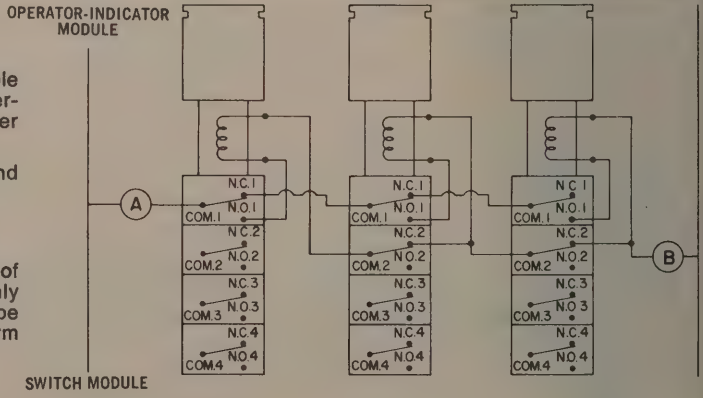
See Catalog 200 for additional information and listings.

**Catalog Listings**

| Barrier Mount Indicator Housing Type | No. of Sockets | Type 2F | Hand Relampable Type 2F200 |
|---|---|---|---|
| Long | 2 (A & C) | 2F7 | 2F207 |
| | 4 (A, B, C, & D) | 2F9 | 2F209 |
| Short | 2 (A & C) | 2F1 | 2F201 |
| | 4 (A, B, C, & D) | 2F3 | 2F203 |

**Catalog Listings**

| Mounting Barriers | For Panel Thickness | Gray | Black | White | Red |
|---|---|---|---|---|---|
| Attach to Long Sides | .06″ to .19″ | 2B2 | 2B4 | 2B14 | 2B15 |
| | .19″ to .31″ | 2B6 | 2B8 | 2B16 | 2B17 |
| Attach to Short Sides | .06″ to .19″ | 2B1 | 2B3 | 2B10 | 2B11 |
| | .19″ to .31″ | 2B5 | 2B7 | 2B12 | 2B13 |



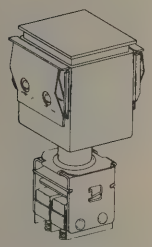

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0,0 — mm / 0.00 — inches

* Switch modules shown on page 80.
† UL Component Recognized.

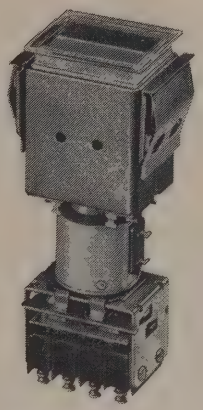
# SERIES 2 FLANGE MOUNT MODULES

## Operator-Indicator Housing Modules



### HOUSINGS WITH FLANGES ON LONG SIDES

These housings have spring clip mounting devices ready-attached on the longer sides.‡



### HOUSINGS WITH FLANGES ON SHORT SIDES

These housings have spring mounting clips ready-attached to the shorter sides.‡

**Catalog Listings**

| Long Flange Operator-Indicator Housing Type | No. of Sockets | Type 2C | Hand Relampable Type 2C200 |
|---|---|---|---|
| No Coil | 2 (A & C) | 2C4† | 2C204† |
| | 4 (A, B, C, & D) | 2C6† | 2C206† |
| 6 vdc Coil (Hold-in) | 2 (A & C) | 2C16 | 2C216 |
| | 4 (A, B, C, & D) | 2C18 | 2C218 |
| 28 vdc Coil (Hold-in) | 2 (A & C) | 2C28 | 2C228 |
| | 4 (A, B, C, & D) | 2C30 | 2C230 |
| 48 vdc Coil (Hold-in) | 2 (A & C) | 2C40 | 2C240 |
| | 4 (A, B, C, & D) | 2C42 | 2C242 |
| 28 vdc Coil* (Pull-in) | 4 (A, B, C, & D) | 2C68 | 2C268 |

* Also available with flanges on all four sides — 2C77 (Type 2C) and 2C277 (Type 2C200)

**Catalog Listings**

| Short Flange Operator-Indicator Housing Type | No. of Sockets | Type 2C | Hand Relampable Type 2C200 |
|---|---|---|---|
| No Coil | 2 (A & C) | 2C10† | 2C210† |
| | 4 (A, B, C, & D) | 2C12† | 2C212† |
| 6 vdc Coil (Hold-in) | 2 (A & C) | 2C22 | 2C222 |
| | 4 (A, B, C, & D) | 2C24 | 2C224 |
| 28 vdc Coil (Hold-in) | 2 (A & C) | 2C34 | 2C234 |
| | 4 (A, B, C, & D) | 2C36 | 2C236 |
| 48 vdc Coil (Hold-in) | 2 (A & C) | 2C46 | 2C246 |
| | 4 (A, B, C, & D) | 2C48 | 2C248 |

## INDICATOR HOUSINGS

**Catalog Listings**

| Flange Mount Indicator Housing Type | No. of Sockets | Type 2F | Hand Relampable Type 2F200 |
|---|---|---|---|
| Long Flange | 2 (A & C) | 2F4 | 2F204 |
| | 4 (A, B, C, & D) | 2F6 | 2F206 |
| Short Flange | 2 (A & C) | 2F10 | 2F210 |
| | 4 (A, B, C, & D) | 2F12 | 2F212 |

## SPACING BARRIERS

Spacing barriers, not necessary for mounting, can be used to color code groupings and prevent accidental actuation of two screens with one push.

**Catalog Listings**

| Spacing Barriers | Gray | Black | White | Red |
|---|---|---|---|---|
| For Long Flange Housing | 2B9 | 2B18 | 2B19 | 2B46 |
| For Short Flange Housing | 2B23 | 2B24 | 2B25 | 2B26 |

## PULL-IN COIL ELECTRICAL DATA

(available in Flange mount only)

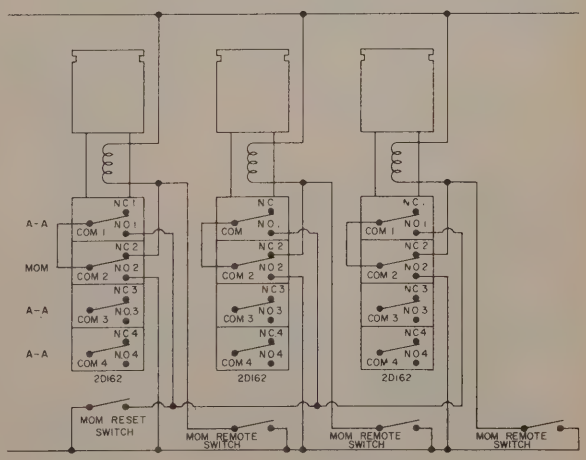
Pull-in coil equipped operator-indicators enable electromagnetic actuated, maintained and released contacts. Energizing the coil pulls in the operating plunger, causing circuit transfer in the switching unit. A 28 vdc, 2.2 amps. (approx.) is required during actuation (for about 20 ms. or less) and only .11 amp. (approx.) during hold-in. (Recommended for operation at 85 to 100% of rated voltage.)

Switch units that can be used are "TB", "PL" and all "SM" types except low force and 4-pole alternate-action designs. Maximum ambient temperature limits are 120°F (48.9°C) (1 or 2 pole momentary-action), 110°F (48.9°C) (3-pole momentary-action), 100°F (37.8°C) (4-pole momentary-action) and 90°F (32.2°C) (all alternate-action or momentary/alternate-action) switch units.

Note: A 4-pole momentary switch such as a 2D9 requires 28 volts for proper actuation.

## ELECTRICAL BAIL

The circuit at right shows how any number of Catalog Listings 2D162 can be operated in one-by-one sequence. Each actuation releases previously actuated switch. Power is required only during the reset pulse. (Reset can also be accomplished by depressing previously actuated screen.)




‡ Switch modules shown on page 17.

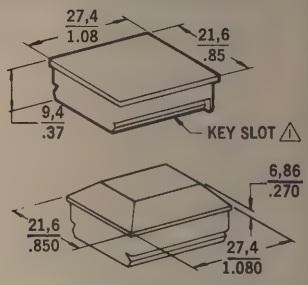
† UL component recognized.

**MICRO SWITCH** A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

# SERIES 2 DISPLAY SCREENS

## ONE-PIECE DISPLAY SCREENS

One-piece single-section display screens are available in two styles — standard (translucent) and truncated pyramid (translucent or transparent).

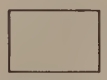



KEY SLOT FACES SIDE OF HOUSING SHOWING CATALOG LISTING (ABOVE LAMP TERMINALS "A" AND "B")

**Catalog Listings**

| Color | Standard | Truncated Pyramid† | |
|---|---|---|---|
| | | Transparent | Translucent |
| Red | 2A1 | 2A97 | 2A92 |
| Yellow | 2A2 | 2A98 | 2A93 |
| Green | 2A3 | 2A99 | 2A94 |
| Blue | 2A4 | 2A100 | 2A95 |
| White | 2A5 | 2A96* | 2A91 |
| Amber | Not Available | 2A113 | 2A112 |

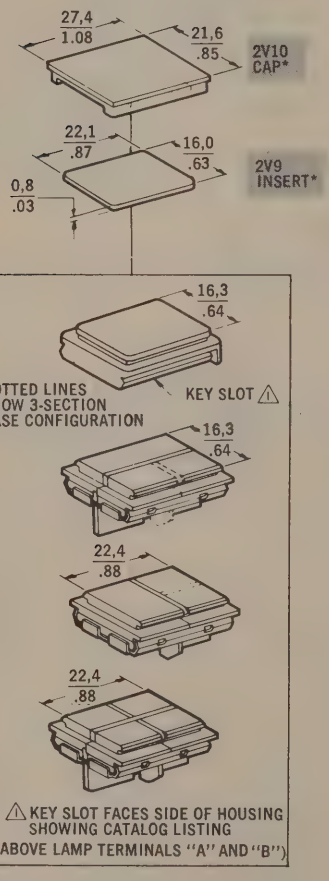
* Colorless transparent
† May not be stock items.



Single Section

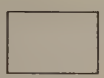
DIMENSIONS SHOWN ARE FOR REFERENCE ONLY
Key: 0,0 — mm / 0.00 — inches

## THREE-PIECE DISPLAY SCREENS




* Order for replacement only.

Single Section



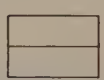
These screens have transparent colored or colorless caps, transparent colorless legend inserts and translucent colored bases.

**Catalog Listings**

| Color | Colored Caps | Colorless Caps |
|---|---|---|
| Red | 2A66 | 2A81 |
| Yellow | 2A67 | 2A82 |
| Green | 2A68 | 2A85 |
| Blue | 2A69 | 2A86 |
| White | — | 2A70 |
| Amber | — | 2A114 |

Two Section

LATERAL SPLIT



LONGITUDINAL SPLIT

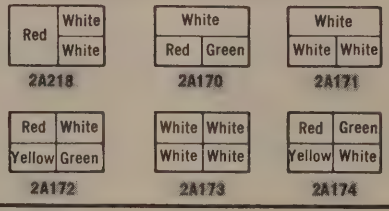
Silicone rubber light baffles prevent spillage from one section to another. Bases are translucent colored with transparent colorless caps and inserts.

**Catalog Listings**

| Colors | Lateral Split | Longitudinal Split |
|---|---|---|
| Yellow-Yellow | 2A44 | 2A59 |
| Green-Blue | 2A45 | 2A60 |
| Green-White | 2A46 | 2A61 |
| Green-Green | 2A47 | 2A62 |
| Blue-White | 2A48 | 2A63 |
| Blue-Blue | 2A49 | 2A64 |
| White-White | 2A50 | 2A65 |

| Colors | Lateral Split | Longitudinal Split |
|---|---|---|
| Red-Red | 2A36 | 2A51 |
| Red-Yellow | 2A37 | 2A52 |
| Red-Green | 2A38 | 2A53 |
| Red Blue | 2A39 | 2A54 |
| Red-White | 2A40 | 2A55 |
| Yellow-Green | 2A41 | 2A56 |
| Yellow-Blue | 2A42 | 2A57 |
| Yellow-White | 2A43 | 2A58 |

## THREE AND FOUR SECTION




These screens are available in any combination of red, yellow, green, blue, amber and white. Half-segments are illuminated by two lamps and quarter-segments by one lamp each. Items shown are stock items. If you desire other color arrangements, contact your nearest MICRO SWITCH Branch Office.

## SCREENS WITH COLORED RIM CAPS

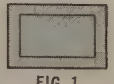


FIG. 1

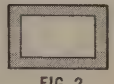


FIG. 2

**Catalog Listings**

| Color of Rim Cap | | |
|---|---|---|
| Red | Green | Blue |
| 2A106 | 2A108 | 2A107 |

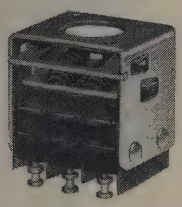
With these screens, a change in control status can be indicated by both color and shape. They have colored transparent rim caps, colorless transparent inserts and white translucent bases. Filters of the same color as the caps are put on two of the four lamps. When the filtered lamps are lighted, a solid color appears (Fig. 1), while the unfiltered lamps, when lighted, result in a white display with a colored frame (Fig. 2).

Since the insert is exposed, legending should be done on the base or reverse side of the insert.

# SERIES 2 SWITCH MODULES

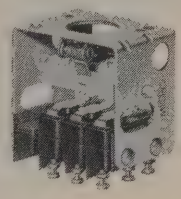
Interchangeable type 2D switch modules attach to spring clips on the bottom of operator-indicator housings. Dependable performance at power or low energy loads is assured by MICRO SWITCH time-proven snap-action basic switches. Options include momentary action (push-on release-off), alternate-action (push-on push-off); 1, 2, or 4-pole double-throw and twin-break circuitry; and solder, screw or quick-connect terminals.

## "SM" SUBMINIATURE (MULTI-SPDT) SWITCH MODULES

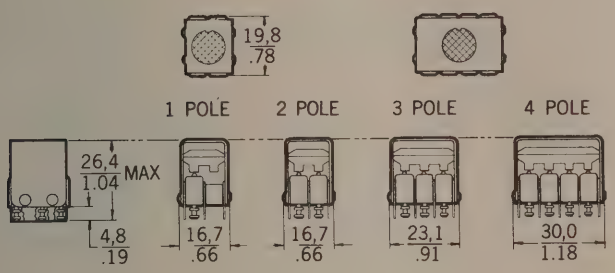


MOMENTARY ACTION

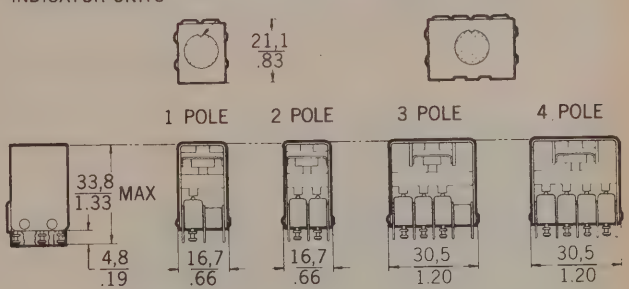
"SM" switch modules are available with momentary-action in a choice of two styles, one having a pronounced touch-feedback, while the other has a low force for rapid operation; alternate-action; and a combination momentary/alternate-action. Extra length turret type terminals are solder plated.



ALTERNATE ACTION




KEYING TAB FOR ORIENTATION OF SWITCH UNITS WITH OPERATOR-INDICATOR UNITS




**Catalog Listings**

| No. of SPDT Circuits | Momentary-Action | | | |
|---|---|---|---|---|
| | Touch-Feedback Type | | Low Force Type | |
| | Gold Contacts | Silver Contacts | Gold Contacts | Silver Contacts |
| 1 | 2D113† | 2D100† | | — |
| 2 | 2D1† | 2D2† | 2D140† | 2D139† |
| 3 | 2D4† | 2D5† | — | — |
| 4 | 2D8† | 2D9† | 2D152† | 2D151† |

NOTE — 'T2' TERMINALS ARE PLATED FOR SOLDERING
— SWITCHES DO NOT NECESSARILY OPERATE SIMULTANEOUSLY

**Catalog Listings**

| No. of SPDT Circuits | Alternate Action | | Mom./Alt.-Action |
|---|---|---|---|
| | Gold Contacts | Silver Contacts | Silver Contacts |
| 1 | 2D174 | 2D118† | — |
| 2 | 2D25† | 2D26† | 2D161*† |
| 3 | 2D28† | 2D101† | — |
| 4 | 2D32† | 2D33† | 2D162‡† |

* Has one momentary and one alternate-action switch.
‡ Has one momentary and three alternate-action switches.
† UL Component Recognized.

## ELECTRICAL RATING

Silver Contacts

30 VDC-5 amps res. sea level or 50,000 ft., 3 amps ind. sea level, 2.5 amps ind., 50,000 ft., max. inrush, 24 amps.

UL and CSA rating for basic switch: 125 or 250 VAC—5 amps
UL Code L-4

Gold Contacts

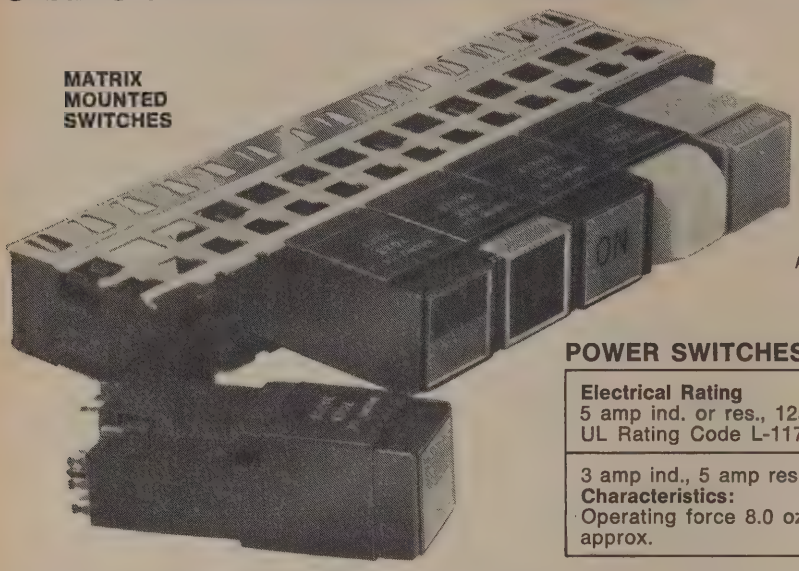
30 VDC-0.5 amp ind., 1 amp res. sea level and 50,000 ft., 2 amps max. inrush.

UL and CSA rating for basic switch: 125 VAC—1 amp
UL Code L-22

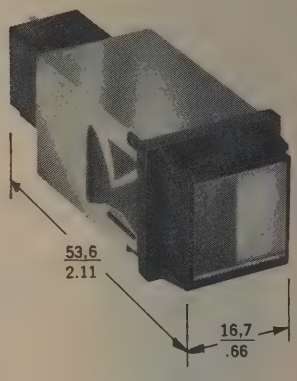
Other switch modules using V3, Z, A, DT, TB, MT, and HS basic switches are available for various circuitry and electrical ratings. See Catalog 200.

**MICRO SWITCH** A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

# SERIES 3 LIGHTED PUSHBUTTON SWITCHES




INDIVIDUAL
MOUNT SWITCH




Approx. Actual Size

## POWER SWITCHES

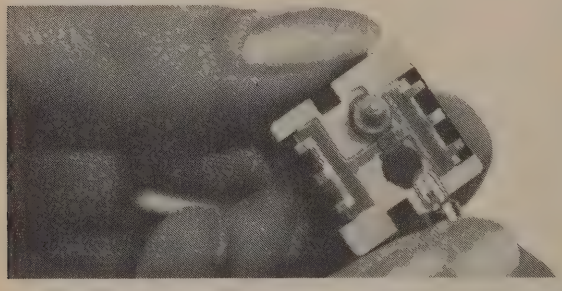
| |
|---|
| **Electrical Rating**<br>5 amp ind. or res., 125 VAC<br>UL Rating Code L-117 |
| 3 amp ind., 5 amp res., 28 VDC<br>**Characteristics:**<br>Operating force 8.0 oz. (2,22 N.) approx. |

Series 3 has multiple options in the same size package. By standardizing on Series 3 as building blocks for your control panels, you can specify either matrix, individual, or strip mounting, momentary and two-level alternate-action, power or reed switches (with audible "click click" feedback), and matching lighted indicators.

Matrix mounted switches are provided with termination suitable for direct wiring, printed circuit board mounting or plug-in termination to customer pre-wired connector blocks. They can be replaced from the panel front by simply using a screw driver to disengage the switch mounting lugs from the mounting rails.

Individual mount switches have spring clips on two sides for front of panel snap-in mounting.

## BUTTONS



Lamps and legends can be changed from the panel front. The button is removed by pulling it forward out of the switch housing. Lamps are retained in the button for ease of replacement.

Relegendable buttons have a transparent colorless insert which fits over a colored diffuser plate and snaps into the button's shell. Legending may be applied to the diffuser plate. The diffuser plate can be easily removed and replaced if a change of legend information is desired. To ensure proper orientation during assembly, the button is keyed to the switch housing. Lighted display is provided by one or two 5, 12, 14 or 28 volt T-1 lamps.

## LEGENDING

MICRO SWITCH will furnish hot stamp legending in standard modified Gothic. Contact our local branch office for Series 3 legend order sheets that provide data on type size and possible number of characters per line.

## INDICATORS

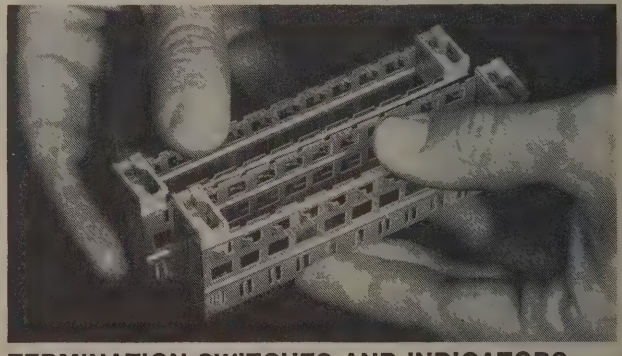
Lighted indicators are identical in size and appearance to the switches, but without provision for switching. See Catalog 200 for ordering.

## MOUNTING

Mounting options for Series 3 switches and indicators are:

1. Individual mount units have integral clips on two sides of the housing for front of panel snap-in mounting. They can be mounted in separate cutouts or strip mounted in a single cutout.

2. Units that require Type 3M mounting hardware are mounted in a single cutout. Two or more rows can be attached together to form a matrix or a single row can be strip mounted.



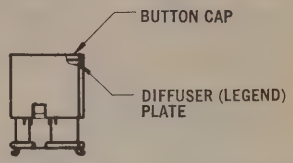
## TERMINATION-SWITCHES AND INDICATORS

Direct wiring to switch, plug-in to connector blocks, or printed circuit board termination. Available on either switch or connector.

NOTE: Caution should be exercised when soldering to direct wire terminations to prevent overheating and flux contamination of the switch contacts.

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY
Key: 0,0 — mm / 0.00 — inches

# SERIES 3 LIGHTED PUSHBUTTON SWITCHES BUTTON ORDERING GUIDES




## THREE-PIECE RELEGENDABLE BUTTONS

(Cap, Diffuser/Legend Plate, and Lampholder), Flat Style Single-Section or Two Section Display

Note: If lamps are not desired, omit the Lamp Code number from the catalog listing.

**3D11WW1L-1** is a relegendable flat button, has a single section display, black button shell, white display color, transparent colorless cap, legend, and one 5-volt lamp. For use with switches only.

Example:

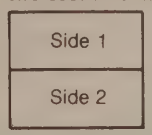
| 3D1 | 1 | WW | 1 | L | 1 |
|---|---|---|---|---|---|
| **CONSTRUCTION** | **SHELL COLOR** | **DISPLAY COLOR*** | **CAP COLOR** | **LEGEND** | **LAMPS** |
| 3D1 Single-section display<br>3D2 Two-section display | 1 Black<br>2 Gray | W white<br>R red<br>G green<br>B blue<br>Y yellow<br>D orange<br>K black | 1 transparent colorless<br>2 Transparent black, hidden color<br>3 Projected color, translucent white | **Switch Buttons:**<br>L with legend<br>N w/o legend<br>**Indicator Buttons:****<br>M with legend<br>P w/o legend | 1 one 5 volt<br>2 two 5 volt<br>3 one 28 volt<br>4 two 28 volt<br>5 one 12 volt<br>6 two 12 volt<br>7 one 14 volt<br>8 two 14 volt<br>(Omit character if no lamp desired.) |

*For single-section buttons, enter a double letter at this position in the Catalog Listing. Example: Red — RR

**Note: Only "indicator style" buttons should be used in indicators, as indicated by the M or P Legend Code letters.

When ordering two-section buttons, add the letter for Side 1 first. Example: If you desire Side 1 to be Red and Side 2 Blue, enter RB.

View from top of two-section button




## ONE-PIECE NON-RELEGENDABLE BUTTONS

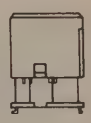
Flat Style or Truncated Style Single-Section Display

Note: If lamps are not desired, omit the lamp Code number from the catalog listing.

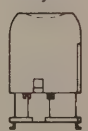
**3D4RM2** is a non-relegendable truncated button, has single section display, red button color, legend, and two 5-volt lamps. For use with indicators only.

| 3D4 | R | M | 2 |
|---|---|---|---|
| **CONSTRUCTION** | **DISPLAY COLOR** | **LEGEND** | **LAMPS** |
| 3D3 Flat style, single-section<br>3D4 Truncated style, single-section | W white<br>R red<br>G green<br>B blue<br>Y yellow | **Switch Buttons:**<br>L with legend<br>N w/o legend<br>**Indicator Buttons:****<br>M with legend<br>P w/o legend | 1 one 5 volt<br>2 two 5 volt<br>3 one 28 volt<br>4 two 28 volt<br>5 one 12 volt<br>6 two 12 volt<br>7 one 14 volt<br>8 two 14 volt<br>(Omit character if no lamp desired.) |

Flat Style



Truncated Style



All 3D4 type buttons will be engraved legending. Hidden color and hidden legending available on request. Contact your nearest MICRO SWITCH Branch Office.

** Note: Only "indicator style" buttons should be used in indicators as indicated by the M or P Legend Code.

**MICRO SWITCH** A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

# SERIES 3 LIGHTED PUSHBUTTON SWITCHES
## POWER SWITCH ORDERING GUIDE

**Ordering Example**
3A10-A is a power switch for matrix or strip mounting, has direct wire termination, 1-pole Form Z circuitry, momentary action, two lamp circuits, and black housing.

**THRU-PLUNGER SWITCHES**
Switches with Electrical Codes 16, 17, 66, and 67, have thru-plungers which attach to mechanical interlock devices to provide bailing and lockout functions.

**Example:** 3A 10 A

**POWER SWITCH MOUNTING TYPE**

3A
For matrix or strip mounting. Requires use of 3M type mounting hardware.

3G
For individual or strip mounting. No additional mounting hardware required.

| ELECTRICAL CODE | | | DESCRIPTION | | | |
|---|---|---|---|---|---|---|
| Thru Plunger for Interlock‡ | Direct Wire | P.C. Term. | Poles | Switch Circuitry | Action | Lamp Ckt(s) |
| 16 | 10 | 70 | 1 | Form Z | Mom | 2 |
| | 11 | | 1 | Form X | Mom | 2 |
| | 12 | | 1 | Form Y | Mom | 2 |
| 17 | 13 | 71 | 1 | Form Z | Mom | 1 |
| | 14 | | 1 | Form X | Mom | 1 |
| | 15 | | 1 | Form Y | Mom | 1 |
| 66 | 20 | 72 | 2 | Form Z | Mom | 2 |
| | 21 | | 2 | Form X | Mom | 2 |
| | 22 | | 2 | Form Y | Mom | 2 |
| | 23 | | 2 | 1 (Z), 1 (Y) | Mom | 2 |
| | 24 | | 2 | 1 (X), 1 (Z) | Mom | 2 |
| 67 | 25 | 73 | 2 | Form Z | Mom | 1 |
| | 26 | | 2 | Form X | Mom | 1 |
| | 27 | | 2 | Form Y | Mom | 1 |
| | 28 | | 2 | 1 (Z), 1 (Y) | Mom | 1 |
| | 29 | | 2 | 1 (X), 1 (Z) | Mom | 1 |
| | 30 | 74 | 1 | Form Z | Alt | 2 |
| | 31 | | 1 | Form X | Alt | 2 |
| | 32 | | 1 | Form Y | Alt | 2 |
| | 33 | 75 | 1 | Form Z | Alt | 1 |
| | 34 | | 1 | Form X | Alt | 1 |
| | 35 | | 1 | Form Y | Alt | 1 |
| | 40 | 76 | 2 | Form Z | Alt | 2 |
| | 41 | | 2 | Form X | Alt | 2 |
| | 42 | | 2 | Form Y | Alt | 2 |
| | 43 | | 2 | 1 (Z), 1 (Y) | Alt | 2 |
| | 44 | | 2 | 1 (X), 1 (Z) | Alt | 2 |
| | 45 | 77 | 2 | Form Z | Alt | 1 |
| | 46 | | 2 | Form X | Alt | 1 |
| | 47 | | 2 | Form Y | Alt | 1 |
| | 48 | | 2 | 1 (Z), 1 (Y) | Alt | 1 |
| | 49 | | 2 | 1 (X), 1 (Z) | Alt | 1 |
| | 50 | | 1 | Form Z | Mom | None |
| | 51 | | 1 | Form X | Mom | None |
| | 52 | | 1 | Form Y | Mom | None |
| | 53 | | 2 | Form Z | Mom | None |
| | 54 | | 2 | Form X | Mom | None |
| | 55 | | 2 | Form Y | Mom | None |
| | 56 | | 2 | 1 (Z), 1 (Y) | Mom | None |
| | 57 | | 2 | 1 (X), 1 (Z) | Mom | None |
| | 58 | | 1 | Form Z | Alt | None |
| | 59 | | 1 | Form X | Alt | None |
| | 60 | | 1 | Form Y | Alt | None |
| | 61 | | 2 | Form Z | Alt | None |
| | 62 | | 2 | Form X | Alt | None |
| | 63 | | 2 | Form Y | Alt | None |
| | 64 | | 2 | 1 (Z), 1 (Y) | Alt | None |
| | 65 | | 2 | 1 (X), 1 (Z) | Alt | None |

‡ Use 3A only

| Color Code | DESCRIPTION | |
|---|---|---|
| | Housing (bezel*) | Barrier |
| A | Black | None |
| F | Black | Black |

* Bezel provided with 3G and 3F only.

**Circuitry:**

X=SPST—N.O. Double Make

Y=SPST—N.C. Double Break

Z=SPDT—Double-make Double-Break Break-before-Make

ADD—1 to listing if connector block is required (3A modules only).

(Connector blocks have direct wire terminations only.)

Reed switch units are also available. See Catalog 200.

## MOUNTING HARDWARE

Mounting hardware for 3A units is provided by a box girder structure. Interlocking tabs enable them to be assembled into a multi-row matrix. To specify the row length in the catalog listing, add the number of switches and/or indicators, then convert the total to the proper suffix number, i.e. "09" for a 5-unit row. proper suffix number, i.e. "09" for a 5-unit row.

Each 3M Type listing consists of two mounting bars and two mounting blocks in packet form.

COMPLETELY ASSEMBLED STRIPS OR MATRICES USING TYPE 3M MOUNTING HARDWARE

MICRO SWITCH will provide completely assembled strips or matrices at an additional charge per station of first level devices (switches) with no set-up charge. Contact your MICRO SWITCH Branch Office for pricing of assembled strips or matrices.

**Example:** 3M1 — 09

| MOUNTING HARDWARE BASE LISTING |
|---|
| 3M1 Standard Type for use with connector blocks for plug-in wiring |
| 3M2 Narrow width type, allows direct wiring |

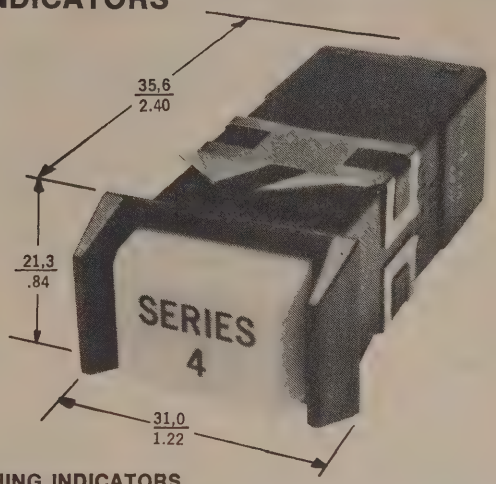
| ROW LENGTH | |
|---|---|
| 01 1-Unit | 17 9-Unit |
| 02 1½-Unit | 18 9½-Unit |
| 03 2-Unit | 19 10-Unit |
| 04 2½-Unit | 20 10½-Unit |
| 05 3-Unit | 21 11-Unit |
| 06 3½-Unit | 22 11½-Unit |
| 07 4-Unit | 23 12-Unit |
| 08 4½-Unit | 24 12½-Unit |
| 09 5-Unit | 25 13-Unit |
| 10 5½-Unit | 26 13½-Unit |
| 11 6-Unit | 27 14-Unit |
| 12 6½-Unit | 28 14½-Unit |
| 13 7-Unit | 29 15-Unit |
| 14 7½-Unit | 30 15½-Unit |
| 15 8-Unit | 31 16-Unit |
| 16 8½-Unit | |

# SERIES 4 LIGHTED PUSHBUTTON SWITCHES/INDICATORS

- Choice of Solid State or Precision Snap-Action Switching
- Low Installed Cost
- Front of Panel Mounting and Relamping — Without Tools
- Distinctive Lighted Display Colors
- Attractive Housings with Barriers or Full Bezels

Series 4 provides an attractive panel display and switching versatility at a low installed cost to help you stretch your panel budget. Units can be furnished assembled, with lamp, ready to snap-in the panel. There is a choice of solder/quick-connect terminals or printed circuit board terminals.

See Catalog 200 for additional information and listings.



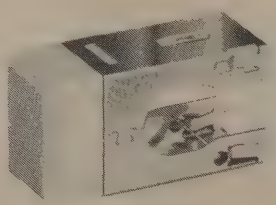

**BUTTONS**
Vivid color buttons provide attractive, clearly visible lighted display with: (1) transmitted color — display color can be distinguished whether the lamp is ON or OFF; (2) projected color — button is white with the lamp OFF and colored when illuminated; and (3) hidden legend/hidden color — button appears black with the lamp off, and legend and color appear when illuminated.

**LAMPS**
The Series 4 lamp remains stationary during button operation, minimizing filament breakage due to a moving lamp. There is a choice of T-3¼ wedge-base lamps (6, 12 and 28 V) or T-2 telephone slide-base lamps (120 V).

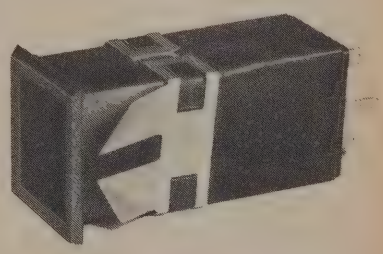
**HOUSINGS**
Housings for switches and indicators are identical in appearance, but the indicator housings have no provision for switching. They may be snap-in mounted on panels up to .20" (10,2mm) thick. Housings are available in full bezel or barrier styles, momentary or alternate action switching, and contain the lamp socket and termination means.

**MATCHING INDICATORS**
The indicators are identical externally to the Series 4 lighted switches for a harmonious panel appearance. See Catalog 200 for ordering.

**LOCKED BUTTON OPTION**
Series 4 can be furnished with a locked button option for use in areas accessible to the public, where tampering and vandalism are problems. The housing has a special mounting clip with built-in button retainer. This mounting clip must be removed from behind panel to allow button removal. Button movement during switch operation is unaffected by the locked button feature. (These units cannot be relamped from front of panel.)


BUTTON

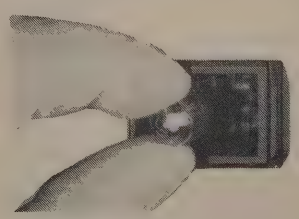
LAMP


HOUSING

## CONVENIENT PANEL FRONT MOUNTING AND RELAMPING

1. Snap-in mounting. Switch or indicator is easily inserted into the cutout. Mounting clips grip the panel. No tools are needed.

2. Lamps and legends can be changed from panel front. When button is removed, lamp is extracted from its socket and retained in button.



3. Ease of lamp replacement. After the inoperative lamp is automatically removed with the button, the new lamp is inserted without the use of tools.

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

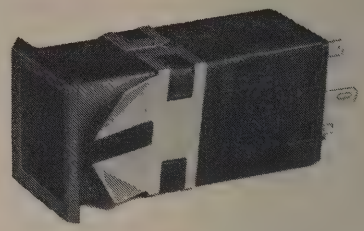
Key: 0,0 — mm / 0.00 — inches

**MICRO SWITCH** A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

# SERIES 4 PUSHBUTTON SWITCH ORDERING GUIDE

Catalog listings for Series 4 pushbutton switch housings may be derived from the ordering guide below. To order buttons, refer to the following page.

4A11BAA11 is a catalog listing for a black switch housing with a bezel on all sides, mounting clips on long sides, 1-pole momentary action 5-amp silver contacts, .110" quick-connect/solder terminals, and a T-3¼ lamp socket. UL listed.



**Example:**

**4A11** **B** **AA** **11**

**SWITCH HOUSING STYLE**

**4A11**
Bezel on all sides, mounting clips on long sides

**4A12**
Bezel on all sides, mounting clips on short sides

**4A13**
Bezel on all sides, mounting clips on long sides, housing provisions for locked button

**4A21**
Barriers on short sides, mounting clips on long sides

**4A22**
Barriers and mounting clips on short sides

**4A23**
Barrier on one short side, mounting clips on long sides

**4A24**
Barrier on one short side, mounting clips on short sides

**4A25**
Barriers on short sides, mounting clips on long sides, housing provisions for locked button

**4A26**
Barrier on one short side, mounting clips on long sides, housing provisions for locked button

**4A31**
Barriers and mounting clips on long sides

**4A32**
Barriers on long sides, mounting clips on short sides

**4A33**
Barrier on one long side, mounting clips on long sides

**4A34**
Barrier on one long side, mounting clips on short sides

**4A35**
Barriers and mounting clips on long sides, housing provisions for locked button

**4A36**
Barrier on one long side, mounting clips on long sides, housing provisions for locked button

**HOUSING COLOR**

**B**
Black

**SNAP-ACTION SWITCHING ELEMENT**

| Electrical Data and UL code | Action | Terminals .110 QC | Terminals PC |
|---|---|---|---|
| 1-Pole (SPDT) 5 a. silver contacts L-4 | Momentary | AA | AD |
| | Alt. Action | BA | BD |
| 2-Pole (DPDT), 5 a. silver contacts L-4 | Momentary | EA | ED |
| | Alt. Action | FA | FD |
| 1-Pole (SPDT), gold contacts L-22 | Momentary | CA | CD |
| | Alt. Action | DA | DD |
| 2-Pole (DPDT) gold contacts L-22 | Momentary | GA | GD |
| | Alt. Action | HA | HD |
| 2-Pole combination gold (SPDT) 1a, and 5 a. silver (SPDT) contacts | Momentary | JA | JD |
| | Alt. Action | KA | KD |
| 1-Pole (SPDT) 10 a. silver contacts L-99 | Momentary | LA | |
| | Alt. Action | MA | |
| 2-Pole (DPDT) 10 a. silver contacts L-99 | Momentary | NA | |
| | Alt. Action | PA | |
| 1-Pole (SPDT) gold alloy contacts | Momentary | QA | |
| | Alt. Action | RA | |
| 2-Pole (DPDT) gold alloy contacts | Momentary | TA | |
| | Alt. Action | VA | |

**SOLID STATE SWITCHING ELEMENT**

| Electrical Data | Action | | |
|---|---|---|---|
| Current Sinking, Regulated 6-16 Volts | Momentary only | SA | SC |
| Current Sourcing, Regulated 6-16 Volts | Momentary only | SB | SD |
| Current Sinking, 5 Volts | Momentary only | SS | SE |

**ILLUMINATION**

**11**
No lamp, has lamp socket for T-3¼ wedge base lamps

**41***
No lamp, has lamp socket for T-2 telephone slide-base No. 5 lamps

**91**
Unlighted, no lamp socket

* If the locked button option is specified in the Housing Style code, the unit will have a UL Listing of 120 volts max., lamp.

**Mounting clips on the long sides** of the housing are specified when individually mounted or when the long sides of strip mounted housings parallel the long sides of the panel cutout slot. The most secure mounting is achieved when the mounting clips are on the long sides.

**Mounting clips on the short sides** of the housing are specified when short sides of strip mounted housings parallel the long sides of the panel cutout slot.

## SERIES 4 BUTTON ORDERING GUIDE

Buttons may be furnished with or without the metal shell, assembled or unassembled. When type B, C, D, E, or F buttons are ordered unassembled, the insert is also unassembled.

Catalog listings for Series 4 buttons are derived from the ordering guide, as shown in the example, below.

4B1AGN is a catalog listing for a green (transmitted color) unlegended button. (If the button shell is also desired, substitute 4B2 for 4B1 in the listing.)

**Example:**

**4B1**

BUTTON WITHOUT METAL SHELL
- 4B1 — Button only (without metal shell)

BUTTON WITH METAL SHELL
- 4B2 — Both button and metal shell provided

BUTTON WITH METAL SHELL, WITH PROVISION FOR LOCKED BUTTON
- 4B3 — Both button and metal shell provided

**A**

BUTTON TYPE

- A — Transmitted color, 5 sides lighted. 1-piece translucent button.
- B — Projected color, 5 sides lighted. Translucent white button & color insert.
- C — Hidden color/hidden legend, 5 sides lighted. Transparent black button & translucent color insert.
- D — Hidden color/hidden legend, only face lighted. Transparent black button & translucent color insert.
- E — Transmitted color, 5 sides lighted. Transparent colorless button & translucent color insert.
- F — Transmitted color, only face lighted. Transparent colorless button & color insert.
- G — Same as type "A" except .250" higher.

**G**

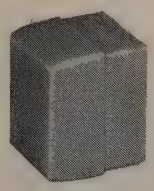
DISPLAY COLOR

- B — Std. Blue
- G — Std. Green
- R — Std. Red
- S — Transparent Black (Unlighted applications only)
- Y — Std. Yellow
- W — Std. White (Do not use with Type B button)
- A — Std. Amber (For use with Type A or G button only)

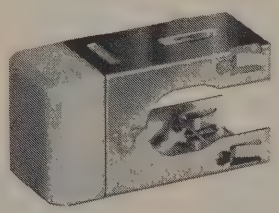
**N**

LEGEND (Legend Order Sheet must accompany all orders for legended buttons)

- U — No legend, button unassembled. (For customer who does his own legending.) Use with any button except 4B1A.
- N — No legend, button assembled. (For applications not requiring legends.) Use with any button except E & F.
- L — Legend on button only, button assembled. (For customer who prefers to have MICRO SWITCH provide legending.) Use with any button.
- K — Legend on insert only, button assembled. (For C, D, E and F button types.)
- J — Legends on both button and insert, button assembled. Use with C & D button types.



Button



Button and Metal Shell

### LAMP DATA

| Listing Code | Industry Lamp No. | Design Volts | Socket Volts | | | | |
|---|---|---|---|---|---|---|---|
| | | | Amps | .15 | .14 | .135 | .12 |
| | | | MSCP | .34 | .27 | .24 | .17 |
| 4Z213 | 159 | 6.3 | Rated Life—Hours Avg. | 9,000 | 16,500 | 28,000 | 28,000 |
| | | | Socket Volts | 6.3 | 6.0 | 5.5 | 5.0 |
| | | | Amps | .25 | .24 | .225 | .21 |
| 4Z212 | 259 | 6.3 | MSCP | .65 | .52 | .39 | .29 |
| | | | Rated Life—Hours Avg. | 9,000 | 16,000 | 44,500 | 50,000 |
| 4Z242 | NONE | 120 | Amps— .025 Rated Life 5,000 Hrs. | | | | |

| Listing Code | Industry Lamp No. | Design Volts | Socket Volts | | | | |
|---|---|---|---|---|---|---|---|
| | | | Amps | .19 | .17 | .16 | .15 |
| | | | MSCP | 1.0 | .60 | .4 | .3 |
| 4Z221 | 161 | 14 | Rated Life—Hours Avg. | 4,000 | 25,000 | 26,500 | 28,000 |
| | | | Socket Volts | 28 | 27 | 26 | 24 |
| | | | Amps | .06 | .057 | .054 | .05 |
| 4Z231 | 656 or 152 | 28 | MSCP | .65 | .52 | .49 | .39 |
| | | | Rated Life—Hours Avg. | 5,000 | 7,500 | 10,000 | 10,000 |

**MICRO SWITCH** A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

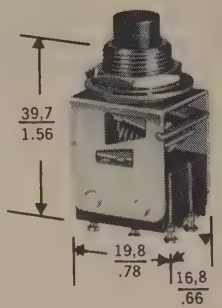
# PB PUSHBUTTON SWITCHES

## TOUCH-FEEDBACK TYPE

2-POLE, 3-POLE, AND 4-POLE

MOMENTARY-ACTION

ALTERNATE-ACTION



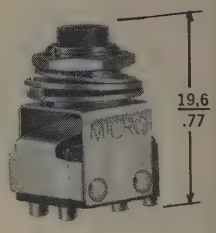

**Catalog Listings**

| Button Color | No. of SPDT Circuits | | | | |
|---|---|---|---|---|---|
| | 2 | 2 | 3 | 4 | 4 |
| | Mom. Action | Alt. Action | Mom. Action | Mom. Action | Alt. Action |
| Black | **2PB11-T2** | **82PB19-T2** | **3PB11-T2** | **4PB11-T2** | **84PB19-T2** |
| | **2PB732-T2** (M8805/ 23-001) | — | — | **4PB714-T2** (M8805/ 23-003) | — |
| Red | **2PB12-T2** | **82PB21-T2** | **3PB12-T2** | **4PB12-T2** | **84PB21-T2** |
| | **2PB717-T2** (M8805/ 23-002) | — | — | **4PB717-T2** (M8805/ 23-004) | — |
| Green | **2PB273-T2** | **82PB22-T2** | **3PB273-T2** | **4PB273-T2** | **84PB22-T2** |

## SHORT TRAVEL SWITCH

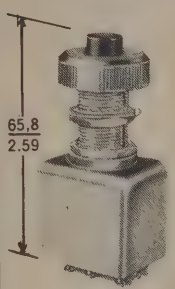
2-POLE AND 3-POLE

MOMENTARY-ACTION




**Catalog Listings**

| Button Color | No. of SPDT Circuits | |
|---|---|---|
| | 2 | 3 |
| Black | **2PB7** | **3PB7** |
| Red | **2PB8** | **3PB8** |




MOMENTARY-ACTION

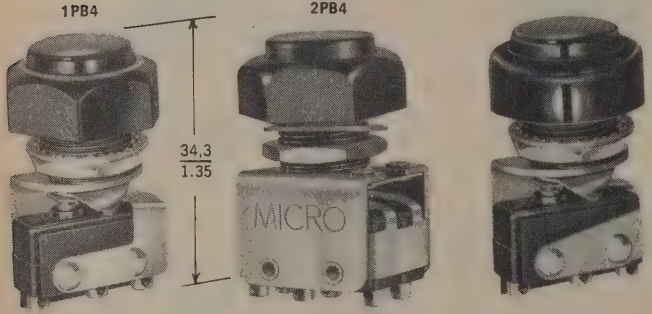
## SEALED AT BUSHING, BUTTON, PANEL AND SWITCH UNITS

Catalog Listing **2PB901-T2** meets the submergence requirements of MIL-STD-108D (up to 10 p.s.i. water pressure for one hour). It is sealed facenut-to-panel, button-to-facenut, and bushing-to-facenut (prevents entry of water from back of panel, up and over bushing wall). The two SPDT switch units are potted in a corrosion-resistant metal enclosure.

The knurled facenut is chrome finished to provide an attractive panel appearance with the black button.

## WITH BUTTON AND PANEL SEALS

This two-piece design assembly enables the pushbutton to be separated from the switch unit and mounted in the panel. The switch unit is then easily wired and snapped into place from behind the panel. There is an elastomer seal bonded between the plunger and button collar and an "O" ring seals the button assembly to the panel front.




MOMENTARY-ACTION
BOTH HAVE BLACK BUTTONS
OPERATING FORCE
1,36 Kg/3 LBS. APPROX.

**1PB42** (Black Button)
**1PB43** (Red Button)
OPERATING FORCE
1,36 Kg/3 LBS. APPROX.

**ELECTRICAL RATING FOR ALL SERIES PB EXCEPT 700PB**

30 VDC-5 amps res. sea level or 50,000 ft., 3 amps ind. sea level, 2.5 amp ind. 50,000 ft., 24 amps max. inrush.

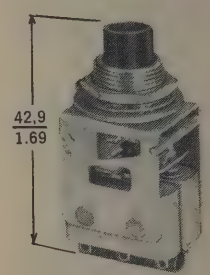
UL and CSA rating for basic switch: 125 or 250 VAC—5 amps
UL Code L-4

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0,0 — mm / 0.00 — inches

## HERMETICALLY SEALED SWITCH UNITS

2-POLE MOMENTARY-ACTION




**Hermetic Seal**

Sealing consists of metal-to-metal fusion around the cover, actuator, base and mounting holes of each switching unit. The terminals are joined to the housing by glass-to-metal seals. The vapor-proof container permits use in damp locations without danger of condensation on the contacts, as well as providing protection from external contaminants. All external parts are corrosion resistant and meet MIL-S-6743 specifications. This design also meets explosion-proof requirements of MIL-E-5272.

**Electrical Rating:** 3 amps, ind., 5 amps res., 28 VDC and 115 VAC 400 cps.

**Catalog Listings**

| Button Color | No. of SPDT Circuits | | |
|---|---|---|---|
| | 2 | 3 | 4 |
| Black | **702PB1** | **703PB1** | **704PB1** |
| Red | **702PB2** | **703PB2** | — |
| Green | **702PB3** | **703PB3** | — |

These pushbuttons are equipped with MICRO SWITCH "HM" hermetically sealed switch units which provide electrical stability under abrupt changes in atmosphere and environmental conditions. Good feel of the switching action is provided by a touch-feedback which is transmitted through the button when it is operated.

See Catalog 200 for additional information and listings.

# SN SOLID STATE PUSHBUTTON SWITCHES

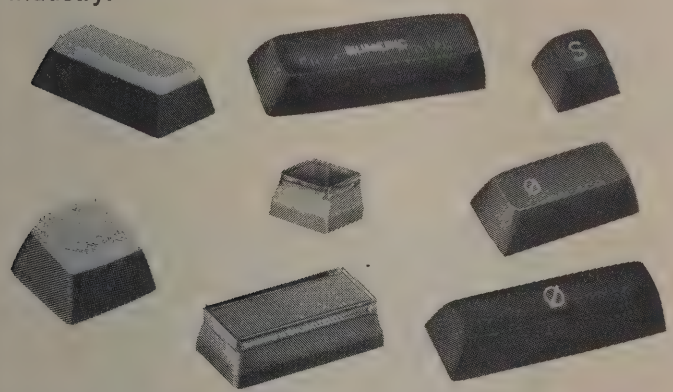
## SWITCHING CONCEPT

The Hall effect solid state concept is one of the most reliable switching elements ever designed. An integrated circuit, actuated by magnets, produces an analog control voltage. This voltage is converted into a digital output with a trigger circuit. Two isolated outputs are available from each switch module which may be used individually or wired in parallel. Level and pulsed outputs are available.

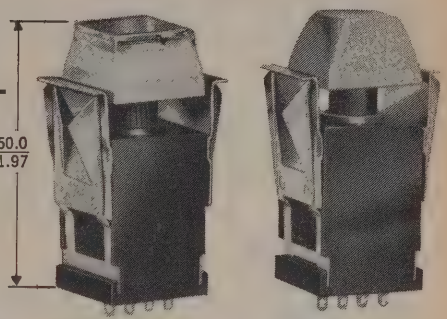
The 11SN Series switches are made for direct panel mounting with snap-in hardware and the 101SN Series, 201SN Series and 301SN Series mount direct to printed circuit boards without additional mounting or support hardware. Lighted modules are available in both the 11SN Series and the 201SN Series.

## SN BUTTONS

The SN Series is ideal for building custom arrays. There are thousands of legends tooled and we have the in-house capability to tool any special legend you may require. Multiple-unit buttons and space bars with complete mounting hardware are available. In fact, MICRO SWITCH has the largest selection of button shapes, sizes, and colors in the industry.

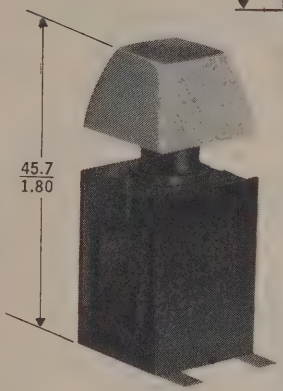


**11SN PANEL MOUNTED MODULES**



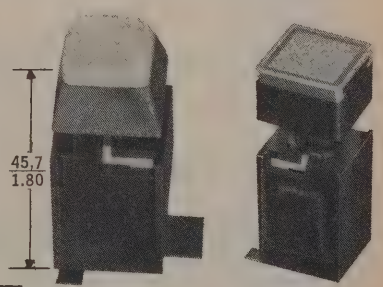

MODULE WITH NON-LIGHTED RELEGENDABLE BUTTON

MODULE WITH NON-LIGHTED TRUNCATED BUTTON




**101SN MODULES non-lighted and 301SN TWO-LEVEL MODULES**

**201SN LIGHTED MODULES**




MODULE WITH TRUNCATED LIGHTED BUTTON

MODULE WITH RELEGENDABLE LIGHTED BUTTON

Additional information for SN and SD is included in Catalog 200.

# SD SOLID STATE MODULES

## BUILD YOUR OWN LOW PROFILE KEYBOARD

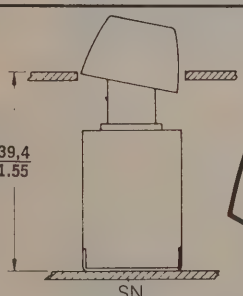
The MICRO SWITCH Series SD module is a low profile solid state keyboard module. The heart of the SD module is the proven MICRO SWITCH Hall Effect integrated circuit.

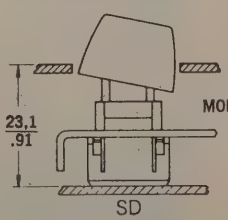
The SD module is directly compatible with all common logic families with no special buffering or electronic circuitry needed.

Buttons are available in a wide variety of sizes, shapes, and colors.

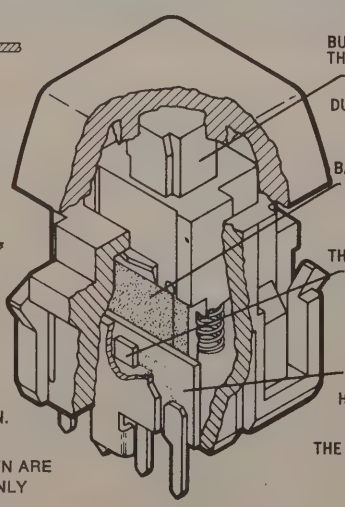
SD modules are available with:

- Level or pulsed outputs
- Sourcing or sinking outputs
- Momentary or alternate action
- Scanning interface
- LED Lighting
- Stepped or sloped buttons




MODERN LOW-PROFILE DESIGN.


BUTTON PLUNGER, THE ONLY MOVING PART IS MADE OF EXTREMELY DURABLE PLASTIC
A VERY STABLE BARIUM FERRITE FILLED MAGNET OPERATES THE CHIP
THE PROVEN HALL EFFECT CHIP IS THE HEART OF EVERY SWITCH MODULE
A CERAMIC SUBSTRATE HOLDS THE CHIP AND PROVIDES A PATH FOR THE CHIP'S OUTPUT

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0.0 — mm / 0.00 — inches

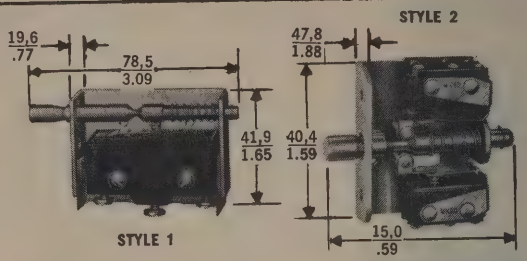
# MICRO SWITCH

A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

## AC DOOR INTERLOCK SWITCHES

For use on hazardous electronic equipment. They automatically cut power when service door or drawer is opened helping to protect personnel and equipment.

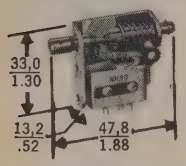
To test circuits with the power "on" the actuating rod can be manually set (pulled) to a maintained-on position. The actuating rod automatically returns to the normal or reset position as door closes.



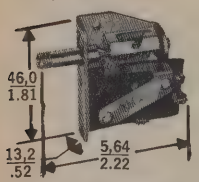

CHARACTERISTICS:
F.P. — Free Position
O.P. — Operating Position
D.P. — Depressed Position

### ORDER GUIDE — DOOR INTERLOCK SWITCHES

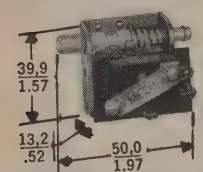
| Actuators | Description | Style No. | Electrical Data Ref. | Catalog Listing | Basic Switch Type | F.P. Max. mm (in.) | O.P. Min. mm (in.) | D.P. Max. mm (in.) |
|---|---|---|---|---|---|---|---|---|
| Steel | High Capacity | 1 | 15 amp | 1AC2 | BZ | 11,1 .438 | 6,35 .250 | 3,18 .125 |
| | Up to 4 separate SPDT circuits | 2 | 5 amp | 8AC1 | SM(4) | 9,53 .375 | 5,16 .203 | 3,18 .125 |
| | Three 6 foot leads Sealed basic switches | 3 | 5 amp | 9AC4 | SE | 9,53 .375 | 5,16 .203 | 3,18 .125 |
| | Two 3 foot leads SPST—N.O. Sealed basic switches | 3 | 5 amp | 9AC12-3 | SE | 9,53 .375 | 5,16 .203 | 3,18 .125 |
| | Can be reset without momentary circuit break | 4 | 15 amp | 13AC1 | V3 | 15,9 .625 | 12,3 .485 | 6,68 .263 |
| | Tapped hole in end of steel actuator rod | 6 | 15 amp | 2AC59 (MS16106-1) | V3 | 9,53 .375 | 5,16 .203 | 3,18 .125 |
| *High strength thermo-plastic | | 6 | 15 amp | 22AC1 | V3 | 9,53 .375 | 5,16 .203 | 3,18 .125 |
| | Tapped hole in end of actuator rod | 6 | 15 amp | 22AC2 | V3 | 9,53 .375 | 5,16 .203 | 3,18 .125 |
| | Up to four separate SPDT circuits | 2 | 5 amp | 8AC9 (MS16106-3) | SM(4) | 9,53 .375 | 5,16 .203 | 3,18 .125 |




STYLE 3




STYLE 4



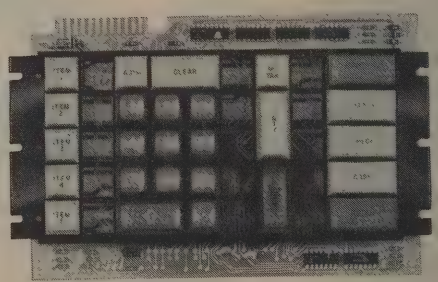

STYLE 6

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

* Not for use in temperatures over +185°F (85°C).
For higher temperatures order steel actuator Catalog Listing. For other variations see Catalog 200.

Key: 0,0 — mm / 0.00 — inches

## KEYBOARDS



MICRO SWITCH now offers a line of truly effective, Sealed Solid State Keyboards for applications in industrial, aerospace, marine, military and other severe environments. These ruggedly constructed, sealed keyboards are especially designed to provide protection against accidental spills of coffee or sodas, splash-over or drip through of oil and moisture, and accumulation of sand, dust, chips or other contaminants which can damage or cause failure of non-sealed units. In addition, this custom designed sealing capability protects the expensive electronics usually located behind or underneath the keyboard. Sealed keyboards meet the requirements of NEMA 2, 3, 3R, 12 and 13, and military specifications (MIL-STD-202) for sealing, vibration and shock.

### KEYBOARDS TO FIT EVERY NEED

At MICRO SWITCH, we have the world's most complete line of solid state keyboards . . . which means unmatched design flexibility for you. Our application engineers will custom tailor a keyboard to your exact specifications, whether from our time-proven SW series or our new low-profile SD series.

Choose from keys offering over 10,000 legends, 30 colors, and 60 shapes, including standards, sculptured or re-legendable keys — or create new keys to fit your needs. Even lighted and two-level keys are available.

MICRO SWITCH keyboards are available with features like MOS, TTL and DTL encoding, and with two-key or N-key rollover. Your choice of alpha and numeric arrays.

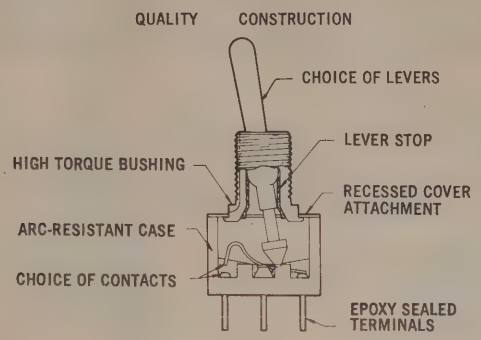
So whatever your needs, and whatever your budget, we'd like to supply a keyboard to fit. Contact a MICRO SWITCH Branch Office for complete information.

## SERIES 8 MINIATURE MANUAL SWITCHES

The MICRO SWITCH Series 8 line of miniature manual switches is ideally suited for commercial applications which have limited space requirements and demand high quality and performance standards.

All switches have silver contacts and solder terminals unless otherwise noted. Many additional circuitry combinations, actuators, terminals variations and contact materials are available. See Catalog 200.

Complete dimension drawings and specifications are shown in Catalog 200.

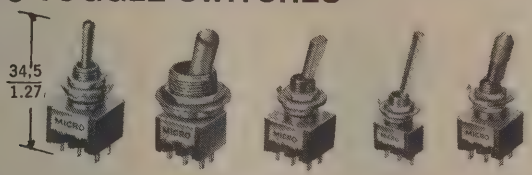



**Electrical Data**

Fine Silver Contacts: 6 amps, res.; 2 amps, ind., 125 VAC (60Hz) and 28 VDC. UL Listed*(most models): 6 amps, 125 VAC. Gold/Nickel Plated Brass or Fine Silver Contacts: 0.5 VA max. at 20 volts max.

*For UL stamped switches see Catalog 200.

## SERIES 8 TOGGLE SWITCHES




**Order Guide**

| Circuitry Description | Small Lever | Large Lever | Flatted Lever | Long Lever | Lever Lock |
|---|---|---|---|---|---|
| **1 POLE** | | | | | |
| On-None-On | 8A1011 | 8B1011 | 8C1011 | 8D1011 | 8E1011 |
| On-None-On PC Terminal | 8A1012A | — | 8C1012A | — | 8E1012A |
| On-Off-On | 8A1021 | 8B1021 | 8C1021 | 8D1021 | 8E1021 |
| (On)-Off-(On) Momentary | 8A1041 | 8B1041 | 8C1041 | 8D1041 | — |
| **2 POLE** | | | | | |
| On-None-On | 8A2011 | 8B2011 | 8C2011 | 8D2011 | 8E2011 |
| On-Off-On | 8A2021 | 8B2021 | 8C2021 | 8D2021 | 8E2021 |
| **4 POLE** | | | | | |
| On-None-On | 8A4011 | 8B4011 | 8C4011 | 8D4011 | 8E4011 |

## COLORED LEVER SLEEVES

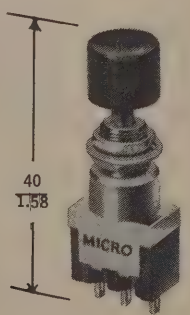
For 8A — For 8B

| Round Tip | Cone Tip | Color | Round Tip |
|---|---|---|---|
| 8Z0111 | 8Z0151 | White | 8Z0131 |
| 8Z0112 | 8Z0152 | Red | 8Z0132 |
| 8Z0113 | 8Z0153 | Black | 8Z0133 |
| 8Z0114 | 8Z0154 | Gray | 8Z0134 |
| 8Z0115 | 8Z0155 | Green | 8Z0135 |
| 8Z0116 | 8Z0156 | Blue | 8Z0136 |
| 8Z0117 | 8Z0157 | Amber | 8Z0137 |
| 8Z0118 | 8Z0158 | Yellow | 8Z0138 |

NOTE: Grayed in listings are nomally stock items. Other listings are available but may have low volume charges in small quantities.

## SERIES 8 PUSHBUTTON SWITCHES

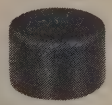
Type 8N switches meet requirements for a miniaturized ¼" diameter bushing mounted pushbutton. Concave surface buttons are available in two sizes and eight colors. Buttons are ordered separately.




**8N Order Guide**

| Circuitry Description | 1 Pole | 2 Pole | 3 Pole | 4 Pole |
|---|---|---|---|---|
| Alternate-Action | 8N1011 | 8N2011 | 8N3011 | 8N4011 |
| Momentary-Action | 8N1021 | 8N2021 | 8N3021 | 8N4021 |

**Buttons**

| | Dimensions | Catalog Listing | Color |
|---|---|---|---|
| LARGE BUTTON  | .59" DIA. BY .39" HEIGHT | 8Z0061 | WHITE |
| | | 8Z0062 | RED |
| | | 8Z0063 | BLACK |
| | | 8Z0064 | GRAY |
| | | 8Z0065 | GREEN |
| | | 8Z0066 | BLUE |
| | | 8Z0067 | AMBER |
| | | 8Z0068 | YELLOW |
| SMALL BUTTON | .39" DIA. BY .30" HEIGHT | 8Z0081 | WHITE |
| | | 8Z0082 | RED |
| | | 8Z0083 | BLACK |
| | | 8Z0084 | GRAY |
| | | 8Z0085 | GREEN |
| | | 8Z0086 | BLUE |
| | | 8Z0087 | AMBER |
| | | 8Z0088 | YELLOW |

**MICRO SWITCH** A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

# SERIES 8 PADDLE AND ROCKER SWITCHES

### 8H TYPE

8H switches with paddle operators enable quick identification of the toggle position. Paddle and rocker operators used with type 8H switches are interchangeable. To simplify user parts inventories and provide versatility in operator options, switches, paddle, and rockers are sold separately.

TYPE 8H ROCKER

TYPE 8H PADDLE

### 8H ORDER GUIDE

| Circuitry Description | 1 Pole | 2 Pole |
|---|---|---|
| On-None-On | 8H1011 | 8H2011 |
| (On)-Off-(On) | 8H1041 | 8H2041 |
| On-None-(On) | 8H1061 | 8H2061 |

(On) Momentary

### BEZEL ACCESSORY

An optional colored bezel accessory is available for use with individual mount units (see photo) to enhance panel appearance and identify control functions. The bezel is assembled by snapping it into the flanges on two sides of the switch. They can be removed and replaced if color changes are necessary.

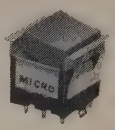
### 8H OPERATORS AND BEZELS

| Color | Rocker | Paddle | Bezel |
|---|---|---|---|
| White | 8Z0021 | 8Z0001 | 8Z0191 |
| Red | 8Z0022 | 8Z0002 | 8Z0192 |
| Black | 8Z0023 | 8Z0003 | 8Z0193 |
| Gray | 8Z0024 | 8Z0004 | 8Z0194 |
| Green | 8Z0025 | 8Z0005 | 8Z0195 |
| Blue | 8Z0026 | 8Z0006 | 8Z0196 |
| Amber | 8Z0027 | 8Z0007 | 8Z0197 |
| Yellow | 8Z0028 | 8Z0008 | 8Z0198 |

### 8K TYPE

8K switches feature one-lamp illumination and relamping from the front of panel. Type 8K lighted switches are used with rocker operators only. Lamps are not furnished with 8K switches. Order below.

TYPE 8K ROCKER (Lighted)




### 8K ORDER GUIDE

| Circuitry Description | Only 2 Pole |
|---|---|
| On-None-On | 8K2011 |
| On-None-(On) | 8K2061 |

See Catalog 200 for additional variations.

### 8K ROCKERS AND BEZELS

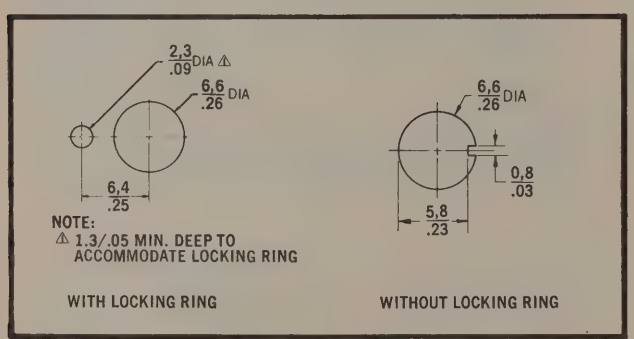
| Color | Rocker | Bezel |
|---|---|---|
| White | 8Z0041 | 8Z0211 |
| Red | 8Z0042 | 8Z0212 |
| Black | 8Z0043 | 8Z0213 |
| Gray | — | 8Z0214 |
| Green | 8Z0045 | 8Z0215 |
| Blue | 8Z0046 | 8Z0216 |
| Amber | 8Z0047 | 8Z0217 |
| Yellow | 8Z0048 | 8Z0218 |

### 8K LAMPS

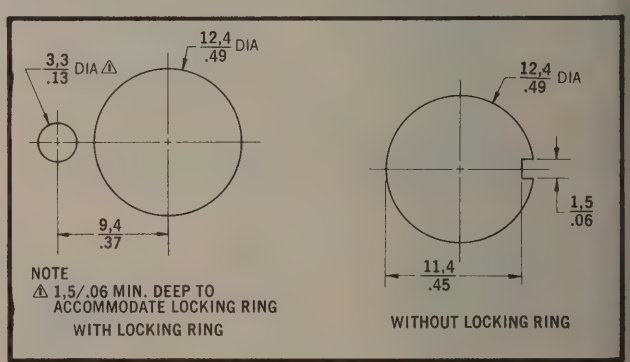
| Catalog Listing | Rated Voltage | Nominal Current (Amps) |
|---|---|---|
| 8Z0101 | 6.3 | .20 |
| 8Z0102 | 14.0 | .08 |
| 8Z0103 | 28.0 | .04 |

### PANEL CUTOUT

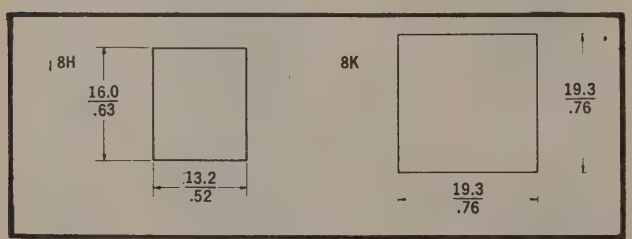
Types 8A, 8C, 8D, 8N:




Type 8B:



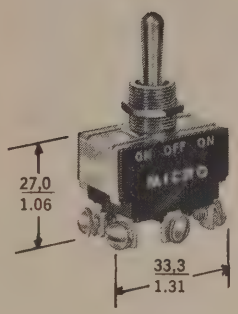

Types 8H and 8K:

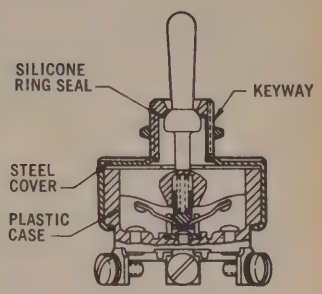



DIMENSIONS SHOWN ARE FOR REFERENCE ONLY
Key: 0,0 — mm / 0.00 — inches

# 11TS AND 12TS TOGGLE SWITCHES

Series 11TS and 12TS toggle switches are ruggedly constructed for contact protection from dust and moisture. Available with either solder, screw or .250″ width quick connect terminals, this series offers a choice of single-pole, double-throw or double-pole double-throw circuitries. The series is UL and CSA listed.




DIMENSIONS SHOWN ARE FOR REFERENCE ONLY
Key: 0,0 — mm / 0.00 — inches

**2-POSITION**

| Circuitry | Circuit(s) Made With Toggle At: Keyway Position | Opposite Keyway | Electrical Rating and UL Code | Catalog Listing: Screw Terminals | Catalog Listing: Solder Terminals | Quick Connect Terminals |
|---|---|---|---|---|---|---|
| ONE POLE | OFF | 2-3 ON | L-80, 15 amps | 11TS15-2 | 11TS115-2 | 11TS95-2 |
| | 2-1 ON | 2-3 ON | L-80, 15 amps | 11TS15-3 | 11TS115-3 | 11TS95-3 |
| | 2-1 ON* | OFF | L-31, 10 amps | 11TS15-6 | 11TS115-6 | 11TS95-6 |
| | 2-1 ON* | 2-3 ON | L-31, 10 amps | 11TS15-8 | 11TS115-8 | 11TS95-8 |
| TWO POLE | OFF | 2-3 & 5-6 ON | L-80, 15 amps | 12TS15-2 | 12TS115-2 | 12TS95-2 |
| | 2-1 & 5-4 ON | 2-3 & 5-6 ON | L-80, 15 amps | 12TS15-3 | 12TS115-3 | 12TS95-3 |
| | 2-1 & 5-4 ON* | OFF | L-37, 15 amps | 12TS15-6 | — | 12TS95-6 |
| | 2-1 & 5-4 ON* | 2-3 & 5-6 ON | L-37, 15 amps | 12TS15-8 | 12TS115-8 | — |

**3-POSITION**

| Circuitry | Circuit(s) Made With Toggle At: Keyway Position | Center Position | Opposite Keyway | Electrical Rating and UL Code | Catalog Listing: Screw Terminals | Catalog Listing: Solder Terminals | Quick Connect Terminals |
|---|---|---|---|---|---|---|---|
| ONE POLE | 2-1 ON | OFF | 2-3 ON | L-80, 15 amps | 11TS15-1 | 11TS115-1 | 11TS95-1 |
| | 2-1 ON* | OFF | 2-3 ON | L-31, 10 amps | 11TS15-5 | — | 11TS95-5 |
| | 2-1 ON* | OFF | 2-3 ON* | L-31, 10 amps | 11TS15-7 | 11TS115-7 | 11TS95-7 |
| TWO POLE | 2-1 & 5-4 ON | OFF | 2-3 & 5-6 ON | L-80, 15 amps | 12TS15-1 | 12TS115-1 | 12TS95-1 |
| | 2-1 & 5-4 ON* | OFF | 2-3 & 5-6 ON | L-37, 15 amps | 12TS15-5 | 12TS115-5 | — |
| | 2-1 & 5-4 ON* | OFF | 2-3 & 5-6 ON* | L-37, 15 amps | 12TS15-7 | 12TS115-7 | 12TS95-7 |
| | 2-1 & 5-4 ON | 2-1 & 5-6 ON | 2-3 & 5-6 ON | L-80, 15 amps | — | 12TS115-10† | 12TS95-10† |

* Marked toggle positions are momentary. All other positions are maintained.
† Circuitry diagrams are shown under Series TP.

## LOCKING CONFIGURATIONS FOR TL, 13AT AND 23AT SERIES ONLY

When ordering pull-to-unlock toggle listings, add the suffix letter shown in this chart to the standard toggle listing and the MS-number. For example, to order a 1TL1-1 pull-to-unlock toggle switch with the lever locked in the center position, add the letter "E"; i.e., 1TL1-1E, MS-24658-21E.

| "A" | "B" | "D" | "E" | "F" |
|---|---|---|---|---|
| | | | | |
| LOCKED IN THREE POSITIONS | LOCKED IN CENTER AND EXTREME POSITION (KEYWAY SIDE) | LOCKED OUT OF CENTER POSITION | LOCKED IN CENTER POSITION | LOCKED IN EXTREME POSITION (OPPOSITE KEYWAY) |

| "G" | "H" | "J" | "K" | "L" | "M" | "N" | "P" |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| LOCKED IN EXTREME POSITION (KEYWAY SIDE) | LOCKED OUT OF CENTER AND EXTREME POSITION (KEYWAY SIDE) | LOCKED OUT OF CENTER AND EXTREME POSITION (OPPOSITE KEYWAY) | LOCKED IN CENTER AND EXTREME POSITION (OPPOSITE KEYWAY) | LOCKED OUT OF EXTREME POSITION (KEYWAY SIDE) | LOCKED OUT OF AND INTO EXTREME POSITION (OPPOSITE KEYWAY) | LOCKED OUT OF EXTREME POSITION (OPPOSITE KEYWAY) | LOCKED OUT OF AND INTO EXTREME POSITION (KEYWAY SIDE) |

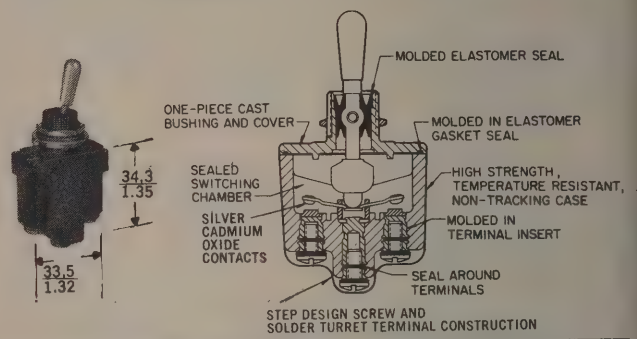
# MICRO SWITCH

A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

## TL TOGGLE SWITCHES

Type TL toggle switches have environment-proof sealing meeting military specification MIL-S-3950 (Immersion). Operating temperature range from −65° to 71°C (−85° to 160°F). 1, 2 and 4-pole circuitry. Standard and Pull-to-Unlock toggle levers. 2- and 3-position, maintained and momentary toggle action.

For additional information, circuitry and terminal options refer to Catalog 200. For UL Listed versions see Catalog 100 or convert the listings below. Substitute a 5 in place of the 1 before the dash. Example: 1TL1-2 becomes 1TL5-2.




### ELECTRICAL RATINGS

| MICRO SWITCH Rating Code* | 28 Volts D.C. | | | 115 VDC | 250 VDC | 115 Volts A.C. 60 & 400 CPS | | | 230 VAC |
|---|---|---|---|---|---|---|---|---|---|
| | Ind. | Res. | Lamp | Res. | Res. | Ind. | Res. | Lamp | Res. |
| 1 | 15 | 20 | 5 | 0.75 | 0.5 | 10 | 15 | 3 | 6 |
| 2 | 10 | 15 | 4 | 0.75 | 0.5 | 7 | 15 | 2 | 6 |
| 3 | 15 | 20 | 7 | 0.75 | 0.5 | 15 | 15 | 4 | 6 |
| 4 | 10 | 18 | 5 | 0.75 | 0.5 | 8 | 11 | 2 | 6 |
| 5 | 12 | 20 | 5 | 0.75 | 0.5 | 15 | 15 | 4 | 6 |
| 6 | 10 | 18 | 4 | 0.75 | 0.5 | 8 | 11 | 2 | 6 |

### ORDER GUIDE — 2-POSITION SWITCHES

| Circuitry | Circuit(s) Made With Toggle At: Keyway Position | Opposite Keyway | Standard Toggle: Electrical Rating Code | Catalog Listing | Military Number | Pull-to-Unlock Toggle: Add Suffix To Standard Toggle Listing‡ | Military Number† |
|---|---|---|---|---|---|---|---|
| ONE POLE | OFF | 2-3 | 1 | 1TL1-2 | MS24523-22 | D, G | MS24658-22 |
| | OFF* | 2-3 | 2 | 1TL1-4 | MS24523-29 | | |
| | 1-2* | OFF | 2 | 1TL1-6 | MS24523-30 | F | MS24658-30 |
| | 1-2 | 2-3 | 1 | 1TL1-3 | MS24523-23 | D, G | MS24658-23 |
| | 1-2* | 2-3 | 2 | 1TL1-8 | MS24523-26 | F | MS24658-26 |
| TWO POLE | OFF | 2-3, 5-6 | 3 | 2TL1-2 | MS24524-22 | D, G | MS24659-22 |
| | OFF* | 2-3, 5-6 | 4 | 2TL1-4 | MS24524-29 | | |
| | 1-2, 4-5* | OFF | 4 | 2TL1-6 | MS24524-30 | F | MS24659-30 |
| | 1-2, 4-5 | 2-3, 5-6 | 3 | 2TL1-3 | MS24524-23 | D, F, G | MS24659-23 |
| | 1-2, 4-5* | 2-3, 5-6 | 4 | 2TL1-8 | MS24524-26 | | |
| FOUR POLE | OFF | 2-3, 5-6, 8-9, 11-12 | 5 | 4TL1-2 | MS24525-22 | | |
| | 1-2, 4-5, 7-8, 10-11* | OFF | 6 | 4TL1-6 | MS24525-30 | | |
| | 1-2, 4-5, 7-8, 10-11 | 2-3, 5-6, 8-9, 11-12 | 5 | 4TL1-3 | MS24525-23 | D, F | MS24660-23 |
| | 1-2, 4-5, 7-8, 10-11* | 2-3, 5-6, 8-9, 11-12 | 6 | 4TL1-8 | MS24525-26 | | |

### ORDER GUIDE — 3-POSITION SWITCHES

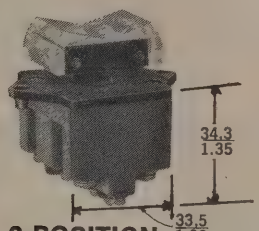
| Circuitry | Circuit(s) Made With Toggle At: Keyway Position | Center Position | Opposite Keyway | Standard Toggle: Electrical Rating Code | Catalog Listing | Military Number | Pull-to-Unlock Toggle: Add Suffix To Standard Toggle Listing‡ | Military Number† |
|---|---|---|---|---|---|---|---|---|
| ONE POLE | 1-2 | OFF | 2-3 | 1 | 1TL1-1 | MS24523-21 | A, E, P | MS24658-21 |
| | 1-2* | OFF | 2-3 | 2 | 1TL1-5 | MS24523-31 | E | MS24658-31 |
| | 1-2* | OFF | 2-3* | 2 | 1TL1-7 | MS24523-27 | E | MS24658-27 |
| | None** | OFF | 2-3 | 1 | 1TL1-21 | MS24523-24 | E, K | MS24658-24 |
| | None** | 1-2 | 2-3 | 1 | 1TL1-31 | MS24523-33 | | |
| | None** | 1-2 | 2-3* | 2 | 1TL1-51 | MS24523-32 | | |
| | 1-2* | OFF | None** | 2 | 1TL1-61 | MS24523-28 | | |
| TWO POLE | 1-2, 4-5 | OFF | 2-3, 5-6 | 3 | 2TL1-1 | MS24524-21 | A, E, L | MS24659-21 |
| | 1-2, 4-5* | OFF | 2-3, 5-6 | 4 | 2TL1-5 | MS24524-31 | M, N | MS24659-31 |
| | 1-2, 4-5* | OFF | 2-3, 5-6* | 4 | 2TL1-7 | MS24524-27 | E | MS24659-27 |
| | None** | OFF | 2-3, 5-6 | 3 | 2TL1-21 | MS24524-24 | E, F, K, M | MS24659-24 |
| | None** | OFF* | 2-3, 5-6 | 4 | 2TL1-41 | MS24524-25 | F | MS24659-25 |
| | None** | 1-2, 4-5 | 2-3, 5-6 | 3 | 2TL1-31 | MS24524-33 | E, F, K, M | MS24659-33 |
| | None** | 1-2, 4-5 | 2-3, 5-6* | 4 | 2TL1-51 | MS24524-32 | E | MS24659-32 |
| | 1-2, 4-5* | OFF | None** | 4 | 2TL1-61 | MS24524-28 | E | MS24659-28 |
| | 1-2, 4-5 | 1-2, 5-6 | 2-3, 5-6 | 3 | 2TL1-10△ | MS27407-4 | A, E, P | MS27408-4 |
| | 1-2, 4-5* | 1-2, 5-6 | 2-3, 5-6 | 4 | 2TL1-50△ | MS27407-5 | K, M | MS27408-5 |
| | 1-2, 4-5* | 1-2, 5-6 | 2-3, 5-6* | 4 | 2TL1-70△ | MS-27407-6 | | |
| FOUR POLE | 1-2, 4-5, 7-8, 10-11 | OFF | 2-3, 5-6, 8-9, 11-12 | 5 | 4TL1-1 | MS24525-21 | A, E | MS24660-21 |
| | 1-2, 4-5, 7-8, 10-11* | OFF | 2-3, 5-6, 8-9, 11-12 | 6 | 4TL1-5 | MS24525-31 | | |
| | 1-2, 4-5, 7-8, 10-11* | OFF | 2-3, 5-6, 8-9, 11-12* | 6 | 4TL1-7 | MS24525-27 | | |
| | None** | OFF | 2-3, 5-6, 8-9, 11-12 | 5 | 4TL1-21 | MS24525-24 | | |
| | None** | 1-2, 4-5, 7-8, 10-11 | 2-3, 5-6, 8-9, 11-12 | 5 | 4TL1-31 | MS24525-33 | | |
| | 1-2, 4-5, 7-8, 10-11 | 2-3, 4-5 | 2-3, 5-6, 8-9, 11-12 | 5 | 4TL1-10△ | — | A | |
| | 1-2, 4-5, 7-8, 10-11* | 2-3, 4-5, 7-8, 11-12 | 2-3, 5-6, 8-9, 11-12 | 6 | 4TL1-50△ | MS27409-2 | | |
| | 1-2, 4-5, 7-8, 10-11* | 2-3, 4-5 | 2-3, 5-6, 8-9, 11-12* | 6 | 4TL1-70△ | — | | |
| | 1-2, 4-5, 7-8, 10-11 | 2-3, 4-5, 7-8, 11-12 | 2-3, 5-6, 8-9, 11-12 | 5 | 4TL1-12△ | MS27406-1 | A | MS27409-1 |
| | 1-2, 4-5, 7-8, 10-11* | 2-3, 4-5, 7-8, 11-12 | 2-3, 5-6, 8-9, 11-12* | 6 | 4TL1-72△ | MS27406-3 | | |

△ Circuitry diagrams are shown under Series TP.
* These positions only are momentary. All others are maintained.
** Toggle lever is blocked from these positions. Toggle becomes two position, with center being one extreme position.
† Also add appropriate suffix letter to the Military Approval number.
‡ See Pull-to-Unlock configurations on the preceding page.

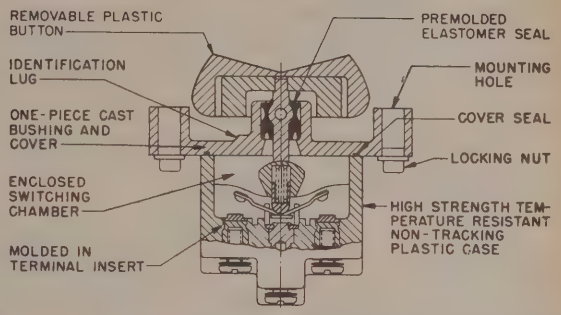
## TP ROCKER BUTTON SWITCHES

"TP" rocker button actuated switches combine the advantages of toggle switch circuitry and current carrying capacity with versatile pushbutton manual control and styling. They also offer similar versatility with two button styles, two- and three-position, maintained and momentary operation and 1-, 2- and 4-pole circuitry. "TP" rocker button switches have a temperature range of from -65° to 160°F (-54° to 71°C). Flush panel or above panel mounting. Series TP is UL listed. Catalog 200 supplies additional information, circuitry and button options, and listings.

ABOVE PANEL TYPE




CONSTRUCTION BELOW PANEL TYPE




### ORDER GUIDE — 2-POSITION

| Circuitry | Circuit(s) Made With Button At: Ident. Lug Position | Opposite Ident. Lug | Electrical Rating and UL Code No. | Catalog Listing: Flush Panel Translucent Button | Flush Panel Transparent Button | Above Panel Translucent Button | Above Panel Transparent Button |
|---|---|---|---|---|---|---|---|
| ONE POLE | OFF | 2-3 | L80, 15 amps | 1TP1-2 | 1TP12-2 | — | — |
| | 1-2* | OFF | L31, 10 amps | 1TP1-6 | — | — | — |
| | 1-2 | 2-3 | L80, 15 amps | 1TP1-3 | 1TP12-3 | 1TP16-3 | 1TP4-3 |
| | OFF | 2-3, 5-6 | L32, 15 amps | 2TP1-2 | 2TP12-2 | — | — |
| TWO POLE | 1-2, 4-5 | 2-3, 5-6 | L32, 15 amps | 2TP1-3 | 2TP12-3 | 2TP16-3 | 2TP4-3 |
| FOUR POLE | OFF | 2-3, 5-6, 8-9, 11-12 | L32, 15 amps | 4TP1-2 | — | — | — |
| | 1-2, 4-5, 7-8, 10-11 | 2-3, 5-6, 8-9, 11-12 | L32, 15 amps | 4TP1-3 | — | — | — |

### ORDER GUIDE — 3-POSITION

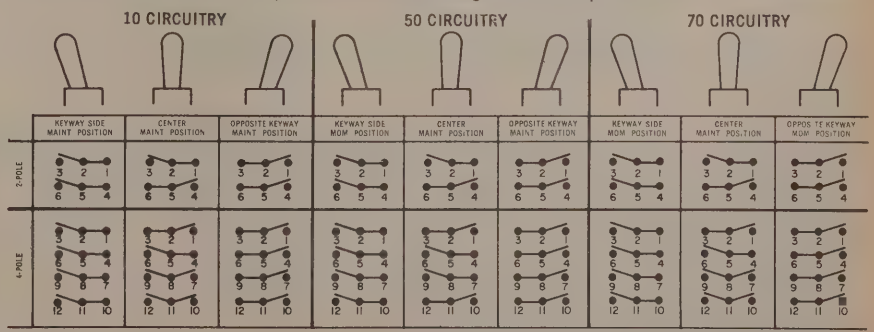
| Circuitry | Circuit(s) Made With Button At: Ident. Lug Position | Center Position | Opposite Ident. Lug | Electrical Rating and UL Code No. | Catalog Listing: Flush Panel Translucent Button | Flush Panel Transparent Button | Above Panel Translucent Button | Above Panel Transparent Button |
|---|---|---|---|---|---|---|---|---|
| ONE POLE | 1-2 | OFF | 2-3 | L80, 15 amps | 1TP1-1 | — | — | 1TP4-1 |
| | 1-2* | OFF | 2-3 | L31, 10 amps | 1TP1-5 | — | — | — |
| | 1-2* | OFF | 2-3* | L31, 10 amps | 1TP1-7 | 1TP12-7 | 1TP16-7 | 1TP4-7 |
| | None** | OFF | 2-3 | L80, 15 amps | 1TP1-21 | — | — | — |
| TWO POLE | 1-2, 4-5 | OFF | 2-3, 5-6 | L32, 15 amps | 2TP1-1 | 2TP12-1 | — | 2TP4-1 |
| | 1-2, 4-5* | OFF | 2-3, 5-6 | L31, 10 amps | 2TP1-5 | — | — | — |
| | 1-2, 4-5* | OFF | 2-3, 5-6* | L31, 10 amps | 2TP1-7 | 2TP12-7 | 2TP16-7 | 2TP4-7 |
| | None** | OFF | 2-3, 5-6 | L32, 15 amps | 2TP1-21 | — | — | — |
| | 1-2, 4-5 | 1-2, 5-6 | 2-3, 5-6 | L32, 15 amps | 2TP1-10 | — | — | — |
| | 1-2, 4-5* | 1-2, 5-6 | 2-3, 5-6* | 4‡ | 2TP1-70 | 2TP12-70 | — | — |
| FOUR POLE | 1-2, 4-5, 7-8, 10-11 | OFF | 2-3, 5-6, 8-9, 11-12 | L32, 15 amps | 4TP1-1 | — | — | — |
| | 1-2, 4-5, 7-8, 10-11* | OFF | 2-3, 5-6, 8-9, 11-12* | L31, 10 amps | 4TP1-7 | 4TP12-7 | — | — |

* These positions only are momentary. All others are maintained.
‡ Refer to TL Electrical Rating Chart.

** Toggle lever is blocked from these positions. Toggle becomes two position with center being one extreme position.

### SPECIAL CIRCUITRIES

Catalog Listings with —10, —50, and —70 suffix numbers shown in the TL, TP, and TS Ordering Charts have special "on-on-on" circuits, as illustrated. TL's with —12 suffix are same as —50, except keyway position is maintained; while —72 is same as —50, except that opposite keyway position is momentary.




DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0.0 — mm / 0.00 — inches

| Catalog listings for button only. | Color | Listing |
|---|---|---|
| | Translucent | 12PA3 |
| | Transparent | 12PA4 |
| | White† | 12PA5-W |
| | Yellow† | 12PA5-Y |
| | Black† | 12PA5-BK |
| | Red† | 12PA5-R |

† Will accept engraved legends.

# MICRO SWITCH

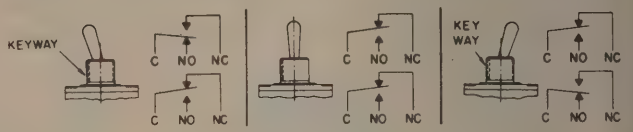
A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

## AT TOGGLE SWITCH ASSEMBLIES

AT Toggle Switch Assemblies couple a toggle switch operator with one or more precision SM, SX, or V3 type basic switches. Momentary and maintained two position and three position devices are available. Schematic at right shows actuation by positions. AT switches offer minimum depth behind panel. Basic switches are UL and CSA listed.

TWO POSITION- 1 POLE

THREE POSITION- 2 POLE




### ELECTRICAL RATINGS (BASIC SWITCHES)

**For 6AT, 13AT, 23AT, and 22AT Switches**

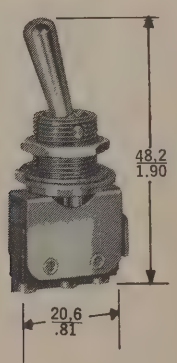
| UL Rating Code L4 | Rating at 30 VDC | | |
|---|---|---|---|
| | Type Load | Amperes at Sea Level | 50,000 feet |
| 5 amps, 125-250 VAC | Inductive | 3 | 2.5 |
| | Resistive | 5 | 5 |
| | Max. Inrush | 24 | 24 |

**For High Capacity AT Switches**

| UL Rating Code L86 | Rating at 30 VDC | | |
|---|---|---|---|
| | Type Load | Ampere Capacity at Sea Level | 50,000 feet |
| 15 Amps, 125-250 VAC<br>⅓ HP, 125-250 VAC<br>½ Amp, 125 VDC<br>¼ Amp, 250 VDC<br>5 Amps, 125 VAC (L) | Inductive | 10 | 6 |
| | Resistive | 10 | 10 |
| | Motor | 6 | 6 |

## 6AT 2-POSITION

Series 6AT Toggle Switch Assemblies control 1, 2, or 3-pole, double-throw precision SM basic switches. Silver contacts in a choice of pierced solder terminals, "T" turret terminals, or "T2" double-turret terminals. Bushing sizes are offered in ¼" or 15/32" as charted below. Gold contact versions for low energy circuits are listed in Catalog 200.




| Mounting Style | Number of Poles | Type Contacts | Catalog Listings | | |
|---|---|---|---|---|---|
| | | | Solder Terminals | "T" Terminals | "T2" Terminals |
| ¼" Bushing with Key Tab | 1 | Silver | 6AT2 | 6AT2-T<br>6AT68-T* | 6AT2-T2<br>6AT68-T2* |
| | 2 | Silver | 6AT3 | 6AT3-T | 6AT3-T2 |
| | 3 | Silver | 6AT501 | 6AT501-T | 6AT501-T2 |
| ¼" Bushing without Key Tab | 1 | Silver | 6AT1 | 6AT1-T<br>6AT75-T*<br>6AT201-T† | 6AT1-T2<br>6AT201-T2† |
| | 2 | Silver | 6AT4 | 6AT4-T<br>6AT231-T† | 6AT4-T2<br>6AT231-T2† |
| 15/32" Bushing with Key Washer | 1 | Silver | 6AT6 | 6AT6-T | 6AT6-T2 |
| | 2 | Silver | 6AT7 | 6AT7-T | 6AT7-T2 |
| | 3 | Silver | 6AT10 | 6AT10-T | 6AT10-T2 |

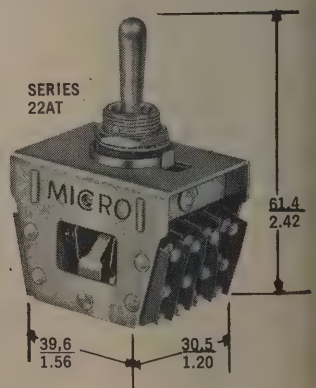
* Extra Long Toggle Lever — 1.70mm/.67"
† Momentary position opposite keyway. Key washer in place of key tab.

## 22AT

Series 22AT Toggle Switch Assemblies contain 8 SPDT silver contact SM basic switches. Basic switches are mounted in two banks controlled by a single lever. Movement of lever from the center position actuates one bank of 4 switches in each extreme position providing a variety of wiring combinations. Splash type bushing and lever seals prevent the entrance of moisture and dust behind the panel, or into the contact area.

| Toggle Lever Position | | | Catalog Listing with "T" Terminals |
|---|---|---|---|
| Key Tab Position | Center Position | Position Opposite Key Tab | |
| Momentary | Maintained | Momentary | 22AT1-T |
| Maintained | Maintained | Maintained | 22AT2-T |
| Maintained | Maintained | Momentary | 22AT3-T |

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY
Key: 0,0 — mm / 0.00 — inches



# AT TOGGLE SWITCH ASSEMBLIES (Cont.)

## 13AT AND 23AT

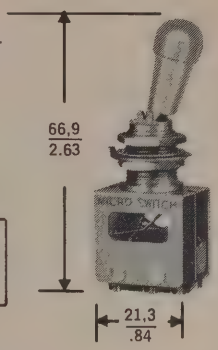
Series 13AT and 23AT contain two, three, or four SPDT subminiature type SM basic switches. Silver contacts. Standard toggle, tab, or pull-to-unlock levers. Gold contact versions are listed in Catalog 200.

### PULL-TO-UNLOCK LEVER OPTIONS

As a guard against accidental operation, pull-to-unlock toggle levers must be pulled .090 inch (approx.) to change positions.

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY
Key: 0,0 — mm or Newtons
0.00 — inches or pounds

* A chart showing the 13 locking configurations and their catalog listing is shown beneath 11TS and 12TS listings. See page 21.




### TWO POSITION

| Toggle Lever Position | | No. of Poles | Type Contacts | Standard Lever Catalog Listings | | | Pull-to-Unlock with Solder Terminals Specify Locking Letter* | | Tab Lever with "T2" Terminals |
|---|---|---|---|---|---|---|---|---|---|
| Keyway | Opposite Keyway | | | Solder Terminals | "T" Terminals | "T2" Terminals | | | |
| Maint. | Maint. | 2 | Silver | 23AT1 | 23AT1-T | 23AT1-T2 | 23AT1- | Specify D, F or G from locking chart and add code letter to catalog listing at left | 23AT402-T2 |
| | | 3 | Silver | 23AT2 | 23AT2-T | 23AT2-T2 | 23AT2- | | 23AT408-T2 |
| | | 4 | Silver | 23AT3 | 23AT3-T | 23AT3-T2 | 23AT3- | | — |
| Mom. | Maint. | 2 | Silver | 23AT4 | 23AT4-T | 23AT4-T2 | — | | 23AT403-T2 |
| | | 3 | Silver | 23AT5 | — | 23AT5-T2 | — | | — |
| | | 4 | Silver | 23AT6 | — | 23AT6-T2 | — | | — |

### THREE POSITION

| Toggle Lever Position | | | No. of Poles | Type Contacts | Standard Lever Catalog Listings | | | Pull-to-Unlock with Solder Terminals Specify Locking Letter* | | Tab Lever with "T2" Terminals |
|---|---|---|---|---|---|---|---|---|---|---|
| Keyway | Center | Opposite Keyway | | | Solder Terminals | "T" Terminals | "T2" Terminals | | | |
| Maint. | Maint. | Maint. | 2 | Silver | 13AT2 | 13AT2-T | 13AT2-T2 | 13AT2- | Specify any locking chart letter and add to catalog listing at left | 13AT402-T2 |
| | | | 3 | Silver | 13AT5 | 13AT5-T | — | 13AT5- | | — |
| | | | 4 | Silver | 13AT9 | 13AT9-T | 13AT9-T2 | 13AT9- | | 13AT409-T2 |
| Mom. | Maint. | Mom. | 2 | Silver | 13AT1 | 13AT1-T | 13AT1-T2 | 13AT1- | Specify E, L or N from locking chart and add code letter to catalog listing at left | 13AT401-T2 |
| | | | 3 | Silver | 13AT4 | — | — | — | | 13AT413-T2 |
| | | | 4 | Silver | 13AT8 | — | 13AT8-T2 | 13AT8- | | 13AT408-T2 |
| Maint. | Maint. | Mom. | 2 | Silver | 13AT3 | 13AT3-T | 13AT3-T2 | 13AT3- | Specify E, G, B, L, P or N from locking chart and add code letter to catalog listing at left | 13AT403-T2 |
| | | | 4 | Silver | 13AT10 | — | — | 13AT10- | | 13AT410-T2 |

## M8805/26 TOGGLE SWITCHES

### TWO POSITION

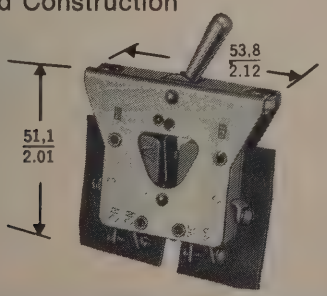
| Toggle Lever Position | | No. of Poles | Type Contacts | Standard Lever With "T2" Terminals | | Tab Lever With "T2" Terminals | |
|---|---|---|---|---|---|---|---|
| Keyway | Opposite Keyway | | | Catalog Listing | Military Approval No. | Catalog Listing | Military Approval No. |
| Maint. | Maint. | 2 | Silver | 23AT73-T2 | M8805/26-001 | 23AT473-T2 | M8805/26-003 |
| | | 4 | Silver | 23AT74-T2 | M8805/26-002 | 23AT474-T2 | M8805/26-004 |

### THREE POSITION

| Toggle Lever Position | | | No. of Poles | Type Contacts | Standard Lever With "T2" Terminals | | Tab Lever With "T2" Terminals | |
|---|---|---|---|---|---|---|---|---|
| Keyway | Center | Opposite Keyway | | | Catalog Listing | Military Approval No. | Catalog Listing | Military Approval No. |
| Mom. | Maint. | Mom. | 2 | Silver | 13AT271-T2 | M8805/26-005 | 13AT471-T2 | M8805/26-006 |
| | | | 3 | Silver | 13AT274-T2 | M8805/26-011 | 13AT474-T2 | M8805/26-012 |
| Maint. | Maint. | Maint. | 2 | Silver | 13AT272-T2 | M8805/26-007 | 13AT472-T2 | M8805/26-008 |
| | | | 3 | Silver | 13AT275-T2 | M8805/26-013 | 13AT475-T2 | M8805/26-014 |
| Maint. | Maint. | Mom. | 2 | Silver | 13AT273-T2 | M8805/26-009 | 13AT473-T2 | M8805/26-010 |

# TOGGLE SWITCH HIGH CAPACITY ASSEMBLIES — 3 POSITIONS

- 2-4-6-8-10 Switch Control
- V3 Basic Switches
- 3-Hole Mounting
- Rugged Construction




| Toggle Lever Positions | | | Number of Basic Switches | Lever Length | | Catalog Listing |
|---|---|---|---|---|---|---|
| One Extreme | Center | Other Extreme | | mm | In. | |
| Maintained | Maintained | Maintained | 2 | 22,4 | .88 | 11AT30 |
| | | | 4 | 22,4 | .88 | 15AT1 |
| | | | 6 | 22,4 | .88 | 7AT4 |
| | | | 8 | 22,4 | .88 | 8AT4 |
| | | | 10 | 31,8 | 1.25 | 10AT4 |
| Momentary | Maintained | Momentary | 2 | 22,4 | .88 | 11AT20 |
| | | | 4 | 22,4 | .88 | 15AT2 |
| | | | 6 | 31,8 | 1.25 | 7AT51 |
| | | | 8 | 31,8 | 1.25 | 8AT1 |
| | | | 10 | 31,8 | 1.25 | 10AT1 |
| Momentary | Maintained | Maintained | 2 | 22,4 | .88 | 11AT50 |
| | | | 4 | 22,4 | .88 | 15AT3 |
| | | | 6 | 22,4 | .88 | 7AT6 |
| | | | 8 | 22,4 | .88 | 8AT6 |

For electrical ratings, refer to preceding page.

**MICRO SWITCH** A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032

# DEFINITIONS

**Alternate Action** — Push "ON" — Push "OFF", maintained contact operation. In some cases a two level operator is provided.

**Basic Switch** — A self-contained switching unit. It can be used alone, gang-mounted, built into assemblies or enclosed in metal housings.

**Double Break Contacts** — (Twin break). This breaks the circuit in two places. Referred to as form Z circuitry also.

**Double-Pole Double-Throw (DPDT)** — Switches which make and break two separate circuits. This circuit provides a normally open and normally closed contact for each pole.

**Dust-Tight** — This seal guards against dust and dirt, but does not seal against moisture and vapors. Premolded elastomer boots and non-hardening cement are often used to accomplish this seal.

**Environment-Proof Switch** — A switch which is completely sealed to ensure constant operating characteristics. Sealing normally includes an "O" ring on actuator shaft and fused glass-to-metal terminal seals or complete potting and an elastomer plunger-case seal.

**Explosion-Proof Switch** — A UL listed switch capable of withstanding an internal explosion of a specified gas without igniting surrounding gases.

Military explosion proof requirements specify that the switch will not cause an explosion. This can be done by sealing the switch contacts from the atmosphere.

**Hermetically Sealed Switch** — A switch completely sealed to provide constant operating characteristics. All junctures made with metal-to-metal or glass-to-metal fusion.

**Momentary Switch** — A switch with contacts that return from operated condition to normal condition when actuating force is removed. Unless otherwise stated, all switches in this catalog are momentary.

**Normally Closed Contacts (N.C.)** — Provide a normally closed circuit when actuator is in free position.

**Normally Open Contacts (N.O.)** — Provide a normally open circuit when actuator is in free position.

**Precision Snap-Acting Switch** — An electromechanical switch having predetermined and accurately controlled characteristics, and having a spring loaded quick make and break contact action.

**Single-Pole Double-Throw (SPDT)** — Switch which may either make or break a circuit, depending on how it is wired.

# OPERATING CHARACTERISTICS

Definitions below explain the meaning of operating characteristics. Characteristics shown in tables throughout catalog were chosen as most significant.

Linear dimensions for in-line actuation are from top of plunger to a reference line, usually the center of the mounting holes, or the top of the switch housing.

**Differential Travel (D.T.)** — Plunger or actuator travel from point where contacts "snap-over" to point where they "snap-back."

**Free Position (F.P.)** — Position of switch plunger or actuator when no external force is applied (other than gravity).

**Full Overtravel Force** — Force required to attain full overtravel of actuator.

**Operating Position (O.P.)** — Position of switch plunger or actuator at which point contacts snap from normal to operated position. Note that in the case of flexible or adjustable actuators, the operating position is measured from the end of the lever or its maximum length. Location of operating position measurement shown on mounting dimension drawings.

**Operating Force (O.F.)** — Amount of force applied to switch plunger or actuator to cause contact "snap-over." Note in the case of adjustable actuators, the force is measured from the maximum length position of the lever.

**Overtravel (O.T.)** — Plunger or actuator travel safely available beyond operating position.

**Pretravel (P.T.)** — Distance or angle traveled in moving plunger or actuator from free position to operating position.

**Release Force (R.F.)** — Amount of force still applied to switch plunger or actuator at moment contacts snap from operated position to unoperated position.

**Total Travel (T.T.)** — Distance from actuator free position to overtravel limit position.

# REFERENCE STANDARDS

The UL and CSA references in this catalog do not imply specific approval of our products but rather that our products are designed to meet the safety and performance standards recommended by such agencies. Evaluation of our products by these agencies is limited to procedures established to examine switch performance within areas of their interest. Actual application requirements may exceed performance levels investigated by these agencies. We recommend that switches be tested to your exact application requirements.

**UL (Underwriter's Laboratories, Inc.)** is chartered as a non-profit organization without capital stock under the laws of the state of Delaware, to establish, maintain, and operate laboratories for the examination and testing of devices, systems and materials. Founded in 1894, the enterprise is operated for service, not for profit.

**CSA (Canadian Standards Association)** is a non-profit, nongovernmental association established as a national standardization body for Canada. Included in its scope of activities is the responsibility of investigating and approving products and materials in the interest of safety.

MILITARY QUALIFICATIONS

To increase your effectiveness in using MIL-S-numbers, minimize your cost, and reduce your delivery time, MICRO SWITCH publishes **Data** Sheet 204. It provides current information on the specification, and is revised and reissued as changes and additions occur. Please contact MICRO SWITCH for the most up-to-date issue.

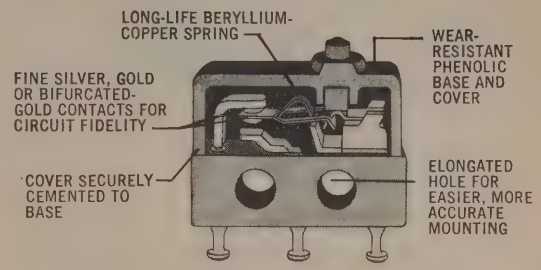
**Mounting Dimensions** — All dimensions on the mounting dimension drawings in this catalog are subject to change without notice and are for reference only. Request current drawings from the nearest MICRO SWITCH Branch Office or write to Freeport.

# TYPE SX SUBMINIATURE BASIC SWITCHES

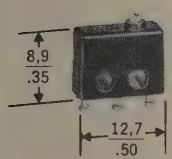
The SX series basic switches are the smallest snap-action switches from MICRO SWITCH. These switches are ideal where savings in space and weight are important. Unless otherwise noted, all listings have silver contacts. Variations include high temperature designs for up to 400°F (204°C), gold contacts for low energy applications, and bifurcated gold contacts for maximum reliability.

The SX switches are available with several types of terminations. The T and T2 terminals provide easy lead wire attachment.

Additional terminal types and switch/actuator variations are available in Catalog 200.


LONG-LIFE BERYLLIUM-COPPER SPRING
WEAR-RESISTANT PHENOLIC BASE AND COVER
FINE SILVER, GOLD OR BIFURCATED-GOLD CONTACTS FOR CIRCUIT FIDELITY
COVER SECURELY CEMENTED TO BASE
ELONGATED HOLE FOR EASIER, MORE ACCURATE MOUNTING

## STRAIGHT PLUNGER ORDER GUIDE



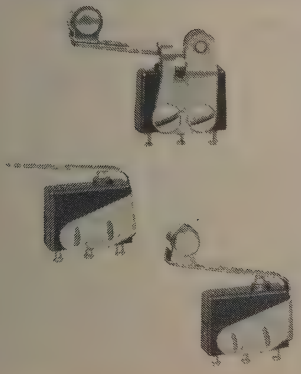

| Recommended For | Electrical Data and UL Code | Typical Catalog Listing | Operating Force Max. | Overtravel Min. | Differential Travel Max. | Operating Point* |
|---|---|---|---|---|---|---|
| Most applications | 5 amps L-4 | **11SX21-T** | 1,39<br>5 | 0,1<br>.004 | 0,051<br>.002 | 8,13<br>.320 |
| Lower Force | 7 amps L-7 | **2SX1-T** | 0,83<br>3 | 0,1<br>.004 | 0,13<br>.005 | 8,13<br>.320 |
| Applications requiring gold contacts | 1 amp L-22 | **3SX1-T** | 1,39<br>5 | 0,1<br>.004 | 0,13<br>.005 | 8,13<br>.320 |
| MIL-S-8805 application requirements +180°F (82°C) maximum use | 7 amps | **21SX39-T (MS24547-1)** | 1,39<br>5 | 0,1<br>.004 | 0,13<br>.005 | 8,13<br>.320 |
| Operating in temperature to: +400°F (204°C)** | 7 amps | **4SX1-T** | 1,39<br>5 | 0,1<br>.004 | 0,13<br>.005 | 8,13<br>.320 |
| Best reliability with higher current rating (Bifurcated gold contacts)** | 1 amp L-22 | **12SX1-T** | 1,39<br>5 | 0,1<br>.004 | 0,076<br>.003 | 8,13<br>.320 |

* ±0,38mm ±.015 in.

## INTEGRAL LEVER ORDER GUIDE

| Description | Electrical Data and UL Code | Typical Catalog Listing | Operating Force Max. | Overtravel Min. | Differential Travel Max. | Operating Point |
|---|---|---|---|---|---|---|
| .505 inch (12,8mm) long straight lever | 5 amps L-4 | **311SX2-T** | 0,31<br>1.1 | 0,64<br>.025 | 0,89<br>.035 | 8,26 ±1,91<br>.325 ±.075 |
| .042 inch (1,1mm) long simulated roller lever | 5 amps L-4 | **311SX4-T** | 0,59<br>2.1 | 0,25<br>.010 | 0,38<br>.015 | 14,15 ±0,91<br>.557 ±.036 |

## AUXILIARY ACTUATOR ORDER GUIDE (order switches separately)



| Description | Actuator Length mm inches | Typical Catalog Listing | Operating Force Max. | Overtravel Min. | Differential Travel Max. | Operating Point‡ | Free Position |
|---|---|---|---|---|---|---|---|
| Roller lever | 16,5<br>.65 | **JX-25** | 0,42<br>1.5 | 0,51<br>.020 | 0,76<br>.030 | 14,9 ±1,14<br>.585 ±.045 | 16,8 max.<br>.660 |
| Straight leaf | 9,4<br>.37 | **JX-40** | 1,95<br>7 | 0,38<br>.015 | 0,64<br>.025 | 7,5<br>.295 | 12,3 ref.<br>.485 |
| Roller leaf | 6,1<br>.24 | **JX-45** | 1,95<br>7 | 0,38<br>.015 | 0,64<br>.025 | 12,2<br>.480 | 16,5 ref.<br>.650 |

NOTE: All characteristics are taken with actuator assembled on Catalog Listing 1SX1-T as shown. Actuators should be used at temperatures below +300°F (149°C).

Except where stated‡ ±0,76mm ±.030 in.

** For best results especially in the application of the bifurcated contact 12SX series and high temperature 4SX1-T, contact a MICRO SWITCH Branch Office.

Key: 0,0 — mm or Newtons / 0.00 — inches or ounces

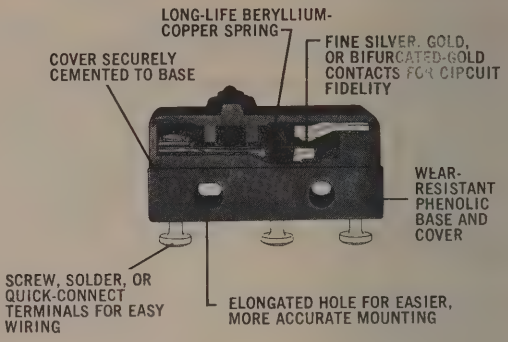
MOUNTING HOLES ACCEPT PINS OR SCREWS OF .087 INCH DIAMETER (2,21mm) ON .19 INCH (4,8mm) CENTERS.

**MICRO SWITCH** A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

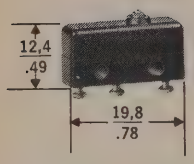
## TYPE SM SUBMINIATURE BASIC SWITCHES

The SM series switches are slightly larger than the SX switches. They feature precision operation, long life, and power load switching to 11 amps (VAC). High temperature construction available for up to 400°F (204°C). Gold contacts for low energy applications, bifurcated contacts for maximum reliability. Unless otherwise noted, all listings have silver contacts.

Additional terminal types and switch/actuator variations are available in Catalog 200.


LONG-LIFE BERYLLIUM-COPPER SPRING
COVER SECURELY CEMENTED TO BASE
FINE SILVER, GOLD, OR BIFURCATED-GOLD CONTACTS FOR CIRCUIT FIDELITY
WEAR-RESISTANT PHENOLIC BASE AND COVER
SCREW, SOLDER, OR QUICK-CONNECT TERMINALS FOR EASY WIRING
ELONGATED HOLE FOR EASIER, MORE ACCURATE MOUNTING

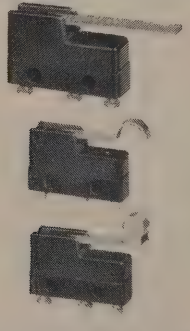
### PIN PLUNGER ORDER GUIDE




| Recommended For | Electrical Data and UL Code | Typical Catalog Listing | Operating Force | Overtravel Min. | Differential Travel Max. | Operating Point* |
|---|---|---|---|---|---|---|
| Most applications | 5 amps L-4 | **11SM1-T** | 0,83-1,39<br>3-5 | 0,13<br>.005 | 0,1<br>.004 | 8,38<br>.330 |
| Operating in temperatures to +400°F (204°C)† | — | **11SM244-T** | 0,83-1,39<br>3-5 | 0,13<br>.005 | 0,1<br>.004 | 8,38<br>.330 |
| Up to 11 ampere ¼ hp (AC) load handling† | 11 amps L-141 | **41SM1-T** | 0,83-1,39<br>3-5 | 0,13<br>.005 | 0,1<br>.004 | 8,38<br>.330 |
| Best reliability Bifurcated gold contacts† | 1 amp L-22 | **12SM4-T** | 0,83-1,39<br>3-5 | 0,076<br>.003 | 0,1<br>.004 | 8,38<br>.330 |
| Sealed plunger construction | 5 amps L-4 | **41SM1** | 0,83-1,39<br>3-7.5 | 0,13<br>.005 | 0,1<br>.004 | 8,38<br>.330 |
| Center plunger position | 5 amps L-4 | **51SM1-T** | 0,56-1,39<br>2-5 | 0,25<br>.010 | 0,15<br>.006 | 10,3 ±0,51<br>.406 ±.020 |
| MIL-S-8805 application requirements solder terminals | 5 amps | **21SM284 (MS25085-1)** | 0,83-1,39<br>3-5 | 0,13<br>.005 | 0,1<br>.004 | 8,38<br>.330 |

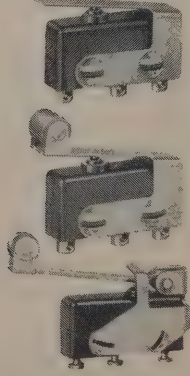
Except where stated* ±0,38mm ±.015 in.

### INTEGRAL LEVER ORDER GUIDE



| Description | Electrical Data and UL Code | Typical Catalog Listing | Operating Force Max. | Characteristics Overtravel Min. | Differential Travel Max. | Operating Point |
|---|---|---|---|---|---|---|
| .565 inch (14,35mm) long straight lever | 5 amps L-4 | **311SM2-T** | 0,31<br>1.1 | 0,66<br>.026 | 0,69<br>.027 | 8,51 ±2<br>.335 ±.080 |
| .251 inch (6,38mm) long simulated roller lever | 5 amps L-4 | **311SM4-T** | 0,39<br>1.4 | 0,46<br>.018 | 0,48<br>.019 | 11,7 ±1,5<br>.460 ±.060 |
| .251 inch (6,38mm) long roller lever | 5 amps L-4 | **311SM6-T** | 0,39<br>1.4 | 0,46<br>.018 | 0,48<br>.019 | 14,2 ±1.5<br>.560 ±.060 |

### AUXILIARY ACTUATOR ORDER GUIDE (order switches separately)



| Description | Actuator Length mm Inches | Typical Catalog Listing | Operating Force Max. | Overtravel Max. | Differential Travel Max. | Operating Point | Free Position Max. |
|---|---|---|---|---|---|---|---|
| Straight leaf | 16,8<br>.66 | **JS-2** | 2,78<br>10 | 0,38<br>.015. | 0,38<br>.015 | 8,89 ±0,76<br>.350 ±.015 | 11,3<br>.445 |
| Roller leaf (bronze roller) | 15<br>.59 | **JS-5** | 2,78<br>10 | 0,38<br>.015 | 0,38<br>.015 | 14,2 ±0,76<br>.560 ±.015 | 16,9<br>.665 |
| Roller lever (steel roller) | 25,4<br>1.00 | **JS-246** | 0,28<br>1 | 0,76<br>.030 | 0,76<br>.030 | 14,3<br>.562 approx. | — |

† Note: For best results, especially in the application of the high temperature 11SM244, 10 ampere capacity 41SM, and the bifurcated contact 12SM, contact a MICRO SWITCH Branch Office. SM basic switches are available with (UL) TV-2 rated versions.

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

NOTE: Actuators should be used below +300°F.
All characteristics are taken with actuator assembled to Catalog Listing 11SM1-T as shown.

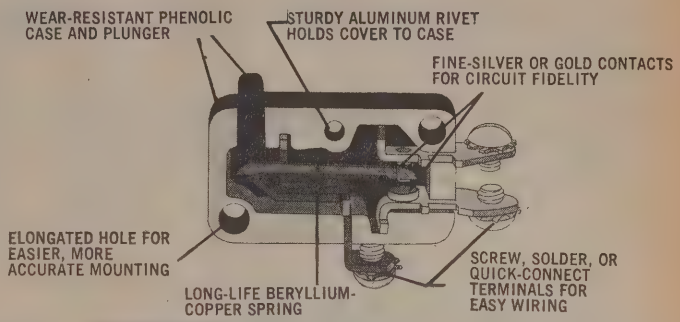
Key: 0,0 — mm or Newtons
0.00 — inches or ounces

MOUNTING HOLES ACCEPT PINS OR SCREWS OF .087 INCH (2,21mm) MAX. DIA. ON .38 INCH (9,5mm) CENTERS.

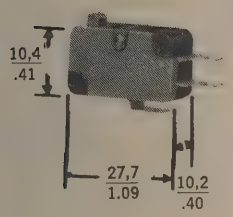
# BASIC SWITCHES

## TYPE V3 MINIATURE BASIC SWITCHES

V3 switches combine small size with high electrical capacity up to 15 amps, ½ hp. Operating force goes as low as 7 grams maximum with actuator. Long mechanical life of 10,000,000 cycles with 95% survival. Standard temperature tolerances up to 180°F (82°C). Catalog 200 offers additional terminations, integral actuators, and switch variations, plus auxiliary actuators.


WEAR-RESISTANT PHENOLIC CASE AND PLUNGER
STURDY ALUMINUM RIVET HOLDS COVER TO CASE
FINE-SILVER OR GOLD CONTACTS FOR CIRCUIT FIDELITY
ELONGATED HOLE FOR EASIER, MORE ACCURATE MOUNTING
LONG-LIFE BERYLLIUM-COPPER SPRING
SCREW, SOLDER, OR QUICK-CONNECT TERMINALS FOR EASY WIRING

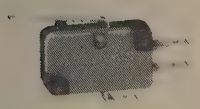
### PLUNGER ORDER GUIDE

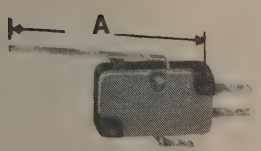



| Recommended For | Electrical Data and UL Code | Typical Catalog Listing | Operating Force | Overtravel Min. | Differential Travel | Operating Point* |
|---|---|---|---|---|---|---|
| Most applications | 11 amps L-156 | **V3-101-D8** | 2,22<br>8 max. | 1,02<br>.040 | 0,15-0,41<br>.006-.016 | 14,7<br>.578 |
| Added overtravel | 10 amps L-112 | **V3-1101-D8** | 0,72 max.<br>2.6 | 1,27<br>.050 | 0,051-0,25<br>.002-.010 | 14,7<br>.578 |
| Lower force<br>Added overtravel | 10 amps L-131 | **V3-2101-D8** | 0,5 max.<br>1.8 | 1,27<br>.050 | 0,051-0,25<br>.002-.010 | 14,7<br>.578 |
| Lower force | 5 amps L-162 | **V3-2401-D8** | 0,25<br>.9 | 1,27<br>.050 | 0,051-0,25<br>.002-.010 | 14,7<br>.578 |
| Lowest force | 3 amps L-163 | **V3-2451-D8** | 0,15<br>.53 | 1,27<br>.050 | 0,051-0,25<br>.002-.010 | 14,7<br>.578 |
| Up to 15 amps load handling | 15 amps L-83 | **V3-3001-D8** | 1,34 max.<br>4.8 | 1,27<br>.050 | 0,051-0,25<br>.002-.010 | 14,7<br>.578 |

* ±0,38mm
±.015 in.

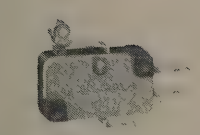
### STRAIGHT LEVER ORDER GUIDE






| Recommended For | Length of "A" mm Inches | Electrical Data and UL Code | Typical Catalog Listing | Operating Force Max. | Overtravel Min. | Differential Travel Max. | Operating Point |
|---|---|---|---|---|---|---|---|
| Most applications | 35,6<br>1.40 | 11 amps L-156 | **V3L-104-D8** | 1,11<br>4 | 2,29<br>.090 | 1,27<br>.050 | 15,2 ±1,5<br>.600 ±.060 |
| Added overtravel | 59,4<br>2.34 | 11 amps L-156 | **V3L-131-D8** | 0,59<br>2.1 | 3,81<br>.150 | 2,29<br>.090 | 14,7 ±2<br>.580 ±.080 |
| | 35,6<br>1.40 | 10 amps L-112 | **V3L-1108-D8** | 0,33<br>1.2 | 2,29<br>.090 | 0,76<br>.030 | 15,2 ±1,5<br>.600 ±.060 |
| | 59,4<br>2.34 | 10 amps L-112 | **V3L-1122-D8** | 0,20<br>.71 | 4,06<br>.160 | 1,4<br>.055 | 15,2 ±1,8<br>.600 ±.070 |
| Lower force<br>Added overtravel | 35,6<br>1.40 | 10 amps L-131 | **V3L-2102-D8** | 0,31<br>1.1 | 2,29<br>.090 | 0,76<br>.030 | 15,2 ±1,5<br>.600 ±.060 |
| | 59,4<br>2.34 | 10 amps L-131 | **V3L-2106-D8** | 0,16<br>.57 | 4,06<br>.160 | 1,4<br>.055 | 15,2 ±1,8<br>.600 ±.070 |
| Lowest force | 35,6<br>1.40 | 5 amps L-162 | **V3L-2424-D8** | 0,12<br>.42 | 2,29<br>.090 | 0,76<br>.030 | 15,2 ±1,5<br>.600 ±.060 |
| | 59,4<br>2.34 | 5 amps L-162 | **V3L-2425-D8** | 0,07<br>.25 | 4,06<br>.160 | 1.4<br>.055 | 15,2 ±2<br>.600 ±.080 |
| Up to 15 amps load handling. Best for performance under shock and vibration | 35,6<br>1.40 | 15 amps L-83 | **V3L-3005-D8** | 0,72<br>2.6 | 2,29<br>.090 | 0,81<br>.032 | 15,2 ±1,5<br>.600 ±.060 |
| | 59,4<br>2.34 | 15 amps L-83 | **V3L-3013-D8** | 0,39<br>1.4 | 4,06<br>.160 | 1,52<br>.060 | 15,2 ±1,9<br>.600 ±.075 |

### ROLLER LEVER ORDER GUIDE



| Recommended For | Length of "A" mm Inches | Electrical Data and UL Code | Typical Catalog Listing | Operating Force Max. | Overtravel Min. | Differential Travel Max. | Operating Point |
|---|---|---|---|---|---|---|---|
| Most applications | 20,6<br>.81 | 11 amps L-156 | **V3L-139-D8** | 2,22<br>8 | 1,02<br>.040 | 0,41<br>.016 | 20,6 ±0,76<br>.810 ±.030 |
| Added overtravel<br>Lower force<br>Added overtravel | 20,6<br>.81 | 10 amps L-112 | **V3L-1117-D8** | 0,72<br>2.6 | 1,14<br>.045 | 0,33<br>.013 | 20,6 ±0,76<br>.810 ±.030 |
| | 20,6<br>.81 | 10 amps L-131 | **V3L-2103-D8** | 0,50<br>1.8 | 1,14<br>.045 | 0,33<br>.013 | 20,6 ±0,76<br>.810 ±.030 |
| Up to 15 amps load handling. Best for performance under shock and vibration | 20,6<br>.81 | 15 amps L-83 | **V3L-3003-D8** | 1,34<br>4.8 | 1,02<br>.040 | 0,33<br>.013 | 20,6 ±0,76<br>.810 ±.030 |

MOUNTING HOLES ACCEPT PINS OR SCREWS OF .11 INCH (2,8mm) DIA. ON .88 INCH (22,4mm) CENTERS.

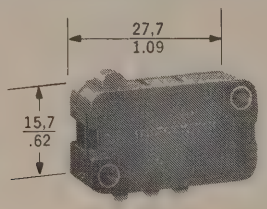
DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0,0 — mm or Newtons
0.00 — inches or ounces

**MICRO SWITCH** A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

# XL MECHANICALLY OPERATED SOLID STATE SWITCHES

Series XL combines precision mechanical switch operating and mounting convenience with solid state reliability. It uses the Hall sensor developed by MICRO SWITCH. An integrated circuit, actuated by a magnet located in the operating plunger, produces a digital output.




Mounting dimensions and mechanical characteristics are similar to the popular V3 type snap-action switch. Over 500 actuators are available, including pin plunger, straight levers, simulated roller levers, and roller levers.

XL switches can be used directly with electronic circuits, such as discrete transistors, integrated logic or SCR's. The digital logic level output eliminates the need for conditioning circuitry to obtain a square wave output.

Terminals are combination solder/quick-connect. A terminal housing can be provided for use with AMP .110" push-on terminals.

For more information, see Product Sheet XL.

## ELECTRICAL CHARACTERISTICS, 5 VDC CIRCUIT

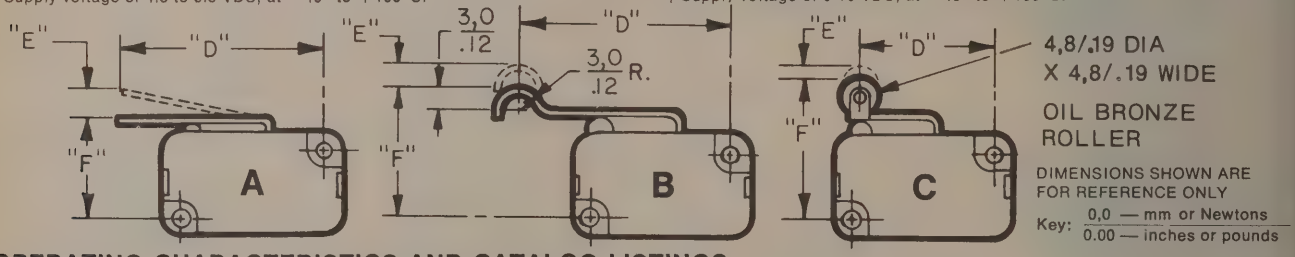
| | Typ. | Max. | Remarks |
|---|---|---|---|
| Supply Current* At 24° ±2°C, supply voltage of 5 ±0.5% VDC | 2.5mA | 4.0mA | Output transistor OFF |
| Output Voltage* (output transistor ON) | 0.15V | 0.4V | Sinking 8mA max. |
| Output Leakage Current (output transistor OFF) | — | 20μA | Leakage into switch output |
| Output Switching Time* Rise | 0.2μsec. | 1.0μsec. | 10% to 90% |
| Output Switching Time* Fall | 0.1μsec. | 0.5μsec. | 90% to 10% |

* Supply voltage of 4.5 to 5.5 VDC, at −40° to +100°C.

## ELECTRICAL CHARACTERISTICS, 6-16 VDC CIRCUIT

| | Typ. | Max. | Remarks |
|---|---|---|---|
| Supply Current At 24° ±2°C | 3mA<br>5mA | 6.5mA<br>10.0mA | Output transistor OFF<br>Vs = 6 volts<br>Vs = 16 volts |
| Output Voltage† (output transistor ON) | 0.15V | 0.4V | Sinking 20mA |
| Output Leakage† Current (output transistor OFF) | — | 20μA | Leakage into switch output |
| Output Switching Time† Rise | 0.2μsec. | 1.5μsec. | 10% to 90% |
| Output Switching Time† Fall | 0.1μsec. | 0.5μsec. | 90% to 10% |

† Supply voltage of 6-16 VDC, at −40° to +100°C.




DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0,0 — mm or Newtons
0.00 — inches or pounds

## OPERATING CHARACTERISTICS AND CATALOG LISTINGS

| Dimension "D" | Lever Style** | "E" Pretravel (Max.) | "F" Operating Point‡ | Overtravel (Min.) | Differential Travel (Max.) | Operating Force Ounces | Operating Force Newtons | 5 VDC Type Sinking | 6-16 VDC Type Sinking |
|---|---|---|---|---|---|---|---|---|---|
| — | None | 1,65mm .065 in. | 14,22mm .560 in. | 0,76mm .030 in. | 0,18mm .007 in. | .35 ±.10 | 0,10 ±0,03 | 37XL11-01 | 47XL11-01 |
| — | | | | | | 1.25 ±.25 | 0,35 ±0,07 | 37XL11-02 | 47XL11-02 |
| | | | | | | 3.00 ±.60 | 0,83 ±0,17 | 37XL11-03 | 47XL11-03 |
| 21,84mm .860 in. | A | 1,78mm .070 in. | 14,73mm .580 in. | 0,64mm .025 in. | 0,25mm .010 in. | △.40 ±.15 | 0,11 ±0,04 | 37XL11XA-11 | 47XL11XA-11 |
| | | | | | | 1.50 ±.30 | 0,42 ±0,08 | 37XL11XA-12 | 47XL11XA-12 |
| | | | | | | 3.00 ±.70 | 0,83 ±0,19 | 37XL11XA-13 | 47XL11XA-13 |
| 35,56mm 1.400 in. | A | 4,44mm .175 in. | 14,22mm .560 in. | 1,27mm .050 in. | 0,38mm .015 in. | △.20 max. | 0,06 max. | 37XL11XA-21 | 47XL11XA-21 |
| | | | | | | .75 max. | 0,21 max. | 37XL11XA-22 | 47XL11XA-22 |
| | | | | | | 1.50 max. | 0,42 max. | 37XL11XA-23 | 47XL11XA-23 |
| 59,44mm 2.340 in. | A | 6,60mm .260 in. | 13,34mm .525 in. | 2,54mm .100 in. | 0,76mm .030 in. | △.15 max. | 0,04 max. | 37XL11XA-31 | 47XL11XA-31 |
| | | | | | | △.50 max. | 0,14 max. | 37XL11XA-32 | 47XL11XA-32 |
| | | | | | | 1.00 max. | 0,28 max. | 37XL11XA-33 | 47XL11XA-33 |
| 32,64mm 1.285 in. | B | 4,44mm .175 in. | 17,40mm .685 in. | 1,27mm .050 in. | 0,38mm .015 in. | △.20 max. | 0,06 max. | 37XL11XB-11 | 47XL11XB-11 |
| | | | | | | .75 max. | 0,21 max. | 37XL11XB-12 | 47XL11XB-12 |
| | | | | | | 1.50 max. | 0,42 max. | 37XL11XB-13 | 47XL11XB-13 |
| 20,57mm .810 in. | C | 1,90mm .075 in. | 20,19mm .795 in. | 0,64mm .025 in. | 0,25mm .010 in. | △.50 max. | 0,14 max. | 37XL11XC-01 | 47XL11XC-01 |
| | | | | | | 1.75 max. | 0,49 max. | 37XL11XC-02 | 47XL11XC-02 |
| | | | | | | 4.00 max. | 1,11 max. | 37XL11XC-03 | 47XL11XC-03 |

△ Lever may not be self returning.

‡ Typical values. Contact Branch Office for information on tolerance.

** Other lever styles are available. Contact Branch Office.

NOTE:
The output transistors of the listings shown are "normally open", i.e., they are not conducting with plunger in free position. To order devices which are "normally closed" (conducting with plunger in free position), substitute 12 for 11 immediately after the XL in the catalog listing. Example: 37XL12XA-11.

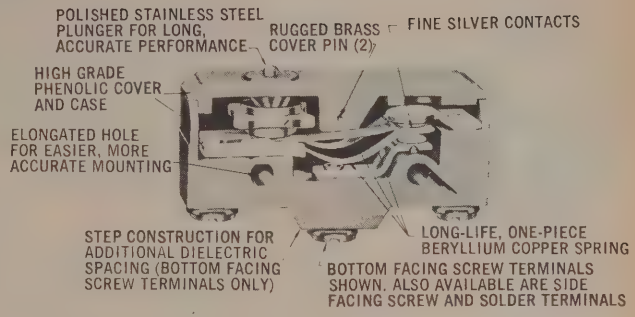
# TYPES Z AND A STANDARD BASIC SWITCHES

The type Z switch design meets most applications needs. Modifications of the standard silver contact design and material, spring configuration, and plunger locations give the type A switches greater electrical load handling capacity. Other changes in materials and switch design provide operating characteristics, temperature tolerances, and sealing to cover a wide range of special requirements. See Catalog 100.

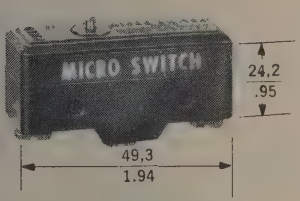
Terminal variations include solder, quick-connect, and side facing screws.

Features include operating force down to 1 oz (28,4 gms.) Differential travel down to .0002 to .0003 inch (0,005 to 0,008mm). Power load switching capacity to 25 amps and motor handling capacity of 2HP at 250 VAC.

Catalog 100 provides additional listings for all variations and accessories shown in this section.


POLISHED STAINLESS STEEL PLUNGER FOR LONG, ACCURATE PERFORMANCE
RUGGED BRASS COVER PIN (2)
FINE SILVER CONTACTS
HIGH GRADE PHENOLIC COVER AND CASE
ELONGATED HOLE FOR EASIER, MORE ACCURATE MOUNTING
STEP CONSTRUCTION FOR ADDITIONAL DIELECTRIC SPACING (BOTTOM FACING SCREW TERMINALS ONLY)
LONG-LIFE, ONE-PIECE BERYLLIUM COPPER SPRING
BOTTOM FACING SCREW TERMINALS SHOWN. ALSO AVAILABLE ARE SIDE FACING SCREW AND SOLDER TERMINALS

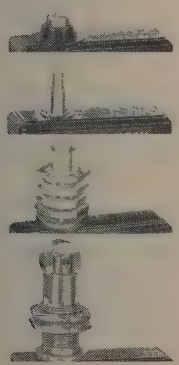
## PIN PLUNGER ORDER GUIDE




| Recommended for | Electrical Data and UL Code | Typical Catalog Listing | Operating Force | Overtravel Min. | Differential Travel | Operating Point* |
|---|---|---|---|---|---|---|
| Most applications | 15 amps L-96 | **BZ-2R-A2** | 2,5-3,61<br>9-13 | 0,13<br>.005 | 0,01-0,05<br>.0004-.0020 | 15,88<br>.625 |
| Up to 22 ampere load handling | 22 amps L-161 | **BM-1R-A2** | 1,95-2,78<br>7-10 | 0,13<br>.005 | 0,013-0,025<br>.0005-.0010 | 15,88<br>.625 |
| Up to 20 ampere load handling | 20 amps L-23 | **BA-2R-A2** | 3,89-6,12<br>14-22 | 0,25<br>.010 | 0,05-0,19<br>.0020-.0075 | 16,26<br>.640 |
| Up to 25 ampere load handling | 25 amps Motor Control | **BE-2R-A4** | 3,89-6,12<br>14-22 | 0,25<br>.010 | 0,05-0,19<br>.0020-.0075 | 16,26<br>.640 |

* ±0,38mm ±.015 in.

## OVERTRAVEL PLUNGER ORDER GUIDE



| Recommended for | Electrical Data and UL Code | Typical Catalog Listing | Operating Force | Overtravel Min. | Differential Travel | Operating Point |
|---|---|---|---|---|---|---|
| Added overtravel. For manual operation and slow 20° (max.) cam rise | 15 amps L-96 | **BZ-2RD-A2** | 2,5-3,61<br>9-13 | 1,52<br>.060 | 0,01-0,05<br>.0004-.0020 | 21,21*<br>.835 |
| Added overtravel. For in-line operation and with JR auxiliary actuators | 15 amps L-96 | **BZ-2RS-A2** | 2,5-3,61<br>9-13 | 1,52<br>.060 | 0,01-0,063<br>.0004-.0025 | 28,20*<br>1.110 |
| Added overtravel. For manual in-line operation and for slow 30° (max.) rise cam | 15 amps L-96 | **BZ-2RQ1-A2** | 2,5-3,61<br>9-13 | 5,56<br>.219 | 0,01-0,05<br>.0004-.0020 | 21,82*<br>.859 |
| Added overtravel. Roller plunger for rapid cam 30° (max.) rise and slide operation | 15 amps L-96 | **BZ-2RQ18-A2** | 2,5-3,61<br>9-13 | 3,56<br>.140 | 0,01-0,05<br>.0004-.0020 | 33,32 ±1,14<br>1.312 ±.045 |

* ±0,51mm ±.020 in.

## STRAIGHT LEVER ORDER GUIDE

| Recommended for | Electrical Data and UL Code | Typical Catalog Listing | Operating Force Max. | Overtravel Min. | Differential Travel | Operating Point |
|---|---|---|---|---|---|---|
| 2.5 inch lever requirements | 15 amps L-96 | **BZ-2RW80-A2** | 0,7<br>2.5 | 5,56<br>.219 | 0,18-1,27<br>.007-.050 | 19,1 ±0,76<br>.750 ±.030 |
| 6-inch lever requirements | 15 amps L-96 | **BZ-2RW863-A2** | 0,28<br>1 | 14,68<br>.578 | 0,46-3,68<br>.018-.145 | 19,1 ±1,52<br>.750 ±.060 |

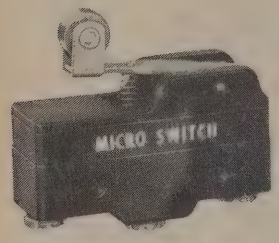
MOUNTING HOLES ACCEPT PINS OR SCREWS OF .139" (3,53mm) DIAMETER ON 1 INCH (25,4mm) CENTERS.
DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0,0 — mm or Newtons
0.00 — inches or ounces

**MICRO SWITCH** A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

# TYPES Z AND A, DT AND MT

## ROLLER LEVER ORDER GUIDE




| Recommended for | Electrical Data and UL Code | Typical Catalog Listing | Operating Force Max. | Overtravel Min. | Differential Travel | Operating Point* |
|---|---|---|---|---|---|---|
| 1.05 inch (26,7mm) long (steel roller) lever applications | 15 amps L-96 | **BZ-2RW822-A2** | 1,67<br>6 | 2,39<br>.094 | 0,08-0,51<br>.003-.020 | 30,17<br>1.188 |
| 1.90 inch (48,3mm) long (steel roller) lever applications | 15 amps L-96 | **BZ-2RW82-A2** | 0,97<br>3.5 | 3,96<br>.156 | 0,10-1,0<br>.004-.040 | 30,17 ±0,76<br>1.188 ±.030 |
| Up to 20 ampere load handling long lever | 20 amps L-23 | **BA-2RV2-A2** | 0,97<br>3.5 | 1,52<br>.060 | 2,16<br>.085 | 30,17 ±0,76<br>1.188 ±.030 |
| Up to 20 ampere load handling short lever | 20 amps L-23 | **BA-2RV22-A2** | 1,67<br>6 | 0,76<br>.030 | 1,14<br>.045 | 29,77<br>1.172 |

Except where stated* ±0,38mm ±.015 in.

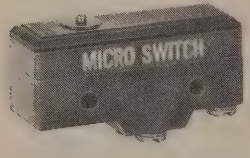
## FLEXIBLE LEAF ORDER GUIDE

| Recommended for | Electrical Data and UL Code | Typical Catalog Listing | Operating Force Max. | Over-travel Max. | Differ-ential Travel Max. | Operating Point* |
|---|---|---|---|---|---|---|
| Force and stability of the flexible leaf actuator | 15 amps L-96 | **BZ-2RL-A2** | 1,39<br>5 | 1.52<br>.060 | 1,27<br>.050 | 17,48<br>.688 |
| Applications requiring the force and stability of the flexible leaf with roller | 15 amps L-96 | **BZ-2RL2-A2** | 1,39<br>5 | 1,52<br>.060 | 1,27<br>.050 | 28,6<br>1.125 |

* ±0,76mm ±.030 in.

# BASIC SWITCH VARIATIONS

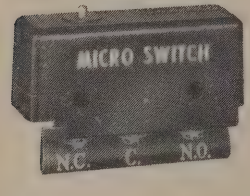
## PIN PLUNGER — SPECIAL CIRCUITRY ORDER GUIDE




| Recommended for | Electrical Data and UL Code | Typical Catalog Listing | Operating Force | Overtravel Min. | Differential Travel | Operating Point* |
|---|---|---|---|---|---|---|
| Double-Break, Low DC applications | 15 amps L-73 | **BZ-3AT** | 4,45-7,23<br>16-26 | 0,13<br>.005 | 0,051-0,13<br>.002-.005 | 15,9<br>.625 |

* ±0,38mm ±.015 in.

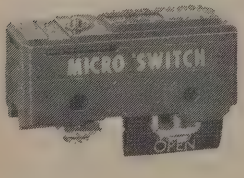
## DT DOUBLE-POLE DOUBLE-THROW ORDER GUIDE




Type DT double-pole double-throw switches offer two independent single-pole double-throw circuits in one basic switch housing. Design permits several wiring combinations.

| Description | Electrical Data and UL Code | Typical Catalog Listing | Operating Force Max. | Overtravel Min. | Differential Travel | Operating Point |
|---|---|---|---|---|---|---|
| Pin plunger | 10 amps L-59 | **DT-2R-A7 (MS25008-1)** | 3,34-5,56<br>12-20 | 0,13<br>.005 | 1,02-1,52<br>.040-.060 | 15,6<br>.615 ±.015 |
| Straight lever | 10 amps L-59 | **DT-2RV-A7** | 0,97-1,67<br>3.5-6 | 1,57<br>.062 | 12,4-19,2<br>.490-.755 | 21.8<br>.859 ±.030 |

## MT MAGNETIC BLOW-OUT ORDER GUIDE




Type MT magnetic blow-out switches offer single-pole double-throw circuitry in a basic switch. Designed for switching high capacity (125 and 250 VDC) systems.

| Description | Electrical Data and UL Code | Typical Catalog Listing | Operating Force Max. | Overtravel Min. | Differential Travel | Operating Point |
|---|---|---|---|---|---|---|
| Pin plunger SPDT | 10 amps L-168* | **MT-4R-A28** | 3,34-5,0<br>12-18 | 0,13<br>.005 | 0,1-0,18<br>.004-.007 | 15,9 ±0,38<br>.625 ±.015 |

* UL rating established with switch non-polarized

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

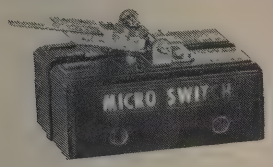
MOUNTING HOLES ACCEPT PINS OR SCREWS OF .139" (3,52mm) DIAMETER ON 1 INCH (25,4mm) CENTERS.

Key: 0,0 — mm or Newtons
0.00 — inches or ounces

# BASIC SWITCH VARIATIONS/ACCESSORIES

## 6AS STRAIGHT LEVER ORDER GUIDE

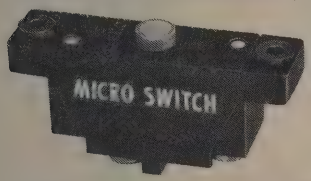
6AS switches are two basic switches ganged together and actuated by a single actuator. See Catalogs 100 or 200 for many additional variations.




| Description | Electrical Data and UL Code | Typical Catalog Listing | Lever Length mm Inches | Operating Force Max. | Over-travel Min. | Differ-ential Travel Max. | Operating Point |
|---|---|---|---|---|---|---|---|
| Centered lever. Adjustment over both switches. 15 amps. | 15 amps L-96 | **6AS32** | 58,72 2.312 | 2,22 8 | 0,51 .020 | 2,77 .109 | 18,29 .720 adj. |

## 3MN DOUBLE-BREAK ORDER GUIDE

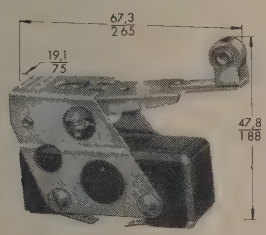
Type 3MN switches are for use with limit or control mechanisms on machine tools, presses, or other industrial equipment. The terminals of two-circuit double-break switches must be wired to equal voltage sources and the same polarity. The loads should be on the same sides of the lines.

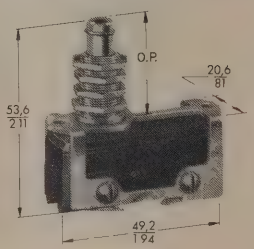



| Description | Electrical Data and UL Code | Typical Catalog Listing | Operating Force | Overtravel Min. | Differential Travel | Operating Point Max.* |
|---|---|---|---|---|---|---|
| For most applications | 15 amps Motor Control | **3MN1** | 3,34-5,56 12-20 | 2,03 .080 | 0,38-0,63 .015-.025 | 2,16 .085 |

* ±0,38mm ±.015 in.

# TYPE Z AUXILIARY ACTUATORS (order switches separately)




| Description | For Type Z Switches | Over-travel Min. | Operating Point* | Free Position Max. |
|---|---|---|---|---|
| Adjustable roller lever. Tang on top of actuator can be bent to adjust O.P. and F.P. | **AD5721R (8805/59) AN3169-1** | 11,1 .437 approx. | 31,75-41,15 1.25-1.62 | 39,6-43,7 1.56-1.72 |
| Straight plunger. Panel mount. Adjustable O.P. | **MC2711 (8805/58) AN3168-2** | 4,78 .188 | 27,79 1.094 | 29,4 1.156 |

Except where stated* ±1,14mm ±.045 in.

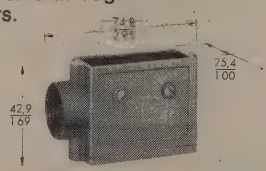
See Catalogs 100 or 200 for other variations.

# ACCESSORIES

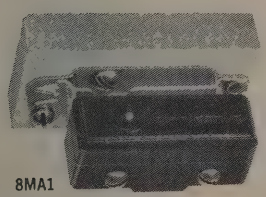
## DIE CAST ALUMINUM ENCLOSURE

- Protect Switch From Physical Abuse
- Protect Personnel From Contact With Exposed Terminals
- ½-14NPSM Internal Thread Conduit Hub

3PA1 SIDE MOUNT—Can be mounted from either side through .140″ (3,55mm) dia. holes on 1″ (25,4mm) centers.




3PA1



8MA1

Key: 0,0 — mm or grams / 0.00 — inches or ounces

MOUNTING HOLES ACCEPT PINS OR SCREWS OF .139″ (3,53mm) DIAMETER.

## ADJUSTABLE MOUNTING BRACKET

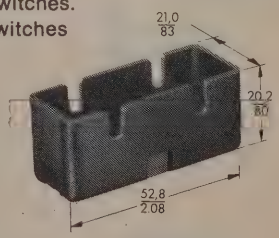
The operation point of the basic switch can be regulated up to .080″ (2mm) by loosening the locking screw, inserting a screwdriver in the adjusting slot, and twisting.

Listing 8MA1 — Has adjustment slot on the left.

## PLASTIC TERMINAL ENCLOSURES

- Protect Personnel From Contact With Exposed Terminals

5PA1—For solder terminal switches.
5PA2—For screw terminal switches




5PA2

17MA1-B

## 17MA1-B CONVERSION MOUNTING BRACKET

- Converts Basic Switches From Side To Top Mount

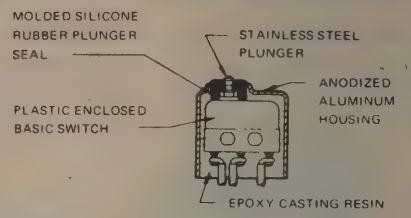
**MICRO SWITCH** A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

# TYPE SE AND XE ENVIRONMENT-PROOF SWITCHES

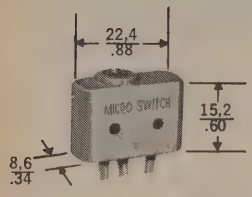
Type SE and XE switches are the smallest environment-proof switches offered by MICRO SWITCH. Both types enclose basic switches within a corrosion resistant aluminum housing. Type SE switches enclose a type SM basic switch and XE switches enclose the smaller SX basic switch.

Type SE and XE offer power load switching capability to 7 amps and temperature tolerance to 230°F (110°C) with high temperature versions to 300°F (149°C). Catalog 200 gives additional information and listings for SE and XE switches, actuators, and terminations.

TYPICAL CONSTRUCTION DETAIL

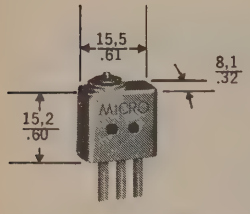



## ORDER GUIDE — TYPE SE ENVIRONMENT-PROOF SWITCHES




| Recommended for | Electrical Data | Typical Catalog Listing | Operating Force | Over-travel Min. | Differ-ential Travel Max. | Operating Point |
|---|---|---|---|---|---|---|
| Most applications | A | **1SE1†** | 1,39-4,73<br>5-17 | 0,08<br>.003 | 0,1<br>.004 | 10,8<br>.425 |
| For customer leading | A | **1SE1-T** | 1,39-4,73<br>5-17 | 0,08<br>.003 | 0,1<br>.004 | 10,8<br>.425 |
| UL and CSA listing and UL and CSA listed lead wire | B<br>L4 | **4SE1†** | 1,39-4,73<br>5-17 | 0,08<br>.003 | 0,1<br>.004 | 10,8<br>.425 |
| Oil resistant Fluosilicone seal | A | **5SE1†** | 1,39-4,73<br>5-17 | 0,08<br>.003 | 0,1<br>.004 | 10,8<br>.425 |
| Oil resistant. Leadwire tolerates +392°F (200°C) | A | **6SE1†** | 1,39-4,73<br>5-17 | 0,08<br>.003 | 0,1<br>.004 | 10,8<br>.425 |

## ORDER GUIDE — TYPE XE ENVIRONMENT-PROOF SWITCHES




DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0,0 — mm or Newtons
0.00 — inches or ounces

| Recommended for | Electrical Data | Typical Catalog Listing | Operating Force | Over-travel Min. | Differ-ential Travel Max. | Operating Point* |
|---|---|---|---|---|---|---|
| Most applications MIL-S-8805 requirements | C | **1XE1† (MS27994-1)** | 1,39-4,73<br>5-17 | 0,1<br>.004 | 0,13<br>.005 | 10,8<br>.425 |
| For customer leading | C | **1XE1-T (MS27994-3)** | 1,39-4,73<br>5-17 | 0,1<br>.004 | 0,13<br>.005 | 10,8<br>.425 |
| UL listing and UL and CSA listed leadwire | D<br>L7 | **4XE1†** | 1,39-4,73<br>5-17 | 0,1<br>.004 | 0,13<br>.005 | 10,8<br>.425 |
| Oil resistant Fluosilicone seal | C | **5XE1†** | 1,39-4,73<br>5-17 | 0,1<br>.004 | 0,13<br>.005 | 10,8<br>.425 |
| Oil resistant. Leadwire tolerates +392°F (200°C) | C | **6XE1†** | 1,39-4,73<br>5-17 | 0,1<br>.004 | 0,13<br>.005 | 10,8<br>.425 |
| For customer leading Use to +300°F (149°C) | E | **14XE1-T** | 2,5<br>9 max. | 0,1<br>.004 | 0,13<br>.005 | 10,9<br>.430 |

† These listings have one foot leads. For longer leads contact your nearest MICRO SWITCH Branch Office.

Except where stated* ±0,51mm ±.020 in.

Switches held depressed for extended periods of time at temperature extremes may experience retarded plunger return upon deactuation. Where such a condition exists in the applications, contact a MICRO SWITCH Branch Office for special designs that are available.

SWITCHES ARE NOT INCLUDED WITH THE ACTUATORS

## ORDER GUIDE — AUXILIARY ACTUATORS FOR TYPE SE SWITCHES

| Description | Catalog Listing | Operating Force Max. | Overtravel Min. | Differential Travel Max. | Operating Point‡ | Free Position* |
|---|---|---|---|---|---|---|
| Straight leaf | **JE-1‡** | 3,34<br>12 | 0,38<br>.015 | 0,64<br>.025 | 11,2<br>.440 | 15<br>.590 |
| Roller leaf | **JE-5** | 3,34<br>12 | 0,38<br>.015 | 0,64<br>.025 | 16,3<br>.640 | 20,1<br>.790 |
| Roller lever | **JE-21** | 1,67<br>6 | 0,25<br>.010 | 0,41<br>.016 | 16,3<br>.640 | 18,8<br>.740 |

All characteristics taken with actuator assembled on 1SE1 switch as shown.
‡ Mounting hardware furnished.

* ±0,76mm ±.030 in.

MOUNTING HOLES WILL ACCEPT PINS OR SCREWS OF 2,21/.087 DIA.

## ORDER GUIDE — AUXILIARY ACTUATORS FOR TYPE XE SWITCHES

| Description | Catalog Listing | Operating Force Max. | Overtravel Min. | Differential Travel Max. | Operating Point | Free Position |
|---|---|---|---|---|---|---|
| Straight leaf | **JM-1** | 5,84<br>21 | 0,23<br>.009 | 0,3<br>.012 | 10,8 ±0,76<br>.425 ±.030 | 14 ±0,76<br>.550 ±.030 |
| Roller lever | **JM-5** | 5,84<br>21 | 0,23<br>.009 | 0,3<br>.012 | 15,9 ±0,89<br>.625 ±.035 | 19,1 ±0,89<br>.750 ±.035 |

All characteristics taken with actuator assembled on 1XE1 switch as shown.

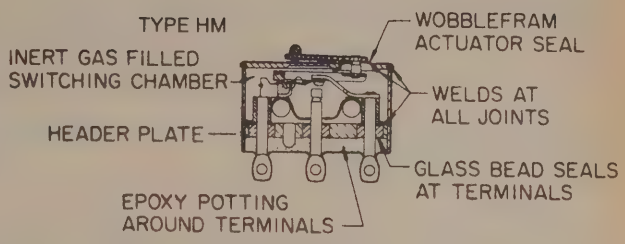
### ELECTRICAL DATA

| | |
|---|---|
| A | 5 amps res., 3 amps ind. (sea level), 5 amps res., 2.5 amps ind. (50,000 feet), 28 VDC, 5 amps res., 5 amps ind., 125 or 250 VAC, 60 Hz. |
| B | UL and CSA Rating — 5 amps, 250 VAC, 60 Hz. L4 |
| C | 7 amps res., 4 amps ind. (sea level), 7 amps res., 2.5 amps ind. (50,000 feet), 28 VDC, 7 amps res., 4 amps ind. sea level), 115 VAC, 400 Hz. |
| D | UL Rating, 7 amps, 250 VAC, 60 Hz. L7 |
| E | 7 amps res., 4 amps ind. (sea level), 7 amps res., 2.5 amps ind. (50,000 feet), 28 VDC. |

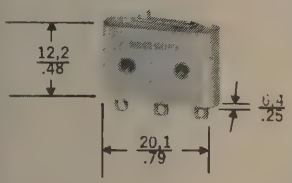
# TYPE HM MINIATURE HERMETICALLY SEALED SWITCHES

Type HM miniature basic switches are the smallest hermetically sealed switches offered by MICRO SWITCH. Features include single-pole double-throw circuitry — power load switching capability to 5 amps, 28 VDC and 125 VAC, 400 Hertz — temperature tolerance from −85° to 250°F (−65° to 121°C) — high temperature version for use from −85° to 500°F (−65° to 260°C) — military approved versions.

Silver, gold, or bifurcated gold contacts are available. Additional information and listings are offered in Catalog 200.



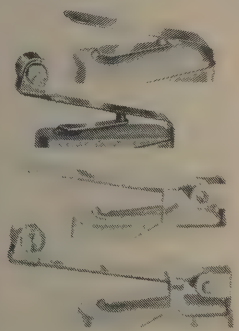

## ORDER GUIDE — TYPE HM HERMETICALLY SEALED SWITCHES




| Recommended for | Electrical Data | Typical Catalog Listing | Operating Force Max. | Over-travel Min. | Differential Travel Max. | Operating Point* |
|---|---|---|---|---|---|---|
| Most applications | F | **1HM1** | 1,95<br>7 | 0,08<br>.003 | 0,15<br>.006 | 8,38<br>.330 |
| Applications requiring gold contacts | H | **3HM1** | 1,95<br>7 | 0,08<br>.003 | 0,15<br>.006 | 8,38<br>.330 |
| Operating in temperature to 300°F (149°C) | G | **5HM1** | 1,95<br>7 | 0,08<br>.003 | 0,15<br>.006 | 8,38<br>.330 |
| 1 foot long leads MIL-W-16878 Type E wire. Use to +500°F (260°C) | G | **6HM1-1** | 1,95<br>7 | 0,08<br>.003 | 0,15<br>.006 | 8,38<br>.330 |
| MIL-S-8805 application requirements | I | **1HM19 (MS27216-1)** | 1,95<br>7 | 0,08<br>.003 | 0,15<br>.006 | 8,38<br>.330 |
| Bifurcated gold contacts | J | **9HM1** | 1,95<br>7 | 0,08<br>.003 | 0,15<br>.006 | 8,38<br>.330 |
| Exceeds MIL-S-8805 requirements for shock and vibration | K | **11HM1** | 1,95<br>7 | 0,08<br>.003 | 0,15<br>.006 | 8,38<br>.330 |

* ±0,38mm
±0.15 in.

## ORDER GUIDE — AUXILIARY ACTUATORS FOR TYPE HM SWITCHES



| Description | Temperature (Max.) | Typical Catalog Listing | Operating Force Max. | Over-travel Min. | Differential Travel Max. | Operating Point | Free Position |
|---|---|---|---|---|---|---|---|
| Leaf | 500°F (260°C) | **JS-152** | 2,50<br>9 | 0,76<br>.030 | 0,76<br>.030 | 8,64<br>.340 approx. | 12,2<br>.480 approx. |
| Roller leaf | 500°F (260°C) | **JS-151** | 2,50<br>9 | 0,76<br>.030 | 0,76<br>.030 | 14<br>.550 approx. | 17,5<br>.690 approx. |
| Straight lever | 500°F (260°C) | **JS-307** | 0,42<br>1.5 | 0,64<br>.025 | 1,42<br>.056 | 10,3<br>.406 approx. | — |
| Roller lever | 500°F (260°C) | **JS-308** | 0,42<br>1.5 | 0,64<br>.025 | 1,42<br>.056 | 14,3<br>.562 approx. | — |

NOTE: Type HM switches are not generally recommended for 115 VAC, 60 Hz. If you have a 60 Hz application in the milliamp range, contact your nearest MICRO SWITCH Branch Office for assistance.

For applications that require the switch to function electrically during exposure to sub-freezing temperatures contact a MICRO SWITCH Branch Office for special design variations that are available.

| ELECTRICAL DATA | | | |
|---|---|---|---|
| F | 5 amps res., 3 amps ind., 23 VDC or 115 VAC, 400 Hz | I | 4 amps res., 2 amps ind., 0.5 amps lamp load, 115 VAC, 400 Hz<br>4 amps res., 2 amps ind., 1 amp lamp load 28 VDC |
| G | 4 amps res., 2 amps ind., 28 VDC<br>2.5 amps res. or ind., 115 VAC, 400 Hz | J | ½ amp res., ¼ amp ind., (sea level or 70,000 ft.) 28 VDC |
| H | 1 amp res., 0.25 amp ind., 28 VDC | K | 3 amps res., 1 amp ind. (sea level or 70,000 ft.) 28 VDC lamp res. or ind. (sea level) 115 VAC, 400 Hz |

MOUNTING HOLES WILL ACCEPT PINS OR SCREWS OF 1,9/.08 DIA. ON .37 INCH (9,4mm) CENTERS.

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

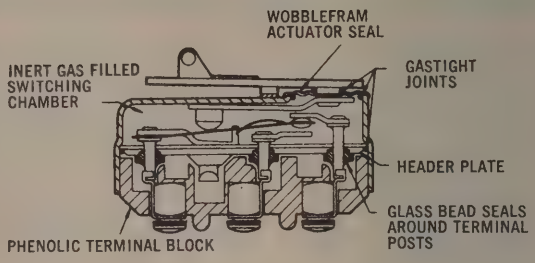
Key: 0,0 — mm or Newtons / 0.00 — inches or ounces

**MICRO SWITCH** A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

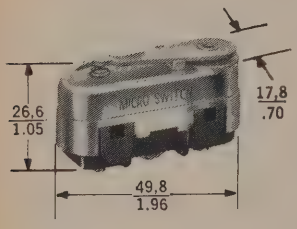
## TYPE HS HERMETICALLY SEALED

Features include power load switching capability to 25 amps, 28 VDC — temperature tolerance from −67° to 180°F (−55° to 82°C) — high temperature construction for use to 300°F (149°C) — military approved versions.

Catalog 200 supplies additional terminal variations, listings, and information.



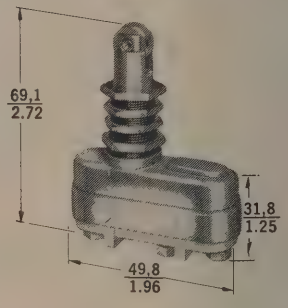

### ORDER GUIDE — TYPE HS HERMETICALLY SEALED SWITCHES



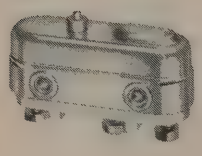

| Recommended for | Electrical Data | Typical Catalog Listing | Operating Force Max. | Overtravel Min. | Differential Travel Max. | Operating Position |
|---|---|---|---|---|---|---|
| Most applications MIL-S-8805 (M8805/47) | L | **1HS1 (MS25011-1)** | 2,78-6,12 10-22 | 0,25 .010 | 0,51 .020 | 13,5 .530 |
| Lead wire termination | M | **4HS4-118** | 2,78-6,12 10-22 | 0,25 .010 | 0,51 .020 | 15,6 .615 ±.020 |
| Roller lever | L | **1HS3** | 2,78-6,12 10-22 | 0,25 .010 | 0,51 .020 | 18,3 .720 |
| Operating in temperature to +250°F (121°C) | N | **101HS1** | 2,78-6,12 10-22 | 0,25 .010 | 0,51 .020 | 13,5 .530 |

## TYPE HT HIGH TEMPERATURE

Type HT switches will withstand temperatures up to +1000°F. These switches contain the switching element mounted on a ceramic base within a stainless steel enclosure. Side and panel mount are available. Catalog 200 provides additional information on HT switches.




### ORDER GUIDE — TYPE HT HIGH TEMPERATURE SWITCHES



| Description | Electrical Data | Catalog Listing | Operating Force | Overtravel Min. | Operating Point |
|---|---|---|---|---|---|
| Straight plunger panel mount | P | **1HT1** | 2,78-5,56 10-20 | 4,78 .188 | 23,7 .935 approx. |
| Roller plunger panel mount | P | **3HT1** | 8,34 30 max. | 4,78 .188 | 16,8 .66 approx. |
| Pin plunger side mount | P | **2HT1** | 2,78-5,56 10-20 | 0,25 .010 | 35,9 1.413 approx. |

**ELECTRICAL DATA**

| | |
|---|---|
| L | 25 amps res., 10 amps ind., 5 amps motor, 3 amps lamp load, 28 VDC<br>1 amp res., 1 amp ind., 125 VAC, 60 Hz<br>UL-CSA Rating: 1 amp, 125 VAC, 60 Hz |
| M | 15 amps res., 10 amps ind., 28 VDC,<br>1 amp res., 1 amp ind., 125 VAC, 60 Hz |
| N | 20 amps res., 10 amps ind., 28 VDC,<br>1 amp res., 1 amp ind., 125 VAC, 60 Hz<br>UL-CSA Rating: 1 amp, 125 VAC, 60 Hz |
| P | 10 amps res., 5 amps ind., 4 amps motor load, 2.4 amps lamp load,<br>28 VDC |
| UL | switches L110<br>3 amps, 1/10 HP, 125 VAC<br>3 amps, 1/6 HP, 250 VAC |

MOUNTING HOLES WILL ACCEPT PINS OR SCREWS OF .139" (3,53mm) DIA. ON 1 INCH (25,4mm) CENTERS.

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

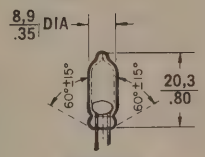
Key: 0,0 — mm or Newtons
0.00 — inches or ounces

## MERCURY SWITCHES

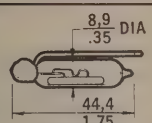
MICRO SWITCH mercury switches are glass tubes into which stationary electrodes and a pool of mercury are hermetically sealed. Tilting the tubes moves the mercury pool which makes or breaks contact between the electrodes.

There is a wide range of sizes, electrical capacities, and operating characteristics. Maintenance costs are minimized since there are no moving parts to wear out.

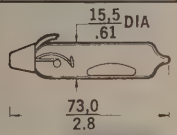
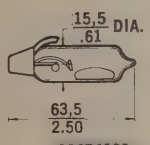
### • SINGLE POLE SINGLE THROW LIGHT DUTY

| Catalog Listing | Differential Angle | Electrical Data | Comments |
|---|---|---|---|
|  AS408V0 | 60° ±15° Break from vertical<br>(one plane only) | Resistive:<br>AC: 2 amps @ 30V<br>1 amp @ 115V<br>.5 amp @ 230V<br>DC: 1.2 amps @ 30V<br>.6 amp @ 115V<br>.3 amp @ 230V<br>Inductive: Inrush current should not exceed above values.<br>50,000 operations at full load | "Tipover" Series. Use as safety switch on portable or mobile equipment. Circuit opens if equipment accidentally tips over. When switch is in vertical position circuit will break within 60° ±15° from vertical in one plane only as shown. Platinum wetted electrodes provide low and stable contact resistance from low energy loads to maximum rated loads. (Mercury to wetted electrode contacts.)<br>No lead wires attached.<br>Mtg. clip 1MR14-A |

### • SINGLE POLE SINGLE THROW MEDIUM DUTY

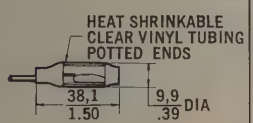
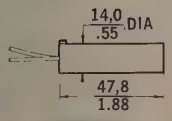
| Catalog Listing | Differential Angle | Electrical Data | Comments |
|---|---|---|---|
|  AS412A1 * | .3° to 1.2° | Resistive:<br>1 amp @ 115 VAC<br>0.6 amp @ 115 VDC<br>Inductive: @ 30 VAC<br>1.5 amps steady state<br>3.5 amps inrush | Low Cost Precision Switch. (Mercury to dry electrode contacts.)<br>Mtg. clip 1MR14-A |

### • SINGLE POLE SINGLE THROW HEAVY DUTY

| Catalog Listing | Differential Angle | Electrical Data | Comments |
|---|---|---|---|
|  AS452A41 * | 1° to 3° | Resistive:<br>AC: 30 amps @ 30V<br>20 amps @ 115V<br>10 amps @ 230V<br>DC: 30 amps @ 30V<br>12 amps @ 115V<br>6 amps @ 230V<br>Motor Loads:<br>AC: .5 hp @ 115V<br>.5 hp @ 230V<br>DC: .25 hp @ 115V<br>.25 hp @ 230V<br>AC lamp load:<br>1000 watts | All switches in these families have the same tube diameter and electrode configuration.<br>Length of tube and mercury fill determine the differential angle.<br>NOTE: AS454A is a high capacity switch at minimum cost. (Mercury to wetted electrode contacts.)<br>Mtg. clips 1MR2-B or 1MR7-B |
|  AS454A89 * | 2° to 5° | | |

* This catalog listing has 1 inch (178mm) PVC leadwires. Other types and lengths are available. See the Mercury Switch Instruction Manual AS-1.

## ENCLOSED MERCURY SWITCHES

| Catalog Listing | Differential Angle | Electrical Data | Comments |
|---|---|---|---|
|  AS408D65 | 12° max. | Resistive:<br>AC: 1.5 amps @ 30V<br>.5 amp @ 115V<br>DC: 2 amps @ 30V<br>.7 amp @ 115V<br>Inductive: Inrush current should not exceed above values. | Heat shrinkable clear vinyl tubing over switch. Ends are potted.<br>(Mercury to dry electrode contacts.)<br>Listing has 7.75 inch (197mm) PVC leads.<br>Mtg. clip 1MR14-A |
|  7MP1-2 | 12° max. | Resistive<br>AC: 8 amps @ 30V<br>4.5 amps @ 115V<br>2.25 amps @ 230V<br>DC: 8 amps @ 30V<br>3 amps @ 115V<br>1.5 amps @ 230V<br>Motor Loads:<br>AC: 1/20 hp @ 115V & 230V<br>DC: 1/40 hp @ 115V & 230V<br>AC Lamp Load: 225 watts | Polypropylene can. The basic switch is AS417B.<br>(Mercury to dry electrode contacts.)<br>Listing has 6 inch (152mm) PVC leads.<br>Mtg. clip 2MR4-B |

**FOR FURTHER INFORMATION**

Request a copy of the Mercury Switch Instruction Manual AS-1 for application data and details on other variations available. Mounting clips described in Catalog 200.

DIMENSIONS SHOWN ARE FOR REFERENCE ONLY

Key: 0,0 — mm / 0.00 — inches

**MICRO SWITCH** A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

# SERIES SR MAGNETICALLY OPERATED SOLID STATE PROXIMITY SENSORS

Series SR solid state Hall effect sensors are versatile, reliable devices operated by the magnetic field of a magnet or electromagnet. They can be used directly with electronic circuits, such as discrete transistors, integrated logic, or SCR's. The digital level output eliminates the need for conditioning circuitry to obtain a square wave output.

## 400SR SENSORS

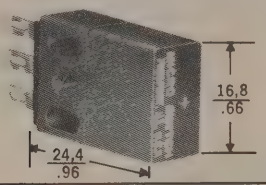
The rugged 400SR plastic package has elongated mounting holes which simplify mounting and adjustment. Solder quick-connect (3-pin) terminals accept standard .110 x .020 push-on connectors.

A locating boss aids in sensor orientation and gang mounting. The boss corresponds to an indentation on the other side of the housing to facilitate positioning. A silver cross mark on the sensor face identifies the sensitive area for accuracy in magnet location.

## 103SR SENSORS

Solid state circuitry for the 103SR is sealed in a threaded aluminum bushing providing environmental protection, plus ease of mounting and adjustment. Six-inch 20-gage stranded leadwires are color coded (other types and lengths are available). The output can be either digital current sourcing, sinking, or analog (linear).

These sensors meet the applicable portions of NEMA Type 3, 3R, 3S, 4, 4X, 6, 12 and 13 classifications.




For more information, see Product Sheets SR and 400SR. Data is included on magnetic field sensor, interfacing, magnets and Calibrated Hall Element.

| Catalog Listing | Supply Voltage | Output Type: Operating Temperature °C | Output Current | Output Voltage | Supply Current | Switching Time μsec: Rise | Switching Time μsec: Fall | Leakage Current μ amps | Magnetic Characteristics: Op Gauss Max. | Op Gauss Typ. | Rel. Gauss Min. | Rel. Gauss Typ. | Diff. Gauss Min. | Diff. Gauss Typ. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **103SR5A-1*** | 4.5-9.0 | Digital (sinking) | 8mA | .4V max. | 4mA max. | 0.5 | 0.5 | 5 max. | 575 | 352 | 82 | 213 | 82 | 140 |
| | | −40 to +100 | | | | | | | | | | | | |
| **103SR11A-1*** | 4.5-7.0 | Digital (sourcing) | 20mA | 3.4V min. | 4mA max. | 0.5 | 1.5 | 5 max. | 575 | 352 | 82 | 213 | 82 | 140 |
| | | −40 to +100 | | | | | | | | | | | | |
| **103SR13A-1†** | 6-16 | Digital (sinking) | 20mA | .4V max. | 3-5mA | 1.5 | 0.5 | 10 max. | 492 | 328 | 40 | 246 | 33 | 82 |
| **103SR17A-1†** | | −40 to +105 | | | | | | | 205 | 49 | −205 | −49 | 33 | 98 |
| **413SR10†** | | −40 to +150 | | | | | | 20 max. | 600 | 400 | 50 | 300 | 40 | 100 |
| **417SR10†** | | −40 to +150 | | | | | | | 250 | 60 | 250 | 60 | 40 | 120 |
| **103SR12A-1†** | 6-16 | Digital (sourcing) | 10mA | (Vs-2)V min. | 3-5mA | 0.5 | 2.0 | 10 max. | 492 | 328 | 40 | 246 | 33 | 82 |
| | | −40 to +105 | | | | | | | | | | | | |
| **412SR10†** | | −40 to +150 | 20mA | | | | | 20 max. | 600 | 400 | 50 | 300 | 40 | 100 |

* Operating characteristics apply at 24° ±2°C and 5 VDC ±.5% supply.
† Operating characteristics apply over the full temperature range and 6-16 VDC supply.

# SERIES XK FERROUS METALS SENSITIVE PROXIMITY SENSORS

Series XK Proximity Sensors are ferromagnetic metals sensitive and will detect stationary or moving targets. They are actuated without physical contact or attraction between the sensor target. Ordinary ferrous metal of any thickness or thin nonferrous metal foil targets will operate the device.

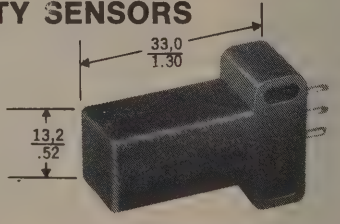
Completely self-contained, XK sensors utilize the Eddy current principle.

These sensors meet the applicable portions of NEMA Type 3, 3R, 3S, and 13 classifications. They are capable of being gang mounted for use in cam sequencing applications.

## ORDERING INFORMATION

| Catalog Listing | Termination |
|---|---|
| **101XK11-1** | One foot of 22 Gage stranded, irradiated PVC insulation |
| **101XK11-Q** | Accepts AMP "110" faston or other .110 x .020" push-on terminals |

For more information, see Product Sheet XK.




LEADWIRE TERMINATION AVAILABLE

## OPERATING CHARACTERISTICS

| | Min. | Max. | Remarks |
|---|---|---|---|
| Supply Voltage ($V_S$) | 6 VDC | 16 VDC | |
| Load Voltage ($V_L$) | | 25 VDC | |
| Supply Current | | 18mA | @ 25°C, No load |
| Output Voltage Operated (Target Present) | | 0.4 VDC | @ 10mA Sinking |
| Output Leakage Current Released (No Target Present) | | 5μA | |
| Output Switching Time (Sinking 20mA) Rise Time | | 1.0μsec. | 10% to 90% |
| Fall Time | | 1.0μsec. | 90% to 10% |

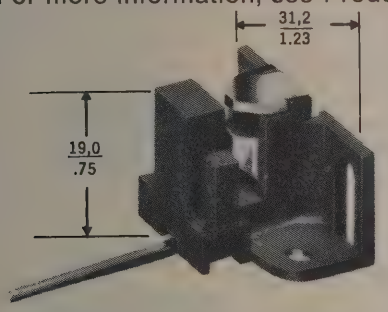
# AV SERIES VANE OPERATED SOLID STATE POSITION SENSORS

Series AV incorporates a Hall effect sensor and magnet in a rugged easy-to-apply package. It is operated by passing a ferrous vane through the gap between the magnet and Hall sensor. The vane shunts the magnetic flux from the Hall sensor, causing a digital output to be produced.

Unlike magnetic pick-ups, there is no minimum speed of operation. The AV may be operated at any speed from 0 to 100 kHz. As long as the vane is in the gap, the output remains in the operated condition. The On and Off time can be programmed by the dimension of the vane, enabling the sensor to be used in many application situations.

The AV may be used as a limit switch by operating with one large vane; as a tachometer sensor by using a toothed wheel; or as a machinery synchronizing element by using a cam or sector. Leadwires or 3 pin solder/quick-connect termination is available. The housing material and leadwires are UL recognized.

For more information, see Product Sheet AV.




## ELECTRICAL CHARACTERISTICS

| | Min. | Typ. | Max. | Remarks |
|---|---|---|---|---|
| Supply Current | —<br>— | 3mA<br>5mA | —<br>13mA | Plus load current<br>$V_S$ = 6 volts<br>$V_S$ = 16 volts |
| Output Voltage (no vane in gap)<br>Sinking | — | — | 0.4V | Sinking 20mA max. |
| Sourcing | $(V_S-2)V$ | $(V_S-1.5)V$ | — | Sourcing 20mA max. |
| Output Leakage Current (vane in gap)<br>Sinking | — | — | 10μA | Leakage into switch output |
| Sourcing | — | — | 10μA | Leakage from switch output |
| Output Switching Time<br>Sinking Rise | — | 0.2μsec. | 1.5μsec. | With 20mA load<br>10% to 90% |
| Fall | — | 0.1μsec. | 0.5μsec | 90% to 10% |
| Sourcing Rise | — | 0.1μsec. | 0.5μsec. | 10% to 90% |
| Fall | — | 0.5μsec. | 2.0μsec. | 90% to 10% |

## ABSOLUTE MAXIMUM RATINGS

| | |
|---|---|
| Supply Voltage ($V_S$) | Continuous: −1.2 VDC and +20 VDC |
| Voltage externally applied to output | Sinking: +20 VDC max. (vane in gap only) −0.5 VDC (vane in or out of gap) |
| | Sourcing: +6.5 VDC max. (vane in gap) ($V_S$ +4) VDC (no vane in gap) |
| Load on Output | 40mA continuous |
| Temperature | −40° to +150°C (−40° to +302°F) |

## ORDERING GUIDE

| Catalog Listing | Type of Output Circuit | Termination |
|---|---|---|
| **1AV2A** | Sinking | Leadwires |
| **1AV3A** | Sinking | Solder/quick-connect |
| **1AV2B** | Sourcing | Leadwires |
| **1AV3B** | Sourcing | Solder/quick-connect |

# SERIES FW MINIATURE SELF CONTAINED PROXIMITY CONTROLS

## 100FW SERIES

Series 100FW proximity switches utilize the eddy current principle. They are actuated by metal objects without physical contact.

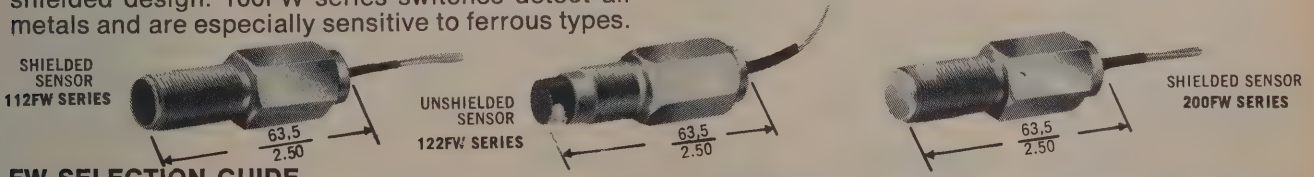
**Shielded Sensor.** Switches with a shielded sensor have the housing extended flush to the sensing face, thus shielding the sensor from the effect of metallic material that might be located near the sides of the switch.

**Unshielded Sensor.** Switches with an unshielded sensor have a longer operating point than the shielded design. 100FW series switches detect all metals and are especially sensitive to ferrous types.

## 200FW SERIES

Series 200FW proximity switches are operated by the magnetic field of a permanent magnet or electromagnet. The switching element is a Hall sensor with a digital output.

**Sensor Design.** The sensor is completely shielded with an all-metal face which provides physical and environmental protection to the switch. Since the 200FW is not affected by surrounding non-ferrous metals, the sensor can be used in applications that require detection of movement through a non-ferrous wall.




## FW SELECTION GUIDE

| Input Voltage | Input Current | Type | Output Current | Output Voltage | Sensing Range Shielded | Sensing Range Unshielded | Catalog Listing | Termination | Circuitry | Temperature Range |
|---|---|---|---|---|---|---|---|---|---|---|
| 18 to 32 VDC | 20mA max. | Sinking | 120mA max. Res. or Ind. | 1.0 VDC max. Actuated | 2,41mm* .095 in. | | **112FW12-R1** | Conn. | SPNO | −65°F −54°C to +257°F +125°C |
| | | | | | | | **112FW12-4** | Wire | | |
| | | | 50mA max. Lamp | 32 VDC max. Deactuated | | 5,84mm* .230 in. | **122FW12-R1** | Conn. | | |
| | | | | | | | **122FW12-4** | Wire | | |
| | | | 50mA max. Lamp | 0.4 VDC max. Actuated 32 VDC max. Deactuated | 350 gauss max. required to operate 30 gauss min. required to release. | | **212FW10-R** | Conn. | SPNO | −65°F −54°C to +212°F +100°C |
| | | | | | | | **212FW10-4** | Wire | | |

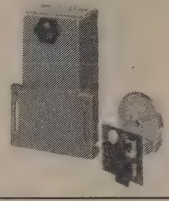
* With standard actuator 15,875 dia. x 1,585 thick (.625 dia. x .062 thick) SAE 1020 steel (Head-on mode).

**MICRO SWITCH** A DIVISION OF HONEYWELL
FREEPORT, ILLINOIS 61032 / PHONE (815) 235-6600

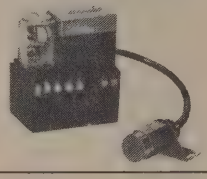
# OTHER PRODUCTS

## NO-TOUCH POSITION SENSING SWITCHES
**REQUEST CATALOG 100.**

### PHOTOELECTRIC CONTROLS
Photoelectric controls detect opaque or translucent materials at short or long range. The many types provide you with the broadest selection available.

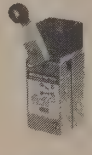


### PROXIMITY CONTROLS
Proximity controls respond to the nearness of metal. MICRO SWITCH offers the most complete line in the industry.

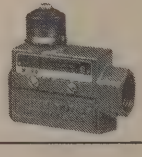


## ELECTRO MECHANICAL POSITION SENSING SWITCHES
**REQUEST CATALOG 100.**

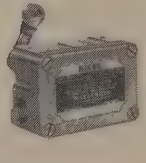
### OILTIGHT LIMIT SWITCHES
Various limit switches provide years of application proven reliability even in the most demanding environmental conditions.



### ENCLOSED SWITCHES
Enclosed switches provide a wide selection of sizes, sealing, actuation, circuitries and electrical ratings.



### EXPLOSION-PROOF SWITCHES
Some explosion-proof switches are fully interchangeable with non-explosion proof types. Others are both explosion-proof and sealed for use in outdoor hazardous applications.



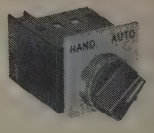
### MINIATURE OILTIGHT LIMIT SWITCHES
The "914CE" are miniature enclosed switches. They are environmentally sealed and have a pre-wired cable.

## SMALL SEALED LIMIT SWITCHES
**REQUEST CATALOG 200.**

"EN" limit switches offer environment-proof versatility. Many combinations of actuators, circuitries, terminals and electrical ratings are offered for military aerospace and commercial aircraft applications.
The "HE" is a hermetically sealed version of the EN switch. Applications will be similar except the HE meets maximum sealing requirements.
"HR" switches combine hermetic sealing with high temperature capabilities.

## MANUALLY OPERATED CONTROLS
**REQUEST CATALOG 100.**

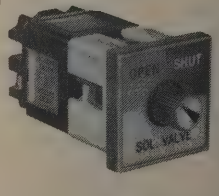
### PW MINIATURE OILTIGHT
Square format PW Miniature oiltight manual controls save panel space yet provide much of the same operating choices as heavy duty oiltight devices.




### PT HEAVY DUTY OILTIGHT
Heavy duty oiltight controls use tandem mounted contact blocks for multiple circuitry choices. Large square legend plates communicate even under the worst conditions.

### PM COMPACT OILTIGHT
Modern square shape PM compact pushbuttons/indicators are the smallest oiltight controls.

### CMC MULTILIGHT OILTIGHT
MICRO SWITCH CMC combines switching, indicator and legend into a single unit with up to 16 heavy duty or 32 electronic duty circuits in an almost unlimited sequence of actuation.



### ES CURRENT SENSOR
The ES package contains a solid state Hall sensor operated by a very low resistance coil. A digital output is provided as long as the current exceeds the specified level. They are used in circuits to protect against damage due to short circuits or other overcurrent conditions. 100 MICROSECOND RESPONSE TIME. Request Product Sheet ES for more details.

### DC CONTROL MOTORS
If you'd like to give your products a faster start, ask us about our complete line of low inertia motors with fast acceleration and deceleration. Sizes from 1 to 6 inches diameter, with integral tachometer options. Request product sheets for more details.

# MICRO SWITCH AUTHORIZED DISTRIBUTOR DIRECTORY

## ALABAMA

**Birmingham**
MG Electronics & Equipment
Phone: 205/328-4525
**Dothan**
Mack Electric Supply Co.
Phone: 205/792-2115
**Mobile**
Brownell Electro, Inc.
Phone: 205/479-8581

Clower Electric Supply Co.
Phone: 205/471-6176

## ALASKA

**Anchorage**
Yukon Radio Supply
Phone: 907/277-1497

## ARIZONA

**Phoenix**
East Side Electric Supply, Inc.
Phone: 602/273-1415

Electric Supply Inc.
Phone: 602/252-2343

Kierulff Electronics
Phone: 602/243-4101
**Tucson**
Tucson Electric Supply Inc.
Phone: 602/624-8241

## ARKANSAS

**El Dorado**
Electra, Inc.
Phone: 501/862-4901
**Fort Smith**
Carlton-Bates Company
Phone: 501/646-8201
**Little Rock**
Carlton-Bates Company
Phone: 501/562-9100

## CALIFORNIA

**Anderson**
Industrial Electric Service Co.
Phone: 916/365-3381
**Arcata**
Industrial Electric Service Co.
Phone: 707/822-2485
**Carson**
Royal Wholesale Co.
Phone: 213/639-8880
**Crescent City**
Industrial Electric Service Co.
Phone: 707/464-4125
**El Monte**
Howland Electric Wholesale
Phone: 213/444-0503
**Fresno**
Electric Motor & Supply Co.
Phone: 209/486-0960
**Los Angeles**
Andrews Industrial Hardware
Phone: 213/483-8110

Crown Wholesale Electric
Phone: 213/391-5228

Electric Switches, Inc.
Phone: 213/660-1310

Kierulff Electronics
Phone: 213/685-5511

Western Electromotive
Phone: 213/820-3777
**Modesto**
Wille Electric Supply Co., Inc.
Phone: 209/523-7771
**Mountain View**
Elmar Electronics
Phone: 415/961-3611
**Oakland**
Western Electro-Mechanical
Phone: 415/452-1936
**Orange**
County Wholesale Electric
Phone: 714/633-6440
**Pico Rivera**
Amfac Electrical Supply Co.
Phone: 213/949-7841
**Riverside**
Consolidated Electrical Dist.
Phone: 714/684-7811
**Sacramento**
Sacramento Electronics Supp.
Phone: 916/441-4821

Valley Bearing & Power Trans.
Phone: 916/444-0700
**Salinas**
Electric Supply of Salinas
Phone: 408/422-4789
**San Diego**
Amfac Electrical Supply Co.
Phone: 714/232-7371

Kierulff Electronics
Phone: 714/278-2112
**San Francisco**
Consolidated Electrical Dist.
Phone: 415/543-1430
**South San Francisco**
Steven Engineering
Phone: 415/583-5868
**San Jose**
Buckles-Smith Electric Co.
Phone: 408/294-8482

Consolidated Parts, Inc.
Phone: 408/263-9521

Quement Electronics
Phone: 408/998-5900
**Stockton**
Valley Electric Co. of Stockton
Phone: 209/948-1911
**Sunnyvale**
Powell Electronics
Phone: 408/739-4321
**Vernon**
Argo Electric Supply
Phone: 213/588-8233
**Visalia**
Medallion Supply, Inc.
Phone: 209/625-0333

## COLORADO

**Denver**
Newark Electronics
Phone: 303/757-3351

Ryall Electric Supply Co.
Phone: 303/629-7721

TESSCO
Phone: 303/778-1119

## CONNECTICUT

**Bridgeport**
Electric Maintenance Service
Phone: 203/333-6163
**Hamden**
Wilshire Electronics/Conn
Phone: 203/281-1166
**Hartford**
Frank A. Blesso, Inc.
Phone: 203/527-6461
**New Britain**
Spring & Buckley
Phone: 203/224-2451
**New Haven**
Grand Light & Supply Co., Inc
Phone: 203/777-5781
**Norwalk**
Machine Drives & Controls, Inc.
Phone: 203/846-2007

## DELAWARE

**Wilmington**
United Electric Supply Inc.
Phone: 302/322-3333

## FLORIDA

**Ft. Lauderdale**
Peerless Radio Corp.
Phone: 305/566-5966
**Jacksonville**
Turner Electric Works
Phone: 904/353-3661
**Lakeland**
A. A. Electric Div. of AEC
Phone: 813/682-6181
**Miami**
Hummel Industrial Sales, Inc.
Phone: 305/651-0196
**Miami Springs**
Powell Electronics Inc.
Phone: 305/592-3260
**Orlando**
Brownell Electro, Inc.
Phone: 305/843-6775

Hammond Electronics, Inc.
Phone: 305/849-6060
**Pensacola**
Trio Electric Supply Co., Inc.
Phone: 904/476-5580
**Tampa**
Tampa Armature Works, Inc.
Phone: 813/621-5661

## GEORGIA

**Atlanta**
A-C Equipment Co.
Phone: 404/451-2747
**Augusta**
Electrical Equipment Co.
Phone: 404/722-6685
**Harpeville**
Brownell Electro, Inc.
Phone: 404/762-5181
**Macon**
Lowe Electric Company
Phone: 912/743-8661
**Norcross**
A-A Electric, Inc.
Phone: 404/449-8670
**Rome**
Battey Machinery Company
Phone: 404/232-2421
**Savannah**
Lakeland Engineering Equip. Co.
Phone: 912/964-7318
**West Point**
Georgia Alabama Supply Co.
Phone: 404/645-1321

## HAWAII

**Honolulu**
ATECS Corporation
Phone: 808/845-2991

## IDAHO

**Boise**
Amfac Electrical Supply
Phone: 208/342-4694

## ILLINOIS

**Aurora**
Electric Supply Corporation
Phone: 312/897-8663
**Broadview**
LCOMP-Chicago, Inc.
Phone: 312/865-7600
**Champaign**
Klaus Radio Co.
Phone: 217/356-1896
**Chicago**
Revere Electric Supply Co.
Phone: 312/738-3636
**Chicago Heights**
Electric Supply Corporation
Phone: 312/754-7677
**Danville**
Danville Electric Supply Co.
Phone: 217/442-5282
**Decatur**
Englewood Electrical Supply
Phone: 217/429-4136

Lakeland Engineering Equip.
Phone: 217/423-2531
**Elgin**
Fox Electric Supply Company
Phone: 312/695-7400

Revere Electric Supply Co.
Phone: 312/741-3160
**Freeport**
Koym Electric Supply
Phone: 815/235-7595
**Joliet**
Englewood Electrical Supply
Phone: 815/725-3900
**Kankakee**
Lang Electrical Supply Co.
Phone: 815/933-5536
**Lombard**
MacGregor & Co.
Phone: 312/629-5752
**Melrose Park**
Electric Supply Corp.
Phone: 312/547-2311
**Peoria**
Kiefer Electrical Supply Co.
Phone: 309/674-1143

Klaus Radio, Inc.
Phone: 309/691-4840
**Peru**
Englewood Electrical Supply
Phone: 815/223-2650
**Quincy**
Heintz Electric Company
Phone: 217/222-0113
**Rockford**
Forest City Electric Supply Co.
Phone: 815/968-5781
**Skokie**
Electric Supply Corporation
Phone: 312/673-1600

## INDIANA

**Anderson**
Ralph David Inc.
Phone: 317/649-3504
**Columbus**
Daniel Hayden Electric Co.
Phone: 812/372-2596
**Evansville**
Evansville Supply Company
Phone: 812/424-7541
**Fort Wayne**
Fort Wayne Electronics
Phone: 219/423-3422

National Mill Supply, Inc.
Phone: 219/484-0575
**Hammond**
Electric Supply of Indiana
Phone: 219/932-8840
312/374-6000
**Indianapolis**
Graham Electronics Supply
Phone: 317/634-8202

Peerless Electric Supply Co.
Phone: 317/635-2361
**Logansport**
Ralph David, Inc.
Phone: 219/753-4186
**South Bend**
Crescent Electric Supply Co.
Phone: 219/233-9406

Koontz-Wagner Electric Co.
Phone: 219/232-2051

## IOWA

**Cedar Rapids**
Hupp Electric Motors, Inc.
Phone: 319/366-0761
**Davenport**
Industrial Eng. Equip. Co.
Phone: 319/323-9721
**Des Moines**
Electrical Engineering & Equip.
Phone: 515/282-0431

Mechanical & Electrical
Phone: 515/243-3102
**Sioux City**
Lakeland Engineering Equip.
Phone: 712/252-3611
**Waterloo**
Mechanical & Electrical
Phone: 319/234-7751

## KANSAS

**Kansas City**
Kornfeld Thorp Electric Co.
Phone: 913/321-7070

Lakeland Engineering Equip.
Phone: 913/384-0050
**Salina**
Kriz-Davis, Inc.
Phone: 913/827-4497
**Wichita**
Interstate Electronic Supply
Phone: 316/264-6316

## KENTUCKY

**Lexington**
Radio Electronic Equip. Co.,
Phone: 606/255-6661
**Louisville**
E & H Electric Supply Co., Inc.
Phone: 502/587-0991
**Paducah**
Hannan Supply Company
Phone: 502/442-5456

## LOUISIANA

**Baton Rouge**
A.W.C., Inc.
Phone: 504/275-5480

Electrical Wholesalers, Inc.
Phone: 504/357-3101
**Harahan**
MG Electronics & Equip. Co.
Phone: 504/733-0070

Summers Electric Co.
Phone: 504/733-4567
**Metairie**
Sterling Electronics
Phone: 504/887-7610
**Shreveport**
Industrial Electronic Supply
Phone: 318/222-9459

## MAINE

**Portland**
Holmes Distributors, Inc.
Phone: 207/774-5901

## MARYLAND

**Baltimore**
Lee Electric Company
Phone: 301/752-4080
**Beltsville**
Powell Electronics
Phone: 301/937-4030
**Cumberland**
Gerome Electrical Wholesaler
Phone: 301/724-6321
**Ellicott City**
Automation Industrial Control
Phone: 301/465-3616
**Kensington**
Marine Air Supply Co., Inc.
Phone: 301/949-1353

## MASSACHUSETTS

**Boston**
Controller Service & Sales Co.
Phone: 617/269-1300
**Burlington**
Wilshire Electronics/New Eng.
Phone: 617/272-8200
**Cambridge**
Brownell Electro, Inc.
Phone: 617/864-7500
**Lawrence**
Dyer Clark Company
Phone: 617/683-2467
**Springfield**
T. F. Cushing, Inc.
Phone: 413/788-7341
**Worcester**
Coghlin Electric Company
Phone: 617/791-7861

## MICHIGAN

**Ann Arbor**
Wedemeyer Electronic Supply
Phone: 313/665-8611
**Battle Creek**
All-Phase Electric Supply Co.
Phone: 616/962-7557
**Benton Harbor**
All-Phase Electric Supply Co.
Phone: 616/926-6194
**Flint**
Advance Electric Supply Co.
Phone: 313/CE-8-5611
**Grand Rapids**
RS Electronics
Phone: 616/241-3483
**Jackson**
Fulton Radio Supply Co.
Phone: 517/784-6106
**Kalamazoo**
All-Phase Electric Supply Co.
Phone: 616/381-1114

RS Electronics
Phone: 616/381-5470
**Lansing**
All-Phase Electric Supply Co.
Phone: 517/489-3791

Fulton Radio Supply Co.
Phone: 517/394-5020
**Livonia**
Allen Electric Supply Co.
Phone: 313/421-9300

RS Electronics
Phone: 313/525-1155
**Madison Heights**
McNaughton-McKay Electric
Phone: 313/399-7500
**Marquette**
N.W.R. Electronics Corp.
Phone: 906/228-9660
**Muskegon**
Fitzpatrick Electric Supply Co.
Phone: 616/722-6621
**Saginaw**
Fischer-Flack Inc.
Phone: 517/752-4181
**Southfield**
Michigan Lectrols Corp.
Phone: 313/353-1350
**Traverse City**
William J. Becker Co.
Phone: 616/947-4440

## MINNESOTA

**Duluth**
Mielke Electric Works, Inc.
Phone: 218/727-7411
**Minneapolis**
Lakeland Eng. Equip. Co.
Phone: 612/544-0321

Northland Electric Supply Co.
Phone: 612/341-6111
**St. Paul**
Gopher Electronics Co.
Phone: 612/645-0241

Power/Mation Divn.
Phone: 612/645-0781

## MISSISSIPPI

**Jackson**
Ellington Electronic Supply
Phone: 601/355-0561

Power Electric Company
Phone: 601/948-4622

## MICRO SWITCH AUTHORIZED DISTRIBUTOR DIRECTORY (cont.)

**MISSOURI**
**Joplin**
Four State Radio Supply Co.
Phone: 417/624-0368
**Kansas City**
LCOMP - Kansas City, Inc.
Phone: 816/221-2400
**Maryland Heights**
Barrett Electrical Supply Co.
Phone: 314/878-1300
LCOMP-St. Louis, Inc.
Phone: 314/291-6200
**St. Louis**
Crescent Electric Supply Co.
Phone: 314/533-6161
Van Dusen Aircraft Supplies
Phone: 314/731-1700
**Springfield**
Southern Materials Company
Phone: 417/865-2822

**MONTANA**

**Billings**
Glacier State Electric Supply
Phone: 406/252-4663
**Missoula**
West Electric Distributors
Phone: 406/728-4020

**NEBRASKA**

**Omaha**
Enterprise Electric Company
Phone: 402/341-4787
Lakeland Engineering Equip.
Phone: 402/734-2600

**NEVADA**

**Reno**
WEDCO, Inc.
Phone: 702/329-1131

**NEW HAMPSHIRE**

**Manchester**
Holmes Distributors, Inc.
Phone: 603/669-5060

**NEW JERSEY**

**Cherry Hill**
Fromm Electric Supply
Phone: 609/662-8300
**Clifton**
Wilshire Electronics
Phone: 201/340-1900
**Dover**
Kahant Electrical Supply Co.
Phone: 201/366-2966
**Edison**
Miller Knapp Incorporated
Phone: 201/985-2600
**Hanover**
State Electronics Parts Corp.
Phone: 201/887-2550
**Linden**
Turtle & Hughes, Inc.
Phone: 201/574-3600
**Newark**
Keer Electrical Supply Co.
Phone: 201/484-7400
**Piscataway**
Fromm Electric Supply Corp.
Phone: 201/981-0400
**Saddlebrook**
Ribble Engineering Co.
Phone: 201/791-0233
**Secaucus**
Franklin & Smith, Inc.
Phone: 201/864-0555
**South Plainfield**
Brownell Electro, Inc.
Phone: 201/753-4600
**Trenton**
Griffith Electric Supply Co.
Phone: 609/695-6121
**Vineland**
Kay Electric Supply Company
Phone: 609/692-2020

**NEW MEXICO**

**Albuquerque**
Sterling Electronics
Phone: 505/345-6601
**Carlsbad**
H & E Electric Supply Co.
Phone: 505/887-1146

**NEW YORK**

**Albany**
Edwin E. Taylor Co., Inc.
Phone: 518/438-7811
Henzel Powers, Inc.
Phone: 518/HO-5-2351
**Brooklyn**
Coleman Electrical Supply
Phone: 212/272-1313
**Buffalo**
Genesee Radio & Parts Co.
Phone: 716/873-9661
Wehle Electric Company, Inc.
Phone: 716/854-3270
**Elmira**
Brady Supply Corporation
Phone: 607/733-6591
**Forest Hills**
The Jack Miller Company
Phone: 212/263-4446
**Jamestown**
Westburgh Electric Inc.
Phone: 716/483-1539
**Lynbrook**
Peerless Radio Corporation
Phone: 516/593-2121
**New York**
Baitinger Electric Co., Inc.
Phone: 212/431-6400
Blan Electronics Corporation
Phone: 212/BE-3-6288
Brownell Electro, Inc.
Phone: 212/924-6000
Central Electrical Supply Corp
Phone: 212/662-4300
City Electric Distributors, Inc.
Phone: 212/564-5454
**Plainview, L.I.**
Mid Island Electrical Sales Co
Phone: 516/293-9300
**Rochester**
Requa Electrical Supply Co.
Phone: 716/442-2020
Simcona Electronics Corp.
Phone: 716/328-3230
Wehle Electric Company, Inc.
Phone: 716/275-0200
**Syracuse**
Baldwin Hall Co., Inc.
Phone: 315/463-9251
**Utica**
M & L Electric Supply Corp.
Phone: 315/733-2326
**Vestal**
Harvey/Federal Electronics
Phone: 607/748-8211
Wholesale Electric Supply Co.
Phone: 607/729-1526
**White Plains**
H. H. Benefield Elec. Supply
Phone: 914/948-6660

**NORTH CAROLINA**

**Charlotte**
Brownell Electro, Inc.
Phone: 704/394-4341
Mill Power Supply Company
Phone: 704/527-2800
**Greensboro**
Hammond Electronics
Phone: 919/275-6391
**Laurinburg**
Electrical Equipment Co.
Phone: 919/276-2141
**Matthews**
Hile Equipment Co.
Phone: 704/847-9125
**Raleigh**
Electrical Equipment Co.
Phone: 919/828-5411
Southeastern Radio Supply
Phone: 919/828-2311
**Shelby**
Shelby Supply Co., Inc.
Phone: 704/482-6781

**OHIO**

**Akron**
Akron Electronic Supply
Phone: 216/762-8818
The Sacks Electrical Supply
Phone: 216/253-2141
Summit Electric Supply Inc.
Phone: 216/434-1901
**Cincinnati**
Graham Electronics, Inc.
Phone: 513/772-1661
Hughes-Peters, Inc.
Phone: 513/351-2000
The Johnson Electric Supply
Phone: 513/421-3700
**Cleveland**
Michigan Lectrols Corp.
Phone: 216/292-6032
Pioneer/Cleveland Division
Phone: 216/587-3600
**Columbus**
Basic Distribution Corp.
Phone: 614/481-8801
Hughes-Peters, Inc.
Phone: 614/294-5351
**Dayton**
John A. Becker Electric
Phone: 513/226-1341
Pioneer/Dayton Division
Phone: 513/236-9900
The Stotts Friedman Co.
Phone: 513/298-5555
**Lancaster**
Basic Distribution Lancaster
Phone: 614/653-9231
**Lima**
Lima Radio Parts Company
Phone: 419/228-1220
**Mansfield**
Mansfield Electric Supply Inc.
Phone: 419/522-6811
**Sandusky**
Brohl & Appell, Inc.
Phone: 419/625-6761
**Solon**
Midland Electric Co.
Phone: 216/248-3800
Radio and Electronic Parts Co
Phone: 216/248-8900
**Toledo**
The H. Poll Electric Company
Phone: 419/255-1660
**Warren**
REM Electronic Supply Co.
Phone: 216/373-1300

**OKLAHOMA**

**Oklahoma City**
Electro Enterprises, Inc.
Phone: 405/478-1752
Hunzicker Brothers
Phone: 405/239-7771
**Tulsa**
Oil Capitol Electronics Corp.
Phone: 918/622-8520

**OREGON**
**Eugene**
North Coast Supply
Phone: 503/343-7701
**Medford**
North Coast Supply
Phone: 503/772-7131
**Portland**
North Coast Electric Co.
Phone: 503/228-5111
Platt Electric Supply Inc.
Phone: 503/228-6121
**Roseburg**
Roseburg Electric Wholesale
Phone: 503/673-6657
**Salem**
Capital Wholesale Elec. Inc.
Phone: 503/581-3711

**PENNSYLVANIA**

**Allentown**
Crowder Jr. Company
Phone: 215/791-1551
**Altoona**
Allegheny Electronics, Inc.
Phone: 814/946-0871
**Bradford**
McKean Supply Division
Phone: 814/362-3523
**Erie**
Erie Industrial Elec. Supply
Phone: 814/455-8051
**Kingston**
Anthracite Electric Supply Co.
Phone: 717/287-2101
**Philadelphia**
Powell Electronics, Inc.
Phone: 215/365-1900
Royal Electric Supply Co.
Phone: 215/221-1200
Rumsey Electric Company
Phone: 215/456-2500
**Pittsburgh**
CAM/RPC Electronics
Phone: 412/782-3770
McCullough Electric Co.
Phone: 412/261-2420
**Reading**
George D. Barbey Co., Inc.
Phone: 215/376-6116
**St. Mary's**
B & R Electric Company
Phone: 814/834-2814
**West Chester**
West Chester Electric Supply
Phone: 215/696-7500
**York**
Graybill's Incorporated
Phone: 717/843-0786

**PUERTO RICO**

**Bayamon**
Caribbean Contracting Corp.
Phone: 809/786-7815

**RHODE ISLAND**

**Providence**
Controller Service & Sales Co.
Phone: 401/781-7100
William Dandreta & Company
Phone: 401/861-2800
Leavitt-Colson Company
Phone: 401/521-8800

**SOUTH CAROLINA**

**Charleston**
Wholesale Radio Supply Co.
Phone: 803/722-2634
**Columbia**
Dixie Electronics, Inc.
Phone: 803/779-5332
**Greenville**
Hammond Electronics
Phone: 803/233-4121
Shealy Electrical Wholesale
Phone: 803/242-6880

**SOUTH DAKOTA**

**Aberdeen**
McLaughlin Electric Supply
Phone: 605/225-7100

**TENNESSEE**

**Chattanooga**
Mills & Lupton Supply Co.
Phone: 615/266-6171
**Kingsport**
Wholesale Electric, Inc.
Phone: 615/246-2900
**Knoxville**
Stokes Electric Company
Phone: 615/525-0351
**Memphis**
Bluff City Distributing Co.
Phone: 901/523-9500
Brownell Electro, Inc.
Phone: 901/332-9258
**Nashville**
Brownell Electro, Inc.
Phone: 615/889-8230
Electra Distributing
Phone: 615/329-3971

**TEXAS**

**Amarillo**
Snook & Aderton, Inc.
Phone: 806/374-5229
**Arlington**
Burgess Power Equip.
Phone: 817/640-3333
**Beaumont**
Ralph's Industrial Electronics
Phone: 713/833-9443
Warren Electric Company
Phone: 713/833-9405
**Corpus Christi**
Nunn Electric Supply Corp.
Phone: 512/884-0311
**Dallas**
Associated Aircraft Supply Co
Phone: 214/331-4381
Burgess Power Equip.
Phone: 214/630-7600
Norvell Electronics, Inc.
Phone: 214/233-0020
Wilkinson Brothers
Phone: 214/747-1571
**El Paso**
Midland Specialty Company
Phone: 915/533-9555
Triangle Electric Supply Co.
Phone: 915/533-5981
**Forth Worth**
SWIECO, Inc.
Phone: 817/335-6521
**Harlingen**
Bush Supply Co., Inc.
Phone: 512/428-1613
**Houston**
Buffalo Electric Company
Phone: 713/228-4431
Burgess Power Equipment
Phone: 713/688-5701
Harrison Equipment Co., Inc.
Phone: 713/652-4750
**Lubbock**
Snook & Aderton, Inc.
Phone: 806/763-9323
**Odessa**
Western Controls Co.
Phone: 915/332-0771
**San Antonio**
Burgess Power Equipment Div.
Phone: 512/342-9501

**UTAH**

**Salt Lake City**
Stuart Electric Supply, Inc.
Phone: 801/466-8603

**VIRGINIA**

**Charlottesville**
Piedmont Electric Supply
Phone: 804/977-2990
**Lynchburg**
Mid-State Electrical Supply
Phone: 804/846-6555
**Norfolk**
Priest Electronics, Inc.
Phone: 804/855-0105
**Richmond**
Electrical Equipment Co.
Phone: 804/353-7841
**Roanoke**
Williams Supply, Inc.
Phone: 703/343-9333

**WASHINGTON**

**Aberdeen**
Industrial Electric Service Co.
Phone: 206/533-2792
**Seattle**
Almac/Stroum Electronics
Phone: 206/763-2300
North Coast Electric Company
Phone: 206/682-4444
**Spokane**
Amfac Electrical Supply
Phone: 509/534-0611
**Tacoma**
Consolidated Electrical Dist.
Phone: 206/383-5961
**Yakima**
Picatti Brothers, Inc.
Phone: 509/248-2540

**WEST VIRGINIA**

**Clarksburg**
Tolley Electric Company
Phone: 304/624-7468
**Dunbar**
State Electric Supply Co.
Phone: 304/768-8856
**Huntington**
West Virginia Electric Supply
Phone: 304/525-0361
**Wheeling**
Gee Electric Company
Phone: 304/233-3200

**WISCONSIN**

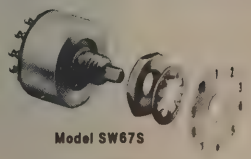
**Appleton**
Langstadt Electric Supply Co.
Phone: 414/733-3791
**Cedarburg**
A.A. Electric, Inc.
Phone: 414/377-8000
**Green Bay**
A.A. Electric Division
Phone: 414/499-0258
Beemster Electric Company
Phone: 414/437-3238
**Janesville**
Cole Electric Supply, Inc.
Phone: 608/752-9496
**Madison**
Satterfield Electronics, Inc.
Phone: 608/257-4801
**Manitowoc**
Englewood Electrical Supply
Phone: 414/684-6653
**Milwaukee**
Standard Electric Supply Co.
Phone: 414/272-8100
**Racine**
Nelson Electric Supply Co.
Phone: 414/637-7661
**Waukesha**
Power/Mation Divn.
Phone: 414/542-2868
**Wauwatosa**
Boggis-Johnson Electric Co.
Phone: 414/475-6900

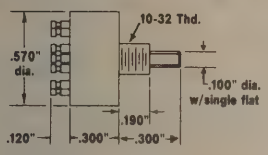
# MINELCO ROTARY SELECTOR SWITCHES

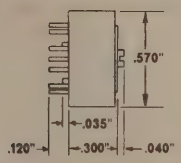
a **TALLEY INDUSTRIES** Company

135 South Main Street, Thomaston, CT 06787
Phone 203-283-8261

## Minelco Miniature Rotary Selector Switches






**Model SW62S** (PC board mounting)
**Model SW67S** (Panel mounting)

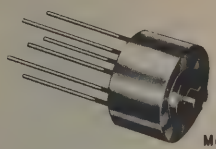
Low-cost, low profile reliable rotary switches, with up to 10 factory-set stops, featuring patented "poker chip" detent action for fast, positive positioning. Detent index is 36 degrees. Both models measure .570" dia. and .300" high. They have molded-in terminals and a slotted shaft for screwdriver adjustment.

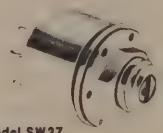
Model SW62S has molded-in spacers for PC board standoff.

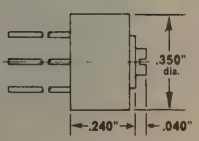
Model SW67S is O-Ring sealed, both shaft-to-bushing and bushing-to-panel.

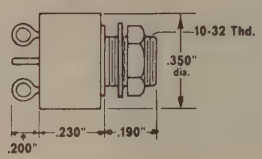
*See Bulletin S-67 for detailed specifications.*

Patent No. 3,596,013




**Model SW32** (PC board mounting)
**Model SW37** (Panel mounting)

Lowest profile switches available. These O-Ring sealed rotary selector switches provide control of several circuits in an absolute minimum of space. Detent action is at 60 degree intervals. Both switches measure .350" in diameter. They are ideally suited for miniaturized electronic and communications equipment and testing circuitry.

Model SW32 has ½ inch tinned terminal leads.

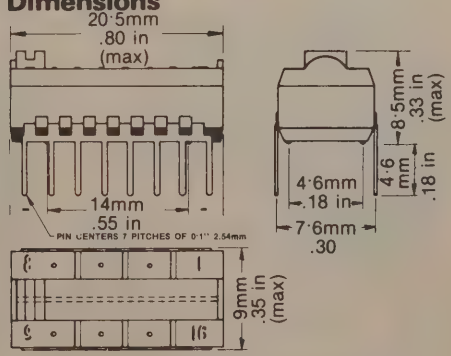
Model SW37 has solder-lug terminals.

*See Bulletin S-66 for detailed specifications.*

Patent No. 3,260,805

## Miniature DIP Slide Switches

**Dimensions**

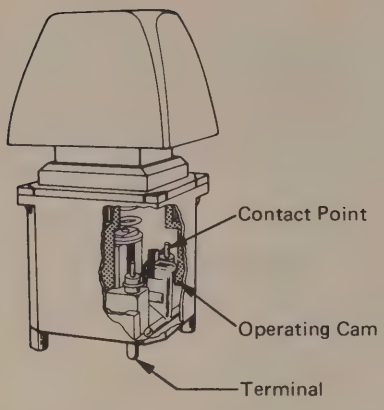



### Model SW40

Minelco Miniature DIP Slide Switches are available in the widest variety of switching combinations in the industry. They feature true "make-before-break" action and have spring loaded, double ball bearing detent action for smooth and positive location of each switching position.

Each switch can perform many functions. They are designed for a wide variety of applications. Clear plastic cover optional.

*See Bulletin S-69 for detailed specifications*




## Mechanical Enterprises, Inc.

# keyboard switches

## series T-5 Mechanical Contact

The T-5 Keyboard Switch has medium life, low-bounce mechanical contacts with all the advantages found in more expensive full-featured keyboard switches. The T-5 is suggested for applications in relatively protected environments where open contacts may be employed and where low cost is a prime requisite in the keyboard design.

Switching action is accomplished by movement of one gold plated bar against another at right angles (classic cross bar switching). The bars strike with a velocity determined only by spring forces and not subject to the speed at which the switch plunger is struck. This type of design provides a much more constant and lower contact bounce than is found in mechanical contact switches of more conventional design. The effects of operator differences are substantially eliminated.

Mechanically, the T-5 switch incorporates precision tracking surfaces between plunger and body which prevent binding even when double-width keytops are installed. The base contains mounting studs in the extreme corners which provide precision alignment. Heavy terminals, when soldered to a 1/16 PC board, produce a rugged assembly without a costly metal mounting frame.

Electrical configurations include both single and double pole versions, with normally open or normally closed contacts. (Form C contact is not available.) All switches are also available with alternate switching action: push on/push off. Lighted versions use a T-1 bi-pin incandescent lamp which is easily changed from the front panel.

## specifications

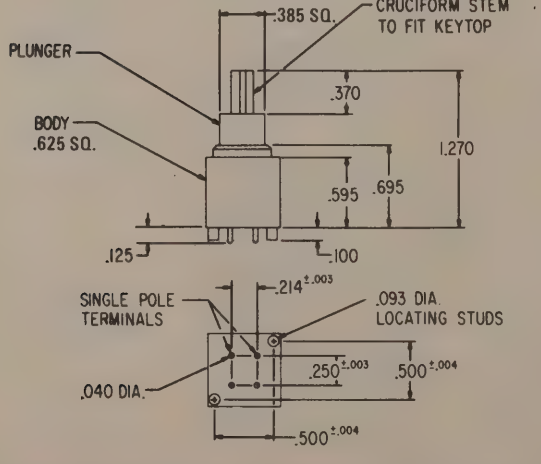
**Contact Rating, DC Resistive:**
3W max.
**Voltage:**
24V max.
**Initial Contact Resistance:**
100 m Ω max.
**Plunger Travel:**
.170 ±.010 in.
**Pre-Travel:**
.080 ±.030 in.

**OPERATING FORCE**
**Single Pole, Momentary:**
2.5 ±0.5 oz.
**Double Pole and/or Alt. Action:**
5.0 ±0.5 oz.

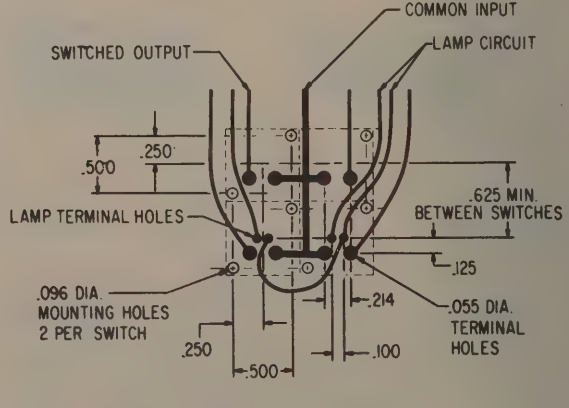
**TEMPERATURE**
**Operating:**
$-25^{0}$C to $+65^{0}$C
**Storage:**
$-40^{0}$C to $+70^{0}$C
**Contact Bounce:**
4 ms max.
**Min. Actuations, @ 5V, 100μ Amps:**
$20 \times 10^{6}$

## Typical Dimensions

(SWITCH ONLY)




## PCB Layout and Mounting




BOTTOM OF PC BOARD
(LAYOUT SHOWN FOR 4 SWITCHES)

## T-5C
### with full size double shot keytop

For 3/4" Center Mounting

## T-5S
### with full size double shot keytop

Makes Stepped Keyboard

For 3/4" Center Mounting

## T-5B
### with small double shot keytop

For 5/8" Center Mounting

## T-5H
### with legend plate

Lowest Profile Pushbutton Style

For 5/8" Center Mounting

## T-5L
### with box lens

Lighted With T-1 Bi-Pin Lamp, Socketed

For 3/4" Center Mounting

## T-5L
### with truncated lens

Lighted With T-1 Bi-Pin Lamp, Socketed

For 3/4" Center Mounting

Truncated Lens Shape Matches T-5C

## T-5K
### with box lens

Lighted With T-1 Bi-Pin Lamp, Socketed

For 5/8" Center Mounting

## T-5Q
### with panel sealing boot and double shot keytop

Neoprene Boot Seals Against Liquid And Dust

For 3/4" Center Mounting

## T-5J
### with sealing boot and box lens

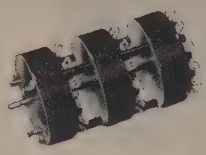
Lighted With Sealing Boot

For 3/4" Center Mounting

**Mechanical Enterprises, Inc.**

8000 Forbes Place
Springfield, Virginia 22151
(703) 321-8282 TWX 710-832-0942

# OHMITE® power tap switches, high current, non-shorting type



**INTRODUCING**

**MODEL 711**

**Smallest Switch for Its Rating**
**7 Amps, 125 Volts**

All Ohmite switches feature the slow-break, quick-make action deemed so desirable for switching of AC current.

All models except 711 feature all ceramic, arc-proof bodies and solid silver alloy, fixed and movable contacts. The large, thick, silver-alloy fixed contact disks are permanently welded to copper studs. These, in turn, are riveted and soldered to sturdy terminal lugs, assuring a permanent mechanical and electrical joint. The rotor (moving) contact, also of solid silver-alloy, is riveted and soldered to the contact arm. Face of the rotor contact is slightly rounded assuring a perfect seating of the contacts with a slight rubbing, self-cleaning motion on every operation. Models 111, 212, 312 and 412 are UL listed.

The new Model 711 tap switch was designed to achieve high current capability with small size. It is actually smaller than many low current instrument switches. It interrupts 7 amperes at 125 VAC and can carry 15 amperes AC or DC. The Model 711 features a melamine phenolic body with solid silver-alloy fixed and movable contacts.

| Model | Alternate Current Rating | | Diameter | Shaft Diameter | Max. Panel Thickness | Weight | No. of Taps |
|---|---|---|---|---|---|---|---|
| | Amps. | Volts | | | | | |
| 711 | 7 | 125 | 1⅛″ | ¼″ | ⅛″ | .047 lb. | 3-11 |
| 111 | 15 | 125 | 1¾″ | ¼″ | ¼″ | .16 lb. | 3-11 |
| 212 | 20 | 150 | 2¼″ | ¼″ | ¼″ | .4 lb. | 3-12 |
| 312 | 30 | 300 | 3⅝″ | ¼″ | ¼″ | .75 lb. | 3-12 |
| 412 | 50 | 300 | 4⅜″ | ¼″ | ¼″ | 1.4 lb. | 3-12 |
| 608 | 100 | 300 | 6″ | ⅜″ | 1″ | 5 lb. | 3-8 |

## ALL CERAMIC OPEN TYPE TAP SWITCHES

Shorting Type

Non-Shorting Type

Designed to transfer currents of several amperes in circuits requiring high voltage insulation. Ceramic body construction. Monel metal taps; silver-graphite brush.

Switches up to 8 taps are approximately 3¼″ diameter including lugs; 9 to 12 tap switches are approximately 4¼″ diameter. Switches can be ordered assembled 2 to 3 in tandem. Single hole mounting by means of ⅜″ diameter bushing and hexagon nut accommodates panels up to ¼″ thick (maximum).

Maximum current capacity is 7 amperes but only 3 amperes at 120 V.A.C. should be interrupted. Current ratings are less for all direct current circuits above 20 volts, for inductive circuits and high voltages.

# OHMITE® OHMITROL solid state power and motor speed controls

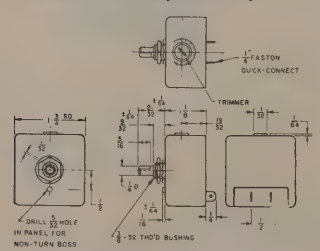
## FEATURES:

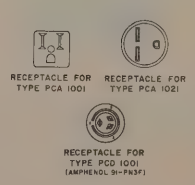
- Conserves space & power
- Smallest 1 & 2 KW control
- AC & DC output types
- Built-in on-off switch
- Adjustable control range
- Choice of component & portable styles
- Long life

| Catalog No. | | Input Volts | Freq. | Output Range (Nominal) | Load Capacity Rating (Maximum) |
|---|---|---|---|---|---|
| Component Style | Portable Style* | | | | |
| PCA-1000 | PCA-1001 | 120 VAC | 60 Hz | 0-120 VAC | 1 KW, 8.3 Amps AC |
| PCA-1050 | — | | | | 15 Amps AC |
| PCA-1100 | PCA-1101 | | 50 Hz | | 1 KW, 8.3 Amps AC |
| PCA-1020 | PCA-1021 | 240 VAC | 60 Hz | 0-240 VAC | 2 KW, 8.3 Amps AC |
| PCA-1120 | PCA-1121 | | 50 Hz | | |
| PCD-1000 | PCD-1001 | 120 VAC | 60 Hz | 0-120 VDC and Full 120 VDC | 6.0 Amp DC Resistive 3.5 Amp DC Motor Load |
| PCD-1100 | PCD-1101 | | 50 Hz | | |
| PCD-1020 | PCD-1021 | 240 VAC | 60 Hz | 0-240 VDC and Full 240 VDC | |
| PCD-1120 | PCD-1121 | | 50 Hz | | |

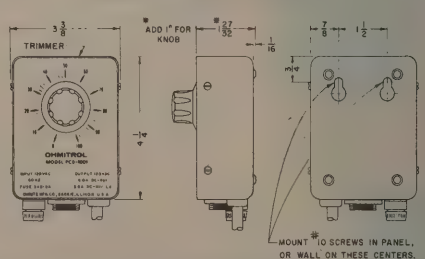
*Available by special order

**Model PCA-Component Style**




**Models PCA and PCD-Portable**



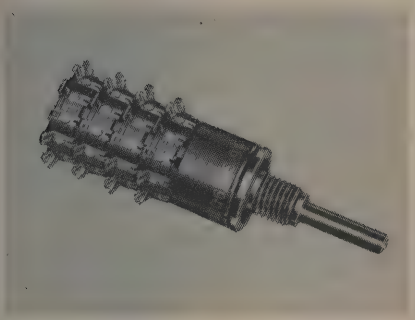

**FOR STOCK ITEMS, CALL LOCAL REPRESENTATIVE LISTED IN INDEX**

**OHMITE MFG. CO., a North AMERICAN PHILIPS company** / 3601 W. Howard St., Skokie, Illinois 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

**OAK Industries Inc.**
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

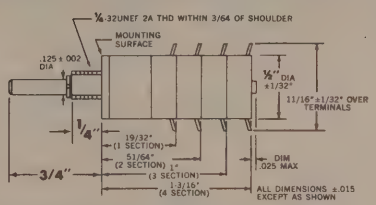
# HALF INCH SUBMINIATURE ROTARY SWITCH

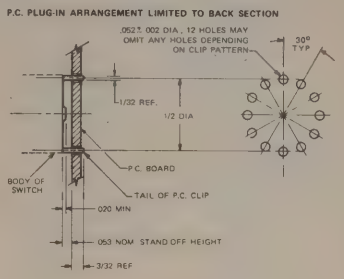
**For applications where extremely small size is essential**

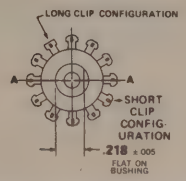


## SPECIFICATIONS

**SIZE:** ½" diameter (1⅛" over terminals) with up to four sections. Maximum depth behind panel, 1⅜".
**MOUNTING:** Single D-hole, with ¼-32 bushing, ¼" long.
**SHAFT:** ⅛" dia. x ¾" long from front mounting surface.
**INDEXING:** 30° with up to 12 positions.
**STATOR MATERIAL:** Stators and spacers are diallyl phthalate; unaffected by moisture, non-corrodible.
**ROTOR MATERIAL:** Thermoplastic.
**CONTACT MATERIAL:** Gold-plated silver alloy.
**CONTACT RESISTANCE:** Initially under 10 milliohms; after rated life, under 20 milliohms.
**INSULATION RESISTANCE:** 10 megohms minimum.
**ELECTRICAL RATING:** 0.25 amp at 110 volts AC resistive; 0.50 amp at 30 volts DC resistive.
**LIFE:** 10,000 cycles minimum, room temperature, rated load.
**AMBIENT TEMPERATURE:** −65°C to +85°C.
**HARDWARE:** Includes ¼" x 32 hex nut, internal tooth lockwasher and adjustable stop washer.
**FINISH:** Suitable to withstand 50-hour salt spray test per MIL-S-3786.





P.C. PLUG-IN ARRANGEMENT LIMITED TO BACK SECTION
.052 ± .002 DIA., 12 HOLES MAY OMIT ANY HOLES DEPENDING ON CLIP PATTERN
.30° TYP
1/32 REF.
1/2 DIA
P.C. BOARD
BODY OF SWITCH
TAIL OF P.C. CLIP
.020 MIN
.053 NOM STAND OFF HEIGHT
3/32 REF




### HALF INCH ROTARY SWITCHES WITH STANDARD CONTACTS

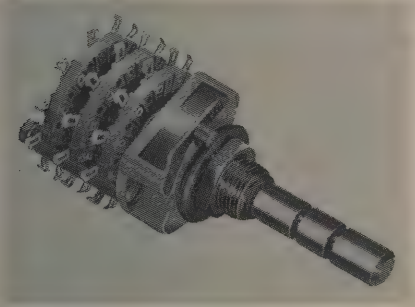
| Total Poles | Active Positions | Poles/ Section | No. of Sections | Catalog No. Shorting | Catalog No. Non-Shorting |
|---|---|---|---|---|---|
| 1 | 2-11 | 1 | 1 | 399630-501 | 399633-511 |
| 2 | 2-11 | 1 | 2 | 399631-502 | 399634-512 |
| 2 | 2-5 | 2 | 1 | 399636-501 | 399639-511 |
| 3 | 2-3 | 3 | 1 | 399642-501 | 399645-511 |
| 3 | 2-11 | 1 | 3 | 399632-503 | 399635-513 |
| 4 | 2-5 | 2 | 2 | 399637-502 | 399640-512 |
| 4 | 2-11 | 1 | 4 | 399626-504 | 399627-514 |
| 6 | 2-3 | 3 | 2 | 399643-502 | 399646-512 |
| 6 | 2-5 | 2 | 3 | 399638-503 | 399641-513 |
| 9 | 2-3 | 3 | 3 | 399644-503 | 399647-513 |

### HALF INCH ROTARY SWITCHES WITH PRINTED CIRCUIT TERMINATIONS

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2-11 | 1 | 1 | 399899-501 | 399898-501 |
| 2 | 2-5 | 2 | 1 | 399897-501 | 399896-501 |
| 3 | 2-3 | 3 | 1 | 399895-501 | 399894-501 |

# TYPE AM ROTARY SWITCH

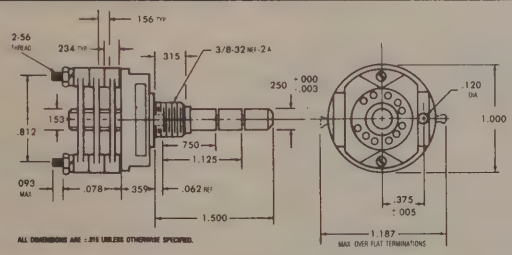
**Rugged miniature switches with diallyl phthalate stators insulation and acetal copolymer rotors**



## SPECIFICATIONS

**SIZE:** 1" dia. nominal, with 1 to 3 sections. Max. depth, 1⅝".
**MOUNTING:** Single hole, with ⅜-32 bushing, ⅜" long. Locating lug on ⅜" radius.
**SHAFT:** .250+.000/−.003; 1½" long; grooved for break-off at ¾", 1⅛".
**INDEXING:** Unidex™ 30°.
**STOP STRENGTH:** One fixed stop, 15 in./lbs.; one adjustable stop, 10 in./lbs.
**STATOR INSULATION:** Diallyl Phthalate per MIL-M-14.
**ROTOR INSULATION:** Celcon (Acetal Copolymer).
**FINISH:** Suitable to withstand 50-hour salt spray per MIL-S-3786.
**CONTACTS STANDARD:** Silver plated brass, with additional gold plating of 15 millionths.
**CONTACT RESISTANCE:** 0.003 to .015 ohms.
**ELECTRICAL RATING:** Break .5 amp at 28 volts DC, 0.25 amp at 110 volts AC, resistive. Carry 5 amps.
**HARDWARE:** Includes ⅜-32 mounting nut and lockwasher.
**PACKAGING:** Oakote protective packaging protects switches from tarnish and corrosion.
**STANDARD PRINTED CIRCUIT BOARD HOLE PATTERNS ARE AVAILABLE FROM YOUR LOCAL DISTRIBUTOR**

| Switch Type | Drawing No. |
|---|---|
| AM | 302300-101 |




### TYPE AM ROTARY SWITCHES WITH STANDARD CONTACTS — 50-HOUR SALT SPRAY
**Silver plated brass contacts with 15 millionths thick gold plating**

| Total Poles | Active Positions | Poles/ Section | No. of Sections | Catalog No. Shorting | Catalog No. Non-Shorting |
|---|---|---|---|---|---|
| 1 | 2-12 | 1 | 1 | 399279-AM | 399280-AM |
| 2 | 2-6 | 2 | 1 | 399281-AM | 399282-AM |
| 2 | 2-12 | 1 | 2 | 399283-AM | 399284-AM |
| 3 | 2-5 | 3 | 1 | 399260-AM | 399261-AM |
| 3 | 2-12 | 1 | 3 | 399285-AM | 399286-AM |
| 4 | 2 | 4 | 1 | 399289-AM | 399290-AM |
| 4 | 2-6 | 2 | 2 | 399287-AM | 399288-AM |
| 5 | 2-3 | 5 | 1 | 399262-AM | 399263-AM |
| 6 | 2-5 | 3 | 2 | 399264-AM | 399265-AM |
| 6 | 2-6 | 2 | 3 | 399291-AM | 399292-AM |
| 8 | 2 | 4 | 2 | 399293-AM | 399294-AM |
| 9 | 2-5 | 3 | 3 | 399266-AM | 399267-AM |
| 10 | 2-3 | 5 | 2 | 399268-AM | 399269-AM |
| 15 | 2-3 | 5 | 3 | 399270-AM | 399271-AM |

### TYPE AM ROTARY SWITCHES WITH SILVER ALLOY CONTACTS
**Silver Alloy contacts with 15 millionths gold plating meet 50-hour salt spray test**

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2-12 | 1 | 1 | 399272-AM | 399273-AM |

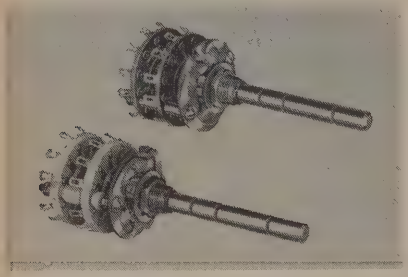
### TYPE AM ROTARY SWITCHES WITH PC TERMINATIONS

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2-12 | 1 | 1 | 399048-AM | 399049-AM |
| 2 | 2-6 | 2 | 1 | 399050-AM | 399051-AM |
| 3 | 2-5 | 3 | 1 | 399052-AM | 399053-AM |
| 6 | 2 | 6 | 1 | 399054-AM | 399055-AM |

**OAK Industries Inc.**
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# TYPE F AND FC SWITCHES

**Only 1 5/16" diameter, with either phenolic or ceramic insulation . . . choice of contact material**



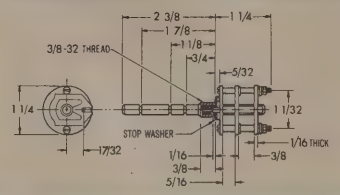
## SPECIFICATIONS

**SIZE:** 1 5/32" wide x 1 5/16" high (Type FC, 1 1/4" wide).
**MOUNTING:** Single hole, with 3/8-32 bushing, 3/8" long. Locating lug on 17/32" radius.
**SHAFT:** .250 +.000/−.003; 2 3/8" long; grooved at 3/4", 1 1/8" and 1 7/8".
**INDEXING:** Ball-type 30°.
**STOP STRENGTH:** One fixed stop, 15 in./lbs.; one adjustable stop, 10 in./lbs.
**SECTION SPACING:** 3/8" spacers between sections; 5/16" spacer with washer between front plate and first section. Type FC has epoxy glass shock washers.
**INSULATION:** Type F, phenolic PBE-P per LP-513; Type FC, ceramic.
**SECTION THICKNESS:** Type F, .062"; Type FC, .120".
**FINISH:** Withstands 50-hour salt spray per MIL-S-3786.
**CONTACTS STANDARD:** Silver plated brass, with additional 15 millionths gold plating.
**CONTACT RESISTANCE:** 0.003 to .015 ohms.
**ELECTRICAL RATING:** Break 1 amp at 28 volts DC, 0.5 amp at 110 volts AC, resistive. Carry 5 amps.
**HARDWARE:** Includes 3/8-32 mounting nut and lockwasher.
**PACKAGING:** Oakote protective packaging resists tarnish and corrosion.

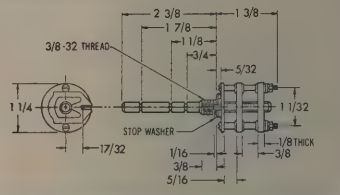
**STANDARD PRINTED CIRCUIT BOARD HOLE PATTERNS ARE AVAILABLE FROM YOUR LOCAL DISTRIBUTOR**

| Switch Type | Drawing No. |
|---|---|
| F | 302300-201 |

F




FC




**TYPE F AND FC ROTARY SWITCHES WITH STANDARD CONTACTS**
**Silver plated brass contacts with 15 millionths thick gold plating over the silver**

| Total Poles | Active Positions | Poles/ Section | No. of Sections | Catalog No. Shorting | Catalog No. Non-Shorting |
|---|---|---|---|---|---|
| 1 | 2-11 | 1 | 1 | 399322-F | 399323-F |
| 2 | 2-5 | 2 | 1 | 399326-F | 399327-F |
| 2 | 2-11 | 1 | 2 | 399324-F | 399325-F |
| 3 | 2-3 | 3 | 1 | 399330-F | 399331-F |
| 4 | 2 | 4 | 1 | 399334-F | 399335-F |
| 4 | 2-5 | 2 | 2 | 399328-F | 399329-F |
| 6 | 2-3 | 3 | 2 | 399332-F | 399333-F |
| 8 | 2 | 4 | 2 | 399336-F | 399337-F |
| 1 | 2-11 | 1 | 1 | 399366-FC | 399367-FC |
| 2 | 2-5 | 2 | 1 | 399370-FC | 399371-FC |
| 2 | 2-11 | 1 | 2 | 399368-FC | 399369-FC |
| 3 | 2-3 | 3 | 1 | 399374-FC | 399375-FC |
| 4 | 2 | 4 | 1 | 399378-FC | 399379-FC |
| 4 | 2-5 | 2 | 2 | 399372-FC | 399373-FC |
| 6 | 2-3 | 3 | 2 | 399376-FC | 399377-FC |
| 8 | 2 | 4 | 2 | 399380-FC | 399381-FC |

**TYPE F ROTARY SWITCHES WITH PRINTED CIRCUIT TERMINATIONS**

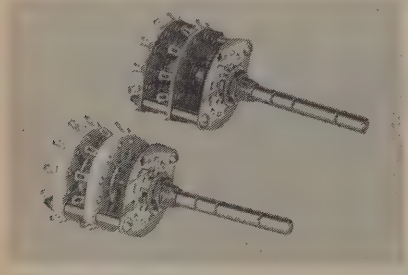
| | | | | | |
|---|---|---|---|---|---|
| 1 | 2-11 | 1 | 1 | 399300-F | 399301-F |
| 2 | 2-5 | 2 | 1 | 399302-F | 399303-F |
| 3 | 2-3 | 3 | 1 | 399304-F | 399305-F |
| 4 | 2 | 4 | 1 | 399306-F | 399307-F |

**TYPE F AND FC ROTARY SWITCHES WITH SILVER ALLOY**
**Silver Alloy Contacts, with 15 millionths gold plating meet 50-hour salt spray test**

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2-11 | 1 | 1 | 399338-F | 399339-F |
| 1 | 2-11 | 1 | 1 | 399382-FC | 399383-FC |

# TYPE H AND HC ROTARY SWITCHES

**Standard 1 7/8" rotary switches, with either phenolic or ceramic insulation**



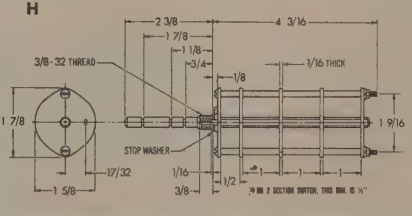
## SPECIFICATIONS

**SIZE:** 1 19/32" wide x 1 7/8" high (Type HC, 1 5/8" wide).
**MOUNTING:** Single hole, with 3/8-32 bushing, 3/8" long. Locating lug on 17/32" radius.
**SHAFT:** .250 +.000/−.003; 2 3/8" long; grooved at 3/4", 1 1/8" and 1 7/8".
**INDEXING:** Ball-type 30°; one fixed, one adjustable stop.
**SECTION SPACING:** 1/2" spacer between front plate and first section; 1" between sections except Type H, two-section, 1/2"; Type HC two-section, 7/16"; Type HC three-section, 15/16" between first and second sections.
**INSULATION:** Type H, phenolic PBE-P per LP-513; Type HC, ceramic.
**SECTION THICKNESS:** Type H, .062"; Type HC, .180".
**FINISH:** Withstands 50-hour salt spray per MIL-S-3786.
**CONTACTS:** Silver plated brass, with additional 15 millionths gold plating.
**CONTACT RESISTANCE:** 0.003 to .015 ohms.
**ELECTRICAL RATING:** Break 1 amp at 28 volts DC, 0.5 amp at 110 volts AC, resistive. Carry 5 amps.
**HARDWARE:** Includes 3/8-32 mounting nut and lockwasher.
**PACKAGING:** Tarnish and corrosion-resistant.

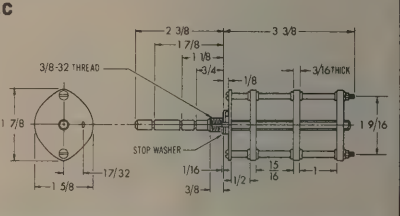
**STANDARD PRINTED CIRCUIT BOARD HOLE PATTERNS ARE AVAILABLE FROM YOUR LOCAL DISTRIBUTOR**

| Switch Type | Drawing No. |
|---|---|
| H | 302300-401 |

H




HC




**TYPE H AND HC ROTARY SWITCHES WITH STANDARD CONTACTS**

| Total Poles | Active Positions | Poles/ Section | No. of Sections | Catalog No. Shorting | Catalog No. Non-Shorting |
|---|---|---|---|---|---|
| 1 | 2-11 | 1 | 1 | 399512-H | 399513-H |
| 2 | 2-11 | 1 | 2 | 399514-H | 399515-H |
| 2 | 2-5 | 2 | 1 | 399518-H | 399519-H |
| 3 | 2-11 | 1 | 3 | 399516-H | 399517-H |
| 4 | 2 | 4 | 1 | 399524-H | 399525-H |
| 4 | 2-11 | 1 | 4 | 399528-H | 399529-H |
| 4 | 2-5 | 2 | 2 | 399520-H | 399521-H |
| 6 | 2-3 | 3 | 2 | 399526-H | 399527-H |
| 6 | 2-5 | 2 | 3 | 399522-H | 399523-H |
| 1 | 2-11 | 1 | 1 | 399562-HC | 399563-HC |
| 1 | 2-6 | 1 | 1 | 399574-HC | — |
| 2 | 2-11 | 1 | 2 | 399564-HC | 399565-HC |
| 2 | 2-5 | 2 | 1 | 399568-HC | 399569-HC |
| 3 | 2-11 | 1 | 3 | 399566-HC | 399567-HC |
| 4 | 2-5 | 2 | 2 | 399570-HC | 399571-HC |
| 6 | 2-5 | 2 | 3 | 399572-HC | 399573-HC |

**TYPE H ROTARY SWITCHES WITH PRINTED CIRCUIT TERMINATIONS**

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2-11 | 1 | 1 | 399504-H | 399505-H |
| 2 | 2-5 | 2 | 1 | 399506-H | 399507-H |
| 3 | 2-3 | 3 | 1 | 399547-H | 399548-H |
| 4 | 2 | 4 | 1 | 399508-H | 399509-H |

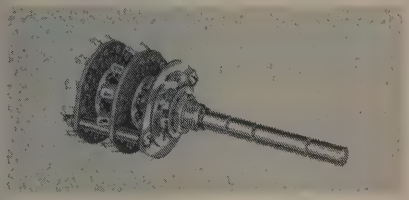
**60° INDEXING HAM SWITCH**

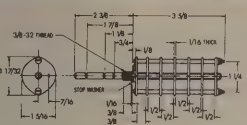
| | | | | | |
|---|---|---|---|---|---|
| 3 | 2-6 | 1 | 3 | — | 399581-HC |

# ROTARY SWITCHES

## TYPE K MULTI-SECTION ROTARY SWITCH

**Standard 1 17/32" switches with phenolic insulation. Up to 6 sections and 12 poles**





### SPECIFICATIONS

**SIZE:** 1 13/32" wide x 1 17/32" high.
**MOUNTING:** Single hole, with 3/8-32 bushing, 3/8" long. Locating hole on 7/16" radius.
**SHAFT:** .250 +.000/−.003; 2 3/8" long; grooved at 3/4", 1 1/8" and 1 7/8".
**INDEXING:** Ball-type 30°; one fixed, one adjustable stop.
**SECTION SPACING:** 1/2" spacers between sections; 3/8" spacer between front plate and first section. Sections are .062" thick.
**INSULATION:** Phenolic PBE-P per LP-513.
**FINISH:** Withstands 50-hour salt spray per MIL-S-3786.
**CONTACTS:** Silver plated brass, with additional 15 millionths gold plating.
**CONTACT RESISTANCE:** 0.003 to .015 ohms.
**ELECTRICAL RATING:** Break 1 amp at 28 volts DC, 0.5 amp at 110 volts AC, resistive. Carry 5 amps.
**HARDWARE:** Includes 3/8-32 mounting nut and lockwasher.
**PACKAGING:** Oakote packaging resists tarnish and corrosion.

**STANDARD PRINTED CIRCUIT BOARD HOLE PATTERNS ARE AVAILABLE FROM YOUR LOCAL DISTRIBUTOR**

| Switch Type | Drawing No. |
|---|---|
| K | 302300-301 |

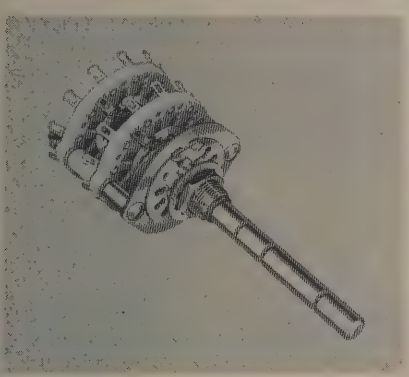
**TYPE K ROTARY SWITCHES WITH STANDARD CONTACTS**

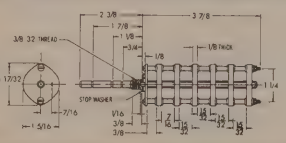
| Total Poles | Active Positions | Poles/ Section | No. of Sections | Catalog No. Shorting | Catalog No. Non-Shorting |
|---|---|---|---|---|---|
| 1 | 2-12 | 1 | 1 | 399418-K | 399419-K |
| 2 | 2-6 | 2 | 1 | 399426-K | 399427-K |
| 2 | 2-12 | 1 | 2 | 399420-K | 399421-K |
| 3 | 2-5 | 3 | 1 | 399490-K | 399491-K |
| 3 | 2-12 | 1 | 3 | 399422-K | 399423-K |
| 4 | 2-6 | 2 | 2 | 399428-K | 399429-K |
| 4 | 2-11 | 1 | 4 | 399424-K | 399425-K |
| 5 | 2-12 | 1 | 5 | 399732-K | 399733-K |
| 6 | 2-3 | 3 | 2 | 399734-K | 399735-K |
| 6 | 2-5 | 3 | 2 | 399492-K | 399493-K |
| 6 | 2-6 | 2 | 3 | 399430-K | 399431-K |
| 6 | 2 | 6 | 1 | 399432-K | 399433-K |
| 6 | 2-11 | 1 | 6 | 399736-K | 399737-K |
| 8 | 2-5 | 2 | 4 | 399738-K | 399739-K |
| 9 | 2-5 | 3 | 3 | 399494-K | 399495-K |
| 10 | 2-5 | 2 | 5 | 399742-K | 399743-K |
| 12 | 2 | 4 | 3 | 399740-K | 399741-K |
| 12 | 2-5 | 2 | 6 | 399744-K | 399745-K |
| 12 | 2 | 6 | 2 | 399434-K | 399435-K |
| **TYPE K ROTARY SWITCHES WITH PRINTED CIRCUIT TERMINATIONS** | | | | | |
| 1 | 2-12 | 1 | 1 | 399400-K | 399401-K |
| 2 | 2-6 | 2 | 1 | 399402-K | 399403-K |
| 3 | 2-5 | 3 | 1 | 399404-K | 399405-K |
| 6 | 2 | 6 | 1 | 399406-K | 399407-K |
| **SPECIAL PURPOSE TYPE K ROTARY SWITCHES SPECIAL CIRCUITS — CONSECUTIVE SHORTING** | | | | | |
| 1 | 2-10 | 1 | 1 | 399748-K | — |
| 1 | 2-10 | 1 | 1 | 399746-K* | — |
| **60° INDEXING — NON-SHORTING** | | | | | |
| 1 | 2-6 | 1 | 1 | — | 399747-K |
| 2 | 2-6 | 1 | 2 | — | 399749-K |
| **SPECIAL PURPOSE TYPE K ROTARY SWITCHES WITH PRINTED CIRCUIT TERMINATIONS 60° INDEXING — NON-SHORTING** | | | | | |
| 1 | 2-6 | 1 | 1 | — | 399410-K |
| **SPECIAL PURPOSE TYPE K ROTARY SWITCH SECTIONS ONLY WITH PRINTED CIRCUIT TERMINATIONS — 60° INDEXING — NON-SHORTING** | | | | | |
| 1 | 2-6 | 1 | — | — | 399488-K |

* Opposite rotation; contacts shorted to common in counter-clockwise position.

## TYPE JC MULTI-SECTION ROTARY SWITCH

**Standard 1 17/32" switches with ceramic insulation . . . up to 6 sections . . . up to 18 poles**





### SPECIFICATIONS

**SIZE:** 1 3/8" wide x 1 17/32" high.
**MOUNTING:** Single hole, with 3/8-32 bushing, 3/8" long. Locating hole on 7/16" radius.
**SHAFT:** .250 +.000/−.003; 2 3/8" long; grooved at 3/4", 1 1/8" and 1 7/8".
**INDEXING:** Ball-type 30°; one fixed, one adjustable stop.
**SECTION SPACING:** 1/32" spacers between sections; 3/8" spacer between front plate and first section; 7/16" between first and second sections. Sections are .120" thick.
**INSULATION:** Ceramic.
**FINISH:** Withstands 50-hour salt spray per MIL-S-3786.
**CONTACTS STANDARD:** Silver plated brass, with additional 15 millionths gold plating.
**CONTACT RESISTANCE:** 0.003 to .015 ohms.
**ELECTRICAL RATING:** Break 1 amp at 28 volts DC, 0.5 amp at 110 volts AC, resistive. Carry 5 amps.
**HARDWARE:** Includes 3/8-32 mounting nut and lockwasher.

**TYPE JC ROTARY SWITCHES WITH STANDARD CONTACTS**

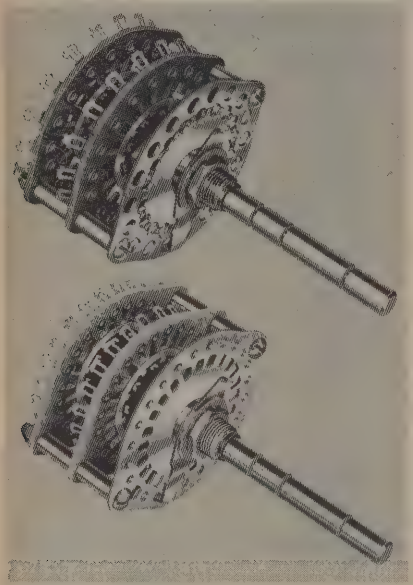
| Total Poles | Active Positions | Poles/ Section | No. of Sections | Catalog No. Shorting | Catalog No. Non-Shorting |
|---|---|---|---|---|---|
| 1 | 2-12 | 1 | 1 | 399468-JC | 399469-JC |
| 2 | 2-6 | 2 | 1 | 399476-JC | 399477-JC |
| 2 | 2-12 | 1 | 2 | 399470-JC | 399471-JC |
| 3 | 2-5 | 3 | 1 | 399704-JC | 399705-JC |
| 3 | 2-12 | 1 | 3 | 399472-JC | 399473-JC |
| 4 | 2-6 | 2 | 2 | 399478-JC | 399479-JC |
| 4 | 2-12 | 1 | 4 | 399474-JC | 399475-JC |
| 6 | 2 | 6 | 1 | 399484-JC | 399485-JC |
| 6 | 2-5 | 3 | 2 | 399696-JC | 399697-JC |
| 6 | 2-6 | 2 | 3 | 399480-JC | 399481-JC |
| 8 | 2-6 | 2 | 4 | 399706-JC | 399707-JC |
| 9 | 2-5 | 3 | 3 | 399708-JC | 399709-JC |
| 10 | 2-3 | 5 | 2 | 399710-JC | 399711-JC |
| 10 | 2-6 | 2 | 5 | 399712-JC | 399713-JC |
| 12 | 2 | 6 | 2 | 399486-JC | 399487-JC |
| 12 | 2-5 | 3 | 4 | 399698-JC | 399699-JC |
| 12 | 2-6 | 2 | 6 | 399714-JC | 399715-JC |
| 15 | 2-3 | 5 | 3 | 399716-JC | 399717-JC |
| 18 | 2 | 6 | 3 | 399718-JC | 399719-JC |
| **TYPE JC ROTARY SWITCHES WITH SILVER ALLOY CONTACTS Silver alloy contacts, with 15 millionths gold plating meet 50-hour salt spray test** | | | | | |
| 2 | 2-12 | 1 | 2 | 399724-JC | 399725-JC |
| **TYPE JC SPECIAL PURPOSE ROTARY SWITCHES SPECIAL CIRCUITS — CONSECUTIVE SHORTING** | | | | | |
| 1 | 2-10 | 1 | 1 | 399722-JC | — |
| 1 | 2-10 | 1 | 1 | 399720-JC* | — |
| **60° INDEXING — NON-SHORTING** | | | | | |
| 1 | 2-6 | 1 | 1 | — | 399729-JC |
| 2 | 2-6 | 1 | 2 | — | 399731-JC |

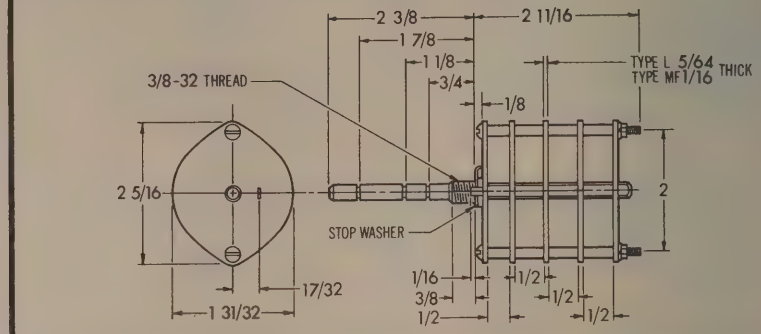
* Opposite rotation; contacts shorted to common in counter-clockwise position.

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# TYPE L, MF MULTI-PURPOSE ROTARY SWITCHES

**Rugged 2⁵⁄₁₆″ switches with phenolic insulation . . . 18 or 24 positions**






## SPECIFICATIONS

**SIZE:** 1³¹⁄₃₂″ wide x 2⅝″ high (Type MF, 1¾″ wide).

**MOUNTING:** Single hole, with ⅜-32 bushing, ⅜″ long. Locating key on adjustable stop washer.

**SHAFT:** .250 +.000/−.003; 2⅜″ long; grooved at ¾″, 1⅛″ and 1⅞″.

**INDEXING:** Type L, 20°; Type MF, 15°. Ball-type. One fixed and one adjustable stop.

**SECTION SPACING:** ½″ spacer between front plate and first section; ½″ between sections.

**INSULATION:** Phenolic PBE-P per LP-513.

**SECTION THICKNESS:** Type L, .078″; Type MF, .062″.

**FINISH:** Withstands 50-hour salt spray per MIL-S-3786.

**CONTACTS:** Silver plated brass, with additional 15 millionths gold plating.

**CONTACT RESISTANCE:** 0.003 to .015 ohms.

**ELECTRICAL RATING:** Break 1 amp at 28 volts DC, 0.5 amp at 110 volts AC, resistive. Carry 5 amps.

**HARDWARE:** Includes ⅜-32 mounting nut and lockwasher.

**PACKAGING:** Oakote protective packaging resists tarnish and corrosion.

**STANDARD PRINTED CIRCUIT BOARD HOLE PATTERNS ARE AVAILABLE FROM YOUR LOCAL DISTRIBUTOR**

| Switch Type | Drawing No. |
|---|---|
| L | 302300-501 |
| MF | 302300-502 |

**TYPE L AND MF SWITCHES WITH STANDARD CONTACTS**

| Total Poles | Active Positions | Poles/ Section | No. of Sections | Catalog No. Shorting | Catalog No. Non-Shorting |
|---|---|---|---|---|---|
| 1 | 2-18 | 1 | 1 | 399621-L | 399622-L |
| 2 | 2-9 | 2 | 1 | 399806-L | 399807-L |
| 2 | 2-18 | 1 | 2 | 399623-L | 399624-L |
| 3 | 2-18 | 1 | 3 | 399625-L | 399648-L |
| 4 | 2-18 | 1 | 4 | 399649-L | 399616-L |
| 1 | 2-24 | 1 | 1 | 399684-MF | 399685-MF |
| 2 | 2-12 | 2 | 1 | 399830-MF | 399831-MF |
| 2 | 2-24 | 1 | 2 | 399686-MF | 399687-MF |
| 3 | 2-24 | 1 | 3 | 399688-MF | 399689-MF |
| 4 | 2-24 | 1 | 4 | 399690-MF | 399691-MF |

**TYPE L AND MF ROTARY SWITCHES WITH PRINTED CIRCUIT TERMINATIONS**

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2-17 | 1 | 1 | 399818-L | 399819-L |
| 2 | 2-8 | 2 | 1 | 399826-L | 399827-L |
| 1 | 2-23 | 1 | 1 | 399824-MF | 399825-MF |
| 2 | 2-11 | 2 | 1 | 399846-MF | 399847-MF |

# SHAFT AND INDEX ASSEMBLIES

Includes mounting nut and lock washer, stop washer, strut screws and spacers, washers, nuts. Choice of two lengths. Indexing, 2-12 position.

| | Catalog No. | Shaft Depth |
|---|---|---|
| AM | 399257-A | 1″ |
| | 399258-A | 4½″ |
| F/FC | 399039-F, FC | 1¼″ |
| | 399021-F, FC | 6⅛″ |
| H/HC | 399785-H, HC | 3³¹⁄₃₂″ |
| | 399023-H, HC | 6⅛″ |

| | Catalog No. | Shaft Depth |
|---|---|---|
| K | 399043-K | 2¹⁷⁄₃₂″ |
| | 399024-K | 6⅛″ |
| JC | 399043-JC | 2¹⁷⁄₃₂″ |
| | 399024-JC | 6⅛″ |
| L/MF | 399183-L | 2¹⁹⁄₃₂″ |
| | 399184-L | 6⅛″ |
| | 399143-MF | 2¹⁷⁄₃₂″ |
| | 399144-MF | 6⅛″ |

# ROTARY SWITCH COMPONENTS

## TYPE AM

| Total Poles | Active Positions | Section Type | Catalog No. Shorting | Catalog No. Non-Shorting |
|---|---|---|---|---|
| **TYPE AM SEPARATE ROTARY SWITCH SECTIONS ONLY** | | | | |
| 1 | 2-12 | Standard | 399114-AM | 399174-AM |
| 2 | 2-6 | Standard | 399115-AM | 399175-AM |
| 3 | 2-5 | Standard | 399106-AM | 399107-AM |
| 4 | 2 | Standard | 399116-AM | 399176-AM |
| 5 | 2-3 | Standard | 399108-AM | 399109-AM |
| 1 | 2-11 | Notched Blade | 399117-AM | — |
| 1 | 2-10 | Consecutive Shorting | 399118-AM | — |
| 1 | — | Capacitor Decade | — | 399177-AM |
| 1 | — | Resistor Decade | — | 399178-AM |
| 1 | 2-10 | Binary Code 2-10 | — | 399179-AM |
| 1 | — | Binary Code 0-11 | — | 399259-AM |
| **TYPE AM ROTARY SWITCH SECTIONS ONLY WITH PRINTED CIRCUIT TERMINATIONS** | | | | |
| 1 | 2-12 | Standard P.C. | 399136-AM | 399137-AM |
| 2 | 2-6 | Standard P.C. | 399138-AM | 399139-AM |
| 3 | 2-5 | Standard P.C. | 399156-AM | 399157-AM |
| 6 | 2 | Standard P.C. | 399158-AM | 399159-AM |
| **SILVER TYPE A 'PCB' ROTARY SWITCH SECTIONS ONLY WITH PRINTED CIRCUIT TERMINATIONS**** | | | | |
| 1 | 2-12 | — | 4-1432-755 | 4-1442-140 |
| 2 | 2-6 | — | 4-2552-115 | 4-2552-415 |

** Glass epoxy insulation

## TYPE F/FC

| | | | | |
|---|---|---|---|---|
| **TYPE F AND FC SEPARATE ROTARY SWITCH SECTIONS ONLY** | | | | |
| 1 | 2-11 | Standard | 399070-F | 399071-F |
| 2 | 2-5 | Standard | 399072-F | 399073-F |
| 3 | 2-3 | Standard | 399074-F | 399075-F |
| 4 | 2 | Standard | 399076-F | 399077-F |
| 1 | 2-11 | Notched Blade | 399060-F | — |
| 1 | 2-11 | Standard | 399090-FC | 399091-FC |
| 2 | 2-5 | Standard | 399092-FC | 399093-FC |
| 3 | 2-3 | Standard | 399094-FC | 399095-FC |
| 4 | 2 | Standard | 399096-FC | 399097-FC |
| 1 | 2-11 | Notched Blade | 399062-FC | — |
| **TYPE F AND FC ROTARY SWITCH SECTIONS ONLY WITH PRINTED CIRCUIT TERMINATIONS** | | | | |
| 1 | 2-11 | Standard | 399340-F | 399341-F |
| 2 | 2-5 | Standard | 399342-F | 399343-F |
| 3 | 2-3 | Standard | 399344-F | 399345-F |
| 4 | 2 | Standard | 399346-F | 399347-F |
| 1 | 2-11 | Standard | 399348-FC | 399349-FC |
| 2 | 2-5 | Standard | 399384-FC | 399385-FC |
| 3 | 2-3 | Standard | 399386-FC | 399387-FC |
| 4 | 2 | Standard | 399388-FC | 399389-FC |

## TYPE H/HC

| | | | | |
|---|---|---|---|---|
| **TYPE H AND HC SEPARATE ROTARY SWITCH SECTIONS ONLY** | | | | |
| 1 | 2-11 | Standard | 399750-H | 399751-H |
| 2 | 2-5 | Standard | 399752-H | 399753-H |
| 3 | 2-3 | Standard | — | 399767-H |
| 4 | 2 | Standard | — | 399769-H |
| 1 | 2-11 | Notched Blade | 399068-H | — |
| 1 | 2-11 | Standard | 399760-HC | 399761-HC |
| 1 | 2-6 | Standard | 399764-HC | — |
| 2 | 2-5 | Standard | 399762-HC | 399763-HC |
| 1 | 2-11 | Notched Blade | 399078-HC | — |
| **TYPE H ROTARY SWITCHES SECTIONS ONLY WITH PRINTED CIRCUIT TERMINATIONS** | | | | |
| 1 | 2-11 | Standard P.C. | 399531-H | 399532-H |
| 2 | 2-5 | Standard P.C. | 399533-H | 399534-H |
| 3 | 2-3 | Standard P.C. | 399549-H | 399561-H |
| 4 | 2 | Standard P.C. | 399544-H | 399545-H |

## TYPE K

| Total Poles | Active Positions | Section Type | Catalog No. Shorting | Catalog No. Non-Shorting |
|---|---|---|---|---|
| **TYPE K SEPARATE ROTARY SWITCH SECTIONS ONLY** | | | | |
| 1 | 2-12 | Standard | 399130-K | 399131-K |
| 1 | 2-11 | Standard | 399242-K | 399243-K |
| 2 | 2-6 | Standard | 399132-K | 399133-K |
| 2 | 2-5 | Standard | 399244-K | 399245-K |
| 3 | 2-3 | Standard | 399246-K | 399247-K |
| 3 | 2-5 | Standard | 399254-K | 399255-K |
| 4 | 2 | Standard | 399248-K | 399249-K |
| 6 | 2 | Standard | 399134-K | 399135-K |
| 1 | 2-11 | Notched Blade | 399064-K | — |
| 1 | 2-10 | Consecutive Shorting | 399252-K | — |
| 1 | 2-10 | Consecutive Shorting* | 399250-K* | — |
| **TYPE K SEPARATE ROTARY SWITCH SECTIONS ONLY WITH PRINTED CIRCUIT TERMINATIONS** | | | | |
| 1 | 2-12 | Standard P.C. | 399396-K | 399397-K |
| 2 | 2-6 | Standard P.C. | 399398-K | 399399-K |
| 3 | 2-5 | Standard P.C. | 399442-K | 399443-K |
| 6 | 2 | Standard P.C. | 399439-K | 399440-K |
| 1 | 2-11 | Notched | 399489-K | — |
| 1 | 2-6 | 60° Throw | — | 399488-K |
| 1 | 2-10 | Consecutive Shorting | 399483-K | — |
| 1 | 2-10 | Consecutive Shorting* | 399482-K* | — |

## TYPE JC

| | | | | |
|---|---|---|---|---|
| **TYPE JC SEPARATE ROTARY SWITCH SECTIONS ONLY** | | | | |
| 1 | 2-12 | Standard | 399150-JC | 399151-JC |
| 2 | 2-6 | Standard | 399152-JC | 399153-JC |
| 3 | 2-5 | Standard | 399444-JC | 399445-JC |
| 5 | 2-3 | Standard | 399446-JC | 399447-JC |
| 6 | 2 | Standard | 399154-JC | 399155-JC |
| 1 | 2-11 | Notched Blade | 399066-JC | — |
| 1 | 2-10 | Consecutive Shorting | 399438-JC | — |
| 1 | 2-10 | Consecutive Shorting* | 399436-JC* | — |

* Opposite rotation; contacts shorted to common in counter-clockwise position.

## TYPE L/MF

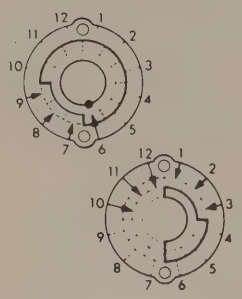
| Total Poles | Active Positions | Poles/ Section | Section Type | Catalog No. Shorting | Catalog No. Non-Shorting |
|---|---|---|---|---|---|
| **TYPE L AND MF SEPARATE ROTARY SWITCH SECTIONS ONLY** | | | | | |
| 1 | 2-18 | 1 | Standard | 399185-L | 399186-L |
| 2 | 2-9 | 2 | Standard | 399808-L | 399809-L |
| 1 | 2-24 | 1 | Standard | 399145-MF | 399182-MF |
| 2 | 2-12 | 2 | Standard | 399832-MF | 399833-MF |
| **TYPE L AND MF SEPARATE ROTARY SWITCH SECTIONS ONLY WITH PRINTED CIRCUIT TERMINATIONS** | | | | | |
| 1 | 2-17 | 1 | Standard | 399814-L | 399815-L |
| 2 | 2-8 | 2 | Standard | 399828-L | 399829-L |
| 1 | 2-23 | 1 | Standard | 399820-MF | 399821-MF |
| 2 | 2-11 | 2 | Standard | 399848-MF | 399849-MF |
| **TYPE L AND MF SPECIAL PURPOSE ROTARY SWITCH SECTIONS ONLY** | | | | | |
| 1 | 2-17 | 1 | Notched Blade | 399802-L | — |
| 1 | 2-23 | 1 | Notched Blade | 399804-MF | — |
| **TYPE L AND MF SPECIAL PURPOSE ROTARY SWITCH SECTIONS ONLY WITH PRINTED CIRCUIT TERMINATIONS** | | | | | |
| 1 | 2-17 | 1 | Notched Blade | 399816-L | — |
| 1 | 2-23 | 1 | Notched Blade | 399822-MF | — |

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

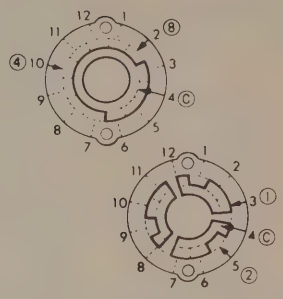
# STANDARD CIRCUIT CONFIGURATIONS

**All layouts are viewed from knob end with switch in extreme counter-clockwise position.**

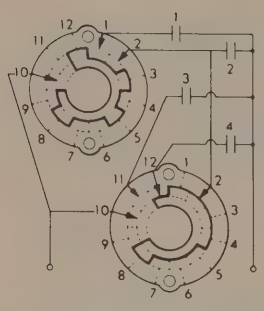
## TYPE AM SPECIAL CIRCUIT CONFIGURATIONS — 30° THROW



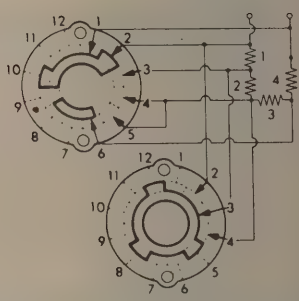
10 POSITION
CONSECUTIVE SHORTING



BINARY CODED
DECIMAL (NS) 0-11



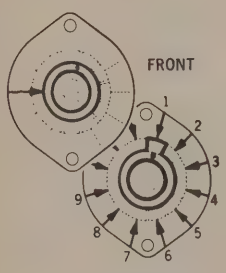
CAPACITOR
DECADE (NS)



RESISTOR
DECADE (NS)

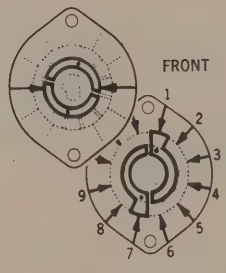
On circuits with fewer positions, short clips will be omitted from clockwise end of rotation. Example: 1 pole, 10 position would have clip 11 omitted.

## TYPE AM, F, FC, JC, K, H AND HC STANDARD SWITCH SECTIONS — 30° THROW




1-POLE
12 POSITIONS

1-POLE
11 POSITIONS

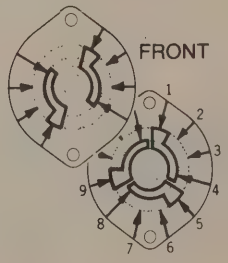



2-POLE
6 POSITIONS

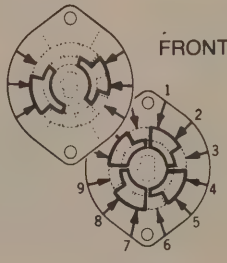
2-POLE
5 POSITIONS

3-POLE
3 POSITIONS

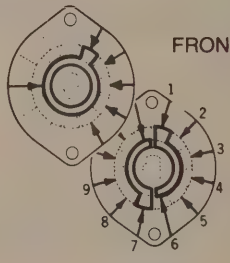
4-POLE
2 POSITIONS




5-POLE
3 POSITIONS



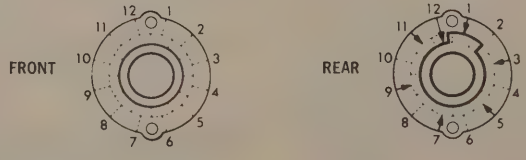

6-POLE
2 POSITIONS




3-POLE
5 POSITIONS

ONLY 12
POSITIONS SHOWN

## TYPE JC, H, K — STANDARD CIRCUIT CONFIGURATIONS — 60° THROW

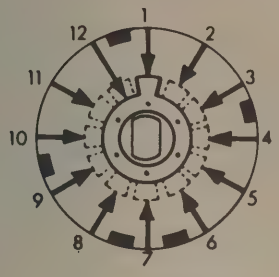



1-POLE
6 POSITION

# ROTARY SWITCHES

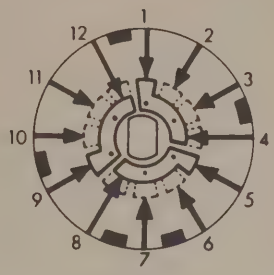
## STANDARD CIRCUIT CONFIGURATIONS

### ½" ROTARY SWITCH STANDARD CIRCUIT CONFIGURATIONS — 30° THROW



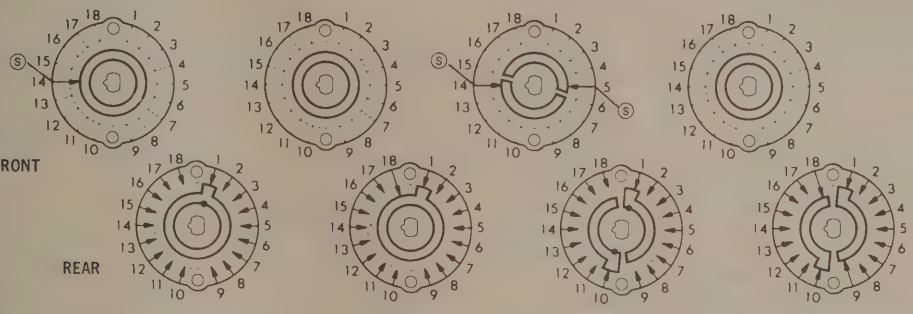
1-POLE, 11 POSITION

2-POLE, 5 POSITION



3-POLE, 3 POSITION

### TYPE L STANDARD CIRCUIT CONFIGURATIONS — 20° THROW




1-POLE
18 POSITION

1-POLE
17 POSITION

2-POLE
9 POSITION

2-POLE
8 POSITION

Ⓢ DESIGNATES INSULATED CLIP

### TYPE MF STANDARD CIRCUIT CONFIGURATIONS — 15° THROW

1-POLE
24 POSITION

1-POLE
23 POSITION

2-POLE
12 POSITION

2-POLE
11 POSITION

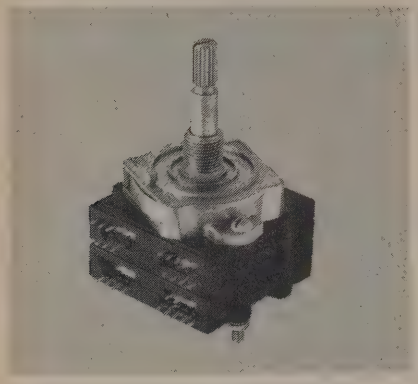
Ⓢ DESIGNATES INSULATED CLIP

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# ENCODER SERIES ROTARY SWITCH WITH UNIDEX® DETENT

## PROGRAMMABLE ROTARY SWITCH FOR:

- Communication Systems
- Data Systems
- Microprocessor Interface
- A-D Converter (Shaft Encoder)
- Mechanical "Read Only Memory" (ROM)



## FULLY PROGRAMMABLE DESIGN

Up to 60 detent positions are available. Oak will design artwork for the double-sided PC board to match your truth table and provide the desired outputs. The number of switch positions is programmed by changing the number of index notches cut into the board edge.

## GUARANTEED SWITCHING ACCURACY

Because of the unique design of this switch, Oak can guarantee switching accuracy. Not only have internal shorts and opens been eliminated, but functional backlash from loose rotors cannot occur since precise detenting is achieved by placing the index notches on the periphery of the rotor.

The Encoder Series rotary switches from Oak mark a breakthrough in rotary switch design. Functional design innovations offer unparalleled long-term contact registry and switch integrity. For the first time ever, a switch capable of up to sixty positions can be offered with guaranteed switch position accuracy for the life of the switch.

All plastic materials used have a 94-VO Underwriters Laboratories flammability listing.

## SPECIFICATIONS:

**MATERIALS**

**HOUSING:** Molded phenolic thermoset

**CONTACTS:** Silver-plated copper-alloy

**CIRCUIT BOARD:** Paper base phenolic, copper clad, silver plated

**METAL PARTS:** Suitably finished for 50 hour salt spray (ref. MIL-S-3786)

**ELECTRICAL/MECHANICAL**

**RATED VOLTAGE AND CURRENT:** (Resistive load at room ambient.) 12 MA @ 28 VDC

**CONTACT RESISTANCE:** 100 milliohms max.

**VOLTAGE BREAKDOWN:** Between common and open contact, 50 VAC, Contact to frame, 500 VAC

**OPERATING TEMPERATURE RANGE:** −30°C to +85°C

**VIBRATION:** 5 to 2000 cycles (ref. MIL-S-3786)

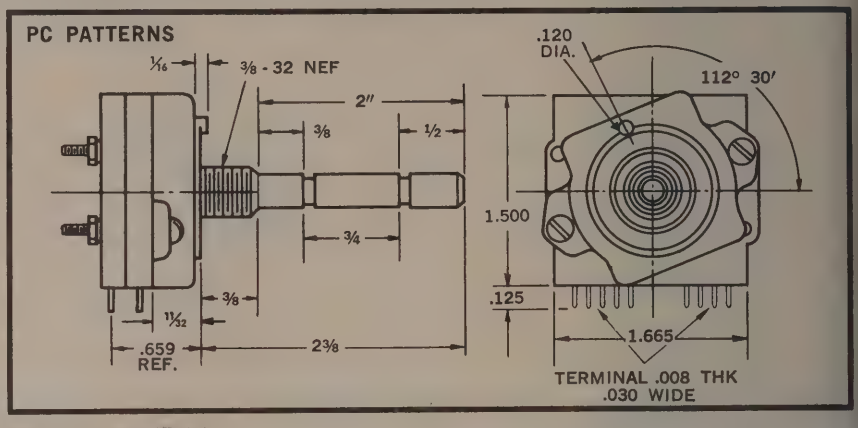
**DETENT TORQUE:** 10 ounce inch approx.

**LIFE:** Over 25,000 cycles min.

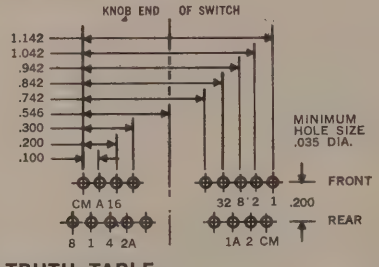
| Part Number | Front (Binary) | Rear (BCD) | Total Pos. |
|---|---|---|---|
| 5-51611-708 | 0-15 | 0-15 | 16 |
| 5-51611-709 | 0-19 | 0-19 | 20 |
| 5-51611-710 | 0-23 | 0-23 | 24 |
| 5-51611-711 | 0-27 | 0-27 | 28 |
| 5-51611-712 | 0-31 | 0-31 | 32 |
| 5-51611-713 | 0-35 | 0-35 | 36 |

For above codes, see Truth Table.

## PC PATTERNS




PRINTED CIRCUIT HOLE PATTERN AS VIEWED FROM TOP OF SWITCH.




Encoder Series switches are available thru OEM with three mounting methods (bushing, strut screw, printed-circuit mount), with an optional right angle drive for tight spaces.

**For additional information request Form F-1050.**

AVAILABLE FROM YOUR LOCAL DISTRIBUTOR

## TRUTH TABLE

| FRONT (BINARY) | | | | | | | | | | | REAR (BCD) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C M | 4 | 16 | | | 32 | 8 | 2 | 1 | POSITION | | 8 | 1 | 4 | 2A | | | 1A | 2 | C M |
| X | | | | | | | | | — 1 — | | | | | | | | | | X |
| X | | | | | | | | X | — 2 — | | | X | | | | | | | X |
| X | | | | | | | X | | — 3 — | | | | | | | | | X | X |
| X | | | | | | | X | X | — 4 — | | | X | | | | | | X | X |
| X | X | | | | | | | | — 5 — | | | | X | | | | | | X |
| X | X | | | | | | | X | — 6 — | | | X | X | | | | | | X |
| X | X | | | | | | X | | — 7 — | | | | X | | | | | X | X |
| X | X | | | | | | X | X | — 8 — | | | X | X | | | | | X | X |
| X | | | | | | X | | | — 9 — | | X | | | | | | | | X |
| X | | | | | | X | | X | — 10 — | | X | X | | | | | | | X |
| X | | | | | | X | X | | — 11 — | | | | | | | | X | | X |
| X | | | | | | X | X | X | — 12 — | | | X | | | | | X | | X |
| X | X | | | | | X | | | — 13 — | | | | | | | | X | X | X |
| X | X | | | | | X | | X | — 14 — | | | X | | | | | X | X | X |
| X | X | | | | | X | X | | — 15 — | | | | X | | | | X | | X |
| X | X | | | | | X | X | X | — 16 — | | | X | X | | | | X | | X |
| X | | X | | | | | | | — 17 — | | | | X | | | | X | X | X |
| X | | X | | | | | | X | — 18 — | | | X | X | | | | X | X | X |
| X | | X | | | | | X | | — 19 — | | X | | | | | | X | | X |
| X | | X | | | | | X | X | — 20 — | | X | X | | | | | X | | X |
| X | X | X | | | | | | | — 21 — | | | | | X | | | | | X |
| X | X | X | | | | | | X | — 22 — | | | X | | X | | | | | X |
| X | X | X | | | | | X | | — 23 — | | | | | X | | | | X | X |
| X | X | X | | | | | X | X | — 24 — | | | X | | X | | | | X | X |
| X | | X | | | | X | | | — 25 — | | | | X | X | | | | | X |
| X | | X | | | | X | | X | — 26 — | | | X | X | X | | | | | X |
| X | | X | | | | X | X | | — 27 — | | | | X | X | | | | X | X |
| X | | X | | | | X | X | X | — 28 — | | | X | X | X | | | | X | X |
| X | X | X | | | | X | | | — 29 — | | X | | | X | | | | | X |
| X | X | X | | | | X | | X | — 30 — | | X | X | | X | | | | | X |
| X | X | X | | | | X | X | | — 31 — | | | | | X | | | X | | X |
| X | X | X | | | | X | X | X | — 32 — | | | X | | X | | | X | | X |
| X | | | | | X | | | | — 33 — | | | | | X | | | X | X | X |
| X | | | | | X | | | X | — 34 — | | | X | | X | | | X | X | X |
| X | | | | | X | | X | | — 35 — | | | | X | X | | | X | | X |
| X | | | | | X | | X | X | — 36 — | | | X | X | X | | | X | | X |

* 8-4-2-1 = UNITS  1A = 10's  2A = 20's

[X] DENOTES CLOSED TO COMMON  ☐ DENOTES OPEN TO COMMON

NOTE: 7 Segment LED Driver available thru distribution upon special request.

# ROTARY SWITCHES

## CROSS REFERENCE

### TYPE AM ROTARY SWITCHES

| Oak Catalog Number Shorting | Oak Catalog Number Non-Shorting | Centralab Equivalent Shorting | Centralab Equivalent Non-Shorting | Old Oak Catalog Number Shorting | Old Oak Catalog Number Non-Shorting |
|---|---|---|---|---|---|
| 399279-AM | 399280-AM | PSA-200 | PSA-201 | 399216-A | 399217-A |
| 399281-AM | 399282-AM | PSA-202 | PSA-203 | 399222-A | 399223-A |
| 399283-AM | 399284-AM | PSA-204 | PSA-205 | 399218-A | 399219-A |
| 399260-AM | 399261-AM | PSA-206 | PSA-207 | — | — |
| 399285-AM | 399286-AM | PSA-208 | PSA-209 | 399220-A | 399221-A |
| 399289-AM | 399290-AM | PSA-246 | PSA-245 | 399234-A | 399235-A |
| 399287-AM | 399288-AM | PSA-210 | PSA-211 | 399224-A | 399225-A |
| 399262-AM | 399263-AM | PSA-214 | PSA-215 | — | — |
| 399264-AM | 399265-AM | PSA-220 | PSA-221 | — | — |
| 399291-AM | 399292-AM | PSA-222 | PSA-223 | 399226-A | 399227-A |
| 399293-AM | 399294-AM | PSA-248 | PSA-247 | 399236-A | 399237-A |
| 399266-AM | 399267-AM | PSA-228 | PSA-229 | — | — |
| 399268-AM | 399269-AM | PSA-230 | PSA-231 | — | — |
| 399270-AM | 399271-AM | PSA-238 | PSA-239 | — | — |
| 399272-AM | 399273-AM | PSA-250 | PSA-249 | 399240-A | 399241-A |

### TYPE AM SEPARATE ROTARY SWITCH SECTIONS

| Oak Catalog Number Shorting | Oak Catalog Number Non-Shorting | Centralab Equivalent Shorting | Centralab Equivalent Non-Shorting | Old Oak Catalog Number Shorting | Old Oak Catalog Number Non-Shorting |
|---|---|---|---|---|---|
| 399114-AM | 399174-AM | PS-50 | PS-51 | 399032-A | 399033-A |
| 399115-AM | 399175-AM | PS-52 | PS-53 | 399034-A | 399035-A |
| 399106-AM | 399107-AM | PS-54 | PS-55 | — | — |
| 399116-AM | 399176-AM | — | — | 399036-A | 399037-A |
| 399108-AM | 399109-AM | PS-56 | PS-57 | — | — |
| 399117-AM | — | — | — | 399058-A | — |
| 399118-AM | — | — | — | 399056-A | — |
| — | 399177-AM | — | — | — | 399059-A |
| — | 399178-AM | — | — | — | 399057-A |
| — | 399179-AM | — | — | — | — |
| — | 399259-AM | — | — | — | 399119-A |

### TYPE AM ROTARY SWITCHES WITH P.C. TERMINATIONS

| Oak Catalog Number Shorting | Oak Catalog Number Non-Shorting | Centralab Equivalent Shorting | Centralab Equivalent Non-Shorting |
|---|---|---|---|
| 399136-AM | 399137-AM | — | — |
| 399138-AM | 399139-AM | — | — |
| 399156-AM | 399157-AM | — | — |
| 399158-AM | 399159-AM | — | — |

### TYPES F AND FC ROTARY SWITCHES

| Oak Catalog Number Shorting | Oak Catalog Number Non-Shorting | Centralab Equivalent Shorting | Centralab Equivalent Non-Shorting |
|---|---|---|---|
| 399322-F | 399323-F | — | — |
| 399326-F | 399327-F | — | — |
| 399324-F | 399325-F | — | — |
| 399330-F | 399331-F | — | — |
| 399334-F | 399335-F | — | — |
| 399328-F | 399329-F | — | — |
| 399332-F | 399333-F | — | — |
| 399336-F | 399337-F | — | — |
| 399366-FC | 339367-FC | PA-6000 | PA-6001 |
| 399370-FC | 399371-FC | PA-6002 | PA-6003 |
| 399368-FC | 399369-FC | PA-6004 | PA-6005 |
| 399374-FC | 399375-FC | PA-6006 | PA-6007 |
| 399378-FC | 399379-FC | PA-6010 | PA-6011 |
| 399372-FC | 399373-FC | PA-6012 | PA-6013 |
| 399376-FC | 399377-FC | PA-6018 | PA-6019 |
| 399380-FC | 399381-FC | PA-6024 | PA-6025 |

### TYPE F ROTARY SWITCHES WITH P.C. TERMINATIONS

| Oak Catalog Number Shorting | Oak Catalog Number Non-Shorting | Centralab Equivalent Shorting | Centralab Equivalent Non-Shorting |
|---|---|---|---|
| 399300-F | 399301-F | — | — |
| 399302-F | 399303-F | — | — |
| 399304-F | 399305-F | — | — |
| 399306-F | 399307-F | — | — |

### TYPES F AND FC ROTARY SWITCHES WITH SILVER ALLOY

| Oak Catalog Number Shorting | Oak Catalog Number Non-Shorting | Centralab Equivalent Shorting | Centralab Equivalent Non-Shorting |
|---|---|---|---|
| 399338-F | 399339-F | — | — |
| 399382-FC | 399383-FC | — | — |

### TYPES F AND FC SEPARATE SECTIONS

| Oak Catalog Number Shorting | Oak Catalog Number Non-Shorting | Centralab Equivalent Shorting | Centralab Equivalent Non-Shorting |
|---|---|---|---|
| 399070-F | 399071-F | PA-60 | PA-61 |
| 399072-F | 399073-F | PA-62 | PA-63 |
| 399074-F | 399075-F | PA-64 | PA-65 |
| 399076-F | 399077-F | PA-66 | PA-67 |
| 399060-F | — | — | — |
| 399090-FC | 399091-FC | PA-80 | PA-81 |
| 399092-FC | 399093-FC | PA-82 | PA-83 |
| 399094-FC | 399095-FC | PA-84 | PA-85 |
| 399096-FC | 399097-FC | PA-86 | PA-87 |
| 399062-FC | — | — | — |

### TYPE F ROTARY SWITCH SECTIONS WITH P.C. TERMINATIONS

| Oak Catalog Number Shorting | Oak Catalog Number Non-Shorting | Centralab Equivalent Shorting | Centralab Equivalent Non-Shorting |
|---|---|---|---|
| 399340-F | 399341-F | — | — |
| 399342-F | 399343-F | — | — |
| 399344-F | 399345-F | — | — |
| 399346-F | 399347-F | — | — |

### TYPES H AND HC ROTARY SWITCHES

| Oak Catalog Number Shorting | Oak Catalog Number Non-Shorting | Centralab Equivalent Shorting | Centralab Equivalent Non-Shorting |
|---|---|---|---|
| 399512-H | 399513-H | 1402 | 1403 |
| 399514-H | 399515-H | 1412 | 1413 |
| 399518-H | 399519-H | 1404 | 1405 |
| 399516-H | 399617-H | 1422 | 1423 |
| 399524-H | 399525-H | 1408 | 1409 |
| 399528-H | 399529-H | 1428 | 1429 |
| 399520-H | 399521-H | 1414 | 1415 |
| 399526-H | 399527-H | 1416 | 1417 |
| 399522-H | 399523-H | 1424 | 1425 |
| 399562-HC | 399563-HC | 2502 | 2503 |
| 399574-HC | — | 2500 | — |
| 399564-HC | 399565-HC | 2512 | 2513 |
| 399568-HC | 399569-HC | 2504 | 2505 |
| 399566-HC | 399567-HC | 2522 | 2523 |
| 399570-HC | 399571-HC | 2514 | 2515 |
| 399572-HC | 399573-HC | 2524 | 2525 |

continued next page

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

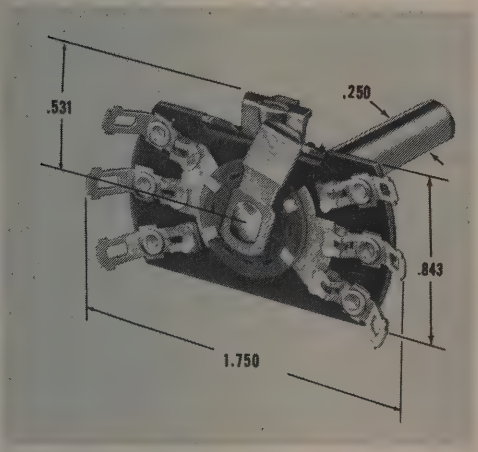
# CROSS REFERENCE

| Oak Catalog Number Shorting | Oak Catalog Number Non-Shorting | Centralab Equivalent Shorting | Centralab Equivalent Non-Shorting |
|---|---|---|---|
| **TYPE H ROTARY SWITCHES WITH P.C. TERMINATIONS** | | | |
| 399504-H | 399505-H | — | — |
| 399506-H | 399507-H | — | — |
| 399547-H | 399548-H | — | — |
| 399508-H | 399509-H | — | — |
| **TYPES K AND JC ROTARY SWITCHES** | | | |
| 399418-K | 399419-K | PA-1000 | PA-1001 |
| 399426-K | 399427-K | PA-1002 | PA-1003 |
| 399420-K | 399421-K | PA-1004 | PA-1005 |
| 399490-K | 399491-K | PA-1006 | PA-1007 |
| 399422-K | 399423-K | PA-1008 | PA-1009 |
| 399428-K | 399429-K | PA-1012 | PA-1013 |
| 399424-K | 399425-K | PA-1014 | PA-1015 |
| 399732-K | 399733-K | PA-1016 | PA-1017 |
| 399734-K | 399735-K | PA-1018 | PA-1019 |
| 399492-K | 399493-K | — | — |
| 399430-K | 399431-K | PA-1020 | PA-1021 |
| 399432-K | 399433-K | — | — |
| 399736-K | 399737-K | PA-1022 | PA-1023 |
| 399738-K | 399739-K | PA-1026 | PA-1027 |
| 399742-K | 399743-K | PA-1030 | PA-1031 |
| 399740-K | 399741-K | PA-1028 | PA-1029 |
| 399744-K | 399745-K | PA-1032 | PA-1033 |
| 399434-K | 399435-K | — | — |
| 399400-K | 399401-K | — | — |
| 399402-K | 399403-K | — | — |
| 399404-K | 399405-K | — | — |
| 399406-K | 399407-K | — | — |
| 399748-K | — | PA-1034 | — |
| 399746-K | — | PA-1040 | — |
| — | 399747-K | — | PA-1035 |
| — | 399749-K | — | PA-1037 |
| **TYPE K SEPARATE SWITCH SECTIONS** | | | |
| 399130-K | 399131-K | — | — |
| 399242-K | 399243-K | PA-30 | PA-31 |
| 399132-K | 399133-K | — | — |
| 399244-K | 399245-K | PA-32 | PA-33 |
| 399246-K | 399247-K | PA-34 | PA-35 |
| 399254-K | 399255-K | — | — |
| 399248-K | 399249-K | PA-36 | PA-37 |
| 399134-K | 399135-K | — | — |
| 399064-K | — | PA-40 | — |
| 399252-K | — | PA-49 | — |
| 399250-K | — | PA-43 | — |
| **TYPE K SEPARATE SECTIONS WITH P.C. TERMINATIONS** | | | |
| 399396-K | 399397-K | — | — |
| 399398-K | 399399-K | — | — |
| 399442-K | 399443-K | — | — |
| 399439-K | 399440-K | — | — |
| 399489-K | — | — | — |
| — | 399488-K | — | — |
| 399483-K | — | — | — |
| 399482-K | — | — | — |
| **TYPE JC SEPARATE SWITCH SECTIONS** | | | |
| 399150-JC | 399151-JC | PA-0 | PA-1 |
| 399152-JC | 399153-JC | PA-2 | PA-3 |

| Oak Catalog Number Shorting | Oak Catalog Number Non-Shorting | Centralab Equivalent Shorting | Centralab Equivalent Non-Shorting |
|---|---|---|---|
| **TYPE JC SEPARATE SWITCH SECTIONS (contd.)** | | | |
| 399444-JC | 399445-JC | PA-4 | PA-5 |
| 399446-JC | 399447-JC | PA-6 | PA-7 |
| 399154-JC | 399155-JC | PA-8 | PA-9 |
| 399066-JC | — | PA-11 | — |
| 399438-JC | — | PA-12 | — |
| 399436-JC | — | PA-13 | — |
| **TYPE JC ROTARY SWITCHES** | | | |
| 399468-JC | 399469-JC | PA-2000 | PA-2001 |
| 399476-JC | 399477-JC | PA-2002 | PA-2003 |
| 399470-JC | 399471-JC | PA-2004 | PA-2005 |
| 399704-JC | 399705-JC | PA-2006 | PA-2007 |
| 399472-JC | 399473-JC | PA-2008 | PA-2009 |
| 399478-JC | 399479-JC | PA-2010 | PA-2011 |
| 399474-JC | 399475-JC | PA-2012 | PA-2013 |
| 399484-JC | 399485-JC | PA-2018 | PA-2019 |
| 399696-JC | 399697-JC | PA-2020 | PA-2021 |
| 399480-JC | 399481-JC | PA-2022 | PA-2023 |
| 399706-JC | 399707-JC | PA-2026 | PA-2027 |
| 399708-JC | 399709-JC | PA-2028 | PA-2029 |
| 399710-JC | 399711-JC | PA-2030 | PA-2031 |
| 399712-JC | 399713-JC | PA-2032 | PA-2033 |
| 399486-JC | 399487-JC | — | — |
| 399698-JC | 399699-JC | — | — |
| 399714-JC | 399715-JC | PA-2036 | PA-2037 |
| 399716-JC | 399717-JC | PA-2038 | PA-2039 |
| 399718-JC | 399719-JC | PA-2040 | PA-2041 |
| 399722-JC | — | PA-2052 | — |
| 399720-JC | — | PA-2042 | — |
| — | 399729-JC | — | PA-2043 |
| — | 399731-JC | — | PA-2045 |
| **TYPES L AND MF ROTARY SWITCHES** | | | |
| 399621-L | 399622-L | PA-3000 | PA-3001 |
| 399806-L | 399807-L | — | — |
| 399623-L | 399624-L | PA-3002 | PA-3003 |
| 399625-L | 399648-L | PA-3004 | PA-3005 |
| 399649-L | 399616-L | PA-3006 | PA-3007 |
| 399684-MF | 399685-MF | PA-4000 | PA-4001 |
| 399830-MF | 399831-MF | — | — |
| 399686-MF | 399687-MF | PA-4002 | PA-4003 |
| 399688-MF | 399689-MF | PA-4004 | PA-4005 |
| 399690-MF | 399691-MF | PA-4006 | PA-4007 |
| **TYPES L AND MF SWITCHES WITH P.C. TERMINATIONS** | | | |
| 399818-L | 399819-L | — | — |
| 399826-L | 399827-L | — | — |
| 399824-MF | 399825-MF | — | — |
| 399846-MF | 399847-MF | — | — |
| **TYPES L AND MF SWITCH SECTIONS** | | | |
| 399185-L | 399186-L | — | PA-393 |
| 399145-MF | 399182-MF | — | PA-493 |
| **20 SERIES LIGHT DUTY ROTARY SWITCHES** | | | |
| 399190-23 | — | 1460 | — |
| 399192-27 | — | 1461 | — |
| 399194-22 | — | 1462 | — |
| — | 399197-22 | — | 1463 |
| 399198-28 | — | 1486 | — |
| 399196-29 | 399135-29 | — | — |
| 399188-28 | 399189-28 | — | — |

# ROTARY SWITCHES

## SERIES 20 LIGHT DUTY ROTARY SWITCHES

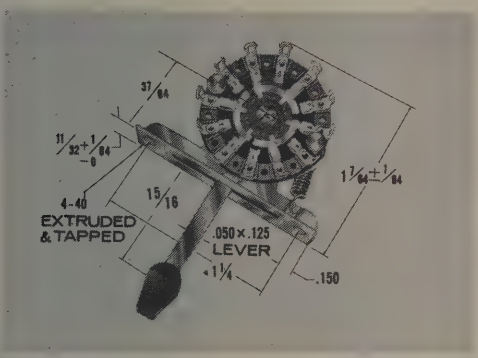



Economy rotary switches are ideal for all light duty requirements, in radio-phonos, meters, speakers, for stereo channel reversing, etc. Phenolic insulation per LP-513 Grade PBE-P for stator and rotor. Silver plated brass contacts with additional gold plating of 15 millionths, double-wiping and self-cleaning. Rated 1 amp at 28 volts or 0.5 amp at 110 volts AC; carry 5 amps. Size: 1.750″ wide x .843″ high. Shaft is 2⅜″ long, grooved for break-off at ¾″, 1⅛″ and 1⅞″. Positive or spring return indexing.

| Total Poles | Active Positions | No. of Sections | Indexing-Note | Insulation | Catalog Number | |
|---|---|---|---|---|---|---|
| | | | | | Shorting | Non-Shorting |
| 1 | 2 | 1 | Positive | Phenolic | 399190-23 | — |
| 1 | 3 | 1 | Positive | Phenolic | 399192-27 | — |
| 2 | 2 | 1 | Positive | Phenolic | 399194-22 | — |
| 2 | 2 | 1 | Spring Return* | Phenolic | — | 399197-22 |
| 2 | 3 | 1 | Positive | Phenolic | 399198-28 | — |
| 1 | 4 | 1 | Positive | Phenolic | 399196-29 | 399195-29 |
| 2 | 3 | 1 | Spring Return† | Phenolic | 399188-28 | 399189-28 |

* Positive 2 to 1 † To Center

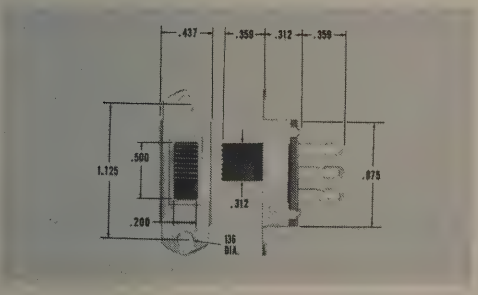
## TYPE 184 LEVER SWITCHES




Rugged switch with molded stator for extra strength. Easily adaptable to miniaturized circuitry. Long-life construction with double-wiping contacts of silver plated brass, with additional 15 millionths gold plating. Rated .5 amp at 28 volts DC or 0.25 amp at 110 volts AC, resistive; carries 5 amps. Stator insulation is diallyl phthalate per MIL-M-14. Positive indexing. Rotor is Celcon, (acetal copolymer). Size: 1⅞₄″ deep behind panel; 1¼″ mounting centers. Supplied with knob.

| Total Poles | Active Positions | Insulation | Catalog Number | |
|---|---|---|---|---|
| | | | Shorting | Non-Shorting |
| 5 | 3 | Diallyl Phthalate | 399162-184 | 399163-184 |
| 6 | 2 | Diallyl Phthalate | 399164-184 | 399165-184 |

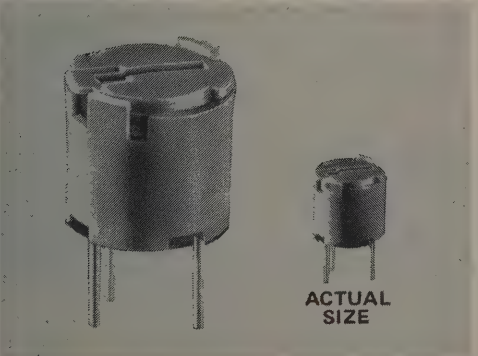
## SERIES 200 SLIDE SWITCHES




Compact design, 30% narrower than ordinary slide switches. Gold plated, double-wiping contacts are self-cleaning. Recommended limit of operation, 3 amps at 125 volts AC. Phenolic insulation per LP-513 Grade PBE-P. Size: .671″ deep behind panel; 1.125″ mounting centers. Non-shorting.

| Contact Arrangement | Poles | No. of Contacts | Insulation | Catalog No. Non-Shorting |
|---|---|---|---|---|
| SPST | 1 | 2 | Phenolic | 399275-275 |
| DPST | 2 | 4 | Phenolic | 399276-276 |
| SPDT | 1 | 3 | Phenolic | 399277-277 |
| DPDT | 2 | 6 | Phenolic | 399278-278 |

## 399799-TS TRIM SWITCH



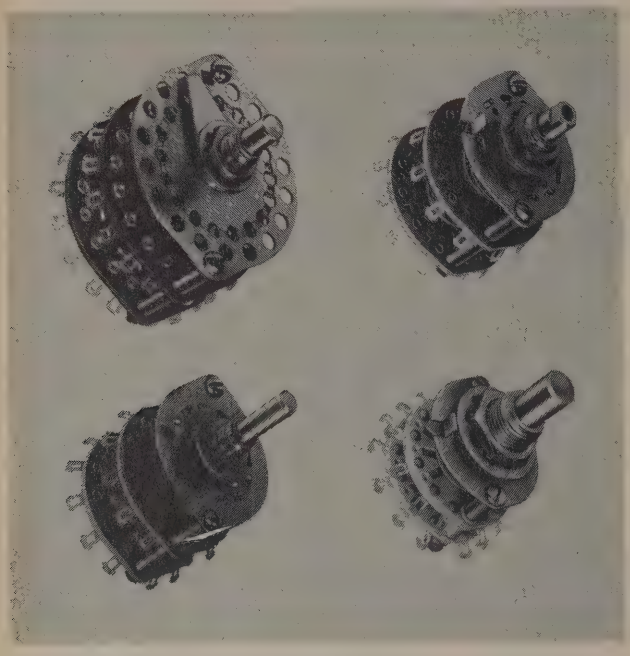

The miniature Trim Switch provides needed electrical switching capability in an equipment area that is physically inaccessible to operators' fingers. For such applications, Oak's TRIM SWITCH is simply inserted and soldered into the PC board and is actuated by a 90° turn of a screwdriver.

**SPECIFICATIONS:** Measures .359″ high by .375″ in diameter. Rated 100 volts DC, 100 milliamps resistive load. Contacts are formed of copper base, gold-plated alloy and have make-before-break action with minimum applied throw pressure. Switch body and rotor are glass-filled polyamide. Switch leads are .025″ diameter and 1⅞₄″ long. Single pole, double throw (SPDT).

**LIFE:** Rated for 25,000 operations or 12,500 cycles.

**OAK Industries Inc.**
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# MODULINE™ ROTARY SWITCHES



This basic table gives a general description of MODULINE Distributor Switches. They total more than 2 million choices! You'll find the selection far more comprehensive than offered by any stock-switch system. So, if you frequently require circuits of new configuration . . . if you would benefit from greater flexibility of selection . . . or if delivery time is vital . . . your situation is **ideal** for profiting from our MODULINE Distributor Switches.

| SIZE | Maximum Number of Positions and "Throw" in Degrees | | | | | Stator Insulation | | | Oak Basic Style Designation |
|---|---|---|---|---|---|---|---|---|---|
| Diameter Over Terminals | 8 45° | 10 36° | 12 30° | 18 20° | 24 15° | Phenolic | Ceramic | Silicone Glass | |
| | | | X | | | | | X | A 01 |
| 1 1/16 | | X | | | | | | X | BA 02 |
| | X | | | | | | | X | AA 03 |
| 1 3/8 | | | X | | | X | | | F 04 |
| | | | X | | | | X | | FC 04 |
| 1 1/16 | | | X | | | | X | | JC 05 |
| | | | X | | | X | | | K 05 |
| 1 7/8 | | | X | | | X | | | H 06 |
| | | | X | | | | X | | HC 06 |
| 2 5/16 | | | | X | | X | | | L 07 |
| 2 5/16 | | | | | X | X | | | MF 08 |

**IN CERTAIN CRITICAL AUDIO AND INSTRUMENT APPLICATIONS . . .**
A requirement for make before break is imperative. Oak switches as well as other brands may not provide positive shorting across the clips adjacent to the strut screws. In these instances, use of these stock switches is not recommended. A specially designed switch should be used.

## FAST, EASY SWITCH SPECIFYING

NO DRAWINGS NECESSARY . . .
YOU ORDER/DESIGN SWITCHES BY NUMBER

Years in realization, this revolutionary ordering system now makes it possible for you to specify rotary switches of superior quality, and have your order for lots of 1 to 99 shipped within 3 days. You'll find sizes to suit every purpose — construction and insulating material for every kind of environment.

Deliveries are faster because MODULINE eliminates time-consuming drafting, and makes possible automatic processing of orders. Drawings are unnecessary. The part numbering system below is all the factory formprint it takes.

Every model of MODULINE switches has already been shock, vibration, torque and life-tested to meet military requirements; quality control levels are equal in every way to custom-made switches. In fact MODULINE switches are indistinguishable in appearance and performance from custom-fabricated types. You get what you want, exactly the way you want it — with record speed.

All you need do is begin encoding the switch you want, following the simple steps.

## GENERAL SPECIFICATIONS

**MILITARY SPECIFICATIONS** — All MODULINE switches are designed in accordance with military specifications. We maintain continuous testing, in approved laboratories, for shock, vibration, torque, life, humidity, altitude, salt spray and numerous other parameters. Highest quality is maintained.

**FINISHES** — 50-hour salt spray: steel and brass parts are cadmium-plated and chromate-dipped.

**INSULATING MATERIALS**

Phenolic — The finest grade paper-base phenolic, per MIL-P-3115, type PBE-P.

Ceramic — Steatite, per MIL-I-10A, Grade L422 or better; impregnated with Dow Corning DC-200.

Silicone glass — per MIL-P-997, type GSG. Rotor insulators are Kel-F.

**CONTACTS** — Make before break (Shorting) or break before make (Non-shorting) as specified.

Type 1 — Silver-plated brass — .0001" minimum plating assures silver-to-silver contact for a minimum of 15,000 operations. Gold-plated 30 millionths inch for tarnish retardation per military specifications.

Type 2 — Silver alloy — Assures silver-to-silver contact in excess of 200,000 operations. Gold-plated 30 millionths inch for tarnish retardation per military specifications. Usable up to 100°C.

Clips — High-pressure, double-wiping, self-cleaning, long-life design.

Contact resistance — Essentially constant; in the order of .003 to .015 ohms, depending on switch type and clip/blade configuration. This measurement includes the resistance of the two contacts and the metal parts. In Oak switches, contact resistance is essentially uniform throughout the life of the switch.

**ELECTRICAL** — Break 1 amp at 28 volts DC, 0.5 amp at 110 volts AC. Carry 5 amps. These are conservative ratings. MODULINE switches are superior or equivalent to all existing switches of comparable published ratings.

**TEMPERATURE RANGE** — from −65°C to +85°C (normal Military).

**DETENTS** — Ball type; hill-and-valley.

**STOPS** — Detents may be had with a fixed counter-clockwise stop and an adjustable clockwise stop; or for continuous rotation with no stops. Adjustable stops are set by Oak at positions designated on order.

**HARDWARE** — Mounting nuts and lockwashers are supplied. Knobs not included.

**PACKAGING** — Individually packaged, unless Bulk Commercial is specified.

**PART NUMBER STAMPING** — In instances where part number identification is required, an imprinted metal tag (consistent with military specifications governing environment tests) will be permanently secured to upper strut screw at front plate. Any combination of letters, digits and blank spaces totaling 17 can be supplied.

## PART NUMBERING SYSTEM — EXAMPLE

| STEP 1 | STEP 2 | STEP 3 | STEP 4 | STEP 5 | STEP 6 | STEP 7 | STEP 8 | STEP 9 |
|---|---|---|---|---|---|---|---|---|
| 0 4 | 0 0 7 | 0 9 | 1 2 | 3 | 1 3 | 1 | 5 1 1 | A |
| BASIC SIZE AND DETENT ANGLE | SECTIONS, CONTACTS AND SWITCHING CONFIGURATIONS | ROTATIONAL STOPS | FRONT SHAFT LENGTH | FRONT SHAFT DETAIL | FRONT SHAFT ANGLE | BUSHINGS AND KEYS | LOCATIONS OF SECTIONS, SHIELDS, MARKER PLATE; AND REAR-SHAFT LENGTH | U.S. SPECS |

# ROTARY SWITCHES

## MODULINE™ SERIES/PART NUMBERING SYSTEM CONTINUED

### STEP 1 / BASIC SIZE AND DETENT ANGLE

STEP 1

| 0 | 4 |
|---|---|

From NUMBER column below, select numerical code for the basic switch you want. (Refer to part numbering system for interpretation of style letters.)

| Number | | |
|---|---|---|
| 01 | * | 30° detent — 12 positions (Style A; silicone glass). Select contacts and switching configurations from Step 2 for this switch 065 to 084; 501 & 502; 803 |
| 02 | ■ | 36° detent — 10 positions (Style BA; silicone glass). Select contacts and switching configurations from Step 2 for this switch 049 to 056; 802 |
| 03 | • | 45° detent — 8 positions (Style AA; silicone glass). Select contacts and switching configurations from Step 2 for this switch 041 to 048; 801 |
| 04 | † | 30° detent — 12 positions (Style F; phenolic) (Style FC; ceramic). Select contacts and switching configurations from Step 2 for this switch 001 to 040; 503 to 506; 804 & 805 |
| 05 | † | 30° detent — 12 positions (Style K; phenolic) (Style JC; ceramic). Select contacts and switching configurations from Step 2 for this switch 001 to 040; 503 to 506; 804 & 805 |
| 06 | † | 30° detent — 12 positions (Style H; phenolic) (Style HC; ceramic). Select contacts and switching configurations from Step 2 for this switch 001 to 040; 503 to 506; 804 & 805 |
| 07 | ♦ | 20° detent — 18 positions (Style L; phenolic). Select contacts and switching configurations from Step 2 for this switch 057 to 060; 507 & 508; 806 |
| 08 | ‡ | 15° detent — 24 positions (Style MF; phenolic). Select contacts and switching configurations from Step 2 for this switch 061 to 064; 509 & 510; 807 |

### STEP 2 / SECTIONS, CONTACTS AND SWITCHING CONFIGURATIONS

STEP 2

| 0 | 0 | 7 |
|---|---|---|

**Refer to Column No. 1 for Section Material used for the type of Switch you want. Matching symbols in Columns I and II will assist you in making your number selection quickly and accurately.**

From NUMBER column below, select numerical code for the combination of section material, contacts, and the switching configuration you want.

| | Number | Section | Contacts | Shorting or Non-Shorting | No. of Poles and Positions |
|---|---|---|---|---|---|
| | 000 | no stator | — | — | — |
| † | 001 | phenolic | brass | Sh | 1P12P |
| † | 002 | phenolic | brass | Sh | 1P11P |
| † | 003 | phenolic | brass | Sh | 2P6P |
| † | 004 | phenolic | brass | Sh | 4P2P |
| † | 005 | phenolic | brass | Sh | 3P3P |
| † | 006 | phenolic | brass | NS | 1P12P |
| † | 007 | phenolic | brass | NS | 1P11P |
| † | 008 | phenolic | brass | NS | 2P6P |
| † | 009 | phenolic | brass | NS | 4P2P |
| † | 010 | phenolic | brass | NS | 3P3P |
| † | 011 | phenolic | silver | Sh | 1P12P |
| † | 012 | phenolic | silver | Sh | 1P11P |
| † | 013 | phenolic | silver | Sh | 2P6P |
| † | 014 | phenolic | silver | Sh | 4P2P |
| † | 015 | phenolic | silver | Sh | 3P3P |
| † | 016 | phenolic | silver | NS | 1P12P |
| † | 017 | phenolic | silver | NS | 1P11P |
| † | 018 | phenolic | silver | NS | 2P6P |
| † | 019 | phenolic | silver | NS | 4P2P |
| † | 020 | phenolic | silver | NS | 3P3P |
| † | 021 | ceramic | brass | Sh | 1P12P |
| † | 022 | ceramic | brass | Sh | 1P11P |
| † | 023 | ceramic | brass | Sh | 2P6P |
| † | 024 | ceramic | brass | Sh | 4P2P |
| † | 025 | ceramic | brass | Sh | 3P3P |
| † | 026 | ceramic | brass | NS | 1P12P |
| † | 027 | ceramic | brass | NS | 1P11P |
| † | 028 | ceramic | brass | NS | 2P6P |
| † | 029 | ceramic | brass | NS | 4P2P |
| † | 030 | ceramic | brass | NS | 3P3P |
| † | 031 | ceramic | silver | Sh | 1P12P |
| † | 032 | ceramic | silver | Sh | 1P11P |
| † | 033 | ceramic | silver | Sh | 2P6P |
| † | 034 | ceramic | silver | Sh | 4P2P |
| † | 035 | ceramic | silver | Sh | 3P3P |
| † | 036 | ceramic | silver | NS | 1P12P |
| † | 037 | ceramic | silver | NS | 1P11P |
| † | 038 | ceramic | silver | NS | 2P6P |
| † | 039 | ceramic | silver | NS | 4P2P |
| † | 040 | ceramic | silver | NS | 3P3P |
| • | 041 | silicone | brass | Sh | 1P8P |
| • | 042 | silicone | brass | Sh | 2P4P |
| • | 043 | silicone | brass | NS | 1P8P |
| • | 044 | silicone | brass | NS | 2P4P |
| • | 045 | silicone | silver | Sh | 1P8P |
| • | 046 | silicone | silver | Sh | 2P4P |
| • | 047 | silicone | silver | NS | 1P8P |
| • | 048 | silicone | silver | NS | 2P4P |
| ■ | 049 | silicone | brass | Sh | 1P10P |
| ■ | 050 | silicone | brass | Sh | 2P5P |
| ■ | 051 | silicone | brass | NS | 1P10P |
| ■ | 052 | silicone | brass | NS | 2P5P |
| ■ | 053 | silicone | silver | Sh | 1P10P |
| ■ | 054 | silicone | silver | Sh | 2P5P |
| ■ | 055 | silicone | silver | NS | 1P10P |
| ■ | 056 | silicone | silver | NS | 2P5P |
| ♦ | 057 | phenolic | brass | Sh | 1P18P |
| ♦ | 058 | phenolic | brass | NS | 1P18P |
| ♦ | 059 | phenolic | silver | Sh | 1P18P |
| ♦ | 060 | phenolic | silver | NS | 1P18P |
| ‡ | 061 | phenolic | brass | Sh | 1P24P |
| ‡ | 062 | phenolic | brass | NS | 1P24P |
| ‡ | 063 | phenolic | silver | Sh | 1P24P |
| ‡ | 064 | phenolic | silver | NS | 1P24P |
| * | 065 | silicone | brass | Sh | 1P12P |
| * | 066 | silicone | brass | Sh | 1P11P |
| * | 067 | silicone | brass | Sh | 2P6P |
| * | 068 | silicone | brass | Sh | 4P2P |
| * | 069 | silicone | brass | Sh | 3P3P |
| * | 070 | silicone | brass | NS | 1P12P |
| * | 071 | silicone | brass | NS | 1P11P |
| * | 072 | silicone | brass | NS | 2P6P |
| * | 073 | silicone | brass | NS | 4P2P |
| * | 074 | silicone | brass | NS | 3P3P |
| * | 075 | silicone | silver | Sh | 1P12P |
| * | 076 | silicone | silver | Sh | 1P11P |
| * | 077 | silicone | silver | Sh | 2P6P |
| * | 078 | silicone | silver | Sh | 4P2P |
| * | 079 | silicone | silver | Sh | 3P3P |
| * | 080 | silicone | silver | NS | 1P12P |
| * | 081 | silicone | silver | NS | 1P11P |
| * | 082 | silicone | silver | NS | 2P6P |
| * | 083 | silicone | silver | NS | 4P2P |
| * | 084 | silicone | silver | NS | 3P3P |
| * | 501 | silicone | silver | Sh | 12 pos.; notched |
| * | 502 | silicone | silver | NS | 12 pos.; notched |
| † | 503 | ceramic | silver | Sh | 12 pos.; notched |
| † | 504 | ceramic | silver | NS | 12 pos.; notched |
| † | 505 | phenolic | silver | Sh | 12 pos.; notched |
| † | 506 | phenolic | silver | NS | 12 pos.; notched |
| ♦ | 507 | phenolic | silver | Sh | 18 pos.; notched |
| ♦ | 508 | phenolic | silver | NS | 18 pos.; notched |
| ‡ | 509 | phenolic | silver | NS | 24 pos.; notched |
| ‡ | 510 | phenolic | silver | Sh | 24 pos.; notched |
| • | 801 | silicone | brass | — | 8 dummy lugs |
| ■ | 802 | silicone | brass | — | 10 dummy lugs |
| * | 803 | silicone | brass | — | 12 dummy lugs |
| † | 804 | ceramic | brass | — | 12 dummy lugs |
| † | 805 | phenolic | brass | — | 12 dummy lugs |
| ♦ | 806 | phenolic | brass | — | 18 dummy lugs |
| ‡ | 807 | phenolic | brass | — | 24 dummy lugs |
| | 999 | each stator different in circuitry | | | |

**NOTE: Sh** = Make before break. **NS** = break before make.

### STEP 3 / ROTATIONAL STOPS

STEP 3

| 0 | 9 |
|---|---|

From NUMBER column below, select numerical code for desired total switch positions (not to exceed allowable maximum for each particular model). Stops will be set accordingly by Oak: clockwise stop is rotatable for repositioning by user any time. Continuous rotation switches **cannot** have stops added later. Unused contacts remaining on stators can be ignored; or used as handy tie points.

The number of positions selected in Step 3 must agree with the positions selected in Step 2. Example: 1P12P from Step 2, requires that you select no more than 12 positions (number 12 from Step 3.) You can select fewer positions, but **not** more positions.

| Number | Total Positions Requested |
|---|---|
| 00 | continuous rotation |
| 02 | 2 positions |
| 03 | 3 positions |
| 04 | 4 positions |
| 05 | 5 positions |
| 06 | 6 positions |
| 07 | 7 positions |
| 08 | 8 positions |
| 09 | 9 positions |
| 10 | 10 positions |
| 11 | 11 positions |
| 12 | 12 positions |
| 13 | 13 positions |
| 14 | 14 positions |
| 15 | 15 positions |
| 16 | 16 positions |
| 17 | 17 positions |
| 18 | 18 positions |
| 19 | 19 positions |
| 20 | 20 positions |
| 21 | 21 positions |
| 22 | 22 positions |
| 23 | 23 positions |
| 24 | 24 positions |

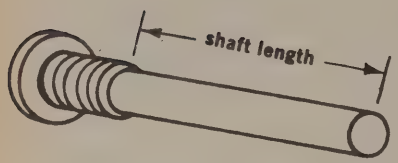
continued next page

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

## STEP 4 / FRONT SHAFT LENGTH

STEP 4

1 | 2




For NUMBER column at right, select numerical code for the desired front shaft length. (Shafts are measured from free end to threaded bushing, as shown.

| Inches 1/4" dia. Shaft | | |
|---|---|---|
| Number | Front Shaft Length | Flat Length (A, Step 5) If Used |
| 00 | NO SHAFT * | — |
| 01 | 3/16"† | — |
| 02 | 1/32"† | — |
| 03 | 5/16" | 3/16" |
| 04 | 1 1/32" | 3/16" |
| 05 | 3/8" | 1/4" |
| 06 | 1 3/32" | 1/4" |
| 07 | 7/16" | 5/16" |
| 08 | 1 5/32" | 5/16" |
| 09 | 1/2" | 3/8" |
| 10 | 1 7/32" | 3/8" |
| 11 | 9/16" | 7/16" |
| 12 | 1 9/32" | 7/16" |

| Inches 1/4" dia. Shaft | | |
|---|---|---|
| Number | Front Shaft Length | Flat Length (A, Step 5) If Used |
| 13 | 5/8" | 1/2" |
| 14 | 2 1/32" | 1/2" |
| 15 | 1 1/16" | 1/2" |
| 16 | 2 3/32" | 1/2" |
| 17 | 3/4" | 1/2" |
| 18 | 25/32" | 1/2" |
| 19 | 1" | 1/2" |
| 20 | 1 1/32" | 1/2" |
| 21 | 1 1/2" | 1/2" |
| 22 | 1 17/32" | 1/2" |
| 23 | 2" | 1/2" |
| 24 | 2 1/32" | 1/2" |

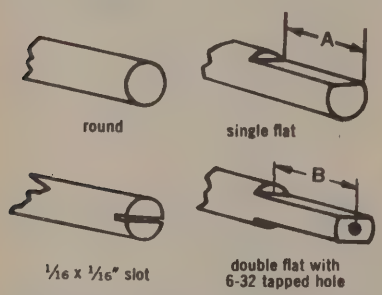
* Omission of front shaft on item No. 00 will leave only 3/32" extension in front of the bushing — sufficient for the retaining ring. A broached hole is left exposed in the detent assembly shaft to permit switch operation only by authorized personnel.

† Slotted shaft only.

## STEP 5 / FRONT SHAFT DETAIL

STEP 5

3




From NUMBER column, select coded designation for desired shaft-end detail.

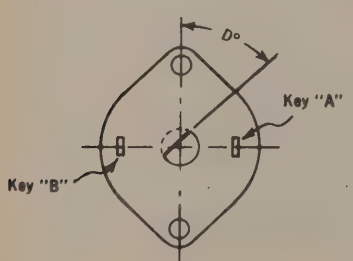
| Number | Shaft End |
|---|---|
| 0 | No Shaft |
| 1 | round<br>Round shaft is not available in 3/16" & 1/32" lengths |
| 2 | Screwdriver Slot .062" x .062"<br>Available only on 3/16" & 1/32" lengths |
| 3 | .218" Single Flat |
| 4 | .187" Single Flat |
| 5 | .156" Single Flat<br>Dim. A — see flat column in Step 4. |
| 6 | .187" Military Double Flat<br>Available only on following shaft lengths |

| Length | Dim. B |
|---|---|
| 5/16" | .187" |
| 3/8" | .250" |
| 7/16" | .312" |

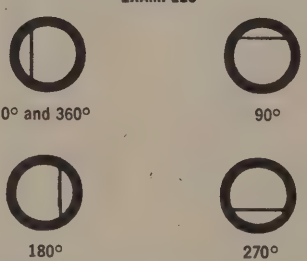
## STEP 6 / FRONT SHAFT ANGLE

STEP 6

1 | 3




EXAMPLES



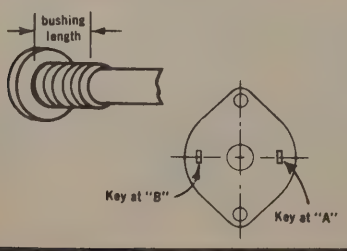

From NUMBER column, select coded designation for front shaft angle. (Switch is always viewed from front with strut screws aligned vertically.)

| Number | Angle "D" | Number | Angle "D" |
|---|---|---|---|
| 00 | No Flat | 13 | 180° |
| 01 | 0° (and 360°) | 14 | 195° |
| 02 | 15° | 15 | 210° |
| 03 | 30° | 16 | 225° |
| 04 | 45° | 17 | 240° |
| 05 | 60° | 18 | 255° |
| 06 | 75° | 19 | 270° |
| 07 | 90° | 20 | 285° |
| 08 | 105° | 21 | 300° |
| 09 | 120° | 22 | 315° |
| 10 | 135° | 23 | 330° |
| 11 | 150° | 24 | 345° |
| 12 | 165° | | |

## STEP 7 / BUSHING AND KEYS

STEP 7

1




From NUMBER column, select designation that encodes the desired bushing size and key location.

| Number | Bushing Size & Key Location |
|---|---|
| 0 | No bushing; no key |
| 1 | 3/8" bushing; key at A |
| 2 | 3/8" bushing; key at B |
| 3 | 3/8" bushing; no key |
| 4 | 1/4" bushing; key at A |
| 5 | 1/4" bushing; key at B |
| 6 | 1/4" bushing; no key |

All switches supplied with mounting nut and washer.

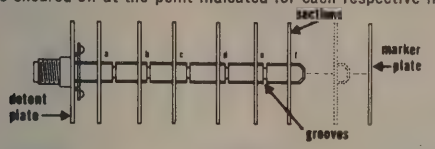
# MODULINE™ SERIES/PART NUMBERING SYSTEM CONTINUED

## STEP 8 / LOCATIONS OF SECTIONS, SHIELDS, MARKER PLATE; AND REAR-SHAFT LENGTH

From NUMBER columns, select the designation that correctly encodes desired assembly of switch parts: that is, the location of each section . . . position of shields (if any) between stators . . . terminus of rear shaft . . . and whether to include marker plate at back of switch.
**Letters a, b, c, d, e and f** convey the position of each section, relative to the diagram below.
**Letter "S" combined with small letter** (Sb, for example) indicates presence of a shield (normally situated only **between** sections) and its location relative to diagram below.
**Letters MP** signify presence of a marker plate.
**Shafts will be sheared off** at rear of switch, at groove immediately following the last-in-order of switch sections — except for those in the 900 series, which will be sheared off at the point indicated for each respective listing.

STEP 8

| 5 | 1 | 1 |
|---|---|---|




| Basic Switch Style | Dimension (inches) From Detent Plate to Grooves | | | | | |
|---|---|---|---|---|---|---|
| | a | b | c | d | e | f |
| A, 01; BA, 02; AA, 03 | 25/64 | 49/64 | 1 9/64 | 1 33/64 | 1 57/64 | 2 17/64 |
| F, 04; FC, 04 | 9/16 | 1 1/8 | 1 11/16 | 2 1/4 | 2 13/16 | 3 3/8 |
| K, 05; JC, 05 | 21/32 | 1 7/32 | 1 25/32 | 2 11/32 | 2 29/32 | 3 15/32 |
| H, 06; HC, 06 | 11/16 | 1 5/16 | 1 15/16 | 2 9/16 | 3 3/16 | 3 13/16 |
| L, 07; MF, 08 | 37/64 | 1 3/32 | 1 39/64 | 2 1/8 | 2 41/64 | 3 5/32 |

| Number | Assembly Description |
|---|---|
| 000 | No detent at all |
| **SHAFT BROKEN AT "a"** | |
| 100 | Detent only |
| 101 | a |
| 151 | a MP |
| **SHAFT BROKEN AT "b"** | |
| 200 | Detent only |
| 201 | — b |
| 202 | a b |
| 251 | — b MP |
| 252 | a b MP |
| **SHAFT BROKEN AT "c"** | |
| 300 | Detent only |
| 301 | — — c |
| 302 | a — c |
| 303 | — b c |
| 304 | a Sb c |
| 305 | a b c |
| 351 | — — c MP |
| 352 | a — c MP |
| 353 | — b c MP |
| 354 | a Sb c MP |
| 355 | a b c MP |
| **SHAFT BROKEN AT "d"** | |
| 400 | Detent only |
| 401 | — — — d |
| 402 | a — — d |
| 403 | — b — d |
| 404 | — — c d |
| 405 | a Sb — d |
| 406 | a — Sc d |
| 407 | — b Sc d |
| 408 | a b — d |
| 409 | a — c d |
| 410 | — b c d |
| 411 | a Sb c d |
| 412 | a b Sc d |
| 413 | a b c d |
| 451 | — — — d MP |
| 452 | a — — d MP |
| 453 | — b — d MP |
| 454 | — — c d MP |
| 455 | a Sb — d MP |
| 456 | a — Sc d MP |
| 457 | — b Sc d MP |
| 458 | a b — d MP |
| 459 | a — c d MP |
| 460 | — b c d MP |
| 461 | a Sb c d MP |
| 462 | a b Sc d MP |
| 463 | a b c d MP |

| Number | Assembly Description |
|---|---|
| **SHAFT BROKEN AT "e"** | |
| 500 | Detent only |
| 501 | — — — — e |
| 502 | a — — — e |
| 503 | — b — — e |
| 504 | — — c — e |
| 505 | — — — d — e |
| 506 | a Sb — — e |
| 507 | a — Sc — e |
| 508 | a — — Sd e |
| 509 | — b Sc — e |
| 510 | — b — Sd e |
| 511 | — — c Sd e |
| 512 | a b — — e |
| 513 | a — c — e |
| 514 | a — — d e |
| 515 | — b c — e |
| 516 | — b — d e |
| 517 | — — c d e |
| 518 | a Sb c — e |
| 519 | a Sb — d e |
| 520 | a — Sc d e |
| 521 | — b Sc d e |
| 522 | a b Sc — e |
| 523 | a b — Sd e |
| 524 | a — c Sd e |
| 525 | — b c Sd e |
| 526 | a Sb c Sd e |
| 527 | a b c — e |
| 528 | a b — d e |
| 529 | a — c d e |
| 530 | — b c d e |
| 531 | a Sb c d e |
| 532 | a b Sc d e |
| 533 | a b c Sd e |
| 534 | a b c d e |
| 551 | — — — — e MP |
| 552 | a — — — e MP |
| 553 | — b — — e MP |
| 554 | — — c — e MP |
| 555 | — — — d e MP |
| 556 | a Sb — — e MP |
| 557 | a — Sc — e MP |
| 558 | a — — Sd e MP |
| 559 | — b Sc — e MP |
| 560 | — b — Sd e MP |
| 561 | — — c Sd e MP |
| 562 | a b — — e MP |
| 563 | a — c — e MP |
| 564 | a — — d e MP |
| 565 | — b c — e MP |
| 566 | — b — d e MP |
| 567 | — — c d e MP |
| 568 | a Sb c — e MP |
| 569 | a Sb — d e MP |
| 570 | a — Sc d e MP |
| 571 | — b Sc d e MP |
| 572 | a b Sc — e MP |
| 573 | a b — Sd e MP |
| 574 | a — c Sd e MP |
| 575 | — b c Sd e MP |
| 576 | a Sb c Sd e MP |
| 577 | a b c — e MP |
| 578 | a b — d e MP |
| 579 | a — c d e MP |
| 580 | — b c d e MP |
| 581 | a Sb c d e MP |
| 582 | a b Sc d e MP |
| 583 | a b c Sd e MP |
| 584 | a b c d e MP |

| Number | Assembly Description |
|---|---|
| **SHAFT FULL LENGTH** | |
| 600 | Detent only |
| 601 | — — — — — f |
| 602 | a — — — — f |
| 603 | — b — — — f |
| 604 | — — c — — f |
| 605 | — — — d — f |
| 606 | — — — — e f |
| 607 | a b — — — f |
| 608 | a — c — — f |
| 609 | a — — d — f |
| 610 | a — — — e f |
| 611 | — b c — — f |
| 612 | — b — d — f |
| 613 | — b — — e f |
| 614 | — — c d — f |
| 615 | — — c — e f |
| 616 | — — — d e f |
| 617 | a b c — — f |
| 618 | a b — d — f |
| 619 | a b — — e f |
| 620 | a — c d — f |
| 621 | a — c — e f |
| 622 | a — — d e f |
| 623 | — b c d — f |
| 624 | — b c — e f |
| 625 | — b — d e f |
| 626 | — — c d e f |
| 627 | a b c d — f |
| 628 | a b c — e f |
| 629 | a b — d e f |
| 630 | a — c d e f |
| 631 | — b c d e f |
| 632 | a b c d e f |
| 651 | — — — — — f MP |
| 652 | a — — — — f MP |
| 653 | — b — — — f MP |
| 654 | — — c — — f MP |
| 655 | — — — d — f MP |
| 656 | — — — — e f MP |
| 657 | a b — — — f MP |
| 658 | a — c — — f MP |
| 659 | a — — d — f MP |
| 660 | a — — — e f MP |
| 661 | — b c — — f MP |
| 662 | — b — d — f MP |
| 663 | — b — — e f MP |
| 664 | — — c d — f MP |
| 665 | — — c — e f MP |
| 666 | — — — d e f MP |
| 667 | a b c — — f MP |
| 668 | a b — d — f MP |
| 669 | a b — — e f MP |
| 670 | a — c d — f MP |
| 671 | a — c — e f MP |
| 672 | a — — d e f MP |
| 673 | — b c d — f MP |
| 674 | — b c — e f MP |
| 675 | — b — d e f MP |
| 676 | — — c d e f MP |
| 677 | a b c d — f MP |
| 678 | a b c — e f MP |
| 679 | a b — d e f MP |
| 680 | a — c d e f MP |
| 681 | — b c d e f MP |
| 682 | a b c d e f MP |

| Number | Assembly Description |
|---|---|
| **SHAFT FULL LENGTH (WITH SHIELDS; NO MARKER PLATES)** | |
| 701 | a Sb — — — f MP |
| 702 | a — Sc — — f MP |
| 703 | a — — Sd — f MP |
| 704 | a — — — Se f MP |
| 705 | — b Sc — — f MP |
| 706 | — b — Sd — f MP |
| 707 | — b — — Se f MP |
| 708 | — — c Sd — f MP |
| 709 | — — c — Se f MP |
| 710 | — — — d Se f MP |
| 711 | a b Sc — — f MP |
| 712 | a b — Sd — f MP |
| 713 | a b — — Se f MP |
| 714 | a — c Sd — f MP |
| 715 | a — c — Se f MP |
| 716 | a — — d Se f MP |
| 717 | — b c Sd — f MP |
| 718 | — b c — Se f MP |
| 719 | — b — d Se f MP |
| 720 | — — c d Se f MP |
| 721 | a Sb c — — f MP |
| 722 | a Sb — d — f MP |
| 723 | a Sb — — e f MP |
| 724 | a — Sc d — f MP |
| 725 | a — Sc — e f MP |
| 726 | a — — Sd e f MP |
| 727 | — b Sc d — f MP |
| 728 | — b Sc — e f MP |
| 729 | — b — Sd e f MP |
| 730 | — — c Sd e f MP |
| 731 | a Sb c Sd — f MP |
| 732 | a Sb c — Se f MP |
| 733 | a Sb — d Se f MP |
| 734 | a — Sc d Se f MP |
| 735 | — b Sc d Se f MP |
| 736 | a b c Sd — f MP |
| 737 | a b c — Se f MP |
| 738 | a b — d Se f MP |
| 739 | a — c d Se f MP |
| 740 | — b c d Se f MP |
| 741 | a b Sc d — f MP |
| 742 | a b Sc — e f MP |
| 743 | a b — Sd e f MP |
| 744 | a — c Sd e f MP |
| 745 | — b c Sd e f MP |
| 746 | a Sb c d — f MP |
| 747 | a Sb c — e f MP |
| 748 | a Sb — d e f MP |
| 749 | a — Sc d e f MP |
| 750 | — b Sc d e f MP |
| 751 | a b Sc d Se f MP |
| 752 | a Sb c Sd e f MP |
| 753 | a Sb c d Se f MP |
| 754 | a b c d Se f MP |
| 755 | a b c Sd e f MP |
| 756 | a b Sc d e f MP |
| 757 | a Sb c d e f MP |

| Number | Assembly Description |
|---|---|
| **SHAFT FULL LENGTH (WITH SHIELDS & MARKER PLATES)** | |
| 801 | a Sb — — — f MP |
| 802 | a — Sc — — f MP |
| 803 | a — — Sd — f MP |
| 804 | a — — — Se f MP |
| 805 | — b Sc — — f MP |
| 806 | — b — Sd — f MP |
| 807 | — b — — Se f MP |
| 808 | — — c Sd — f MP |
| 809 | — — c — Se f MP |
| 810 | — — — d Se f MP |
| 811 | a b Sc — — f MP |
| 812 | a b — Sd — f MP |
| 813 | a b — — Se f MP |
| 814 | a — c Sd — f MP |
| 815 | a — c — Se f MP |
| 816 | a — — d Se f MP |
| 817 | — b c Sd — f MP |
| 818 | — b c — Se f MP |
| 819 | — b — d Se f MP |
| 820 | — — c d Se f MP |
| 821 | a Sb c — — f MP |
| 822 | a Sb — d — f MP |
| 823 | a Sb — — e f MP |
| 824 | a — Sc d — f MP |
| 825 | a — Sc — e f MP |
| 826 | a — — Sd e f MP |
| 827 | — b Sc d — f MP |
| 828 | — b Sc — e f MP |
| 829 | — b — Sd e f MP |
| 830 | — — c Sd e f MP |
| 831 | a Sb c Sd — f MP |
| 832 | a Sb c — Se f MP |
| 833 | a Sb — d Se f MP |
| 834 | a — Sc d Se f MP |
| 835 | — b Sc d Se f MP |
| 836 | a b c Sd — f MP |
| 837 | a b c — Se f MP |
| 838 | a b — d Se f MP |
| 839 | a — c d Se f MP |
| 840 | — b c d Se f MP |
| 841 | a b Sc d — f MP |
| 842 | a b Sc — e f MP |
| 843 | a b — Sd e f MP |
| 844 | a — c Sd e f MP |
| 845 | — b c Sd e f MP |
| 846 | a Sb c d — f MP |
| 847 | a Sb c — e f MP |
| 848 | a Sb — d e f MP |
| 849 | a — Sc d e f MP |
| 850 | — b Sc d e f MP |
| 851 | a b Sc d Se f MP |
| 852 | a Sb c Sd e f MP |
| 853 | a Sb c d Se f MP |
| 854 | a b c d Se f MP |
| 855 | a b c Sd e f MP |
| 856 | a b Sc d e f MP |
| 857 | a Sb c d e f MP |
| **SWITCHES WITH EXTENDED REAR SHAFT** | **Shaft Terminus** |
| 901 | a — groove b |
| 902 | a — — groove c |
| 903 | — b — groove c |
| 904 | a b — groove c |
| 905 | a — — — groove d |
| 906 | — b — — groove d |
| 907 | — — c — groove d |
| 908 | a b — — groove d |
| 909 | a — c — groove d |
| 910 | — b c — groove d |
| 911 | a Sb c — groove d |
| 912 | a b c — groove d |

| Number | Assembly Description | Shaft Terminus |
|---|---|---|
| 913 | a — — — — | groove e |
| 914 | — b — — — | groove e |
| 915 | — — c — — | groove e |
| 916 | — — — d — | groove e |
| 917 | a b — — — | groove e |
| 918 | a — c — — | groove e |
| 919 | a — — d — | groove e |
| 920 | — b c — — | groove e |
| 921 | — b — d — | groove e |
| 922 | — — c d — | groove e |
| 923 | a Sb c — — | groove e |
| 924 | a Sb — d — | groove e |
| 925 | a — Sc d — | groove e |
| 926 | — b Sc d — | groove e |
| 927 | a b c — — | groove e |
| 928 | a b — d — | groove e |
| 929 | a — c d — | groove e |
| 930 | — b c d — | groove e |
| 931 | a Sb c d — | groove e |
| 932 | a b Sc d — | groove e |
| 933 | a b c d — | groove e |
| 934 | a — — — — — | full shaft |
| 935 | — b — — — — | full shaft |
| 936 | — — c — — — | full shaft |
| 937 | — — — d — — | full shaft |
| 938 | — — — — e — | full shaft |
| 939 | a b — — — — | full shaft |
| 940 | a — c — — — | full shaft |
| 941 | a — — d — — | full shaft |
| 942 | a — — — e — | full shaft |
| 943 | — b c — — — | full shaft |
| 944 | — b — d — — | full shaft |
| 945 | — b — — e — | full shaft |
| 946 | — — c d — — | full shaft |
| 947 | — — c — e — | full shaft |
| 948 | — — — d e — | full shaft |
| 949 | a Sb c — — — | full shaft |
| 950 | a Sb — d — — | full shaft |
| 951 | a Sb — — e — | full shaft |
| 952 | a — Sc d — — | full shaft |
| 953 | a — Sc — e — | full shaft |
| 954 | a — — Sd e — | full shaft |
| 955 | — b Sc d — — | full shaft |
| 956 | — b Sc — e — | full shaft |
| 957 | — b — Sd e — | full shaft |
| 958 | — — c Sd e — | full shaft |
| 959 | a b c — — — | full shaft |
| 960 | a b — d — — | full shaft |
| 961 | a b — — e — | full shaft |
| 962 | a — c d — — | full shaft |
| 963 | a — c — e — | full shaft |
| 964 | a — — d e — | full shaft |
| 965 | — b c d — — | full shaft |
| 966 | — b c — e — | full shaft |
| 967 | — b — d e — | full shaft |
| 968 | — — c d e — | full shaft |
| 969 | a Sb c d — — | full shaft |
| 970 | a Sb c — e — | full shaft |
| 971 | a Sb — d e — | full shaft |
| 972 | a — Sc d e — | full shaft |
| 973 | — b Sc d e — | full shaft |
| 974 | a b Sc d — — | full shaft |
| 975 | a b Sc — e — | full shaft |
| 976 | a b — Sd e — | full shaft |
| 977 | a — c Sd e — | full shaft |
| 978 | — b c Sd e — | full shaft |
| 979 | a Sb c Sd e — | full shaft |
| 980 | a b c d — — | full shaft |
| 981 | a b c — e — | full shaft |
| 982 | a b — d e — | full shaft |
| 983 | a — c d e — | full shaft |
| 984 | — b c d e — | full shaft |
| 985 | a Sb c d e — | full shaft |
| 986 | a b Sc d e — | full shaft |
| 987 | a b c Sd e — | full shaft |
| 988 | a b c d e — | full shaft |

## STEP 9 / FOR SCREW THREADS AND DIMENSIONS TO AMERICAN STANDARDS

STEP 9

| A |
|---|

**MODULINE switches are marketed world-wide. Therefore an "A" is shown in the last box of the part numbering system to signify that the order originates in the United States, Canada or other countries on this continent. It also indicates that screw threads and other dimensional details are manufactured to American standards.**

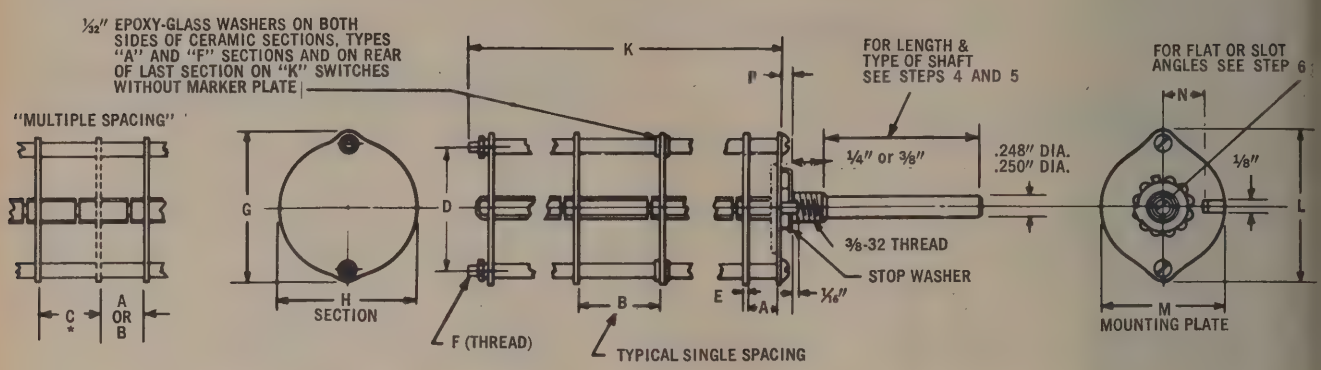
**EACH SECTION DIFFERENT IN CIRCUITRY**
**Where a switch having multiple sections of different circuitry is required you can write your order thusly—**
**Example:** 04-999-09-12-3-13-1-519-A

Note: When 999 is shown in **STEP 2**, specify separately code number of section desired at each location.

continued next page

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

## DIMENSIONS




| Switch Type | Dimensions (Inches) | | | | | | | | | | | | | Insulation | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C* | D | E | F | G | H | K† | L | M | N | P | Stator | Rotor |
| A, 01; BA, 02; AA, 03 | 3/32 | 5/16 | 3/8 | 13/16 | .062 | 2-56 | 1 | 15/16 | 2 1/2 | 1 | 15/16 | 3/8 | 5/64‡ | silicone glass | Kel-F |
| F, 04 | 3/8 | 1/2 | 3/16 | 1 1/32 | .062 | 4-40 | 1 5/16 | 1 3/32 | 3 5/8 | 1 1/4 dia. | 1 1/4 | 17/32 | 5/32 | phenolic | phenolic |
| FC, 04 | 5/16 | 7/16 | 3/16 | 1 1/32 | .125 | 4-40 | 1 5/16 | 1 1/4 | 3 5/8 | 1 1/4 dia. | 1 1/4 | 17/32 | 5/32 | ceramic | ceramic |
| K, 05 | 7/16 | 1/2 | 3/16 | 1 1/4 | .062 | 4-40 | 1 17/32 | 1 13/32 | 3 5/8 | 1 17/32 | 1 5/16 | 17/32 | 1/8 | phenolic | phenolic |
| JC, 05 | 3/8 | 7/16 | 3/16 | 1 1/4 | .125 | 4-40 | 1 17/32 | 1 3/8 | 3 5/8 | 1 17/32 | 1 5/16 | 17/32 | 1/8 | ceramic | ceramic |
| H, 06 | 1/2 | 35/64 | 5/8 | 1 5/16 | .078 | 5-40 | 1 7/8 | 1 13/32 | 4 | 1 7/8 | 1 33/64 | 17/32 | 1/8 | phenolic | phenolic |
| HC, 06 | 3/8 | 7/16 | 5/8 | 1 5/16 | .180 | 5-40 | 1 7/8 | 1 5/8 | 4 | 1 7/8 | 1 33/64 | 17/32 | 1/8 | ceramic | ceramic |
| L, 07 | 3/8 | 7/16 | 33/64 | 2 | .078 | 5-40 | 2 5/16 | 1 31/32 | 3 1/4 | 2 5/16 | 1 31/32 | 17/32 | 1/8 | phenolic | phenolic |
| MF, 08 | 3/8 | 29/64 | 33/64 | 2 | .062 | 5-40 | 2 5/16 | 1 3/4 | 3 1/4 | 2 5/16 | 1 31/32 | 17/32 | 1/8 | phenolic | phenolic |

* "C" dimension is a combination of spacer length and stator thickness, which is then added to "A" spacer when doubled spacing is required from detent plate to first stator; or added to the "B" spacer when doubled spacing is required between sections. Multiples of "C" dimension are used for each additional spacing length required.

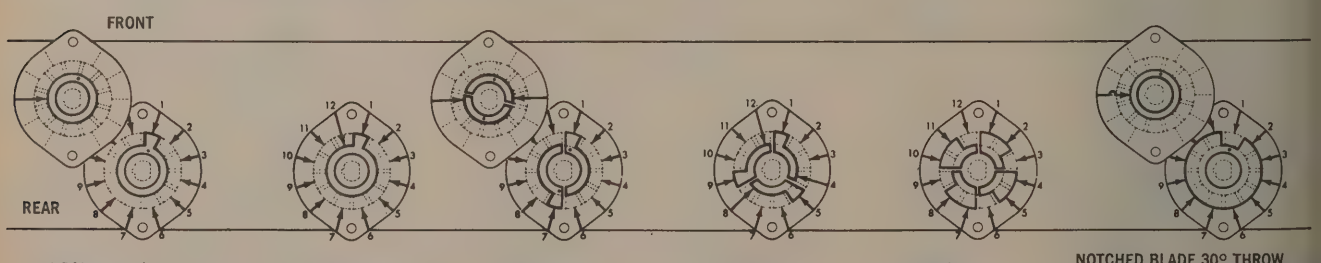
**NOTE:** To determine depth behind mounting panel add 1/8" to "P" dimension and add "K" or adjusted "K" dimension.

† Maximum length excludes marker plate. Add "C" to arrive at "K" dimension including marker plates.
‡ 1/8" with continuous rotation.

## CIRCUIT DIAGRAMS

### FOR STANDARD MODULINE SWITCH SECTIONS

All circuits are viewed from front of switch with strut screws vertically aligned.




1 POLE
12 ACTIVE POSITIONS
30° THROW

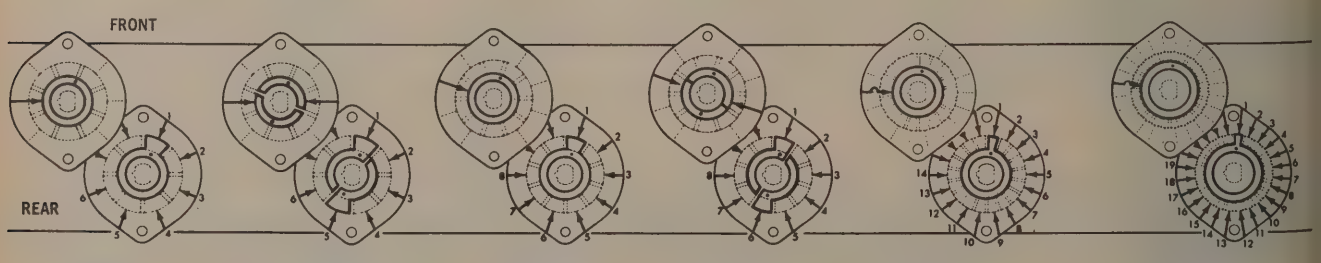
1 POLE
11 POSITIONS
30° THROW

2 POLE
6 POSITIONS
30° THROW

3 POLE
3 POSITIONS
30° THROW

4 POLE
2 POSITIONS
30° THROW

NOTCHED BLADE 30° THROW
(Also available in 20° and 15° THROW)
SEE STEP 2
NUMBERS 501-510




1 POLE
8 POSITIONS
45° THROW

2 POLE
4 POSITIONS
45° THROW

1 POLE
10 POSITIONS
36° THROW

2 POLE
5 POSITIONS
36° THROW

1 POLE
18 POSITIONS
20° THROW

1 POLE
24 POSITIONS
15° THROW

Complete complement of dummy lugs available on 8, 10, 12, 18 and 24 position stators. SEE STEP 2 numbers 801-807.
Specifications subject to change without notice.

# SWITCH SELECTION GUIDE

## Friction Cap Presslites

**MATCHING INDICATOR BASES**

| DESCRIPTION | TYPE | PAGE NO. |
|---|---|---|
| General Purpose | 332,* 532* 534 | 7 |
| Press-to-Test | 533,* 535 | 7 |

**MOMENTARY ACTION SWITCH BASES**

| DESCRIPTION | TYPE | PAGE NO. |
|---|---|---|
| ½ Amp reed, single pole form A | 830, 860 | 7 |
| Low level S.P.D.T. 2 circuit form Z | 545 | 8 |
| | 546 | 8 |
| | 567 | 8 |
| | 568 | 9 |
| 3 Amp S.P.D.T. 2 circuit form Z | 542* | 8 |
| | 543* | 8 |
| | 562 | 8 |
| | 563 | 9 |
| 5 Amp S.P.D.T. form C | 318, 518* | 9 |
| 5 Amp D.P.D.T. form C | 321, 521* | 9 |
| 10.5 amp S.P.S.T.—N.O. form X | 585* | 10 |
| 10.5 Amp S.P.D.T. 2 circuit form Z | 581* | 10 |
| 10.5 Amp D.P.S.T.—N.O. form X | 586* | 10 |
| 10.5 Amp D.P.D.T. 2 circuit form Z | 582* | 11 |
| 15 Amp S.P.D.T. form C | 319, 519* | 11 |

**ALTERNATE ACTION SWITCH BASES**

| DESCRIPTION | TYPE | PAGE NO. |
|---|---|---|
| 5 Amp S.P.D.T. form C | 316, 516* | 9 |
| 5 Amp D.P.D.T. form C | 320, 520* | 9 |
| 10.5 Amp S.P.S.T.—N.O. form X | 575* | 10 |
| 10.5 Amp S.P.D.T. 2 circuit form Z | 571* | 10 |
| 10.5 Amp D.P.S.T.—N.O. form X | 576* | 10 |
| 10.5 Amp D.P.D.T. 2 circuit form Z | 572* | 11 |
| 15 Amp S.P.D.T. form C | 317, 517* | 11 |

**PUSHBUTTONS**

| DESCRIPTION | TYPE | PAGE NO. |
|---|---|---|
| Round, square, and rectangular. Various styles and colors | — | 12,13 |

**MOUNTING HARDWARE**

| DESCRIPTION | TYPE | PAGE NO. |
|---|---|---|
| Surface or recess mounting. | — | 14-17 |

## Low Profile Presslites

**MOMENTARY ACTION**

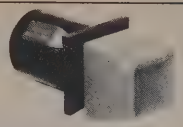
| DESCRIPTION | TYPE | PAGE NO. |
|---|---|---|
| 5 Amp S.P.D.T. form C | 418,* 618* | 18 |
| 10.5 Amp S.P.S.T.—N.O. form X | 685* | 19 |
| 10.5 Amp S.P.D.T. 2 circuit form Z | 681* | 19 |
| 10.5 Amp D.P.S.T.—N.O. form X | 686* | 19 |
| 10.5 Amp D.P.D.T. 2 circuit form Z | 682* | 19 |

**ALTERNATE ACTION**

| DESCRIPTION | TYPE | PAGE NO. |
|---|---|---|
| 5 Amp S.P.D.T. form C | 416,* 616* | 18 |
| 10.5 Amp S.P.S.T.—N.O. form X | 675* | 19 |
| 10.5 Amp S.P.D.T. 2 circuit form Z | 671* | 19 |
| 10.5 Amp D.P.S.T.—N.O. form X | 676* | 19 |
| 10.5 Amp D.P.D.T. 2 circuit form Z | 672* | 19 |

☐ Suitable for use with Light Emitting Diode (L.E.D.)

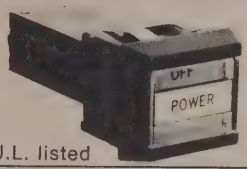
## Snap-in Presslites



**MOMENTARY ACTION SWITCH**

| DESCRIPTION | TYPE | PAGE NO. |
|---|---|---|
| ½ Amp S.P.S.T.—N.O. form X | 590 | 20,21 |
| | 591 | 20,21 |
| Matching indicators | 592 | 20,21 |
| | 593 | 20,21 |

## Rainbow(TM) Presslites




Contact module is U.L. listed

**MOMENTARY ACTION**

| DESCRIPTION | TYPE | PAGE NO. |
|---|---|---|
| 10.5 Amp S.P.S.T.—N.O. form X | 1113 | 22,23 |
| 10.5 Amp S.P.D.T. 2 circuit form Z | 1111 | 22,23 |
| 10.5 Amp D.P.S.T.—N.O. form X | 1114 | 22,23 |
| 10.5 Amp D.P.D.T. 2 circuit form Z | 1112 | 22,23 |

**ALTERNATE ACTION**

| DESCRIPTION | TYPE | PAGE NO. |
|---|---|---|
| 10.5 Amp S.P.S.T.—N.O. form X | 1123 | 22,23 |
| 10.5 Amp S.P.D.T. 2 circuit form Z | 1121 | 22,23 |
| 10.5 Amp D.P.S.T.—N.O. form X | 1124 | 22,23 |
| 10.5 Amp D.P.D.T. 2 circuit form Z | 1122 | 22,23 |

## Watertight and E.M.I. Suppressed Presslites

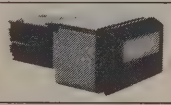
**MOMENTARY ACTION**

| DESCRIPTION | TYPE | PAGE NO. |
|---|---|---|
| Watertight, 3 Amp S.P.D.T. 2 circuit | 643 | 24 |

**MOMENTARY OR ALTERNATE ACTION**

| DESCRIPTION | TYPE | PAGE NO. |
|---|---|---|
| Splashproof or oiltight | — | 25 |
| Splashproof and E.M.I. suppressed | — | 25 |

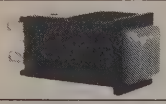
## Split Legend



**ALTERNATE & MOMENTARY ACTION**

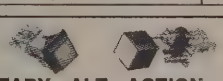
| DESCRIPTION | TYPE | PAGE NO. |
|---|---|---|
| 10.5 Amp Form X and Z | 700 & 800 | 26,27 |

## Marcoflex



**ALTERNATE & MOMENTARY ACTION**

| DESCRIPTION | TYPE | PAGE NO. |
|---|---|---|
| 1 Amp S.P.D.T. (Form C) | 650 | 28,29 |



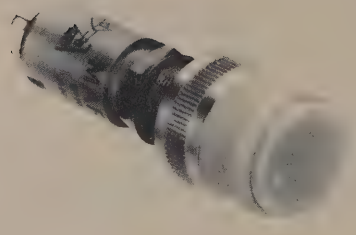
**300-MOMENTARY, ALT. ACTION, LATCHING, BLOCKOUT, INDICATOR**
**300SL-MOMENTARY, ALT. ACTION, INDICATOR**

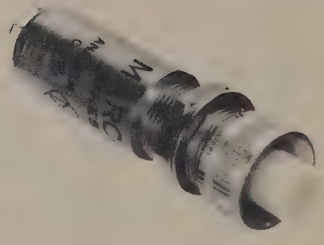
| DESCRIPTION | TYPE | PAGE NO. |
|---|---|---|
| Solid Silver: 1.0 A @ 28 VDC 0.5 A @ 110 VAC | 300 | 30 |
| Silver Plated Brass: 0.5 A @ 28 VDC 0.25 A @ 100 VAC | 300SL | |

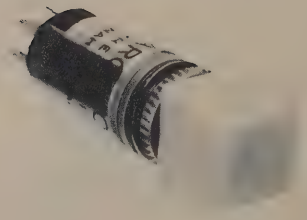
* UL Recognized

**OAK Industries Inc.**
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# Presslite Switches







Oak Switch Divisions' versatile and expanding line of modular Presslite switch and matching indicator assemblies is the end product of years of continuing design improvement to meet the increasing demands of the control/display markets. The incorporation of modern materials, combined with rigid quality control procedures and continuous testing of production samples, assures high reliability and extremely long life.

A wide range of electrical ratings and contact configurations are available in both alternate (push-on-push-off) and momentary operation. Where the switch is operated within its rating, the following life expectancies apply:

| Rating | Type | Expected Life at Rated Load |
|---|---|---|
| ½ Amp | 590, 591 | 1 to 3 million cycles |
| ½ Amp | 830, 860 (dry reed) | 2 to 10 million cycles |
| 3 Amps | 542, 543, 545, 546, 562, 563, 565, 567, 568, 643 | 1 to 2 million cycles |
| 5 Amps | 316, 318, 320, 321, 416, 418, 516, 518, 520, 521, 616, 618 | 500,000 to 1 million cycles |
| 10.5 Amps | 571, 572, 575, 576, 581, 582, 585, 586, 671, 672, 675, 676, 681, 682, 685, 686, 700 series, 800 series, and all Rainbow™ switches | 100,000 cycles @ 10.5 Amps to 1 million cycles @ 5 Amps |
| 15 Amps | 317, 319, 517, 519 | 50,000 to 100,000 cycles |

Unless otherwise specified in the following pages, Presslite materials are as follows:

Contacts: Coin silver

Solder Terminals: Coin silver or plated brass

Terminal Insulation: Molded thermoset plastic

Housing: Anodized aluminum, except 10.5 amps Presslite bases on Pages 10, and 11, 19 and 22 which have thermoplastic housing and nickel plated brass mounting bushing.

Marcoflex switches on Pages 28 and 29 have one piece thermoplastic housing and terminal insulation.

Where the Presslite or Matching Indicator is to be used with a neon lamp, the A1H high brightness type is recommended. Best illumination is achieved with lunar or other light color pushbuttons. Green or blue should be avoided. A 27K ohm dropping resistor is recommended for the A1H neon lamp. On most types, this resistor can be provided as an integral part of the switch or indicator base.

# Presslites, Friction Cap

## Ordering Information

The Friction Cap Presslite series provides the broadest possible flexibility in terms of electrical characteristics, appearance and mounting procedure, allowing the user to "engineer" a switch assembly to meet his specific requirements.

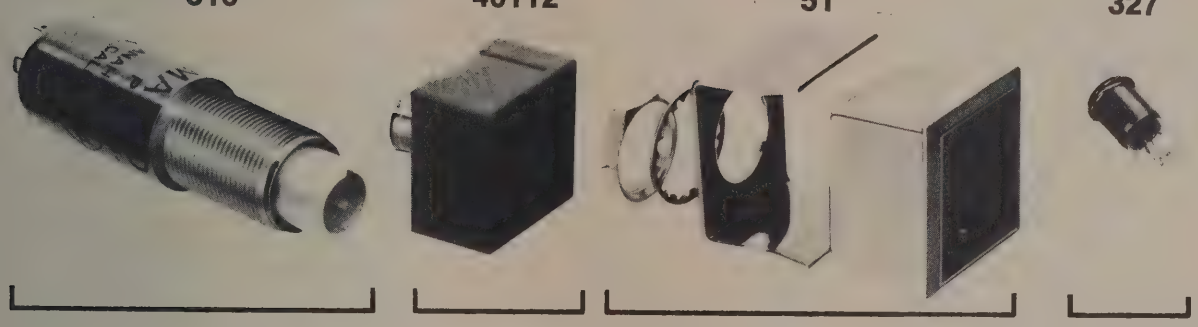
Many pushbutton sizes and configurations are offered, with sufficient space for engraved legends or symbols.

A wide range of mounting hardware is available to meet virtually every panel appearance or mounting requirement.

Many Presslite illuminated switch bases and pushbuttons meet applicable specifications MIL-S-22885. Consult factory for details of military construction.

**A complete part number for a Friction Cap Presslite assembly consists of four blocks of digits, such as the following:**

**516** **40112** **51** **327**



**Switch or Indicator**

**Base Type** — select from those described on Pages 7 thru 11.

**Lamps** — T-1 ¾ midget flange base. Select from Group A, page 64.

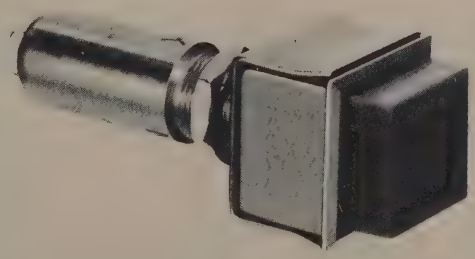
**Pushbutton** — select assembly as described on Pages 12 and 13.

**Mounting Hardware** — select assembly as described on Pages 14 thru 17.

**PUSHBUTTON CODE**

4 0 1 12

Size
Keying
Style
Color



**Complete Assembly Part Number 516-40112-51-327**

**OAK Industries Inc.**
SWITCH DIVISION / CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# Presslites, Friction Cap

## indicator base

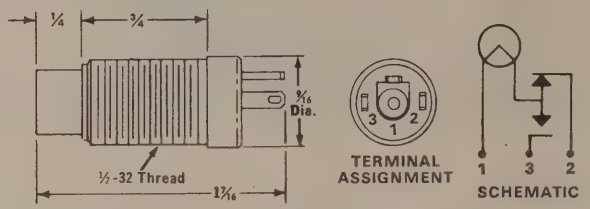
### TYPE 532
U.L. RECOGNIZED

- Provides same pushbutton projection as Presslite switch bases in all styles of mounting hardware.

### TYPE 332
U.L. RECOGNIZED
INTERNAL RESISTOR

- An internal 27K OHM resistor, connected to terminal No. 1 provides for A1H neon lamp operation.

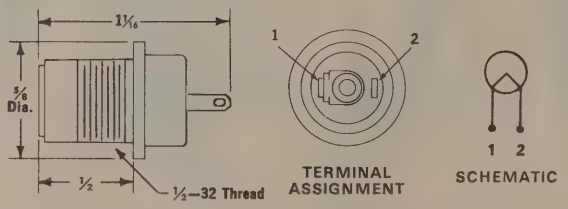
## press-to-test indicator base




### TYPE 533
U.L. RECOGNIZED

- Provides same pushbutton projection as Presslite switch bases in all styles of mounting hardware.
- Nominal operating force: 16 oz.
- Nominal pushbutton travel: 1/32 in.

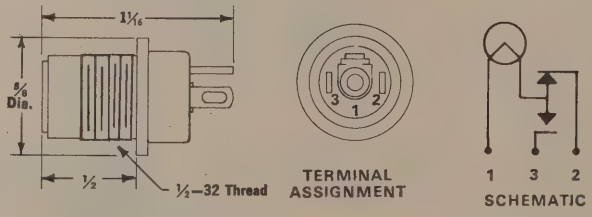
## indicator base




### TYPE 534

- Intended for use with Friction Cap mounting hardware styles 7 and 8 only.
- Provides same pushbutton projection as Presslite switch bases.

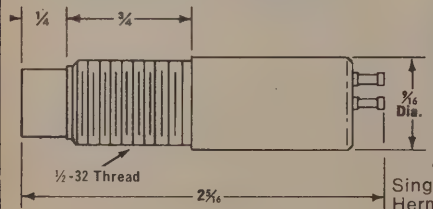
## press-to-test indicator base




### TYPE 535

- Intended for use with Friction Cap mounting hardware styles 7 and 8 only.
- Provides same pushbutton projection as presslite switch bases.
- Nominal operating force: 16 oz.
- Nominal pushbutton travel: 1/32 in.

## ½ amp switch base




Single pole, single throw, normally open (Form A)
Hermetically sealed (reed switch) contacts
Contact rating: ½ amp max., 200 volts max.
10 watts resistive max.
Nominal pushbutton travel: 3/16 in.

### MOMENTARY ACTION TYPE 830

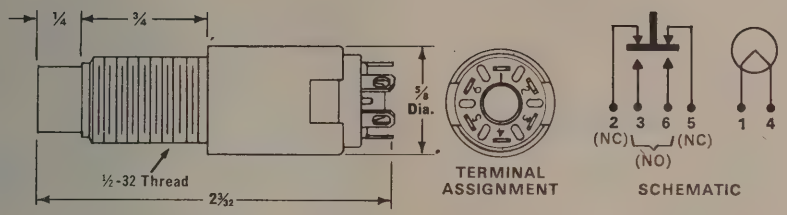
- Nominal operating force: 5 oz.

### MOMENTARY ACTION TYPE 860

- Nominal operating force: 10 oz.

## Presslites, Friction Cap

### 3 amp switch base




Single pole, 2 circuit, double break (Form Z).
Contact rating: 3 amps resistive at 115 VAC or 30 VDC.
Nominal pushbutton travel: ⅛ in. including 1/32 in. pretravel and 1/32 in. overtravel.

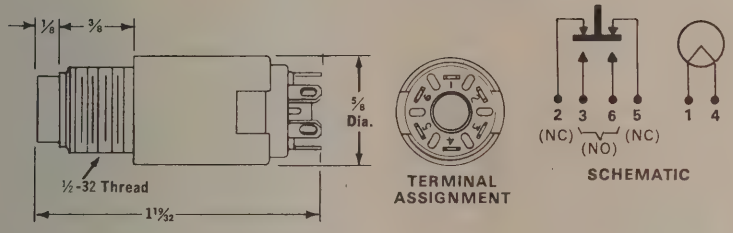
**MOMENTARY ACTION**
**TYPE 542**
U.L. RECOGNIZED

- Nominal operating force: 14 oz. to close normally open contacts.

**MOMENTARY ACTION**
**TYPE 545**
LOW LEVEL

- Contacts: Gold plated for low level switching.
- Nominal operating force: 7 oz. to close normally open contacts.
- For 14 oz. operating force specify type 547.

### 3 amp switch base




Single pole, 2 circuit, double break (Form Z)
Contact rating: 3 amps resistive at 115 VAC or 30 VDC.
Nominal pushbutton travel: ⅛ in. including 1/32 in. pretravel and 1/32 in. overtravel.
Mounting hardware: intended for use with style 1 (knurled nut) or styles 7 and 8 (snap-in mounting adaptors).

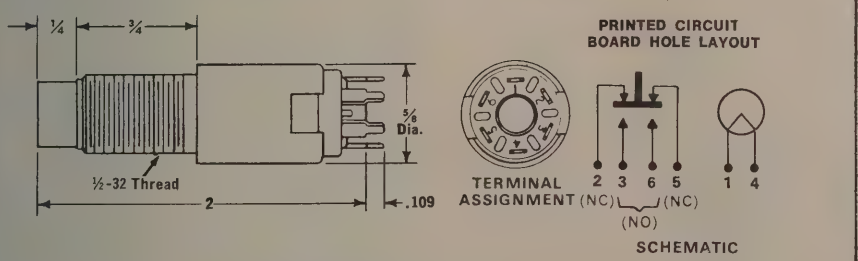
**MOMENTARY ACTION**
**TYPE 543**
U.L. RECOGNIZED

- Nominal operating force: 14 oz. to close normally open contacts.

**MOMENTARY ACTION**
**TYPE 546**
LOW LEVEL

- Contacts: Gold plated for low level switching.
- Nominal operating force: 7 oz. to close normally open contacts.

### 3 amp switch base




Single pole, 2 circuit, double break (Form Z)
Contact rating: 3 amps resistive at 115 VAC or 30 VDC.
Nominal pushbutton travel: ⅛ in. including 1/32 in. pretravel and 1/32 in. overtravel.
Terminals: Designed for soldering to P.C. Board.

**MOMENTARY ACTION**
**TYPE 562**

- Nominal operating force: 14 oz. to close normally open contacts.

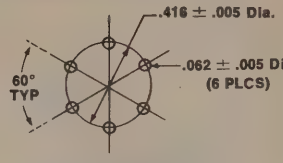
**MOMENTARY ACTION**
**TYPE 567**
LOW LEVEL

- Contacts: Gold plated for low level switching.
- Nominal operating force: 7 oz. to close normally open contacts.

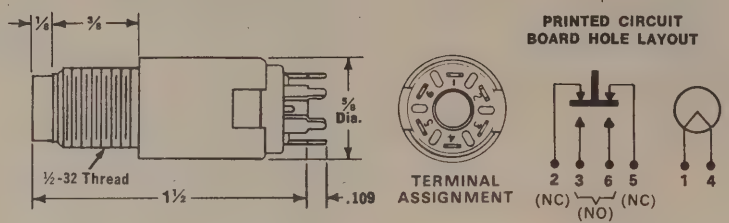
**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# Presslites, Friction Cap

## 3 amp switch base




PRINTED CIRCUIT BOARD HOLE LAYOUT




Single pole, 2 circuit, double break (Form Z)
Contact rating: 3 amps resistive at 115 VAC or 30 VDC.
Nominal pushbutton travel: ⅛ in. including 1/32 in. pretravel and 1/32 in. overtravel.
Mounting hardware: intended for use with style 1 (knurled nut) or styles 7 and 8 (snap-in mounting adaptors).

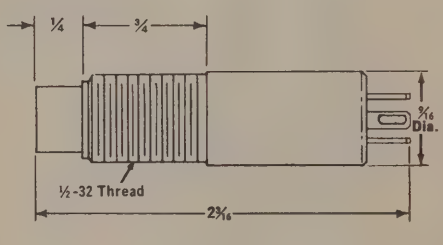
### MOMENTARY ACTION TYPE 563

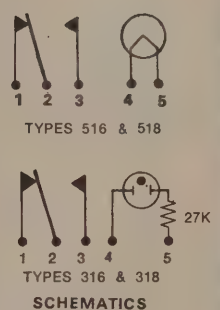
- Nominal operating force: 14 oz. to close normally open contacts.

### MOMENTARY ACTION, TYPE 568
LOW LEVEL

- Contacts: Gold plated for low level switching.
- Nominal operating force: 7 oz. to close normally open contacts.

## 5 amp switch base




Single pole, double throw (Form C) snap action contacts.
Contact rating: 5 amps resistive at 115 VAC or 28 VDC

### ALTERNATE ACTION TYPE 516
U.L. RECOGNIZED

- Nominal operating force: 24 oz.
- Nominal pushbutton travel: 3/32 in.

### TYPE 316
INTERNAL RESISTOR

- An internal 27K OHM resistor, connected to terminal No. 5, provides for A1H neon lamp operation.

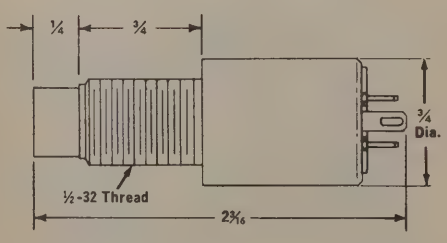
### MOMENTARY ACTION TYPE 518
U.L. RECOGNIZED

- Nominal operating force: 32 oz.
- Nominal pushbutton travel: 3/32 in.

### TYPE 318
INTERNAL RESISTOR

- An internal 27K OHM resistor, connected to terminal No. 5, provides for A1H neon lamp operation.

## 5 amp switch base



Double pole, double throw (Form C) snap action contacts.
Contact rating: 5 amps resistive at 115 VAC or 28 VDC.

### ALTERNATE ACTION TYPE 520
U.L. RECOGNIZED

- Nominal operating force: 32 oz.
- Nominal pushbutton travel: 3/32 in.

### TYPE 320
INTERNAL RESISTOR

- An internal 27K OHM resistor, connected to terminal No. 7, provides for A1H neon lamp operation.

### MOMENTARY ACTION TYPE 521
U.L. RECOGNIZED

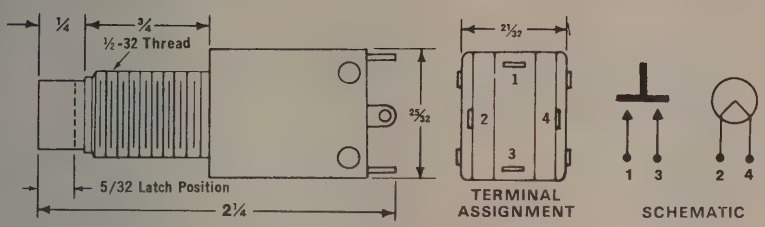
- Nominal operating force: 40 oz.
- Nominal pushbutton travel: 3/32 in.

### TYPE 321
INTERNAL RESISTOR

- An internal 27K OHM resistor, connected to terminal No. 7, provides for A1H neon lamp operation.

## Presslites, Friction Cap

### 10.5 amp switch base




Single pole, single throw, double make (Form X) snap action contacts.
Contact rating: 10.5 amps resistive, 125/250 VAC
10.5 amps resistive, 28 VDC
¼ H.P., 125/250 VAC

#### ALTERNATE LATCHING ACTION TYPE 575

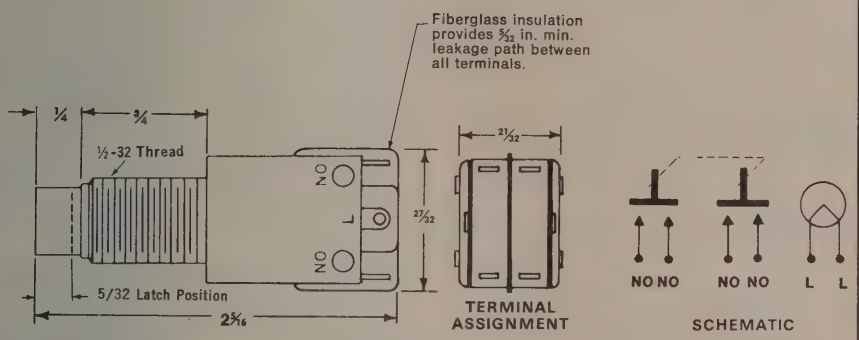
- Nominal operating force: 12 oz.
- Nominal pushbutton travel: 7/32 in.
- Latching action: Pushing plunger closes N.O. contacts and latches plunger, pushing plunger again releases contacts and plunger returns to "out" position. Plunger latch point is 5/32 from "out" position. Switch and latch interlocked to prevent teasing.

#### MOMENTARY ACTION TYPE 585

- Nominal operating force: 10 oz.
- Nominal pushbutton travel: 3/32 in.

Both U.L. recognized

### 10.5 amp switch base




Double pole, single throw, double make (Form X) snap action contacts.
Contact rating: 10.5 amps resistive, 125/250 VAC
10.5 amps resistive, 28 VDC
¼ H.P., 125/250 VAC

#### ALTERNATE LATCHING ACTION TYPE 576

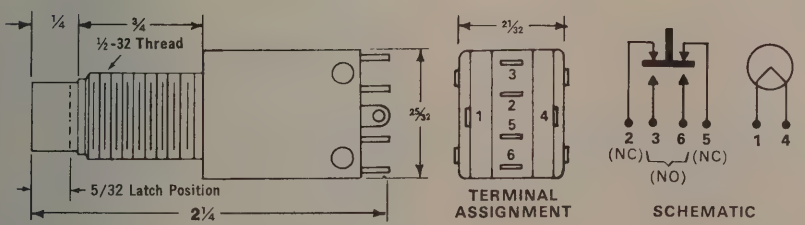
- Nominal operating force: 20 oz.
- Nominal pushbutton travel: 7/32 in.
- Latching action: Pushing plunger closes N.O. contacts and latches plunger. Pushing plunger again releases contacts and returns plunger to "out" position. Plunger latch point is 5/32 from "out" position. Switch and latch interlocked to prevent teasing.

#### MOMENTARY ACTION TYPE 586

- Nominal operating force: 16 oz.
- Nominal pushbutton travel: 3/32 in.

Both U.L. recognized

### 10.5 amp switch base




Single pole, 2 circuit, double break (Form Z) snap action contacts.
Contact rating: 10.5 amps resistive, 125/250 VAC
10.5 amps resistive, 28 VDC
¼ H.P., 125/250 VAC

#### ALTERNATE LATCHING ACTION TYPE 571

- Nominal operating force: 12 oz.
- Nominal pushbutton travel: 7/32 in.
- Latching action: Pushing plunger closes N.O. contacts and latches plunger. Pushing plunger again releases contacts and plunger returns to "out" position. Plunger latch point is 5/32 from "out" position. Switch and latch interlocked to prevent teasing.

#### MOMENTARY ACTION TYPE 581

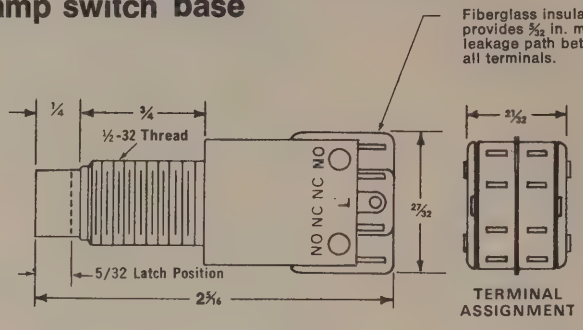
- Nominal operating force: 10 oz.
- Nominal pushbutton travel: 3/32 in.

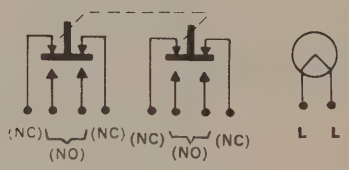
Both U.L. recognized

**OAK Industries Inc.**
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

## Presslites, Friction Cap

### 10.5 amp switch base




SCHEMATIC

Double pole, 2 circuit, double break (Form Z) snap action contacts.
Contact rating: 10.5 amps resistive, 125/250 VAC
10.5 amps resistive, 28 VDC
1/4 H.P., 125/250 VAC

### ALTERNATE LATCHING ACTION TYPE 572

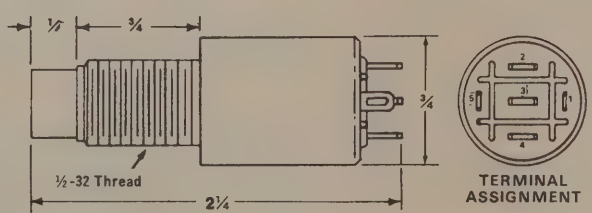
- Nominal operating force: 20 oz.
- Nominal pushbutton travel: 7/32 in.
- Latching action: Pushing plunger closes N.O. contacts and latches plunger. Pushing plunger again releases contacts and returns plunger to "out" position. Plunger latch point is 5/32 from "out" position. Switch and latch interlocked to prevent teasing.

### MOMENTARY ACTION TYPE 582

- Nominal operating force: 16 oz.
- Nominal pushbutton travel: 3/32 in.

Both U.L. recognized

### 15 amp switch base



TYPES 517 & 519

TYPES 317 & 319

SCHEMATICS

Single pole, double throw (Form C) snap action contacts.
Contact rating: 15amps resistive at 115 VAC or 28 VDC.

### ALTERNATE ACTION TYPE 517

- Nominal operating force: 32 oz.
- Nominal pushbutton travel: 7/32 in.

### TYPE 317
INTERNAL RESISTOR

- An internal 27K OHM resistor connected to terminal No. 5 provides for A1H neon lamp operation.

### MOMENTARY ACTION TYPE 519

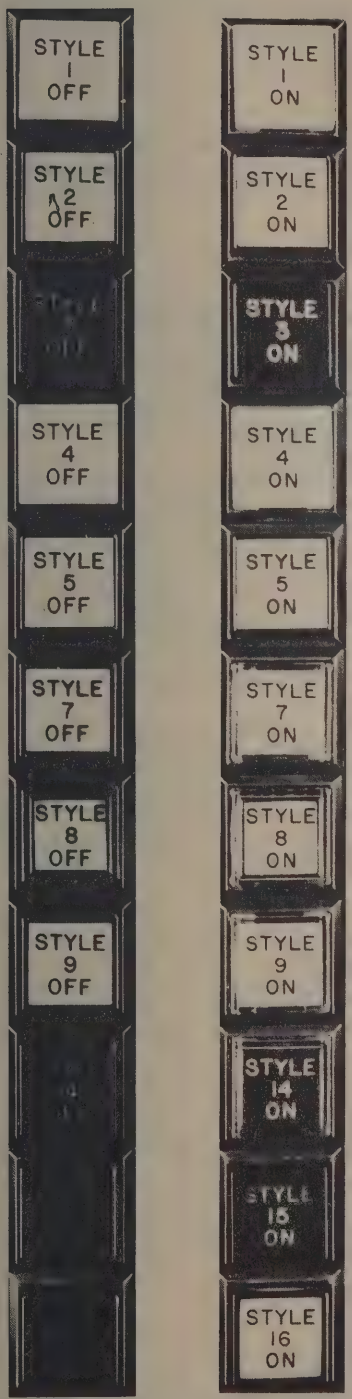
- Nominal operating force: 40 oz.
- Nominal pushbutton travel: 5/32 in.

### TYPE 319
INTERNAL RESISTOR

- An internal 27K OHM resistor connected to terminal No. 5 provides for A1H neon lamp operation.

# Presslites, Friction Cap

## Pushbuttons




A wide variety of pushbuttons are available for the Friction Cap Presslite switch line. Round, square and rectangular sizes are offered, in nine different colors, with or without legends or symbols.

Pushbutton part numbers are shown in the table on page 13. These part numbers are used to construct a complete assembly part number as shown on page 6.

**STYLES**

Eleven different pushbutton styles are offered for Friction Cap and Snap-in Presslites. An understanding of these styles will permit selecting pushbuttons to provide the best possible panel appearance and operating convenience. All eleven styles are shown in color on the back cover of this catalog.

**Style 1** . . . . . is the most frequently used. It features "wrap-around" construction, providing front and side surfaces of one continuous piece of translucent plastic in the color specified. It also provides the largest possible legend area in each size.

**Style 2** . . . . . provides a flat lens of the specified color with black opaque sides. It is used where a 1/32 inch wide black frame around the illuminated area is desired, or where no transmission of light through the sides is allowed, such as in matrix groups.

**Style 3** . . . . . is a Style 1 pushbutton oversprayed black on all surfaces. It is used only with engraved legends, where the message illuminates in the specified color while the background remains black. This style provides maximum legibility in the "on" condition. Where severe usage is anticipated, a protective cover (Style 14 or 15) is recommended to prevent damage to the black surface.

**Style 4** . . . . . has a lunar Style 1 wrap-around lens with an internal filter of the specified color. The color is visible only when the lamp is "on". In a low ambient light environment, Style 4 is virtually identical to Style 1 in appearance. The greater the ambient light, the less saturated the appearance of the color when the lamp is on.

**Style 5** . . . . . is similar in performance to Style 4, but features black opaque sides with the 1/32 inch wide frame around the illuminated area, as described under Style 2.

**Style 7** . . . . . is a Style 1 cap of the specified color, with a clear protective cover over the front and sides. It is used in applications where the legend must be protected from wear or dirt. It also permits use with customer-provided film or vellum legends. The protective cover provides a 1/16 inch wide frame around the translucent legend area.

**Style 8** . . . . . is a Style 2 pushbutton of the specified color with a clear protective cover, but is otherwise similar to Style 7. The legend area is framed by a 3/32 inch wide border.

**Style 9** . . . . . is a Style 4 pushbutton with a clear protective cover. The legend area is framed by a 1/16 inch wide border.

**Style 14** . . . . is a Style 3 pushbutton with a clear protective cover.

**Style 15** . . . . is a Style 3 pushbutton with a grey, neutral density protective cover of about 25% light transmission, for use in hidden legend applications. The legend is nearly invisible when the lamp is "off". This style is particularly effective under high ambient light conditions.

**Style 16** . . . . is a Style 4 pushbutton with the neutral density cover described in Style 15. In the "off" condition, the background is dark grey, and the legend is barely visible under normal ambient light levels. When "on", the background illuminates in the selected color, and is framed by a 1/16 inch wide black border.

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447



## Pushbuttons

### COLORS

The standard Presslite pushbutton colors were selected to provide the best compromise between pleasing appearance in the "off" condition and high light transmission in the "on" condition when used with Style 1 and similar pushbuttons. Several colors are offered in more than one transmission grade, or otherwise require discussion:

**White**
(Color No. 5) is snow white in the off condition. When used with black oversprayed pushbuttons (styles 3, 14, and 15), a pale blue internal color filter is also provided to eliminate possible confusion with yellow when the lamp is on.

**Lunar**
(Color No. 17) provides transmission characteristics midway between clear and white (color No. 5). It is recommended where high ambient light level might otherwise make it difficult to determine when the lamp behind a white lens is "on", or in applications involving low brightness lamps such as neons. Because of its high transmission, the outline of the filament is slightly noticeable. Lunar is also used in Styles 4, 5, 9, and 16 Presslite pushbuttons to provide maximum color transmission from the internal color filter. When supplied as color No. 5 (White, when lamp is on), a pale blue internal color filter is also provided in Styles 4, 5, 9, and 16, to eliminate possible confusion with yellow when the lamp is on.

**Red**
(Colors No. 6 and 36) is provided in two transmission grades to meet both general purpose and warning applications. Color No. 6 is a pure "lipstick red" color in the "off" condition, providing excellent diffusion when "on". Color No. 36 is recommended for warning applications and for use with neon lamps. This color is much darker in the "off" condition than Color No. 6, and provides greater light transmission. In high ambient light areas, Color No. 36 provides a greater on-off contrast ratio than does No. 6.

**Green**
(Colors No. 7 and 37) is also provided in two transmission grades. Color No. 7 is a rather dark, "grass green" in the "off" condition and is a very saturated, pure green when "on". No. 37 is a greyish-green in the "off" condition and transmits more light when "on" than does No. 7. Both grades completely hide the lamp filament. Green is not satisfactory for use with neon lamps.

**Blue**
(Color No. 11) is selected in a transmission grade that allows the lamp filament to be slightly noticeable. This is necessary to provide sufficient brightness for general use, since incandescent lamps have very little blue in their output. Like green, blue cannot be used with neon lamps.

Other Standard Colors offered are yellow (No. 12) and orange (No. 16).

Frequently, styling considerations for a commercial product dictate the use of non-standard colors to achieve a particular effect. Illuminated Products' engineers will be glad to assist you in developing special colors for such applications.

### LEGENDS

In addition to identifying the function of Presslite pushbuttons and indicator lens caps by the suitable selection of colors, their versatility and convenience may be greatly extended by an engraved or hot-stamped legend.

Hot stamping is not as durable as engraving. While it is entirely satisfactory for indicator lens caps and infrequently used pushbuttons, it is not recommended in applications where the pushbutton may be operated many times a day. In this case engraving is essential.

The most common type used for hot-stamped and engraved legends is ⅛ inch high News Gothic, which permits an average of about 8 letters per horizontal inch. For best appearance, at least ⅛ inch of space should be allowed at both the beginning and end of each line. The same amount of space should be allowed between lines. For example, a ¾ inch square pushbutton will accept 3 lines of type, each line having up to 5 letters, while a ½ inch square pushbutton can accommodate only 2 lines of 3 letters each. Where more letters per line are required, Condensed News Gothic may be used or the letter size reduced.

Most Oak Switch Division's distributors provide custom engraving of Presslites and indicators, and the factory maintains a well equipped engraving and hot stamping department. When ordering custom engraving, full details should be provided on a drawing or sketch. Unless otherwise specified by the customer, black letters will be used on white, orange, and yellow backgrounds, and white will be used on red, green, and blue backgrounds.

**PUSHBUTTON PART NUMBERS FOR FRICTION CAP PRESSLITES**
**(Where a number is not shown, the pushbutton is not available in that style)**

| PUSHBUTTON SHAPE | PUSHBUTTON SIZE | PUSHBUTTON STYLE (See Page 12) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 7 | 8 | 9 | 14 | 15 | 16 |
| ROUND | ½ IN. | 1016 | 1026 | 1036 | — | — | — | — | — | — | — | — |
| | ⅝ IN. | 6016 | 6026 | 6036 | 6046 | 6056 | 6076 | 6086 | — | 60146 | 60156 | — |
| | ¾ IN. | 5016 | 5026 | 5036 | 5046 | 5056 | — | — | — | — | — | — |
| SQUARE | ½ IN. | 2016 | 2026 | 2036 | 2046 | 2056 | — | — | — | — | — | — |
| | ⅝ IN. | 3016 | 3026 | 3036 | 3046 | 3056 | — | — | — | — | — | — |
| | ¾ IN. | 4016 | 4026 | 4036 | 4046 | 4056 | 4076 | 4086 | 4096 | 40146 | 40156 | 40166 |
| | ¾ IN. KEYBOARD | 15016 | — | — | 15046 | — | — | — | — | — | — | — |
| RECTANGULAR | ½ x ¾ IN. | 8016 | — | 8036 | 8046 | — | — | — | — | — | — | — |
| | ½ x ⅞ IN. | 7016 | 7026 | 7036 | 7046 | 7056 | — | — | — | — | — | — |
| | ¾ x 1 IN. | 12016 | 12026† | 12036 | 12046 | 12056† | — | 12086 | 12096† | — | — | — |

**Pushbutton Colors:** Last digit, 6, of above part number designates translucent red color.

For other colors, substitute one of the following:

White*: 5 Dark Red*: 36 Orange: 16 Blue: 11
Yellow: 12 Light Green*: 37 Green: 7 Lunar*: 17

*Colors 5, 17, 36, and 37 not available in Styles 4, 5, 9, and 16 (internal color filters).

Above part numbers are for unkeyed (rotatable) caps.
For keyed (non-rotatable) caps, substitute "1" for the first "0" of the part number. Example: 1016 is unkeyed. 1116 is keyed.

Square or rectangular mounting hardware provides inherent cap keying. Therefore, assemblies which use square or rectangular recess adaptors or recess barrier mounts are provided with unkeyed caps.

**Pushbutton Materials:** All of the above pushbuttons are high impact-resistant plastic per L-P-349a (Tenite) except those marked "†" are per L-P-393 (polycarbonate).

# Presslites, Friction Cap

## Friction Cap Presslite Mounting Hardware

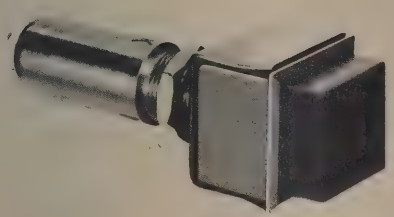
The versatility of Oak Switch Divisions' Presslites is extended by the broad selection of mounting hardware styles and finishes. These include knurled nut and safety collar for surface or sub panel mounting, and 6 different recess mounting configurations including the low cost snap-in type.

The third block of digits in the complete Presslite part number identifies mounting hardware, as follows:

**516 — 40112 — 51 — 327**

**Finish**
1 Bright
2 Black

**Style**
1 Knurled Nut
4 Safety Collar
5 Recess Adaptor
6 Recess Barrier Mount
7 Flush Snap-In Mount
8 Barrier Snap-In Mount
50X Recess Adaptors on Mounting Strip
60X Recess Barrier Mounts on Mounting Strip



The above part number describes an assembly which includes a bright recess adaptor.

The projection of the Presslite base behind the front of the mounting panel depends on the base type, and the style of mounting hardware, as shown below. To determine projection behind the back of the panel, the panel thickness must be subtracted from this dimension.

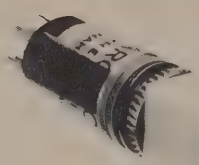
**BASE PROJECTION BEHIND FRONT OF MOUNTING PANEL**

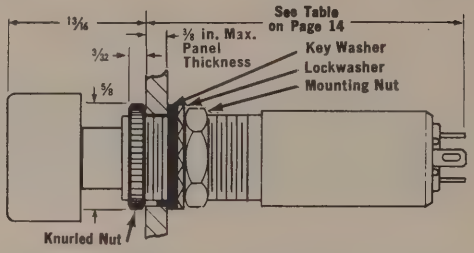
| OVERALL BASE LENGTH (See pages 7-11) | MOUNTING HARDWARE STYLE (See pages 15-17) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 KNURLED NUT | 4 SAFETY COLLAR | 5 RECESS ADAPTOR | 6 RECESS BARRIER MOUNT | 7 FLUSH SNAP-IN MOUNT | 8 BARRIER SNAP-IN MOUNT | 50X RECESS MOUNTING STRIP | 60X BARRIER MOUNTING STRIP |
| 1 1/16 | — | — | — | — | 1 5/16 | 1 5/16 | — | — |
| 1 7/16 | 1 1/16 | 1 5/16 | 1 7/16 | 1 7/16 | 1 11/16 | 1 11/16 | 1 7/16 | 1 7/16 |
| 1 19/32 | 1 11/32 | — | — | — | 1 13/16 | 1 13/16 | — | — |
| 2 3/32 | 1 3/4 | 1 5/8 | 2 3/16 | 2 3/16 | 2 5/16 | 2 5/16 | 2 1/4 | 2 1/4 |
| 2 3/16 | 1 13/16 | 1 11/16 | 2 5/16 | 2 5/16 | 2 7/16 | 2 7/16 | 2 5/16 | 2 5/16 |
| 2 1/4 | 1 7/8 | 1 3/4 | 2 3/8 | 2 3/8 | 2 1/2 | 2 1/2 | 2 3/8 | 2 3/8 |
| 2 5/16 | 1 15/16 | 1 13/16 | 2 7/16 | 2 7/16 | 2 9/16 | 2 9/16 | 2 7/16 | 2 7/16 |

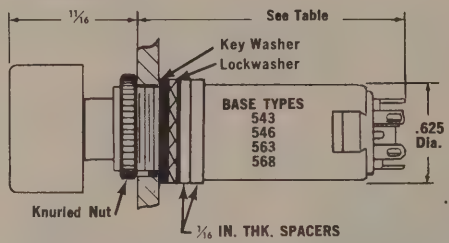
**OAK Industries Inc.**
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# Presslites, Friction Cap

## STYLE 1
## knurled nut





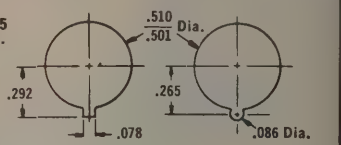




**AVAILABLE PUSHBUTTON SIZES**

- ○ 1/2 in. round, 5/8 in. round, 3/4 in. round
- □ 1/2 in. square, 5/8 in. square, 3/4 in. square
- ▭ 1/2 in. x 3/4 in. rect., 1/2 in. x 7/8 in. rect., 3/4 in. x 1 in. rect.

**FINISH**
Bright (No. 1) or Black (No. 2)

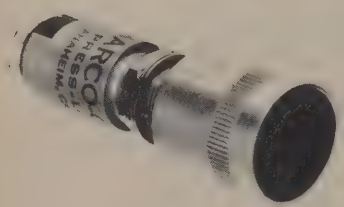
**PANEL CUTOUTS** (Key washer and slot may be omitted in some installations)

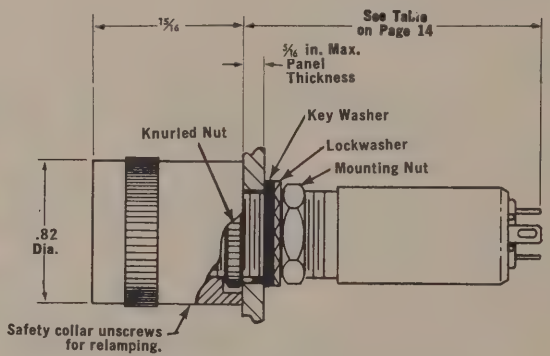



**Materials and Finishes:**
Knurled nut: anodized aluminum.
Key washer: brass, nickel plated.
Lockwasher: stainless steel.
Mounting nut: brass, nickel plated.

Recommended mounting tool for tightening knurled nut:
Oak #51630

## STYLE 4
## safety collar



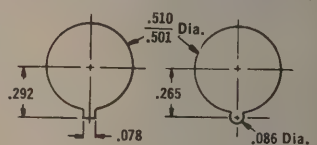



**AVAILABLE PUSHBUTTON SIZES**

- ○ 3/4 in. round

**FINISH**
Bright (No. 1) only

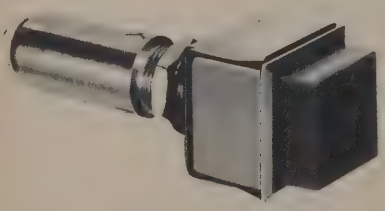
**PANEL CUTOUT** (Key washer and slot may be omitted in some installations)

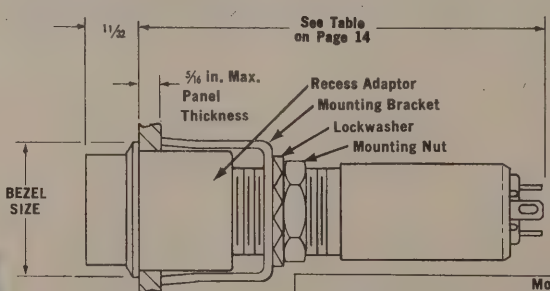



**Materials and Finishes:**
Safety collar: anodized aluminum.
Knurled nut: anodized aluminum.
Key washer: brass, nickel plated.
Lockwasher: stainless steel.
Mounting nut: brass, nickel plated.

Recommended mounting tool for tightening knurled nut:
Oak #51630

## STYLE 5
## recess adaptor






**AVAILABLE PUSHBUTTON SIZES**

- ○ 1/2 in. round, 5/8 in. round, 3/4 in. round
- □ 1/2 in. square, 5/8 in. square, 3/4 in. square
- ▭ 1/2 in. x 7/8 in. rect.

**FINISH**
Bright (No. 1) or Black (No. 2)

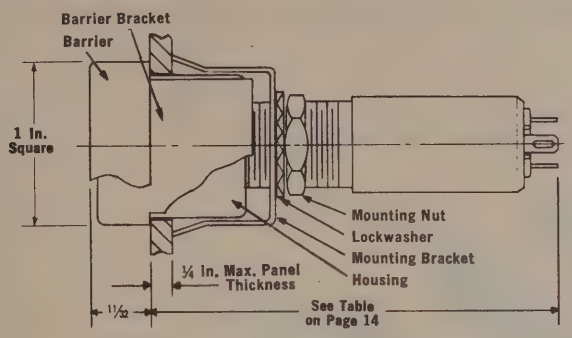
| Mounting Dimensions | | | |
|---|---|---|---|
| | | Panel Cutout Dimensions | |
| Pushbutton Size | Bezel Size | Single Unit +.015 −.000 | Stacked Units |
| 1/2 in. Round | .65 Dia. | .562 Dia. | — |
| 5/8 in. Round | .80 Dia. | .718 Dia. | — |
| 3/4 in. Round | .93 Dia. | .843 Dia. | — |
| 1/2 in. Square | .67 Sq. | .571 So. | Add .671 x N * |
| 5/8 in. Square | .81 Sq. | .718 Sq. | Add .817 x N * |
| 3/4 in. Square | .94 Sq. | .843 Sq. | Add .942 x N * |
| 1/2 in. 7/8 in. Rect. | .67 x 1.05 Rect. | .571 x .961 Rect. | Add 1.060 x N * |

*N = No. of additional units. Example: Cutout length for three 1/2 in. sq. recess adaptors is .671 x 2 + .571 = 1.913 $^{+.015}_{-.000}$

**Materials and Finishes:**
Recess adaptor: aluminum, anodized or bright nickel plated.
Mounting bracket: stainless steel.
Lockwasher: stainless steel.
Mounting nut: brass, nickel plated.

# Presslites, Friction Cap

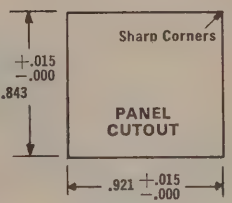
## STYLE 6
## recess barrier mount




**AVAILABLE PUSHBUTTON SIZES**

☐ ¾ in. square

**FINISH**
Black (No. 2) only

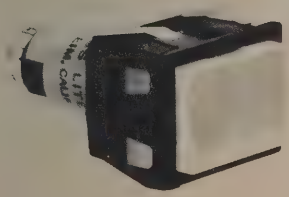


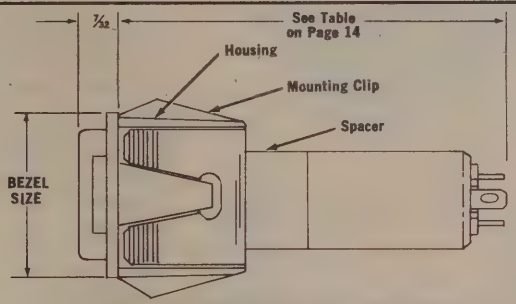

For each additional assembly add .906.

**Materials and Finishes:**
Barrier: thermoplastic.
Barrier bracket: anodized aluminum.
Housing: anodized aluminum.
Mounting bracket: stainless steel.
Lockwasher: stainless steel.
Mounting nut: brass, nickel plated.

**NOTE:** When ordering please specify number of assemblies to be mounted in a single slot, to assure proper quantity of intermediate barriers. (Style 60X is recommended where 3 or more switches are to be mounted together.)

## STYLE 7
## flush snap-in mount






**AVAILABLE PUSHBUTTON SIZES**

☐ ⅝ in. square**
¾ in. square

▭ ¾ in. x 1 in. rectangular

**FINISH**
Black (No.2) only

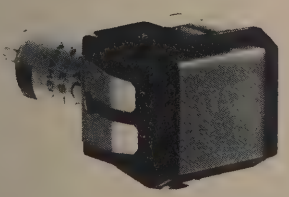
**Not recommended for use with 10.5 amp Presslite bases shown on pages 10 and 11, since they will not pass through panel cutout.

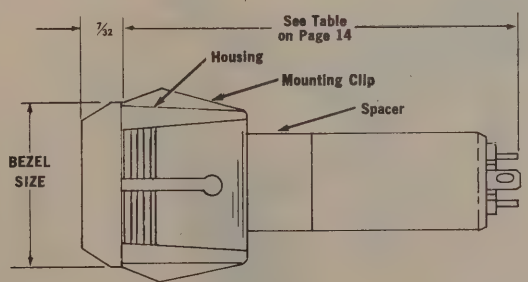
| Mounting Dimensions | | | |
|---|---|---|---|
| Pushbutton Size | Bezel Size | Single Unit Cutout ±.005 | Stacked Units* |
| ⅝ in. Square** | .81 Sq. | .745 for panels .050 to .120 THK.<br>.755 for panels .120 to .187 THK. | Add .815 x N |
| ¾ in. Square | .94 Sq. | .870 for panels .050 to .120 THK.<br>.880 for panels .120 to .187 THK. | Add .940 x N |
| ¾ in. x 1 in. Rect. | .94 x 1.18 Rect. | .870 x 1.110 | Add .942 x N Vertical<br>Add 1.182 x N Horizontal |

*N = No. of additional units. Example: Cutout length for three ⅝ in sq. mounts is .815 x 2 + .745 = 2.375 ±.005.

**Materials and Finishes:**
Housing: thermoplastic.
Mounting clip: stainless steel.
Spacer: aluminum.

## STYLE 8
## barrier snap-in mount






**AVAILABLE PUSHBUTTON SIZES**

☐ ⅝ in. square**
¾ in. square

**FINISH**
Black (No. 2) only

**Not recommended for use with 10.5 amp Presslite bases shown on pages 10 and 11, since they will not pass through panel cutout.

| Mounting Dimensions | | | |
|---|---|---|---|
| Pushbutton Size | Bezel Size | Single Unit Cutout ±.005 | Stacked Units* |
| ⅝ in Square** | .81 Sq. | .745 for panels .050 to .120 THK.<br>.755 for panels .120 to .187 THK. | Add .815 x N |
| ¾ in. Square | .94 Sq. | .870 for panels .050 to .120 THK.<br>.880 for panels .120 to .187 THK. | Add .940 x N |

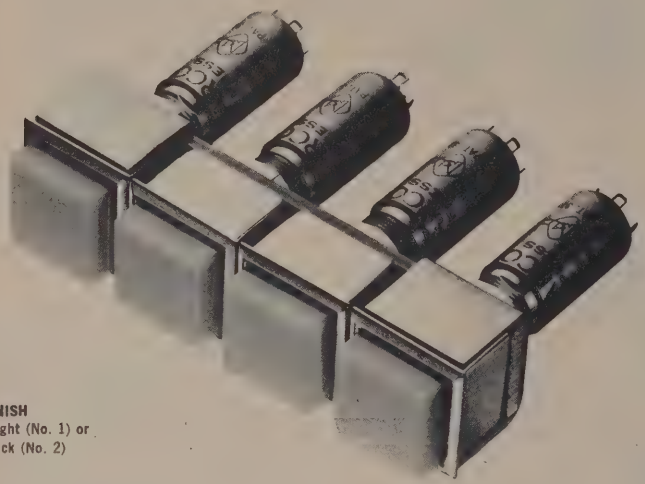
*N = No. of additional units. Example: Cutout length for three ⅝ in sq. mounts is .815 x 2 + .745 = 2.375 ±.005.

**Materials and Finishes:**
Housing: thermoplastic.
Mounting clip: stainless steel.
Spacer: aluminum.

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014 DIARY OF OAK INDUSTRIES INC.
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447 92711 / TEL: (714) 540-9471 / TWX: 910-595-1504



## STYLE 50X
## recess adaptors on mounting strip



**FINISH**
Bright (No. 1) or
Black (No. 2)

Available
Pushbutton Sizes
□ ¾ In. Square

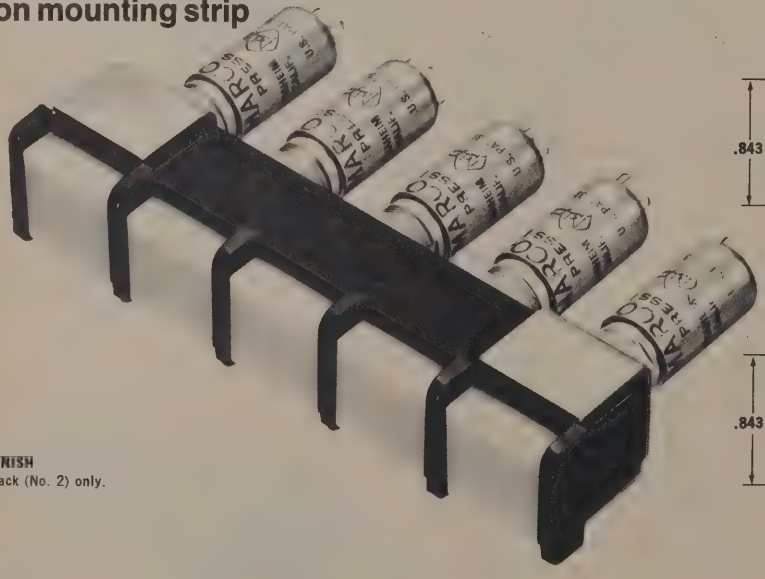
Where 3 or more Recess Adaptors (Style 5) or Recess Barrier Mounts (Style 6) are to be mounted next to each other, it is recommended complete assemblies be ordered mounted on an aluminum strip to facilitate final assembly into the panel. Installation requires tightening of only 2 hex nuts.

When ordering 50X or 60X assemblies, X is the number of stations. Thus, part no. 516-4015-5081 describes an 8 station recess adaptor assembly with bright finish.

Where more than one type of base or pushbutton color is to be installed on the mounting strip, or special legends are required, provide complete information and a special part number will be assigned to identify the assembly.

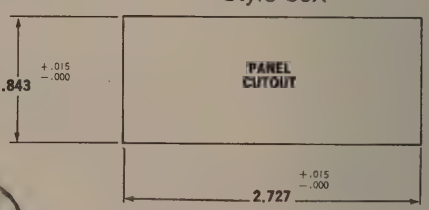
The mounting strips do not alter space requirements of Style 5 or 6. The panel cutouts for 3 or more stations are as follows:

## STYLE 60X
## recess barrier mounts on mounting strip



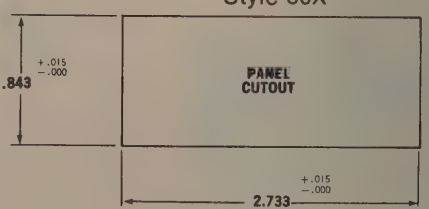
**FINISH**
Black (No. 2) only.

Style 50X




For 3 assemblies on strip.
For each additional assembly add .942.

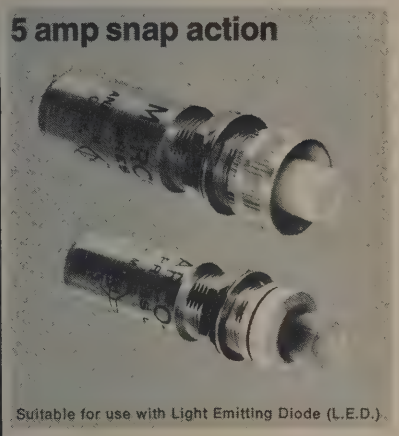
Style 60X




For 3 assemblies on strip.
For each additional assembly add .906.

# Presslites, Low Profile

## 5 amp snap action



Suitable for use with Light Emitting Diode (L.E.D.)

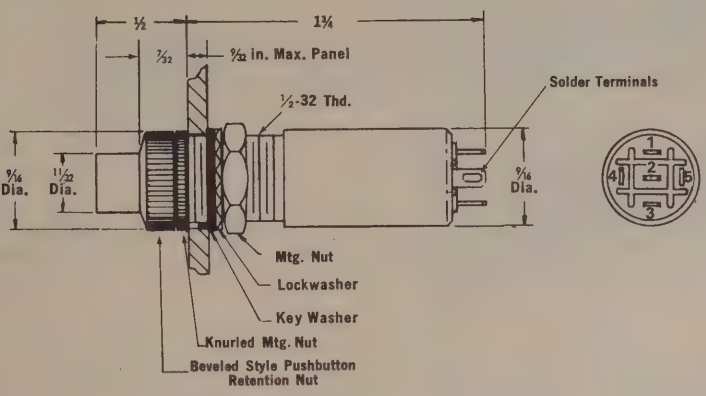
## ALTERNATE ACTION TYPE 416, TYPE 616
## MOMENTARY ACTION TYPE 418, TYPE 618

U.L. RECOGNIZED

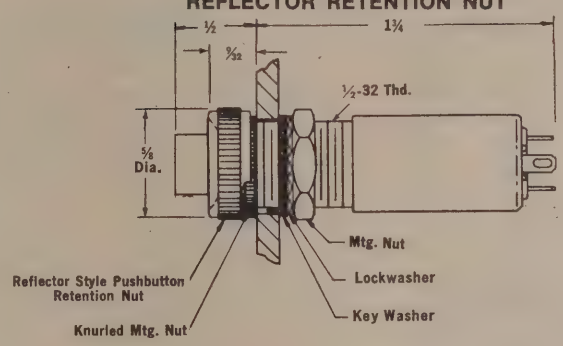
**Notes:**

1. **Switch Characteristics:**
   - Contact rating: 5 amps resistive at 115 VAC or 28 VDC.
   - Nominal pushbutton travel:
     Type 416,676 7/32 in.
     Type 418,618 1/8 in.
   - Nominal operating force:
     Type 416,616 1½ lbs.
     Type 416,618 2 lbs.
2. **Materials and Finishes:**
   - Pushbutton: high impact resistant plastic per L-P-349.
   - Pushbutton retention and knurled Mtg. nut: aluminum, bright anodized.
   - Keywasher and Mtg. nut; brass, nickel plated.
   - Housing: aluminum, anodized.
   - Terminals and contacts; coin silver.
   - Terminal board; molded thermoset plastic.
3. **Lamp:** T-1¾ incandescent, T-2 neon, or D2 L.E.D. with midget flange base. See lamp selection guide. Lamp may be replaced from front of panel by removing pushbutton retention nut. Switches will not operate with lamp removed.
4. **Weight:** Approx. .5 oz.
5. **Styles:** Where maximum indication of pushbutton illumination is of primary importance, the reflector style retention nut is recommended.

### Style 1
### BEVELED RETENTION NUT




### Style 2
### REFLECTOR RETENTION NUT




**PANEL CUTOUTS**

Key washer and slot may be omitted for mounting in round hole.

**SCHEMATICS**

| Complete Assembly Part Numbers For Style 1 Pushbutton Retention Nut | | | | | | |
|---|---|---|---|---|---|---|
| Translucent Pushbutton Colors | Incandescent (Less Lamp) | | 115 VAC Neon (Includes A1H Lamp) | | Light Emitting Diode (Includes D2 Lamp) | |
| | Alternate Action | Momentary Action | Alternate Action | Momentary Action | Alternate Action | Momentary Action |
| White | 616-5-1 | 618-5-1 | 416-5-1-A1H | 418-5-1-A1H | — | — |
| Red | 616-6-1 | 618-6-1 | 416-6-1-A1H | 418-6-1-A1H | 616-6-1-D2 | 618-6-1-D2 |
| Green | 616-7-1 | 618-7-1 | — | — | — | — |
| Amber | 616-8-1 | 618-8-1 | 416-8-1-A1H | 418-8-1-A1H | — | — |
| Blue | 616-11-1 | 618-11-1 | — | — | — | — |
| Yellow | 616-12-1 | 618-12-1 | — | — | — | — |
| Orange | 616-16-1 | 618-16-1 | — | — | — | — |
| Lunar | 616-17-1 | 618-17-1 | 416-17-1-A1H | 418-17-1-A1H | — | — |

( ) Designates color selection.

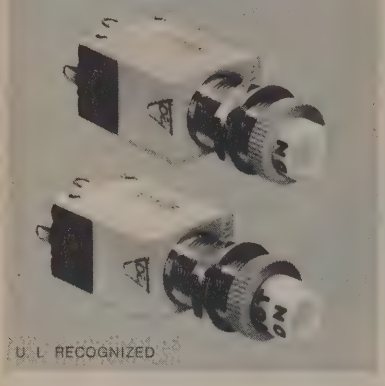
To order switch with reflector style pushbutton retention nut (style 2), change hardware designation number from 1 to 2. Example: 616-5-2.

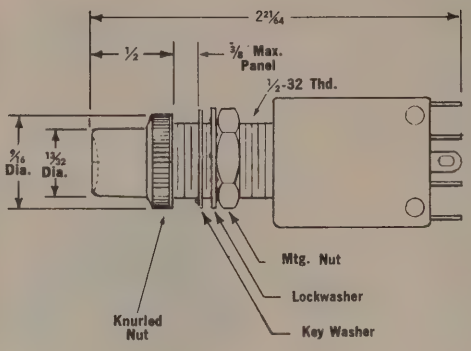
To order switch with incandescent lamp installed, add lamp number as 3 digit suffix to part number. Example: 616-5-1-327.

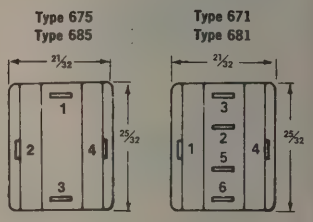
**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# Presslites, Low Profile

## 10.5 amp snap action



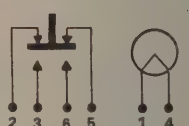

**Notes:**

1. **Switch Characteristics:**
   - Contact rating; 10.5 amps resistive, 125/250 VAC. 10.5 amps resistive, 28 VDC, ¼ H.P. 125/250 VAC.
   - Alternate action switches: pushing button closes N.O. contacts and latches pushbutton. Pushing button again releases contacts and returns pushbutton to "out" position. Pushbutton latch point is 5/32 in. from "out" position. Switch and latch interlocked to prevent teasing.
   - Nominal pushbutton travel: Alternate action switches: 7/32 in. Momentary action switches: 3/32 in.
   - Nominal operating force: Single pole switches: 12 oz. Double pole switches: 20 oz.
2. **Materials and Finishes:**
   - Pushbuttons; high impact resistant plastic per L-P-349a.
   - Knurled nut; aluminum, bright anodized.
   - Keywasher and mtg. nut; brass, nickel plated.
   - Lockwasher; stainless steel.
   - Housing; molded thermoplastic.
   - Contacts: coin silver.
3. **Lamp:** T-1¾ incandescent with midget flange base or AIH neon. See lamp selection guide. Lamp may be replaced from front of panel by removing pushbutton.
4. **Weight:** Approx. .6 oz.

**5. Solder Terminals:** Terminals accept AMP FASTON No. 60729-1 receptacles or equiv.

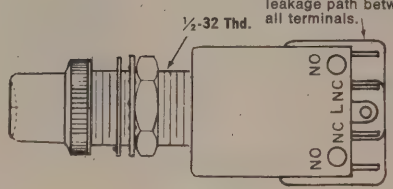
Single Throw, Normally Open
Type 675 Alternate Action
Type 685 Momentary Action
Contact Module
U.L. Listed

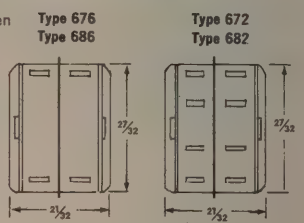
SCHEMATICS

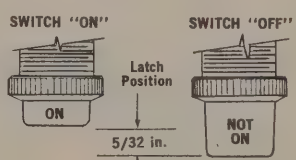



Double Throw, 2 Circuit
Type 671 Alternate Action
Type 681 Momentary Action
Contact Module
U.L. Listed

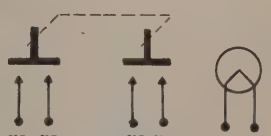
Fiberglass insulation provides 5/32 in. min. leakage path between all terminals.



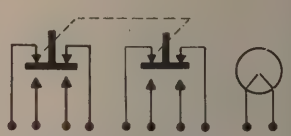




Alternate action switches may be ordered with pushbuttons marked as shown to give positive indication of switch position.



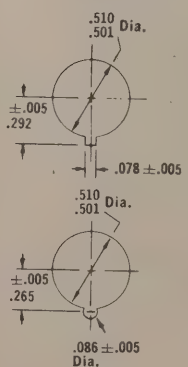

Single Throw, Normally Open
Type 676 Alternate Action
Type 686 Momentary Action
Contact Modules
U.L. Listed

SCHEMATICS




Double Throw, 2 Circuit
Type 672 Alternate Action
Type 682 Momentary Action
Contact Modules
U.L. Listed

**PANEL CUTOUTS**

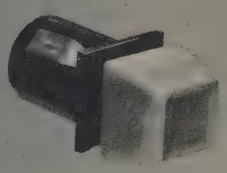



| Translucent Pushbutton Colors | Complete Assembly Part Numbers (Less Lamp) For Switches With Unmarked Pushbutton | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Single Pole | | | | Double Pole | | | |
| | Single Throw, Normally Open | | Double Throw, 2 Circuit | | Single Throw, Normally Open | | Double Throw, 2 Circuit | |
| | Alternate | Momentary | Alternate | Momentary | Alternate | Momentary | Alternate | Momentary |
| White | 675-5 | 685-5 | 671-5 | 681-5 | 676-5 | 686-5 | 672-5 | 682-5 |
| Red | 675-6 | 685-6 | 671-6 | 681-6 | 676-6 | 686-6 | 672-6 | 682-6 |
| Green | 675-7 | 685-7 | 671-7 | 681-7 | 676-7 | 686-7 | 672-7 | 682-7 |
| Amber | 675-8 | 685-8 | 671-8 | 681-8 | 676-8 | 686-8 | 672-8 | 682-8 |
| Blue | 675-11 | 685-11 | 671-11 | 681-11 | 676-11 | 686-11 | 672-11 | 682-11 |
| Yellow | 675-12 | 685-12 | 671-12 | 681-12 | 676-12 | 686-12 | 672-12 | 682-12 |
| Orange | 675-16 | 685-16 | 671-16 | 681-16 | 676-16 | 686-16 | 672-16 | 682-16 |
| Lunar | 675-17 | 685-17 | 671-17 | 681-17 | 676-17 | 686-17 | 672-17 | 682-17 |

To order switch with "Not On" marking on pushbutton, add 5 to part number suffix. Examples: 675-55, 671-56.
To order switch with lamp installed, add lamp number as 3 digit suffix to part number. Example: 675-55-327.

# Presslites, Snap-in

## ½ amp momentary action switch and matching indicator

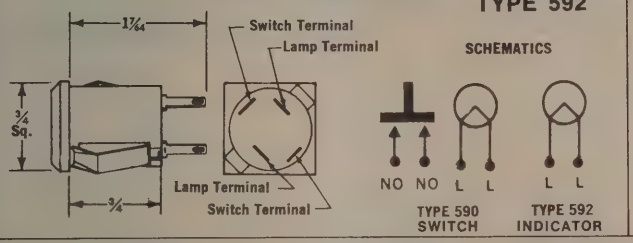


Suitable for use with Light Emitting Diode (L.E.D.)

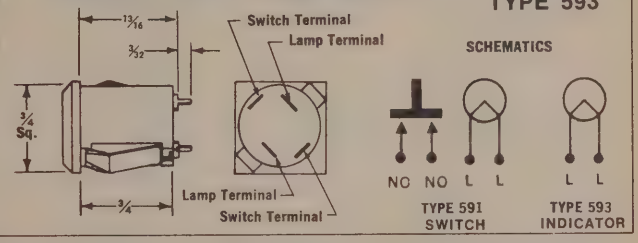
The double break bifurcated wiping action contacts of the Snap-In Presslite Series provide extremely reliable switching for data entry and control applications. In addition to low initial cost, a further major saving results from the very simple mounting procedure of pressing the switch into a round panel hole. The round mounting hole provides a further advantage for matrix mount applications. Instead of the complicated egg crate assemblies which were used in the past, a simple plate with 11/16 inch diameter holes punched on ¾ inch centers is all that is needed to mount any size matrix.

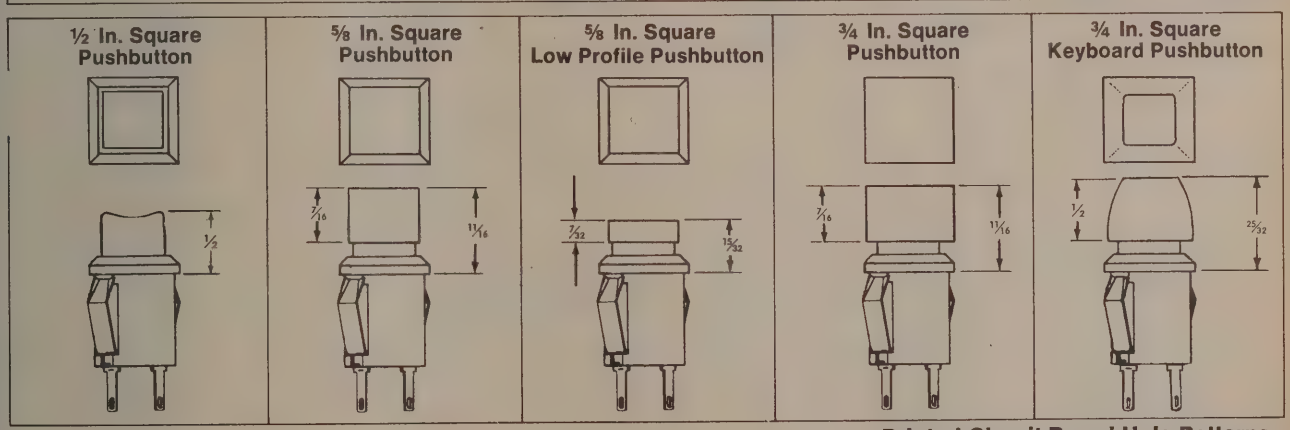
All of the pushbutton styles described on Page 12 are available for the Snap-In Presslite. In addition, pushbuttons are available which enhance legibility for use with light emitting diodes and neon lamps. These pushbuttons may be used interchangeably with both the Types 590 and 591 Presslite, and the Types 592 and 593 matching indicator.

### SOLDER TERMINALS — TYPE 590 TYPE 592




### PRINTED CIRCUIT TERMINALS — TYPE 591 TYPE 593



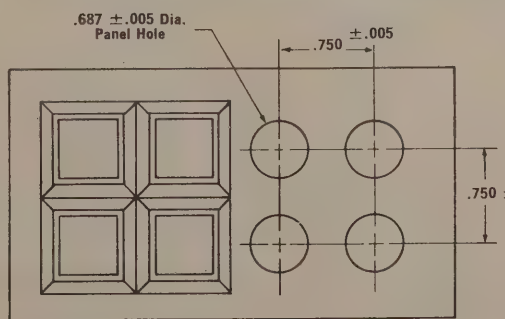




**Notes:**

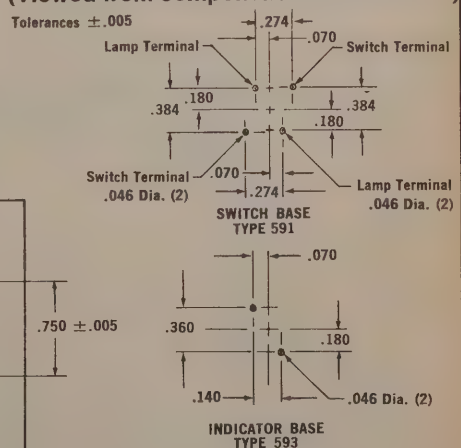
1. **Switch Characteristics**
   - Contact rating: ½ amp resistive at 30 VDC. 1/10 amp resistive at 115 VAC.
   - Nominal pushbutton travel: .1 in.
   - Nominal operating force: 4 oz.
2. **Materials and Finishes:**
   - Pushbuttons: high impact plastic per L-P-349a.
   - Housing: black thermoplastic.
   - Mounting clip: stainless steel.
   - Lamp terminals: beryllium copper, tin plated.
   - Switch terminals and contacts: brass, gold plated.
3. **Lamp:** T-1¾ incandescent, T-2 neon, or L.E.D. with midget flange base. See lamp selection guide. Lamp remains stationary when pushbutton is depressed.
4. **Mounting:** Assemblies press fit into .687 ±.005 dia. holes from front of panel .Mounting clips accommodate panels from 1/16 in. to 3/16 in.
5. **Weight:** Approx. .25 oz.
6. **Solder Terminals:** Terminals accept AMP FASTON receptacle #60415 -1 or equiv.

### MATRIX MOUNTING

Switch and Indicator Bases may be mounted to form any size Matrix by spacing panel holes as shown.



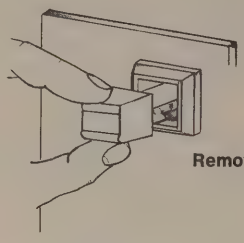

### Printed Circuit Board Hole Patterns (Viewed from component side of boards.)



**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

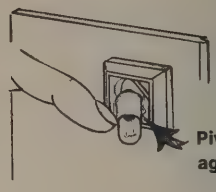


## RELAMPING PROCEDURE



Remove pushbutton.

To replace lamp, reverse procedure.



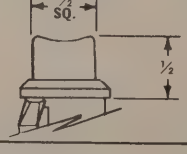
Pivot lamp diagonally against exposed contact.

**COMPLETE ASSEMBLY PART NUMBERS (LESS LAMPS) FOR SWITCH WITH SOLDER TERMINALS**

| Pushbutton Style Designation<br>See Pages 12 and 13 | ½ In. Square Pushbutton | ⅝ In. Square Pushbutton | ⅝ In. Square Low Profile Pushbutton | ¾ In. Square Pushbutton | ¾ In. Square Keyboard Pushbutton |
|---|---|---|---|---|---|
| 1 | 590-5216 | 590-5316 | 590-5416 | 590-5516 | 590-5616 |
| 2 | — | 590-5326 | 590-5426 | 590-5526 | — |
| 3 | — | 590-5336 | 590-5436 | 590-5536 | — |
| 4 | 590-5246 | 590-5346 | — | 590-5546 | 590-5646 |
| 5 | — | 590-5356 | — | 590-5556 | — |
| 7 | — | — | — | 590-5576 | — |
| 8 | — | — | — | 590-5586 | — |
| 9 | — | — | — | 590-5596 | — |
| 14 | — | — | — | 590-55146 | — |
| 15 | — | — | — | 590-55156 | — |
| 16 | — | — | — | 590-55166 | — |

- **Pushbutton Colors:** Last digit, 6, of above part numbers designates translucent red color. For other colors change to one of following: white 5; green 7; blue 11; yellow 12; orange 16; lunar 17; dark red 36; light green 37. Do not specify colors 17, 36, and 37 as filter colors for styles 4, 5, 9, and 16.
- **Base Types:** To order complete assembly with other base types change 590 to desired type,(i.e., 591, 592, 593)
- **Lamps:** To order complete assembly with lamp installed, add lamp no. as 3 digit suffix to part no. Example: 590-5216-327.
- **Styles:** See pages 12 and 13 for description of pushbutton styles.

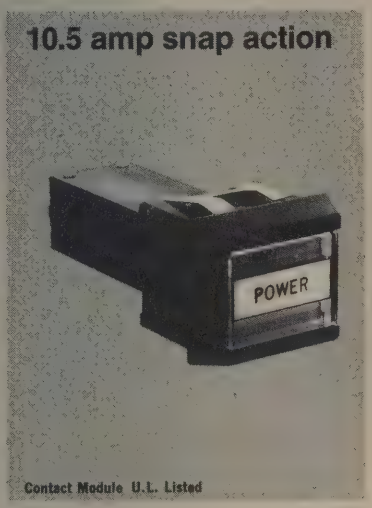
**COMPLETE ASSEMBLY PART NUMBERS WITH NEON OR LIGHT EMITTING DIODE LAMP FOR SWITCH WITH SOLDER TERMINALS**

| ½ In. Square High Brightness Pushbutton | Transparent Pushbutton Colors | 115 VAC Neon (Includes A1H Lamp) | Light Emitting Diode* (Includes D2 Lamp) |
|---|---|---|---|
|  | Clear | 590- 5P73-A1H | — |
| | Red | 590- 6P73-A1H | 590-6P71-D2 |
| | Amber | 590- 8P73-A1H | — |
| | Lunar | 590-17P73-A1H | — |

- **Base Types:** To order complete assembly with other base types change 590 to desired type,(i.e., 591, 592, 593)
- **Translucent Colors:** Not recommended.

* Pushbutton has an internal microgroove lens for optimum light dispersion.

# Presslites, Rainbow

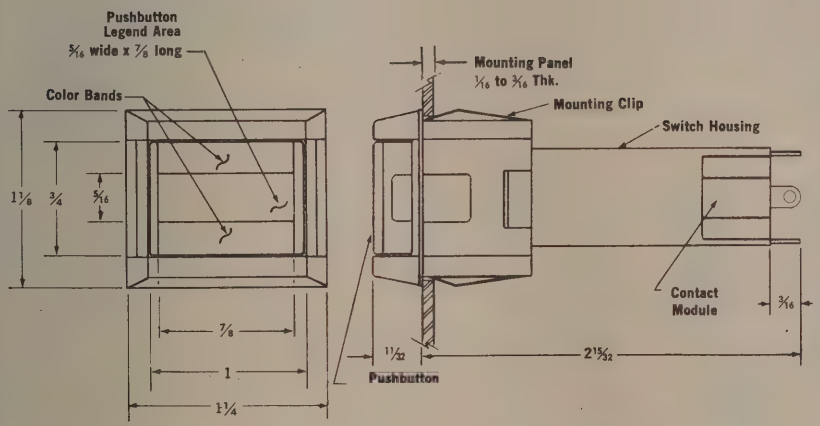



The Rainbow Switch is totally unique in its ability to change pushbutton color when it is depressed from the "off" to the "on" condition. A varied selection of colors is available to the designer.

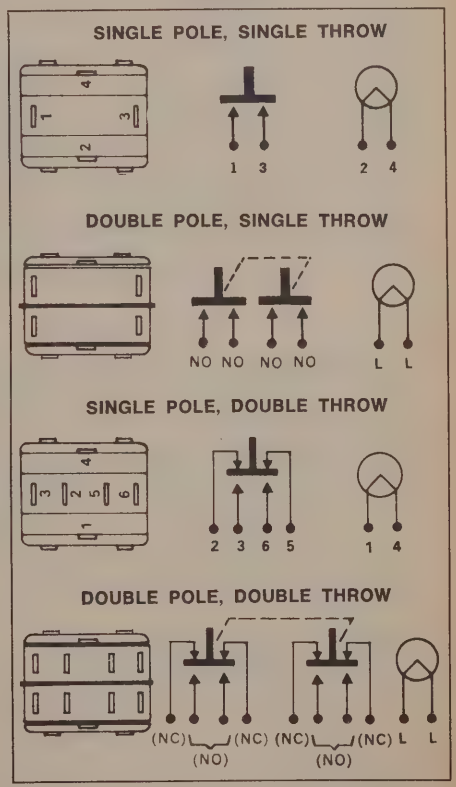
A white legend area is provided between the color bands, which may be illuminated by a lamp contained inside the pushbutton. This lamp also provides illumination of the color bands for operation in a dark environment, but this additional illumination is unnecessary for viewing under normal ambient light levels.

Alternate action switches provide a latching action, so the pushbutton remains down while the switch is "on", and returns to the out position when the switch is turned "off" by again depressing the pushbutton. This latching action retains the color and legend changes between operations. Momentary action Rainbow Switches are also offered as companion items. Their color and legends remain changed only while the pushbutton is depressed, after which they return to the out position.

In addition to the combinations listed below, many other variations are possible, and should be discussed with IPI Application Engineers.




SCHEMATICS




**Notes:**

**1. Switch Characteristics:**
- Contact rating: 10.5 amps at 125/250 volts AC or 28 volts DC resistive, ¼ HP 125/250 volts AC. Contact module U.L. listed.
- Alternate action switches: depressing pushbutton from "out" to "in" position changes color bands from one selected color to any other selected color, and button remains latched down. The next actuation restores color bands and switch to the "out" position. Switch and latch interlocked to prevent teasing.

**2. Materials and Finishes:**
- Switch housing: Molded thermoplastic, optional black or light gray color.
- Mounting clips: stainless steel.
- Lamp terminals: brass, gold flashed and tin plated.
- Switch terminals: brass, silver plated.
- Cap assembly: molded thermoplastic.

**3. Lamp:** T-1¾ bulb with midget flange base. See lamp selection guide. Pushbutton engages switch plunger with tight friction fit permitting relamp from front of panel without use of tools.

**4. Mounting:** assembly snaps in from front of panel without the use of tools.

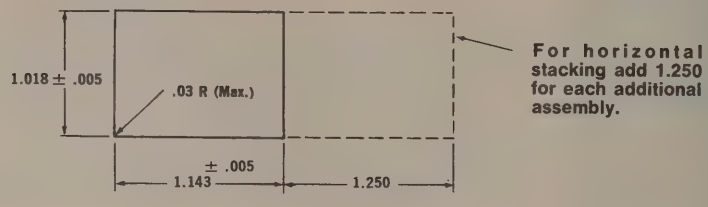
**5.** Terminals accept AMP FASTON receptacle #60729-1 or equal.

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447



## PANEL CUTOUT

**BASE SIZE 1**
**(¾ IN. x 1 IN. PUSHBUTTON)**




**Complete Assembly Part Numbers (Less Lamp) For Rainbow™ Switch With Gray Housing and ¾ in. x 1 in. Pushbutton**

| "In" Position Color Band Colors | Single Pole | | | | Double Pole | | | |
|---|---|---|---|---|---|---|---|---|
| | Single Throw Normally Open | | Double Throw 2 Circuit | | Single Throw Normally Open | | Double Throw 2 Circuit | |
| | Alternate | Momentary | Alternate | Momentary | Alternate | Momentary | Alternate | Momentary |
| Black | 1123-5-0-120105 | 1113-5-0-120105 | 1121-5-0-120105 | 1111-5-0-120105 | 1124-5-0-120105 | 1114-5-0-120105 | 1122-5-0-120105 | 1112-5-0-120105 |
| White | 1123-5-5-120105 | 1113-5-5-120105 | 1121-5-5-120105 | 1111-5-5-120105 | 1124-5-5-120105 | 1114-5-5-120105 | 1122-5-5-120105 | 1112-5-5-120105 |
| Red | 1123-5-6-120105 | 1113-5-6-120105 | 1121-5-6-120105 | 1111-5-6-120105 | 1124-5-6-120105 | 1114-5-6-120105 | 1122-5-6-120105 | 1112-5-6-120105 |
| Green | 1123-5-7-120105 | 1113-5-7-120105 | 1121-5-7-120105 | 1111-5-7-120105 | 1124-5-7-120105 | 1114-5-7-120105 | 1122-5-7-120105 | 1112-5-7-120105 |
| Blue | 1123-5-11-120105 | 1113-5-11-120105 | 1121-5-11-120105 | 1111-5-11-120105 | 1124-5-11-120105 | 1114-5-11-120105 | 1122-5-11-120105 | 1112-5-11-120105 |
| Yellow | 1123-5-12-120105 | 1113-5-12-120105 | 1121-5-12-120105 | 1111-5-12-120105 | 1124-5-12-120105 | 1114-5-12-120105 | 1122-5-12-120105 | 1112-5-12-120105 |
| Orange | 1123-5-16-120105 | 1113-5-16-120105 | 1121-5-16-120105 | 1111-5-16-120105 | 1124-5-16-120105 | 1114-5-16-120105 | 1122-5-16-120105 | 1112-5-16-120105 |

- **Housing Colors:** To order switch with black housing color, change second digit of base assembly part number from 1 to 0. Examples: 1023-5-0-120105.

- **Color Bands:** Above part numbers are for switches with white "out" color bands. To order switch with other colors, change first dash no. of part number from 5 to one of the following:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Black | 0 | Red | 6 | Blue | 11 | Orange | 16 |
| White | 5 | Green | 7 | Yellow | 12 | | |

Examples: For red "out" color band: 1123-6-0-120105.

- **Lamps:** To order complete assembly with lamp installed, add lamp no. as 3 digit suffix to part number. Examples: 1123-5-0-120105-327.

## LEGENDS

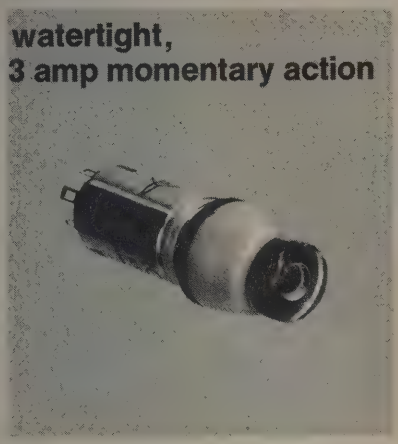
Pushbuttons and color bands may be marked with any letter/number combination space permitting. Specify marking desired after selecting assembly part number designating switch type and color band colors from above tables. Unless otherwise specified all marking will be black, 7/64 in. high. Maximum number of characters per line is nine. Indicate desired marking for pushbutton and each upper and lower color band. Note that pushbutton legend marking does not change when pushbutton is depressed and marking for upper and lower color bands may be different if desired. A sketch similar to the illustrated example should be included with order.

EXAMPLE:
ASSEMBLY PART NO. 1121-5-16-120105
With Special Marking

| | | |
|---|---|---|
| "Out" Position | OFF | Upper color band (white) |
| | POWER | Pushbutton legend (white) |
| | OFF | Lower color band (white) |
| "In" Position | ON | Upper color band (orange) |
| | POWER | Pushbutton legend (white) |
| | ON | Lower color band (orange) |

# Presslites, Watertight, Splashproof, and E.M.I. Suppressed

## watertight, 3 amp momentary action



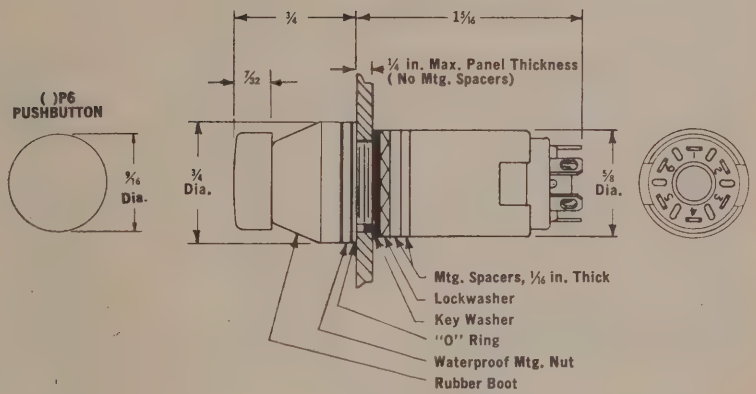
This switch features a grey silicone rubber boot and rubber washer which provide a true watertight seal from the front of the mounting panel. The pushbutton screws into the switch base and may be removed from the front of the panel for relamping.

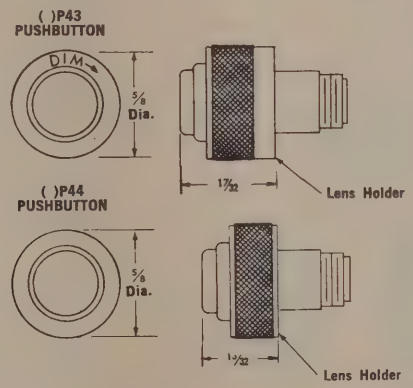
When switching a 3 amp resistive load, life expectancy exceeds 1 million cycles.

The linear action switch mechanism is provided with a special overtravel device which prevents damage to the contacts from excessive pushbutton pressure and assures positive engagement of the contacts at an optimum force. To assure immunity to mildly corrosive environments, all terminals, contacts and springs are heavy gold flashed.

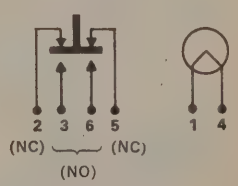
**Notes:**

1. **Switch Characteristics:**
   - Contact rating: 3 amps resistive at 115 VAC or 30 VDC.
   - Nominal pushbutton travel: 1/8 in. including 1/32 in. pretravel and 1/32 in. overtravel.
   - Nominal operating force: 48 oz.
2. **Materials and Finishes:**
   - Pushbuttons: high impact resistant plastic per L-P-349a.
   - Lens holders: aluminum, black anodized.
   - Rubber boot and "O"-ring: silicone rubber.
   - Mtg. tube and spacers: aluminum, anodized per MIL-A-8625.
   - Keywasher: brass, nickel plated.
   - Lockwasher: stainless steel.
   - Terminal board: molded thermoset plastic.
   - Terminals and contacts: coin silver, gold plated.
3. **Lamp:** T-1¾ bulb with midget flange base. See lamp selection guide.
4. **Mounting:** Recommended mounting tool for tightening mounting nut: Marco-Oak #51630 (Xcelite Inc. #ST62-196 or equivalent).

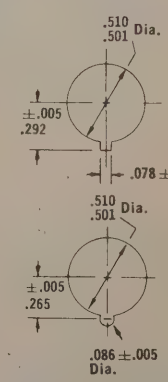



SCHEMATIC




PANEL CUTOUTS




(Key washer and slot may be omitted in some installations)

| Complete Assembly Part Numbers (Less Lamp) | | | |
|---|---|---|---|
| Transparent Pushbutton Colors | ( )P6 Pushbutton | ( )P43 Dimmer Pushbutton | ( )P44 Non-Dim Pushbutton |
| Clear* | 643-35-7 | 643-15-7 | 643-25-7 |
| Red | 643-36-7 | 643-16-7 | 643-26-7 |
| Green | 643-37-7 | 643-17-7 | 643-27-7 |
| Amber | 643-38-7 | 643-18-7 | 643-28-7 |
| Blue | 643-311-7 | 643-111-7 | 643-211-7 |
| Yellow | 643-312-7 | 643-112-7 | 643-212-7 |
| Orange | 643-316-7 | 643-116-7 | 643-216-7 |
| Lunar | 643-317-7 | 643-117-7 | 643-217-7 |

Translucent colors: Add "TL" to first Dash No. of Part Number. Example: TL

*White if translucent color specified.

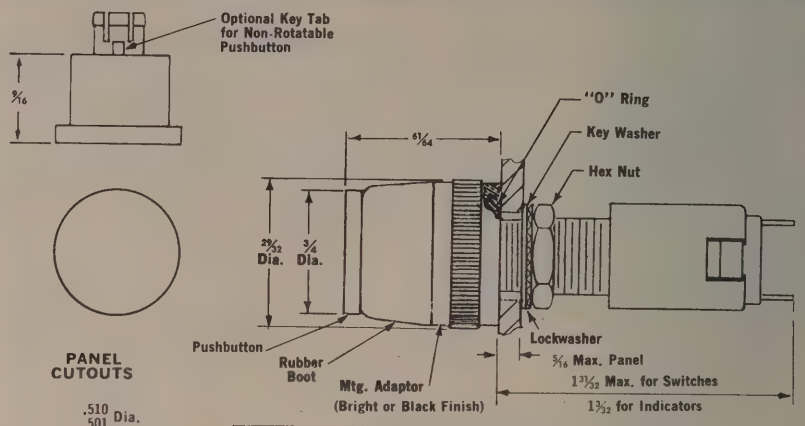
( ) Designates color selection.

To order complete assembly with lamp installed, add Lamp No. as 3 digit suffix to Part No. Example: 643-36-7-327.

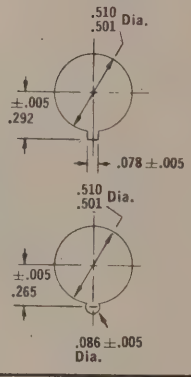
**OAK Industries Inc.**
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# Presslites, Watertight, Splashproof, and E.M.I. Suppressed

## splashproof, oiltight presslites




**PANEL CUTOUTS**




**Notes:**

1. **Switch or Indicator Bases:**
   - All Presslite base types shown on pages 7, 8, 9, 10, and 11 except types 534, 535, 543, 546, 563, and 568 may be used with this mounting accessory.
2. **Materials and Finishes:**
   - Pushbutton: high impact resistant plastic per L-P-349a.
   - Rubber boot: gray silicone rubber supplied with bright anodized adaptor. Black neoprene rubber supplied with black anodized adaptor. (Neoprene seals recommended for oiltight applications.)
   - Mounting adaptor: aluminum, bright or black anodized.
   - Hex nut: brass, nickel plated.
   - Lockwasher: stainless steel.
3. **Lamp:** T-1¾ bulb with midget flange base. See lamp selection guide. Lamp may be replaced from front of panel by removing pushbutton.

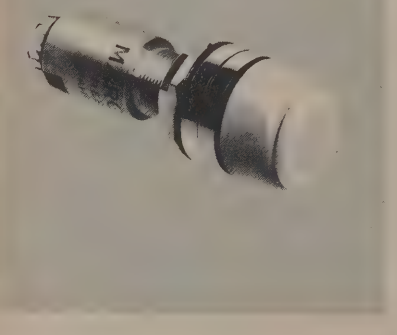
| Complete Assembly Part Numbers (Less Lamp) With Rotatable Pushbutton and Type 542 Switch | | |
|---|---|---|
| Translucent Pushbutton Colors | Mounting Adaptor Finish | |
| | Bright Anodized | Black Anodized |
| White | 542-9015-91 | 542-9015-92 |
| Red | 542-9016-91 | 542-9016-92 |
| Green | 542-9017-91 | 542-9017-92 |
| Blue | 542-90111-91 | 542-90111-92 |
| Yellow | 542-90112-91 | 542-90112-92 |
| Orange | 542-90116-91 | 542-90116-92 |
| Lunar | 542-90117-91 | 542-90117-92 |

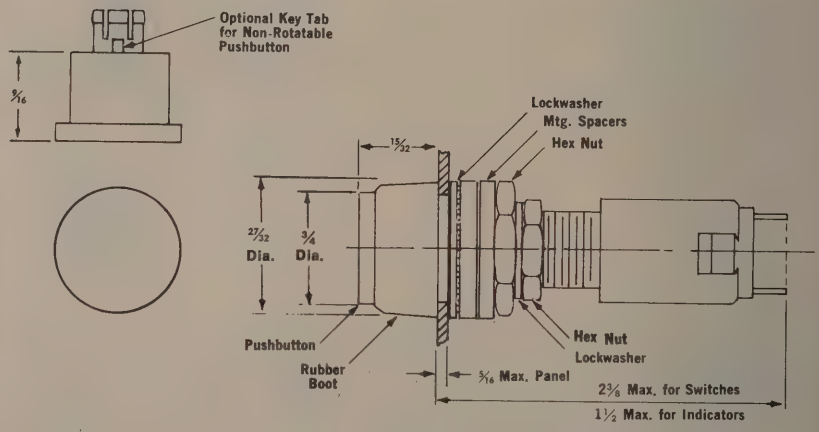
To order complete assembly with other base type, change Base No. 542 to desired type. Example: 521-9015-91

To order non-rotatable pushbutton change second digit of Pushbutton No. from 0 to 1. Example: 542-9115-91

To order complete assembly with lamp installed, add Lamp No. as 3 digit suffix to Part No. Example: 542-9015-91-327

## splashproof, E.M.I. suppressed, presslites






**PANEL CUTOUT**

**Notes:**

1. **Switch or Indicator Bases:**
   - All Presslite base types shown on pages 7, 8, 9, 10, and 11 except types 534, 535, 543, 546, 563, and 568 may be used with this mounting accessory.
2. **Materials and Finishes:**
   - Pushbutton: high impact resistant plastic per L-P-349a.
   - Rubber boot: gray silicone rubber.
   - Hex nuts and spacers: brass, nickel plated.
   - Lockwashers: stainless steel.
3. **Lamp:** T-1¾ bulb with midget flange base. See lamp selection guide. Lamp may be replaced from front of panel by removing pushbutton.

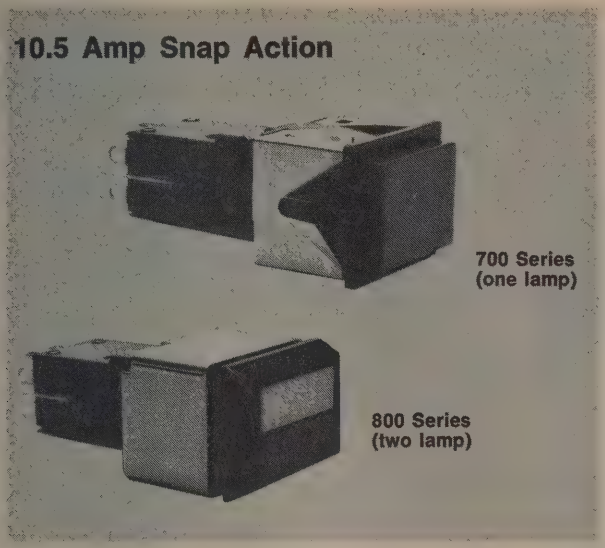
| Complete Assembly Part Numbers (Less Lamp) With Type 542 Switch | | |
|---|---|---|
| Translucent Pushbutton Colors | Rotatable Pushbutton | Non-Rotatable Pushbutton |
| White | 542-53660-10-5 | 542-53660-11-5 |
| Red | 542-53660-10-6 | 542-53660-11-6 |
| Green | 542-53660-10-7 | 542-53660-11-7 |
| Blue | 542-53660-10-11 | 542-53660-11-11 |
| Yellow | 542-53660-10-12 | 542-53660-11-12 |
| Orange | 542-53660-10-16 | 542-53660-11-16 |
| Lunar | 542-53660-10-17 | 542-53660-11-17 |

To order complete assembly with other base type, change Base No. 542 to desired type. Example: 521-53660-10-5

To order complete assembly with lamp installed, add Lamp No. as 3 digit suffix to Part No. Example: 542-53660-10-5-327

# SINGLE & SPLIT LEGEND PRESSLITES

## 10.5 Amp Snap Action




- Five Pushbutton Styles
- Nine Standard Colors
- Single or Split Legends
- Momentary or Alternate Actions
- Snap-in or Hard mounting
- U.L. Recognized

Either Presslite series—the *700* (single lamp) or *800* (two lamps)—are available with a wide range of legends, colors, styles, actions and mountings to fit your needs.

Five pushbutton styles are available in any of nine standard colors. They come in either single or split legend designs, with or without barriers, in either black or light gray.

**Unmatched flexibility.** Not only in color and style, but in mountings and actions. You can choose from two mounting styles: A snap-in for fast mounting and a hard-mount for severe conditions.

You can specify momentary or alternate action. Alternate action switches come with a latching pushbutton which remains depressed while the switch is "on."

Our new patented mechanism interlocks the switching and latching actions so it's impossible to "tease" the switch. Either it's on or it's off. Period. Competitive designs require full depression to latch; incomplete depression only provides a temporary closure until finger pressure is removed.

**Display options.** Applications are limited only by the designer's ingenuity and job requirements. In the simplest application, single lamp models are energized directly by the voltage being switched resulting in direct display of on-off condition. With dual lamp, split legend models, far more sophistication is possible. For instance, the upper legend could light up when the system is ready for a special command. Then when the command is given (by depressing the pushbutton) the light would go out. As soon as the command was executed, the lower legend could then light. Either or both legends might flash on and off to indicate a malfunction or emergency condition. There's no end to the flexibility.

**Easy installation and maintenance.** Unlike many switches, Presslite assemblies snap in quickly from the front of the panel. The most popular versions take a simple push in and snap, they're in place. Relamping is accomplished simply by removing the pushbutton and inserting the new lamp. If you want to change the legend that's easy, too, because each color legend plate is quickly replaced without removing the whole assembly.

### PUSHBUTTONS

**Styles:** Series 700 and 800 Presslites' five standard styles meet most application requirements. Specials, such as hidden legends, are also available. When you require two different styles on a split legend pushbutton, a drawing or sketch should be provided.

**Colors:** Standard—white, lunar, red, dark red, green, light green, blue, orange, and yellow. Standard colors were selected to provide a pleasing appearance in the "off" position and high light transmission when the lamp is "on." Two different reds and greens are offered for most effective illumination. Dark Red and Light Green provide optimum legibility under high ambient light. Lunar is similar to white, but provides higher light transmission.

**Engraving:** Presslites are engraved at the factory, or your Oak Switch Division distributor can provide custom engraving. Where you anticipate severe service, Style 8 is recommended to protect the engraved legend.

**Style 1**—One-piece design with wrap-around construction provides colored front and side surfaces.

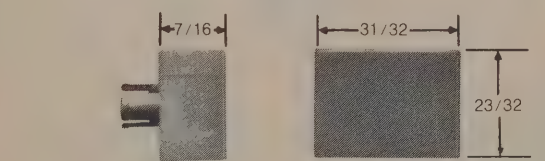
**Style 2**—Flat colored lens has a 1/32" black opaque frame and black opaque sides. Used where no light transmission through the sides is allowed.

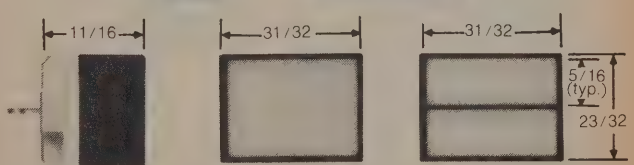
**Style 4**—This lunar color Style 1 pushbutton has an internal filter of the desired color, which is visible only when the lamp is illuminated.

**Style 5**—Same as Style 4, but has black opaque sides.

**Style 8**—Same as Style 2, except colored lens is covered with a clear window. Recommended for applications where the legend must be protected from abrasion.

**Single lamp**




**Two lamp**

**Single lamp pushbutton part numbers**

| Lens or Filter Color | Pushbutton Style | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 4 | 5 | 8 |
| WHITE | 12015 | 12025 | — | — | 12085 |
| RED | 12016 | 12056 | 12046 | 12056 | 12086 |
| GREEN | 12017 | 12027 | 12047 | 12057 | 12087 |
| BLUE | 120111 | 120211 | 120411 | 120511 | 120811 |
| YELLOW | 120112 | 120212 | 120412 | 120512 | 120812 |
| ORANGE | 120116 | 120216 | 120416 | 120516 | 120816 |
| LUNAR | 120117 | 120217 | — | — | 120817 |
| DARK RED | 120136 | 120236 | — | — | 120836 |
| LIGHT GREEN | 120137 | 120237 | — | — | 120837 |

Single lamp pushbuttons are made from butyrate plastic, per L-P-349.
Two lamp pushbuttons are made from polycarbonate plastic, per L-P-393.

**Two lamp pushbutton part numbers**

| Lens or Filter Color | Single Lens | | | Split Lens | | |
|---|---|---|---|---|---|---|
| | Style 2 | Style 5 | Style 8 | Style 2 | Style 5 | Style 8 |
| WHITE | 3225 | — | 3285 | 3325 | 3355 | 3385 |
| RED | 3226 | 3256 | 3286 | 3326 | 3356 | 3386 |
| GREEN | 3227 | 3257 | 3287 | 3327 | 3357 | 3387 |
| BLUE | 32211 | 32511 | 32811 | 33211 | 33511 | 33811 |
| YELLOW | 32212 | 32512 | 32812 | 33212 | 33512 | 33812 |
| ORANGE | 32216 | 32516 | 32816 | 33216 | 33516 | 33816 |
| LUNAR | 32217 | — | 32817 | 33217 | — | 33817 |
| DARK RED | 32236 | — | 32836 | 33236 | — | 33836 |
| LIGHT GREEN | 32237 | — | 32837 | 33237 | — | 33837 |

Part numbers listed for split legend pushbuttons designate the same color lens or filter on both top and bottom. For different colors at the bottom portion, add one of the following numbers: white 5, red 6, green 7, blue 11, yellow 12, orange 16, lunar 17, dark red 36, light green 37. Example: 332512 for white lens on the top, yellow lens on the bottom.

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# SINGLE & SPLIT LEGEND PRESSLITES

## BASE ASSEMBLIES

**Contact rating:** 10.5 amps resistive, ¼ hp, 125/250 vac. 10.5 amps resistive, 28 vdc. Contact modules U.L. listed, CSA certified.

**Latching action:** Alternate action switches have latching pushbutton feature. Pushbutton latch point is 3/32" from "out" position.

**Materials and finishes:** Black or light gray thermoplastic housing. Contacts are silver alloy. Switch terminals are silverplated brass. Lamp terminals are tin-plated brass.

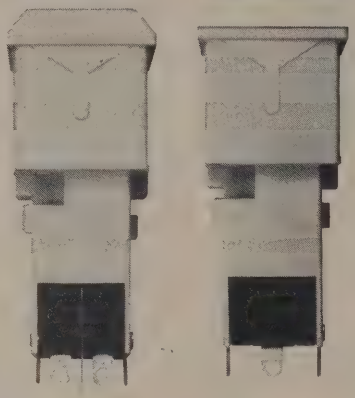
**Nominal operating force:** Single pole, alternate; 16 ozs., double pole, alternate; 24 ozs. Single pole, momentary; 10 ozs. double pole, momentary; 16 ozs.

### LAMP CIRCUITS

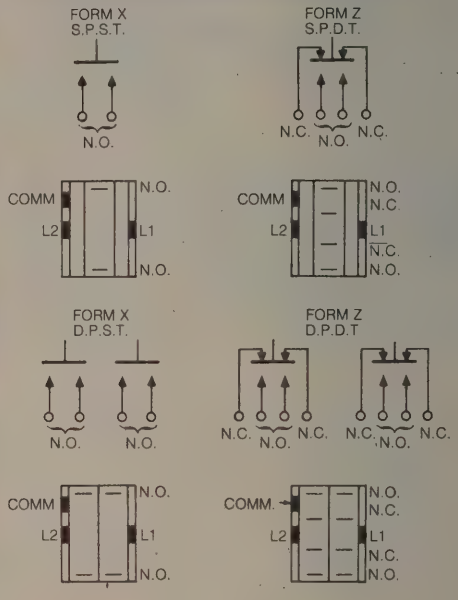
Single lamp — Two lamp

### BARRIER

### BEZEL



### CONTACT AND TERMINAL ARRANGEMENTS




### Base assembly part numbers

| Base Type | | | Single Lamp—700 Series | | | | Two Lamp—800 Series | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Black Housing | | Gray Housing | | Black Housing | | Gray Housing | |
| | | | Bezel | Barrier | Bezel | Barrier | Bezel | Barrier | Bezel | Barrier |
| Matching Indicator | | | 700 | 750 | 710 | 770 | 800 | 850 | 810 | 870 |
| ALTERNATE ACTION SWITCHES | FORM X | S.P.S.T. | 701 | 751 | 711 | 771 | 801 | 851 | 811 | 871 |
| | | D.P.S.T. | 702 | 752 | 712 | 772 | 802 | 852 | 812 | 872 |
| | FORM Z | S.P.D.T. | 703 | 753 | 713 | 773 | 803 | 853 | 813 | 873 |
| | | D.P.D.T. | 704 | 754 | 714 | 774 | 804 | 854 | 814 | 874 |
| MOMENTARY ACTION SWITCHES | FORM X | S.P.S.T. | 705 | 755 | 715 | 775 | 805 | 855 | 815 | 875 |
| | | D.P.S.T. | 706 | 756 | 716 | 776 | 806 | 856 | 816 | 876 |
| | FORM Z | S.P.D.T. | 707 | 757 | 717 | 777 | 807 | 857 | 817 | 877 |
| | | D.P.D.T. | 708 | 758 | 718 | 778 | 808 | 858 | 818 | 878 |

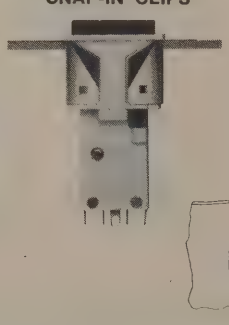
## MOUNTING HARDWARE

For most applications, snap-in clips provide more than adequate retention and minimal mounting time. In severe applications involving shock, vibration or substantial wiring harness loads, the sleeve mounting method provides extremely rigid clamping. The sleeve is easily tightened by means of two screws behind the pushbutton.

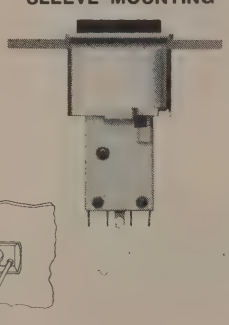
| MOUNTING HARDWARE PART NUMBERS | |
|---|---|
| Snap-in | Sleeve |
| 01 | 02 |

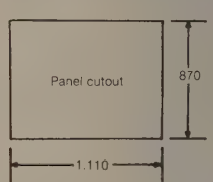
Snap-in clip and mounting sleeve material is stainless steel.
Panel thickness:
Snap-in—1/16" to 3/16"
Sleeve —1/32" to 1/4"

### SNAP-IN CLIPS



### SLEEVE MOUNTING






For vertical stacking, add .942 for each additional assembly.
For horizontal stacking, add 1.182 for each additional assembly.

Tolerances:
±.005 for snap-in
+.015 −.005 for sleeve mounting

### Lamp part numbers

SIZE T-1¾
MIDGET FLANGE BASE

| Lamp No. | Rated Voltage | Amps | Approx. M.S.C.P. | Average Life (Hrs.) | MS Part No. |
|---|---|---|---|---|---|
| 345 | 6.0 | .04 | .04 | 10,000 | — |
| 328 | 6.0 (5.0)* | .20 (.18)* | .60 (.34)* | 1,000 (10,000)* | MS25237-328 |
| 381 | 6.3 | .20 | .40 | 2,000 | — |
| 344 | 10.0 | .014 | .006 | 50,000 | — |
| 330 | 14.0 | .08 | .50 | 1,500 | MS25237-330 |
| 327 | 28.0 | .04 | .34 | 4,000 | MS25237-327 |
| 387 | 28.0 | .04 | .30 | 7,000 | MS25237-387 |

* Figures in parentheses are for derated operation at 5 volts.
Service conditions such as dc operation, voltage surges, temperature, shock, and vibration may contribute to shorter average life.

## HOW TO ORDER

A complete part number for an assembly consists of four block of digits, like these . . .

**711-12016-01-327**

Switch or indicator base assembly (select above)
Pushbutton (select from Page 26)
Mounting hardware (select above)
Lamp (select above)

# MARCOFLEX SWITCHES

- Alternate or Momentary Action
- Double Throw
- Small Size
- Fewer Parts/Higher Reliability
- Low Cost
- Tactile Feel
- High Contact Force
- Mounts in .625 Square Opening or P.C. Board

Oak Switch Division's new dimension in low-cost, high-quality small switches has the features of units twice its size. It also represents a major design breakthrough—the first small switch to break the alternate action/double throw barrier. And for application versatility, you can also purchase it as a momentary action switch or indicator.

**Immediate applications for Series 650**

The first switch to benefit from Marcoflex construction fits into a standard sized .625" panel opening...or mounts on a P.C. board. It's a direct replacement for the compact switches presently on the market, which offer only momentary action and single throw. You're sure to find many uses for Series 650.

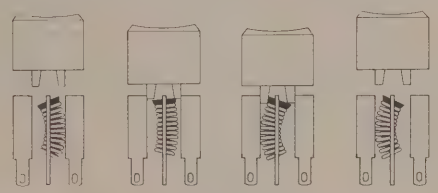
For example, high contact force combines with wiping action and bifurcated contacts to make these units particularly well suited for low level use. They're also ideal for peripheral equipment, eliminating the complex circuits otherwise required to compensate for lack of alternate or double throw mechanical action.

Versatility and low cost broaden the spectrum of applications to include lab test equipment, process control apparatus, broadcast studio controls, vending machines, hotel and airline reservation systems, and much more.

This Form C switch (single pole, double throw) has uniquely simple construction. It's the first to use Oak's patented Marcoflex design. Lower parts count and easy manufacturing combine to produce a cost-effective switch with inherent reliability.

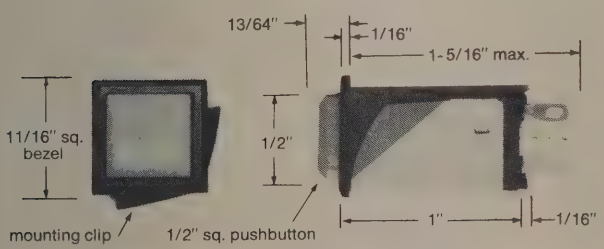
**How the Marcoflex mechanism works**

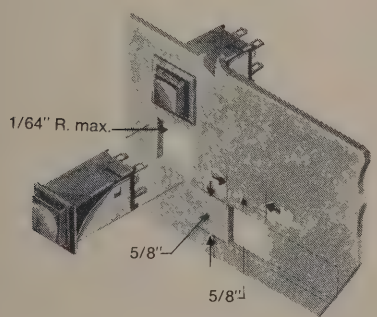
The Marcoflex design is based on a compressed spring, mounted in a slot in the common terminal with a slider inserted in the top of the spring. The spring's geometry is such that it stays in a buckled condition. Because of the bi-stable configuration of this assembly, the spring can be buckled to the left or right of the common terminal, turning the switch on or off.



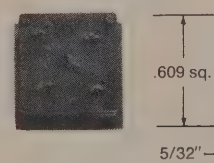
**Alternate action** begins with switch OFF. As push-button begins descent, right-hand actuator contacts slider disc. Bi-stable spring is forced to the left creating wiping action; switch turns ON. Pushbutton returns to top position. To turn switch OFF, the action repeats in reverse.

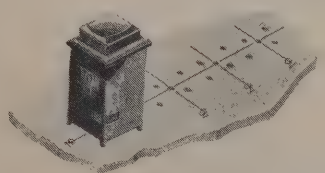
**Momentary action** switches have reduced contact gap on one side so that the spring does not reach a stable position at the opposite side, and returns to previous position when push-button is released.



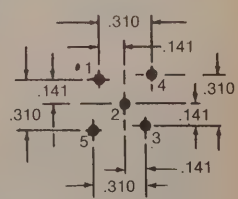




Series 650 mounts in panels from 3/64" to 3/16" thick. For horizontal or vertical stacking, add .690" for each additional unit.



Series 650 mounts directly on the P.C. board. Note the location of the P.C. board holes in relation to the fingernail groove and "IPI" logo.




PC board layout, viewed from component side All holes .046 in. diameter. Omit No. 1, 2 & 3 holes for indicators.

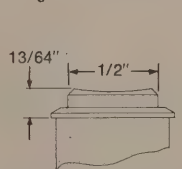



Fig. 1

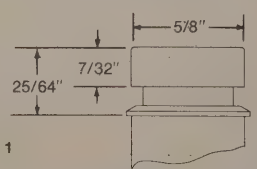


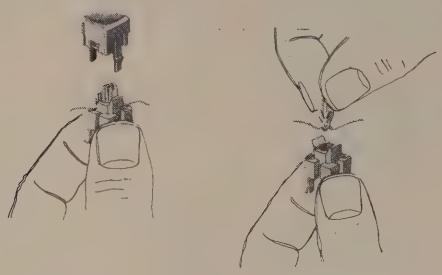

Fig. 2

Pushbuttons are available in ½ inch and ⅝ inch square sizes. The ½ inch size (Fig. 1) features a concave top and solid color construction. The ⅝ inch version (Fig. 2) has a flat top. It is available in solid colors or with black opaque sides.

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# MARCOFLEX SWITCHES

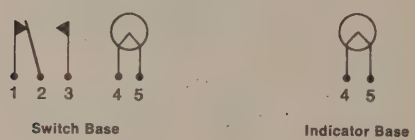
## Economical lamps, easily replaced



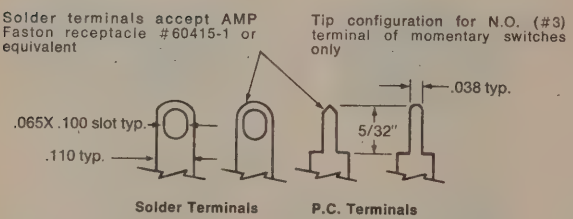
Series 650 accepts any low-cost, unbased T-1¾ incandescent or AIC neon lamp. Assembled units come with your choice of eight lamps, with voltages from 5-125 volts and rated life of as high as 7,000 hours. Lamps with other characteristics are also available on special order.

No special tools are required to relamp. Just spread the lamp leads as shown, then insert into cavity. Press the pushbutton firmly over the lamp retainer, until parts lock together, then cut the leads off flush.

## Schematics




## Terminals


Solder terminals accept AMP Faston receptacle #60415-1 or equivalent
Tip configuration for N.O. (#3) terminal of momentary switches only
.038 typ.
.065X .100 slot typ.
.110 typ.
5/32"
Solder Terminals
P.C. Terminals

## Technical data

**Switch characteristics:**
- Single pole, double throw (Form C)
- Alternate/momentary action with independent lamp circuit.
- Also available as matching indicator light

**Materials and finishes:**
- Molded thermoplastic pushbutton
- Molded black thermoplastic base
- Lamp terminals are .012" thick copper alloy
- Stainless steel mounting clip

**Contact Rating:**
- 1 amp resistive at 30 VDC
- ¼ amp resistive at 125 VAC

**Pushbutton travel:**
- .08" total

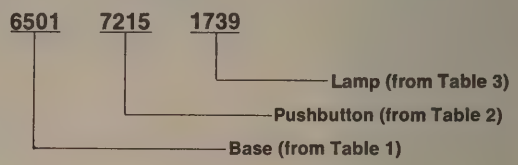
**Operating force:**
- 12 oz. nominal

**Recommended chassis punch:**
- Greenlee #731 (⅝" square)

**Soldering and cleaning:**
To assure clean contacts, solvents or flux should not be allowed to enter the back of the housing. Vapor degreasing should also be avoided.

## How to order

A complete part number for an assembly consists of three blocks of digits, like these...




### TABLE 1. BASE SELECTOR

| Mounting Method | Part Number* | | |
|---|---|---|---|
| | Alternate Action Switch | Momentary Action Switch | Indicator Light |
| Square Panel Cutout (Solder Terminals, 1 clip) | 6511 | 6521 | 6501 |
| Horizontal or Vertical Panel Stack (Solder Terminals, 2 clips) | 6512 | 6522 | 6502 |
| Printed Circuit Board Mount (PCB Terminals, no clips) | 6610 | 6620 | 6600 |

*Note: Last digit of base assembly number designates quantity of mounting clips which are recommended for the indicated mounting method (0, 1 or 2). A different quantity may be specified by changing this digit accordingly.

### TABLE 2. PUSHBUTTON SELECTOR*

| Pushbutton Color (Translucent) | Part Number | | |
|---|---|---|---|
| | ½" sq. concave top, solid color | ⅝" sq. flat top solid color | ⅝" sq. flat top with black opaque sides |
| Dark Red** | 72136 | 74136 | 74236 |
| Orange | 72116 | 74116 | 74216 |
| Yellow | 72112 | 74112 | 74212 |
| Light Green | 72137 | 74137 | 74237 |
| Blue | 72111 | 74111 | 74211 |
| White** | 7215 | 7415 | 7425 |
| Lunar** | 72117 | 74117 | 74217 |

*May be custom-marked to your requirements
**Suitable for illumination with AIC neon lamp

### TABLE 3. LAMP SELECTOR*

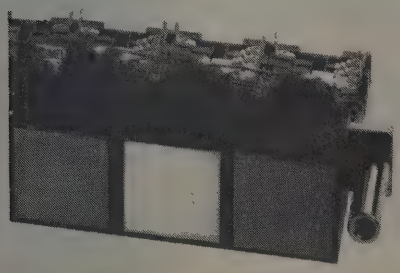
| Rated Voltage | Amps | Approx. M.S.C.P. | Avg. Life (hours) | Part Number |
|---|---|---|---|---|
| 5 | .066 | .11 | 7,000 | 1739 |
| 6 | .200 | .60 | 1,000 | 1784 |
| 6.3 | .075 | .23 | 1,000 | 1739 |
| 10 | .04 | .08 | 5,000 | 2107 |
| 14 | .08 | .50 | 1,500 | 1705 |
| 28 | .04 | .34 | 4,000 | 1764 |
| 28 | .04 | .30 | 7,000 | 2187 |
| 105-125 | .0012 | — | 5,000 | AIC** |

*Consult factory for availability of lamps with other ratings
**Requires external 27K Ohm series resistor

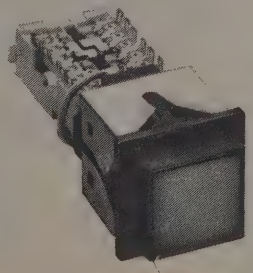
In addition to the complete assemblies shown above, the base, pushbutton, and lamp may be ordered separately by the individual part numbers shown in the tables.

# ILLUMINATED PUSHBUTTON SWITCHES SERIES 300/300SL — GANGED AND SNAP-IN

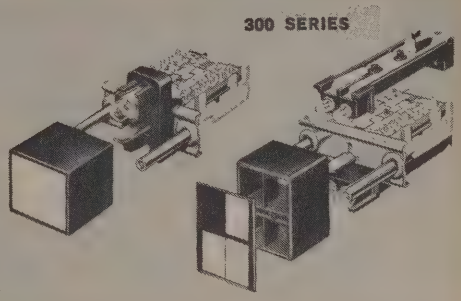
300 SERIES (GANGED)



300SL SERIES (SNAP-IN)



300 SERIES



The Series 300 switches are built for dependable performance and long life. They are ideal for such demanding applications as computers, peripheral equipment, security systems, bank terminals, medical equipment, numerically controlled equipment, copiers and point-of-sale terminals where reliability is essential.

- Ganged type available with single, dual, four-lamp or non-lighted displays.
- Front replaceable lamps are stationary. Do not move with button.
- Up to four pole double throw switching capacity.
- Available in momentary or alternate action, indicator.
- 500,000 cycle minimum life (momentary action).

## SPECIFICATIONS AND PERFORMANCE DATA

**ELECTRICAL RATING:**
Silver Plated Brass: 0.5 amp at 28 volts DC
0.25 amp at 110 volts AC
Solid Silver: 1.0 amp at 28 volts DC
0.5 amp at 110 volts AC
Carry 5 amps (non-switching).
All ratings for resistive loads at room ambient.

**VOLTAGE BREAKDOWN:**
Over 750 volts AC at sea level.

**LIFE:**
Excellent long life. Nylon-filled alkyd, tested to 500,000 cycles, momentary action only.

**OPERATING FORCE:**
7 oz. minimum to 28 oz. maximum. Pressure depends on number of poles and contact material (Standard tolerance is ±30%.)

**STROKE:**
To Latch: .134 in.
Overtravel: .044 in.
Total: .178 in.

**LOCKOUT:**
Effective over full length of switch to maximum of 12 buttons. Lockout is mechanical only.

**INSULATION:**
Stator: Nylon-filled alkyd.
Slider: Acetal. (UL Rated 94 HB.)
Note: The following insulator materials are available but are considered special:
Stator — diallyl phthalate (for improved insulation resistance) UL Rated 94V-0.
Stator — nylon-filled alkyd (for long mechanical life — 500,000 operations momentary action only). UL Rated 94 HB.
Shorter life glass-filled alkyd optional. UL Rated 94 HB.
Slider — glass-filled Kel-F (for high insulation resistance and temperatures above 85°C). UL Rating not available.

**TEMPERATURE RANGE:**
Standard Commercial −25°C to +85°C.
Special Commercial Extended range above or below standard, available on special order only.

**CONTACTS:**
Contact resistance less than 10 milliohms initial and 20 milliohms after life test.
Type 1. Silver plated brass — .0001″ minimum plating will assure silver to silver contact for about 10,000 cycles. Usable to temperatures of +100°C.
Type 2: Silver alloy — will assure silver to silver contact in excess of 200,000 cycles. Usable to temperatures of +100°C.

**TERMINALS:**
Wire hole solder terminals are standard. Printed circuit contacts or lugs available when required.

**FINISH:**
Basic frame parts plated to resist corrosion.

**PUSH ROD: (Series 300)**
Nominal size at button end is 0.188 ±.002 x 0.049 ±.002 in.
Push rod lengths: Minimum 0.375; Maximum, 2.750 for unlighted versions.

**MOUNTING (Series 300 Lighted Switches):**
Mounting posts are riveted to channel mounting holes, one on each end of channel. Posts are threaded to permit mounting switch from front or subpanel as required.

**MOUNTING (Series 300 Unlighted Switches):**
Mounting is provided by perforated holes in either end of channel. Holes are located in embossings.
Alternate mounting is provided between push rods, by square posts riveted into the channel. The posts are drilled and tapped for mounting screws. Post can be provided between any two push rods. (When post mounting is used, then mounting extensions outside of end modules may be cut off.)

**BUTTONS: (Series 300)**
Two button sizes — ¾ in. square and ¾ x 1 in. — available in standard legend plate colors of lunar white, white, red, amber, green, blue, yellow, orange.‡
Buttons are pressed on push rods.

**BUTTONS: (Series 300 SL)**
Two styles — single display and split display — each .732 inches square, available in standard legend plate colors of lunar white, white, red, amber, green, blue, yellow, orange.‡
Buttons are pressed on to push rods.

**CIRCUITRY:**
Sufficient contact locations for 4P2T. Each contact position may carry long or short contacts.
Two additional contact positions at extreme rear of stator are available. These may be used for dummy lugs. If used as contact positions for special circuitry, then only long contacts may be used. A maximum of 4 moving contacts may be mounted to the slider insulator.

## HOW TO ORDER

**300 4-1 M G/P S I S R**

**SERIES**
300SL — Snap-in type (no position or location designation)
300 — Ganged type (requires position/location designation)

**POSITIONS/LOCATION**
For Series 300 only. First digit indicates number 1 to 12) of positions in bank. Second digit indicates location of individual switch, left to right, when viewed from front of array.

**ACTION**
**300SL** — M-Momentary — A-Alternate Action — I Indicator
**300** — M-Momentary — A-Alternate Action — L-Latching
B-Blockout — I-Indicator

**CIRCUITRY**

| | | | |
|---|---|---|---|
| A-1PNO | D-4PNO | G-3PDT | K-2PNC |
| B-2PNO | E-1PDT | H-4PDT | L-3PNC |
| C-3PNO | F-2PDT | J-1PNC | M-4PNC |

/P-PCB lugs (omit for solder terminals)

**ELECTRICAL ACTION**
S-Make before break
N-Break before make

**CONTACT MATERIAL**
See type number under contact specifications

**SHAPE OF BUTTON**
S-¾″ square, ganged or snap-in
SS-¾″ square, split, snap-in only
R-¾″ x 1″ rectangular, ganged only

**LEGEND PLATES***

| | |
|---|---|
| LW-Lunar White | A-Amber |
| W-White | G-Green |
| R-Red | Y-Yellow |
| B-Blue | O-Orange |

Example: 300/4-1MG/PSISR — Position 1 of a 4 position **300 Series Switch**, momentary action, 3-pole, 2-throw with printed circuit lugs, shorting brass silver-plated contacts, ¾ in. square button, red legend plate.
For the second switch in the gang, the order number would begin 300/4-2 . . . for the third, 300/4-3 . . . etc., with whatever changes in action, colors, etc., would be appropriate.
For **300SL Series Switch**, SL is added after "300" and position/location numbers are omitted.

* For double-plate buttons, show colors for both legend plates, top to bottom. For 4-plate buttons, show colors left to right at top, then left to right at bottom. for single-legend plate buttons, use the one appropriate letter.

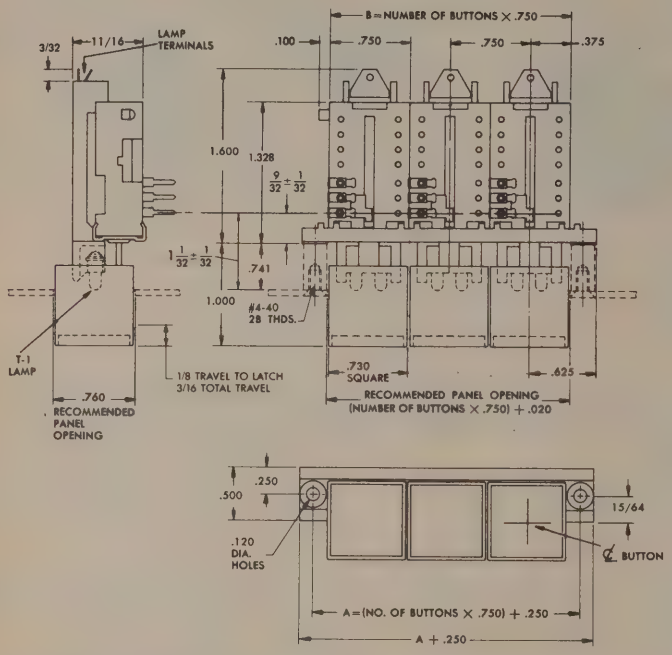
‡ Green not recommended in brightly lighted areas. Blue not recommended except when necessary

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

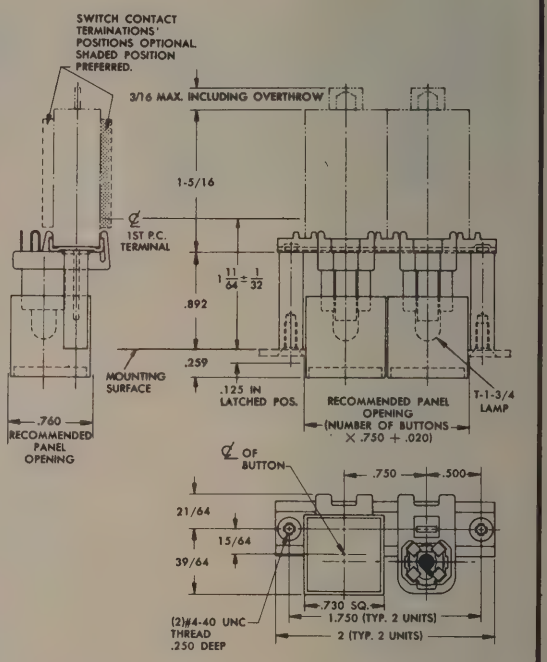
# ILLUMINATED PUSHBUTTON SWITCHES SERIES 300/300SL

## DIMENSIONS AND MOUNTING STANDARD REQUIREMENTS

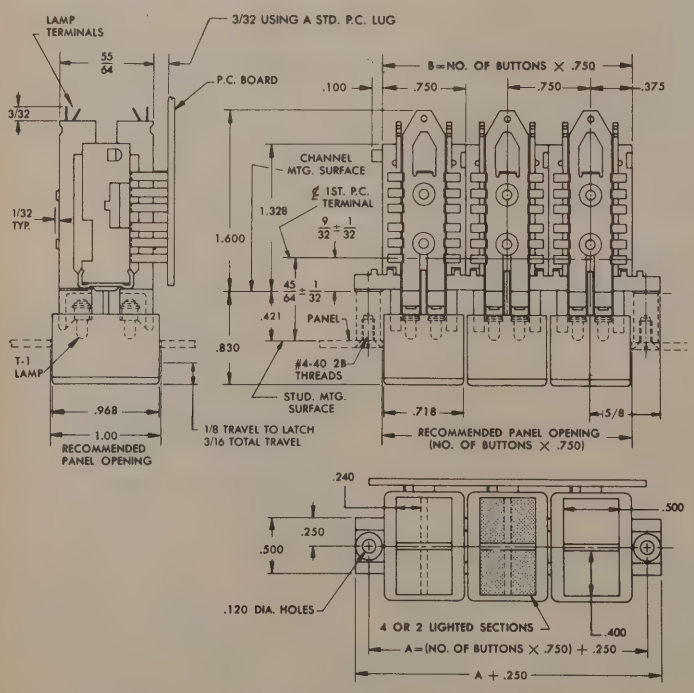
### SINGLE-DISPLAY TWO-LAMP



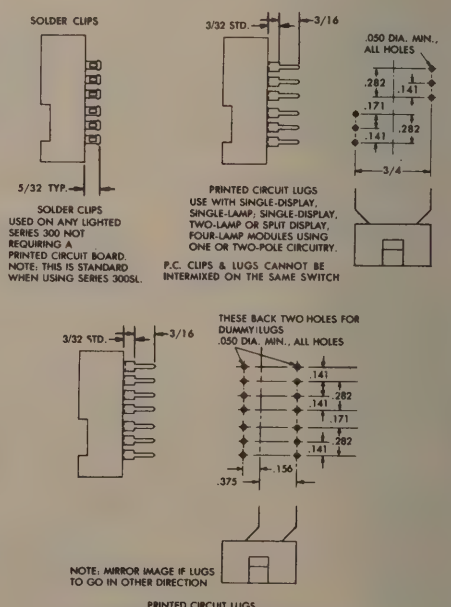

### SINGLE-DISPLAY SINGLE-LAMP




### SPLIT-DISPLAY FOUR-LAMP

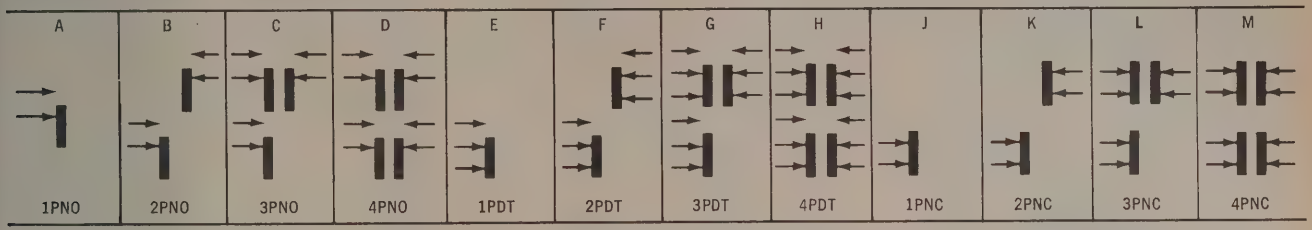



### SOLDER CLIPS AND PRINTED CIRCUIT LUGS

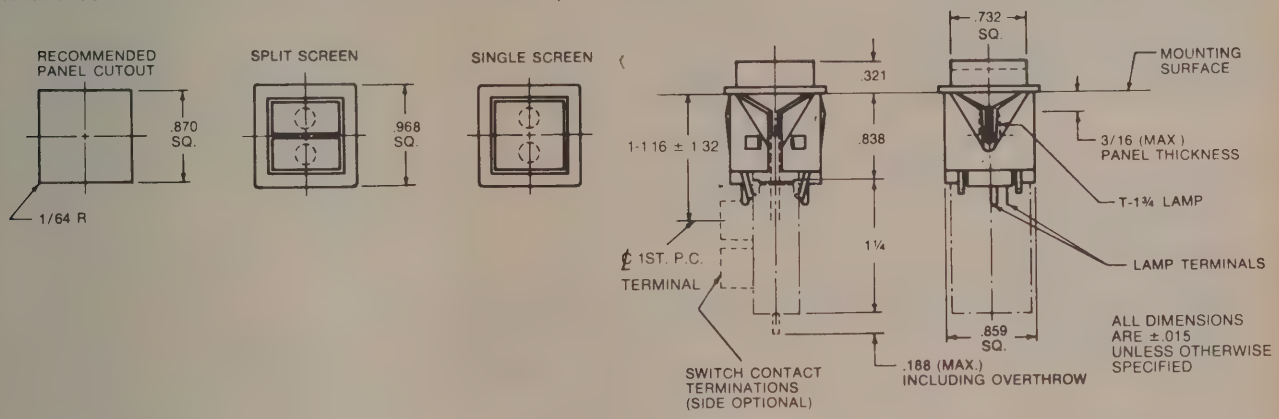

SOLDER CLIPS
5/32 TYP.
SOLDER CLIPS USED ON ANY LIGHTED SERIES 300 NOT REQUIRING A PRINTED CIRCUIT BOARD. NOTE: THIS IS STANDARD WHEN USING SERIES 300SL.
3/32 STD.
3/16
.050 DIA. MIN., ALL HOLES
.282
.141
.171
.141
.282
3/4
PRINTED CIRCUIT LUGS USE WITH SINGLE-DISPLAY, SINGLE-LAMP; SINGLE-DISPLAY, TWO-LAMP OR SPLIT DISPLAY, FOUR-LAMP MODULES USING ONE OR TWO-POLE CIRCUITRY.
P.C. CLIPS & LUGS CANNOT BE INTERMIXED ON THE SAME SWITCH
3/32 STD.
3/16
THESE BACK TWO HOLES FOR DUMMY LUGS .050 DIA. MIN., ALL HOLES
.141
.282
.141
.171
.141
.282
.141
.375
.156
NOTE: MIRROR IMAGE IF LUGS TO GO IN OTHER DIRECTION
PRINTED CIRCUIT LUGS USE WITH SINGLE-DISPLAY, SINGLE-LAMP OR WITH SINGLE-DISPLAY, TWO-LAMP SERIES 300 GANGED-MODULE UNIT REQUIRING THREE OR FOUR-POLE CIRCUITRY.

# ILLUMINATED PUSHBUTTON SWITCHES SERIES 300 300S/L

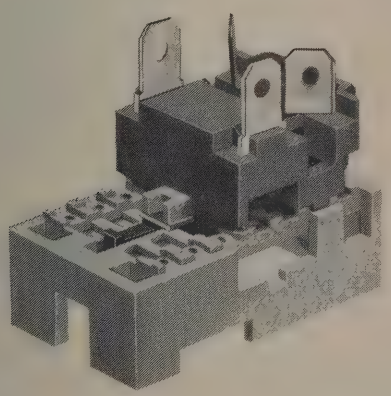
## STANDARD CIRCUIT CONFIGURATIONS

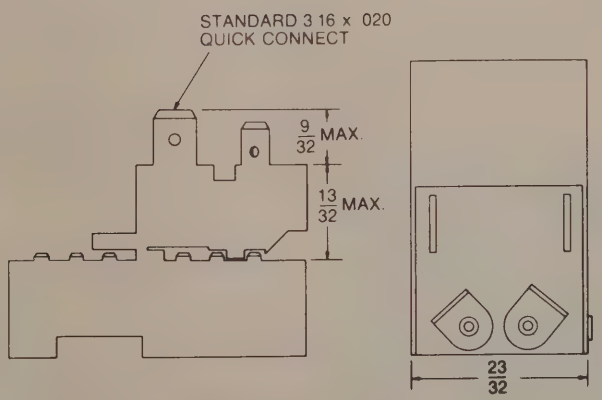



## SERIES 300SL — SNAP-IN SINGLE OR SPLIT DISPLAY, DUAL LAMP




## POWER MODULE






## LAMP SELECTION GUIDE

**SERIES 300 AND 300SL**

| Incandescent Size: T-1¾ | Lamp Number | Voltage | Amperage | Candlepower | Life (Hrs.) |
|---|---|---|---|---|---|
| Midget Flange Base Single Contact | 328 | 6.0 | .20 | .34 @ 5.0 V | 1,000 |
| | 330 | 14.0 | .08 | .50 | 750 |
| | 382 | 14.0 | .08 | .30 | 15,000 |
| | 327 | 28.0 | .04 | .34 | 1,000 |
| | 387 | 28.0 | .04 | .30 | 25,000 |

**SERIES 300 ONLY**

| Incandescent Size: T-1 | Lamp Number | USASI* Number | Military Specification Number | Voltage | Amperage | Number Support | Candlepower (MSCP) | Life (Hrs.) |
|---|---|---|---|---|---|---|---|---|
| Unsupported Filament Based | 27 | 718 | 24515-718 AS15 | 5.0 | .115 | — | .15 ±15% | 40,000 |
| Supported Filament Based | 64 | 6839 | MS3338-6839 AS25 | 28.0 | .024 | 2 | .13 ±25% | 16,000 |
| | 154† | 7243 | | 28.0 | .024 | 3 | .13 ±25% | 16,000 |

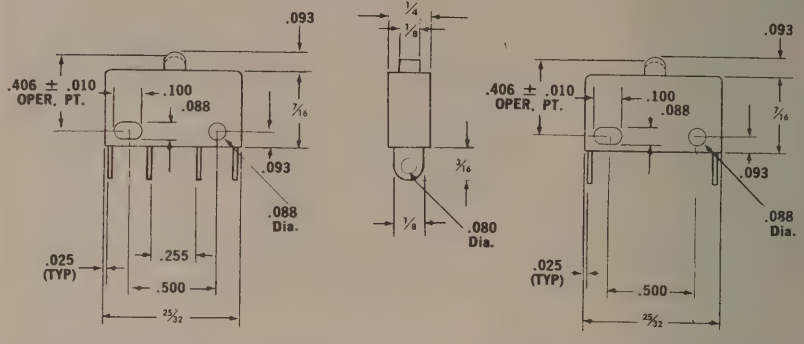
* Formerly ASA number  † High reliability 3-support filament

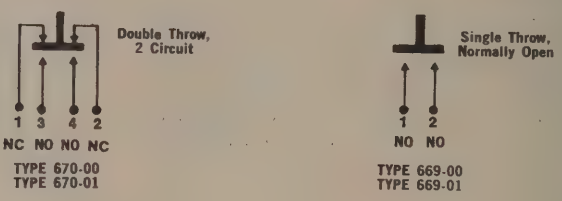
**OAK Industries Inc.**
SWITCH DIVISION/CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# SNIPE Switch and Actuators

## 10.5 amp, momentary action SNIPE switch

U.L. listed
C.S.A. certified




**Notes:**

1. **Contact Rating:** 10.5 amps resistive, 125/250 VAC, 10.5 amps resistive, 28 VDC. ¼ h.p., 125/250 VAC.
2. **Switch Characteristics:**
   - Pretravel; .050 in. max.
   - Overtravel; .012 in. min.
   - Operating force; 8 oz. max.
   - Release force; 2 oz. nominal
   - Movement diff.; .020 ± .005 in.
3. **Materials and Finishes:**
   - Plunger: molded thermoplastic & copper alloy
   - Housing: molded plastic
   - Terminals; brass, silver plated
   - Contacts: silver. Gold plating optional.
4. **Solder Terminals:** Terminals accept AMP FASTON No. 60729-1 receptacles.
5. U.S. Patent No. 3624332
6. **Operating characteristics with actuators*:**
   - Pretravel: .110 max.
   - Overtravel: .03 min.
   - Release force: .5 oz. min.
   - Operating force: 2-4 oz.
   - Movement differential: .044 ± .012

* Measured at the top of lever or roller.

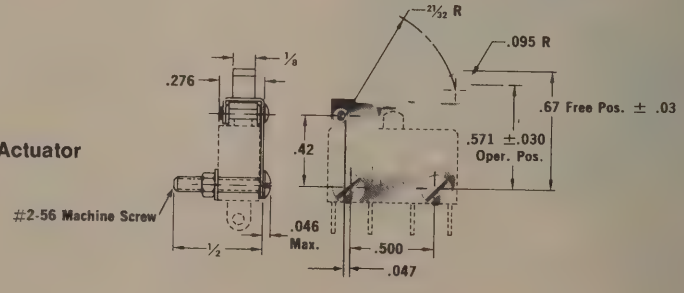
| Part Numbers — Switches | | |
|---|---|---|
| **Contacts** | **Double Throw 2 Circuit** | **Single Throw Normally Open** |
| Coin Silver | 670-00* | 669-00* |
| Coin Silver, Gold Plated | 670-01* | 669-01* |

*U.L. listed and C.S.A. certified

| Part Numbers — Actuators | |
|---|---|
| Lever Type | 67042-1 |
| Roller Type | 67042-2 |

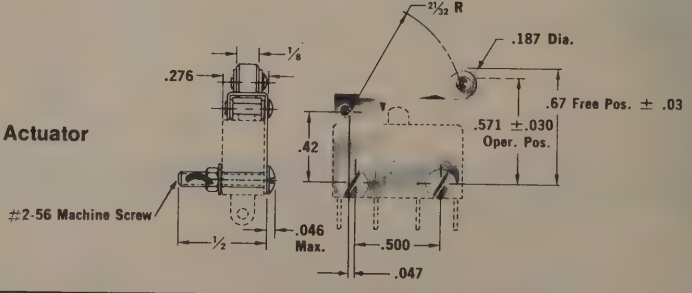
## lever actuator

Lever Actuator




## roller actuator

Roller Actuator



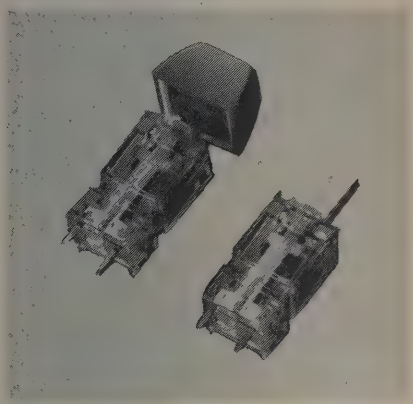
# SERIES 400 AND 475 KEYBOARD SWITCHES

**Low cost, versatile, long life Series 400 and 475 Keyboard Switch** applications include data entry terminals, bank terminals, business machines, typewriter and calculator keyboards, reservation and credit verification systems.

Engineered for comfortable, fatigue-free operation, Series 400 and 475 switches have the inherent reliability of gold alloy, crossbar wiping contacts, and are self-cleaning and tarnish resistant. Tested for more than 20 million operations.

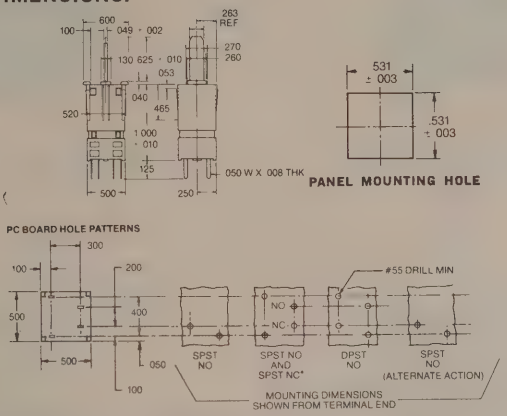
Series 400 and 475 switches mate with industry standard keycaps. Keycaps supplied blank only. For legend information, contact factory.

## SERIES 400



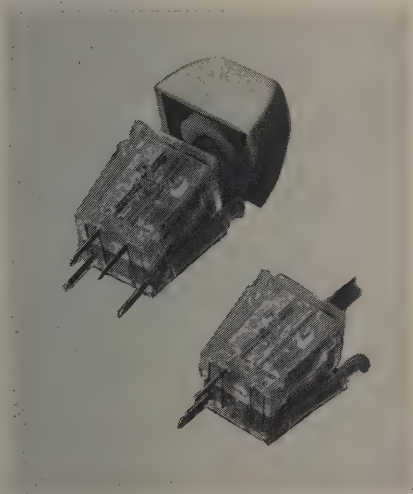
Straight plunger standard. Plug-in printed circuit terminals with snap-in feature for panel mounting.

### SERIES 400 DIMENSIONS:




*To make SPDT the common, contacts must be connected together.

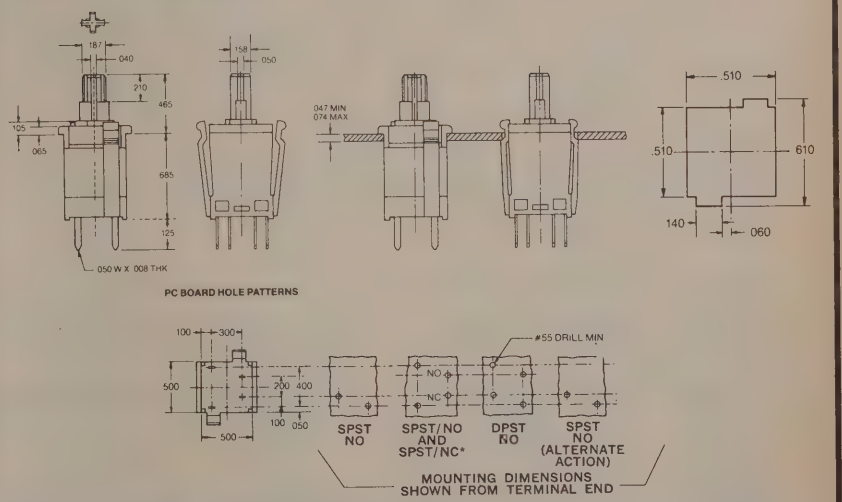
## SERIES 475



Straight plungers. Plug-in printed circuit terminals with snap-in mounting ears for panel mount.

Custom keyboard arrangements available. Contact your Oak representative or factory for information.

### SERIES 475 DIMENSIONS:




*To make SPDT the common, contacts must be connected together.

## SPECIFICATIONS:

**PERFORMANCE DATA**

**OPERATING LIFE:** Tested for more than 20 million operations per key at rated load.

**OPERATING FORCE:** 3 oz. ±½ oz. (85 gm. ±15 gm.)

**KEY TRAVEL:** 0.125 ±0.010″ total.

**PRE-TRAVEL, SERIES 400:** Normally open, 0.070″ nominal. Normally closed, 0.060″ nominal.

**PRE-TRAVEL, SERIES 475:** Normally open, 0.075″ nominal. Normally closed, 0.050″ nominal.

**TEMPERATURE RANGE:** 0°C to +85°C.

**CONTACT BOUNCE:** Less than 3 milliseconds, N.O. only.

**CONTACT RESISTANCE:** Less than 100 milliohms throughout switch life.

**BREAKDOWN VOLTAGE:** Over 500 VAC.

**CONTACT RATING:** 5 VDC resistive load. 100 Ma. (Higher ratings can be applied with corresponding decrease in life expectancy.)

**MATERIALS**

**CONTACT:** Gold alloy crown on nickel base, crossbar wiping.

**CONTACT LEAVES:** Copper alloy.

**HOUSING:** Polycarbonate, UL listed 94 V1.

**ACTUATOR, SERIES 400:** Polycarbonate, UL listed 94 V1.

**PLUNGER, SERIES 400:** Stainless steel.

**ACTUATOR PLUNGER, SERIES 475:** Modified PPO, UL listed 94 V1.

**PHYSICAL CHARACTERISTICS, SERIES 400**

**HOUSING:** 0.50 x 0.50 (±.003) x .990 (±.010) inches high.

**MOUNTING:** Plug-in printed circuit terminals with snap-in feature for panel mounting.

**TERMINALS:** 0.050 (±0.002) x 0.008 x 0.125 inches long (below standoffs on housing). Terminal ends are tinned to facilitate soldering. Also available with .240 inch long terminals (please specify).

**PLUNGER:** 0.187 (±0.002) x 0.049 (±0.002) inches at keycap end. Length, 0.625 (±.010) inches standard.

**PHYSICAL CHARACTERISTICS, SERIES 475**

**HOUSING:** .685 (±.010) x .510 x .610 (±.003) inches high.

**MOUNTING:** Plug-in printed circuit terminals with snap-in mounting ears for panel mount.

**TERMINALS:** Same as Series 400, above.

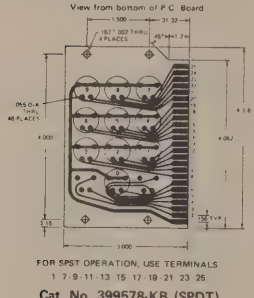
**PLUNGER:** 0.187 (±0.003) x .158 (±0.003) inches at keycap end. Length, .465 (±.010) inches standard.

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# SERIES 400 AND 475 KEYBOARD SWITCHES
# SERIES 400 KEYBOARD SWITCH ASSEMBLIES

NOTE: Series 475 custom keyboard arrangements available. Contact your OAK representative or factory for infomation.

### 10 POSITION KEYBOARD
**399578-KB**

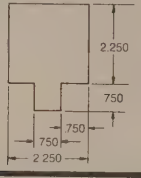



Cat. No. 399578-KB (SPDT)

Contains all SPDT switches

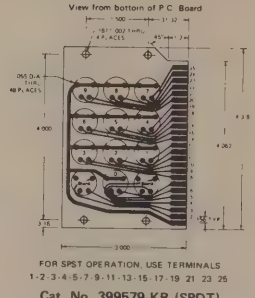
**KEYCAPS**
Keyboards furnished with gray keycaps; all blank or 0-9.

**KEYBOARD CUTOUTS**




Mounting hole dimensions for 10 and 12 position keyboards are: 3″ x 3½″

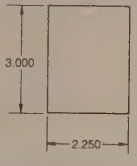
### 12 POSITION KEYBOARD
**399579-KB**

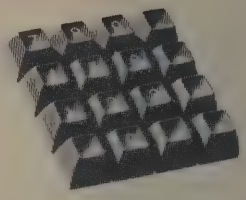



Cat. No. 399579-KB (SPDT)

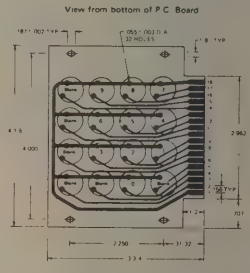
Contains ten SPDT switches for numeric key functions and two blank keys which are SPST.

**KEYCAPS**
Keyboards furnished with gray keycaps; all blank or 0-9 with two blank keycaps.



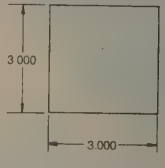
### 16 POSITION KEYBOARD
**399579-KB**




Cat. No. 399580-KB (SPST)

Contains all SPST switches.

**KEYCAPS**
Keyboards furnished with gray keycaps; all blank or 0-9 with six blank keycaps.




Mounting hole dimensions for 16 position keyboard 3¼″ x 3½″

## SERIES 400 KEYBOARD SWITCHES
(Available to 2499 pieces. For 2500 pieces and over, request FORM F-1020).

| Circuitry | Distributor Cat. No. |
|---|---|
| SPST/NO | 399576-KS |
| SPST/NO and SPST/NC* | 399577-KS |
| DPST/NO | 399582-KS |
| Alternate Action SPST/NO | 399583-KS |

## SERIES 475 KEYBOARD SWITCHES
(Available to 2499 pieces. For 2500 pieces and over, request FORM F-1020).

| Circuitry | Distributor Cat. No. |
|---|---|
| SPST/NO | 399587-LKS |
| SPST/NO and SPST/NC* | 399588-LKS |
| DPST/NO | 399589-LKS |
| Alternate Action SPST/NO | 399590-LKS |

All individual Series 400 and 475 Keyboard Switches supplied with blank gray keycaps. For colors other than standard, or legends, contact distributor.

*** To make SPDT the common, contacts must be connected together.**

## SERIES 400 KEYBOARD ASSEMBLIES
(Available to 99 pieces. For 100 pieces and over, use OEM request FORM F-1020).

| No. of Positions | Distributor Cat. No. | Distributor keyboard assemblies supplied as listed below. For keycap colors other than standard, or legends, contact distributor. |
|---|---|---|
| 10 | 399578-KB | 0-9 |
| 12 | 399579-KB | 0-9 with two blank keycaps |
| 16 | 399580-KB | 0-9 with six blank keycaps |

## RECOMMENDED CLEANING SOLVENTS:

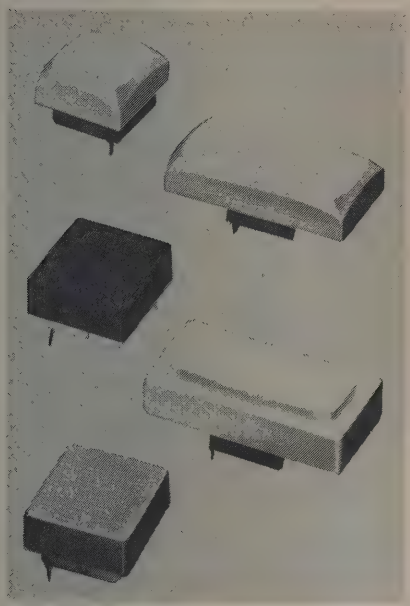
When cleaning PC boards after soldering, we recommend the use of Denatured Alcohol No. 1430, Ethanol (grain alcohol), Methanol (wood alcohol), Isopropyl Alcohol, Liquid Detergent Solution (1% in water), Freon TF, Heptane Petroleum Ether, VM and P Naptha, or White Kerosene. CLEANING SOLVENTS DETRIMENTAL TO POLYCARBONATE (LEXAN) AND MODIFIED PPO (NORYL) — **DO NOT USE:** Acetone, Benzol, Carbon Tetrachloride, Methyl Ethyl Ketone, Methyl Isobutyl Ketone, Toluol, Trichlorethylene, Triclene, or any halogenated or aromatic hydrocarbon.

**IMPORTANT:**
Series 400 and 475 Keyboard Switches should NOT be immersed in the cleaning solution. Such practices will coat the internal surfaces with foreign matter (flux, etc. and also remove lubrication from necessary areas. This can result in "sticky" plunger action, affecting electrical characteristics of the switch.

**Request Form F-1020, Dept. EEM, for additional information.**

# KEYBOARD SWITCHES

## LOW PROFILE KEYBOARD SWITCH SERIES 415



**Low cost, dependable and adaptable,** these low profile keyboard switches are available in a choice of styles and colors in both ⅝"* and ¾" sizes, including two station. Tested to 10,000,000 operations at 100 ma, 5 VDC.

Oak Series 415 Keyboard Switches are used as individual switches allowing unlimited versatility in any keyboard layout for calculators, data entry devices, office equipment, security devices, electronic scales, timers, video games, test equipment and point-of-sale terminals.

* Flat Top Keyboard Switch (with and without LED) available in ⅝" single position only.

Patent 4,016,388 and 3,916,131

### SPECIFICATIONS

**PERFORMANCE DATA**

**Operating Life:** Tested to 10 million operations
**Switching:** SPST N/O
**Travel:** 0.100" (approximate)
**Pre-Travel:** 0.070" (nominal)
**Operating Force:** 114 gm. (+30 gm., −25 gm.)
**Contact Bounce:** 3 milliseconds (max.)
**Contact Material:** W.E. #1 gold alloy inlay
**Contact Resistance:** 100 milliohms (max.)
**Temperature Range:** −20°C to +75°C
**Loads:** 5 V, AC-DC @ 100 mA
**Voltage Breakdown:** 500 VAC

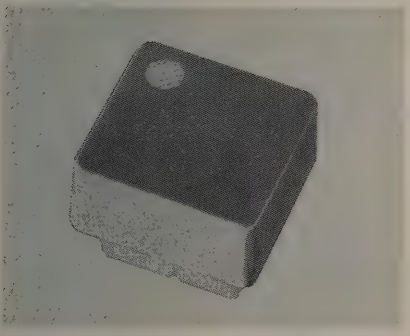
**MATERIALS**

**Base:** High temperature thermoplastic UL 94 HB Rated
**Top:** A.B.S. or similar UL 94 HB Rated
**Note:** Contact factory for additional UL listed materials

**PHYSICAL CHARACTERISTICS**

**Terminals:** 0.125" Long on 0.400 Grid
**Height:** (Includes keytop)
.410" — Flat Top Keyboard Switch with and without LED)
.415" — Standard Keyboard Switch
.467" — Square Raised Keyboard Switch
**Mounting:** Printed circuit board
**Standard Colors:** White, red, gray, blue, black, specials available on request
**Legend:** Hot-stamped
**Note:** Contact your distributor for keytop legends

## SERIES 415 LED FLAT TOP KEYBOARD SWITCHES WITH LIGHT EMITTING DIODE (L.E.D.) INDICATOR



Series 415 LED Keyboard Switches with red LED indicator provides positive visual confirmation of data entry and operation status in data terminal communications, security and educational equipment.

These low profile switches may be combined on a keyboard matrix with other Oak Series 415 switches to provide unlimited keyboard design flexibility.

Low initial cost, tested long life, high reliability, and minimal contact bounce for demanding requirements.

### SPECIFICATIONS

**ABSOLUTE MAXIMUM RATING**

**Power Dissipation @ 25°C Ambient:** 80 mW
**Derate Linearly from 25°C:** 1.0 mW/°C
**Storage and Operating Temperature:** −55°C to 100°C
**Peak Forward Current:** (1 μsec. pulse width, 0.1% duty cycle), 5A
**Lead Solder Time @ 260°C:** 10 seconds
**Continuous Forward Current:** 40 mA
**Reverse Current:** 10 μA

**TYPICAL OPERATING CHARACTERISTICS**

**Forward Voltage:** 1.65 V
**Forward Current:** 20 mA
**Reverse Current @ 3 V:** 5.0 nA
(For additional electro-optical characteristic specifications, see catalog data for Monsanto MV-50.)

**PERFORMANCE AND PHYSICAL CHARACTERISTICS**

Same as 415 Keyboard Switches.

### DISTRIBUTOR STOCK ORDERING INFORMATION

(To 9999 pieces only).

| CATALOG NO. | DESCRIPTION (Blank key tops except sets) | SIZE | POSITION | COLOR |
|---|---|---|---|---|
| 399591-LP | Standard | ⅝" | Single | Black |
| 399592-LP | Standard | ⅝" | Single | Red |
| 399596-LP | Standard | ⅝" | Single | White |
| 399597-LP | Standard | ⅝" | Single | Blue |
| 5-61913-008 | Standard | ⅝" | Single | Gray |
| 399595-LP | Standard; Set, 0-9 | ⅝" ea | Single | White |
| 399593-LP | Standard | ⅝" | Double | Black |
| 399594-LP | Standard | ⅝" | Double | Red |
| 399598-LP | Standard | ⅝" | Double | White |
| 399599-LP | Standard | ⅝" | Double | Blue |
| 399536-LP | Standard | ¾" | Single | Black |
| 399537-LP | Standard | ¾" | Single | Red |
| 399538-LP | Standard | ¾" | Single | White |
| 399539-LP | Standard | ¾" | Single | Blue |
| 399535-LP | Standard; Set, 0-9 | ¾" ea. | Single | White |
| 399540-LP | Standard | ¾" | Double | Black |
| 399541-LP | Standard | ¾" | Double | Red |
| 399542-LP | Standard | ¾" | Double | White |
| 399543-LP | Standard | ¾" | Double | Blue |
| 5-61913-089 | Square Raised | ⅝" | Single | White |
| 5-68581-269 | Square Raised; Set, 0-9 | ⅝" ea. | Single | White |
| 5-61913-685 | Square Raised | ⅝" | Double | White |
| 5-61913-100 | Flat Top w/LED* | ⅝" | Single | Black |
| 5-61913-108 | Flat Top w/LED* | ⅝" | Single | Gray |
| 5-61913-109 | Flat Top w/LED* | ⅝" | Single | White |
| 5-61913-106 | Flat Top w/LED* | ⅝" | Single | Blue |
| 5-61913-160 | Flat Top | ⅝" | Single | Black |
| 5-61913-151 | Flat Top | ⅝" | Single | White |
| 5-61913-156 | Flat Top | ⅝" | Single | Blue |

* Red LED's available only

### CHEMICAL RESISTANCE:

The bottom housing is not affected by most chemicals. However, the top housing resists alkalies, mineral acids (except strongly oxidizing acids, such as concentrated nitric and sulfuric), animal, vegetable and mineral oils, alcohols and many organic chemicals.

Cleaning solvents should be selected carefully with designated chemicals in mind. The switch should never be immersed in the cleaning solution or brought too close to detrimental vapors which tend to eliminate lubricity on mechanical guide surfaces.

**For additional information, request Form F-1021 and F-1023.**

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

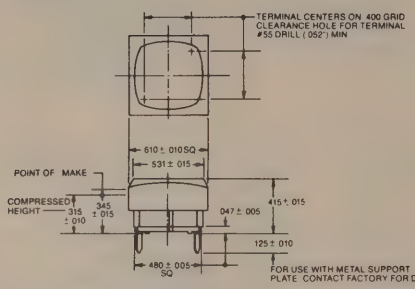
# SERIES 415

## DIMENSIONS AND MOUNTING STANDARD REQUIREMENTS

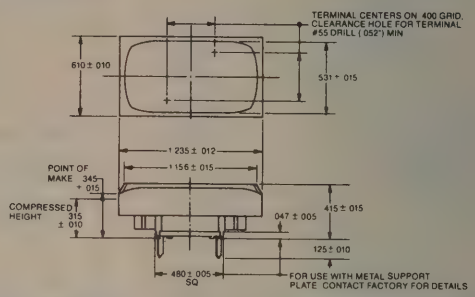
### STANDARD 5/8" KEYBOARD SWITCH

Available from distributor stock to 9999 pieces

**ONE STATION**


TERMINAL CENTERS ON .400 GRID
CLEARANCE HOLE FOR TERMINAL
#55 DRILL (.052") MIN
.610 ± .010 SQ
.531 ± .015
POINT OF MAKE
COMPRESSED HEIGHT .315 ± .010
.345 ± .015
.047 ± .005
.415 ± .015
.125 ± .010
.480 ± .005 SQ
FOR USE WITH METAL SUPPORT PLATE CONTACT FACTORY FOR DETAILS

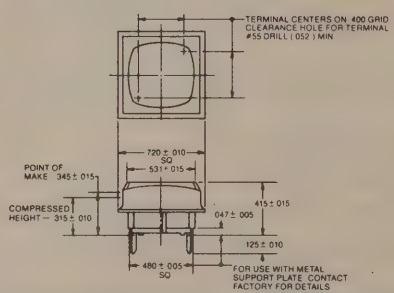
**TWO STATION**


TERMINAL CENTERS ON .400 GRID
CLEARANCE HOLE FOR TERMINAL
#55 DRILL (.052") MIN
.610 ± .010
.531 ± .015
1.235 ± .012
1.156 ± .015
POINT OF MAKE .345 ± .015
COMPRESSED HEIGHT .315 ± .010
.047 ± .005
.415 ± .015
.125 ± .010
.480 ± .005 SQ
FOR USE WITH METAL SUPPORT PLATE CONTACT FACTORY FOR DETAILS

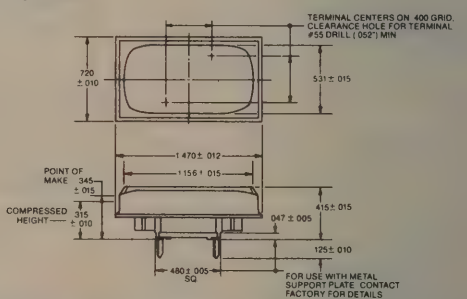
### STANDARD 3/4" KEYBOARD SWITCH

Available from distributor stock to 9999 pieces

**ONE STATION**


TERMINAL CENTERS ON .400 GRID
CLEARANCE HOLE FOR TERMINAL
#55 DRILL (.052") MIN
.720 ± .010 SQ
.531 ± .015
POINT OF MAKE .345 ± .015
COMPRESSED HEIGHT .315 ± .010
.047 ± .005
.415 ± .015
.125 ± .010
.480 ± .005 SQ
FOR USE WITH METAL SUPPORT PLATE CONTACT FACTORY FOR DETAILS

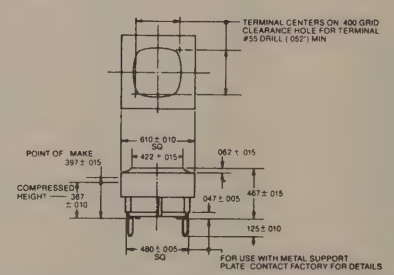
**TWO STATION**


TERMINAL CENTERS ON .400 GRID
CLEARANCE HOLE FOR TERMINAL
#55 DRILL (.052") MIN
.720 ± .010
.531 ± .015
1.470 ± .012
1.156 ± .015
POINT OF MAKE .345 ± .015
COMPRESSED HEIGHT .315 ± .010
.047 ± .005
.415 ± .015
.125 ± .010
.480 ± .005 SQ
FOR USE WITH METAL SUPPORT PLATE CONTACT FACTORY FOR DETAILS

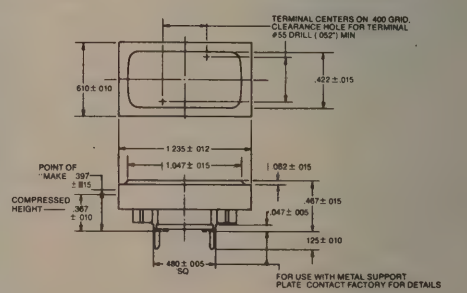
### SQUARE RAISED 5/8" KEYBOARD SWITCH

Available from distributor stock to 9999 pieces

**ONE STATION**


TERMINAL CENTERS ON .400 GRID
CLEARANCE HOLE FOR TERMINAL
#55 DRILL (.052") MIN
.610 ± .010 SQ
.422 ± .015
.062 ± .015
POINT OF MAKE .397 ± .015
COMPRESSED HEIGHT .367 ± .010
.047 ± .005
.467 ± .015
.125 ± .010
.480 ± .005 SQ
FOR USE WITH METAL SUPPORT PLATE CONTACT FACTORY FOR DETAILS

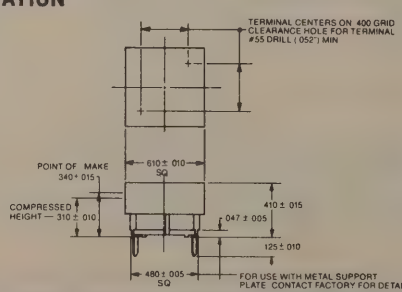
**TWO STATION**


TERMINAL CENTERS ON .400 GRID
CLEARANCE HOLE FOR TERMINAL
#55 DRILL (.052") MIN
.610 ± .010
.422 ± .015
1.235 ± .012
1.047 ± .015
1.082 ± .015
POINT OF MAKE .397 ± .015
COMPRESSED HEIGHT .367 ± .010
.047 ± .005
.467 ± .015
.125 ± .010
.480 ± .005 SQ
FOR USE WITH METAL SUPPORT PLATE CONTACT FACTORY FOR DETAILS

### FLAT TOP 5/8" KEYBOARD SWITCH

Available from distributor stock to 9999 pieces

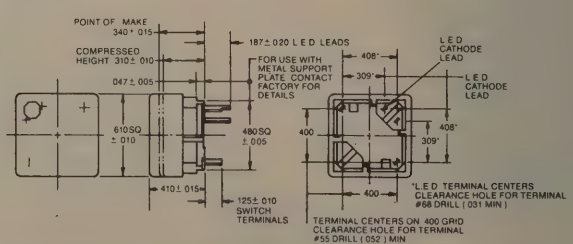
**ONE STATION**


TERMINAL CENTERS ON .400 GRID
CLEARANCE HOLE FOR TERMINAL
#55 DRILL (.052") MIN
.610 ± .010 SQ
POINT OF MAKE .340 ± .015
COMPRESSED HEIGHT .310 ± .010
.047 ± .005
.410 ± .015
.125 ± .010
.480 ± .005 SQ
FOR USE WITH METAL SUPPORT PLATE CONTACT FACTORY FOR DETAILS

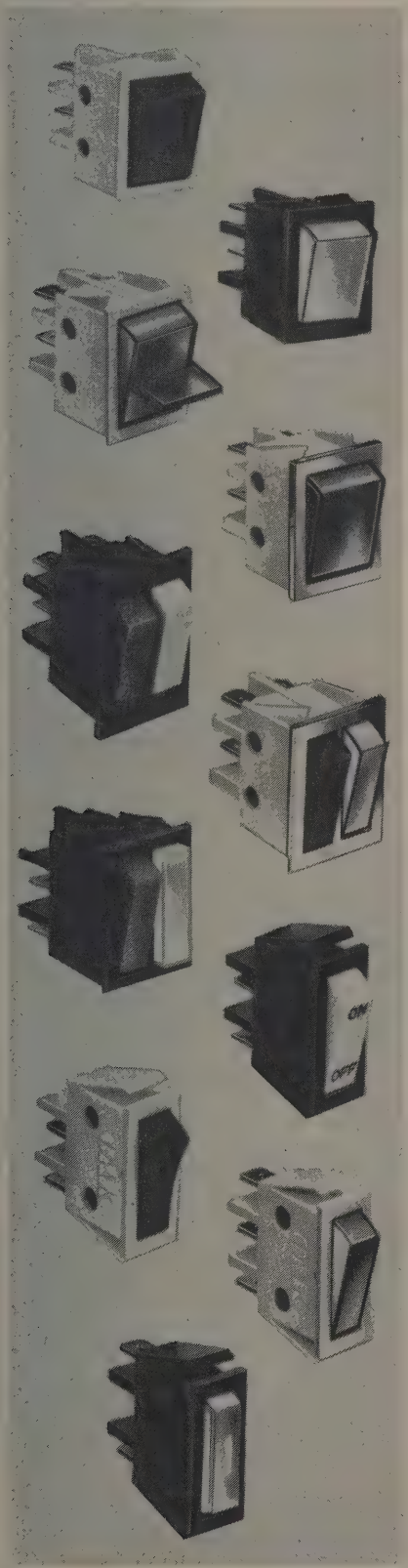
### FLAT TOP 5/8" KEYBOARD SWITCH W/LED

Available from distributor stock to 9999 pieces

**ONE STATION**


POINT OF MAKE .340 ± .015
COMPRESSED HEIGHT .310 ± .010
.047 ± .005
.187 ± .020 L E D LEADS
FOR USE WITH METAL SUPPORT PLATE CONTACT FACTORY FOR DETAILS
.610 SQ ± .010
.480 SQ ± .005
.410 ± .015
.125 ± .010 SWITCH TERMINALS
L E D CATHODE LEAD
.408"
.309"
.400
*L E D TERMINAL CENTERS CLEARANCE HOLE FOR TERMINAL #68 DRILL (.031 MIN)
TERMINAL CENTERS ON .400 GRID CLEARANCE HOLE FOR TERMINAL #55 DRILL (.052") MIN

# SNAP-IN ROCKER SWITCHES — LIGHTED AND UNLIGHTED / AND INDICATOR LIGHTS




## VERSATILE, EYE APPEALING, DEPENDABLE, FOR: Appliances / Business Machines / Computers / Test Instruments / Industrial Controls

These attractive Oak switches and indicator lights will enhance the appearance of any equipment. They offer many significant advantages:

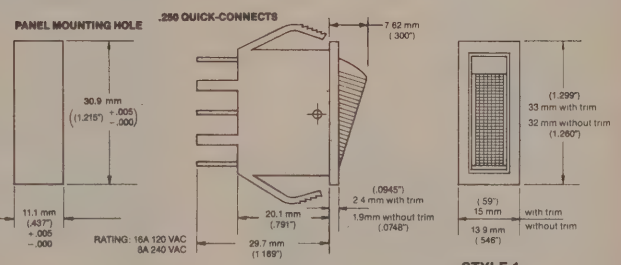
- Snap-in design speeds assembly and accommodates a wide range of panel thicknesses.
- UL and CSA listed.
- One piece plastic case, with integral molded barriers between terminals.
- 16 Ampere rating.
- 20mm (1.14 in.) depth, including barriers.
- Optional chrome bezels available.
- Silver Cadmium Oxide and Solid Silver contacts for long life and dependability.
- Substantial savings in assembly costs can be achieved by using the double housing version, with two switches, or one switch and an indicator light in the same housing.

Available through Oak distributors.

### SINGLE HOUSING STYLE (15mm/.59" WIDE)

**STANDARD TYPES**

1. On-off switch (SPST), lighted
2. On/on switch, (SPDT), unlighted
3. On/off switch (SPST), unlighted
4. On/off/on — 3 position (SPDT), unlighted (single housing only)
5. Matching indicator lights.

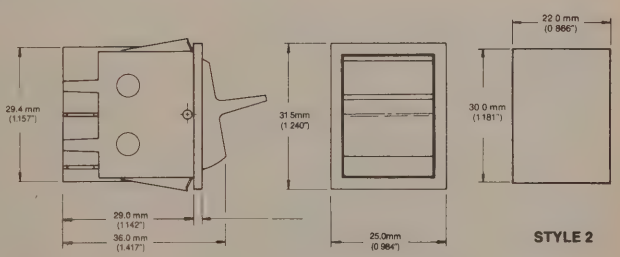

PANEL MOUNTING HOLE
.250 QUICK-CONNECTS
30.9 mm (1.215") +.005 −.000
11.1 mm (.437") +.005 −.000
RATING: 16A 120 VAC 8A 240 VAC
7.62 mm (.300")
20.1 mm (.791")
29.7 mm (1.169")
(.0945") 2.4 mm with trim
1.9mm without trim (.0748")
(1.299") 33 mm with trim
32 mm without trim (1.260")
(.59") 15 mm with trim
13.9 mm (.546") without trim

STYLE 1

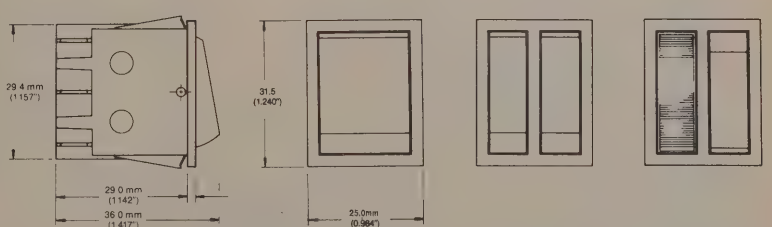
### DOUBLE HOUSING STYLE (25.0mm/0.984" WIDE)

**STANDARD TYPES**

1. On/off (DPST) one actuator, lighted
2. On/off (DPST) one actuator, unlighted
3. On/on (DPDT) one actuator, lighted
4. On/on (DPDT) one actuator, unlighted
5. On/off (SPST) and on/-/on (SPDT), two actuators, unlighted
6. On/off (SPST) actuator and indicator




STYLE 2




STYLE 2 STYLE 3 STYLE 3

continued next page

**OAK Industries Inc.**
SWITCH DIVISION/ CRYSTAL LAKE, ILLINOIS 60014
TELEPHONE: (815) 459-5000/TWX: 910-634-3353/TELEX: 72-2447

# SNAP-IN ROCKER SWITCHES — LIGHTED AND UNLIGHTED/ AND INDICATOR LIGHTS

## SPECIFICATIONS

### SINGLE HOUSING STYLE

**DIMENSIONS:**
**WITH TRIM**
Length: 33.0mm (1.299″).
Depth: 29.5mm (1.161″).
Width: 15.0mm (0.590″).
**WITHOUT TRIM**
Length: 32.0mm (1.260″).
Depth: 29.7mm (1.169″).
Width: 13.9mm (0.546″).
**MOUNTING HOLE**
Length: 30.9mm (1.215″).
Width: 11.1mm (0.437″).
**MOUNTING HOLE TOLERANCES**
+0.12mm (+.005″, −.000″).

**PANEL THICKNESS**
Minimum: 0.8mm (0.032″).
Maximum: 4.74mm (0.187″).
**TERMINALS**
Quick connect with solder hole 6.3mm (0.250″).
**COLORS AND SHAPES**
Housing: Black, white.
Actuator: Black, white, red, green, orange, yellow.
Actuator Lens: Clear, red, amber, yellow.
Actuator Shape: Flat (for other colors consult OAK).
**ELECTRICAL RATING**
16 Amp, 120 VAC or 8 Amp, 240 VAC (Horsepower ratings available).
Neon Lamp: 120 or 240 VAC.

**TEMPERATURE RATING**
Up to 90°C.
**SWITCHING**
Unlighted: SPST, SPDT.
Lighted: SPST.
**MATERIALS**
Housing: 94V-2 polycarbonate.
Actuator: 94V-2 polycarbonate.
Terminals: Copper alloy.
Contacts: Silver-composition, riveted.
Bezel: Chrome plated steel.

### DOUBLE HOUSING STYLE

**DIMENSIONS:**
**WITH TRIM**
Length: 32.1mm (1.264″).
Depth: 28.7mm (1.130″).
Width: 25.8mm (1.016″).
**WITHOUT TRIM**
Length: 31.5mm (1.240″).
Depth: 29.0mm (1.142″).
Width: 25.0mm (0.984″).
**MOUNTING HOLE**
Length: 30.0mm (1.181″).
Width: 22.0mm (0.866″).

**MOUNTING HOLE TOLERANCES**

| Panel Thickness | 0.8 to 1.0mm (.031″ to .040″) | 1.0 to 1.5mm (.040″ to .060″) |
|---|---|---|
| Length 30mm (1.181″) | −0.3mm [+.000″ −.012″] | +0.3mm [+.012″ −.000″] |
| Width 22mm (0.866″) | −0.3mm [+.012″ −.000″] | +0.3mm [+.012″ −.000″] |

**PANEL THICKNESS**
Minimum: 0.8mm (0.032″).
Maximum: 1.5mm (0.060″).
(For panel thicknesses to 2.3mm/0.091″, contact Oak).
**TERMINALS**
Quick connect with solder hole 6.33mm (0.250″).
**COLORS AND SHAPES**
Housing: Black, white.
Actuator: Black, white, red, green, orange, yellow.
Actuator Lens: Clear, red, amber, yellow.
Actuator Shape: Flat, paddle.
**ELECTRICAL RATING***
16 Amp, 125/250 VAC.
Neon Lamp: 120 or 240 VAC.
**TEMPERATURE RATING***
65°C, (T-100, VDE), (Ultramid). Up to 105°C upon request (Zytel).

**SWITCHING**
**One Actuator**
Unlighted: DPST, DPDT.
Lighted: DPST, DPDT.
**Two Actuators**
Unlighted: SPST, SPDT.
Lighted: SPST and indicator, 2 SPST, 2 indicators.
**MATERIALS**
Housing*
Unlighted Buttons: Nylon — (Polyamide).
Internal Actuator (Lighted Buttons): Type 6/6.
Lighted External Buttons: Polycarbonate.
Terminals: Copper alloy.
Contacts: Solid silver, welded.
Bezel: Aluminum, bright anodized.

*** Listings:** In addition to UL and CSA, the following listings apply: C, VDE, BSI, KEMA, N, S, $\overset{+}{\text{S}}$VE,

## HOW TO ORDER

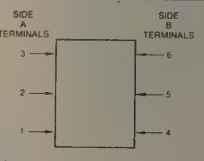
(——) — (—) — (SIDE A —— SIDE B) — (—) — (——)

**Series indicates housing color of switch and/or indicator function.**

| White Housing | Black Housing | |
|---|---|---|
| SINGLE HOUSING, AVAILABLE STYLE #1 ONLY | | |
| 14 | 24 | On/off/on, 3 position, center off unlighted |
| 15 | 25 | On/off,SPST, unlighted |
| 16 | 26 | On/on, SPDT, unlighted |
| 17 | 27 | On/off, SPST, lighted |
| 18 | 28 | Neon indicator light only |
| DOUBLE HOUSING, AVAILABLE STYLE #2 ONLY | | |
| 35 | 45 | One actuator, DPST, lighted |
| 36 | 46 | One actuator, DPST, unlighted |
| 37 | 47 | One actuator, DPDT, lighted |
| 38 | 48 | One actuator, DPDT, unlighted |
| DOUBLE HOUSING, AVAILABLE STYLE #3 ONLY | | |
| 39 | 49 | *One actuator, SPST unlighted, one indicator lighted |
| 40 | 50 | *Two actuators, each SPST, unlighted |
| 41 | 51 | Two lighted indicators only |
| 42 | 52 | Two actuators, one SPST lighted, one SPST unlighted |
| 43 | 53 | Two actuators, one SPST lighted, one SPDT unlighted |

Part numbers and code numbers must be specified in the sequence shown above.

**Actuator or lens color ***
Y = Yellow lens or actuator(s)
W = White actuator(s)
B = Black actuator(s) (unlighted only)
A = Amber lens
R = Red lens — or actuator(s)
C = Clear lens
G = Green lens — or actuator(s)
O = Orange lens — or actuator(s)




*When choosing colors for two actuators or indicators specify side "A" first (see drawing opposite).

**Trim**
T = Bezel added if requested

**Voltage** must be specified on lighted versions only due to the internal series resistor required for the neon lamp.
1 = 120 volts AC (lighted only)
2 = 240 volts AC (lighted only)

**Actuator or lens shape**
F = Flat
P = Paddle, (double housing, single actuator only)

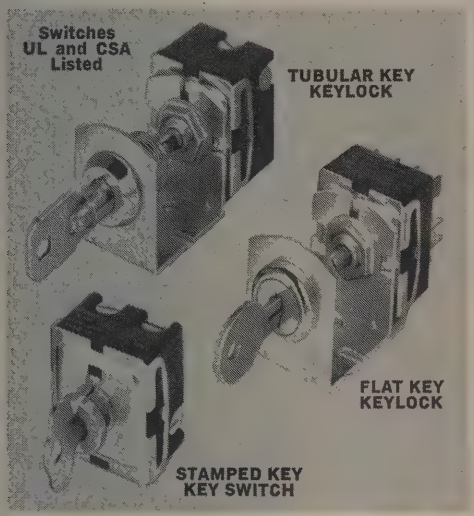
### EXAMPLES:

1. (40)-(T)-(BR)-(F)-(—)
White housing
Double housing, Style #3
Two actuators each, SPST, unlighted
Bezel added
Side "A" — Black
Side "B" — Red
Flat actuator
Unlighted

2. (45)-(—)-(A——)-(F)-(1)
Black housing
Double housing, Style #2
One actuator, DPST, lighted
No bezel
Amber lens (one only)
Flat actuator
120 VAC

NOTE:
On single throw switches, terminals 1 and 2 will be utilized on side "A" and 4 and 5 on side "B".

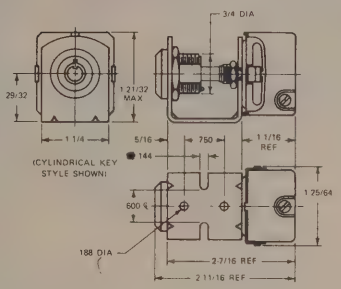
# SECURITY KEYLOCK AND KEY SWITCHES — 90° THROW



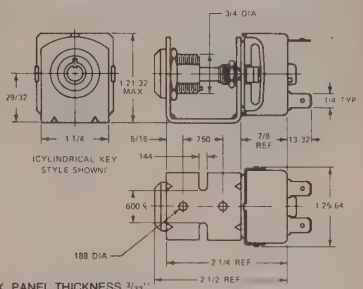

All offer power input ratings of 7½ amps through 38 amps, including motor ratings of ¼ H.P. to 1 H.P., 120 V; 2 H.P., 240 V.

All power switches illustrated offer almost identical capabilities. Models shown on the left and right have screw terminals. Spade terminal is shown in the center.

KEY OPERATED SWITCH — TYPE 240

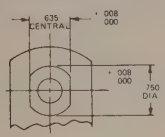



KEY OPERATED SWITCH — TYPE 390




MAX. PANEL THICKNESS 3/32"
ALL DIMENSIONS ARE ±.015 UNLESS OTHERWISE SPECIFIED
BRACKET AND LOCK ASSEMBLY MUST BE ORDERED SEPARATELY.

RECOMMENDED PANEL CUT OUTS




**STAMPED KEY KEYSWITCH 90° THROW**

| Catalog No. | Circuitry | Switch Function |
|---|---|---|
| KS-390S12M-R | SPDT | No Off |
| KS-390S4H-N | DPDT | Center Off |
| KS-391S6H-S | SPST | Off/On |
| KS-240S11HPD-E | SPST | Off/On |
| KS-240S14H-E | SPDT | No Off |
| KS-240S4HP-B | DPDT | Center Off |
| KS-241S7H-E | DPST | Off/On |

Above switches supplied with one key

**KEYLOCKS (TUBULAR AND FLAT KEY)**

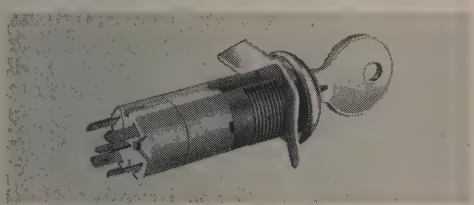
| Catalog No. | Circuitry | Switch Function |
|---|---|---|
| 39S6H-R | SPST | Off/On |
| 390S12M-P | SPDT | No Off |
| 390S4H-M | DPDT | Center Off |
| 240S4HP-C | DPDT | Center Off |
| 240S11HPD-D | SPST | Off/On |
| 240S14H-F | SPDT | No/Off |
| 241S7H-D | DPST | Off/On |

Above switches supplied with two keys

| Extra Keys | Bracket | Lock Assembly |
|---|---|---|
| Flat Key<br>Round Key<br>Registered Key | 3-7324-203 | *2-2881-016 (Flat)<br>†2-2881-017 (Round) |

* Key removed at 0° and 180°
† Key removed at 0°, 90°, 180° and 270°

# ANTI-STATIC KEYLOCK SWITCHES — 90° THROW



## SPECIFICATIONS

- Operating voltages from dry circut to 4 amps @ 120 volts AC
- Compact, miniature design — ¾" diameter x 2 1/16" deep — for high density packaging
- Long switching life — up to 10,000 operations
- UL and CSA listed
- Economical design

### Performance Characteristics

**OPERATING LIFE:** Tested to 10,000 operations
**SWITCHING:** Enclosed: SPST, SPDT, SP3T
**THROW:** 90° standard
**OPERATING TORQUE:** 7 to 16 in.-oz.
**TEMPERATURE RANGE:** 0°C to +85°C
**POSITIVE DETENTING STOPS:** Integral with lock mechanism

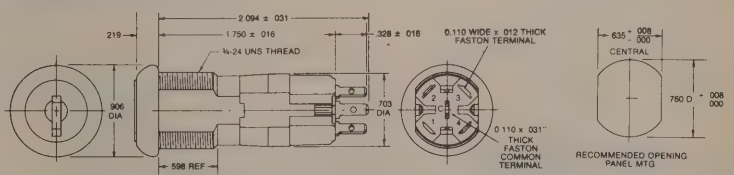
### Physical Characteristics

**HOUSING:** Zytel 101, Gray
**SWITCH TERMINALS:** Copper alloy, silver-plated
**CONTACT MATERIAL:** Copper alloy
**CONTACT PLATING:** Silver
**BARREL:** Zinc alloy, chromate dipped
**BEZEL:** Polished stainless steel
**KEY:** Brass
**HEX MOUNTING NUT:** Supplied standard

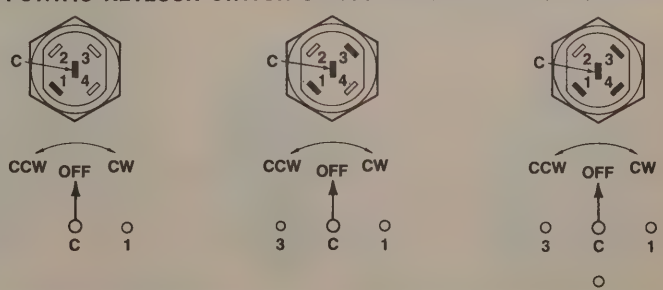
### Electrical Specifications

**ELECTRICAL RATINGS:** 1.0 amp @ 28 volts DC
4.0 amps @ 120 volts AC
2.0 amps @ 240 volts AC
**CONTACT RESISTANCE:** 10 milliohms

DIMENSIONAL DATA:




**ANTI-STATIC KEYLOCK SWITCH 5 DISC VERSION 4A 120 VAC ONLY**




| 5-51115-501 | 5-1115-601 | 5-51115-701 |
|---|---|---|
| 2 POSITION<br>90° THROW | 3 POSITION<br>90° THROW | 4 POSITION<br>90° THROW |

**ANTI-STATIC KEYLOCK SWITCHES — 90° THROW**

| Catalog No. | No. of Positions | Switch Function |
|---|---|---|
| 5-51115-501 | 2 | Off/On (CW) |
| 5-51115-601 | 3 | Off/On (CW) and ON (CCW) |
| 5-51115-701 | 4 | Off/On/On/On (continuous rotation) |

**OTTO CONTROLS**

# OTTO SNAP-ACTION SWITCHES...

## because the OTTO design features inherent rocking-action

## BASIC SWITCHES sub-miniature

### DOUBLE-BREAK B3 SERIES

MIL-S-8805/76

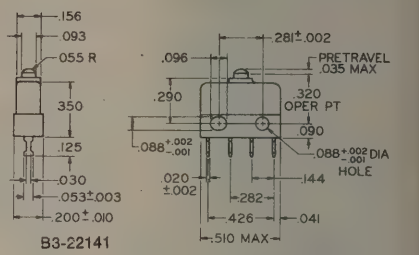
MIL-S-8805/101

**CHARACTERISTICS**

- Contact Resistance: .010Ω max.
- 10 million mechanical cycles.
- 100,000 cycles at full load.
- Operating Force: 5 $^{+3}_{-2}$ oz.
- Release Force: 1.5 oz. min.
- Pretravel: .035″ max.
- Overtravel: .006″ min.
- Move. Diff.: .015 ±.005″.
- Temp. Range: −65°C to +125°C.
- Size: .200″ or .156″ wide x .350″ h. x .510″ lg.

**MIL-S-8805/76 THIN** **B3-22141**

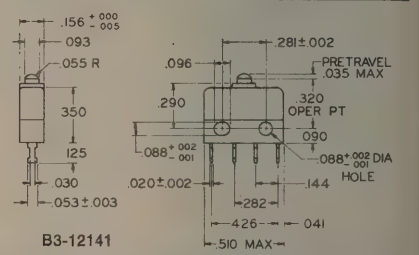
For your run-of-the-"MIL" projects, OTTO's B3-22141 Series is only .200″ thick. Contact resistance less than 10 milliohms, contact pressure higher than normal, minimal contact bounce. Gold flashed contacts, solder terminals in diallyl case. Rated 4A Res. SPDT; 8A. Res., SPDT-DB.




B3-22141

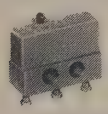
**MIL-S-8805/101 THINNER** **B3-12141**

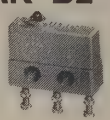
Brand new, OTTO inspired military spec. Only .156″ thin, yet all the rating, life, and reliability of the /76 version. You can get five B3-12141 Series in the space of four B3-22141 with room to spare. Your choice of double-break form X, Y, Z and single break form C. B3-12141 turret terminals, B3-23141 solder terminals. Also commercial versions.




B3-12141

### SINGLE-BREAK B2 SERIES





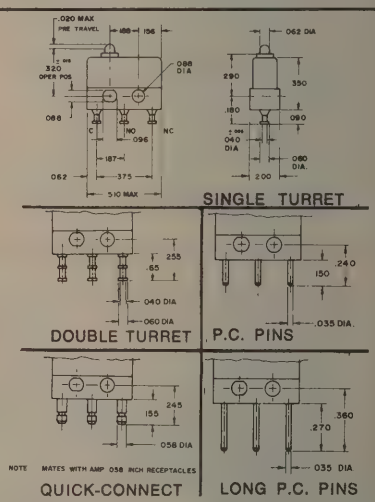
**CHARACTERISTICS**

- Contact Resistance: .025Ω max.
- 5 million mechanical cycles.
- 50,000 cycles at full load.
- Operating Force: 5 oz. max.
- Release Force: 1 oz. min.
- Pretravel: .020″ max.
- Overtravel: .010″ min.
- Move. Diff.: .005″.
- Temp. Range: −55°C to +85°C.
- Rating: 7A res. @ 115/250 VAC, 28 VDC.

While the OTTO B2 conforms to and is qualified to MIL-S-8805/4, the same switch can be specified for commercial use at a cost savings. Whether it be military or commercial, low-level "dry circuit" or high ampacity, large or close differentials, you can specify the exact switch to meet your needs. Case is diallyl. Terminals are gold-flashed brass. Contacts are silver or gold.

**APPROVALS TO MIL-S-8805/4**

| MS P/N | OTTO P/N |
|---|---|
| MS24547-1 | B2-211351 |
| MS24547-2 | B2-211353 |
| MS24547-4 | B2-212351 |
| MS24547-5 | B2-212353 |




## ACTUATORS FOR BASICS

### PUSHBUTTONS

¼″ OR $^{15}/_{32}$″ BUSHING

¼″ or $^{15}/_{32}$″ bushings, red or black button, 1 to 4 poles. Feature B3 basics. Overtravel: .006″ min. Total travel: .036″ Typical.

SEALED

Choice of 3 panel bezels styles, 1 or 2 poles. Feature B3 basics. Operating force: 4 lbs. max. Total travel: .050″ Typical.

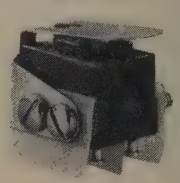
### TOGGLES

¼″ or $^{15}/_{32}$″ bushings, 1 to 3 poles, B2 or B3 basics. Momentary and three position.

### LEVERS

**For B3 Basics**

| # Poles | Cat. No. |
|---|---|
| 1 | A3-101 |
| 2 | A3-102 |



**For B2 Basics**

| # Poles | Cat. No. |
|---|---|
| 1 | A2-101 |
| 2 | A2-102 |

**OTTO CONTROLS Division / OTTO Engineering Inc.**

**OTTO CONTROLS**

# ...MAKE AND BREAK EVERYTIME

## ...that breaks welds and wipes contacts clean

## PUSHBUTTONS* miniature & moistureproof

### TYPE P1 (MIL-S-8805/3)

P1-1 P1-2 P1-3 P1-5 P1-6 P1-7 P1-8

**FEATURES**

- 250,000 mechanical cycles.
- High Contact Pressure: 120 gr.
- Low Contact Resistance: <10 milliohms.
- Repeatable trip point within .001″.
- Rolling sleeve principle seals button.
- Sealed case and terminals.

Pushbutton is sealed by silicone rubber boot operating on a "rolling sleeve" principle to give long life and smooth operation. Case and terminals sealed against environment and solder flux. Load ratings: 10A res., 5A ind., 3A lamp. Contact forms: N.O., N.C., 2-circuit. Red or black button.

### TYPE P3 Commercial Grade

P3-3 P3-6 P3-7 P3-8

Momentary or push-pull double-break action. Same specs as P1 military series. Choice of solder or screw terminals. Designed for use in panel boards, computers, business machines, instruments. Can be used as limit switch.

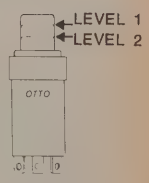
## twostep™ for applications requiring 3 modes of operation

**FEATURES**

- Unique 2-position design.
- Sequential contact action.
- 12 contact arrangements.
- Make-before-break contact option.
- Moistureproof construction.
- 100,000 mechanical cycles.

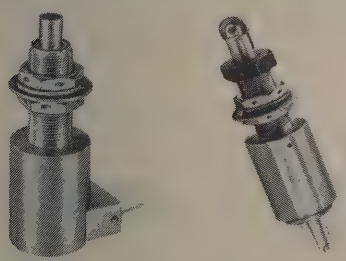
P2-1 P2-3 P2-6

Ideal for "off-high-low," "off-slow-fast," "Stop-fine-course" applications. Each level operates an independent set of SPDT circuits rated to 5A. Twelve contact arrangements are offered to satisfy just about any circuit requirement. Also available as DPDT single detent.




# SPECIAL PURPOSE SWITCHES

## ENVIRONMENT-FREE

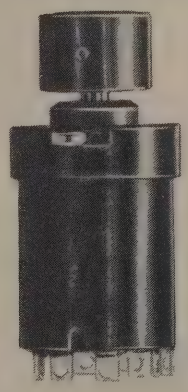


One piece housing, sealed at plunger with ring seals and at base with hermetic header for immersion proof and against corrosive atmospheres. Case grounded for EMI reduction. P6 Series available with roller or in-line plunger.

**CHARACTERISTICS**

- Rating: 7A res. at 28 VDC.
- Actuating Force: 9 lbs. Typ.
- Reset Force: 5 lbs. min.
- Movement Differential: .030″ max.
- Overtravel: .125″ min.
- Mechanical Life: 25,000 cycles.

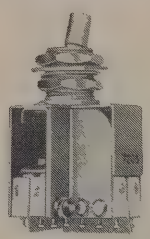
## TOGGLE/ PUSHBUTTON



T2-0001

Combo toggle and pushbutton. It's a 2-position toggle and a pushbutton switch all in one. 30° toggle throw, .135″ total pushbutton travel with 4.5 lbs. operating force. Rated 10A res. and ind.

## TOGGLE



T1-0001

Four position, 6-pole toggle featuring MIL-S-8805/4 basic switches. Positions #1 and #3 are 2PDT maintained action each, position #4 is 2PDT momentary, position #2 is center "off." Rated 7A. res. each pole.

T1-0004

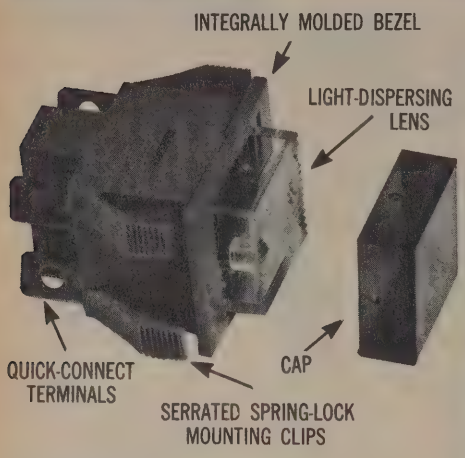
Same except 3-position, 4-pole toggle. Position #1 is 2PDT momentary, position #2 is center "off," position #3 is 2PDT maintained action.

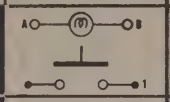
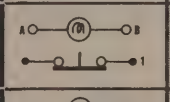
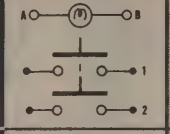
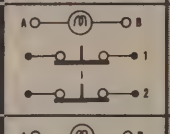
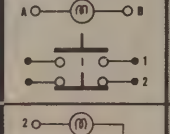
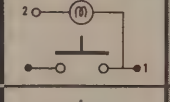
T1-0005

Same as T1-0001 except all four positions are maintained action.

36 MAIN STREET / CARPENTERSVILLE, ILLINOIS 60110 / TEL: (312) 428-7171

# OSLO PUSHBUTTON SWITCHES




| Circuit Number | Circuit Diagram | Switching | TYPE DL LIGHTED CATALOG NUMBER Momentary Action | TYPE DL LIGHTED CATALOG NUMBER Alternating Action | TYPE DP NON-LIGHTED CATALOG NUMBER Momentary Action | TYPE DP NON-LIGHTED CATALOG NUMBER Alternating Action |
|---|---|---|---|---|---|---|
| 1 |  | single-pole single-throw normally open | DLM1 | DLA1 | DPM1 | DPA1 |
| 2 |  | single-pole single-throw normally closed | DLM2 | DLA2 | DPM2 | DPA2 |
| 3 |  | double-pole single-throw normally open | DLM3 | DLA3 | DPM3 | DPA3 |
| 4 |  | double-pole single-throw normally closed | DLM4 | DLA4 | DPM4 | DPA4 |
| 5 |  | double-pole cir. #1 normally open cir. #2 normally closed | DLM5 | DLA5 | DPM5 | DPA5 |
| 6 |  | single-pole single-throw normally open | DLM6 | DLA6 | Above types do not include lamp-circuit. | |
| 7 | | double-pole single-throw normally open | DLM7 | DLA7 | | |

## ELECTRICAL FEATURES

Load rating: 10 amperes 125/250 volts ac.
Contacts: fine silver, double-break, break-before-make
Circuits: single-pole and double-pole
Dielectric strength: 2000 volts ac rms.
Life: 25,000 operations at maximum rating

## MECHANICAL FEATURES

One-piece molded-nylon body has integral, serrated, spring-lock clips.
Bezel molded integral with body.
Metal bezel available.
Molded-in light-dispersing lens.
Interchangeable lens-caps in wide choice of colors.
Positive mechanical indication of switch-contact position.
250,000 mechanical operations.

## TERMINALS

Style A—1/4-inch quick-connect
Style B—3/16-inch quick-connect
Style C—Solder-lug, for #12 wire

## STANDARD LAMPS

Integral with switch;
Internally connected per diagrams above.
6, 12, and 28 volt incandescent lamps standard.
125 and 250 volt neon lamps standard.

## SPECIAL ORDER LAMPS

125 volt incandescent lamp available.
125 and 250 volt Blue or Green neon lamps available. Consult factory for price and delivery information.

## COLOR DESIGNATIONS

**Body and integral bezel**
White—C7, Grey—C8, Black—C9,

**Transparent lens-cap**
Red—1, Clear—2, Amber—3, Green—4, Blue—5

**Opaque pushbutton-cap**
White—7, Grey—8, Black—9, Blue—10, Green—11, Red—12

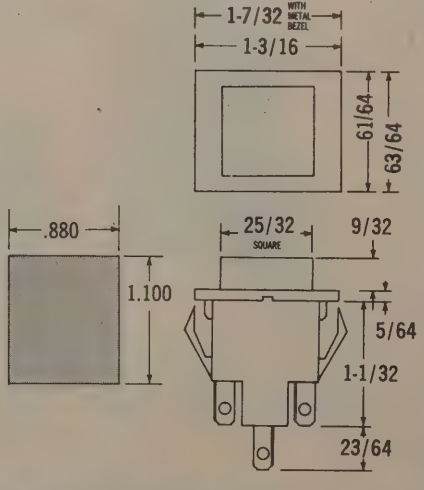
# TYPE DG – Lighted Indicators

Type DG Lighted Indicators are identical in size and mounting with Type DL and DP switches and can be grouped easily with them without need for special mounting provision. A choice of different lens-cap heights is available.

**TYPE DGS** the low-profile indicator extends the same distance from the panel as the Type DL or DP switch in its ON position (1/16 inch).

**TYPE DGT** the high-profile indicator extends the same distance from the panel as the Type DL or DP switch in its OFF position (9/32 inch).

## OUTLINE DIMENSIONS (inches)




## METAL BEZELS (optional)

Gold-color—F1, Chrome—F2

## MARKINGS

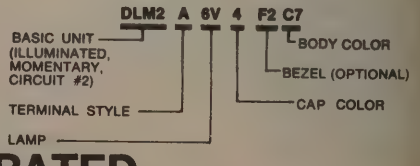
Letters, numbers, and symbols can be applied to lens-caps.

## MOUNTING

Snap-in mounting in rectangular hole; fits any panel-thickness 1/32 to 3/16 inch.

## ORDERING EXAMPLE

Develop catalog-number of unit by adding to the basic Type Number, shown above, the applicable code-letters or numbers in the sequence shown below.

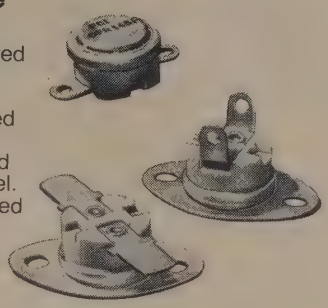



OSLO CONTROLS INCORPORATED
328 Industrial Avenue, Cheshire, Conn. 06410 Tel: (203) 272-2794

# SNAP-ACTION THERMOSTATS

## SERIES 5002—Miniature High Temp Thermostat

Miniature, rugged switch suited for high temperature applications; plattens, steam equipment, electrically heated press heads, etc. Available in ceramic base only with closed caps of brass or stainless steel. Cap construction can be sealed with resin for additional protection.



| Series Part No. | Type | Contacts Amps | Volts | Operating Temp. Range |
|---|---|---|---|---|
| 5002 | SPST Single Break | 3<br>1.5 | 120V ac<br>240V ac | −20°F to +575°F |

Ask for Reference Sheet 5002

## SERIES 5003—Close Control Thermostat

Extremely thin, lightweight, water type thermal switch. Overall depth .250". Provides fast, positive response and good shock and vibration resistance. NC or NO contacts. Excellent repeat reliability. Factory calibrated.

| Series Part No. | Type | Contacts Amps | Volts | Operating Temp. Range |
|---|---|---|---|---|
| 5003 | SPST Single Break | 5 | 120V ac | +300°F to +575°F |

Ask for Reference Sheet 5003

## SERIES 5004—240V AC Surface Thermostat

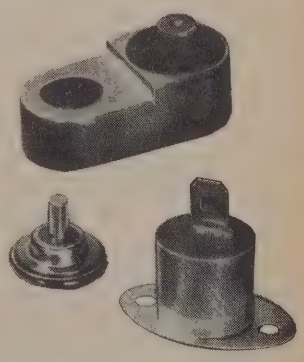
Designed with 4 mm clearance and for operation at 240V ac. Applications include industrial, electronic and electrical equipment such as business machines, radar, computer peripherals, heater blanket controls and heat sink protection. Excellent shock and vibration resistance. Rapid thermal response due to low mass. Factory calibrated. U/L recognized.

| Series Part No. | Type | Contacts Amps | Volts | Operating Temp. Range |
|---|---|---|---|---|
| 5004 | SPST Single Break | 7 | 240V ac | −20°F to +350°F |

Ask for Reference Sheet 5004

## SERIES 5011—Hermetically Sealed Surface Thermostat

Low cost, designed to meet exacting requirements of shock and vibration applications. For use where temperature control, warning or protection is required. Fast response. Factory calibrated and 100% inspected. Available with a variety of adapter packages (plug, bolt or isolated base mounting) to suit specific applications.

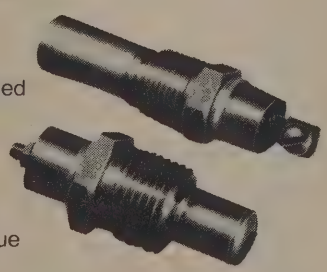


| Series Part No. | Type | Contacts Amps | Volts | Operating Temp. Range |
|---|---|---|---|---|
| 5011 | SPST Single Break | 3 | 120V ac<br>32V dc | −20°F to +575°F |

Ask for Reference Sheet 5011

## SERIES 5020—Immersion Thermostst

A snap-acting hemetically sealed temperature control designed for use where a sealed unit and high vibration resistance are required. Applications include water-cooled engines and engine generator sets. Temperature sensing element confined to very tip, assuring rapid and true response to liquid or air temperature.



| Series Part No. | Type | Contacts Amps | Volts | Operating Temp. Range |
|---|---|---|---|---|
| 5020 | SPST Single Break | 3 | 32V dc | −20°F to +525°F |

Ask for Reference Sheet 5020

## SERIES 5100—Immersion Thermostat

Especially designed for use where a sealed unit and high vibration resistance are required. Applications include water-cooled engines, hydraulic systems, degreasers, industrial air compressors and tanks where liquids are heated as in commerical dryers and sterilizing equipment. Designed for rapid response to liquid or air temperature. Approved for vibration per MIL-E-5272 proc. XII 10G.

| Series Part No. | Type | Contacts Amps | Volts | Operating Temp. Range |
|---|---|---|---|---|
| 5100 | SPST Single Break | 3<br>1.5 | 120V ac<br>240V ac | −20°F to +575°F |

Ask for Reference Sheet 5100

**Protective Controls Inc.**
A subsidiary of North American Philips Controls Corp., Frederick, Md. 21701—(301) 663-5141

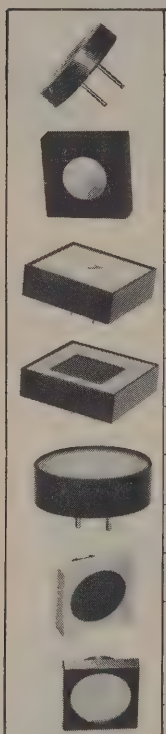
# WILD ROVER®

## Touch Switches
## Keyboards

PRODUCTS OF:
REFAC electronics corporation
DEPT. EM, P.O. BOX 809, WINSTED, CT 06098 (203) 379-2731

### TOUCH SWITCH FEATURES

- Extremely fast turn-on and turn-off.
- Very low transient noise.
- Exceptionally rugged construction for long life and ease of handling during assembly.
- Economical design. Simple to mount.
- Clean, contemporary graphics to accent highly functional packaging.
- Unique ability to handle inductive loads as well as dry circuits or low level applications with ease.
- Optional legendizing.



| Part No. | Description | Rating | Contact Form | Contact Resistance | Operating Force | Life | Temperature Range | Terminal Type | Nom. Weight | Dimensions | Touch Plate Dimension | List Price |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TC-1C | Touch switch capsule | 115 VAC, 1.6 amp; 24 VDC, 1 amp resistive | Single pole, single throw, normally open, momentary | 30 milliohms nominal | 50 ±30 grams | High Loads: More than 1,000,000 cycles Low Level Loads: More than 10,000,000 cycles | (−54°C - +93°C) −65°F - +200°F | ¼" long, 0.041" dia. printed circuit pins | 1.4 grams | 0.615" dia. x 0.160" thick | 0.465" dia. | $ .70 |
| MM-1 | Micro-movement touch switch | 24 VAC or DC at 100 ma. resistive | Single pole, single throw, normally open, momentary | 0.0075 ohms nominal; 0.100 ohms after 1,000,000 cycles | 15 grams minimum, 58 grams nominal 100 grams maximum, 0.010" travel | 1,000,000 cycles at rated load | (−20°C - +65°C) −4°F - +149°F | 7/32" long, 0.040" dia. printed circuit pins | 1.5 grams | 0.590" sq. x 0.172" nom. thick | 0.315" sq. | .40 |
| MM-2 | | | | | | | | | 1.4 grams | 0.590" sq. x 0.172" nom. thick | 0.315" dia. | .40 |
| MM-3 | | | | | | | | | 1.3 grams | 0.630" dia. x 0.172" nom. thick | 0.315" dia. | .40 |
| MM-4 | | | | | | | | | 1.1 grams | 0.492" sq. x 0.172" nom. thick | 0.315" dia. | .40 |
| MM-5 | | | | | | | | | 1.1 grams | 0.492" sq. x 0.172" nom. thick | 0.315" sq. | .40 |
| TC-1M7 | Mini-lithic touch switch | 115 VAC RMS, 1.6 amp, resistive; 24 VDC, 1 amp resistive | Form A (SPST) momentary, normally open | 0.030 ohms nominal; 0.100 ohms max. throughout life | 50-120 grams | 1,000,000 cycles at rated load | (−45°C - +75°C) −50°F - +167°F | 13/64" long, 0.041" dia. printed circuit pins | 4.1 grams | 0.750" sq. x 0.250" nom. thick | 0.500" dia. (approx.) | 1.35 |
| TC-1M8 | | | | | | | | | 3.4 grams | 0.750" sq. x 0.250" nom. thick | 0.500" dia. (approx.) | 1.35 |
| TC-1M9 | | | | | | | | | 5.3 grams | 0.875" sq. x 0.255" nom. thick | 0.500" sq. | 1.35 |
| TC-1/SE1 | Sealed touch switch | 115 VAC, 1.6 amp; 24 VDC, 1 amp | Form A (SPST) momentary, normally open | 30 milliohms nominal 100 milliohms maximum | 75-150 grams | High Loads: More than 1,000,000 cycles Low Level Loads: More than 10,000,000 cycles | (−54°C - +75°C) −65°F - +167°F | Screw type (recessed 4-40 screw) standard; other types available | 0.3 oz. nominal | 1.00" square | 0.800" dia. | 3.10 |
| TC-1/SE2 | | | | | | | | | 0.3 oz. nominal | 1.00" square | 0.800" dia. | 3.10 |
| TC-1/SE3 | | | | | | | | | 0.3 oz. nominal | 1.00" diameter | 0.800" dia. | 3.10 |
| TC-1/SE4 | | | | | | | | | 0.3 oz. nominal | 0.950" diameter | 0.820" dia. | 2.90 |

### KEYBOARD FEATURES

- PCK-1 or -2 individual keyboard switches for short-run or custom-design keyboard construction.
- PCK-12 and -16 keyboards with touch tone, business machine and special legends available.
- Standard 5, 8, and 12-key MKM, MK Series military and commercial touch keyboards.
- All long life, positive feel, low bounce, and inexpensive.

| Part No. | Description | Rating | Contact Resistance | Contact Configuration | Bounce | Life | Temperature Range | PC Contacts | Terminals | Shorting Contact | Overall Dimensions | List Price |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PCK-1* | Individual key for 1/32" board | 24 VDC resistive up to 200 ma. | 50 milliohms max. after life test | SPST N.O. (Form A) | Less than 2 milliseconds leading or trailing edge | 10 million cycles at 5 VDC, 5 ma; 2 million cycles at 24 VAC, 200 ma | −65°F to +167°F (−54°C to +75°C) | N/A | N/A | Beryllium copper 0.000010" gold over nickel | 0.500" square x 0.300" nom. thick | $ .25 |
| PCK-2* | Individual key for 1/16" board | | | | | | | 0.00005" gold over nickel on 1 oz. copper pads | 0.025" square x 0.500" long Wire Wrap® pins, tin plated | | | .25 |
| PCK-12-TC* | 3 x 4 keyboard touch tone legend | | | | | | | | | | 3.000" high x 2.380" wide | 6.16 |
| PCK-12-MC* | 3 x 4 keyboard machine legend | | | | | | | | | | | 6.16 |
| PCK-12-MT* | 3 x 4 keyboard machine legend, | | | | | | | | | | | 6.80 |
| PCK-12-TT* | 3 x 4 keyboard touch tone legend | | | | | | | | | | | 6.80 |
| PCK-16-TC* | 4 x 4 keyboard touch tone legend | | | | | | | | | | | 8.16 |
| PCK-16-MC* | 4 x 4 keyboard machine legend | | | | | | | | | | 3.000" high x 3.000" wide | 8.16 |
| PCK-16-MT* | 4 x 4 keyboard machine legend, | | | | | | | | | | | 8.88 |
| PCK-16-TT* | 4 x 4 keyboard touch tone legend | | | | | | | | | | | 8.88 |
| MK-5† | 5 key commercial | 5 VDC, 10 ma inductive or 24 VDC, 200 ma resistive after life test 2 ohms maximum after life test | | SPST N.O. momentary contact | Less than 5 milliseconds | 1 million cycles | −67°F to +185°F (−55°C to +85°C) | 0.00005" gold over nickel on 1 oz. copper pads | Tin plated brass, 0.025" square x 0.500" long | Silver grid | 2.375" high x 1.750" wide | 13.60 |
| MK-8† | 8 key commercial | | | | | | | | | | 3.250" high x 1.750" wide | 14.80 |
| MK-12† | 12 key commercial | | | | | | | | | | 3.000" high x 2.375" wide | 16.40 |
| MKM-5† | 5 key military | | | | | | | | Gold plated brass, 0.025" square x 0.500" long | | 2.375" high x 1.750" wide | 19.10 |
| MKM-8† | 8 key miltary | | | | | | | | | | 3.250" high x 1.750" wide | 20.40 |
| MKM-12† | 12 key military | | | | | | | | | | 3.000" high x 2.375" wide | 22.10 |

* Operating Force 20-60 grams. Key Travel 0.055" ±0.015". Cap and Base Material Celcon®, black. Touch Plate Area 0.500" square.
† Operating Force 100-400 grams. Key Trvel 0.005" nom. Touch Plate Area 0.500" square x 1/32" recess.

RAYTHEON

# SWITCHES INDEX

## INDEX


### TOGGLE SWITCHES
Bushing Mounted . . . . . p 4, 5, 6
Right-angle pc Mounted . . . . . p 6

### ROCKER SWITCHES
Snap-in . . . . . p 1
Lighted (Snap-in) . . . . . p 2
Rear panel mounted . . . . . p 3

### LEVER SWITCHES
Snap-in . . . . . p 1
Rear panel mounted . . . . . p 3

### PUSH BUTTON SWITCHES
Snap action bushing mount . . . . . p 8
Snap action, snap-in . . . . . p 9

### PUSH BUTTON SWITCHES (Cont'd)
Butt contact bushing mount . . . . . p 8
6A Alternate action snap-in . . . . . p 9

### SLIDE SWITCHES (Snap action)
Panel mount . . . . . p 7
PC mount . . . . . p 7


**See these other Raytheon Products in EEM**

Knobs—Section 2400 Hardware—Section 2800
Test Jacks—Section 2100 Opto-electronics—Section 3700

ROCKER SPDT

LEVER SPDT

## SNAP-IN ROCKER/LEVER SERIES R, SERIES LE

The Series R and Series LE rocker and lever switches are high quality with actuators styled to complement modern panel design. Both series snap-in front panel mounting. Bezel and actuator colors can be color coordinated. A black bezel and black actuator is supplied, unless otherwise specified. Spring steel springs hold the switches firmly in place. Rated at 5 Amperes with resistive load at 120 VAC or 28 VDC; 2 Amperes with resistive load at 250 VAC: both SPDT and DPDT versions are available. Solder-lug terminal.

### SPECIFICATIONS

**Contact Rating:** 5 Amperes with resistive load at 120 VAC or 28 VAC; 2 Amperes with resistive load at 250 VAC.
**Electrical Life:** 100,000 make and break cycles at full load on all models.
**Contact Resistance:** 10 milliohms maximum initial at 2 to 4 VDC, 100 milliamps for both coin silver and gold plated contacts.
**Insulation Resistance:** 1000 megohms minimum.
**Dielectric Strength:** 1000 Volts RMS at sea level.

### MATERIALS

**Case:** Black phenolic resin.
**Rockers and Lever Handles:** Nylon.
**Mounting Bracket:** Stainless steel.
**End Contact:** Coin silver, silver plated.
**End Terminal:** Brass, silver plated.
**Center Contact and Terminal:** Brass or zinc, silver plated.
**Snap-in Springs:** Spring steel, nickel plated.
**Bezel:** Nylon.

### ROCKER SNAP-IN SOLDER TERMINALS UL LISTED

| Cat. No. | Type | Desc. |
|---|---|---|
| R1A1* | SPDT | On-None-On |
| R2A1* | DPDT | On-None-On |

### LEVER SNAP-IN SOLDER TERMINALS UL LISTED

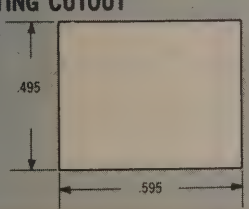
| Cat. No. | Type | Desc. |
|---|---|---|
| LE1A1* | SPDT | On-None-On |
| LE2A1* | DPDT | On-None-On |

*Unless specified bezel and actuator supplied in black. See table

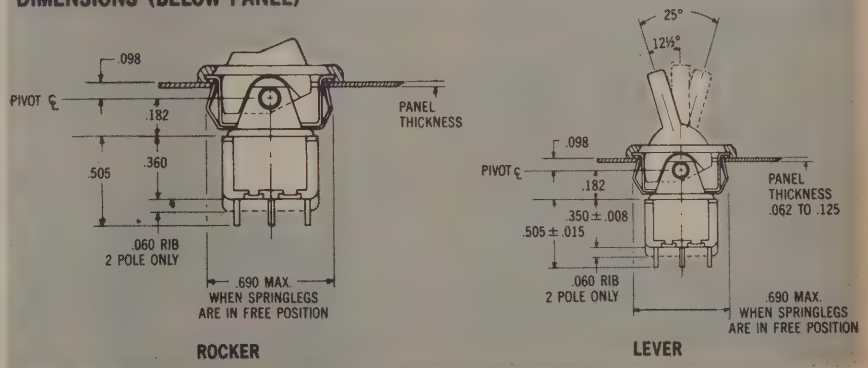
### TABLE 1

COLOR OPTIONS BEZEL AND ACTUATOR
W = White BL = Black R = Red

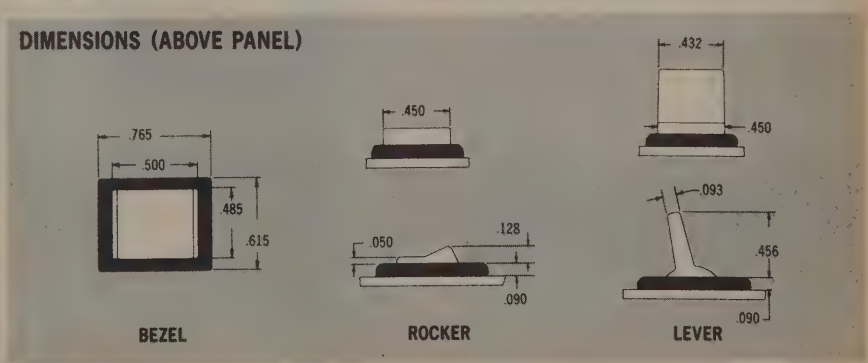
### MOUNTING CUTOUT




### DIMENSIONS (BELOW PANEL)




### DIMENSIONS (ABOVE PANEL)




**RAYTHEON COMPANY / DISTRIBUTOR PRODUCTS OPERATION**
DEPT. EM / FOURTH AVE. / BURLINGTON, MA 01803 / TEL: (617) 272-6400 / TWX: 710-332-7641

RAYTHEON

# ROCKER AND LEVER SWITCHES

LIGHTED ROCKER DPDT

## ROCKER SNAP-IN, LIGHTED, SOLDER TERMINALS UL LISTED

| Cat. No. | Type | Desc. |
|---|---|---|
| LR1A1 | SPDT | On-None-On |
| LR1C1 | SPDT | On-Off-On |
| LR1B1 | SPDT | On-None-(On) |
| LR2A1 | DPDT | On-None-On |
| LR2C1 | DPDT | On-Off-On |
| LR2B1 | DPDT | On-None-(On) |

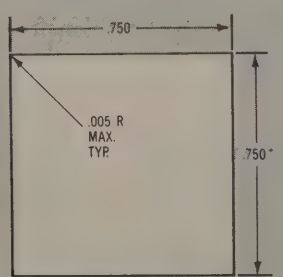
L1 = Lens B2 = Bezel provided with switch. See table 1 for color choice.

## TABLE 1

### COLOR OPTIONS BEZEL AND LENS

| | | |
|---|---|---|
| W = White | Or = Orange | GR = Green |
| R = Red | Y = Yellow | BL = Black (bezel only) |

## MOUNTING CUTOUT




## LIGHTED ROCKER SNAP-IN MOUNT—SERIES LR

This high quality lighted rocker switch snaps into front of panel. The bezel/lens combination suits them for attractive modern panel styling. A choice of bezel and lens colors is available (Table 1). A black bezel with a white lens is provided, unless otherwise specified. SPDT and DPDT models available. Solder-lug terminals. Bulb is not supplied. (Use bulb sizes T 1½ and T 1¾). Separate lamp circuit for added flexibility. Rated at 5 Amperes with resistive load at 120 VAC or 28 VDC; 2 Amperes at 250 VAC. Actuator/lens is removable from front for easy bulb replacement.

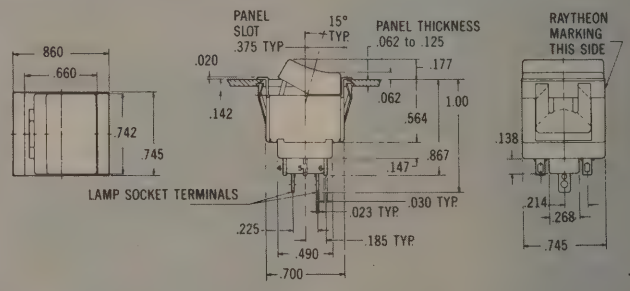
## SPECIFICATIONS

**Contact Rating:** 5 Amperes with resistive load at 120 VAC or 28 VDC. 2 Amperes with resistive load at 250 VAC.
**Electrical Life:** 100,000 make and break cycles at full load.
**Contact Resistance:** 5 milliohms maximum initial at 2 to 4 VDC, 100 milliamps for both coin silver and gold plated contacts.
**Insulation Resistance:** 20,000 megohms minimum.
**Dielectric Strength:** 1000 Volts RMS at sea level.

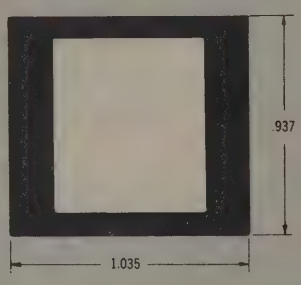
## MATERIALS

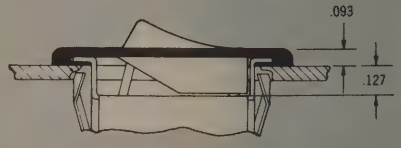
**Case:** Melamine.
**Housing:** Stainless steel.
**Bezel:** Nylon.
**Lens:** Lexan (R).
**Snap-in Springs:** Spring steel, nickel plated.
**End Contacts:** Coin silver, silver plated.
**End Terminals:** Brass, silver plated.
**Center Contact and Terminals:** Brass, silver plated.
**Lamps Socket Terminals:** Brass, electro-tin plated.

### SPDT & DPDT Same Dimensions




### BEZEL

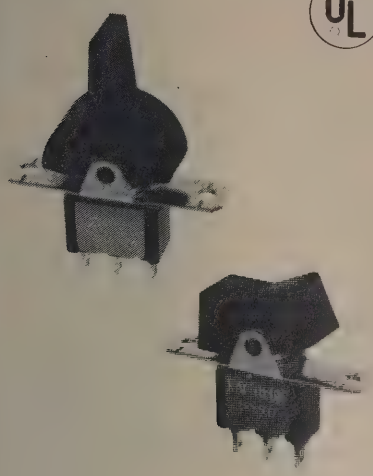



RAYTHEON COMPANY / DISTRIBUTOR PRODUCTS OPERATION
DEPT. EM / FOURTH AVE. / BURLINGTON, MA 01803 / TEL: (617) 272-6400 / TWX: 710-332-7641

RAYTHEON

# ROCKER AND LEVER SWITCHES



## REAR-PANEL MOUNTED ROCKER AND LEVER

Ruggedly constructed, these compact switches can handle 5 Amperes at 120 VAC. Both rocker and lever models are available. Designed to mount behind a front panel, standoff hardware is provided. Terminals are solder-lug. SPDT, DPDT, 3PDT, and 4PDT sizes are available in both styles. Actuator color is black, unless otherwise specified. See Table 1 for color choices.

### SPECIFICATIONS

**Contact Rating:** 5 Amperes with resistive load at 120 VAC or 28 VDC; 2 Amperes with resistive load at 250 VAC.
**Electrical Life:** 100,000 make and break cycles at full load on all models. All momentary models—40,000 cycles.
**Contact Resistance:** 10 millohms maximum initial at 2 to 4 VDC.
**Insulation Resistance:** 1000 megohms minimum
**Dielectric Strength:** 1000 Volts RMS at sea level.

### MATERIALS

**Case:** Black phenolic resin.
**Rockers and Lever Handles:** Nylon.
**Housing:** Stainless steel.
**Mounting Bracket:** Stainless steel.
**End Contact:** Coin silver, silver plated.
**End Terminal:** Brass, silver plated.
**Center Contact and Terminal:** Brass or zinc, silver plated.
**Hardware Supplied:** Two screws, two lockwashers, two nuts, and two standoffs for 1/8 inch panels.

### ROCKER—BEHIND PANEL MOUNT, SOLDER TERMINALS, UL LISTED

| Cat. No. | Type | Desc. |
|---|---|---|
| 105DJ1 | SPDT | On-None-On |
| 105EJ1 | SPDT | On-Off-On |
| 105FJ1 | SPDT | None-On-(On) |
| 205NJ1 | DPDT | On-None-On |
| 205PJ1 | DPDT | On-Off-On |
| 205RJ1 | DPDT | None-On-(On) |
| 305DJ1 | 3PDT | On-None-On |
| 405NJ1 | 4PDT | On-None-On |

### LEVER—BEHIND PANEL MOUNT, SOLDER TERMINALS, UL LISTED

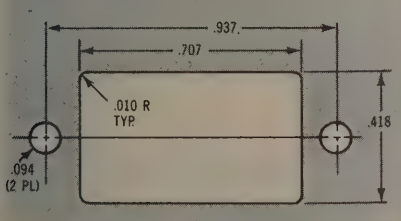
| Cat. No. | Type | Desc. |
|---|---|---|
| 105DJ2 | SPDT | On-None-On |
| 105EJ2 | SPDT | On-Off-On |
| 105FJ2 | SPDT | None-On-(On) |
| 205NJ2 | DPDT | On-None-On |
| 205PJ2 | DPDT | ON-Off-On |
| 205RJ2 | DPDT | None-On-(On) |
| 305DJ2 | 3PDT | On-None-On |
| 405NJ2 | 4PDT | On-None-On |

### TABLE 1

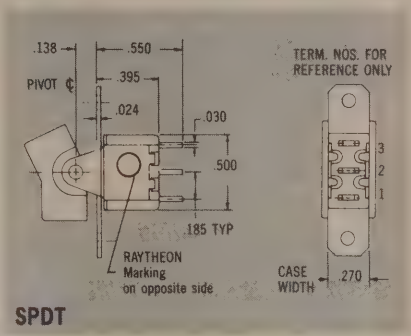
**COLOR OPTIONS ROCKER/LEVER**

W = White R = Red BL = Black

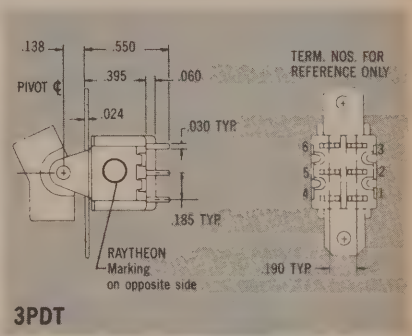
### PANEL CUTOUT



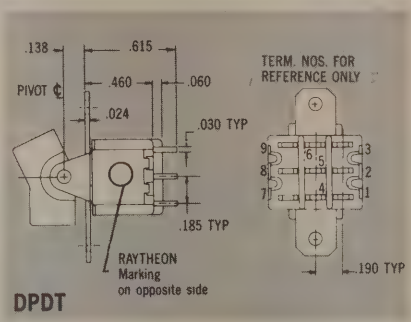

### DIMENSIONS APPLY TO BOTH ROCKER AND LEVER STYLES



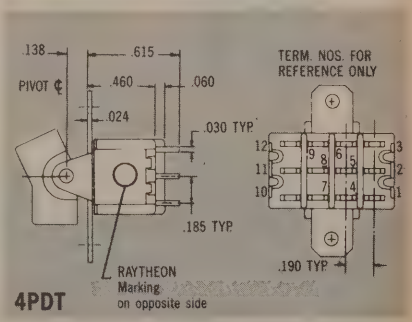

SPDT



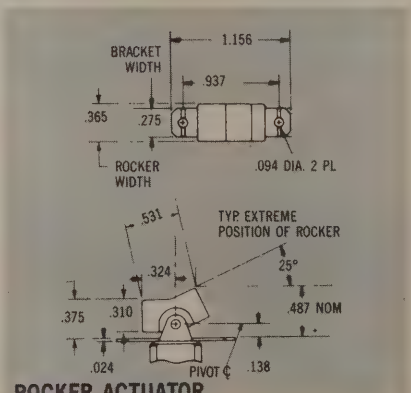

3PDT



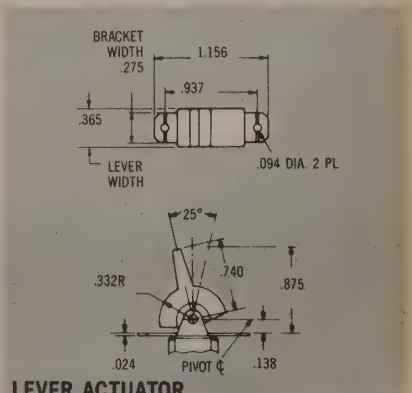

DPDT




4PDT




ROCKER ACTUATOR




LEVER ACTUATOR

RAYTHEON COMPANY / DISTRIBUTOR PRODUCTS OPERATION
DEPT. EM / FOURTH AVE. / BURLINGTON, MA 01803 / TEL: (617) 272-6400 / TWX: 710-332-7641

RAYTHEON

# TOGGLE SWITCHES

## MINIATURE TOGGLE SWITCHES

Quality ultra-small toggle switches combining high current capacity and long life in a miniature package. The small case size makes them ideally suited for miniaturized equipment where front, and rear of panel space is limited. There are two mounting styles: bushing mounted, and right angle PC mounted. All standard terminals have coin silver contacts and terminals. PC, right angle PC, and wire-wrap terminals have gold contacts and terminals.
Most models UL listed. File E53864.

### SPECIFICATIONS—ELECTRICAL

**Current Rating:** Coin silver contacts 5 Amperes resistive load at 120 VAC or 28 VDC, or 2 Amperes at 250 VAC. Brass contacts with gold over nickel plate 0.4 Volt-Amperes at 20 Volts maximum (AC or DC).
**Contact Resistance:** 10 milliohms maximum initial at 2 to 4 VDC, 100 milliamps for both silver and gold-plated contacts.
**Insulating Resistance:** Over 1000 megohms between terminals and case ground at 500 VDC.
**Dielectric Strength:** 1000 VAC between terminals and case ground for a duration of 1 minute.
**Electrical Life:** 100,000 (40,000 on momentary types) on-off, switching actions at rated current.

### SPECIFICATIONS—MATERIAL

**Case:** Black phenolic resin.
**Toggle:** Brass, chrome plated.
**Bushing:** Brass, nickel plated.
**Housing:** Stainless steel.

### SPECIFICATIONS—CONTACTS

**STANDARD TERMINALS AND CONTACTS:**
**End Terminals:** Contact surface—coin silver; Body—coin silver or brass, silver plated.
**Center Terminal:** Contact surface—brass or zinc, silver plated; Body—brass or zinc silver plated.
**PC TERMINALS:**
**End Terminals:** Contact surface—brass with 50 millionths minimum gold plate, over 200 millionths nominal nickel plate; Body—brass with 50 millionths minimum gold plate, over 200 millionths nominal nickel plate.
**Center Terminal:** Contact surface—brass or zinc with 50 millionths minimum gold plate, over 200 millionths nominal nickel plate; Body—single pole model. Brass with gold plate over nickel plate. Two, three and four pole models-brass, silver plated, or zinc, gold plated.
**WIRE-WRAP AND RIGHT ANGLE PC TYPES:**
**End Terminals:** Contact surface—brass with 50 millionths minimum gold plate, over 200 millionths nominal nickel plate; Body—brass with 50 millionths minimum gold plate, over 200 millionths nominal nickel plate.
**Center Terminal:** Contact surface—brass with 50 millionths minimum gold plate, over 200 millionths nominal nickel plate; Body—brass with 50 millionths minimum gold plate, over 200 millionths nominal nickel plate.

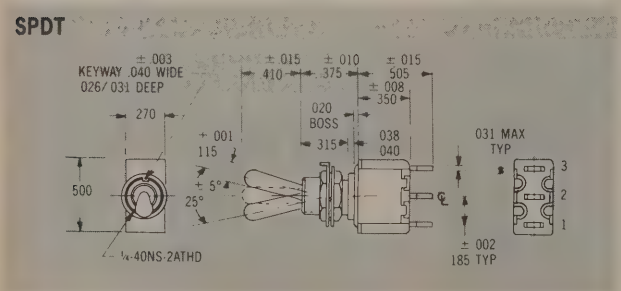
### HARDWARE SUPPLIED

**Flatted toggle:** one N-3 dress nut, one N-2 hex nut, one standard locking ring;
**Right angle toggle:** none (has non-threaded bushing);
**All other toggles:** two N-2 hex nuts, one standard locking ring.

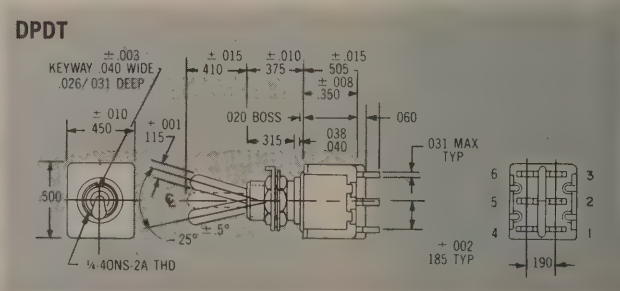
## BUSHING MOUNTED

Four toggle styles are available: standard length bat, long bat, long plastic bat, and flatted toggle. The flatted style is supplied with a special dress mounting nut (N-3). Solder lug, PC pin, or wire-wrap (R) terminals are available on some styles. Not all combinations of switch size, toggle style, and terminals are available. See chart on page 5.

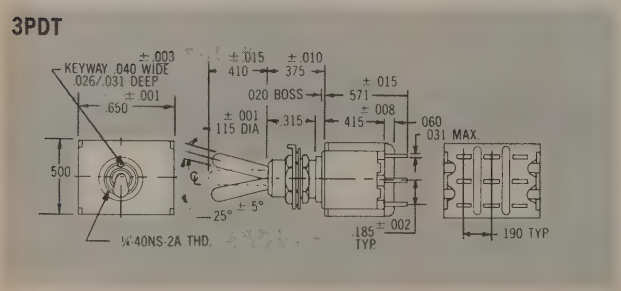
**SPDT**



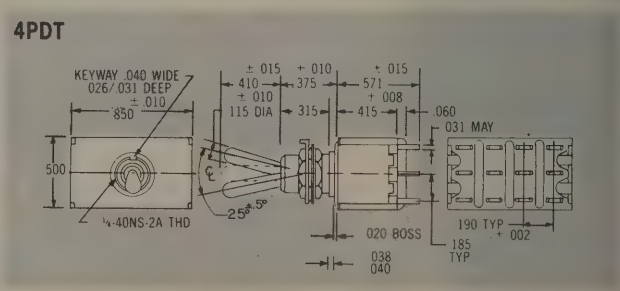

**DPDT**




**3PDT**




**4PDT**



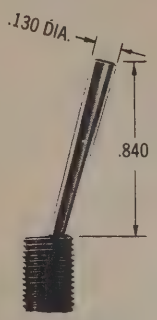

**RAYTHEON COMPANY / DISTRIBUTOR PRODUCTS OPERATION**
DEPT. EM / FOURTH AVE. / BURLINGTON, MA 01803 / TEL: (617) 272-6400 / TWX: 710-332-7641

RAYTHEON

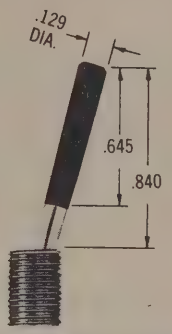
# TOGGLE SWITCHES

## BUSHING MOUNTED (Cont.)

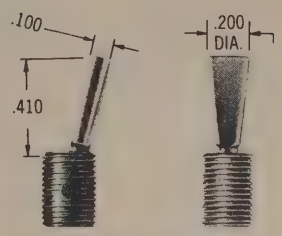
STANDARD TOGGLE




LONG TOGGLE




LONG PLASTIC TOGGLE
Black Only




FLATTED TOGGLE
With Anti-Rotation Pinning

### STANDARD TOGGLE— SOLDER TERMINALS

1/4—40NS 2Athd bushing, UL listed.

| Cat. No. | Type | Desc. |
|---|---|---|
| 105B | SPDT | On-None-(On) |
| 105D | SPDT | On-None-On |
| 105E | SPDT | On-Off-On |
| 105F | SPDT | None-On-(On) |
| 105G | SPDT | (On)-Off-(On) |
| 105H | SPDT | On-Off-(On) |
| 205B | DPDT | On-None-(On) |
| 205N | DPDT | On-None-On |
| 205P | DPDT | On-Off-On |
| 205PA | DPDT | On-On-On |
| 205R | DPDT | None-On-(On) |
| 205S | DPDT | (On)-Off-(On) |
| 205SA | DPDT | (On)-On-(On) |
| 205T | DPDT | On-Off-(On) |
| 205TA | DPDT | On-On-(On) |
| 305B | 3PDT | On-None-(On) |
| 305D | 3PDT | On-None-(On) |
| 305E | 3PDT | On-Off-On |
| 305H | 3PDT | On-Off-(On) |
| 405N | 4PDT | On-None-On |
| 405P | 4PDT | On-Off-On |
| 405Pa | 4PDT | On-On-On |

### STANDARD TOGGLE— PC TERMINALS

1/4-40NS 2Athd bushing, gold contacts and terminals.

| Cat. No. | Type | Desc. |
|---|---|---|
| 105D2 | SPDT | On-None-On |
| 105E2 | SPDT | On-Off-On |
| 105F2 | SPDT | None-On-(On) |
| 105G2 | SPDT | (On-Off-(On) |
| 105H2 | SPDT | On-Off-(On) |
| 205N2 | DPDT | On-None-On |
| 205P2 | DPDT | On-Off-On |
| 205PA2 | DPDT | On-On-On |
| 205R2 | DPDT | None-On-(On) |
| 205S2 | DPDT | (On)-Off-(On) |
| 205T2 | DPDT | On-Off-(On) |
| 305D2 | 3PDT | On-None-On |
| 305E2 | 3PDT | On-Off-On |
| 405N2 | 4PDT | On-None-On |
| 405P2 | 4PDT | On-Off-On |
| 405PA2 | 4PDT | On-On-On |

### STANDARD TOGGLE— WIRE WRAP TERMINALS

1/4-40NS 2Athd bushing, gold terminals and contacts

| Cat. No. | Type | Desc. |
|---|---|---|
| 105D6 | SPDT | On-None-On |
| 105E6 | SPDT | On-Off-On |
| 205N6 | DPDT | On-None-On |
| 305D6 | 3PDT | On-None-On |
| 405N6 | 4PDT | On-None-On |

UL

### LONG TOGGLE—PC TERMINALS

1/4-40NS 2Athd bushing—gold terminals & contacts

| Cat. No. | Type | Desc. |
|---|---|---|
| 105D2L | SPDT | On-None-On |
| 105E2L | SPDT | On-Off-On |
| 205N2L | DPDT | On-None-On |
| 205P2L | DPDT | On-Off-On |
| 305D2L | 3PDT | On-None-On |
| 405N2L | 4PDT | On-None-On |

**Color caps available:** Order C-9 cap in black, red, white, yellow, green, blue gray. Cap is 0.375 inch long vinyl.

### LONG PLASTIC TOGGLE— SOLDER TERMINALS

1/4-40NS 2Athd bushing, UL listed

| Cat. No. | Type | Desc. |
|---|---|---|
| 105DL3 | SPDT | On-None-On |
| 105EL3 | SPDT | On-Off-On |
| 105FL3 | SPDT | None-On-(On) |
| 205NL3 | DPDT | On-None-On |
| 205PL3 | DPDT | On-Off-On |
| 205TL3 | DPDT | On-Off-(On) |
| 305DL3 | 3PDT | On-None-On |
| 405NL3 | 4PDT | On-None-On |

### FLATTED TOGGLE—SOLDER TERMINALS

1/4-40NS, 2Athd bushing, UL listed

| Cat. No. | Type | Desc. |
|---|---|---|
| 105D49 | SPDT | On-None-On |
| 105E49 | SPDT | On-Off-On |
| 105G49 | SPDT | (On)-Off-(On) |
| 205N49 | DPDT | On-None-On |
| 205P49 | DPDT | On-Off-On |
| 205R49 | DPDT | None-On-(On) |
| 205SA49 | DPDT | (On)-On-(On) |

RAYTHEON COMPANY / DISTRIBUTOR PRODUCTS OPERATION
DEPT. EM / FOURTH AVE. / BURLINGTON, MA 01803 / TEL: (617) 272-6400 / TWX: 710-332-7641

RAYTHEON

# TOGGLE SWITCHES

## BUSHING MOUNTED (Cont)

### TERMINALS

STANDARD TERMINALS | PC TERMINALS | WIRE WRAP (R) TERMINALS

### MOUNTING HARDWARE

**N-1** Knurled nut 0.363 inch diameter, 0.062 thickness. Brass, bright nickel finish.

**N-1A** Decorative knurled nut 0.312 inch diameter, 0.08 inch thickness. Fine straight knurl, blind internal thread. Brass, bright nickel finish.

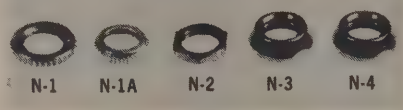
**N-2** Hex nut ¼-40 thousands 0.312 inch diameter, 0.062 inch thickness. Cold rold steel bright nickel finish.

**N-3** Dress nut, blind thread 0.350 inch diameter (flats), 0.375 inch diameter and 0.120 inch thickness. Brass, bright nickel finish.

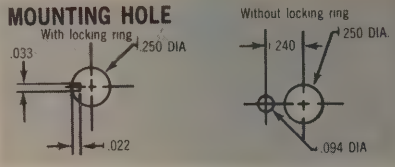
**N-4** Dress nut, through thread 0.350 inch diameter (flats), 0.375 inch diameter and 0.120 inch thickness. Brass, bright nickel finish.

### C9 TOGGLE CAP

### MOUNTING HARDWARE




### MOUNTING HOLE




## RIGHT ANGLE PC MOUNTED

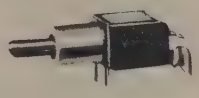
These switches are provided with a short toggle and a nonthreaded bushing; they mount directly on a PC board. Toggle moves in a direction parallel to the surface of the board.

### SHORT TOGGLE RIGHT ANGLE PC TERMINALS

Unthreaded bushing, gold terminals and contacts

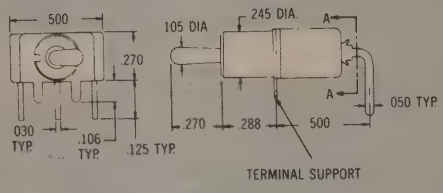
| Cat. No. | Type | Desc. |
|---|---|---|
| 105DPC | SPDT | On-None-On |
| 105E3 | SPDT | On-Off-On |
| 105F3 | SPDT | None-On-(On) |
| 205NPC | DPDT | On-None-On |
| 205P3 | DPDT | On-Off-On |

### SPDT A RIGHT ANGLE MOUNTING

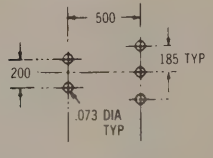


### DPDT A RIGHT ANGLE MOUNTING

### SPDT



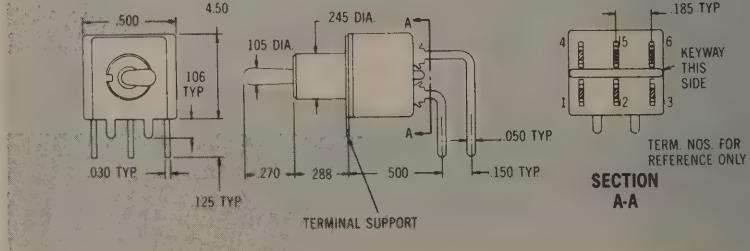

### PC HOLE PATTERN




SPDT

DPDT

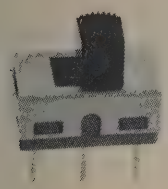
### DPDT



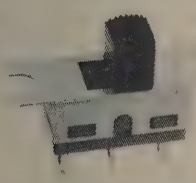

RAYTHEON COMPANY / DISTRIBUTOR PRODUCTS OPERATION
DEPT. EM / FOURTH AVE. / BURLINGTON, MA 01803 / TEL: (617) 272-6400 / TWX: 710-332-7641

RAYTHEON

# SLIDE SWITCHES, SNAP ACTION



PC MOUNT



PANEL MOUNT

## PANEL AND PC MOUNT—SERIES S1

These subminiature slide switches have the same toggle-action mechanism as used in the Raytheon toggle switches. A spring-loaded teflon actuator operates the mechanism. The standard version can handle 6 Amperes resistive at 120 VAC or 20 VDC (3 Amperes at 250 VAC). A low energy version Model S1A2M2 has gold plated contacts for levels as low as 0.4 Volt-Amperes at 20 Volts maximum (AC or DC). Panel mounting or PC board mount models are available. A black slide handle is provided, unless otherwise specified on special order; see Table 1. Terminals on panel mount style are solder-lug.

## SPECIFICATIONS

**Contact Rating—Standard Version:** 6 Amperes with resistive load at 120 VAC or 28 VDC; 3 Amperes at 250 VAC.
**Contact Rating—Low Energy Version:** 0.4 Volt-Amperes at 20 Volts maximum; AC or DC.
**Contact Resistance:** 10 milliohms maximum initially.
**Electrical Life:** 40,000 actuations at full load.
**Mechanical Life:** 250,000 actuations (low energy).
**Insulation Resistance:** 100,000 megohms minimum.
**Dielectric Strength:** 1000 Volts RMS at sea level.
**Actuation Force:** 150 to 350 grams initially.

## MATERIALS

**Case:** Melamine.
**Housing:** Stainless steel.
**Slide Handle:** Nylon.
**End Contact—Standard Version:** Coin silver, silver plated.
**End Contact—Low Energy Version:** Brass with 50 millionths minimum gold plate over 200 millionths nominal nickel plate.
**End Terminal:** Brass, silver plated.
**Center Contact and Terminal—Standard Version:** Brass, silver plated.
**Center Contact and Terminal—Low Energy Version:** Brass with 50 millionths minimum gold plate over 200 millionths nominal nickel plate.

## TABLE 1

COLOR OPTIONS*

W = White
R = Red
Y = Yellow
B = Blue
BL = Black
OR = Orange
GR = Green

*Available on special order, minimum 500 pieces

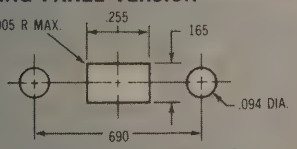
## PANEL MOUNT—SOLDER TERMINAL

| Cat. No. | Type | Desc. |
|---|---|---|
| S1A1M1 | SPDT | On-None-On |

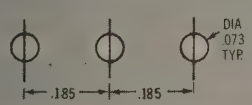
## PC MOUNT—PC TERMINALS

| Cat. No. | Type | Desc. |
|---|---|---|
| S1A2M2 | SPDT<br>PC-Mount—gold terminals and contacts | On-None-On |
| S1A7M2 | SPDT<br>PC Mount—silver terminals and contacts | On-None-On |

### MOUNTING PANEL VERSION

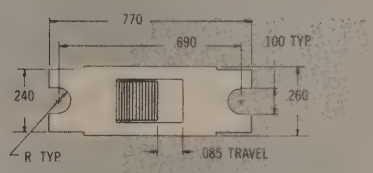


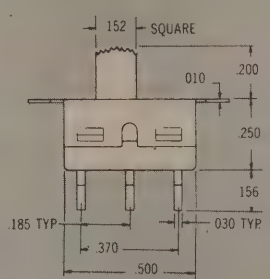

### PC MOUNT VERSION




### PANEL MOUNT

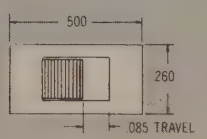
S1A1M1

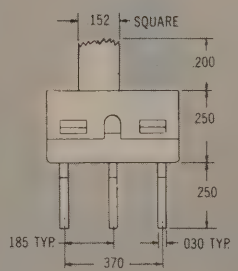


### PC MOUNT

S1A2M2
S1A7M2



RAYTHEON COMPANY / DISTRIBUTOR PRODUCTS OPERATION
DEPT. EM / FOURTH AVE. / BURLINGTON, MA 01803 / TEL: (617) 272-6400 / TWX: 710-332-7641

RAYTHEON

# PUSH BUTTON SWITCHES

DPDT Version Shown
SPDT Available

## BUSHING MOUNTED SNAP-ACTION—SERIES P

These momentary snap-action switches are especially recommended for low energy circuits because of their gold-on-brass contacts. The solder-lug terminals are epoxy sealed. Two sizes of snap-on nylon caps are available in a choice of colors. The switches can be wired for either normally open or normally closed operation. SPDT and DPDT.

### ORDERING INFORMATION

| Model No. | Type | Description | Caps* Style |
|---|---|---|---|
| P1F1 | SPDT | Momentary | C7, C8 |
| P2F1 | DPDT | Momentary | C7, C8 |

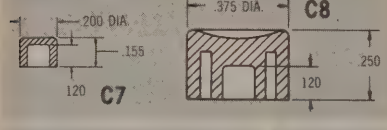
*There is a choice of colors in either style. See Table 1. Specify color required and cap style.

### TABLE 1

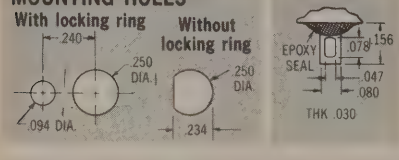
Color Caps for Small cap C-7, Large cap C-8

BL = Black OR = Orange G = Gray
B = Brown Y = Yellow W = White
R = Red GN = Green

### SWITCH CAPS




### MOUNTING HOLES



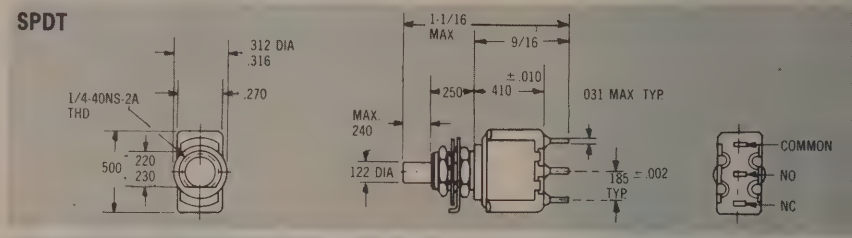

### SPECIFICATIONS

**Common Contact:** Brass with gold plate over nickel.
**Center and End Contact:** Precious metal inlay on brass, gold plated.
**Contact Rating:** 1 Ampere resistive load at 120 VAC or 28 VDC.
**Terminals:** Gold over brass terminals, epoxy sealed.
**Insulation Resistance:** 1000 megohms minimum.
**Dielectric Strength:** 1000 Volts RMS at sea level.
**Electric Life:** 60,000 cycles minimum at full load.
**Mechanical Life:** 100,000 make and break cycles, minimum.
**Maximum Allowable Force on Plunger:** 10 pounds.

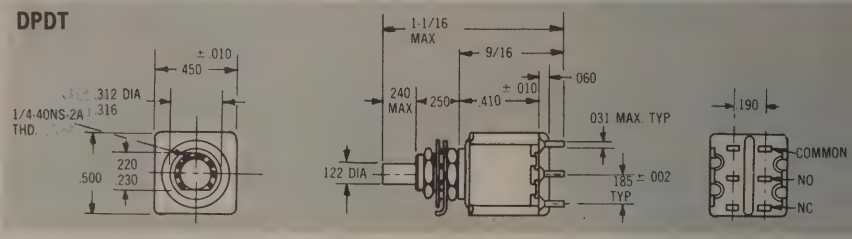
### MATERIALS

**Case:** General purpose phenolic.
**Housing:** Stainless steel.
**Bushing:** Cadmium with clear chromate over brass. High torque to withstand 12 inches per pound.
**Hardware:** Two hex mounting nuts, one internal tooth lockwasher, one locking ring.

**SPDT**




**DPDT**




---

SERIES MP

## BUSHING MOUNTED BUTT CONTACT—SERIES MP

These tiny, low cost switches, just over 1 inch long, can carry 1 Ampere at 28 VDC. Butt contacts for simple, reliable operation. Standard terminal is solder-lug. Black phenolic plunger. SPST only.

### ORDERING INFORMATION
### UL LISTED

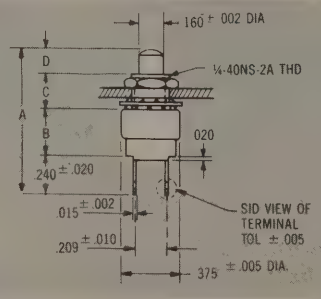
| Model No. | Type | Description (Momentary) |
|---|---|---|
| MP1F1* | SPST (N.O.) | Momentary-N.O. |
| MP1E1** | SPST (N.C.) | Momentary-N.C. |

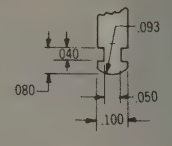
*Red Plunger **Black Plunger

### MOUNTING HOLE

### SPECIFICATIONS

**Contacts:** Coin Silver.
**Contact Rating:** 1 Ampere resistive load at 120 VAC or 28 VDC or 0.5 Ampere at 250 VAC.
**Terminals:** Coin Silver.
**Insulation Resistance:** 20,000 megohms minimum.
**Dielectric Strength:** 1000 volts rms at sea level.
**Initial Contact Resistance:** 10 millohms, maximum.
**Electric Life:** 1,000,000 make and break cycles.
**Total Plunger Travel:** MP1F1 = .110 includes .020 minimum over travel. MP1E1 = .055 includes .020 minimum pre travel.
**Actuation Force:** 8 ounces ±4.
**Case:** Diallyl Phthalate (DAP).
**Bushing:** Brass, cadmium plated with clear chromate finish.
**Hardware:** 1 Hex mounting nut; 1 internal tooth lockwasher.
**Mounting Hole:** ¼ inch diameter.



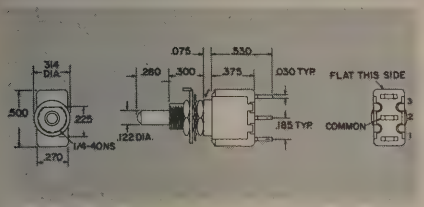




| | A (REF) | B ±0.015 | C ±0.010 | D ±0.015 |
|---|---|---|---|---|
| MP1F1 | 1.047 | 0.407 | 0.227 | 0.173 |
| MP1E1 | 1.047 | 0.407 | 0.250 | 0.150 |

RAYTHEON COMPANY / DISTRIBUTOR PRODUCTS OPERATION
DEPT. EM / FOURTH AVE. / BURLINGTON, MA 01803 / TEL: (617) 272-6400 / TWX: 710-332-7641

RAYTHEON

# PUSH BUTTON SWITCHES




## BUSHING MOUNTED 6 AMP, SERIES 6P

These snap action bushing mounted switches have a 6 Amp rating at 120 Vac. Standard solder lug terminals. Two versions available: momentary, and alternate action.

### ORDERING INFORMATION

| Model No. | Contacts | Description | Caps* |
|---|---|---|---|
| 6P1K1 | SPDT | Alternate Action | C7, C8 |
| 6P1F1 | SPDT | Momentary | C7, C8 |

*There is a choice of colors available in either style. See Table I page 8. Specify color and style.

### SPECIFICATIONS

**Contact Rating:** 6 amps with resistive load @ 120 VAC or 28 VDC; 3 amps with resistive load @ 250 VAC.
**Contact Resistance:** 20 milliohms max. initial @ 2-4 VDC, 100 milliamps for both coin silver & gold plated contacts.
**Insulation Resistance:** 1,000 megohms min.
**Dielectric Strength:** 1,000 volts RMS @ sea level
**Electrical Life:** 100,000 operations at full load
**Operating Force:** 2.5 pounds

### MATERIALS

**Case:** Melamine
**Bushing:** Brass, nickel plated
**Housing:** Stainless steel
**Plunger:** Nylon
**End Contact:** Coin silver, silver plated
**End Terminal:** Brass, silver plated
**Center Contact & Terminal:** Brass, silver plated
**Hardware:** Nut—Brass, nickel plated
Locking Ring—Brass, bright nickel plated
Lockwasher—C.R.S., bright nickel plated

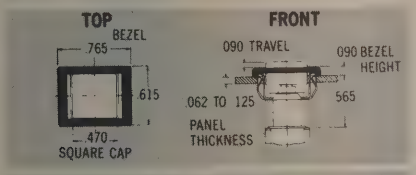
## SNAP-IN ALTERNATE ACTION 6 AMPERE—SERIES 6P

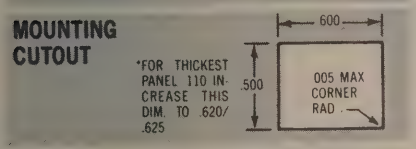
This miniature snap-in pushbutton has a pushbutton cap less than ½ inch square. Yet the switch can carry a big load—6 Amperes at 120 VAC. An attractive front panel bezel can be color coordinated with the cap, both being available in a choice of colors. The alternate action, push on-off feature, is an added plus in a switch of such a small size. SPDT configuration only. Standard solder-lug terminals. Switch is held firmly in place in panel by spring steel clips. Front panel mounted.

### TABLE 1

COLORS FOR BEZEL (B1) AND CAP (C6)

W = White
BL = Black
OR = Orange
Y = Yellow
GR = Green
G = Gray (bezel only)
R = Red




### ORDERING INFORMATION

| Model No. | Contacts | Description** Alternate Action | Bezel | | Cap | |
|---|---|---|---|---|---|---|
| | | | Order No. | Color* | Order No. | Color* |
| 6P1K1J81 | SPDT | push on/off | B1 | Black | C6 | White |

*Other colors available. See Table 1. Specify color required.
**Sequence depends on wiring.

### SPECIFICATIONS

**End Contact:** Coin silver, silver plated.
**End Terminal:** Brass, silver plated.
**Center Contact and Terminal:** Brass, silver plated.
**Contact Rating:** 6 Amperes with resistive load at 120 VAC or 28 VDC; 3 Amperes with resistive load at 250 VAC.
**Insulation Resistance:** 1000 megohms minimum.
**Dielectric Strength:** 1000 Volts RMS at sea level.
**Initial Contact Resistance:** 20 milliohms maximum at 2 to 4 VDC.
**Electrical Life:** 100,000 operations at full load.
**Operating Force:** 2.0 pounds.

### MATERIALS

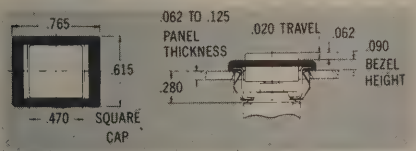
**Case:** Phenolic resin.
**Housing:** Stainless steel.
**Spring:** Steel, nickel plated.
**Bezel:** Nylon.
**Cap:** Nylon.
**Bracket:** Stainless steel.

### TABLE 1

*COLOR OPTIONS BEZEL (B1) AND CAP (C6)

W = White
BL = Black
R = Red
OR = Orange
Y = Yellow
GR = Green
GY = Gray

(1 & 2 Pole only)




## SNAP-IN SNAP-ACTION SERIES P-J81

These snap-action pushbutton switches mount from the front of the panel, snapping into place and held by nickel plated spring steel clips. The pushbutton cap is less than ½ inch square. Both cap and bezel can be color coordinated by selecting from the available colors; see Table 1. A white cap with a black bezel is supplied, unless otherwise specified. Terminals are solder-lug and are epoxy sealed. Both bezel and cap are nylon. The switches can be wired for either normally open or normally closed operation. SPDT and DPDT.

### ORDERING INFORMATION

| Model No. | Contacts | Description | Bezel | | Cap | |
|---|---|---|---|---|---|---|
| | | | Order No. | Color* | Order No. | Color* |
| P1F1J81 | SPDT | Momentary | B1 | Black | C6 | White |
| P2F1J81 | DPDT | Momentary | B1 | Black | C6 | White |

### SPECIFICATIONS

**Common Contact:** Brass with gold plate over nickel.
**Center and End Contact:** Precious metal inlay on brass, gold plated.
**Contact Rating:** 1 Ampere resistive load at 120 VAC or 28 VDC.
**Terminals:** Gold over brass terminals, epoxy sealed.
**Insulation Resistance:** 1000 megohms minimum.
**Dielectric Strength:** 1000 Volts RMS at sea level.
**Electric Life:** 60,000 cycles minimum at full load.
**Mechanical Life:** 100,000 make and break cycles, minimum.
**Maximum Allowable Force On Plunger:** 10 pounds.

### MATERIALS

**Case:** General purpose phenolic.
**Housing:** Stainless steel.
**Bezel:** Nylon.
**Cap:** Nylon.

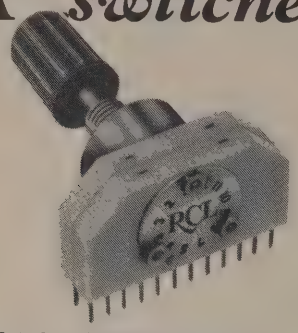
**RAYTHEON COMPANY / DISTRIBUTOR PRODUCTS OPERATION**
DEPT. EM / FOURTH AVE. / BURLINGTON, MA 01803 / TEL: (617) 272-6400 / TWX: 710-332-7641

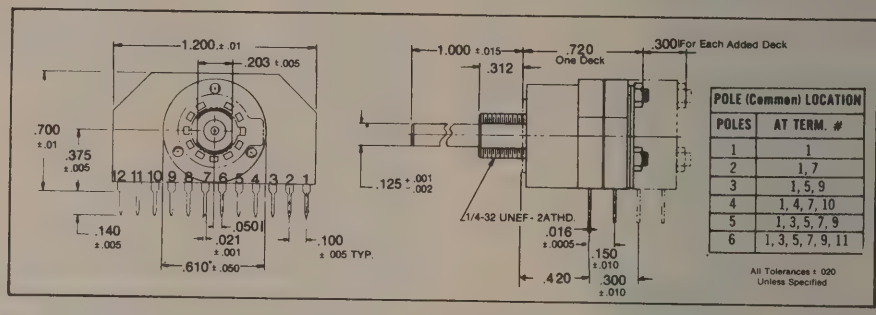
AMF

**GENERAL SALES OFFICE:**
DEPT. EM, 700 SOUTH 21st STREET
IRVINGTON, NEW JERSEY 07111
TELEPHONE (201) 374-3311 • TWX 710-999-5511 • TELEX 138163

# RCL Electronics "X" switches

## series "X30" 12 position, enclosed molded pc switches...






| POLE (Common) LOCATION | |
|---|---|
| POLES | AT TERM. # |
| 1 | 1 |
| 2 | 1, 7 |
| 3 | 1, 5, 9 |
| 4 | 1, 4, 7, 10 |
| 5 | 1, 3, 5, 7, 9 |
| 6 | 1, 3, 5, 7, 9, 11 |

### 30° SHORTING

| Type No. | Single Deck Number of Poles Per Deck | Maximum Number of Positions Per Pole |
|---|---|---|
| 11-X30M-12-J | 1 Pole Per Deck | 2 through 12 |
| 12-X30M-6-J | 2 Poles Per Deck | 2 through 6 |
| 13-X30M-4-J | 3 Poles Per Deck | 2 through 4 |
| 14-X30M-3-J | 4 Poles Per Deck* | 2 or 3 |

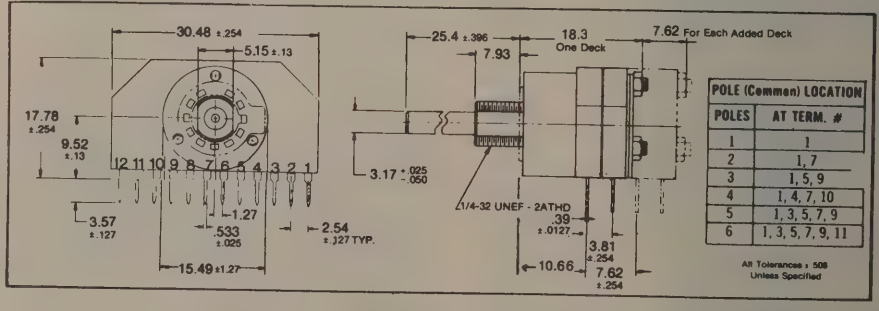
* 5 and 6 poles available (maximum 2 positions per pole)

### 30° NON-SHORTING

| Type No. | Single Deck Number of Poles Per Deck | Maximum Number of Positions Per Pole |
|---|---|---|
| 11-X30B-12-J | 1 Pole Per Deck | 2 through 12 |
| 12-X30B-6-J | 2 Poles Per Deck | 2 through 6 |
| 13-X30B-4-J | 3 Poles Per Deck | 2 through 4 |
| 14-X30B-3-J | 4 Poles Per Deck* | 2 or 3 |

* 5 and 6 poles available (maximum 2 positions per pole)

### METRIC DIMENSIONS




| POLE (Common) LOCATION | |
|---|---|
| POLES | AT TERM. # |
| 1 | 1 |
| 2 | 1, 7 |
| 3 | 1, 5, 9 |
| 4 | 1, 4, 7, 10 |
| 5 | 1, 3, 5, 7, 9 |
| 6 | 1, 3, 5, 7, 9, 11 |

### ONLY RCL OFFERS THESE EXCLUSIVE FEATURES:

- An exceptionally sturdy miniature switch with adjustable stops, as standard, designed for insertion into printed circuit boards. Engineered to withstand unusual stress and strains.
- Provides the ultimate in reliability as all point-to-point soldering is completely eliminated.
- Behind panel stickout is .687" (17.46mm) for 1 deck and .300" (7.62mm) for each additional deck.
- Eliminates all point to point wiring-labor costs.
- Sells at lower cost than old-fashioned open deck wafer switches.
- Up to 12 active positions per deck — shorting or non-shorting, with 30° spacing.
- On any one deck of a multi-pole switch a variety of combinations of shorting (MBB) and non-shorting (BBM) actions may be obtained. For example, a six pole switch may be ordered with 4 poles — shorting action, and 2 poles, non-shorting action.

### GENERAL FEATURES:

- Adjustable stops offer maximum versatility at no extra charge. (Fixed stops optional at no extra charge.)
- Up to 12 positions per pole (30° Spacing) and as many as 6 poles per deck are available.
- Shorting and non-shorting poles may be grouped on one deck in any combination. Shorting and non-shorting positions on any one pole are also available.
- Switching elements are completely enclosed.
- Contact and lug assembly is integrally molded and completely enclosed. This eliminates the possibility of movement of contacts and terminals, and prevents flux flowing onto the contact surface during soldering or cleaning operations.
- Industry standard spacing on terminals.
- Shaft and panel seals available on fixed stop versions.

### ELECTRICAL FEATURES:

- **Initial contact resistance** — .015 max.
- **Current breaking capacities:**
  250 MA — 115 VAC resistive
  250 MA — 28 VDC resistive
  125 MA — 28 VDC inductive
- **Dielectric strength (voltage breakdown)** —
  a. Between any two adjacent positions — 1000 V-RMS (60 cycles)
  b. Between any active position to ground — 1000 V-RMS (60 cycles)
- **BCD Coding Available**
- **Current Carrying Capacity** — 5.3 amps
- **Insulation Resistance** (measured at 25°C, 50%RH) — 10⁹ megohms
- **Capacitance** — Between adjacent active contacts — .2 pF max. Between contact and common terminal — .2 pF max.

### UP TO 12 DECKS ARE AVAILABLE

### MECHANICAL FEATURES:

- Life expectancy — in excess of 25,000 mechanical operations. (NOTE: The actual life is determined by a number of variable factors. These include: electrical loading, environment, rate of rotation, maximum contact resistance, minimum insulation resistance, and the minimum voltage breakdown which is required at the end of the life.)
- Detent — stainless steel ball-type snaps positively from position to position. The detent housing is made of special high strength plastic, providing positive action and minimal wear. Commercial series, "Zamac" (Zinc) detent housing.
- Stop strength — Designed to withstand 10 pound-inches of torque.
- "Molded-in" terminals result in exceptionally high contact stability, completely eliminating movement.
- Terminal locations clearly marked on rear cover plate.
- Materials and Finishes:
  **Rotor** — Lexan
  **Rotor Blade** — Beryllium copper (heavy silver plated) Gold plating available — consult factory
  **Detent Housing** — High Grade Die Cast
  **Shaft** — Stainless steel
  **Stators** — Glass filled polyester
  **Contacts** — Brass (silver & gold plate) heavy gold plating available, contact factory.

FOR ADDITIONAL AMF SWITCH PRODUCTS REFER TO UID DIVISION SECTION 5100

AMF

**GENERAL SALES OFFICE:**
DEPT. EM, 700 SOUTH 21st STREET
IRVINGTON, NEW JERSEY 07111
TELEPHONE (201) 374-3311 • TWX 710-999-5511 • TELEX 138163

# RCL Electronics

# *series "V" switch*

**AVAILABLE IN 12, 10, 8 OR 6 POSITIONS! (30°, 36°, 45° AND 60° SPACING)**

**WITH TRUE ½" DIAMETER AND .355" LENGTH!**

A totally integrated series of switches where all common angles of rotation are available in a single subminiature size (½" True Diameter x .355 length).

Overall length including terminals (total depth-behind-panel) has been significantly reduce to less than ½" (.355)!

**SPECIFICATIONS:**

**Contact Resistance:** 10 milliohms maximum initial.

**Insulation Resistance:** 50,000 megohms initial; 10,000 megohms minimum between mutually insulated parts.

**Voltage Breakdown:** 600 VAC minimum between mutually insulated parts.

**Electrical Rating:** Will make and break 50 milliamperes: 115 VAC for 25,000 cycles or 200 milliamperes: 115 VAC for 10,000 cycles.

**Poles:** Available in 1 and/or 2 poles.

**Spacing Between Positions:** Available with 30°, 36°, 45°, 60° Spacing.

**Deck and Terminal Arrangement:** Available only in one deck with terminals projecting from rear of switch.

**Shaft Length, Flat and Orientation:** Available in accordance with individual requirements.

**Materials and Finishes:** In accordance with applicable MIL specs.

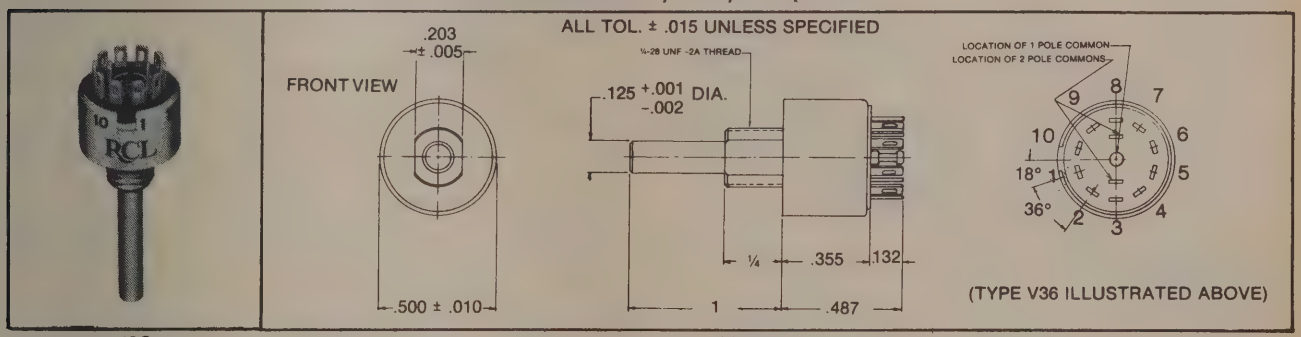
**Contacts: Common Terminals, Wipers:** Metal alloys with characteristics consistent with performance requirements.

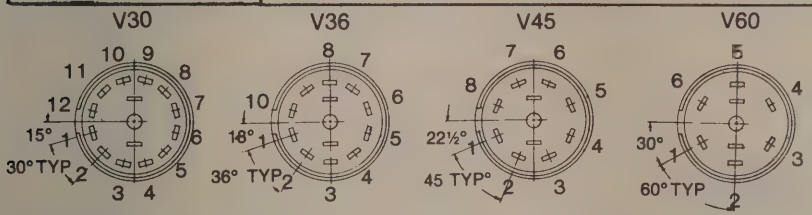
**Environmental Requirements:** Meets or exceeds MIL-S-3786.

**Explosion Proof:** Per paragraph 4.8.12 of MIL-S-3786.

**MEETS ALL REQUIREMENTS OF MIL-S-3786/20 & 35**

**RCL SERIES V30, V36, V45, V60**




**SHORTING — 1 POLE**

| POSITIONS | V30 30° Between Positions | V36 36° Between Positions | V60* 60° Between Positions |
|---|---|---|---|
| 2 | 11-V30 M-2 | 11-V36 M-2 | 11-V60 M-2 |
| 3 | 11-V30 M-3 | 11-V36 M-3 | 11-V60 M-3 |
| 4 | 11-V30 M-4 | 11-V36 M-4 | 11-V60 M-4 |
| 5 | 11-V30 M-5 | 11-V36 M-5 | 11-V60 M-5 |
| 6 | 11-V30 M-6 | 11-V36 M-6 | 11-V60 M-6* |
| 7 | 11-V30 M-7 | 11-V36 M-7 | |
| 8 | 11-V30 M-8 | 11-V36 M-8 | |
| 9 | 11-V30 M-9 | 11-V36 M-9 | |
| 10 | 11-V30 M-10 | 11-V36 M-10* | |
| 11 | 11-V30 M-11 | | |
| 12 | 11-V30 M-12* | | |

**NON-SHORTING — 1 POLE**

| POSITIONS | V30 30° Between Positions | V36 36° Between Positions | V45* 45° Between Positions | V60 60° Between Positions |
|---|---|---|---|---|
| 2 | 11-V30 B-2 | 11-V36 B-2 | 11-V45 B-2 | 11-V60 B-2 |
| 3 | 11-V30 B-3 | 11-V36 B-3 | 11-V45 B-3 | 11-V60 B-3 |
| 4 | 11-V30 B-4 | 11-V36 B-4 | 11-V45 B-4 | 11-V60 B-4 |
| 5 | 11-V30 B-5 | 11-V36 B-5 | 11-V45 B-5 | 11-V60 B-5 |
| 6 | 11-V30 B-6 | 11-V36 B-6 | 11-V45 B-6 | 11-V60 B-6* |
| 7 | 11-V30 B-7 | 11-V36 B-7 | 11-V45 B-7 | |
| 8 | 11-V30 B-8 | 11-V36 B-8 | 11-V45 B-8* | |
| 9 | 11-V30 B-9 | 11-V36 B-9 | | |
| 10 | 11-V30 B-10 | 11-V36 B-10* | | |
| 11 | 11-V30 B-11 | | | |
| 12 | 11-V30 B-12* | | | |

**SHORTING — 2 POLES**

| | | | |
|---|---|---|---|
| 2 | 12-V30 M-2 | 12-V36 M-2 | 12-V60 M-2 |
| 3 | 12-V30 M-3 | 12-V36 M-3 | 12-V60 M-3* |
| 4 | 12-V30 M-4 | 12-V36 M-4 | |
| 5 | 12-V30 M-5 | 12-V36 M-5* | |
| 6 | 12-V30 M-6* | | |

**NON-SHORTING — 2 POLES**

| | | | | |
|---|---|---|---|---|
| 2 | 12-V30 B-2 | 12-V36 B-2 | 12-V45 B-2 | 12-V60 B-2 |
| 3 | 12-V30 B-3 | 12-V36 B-3 | 12-V45 B-3 | 12-V60 B-3* |
| 4 | 12-V30 B-4 | 12-V36 B-4 | 12-V45 B-4* | |
| 5 | 12-V30 B-5 | 12-V36 B-5* | | |
| 6 | 12-V30 B-6* | | | |

* Contact factory.
All switches furnished with fixed stops. For Continuous Rotation add suffix "CR". Adjustable stop versions available. To order add suffix "J".

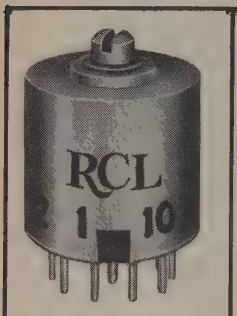
FOR ADDITIONAL AMF SWITCH PRODUCTS REFER TO UID DIVISION SECTION 5100

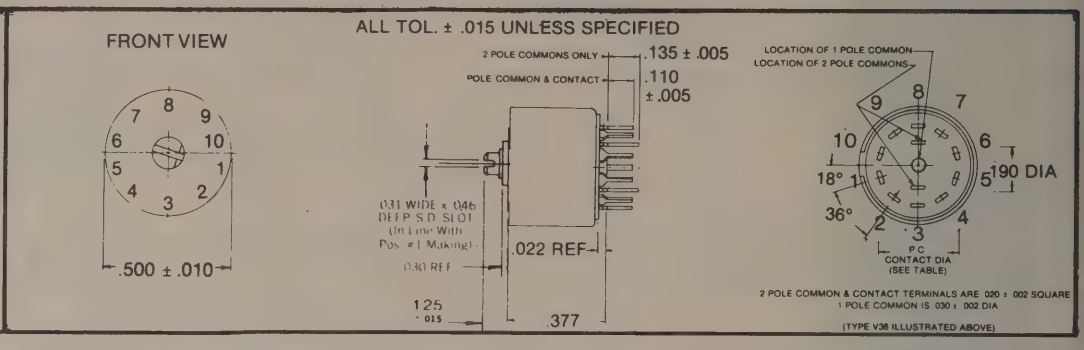
AMF

**GENERAL SALES OFFICE:**
DEPT. EM, 700 SOUTH 21st STREET
IRVINGTON, NEW JERSEY 07111
TELEPHONE (201) 374-3311 • TWX 710-999-5511 • TELEX 138163

# RCL Electronics

# *series "V" switches--printed circuit*





FRONT VIEW
ALL TOL. ± .015 UNLESS SPECIFIED
2 POLE COMMONS ONLY
.135 ± .005
POLE COMMON & CONTACT
.110
± .005
.031 WIDE x .046 DEEP S.D. SLOT (In Line With Pos. #1 Making)
.030 REF
.022 REF
.125 -.015
.377
.500 ± .010
LOCATION OF 1 POLE COMMON
LOCATION OF 2 POLE COMMONS
.190 DIA
18°
36°
P.C. CONTACT DIA (SEE TABLE)
2 POLE COMMON & CONTACT TERMINALS ARE .020 ± .002 SQUARE
1 POLE COMMON IS .030 ± .002 DIA
(TYPE V36 ILLUSTRATED ABOVE)

**BEHIND PANEL DISTANCE FROM MOUNTING SURFACE TO PC BOARD IS .380" SHORTER THAN SIMILAR COMPETITIVE SWITCHES**

* All switches furnished with fixed stops. For Continuous Rotation add suffix "CR". Note: Also available with standard ¼" long bushing & 1" long shaft. To order, use Suffix PC.

• Shaft and panel seals not available on PCA versions.

**SHORTING - 1 POLE**

| Positions | V30 30° Between Positions | V36 36° Between Positions | V45 45° Between Positions | V60 60° Between Positions |
|---|---|---|---|---|
| 2 | 11-V30 M-2(PCA) | 11-V36 M-2(PCA) | 11-V45 M-2(PCA) | 11-V60 M-2(PCA) |
| 3 | 11-V30 M-3(PCA) | 11-V36 M-3(PCA) | 11-V45 M-3(PCA) | 11-V60 M-3(PCA) |
| 4 | 11-V30 M-4(PCA) | 11-V36 M-4(PCA) | 11-V45 M-4(PCA) | 11-V60 M-4(PCA) |
| 5 | 11-V30 M-5(PCA) | 11-V36 M-5(PCA) | 11-V45 M-5(PCA) | 11-V60 M-5(PCA) |
| 6 | 11-V30 M-6(PCA) | 11-V36 M-6(PCA) | 11-V45 M-6(PCA) | 11-V60 M-6(PCA)* |
| 7 | 11-V30 M-7(PCA) | 11-V36 M-7(PCA) | 11-V45 M-7(PCA) | |
| 8 | 11-V30 M-8(PCA) | 11-V36 M-8(PCA) | 11-V45 M-8(PCA)* | |
| 9 | 11-V30 M-9(PCA) | 11-V36 M-9(PCA) | | |
| 10 | 11-V30 M-10(PCA) | 11-V36 M-10(PCA)* | | |
| 11 | 11-V30 M-11(PCA) | | | |
| 12 | 11-V30 M-12(PCA)* | | | |

| TYPE | PC CONTACT PITCH DIA. | | POSITIONS |
|---|---|---|---|
| V30 PCA | .366 | 9.29mm | 12 |
| V36 PCA | .340 | 8.63mm | 10 |
| V45 PCA | .340 | 8.63mm | 8 |
| V60 PCA | .340 | 8.63mm | 6 |

**ORDERING INFORMATION:**

TO ORDER "SHORTING - 2 POLES", SUBSTITUTE PREFIX "12" FOR "11"
**EXAMPLE: 12-V30 M-2(PCA)**

TO ORDER "NON-SHORTING - 1 POLE", SUBSTITUTE "B" FOR "M"
**EXAMPLE: 11-V30 B-2(PCA)**

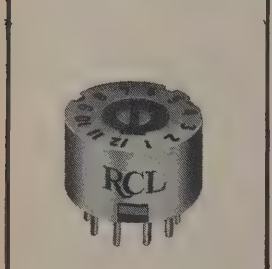
TO ORDER "NON-SHORTING - 2 POLES", SUBSTITUTE "12" FOR "11"
**EXAMPLE: 12-V30 B-2(PCA)**

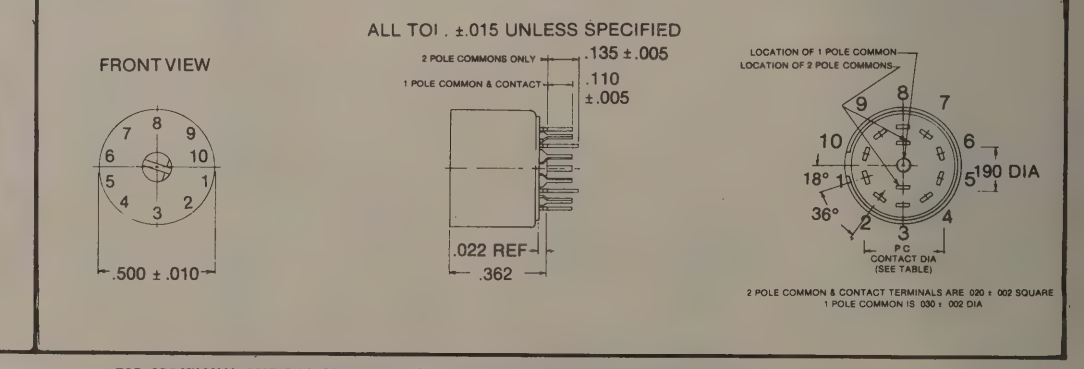
(ALL ABOVE EXAMPLES ARE 2 POSITION 30° SWITCHES)

# *subminiature printed circuit*

**DEVELOPED TO MOUNT ON PC CARDS WHERE BOARD-TO-BOARD SPACING IS AT A PREMIUM OVERALL DEPTH ABOVE CARD IS .362"**

TO ORDER SUBMINIATURE PRINTED CIRCUIT "V" SERIES, SUBSTITUTE "PCB" FOR "PCA" ON CHART ABOVE.
**EXAMPLE: 11-V30 M-2(PCB)**



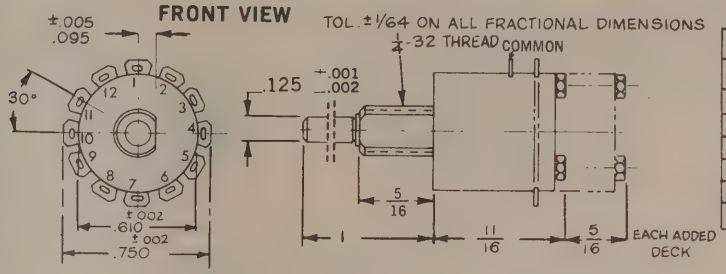
AMF
**GENERAL SALES OFFICE:**
DEPT. EM, 700 SOUTH 21st STREET
IRVINGTON, NEW JERSEY 07111
TELEPHONE (201) 374-3311 • TWX 710-999-5511 • TELEX 138163

# RCL Electronics

# *series "c" miniature rotary switches*

- Up to 12 active positions per deck shorting **or** non-shorting, with 30° spacing.
- Shorting **AND** non-shorting poles may be grouped on one deck in any combination.
- As many as 6 poles per deck.
- All individual deck parts are self-contained, and are permanently molded into place.
- Available with adjustable stops.
- **MILITARY QUALIFIED TO MIL-S-3786/41 AND LISTED ON QPL**

U.S. Pat. #3352979




| POLE (Common) LOCATION | |
|---|---|
| POLES | AT TERM. # |
| 1 | 1 |
| 2 | 1, 7 |
| 3 | 1, 5, 9 |
| 4 | 1, 4, 7, 10 |
| 5 | 1, 3, 5, 7, 9 |
| 6 | 1, 3, 5, 7, 9, 11 |

## SERIES "CC" (COMMERCIAL VERSION OF SERIES "C")

All specifications and features remain essentially the same as in the Series "C" switch. Electrical specifications are:

1. Initial contact resistance—.015Ω max.
2. Current breaking capacities
   1/8 amp—115 V.A.C. resistive
   1/8 amp— 28 V.D.C. resistive
   1/8 amp— 28 V.D.C. inductive
3. Dielectric strength (voltage breakdown)—
   a. between any two adjacent positions—500V (60 cycles)
   b. between any active position to ground 1000V (60 cycles)

Materials and tooling are modified to reduce cost. Priced at the same level as open frame or wafer switches. Off-the-shelf delivery. For ordering information see below, but indicate CC. (For example: 11-CCM-2).

### ELECTRICAL FEATURES

1. Initial contact resistance — .010Ω max.
2. Current carrying capacity — 5.5 amps.
3. Current breaking capacities
   ¼ amp — 115 V.A.C. resistive
   ¼ amp — 28 V.D.C. resistive
   ⅛ amp — 28 V.D.C. inductive.
4. Dielectric strength (voltage breakdown) —
   a. between any two adjacent positions — 800 v RMs (60 cycles).
   b. between any active position to ground 1500 V (60 cycles).
5. Insulation resistance (measured at 25°C, 50% RH at sea level) — $10^5$ megohms.
6. Thermal EMF — 1 microvolt/°C maximum.
7. Capacitance — between adjacent active contacts .5 PFD Max.
8. Capacitance — between contact and common terminal .9 PFD Max.

### MECHANICAL FEATURES

1. Life expectancy — in excess of 50,000 mechanical operations.
2. Detent — stainless steel roller-type detent snaps from position to position. Detent housing made of special high-strength plastic, providing positive action and minimal wear.
3. Stop strength — Designed to withstand 10 pounds-inches of torque.
4. "Molded in" terminals give exceptional terminal strength, completely eliminating movement.
5. Terminal locations clearly marked on rear cover plate.
6. On any one deck of a multi-pole switch, a variety of combinations of shorting (MBB) and non-shorting (BBM) actions may be obtained.
7. Materials and finishes:
   Rotor — Lexan
   Rotor blade — Beryllium copper (silver plated)
   Contacts & solder terminals — solid silver alloy
   Housing — Diallyl Phthalate
   Stator — Diallyl Phthalate
   Shaft — stainless steel
8. One piece contact terminal construction has holes large enough to accept two #22 AWG wires.
9. Shaft and panel seal at additional cost may be specified by using prefix "S" before switch type numbers. Bushing and shaft stick-out from mounting surface is reduced by 1/16". Overall length of switch from mounting surface is increased by 1/16".
10. Explosion proof per paragraph 4, p. 12 of MIL-S-3786.

**ENGINEERING NOTE**
**Series "A" available with above specifications but with "wrap-around" turret-type solder lugs. "Across-terminal" dimension is .820 (±.002).**

### ADJUSTABLE STOP VERSIONS AVAILABLE
### (To specify add "J" to below ordering information)

### SINGLE DECK

**Spacing: 30° between positions**

#### SHORTING

**SINGLE POLE**

| Positions | Type |
|---|---|
| 2 | 11-CM-2 |
| 3 | 11-CM-3 |
| 4 | 11-CM-4 |
| 5 | 11-CM-5 |
| 6 | 11-CM-6 |
| 7 | 11-CM-7 |
| 8 | 11-CM-8 |
| 9 | 11-CM-9 |
| 10 | 11-CM-10 |
| 11 | 11-CM-11 |
| 12 | 11-CM-12 (with stops) |
| 12 | 11-CM-12-CR (continuous rotation) |

**2 POLES PER DECK**

| Positions | Type |
|---|---|
| 2 | 12-CM-2 |
| 3 | 12-CM-3 |
| 4 | 12-CM-4 |
| 5 | 12-CM-5 |
| 6 | 12-CM-6 |

**3 POLES**

| Positions | Type |
|---|---|
| 2 | 13-CM-2 |
| 3 | 13-CM-3 |
| 4 | 13-CM-4 |

**4 POLES**

| Positions | Type |
|---|---|
| 2 | 14-CM-2 |
| 3 | 14-CM-3 |

**5 POLES**

| Positions | Type |
|---|---|
| 2 | 15-CM-2 |

**6 POLES**

| Positions | Type |
|---|---|
| 2 | 16-CM-2 |

#### NON-SHORTING

**SINGLE POLE**

| Positions | Type |
|---|---|
| 2 | 11-CB-2 |
| 3 | 11-CB-3 |
| 4 | 11-CB-4 |
| 5 | 11-CB-5 |
| 6 | 11-CB-6 |
| 7 | 11-CB-7 |
| 8 | 11-CB-8 |
| 9 | 11-CB-9 |
| 10 | 11-CB-10 |
| 11 | 11-CB-11 |
| 12 | 11-CB-12 (with stops) |
| 12 | 11-CB-12-CR (continuous rotation) |

**2 POLES PER DECK**

| Positions | Type |
|---|---|
| 2 | 12-CB-2 |
| 3 | 12-CB-3 |
| 4 | 12-CB-4 |
| 5 | 12-CB-5 |
| 6 | 12-CB-6 |

**3 POLES PER DECK**

| Positions | Type |
|---|---|
| 2 | 13-CB-2 |
| 3 | 13-CB-3 |
| 4 | 13-CB-4 |

**4 POLES PER DECK**

| Positions | Type |
|---|---|
| 2 | 14-CB-2 |
| 3 | 14-CB-3 |

**5 POLES PER DECK**

| Positions | Type |
|---|---|
| 2 | 15-CB-2 |

**6 POLES PER DECK**

| Positions | Type |
|---|---|
| 2 | 16-CB-2 |

### MULTI-DECK SWITCHES UP TO 12 DECKS AVAILABLE

For multi-deck version of these switches, indicate number of decks as follows. Merely change first number of coding as shown:

| Number of decks | |
|---|---|
| One deck | 1 1-CB-4 |
| Two decks | 2 1-CB-4 |
| Three decks | 3 1-CB-4 |

"M" = Shorting action (MBB)
"B" = Non-shorting action (BBM)
Supplied unless otherwise specified.

**Code: 2 6—C-M—2**

- 2 — Number of decks
- 6 — Poles per deck
- C — Series
- M — Shorting (B indicates non-shorting)
- 2 — Positions per pole

e.g. this is 2 decks, 6 poles per deck, Series "C" shorting action, 2 positions per pole.

FOR ADDITIONAL AMF SWITCH PRODUCTS REFER TO UID DIVISION SECTION 5100

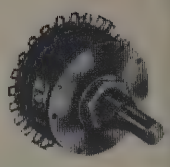
AMF

**GENERAL SALES OFFICE:**
DEPT. EM, 700 SOUTH 21st STREET
IRVINGTON, NEW JERSEY 07111
TELEPHONE (201) 374-3311 • TWX 710-999-5511 • TELEX 138163

# RCL Electronics

## *miniature rotary switches*

## (LOW COST COMMERCIAL VERSIONS)



Completely automated facilities and mass production tooling, now makes RCL highly competitive in commercial applications with "obsolete" wafer-type and open frame switches.

Material and tooling are modified to reduce cost, but comparable performance is maintained with our "standard" series of switches, to correspond with "instrument type" switches.

### MODIFICATIONS OF ELECTRICAL FEATURES

**COMMERCIAL TYPE "CC," "DC," "HC," "FC," "RC"**

- Initial Contact Resistance: .015Ω max.
- Current Breaking Capacities:
  1/8 amp — 115 VAC resistive
  1/8 amp — 28 VDC resistive
  1/8 amp — 28 VDC inductive
- Dielectric Strength (Voltage Breakdown):
  a. Between any two adjacent positions — 500V (60 cycles)
  b. Between any active position to ground — 1000V (60 cycles)

**COMMERCIAL TYPES "EC," "TC"**

- Current Carrying Capacity: 6 amps
- Current Breaking Capacity (Rated Load at 125°C)
  1 amp — 115 VAC resistive
  3/4 amp — 28 VDC resistive
  1/4 amp — 28 VDC inductive

### SPECIAL MODIFICATIONS AVAILABLE

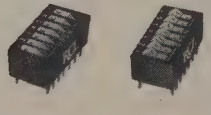
All commercial version RCL switches are available with the following features at additional cost:

- Spring return feature (Series CC and DC only)
- "Push-to-turn" and "pull-to-turn" spring loaded action where an isolated position is required (Series CC, DC)
- Non-standard shaft and bushing lengths
- Specially coded outputs, including decimal to binary for digital applications
- 1/4" diameter shaft and 3/8"-32 threaded bushing (Series CC, DC, HC, AC only)

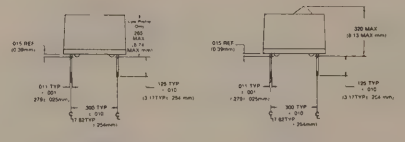
| RCL STANDARD SERIES | RCL SERIES | BODY DIAM. | MAX. POS. PER DECK | MAX. POLES PER DECK | MAX. NO. OF DECKS |
|---|---|---|---|---|---|
| C | CC | .610 | 12 | 5 | 12 |
| D | DD | .610 | 10 | 2 | 12 |
| H | HC | .610 | 6 | 3 | 12 |
| T | TC | 1.380 | 12 | 6 | 20 |
| E | EC | 1.380 | 24 | 12 | 20 |
| F<br>FPC | FC<br>FCPC | .524 | 10 | 3 | 1 |
| R<br>RPC | RC<br>RCPC | .586 | 12 | 4 | 1 |
| FJ | FCJ | .524 | 10 | 3 | 1 |
| RJ | RCJ | .586 | 12 | 4 | 1 |
|  | K | 1.260 | 12 | 2 | 8 |

# RCL "PIP"/DIP SWITCH

### "PROGRAMMABLE IN-LINE PACKAGE" SWITCH



LOW PROFILE VERSION — STANDARD VERSION



LOW PROFILE VERSION — STANDARD VERSION

- Positive detent action
- Low and uniform contact resistance
- Snap-on transparent plastic shield available
- True wiping action
- Delivery from stock
- Withstands ultrasonic cleaning
- Long life expectancy (3000 operations per rocker minimum)
- Rocker marking available for positive position identification
- Competitively priced

### GENERAL FEATURES

**EASE OF OPERATION:** Programs easily modified by manually changing position of rocker arms.

**ECONOMICAL:** Board mounted switches permit updating circuits without costly wiring changes.

**DEPENDABILITY:** Complete insulation of contact surfaces from unwanted surrounding risks.

**SIZE AVAILABILITY:** From 2 through 10 positions.

**INTEGRATED TERMINALS:** Terminals are molded into the basic switch structure, offering the ultimate in contact protection.

**LOW PROFILE RECESSED ROCKER VERSION**

- Low Profile above PC Board .265
- Provides total security once the switches are set
- Recessed Rocker prevents accidental actuation of positions
- Can be easily sealed prior to board immersion
- Red marker available for positive position identification

**SMALL SIZE:** Overall height will not exceed .320". Utilizes least possible P.C. board space.

**WIPING BALL CONTACT:** Spring loaded contacts prevent possible "opens" during normal operation, including shock and vibration. Important in logic applications.

**PLASTIC DUST COVER:** Available as an optional feature. Permits switch to remain in position during cleaning or soldering operations with minimum resultant contamination. Aids in prevention of accidental actuation of switch during regular day to day operations.

### ELECTRICAL SPECIFICATIONS

SPST Switching: Make before break

Current Voltage Ratings:

| Non-Switching | Switching |
|---|---|
| 50 VDC @ 100 mA | 5 VDC @ 100 mA (Typ.)<br>24 VDC @ 25 mA (Max.) |

Contact Resistance:
100 Milliohms (Max.) after life, measured at 100 Milliamps and 5 VDC (Typ.)

Insulation Resistance (at 100 VDC):
Between adjacent open or closed switches —
$1 \times 10^{11}$ ohm (initial)
$1 \times 10^{9}$ after environmental tests

Dielectric Breakdown Voltage: Between adjacent open or closed switches — 500 VDC (Min.)

Circuit Capacitance (between adjacent switches): 5 pfd

### MECHANICAL SPECIFICATIONS:

Operating Temperature: −40°F thru +195°F

Shock: 20g level — 11 milliseconds

Vibration: Discontinuity shall not exceed 10 microseconds when tested in accordance with MIL-STD-202D, Method 204, Condition C.

Life Expectancy: 3000 operations per rocker (minimum).

### ORDERING INFORMATION

| RCL PART NUMBER | NO. OF ROCKERS | LENGTH INCHES | LENGTH MM |
|---|---|---|---|
| PIP-2 | 2 | 0.300 | 7.62 |
| PIP-3 | 3 | 0.400 | 10.16 |
| PIP-4 | 4 | 0.500 | 12.7 |
| PIP-5 | 5 | 0.600 | 15.24 |
| PIP-6 | 6 | 0.700 | 17.78 |
| PIP-7 | 7 | 0.800 | 20.32 |
| PIP-8 | 8 | 0.900 | 22.86 |
| PIP-9 | 9 | 1.000 | 25.4 |
| PIP-10 | 10 | 1.100 | 27.94 |

FOR ADDITIONAL AMF SWITCH PRODUCTS REFER TO UID DIVISION SECTION 5100

AMF
GENERAL SALES OFFICE:
DEPT. EM, 700 SOUTH 21st STREET
IRVINGTON, NEW JERSEY 07111
TELEPHONE (201) 374-3311 • TWX 710-999-5511 • TELEX 138163

# RCL Electronics

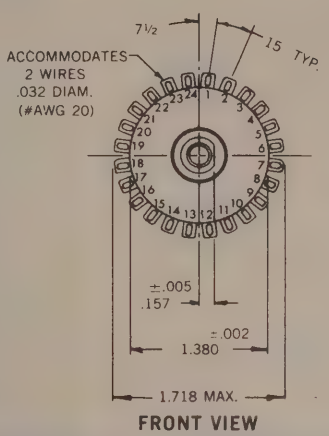
# *miniature rotary switches*

**AVAILABLE WITH CONCENTRIC SHAFT**

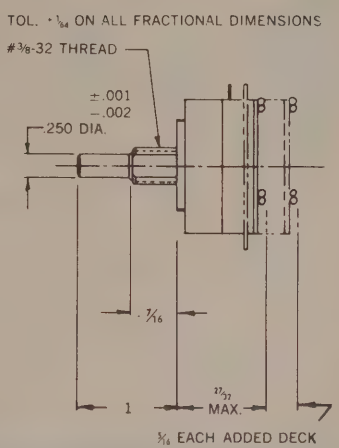
## SERIES "E" 1⅜" BODY DIAMETER

- Up to 24 active positions per deck, **shorting or non-shorting**, and up to 12 poles per deck
- Meets all applicable requirements of Mil S-3786
- Available with concentric shaft
- Available with adjustable stops

| Poles | Pole (Common) Location At Term. # |
|---|---|
| 1 | 1 |
| 2 | 1, 13 |
| 3 | 1, 9, 17 |
| 4 | 1, 7, 13, 19 |
| 5 | 1, 5, 9, 13, 17 |
| 6 | 1, 5, 9, 13, 17, 21 |
| 7 | 1, 3, 5, 7, 9, 11, 13 |
| 8 | 1, 3, 5, 7, 9, 11, 13, 15 |
| 9 | 1, 3, 5, 7, 9, 11, 13, 15, 17 |
| 10 | 1, 3, 5, 7, 9, 11, 13, 15, 17, 19 |
| 11 | 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21 |
| 12 | 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23 |



FRONT VIEW



1/16 EACH ADDED DECK

## SERIES "EC" (LOW COST COMMERCIAL VERSION OF SERIES "E")

All specifications and features remain essentially the same as in the Series "E" switch. Materials and tooling are modified to reduce cost. Electrical specifications are derated by approximately 40%.

Priced at the same level as open frame or wafer switches. For ordering information see below but indicate EC. (For example: 11-ECM-2)

### ELECTRICAL FEATURES

**SERIES E**

- Contact Resistance: .010 ohms max. initial
- Current Carrying Capacity: 10 amps
- Current Breaking Capacity:
  2 amp — 115 VAC Resistive
  1 amp — 28 VDC Resistive
  .5 amp — 28 VDC Inductive

**SERIES EC**

- Current Carrying Capacity: 6 amps
- Current Breaking Capacity:
  1 amp — 115 VAC Resistive
  ¾ amp — 28 VDC Resistive
  ¼ amp — 28 VDC Inductive

### MECHANICAL FEATURES

- Life Expectancy: In excess of 50,000 mechanical operations
- Rotational Torque: 20 to 80 ounce-inches depending on number of poles per deck and number of decks.
- Stop Strength: 15 pound-inches.
- Solder terminals will accept two .032 diam. (AWG #20) wires.
- "Molded-in" terminals result in exceptionally high contact stability, completely eliminating movement.
- Shaft and Panel Seals at additional cost may be specified by using Prefix "S" before Switch Type Numbers. This reduces bushing and shaft stick-out from mounting surface by 1/16". Overall lengths of switch from mounting surface is increased by 1/16".
- Explosion Proof per paragraph 4.8.12 of MIL-S-3786.
- Weight: 1 Deck Switch 1.75 oz. For each additional deck add .500 oz.

ALSO AVAILABLE IN 12 POSITION VERSION AS SERIES "T"
AND IN 12 POSITION COMMERCIAL VERSION AS SERIES "TC"

**ALTHOUGH ONLY 1 DECK IS SHOWN FOR ILLUSTRATIVE PURPOSES, UP TO 20 DECKS ARE AVAILABLE.**

FOR ADDITIONAL AMF SWITCH PRODUCTS REFER TO UID DIVISION SECTION 5100

### SINGLE DECK SPACING 15° BETWEEN POSITIONS

**SINGLE POLE**

| Positions | Shorting Type | Non-Shorting Type |
|---|---|---|
| 2 | 11-EM-2 | 11-EB-2 |
| 3 | 11-EM-3 | 11-EB-3 |
| 4 | 11-EM-4 | 11-EB-4 |
| 5 | 11-EM-5 | 11-EB-5 |
| 6 | 11-EM-6 | 11-EB-6 |
| 7 | 11-EM-7 | 11-EB-7 |
| 8 | 11-EM-8 | 11-EB-8 |
| 9 | 11-EM-9 | 11-EB-9 |
| 10 | 11-EM-10 | 11-EB-10 |
| 11 | 11-EM-11 | 11-EB-11 |
| 12 | 11-EM-12 | 11-EB-12 |
| 13 | 11-EM-13 | 11-EB-13 |
| 14 | 11-EM-14 | 11-EB-14 |
| 15 | 11-EM-15 | 11-EB-15 |
| 16 | 11-EM-16 | 11-EB-16 |
| 17 | 11-EM-17 | 11-EB-17 |
| 18 | 11-EM-18 | 11-EB-18 |
| 19 | 11-EM-19 | 11-EB-19 |
| 20 | 11-EM-20 | 11-EB-20 |
| 21 | 11-EM-21 | 11-EB-21 |
| 22 | 11-EM-22 | 11-EB-22 |
| 23 | 11-EM-23 | 11-EB-23 |
| 24 | 11-EM-24 | 11-EB-24 |
| *24 | 11-EM-24CR Continuous Rotation | 11-EB-24CR Continuous Rotation |

**2 POLES PER DECK**

| Positions | Shorting Type | Non-Shorting Type |
|---|---|---|
| 2 | 12-EM-2 | 12-EB-2 |
| 3 | 12-EM-3 | 12-EB-3 |
| 4 | 12-EM-4 | 12-EB-4 |
| 5 | 12-EM-5 | 12-EB-5 |
| 6 | 12-EM-6 | 12-EB-6 |
| 7 | 12-EM-7 | 12-EB-7 |
| 8 | 12-EM-8 | 12-EB-8 |
| 9 | 12-EM-9 | 12-EB-9 |
| 10 | 12-EM-10 | 12-EB-10 |
| 11 | 12-EM-11 | 12-EB-11 |
| 12 | 12-EM-12 | 12-EB-12 |

**3 POLES PER DECK**

| Positions | Shorting Type | Non-Shorting Type |
|---|---|---|
| 2 | 13-EM-2 | 13-EB-2 |
| 3 | 13-EM-3 | 13-EB-3 |
| 4 | 13-EM-4 | 13-EB-4 |
| 5 | 13-EM-5 | 13-EB-5 |
| 6 | 13-EM-6 | 13-EB-6 |
| 7 | 13-EM-7 | 13-EB-7 |
| 8 | 13-EM-8 | 13-EB-8 |

**4 POLES PER DECK**

| Positions | Shorting Type | Non-Shorting Type |
|---|---|---|
| 2 | 14-EM-2 | 14-EB-2 |
| 3 | 14-EM-3 | 14-EB-3 |
| 4 | 14-EM-4 | 14-EB-4 |
| 5 | 14-EM-5 | 14-EB-5 |
| 6 | 14-EM-6 | 14-EB-6 |

**5 POLES PER DECK**

| Positions | Shorting Type | Non-Shorting Type |
|---|---|---|
| 2 | 15-EM-2 | 15-EB-2 |
| 3 | 15-EM-3 | 15-EB-3 |
| 4 | 15-EM-4 | 15-EB-4 |

**6 POLES PER DECK**

| Positions | Shorting Type | Non-Shorting Type |
|---|---|---|
| 2 | 16-EM-2 | 16-EB-2 |
| 3 | 16-EM-3 | 16-EB-3 |
| 4 | 16-EM-4 | 16-EB-4 |

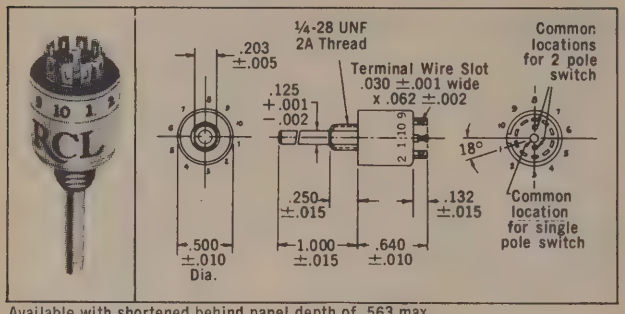
AMF
GENERAL SALES OFFICE:
DEPT. EM, 700 SOUTH 21st STREET
IRVINGTON, NEW JERSEY 07111
TELEPHONE (201) 374-3311 • TWX 710-999-5511 • TELEX 138163

# RCL Electronics
# *miniature rotary switches*

**OFF-THE-SHELF DELIVERY**

**MILITARY QUALIFIED TO MIL-S-3786/20 AND LISTED ON QPL**

## RCL SERIES "F" 10-POSITION SWITCHES




Available with shortened behind panel depth of .563 max. (Instead of .640 ± .010, specify Series "FF".)

**NOW AVAILABLE**

**SERIES "G" 6-POSITION SWITCHES**

Specifications are the same as RCL's "F" series, but with 60° throw and non-shorting only. Up to 1 pole-6 position, or 2 pole-3 position.

Available with standard solder lugs or printed circuit terminals.

### ½" DIAMETER

This subminiature rotary switch has been designed to offer the features of larger switches in a fraction of the space formerly required.

### SPECIFICATIONS FOR BOTH "F" AND "R" SERIES

**Contact Resistance:** 10 milliohms maximum initial.

**Insulation Resistance:** 50,000 megohms initial; 10,000 megohms min. between mutually insulated parts.

**Voltage Breakdown:** 600 VAC min. between mutually insulated parts.

**Electrical Rating:** Will make and break 50 milliamperes: 115 VAC for 25,000 cycles or 200 milliamperes 115 VAC for 10,000 cycles.

**Contacts:** Shorting or non-shorting contacts.

**Deck and Terminal Arrangement:** Available only in one deck with terminals projecting from rear of switch.

**Shaft Length, Flat and Orientation:** Available in accordance with individual requirements.

**Materials and Finishes:** In accordance with applicable MIL specs.

**Contact Terminals:** Solid silver alloy gold plated. Will accept Two #22 AWG wires.

**Common:** Terminal brass gold plated.

**Wipers:** Solid silver alloy.

**Environmental requirements:** Meets or exceeds MIL-S-3786. Explosion proof per paragraph 4.8.12 of MIL-S-3786.

## SERIES "F" SINGLE DECK — 36° BETWEEN POSITIONS

### SHORTING

SINGLE POLE

| Positions | Type |
|---|---|
| 2 | 11-FM-2 |
| 3 | 11-FM-3 |
| 4 | 11-FM-4 |
| 5 | 11-FM-5 |
| 6 | 11-FM-6 |
| 7 | 11-FM-7 |
| 8 | 11-FM-8 |
| 9 | 11-FM-9 |
| 10 | 11-FM-10 |
| *10 | 11-FM-10-CR |

2 POLES

| Positions | Type |
|---|---|
| 2 | 12-FM-2 |
| 3 | 12-FM-3 |
| 4 | 12-FM-4 |
| 5 | 12-FM-5 |

3 POLES

| Positions | Type |
|---|---|
| 2 | 13-FM-2 |
| 3 | 13-FM-3 |

(*continuous rotation)

### NON-SHORTING

SINGLE POLE

| Positions | Type |
|---|---|
| 2 | 11-FB-2 |
| 3 | 11-FB-3 |
| 4 | 11-FB-4 |
| 5 | 11-FB-5 |
| 6 | 11-FB-6 |
| 7 | 11-FB-7 |
| 8 | 11-FB-8 |
| 9 | 11-FB-9 |
| 10 | 11-FB-10 |
| *10 | 11-FB-10-CR |

2 POLES

| Positions | Type |
|---|---|
| 2 | 12-FB-2 |
| 3 | 12-FB-3 |
| 4 | 12-FB-4 |
| 5 | 12-FB-5 |

3 POLES

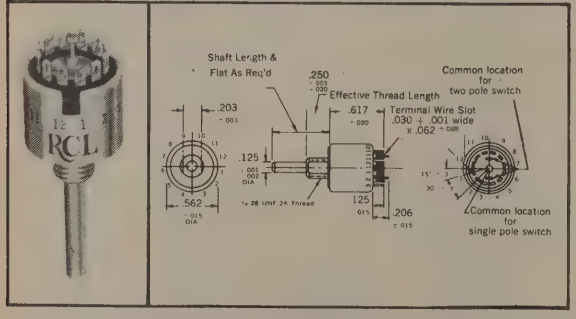
| Positions | Type |
|---|---|
| 2 | 13-FB-2 |
| 3 | 13-FB-3 |

(*continuous rotation)

**ORDERING INFORMATION:**
△ Shortened bushing and shaft stick-out available with screwdriver slot for P.C. applications. Specify PCA
△ Shaft and panel seals may be specified by using Prefix "S".
△ Standard terminal with shortened bushing and shaft stick-out available. Contact factory.

## SERIES "R" 12-POSITION SWITCHES

**MILITARY QUALIFIED TO MIL-S-3786/20 AND LISTED ON QPL**




**SPECIAL ENGINEERING NOTE**
**BOTH SERIES ("F" and "R") AVAILABLE WITH PRINTED CIRCUIT TERMINALS! (To order specify suffix "PC")**

### 5/16" DIAMETER

### SHORTING

SINGLE POLE

| Positions | Type |
|---|---|
| 2 | 11-RM-2 |
| 3 | 11-RM-3 |
| 4 | 11-RM-4 |
| 5 | 11-RM-5 |
| 6 | 11-RM-6 |
| 7 | 11-RM-7 |
| 8 | 11-RM-8 |
| 9 | 11-RM-9 |
| 10 | 11-RM-10 |
| 11 | 11-RM-11 |
| 12 | 11-RM-12 |
| *12 | 11-RM-12-CR |

(*continuous rotation)

2 POLES

| Positions | Type |
|---|---|
| 2 | 12-RM-2 |
| 3 | 12-RM-3 |
| 4 | 12-RM-4 |
| 5 | 12-RM-5 |
| 6 | 12-RM-6 |

3 POLES

| Positions | Type |
|---|---|
| 2 | 13-RM-2 |
| 3 | 13-RM-3 |
| 4 | 13-RM-4 |

4 POLES

| Positions | Type |
|---|---|
| 2 | 14-RM-2 |
| 3 | 14-RM-3 |

6 POLES

| Positions | Type |
|---|---|
| 2 | 16-RM-2 |

### NON-SHORTING

SINGLE POLE

| Positions | Type |
|---|---|
| 2 | 11-RB-2 |
| 3 | 11-RB-3 |
| 4 | 11-RB-4 |
| 5 | 11-RB-5 |
| 6 | 11-RB-6 |
| 7 | 11-RB-7 |
| 8 | 11-RB-8 |
| 9 | 11-RB-9 |
| 10 | 11-RB-10 |
| 11 | 11-RB-11 |
| 12 | 11-RB-12 |
| *12 | 11-RB-12-CR |

(*continuous rotation)

† 6 POLE SERIES AVAILABLE WITH STANDARD TERMINALS ONLY

2 POLES

| Positions | Type |
|---|---|
| 2 | 12-RB-2 |
| 3 | 12-RB-3 |
| 4 | 12-RB-4 |
| 5 | 12-RB-5 |
| 6 | 12-RB-6 |

3 POLES

| Positions | Type |
|---|---|
| 2 | 13-RB-2 |
| 3 | 13-RB-3 |
| 4 | 13-RB-4 |

4 POLES

| Positions | Type |
|---|---|
| 2 | 14-RB-2 |
| 3 | 14-RB-3 |

6 POLES†

| Positions | Type |
|---|---|
| 2 | 16-RB-2 |

FOR ADDITIONAL AMF SWITCH PRODUCTS REFER TO UID DIVISION SECTION 5100

AMF
RCL Electronics

RESISTOR DIVISION
DEPT. EM, 195 McGREGOR STREET • MANCHESTER, NEW HAMPSHIRE 03102
TELEPHONE: (603) 627-3831 • TWX: 710-220-1876

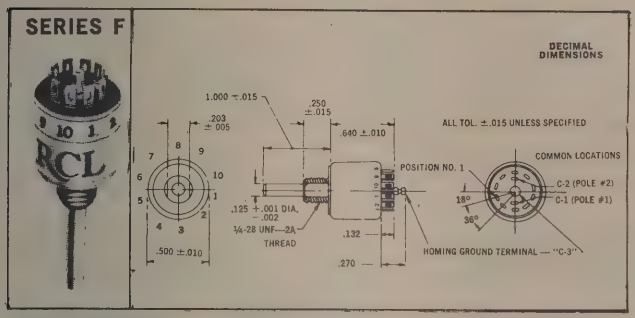
## NEW FROM RCL . . . SERIES 10 AND 12 POSITION, PRINTED CIRCUIT

# *homing switches*

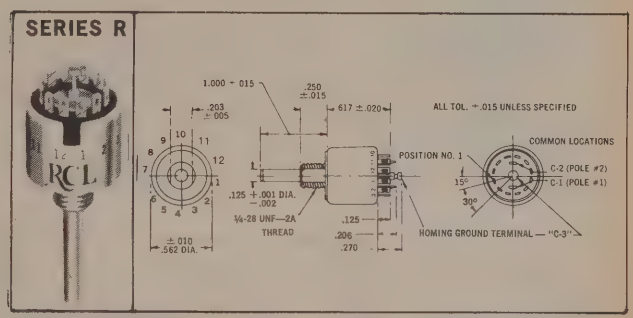
**SPECIFICALLY DEVELOPED FOR PORTABLE COMMUNICATIONS EQUIPMENT AND SIMILAR APPLICATIONS.**

(. . . special features available on Series "F" 10 position miniature rotary switches, and Series "R" 12 position miniature rotary switches.)

**SERIES F**




**SERIES R**




**1 POLE (10 POSITION)** — **2 POLE (5 POSITION)**

| TERMINAL NO. | SHAFT POSITION 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | SHAFT POSITION 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 TO | C-1 | | | | | | | | | | C-1 | | | | |
| 2 TO | | C-1 | | | C-3 | | | | C-3 | | | C-1 | | | C-3 |
| 3 TO | | | C-1 | | | | | | | | | | C-1 | | |
| 4 TO | | | | C-1 | | | | | | | C-3 | | | C-1 | |
| 5 TO | C-3 | | | | C-1 | | | | | | | | | | C-1 |
| 6 TO | | | | | | C-1 | | | C-3 | | C-2 | | | | |
| 7 TO | | | | | | | C-1 | | | | | C-2 | | | C-3 |
| 8 TO | | C-3 | | | | | | C-1 | | | | | C-2 | | |
| 9 TO | | | | | C-3 | | | | C-1 | | C-3 | | | C-2 | |
| 10 TO | | | | | | | | | | C-1 | | | | | C-2 |

**1 POLE (12 POSITION)** — **2 POLE (6 POSITION)**

| TERMINAL NO. | SHAFT POSITION 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | SHAFT POSITION 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 TO | C-1 | | | | | | | | | | | | C-1 | | | | | |
| 2 TO | | C-1 | | | C-3 | | | | | C-3 | | | | C-1 | | | C-3 | |
| 3 TO | | | C-1 | | | | | | | | | | | | C-1 | | | |
| 4 TO | | | | C-1 | | | | | | | | | | | | C-1 | | |
| 5 TO | C-3 | | | | C-1 | | | | | | | | C-3 | | | | C-1 | |
| 6 TO | | | | | | C-1 | | | | C-3 | | | | | | | | C-1 |
| 7 TO | | | | | | | C-1 | | | | | | C-2 | | | | | |
| 8 TO | | | | | | | | C-1 | | | | | | C-2 | | | C-3 | |
| 9 TO | | C-3 | | | | | | | C-1 | | | | | | C-2 | | | |
| 10 TO | | | | | | | | | | C-1 | | | | | | C-2 | | |
| 11 TO | | | | | C-3 | | | | | | C-1 | | C-3 | | | | C-2 | |
| 12 TO | | | | | | | | | | | | C-1 | | | | | | C-2 |

The RCL HOMING SWITCH produces circuitry connecting all of the terminals to a special common except the terminal in the pre-selected switch position. The terminal with pre-selected switch position makes to its common, and is isolated from the homing common.

MULTI-POLE SWITCHES . . . EACH POLE OFFERS NORMAL SEQUENTIAL SWITCHING.

SWITCH POSITIONS ARE ALL SHORTED EXCEPT ONE (Electrically isolated circuits on the poles). Non-isolated terminals are internally tied together and have an external grounding terminal.

APPLICATION NOTES:

(A) Multi-channel systems operating in the high frequency range, often produce "feedback" resulting in garbled reception or transmission. Until the development and perfection of the homing feature, it was necessary to utilize a more expensive squelch circuit. This squelching can now be accomplished WITHOUT THE NECESSITY OF UTILIZING EXTERNAL CIRCUIT ELEMENTS.

(B) Cross-talk between frequency channels is also eliminated as a result of this homing feature.

## SPECIFICATIONS:

(Same as "F" switch on facing page with following modifications)

**Electrical Rating:** Will make and break 100 milliamperes @ 28 VDC for 10,000 cycles.

**Poles:** Only shorting available.

**Common Terminal:** Brass, silver and gold plated.

All positions except the position in use are tied together.

All positions except the position in use are grounded functioning contacts allowing for this unique circuitry.

### SERIES "F" SINGLE DECK SHORTING
36° BETWEEN POSITIONS

| SINGLE POLE | | 2 POLES | |
|---|---|---|---|
| Positions | Type | Positions | Type |
| 2 | 11-FM-2-H | 2 | 12-FM-2-H |
| 3 | 11-FM-3-H | 3 | 12-FM-3-H |
| 4 | 11-FM-4-H | 4 | 12-FM-4-H |
| 5 | 11-FM-5-H | 5 | 12-FM-5-H |
| 6 | 11-FM-6-H | | |
| 7 | 11-FM-7-H | | |
| 8 | 11-FM-8-H | | |
| 9 | 11-FM-9-H | | |
| 10 | 11-FM-10-H | | |
| *10 | 11-FM-10-H CR | | |

* Continuous Rotation

△ To specify shaft and panel seals . . . use Prefix "S".

### SERIES "R" SINGLE DECK SHORTING
30° BETWEEN POSITIONS

| SINGLE POLE | | 2 POLES | |
|---|---|---|---|
| Positions | Type | Positions | Type |
| 2 | 11-RM-2-H | 2 | 12-RM-2-H |
| 3 | 11-RM-3-H | 3 | 12-RM-3-H |
| 4 | 11-RM-4-H | 4 | 12-RM-4-H |
| 5 | 11-RM-5-H | 5 | 12-RM-5-H |
| 6 | 11-RM-6-H | 6 | 12-RM-6-H |
| 7 | 11-RM-7-H | | |
| 8 | 11-RM-8-H | | |
| 9 | 11-RM-9-H | | |
| 10 | 11-RM-10-H | | |
| 11 | 11-RM-11-H | | |
| 12 | 11-RM-12-H | | |
| *12 | 11-RM-12-H CR | | |

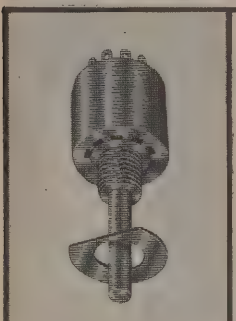
FOR ADDITIONAL AMF SWITCH PRODUCTS REFER TO UID DIVISION SECTION 5100

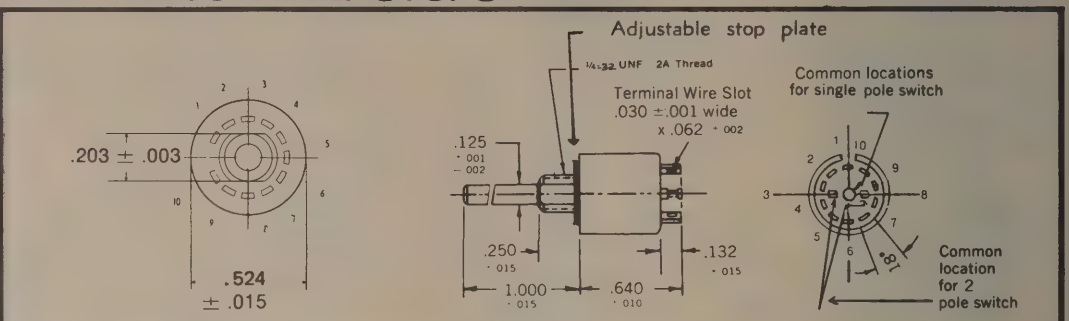
AMF
RCL Electronics

GENERAL SALES OFFICE:
DEPT. EM, 700 SOUTH 21st STREET
IRVINGTON, NEW JERSEY 07111
TELEPHONE (201) 374-3311 • TWX 710-999-5511 • TELEX 138163

# commercial sub-miniature rotary switches

## RCL SERIES "FCJ" COMPLETELY ENCLOSED SWITCHES WITH ADJUSTABLE STOPS






A subminiature rotary switch with adjustable stops . . . permits the user to vary the number of positions!

**FEATURES**

- **From 2 to 10 positions available merely by moving external plate!**
- **Shorting or non-shorting action available.**
- **As many as 3 poles possible on one deck!**
- **Instant switching to any desired number of positions.**
- **Available with P.C. terminals. To order use Suffix P.C.**
- **Permits stocking of a minimum number of switch types.**
- **Ideal for breadboard setups and prototype work — where rapid circuit modification may be desired.**

This switch is furnished with one internal fixed stop and one external adjustable stop plate. This permits adjustment of the number of positions.

Adjustments are made merely by rotating the external adjustable plate until its integral stop tab passes through the proper hole in the switch front plate.

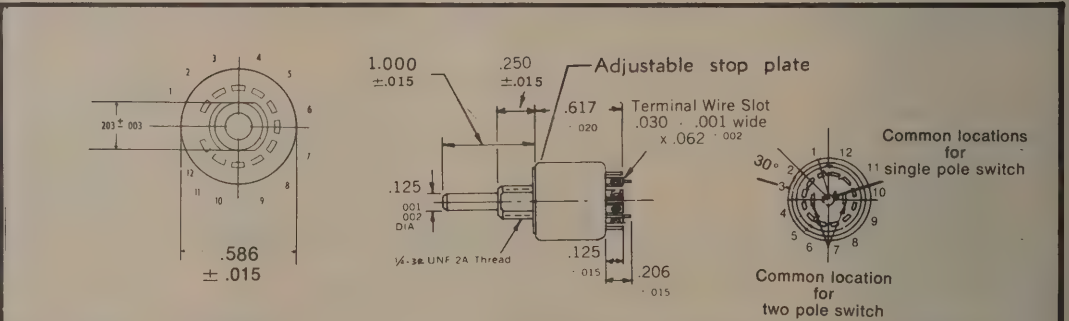
**36° SHORTING**

| Type No. | Single Deck Number of Poles Per Deck | Maximum Number of Positions Per Pole |
|---|---|---|
| 11-FCM-10-J | 1 pole per deck | 2 through 10 |
| 12-FCM-5-J | 2 poles per deck | 2 through 5 |
| 13-FCM-3-J | 3 poles per deck | 2 or 3 |

**36° NON-SHORTING**

| Type No. | Single Deck Number of Poles Per Deck | Maximum Number of Positions Per Pole |
|---|---|---|
| 11-FCB-10-J | 1 pole per deck | 2 through 10 |
| 12-FCB-5-J | 2 poles per deck | 2 through 5 |
| 13-FCB-3-J | 3 poles per deck | 2 or 3 |

## RCL SERIES "RCJ" COMPLETELY ENCLOSED SWITCHES WITH ADJUSTABLE STOPS




A subminiature rotary switch with adjustable stops . . . permits the user to vary the number of positions!

**FEATURES**

- **From 2 to 12 positions available merely by moving external plate!**
- **Shorting or non-shorting action available.**
- **As many as 4 poles possible on one deck!**
- **Instant switching to any desired number of positions.**
- **Available with P.C. terminals. To order use Suffix P.C.**
- **Permits stocking of a minimum number of switch types.**
- **Ideal for breadboard setups and prototype work — where rapid circuit modification may be desired.**

This switch is furnished with one internal fixed stop and one external adjustable stop plate. This permits adjustment of the number of positions.

Adjustments are made merely by rotating the external adjustable plate until its integral stop tab passes through the proper hole in the switch front plate.

**30° SHORTING**

| Type No. | Single Deck Number of Poles Per Deck | Maximum Number of Positions Per Pole |
|---|---|---|
| 11-RCM-12-J | 1 pole per deck | 2 through 12 |
| 12-RCM-6-J | 2 poles per deck | 2 through 6 |
| 13-RCM-4-J | 3 poles per deck | 2 through 4 |
| 14-RCM-3-J | 4 poles per deck | 2 or 3 |

**30° NON-SHORTING**

| Type No. | Single Deck Number of Poles Per Deck | Maximum Number of Positions Per Pole |
|---|---|---|
| 11-RCB-12-J | 1 pole per deck | 2 through 12 |
| 12-RCB-6-J | 2 poles per deck | 2 through 6 |
| 13-RCB-4-J | 3 poles per deck | 2 through 4 |
| 14-RCB-3-J | 4 poles per deck | 2 or 3 |

***INDUSTRY'S BEST DELIVERY***

FOR ADDITIONAL AMF SWITCH PRODUCTS REFER TO UID DIVISION SECTION 5100

AMF
RCL Electronics

GENERAL SALES OFFICE:
DEPT. EM, 700 SOUTH 21st STREET
IRVINGTON, NEW JERSEY 07111
TELEPHONE (201) 374-3311 • TWX 710-999-5511 • TELEX 138163

# keylock switches

## SERIES CC, DC, HC, FC, RC

Provides maximum security by permitting operation only by authorized personnel.

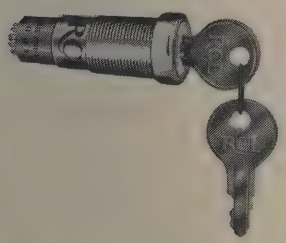
Adaptable to most RCL commercial style miniature rotary switches (6 to 12 positions).

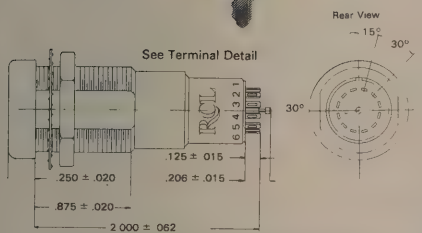
Specifications: 8 tumblers . . . ⅞" diameter . . . Double bitted lock. Operation by double sided flat key . . . 2 provided. Secured by nut at rear of panel to prevent unauthorized loosening or dismounting.

TERMINAL NUMBERS

| RCL SERIES | TOTAL # OF POSITIONS AVAILABLE | A | KEY INSERTION AND WITHDRAWAL POSITIONS B | C | D | ANGLE OF THROW | CONFIGURATIONS |
|---|---|---|---|---|---|---|---|
| CC | 12 | 1 | 4 | 7 | 10 | 30° | 2 |
| CC | 12 | 1 | | 7 | | 30° | 1 |
| DC | 10 | 1 | | 6 | | 36° | 3 |
| HC | 6 | 1 | | 4 | | 60° | 4 |
| FC | 10 | 1 | | 6 | | 36° | 3 |
| RC | 12 | 1 | 4 | 7 | 10 | 30° | 2 |
| RC | 12 | 1 | | 7 | | 30° | 1 |

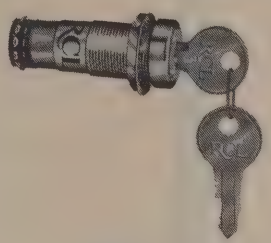
## TYPE RC

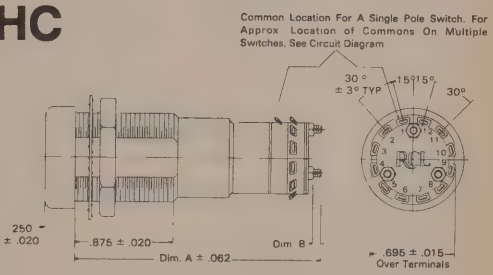





Common Location For a Single Pole Switch For Approx. Location of Commons on a Multi-Pole Switch See Circuit Diagrams Type "R"

## TYPE CC, DC, HC

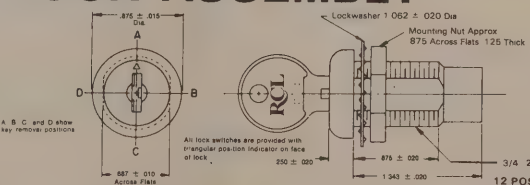



Common Location For A Single Pole Switch. For Approx Location of Commons On Multiple Switches, See Circuit Diagram
30° ± 3° TYP
15°
15°
30°
250 ± .020
.875 ± .020
Dim. B
Dim. A ± .062
.695 ± .015 Over Terminals

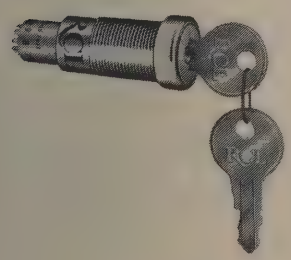
| NO. OF DECKS | DIM A | DIM B |
|---|---|---|
| 1 | 2.070 | .062 |
| 2 | 2.365 | .062 |
| 3 | 2.660 | .062 |
| 4 | 2.995 | .062 |
| 5 | 3.250 | .062 |
| 6 | 3.795 | .312 |

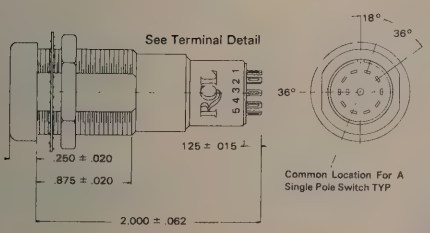
| NO. OF DECKS | DIM A | DIM B |
|---|---|---|
| 7 | 4.090 | .312 |
| 8 | 4.385 | .312 |
| 9 | 4.680 | .312 |
| 10 | 4.975 | .312 |
| 11 | 5.270 | .312 |
| 12 | 5.565 | .312 |

## LOCK ASSEMBLY


.875 ± .015 Dia
A
D
B
C
.587 ± .010 Across Flats
A, B, C, and D show key removal positions
All lock switches are provided with triangular pos-ition indicator on face of lock
Lockwasher 1.062 ± .020 Dia
Mounting Nut Approx .875 Across Flats .125 Thick
.250 ± .020
.875 ± .020
1.343 ± .020
3/4 24 NS-2 Thread

## TYPE FC

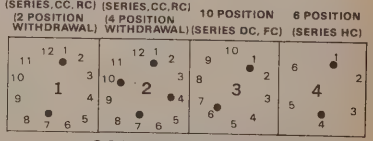





## STANDARD KEY WITHDRAWAL POSITIONS

Available With Key Removal Only at Position Indicated.

Engineering Note: All Configurations Available For Key Withdrawal In Every Position. Contact Factory. Special 2, 3 or 4 key lock Switches available to provide limited access on different levels of authority. Consult factory.


12 POSITION (SERIES, CC, RC) (2 POSITION WITHDRAWAL)
12 POSITION (SERIES, CC, RC) (4 POSITION WITHDRAWAL)
10 POSITION (SERIES DC, FC)
6 POSITION (SERIES HC)

CONFIGURATIONS

## ORDERING INFORMATION

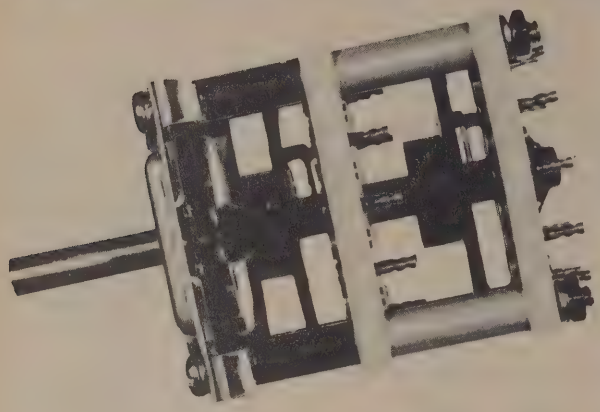
To order Keylock Modification, use prefix -001

**EXAMPLE:**

To order CC Type Switch (Commercial Version) 2001-11-CCM-2
(2 position, single pole, single deck with keylock)
(4001 would indicate 4 position Key Withdrawal — available only in 12 position switch)

**Refer to RCL miniature Rotary Switch Catalog for complete ordering information on all series of switches.**

# Shallco ROTARY SWITCHES SERIES C



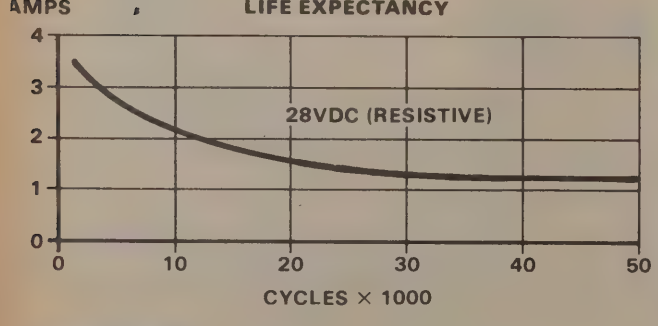
## SPECIFICATIONS

### GENERAL:
Meets or surpasses requirements of MIL-S-3786

### ELECTRICAL:
Current carrying capacity—10 amps.
Current switching capacity—up to 2 amps.
Contact resistance—Initial—.005 ohms max.
Contact resistance—After Life—.010 ohms max.
Insulation resistance—50,000 megohms
Dielectric withstanding voltage—1500V RMS
Dielectric withstanding voltage after life—1000V RMS

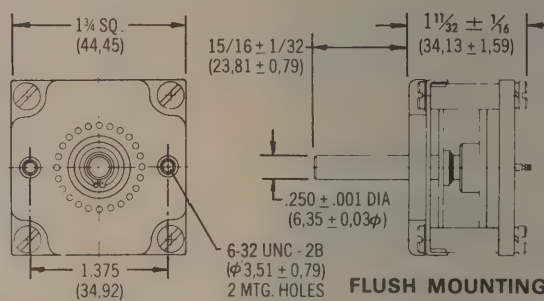
### MECHANICAL:
Rotational life—50,000 cycles* min.@.250 amps.@85°C
Stop torque—50 In. Lbs.
Type construction—Open frame
Adjustable stops—To any desired position.
Optional features—⅜-32 UNEF-2A bushing mount with anti-rotation tab. Shaft and front panel "O" ring seals.
Progressive shorting based on either 20 or 24 equally spaced contacts.

*One cycle = one full cw plus one full ccw rotation.



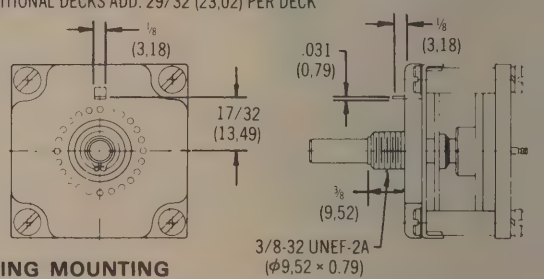

## FEATURES OF SHALLCO 1-3/4" (44,45) SQUARE SERIES C SINGLE OR MULTIDECK SWITCH

- Meets or surpasses requirements of MIL-S-3786
- Available in one pole 2-32 position through four pole 2-7 position
- High current carrying capacity
- Low contact resistance




FLUSH MOUNTING

FOR ADDITIONAL DECKS ADD. 29/32 (23,02) PER DECK




BUSHING MOUNTING

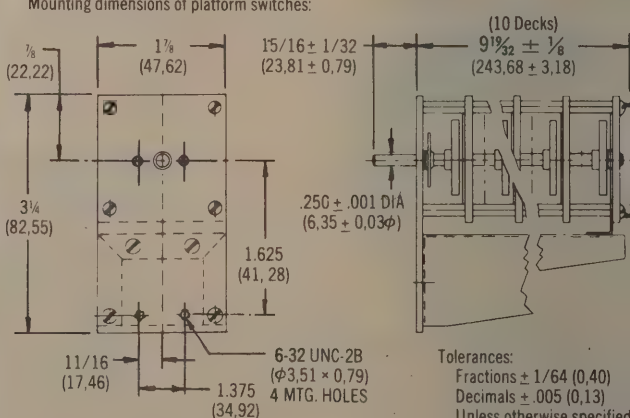
Standard switches above 5 decks are provided with 4 rear support spacers tapped 6-32 UNC-2B (φ3,51 × 0,79) × ¼ (6,35) deep min. Add 21/64 (8,33) to total length when rear support spacers are supplied.

Unless otherwise specified, platforms are supplied for:

1 & 2 pole switches, 10 decks and up.

3 & 4 pole switches, 9 decks and up.

Mounting dimensions of platform switches:




Tolerances:
Fractions ± 1/64 (0,40)
Decimals ± .005 (0,13)
Unless otherwise specified

FOR ADDITIONAL DECKS ADD 29/32 (23.02) PER DECK

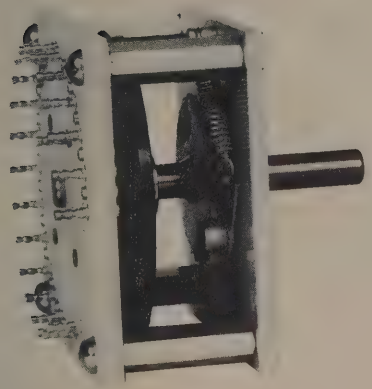
NUMBERS IN ( ) ARE METRIC EQUIVALENT (MILLIMETERS)

DAVEN DESIGNED

USE ORDER FORM — PAGE 4243

# Shallco

# ROTARY SWITCHES SERIES D



## SPECIFICATIONS

### GENERAL:

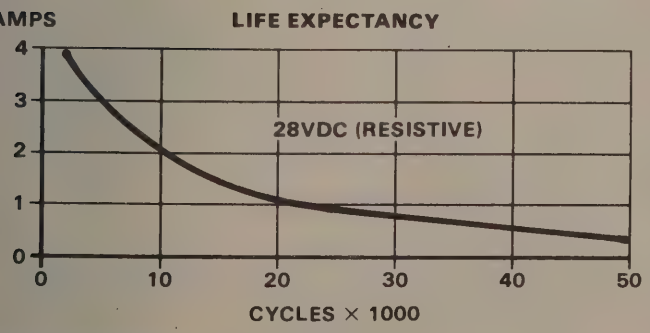
Meets or surpasses requirements of MIL-S-3786

### ELECTRICAL:

Current carrying capacity—10 amps.
Current switching capacity—up to 2 amps.
Contact resistance—Initial—.005 ohms max.
Contact resistance—After Life—.010 ohms max.
Insulation resistance—50,000 megohms
Dielectric withstanding voltage—1500V rms
Dielectric withstanding voltage after life—1000V rms

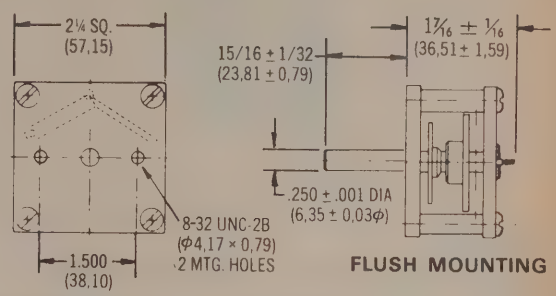
### MECHANICAL:

Rotational life—50,000 cycles* min.@.250 amps.@85° C
Stop torque—50 In. Lbs.
Type construction—Open frame
Stops—Factory set to desired position.
Optional features—⅜-32 UNEF-2A bushing mount with anti-rotation pin. Shaft and front panel "O" ring seals. Spring return feature.
Concentric shafts available
Progressive shorting based on either 24 or 32 equally spaced contacts.
*One cycle = one full cw plus one full ccw rotation.



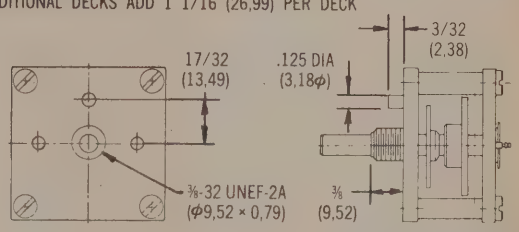

## FEATURES OF SHALLCO 2-1/4" (57,15) SQUARE SERIES D SINGLE OR MULTIDECK SWITCH

- Meets or surpasses requirements of MIL-S-3786
- Available in one pole 2-48 position through four pole 2-15 position
- High current carrying capacity
- Low contact resistance




FLUSH MOUNTING

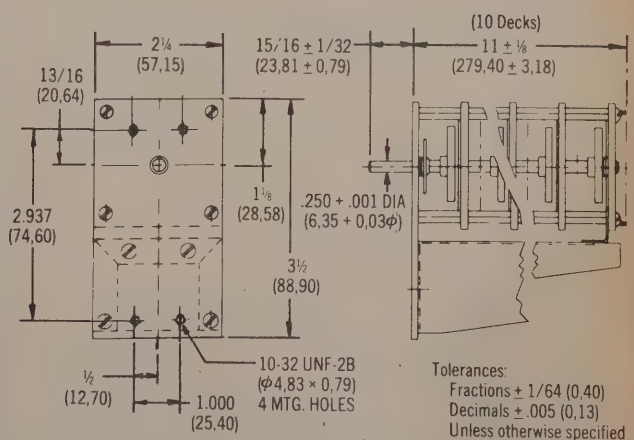
FOR ADDITIONAL DECKS ADD 1 1/16 (26,99) PER DECK




BUSHING MOUNTING

Unless otherwise specified, platforms are supplied for:
1 & 2 pole switches, 10 decks and up.
3 & 4, pole switches, 9 decks and up.

Mounting dimensions of platform switches:




Tolerances:
Fractions ± 1/64 (0,40)
Decimals ± .005 (0,13)
Unless otherwise specified

FOR ADDITIONAL DECKS ADD 1 1/16 (26,99) PER DECK

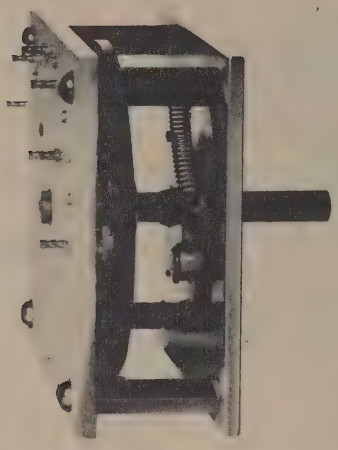
NUMBERS IN ( ) ARE METRIC EQUIVALENT (MILLIMETERS)

DAVEN DESIGNED

USE ORDER FORM — PAGE 4243

# Shallco

# ROTARY SWITCHES SERIES E

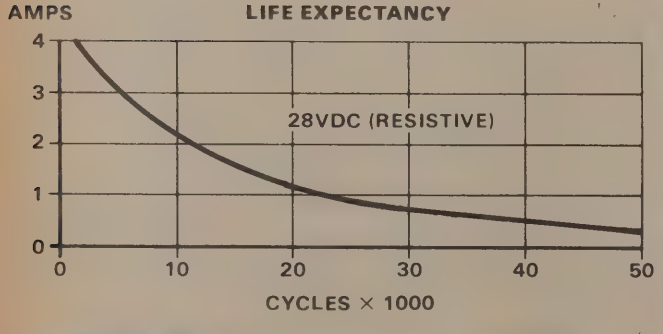


## SPECIFICATIONS

### GENERAL:
Meets or surpasses the requirements of MIL-S-3786.

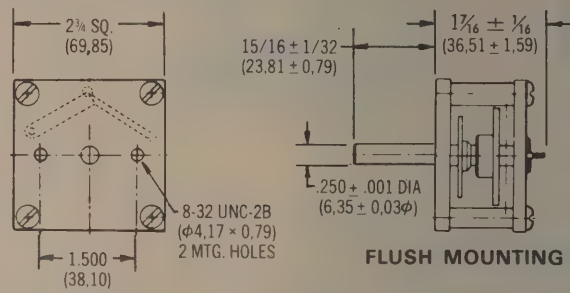
### ELECTRICAL:
Current carrying capacity—10 amps.
Current switching capacity—up to 2 amps.
Contact resistance—Initial—.005 ohms max.
Contact resistance—After Life—.010 ohms max.
Insulation resistance—50,000 megohms
Dielectric withstanding voltage—1500V rms
Dielectric withstanding voltage after life—1000V rms

### MECHANICAL:
Rotational life—50,000 cycles* min.@.250 amps.@85° C
Stop torque—50 In. Lbs.
Type construction—Open frame
Stops—Factory set to desired position.
Optional features—⅜-32 UNEF-2A bushing mount with anti-rotation pin. Shaft and front panel "O" ring seals. Spring return feature.
Concentric shafts available
Progressive shorting based on either 24 or 32 equally spaced contacts.
*One cycle = one full cw plus one full ccw rotation.



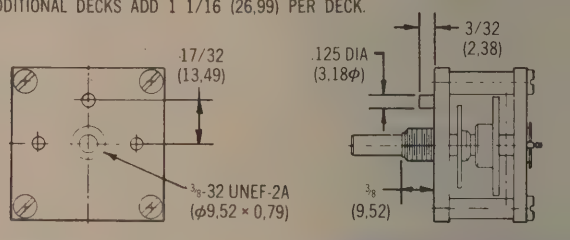

## FEATURES OF SHALLCO 2-3/4" (69,85) SQUARE SERIES E SINGLE OR MULTIDECK SWITCH

- Meets or surpasses requirements of MIL-S-3786.
- Available in one pole 2-48 position through eight pole 2-11 position.
- High current carrying capacity.
- Low contact resistance.




FLUSH MOUNTING

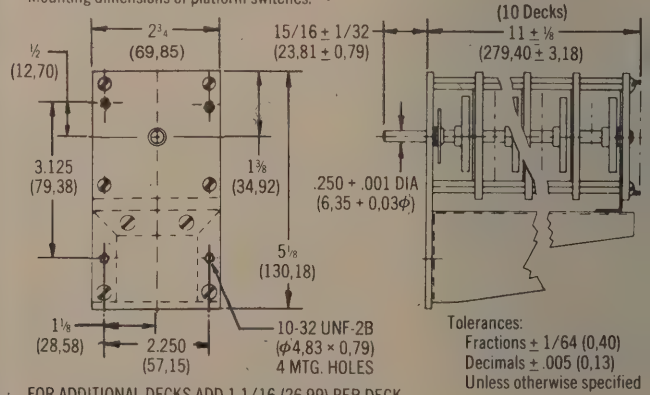
FOR ADDITIONAL DECKS ADD 1 1/16 (26,99) PER DECK.




BUSHING MOUNTING

SHAFT DIAMETER
A ⅜" DIA. (9,52 ϕ) stainless steel shaft is used in the following switches:
(a) When 60 poles or more are specified.
(b) When a switch has 12 decks or more with 11¼° contact spacing or greater.
(c) When a switch has 10 decks or more with 7½° contact spacing or less.

PLATFORM MOUNTING
Unless otherwise specified, platforms are supplied for:
1 & 2 pole switches, 10 decks and up.
3, 4, 5, pole switches, 9 decks and up.
6, 7, 8 pole switches 8 decks and up.
Mounting dimensions of platform switches:




FOR ADDITIONAL DECKS ADD 1 1/16 (26,99) PER DECK

NUMBERS IN ( ) ARE METRIC EQUIVALENT (MILLIMETERS)

DAVEN DESIGNED

USE ORDER FORM — PAGE 4243

# ORDERING INFORMATION

| SHORTING | | | | NON-SHORTING | | |
|---|---|---|---|---|---|---|
| SERIES | SPACING BETWEEN POSITIONS | MAXIMUM POSITIONS PER POLE | NUMBER OF POLES | SERIES | SPACING BETWEEN POSITIONS | MAXIMUM POSITIONS PER POLE |
| 111-CM | 15° | 24* | one | 111-CB | 30° | 12** |
| 112-CM | 11¼° | 32* | | 112-CB | 22½° | 16** |
| 121-CM | 15° | 11 | two | 121-CB | 30° | 6 |
| 122-CM | 11¼° | 15 | | 122-CB | 22½° | 8 |
| 131-CM | 15° | 5 | three | 131-CB | 30° | 3 |
| 132-CM | 11¼° | 7 | | 132-CB | 22½° | 4 |
| 141-CM | 15° | 5 | four | 141-CB | 30° | 3 |
| 142-CM | 11¼° | 7 | | 142-CB | 22½° | 4 |

*Maximum number of positions may be used with continuous rotation only.
**Normally supplied as continuous rotation; stops available on request.

| SHORTING | | | | NON-SHORTING | | |
|---|---|---|---|---|---|---|
| SERIES | SPACING BETWEEN POSITIONS | MAXIMUM POSITIONS PER POLE | NUMBER OF POLES | SERIES | SPACING BETWEEN POSITIONS | MAXIMUM POSITIONS PER POLE |
| 111-DM | 15° | 24* | one | 111-DB | 30° | 12* |
| 112-DM | 11¼° | 32 | | 112-DB | 22½° | 16* |
| 113-DM | 7½° | 48 | | 113-DB | 15° | 24* |
| 121-DM | 15° | 24* | two | 121-DB | 30° | 12* |
| 122-DM | 11¼° | 32 | | 122-DB | 22½° | 16* |
| 123-DM | 7½° | 23 | | 123-DB | 15° | 12 |
| 141-DM | 15° | 11 | four | 141-DB | 30° | 6 |
| 142-DM | 11¼° | 15 | | 142-DB | 22½° | 8 |
| 143-DM | 7½° | 11 | | 143-DB | 15° | 6 |

*Normally supplied as continuous rotation; stops available on request.

| SHORTING | | | | NON-SHORTING | | |
|---|---|---|---|---|---|---|
| SERIES | SPACING BETWEEN POSITIONS | MAXIMUM POSITIONS PER POLE | NUMBER OF POLES | SERIES | SPACING BETWEEN POSITIONS | MAXIMUM POSITIONS PER POLE |
| 111-EM | 15° | 24* | one | 111-EB | 30° | 12* |
| 112-EM | 11¼° | 32 | | 112-EB | 22½° | 16* |
| 113-EM | 7½° | 48 | | 113-EB | 15° | 24* |
| 121-EM | 15° | 24* | two | 121-EB | 30° | 12* |
| 122-EM | 11¼° | 32 | | 122-EB | 22½° | 16* |
| 123-EM | 7½° | 48 | | 123-EB | 15° | 24* |
| 141-EM | 15° | 11 | four | 141-EB | 30° | 6 |
| 142-EM | 11¼° | 15 | | 142-EB | 22½° | 8 |
| 143-EM | 7½° | 23 | | 143-EB | 15° | 12 |
| 161-EM | 15° | 7 | six | 161-EB | 30° | 4 |
| 162-EM | 11¼° | 9 | | 162-EB | 22½° | 5 |
| 163-EM | 7½° | 15 | | 163-EB | 15° | 8 |
| 181-EM | 15° | 5 | eight | 181-EB | 30° | 3 |
| 182-EM | 11¼° | 7 | | 182-EB | 22½° | 4 |
| 183-EM | 7½° | 11 | | 183-EB | 15° | 6 |

*Normally supplied as continuous rotation; stops available on request.

## (Order Form to order Series C, D, E)

Order by using a six-place "shorthand" description

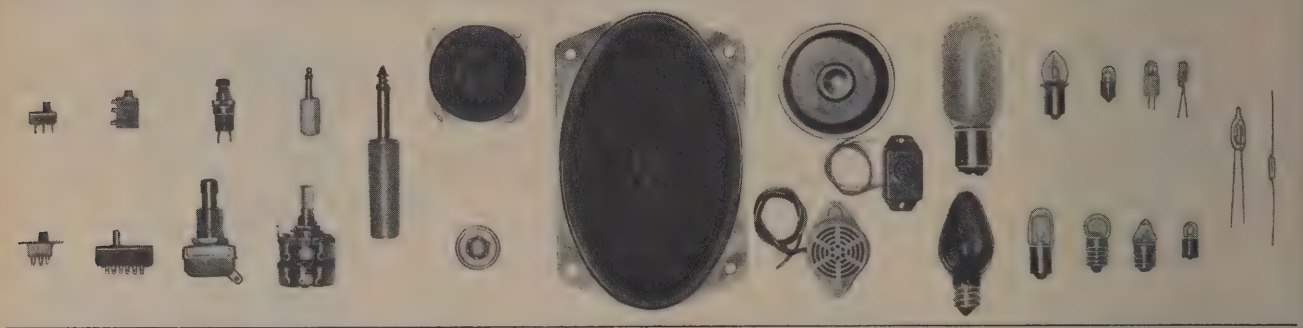
**Example:** 211—EB—12

Rotary Selector Switch, two decks, 1 pole per deck, 30° of spacing between positions, E series, non-shorting, 12 positions.

**2 1 1 - E B - 12**

| PLACE 1 | PLACE 2 | PLACE 3 | PLACE 4 | PLACE 5 | PLACE 6 |
|---|---|---|---|---|---|
| indicates number of decks:*<br>1 = One Deck<br>2 = Two Decks<br>3 = Three Decks, etc. | indicates number of poles per deck:<br>1 = One Pole<br>2 = Two Poles<br>3 = Three Poles<br>4 = Four Poles | indicates degrees of spacing between positions:<br>Shorting<br>1 = 15° 2 = 11¼°<br>3 = 7½°<br>Non-Shorting<br>1 = 30° 2 = 22½°<br>3 = 15° | indicates series of switch:<br>C = C Series<br>D = D Series<br>E = E Series | indicates Shorting or Non-Shorting:<br>M = Shorting (make before break)<br>B = Non-Shorting (break before make) | indicates number of positions per pole:<br>2 = Two positions<br>3 = Three positions<br>4 = Four Positions, etc. |

**Request catalog RS-77 for more detailed information and additional switch types.**



# Get your chief engineers off your back. Your cost accountants, too.

Shigoto controls *every* step of design, production, testing and delivery of *every* component we sell. Our consistent standards and tolerances will keep engineers happy. And it lets us hold down costs. Accountants will love that.

Shigoto has even more ways to keep *you* happy.

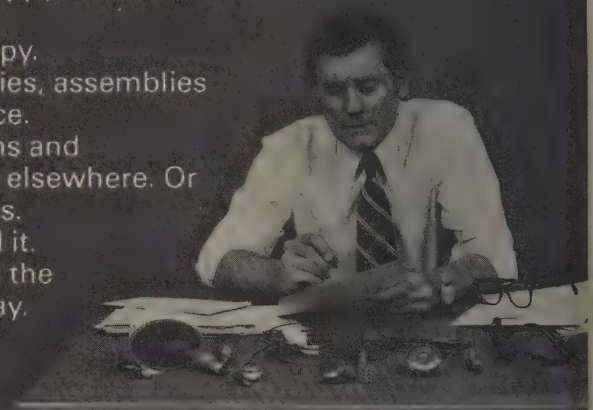
We make so many components, sub-assemblies, assemblies and systems, you can make us your single source.

We'll help you design and produce adaptations and modifications at a fraction of the cost you'd pay elsewhere. Or make entirely new systems to your precise specs.

And we get it there where and when you need it.

Trust Shigoto. Our components are already in the things you rely on. Like your phone. Call us today.

**Shigoto. The solution.**



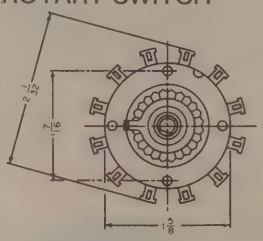
SHIGOTO
FAR EAST LTD.
*1500 Broadway, New York, N.Y. 10036*
*(212) 840-8670 • TELEX 234219*

# STACKPOLE

## ROTARY SWITCHES

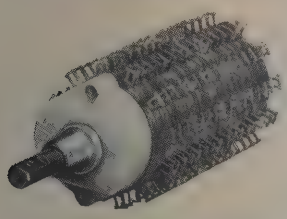
Stackpole rotary switches combine the high reliability of fully enclosed, modular construction with economy and a wide range of off-the-shelf options. Three separate series provide sizes and configurations to meet any application need. For complete specifications of standard rotary switches, request Bulletin 73-108.

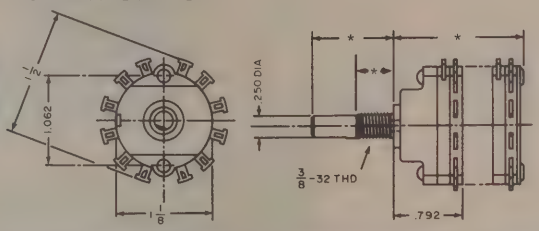
### SERIES 600—1⅝" DIA. ENVIRONMENT-PROOF ROTARY SWITCH




| | |
|---|---|
| Index Angles | 15°, 30°, 60°, 90° |
| No. of Decks | 15°—3 max.<br>30°, 60° & 90°—<br>15 max. |
| Poles per Deck | 15°—12 max.<br>30°— 6 max.<br>60°— 4 max.<br>90°— 3 max. |

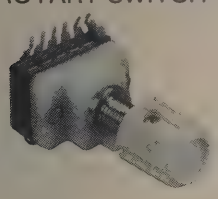
### SERIES 100—1⅛" DIA. ENVIRONMENT-PROOF ROTARY SWITCH

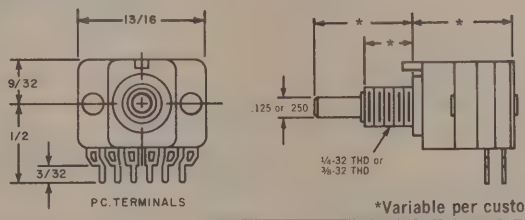





| | |
|---|---|
| Index Angles | 22½°, 30°, 36°,<br>45°, 60°, 90° |
| No. of Decks | 20 max. for any<br>Index Angle |
| Poles per Deck | 30°, up to 6, max.<br>36°, up to 5, max.<br>60°, 4 max.<br>90°, 3 max.<br>*22½° & 45°—<br>Consult Stackpole |

### SERIES 80—SUBMINIATURE ENVIRONMENT-PROOF ROTARY SWITCH






| PC or Solder Lug Terminals | |
|---|---|
| Index Angles | 30°, 60°, 90° |
| No. of Decks | 30°, 10 max.<br>60°, 10 max.<br>90°, 10 max. |
| Poles per Deck | 30°, up to 6, max.<br>60°, up to 4, max.<br>90°, up to 3, max. |

*Variable per customer requirements.

### ELECTRICAL SPECIFICATIONS

| | Series 80 | Series 100 | Series 600 |
|---|---|---|---|
| Breakdown Voltage (Sea Level) | | | |
| Terminal to terminal | 600 VAC | 1000 VAC | 1000 VAC |
| Terminal to ground | 1000 VAC | 2000 VAC | 2000 VAC |
| Electrical Rating (Resistive Load) | | | |
| Silver-plated brass contacts | | | |
| At 125 VAC | .050 Amp | .3 Amp | .5 Amp |
| At 28 VDC | .1 Amp | .5 Amp | 1 Amp |
| Silver-alloy contacts | | | |
| At 125 VAC | .075 Amp | .5 Amp | 1 Amp |
| At 28 VDC | .125 Amp | 1 Amp | 2 Amp |
| Current-carrying capacity (Max temp rise, 30° C) | 6 Amp | 15 Amp | 25 Amp |
| Contact Resistance (Silver-Plated Brass) | | | |
| Average initial, less than | .005 Ohm | .005 Ohm | .005 Ohm |
| Maximum initial | .010 Ohm | .010 Ohm | .010 Ohm |

### ADVANTAGES

All series feature totally enclosed designs, seal out dirt, moisture and corrosion, seal in lubrication. Rugged, torsionally rigid assemblies withstand rough usage. Series 100 conforms to MIL-S-3786 for shock, vibration and explosion-proofing.

Series 80 has 13/16" x 9/16" body with in-line pins, ideal for either PC board insertion or hand solder applications.

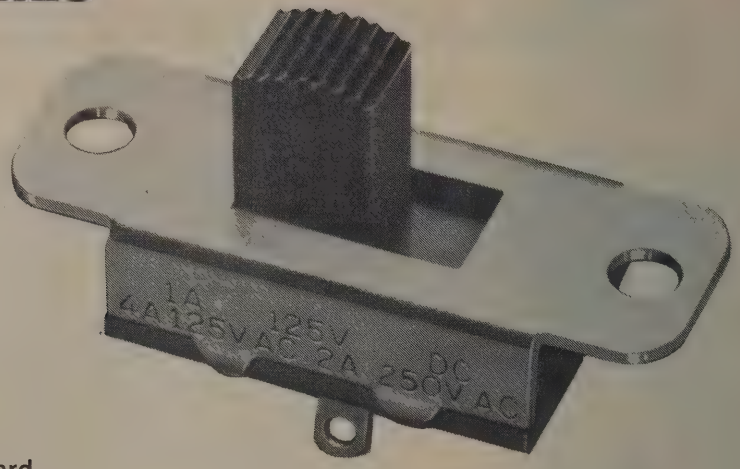
### DELIVERY

Fastest in the industry. Within two weeks for standard configurations, within three weeks on specials (samples in 2-3 days). Request Bulletin 73-108 for information and method of specifying custom-design switches.

STACKPOLE COMPONENTS CO. • P. O. BOX 14466 • RALEIGH, N. C. 27610 • PHONE: 919-828-6201

**STACKPOLE**
**COMPONENTS COMPANY**
Dept. EM, P.O. BOX M, FARMVILLE, VA 23901 • Phone (804) 392-4111 • TWX 710-874-3710

# BASIC SINGLE-POLE SWITCHES




## TWO POSITION OR MULTI-POSITION ON-OFF OR MULTI-SPEED

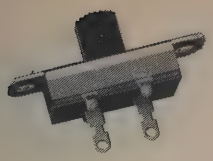
Universally acclaimed as the standard of the industry, these Stackpole switches are the most rugged, most dependable and long-lived switches for power control — at any price. An example of the design-proven features is the movable contact (a heavy slug of silver-plated copper alloy, coil spring-loaded to assure positive contacting) which eliminates distortion through light and heavy loads. It has been the obvious choice for thousands of applications and proven through the hundreds of millions of Stackpole switches in customer use today.

**TOLERANCES**
2 place decimal inches (1 place mm) ±.015″ (±0.4mm)
3 place decimal inches (2 place mm) ±.005″ (±0.13mm)

| Dim. | Inches | mm |
|---|---|---|
| A | 1.375 | 34.92 |
| B | 1.125 | 28.58 |
| C | .469 | 11.91 |
| D | .293 | 7.44 |
| E | .53 | 13.5 |
| F | .454 | 11.53 |
| G | .243 | 6.17 |
| H | .224 | 5.69 |
| J | .191 | 4.85 |
| K | .278 | 7.06 |
| L | .88 | 22.4 |
| M | .138 D | 3.51 D |
| N | .34 | 8.6 |
| P | .025 | 0.64 |
| Q | .28 | 7.1 |
| R | .31 | 7.9 |
| S | .37 | 9.4 |
| T | .26 | 6.6 |
| U | .070 D | 1.78 D |
| V | .110 | 2.79 |
| W | .172 | 4.37 |
| X | .080 D | 2.03 D |
| Y | .080 | 2.03 |
| Z | .160 | 4.06 |

### STANDARD MATERIALS

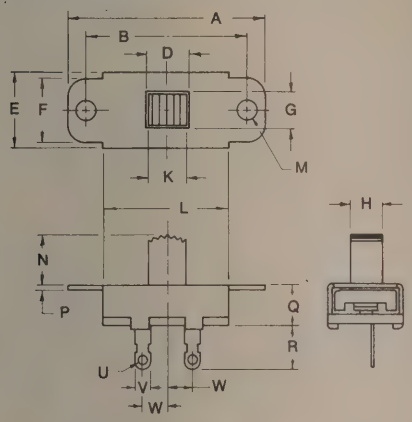
**CASE:** Cold Rolled Steel, Zinc Plated
**BASE:** Fibre surfaced XP Phenolic Laminate
**ACTUATOR:** Phenolic or Nylon, Black
**TERMINALS:** Copper Alloy, Silver Plated
**SLIDING CONTACT:** Copper Alloy, Silver Plated
**SPRING FOR CONTACT:** Music Wire



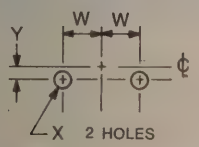
## SERIES P-20 PUSH SWITCH

**(Momentary Action — Normally Open)**

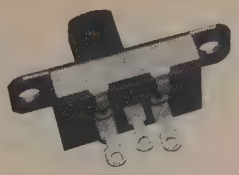
Depress the actuator for instant "ON". Applications range from ringing a bell to activating an alarm or completing a circuit. Single circuit is closed, as long as the knob is depressed.




### P.C BOARD LAYOUT



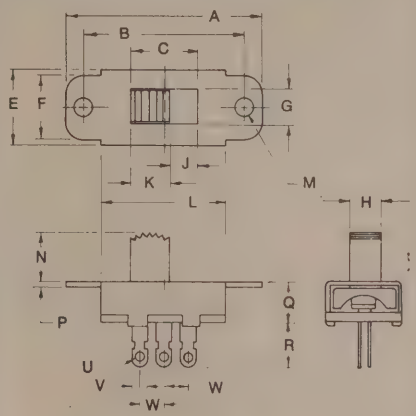

| 125 VAC UL & CSA RATING | PART NO. |
|---|---|
| 3 amp. | P-2011SR03-O |



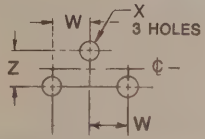
## SERIES S-20 STANDARD SWITCH

**(Most Economical)**

Basic and most economical "ON-OFF" type switch. Available to 7 amps in maintained action; to 6 amps in spring-return action. Both single-throw and double-throw versions can be supplied.

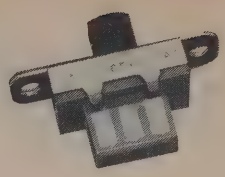



### P.C BOARD LAYOUT




| 125 VAC UL & CSA RATING | PART NO. | |
|---|---|---|
| | Single-Throw | Double-Throw |
| Maintained Action | | |
| 4 amp. | S-2011SD04-O | S-2012SD04-O |
| 6 amp. | S-2011SD06-O | S-2012SD06-O |
| *7 amp. | S-2011SD07-O | S-2012SD07-O |
| Spring Return | | |
| 6 amp | — | S-2012SR06-O |
| 6 amp N.O. | S-2011SR06-O | — |
| 6 amp N.C. | S-2011SR06-R | — |

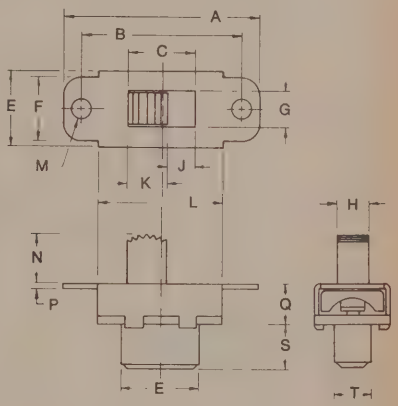
* UL only



## SERIES S-25 "PUSH-IN-LEAD" SWITCH

**(No Soldering Required)**

Optimum in labor savings design . . . stranded (pre-tinned) or single strand 18 or 20 gauge wire leads can be inserted directly into the switch base without special connectors, machines or fixtures. Soldering and other hand operations are eliminated. Available to 6 amps in maintained and spring-return action.

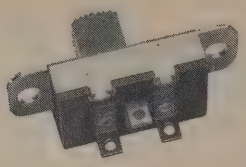



| 125 VAC UL & CSA RATING | PART NO. | |
|---|---|---|
| | Single-Throw | Double-Throw |
| Maintained Action | | |
| 4 amp. | S-2511CD04-O | S-2512CD04-O |
| 6 amp. | S-2511CD06-O | S-2512CD06-O |
| Spring Return | | |
| 6 amp | — | S-2512SR06-O |
| 6 amp N.O. | S-2511SR06-O | — |
| 6 amp N.C. | S-2511SR06-R | — |

## OPTIONAL MODIFICATIONS — OPTIONS AND ACCESSORIES AVAILABLE

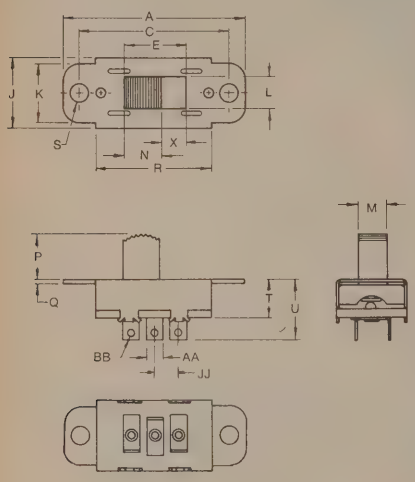
| | | | |
|---|---|---|---|
| ACTUATOR HEIGHTS | Yes | Yes | Yes |
| ACTUATOR COLORS | Yes | Yes | Yes |
| SPECIAL BASE MATERIALS | Yes | Yes | |
| SPECIAL TERMINALS | Yes | Yes | |
| TERMINAL SHIELDS | | Yes | |
| ROCKER VERSIONS | | Yes | Yes |
| SPECIAL MOUNTING HOLES | Yes | Yes | Yes |
| TWIST-TAB MOUNTING | Yes | Yes | Yes |
| REMOVE MOUNTING EARS | Yes | Yes | Yes |
| WELDED LEADS | Yes | Yes | |
| SPECIALLY PLATED CASES | Yes | Yes | Yes |
| HEAVY DETENTS | | | |
| SOLDER GUARDS | Yes | Yes | |

STACKPOLE COMPONENTS COMPANY

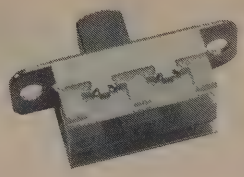


## SERIES S-22
## HIGH-POWER SWITCH
**(Unique Rivet Contacts)**

Heavy-duty design features special rivet contacts and extra-sturdy terminals. Rugged construction single-throw or double-throw available to 10 amps.

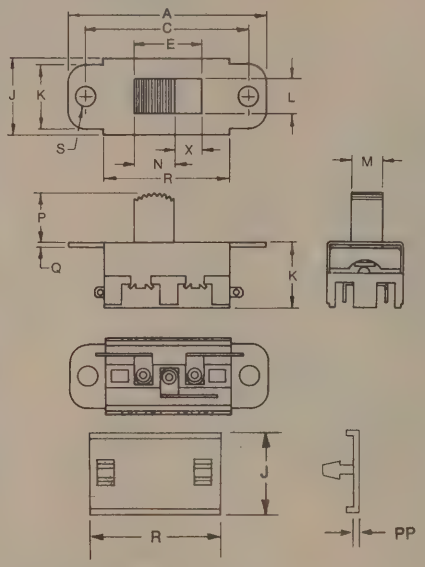



| 125 VAC UL & CSA RATING | PART NO. | |
|---|---|---|
| | Single-Throw | Double-Throw |
| 10 amp. | S-2211CD10-0 | S-2212CD10-0 |



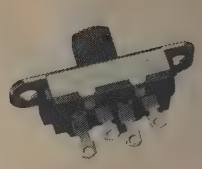
## SERIES S-21
## QUICK-CONNECT SWITCH
**(Accepts Push-On Connectors)**

A high-power switch with specially designed nylon base providing foolproof insulation and use of 110 (Faston®) type connectors. Maintained action to 10 amps; spring-return to 8 amps in single-throw or double-throw.



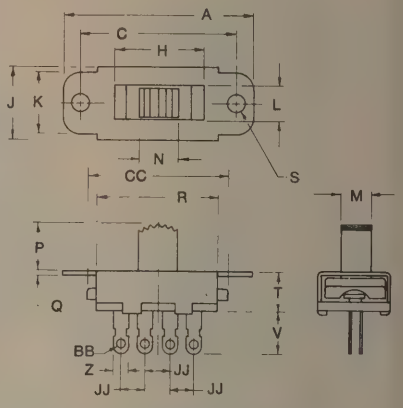

| 125 VAC UL & CSA RATING | PART NO. | |
|---|---|---|
| | Single-Throw | Double-Throw |
| **Maintained Action** | | |
| *6 amp. | S-2111SD06-O | S-2112SD06-O |
| 10 amp. | S-2111CD10-O | S-2112CD10-O |
| **Spring Return** | | |
| 3 amp. | — | S-2112SR03-O |
| *8 amp. | — | S-2112SR08-O |
| 3 amp N.O. | S-2111SR03-O | — |
| *8 amp. N.O. | S-2111SR08-O | — |
| 3 amp. N.C. | S-2111SR03-R | — |
| *8 amp. N.C. | S-2111SR08-R | — |

Note: Terminal shield shown above is optional.
* UL only

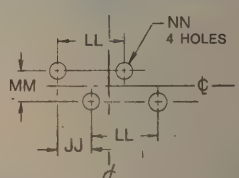


## SERIES S-20
## STANDARD SWITCH
**(Most Economical Three-Position)**

Three-position switch with optional uses such as "CENTER-OFF" or "OFF-LOW-HIGH". Available to 6 amps in maintained detent, spring-return from one end to center, or spring-return from position 3 to position 1.




## P.C BOARD LAYOUT



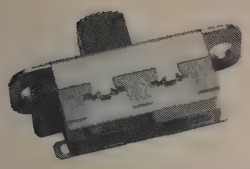

| 125 VAC UL & CSA RATING | PART NO. | |
|---|---|---|
| | (Standard) | (With Ball Detent) |
| **Maintained Action** | | |
| 6 amp. | S-2013SD06-O | S-2013BD06-O |
| **Spring-Return To Center From One End** | | |
| 6 amp. | | S-2013RC06-U |
| **Spring-Return From Position 3 to Position 1** | | |
| 6 amp. | | S-2013SR06-U |

## OPTIONAL MODIFICATIONS — OPTIONS AND ACCESSORIES AVAILABLE

| | | | |
|---|---|---|---|
| ACTUATOR HEIGHTS | Yes | Yes | Yes |
| ACTUATOR COLORS | Yes | Yes | Yes |
| SPECIAL BASE MATERIALS | Yes | | Yes |
| SPECIAL TERMINALS | Yes | Yes | Yes |
| TERMINAL SHIELDS | Yes | Yes | Yes |
| ROCKER VERSIONS | Yes | Yes | Yes |
| SPECIAL MOUNTING HOLES | Yes | Yes | Yes |
| TWIST-TAB MOUNTING | Yes | Yes | Yes |
| REMOVE MOUNTING EARS | Yes | Yes | Yes |
| WELDED LEADS | Yes | | Yes |
| SPECIALLY PLATED CASES | Yes | Yes | Yes |
| HEAVY DETENTS | | | |
| SOLDER GUARDS | Yes | | Yes |

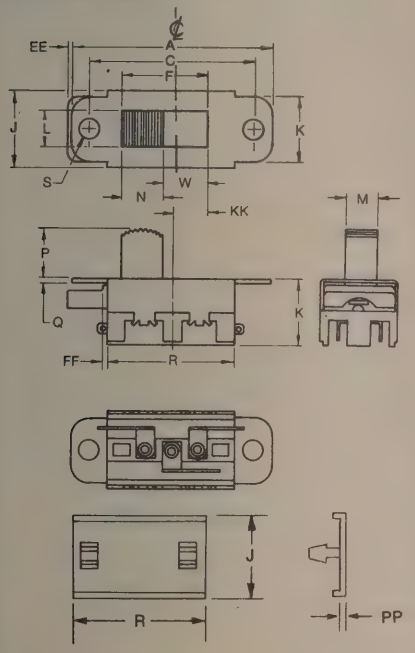
| Dim. | Inches | mm |
|---|---|---|
| A | 1.375 | 34.92 |
| B | 1.656 | 42.06 |
| C | 1.125 | 28.58 |
| D | 1.406 | 35.71 |
| E | .469 | 11.91 |
| F | .594 | 15.09 |
| G | .771 | 19.58 |
| H | .646 | 16.41 |
| J | .53 | 13.5 |
| K | .45 | 11.4 |
| L | .243 | 6.17 |
| M | .224 | 5.69 |
| N | .278 | 7.06 |
| P | .34 | 8.6 |
| Q | .025 | 0.64 |
| R | .88 | 22.4 |
| S | .138 D | 3.51 D |
| T | .28 | 7.1 |
| U | .47 | 11.9 |

TOLERANCES - PG. 4246



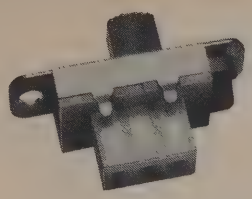
## SERIES S-21
## QUICK-CONNECT SWITCH
**(Accepts Push-On Connectors)**

Three-position, high-power switch with specially designed nylon base for foolproof insulation and use of 110 (Faston®) type connectors. Available to 6 amps. End position is "OFF"



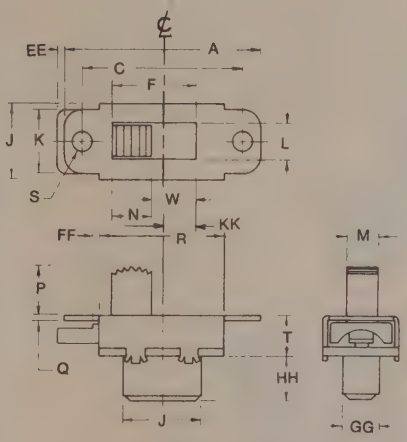

| 125 VAC UL & CSA RATING | PART NO. |
|---|---|
| *6 amp. | S-2113SD06-X |

Note: Terminal shield shown above is optional.
* UL only

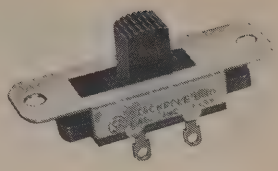


## SERIES S-25
## THREE-POSITION, PUSH-IN-LEAD
**(No Soldering Required)**

Optimum in labor saving design . . . Special nylon base provides for insertion of 18 or 20 gauge stranded (pre-tinned) or solid leads. The design allows "OFF-LOW-HIGH" application. Available to 5 amps. End position is "OFF".

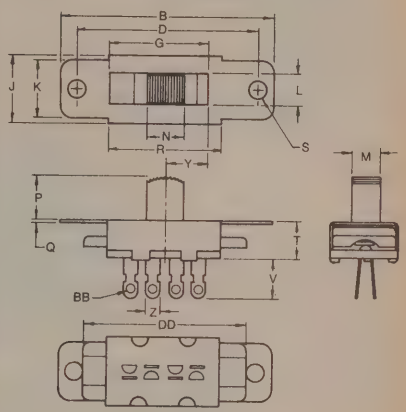



| 125 VAC UL & CSA RATING | PART NO. |
|---|---|
| 5 amp. | S-2513SD05-X |

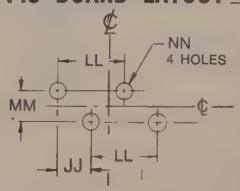


## SERIES S-20
## STANDARD, FOUR-POSITION SWITCH

A four-position switch specifically designed for three-speed appliance applications "OFF-LO-MED-HIGH". Available to 6 amps. End position is "OFF".




## P.C BOARD LAYOUT




| 125 VAC UL & CSA RATING | PART NO. |
|---|---|
| 6 amp. | S-2014SD06-X |

| Dim. | Inches | mm |
|---|---|---|
| V | .31 | 7.9 |
| W | .316 | 8.03 |
| X | .191 | 4.85 |
| Y | .323 | 8.20 |
| Z | .110 | 2.79 |
| AA | .125 | 3.18 |
| BB | .070 D | 1.78 D |
| CC | 1.022 | 25.96 |
| DD | 1.264 | 32.11 |
| EE | .05 | 1.3 |
| FF | .04 | 1.0 |
| GG | .27 | 6.9 |
| HH | .37 | 9.4 |
| JJ | .172 | 4.37 |
| KK | .235 | 5.97 |
| LL | .344 | 8.74 |
| MM | .160 | 4.06 |
| NN | .080 D | 2.03 D |
| PP | .031 | 0.79 |

## OPTIONAL MODIFICATIONS — OPTIONS AND ACCESSORIES AVAILABLE

| | | | |
|---|---|---|---|
| Yes | Yes | | ACTUATOR HEIGHTS |
| Yes | Yes | | ACTUATOR COLORS |
| | | Yes | SPECIAL BASE MATERIALS |
| Yes | | Yes | SPECIAL TERMINALS |
| Yes | | Yes | TERMINAL SHIELDS |
| | | | ROCKER VERSIONS |
| Yes | Yes | | SPECIAL MOUNTING HOLES |
| | | | TWIST-TAB MOUNTING |
| Yes | Yes | | REMOVE MOUNTING EARS |
| | | Yes | WELDED LEADS |
| Yes | Yes | Yes | SPECIALLY PLATED CASES |
| | | | HEAVY DETENTS |
| | | Yes | SOLDER GUARDS |

TOLERANCES - PG. 4246

STACKPOLE COMPONENTS COMPANY

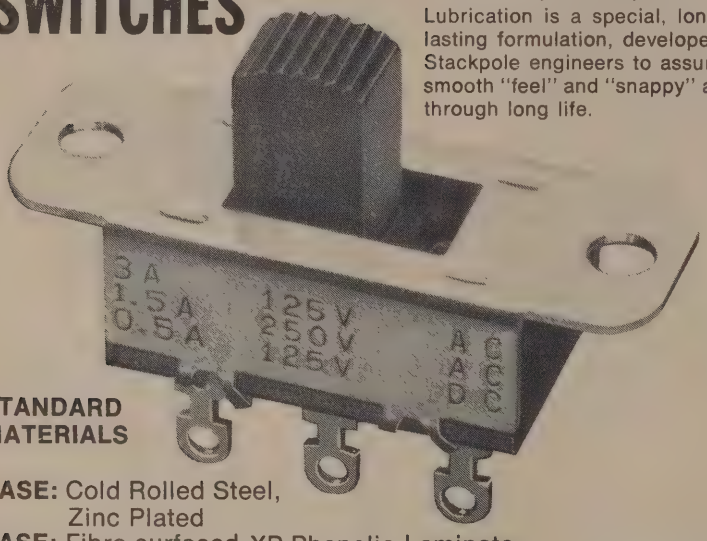
**STACKPOLE**
**COMPONENTS COMPANY**
Dept. EM, Box M, Farmville, VA 23901
Phone (804) 392-4111 • TWX 710-874-3710

# BASIC DOUBLE-POLE SWITCHES

## SIMPLE TWO-CIRCUIT SWITCHING

These famed Stackpole switches are mass produced with many unique design features. The terminals are firmly anchored in the base by a swaging process which assures that they will not loosen or shift, even after rugged use. Terminals are silver-plated copper alloy, heavier than that found in any similar product.

Lubrication is a special, long-lasting formulation, developed by Stackpole engineers to assure a smooth "feel" and "snappy" action through long life.



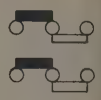

**STANDARD MATERIALS**

**CASE:** Cold Rolled Steel, Zinc Plated
**BASE:** Fibre surfaced XP Phenolic Laminate
**ACTUATOR:** Phenolic or Nylon, Black
**TERMINALS:** Copper Alloy, Silver Plated
**SLIDING CONTACT:** Silver Clad Phos. Bronze (Except S-5224XD11-U)

| Dim. | Inches | mm | Dim. | Inches | mm |
|---|---|---|---|---|---|
| A | 1.375 | 34.92 | Z | .282 | 7.16 |
| B | 1.968 | 49.99 | AA | .246 | 6.25 |
| C | 1.656 | 42.06 | BB | .37 | 9.4 |
| D | 1.125 | 28.58 | CC | 1.23 | 31.2 |
| E | 1.718 | 43.64 | DD | .472 | 11.99 |
| F | 1.406 | 35.71 | EE | .250 | 6.35 |
| G | .469 | 11.91 | FF | .45 | 11.4 |
| H | 1.112 | 28.24 | GG | .82 | 20.8 |
| J | .750 | 19.05 | HH | .266 | 6.76 |
| K | .52 | 13.2 | JJ | .217 | 5.51 |
| L | .454 | 11.53 | KK | .61 | 15.5 |
| M | .243 | 6.17 | LL | .32 | 8.1 |
| N | .224 | 5.69 | MM | .240 | 6.10 |
| P | .138 D | 3.51 D | NN | .805 | 20.45 |
| Q | .278 | 7.06 | PP | .307 | 7.80 |
| R | .191 | 4.85 | QQ | 1.50 | 38.1 |
| S | .88 | 22.4 | RR | .022 | 0.56 |
| T | .34 | 8.6 | SS | .56 | 14.2 |
| U | .025 | 0.64 | TT | .460 | 11.68 |
| V | .35 | 8.9 | UU | .123 | 3.12 |
| W | .070 D | 1.78 D | VV | .073 D | 1.85 D |
| X | .117 | 2.97 | WW | .133 | 3.38 |
| Y | .29 | 7.4 | XX | .030 | 0.76 |

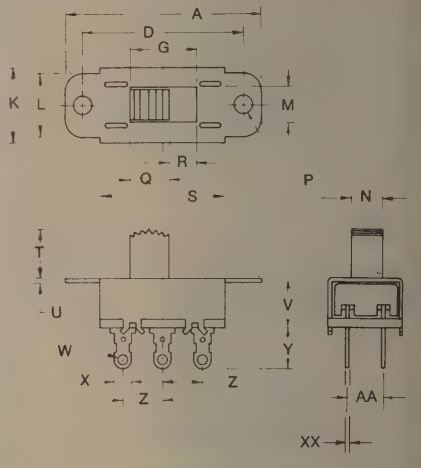
TOLERANCES - PG. 4246

## SERIES S-50

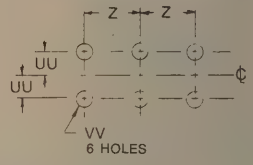


### STANDARD DOUBLE-POLE (MOST ECONOMICAL)

Basic double-pole, double-throw switch. Six terminal switch for control of two different circuits. Break or make both sides of a circuit in one package. Available to 4 amps.



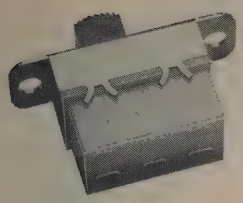

## P.C BOARD LAYOUT




| 125 VAC UL & CSA RATING | PART NO. |
|---|---|
| 3 amp. | S-5022CD03-O |
| 4 amp. | S-5022CD04-O |

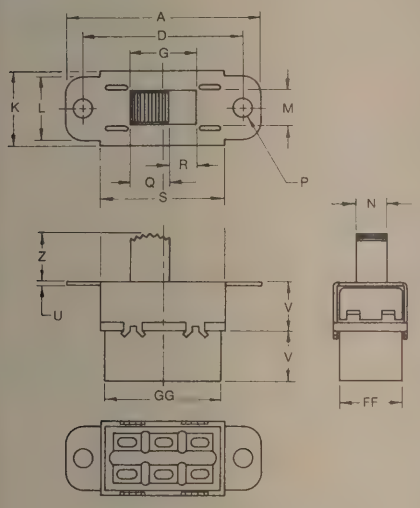
## OPTIONAL MODIFICATIONS

| | |
|---|---|
| ACTUATOR HEIGHTS | Yes |
| ACTUATOR COLORS | Yes |
| SPECIAL BASE MATERIALS | Yes |
| SPECIAL TERMINALS | Yes |
| TERMINAL SHIELDS | Yes |
| ROCKER VERSIONS | Yes |
| SPECIAL MOUNTING HOLES | Yes |
| TWIST-TAB MOUNTING | Yes |
| REMOVE MOUNTING EARS | Yes |
| WELDED LEADS | Yes |
| SPECIALLY PLATED CASES | Yes |
| HEAVY DETENTS | Yes |
| SOLDER GUARDS | Yes |



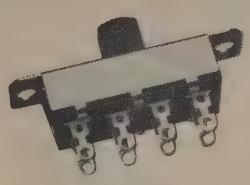
## SERIES S-55
## "PUSH-IN-LEAD" SWITCH
**(FAST ASSEMBLY)**

Double-pole, double-throw performance for control of two circuits—stranded (pre-tinned) or single strand, 18 or 20 gauge leads can be inserted directly into the switch base without special connectors, machines or fixtures. Save by reducing assembly time.



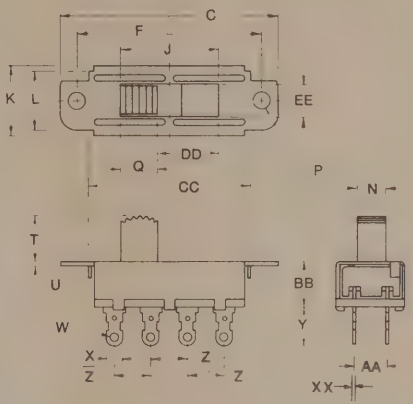

**125 VAC UL & CSA**

| RATING | PART NO. |
|---|---|
| Not Rated | S-5522CD00-O |

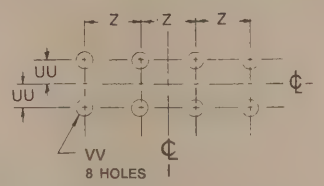


## SERIES S-51
## DOUBLE-POLE, THREE-POSITION
**(ISOLATED POLES)**

Ideal for appliances requiring "LOW-OFF-HIGH" or "HIGH-LOW-OFF". Switch action is maintained by utilizing either standard (for 1 amp.) or ball detent (for 3 amps.). Available to 3 amps.

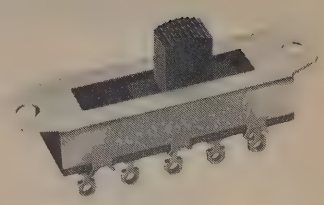



### P.C BOARD LAYOUT



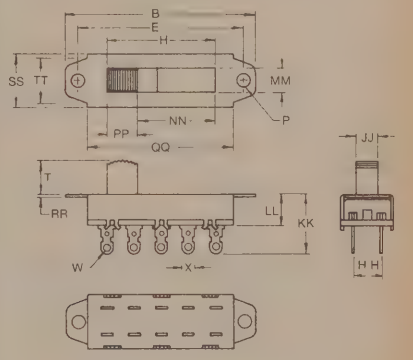

**125 VAC UL & CSA**

| RATING | PART NO. |
|---|---|
| 1 amp. | S-5123SD01-O |
| 3 amp. (Ball Detent) | S-5123BD03-O |

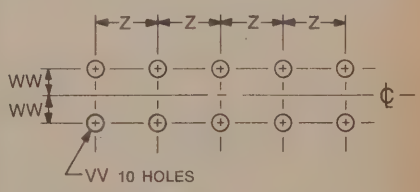


## SERIES S-52
## FOUR-POSITION, POWER SWITCH
**(TWO CIRCUITS)**

Specially designed 11 amp rated appliance switch. Built with extra-rugged .040" (1.02mm) thick terminals, a unique, ramp detent construction and coil spring-loaded, silver-plated copper alloy contacts. Feel the quality and depend on trouble-free performance. (Special economy version available unrated part S-5224BD00-U. Send for drawing.)




### P.C BOARD LAYOUT



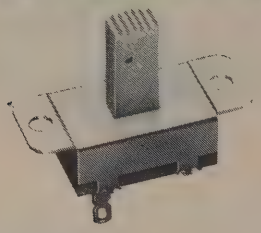

**125 VAC UL & CSA**

| RATING | PART NO. |
|---|---|
| Not Rated | S-5224BD00-U |
| 11 amp. | S-5224XD11-U |

## —OPTIONS AND ACCESSORIES AVAILABLE

| | | | |
|---|---|---|---|
| | Yes | Yes | ACTUATOR HEIGHTS |
| | Yes | Yes | ACTUATOR COLORS |
| | Yes | Yes | SPECIAL BASE MATERIALS |
| | Yes | Yes | SPECIAL TERMINALS |
| | | | TERMINAL SHIELDS |
| Yes | | | ROCKER VERSIONS |
| Yes | Yes | Yes | SPECIAL MOUNTING HOLES |
| Yes | Yes | | TWIST-TAB MOUNTING |
| Yes | Yes | | REMOVE MOUNTING EARS |
| | Yes | Yes | WELDED LEADS |
| Yes | Yes | Yes | SPECIALLY PLATED CASES |
| Yes | Yes | | HEAVY DETENTS |
| | Yes | | SOLDER GUARDS |

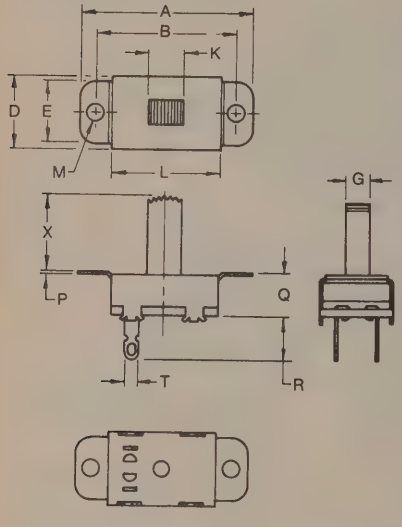
# STACKPOLE MINIATURE SWITCHES



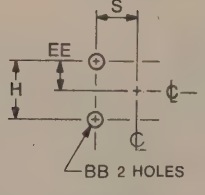
## SERIES P-90 MOMENTARY ACTION

**NORMALLY OPEN, PUSH SWITCH**

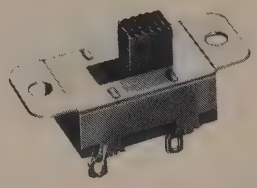
Depress the actuator for instant "ON". Applications range from ringing a bell to activating a circuit for remote control. Single circuit is closed, as long as the knob is depressed.




### P.C BOARD LAYOUT



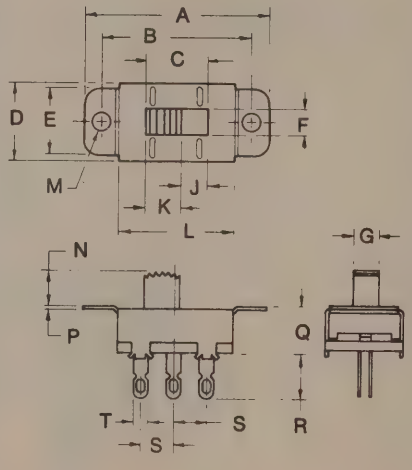

| PART NO. |
|---|
| P-9011SR00-0 |



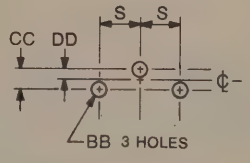
## SERIES S-90 STANDARD MINIATURE SWITCH

**SINGLE-POLE, TWO-POSITION**

Basic "ON-OFF" performance and high-quality, long-life construction in maintained detent. Available in 1 and 3 amp versions. Contact factory for optional heavy detent.

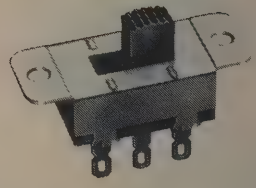



### P.C BOARD LAYOUT

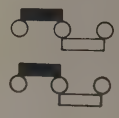



**125 VAC UL & CSA**

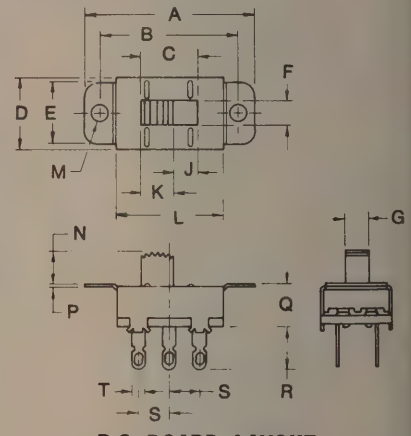
| RATING | PART NO. | |
|---|---|---|
| Maintained Action | Single-Throw | Double-Throw |
| 1 amp. | S-9011CD01-O | S-9012CD01-O |
| 3 amp. | S-9011CD03-O | S-9012CD03-O |



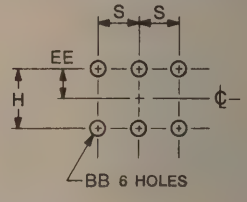
## SERIES S-90 STANDARD TWO-POLE, TWO-POSITION MINIATURE SWITCH



Basic miniature size double-pole, double-throw switch. For control of two circuits. Make or break both sides of a circuit with one device. One row of terminals is omitted for single pole spring return. Available to 3 amps.




### P.C BOARD LAYOUT




**125 VAC UL & CSA**

| RATING | PART NO. | |
|---|---|---|
| 1 amp. | S-9022CD01-O | |
| 3 amp. | S-9022CD03-O | |
| Spring-Return | Single-Throw | Double-Throw |
| 3 amp. | S-9011SR03-C | S-9012SR03-C |

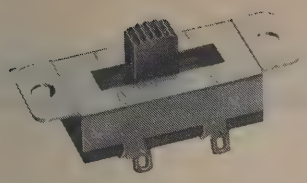
**(For single-throw normally closed specify S-9011SR03-CR)**

## OPTIONAL MODIFICATIONS — OPTIONS AND ACCESSORIES AVAILABLE

| | | | |
|---|---|---|---|
| ACTUATOR HEIGHTS | Yes | Yes | Yes |
| ACTUATOR COLORS | Yes | Yes | Yes |
| SPECIAL BASE MATERIALS | Yes | Yes | Yes |
| SPECIAL TERMINALS | Yes | Yes | Yes |
| SPECIAL MOUNTING HOLES | Yes | Yes | Yes |
| REMOVE MOUNTING EARS | Yes | Yes | Yes |
| WELDED LEADS | Yes | Yes | Yes |
| SPECIALLY PLATED CASES | Yes | Yes | Yes |
| HEAVY DETENTS | | Yes | Yes |
| SOLDER GUARDS | | Yes | Yes |

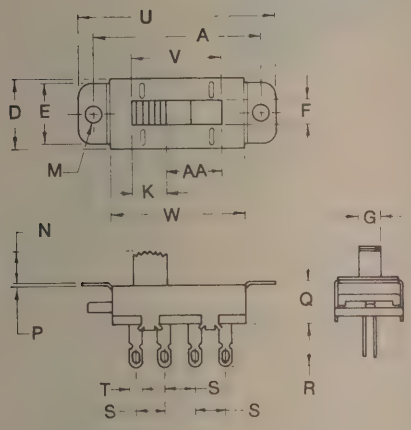
| Dim. | Inches | mm |
|---|---|---|
| A | 1.000 | 25.40 |
| B | .812 | 20.62 |
| C | .342 | 8.69 |
| D | .43 | 10.9 |
| E | .371 | 9.42 |
| F | .143 | 3.63 |
| G | .125 | 3.18 |
| H | .272 | 6.91 |
| J | .142 | 3.61 |
| K | .200 | 5.08 |
| L | .63 | 16.0 |
| M | .100 D | 2.54 D |
| N | .19 | 4.8 |
| P | .018 | 0.46 |
| Q | .26 | 6.6 |

TOLERANCES - PG. 4245

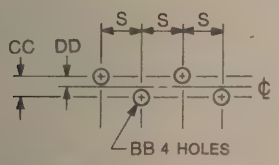


## SERIES S-91
## SINGLE-POLE, THREE-POSITION MINIATURE

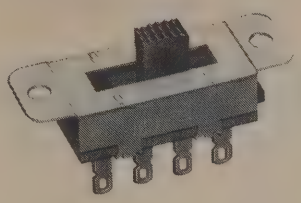
Ideal for applications such as "OFF-LOW-HIGH", "LOW-MED-HIGH". Maintained detent. Available to 3 amps.




### P.C BOARD LAYOUT

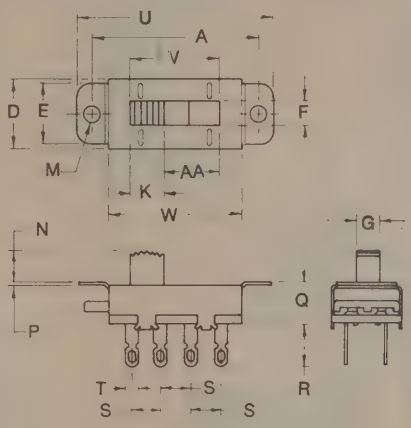



| 125 VAC UL & CSA RATING | PART NO. |
|---|---|
| Maintained Action | |
| 1 amp. | S-9113CD01-O |
| 3 amp. | S-9113CD03-O |

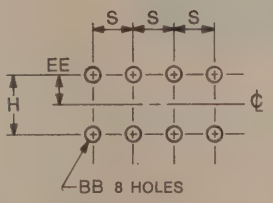


## SERIES S-91
## DOUBLE-POLE, THREE-POSITION MINIATURE

Switch isolated circuits to three modes with a single device. Available to 3 amps. One row of terminals is omitted for single pole spring return.

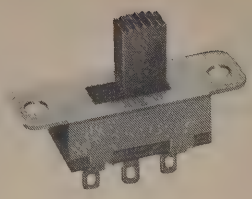



### P.C BOARD LAYOUT



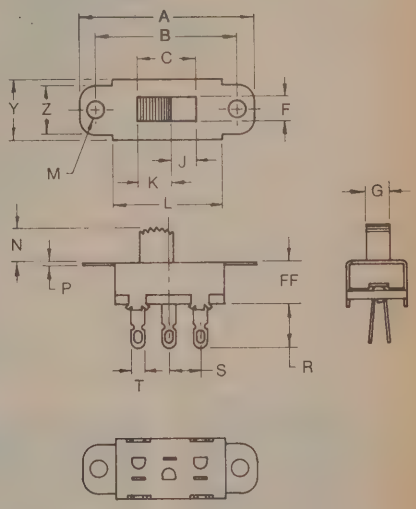

| 125 VAC UL & CSA RATING | PART NO. |
|---|---|
| 1 amp. | S-9123CD01-O |
| 3 amp. | S-9123CD03-O |
| †Spring-Return, both ends to center | S-9113SB00-C |
| †Spring-Return, one end to center | S-9113SC00-CE |

† Not Rated

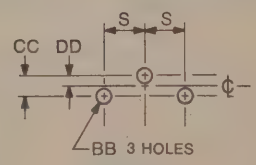


## SERIES S-98
## THE SKINNY MINI

Basic "ON-OFF" switch to meet the requirement for minimum switch space in cases where width is a prime consideration. For optional case style see page 20.




### P.C BOARD LAYOUT




| NO RATING | PART NO. |
|---|---|
| Single-Throw | S-9811CD00-O |
| Double Throw | S-9812CD00-O |

| Dim. | Inches | mm |
|---|---|---|
| R | .24 | 6.1 |
| S | .181 | 4.60 |
| T | .080 | 2.03 |
| U | 1.190 | 30.23 |
| V | .548 | 13.92 |
| W | .80 | 20.3 |
| X | .44 | 11.2 |
| Y | .35 | 8.9 |
| Z | .290 | 7.37 |
| AA | .348 | 8.84 |
| BB | .065 D | 1.65 D |
| CC | .095 | 2.41 |
| DD | .047 | 1.19 |
| EE | .136 | 3.45 |
| FF | .25 | 6.4 |

TOLERANCE

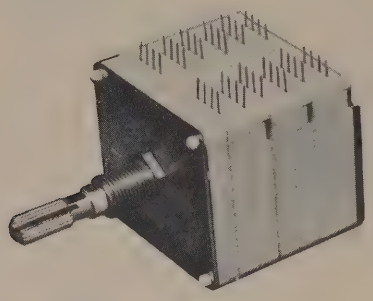
## OPTIONAL MODIFICATIONS — OPTIONS AND ACCESSORIES AVAILABLE

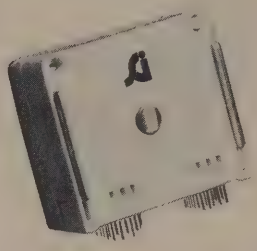
| | | | |
|---|---|---|---|
| Yes | Yes | Yes | ACTUATOR HEIGHTS |
| Yes | Yes | Yes | ACTUATOR COLORS |
| Yes | Yes | Yes | SPECIAL BASE MATERIALS |
| Yes | Yes | Yes | SPECIAL TERMINALS |
| Yes | Yes | | SPECIAL MOUNTING HOLES |
| Yes | Yes | Yes | REMOVE MOUNTING EARS |
| Yes | Yes | Yes | WELDED LEADS |
| Yes | Yes | Yes | SPECIALLY PLATED CASES |
| Yes | Yes | | HEAVY DETENTS |
| Yes | Yes | | SOLDER GUARDS |

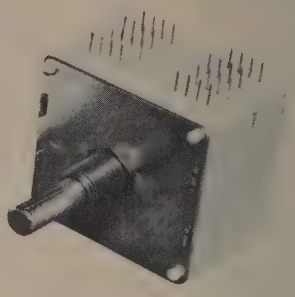
STACKPOLE
COMPONENTS COMPANY

## P/REL™ STANDARD GRIGSBY'S NEW PROGRAMMABLE ROTARY ENCODED LOGIC SWITCH

• Fully programmable up to 60 detent positions





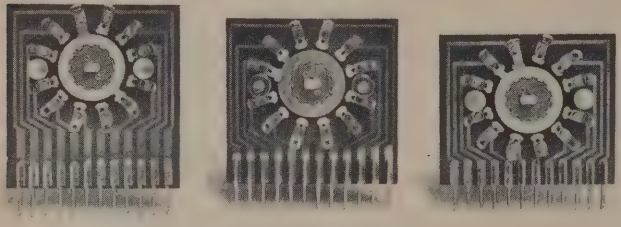


ELECTRICAL RATINGS

| | |
|---|---|
| Current Carrying Capacity | .25 amp @ 115 VAC |
| Resistive Load | .125 amp @ 115 AC |
| Contact Resistance | initial 0.10 ohm maximum |
| Insulation Resistance | 100 megohms |
| Dielectric Strength | 500 VAC minimum |
| Contact Life | 25K cycles of 720° (50K cycles of 360°) |

| | |
|---|---|
| Operating Force | 14 to 24 inch oz. standard |
| Temperature Ranges | -55°C to +85°C |
| Insulation | Molded Valox 310 |
| Programmable Disc Contacts | Plated Copper clad laminate Plated spring tempered material |
| Front Plate and Shaft | Cold rolled steel cadmium plated |
| Bushing | Brass, aluminum or die cast zinc |

## NEW SM-PCB ROTARY SWITCHES



• Three profile heights .625", .742", .875"

Current and Voltage Ratings: Resistive Load.
Brass silver plated, make and break:

| | |
|---|---|
| .550 amp at 28 VDC | .170 amp at 115 VAC RMS |
| 135 amp at 100 VDC | .8 amp at 24 VAC RMS |

Coin silver alloy, make and break:

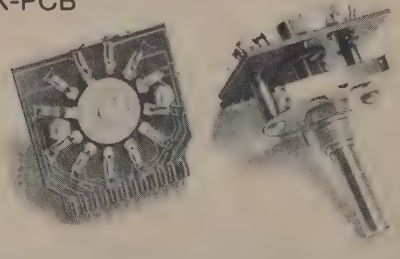
| | |
|---|---|
| 1.10 amp at 28 VDC | .335 amp at 115 VAC RMS |
| .27 amp at 100 VDC | 1.6 amp at 24 VAC RMS |

Current Carrying Capacity:
Brass silver plated - 2 amp Coin silver alloy - 2 amp

Dielectric Stength: 750 VAC between critical parts and ground.

Contact Resistance: (Path resistance not included).
Silver plated parts - average initial 5 milliohms.
Coin silver alloy parts - average initial 3 milliohms.

## SK-PCB



• Available in standard .875" profile height

Current and Voltage Ratings: Resistive Load.
Brass silver plated, make and break:

| | |
|---|---|
| 1.5 amp at 28 VDC | .230 amp at 115 VAC RMS |
| .22 amp at 100 VDC | 1.75 amp at 24 VAC RMS |

Coin silver alloy, make and break:

| | |
|---|---|
| .34 amp at 100 VDC | .450 amp at 115 VAC RMS |

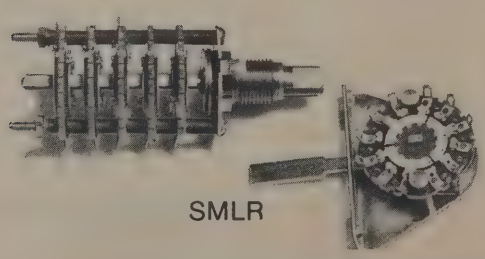
Current Carrying Capacity:
Brass silver plated - 2 amp, Coin silver alloy - 2 amp

Dielectric Strength: 750 VAC between critical parts and ground

Contact Resistance: (Path resistance not included)
Silver plated parts - average initial 3 milliohms.
Coin silver alloy parts - average initial milliohms.

## SUBMINIATURE TYPE ROTARY SWITCHES

• Available 1-6 Poles • 12 position 30° Throw



SMLR

Current and Voltage Ratings: Resistive Load.
Brass, silver plated, make and break:

| | |
|---|---|
| .550 amp at 28 VDC | .170 amp at 115 VAC RMS |
| .135 amp at 100 VDC | .8 amp at 24 VAC RMS |

Coin silver alloy, make and break:

| | |
|---|---|
| 1.100 amp at 28 VDC | .335 amp at 115 VAC RMS |
| .27 amp at 100 VDC | 1.6 amp at 24 VAC RMS |

Current Carrying Capacity:
Brass silver plated - 7 amp. Coin silver alloy - 9 amp

Dielectric Strength: 750 VAC between critical parts and ground.

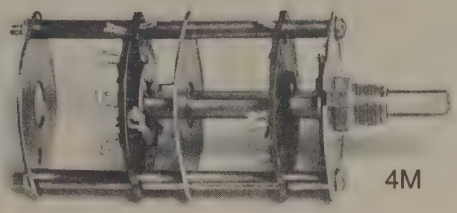
Contact Resistance: Silver plated parts - average initial 5 milliohms.
Coin silver alloy parts - average initial 3 milliohms.

# Standard Grigsby

# Rotary Switches

## SK, 4M, 42LR, 7M, 5M ROTARY SWITCHES

SK


4M

42LR

7M

5M

Current and Voltage Ratings: Resistive Load.
Brass, silver plated, make and break:

| | |
|---|---|
| 1.5 amp at 28 VDC | .230 amp at 115 VAC RMS |
| .22 amp at 100 VDC | 1.75 amp at 24 VAC RMS |

Coin silver alloy, make and break:

| | |
|---|---|
| 2.6 amp at 38 VDC | .450 amp at 115 VAC RMS |
| .34 amp at 100 VDC | 3.4 amp at 24 VAC RMS |

Current Carrying Capacity:
Brass silver plated - 9 amp. Coin silver alloy - 12 amp

Dielectric Strength: 1,000 VAC between critical parts and ground.

Contact Resistance: Silver plated parts - average initial 5 milliohms.
Coin silver alloy parts - average initial 3 milliohms.

New Dual Flex Detent™
added to 7M line

- 1 9/16" Detent
- Dual ball starwheel design for long life
- Positive indexing

## PB 400 PUSHBUTTON SWITCHES

Contact Resistance: (Contact + Path): Average initial less than 5 milliohms. Average after 25,000 cycles (no load) is less than 10 milliohms.

Insulation Resistance: Between adjacent terminals, also between terminals and chassis - greater than 7,500 megohms.

Current/Voltage Ratings: Resistive Load a.c. 40 watt/d.c. 15 watt.

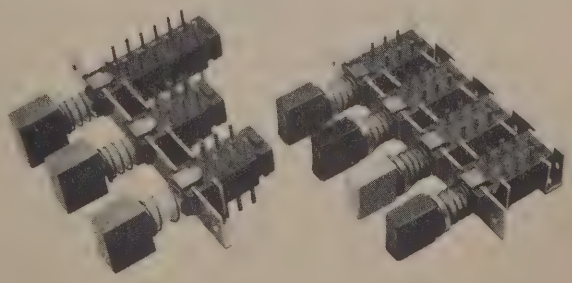
| | |
|---|---|
| 100 ma @ 150 VDC | 175 ma @ 250 VAC |
| 350 ma @ 125 VAC | 1.3 amp @ 28 VAC |

Current Carrying Capacity: 2 amp maximum

Voltage Breakdown: Between all terminals connected together and mounting chassis, also between adjacent terminals—1500 VAC minimum.

Switching Functions: 2, 4, 6 and 8 pole, double-throw, non-shorting.

A/C Switch Availability: A two pole double throw A/C switch, rated at 4A/250V can be included in the switching functions on any available switch chassis.

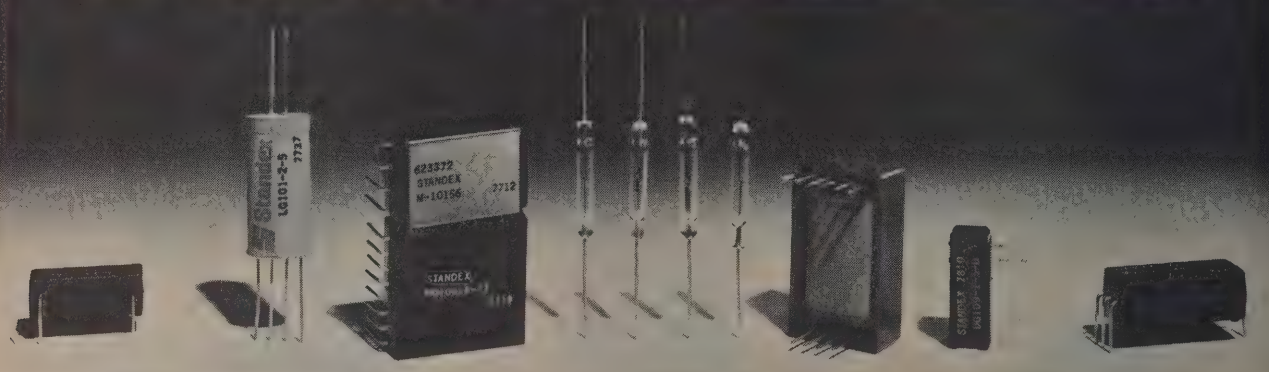


Standard Grigsby's Engineering Staff will answer any inquiries regarding your switch problems or switch design. Because our switches are custom built, it is necessary for us to know how you wish to combine your options and what circuitry is required. Your own drawings may be submitted or you may use our convenient layout sheets that are available without charge by contacting our Sales Office.

**standard grigsby, inc.**

Dept. 10D, 920 Rathbone Ave., Aurora, IL 60507 (312) 844-4300
TWX 910-232-3138

# FASTEST GROWING MANUFACTURER OF REED SWITCHES AND RELAYS.



## STANDEX REED RELAYS

| Series | Features | Part No. | Poles | Rated Coil Volts | Must Operate | Must Release | Coil Ohms |
|---|---|---|---|---|---|---|---|
| DG | • D.I.P. and S.I.P. (DG100 & DG109) | DG100-1-5 | 1 | 5 | 4.0 | .5 | 500 |
| | • Diode suppression | DG100-2-12 | 2 | 12 | 9.6 | 1.0 | 500 |
| | • Materials UL rated | DG109-1-5 | 1 | 5 | 4.0 | .5 | 500 |
| | | DG109-1-12 | 1 | 12 | 9.6 | 1.0 | 500 |
| JG | • Dust covered, self leaded | JG100-1-5 | 1 | 5 | 4.0 | .5 | 500 |
| | • 1.00 X .100 and 1.00 X .150 pin spacing | JG100-2-12 | 2 | 12 | 9.6 | 1.0 | 440 |
| | • Materials UL rated | JG102-3-6 | 3 | 6 | 4.0 | .5 | 85 |
| | | JG102-4-12 | 4 | 12 | 9.6 | 1.0 | 250 |
| LG | • Low cost | LG101-1-5 | 1 | 5 | 4.0 | .5 | 500 |
| | • Single and dual poles | LG101-1-12 | 1 | 12 | 9.6 | 1.0 | 500 |
| | • 1.00 X .100 pin spacing | LG100-1-5 | 1 | 5 | 4.0 | .5 | 500 |
| | | LG101-2-12 | 2 | 12 | 9.6 | 1.0 | 300 |
| MG | • Molded construction, self leaded | MG100-1-5 | 1 | 5 | 4.0 | .5 | 500 |
| | • 1.00 X .100 and 1.00 X .150 pin spacing | MG100-2-12 | 2 | 12 | 9.6 | 1.0 | 440 |
| | • Materials UL rated | MG102-1-6 | 1 | 6 | 4.0 | .5 | 125 |
| | | MG102-3-24 | 3 | 24 | 19.0 | 2.0 | 1360 |

## STANDEX REED SWITCHES S.P.N.O. (Form A)

| Switch Type | Operate A.T. | Glass Dia. X Lgth. In. | Power Cap. | Current Switch | Voltage Switching | Contact Resis. Max. | Break Volts Min. | Insulation Resis. Min. |
|---|---|---|---|---|---|---|---|---|
| GS125 | 30-62.5 | .125 X .780 | 10VA | 1 amp | 150 VDC (250 VAC) | .150 ohm | 350 VDC Min. | $10^{12}$ ohm |
| GR125 | 17.5-62.5 | | | | | | | |
| GS100 | 30-62.5 | .095 X .780 | 10VA | 1 amp | 150 VDC (250 VAC) | .150 ohm | 350 VDC Min. | $10^{12}$ ohm |
| GR100 | 17.5-62.5 | | | | | | | |
| GT200 | 50-200 | .210 X 2.20 | 50VA | 3 amp | 150 VDC (250 VAC) | .100 ohm | 500 VDC Min. | $10^{10}$ ohm |
| GT150 | 50-100 | .150 X .850 | 25VA | 1.5 amp | 150 VDC (250 VAC) | .150 ohm | 350 VDC Min. | $10^{10}$ ohm |
| GS560 | 30-42.5 | .090 X .560 | 10VA | 1 amp | 100 VDC (250 VAC) | .150 ohm | 250 VDC Min. | $10^{10}$ ohm |
| GR560 | 12.5-42.5 | | | | | | | |
| VS200 | 100-250 | .210 X 2.10 | 50VA | 0.005 amp | 7.5KV | .100 ohm | 10KV | $10^{10}$ ohm |

CONTACT MATERIAL: GS-Standalloy ***(copper/gold)*** GR-Rhodium GT-Tungsten VS-Optional

**Standex Electronics** a Standex company

4538 Camberwell Road, Cincinnati, Ohio 45209 • (513) 871-3777

Morley Road, Tonbridge, Kent, England • (732) 358398

# TAPESWITCH®

## PRESS-AT-ANY-POINT RIBBON AND MAT

# SENSING SWITCHES

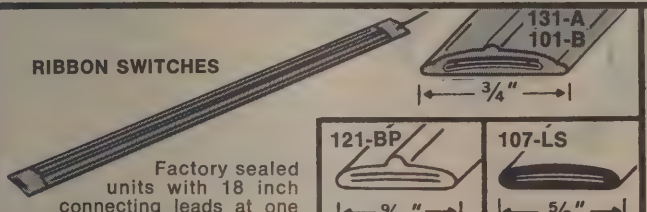
Tapeswitch products are proven in all industries. Patented construction withstands tons of force yet can close on light finger pressure. TAPESWITCHES are unexcelled for—*safety . . . automation . . . antiburglar systems . . . counting . . . timing . . . door control . . . light switching . . . machine control . . . material handling . . . seat switching . . . computer and console switching . . .* plus many other applications. TAPESWITCH RIBBON SWITCHES can be bought in the size and length needed.

**Features:** Inherently sealed. Self bottoming. **Press-at-any-point operation** eliminates linkages. All styles except flex-action switches can be coiled without shorting. Millions of impacts at one point.

**Rating:** All Tapeswitches are rated at more than 1 ampere, 117 VAC. However, for floor switching low voltage is recommended.

TAPESWITCHES are designed in accord with the best principles of switch and cable design, with jacketing and insulation meeting the requirements of MIL-C-9154 and MIL-I-631C respectively. Unique Fail-Safe circuitry is feasible with all Tapeswitches. See our Literature.

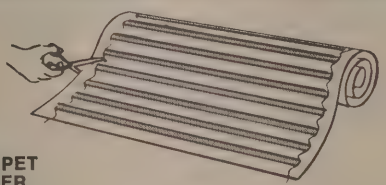
### RIBBON SWITCHES




Factory sealed units with 18 inch connecting leads at one end. Sensitivity: 8, 12, or 40 ounces finger pressure. Standard lengths: 1, 2, 5, 8, 10, 12, 15, 18, 20 ft. Double leads on order. See text at top.

### TAPESWITCH CONTROFLEX® SAFETY EDGES

Serve as cushioned sensing switches for the leading edges of doors, gate arms, machinery, presses, elevators, to stop or reverse the acting force. Numerous styles available. Double leads optional for Tapeswitch true "Fail-Safe" Circuit. Write or call for detailed literature.

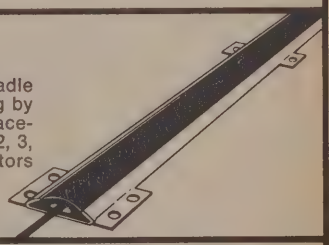


### PE-30 UNDER CARPET SWITCHING RUNNER

30 inches wide x 3½ inches thick 5ft., 25ft., 50ft. roll. Can be cut to any length from roll. For indoor use under carpeting. Excellent under plywood or tile. Parallel Tapeswitches between clear sheeting. Tinned wires for easy connections.

### RBMA ROAD SWITCH

Successful, rugged roadway treadle for counting, timing, controlling by vehicles. 7/16" thick. Sealed, replaceable switch element. Lengths: 2, 3, 5, 8, 10 ft. Cast iron end protectors available.

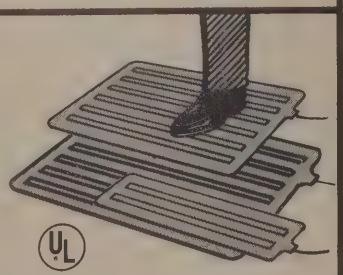


### TAPESWITCH RELAY R-1

FOR AC CONTROL WITH ANY TAPESWITCH. This plug-in unit has AC outlet sockets giving Normally **ON** or Normally **OFF** 117 Volts AC at 5 Amperes. Built-in low voltage transformer. Simultaneous action.

### CVP SWITCHING MATS

CVP style mats are durable flexible area switches for use exposed or under rubber mat or carpeting. UL listed for use in alarms. 3/32" thick. Available 6" x 23", 17" x 23", 23" x 35".



### POINT AND WAFER SWITCHES

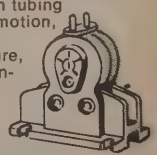
**NO-1 and NO-1R**—Rugged compact wafer switch. Normally Open. For under valuable objects or general purpose detection. 2 lb. nom. sensitivity.

**NC-3**—Normally closed detector switch. Opens when weight is lifted off. 2 lb. nom. sensitivity.

**NO-S**—1 ounce sensitivity wiping action. Super sensitive.

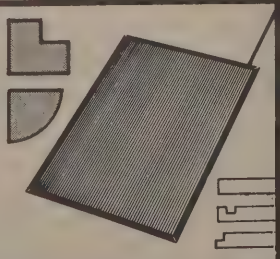
### SENSITIVE AIRWAVE SWITCH MODEL AW

High quality diaphragm switch, adjustable sensitivity. Operates from tubing squeeze, air motion, light vacuum, breath pressure, etc. Silver contacts. Many adjustment features.



### CKP & CRP HEAVY DUTY INDUSTRIAL SWITCH CARPET.

Both styles ½ inch thick with ramped edging. Sealed. Available any size or shape. Weatherproof. Standard sizes: 24" x 36", 30" x 30", 30" x 48", 36" x 48", 36" x 72". Optional features available.



### 111 CONTROFLEX® FOOTSWITCH

Rugged, low-profile sealed vinyl footswitch. Rated at 100 watts. Employs Controflex® in flat pad. Non tiring. Stand or jump on it. 2" x 5" x 3/8" 6 ft. lead wire. SPST N.O.

### 177 CONTROFLEX® HAND FLEX SWITCH

Innovation in hand controls. Rugged, sealed, compact. Hold in Palm and flex with thumb. 177 NO is **Normally Open.** 177 NC-3 is SPDT.

***CALL OR WRITE FOR OUR COMPLETE CATALOG C-5A***

## TAPESWITCH CORPORATION OF AMERICA

100 SCHMITT BLVD., FARMINGDALE, N.Y. 11735 • (516) 694-6312 • (212) 895-8713 • Telex: 144611

P.C.

# WE'VE GOTTEM!

## HEINEMANN
*Circuit Breakers*

WE STOCK - IN DEPTH - SERIES
JA, AM, CF & KD. MULTIPLES OF
FIVE AMPS; SINGLE, TWO & THREE POLE
SLOW AND FAST TIME DELAY, 60 Hz & DC.

**POCO SALES**

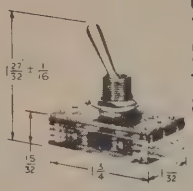
6311-F DE SOTO AVENUE
WOODLAND HILLS, CA 91367

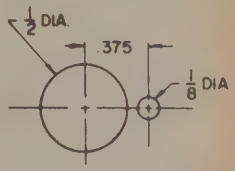
**(213) 999-2912** **TLX: 69-1603**

# T-bar SWITCHES for Multipole High Density Switching

## T-Bar Toggle Switches

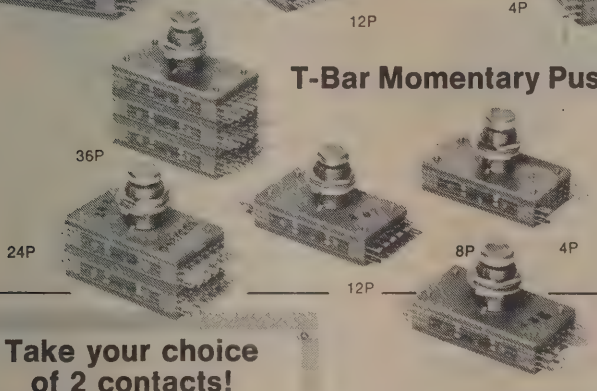
Switch from 4 to 144 circuits with one T-Bar Toggle Switch. Available in configurations of 4, 8, 12, 24, 36, 48, 72, 108 and 144 poles. For low level applications specify the 902 Series.



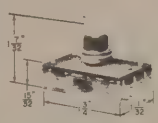



PANEL CUTOUT FOR TOGGLE AND PUSH-BUTTON SWITCHES

## T-Bar Momentary Push-Button Switches

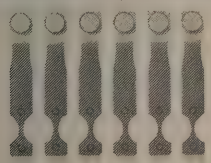



Switch from 4 to 36 circuits with one T-Bar Momentary Push-Button Switch. Available in configurations of 4, 8, 12, 24 and 36 poles.



## Take your choice of 2 contacts!

**800 SERIES**
**for reliable General Purpose Switching**



The 800 Series contact is a highly reliable gold-plated button contact. With its high contact pressure and positive wiping action, it is used in control type applications and in general purpose switching, such as relays, valves, lamps, etc. Contact Rating: up to 5 AMPS max.

**900 SERIES**
**for reliable Low Level Switching**

The 900 Series DATA-RITE™ contact has the reliability of a bifurcated contact with the added feature of two degrees of wiping action. The unique EDGE-TO-DOME contact guarantees a clean surface, which is critical for low level signals. The 900 Series is typically used in computer I/O signals; voice and data-grade communications; thermocouple and strain gauge outputs; all low level switching, whenever reliability is a premium, or whenever slight variations in contact resistance cannot be tolerated. Contact Rating: Microvolts up to 1 AMP max.

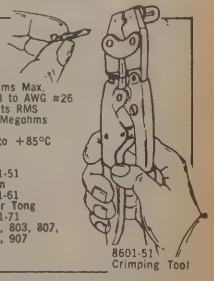
## SWITCH SPECIFICATIONS

| | |
|---|---|
| Contacts: | Series 800—general purpose gold plated<br>Series 900—low-level bifurcated gold plated |
| Contact Rating: | Series 800—5 amps max. resistive to 150 watts<br>Series 900—1 amp maximum resistive to 50 watts |
| Life Expectancy: at 20 CPM | Series 800—50,000 cycles<br>Series 900—50,000 cycles |
| Contact Resistance: | 20 milliohms typical |
| Ambient Temperatures: | —55° to plus 85°C |
| Terminals: | Mate with T-Bar Connectors |
| Dielectric Strength: | 1000 VRMS @ 60 cycles/sec. (higher available) |
| Insulation: | 5000 megohms min. (higher available) |

## T-BAR CONNECTORS

The T-Bar Series 88601 Connector has been specifically designed for use with T-Bar switches and relays. The connector contacts are crimp type which are snapped into a plastic insulator block. After installation, connectors are held in place against shock and vibration by use of a retaining clip.

| | |
|---|---|
| Current Carrying Capacity | 5 Amps |
| Contact Resistance | 5 Milliohms Max. |
| Wire Accommodated | AWG #18 to AWG #26 |
| Dielectric Strength | 1000 Volts RMS |
| Insulation Resistance | 100,000 Megohms Min. |
| Ambient Temperature | —55°C to +85°C |
| Weight | 0.3 Oz. |
| Recommended Tools | Crimper P/N 8601-51<br>Extraction P/N 8601-61<br>Connector Tong P/N 8601-71 |
| Use 88601 With | 801, 802, 803, 807, 901, 902, 907 |




## HOW TO ORDER

**1.** Specify Series **2.** Specify Number of Poles and Contact Form

Don't forget to order the mating T-Bar Series 88601 Connector! One for each 6 poles.

902 — 12 C

| SERIES | Application | No. of Poles | Contact Forms* |
|---|---|---|---|
| T-Bar® TOGGLE SWITCHES | | | |
| 802 | Gen. Purpose | 4 to 144 | "A" or "C" |
| 902 | Low Level | | |
| T-Bar® PUSHBUTTON SWITCHES | | | |
| 803 | Gen. Purpose | 4 to 36 | "A" or "C" |

*Form "A" — normally open contacts. Form "C" — double throw, break-before-make.

Manufactured under 1 or more of the following patents: 3206990, 3226508, 3689856.

®"T-Bar"—Reg. T.M.

T-bar INCORPORATED
SWITCHING COMPONENTS DIV.
141 Danbury Road, Wilton, Conn. 06897 • (203) 762-8351
Bob Paul -4944

# Tech labs
SINCE 1935

# SWITCHES AND ATTENUATORS

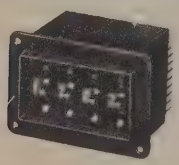
**TECH LABORATORIES, INC.**
DEPT. EM
BERGEN AND EDSALL BOULEVARDS
PALISADES PARK, N.J. 07650
TEL: (201) 944-2221

## SWITCHES

### SQUARE ROTARY SWITCHES

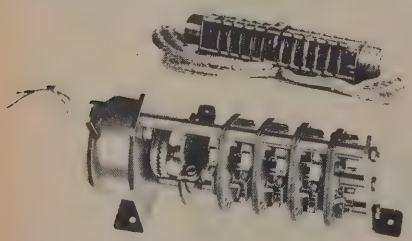
- 13 models available
- 1 5/16" sq. to 8" sq. x 15 decks (max.)
- 1 to 12 poles
- Up to 150 positions/pole
- Fixed stops or continuous rotation
- 3 amps at 120 VAC
  to 15 amps at 120 VAC
- Precious metal contacts

### THUMBWHEEL SWITCHES



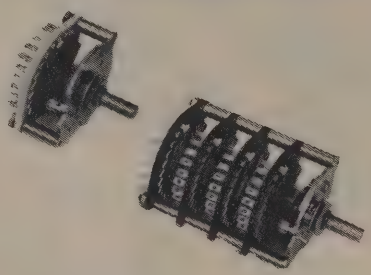
- Modular construction
- Compact
- Wide range of logic codes
- Positive detent
- Simple installation
- Two models available — Panelmite and Thumbmite

### REMOTELY CONTROLLED ROTARY SWITCHES



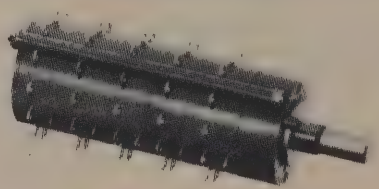
- All Tech Lab Switches can be supplied as stepping switches or continuous motor driven
- Solenoid drives
- Motor and Geneva drives
- Enercon AC incremental motor drive
- Available with interrupters or homing decks
- Completely pre-wired ready to install
- Hermetic sealing available
- May be remotely controlled by: Master-slave arrangement; Computer or other; External pulse
- Either AC or DC operation

### TYPE 2 ROTARY SWITCH

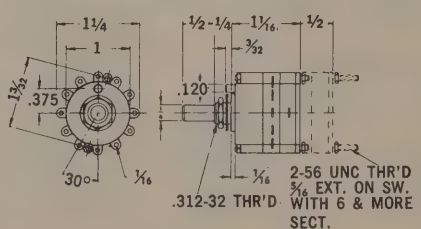


- Four insulation materials available
- 1 to 4 poles/deck
- Up to 24 positions/pole
- 2¼" x 1¾" x 24 decks (max.)
- Adjustable stops
- 5 amps, 120 VAC max.
- Precious metal contacts

### TYPE 3 ROTARY SWITCH



DIMENSIONS

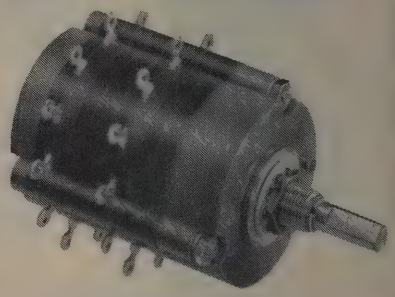



- Enclosed molding in diallyl phthalate
- Molded in terminals
- 1 or 2 poles/deck
- Up to 12 positions/pole
- 1¼" OD up to 8 decks (max.)
- Adjustable stops
- 12 amps, 28 VDC
- Precious metal contacts
- Mixed decks of shorting and non-shorting
- Mixed shorting and non-shorting contacts on each deck
- Choice of either ⅜-32 or 5/16-32 mounting bushing

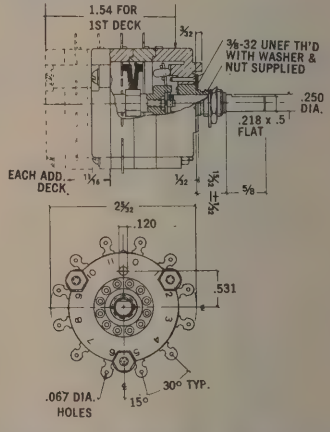
### SPECIALS

**Tech Labs can customize your Switch and Attenuator requirements, completely pre-wire your switches ready for installation. We can also undertake prototype design and manufacturing. Contact our factory for quotations.**

### ROTARY INSTRUMENT SWITCH SERIES 2000



- Extremely low contact resistance — <1 milliohm
- Extremely high insulation resistance — more than one million megohms
- Totally enclosed -- dust tight
- Long life — > one million
- 12 position/1-6 pole/deck max.
- Solid silver contacts
- External adjustable stops
- Shorting (MBB)




### SPECIAL DESIGN VARIATIONS

**SIX AND ELEVEN POSITION DETENTS**
The six position detent is 60° throw, skipping every other contact. The eleven position detent is 30° throw with the eleventh position omitted so that the detent goes 60° from position ten to position zero.

**OFFSET WIPERS**
30° and 180° offset wipers are available for use in special circuits.

**CAPACITANCE**
Less than 1 micromicrofarad between contacts or to ground.

**CURRENT CAPACITY**
5 amps maximum continuous duty.

**THERMAL EMF**
Extremely low. Silver contacts & brushes.

**VOLTAGE BREAKDOWN**
Withstands 1500V RMS between contacts and to ground.

**LOSSES**
Low electrical losses at frequencies up to several megacycles.

Tech labs
SINCE 1935

**TECH LABORATORIES, INC.**
DEPT. EM
BERGEN AND EDSALL BOULEVARDS
PALISADES PARK, N.J. 07650
TEL: (201) 944-2221

# TEC LAB 5 AMP 50 VDC TOGGLE SWITCHES

EQUIVALENT TO TORBAL 5 AMP

Tec Lab switches are available in many **combinations** of bushings, terminals, handles, housings and electrical styles.

The most widely used **combinations**, or **types**, are listed in the table below. These are coded with the outline drawings on this page so you can determine construction details and dimensions of the various parts of the switch.

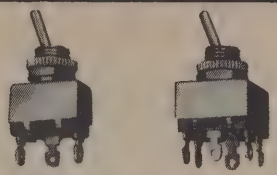
The SP-1, for example, has short bushing, solder terminals, long stem handle, single-pole housing and double-throw electrical style.

| Model Designation | Bushing A | Terminal B | Handle C | Housing D | Elec. E |
|---|---|---|---|---|---|
| SP-1 | 1 | 1 | 1 | 1 | 1 |
| SP-3 | 2 | 1 | 1 | 1 | 1 |
| SP-4 | 1 | 1 | 1 | 1 | 2 |
| SP-5 | 1 | 2 | 1 | 1 | 1 |
| SP-6 | 1 | 1 | 4 | 1 | 1 |
| SP-7 | 1 | 1 | 2 | 1 | 1 |
| SP-10 | 2 | 1 | 3 | 1 | 1 |
| SP-11 | 1 | 1 | 3 | 1 | 1 |
| SP-14 | 2 | 1 | 4 | 1 | 1 |
| DP-1 | 1 | 1 | 1 | 2 | 1 |
| DP-3 | 2 | 1 | 1 | 2 | 1 |
| DP-6 | 1 | 1 | 4 | 2 | 1 |
| DP-7 | 1 | 1 | 2 | 2 | 1 |
| DP-10 | 2 | 1 | 3 | 2 | 1 |
| DP-11 | 1 | 1 | 3 | 2 | 1 |

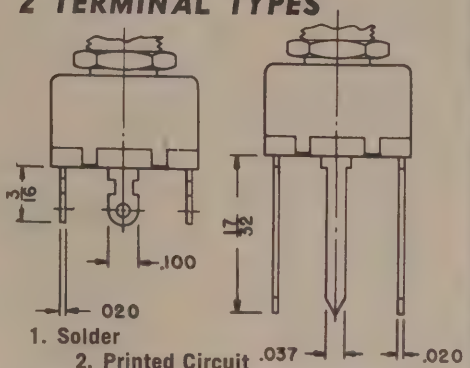
Generally, switch types not listed in this table can be made available. To specify the type desired in your inquiry, list the numerical style desired for each switch feature. Example, to specify switch having the following styles:

| | Block Letter | Style No. |
|---|---|---|
| **Bushing, long** | **A** | **2** |
| **Terminal, printed circuit** | **B** | **2** |
| **Handle, ball end, long** | **C** | **4** |
| **Housing, single-pole** | **D** | **1** |
| **Electrical, double-throw** | **E** | **1** |

**Specify A2 — B2 — C4 — D1 — E1**



## 2 TERMINAL TYPES




1. Solder
2. Printed Circuit

## APPLICABLE MIL SPEC

MIL-S-3950 MS-75028 MS-75029

## MATERIAL SPEC

- **Base**
  Rogers RX-600
  Phenolic Glass Fiber
- **Housing and Mounting Bushing**
  One-piece casting of Duronze III — corrosion proof
  Conforms to QQ-M-151 & AN-QQ-S-91
- **Contacts**
  Fine silver-gold plated

## OPERATING CHARACTERISTICS

- **Insulation Resistance**
  Greater than 100,000 megohms at 100 VDC and 70°F
- **Dielectric Strength**
  At sea level 1,000V rms at 60 cps for 1 min.
- **Contact Resistance**
  Initial — less than .010 ohms
- **Contact Rating**

| DC Load Inductive | AC Load Inductive |
|---|---|
| **28V** | **125V** |
| 5 amp | 5 amp |

- **Temperature Range**
  −55°C to 85°C
- **Vibration Endurance**
  10 to 2,000 cps per MIL-R-25018
- **Shock Endurance**
  75G
- **Contact Chatter**
  10 microseconds or less MIL-R-5757
- **Corrosion Resistance**
  of complete assembly 50 hrs per QQ-M-151
- **Mechanical Endurance**
  100,000 cycles switching 10 amp. 50 VDC resistive load

# ATTENUATORS

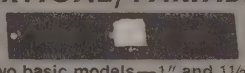
## ROTARY/VARIABLE

- Five basic models — 1⅞" to 3" dia.
- All circuit configurations
- Wide range of impedance
- Available with detents, tapers and cueing
- Aluminum anodized can
- Precious metal contacts
- Up to 45 steps
- Audio, video and RF

## FIXED ATTENUATORS

- Two basic models
- Standard circuits "T" and Bridged "H" — others available
- Octal plug-in base available
- Up to 80 db loss
- Many impedance available

## VERTICAL/VARIABLE



- Two basic models — 1" and 1½" wide
- Many circuit configurations available
- Wide range of impedance
- Available with detents, tapers and cueing
- Black anodized escutcheon plate
- Precious metal contacts
- Up to 30 steps

## PRECISION ATTENUATORS

TYPE 11T AND 11H PRECISION ATTENUATORS — DC to 10 MHz*

- Circuit: "T" or Balanced "H"
- Impedance: 50 to 600 ohms, as specified
- Resistor Accuracy: ±0.1% or better
- Accuracy: ±0.1 db to 200 KHz (overall) ±0.6 db to 2 MHz
  Lower values of loss, essentially flat to 10 MHz

| Type No. | Circuit | db Range | db/ Step | Dimensions |
|---|---|---|---|---|
| 11-T | "T" | 111 | 0.1 | 5¼"x19"x5" |
| 11-H | Bal. "H" | 111 | 0.1 | 5¼"x19"x10" |

* On Low Impedance Units, Lower Losses Usable to 100 MHz.

TYPE 850T AND 850H FOR THE AUDIO RANGE

- Circuit: "T" or Balanced "H"
- Impedance: 600/600 ohms unless specified — Other values to order
- Range: 2 dial unit gives 93 db in 0.1 db steps: 3 dial unit gives 111 db in 0.1 db steps
- Terminals: Telephone type jacks for input and output — Solder terminals provided on rear for permanent connections: Insertion of plugs into jacks lifts rear connections
- Accuracy: Resistors adjusted to ±0.1% excepting low values of loss are ±.25%

AMF
4105 PEMBROKE ROAD
HOLLYWOOD, FLORIDA 33021
PHONE: (305) 981-1211
TWX: 510-954-9810

# UID Electronics Division

# BASIC SLIDE SWITCHES

### GENERAL DESCRIPTION

This complete line of compact slide switches offers quality switching where space is at a premium. UID's simple, trouble-free design assures long service under extreme conditions. A thorough contact wipe provides uniformly low contact resistance throughout the life of the switch. Both UL and CSA listings, including fire retardant T.V. rated switches, are maintained; special ratings can be obtained if warranted.

### CONSTRUCTION

UID slide switches are designed to be versatile to meet the varied mounting and terminal types desired. Standard plain mounting holes, extruded, extruded and tapped, twist tab, and plug-in mounting with variations, are manufactured daily for thousands of applications.

Terminals (solder lug, printed circuit, half terminal, wire wrap, and quick connect) are adequately spaced for easy connection.

### APPLICATIONS

Computers, electronic test equipment, electric tools, battery chargers, organs, home appliances, home entertainment equipment, and thousands of similar products incorporate UID switches. Custom switches to meet special applications are a favorite challenge to UID's engineering design department.

### EXAMPLE AND ORDERING CODES

| Product | Current Rating | Contact | Actuation | Mounting | Terminal | Button Colors | Button Heights | Extra Features |
|---|---|---|---|---|---|---|---|---|
| SW | 10 | 12 | SD | OO | F | B1 | OO | SG |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

### ORDERING CODES

1. **Product:**
   SW – Slide Switch
   ST – Snap Switch – Fig 10 only
   STV – TV Rated Slide Switch
2. **Current Rating:**
   00 – UL not required
   01 – TV 1 Rated
   02 – TV 2 Rated (SP only)
   03 – 3 Ampere – 125 VAC
   04 – 4 Ampere – 125 VAC
   05 – 5 Ampere – 125 VAC (SP only)
   06 – 6 Ampere – 125 VAC
   75 – 7.5 Ampere – 125 VAC (SP only)
   10 – 10.1 Ampere – 125 VAC (SP only)
   11 – 11 Ampere – 125 VAC
3. **Contact Arrangement:**
   11 SPST 21 DPST 31 TPST 41 4PST
   12 SPDT 22 DPDT 32 TPDT 42 4PDT
   13 SPTT 23 DPTT 33 TPTT 43 4PTT
   24 DP4T
4. **Actuation:**
   SD – Standard Detent
   ND – No Detent (Smooth Actuation)
   SR – Spring Return (2 position)
   SRO – Spring Return from One Side to Center (3 position)
   SRC – Spring Return from Both Sides to Center (3 position)
5. **Mounting:**
   00 – Standard
   TT – Twist Tab Mounting
   PI – Plug in Mounting
   SO – Side Operated
   PP – Push-Pull
6. **Terminal:**
   S – Solder (Standard)
   A – Long Printed Circuit
   F – Faston .110
   H – Half Solder
   P – Printed Circuit
   W – Wire Wrap
7. **Button Colors:**
   B1 – Black
   Other colors available. Consult factory
8. **Button Heights For Standard Knobs**
   00 – 11/32" (Standard)
   Other sizes available. Consult factory
9. **Extra Features:**
   NB – Notched Terminal Board (for Nylon Terminal Cover)
   SG – Solder Guard (Assembled on Switch)
   GP – Gold Plated Contacts and Terminals .000035
   GF – Gold Flash Contacts and Terminals
   PN – Your Part Number Stamped on Shell
   T4 – Extruded and Tapped for 4-40 Screw
   T6 – Extruded and Tapped for 6-32 Screw

### MATERIAL:

**Housing**
– Zinc-plated steel .025" thick (std.) Cadmium, black oxide, and other platings are available to customer specifications.

**Terminal Board**
– XP laminate phenolic (Std.). Flame retardant or other special grades available.

**Mounting Holes**
– .136 – .140 dia. plain (std.). Extruded not tapped, extruded and tapped for 4-40 and 6-32 screws available.

**Button Length**
– 11/32" (std.) Others available.

**Button Color**
– Black (std.)
A spectrum of colors can be supplied. Button markings to meet customer specifications are available.

**Button Material**
– Phenolics and nylon.

**Contacts**
– Silver-plated bronze (std.)
Silver laminate on bronze and gold flash over silver plating are available.

**Terminals**
**Solder**
– Silver-plated copper (std.)
**Faston**
– Silver-plated copper (std.) Accepts Amp. no. 42068-1
**Wire-Wrap**
– Silver-plated brass (std.)
**Printed Circuit**
– Silver-plated copper (std.)

**Terminal Shields**
– Nylon snap-on

**Solder Guard**
– Available for all solder lug terminals

### SPECIAL FEATURES:

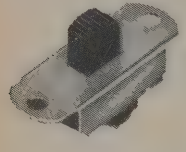
– Stamped part number.
– Various mounting arrangements and mounting plates.
– Glamour caps for buttons.
– Wire leads attached.
– A multitude of variations from standard construction.

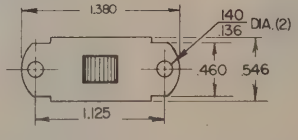
### ELECTRICAL DATA

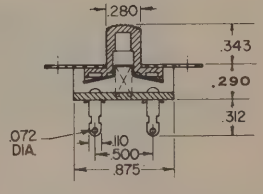
**Contact resistance (initial) – .005 ohms (max.)**
**Dielectric withstanding voltage – 1200V RMS**
**Underwriters Laboratories and Canadian Standard Associates Listings – as stated.**

## SW-311-M

SINGLE POLE – SINGLE THROW
MOMENTARY NORMALLY OPEN

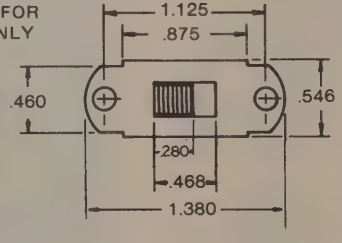


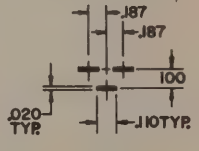


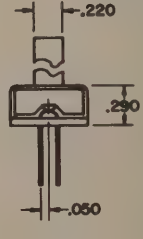



## SW-1012

3/16" TERMINAL SPACING FOR
F and H TERMINAL ONLY



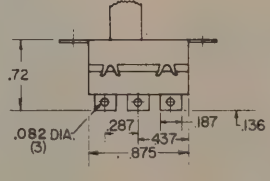



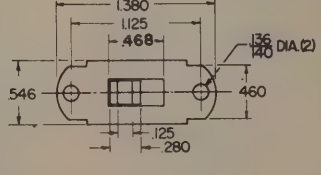



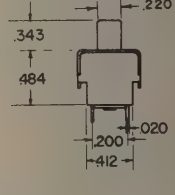

OTHER AMPERAGE RATINGS AVAILABLE

## ST-612

SINGLE POLE – DOUBLE THROW






Designed to meet European specifications.

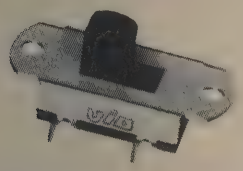
FOR ADDITIONAL AMF SWITCH PRODUCTS REFER TO RCL DIVISION PAGES 4230 - 4239

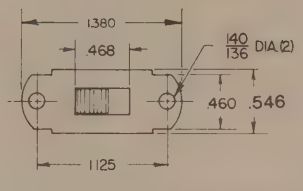
AMF
4105 PEMBROKE ROAD
HOLLYWOOD, FLORIDA 33021
PHONE: (305) 981-1211
TWX: 510-954-9810

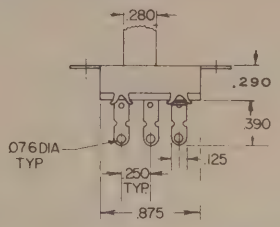
# UID Electronics Division

## BASIC SLIDE SWITCHES

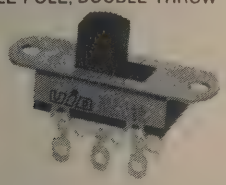
### SW-612-SR
SINGLE POLE – DOUBLE THROW
SPRING RETURN

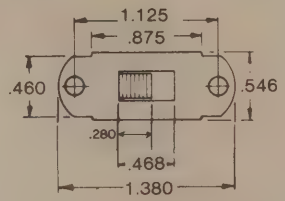


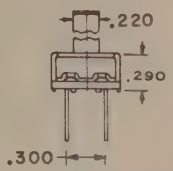


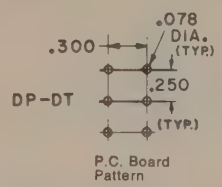



### SW-622
DOUBLE POLE, DOUBLE THROW

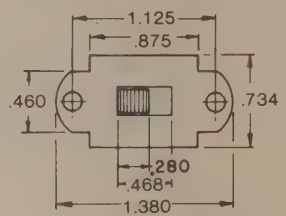


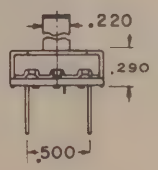


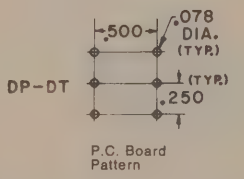



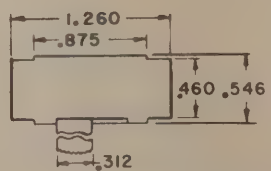

### SW-622-SR
DOUBLE POLE, DOUBLE
SPRING RETURN

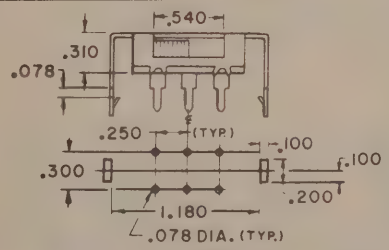


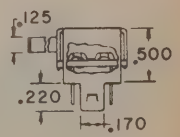



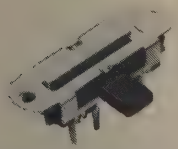

### SW-622-SOP
DOUBLE POLE, DOUBLE THROW
SIDE OPERATED

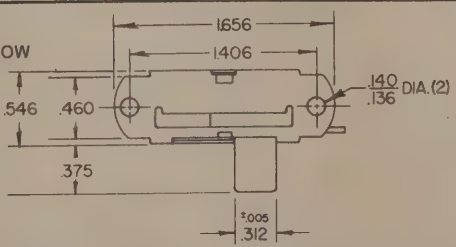


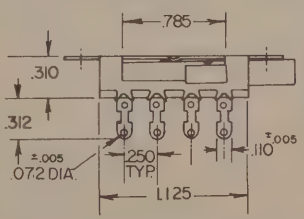



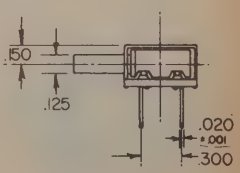




### SW-323-SO
DOUBLE POLE – TRIPLE THROW
SIDE ACTUATED

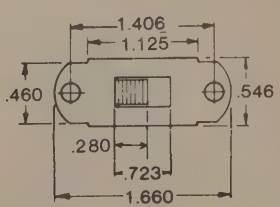


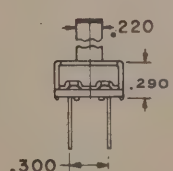


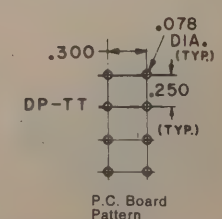




### SW-623
DOUBLE POLE, TRIPLE THROW



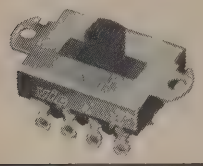

FOR ADDITIONAL AMF SWITCH PRODUCTS REFER TO RCL DIVISION PAGES 4230 - 4239

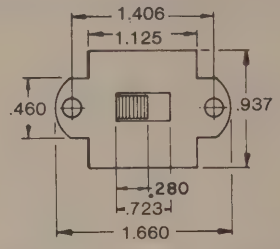
AMF
4105 PEMBROKE ROAD
HOLLYWOOD, FLORIDA 33021
PHONE: (305) 981-1211
TWX: 510-954-9810

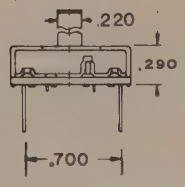
# UID Electronics Division

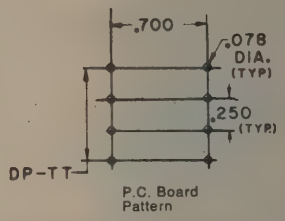
## BASIC SLIDE SWITCHES

### SW-623-SRC
DOUBLE POLE, TRIPLE THROW
SPRING RETURN (SRC)

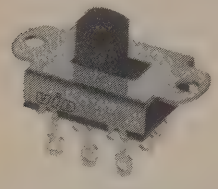


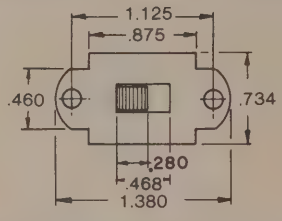


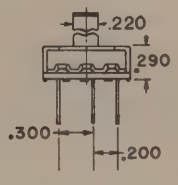



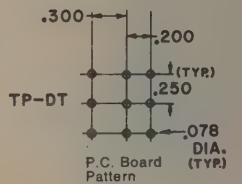




### SW-632
TRIPLE POLE, DOUBLE THROW

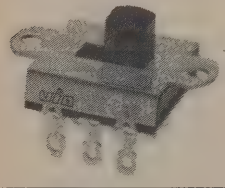


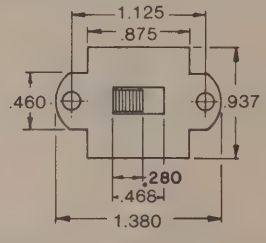


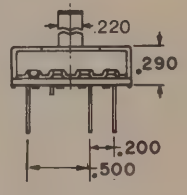



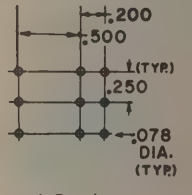




### SW-632-SR
TRIPLE POLE SPRING RETURN

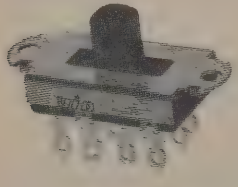


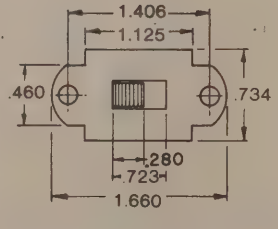


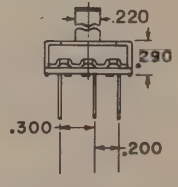



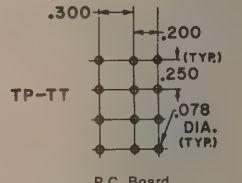




### SW-633
TRIPLE POLE, TRIPLE THROW

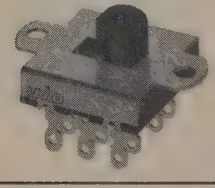


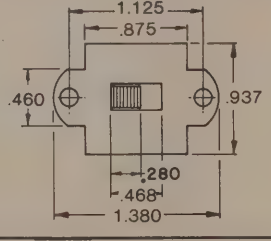


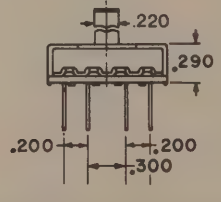



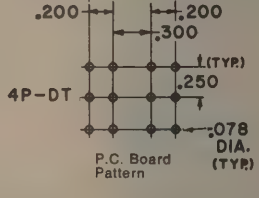




### SW-642
FOUR POLE DOUBLE THROW

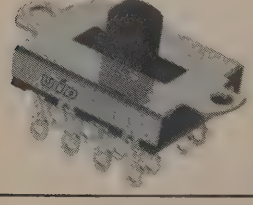


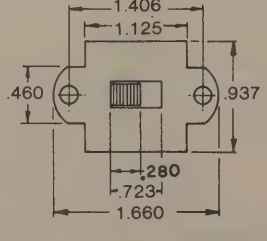


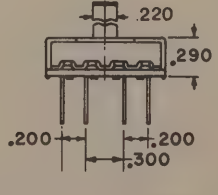



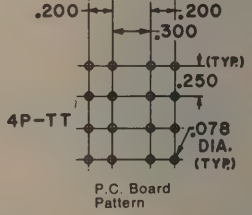




### SW-643
FOUR POLE TRIPLE THROW






FOR ADDITIONAL AMF SWITCH PRODUCTS REFER TO RCL DIVISION PAGES 4230 - 4239

AMF
4105 PEMBROKE ROAD
HOLLYWOOD, FLORIDA 33021
PHONE: (305) 981-1211
TWX: 510-954-9810

# UID Electronics Division

# ROCKER SWITCHES

### GENERAL DESCRIPTION

UID Electronics offers UL and CSA light and heavy duty rocker switches for today's fashionable products. Automated production enables uniform premium quality across the line. Styled molded actuators in a spectrum of colors enhance the switches. Beautifully metalized rockers can be had on all types. Single and two piece steel housings provide numerous mountings to meet custom requirements. The thorough wiping contact guarantees extremely low contact resistance to meet advanced circuit switching specifications. A selection of terminals insure the proper choice for the most economical connection to UID Rocker Switches. For a solution to your switching problems, contact UID direct or through your nearest field sales office.

UID's dependable Rocker Switches incorporate heavy duty plastic actuators in standard colors as well as custom blended shades. Switches are available in single or two-piece housings, and with several plastic actuator configurations to meet customer requirements. Long life and uniformly low contact resistance are assured by silver-plated terminals and contacts.

### SPECIAL FEATURES:

Rocker switches are available with:

- Various stampings on the rocker button.
- Custom rockers in multiple hues to enhance modern designs
- Color-coded leads extending from terminals for accurate, economical connection.
- A switch to meet almost any requirement.

### ELECTRICAL DATA

- Contact resistance (initial) - 0.005 ohms (max.)
- Dielectric withstanding voltage - 1200V RMS
- Underwriters' Laboratories and Canadian Standard Association - as stated.

### APPLICATIONS

UID Rocker Switches are finding ever increasing use in industrial control panels, appliances, home entertainment systems, and a host of other modern products.

### MATERIAL:

**Housing**
- Zinc plated steel 0.025" thick – (Standard) Cadmium, black oxide, and other platings are available

**Rocker**
- Cycolac in color and plateable grades

**Terminal Board**
- XP laminate phenolic (Std.). Flame retardant or other special grades available.

**Mounting holes**
- 0.136 - 0.140 diameter, plain round standard Extruded not tapped, extruded and tapped for 4-40 and 6-32 screws available

**Contacts**
- Silver-plated (Std.), Silver laminate, gold-flashed, or gold plating over copper, bronze, phosphor bronze, and other contact base metals are offered to meet specific requirements.

**Terminals**
- Solder terminal - provided unless otherwise specified. Two holes provide easy wire insertion for rapid soldering. 0.110 and 0.125 wide to accept AMP No. 42470-1 (loose piece) or 42068-1 (strip) and AMP Faston Connector Series 110 or equivalent.

  Wire wrap (WW)
  Silver-plated brass.
  Printed circuit (PC)
  Silver-plated copper or brass.
  Half terminal (HT)
  Silver-plated copper or brass.
  Long printed circuit (AP)
  Silver-plated brass

**Terminal shields** – For SPDT, DPDT, TPDT only
- Snap-on nylon box shield completely covers all exposed terminals, (specify notch terminal board on switch.)

**Solder guard**
- Fish paper protector against excessive solder and flux flow.

### EXAMPLE AND ORDERING CODES

| Product | Current Rating | Contact Arrangement | | Actuation | Mounting | Terminal | Rocker Color | Rocker Type | Extra Features |
|---|---|---|---|---|---|---|---|---|---|
| R S W | 0 4 | 1 2 | – | S R C | – G G | – S | – B 1 | B K | S G T 4 |
| 1 | 2 | 3 | | 4 | 5 | 6 | 7 | 8 | 9 |

### ORDERING CODES

**1. Product:**
RSW - Rocker Switch
RTV - TV Rated Rocker Switch

**2. Current Rating:**

| | | |
|---|---|---|
| 00 | UL not required | |
| 01 | TV 1 Rated | |
| 02 | TV 2 Rated (SP only) | |
| 04 | 4 Ampere | 125 VAC |
| 05 | 5 Ampere | 125 VAC (SP only) |
| 06 | 6 Ampere | 125 VAC |
| 07 | 7 Ampere | 125 VAC (SP only) |
| 10 | 10.1 Ampere | 125 VAC (SP only) |

**3. Contact Arrangement:**

| | | | |
|---|---|---|---|
| 11 - SPST | 21 - DPST | 31 - TPST | 41 - 4PST |
| 12 - SPDT | 22 - DPDT | 32 - TPDT | 42 - 4PDT |
| 13 - SPTT | 23 - DPTT | 33 - TPTT | 43 - 4PTT |

**4. Actuation:**

| | |
|---|---|
| SD | Standard Detent |
| ND | No Detent (Smooth Actuation) |
| SR | Spring Return (2 position) |
| SRO | Spring Return from One Side to Center (3 position) |
| SRC | Spring Return from Both Sides to Center (3 position) |

**5. Mounting:**

| | |
|---|---|
| BB | 1.312" Mtg. Centers 1.562" Overall - 2 Pos. |
| HH | 1.500" Mtg. Centers 1.750" Overall - 3 Pos. |

Other mountings available Consult factory

**6. Terminal:**

| | |
|---|---|
| S | Solder (Standard) |
| A | Long Printed Circuit |
| F | Faston .110 |
| H | Half Solder |
| P | Printed Circuit |
| W | Wire-Wrap |

**7. Rocker Color:**
(Not to be construed as stocked items)

| UID No. | | MARBON NO. |
|---|---|---|
| B1 | Black | STD 4500-66 |

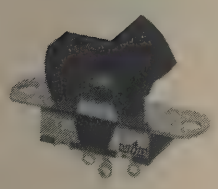
Other colors available Consult factory

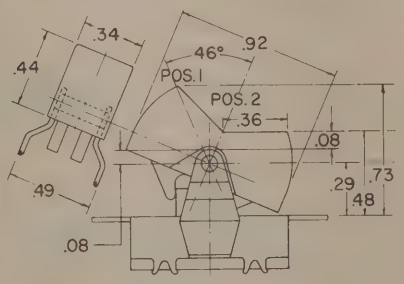
**8. Rocker Type:** **Shells Available:**
BK Standard 2 & 3 Pos... 2 Pos. AA, BB, B1, CC, DD, EE, FF
3 Pos. HH, GG, JJ

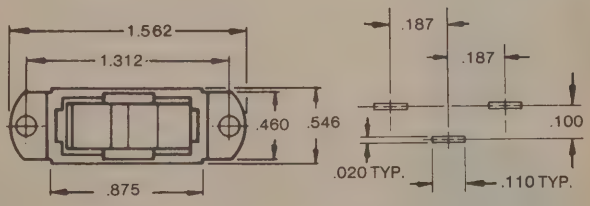
Other types available. Consult factory

**9. Extra Features**
NB Notched Terminal Board (for Nylon Terminal Cover)
SG Solder Guard (Assembled on Switch)
GP Gold Plated Contacts and Terminals .000035
GF Gold Flash Contacts and Terminals
PN Your Part Number Stamped on Shell
SA Snap Action Feature (2 Pos. Only)
T4 Extruded & Tapped for No. 4-40 Machine Screw
T6 Extruded & Tapped for No. 6-32 Machine Screw

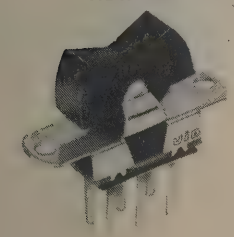
### RSW-1012

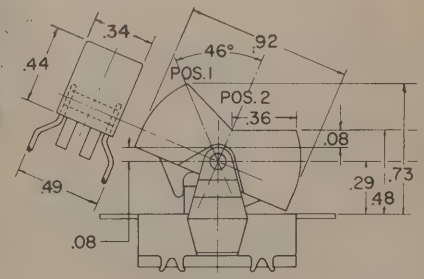


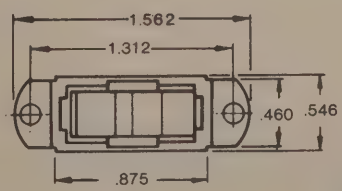


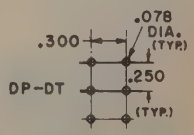




### RSW-622





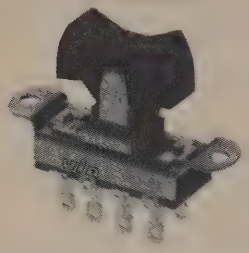

FOR ADDITIONAL AMF SWITCH PRODUCTS REFER TO RCL DIVISION PAGES 4230 - 4239

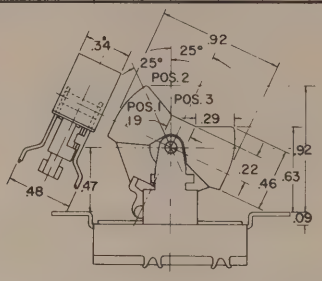
AMF
4105 PEMBROKE ROAD
HOLLYWOOD, FLORIDA 33021
PHONE: (305) 981-1211
TWX: 510-954-9810

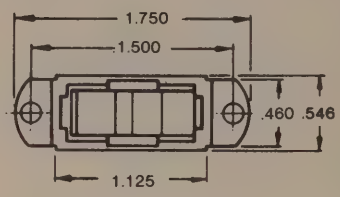
# UID Electronics Division

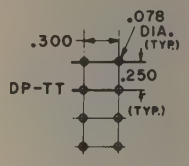
## ROCKER SWITCHES

### RSW-623-SRC

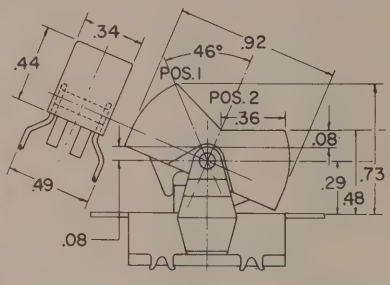


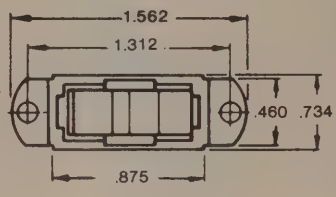


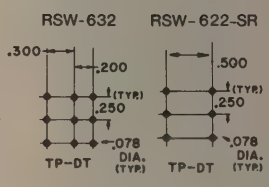



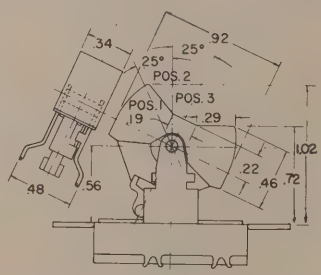

### RSW-632
### RSW-622-SR

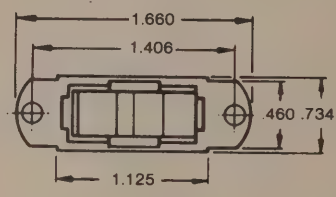


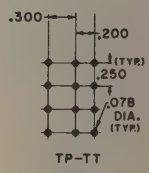



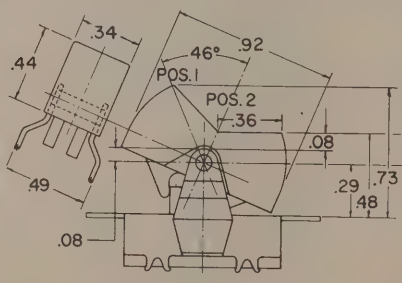

### RSW-633

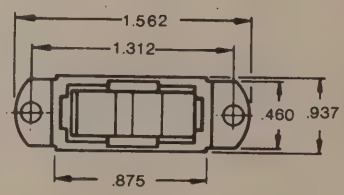


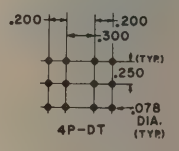



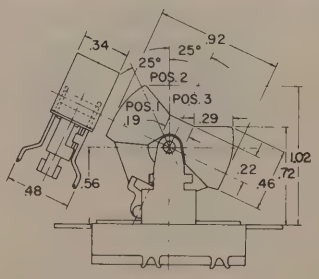

### RSW-642
### RSW-632-SR

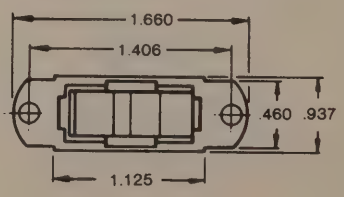


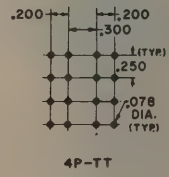




### RSW-643




FOR ADDITIONAL AMF SWITCH PRODUCTS REFER TO RCL DIVISION PAGES 4230 - 4239

AMF
4105 PEMBROKE ROAD
HOLLYWOOD, FLORIDA 33021
PHONE: (305) 981-1211
TWX: 510-954-9810

# UID Electronics Division

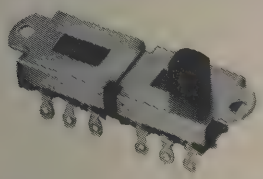
## CUSTOM MADE SWITCHES

The custom capabilities of UID are limited only by the imagination of design engineers. Illustrated are some of the many types of special configurations and modifications already designed and produced to solve specific engineering problems.

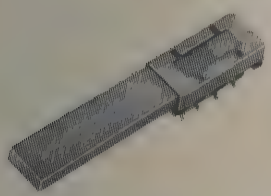
Our highly trained and experienced staff of engineers is ready to assist you in any way possible.

### SLIDE SWITCHES

Inexpensive control for intercoms and other communication equipment is available with this standard DPDT printed circuit mounted switch with offset shell.



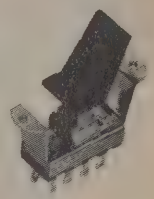
T.V. service switch – standard 6 PDT slide switches.



TV color test functions are simplified by specifying UID push-pull switches. Shown is a DPTT printed-circuit mounted push-pull switch.

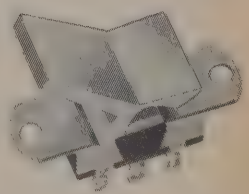
### ROCKER SWITCHES

Type "L" paddle rocker switch DPTT with "G" offset shell allows direct panel mounting without special offset hardware.



Multiprocessor control switches for computers take on a custom look with this large DPDT "M" style rocker switch, capable of logic circuit type switching.

The contemporary look is in with this standard "L" style rocker available in a wide spectrum of ABS colors.



### PUSH BUTTON SWITCHES

Solenoid-release push button switch with interlock and positive lock out features. Solenoid can be mounted on switch or separately.

Enclosed push button switch with integral PC board for insertion into an edge connector.

## NEW SWITCHES

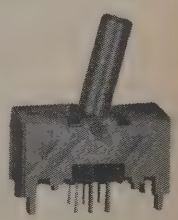
UID constantly introduces new types of switches to maintain our leadership in the field. Here are a few of our more popular recent additions.

### 1'' PUSHBUTTON SWITCHES

Designed for vending machines, photocopiers, & home entertainment products. Can be used in many other applications requiring a single-pole, normally open, momentary switch. Easy connection via faston connectors to our 3/16" tab terminals.

### MINIATURE SWITCHES

Miniature switches designed as direct replacements for ALPS or ALCO. PC board mountings for greater stability.



### MINIATURE TOGGLE SWITCHES

Included in the line are single, double, triple and four pole versions, with variations of terminals and toggle handles available. Locking ring, lock washer, and two hex nuts included with each unit.

### MINIATURE TRIPLE THROW SLIDE SWITCHES

Single pole construction incorporates highly successful dual wipe and ball and spring contact. Available with or without mounting ears.

FOR ADDITIONAL AMF SWITCH PRODUCTS REFER TO RCL DIVISION PAGES 4230 - 4239

# UNIMAX: BETTER SWITCHING SOLUTIONS

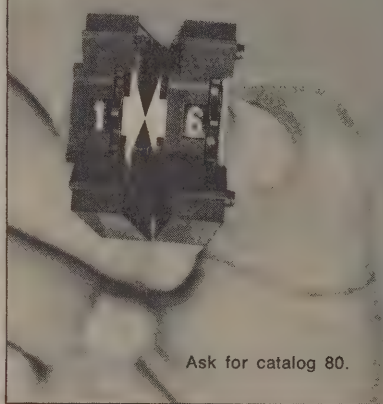
## Lighted Pushbutton Switches

Ask for Catalog LPB

In a field full of appearance quality/performance switching variables, Unimax switches are the ones that *show* you care about quality, performance and price.

- *Single Lamp*—Round, square or rectangular, lighted and unlighted, momentary or alternate switching. 1-4 poles.
- *Dual Lamp*—Rectagular and square, double pole, momentary or alternate action. 5A @ 250VAC or 28 VDC. Keylock versions.
- *Four Lamp*—Multi-switch configurations. Approved to MIL-S-22885/9-12. Also meets high-shock requirements of MIL-S-910C.
- *Oil-Tight*—Pilot, lighted, unlighted, emergency, key-operated rotary types. 500V @ 10A ratings.

## they SNAP together!



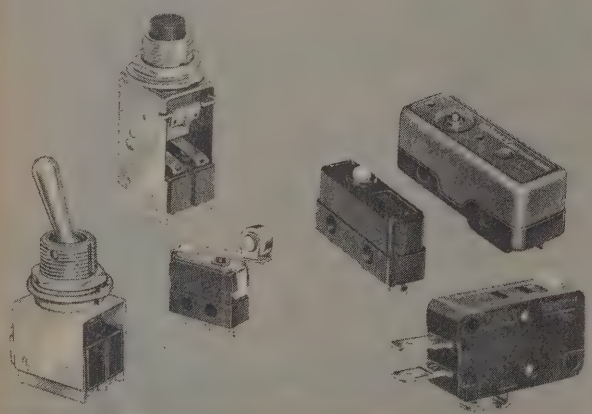
Ask for catalog 80.

**"No Hardware" Digital Thumbwheel Switches**

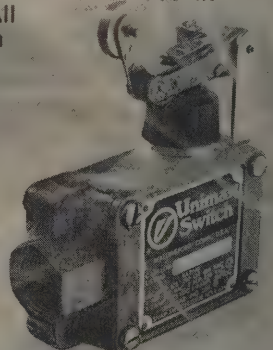
- No assembly hardware required
- Large selection of output codes on standard models
- Built-in logic standard on "Smart Switches"
- Either Snap-in front, or rear hard mount
- Matte finish standard
- Only 5 parts per switch
- Standard .315" (8mm) width
- Removable stop pins

The industry's widest selection of precision, general purpose, miniature and sub-miniature snap-action switches, as well as toggle and push-button switch assemblies. Ratings from low-level to 25A. All actuator styles available. Ask for catalog 60.

## Snap-Action Switches



A full range of snap-acting switches enclosed in rugged die cast metal housings for protection against mechanical damage and, depending on the method of sealing, against destructive environmental conditions, Series KS (compact) is available with either through bolt or flange mounting. Series KL (heavy duty) is horsepower rated. Series KWL (splash proof) and KXL (explosion proof) are suitable for use in severe environments. All types are available with a variety of actuators. Ask for Catalog 30.



## Metal Case Limit Switches

**Unimax Switch®**

**A Subsidiary of The Unimax Group Inc., Wallingford, Conn. 06492 • (203) 269-8701**
or your local distributor

# VEETRONIX, INC.

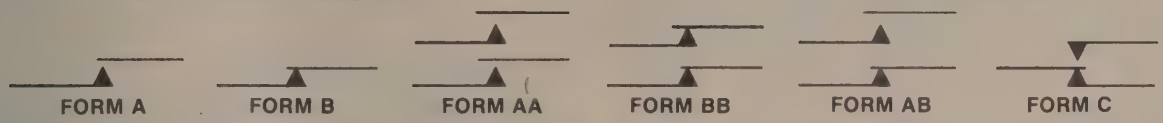
*THE KEY TO QUALITY IN ELECTRONIC AND ELECTRO-MECHANICAL PRODUCTS*

## KEYBOARD SWITCHES

*alternate action and bi-level types available*

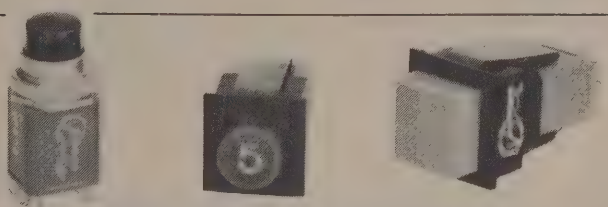
KEYBOARD AND PANEL SWITCHES AVAILABLE IN DOUBLE & SINGLE POLE FORMS SHOWN IN DIAGRAM

***Keycap Illumination Optional***
***3 to 28 Volt Lamps***




## PANEL SWITCHES

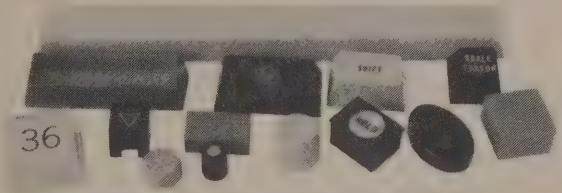
SWITCHES FURNISHED WITH DRY REED OR MECHANICAL CONTACTS
ASK FOR COMPLETE SWITCH DATA



**OUR REED SWITCHES ARE MADE UNDER U.S. PATENT #3,753,179**
**WE ARE ALSO VALID LICENSEES UNDER U.S. PATENT #3,283,274**

## SWITCH CAPS

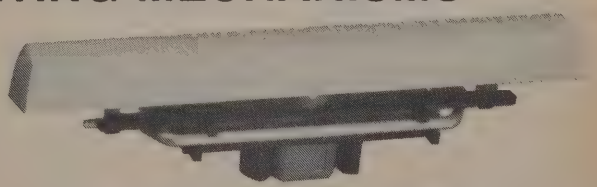
VEETRONIX HAS DESIGN AND TOOLING CAPABILITY TO PRODUCE PROPRIETARY KEY CAP SHAPES



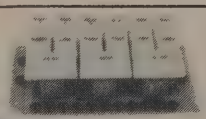
***Typical Standard And Custom Caps***

## SPACE-BARS & SUPPORTING MECHANISMS

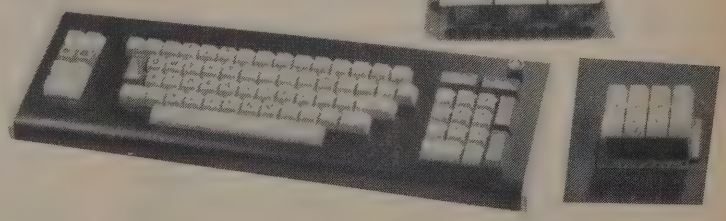
SPACE-BAR ACTIONS
KEYBOARD HARDWARE
WIDE CHOICE OF CAP SHAPES & COLORS
ANY CAP LEGEND DOUBLE SHOT OR ENGRAVED



## KEYBOARDS TO CUSTOMER SPECS



**SUBMIT YOUR REQUIREMENT FOR BID**
VEETRONIX CAN FURNISH COMPLETE KEYBOARDS WITH THE ENCODING THAT YOU SPECIFY, CHOICE OF CAP SHAPES, COLORS, AND LEGENDS



**Veetronix Inc. maintains its own "in house" tool and mold shop. As plastic molding and tooling is done in plant, we are able to respond to requests for special items, and make modifications for special uses. We furnish several well known OEM's with special items produced on proprietary tooling.**

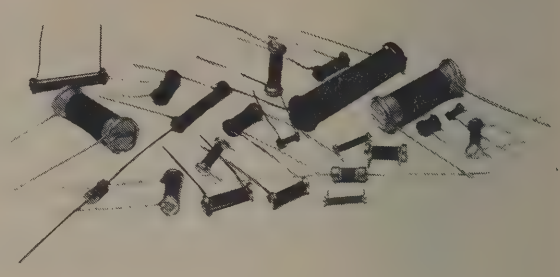
***FOR DETAILED INFORMATION, QUOTATIONS, OR NAME OF NEAREST REP, CONTACT:***
***VEETRONIX, INC. P.O. BOX 209E COZAD, NEBRASKA 69130 (308) 784-4000***

# CARBORUNDUM THERMISTORS

## APPLICATION DATA

Carborundum thermistors are temperature dependent resistors, offered in a wide variety of resistance-temperature characteristics. They are available with a wide range of negative temperature coefficients at 25°C ranging from −0.3%/°C to −5.4%/°C. These parts are made from ceramic materials, bonded in a high-temperature firing process into rod, disc, and chip configurations. They are available in a large range of sizes, thermal characteristics, resistance values, and temperature coefficients to suit the needs of many types of electrical and electronic circuits.

Carborundum offers long experience in the design of special resistance devices. This, together with expertise in the field of ceramic technology, assures a stable and uniform product to meet your thermistor requirements. All materials used in the manufacture of Carborundum thermistors are of the highest quality. Strict quality control is maintained over all stages of manufacture, and a minimum of two calibrations at the specified reference temperature is standard.



## DEFINITIONS

**Zero Power Resistance** ... is the resistance of a thermistor at the calibrating temperature, measured in such a manner that the measuring current does not appreciably heat the thermistor. Resistance, as used here, means zero power resistance unless otherwise stated.

**Beta** ($\beta$) ... is the number that satisfies the equation:

$$R_1/R_2 = \epsilon^{\beta\,(1/T_1 - 1/T_2)}$$

Carborundum determines beta from measurements at 25°C and 73.2°C. Beta is proportional to the slope of the resistance-temperature characteristic, and it is also known as the material constant. It is not truly a constant, but it gives a good approximation of resistance over a substantial working range. In the equation, $\epsilon$ is 2.718..., the base of natural logarithms, and $\beta$, $T_1$, and $T_2$ are in Kelvin (K).

**Alpha** ($\alpha$) ... or temperature coefficient of resistance (TCR) is proportional both to beta and to the square root of the temperature at which it is specified. Very nearly,

$$\alpha = -100\ \beta/T^2$$

In this equation, temperature is in Kelvin (K), and $\alpha$ is in percent per degree C (%/°C). It is evident that alpha becomes much higher as temperatures decrease.

**Dissipation Constant** ($\delta$) ... is the ratio of power dissipated by the thermistor divided by the temperature rise above ambient due to self-heating. Here, it is 20 times the power required, in watts, to bring the thermistor to 75°C in an ambient of 25°C, and it is expressed in milliwatts.

**Time Constant** ($\tau$) ... is the time required for a thermistor which has attained equilibrium after being self-heated to 75°C to cool to 43.4°C in an ambient of 25°C. It is expressed in seconds.

*Both $\delta$ and $\tau$ are necessarily approximate quantities, and they represent complicated concepts. They cannot be fully defined or used unless the conditions under which they are measured are fully defined.*

*In particular, note that the dissipation of a thermistor is the sum of dissipation due to conduction, convection, and radiation, which are related to temperature by linear, square-law, and fourth-power equations respectively. Only over narrow temperature ranges can dissipation constant be considered constant.*

*Also note that time constant is defined by a zero-power cooling curve. If the thermistor is attached to a heat sink the effective time constant is changed substantially. The time required for a thermistor to reach equilibrium due to heating from a current passing through it may be dramatically different from the time constant as defined above.*

## THERMISTOR SPECIFICATION

Thermistors are most often specified by a zero power resistance, suitably toleranced, at some specified temperature (most often 25°C or 37.8°C), and by a temperature coefficient, also suitably toleranced. This is all that is required as an electrical specification. Additional specifications may result in double dimensioning and be unduly restrictive (and therefore costly) or ambiguous.

The zero power resistance of a thermistor should be read in a temperature controlled, agitated oil bath. Not only does the oil bath provide a more controllable constant temperature, but it also speeds the settling of the reading.

## ROD THERMISTORS

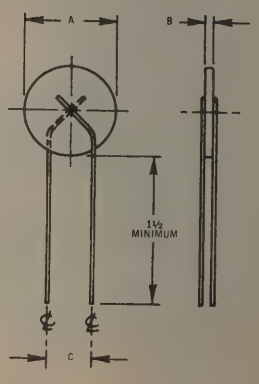
Rod thermistors are manufactured by extruding and firing a suitable ceramic mixture. For a given type of thermistor, low-, medium-, or high-sensitivity, a number of mixtures are available: in general, a mixture yielding a higher resistivity product also yields a higher beta or temperature sensitivity.

Standard rod thermistors are shown in the following table. They have a resistance tolerance of ±10% at 25°C, and they are neither coated nor marked. Special rod thermistors may be ordered with intermediate resistance values, other resistance tolerances, other calibration temperatures, coating, marking, special lead preparation, etc. Parts without wire leads are also available.

## DISC THERMISTORS

Disc thermistors are manufactured by pressing and firing a suitable ceramic mixture. Carborundum offers six standard mixtures of various resistivity and beta.

Standard disc thermistors are shown in the following table. They have a resistance tolerance of ±10% at 25°C, and they are neither coated nor marked. Special disc thermistors may be ordered with intermediate resistance values, other resistance tolerances, other calibration temperatures, coating, marking, special lead preparation, etc. Parts without wire leads are also available.




CARBORUNDUM

The Carborundum Company, Graphite Products Division, Post Office Box 339, Niagara Falls, N.Y. 14302 Tel: (716) 278-2521 Telex: 91-555 (CARBO GLO NGF)

# CARBORUNDUM THERMISTORS

| Specifications | Type A | Type B | Type C | Types D & L | Type M |
|---|---|---|---|---|---|
| R @ 25°C / R @ 125°C | 28.5 | 14.2 | 18.7 | 35.3 | 62.0 |
| $\beta$ (K) ±5% (25.0°C - 73.2°C) | 3980 | 3070 | 3415 | 4200 | 4900 |
| Temp. Coef. ($\alpha$) %/°C @ 25°C | −4.4 | −3.4 | −3.8 | −4.7 | −5.4 |

## ROD THERMISTORS

FIGURE 1

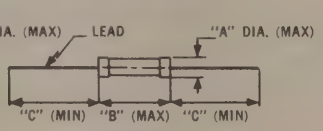


FIGURE 2

| Style | Figure | Dimensions (inches) A | B | C | AWG | Dissipation Constant (mw/°C) | Time Constant (seconds) |
|---|---|---|---|---|---|---|---|
| 0325F5-<br>0325H5- | 1 | 0.12 | 0.30 | 1.00 | 24 | 6.0 | 10 |
| 0540F4-<br>0550H4- | 2<br>2 | 0.20<br>0.20 | 0.50<br>0.63 | 1.25<br>1.25 | 20<br>20 | 9.5<br>11.0 | 22<br>25 |
| 0550F5-<br>0550H5- | 1 | 0.22 | 0.63 | 1.38 | 20 | 11.0 | 25 |
| 1099F5- | 1 | 0.38 | 1.13 | 1.38 | 20 | 24.0 | 90 |

| | | MEDIUM TEMPERATURE COEFFICIENT Type "F" Rods Beta ±10% | | | HIGH TEMPERATURE COEFFICIENT Type "H" Rods Beta ±5% | |
|---|---|---|---|---|---|---|
| Resistance Ohms ±10% @ 25°C | Dash Number | Style 0325F5 | Styles 0540F4- 0550F5- | Style 1099F5- | Style 0325H5- | Styles 0550H4- 0550H5- |
| 2.2 | -402 | — | — | 1300 | — | — |
| 3.3 | -403 | — | — | 1350 | — | — |
| 4.7 | -404 | — | 1300 | 1400 | — | — |
| 6.8 | -406 | — | 1350 | 1450 | — | — |
| 10.0 | -410 | 1300 | 1400 | 1500 | — | — |
| 15.0 | -411 | 1350 | 1450 | 1550 | — | — |
| 22.0 | -412 | 1400 | 1500 | 1600 | — | — |
| 33.0 | -413 | 1450 | 1550 | 1600 | — | — |
| 47.0 | -414 | 1500 | 1600 | 1650 | — | — |
| 68.0 | -416 | 1550 | 1600 | 1650 | — | — |
| 100 | -420 | 1600 | 1650 | 1700 | — | — |
| 150 | -421 | 1600 | 1650 | 1700 | — | — |
| 220 | -422 | 1650 | 1700 | 1750 | — | — |
| 330 | -423 | 1650 | 1700 | 1750 | — | — |
| 470 | -424 | 1700 | 1750 | 1800 | — | — |
| 680 | -426 | 1700 | 1750 | 1800 | — | — |
| 1,000 | -430 | 1750 | 1800 | 1850 | — | 3000 |
| 1,500 | -431 | 1750 | 1800 | 1850 | — | 3100 |
| 2,200 | -432 | 1800 | 1850 | 1900 | 3000 | 3150 |
| 3,300 | -433 | 1800 | 1850 | 1900 | 3100 | 3200 |
| 4,700 | -434 | 1850 | 1900 | 1950 | 3150 | 3300 |
| 6,800 | -436 | 1850 | 1900 | 1950 | 3200 | 3400 |
| 10,000 | -440 | 1900 | 1950 | 2000 | 3300 | 3500 |
| 15,000 | -441 | 1900 | 1950 | 2000 | 3400 | 3600 |
| 22,000 | -442 | 1950 | 2000 | 2050 | 3500 | 3700 |
| 33,000 | -443 | 1950 | 2000 | 2050 | 3600 | 3800 |
| 47,000 | -444 | 2000 | 2050 | 2100 | 3700 | 3900 |
| 68,000 | -446 | 2000 | 2050 | 2100 | 3800 | 4000 |
| 100,000 | -450 | 2050 | 2100 | 2150 | 3900 | 4100 |
| 150,000 | -451 | 2050 | 2100 | 2150 | 4000 | 4150 |
| 220,000 | -452 | 2100 | 2150 | 2200 | 4100 | 4200 |
| 330,000 | -453 | 2100 | 2150 | 2200 | 4150 | 4250 |
| 470,000 | -454 | 2150 | 2200 | 2200 | 4200 | 4300 |
| 680,000 | -456 | 2150 | 2200 | — | 4250 | 4350 |
| 1,000,000 | -460 | 2200 | 2200 | — | 4300 | 4400 |
| 1,500,000 | -461 | 2200 | — | — | 4350 | — |
| 2,200,000 | -462 | 2200 | — | — | 4400 | — |

Order by the style number followed by the dash number. For example, part number 0540F4-404 is a thermistor of style 0540F4-, of 4.7 ±10% ohms resistance, and with a beta of 1300 ±10% K.

## HIGH SENSITIVITY NTC DISCS

### TYPICAL PARTS

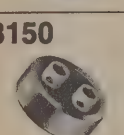
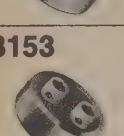
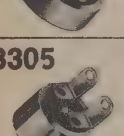
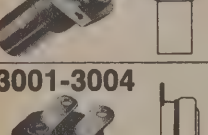
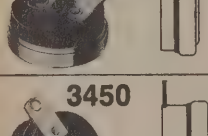
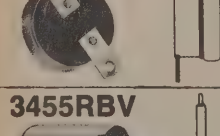
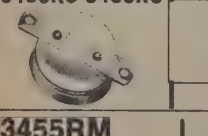
| Carborundum Part Number | Resistance at 25°C in Ohms | Dimensions A | B | C | Lead Wires AWG | Dissipation Constant mw/°C | Time Constant Seconds |
|---|---|---|---|---|---|---|---|
| **TYPE "A" HIGH NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS** | | | | | | | |
| A3306J-16 | 50 ±20% | 0.82 | 0.06 | 3/8 | 18 | 29.0 | 100 |
| A2606J-16 | 75 ±20% | 0.65 | 0.06 | 3/8 | 20 | 20.0 | 80 |
| A2004J-16 | 100 ±10% | 0.50 | 0.04 | 1/4 | 20 | 15.0 | 60 |
| A3311J-16 | 100 ±20% | 0.82 | 0.11 | 3/8 | 18 | 29.0 | 150 |
| A2207J-16 | 120 ±20% | 0.55 | 0.07 | 1/4 | 20 | 17.0 | 75 |
| A3312J-16 | 120 ±20% | 0.82 | 0.12 | 3/8 | 18 | 29.0 | 150 |
| A1604J-16 | 150 ±10% | 0.40 | 0.04 | 1/4 | 20 | 9.0 | 38 |
| A1203J-16 | 200 ±10% | 0.30 | 0.03 | 1/4 | 24 | 8.0 | 30 |
| A2612J-16 | 200 ±20% | 0.65 | 0.12 | 3/8 | 20 | 22.0 | 100 |
| A1204J-16 | 300 ±10% | 0.30 | 0.04 | 1/4 | 24 | 8.0 | 30 |
| A0803J-16 | 500 ±10% | 0.20 | 0.03 | 1/8 | 24 | 7.0 | 20 |
| A1612J-16 | 500 ±10% | 0.40 | 0.12 | 1/4 | 20 | 11.0 | 60 |
| A0805J-16 | 750 ±10% | 0.20 | 0.05 | 1/8 | 24 | 7.0 | 23 |
| A0807J-16 | 1,000 ±10% | 0.20 | 0.07 | 1/8 | 24 | 7.2 | 26 |
| A1212J-16 | 1,000 ±10% | 0.30 | 0.12 | 1/4 | 24 | 9.0 | 40 |
| A0809J-16 | 1,500 ±10% | 0.20 | 0.09 | 1/8 | 24 | 7.5 | 30 |
| A0810J-16 | 2,000 ±10% | 0.20 | 0.10 | 1/8 | 24 | 7.5 | 30 |
| **TYPE "B" HIGH NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS** | | | | | | | |
| B3306J-16 | 2.0 ±20% | 0.82 | 0.06 | 3/8 | 18 | 29.0 | 100 |
| B2605J-16 | 3.0 ±20% | 0.65 | 0.05 | 3/8 | 20 | 20.0 | 80 |
| B1804J-16 | 3.8 ±20% | 0.45 | 0.04 | 3/8 | 22 | 12.0 | 48 |
| B2004J-16 | 5.0 ±10% | 0.50 | 0.04 | 1/4 | 20 | 15.0 | 60 |
| B3312J-16 | 5.0 ±20% | 0.82 | 0.12 | 3/8 | 18 | 29.0 | 150 |
| B1604J-16 | 7.5 ±10% | 0.40 | 0.04 | 1/4 | 20 | 9.0 | 38 |
| B1203J-16 | 10.0 ±10% | 0.30 | 0.03 | 1/4 | 24 | 8.0 | 30 |
| B2612J-16 | 10.0 ±20% | 0.65 | 0.12 | 3/8 | 20 | 22.0 | 100 |
| B1205J-16 | 15.0 ±10% | 0.30 | 0.05 | 1/4 | 24 | 8.5 | 35 |
| B1206J-16 | 20.0 ±10% | 0.30 | 0.06 | 1/4 | 24 | 8.5 | 35 |
| B2012J-16 | 20.0 ±10% | 0.50 | 0.12 | 1/4 | 20 | 16.0 | 80 |
| B0804J-16 | 30.0 ±10% | 0.20 | 0.04 | 1/8 | 24 | 7.0 | 20 |
| B0807J-16 | 50.0 ±10% | 0.20 | 0.07 | 1/8 | 24 | 7.2 | 26 |
| B1212J-16 | 50.0 ±10% | 0.30 | 0.12 | 1/4 | 24 | 9.0 | 40 |
| B0809J-16 | 75.0 ±10% | 0.20 | 0.09 | 1/8 | 24 | 7.5 | 30 |
| B0810J-16 | 100.0 ±10% | 0.20 | 0.10 | 1/8 | 24 | 7.5 | 30 |
| **TYPE "C" HIGH NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS** | | | | | | | |
| C2604J-16 | 10.0 ±10% | 0.65 | 0.04 | 3/8 | 20 | 20.0 | 80 |
| C2004J-16 | 15.0 ±10% | 0.50 | 0.04 | 1/4 | 20 | 15.0 | 60 |
| C1603J-16 | 20.0 ±10% | 0.40 | 0.03 | 1/4 | 20 | 9.0 | 38 |
| C3312J-16 | 20.0 ±20% | 0.82 | 0.12 | 3/8 | 18 | 29.0 | 150 |
| C1605J-16 | 30.0 ±10% | 0.40 | 0.05 | 1/4 | 20 | 9.0 | 38 |
| C1205J-16 | 50.0 ±10% | 0.30 | 0.05 | 1/4 | 24 | 8.5 | 35 |
| C2012J-16 | 50.0 ±10% | 0.50 | 0.12 | 1/4 | 20 | 16.0 | 80 |
| C0803J-16 | 75.0 ±10% | 0.20 | 0.03 | 1/8 | 24 | 7.0 | 20 |
| C0804J-16 | 100.0 ±10% | 0.20 | 0.04 | 1/8 | 24 | 7.0 | 20 |
| C1612J-16 | 100.0 ±10% | 0.40 | 0.12 | 1/4 | 20 | 11.0 | 60 |
| C0807J-16 | 150.0 ±10% | 0.20 | 0.07 | 1/8 | 24 | 7.2 | 26 |
| C0808J-16 | 200.0 ±10% | 0.20 | 0.08 | 1/8 | 24 | 7.2 | 26 |
| C1212J-16 | 200.0 ±10% | 0.30 | 0.12 | 1/4 | 24 | 9.0 | 40 |
| C0810J-16 | 300.0 ±10% | 0.20 | 0.10 | 1/8 | 24 | 7.5 | 30 |
| **TYPE "D" HIGH NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS** | | | | | | | |
| D2604J-16 | 100 ±20% | 0.65 | 0.04 | 3/8 | 20 | 20.0 | 80 |
| D2003J-16 | 150 ±10% | 0.50 | 0.03 | 1/4 | 20 | 15.0 | 60 |
| D1804J-16 | 200 ±10% | 0.45 | 0.04 | 1/4 | 20 | 12.0 | 48 |
| D3312J-16 | 200 ±20% | 0.82 | 0.12 | 3/8 | 18 | 29.0 | 150 |
| D1604J-16 | 300 ±10% | 0.40 | 0.04 | 1/4 | 20 | 9.0 | 38 |
| D1204J-16 | 500 ±10% | 0.30 | 0.04 | 1/4 | 24 | 8.0 | 30 |
| D2612J-16 | 500 ±20% | 0.65 | 0.12 | 3/8 | 20 | 22.0 | 100 |
| D1206J-16 | 750 ±10% | 0.30 | 0.06 | 1/4 | 24 | 8.5 | 35 |
| D1207J-16 | 1,000 ±10% | 0.30 | 0.07 | 1/4 | 24 | 8.5 | 35 |
| D1612J-16 | 1,000 ±10% | 0.40 | 0.12 | 1/4 | 20 | 11.0 | 60 |
| D0806J-16 | 1,500 ±10% | 0.20 | 0.06 | 1/8 | 24 | 7.0 | 23 |
| D0807J-16 | 2,000 ±10% | 0.20 | 0.07 | 1/8 | 24 | 7.2 | 26 |
| D1212J-16 | 2,000 ±10% | 0.30 | 0.12 | 1/4 | 24 | 9.0 | 40 |
| D0810J-16 | 3,000 ±10% | 0.20 | 0.10 | 1/8 | 24 | 7.5 | 30 |
| **TYPE "L" HIGH NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS** | | | | | | | |
| L1205J-16 | 3,000 ±10% | 0.30 | 0.05 | 1/4 | 24 | 8.5 | 35 |
| L1209J-16 | 5,000 ±10% | 0.30 | 0.09 | 1/4 | 24 | 9.0 | 40 |
| L0805J-16 | 7,500 ±10% | 0.20 | 0.05 | 1/8 | 24 | 7.0 | 23 |
| L0807J-16 | 10,000 ±10% | 0.20 | 0.07 | 1/8 | 24 | 7.2 | 26 |
| L0810J-16 | 15,000 ±10% | 0.20 | 0.10 | 1/8 | 24 | 7.5 | 30 |
| **TYPE "M" HIGH NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS** | | | | | | | |
| M1203J-16 | 7,500 ±10% | 0.30 | 0.03 | 1/4 | 24 | 8.0 | 30 |
| M1204J-16 | 10,000 ±10% | 0.30 | 0.04 | 1/4 | 24 | 8.5 | 35 |
| M2012J-16 | 10,000 ±10% | 0.50 | 0.12 | 1/4 | 20 | 16.0 | 80 |
| M1207J-16 | 15,000 ±10% | 0.30 | 0.07 | 1/4 | 24 | 8.5 | 35 |
| M0803J-16 | 20,000 ±10% | 0.20 | 0.03 | 1/8 | 24 | 7.0 | 20 |
| M1209J-16 | 20,000 ±10% | 0.30 | 0.09 | 1/4 | 24 | 9.0 | 40 |
| M0805J-16 | 30,000 ±10% | 0.20 | 0.05 | 1/8 | 24 | 7.0 | 23 |
| M0809J-16 | 50,000 ±10% | 0.20 | 0.09 | 1/8 | 24 | 7.5 | 30 |
| M0810J-16 | 75,000 ±10% | 0.20 | 0.10 | 1/8 | 24 | 7.5 | 30 |

**Elmwood Sensors**
Precision Controls
1653 Elmwood Avenue, Cranston, R.I. 02907
Phone (401) 781-6500 ● TWX (710) 381-6413

**Elmwood Sensors, Ltd.** North Shields, Tyne & Wear, NE29 8SA England
Phone (089) 45-82821 ● TELEX: 53284

Elmwood thermostats are precision-engineered for quick, reliable response in high limit or control applications. Many meet military specifications, as well as U.L., C.S.A. and European requirements. Exposures are from —65°F to +550°F, ratings to 15 Amps, with narrow or wide differentials as required. A variety of brackets and terminals are available, as well as custom packaging. Write or phone for complete catalog.

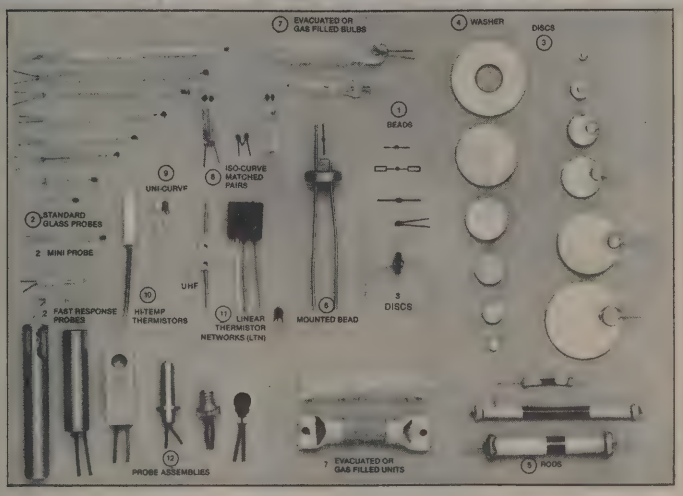
# SUB-MINIATURE SNAP-ACTION THERMOSTATS

| DESCRIPTION | ELECTRICAL RESISTIVE RATINGS | TEMPERATURE SET POINT RANGE | NARROWEST TOLERANCE ALLOWABLE | NARROWEST DIFFERENTIAL AVAILABLE | APPROV AGENCY LISTINGS | TYPICAL APPLICATIONS |
|---|---|---|---|---|---|---|
| **3100** Hermetically sealed, all welded construction long life, narrow or wide tolerances and differentials. | 6 Amp. 125 VAC<br>7 Amp 30 VDC<br>3 Amp 250 VAC | —30° to 500°F<br>—34.44° to 260°C | ±3°F<br>±1.7°C | 6°F max.<br>3.3°C max. | U.L. | High-temp control for glue guns, copy machines, computers, aircraft, electronic controls with commercial or military specifications. |
| **3MS1** Qualified for Q.P.L. listing under Mil-S-24236, Type 1, Class 4. SPST, hermetically sealed, subminiature bimetallic thermostat. | 6 Amp 125 VAC<br>7 Amp 30 VDC<br>3 Amp 250 VAC | —30° to 500°F<br>—34.44° to 260°C | ±3°F<br>±1.7°C | 6°F max.<br>3.3°C max. | DESC-EQA | Aerospace, aircraft, weapons systems, communications, military vehicles, or wherever a high reliability thermostat is needed. |
| **3150**  Hermetically sealed, all welded const. Similar to 3100 except low silhouette .301" max. design | 4 Amp 120 VAC 30 VDC<br>2 Amp 250 VAC | —30° to 350°F<br>—34.44° to 177°C | ±3°F<br>±1.7°C | 6°F max.<br>3.3°C max. | U.L. | Copy machines, computers, aircraft, electronic controls with commercial or military specifications where space is critical. |
| **3153**  Similar to 3150 with additional mfg. and testing to requirements of MIL-S-24236 | 4 Amp 120 VAC 30 VDC<br>2 Amp 250 VAC | —30° to 350°F<br>—34.44° to 177°C | ±3°F<br>±1.7°C | 6°F max.<br>3.3°C max. | U.L. | Similar to 3150, for more stringent military requirements, such as Apollo and Skylab heat controls. |
| **3305**  Subminiature .430" dia., hermetically sealed, tolerances to ±3°F and narrow differentials. | 3 Amp 120 VAC 30 VDC | 100° to 250°F<br>37.8° to 121°C | ±3°F<br>±1.7°C | 6°F max.<br>3.3°C max. | None | Crystal ovens, gyros, electronics overheat protection where subminiature thermostat is required. |
| **3000** Custom package housings for any Elmwood thermostats. Housings all-welded stainless steel. | Any model | —30° to 500°F<br>—34.44° to 260°C | ±4°F<br>±2.2°C | 8°F max.<br>4.4°C max. | See other models | Aircraft bleed air duct sensing, hydraulic oil temp control, liquid bath control, heater control. |
| **3001-3004**  Non-hermetic, utilizing 3100 design with phenolic and metal housing. | 7 Amp 120 VAC 30 VDC<br>3 Amp 250 VAC | 0° to 335°F<br>—17.8° to 168.3°C | ±4°F<br>±2.2°C | 8°F max.<br>4.4°C max. | U.L. C.S.A. | **3001-** Computers, copy machines, radar equipment, where low height .281" is required.<br>**3004-** Where 4mm spacing is required for Europe. |
| **3450**  Non-hermetic, with 15 Amp 120 VAC rating. U.L. and C.S.A. listings for 100,000 cycles. | 15 Amp 120 VAC 12 VDC<br>10 Amp 277 VAC | 32° to 335°F<br>0° to 170°C | ±5°F<br>±3°C | 20°F 11°C min. below set point. | U.L. C.S.A. | Power supplies, communication, medical equipment, computers where high amp loads are present.<br>Where 4mm spacing is required for Europe specify 3455R. |
| **3455RBV**  Epoxy overmold constr. of 3455R. For elec. insulation of terminal or moist conditions. | 15 Amp 120 VAC 12 VDC<br>10 Amp 277 VAC | 0° to 221°F<br>—20° to 105°C | ±5°F<br>±3°C | 20°F 11°C min. below set point. | U.L. C.S.A. Internat'l | Similar to 3455R with epoxy overmold for protection of terminals and sealing of unit. |
| **3450RC-3455RC** High temperature, with 15 Amp 120 VAC rating. Rivet insert sleeve construction for International listings. | 15 Amp 120 VAC 12 VDC<br>10 Amp 277 VAC | 32° to 500°F<br>0° to 260°C | ±5°F<br>±3°C | 20°F 11°C min. below set point. | U.L. C.S.A. Internat'l | Similar to above, where high temperatures are present.<br>3450RC — 3 mm spacing<br>3455RC — 4 mm spacing |
| **3455RM**  Non-hermetic manual reset. Will not recycle automatically at room temperature. | 15 Amp 120 VAC<br>10 Amp 240 VAC | 125° to 300°F<br>52° to 150°C | ±8°F<br>±5°C | Man. reset Auto. reset below 40°F 4.44°C | U.L. Internat'l | High limit protection where manual reset is required.<br>3455RM meets 4mm spacing required for Europe. |

# THERMISTORS

Fenwal Electronics

WORLDWIDE THERMISTOR LEADERSHIP THROUGH QUALITY




## ● THERMISTOR CONFIGURATIONS ●

**1. Glass Coated Beads** — used where small size, fast response, high precision, stability, and temperatures to 300°C are required.

**2. Glass Probes** — medium-small in size. Many of the advantages of beads but rugged, more easily mounted, useful in liquid media.

**3. Discs** — used where medium power dissipation is a requirement and space not a problem. Useful to 150°C.

**4. Washers** — used where high power dissipation is a prime requirement.

**5. Rods** — these units have power dissipation intermediate between discs and washers and are also used where their physical shape is an asset.

**6. Mounted Beads** — provide ease in using glass beads in such applications as gas chromatography, flow and vacuum measurement, etc.

**7. Vacuum and Gas Filled Assemblies** — high power sensitivity for specialized circuit applications.

## ● INTERCHANGEABLE THERMISTORS ●

**8. Iso-Curve® Interchangeable Thermistors** — these units available in bead or glass probe configurations, follow standard curves over wide temperature range, and are completely interchangeable. Units match standard curves as close as ± ¼% of resistance or as required.

**9. Uni-Curve® Interchangeable Thermistors** — completely interchangeable units having an accuracy of +0.2°C over a temperature range of 0°C to 70°C and available on special order to other tolerances and ranges.

## ● HI-TEMP THERMISTORS ●

**10. Hi-Temp Thermistors** — designed specifically for HI-TEMP measurement and control in applications having operating ranges from 500°C to 1000°C.

## ● LINEAR THERMISTOR NETWORKS (LTN) ●

**11. Linear Thermistor Networks (LTN™)** — precision resistors and thermistors which are designed to produce a resistance change or voltage output that varies linearly with temperature over the selected temperature range. Ask for Bulletin L-9A.

## ● THERMISTOR PROBES ●

**12. Probe Assemblies** — standard catalog types or built to specific military or commercial requirements. We are experienced in design of probe assemblies for all fields of application including industrial control and indication, aerospace — specializing in telemetry applications, and oceanographic — featuring fast response, very high pressure, and interchangeability using our Iso-Curve and Uni-Curve Thermistors.

## Here's Help in Applying F. E. Thermistors . . .

THERMISTOR MANUAL (EMC-6A). Most complete up-to-date listing of thermistors available. Theory, engineering data, complete specifications.

THERMISTOR HOUSING MANUAL (L-5A). Detailed information on how Fenwal Electronics can build thermistor sensor assemblies to fit your requirements.

THERMISTOR APPLICATIONS NOTES (AN-1A, AN-2A). "Methods for designing linear temperature read out circuits (AN-1A)" and "Using thermistors to compensate for transistor temperature sensitivity (AN-2A)"

HI-TEMP THERMISTOR BULLETIN (L-8A) features thermistors designed specifically for high temperature measurement and control applications having operating ranges from 500°C to 1000°C.

LINEAR THERMISTOR NETWORKS (LTN™) precision resistors and thermistors which are designed to produce a resistance change or voltage output that varies linearly with temperature over the selected temperature range. Ask for Bulletin L-9A.

INTERCHANGEABLE THERMISTORS: ISO-CURVE manual (L-2B) and UNI-CURVE manual (L-6A) provide indepth data pertaining to precision and low-cost RT, curve-matched interchangeable thermistors.

CAPSULE THERMISTOR COURSES (L-3A). A complete 24-page primer on thermistors, their characteristics and uses, including curves, circuit diagrams and applications data.

## EXPERIMENTER'S THERMISTOR KITS

**Model G-200** Standard Kit. Contains 12 different thermistors (2 glass probes, 3 beads, 2 discs, 3 rods, 2 washers). Each thermistor is packed with specification sheets showing characteristics. **PRICE: 19.95**

**Model G-700** Low-Cost Kit. Includes four glass beads and probes, manual, and computer for a variety of applications. **PRICE: 4.95**

**Model G-701** Economy Kit. Includes 10 glass beads and probes, manual and computer for a wider range of applications than G-700 kit above. **PRICE: 9.95**

**Model G-500** Uni-Curve Kit. Contains 6 standard Rt curve matched interchangeable thermistors (3K, 5K, 10K, 30K, 50K, 100K. Includes complete data sheets with full specifications and DC. TC listings. **PRICE 19.95**

IN THE U.S.A.
**FENWAL ELECTRONICS**
KIDDE

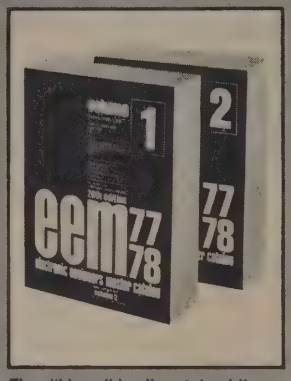
Fenwal Electronics

OUTSIDE THE U.S.A.
**FENWAL ELECTRONICS LIMITED**
LYONS HOUSE, 2A STATION ROAD
FRIMLEY, CAMBERLEY, SURREY GU16 5HF
ENGLAND
TELEPHONE CAMBERLEY 26838 TELEX 858840

# WE KNOW OUR STUFF

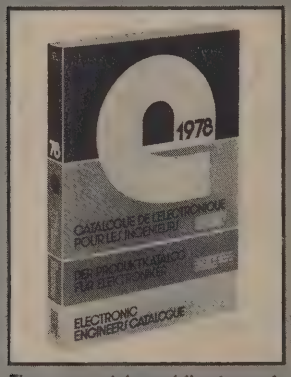
## 41 YEARS OF EXPERIENCE IN CATALOGING, 21 EDITIONS OF eem

### eem/ELECTRONIC ENGINEERS MASTER CATALOG —




The "blue-ribbon" catalog/directory that has become "the standard of the industry" for electronic engineers, buyers and specifiers.

### ELECTRONIC ENGINEERS CATALOGUE




The new catalogue/directory of electronic products available to and from Western Europe and the United Kingdom. Designed especially for the European electronics engineer.

### eem FILE SYSTEM —

The only filing system designed especially for the electronics engineer. Instant retrieval and organization of data sheets and catalogs.

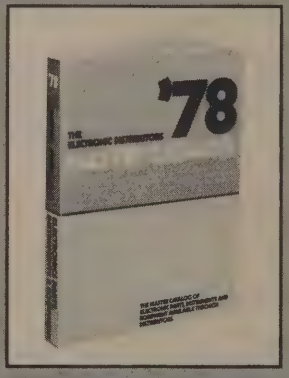
### UTP CUSTOM CATALOGS —

The Cadillac of individualized catalogs for the electronic parts distributor, featuring solely his lines and services.

### IC MASTER AND THE UPDATES —

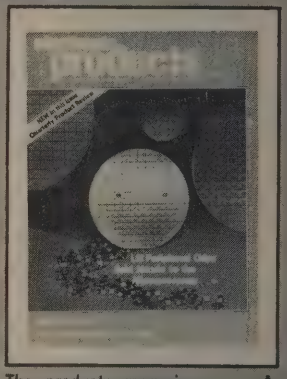
The only complete single-source directory including all IC devices manufactured in the United States. Updated three times yearly with accumulative supplements.

### ELECTRONIC DISTRIBUTORS MASTER CATALOG —




The only national catalog designed exclusively for distributors and their customers featuring electronic parts, instruments and equipment.

### ELECTRONIC PRODUCTS MAGAZINE —



The products magazine . . . A 100% product-oriented magazine including hundreds of new products and special features every month.

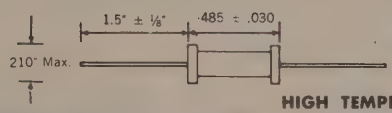
### UNITED COST AND PRICING SERVICES —

The electronic distributors' proven method of being up to the minute on his cost and selling prices.

*United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Ave., Garden City, N.Y. 11530 / (516) 222-2500 TWX 510-222-1673*

Keystone CARBON COMPANY

# ROD TYPE THERMISTORS




Tolerance on resistance is ± 10% at 25°C.
Maximum operating temperature is 125°C.

## LOW/MEDIUM TEMPERATURE COEFFICIENT

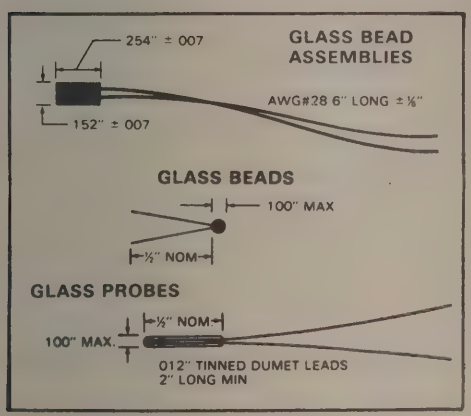
| TYPE | RESISTANCE AT °C | | | | | | | BETA ±10% | R @ 25°C | Neg. Temp. |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 25 | 37.8 | 50 | 75 | 104.4 | 125 | (37.8-104.4°C) | R @ 125°C | Coef. @ 25°C |
| 15-20-35-S1 | 30.6 | 20 | 16.4 | 13.8 | 9.90 | 7.01 | 5.65 | 1500 | 3.5 | 1.59 |
| 15-50-42-S1 | 80.6 | 50 | 40.1 | 32.9 | 22.6 | 15.3 | 11.9 | 1700 | 4.2 | 1.78 |
| 15-100-42-S1 | 161 | 100 | 80.2 | 65.8 | 45.3 | 30.6 | 23.8 | 1700 | 4.2 | 1.78 |
| 15-200-42-S1 | 322 | 200 | 160 | 132 | 90.6 | 61.2 | 47.7 | 1700 | 4.2 | 1.78 |
| 15-500-50-S1 | 847 | 500 | 391 | 314 | 206 | 133 | 100 | 1900 | 5.0 | 1.98 |
| 15-1K-50-S1 | 1690 | 1K | 782 | 628 | 413 | 266 | 201 | 1900 | 5.0 | 1.98 |
| 15-2K-52-S1 | 3430 | 2K | 1560 | 1240 | 808 | 515 | 387 | 1950 | 5.2 | 2.03 |
| 15-5K-54-S1 | 8680 | 5K | 3860 | 3060 | 1980 | 1240 | 924 | 2000 | 5.4 | 2.07 |
| 15-10K-54-S1 | 17.4K | 10K | 7730 | 6130 | 3950 | 2480 | 1850 | 2000 | 5.4 | 2.07 |
| 15-20K-59-S1 | 35.6K | 20K | 15.3K | 12K | 7560 | 4640 | 3400 | 2100 | 5.9 | 2.17 |
| 15-50K-62-S1 | 90K | 50K | 37.9K | 29.5K | 18.5K | 11.2K | 8120 | 2150 | 6.2 | 2.22 |

## HIGH TEMPERATURE COEFFICIENT

| TYPE | RESISTANCE AT °C | | | | | | | BETA ±10% | R @ 25°C | Neg. Temp. |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 25 | 37.8 | 50 | 75 | 104.4 | 125 | (37.8-104.4°C) | R @ 125°C | Coef. @ 25°C |
| 15-5K-181-S1 | 13.7K | 5K | 3150 | 2100 | 979 | 450 | 276 | 3425 | 18.1 | 3.74 |
| 15-10K-192-S1 | 28.2K | 10K | 6240 | 4100 | 1890 | 855 | 520 | 3500 | 19.2 | 3.83 |
| 15-20K-292-S1 | 67.2K | 20K | 11.6K | 7140 | 2920 | 1190 | 685 | 4000 | 29.2 | 4.46 |
| 15-50K-292-S1 | 168K | 50K | 28.9K | 17.8K | 7320 | 2980 | 1710 | 4000 | 29.2 | 4.46 |
| 15-100K-404-S1 | 372K | 100K | 55K | 32.4K | 12.2K | 4540 | 2080 | 4400 | 40.4 | 4.86 |
| 15-200K-424-S1 | 753K | 200K | 109K | 63.9K | 23.9K | 8740 | 4720 | 4450 | 42.4 | 4.91 |
| 15-500K-482-S1 | 1.95meg | 500K | 268K | 154K | 55.6K | 19.7K | 10.4K | 4600 | 48.2 | 5.03 |
| 15-1meg-583-S1 | 4.06meg | 1meg | 523K | 294K | 100K | 33.7K | 17.1K | 4830 | 58.3 | 5.22 |

# GLASS BEADS • GLASS PROBES • GLASS BEAD ASSEMBLIES

Glass bead thermistors are exceptionally stable because the glass seal protects the thermistor from hostile environments.



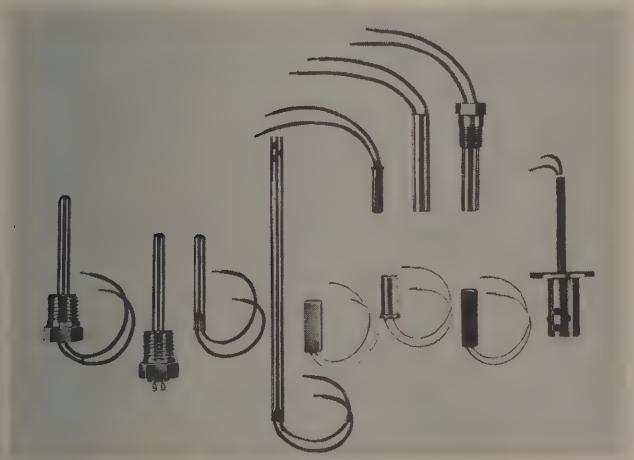

## RESISTANCE/TEMPERATURE CHARACTERISTICS

| TYPE | −21.5°C | 0°C | 25°C | 37.8°C | 50°C | 104.4°C | 150°C | 232°C | TEMP. COEFF. AT 25°C |
|---|---|---|---|---|---|---|---|---|---|
| RL0504-614.8-71-G___* | 7687 | 2775 | 1K | 614.8 | 398.8 | 86.59 | 32.85 | 8.865 | −3.88% |
| RL0504-8783-95-G___* | 154.5K | 48.48K | 15K | 8783 | 5484 | 924.5 | 290.3 | 59.55 | −4.36% |
| RL0504-16.92K-112-G___ | 370.3K | 105.3K | 30K | 16.92K | 10.18K | 1511 | 426.9 | 83.08 | −4.67% |
| RL0504-27.76K-120-G___ | 643.1K | 182.2K | 50K | 27.76K | 16.50K | 2313 | 642.0 | 109.7 | −4.80% |
| RL0504-55.53K-120-G___ | 1.286 meg | 364.5K | 100K | 55.53K | 32.99K | 4628 | 1284 | 219.5 | −4.80% |
| RL0504-111.3K-125-G___ | 2.699 meg | 743.5K | 200K | 111.3K | 65.78K | 8904 | 2415 | 407.4 | −4.85% |
| RL0504-272.6K-142-G___ | 7.391 meg | 1.976 meg | 500K | 272.6K | 158.6K | 19.20K | 4706 | 682.0 | −5.04% |
| RL0504-530.5K-148-G___ | 15.04 meg | 3.939 meg | 1 meg | 530.5K | 301.7K | 35.84K | 8780 | 1252 | −5.14% |
| RL0504-1.294Meg-178-G___ | 40.98 meg | 10.34 meg | 2.5 meg | 1.294 meg | 716.7K | 73.52K | 15.95K | 1.812K | −5.34% |
| RL0504-2.588Meg-176-G___ | 81.96 meg | 20.68 meg | 5 meg | 2.588 meg | 1.434 meg | 147.0K | 31.90K | 3.624K | −5.34% |

*Not presently available in Glass Probes.
Tolerance on resistance values ± 20% @25°C. Closer tolerances available.
Beads have a maximum operating temperature of 260°C.

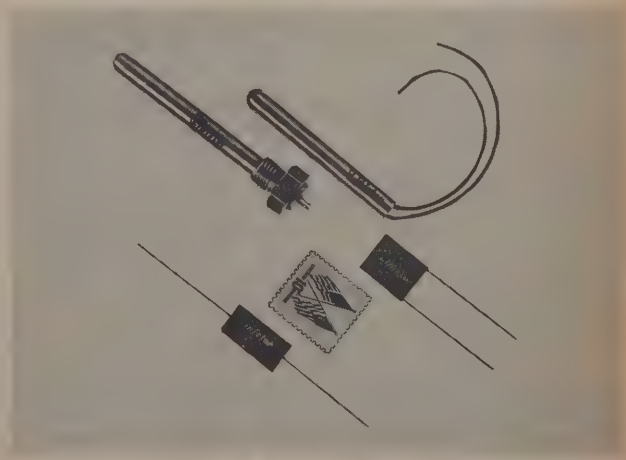
-G1 for Glass Beads with platinum leads
-G15 for Glass Probes
-G20 for Glass Bead Assemblies

# THERMISTOR PROBES



The probes illustrated above include stainless steel, aluminum, and chrome-plated materials in a variety of configurations. In addition, a variety of other designs are available. These probes are used in conjunction with solid state circuitry for liquid level measurement, and for use as sensors to measure the temperature of liquids or surface temperatures. Write for probe catalog TP-739.

# LINISTOR® ASSEMBLIES

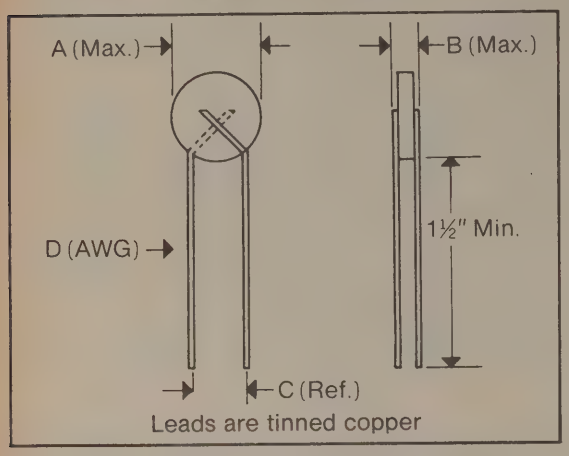


Keystone developed Linistor assemblies to give an accurate resistance response over a temperature span of 0° to 100° C. Because Linistor assemblies have flattened out the thermistor resistance curve to a constant and predictable straight-line plot, they are valuable in a wide range of applications. Four standard encasements are available. Tolerance on resistance of Linistor is ± 2% at 25°C. Write for Linistor Bulletin L-601.

Keystone CARBON COMPANY
Thermistor Division • St. Marys, Pa. 15857
814-781-1591 • Telex No. 91-4517

Keystone CARBON COMPANY

# DISC TYPE THERMISTORS WITH CROSSED LEADS

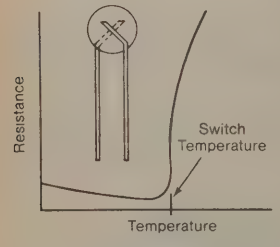



| KCC TYPE | R @ 25°C | Tol. ±% | A Max. | B Max. | C Ref. | D AWG | Dissipation Constant (MW °/C) | Time Constant (Sec) | Temp. Coef. at 25°C % per °C |
|---|---|---|---|---|---|---|---|---|---|
| RL1004-65.6-59-D1 | 100 | 20 | 110" | 120" | 100 | 26 | 2.5 | 9 | −3.38 |
| RL1003-312-73-D1 | 500 | 10 | 110" | 110" | 100 | 26 | 2.5 | 9 | −3.83 |
| RL1007-624-73-D1 | 1000 | 10 | 110" | 160" | 100 | 26 | 2.8 | 10 | −3.83 |
| RL1003-1746-97-D1 | 3000 | 10 | 110" | 110" | 100 | 26 | 2.5 | 9 | −4.39 |
| RL1004-2910-97-D1 | 5000 | 10 | 110" | 120" | 100 | 26 | 2.5 | 9 | −4.39 |
| RL1009-5820-97-D1 | 10,000 | 10 | 110" | 180" | 100 | 26 | 3.0 | 10 | −4.39 |
| RL1007-13770-120-D1 | 25,000 | 10 | 110" | 160" | 100 | 26 | 2.8 | 10 | −4.84 |
| RL1003-26670-140D1 | 50,000 | 10 | 110" | 110" | 100 | 26 | 2.5 | 9 | −5.08 |
| RL1006-53330-140-D1 | 100,000 | 10 | 110" | 145" | 100 | 26 | 2.8 | 10 | −5.08 |
| RL1004-104550-155-D1 | 200,000 | 10 | 110" | 120" | 100 | 26 | 2.5 | 9 | −5.22 |
| RL2004-16.4-59-D1 | 25 | 20 | 220" | 125" | 156 | 24 | 6.5 | 20 | −3.38 |
| RL2007-32.8-59-D1 | 50 | 20 | 220" | 165" | 156 | 24 | 6.5 | 30 | −3.38 |
| RL2003-62.4-73-D1 | 100 | 10 | 220" | 115" | 156 | 24 | 6.5 | 20 | −3.83 |
| RL2005-124 8-73-D1 | 200 | 10 | 220" | 140" | 156 | 24 | 6.5 | 20 | −3.83 |
| RL2008-187.1-73-D1 | 300 | 10 | 220" | 175" | 156 | 24 | 6.5 | 30 | −3.83 |
| RL2013-312-73-D1 | 500 | 10 | 220" | 230" | 156 | 24 | 7 2 | 50 | −3 83 |
| RL2004-582-97-D1 | 1000 | 10 | 220" | 125" | 156 | 24 | 6 5 | 20 | −4 39 |
| RL2006-657-69-D1 | 1000 | 20 | 220" | 150" | 156 | 24 | 6.5 | 20 | −3 58 |
| RL2007-1164-97-D1 | 2000 | 10 | 220" | 165" | 156 | 24 | 6.5 | 30 | −4 39 |
| RL2009-1446-97-D1 | 2500 | 10 | 220" | 185" | 156 | 24 | 6 5 | 30 | −4.39 |
| RL2010-1746-97-D1 | 3000 | 10 | 220" | 195" | 156 | 24 | 7.0 | 35 | −4 39 |
| RL2006-2753-120-D1 | 5000 | 10 | 220" | 150" | 156 | 24 | 6.5 | 20 | −4.84 |
| RL2012-5506-120-D1 | 10,000 | 10 | 220" | 220" | 156 | 24 | 7 2 | 50 | -4.84 |
| RL2006-13330-140-D1 | 25,000 | 10 | 220" | 150" | 156 | 24 | 6 5 | 20 | −5 08 |
| RL2012-26660-140-D1 | 50,000 | 10 | 220" | 220" | 156 | 24 | 7 2 | 50 | −5 08 |
| RL2008-52270-155-D1 | 100,000 | 10 | 220" | 175" | 156 | 24 | 6.5 | 30 | −5.22 |
| RL3004-6.56-59-D1 | 10 | 20 | .320" | .125" | .250 | 24 | 7.0 | 35 | −3.38 |
| RL3504-31 2-73-D1 | 50 | 10 | 370" | 125" | 250 | 24 | 7 5 | 45 | −3.83 |
| RL4004-174 6-97-D1 | 300 | 10 | 420" | 125" | 250 | 24 | 8 0 | 50 | −4.39 |
| RL4504-3 28-59-D1 | 5 | 20 | 475" | 130" | 328 | 22 | 10 0 | 60 | −3.38 |
| RL4504-15.6-73-D1 | 25 | 10 | 475" | 130" | 328 | 22 | 10.0 | 60 | −3 83 |
| RL4504-116.4-97-D1 | 200 | 10 | 475" | 130" | 328 | 22 | 10.0 | 60 | −4 39 |
| RL7605-6 24-73-D1 | 10 | 20 | 795" | 150" | 328 | 20 | 16 0 | 70 | −3.83 |
| RL7605-58.2-97-D1 | 100 | 10 | 795" | 150" | 328 | 20 | 16.0 | 70 | −4.39 |

**Maximum operating temperature—125°C**

Keystone also offers a line of Disc-Type Thermistors ranging in sizes from .100 inch to 1.00 inch in diameter. Thirty-four different slopes are available (temperature coefficients from −3.75% per °C at 25°C to −5.22% per °C at 25°C). Resistance values range from 11.16 ohms to 518,400 ohms at 25°C. Write for short form catalog T-504 or complete catalog BW2.

# PTC—POSITIVE TEMPERATURE COEFFICIENT THERMISTORS



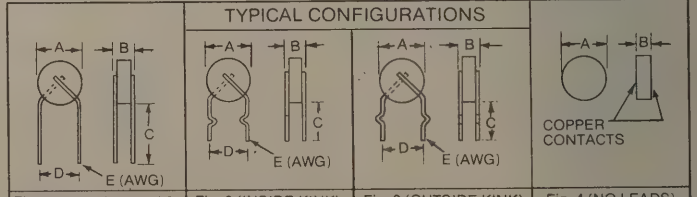

Positive Temperature Coefficient (PTC) thermistors are characterized by an extremely large resistance change in a small temperature span. The figure at left depicts a generalized resistance temperature plot for a PTC. The temperature at which the resistance begins to increase rapidly is referred to as the switching temperature. This point can be changed from below 0°C to above 120°C.

## TYPICAL PTC APPLICATIONS

• Automatic Color TV Degaussing • Air Flow Measurement • Non-Destructive Fuse • Single Phase Motor Starting • Liquid Level Sensing • Combination Heater-Thermostat • Arc Suppression • Time Delay Fusing

For detailed application notes, write for Bulletin P-780.

| Type No. | Switch Point | Res. in Ohms @ 25°C ±30% | Oper. Voltage 2 | Ref. Dimensions (in.) A | B | C | D | E | Lead Mat'l. 1 | D.C. MW/°C | T.C. (Sec.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RL3006-50-30-25-PTO | 30°C | 50.0 | 25 | .30 | .06 | 1.5 | .25 | 24 | TC | 7.0 | 35 |
| RL3006-50-40-25-PTO | 40°C | 50 0 | 25 | .30 | .06 | 1 5 | .25 | 24 | TC | 7 0 | 35 |
| RL3006-50 50-25-PTO | 50°C | 50 0 | 25 | .30 | .06 | 1 5 | .25 | 24 | TC | 7 0 | 35 |
| RL3006-50-60-25-PTO | 60°C | 50.0 | 25 | .30 | .06 | 1 5 | .25 | 24 | TC | 7.0 | 35 |
| RL5506-5-65-50-PTO | 65°C | 5.00 | 50 | .55 | .06 | 1.5 | .33 | 20 | TC | 14 0 | 50 |
| RL5510-25-65-120-PTO | 65°C | 25.0 | 120 | .55 | .10 | .5 | .33 | 22 | TAS | 15.0 | 90 |
| RL3006-50 70-25-PTO | 70°C | 50 0 | 25 | .30 | .06 | 1 5 | .25 | 24 | TC | 7.0 | 35 |
| RL3006-50-80-25-PTO | 80°C | 50.0 | 25 | .30 | .06 | 1.5 | .25 | 24 | TC | 7.0 | 35 |
| RL3006-50-90-25-PTO | 90°C | 50.0 | 25 | 30 | 06 | 1.5 | .25 | 24 | TC | 7.0 | 35 |
| RL3006-50-100-25-PTO | 100°C | 50 0 | 25 | .30 | 06 | 1.5 | 25 | 24 | TC | 7 0 | 35 |
| RL3006-50-110-25-PTO | 110°C | 50 0 | 25 | .30 | 06 | 1.5 | 25 | 24 | TC | 7.0 | 35 |
| RL5510-32-110-50-PTO | 110°C | 32 0 | 50 | 55 | 10 | 1.5 | .33 | 20 | TC | 20.0 | 80 |
| RL3006-20-120-25-PTO | 120°C | 20 0 | 25 | .30 | 06 | 1 5 | .25 | 22 | TC | 8 0 | 30 |
| RL3006-50-120-25-PTO | 120°C | 50 0 | 25 | .30 | .06 | 1.5 | 25 | 24 | TC | 7.0 | 35 |
| RL3312-200-120-50-PTO | 120°C | 200.0 | 50 | .33 | .12 | 1.5 | .25 | 20 | TC | 12.0 | 40 |
| RL5505-2.5-120-20-PTO | 120°C | 2.50 | 20 | .55 | 05 | 1.5 | .33 | 20 | TC | 14.0 | 50 |
| RL5505-5-120-20-PTO | 120°C | 5.00 | 20 | .55 | .05 | 1 5 | .33 | 20 | TC | 14.0 | 50 |
| RL6306-11-120-20-PTO | 120°C | 11.0 | 20 | .63 | .06 | 1.5 | 33 | 20 | TC | 15.0 | 70 |
| RL8206-4-120-30-PTO | 120°C | 4 00 | 30 | 82 | .06 | 1.5 | .33 | 18 | TC | 20.0 | 80 |

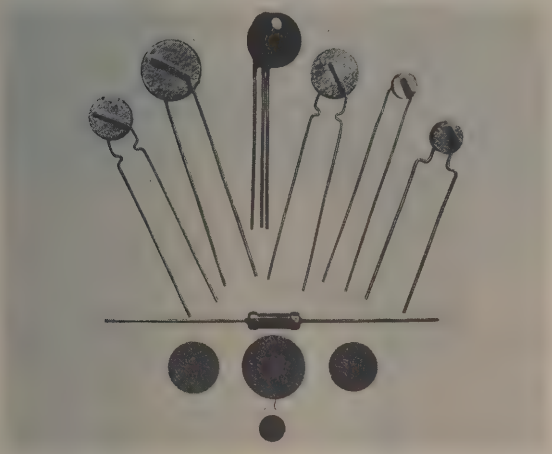



NOTE: 1. Lead Material: TC = Tinned Copper. TAS = Tinned Annealed Steel.
2. Operating Voltage: D.C. or 60Hz A.C. (for higher voltage req. —contact factory).
3. The specifications and configurations shown above are typical of standard items. Special characteristics, designs and alternate physical sizes are available upon request.

Keystone CARBON COMPANY
*Thermistor Division • St. Marys, Pa. 15857*
*814-781-1591 • Telex No. 91-4517*

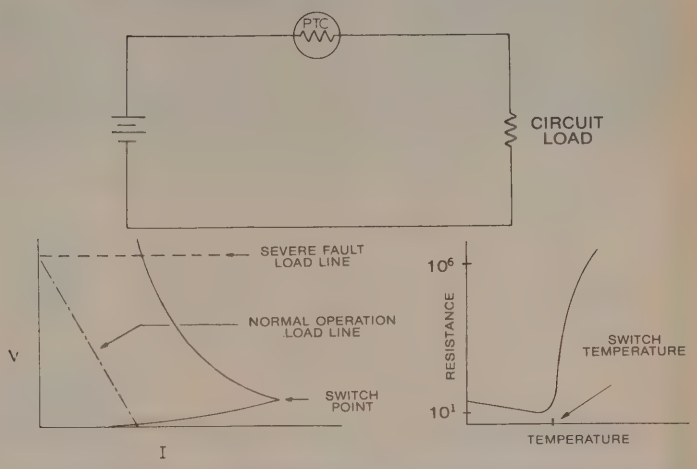
Keystone CARBON COMPANY

# POPULAR PTC CIRCUIT APPLICATIONS



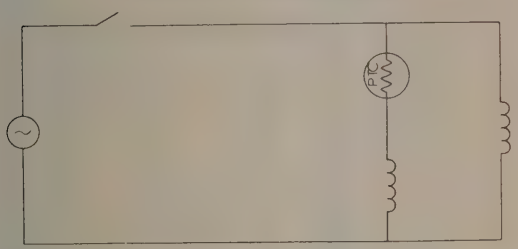
A large resistance change in a small temperature span best describes PTC thermistors. The temperature at which the resistance begins to increase rapidly is known as the "switching temperature." Because of this transformation, PTC's are an ideal component for circuits where the built-in switching temperature can be used to advantage. A few of the many applications are shown on this page.

## NON-DESTRUCTIVE FUSE



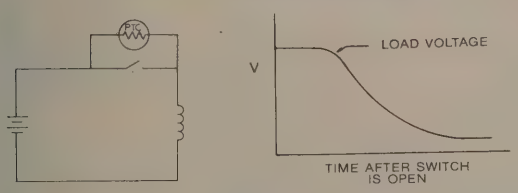

In normal operation the PTC dissipates minimal power keeping its body temperature well below the switch temperature. If a fault of sufficient magnitude occurs, additional power drives the temperature of the PTC up to the switch temperature. At this point additional power becomes available to the PTC, and the only stable operating point is at a much higher resistance than the switch temperature resistance as shown in the illustration above.

## MOTOR STARTING



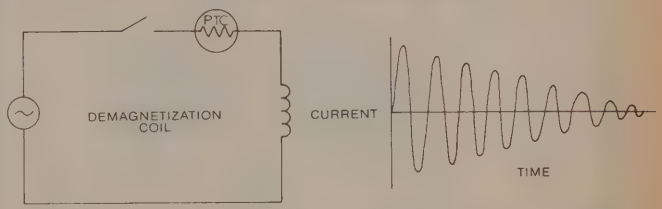

In the above circuit the PTC thermistor replaces the troublesome starting switch in a single-phase motor. When the circuit is energized the PTC has a low resistance and permits most of the line voltage to be applied to the starter winding. As the motor starts, the PTC heats up until the switch temperature is reached at a rate determined by the thermal inertia of the PTC and current flowing through the starting winding. At this point, the thermistor rapidly changes from a low resistance device to a high resistance unit, and the steady state power applied to the PTC is very low causing the current through the starting winding to be negligible.

## ARC SUPPRESSION



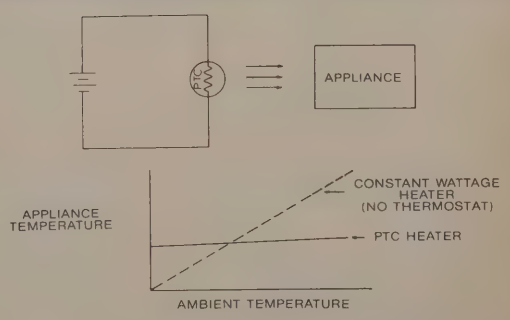

In the above illustrations the PTC switches from a low resistance to a high resistance when the switch is opened. The low resistance of the PTC provides effective arc suppression, and the subsequent PTC switching action transfers essentially all of the power supply voltage from the inductive load to the PTC element.

## AUTOMATIC DEGAUSSING




When the switch on the above circuit is closed, a high percentage of the line voltage is impressed across the demagnetization coil. Within a short period of time, the PTC self-heats, switching from a low resistance level to a high resistance, and thereby decreasing the demagnetization coil current to near zero. The length of time for this switching action to occur is a function of the power applied to the PTC and its thermal inertia.

## COMBINATION HEATER-THERMOSTAT




PTC thermistors provide an economical method of temperature control by combining the function of the heater and thermostat in one ceramic pellet. This thermostatic action is accomplished by the steep PTC characteristic. As the ambient temperature rises, the resistance of the PTC is increased, thus reducing the input power to the circuit maintaining a relatively constant temperature.

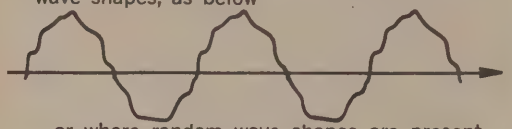
Keystone CARBON COMPANY
Thermistor Division • St. Marys, Pa. 15857
814-781-1591 • Telex No. 91-4517

# Guide to types, models and applications of BEST vacuo-junction THERMOCOUPLES

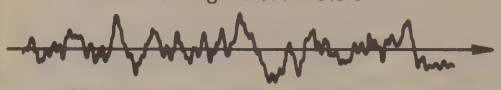
## as used by leading instrument manufacturers for:

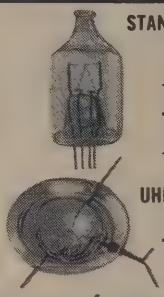
### TRUE RMS MEASUREMENT

—where the signal is periodic with distorted wave shapes, as below



—or where random wave shapes are present, even with high crest factors



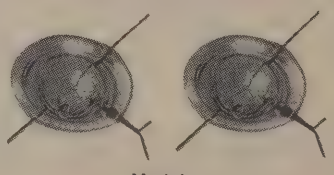


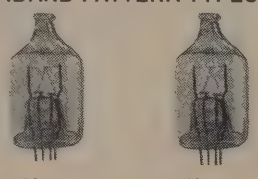

**(Use either standard or UHF pattern, depending upon frequency)**

### LINEAR TRUE RMS MEASUREMENT

MATCHED PAIRS

| | UHF TYPES | STANDARD PATTERN TYPES | |
|---|---|---|---|
| | Model MPU 1 | Model MP1S7 | Model MP219 |
| Tracking accuracy | 0.5% | 0.5% | 0.2% |
| Time constant | 1 sec | 1 sec | 200ms |
| Nominal current | 5mA | 5mA | 6.67mA |





**Tracking accuracy applies over full 25°C temperature range.**

**Single standard patterns** for 5mA and higher, usable to −65MHz; for less than 5mA, usable to 10MHz.

**Single UHF types** usable to 500MHz.

**Temperature coefficient** of output available from −0.2% per °C down to 0.005% per °C in some models.

**Reversal error**, standard 0.2%. Most models available with R/E down to 0.02%, some models to 0.005%.

**Optional special features:** short time constants to 50 ms; double heater devices, ultra miniature sizes.

**PHYSICAL DATA, STANDARD PATTERNS**

| | |
|---|---|
| Height of envelope | 0.900 inch |
| Diameter of envelope | 0.437 |
| Length of lead from envelope | 2 ± ¼ inches |
| Length of sleeve from envelope | 1¾ ± ¼ inches |
| Heater leads: | |
| Up to 400 milliamps | 0.012 ± 0.002 inch diameter |
| 500 milliamps and over | 0.020 ± 0.002 inch diameter |
| Couple leads—all ranges | 0.012 ± 0.002 inch diameter |

**PHYSICAL DATA, U.H.F. PATTERNS**

| | |
|---|---|
| Height of envelopes | 0.750 inch |
| Diameter of envelope | 0.800 inch |
| Width across heater leads | 1.500 inches |
| Diameter of heater and couple wires | 0.020 inch |

Positive indicated by spot of red lacquer.

Specifications subject to change without notice.

Write on company letterhead for application notes and full line catalog

**BEST ELECTRICS DIVISION**
**HARRY LEVINSON COMPANY**
1211 E. Denny Way, Seattle, Wash. 98122 • Tel. (206) 323-5100 • TWX 910-444-2154

### Partial list of BEST STANDARD PATTERNS, INSULATED

*Preferred units, available from stock.

| Model No. | Range mA | Heater ohms Resistance ±10% | Couple ohms Resistance ±10% |
|---|---|---|---|
| Following models have O/C E.M.F. of 7mV ±12%. Maximum permissible load, 250% of nominal. | | | |
| *S1 | 1.0 | 1750 | 13 |
| S2 | 1.25 | 1600 | 13 |
| S3 | 1.5 | 1000 | 13 |
| *S4 | 2.0 | 800 | 12 |
| *S5 | 2.5 | 400 | 8 |
| S6 | 3.0 | 200 | 8 |
| *S7 | 5.0 | 90 | 8 |
| *S8 | 7.5 | 45 | 8 |
| *S9 | 10.0 | 25 | 8 |
| S10 | 15.0 | 20 | 4 |
| S11 | 20.0 | 15 | 4 |
| S12 thru S23 | 25.0 thru 1000.0 | 10.0 thru 0.15 | 4 |
| Following have O/C E.M.F. of 20mV ±12%. Maximum permissible load, 200% of nominal. | | | |
| S45 | 2.0 | 2000 | 13 |
| S46 | 2.5 | 1600 | 13 |
| S47 | 3.0 | 800 | 13 |
| *S48 | 5.0 | 250 | 8 |
| S49 | 7.5 | 180 | 8 |
| *S50 | 10.0 | 125 | 8 |
| S51 | 15.0 | 50 | 4 |
| S52 | 20.0 | 30 | 4 |
| S53 thru S64 | 25.0 thru 1000.0 | 25.0 thru 0.25 | 4 |
| Following models have O/C E.M.F. of 10mV ±12%. Maximum permissible load, 200% of nominal. | | | |
| S98 | 1.25 | 1600 | 13 |
| S99 | 2.0 | 800 | 13 |
| S100 | 2.5 | 400 | 8 |
| S101 | 3.0 | 300 | 8 |
| *S102 | 5.0 | 125 | 8 |
| S103 | 7.5 | 70 | 8 |
| *S104 | 10.0 | 40 | 8 |
| S105 | 15.0 | 25 | 4 |
| S106 | 20.0 | 20 | 4 |
| S107 thru S118 | 25.0 thru 1000.0 | 15.0 thru 0.15 | 4 |

### BEST U.H.F. UNITS, INSULATED

*Preferred units, available from stock.

| | |
|---|---|
| Capacitance | 0.3 mfd |
| Inductance, approx. | 0.02 uH |

Following models have O/C E.M.F. of 7 mv ±12%. Maximum permissible load, 250% of nominal.

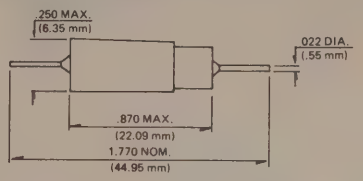
| | | | |
|---|---|---|---|
| *U1 | 5 | 90 | 8 |
| *U2 | 10 | 25 | 8 |
| U3 | 15 | 20 | 4 |
| U4 | 20 | 15 | 4 |
| U5 | 25 | 10 | 4 |
| U6 | 50 | 3 | 4 |
| U7 | 100 | 1.5 | 4 |
| U8 | 150 | 1.0 | 4 |
| U9 | 200 | 0.7 | 4 |
| U10 | 250 | 0.6 | 4 |
| U11 | 500 | 0.3 | 4 |
| U12 | 1000 | 0.15 | 4 |
| U27 | 2.5 | 200 | 8 |

(Max. Perm. Load, Model U27, 150% of nominal)

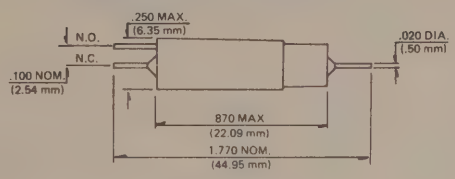
# TEMPERATURE SENSING SWITCH

## CONVENIENT AND RELIABLE TEMPERATURE CONTROL

Miniature temperature switches use an electro-ceramic element instead of a bimetallic switch. The hermetically sealed sensors are corrosion and explosion proof. Switches may be specified as normally open, normally closed or a combination of both in an SPDT switch configuration. Fast response time is achieved by packaging the devices in a small (0.25x0.5 in.) case. At full rated load, the switches can perform 3-million operations. Switch temperatures from 0°C and up are available.




SPST Form B (NC)
SPST Form A (NO)

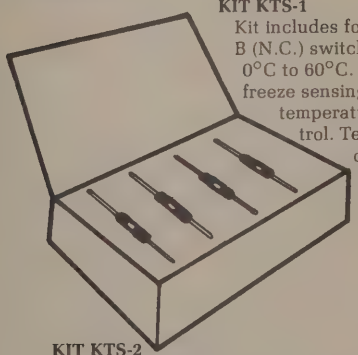



SPDT Form C

## SPECIFICATIONS

| | SPST Form B (NC) | SPST Form A (NO) SPDT Form C |
|---|---|---|
| CONTACT RATING | Watts — 10W maximum<br>Volt Amps — 12 V.A. maximum | Watts — 3W maximum<br>Volt Amps — 3 VA maximum |
| VOLTAGE | Volts D.C. — 100 VDC maximum<br>Volts A.C. — 120 VAC maximum | Volts D.C. — 100 VDC maximum<br>Volts A.C. — 120 VAC maximum |
| CURRENT | Carry — 1 amp maximum<br>Break — 1 amp maximum<br>Make — .5 amp maximum | Carry — 1 amp maximum<br>Break — 1 amp maximum<br>Make — .250 amp maximum |
| SWITCH TEMPERATURE — NOMINAL | 5° increments starting at 0°C | 5° increments starting at 0°C |
| TOLERANCE | ±5°C | ±5°C |
| RESET DIFFERENTIAL | 10°C maximum | 10°C maximum |

## SWITCH DETERMINATOR KITS



**KIT KTS-1**
Kit includes four Form B (N.C.) switches from 0°C to 60°C. Use for freeze sensing and temperature control. Technical data also included.

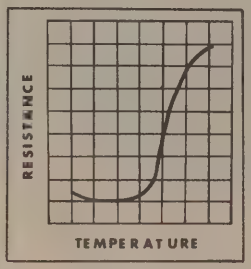
**KIT KTS-2**
Kit includes four Form B (N.C.) switches from 80°C to 100°C. Use for temperature control, monitoring, and over temperature protection. Technical data also included.

| TYPE NO. | TEMP. (°C) | CONTACTS |
|---|---|---|
| TS0B | 0 | N.C. |
| TS0A | 0 | N.O. |
| TS0C | 0 | S.P.D.T |
| TS5B | 5 | N.C |
| TS5A | 5 | N.O |
| TS15B | 15 | N.C. |
| TS20B | 20 | N.C |
| TS25B | 25 | N.C. |
| TS25A | 25 | N.O. |
| TS25C | 25 | S.P.D.T |
| TS35B | 35 | N.C. |
| TS35A | 35 | N.O. |
| TS35C | 35 | S.P.D.T |
| TS40B | 40 | N.C. |
| TS40A | 40 | N O. |
| TS40C | 40 | S.P.D T. |
| TS45B | 45 | N.C. |
| TS50B | 50 | N.C. |
| TS50A | 50 | N.O. |
| TS50C | 50 | S.P.D.T. |
| TS60B | 60 | N.C. |
| TS65B | 65 | N.C. |
| TS65A | 65 | N.O. |
| TS70A | 70 | N.O. |
| TS80B | 80 | N.C. |
| TS80A | 80 | N.O. |
| TS85B | 85 | N.C. |
| TS85A | 85 | N.O. |
| TS95B | 95 | N.C. |
| TS95A | 95 | N.O. |
| TS95C | 95 | S.P.D.T. |
| TS100B | 100 | N.C. |
| TS105B | 105 | N.C. |
| TS110B | 110 | N.C. |

MCI
MIDWEST COMPONENTS INC.
P.O. Box 787/1981 Port City Blvd.
Muskegon, MI 49443
(616) 777-2602/TWX: 510-394-4130

# PTC SWITCHING THERMISTORS

## The Positive Way to SENSE, MEASURE, CONTROL, REGULATE, PROTECT

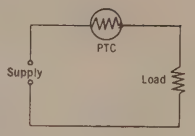



TYPICAL PTC RESISTANCE VS. TEMPERATURE CURVE

### PTC SWITCHING THERMISTOR APPLICATIONS

#### THERMAL OVERLOAD

The PTC Switching Thermistor can be used for thermal overload protection by placing it in close thermal contact to, and electrically in series with the device to be protected.

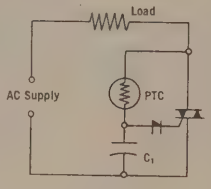



#### HIGH POWER THERMAL OVERLOAD

For high power overload protection, the PTC switching thermistor can be used as a sensor in the gate circuit of a Triac.

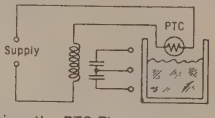
#### TEMPERATURE CONTROL

The above circuit may also be used as a temperature controller. Control temperature will be determined by switch temperature of the thermistor.



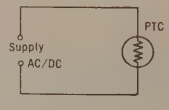

#### LIQUID LEVEL SENSING

A PTC Thermistor can be used to sense liquid level by placing it in series with a relay or in conjunction with other solid state devices. In operation, the PTC is selected to self-heat to its high-resistance mode in free air. When the liquid comes in contact with the thermistor, this heat is dissipated into the liquid, thus cooling the thermistor to its low-resistance mode to energize a solenoid or relay.



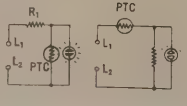

#### HEATER

In this application, the PTC Thermistor is connected directly across the supply. When the circuit is energized, the thermistor quickly heats to its control temperature because of its low base resistance. Once the control temperature is reached, it very accurately maintains that temperature.



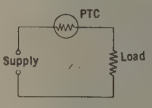

#### SIMPLE TEMPERATURE INDICATOR

Using only a PTC, Indicator Light, and Supply Voltage; a simple indicator can be devised by placing the PTC either in series or parallel with light to give desired on-off indications with temperature.



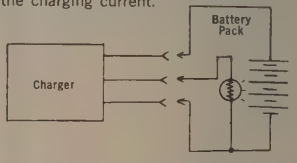

#### CURRENT LIMITING

The PTC Thermistor is placed in series with the load. The thermistor is operated normally in its low-resistance mode until there is an over-current situation. At that time the thermistor quickly self-heats to its high-resistance mode thus limiting current to the load.



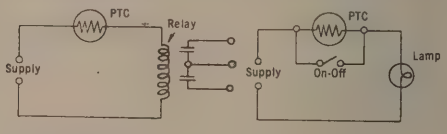

#### OVER-CHARGE PROTECTOR

The PTC Thermistor will easily interface with electronic charging circuitry. By inbedding PTC directly in the battery pack, it will sense the temperature of the pack. When the critical charging temperature is reached, the PTC will trigger the charger to reduce the charging current.



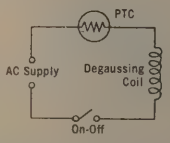

#### TIME DELAY

The PTC Thermistor can be used as the time delay element in a time delay circuit. By placing the thermistor in series with a relay, the relay will pull in immediately and then after a certain time will drop out due to the self-heating and switching action of the thermistor. Another time delay application of the PTC Switching Thermistor is slow turn-off of lighting circuits. When the switch is on, the thermistor remains cold and thus in its low-resistance mode. Once the switch is opened, the thermistor begins to heat and will switch off the lamp.




#### SURGE GENERATION

Because PTC thermistors are available with a very low base resistance, they can deliver very high currents for a short period of time before switching to their high-resistance mode. A typical application of this sort is automatic degaussing of a color TV CRT.




### PTC ENGINEERING APPRAISAL KITS

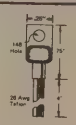
**KIT KPTC-1** Kit contains four PTC devices ranging from break-points of 0°C to 125°C in typical lead configurations. Technical data also included.

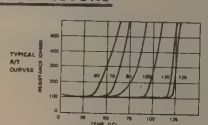
**KIT KPTC-2** Kit contains four PTC devices for use as current limiters or sensors. Protective currents range from 20 to 100 MA. Break-points from 60°C to 125°C.

### OVER TEMPERATURE PROTECTORS

MIDWEST COMPONENTS' Over Temperature Protector provides shutoff or regulation of expensive RF or AF Power Transistors. Protects against over heating that occurs from output stage component failure, antenna breakage, or short conditions.

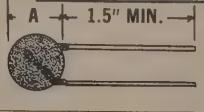
Unlike fuses or bi-metal elements its action is recyclable and has no hysteresis effect.






| ORDER NUMBER | SWITCHING TEMPERATURE (NOM.) | RESISTANCE AT 25°C (OHMS) | RESISTANCE AT SWITCHING TEMPERATURE | MAX. CONT. OPERATING TEMP. |
|---|---|---|---|---|
| OTP60.11 | 60°C | 100 ± 40% | 250 OHMS (min.) | 150°C |
| OTP70.11 | 70°C | 100 ± 40% | 250 OHMS (min.) | 150°C |
| OTP80.11 | 80°C | 100 ± 40% | 250 OHMS (min.) | 150°C |
| OTP100.11 | 100°C | 100 ± 40% | 250 OHMS (min.) | 150°C |
| OTP120.11 | 120°C | 100 ± 40% | 250 OHMS (min.) | 150°C |
| OTP125.11 | 125°C | 100 ± 40% | 250 OHMS (min.) | 150°C |

### CURRENT LIMITERS ACT LIKE A RECOVERABLE FUSE.




The PTC Thermistor is placed in series with the load. The thermistor is operated normally in its low-resistance mode until there is an over-current situation. At that time the thermistor quickly self-heats to its high-resistance mode thus limiting current to the load

| TYPE NO. | OHMS @ 25°C | PROTECTIVE THRESHOLD CURRENT | "A" DIA. |
|---|---|---|---|
| 160D | 100 ± 40% | 20 MA. | 23 |
| 170D | 100 ± 40% | 40 MA. | 23 |
| 200D | 65 ± 40% | 80 MA. | 40 |
| 225D | 100 ± 40% | 100 MA. | 40 |
| 227D | 60 ± 40% | 125 MA. | 60 |

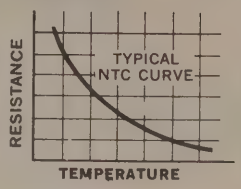
**MIDWEST COMPONENTS INC.**
P.O. Box 787/1981 Port City Boulevard
Muskegon, MI 49443/(616) 777-2602/TWX: 510-394-4130

# NTC THERMISTORS VARISTORS

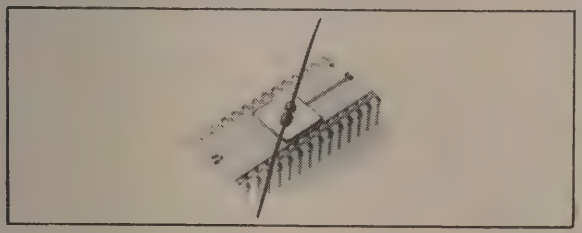
## NTC (Negative Temperature Coefficient)

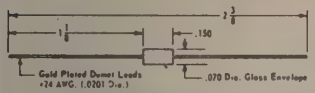
Thermistors offer inexpensive solutions to:

- Temperature Compensation
- Time Delay
- Surge Suppression
- Gas and Liquid Level Sensing
- Temperature Sensing




## HIGH TEMPERATURE SENSOR






| Catalog Number | 1H-104 | 1H503 | 1H-203 | 2H-103 | 2H502 |
|---|---|---|---|---|---|
| Zero Power Resistance @ 25°C Ohms ±10% | 100,000 | 50,000 | 20,000 | 10,000 | 5,000 |
| Resistance Ratio $\frac{R25°C}{R125°C}$ | 29.85 | 29.85 | 29.85 | 19.80 | 19.80 |
| Dissipation Constant ( ) $\frac{\text{milliwatts}}{°C}$ | 2 | 2 | 2 | 2 | 2 |
| Thermal Time Constant ($\tau$) (sec.) | 8 | 8 | 8 | 8 | 8 |
| Maximum Operating Temperature (°C) | 400 | 400 | 400 | 400 | 400 |

## BEAD PROBE

| Zero Power Resistance at 25°C Ohms ±20% | Catalog Number | Resistance Ratio R25°C/R125°C ±5% | Thermal Time Constant ($\tau$) Seconds |
|---|---|---|---|
| 10,000 | 81G-10350 | 29.85 | 25 |
| 50,000 | 81G-50350 | 35.0 | 25 |
| 500,000 | 81G-50450 | 46.5 | 25 |
| 1,000,000 | 81G-10550 | 51.5 | 25 |

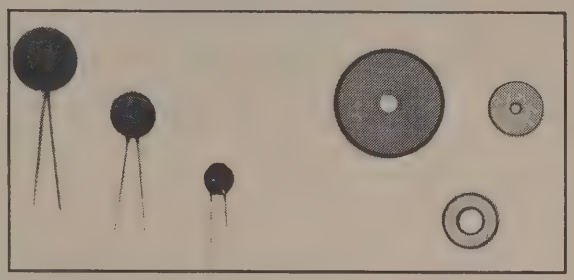
### TEMPERATURE COMPENSATION AND SENSING

| Type | Ohms @ 25°C | Res. Ratio 25°C/125°C | Diss. Const. MW/°C | Time Const. | Dia. In. |
|---|---|---|---|---|---|
| 4D101 | 100K | 48.78 | 4 | 12 | .1 |
| 4D103 | 50K | 48.78 | 4 | 8 | .1 |
| 1D051 | 20K | 29.85 | 2 | 4.5 | .05 |
| 1D101 | 10K | 29.85 | 4 | 12 | .1 |
| 1D103 | 5K | 29.85 | 4 | 8 | .1 |
| 1D201 | 3K | 29.85 | 8 | 34 | .2 |
| 1D501 | 1K | 29.85 | 19 | 140 | .5 |
| 2D054 | 1K | 19.80 | 2 | 3 | .05 |
| 2D102 | 1K | 19.80 | 4 | 10 | .1 |
| 2D104 | 500 | 19.80 | 4 | 6 | .1 |
| 2D202 | 300 | 19.80 | 8 | 24 | .2 |
| 3D504 | 5 | 12.95 | 15.5 | 70 | .5 |
| 4D051 | 200K | 48.78 | 2 | 4.5 | .05 |

### NTC THERMISTORS FOR SURGE SUPPRESSION

Stud assembly allows heat sinking for max. power dissipation. Available in resistances as low as 1 ohm at 25°C.

Midwests' Varistors offer inexpensive answers to problems of transient, surge, and lightning suppression. Energy handling capabilities are limitless depending upon size and construction of devices.



**SMALL TYPE DISCS DESIGNED FOR PROTECTION OF CONTACTORS, RELAYS, AND SOLID STATE COMPONENTS**

**3" AND 6" DIAMETER DISCS FOR MEDIUM POWER APPLICATIONS ALLOW FOR CUSTOM ASSEMBLIES FOR POWER SUPPLY COMPONENTS**

| Catalog Number | Maximum Values: Continuous Operating Voltage (Volts) (DC) | (AC) | Continuous Power Rating (Watts) | Discharge Capacity (Watt-Seconds) | Peak Discharge -Voltage for Given DC Discharge Current (Amps) | (Volts) | Specifications: DC Test Voltage & Current (Volts ±20)% | (Amps) |
|---|---|---|---|---|---|---|---|---|
| .5" DIA. | | | | | | | | |
| 70D-5010 | 150 | 135 | .25 | 30 | .10 | 400 | 175 | .001 |
| 68D-5010 | 60 | 54 | .25 | 30 | .10 | 200 | 75 | .0025 |
| 67D-5010 | 30 | 27 | .25 | 30 | .25 | 100 | 35 | .005 |
| 65D-5010 | 15 | 13.5 | .25 | 20 | .25 | 60 | 15 | .010 |
| .75" DIA. | | | | | | | | |
| 71D-7000 | 150 | 135 | .75 | 50 | .125 | 400 | 175 | .005 |
| 68D-7000 | 60 | 54 | .75 | 50 | .25 | 185 | 70 | .0125 |
| 66D-7000 | 30 | 27 | .75 | 50 | .25 | 185 | 70 | .0125 |
| 63D-7000 | 15 | 13.5 | .75 | 50 | .50 | 100 | 35 | .025 |
| 1.0" DIA. | | | | | | | | |
| 71D10000 | 300 | 270 | 1.5 | 275 | .25 | 1000 | 350 | .005 |
| 68D10000 | 150 | 135 | 1.5 | 275 | .50 | 575 | 175 | .010 |
| 66D10000 | 60 | 54 | 1.5 | 275 | 1.0 | 305 | 70 | .025 |
| 63D10000 | 30 | 27 | 1.5 | 275 | 1.5 | 175 | 35 | .050 |
| 3" DIA. | | | | | | | | |
| 71W30100 | 1500 | 1350 | 3.5 | 9250 | 10 | 7500 | 1800 | 0.0025 |
| 69W30100 | 300 | 270 | 3.0 | 5100 | 1.5 | 1350 | 520 | 0.050 |
| 68W30100 | 150 | 135 | 3.0 | 5100 | 2.5 | 800 | 230 | 0.050 |
| 67W30100 | 60 | 54 | 3.0 | 1700 | 5.0 | 250 | 85 | 0.100 |
| 66W30100 | 30 | 27 | 3.0 | 1700 | 5.0 | 150 | 36 | 0.100 |
| 63W30100 | 15 | 13.5 | 3.0 | 1350 | 10 | 100 | 25 | 0.500 |
| 62W30100 | 7 | 6.3 | 3.0 | 1100 | 10 | 40 | 9 | 0.500 |
| 6" DIA. | | | | | | | | |
| 69W60100 | 275 | 250 | 10 | 22,500 | 10 | 1200 | 550 | 0.500 |
| 68W60200 | 200 | 180 | 10 | 22,500 | 12.5 | 990 | 400 | 0.500 |
| 68W60100 | 150 | 135 | 10 | 22,500 | 15 | 780 | 300 | 0.500 |

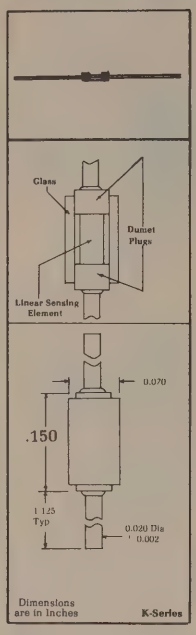
**3" AND 6" ASSEMBLIES FOR HIGH ENERGY USES. ALL UNITS HAVE STANDARD BRACKET MOUNTS AND SOLDERLESS TERMINALS FOR FAST CONNECTION**

| Type | Catalog Number | Continuous DC Operating Voltage Rating (Volts) | Continuous Power Loss in Operation (Watts) | Discharge Capacity (Watt-Seconds) |
|---|---|---|---|---|
| BRACKET | 9RV3A12 | 150 | 3 | 5,100 |
| | 9RV3A14 | 300 | 3 | 5,100 |
| | 9RV3A15 | 600 | 6 | 10,200 |
| | 9RV6A4 | 150 | 40 | 90,000 |
| | 9RV6A5 | 300 | 20 | 45,000 |
| | 9RV6A6 | 275 | 10 | 22,500 |
| | 9RV6A7 | 275 | 20 | 45,000 |
| | 9RV6A8 | 275 | 30 | 67,500 |
| | 9RV6A9 | 275 | 40 | 90,000 |
| | 9RV6A10 | 550 | 20 | 45,000 |
| BOX | 9RV6A65 | 550 | 120 | 270,000 |
| | 9RV6A55 | 550 | 240 | 540,000 |

MCI
MIDWEST COMPONENTS INC.
P.O. Box 787/1981 Port City Blvd./Muskegon, MI 49443/(616) 777-2602/TWX: 510-394-4130

# TEMPSISTOR™

**A SOLID STATE LINEAR TEMPERATURE DEVICE**




**A Solid State Linear Temperature Device that can be used:** TO PROVIDE OUTSTANDING TRACKING & INTERCHANGEABILITY. The Tempsistor™ has a repeatable positive temperature coefficient over the operating temperature range, averaging +0.7%/°C.

TO PROVIDE EASY MATING WITH MICRO-PROCESSOR CIRCUITS. The Tempsistor™ is highly linear over its −65° to 200°C temperature range.

TO CONTROL & MEASURE CIRCUITS. The Tempsistor™ responds exceptionally fast to temperature changes, making it an ideal temperature sensor.

TO STABILIZE DIGITAL & LINEAR INTEGRATED CIRCUITS. The Tempsistor™ temperature coefficient of +0.7%/°C provides compensation for thermal changes because its temperature coefficient is an ideal compliment for silicon devices.

The Tempsistor™ can efficiently be used for all of these functions because it was designed to meet or exceed all electrical requirements of the MIL-T-23648 for positive TC thermistors and because it has a big positive temperature coefficient of resistance that is approx. 0.7%/deg.

**APPLICATIONS FOR THE TEMPSISTOR™.**

**Consumer Products**

| | | |
|---|---|---|
| Automobiles | Televisions | Microwave Ovens |
| Airplanes | Clothes Dryers | Calculators |
| Freezers | Coffee Pots | Battery Chargers |
| Fire & Smoke Detectors | CB Radios | |

**Industrial and Military Products**

| | | |
|---|---|---|
| Telephone Switching Stations | Solar Systems | Missles |
| Photo Copiers | Computers | Volt Meters |
| Commercial Deep Fryers | Electric Typewriters | Watt Meters |

## TEMPSISTOR™ SPECIFICATIONS

| *** Resistance Ratio Temperature Characteristics | | | | | |
|---|---|---|---|---|---|
| Temp. | | $R_T/R_{25}$ Multiplier | | | |
| | | RESISTANCE VALUES (Ohms) | | | |
| °C | °F | 10-56Ω | 68-820Ω | 1-2.7KΩ | 3.3-10KΩ |
| -25 | -13 | .73 | .65 | .65 | .61 |
| 0 | 32 | .86 | .82 | .81 | .83 |
| 25 | 77 | 1.00 | 1.00 | 1.00 | 1.00 |
| 50 | 122 | 1.15 | 1.21 | 1.19 | 1.19 |
| 75 | 167 | 1.32 | 1.44 | 1.39 | 1.37 |
| 100 | 212 | 1.49 | 1.68 | 1.58 | 1.52 |
| 125 | 257 | 1.68 | 1.94 | 1.75 | 1.64 |
| 150 | 302 | 1.89 | 2.21 | 1.89 | N.A. |

To find the resistance of a particular Tempsistor™ at any temperature in this table, multiply its 25°C resistance by the multiplier for that temperature.

## THE TEMPSISTOR™ KIT KLTS-1

Kit contains six **TEMPSISTOR™** devices with resistances of 10, 100, 500, 1000, 5000, and 10,000 ohms. Technical data also included

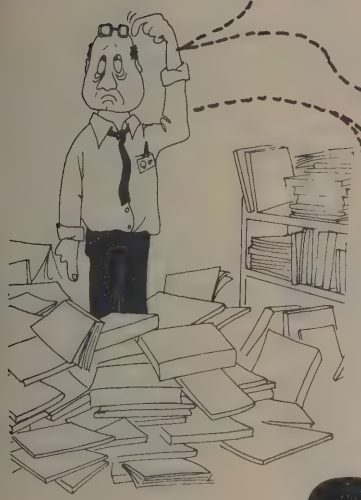
| TYPE | (Ohms) at 25°C AMBIENT TEMP. ± 10% | DISSIPATION CONSTANT mw/°C | TIME CONSTANT (sec.) | DIM. "A" | MAX OPERATE TEMP. °C. |
|---|---|---|---|---|---|
| 1K100K | 10 | 2.5 | 15 | .150 | 200 |
| 1K120K | 12 | 2.5 | 15 | .150 | 200 |
| 1K150K | 15 | 2.5 | 15 | .150 | 200 |
| 1K180K | 18 | 2.5 | 15 | .150 | 200 |
| 1K220K | 22 | 2.5 | 15 | .150 | 200 |
| 1K270K | 27 | 2.5 | 15 | .150 | 200 |
| 1K330K | 33 | 2.5 | 15 | .150 | 200 |
| 1K390K | 39 | 2.5 | 15 | .150 | 200 |
| 1K470K | 47 | 2.5 | 15 | .150 | 200 |
| 1K500K | 50 | 2.5 | 15 | .150 | 200 |
| 1K560K | 56 | 2.5 | 15 | .150 | 200 |
| 1K680K | 68 | 2.5 | 15 | .150 | 200 |
| 1K820K | 82 | 2.5 | 15 | .150 | 200 |
| 1K101K | 100 | 2.5 | 15 | .150 | 200 |
| 1K121K | 120 | 2.5 | 15 | .150 | 200 |
| 1K151K | 150 | 2.5 | 15 | .150 | 200 |
| 1K181K | 180 | 2.5 | 15 | .150 | 200 |
| 1K221K | 220 | 2.5 | 15 | .150 | 200 |
| 1K271K | 270 | 2.5 | 15 | .150 | 200 |
| 1K331K | 330 | 2.5 | 15 | .150 | 200 |

| TYPE | (Ohms) at 25°C AMBIENT TEMP. ± 10% | DISSIPATION CONSTANT mw/°C | TIME CONSTANT (sec.) | DIM. "A" | MAX OPERATE TEMP. °C. |
|---|---|---|---|---|---|
| 1K391K | 390 | 2.5 | 15 | .150 | 200 |
| 1K471K | 470 | 2.5 | 15 | .150 | 200 |
| 1K501K | 500 | 2.5 | 15 | .150 | 200 |
| 1K561K | 560 | 2.5 | 15 | .150 | 200 |
| 1K681K | 680 | 2.5 | 15 | .150 | 200 |
| 1K821K | 820 | 2.5 | 15 | .150 | 200 |
| 2K102K | 1000 | 2.5 | 15 | .150 | 150 |
| 2K122K | 1200 | 2.5 | 15 | .150 | 150 |
| 2K152K | 1500 | 2.5 | 15 | .150 | 150 |
| 2K182K | 1800 | 2.5 | 15 | .150 | 150 |
| 2K222K | 2200 | 2.5 | 15 | .150 | 150 |
| 2K272K | 2700 | 2.5 | 15 | .150 | 150 |
| 2K332K | 3300 | 2.5 | 15 | .150 | 125 |
| 2K392K | 3900 | 2.5 | 15 | .150 | 125 |
| 2K472K | 4700 | 2.5 | 15 | .150 | 125 |
| 2K502K | 5000 | 2.5 | 15 | .150 | 125 |
| 2K562K | 5600 | 2.5 | 15 | .150 | 125 |
| 2K682K | 6800 | 2.5 | 15 | .150 | 125 |
| 2K822K | 8200 | 2.5 | 15 | .150 | 125 |
| 2K103K | 10000 | 2.5 | 15 | .150 | 125 |

**MIDWEST COMPONENTS INC.**
P.O. Box 787/1981 Port City Boulevard
Muskegon, MI 49443/(616) 777-2602/TWX: 510-394-4130

*What can I use to keep all the manufacturers' product data I receive in order?*

*What system makes filing or retrieving manufacturers' catalogs fast and easy?*



*Which file system have thousands of engineers purchased because they know it works?*

# eem FILE SYSTEM

## THE ONLY FILE SYSTEM DESIGNED SPECIALLY FOR THE ELECTRONIC ENGINEER!

The publishers of **eem** have put together a unique filing system for electronic product information. The complete system includes: a product index booklet which classifies electronic products into 3,000 listings both alphabetically and by product group, and 45 file folders imprinted with the **eem** product sections (extra gummed labels included for expanding the system.)

As you receive manufacturers' catalog data sheets, technical bulletins, or clip magazine articles, jot down the proper Product Section Numbers from the **eem** PRODUCT-TO-SECTION INDEX. Then simply file in order. When you require information on a specific product, refer to PRODUCT-TO-SECTION INDEX again to locate the correct file folder. It's simple, and you'll always have the necessary data to compare, specify and buy, right at your fingertips.

**Here's how to order your eem FILE SYSTEM:**

For the complete system send $10 (plus tax; N.Y., 8%, CA, 6½%) in check or money order to:

United Technical Publications, Inc.,
645 Stewart Avenue, Garden City, N.Y. 11530
Att: Circulation dept.

For an **eem FILE SYSTEM** without file folders send $7.50 (plus tax; N.Y. 8%; CA, 6½%).

*UNITED TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500*

# OMEGA®

## OMEGA ENGINEERING, INC.

**Dept. EM, P.O. Box 4047, Stamford, CT 06907**

**WRITE OR PHONE . . .**

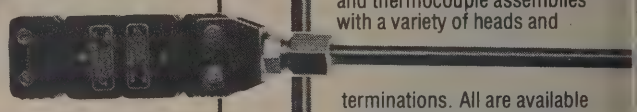
## NEW! FREE!

### THERMOCOUPLE HANDBOOK

**OMEGA'S HANDBOOK and CATALOG . . .**
Most complete listing of over 8,000 temperature measurement products. All prices included.

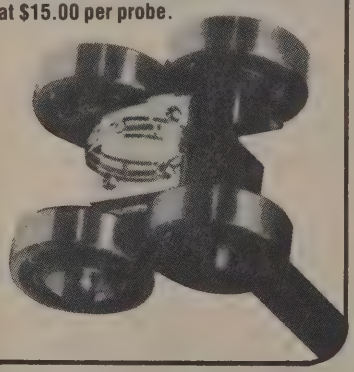
### THERMOCOUPLES AND ASSEMBLIES

OMEGA produces a broad range of thermocouples, probes and assemblies, including a full line of sub-miniature probes, bare wire-type thermocouples with a diameter as fine as 0.0005 inches, quick-disconnect type assemblies, replacement probes and thermocouple assemblies with a variety of heads and terminations. All are available for IMMEDIATE DELIVERY. Refer to FREE catalog for complete listing and prices. **Prices start at $2.50 per thermocouple.**



### SURFACE PROBES AND PYROMETERS

OMEGA offers a number of unique, patented thermocouple probes designed for measuring the precise temperature of moving and stationary surfaces. Also available are companion readout meters, portable pyrometers and companion probes for heavy duty service. New miniature thermometer and its companion probes are in stock also ALL OFF-THE-SHELF. **Prices start at $15.00 per probe.**

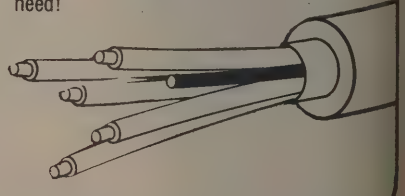


### YOUR THERMOCOUPLE PROBLEMS RECEIVE REALISTIC SOLUTIONS AT OMEGA

**Most thermocouple problems can be solved using Omega's "off-the-shelf" thermocouple products. But, if you have that SPECIAL problem requiring exotic thermocouples, multipoint/profile thermocouples, motorized switches, or anything unusual in thermometry, just send us a print. Omega will quote you realistically. Our years of experience and technology assure you QUICK DELIVERY and the right temperature sensor for the job. AND, WE KEEP OUR PROMISES.**

### THERMOCOUPLE WIRE

OMEGA's broad range of thermocouple wire encompasses just about every conceivable type available, including bare wire, teflon coated wire, metal-sheathed wire, all types of asbestos, glass, plastic covered and enameled wire in sizes from 0.0005" diameter on up. Even tungsten-rhenium, platinum and base metal alloys, plus various extension wire types . . . all ON HAND for IMMEDIATE DELIVERY. Buy as little or as much as you need!



## *FOR IMMEDIATE OFF-THE-SHELF DELIVERY CALL OMEGA . . . (203) 359-1660 or TELEX 996404*

***Ask about "Speed Service": orders shipped within 24 hours when requested. Minimum Order: $10.00.***

# THERMOCOUPLES

## ONE COMPLETE SOURCE FOR ALL YOUR OFF-THE-SHELF THERMOCOUPLE REQUIREMENTS.

### NEW! ELECTRONIC ICE POINT

The OMEGA-MCJ is an incredible Thermocouple Ice Point Reference built into a color-coded thermocouple connector! Available in 9 calibrations, converts from a "female" to a "male" connector in seconds. **Priced at $49.00.**

OMEGA also offers many other types of thermocouple references and cold junctions compensators to fill all of your needs. **Prices begin at $49.00.**

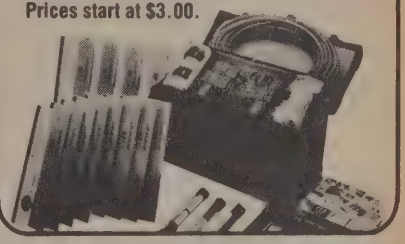
### METERS, AMPLIFIERS AND READOUTS

OMEGA's expanded line of readout meters, digital readouts for thermocouples, thermistors and RTD's, plus thermocouple amplifiers are available now for IMMEDIATE DELIVERY. **Meter prices start at $36.00.**

### THERMOCOUPLE ASSEMBLY KITS

CEMENTS AND LACQUERS

OMEGA offers an expanded variety of kits to cement fine gage thermocouples in place and to build a variety of thermocouple probes and assemblies in only minutes, available OFF-THE-SHELF. **Prices start at $3.00.**

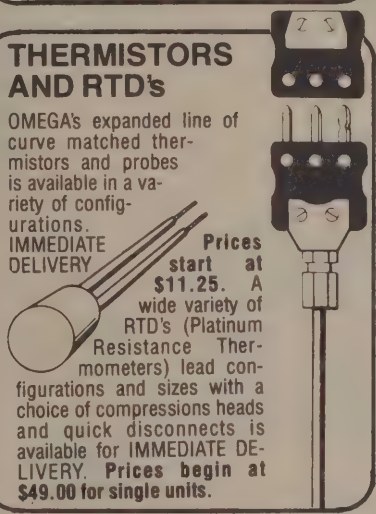


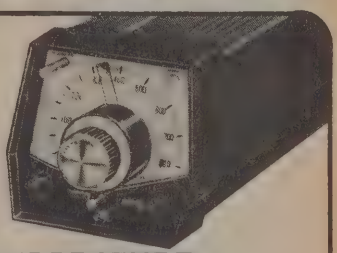
### TEMPERATURE SENSITIVE PAINTS, LACQUERS, CRAYONS, SPRAYS AND PELLETS

If you require any markers to be used as high quality surface temperature indicators, OMEGA has a vast variety of convenient forms, including paints, lacquers, crayons, sprays and pellets OFF-THE-SHELF. **Prices start at $1.00.**

### THERMISTORS AND RTD's

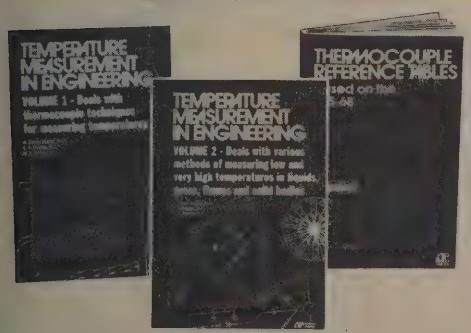
OMEGA's expanded line of curve matched thermistors and probes is available in a variety of configurations. IMMEDIATE DELIVERY **Prices start at $11.25.** A wide variety of RTD's (Platinum Resistance Thermometers) lead configurations and sizes with a choice of compressions heads and quick disconnects is available for IMMEDIATE DELIVERY. **Prices begin at $49.00 for single units.**





### TEMPERATURE CONTROLLERS

OMEGA's solid state plug-in electronic indicating temperature controllers feature full plug-in construction; plug-in relays; full-time, full-scale indication; thermocouple break protection; heating and cooling lights and easy screw terminal wiring. 3 lbs. Available for IMMEDIATE DELIVERY. **Price: $160.00.**


TEMPERATURE MEASUREMENT IN ENGINEERING
VOLUME 1 - Deals with
TEMPERATURE MEASUREMENT IN ENGINEERING
VOLUME 2 - Deals with various methods of measuring low and very high temperatures in Solids,
THERMOCOUPLE REFERENCE TABLES

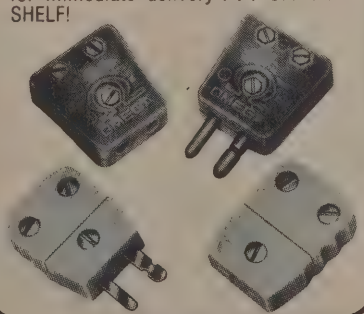
### Some of the MOST USEFUL AND NEEDED BOOKS ON TEMPERATURE MEASUREMENT!

Temperature Measurement in Engineering, volumes 1 & 2, by H. Dean Baker, E.A. Ryder & N.H. Baker, are classics in the field of temperature measurement and should be on the shelf of every serious temperature measurement researcher or engineer. Vol. 1 $4.95, Vol. 2 $9.95.

Thermocouple Reference Tables based on the IPTS-68 completely revised and unabridged reference tables were developed the National Bureau of Standards; in a handy pocket editions. $2.95.

### THERMOCOUPLE CONNECTORS

Omega has the MOST complete selection of Thermocouple CONNECTORS offered today! We can fill your every connector need . . . from Ultra-High Temperature Ceramic Connectors, to our new extra small Sub-Miniature Connectors. And a full selection of every needed thermocouple accessory is also available . . . connectors and accessories are available for immediate delivery . . . OFF-THE-SHELF!



### "OMNI-AMP" THERMOCOUPLE AMPLIFIERS

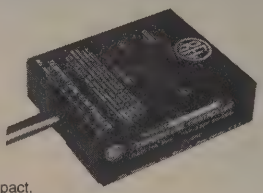
Just plug a thermocouple into Omega's unique new miniature, portable amplifier. A choice of ranges will enable you to boost any millivolt signal from unity to 100 times. Low cost and inexpensive operation from two small mercury batteries eliminates need for thermocouple and meter impedance matching. Drives any readout device with 1000 ohms or greater input impedance. Lab models too! NOW . . . OFF-THE-SHELF! Nothing like it is available from any other source. **Prices start at only $95.00.**

# THERMOCONTROL DIVISION

Since 1922

## Temperature Measurement and Control Equipment

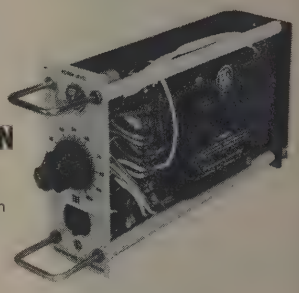
### MINIATURE COMPONENT-TYPE PROPORTIONAL CONTROLLERS



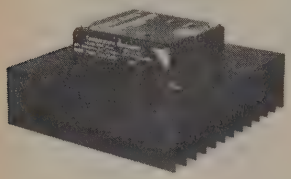
RFL Models 70A, 72A and 75A are compact, nonindicating units capable of precision control of electrically energized heating applications. 70A & 72A units feature proportional bandwidth and coarse and fine temperature set point adjustments. Model 75A low cost model has a single set point adjustment and a fixed, narrow bandwidth.

Current to heating load is controlled by all solid-state components for reliable long life performance. Operates into resistive loads ranging from 1 to 15 amperes using a negative temperature coefficient sensor (Thermistor) as the sensing element. Model 70A's mode of operation is phase angle firing. Models 72A and 75A are zero voltage firing.

### PLUG-IN SYSTEM MODULES FOR MULTIPOINT OPERATION



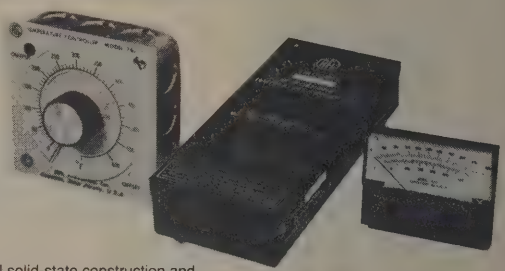
By combining RFL 70A Series Controllers with RFL's new TB-1 Plug-in Modules and TB-3 Chassis, a complete 8-point "do it yourself" control system is possible.



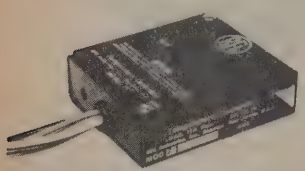
### 9200 WATTS

RFL Model 7040 is a completely solid-state, high load capability, proportional controller. The controller, while small in size, will control resistive loads from 100 to 9,200 watts. Thermistor sensors operating between 8000 ohms and 100 ohms are used providing an operating range of -70°C to +450°C.

### NEW MODEL 76 THERMOCOUPLE/RTD SENSING CONTROLLER

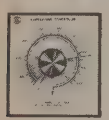


Wide range, all solid-state construction and high accuracy are just a few of the features of the new Model 76. Options include direct setting dials, full range temperature indicator, output level indicator and assorted sensor configurations. Specs: Accuracy to +0.1°C, loads from 1 to 15 amps — 115 or 230 volts, zero voltage firing proportioning mode, size 7¾" × 3⅜" × 1⅝" high.



### DIRECT-SETTING, RTD (WIRE) SENSING, PRECISION CONTROLLER

RFL Model 71A is a completely solid-state, null balance, visual set point, proportional temperature controller. The controller is capable of precisely controlling resistive heaters with one RTD type sensor throughout a visual set point temperature range of 0°C to +500°C (+32°F to +932°F). The controller, while small in size, will control resistive loads from 100 to 3000 watts.



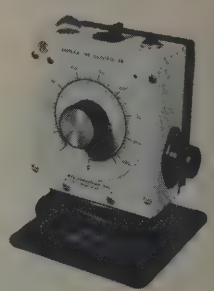
Direct-setting control dial 42065 (Optional)

**STANDARD MODELS**

| | | | | | |
|---|---|---|---|---|---|
| 76T-1 | -100 to +200°C | 76J-1 | 0-300°C | 76K-1 | 0-1000°C |
| 76P-1 | 0 to +500°C | 76J-2 | 0-500°C | | |

| Model | Overall Range (°C) | Accuracy to | Current Load | Sensor Resistance | Sensors |
|---|---|---|---|---|---|
| 70A | -70 to +450 | ±0.05°C | 1-15 Amps | 8000 to 100 ohms | Series 27687 |
| 71A | 0 to +500 | ±0.05°C | 1-15 Amps | RTD Type (100 ohms) Sensor | 24928 |
| 72A | -90 to +450 | ±0.1°C | 1-15 Amps | 30,000 to 300 ohms | Series 27687 |
| 75A | -65 to +450 | ±0.2°C | 1-15 Amps | 6000 to 100 ohms | Series 27687 |
| 7040 | -70 to +450 | ±0.05°C | 1-40 Amps | 8000 to 100 ohms | Series 27687 |

### PORTABLE 800 SERIES TEMPERATURE CONTROLLERS



Available with RFL Models 70A, 71A, 72A, and 75A Temperature Controllers. An ideal unit to evaluate the effectiveness of closer temperature control of your existing equipment. These convenient units consist of the solid-state controller, a control box containing an ON/OFF switch, power level indicator, load-output socket (115 or 230V), sensor jack, set point knob and scale, line fuse and an 8-foot line cord. Select probes from table below.

**RFL SENSORS**

| SENSOR | RANGE (°C) | | | |
|---|---|---|---|---|
| | Model 71A | Models 70A & 7040 | Model 72A | Model 75A |
| 24928 | 0 to +500 | | | |
| 27687-3 | | −5 to +120 | −30 to +80 | −0 to +120 |
| 27687-5 | | +30 to +160 | +10 to +130 | +40 to +160 |
| 27687-7 | | +80 to +250 | +40 to +200 | +85 to +250 |
| 27687-13 | | +220 to +325 | +165 to +325 | +230 to +325 |
| 27687-15 | | −70 to +10 | −90 to −10 | −65 to +10 |
| 27687-18 | | +300 to +450 | +300 to +450 | +300 to +450 |

**SENSORS AND RANGES (°C)**

| SENSOR | for MODEL 871 | for MODEL 870 | for MODEL 872 | for MODEL 875 |
|---|---|---|---|---|
| 42301 | 0 to +500 | | | |
| 42300-3 | | −5 to +120 | −30 to +80 | 0 to +120 |
| 42300-5 | | +30 to +160 | +10 to +130 | +40 to +160 |
| 42300-7 | | +80 to +250 | +40 to +200 | +85 to +250 |
| 42300-13 | | +220 to +325 | +165 to +325 | +230 to +325 |
| 42300-15 | | −70 to +10 | −90 to −10 | −65 to +10 |

Models 70A, 72A, 75A, and 7040 probes 3/16" diameter by 1¼" long.
Model 71A probe 3/16" diameter by 4" long.

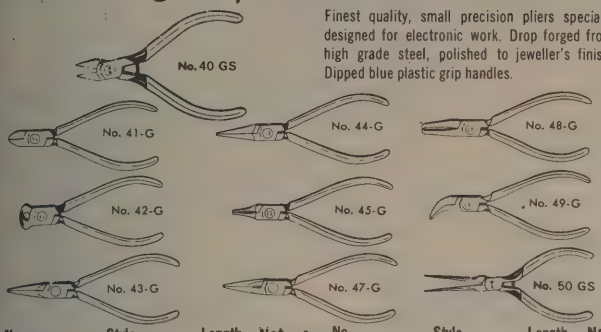
**NOTE:** 34739 Stainless Steel Well must be used for liquid immersion of all probes except 24928 and 42301
42060 0-100 Setting Dial (for Models 70A, 75A, and 7040)
42070 0-100 Setting Dial (for Model 72A)

**RFL Industries, Inc.**
Thermocontrol Division • Boonton, New Jersey 07005 • U.S.A.
(201) 334-3100 / TWX: 710-987-8352 / CABLE: RADAIRCO, N. J.

TOOLS BY **CHANNELLOCK®** MEADVILLE, PA. 16335

## *Little Champ* PRECISION PLIERS

Finest quality, small precision pliers specially designed for electronic work. Drop forged from high grade steel, polished to jeweller's finish. Dipped blue plastic grip handles.

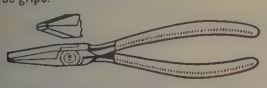



| No. | Style | Length | Net |
|---|---|---|---|
| 40GS | Flush Cutting, Sharp Nose Diagonal, Coiled Spring | 4¼″ | $9.02 |
| 41G | Diagonal Cutter | 4¼″ | 7.14 |
| 41GS | Diagonal Cutter, Coiled Spring | 4¼″ | 7.74 |
| 42G | End Cutting Nipper | 4″ | 7.14 |
| 43G | Needle Nose, No Side Cutter, Plain Nose | 4¾″ | 6.54 |
| 43GS | Needle Nose, No Cutter, Plain Nose, Coiled Spring | 4¾″ | 7.14 |
| 44G | Plain Nose | 4¾″ | $6.20 |
| 45G | Round Nose | 4½″ | 6.54 |
| 47G | Needle Nose, Side-Cutter, Nose Serrations | 4¾″ | 7.38 |
| 47GS | Needle Nose, Side Cutter, Nose Serrations, Coiled Spring | 4¾″ | 7.98 |
| 48G | Transverse End Cutter | 4¼″ | 7.14 |
| 49G | Curved Needle Nose | 4½″ | 6.90 |
| 50GS | Extra Long Needle Nose, Coiled Spring | 5¾″ | 8.08 |

## Specially Designed ELECTRONICS PLIERS

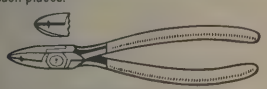
Four matched, long-reach pliers with precision matched jaws, hand honed cutting edges. Drop forged of special analysis steel, properly heat treated. Polished finish. Smooth, dipped plastic, blue grips.

| No. | Size | Net |
|---|---|---|
| 718G | 8″ | $6.94 |
| 728G | 7½″ | 8.10 |
| 738G | 8″ | 6.94 |
| 748G | 8″ | 6.94 |



### NO. 718G FLAT NOSE PLIERS

Precision-matched jaws give firm grip in hard-to-reach places.

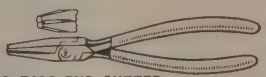


### NO. 728G DIAGONAL CUTTER

Patented wire-stripping notch that really works!

### NO. 738G ROUND NOSE PLIERS

You can pick up a hair with these precision machined points.



### NO. 748G END CUTTER

Fine enough to cut a human hair, sturdy enough to cut 12 gauge copper wire.

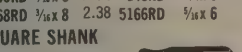
## SCREWDRIVERS

Blades forged from tough chrome vanadium steel. Tips ground lengthwise for greater end strength and snug fit in screw slot. Opaque blue plastic (UL) handles are shockproof, breakproof and shaped for non-slip grip.

### ROUND SHANK

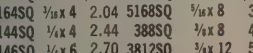
| No. | Blade Size, In. | List | No. | Blade Size, In. | Net |
|---|---|---|---|---|---|
| 181RD | 1/16 x 1 | $1.62 | 31610RD | 5/16 x 10 | $2.56 |
| 3164RD | 3/16 x 4 | 1.94 | 144RD | 1/4 x 4 | 2.42 |
| 3166RD | 3/16 x 6 | 2.04 | 146RD | 1/4 x 6 | 2.56 |
| 3168RD | 3/16 x 8 | 2.38 | 5166RD | 5/16 x 6 | 2.88 |

### SQUARE SHANK



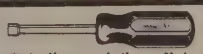
| No. | Blade Size, In. | List | No. | Blade Size, In. | Net |
|---|---|---|---|---|---|
| 141SQ | 1/16 x 1 | $1.62 | 5166SQ | 5/16 x 6 | $3.02 |
| 3164SQ | 3/16 x 4 | 2.04 | 5168SQ | 5/16 x 8 | 3.34 |
| 144SQ | 1/4 x 4 | 2.44 | 388SQ | 3/8 x 8 | 4.26 |
| 146SQ | 1/4 x 6 | 2.70 | 3812SQ | 3/8 x 12 | 5.88 |
| 148SQ | 1/4 x 8 | 2.88 | | | |

### PHILLIPS SCREWDRIVERS



| No. | Blade Size, In. | Net |
|---|---|---|
| 102-SP | 1/4 x 15/16 | $2.34 |
| 101-P | 3/16 x 3 | 2.20 |
| 102-P | 1/4 x 4 | 2.56 |
| 103-P | 5/16 x 6 | 3.40 |
| 104-P | 3/8 x 8 | 4.14 |

## NUTDRIVERS



| Hex | Lgth. | Net | Hex | Lgth. | Net |
|---|---|---|---|---|---|
| 5/16 | 3 | $2.38 | 11/32 | 3 | $2.38 |
| 7/32 | 3 | 2.38 | 3/8 | 3 | 2.38 |
| 1/4 | 3 | 2.38 | 7/16 | 3 1/8 | 2.88 |
| 9/32 | 3 | 2.38 | 1/2 | 3 1/8 | 2.88 |
| 5/16 | 3 | 2.38 | | | |

## SCREWDRIVER KIT

Pocket-size, handy bench sets, color coded. Special E-Z Grip handle included.

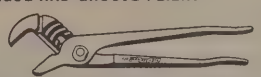
**SCREWDRIVER KIT SD-5**
**Includes:**
**5 Screwdrivers:**
3/32″, 1/8″, 5/32″, 3/16″, 1/4″
**3 Phillips Head:**
**No. 0, No. 1 and No. 2**
**Net: $9.98**

## NUTDRIVER KIT

Pocket-size, handy bench sets, color coded. Special E-Z Grip handle included.

**NUTDRIVER KIT ND-1**
**Includes:**
**10 Nutdrivers:**
3/32″, 1/8″, 5/32″, 3/16″, 7/32″, 1/4″, 9/32″, 5/16″, 11/32″, 3/8″
**Net: $13.64**

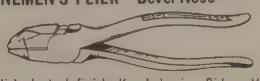
## TONGUE AND GROOVE PLIERS



The **original, genuine** tongue and groove plier. Patented, non-slip undercut channels. Patented reinforcing rib for extra strength. Dipped plastic grips optional at slight extra cost.

| No. | Size | Adjust | Capacity | Net |
|---|---|---|---|---|
| 420 | 9½″ | 5 | 1½″ | $6.14 |
| 424 | 4½″ | 4 | ½″ | 5.44 |
| 426 | 6½″ | 5 | 7/8″ | 4.78 |
| 430 | 10″ | 7 | 2″ | 6.36 |
| 440 | 12″ | 7 | 2¼″ | 6.82 |
| 460G | 16″ | 8 | 4¼″ | 10.22 |

## LINEMEN'S PLIER—Bevel Nose



Polished steel finish. Knurled grips. Side cutter. Dipped plastic grips optional at slight extra cost.

| No. | Size | Net |
|---|---|---|
| 3046 | 6″ | $7.52 |
| 3047 | 7″ | 7.86 |
| 3048 | 8½″ | 9.26 |

## LINEMEN'S PLIER—Rounded Nose

Polished steel finish. Knurled grips. Side cutter. Dipped plastic grips optional at slight extra cost.

| No. | Size | Net |
|---|---|---|
| 346 | 6″ | $7.52 |
| 347 | 7″ | 7.86 |
| 348 | 8½″ | 9.26 |

## LONG NOSE PLIER

Point 3/32″ round. Polish steel finish. Knurled grips. Dipped plastic grips optional at slight extra cost.

| No. | Size | Side Cutter | Net |
|---|---|---|---|
| 317 | 7½″ | With | $7.52 |
| 3017 | 7½″ | Without | 6.26 |
| 326 | 6″ | With | 6.84 |
| 3026 | 6″ | Without | 5.68 |

## SLIP JOINT PLIERS

**Thin Nose.** Polished steel. Wire cutting shear

| No. | Size | Net |
|---|---|---|
| 516 | 6″ | $4.98 |

**With Side Cutter.** Polished steel. Precision tool with fine cutting edge.

| No. | Size | Net |
|---|---|---|
| 537 | 7″ | $8.10 |

**Heavy Duty With Cutter.** Finest quality. Polished steel.

| No. | Size | Net |
|---|---|---|
| 546 | 6″ | $4.98 |
| 548 | 8″ | 5.78 |
| 5410 | 10″ | 6.14 |

## TOOL HOLSTERS

Highest quality top grain leather. Stress points reinforced with rivets. Convenient knife or wrench snap.

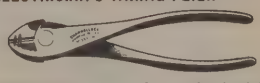
| No. | Size | Pkts. | Net |
|---|---|---|---|
| 1 | 9½″ x 8½″ | 5 | $11.16 |
| 2 | 9¾″ x 10½″ | 5 | 12.42 |

## WIREMASTER PLIER

Finest wire-cutting plier ever made. Joint rivet closer to cutting provides 40% more cutting power than standard design pliers. Special enclosed-joint construction holds cutter edges in perfect alignment for life of plier. Dipped plastic grips optional at slight extra cost.

| No. | Size | Net |
|---|---|---|
| 349 | 9″ | $11.78 |

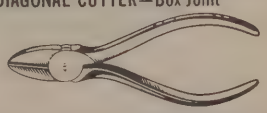
## ELECTRICIAN'S WIRING PLIER



Triple-use wiring plier: Cuts, strips insulation, loops wire. Patented wire stripping notches strip insulation from 14 and 12 gauge copper wire quickly, cleanly. Dipped plastic grips optional at slight extra cost.

| No. | Size | Net |
|---|---|---|
| 337-W | 7″ | $7.86 |

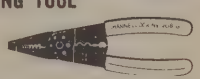
## DIAGONAL CUTTER—Box Joint



Precision honed cutting edges. Polished steel finish. Knurled grips. Dipped plastic grips optional at slight extra cost.

| No. | Size | Net |
|---|---|---|
| 435 | 5″ | $6.36 |
| 436 | 6″ | 6.94 |
| 437 | 7″ | 7.76 |

## WIRING TOOL



Five tools in one: Long nose plier. Wire stripper. Wire cutter, Bolt cutter. Wire crimper. Dipped plastic grips.

| No. | Size | Net |
|---|---|---|
| 908G | 8¼″ | $8.90 |

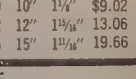
## ADJUSTABLE WRENCHES

Drop forged of special analysis steel. Chrome plated. Dipped plastic grips optional at slight extra cost.

| No. | Size | Cap. | Net | No. | Size | Cap. | Net |
|---|---|---|---|---|---|---|---|
| 804 | 4″ | ½″ | $6.14 | 810 | 10″ | 1¼″ | $9.02 |
| 806 | 6″ | ¾″ | 6.26 | 812 | 12″ | 1 5/16″ | 13.06 |
| 808 | 8″ | 15/16″ | 7.04 | 815 | 15″ | 1 11/16″ | 19.66 |

## ELECTRICIAN'S KNIFE

2½″ precision-honed blade. 3″ self-locking screwdriver. Unbreakable phenolic plastic handle.



| No. | Closed Length | Net |
|---|---|---|
| 11 | 3¼″ | $7.40 |

## SKINNING KNIFE

3″ precision-honed blade. Self-locking. Unbreakable phenolic plastic handle.

| No. | Closed Length | List |
|---|---|---|
| 10 | 4″ | $8.44 |

## SUPERIOR PLASTIC GRIPS

For maximum hand comfort, durable molded plastic grips. Blue color for good visibility, reduce plier loss. Easy to install. Order by desired grip size.

| Plier Size | Grip Size | Net |
|---|---|---|
| 6″ | Small | $1.18 |
| 7″ | Medium | 1.28 |
| 8″, 9½″, 10″ | Large | 1.40 |

# SOLDERING + DESOLDERING + RESOLDERING

FOR HOME AND INDUSTRY — DSV® PRODUCTS

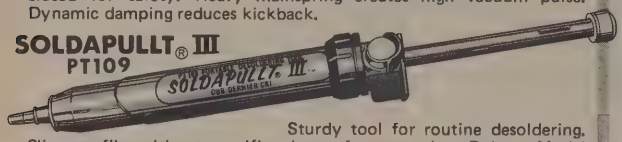
## HOW TO *Choose* A SOLDERING INSTRUMENT

### SOLDAPULLT® DESOLDERING TOOLS

**DELUXE DS017**

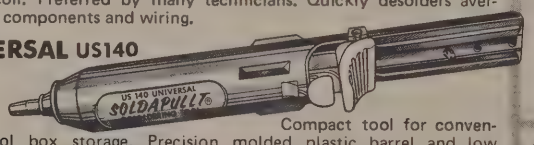
Extremely rugged for volume desoldering. Heavy duty plastic barrel and trigger housing for long, dependable operation. Simple twist-lock separation for fast cleaning. Oversize plunger fully enclosed for safety. Heavy mainspring creates high vacuum pulse. Dynamic damping reduces kickback.

**SOLDAPULLT® III PT109**



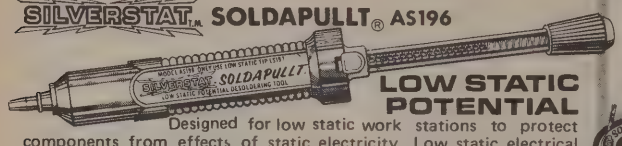

Sturdy tool for routine desoldering. Slim profile without sacrifice in performance has Deluxe Model features; fully enclosed plunger shaft; dynamic damping for very low recoil. Preferred by many technicians. Quickly desolders average size components and wiring.

**UNIVERSAL US140**




Compact tool for convenient tool box storage. Precision molded plastic barrel and low mass plunger creates rapid vacuum impulse with negligible recoil. Three position plunger adjusts loading span to fit large or small hands. Ample vacuum for most circuit board desoldering requirements.

**SILVERSTAT™ SOLDAPULLT® AS196**

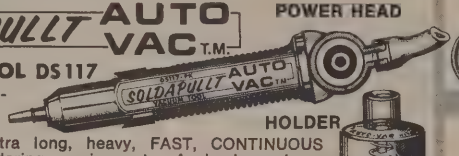



**LOW STATIC POTENTIAL**

Designed for low static work stations to protect components from effects of static electricity. Low static electrical characteristics providing ground path via operator, reducing discharge to susceptible components. Special material protects operator from a direct electrical short or shock.

**SOLDAPULLT AUTO VAC™ POWER HEAD**

**VACUUM TOOL DS117**



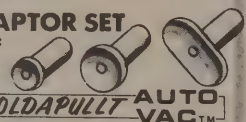

Completely-AUTO-MATIC Vacuum Desoldering Tool. Designed for extra long, heavy, FAST, CONTINUOUS production desoldering requirements. A simple push on the trigger will vacuum up solder-terminal point after point, WITHOUT manual reloading.

**HOLDER**

**POWER HEAD and HOLDER are offered as a set DS117**

**HOLDER** Simply insert Desoldering Tool in Holder pushing trigger. Presto! Tool is SELF-CLEANED! Vacuum Pump VP171 powers both units. New-clean-fast-safe-efficient = time + money saver!

**SP198 PICKUP ADAPTOR SET**

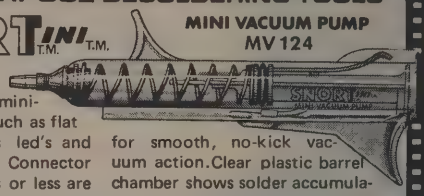


Simplifies pickup of small components

FOR USE ONLY WITH DS117 SOLDAPULLT AUTO VAC™

### SPECIAL PURPOSE DESOLDERING TOOLS

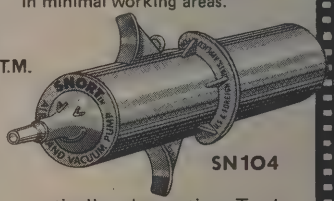
**SNORT™ MINI™ MINI VACUUM PUMP MV 124**




Designed expressly for desoldering micro-miniature components, such as flat pac IC's, pin diodes led's and 28-30 AWG wiring. Connector pins on .100 centers or less are easily desoldered. Features are resilient teflon tip, spring arrestor plunger, with de-acceleration tab for smooth, no-kick vacuum action. Clear plastic barrel chamber shows solder accumulation at all times. Easy tool to manipulate for maximum dexterity in minimal working areas.

**SNORT™**

**AIR and VACUUM PUMP**

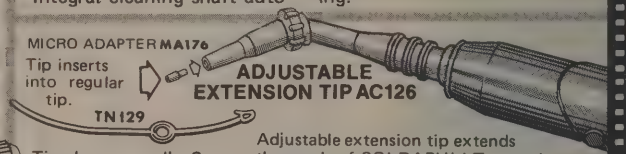



Ideal tool for occasional TV or Hi-Fi repairs and hobby projects. Operates similarly to bellows or squeeze bulb. Two-piece plastic construction with built in spring. Integral cleaning shaft automatically cleans tips. Tool snaps apart for routine cleaning.

**MICRO ADAPTER MA176**

Tip inserts into regular tip.

**ADJUSTABLE EXTENSION TIP AC126**



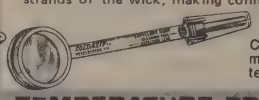
**TN129**

Tip cleaner needle. Special design for fast tying of wire bundles or components with lacing cord.

Adjustable extension tip extends the reach of SOLDAPULLT® and SOLDAVAC® Tools. 360° swivel tip allows angular adjustment without loss of vacuum. Quickly snaps on or off regular tips.

**SOLDASIP® RESOLDERING WICK SW091**

Place SOLDASIP® Wick on solder connection, pressing soldering iron tip against the wick. Solder will flow away from connection and into strands of the wick, making connection ready for removal or resoldering.



**BURNISHING TOOL BT028**

Combination of fine abrasive, high quality magnifying lens plus hi power lens in protective cap.

### TEMPERATURE PROBES and ACCESSORIES

**LONER® TEMPERATURE PROBE TP110**

Essential for obtaining tip temperature. Sensitive probe measures temperature on any flat or curved surface. Slim handle, long tip reaches into recessed areas. Burn resistant cord. **Use only with T1128**

**LONER® DIGITAL TEMPERATURE INDICATOR TI128**

Precision instrument temp. range 0°F to 1600°F Integrated circuit A/D processing ± 0.5°F accuracy. 1/2" high characters. Type J lead. 115 or 220 VAC — 50 Watts.

**LONER® ANALOG (DIAL) METER LTM95**

Dial meter, accurate °C and °F scale covers soldering tip temp. range 400°F to 900°F. Type J. Thermocouple lead, calibration seals included.

## Triple Mate™ PERFECT SOLDERING TIPS

**Designed Exclusively for the LONER® and ERSA Soldering Tools**

Work Rated as GOOD, BETTER or BEST for:
1. HEAT TRANSFER
2. DURABILITY
3. THERMAL LOAD IN WATTS

**IMPORTANT:** WHEN ORDERING TIPS, ALWAYS SPECIFY MODEL NUMBER OF YOUR LONER® OR ERSA™ TOOLS
EXAMPLES: LONER MODEL 950-950A-950B ERSA Tip16

TA153 Converts 32 THREAD to 20 MODEL 950

TA185 Converts 20 THREAD to 32 MODEL 950A

**LONG SPADE** Part No. LT081 — 1 BETTER, 2 BETTER, 3 15-25

**SOLDASIP** Part No. LT083 — 1 GOOD, 2 GOOD, 3 15-25

**SHORT SPADE** Part No. LT085 — 1 GOOD, 2 BETTER, 3 10-25

**MINI SPADE** Part No. LT086 — 1 GOOD, 2 BETTER, 3 5-20

**NEEDLE POINT** Part No. LT087 — 1 GOOD, 2 BETTER, 3 5-15

**MINI ANGLE FACE** Part No. LT097 — 1 GOOD, 2 BETTER, 3 5-15

**MICRO LONG SPADE** Part No. ML127 — 1 GOOD, 2 GOOD, 3 5-10

**CHECK Form 101** FOR CURRENT TIP SELECTION AND PRICES

**BLUNT SPADE** Part No. LT274 — BEST, BETTER 10-25

**THIN PROBE** Part No. LT275 — 1 BETTER, 2 BETTER, 3 10-20

**BEVEL FACE** Part No. LT276 — 1 GOOD, 2 BETTER, 3 10-20

**MEDIUM SPADE** Part No. LT277 — 1 BETTER, 2 BETTER, 3 10-20

**MINI LONG** Part No. LT278 — 1 GOOD, 2 GOOD, 3 5-15

**HEAVY SPADE** Part No. HS106A — 1 BEST, 2 BETTER, 3 25-50

**ACCUMULATOR COLLAR** Part No. AC148A — 1 BETTER, 2 BETTER, 3 5-20

**HEAVY PROBE** Part No. HP107A — 1 BEST, 2 BETTER, 3 25-50

**MEDIUM HEAVY SPADE** Part No. MT145A — 1 BEST, 2 BETTER, 3 25-50

**ARMORED SPADE** Part No. AS269A — 1 BEST, 2 BETTER, 3 25-50

## HOW TO *Choose* AND *Use* THE WORLD'S

# = SOLDER *Ability!*

EDSYN pioneer in SolderABILITY, presents FANOVISION – graphic motion in a training manual designed to stimulate the mind to SAVE TIME on the line. Available at $7.95

FANOVISION T.M.

AT PARTICIPATING DISTRIBUTORS ONLY

144 PAGE TRAINING MANUAL
OVER 1,000 ILLUSTRATIONS
IT'S FAN TO LEARN!

## LONER® SOLDERING INSTRUMENT

*in a class by itself . . . for you alone!*

Model No. 950 CL080

UL LISTED TIP TO PLUG

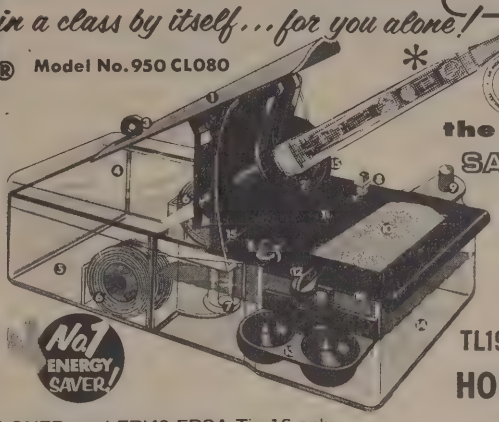
LONER® STORY

**FEATURES:** a soldering instrument with nothing to hide, we left everything in plain view so that you can best see how a soldering instrument differs from a soldering iron. One instrument performs most soldering cycles from heavy to micro termination — The LONER® SOLDERING INSTRUMENT.

**FAST ACCURATE SOLDERING CYCLES:** After a fast 45 second warm-up, each soldering cycle is automatically thermally balanced to match each termination load (range: 590°F to 750°F) with the precise preset soldering temperature.

**ENERGY SAVER:** High power is consumed ONLY during soldering operation and NOT during energy saving idling cycle.

**BASIC DESIGN:** Allows use of a wide variety of tip styles to simplify a maximum of techniques required in working on today's electronic hardware.




Not ENERGY SAVER!

*For UL Listed CL080 Closed Loop LONER® and ERI40 ERSA Tip 16 only

## B-170 *Base1*

**the first FULLY engineered SAFELOCK idle-rest® SOLDERING STATION**

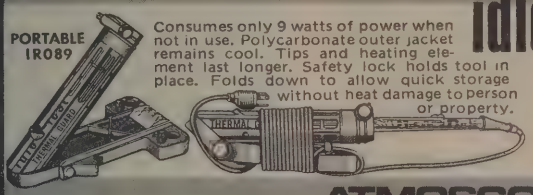
## General Purpose SOLDERING TOOL HOLDER TL194 idle-rest®

**HOLDS MOST TOOLS**

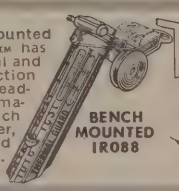
## idle-rest®

PORTABLE IR089

Consumes only 9 watts of power when not in use. Polycarbonate outer jacket remains cool. Tips and heating element last longer. Safety lock holds tool in place. Folds down to allow quick storage without heat damage to person or property.



Bench mounted IDLE-REST™ has same thermal and Polycarbonate construction as portable model. Threaded bushing allows permanent installation on bench top. Two spools of solder, accessory apron and sponge included.



BENCH MOUNTED IR088

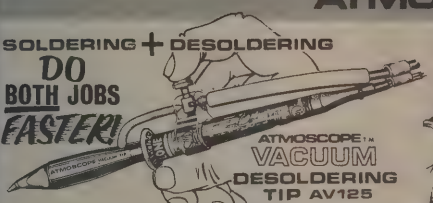
SOLDER AND WICK

TWIP™ T.M. AT FINGER TIPS

TW108

## ATMOSCOPE T.M. ACCESSORIES

SOLDERING + DESOLDERING
DO BOTH JOBS FASTER!

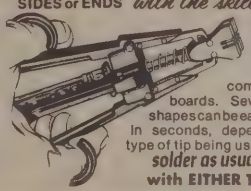


ATMOSCOPE™ VACUUM DESOLDERING TIP AV125

Converts LONER to a dual soldering and desoldering tool. Large mass head provides high-heat reserve for continuous production line work. Unbreakable desoldering chamber allows fast & safe handling. Simple ONE hand, ONE finger operation. NO FOOT PEDAL NEEDED.

## KLATCH™ DIP EXTRACTOR DE180

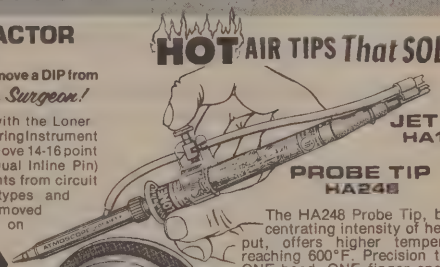
QUADRAMATIC Action allows YOU to remove a DIP from SIDES or ENDS *with the skill of a Surgeon!*



Use with the Loner Soldering Instrument to remove 14-16 point DIP (Dual Inline Pin) components from circuit boards. Several types and shapes can be easily removed in seconds, depending on type of tip being used.

*solder as usual with EITHER TIP*

## HOT AIR TIPS *That SOLDER*



JET TIP HA120

PROBE TIP HA248

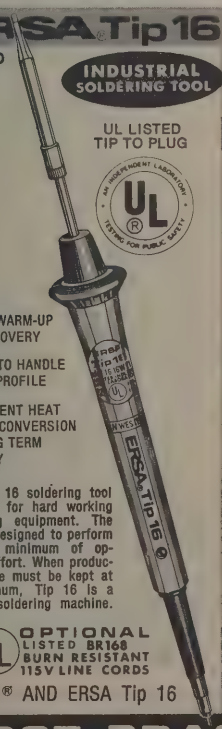
The HA248 Probe Tip, by concentrating intensity of heat output, offers higher temperatures reaching 600°F. Precision trigger, ONE hand, ONE finger operation, NO FOOT PEDAL NEEDED! Operates on low pressure air. Solder as usual.

## ERSA Tip 16

ER140

INDUSTRIAL SOLDERING TOOL

UL LISTED TIP TO PLUG



- FAST WARM-UP AND RECOVERY
- EASY TO HANDLE PENCIL PROFILE
- EFFICIENT HEAT ENERGY CONVERSION FOR LONG TERM ECONOMY

The Tip 16 soldering tool is built for hard working soldering equipment. The tool is designed to perform with a minimum of operator effort. When production time must be kept at a minimum, Tip 16 is a rugged soldering machine.

OPTIONAL LISTED BR168 BURN RESISTANT 115V LINE CORDS

LONER® AND ERSA Tip 16

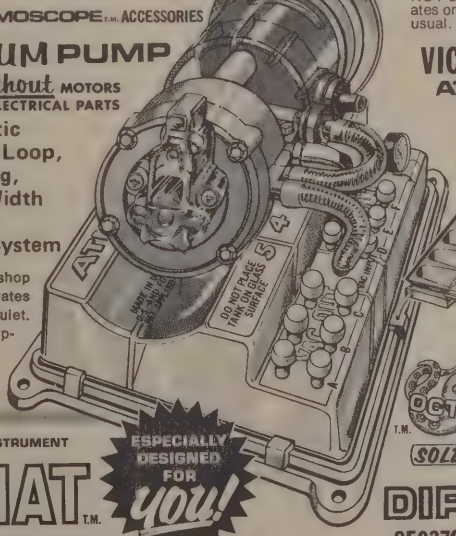
IDEAL SOURCE OF VACUUM FOR ATMOSCOPE™ ACCESSORIES

## ATMOSCOPE™ VP171 VACUUM PUMP

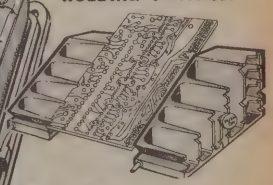
**HIGH VACUUM** without MOTORS or ELECTRICAL PARTS

**100% Pneumatic Automatic Closed Loop, Self-Regulating, Variable Pulse Width Modulation Vacuum Control System**

Vacuum to 22" mercury from shop air supply of 90 to 120 PSI. Operates on demand, compact, whisper quiet. Twelve manifold outlets allow operation of several vacuum tools from one pump.



## VICE less VICE ATMOSCOPE T.M. HF172 VACUUM HOLDING Fixtures

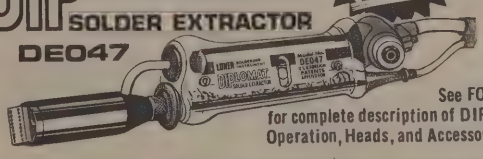


## OCTAVAC™ ACCESSORIES

FOR USE ONLY WITH SOLDAPULLT AUTO VAC™

## LONER® SOLDERING INSTRUMENT DIPLOMAT™ SOLDER EXTRACTOR DE047

ESPECIALLY DESIGNED FOR *you!*



See FORM 265 for complete description of DIPLOMAT Operation, Heads, and Accessories.

## DIP QUICK TIP SE037QT

Desolder all 14-16 pin DIPS at once with Quick Tip

EQUIPPED WITH SPECIAL CLEANER HOLDER

See FORM 245 for complete description of OCTAVAC ACCESSORIES

© Copyright 1978 by EDSYN, Inc.

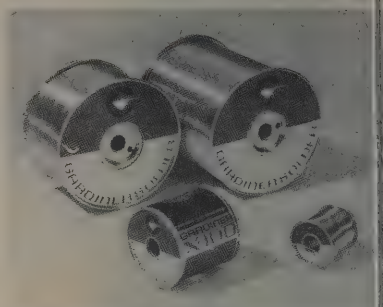
MOST PRODUCTS COVERED BY U.S. AND FOREIGN PATENTS AND PENDING APPLICATIONS. PRICES, DESIGN, COLORS, AND MATERIALS SUBJECT TO CHANGE WITHOUT NOTICE.

## MOST PRACTICAL SOLDER HANDLING TOOLS

# GARDINER SOLDERING PRODUCTS

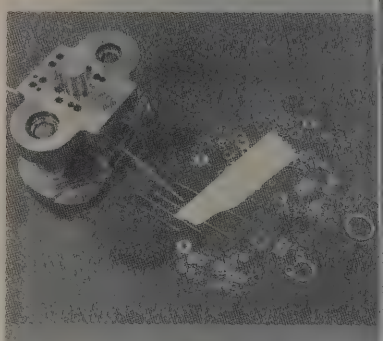
## GARDINER SOLID & FLUX CORED WIRE SOLDERS

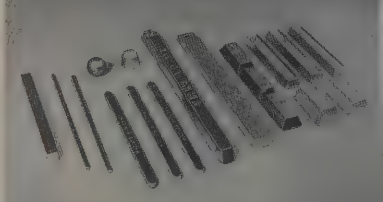
**Solid Wire Solder:** Gardiner solid wire solders are uniform in diameter and alloy and are equal to flux cored solders in purity and quality. Made in all standard diameters.
**WW-300 Rosin Cored Wire Solder:** Pure water-white rosin flux core with non-conductive, non-corrosive, non-hygroscopic flux soldering residues which need not be removed. As with all Gardiner flux cored wire solder, WW-300 is available in any solder alloy and in a broad range of wire sizes and flux core percentages. Conforms to Federal Specification: QQ-S-571, Type R.
**XM-200 Mildly Activated Rosin Cored Wire Solder:** For use with copper, silver, gold, cadmium plate, tinplate and other easily solderable metals whose surface tarnish is not easily removed by natural rosin but where a highly activated flux may present latent complications. Conforms to Federal Specification: QQ-S-571, Type RMA.
**X-45 Highly Active Rosin Cored Wire Solder:** For difficult-to-solder electronic applications. Gardiner's most active rosin core with water resistivity in excess of 50,000 Ohms/Cm. Conforms to Federal Specification: QQ-S-571, Type RA.
**X-55 Activated Rosin Cored Wire Solder:** For super-critical electronic circuits. Extra refinement reduces remaining residual matters to an absolute minimum. Specially formulated activator is "burned off" during soldering to leave only pure rosin residue. Conforms to Federal Specification: QQ-S-571, Type RA.
**X-100 Activated Rosin Cored Wire Solder:** For speed soldering of tarnished electronic parts. Possesses extra fast wetting action. Ideally suited to brass, bronze, copper, silver, gold, cadmium plate, terneplate and tinplate. Conforms to Federal Specification: QQ-S-571, Type RA.
**Mildly Activated and Activated Solder Pastes:** For electrical/electronic soldering. Pre-alloyed, pulverized soft solder is evenly dispersed in rosin flux to produce a homogeneous easy-to-use solder paste. Suspension of solder particles in the flux medium remains stable up to 27°C (80° F). Available in any solder alloy and in particle sizes from 200 to 325 mesh, Mildly Activated and Activated Rosin Flux Pastes adhere to Federal Specification: QQ-S-571, Type RMA or Type RA.
**GSP-5800 Organic and GSP-6800 Inorganic Chloride Solder Pastes:** For non-electronic applications such as flashing, plumbing and sheet metal. The finely granulated pre-alloyed solder particles are uniformly dispersed in a special flux medium, which assures them a non-Newtonic condition up to 27° C (80° F) for GSP-5800 and up to 28° C (82° F) for GSP-6800. Both types are available in all solder alloy and in any particle size from 200 to 325 mesh. Flux residues are water-soluble.



## GARDINER SOLDER PREFORMS

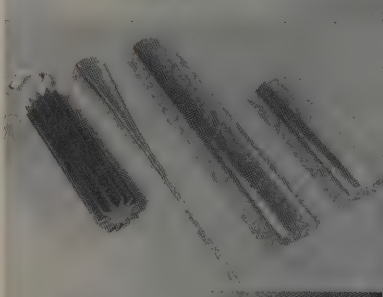
**Solid or Flux Cored Solder Preforms:** Developed to meet the critical demands of high-speed, mass-production soldering, especially in the electronics industry. Preforms are used to great advantage in both fully automated and semi-automatic production setups. They assure absolute uniformity and a high degree of production control. Being of predetermined size, shape, (rings, washers, discs, sleeves, pellets or segments), alloy, flux type and percentage, they yield an extremely high rate of reliability by eliminating the factor of human error. Along with reliability, solder Preforms make possible the cost saving advantages of automated production.





## GARDINER PURE-A-LOY BAR SOLDERS & ANODES

**PURE-A-LOY Cast and Extruded Bar Solders:** As its name implies, PURE-A-LOY is pure solder of the highest order yet attainable on a commercial basis. Supplied in bars, ingots and anodes, its prime purpose is to meet extremely critical demands of the electronics industry where soldering dependability is an absolute must. PURE-A-LOY, with non-metallic inclusions not exceeding 0.0010% (10 PPM) and sulphur content less than .0005% (5 PPM), meets and exceeds QQ-S-571 and ASTM specifications.
**PURE-A-LOY Extruded Anodes:** The extrusion process for PURE-A-LOY anodes insures a complete homogeniety of the alloy and a fine grain structure. Such anodes corrode uniformly and the life of the anode is thus prolonged. This in turn provides a uniform plating of the work-piece, because the number of metallic ions entering the solution at the anode during the electrolysis tends to be equal to that leaving the solution at the cathode. On this behavior depends the stability of the electrolyte. The Gardiner PURE-A-LOY anodes offer the following advantages: 1. A uniform oxidation and maximum life of the anodes. 2. Because they are cleaner and purer they allow the use of higher current densities—faster plating. 3. A reduction of sludging and necking. Necessity for bagging reduced. 4. Bright and uniform plating with a high density of solder coating.



## GARDINER TEST SERVICES

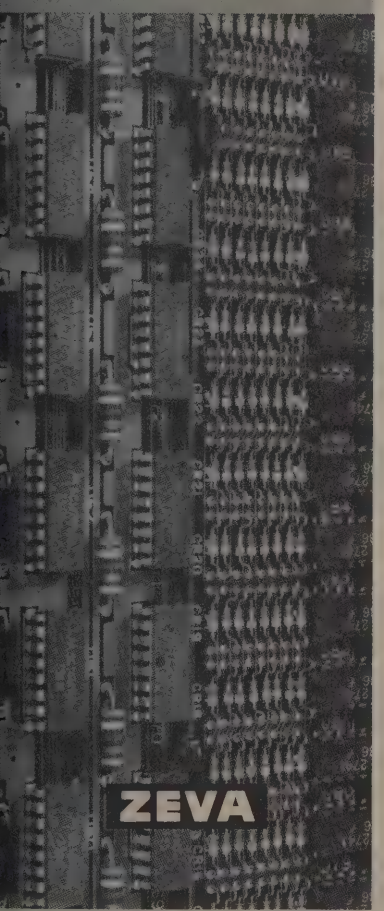
**Gardiner Test Services:** Gardiner's laboratories are well equipped: atomic absorption and colorimeter spectrophotometer techniques are but a few of the methods used by Gardiner in the daily routine inspections of raw materials and finished products for quality compliances. Gardiner has also instituted a Solder Alloys Analysis Program. These laboratories are also staffed with specialists, well versed in the science of their respective fields; be it in chemical analysis of inorganic or organic materials, in the metallurgy of soldering or chemistry of soft soldering fluxing.

## ZEVA PLANAR SOLDERING MACHINES & SYSTEMS

**Zeva Planar Soldering Machines and Systems:** Small, automatic, high-speed laboratory machines fully programmable. Low maintenance cost, low solder usage, no bridges, icicles. No pumps, no oil and one-tenth the dross of wave machines. Soldering time and transport speed are independently adjustable. Complete customer list available.

**GARDINER SOLDER COMPANY** • DIVISION GARDINER METAL COMPANY
4820 SOUTH CAMPBELL AVE. • CHICAGO, ILLINOIS 60632 • PHONE: 312-847-0100 • TWX 910 221 2510
WESTERN DIVISION • 15525 HERON AVE. • LA MIRADA, CA 90638 • PHONE: 714-994-6350 • TWX 910 596 1488

# GARDINER SOLDERING PRODUCTS




## GARDINER FLUXES & RELATED PRODUCTS

**Series GF-1000 Water-white Rosin Flux:** Designed for easy-to-solder metals leaving only minimal easily removable residue. Conforms to Mil-S-14256, Type R, with a flash point of 93° F, open cup.

**Series GF-1100 Water-white Rosin Flux:** Same as GF-1000 but having a much faster drying action.

**Series GF-1200 Mildly Activated Rosin Flux:** Compounded with Electronic Grade Rosin. Its ability to remove the oxide film of the very-easy-to-solder metals group is far better than that of the two previous flux series or any R type flux. Conforms to Mil-S-14256, Type RMA.

**Series GF-2000 Activated Rosin Flux:** Highly stable flux having an excellent wetting action and a high flash point, 97° F, open cup, for the high production soldering and high reliability of electronic circuitry.

**Series GF-2100 Activated Rosin Flux:** For foaming application with an outstanding ability to remove tenacious tarnish films from solderable metals.

**Series GF-2200 Activated Rosin Flux:** Designed for the very-hard-to-handle soldering jobs. Compounded with activated rosin and a blend of alcohols, these fluxes, when properly applied in commercial electronics applications, leave a non-corrosive residue after soldering.

**Series GF-2300 Activated Rosin Flux:** A non-halogen activated rosin flux for automatic soldering where components and boards are very solderable. Under normal conditions its residue is non-corrosive, non-conductive and non-hygroscopic.

**Series GF-2400 Activated Rosin Flux:** A non-halogen activated rosin flux with excellent air drying characteristics. It is often used as a printed circuit board sealer to prevent oxidation before soldering and as a reflow flux for soldering integrated circuits to a circuit board.

**Series GF-2400F Mildly Activated Non-Halogen Rosin Flux:** Chemical properties similar to GF-2400, but designed for foaming application.

**Series GF-2500 Activated Rosin Flux:** The liquid form of the solid activated Rosin Flux used in Gardiner X-45 cored wire solder. This liquid flux is widely used throughout the electronic industry.

**Series GF-2600F Activated Rosin Foam Flux:** Designed for foam applications follows the requirements of Federal Specification QQ-S-571 for RA. It can also be used with any method of application. The high flash point, 97° F, open cup, provides a greater margin of safety.

**Series GF-2700 Activated Rosin Liquid Flux:** Meets the Mil-S-14256 amendment of June 1975. The minimum Water Extract Resistivity is 50,000 Ohm/Cm. It can be applied by any conventional means.

**Series GF-2800 Activated Rosin Flux:** Having a low rate of evaporation and a flash point of 147° F, open cup, makes this flux ideal for the soldering of electronic components. Conforms to QQ-S-571, amendment of June 1975.

**Series GF-5100 Aquasolv Organic Flux:** Formulated to remove from metals to be soldered the tarnish films that resist the action of activated Rosin Fluxes. Flux residues remaining after soldering are water soluble and are easily removable in lukewarm demineralized water.

**Series GF-5300 Aquasolv Organic Flux:** Developed for the automated soldering of printed circuit assemblies and printed circuit cards using the Hydro-squeegee Process. Used on the electronics applications where residues are completely removed, it is suitable for low temperature soldering.

**Series GF-5400 Aquasolv Organic Flux:** A liquid organic flux whose soldering residues are easily and completely soluble in water. This flux has been specially formulated for the soldering of electronic components that are compatible with water.

**Series GF-5500 Aquasolv Organic Flux:** Designed for reflow soldering where radiant heat is used to melt/reflow the plating of solder or tin-plated printed circuit boards. Its soldering residues are water soluble and are easily removable in lukewarm demineralized water.

**Series GF-8000 Surf-Klean Copper Cleaner:** A solution designed for the removal of unusually thick tarnish films from copper or nickel leads, or printed wiring prior to soldering.

**Series GF-8500 Surf-Seal:** An organic lacquer for protecting solderability of printed circuit boards during extended storage. Protective coating is compatible with all rosin fluxes.

**GFT-3000 Rosin Flux Thinner:** For GF-2000 Activated Rosin Flux.

**GFT-3100 Rosin Flux Thinner:** For GF-1000 WW Rosin Flux.

**GFT-3200 Rosin Flux Thinner:** For organic fluxes GF-5132 and GF-5425.

**GFT-3300 Rosin Flux Thinner:** For GF-2100F.

**GFT-3400 Rosin Flux Thinner:** For GF-2300 and GF-2400 Activated Rosin Fluxes.

**GFT-3500 Rosin Flux Thinner:** For GF-2400F and GF-2600F Activated Rosin Fluxes.

**GFT-3600 Rosin Flux Thinner:** For GF-1100 and GF-2200.

**GFT-3700 Rosin Flux Thinner:** For GF-2700F.

**GFT-3800 Rosin Flux Thinner:** For GF-2200.

**GFT-3900 Rosin Flux Thinner:** For GF-2800F.

**GFR-4000 Rosin Flux Remover:** A non-flammable, rosin residue remover having a low evaporation rate. May be used in a vapor degreaser. Biodegradable.

**GFR-4060 Rosin Flux Remover:** Similar to 4000 but a little more active. Biodegradable.

**GFR-4100 Rosin Flux Remover:** A low boiling solvent cleaner and flux remover that removes ionic as well as non-ionic soils. The low boiling point and fast drying action renders its use in a vapor degreaser operation less expensive than the use of other similar products with a high boiling point.

**GFR-4300 Rosin Flux Remover:** The same as 4100 but it permits the cleaning of polycarbonate resins without visible effects.

**GFR-4420 Rosin Flux Remover:** Dissolves rosin residues, ionic activators, greases, oils and picks up any residual water from the work-piece. Can be used in a vapor degreaser operation.

**GARDINER SOLDER COMPANY** • DIVISION GARDINER METAL COMPANY
4820 SOUTH CAMPBELL AVE. • CHICAGO, ILLINOIS 60632 • PHONE: 312-847-0100 • TWX 910 221 2510
WESTERN DIVISION • 15525 HERON AVE. • LA MIRADA, CA 90638 • PHONE: 714-994-6350 • TWX 910 596 1488

# CATALOGUE DE L'ELECTRONIQUE POUR LES INGENIEURS
# DER PRODUKTKATALOG FÜR ELEKTRONIKER
# ELECTRONIC ENGINEERS CATALOGUE

**The 1978 edition is out...and the response is in...**
**IMMEDIATE AND OVERWHELMING**

ACCEPTANCE

The ELECTRONIC ENGINEERS CATALOGUE is the only comprehensive, trilingual catalogue/source-directory of electronic products available to—and from—Western Europe.

It is divided into three distinct sections: 1. **The Product Index and Directory,** which lists more than 3,000 product headings & cross-references alphabetically in English with their French and German equivalents. 2. **The Manufacturers' Catalogue Section,** which is a compilation of Manufacturers' Catalogues in alphabetical order. 3. **The Manufacturers' Sales Offices and Trade Marks Directory,** which alphabetically includes country, address, telex or TWX numbers of the Manufacturers' main and local sales offices and/or agents.

The ELECTRONIC ENGINEERS CATALOGUE offers U.S. manufacturers the most cost-efficient method of distributing their catalogue data to **25,000** electronic engineers and buyers throughout Western Europe. It represents the carefully conceived application of the time-proven **eem** "cataloging" concept to the elusive European marketplace.

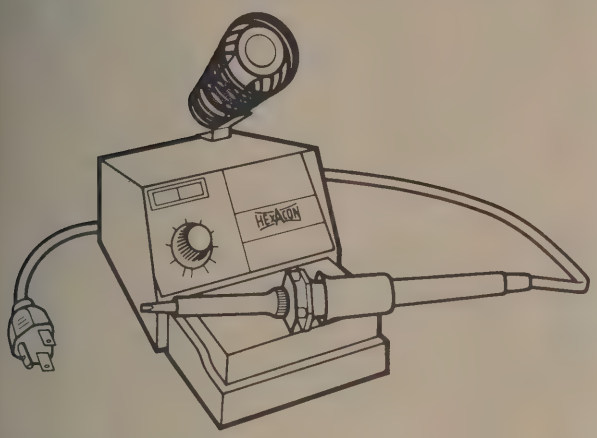
United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Avenue, Garden City, New York 11530 / 516 222-2500

# SOLDERING IRONS

**VOLTAGE RANGE: 6 to 240 • OPERATE IDENTICALLY ON A.C. OR D.C., ANY CYCLE**
**STANDARD VOLTAGES 110/120, 220/240 • SPECIFY VOLTAGE ON ORDER**

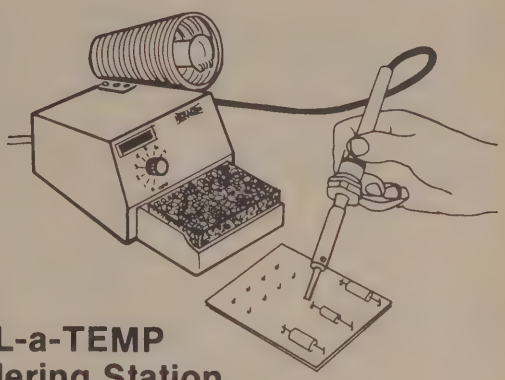
Equipped with extra flexible, high temperature approved cords. Three wire cords standard with all irons. Nickel chromium replaceable heating elements, insulated with finest mica, protected by rugged outer housing. Replaceable tips.

**POSI-GROUND® AVAILABLE TO PROTECT VOLTAGE SENSITIVE COMPONENTS**



## THERM-O-TRAC
### Controlled Heat Soldering Stations

- Temperature sensor "up front" where it belongs
- All solid state electronic switching
- Dial selected temperature to 850°F
- Close control—within 10°F
- No magnetic field or voltage leakage—safe for sensitive circuitry
- Wide selection of XTRADUR Long Life Tips
- Model 1001 500-720°F
- Model 1002 525-850°F



## DIAL-a-TEMP Soldering Station

- Isolated, low voltage power supply
- Posi-Ground® construction eliminates all voltage leakages for protection of sensitive components
- Internally fused for added safety
- Infinitely variable temperatures from 350°F to 950°F easily selected by dialing
- On-Off Switch with Indicator Light
- Five models available: No 1511 (1/8" screw tip), 1520 (3/16" plug tip), 1521 (1/8" plug tip), 1524 (1/4" plug tip), 1575 (1/16" micro tip).
- No special tip requirements—uses standard Xtradur and Durotherm Long-Life plug tips

## HEXACON MINIRONS

- Rugged quality construction that will withstand production line conditions
- Slim-line case promotes maximum visibility
- Lightweight—perfect balance
- Full wattage range 15 to 60 watts

SLIM LINE CASE— SLIM LINE HANDLE

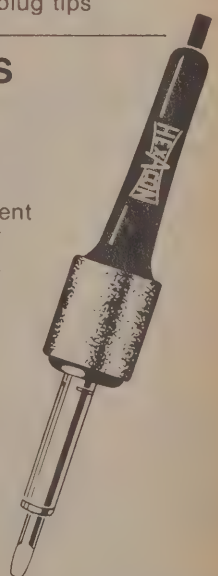
| Cat. No. | Watts | Tip Dia. |
|---|---|---|
| 21A | 15 | 1/8" |
| 21A | 20 | 1/8" |
| 21A | 25 | 1/8" |
| 22A | 15 | 3/16" |
| 22A | 20 | 3/16" |
| 22A | 25 | 3/16" |
| 22A | 30 | 3/16" |
| 22A | 35 | 3/16" |
| 23A | 20 | 1/4" |
| 23A | 25 | 1/4" |
| 23A | 30 | 1/4" |
| 23A | 40 | 1/4" |
| 23A | 50 | 1/4" |
| 23A | 60 | 1/4" |

DUROTHERM and XTRADUR tips

## SUPER PENCIL IRONS

- Standard for dependability in production throughout industry.
- Strong fiberglass handle with cool cork finger grip
- Precision wound heavy-duty element

| Cat. No. | Watts | Tip Dia. |
|---|---|---|
| 25S | 20 | 1/8" |
| 25S | 25 | 1/8" |
| 25S | 30 | 1/8" |
| 25S | 35 | 1/8" |
| 25S | 40 | 1/8" |
| 26S | 20 | 3/16" |
| 26S | 25 | 3/16" |
| 26S | 30 | 3/16" |
| 26S | 35 | 3/16" |
| 26S | 40 | 3/16" |
| 26S | 50 | 3/16" |
| 24S | 20 | 1/4" |
| 24S | 25 | 1/4" |
| 24S | 30 | 1/4" |
| 24S | 40 | 1/4" |
| 24S | 50 | 1/4" |
| 24S | 60 | 1/4" |
| 30S | 80 | 1/4" |

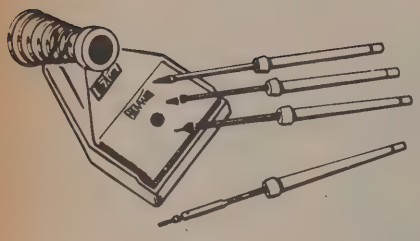


DUROTHERM and XTRADUR tips

**HEXACON ELECTRIC COMPANY** 159 WEST CLAY AVE., ROSELLE PARK, N. J. 07204
PHONE (201) 245-6200 • TELEX 138812

# SOLDERING IRONS

## MICRO-MINI IRON AND STAND

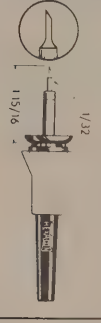


Tip Kit "K" includes
Holder, Iron plus 7 Tips

**Iron Specifications**

| No. | Temp. |
|---|---|
| M 65<br>M 65K | 650 |
| M 70<br>M 70K | 700 |
| M 75<br>M 75K | 750 |
| M 85<br>M 85K | 850 |
| M 065 | 650 |
| M 070 | 700 |
| M 075 | 750 |
| M 085 | 850 |

## HEXACON HORNET IRONS



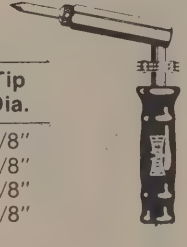
H 10 K Kit (12 watts)
H 11 K Kit (17 watts)
H 14 K Kit (20 watts)

- Lightweight
- Cool Handle

Kits include iron, 2 tips and sponge.

**DUROTHERM and XTRADUR tips**

## HEAVY DUTY HATCHET IRONS



| Cat. No. | Watts | Tip Dia. | Cat. No. | Watts | Tip Dia. |
|---|---|---|---|---|---|
| 70H | 100 | 3/8" | 153H | 175 | 3/8" |
| 74H | 125 | 1/4" | 155H | 200 | 3/8" |
| 100H | 110 | 3/8" | 200H | 200 | 5/8" |
| 116H | 175 | 3/8" | 300H | 300 | 7/8" |
| 150H | 150 | 3/8" | | | |

## HEAVY-DUTY SCREW TIP IRONS

| Cat. No. | Watt | Tip Dia. |
|---|---|---|
| 85 | 90 | 1/2 |
| 120 | 120 | 5/8 |
| 170 | 175 | 1 |
| 225 | 250 | 1-1/8 |
| 350 | 350 | 1-3/8 |
| 500 | 500 | 1-5/8 |
| 700 | 700 | 1-3/4 |
| 800 | 800 | 1-3/4 |

## PINPOINT IRONS

**DUROTHERM and XTRADUR tips**

| Cat. No. | Watts | Tip Dia. | Cat. No. | Watts | Tip Dia. |
|---|---|---|---|---|---|
| P25 | 25 | 1/8" | 25H | 25 | 1/8" |
| P25 | 35 | 1/8" | 25H | 35 | 1/8" |
| P25 | 50 | 1/8" | 25H | 50 | 1/8" |
| P26 | 30 | 3/16" | 26H | 30 | 3/16" |
| P26 | 40 | 3/16" | 26H | 35 | 3/16" |
| P26 | 50 | 3/16" | 26H | 50 | 3/16" |
| P24 | 40 | 1/4" | 24H | 40 | 1/4" |
| P24 | 50 | 1/4" | 24H | 50 | 1/4" |
| P24 | 60 | 1/4" | 24H | 60 | 1/4" |

## HEAVY DUTY PLUG-TIP IRONS

| Cat. No. | Watt | Tip Dia. | Cat. No. | Watt | Tip Dia. |
|---|---|---|---|---|---|
| P70 | 100 | 3/8 | P155 | 200 | 3/8 |
| P100 | 110 | 3/8 | P151 | 175 | 1/2 |
| P111 | 130 | 3/8 | P152 | 200 | 1/2 |
| P115 | 150 | 3/8 | P200 | 200 | 5/8 |
| P116 | 175 | 3/8 | P250 | 250 | 5/8 |
| P150 | 150 | 3/8 | P300 | 300 | 7/8 |
| P153 | 175 | 3/8 | P550 | 550 | 1-1/8 |

## POWERHOUSE IRONS

| Cat. No. | Watts | Tip Dia. | Cat. No. | Watts | Tip Dia. |
|---|---|---|---|---|---|
| P30 | 40 | 1/4" | P34 | 80 | 1/4" |
| P30 | 60 | 1/4" | P34 | 90 | 1/4" |
| P30 | 75 | 1/4" | P35 | 80 | 5/16" |
| P30 | 80 | 1/4" | P35 | 90 | 5/16" |
| P34 | 70 | 1/4" | P35 | 100 | 5/16" |

## POWERHOUSE IRONS (Hatchet Type)

| Cat. No. | Watt | Tip Dia. | Cat. No. | Watt | Tip Dia. |
|---|---|---|---|---|---|
| 30H | 40 | 1/4" | 34H | 70 | 1/4" |
| 30H | 50 | 1/4" | 34H | 80 | 1/4" |
| 30H | 60 | 1/4" | 34H | 90 | 1/4" |
| 60H | 70 | 1/4" | 35H | 80 | 5/16" |
| 30H | 75 | 1/4" | 35H | 90 | 5/16" |
| 30H | 75 | 1/4 | 35H | 90 | 5/16" |
| 30H | 80 | 1/4" | 35H | 100 | 5/16" |

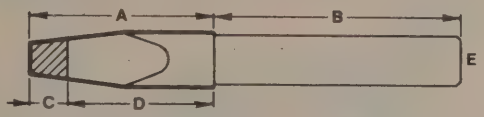
## "COPPER MISER" IRONS

| Cat. No. | Watts | Tip Dia. |
|---|---|---|
| P114 | 100 | 1/4" |
| P154 | 150 | 1/4" |
| P238 | 200 | 3/8" |
| P212 | 200 | 1/2" |
| P338 | 300 | 3/8" |

# SOLDERING IRON TIPS

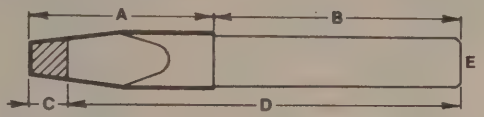
**DUROTHERM** Iron plated with patented stainless steel bonded to copper shank. Precision ground to tolerance of .001. Lectrotin on working surface and immunized over entire surface.

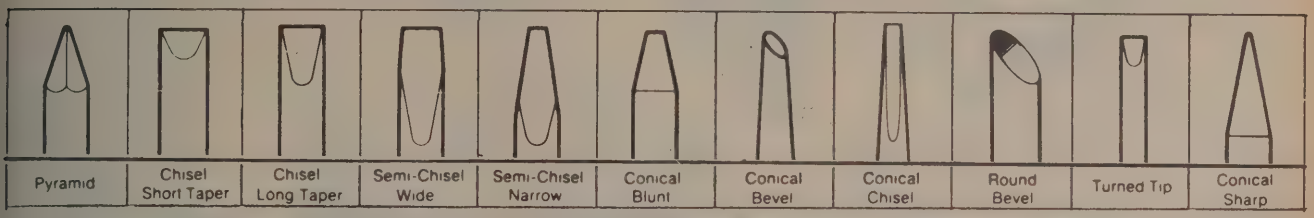
A. Heavy Iron Coating
B. Scale resistant Stainless Steel
C. Pretinned Lectrotin
D. Immunized Nickel and Chrome
E. Iron, Nickel and Chrome coated




**XTRADUR** Heavy Iron plated over OFHC Copper alloy with shank precision ground to tolerance of .001. Pretinned with Lectrotin process and immunized with Nickel and Chrome.

A. Heavy Iron Coating
B. Iron, Nickel and Chrome
C. Pretinned Lectrotin
D. Immunized Nickel and Chrome
E. Iron, Nickel and Chrome coated




## CATALOG NUMBERS ARE FOR DUROTHERM TIPS. FOR XTRADUR, SEE NOTES

| o No. | Style of Point | Tip No. | Style of Point | Tip No. | Style of Point |
|---|---|---|---|---|---|
| **' x 2-1/4" Fit Iron Nos. 25S, P25, 25H, 21A** | | | | | |
| 248D | Pyramid | HT222D | Conical, blunt | HT693D | R. B., TT 1/16" |
| 249D | Chisel, short | HT331D | Conical, sharp | HT104D | R. B., TT 1/32" |
| 376D | Chisel, long | HT638D | Round, bevel | HT216D | R. B., groove |
| 560D | Semi-chisel | HT361D | Chisel, TT 1/16" | HT244D | Conical, bevel |
| **3" x 2-1/4" Fit Iron Nos. 26S, P26, 26H, 22A** | | | | | |
| 251D | Pyramid | HT190D | Semi-chisel, W | HT290D | Chisel, TT 1/8" |
| 294D | Chisel, short | HT214D | Conical, blunt | HT548D | S-chisel, N, TT 1/8" |
| 195D | Chisel, long | HT281D | Conical, sharp | HT479D | Conical TT 1/8" |
| 207D | Semi-chisel, N | HT288D | Pyramid, TT 1/8" | HT220D | R. B., TT 1/16" |
| **' x 2-1/4" Fit Iron Nos. 24S, P24, 24H, 23A** | | | | | |
| 325D | Pyramid | HT102D | Round, bevel | HT513D | Conical, TT 1/8" |
| 553D | Chisel, short | HT586D | Conical, S-chisel | HT463D | Chisel, L, TT 3/16" |
| 313D | Semi-chisel, W | HT691D | Chisel, TT 1/16" | HT841D | S-chisel, N, TT 1/8" |
| 397D | Semi-chisel, M | HT699D | S-chisel, Lg, TT 1/8" | HT692D | Chisel, L, TT 1/8" |
| 117D | Semi-chisel, N | HT451D | Chisel, L, TT 1/8" | HT552D | S-chisel, 3/8" Shank |
| 418D | Conical, blunt | HT324D | Chisel, S, TT 1/8" | | |
| **' x 2-3/4" Fit Iron Nos. P30, 30H, P34, 34H** | | | | | |
| 252D | Pyramid | HT263D | Pyramid, TT 1/8" | HT452D | Conical, TT 1/8" |
| 253D | Chisel, short | HT264D | Chisel, SH, TT 1/8" | HT580D | Conical, TT 3/16" |
| 202D | S-chisel, Wide | HT356D | Chisel, M, TT 1/8" | HT473D | Chisel, TT 3/16" |
| 426D | S-chisel, N | HT685D | Chisel, Lg, TT 1/8" | HT130D | Round, bevel |
| 131D | Conical, sharp | | | | |
| **' x 3" Extra long for P30, 30H, P34, 34H. Also for competitive makes** | | | | | |
| 468D | Chisel, long | HT708D | S-chisel, N, Lg | HT487D | Chisel, Lg, TT 1/8" |
| 299D | Semi-chisel, W | HT453D | Conical, bevel | HT519D | Chisel, Lg, TT 1/8" |
| 328D | Semi-chisel, N | HT234D | Chisel, Lg, TT 5/32" | HT362D | Conical groove |
| **' x 3-3/4" Extra long for P30, 30H, P34, 34H. Also for competitive makes.** | | | | | |
| 563D | Pyramid, long | HT691D | Semi-chisel, N | HT603D | Chisel, Lg, TT 1/8" |
| 188D | Chisel, long | HT626D | Pyramid, TT, 1/8" | HT391D | Semi-chisel, N |
| 382D | Semi-chisel, W | HT698D | S-chisel, TT 1/8" | HT277D | Chisel, Lg, TT 3/16" |
| **' x 4" Fit Irons P114, P154, P214.** | | | | | |
| 395D | Chis., Lg, TT 3/16" | HT494D | Semi-chisel, N | HT496D | Chisel, long |
| **' x 4-1/4" Fit Irons P114, P154** | | | | | |
| 258D | Pyramid | HT230D | Semi-chisel, W | HT460D | Conical, bevel |
| 259D | Chisel, short | | | | |
| **' x 4-1/4" Fit Iron Nos. P100, P150, P238, P338, 100H, 150H** | | | | | |
| 255D | Pyramid | HT266D | Chisel, Sh, TT 1/4" | HT177D | S-chisel, W, TT 1/4" |
| 393D | Chisel, short | HT335D | Chisel, Lg, TT 1/4" | HT577D | S-chisel, N, TT 1/4" |
| 151D | Chisel, long | HT108D | Conical, sharp | HT145D | Chisel, Sh, TT 3/16" |
| 183D | Semi-chisel, N | HT114D | Conical, blunt, Sm | HT475D | S-chisel, N, TT 3/16" |
| 593D | Semi-chisel, W | HT240D | Conical, blunt M | HT481D | Chisel, N, Sh, TT 1/8" |
| 265D | Pyramid, TT 1/4" | | | | |
| **' x 4" Fit Iron Nos. P100, P150, P238, 100H, 150H; Extra long for P70, 70H.** | | | | | |
| 566D | Pyramid | HT365D | Semi-chisel, thin | HT4300 | Round, bevel |
| 198D | Chisel, short | HT370D | S-chisel, Lg, N | HT319D | S-chisel, N, TT 1/4" |
| 918D | S-chisel, Sh, M | HT140D | Semi-chisel, W | | |

| Tip No. | Style of Point | Tip No. | Style of Point | Tip No. | Style of Point |
|---|---|---|---|---|---|
| **3/8" x 3-3/4" Fit Iron Nos. P70, 70H; Also fit other makes** | | | | | |
| HT254D | Pyramid | HT339D | S-chisel, N, TT 1/4" | HT291D | S-chisel, W, TT 1/4" |
| HT488D | Chisel, short | HT129D | Semi-chisel, W | HT510D | Conical, sharp |
| **1/2" x 4" Fit Iron Nos. P151, 151H, P152, P212** | | | | | |
| HT323D | Chisel, short blunt | HT2030 | Conical, blunt | | |
| HT1630 | Semi-chisel, N | HT1940 | Semi-chisel, thin | | |
| HT444D | S-chisel, long taper | | | | |
| **1/2" x 4-1/4" Fit Iron Nos. P151, P212, 151H** | | | | | |
| HT257D | Pyramid | HT293D | Chisel, short | HT446D | S-chisel, Lg, Taper |
| HT123D | S-chisel N, TT 3/8" | | | | |
| **5/8" x 4" Fit Iron Nos. P125, P200, 200H, P250** | | | | | |
| HT256D | Pyramid | HT891D | Chisel, long | HT178D | Semi-chisel, W |
| **5/8" x 4-1/4" Fit Iron Nos. P200, P250, 200H** | | | | | |
| HT260D | Pyramid | HT371D | Semi-chisel, N | HT499D | Chisel, long |
| **7/8" x 4-3/4" Fit Iron Nos. P300, 300H** | | | | | |
| HT261D | Chisel, short | HT179D | Semi-chisel, W | | |
| **1-1/8" x 5-1/4" Fits No. 500** | | | | | |
| HT262X | Chisel | HT229X | Semi-chisel | HT233X | Pyramid |

**Special types available upon request.**

## SCREW TIPS All Conventional Semi-chisel Types

| Tip No. | Dia. | Thread | Iron No. | Tip No. | Dia. | Thread | Iron No. |
|---|---|---|---|---|---|---|---|
| HT268X | 1/2" | 5/16-18 | 60 and 85 | HT272X | 1-1/8" | 5/8-11 | 225 |
| | | | | HT273X | 1-3/8" | 5/8-11 | 350 |
| HT269X | 5/8" | 5/16-18 | 120 | HT274X | 1-5/8" | 5/8-11 | 500 |
| HT271X | 1" | 1/2-13 | 170 | HT275X | 1-3/4" | 5/8-11 | 700 |

## HORNET TIPS

**TIPS FOR IRONS Nos. H10 and H11**

| No. | Dia. | No. | Dia. | No. | Dia. |
|---|---|---|---|---|---|
| HT866D | 1/32" | HT896D | 1/16" | HT871X | 1/8" |
| HT867D | 1/32" | HT864X | 1/8" | HT873X | 1/8" |
| HT868D | 1/16" | HT870X | 1/8" | | |

**TIPS FOR IRON No. H14**

| No. | Dia. | No. | Dia. | No. | Dia. |
|---|---|---|---|---|---|
| HT654X | 1/8" | HT656X | 3/16" | HT658X | 1/8" |
| HT655X | 1/8" | HT657X | 3/16" | HT659X | 1/8" |

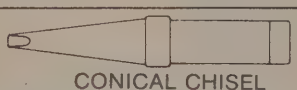
**CATALOG NOS.** shown are for DUROTHERM. For XTRADUR substitute "X" for "D"; cost approximately 10% less than DUROTHERM

**SAMPLE TIPS** for your evaluation. Ask for new Tip Sketch Catalog with detailed sketches of 250 Standard Coated Tips

## WL TIPS FOR WTCP UNITS

| | | | |
|---|---|---|---|
| 1 Semi-chisel 1/16" | WL5 Chisel 1/4" | WL9 Bevel 3/32" | WL13 Semi-chisel 1/32" |
| 2 Semi-chisel 3/32" | WL6 Semi-chisel 5/64" | WL10 Bevel 1/8" | WL14 Conical 1/32" |
| 3 Semi-chisel 1/8" | WL7 Semi-chisel 3/64" | WL11 Bevel 3/16" | WL15 Semi-chisel 1/8" |
| 4 Chisel 1/4" | WL8 Bevel 1/16" | WL12 Bevel 1/32" | WL16 Conical 1/64" |

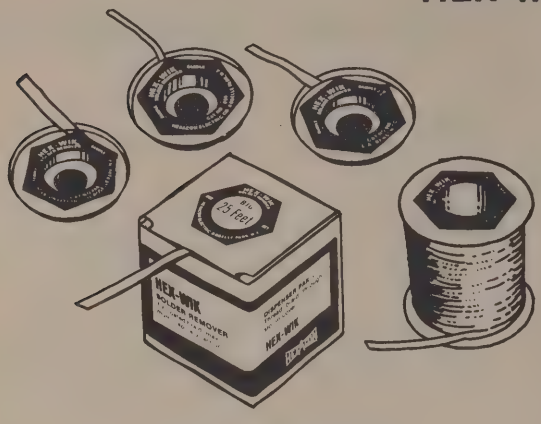
Specify temperature desired. Other sizes available.
Send for complete list.


CONICAL CHISEL

CONICAL BEVEL

# HEXACON SOLDERING ACCESSORIES HEXACON

## HEX-WIK the superior solder removal braid



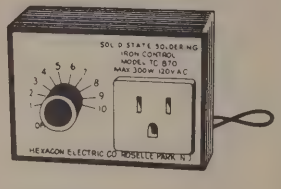
Meets all Military and Government specifications

- The easiest and most economical method of desoldering printed wiring boards without measling, delamination or lifted pads.
- Simplifies removal and replacement of components.
- Can be used for solder removal on plated thru and multi-layer printed wiring board assemblies.
- Braid processed for long shelf life insures greater capillary action.
- Available in 6 sizes 1/32", 3/64" and 1/16" for micro work, 5/64", 1/8" and 5/32" for larger work.
- For convenience ... 6, 10 or 15 ft. on 2" spools.
- For economy ... 25, 50 or 100 ft. in handy Dispenser Paks. Larger spools available on request.

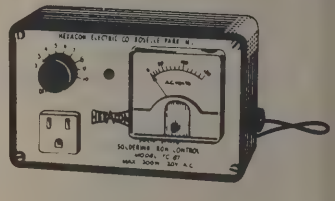
Hexacon manufactures a complete line of soldering accessories: solder suckers, heat sinks, braid cleaners, erasure cleaners, tweezers, tip cleaning sponges, desoldering tips, desoldering wells, mini pots, etc.

## Temperature Control Units

- Controlled AC input provided from 0-95% of line voltage
- Capacity 300 watts on 115 volts
- Solid state circuitry includes built-in fuse protection
- Idling temperature may be readily controlled
- Thermal working zones may be varied by adjusting input control
- Use same iron for different capacity jobs
- Calibrate control settings to maintain proper working ranges as required by government specifications
- Rugged design provides long maintenance, free operational life



**Model 870**
3 wire grounded design.
Size 1⅝" x 4".
Weight 10 oz.



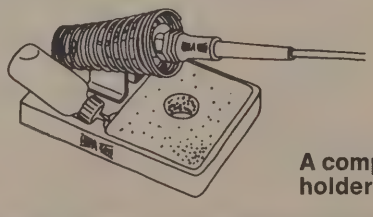
**Model 871**
3 wire design. Comes with voltmeter for visual indication of voltage input to iron. Size 2" x 6¼".
Weight 18 oz.

## HEAT GUARD SOLDERING IRON HOLDERS

- Protect iron and tip
- Conserve energy — nonheat sinking
- Cool, safe holder assembly
- Full operator protection

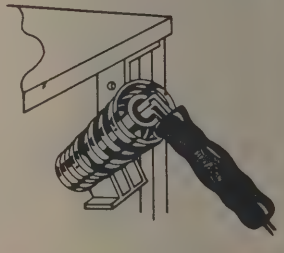
**MODEL 890**
**Ceramic Base with Reservoir and Sponge**

- For instrument irons
- Water injection keeps sponge wet
- Non-skid base — can be used in clean room without marring bench
- Base easily cleaned



**MODEL 893**
**Bench Mounted**

- For under-bench mounting
- Angle adjustable for operator convenience and safety
- Sturdy construction — easily cleaned



**A complete line of iron holders are available.**

**For complete Information on Soldering Irons and Accessories, write for Catalog "Soldering Irons." Write for complete tip catalog with 250 standard sizes and shapes. Custom tips designed to specifications.**

**HEXACON ELECTRIC COMPANY** 159 WEST CLAY AVE., ROSELLE PARK, N. J. 07204
PHONE (201) 245-6200 • TELEX 138812

# DIP TOOLS from TECHNI-TOOL

YOUR TOTAL SPECTRUM TOOL SUPPLIER

## Little Dipper™

DIP INSERTER No. 4990

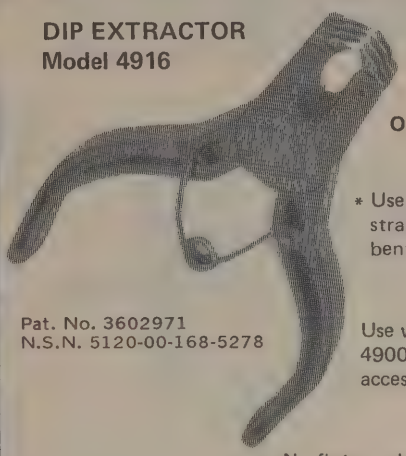
- SPEEDS DIP INSERTIONS
- FASTEST MANUAL DEVICE AVAILABLE
- Aluminum and Stainless Steel Construction
- Adjustable for Package Manufacturers' Varying Production Tolerances
- Models Available for 8, 14/16, 28 and 36/40 Pin Configurations
- Will Not Wear Out
- Safe for All Packages
- Optional Drain Strap

**LOADS** from any surface or magazine

**ALIGNS** leads

**INSERTS** with no stress

## DIP EXTRACTOR
Model 4916



O.A.L. 5"

* Use handle to straighten bent leads

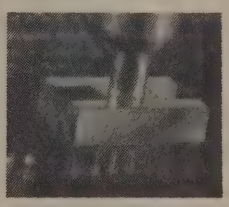
Pat. No. 3602971
N.S.N. 5120-00-168-5278

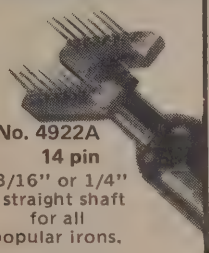
Use with 4900 Series accessories

- Makes extraction a one-hand operation.
- Removes 4-48 pin DIP's.
- Extracts ALL types of components.
- Does not bend leads.
- Lifts DIP vertically.
- Teeth act as heat sink.
- Does not pop up.
- No flying solder.
- Can be used anywhere DIP's butt together.
- Use as close as .250" between rows.
- Grips underneath leads; safe for ceramic DIP's.
- Insulated for live board work.
- Self actuating.

## DIP APERTURE CLEANER
Pat. No. 3,632,972

No. 4922
7 pin





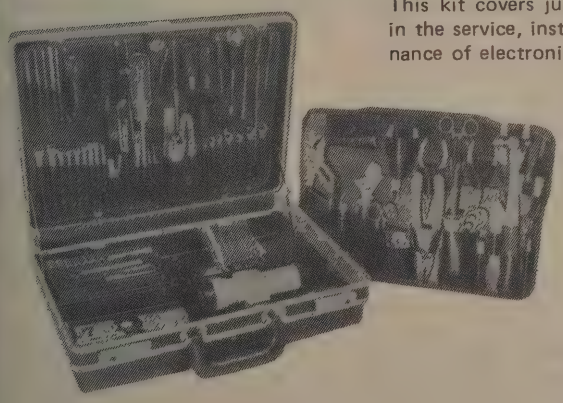
**No. 4922A**
**14 pin**
3/16" or 1/4" straight shaft for all popular irons.

- Opens holes when desoldering multi-layer boards.
- Heats only the aperture area, not surrounding eyelets or plated through holes.
- Will not delaminate boards or lift pads.
- Pushes solder OUT. Solder won't stick to tips.
- Leaves clear hole for component insertion.
- Use hot in iron or cold over solder pot.
- Use with 45 watt iron.

## DIP DESOLDERING TIP
Model 4918
Pat. No. 3,469,809

- Contacts all leads at once.
- Will not delaminate boards.
- Ventilated for heat control.
- Will not lift pads or artwork.
- Solder flows into shallow channel.
- Touches only the DIP leads.
- Does not touch the board.
- Tapered ends can be used for straightening leads and resoldering in 1/4 the time.
- Plated copper contruction.
- 3/16-1/4" and screw type shaft available.
- Accommodates 14-16 pin DIP's.

## GENESIS I — Basic Technician's Tool Kit No. 7609M
**A best seller from our complete line of kits & cases**



18¼" x 13" x 5¾"

This kit covers just about every need in the service, installation and maintenance of electronic equipment — from pinball machines to computers. Packed in a rugged ABS case, it includes the most requested items such as punches & alignment tools, hammers, flashlights, inspection mirrors, scribes, soldering iron, spring hooks, VOM's, parts boxes & much, much more!

DEALER INQUIRIES INVITED

## TECHNI-TOOL inc.

**Total Spectrum Tool Supplier**
Apollo Road
Plymouth Meeting, Pa. 19462
(215) 825-4990 Telex 83-4763

Order Dept. 800-523-7798

**FREE**
General catalog with over 10,000 items. 165 pages of pictures, descriptions and prices. Worth looking at!

**American Aerospace Controls Inc.**
570 SMITH STREET, FARMINGDALE, NEW YORK 11735 □ (516) 694-5100

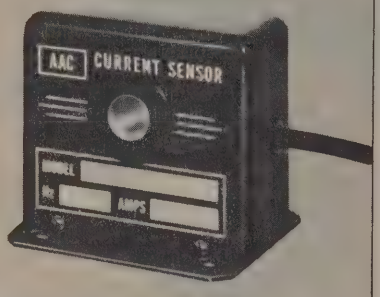



Figure 1 Size: 2 1/16" x 2" x 1 3/4"

## (A.C.) CURRENT SENSORS

| SERIES | INPUT RANGES | # OF MODELS | FULL SCALE OUTPUT | ACCURACY | RESPONSE | FIG. |
|---|---|---|---|---|---|---|
| C5 | 5 A | 1 | +1 mA DC | 0.3% F.S. | 400 ms | — |
| 1003AM1 | 2 to 100 A | 6 | +5 VDC | 2% F.S. | 150 ms | 1 |
| 1002 | 5 to 100 A | 5 | +5 VDC | 1% F.S. | 50 ms | 5 |
| 1004 | 5 to 100 A | 5 | +5 VDC | 2% F.S. | 150 ms | 5 |
| 1003AM2 | 50 to 250 A | 5 | +5 VDC | 1% F.S. | 150 ms | — |
| 1001 | 150 to 5000 A | 9 | +5 VDC | 2% F.S. | 150 ms | 4 |
| 1003AM3 | 250 to 1500 A | 9 | +5 VDC | 2% F.S. | 150 ms | — |
| 1003AM4 | 300 to 500 A | 4 | +5 VDC | 1% F.S. | 150 ms | — |

Figure 2 Size: 2 11/16" x 1 5/8" x 1 5/8"

## (D.C.) CURRENT SENSORS

| SERIES | INPUT RANGES | # OF MODELS | FULL SCALE OUTPUT | ACCURACY | RESPONSE | FIG. |
|---|---|---|---|---|---|---|
| 904B | 0.1 to 5 mA | 6 | +5 VDC | 1% F.S. | 50 ms | — |
| 903B | 5 to 5000 mA | 10 | +5 VDC | 1% F.S. | 50 ms | 5 |
| 903C | 5 to 5000 mA | 10 | +5 VDC | 2% F.S. | 50 ms | 5 |
| 939A | 50 to 5000 mA | 7 | + 5 VDC | 1% F.S. | 5 ms | 5 |
| 939B | 50 to 5000 mA | 7 | + 1 mA DC | 1% F.S. | 5 ms | 5 |
| 936 | 50 to 500 mA | 2 | +5 VDC | 2% F.S. | 100 ms | — |
| 937 | 10 to 30 A | 3 | +5 VDC | 2% F.S. | 1 ms | — |
| 913A | 10 to 100 A | 4 | +5 VDC | 1% F.S. | 1 ms | 2 |
| 913B | 10 to 100 A | 4 | +5 VDC | 1% F.S. | 1 ms | 5 |
| 913C | 10 to 100 A | 4 | +5 VDC | 2% F.S. | 1 ms | 5 |
| 923B | 10 to 100 A | 4 | +5 VDC | 1% F.S. | 1 ms | 5 |
| 923C | 10 to 100 A | 4 | +5 VDC | 2% F.S. | 1 ms | 5 |
| 902 | 50 to 500 A | 5 | +5 VDC | 1% F.S. | 5 ms | — |
| 934 | 100 to 1000 A | 7 | +5 VDC | 2% F.S. | 1 ms | — |

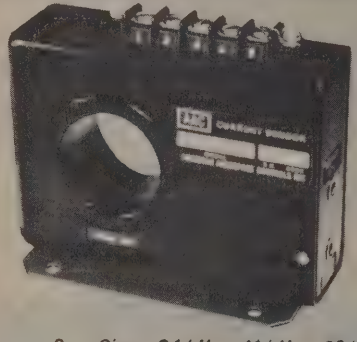


Figure 3 Size: 3 1/2" x 4 1/4" x 2 3/16"

## BIDIRECTIONAL CURRENT SENSORS

| SERIES | INPUT RANGES | # OF MODELS | FULL SCALE OUTPUT | ACCURACY | RESPONSE | FIG. |
|---|---|---|---|---|---|---|
| 905B | ±50 to ±5000 mA | 7 | ±5 V | 1% F.S. | 50 ms | 5 |
| 905C | ±50 to ±5000 mA | 7 | ±5 V | 2% F.S. | 50 ms | 5 |
| 925B | ±10 to ±100 A | 4 | ±5 V | 1% F.S. | 1 ms | 5 |
| 925C | ±10 to ±100 A | 4 | ±5 V | 2% F.S. | 1 ms | 5 |
| 907A | ±25 to ±250 A | 6 | ±5 V | 2% F.S. | 40 μs | — |
| 908 | ±25 to ±200 A | 5 | ±250 mV | 2.5% F.S. | 5 μs | — |
| 910 | ±25 to ±250 A | 6 | ±250 mV | 2% F.S. | 5 μs | — |
| 927C | ±50 to ±1000 A | 9 | ±5 V | 2% F.S. | 100 μs | — |
| 942A | ±100 to ±1000 A | 8 | ±5 V | 1% F.S. | 100 μs | 3 |
| 942B | ±100 to ±1000 A | 8 | ±10 V | 1% F.S. | 100 μs | 3 |
| 927B | ±150 to ±1000 A | 7 | ±5 V | 1% F.S. | 100 μs | — |
| 909 | ±150 to ±2500 A | 8 | ±250 mV | 2% F.S. | 200 μs | 4 |
| 909M4 | ±150 to ±2500 A | 8 | ±5 V | 2.5% F.S. | 200 μs | 4 |

Figure 4 Size: 5" x 3 1/4" x 1 9/16"

# CURRENT, VOLTAGE AND POWER INSTRUMENTATION

**CALL 516-694-5100**

## MOVEABLE JAW CURRENT SENSORS

| SERIES | INPUT RANGES | # OF MODELS | FULL SCALE OUTPUT | ACCURACY | RESPONSE | FIG. |
|---|---|---|---|---|---|---|
| 932 | ±10 to ±500 A | 10 | ±5 V | 1% F.S. | 100 μs | 6 |
| 930 | ±30 to ±500 A | 4 | ±1 V | 2% F.S. | 100 μs | 6 |
| 929 | 50 to 500 A | 6 | +5 V | 1% F.S. | 200 μs | 6 |

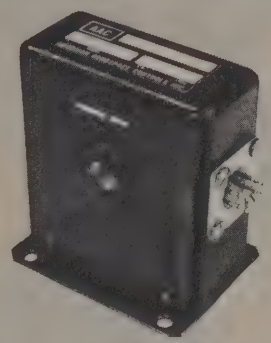


Figure 5 Size: 2⅞" x 2⁹⁄₁₆" x 2"

## CURRENT LEVEL DETECTORS

| SERIES | INPUT RANGES | # OF MODELS | OUTPUT | REPEATABILITY | RESPONSE | FIG. |
|---|---|---|---|---|---|---|
| 850 | 2 to 250 A AC | 9 | Relay | 2% F.S. | 500 ms | — |
| 901B | 20 to 5000 mA DC | 9 | +5 V & SW. | 1% F.S. | 50 ms | — |
| 800 | 200 mA DC | 1 | Switch | N/A | 1 ms | — |

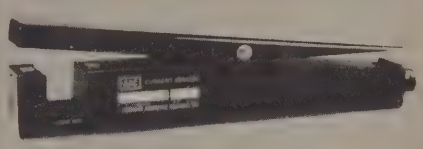


Figure 6 Size: 1⅞" x 9" x 1⅛"

## VOLTAGE SENSORS

| SERIES | INPUT RANGES | # OF MODELS | FULL SCALE OUTPUT | ACCURACY | RESPONSE | FIG. |
|---|---|---|---|---|---|---|
| V150 | 150 VAC | 1 | +1 mA DC | 0.3% F.S. | 400 ms | — |
| 101 | 90 to 300 VAC | 2 | +1.35 VDC | 2% Vmax. | 17 ms | 7 |
| 101M3 | 90 to 150 VAC | 1 | +5 VDC | 2% F.S. | 17 ms | 7 |
| 102M3 | 90 to 175 VAC | 1 | +5 VDC | 2% F.S. | 3 ms | 7 |
| 105 | 340 to 540 VAC | 4 | +5 VDC | 2% F.S. | 17 ms | 7 |
| 108 | 130 to 500 VAC | 4 | +5 VDC | 2% F.S. | 200 ms | — |
| 109 | 120 to 270 VAC | 6 | +1 ma DC | .5% Vmax. | 300 ms | — |
| 110 | 120 to 270 VAC | 6 | +1 ma DC | .5% Vmax. | 300 ms | — |

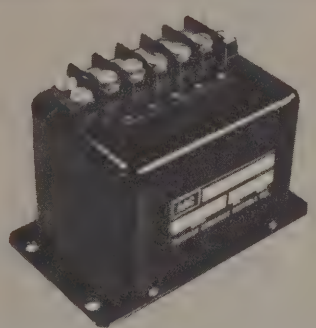


Figure 7 Size: 3¹⁄₁₆" x 3¾" x 2³⁄₁₆"

## WATT TRANSDUCERS

| SERIES | INPUT RANGES | # OF MODELS | FULL SCALE OUTPUT | ACCURACY | RESPONSE | FIG. |
|---|---|---|---|---|---|---|
| 407 | 0.3 to 60 KW DC | 12 | +250 mV DC | 2% F.S. | 5 μs | — |
| 401 | 2.7 to 150 KW DC | 70 | +250 mV DC | 2.5% F.S. | 200 μs | 4 |
| W156 | 500 W AC | 1 | +1 mA DC | 0.25% F.S. | 400 ms | — |
| W206 | 1000 W AC | 1 | +1 mA DC | 0.25% F.S. | 400 ms | — |
| W256 | 1500 W AC | 1 | +1 mA DC | 0.25% F.S. | 400 ms | — |
| 411 | 1 to 100 KW AC | 16 | +100 mV DC | 2% F.S. | 400 ms | 8 |
| 412 | 1 to 80 KW AC | 16 | +100 mV DC | 2% F.S. | 400 ms | 8 |
| 414 | 1 to 80 KW AC | 16 | +5 VDC | 2% F.S. | 400 ms | 8 |
| 415A | 1 to 100 KW AC | 8 | +5 VDC | 2% F.S. | 400 ms | 8 |
| 411M1 | 4 to 200 KW AC | 8 | +100 mV DC | 2% F.S. | 400 ms | 8 |
| 416A | 4 to 200 KW AC | 8 | +5 VDC | 2% F.S. | 400 ms | 8 |

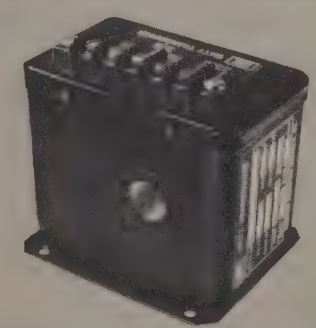


Figure 8 Size: 4" x 4⅛" x 3⅜"

***AAC** manufactures Current, Voltage and Power Sensing Instruments for Industrial, Military and Space Applications. Send for complete catalog. Our Application Engineering Staff is available to assist you.*

# GAUSSMETERS • MAGNETIZERS • POWER TRANSDUCERS F. W. BELL, Inc.

## HALL EFFECT GAUSSMETERS

### DESCRIPTION

Bell Gaussmeters are designed to accurately measure magnetic flux density. Twenty-eight models and 110 standard field probes meet the demanding requirements of most applications.

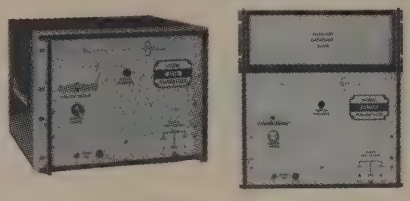
Bell Gaussmeters provide four magnetic field measurement models: direct measurement of absolute magnetic field density, differential measurement of the difference in magnetic field density at two probe locations, incremental field measurements using an expanded scale and summation measurements.

There are 110 standard probe models for each gaussmeter model. Each is a precision, solid-state, magnetic field sensor built into a rugged package for accurate, repeatable, stable, field measurements. Models available for transverse, axial, differential, two-axis, and three-axis measurements with a variety of field ranges, field sensitivities, and configurations for each.

### SPECIFICATIONS

| Gaussmeter model | ranges FS Gauss | accuracy | dc output voltage FS |
|---|---|---|---|
| 811 digital | 10 to 100,000 | ±0.1% FS | 1 Volt |
| 810 field monitor | 10 to 100,000 | ±0.1% FS | 1 Volt |
| 660 digital | 1 to 100,000 | ±0.1% to 10 kG<br>±0.3% to 30 kG | 1 Volt |
| 640 incremental | 0.1 to 30,000 | ±0.25% FS | 1 Volt<br>5 Volts |
| 620 precalibrated | 0.1 to 30,000 | ±0.25% FS | 1 Volt |
| 615 digital | 10 to 100,000 | ±0.5% FS | 100 mV BCD |
| 610 self-calibrated | 1 to 100,000 | ±0.5% FS | 100 mV |
| 600 general purpose | 100 to 30,000 | ±4% FS | 1 Volt |

## MAGNETIZERS



### DESCRIPTION

Bell magnetizers are capacitive discharge power units designed to supply current pulses to a magnetizing fixture coil. The energy level of the pulse is variable and accurately repeatable.

Bell fixtures are designed to apply the proper pulsed magnetic field to the magnet or magnet assembly. The fixtures provide the field shape and direction to accommodate the specific magnet configuration and magnetization direction. Special fixtures that simulate specific magnetic circuits are available. F. W. Bell supplies fixture design assistance.

### FEATURES

- **FULLY SOLID-STATE**

The entirely solid-state units are designed for long life and high reliability.

- **LOW VOLTAGE MAGNETIZER**

The magnetizer operates at high capacity and low voltage for personal safety and long equipment life.

- **MANUAL OR AUTOMATIC OPERATION**

Magnetizer and stabilizer units are usually manually operated, but they may be integrated into automatic systems through the use of optional equipment.

### SPECIFICATIONS

| model number | energy maximum watt-sec | storage voltage, Volts |
|---|---|---|
| 860 | 600 | 35 to 350 |
| 861 | | |
| 860 A | 1200 | |
| 861 A | | |
| 870 | 1800 | |
| 871 | | |
| 870 A | 3000 | |
| 871 A | | |

## REAL POWER TRANSDUCERS

### DESCRIPTION

PX 2000 and PX 4000 series transducers are compact, accurate, and dependable solid-state modules for the measurement and control of single-phase and three-phase power in various frequency ranges. The module output is a power-proportional dc voltage.

The light-weight transducers are epoxied in small nylon cases with through mounting holes and wire leads. This configuration facilitates assembly with associated devices. Simplicity, versatility, high performance, and low cost make these modules ideal for many applications.

### SPECIFICATIONS

| | PX 2000 series | PX 4000 series |
|---|---|---|
| Rated power levels | 50-2000 W | 1000-2000 W |
| Rated current levels | 0.5-20 A | 5 A |
| Rated voltage | 120 V<br>220 V | 220 V |
| Frequencies, nominal | 60-180-360 Hz | 1-3 kHz |
| Frequency range | 25 to 1200 Hz | 0.5 to 10 kHz |
| Rated dc output across 50 ohm | ± 55 mV | ≥ 27 mV |
| Ripple, peak to peak | <200% | <200% |
| Response time to 99% | <50μs | <5μs |
| Rated accuracy | 0.5% | 0.5% |
| Linearity vs. power | ± 0.2% | ± 0.2% |

## ORDERING INFORMATION

Contact F. W. Bell, Inc. for application assistance. Product assistance and technical literature are available. If standard models are not suitable, F. W. Bell, Inc. can design one for your special electrical and physical requirements.

A Subsidiary of
The Arnold Engineering Company

BELL INC.®
4949 Freeway Drive E.
Columbus, Ohio 43229
Phone: (614) 888-750
TWX: 810-337-2851

**A complete product line of local or remote sensing accelerometers with a built-in pre-amplifier. Total freedom from expensive and inaccurate charge amplifiers. Drive 60, or more, feet of cable without signal degradation. Cable noise, which introduces distortion in charge-coupled accelerometers, does not affect these accelerometers.**

All specifications per axis

| | Miniature, Low Mass, High Frequency | | Miniature Triaxial, Low Mass, High Frequency | | High Sensitivity, Low Noise Floor | High Sensitivity, OEM | General Purpose, Low Cost | Very High Stability | Seismic |
|---|---|---|---|---|---|---|---|---|---|
| | Model 501 | Model 506 | Model 505 | Model 505-ISO | Model 307 | Model 524-ISO | Model 508A | Model 525-ISO | Model 510 |
| **Sensitivity (at 70°F and 100 Hz).** Sensitivity calibration supplied with each unit. | 10 mV/g ±10% | | 10 mV/g ±10% | | 100 mV/g ±5% | 100 mV/g ±5% | 10 mV/g ±5% | 25 mV/g ±5% | 8 V/g ±20% |
| Sensitivity change vs. temperature (max.)<br>−65°F<br>70°F (Reference Temp.)<br>150°F<br>200°F<br>250°F | +10%<br>0%<br>−5%<br>−10%<br>−15% | | +10%<br>0%<br>−5%<br>−10%<br>−15% | | +10%<br>0%<br>−5%<br>−10%<br>−15% | +10%<br>0%<br>−5%<br>−10%<br>−15% | +10%<br>0%<br>−5%<br>−10%<br>−15% | +5%<br>0%<br>−3%<br>−4%<br>−5% | 50°F to 100°F, ±5%<br>32°F to 150°F, ±10% |
| Transverse sensitivity (max.) | 5% | | 5% | | 5% | 5% | 5% | 5% | 3% |
| Noise floor (max.) | 20μV | | 20μV | | 20μV | 30μV | 20μV | 20μV | Equivalent to 0.000005 g rms (0.1 to 100 Hz) |
| Equivalent g's rms (max.) at 1 Hz to 25 kHz | 0.0020 g rms | | 0.0020 g rms | | 0.0002 g rms | 0.0003 g rms | 0.0020 g rms | 0.0008 g rms | |
| **Amplitude linearity** | ±1% to ±212 g peak | | ±1% to ±212 g peak | | ±1% to ±21 g peak | ±1% to ±25 g peak<br>±3% to ±50 g peak | ±1% to ±212 g peak | ±1% to ±84 g peak | ±1% to ±0.3 g peak |
| **Operating temperature range**<br>**Peak operating g's**<br>**Shock survivability (peak g's)** | −65°F to 250°F<br>±212<br>±10,000 | | −65°F to 250°F<br>±212<br>±10,000 | | −65°F to 250°F<br>±21<br>±5,000 | −65°F to 250°F<br>±25<br>±5,000 | −65°F to 250°F<br>±212<br>±10,000 | −65°F to 250°F<br>±84<br>±5,000 | 32°F to 150°F<br>±0.25<br>±10 (fragile) |
| **Frequency response**<br>Basic unit: −65°F to 200°F, ±5% points, min.-max.<br>−65°F to 250°F, ±5% points, min.-max.<br>−65°F to 250°F, ±3dB points, min.-max. | 4 to 20,000 Hz<br>7 to 20,000 Hz<br>2 to 40,000 Hz | 4 to 15,000 Hz<br>7 to 15,000 Hz<br>2 to 33,000 Hz | 4 to 12,000 Hz<br>7 to 12,000 Hz<br>2 to 25,000 Hz | 4 to 10,000 Hz<br>7 to 10,000 Hz<br>2 to 16,000 Hz | 3 to 7,000 Hz<br>6 to 7,000 Hz<br>2 to 12,000 Hz | 3 to 5,000 Hz<br>6 to 5,000 Hz<br>2 to 12,000 Hz | 3 to 15,000 Hz<br>6 to 15,000 Hz<br>2 to 30,000 Hz | 3 to 12,000 Hz<br>5 to 12,000 Hz<br>2 to 20,000 Hz | For 32°F to 150°F<br>0.1 to 150 Hz ±5%<br>0.03 to 250 Hz ±3dB |
| Mounted resonant frequency (typical) | 65 kHz | 55 kHz | 45 kHz | 38 kHz | 26 kHz | 30 kHz | 45 kHz | 35 kHz | 600 Hz |
| Unit with isolation stud, mounted; ±5% points<br>Resonant frequency (typical) | N/A | | N/A | | 6 to 4,000 Hz<br>20 kHz | 6 to 3,000 Hz<br>20 kHz | 3 to 8,000 Hz<br>32 kHz | 3 to 7,000 Hz<br>30 kHz | N/A |
| Unit with magnetic mount, mounted; ±5% points<br>Resonant frequency (typical) | 4 to 10,000 Hz<br>35 kHz | 4 to 8,000 Hz<br>30 kHz | N/A | | 6 to 4,000 Hz<br>22 kHz | 6 to 2,500 Hz<br>20 kHz | 3 to 7,000 Hz<br>28 kHz | 3 to 6,000 Hz<br>25 kHz | N/A |
| **Dynamic output impedance** (at 70°F and 100 Hz), max. | 1,500 Ω | | 1,500 Ω | | 1,500 Ω | 600 Ω | 1,500 Ω | 1,500 Ω | 1,500 Ω |
| **Grounding** (Isolated units available grounded) | Case grounded | Case isolated | Case grounded | Case isolated | Case grounded | Case isolated | Case grounded | Case isolated | Case grounded |
| **Power requirements,** mA at a reference of 12 to 30 VDC<br>Nominal quiescent bias voltage (at 70%F) | 0.5 +5/−15%<br>3 VDC | | 0.5 +5/−15%<br>3 VDC | | 0.5 +5/−15%<br>3 VDC | 4.0 ±10%<br>5 VDC | 0.5 +5/−15%<br>3 VDC | 0.5 +5/−15%<br>3 VDC | 0.5 +5/−15%<br>3 VDC |
| **Isolation stud** (Optional) P/N<br>Mounting | Use Model 506 | N/A | Use Model 505-ISO | N/A | 070106<br>¼-28 UNC x 0.150" | 070106<br>¼-28 UNC x 0.150" | 070108<br>10-32 UNC x 0.150" | 070106<br>¼-28 UNC x 0.150" | N/A |
| **Magnetic mount** (Optional) P/N<br>Grounding | 070112<br>Grounded | | 070109<br>Isolated | | 070110<br>Isolated | 070110<br>Isolated | 070109<br>Isolated | 070110<br>Isolated | N/A |
| **Cable** | 2 ft. coaxial, integral | | Optional | | Optional | Optional | Optional | Optional | Optional |
| **Connector** | Microdot S-50,<br>on cable, male | | 4 Pin<br>Microtech DR-4S-4 | | Microdot S-50,<br>female | 2 Pin,<br>S-2051-10SL-4P | Microdot S-50,<br>female | Bayonet, SS7002-8-2P,<br>Hermetic Seal Corp. (or equiv.) | Microdot S-50,<br>female |
| **Case** | Titanium | | Block, aluminum | | Titanium | 303SS,<br>hermetic seal | Base: 303SS; Cap:<br>anodized alum. (blue) | Titanium,<br>hermetic seal | Anodized alum.,<br>black |
| **Weight** | 1.8 grams | 2 grams | 10 grams | 11 grams | 35 grams | 100 grams | 12 grams | 40 grams | 485 grams |
| **Size** | 0.31" Dia. x 0.42" H | | 0.84" H x 0.84" W x 0.84" L | | 0.75" Hex. x 1.27" H | 1.00" Hex. x 2.00" H | 0.50" Hex. x 0.77 " H | 0.75" Hex. x 1.75" H | 2.00" Dia. x 2.17" H |
| **Mounting** | Integral stud<br>6-32 UNC-2A x 0.135" | | 10-32 Tapped hole<br>in base, 0.20" dp. | | ¼-28 Tapped hole<br>in base, 0.19" dp. | ¼-28 Tapped hole<br>in base, 0.19" dp. | 10-32 Tapped hole<br>in base, 0.12" dp. | ¼-28 Tapped hole<br>in base, 0.19" dp. | ¼-28 Tapped hole<br>in base, 0.30" dp. |
| **Options** | Flat base, or 5-40 x 0.135" stud | | SEE ACCESSORIES BELOW FOR: Power Supplies, Cables, Isolation Studs, and Magnetic Base Mounts. | | | | | | |
| **Compatible Power Supplies** | P-16, P-18, P-20 | | P-16, P-18, P-20, one per axis required | | P-16, P-18, P-20 | P-18/4 | P-16, P-18, P-20 | P-16, P-18, P-20 | P-16, P-18 |
| **Unit Price** (1 to 4) — Quantity Discounts Available | $300 | $325 | $975 | | $250 | $250 | $175 | $275 | $700 |

| ACCESSORIES | Description | | Quantity | Unit Price |
|---|---|---|---|---|
| Power Supplies | Model P-16 | 0.5 mA, constant current; 1.5 V rms maximum output. With internal battery | 1-4 | $ 70.00 |
| | Model P-18 | OEM, 0.5 mA, constant current; 1.5 V rms maximum output. 12 to30 VDC input supplied by customer. | 1-4 | $ 55.00 |
| | Model P-18/4 | OEM, 4.0 mA, constant current; 3.5 V rms maximum output. 12 to 30 VDC input supplied by customer. | 1-4 | $ 65.00 |
| | Model P-20 | 0.5 mA, constant current; 1.5 V rms or 5 V rms maximum output (x 1 or x 10 gain). Gain adjustable for sensitivity normalization. With internal battery. | 1-4 | $225.00 |
| Interface Extension Cables | P/N 070603 | The standard is low noise, high temperature (250°F) coax cable terminated with Microdot connectors, 3 foot section. For special length cables add $3.00/ft. | 1-24 | $ 35.00 |
| | P/N 070623 | For use with Model 505 and 505-ISO. Three feet of four conductor cable ending in three one-foot coax cables to mate with three power supplies. | 1-99 | $ 75.00 |
| Cable Adaptor | P/N 070806 | Required when Model 501 or 506 is used with an Extension Cable. | 1-99 | $ 8.00 |
| Accelerometer Isolation Studs | P/N 070106 | For use with Accelerometer Models 507, 524-ISO, and 525-ISO | 1-99 | $ 8.00 |
| | P/N 070108 | For use with Accelerometer Model 508A | 1-99 | $ 8.00 |
| Magnetic Base Mounts | P/N 070109 | For use with Accelerometer Models 505, 505-ISO and 508A | 1-99 | $ 50.00 |
| | P/N 070110 | For use with Accelerometer Models 507, 524-ISO and 525-ISO | 1-99 | $ 50.00 |
| | P/N 070112 | For use with Accelerometer Models 501 and 506 | 1-99 | $ 50.00 |

- Available on **GSA.**
- Minimum Order: $50.
- Prices: F.O.B. Cambridge, MA.
- Custom designed units available.
- Typical Delivery: 2-4 Weeks

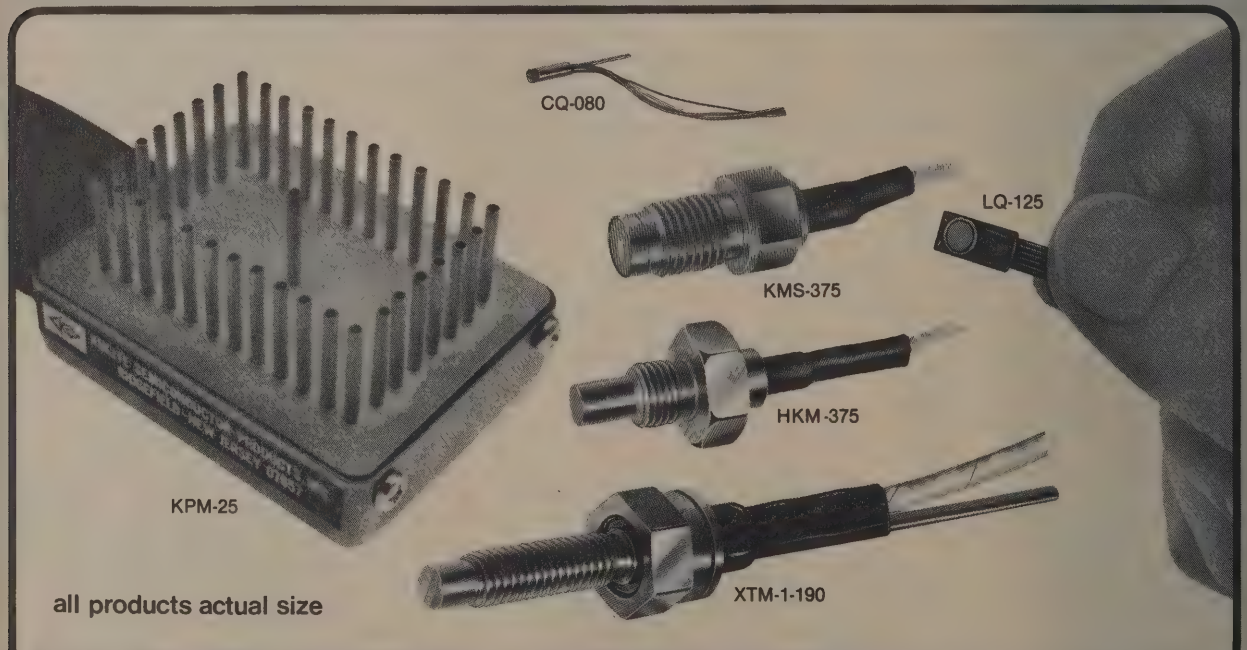
**BBN Instruments Company**
A Division of Bolt Beranek and Newman, Inc.
50 Moulton Street, Cambridge, Ma. 02138 U.S.A.
Phone: (617) 491-0091/Telex: 92-1470/Cable BBNCO

# Kulite pressure transducers

| MODEL NO. | RANGE PSI (A), (G) (D), (S) | OUTPUT FS (Nominal) | NON-LINEARITY AND HYSTERESIS | EXCITATION | TEMPERATURE RANGE (OPERATING) | UNIT PRICE* | BULLETIN REFERENCE |
|---|---|---|---|---|---|---|---|
| **HIGH PERFORMANCE SERIES** | | | | | | | |
| CQ-030/050 | PSI (A), (G), (D), (S), 0-100 | 40 mV | ±1% FS | 5 VDC/AC | −65° to +250°F | $810/$835 | KPS-CQ3B |
| CQ-052/062 | PSI (A), (G), (D), (S), 0-25 to 0-500 | 75 mV | | | | 650/675 | |
| CQ-070 | PSI (A), (G), (D), (S), 0-25 to 0-200 | 75 mV | | | | 470 | |
| CQ-080 | PSI (A), (G), (D), (S), 0-25 to 0-500 | 100 mV | | | | 440/350 | KPS CQ-080 CR-080 |
| CQ-140 | PSI (A), (G), (D), (S), 0-5 to 0-2000 | 100 mV | ±0.5% FS | | | 380 | KPS CQ-140B |
| **HIGH PERFORMANCE THREADED SERIES** | | | | | | | |
| XT-140 | PSI (A), (G), (D), (S), 0-5 to 0-2000 | 100 mV | ±1% FS | 5 VDC/AC | −65° to +250°F | $465 | KPS-XT-140 B |
| XT-190 XT-1-190 | PSI (A), (G), (D), (S), 0-5 to 0-2000 | 100 mV | ±0.5% FS | | | 345 370 | KPS-XT-190 2D |
| XTM-1-190 | PSI (A), (G), (D), (S), 0-10 to 0-2000 | 75 mV | ±1% FS | | | 385 | KPS-XTM-1-190B |
| XTE-1-190 | PSI (A), (G), (D), (S), 0-25 to 0-500 | 80 mV | | 10 VDC/AC | −65° to +525°F | 700 | KPS-E SERIES |
| **THIN LINE SERIES** | | | | | | | |
| LE-125 | PSI (A), (S), 0-25, 0-50, 0-100 | 50 mV (0-25) | ±0.5% FS | 15 VDC/AC | −65° to +525°F | $675 | KPS-LQ-3B |
| LE-30-125 | PSI (A), (G), (D), (S), 0-25, 0-50, 0-100 | 100 mV (0-50) (0-100) | | 5 VDC/AC | | 675 | |
| LQ-080 | PSI (A), (G), (D), (S), 0-25 to 0-100 | 100 mV | ±1% FS | | −65° to +250°F | 440 | |
| LQ-5-080 | PSI (A), (G), (S), 0-25 to 0-100 | | | | | 440 | |
| LQ-125 | PSI (A), (G), (D), (S), 0-25 to 0-500 | 100 mV | | | | 325 | |
| LQ-26-125 | PSI (A), (G), (S), 0-25 to 0-500 | | | | | 380 | |
| LQ-30-125 | PSI (A), (G), (D), (S), 0-25 to 0-100 | | ±0.5% FS | | | 380 | |
| **HIGH PRESSURE SERIES** | | | | | | | |
| HKM-375 HEM-375 | PSI (A), (S), 0-25 to 0-30000 | 75 mV | ±1% FS | 10 VDC/AC | −65° to +250°F | $395 550 | KPS-HKM-375 B KPS-HEM-375 |
| HKS-375 HJS-375 | PSI (A), (S), 0-500 to 0-30,000 | 100 mV | | 5 VDC/AC | | 450 450 | KPS-HKHJ-375D |
| **MULTICHANNEL (25 CHANNEL)** | | | | | | | |
| KPM-25 | PSI (G), (D), 0-10 to 0-100 | 75 mV | 0.15% B.F.S.L. (MAX.) | 5 VDC/AC | 0 to +200°F | $3600 | KPM-25 |

Available on GSA

*Quantity discounts available. Prices subject to change without notice.



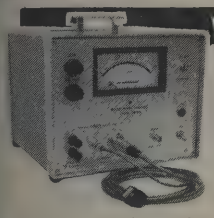

**SPECIAL APPLICATIONS** — Special transducers can be produced for hostile environments such as the oceanographic and biomedical applications. Custom configurations are also available. For information contact KULITE APPLICATIONS DEPARTMENT.

KULITE SEMICONDUCTOR PRODUCTS, INC. • 1039 Hoyt Avenue • Ridgefield, New Jersey 07657 • Tel: 201-945-3000 • Cable: Kultung • Telex: 135 458
EUROPEAN SUBSIDIARIES: UNITED KINGDOM • KULITE SENSORS LTD. • 11-12, Brighton Hill Parade, Sullivan Road, Basingstoke, Hants RG 22 4 EH, England • Tele: 0256-61646/7 • Telex: 858434 KULITE G
FRANCE • KULITE INTERNATIONAL S.A.R.L. • Siege Social et bureaux, 41, rue Parmentier 92600 • Asnieres, France • Tel: (1) 733-13-62 • Telex: 620 256F

# EQUIPMENT FOR ENERGY, POWER AND CURRENT MEASUREMENT

OSI

## WIDEBAND POWER MONITORS

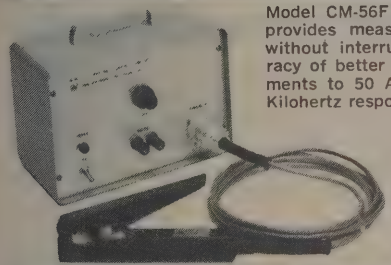


The PM Series Power Monitors are designed to provide measurements of current or power in systems operating from d.c. to 100 Kilohertz frequencies. These units feature response times of less than 1 microsecond so that detailed observation of fast switching waveforms can be observed with an accessory oscilloscope. Currents up to 1000 Amperes peak can be handled by standard models. Meter display of average power is provided. A 0 to ±1 volt output proportional to instantaneous power or instantaneous current is available for detailed observation of waveforms with risetimes of 1 microsecond or more. A bidirectional capability is standard for the instantaneous outputs.

## WIDEBAND d.c. to Megahertz CURRENT MEASURING EQUIPMENT

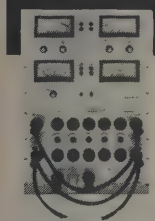
CM Series current measuring units provide an output signal proportional to instantaneous current flowing through the transducer window. The d.c. to Megahertz response and ability to faithfully reproduce 1 micro-second transients provide an ideal way to monitor critical circuits without electrical connection and with minimum interaction caused by measurement. The panel meter provides a display of direct current while the +1 to −1 volt output can be used for monitoring or control purposes with current flow in either direction.

## CLAMP-ON CURRENT TRANSDUCER



Model CM-56F Current Transducer provides measurement of current without interrupting circuit. Accuracy of better than 0.5% measurements to 50 Amperes and d.c. to Kilohertz response are featured. An electrical output providing an analog 0.1 Volt/Ampere signal is available for use in control systems, computer interfacing or recording.

## POWER TEST PANELS

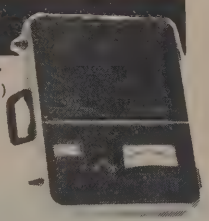


Current
Voltage
Power
VARS

Power Factor
(Phase Angle)
Frequency
Watt-hour
Amp-hour

**MODEL PTP-100**

**MODEL WM-2C5C**

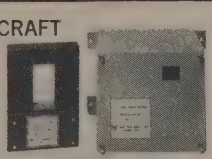


Power test panels are available for DC and AC (2, 3, or 4 wire) system loads. Voltage ranges from 50 to 500 volts and current ranges from 10 to 10,000 Amperes may be specified. Isolated electrical outputs are provided to drive recorders or remote indicators. Packaging methods include 19" rack panel, standard instrument housings and NEMA type enclosures. Available options: Digital meters, BCD outputs, true RMS outputs, set-point switched outputs and data storage for computer interfacing.

## MILITARY EQUIPMENT

SHIPBOARD • AVIONICS • SPACECRAFT
NUCLEAR POWER PLANTS

OSI has an established reputation for building rugged, highly reliable measurement systems to meet government and military specifications. Systems include current, power, amp-hour, watt-hour, etc.



**MODEL AH-10**

# NEW! ENERGY MONITORING INSTRUMENTS

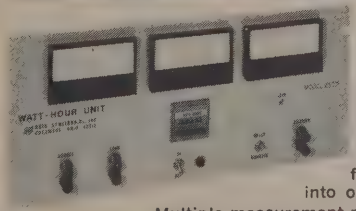
- LOW COST EM SERIES
- ½ PERCENT ACCURACY

The new, low-cost, EM series of instruments provides 0.5 percent accuracy and digital display of direct or alternating current, electrical power, totalized electrical energy or magnetic field. Basic ranges are as shown below.

| Model | Description and Ranges |
|---|---|
| EM-1 | Direct current, 0-100.0 Amps, optional 0-1000 Amps |
| EM-1A | Direct current or RMS, 0-100.0 Amps, optional 0-1000 Amps |
| EM-1F | Direct current, clamp-on, 0-10.00 and 0-100.0 Amps |
| EM-2 | AC Wattmeter, 0-2000 watts, 120/240 Volts, 0-10 Amps |
| EM-3 | AC Multipurpose, 0-150.0 volts, 0-10.00 Amps, 0-1500 watts |
| EM-4 | Gaussmeter, 0-1.000 and 0-10.00 Kilogauss |
| EM-5 | AC Watt-Hour, 0-1200 watts, 0-120 Volts, 0-10 Amps |

A detailed brochure provides information helpful in the selection of optimum units for particular testing or monitoring needs. Some wattmeters have arrangements so an instrument or piece of apparatus can be plugged into receptacle of instrument. The clamp-on feature of the EM-1F permits accurate current measurements without disconnecting power leads to apparatus.

## WATT-HOUR AND AMP-HOUR METERS



Registration of total energy consumption of motors, processes and equipment in a.c. or d.c. circuits is available on resettable counters. Other units provide a registration of charge flow, or Ampere-Hours, into or out of battery systems. Multiple measurement panels are available which provide display and electrical outputs related to instantaneous current, voltage and power in addition to energy registration.

PHONE 614/486-9561
1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212

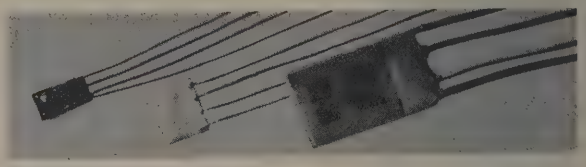
**OHIO SEMITRONICS, INC.** 1

SPECIALISTS IN MEASUREMENT MONITORING, AND CONTROL OF CURRENT, POWER AND ENERGY

# SEMICONDUCTOR MATERIALS, DEVICES HALL EFFECT-INFRARED-THERMOELECTRIC

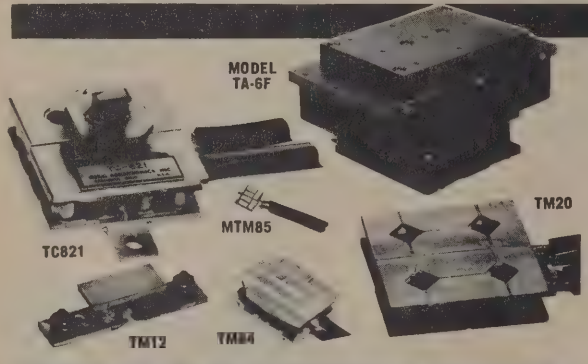
## HALLTRON, MAGNETIC FIELD SENSORS

OSI offers a wide variety of standard Hall Effect probes for magnetic sensing or measuring applications. The high linearity, low noise, excellent stability and ruggedness permit optimum use in your most critical applications. Reliability has been proved by years of continuous operation in industrial and military systems. Large quantity production enables OSI to offer high quality units at attractive prices.



| MODEL | DESCRIPTION | HALL OUTPUT, $V_H$, MILLIVOLTS ±25% (B = 10Kg, Ic = NOMINAL) | NOMINAL CONTROL CURRENT, Ic, mA | OHMIC RESIDUAL $V_{RO}$, MILLIVOLTS (B = 0 Ic = 10mA.) | (B = 0 Ic = 100mA.) | INPUT RESISTANCE $R_{IN}$, OHMS (NOMINAL) | OUTPUT RESISTANCE $R_{OUT}$, OHMS (NOMINAL) | DIMENSIONS L/W/T INCHES | TEMPERATURE COEFFICIENT OF $V_H$IN%/°C (AVG.) |
|---|---|---|---|---|---|---|---|---|---|
| HP316 | Miniature Axial | 100 | 100 | — | 0.5 | 2 | 1 | .125 dia. .250 | —0.2 |
| HP318 | Standard Axial | 250 | 100 | — | 0.5 | 5 | 4 | .250 dia. .5 | —0.2 |
| HP325 | Miniature Transverse | 200 | 25 | 0.5 | — | 15 | 10 | .187 .075 .015 | —0.25 |
| HR36 | High Linearity | 350 | 350 | — | 0.15 | 1.5 | 1.5 | .500 .375 .025 | —0.1 |
| HR66 | General Purpose | 500 | 200 | — | 0.5 | 5 | 4 | .250 .200 .028 | —0.15 |
| HR70 | General Purpose | 340 | 200 | — | 0.5 | 2 | 2 | .250 .200 .028 | —0.1 |
| HR72 | High Sensitivity | 700 | 100 | 0.2 | — | 9 | 6 | .250 .200 .028 | —0.25 |
| HR170 | Low Temperature coefficient | 10 | 100 | — | 0.03 | 1.2 | .6 | .250 .200 .025 | —.005 |

## THERMOELECTRIC DEVICES




O.S.I. offers a variety of thermoelectric cooling units ranging from the TC Series, used in spot cooling applications where up to 115 degree Centigrade temperature depression is needed, to the TA Series which can remove up to 85 watts from chemical bath, electronic package, or enclosure. The controllable, reversible heat pumping properties of thermoelectric devices make them ideally suited for temperature control. The MTM85 and TM84 are suited to IR detector cooling. Two and three stage coolers are also available for lower temperature IR detector cooling.

| MODEL | △T DEG. C. | HEAT PUMP WATTS AT △T = 0 | MAX. INPUT CURRENT AMPERES |
|---|---|---|---|
| TM-20 | 65 | 20 | 30 |
| TC-44 | 90 | 6 | 30 |
| TM-12 | 65 | 2.4 | 30 |
| TA-6F | 55 | 85 | 30 |
| TC-1851 | 115 | 3 | 25 |
| TC-821 | 115 | 1.3 | 25 |
| TM-318 | 60 | 20 | 8 |
| MTM-85 | 60 | 1.7 | 5 |
| TM-84 | 65 | 1 | 4.4 |
| MTM-124 | 60 | 3.5 | 4 |

## ENERGY CONVERSION— IR—DEVICE MATERIALS

Semiconductor compounds and alloys of the following types, covering a wide range of controlled electronic properties for applications such as INFRA-RED DETECTORS, MAGNETIC SENSORS, THERMOELECTRIC COOLING/POWER GENERATION, OPTICAL AND INFRA-RED COATINGS/FILTERS, AND CRYOGENIC SENSORS, are available from stock. High quality electronically characterized materials suitable for PHOTO-CONDUCTIVE and PHOTOVOLTAIC sensors are available.

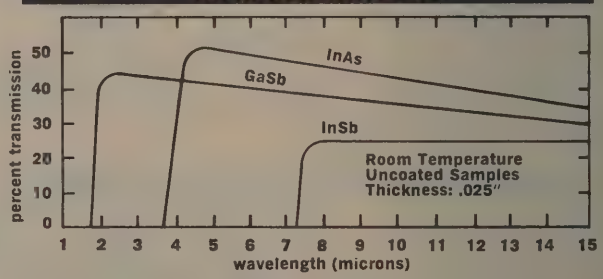
| Material | Carrier Concentration/$cm^3$ |
|---|---|
| InAs | $10^{15}$ - $10^{19}$ |
| InSb | $10^{13}$ - $10^{19}$ |
| GaSb | $10^{16}$ - $10^{18}$ |
| Bi-Te alloys | $10^{18}$ - $10^{19}$ |
| PbTe and PbTe alloys | As Desired |

These materials are available in ingot, rod, slice and polished wafer form. Oriented single crystals of InSb having dislocation densities well below 100/$cm^2$ are available for infra-red sensor construction. High figure of merit p and n type Bi-Te alloys are in stock for thermoelectric applications. InAs with Hall coefficients at R.T. in the range from 10 to 1000$cm^3$/coulomb is immediately available for many device applications.

Any feasible high purity alloy or compound consisting of Pb, Bi, Tl, Tn, As, Sn, Sb, Se or Te with selective doping can be manufactured and supplied on request.

High purity zone refined ingots of most of the above elements used in our electronically characterized compounds can be delivered on request.

## INFRARED WINDOWS




Polished IR windows of single crystal and polycrystalline InSb and polycrystalline InAs and GaSb are available in sizes up to 1" in square or circular shapes and any desired thickness. Applications include broad band transmission for IR detectors and sources at wave lengths above the cutoff value. Anti-reflective coatings are available, on quantity orders, to increase peak transmission to about 90% for InAs and 80% for InSb.

2 OHIO SEMITRONICS, INC. PHONE 614/486-9561 1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212

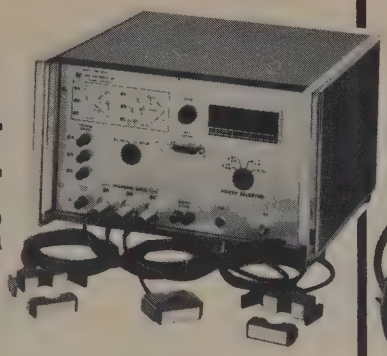
SPECIALISTS IN MEASUREMENT MONITORING, AND CONTROL OF CURRENT, POWER AND ENERGY

OSI

MODEL WM365A

# DIGITAL WATT-METER

D.C. TO 5 KHZ RESPONSE



**APPLICATIONS:**

- TRACTION MOTOR MONITORING
- DRIVE MOTOR MONITORING
- POWER CONVERTERS
- VARIABLE FREQUENCY MOTOR DRIVES
- POWER SYSTEMS WITH DC COMPONENTS
- POWER SYSTEMS WITH NONSYMMETRICAL WAVE SHAPES
- POWER SYSTEM PROTECTION
- POWER DATA FOR COMPUTER INPUT

**DESCRIPTION:**

The Model WM365A Digital Wattmeter measures power in single-phase or three-phase systems where the input power frequency may vary from d.c. to 400 Hertz. The d.c. to 5 kilohertz response insures accurate measurements when harmonics are present due to solid state switching, non symmetrical waveforms or d.c. components.

The digital panel meter displays total power or phase power. BCD and analog signals related to power are provided for computer and recorder interface. The BCD and analog outputs are electrically isolated from the power system.

The WM365A utilizes split-core transducers which can be installed in the system without disconnecting the high current leads.

**SPECIFICATIONS:**

| | |
|---|---|
| Input Voltage Range | 0 to 500 volts d.c. or rms line-to-line or line-to-neutral. |
| Input Current Range | 0 to 100 Amperes d.c. or rms per line through transducer. |
| Frequency Range | d.c. to 400 Hertz. |
| Full Scale Power | 150.0 Kilowatts for 3 phase. 50.0 Kilowatts per phase or in single phase. |
| Meter Indication | 3½ digit display with 0.1 Kilowatt resolution. |
| Electrical Output | 0 to 5 volts d.c. for 0 to 150KW in total power arrangement. 0 to 5 volts d.c. for 0 to 50KW in single phase arrangement. |
| BCD Output | A BCD coded output is available on the front panel. |
| Electrical Isolation | 1000 volts d.c. or rms between any line and output terminals. |
| Accuracy | ±1 per cent of full scale in temperature range of 15 to 35°C and with power factor of .5 lead to .5 lag. |
| Case Size | 17 x 10 x 14 inches. |
| Power Requirements For Electronics | 120 volt 60 Hertz. |

MODEL WM1000 MULTIRANGE

# AC WATT-METER

FOR 120 VAC, 60 HZ LOADS

**APPLICATIONS:**

- PROCESS POWER MONITORING
- PROCESS POWER MEASUREMENT
- TRANSIENT POWER DETERMINATION
- PROTOTYPE CHARACTERIZATION
- PRODUCTION AND QUALITY TESTING

**DESCRIPTION:**

OSI's Model WM1000 Multirange Wattmeter provides an accurate, convenient way to monitor 60 Hertz power supplied to various laboratory and industrial process apparatus. Acting as an in-line extension cord, the WM1000 measures average AC power drawn by the load. Results are indicated on a calibrated four range panel meter. The isolated output provides an electrical signal proportional to the instantaneous power and may be used for recording and display purposes.

Use to measure power consumption of equipment consuming less than 1000 watts of sinusoidal, zero-crossing or SCR controlled waveform power.

**SPECIFICATIONS:**

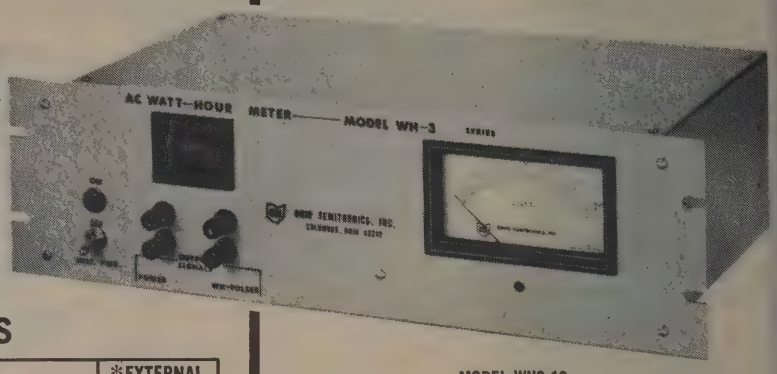
| | |
|---|---|
| Power Ranges | 50, 100, 500 and 1000 Watt |
| Voltage Input | 75 to 150 VAC, 60 Hz |
| Current Input | 0 to 10 amp |
| Max. Overload Current | 20A Without Damage |
| Power Factor Range | .5 lead to .5 lag |
| Ambient Temperature | 15° to 35°C (60° to 95°F) |
| Output Voltage | 1mV/Watt |
| Recorder Impedance | 1000 ohms or higher |
| Accuracy | ±2% F.S., meter reading ±1% F.S., electrical output |
| Size | 8" x 6" x 8" DWH |
| Weight | 5 pounds |

PHONE 614/486-9561
1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212

**OHIO SEMITRONICS, INC.** 3

SPECIALISTS IN MEASUREMENT MONITORING, AND CONTROL OF CURRENT, POWER AND ENERGY

# AC WATT-HOUR METER




MODEL WH3-19

**MEASURES AND DISPLAYS WATTS AND WATT-HOURS**

**WH3 SERIES**

## SINGLE PHASE 60 Hz MODELS

| MODEL NUMBER WH3- | INPUT VOLTS | INPUT CURRENT AMPERES | METER FULL SCALE WATTS | W-H PER COUNT | *EXTERNAL CURRENT SENSOR DIMENSIONS |
|---|---|---|---|---|---|
| 1 | 120 | 5 | 600 | 0.1 | — |
| 2 | 240 | 5 | 1.2K | 1 | — |
| 3 | 480 | 5 | 2.5K | 1 | — |
| 10 | 120 | 10 | 1.2K | 1 | — |
| 11 | 240 | 10 | 2.5K | 1 | — |
| 12 | 480 | 10 | 5.K | 1 | — |
| 19 | 120 | 15 | 2.K | 1 | — |
| 20 | 240 | 15 | 4K | 1 | — |
| 21 | 480 | 15 | 8K | 1 | — |
| 28 | 120 | 50 | 6K | 1 | — |
| 29 | 240 | 50 | 12K | 1 | — |
| 30 | 480 | 50 | 25K | 10 | — |
| 31 | 120 | 100 | 12K | 10 | C |
| 32 | 240 | 100 | 25K | 10 | C |
| 33 | 480 | 100 | 50K | 10 | C |
| 34 | 120 | 200 | 25K | 10 | D |
| 35 | 240 | 200 | 50K | 10 | D |
| 36 | 480 | 200 | 100K | 10 | D |
| 37 | 120 | 400 | 50K | 10 | D |
| 38 | 240 | 400 | 100K | 10 | D |
| 39 | 480 | 400 | 200K | 100 | D |
| 40 | 120 | 600 | 80K | 10 | E |
| 41 | 240 | 600 | 150K | 100 | E |
| 42 | 480 | 600 | 300K | 100 | E |
| 43 | 120 | 1000 | 120K | 100 | E |
| 44 | 240 | 1000 | 250K | 100 | E |
| 45 | 480 | 1000 | 500K | 100 | E |
| 46 | 120 | 2000 | 250K | 100 | E |
| 47 | 240 | 2000 | 500K | 100 | E |
| 48 | 480 | 2000 | 1M | 100 | E |
| 49 | 120 | 50 | 6K | 1 | — |
| 50 | 240 | 50 | 12K | 1 | — |
| 51 | 480 | 50 | 25K | 10 | — |
| 58 | 120 | 100 | 12K | 1 | W |
| 59 | 240 | 100 | 25K | 10 | W |
| 60 | 480 | 100 | 50K | 10 | W |
| 67 | 120 | 200 | 25K | 10 | W |
| 68 | 240 | 200 | 50K | 10 | W |
| 69 | 480 | 200 | 100K | 10 | W |
| 76 | 120 | 400 | 50K | 10 | X |
| 77 | 240 | 400 | 100K | 10 | X |
| 78 | 480 | 400 | 200K | 100 | X |
| 85 | 120 | 600 | 80K | 10 | X |
| 86 | 240 | 600 | 150K | 100 | X |
| 87 | 480 | 600 | 300K | 100 | X |
| 94 | 120 | 1000 | 120K | 100 | Y |
| 95 | 240 | 1000 | 250K | 100 | Y |
| 96 | 480 | 1000 | 500K | 100 | Y |

*100 AMPERES AND ABOVE, 1 EXTERNAL SENSOR IS SUPPLIED. See Page 11 for dimensions.

## APPLICATIONS:

- SCR Controlled Apparatus
- Precision Contour Grinders
- Machine Tool Equipment
- Furnace Loads—Arc Melting
- Torque Drive Systems
- Energy Conversion Systems

## DESCRIPTIONS:

The O.S.I. WH series AC Watt-Hour Meters provide a convenient and highly accurate way to characterize, monitor and control critical manufacturing processes where product quality and cost are related to electrical energy input.

These solid-state units utilize Hall-effect watt-transducers and are especially suitable for watt-hour totalization, power monitoring and observation of power waveforms in applications where SCR chopped, or other non-sinusoidal wave-forms are involved. The power wave shape applied to the load may be sinusoidal with wide power-factor variations, zero-crossing controlled sinusoidal, phase controlled SCR, or other wave-forms derived from a 60 Hertz input.

In addition to the display of totalized watt-hours since last reset, the units provide a panel meter indication of average power in watts.

These units should be invaluable in processes where monitoring can lead to increased yields of quality products. They should lead to elimination of much costly down-time through the early detection of process variations which, if not corrected, could lead to breakdown.

The higher current models obtain the current signal via an external current transducer or transformer (supplied with the instrument).

4 OHIO SEMITRONICS, INC. PHONE 614/486-9561 1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212

SPECIALISTS IN MEASUREMENT MONITORING, AND CONTROL OF CURRENT, POWER AND ENERGY

OSI

# AC WATT-HOUR METER

**MEASURES AND DISPLAYS WATTS AND WATT-HOURS**

**WH3 SERIES**

## SPECIFICATIONS

### INPUT

Overload (Continuous):
Voltage, 1.25 X Rating
Current, 2X Rating (5, 10, 15, 50A Models)
10X Rating (100 thru 2000A Models)

Burden (At Max Rated Input)
Voltage: 1.25VA
Current: 1.25VA

Power Factor Range: 0 Lead to 0 Lag

Frequency Range: 50 to 70Hz

Instrument Power: 115VAC 60Hz 5VA

Response: (Transient—90%) 100 microseconds with models using transducers.
1 millisecond with models using current transformers.

### OUTPUT

Response: 250 milliseconds

Temperature Effect: (+15°C to +35°C) ±0.5% F.S.
(−10°C to +60°C) ±1% F.S.

Wattmeter: 4½" panel meter

Watthour Counter: 6 Digit (Push Button Reset)

Electrical Output: 8V at Calibration Point

Pulse Output: 4V for External Electronic Counter

Accuracy: (Linearity, setpoint, P.F.)
Meter: ±1.5% FS (WH3-1 to WH3-42)
±2.0% FS (WH3-43 to WH3-102)
W-H Counter: ±0.5% FS (WH3-1 to WH3-42)
±1.0% FS (WH3-43 to WH3-102)

Electrical Output: (Watts and W-H)
±0.5% FS (WH3-1 to WH3-42)
±1.0% FS (WH3-43 to WH3-102)

Zero Drift: ±0.1% FS of rated W-H per hour

Instrument Size: 19"x5¼"x11" WHD

## 3 PHASE 3 WIRE 60 Hz MODELS

| MODEL NUMBER WH3- | INPUT VOLTS | INPUT CURRENT AMPERES | METER FULL SCALE WATTS | W-H PER COUNT | *CURRENT SENSOR DIMENSIONS |
|---|---|---|---|---|---|
| 4 | 120 | 5 | 1.2K | 1 | — |
| 5 | 240 | 5 | 2.5K | 1 | — |
| 6 | 480 | 5 | 5K | 1 | — |
| 13 | 120 | 10 | 2.5K | 1 | — |
| 14 | 240 | 10 | 5K | 1 | — |
| 15 | 480 | 10 | 10K | 1 | — |
| 22 | 120 | 15 | 4K | 1 | — |
| 23 | 240 | 15 | 8K | 1 | — |
| 24 | 480 | 15 | 15K | 10 | — |
| 31-2 | 120 | 100 | 20K | 10 | C |
| 32-2 | 240 | 100 | 40K | 10 | C |
| 33-2 | 480 | 100 | 80K | 10 | C |
| 52 | 120 | 50 | 12K | 1 | — |
| 53 | 240 | 50 | 25K | 10 | — |
| 54 | 480 | 50 | 50K | 10 | — |
| 61 | 120 | 100 | 25K | 10 | W |
| 62 | 240 | 100 | 50K | 10 | W |
| 63 | 480 | 100 | 100K | 10 | W |
| 70 | 120 | 200 | 50K | 10 | W |
| 71 | 240 | 200 | 100K | 10 | W |
| 72 | 480 | 200 | 200K | 100 | W |
| 79 | 120 | 400 | 100K | 10 | X |
| 80 | 240 | 400 | 200K | 100 | X |
| 81 | 480 | 400 | 400K | 100 | X |
| 88 | 120 | 600 | 150K | 100 | X |
| 89 | 240 | 600 | 300K | 100 | X |
| 90 | 480 | 600 | 600K | 100 | X |
| 97 | 120 | 1000 | 250K | 100 | Y |
| 98 | 240 | 1000 | 500K | 100 | Y |
| 99 | 480 | 1000 | 1M | 100 | Y |

*100 AMPERES AND ABOVE, 2 EXTERNAL SENSORS ARE SUPPLIED
See Page 11 for dimensions.

## 3 PHASE 4 WIRE 60 Hz MODELS

| MODEL NUMBER WH3- | INPUT VOLTS | INPUT CURRENT AMPERES | METER FULL SCALE WATTS | W-H PER COUNT | *CURRENT SENSOR DIMENSIONS |
|---|---|---|---|---|---|
| 7 | 120 | 5 | 2K | 1 | — |
| 8 | 240 | 5 | 4K | 1 | — |
| 9 | 480 | 5 | 8K | 1 | — |
| 16 | 120 | 10 | 4K | 1 | — |
| 17 | 240 | 10 | 8K | 1 | — |
| 18 | 480 | 10 | 15K | 10 | — |
| 25 | 120 | 15 | 6K | 1 | — |
| 26 | 240 | 15 | 12K | 1 | — |
| 27 | 480 | 15 | 25K | 10 | — |
| 55 | 120 | 50 | 20K | 10 | — |
| 56 | 240 | 50 | 40K | 10 | — |
| 57 | 480 | 50 | 80K | 10 | — |
| 64 | 120 | 100 | 40K | 10 | W |
| 65 | 240 | 100 | 80K | 10 | W |
| 66 | 480 | 100 | 150K | 100 | W |
| 73 | 120 | 200 | 80K | 10 | W |
| 74 | 240 | 200 | 150K | 100 | W |
| 75 | 480 | 200 | 300K | 100 | W |
| 82 | 120 | 400 | 150K | 100 | X |
| 83 | 240 | 400 | 300K | 100 | X |
| 84 | 480 | 400 | 600K | 100 | X |
| 91 | 120 | 600 | 250K | 100 | X |
| 92 | 240 | 600 | 500K | 100 | X |
| 93 | 480 | 600 | 1M | 100 | X |
| 100 | 120 | 1000 | 360K | 100 | Y |
| 101 | 240 | 1000 | 800K | 100 | Y |
| 102 | 480 | 1000 | 1.5M | 1000 | Y |

*100 AMPERES AND ABOVE, 3 EXTERNAL SENSORS ARE SUPPLIED
See Page 11 for dimensions.

PHONE 614/486-9561
1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212

**OHIO SEMITRONICS, INC.** 5

SPECIALISTS IN MEASUREMENT MONITORING, AND CONTROL OF CURRENT, POWER AND ENERGY

# DC WATT-HOUR METER

**MEASURES AND DISPLAYS WATTS AND WATT-HOURS**

**WH7 SERIES**

MODEL WH7-1

## DESCRIPTION:

The O.S.I. WH series DC Watt-Hour Meters provide a convenient and highly accurate way to characterize, monitor and control critical manufacturing processes where product quality and cost are related to electrical energy input.

These solid state units utilize Hall-effect watt transducers and respond accurately to both A.C. and D.C. components in electrical energy. They are especially suited to complex wave shapes found in SCR power supplies as well as D.C. found in generators, batteries, converters, and solar cell arrays.

The 5, 10, 15, and 50 Amp models are connected to circuits being monitored via a screw type terminal block on the rear of the instrument. The higher current models obtain the current signal via an external current transducer (supplied with the instrument).

## STANDARD DC MODELS

| MODEL NUMBER WH7- | INPUT VOLTS | INPUT CURRENT AMPERES | METER FULL SCALE WATTS | W-H PER COUNT | *EXTERNAL TRANSDUCER DIMENSIONS |
|---|---|---|---|---|---|
| 1 | 120 | 5 | 600 | 0.1 | — |
| 2 | 240 | 5 | 1.2K | 1 | — |
| 3 | 480 | 5 | 2.5K | 1 | — |
| 10 | 120 | 10 | 1.2K | 1 | — |
| 11 | 240 | 10 | 2.5K | 1 | — |
| 12 | 480 | 10 | 5.0K | 1 | — |
| 19 | 120 | 15 | 2.0K | 1 | — |
| 20 | 240 | 15 | 4K | 1 | — |
| 21 | 480 | 15 | 8K | 1 | — |
| 28 | 120 | 50 | 6K | 1 | — |
| 29 | 240 | 50 | 12K | 1 | — |
| 30 | 480 | 50 | 25K | 1 | — |
| 31 | 120 | 100 | 12K | 1 | C |
| 32 | 240 | 100 | 25K | 10 | C |
| 33 | 480 | 100 | 50K | 10 | C |
| 34 | 120 | 200 | 25K | 10 | D |
| 35 | 240 | 200 | 50K | 10 | D |
| 36 | 480 | 200 | 100K | 10 | D |
| 37 | 120 | 400 | 50K | 10 | D |
| 38 | 240 | 400 | 100K | 10 | D |
| 39 | 480 | 400 | 200K | 100 | D |
| 40 | 120 | 600 | 80K | 10 | E |
| 41 | 240 | 600 | 150K | 100 | E |
| 42 | 480 | 600 | 300K | 100 | E |
| 43 | 120 | 1000 | 120K | 100 | E |
| 44 | 240 | 1000 | 250K | 100 | E |
| 45 | 480 | 1000 | 500K | 100 | E |
| 46 | 120 | 2000 | 250K | 100 | E |
| 47 | 240 | 2000 | 500K | 100 | E |
| 48 | 480 | 2000 | 1M | 100 | E |

*100 AMPERES AND ABOVE, 1 EXTERNAL TRANSDUCER IS SUPPLIED
See Page 11 for external transducer dimensions.

## SPECIFICATIONS:

### INPUT

Overload (Continuous):
- Voltage, 1.25 X Rating
- Current, 2 X Rating (5, 10, 15, and 50A Models)
  10 X Rating (100 thru 2000A Models)

Burden (At Max. Rated Input)
- Voltage: .25VA
- Current: .25VA (5 thru 50A),
  O VA (100 thru 2000A)

Frequency Range: DC to 100Hz

Extended Frequency Range: DC to 400Hz†

Instrument Power: 115VAC, 60Hz, 5VA

Response: (Transient) 50 microsecond

### OUTPUT

Response: 250 milliseconds

Temperature Effect (0 to 40° C):
±0.1% FS ±1% Reading

Wattmeter: 4½" panel meter
Watt-hour Counter: 6 Digit (Push Button Reset)
Analog Wattmeter Output: 8V at calibration point.

NOTE: Output not isolated from input voltage
See Option Below††

Watt-hour Pulse Output: 4V (peak) for External Electronic Counter Operation.

Accuracy: (Linearity, setpoint)
- Meter: ±1.5% FS
- Watt-hour Counter: ±0.5% FS
- Electrical Output: (Watts and W-H) ±0.5% FS

†Extended Frequency Range: Add 1% to above accuracy figures

Zero Drift: (Max.) ±0.1% FS of rated watt-hour per hour

Instrument Size: 19"x5¼"x11" WHD

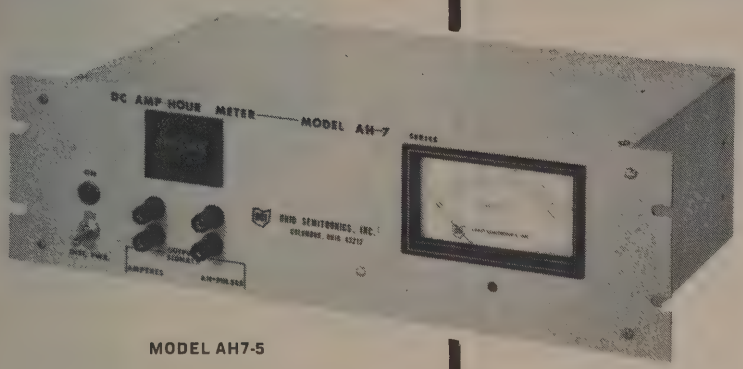
Instrument Panel Color: Gray

††OPTION: Isolated output for watts and watt-hours add "U" after the model number. For example: Requirement is for a 120 volt, 100 amp input with an isolated output. Model to be ordered is WH7-31U.

6 OHIO SEMITRONICS, INC. PHONE 614/486-9561
1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212

SPECIALISTS IN MEASUREMENT MONITORING, AND CONTROL OF CURRENT, POWER AND ENERGY

OSI




MODEL AH7-5

# DC AMPERE-HOUR METER

**MEASURES AND DISPLAYS AMPERES AND AMPERE-HOURS**

**AH7 SERIES**

## SPECIFICATIONS:

### INPUT

Overload (Continuous)
2 X Rating (5-50 Ampere)
10 X Rating (100A-10KA)

DC Insertion Loss
<.01V × I (5-50 Amp)
Zero (100A-10KA)

Isolation: 1.5KV (5-50 Amperes)
5KV (100A-10KA)

Instrument Power: 115VAC, ±15%, 50/60Hz

Response: (Transient) 50 microsecond

### OUTPUT

Response Time: 250 milliseconds

Temperature Effect (0 to 40°C):
±0.1% F.S. ±1% of reading

Ammeter: 4½" panel meter

Ampere Hour Counter: 6 digit push button reset

Electrical Output: 8V d.c. FS (Amps)
4V Pulse (Amp-hour)

Accuracy & Linearity
±0.5%FS (5A-2KA)
±1.0%FS (5KA-10KA)
Meter 1.5%FS
Electrical Output
±0.5%FS (5A-2KA)
±1.0%FS (5KA-10KA)

Zero Drift (max.): ±0.1%FS of rated Ampere Hour per Hour

Instrument Case Size: 19" x 5¼" x 11" WHD

External Transducer: See Table at right

Instrument Panel Color: Gray

## DESCRIPTION:

The O.S.I. AH series Ampere-Hour Meters provide a convenient and highly accurate way to monitor and control manufacturing and experimental processes. The unique zero dc insertion loss and split-core features on the 100 ampere to 10,000 ampere models increase the applicational possibilities.

The solid-state units utilize Hall-effect transducers and are especially suited for current monitoring of various current wave shapes which may be found riding on dc signals.

In addition to the display of totalized amp-hours since last reset, the unit provides a panel meter indication of the average instantaneous current in amperes and an isolated electrical output signal proportional to instantaneous current. The bipolar models indicate charge and discharge on normal and reverse ampere hours on separate 6 digit counters.

## STANDARD DC MODELS

| MODEL NUMBER AH7- | INPUT CURRENT AMPERES | METER FULL SCALE CURRENT | A-H PER COUNT | *EXTERNAL TRANSDUCER DIMENSIONS |
|---|---|---|---|---|
| 5 | 5 | 5 | .001 | — |
| 10 | 10 | 10 | .001 | — |
| 25 | 25 | 25 | .01 | |
| 50 | 50 | 50 | .01 | — |
| 100 | 100 | 100 | .01 | C |
| 200 | 200 | 200 | .1 | D |
| 400 | 400 | 400 | .1 | D |
| 600 | 600 | 600 | .1 | E |
| 1K | 1K | 1K | .1 | E |
| 2K | 2K | 2K | 1 | E |
| 5K | 5K | 5K | 1 | G |
| 10K | 10K | 10K | 1 | H |

* 100 AMPERES AND ABOVE, 1 EXTERNAL TRANSDUCER IS SUPPLIED.
See Page 11 for external transducer dimensions.

NOTE 1: Models listed above are unipolar. For bi-polar units add a dash 2 after the model number.

NOTE 2: For split core option add S after model number. For example, a 100 ampere unit with split core would be listed as AH7-100S.

PHONE 614/486-9561
1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212
OHIO SEMITRONICS, INC. 7

SPECIALISTS IN MEASUREMENT MONITORING, AND CONTROL OF CURRENT, POWER AND ENERGY

PC 5 SERIES

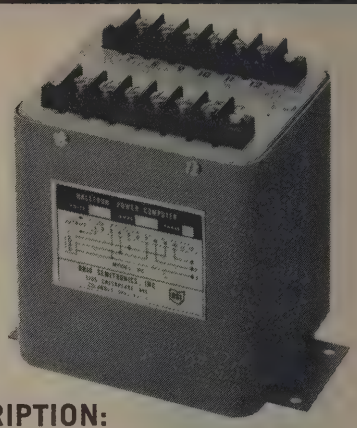
# AC WATT TRANSDUCER

## SINGLE PHASE 60 Hz MODELS

| MODEL NUMBER PC5- | FULL SCALE INPUTS | | | OUTPUT CALIB. 50MVDC | *CURRENT SENSOR DIMENSIONS |
|---|---|---|---|---|---|
| | VOLTS | AMPS | WATTS | | |
| 1 | 120 | 5 | 600 | 500W | — |
| 2 | 240 | 5 | 1.2K | 1KW | — |
| 3 | 480 | 5 | 2.4K | 2KW | — |
| 10 | 120 | 10 | 1.2K | 1KW | — |
| 11 | 240 | 10 | 2.4K | 2KW | — |
| 12 | 480 | 10 | 4.8K | 4KW | — |
| 19 | 120 | 15 | 1.8K | 1.5KW | — |
| 20 | 240 | 15 | 3.6K | 3KW | — |
| 21 | 480 | 15 | 7.2K | 6KW | — |
| 28 | 120 | 50 | 6K | 5KW | †C |
| 29 | 240 | 50 | 12K | 10KW | †C |
| 30 | 480 | 50 | 24K | 20KW | †C |
| 31 | 120 | 100 | 12K | 10KW | C |
| 32 | 240 | 100 | 24K | 20KW | C |
| 33 | 480 | 100 | 48K | 40KW | C |
| 34 | 120 | 200 | 24K | 20KW | D |
| 35 | 240 | 200 | 48K | 40KW | D |
| 36 | 480 | 200 | 96K | 80KW | D |
| 37 | 120 | 400 | 48K | 40KW | D |
| 38 | 240 | 400 | 96K | 80KW | D |
| 39 | 480 | 400 | 192K | 160KW | D |
| 40 | 120 | 600 | 72K | 60KW | E |
| 41 | 240 | 600 | 144K | 120KW | E |
| 42 | 480 | 600 | 288K | 240KW | E |
| 43 | 120 | 1000 | 120K | 100KW | E |
| 44 | 240 | 1000 | 240K | 200KW | E |
| 45 | 480 | 1000 | 480K | 400KW | E |
| 46 | 120 | 2000 | 240K | 200KW | E |
| 47 | 240 | 2000 | 480K | 400KW | E |
| 48 | 480 | 2000 | 960K | 800KW | E |
| 49 | 120 | 50 | 6K | 5KW | †W |
| 50 | 240 | 50 | 12K | 10KW | †W |
| 51 | 480 | 50 | 24K | 20KW | †W |
| 58 | 120 | 100 | 12K | 10KW | W |
| 59 | 240 | 100 | 24K | 20KW | W |
| 60 | 480 | 100 | 48K | 40K | W |
| 67 | 120 | 200 | 24K | 20KW | W |
| 68 | 240 | 200 | 48K | 40KW | W |
| 69 | 480 | 200 | 96K | 80KW | W |
| 76 | 120 | 400 | 48K | 40KW | X |
| 77 | 240 | 400 | 96K | 80KW | X |
| 78 | 480 | 400 | 192K | 160KW | X |
| 85 | 120 | 600 | 72K | 60KW | X |
| 86 | 240 | 600 | 144K | 120KW | X |
| 87 | 480 | 600 | 288K | 240KW | X |
| 94 | 120 | 1000 | 120K | 100KW | Y |
| 95 | 240 | 1000 | 240K | 200KW | Y |
| 96 | 480 | 1000 | 480K | 400KW | Y |
| 103 | 120 | 1 | 120 | 100W | — |
| 104 | 240 | 1 | 240 | 200W | — |
| 105 | 480 | 1 | 480 | 500W | — |
| 106 | 120 | 2.5 | 300 | 300W | — |
| 107 | 240 | 2.5 | 600 | 600W | — |
| 108 | 480 | 2.5 | 1200 | 1200W | — |

CASE SIZE DRAWING H, See Page 11

*50 AMPS and ABOVE, 1 EXTERNAL SENSOR IS SUPPLIED, See Page 11.
Standard units have millivolt outputs as indicated. Units having 0 to + 1 milliampere or 0 to + 10 volts are available as options and are ordered by adding the option letter as a suffix to the standard model number. For example PC5-1A has an output of 0 to + 1 milliampere for 500 watt input.



MODEL PC5-4

## DESCRIPTION:

OSI Watt Transducers utilize Hall Effect multipliers in order to provide an output which is proportional to the electrical power consumed in single phase or three phase loads or equipment. The multipliers provide instantaneous multiplication of the voltage times the current on a continuous basis.

The Watt Transducers are especially useful in monitoring, control, protection and regulation circuits. Their fast response results in accurate power measurement even when distorted or chopped waveforms are present.

Various output filtering and signal conditioning features are provided in watt transducer models to permit easy interface with circuits where amplified voltage output or current output is desirable. In all units the output signal is electrically isolated from the power lines to provide maximum flexibility in interfacing with other electrical or electronic circuits.

The unique, four-quadrant, high-accuracy multiplying properties of Hall Effect devices coupled with their demonstrated reliability provides a low-cost approach to power measurement where linearity, repeatability, and long life are important considerations.

## ADJUSTMENTS:

All PC5 series watt transducers have been calibrated at the factory to give the correct output at the specified power rating.

Each unit has an overall "CAL" and an optional "ZERO" adjustment located on the lid. The "CAL" adjustment is set at the factory and should not be adjusted unless recalibration is required. The optional "ZERO" adjustment is provided to correct for an output offset, "at no load condition", without effecting the calibration of the unit.

## OUTPUT OPTIONS:

**A:** 0 to + 1 milliampere DC output. No external amplifier power required. Output load 0 to 10K ohms.

**B:** 0 to +1 milliampere DC output. External amplifier power required. 85—135 VAC at 2 watts. Output load 0 to 10K ohms.

**C:** 0 to + 10 volt DC output. No external amplifier power required. Output load greater than 2K ohms.

**D:** 0 to + 10 volt DC output. External amplifier power required. 85—135 VAC at 2 watt. Output load greater than 2K ohms.

**E:** 4 to 20 milliampere DC output. External amplifier power required. 85—135 VAC at 2 watt. Output load less than 1500 ohms.

**F:** Filtered output. Ripple reduced to <1%. Load on output should be >1 megohm.

**NOTE 1:** For chopped waveforms select only models that use current transducers C, D or E, in Sensor Dimension column.

**NOTE 2:** † Indicates 2 turns thru the external transducer or transformer window.

8 OHIO SEMITRONICS, INC. PHONE 614/486-9561 1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212

# AC WATT TRANSDUCER

## PC 5 SERIES

SPECIALISTS IN MEASUREMENT MONITORING, AND CONTROL OF CURRENT, POWER AND ENERGY

OSI

## SPECIFICATIONS:

### INPUT:

VOLTAGE: 0 to 110% FS

CURRENT: 0 to FS

OVERLOAD (Continuous):
- —Voltage 1.25 X Rating
- —Current:
  - —2 X Rating: 1 Ampere thru 15 Ampere Models and All Current Transformers Model W, X, Y
  - —50 X Rating: Current Transducer Models C, D & E

BURDEN (Full scale input):
- —Voltage 1.25 VA
- —Current 1.25 VA
- —Option Amplifier 2 Watts

POWER FACTOR RANGE: Unity to lead, lag 0.

FREQUENCY RANGE: 50 to 70 Hz

DIELECTRIC TEST:
(Input/Output/Case): 1500 VAC

RESPONSE: (Transient—90%)
100 microseconds with models using transducers.
1 millisecond with models using current transformers.

### OUTPUT:

OUTPUT LOADING:
- —Base Unit: > 100K ohms
- —Options A & B: 0-10K ohms
- —Options C & D: > 2K ohms
- —Option F > 1 meg ohms

ADJUSTMENT RANGE: (See Adj. Note Page 8)
- —Base Unit: 0 to 110%
- —With Options: ±10% Min.

RESPONSE TIME:
- —Base Unit: 1 millisecond

With Options: 250 milliseconds

TEMPERATURE EFFECT: (−10° to +60° C)
± 1% of Reading
With Options: ± 1% of Reading
± 0.1% FS

AC COMPONENT AT UNITY P.F.:
- —Base Unit: DC with an AC Component of 200% p to p
- —With Option: DC with an AC Component of < 1% FS

### ACCURACY:

Including power factor, linearity, repeatability and initial set point:
- ±0.5% F.S.: PC5-1 thru PC5-48, PC5-31-2 thru PC5-33-2, PC5-103 thru PC5-108
- ±0.75% F.S.: PC5-49 thru PC5-102

## 3 PHASE 3 WIRE 60 Hz MODELS

| MODEL NUMBER PC5- | FULL SCALE INPUTS | | | OUTPUT CALIB. 100MVDC | *CURRENT SENSOR DIMENSIONS | NUMBER OF SENSORS SUPPLIED |
|---|---|---|---|---|---|---|
| | VOLTS | AMPS | WATTS | | | |
| 4 | 120 | 5 | 1.04K | 1KW | — | — |
| 5 | 240 | 5 | 2.08K | 2KW | — | — |
| 6 | 480 | 5 | 4.16K | 4KW | — | — |
| 13 | 120 | 10 | 2.08K | 2KW | — | — |
| 14 | 240 | 10 | 4.16K | 4KW | — | — |
| 15 | 480 | 10 | 8.31K | 8KW | — | — |
| 22 | 120 | 15 | 3.12K | 3KW | — | — |
| 23 | 240 | 15 | 6.24K | 6KW | — | — |
| 24 | 480 | 15 | 12.5K | 12KW | — | — |
| 31-2 | 120 | 100 | 20.8 | 20KW | C | 2 |
| 32-2 | 240 | 100 | 41.6 | 40KW | C | 2 |
| 33-2 | 480 | 100 | 83.1 | 80KW | C | 2 |
| 52 | 120 | 50 | 10.4K | 10KW | W | †2 |
| 53 | 240 | 50 | 20.8K | 20KW | W | †2 |
| 54 | 480 | 50 | 41.6K | 40KW | W | †2 |
| 61 | 120 | 100 | 20.8K | 20KW | W | 2 |
| 62 | 240 | 100 | 41.6K | 40KW | W | 2 |
| 63 | 480 | 100 | 83.1K | 80KW | W | 2 |
| 70 | 120 | 200 | 41.6K | 40KW | W | 2 |
| 71 | 240 | 200 | 83.1K | 80KW | W | 2 |
| 72 | 480 | 200 | 166K | 160KW | W | 2 |
| 79 | 120 | 400 | 83.1K | 80KW | X | 2 |
| 80 | 240 | 400 | 166K | 160KW | X | 2 |
| 81 | 480 | 400 | 332K | 320KW | X | 2 |
| 88 | 120 | 600 | 125K | 120KW | X | 2 |
| 89 | 240 | 600 | 249K | 240KW | X | 2 |
| 90 | 480 | 600 | 499K | 480KW | X | 2 |
| 97 | 120 | 1000 | 208K | 200KW | Y | 2 |
| 98 | 240 | 1000 | 416K | 400KW | Y | 2 |
| 99 | 480 | 1000 | 831K | 800KW | Y | 2 |

CASE SIZE DRAWING H OR DRAWING K WITH OPTION E, Page 11

## 3 PHASE 4 WIRE 60 Hz MODELS

| MODEL NUMBER PC5- | FULL SCALE INPUTS | | | OUTPUT CALIB. 150MVDC | *CURRENT SENSOR DIMENSIONS | NUMBER OF SENSORS SUPPLIED |
|---|---|---|---|---|---|---|
| | VOLTS | AMPS | WATTS | | | |
| 7 | 120 | 5 | 1.80K | 1.5KW | — | — |
| 8 | 240 | 5 | 3.60K | 3KW | — | — |
| 9 | 480 | 5 | 7.2K | 6KW | — | — |
| 16 | 120 | 10 | 3.6K | 3KW | — | — |
| 17 | 240 | 10 | 7.2K | 6KW | — | — |
| 18 | 480 | 10 | 14.4K | 12KW | — | — |
| 25 | 120 | 15 | 5.4K | 4.5KW | — | — |
| 26 | 240 | 15 | 10.8K | 9KW | — | — |
| 27 | 480 | 15 | 21.6K | 18KW | — | — |
| 55 | 120 | 50 | 18K | 15KW | W | †3 |
| 56 | 240 | 50 | 36K | 30KW | W | †3 |
| 57 | 480 | 50 | 72K | 60KW | W | †3 |
| 64 | 120 | 100 | 36K | 30KW | W | 3 |
| 65 | 240 | 100 | 72K | 60KW | W | 3 |
| 66 | 480 | 100 | 144K | 120KW | W | 3 |
| 73 | 120 | 200 | 72K | 60KW | W | 3 |
| 74 | 240 | 200 | 144K | 120KW | W | 3 |
| 75 | 480 | 200 | 288K | 240KW | W | 3 |
| 82 | 120 | 400 | 144K | 120KW | X | 3 |
| 83 | 240 | 400 | 288K | 240KW | X | 3 |
| 84 | 480 | 400 | 576K | 480KW | X | 3 |
| 91 | 120 | 600 | 216K | 180KW | X | 3 |
| 92 | 240 | 600 | 432K | 360KW | X | 3 |
| 93 | 480 | 600 | 864K | 720KW | X | 3 |
| 100 | 120 | 1000 | 360K | 300KW | Y | 3 |
| 101 | 240 | 1000 | 720K | 600KW | Y | 3 |
| 102 | 480 | 1000 | 1.44M | 1.2MW | Y | 3 |

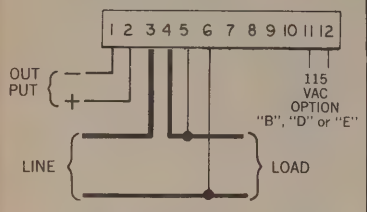
CASE SIZE DRAWING H (BASE UNIT AND OPTION F), Page 11
CASE SIZE DRAWING K (WITH OPTION A, B, C, D, OR E), Page 11
*See Page 11 for all external sensor dimensions.

PHONE 614/486-9561
1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212

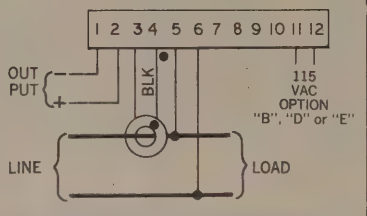
**OHIO SEMITRONICS, INC.** 9

# AC WATT TRANSDUCER CONNECTIONS

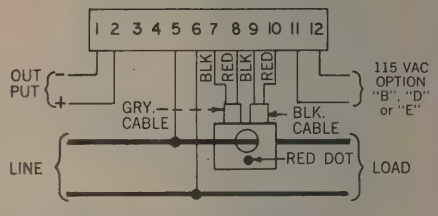
## CONNECTIONS FOR 1 PHASE - 2 WIRE (PC5 SERIES)



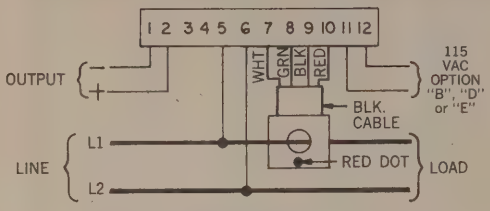

DIRECT CONNECTIONS



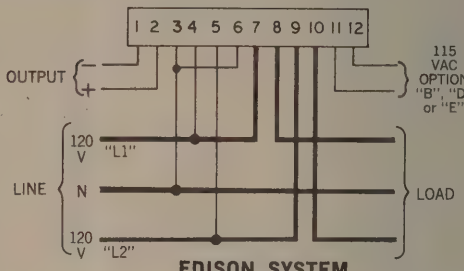

USING CURRENT TRANSFORMERS
(HIGH CURRENT)




USING CURRENT TRANSDUCERS
(HIGH CURRENT)



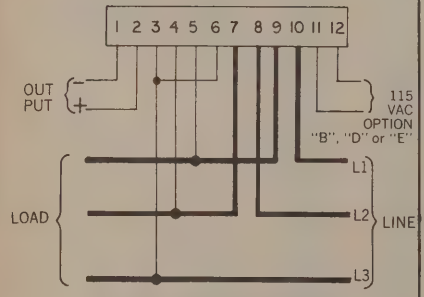

USING CURRENT TRANSDUCER
(SPLIT CORE)



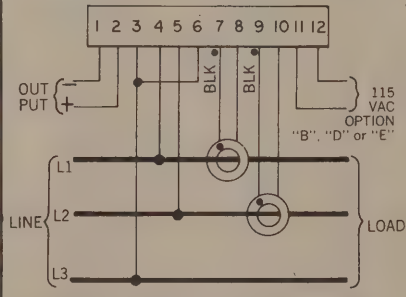

EDISON SYSTEM
(120/240/3 WIRE)

For currents above 15 amperes use 3$\phi$ 3W Current Transformer connection diagram with L3, shown in drawing, used as neutral.

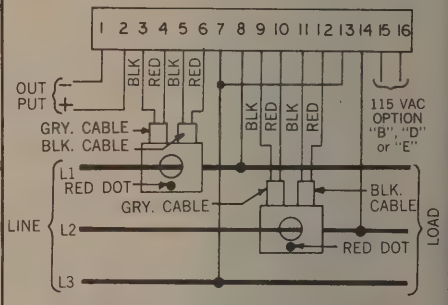
## CONNECTIONS FOR 3 PHASE - 3 WIRE (PC5 SERIES)




DIRECT CONNECTIONS

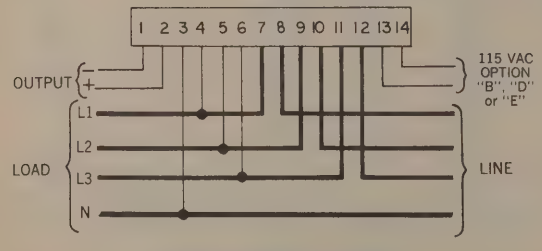



USING CURRENT TRANSFORMERS
(HIGH CURRENT)

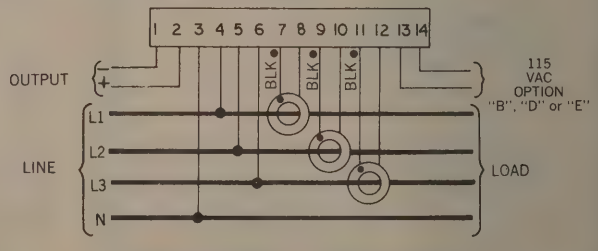



USING CURRENT TRANSDUCERS
(HIGH CURRENT)

## CONNECTIONS FOR 3 PHASE - 4 WIRE (PC5 SERIES)




DIRECT CONNECTIONS



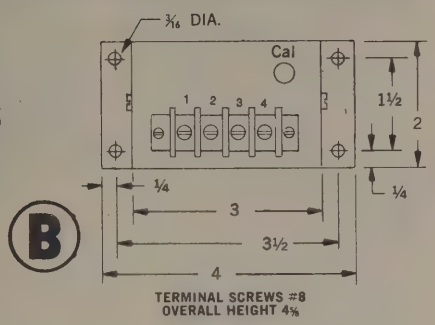

USING CURRENT TRANSFORMERS
(HIGH CURRENT)

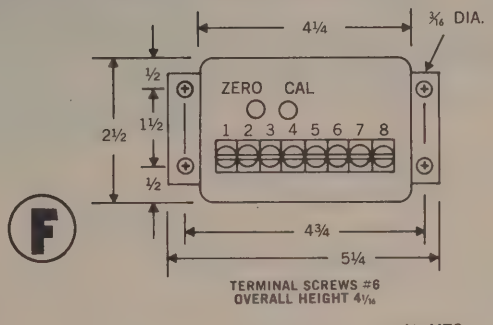
10 OHIO SEMITRONICS, INC.
PHONE 614/486-9561
1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212

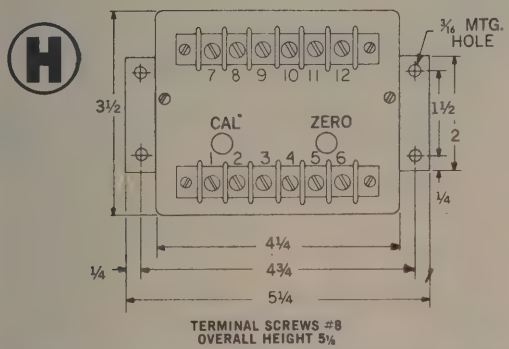
# TRANSDUCER, SENSOR AND TRANSFORMER DIMENSIONS

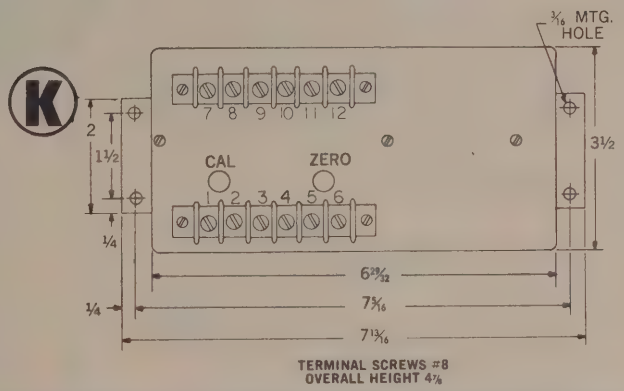
OSI

## CASE-SIZE DRAWINGS

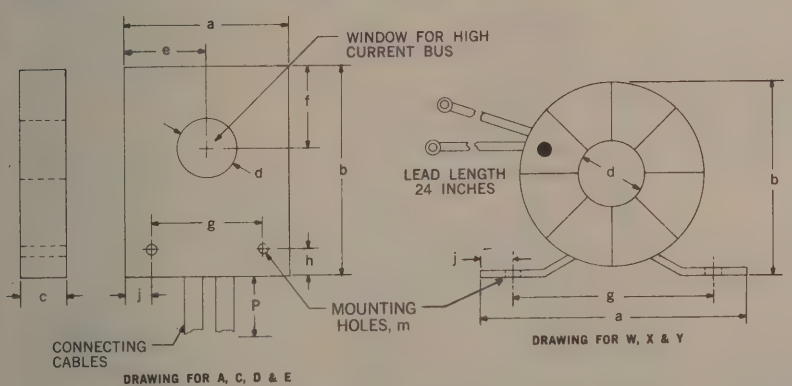


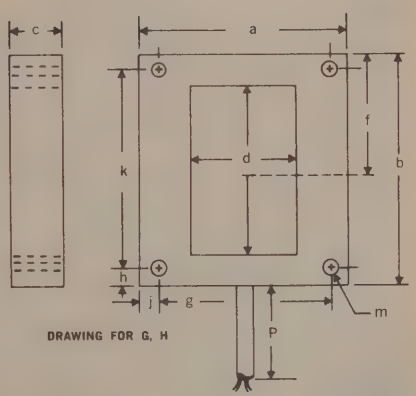




## SENSOR OUTLINES AND DIMENSIONS




| SENSOR DRAWING | OUTLINE DIMENSIONS (INCHES) | | | | | | | | | | | | WEIGHT IN LBS. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | a | b | c | d | e | f | g | h | j | k | m | *P | |
| A | 1½ | 1⅛ | ½ | ⅜ | 5/16 | 9/16 | ½ | 3/16 | 5/16 | | ⅛ | 15 | 1/16 |
| C | 2 | 2 | ¾ | ¾ | 1 | ⅞ | 1½ | ¼ | ¼ | | 5/32 | 15 | ¼ |
| D | 3⅛ | 4 | ¾ | 1⅛ | 1 5/16 | 1½ | 2⅛ | ½ | ½ | | 11/64 | 15 | ¾ |
| E | 4⅛ | 5 | 1¼ | 2 | 2 1/16 | 2 | 3¼ | 7/16 | 7/16 | | 17/64 | 15 | 2 |
| G | 7¾ | 12 | 1¾ | 3 x 6½ | 3⅞ | 6 | 6½ | ⅝ | ⅝ | 10¾ | 5/16 | 96 | 12¼ |
| H | 10 | 13¾ | 1¾ | 5½ x 8 | 5 | 6½ | 8¾ | 1½ | ⅝ | 11½ | 5/16 | 96 | 13 |
| W | 5⅛ | 3⅞ | 1⅝ | 1¼ | 1 13/16 | 1 15/16 | 3⅞ | | ⅝ | | 9/32 | 25 | 2 |
| X | 7⅛ | 5⅛ | 1½ | 2¼ | 2 1/16 | 2 1/16 | 5⅛ | | 1 | | 9/32 | 25 | 3 |
| Y | 7⅛ | 5¼ | 1½ | 2¾ | 2⅝ | 2⅝ | 5⅛ | | 1 | | 9/32 | 24 | 2¼ |

All Dimensions in Inches

* For Split Core Transducers, Cable is 96".

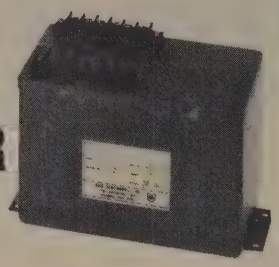
PHONE 614/486-9561
1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212
OHIO SEMITRONICS, INC. 11

OSI

SPECIALISTS IN MEASUREMENT MONITORING, AND CONTROL OF CURRENT, POWER AND ENERGY

# DC WATT TRANSDUCER

## PC8 SERIES



### DESCRIPTION:

The PC8 series of Watt Transducers are unique since they provide an accurate means of monitoring power that contains D.C., A.C. and non-sinusoidal waveforms. The input response of less than 50 microseconds makes these units ideal for use in SCR and other A.C. or D.C. switching circuits operating from d.c. to 400 Hertz. The output is completely isolated thereby offering safety and freedom from interaction with other signals being monitored or recorded.

The output is proportional to the product of the voltage applied and the ampere-turns through the window. Therefore, the seven (7) standard current ranges offered can be adapted to currents of lower values by winding additional turns through the window of the transducer.

### SPECIFICATIONS:

#### INPUT:

Voltage: Check code designation for F.S. voltage ranges from 25 to 600 volts (peak A.C. or D.C.)
Burden: <1 megohm
Current: Check code designation (specify FS range from 100 ampere to 2000 ampere, lower range uses 100 ampere transducer with ampere turns)
DC Insertion Loss: **None**
Overrange Without Damage: 10 times rating
Frequency Range: DC to 400Hz
Response Time: <50 microseconds

#### OUTPUT:

Full Scale Output: 1ma D.C. (0 to 10K ohm)
Response: 250 milliseconds
Ripple: <1% Full Scale
Accuracy: (FS Voltage × FS Current) ± 1.0% FS
Temperature Effect: (0 to 40°C) ±0.1% of FS ±1% of Reading
**Isolation:** Input/Output/Case 1000VDC
Instrument Power: 115VAC ±10% 60Hz
Case Size Drawing: K See Page 11
Transducer Size: Drawing on Page 11
100 amp—Drawing C
200 to 400 amp—Drawing D
600 to 2000 amp—Drawing E

#### Ordering Information:

The part numbers listed in the selection tables are incomplete. The voltage and current designation code must be added.

**Part Number PC8-** ____* — ____△

Example: PC8-3-01, which would be a PC8 transducer with 125VDC @ 100 amperes.

"*" Voltage Designation "△" Current Designation

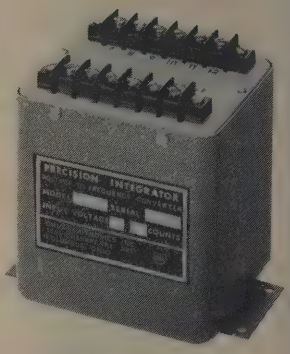
| Code | FS Volts | Range |
|---|---|---|
| 1 | 25 | 0 to 30 |
| 2 | 50 | 0 to 60 |
| 3 | 125 | 0 to 135 |
| 4 | 250 | 0 to 275 |
| 5 | 400 | 0 to 450 |
| 6 | 500 | 0 to 550 |
| 7 | 600 | 0 to 650 |

| Code | FS Current | Range |
|---|---|---|
| 01 | 100 | 0-100 |
| 02 | 200 | 0-200 |
| 03 | 300 | 0-300 |
| 04 | 400 | 0-400 |
| 05 | 600 | 0-600 |
| 06 | 1000 | 0-1000 |
| 07 | 2000 | 0-2000 |

# PRECISION INTEGRATOR

## VOLTAGE TO FREQUENCY TRANSDUCER

## VFC SERIES



### DESCRIPTION:

The VFC Series Precision Integrators are designed to provide an output directly related to the time integral of a d.c., pulsating d.c., or d.c. signal with a.c. ripple. The output is a switch closure for activating external circuits. Each switch closure can be directly related to a specific integrated quantity such as ampere-seconds, kilowatt-hours, or other quantity as desired. Units can be preset at the factory to interface with specific transducer characteristics as indicated by customer.

One of the many applications of integrators is to provide information on electrical energy consumption. The VFC unit may be connected to a PC5 Series Watt Transducer for this application.

### SPECIFICATIONS (common to all):

#### INPUT:

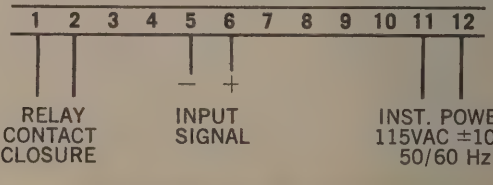
MAX. VOLTAGE: 10V
IMPEDANCE: >1 megohm
USEABLE RANGE: Up to 1.25 x FS
FREQUENCY: DC with up to 100% ripple at 120Hz or higher

#### OUTPUT:

TEMPERATURE EFFECT: (−10°C to +60°C) ±0.5%
ZERO DRIFT: ±0.1%FS
ACCURACY: ±0.25%FS
LINEARITY: ±0.1%FS
RELAY: Normally open
RELAY CONTACT RATING: 15VA Max., 120V Max., .5A Max
RELAY CLOSED PERIOD: 20 milliseconds, typ.
INSTRUMENT POWER: 115 VAC ±10%, 50/60 Hz
CASE SIZE: Drawing H, Page 11
DIELECTRIC TEST: (INPUT/OUTPUT/CASE) 1000 Volts

| MODEL | INPUT | OUTPUT RELAY CLOSURE RATE* |
|---|---|---|
| VFC-1 | 0 to +50 mv | 0 to 10,000 per hour |
| VFC-2 | 0 to +100 mv | 0 to 10,000 per hour |
| VFC-3 | 0 to +150 mv | 0 to 10,000 per hour |
| VFC-4 | 0 to +250 mv | 0 to 10,000 per hour |
| | | |

*NOTE: Option 1—Output closure rate can be set anywhere between 1K to 10K at specified input for a nominal charge.




12 OHIO SEMITRONICS, INC. PHONE 614/488-8561 1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212

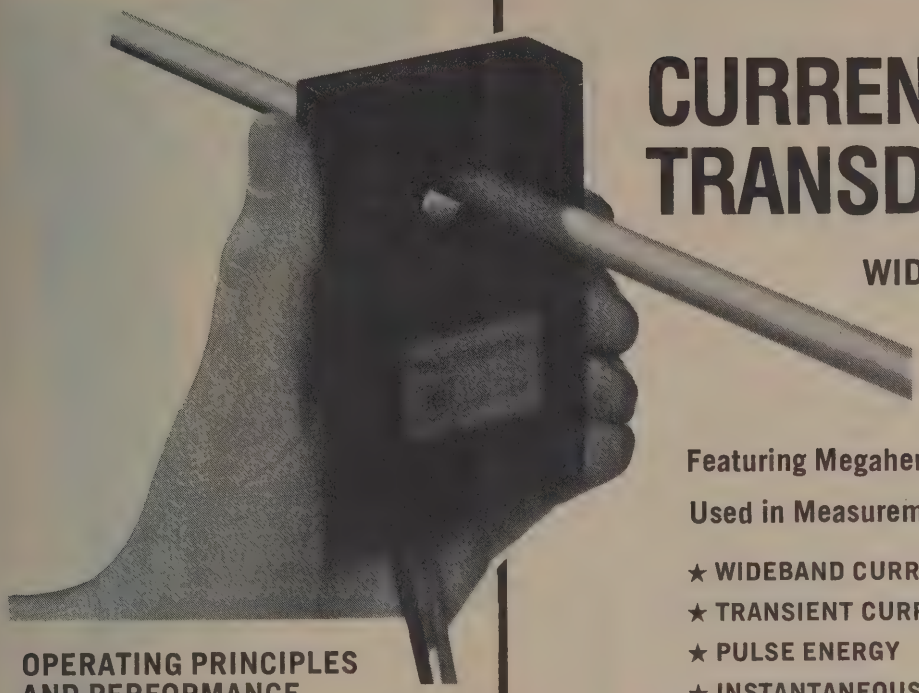
SPECIALISTS IN MEASUREMENT MONITORING, AND CONTROL OF CURRENT, POWER AND ENERGY

OSI

# CURRENT TRANSDUCERS

## WIDEBAND, DC TO MEGAHERTZ

### CT-W SERIES



**Featuring Megahertz Response**

**Used in Measurement of**

- ★ WIDEBAND CURRENT
- ★ TRANSIENT CURRENT WAVEFORM
- ★ PULSE ENERGY
- ★ INSTANTANEOUS POWER
- ★ PEAK CURRENT

## OPERATING PRINCIPLES AND PERFORMANCE

The CT-W Series Wideband Current Transducers provide an output which is the instantaneous product of a control current to the unit and a current flowing in a conductor threaded through the window. With a fixed control current, the output is an exact replica of the waveform or transient present in the conductor with all time-dependent information. If time-dependent signals are applied to both inputs, the output is the true-product of the input signals.

## FEATURES:

The striking applicational features of the Halltron Current Transducers arise from:

1. **Wide Dynamic Range.** The CT7W, for example, has been used to measure from 1 milliampere to 30 amperes peak pulse currents.
2. **Wide Frequency Range.** All units have provided an output of ± 1 db from 5 Hz. to 1 Megahertz with constant amplitude input.
3. **True-Product Output.** Since the output is a true-product; pulse sampling, modulation, and multiplier functions may be achieved.

In operation the units provide an output voltage, $V_H$ of the form

$$V_H = K_t I_c I_m$$

where $K_t$ is a device constant, $I_c$ is the control current, and $I_m$ the current to be measured.

The true-product nature of the units is illustrated by the equation. Either or both currents may be time-dependent or fixed at a d.c. level of either direction. Full four-quadrant operation then results.

## SPECIFICATIONS (common to all models):

| | |
|---|---|
| Nominal Control Current, $I_c$ (milliampere) | 100 |
| Maximum Control Current $I_c$ (milliampere) | 200 |
| Rise Time, 70% (microseconds) | <1 |
| Input Resistance (ohms) Typ. | 10 |
| Output Resistance (ohms) Typ. | 8 |
| Lead Length (Inches) | 24 |
| Lead Type | Shielded Twisted Pair |

| MODEL | CT7W | CT100W | CT200W | CT600W | CT1000W | CT2000W |
|---|---|---|---|---|---|---|
| Peak Enclosed Current | 30A | 100A | 200A | 600A | 1000A | 2000A |
| Output (Typical with $I_c$ = 100mA) | 30mV | 50mV | 60mV | 150mV | 100mV | 100mV |
| Length (Inches) | 1 | 3 | 4 | 4 | 4 | 6 |
| Width (Inches) | ¾ | 2 | 2½ | 2½ | 2½ | 5 |
| Thickness (Inches) | ⅜ | ½ | ⅞ | ⅞ | ⅞ | 1¼ |
| Window Diameter (Inches) | 3/16 | ½ | 1⅛ | 1⅛ | 1⅛ | 1⅛ |
| Mtg. Hole Diameter (Inches) | 3/32 | 9/64 | 9/64 | 9/64 | 9/64 | 3/16 |

PHONE 614/486-9561
1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212

**OHIO SEMITRONICS, INC.** 13

OSI

SPECIALISTS IN MEASUREMENT MONITORING, AND CONTROL OF CURRENT, POWER AND ENERGY

# CURRENT TRANSDUCERS

## DC to 5 KILOHERTZ

### CT-L SERIES

### DESCRIPTION:

The OSI line of current transducers includes fixed and split-core models with full-scale ranges of ±50 to ±8000 Amperes.

All units provide an electrically isolated output which is proportional to the instantaneous, direct, alternating or pulse current, flowing through the transducer window. These transducers have features especially suited for monitoring of total, branch or fault currents in DC systems, variable frequency AC systems, AC systems with DC components, chopped wave form systems, zero-crossing switched systems and sinusoidal systems.

The excellent linearity and lack of damage with currents in excess of ten times rating make these rugged units especially attractive for application in industrial and defense-related applications.

The transducer output is proportional to the product of the current through the window times the control current. If desired, the customer can adjust the control current for desired calibration level or gate the control current when desirable for use with data systems.

### FEATURES:

- 5000 VOLT LINE-TO-OUTPUT ISOLATION
- DC TO 5 KILOHERTZ RESPONSE
- BI-DIRECTIONAL OPERATION
- LINEARITY 0.5%, 50 TO 2000 AMP
- SUSTAINED OVERLOAD CAPABILITY
- ± 1% OPERATION OVER TEMPERATURE RANGE
- LESS THAN 50 MICROSECOND RESPONSE TIME FOR 50 TO 2000 AMPERE UNITS
- STABLE DURING SEVERE VIBRATION
- EASY INSTALLATION

**±0.5% FS LINEARITY**

CT8KL

CT50L

CT200L

CT1KLTS SPLIT-CORE OPTION

**NOTES:** The split core option is available on all Models except the 50 Ampere size. To order, add the letter "S" to the Model Number.

The electrical isolation (line to output) is at least 5000 volts for all Models, except the 50 Ampere size which is rated at 600 volts.

14 **OHIO SEMITRONICS, INC.** PHONE 614/486-9561
1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212

# CURRENT TRANSDUCERS
## DC to 5 KILOHERTZ

OSI

## CT-L SERIES
## SPECIFICATIONS FOR STANDARD MODELS

| Model | Enclosed Current Amps | Excitation Current ma (nom) | Output mV. (typ.) | Linearity %f.s. | Temp. Effect On Output | Temp. Range °C | Resistance typ. In Ω | Resistance typ. Out Ω | Transducer Dimensions See Page 11 |
|---|---|---|---|---|---|---|---|---|---|
| CT50L | 50 rms | 100 | 30 | 0.5 | −0.15%/°C | −40 +65 | 4 | 3 | A |
| CT50LTT | 50 rms | 100 | 20 | 0.5 | ±1% | 0 +40 | 4 | 25 | A |
| CT50LT | 50 rms | 100 | 20 | 0.5 | ±1% | −40 +65 | 4 | 25 | A |
| CT100L | 100 rms | 100 | 50 | 0.5 | −0.15%/°C | −40 +65 | 4 | 3 | C |
| CT100LTT | 100 rms | 100 | 50 | 0.5 | ±1% | 0 +40 | 4 | 25 | C |
| CT100LT | 100 rms | 100 | 50 | 0.5 | ±1% | −40 +65 | 4 | 25 | C |
| CT200L | 200 rms | 100 | 75 | 0.5 | −0.15%/°C | −40 +65 | 4 | 3 | D |
| CT200LTT | 200 rms | 100 | 50 | 0.5 | ±1% | 0 +40 | 4 | 25 | D |
| CT200LT | 200 rms | 100 | 50 | 0.5 | ±1% | −40 +65 | 4 | 25 | D |
| CT400L | 400 rms | 100 | 50 | 0.5 | −0.15%/°C | −40 +65 | 4 | 3 | D |
| CT400LTT | 400 rms | 100 | 50 | 0.5 | ±1% | 0 +40 | 4 | 25 | D |
| CT400LT | 400 rms | 100 | 50 | 0.5 | ±1% | −40 +65 | 4 | 25 | D |
| CT600L | 600 rms | 100 | 75 | 0.5 | −0.15%/°C | −40 +65 | 4 | 3 | E |
| CT600LTT | 600 rms | 100 | 50 | 0.5 | ±1% | 0 +40 | 4 | 25 | E |
| CT600LT | 600 rms | 100 | 50 | 0.5 | ±1% | −40 +65 | 4 | 25 | E |
| CT1KL | 1000 rms | 200 | 75 | 0.5 | −0.15%/°C | −40 +65 | 25 | 6 | E |
| CT1KLTT | 1000 rms | 200 | 50 | 0.5 | ±1% | 0 +40 | 25 | 25 | E |
| CT1KLT | 1000 rms | 200 | 50 | 0.5 | ±1% | −40 +65 | 25 | 25 | E |
| CT2KL | 2000 rms | 200 | 150 | 0.5 | −0.15%/°C | −40 +65 | 25 | 6 | E |
| CT2KLTT | 2000 rms | 200 | 100 | 0.5 | ±1% | 0 +40 | 25 | 25 | E |
| CT2KLT | 2000 rms | 200 | 100 | 0.5 | ±1% | −40 +65 | 25 | 25 | E |
| CT4KLTT | 4000 peak | 200 | 150 | 1 | ±1% | 0 +40 | 25 | 25 | G |
| CT4KLT | 4000 peak | 200 | 150 | 1 | ±1% | −40 +65 | 25 | 25 | G |
| CT5KLTT | 5000 peak | 200 | 150 | 1 | ±1% | 0 +40 | 25 | 25 | G |
| CT5KLT | 5000 peak | 200 | 150 | 1 | ±1% | −40 +65 | 25 | 25 | G |
| CT8KLTT | 8000 peak | 200 | 75 | 1 | ±1% | 0 +40 | 25 | 25 | H |
| CT8KLT | 8000 peak | 200 | 75 | 1 | ±1% | −40 +65 | 25 | 25 | H |

### APPLICATION NOTES:

1. Input and output are ohmically related, therefore the excitation power supply should be floating or should not have circuits common with the output terminals of the transducer.
2. Output is directly proportional to both the current through the window and the excitation current. Each transducer is tagged with the exact excitation current required to produce the stated sensitivity. By adjusting the excitation current, the user may adjust the output from 0 to 1.5 X the stated sensitivity.
3. Transducers will withstand sustained 10 X rated current overloads without damage.
4. To measure the current in a conductor, simply pass the conductor through the window, apply excitation current (specified on tag) to the input terminals and measure the millivolt output.
5. The cases of this series are formed of impact resistant plastic and therefore will withstand most hostile environments.
6. Companion signal conditioners are available to supply the excitation current and output amplification. See CTA data bulletin for information.
7. Other current transducers and signal conditioners are available for clamp-on style, true RMS, higher currents, and wider temperature range operation.

PHONE 614/486-9561
1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212
OHIO SEMITRONICS, INC.

OSI

SPECIALISTS IN MEASUREMENT MONITORING, AND CONTROL OF CURRENT, POWER AND ENERGY

# LOW COST CURRENT TRANSDUCERS

## DC to 1 KILOHERTZ

### CTP SERIES

CTP-1, CTP-2

CTP-3, CTP-4

| MODEL | CTP-1 | CTP-2 | CTP-3 | CTP-4 |
|---|---|---|---|---|
| DC or Peak AC Current for ±1% F.S. Linearity | 225A | 500A | 1000A | 2000A |
| DC or Peak AC Current for —10% F.S. Linearity | 500A | 700A | 1400A | 3500A |
| Output Sensitivity* (Nominal Excitation Current, mV/Amp) (Min) | 0.4 | 0.2 | 0.1 | 0.075 |
| Excitation Current*— (Nominal) | 100mA | 100mA | 100mA | 100mA |
| Excitation Current* (Max. Continuous) | 200mA | 200mA | 200mA | 200mA |
| Input Resistance (Max) | 6Ω | 6Ω | 6Ω | 28Ω |
| Output Resistance (Max) | 28Ω | 28Ω | 28Ω | 28Ω |
| Response Time Microseconds (Typical) | 50 | 50 | 50 | 50 |
| Effect of Conductor Position in Window | (0.25" dia) 0.03% | (0.5" dia) 0.04% | (0.75" dia) 0.3% | (0.75" dia) 0.5% |
| Effect of Close Proximity of Return Conductor (Max) | 0.09% | 0.08% | 0.35% | 0.6% |
| Effect of Close Proximity of Ferrous Metals (Max) | None | 0.8% | 0.2% | 0.15% |
| Effect of Loading with 100K Ohm (Max) | —0.1% | —0.1% | —0.1% | —0.1% |
| Effect of Temperature on Sensitivity (0° to 40°C) (Max) | ±2% | ±2% | ±2% | ±2% |
| Initial Offset (Max) | 1.0mV | 1.0mV | 1.0mV | 1.0mV |
| Isolation—Line to Output (Min) | 5KV | 5KV | 5KV | 5KV |

## DESCRIPTION:

The CTP series of transducers provides a superior method of non-contact, non-frequency sensitive, completely isolated, and low-cost current sensing. The isolated output feature makes the units especially attractive for control applications. The D.C. to 1 Kilohertz frequency response insures accurate measurements when harmonics are present in power systems.

As replacement for a shunt, CTP current transducers create no power loss to the circuit being monitored since there is zero d.c. insertion-loss.

These transducers respond to ampere-turns, therefore sensitivity can be multiplied by the number of turns passed through the window.

*SEE APPLICATION NOTE 2, Page 17

16 OHIO SEMITRONICS, INC. PHONE 614/486-9561 1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212

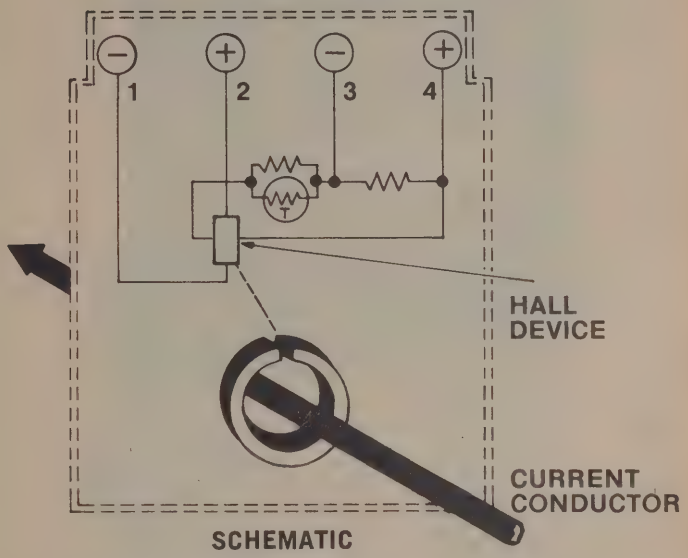
SPECIALISTS IN MEASUREMENT MONITORING, AND CONTROL OF CURRENT, POWER AND ENERGY

OSI

# LOW COST CURRENT TRANSDUCERS

## DC to 1 KILOHERTZ

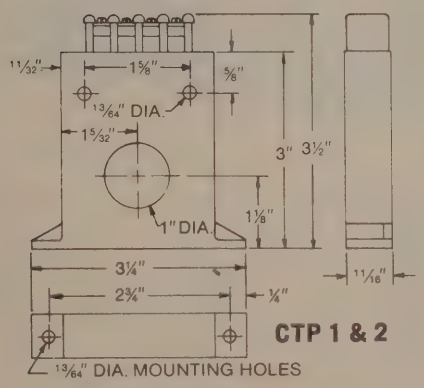
### CTP SERIES




SCHEMATIC

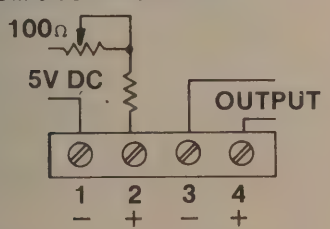
**APPLICATION NOTES:**

1. Input and output are ohmically related, therefore the excitation power supply should be floating or should not have circuits common with the output terminals of the transducer.
2. Output is directly proportional to both the current through the window and the excitation current. Each transducer is tagged with the exact excitation current required to produce the stated sensitivity. By adjusting the excitation current, the user may adjust the output from 0 to 2 X the stated sensitivity.
3. Transducers will withstand sustained 10 X rated current overloads without damage.
4. To measure the current in a conductor, simply pass the conductor through the window, apply excitation current specified on tag to the input terminals and measure the millivolt output.
5. The case and terminal block of this series are molded of impact resistant plastic and therefore will withstand most hostile environments.
6. Companion signal conditioners are available to supply the excitation current and output amplification. See page 18 for information.
7. Terminal screws are number 5.

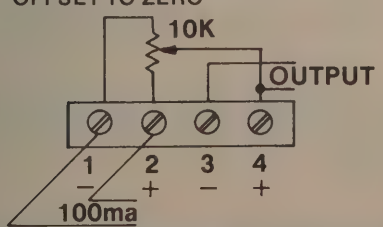



CTP 1 & 2

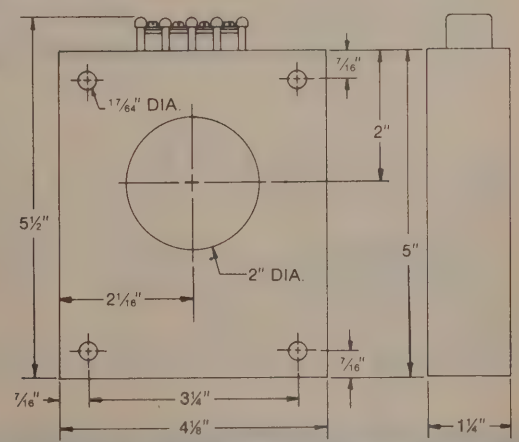
CIRCUIT FOR OPERATING FROM 5 VOLT DC SUPPLY




CIRCUIT FOR CORRECTING OFFSET TO ZERO




CTP 3 & 4



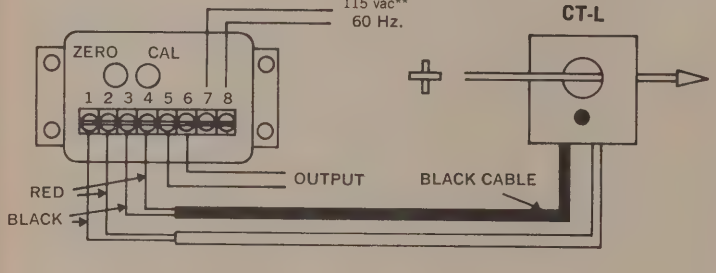

PHONE 614/486-9561
1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212
OHIO SEMITRONICS, INC. 17

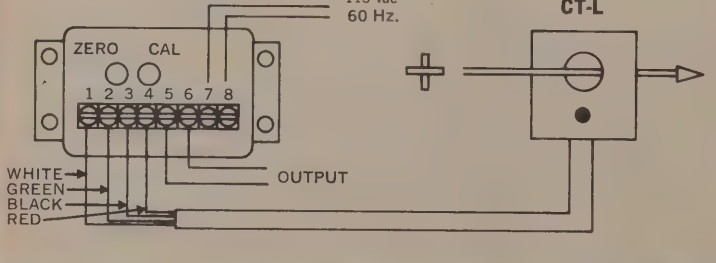
SPECIALISTS IN MEASUREMENT MONITORING, AND CONTROL OF CURRENT, POWER AND ENERGY

# SIGNAL CONDITIONERS

## CTA SERIES

| MODEL | INPUT SIGNAL | OUTPUT SIGNAL | CONTROL CURRENT OUTPUT | OPERATING POWER |
|---|---|---|---|---|
| CTA 101 | ±50mv | ±10v | 100 ma | 115 vac ±10% |
| CTA 201 | ±50mv | ±10v | 200 ma | 115 vac ±10% |
| CTA 112 | +50mv | 4-20ma | 100 ma | 115 vac ±10% |
| CTA 113 | 50mv ac | +10 vdc | 100 ma | 115 vac ±10% |
| CTA 114 | 50mv ac | +1ma dc | 100 ma | 115 vac ±10% |
| CTA 128 | ±50mv | ±10v | 100 ma | 28 vdc ±10% |
| CTA 501 | ±50mv to 200mv | ±1ma | 100 ma | 115 vac ±10% |




## DESCRIPTION:

The CTA line of signal conditioners was designed for use with OSI current transducers. They provide the control current for the transducer and signal amplification with output suitable for monitoring or control purposes. Outputs of 0 to ±10 volts, 0 to ±1ma and 4 to 20ma are available in standard units.

The CTA113 and CTA114 units provide outputs proportional to the true rms value of the input signal, even with d.c. components.

Calibration and zero adjustments are provided through openings in the top of the case. The calibration control provides a ±30% adjustment of the constant current supply providing excitation to the transducer so the output can be calibrated directly in terms of current flow through transducer window.

## SPECIFICATIONS:

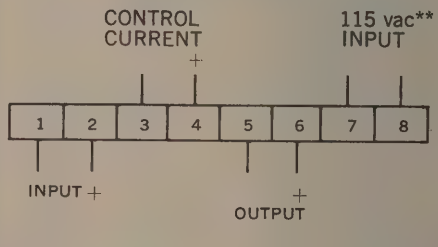
AMPLIFIER (OUTPUT)
- NOISE: <15mv peak-peak
- DRIFT: <2mv/°C
- LOAD
  - VOLTAGE: >2K ohms
  - CURRENT: ≤10v drop
- FREQUENCY RANGE: DC to 5KHZ
- *RESPONSE: 40 microseconds to 90%
- LINEARITY: 0.1%
- GAIN: 200
- TEMPERATURE RANGE: 0-70°C
- OUTPUT IS SHORT-CIRCUIT PROTECTED
- OUTPUT SATURATION: 12.5v

CONTROL CURRENT (CONSTANT)
- ADJUSTMENT: ±30%
- DRIFT: 0.005%/°C

*CTA113 and CTA114
- RESPONSE: 200 milliseconds to 90%

CASE SIZE: DRAWING F, Page 11

## CONNECTIONS




NOTE: Terminals 3 and 5 are internally connected.

NOTE:
(1) If the shield is used, connect it to terminal 5.
(2) Red dot on transducer toward the most positive voltage terminal for a positive output.
**Except for CTA 128 which requires 28 vdc. (positive on terminal 8)

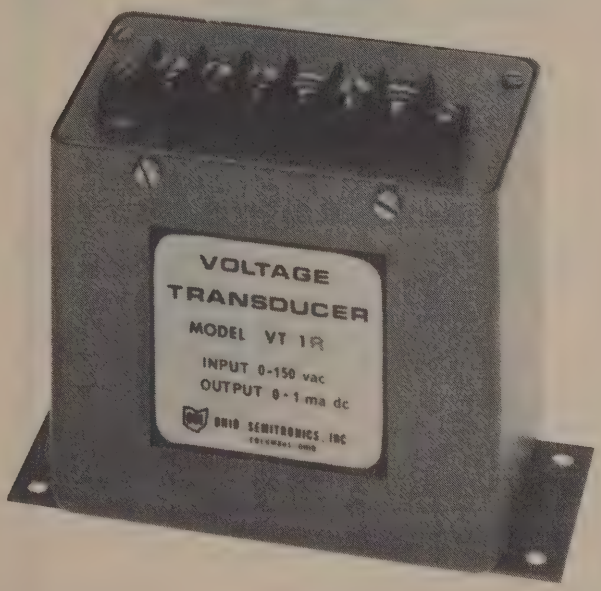
18 OHIO SEMITRONICS, INC. PHONE 614/486-9561 1205 CHESAPEAKE AVENUE COLUMBUS, OHIO 43212

SPECIALISTS IN MEASUREMENT MONITORING, AND CONTROL OF CURRENT, POWER AND ENERGY

OSI

# RMS VOLTAGE & CURRENT TRANSDUCERS

☐ VT-R SERIES ☐ CT-R SERIES




## DESCRIPTION:

The OSI "RMS" transducers provide an electrical output directly proportional to the rms value of the input waveform. Both Voltage Transducers and Current Transducers can be obtained with either a 0 to 1ma output or a 0 to 10 volt output. Any unit can be calibrated to give 1ma output at 20% higher input.

Current transducers provide 0.5 per cent operation over a 20 to 2000 Hertz range. Voltage transducers can be obtained for 50 to 400 Hertz or 20 to 2000 Hertz operation.

## SPECIFICATIONS:

ACCURACY & LINEARITY: ±0.5% FS

FREQUENCY RANGE:
*VOLTAGE: 50 to 400Hz
CURRENT: 20 to 2KHz

INPUTS:
VOLTAGE: 0 to 480 VAC
CURRENT: 0 to 6 Amps

INPUT SIGNAL BURDEN:
VOLTAGE: 0.12VA FS
CURRENT: 0.5VA FS

DIELECTRIC TEST:
(Input/Output/Case)
VOLTAGE: 1000 VAC Peak
CURRENT: None

OUTPUT RESPONSE:
200 milliseconds to 90%

OUTPUT SHORT CIRCUIT PROTECTED

TEMPERATURE EFFECT: ±0.5%
(—10°C to 60°C)

RIPPLE: <1% FS

EXTERNAL POWER: 115 VAC ±10%
50 to 400Hz

CASE SIZE: DRAWING F, PAGE 11

NOTE: CTR Series output is NOT isolated from input. Caution is advised when making connections.

Calibration and zero adjustments are provided through recess holes in the top of the case.

| MODEL | INPUT SIGNAL | OUTPUT SIGNAL | LOAD OHMS |
|---|---|---|---|
| VT1R | 0-120V | 0-1maDC | 0-6K |
| VT2R | 0-240V | 0-1maDC | 0-6K |
| VT4R | 0-480V | 0-1maDC | 0-6K |
| VT1RV | 0-120V | 0-10VDC | > 2K |
| VT2RV | 0-240V | 0-10VDC | > 2K |
| VT4RV | 0-480V | 0-10VDC | > 2K |
| CT1R | 0-5A | 0-1maDC | 0-6K |
| CT1RV | 0-5A | 0-10VDC | > 2K |

**OPTIONS (VOLTAGE)**

*(A) Extended frequency range ±0.5% accuracy 20 Hz to 2KHz.

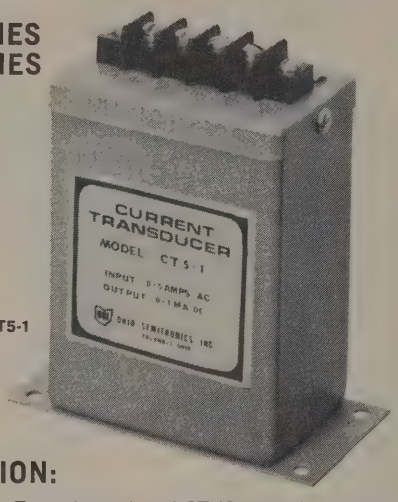
PHONE 614/486-9561
1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212

**OHIO SEMITRONICS, INC.** 19

SPECIALISTS IN MEASUREMENT MONITORING, AND CONTROL OF CURRENT, POWER AND ENERGY

# AC VOLTAGE AND CURRENT TRANSDUCERS

## VT SERIES
## CT SERIES




MODEL CT5-1

## DESCRIPTION:

The VT (Voltage Transducers) and CT (Current Transducers) provide a 0 to 1ma d.c. output related to the a.c. input signal to the transducer. Transducer output is derived from the average absolute value of the input and is calibrated in terms of the rms value for sine wave input.

Voltage transducers are available for 120, 240, 480 volt inputs at 50 to 500 Hz.

Current transducers are available with full-scale current input ranges from 5 to 1000 Amperes rms.

| MODEL | VOLTAGE (VAC) Nominal | Full Scale |
|---|---|---|
| VT120 | 120 | 150 |
| VT240 | 240 | 300 |
| *VT480 | 480 | 575 |

| MODEL | CURRENT (AMPS. AC) (Full Scale) |
|---|---|
| CT5-1 | 5 |
| CT10-1 | 10 |
| CT20-1 | 20 |
| CT5-100 | 100 |
| CT5-200 | 200 |
| CT5-300 | 300 |
| CT5-400 | 400 |
| CT5-600 | 600 |
| CT5-1000 | 1000 |

*Includes OSI 226-145 Potential Transformer.

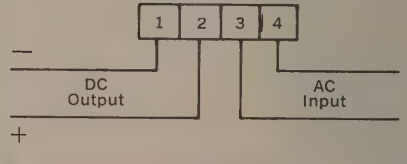
## SPECIFICATIONS (Common to All Models):

| | |
|---|---|
| ACCURACY (Calibration, linearity @ 25°C) | ±0.5% FS |
| FREQUENCY RANGE | 50 to 500Hz |
| RESPONSE TIME | 400ms |
| TEMPERATURE EFFECT (from calibrated value) —20°C to +60°C | ±1% of Reading |
| RIPPLE | <1% FS |
| FULL SCALE OUTPUT | 1ma dc |
| OUTPUT LOADING | 0-10K ohms |
| OVERLOAD (Continuous) | |
| Voltage | Full Scale Rating |
| Current | 2 X Rating |
| Except CT10-1 & CT20-1 | 1.25 Rating |
| 1 Second Transients | 50 X Rated Input |
| BURDEN | |
| Voltage | 2.8VA FS |
| Current | 1VA FS |
| OPERATING RANGE (Extended) | |
| Voltage | Full Scale |
| Current | 1.2 X Rating |
| DIELECTRIC TEST: (Input/Output/Case) VT and CT | 1000 VAC |

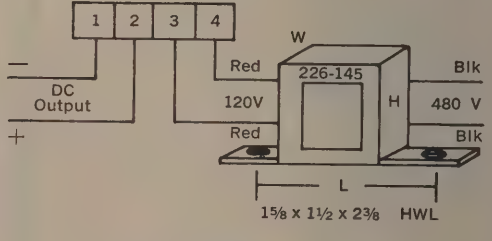
CASE SIZE DRAWING B, Page 11

## VOLTAGE AND CURRENT TRANSDUCER CONNECTIONS

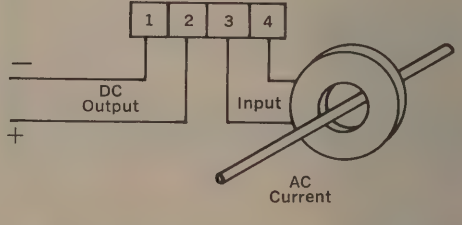
**MODELS CT5-1 THRU CT20-1 VT120 AND VT240**




**MODEL VT480**




**MODELS CT5-100 THRU CT5-1000**

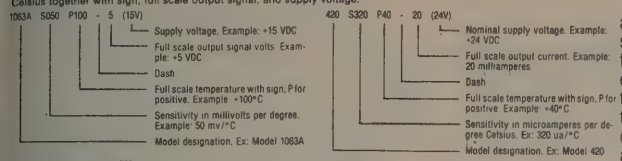



20 OHIO SEMITRONICS, INC. PHONE 614/486-9561
1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212

# TEMPERATURE TRANSDUCERS

**How to Specify**

To order, specify the model number, required sensitivity using the Celsius scale of temperatures, full scale temperature in degrees Celsius together with sign, full scale output signal, and supply voltage.


1063A S050 P100 - 5 (15V)
Supply voltage. Example: +15 VDC
Full scale output signal volts Example: +5 VDC
Dash
Full scale temperature with sign, P for positive. Example +100°C
Sensitivity in millivolts per degree. Example: 50 mv/°C
Model designation. Ex: Model 1063A
420 S320 P40 - 20 (24V)
Nominal supply voltage. Example: +24 VDC
Full scale output current. Example: 20 milliamperes
Dash
Full scale temperature with sign, P for positive Example: +40°C
Sensitivity in microamperes per degree Celsius. Ex: 320 ua/°C
Model designation. Ex: Model 420

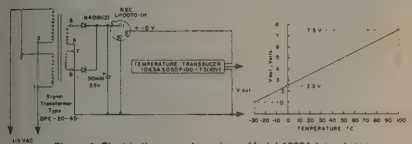



Figure 1. Electric thermometer using a Model 1063A transducer together with graph of the output signal.

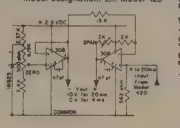
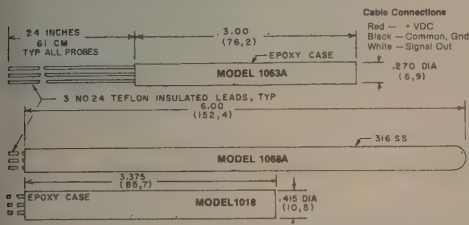



Figure 2. Process interface circuit for use with Model 420

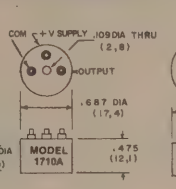
The **solid state temperature transducer** was invented at **Relco Products** and uses a silicon transistor as the temperature sensing element operating in a proprietary circuit made up of a selfadjusting bridge and a feedback amplifier[1]. The result is a very linear temperature transducer having high accuracy and sensitivity without requiring additional external circuitry[2]. The transducer is designed so that less than 50 microwatts is dissipated in the temperature sensing transistor so the selfheating error is less than that of monolithic type temperature transducers now appearing on the scene by a factor of .02 or better, also Mil grade components are used for maximum reliability. Originally developed in 1966 for military and aerospace applications, these transducers have been improved and refined over the last 10 years and are now used worldwide in such diverse applications as petrochemical plants and solar heated homes.

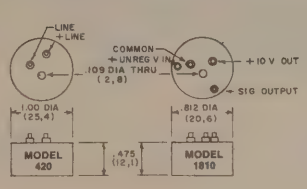
Small quantity prices: 1063A-$19.50; 1068A & 1710A-$29.50; 1810-$39.50; 1067A & 420—$59.50.

1. Robert A. Ruehle, "Solid-State Temperature Sensor Outperforms Previous Transducers," Electronics, March 20, 1957, Volume 48. No. 6, Page 127-130, McGraw-Hill, 1221 Avenue of the Americas, New York, New York.
2. Patented, U.S. 3,708,755; Canada 966,902; G. B. 1,372,917; U.S. and foreign patents pending.

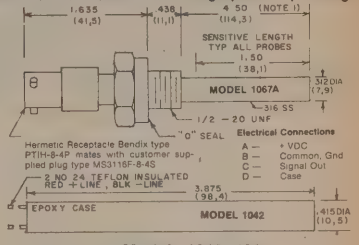



Models 1063A, 1067A, 1068A, 1710A




Models 1810, 1018




Models 1042, 420

| | | | |
|---|---|---|---|
| **RANGE** | Any range between -100 and +150°C (-150 & +300°F). The transducer may be operated intermittently up to +160°C. | Any range between -55 and +125°C (-67 and +257°F) | |
| **ACCURACY** | ±½% F.S. or +.5°C. The transducer can be factory calibrated to an accuracy of ±.1°C within the span of -40 to +110°C. The minimum calibration point always starts at a transducer output of > +.75 volts. | | ±1% F.S. or +1°C; The transducer can be factory calibrated to an accuracy of ±.3°C within the span of -40 to +110°C. |
| **LINEARITY (Note 2)** | ±.15% of span -35 to +110°C; ±.3% of span -60 to +130°C. | ±.15% of span -35 to +110°C; ±.3% of span -55 to +125°C | |
| **OUTPUT SIGNAL** | A linear voltage which increases with increasing temperature ranging from zero volts up to the full scale value specified. (Note 3) | | A linear current which increases with increasing temperature ranging from 4 ma. at 0% of span to 20 ma. at 100% of span. |
| **SENSITIVITY** | Any sensitivity up to 250 millivolts per degree Celsius may be specified (139 mv/°F). | | Any sensitivity between 80 & 320 microamperes/°C (44 & 178 ua/°F) may be specified. |
| **MAXIMUM FULL SCALE OUTPUT (Note 7)** | V supply: +15, +12, +10, +5 — V out max: +12, +9, +7.5, +2.5 | +7.5 volts | 20 milliamperes |
| **SUPPLY VOLTAGE** | Standard: +15, +12, +10 and +5 volts, ±.1% regulated. Optional: Any regulated voltage from +5 to +25 volts, ±.1%. | +15 V unregulated nominal, +12.5 V minimum, +30 V maximum (Note 4) | +24 V unregulated nominal, +12.5 V minimum, +35 V maximum |
| **OUTPUT IMPEDANCE** | 25 ohms typ., 10 ohms minimum, 35 ohms maximum | | The transducer is a current source with a high source impedance. |
| **LOAD IMPEDANCE** | The maximum current drawn from the transducer should not exceed .25 ma. to minimize self heating errors. | | See Figure 2 |
| **TIME CONSTANT (Note 5)** | 1063A 10 seconds, 1067A 1068A and 1710A 15 seconds | 20 seconds | 25 seconds |
| **POWER CONSUMPTION (Note 6)** | 10 to 25 milliwatts typ. | 15 to 35 milliwatts typ. | 85 to 230 milliwatts typ. See Figure 2 |
| **SELF HEATING ERROR** | .004°C per milliwatt power dissipation typical with the transducer mounted in place and operated with standard or nominal supply voltages. | | |
| **STABILITY** | ±.1°C over 90 days | | ±.25°C over 90 days |
| **REFERENCE OUTPUT VOLTAGE** | | The +10 V reference is standard on Model 1810; it can also be brought out on Model 1018 if so specified on ordering. External load on +10 V is limited to 10 ma. maximum and this load will add to transducer self heating error. | |

Note 1. Standard immersion length , longer lengths can be supplied.

Note 2. The maximum error incurred when the best straight line fit is used to approximate the transfer characteristic is as specified. The straight line fit is between +.75 volts out and full scale output. For current output models the fit is between 4 ma. and 20 ma.

Note 3. The output signal departs from the specified linearity at levels of less than +.75 volts due to a drop in amplifier openloop gain as the amplifier approaches negative saturation.

Note 4. The transducer should be operated with the minimum supply voltage consistant with anticipated voltage fluctuations for minimum self heating error.

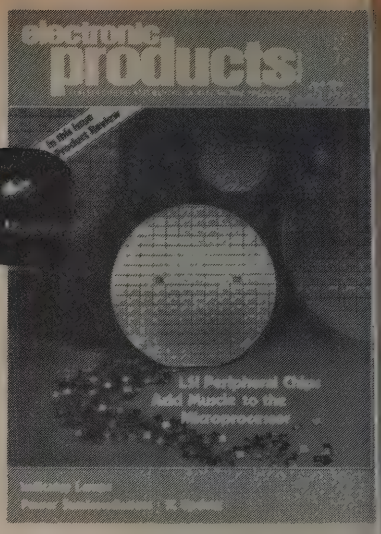
Note 5. Time Constant: The time required for a 63% response to a step change from 24°C to an oil bath of #200 Dow Corning 1.5 CTSK at 76°C and flowing at 3FPS transverse to the sensing surface is less than the figure given. The inservice response will depend upon how it is mounted and the environment in which it is used.

Note 6. Power consumption depends upon the supply voltage, transducer load and output signal swing.

Note 7. V out max for +5 volt units with sensitivities > 25 mv/°C is +3 volts.

**RELCO PRODUCTS, INC.**
5594 EAST JEFFERSON • DENVER, COLORADO 80237 • PHONE (303) 756-1143

# stay up to date



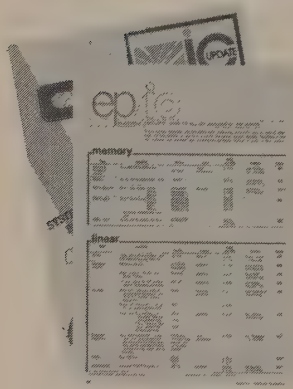

**SUBSCRIBE TO ELECTRONIC PRODUCTS MAGAZINE. IT'S YOUR *COMPLETE* GUIDE TO EVERYTHING THAT'S NEW IN THE FAST-CHANGING WORLD OF ELECTRONIC PRODUCTS AND SYSTEMS.**

**FEATURE STORIES** every month on electronic products, applications and availability.

**FORUMS**—Reports on meetings of manufacturers, users and distributors. Get the very latest news on a wide variety of products.

**NEW PRODUCT NEWS**—Hundreds of new products are introduced each month. You'll get the facts on not only what the new product is, but also where to get it, basic prices and current delivery.

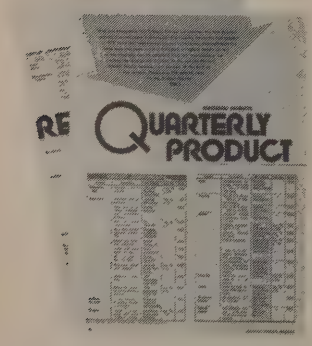
**EP/IC UPDATE**—Exclusive in ELECTRONIC PRODUCTS. A monthly report on *everything* that's new in the fast-moving world of integrated circuits.



**QUARTERLY PRODUCT REVIEW**—Another exclusive in ELECTRONIC PRODUCTS. A complete report of *every* new electronic product introduced in the previous quarter. This feature is in the January, April, July and October issues.

**QUARTERLY PRODUCT PLANNING DIRECTORY**—A compilation of the latest catalogs of a wide variety of electronic products and systems.

**OUTLOOK**—Important industry news affecting electronic products and systems.



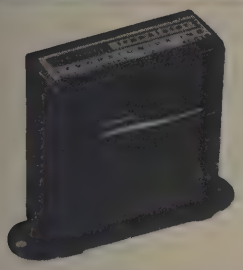

**COMPONENT CAPERS**—A humorous look at the strange and wonderful world of electronics.

**MINI-GLOSSARIES,** Quizzes and more—Each and every month for over twenty years the readers of ELECTRONIC PRODUCTS learn something new about the products they work with and specify.

***If you are not now a subscriber, write to:***
***Dorothy Renoud, ELECTRONIC PRODUCTS MAGAZINE, 645 Stewart Avenue, Garden City, NY 11530.***
***Ask for a free qualification card.***

United Technical Publications, Inc., Div. of Cox Broadcasting Corp., 645 Stewart Ave., Garden City, NY 11530/(516) 222-2500

# abbott 60 industrial power transformers



## *specifications*

**INPUT PRIMARY:** 115 VAC standard.
230 VAC at no additional cost. Specify by suffixing "A" to model number.
115/230 VAC dual input at 10% additional. Specify by suffixing "B" to model number.

**INPUT FREQUENCY:** 50 to 400 Hz, 1 phase.

**REGULATION:** 15% max. from no load to full load (6% on units size 8 and larger).

**SECONDARY VOLTAGE TOLERANCE:** Within 5% of listed output voltage when measured at full load and 115 VAC input.

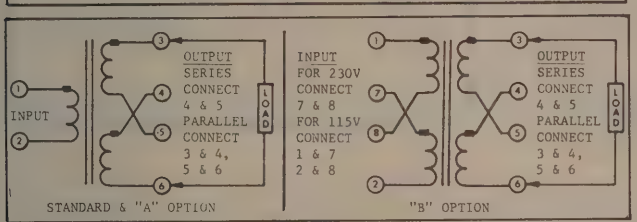
**INSULATION TEST:** 1500 VAC.

**OPERATING TEMPERATURE:** 80°C maximum ambient (70°C on units size 8 and larger).

**APPROXIMATE EFFICIENCY:** Ranges from 80% to 90%.

**CONSTRUCTION:** Commercial grade using Silicon Iron for core and heavy insulated synthetic film magnet wire with class "B" rating impregnated with a high quality insulating varnish having a class "H" rating.
Other outputs and/or inputs available on request.

| Output Volts (F.L.) | Output Current (Amps) Parallel Connection | Output Current (Amps) Series Connection | Size | Weight Lbs. Typ. | Model Number | Price 1-9 pcs. |
|---|---|---|---|---|---|---|
| 5 V Parallel | 2.0 | 1.0 | 1 | 1.2 | 6B5-10 | $9.60 |
| 10 V.C.T. Series | 3.0 | 1.5 | 2 | 1.5 | 6B5-15 | 10.50 |
| | 6.0 | 3.0 | 3 | 2.2 | 6B5-30 | 11.40 |
| | 12.0 | 6.0 | 4 | 3.0 | 6B5-60 | 14.10 |
| | 18.0 | 9.0 | 5 | 4.3 | 6B5-90 | 17.40 |
| | 26.0 | 13.0 | 6 | 5.5 | 6B5-130 | 20.70 |
| | 32.0 | 16.0 | 7 | 7.0 | 6B5-160 | 22.80 |
| | 60.0 | 30.0 | 8 | 13.0 | 6B5-300 | 44.50 |
| | 100.0 | 50.0 | 9 | 23.0 | 6B5-500 | 65.50 |
| 6.3 V Parallel | 1.60 | 0.80 | 1 | 1.2 | 6B6-10 | 9.60 |
| 12.6 V.C.T. Series | 2.40 | 1.20 | 2 | 1.5 | 6B6-15 | 10.50 |
| | 4.80 | 2.40 | 3 | 2.2 | 6B6-30 | 11.40 |
| | 9.40 | 4.70 | 4 | 3.0 | 6B6-60 | 14.10 |
| | 14.4 | 7.20 | 5 | 4.3 | 6B6-90 | 17.40 |
| | 20.6 | 10.3 | 6 | 5.5 | 6B6-130 | 20.70 |
| | 25.4 | 12.7 | 7 | 7.0 | 6B6-160 | 22.80 |
| | 48.0 | 24.0 | 8 | 13.0 | 6B6-300 | 44.50 |
| | 95.0 | 47.5 | 9 | 23.0 | 6B6-600 | 65.60 |
| 8 V Parallel | 1.20 | 0.60 | 1 | 1.2 | 6B8-10 | 9.60 |
| 16 V.C.T. Series | 1.80 | 0.90 | 2 | 1.5 | 6B8-15 | 10.50 |
| | 3.60 | 1.80 | 3 | 2.2 | 6B8-30 | 11.40 |
| | 7.60 | 3.80 | 4 | 3.0 | 6B8-60 | 14.10 |
| | 11.2 | 5.60 | 5 | 4.3 | 6B8-90 | 17.40 |
| | 16.2 | 8.10 | 6 | 5.5 | 6B8-130 | 20.70 |
| | 20.0 | 10.0 | 7 | 7.0 | 6B8-160 | 22.80 |
| | 37.5 | 18.75 | 8 | 13.0 | 6B8-300 | 44.50 |
| | 75.0 | 37.50 | 9 | 23.0 | 6B8-600 | 65.60 |
| | 100.0 | 50.0 | 10 | 26.0 | 6B8-800 | 71.70 |
| 10 V Parallel | 1.0 | 0.5 | 1 | 1.2 | 6B10-10 | 9.60 |
| 20 V.C.T. Series | 1.5 | 0.75 | 2 | 1.5 | 6B10-15 | 10.50 |
| | 3.0 | 1.5 | 3 | 2.2 | 6B10-30 | 11.40 |
| | 6.0 | 3.0 | 4 | 3.0 | 6B10-60 | 14.10 |
| | 9.0 | 4.5 | 5 | 4.3 | 6B10-90 | 17.40 |
| | 13.0 | 6.5 | 6 | 5.5 | 6B10-130 | 20.70 |
| | 16.0 | 8.0 | 7 | 7.0 | 6B10-160 | 22.80 |
| | 30.0 | 15.0 | 8 | 13.0 | 6B10-300 | 44.50 |
| | 60.0 | 30.0 | 9 | 23.0 | 6B10-600 | 65.60 |
| | 85.0 | 42.5 | 10 | 26.0 | 6B10-850 | 71.70 |
| | 100.0 | 50.0 | 11 | 36.0 | 6B10-1000 | 101.80 |
| 12 V Parallel | 0.82 | 0.41 | 1 | 1.2 | 6B12-10 | 9.60 |
| 24 V.C.T. Series | 1.24 | 0.62 | 2 | 1.5 | 6B12-15 | 10.50 |
| | 2.50 | 1.25 | 3 | 2.2 | 6B12-30 | 11.40 |
| | 5.0 | 2.50 | 4 | 3.0 | 6B12-60 | 14.10 |
| | 7.5 | 3.75 | 5 | 4.3 | 6B12-90 | 17.40 |
| | 10.82 | 5.41 | 6 | 5.5 | 6B12-130 | 20.70 |
| | 13.32 | 6.66 | 7 | 7.0 | 6B12-160 | 22.80 |
| | 25.00 | 12.50 | 8 | 13.0 | 6B12-300 | 44.50 |
| | 50.00 | 25.00 | 9 | 23.0 | 6B12-600 | 65.60 |
| | 71.00 | 35.50 | 10 | 26.0 | 6B12-850 | 71.70 |
| | 100.00 | 50.00 | 11 | 36.0 | 6B12-1200 | 101.80 |


INPUT
OUTPUT SERIES CONNECT 4 & 5 PARALLEL CONNECT 3 & 4, 5 & 6
LOAD
INPUT FOR 230V CONNECT 7 & 8 FOR 115V CONNECT 1 & 7 2 & 8
OUTPUT SERIES CONNECT 4 & 5 PARALLEL CONNECT 3 & 4, 5 & 6
LOAD
STANDARD & "A" OPTION
"B" OPTION

| Output Volts (F.L.) | Output Current (Amps) Parallel Connection | Output Current (Amps) Series Connection | Size | Weight Lbs. Typ. | Model Number | Price 1-9 pcs. |
|---|---|---|---|---|---|---|
| 17 V Parallel | 0.58 | 0.29 | 1 | 1.2 | 6B17-10 | 9.60 |
| 34 V.C.T. Series | 0.88 | 0.44 | 2 | 1.5 | 6B17-15 | 10.50 |
| | 1.76 | 0.88 | 3 | 2.2 | 6B17-30 | 11.40 |
| | 3.52 | 1.76 | 4 | 3.0 | 6B17-60 | 14.10 |
| | 5.28 | 2.64 | 5 | 4.3 | 6B17-90 | 17.40 |
| | 7.64 | 3.82 | 6 | 5.5 | 6B17-130 | 20.70 |
| | 9.40 | 4.70 | 7 | 7.0 | 6B17-160 | 22.80 |
| | 17.65 | 8.8 | 8 | 13.0 | 6B17-300 | 44.50 |
| | 35.00 | 17.5 | 9 | 23.0 | 6B17-600 | 65.60 |
| | 50.00 | 25.00 | 10 | 26.0 | 6B17-850 | 71.70 |
| | 76.5 | 38.25 | 11 | 36.0 | 6B17-1300 | 101.80 |
| 20 V Parallel | 0.5 | 0.25 | 1 | 1.2 | 6B20-10 | 9.60 |
| 40 V.C.T. Series | 0.74 | 0.37 | 2 | 1.5 | 6B20-15 | 10.50 |
| | 1.5 | 0.75 | 3 | 2.2 | 6B20-30 | 11.40 |
| | 3.0 | 1.5 | 4 | 3.0 | 6B20-60 | 14.10 |
| | 4.5 | 2.25 | 5 | 4.3 | 6B20-90 | 17.40 |
| | 6.5 | 3.25 | 6 | 5.5 | 6B20-130 | 20.70 |
| | 8.0 | 4.0 | 7 | 7.0 | 6B20-160 | 22.80 |
| | 15.0 | 7.50 | 8 | 13.0 | 6B20-300 | 44.50 |
| | 30.0 | 15.0 | 9 | 23.0 | 6B20-600 | 65.60 |
| | 42.5 | 21.25 | 10 | 26.0 | 6B20-850 | 71.70 |
| | 65.0 | 32.50 | 11 | 36.0 | 6B20-1300 | 101.80 |
| 28 V Parallel | 0.36 | 0.18 | 1 | 1.2 | 6B28-10 | 9.60 |
| 56 V.C.T. Series | 0.52 | 0.26 | 2 | 1.5 | 6B28-15 | 10.50 |
| | 1.06 | 0.53 | 3 | 2.2 | 6B28-30 | 11.40 |
| | 2.14 | 1.07 | 4 | 3.0 | 6B28-60 | 14.10 |
| | 3.20 | 1.60 | 5 | 4.3 | 6B28-90 | 17.40 |
| | 4.64 | 2.32 | 6 | 5.5 | 6B28-130 | 20.70 |
| | 5.70 | 2.85 | 7 | 7.0 | 6B28-160 | 22.80 |
| | 10.70 | 5.35 | 8 | 13.0 | 6B28-300 | 44.50 |
| | 21.43 | 10.71 | 9 | 23.0 | 6B28-600 | 65.60 |
| | 30.36 | 15.18 | 10 | 26.0 | 6B28-850 | 71.70 |
| | 46.42 | 23.21 | 11 | 36.0 | 6B28-1300 | 101.80 |
| 44 V Parallel | 0.22 | 0.11 | 1 | 1.2 | 6B44-10 | 9.60 |
| 88 V.C.T. Series | 0.34 | 0.17 | 2 | 1.5 | 6B44-15 | 10.50 |
| | 0.68 | 0.34 | 3 | 2.2 | 6B44-30 | 11.40 |
| | 1.36 | 0.68 | 4 | 3.0 | 6B44-60 | 14.10 |
| | 2.04 | 1.02 | 5 | 4.3 | 6B44-90 | 17.40 |
| | 2.94 | 1.47 | 6 | 5.5 | 6B44-130 | 20.70 |
| | 3.62 | 1.81 | 7 | 7.0 | 6B44-160 | 22.80 |
| | 6.82 | 3.41 | 8 | 13.0 | 6M44-300 | 44.50 |
| | 13.64 | 6.82 | 9 | 23.0 | 6B44-600 | 65.60 |
| | 19.32 | 9.66 | 10 | 26.0 | 6B44-850 | 71.70 |
| | 29.54 | 14.77 | 11 | 36.0 | 6B44-1300 | 101.80 |
| 60 V Parallel | 0.16 | 0.08 | 1 | 1.2 | 6B60-10 | 9.60 |
| 120 V.C.T. Series | 0.250 | 0.125 | 2 | 1.5 | 6B60-15 | 10.50 |
| | 0.50 | 0.25 | 3 | 2.2 | 6B60-30 | 11.40 |
| | 1.0 | 0.50 | 4 | 3.0 | 6B60-60 | 14.10 |
| | 1.5 | 0.75 | 5 | 4.3 | 6B60-90 | 17.40 |
| | 2.16 | 1.08 | 6 | 5.5 | 6B60-130 | 20.70 |
| | 2.66 | 1.33 | 7 | 7.0 | 6B60-160 | 22.80 |
| | 5.00 | 2.50 | 8 | 13.0 | 6B60-300 | 44.50 |
| | 10.00 | 5.00 | 9 | 23.0 | 6B60-600 | 65.60 |
| | 14.16 | 7.08 | 10 | 26.0 | 6B60-850 | 71.70 |
| | 21.67 | 10.83 | 11 | 36.0 | 6B60-1300 | 101.80 |

## QUANTITY DISCOUNTS

| | |
|---|---|
| 1-9 pcs. | — price listed. |
| 10-24 pcs. | — less 10% of the 1-9 piece price. |
| 25-49 pcs. | — less 19% of the 1-9 piece price. |
| 50-99 pcs. | — less 25% of the 1-9 piece price. |
| Above 100 pcs. | — Contact nearest office for an exact quotation. |

All Prices subject to change without notice.

| Size | A | B | C | D | E | F | HOLE* | |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.95 | 1.62 | 2.31 | 2.37 | — | 2.87 | .18 | FIG. 1 |
| 2 | 2.26 | 1.87 | 2.68 | 2.81 | — | 3.12 | .18 | FIG. 1 |
| 3 | 2.57 | 2.12 | 3.06 | 3.12 | — | 3.56 | .18 | FIG. 1 |
| 4 | 2.81 | 2.37 | 3.37 | 2.25 | 2.12 | 2.70 | .2 x .3 | FIG. 2 |
| 5 | 3.12 | 2.62 | 3.75 | 2.50 | 2.25 | 2.86 | .2 x .3 | FIG. 2 |
| 6 | 3.44 | 2.87 | 4.12 | 2.75 | 2.37 | 2.98 | .2 x .3 | FIG. 3 |
| 7 | 3.75 | 3.12 | 4.50 | 3.00 | 2.50 | 3.11 | .2 x .3 | FIG. 3 |
| 8 | 5.25 | 3.81 | 4.37 | 4.37 | 2.85 | 3.75 | .26 x 4 | FIG. 3 |
| 9 | 6.37 | 4.56 | 5.31 | 5.31 | 3.22 | 4.20 | .26 x 4 | FIG. 3 |
| 10 | 6.37 | 4.93 | 5.31 | 5.31 | 3.60 | 4.58 | .26 x 4 | FIG. 3 |
| 11 | 7.50 | 5.31 | 6.25 | 6.75 | 3.60 | 4.85 | .26 x 4 | FIG. 3 |

**DIMENSIONAL TOLERANCE** = ±.06

**TERMINATION:** Less than 16A output — solder lugs
16A or greater output — threaded screws on terminal board; screw height 1" above C dimension.

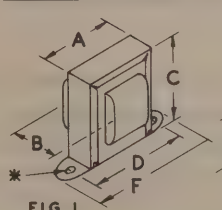


FIG. 1

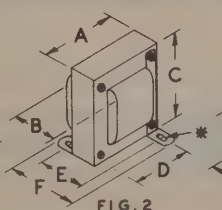
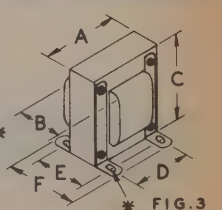


FIG. 2



* FIG. 3

# abbott 60~/400~ P.C. transformers

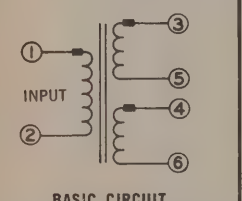
| SPECIFICATIONS | 6PC SERIES | 4PC SERIES |
|---|---|---|
| INPUT PRIMARY: | 115 vac, 50-400 Hz, 1 Phase | 115 vac, 380-420 Hz, 1 Phase |
| REGULATION: | 20% or less from no load to full load | 10% or less from no load to full load |
| SECONDARY VOLTAGE TOLERANCE: | Within 5% of listed output voltage when measured at full load and 115 vac input | |
| INSULATION TEST: | 1000 vac | |
| OPERATING TEMPERATURE: | 85°C maximum ambient | |
| CONSTRUCTION: | Printed circuit pin plug-in | |
| TYPICAL EFFICIENCY RANGE: | 72%-76% | 90%-93% |
| OPTIONS AVAILABLE: | Other output voltages, 230 VAC and 115/230 VAC inputs are available. Please consult our nearest office for complete information. | |

## *features*

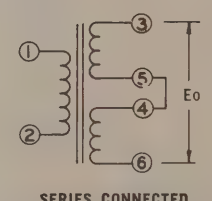
- For Printed Circuits
- Close Regulation
- 85°C Operation
- Small Size
- Stock Delivery

The miniature power transformers listed on this page are specifically designed for mounting on printed circuit boards. Two lines are available: the 6PC Series for 60 Hz application, and the 4PC Series for 400 Hz. Small size, reliability and sensible prices are major features of these OEM transformers. Take a good look at these Models. If you don't find what you want, call us for a special quotation.

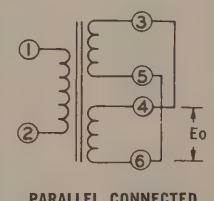
| | | | 60~ | | | | 400~ | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Output Volts (F.L.) | Size | Weight Lbs. Typ. | Output Cur. (Amps) Parallel Connection | Series Connection | Model No. | Price 1-9 Pcs. | Output Cur. (Amps) Parallel Connection | Series Connection | Model No. | Price 1-9 pcs. |
| 5V Parallel | 1 | 0.20 | 0.300 | 0.150 | 6PC5-1 | $5.61 | 2.0 | 1.0 | 4PC5-10 | $7.70 |
| 10VCT Series | 2 | 0.33 | 0.800 | 0.400 | 6PC5-4 | 5.78 | 5.0 | 2.5 | 4PC5-25 | 9.63 |
| | 3 | 0.56 | 1.500 | 0.750 | 6PC5-7 | 6.33 | 8.0 | 4.0 | 4PC5-40 | 10.56 |
| 6.3V Parallel | 1 | 0.20 | 0.238 | 0.119 | 6PC6-1 | 5.61 | 1.58 | 0.79 | 4PC6-10 | 7.70 |
| 12.6VCT Series | 2 | 0.33 | 0.636 | 0.318 | 6PC6-4 | 5.78 | 4.00 | 2.0 | 4PC6-25 | 9.63 |
| | 3 | 0.56 | 1.190 | 0.595 | 6PC6-7 | 6.33 | 8.0 | 4.0 | 4PC6-50 | 10.56 |
| 8V Parallel | 1 | 0.20 | 0.186 | 0.093 | 6PC8-1 | 5.61 | 1.25 | 0.625 | 4PC8-10 | 7.70 |
| 16VCT Series | 2 | 0.33 | 0.500 | 0.250 | 6PC8-4 | 5.78 | 3.12 | 1.56 | 4PC8-25 | 9.63 |
| | 3 | 0.56 | 0.936 | 0.468 | 6PC8-7 | 6.33 | 6.2 | 3.1 | 4PC8-50 | 10.56 |
| 10V Parallel | 1 | 0.20 | 0.150 | 0.075 | 6PC10-1 | 5.61 | 1.0 | 0.5 | 4PC10-10 | 7.70 |
| 20VCT Series | 2 | 0.33 | 0.400 | 0.200 | 6PC10-4 | 5.78 | 2.5 | 1.25 | 4PC10-25 | 9.63 |
| | 3 | 0.56 | 0.750 | 0.375 | 6PC10-7 | 6.33 | 5.0 | 2.5 | 4PC10-50 | 10.56 |
| 12V Parallel | 1 | 0.20 | 0.124 | 0.062 | 6PC12-1 | 5.61 | 0.832 | 0.416 | 4PC12-10 | 7.70 |
| 24VCT Series | 2 | 0.33 | 0.334 | 0.167 | 6PC12-4 | 5.78 | 2.5 | 1.25 | 4PC12-25 | 9.63 |
| | 3 | 0.56 | 0.62 | 0.312 | 6PC12-7 | 6.33 | 4.2 | 2.1 | 4PC12-50 | 10.56 |
| 17V Parallel | 1 | 0.20 | 0.088 | 0.044 | 6PC17-1 | 5.61 | 0.588 | 0.294 | 4PC17-10 | 7.70 |
| 34VCT Series | 2 | 0.33 | 0.236 | 0.118 | 6PC17-4 | 5.78 | 1.47 | 0.735 | 4PC17-25 | 9.63 |
| | 3 | 0.56 | 0.440 | 0.220 | 6PC17-7 | 6.33 | 2.94 | 1.47 | 4PC17-50 | 10.56 |
| 20V Parallel | 1 | 0.20 | 0.074 | 0.037 | 6PC20-1 | 5.61 | 0.500 | 0.250 | 4PC20-10 | 7.70 |
| 40VCT Series | 2 | 0.33 | 0.200 | 0.100 | 6PC20-4 | 5.78 | 1.25 | 0.625 | 4PC20-25 | 9.63 |
| | 3 | 0.56 | 0.374 | 0.187 | 6PC20-7 | 6.33 | 2.50 | 1.25 | 4PC20-50 | 10.56 |
| 28V Parallel | 1 | 0.20 | 0.052 | 0.026 | 6PC28-1 | 5.61 | 0.356 | 0.178 | 4PC28-10 | 7.70 |
| 56VCT Series | 2 | 0.33 | 0.144 | 0.072 | 6PC28-4 | 5.78 | 0.892 | 0.446 | 4PC28-25 | 9.63 |
| | 3 | 0.56 | 0.266 | 0.133 | 6PC28-7 | 6.33 | 1.78 | 0.89 | 4PC28-50 | 10.56 |
| 44V Parallel | 1 | 0.20 | 0.034 | 0.017 | 6PC44-1 | 5.61 | 0.226 | 0.113 | 4PC44-10 | 7.70 |
| 88VCT Series | 2 | 0.33 | 0.092 | 0.046 | 6PC44-4 | 5.78 | 0.568 | 0.284 | 4PC44-25 | 9.63 |
| | 3 | 0.56 | 0.170 | 0.085 | 6PC44-7 | 6.33 | 1.12 | 0.56 | 4PC44-50 | 10.56 |
| 60V Parallel | 1 | 0.20 | 0.024 | 0.012 | 6PC60-1 | 5.61 | 0.166 | 0.083 | 4PC60-10 | 7.70 |
| 120VCT Series | 2 | 0.33 | 0.068 | 0.034 | 6PC60-4 | 5.78 | 0.416 | 0.208 | 4PC60-25 | 9.63 |
| | 3 | 0.56 | 0.124 | 0.062 | 6PC60-7 | 6.33 | 0.82 | 0.41 | 4PC60-50 | 10.56 |



BASIC CIRCUIT



SERIES CONNECTED



PARALLEL CONNECTED

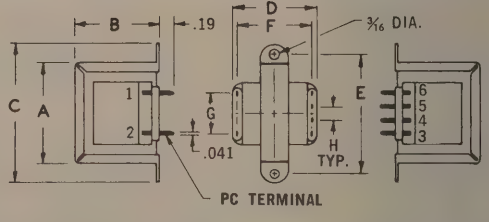
## QUANTITY DISCOUNTS

| | |
|---|---|
| 1-9 pcs. | — price listed. |
| 10-24 pcs. | — less 10% of the 1-9 piece price. |
| 25-49 pcs. | — less 19% of the 1-9 piece price. |
| 50-99 pcs. | — less 25% of the 1-9 piece price. |
| Above 100 pcs. | — Contact nearest office for an exact quotation. |

All Prices subject to change without notice.

| SIZE | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.46 | 1.22 | 2.06 | 1.13 | 1.75 | 1.00 | .600 | .200 |
| 2 | 1.72 | 1.40 | 2.35 | 1.23 | 2.00 | 1.10 | .750 | .250 |
| 3 | 1.96 | 1.65 | 2.81 | 1.43 | 2.37 | 1.30 | .750 | .250 |

DIMENSIONAL TOLERANCE: .XX = ±.02 .XXX = ±.007



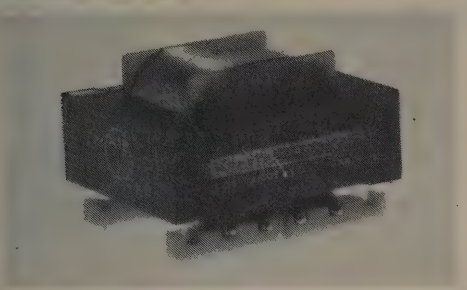

abbott transistor
TRANSFORMER DIVISION

GENERAL OFFICES
Dept. EM 639 S. Glenwood Place
Burbank, CA 91506
(213) 841-3630
Telex 69-6282

EASTERN OFFICES
Dept. EM, 1224 Anderson Ave.
Fort Lee, NJ 07024
(201) 224-6900
Telex 13-5332

abbott

# low profile transformers



These miniature power transformers are specifically designed for use in PC board card racks where height above the board is critical. These low profile transformers have a height of only 1.03 inches for 1.2 watts output, 1.17 inches for 3.25 watts output, and 1.31 inches for 6.0 watts output.

If the exact unit you require is not listed as a standard item, please contact our nearest office and we will be happy to quote on your exact requirements.

| Output Volts (F.L.) | Output Current (Amps) Parallel Connection | Output Current (Amps) Series Connection | Size | Weight Lbs. Typ. | Model No. | Price 1-9 Pcs. |
|---|---|---|---|---|---|---|
| 5V Parallel | 0.240 | 0.120 | 1 | 0.18 | 6LP5-1 | $6.33 |
| 10V.C.T. Series | 0.650 | 0.325 | 2 | 0.31 | 6LP5-3 | 6.49 |
| | 1.2000 | 0.600 | 3 | 0.52 | 6LP5-6 | 7.48 |
| 6.3V Parallel | 0.190 | 0.095 | 1 | 0.18 | 6LP6-1 | 6.33 |
| 12.6V.C.T. Series | 0.516 | 0.258 | 2 | 0.31 | 6LP6-3 | 6.49 |
| | 0.954 | 0.477 | 3 | 0.52 | 6LP6-6 | 7.48 |
| 8V Parallel | 0.150 | 0.075 | 1 | 0.18 | 6LP8-1 | 6.33 |
| 16V.C.T. Series | 0.406 | 0.203 | 2 | 0.31 | 6LP8-3 | 6.49 |
| | 0.750 | 0.375 | 3 | 0.52 | 6LP8-6 | 7.48 |
| 10V Parallel | 0.120 | 0.060 | 1 | 0.18 | 6LP10-1 | 6.33 |
| 20V.C.T. Series | 0.326 | 0.163 | 2 | 0.31 | 6LP10-3 | 6.49 |
| | 0.600 | 0.300 | 3 | 0.52 | 6LP10-6 | 7.48 |
| 12V Parallel | 0.100 | 0.050 | 1 | 0.18 | 6LP12-1 | 6.33 |
| 24V.C.T. Series | 0.272 | 0.136 | 2 | 0.31 | 6LP12-3 | 6.49 |
| | 0.500 | 0.250 | 3 | 0.52 | 6LP12-6 | 7.48 |
| 17V Parallel | 0.070 | 0.035 | 1 | 0.18 | 6LP17-1 | 6.33 |
| 34V.C.T. Series | 0.192 | 0.096 | 2 | 0.31 | 6LP17-3 | 6.49 |
| | 0.352 | 0.176 | 3 | 0.52 | 6LP17-6 | 7.48 |
| 20V Parallel | 0.060 | 0.030 | 1 | 0.18 | 6LP20-1 | 6.33 |
| 40V.C.T. Series | 0.160 | 0.080 | 2 | 0.31 | 6LP20-3 | 6.49 |
| | 0.300 | 0.150 | 3 | 0.52 | 6LP20-6 | 7.48 |
| 28V Parallel | 0.044 | 0.022 | 1 | 0.18 | 6LP28-1 | 6.33 |
| 56V.C.T. Series | 0.116 | 0.058 | 2 | 0.31 | 6LP28-3 | 6.49 |
| | 0.214 | 0.107 | 3 | 0.52 | 6LP28-6 | 7.48 |
| 44V Parallel | 0.028 | 0.014 | 1 | 0.18 | 6LP44-1 | 6.33 |
| 88V.C.T. Series | 0.074 | 0.037 | 2 | 0.31 | 6LP44-3 | 6.49 |
| | 0.136 | 0.068 | 3 | 0.52 | 6LP44-6 | 7.48 |
| 60V Parallel | 0.020 | 0.010 | 1 | 0.18 | 6LP60-1 | 6.33 |
| 120V.C.T. Series | 0.054 | 0.027 | 2 | 0.31 | 6LP60-3 | 6.49 |
| | 0.100 | 0.050 | 3 | 0.52 | 6LP60-6 | 7.48 |

## *features*

- Low Profile PC Mounting
- 85°C Operation
- Hi-Reliability

## *specifications*

**INPUT PRIMARY:** 115 VAC standard.
230 VAC at no additional cost. Specify by suffixing "A" to model number.
115/230 VAC dual input at 10% additional. Specify by suffixing "B" to model number.

**INPUT FREQUENCY:** 50 to 400 Hz, 1 phase

**REGULATION:** 20% or less from no load to full load.

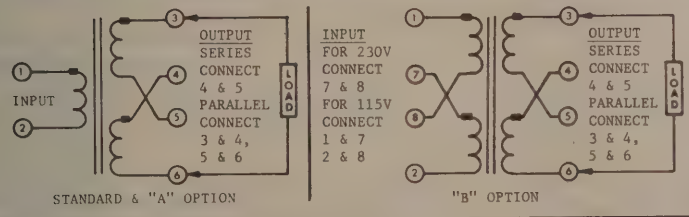
**SECONDARY VOLTAGE TOLERANCE:** Within 5% of listed output voltage when measured at full load and 115 VAC input.

**INSULATION TEST:** 1000 VAC.

**OPERATING TEMPERATURE:** 85°C maximum ambient.

**CONSTRUCTION:** Printed circuit pin plug in.

**APPROXIMATE EFFICIENCY:** Ranges from 72% to 76%.


INPUT
OUTPUT SERIES CONNECT 4 & 5 PARALLEL CONNECT 3 & 4, 5 & 6
LOAD
INPUT FOR 230V CONNECT 7 & 8 FOR 115V CONNECT 1 & 7 2 & 8
OUTPUT SERIES CONNECT 4 & 5 PARALLEL CONNECT 3 & 4, 5 & 6
LOAD

STANDARD & "A" OPTION "B" OPTION

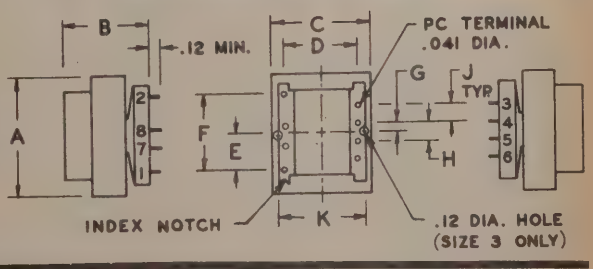
## QUANTITY DISCOUNTS

| | |
|---|---|
| 1-9 pcs. | — price listed. |
| 10-24 pcs. | — less 10% of the 1-9 piece price. |
| 25-49 pcs. | — less 19% of the 1-9 piece price. |
| 50-99 pcs. | — less 25% of the 1-9 piece price. |
| Above 100 pcs. | — Contact nearest office for an exact quotation. |

All Prices subject to change without notice.

| Size | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.37 | 1.03 | 1.12 | .85 | .250 | .550 | .100 | .200 | .200 | 1.000 |
| 2 | 1.62 | 1.17 | 1.31 | .95 | .375 | .750 | .125 | .250 | .250 | 1.160 |
| 3 | 1.87 | 1.31 | 1.56 | 1.10 | .650 | 1.400 | .150 | .300 | .300 | 1.250 |

DIMENSIONAL TOLERANCE .XX = ±.02 .XXX = ±.007



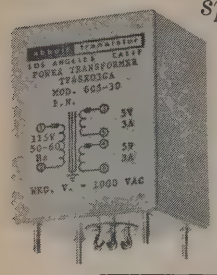

abbott transistor
TRANSFORMER DIVISION

**GENERAL OFFICES**
Dept. EM 639 S. Glenwood Place
Burbank, CA 91506
(213) 841-3630
Telex 69-6282

**EASTERN OFFICES**
Dept. EM, 1224 Anderson Ave.
Fort Lee, NJ 07024
(201) 224-6900
Telex 13-5332

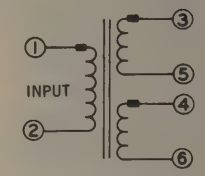
# abbott 60 ~/400 ~ MIL-T-27D power transformers

*specifications*

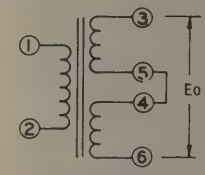


| Specifications | 6C Series | 4A Series |
|---|---|---|
| INPUT PRIMARY: | 115 VAC, 50 to 65 Hz, 1 Phase | 115V , 400 Hz ±20 Hz, 1 Phase |
| REGULATION: | 10% no load to full load | 10% no load to full load |
| SECONDARY VOLTAGE TOLERANCE: | Within 3% when measured at full load and 115 VAC input | Within 5% when measured at full load and 115 VAC input |
| INSULATION TEST: | 1500 VAC | 1500 VAC |
| OPERATING TEMP.: | 90°C maximum ambient | 105°C maximum ambient |
| CONSTRUCTION: | To MIL-T-27D, grade 4, class "S", life "X", (10,000 hrs.) | To MIL-T-27D, grade 5, class "S", life "X", (10,000 hrs.) |
| EFFICIENCY: | From 80% to 90% | From 90% to 93% |
| ENVIRONMENT: | Encapsulated to meet MIL-STD-810B for vibration, shock, sand, dust, humidity, salt spray, fungus, sunshine, rain, explosion, and altitude (to a vacuum). NOTE: for high altitude operation, encapsulate terminals. | |
| OPTIONS AVAILABLE: | Other output voltages and 230 VAC input are available. Please consult our nearest office for complete information. | |

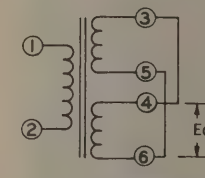
| | 60 ~ | | | | | | 400 ~ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Output Current (Amps) | | | | | | Output Current (Amps) | | | | | |
| Output Volts (F.L.) | Parallel Connection | Series Connection | Size | Weight Lbs. Typ. | Model Number | Price 1-4 Pcs. | Parallel Connection | Series Connection | Size | Weight Lbs. Typ. | Model Number | Price 1-4 Pcs. |
| 5V Parallel | 1.00 | 0.50 | EB | 1.2 | 6C5-5 | $35.00 | 1.40 | 0.70 | 1 | .26 | 4A5-7 | $22.00 |
| 10V.C.T. | 3.00 | 1.50 | FA | 2.2 | 6C5-15 | 40.00 | 2.00 | 1.00 | 2 | .30 | 4A5-10 | 23.10 |
| Series | 6.00 | 3.00 | GA | 3.3 | 6C5-30 | 45.00 | 5.00 | 2.50 | 3 | .47 | 4A5-25 | 25.30 |
| | 12.00 | 6.00 | HA | 4.7 | 6C5-60 | 50.00 | 8.00 | 4.00 | 4 | .77 | 4A5-50 | 28.60 |
| | 20.00 | 10.00 | JA | 7.4 | 6C5-100 | 60.00 | | | | | | |
| 6.3V Parallel | 0.80 | 0.40 | EB | 1.2 | 6C6-5 | 35.00 | 1.11 | 0.55 | 1 | .26 | 4A6-7 | 22.00 |
| 12.6V.C.T. | 2.38 | 1.19 | FA | 2.2 | 6C6-15 | 40.00 | 1.58 | 0.79 | 2 | .30 | 4A6-10 | 23.10 |
| Series | 4.76 | 2.38 | GA | 3.3 | 6C6-30 | 45.00 | 4.00 | 2.00 | 3 | .47 | 4A6-25 | 25.30 |
| | 9.52 | 4.76 | HA | 4.7 | 6C6-60 | 50.00 | 8.00 | 4.00 | 4 | .77 | 4A6-50 | 28.60 |
| | 20.00 | 10.00 | JA | 7.4 | 6C6-126 | 60.00 | | | | | | |
| 8V Parallel | 0.62 | 0.31 | EB | 1.2 | 6C8-5 | 35.00 | 0.874 | 0.437 | 1 | .26 | 4A8-7 | 22.00 |
| 16V.C.T. | 1.86 | 0.93 | FA | 2.2 | 6C8-15 | 40.00 | 1.25 | 0.625 | 2 | .30 | 4A8-10 | 23.10 |
| Series | 3.72 | 1.86 | GA | 3.3 | 6C8-30 | 45.00 | 3.12 | 1.56 | 3 | .47 | 4A8-25 | 25.30 |
| | 7.44 | 3.72 | HA | 4.7 | 6C8-60 | 50.00 | 6.24 | 3.12 | 4 | .77 | 4A8-50 | 28.60 |
| | 17.50 | 8.75 | JA | 7.4 | 6C8-140 | 60.00 | | | | | | |
| | 20.00 | 10.00 | KA | 9.8 | 6C8-160 | 65.00 | | | | | | |
| 10V Parallel | 0.50 | 0.25 | EB | 1.2 | 6C10-5 | 35.00 | 0.70 | 0.35 | 1 | .26 | 4A10-7 | 22.00 |
| 20V.C.T. | 1.50 | 0.75 | FA | 2.2 | 6C10-15 | 40.00 | 1.00 | 0.50 | 2 | .30 | 4A10-10 | 23.10 |
| Series | 3.00 | 1.50 | GA | 3.3 | 6C10-30 | 45.00 | 2.50 | 1.25 | 3 | .47 | 4A10-25 | 25.30 |
| | 6.00 | 3.00 | HA | 4.7 | 6C10-60 | 50.00 | 5.00 | 2.50 | 4 | .77 | 4A10-50 | 28.60 |
| | 14.00 | 7.00 | JA | 7.4 | 6C10-140 | 60.00 | | | | | | |
| | 17.00 | 8.50 | KA | 9.8 | 6C10-170 | 65.00 | | | | | | |
| 12V Parallel | 0.40 | 0.20 | EB | 1.2 | 6C12-5 | 35.00 | 0.58 | 0.29 | 1 | .26 | 4A12-7 | 22.00 |
| 24V.C.T. | 1.20 | 0.60 | FA | 2.2 | 6C12-15 | 40.00 | 0.84 | 0.42 | 2 | .30 | 4A12-10 | 23.10 |
| Series | 2.40 | 1.20 | GA | 3.3 | 6C12-30 | 45.00 | 2.08 | 1.04 | 3 | .47 | 4A12-25 | 25.30 |
| | 4.80 | 2.40 | HA | 4.7 | 6C12-60 | 50.00 | 4.16 | 2.08 | 4 | .77 | 4A12-50 | 28.60 |
| | 11.60 | 5.80 | JA | 7.4 | 6C12-140 | 60.00 | | | | | | |
| | 14.16 | 7.08 | KA | 9.8 | 6C12-170 | 65.00 | | | | | | |
| 17V Parallel | 0.30 | 0.15 | EB | 1.2 | 6C17-5 | 35.00 | 0.411 | 0.205 | 1 | .26 | 4A17-7 | 22.00 |
| 34V.C.T. | 0.88 | 0.44 | FA | 2.2 | 6C17-15 | 40.00 | 0.588 | 0.294 | 2 | .30 | 4A17-10 | 23.10 |
| Series | 1.76 | 0.88 | GA | 3.3 | 6C17-30 | 45.00 | 1.47 | 0.735 | 3 | .47 | 4A17-25 | 25.30 |
| | 3.52 | 1.76 | HA | 4.7 | 6C17-60 | 50.00 | 2.94 | 1.47 | 4 | .77 | 4A17-50 | 28.60 |
| | 8.20 | 4.10 | JA | 7.4 | 6C17-140 | 60.00 | | | | | | |
| | 10.00 | 5.00 | KA | 9.8 | 6C17-170 | 65.00 | | | | | | |
| 20V Parallel | 0.24 | 0.12 | EB | 1.2 | 6C20-5 | 35.00 | 0.350 | 0.175 | 1 | .26 | 4A20-7 | 22.00 |
| 40V.C.T. | 0.72 | 0.36 | FA | 2.2 | 6C20-15 | 40.00 | 0.50 | 0.250 | 2 | .30 | 4A20-10 | 23.10 |
| Series | 1.44 | 0.72 | GA | 3.3 | 6C20-30 | 45.00 | 1.25 | 0.625 | 3 | .47 | 4A20-25 | 25.30 |
| | 2.88 | 1.44 | HA | 4.7 | 6C20-60 | 50.00 | 2.50 | 1.25 | 4 | .77 | 4A20-50 | 28.60 |
| | 7.00 | 3.50 | JA | 7.4 | 6C20-140 | 60.00 | | | | | | |
| | 8.50 | 4.25 | KA | 9.8 | 6C20-170 | 65.00 | | | | | | |
| 28V Parallel | 0.18 | 0.09 | EB | 1.2 | 6C28-5 | 35.00 | 0.250 | 0.125 | 1 | .26 | 4A28-7 | 22.00 |
| 56V.C.T. | 0.54 | 0.27 | FA | 2.2 | 6C28-15 | 40.00 | 0.356 | 0.178 | 2 | .30 | 4A28-10 | 23.10 |
| Series | 1.08 | 0.54 | GA | 3.3 | 6C28-30 | 45.00 | 0.892 | 0.446 | 3 | .47 | 4A28-25 | 25.30 |
| | 2.16 | 1.08 | HA | 4.7 | 6C28-60 | 50.00 | 1.78 | 0.89 | 4 | .77 | 4A28-50 | 28.60 |
| | 5.00 | 2.50 | JA | 7.4 | 6C28-140 | 60.00 | | | | | | |
| | 6.06 | 3.03 | KA | 9.8 | 6C28-170 | 65.00 | | | | | | |
| 44V Parallel | 0.10 | 0.05 | EB | 1.2 | 6C44-5 | 35.00 | 0.158 | 0.079 | 1 | .26 | 4A44-7 | 22.00 |
| 88V.C.T. | 0.30 | 0.15 | FA | 2.2 | 6C44-15 | 40.00 | 0.226 | 0.113 | 2 | .30 | 4A44-10 | 23.10 |
| Series | 0.60 | 0.30 | GA | 3.3 | 6C44-30 | 45.00 | 0.568 | 0.284 | 3 | .47 | 4A44-25 | 25.30 |
| | 1.20 | 0.60 | HA | 4.7 | 6C44-60 | 50.00 | 1.12 | 0.56 | 4 | .77 | 4A44-50 | 28.60 |
| | 3.16 | 1.58 | JA | 7.4 | 6C44-140 | 60.00 | | | | | | |
| | 3.86 | 1.93 | KA | 9.8 | 6C44-170 | 65.00 | | | | | | |
| 60V Parallel | 0.08 | 0.04 | EB | 1.2 | 6C60-5 | 35.00 | 0.116 | 0.058 | 1 | .26 | 4A60-7 | 22.00 |
| 120V.C.T. | 0.24 | 0.12 | FA | 2.2 | 6C60-15 | 40.00 | 0.166 | 0.083 | 2 | .30 | 4A60-10 | 23.10 |
| Series | 0.48 | 0.24 | GA | 3.3 | 6C60-30 | 45.00 | 0.416 | 0.208 | 3 | .47 | 4A60-25 | 25.30 |
| | 0.96 | 0.48 | HA | 4.7 | 6C60-60 | 50.00 | 0.82 | 0.41 | 4 | .77 | 4A60-50 | 28.60 |
| | 2.32 | 1.16 | JA | 7.4 | 6C60-140 | 60.00 | | | | | | |
| | 2.82 | 1.41 | KA | 9.8 | 6C60-170 | 65.00 | | | | | | |




BASIC CIRCUIT




SERIES CONNECTED




PARALLEL CONNECTED

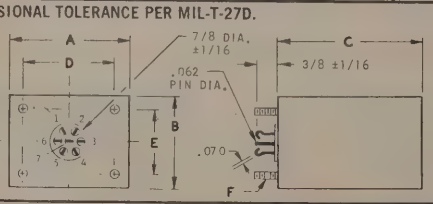
## QUANTITY DISCOUNTS

1-4 pcs. - price listed
5-9 pcs. - less 4% of the 1-4 piece price.
10-24 pcs. - less 8% of the 1-4 piece price.
25-49 pcs. - less 13% of the 1-4 piece price.
50-99 pcs. - less 19% of the 1-4 piece price.
Above 100 pcs. - Contact nearest office for an exact quotation.

All Prices subject to change without notice.

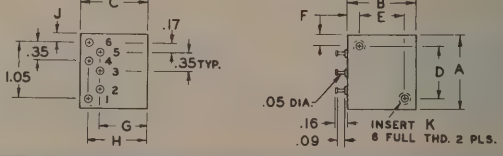
| Size | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| EB | 1.938 | 1.812 | 2.438 | 1.375 | 1.250 | 6-32 x 3/8 |
| FA | 2.312 | 2.062 | 3.125 | 1.688 | 1.438 | 6-32 x 3/8 |
| GA | 2.750 | 2.375 | 3.812 | 2.125 | 1.750 | 6-32 x 3/8 |
| HA | 3.062 | 2.625 | 4.250 | 2.297 | 1.859 | 8-32 x 3/8 |
| JA | 3.562 | 3.062 | 4.875 | 2.625 | 2.125 | 8-32 x 3/8 |
| KA | 3.938 | 3.375 | 5.250 | 3.000 | 2.438 | 10-32 x 1/2 |

DIMENSIONAL TOLERANCE PER MIL-T-27D.




| Size | A | B | C | D | E | F | G | H | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.37 | 1.25 | 1.31 | 1.00 | .87 | .19 | 1.00 | 1.19 | .16 | 4-40 |
| 2 | 1.50 | 1.37 | 1.37 | 1.12 | 1.00 | .19 | 1.06 | 1.25 | .22 | 4-40 |
| 3 | 1.75 | 1.50 | 1.56 | 1.25 | 1.00 | .25 | 1.25 | 1.44 | .35 | 6-32 |
| 4 | 2.00 | 1.62 | 1.81 | 1.50 | 1.12 | .25 | 1.50 | 1.69 | .47 | 6-32 |

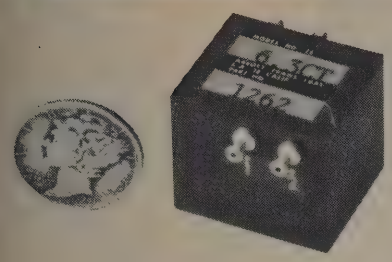
DIMENSIONAL TOLERANCE = ±.02, EXCEPT F, G, H, J = ±.04






Add Dept. EM to address to tell them you saw it in eem

# abbott 400 ~ transformers



## *features*

- Hermetically sealed
- 105°C operation
- To meet MIL-T-27D
- Designed exclusively for 400 Hz
- For aerospace application
- Molded diallyl phthalate

**DELIVERY IS FROM STOCK**

## *specifications*

**Input Primary**
115V, 400 Hz ±20 Hz, 1 phase

**Regulation**
10% no load to full load

**Secondary Voltage Tolerance**
Within 5% when measured at full load and 115 VAC input

**Insulation Test**
2500 VDC or 150% of secondary voltage (whichever is higher)

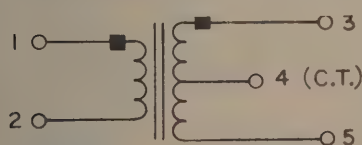
**Construction**
To MIL-T-27D, grade: 5, class: "S", life: "X" (10,000 hrs.) case: smaller

**Environment**
Encapsulated to meet MIL-STD-810B, including vibration to Proc. XII, temperature to 105°C, shock, sand, dust, humidity, saltspray, fungus, sunshine, rain, explosion, and altitude (to a vacuum)

**Output Secondary**
See voltage and current of specific models listed

Other models are available with outputs to 5000V. Contact our nearest office for complete information.

### TYPICAL CIRCUIT DIAGRAM



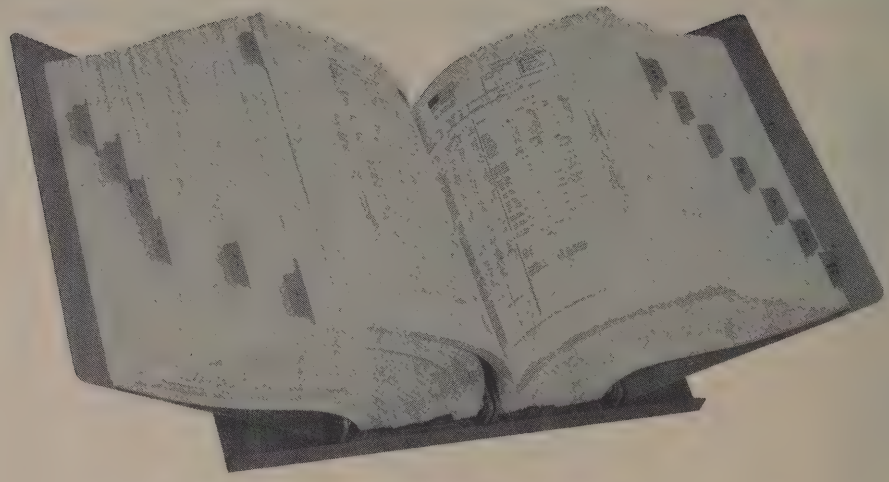

"■" refers to in-phase points

| Case Size | Width (in.) | Depth (in.) | Height (in.) | Weight (lbs.) |
|---|---|---|---|---|
| A | 0.87 | 0.74 | 0.78 | 0.06 |
| B | 1.25 | 1.19 | 0.88 | 0.12 |
| C | 1.43 | 1.24 | 1.27 | 0.26 |
| D | 1.47 | 1.28 | 1.40 | 0.29 |
| E | 2.31 | 1.52 | 1.75 | 0.75 |
| F | 2.75 | 2.71 | 2.31 | 1.84 |

| Output Volt | Output Current (Amps) | Size | Sec. DCR (ohms) | Model Number | Price 1 Pc. | Price 2-4 Pcs. |
|---|---|---|---|---|---|---|
| 5.0 | 0.400 | A | 0.60 | 2E5CT | $34.56 | $28.20 |
| | 1.200 | B | 0.144 | 6E5CT | 33.20 | 27.60 |
| | 3.000 | C | 0.046 | 15E5CT | 31.68 | 26.40 |
| | 4.800 | D | 0.040 | 24E5CT | 34.32 | 28.60 |
| | 16.000 | E | 0.009 | 80E5CT | 43.20 | 36.00 |
| | 35.000 | F | 0.012 | 175E5CT | 66.00 | 55.00 |
| 6.3 | 0.317 | A | 1.06 | 2E6.3CT | 34.56 | 28.20 |
| | 0.950 | B | 0.24 | 6E6.3CT | 33.20 | 27.60 |
| | 2.380 | C | 0.088 | 15E6.3CT | 31.68 | 26.40 |
| | 3.800 | D | 0.107 | 24E6.3CT | 34.32 | 28.60 |
| | 12.800 | E | 0.016 | 80E6.3CT | 43.20 | 36.00 |
| | 27.800 | F | 0.019 | 175E6.3CT | 66.00 | 55.00 |
| 8.0 | 0.250 | A | 1.63 | 2E8CT | 34.56 | 28.20 |
| | 0.750 | B | 0.396 | 6E8CT | 33.20 | 27.60 |
| | 1.880 | C | 0.135 | 15E8CT | 31.68 | 26.40 |
| | 3.000 | D | 0.140 | 24E8CT | 34.32 | 28.60 |
| | 10.000 | E | 0.017 | 80E8CT | 43.20 | 36.00 |
| | 22.000 | F | 0.010 | 175E8CT | 66.00 | 55.00 |
| 10 | 0.200 | A | 2.50 | 2E10CT | 34.56 | 28.20 |
| | 0.600 | B | 0.587 | 6E10CT | 33.20 | 27.60 |
| | 1.500 | C | 0.27 | 15E10CT | 31.68 | 26.40 |
| | 2.400 | D | 0.180 | 24E10CT | 34.32 | 28.60 |
| | 8.000 | E | 7.2 | 80E10CT | 43.20 | 36.00 |
| | 17.500 | F | 0.020 | 175E10CT | 66.00 | 55.00 |
| 12.6 | 0.158 | A | 4.10 | 2E12.6CT | 34.56 | 28.20 |
| | 0.475 | B | 0.99 | 6E12.6CT | 33.20 | 27.60 |
| | 1.180 | C | 0.32 | 15E12.6CT | 31.68 | 26.40 |
| | 1.900 | D | 0.225 | 24E12.6CT | 34.32 | 28.60 |
| | 6.350 | E | 0.030 | 80E12.6CT | 43.20 | 36.00 |
| | 13.900 | F | 0.021 | 175E12.6CT | 66.00 | 55.00 |
| 14 | 0.142 | A | 5.59 | 2E14CT | 34.56 | 28.20 |
| | 0.428 | B | 1.11 | 6E14CT | 33.20 | 27.60 |
| | 1.070 | C | 0.35 | 15E14CT | 31.68 | 26.40 |
| | 1.720 | D | 0.32 | 24E14CT | 34.32 | 28.60 |
| | 5.600 | E | 0.04 | 80E14CT | 43.20 | 36.00 |
| | 12.500 | F | 0.022 | 175E14CT | 66.00 | 55.00 |
| 16 | 0.125 | A | 6.63 | 2E16CT | 34.56 | 28.20 |
| | 0.375 | B | 1.58 | 6E16CT | 33.20 | 27.60 |
| | 0.940 | C | 0.54 | 15E16CT | 31.68 | 26.40 |
| | 1.500 | D | 0.35 | 24E16CT | 34.32 | 28.60 |
| | 5.000 | E | 0.05 | 80E16CT | 43.20 | 36.00 |
| | 10.900 | F | 0.025 | 175E16CT | 66.00 | 55.00 |
| 18 | 0.111 | A | 9.00 | 2E18CT | 34.56 | 28.20 |
| | 0.333 | B | 2.21 | 6E18CT | 33.20 | 27.60 |
| | 0.832 | C | 0.74 | 15E18CT | 31.68 | 26.40 |
| | 1.330 | D | 0.40 | 24E18CT | 34.32 | 28.60 |
| | 4.450 | E | 0.08 | 80E18CT | 43.20 | 36.00 |
| | 9.700 | F | 0.027 | 175E18CT | 66.00 | 55.00 |
| 20 | 0.100 | A | 10.9 | 2E20CT | 34.56 | 28.20 |
| | 0.300 | B | 2.78 | 6E20CT | 33.20 | 27.60 |
| | 0.750 | C | 1.4 | 15E20CT | 31.68 | 26.40 |
| | 1.200 | D | 0.48 | 24E20CT | 34.32 | 28.60 |
| | 4.000 | E | 0.09 | 80E20CT | 43.20 | 36.00 |
| | 8.750 | F | 0.020 | 175E20CT | 66.00 | 55.00 |
| 22 | 0.091 | A | 14.6 | 2E22CT | 34.56 | 28.20 |
| | 0.273 | B | 2.80 | 6E22CT | 33.20 | 27.60 |
| | 0.680 | C | 0.92 | 15E22CT | 31.68 | 26.40 |
| | 1.090 | D | 0.63 | 24E22CT | 34.32 | 28.60 |
| | 3.630 | E | 0.12 | 80E22CT | 43.20 | 36.00 |
| | 7.900 | F | 0.020 | 175E22CT | 66.00 | 55.00 |
| 25 | 0.080 | A | 20.4 | 2E25CT | 34.56 | 28.20 |
| | 0.240 | B | 3.60 | 6E25CT | 33.20 | 27.60 |
| | 0.600 | C | 1.3 | 15E25CT | 31.68 | 26.40 |
| | 0.900 | D | 0.68 | 24E25CT | 34.32 | 28.60 |
| | 3.200 | E | 0.13 | 80E25CT | 43.20 | 36.00 |
| | 7.000 | F | 0.042 | 175E25CT | 66.00 | 55.00 |
| 28 | 0.071 | A | 30.0 | 2E28CT | 34.56 | 28.20 |
| | 0.214 | B | 4.20 | 6E28CT | 33.20 | 27.60 |
| | 0.535 | C | 1.83 | 15E28CT | 31.68 | 26.40 |
| | 0.855 | D | 0.98 | 24E28CT | 34.32 | 28.60 |
| | 2.850 | E | 0.14 | 80E28CT | 43.20 | 36.00 |
| | 6.250 | F | 0.043 | 175E28CT | 66.00 | 55.00 |
| 31 | 0.064 | A | 25.6 | 2E31CT | 34.56 | 28.20 |
| | 0.192 | B | 5.71 | 6E31CT | 33.20 | 27.60 |
| | 0.485 | C | 1.62 | 15E31CT | 31.68 | 26.40 |
| | 0.772 | D | 1.27 | 24E31CT | 34.32 | 28.60 |
| | 2.470 | E | 0.18 | 80E31CT | 43.20 | 36.00 |
| | 5.650 | F | 0.061 | 175E31CT | 66.00 | 55.00 |
| 35 | 0.057 | A | 29.5 | 2E35CT | 34.56 | 28.20 |
| | 0.171 | B | 6.89 | 6E35CT | 33.20 | 27.60 |
| | 0.428 | C | 2.28 | 15E35CT | 31.68 | 26.40 |
| | 0.685 | D | 1.70 | 24E35CT | 34.32 | 28.60 |
| | 2.280 | E | 0.28 | 80E35CT | 43.20 | 36.00 |
| | 5.000 | F | 0.098 | 175E35CT | 66.00 | 55.00 |
| 39 | 0.051 | A | 38.6 | 2E39CT | 34.56 | 28.20 |
| | 0.154 | B | 9.39 | 6E39CT | 33.20 | 27.60 |
| | 0.384 | C | 2.54 | 15E39CT | 31.68 | 26.40 |
| | 0.615 | D | 2.20 | 24E39CT | 34.32 | 28.60 |
| | 2.050 | E | 0.32 | 80E39CT | 43.20 | 36.00 |
| | 4.480 | F | 0.110 | 175E39CT | 66.00 | 55.00 |
| 43 | 0.046 | A | 44.3 | 2E43CT | 34.56 | 28.20 |
| | 0.139 | B | 10.25 | 6E43CT | 33.20 | 27.60 |
| | 0.348 | C | 2.85 | 15E43CT | 31.68 | 26.40 |
| | 0.556 | D | 2.42 | 24E43CT | 34.32 | 28.60 |
| | 1.860 | E | 0.35 | 80E43CT | 43.20 | 36.00 |
| | 4.060 | F | 0.114 | 175E43CT | 66.00 | 55.00 |

| Output Volt | Output Current (Amps) | Size | Sec. DCR (ohms) | Model Number | Price 1 Pc. | Price 2-4 Pcs. |
|---|---|---|---|---|---|---|
| 48 | 0.041 | A | 57. | 2E48CT | $34.56 | $28.20 |
| | 0.125 | B | 15.30 | 6E48CT | 33.20 | 27.60 |
| | 0.312 | C | 4.05 | 15E48CT | 31.68 | 26.40 |
| | 0.500 | D | 3.27 | 24E48CT | 34.32 | 28.60 |
| | 1.660 | E | 0.40 | 80E48CT | 43.20 | 36.00 |
| | 3.650 | F | 0.160 | 175E48CT | 66.00 | 55.00 |
| 55 | 0.036 | A | 89. | 2E55CT | 34.56 | 28.20 |
| | 0.109 | B | 17.30 | 6E55CT | 33.20 | 27.60 |
| | 0.262 | C | 7.2 | 15E55CT | 31.68 | 26.40 |
| | 0.435 | D | 3.83 | 24E55CT | 34.32 | 28.60 |
| | 1.450 | E | 0.67 | 80E55CT | 43.20 | 36.00 |
| | 3.170 | F | 0.196 | 175E55CT | 66.00 | 55.00 |
| 63 | 0.031 | A | 100. | 2E63CT | 34.56 | 28.20 |
| | 0.095 | B | 24.9 | 6E63CT | 33.20 | 27.60 |
| | 0.238 | C | 6.51 | 15E63CT | 31.68 | 26.40 |
| | 0.380 | D | 5.35 | 24E63CT | 34.32 | 28.60 |
| | 1.270 | E | 0.71 | 80E63CT | 43.20 | 36.00 |
| | 2.770 | F | 0.20 | 175E63CT | 66.00 | 55.00 |
| 70 | 0.028 | A | 139 | 2E70CT | 34.56 | 28.20 |
| | 0.085 | B | 27.1 | 6E70CT | 33.20 | 27.60 |
| | 0.214 | C | 9.4 | 15E70CT | 31.68 | 26.40 |
| | 0.342 | D | 8.10 | 24E70CT | 34.32 | 28.60 |
| | 1.140 | E | 0.80 | 80E70CT | 43.20 | 36.00 |
| | 2.500 | F | 0.25 | 175E70CT | 66.00 | 55.00 |
| 80 | 0.025 | A | 163. | 2E80CT | 34.56 | 28.20 |
| | 0.075 | B | 39.0 | 6E80CT | 33.20 | 27.60 |
| | 0.198 | C | 13.4 | 15E80CT | 31.68 | 26.40 |
| | 0.300 | D | 9.0 | 24E80CT | 34.32 | 28.60 |
| | 1.000 | E | 0.92 | 80E80CT | 43.20 | 36.00 |
| | 2.180 | F | 0.34 | 175E80CT | 66.00 | 55.00 |
| 90 | 0.022 | A | 218. | 2E90CT | 34.56 | 28.20 |
| | 0.067 | B | 41.0 | 6E90CT | 33.20 | 27.60 |
| | 0.166 | C | 15.9 | 15E90CT | 31.68 | 26.40 |
| | 0.267 | D | 12.5 | 24E90CT | 34.32 | 28.60 |
| | 0.890 | E | 1.08 | 80E90CT | 43.20 | 36.00 |
| | 1.940 | F | 0.38 | 175E90CT | 66.00 | 55.00 |
| 100 | 0.020 | A | 283. | 2E100CT | 34.56 | 28.20 |
| | 0.060 | B | 59.5 | 6E100CT | 33.20 | 27.60 |
| | 0.150 | C | 16.8 | 15E100CT | 31.68 | 26.40 |
| | 0.240 | D | 14.4 | 24E100CT | 34.32 | 28.60 |
| | 0.800 | E | 1.64 | 80E100CT | 43.20 | 36.00 |
| | 1.750 | F | 0.52 | 175E100CT | 66.00 | 55.00 |
| 110 | 0.018 | A | 392. | 2E110CT | 34.56 | 28.20 |
| | 0.054 | B | 62.3 | 6E110CT | 33.20 | 27.60 |
| | 0.136 | C | 22.1 | 15E110CT | 31.68 | 26.40 |
| | 0.218 | D | 19.5 | 24E110CT | 34.32 | 28.60 |
| | 0.728 | E | 2.03 | 80E110CT | 43.20 | 36.00 |
| | 1.590 | F | 0.72 | 175E110CT | 66.00 | 55.00 |
| 123 | 0.016 | A | 495. | 2E123CT | 34.56 | 28.20 |
| | 0.048 | B | 96.0 | 6E123CT | 33.20 | 27.60 |
| | 0.122 | C | 30.7 | 15E123CT | 31.68 | 26.40 |
| | 0.195 | D | 21.9 | 24E123CT | 34.32 | 28.60 |
| | 0.650 | E | 2.35 | 80E123CT | 43.20 | 36.00 |
| | 1.420 | F | 0.81 | 175E123CT | 66.00 | 55.00 |
| 138 | 0.014 | A | 550. | 2E138CT | 34.56 | 28.20 |
| | 0.043 | B | 133.0 | 6E138CT | 33.20 | 27.60 |
| | 0.108 | C | 36.0 | 15E138CT | 31.68 | 26.40 |
| | 0.174 | D | 30.3 | 24E138CT | 34.32 | 28.60 |
| | 0.580 | E | 3.17 | 80E138CT | 43.20 | 36.00 |
| | 1.260 | F | 1.14 | 175E138CT | 66.00 | 55.00 |
| 157 | 0.038 | B | 153.0 | 6E157CT | 33.20 | 27.60 |
| | 0.095 | C | 53. | 15E157CT | 31.68 | 26.40 |
| | 0.152 | D | 36.1 | 24E157CT | 34.32 | 28.60 |
| | 0.508 | E | 3.60 | 80E157CT | 43.20 | 36.00 |
| | 1.100 | F | 1.31 | 175E157CT | 66.00 | 55.00 |
| 175 | 0.034 | B | 168.0 | 6E175CT | 33.20 | 27.60 |
| | 0.085 | C | 56. | 15E175CT | 31.68 | 26.40 |
| | 0.136 | D | 49.5 | 24E175CT | 34.32 | 28.60 |
| | 0.455 | E | 5.50 | 80E175CT | 43.20 | 36.00 |
| | 1.000 | F | 1.87 | 175E175CT | 66.00 | 55.00 |
| 200 | 0.030 | B | 248.0 | 6E200CT | 33.20 | 27.60 |
| | 0.071 | C | 65. | 15E200CT | 31.68 | 26.40 |
| | 0.120 | D | 57. | 24E200CT | 34.32 | 28.60 |
| | 0.400 | E | 5.60 | 80E200CT | 43.20 | 36.00 |
| | 0.875 | F | 2.65 | 175E200CT | 66.00 | 55.00 |
| 220 | 0.027 | B | 278. | 6E220CT | 33.20 | 27.60 |
| | 0.068 | C | 91.5 | 15E220CT | 31.68 | 26.40 |
| | 0.109 | D | 79. | 24E220CT | 34.32 | 28.60 |
| | 0.364 | E | 8.1 | 80E220CT | 43.20 | 36.00 |
| | 0.790 | F | 2.92 | 175E220CT | 66.00 | 55.00 |
| 250 | 0.024 | B | 407. | 6E250CT | 33.20 | 27.60 |
| | 0.060 | C | 141. | 15E250CT | 31.68 | 26.40 |
| | 0.096 | D | 114. | 24E250CT | 34.32 | 28.60 |
| | 0.320 | E | 11.2 | 80E250CT | 43.20 | 36.00 |
| | 0.700 | F | 3.95 | 175E250CT | 66.00 | 55.00 |
| 275 | 0.021 | B | 417. | 6E275CT | 33.20 | 27.60 |
| | 0.054 | C | 146. | 15E275CT | 31.68 | 26.40 |
| | 0.087 | D | 120. | 24E275CT | 34.32 | 28.60 |
| | 0.290 | E | 13.6 | 80E275CT | 43.20 | 36.00 |
| | 0.635 | F | 4.65 | 175E275CT | 66.00 | 55.00 |
| 310 | 0.019 | B | 592. | 6E310CT | 33.20 | 27.60 |
| | 0.048 | C | 160. | 15E310CT | 31.68 | 26.40 |
| | 0.077 | D | 180. | 24E310CT | 34.32 | 28.60 |
| | 0.266 | E | 14.1 | 80E310CT | 43.20 | 36.00 |
| | 0.565 | F | 6.80 | 175E310CT | 66.00 | 55.00 |

Other models are available with outputs to 5000V. Contact our nearest office for complete information.



# UNITED PRICING REPORTS

## the single source that speeds up invoicing, pricing, quoting, purchasing and estimating

Electronic component prices change so fast, you'd need a team of people just to keep up.

United Pricing Reports is the better way. When you subscribe to Pricing Reports you receive 1500 pricing sheets (3000 pages) of the latest prices, as of the date we ship them to you.

This gives you, in a single source, up-to-the minute selling prices on more than 500,000 electronic components.

United Pricing Reports gives you accurate resale prices at the exact moment you need them. Not hours or days later. So it helps you eliminate frantic phone calls, letter writing and catalog scanning to check on prices when you write an invoice or type a purchase order.

## Twice weekly price updates.

One week after you receive your Pricing Reports source book (1500 pricing sheets) you begin receiving twice weekly price updates. You simply take these new price pages and replace the now obsolete pages with them.

The whole process is simple. All information is organized alphabetically by manufacturer. And each manufacturer's price schedule is listed by part number in numerical/alphabetical sequence.

One more thing. When we promise twice weekly updates, we deliver. 52 weeks a year, consistently. Not monthly or every other month. We have a tradition of delivery on our promises, and we're certainly not going to stop now.

*UNITED TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500 TWX-510/222-1*

# MAGNETICS PRODUCTS

Bourns Magnetics Products is a recognized leader in the field of magnetic components and assemblies. Advanced engineering techniques and diversification of its product lines serves to continually increase the company's ability to serve the electronics industry. Emphasis on product development has pioneered the 1/8" and 1/4" cube microminiature transformers and inductors. Numerous state-of-the-art advancements ensure high performance and consistent reliability in the volume production of magnetic components and assemblies.

## GENERAL SPECIFICATIONS

Bourns microtransformers and microinductors have been designed and manufactured to meet applicable requirements of MIL-T-27, grade 5.

**Physical Specifications**

Enclosure: High temperature DAP and epoxy
Markings: BMP part numbers, date code and pin numbers

**Environmental Specifications**

Life: Greater than 10,000 hours
MIL-T-27 Environments: Meets or exceeds requirements of grade 5
Moisture Resistance: Cycling from −10° to +65°C in 90-98% relative humidity with vibration following cold shocks
Vibration: 0.06 inch da from 10-80 cps 20Gs from 80-2000 cps (20 hour test)
Shock: 18 drops from 13 inches with impact blocks landing in sand (approximately 30Gs for 11 milliseconds)
Flammability: Torch flame applied for 15 seconds
Insulation Resistance: 10,000 megohms
Sealing: Immersion in 85°C water for 2 minutes
Immersion: Immersion in water bath at temperatures of 65°C and 25°C for 1 hour, 2 cycles

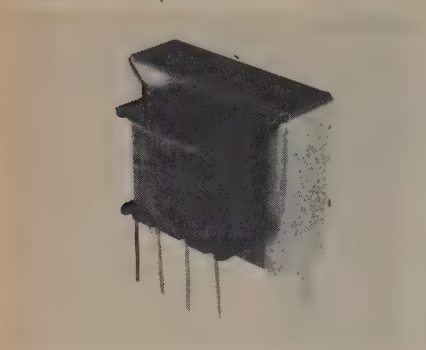
## AVAILABLE SPECIAL ORDER MODIFICATIONS

- Electrostatic shield between windings
- Magnetic shielding-slip on cover
- Up to ten (10) leads on .050" centers
- Special marking, i.e., customer part number, etc.
- Special testing — group A, B, or C
- Special pulse designs
- Rise times as low as .01 μsec.
- Pulse width to 10 μsec.
- ET constants to 25 volt-μsec.
- High Q
- Custom designs for high reliability, pulse, blocking oscillator, power, tuned circuit and various other applications

BOURNS INC.
MAGNETICS PRODUCTS
DEPT. EM 28151 HIGHWAY 74
ROMOLAND, CALIFORNIA 92380
PHONE (714) 657-5195
TELEX 67-6446

# TRANSFORMERS

Industrial/Commercial



## PW-9000 SERIES

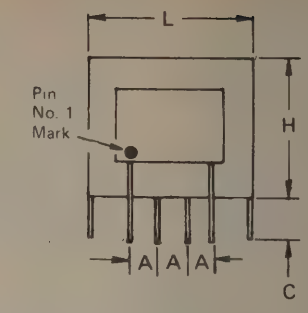
Miniature Power Transformers

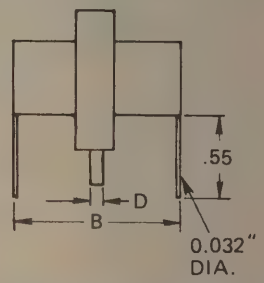
### FEATURES

- Dual secondaries
- Less than 20% load regulation
- Primaries rated 50 Hz to 500 Hz
- Printed circuit mounting

This series of power transformers includes units for transistorized control and instrumentation applications. Primaries are rated at 115 V, 50 to 500 Hz and dual secondaries provide voltages from 4 to 38 volts parallel connected, and 8 to 76 volts series connected. Load regulation will not exceed 20%. Also available in 220 and 240 V, 50 Hz to 500 Hz primaries.

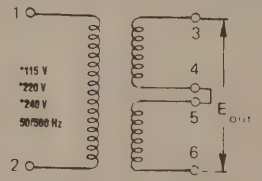
### DIMENSIONS



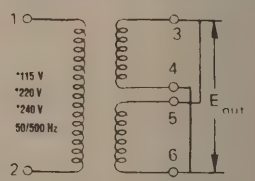




| Model No. | Output V.A. | Series Connection | Parallel Connection | Outline |
|---|---|---|---|---|
| PW-9000 | 1.2 | 8 V CT @ 0.150A | 4 V @ 0.300A | 1 |
| PW-9001 | 4.2 | 8 V CT @ 0.525 | 4 V @ 1.05 | 2 |
| PW-9002 | 10.0 | 8 V CT @ 1.25 | 4 V @ 2.50 | 3 |
| PW-9003 | 1.2 | 15 V CT @ 0.080 | 7.5 V @ 0.160 | 1 |
| PW-9004 | 4.2 | 15 V CT @ 0.280 | 7.5 V @ 0.560 | 2 |
| PW-9005 | 10.0 | 15 V CT @ 0.670 | 7.5 V @ 1.34 | 3 |
| PW-9006 | 1.2 | 30 V CT @ 0.040 | 15 V @ 0.080 | 1 |
| PW-9007 | 4.2 | 30 V CT @ 0.140 | 15 V @ 0.280 | 2 |
| PW-9008 | 10.0 | 30 V CT @ 0.330 | 15 V @ 0.660 | 3 |
| PW-9009 | 1.2 | 54 V CT @ 0.022 | 27 V @ 0.044 | 1 |
| PW-9010 | 4.2 | 54 V CT @ 0.080 | 27 V @ 0.160 | 2 |
| PW-9011 | 10.0 | 54 V CT @ 0.190 | 27 V @ 0.380 | 3 |
| PW-9012 | 1.2 | 76 V CT @ 0.016 | 38 V @ 0.032 | 1 |
| PW-9013 | 4.2 | 76 V CT @ 0.055 | 38 V @ 0.110 | 2 |
| PW-9014 | 10.0 | 76 V CT @ 0.132 | 38 V @ 0.264 | 3 |
| PW-9015 | 1.2 | 12.6 V CT @ 0.095 | 6.3 V @ 0.190 | 1 |
| PW-9016 | 4.2 | 12.6 V CT @ 0.330 | 6.3 V @ 0.660 | 2 |
| PW-9017 | 10.0 | 12.6 V CT @ 0.795 | 6.3 V @ 1.590 | 3 |

| Outline | Dimensions | | | | | | | Wt. Oz. |
|---|---|---|---|---|---|---|---|---|
| | L | W | H | A | B | C | D | |
| 1 | 1.44 | 1.04 | 1.24 | .197 | 0.93 | .19 | .125 | 3.1 |
| 2 | 1.68 | 1.42 | 1.38 | .236 | 1.35 | .28 | .125 | 5.6 |
| 3 | 1.95 | 1.48 | 1.65 | .236 | 1.40 | .32 | .187 | 9.0 |




Series Connection




Parallel Connection

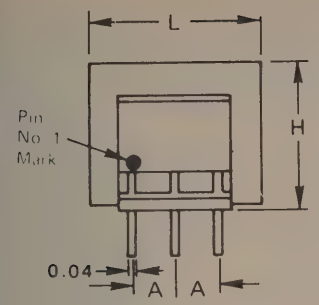
## DUAL PRIMARY FOR 115V OR 230V POWER TRANSFORMERS

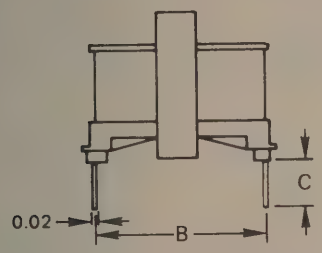
| Part No. | Output V.A. | Input Voltage VRMS | | Output Voltage | Outline |
|---|---|---|---|---|---|
| | | Series Connection | Parallel Connection | | |
| PW-9500 | 1.2 | 230 | 115 | 24 V CT @ 0.5A | 1 |
| PW-9501 | 4.2 | 230 | 115 | 24 V CT @ .18A | 2 |
| PW-9502 | 10.0 | 230 | 115 | 24 V CT @ .42A | 3 |

BOURNS INC

MAGNETICS PRODUCTS
DEPT. EM 28151 HIGHWAY 74
ROMOLAND, CALIFORNIA 92380
PHONE (714) 657-5195
TELEX 67-6446

## DIMENSIONS



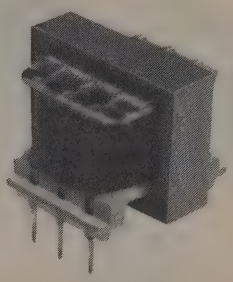

This series of transformers covers input, output and driver applications with a broad frequency response of ±3db from 300-10,000 Hz. It features precision molded terminals for rapid circuit board insertion and the primary and secondary windings may be reversed. These units are ideal impedance matching.

## CONVERTER TRANSFORMERS

These Transformers are designed for use in self saturating DC to DC or DC to AC converters. They can be used at switching frequencies from 15 KHz to 50 KHz. Utilization of ferrite cores yields efficiencies up to 80%.

# AUDIO TRANSFORMERS

Industrial/Commercial



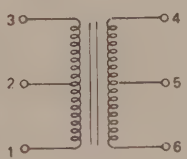
## AU-9000 SERIES

Miniature Audio Transformers

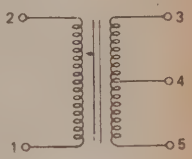
### FEATURES

- Precision molded terminals
- Broad frequency response
- Reversable, primary and secondary windings
- Ideal for impedance matching

| Model No. | Power Level MW | Impedance Pri Ω | Impedance Sec Ω | Turns Ratio Pri:Sec | DC Resistance Pri Ω | DC Resistance Sec Ω | Outline | Schematic |
|---|---|---|---|---|---|---|---|---|
| AU-9000 | 300 | 1K CT | 200K CT | 1:13.7 | 100 | 2500 | 1 | I |
| AU-9001 | 300 | 500 CT | 500 CT | 1:1.05 | 40 | 53 | 1 | I |
| AU-9002 | 300 | 20K CT | 2K CT | 2.98:1 | 1250 | 185 | 1 | I |
| AU-9003 | 150 | 100 CT | 10 CT | 2.84:1 | 18 | 1.3 | 2 | I |
| AU-9004 | 150 | 5K CT | 7.5K CT | 1:1.22 | 520 | 520 | 2 | I |
| AU-9005 | 150 | 5K CT | 10K CT | 1:1.48 | 520 | 970 | 2 | I |
| AU-9006 | 150 | 5K CT | 80K CT | 1:3.93 | 420 | 3500 | 2 | I |
| AU-9007 | 150 | 500 CT | 150 CT | 1.75:1 | 42 | 14 | 2 | I |
| AU-9008 | 150 | 1.2K | 20K CT | 1:4.2 | 140 | 1350 | 2 | II |
| AU-9009 | 150 | 1500 | 500 CT | 1.67:1 | 100 | 45 | 2 | II |
| AU-9010 | 150 | 10K | 200 CT | 7.1:1 | 760 | 16 | 2 | II |
| AU-9011 | 150 | 10K | 2K CT | 2.24:1 | 760 | 140 | 2 | II |
| AU-9012 | 150 | 10K | 3K CT | 1.83:1 | 750 | 230 | 2 | II |




SCHEMATIC I



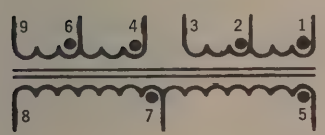

SCHEMATIC II

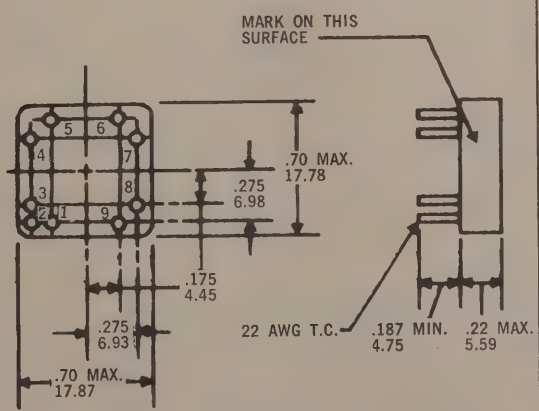
| Outline | Dimensions L | W | H | A | B | C | Wt. Oz. |
|---|---|---|---|---|---|---|---|
| 1 | 1.02 | .92 | .85 | .25 | .72 | .236 | 1.12 |
| 2 | 0.78 | .55 | .71 | 1.87 | .421 | .197 | 0.55 |

| Transformer P/N | Typical Input Voltage DC | Turns Ratio Input | Turns Ratio Output | Turns Ratio Feedback | Typical Power Output |
|---|---|---|---|---|---|
| PW-0044 | 5-8 | 1 CT | 1.125 CT | 0.125 CT | 500 mW |
| PW-0046 | 3-6 | 1 CT | 2.7 CT | 0.47 CT | 1000 mW |
| PW-0038 | 3-6 | 1 CT | 2.8 CT | 0.4 CT | 500 mW |

# CONVERTER TRANSFORMERS

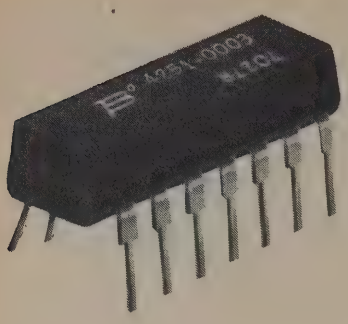
TYPICAL SCHEMATIC



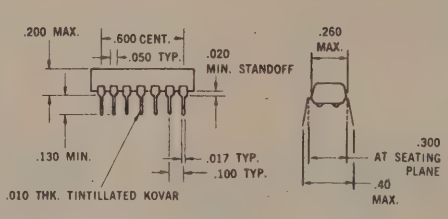

BOURNS INC
MAGNETICS PRODUCTS
DEPT. EM 28151 HIGHWAY 74
ROMOLAND, CALIFORNIA 92380
PHONE (714) 657-5195
TELEX 67-6446

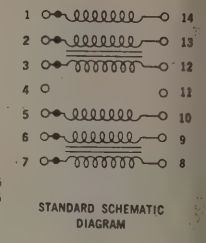
# PULSE TRANSFORMERS

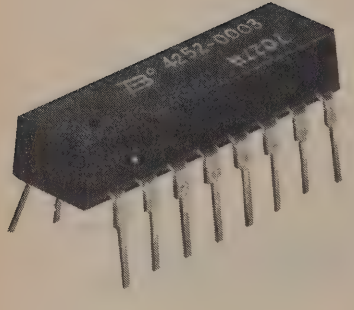


## MODEL 4251 .260" x .230" x .750"
## DUAL-IN-LINE PULSE TRANSFORMER/14 PIN

| Transformer P/N | Turns Ratio Pri:Sec | Primary Pulse Induct. μH (Min.) | ET Const. Volt μSec | Leakage Induct. μH (Max.) | Coupling Capac. pf (Max.) | DC Resistance Ω (Max.) (1-14) (5-10) Pri | (2-13) (6-9) Sec | (3-12) (7-8) Tert |
|---|---|---|---|---|---|---|---|---|
| 4251-0001 | 1:1:1 | 8 | 1.0 | 0.30 | 7 | 0.16 | 0.16 | 0.16 |
| 4251-0002 | 2:1:1 | 8 | 1.0 | 0.70 | 5 | 0.16 | 0.12 | 0.12 |
| 4251-0003 | 1:1:1 | 30 | 2.1 | 0.30 | 9 | 0.19 | 0.19 | 0.19 |
| 4251-0004 | 2:1:1 | 30 | 2.1 | 0.70 | 7 | 0.19 | 0.13 | 0.13 |
| 4251-0005 | 1:1:1 | 57 | 2.8 | 0.30 | 11 | 0.34 | 0.34 | 0.34 |
| 4251-0006 | 2:1:1 | 57 | 2.8 | 0.70 | 7 | 0.34 | 0.25 | 0.25 |
| 4251-0007 | 1:1:1 | 130 | 2.0 | 0.30 | 11 | 0.34 | 0.34 | 0.34 |
| 4251-0008 | 2:1:1 | 130 | 2.0 | 0.70 | 7 | 0.34 | 0.25 | 0.25 |
| 4251-0009 | 1:1:1 | 230 | 2.7 | 0.30 | 13 | 0.55 | 0.55 | 0.55 |
| 4251-0010 | 2:1:1 | 230 | 2.7 | 0.70 | 9 | 0.55 | 0.32 | 0.32 |
| 4251-0011 | 1:1:1 | 430 | 3.8 | 0.30 | 18 | 0.75 | 0.75 | 0.75 |
| 4251-0012 | 2:1:1 | 430 | 3.8 | 0.70 | 11 | 0.75 | 0.38 | 0.38 |

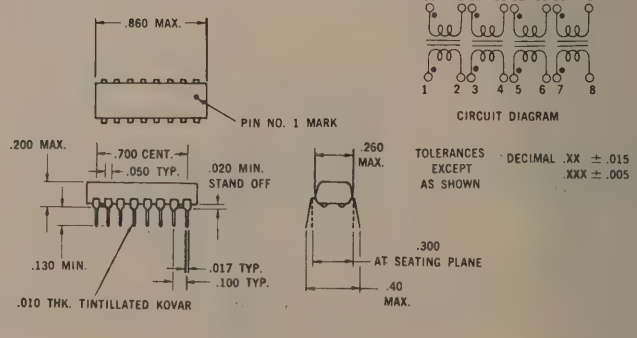


## MODEL 4252 .260" x .230" x .860"
## DUAL-IN-LINE PULSE TRANSFORMER/16 PIN

| Transformer P/N | Turns Ratio Pri:Sec | Primary Pulse Induct. μH (Min.) | ET Const. Volt μSec | Leakage Induct. μH (Max.) | Coupling Capac. pf (Max.) | DC Resistance Ω (Max.) Pri | Sec |
|---|---|---|---|---|---|---|---|
| 4252-0001 | 1:1 | 8 | 1.0 | 0.25 | 7 | 0.16 | 0.16 |
| 4252-0002 | 2:1 | 8 | 1.0 | 0.50 | 5 | 0.16 | 0.12 |
| 4252-0003 | 1:1 | 30 | 2.1 | 0.25 | 9 | 0.19 | 0.19 |
| 4252-0004 | 2:1 | 30 | 2.1 | 0.50 | 7 | 0.19 | 0.13 |
| 4252 0005 | 1:1 | 57 | 2.8 | 0.25 | 11 | 0.34 | 0.34 |
| 4252-0006 | 2:1 | 57 | 2.8 | 0.50 | 7 | 0.34 | 0.25 |
| 4252-0007 | 1:1 | 130 | 2.0 | 0.25 | 11 | 0.34 | 0.34 |
| 4252-0008 | 2:1 | 130 | 2.0 | 0.50 | 7 | 0.34 | 0.25 |
| 4252-0009 | 1:1 | 230 | 2.7 | 0.25 | 13 | 0.55 | 0.55 |
| 4252-0010 | 2:1 | 230 | 2.7 | 0.50 | 9 | 0.55 | 0.32 |
| 4252-0011 | 1:1 | 430 | 3.8 | 0.25 | 18 | 0.75 | 0.75 |
| 4252-0012 | 2:1 | 430 | 3.8 | 0.50 | 11 | 0.75 | 0.38 |




**SPECIAL ORDER MODIFICATIONS AVAILABLE**

BOURNS INC.
MAGNETICS PRODUCTS
DEPT. EM 28151 HIGHWAY 74
ROMOLAND, CALIFORNIA 92380
PHONE (714) 657-5195
TELEX 67-6446

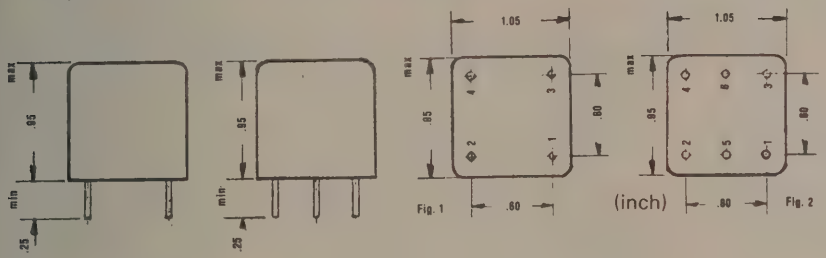
## PL 9000 SERIES

| Part No. | Turns Ratio ±10% | Figure | Primary Inductance (μH Min.) | Leakage Inductance (μH Max.) | Interwinding Capacity (pF Max.) | 1-2, 3-4, 5-6 DCR (Ω Max.) |
|---|---|---|---|---|---|---|
| PL-9001 | 1:1 | 1 | 200 | 3.0 | 800 | 1.5 - 1.5 |
| PL-9002 | 1:1 | 1 | 500 | 6.0 | 1500 | 4.5 - 4.5 |
| PL-9003 | 1:1 | 1 | 1000 | 12.0 | 2000 | 8 - 8 |
| PL-9004 | 1:1 | 1 | 2000 | 13.0 | 2800 | 22 - 22 |
| PL-9005 | 1:1 | 1 | 5000 | 15.0 | 3500 | 18 - 18 |
| PL-9006 | 1:1:1 | 2 | 200 | 3.0 | 800 | 2 - 2 - 2 |
| PL-9007 | 1:1:1 | 2 | 500 | 6.0 | 1500 | 6 - 6 - 6 |
| PL-9008 | 1:1:1 | 2 | 1000 | 12.0 | 2000 | 10 - 10 - 10 |
| PL-9009 | 1:1:1 | 2 | 2000 | 13.0 | 2800 | 15 - 15 - 15 |
| PL-9010 | 1:1:1 | 2 | 5000 | 15.0 | 3500 | 27 - 27 - 27 |
| PL-9011 | 2:1 | 1 | 500 | 6.0 | 1000 | 4 - 2 |
| PL-9012 | 2:1 | 1 | 1000 | 10.0 | 1300 | 10 - 2 |
| PL-9013 | 2:1 | 1 | 2000 | 12.0 | 1800 | 10 - 5 |
| PL-9014 | 2:1 | 1 | 5000 | 15.0 | 2400 | 18 - 10 |
| PL-9015 | 2:1:1 | 2 | 200 | 8.0 | 700 | 4 - 2 - 2 |
| PL-9016 | 2:1:1 | 2 | 500 | 11.0 | 1000 | 6 - 2 - 2 |
| PL-9017 | 2:1:1 | 2 | 1000 | 15.0 | 1300 | 10 - 2 - 2 |
| PL-9018 | 2:1:1 | 2 | 2000 | 60 | 2000 | 10 - 5 - 5 |
| PL-9019 | 2:1:1 | 2 | 5000 | 75 | 2100 | 22- 12 - 12 |
| PL-9020 | 5:1 | 1 | 5000 | 1500 | 400 | 19 - 3 |
| PL-9021 | 5:1:1 | 2 | 5000 | 1500 | 400 | 20 - 4 - 4 |

## PL-9100 SERIES

### FEATURES

- 2600 V RMS dielectric strength
- Printed circuit mounting
- High inductance
- Potted construction
- Turns ratio: 1:1, 1:1:1, 2:1, 2:1:1
- Primary inductance (μH): 1000, 5000, 10000
- Temperature range: —10° to +70°C




## PL-9200 SERIES

### FEATURES

Flexible leads of polyurethane insulated magnet wire can be soldered directly to terminals without need for removal of wire insulation.

- Designed to transfer high amplitude or long duration pulses without saturation.
- Turns ratio: 1:1, 1:1:1, 2:1, 2:1:1, 5:1, 5:1:1
- Primary inductance (μH): 200, 500, 1000, 2000, 5000
- Operating voltage to 240 V line
- Dielectric test at 60 Hz: 1600 V RMS

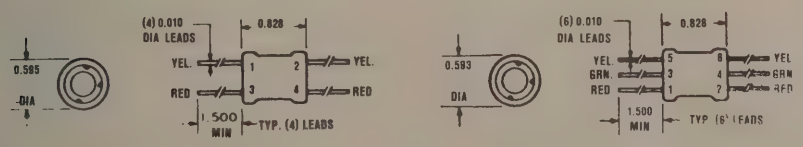



Fig. 1

# TRIGGER TRANSFORMERS

## PL-9000 SERIES

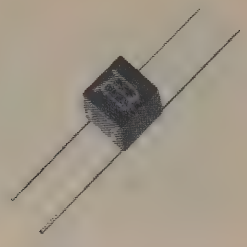
### FEATURES

- Printed circuit mounting
- Designed to transfer high amplitude or long duration pulses without saturation
- AC line voltage: 240 RMS
- Dielectric test at 50/60 Hz; 1600 V RMS
- Temperature range: —10°C to +70°C

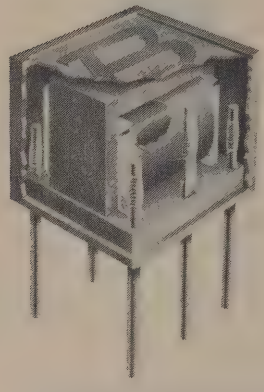
BOURNS INC.
MAGNETICS PRODUCTS
DEPT. EM 28151 HIGHWAY 74
ROMOLAND, CALIFORNIA 92380
PHONE (714) 657-5195
TELEX 67-6446

# TRANSFORMERS

Microminiature



MODEL 4211 MICROTRANSFORMER



MODEL 4210 MICROTRANSFORMER

MODEL 4212 MICROTRANSFORMER

## MODEL 4211 MICROTRANSFORMER/.125″ x .125″ x .125″

**Standard Part Numbers — Stock Available**

| Transformer P/N | Turns Ratio Pri:Sec | Typical Impedance Ω | | DCR Ω | | Rated Power MW 10 KHz |
|---|---|---|---|---|---|---|
| | | Pri | Sec | Pri | Sec | |
| 4211-0001 | 1:1 | 15 | 15 | 0.85 | 0.90 | 25 |
| 4211-0002 | 1:1 | 1K | 1K | 105 | 125 | 25 |
| 4211-0003 | 1:1 | 10K | 10K | 870 | 1035 | 25 |
| 4211-0004 | 1:2 | 10 | 40 | 1.3 | 4.7 | 25 |
| 4211-0005 | 1:2 | 100 | 400 | 10 | 46 | 25 |
| 4211-0006 | 1:2 | 500 | 2000 | 37 | 224 | 25 |
| 4211-0007 | 1:4 | 10 | 160 | 0.75 | 17 | 25 |
| 4211-0008 | 1:5 | 10 | 250 | 1.3 | 40 | 25 |

## MODEL 4210 MICROTRANSFORMER/.250″ x .250″ x .250″

**Standard Part Numbers — Stock Available**

| Transformer P/N | Turns Ratio Pri:Sec | Typical Impedance Ω | | DCR Ω | | Rated Power MW 400 Hz | 1000 Hz | 2000 Hz | DC ma | Application |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Pri | Sec | Pri | Sec | | | | | |
| 4210-0010 | 4.46:1 | 10,000 CT | 500 | 1022 | 118 | 5 | 50 | 200 | 0.5 | Output |
| 4210-0011 | 5:1 | 25,000 CT | 1,000 | 1130 | 145 | 2 | 25 | 100 | .25 | Interstage |
| 4210-0012 | 1:1 | 1,000 CT | 1,000 CT | 90 | 110 | 5 | 50 | 200 | .25 | Isolation |
| 4210-0013 | 1:1 | 10,000 CT | 10,000 CT | 600 | 746 | 4 | 50 | 200 | 0 | Driver |
| 4210-0014 | 1.22:1 | 900 CT | 600 | 102 | 83 | 5 | 50 | 200 | .75 | Output |
| 4210-0015 | 1:1 | 10,000 | 10,000 CT | 600 | 746 | 4 | 50 | 200 | 0 | Isolation |
| 4210-0016 | 2.24:1 | 10,000 | 2,000 CT | 1010 | 282 | 5 | 50 | 200 | .25 | Driver |
| 4210-0017 | 3.53:1 | 150 CT | 12 | 19 | 1.4 | 5 | 50 | 200 | 3.0 | Output |
| 4210-0018 | 3.16:1 | 500 CT | 50 CT | 55 | 6 | 5 | 50 | 200 | 1.5 | Output |
| 4210-0019 | 6.12:1 | 120 CT | 3.2 CT | 13 | .6 | 5 | 50 | 200 | 3.0 | Output |
| 4210-0020 | 1.53:1 | 1,500 CT | 600 | 231 | 93 | 5 | 50 | 200 | 1.5 | Output |
| 4210-0021 | 4.46:1 | 10,000 CT | 500 CT | 1022 | 118 | 5 | 50 | 200 | .5 | Driver |
| 4210-0022 | 2.89:1 | 10,000 | 1,200 CT | 1022 | 248 | 5 | 50 | 200 | .5 | Driver |
| 4210-0023 | 5:1 | 25,000 CT | 1,000 CT | 1130 | 145 | 2 | 25 | 100 | .25 | Interstage |
| 4210-0024 | 5:1 | 25,000 | 1,000 | 1130 | 145 | 2 | 25 | 100 | .25 | Interstage |
| 4210-0025 | 1:1 | 600 CT | 600 CT | 69 | 83 | 5 | 50 | 200 | 1.0 | Output |
| 4210-0026 | 1:1 | 10,000 | 10,000 | 600 | 746 | 4 | 50 | 200 | 0 | Isolation |
| 4210-0028 | 5:1 | 30,000 | 1,200 | 1180 | 290 | 4 | 25 | 100 | 0 | Interstage |
| 4210-0030 | 1:1.1 | 500 CT | 600 | 46 | 82 | 5 | 50 | 200 | 1.0 | Output |

## MODEL 4212 MICROTRANSFORMER/.310″ x .410″ x .465″

**Standard Part Numbers — Stock Available**

| Transformer P/N | Turns Ratio Pri:Sec | Typical Impedance Ω | | DCR Ω | | Rated Power MW at 300 Hz | DC ma | Application |
|---|---|---|---|---|---|---|---|---|
| | | Pri | Sec | Pri | Sec | | | |
| 4212-0001 | 14.1:1 | 200,000 | 1,000 | 5300 | 120 | 12 | 0 | Input |
| 4212-0002 | 7.1:1 | 50,000 CT | 1,000 CT | 3800 | 90 | 25 | 0 | Input |
| 4212-0003 | 5:1 | 25,000 CT | 1,000 CT | 1600 | 95 | 30 | 0.5 | Interstage |
| 4212-0004 | 4.47:1 | 20,000 CT | 1,000 CT | 1500 | 100 | 30 | 0.5 | Interstage |
| 4212-0005 | 1:1 | 10,000 CT | 10,000 CT | 1000 | 1300 | 45 | 1 | Output Isolation |
| 4212-0006 | 2.24:1 | 10,000 CT | 2,000 CT | 1000 | 300 | 45 | 1 | Driver |
| 4212-0007 | 2.58:1 | 10,000 CT | 1,500 CT | 1000 | 260 | 45 | 1 | Driver |
| 4212-0008 | 2.88:1 | 10,000 CT | 1,200 CT | 1000 | 220 | 45 | 1 | Driver |
| 4212-0009 | 1.58:1 | 5,000 CT | 2,000 CT | 490 | 300 | 45 | 1 | Driver |
| 4212-0010 | 1.58:1 | 1,500 CT | 600 | 160 | 95 | 65 | 3 | Output |
| 4212-0011 | 1:1 | 600 CT | 600 CT | 70 | 95 | 65 | 3 | Output Isolation |
| 4212-0012 | 1:1.09 | 500 CT | 600 CT | 65 | 95 | 65 | 3 | Output |
| 4212-0013 | 2:1 : 1 | 10,000 | 10,000 CT 2,500 Split | 1000 | 1300* | 45 | 1 | Output Isolation |
| 4212-0014 | 1:1 | 1,000 CT | 1,000 CT | 80 | 100 | 65 | 2.5 | Output Isolation |
| 4212-0015 | 2:1 : 1 | 600 | 600 CT 150 Split | 70 | 95* | 65 | 3 | Output Isolation |
| 4212-0016 | 4.47:1 | 10,000 CT | 500 CT | 1000 | 80 | 45 | 1 | Driver |
| 4212-0017 | 56:1 | 10,000 | 3.2 | 1200 | 0.8 | 65 | 1 | Output |
| 4212-0018 | 1:1.42 | 300 CT | 600 | 41 | 98 | 65 | 7 | Output |
| 4212-0019 | 22.3:1 | 1,600 CT | 3.2 | 186 | 0.8 | 65 | 2.5 | Output |

* Total DCR of split secondaries in series

BOURNS INC

MAGNETICS PRODUCTS
DEPT. EM 28151 HIGHWAY 74
ROMOLAND, CALIFORNIA 92380
PHONE (714) 657-5195
TELEX 67-6446

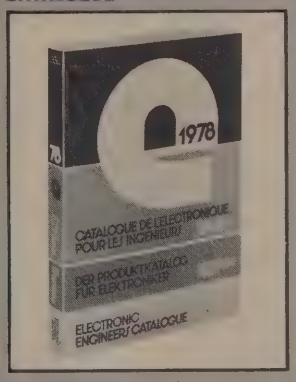
# WE KNOW OUR STUFF

## 41 YEARS OF EXPERIENCE IN CATALOGING, 21 EDITIONS OF eem

### eem/ELECTRONIC ENGINEERS MASTER CATALOG —

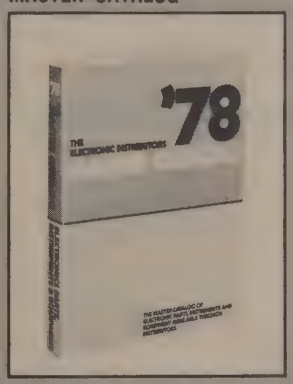
The "blue-ribbon" catalog/directory that has become "the standard of the industry" for electronic engineers, buyers and specifiers.

### ELECTRONIC ENGINEERS CATALOGUE



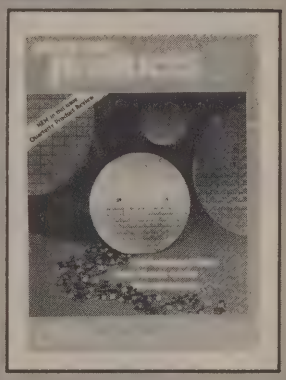

The new catalogue/directory of electronic products available to and from Western Europe and the United Kingdom. Designed especially for the European electronics engineer.

### ELECTRONIC DISTRIBUTORS MASTER CATALOG —



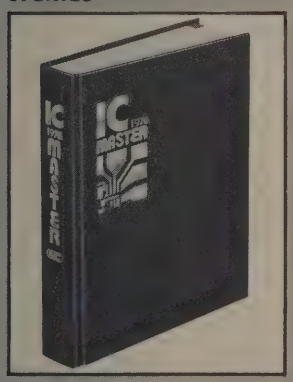

The only national catalog designed exclusively for distributors and their customers featuring electronic parts, instruments and equipment.

### ELECTRONIC PRODUCTS MAGAZINE —



The products magazine . . . A 100% product-oriented magazine including hundreds of new products and special features every month.

### IC MASTER AND THE UPDATES —




The only complete single-source directory including all IC devices manufactured in the United States. Updated three times yearly with accumulative supplements.

### eem FILE SYSTEM —

The only filing system designed especially for the electronics engineer. Instant retrieval and organization of data sheets and catalogs.

### UTP CUSTOM CATALOGS —

The Cadillac of individualized catalogs for the electronic parts distributor, featuring solely his lines and services.

### UNITED COST AND PRICING SERVICES —

The electronic distributors' proven method of being up to the minute on his cost and selling prices.

*United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Ave., Garden City, N.Y. 11530 / (516) 222-2500 TWX 510-222-1673*

DALE®

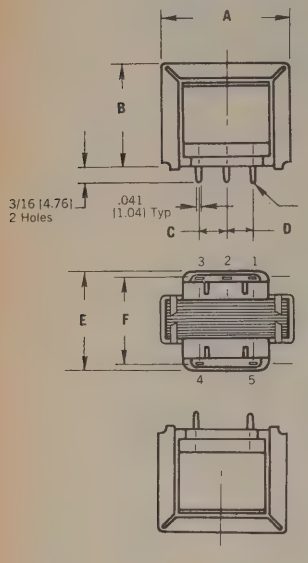
# LOW POWER TRANSFORMERS

## PL Series, Dual and Single Secondary

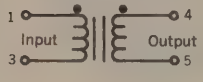
## PL-32, PL-33, PL-34

### Single Secondary Power Transformer, 115 Volt Primary Input

BASIC STYLE



SCHEMATIC



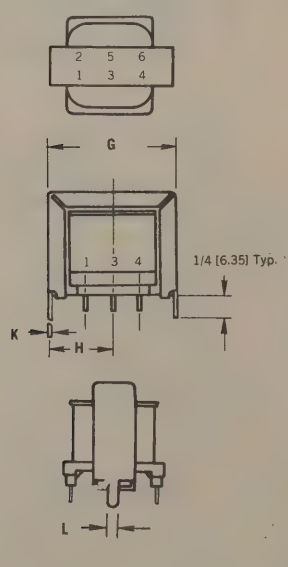

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| PL32 | 1.45 [36.91] | 1.16 [29.37] | .31 [ 7.92] | .31 [ 7.92] | 1.13 [28.58] | 1.00 [25.40] |
| PL33 | 1.70 [43.26] | 1.38 [34.93] | .40 [10.16] | .40 [10.16] | 1.25 [31.75] | 1.10 [27.94] |
| PL34 | 1.95 [49.61] | 1.63 [41.28] | .40 [10.16] | .40 [10.16] | 1.44 [36.51] | 1.30 [33.02] |

### ELECTRICAL CHARACTERISTICS

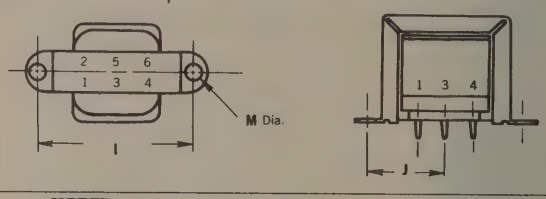
| OUTPUT VOLTAGE | OUTPUT CURRENT | MODEL NO. |
|---|---|---|
| 6.4 V | 200 | PL32-01 |
| | 700 | PL33-01 |
| | 1300 | PL34-01 |
| 10 V | 120 | PL32-02 |
| | 450 | PL33-02 |
| | 800 | PL34-02 |
| 12.6 V | 100 | PL32-03 |
| | 350 | PL33-03 |
| | 650 | PL34-03 |
| 15 V | 80 | PL32-04 |
| | 300 | PL33-04 |
| | 550 | PL34-04 |
| 20 V | 60 | PL32-05 |
| | 225 | PL33-05 |
| | 400 | PL34-05 |
| 24 V | 50 | PL32-06 |
| | 185 | PL33-06 |
| | 330 | PL34-06 |
| 30 V | 40 | PL32-07 |
| | 150 | PL33-07 |
| | 270 | PL34-07 |
| 54 V | 22 | PL32-08 |
| | 80 | PL33-08 |
| | 150 | PL34-08 |
| 76 V | 16 | PL32-09 |
| | 60 | PL33-09 |
| | 110 | PL34-09 |
| 88 V | 14 | PL32-10 |
| | 50 | PL33-10 |
| | 90 | PL34-10 |
| 115 V | 10 | PL32-11 |
| | 40 | PL33-11 |
| | 70 | PL34-11 |
| 180 V | 7 | PL32-12 |
| | 25 | PL33-12 |
| | 45 | PL34-12 |
| 230 V | 5 | PL32-13 |
| | 20 | PL33-13 |
| | 35 | PL34-13 |

## OPTIONAL MOUNTING FRAMES AVAILABLE

"A" TYPE OF MOUNTING FRAME




"B" TYPE OF MOUNTING FRAME




| MODEL SERIES | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|
| PL-11 | 1.06 [26.92] | .52 [13.21] | 1-3/8 [34.92] | 11/16 [17.46] | .018 [.046] | 1/8 [3.20] | .120 [3.05] |
| PL-12, PL-22, PL-32 | 1-29/64 [36.91] | .71 [18.03] | 1-3/4 [44.35] | 7/8 [22.22] | .031 [0.79] | 1/8 [3.20] | 3/16 [4.81] |
| PL-13, PL-23, PL-33 | 1-45/64 [43.26] | .84 [21.34] | 2.00 [50.80] | 1.00 [25.40] | .031 [0.79] | 1/8 [3.20] | 3/16 [4.81] |
| PL-14, PL-24, PL-34 | 1-61/64 [49.61] | .97 [24.64] | 2-3/8 [60.33] | 1-3/16 [30.16] | .031 [0.79] | 3/16 [4.81] | 3/16 [4.81] |

### ORDERING INFORMATION

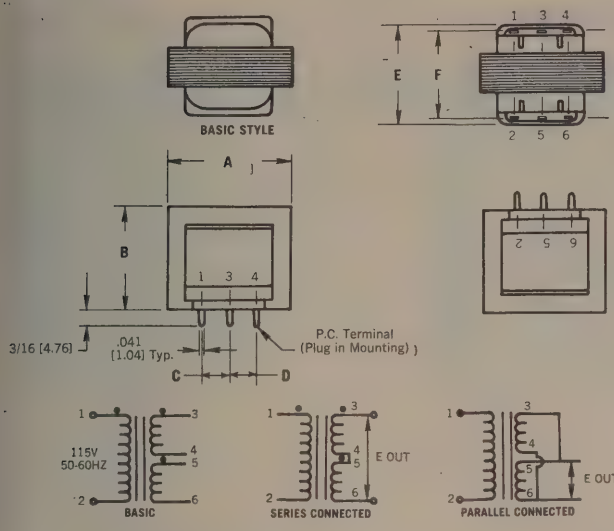
| PL-33 | -04 | "A" |
|---|---|---|
| MODEL SERIES NO. | DASH NO. | TYPE OF MOUNTING FRAME, if required. (If none, leave blank) |

*For complete information, write or phone*
**DALE ELECTRONICS, INC.,** East Highway 50, Yankton, South Dakota 57078. Phone 605-665-9301

DALE®

# PL-11, PL-12, PL-13, PL-14

## Low Power Dual Secondary Transformers




### BASIC SCHEMATICS

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| PL-11 | 1.01 [25.65] | .84 [21.34] | .25 [ 6.35] | .25 [ 6.35] | 875 [22.22] | .720 [18.29] |
| PL-12 | 1-3/8 [34.92] | 1-3/16 [30.16] | .312 [ 7.92] | .312 [ 7.92] | 1-1/8 [28.58] | 1.00 [25.4] |
| PL-13 | 1-5/8 [41.28] | 1-3/8 [34.92] | .400 [10.16] | .400 [10.16] | 1-1/4 [31.75] | 1.100 [27.94] |
| PL-14 | 1-7/8 [47.62] | 1.60 [40.64] | .400 [10.16] | .400 [10.16] | 1-7/16 [36.51] | 1.30 [33.02] |

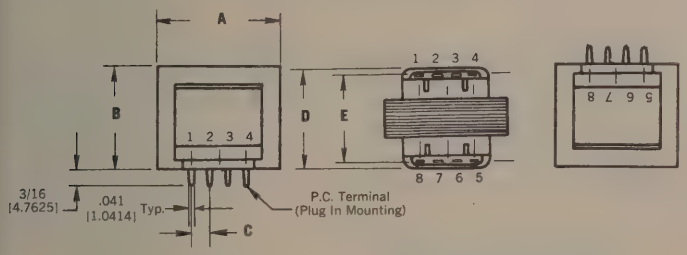
### ELECTRICAL CHARACTERISTICS

INPUT VOLTAGE 115V @ 60HZ

| OUTPUT VOLTAGE Series | OUTPUT VOLTAGE Parallel | OUTPUT CURRENT (MA) Series | OUTPUT CURRENT (MA) Parallel | MODEL NO. |
|---|---|---|---|---|
| 8 V CT | 4 V | 94 | 188 | PL-11-01 |
| | | 188 | 376 | PL-12-01 |
| | | 562 | 1124 | PL-13-01 |
| | | 940 | 1880 | PL-14-01 |
| 10 V CT | 5 V | 75 | 150 | PL-11-02 |
| | | 120 | 240 | PL-12-02 |
| | | 440 | 880 | PL-13-02 |
| | | 1000 | 2000 | PL-14-02 |
| 12.6 V CT | 6.3 V | 60 | 120 | PL-11-03 |
| | | 100 | 200 | PL-12-03 |
| | | 350 | 700 | PL-13-03 |
| | | 800 | 1600 | PL-14-03 |
| 15 V CT | 7.5 V | 50 | 100 | PL-11-04 |
| | | 100 | 200 | PL-12-04 |
| | | 300 | 600 | PL-13-04 |
| | | 500 | 1000 | PL-14-04 |
| 16 V CT | 8 V | 47 | 94 | PL-11-05 |
| | | 75 | 150 | PL-12-05 |
| | | 260 | 520 | PL-13-05 |
| | | 640 | 1280 | PL-14-05 |
| 20 V CT | 10 V | 38 | 76 | PL-11-06 |
| | | 60 | 120 | PL-12-06 |
| | | 220 | 440 | PL-13-06 |
| | | 500 | 1000 | PL-14-06 |
| 24 V CT | 12 V | 31 | 62 | PL-11-07 |
| | | 50 | 100 | PL-12-07 |
| | | 180 | 360 | PL-13-07 |
| | | 450 | 900 | PL-14-07 |
| 30 V CT | 15 V | 25 | 50 | PL-11-08 |
| | | 50 | 100 | PL-12-08 |
| | | 150 | 300 | PL-13-08 |
| | | 250 | 500 | PL-14-08 |
| 34 V CT | 17 V | 22 | 44 | PL-11-09 |
| | | 35 | 70 | PL-12-09 |
| | | 125 | 250 | PL-13-09 |
| | | 300 | 600 | PL-14-09 |
| 40 V CT | 20 V | 19 | 38 | PL-11-10 |
| | | 30 | 60 | PL-12-10 |
| | | 110 | 220 | PL-13-10 |
| | | 250 | 500 | PL-14-10 |
| 54 V CT | 27 V | 28 | 56 | PL-12-11 |
| | | 84 | 168 | PL-13-11 |
| | | 140 | 280 | PL-14-11 |
| 56 V CT | 28 V | 20 | 40 | PL-12-12 |
| | | 80 | 160 | PL-13-12 |
| | | 180 | 360 | PL-14-12 |
| 76 V CT | 38 V | 20 | 40 | PL-12-13 |
| | | 60 | 120 | PL-13-13 |
| | | 100 | 200 | PL-14-13 |
| 88 V CT | 44 V | 15 | 30 | PL-12-14 |
| | | 50 | 100 | PL-13-14 |
| | | 120 | 240 | PL-14-14 |
| 120 V CT | 60 V | 10 | 20 | PL-12-15 |
| | | 35 | 70 | PL-13-15 |
| | | 85 | 170 | PL-14-15 |
| 180 V CT | 90 V | 6 | 12 | PL-12-16 |
| | | 24 | 48 | PL-13-16 |
| | | 55 | 110 | PL-14-16 |
| 230 V CT | 115 V | 5 | 10 | PL-12-17 |
| | | 20 | 40 | PL-13-17 |
| | | 40 | 80 | PL-14-17 |

# PL-22, PL-23, PL-24

## Low Power Transformers
## Dual Primary—Dual Secondary




| | A | B | C | D | E |
|---|---|---|---|---|---|
| PL-22 | 1-3/8 [34.92] | 1-3/16 [30.16] | .20 [5.08] | 1-1/8 [28.58] | 1.00 [25.40] |
| PL-23 | 1-5/8 [41.28] | 1-3/8 [34.92] | .25 [6.35] | 1-1/4 [31.75] | 1.10 [27.94] |
| PL-24 | 1-7/8 [47.62] | 1.60 [40.64] | .25 [6.35] | 1-7/16 [36.51] | 1.30 [33.02] |

### ELECTRICAL CHARACTERISTICS

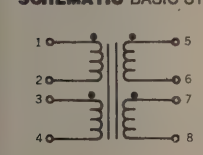
**INPUT VOLTAGE = 115V 60HZ OR 230V 50HZ-60HZ**

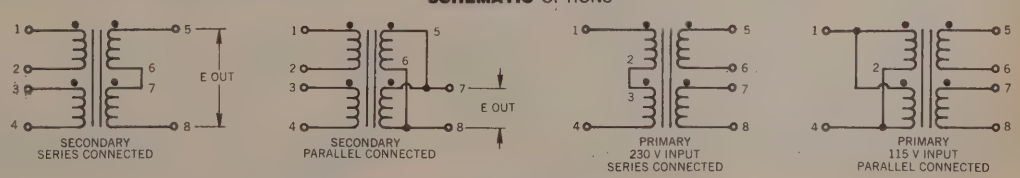
Same characteristics as PL-12, 13, 14 except dual primary for 115 or 230 volt operation.

### CUSTOMER APPLICATION

**SCHEMATIC** OPTIONS

**SCHEMATIC** BASIC STYLE




*For complete information, write or phone*

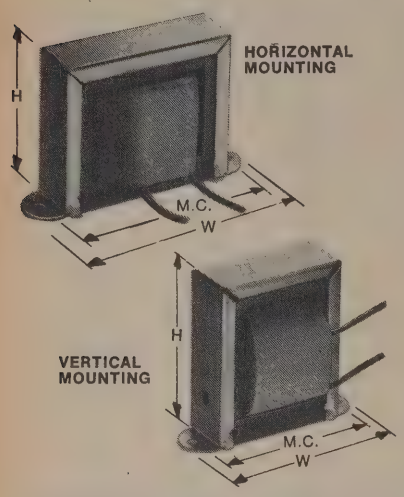
**DALE ELECTRONICS, INC.**, East Highway 50, Yankton, South Dakota 57078. Phone 605-665-9301

# DORMEYER INDUSTRIES

*A Division of A. F. Dormeyer Mfg. Co., Inc.*

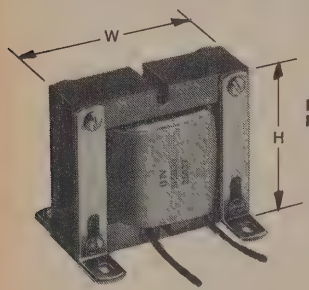
# TRANSFORMERS

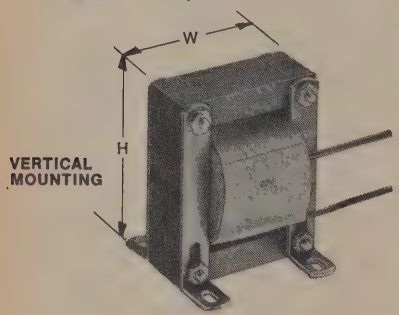
## CHANNEL FRAME MOUNT OPEN COIL TYPE TRANSFORMERS




| Core (inches) | Max. VA 65°C Temp. Rise | Horizontal Mounting | | | | Vertical Mounting | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | W (inches) | H (inches) | MC (inches) | Over Coil (inches) | W (inches) | H (inches) | MC (inches) | Over Coil (inches) |
| 3/8 x 3/8 | 2.4 | 2 1/16 | 1 3/16 | 1 3/4 | 1 3/8 | 1 13/16 | 1 7/16 | 1 1/2 | 1 3/8 |
| 1/2 x 1/2 | 6.2 | 2 3/8 | 1 3/8 | 2 | 1 1/2 | 2 | 1 11/16 | 1 23/32 | 1 1/2 |
| 1/2 x 5/8 | 8.2 | 2 3/8 | 1 3/8 | 2 | 1 5/8 | 2 | 1 11/16 | 1 23/32 | 1 5/8 |
| 5/8 x 1/2 | 8.6 | 2 13/16 | 1 5/8 | 2 3/8 | 1 1/2 | 2 3/8 | 1 15/16 | 2 | 1 1/2 |
| 5/8 x 5/8 | 11.1 | 2 13/16 | 1 5/8 | 2 3/8 | 1 5/8 | 2 3/8 | 1 15/16 | 2 | 1 5/8 |
| 5/8 x 3/4 | 13.2 | 2 13/16 | 1 5/8 | 2 3/8 | 1 3/4 | 2 7/16 | 1 15/16 | 2 | 1 3/4 |
| 3/4 x 5/8 | 18.9 | 3 1/4 | 1 15/16 | 2 13/16 | 1 3/4 | 2 7/8 | 2 5/16 | 2 3/8 | 1 3/4 |
| 3/4 x 3/4 | 21.7 | 3 1/4 | 1 15/16 | 2 13/16 | 1 7/8 | 2 7/8 | 2 5/16 | 2 3/8 | 1 7/8 |
| 3/4 x 1 | 31.8 | 3 1/4 | 1 15/16 | 2 13/16 | 2 1/8 | 2 13/16 | 2 5/16 | 2 3/8 | 2 1/8 |
| 7/8 x 3/4 | 33.7 | 3 11/16 | 2 1/4 | 3 1/8 | 2 | 3 1/8 | 2 11/16 | 2 13/16 | 2 |
| 7/8 x 7/8 | 36. | 3 11/16 | 2 1/4 | 3 1/8 | 2 1/8 | 3 1/8 | 2 11/16 | 2 13/16 | 2 1/8 |
| 7/8 x 1 | 42.7 | 3 11/16 | 2 1/4 | 3 1/8 | 2 1/4 | 3 1/8 | 2 11/16 | 2 13/16 | 2 1/4 |
| 1 x 1 | 50. | 4 | 2 5/16 | 3 5/16 | 2 3/8 | 3 5/16 | 3 1/16 | 3 1/8 | 2 3/8 |

## BRACKET MOUNT OPEN COIL TYPE TRANSFORMERS




| Core (inches) | Max. VA 65°C. Temp. Rise | Horizontal Mounting | | | | Vertical Mounting | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Mounting Centers (inches) | H (inches) | W (inches) | Over Coil (inches) | Mounting Centers (inches) | H (inches) | W (inches) | Over Coil (inches) |
| 15/16 x 1 1/4 | 58 | 2 1/2 x 2 1/4 | 2 1/2 | 3 | 2 3/4 | 2 x 2 1/4 | 3 | 2 1/2 | 2 3/4 |
| 1 1/8 x 1 1/8 | 71.5 | 2 13/16 x 2 1/8 | 2 13/16 | 3 3/8 | 2 5/8 | 2 1/4 x 2 1/8 | 3 3/8 | 2 13/16 | 2 5/8 |
| 1 1/4 x 1 3/8 | 116 | 3 1/8 x 2 3/8 | 3 1/8 | 3 3/4 | 3 | 2 1/2 x 2 3/8 | 3 3/4 | 3 1/8 | 3 |
| 1 3/8 x 1 1/2 | 154 | 3 7/16 x 2 1/2 | 3 7/16 | 4 1/8 | 3 1/4 | 2 3/4 x 2 1/2 | 4 1/8 | 3 7/8 | 3 1/4 |
| 1 1/2 x 1 3/4 | 232 | 3 3/4 x 2 3/4 | 3 3/4 | 4 1/2 | 3 3/4 | 3 x 2 3/4 | 4 1/2 | 3 3/4 | 3 3/4 |
| 1 3/4 x 2 | 380 | 4 3/8 x 3 | 4 3/8 | 5 1/4 | 4 1/4 | 3 1/2 x 3 | 5 1/4 | 4 3/8 | 4 1/4 |
| 1 3/4 x 3 1/8 | 500 | 4 3/8 x 4 1/8 | 4 3/8 | 5 1/4 | 5 1/2 | 3 1/2 x 4 1/8 | 5 1/4 | 4 3/8 | 5 1/2 |

NOTES:

1. The purpose of the above tables is to help the design engineer to approximate the size and type of the transformer required in the circuit being developed.
2. Electrical outputs are approximate and are based on the following conditions:
   A. Resistive loads.
   B. Break-down voltage 1,500V RMS max.
   C. Transformer installed where air circulation is permitted.
3. Transformers with enclosed coils are available; however, the rating of the transformer will be reduced due to the increase in coil temperature.
4. Transformers noted in the above table are estimated with single secondary and 30V maximum output. Voltage outputs other than 30V and multiple secondaries are available, but the overall VA rating of the transformer must be adjusted accordingly.
5. All transformers are available with various types of termination: leads, solder lugs, quick-disconnect connectors, etc.

## SPECIALTY TRANSFORMERS

Our large engineering staff, laboratory facilities, tool facilities, winding department, molding department and multiple plant production facilities provide the advantage of high volume transformer production not common to the industry. Many of today's transformer manufacturers are not capable of handling the special design or tooling that is required for specialty transformer manufacturing.

Typical examples of special type volume transformers manufactured by Dormeyer Industries are shown above.

Some of these special type transformers are as follows:

Molded transformers • Control transformers • High voltage transformers, fence/chargers and power supplies • Isolation • Step up-step down • Auto transformers • High reactance power transformers

Our Sales and Engineering personnel are always available for consultation on any of your transformer needs.

## DORMEYER COILS

Dormeyer Industries has extensive winding and molding facilities at all plants for the high volume production of coils. These facilities, together with our production know-how and engineering, can assure a high quality product at competitive prices.

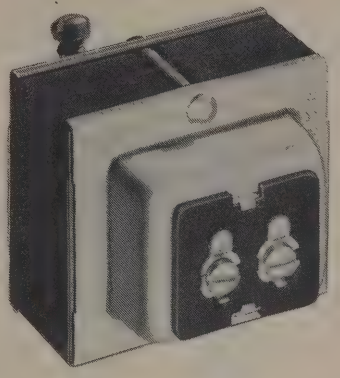
Some of the types of coils manufactured in high volume by Dormeyer Industries are shown above. These are:

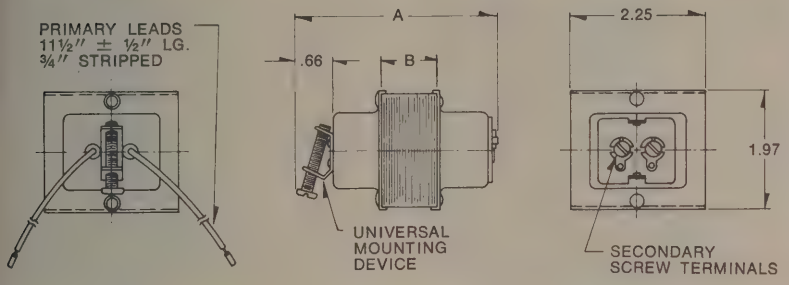
- BOBBIN WOUND
- PAPER SECTION
- ENCAPSULATED

Our Sales and Engineering personnel are always available for consultation on any of your coil requirements.

# TRANSFORMERS

## UNIVERSAL MOUNT CONTROL TRANSFORMERS






Transformers on this page comprise a standardized line of universal mount control transformers. All are priced very competitively, and are manufactured by using highly automated production line techniques.

Raw materials and sub-assemblies for the complete product line are carried in stock. Those transformers marked with an * are carried in stock as completed units and are available for immediate shipment. Sub-assemblies are carried in stock for all remaining transformers, and complete units are available on a reduced lead time basis.

Various mounting accessories are available from stock. Special mounting plates and styles are available on special order.

This transformer line carries UL and CSA individual listings. They are shipped bearing the UL and CSA seal, except that in some special mounting and termination variations where they are component approved and total acceptability must be evaluated in the end product.

**FEATURES:**

Wide range of voltage and wattage ratings available to meet virtually any requirement for which a control transformer can be used.

No costly mounting devices are required for most installations.

Construction is UL listed and CSA certified.

Sturdily built for long, trouble-free service life.

**MOUNTING DEVICE:**

Unless otherwise specified, all Dormeyer Control Transformers are equipped with a universal mounting device that permits mounting the transformer in the ⅞″ knockout hole of any junction box.

**MOUNTING SUPPORTS:**

A variety of mounting devices are available, including several universal mounting plates for junction boxes, a plug-in device and a conduit fitting.

## SPECIFICATIONS AND LOAD CHARACTERISTICS

### DCT-5 SERIES

| Cat. No. | Primary (Input) Voltage | Secondary (Output) Voltage | VA Rating (Wattage) | Ship. Wght. | DIMENSIONS (inches) A | B |
|---|---|---|---|---|---|---|
| DCT-5-120* | 120V | 10V | 5 VA | 10 oz. | 2.6 | .31 |

NOTES: 1. DCT-5-120 is carried in stock as a complete transformer.
2. For mounting accessories, see next page.

### DCT-10 SERIES

| Cat. No. | Primary (Input) Voltage | Secondary (Output) Voltage | VA Rating (Wattage) | Ship. Wght. | DIMENSIONS (inches) A | B |
|---|---|---|---|---|---|---|
| DCT-10-120* | 120V | 16V | 10 VA | 11 oz. | 2.6 | .31 |

NOTES: 1. DCT-10-120 Series is carried in stock as a completed transformer.
2. For mounting accessories, see next page.

### DCT-12 SERIES

| Cat. No. | Primary (Input) Voltage | Secondary (Output) Voltage | VA Rating (Wattage) | Ship. Wght. | DIMENSIONS (inches) A | B |
|---|---|---|---|---|---|---|
| DCT-12-120* | 120V | 24V | 12 VA | 12 oz. | 2.65 | .36 |
| DCT-12-208 | 208V | 24V | 12 VA | 12 oz. | 2.65 | .36 |
| DCT-12-240 | 240V | 24V | 12 VA | 12 oz. | 2.65 | .36 |
| DCT-12-284 | 208/240V† | 24V | 12 VA | 12 oz. | 2.65 | .36 |
| DCT-12-480 | 480V | 24V | 12 VA | 12 oz. | 2.65 | .36 |

NOTES: 1. DCT-12-120 is carried in stock as a completed transformer.
2. For mounting accessories, see next page.
3. Transformers marked with a † are dual voltage (208V-240V) and are equipped with 3 primary leads: common — white, 208V — yellow and 240V — black.

### DCT-20 SERIES

| Cat. No. | Primary (Input) Voltage | Secondary (Output) Voltage | VA Rating (Wattage) | Ship. Wght. | DIMENSIONS (inches) A | B |
|---|---|---|---|---|---|---|
| DCT-20-120* | 120V | 24V | 20 VA | 15 oz. | 2.90 | .61 |
| DCT-20-208 | 208V | 24V | 20 VA | 15 oz. | 2.90 | .61 |
| DCT-20-240 | 240V | 24V | 20 VA | 15 oz. | 2.90 | .61 |
| DCT-20-284 | 208/240V† | 24V | 20 VA | 15 oz. | 2.90 | .61 |
| DCT-20-480 | 480V | 24V | 20 VA | 15 oz. | 2.90 | .61 |

NOTES: 1. DCT-20-120 is carried in stock as a completed transformer.
2. For mounting accessories, see next page.
3. Transformers marked with a † are dual voltage (208V-240V) and are equipped with 3 primary leads: common — white, 208V — yellow and 240V — black.

### DCT-40 SERIES

| Cat. No. | Primary (Input) Voltage | Secondary (Output) Voltage | VA Rating (Wattage) | Ship. Wght. | DIMENSIONS (inches) A | B |
|---|---|---|---|---|---|---|
| DCT-40-120* | 120V | 24V | 40 VA | 22 oz. | 3.30 | 1.01 |
| DCT-40-208 | 208V | 24V | 40 VA | 22 oz. | 3.30 | 1.01 |
| DCT-40-240 | 240V | 24V | 40 VA | 22 oz. | 3.30 | 1.01 |
| DCT-40-284 | 208/240V† | 24V | 40 VA | 22 oz. | 3.30 | 1.01 |
| DCT-40-480 | 480V | 24V | 40 VA | 22 oz. | 3.30 | 1.01 |

NOTES: 1. DCT-40-120 is carried in stock as a completed transformer.
2. For mounting accessories, see next page.
3. Transformers marked with a † are dual voltage (208V-240V) and are equipped with 3 primary leads: common — white, 208V — yellow and 240V — black.

### DCT-55 SERIES

| Cat. No. | Primary (Input) Voltage | Senondary (Output) Voltage | VA Rating (Wattage) | Ship. Wght. | DIMENSIONS (inches) A | B |
|---|---|---|---|---|---|---|
| DCT-55-120* | 120V | 24V | 55 VA | 33 oz. | 3.83 | 1.64 |
| DCT-55-208 | 208V | 24V | 55 VA | 33 oz. | 3.83 | 1.64 |
| DCT-55-240 | 240V | 24V | 55 VA | 33 oz. | 3.83 | 1.64 |
| DCT-55-284 | 208/240V† | 24V | 55 VA | 33 oz. | 3.83 | 1.64 |
| DCT-55-480 | 480V | 24V | 55 VA | 33 oz. | 3.83 | 1.64 |

NOTES: 1. DCT-55-120 is carried in stock as a completed transformer.
2. For mounting accessories, see next page.
3. Transformers marked with a † are dual voltage (208V-240V) and are equipped with 3 primary leads: common — white, 208V — yellow and 240V — black.

# DORMEYER INDUSTRIES

*A Division of A. F. Dormeyer Mfg. Co., Inc.*

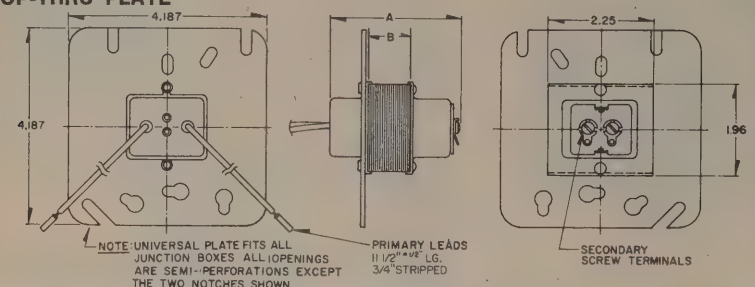
# TRANSFORMERS

## CONTROL TRANSFORMERS

### SPECIAL MOUNTING PLATES

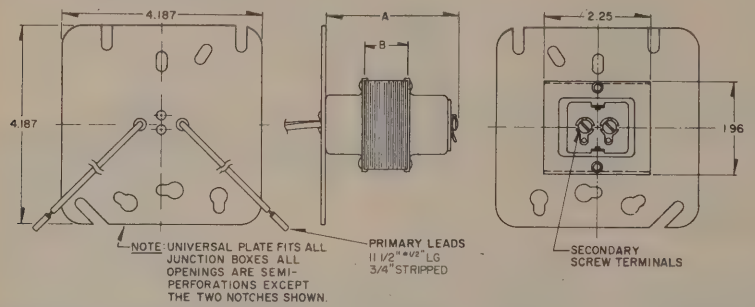
In addition to the standard mounting plate shown on page 10, several styles of special plates for mounting the transformer are available. All are designed for mounting on any square, round or octagonal junction box. Two examples are shown on this page.

### DROP-THRU PLATE



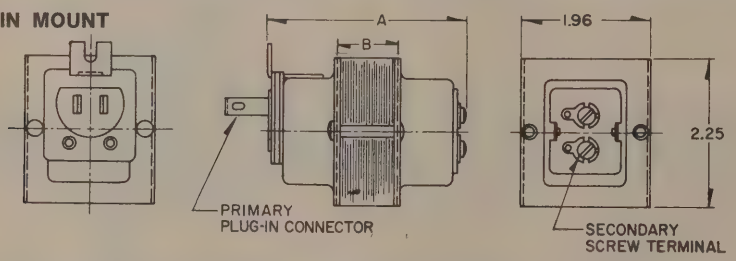

This plate is for use where there is sufficient room inside the box for the primary side of the transformer. It is furnished assembled to the transformer at nominal extra cost. For approximate transformer dimensions refer to preceding page.

### SURFACE MOUNTED PLATES




Where there is no room for the "Drop-Thru" plate, a surface mount plate can be furnished assembled to the transformer cover at nominal extra cost. For approximate transformer dimensions refer to preceding page.

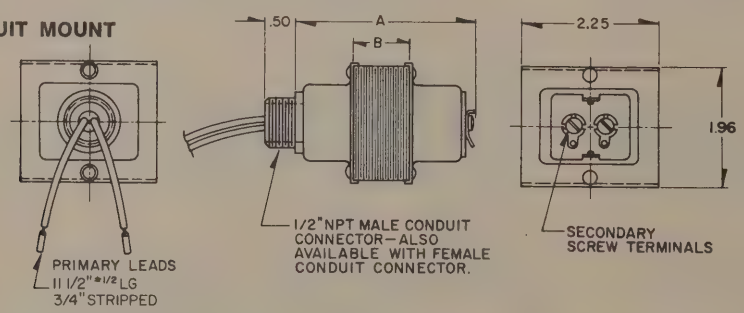
### PLUG-IN MOUNT




All 120V primary models are available with a plug-in mount that can be plugged into any standard wall outlet, thus eliminating the need for line cords or mounting brackets.

UL and CSA listing on this style is limited. If listing is required, consult Dormeyer Engineerng Department. For approximate transformer dimensions, refer to preceding page.

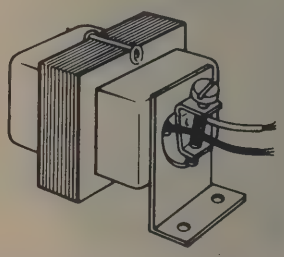
### CONDUIT MOUNT



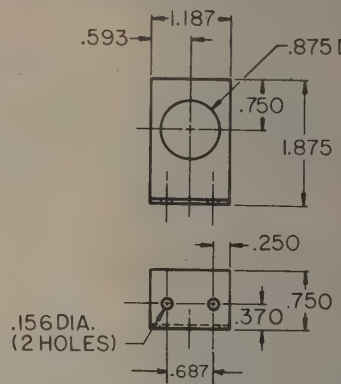

This mount permits the transformer to be connected directly to the conduit or pipe that encloses the primary conductors. It is available with either male or female thread at nominal extra cost. For approximate transformer dimensions, refer to preceding page.

## MOUNTING ACCESSORIES

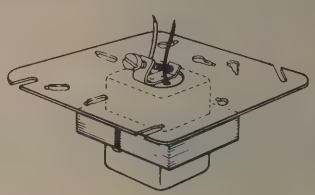
### MOUNTING FOOT (CAT. NO. TR-138)



For mounting on wall, post or a foot that permits the transformer to be mounted horizontally or vertically is available at nominal extra cost. Post opening required for this mounting is the same size as knockout in junction box.

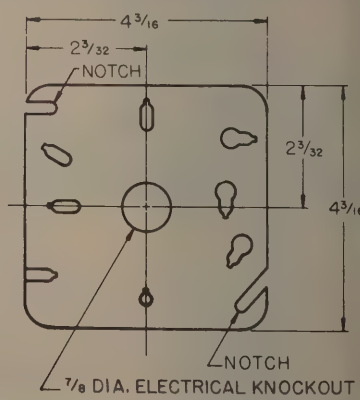



### MOUNTING PLATE (CAT. NO. TR-146)

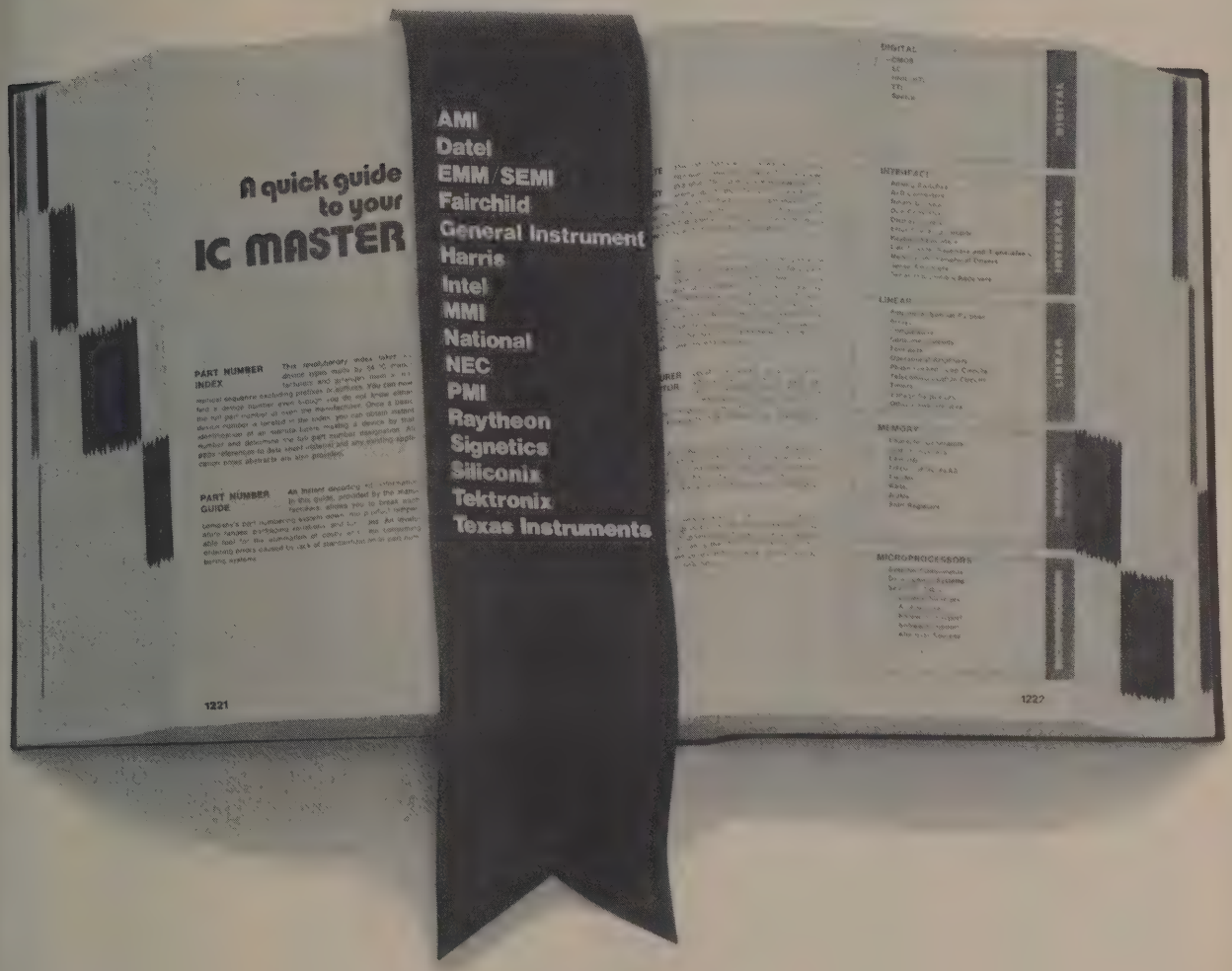


For mounting on the front of a junction box, a universal plate is available at nominal extra cost.

Knockout openings are provided that will permit its use with square, round or octagonal junction boxes. The center opening is sized to take the universal mounting device.



# A GOOD BOOK IS KNOWN BY THE COMPANIES IT KEEPS.




These manufacturers have invested in the IC MASTER to bring you the most complete information on their newest standard products.

HEN USING THE IC MASTER, REFER TO THESE MANUFACTURERS' COMPLETE DATA SHEETS TO HELP YOU IN YOUR IC SELECTION . . .

## THE WHOLE WORLD FOLLOWS THE MASTER.

**IC Master**
**1333 Lawrence Expressway, Suite 420**
**Santa Clara, CA 95051**
**(408) 248-8044**

***It's Faster With the Master***

# POWER TRANSFORMERS-P.C. PLUS FAST SERVICE! INC.

**SECONDARY RMS RATING** | **PRIMARY 50/500 Hz**

| Series V.C.T. MA | Parallel @ 2x Current V MA | Size | Single 115V 6 Pin | Single 230V 6 Pin | Dual 115/230V 8 Pin | Single 277V 6 Pin | Single 332V 6 Pin |
|---|---|---|---|---|---|---|---|
| 10 @ 120 | 5 @ 240 | 37 | PC-10-120B1 | CPC-10-120B1 | DPC-10-120B1 | EPC-10-120B1 | FPC-10-120B1 |
| 10 @ 440 | 5 @ 880 | 50 | PC-10-440B2 | CPC-10-440B2 | DPC-10-440B2 | EPC-10-440B2 | FPC-10-440B2 |
| 10 @ 1000 | 5 @ 2000 | 62 | PC-10-1000B3 | CPC-10-1000B3 | DPC-10-1000B3 | EPC-10-1000B3 | FPC-10-1000B3 |
| 10 @ 2400 | 5 @ 4800 | 24 | PC-10-2400B4 | CPC-10-2400B4 | DPC-10-2400B4 | EPC-10-2400B4 | FPC-10-2400B4 |
| 12.6 @ 100 | 6.3 @ 200 | 37 | PC-12-100B5 | CPC-12-100B5 | DPC-12-100B5 | EPC-12-100B5 | FPC-12-100B5 |
| 12.6 @ 350 | 6.3 @ 700 | 50 | PC-12-350B6 | CPC-12-350B6 | DPC-12-350B6 | EPC-12-350B6 | FPC-12-350B6 |
| 12.6 @ 800 | 6.3 @ 1600 | 62 | PC-12-800B7 | CPC-12-800B7 | DPC-12-800B7 | EPC-12-800B7 | FPC-12-800B7 |
| 12.6 @ 2000 | 6.3 @ 4000 | 24 | PC-12-2000B8 | CPC-12-2000B8 | DPC-12-2000B8 | EPC-12-2000B8 | FPC-12-2000B8 |
| 16 @ 75 | 8 @ 150 | 37 | PC-16-75B9 | CPC-16-75B9 | DPC-16-75B9 | EPC-16-75B9 | FPC-16-75B9 |
| 16 @ 260 | 8 @ 520 | 50 | PC-16-260B10 | CPC-16-260B10 | DPC-16-260B10 | EPC-16-260B10 | FPC-16-260B10 |
| 16 @ 640 | 8 @ 1280 | 62 | PC-16-640B11 | CPC-16-640B11 | DPC-16-640B11 | EPC-16-640B11 | FPC-16-640B11 |
| 16 @ 1500 | 8 @ 3000 | 24 | PC-16-1500B12 | CPC-16-1500B12 | DPC-16-1500B12 | EPC-16-1500B12 | FPC-16-1500B12 |
| 20 @ 60 | 10 @ 120 | 37 | PC-20-60B13 | CPC-20-60B13 | DPC-20-60B13 | EPC-20-60B13 | FPC-20-60B13 |
| 20 @ 220 | 10 @ 440 | 50 | PC-20-220B14 | CPC-20-220B14 | DPC-20-220B14 | EPC-20-220B14 | FPC-20-220B14 |
| 20 @ 500 | 10 @ 1000 | 62 | PC-20-500B15 | CPC-20-500B15 | DPC-20-500B15 | EPC-20-500B15 | FPC-20-500B15 |
| 20 @ 1200 | 10 @ 2400 | 24 | PC-20-1200B16 | CPC-20-1200B16 | DPC-20-1200B16 | EPC-20-1200B16 | FPC-20-1200B16 |
| 24 @ 50 | 12 @ 100 | 37 | PC-24-50B17 | CPC-24-50B17 | DPC-24-50B17 | EPC-24-50B17 | FPC-24-50B17 |
| 24 @ 180 | 12 @ 360 | 50 | PC-24-180B18 | CPC-24-180B18 | DPC-24-180B18 | EPC-24-180B18 | FPC-24-180B18 |
| 24 @ 450 | 12 @ 900 | 62 | PC-24-450B19 | CPC-24-450B19 | DPC-24-450B19 | EPC-24-450B19 | FPC-24-450B19 |
| 24 @ 1000 | 12 @ 2000 | 24 | PC-24-1000B20 | CPC-24-1000B20 | DPC-24-1000B20 | EPC-24-1000B20 | FPC-24-1000B20 |
| 34 @ 35 | 17 @ 70 | 37 | PC-34-35B21 | CPC-34-35B21 | DPC-34-35B21 | EPC-34-35B21 | FPC-34-35B21 |
| 34 @ 125 | 17 @ 250 | 50 | PC-34-125B22 | CPC-34-125B22 | DPC-34-125B22 | EPC-34-125B22 | FPC-34-125B22 |
| 34 @ 300 | 17 @ 600 | 62 | PC-34-300B23 | CPC-34-300B23 | DPC-34-300B23 | EPC-34-300B23 | FPC-34-300B23 |
| 34 @ 700 | 17 @ 1400 | 24 | PC-34-700B24 | CPC-34-700B24 | DPC-34-700B24 | EPC-34-700B24 | FPC-34-700B24 |
| 40 @ 30 | 20 @ 60 | 37 | PC-40-30B25 | CPC-40-30B25 | DPC-40-30B25 | EPC-40-30B25 | FPC-40-30B25 |
| 40 @ 110 | 20 @ 220 | 50 | PC-40-110B26 | CPC-40-110B26 | DPC-40-110B26 | EPC-40-110B26 | FPC-40-110B26 |
| 40 @ 250 | 20 @ 500 | 62 | PC-40-250B27 | CPC-40-250B27 | DPC-40-250B27 | EPC-40-250B27 | FPC-40-250B27 |
| 40 @ 600 | 20 @ 1200 | 24 | PC-40-600B28 | CPC-40-600B28 | DPC-40-600B28 | EPC-40-600B28 | FPC-40-600B28 |
| 56 @ 20 | 28 @ 40 | 37 | PC-56-20B29 | CPC-56-20B29 | DPC-56-20B29 | EPC-56-20B29 | FPC-56-20B29 |
| 56 @ 80 | 28 @ 160 | 50 | PC-56-80B30 | CPC-56-80B30 | DPC-56-80B30 | EPC-56-80B30 | FPC-56-80B30 |
| 56 @ 180 | 28 @ 360 | 62 | PC-56-180B31 | CPC-56-180B31 | DPC-56-180B31 | EPC-56-180B31 | FPC-56-180B31 |
| 56 @ 420 | 28 @ 840 | 24 | PC-56-420B32 | CPC-56-420B32 | DPC-56-420B32 | EPC-56-420B32 | FPC-56-420B32 |
| 88 @ 15 | 44 @ 30 | 37 | PC-88-15B33 | CPC-88-15B33 | DPC-88-15B33 | EPC-88-15B33 | FPC-88-15B33 |
| 88 @ 50 | 44 @ 100 | 50 | PC-88-50B34 | CPC-88-50B34 | DPC-88-50B34 | EPC-88-50B34 | FPC-88-50B34 |
| 88 @ 120 | 44 @ 240 | 62 | PC-88-120B35 | CPC-88-120B35 | DPC-88-120B35 | EPC-88-120B35 | FPC-88-120B35 |
| 88 @ 270 | 44 @ 540 | 24 | PC-88-270B36 | CPC-88-270B36 | DPC-88-270B36 | EPC-88-270B36 | FPC-88-270B36 |
| 120 @ 10 | 60 @ 20 | 37 | PC-120-10B37 | CPC-120-10B37 | DPC-120-10B37 | EPC-120-10B37 | FPC-120-10B37 |
| 120 @ 35 | 60 @ 70 | 50 | PC-120-35B38 | CPC-120-35B38 | DPC-120-35B38 | EPC-120-35B38 | FPC-120-35B38 |
| 120 @ 85 | 60 @ 170 | 62 | PC-120-85B39 | CPC-120-85B39 | DPC-120-85B39 | EPC-120-85B39 | FPC-120-85B39 |
| 120 @ 200 | 60 @ 400 | 24 | PC-120-200B40 | CPC-120-200B40 | DPC-120-200B40 | EPC-120-200B40 | FPC-120-200B40 |
| 180 @ 6 | 90 @ 12 | 37 | PC-180-6B41 | CPC-180-6B41 | DPC-180-6B41 | EPC-180-6B41 | FPC-180-6B41 |
| 180 @ 24 | 90 @ 48 | 50 | PC-180-24B42 | CPC-180-24B42 | DPC-180-24B42 | EPC-180-24B42 | FPC-180-24B42 |
| 180 @ 55 | 90 @ 110 | 62 | PC-180-55B43 | CPC-180-55B43 | DPC-180-55B43 | EPC-180-55B43 | FPC-180-55B43 |
| 180 @ 130 | 90 @ 260 | 24 | PC-180-130B44 | CPC-180-130B44 | DPC-180-130B44 | EPC-180-130B44 | FPC-180-130B44 |
| 230 @ 5 | 115 @ 10 | 37 | PC-230-5B45 | CPC-230-5B45 | DPC-230-5B45 | EPC-230-5B45 | FPC-230-5B45 |
| 230 @ 20 | 115 @ 40 | 50 | PC-230-20B46 | CPC-230-20B46 | DPC-230-20B46 | EPC-230-20B46 | FPC-230-20B46 |
| 230 @ 40 | 115 @ 80 | 62 | PC-230-40B47 | CPC-230-40B47 | DPC-230-40B47 | EPC-230-40B47 | FPC-230-40B47 |
| 230 @ 100 | 115 @ 200 | 24 | PC-230-100B48 | CPC-230-100B48 | DPC-230-100B48 | EPC-230-100B48 | FPC-230-100B48 |

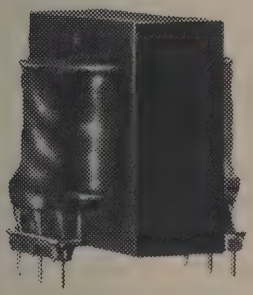
**RATINGS BASED ON 20% REGULATION.**

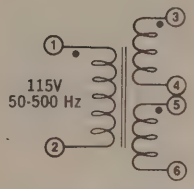
**METHOD OF DETERMINING SECONDARY RMS CURRENT:**

| Rectifier Type | Filter Type | RMS Secondary Current |
|---|---|---|
| Full Wave Center Tap | Choke Input | .7 x DC Amps |
| Full Wave Center Tap | Capacitor Input | 1.2 x DC Amps |
| Full Wave Bridge | Choke Input | 1.0 x DC Amps |
| Full Wave Bridge | Capacitor Input | 1.8 x DC Amps |

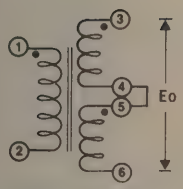
# POWER TRANSFORMERS-P.C. PLUS FAST SERVICE!

## Single 115V Primary Type PC-6 Pins

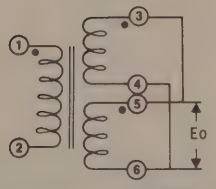




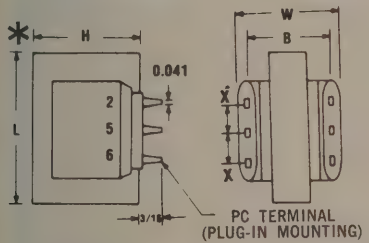

BASIC SCHEMATIC
Transformer can be connected in series or parallel.




SERIES CONNECTED

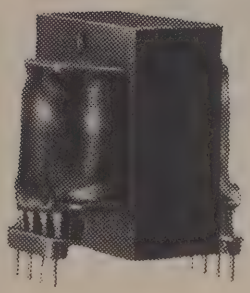


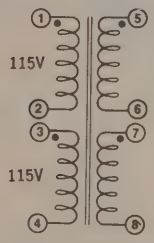

PARALLEL CONNECTED



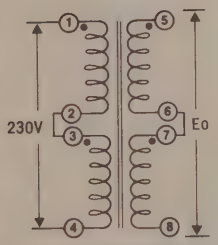

BRACKET AND CHANNEL FRAME MOUNTING AVAILABLE

## Dual 115/230V Primary Type DPC-8 Pins

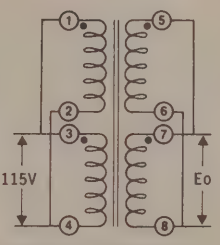




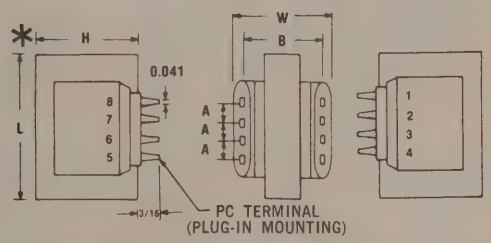

BASIC SCHEMATIC
Transformer can be connected in series or parallel.




SERIES CONNECTED

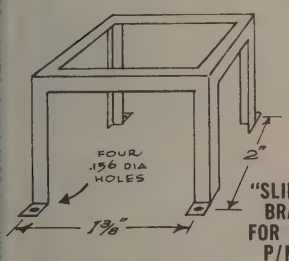



PARALLEL CONNECTED




BRACKET AND CHANNEL FRAME MOUNTING AVAILABLE

| *Size | VA | L | W | H | 6 PIN X | 8 PIN X | B | Wt. Oz. |
|---|---|---|---|---|---|---|---|---|
| 37 | 1.2 | 1⅜ | 1⅛ | 1⅜ | 0.312 | .200 | 1.000 | 3 |
| 50 | 4.4 | 1⅝ | 1¼ | 1⅜ | 0.400 | .250 | 1.100 | 5 |
| 62 | 10 | 1⅞ | 1⅞ | 1⅝ | 0.400 | .250 | 1.300 | 9 |
| 24 | 24 | 1⅝ | 2¼ | 1⅜ | 0.400 | .250 | 2.100 | 12 |




"SLIDE ON" BRACKET FOR SIZE 24 P/N B24

**EWC for fast service.** Efficient and speedy response to customer needs is what EWC is all about. In addition to our standard line, we welcome inquiries about problems calling for custom designs. Cutting through red tape with person-to-person discussions has established EWC as an ideal supplier of quality products for quality-conscious companies.

EWC INC.

Dept. EM / 725 Federal Ave. / Kenilworth, NJ 07033 / (201) 245-3200 / TWX 710-996-5993

# FREED TRANSFORMER CO., INC.

## MIL-T-27 COMPONENTS

### TRANSISTOR SUPPLY TRANSFORMERS
### TST SERIES

Manufactured and Guaranteed to Specifications MIL-T-27

TST-6 — Frequency 57 Hz to 63 Hz — Primary 115 volts units with * primary 115 and/or 230 volts

TST-4 — Frequency 380 Hz to 1000 Hz — Primary 115 volts

TST units can be supplied in commercial type construction (channel or shell type with leads).

**When ordering specify (6) for 57 to 63 Hz and (4) for 380 to 1000 Hz

**D.C. to RMS Conversion Chart**

| Resistive or Inductive Loads | | Capacitive Loads | |
|---|---|---|---|
| Full Wave Center Tapped | Full Wave Bridge | Full Wave Center Tapped | Full Wave Bridge |
| $E_{RMS} = 2.22$ Edc | $E_{RMS} = 1.11$ Edc | $E_{RMS} = 1.6$ Edc | $E_{RMS} = 8$ Edc |
| $I_{RMS} = .75$ Idc | $I_{RMS} = 1.05$ Idc | $I_{RMS} = 1.1$ Idc | $I_{RMS} = 1.55$ Idc |

Edc – should include voltage drop across reactor and voltage drop across one diode for F W C T and voltage drop across two diodes for F-W Bridge

| Part No. | R.M.S. Output Volt | Amp | Case —4 | Case —6 |
|---|---|---|---|---|
| TST(**)-1 | 6.3 CT | .30 | AH | AH |
| TST(**)-2 | 6.3 CT | .60 | AH | AJ |
| TST(**)-3 | 12.6 Split | .80 | AJ | EB |
| TST(**)-4 | 12.6 Split | 1.5 | AJ | FA |
| TST(**)-5 | 12.6 Split | 2.0 | AJ | GB* |
| TST(**)-6 | 25.2 Split | 1.5 | EB | GA* |
| TST(**)-7 | 25.2 Split | 4.0 | GB | JA* |
| TST(**)-8 | 30 Split | .50 | AJ | FA |
| TST(**)-9 | 30 Split | 1.0 | AJ | GB* |
| TST(**)-10 | 30 Split | 1.5 | EB | GA* |
| TST(**)-11 | 30 Split | 2.0 | FA | HA* |
| TST(**)-12 | 40 Split | .50 | AJ | FA |
| TST(**)-13 | 40 Split | 1.0 | EB | GA* |
| TST(**)-14 | 40 Split | 1.5 | FA | HA* |
| TST(**)-15 | 40 Split | 2.0 | FA | JB* |
| TST(**)-16 | 50 Split | .50 | AJ | GB* |
| TST(**)-17 | 50 Split | 1.0 | FA | GA* |
| TST(**)-18 | 50 Split | 1.5 | FA | JB* |
| TST(**)-19 | 50 Split | 2.0 | GB | JA* |
| TST(**)-20 | 60 Split | .50 | AJ | GB* |
| TST(**)-21 | 60 Split | 1.0 | FA | HA* |
| TST(**)-22 | 60 Split | 1.5 | FA | JA* |
| TST(**)-23 | 70 Split | .50 | EB | GA* |
| TST(**)-24 | 70 Split | 1.0 | FA | JB* |
| TST(**)-25 | 70 Split | 1.5 | GB | JA* |
| TST(**)-26 | 80 Split | .25 | AJ | FA |
| TST(**)-27 | 80 Split | .50 | EB | GA* |
| TST(**)-28 | 80 Split | 1.0 | FA | JB* |
| TST(**)-29 | 90 Split | .25 | AJ | GB* |
| TST(**)-30 | 90 Split | .50 | EB | GA* |
| TST(**)-31 | 90 Split | 1.0 | FA | JA* |
| TST(**)-32 | 100 Split | .25 | AJ | GB* |
| TST(**)-33 | 100 Split | .50 | FA | GA* |
| TST(**)-34 | 100 Split | 1.20 | GA | KB* |

### STANDARD MILITARY AUDIO TRANSFORMERS
**Frequency Response 300-10,000 Hz ±2 DB**

| Catalog No. | Application | Type Designation | Impedance Level in Ohms Primary | Secondary | Ratio | Max. Power Level DBM | Pri. D.C. Per Side in Ma | Max. D.C. unbalance | Case |
|---|---|---|---|---|---|---|---|---|---|
| MGA 1 | Transformer; interstage, single or P.P. plates to single or P.P. grid | TF4RX15AJ | 10,000 C.T. | 90,000 split and C.T. | 1:3 overall | +15 | 10 | 10 | AJ |
| MGA 2 | Transformer; matching 600 ohm line to voice coil. | TF4RX16AJ | 600 split | 4, 8, 16 | 6.12:1 overall | +33 | 0 | 0 | AJ |
| MGA 3 | Transformer; input, 600 ohm line to single or P.P. grids. | TF4RX10AJ | 600 split | 135,000 C.T. | 1:15 | +15 | 0 | 0 | AJ |
| MGA 4 | Transformer; matching, 600 ohm line to 600 ohm line. | TF4RX16AJ | 600 split | 600 split | 1:1 | +15 | 0 | 0 | AJ |
| MGA 5 | Transformer; output, single plate 7,600 ohm, 4,800 ohm to 600 ohm line. | TF4RX13AJ | 7,600 tap @ 4,800 | 600 split | 3.56:1 | +33 | 40 | 40 | AJ |
| MGA 6 | Transformer; output, single plate 7,600 ohm, 4,800 ohm to voice coil. | TF4RX13AJ | 7,600 tap @ 4,800 | 4, 8, 16 | 21.8:1 | +33 | 40 | 40 | AJ |
| MGA 7 | Transformer; output, single or P.P. plates to 600 ohm line. | TF4RX13AJ | 15,000 C.T. | 600 split | 5:1 | +33 | 10 | 10 | AJ |
| MGA 8 | Transformer; output, P.P. plates to 600 ohm line. | TF4RX13AJ | 24,000 C.T. | 600 split | 6.32:1 | +30 | 10 | 1 | AJ |
| MGA 9 | Transformer; output, P.P. plates to 600 ohm line. | TF4RX13AJ | 60,000 C.T. | 600 split | 10:1 | +27 | 10 | 1 | AJ |

### STANDARD MILITARY POWER AND FILAMENT TRANSFORMERS
**Primary 105/115/125V 60~**

SINGLE PHASE 400 Hz, AND THREE PHASE 60 AND 400 Hz TRANSFORMERS CAN BE SUPPLIED ON SPECIAL ORDER.

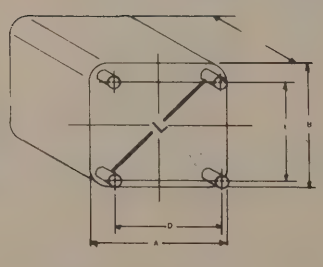
| Catalog No. | MIL-T-27 Type Designation | Hi Volt | D.C. Volts | D.C. Amps | Fil. No. 1 | Fil. No. 2 | Case |
|---|---|---|---|---|---|---|---|
| MGP 1 | TF4RX03HA001 | 200/100/0/100 200 | 185 | .070 | 5 6.3V @ 2A | 6.3V @ 3A | HA |
| MGP 2 | TF4RX03JB002 | 690 C.T. | 260 | .070 | 5 6.3V @ 2A | 6.3V @ 4A | JB |
| MGP 3 | TF4RX03KB006 | 650 C.T. | 245 | .150 | 6.3V @ 5A | 5V @ 3A | KB |
| MGP 4 | TF4RX03LB003 | 800 C.T. | 318 | .175 | 5V @ 3A | 6.3V @ 8A | LB |
| MGP 5 | TF4RX03MB004 | 900 C.T. | 345 | .250 | 5V @ 3A | 6.3V @ 8A | MB |
| MGP 6 | TF4RX02KB001 | 700 C.T. | 255 | .250 | | | KB |
| MGP 7 | TF4RX02LB002 | 1100 C.T. | 419 | .250 | | | LB |
| MGP 8 | TF4RX02NB003 | 1600 C.T. | 640 | .250 | | | NB |

| Catalog No. | MIL-T-27 Type Designation | Secondary Volts | Secondary Current Amps | Secondary Test Volts RMS | Case |
|---|---|---|---|---|---|
| MGF 1 | TF4RX01EB002 | 2.5 | 3.0 | 2,500 | EB |
| MGF 2 | TF4RX01GB003 | 2.5 | 10.0 | 2,500 | GB |
| MGF 3 | TF4RX01FB004 | 5.0 | 3.0 | 2,500 | FB |
| MGF 4 | TF4RX01HB005 | 5.0 | 10.0 | 2,500 | HB |
| MGF 5 | TF4RX01FB006 | 6.3 | 2.0 | 2,500 | FB |
| MGF 6 | TF4RX01GB007 | 6.3 | 5.0 | 2,500 | GB |
| MGF 7 | TF4RX01JB008 | 6.3 | 10.0 | 2,500 | JB |
| MGF 8 | TF4RX01KB009 | 6.3 | 20.0 | 2,500 | KB |
| MGF 9 | TF4RX01JB012 | 2.5 | 10.0 | 10,000 | JB |
| MGF 10 | TF4RX01KB013 | 5.0 | 10.0 | 10,000 | KB |

### PULSE TRANSFORMERS

| Catalog No. | MIL Type | Blocking Osc. | Interstage Coupling | Low Power Output | Pulse Voltage Kilovolts | Pulse Duration Microseconds | Duty Rate | No. of Windings | Test Voltage KV. RMS | Characteristic Impedance Ohms | Case No. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MPT-1 | TF4RX35YY | √ | √ | | 0.25/0.25/0.25 | 0.2-1.0 | .004 | 3 | 0.7 | 250 | DM-20 |
| MPT-2 | TFR4X35YY | √ | √ | | 0.25/0.25 | 0.2-1.0 | .004 | 2 | 0.7 | 250 | DM-20 |
| MPT-3 | TF4RX35YY | √ | √ | | 0.5/0.5/0.5 | 0.2-1.5 | .002 | 3 | 1.0 | 250 | DM-18 |
| MPT-4 | TF4RX35YY | √ | √ | | 0.5/0.5 | 0.2-1.5 | .002 | 2 | 1.0 | 250 | DM-18 |
| MPT-5 | TF4RX35YY | √ | √ | | 0.5/0.5/0.5 | 0.5-2.0 | .002 | 3 | 1.0 | 500 | DM-20 |
| MPT-6 | TF4RX35YY | √ | √ | | 0.5/0.5 | 0.5-2.0 | .002 | 2 | 1.0 | 500 | DM-20 |
| MPT-7 | TF4RX35YY | √ | √ | √ | 0.7/0.7/0.7 | 0.5-1.5 | .002 | 3 | 1.5 | 200 | DM-18 |
| MPT-8 | TF4RX35YY | √ | √ | √ | 0.7/0.7 | 0.5-1.5 | .002 | 2 | 1.5 | 200 | DM-18 |
| MPT-9 | TF4RX35YY | √ | √ | √ | 1.0/1.0/1.0 | 0.7-3.5 | .002 | 3 | 2.0 | 200 | DM-18 |
| MPT-10 | TF4RX35YY | √ | √ | √ | 1.0/1.0 | 0.7-3.5 | .002 | 2 | 2.0 | 200 | DM-18 |
| MPT-11 | TF4RX35YY | √ | √ | √ | 1.0/1.0/1.0 | 1.0-5.0 | .002 | 3 | 2.0 | 500 | DM-01 |
| MPT-12 | TF4RX35YY | √ | √ | √ | 0.15/0.15/0.3/0.3 | 0.2-1.0 | .004 | 4 | 0.7 | 700 | DM-8 |

**MIL CASES, NOMINAL DIMENSIONS, INCHES**




| Mil Case | A | B | C | D | L | E | Mtg. Studs | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|
| AH | 1 5/16 | 1 5/16 | 1 3/4 | | 1 1/4 | | 6-32 x 3/8 | 3/8 |
| AJ | 1 3/8 | 1 3/8 | 2 3/8 | 1 3/16 | | 1 3/16 | 6-32 x 3/8 | 2/3 |
| EA | 1 15/16 | 1 13/16 | 2 3/4 | 1 3/8 | | 1 1/4 | 6-32 x 3/8 | 1 |
| EB | 1 15/16 | 1 13/16 | 2 7/16 | 1 1/8 | | 1 1/4 | 6-32 x 3/8 | 7/8 |
| FA | 2 5/16 | 2 1/16 | 3 1/8 | 1 11/16 | | 1 7/16 | 6-32 x 3/8 | 1 3/4 |
| FB | 2 5/16 | 2 1/16 | 2 1/2 | 1 11/16 | | 1 7/16 | 6-32 x 3/8 | 1 1/2 |
| GA | 2 3/4 | 2 3/8 | 3 13/16 | 2 1/8 | | 1 3/4 | 6-23 x 3/8 | 3 1/2 |
| GB | 2 3/4 | 2 3/8 | 2 13/16 | 2 1/8 | | 1 3/4 | 6-32 x 3/8 | 2 1/2 |
| HA | 3 1/16 | 2 5/8 | 4 1/4 | 2 19/64 | | 1 55/64 | 8-32 x 3/8 | 4 1/2 |
| HB | 3 1/16 | 2 5/8 | 3 3/16 | 2 19/64 | | 1 55/64 | 8-32 x 3/8 | 3 1/2 |
| JA | 3 9/16 | 3 1/16 | 4 7/8 | 2 5/8 | | 2 1/8 | 8-32 x 3/8 | 6 |
| JB | 3 9/16 | 3 1/16 | 3 7/8 | 2 5/8 | | 2 1/8 | 8-32 x 3/8 | 5 |
| KA | 3 15/16 | 3 3/8 | 5 1/4 | 3 | | 2 7/16 | 10-32 x 1/2 | 8 1/2 |
| KB | 3 15/16 | 3 3/8 | 4 5/16 | 3 | | 2 7/16 | 10-32 x 1/2 | 7 |

# HERMETICALLY SEALED MINIATURE AND SUB-MINIATURE FILTERS TO MIL-F-18327

Freed Standard Filters are **Hermetically Sealed Miniature and Sub-Miniature** high performance components designed for both production and laboratory applications in the Communications and Electronic industry. In order to achieve attenuation requirements not obtainable with one single filter, one can combine several standard filters of different transmission characteristics. Wide Band Pass characteristics are obtainable by combining low and high Pass Units. The astatic construction of inductive components together with special shielding reduces the hum pick-up of the standard filters.

**Low Pass Filters:** The attenuation characteristics of Low Pass Filters are 6db or less at cut-off frequency • **ILP-ILM Interstage Low Pass Filter.** Characteristic impedance 10,000 ohms, in and out • **LLP-LLM Line Low Pass Filter.** Characteristic Impedance 500 to 600 ohms, in and out • **High Pass Filters:** The attenuation characteristics of High Pass Filters are 6db or less at cut-off frequency • **IHP-IHM Interstage High Pass Filter.** Characteristic Impedance 10,000 ohms, in and out. • **LHP-LHM Line High Pass Filter.** Characteristic Impedance 500 to 600 ohms, in and out • **Band Pass Filters:** The attenuation characteristics of Band Pass Filters are 2db or less at plus or minus 3% of center frequency • **IBP-IBM Interstage Band Pass Filter.** Normal input impedance — 10,000 ohms. Output impedance .5 megohms. Effective voltage step-up 2:1. (Output voltage to source voltage.) • **LBP-LBM Line Band Pass Filter.** Nominal input impedance 500 to 600 ohms. Output impedance .5 megohms. Effective voltage step-up 5:1. (Output voltage to source voltage.)

**Special filters in all six types are available upon request.**

## MINIATURE

| Catalog No. | Cut-off Frequency Hz |
|---|---|
| ILP- 100 | 100 |
| ILP- 200 | 200 |
| ILP- 300 | 300 |
| ILP- 500 | 500 |
| ILP- 750 | 750 |
| ILP- 1,000 | 1,000 |
| ILP- 1,500 | 1,500 |
| ILP- 2,000 | 2,000 |
| ILP- 2,500 | 2,500 |
| ILP- 3,000 | 3,000 |
| ILP- 5,000 | 5,000 |
| ILP- 7,000 | 7,000 |
| ILP- 10,000 | 10,000 |
| ILP- 15,000 | 15,000 |
| ILP- 20,000 | 20,000 |
| ILP- 23,000 | 23,000 |
| ILP- 25,000 | 25,000 |
| ILP- 32,000 | 32,000 |
| ILP-130,000 | 130,000 |
| ILP-150,000 | 150,000 |
| LLP- 500 | 500 |
| LLP- 1,000 | 1,000 |
| LLP- 1,500 | 1,500 |
| LLP- 1,600 | 1,600 |
| LLP- 2,000 | 2,000 |
| LLP- 2,500 | 2,500 |
| LLP- 3,000 | 3,000 |
| LLP-16,000 | 16,000 |
| LLP-20,000 | 20,000 |
| LLP-70,000 | 70,000 |
| LLP-80,000 | 80,000 |

**Low Pass Filters** attenuation ≧35 Db at 1.5 x Fc ≧40 Db at 2 x Fc

| Catalog No. | Cut-off Freq. Hz | Case No. |
|---|---|---|
| ILM- 300 | 300 | DF-01 |
| ILM- 500 | 500 | DF-01 |
| ILM- 750 | 750 | DF-01 |
| ILM- 1,000 | 1,000 | DF-01 |
| ILM- 1,500 | 1,500 | DF-01 |
| ILM- 2,000 | 2,000 | DF-01 |
| ILM- 2,500 | 2,500 | DF-01 |
| ILM- 3,000 | 3,000 | DF-01 |
| ILM- 5,000 | 5,000 | DF-01 |
| ILM- 7,000 | 7,000 | DF-01 |
| ILM- 10,000 | 10,000 | DF-01 |
| ILM- 15,000 | 15,000 | DF-01 |
| ILM- 20,000 | 20,000 | DF-01 |
| ILM- 23,000 | 23,000 | DF-01 |
| ILM- 25,000 | 25,000 | DF-01 |
| ILM- 32,000 | 32,000 | DF-01 |
| ILM-130,000 | 130,000 | DF-01 |
| ILM-150,000 | 150,000 | DF-01 |
| LLM- 500 | 500 | DF-03 |
| LLM- 1,000 | 1,000 | DF-03 |
| LLM- 1,500 | 1,500 | DF-02 |
| LLM- 1,600 | 1,600 | DF-02 |
| LLM- 2,000 | 2,000 | DF-02 |
| LLM- 2,500 | 2,500 | DF-02 |
| LLM- 3,000 | 3,000 | DF-02 |
| LLM-16,000 | 16,000 | DF-02 |
| LLM-20,000 | 20,000 | DF-02 |
| LLM-70,000 | 70,000 | DF-02 |
| LLM-80,000 | 80,000 | DF-02 |

**Low Pass Filters** attenuation ≧30 Db at 1.5 x Fc ≧40 Db at 2 x Fc

| | | |
|---|---|---|
| IHP- 200 | 200 | |
| IHP- 250 | 250 | |
| IHP- 300 | 300 | |
| IHP- 400 | 400 | |
| IHP- 500 | 500 | |
| IHP- 1,000 | 1,000 | |
| IHP- 2,000 | 2,000 | |
| IHP- 3,000 | 3,000 | |
| IHP-10,000 | 10,000 | |
| IHP-15,000 | 15,000 | |
| LHP- 200 | 200 | |
| LHP- 300 | 300 | |
| LHP- 400 | 400 | |
| LHP- 500 | 500 | |
| LHP- 800 | 800 | |
| LHP- 1,000 | 1,000 | |
| LHP- 2,000 | 2,000 | |
| LHP- 6,000 | 6,000 | |
| LHP-10,000 | 10,000 | |

**High Pass Filters** attenuation ≧35 Db at .67 x Fc ≧40 Db at .5 Fc

| | | |
|---|---|---|
| IHM- 300 | 300 | DF-01 |
| IHM- 400 | 400 | DF-01 |
| IHM- 500 | 500 | DF-01 |
| IHM- 1,000 | 1,000 | DF-01 |
| IHM- 2,000 | 2,000 | DF-01 |
| IHM- 3,000 | 3,000 | DF-01 |
| IHM-10,000 | 10,000 | DF-01 |
| IHM-15,000 | 15,000 | DF-01 |
| LHM- 300 | 300 | DF-03 |
| LHM- 400 | 400 | DF-03 |
| LHM- 500 | 500 | DF-03 |
| LHM- 800 | 800 | DF-03 |
| LHM- 1,000 | 1,000 | DF-02 |
| LHM- 2,000 | 2,000 | DF-02 |
| LHM- 6,000 | 6,000 | DF-02 |
| LHM-10,000 | 10,000 | DF-02 |

**High Pass Filters** attenuation ≧30 Db at .67 x Fc ≧40 Db at .5 Fc

| | | |
|---|---|---|
| IBP- 100 | 100 | |
| IBP- 200 | 200 | |
| IBP- 250 | 250 | |
| IBP- 400 | 400 | |
| IBP- 500 | 500 | |
| IBP- 700 | 700 | |
| IBP- 800 | 800 | |
| IBP- 900 | 900 | |
| IBP- 1,000 | 1,000 | |
| IBP- 1,500 | 1,500 | |
| IBP- 2,000 | 2,000 | |
| IBP- 3,000 | 3,000 | |
| IBP- 5,000 | 5,000 | |
| IBP- 7,200 | 7,200 | |
| IBP-10,000 | 10,000 | |
| IBP-12,000 | 12,000 | |
| IBP-15,000 | 15,000 | |
| IBP-30,000 | 30,000 | |
| IBP-57,600 | 57,600 | |
| LBP- 100 | 100 | |
| LBP- 300 | 300 | |
| LBP- 400 | 400 | |
| LBP- 600 | 600 | |
| LBP- 800 | 800 | |
| LBP- 1,000 | 1,000 | |
| LBP- 1,500 | 1,500 | |
| LBP- 2,000 | 2,000 | |
| LBP- 3,000 | 3,000 | |
| LBP- 7,200 | 7,200 | |
| LBP-10,000 | 10,000 | |
| LBP-14,400 | 14,400 | |
| LBP-20,000 | 20,000 | |
| LBP-28,800 | 28,800 | |

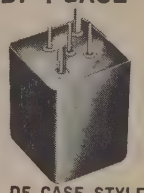
**Band Pass Filters** attenuation ≧40 Db at 0.5 x Fc and 2 x Fc

| | | |
|---|---|---|
| IBM- 400 | 400 | DF-02 |
| IBM- 500 | 500 | DF-02 |
| IBM- 700 | 700 | DF-02 |
| IBM- 800 | 800 | DF-02 |
| IBM- 900 | 900 | DF-02 |
| IBM- 1,000 | 1,000 | DF-02 |
| IBM- 1,500 | 1,500 | DF-02 |
| IBM- 2,000 | 2,000 | DF-01 |
| IBM- 3,000 | 3,000 | DF-01 |
| IBM- 5,000 | 5,000 | DF-01 |
| IBM- 7,200 | 7,200 | DF-01 |
| IBM-10,000 | 10,000 | DF-01 |
| IBM-12,000 | 12,000 | DF-01 |
| IBM-15,000 | 15,000 | DF-01 |
| IBM-30,000 | 30,000 | DF-01 |
| IBM-57,600 | 57,600 | DF-01 |
| LBM- 300 | 300 | DF-02 |
| LBM- 400 | 400 | DF-02 |
| LBM- 600 | 600 | DF-02 |
| LBM- 800 | 800 | DF-02 |
| LBM- 1,000 | 1,000 | DF-01 |
| LBM- 1,500 | 1,500 | DF-01 |
| LBM- 2,000 | 2,000 | DF-01 |
| LBM- 3,000 | 3,000 | DF-01 |
| LBM- 7,200 | 7,200 | DF-01 |
| LBM-10,000 | 10,000 | DF-01 |
| LBM-14,400 | 14,400 | DF-01 |
| LBM-20,000 | 20,000 | DF-01 |
| LBM-28,800 | 28,800 | DF-01 |

**Band Pass Filters** attenuation ≧35 Db at 0.5 x Fc and 2 x Fc

## ALL MINIATURE FILTERS ARE SUPPLIED IN DF-1 CASE

**DF-1 CASE**
Height: 2½"
Width: 1 11/16"
Depth: 1 3/16"
Mtg. Cen.: 1¼"x¾"
Studs: 4 6-32x3/8"
Knockout: ⅛" dia.



**DF CASE STYLE DF-01**
Height: 1⅜"
Width: ¾"
Depth.: ¾"
Mtg. Cen.: 9/16" Diag.
Studs: 2 ÷ 4-40

**DF-02**
Height: 1⅜"
Width: 1"
Depth.: 1"
Mtg. Cen.: ¾" Diag.
Studs: 2 ÷ 4-40

**DF-03**
Height: 1¾"
Width: 1"
Depth.: 1"
Mtg. Cen.: ¾"
Studs: 2 ÷ 4-40

## SUBMINIATURE TELEMETERING BAND PASS FILTERS

| Type No. | Center Frequency Fo - in Hz | Band Width <3DB | Stop Band Attenuation |
|---|---|---|---|
| MTN-.4 | .4 | ±7½% | ≧ 38 DB @ 1.75 & .58 Fo |
| MTN-.56 | .56 | ±7½% | ≧ 38 DB @ 1.75 & .58 Fo |
| MTN-.73 | .73 | ±7½% | ≧ 38 DB @ 1.75 & .58 Fo |
| MTN-.96 | .96 | ±7½% | ≧ 38 DB @ 1.75 & .58 Fo |
| MTN-1.3 | 1.3 | ±7½% | ≧ 38 DB @ 1.75 & .58 Fo |
| MTN-1.7 | 1.7 | ±7½% | ≧ 38 DB @ 1.75 & .58 Fo |
| MTN-2.3 | 2.3 | ±7½% | ≧ 38 DB @ 1.75 & .58 Fo |
| MTN-3.0 | 3.0 | ±7½% | ≧ 38 DB @ 1.75 & .58 Fo |
| MTH-3.9 | 3.9 | ±7½% | ≧ 38 DB @ 1.75 & .58 Fo |
| MTN-5.4 | 5.4 | ±7½% | ≧ 38 DB @ 1.75 & .58 Fo |
| MTN-7.35 | 7.35 | ±7½% | ≧ 38 DB @ 1.75 & .58 Fo |
| MTH-10.5 | 10.5 | ±7½% | ≧ 38 DB @ 1.75 & .58 Fo |
| MTN-14.5 | 14.5 | ±7½% | ≧ 38 DB @ 1.75 & .58 Fo |
| MTN-22 | 22 | ±7½% | ≧ 38 DB @ 1.75 & .58 Fo |
| MTN-30 | 30 | ±7½% | ≧ 38 DB @ 1.75 & .58 Fo |
| MTN-40 | 40 | ±7½% | ≧ 38 DB @ 1.75 & .58 Fo |
| MTN-52.5 | 52.5 | ±7½% | ≧ 38 DB @ 1.75 & .58 Fo |
| MTN-70 | 70 | ±7½% | ≧ 38 DB @ 1.75 & .58 Fo |
| MTN-22 | 22 | ±15% | ≧ 40 DB @ 2.5 & .4 Fo |
| MTW-30 | 30 | ±15% | ≧ 40 DB @ 2.5 & .4 Fo |
| MTW-40 | 40 | ±15% | ≧ 40 DB @ 2.5 & .4 Fo |
| MTW-52.5 | 52.5 | ±15% | ≧ 40 DB @ 2.5 & .4 Fo |
| MTW-70 | 70 | ±15% | ≧ 40 DB @ 2.5 & .4 Fo |

**DF-01 CASE SIZES DF-02**
¾ x ¾ x 1¾ 1 x 1 x 1⅜
MTN-2.3 Thru MTW-70 MTN-4 Thru MTN 1.7

## NULL "T" FILTERS SERIES 1950

Standard models are available for 30, 60 and 120 cycles in a wide range of impedances. Each network will give a minimum of 50 db attenuation at the null frequency.

The null frequency is adjusted to a tolerance of ±2%.

All Null T Filters are hermetically sealed.

Prices on request.

| Catalog No. | Frequency |
|---|---|
| NTF- 30 | 30 Hz |
| NTF- 60 | 60 Hz |
| NTF-120 | 120 Hz |

FREED TRANSFORMER COMPANY, INC. 1795 WEIRFIELD ST. (Ridgewood) Brooklyn, N. Y. 11227

# FREED TRANSFORMER CO., INC.

## TOROIDAL INDUCTORS

Using the latest developments in the field of magnetic materials and new impregnation and molding techniques the Freed Transformer Co. makes available to the industry the most extensive line of toroidal inductors.

Freed toroids are available in three types of constructions. Open units coated with a special high temperature extremely low loss compound, hermetically sealed in metal cases or molded in special **Freed Epoxy Resin.** Both hermetically sealed and molded units meet the latest military specification MIL-T-27A(graded 1 or 4 and 2 or 5 respectively.)Freed toroidal inductors are supplied with either molypermalloy or carbonyl iron powder cores

**1. Temperature Stabilization:**

The molypermalloy and carbonyl iron powder cores have a temperature coefficient of inductance. Depending on the degree of temperature stabilization the cores have different temperature coefficients. The degree of stabilization is denoted by a two-letter code.

SF Non-stabilized cores, ±2½% inductance variations from —55°C to +85°C.
SN Non-stabilized cores, +2% inductance variations from —55°C to +85°C.
SE Temperature stabilized cores, +0.1% to —0.4% inductance variations from —1.5°C to +54°C.
SB Temperature stabilized cores, ±0.1% inductance variations from +13°C to +35°C.
SD Temperature stabilized cores, ±0.1% inductance variations from —1.5°C to +54°C.
SW Temperature stabilized cores, ±0.25% inductance variations from —54°C to +85°C.
SM Temperature stabilized cores, ±.25% —65°C to +125°C.
SP Temperature stable carbonyl iron cores, ±0.3% inductance variations from —55°C to +85°C.

The temperature (stabilization) coefficient of an inductor will depend upon the nominal inductance value, operating frequency and A.C. voltage across the coil. Under some unfavorable working conditions the temperature coefficient of inductance corresponding to a given stability characteristic may be exceeded.

**Toroids with special requirements such as tapped toroids, toroidal transformers, molded and cased units with dimensions other than standard sizes and high temperature toroids can be supplied on request. Our engineering and laboratory facilities are available for consultation, research and development.**

### TOROIDAL INDUCTORS

| Type | Ω/H | Max. Norm. Idc | Max. Norm. Iac | Max. Norm. Vac | Uncased | Mold | Case | Frequency |
|---|---|---|---|---|---|---|---|---|
| TI- 1 | 70 | 55 | 73.5 | 0.46 | OS-8 | MR-6 | DT-3, DT-5 | 1–15 KHz |
| TI- 1A | 68 | 75 | 90.5 | 0.57 | OS-9 | MR-7 | DT-4 | 1–15 KHz |
| TI- 2 | 160 | 90 | 135 | 0.85 | OS-6 | MR-5 | DT-3, DT-5 | 10–50 KHz |
| TI- 3 | 600 | 100 | 67 | 0.42 | OS-6 | MR-5 | DT-3, DT-5 | 50–200 KHz |
| TI- 3A | 310 | 150 | 240 | 1.5 | OS-10 | MR-8 | DT-4 | 50–200 KHz |
| TI- 4 | 110 | 55 | 67 | 0.42 | OS-5 | MR-4 | DT-2, DM-11 | 1–15 KHz |
| TI- 5 | 260 | 28 | 35 | 0.22 | OS-3 | MR-3 | DT-1, DM-2 | 1–15 KHz |
| TI- 6 | 230 | 75 | 125 | 0.80 | OS-10 | MR-8 | DT-4 | 10–50 KHz |
| TI- 7 | 480 | 40 | 53 | 0.33 | OS-3 | MR-3 | DT-1, DM-2 | 10–50 KHz |
| TI- 8 | 1,500 | 50 | 80 | 0.5 | OS-3 | MR-3 | DT-1, DM-2 | 30–75 KHz |
| TI- 9 | 150 | 200 | 240 | 1.5 | OS-10 | MR-3 | DT-4 | 30–75 KHz |
| TI-10 | 430 | 125 | 270 | 1.7 | OS-7 | MR-5 | DT-3, DT-5 | 30–75 KHz |
| TI-11 | 30 | 120 | 190 | 1.2 | OS-11 | MR-10 | DT-4 | 1–15 KHz |
| TI-12 | 45 | 100 | 160 | 1 | OS-9 | MR-8 | DT-4 | 1–15 KHz |
| TI-13 | 55 | 140 | 175 | 1.1 | OS-9 | MR-8 | DT-4 | 10–50 KHz |
| TI-14 | 580 | 150 | — | — | OS-5 | MR-4 | DT-2, DM-11 | 10–100 KHz |
| TI-15 | 900 | 100 | — | — | OS-3 | MR-3 | DT-1, DM-2 | 10–100 KHz |
| TI-16 | 600 | 16 | 21 | 0.13 | OS-1 | MR-1, MS-1 | DST-1 | 1–15 KHz |
| TI-17 | 1,200 | 20 | 29 | 0.18 | OS-1 | MR-1, MS-1 | DST-1 | 10–50 KHz |
| TI-18 | 2,600 | 30 | 40 | 0.25 | OS-1 | MR-1, MS-1 | DST-1 | 30–75 KHz |

| Type | Ω/H | Max. Norm. Idc | Max. Norm. Iac | Max. Norm. Vac | Uncased | Mold | Case | Frequency |
|---|---|---|---|---|---|---|---|---|
| TI-19 | 4,500 | 25 | 29 | 0.18 | OS-1 | MR-1, MS-1 | DST-1 | 50–200 KHz |
| TI-20 | 2,750 | 100 | * | * | OS-4 | MR-3A | DT-2 | 20KHz-2MHz |
| TI-21 | 1,200 | 350 | * | * | OS-1 | MR-1, MS-1 | DT-1 | 100KH –10MHz |
| TI-22 | 5,600 | 210 | * | * | OS-2 | MR-2 | DT-1 | 50KHz–5MHz |
| TI-23 | 7,000 | 250 | * | * | OS-2 | MR-2 | DT-1 | 50KHz–5MHz |
| TI-24 | 330 | 15 | 18 | 0.11 | OS-1 | MR-1, MS-1 | DST-1 | 200Hz–12KHz |
| TI-25 | 200 | 20 | 24 | 0.15 | OS-12 | MR-2 | DT-1 | 200Hz–12KHz |
| TI-26 | 150 | 25 | 32 | 0.20 | OS-3 | MR-3 | DT-1, DM-3 | 200Hz–12KHz |
| TI-27 | 76.5 | 50 | 62 | 0.39 | OS-5 | MR-4 | DT-2, DM-11 | 200Hz–12KHz |
| TI-28 | 48.5 | 50 | 64 | 0.40 | OS-8 | MR-6 | DT-3, DT-5 | 200Hz–12KHz |
| TI-29 | 33.5 | 70 | 88 | 0.55 | OS-9 | MR-7 | DT-4 | 200Hz–12KHz |
| TI-30 | 28 | 100 | 135 | 0.84 | OS-9 | MR-8 | DT-4 | 200Hz–12KHz |
| TI-31 | 19.5 | 100 | 136 | 0.85 | OS-11 | MR-10 | DT-4 | 200Hz–12KHz |
| TI-32 | 48.5 | 6 | 14.5 | 0.09 | OS-3 | MR-3 | DT-1, DM-2 | 100Hz–10KHz |
| TI-33 | 2,150 | 8 | 13 | 0.08 | OS-13 | MR-11 | DT-6 | 1–15 KHz |
| TI-34 | 1,700 | 8 | 9.5 | 0.06 | OS-14 | MR-11 | DT-6 | 1–15 KHz |
| TI-35 | 4,100 | 10 | 18 | 0.11 | OS-13 | MR-11 | DT-6 | 10–50 KHz |
| TI-36 | 3,950 | 10 | 11 | 0.07 | OS-14 | MR-11 | DT-6 | 10–50 KHz |
| TI-37 | 23.5 | 10 | 32 | 0.20 | OS-5 | MR-14 | DT-2, DM-11 | 100Hz–10KHz |
| TI-38 | 100 | 4 | 9.5 | 0.06 | OS-1 | MR-1, MS-1 | DST-1 | 100Hz–10KHz |

*TI-20 through TI-23 have a very low voltage coefficient and inductance will change very little with voltage. Because of high frequency application, the maximum voltage is limited rather by breakdown than by saturation.

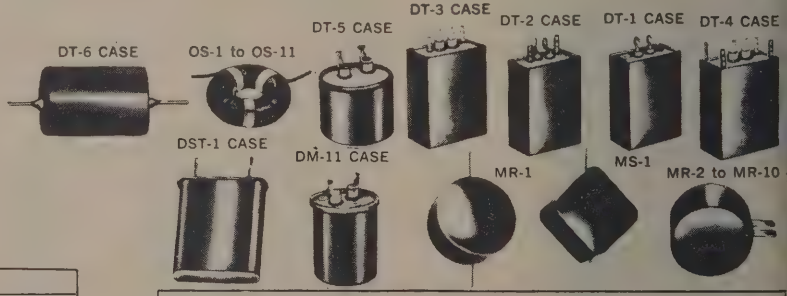
$$\text{Normalized } V_{AC} = \frac{V}{F}\,\frac{1}{\sqrt{L_H}}$$

$$\text{Normalized } I_{AC} = I_{AC}\sqrt{L_H}$$

$$\text{Normalized } I_{DC} = I_{DC}\sqrt{L_H}$$

where F —operating frequency in Hz
$L_H$ —inductance in henries
Iac—A.C. current in MA
Idc—D.C. current in MA
V —A.C. voltage across the core

**CASED, UNCASED AND MOLDED UNITS**




| UNCASED | | |
|---|---|---|
| Type | O.D. | Hi. |
| OS-1 | 5/8" | 5/16" |
| OS-2 | 7/8" | 3/8" |
| OS-3 | 1" | 3/8" |
| OS-4 | 1" | 9/16" |
| OS-5 | 1 3/16" | 5/8" |
| OS-6 | 1 5/8" | 7/8" |
| OS-7 | 1 11/16" | 5/8" |
| OS-8 | 1 7/8" | 11/16" |
| OS-9 | 2 1/4" | 1 1/8" |
| OS-10 | 2 3/8" | 1 1/4" |
| OS-11 | 2 5/8" | 1 1/8" |
| OS-12 | 13/16" | 3/8" |
| OS-13 | 3/8" | 1/8" |
| OS-14 | 7/16" | 7/32" |

| MOLDED | | | |
|---|---|---|---|
| Type | O.D. | Hi. | Clearance Hole Mounting |
| MR-1 | 7/8" | 13/32" | Pig Tails |
| MR-2 | 1 1/16" | 1/2" | No. 4 |
| MR-3 | 1 3/16" | 1/2" | No. 6 |
| MR-3A | 1 3/16" | 11/16" | No. 6 |
| MR-4 | 1 1/2" | 3/4" | No. 8 |
| MR-5 | 1 7/8" | 1" | No. 8 |
| MR-6 | 2 1/8" | 7/8" | No. 8 |
| MR-7 | 2 3/8" | 1 3/16" | No. 10 |
| MR-8 | 2 1/2" | 1 3/8" | No. 10 |
| MR-9 | 2 5/8" | 1 7/16" | No. 10 |
| MR-10 | 2 7/8" | 1 5/8" | No. 10 |
| MR-11 | 7/16" | 1/4" | Pig Tails |
| MS-1 | 25/32" x 25/32" | 13/32" | Pig Tails |

| CASED | | | | | | | |
|---|---|---|---|---|---|---|---|
| Type | Hi. | Dia. | Length | Width | Mtg. | Mtg. Cen. | Cutout |
| DT-1 | 1 1/32" | | 1 1/16" | 1/2" | 2 4-40 inserts | 3/4" | 3/4" x 1/2". |
| DT-2 | 1 3/4" | | 1 7/16" | 13/16" | 2 6-32 studs | 7/8" x 5/32" | 3/8" x 11/16" |
| DT-3 | 2" | | 1 23/32" | 7/8" | 2 6-32 studs | 1 1/4" x 3/8" | 3/8" x 3/4" |
| DT-4 | 3 1/8" | | 2 3/4" | 1 3/16" | 4 8-32 studs | 2 1/16" x 1 1/16" | 3/4" x 3/4" |
| DT-5 | 1 3/16" | 1 13/16" | | | 2 6-32 inserts | 1 1/4" | 3/8" x 1" |
| DT-6 | 5/8" | 1/2" | | | Pig Tails | | |
| DM-2 | 1" | 1 1/8" | | | 2 4-40 inserts | 5/8" | 3/8" x 7/8" |
| DM-11 | 1 1/2" | 1 3/8" | | | 2 6-32 inserts | 7/8" | 3/4" x 7/8" |
| DST-1 | 25/32" | | 3/4" | 11/32" | 1/4" long pins | To fit 1/2" crystal socket | |

# FREED TRANSFORMER CO., INC.

## COMMERCIAL GRADE COMPONENTS

These components are designed to meet the demand for low-cost replacement parts for commercial electronic equipment.

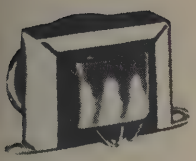
The best commercially available materials have been utilized in the design of these units, to insure reliability and excellent performance characteristics. Vacuum impregnation with a non-hygroscopic varnish to prevent penetration of humidity are employed to give these units long life and trouble-free performance.

230-115 V, 50-60 C.P.S. Stepdown Transformers rated from 25 V A up to 5,000 V A Rating and line booster transformers are included in this series.

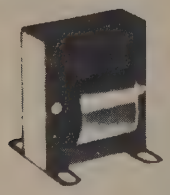
All units, with only a few exceptions, are uncased or of shell-type construction.

Isolation transformers and Stepdown transformers are equipped with line cord and receptacle.

DC



CH



FV

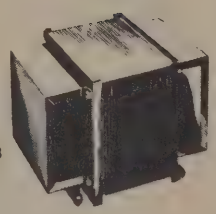
| Case No. | Height | Width | Depth | Mtg. Centers | Mtg. Studs |
|---|---|---|---|---|---|
| DC2B | 3 1/2 | 2 5/8 | 2 1/4 | 2x1 3/4 | (4)8-32 |
| DC4A | 3 3/4 | 3 1/8 | 3 | 2 1/2x2 1/2 | (4)8-32 |
| DC5C | 4 7/8 | 4 1/8 | 3 1/2 | 3 1/8x2 5/8 | (4)10-32 |
| DC6A | 4 7/8 | 5 | 4 1/8 | 3 3/4x3 | (4)10-32 |
| CH60 | 2 | 3 1/4 | 1 3/4 | 2 13/16 | (2)3/16 |
| CH62 | 2 | 3 1/4 | 2 1/8 | 2 13/16 | (2)3/16 |
| CH70 | 2 5/16 | 3 11/16 | 2 1/4 | 3 1/8 | (2)3/16 |
| CH80 | 2 5/8 | 4 | 2 5/8 | 3 5/16 | (2)3/16 |
| FV10 | 3 1/16 | 2 1/2 | 2 5/16 | 2x2 | (4)13/64x21/64 |
| FV12 | 3 1/16 | 2 1/2 | 2 11/16 | 2x2 1/8 | (4)13/64x21/64 |
| FV22 | 3 7/16 | 2 13/16 | 2 7/8 | 2 1/4x2 1/4 | (4)3/16x3/8 |
| FV30 | 4 1/32 | 3 1/8 | 3 | 2 1/2x2 1/4 | (4)13/64x21/64 |
| HB718 | 6 1/4 | 6 1/2 | 8 1/2 | 4 3/4x4 1/2 | (4)9/32x21/32 |
| HB728 | 6 1/4 | 6 1/2 | 9 3/4 | 4 3/4x5 3/4 | (4)9/32x21/32 |
| VS401 | 3 5/16 | 2 13/16 | 3 1/4 | 2 1/4x1 15/16 | (4)3/16x3/8 |
| VS501 | 3 29/32 | 3 1/4 | 3 3/8 | 2 1/2x2 1/16 | (4)3/16x3/8 |
| VS503 | 3 29/32 | 3 1/4 | 3 3/8 | 2 1/2x2 5/16 | (4)3/16x3/8 |
| VS601 | 4 21/32 | 3 7/8 | 3 5/8 | 3x2 7/16 | (4)3/16x3/8 |
| VS603 | 4 21/32 | 3 7/8 | 3 7/8 | 3x2 11/16 | (4)3/16x3/8 |
| VS604 | 4 21/32 | 3 7/8 | 4 | 3x2 7/8 | (4)3/16x3/8 |
| VS611 | 4 21/32 | 3 7/8 | 4 7/8 | 3x3 11/16 | (4)3/16x3/8 |
| VS612 | 4 21/32 | 3 7/8 | 5 | 3x3 13/16 | (4)3/16x3/8 |
| VS706 | 5 7/16 | 4 5/16 | 5 1/2 | 3 1/2x3 3/4 | (4)3/16x3/8 |
| VS714 | 5 7/16 | 4 5/16 | 6 1/2 | 3 1/2x4 3/4 | (4)3/16x3/8 |
| VS718 | 5 7/16 | 4 5/16 | 7 | 3 1/2x5 1/4 | (4)9/32x21/32 |
| VS728 | 5 7/16 | 4 5/16 | 8 1/4 | 3 1/2x6 1/2 | (4)3/16x3/8 |

### FILAMENT TRANSFORMERS

All primaries are for 115V, 50/60 c.p.s.

| Catalog No. | Secondary Voltage | Secondary Current Amps | Secondary Test Voltage RMS | Case Size |
|---|---|---|---|---|
| TF 1 | 2.5 (C.T.) | 7.5 | 1500 | CH60 |
| TF 2 | 2.5 (C.T.) | 10 | 1500 | CH70 |
| TF 3 | 2.5 (C.T.) | 5 | 7500 | DC2B |
| TF 4 | 2.5 (C.T.) | 10 | 7500 | DC4A |
| TF 5 | 5.0 (C.T.) | 4 | 1500 | CH60 |
| TF 6 | 5.0 (C.T.) | 6 | 1500 | CH70 |
| TF 7 | 5.0 (C.T.) | 10 | 1500 | CH80 |
| TF 8 | 5.0 (C.T.) | 10 | 1500 | FV10 |
| TF 9 | 5.0 (C.T.) | 20 | 2500 | FV30 |
| TF 10 | 5.0 (C.T.) | 20 | 10,000 | DC6A |
| TF 11 | 6.3 (C.T.) | 1.35 | 1500 | CH50 |
| TF 12 | 6.3 (C.T.) | 3 | 1500 | CH60 |
| TF 13 | 6.3 (C.T.) | 5 | 1500 | CH70 |
| TF 14 | 6.3 (C.T.) | 7 | 1500 | FV12 |
| TF 15 | 6.3 (C.T.) | 10 | 1500 | FV22 |
| TF 16 | 10 (C.T.) | 5 | 2500 | CH80 |
| TF 17 | 10 (C.T.) | 5 | 2500 | FV10 |
| TF 18 | 10 (C.T.) or 11 (C.T.) (tapped primary) | 12 or 11 | 7500 | DC-5C |
| TF 19 | 12.6 (C.T.) | 2 | 1500 | CH62 |

TF 3, 4, 10 & 18 supplied with terminals. All others with leads.



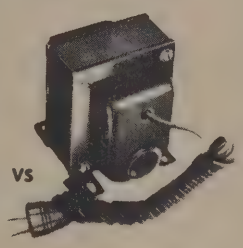
HB

### AUTO TRANSFORMERS

To be used as step-down transformer. Equipped with standard receptacle and line cord.

| Catalog No. | Transformation | VA Rating | Weight (lbs.) | Case Size |
|---|---|---|---|---|
| SDT 1* | 230/115 V. 50/60 c.p.s. | 25 | 1 | CH-60 |
| SDT 2* | 230/115 V. 50/60 c.p.s | 50 | 1 1/4 | CH-62 |
| SDT 3 | 230/115 V. 50/60 c.p.s. | 50 | 2 1/2 | VS-300 |
| SDT 4 | 230/115 V. 50/60 c.p.s. | 100 | 3 | VS-401 |
| SDT 5 | 230/115 V. 50/60 c.p.s. | 200 | 5 | VS-501 |
| SDT 6 | 230/115 V. 50/60 c.p.s. | 300 | 6 1/2 | VS-601 |
| SDT 7 | 230/115 V. 50/60 c.p.s. | 400 | 8 | VS-604 |
| SDT 8 | 230/115 V. 50/60 c.p.s. | 500 | 11 | VS-611 |
| SDT 9 | 230/115 V. 50/60 c.p.s. | 750 | 15 | VS-706 |
| SDT 10 | 230/115 V. 50/60 c.p.s. | 1000 | 23 | VS-718 |
| SDT 11 | 230/115 V. 50/60 c.p.s | 1500 | 29 1/2 | VS-728 |
| SDT 12* | 230/115 V. 50/60 c.p.s | 2000 | 37 | HB-718 |

*Supplied with leads without line cord and receptacle



VS

### ISOLATION TRANSFORMERS

Electrostatic shield between primary and secondary. Equipped with standard receptacle and line cord.

| Catalog Number | Primary Voltage 50/60 c.p.s. | Secondary Voltage | VA Rating | Case Size |
|---|---|---|---|---|
| IT 1 | 115 | 115 | 50 | VS-401 |
| IT 2 | 115 | 115 | 100 | VS-503 |
| IT 3 | 115 | 115 | 300 | VS-700 |
| IT 4 | 115 | 115 | 500 | VS-714 |
| IT 5* | 220/440 | 110/220 | 250 | VS-612 |
| IT 6* | 220/440 | 110/220 | 500 | VS-714 |

*Supplied with leads without line cords and receptacle.

## MCV – CONSTANT VOLTAGE TRANSFORMERS – MCV
### (FERRO-RESONANT TRANSFORMERS)

The MCV line of constant voltage transformers provides accurate regulation against line and/or load variations, without the use of tubes or moving parts.

**Input Voltage Range**
**95 to 130**

Rated output within ± 2% of nominal value. Regulation automatically maintained within ± 1%. Regulation from 25% to full load ± 2%.

- MILITARY SPECIFICATIONS
- NO TUBES
- COMMERCIAL
- NO MOVING PARTS
- ACCURATE REGULATIONS
- FAST RESPONSE
- FULLY AUTOMATIC
- SUPPLIED WITH CONDENSERS

| Reg. Output in R.M.S. Volts | Output in V.A. P.F-1 | CATALOG NUMBERS | | | |
|---|---|---|---|---|---|
| | | 60 Cycles | | 400 Cycles | |
| | | Comm. | Military* | Comm.* | Military* |
| 115 | 5 | MCV65LC | MCV65LM | MCV45LC | MCV45LM |
| 115 | 25 | MCV625LC | MCV625LM | MCV425LC | MCV425LM |
| 115 | 75 | MCV675LC | MCV675LM | MCV475LC | MCV475LM |
| 115 | 125 | MCV6125LC | MCV6125LM | MCV4125LC | MCV4125LM |
| 115 | 175 | MCV6175LC | MCV6175LM | MCV4175LC | MCV4175LM |
| 115 | 250 | MCV6250LC | MCV6250LM | MCV4250LC | MCV4250LM |
| 115 | 375 | MCV6375LC | MCV6375LM | MCV4375LC | MCV4375LM |
| 115 | 500 | MCV6500LC | MCV6500LM | MCV4500LC | MCV4500LM |
| 115 | 750 | MCV6750LC | MCV6750LM | MCV4750LC | MCV4750LM |
| 115 | 1000 | MCV61000LC | MCV61000LM | MCV41000LC | MCV41000LM |
| 26 | 5 | MCV654FC | MCV654FM | MCV454FC | MCV454FM |
| 26 | 25 | MCV6254FC | MCV6254FM | MCV4254FC | MCV4254FM |
| 26 | 75 | MCV6754FC | MCV6754FM | MCV4754FC | MCV4754FM |
| 26 | 125 | MCV61254FC | MCV61254FM | MCV41254FC | MCV41254FM |
| 6.4 | 5 | MCV65FC | MCV65FM | MCV45FC | MCV45FM |
| 6.4 | 25 | MCV625FC | MCV625FM | MCV425FC | MCV425FM |
| 6.4 | 75 | MCV675FC | MCV675FM | MCV475FC | MCV475FM |
| 6.4 | 125 | MCV6125FC | MCV6125FM | MCV4125FC | MCV4125FM |

*Condensers are not provided with units. Where condensers are provided they are external to units

**AVAILABLE UPON REQUEST**
**MAGNETIC AMPLIFIERS AND SATURABLE TRANSFORMERS**

FREED TRANSFORMER COMPANY, INC. 1795 WEIRFIELD ST. (Ridgewood) Brooklyn, N. Y. 11227

# Variac® Adjustable Autotransformers

## VARIAC® MANUALLY OPERATED AUTOTRANSFORMERS

The GenRad Variac autotransformer is a continuously variable unit used to control AC voltage. Features the Duratrak® contact surface, a uniform silver-alloy coating to prevent injurious high-temperature oxidation and resultant brush-track deterioration — track will show no significant wear after 1,000,000 cycles of brush operation. Variac autotransformers are highly efficient, have high thermal capacity, can withstand very high short-term overloads, and do not affect waveform or power factor. Other features: Good regulation; smooth control; long life; linear output voltage; low maintenance; easy installation. All necessary mounting hardware is included with each unit. Portable types, indicated by T in Model No., have an overload protection reset switch, line switch, convenience outlet, and a 6-ft. two- or three-wire line cord. Manually operated and motor-driven Variacs are available in a wide variety of voltage and current ratings, with or without cases. All except portable units can be equipped with ball bearings at slightly higher prices; ball bearings, indicated by BB in Model No. of manually operated units, are included with 4- and 6-gang types. **Angle of Rotation:** 320°. **Line Frequency:** 50 and/or 60 Hz unless otherwise specified. **Input Voltages:** 120, 208, 240 or 280 volts. **Output Voltages:** 0-120/140, 0-208, 0-240/280, 0-480 or 0-560 volts, continuously adjustable. **Current Ratings:** 2 to 300 amps.

### ACCESSORIES FOR VARIACS
**REPLACEMENT BRUSHES**

| Model No. | For Variac Model |
|---|---|
| VB-1 | M2, U2, V2, W2, W5H |
| VB-2 | M5, V5, W5, W5L |
| VB-3 | W8, W8L |
| VBT-6† | W50 |
| VBT-7† | W50H |
| VBT-8† | M20, W20 |
| VBT-10 | M10, W10 |
| VBT-11 | W10H |
| VBT-12† | W20H |
| VBT-13† | W30 |
| VBT-14† | W30H |

† Brush set.

## SINGLE-PHASE MODELS

**MANY MODELS, AS NOTED, LISTED UNDER UL RE-EXAMINATION SERVICE AND CSA**

**120-VOLT INPUT UNITS**

Line voltage connection output, 0-120 volts; overvoltage connection output, 0-140 volts.

| Model No. | Output Amps Rated | Output Amps Max. | kVA | Description | Size, Inches W. | Size, Inches D.↓ | Size, Inches H. | Shpg. Lbs. |
|---|---|---|---|---|---|---|---|---|
| U2 | 2.25‡ | 3.0‡ | 0.36 | Uncased | 3 | 2 7/8 | 3 1/4 | 5 |
| W2M | 2.0 | 2.6 | 0.31 | Cased† | 4 1/8 | 4 3/8 | 5 5/16 | 9 |
| W2 | 2.4 | 3.1 | 0.37 | Uncased† | 3 1/4 | 3 15/16 | 3 1/4 | 6 |
| W5M | 5.0 | 6.5 | 0.78 | Cased†§ | 4 7/8 | 4 3/8 | 6 5/16 | 13 |
| W5 | 6.0 | 7.8 | 0.94 | Uncased†§ | 4 1/2 | 3 15/16 | 4 1/2 | 12 |
| W5LM | 7.1 | 9.2 | 1.1 | Cased¶ | 4 7/8 | 4 3/8 | 6 5/16 | 13 |
| W5L | 8.5 | 11.0 | 1.32 | Uncased¶ | 4 1/2 | 3 15/16 | 4 1/2 | 12 |
| W8 | 8.5 | 11.0 | 1.32 | Uncased | 4 1/2 | 4 7/16 | 4 1/2 | 15 |
| W8L | 10.0 | 13.0 | 1.56 | Uncased¶ | 4 1/2 | 4 7/16 | 4 1/2 | 15 |
| W10 | 10.0 | 13.0 | 1.56 | Uncased†§ | 5 3/4 | 4 11/16 | 5 3/4 | 18 |
| W10M | 10.0 | 13.0 | 1.56 | Cased†§ | 6 3/4 | 5 1/4 | 9 15/32 | 21 |
| W20 | 20.0 | 26.0 | 3.12 | Uncased†§ | 7 1/2 | 4 5/8 | 7 1/2 | 27 |
| W20M | 20.0 | 26.0 | 3.12 | Cased† | 8 5/8 | 5 3/8 | 11 13/16 | 27 |
| W30M | 28.0 | 32.0 | 3.84 | Cased | 11 | 5 3/4 | 14 3/4 | 46 |
| W30 | 30.0 | 36.0 | 4.32 | Uncased | 10 | 4 3/32 | 10 3/4 | 36 |
| W50M | 40.0 | 45.0 | 5.40 | Cased†§ | 13 7/16 | 7 1/4 | 16 27/32 | 74 |
| W50 | 50.0 | 50.0 | 6.00 | Uncased†§ | 12 1/2 | 6 7/32 | 12 1/2 | 65 |
| W30G2M | 56.0 | 64.0 | 7.7 | 2-Gang W30M▲ | 11 3/8 | 11 1/2 | 14 13/16 | 83 |
| W30G2 | 60.0 | 72.0 | 8.6 | 2-Gang W30▲ | 10 | 11 5/16 | 10 3/4 | 77 |
| W50G2M | 80.0 | 90.0 | 10.8 | 2-Gang W50M▲ | 13 13/16 | 16 1/8 | 17 1/16 | 160 |
| W30G3M | 84.0 | 96.0 | 11.5 | 3-Gang W30M▲ | 11 3/8 | 16 1/8 | 14 13/16 | 115 |
| W50G2 | 100.0 | 100.0 | 12.0 | 2-Gang W50▲ | 12 1/2 | 15 13/16 | 12 1/2 | 147 |
| W30G3 | 90.0 | 108.0 | 13.0 | 3-Gang W30▲ | 10 | 15 13/16 | 10 3/4 | 108 |
| W50G3M | 120.0 | 135.0 | 16.2 | 3-Gang W50M▲ | 13 13/16 | 22 1/2 | 17 1/16 | 221 |
| W50G3 | 150.0 | 150.0 | 18.0 | 3-Gang W50▲ | 12 1/2 | 22 5/16 | 12 1/2 | 206 |
| W50G4BBM | 160.0 | 180.0 | 21.6 | 4-Gang W50BBM▲ | 13 13/16 | 28 7/8 | 17 1/16 | 313 |
| W50G4BB | 200.0 | 200.0 | 24.0 | 4-Gang W50BB▲ | 12 1/2 | 28 11/16 | 12 1/2 | 288 |
| W50G6BBM | 240.0 | 270.0 | 32.4 | 6-Gang W50BBM▲ | 13 13/16 | 41 5/8 | 17 1/16 | 430 |
| W50G6BB | 300.0 | 300.0 | 36.0 | 6-Gang W50BB▲ | 12 1/2 | 41 7/16 | 12 1/2 | 400 |

**240-VOLT INPUT UNITS**

Line voltage connection output, 0-240 volts; overvoltage connection output, 0-280 volts. All types except portable units can also use a 120-volt input.

| Model No. | Output Amps Rated | Output Amps Max. | kVA | Description | Size, Inches W. | Size, Inches D.↓ | Size, Inches H. | Shpg. Lbs. |
|---|---|---|---|---|---|---|---|---|
| W5H | 2.0 | 2.6 | 0.62 | Uncased† | 4 1/2 | 3 15/16 | 4 1/2 | 10 |
| W5HM | 2.0 | 2.6 | 0.62 | Cased† | 4 7/8 | 4 3/8 | 6 5/16 | 13 |
| W10H | 4.0 | 5.2 | 1.25 | Uncased† | 5 3/4 | 4 11/16 | 5 3/4 | 18 |
| W10HM | 4.0 | 5.2 | 1.25 | Uncased† | 6 3/4 | 5 1/4 | 9 15/32 | 21 |
| W20H | 8.0 | 10.4 | 2.50 | Uncased†§ | 7 1/2 | 4 5/8 | 7 1/2 | 27 |
| W20HM | 8.0 | 10.4 | 2.50 | Cased† | 8 5/8 | 5 3/8 | 11 13/16 | 31 |
| W30H | 12.0 | 15.6 | 3.74 | Uncased | 10 | 4 3/32 | 10 3/4 | 36 |
| W30HM | 12.0 | 15.6 | 3.74 | Cased | 11 | 5 3/4 | 14 3/4 | 46 |
| W50HM | 20.0 | 31.0 | 7.45 | Cased†§ | 13 7/16 | 7 1/4 | 16 27/32 | 76 |
| W50H | 25.0 | 32.5 | 7.80 | Uncased†§ | 12 1/2 | 6 7/32 | 12 1/2 | 67 |
| W30HG2 | 24.0 | 31.2 | 7.50 | 2-Gang W30H▲ | 10 | 11 5/16 | 10 3/4 | 75 |
| W30HG2M | 24.0 | 31.2 | 7.50 | 2-Gang W30HM▲ | 11 3/8 | 11 1/2 | 14 13/16 | 81 |
| W30G2M | 28.0 | 32.0 | 7.70 | 2-Gang W30M•■ | 11 3/8 | 11 1/2 | 14 13/16 | 83 |
| W30G2 | 30.0 | 36.0 | 8.60 | 2-Gang W30•■ | 10 | 11 5/16 | 10 3/4 | 77 |
| W50HG2M | 40.0 | 62.0 | 14.90 | 2-Gang W50HM▲ | 13 13/16 | 16 1/8 | 17 1/16 | 165 |
| W50HG2 | 50.0 | 65.0 | 15.60 | 2-Gang W50H▲ | 12 1/2 | 15 13/16 | 12 1/2 | 153 |
| W50HG3M | 60.0 | 93.0 | 22.30 | 3-Gang W50HM▲ | 13 13/16 | 22 1/2 | 17 1/16 | 230 |
| W50HG3 | 75.0 | 97.5 | 23.4 | 3-Gang W50H▲ | 12 1/2 | 22 5/16 | 12 1/2 | 214 |
| W50HG4BBM | 80.0 | 124.0 | 29.8 | 4-Gg. W50HBBM▲ | 13 13/16 | 28 7/8 | 17 1/16 | 328 |
| W50HG4BB | 100.0 | 130.0 | 31.2 | 4-Gang W50HBB▲ | 12 1/2 | 28 11/16 | 12 1/2 | 300 |
| W50HG6BBM | 120.0 | 186.0 | 44.6 | 6-Gg. W50HBBM▲ | 13 13/16 | 41 5/8 | 17 1/16 | 458 |
| W50HG6BB | 150.0 | 195.0 | 46.8 | 6-Gang W50HBB▲ | 12 1/2 | 41 7/16 | 12 1/2 | 428 |

*kVA ratings — normal input line voltage times maximum current; maximum current can be drawn at maximum voltage for line voltage connection only. †CSA Approved. ††Listed ratings are for metal panel mountings, ratings in air, 2.0 and 2.5 amps respectively. §Listed under Re-examination Service of UL. ¶For 60 Hz only; no overvoltage connection supplied. • Series-connected windings; do not use with grounded load. ▲ Parallel-connected windings; one or more W50-P1 chokes required (see below). ■Also can be used at 120-volt input with 2x the output ratings shown. ↓Depth behind panel except cased types (excluding knobs).

### MODEL W50-P1 CHOKE FOR PARALLEL COMBINATIONS

When windings of identical Variacs are paralleled to obtain higher load ratings, it is recommended to use one or more chokes to limit excess circulating current in the event that brushes accidentally get out of line. Use 1 choke for 2 Variacs in parallel; 3 chokes for 3 Variacs; 4 chokes for 5 Variacs; 6 chokes for 6 Variacs. Parallel operation of units smaller than Model W30 is not recommended since the next larger unit is more economical. For W50 Series Variacs, the choke can be mounted directly on the terminal plates.

GenRad
DEPT. EM, 300 BAKER AVE., CONCORD, MASS. 01742

NEW YORK [N. Y.] (212) 964-2722, [N. J.] (201) 791-8990
BOSTON (617) 646-0550 • DAYTON (513) 294-1500
CHICAGO (312) 884-6900 • WASHINGTON, D. C. (301) 948-7071
ATLANTA (404) 394-5380 • LOS ANGELES (714) 540-9830
SAN FRANCISCO • (408) 985-0662 • DALLAS (214) 234-3357
TORONTO (416) 252-3395

# Variac® Adjustable Autotransformers

## VARIAC® MANUALLY OPERATED AUTOTRANSFORMERS

### W-TYPE MANUAL THREE-PHASE GANGED MODELS

#### 240-VOLT INPUT GANGED UNITS

All units listed require an input of 240 volts except W5LG3M, W5LG3, and W8LG3, which require 208 volts. All have an output range of 0-240 volts except types with H in Model No., 0-280 volts, and types with L in Model No., 0-208 volts. Ball bearings are included with 4- and 6-gang types; available for other types at extra cost.

| Model No. | Output Amps Rated | Output Amps Max. | kVA* | Description | Size, Inches W. | Size, Inches D.♦ | Size, Inches H. | Shpg. Lbs. |
|---|---|---|---|---|---|---|---|---|
| W5LG3M | 7.1 | 9.2 | 3.31 | 3-Gang W5LM†‡ | 5⅛ | 13⅜₂ | 6¾ | 32 |
| W5LG3 | 8.5 | 11.0 | 3.96 | 3-Gang W5L†‡ | 4½ | 12¹³⁄₁₆ | 4½ | 30 |
| W8LG3 | 10.0 | 13.0 | 4.68 | 3-Gang W8L†‡ | 4½ | 14¾ | 4½ | 36½ |
| W5HG2 | 2.0 | 2.6 | 1.08 | 2-Gang W5H§ | 4½ | 8¹³⁄₁₆ | 4½ | 21 |
| W5HG2M | 2.0 | 2.6 | 1.08 | 2-Gang W5HM§ | 5⅛ | 8⁹⁄₃₂ | 6¾ | 23 |
| W2G3M | 2.0 | 2.6 | 1.08 | 3-Gang W2M†¶ | 4⅜ | 12¹⅝ | 5¾ | 21 |
| W2G3 | 2.4 | 3.1 | 1.29 | 3-Gang W2†¶ | 3¼ | 12⅝ | 3¼ | 19 |
| W10HG2 | 4.0 | 5.2 | 2.16 | 2-Gang W10H§ | 5¾ | 10⅞ | 5¾ | 33 |
| W10HG2M | 4.0 | 5.2 | 2.16 | 2-Gang W10HM§ | 7⅛ | 10⅝ | 9¹¹⁄₁₆ | 37 |
| W5G3M | 5.0 | 6.5 | 2.70 | 3-Gang W5M†¶ | 5⅛ | 13⅜₂ | 6¾ | 32 |
| W5G3 | 6.0 | 7.8 | 3.24 | 3-Gang W5†¶ | 4½ | 12¹³⁄₁₆ | 4½ | 30 |
| W8G3 | 8.5 | 11.0 | 4.57 | 3-Gang W8†¶ | 4½ | 14¾ | 4½ | 36 |
| W20HG2 | 8.0 | 10.4 | 4.32 | 2-Gang W20H§# | 7½ | 10⅝ | 7½ | 55 |
| W20HG2M | 8.0 | 10.4 | 4.32 | 2-Gang W20HM§# | 9 | 10½ | 12¼ | 59 |
| W10G3 | 10.0 | 13.0 | 5.40 | 3-Gang W10†¶ | 5¾ | 15⅛ | 5¾ | 48 |
| W10G3M | 10.0 | 13.0 | 5.40 | 3-Gang W10M†¶ | 7⅛ | 15⅜ | 9¹¹⁄₁₆ | 54 |
| W30HG2 | 12.0 | 15.6 | 6.48 | 2-Gang W30H§# | 10 | 11⅜ | 10¾ | 75 |
| W30HG2M | 12.0 | 15.6 | 6.48 | 2-Gang W30HM§# | 11⅜ | 11½ | 14¹⅜ | 81 |
| W20G3 | 20.0 | 26.0 | 10.80 | 3-Gang W20†¶# | 7½ | 14⅞ | 7½ | 78 |
| W20G3M | 20.0 | 26.0 | 10.80 | 3-Gang W20M†¶# | 9 | 15⅛ | 12¼ | 84 |
| W50HG2M | 20.0 | 31.0 | 12.90 | 2-Gang W50HM§# | 13¹³⁄₁₆ | 16⅛ | 17¹⁄₁₆ | 165 |
| W30G3M | 28.0 | 32.0 | 13.30 | 3-Gang W30M†¶# | 11⅜ | 16⅛ | 14¹³⁄₁₆ | 115 |
| W50HG2 | 25.0 | 32.5 | 13.50 | 2-Gang W50H§# | 12½ | 15¹³⁄₁₆ | 12½ | 153 |
| W30G3 | 30.0 | 36.0 | 15.00 | 3-Gang W30†¶# | 10 | 15¹³⁄₁₆ | 10¾ | 108 |
| W50G3M | 40.0 | 45.0 | 18.70 | 3-Gang W50M†¶# | 13¹³⁄₁₆ | 22½ | 17¹⁄₁₆ | 221 |
| W50G3 | 50.0 | 50.0 | 20.80 | 3-Gang W50†¶# | 12½ | 22⅝ | 12½ | 206 |
| W50HG4BBM | 40.0 | 62.0 | 25.80 | 4-Gg. W50HBBM§# | 13¹³⁄₁₆ | 28⅞ | 17¹⁄₁₆ | 328 |
| W50HG4BB | 50.0 | 65.0 | 27.00 | 4-Gg. W50HBB§# | 12½ | 28¹¹⁄₁₆ | 12½ | 300 |
| W50G6BBM | 80.0 | 90.0 | 37.40 | 6-Gg. W50BBM†¶#▲ | 13¹³⁄₁₆ | 41⅝ | 17¹⁄₁₆ | 430 |
| W50G6BB | 100.0 | 100.0 | 41.60 | 6-Gg. W50BB†¶#▲ | 12½ | 41⅞ | 12½ | 400 |

#### 480-VOLT INPUT GANGED UNITS

All Variacs listed are for "Y" connection. Overvoltage circuits are not recommended. Ball bearings are included with 6-gang types; available for remaining types at extra cost. Output voltage range, 0-480 volts.

| Model No. | Output Amps Rated | Output Amps Max. | kVA* | Description | Sizes, Inches W. | Sizes, Inches D.♦ | Sizes, Inches H. | Shpg. Lbs. |
|---|---|---|---|---|---|---|---|---|
| W5HG3 | 2.0 | 2.6 | 2.16 | 3-Gang W5H | 4½ | 12¹³⁄₁₆ | 4½ | 29 |
| W5HG3M | 2.0 | 2.6 | 2.16 | 3-Gang W5HM | 5⅛ | 13⅜₂ | 6¾ | 31 |
| W10HG3 | 4.0 | 5.2 | 4.32 | 3-Gang W10H | 5¾ | 15⅛ | 5¾ | 46 |
| W10HG3M | 4.0 | 5.2 | 4.32 | 3-Gang W10HM | 7⅛ | 15⅜ | 9¹¹⁄₁₆ | 52 |
| W20HG3 | 8.0 | 10.4 | 8.65 | 3-Gang W20H | 7½ | 14⅞ | 7½ | 73 |
| W20HG3M | 8.0 | 10.4 | 8.65 | 3-Gang W20HM | 9 | 15⅛ | 12¼ | 81 |
| W30HG3 | 12.0 | 15.6 | 13.00 | 3-Gang W30H | 10 | 15¹³⁄₁₆ | 10¾ | 107 |
| W30HG3M | 12.0 | 15.6 | 13.00 | 3-Gang W30HM | 11⅜ | 16⅛ | 14¹³⁄₁₆ | 113 |
| W50HG3M | 20.0 | 31.0 | 25.80 | 3-Gang W50HM | 13¹³⁄₁₆ | 22½ | 17¹⁄₁₆ | 230 |
| W50HG3 | 25.0 | 32.5 | 27.00 | 3-Gang W50H | 12½ | 22⅝ | 12½ | 214 |
| W50HG6BBM .. | 40.0 | 62.0 | 51.50 | 6-Gang W50HBBM▲ | 13¹³⁄₁₆ | 41⅝ | 17¹⁄₁₆ | 458 |
| W50HG6BB | 50.0 | 65.0 | 54.00 | 6-Gang W50HBB▲ | 12½ | 41⅞ | 12½ | 428 |

* kVA ratings — normal input line voltage times maximum current; maximum current can be drawn at maximum voltage for line voltage connection only. † "Y"-circuit connected. ‡ For 60 Hz only; no overvoltage connection. § Open-delta circuit connected. ¶ Overvoltage connection not recommended. ▲ See previous page for W50-P1 Choke for parallel combinations. ♦ Depth behind panel except cased types (excluding knobs). # Also for single-phase 120-volts input.

### SINGLE-PHASE PORTABLE VARIACS

Portable, metered, cased Variacs with 2-wire or 3-wire cord and receptacle, and convenient carrying handle. Meter accuracy is 3% of full scale except 5% for ammetered Model W20HMT3A. Power switch disconnects both sides of line. Meters are switchable under load. Types MT and MT3 have overvoltage connections and corresponding dial scales; line-voltage connections and dial scales on special order.

#### 120-VOLT INPUT

All units have max. output voltage range of 0-140 volts except W5LMT3 which has 0-120 volts. Models W5MT and W10MT come in 2-wire version; all others in 3-wire version.

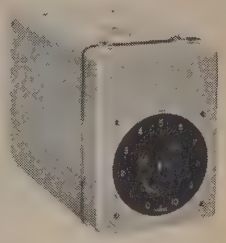
| Model No. | Rated Output, Amps | Meter Range (full-scale) Amps | Meter Range (full-scale) Watts | V | Size, Inches W. | Size, Inches D. | Size, Inches H. | Shpg. Weight Lbs. |
|---|---|---|---|---|---|---|---|---|
| W5MT*† | 5.0 | ..... | ..... | ..... | 4⅞ | 4⅜ | 6⁹⁄₁₆ | 15 |
| W5MT3*† | 5.0 | ..... | ..... | ..... | 4⅞ | 4⅜ | 6⁹⁄₁₆ | 15 |
| W5MT3VM | 5.0 | ..... | ..... | 150 | 4⅞ | 4⅜ | 6⁹⁄₁₆ | 19 |
| W5MT3A | 5.0 | 1/5 | ..... | 150 | 6¾ | 5¼ | 9½ | 19 |
| W5MT3W | 5.0 | ..... | 150/750 | 150 | 6¾ | 5¼ | 9½ | 19 |
| W5MT3AW | 5.0 | 1/5 | 150/750 | 150 | 11¹³⁄₁₆ | 5⅜ | 8⅝ | 21 |
| W5LMT3§ | 7.1 | ..... | ..... | ..... | 4⅞ | 4⅜ | 6⁹⁄₁₆ | 18 |
| W8MT3 | 10.0 | ..... | ..... | ..... | 5⅜ | 6⅛ | 7 | 16 |
| W8MT3VM | 10.0 | ..... | ..... | 150 | 5⅜ | 6⅛ | 7 | 16 |
| W10MT† | 10.0 | ..... | ..... | ..... | 6¾ | 5¼ | 9½ | 24 |
| W10MT3† | 10.0 | ..... | ..... | ..... | 6¾ | 5¼ | 9½ | 24 |
| W10MT3A | 10.0 | 2/10 | ..... | 150 | 8⅝ | 5⅜ | 11¹³⁄₁₆ | 30 |
| W10MT3W | 10.0 | ..... | 300/1500 | 150 | 8⅝ | 5⅜ | 11¹³⁄₁₆ | 30 |
| W20MT3A | 18.0 | 20 | ..... | 150 | 8⅝ | 5⅜ | 11¹³⁄₁₆ | 34 |
| W20MT3† | 18.0 | ..... | ..... | ..... | 8⅝ | 5⅜ | 11¹³⁄₁₆ | 23 |

#### 240-VOLT INPUT

All units have max. output voltage range of 0-280 volts. Models W5HMT and W10HMT come in 2-wire cord and receptacle; all others in 3-wire cord and receptacle.

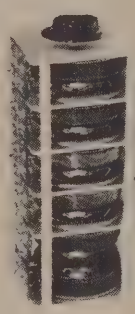
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| W5HMT† | 2.0 | ..... | ..... | ..... | 4⅞ | 4⅜ | 6⁹⁄₁₆ | 15 |
| W10HMT | 4.0 | ..... | ..... | ..... | 6¾ | 5¼ | 9½ | 24 |
| W10HMT3† | 4.0 | ..... | ..... | ..... | 6¾ | 5¼ | 9½ | 24 |
| W20HMT3† | 8.0 | ..... | ..... | ..... | 8⅝ | 5⅜ | 11¹³⁄₁₆ | 35 |
| W20HMT3A | 8.0 | 10 | ..... | 300 | 8⅝ | 5⅜ | 11¹³⁄₁₆ | 31 |

* Listed under UL Re-examination Service. † CSA Approved. § 60 Hz only.



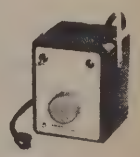
W10G3M
3-Gang
Cased

W5G3
3-Gang
Uncased



W30G6BB
6-Gang
Uncased

W8MT3VM



W8MT3

# Variac® Adjustable Autotransformers

## VARIAC® MANUAL AND MOTOR-DRIVEN AUTOTRANSFORMERS

### M-TYPE MANUAL MODELS FOR 350-1200 Hz OPERATION

For use at line frequencies between 350 and 1200 Hz. Equivalent to their Type-W counterparts, but smaller and lighter, and provide better regulation at 400 Hz than 60 Hz models. Conform to most military specifications for shock, vibration, salt spray, tropicalization, altitude, humidity and temperature.

#### SINGLE-PHASE 120-VOLT INPUT UNITS

Line voltage connection output, 0-120 volts; overvoltage connection output, 0-140 volts.

| Model No. | Output Amps Rated | Output Amps Max. | kVA* | Description | Shpg. Wt. Lbs. |
|---|---|---|---|---|---|
| M2 | 2.4 | 3.1 | 0.37 | Uncased | 4 |
| M5 | 6.0 | 7.8 | 0.94 | Uncased | 6 |
| M10 | 10.0 | 13.0 | 1.56 | Uncased | 11 |
| M20 | 20.0 | 26.0 | 3.12 | Uncased | 18 |

* kVA ratings — normal input line voltage times maximum current; maximum current can be drawn at maximum voltage for line voltage connection only.

#### SINGLE-PHASE 240-VOLT INPUT UNITS

Line voltage connection output, 0-240 volts; overvoltage connection output, 0-280 volts.

| Model No. | Output Amps Rated | Output Amps Max. | kVA* | Description | Shpg. Wt. Lbs. |
|---|---|---|---|---|---|
| M2G2 | 2.4 | 3.1 | 0.74 | 2-Gang M2 | 6 |
| M5G2 | 6.0 | 7.8 | 1.88 | 2-Gang M5 | 12 |
| M10G2 | 10.0 | 13.0 | 3.12 | 2-Gang M10 | 18 |
| M20G2 | 20.0 | 26.0 | 6.24 | 2-Gang M20 | 34 |

#### THREE-PHASE 240-VOLT INPUT UNITS

Line voltage connection output, 0-240 volts; overvoltage connection not recommended.

| Model No. | Output Amps Rated | Output Amps Max. | kVA* | Description | Shpg. Wt. Lbs. |
|---|---|---|---|---|---|
| M2G3 | 2.4 | 3.1 | 1.29 | 3-Gang M2 | 9 |
| M5G3 | 6.0 | 7.8 | 3.24 | 3-Gang M5 | 14 |
| M10G3 | 10.0 | 13.0 | 5.40 | 3-Gang M10 | 27 |
| M20G3 | 20.0 | 26.0 | 10.80 | 3-Gang M20 | 48 |

### MOTOR DRIVEN MODELS

All W- and M-type Variac autotransformers, both single and ganged, can be supplied with motor drives. Motors are fully enclosed, two-phase gear-reduction servo types having very low moments of inertia; the motor mounting plate is attached to the base end of the autotransformer by means of four heavy corner posts. Gear coupling is used to facilitate precise alignment, eliminate phase shift problems, and permit a number of drive speeds by simple change of gears. Three basic internal-geared motor speeds are available which, with a selection of standard coupling gears, makes possible the assembly of units having nominal full-traverse (320°) speeds of 2, 4, 8, 16, 32, 64 or 128 seconds at 60 Hz (approximately 20% slower at 50 Hz). The 2- and 4-second units are intended for high-speed servo applications; slower speed models are primarily for remote positioning. Cases are available for most models as indicated. **All motor-driven Variacs are furnished complete with ball bearings, a 120-volt phase-shift capacitor, and an adjustable microswitch for setting traverse limits.**

### HOW TO ORDER

**W 5 H G 3** (A) **D 8 C K** (B) **M** (C)

A **Basic Unit Prefix:** Select from table below the desired basic Variac unit, as described elsewhere in these pages.

| Variac Prefix No. | Motor Indicator: D ( ) CK 2 | 4 | 8 | 16 | 32 | 32 | 64 | 128 |
|---|---|---|---|---|---|---|---|---|
| M2 | X | X | X | X | ..... | X | X | ..... |
| M2G2 | X | X | X | X | ..... | X | X | ..... |
| M2G3 | ..... | X | X | X | ..... | X | X | ..... |
| M5 | X | X | X | X | ..... | X | X | ..... |
| M5G2 | X | X | X | X | ..... | X | X | ..... |
| M5G3 | ..... | X | X | X | ..... | X | X | ..... |
| M10 | X | X | X | X | X | ..... | X | X |
| M10G2 | ..... | X | X | X | X | ..... | X | X |
| M10G3 | ..... | ..... | X | X | X | ..... | X | X |
| M20 | ..... | X | X | X | X | ..... | X | X |
| M20G2 | ..... | ..... | X | X | X | ..... | X | X |
| M20G3 | ..... | ..... | X | X | X | ..... | X | X |
| W2 | X | X | X | X | ..... | X | X | ..... |
| W2G2 | X | X | X | X | ..... | X | X | ..... |
| W2G3 | ..... | X | X | X | ..... | X | X | ..... |
| W5 | X | X | X | X | ..... | X | X | ..... |
| W5G2 | X | X | X | X | ..... | X | X | ..... |
| W5G3 | ..... | X | X | X | ..... | X | X | ..... |
| W5H | X | X | X | X | ..... | X | X | ..... |
| W5HG2 | X | X | X | X | ..... | X | X | ..... |
| W5HG3 | ..... | X | X | X | ..... | X | X | ..... |
| W5L | X | X | X | X | ..... | X | X | ..... |
| W5LG2 | X | X | X | X | ..... | X | X | ..... |
| W5LG3 | ..... | X | X | X | ..... | X | X | ..... |
| W8 | X | X | X | X | ..... | X | X | ..... |
| W8G2 | X | X | X | X | ..... | X | X | ..... |
| W8G3 | ..... | X | X | X | ..... | X | X | ..... |
| W8L | X | X | X | X | ..... | X | X | ..... |
| W8LG2 | X | X | X | X | ..... | X | X | ..... |

B **Motor Indicator Suffix:** Add appropriate suffix for each Variac as indicated by an X in columns below. Suffix indicates seconds for 320° traverse.

C **Case Suffix:** Add final suffix M if case available and desired. Case fully encloses both motor and Variac.

| Variac Prefix No. | Motor Indicator: D ( ) CK 2 | 4 | 8 | 16 | 32 | 32 | 64 | 128 |
|---|---|---|---|---|---|---|---|---|
| W8LG3 | ..... | X | X | X | ..... | X | X | ..... |
| W10 | X | X | X | X | X | ..... | X | X |
| W10G2 | ..... | X | X | X | X | ..... | X | X |
| W10G3 | ..... | ..... | X | X | X | ..... | X | X |
| W10H | X | X | X | X | X | ..... | X | X |
| W10HG2 | ..... | X | X | X | X | ..... | X | X |
| W10HG3 | ..... | ..... | X | X | X | ..... | X | X |
| W20 | ..... | X | X | X | X | ..... | X | X |
| W20G2 | ..... | ..... | X | X | X | ..... | X | X |
| W20G3 | ..... | ..... | X | X | X | ..... | X | X |
| W20H | ..... | X | X | X | X | ..... | X | X |
| W20HG2 | ..... | ..... | X | X | X | ..... | X | X |
| W20HG3 | ..... | ..... | X | X | X | ..... | X | X |
| W30 | ..... | X | X | X | X | ..... | X | X |
| W30G2 | ..... | ..... | ..... | X | X | ..... | X | X |
| W30G3 | ..... | ..... | ..... | ..... | X | ..... | X | X |
| W30H | ..... | X | X | X | X | ..... | X | X |
| W30HG2 | ..... | ..... | ..... | X | X | ..... | X | X |
| W30HG3 | ..... | ..... | ..... | ..... | X | ..... | X | X |
| W50 | ..... | ..... | ..... | X | X | ..... | X | X |
| W50G2 | ..... | ..... | ..... | ..... | X | ..... | X | X |
| W50G3 | ..... | ..... | ..... | ..... | X | ..... | X | X |
| W50G4 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | X |
| W50G6 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | X |
| W50H | ..... | ..... | ..... | X | X | ..... | X | X |
| W50HG2 | ..... | ..... | ..... | ..... | X | ..... | X | X |
| W50HG3 | ..... | ..... | ..... | ..... | X | ..... | X | X |
| W50HG4 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | X |
| W50HG6 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | X |

### Stocking Distributors For Variac® Autotransformers

**AL:** Birmingham — J. W. Clary Co., (205) 322-2486
**CT:** Wallingford — Abern Safety Equipment, (203) 265-5621
**CA:** Chatsworth — Westates Electronics, (213) 341-4411
Sunnyvale — Westates Electronics, (408) 733-8383
**IL:** Chicago — Delta Technical Products, (312) 286-1141
Peoria — Klaus Radio & Electronics, (309) 691-4840
**MA:** Natick — Lafayette Industrial Electronics, (617) 969-6100
N. Woburn — Abbott Electronics, (617) 935-2040
**MI:** Dearborn — Industrial Temperature Control, (313) 278-2210
**MN:** St. Paul — Gopher Electronics, (612) 654-0241
**NH:** Londonderry — Yankee Electronic Supply, (603) 625-9746
**NY:** E. Farmingdale — Harrison Electronic, (516) 293-7990
**OH:** Dayton — ESCO, (513) 224-9192
**PA:** Philadelphia — Philadelphia Electronics, (215) 568-7444
**TX:** Dallas — Economy Gauge & Instrument, (214) 243-8370

GenRad
DEPT. EM, 300 BAKER AVE., CONCORD, MASS. 01742

NEW YORK [N. Y.] (212) 964-2722, [N. J.] (201) 791-8990
BOSTON (617) 646-0550 • DAYTON (513) 294-1500
CHICAGO (312) 884-6900 • WASHINGTON, D. C. (301) 948-7071
ATLANTA (404) 394-5380 • LOS ANGELES (714) 540-9830
SAN FRANCISCO • (408) 985-0662 • DALLAS (214) 234-3357
TORONTO (416) 252-3395

hisonic inc.

249 N. TROOST • OLATHE, KANSAS 66061
PHONE: 913-782-0012
TELEX: 4-2562

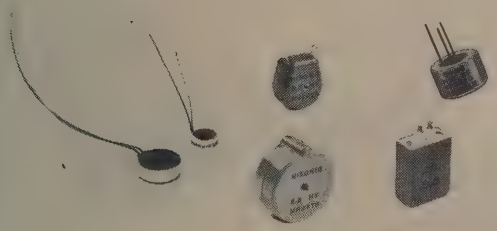
## INDUCTORS

Hisonic has long been a leader in the custom development and manufacture of high Q precision inductors. Originally confined to MPP and PI toroidal types, capabilities have been expanded to include ferrite pot core and laminated alloy core types and cover virtually every known construction that applications may require.

Although Hisonic stocks several series (primarily toroidal) most are custom made to specific requirements which results in less compromise in your applications and usually lower cost.

STANDARD

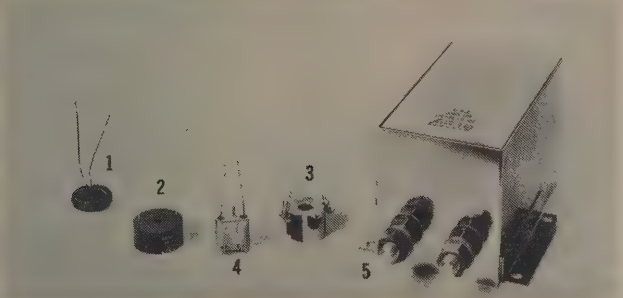
UNCASED MOLDED METAL CASED



| *Toroidal Series | Ind. Range | Max Q | Freq Range | DC R Ohms/MH | Uncased Size |
|---|---|---|---|---|---|
| J2 | 5.6MH to 3.3HY | 90 | Up to 30KHZ | .50 | .620D x .30H |
| J3 | 2.7 to 470MH | 110 | 20 to 150KHZ | 1.1 | .620D x .30H |
| J4 | .56 to 33MH | 110 | 100 to 400KHZ | 5.1 | .620D x .30H |
| J5 | .10 to 10MH | 150 | 250KHZ to 1.5MHZ | 8.9 | .620D x .30H |
| R2 | 6.8MH to 6.8HY | 135 | Up to 20KHZ | .18 | .960D x .40H |
| R3 | 3.3 to 470MH | 180 | 10 to 60KHZ | .39 | .960D x .40H |
| R4 | 1.2 to 68MH | 170 | 40 to 160KHZ | .90 | .960D x .40H |
| S2 | 6.8MH to 15HY | 160 | Up to 15KHZ | .10 | 1.250D x .62H |
| S3 | 3.3 to 560MH | 225 | 10 to 60KHZ | .21 | 1.250D x .62H |
| T2 | 22MH to 39HY | 210 | Up to 15KHZ | .045 | 1.850D x .85H |
| V2 | 68MH to 68HY | 245 | Up to 8KHZ | .028 | 2.400D x .92H |
| W2 | 100MH to 100HY | 260 | Up to 6KHZ | .021 | 2.700D x 1.05H |

*Write for Series Bulletins on electrical and case style details

EXAMPLE *CUSTOM INDUCTORS




| P/N | Fig. | Description | Characteristics | Type | Size |
|---|---|---|---|---|---|
| 26-5103 Series | 2 | Encaps. PC Mtg. | See R Series Std | Tor. | 1.06x.5H |
| 06-4000-27 | 1 | DC Filter Choke | 250μH@1.5ADC | Tor. | .970Dx.4H |
| 06-4000-39 | 3 | Var. Ind. PC Mtg. | 90-110MH Q250 | Pot | .80Dx.5H |
| 26-5034 Series | 4 | Xtal Case Mtg. | See J Series Std | Tor. | .34x.75x.8H |
| 26-5135-00 | 5 | Shielded Choke | 50 uH @100ADC | Lam | 2.65x5x3H |

*Advise requirements for recommended solution and quotation

## TRANSFORMERS

Hisonic has recognized capabilities in the design and manufacture of transformers, particularly for technically sophisticated custom applications. Thousands of Hisonic converter transformers are "flying" over the world, powering aircraft com/nav equipment. Special signal and matching transformers for both voice and wide video ranges are in use in communication systems.

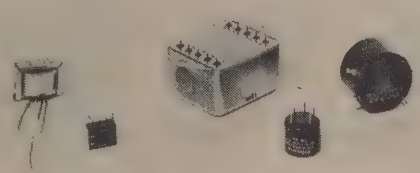
Constructions include toroidal, pot core and laminated core to commercial and MIL specifications.

There are few "stock" items, but hundreds of designs and our engineering staff are ready to solve your transformer problems quickly.

EXAMPLE DC CONV/AC POWER

| P/N | Input | OP Freq | VA Rating | Output Volts Peak (or RMS) | Size |
|---|---|---|---|---|---|
| 24-0170-10 | 10V DC | 24KHZ | 0.8 | 20CT | .28x.6x.48H |
| 24-0193-10 | 14/28V DC | 6KHZ | 18 | 4.7,11.5CT,22.5CT,550 | 1.8 ODx.94H |
| 24-0135-10 | 14/28V DC | 4KHZ | 25 | 9,20CT,1170 | 1.8x2.0x.88H |
| 24-0107-10 | 14/28V DC | 2KHZ | 27 | 90/45CT,180/25,180/25 | 2.1 ODx.88H |
| 24-0202-11 | 14/28V DC | 4KHZ | 35 | 9.5CT,22.5CT,100,100 | 1.8x2.0x.88H |
| 24-0114-10 | 14/28V DC | 400HZ | 75 | 26 , 60 | 2.9 ODx1.5H |
| 24-0271-10 | 14/28V DC | 5KHZ | 80 | 6.5CT,22.5CT,100,100 | 2.0x2.0x1.0H |
| 24-0277-10 | 42V DC | 10KHZ | 200 | 100 | 2.0x2.5x1.2H |
| 24-0177-10 | 10V AC | 400HZ | 2 | 1.4,1.4,10 (RMS) | 1.9 ODx.86H |
| 24-0169-10 | 26V AC | 400HZ | 17 | 21/13CT (RMS) | 1.0x1.4x1.3H |
| 24-0215-10 | 115V AC | 400HZ | 180 | 20,27,27,42 (RMS) | 3.2x3.8x4.1H |

EXAMPLE SIGNAL/PULSE/MATCH



| P/N | Description | Impedance | Response | Level | Size |
|---|---|---|---|---|---|
| 24-0239-11 | Video Range Match | 150:150,25 | 100KHZ–2.5MHZ | 60mw | .63x.63x.44H |
| 24-0275-10 | Wide Band Match | 135CT:1000 | 1KHZ–2MHZ | 4mw | 1.1 ODx.75H |
| 24-0205-10 | Voice Range Hybrid | 600:600+600 | 300–3000HZ | 100mw | 1.0x1.0x1.0H |
| 24-0240-10 | Wide Band Hybrid | 600:600+600 | 50HZ–50KHZ | 1mw | 1.8x2.0x1.0H |
| 24-0171-10 | Radio Freq. Hybrid | 50:100+100 | 700KHZ–4MHZ | 10mw | .75 ODx.85H |
| 24-0153-10 | Pulse Match | 10K.40K | tp1.2ms,tr60μs | 25mw | .53x.53x.7H |
| 24-0180-10 | Pulse Output | 5:600w/tap | tp.4μs,tr.2μ | 6KW | 1.5 ODx.8H |

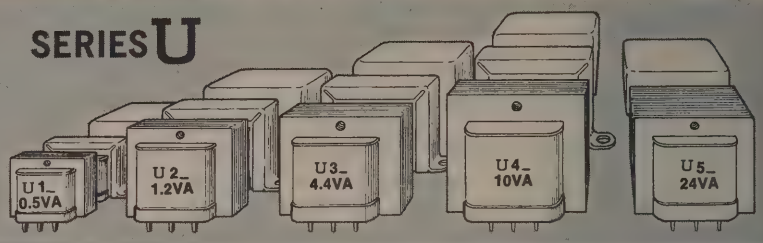
hisonic inc.

OTHER PRODUCTS: High, Low & Band Pass and Suppression Filters • Tuned Circuits • Amp/Phase Equalizers • Lumped Constant Delay Lines

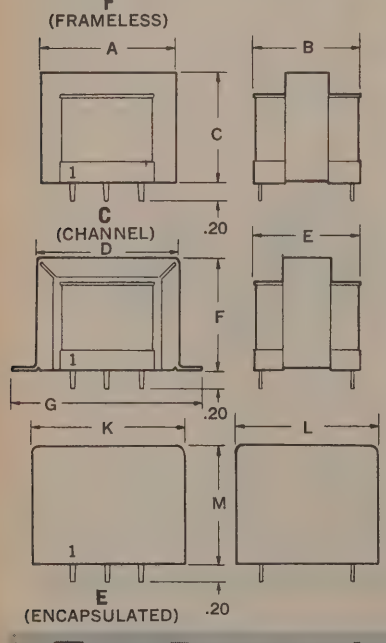
# PLUG-IN P.C. BOARD POWER

- OVER 2,500 STD. MODELS
- 115V - 115/230V INPUT
- SINGLE - DUAL - CT OUTPUT
- 25 STD. OUTPUT VOLTAGES
- POWER RATINGS TO 24 VA
- ELECTROSTATIC SHIELD OPTION

## SERIES U




| OUTPUT VOLTAGE Eo (RMS) | 4.0 | 4.5 | 5.0 | 5.5 | 6.3 | 7.5 | 8.0 | 9.0 | 10 | 12 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| WINDING CONFIGURATION / Dash | -004 | -04.5 | -005 | -05.5 | -06.3 | -07.5 | -008 | -009 | -010 | -012 | -015 |
| Model | OUTPUT CURRENT IL (MA) PER SECONDARY | | | | | | | | | | |
| 115V, 6 PIN — U11- / U21- | 120 / 300 | 110 / 270 | 100 / 240 | 95 / 220 | 80 / 200 | 65 / 170 | 60 / 150 | 55 / 140 | 50 / 120 | 45 / 100 | 35 / 80 |
| U31- | 1100 | 980 | 880 | 800 | 700• | 600• | 520 | 480 | 440 | 360 | 300• |
| U41- / U51- | 2400 / 6000 | 2200 / 5300 | 2000 / 4800 | 1800 / 4400 | 1600• / 4000• | 1400• / 3200• | 1300 / 3000 | 1100 / 2600 | 1000 / 2400 | 900 / 2000 | 670• / 1600• |
| 115V 115V, 8 PIN — U12- / U22- | 105 / 300 | 95 / 270 | 90 / 240 | 80 / 220 | 70 / 200 | 55 / 170 | 50 / 150 | 48 / 140 | 44 / 120 | 40 / 100 | 30 / 80 |
| U32- | 1100 | 980 | 880 | 800 | 700 | 600 | 520 | 480 | 440 | 360 | 300 |
| U42- / U52- | 2400 / 6000 | 2200 / 5300 | 2000 / 4800 | 1800 / 4400 | 1600 / 4000 | 1400 / 3200 | 1300 / 3000 | 1100 / 2600 | 1000 / 2400 | 900 / 2000 | 670 / 1600 |
| 115V, 6 PIN, LUG — U13- / U23- | 45 / 150 | 41 / 135 | 38 / 120• | 36 / 110 | 30 / 100• | 24 / 85 | 22 / 75• | 21 / 70 | 19 / 60• | 17 / 50• | 13 / 40 |
| U33- | 550 | 490 | 440• | 400 | 350• | 300 | 260• | 240 | 220• | 180• | 150 |
| U43- / U53- | 1200 / 3000 | 1100 / 2600 | 1000• / 2400• | 900 / 2200 | 800• / 2000• | 700 / 1600 | 650• / 1500• | 550 / 1300 | 500• / 1200• | 450• / 1000• | 335 / 800 |
| 115V 115V, 8 PIN, LUG — U14- / U24- | 42 / 150 | 38 / 135 | 35 / 120• | 34 / 110 | 28 / 100• | 22 / 85 | 21 / 75• | 20 / 70 | 18 / 60• | 16 / 50• | 12 / 40 |
| U34- | 550 | 490 | 440• | 400 | 350• | 300 | 260• | 240 | 220• | 180• | 150 |
| U44- / U54- | 1200 / 3000 | 1100 / 2600 | 1000• / 2400• | 900 / 2200 | 800• / 2000• | 700 / 1600 | 650• / 1500• | 550 / 1300 | 500• / 1200• | 450• / 1000• | 335 / 800 |

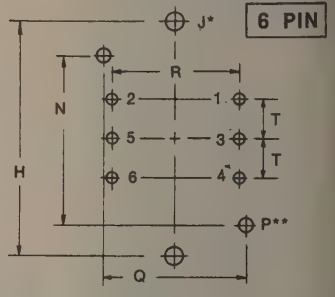


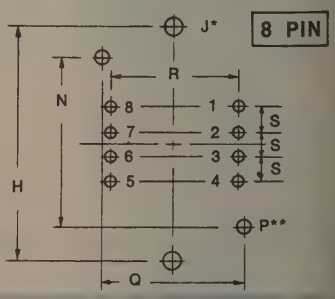

## MECHANICAL DIMENSIONS (INCHES)

| | U1_ | U2_ | U3_ | U4_ | U5_ |
|---|---|---|---|---|---|
| A | 1.00 | 1.38 | 1.63 | 1.88 | 1.63 |
| B | 0.95 | 1.13 | 1.24 | 1.44 | 2.23 |
| C | 0.83 | 1.15 | 1.38 | 1.59 | 1.38 |
| D | NA | 1.46 | 1.72 | 1.96 | NA |
| E | NA | 1.13 | 1.24 | 1.44 | NA |
| F | NA | 1.22 | 1.40 | 1.65 | NA |
| G | NA | 2.07 | 2.38 | 2.82 | NA |
| H | NA | 1.75 | 2.00 | 2.38 | NA |
| J* | NA | 0.19D | 0.19D | 0.19D | NA |
| K | 1.15 | 1.67 | 1.76 | 2.02 | 1.87 |
| L | 1.37 | 1.42 | 1.64 | 1.76 | 2.73 |
| M | 0.87 | 1.25 | 1.40 | 1.65 | 1.40 |
| N | 0.92 | 1.36 | 1.45 | 1.71 | 1.51 |
| P** | 4-40 | 6-32 | 6-32 | 6-32 | 8-32 |
| Q | 1.13 | 1.12 | 1.34 | 1.46 | 2.34 |
| R | 0.78 | 1.00 | 1.10 | 1.30 | 2.10 |
| S | 0.15 | 0.20 | 0.25 | 0.25 | 0.25 |
| T | 0.20 | 0.31 | 0.40 | 0.40 | 0.40 |

*FASTENER HOLES PROVIDED ON C STYLE
**TAPPED INSERTS PROVIDED ON E STYLE
RECOMMENDED P.C. PIN HOLE DIA. = .052

## P.C. BOARD LAYOUT
(CIRCUIT SIDE)




**Inductive Components, Inc.**
DEPT. EM, 181 BRIDGE ROAD • HAUPPAUGE, NEW YORK 11787 • (516) 582-9370

# TRANSFORMERS FROM STOCK

## TRANSFORMER SELECTION AND PART NUMBER SYSTEM

1. DETERMINE DESIRED WINDING CONFIGURATION. 2. SELECT APPROPRIATE LOAD CURRENT RATING $I_L$ (WITHIN WINDING CONFIGURATION) UNDER DESIRED OUTPUT VOLTAGE $E_O$ COLUMN HEADING. 3. READ MODEL (VERTICAL SHADED COLUMN) AND DASH NO. (HORIZONTAL SHADED COLUMN). ADD APPROPRIATE SUFFIXES TO SPECIFY MOUNTING AND SHIELDING.

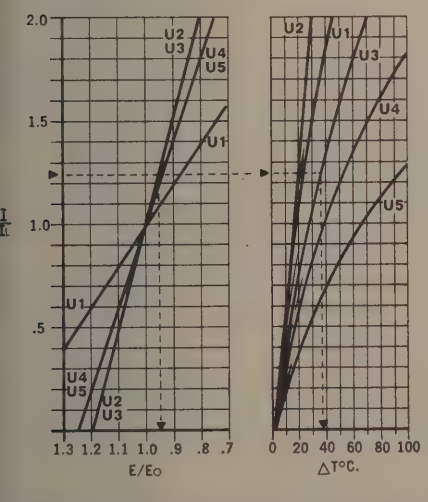
DEFINES V.A., SIZE AND WINDING — MODEL — ELECTROSTATIC SHIELDING — N — NO SHIELD, S — SHIELD

**U31-005-C-S**

DEFINES $E_O$ AT RATED LOAD $I_L$ — DASH NO. — MOUNTING STYLE — F — FRAMELESS, C — CHANNEL FRAME, E — ENCAPSULATED

| | 17 | 20 | 24 | 28 | 32 | 38 | 44 | 54 | 60 | 75 | 90 | 100 | 115 | 230 | | AVAILABILITY OF OPTIONS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dash | -017 | -020 | -024 | -028 | -032 | -038 | -044 | -054 | -060 | -075 | -090 | -100 | -115 | -230 | DASH | | | | |
| Model | OUTPUT CURRENT $I_L$ (MA) PER SECONDARY | | | | | | | | | | | | | | MODEL | -F | -C | -E | -S |
| U11- | 30 | 25 | 20 | 18 | 15 | 12 | 11 | 10 | 8 | 7 | 5 | 3 | 2 | NA | U11- | ✓ | NA | ✓ | ✓ |
| U21- | 70 | 60 | 50 | 40 | 38 | 35 | 30 | 25 | 20 | 15 | 12 | 11 | 10• | 5• | U21- | ✓ | ✓ | ✓ | ✓ |
| U31- | 250 | 220 | 180 | 160 | 140 | 120 | 100 | 80 | 70 | 60 | 48 | 45 | 40• | 20• | U31- | ✓ | ✓ | ✓ | ✓ |
| U41- | 600 | 500 | 420 | 360 | 310 | 260 | 240 | 190 | 170 | 130 | 110 | 100 | 90• | 45• | U41- | ✓ | ✓ | ✓ | ✓ |
| U51- | 1400 | 1200 | 1000 | 840 | 750 | 640 | 540 | 440 | 400 | 320 | 260 | 240 | 200• | 100• | U51- | ✓ | NA | ✓ | ✓ |
| U12- | 25 | 22 | 18 | 16 | 13 | 11 | 10 | 8 | 7 | 6 | 4 | 2 | 2 | NA | U12- | ✓ | NA | ✓ | ✓ |
| U22- | 70 | 60 | 50 | 40 | 38 | 35 | 30 | 25 | 20 | 15 | 12 | 11 | 10 | 5 | U22- | ✓ | ✓ | ✓ | ✓ |
| U32- | 250 | 220 | 180 | 160 | 140 | 120 | 100 | 80 | 70 | 60 | 48 | 45 | 40 | 20 | U32- | ✓ | ✓ | ✓ | ✓ |
| U42- | 600 | 500 | 420 | 360 | 310 | 260 | 240 | 190 | 170 | 130 | 110 | 100 | 90 | 45 | U42- | ✓ | ✓ | ✓ | ✓ |
| U52- | 1400 | 1200 | 1000 | 840 | 750 | 640 | 540 | 440 | 400 | 320 | 260 | 240 | 200 | 100 | U52- | ✓ | NA | ✓ | ✓ |
| U13- | 11 | 10 | 8 | 7 | 6 | 5 | 4 | 4 | NA | NA | NA | NA | NA | NA | U13- | ✓ | NA | ✓ | ✓ |
| U23- | 35• | 30• | 25 | 20• | 19 | 18 | 15• | 13 | 10• | 8 | 6 | 6 | 5 | 2 | U23- | ✓ | ✓ | ✓ | ✓ |
| U33- | 125• | 110• | 90 | 80• | 70 | 60 | 50• | 40 | 35• | 30 | 24 | 22 | 20 | 10 | U33- | ✓ | ✓ | ✓ | ✓ |
| U43- | 300• | 250• | 210 | 180• | 155 | 130 | 120• | 95 | 85• | 65 | 55 | 50 | 45 | 20 | U43- | ✓ | ✓ | ✓ | ✓ |
| U53- | 700• | 600• | 500 | 420• | 370 | 320 | 270• | 220 | 200• | 160 | 130 | 120 | 100 | 50 | U53- | ✓ | NA | ✓ | ✓ |
| U14- | 10 | 9 | 7 | 7 | 6 | 5 | 4 | 3 | NA | NA | NA | NA | NA | NA | U14- | ✓ | NA | ✓ | ✓ |
| U24- | 35• | 30• | 25 | 20• | 19 | 18 | 15• | 13 | 10• | 8 | 6 | 6 | 5 | 2 | U24- | ✓ | ✓ | ✓ | ✓ |
| U34- | 125• | 110• | 90 | 80• | 70 | 60 | 50• | 40 | 35• | 30 | 24 | 22 | 20 | 10• | U34- | ✓ | ✓ | ✓ | ✓ |
| U44- | 300• | 250• | 210 | 180• | 155 | 130 | 120• | 95 | 85• | 65 | 55 | 50 | 45 | 20• | U44- | ✓ | ✓ | ✓ | ✓ |
| U54- | 700• | 600• | 500 | 420• | 370 | 320 | 270• | 220 | 200• | 160 | 130 | 120 | 100 | 50• | U54- | ✓ | NA | ✓ | ✓ |

■ DELIVERY: MODELS MARKED • ARE IN STOCK FOR IMMEDIATE DELIVERY (STYLE **F-N**). OTHER MODELS AND STYLES — STOCK TO ONE WEEK.
■ NO MINIMUM ORDER FOR STOCK • UNITS. ■ CONSULT CURRENT PRICE LIST, REP OR FACTORY FOR NET PRICES AND QUANTITY DISCOUNTS.
■ SPECIFICATIONS AND PRICES SUBJECT TO CHANGE WITHOUT NOTICE.




## REGULATION AND TEMPERATURE RISE

To determine the actual voltage output (E) of any transformer (listed in the chart above) when the required load current (I) is other than rated ($I_L$), refer to the graphs shown. Use of these curves enables the designer to predict, with useful accuracy, the actual voltage output and expected temperature rise of the transformer under consideration as a function of load current. All data shown represents operation at nominal voltage input, (115 or 230V) 60 Hz sine wave, with free convection cooling in still air at 25°C. ambient.

To use the curves, first determine the ratio of the required load current (I) to the rated load current ($I_L$). Enter the graphs at the extreme left vertical axis ($I/I_L$) at the appropriate ratio and read ratio of $E/E_O$ and $\triangle T$°C.

The following example is illustrated in dotted lines on the graphs:
Transformer model selected — U32-012-X-X
From above chart — $E_O$ = 12 volts at $I_L$ = 360 MA.
Required load current — I = 450 MA.
$I/I_L = 450/360 = 1.25$ ∴ $E/E_O = .95$ or $E = .95 \times E_O$
$E_O = .95 \times 12 \approx 11.4$ volts and $\triangle T \approx 37$°C.

To summarize, A **U32-012-X-X** transformer will deliver approximately 11.4 volts at a load current of 450 MA and will exhibit a temperature rise of approximately 37°C above ambient at that load.

Series U transformers are rated for continuous operation at 105°C. Therefore, the maximum permissible ambient temperature in which the U-32-012-X-X transformer can be operated when delivering 450 MA load current is 105° - 37° = 68°C (154°F).

All Series U transformers **(except style -E)** are varnish impregnated and finished with a special black polyurethane overcoat for added moisture resistance. All models are tested for primary to secondary and winding to core dielectric strength of **1500** VRMS.

For operation at 400 Hz, the rated load current ($I_L$) shown in the chart above can be increased **by as much as 1.8 times. Contact factory for specific data.**

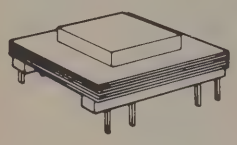
**SPECIAL WINDING CONFIGURATIONS AND VOLTAGE/CURRENT RATINGS AVAILABLE TO MEET YOUR REQUIREMENTS. CONTACT OUR NEAREST REPRESENTATIVE OR FACTORY FOR DETAILED APPLICATIONS INFORMATION.**

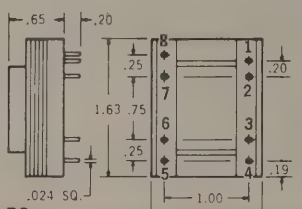
**Inductive Components, Inc.**
DEPT. EM, 181 BRIDGE ROAD • HAUPPAUGE, NEW YORK 11787 • (516) 582-9370

# SERIES F FLATFORMER™

## LOW PROFILE·PLUG-IN P.C. BOARD MOUNT·50/60/500 Hz·POWER TRANSFORMERS

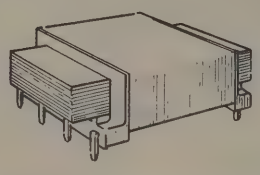
**MODEL F2**

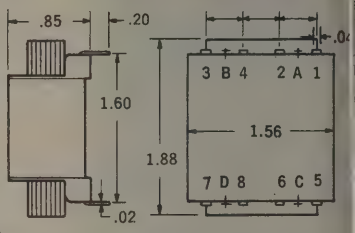





0.65 HIGH
1 VA AT 60 HZ WT. = .25 LBS.

**MODEL F4**






0.85 HIGH
7 VA AT 60 HZ WT. = .33 LBS.

### TRANSFORMER SELECTION AND PART NUMBER SYSTEM

1. DETERMINE DESIRED WINDING CONFIGURATION. 2. SELECT APPROPRIATE LOAD CURRENT RATING $I_L$ (WITHIN WINDING CONFIGURATION IN DESIRED OUTPUT VOLTAGE $E_O$ LINE HEADING. 3. READ MODEL (HORIZONTAL SHADED COLUMN) AND DASH NO. (VERTICAL SHADED COLUMN). ADD APPROPRIATE SUFFIXES to SPECIFY MOUNTING AND SHIELDING.

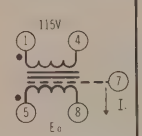
DEFINES V.A., SIZE AND WINDING — MODEL
DEFINES $E_O$ AT RATED LOAD $I_L$ — DASH NO.

**F44-008-F-S**

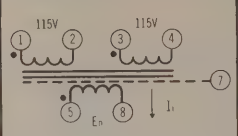
ELECTROSTATIC SHIELDING — N — NO SHIELD / S — SHIELD
MOUNTING STYLE — F — FRAMELESS

### STANDARD WIRING CONFIGURATIONS

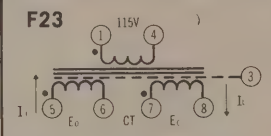
F21



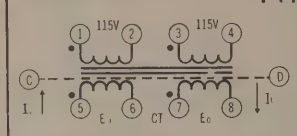

F22



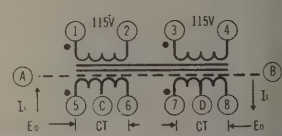

F23




F24
F44



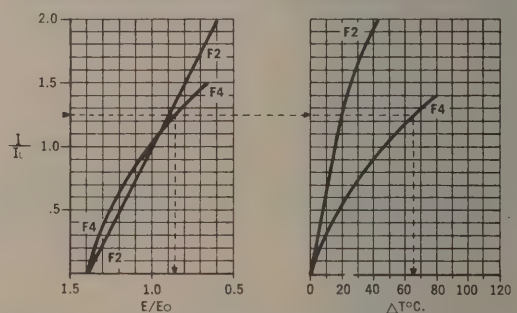

F45




SPECIAL WINDING CONFIGURATIONS AND VOLTAGE/CURRENT RATINGS AVAILABLE TO MEET YOUR REQUIREMENTS. CONTACT OUR NEAREST REPRESENTATIVE OR FACTORY FOR DETAILED APPLICATIONS INFORMATION.

| $E_O$(RMS) | DASH | STANDARD MODELS | | | | | |
|---|---|---|---|---|---|---|---|
| | | F21 | F22 | F23 | F24 | F44 | F45 |
| | | OUTPUT CURRENT $I_L$ (MA) PER SECONDARY | | | | | |
| 2.0 | −002 | 500 | 500 | 250 | 225 | 1600 | 1600 |
| 4.0 | −004 | 250 | 250 | 125 | 110 | 800 | 800 |
| 4.5 | −0.45 | 220 | 220 | 110 | 100 | 750 | 750 |
| 5.0 | −005 | 200 | 200 | 100 | 90• | 700• | 700 |
| 5.5 | −0.05 | 180 | 180 | 90 | 80 | 630 | 630 |
| 6.3 | −06.3 | 150 | 150 | 75 | 68• | 550• | 550 |
| 7.5 | −07.5 | 130 | 130 | 65 | 58 | 490 | 490 |
| 8.0 | −008 | 120 | 120 | 60 | 54• | 400• | 400 |
| 9.0 | −009 | 110 | 110 | 55 | 50 | 375 | 375 |
| 10 | −010 | 100 | 100 | 50 | 45• | 350• | 350 |
| 12 | −012 | 80 | 80 | 40 | 36• | 290• | 290 |
| 15 | −015 | 65 | 65 | 32 | 28 | 230 | 230 |
| 17 | −017 | 58 | 58 | 29 | 26• | 200• | 200 |
| 20 | −020 | 50 | 50 | 25 | 22• | 175• | 175 |
| 24 | −024 | 40 | 40 | 20 | 18 | 140 | 140 |
| 28 | −028 | 35 | 35 | 17 | 15• | 120• | 120 |
| 32 | −032 | 30 | 30 | 15 | 13 | 105 | 105 |
| 44 | −044 | 20 | 20 | 10 | 9 | 75• | 75 |
| 60 | −060 | 15 | 15 | 7 | 6• | 55• | 55 |
| 115 | −115 | 8 | 8 | 4 | 3 | 30• | 30 |
| Shield Available | | YES | YES | YES | NO | YES | YES |

### REGULATION AND TEMPERATURE RISE




To determine the actual voltage output (E) of any listed transformer when the load current (I) is other than rated ($I_L$), first determine the ratio of required load current (I) to the rated current ($I_L$). Enter the graphs at the extreme left vertical axis ($I/I_L$) at the ratio determined above and read ratio of $E/E_O$ and $\triangle T°C$.

The dotted lines illustrate the following example:

Transformer model selected — F44-020-X-X
From chart (to left) — $E_O$ = 20 volts at $I_L$ = 175 MA (per secondary)
Required load current (per secondary) — 220 MA
$I/I_L = 220/175 = 1.26 \therefore E/E_O = .86$ or $E = .86 \times E_O$
$E = .86 \times 20 \approx 17.2$ volts and $\triangle T \approx 65°C$.

To summarize, an F44-020-X-X transformer will deliver ≈ 17.2 volts at a load current of 220 MA (per secondary) and will exhibit a temperature rise of ≈ 65°C above ambient.

Series F transformers are rated for continuous operation at 130°C. Thus, the maximum permissible ambient temperature in which the F44-020-X-X unit can be operated when delivering 220 MA (per secondary) is 130°-65°=65°C (149°F). For operation at 400/500 Hz the load current shown can be increased by ≈ 1.5; consult factory for specific data.

■ CONSTRUCTION: ALL MODELS VACUUM VARNISHED AND FURNISHED WITH SPECIAL BLACK POLYURETHANE OVERCOAT. ■ RATINGS: $E_O$ AND $I_L$ GIVEN FOR 115V 50/60 HZ SINE WAVE INPUT. ■ HI-POT: 1500V RMS WINDING TO WINDING & WINDING TO CORE. ■ DELIVERY: MODELS MARKED • FOLLOWING $I_L$ RATING ARE AVAILABLE FROM STOCK (STYLE F-N). OTHER MODELS — STOCK TO ONE WEEK. ■ CONSULT CURRENT PRICE LIST, REP OR FACTORY FOR NET PRICES & QUANTITY DISCOUNTS. ■ NO MINIMUM ORDER FOR STOCK • UNITS. ■ SPECIFICATIONS AND PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

**Inductive Components, Inc.**
DEPT. EM, 181 BRIDGE ROAD • HAUPPAUGE, NEW YORK 11787 • (516) 582-9370

# J M Transformer Company

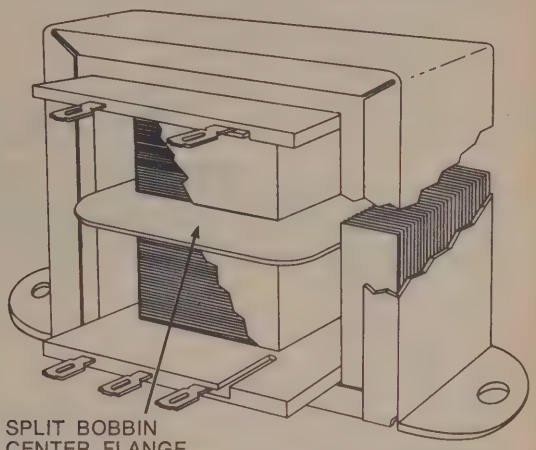
DEPT. EM
262 MOTT STREET
NEW YORK, N.Y. 10012
(212) 966-4195

- **TRANSFORMERS WITH RATING TO 1200 VA**
- **Available with secondary voltages up to 500 V**
- **Available with secondary current ratings to 20 Amps**
- **PROTOTYPES AVAILABLE WITHIN ONE WEEK**
- **No set-up charges on special orders**
- **CHECK OUR LOW PRICES!**

## SPLIT BOBBIN POWER TRANSFORMERS

- 50/60 Hz
- Power Ratings to 200 VA
- 115 V and 230 V Primaries
- Terminals and Flexible Leads Available
- Non-Concentric Winding — Lower Capacitance — Better Insulation — 2500 VRMS Hipot — No need for Electro-static Shield
- Also useful for Medical Applications

See Stock Low Profile Type at bottom of this page

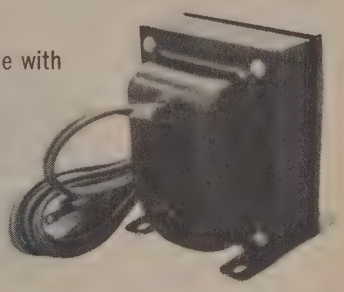



## RECTIFIER POWER TRANSFORMERS WITH FLEXIBLE LEADS

- 50/500 Hz
- Power Ratings up to 500 VA
- Wide Range of Voltages
- Single, Dual, and Tapped Primaries
- Single and Multiple Outputs
- Available with End Bells
- Terminals also available

## STEP DOWN AUTO TRANSFORMERS

- 50/60 Hz
- 230/115 V
- 100-1200 VA
- Also available with open frame construction

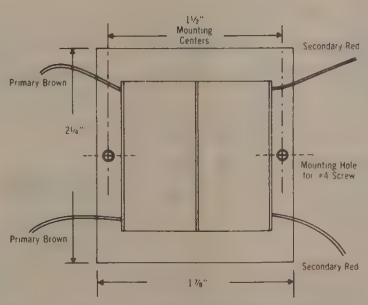


## LOW PROFILE SPLIT BOBBIN POWER TRANSFORMERS with 4" Flexible Leads

- Only 1.1 inches high — Wt. ½ lb.
- Ideal for PC Board and Chassis Mounting where low height is required

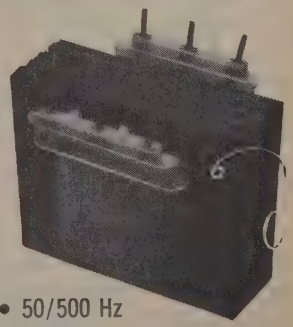
Stock Transformers:
115 V 50/60 Hz Primary — 10 VA

| Part Number | Secondary RMS Full Load Rating | Price, ea. (1-9) |
|---|---|---|
| Lps 10-8 | 8 V @ 1.25 A | $6.00 |
| Lps 10-10 | 10 V @ 1 A | 6.00 |
| Lps 10-12 | 12.6 V @ .8 A | 6.00 |
| Lps 10-16 | 16 V @ .63 A | 6.00 |
| Lps 10-20 | 20 V @ .5 A | 6.00 |
| Lps 10-24 | 24 V @ .42 A | 6.00 |
| Lps 10-32 | 32 V @ .31 A | 6.00 |




● Plug-in units with 1.15 x 1.15 pin spacing (.041 pin dia.) also available.

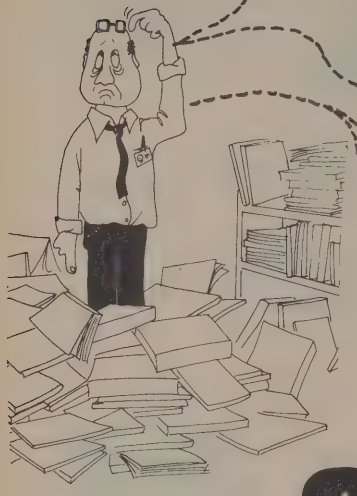
## MINIATURE PLUG-IN POWER TRANSFORMERS PC APPLICATION



- 50/500 Hz
- 10 VA
- Single or Dual Primaries
- Single or Dual Secondaries

***What can I use to keep all the manufacturers' product data I receive in order?***

***What system makes filing or retrieving manufacturers' catalogs fast and easy?***



***Which file system have thousands of engineers purchased because they know it works?***

# eem FILE SYSTEM

## THE ONLY FILE SYSTEM DESIGNED SPECIALLY FOR THE ELECTRONIC ENGINEER!

The publishers of **eem** have put together a unique filing system for electronic product information. The complete system includes: a product index booklet which classifies electronic products into 3,000 listings both alphabetically and by product group, and 45 file folders imprinted with the **eem** product sections (extra gummed labels included for expanding the system.)

As you receive manufacturers' catalog data sheets, technical bulletins, or clip magazine articles, jot down the proper Product Section Numbers from the **eem** PRODUCT-TO-SECTION INDEX. Then simply file in order. When you require information on a specific product, refer to PRODUCT-TO-SECTION INDEX again to locate the correct file folder. It's simple, and you'll always have the necessary data to compare, specify and buy, right at your fingertips.

**Here's how to order your eem FILE SYSTEM:**

For the complete system send $10 (plus tax; N.Y., 8%, CA, 6½%) in check or money order to:

United Technical Publications, Inc.,
645 Stewart Avenue, Garden City, N.Y. 11530
Att: Circulation dept.

For an **eem FILE SYSTEM** without file folders send $7.50 (plus tax; N.Y. 8%; CA, 6½%).

*UNITED TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500*

# SCOTT T TRANSFORMERS

## SYNCHRO TO RESOLVER CONVERTER TRANSFORMERS

| Part No. | Input Voltage Line to Line | Output Voltage RMS Sine & Cosine | Frequency Hz | Input Z K Ohm | Typical Load K Ohm | Accuracy Arc Seconds | Size Inches | Weight Oz. |
|---|---|---|---|---|---|---|---|---|
| 50890 | 11.8 | 6 | 400 | 20 | 100 | 4 min. | ⅞ x ½ x ¾ | .5 |
| 10472 | 11.8 | 6 | 400 | 10 | 10 | 5 min. | ¾ x 1½ x ⅜ | .6 |
| 11870 | 90 | 6 CT | 60 | 500 | 100 | 60 | 1.1 x 2.1 x 1.1 | 4 |
| 12092 | 90 | 6 CT | 400 | 5000 | 100 | 60 | 1.1 x 2.1 x 1.1 | 4 |
| 12094 | 90 | 6 CT | 60 & 400 | 500 | 100 | 2 min. | 1.1 x 2.1 x 1.1 | 4 |
| 50460 | 90 | 6 | 400 | 60 | 10 | 60 | ⅞ x 1⅝ x 1 1/16 | 2 |
| 50642 | 11.8 | 6 | 400 | 30 | 10 | 60 | ⅞ x 1⅝ x 1 1/16 | 2 |
| 50726 | 90 | 6 CT | 400 | 500 | 100 | 60 | 13/16 x 1½ x ⅝ | 1.5 |
| 50728 | 90 | 3 CT | 400 | 500 | 100 | 60 | 13/16 x 1½ x ⅝ | 1.5 |
| 50738 | 11.8 | 6 CT | 400 | 10 | 100 | 60 | 13/16 x 1½ x ⅝ | 1.5 |
| 50740 | 11.8 | 3 CT | 400 | 10 | 100 | 60 | 13/16 x 1½ x ⅝ | 1.5 |
| 9652 | 11.8 | 5 | 400 | 100 | 10 | 30 | 1⅜ x 2¾ x ⅞ | 5 |
| 9514 | 90 | 4.25 | 400 | 1000 | 10 | 30 | 1⅜ x 2¾ x ⅞ | 5 |
| 9561 | 11.8 | 1.75 | 400 | 10 | 10 | 2 min. | 1 x 2 x ⅝ | 3 |
| 52450 | 90 | 6 | 400 | 100 | 100 | 5 min. | ⅝ x 1¼ x ½ | ¾ |
| 52290 | 11.8 | 3.2 | 400 | 20 | 10 | 3 min. | ⅞ x ½ x 3/16 | ⅓ |
| 52448 | 90 | 6 | 60 | 200 | 100 | 1 min. | 1 x 1⅝ x 1 1/16 | 3 |
| 13051 | 11.8 | 2 CT | 400 | 10 | 100 | 3 min. | 1⅛ x 2 x ¼ | 1 |
| 52569 | 90 | 2 CT | 400 | 80 | 100 | 5 min. | ⅝ x ⅞ x 5/16 | ⅓ |
| 12850 | 11.8 | 5.9 | 400 | 25 | 50 | 15 | 1 x 2 x ⅝ | 2 |
| 13084 | 11.8 | 6 CT | 400 | 100 | 100 | 1 min. | ¾ x 1½ x ⅜ | ½ |

## RESOLVER TO SYNCHRO CONVERTER TRANSFORMERS

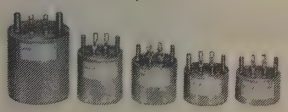
| Part No. | Input Voltage 2 Phase, 4 Wire | Output Voltage 3 Phase, 3 Wire (L-L) | Frequency Hz | Load Typical Min. Ohms (L-L) | Input Z Typical Ohms Open Ckt | Accuracy Arc Minutes | Size Inches | VA Rating |
|---|---|---|---|---|---|---|---|---|
| 10084 | 11.8 | 11.8 | 400 | 150 | 1.5K | 2 | 1 x 2 x .65 H | 1 |
| 10086 | 6.0 | 11.8 | 400 | 150 | 1K | 2 | 1 x 2 x .65 H | 1 |
| 10088 | 9.0 | 11.8 | 400 | 150 | 2K | 1.5 | 1⅜ x 2¾ x .65 H | 1 |
| 10090 | 9.0 | 90 | 400 | 2500 | 1K | 1 | 1⅜ x 2¾ x ⅞ H | 3.2 |
| 11999 | 7.0 | 11.8 | 400 | 30 | 500 | 2 | 2 x 4 x 1 H | 4.5 |
| 50749 | 7.2 | 90 | 60 | 8000 | 700 | 1 | 1½ x 3⅜ x 1¼ H | 1 |
| 12186 | 7.0 | 90 | 60 | 4000 | 250 | 1 | 2 x 4 x 1½ H | 2 |
| 52020 | 9 | 11.8 | 400 | 14 | 100 | 3.5 | 1½ x 2½ x 1¼ | 10 |
| 52021 | 9 | 90 | 400 | 800 | 100 | 3.5 | 2 x 4 x 1¼ | 10 |
| 52022 | 9 | 11.8 | 60 | 19 | 100 | 3.5 | 3 x 6 x 2 | 10 |
| 52023 | 9 | 90 | 60 | 800 | 100 | 3.5 | 4 x 8 x 2 | 10 |
| 52378 | 14 | 90 | 400 | 325 | 50 | 10 | 3 x 3½ x 4 13/16 | 25 |
| 52449 | 6 | 90 | 400 | 2500 | 150 | 3 | 1 x 1⅝ x 1 1/16 | 3 |
| 52164 | 6 | 90 | 400 | 2500 | 100 | 2 | 1½ x 3 x 1⅛ | 3 |
| 12945 | 6 | 11.8 | 400 | 300 | 1K | 5 | ¾ x 1½ x 3/16 | .5 |
| 12961 | 9 | 90 | 60 | 330 | 25 | 2 | 3 x 4¾ x 2¼ | 25 |
| 52454 | 9 | 90 | 400 | 100 | 30 | 5 | 3 x 4¾ x 2¼ | 100 |

**FEATURES:**

- PRECISION
- REPEATABILITY
- STABILITY
- NO SYSTEM TRIMMING REQUIRED

**LOW COST QUICK RESPONSE PROTOTYPE TRANSFORMER SERVICE**

Primary 115 V 60 or 400 Hz, you specify single secondary E & I. Typical 2-3 day delivery for open types up to 100 watts 60 Hz, 500 watts 400 Hz. Standard Inductors available. Also Standard Miniature 400 Hz Transformers, 2 to 9 VA, 1″ diameter. Free spec. sheets.



**HOW TO ORDER:**

Order Magnetico Standard Units directly by using the Magnetico Part Number.

| VA RATING | SECONDARY VOLTAGE |
|---|---|
| Catalog Number | 6.0 thru 300 (VRMS) |

| SCHEMATIC | SHIELD |
|---|---|
| X — No Tap | N — No Shield |
| T — Center Tap | S — Electrostatic Shield |

**EXAMPLE:**

To order a 115 V 400 Hz to 26 V center tapped, 6 VA power transformer with no shield. Order Magnetico Number: **9602-26-T-N.**

## STANDARD MINIATURE 400 Hz POWER TRANSFORMERS

**CONDENSED PERFORMANCE DATA — PRIMARY VOLTAGE 115 VRMS**

**All Units Designed to Meet MIL-T-27D, Grade 4, Class S, Life Expectancy X, Military Designation TF4SX01YY**

| Catalog Number | VA Rating | Secondary Voltage (RMS) | O.D. ±1/32 | Height ±1/32 | Nominal Weight | Nom. Reg. | Nom.* Temp. Rise |
|---|---|---|---|---|---|---|---|
| 9600 | 2 | 6-300 V | 1″ | 15/32″ | 1 oz/ 30 gm | 18% | 10°C |
| 9601 | 4 | 6-300 V | 1″ | 17/32″ | 1.2 oz/ 35 gm | 15% | 12°C |
| 9602 | 6 | 6-300 V | 1″ | ⅞″ | 1.6 oz/ 45 gm | 10% | 18°C |
| 9603 | 9 | 6-300 V | 1″ | 1¼″ | 2.1 oz/ 60 gm | 8% | 20°C |
| 9604 | 30 | 6-300 V | 1″ | 1½″ | 5.3 oz/150 gm | 7% | 23°C |
| 10648 | 75 | 10-300 V | 2″ | 1⅝″ | 10 oz | ±3% | 30°C |
| 10649 | 150 | 10-300 V | 2¼″ | 1¾″ | 18 oz | ±3% | 40°C |

Approximately 3° less on 2 x 2 x ⅛″ aluminum plate

**IMMEDIATE DELIVERY FOR PROTOTYPE QUANTITIES**

| VA RATING | SCHEMATIC | SECONDARY VOLTAGE | SHIELD |
|---|---|---|---|
| 9602 | T | 26 | N |

## LC FILTERS — LOW PASS / HIGH PASS / BAND PASS / BAND STOP

**Filters:** All types of filters, 200 Hz to 30 MHz, including high performance elliptic function filters.

**For prompt quote provide:** Type, Insertion Loss, Desired Attention Characteristic, Source Z and Load Z, Quantity and delivery requirements.

## AUDIO HYBRID PART No. 50819

**Frequency Response:** ±0.5 dB 300 to 3500 Hz.
**Long. Bal.:** 45 dB Min.
**Distortion:** 0.5% Max.
**Return Loss:** 26 dB Min.
**Trans-Hybrid Loss:** 45 dB typical.
**Operating Level:** −30 to +10 DBM.

## SELF REGULATING TRANSFORMERS REGULATED DC OUTPUT

**Application:** For operation into external FWB with capacitor filters.
**DC Voltage:** Fixed, from 5 to 30 VDC.
**Line Reg:** ±1% DC for 115 ±10% VRMS, 60 Hz input.
**Ripple:** RMS, 10% of DC average.
**Load Regulation:** ±10%.

## LOW PROFILE PRINTED CIRCUIT TRANSFORMERS

Input 115 V 60 Hz

For Special Units, ask for 52 Series and Specify AC or DC Load Voltage, Type Filter and Current.

| Part No. | For Typical DC Output | Size |
|---|---|---|
| 52470 | 7 VDC with 1 A | 1 3/16 x 1⅝ x 1 3/16 Hi |
| 52540 | 2X 17 VDC with .15 A | 1 3/16 x 1⅝ x 1 3/16 Hi |
| 52564 | 7 VDC with 1½ A | 1 3/16 x 1⅞ x 1⅜ Hi |
| 52565 | 2X 17 VDC with .215 A | 1 3/16 x 1⅞ x 1⅜ Hi |

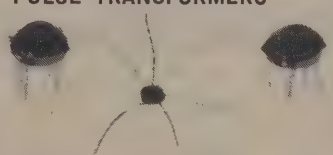
## SWITCHING & FILTER INDUCTORS

Types 10871 thru 10877, 10 μH to 5 MH, to 30 Amp DC Rated.
⅝ x ⅝ x 5/16 thru 2½ x 2½ x 1¾.
Write for Spec Sheet 10871-7.

## MINIATURE TOROIDAL INDUCTORS

- 5 mh to 5 H.
- Unequalled Temperature Stability.
- −55 to +125°C operation.
- Military Designation TF5RX20ZZ.

## PULSE TRANSFORMERS



**12999 Series:** 10 kHz to 2 MHz
**Primary L:** 1 Millihenry
**Ratio:** 1:1, 2:1 4:1 Standard
**Rise Times:** .2 Micro Sec Typical
**Size:** ⅜ D x ¼ Hi, PC Mount

Laminated • Telephone Matching • Precision Inductors High Voltage

**MAGNETICO INC.**

182 MORRIS AVENUE, HOLTSVILLE, N.Y. 11742 TELEPHONE: (516) 654-1166

Toroidal Winding Scott-T • Inverter Current • Wideband Pulse

LET MAGNETICO QUOTE "ALL" YOUR REQUIREMENTS • THE BEST IN TRANSFORMERS • FILTERS • AUDIO HYBRIDS • POWER SUPPLIES

# MICROTRAN COMPANY, INC.

## POWER TRANSFORMERS AND CHOKES
## DC-DC CONVERTER TRANSFORMERS

Dept. EM • 145 E. Mineola Ave. • P.O. Box 236 • Valley Stream, N.Y. 11582 • Phone: (516) 561-6050 • TWX: 510-225-8412

**IMMEDIATE DELIVERY OF CATALOG ITEMS FROM STOCKING DISTRIBUTORS**

**SEND FOR CATALOG**

**MODIFIED CATALOG ITEMS** are available on special order with revisions of electrical and mechanical specifications. Please contact factory.

**CUSTOM DESIGNS TO MEET YOUR NEEDS!**

## 400 Hz TOROIDAL PC POWER TRANSFORMERS (Fig. W)

Ideal for applications requiring minimum size and weight. Feature epoxy molded case and printed circuit pins which can be bent for chassis mounting. Toroidal cores provide greater efficiency and low phase shift. All have 115V primary windings and center .170" clearance hole for #8 screw. MIL Type TF5SX01ZZ.

| Part No. | Secondary V | Secondary mA | VA | Size, Inches O.D. x Ht. | Wt., Oz. | Net Ea., 1-9★ |
|---|---|---|---|---|---|---|
| M8106 | 28 CT | 320 | 9 | 1 5/32 x 1 1/8 | 2 | $19.65 |
| M8107 | 28 CT | 710 | 20 | 1 1/2 x 1 1/4 | 4 | 22.80 |
| M8108 | 56 CT | 160 | 9 | 1 5/32 x 1 1/8 | 2 | 19.80 |
| M8109 | 56 CT | 356 | 20 | 1 1/2 x 1 1/4 | 4 | 22.80 |
| M8111 | 115 CT | 170 | 20 | 1 1/2 x 1 1/4 | 4 | 22.80 |

## INDUSTRIAL AND HERMETICALLY SEALED POWER TRANSFORMERS AND CHOKES

For low voltage, high current applications such as filament supplies, silicon rectifiers, etc. Primary Isolation Transformers have electrostatic shielding and CT for use in either FW bridge or FW CT. 105/115/125 VAC. DC output for resistive or inductive load based on 1V drop per rectifier.

### HERMETIC 50/60 Hz POWER (Fig. P)

| Part No. | Secondary VAC | Secondary RMS Amps | Rectifier Circuit VDC‡ | Rectifier Circuit VDC† | Size, Inches W x D x H | MIL Case | Net 1-9★ |
|---|---|---|---|---|---|---|---|
| M8042 | 6.3 CT | .6 | 1.9 | 3.8 | 1 5/8 x 1 5/8 x 2 3/8 | AJ | $20.85 |
| M8043 | 6.3 CT | 2 | 1.9 | 3.8 | 2 1/16 x 2 5/16 x 2 1/2 | FB | 29.10 |
| M8087 | 12.6 CT | 3 | 4.7 | 9.4 | 2 3/8 x 2 3/4 x 3 13/16 | GA | 33.00 |
| M8044 | 12.6 CT | 2 | 10.5§ | 21§ | 3 1/16 x 3 9/16 x 3 7/8 | JB | 38.70 |
| | 12.6 CT | 2 | | | | | |
| M8088 | 26 CT | 2.5 | 10.8 | 21.6 | 2 5/8 x 3 1/16 x 4 1/4 | HA | 34.20 |
| M8152 | 28 CT | .15 | 11.7 | 23.4 | 1 5/8 x 1 5/8 x 2 3/8 | AJ | 21.90 |
| M8045 | 28 CT | .6 | 11.7 | 23.4 | 2 1/16 x 2 5/16 x 3 1/8 | FA | 31.50 |
| M8023 | 35 CT | 3 | 14.5 | 29 | 3 3/8 x 3 15/16 x 5 1/4 | KA | 46.05 |
| M8089 | 40 CT | .1 | 17 | 34 | 1 3/4 x 1 5/8 x 2 3/8 | AJ | 22.80 |
| M8046 | 49 CT | 2.5 | 21 | 42 | 3 11/16 x 4 9/16 x 5 9/16 | LA | 46.05 |
| M8024 | 70 CT | 1 | 30 | 60 | 3 1/16 x 3 9/16 x 4 7/8 | JA | 38.70 |
| M8056 | 80 CT | .6 | 35 | 70 | 2 5/8 x 3 1/16 x 4 1/4 | HA | 39.60 |

‡Full-wave CT. †Full-wave bridge. §Series.

### HERMETIC 50/60 Hz ISOLATION/POWER (Fig. P)

| Part No. | Input Volts | Output Volts | RMS Amps | VA | Size, Inches W x D x H | MIL Case | Net Each 1-9★ |
|---|---|---|---|---|---|---|---|
| M8094 | 115 | 115 CT | .0085 | 1 | 1 5/16 x 1 5/16 x 1 3/4 | AH | $18.30 |
| M8151 | 115 | 115 CT | .13 | 15 | 2 1/16 x 2 5/16 x 3 1/8 | FA | 32.10* |
| M8096† | 115 | 115 CT | .35 | 40 | 2 5/8 x 2 3/4 x 3 13/16 | GA | 37.80 |

†Primary 105/115/125V.

### INDUSTRIAL 50/60 Hz CONTROL/POWER

| Part No. | Secondary VAC | Secondary RMS Amp | Rectifier Circuit CT Full Wave DC Volts † | Rectifier Circuit F. W. Bridge DC Volts ‡ | Size, Inches L x W x H | Mounting Centers | Fig. | Net Each 1-9★ |
|---|---|---|---|---|---|---|---|---|
| M8243 | 6.3 CT | 2.0 | 1.9 | 3.8 | 3 1/4 x 1 5/8 x 1 15/16 | 2 13/16 | X | $12.00* |
| M8286 | 6.3 CT | 6.0 | 1.9 | 3.8 | 3 11/16 x 2 1/16 x 2 1/4 | 3 1/16 | X | 13.05 |
| M8287 | 12.6 CT | 3.0 | 4.7 | 9.4 | 3 11/16 x 2 1/16 x 2 1/4 | 3 1/16 | X | 13.05 |
| M8244 | 12.6 CT | 2.0 | 10.5§ | 21§ | 3 3/8 x 2 1/16 x 3 9/32 | 2 13/16 x 2 1/2 | Y | 15.00* |
| | 12.6 | 2.0 | | | | | | |
| M8222 | 18.5 CT | 3.0 | 7.4 | 14.8 | 3 3/4 x 2 1/2 x 3 9/32 | 2 13/16 x 2 1/16 | Y | 14.85 |
| M8288 | 26 CT | 2.5 | 10.8 | 21.6 | 3 x 2 3/4 x 2 3/4 | 2 1/2 x 2 3/8 | Y | 14.85 |
| M8245 | 28 CT | .6 | 11.7 | 23.4 | 3 1/4 x 2 1/16 x 1 15/16 | 2 13/16 | X | 11.25 |
| M8255 | 30 CT | 2.5 | 12.5 | 25 | 3 3/4 x 2 3/4 x 3 15/32 | 3 1/16 x 2 1/4 | Y | 20.10 |
| M8223 | 35 CT | 3.0 | 14.5 | 29 | 4 1/2 x 3 x 3 3/4 | 3 7/16 x 2 3/8 | Y | 21.60 |
| M8289 | 40 CT | .1 | 17 | 34 | 2 3/8 x 1 3/8 x 1 1/2 | 2 | X | 16.20 |
| M8290 | 40 CT | .3 | 17 | 34 | 2 13/16 x 1 5/8 x 1 5/8 | 2 3/8 | X | 9.45 |
| M8291 | 40 CT | .75 | 17 | 34 | 3 11/16 x 2 1/16 x 2 1/4 | 3 1/16 | X | 13.05 |
| M8246 | 49 CT | 2.5 | 21 | 42 | 4 1/2 x 3 1/4 x 4 15/32 | 3 3/4 x 2 1/2 | Y | 28.50 |
| M8224 | 70 CT | 1.0 | 30 | 60 | 3 3/4 x 2 3/4 x 3 15/32 | 3 1/16 x 2 1/4 | Y | 18.75 |
| M8256 | 80 CT | .6 | 35 | 70 | 3 x 2 5/16 x 2 3/4 | 2 1/2 x 2 3/8 | Y | 18.15 |

†CT Full-wave ‡Bridge §Series #Sec. connected in series, 24V @ 4A; parallel connected 12V @ 8A. All units color coded leads.

### HERMETIC 400 Hz POWER (Fig. P)

| Part No. | Secondary VAC | Secondary RMS Amps | Rectifier Circuit VDC✱ | Rectifier Circuit VDC† | Size, Inches W x D x H | MIL Case | Net 1-9★ |
|---|---|---|---|---|---|---|---|
| M8063‡• | 2.85 | .045 | 1.5§ | 3 | 15/16 dia. x 1 1/16 | YY | $12.45 |
| | 2.85 | .045 | | | | | |
| M8064‡ | 6.3 CT | .6 | 1.9 | 3.8 | 1 5/16 x 1 5/16 x 1 3/4 | AH | 16.65 |
| M8075‡• | 6.3 CT | .3 | 1.9 | 3.8 | 15/16 dia. x 1 1/16 | YY | 11.40 |
| M8076‡ | 12.6 CT | .3 | 4.7 | 9.4 | 1 5/16 x 1 5/16 x 1 3/4 | AH | 16.65 |
| M8039 | 12.6 | .8 | 10.5§ | 21§ | 1 5/8 x 1 5/8 x 2 3/8 | AJ | 25.20 |
| | 12.6 CT | .8 | | | | | |
| M8077 | 12.6 | 2 | 10.5§ | 21§ | 2 1/16 x 2 5/16 x 3 1/8 | FA | 35.40* |
| | 12.6 CT | 2 | | | | | |
| M8038 | 12.6 | .3 | 16§ | 32§ | 1 5/8 x 1 5/8 x 2 3/8 | AJ | 24.75 |
| | 12.6 | .3 | | | | | |
| M8018 | 18.5 CT | 1 | 7.4 | 14.8 | 1 13/16 x 1 15/16 x 2 3/4 | EA | 27.60 |
| M8019 | 18.5 CT | 3 | 7.4 | 14.8 | 2 1/16 x 2 5/16 x 3 1/8 | FA | 32.10 |
| M8065 | 26 CT | 1.5 | 10.8 | 21.6 | 1 13/16 x 1 15/16 x 2 3/4 | EA | 31.80 |
| M8066 | 26 CT | 3 | 10.7 | 21.5 | 2 1/16 x 2 5/16 x 3 1/8 | FA | 40.20 |
| M8079 | 26 CT | 4 | 10.8 | 21.6 | 2 5/8 x 3 1/16 x 4 1/4 | HA | 34.20 |
| M8020 | 35 CT | 3 | 14.5 | 29 | 2 5/8 x 2 3/4 x 3 13/16 | GA | 39.60 |
| M8068 | 40 CT | .2 | 17 | 34 | 1 5/8 x 1 5/8 x 2 3/8 | AJ | 20.25 |
| M8041‡ | 50 CT | .25 | 21.5 | 43 | 1 5/16 x 1 5/16 x 1 3/4 | AH | 15.75 |
| M8021 | 70 CT | 1 | 30 | 60 | 2 1/16 x 2 5/16 x 3 1/8 | FA | 44.70 |

#Full-wave CT. †Full-wave bridge. ‡Primary 115V only. §Series. •Fig. K.

### HERMETIC 400 Hz ISOLATION/POWER (Fig. P)

| Part No. | Input Volts | Output Volts | RMS Amps | VA | Size, Inches W x D x H | MIL Case | Net 1-9★ |
|---|---|---|---|---|---|---|---|
| M8058† | 115 | 115 CT | .017 | 2 | 15/16 Dia. x 1 7/16 | YY | $14.55 |
| M8059 | 115 | 115 CT | .35 | 40 | 1 13/16 x 1 15/16 x 2 7/16 | EB | 24.00 |
| M8060 | 115 | 115 CT | 1.3 | 150 | 2 3/8 x 2 3/4 x 3 13/16 | GA | 42.00 |
| M8061† | 115 | 115 CT | 2.6 | 300 | 3 1/16 x 3 9/16 x 4 7/8 | JA | 69.60 |
| M8062† | 115 | 115 CT | 4.4 | 500 | 3 3/8 x 3 15/16 x 5 1/4 | KA | 75.00 |
| M8082† | 26 | 12.6 CT | .15 | 1.9 | 15/16 Dia. x 1 7/16 | YY | 18.30 |
| | | 12.6 | .15 | 1.9 | | | |
| M8083 | 115 | 115 CT | .03 | 10 total | 1 5/8 x 1 5/8 x 2 3/8 | AJ | 26.40 |
| | | 12.6 CT | .25 | | | | |
| | | 12.6 | .25 | | | | |
| M8084 | 115 | 115 CT | .12 | 14 | 1 5/8 x 1 5/8 x 2 3/8 | AJ | 19.50 |
| M8085 | 115 | 115 CT | .7 | 80 | 2 1/16 x 2 5/16 x 3 1/8 | FA | 40.20 |

‡Primary 105/115/125V. †Fig. K.

### INDUSTRIAL 50/60 ISOLATION/POWER

| Part No. | Input Volts | Output Volts | Current RMS Amps | VA | Size, Inches L x W x H | Mounting Centers | Fig. | Net Each 1-9★ |
|---|---|---|---|---|---|---|---|---|
| M8294 | 115 | 115 CT | .0085 | 1 | 2 1/8 x 1 1/8 x 1 3/16 | 1 3/4 | X | $7.50 |
| M8295 | 115 | 115 CT | .030 | 3.5 | 2 13/16 x 1 1/8 x 1 5/8 | 2 3/8 | X | 14.55 |
| | | 12.6 CT | .25 | 3.15 | | | | |
| | | 12.6 | .25 | 3.15 | | | | |
| M8251 | 115 | 115 CT | .13 | 15 | 3 1/4 x 1 5/8 x 1 15/16 | 2 13/16 | X | 14.25 |
| M8296† | 115 | 115 CT | .35 | 40 | 4 x 2 1/4 x 2 9/16 | 3 9/16 | X | 15.60 |
| M8278† | 115 | 115 CT | .9 | 100 | 3 3/4 x 3 1/4 x 3 15/32 | 3 1/8 x 2 3/4 | Y | 24.75 |

† Primary 105/115/125V. All units color coded leads.

## FILTER INDUCTORS

For transistor and low voltage applications. May be connected in series or parallel. 1500V test. MIL Type TF4RX04 (Fig. P) listed on left. Open frame model numbers listed on right.

### HERMETICALLY SEALED INDUCTORS

| HERMETIC Part No. | Mil Case Fig. P xx | Series Connected Inductance Henrys | Series Connected DC Amps | Series Connected DCR Ohms | Parallel Connected Inductance Henrys | Parallel Connected DC Amps | Parallel Connected DCR Ohms | Net Each 1-9★ |
|---|---|---|---|---|---|---|---|---|
| M8098 | AH | 3.5 | .050 | 200 | .875 | .10 | 50 | $12.90 |
| M8099 | AJ | 1.0 | .15 | 65 | .25 | .30 | 16 | 15.90 |
| M8101 | FB | .32 | .6 | 16 | .08 | 1.2 | 4 | 23.55* |
| M8102 | JA | .2 | 1.0 | 4 | .05 | 2.0 | 1 | 29.40* |
| M8103 | JA | .07 | 2.5 | .84 | .0175 | 5.0 | .21 | 39.60* |
| M8104 | JA | .022 | 4.0 | .4 | .0055 | 8.0 | .1 | 35.40* |
| M8105 | KA | .022 | 5.0 | .2 | .005 | 10.0 | .05 | 43.50* |

*Special order only, add $25.00 for set-up charge.

### OPEN FRAME INDUCTORS

| OPEN Part No. | Size, Inches L x W x H | Mounting Centers | Fig. | Net Each 1-9★ |
|---|---|---|---|---|
| M8198 | 2 1/16 x 1 1/16 x 1 3/16 | 1 3/4 | X | $6.15 |
| M8199 | 2 3/8 x 1 1/4 x 1 1/2 | 2 | X | 7.05 |
| M8201 | 3 1/4 x 1 5/8 x 1 15/16 | 2 13/16 | X | 8.70 |
| M8202 | 3 3/8 x 2 3/8 x 3 3/32 | 2 13/16 x 2 1/8 | Y | 14.40 |
| M8203 | 3 3/4 x 2 1/8 x 3 17/32 | 3 1/8 x 2 1/2 | Y | 19.20* |
| M8204 | 3 3/8 x 2 3/4 x 3 9/32 | 2 13/16 x 2 1/2 | Y | 15.90 |
| M8205 | 4 1/2 x 3 1/8 x 4 1/32 | 3 3/4 x 2 1/2 | Y | 23.40 |

## DC TO DC CONVERTER TRANSFORMERS—SWITCHING TYPE▲

Permits conversion of low-voltage DC to higher voltages for operating mobile equipment or for DC isolation. Supplied with schematic and component values.

| Select the Unit That Meets Your Power & Size Requirements | Part No. | Total VA Output‡ | DC Input Volts | Volts | DC Output** Bridge mA | DC Output** CT Full Wave Volts | DC Output** CT Full Wave mA | Switching Freq. Hz (approx.) | Size, Inches D x W x H | Mtg. MD | Cent. MW | Type of Construction | Fig. | Approx. Weight Oz. | Net Each 1-9★ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High Voltage Low Power Miniature Design | M8149 | 25mW | 3 | 1,000* | 25μA | — | — | 400 | 1 1/64 x 6 1/64 x 27/32 | — | — | Plug-in | U | 1.2 | $9.30 |
| | M8050 | 25mW | 1 | 1,000* | 25μA | — | — | 400 | 1 11/16 x 1 5/16 x 27/32 | 1 3/8 | — | Open Frame with Leads | L | 1.25 | 7.65 |
| | M8051 | 25mW | 3 | 1,000* | 25μA | — | — | 400 | 1 x 1 x 1 3/8 | 1 1/8 | — | MIL — AG | Q | 2.4 | 14.85 |
| | M8073 | 25mW | 4 | 425-500* | 50μA | — | — | 50-3K† | 3/8 x 3/8 x 5/8 | | | Open Frame | C | .1 | 6.60 |
| | M8074 | 50mW | 3 | 535* | 90μA | — | — | 400 | 1 11/16 x 1 5/16 x 27/32 | 1 3/8 | — | Open Frame | L | 1.25 | 7.35 |
| | M8072 | 190mW | 2.7 | 480* | 400μA | — | — | 800 | 1 11/16 x 1 5/16 x 27/32 | 1 3/8 | — | Open Frame | L | 1.25 | 10.05 |
| | M8120 | 190mW | 28 | 480* | 400μA | — | — | 3.5K | 1 11/16 x 1 5/16 x 27/32 | 1 3/8 | — | Open Frame | L | 1.25 | 10.65 |
| For Displays Nixie-Panaplex | M8121 | 3 | 5 | 190 | 15 | — | — | 20K | 9/16D x 1 1/32H — ‡ | | | Open Frame | V | .3 | 7.80 |
| 5 VA High Voltage Low Profile Encapsulated | M8115 | 5 | 13.8 | ±250 or 500■ | 10 | 250 | 20 | 6K | 1 1/4D x 3/4H — .140 Cl. Hole | | | Toroidal | V | 1.1 | 26.10 |
| | M8117 | 5 | 28 | ±250 or 500■ | 10 | 250 | 20 | 6K | 1 1/4D x 3/4H — .140 Cl. Hole | | | Toroidal | V | 1.1 | 27.15 |
| | M8122 | 5 | 5 | ±15 or 30 | 175 | 15 | 350 | 20K | 7/8D x 17/32H — .140 Cl. Hole | | | Toroidal | W | 1.1 | 21.30 |
| High Frequency Encapsulated | M8132 | 30 | 13.8 | ±15 or 30■ | 1,000 | 15 | 2,000 | 20K | 1 1/4D x 3/4H — .140 Cl. Hole | | | Toroidal | V | 1.1 | 24.90 |
| | M8133 | 30 | 28 | ±15 or 30■ | 1,000 | 15 | 2,000 | 20K | 1 1/4D x 3/4H — .140 Cl. Hole | | | Toroidal | V | 1.1 | 24.90 |
| Medium Power Low Profile Encapsulated | M8113 | 50 | 13.8 | ±14 or 28■ | 1,750 | 14 | 3,500 | 2.5K | 2 1/2D x 1 1/4H — .170 Cl. Hole | | | Toroidal | V | 6 | 45.00 |
| | M8114 | 50 | 28 | ±14 or 28■ | 1,750 | 14 | 3,500 | 2.5K | 2 1/2D x 1 1/4H — .170 Cl. Hole | | | Toroidal | V | 6 | 38.70 |
| | M8116 | 50 | 13.8 | ±35 or 70■ | 700 | 35 | 1,400 | 2.5K | 2 1/2D x 1 1/4H — .170 Cl. Hole | | | Toroidal | V | 6 | 45.00 |
| | M8118 | 50 | 28 | ±35 or 70■ | 700 | 35 | 1,400 | 2.5K | 2 1/2D x 1 1/4H — .170 Cl. Hole | | | Toroidal | V | 6 | 38.70 |

‡Full-wave and CT loads may be simultaneously drawn, but for continuous duty, total V.A. output should not be exceeded.
■For positive and negative voltage supply as utilized in op-amp and similar circuitry.
**Based on approximately 1 volt drop per rectifier.
†Frequency depends on load and bias conditions.
▲M8050, M8051, M8073, M8074 are blocking oscillator types.

★Quantity pricing schedule is as follows: 1-9 net, 10-49 less 10%, 50-99 less 16⅔%, 100-249 less 33⅓%. Contact factory for prices over 249.

# MICROTRAN COMPANY, INC.

## PRINTED CIRCUIT 50/60 Hz POWER TELEPHONE COUPLING TRANSFORMERS

Dept. EM • 145 E. Mineola Ave. • P.O. Box 236 • Valley Stream, N.Y. 11582 • Phone: (516) 561-6050 • TWX: 510-225-8412

## PLUG-IN PRINTED CIRCUIT POWER TRANSFORMERS

PERMITS PACKAGING FLEXIBILITY UNOBTAINABLE WITH PREPACKAGED POWER SUPPLIES • LOW PROFILE MINIATURIZED CONSTRUCTION • PRECISION SPACED MOLDED-IN TERMINALS • DUAL SECONDARIES MAY BE PARALLEL OR SERIES CONNECTED.

**Lugs on PC2000 Series Provide for 115/230V Primary Voltage Options Without Changes in PC Board. PC3000 Series has 8 PC Pins. 50/60 Hz.**

### TRANSFORMERS FOR POWER SUPPLIES, INSTRUMENTS, AND CONTROL EQUIPMENT

| 115V. Primary | | 115/230V. Primary | | | Secondary | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Parallel Connected | | Series Connected | |
| Part No. | Price 1-9★ | Part No. | Price 1-9★ | Part No. | Price 1-9★ | AC Volts | RMS Amps | AC Volts | RMS Amps |
| PC6506 | $7.20 | PC2506 | $8.25 | PC3506 | $7.95 | 6.3 | .250 | (Single Secondary) | |
| PC6512 | 7.50 | PC2512 | 8.55 | PC3512 | 8.25 | 12.6 | .120 | 25.2 C.T. | .060 |
| PC6524 | 7.50 | PC2524 | 8.70 | PC3524 | 8.40 | 40.0 | .040 | 80.0 C.T. | .020 |
| PC6528 | 7.65 | PC2528 | 8.85 | PC3528 | 8.55 | 58.0 | .026 | 116.0 C.T. | .013 |
| PC6608 | 7.50 | PC2608 | 9.30 | PC3608 | 8.55 | 6.3 | .700 | 12.6 C.T. | .350 |
| PC6616 | 7.65 | PC2616 | 9.45 | PC3616 | 8.70 | 28.0 | .156 | 56.0 C.T. | .078 |
| PC6624 | 7.65 | PC2624 | 9.45 | PC3624 | 8.70 | 40.0 | .110 | 80.0 C.T. | .055 |
| PC6628 | 7.65 | PC2628 | 9.45 | PC3628 | 8.70 | 58.0 | .066 | 116.0 C.T. | .033 |
| PC6632 | 7.65 | PC2632 | 9.60 | PC3632 | 8.85 | 115.0V @ .020A and 12.6V @ .150A | | | |
| PC6708 | 7.65 | PC2708 | 9.00 | PC3708 | 8.40 | 6.3 | 1.200 | 12.6 C.T. | .600 |
| PC6712 | 7.65 | PC2712 | 9.00 | PC3712 | 8.40 | 12.6 | .600 | 25.2 C.T. | .300 |
| PC6715 | 7.65 | PC2715 | 9.00 | PC3715 | 8.40 | 20.0 | .370 | 40.0 C.T. | .185 |
| PC6716 | 7.65 | PC2716 | 9.15 | PC3716 | 8.40 | 28.0 | .270 | 56.0 C.T. | .135 |
| PC6724 | 7.65 | PC2724 | 9.15 | PC3724 | 8.55 | 40.0 | .180 | 80.0 C.T. | .090 |
| PC6728 | 7.65 | PC2728 | 9.15 | PC3728 | 8.55 | 58.0 | .130 | 116.0 C.T. | .065 |
| PC6732 | 7.65 | PC2732 | 9.30 | PC3732 | 8.55 | 115.0V @ .025A and 12.6V @ .250A | | | |

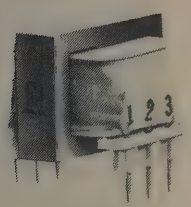



FIG. U

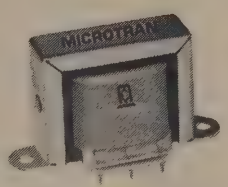
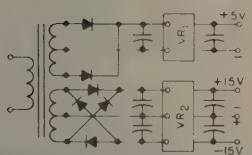



FIG. 2




Typical Application

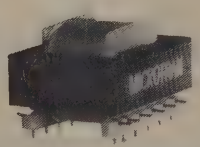


FIG. F

| Series | Approx. Watts | Fig. | Size, Inches W | D | H | Wt. Oz. |
|---|---|---|---|---|---|---|
| PC6200/PCT6200 | 1 | U | 1 1/64 | 1 3/8 | 27/32 | 2.3 |
| PC2500/PC3500/PC6500 | 1½ | U | 1 25/64 | 1 5/32 | 1 11/64 | 3.2 |
| PC2600/PC3600/PC6600† | 4½ | 2 | 1 45/64 | 1¼ | 1 25/64 | 6.5 |
| PCL6600 | 4½ | F | 1 51/64 | 1 13/32 | 1 3/16 | 6.6 |
| PC2700/PC3700/PC6700‡ | 7½ | 2 | 1 61/64 | 1 15/32 | 1 41/64 | 9.5 |
| PC6900/PCT6900§ | 24 | U | 1 41/64 | 2¼ | 1 11/32 | 12.0 |

†Channel mtg. 2" M.C. ‡2⅜" M.C. PC and PCT Series have same dimensions.
§PC6900-FB mtg. bracket avail. on special order; four 5/32" holes on 1⅜" x 2" ctrs.

**For Construction of Low Cost, Miniaturized, Regulated and Unregulated DC Power Supplies for Latest Solid-State Logic and Op Amp Circuitry. All Primaries 115V 50/60 Hz Except PCL6600 Series 115/230V.**

### TRANSFORMERS FOR +5V DC UNREGULATED AND REGULATED POWER SUPPLIES

| | SECONDARY | | | | DC OUTPUT | | | |
|---|---|---|---|---|---|---|---|---|
| | Parallel Connected | | Series Connected | | | | | |
| Part No. | AC Volts | RMS Amps | AC Volts | RMS Amps | C.T. F.W. DC Volts | Current mA DC | Fig. No | Net Price 1-9★ |
| PC6205 | 4.50 | 0.18 | 9.0 C.T. | 0.09 | +5.0 | 75 | U | $9.15 |
| PC6505 | 4.50 | 0.36 | 9.0 C.T. | 0.18 | +5.0 | 150 | U | 7.50 |
| PC6605 | 4.50 | 1.10 | 9.0 C.T. | 0.55 | +5.0 | 450 | 2 | 7.95 |
| PCL6605 | 4.50 | 1.10 | 9.0 C.T. | 0.55 | +5.0 | 450 | F | 9.75 |
| PC6705 | 4.50 | 2.00 | 9.0 C.T. | 1.00 | +5.0 | 825 | 2 | 7.95 |
| PC6905 | 4.50 | 5.00 | 9.0 C.T. | 2.50 | +5.0 | 2000 | U | 10.50 |
| PC6210 | 7.75 | 0.12 | 15.5 C.T. | 0.06 | +8.5† | 50 | U | 9.30 |
| PC6510 | 7.75 | 0.22 | 15.5 C.T. | 0.11 | +8.5† | 90 | U | 7.50 |
| PC6610 | 7.75 | 0.64 | 15.5 C.T. | 0.32 | +8.5† | 265 | 2 | 7.95 |
| PCL6610 | 7.75 | 0.64 | 15.5 C.T. | 0.32 | +8.5† | 265 | F | 9.75 |
| PC6710 | 7.75 | 1.20 | 15.5 C.T. | 0.60 | +8.5† | 500 | 2 | 7.95 |
| PC6910 | 7.75 | 3.10 | 15.5 C.T. | 1.55 | +8.5† | 1300 | U | 10.50 |

†+8.5 DC output volts for input to +5V IC Voltage Regulator.

### TRANSFORMERS FOR ±15V DC DUAL OUTPUT UNREGULATED AND REGULATED POWER SUPPLIES

| | SECONDARY | | | | DC OUTPUT | | | |
|---|---|---|---|---|---|---|---|---|
| | Parallel Connected | | Series Connected | | | | | |
| Part No. | AC Volts | RMS Amps | AC Volts | RMS Amps | C.T. F.W. DC Volts | Current mA DC | Fig. No | Net Price 1-9★ |
| PC6211 | 12.0 | 0.07 | 24.0 C.T. | 0.035 | ±15 | 22 | U | $9.30 |
| PC6511 | 12.0 | 0.13 | 24.0 C.T. | 0.065 | ±15 | 40 | U | 7.50 |
| PC6611 | 12.0 | 0.40 | 24.0 C.T. | 0.200 | ±15 | 120 | 2 | 7.95 |
| PCL6611 | 12.0 | 0.40 | 24.0 C.T. | 0.200 | ±15 | 120 | F | 9.75 |
| PC6711 | 12.0 | 0.76 | 24.0 C.T. | 0.380 | ±15 | 220 | 2 | 7.95 |
| PC6911 | 12.0 | 1.90 | 24.0 C.T. | 0.950 | ±15 | 550 | U | 10.50 |
| PC6214 | 16.0 | 0.05 | 32.0 C.T. | 0.025 | ±20† | 15 | U | 9.30 |
| PC6514 | 16.0 | 0.10 | 32.0 C.T. | 0.050 | ±20† | 30 | U | 7.50 |
| PC6614 | 16.0 | 0.30 | 32.0 C.T. | 0.150 | ±20† | 90 | 2 | 7.95 |
| PCL6614 | 16.0 | 0.30 | 32.0 C.T. | 0.150 | ±20† | 90 | F | 9.75 |
| PC6714 | 16.0 | 0.56 | 32.0 C.T. | 0.280 | ±20† | 165 | 2 | 7.95 |
| PC6914 | 16.0 | 1.40 | 32.0 C.T. | 0.700 | ±20† | 410 | U | 10.50 |

†±20 DC output volts for input to ±15V output IC Voltage Regulator.

### TRANSFORMERS FOR +5V AND ±15V DC TRIPLE OUTPUT UNREGULATED AND REGULATED POWER SUPPLIES

| | Secondary #1 | | Secondary #2 | | DC Output #1 | | DC Output #2 | | | Net |
|---|---|---|---|---|---|---|---|---|---|---|
| Part No. | AC Volts | RMS Amps | AC Volts | RMS Amps | C.T.F.W. DC Volts | Cur. mA DC | C.T.F.W. DC Volts | Cur. mA DC | Fig. No. | Price 1-9★ |
| PCT6230 | 9.0 C.T. | 0.048 | 24 C.T. | 0.020 | +5.0 | 40 | ±15 | 12 | U | $10.05 |
| PCT6530 | 9.0 C.T. | 0.072 | 24 C.T. | 0.032 | +5.0 | 60 | ±15 | 20 | U | 7.95 |
| PCT6630 | 9.0 C.T. | 0.240 | 24 C.T. | 0.080 | +5.0 | 200 | ±15 | 50 | 2 | 8.40 |
| PCL6630 | 9.0 C.T. | 0.240 | 24 C.T. | 0.080 | +5.0 | 200 | ±15 | 50 | F | 10.05 |
| PCT6730 | 9.0 C.T. | 0.480 | 24 C.T. | 0.160 | +5.0 | 400 | ±15 | 100 | 2 | 8.40 |
| PCT6930 | 9.0 C.T. | 1.200 | 24 C.T. | 0.440 | +5.0 | 1000 | ±15 | 275 | U | 10.95 |
| PCT6531 | 15.5 C.T. | 0.048 | 32 C.T. | 0.020 | +8.5† | 40 | ±20† | 12 | U | 7.95 |
| PCT6631 | 15.5 C.T. | 0.140 | 32 C.T. | 0.058 | +8.5† | 115 | ±20† | 35 | 2 | 8.40 |
| PCL6631 | 15.5 C.T. | 0.140 | 32 C.T. | 0.058 | +8.5† | 115 | ±20† | 35 | F | 10.05 |
| PCT6731 | 15.5 C.T. | 0.300 | 32 C.T. | 0.100 | +8.5† | 250 | ±20† | 60 | 2 | 8.40 |
| PCT6931 | 15.5 C.T. | 0.690 | 32 C.T. | 0.298 | +8.5† | 575 | ±20† | 175 | U | 10.95 |

†+8.5 and ±20 DC output volts are for inputs to +5V and ±15V IC Voltage Regulators.

**TRANSFORMERS SUPPLIED WITH ENGINEERING BULLETIN PROVIDING SCHEMATICS AND SUGGESTED COMPONENTS.** Latest 3-terminal IC regulators permit manufacture of power supplies, using only 5 components, with typical regulation of 0.1% load and line, and 1 mV ripple.

## TELEPHONE COUPLING TRANSFORMERS

FIG. U

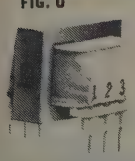



FIG. Q-F

### DESIGNED TO MEET FCC PART 68

For interconnect of voice/data modem terminals to telephone lines. Permits optimum use of voice-grade telephone lines for broadband computer modems over a wide dynamic signal range with minimum distortion. PC construction.

- **Frequency Response:** 300-3500 Hz ±0.5 dB.
- **Level:** −45 dBm to +7 dBm.
- **Return Loss:** 26 dB min.
- **Impedance Matching:** ±10% over entire frequency range.
- **Distortion:** 0.5% max.
- **Long Balance:** Per FCC 68.310.

**DIMENSIONS**

| Series | Width | Depth | Height | Weight |
|---|---|---|---|---|
| T1000 | ¾" | 1 9/32" | 7/16" | .4 oz. |
| T2000 | 49/64" | 1 1/16" | 2 3/32" | .5 oz. |
| T3000 | 1 1/64" | 6 1/64" | 2 7/32" | 1.2 oz. |
| T4000 | 1 13/32" | 1 5/32" | 1¼" | 3.5 oz. |
| T6000† | 1 61/64" | 1 13/32" | 1 41/64" | 9.5 oz. |

†Channel frame mounting 2⅜" M.C. T5220 dimensions same as PCL6600.

| Part No. | Application | Primary Impedance | Secondary Impedance | Fig. No. | Price 1-9★ |
|---|---|---|---|---|---|
| T1104 | Coupling | 600 | 600 | U | $5.70 |
| T2104 | Coupling | 600 | 600 | U | 4.65 |
| T2106 | Coupling | 600 C.T. | 600 C.T. | U | 4.95 |
| T2108 | Coupling | 600 | 900 | U | 4.65 |
| T2110 | Coupling§ | 900 | 900 | U | 4.95 |
| T4113 | Coupling□ | 900/600 @ 60/75 mA D.C. | 600 Split | U | 7.65 |
| T6112 | Coupling§ | 600 | 900/600 @ 100/120 mA D.C. | 2 | 15.75 |
| T2220 | Hybrid‡ | 600(4W) | 600/600 | U | 6.15 |
| T3220 | Hybrid‡ | 600(4W) | 600/600 | U | 6.60 |
| T4220 | Hybrid‡§ | 600(4W) | 600/600 @ 60 mA D.C.(2W) | U | 11.40 |
| T5220 | Hybrid‡§ | 600(4W) | 600/600@ 100 mA D.C.(2W) | F | 21.00 |
| T2316 | Bridging | 4000 | 600 | U | 4.80 |
| T4415 | Holding Coil | 2.0 hy @ 60 mA, 1.3 hy @ 100 mA D.C., 180Ω | | U | 5.10 |
| T7410 | Holding Coil | 1.0 hy @ 0 mA, 0.8 hy @ 25 mA D.C., 225Ω | | Q-F | 7.95 |
| T8410 | Holding Coil | 1.0 hy @ 0 mA, 0.8 hy @ 40 mA D.C., 113Ω | | Q-F | 8.40 |

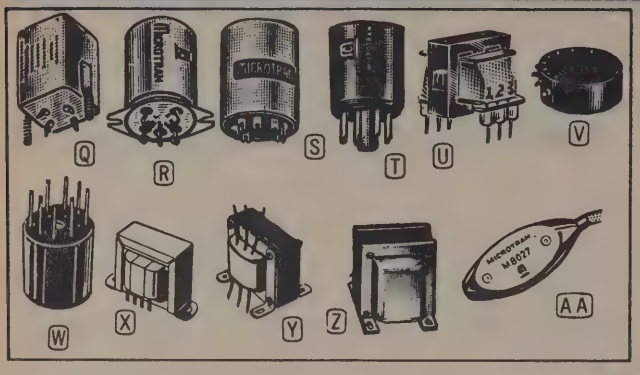
‡2 required for Hybrid operation, trans-hybrid loss 45 db typical.
§Electrostatic Shield. □Level −15 to +7 dBm.
**REQUEST ENGINEERING APPLICATION BULLETIN F232.**

★Quantity pricing schedule is as follows: 1-9 net, 10-49 less 10%, 50-99 less 16⅔%, 100-249 less 33⅓%. Contact factory for prices over 249.

# MICROTRAN COMPANY, INC.

## MINIATURIZED AUDIO TRANSFORMERS

Dept. EM • 145 E. Mineola Ave. • P.O. Box 236 • Valley Stream, N.Y. 11582 • Phone: (516) 561-6050 • TWX: 510-225-8412




## MINIATURE TRANSISTOR AND AUDIO TRANSFORMERS — M AND MT SERIES

**M-M (Fig. O):** Molded, for P.C. use. Cast epoxy resin provides highest resistance to temperature extremes. MIL Types TF5RX—ZZ. Max. Size, 1⁹⁄₃₂" x ⅞" x ⅞". Wt., 1¾ oz. **M-AG (Fig. Q):** Enclosed in modified MIL-T-27 AG case with compression sealed ceramic terminals. MIL Type TF4RX—YY. Max. Size, 1" x 1" x 1⅜". Wt., 2⅜ oz. **M-H (Fig. R):** Hermetically sealed with high compression glass terminals, gray enamel finish. Available on special order with .120" holes. MIL Type TF4RX—YY. Size, 1⁵⁄₁₆" dia. x 1⁷⁄₁₆" max. Wt., 1¼ oz. **M-A (Fig. S):** Aluminum case with 2-56 screws. MIL Type TF3RX—YY. Size, .875" dia. x 1³⁄₁₆". Wt., 1.25 oz. **M-FB (Fig. L):** Open frame with channel. Available with plug-in tab channel or without channel on special order. MIL Type TF6RX—ZZ. Size, 1³⁄₆₄" x 1³⁄₁₆" x 2⁷⁄₃₂" max., plus tabs. Wt., 1.13 oz. **M-P (Fig. T):** Octal plug-in type in sealed plastic housing. MIL Type TF6RX—ZZ. Size, 1³⁄₃₂" dia. x 1¹⁵⁄₃₂". Wt., 2 oz. **M90 Shield (Fig. E):** 25 db magnetic shield for Type M-A. Two clearance holes on 1¹⁄₁₆" centers. **M-PC (Fig. U):** Open frame PC with terminals molded into bobbin to maintain accurate dimensions for PC board. MIL Type TF6RX—ZZ. Size, ⅞" x 1¹⁄₃₂" x 1"; terminals ³⁄₁₆" below bobbin. Wt., 1.2 oz. See PC4400 Series for dimensions.

## MINIATURE AUDIO TRANSFORMERS — M AND MT SERIES

| Part No.† | Primary Impedance | Secondary Impedance | Primary DC mA Unbalance | Operating Level DBM | Freq. Response ±2 db | Net Each, Lots of 1-9★ -A | -AG | -FB -PC | -H | -M | -P |
|---|---|---|---|---|---|---|---|---|---|---|---|
| •M12- | 50/250 CT | 50/250/600 CT | 0 | 8 | 20-20,000 | $12.15 | $15.15 | $6.75 | $13.35 | $13.35 | $11.40* |
| •M1- | 50/250/600 CT | 50,000 | 0 | 5 | 20-20,000 | 13.05 | 15.60 | 7.80 | 14.10 | 14.10 | 12.00 |
| M1-S | Same as M1 above — with dual nickel alloy shield — (see Fig. H) | | | | | 15.60 (M1-S Pricing) | | | | | |
| •M2- | 50/250/600 CT | 50,000 CT | 0 | 5 | 20-20,000 | 13.65 | 16.65* | 8.25 | 14.85* | 14.85* | 12.90* |
| M14- | 200 | ½ Megohm | 0 | 9 | 80- 3,000 | 11.25* | 12.75* | 6.60* | 11.70 | 11.85* | 10.80* |
| M4- | 15,000 | 60,000 | 0 | 6 | 20-15,000 | 11.25 | 12.75 | 6.60 | 11.70 | 11.85* | 10.95* |
| M8- | 15,000 | 95,000 CT | 0 | 5 | 20-15,000 | 12.15 | 13.85* | 7.20 | 12.45 | 12.75* | 11.25* |
| •M11- | 50,000 | 50/250/600 CT | 0 | 5 | 20-20,000 | 13.20 | 15.75* | 7.95 | 14.25* | 14.25* | 12.45* |
| M13- | Reactor | 300 Hy. 0 DC | 50 Hy. @ 3 mA | | 6,000Ω DCR | 8.40* | 10.65* | 5.40* | 9.90* | 10.05 | 9.60* |
| M90 | Magnetic Shield Mu-Metal slip on can for M-A Series. 25 db shielding. | | | | | 1.95 (M90 Pricing) | | | | | |
| MT14- | 400 | 10 | 50 | 25 | 200-20,000 | 9.00* | 10.50* | 4.35* | 9.45 | 9.60 | 9.00* |
| MT1- | 600 | 600 | 10 | 23 | 200-15,000 | 10.05 | 11.55 | 5.40* | 10.50 | 10.65* | 9.60 |
| ††MT35- | 600 | 600 CT & 600 CT | 0 | 5 | 40-20,000 | 12.35 | 15.30* | 7.20* | 13.50* | 13.95 | 11.55 |
| MT26- | 600 CT | 600 CT | 20 | 23 | 200-15,000 | 10.65 | 13.05 | 5.70 | 11.40 | 11.70 | 10.20 |
| MT9- | 600 CT | 1,200 CT | 4 | 23 | 200-15,000 | 10.80* | 13.20 | 5.85 | 11.55 | 11.85 | 10.20 |
| MT33- | 600/150 Split | 600/150 Split | 20 | 23 | 200-20,000 | 12.45* | 15.45* | 7.05 | 13.65 | 13.65 | 11.70 |
| •MT22- | 600/150 Split | 1,200 CT | 4 | 23 | 200-15,000 | 11.70* | 14.25* | 6.45 | 12.75* | 12.75* | 10.95* |
| MT12- | 2,000 | 3.4 | 10 | 32 | 200-15,000 | 8.70* | 10.50* | 4.35 | 9.45* | 9.60* | 9.00* |
| MT24- | 2,500 | 600 CT | 10 | 32 | 200-15,000 | 9.60* | 11.10* | 4.85* | 9.75 | 10.20 | 9.30* |
| •MT13- | 4,000 CT | 3.4 | 3 | 32 | 200-15,000 | 9.75* | 11.25* | 4.80 | 10.05 | 10.35* | 9.45* |
| MT11- | 4,000 CT | 600 CT | 3 | 32 | 200-15,000 | 10.20 | 12.60* | 5.25 | 11.25* | 11.25 | 10.20* |
| MT21- | 4,000 CT | 600/150 Split | 3 | 32 | 200-15,000 | 11.70 | 14.25* | 6.45* | 12.75 | 12.75 | 10.65* |
| MT25- | 7,500 CT | 600 CT | 8 | 32 | 200-15,000 | 10.50 | 12.90 | 5.55 | 11.25* | 11.55 | 10.20* |
| •MT34- | 10,000/2,500 Split | 2,000/500 Split | 4 | 20 | 200-20,000 | 12.30* | 15.45* | 7.05 | 13.65 | 13.65* | 11.70* |
| •MT10- | 25,000 | 600 | 3 | 22 | 200-15,000 | 9.75* | 11.25* | 5.10 | 10.20* | 10.35* | 9.60* |
| •MT7- | 25,000 | 1,200 CT | 3 | 22 | 200-15,000 | 10.65* | 12.15 | 5.70 | 10.95 | 11.25* | 10.20* |
| •MT18- | 25,000 CT | 1,200 CT | 6 | 22 | 200-15,000 | 11.10* | 13.50 | 6.15 | 11.85* | 12.15 | 10.65* |
| MT3- | 50,000 | 600 | 3 | 20 | 300-15,000 | 10.35* | 11.85* | 5.70* | 10.80* | 10.95* | 9.90* |
| MT8- | 50,000 CT | 1,200 CT | 3 | 20 | 300-15,000 | 11.10* | 13.50* | 6.15* | 11.85* | 12.15* | 10.65* |

•Not available in PC construction. ††For telephone line coupling or hybrid telephone line.

†ORDER BY COMPLETE MICROTRAN NUMBER (M1-A).

## MICRO-MINIATURE AUDIO AND TRANSISTOR TRANSFORMERS — MM AND MMT SERIES

**MM-M (Fig. J):** Molded, for plug-in printed circuit applications. Cast epoxy resin for high resistance to extremes of ambient temperature. MIL Type TF5RX—ZZ. Size, ⅞" x 2⁵⁄₃₂" x 1⁷⁄₃₂" with ⁵⁄₆₄" pins, .020" dia. Wt., ½ oz. **MM-H (Fig. K):** Hermetically sealed with high compression glass term. Gray enamel finish. MIL Type TF4RX—YY. Size, 1⁵⁄₁₆" dia. x 1¹⁄₁₆". Wt., ¾ oz. **MM-FB (Fig. L):** Open frame with channel. Available with plug-in tab channel or without channel on special order. MIL Type TF6RX—ZZ. Size, 1³⁄₁₆" x 1³⁄₃₂" x 1⁵⁄₃₂", plus tabs.

†ORDER BY COMPLETE MICROTRAN NUMBER (MM1-M).

| Part No.† | Primary Impedance | Secondary Impedance | Primary DC mA Unbalance | Operating Level DBM | Frequency Response ±2 db | Net Each, Lots of 1-9★ -FB | -H | -M |
|---|---|---|---|---|---|---|---|---|
| MM2- | 10,000 | 90,000 | 0 | 4 | 150-10,000 | $6.75* | $11.70 | $10.20* |
| MM7- | 30,000 | 1,200 | 0.5 | 20 | 200-10,000 | 5.70 | 10.65* | 9.15* |
| MM6- | 100,000 | 60 | 0.5 | 20 | 250-10,000 | 6.00 | 10.80* | 9.15 |
| MM5- | Reactor 50 Hy. @ 1 Mil DC | | | 4,700 ohms DC Res. | | 5.55* | 9.75 | 8.70* |
| MMT1- | 600 | 600 | 8 | 22 | 200-15,000 | 4.65 | 9.60 | 8.55 |
| MMT26- | 600 CT | 600 CT | 16 | 22 | 200-15,000 | 5.40 | 11.40 | 9.30 |
| MMT33- | 600 CT | 600/150 Split | 16 | 22 | 200-15,000 | 6.30 | 12.45 | 10.50 |
| MMT9- | 600 CT | 1,200 CT | 16 | 22 | 200-15,000 | 5.40 | 11.40 | 9.30 |
| MMT32- | 600 CT | 1,200/300 Split | 16 | 22 | 200-15,000 | 6.30 | 12.30* | 10.50* |
| MMT12- | 2,000 | 3.4 | 5 | 28 | 200-15,000 | 4.80 | 9.75* | 8.55* |
| MMT31- | 2,000 CT | 500 CT | 10 | 28 | 200-15,000 | 5.55 | 11.25* | 9.75 |
| MMT19- | 2,500 | 2,500 CT | 2 | 23 | 200-15,000 | 5.55 | 10.95* | 9.30 |
| MMT11- | 4,000 CT | 600 CT | 5 | 28 | 200-15,000 | 5.55 | 11.40 | 9.45 |
| MMT21- | 4,000 CT | 600/150 Split | 5 | 28 | 200-15,000 | 6.45 | 12.30* | 10.65 |
| MMT25- | 7,500 CT | 600 CT | 4 | 22 | 200-15,000 | 5.85 | 11.55* | 9.90* |
| MMT17- | 10,000 CT | 200 CT | 6 | 20 | 200-15,000 | 6.45 | 12.15* | 10.35* |
| MMT28- | 10,000 CT | 1,500 CT | 2 | 20 | 200-15,000 | 5.85 | 11.55* | 9.90 |
| MMT29- | 10,000 CT | 10,000 CT | 2 | 20 | 200-15,000 | 6.00 | 11.85 | 10.05 |
| MMT10- | 25,000 | 600 | 1 | 20 | 200-15,000 | 5.85 | 10.65* | 9.00 |
| MMT27- | 25,000 CT | 600 CT | 2 | 20 | 200-15,000 | 6.15 | 11.85* | 10.20* |
| MMT7- | 25,000 | 1,200 CT | 1 | 20 | 200-15,000 | 6.00 | 11.10 | 9.60 |
| MMT18- | 25,000 CT | 1,200 CT | 2 | 20 | 200-15,000 | 6.15 | 11.85* | 10.20 |
| MMT5- | 50,000 | 6 | 1 | 20 | 200-15,000 | 6.00 | 10.95* | 9.60* |
| MMT3- | 50,000 | 600 | 0.7 | 20 | 200-15,000 | 6.00 | 10.95* | 9.60 |
| MMT4- | 50,000 CT | 600 CT | 1.4 | 20 | 200-15,000 | 6.75 | 12.45* | 10.80 |

## SUBMINIATURE AUDIO AND TRANSISTOR TRANSFORMERS — SM AND SMT SERIES

**SM-AF (Fig. N):** MIL-T-27B-AF modified case; compression sealed ceramic terminals; gray enamel finish. MIL Type TF4RX—YY. Size, ¾" x ¾" x 1¼" max. with two 4-40NC-2 spade mtg. bolts. Wt., 1⅛ oz. **SM-H (Fig. K):** Hermetically sealed; high compression glass terminals; Gray enamel finish. MIL Type TF4RX—YY. Size, 1⁵⁄₁₆" dia. x 1⁵⁄₁₆" h. Wt., 1 oz. **SM-FB (Fig. L):** Open frame with channel. With plug-in tab mounted channel or without channel on special order. MIL Type TF6RX—ZZ. Size, 1⁵⁄₁₆" x 1¹⁵⁄₃₂" x ¾", plus tabs. Wt., 0.750 oz. **SM-M (Fig. O):** Molded, for plug-in PC applications. MIL Type TF5RX—ZZ. Size, 1⁵⁄₃₂" x ⅞" x ¾" max. Wt., 1½ oz.

| Part No.† | Primary Impedance | Secondary Impedance | Primary DC mA Unbalance | Operating Level DBM | Frequency Response ±2 db | Net Each, Lots of 1-9★ -AF | -FB | -H | -M |
|---|---|---|---|---|---|---|---|---|---|
| SM2- | 10,000 | 90,000 | 0 | 8 | 100-10,000 | $15.15* | $7.65 | $13.65* | $13.65* |
| SM5- | Reactor 50 Hy. @ 1 Mil DC | | | 3,000 ohms DC Res. | | 12.45* | 6.00 | 11.55* | 11.55* |
| SMT1- | 600 | 600 | 9 | 23 | 200-15,000 | 13.50 | 6.00 | 12.00* | 12.00* |
| •SMT26- | 600 CT | 600 CT | 18 | 23 | 200-15,000 | — | 6.60 | 13.35* | 13.20 |
| •SMT9- | 600 CT | 1,200 CT | 18 | 23 | 200-15,000 | — | 7.20 | 13.95* | 13.80* |
| SMT19- | 2,500 | 2,500 CT | 5 | 26 | 200-15,000 | 15.00* | 7.20 | 13.65* | 13.50 |
| •SMT17- | 10,000 CT | 200 CT | 6 | 20 | 200-15,000 | — | 7.50 | 14.25* | 14.10 |
| SMT7- | 25,000 | 1,200 CT | 1.5 | 20 | 200-15,000 | 15.00* | 7.20 | 13.65* | 13.50 |

*Special order only, add $25.00 lot set-up charge.

†ORDER BY COMPLETE MICROTRAN NUMBER (SMT1-FB).

★Quantity pricing schedule is as follows: 1-9 net, 10-49 less 10%, 50-99 less 16⅔%, 100-249 less 33⅓%. Contact factory for prices over 249.

# MICROTRAN COMPANY, INC.

## AUDIO INPUT TRANSFORMERS
## MINIATURIZED AUDIO TRANSFORMERS

Dept. EM • 145 E. Mineola Ave. • P.O. Box 236 • Valley Stream, N.Y. 11582 • Phone: (516) 561-6050 • TWX: 510-225-8412

## MICROPHONE/TRANSDUCER INPUT TRANSFORMERS

**FOR PROFESSIONAL SOUND STUDIOS**
**BROADCAST MIXING CONSOLES**
**CONTROL & INSTRUMENT AMPLIFIERS**

**Fig. -SP**
**PRINTED CIRCUIT MOUNTED**
Double Mu-metal Shielded. ¾" D x 1 1/16" H. 7-.040 pins ⅛" H.

**Fig. -S**
**SINGLE THREADED STUD MOUNTING**
Double Mu-metal shielding. 3/8" color coded leads. 5/8" D x 1 3/4" H. 3/16" D stud.

Wide bandwidth — Broad frequency response — Hi efficiency. Extremely low distortion. Power level range up to +0 dBm. Negligible hum pick-up due to nested Mu-metal shields and unique gapless core construction. Ease of mounting and orientation for minimum hum pick-up. Polarizing voltage connection for condenser microphones. Subminiature size permits close spacing to adjacent circuitry. Low microphonics.

| Part No.† | Nominal Turns Ratio Pri:Sec | Nominal Impedance Ratio Primary | Nominal Impedance Ratio Secondary | Typical Open Circuit Pri. Impedance @ 50 Hz | Frequency Response | Replaces Threaded Stud Mounting Beyer P/N‡ | Net Each Lots of 1-9★ -S | Net Each Lots of 1-9★ -SP |
|---|---|---|---|---|---|---|---|---|
| S101-† | 1:20 | 12.5 | 5,000 | 100 | 30-15,000Hz ±1db | TR-BV35704 | $15.15 | $18.15 |
| S105-† | 1:15 | 200 | 45,000 | 2,000 | 30-15,000Hz ±1db | 351.015.006 | 17.40 | 22.65 |
| S107-† | 1:15 | 200/50 Split | 45,000 | 2,000 | 30-15,000Hz ±1db | 351.215.006 | 19.20 | 24.60 |
| S108-† | 1:10 | 200 | 20,000 | 2,000 | 30-15,000Hz ±1db | 351.010.005 | 14.85 | 19.05 |
| S111-† | 1:7.1 | 200 | 10,000 | 2,000 | 30-15,000Hz ±1db | 351.007.004 | 14.40 | 19.20 |
| S116-† | 1:5 | 200 | 5,000 | 2,000 | 30-15,000Hz ±1db | 351.005.003 | 13.95 | 18.15 |
| S118-† | 1:5 | 200/50 Split | 5,000 | 2,000 | 30-15,000Hz ±1db | 351.205.003 | 16.20 | 20.40 |
| S126-† | 1:1 | 600 CT | 600 | 3,750 | 30-20,000Hz ±.5db | TR-145/BV35508 | 14.70 | 19.20 |
| S130-† | 1:1 | 10,000 | 10,000 | 100,000 | 30-15,000Hz ±1db | TR-145/BV35590 | 13.80 | 18.00 |
| S100-FB | Right angle mounting bracket for S100-S Series. | | | | | | .81 | — |

‡ -SP Type is replacement for STR/BV37 & 370 PC pins.

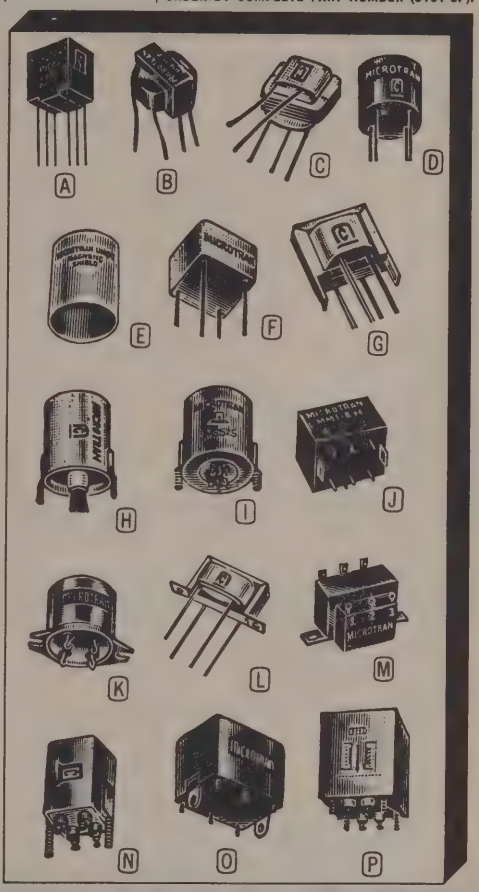
† ORDER BY COMPLETE PART NUMBER (S101-SP).

## PICO MINIATURE TRANSFORMERS — PM SERIES

**PM-M (Fig. A):** Epoxy molded finish; gold plated leads, 0.020" x ¾". Frequency Response, ±2 db, 300 Hz to 100 kHz (PM3 and PM5, to 45 kHz). Power level given for 15% max. distortion, except PM35, 20% and PM37, 25%. Size, .410" x .465" x .310" max. Wt., 0.1 oz. MIL Type TF5RZ—ZZ. **PM-F (Fig. B).** Open frame, resin impregnated, 4" #30 plastic leads. Size, .250" x .375" x .406" max. Wt., .05 oz. MIL Type TF6RX—ZZ.

† ORDER BY COMPLETE MICROTRAN NO. (PM3-M).

| Part No.† | Primary Impedance | Secondary Impedance | Unbal. Pri. DC mA | Pri. DCR | Sec. DCR | Power Level MW | Lots of 1-9★ Net Each -M | Lots of 1-9★ Net Each -F |
|---|---|---|---|---|---|---|---|---|
| PM37- | 120 CT | 3.2 | 10 | 16 | 0.75 | 50 | $11.85 | $6.90 |
| PM38- | 300 CT | 600 | 7 | 41 | 98 | 50 | 12.00 | 7.20 |
| PM35- | 500 | 50 | 3 | 60 | 8 | 50 | 11.70 | 6.45 |
| PM36- | 500 | 500/125 Split | 3 | 72 | 85 | 50 | 12.60 | 7.20 |
| PM34- | 600 CT | 600 CT | 3 | 75 | 105 | 50 | 12.75 | 7.50 |
| PM33- | 1,500 CT | 600 | 3 | 170 | 95 | 50 | 12.60 | 7.35 |
| PM31- | 2,500 | 2,500 CT | 1 | 250 | 325 | 50 | 12.60 | 7.05 |
| PM29- | 10,000 CT | 500 CT | 1 | 1,050 | 80 | 50 | 13.65 | — |
| PM27- | 10,000 | 1,200 | 0.5 | 1,050 | 280 | 50 | 12.90 | 7.35 |
| PM23- | 10,000 CT | 1,200 CT | 1 | 1,050 | 280 | 50 | 13.65 | — |
| PM25- | 10,000 | 1200/300 Split | 0.5 | 1,050 | 280 | 50 | 13.80 | — |
| PM19- | 10,000 CT | 2,000 CT | 1 | 1,000 | 300 | 50 | 13.50 | — |
| PM21- | 10,000 | 2000/500 Split | 0.5 | 1,000 | 300 | 50 | 13.80 | — |
| PM17- | 10,000 CT | 10,000 CT | 1 | 1,000 | 1,300 | 50 | 14.25 | — |
| PM15- | 25,000 | 1,000 | 0.25 | 1,700 | 110 | 40 | 13.95 | 7.35 |
| PM11- | 25,000 CT | 1,000 CT | 0.5 | 1,700 | 110 | 40 | 14.55 | — |
| PM13- | 25,000 | 1000/250 Split | 0.25 | 1,700 | 110 | 40 | 14.70 | — |
| PM7- | 50,000 CT | 1,000 CT | 0 | 3,300 | 75 | 10 | 15.30 | — |
| PM9- | 50,000 | 1000/250 Split | 0 | 3,300 | 75 | 10 | 15.75 | — |
| PM5- | 200,000 | 1,000 | 0 | 5,300 | 110 | 10 | 15.00 | — |
| PM3- | 200,000 CT | 1,000 CT | 0 | 5,300 | 110 | 10 | 15.60 | — |
| PM40- | Audio Choke | 3.5 Hy. | 2 | 700 | — | — | 9.00 | 5.70* |
| PM39- | Audio Choke | 6 Hy. | 2 | 1,800 | — | — | 9.75* | 6.30* |
| PM90 | Magnetic Shield Mu-Metal slip-on can for PM-M Series. 20 db shielding. | | | | | | 1.50 | — |




## ULTRA-MINIATURE TRANSISTOR TRANSFORMERS — UM SERIES

Frequency Response, ±2 db, 300-10 kHz. Leads supplied, 4" #27 color-coded. Power levels given for 7½% max. distortion. **UM-F (Fig. C):** Size, 3/8" x 3/8" x 11/32". Wt., 0.08 oz. MIL Type TF6RX—ZZ (Insert MIL No. from table). **UM-M (Fig. D):** Size, ½" dia. x ½", with 1" leads. Wt., 0.14 oz. MIL Type TF5RX—ZZ.

†ORDER BY COMPLETE MICROTRAN NO. (UM25-M).

| Part No.† | Primary Impedance | Secondary Impedance | Unbal. Pri. DC mA | Pri. DCR | Sec. DCR | Level @ 300 Hz | Level @ 1 kHz | Net Each Lots of 1-9★ -F | Net Each Lots of 1-9★ -M |
|---|---|---|---|---|---|---|---|---|---|
| UM25- | 400 | 50 | 3 | 35 | 5 | 15mw | 500mw | $4.50 | $9.15 |
| UM29- | 600 CT | 600 CT | 7 | 45 | 60 | 5mw | 400mw | 5.25 | 8.70 |
| UM24- | 1,000 | 50 | 3 | 65 | 10 | 5mw | 500mw | 4.50 | 9.15* |
| UM33- | 1,000 CT | 600 | 6 | 80 | 65 | 5mw | 500mw | 6.00 | 9.15 |
| UM32- | 1,500 CT | 600 | 5 | 135 | 65 | 5mw | 500mw | 6.00 | 9.15 |
| UM39- | 2,500 CT | 600 CT | 2 | 250 | 50 | 5mw | 500mw | 5.85 | 9.75 |
| UM34- | 10,000 CT | 600 CT | 2 | 850 | 40 | 5mw | 500mw | 6.00 | 10.35 |
| UM31- | 10,000 CT | 1,200 CT | 2 | 850 | 120 | 5mw | 500mw | 6.00 | 10.35 |
| UM37- | 10,000 | 2,000 CT | 1 | 850 | 200 | 5mw | 500mw | 5.25 | 9.75 |
| UM35- | 15,000 CT | 15,000 CT | 1 | 930 | 1,210 | 5mw | 300mw | 6.30 | 10.95 |
| UM36- | 20,000 CT | 800 CT | .5 | 1,100 | 80 | 5mw | 500mw | 5.55 | 10.95 |
| UM23- | 20,000 | 1,200 CT | .5 | 1,100 | 110 | 5mw | 300mw | 5.25 | 10.50 |
| UM21- | 100,000 | 1,000 | 0 | 1,900 | 135 | 5mw | 70mw | 6.00 | 9.45 |
| UM28- | Choke | 10 Hy. (0 DC) 8 Hy. (0.5mA) | | | | | 650 | 3.75 | 7.05* |
| UM90 | Magnetic Shield Mu-Metal slip-on can for UM-M Series. 20 db shielding. | | | | | | | 2.40 | — |

## VERI-MINIATURE TRANSISTOR TRANSFORMERS — VM SERIES

Frequency Response, ±2 db, 200-10 kHz. Lead supplied, 4" #27 color-coded. Power levels given for 7½% max. distortion. **VM-M (Fig. F):** For plug-in printed circuit applications. Cast epoxy resin provides high resistance. Size, 9/16" x 9/16" x ½". Wt., 0.25 oz. MIL Type TF5RX—ZZ (Insert MIL No. from table). **VM-FPB (Fig. G):** Plug-in tab mounted channel. Size, 17/32" x 15/32" x 7/16". Wt., 0.2 oz. MIL Type TF6RX—ZZ.

† ORDER BY COMPLETE MICROTRAN NO. (VM8-M).

| Part No.† | Primary Impedance | Secondary Impedance | Unbal. Pri. DC mA | Pri. DCR | Sec. DCR | Power Level MW | Net Each Lots of 1-9★ -FPB | Net Each Lots of 1-9★ -M |
|---|---|---|---|---|---|---|---|---|
| VM1- | 50 | 600 | 5.5 | 7 | 90 | 15 | $4.80 | $8.25 |
| VM7- | 500 | 3.4 | 3.5 | 50 | .5 | 15 | 4.80 | 8.55 |
| VM16- | 500 CT | 250 CT | 7.5 | 50 | 25 | 15 | 5.10 | 8.85* |
| VM14- | 600 CT | 600 CT | 7.0 | 50 | 65 | 15 | 5.25 | 9.60 |
| VM8- | 1,250 | 3.4 | 2.0 | 135 | .5 | 15 | 4.95 | 8.85 |
| VM10- | 2,500 | 2,500 CT | 1.5 | 225 | 215 | 3 | 5.70 | 9.45 |
| VM17- | 10,000 CT | 5,000 CT | 0 | 400 | 300 | 5 | 6.15* | 9.90 |
| VM12- | 20,000 | 1,000 | .16 | 625 | 85 | 5 | 5.40* | 8.85 |
| VM13- | 20,000 | 1,000 CT | .16 | 625 | 85 | 5 | 5.55* | 9.60 |
| VM3- | 25,000 | 600 | .15 | 720 | 45 | 2.5 | 5.40 | 9.00 |
| VM5- | 50,000 | 600 | .1 | 830 | 55 | 5 | 5.40 | 9.45 |
| VM15- | 50,000 CT | 50,000 CT | 0 | 2,000 | 2,600 | 5 | 6.90 | 9.75 |
| VM6- | 100,000 | 1,200 CT | .07 | 2,000 | 150 | 5 | 6.15* | 8.85 |
| VM2- | 200,000 | 600 | .05 | 3,000 | 110 | 2.5 | 6.00 | 8.85 |
| VM4- | 200,000 | 1,200 | .035 | 3,100 | 165 | 5 | 6.15 | 9.90 |
| VM90 | Magnetic Shield Mu-Metal slip-on can for VM-M Series. 20 db shielding. | | | | | | 1.95 | — |

*Special order only, add $25.00 lot set-up charge.

## DECI-MINIATURE PC AUDIO TRANSFORMERS AND CHOKES

Primary and secondary windings may be interchanged to obtain varied matching requirements such as input, interstage, output and isolation. Designed for printed circuits. Frequency Response, ±2 db, 200-15,000 Hz. Size, 13/16"W x 19/32"D x ¾"H. Open frame — plug-in design. Fig. U. See PC4300 Series for dimensions.

| Part No. | Primary Impedance | Secondary Impedance | Pri. DC Unbalance mA | Operating Level DBM | Net Each 1-9★ |
|---|---|---|---|---|---|
| DCM2-PC | 15,000 CT | 15,000 CT | 3 | 19 | $5.55 |
| DCM3-PC | 15,000 CT | 600 CT | 3 | 19 | 5.25 |
| DCM4-PC | 10,000 CT | 5,000 CT | 4 | 20 | 5.40 |
| DCM6-PC | 10,000 CT | 1,500 CT | 4 | 20 | 5.25 |
| DCM7-PC | 5,000 CT | 80,000 CT | 6 | 15 | 5.70 |
| DCM8-PC | 4,000 CT | 1,200 CT | 6 | 20 | 4.95 |
| DCM9-PC | 4,000 CT | 600 CT | 6 | 20 | 4.95 |
| DCM10-PC | 4,000 | 600/150 Split | 3 | 20 | 5.25 |
| DCM11-PC | 2,500 CT | 2,500 CT | 8 | 20 | 4.95 |
| DCM12-PC | 2,500 | 2500/625 Split | 4 | 20 | 5.25 |
| DCM13-PC | 2,500 CT | 625 CT | 8 | 20 | 4.80 |
| DCM14-PC | 2,500 CT | 200 CT | 8 | 20 | 4.65 |
| DCM18-PC | 600 CT | 50,000 CT | 16 | 20 | 5.70 |
| DCM19-PC | 600 | 8000/2000 Split | 8 | 20 | 5.25 |
| DCM20-PC | 600 CT | 200 CT | 16 | 20 | 4.35 |
| DCM21-PC | 600 CT | 600 CT | 16 | 20 | 4.35 |
| DCM22-PC | 250 CT | 600 CT | 25 | 20 | 4.35 |
| DCM51-PC | Choke 10Hy @ 0mA DC 5Hy @ 3mA DC | | | | 300Ω DCR 4.05 |
| DCM52-PC | Choke 5Hy @ 0mA DC 2Hy @ 5mA DC | | | | 155Ω DCR 3.60 |
| DCM53-PC | Choke 2.5Hy @ 0mA DC 1Hy @ 7mA DC | | | | 75Ω DCR 3.45 |

## IMMEDIATE DELIVERY FROM STOCKING DISTRIBUTORS

★Quantity pricing schedule is as follows: 1-9 net, 10-49 less 10%, 50-99 less 16⅔%, 100-249 less 33⅓%. Contact factory for prices over 249.

# WIDEBAND TRANSFORMERS

North Hills

## UNBALANCED TO BALANCED TRANSFORMERS

Balanced secondaries center-tapped and dc-isolated from primaries. Mid-band insertion loss less than 0.5 dB. Bandwidth defined at low frequency end by 3 dB drop from mid-band response, at high end by max. VSWR of 1.25.

### LOW POWER SERIES (1W)

| Series | Radio Frequency | | Medium Frequency | | Video | |
|---|---|---|---|---|---|---|
| Cases | BA, BB, HB | | BA, BB | | LA, LB | |
| Unb./Bal. (Ω) | Type No. | Bandwidth MHz | Type No. | Bandwidth MHz | Type No. | Bandwidth MHz |
| 50:50 | 0001 | .1-125 | 0010 | .01-80 | 0009 | .001-25 |
| 50:75 | 0101 | .1-125 | 0111 | .01-80 | 0104 | .001-25 |
| 50:90 | 0200 | .1-125 | 0202 | .01-60 | 0203 | .001-20 |
| 50:100 | 0300 | .1-100 | 0301 | .01-60 | 0311 | .001-20 |
| 50:124 | 0307 | .1-100 | 0302 | .01-60 | 0306 | .001-20 |
| 50:135 | 0310 | .1-100 | 0312 | .01-60 | 0303 | .001-18 |
| 50:150 | 0400 | .1-100 | 0401 | .01-60 | 0415 | .001-15 |
| 50:200 | 0500 | .1-100 | 0520 | .01-60 | 0511 | .001-15 |
| 50:300 | 0501 | .1-100 | 0521 | .01-50 | 0517 | .001-12 |
| 50:450 | 0600 | .1-65 | 0602 | .01-40 | 0603 | .001-10 |
| 50:600 | 0700 | .1-65 | 0703 | .01-32 | 0706 | .001-8 |
| 50:800 | 0800 | .1-60 | 0801 | .01-25 | 0802 | .001-7 |
| 50:1200 | 0900 | .1-30 | 0902 | .01-15 | 0904 | .001-6 |
| 75:50 | 1000 | .1-100 | 1001 | .01-60 | 1002 | .001-25 |
| 75:75 | 1100 | .1-100 | 1112 | .01-60 | 1102 | .001-25 |
| 75:90 | 1200 | .1-100 | 1201 | .01-60 | 1202 | .001-20 |
| 75:100 | 1300 | .1-100 | 1310 | .01-60 | 1314 | .001-20 |
| 75:124 | 1302 | .1-100 | 1311 | .01-60 | 1301 | .001-20 |
| 75:135 | 1317 | .1-100 | 1315 | .01-60 | 1312 | .001-20 |
| 75:150 | 1400 | .1-100 | 1405 | .01-60 | 1404 | .001-16 |
| 75:200 | 1500 | .1-100 | 1513 | .01-60 | 1516 | .001-15 |
| 75:300 | 1501 | .1-100 | 1514 | .01-60 | 1502 | .001-15 |
| 75:450 | 1600 | .1-60 | 1601 | .01-40 | 1602 | .001-12 |
| 75:600 | 1700 | .1-60 | 1707 | .01-32 | 1704 | .001-10 |
| 75:800 | 1800 | .1-30 | 1801 | .01-20 | 1802 | .001-10 |
| 75:1200 | 1900 | .1-30 | 1905 | .01-15 | 1902 | .001-9 |
| 75:1850 | 1906 | .1-15 | 1901 | .01-8 | 1903 | .001-6 |

### EXTENDED VIDEO SERIES Response down to 20 Hz

| Type No. | Unb./Bal. | Bandwidth | Case Styles |
|---|---|---|---|
| 0014 | 50:50 | 20 Hz-6 MHz | PB |
| 0113 | 50:75 | 20 Hz-6 MHz | PB |
| 0315 | 50:100 | 20 Hz-6 MHz | PB |
| 0316 | 50:124 | 20 Hz-6 MHz | PB |
| 0522 | 50:200 | 20 Hz-4 MHz | PB |
| 1003 | 75:50 | 20 Hz-6 MHz | PB |
| 1111 | 75:75 | 20 Hz-6 MHz | LA, LB |
| 1307 | 75:110 | 20 Hz-6 MHz | LA, LB |
| 1309 | 75:124 | 20 Hz-9 MHz | PB |
| 1408 | 75:150 | 20 Hz-6 MHz | PB |
| 1520 | 75:300 | 20 Hz-4 MHz | PB |

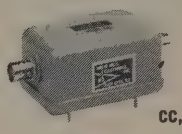
### HIGH POWER SERIES

| Power Level | 10 W | 25 W | 100 W | 1 kW |
|---|---|---|---|---|
| Cases | HB | BA, BB | BA, BB | KA |
| MHz Range | .1-30 | .1-30 | .5-30 | 2-32 |
| Unb./Bal. (Ω) | Type No. | Type No. | Type No. | Type No. |
| 50:50 | 0008 | 0011 | 0012 | 0013 |
| 50:75 | 0108 | 0109 | 0105 | 0107 |
| 50:100 | 0309 | 0308 | 0304 | 0314 |
| 50:150 | 0406 | 0402 | 0404 | 0407 |
| 50:200 | 0519 | 0512 | 0516 | 0515 |
| 50:300 | 0514 | 0518 | 0506 | 0513 |
| 50:450 | 0604 | 0605 | 0606 | 0601 |
| 50:600 | 0705 | 0701 | 0704 | 0702 |
| 75:75 | 1105 | 1110 | 1118 | 1108 |
| 75:100 | 1306 | 1304 | 1305 | 1316 |
| 75:150 | 1406 | 1401 | 1403 | 1407 |
| 75:200 | 1517 | 1519 | 1512 | 1518 |
| 75:300 | 1515 | 1510 | 1505 | 1511 |
| 75:450 | 1603 | 1604 | 1605 | 1606 |
| 75:600 | 1709 | 1703 | 1708 | 1705 |

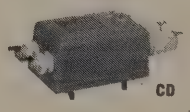
**MANY VARIATIONS AND CUSTOM DESIGNS TO 1 GHz ALSO AVAILABLE**

## ISOLATION TRANSFORMERS UNBALANCED TO UNBALANCED

**Ground Isolation in 50 and 75Ω Coaxial Systems**



CC, PA



CD

- Flat frequency, linear phase response.
- Insulated BNC connectors.
- 140 dB isolation at power frequencies.

| Type No. | Impedance Unb/Unb(Ω) | Bandwidth |
|---|---|---|
| 0005-CC | 50:50 | 1 kHz - 25 MHz |
| 1103-CC | 75:75 | 1 kHz - 25 MHz |
| 0112-CC | 50:75 | 1 kHz - 25 MHz |
| 0017-CC | 50:50 | 10 Hz - 5 MHz |
| 1117-CC | 75:75 | 10 Hz - 5 MHz |
| 0016-PA | 50:50 | 20 Hz - 20 MHz |
| 1116-PA | 75:75 | 20 Hz - 20 MHz |

**10 KV Isolation for Public Utility Data Transmission**
1 kHz to 6 MHz bandwidths.
1115-CD: 75Ω coax to 75Ω coax.
1313-CD: 75Ω coax to 124Ω balanced line.

## HUMBUCKING CHOKES

75:75 ohms, Insulated BNC connectors

| Type | Bandwidth | Rejection at 60 Hz |
|---|---|---|
| 1119-PA | DC to 15 MHz | 50 dB min. |
| 1120-CC | DC to 20 MHz | 40 dB min. |

## ULTRA-WIDE COAXIAL MATCHING TRANSFORMERS

Unbalanced to unbalanced. BNC male and female input and output connectors in all combinations. Low VSWR. JA case.

JA

| | | | |
|---|---|---|---|
| 0003-JA | 50:50 | .05-300 MHz | Phase Reversing |
| 0102-JA | 50:75 | .05-300 MHz | Impedance Adapter |
| 0114-JA | 50:75 | 10-1000 MHz | Impedance Adapter |
| 0201-JA | 50:90 | .05-300 MHz | Impedance Adapter |
| 1106-JA | 75:75 | .05-300 MHz | Phase Reversing |
| 1203-JA | 75:90 | .05-300 MHz | Impedance Adapter |

## SUBMINIATURE SERIES

NA molded case. 0.1-300 MHz bandwidth.

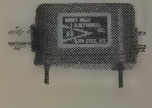
.6 x .6 x .4"

| | | |
|---|---|---|
| 0003-NA<br>1106-NA<br>2200-NA | 50: 50<br>75: 75<br>90: 90 | Unbalanced to Unbalanced<br>Phase Reversing<br>DC Coupled |
| 0007-NA<br>1107-NA<br>2201-NA | 50: 50<br>75: 75<br>90: 90 | Unbalanced to Unbalanced<br>Phase Reversing<br>DC Isolated |
| 0002-NA<br>0508-NA<br>1506-NA | 50: 12.5<br>50:200<br>75:300 | Unbalanced to Unbalanced<br>Non-Inverting<br>DC Coupled |
| 0004-NA<br>0509-NA<br>1101-NA<br>1507-NA | 50: 50<br>50:200<br>75: 75<br>75:300 | Unbalanced to Balanced<br>DC Coupled |
| 0510-NA<br>1508-NA | 50:200<br>75:300 | Balanced to Balanced<br>DC Coupled |

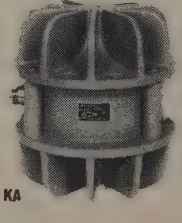
## CASE STYLES

HB

BA, LA



BB, LB, PB



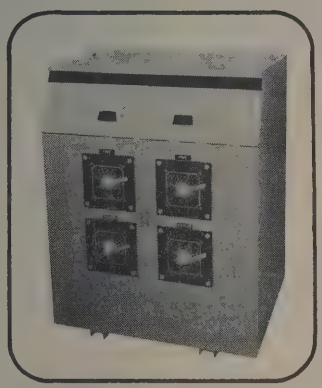
KA

## OVERALL DIMENSIONS (Inches)

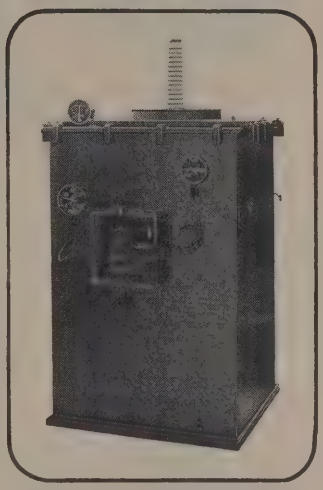
| Case | L | W | H |
|---|---|---|---|
| BA | 2.3 | 1.3 | 1.2 |
| BB | 2.6 | 1.3 | 1.2 |
| CC | 3.5 | 1.7 | 1.6 |
| HB | 0.9 | 0.9 | 0.7 |
| KA | 5.4 | 4.6 | 5.5 |
| LA | 2.9 | 1.7 | 1.3 |
| LB | 3.2 | 1.7 | 1.3 |
| PA | 3.0 | 4.0 | 2.0 |
| PB | 3.0 | 3.6 | 2.0 |

North Hills Electronics, INC.
GLEN COVE, N.Y. 11542 • 516-671-5700

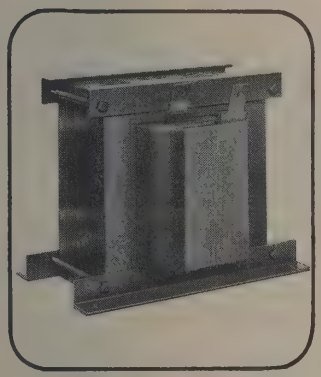
# NWL ...the source for industrial and electronic transformers



Heating transformers for resistance and induction furnaces

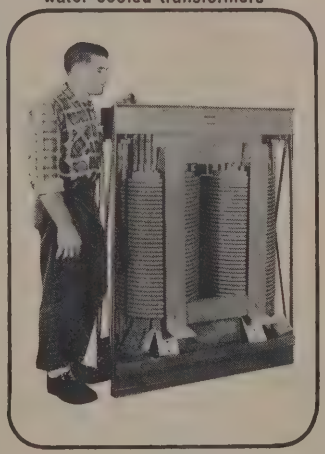


Oil filled high voltage transformers

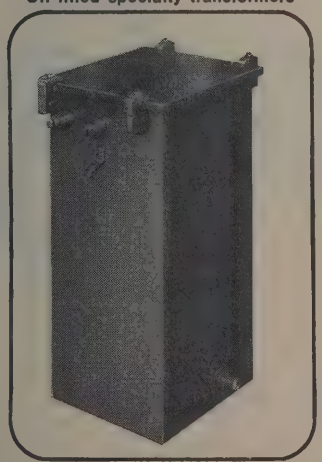


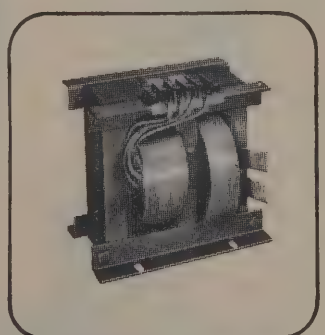
Current limiting reactors

High power and high current water cooled transformers



Oil filled specialty transformers





High impedance transformers

Since 1929, NWL has consistently been in the forefront of transformer design and manufacture.

High voltage, high frequency and high current transformers are particular strengths at NWL — whether for prototype, standard or special applications.

There's another reason you should look to NWL for solutions to your specific transformer problems. We've never hesitated to tackle the tough design problems head-on. In fact, NWL's technological superiority is a recognized fact in the precipitator, furnace, desalting, nuclear, and other fields requiring high technology.

## NWL ...the source for:

**TRANSFORMERS ● Furnace ● Filament ● Heating ● Lighting ● SCR Controls ● Plate ● High Frequency ● Instrument ● Phase Changing ● Welding ● High Voltage ● Testing ● High Reactance ● Output**

**PLUS ● Saturable Core Reactors ● Chokes ● Packaged Controls ● AC Reactors ● Air Core Reactors**

**NWL ... transformers from the ordinary to the extraordinary**

**NWL TRANSFORMERS**

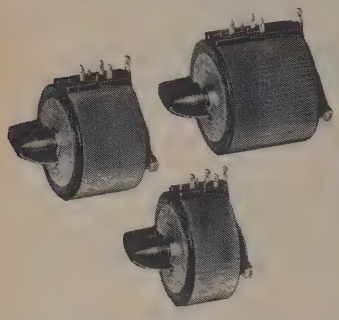
**Rising Sun Road, Bordentown, N.J.**

**609-298-7300**

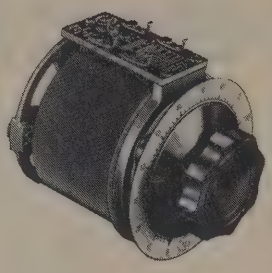
**Call us for quote or specs**

NWL also designs and manufactures custom built AC/DC power supplies, laboratory and industrial types. See our ad under DC POWER SOURCES.

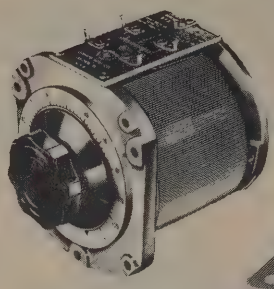
# OHMITE® variable transformers



VT1, VT02, VT3 SERIES, SINGLE UNCASED
The VT1, rated 1 ampere, is the smallest commercial variable transformer available.



VT5 SERIES, SINGLE, UNCASED



VT10 SERIES, SINGLE, UNCASED

VT25 SERIES, UNCASED

Unique for the design innovations they incorporate, Ohmite "OHMITRAN" v.t.® variable transformers include exclusive field-proven features. They offer long, low maintenance operation with excellent regulation at any voltage setting within the rated load plus an output free of waveform distortion. (Ratings shown at right are for use in free air.) Enclosed units, units with meters, 2 & 3 in tandem and 3 phase models are available in most models in the basic series.

## FEATURES

- Positive current transfer — specially designed brushes are connected through high conductivity contact arms to large slip ring which contacts a wide area of the collector ring.
- Adjustable shaft extends from either side.
- Mounts interchangeable with virtually all other comparable types.
- Direct reading, two scale dial — calibrated for overvoltage connection on front, line voltage connection on reverse side.
- Overvoltage options available.
- UL and CSA listings available in certain models.
- Easily replaceable brushes
- Clockwise or counter-clockwise operation on Series VT5, VT10 and VT25

## ENCLOSURES

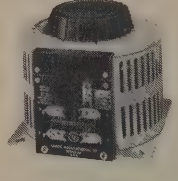
| Type | Available for: | Features |
|---|---|---|
| B | VT25 | EXPOSES TRANSFORMER'S TERMINAL RANGE & MOUNTING BASE |
| E | All | FOR PERMANENT MOUNTING ON PANEL, ETC. |
| F | All | STANDARD PORTABLE<br>LINE CORD, OUTLET SOCKET, FUSE |
| G | VT8<br>VT25 | DELUXE PORTABLE<br>CIRCUIT BREAKER, OVERVOLTAGE — NO OVERVOLTAGE SELECTOR, HANDLE DOUBLES AS EASEL |
| Metered | VT8<br>VT25 | VOLTMETER<br>VOLTMETER + AMMETER<br>VOLTMETER + WATTMETER |

| Series Catalog No. | Wt. Lbs. | Dimensions | |
|---|---|---|---|
| | | Base | Depth |
| VT1 | 1.5 | 2⅞" Diam. | 1 13/16" |
| VT02 | 2.25 | 2⅞" Diam. | 2 5/16" |
| VT3 | 3 | 2⅞" Diam. | 2 13/16" |
| VT5 | 5.25 | 3 5/16" Diam. | 3⅝" |
| VT10 | 10.25 | 4⅞" x 5 11/16" | 4½" |
| VT25 | 22 | 7½" x 7½" | 4½" |

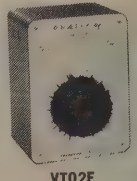
## BASIC SERIES

| Cat. No. | Input Volts | Freq. Hz. | Description | Output Volts | Output Amps |
|---|---|---|---|---|---|
| VT1 | 120 | 50<br>60 | Basic Uncased Model | 0-120<br>0-132 | 1.3 |
| VT1F | 120 | 60 | Portable Enclosure | 0-132 | 1.0 |
| VT1N | 120 | 60 | Basic Uncased Model | 0-120 | 1.5 |
| VT1NF | 120 | 60 | Portable Enclosure | 0-120 | 1.2 |
| VT02 | 120 | 50<br>60 | Basic Uncased Model | 0-120<br>0-132 | 2.0 |
| VT02F | 120 | 60 | Portable Enclosure | 0-132 | 1.75 |
| VT02N | 120 | 60 | Basic Uncased Model | 0-120 | 2.5 |
| VT02NF | 120 | 60 | Portable Enclosure | 0-120 | 2.0 |
| VT2LN | 40 | 60 | Hi-Amps, Low Volts | 0-40 | 5.0 |
| VT3 | 120 | 50<br>60 | Basic Uncased Model | 0-120<br>0-132 | 3.0 |
| VT3N | 120 | 60 | Basic Uncased Model | 0-120 | 3.3 |
| *VT5 | 120 | 50<br>60 | Basic Uncased Model | 0-120<br>0-140 | 4.75 |
| VT5F | 120 | 60 | Portable Enclosure | 0-140 | 4.75 |
| VT4LN | 40 | 50 | Hi-Amps, Low Volts | 0-40 | 12.0 |
| *VT10 | 120 | 50<br>60 | Basic Uncased Model | 0-120<br>0-140 | 10.0 |
| VT10F | 120 | 60 | Portable Enclosure | 0-140 | 10.0 |
| VT10G | 120 | 50<br>60 | Deluxe Portable Enclosure | 0-120<br>0-140 | 8.0 |
| VT10H | 240 | 50<br>60 | Basic Uncased Model | 0-240<br>0-280 | 4.0 |
| VT8LN | 40 | 50 | Hi-Amps, Low Volts | 0-40 | 22.0 |
| *VT25 | 120 | 50<br>60 | Basic Uncased 20A Model | 0-120<br>0-140 | 25.0 |
| VT25B | 120 | 50<br>60 | "B" Type Enclosure | 0-120<br>0-140 | 25.0 |
| VT25H | 240 | 50<br>60 | Basic Uncased Model | 0-240<br>0-280 | 11.0 |
| VT25HB | 240 | 50<br>60 | "B" Type Enclosure | 0-240<br>0-280 | 11.0 |
| VT25G | 120 | 50<br>60 | Deluxe Portable Enclosure | 0-120<br>0-140 | 20.0 |
| VT25F | 120 | 50<br>60 | Portable Enclosure | 0-120<br>0-140 | 25.0 |

*Models VT5, VT10 and VT25 have replaced the industry standard VT4, VT8 and VT20 Models.

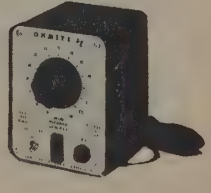


VT25B



VT02E

VT10G



VT5F

VT10GCV
(with voltmeter)

**FOR STOCK ITEMS, CALL LOCAL REPRESENTATIVE LISTED IN INDEX**

OHMITE MFG. CO., a North AMERICAN PHILIPS company / 3601 W. Howard St., Skokie, Illinois 60076 / (312) 675-2600 / TWX 910-223-0805 / TELEX 72-4433

# PERKIN-ELMER

## PRECISION TOROIDAL TRANSFORMERS

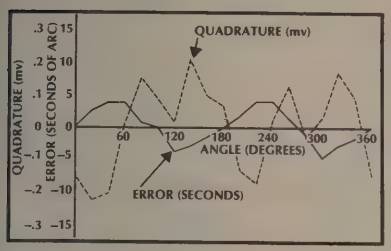
- INPUT SCOTT T
- REFERENCE ISOLATION
- OUTPUT SCOTT T
- DIGITALLY TAPPED
- COMBINATION
- PRECISION RATIO
- RESOLVER ISOLATION
- CUSTOM DESIGNS

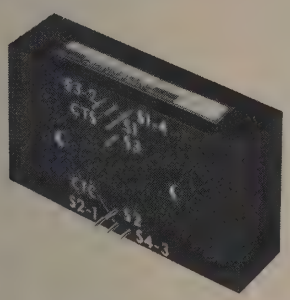
The Electronic Products Department of the Perkin-Elmer Corporation is in a unique position to provide Custom Precision Signal Transformers as a result of 20 years of experience designing and manufacturing very special transformers for the Vernistat® a.c. potentiometer and allied products. **High Performance in small size has always been a successful objective.** Our State of The Art Winding Equipment and Techniques enable close control of turns and taps for close matching of windings and repeatibility of product.

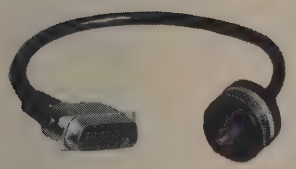
Perkin-Elmer can provide Custom Signal Transformers with high accuracies over the full MIL temperature range. For example, exponential function units with 80 taps to an accuracy of ±0.003% can be provided. SCOTT T Transformers have been built to an accuracy of 5 seconds of arc with a null of 0.1 millivolt. The transformers are fully encapsulated toroidal units and are available with contact pins for PC board mounting. They are manufactured in accordance with MIL-T-27C Grade 5. High input impedance and low output impedance can be matched to specifications. Operating frequency can also be per specifications.

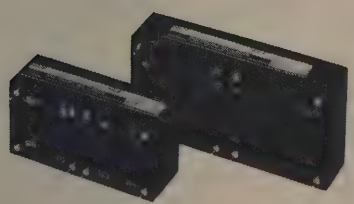
### SCOTT T TRANSFORMERS

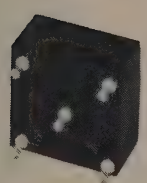
The SCOTT T input transformers converts 3 wire synchro inputs to 4 wire resolver outputs (sin $\theta$ and cos $\theta$) with high transformation accuracy and minimum quadrature. SCOTT T Transformers for converting 4 wire resolver inputs to 3 wire synchro outputs can also be supplied. Our output SCOTT T Transformers maintain high accuracies even under heavy load conditions. These units are useful in solid state synchro to digital and digital to synchro converter applications and are particularly applicable in multiplexed conversion systems.









### INPUT SCOTT T TRANSFORMERS (SYNCHRO TO RESOLVER)

| Input V rms L-L | Output V rms | Load K Ω | Trans. Accuracy Arc. Sec. | Output Quadrature Null mV | Z in K Ω | Z out Ω | Dimensions L x W x H | Mount | Part Number |
|---|---|---|---|---|---|---|---|---|---|
| 11.8 | 2.5 | 25 | 45 | 1.0 | 40 | 8 | 2x1x.625 | PC 2x6-32 | 403-2187 |
| | 5.0 | 20 | 30 | 1.0 | 50 | 75 | 2x1x.6 | PC 2x4-40 | 403-2064 |
| | 7.2 CT | 10 to CT | 60 | 1.0 | 20 | 10 to CT | 2x1x.6 | PC 2x4-40 | 403-2065 |
| | 10.2 | 10 | 60 | 2.0 | 50 | 50 | 2x1x.6 | PC 2-4-40 | 403-2066 |
| 12 | 7.5 | 10 | 15 | 1.0 | 50 | 75 | 2x1x.6 | PC 2x4-40 | 403-2055 |
| 90 | 1.1 | 10 | 15 | 0.03 | 300 | 1 | 2x1x1.1 | PC 2x4-40 | 403-2078 |
| | 4.25 | 10 | 30 | 1.0 | 1000 | 11 | 2.5x1.25x.65 | PC 2x4-40 | 403-2034 |
| | 4.25 CT | 10 | 30 | 1.0 | 1000 | 11 | 2.78x1.41x.8 | PC 2x4-40 | 403-2033 |
| | 17.8 CT | 2.3 to CT | 30 | .7 | 100 | 12 to CT | 2.78x1.41x.8 | PC 2x4-40 | 403-2019 |
| | 26.0 CT | 10 to CT | 30 | 1.4 | 100 | 15 to CT | 2.78x1.41x.8 | PC 2x4-40 | 403-2051 |
| 90 (60 Hz) | 14 CT | 100 to CT | 360 | 12.0 | 45 | 15 to CT | 4x2.25x1.15 | 2x6-32 | 403-2058 |
| 96 | 14.4 CT | 10 to CT | 15 | .25 | 200 | 12 to CT | 2.78x1.41x.8 | PC 2x4-40 | 403-2067 |
| | | | 45 | .75 | 200 | 12 to CT | 2.78x1.41x.8 | PC 2x4-40 | 403-2068 |
| | | | 180 | 5.0 | 30 | 12 to CT | 2.78x1.41x.8 | PC 2x4-40 | 403-2069 |
| | 20 CT | 10 to CT | 15 | .25 | 200 | 10 to CT | 2.78x1.41x.8 | PC 2x4-40 | 403-2007 |

### COMBINATION INPUT SCOTT T TRANSFORMERS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 11.8 2 channel | 5.0 | 20 | 30 | 1.0 | 50 | 45 | 2x1x.8 | PC 2x4-40 | 403-2042 |
| 11.8 3 channel | 3.2 | 300 | 45 | .5 | 50 | 20 | 2.94x1.06x.8 | PC 2x4-40 | 403-2048 |

### COMBINATION SCOTT T / RESOLVER ISOLATION

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Scott T 11.8 OR Resolver 26 | 6.0 | 20 | 30 | 1.0 | 35 | 20 | 2x1x.6 | PC 2x4-40 | 403-2070 |
| | 6.0 | 20 | 30 | 1.0 | 300 | 20 | | | |

### OUTPUT SCOTT T TRANSFORMERS (RESOLVER TO SYNCHRO)

| Output V rms | Input V rms L-L | Load Ω L-L | Trans. Accuracy Arc. Min. | Output Quadrature Null mV | Z in K Ω | Z out Ω | Dimensions L x W x H | Mount | Part Number |
|---|---|---|---|---|---|---|---|---|---|
| 11.8 | 4.7 | 150 | 1 | 15 | .25 | 7 | 2.78x1.41x.8 | PC 2x4-40 | 403-2027 |
| | 6 | 150 | 2 | 8 | .5 | 8 | 2.78x1.41x.61 | PC 2x4-40 | 403-2071 |
| | 5 F.B. 2.5 | 100 | 3 | 8 | .35 | 8 | 2.78x1.41x.61 | PC 2x4-40 | 403-2075 |
| | 11.8 F.B. 6 CT | 25 | 6 | 12 | .8 | 2 | 2.78x1.41x.61 | PC 2x4-40 | 403-2056 |
| 90 | 7 F.B. 2.8 | 6000 | 1.5 | 50 | 3.0 | 600 | 2x1x1.1 | PC 2x4-40 | 403-2077 |
| | | 6000 | 1.5 | 80 | 3.0 | 500 | 2.3x1.3x1 | PC 4x4-40 | 403-2176 |

F.B. = Feedback winding.

### RESOLVER ISOLATION TRANSFORMERS

| Output V rms L-L | Input V rms L-L | Load K Ω L-L | Trans. Accuracy Arc. Sec. | Output Quadrature Null mV | Z in K Ω | Z out Ω | Dimensions L x W x H | Mount | Part Number |
|---|---|---|---|---|---|---|---|---|---|
| 7 | 7 (5 KHz) | 10 | .5 | 2 | 50 | 25 | 2x1x.6 | PC 2x4-40 | 403-2072 |
| 9 CT | 11.8 | 25 to CT | .3 | 1 | 80 | 50 to CT | 1.63x.81x.5 | PC | 403-2063 |
| 11.1 | 6 | .4 | 2 | 36 | 6 | 14 | 2.5x1.25x.65 | PC 2x4-40 | 403-2003 |
| 26 | 6 | 6 | 3 | 36 | .2 | 10 | 2.78x1.41x.61 | PC 2x4-40 | 403-2073 |

### PRECISION REFERENCE ISOLATION TRANSFORMERS

| Output V rms | Input V rms | Load K Ω | Trans. Accuracy % | Output Quadrature Null mV | Z in K Ω | Z out Ω | Dimensions L x W x H | Mount | Part Number |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 115 | 90 | .05 | 2.5 | 40 | .7 | 1.5x1.5x.75 | PC 1x6-32 | 403-2061 |
| | 26 | | | 5 | 4.5 | | | | |
| | 115 | 10 | .1 | 1.3 | 180 | 2.75 | .814x.814x.5 | PC | 403-2166 |
| 5 | 26 | .4 | .1 | 1 | 100 | 5.5 | 1x1x.58 | PC | 403-2026 |
| | | 20 | 2 | 6* | 100 | 30 | .813x.813x.5 | PC | 403-2189 |
| 6 | 26 | 10 | .01 | 2.5 | 70 | 15 | 1x1x.58 | PC | 403-2040 |
| | | | .02 | 2.5 | 70 | 15 | 1x1x.58 | PC | 403-2041 |
| 6 CT | 26 | 45 to CT | .1 | 1.5 | 100 | 4 to CT | 1.25x1.25x.5 | PC | 403-2015 |
| 20 | 20 | 5 | .2 | 2 | 50 | 140 | 1x1x.5 | PC | 403-2062 |
| 30 | 7.5 | 50 | .2 | 200 | .5 | 225 | .88x.88x.88 | 2x2-56 | 403-2047 |

Operating Temperature Range −55°C to +125°C.
Frequencies 400 Hz except as otherwise stated.

Manufactured in accordance with MIL-T-27 Grade 5.
Specified transformation accuracies are with stated load.

**For information on price, delivery and other standard or custom designed transformers call or write**
**THE PERKIN-ELMER CORPORATION** • ELECTRONIC PRODUCTS DEPT. • Main Avenue, Norwalk, Connecticut 06856 • Telephone (203) 762-6574 or 762-4786
Contact us about our **VERNISTAT® a.c. Potentiometers, Adjustable Function Generators and Digital Converters.**

# PICO Catalog Contents

19 PAGES OF MINIATURIZED TRANSFORMERS OPERATING OVER THE FREQUENCY RANGE OF 20 Hz TO 250 KHz, WITH PULSE TRANSFORMERS OPERATING TO 32MHz.

AUDIO TRANSFORMERS ARE ARRANGED ACCORDING TO SIZE WITH 1/4" X 1/4" (400 Hz-250 KHz) SHOWN FIRST, AND THE 3/4" X 13/16" (20 Hz-25 KHz) SHOWN LAST.

PULSE TRANSFORMERS .05μSEC TO 100μSEC WITH MINIATURIZED PLUG-IN CONSTRUCTION.

400 Hz POWER TRANSFORMERS. PRIMARY VOLTAGES OF 115V OR 26V. PLUG-IN CONSTRUCTION. ULTRA-MINIATURE SIZE.

LISTING OF TRANSFORMERS INTERCHANGEABLE WITH UNITS MADE BY UTC/TRW. D1-T, D0-T, 1-D1-T, 1-D0-T.


| Description | Page |
|---|---|
| 1/4" X 1/4"; 3.2 OHM TO 30K OHM; 400 Hz TO 250 KHz 100 MILLIWATT AT 1 KHz | 4369 |
| .35" X .36"; 3 OHM TO 40K OHM; 400 Hz TO 100 KHz 600 MILLIWATT AT 1 KHz | 4370 4371 |
| .35" X .5"; 3 OHM TO 250K OHM; 300 Hz TO 100 KHz 600 MILLIWATT AT 1 KHz | 4372 4373 |
| .5" X .35"; 2 OHM TO 100K OHM; 300 Hz TO 75 KHz 600 MILLIWATT AT 1 KHz | 4374 4375 |
| .5" X .5"; 2 OHM TO 250K OHM; 150 Hz TO 75 KHz 1 WATT AT 1 KHz | 4376 4377 |
| .75" X .375"; 2 OHM TO 135K OHM; 75 Hz TO 30 KHz 1.5 WATT AT 1 KHz | 4378 4379 |
| .75" X .52"; 2 OHM TO 135 OHM; 50 Hz TO 30KHz 2 WATT AT 1 KHz | 4380 4381 |
| .75" X .82"; 2 OHM TO 80K OHM; 20 Hz TO 25 KHz 3 WATT AT 1 KHz | 4382 4383 |
| PULSE TRANSFORMERS .05μSEC TO 100μSEC WITH MINIATURIZED PLUG-IN CONSTRUCTION. | 4384 4385 |
| 400 Hz POWER TRANSFORMERS. PRIMARY VOLTAGES OF 115V OR 26V. PLUG-IN CONSTRUCTION. ULTRA-MINIATURE SIZE. | 4386 |
| LISTING OF TRANSFORMERS INTERCHANGEABLE WITH UNITS MADE BY UTC/TRW. D1-T, D0-T, 1-D1-T, 1-D0-T. | 4387 |



Delivery— stock to one week

*For immediate engineering assistance or to place an order—* ***Call Toll Free 800-431-1064***

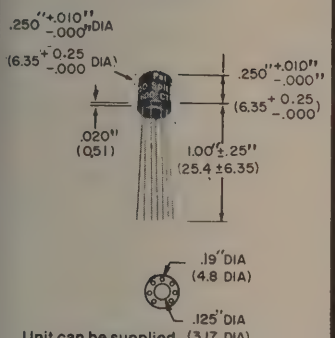
**PICO Electronics, Inc.**

P.O. Box 1206, Mt. Vernon, New York 10551 • phone 914-699-5514

# PICO's ultra-miniature AUDIO transformers

1/4" x 1/4"

## F SERIES
### Plug-In

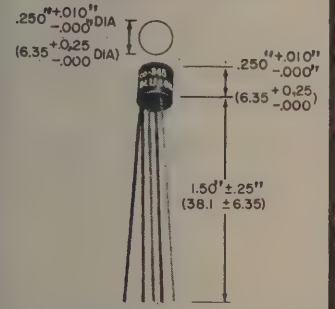






Unit can be supplied without barrier

## G SERIES
### Insulated Leads




Dimensions are in inches (MM)

**Send for new 68 page Pico Catalog**

| PART NUMBER | | | SECONDARY IMPEDANCE OHMS SPLIT WINDINGS | | POWER MILLI-WATTS | PRIMARY UNBALANCED DC CURRENT | PRIMARY DC RESISTANCE | SECONDARY DC RESISTANCE OHMS | | TURNS RATIO PRIM/SEC | | PRICES 1-9 * | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F-Series Plug-In | G-Series Insulated Leads | PRIMARY IMPEDANCE OHMS | SER | PAR | 1KHz | ma | OHMS | SER CONN | PAR CONN | SEC SER CONN | SEC PAR CONN | F-Series | G-Series |
| F-5701 | G-6001 | 20 ct | 20 ct | 5 | 100 | 8 | 2.4 | 3 | .75 | 1:1 | 2:1 | 10.89 | 10.35 |
| F-5703 | G-6003 | 40 ct | 40 ct | 10 | 100 | 5.6 | 4.8 | 6 | 1.5 | 1:1 | 2:1 | 10.80 | 10.35 |
| F-5705 | G-6005 | 50 | 50 | - | 100 | 5 | 7.5 | 9 | - | 1:1 | - | 9.90 | 9.43 |
| F-5707 | G-6007 | 80 ct | 32 ct | 8 | 100 | 5 | 10 | 4.8 | 1.2 | 1.58:1 | 3.16:1 | 10.80 | 9.43 |
| F-5710 | G-6010 | 100 | 100 | - | 100 | 5 | 15 | 18 | - | 1:1 | - | 9.90 | 9.43 |
| F-5715 | G-6015 | 120 ct | 3.2 | - | 100 | 4.5 | 15 | .75 | - | 6.12:1 | - | 9.90 | 9.43 |
| F-5717 | G-6017 | 120 ct | 60 ct | 15 | 100 | 4.5 | 15 | 9 | 2.3 | 1.41:1 | 2.83:1 | 11.83 | 9.43 |
| F-5718 | G-6018 | 120 ct | 120 ct | 30 | 100 | 4.5 | 15 | 18 | 4.5 | 1:1 | 2:1 | 11.83 | 11.23 |
| F-5720 | G-6020 | 150 ct | 12 ct | 3 | 100 | 4 | 20 | 2.4 | .6 | 3.53:1 | 7.07:1 | 10.75 | 10.24 |
| F-5721 | G-6021 | 150 ct | 50 ct | 12.5 | 100 | 4 | 20 | 8.0 | 2 | 1.73:1 | 3.46:1 | 11.83 | 10.24 |
| F-5722 | G-6022 | 150 ct | 100 ct | 25 | 100 | 4 | 20 | 15 | 4 | 1.22:1 | 2.45:1 | 11.83 | 11.23 |
| F-5723 | G-6023 | 300 ct | 48 ct | 12 | 100 | 3 | 40 | 8 | 2 | 2.5:1 | 5:1 | 11.83 | 11.23 |
| F-5724 | G-6024 | 300 ct | 300 ct | 75 | 100 | 3 | 40 | 45 | 11.5 | 1:1 | 2:1 | 11.83 | 11.23 |
| F-5725 | G-6025 | 300 ct | 600 ct | 150 | 100 | 3 | 40 | 90 | 23 | 1:1.41 | 1.41:1 | 10.75 | 10.24 |
| F-5726 | G-6026 | 300 ct | 12.8 ct | 3.2 | 100 | 3 | 40 | 2.4 | .6 | 4.84:1 | 9.68:1 | 12.68 | 12.05 |
| F-5727 | G-6027 | 400 ct | 40 ct | 10 | 100 | 2.5 | 50 | 6 | 1.5 | 3.16:1 | 6.32:1 | 12.68 | 12.05 |
| F-5728 | G-6028 | 400 ct | 120 ct | 30 | 100 | 2.5 | 50 | 18 | 4.5 | 1.83:1 | 3.65:1 | 12.68 | 12.05 |
| F-5729 | G-6029 | 400 ct | 200 ct | 50 | 100 | 2.5 | 50 | 30 | 7.5 | 1.41:1 | 2.83:1 | 12.68 | 12.05 |
| F-5730 | G-6030 | 400 ct | 400 ct | 100 | 100 | 2.5 | 54 | 58 | 15 | 1:1 | 2:1 | 11.53 | 10.98 |
| F-5733 | G-6033 | 400 ct | 4000 ct | 1000 | 100 | 2.5 | 50 | 600 | 150 | 1:3.16 | 1:1.58 | 12.68 | 12.05 |
| F-5735 | G-6035 | 500 ct | 50 ct | 12.5 | 100 | 2 | 62 | 10 | 2.5 | 3.16:1 | 6.32:1 | 11.53 | 10.98 |
| F-5737 | G-6037 | *500 ct | 500 ct | - | 100 | 2 | 62 | 75 | - | 1:1 | - | 12.68 | 12.05 |
| F-5738 | G-6038 | 500 ct | 500 ct | 125 | 100 | 2 | 62 | 75 | 19 | 1:1 | 2:1 | 12.68 | 12.05 |
| F-5740 | G-6040 | 500 | 600 | - | 100 | 2 | 62 | 90 | - | 1:1.1 | - | 10.75 | 10.24 |
| F-5742 | G-6042 | 500 ct | 600 ct | 150 | 100 | 2 | 62 | 90 | 23 | 1.1:1 | 1.83:1 | 12.68 | 12.05 |
| F-5743 | G-6043 | 600 ct | 12.8 ct | 3.2 | 100 | 2 | 70 | 2.4 | .6 | 6.85:1 | 13.7:1 | 12.68 | 12.05 |
| F-5745 | G-6045 | 600 ct | 600 ct | 150 | 100 | 2 | 70 | 90 | 23 | 1:1 | 2:1 | 11.53 | 10.98 |
| F-5746 | G-6046 | *600 ct | 600 ct | - | 100 | 2 | 70 | 90 | - | 1.1 | - | 12.68 | 12.05 |
| F-5748 | G-6048 | 800 ct | 12.8 ct | 3.2 | 100 | 1.5 | 96 | 2.4 | .6 | 7.9:1 | 15.8:1 | 12.68 | 12.05 |
| F-5750 | G-6050 | 900 ct | 600 | - | 100 | 1.5 | 130 | 90 | 23 | 1.23:1 | - | 11.83 | 11.27 |
| F-5752 | G-6052 | 1000 ct | 12.8 ct | 3.2 | 100 | 1.5 | 110 | 2.4 | .6 | 8.84:1 | 17.7:1 | 13.01 | 12.36 |
| F-5753 | G-6053 | 1000 ct | 50 ct | 12.5 | 100 | 1.5 | 110 | 7.5 | 1.9 | 4.47:1 | 8.94:1 | 13.01 | 12.36 |
| F-5755 | G-6055 | 1000 ct | 1000 ct | 250 | 100 | 1.5 | 110 | 140 | 35 | 1:1 | 2:1 | 11.83 | 11.27 |
| F-5756 | G-6056 | 1000 ct | 16,000 ct | 4000 | 50 | 1.5 | 110 | 2000 | 500 | 1:4 | 1:2 | 13.01 | 12.36 |
| F-5757 | G-6057 | 1200 ct | 12.8 ct | 3.2 | 100 | 1.5 | 150 | 2.4 | .6 | 9.68:1 | 19.37:1 | 13.01 | 12.36 |
| F-5758 | G-6058 | 1200 ct | 1200 ct | 300 | 100 | 1.5 | 150 | 180 | 45 | 1:1 | 2:1 | 13.01 | 12.36 |
| F-5759 | G-6059 | 1500 ct | 12 ct | 3 | 100 | 1.2 | 175 | 2.4 | .6 | 11.18:1 | 22.4:1 | 13.01 | 12.36 |
| F-5760 | G-6060 | 1500 ct | 600 ct | 150 | 100 | 1.2 | 175 | 69 | 17 | 1.58:1 | 3.16:1 | 11.83 | 11.27 |
| F-5762 | G-6062 | *1500 ct | 1500 ct | - | 100 | 1.2 | 150 | 225 | - | 1:1 | - | 13.01 | 12.36 |
| F-5763 | G-6063 | 2000 ct | 2000 ct | 500 | 80 | 1 | 200 | 300 | 75 | 1:1 | 2:1 | 13.01 | 12.36 |
| F-5765 | G-6065 | 2000 ct | 8000 ct | 2000 | 80 | 1.0 | 200 | 1000 | 250 | 1:2 | 1:1 | 12.68 | 12.08 |
| F-5766 | G-6066 | 4000 ct | 8000 ct | 2000 | 80 | .5 | 480 | 1200 | 300 | 1:1.41 | 1.41:1 | 13.95 | 13.25 |
| F-5767 | G-6067 | 7500 ct | 50 ct | 12.5 | 80 | .5 | 1000 | 75 | 19 | 12.25:1 | 24.5:1 | 13.95 | 13.25 |
| F-5768 | G-6068 | 8000 ct | 12.8 ct | 3.2 | 80 | .5 | 1000 | 2.4 | .6 | 25:1 | 50:1 | 13.95 | 13.25 |
| F-5769 | G-6069 | 8000 ct | 1200 ct | 300 | 80 | .5 | 1000 | 180 | 45 | 2.58:1 | 5.16:1 | 13.95 | 13.25 |
| F-5770 | G-6070 | 10,000 ct | 500 ct | 125 | 80 | .5 | 1000 | 60 | 15 | 4.47:1 | 8.94:1 | 12.98 | 12.36 |
| F-5772 | G-6072 | 10,000 ct | 12.8 ct | 3.2 | 80 | .5 | 1000 | 2.4 | .6 | 28:1 | 56:1 | 13.95 | 13.25 |
| F-5775 | G-6075 | 10,000 | 500 | - | 80 | .5 | 1000 | 60 | - | 4.47:1 | - | 12.68 | 12.08 |
| F-5780 | G-6080 | 10,000 ct | 1200 ct | 300 | 80 | .5 | 1100 | 160 | 40 | 2.89:1 | 5.77:1 | 12.98 | 12.36 |
| F-5785 | G-6085 | 10,000 | 1200 | - | 80 | .5 | 1100 | 130 | - | 2.89:1 | - | 12.68 | 12.08 |
| F-5787 | G-6087 | 10,000 ct | 1500 ct | 375 | 80 | .5 | 1100 | 200 | 50 | 2.58:1 | 5.16:1 | 13.25 | 13.25 |
| F-5790 | G-6090 | 10,000 ct | 2000 ct | 500 | 80 | .5 | 1100 | 250 | 63 | 2.24:1 | 4.47:1 | 12.98 | 12.36 |
| F-5793 | G-6093 | *10,000 ct | 10,000 ct | - | 80 | .5 | 1000 | 1000 | - | 1:1 | - | 13.95 | 13.25 |
| F-5795 | G-6095 | 10,000 ct | 10,000 ct | - | 80 | .5 | 1100 | 1100 | - | 1:1 | - | 11.83 | 11.27 |
| F-5800 | G-6100 | 10,000 | 10,000 | - | 80 | .5 | 1100 | 1100 | - | 1:1 | - | 11.53 | 10.98 |
| F-5805 | G-6105 | 10,000 ct | 10,000 ct | 2500 | 80 | .5 | 1100 | 1100 | 275 | 1:1 | 2:1 | 12.98 | 12.36 |
| F-5807 | G-6107 | 20,000 ct | 800 ct | 200 | 50 | .5 | 2100 | 120 | 30 | 5:1 | 10:1 | 13.95 | 13.25 |
| F-5808 | G-6108 | 20,000 ct | 1000 ct | 250 | 50 | .5 | 2100 | 130 | 33 | 4.47:1 | 8.94:1 | 13.95 | 13.25 |
| F-5810 | G-6110 | 25,000 ct | 1000 ct | 250 | 50 | .3 | 2100 | 130 | 33 | 5:1 | 10:1 | 13.77 | 13.11 |
| F-5815 | G-6115 | 25,000 | 1000 | - | 50 | .3 | 2100 | 130 | - | 5:1 | - | 12.98 | 12.36 |
| F-5820 | G-6120 | 30,000 ct | 1200 | - | 50 | .3 | 2300 | 180 | - | 5:1 | - | 13.77 | 13.11 |
| F-SHIELD MU-METAL SHIELD .285" d X .265" h (7.24 mm d X 6.73 mm h) SINGLE SHIELD | | | | | | | | | | | | 1.20 | |
| FYY-SHIELD MU-METAL SHIELD .315" d X .275" h (8.0 mm d X 6.99 mm h) DOUBLE SHIELDING | | | | | | | | | | | | 1.20 | |
| G-SHIELD MU-METAL SHIELD .285" d X .335" h (7.24 MM d X 8.51 mm h) SINGLE SHIELD | | | | | | | | | | | | | 1.20 |
| GYY-SHIELD MU-METAL SHIELD .315" d X .40" h (8.00 mm d X 10.16 mm h) FOR DOUBLE SHIELDING | | | | | | | | | | | | | 1.20 |
| GXX-SHIELD MU-METAL SHIELD .35" d X .465" h (8.89 mm d X 11.81 mm h) FOR TRIPLE SHIELDING | | | | | | | | | | | | | 1.20 |

* INCLUDES ELECTROSTATIC SHIELD

SPECIFICATIONS

- MIL-T-27: All Units Are Designed to MIL-T-27 and Are Hermetically Sealed in a Metal Case Transformers are Type TF5R21ZZ.
- FREQUENCY RESPONSE: ±3 db, 400 Hz - 250 KHz at 1.0 milliwatt
- MAXIMUM DISTORTION: 5% With Rated Power Level at 1 KHz
- DIELECTRIC STRENGTH: All Units Tested at 200 V RMS
- INSULATION RESISTANCE: Greater than 10,000 Megohms at 300 V DC
- WEIGHT: 1.1 Grams
- OPERATING TEMPERATURE: -55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c maximum)
- TERMINALS: Solid .012 Diameter Conductor. Conductor is Gold Plated, Nickel-Iron Core Wire (Dumet) in Accordance with MIL-STD-1276 Type D.
- THERMAL SHOCK: 25 Cycles, Method 107C, MIL-STD-202D. Test Condition A-1

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- 5 MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

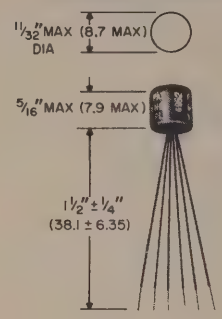
For immediate engineering assistance or to place an order—

**Call Toll Free 800-431-1064**

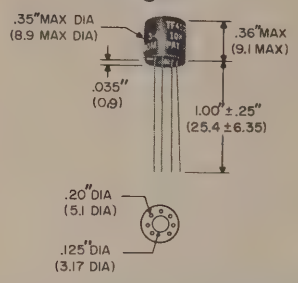
**PICO Electronics, Inc.**
P.O. Box 1206
Mt. Vernon
New York 10551
914-699-5514

# PICO's ultra-miniature transformers

## B SERIES
### Insulated Leads




## C SERIES
### Plug-In




Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27: . . . . . .
  All Units Are Designed to MIL-T-27 and Are Hermetically Sealed in a Metal Case
  **Transformers are Type TF5R21ZZ.**
  **Inductors are TF5R20ZZ.**
- FREQUENCY RESPONSE: . .
  ±3 db, 400 Hz - 100 KHz At 1.0 Milliwatt
- MAXIMUM DISTORTION: . .
  5% With Rated Power Level at 1 KHz
- DIELECTRIC STRENGTH: .
  All Units Tested at 200 V RMS
- INSULATION RESISTANCE .
  Greater than 10,000 Megohms at 300 V DC
- WEIGHT: . . . . . .
  1/15 Ounce
- OPERATING TEMPERATURE:
  -55° c to 105° c (All Units Can Be Supplied to Class S Requirements 130° c maximum)
- TERMINALS: . . . . . .
  Solid .016 Diameter Conductor. Conductor is Gold Plated, Nickel-Iron Core Wire (Dumet) in Accordance with MIL-STD-1276 Type D
- THERMAL SHOCK: . . . . .
  25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

**Send for new 68 page Pico Catalog**

*(All PICO Products are patented)*

| PICO PART NUMBER | | PRIMARY IMPEDANCE OHMS | SECONDARY IMPEDANCE OHMS | POWER MILLIWATTS at 1 KHz | PRIMARY UNBALANCED DC CURRENT ma | PRIMARY DC RESISTANCE OHMS | SECONDARY DC RESISTANCE OHMS | PICO PRICES 1-9 * | |
|---|---|---|---|---|---|---|---|---|---|
| B-Series Insulated Leads | C-Series (Plug-In) | | | | | | | B-Series | C-Series |
| B2020 | C3020 | 40 | 40 | 600 | 15 | 4 | 5 | $ 7.66 | $ 8.04 |
| B2025 | C3025 | 80 ct | 32 split | 600 | 12 | 11.5 | 4 | 9.63 | 10.11 |
| B2030 | C3030 | 120 ct | 3.2 | 600 | 10 | 10 | 0.38 | 7.30 | 7.67 |
| B2035 | C3035 | 120 ct | 60 ct | 600 | 10 | 10 | 6 | 9.63 | 10.11 |
| B2040 | C3040 | 120 ct | 120 ct | 600 | 10 | 11 | 12 | 9.63 | 10.11 |
| B2045 | C3045 | 150 ct | 12 | 600 | 10 | 11 | 1.5 | 7.30 | 7.67 |
| B2050 | C3050 | 150 ct | 50 | 600 | 10 | 15 | 5 | 8.11 | 8.52 |
| B2055 | C3055 | 150 ct | 100 | 600 | 10 | 15 | 10 | 8.11 | 8.52 |
| B2060 | C3060 | 150 ct | 150 ct | 600 | 10 | 14 | 16 | 9.63 | 10.11 |
| B2065 | C3065 | 150 | 600 ct | 600 | 10 | 15 | 60 | 8.11 | 8.52 |
| B2070 | C3070 | 300 ct | 12 | 600 | 7 | 20 | 1.6 | 7.30 | 7.67 |
| B2075 | C3075 | 300 ct | 50 | 600 | 7 | 30 | 5 | 8.11 | 8.52 |
| B2080 | C3080 | 300 ct | 150 | 600 | 7 | 30 | 15 | 8.11 | 8.52 |
| B2085 | C3085 | 300 ct | 300 ct | 600 | 7 | 29 | 31 | 9.63 | 10.11 |
| B2090 | C3090 | 300 ct | 600 | 600 | 7 | 20 | 89 | 7.66 | 8.04 |
| B2091 | C3091 | 300 ct | 600 ct | 600 | 7 | 20 | 89 | 9.63 | 10.11 |
| B2095 | C3095 | 320 ct | 3.2 | 600 | 7 | 20 | 0.38 | 7.30 | 7.67 |
| B2100 | C3100 | 400 | 10 | 600 | 8 | 40 | 1 | 7.66 | 8.04 |
| B2105 | C3105 | 400 ct | 40 split | 600 | 8 | 50 | 6.5 | 9.63 | 10.11 |
| B2110 | C3110 | 400 | 100 | 600 | 8 | 40 | 10 | 7.66 | 8.04 |
| B2115 | C3115 | 400 ct | 120 split | 600 | 8 | 45 | 25 | 9.63 | 10.11 |
| B2120 | C3120 | 400 ct | 200 | 600 | 8 | 40 | 20 | 8.11 | 8.52 |
| B2125 | C3125 | 400 ct | 400 split | 600 | 8 | 50 | 89 | 9.63 | 10.11 |
| B2130 | C3130 | 400 ct | 1000 ct | 600 | 8 | 40 | 100 | 11.06 | 11.61 |
| B2135 | C3135 | 400 ct | 2000 ct | 600 | 8 | 40 | 200 | 11.06 | 11.61 |
| B2140 | C3140 | 400 ct | 4000 ct | 600 | 8 | 45 | 365 | 9.97 | 10.47 |
| B2145 | C3145 | 500 ct | 50 ct | 600 | 3 | 65 | 8.5 | 8.45 | 8.87 |
| B2150 | C3150 | 500 | 50 | 600 | 3 | 65 | 8.5 | 6.90 | 7.25 |
| B2155 | C3155 | *500 | 500 | 600 | 3 | 45 | 55 | 8.45 | 8.87 |
| B2160 | C3160 | 500 ct | 500 ct | 600 | 5.5 | 49 | 52 | 8.45 | 8.87 |
| B2165 | C3165 | 500 ct | 600 | 600 | 5.5 | 32 | 89 | 7.66 | 8.04 |
| B2170 | C3170 | 500 ct | 600 ct | 600 | 5.5 | 32 | 89 | 8.45 | 8.87 |
| B2175 | C3175 | 600 | 3.2 | 600 | 3 | 60 | 0.5 | 6.90 | 7.25 |
| B2180 | C3180 | 600 ct | 12 | 600 | 5 | 43 | 1.5 | 7.66 | 8.04 |
| B2185 | C3185 | 600 ct | 50 | 600 | 5 | 60 | 5 | 7.66 | 8.04 |
| B2190 | C3190 | 640 ct | 3.2 | 600 | 5 | 43 | 0.38 | 7.66 | 8.04 |
| B2195 | C3195 | 700 | 100 | 600 | 5 | 70 | 10 | 7.66 | 8.04 |
| B2200 | C3200 | 800 ct | 3.2 | 600 | 4 | 50 | 0.38 | 7.66 | 8.04 |
| B2205 | C3205 | 800 ct | 12 | 600 | 4 | 50 | 1.5 | 7.66 | 8.04 |
| B2210 | C3210 | 800 ct | 800 | 600 | 4 | 78 | 82 | 8.45 | 8.87 |
| B2215 | C3215 | 900 ct | 600 | 600 | 4 | 53 | 90 | 7.66 | 8.04 |
| B2220 | C3220 | 1000 ct | 12 | 600 | 3.5 | 70 | 1.5 | 7.66 | 8.04 |
| B2225 | C3225 | 1000 ct | 50 ct | 600 | 3 | 110 | 8.5 | 8.45 | 8.87 |
| B2230 | C3230 | 1000 | 50 | 600 | 3 | 110 | 8.5 | 6.90 | 7.25 |
| B2235 | C3235 | 1000 ct | 50 | 600 | 3 | 110 | 8 | 8.45 | 8.87 |
| B2240 | C3240 | 1000 ct | 1000 ct | 600 | 3 | 98 | 105 | 8.45 | 8.87 |
| B2245 | C3245 | 1000 | 4000 split | 600 | 3 | 100 | 425 | 11.06 | 11.61 |
| B2250 | C3250 | 1060 ct | 3.2 | 600 | 3.5 | 70 | 0.38 | 7.66 | 8.04 |
| B2255 | C3255 | 1200 | 3.2 | 600 | 2 | 110 | 0.45 | 6.90 | 7.25 |
| B2260 | C3260 | 1200 | 1200 | 600 | 3 | 110 | 125 | 6.90 | 7.25 |
| B2265 | C3265 | 1500 ct | 12 | 600 | 3 | 105 | 1.5 | 7.66 | 8.04 |
| B2270 | C3270 | 1500 ct | 600 ct | 600 | 3 | 87 | 90 | 6.90 | 7.25 |
| B2275 | C3275 | 1500 ct | 600 | 600 | 3 | 87 | 90 | 7.66 | 8.04 |
| B2285 | C3285 | *1500 | 1500 | 600 | 3 | 140 | 155 | 8.45 | 8.87 |
| B2290 | C3290 | 1600 ct | 3.2 | 600 | 3 | 109 | 0.38 | 7.66 | 8.04 |
| B2295 | C3295 | 2000 ct | 2000 split | 600 | 3 | 180 | 110 | 9.97 | 10.47 |
| B2300 | C3300 | 1000 ct | 16,000 split | 125 | 3.5 | 120 | 1600 | 9.97 | 10.47 |
| B2305 | C3305 | 2000 ct | 8000 split | 125 | 3 | 180 | 440 | 9.97 | 10.47 |
| B2310 | C3310 | 3000 | 3000 | 125 | 3 | 280 | 340 | 8.11 | 8.52 |
| B2315 | C3315 | *4000 ct | 8000 ct | 125 | 2 | 300 | 530 | 9.97 | 10.47 |
| B2320 | C3320 | 7500 ct | 12 | 125 | 1 | 500 | 1.6 | 8.45 | 8.87 |
| B2325 | C3325 | 7500 ct | 50 | 125 | 1 | 750 | 5 | 8.45 | 8.87 |
| B2330 | C3330 | 7500 | 100 | 125 | 1 | 750 | 10 | 8.45 | 8.87 |
| B2335 | C3335 | 7500 | 600 | 125 | 1 | 750 | 60 | 9.42 | 9.89 |
| B2340 | C3340 | 7500 | 2500 | 125 | 1 | 750 | 250 | 9.42 | 9.89 |
| B2345 | C3345 | *7500 | 7500 | 125 | 1 | 725 | 875 | 9.97 | 10.47 |
| B2350 | C3350 | 8000 ct | 3.2 | 125 | 1 | 500 | 0.38 | 8.45 | 8.87 |
| B2355 | C3355 | 8000 | 1000 | 125 | 1 | 800 | 100 | 9.42 | 9.89 |

*Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

* INCLUDES ELECTROSTATIC SHIELD

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

Delivery: Stock to one week

*For immediate engineering assistance or to place an order—* ***Call Toll Free 800-431-1064***

# PICO Electronics, Inc.

P O Box 1206 Mt. Vernon, New York 10551 • phone 914-699-5514

| PICO PART NUMBER | | PRIMARY IMPEDANCE OHMS | SECONDARY IMPEDANCE OHMS | POWER MILLIWATTS at 1 KHz | PRIMARY UNBALANCED DC CURRENT ma | PRIMARY DC RESISTANCE OHMS | SECONDARY DC RESISTANCE OHMS | PICO PRICES 1-9 * | |
|---|---|---|---|---|---|---|---|---|---|
| B-Series Insulated Leads | C-Series (Plug-In) | | | | | | | B-Series | C-Series |
| B2360 | C3360 | *8000 ct | 1200 ct | 125 | 1 | 800 | 120 | 9.97 | 10.47 |
| B2365 | C3365 | *9000 ct | 9000 ct | 125 | 1 | 850 | 950 | 9.97 | 10.47 |
| B2370 | C3370 | 10,000 | 3.2 | 125 | 1 | 790 | 0.6 | 7.66 | 8.04 |
| B2375 | C3375 | 10,000 | 100 | 125 | 1 | 1000 | 10 | 8.45 | 8.87 |
| B2380 | C3380 | 10,000 | 500 ct | 125 | 1 | 850 | 50 | 8.45 | 8.87 |
| B2385 | C3385 | 10,000 ct | 500 ct | 125 | 1 | 870 | 50 | 9.97 | 10.47 |
| B2390 | C3390 | 10,000 | 1000 | 125 | 1 | 1000 | 100 | 8.45 | 8.87 |
| B2395 | C3395 | 10,000 | 1200 ct | 125 | 1 | 850 | 130 | 8.45 | 8.87 |
| B2400 | C3400 | 10,000 ct | 1200 ct | 125 | 1 | 870 | 130 | 9.97 | 10.47 |
| B2405 | C3405 | 10,000 ct | 1500 ct | 125 | 1 | 850 | 115 | 9.22 | 9.68 |
| B2410 | C3410 | 10,000 | 2000 ct | 125 | 1 | 1000 | 200 | 9.42 | 9.89 |
| B2415 | C3415 | 10,000 ct | 2000 split | 125 | 1 | 620 | 220 | 9.97 | 10.47 |
| B2420 | C3420 | 10,000 ct | 2000 ct | 125 | 1 | 870 | 180 | 9.97 | 10.47 |
| B2425 | C3425 | 10,000 | 2000 ct | 125 | 1 | 850 | 180 | 8.45 | 8.87 |
| B2430 | C3430 | 10,000 | 5000 | 125 | 1 | 1000 | 500 | 9.97 | 10.47 |
| B2435 | C3435 | 10,000 | 7500 | 125 | 1 | 1000 | 750 | 9.97 | 10.47 |
| B2440 | C3440 | 10,000 ct | 10,000 ct | 125 | 1 | 970 | 1200 | 9.63 | 10.11 |
| B2445 | C3445 | *10,000 | 10,000 | 125 | 1 | 1000 | 1300 | 9.63 | 10.11 |
| B2450 | C3450 | 15,000 | 10,000 | 60 | 0.75 | 1500 | 1000 | 9.63 | 10.11 |
| B2455 | C3455 | 20,000 | 500 | 60 | 0.5 | 2000 | 50 | 9.63 | 10.11 |
| B2460 | C3460 | 20,000 | 800 | 60 | 0.5 | 800 | 140 | 7.66 | 8.04 |
| B2465 | C3465 | 20,000 ct | 800 ct | 60 | 0.5 | 800 | 140 | 8.81 | 9.25 |
| B2470 | C3470 | 20,000 | 1000 | 60 | 0.5 | 2000 | 100 | 9.63 | 10.11 |
| B2475 | C3475 | 20,000 ct | 1000 split | 60 | 0.5 | 800 | 110 | 11.06 | 11.61 |
| B2480 | C3480 | 20,000 | 5000 | 60 | 0.5 | 2000 | 500 | 9.63 | 10.11 |
| B2485 | C3485 | 20,000 | 10,000 | 60 | 0.5 | 2000 | 1000 | 9.63 | 10.11 |
| B2490 | C3490 | 20,000 | 20,000 | 60 | 0.5 | 2000 | 2300 | 9.63 | 10.11 |
| B2495 | C3495 | 30,000 | 5000 | 60 | 0.25 | 2800 | 500 | 9.97 | 10.47 |
| B2500 | C3500 | 30,000 | 10,000 | 60 | 0.25 | 2800 | 1000 | 9.97 | 10.47 |
| B2505 | C3505 | 30,000 | 30,000 | 60 | 0.25 | 2800 | 3500 | 9.97 | 10.47 |
| B2510 | C3510 | 40,000 ct | 400 split | 60 | 0 | 2800 | 38 | 11.06 | 11.61 |
| B2515 | C3515 | 40,000 | 1000 | 60 | 0 | 2800 | 90 | 11.06 | 11.61 |
| B2520 | C3520 | 40,000 | 2000 | 60 | 0 | 2800 | 200 | 11.06 | 11.61 |
| B2525 | C3525 | 40,000 ct | 4000 ct | 60 | 0 | 2800 | 370 | 11.06 | 11.61 |
| B2530 | C3530 | 40,000 | 10,000 | 60 | 0 | 2800 | 930 | 11.06 | 11.61 |
| B2535 | C3535 | 40,000 | 20,000 | 60 | 0 | 2800 | 2000 | 11.06 | 11.61 |
| B2540 | C3540 | 40,000 | 40,000 | 60 | 0 | 2800 | 3500 | 11.06 | 11.61 |
| B-Shield | C-Shield | MU-METAL SHIELD .37" d X .40" h (9.40 mm d X 10.16 mm h) | | | | | | 1.20 | 1.20 |

# PICO's ultra-miniature transformers

## B SERIES
Insulated Leads

## C SERIES
Plug-In

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS

*(All PICO Products are patented)*

**Send for new 68 page Pico Catalog**

* Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

## INDUCTORS

TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF DC CURRENT, ARE LISTED FOR EACH INDUCTOR. ALL INDUCTORS WITH SPLIT WINDINGS HAVE MEASUREMENTS LISTED FOR BOTH SERIES CONNECTIONS AND PARALLEL CONNECTIONS.

SINGLE WINDINGS

| PICO PART NUMBER | | INDUCTANCE HENRIES | DC CURRENT ma | DC RESISTANCE OHMS | PICO PRICES 1-9 * | |
|---|---|---|---|---|---|---|
| B-Series Insulated Leads | C-Series (Plug-In) | | | | B-Series | C-Series |
| B2570 | C3570 | 0.1<br>.08 | 4<br>10 | 25 | 6.14 | 6.45 |
| B2575 | C3575 | 0.9<br>0.5 | 2<br>6 | 105 | 6.14 | 6.45 |
| B2580 | C3580 | 2.5<br>0.9 | 2<br>4 | 630 | 6.14 | 6.45 |
| B2585 | C3585 | 4.5<br>1.2 | 2<br>4 | 2300 | 7.30 | 7.67 |

SPLIT WINDINGS

| PICO PART NUMBER | | INDUCTANCE HENRIES | DC CURRENT ma | DC RESISTANCE OHMS | PICO PRICES 1-9 * | |
|---|---|---|---|---|---|---|
| B-Series Insulated Leads | C-Series (Plug-In) | | | | B-Series | C-Series |
| B2590 | C3590 | SERIES 0.1<br>.08<br>PARALLEL .025<br>.02 | 4<br>10<br>8<br>20 | 25<br>6.5 | 7.66 | 8.04 |
| B2595 | C3595 | SERIES 0.9<br>0.5<br>PARALLEL 0.23<br>0.13 | 2<br>6<br>4<br>12 | 105<br>26 | 7.66 | 8.04 |
| B2600 | C3600 | SERIES 2.5<br>0.9<br>PARALLEL 0.6<br>0.23 | 2<br>4<br>4<br>8 | 630<br>160 | 7.66 | 8.04 |
| B2605 | C3605 | SERIES 4.5<br>1.2<br>PARALLEL 1.1<br>0.3 | 2<br>4<br>4<br>8 | 2300<br>575 | 8.11 | 8.52 |

* Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

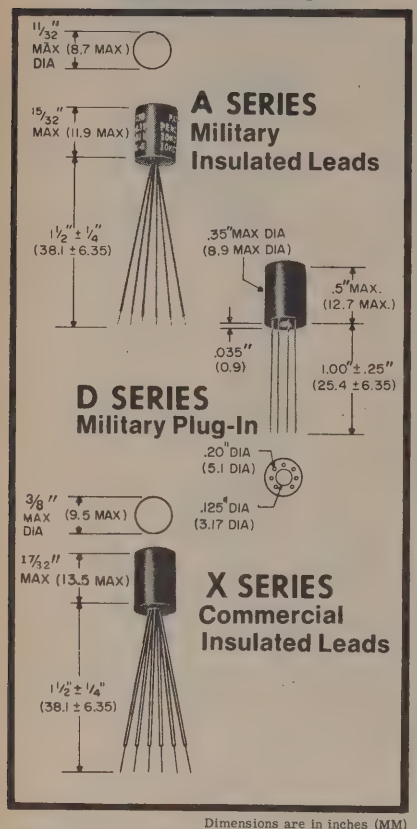
Delivery: Stock to one week

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

# PICO Electronics, Inc.

P.O. Box 1206, Mt. Vernon, New York 10551 • phone 914-699-5514

# PICO's ultra-miniature transformers




Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27 . . . . . .
  All **MILITARY** Units Are Designed to MIL-T-27 and Are Hermetically Sealed in a Metal Case
  Transformers are Type TF5R21ZZ.
  Inductors are TF5R20ZZ.
- FREQUENCY RESPONSE: . . . . .
  ±3 db, 300 Hz - 100 KHz At 1.0 Milliwatt
- MAXIMUM DISTORTION: . . . . .
  5% With Rated Power Level at 1 KHz
- DIELECTRIC STRENGTH: . . . .
  All Units Tested at 200 V RMS
- INSULATION RESISTANCE: . . . .
  Greater than 10,000 Megohms at 300 V DC
- WEIGHT: . . . . . .
  1/10 Ounce
- OPERATING TEMPERATURE: . .
  -55° c to 105° c (All Units Can Be Supplied to Class S Requirements 130° c maximum)
  Commercial Units have maximum operating temperature of +85°C
- TERMINALS: . . . . . .
  Solid .016 Diameter Conductor. Conductor is Gold Plated, Nickel-Iron Core Wire (Dumet) in Accordance with MIL-STD-1276 Type D
- THERMAL SHOCK: . . . . . .
  25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

**Send for new 68 page Pico Catalog**

*(All PICO Products are patented)*

| PICO PART NUMBER | | | PRIMARY IMPEDANCE OHMS | SECONDARY IMPEDANCE OHMS | POWER MILLIWATTS at 1 KHz | PRIMARY UNBALANCED DC CURRENT ma | PRIMARY DC RESISTANCE OHMS | SECONDARY DC RESISTANCE OHMS | PICO PRICES 1-9 * | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A-Series Insulated Leads | D-Series PLUG-IN | X-Series Comm | | | | | | | A-Series | D-Series | X-Series |
| A1020 | D4020 | X10200 | 40 | 40 | 600 | 15 | 4 | 4.8 | $ 7.66 | $ 8.04 | $ 6.23 |
| A1025 | D4025 | X10250 | 80 ct | 32 split | 600 | 12 | 9.8 | 6 | 9.63 | 10.11 | 7.82 |
| A1030 | D4030 | X10300 | 120 ct | 3.2 | 600 | 10 | 10 | 0.46 | 7.30 | 7.67 | 5.94 |
| A1035 | D4035 | X10350 | 120 ct | 60 ct | 600 | 10 | 12 | 6 | 9.63 | 10.11 | 7.82 |
| A1040 | D4040 | X10400 | 120 ct | 120 ct | 600 | 10 | 12 | 16 | 9.63 | 10.11 | 7.82 |
| A1045 | D4045 | X10450 | 150 ct | 12 | 600 | 10 | 11 | 1.5 | 7.30 | 7.67 | 5.94 |
| A1050 | D4050 | X10500 | 150 ct | 50 | 600 | 10 | 15 | 5 | 8.11 | 8.52 | 6.59 |
| A1055 | D4055 | X10550 | 150 ct | 100 | 600 | 10 | 15 | 10 | 8.11 | 8.52 | 6.59 |
| A1060 | D4060 | X10600 | 150 ct | 150 ct | 600 | 10 | 15 | 17 | 9.63 | 10.11 | 7.82 |
| A1065 | D4065 | X10650 | 150 | 600 ct | 600 | 10 | 15 | 60 | 8.11 | 8.52 | 6.59 |
| A1070 | D4070 | X10700 | 300 ct | 12 | 600 | 7 | 20 | 1.6 | 7.30 | 7.67 | 5.94 |
| A1075 | D4075 | X10750 | 300 ct | 50 | 600 | 7 | 30 | 5 | 8.11 | 8.52 | 6.59 |
| A1080 | D4080 | X10800 | 300 ct | 150 | 600 | 7 | 30 | 15 | 8.11 | 8.52 | 6.59 |
| A1085 | D4085 | X10850 | 300 ct | 300 ct | 600 | 7 | 30 | 36 | 9.63 | 10.11 | 7.82 |
| A1090 | D4090 | X10900 | 300 ct | 600 | 600 | 7 | 19 | 89 | 7.66 | 8.04 | 6.23 |
| A1092 | D4092 | X10920 | 300 ct | 600 ct | 600 | 7 | 30 | 60 | 9.63 | 10.11 | 7.82 |
| A1095 | D4095 | X10950 | 320 ct | 3.2 | 600 | 7 | 20 | 0.46 | 7.30 | 7.67 | 5.94 |
| A1100 | D4100 | X11000 | 400 | 10 | 600 | 8 | 40 | 1 | 7.66 | 8.04 | 6.23 |
| A1105 | D4105 | X11050 | 400 ct | 40 split | 600 | 8 | 46 | 8 | 9.63 | 10.11 | 7.82 |
| A1110 | D4110 | X11100 | 400 | 100 | 600 | 8 | 40 | 10 | 7.66 | 8.04 | 6.23 |
| A1115 | D4115 | X11150 | 400 ct | 120 split | 600 | 8 | 46 | 26 | 9.63 | 10.11 | 7.82 |
| A1120 | D4120 | X11200 | 400 ct | 200 | 600 | 8 | 40 | 20 | 8.11 | 8.52 | 6.59 |
| A1125 | D4125 | X11250 | 400 ct | 400 split | 600 | 8 | 46 | 74 | 9.63 | 10.11 | 7.82 |
| A1130 | D4130 | X11300 | 400 ct | 1000 ct | 600 | 8 | 40 | 100 | 11.06 | 11.61 | 9.00 |
| A1135 | D4135 | X11350 | 400 ct | 2000 ct | 600 | 8 | 40 | 200 | 11.06 | 11.61 | 9.00 |
| A1140 | D4140 | X11400 | 400 ct | 4000 ct | 600 | 8 | 45 | 550 | 9.97 | 10.47 | 8.11 |
| A1145 | D4145 | X11450 | 500 ct | 50 ct | 600 | 3 | 50 | 5 | 8.57 | 9.00 | 6.96 |
| A1150 | D4150 | X11500 | 500 | 50 | 600 | 3 | 60 | 8 | 6.90 | 7.25 | 5.61 |
| A1155 | D4155 | X11550 | *500 | 500 | 600 | 3 | 50 | 60 | 8.57 | 9.00 | 6.96 |
| A1160 | D4160 | X11600 | 500 ct | 500 ct | 600 | 3 | 50 | 60 | 8.57 | 9.00 | 6.96 |
| A1165 | D4165 | X11650 | 500 ct | 600 | 600 | 5.5 | 31 | 90 | 7.66 | 8.04 | 6.23 |
| A1170 | D4170 | X11700 | 500 ct | 600 ct | 600 | 5.5 | 50 | 68 | 8.57 | 9.00 | 6.96 |
| A1175 | D4175 | X11750 | 600 | 3.2 | 600 | 3 | 60 | 0.58 | 6.90 | 7.25 | 5.61 |
| A1180 | D4180 | X11800 | 600 ct | 12 | 600 | 5 | 43 | 1.5 | 7.66 | 8.04 | 6.23 |
| A1185 | D4185 | X11850 | 600 ct | 50 | 600 | 5 | 60 | 5 | 7.66 | 8.04 | 6.23 |
| A1190 | D4190 | X11900 | 640 ct | 3.2 | 600 | 5 | 43 | 0.46 | 7.66 | 8.04 | 6.23 |
| A1195 | D4195 | X11950 | 700 | 100 | 600 | 4 | 70 | 10 | 7.66 | 8.04 | 6.23 |
| A1200 | D4200 | X12000 | 800 ct | 3.2 | 600 | 4 | 51 | 0.46 | 7.66 | 8.04 | 6.23 |
| A1205 | D4205 | X12050 | 800 ct | 12 | 600 | 4 | 50 | 1.5 | 7.66 | 8.04 | 6.23 |
| A1210 | D4210 | X12100 | 800 ct | 800 | 600 | 4 | 80 | 80 | 8.57 | 9.00 | 6.96 |
| A1215 | D4215 | X12150 | 900 ct | 600 | 600 | 4 | 52 | 89 | 7.66 | 8.04 | 6.23 |
| A1220 | D4220 | X12200 | 1000 ct | 12 | 600 | 3.5 | 70 | 1.5 | 7.66 | 8.04 | 6.23 |
| A1225 | D4225 | X12250 | 1000 ct | 50 ct | 600 | 3.5 | 100 | 5 | 8.57 | 9.00 | 6.96 |
| A1230 | D4230 | X12300 | 1000 | 50 | 600 | 3 | 110 | 8 | 6.90 | 7.25 | 5.61 |
| A1235 | D4235 | X12350 | 1000 ct | 50 | 600 | 3 | 110 | 8 | 8.57 | 9.00 | 6.96 |
| A1240 | D4240 | X12400 | 1000 ct | 1000 ct | 600 | 3 | 100 | 100 | 8.57 | 9.00 | 6.96 |
| A1245 | D4245 | X12450 | 1000 ct | 4000 split | 600 | 3 | 100 | 400 | 11.06 | 11.61 | 9.00 |
| A1250 | D4250 | X12500 | 1060 ct | 3.2 | 600 | 3.5 | 70 | 0.38 | 7.66 | 8.04 | 6.23 |
| A1255 | D4255 | X12550 | 1200 | 3.2 | 600 | 2 | 100 | 0.5 | 6.90 | 7.25 | 5.61 |
| A1260 | D4260 | X12600 | 1200 | 1200 | 600 | 2 | 120 | 120 | 6.90 | 7.25 | 5.61 |
| A1265 | D4265 | X12650 | 1500 ct | 12 | 600 | 3 | 105 | 1.5 | 7.66 | 8.04 | 6.23 |
| A1270 | D4270 | X12700 | *1500 ct | 600 ct | 600 | 3 | 150 | 60 | 11.06 | 11.61 | 9.00 |
| A1275 | D4275 | X12750 | 1500 ct | 600 | 600 | 3 | 85 | 89 | 7.66 | 8.04 | 6.23 |
| A1280 | D4280 | X12800 | 1500 ct | 600 ct | 600 | 3 | 150 | 60 | 8.57 | 9.00 | 6.96 |
| A1285 | D4285 | X12850 | *1500 | 1500 | 600 | 3 | 150 | 150 | 8.57 | 9.00 | 6.96 |
| A1290 | D4290 | X12900 | 1600 ct | 3.2 | 600 | 3 | 109 | 0.46 | 7.66 | 8.04 | 6.23 |
| A1295 | D4295 | X12950 | 2000 ct | 2000 split | 600 | 3 | 195 | 125 | 9.97 | 10.47 | 8.11 |
| A1300 | D4300 | X13000 | 1000 ct | 16,000 split | 125 | 3.5 | 120 | 940 | 9.97 | 10.47 | 8.11 |
| A1305 | D4305 | X13050 | 2000 ct | 8000 split | 125 | 3 | 195 | 450 | 9.97 | 10.47 | 8.11 |
| A1310 | D4310 | X13100 | 3000 | 3000 | 125 | 2 | 300 | 300 | 8.04 | 8.44 | 6.53 |
| A1315 | D4315 | X13150 | *4000 ct | 8000 ct | 125 | 2 | 320 | 590 | 9.97 | 10.47 | 8.11 |
| A1320 | D4320 | X13200 | 7500 ct | 12 | 125 | 1 | 500 | 1.6 | 8.04 | 8.44 | 6.53 |
| A1325 | D4325 | X13250 | 7500 ct | 50 | 125 | 1 | 750 | 5 | 8.57 | 9.00 | 6.96 |
| A1330 | D4330 | X13300 | 7500 | 100 | 125 | 1 | 750 | 10 | 8.57 | 9.00 | 6.96 |
| A1335 | D4335 | X13350 | 7500 | 600 | 125 | 1 | 750 | 60 | 9.42 | 9.89 | 7.66 |
| A1340 | D4340 | X13400 | 7500 | 2500 | 125 | 1 | 750 | 250 | 9.42 | 9.89 | 7.66 |
| A1345 | D4345 | X13450 | *7500 ct | 7500 ct | 125 | 1 | 750 | 750 | 11.06 | 11.61 | 9.00 |
| A1350 | D4350 | X13500 | 8000 ct | 3.2 | 125 | 1 | 500 | 0.38 | 8.04 | 8.44 | 6.53 |

*Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

Delivery— stock to one week

*For immediate engineering assistance or to place an order—* ***Call Toll Free 800-431-1064***

# PICO Electronics, Inc.

P.O. Box 1206, Mt. Vernon, New York 10551 • phone 914-699-5514

| PICO PART NUMBER | | | PRIMARY IMPEDANCE OHMS | SECONDARY IMPEDANCE OHMS | POWER MILLIWATTS at 1 KHz | PRIMARY UNBALANCED DC CURRENT | PRIMARY DC RESISTANCE OHMS | SECONDARY DC RESISTANCE OHMS | PICO PRICES 1-9 * | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A-Series Insulated Leads | D-Series Plug-In | X-Series Comm | | | | | | | A-Series | D-Series | X-Series |
| A1355 | D4355 | X13550 | 8000 | 1000 | 125 | 1 | 800 | 100 | 9.42 | 9.89 | 7.66 |
| A1360 | D4360 | X13600 | *8000 ct | 1200 ct | 125 | 1 | 640 | 115 | 9.97 | 10.47 | 8.11 |
| A1365 | D4365 | X13650 | *9000 ct | 9000 ct | 125 | 1 | 850 | 1080 | 10.38 | 10.90 | 8.45 |
| A1370 | D4370 | X13700 | 10,000 | 3.2 | 125 | 1 | 790 | 0.6 | 7.66 | 8.04 | 6.23 |
| A1375 | D4375 | X13750 | 10,000 | 100 | 125 | 1 | 1000 | 10 | 8.45 | 8.87 | 6.88 |
| A1380 | D4380 | X13800 | 10,000 | 500 ct | 125 | 1 | 780 | 50 | 8.45 | 8.87 | 6.88 |
| A1385 | D4385 | X13850 | 10,000 ct | 500 ct | 125 | 1 | 1000 | 50 | 10.24 | 10.75 | 8.33 |
| A1390 | D4390 | X13900 | 10,000 | 1000 | 125 | 1 | 1000 | 100 | 8.45 | 8.87 | 6.88 |
| A1395 | D4395 | X13950 | 10,000 | 1200 ct | 125 | 1 | 780 | 110 | 8.45 | 8.87 | 6.88 |
| A1400 | D4400 | X14000 | 10,000 ct | 1200 ct | 125 | 1 | 1000 | 120 | 10.24 | 10.75 | 8.33 |
| A1405 | D4405 | X14050 | 10,000 ct | 1500 ct | 125 | 1 | 780 | 125 | 9.22 | 9.68 | 7.50 |
| A1410 | D4410 | X14100 | 10,000 | 2000 ct | 125 | 1 | 1000 | 200 | 9.42 | 9.68 | 7.66 |
| A1415 | D4415 | X14150 | 10,000 ct | 2000 split | 125 | 1 | 550 | 225 | 9.97 | 10.47 | 8.11 |
| A1420 | D4420 | X14200 | 10,000 ct | 2000 ct | 125 | 1 | 1000 | 200 | 10.24 | 10.75 | 8.33 |
| A1425 | D4425 | X14250 | 10,000 | 2000 ct | 125 | 1 | 780 | 190 | 8.45 | 8.87 | 6.88 |
| A1430 | D4430 | X14300 | 10,000 | 5000 | 125 | 1 | 1000 | 500 | 9.87 | 10.36 | 8.02 |
| A1435 | D4435 | X14350 | 10,000 | 7500 | 125 | 1 | 1000 | 750 | 9.87 | 10.36 | 8.02 |
| A1440 | D4440 | X14400 | 10,000 ct | 10,000 ct | 125 | 1 | 975 | 1175 | 9.63 | 10.11 | 7.82 |
| A1445 | D4445 | X14450 | *10,000 | 10,000 | 125 | 1 | 1000 | 1000 | 10.74 | 11.28 | 8.73 |
| A1450 | D4450 | X14500 | 15,000 | 10,000 | 60 | 0.5 | 1500 | 1000 | 10.74 | 11.28 | 8.73 |
| A1455 | D4455 | X14550 | 20,000 | 500 | 60 | 0.5 | 1600 | 60 | 9.63 | 10.11 | 7.82 |
| A1460 | D4460 | X14600 | 20,000 | 800 | 60 | 0.5 | 825 | 110 | 7.66 | 8.04 | 6.23 |
| A1465 | D4465 | X14650 | 20,000 ct | 800 ct | 60 | 0.5 | 830 | 110 | 8.81 | 9.25 | 7.16 |
| A1470 | D4470 | X14700 | 20,000 | 1000 | 60 | 0.5 | 1600 | 130 | 9.63 | 10.11 | 7.82 |
| A1475 | D4475 | X14750 | 20,000 ct | 1000 split | 60 | 0.5 | 800 | 110 | 9.97 | 10.47 | 8.11 |
| A1480 | D4480 | X14800 | 20,000 | 5000 | 60 | 0.5 | 1600 | 550 | 9.63 | 10.11 | 7.82 |
| A1485 | D4485 | X14850 | 20,000 | 10,000 | 60 | 0.5 | 1600 | 1100 | 9.63 | 10.11 | 7.82 |
| A1490 | D4490 | X14900 | 20,000 | 20,000 | 60 | 0.5 | 1600 | 1850 | 9.63 | 10.11 | 7.82 |
| A1495 | D4495 | X14950 | 30,000 | 5000 | 60 | 0.5 | 1700 | 500 | 10.74 | 11.28 | 8.73 |
| A1500 | D4500 | X15000 | 30,000 | 10,000 | 60 | 0.5 | 1700 | 1000 | 10.74 | 11.28 | 8.73 |
| A1505 | D4505 | X15050 | 30,000 | 30,000 | 60 | 0.25 | 1700 | 2000 | 10.74 | 11.28 | 8.73 |
| A1510 | D4510 | X15100 | 40,000 ct | 400 split | 60 | 0.25 | 1700 | 60 | 10.74 | 11.28 | 8.73 |
| A1515 | D4515 | X15150 | 40,000 | 1000 | 60 | 0.25 | 1700 | 115 | 10.74 | 11.28 | 8.73 |
| A1520 | D4520 | X15200 | 40,000 | 2000 | 60 | 0.25 | 1700 | 225 | 10.74 | 11.28 | 8.73 |
| A1525 | D4525 | X15250 | 40,000 ct | 4000 ct | 60 | 0.25 | 1700 | 450 | 11.13 | 11.69 | 9.05 |
| A1530 | D4530 | X15300 | 40,000 | 10,000 | 60 | 0.25 | 1700 | 1200 | 10.74 | 11.28 | 8.73 |
| A1535 | D4535 | X15350 | 40,000 | 20,000 | 60 | 0.25 | 1700 | 2300 | 10.74 | 11.28 | 8.73 |
| A1540 | D4540 | X15400 | 40,000 | 40,000 | 60 | 0.25 | 1700 | 2000 | 10.74 | 11.28 | 8.73 |
| A1545 | D4545 | X15450 | d 100,000 | 100 | 30 | 0 | 7900 | 17 | 12.31 | 12.93 | 10.01 |
| A1550 | D4550 | X15500 | *d100,000 ct | 500 ct | 30 | 0 | 7900 | 85 | 12.31 | 12.93 | 10.01 |
| A1555 | D4555 | X15550 | d 100,000 | 10,000 | 30 | 0 | 7900 | 1700 | 11.85 | 12.44 | 9.64 |
| A1560 | D4560 | X15600 | d 200,000 | 1000 | 30 | 0 | 8500 | 100 | 11.85 | 12.44 | 9.64 |
| A1565 | D4565 | X15650 | d 200,000 ct | 1000 ct | 30 | 0 | 8500 | 100 | 12.59 | 13.22 | 10.24 |
| A1570 | D4570 | X15700 | d 200,000 | 10,000 | 30 | 0 | 8500 | 1000 | 14.03 | 14.73 | 11.41 |
| A1575 | D4575 | X15750 | d 200,000 ct | 20,000 | 30 | 0 | 8500 | 2900 | 14.03 | 14.73 | 11.41 |
| A1580 | D4580 | X15800 | d 250,000 | 1000 | 30 | 0 | 10,000 | 125 | 14.03 | 14.73 | 11.41 |
| A-SHIELD | D-SHIELD | | Magnetic shield—mu metal case .37" d X .56" h (single) | | | | | | 1.20 | 1.20 | |
| AYY-SHIELD | DYY-SHIELD | | Magnetic shield—mu metal case .395" d X .64" h (double) | | | | | | 1.20 | 1.20 | |

* INCLUDES ELECTROSTATIC SHIELD  d RESPONSE AT 100 KHz NOT WITHIN 3db

*Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

## INDUCTORS

TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF DC CURRENT, ARE LISTED FOR EACH INDUCTOR. ALL INDUCTORS WITH SPLIT WINDINGS HAVE MEASUREMENTS LISTED FOR BOTH SERIES CONNECTIONS AND PARALLEL CONNECTIONS.

SINGLE WINDINGS

| PICO PART NUMBER | | | INDUCTANCE HENRIES | DC CURRENT ma | DC RESISTANCE OHMS | PICO PRICES 1-9 * | | |
|---|---|---|---|---|---|---|---|---|
| A-Series | D-Series | X-Series | | | | A | D | X |
| A1820 | D4700 | X18200 | .075<br>.018 | 10<br>20 | 10.5 | 6.14 | 6.45 | 4.99 |
| A1830 | D4705 | X18300 | 0.3<br>0.15 | 4<br>20 | 25 | 6.14 | 6.45 | 4.99 |
| A1840 | D4710 | X18400 | 1.25<br>0.5 | 2<br>11 | 100 | 6.20 | 6.51 | 5.04 |
| A1850 | D4715 | X18500 | 3.5<br>1.0 | 2<br>5 | 560 | 6.14 | 6.45 | 4.99 |
| A1860 | D4720 | X18600 | 6.0<br>1.5 | 2<br>5 | 2100 | 7.30 | 7.67 | 5.94 |
| A1870 | D4725 | X18700 | 20.0<br>8.0 | 1<br>3 | 5100 | 9.22 | 9.68 | 7.51 |

SPLIT WINDINGS

| PICO PART NUMBER | | | INDUCTANCE HENRIES | DC CURRENT ma * | DC RESISTANCE OHMS | PICO PRICES 1-9 * | | |
|---|---|---|---|---|---|---|---|---|
| A Series | D Series | X Series | | | | A | D | X |
| A1880 | D4730 | X18800 | SERIES .075<br>.06<br>PARALLEL .018<br>.015 | 10<br>30<br>20<br>60 | 10.5<br>2.6 | 7.30 | 7.67 | 5.94 |
| A1890 | D4735 | X18900 | SERIES 0.3<br>0.15<br>PARALLEL .075<br>.04 | 4<br>20<br>8<br>40 | 25<br>6.2 | 8.11 | 8.52 | 6.59 |
| A1900 | D4740 | X19000 | SERIES 3.5<br>1.0<br>PARALLEL 0.9<br>0.25 | 2<br>5<br>4<br>10 | 560<br>140 | 8.11 | 8.52 | 6.59 |
| A1910 | D4745 | X19100 | SERIES 6.0<br>1.5<br>PARALLEL 1.5<br>0.38 | 2<br>5<br>4<br>10 | 2100<br>525 | 8.11 | 8.52 | 6.59 |
| A1920 | D4750 | X19200 | SERIES 20<br>8<br>PARALLEL 5<br>2 | 1<br>3<br>2<br>6 | 5100<br>1275 | 9.97 | 1047 | 8.11 |

# PICO's ultra-miniature transformers

## A SERIES
### Military Insulated Leads
## D SERIES Military Plug-In
## X SERIES
### Commercial Insulated Leads

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS

POWER TRANSFORMERS (FREQ. 380 1000 Hz)

| PICO PART NUMBER | | | PRIMARY VOLTAGE (VOLTS) | SECONDARY VOLTAGE (VOLTS) | SECONDARY CURRENT MILLIAMPS | PICO PRICES 1-9 * | | |
|---|---|---|---|---|---|---|---|---|
| A Series | D Series | X Series | | | | A | D | X |
| A1705 | D4605 | X17050 | 28 | 6.3<br>6.3 | 30<br>30 | 9.97 | 10.47 | 8.11 |
| A1710 | D4610 | X17100 | 28 | 6.3 | 60 | 8.45 | 8.87 | 6.88 |
| A1715 | D4615 | X17150 | *28 | 28 | 10 | 9.97 | 10.47 | 8.11 |
| A1720 | D4620 | X17200 | *115 | 115 | 2 | 11.06 | 11.61 | 9.00 |
| A1725 | D4625 | X17250 | 115 | 57.5 | 4 | 11.06 | 11.61 | 9.00 |
| A1730 | D4630 | X17300 | 115 | 6.3 | 40 | 11.06 | 11.61 | 9.00 |

**Send for new 68 page Pico Catalog**

*(All PICO Products are patented)*

Delivery—stock to one week

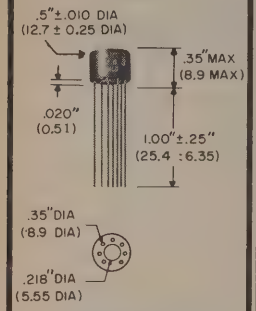
*For immediate engineering assistance or to place an order—* ***Call Toll Free 800-431-1064***

# PICO Electronics, Inc.

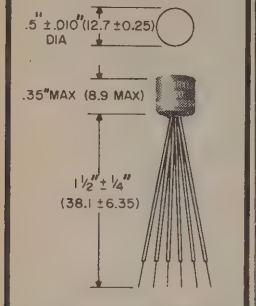
P.O. Box 1206, Mt. Vernon, New York 10551 • phone 914-699-5514

# PICO's ultra-miniature transformers

## L SERIES Plug-In




## P SERIES Insulated Leads




Dimensions are in inches (MM)

| PICO PART NUMBER | | | SECONDARY IMPEDANCE OHMS SPLIT WINDINGS | | POWER WATTS | | | PRIMARY UNBALANCED DC CURRENT | PRIMARY DC RESISTANCE | SECONDARY DC RESISTANCE OHMS | | TURNS RATIO PRIM/SEC | | PICO PRICES 1-9* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L-Series Plug-in | P-Series Insulated Leads | PRIMARY IMPEDANCE OHMS | SER | PAR | 1KHz and HIGHER | 400 Hz | 300 Hz | ma | OHMS | SER CONN | PAR CONN | SEC SER CONN | SEC PAR CONN | L-Series | P-Series |
| L-8203 | P-9203 | 20 ct | 8 ct | 2 | .6 | .3 | .16 | 30.0 | 2 | 1.2 | .3 | 1.58:1 | 3.16:1 | 9.97 | 9.63 |
| L-8205 | P-9205 | 20 ct | 20 ct | 5 | .6 | .3 | .16 | 30.0 | 2 | 2.8 | .7 | 1:1 | 2:1 | 9.97 | 9.63 |
| L-8210 | P-9210 | 32 ct | 32 ct | 8 | .6 | .3 | .16 | 23.0 | 3.3 | 4.5 | 1.13 | 1:1 | 2:1 | 9.97 | 9.63 |
| L-8215 | P-9215 | 40 ct | 40 ct | 10 | .6 | .3 | .16 | 21.0 | 3.7 | 5 | 1.25 | 1:1 | 2:1 | 9.97 | 9.63 |
| L-8218 | P-9218 | 48 ct | 16 ct | 4 | .6 | .3 | .16 | 19.0 | 3.75 | 3 | .75 | 1.73:1 | 3.46:1 | 9.97 | 9.63 |
| L-8220 | P-9220 | 50 ct | 50 ct | 12.5 | .6 | .2 | .16 | 19.0 | 5 | 7 | 1.75 | 1:1 | 2:1 | 9.97 | 9.63 |
| L-8225 | P-9225 | 80 ct | 32 ct | 8 | .6 | .3 | .16 | 15.0 | 7.5 | 4.3 | 1.13 | 1.58:1 | 3.16:1 | 9.97 | 9.63 |
| L-8228 | P-9228 | 100 ct | 40 ct | 10 | .6 | .3 | .16 | 13.0 | 10.8 | 5 | 1.25 | 1.58:1 | 3.16:1 | 9.97 | 9.63 |
| L-8230 | P-9230 | 100 ct | 100 ct | 25 | .6 | .3 | .16 | 13.0 | 10.8 | 12 | 3 | 1:1 | 2:1 | 9.97 | 9.63 |
| L-8235 | P-9235 | 120 ct | 12.8 ct | 3.2 | .6 | .3 | .16 | 12.0 | 9.3 | 2.2 | .55 | 3.06:1 | 6.12:1 | 9.97 | 9.63 |
| L-8240 | P-9240 | 120 ct | 60 ct | 15 | .6 | .3 | .16 | 12.0 | 9 | 7.2 | 1.8 | 1.41:1 | 2.83:1 | 9.97 | 9.63 |
| L-8245 | P-9245 | 120 ct | 120 ct | 30 | .6 | .3 | .16 | 12.0 | 11.6 | 13 | 3.3 | 1:1 | 2:1 | 9.97 | 9.63 |
| L-8250 | P-9250 | 150 ct | 12 ct | 3 | .6 | .3 | .16 | 11.0 | 11.2 | 2.2 | .55 | 3.54:1 | 7.08:1 | 9.97 | 9.63 |
| L-8255 | P-9255 | 150 ct | 50 ct | 12.5 | .6 | .3 | .16 | 11.0 | 13 | 6.8 | 1.7 | 1.73:1 | 3.46:1 | 9.97 | 9.63 |
| L-8260 | P-9260 | 150 ct | 100 ct | 25 | .6 | .3 | .16 | 11.0 | 13 | 11.8 | 3 | 1.22:1 | 2.45:1 | 9.97 | 9.63 |
| L-8265 | P-9265 | 150 ct | 150 ct | 37.5 | .6 | .3 | .16 | 11.0 | 13 | 18.3 | 4.6 | 1:1 | 2:1 | 9.97 | 9.63 |
| L-8270 | P-9270 | 150 ct | 600 ct | 150 | .6 | .3 | .16 | 11.0 | 13 | 75 | 19 | 1:2 | 1:1 | 9.97 | 9.63 |
| L-8275 | P-9275 | 200 ct | 200 ct | 50 | .6 | .3 | .16 | 10.0 | 19 | 21.3 | 5.4 | 1:1 | 2:1 | 9.97 | 9.63 |
| L-8280 | P-9280 | 300 ct | 12 ct | 3 | .6 | .3 | .16 | 8.0 | 24 | 1.7 | .43 | 5:1 | 10:1 | 9.97 | 9.63 |
| L-8285 | P-9285 | 300 ct | 50 ct | 12.5 | .6 | .3 | .16 | 8.0 | 30 | 6.8 | 1.7 | 2.45:1 | 4.9:1 | 9.97 | 9.63 |
| L-8290 | P-9290 | 300 ct | 150 ct | 37.5 | .6 | .3 | .16 | 8.0 | 30 | 18 | 4.6 | 1.41:1 | 2.83:1 | 9.97 | 9.63 |
| L-8295 | P-9295 | 300 ct | 300 ct | 75 | .6 | .3 | .16 | 8.0 | 30 | 34 | 8.5 | 1:1 | 2:1 | 9.97 | 9.63 |
| L-8300 | P-9300 | 300 ct | 600 ct | 150 | .6 | .3 | .16 | 8.0 | 30 | 60 | 15 | 1:1.41 | 1.41:1 | 9.97 | 9.63 |
| L-8305 | P-9305 | 320 ct | 12.8 ct | 3.2 | .6 | .3 | .16 | 7.5 | 31 | 1.7 | .43 | 5:1 | 10:1 | 9.97 | 9.63 |
| L-8310 | P-9310 | 400 ct | 40 ct | 10 | .6 | .3 | .16 | 7.0 | 41 | 4.5 | 1.13 | 3.16:1 | 6.32:1 | 9.97 | 9.63 |
| L-8315 | P-9315 | 400 ct | 120 ct | 30 | .6 | .3 | .16 | 7.0 | 41 | 12 | 3 | 1.83:1 | 3.65:1 | 9.97 | 9.63 |
| L-8320 | P-9320 | 400 ct | 200 ct | 50 | .6 | .3 | .16 | 7.0 | 41 | 21.3 | 5.4 | 1.41:1 | 2.83:1 | 9.97 | 9.63 |
| L-8325 | P-9325 | 400 ct | 400 ct | 100 | .6 | .3 | .16 | 7.0 | 41 | 37.5 | 9.4 | 1:1 | 2:1 | 9.97 | 9.63 |
| L-8330 | P-9330 | 400 ct | 1000 ct | 250 | .6 | .3 | .16 | 7.0 | 41 | 96 | 24 | 1:1.58 | 1.26:1 | 9.97 | 9.63 |
| L-8335 | P-9335 | 400 ct | 2000 ct | 500 | .6 | .3 | .16 | 7.0 | 41 | 212 | 53 | 1:2.24 | 1:1.12 | 9.97 | 9.63 |
| L-8340 | P-9340 | 400 ct | 4000 ct | 1000 | .6 | .3 | .16 | 7.0 | 41 | 375 | 94 | 1:3.16 | 1:1.58 | 9.97 | 9.63 |
| L-8342 | P-9342 | 500 ct | 12.8 ct | 3.2 | .6 | .3 | .16 | 6.0 | 48 | 1.7 | .43 | 6.25:1 | 12.5:1 | 9.97 | 9.63 |
| L-8344 | P-9344 | 500 ct | 16 ct | 4 | .6 | .3 | .16 | 6.0 | 48 | 1.9 | .5 | 5.6:1 | 11.2:1 | 9.97 | 9.63 |
| L-8345 | P-9345 | 500 ct | 50 ct | 12.5 | .6 | .3 | .16 | 6.0 | 39 | 6.8 | 1.7 | 3.16:1 | 6.32:1 | 9.97 | 9.63 |
| L-8347 | P-9347 | 500 ct | 150 ct | 37.5 | .6 | .3 | .16 | 6.0 | 48 | 18 | 4.6 | 1.83:1 | 3.65:1 | 9.97 | 9.63 |
| L-8350 | P-9350 | 500 ct | 500 ct | 125 | .6 | .3 | .16 | 6.0 | 48 | 54 | - | 1:1 | 2:1 | 9.97 | 9.63 |
| L-8355 | P-9355 | *500 ct | 500 ct | | .6 | .3 | .16 | 6.0 | 48 | 68 | - | 1:1 | - | 10.38 | 9.97 |
| L-8360 | P-9360 | 500 ct | 600 ct | 150 | .6 | .3 | .16 | 6.0 | 48 | 59 | 15 | 1:1.1 | 1.83:1 | 9.97 | 9.63 |
| L-8365 | P-9365 | 600 ct | 12.8 ct | 3.2 | .6 | .3 | .16 | 5.5 | 53 | 1.7 | .43 | 6.85:1 | 13.7:1 | 9.97 | 9.63 |
| L-8367 | P-9367 | 600 ct | 30 ct | 7.5 | .6 | .3 | .16 | 5.5 | 53 | 4.2 | 1.1 | 4.47:1 | 8.94:1 | 9.97 | 9.63 |
| L-8370 | P-9370 | 600 ct | 48 ct | 12 | .6 | .3 | .16 | 5.5 | 53 | 6.8 | 1.7 | 3.54:1 | 7.07:1 | 9.97 | 9.63 |
| L-8375 | P-9375 | 600 ct | 200 ct | 50 | .6 | .3 | .16 | 5.5 | 53 | 21.3 | 5.3 | 1.73:1 | 3.46:1 | 9.97 | 9.63 |
| L-8380 | P-9380 | 600 ct | 600 ct | 150 | .6 | .3 | .16 | 5.5 | 57 | 79 | 20 | 1:1 | 2:1 | 9.97 | 9.63 |
| L-8385 | P-9385 | *600 ct | 600 ct | - | .6 | .3 | .16 | 5.5 | 53 | 75 | - | 1:1 | - | 10.38 | 9.97 |
| L-8387 | P-9387 | 600 ct | 1200 ct | 300 | .6 | .3 | .16 | 5.5 | 53 | 105 | 26 | 1:1.41 | 1.41:1 | 9.97 | 9.63 |
| L-8390 | P-9390 | 640 ct | 12.8 ct | 3.2 | .6 | .3 | .16 | 5.5 | 66 | 1.7 | .43 | 7.07:1 | 14.14:1 | 9.97 | 9.63 |
| L-8395 | P-9395 | 700 ct | 100 ct | 25 | .6 | .3 | .16 | 5.0 | 69 | 12 | 3 | 2.65:1 | 5.29:1 | 9.97 | 9.63 |
| L-8400 | P-9400 | 800 ct | 12.8 ct | 3.2 | .6 | .3 | .16 | 5.0 | 75 | 1.7 | .43 | 7.9:1 | 15.8:1 | 9.97 | 9.63 |
| L-8405 | P-9405 | 800 ct | 48 ct | 12 | .6 | .3 | .16 | 5.0 | 75 | 6.8 | 1.7 | 4.08:1 | 8.16:1 | 9.97 | 9.63 |
| L-8410 | P-9410 | 800 ct | 800 ct | 200 | .6 | .3 | .16 | 5.0 | 75 | 105 | 26 | 1:1 | 2:1 | 9.97 | 9.63 |
| L-8415 | P-9415 | 900 ct | 600 ct | 150 | .6 | .3 | .16 | 4.5 | 79 | 75 | 19 | 1.22:1 | 2.45:1 | 9.97 | 9.63 |
| L-8420 | P-9420 | 1000 ct | 12 ct | 3 | .6 | .3 | .16 | 4.5 | 103 | 1.6 | .4 | 9.13:1 | 18.3:1 | 9.97 | 9.63 |
| L-8425 | P-9425 | 1000 ct | 50 ct | 12.5 | .6 | .3 | .16 | 4.5 | 103 | 6.4 | 1.6 | 4.47:1 | 8.94:1 | 9.97 | 9.63 |
| L-8430 | P-9430 | 1000 ct | 1000 ct | 250 | .6 | .3 | .16 | 4.5 | 103 | 115 | 29 | 1:1 | 2:1 | 9.97 | 9.63 |
| L-8435 | P-9435 | 1060 ct | 12.8 ct | 3.2 | .6 | .3 | .16 | 4.0 | 108 | 1.7 | .43 | 9.1:1 | 18.2:1 | 9.97 | 9.63 |
| L-8440 | P-9440 | 1200 ct | 12.8 ct | 3.2 | .6 | .3 | .16 | 4.0 | 113 | 1.7 | .43 | 9.68:1 | 19.4:1 | 9.97 | 9.63 |
| L-8445 | P-9445 | 1200 ct | 500 ct | 125 | .6 | .3 | .16 | 4.0 | 113 | 54 | 13.5 | 1.55:1 | 3.1:1 | 9.97 | 9.63 |
| L-8450 | P-9450 | 1200 ct | 1200 ct | 300 | .6 | .3 | .16 | 4.0 | 113 | 126 | 31.6 | 1:1 | 2:1 | 9.97 | 9.63 |
| L-8455 | P-9455 | *1200 ct | 1200 ct | - | .6 | .3 | .16 | 4.0 | 111 | 125 | - | 1:1 | - | 10.38 | 9.97 |
| L-8460 | P-9460 | 1500 ct | 12 ct | 3 | .6 | .3 | .16 | 3.5 | 126 | 1.6 | .4 | 11.2:1 | 22.4:1 | 9.97 | 9.63 |
| L-8465 | P-9465 | 1500 ct | 500 ct | 125 | .6 | .3 | .16 | 3.5 | 126 | 68 | 17 | 1.73:1 | 3.46:1 | 9.97 | 9.63 |
| L-8470 | P-9470 | *1500 ct | 600 ct | - | .6 | .3 | .16 | 3.5 | 126 | 94 | - | 1.58:1 | - | 10.38 | 9.97 |
| L-8475 | P-9475 | *1500 ct | 1500 ct | - | .6 | .3 | .16 | 3.5 | 126 | 176 | - | 1:1 | - | 10.38 | 9.97 |
| L-8480 | P-9480 | 1600 ct | 12.8 ct | 3.2 | .6 | .3 | .16 | 3.5 | 130 | 1.7 | .43 | 11.2:1 | 22.4:1 | 9.97 | 9.63 |
| L-8483 | P-9483 | 2000 ct | 8 ct | 2 | .6 | .3 | .16 | 3.0 | 210 | 1.2 | .3 | 15.8:1 | 31.6:1 | 9.97 | 9.63 |
| L-8485 | P-9485 | 2000 ct | 2000 ct | 500 | .6 | .3 | .16 | 3.0 | 198 | 218 | 55 | 1:1 | 2:1 | 9.97 | 9.63 |
| L-8490 | P-9490 | *2000 ct | 2000 ct | - | .6 | .3 | .16 | 3.0 | 198 | 218 | - | 1:1 | - | 9.97 | 9.63 |
| L-8495 | P-9495 | 2000 ct | 8000 ct | 2000 | .6 | .3 | .16 | 3.0 | 198 | 850 | 213 | 1:2 | 1:1 | 9.97 | 9.63 |
| L-8497 | P-9497 | 2500 ct | 2500 ct | 625 | .6 | .3 | .16 | 2.5 | 220 | 305 | 76 | 1:1 | 2:1 | 9.97 | 9.63 |
| L-8500 | P-9500 | 3000 ct | 3000 ct | 750 | .6 | .3 | .16 | 2.5 | 243 | 335 | 84 | 1:1 | 2:1 | 9.97 | 9.63 |

### SPECIFICATIONS

- **MIL-T-27** . . . . . All Units are Designed to MIL-T-27 and are Hermetically Sealed in a Metal Case. Audio Transformers are Type TF5R21ZZ.
- **FREQUENCY RESPONSE:** . . . . ±3db, 300 Hz - 75 KHz At 1.0 Milliwatt
- **MAXIMUM DISTORTION:** . . . . . 5% With Rated Power Level at 1 KHz, 400 Hz and 300 Hz
- **DIELECTRIC STRENGTH:** . . . . All Units Tested at 200 V RMS
- **INSULATION RESISTANCE:** . . . Greater than 10,000 Megohms at 300 V DC
- **WEIGHT:** . . . . . 5 Grams
- **OPERATING TEMPERATURE:** . . -55°C to 105°C (All Units Can Be Supplied to Class S Requirements 130°C maximum)
- **TERMINALS:** . . . . . Solid .016 Diameter Conductor. Conductor is Gold Plated, Nickel-Iron Core Wire (Dumet) in Accordance with MIL-STD-1276 Type D
- **THERMAL SHOCK:** . . . . . 25 Cycles, Method 107C. MIL-STD-202D, Test Condition A-1

*(All PICO Products are patented)*

* Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30% •INCLUDES ELECTROSTATIC SHIELD

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

*For immediate engineering assistance or to place an order—* ***Call Toll Free 800-431-1064***

Delivery— stock to one week

# PICO Electronics, Inc.

P.O. Box 1206, Mt. Vernon, New York 10551 • phone 914-699-5514

| PICO PART NUMBER | | | SECONDARY IMPEDANCE OHMS SPLIT WINDINGS | | POWER WATTS | | | PRIMARY UNBALANCED DC CURRENT | PRIMARY DC RESISTANCE | SECONDARY DC RESISTANCE OHMS | | TURNS RATIO PRIM/SEC | | PICO PRICES 1-9* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L-Series Plug-in | P-Series Insulated Leads | PRIMARY IMPEDANCE OHMS | SER | PAR | 1KHz and HIGHER | 400 Hz | 300 Hz | ma | OHMS | SER CONN | PAR CONN | SEC SER CONN | SEC PAR CONN | L-Series | P-Series |
| L-8505 | P-9505 | *3000 ct | 3000 ct | - | .6 | .3 | .16 | 2.5 | 304 | 335 | - | 1:1 | - | 10.38 | 9.97 |
| L-8510 | P-9510 | 3600 ct | 3600 ct | 900 | .6 | .3 | .16 | 2.5 | 330 | 366 | 92 | 1:1 | 2:1 | 9.97 | 9.63 |
| L-8512 | P-9512 | 4000 ct | 16 ct | 4 | .6 | .3 | .16 | 2.0 | 350 | 3 | .75 | 15.8:1 | 31.6:1 | 9.97 | 9.63 |
| L-8514 | P-9514 | 4000 ct | 600 ct | 150 | .6 | .3 | .16 | 2.0 | 350 | 76 | 19 | 2.58:1 | 5.16:1 | 9.97 | 9.63 |
| L-8515 | P-9515 | 4000 ct | 1000 ct | 250 | .6 | .3 | .16 | 2.0 | 350 | 115 | 29 | 2:1 | 4:1 | 9.97 | 9.63 |
| L-8520 | P-9520 | *4000 ct | 8000 ct | - | .6 | .3 | .16 | 2.0 | 350 | 1062 | - | 1:1.41 | - | 10.38 | 9.97 |
| L-8525 | P-9525 | 5000 ct | 500 ct | 125 | .6 | .3 | .16 | 2.0 | 350 | 67 | 17 | 3.16:1 | 6.32:1 | 9.97 | 9.63 |
| L-8530 | P-9530 | 5000 ct | 5000 ct | 1250 | .6 | .3 | .16 | 2.0 | 390 | 538 | 135 | 1:1 | 2:1 | 9.97 | 9.63 |
| L-8535 | P-9535 | 7500 ct | 50 ct | 12.5 | .6 | .3 | .16 | 1.5 | 600 | 7 | 1.75 | 12.2:1 | 24.5:1 | 11.06 | 10.74 |
| L-8540 | P-9540 | 7500 ct | 100 ct | 25 | .6 | .3 | .16 | 1.5 | 600 | 12 | 3 | 8.66:1 | 17.3:1 | 11.06 | 10.74 |
| L-8545 | P-9545 | 7500 ct | 600 ct | 150 | .6 | .3 | .16 | 1.5 | 600 | 78 | 19.5 | 3.54:1 | 7.07:1 | 11.06 | 10.74 |
| L-8550 | P-9550 | 7500 ct | 2500 ct | 625 | .6 | .3 | .16 | 1.5 | 600 | 305 | 77 | 1.73:1 | 3.46:1 | 11.06 | 10.74 |
| L-8555 | P-9555 | *7500 ct | 7500 ct | - | .6 | .3 | .16 | 1.5 | 750 | 828 | - | 1:1 | - | 11.85 | 11.06 |
| L-8560 | P-9560 | 8000 ct | 12.8 ct | 3.2 | .6 | .3 | .16 | 1.5 | 750 | 1.7 | .43 | 25:1 | 50:1 | 11.06 | 10.74 |
| L-8565 | P-9565 | 8000 ct | 1000 ct | 250 | .6 | .3 | .16 | 1.5 | 750 | 115 | 29 | 2.83:1 | 5.66:1 | 11.06 | 10.74 |
| L-8570 | P-9570 | *8000 ct | 1200 ct | - | .6 | .3 | .16 | 1.5 | 750 | 158 | - | 2.58:1 | - | 11.85 | 11.06 |
| L-8575 | P-9575 | *9000 ct | 9000 ct | - | .6 | .3 | .16 | 1.4 | 796 | 1100 | - | 1:1 | - | 11.85 | 11.06 |
| L-8580 | P-9580 | 10,000 ct | 12.8 ct | 3.2 | .6 | .3 | .16 | 1.4 | 1048 | 1.7 | .43 | 28:1 | 56:1 | 11.06 | 10.74 |
| L-8585 | P-9585 | 10,000 ct | 16 ct | 4 | .6 | .3 | .16 | 1.4 | 1048 | 3 | .75 | 25:1 | 50:1 | 11.06 | 10.74 |
| L-8590 | P-9590 | 10,000 ct | 100 ct | 25 | .6 | .3 | .16 | 1.4 | 839 | 12 | 3 | 10:1 | 20:1 | 11.06 | 10.74 |
| L-8595 | P-9595 | 10,000 ct | 200 ct | 50 | .6 | .3 | .16 | 1.4 | 839 | 27 | 6.7 | 7.07:1 | 14.14:1 | 11.06 | 10.74 |
| L-8600 | P-9600 | 10,000 ct | 500 ct | 125 | .6 | .3 | .16 | 1.4 | 850 | 67 | 17 | 4.47:1 | 8.94:1 | 11.06 | 10.74 |
| L-8605 | P-9605 | 10,000 ct | 600 ct | 150 | .6 | .3 | .16 | 1.4 | 850 | 74 | 18.5 | 4.08:1 | 8.16:1 | 11.06 | 10.74 |
| L-8610 | P-9610 | 10,000 ct | 1000 ct | 250 | .6 | .3 | .16 | 1.4 | 850 | 115 | 29 | 3.16:1 | 6.32:1 | 11.06 | 10.74 |
| L-8615 | P-9615 | 10,000 ct | 1200 ct | 300 | .6 | .3 | .16 | 1.4 | 850 | 158 | 39.5 | 2.89:1 | 5.77:1 | 11.06 | 10.74 |
| L-8620 | P-9620 | 10,000 ct | 1500 ct | 375 | .6 | .3 | .16 | 1.4 | 850 | 177 | 44 | 2.58:1 | 5.16:1 | 11.06 | 10.74 |
| L-8625 | P-9625 | 10,000 ct | 2000 ct | 500 | .6 | .3 | .16 | 1.4 | 850 | 255 | 64 | 2.24:1 | 4.47:1 | 11.06 | 10.74 |
| L-8630 | P-9630 | 10,000 ct | 5000 ct | 1250 | .6 | .3 | .16 | 1.4 | 850 | 630 | 158 | 1.41:1 | 2.83:1 | 11.06 | 10.74 |
| L-8635 | P-9635 | 10,000 ct | 7500 ct | 1875 | .6 | .3 | .16 | 1.4 | 850 | 772 | 193 | 1.15:1 | 2.3:1 | 11.06 | 10.74 |
| L-8640 | P-9640 | 10,000 ct | 10,000 ct | 2500 | .6 | .3 | .16 | 1.4 | 866 | 1215 | 304 | 1:1 | 2:1 | 11.06 | 10.74 |
| L-8645 | P-9645 | *10,000 ct | 10,000 ct | - | .6 | .3 | .16 | 1.4 | 1060 | 1215 | - | 1:1 | - | 11.85 | 11.06 |
| L-8650 | P-9650 | 15,000 ct | 400 ct | 100 | .6 | .3 | .16 | 1.0 | 1305 | 47 | 12 | 6.12:1 | 12.24:1 | 11.06 | 10.74 |
| L-8652 | P-9652 | 15,000 ct | 500 ct | 125 | .6 | .3 | .16 | 1.0 | 1305 | 53 | 13 | 5.48:1 | 10.95:1 | 11.06 | 10.74 |
| L-8655 | P-9655 | 15,000 ct | 600 ct | 150 | .6 | .3 | .16 | 1.0 | 1305 | 72.5 | 18 | 5:1 | 10:1 | 11.06 | 10.74 |
| L-8660 | P-9660 | 15,000 ct | 10,000 ct | 2500 | .6 | .3 | .16 | 1.0 | 1305 | 1215 | 304 | 1.22:1 | 2.45:1 | 11.06 | 10.74 |
| L-8665 | P-9665 | *15,000 ct | 15,000 ct | - | .6 | .3 | .16 | 1.0 | 1305 | 1800 | - | 1:1 | - | 11.85 | 11.06 |
| L-8670 | P-9670 | 15,000 ct | 15,000 ct | 3750 | .6 | .3 | .16 | 1.0 | 1305 | 1800 | 450 | 1:1 | 2:1 | 11.06 | 10.74 |
| L-8675 | P-9675 | 16,000 ct | 1000 ct | 250 | .6 | .3 | .16 | 1.0 | 1343 | 115 | 29 | 4:1 | 8:1 | 11.06 | 10.74 |
| L-8680 | P-9680 | 20,000 ct | 500 ct | 125 | .5 | .3 | .16 | 1.0 | 1560 | 68 | 17 | 6.33:1 | 12.65:1 | 11.85 | 11.06 |
| L-8685 | P-9685 | 20,000 ct | 600 ct | 150 | .5 | .3 | .16 | 1.0 | 1560 | 75 | 19 | 5.77:1 | 11.55:1 | 11.85 | 11.06 |
| L-8690 | P-9690 | 20,000 ct | 800 ct | 200 | .5 | .3 | .16 | 1.0 | 1560 | 108 | 27 | 5:1 | 10:1 | 11.85 | 11.06 |
| L-8695 | P-9695 | 20,000 ct | 1000 ct | 250 | .5 | .3 | .16 | 1.0 | 1560 | 121 | 30.5 | 4.47:1 | 8.94:1 | 11.85 | 11.06 |
| L-8700 | P-9700 | 20,000 ct | 5000 ct | 1250 | .5 | .3 | .16 | 1.0 | 1560 | 672 | 168 | 2:1 | 4:1 | 11.85 | 11.06 |
| L-8705 | P-9705 | 20,000 ct | 10,000 ct | 2500 | .5 | .3 | .16 | 1.0 | 1560 | 1520 | 380 | 1.41:1 | 2.83:1 | 11.85 | 11.06 |
| L-8710 | P-9710 | *20,000 ct | 20,000 ct | - | .5 | .3 | .16 | 1.0 | 1560 | 2727 | 682 | 1:1 | - | 12.31 | 11.85 |
| L-8715 | P-9715 | 25,000 ct | 500 ct | 125 | .4 | .3 | .16 | 0.8 | 2170 | 68 | 17 | 7.07:1 | 14.14:1 | 11.85 | 11.06 |
| L-8720 | P-9720 | 25,000 ct | 1000 ct | 250 | .4 | .3 | .16 | 0.8 | 2170 | 120 | 30 | 5:1 | 10:1 | 11.85 | 11.06 |
| L-8725 | P-9725 | 30,000 ct | 50 ct | 12.5 | .33 | .3 | .16 | 0.8 | 2400 | 7 | 1.75 | 24.5:1 | 49:1 | 12.31 | 11.85 |
| L-8730 | P-9730 | 30,000 ct | 1200 ct | 300 | .33 | .3 | .16 | 0.8 | 2400 | 156 | 39 | 5:1 | 10:1 | 12.31 | 11.85 |
| L-8732 | P-9732 | 30,000 ct | 500 ct | 125 | .33 | .3 | .16 | 0.8 | 2400 | 68 | 17 | 7.75:1 | 15.5:1 | 12.31 | 11.85 |
| L-8734 | P-9734 | 30,000 ct | 200 ct | 50 | .33 | .3 | .16 | 0.8 | 2400 | 29 | 7.2 | 12.25:1 | 24.5:1 | 12.31 | 11.85 |
| L-8735 | P-9735 | 30,000 ct | 5000 ct | 1250 | .33 | .3 | .16 | 0.8 | 2400 | 673 | 169 | 2.45:1 | 4.9:1 | 12.31 | 11.85 |
| L-8740 | P-9740 | 30,000 ct | 10,000 ct | 2500 | .33 | .3 | .16 | 0.8 | 2400 | 1520 | 380 | 1.73:1 | 3.46:1 | 12.31 | 11.85 |
| L-8745 | P-9745 | *30,000 ct | 30,000 ct | - | .33 | .3 | .16 | 0.8 | 3000 | 3310 | - | 1:1 | - | 13.22 | 12.44 |
| L-8750 | P-9750 | 40,000 ct | 400 ct | 100 | .25 | .25 | .16 | 0.7 | 3400 | 57 | 14.3 | 10:1 | 20:1 | 13.22 | 12.44 |
| L-8755 | P-9755 | 40,000 ct | 2000 ct | 500 | .25 | .25 | .16 | 0.7 | 3400 | 268 | 67 | 4.47:1 | 8.94:1 | 13.22 | 12.44 |
| L-8760 | P-9760 | 40,000 ct | 4000 ct | 1000 | .25 | .25 | .16 | 0.7 | 3400 | 476 | 119 | 3.16:1 | 6.32:1 | 13.22 | 12.44 |
| L-8765 | P-9765 | 40,000 ct | 20,000 ct | 5000 | .25 | .25 | .16 | 0.7 | 3400 | 2700 | 675 | 1.41:1 | 2.83:1 | 13.22 | 12.44 |
| L-8770 | P-9770 | *40,000 ct | 40,000 ct | - | .25 | .25 | .16 | 0.7 | 3400 | 4750 | - | 1:1 | - | 14.73 | 14.10 |
| L-8775 | P-9775 | 50,000 ct | 200 ct | 50 | .2 | .2 | .16 | 0.6 | 4850 | 27 | 6.7 | 15.8:1 | 31.6:1 | 14.73 | 14.10 |
| L-8777 | P-9777 | 50,000 ct | 500 ct | 125 | .2 | .2 | .16 | 0.6 | 4850 | 68 | 17 | 10:1 | 20:1 | 14.73 | 14.10 |
| L-8779 | P-9779 | 50,000 ct | 600 ct | 150 | .2 | .2 | .16 | 0.6 | 4850 | 75 | 18.5 | 9.13:1 | 18.26:1 | 14.73 | 14.10 |
| L-8780 | P-9780 | 60,000 ct | 15,000 ct | 3750 | .16 | .16 | .16 | 0.5 | 5275 | 2250 | 563 | 2.1 | 4:1 | 15.90 | 15.50 |
| L-8785 | P-9785 | 62,500 ct | 50 ct | 12.5 | .16 | .16 | .16 | 0.5 | 5445 | 8.7 | 2.2 | 35.4:1 | 70.7:1 | 15.90 | 15.50 |
| L-8787 | P-9787 | 80,000 ct | 15,000 ct | 3750 | .12 | .12 | .12 | 0.4 | 6130 | 2250 | 563 | 2.3:1 | 4.6:1 | 15.90 | 15.50 |
| L-8790 | P-9790 | 90,000 ct | 10,000 ct | 2500 | .1 | .1 | .1 | 0.4 | 8140 | 1520 | 380 | 3:1 | 6:1 | 16.70 | 16.10 |
| L-8795 | P-9795 | 95,000 ct | 15,000 ct | 3750 | .1 | .1 | .1 | 0.4 | 8400 | 2250 | 563 | 2.52:1 | 5.03:1 | 16.70 | 16.10 |
| L-8800 | P-9800 | 100,000 ct | 60 ct | 15 | .1 | .1 | .1 | 0.4 | 8750 | 9.2 | 2.3 | 40.8:1 | 81.6:1 | 16.70 | 16.10 |
| L-8805 | P-9805 | 100,000 ct | 100 ct | 25 | .1 | .1 | .1 | 0.4 | 8750 | 15 | 3.8 | 31.6:1 | 63.2:1 | 16.70 | 16.10 |
| L-8810 | P-9810 | 100,000 ct | 500 ct | 125 | .1 | .1 | .1 | 0.4 | 8750 | 68 | 17 | 14.1:1 | 28.3:1 | 16.70 | 16.10 |
| L-8815 | P-9815 | 100,000 ct | 10,000 ct | 2500 | .1 | .1 | .1 | 0.4 | 8750 | 1535 | 385 | 3.16:1 | 6.32:1 | 16.70 | 16.10 |
| PICO-L-SHIELD MU-METAL SHIELD .53" d X .41" h (13.46 mm d X 10.41 mm h) | | | | | | | | | | | | | | 1.20 | |
| PICO-P-SHIELD MU-METAL SHIELD .53" d X .41" h (13.46 mm d X 10.41 mm h) | | | | | | | | | | | | | | | 1.20 |

*INCLUDES ELECTROSTATIC SHIELD

* Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

## PICO's ultra-miniature transformers

### L SERIES Plug-In

### P SERIES Insulated Leads

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.
- ALL POSSIBLE LEAD SPACINGS AVAILABLE - CONTACT FACTORY FOR PIN LAYOUT SAME AS DUAL IN-LINE INTEGRATED CIRCUITS ("DIP" PACKAGE).

*(All PICO Products are patented)*

**Send for new 68 page Pico Catalog**

**PICO Electronics, Inc.**

P.O. Box 1206
Mt. Vernon
New York 10551

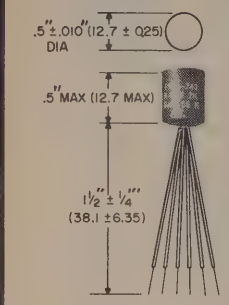
phone
914-699-5514

*For immediate engineering assistance or to place an order—*

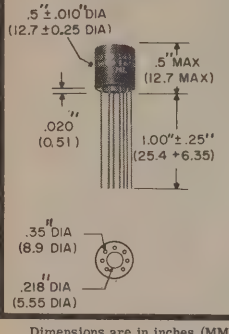
**Call Toll Free 800-431-1064**

# PICO's ultra-miniature transformers

## K SERIES Insulated Leads




## N SERIES Plug-In




Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27 . . . . . All Units Are Designed to MIL-T-27 and Are Hermetically Sealed in a Metal Case, Audio Transformers Are Type TF5R21ZZ.
- FREQUENCY RESPONSE: . . . ±3 db, 150 Hz - 75 KHz at 1.0 Milliwatt (When Primary Impedance ≥ 50K Ohms, ±3 db 150 Hz to 20 KHz)
- MAXIMUM DISTORTION: . . . . 5% With Rated Power Level at 1 KHz, 400 Hz and 150 Hz
- DIELECTRIC STRENGTH: . . . . All Units Tested at 200 V RMS
- INSULATION RESISTANCE: . . . Greater Than 10,000 Megohms at 300 V DC
- WEIGHT: . . . . . 7.5 Grams
- OPERATING TEMPERATURE: . . -55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c maximum)
- TERMINALS: . . . . . Solid .016 Diameter Conductor Conductor is Gold Plated, Nickel-Iron Core Wire (Dumet) in Accordance with MIL-STD-1276 Type D
- THERMAL SHOCK: . . . . . 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

*(All PICO Products are patented)*

**Send for new 68 page Pico Catalog**

| PICO PART NUMBER K-Series Insulated Leads | PICO PART NUMBER N-Series Plug-in | PRIMARY IMPEDANCE OHMS | SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER | SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR | POWER WATTS 1KHz and HIGHER | POWER WATTS 400 Hz | POWER WATTS 150 Hz | PRIMARY UNBALANCED DC CURRENT ma | PRIMARY DC RESISTANCE OHMS | SECONDARY DC RESISTANCE OHMS SER CONN | SECONDARY DC RESISTANCE OHMS PAR CONN | TURNS RATIO PRIM/SEC SEC SER CONN | TURNS RATIO PRIM/SEC SEC PAR CONN | PICO PRICES 1-9* K-Series | PICO PRICES 1-9* N-Series |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| K-7203 | N-6203 | 20 ct | 8 ct | 2 | 1.0 | .75 | .075 | 22.0 | 1.75 | 1.0 | .3 | 1.58:1 | 3.16:1 | 9.63 | 9.97 |
| K-7205 | N-6205 | 20 ct | 20 ct | 5 | 1.0 | .75 | .075 | 22.0 | 1.75 | 2.5 | .63 | 1:1 | 2:1 | 9.63 | 9.97 |
| K-7210 | N-6210 | 32 ct | 32 ct | 8 | 1.0 | .75 | .075 | 18.0 | 2.7 | 3.7 | .93 | 1:1 | 2:1 | 9.63 | 9.97 |
| K-7215 | N-6215 | 40 ct | 40 ct | 10 | 1.0 | .75 | .075 | 16.0 | 3 | 5.2 | 1.3 | 1:1 | 2:1 | 9.63 | 9.97 |
| K-7218 | N-6218 | 48 ct | 16 ct | 4 | 1.0 | .75 | .075 | 13.0 | 4.5 | 2.4 | .6 | 1.73:1 | 3.46:1 | 9.63 | 9.97 |
| K-7220 | N-6220 | 50 ct | 50 ct | 12.5 | 1.0 | .75 | .075 | 13.0 | 4.5 | 6.2 | 1.6 | 1:1 | 2:1 | 9.63 | 9.97 |
| K-7225 | N-6225 | 80 ct | 32 ct | 8 | 1.0 | .75 | .075 | 11.0 | 6.6 | 3.7 | .93 | 1.58:1 | 3.16:1 | 9.63 | 9.97 |
| K-7228 | N-6228 | 100 ct | 40 ct | 10 | 1.0 | .75 | .075 | 10.0 | 9.7 | 5.6 | 1.4 | 1.58:1 | 3.16:1 | 9.63 | 9.97 |
| K-7230 | N-6230 | 100 ct | 100 ct | 25 | 1.0 | .75 | .075 | 10.0 | 9.7 | 11 | 2.8 | 1:1 | 2:1 | 9.63 | 9.97 |
| K-7235 | N-6235 | 120 ct | 12.8 ct | 3.2 | 1.0 | .75 | .075 | 9.0 | 10.8 | 1.6 | .4 | 3.06:1 | 6.12:1 | 9.63 | 9.97 |
| K-7240 | N-6240 | 120 ct | 60 ct | 15 | 1.0 | .75 | .075 | 9.0 | 10.8 | 8.5 | 2.2 | 1.41:1 | 2.83:1 | 9.63 | 9.97 |
| K-7245 | N-6245 | 120 ct | 120 ct | 30 | 1.0 | .75 | .075 | 9.0 | 10.8 | 15 | 3.8 | 1:1 | 2:1 | 9.63 | 9.97 |
| K-7250 | N-6250 | 150 ct | 12 ct | 3 | 1.0 | .75 | .075 | 8.0 | 13.5 | 1.75 | .44 | 3.54:1 | 7.08:1 | 9.63 | 9.97 |
| K-7255 | N-6255 | 150 ct | 50 ct | 12.5 | 1.0 | .75 | .075 | 8.0 | 12 | 5.8 | 1.5 | 1.73:1 | 3.46:1 | 9.63 | 9.97 |
| K-7260 | N-6260 | 150 ct | 100 ct | 25 | 1.0 | .75 | .075 | 8.0 | 12 | 13 | 3.3 | 1.22:1 | 2.44:1 | 9.63 | 9.97 |
| K-7265 | N-6265 | 150 ct | 150 ct | 37.5 | 1.0 | .75 | .075 | 8.0 | 12 | 20 | 5 | 1:1 | 2:1 | 9.63 | 9.97 |
| K-7270 | N-6270 | 150 ct | 600 ct | 150 | 1.0 | .75 | .075 | 8.0 | 12 | 82 | 20.5 | 1:2 | 1:1 | 9.63 | 9.97 |
| K-7275 | N-6275 | 200 ct | 200 ct | 50 | 1.0 | .75 | .075 | 7.0 | 17 | 24 | 6.0 | 1:1 | 2:1 | 9.63 | 9.97 |
| K-7280 | N-6280 | 300 ct | 12 ct | 3 | 1.0 | .75 | .075 | 5.0 | 30 | 1.75 | .44 | 5:1 | 10:1 | 9.63 | 9.97 |
| K-7285 | N-6285 | 300 ct | 50 ct | 12.5 | 1.0 | .75 | .075 | 5.0 | 27 | 6.2 | 1.6 | 2.45:1 | 4.9:1 | 9.63 | 9.97 |
| K-7290 | N-6290 | 300 ct | 150 ct | 37.5 | 1.0 | .75 | .075 | 5.0 | 26 | 21 | 5.3 | 1.41:1 | 2.83:1 | 9.63 | 9.97 |
| K-7295 | N-6295 | 300 ct | 300 ct | 75 | 1.0 | .75 | .075 | 5.0 | 27 | 38 | 9.5 | 1:1 | 2:1 | 9.63 | 9.97 |
| K-7300 | N-6300 | 300 ct | 600 ct | 150 | 1.0 | .75 | .075 | 5.0 | 27 | 66 | 17 | 1:1.41 | 1.41:1 | 9.63 | 9.97 |
| K-7305 | N-6305 | 320 ct | 12.8 ct | 3.2 | 1.0 | .75 | .075 | 5.0 | 30 | 1.75 | .44 | 5:1 | 10:1 | 9.63 | 9.97 |
| K-7310 | N-6310 | 400 ct | 40 ct | 10 | 1.0 | .75 | .075 | 5.0 | 39 | 4.3 | 1.1 | 3.16:1 | 6.32:1 | 9.63 | 9.97 |
| K-7315 | N-6315 | 400 ct | 120 ct | 30 | 1.0 | .75 | .075 | 5.0 | 30 | 14 | 3.5 | 1:83:1 | 3.65:1 | 9.63 | 9.97 |
| K-7320 | N-6320 | 400 ct | 200 ct | 50 | 1.0 | .75 | .075 | 5.0 | 39 | 24 | 6 | 1.41:1 | 2.83:1 | 9.63 | 9.97 |
| K-7325 | N-6325 | 400 ct | 400 ct | 100 | 1.0 | .75 | .075 | 5.0 | 39 | 42 | 10.5 | 1:1 | 2:1 | 9.63 | 9.97 |
| K-7330 | N-6330 | 400 ct | 1000 ct | 250 | 1.0 | .75 | .075 | 5.0 | 39 | 109 | 28 | 1:1.58 | 1.26:1 | 9.63 | 9.97 |
| K-7335 | N-6335 | 400 ct | 2000 ct | 500 | 1.0 | .75 | .075 | 5.0 | 39 | 198 | 49 | 1:2.24 | 1:1.12 | 9.63 | 9.97 |
| K-7340 | N-6340 | 400 ct | 4000 ct | 1000 | 1.0 | .75 | .075 | 5.0 | 39 | 436 | 109 | 1:3.16 | 1:1.58 | 9.63 | 9.97 |
| K-7342 | N-6342 | 500 ct | 12.8 ct | 3.2 | 1.0 | .75 | .075 | 4.5 | 43 | 1.6 | .4 | 6.25:1 | 12.5:1 | 9.63 | 9.97 |
| K-7344 | N-6344 | 500 ct | 16 ct | 4 | 1.0 | .75 | .075 | 4.5 | 43 | 2.3 | .56 | 5.6:1 | 11.2:1 | 9.63 | 9.97 |
| K-7345 | N-6345 | 500 ct | 50 ct | 12.5 | 1.0 | .75 | .075 | 4.5 | 43 | 5.8 | 1.5 | 3.16:1 | 6.32:1 | 9.63 | 9.97 |
| K-7347 | N-6347 | 500 ct | 150 ct | 37.5 | 1.0 | .75 | .075 | 4.5 | 43 | 19.8 | 5 | 1.83:1 | 3.65:1 | 9.63 | 9.97 |
| K-7350 | N-6350 | 500 ct | 500 ct | 125 | 1.0 | .75 | .075 | 4.5 | 43 | 60 | 15 | 1:1 | 2:1 | 9.63 | 9.97 |
| K-7355 | N-6355 | *500 ct | 500 ct | - | 1.0 | .75 | .075 | 4.5 | 43 | 60 | - | 1:1 | - | 9.97 | 10.38 |
| K-7360 | N-6360 | 500 ct | 600 ct | 150 | 1.0 | .75 | .075 | 4.5 | 43 | 66 | 17 | 1:1.1 | 1.83:1 | 9.63 | 9.97 |
| K-7365 | N-6365 | 600 ct | 12.8 ct | 3.2 | 1.0 | .75 | .075 | 4.0 | 68 | 1.75 | .44 | 6.85:1 | 13.7:1 | 9.63 | 9.97 |
| K-7367 | N-6367 | 600 ct | 30 ct | 7.5 | 1.0 | .75 | .075 | 4.0 | 60 | 3.7 | .93 | 4.47:1 | 8.94:1 | 9.63 | 9.97 |
| K-7370 | N-6370 | 600 ct | 48 ct | 12 | 1.0 | .75 | .075 | 4.0 | 60 | 5.9 | 1.5 | 3.54:1 | 7.07:1 | 9.63 | 9.97 |
| K-7375 | N-6375 | 600 ct | 200 ct | 50 | 1.0 | .75 | .075 | 4.0 | 60 | 25 | 6.3 | 1.73:1 | 3.46:1 | 9.63 | 9.97 |
| K-7380** | N-6380** | 600 ct | 600 ct | 150 | 1.0 | .75 | .075 | 4.0 | 60 | 66 | 17 | 1:1 | 2:1 | 9.63 | 9.97 |
| K-7385** | N-6385** | *600 ct | 600 ct | - | 1.0 | .75 | .075 | 4.0 | 60 | 68 | - | 1:1 | - | 9.97 | 10.38 |
| K-7386** | N-6386** | *600 ct | 900 ct | - | 1.0 | .75 | .075 | 4.0 | 60 | 104 | - | 1:1.22 | - | 9.97 | 10.38 |
| K-7387** | N-6387** | 600 ct | 1200 ct | 300 | 1.0 | .75 | .075 | 4.0 | 60 | 116 | 29 | 1:1.41 | 1.41:1 | 9.63 | 9.97 |
| K-7390 | N-6390 | 640 ct | 12.8 ct | 3.2 | 1.0 | .75 | .075 | 4.0 | 69 | 1.75 | .44 | 7.07:1 | 14.14:1 | 9.63 | 9.97 |
| K-7395 | N-6395 | 700 ct | 100 ct | 25 | 1.0 | .75 | .075 | 4.0 | 62 | 10.6 | 2.7 | 2.65:1 | 5.29:1 | 9.63 | 9.97 |
| K-7400 | N-6400 | 800 ct | 12.8 ct | 3.2 | 1.0 | .75 | .075 | 3.5 | 78 | 1.75 | .44 | 7.91:1 | 15.8:1 | 9.63 | 9.97 |
| K-7405 | N-6405 | 800 ct | 48 ct | 12 | 1.0 | .75 | .075 | 3.5 | 74 | 6 | 1.5 | 4.08:1 | 8.16:1 | 9.63 | 9.97 |
| K-7410 | N-6410 | 800 ct | 800 ct | 200 | 1.0 | .75 | .075 | 3.5 | 74 | 102 | 26 | 1:1 | 2:1 | 9.63 | 9.97 |
| K-7415 | N-6415 | 900 ct | 600 ct | 150 | 1.0 | .75 | .075 | 3.0 | 90 | 66 | 17 | 1.23:1 | 2.45:1 | 9.63 | 9.97 |
| K-7417** | N-6417** | *900 ct | 900 ct | - | 1.0 | .75 | .075 | 3.0 | 90 | 102 | - | 1:1 | - | 9.97 | 10.38 |
| K-7420 | N-6420 | 1000 ct | 12 ct | 3 | 1.0 | .75 | .075 | 3.0 | 115 | 1.75 | .44 | 9.13:1 | 18.26:1 | 9.63 | 9.97 |
| K-7425 | N-6425 | 1000 ct | 50 ct | 12.5 | 1.0 | .75 | .075 | 3.0 | 100 | 5.8 | 1.5 | 4.47:1 | 8.94:1 | 9.63 | 9.97 |
| K-7430 | N-6430 | 1000 ct | 1000 ct | 250 | 1.0 | .75 | .075 | 3.0 | 75 | 103 | 26 | 1:1 | 2:1 | 9.63 | 9.97 |
| K-7435 | N-6435 | 1060 ct | 12.8 ct | 3.2 | 1.0 | .75 | .075 | 3.0 | 115 | 1.75 | .44 | 9.1:1 | 18.2:1 | 9.63 | 9.97 |
| K-7440 | N-6440 | 1200 ct | 12.8 ct | 3.2 | 1.0 | .75 | .075 | 3.0 | 122 | 1.75 | .44 | 9.68:1 | 19.4:1 | 9.63 | 9.97 |
| K-7445 | N-6445 | 1200 ct | 500 ct | 125 | 1.0 | .75 | .075 | 3.0 | 113 | 63 | 16 | 1.55:1 | 3.1:1 | 9.63 | 9.97 |
| K-7450 | N-6450 | 1200 ct | 1200 ct | 300 | 1.0 | .75 | .075 | 3.0 | 113 | 155 | 39 | 1:1 | 2:1 | 9.63 | 9.97 |
| K-7455 | N-6455 | *1200 ct | 1200 ct | - | 1.0 | .75 | .075 | 3.0 | 109 | 150 | - | 1:1 | - | 9.97 | 10.38 |
| K-7460 | N-6460 | 1500 ct | 12 ct | 3 | 1.0 | .75 | .075 | 2.5 | 140 | 1.75 | .44 | 11.18:1 | 22.36:1 | 9.63 | 9.97 |
| K-7465 | N-6465 | 1500 ct | 500 ct | 125 | 1.0 | .75 | .075 | 2.5 | 150 | 60 | 15 | 1.73:1 | 3.46:1 | 9.63 | 9.97 |
| K-7470 | N-6470 | *1500 ct | 600 ct | - | 1.0 | .75 | .075 | 2.5 | 150 | 66 | - | 1.58:1 | - | 9.97 | 10.38 |
| K-7475 | N-6475 | *1500 ct | 1500 ct | - | 1.0 | .75 | .075 | 2.5 | 150 | 168 | - | 1:1 | - | 9.97 | 10.38 |
| K-7480 | N-6480 | 1600 ct | 12.8 ct | 3.2 | 1.0 | .75 | .075 | 2.5 | 140 | 1.75 | .44 | 11.18:1 | 22.36:1 | 9.63 | 9.97 |
| K-7483 | N-6483 | 2000 ct | 8 ct | 2 | 1.0 | .75 | .075 | 2.0 | 250 | 1.0 | .25 | 15.8:1 | 31.6:1 | 9.63 | 9.97 |
| K-7485 | N-6485 | 2000 ct | 2000 ct | 500 | 1.0 | .75 | .075 | 2.0 | 185 | 255 | 64 | 1:1 | 2:1 | 9.63 | 9.97 |
| K-7490 | N-6490 | *2000 ct | 2000 ct | - | 1.0 | .75 | .075 | 2.0 | 175 | 240 | - | 1:1 | - | 9.97 | 10.38 |
| K-7495 | N-6495 | 2000 ct | 8000 ct | 2000 | 1.0 | .75 | .075 | 2.0 | 185 | 1015 | 254 | 1:2 | 1:1 | 9.63 | 9.97 |
| K-7497 | N-6497 | 2500 ct | 2500 ct | 625 | 1.0 | .75 | .075 | 2.0 | 245 | 268 | 68 | 1:1 | 2:1 | 9.63 | 9.97 |
| K-7500 | N-6500 | 3000 ct | 3000 ct | 750 | 1.0 | .75 | .075 | 1.8 | 267 | 295 | 74 | 1:1 | 2:1 | 9.63 | 9.97 |
| K-7505 | N-6505 | *3000 ct | 3000 ct | - | 1.0 | .75 | .075 | 1.8 | 267 | 368 | - | 1:1 | - | 9.97 | 10.38 |
| K-7510 | N-6510 | 3600 ct | 3600 ct | 900 | 1.0 | .75 | .075 | 1.5 | 300 | 413 | 103 | 1:1 | 2:1 | 9.63 | 9.97 |
| K-7512 | N-6512 | 4000 ct | 16 ct | 4 | 1.0 | .75 | .075 | 1.5 | 395 | 2.5 | .65 | 15.8:1 | 31.6:1 | 9.63 | 9.97 |
| K-7514** | N-6514** | 4000 ct | 600 ct | 150 | 1.0 | .75 | .075 | 1.5 | 395 | 66 | 17 | 2.58:1 | 5.16:1 | 9.63 | 9.97 |

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

*Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

| PICO PART NUMBER K-Series Insulated Leads | PICO PART NUMBER N-Series Plug-in | PRIMARY IMPEDANCE OHMS | SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER | SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR | POWER WATTS 1KHz and HIGHER | POWER WATTS 400 Hz | POWER WATTS 150 Hz | PRIMARY UNBALANCED DC CURRENT ma | PRIMARY DC RESISTANCE OHMS | SECONDARY DC RESISTANCE OHMS SER CONN | SECONDARY DC RESISTANCE OHMS PAR CONN | TURNS RATIO PRIM/SEC SEC SER CONN | TURNS RATIO PRIM/SEC SEC PAR CONN | PICO PRICES 1-9* K-Series | PICO PRICES 1-9* N-Series |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| K-7515 | N-6515 | 4000 ct | 1000 ct | 250 | 1.0 | .75 | .075 | 1.5 | 395 | 108 | 27 | 2:1 | 4:1 | 9.63 | 9.97 |
| K-7520 | N-6520 | *4000 ct | 8000 ct | - | 1.0 | .75 | .075 | 1.5 | 390 | 955 | - | 1:1.41 | - | 9.97 | 10.38 |
| K-7525 | N-6525 | 5000 ct | 500 ct | 125 | 1.0 | .75 | .075 | 1.3 | 450 | 62 | 16 | 3.16:1 | 6.32:1 | 9.63 | 9.97 |
| K-7530 | N-6530 | 5000 ct | 5000 ct | 1250 | 1.0 | .75 | .075 | 1.3 | 450 | 620 | 155 | 1:1 | 2:1 | 9.63 | 9.97 |
| K-7535 | N-6535 | 7500 ct | 50 ct | 12.5 | 1.0 | .75 | .075 | 1.0 | 670 | 6 | 1.5 | 12.25:1 | 24.5:1 | 10.74 | 11.06 |
| K-7540 | N-6540 | 7500 ct | 100 ct | 25 | 1.0 | .75 | .075 | 1.0 | 670 | 11 | 2.8 | 8.66:1 | 17.32:1 | 10.74 | 11.06 |
| K-7545 | N-6545 | 7500 ct | 600 ct | 150 | 1.0 | .75 | .075 | 1.0 | 670 | 66 | 16.5 | 3.54:1 | 7.07:1 | 10.74 | 11.06 |
| K-7550 | N-6550 | 7500 ct | 2500 ct | 625 | 1.0 | .75 | .075 | 1.0 | 670 | 268 | 67 | 1.73:1 | 3.46:1 | 10.74 | 11.06 |
| K-7555 | N-6555 | *7500 ct | 7500 ct | - | 1.0 | .75 | .075 | 1.0 | 670 | 925 | - | 1:1 | - | 11.06 | 11.85 |
| K-7560 | N-6560 | 8000 ct | 12.8 ct | 3.2 | 1.0 | .75 | .075 | 1.0 | 765 | 1.75 | .44 | 25:1 | 50:1 | 10.74 | 11.06 |
| K-7565 | N-6565 | 8000 ct | 1000 ct | 250 | 1.0 | .75 | .075 | 1.0 | 695 | 106 | 26.5 | 2.83:1 | 5.66:1 | 10.74 | 11.06 |
| K-7570 | N-6570 | *8000 ct | 1200 ct | - | 1.0 | .75 | .075 | 1.0 | 715 | 153 | - | 2.58:1 | - | 11.06 | 11.85 |
| K-7575 | N-6575 | *9000 ct | 9000 ct | - | 1.0 | .75 | .075 | 1.0 | 925 | 1020 | - | 1:1 | - | 11.06 | 11.85 |
| K-7580 | N-6580 | 10,000 ct | 12.8 ct | 3.2 | 1.0 | .75 | .075 | 1.0 | 768 | 1.6 | .4 | 28:1 | 56:1 | 10.74 | 11.06 |
| K-7585 | N-6585 | 10,000 ct | 16 ct | 4 | 1.0 | .75 | .075 | 1.0 | 756 | 1.7 | .43 | 25:1 | 50:1 | 10.74 | 11.06 |
| K-7590 | N-6590 | 10,000 ct | 100 ct | 25 | 1.0 | .75 | .075 | 1.0 | 780 | 10 | 2.5 | 10:1 | 20:1 | 10.74 | 11.06 |
| K-7595 | N-6595 | 10,000 ct | 200 ct | 50 | 1.0 | .75 | .075 | 1.0 | 780 | 24 | 6 | 7.07:1 | 14.14:1 | 10.74 | 11.06 |
| K-7600 | N-6600 | 10,000 ct | 500 ct | 125 | 1.0 | .75 | .075 | 1.0 | 780 | 60 | 15 | 4.47:1 | 8.94:1 | 10.74 | 11.06 |
| K-7605 | N-6605 | 10,000 ct | 600 ct | 150 | 1.0 | .75 | .075 | 1.0 | 780 | 83 | 21 | 4.08:1 | 8.16:1 | 10.74 | 11.06 |
| K-7610 | N-6610 | 10,000 ct | 1000 ct | 250 | 1.0 | .75 | .075 | 1.0 | 780 | 106 | 27 | 3.16:1 | 6.32:1 | 10.74 | 11.06 |
| K-7615 | N-6615 | 10,000 ct | 1200 ct | 300 | 1.0 | .75 | .075 | 1.0 | 780 | 145 | 36 | 2.89:1 | 5.77:1 | 10.74 | 11.06 |
| K-7620 | N-6620 | 10,000 ct | 1500 ct | 375 | 1.0 | .75 | .075 | 1.0 | 780 | 160 | 40 | 2.58:1 | 5.16:1 | 10.74 | 11.06 |
| K-7625 | N-6625 | 10,000 ct | 2000 ct | 500 | 1.0 | .75 | .075 | 1.0 | 780 | 300 | 75 | 2.24:1 | 4.47:1 | 10.74 | 11.06 |
| K-7630 | N-6630 | 10,000 ct | 5000 ct | 1250 | 1.0 | .75 | .075 | 1.0 | 780 | 610 | 153 | 1.41:1 | 2.83:1 | 10.74 | 11.06 |
| K-7635 | N-6635 | 10,000 ct | 7500 ct | 1875 | 1.0 | .75 | .075 | 1.0 | 780 | 932 | 233 | 1.16:1 | 2.31:1 | 10.74 | 11.06 |
| K-7640 | N-6640 | 10,000 ct | 10,000 ct | 2500 | 1.0 | .75 | .075 | 1.0 | 780 | 1075 | 269 | 1:1 | 2:1 | 10.74 | 11.06 |
| K-7645 | N-6645 | *10,000 ct | 10,000 ct | - | 1.0 | .75 | .075 | 1.0 | 715 | 985 | - | 1:1 | - | 11.06 | 11.85 |
| K-7650 | N-6650 | 15,000 ct | 400 ct | 100 | .66 | .66 | .075 | 0.8 | 1165 | 52 | 13 | 6.12:1 | 12.25:1 | 10.74 | 11.06 |
| K-7652 | N-6652 | 15,000 ct | 500 ct | 125 | .66 | .66 | .075 | 0.8 | 1165 | 60 | 15 | 5.48:1 | 10.95:1 | 10.74 | 11.06 |
| K-7655 | N-6655 | 15,000 ct | 600 ct | 150 | .66 | .66 | .075 | 0.8 | 1165 | 80 | 20 | 5:1 | 10:1 | 10.74 | 11.06 |
| K-7660 | N-6660 | 15,000 ct | 10,000 ct | 2500 | .66 | .66 | .075 | 0.8 | 1165 | 1050 | 263 | 1.22:1 | 2.45:1 | 10.74 | 11.06 |
| K-7665 | N-6665 | *15,000 ct | 15,000 ct | - | .66 | .66 | .075 | 0.8 | 1165 | 1600 | - | 1:1 | - | 11.06 | 11.85 |
| K-7670 | N-6670 | 15,000 ct | 15,000 ct | 3750 | .66 | .66 | .075 | 0.8 | 1165 | 1600 | 400 | 1:1 | 2:1 | 10.74 | 11.06 |
| K-7675 | N-6675 | 16,000 ct | 1000 ct | 250 | .62 | .62 | .075 | 0.8 | 1560 | 108 | 27 | 4:1 | 8:1 | 10.74 | 11.06 |
| K-7680 | N-6680 | 20,000 ct | 500 ct | 125 | .5 | .5 | .075 | 0.7 | 1750 | 60 | 15 | 6.32:1 | 12.65:1 | 11.06 | 11.85 |
| K-7685 | N-6685 | 20,000 ct | 600 ct | 150 | .5 | .5 | .075 | 0.7 | 1750 | 82 | 20.5 | 5.77:1 | 11.55:1 | 11.06 | 11.85 |
| K-7690 | N-6690 | 20,000 ct | 800 ct | 200 | .5 | .5 | .075 | 0.7 | 1750 | 98 | 24.5 | 5:1 | 10:1 | 11.06 | 11.85 |
| K-7695 | N-6695 | 20,000 ct | 1000 ct | 250 | .5 | .5 | .075 | 0.7 | 1750 | 135 | 34 | 4.47:1 | 8.94:1 | 11.06 | 11.85 |
| K-7700 | N-6700 | 20,000 ct | 5000 ct | 1250 | .5 | .5 | .075 | 0.7 | 1750 | 610 | 153 | 2:1 | 4:1 | 11.06 | 11.85 |
| K-7705 | N-6705 | 20,000 ct | 10,000 ct | 2500 | .5 | .5 | .075 | 0.7 | 1750 | 1075 | 269 | 1.41:1 | 2.83:1 | 11.06 | 11.85 |
| K-7710 | N-6710 | *20,000 ct | 20,000 ct | - | .5 | .5 | .075 | 0.7 | 1715 | 2370 | - | 1:1 | - | 11.85 | 12.31 |
| K-7715 | N-6715 | 25,000 ct | 500 ct | 125 | .4 | .4 | .075 | 0.6 | 2470 | 60 | 15 | 7.07:1 | 14.14:1 | 11.06 | 11.85 |
| K-7720 | N-6720 | 25,000 ct | 1000 ct | 250 | .4 | .4 | .075 | 0.6 | 2470 | 106 | 27 | 5:1 | 10:1 | 11.06 | 11.85 |
| K-7725 | N-6725 | 30,000 ct | 50 ct | 12.5 | .33 | .33 | .075 | 0.5 | 2730 | 6.2 | 1.6 | 24.5:1 | 49:1 | 11.85 | 12.31 |
| K-7730 | N-6730 | 30,000 ct | 1200 ct | 300 | .33 | .33 | .075 | 0.5 | 2815 | 156 | 39 | 5:1 | 10:1 | 11.85 | 12.31 |
| K-7732 | N-6732 | 30,000 ct | 500 ct | 125 | .33 | .33 | .075 | 0.5 | 2730 | 61 | 15.3 | 7.7:1 | 15.5:1 | 11.85 | 12.31 |
| K-7734 | N-6734 | 30,000 ct | 200 ct | 50 | .33 | .33 | .075 | 0.5 | 2730 | 24 | 6 | 12.2:1 | 24.5:1 | 11.85 | 12.31 |
| K-7735 | N-6735 | 30,000 ct | 5000 ct | 1250 | .33 | .33 | .075 | 0.5 | 2730 | 620 | 155 | 2.45:1 | 4.9:1 | 11.85 | 12.31 |
| K-7740 | N-6740 | 30,000 ct | 10,000 ct | 2500 | .33 | .33 | .075 | 0.5 | 2730 | 1090 | 272 | 1.73:1 | 3.46:1 | 11.85 | 12.31 |
| K-7745 | N-6745 | *30,000 ct | 30,000 ct | - | .33 | .33 | .075 | 0.5 | 2730 | 3740 | - | 1:1 | - | 12.44 | 13.22 |
| K-7750 | N-6750 | 40,000 ct | 400 ct | 100 | .25 | .25 | .075 | 0.5 | 3150 | 53 | 13 | 10:1 | 20:1 | 12.44 | 13.22 |
| K-7755 | N-6755 | 40,000 ct | 2000 ct | 500 | .25 | .25 | .075 | 0.5 | 3150 | 300 | 75 | 4.47:1 | 8.94:1 | 12.44 | 13.22 |
| K-7760 | N-6760 | 40,000 ct | 4000 ct | 1000 | .25 | .25 | .075 | 0.5 | 3150 | 548 | 137 | 3.16:1 | 6.32:1 | 12.44 | 13.22 |
| K-7765 | N-6765 | 40,000 ct | 20,000 ct | 5000 | .25 | .25 | .075 | 0.5 | 3150 | 3075 | 769 | 1.41:1 | 2.83:1 | 12.44 | 13.22 |
| K-7770 | N-6770 | *40,000 ct | 40,000 ct | - | .25 | .25 | .075 | 0.5 | 3940 | 4350 | - | 1:1 | - | 14.10 | 14.73 |
| K-7775 | N-6775 | 50,000 ct | 200 ct | 50 | .2 | .2 | .075 | 0.4 | 4275 | 24 | 6 | 15.8:1 | 31.6:1 | 14.10 | 14.73 |
| K-7777 | N-6777 | 50,000 ct | 500 ct | 125 | .2 | .2 | .075 | 0.4 | 4275 | 60 | 15 | 10:1 | 20:1 | 14.10 | 14.73 |
| K-7778 | N-6778 | 50,000 ct | 600 ct | 150 | .2 | .2 | .075 | 0.4 | 4275 | 82 | 21 | 9.13:1 | 18.26:1 | 14.10 | 14.73 |
| K-7779 | N-6779 | 50,000 ct | 50,000 ct | 12,500 | .2 | .2 | .075 | 0.4 | 4500 | 6270 | 1568 | 1:1 | 2:1 | 14.10 | 14.73 |
| K-7780 | N-6780 | 60,000 ct | 15,000 ct | 3750 | .16 | .16 | .075 | 0.4 | 5960 | 1650 | 412 | 2:1 | 4:1 | 15.50 | 15.90 |
| K-7785 | N-6785 | 62,500 ct | 50 ct | 12.5 | .16 | .16 | .075 | 0.4 | 5960 | 6 | 1.5 | 35.4:1 | 70.7:1 | 15.50 | 15.90 |
| K-7787 | N-6787 | 80,000 ct | 15,000 ct | 3750 | .12 | .12 | .075 | 0.3 | 7200 | 1690 | 423 | 2.3:1 | 4.6:1 | 15.50 | 15.90 |
| K-7789 | N-6789 | 80,000 ct | 80,000 ct | 20,000 | .12 | .12 | .075 | 0.3 | 7200 | 9920 | 2480 | 1:1 | 2:1 | 15.50 | 15.90 |
| K-7790 | N-6790 | 90,000 ct | 10,000 ct | 2500 | .11 | .11 | .075 | 0.3 | 7500 | 1350 | 338 | 3:1 | 6:1 | 16.10 | 16.70 |
| K-7795 | N-6795 | 95,000 ct | 15,000 ct | 3750 | .1 | .1 | .075 | 0.3 | 9550 | 1635 | 410 | 2.5:1 | 5:1 | 16.10 | 16.70 |
| K-7800 | N-6800 | 100,000 ct | 60 ct | 15 | .1 | .1 | .075 | 0.3 | 10,000 | 8.5 | 2.2 | 40.8:1 | 81.6:1 | 16.10 | 16.70 |
| K-7805 | N-6805 | 100,000 ct | 100 ct | 25 | .1 | .1 | .075 | 0.3 | 10,000 | 14 | 3.5 | 31.6:1 | 63.2:1 | 16.10 | 16.70 |
| K-7810 | N-6810 | 100,000 ct | 500 ct | 125 | .1 | .1 | .075 | 0.3 | 10,000 | 62 | 15.5 | 14.1:1 | 28.3:1 | 16.10 | 16.70 |
| K-7813 | N-6813 | 100,000 ct | 1000 ct | 250 | .1 | .1 | .075 | 0.3 | 10,000 | 140 | 35 | 10:1 | 20:1 | 16.10 | 16.70 |
| K-7814 | N-6814 | 100,000 ct | 2000 ct | 500 | .1 | .1 | .075 | 0.3 | 10,000 | 248 | 62 | 7.07:1 | 14.14:1 | 16.10 | 16.70 |
| K-7815 | N-6815 | 100,000 ct | 10,000 ct | 2500 | .1 | .1 | .075 | 0.3 | 10,000 | 1075 | 270 | 3.16:1 | 6.32:1 | 16.10 | 16.70 |
| K-7820 | N-6820 | 135,000 ct | 82 ct | 20.5 | .074 | .074 | .074 | 0.25 | 13,700 | 9.5 | 2.4 | 40.6:1 | 81.2:1 | 16.95 | 17.45 |
| K-7823 | N-6823 | 200,000 ct | 500 ct | 125 | .05 | .05 | .05 | 0.2 | 17,340 | 75 | 19 | 20:1 | 40:1 | 16.95 | 17.45 |
| K-7825 | N-6825 | 200,000 ct | 1000 ct | 250 | .05 | .05 | .05 | 0.2 | 17,340 | 133 | 33 | 14.1:1 | 28.3:1 | 16.95 | 17.45 |
| K-7830 | N-6830 | 200,000 ct | 10,000 ct | 2500 | .05 | .05 | .05 | 0.2 | 17,340 | 1350 | 336 | 4.47:1 | 8.94:1 | 16.95 | 17.45 |
| K-7835 | N-6835 | 200,000 ct | 20,000 ct | 5000 | .05 | .05 | .05 | 0.2 | 17,340 | 3000 | 750 | 3.16:1 | 6.32:1 | 16.95 | 17.45 |
| K-7837 | N-6837 | 250,000 ct | 200 ct | 50 | .04 | .04 | .04 | 0.2 | 17,340 | 28 | 7 | 35.4:1 | 70.7:1 | 17.45 | 17.90 |
| K-7840 | N-6840 | 250,000 ct | 1000 ct | 250 | .04 | .04 | .04 | 0.2 | 17,340 | 118 | 30 | 15.8:1 | 31.6:1 | 17.45 | 17.90 |
| PICO-K-SHIELD MU-METAL SHIELD .53" d X .56" h (13.46 mm d X 14.22 mm h) | | | | | | | | | | | | | | 1.20 | |
| PICO-N-SHIELD MU-METAL SHIELD .53" d X .56" h (13.46 mm d X 14.22 mm h) | | | | | | | | | | | | | | | 1.20 |


**PICO's ultra-miniature transformers**

**K SERIES Insulated Leads**

**N SERIES Plug-In**

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

*(All PICO Products are patented)*

**Send for new 68 page Pico Catalog**

Delivery: Stock to one week

**PICO Electronics, Inc.**

P.O. Box 1206
Mt. Vernon
New York 10551

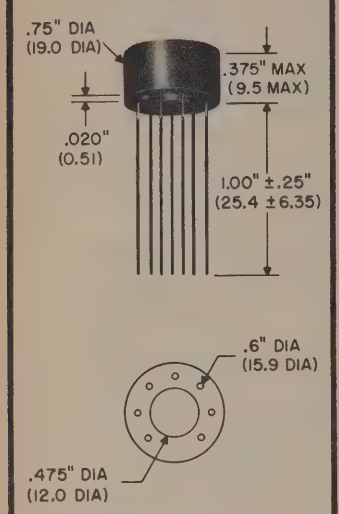
phone
914-699-5514

For immediate engineering assistance or to place an order—

**Call Toll Free 800-431-1064**

# PICO's ultra-miniature transformers

## R SERIES Plug-In




Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27: . . . . . All Units Are Designed to MIL-T-27 And Are Hermetically Sealed in a Metal Case, Audio Transformers Are Type TF5R21ZZ.
- FREQUENCY RESPONSE: . . . ± 3 db, 75 Hz - 30 KHz at 1.0 Milliwatt.
- MAXIMUM DISTORTION: . . . 5% With Rated Power Level at 1 KHz, 300 Hz and 75 Hz
- DIELECTRIC STRENGTH: . . . All Units Tested at 200 V RMS.
- INSULATION RESISTANCE: . . Greater Than 10,000 Megohms at 300 V DC.
- WEIGHT: . . . . . 12 Grams
- OPERATING TEMPERATURE: . -55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c Maximum).
- TERMINALS: . . . . . Solid .016 Diameter Conductor. Conductor is Gold Plated, Nickel-Iron Core Wire (Dumet) in Accordance With MIL-STD-1276 Type D.
- THERMAL SHOCK: . . . . . 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

*(All PICO Products are patented)*

**Send for new 68 page Pico Catalog**

**Delivery— stock to one week**

| PICO PART NUMBER R-Series Plug-in | PRIMARY IMPEDANCE OHMS | SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER | PAR | POWER WATTS 1KHz and HIGHER | 300 Hz | 75 Hz | PRIMARY UNBAL DC CURRENT ma | PRIMARY DC RESIST OHMS | SECONDARY DC RESISTANCE OHMS SER CONN | PAR CONN | TURNS RATIO PRIM/SEC SEC SER CONN | SEC PAR CONN | PICO PRICES 1-9* R-Series |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R-20003 | 20 ct | 8 ct | 2 | 1.5 | .9 | .03 | 22 | 1.6 | .76 | .19 | 1.58:1 | 3.16:1 | 9.97 |
| R-20005 | 20 ct | 20 ct | 5 | 1.5 | .9 | .03 | 22 | 1.6 | 1.9 | .48 | 1:1 | 2:1 | 9.97 |
| R-20010 | 32 ct | 32 ct | 8 | 1.5 | .9 | .03 | 17.5 | 2.56 | 3 | .75 | 1:1 | 2:1 | 9.97 |
| R-20015 | 40 ct | 40 ct | 10 | 1.5 | .9 | .03 | 16 | 3.2 | 3.8 | .95 | 1:1 | 2:1 | 9.97 |
| R-20018 | 48 ct | 16 ct | 4 | 1.5 | .9 | .03 | 14.5 | 3.84 | 1.52 | .38 | 1.73:1 | 3.46:1 | 9.97 |
| R-20020 | 50 ct | 50 ct | 12.5 | 1.5 | .9 | .03 | 14 | 4 | 4.75 | 1.19 | 1:1 | 2:1 | 9.97 |
| R-20025 | 80 ct | 32 ct | 8 | 1.5 | .9 | .03 | 11 | 6.4 | 3 | .75 | 1.58:1 | 3.16:1 | 9.97 |
| R-20028 | 100 ct | 40 ct | 10 | 1.5 | .9 | .03 | 10 | 8 | 3.8 | .95 | 1.58:1 | 3.16:1 | 9.97 |
| R-20030 | 100 ct | 100 ct | 25 | 1.5 | .9 | .03 | 10 | 8 | 9.5 | 2.38 | 1:1 | 2:1 | 9.97 |
| R-20035 | 120 ct | 12.8 ct | 3.2 | 1.5 | .9 | .03 | 9 | 9.6 | 1.22 | .3 | 3.06:1 | 6.12:1 | 9.97 |
| R-20040 | 120 ct | 60 ct | 15 | 1.5 | .9 | .03 | 9 | 9.6 | 5.7 | 1.4 | 1.41:1 | 2.83:1 | 9.97 |
| R-20045 | 120 ct | 120 ct | 30 | 1.5 | .9 | .03 | 9 | 9.6 | 11.4 | 2.85 | 1:1 | 2:1 | 9.97 |
| R-20050 | 150 ct | 12 ct | 3 | 1.5 | .9 | .03 | 8 | 12 | 1.14 | .29 | 3.54:1 | 7.08:1 | 9.97 |
| R-20055 | 150 ct | 50 ct | 12.5 | 1.5 | .9 | .03 | 8 | 12 | 4.75 | 1.19 | 1.73:1 | 3.46:1 | 9.97 |
| R-20060 | 150 ct | 100 ct | 25 | 1.5 | .9 | .03 | 8 | 12 | 9.5 | 2.38 | 1.22:1 | 2.44:1 | 9.97 |
| R-20065 | 150 ct | 150 ct | 37.5 | 1.5 | .9 | .03 | 8 | 12 | 14.3 | 3.56 | 1:1 | 2:1 | 9.97 |
| R-20070 | 150 ct | 600 ct | 150 | 1.5 | .9 | .03 | 8 | 12 | 57 | 14.3 | 1:2 | 1:1 | 9.97 |
| R-20075 | 200 ct | 200 ct | 50 | 1.5 | .9 | .03 | 7 | 16 | 19 | 4.75 | 1:1 | 2:1 | 9.97 |
| R-20080 | 300 ct | 12 ct | 3 | 1.5 | .9 | .03 | 5.5 | 24 | 1.14 | .29 | 5:1 | 10:1 | 9.97 |
| R-20085 | 300 ct | 50 ct | 12.5 | 1.5 | .9 | .03 | 5.5 | 24 | 4.75 | 1.19 | 2.45:1 | 4.9:1 | 9.97 |
| R-20090 | 300 ct | 150 ct | 37.5 | 1.5 | .9 | .03 | 5.5 | 24 | 14.25 | 3.56 | 1.41:1 | 2.83:1 | 9.97 |
| R-20095 | 300 ct | 300 ct | 75 | 1.5 | .9 | .03 | 5.5 | 24 | 28.5 | 7.13 | 1:1 | 2:1 | 9.97 |
| R-20100 | 300 ct | 600 ct | 150 | 1.5 | .9 | .03 | 5.5 | 24 | 57 | 14.25 | 1:1.41 | 1.41:1 | 9.97 |
| R-20105 | 320 ct | 12.8 ct | 3.2 | 1.5 | .9 | .03 | 5.5 | 25.6 | 1.22 | .3 | 5:1 | 10:1 | 9.97 |
| R-20110 | 400 ct | 40 ct | 10 | 1.5 | .9 | .03 | 5 | 32 | 3.8 | .95 | 3.16:1 | 6.32:1 | 9.97 |
| R-20115 | 400 ct | 120 ct | 30 | 1.5 | .9 | .03 | 5 | 32 | 11.4 | 2.85 | 1.83:1 | 3.65:1 | 9.97 |
| R-20120 | 400 ct | 200 ct | 50 | 1.5 | .9 | .03 | 5 | 32 | 19 | 4.75 | 1.41:1 | 2.83:1 | 9.97 |
| R-20125 | 400 ct | 400 ct | 100 | 1.5 | .9 | .03 | 5 | 32 | 38 | 9.5 | 1:1 | 2:1 | 9.97 |
| R-20130 | 400 ct | 1000 ct | 250 | 1.5 | .9 | .03 | 5 | 32 | 95 | 23.8 | 1:1.58 | 1.26:1 | 9.97 |
| R-20135 | 400 ct | 2000 ct | 500 | 1.5 | .9 | .03 | 5 | 32 | 190 | 47.5 | 1:2.24 | 1:1.12 | 9.97 |
| R-20140 | 400 ct | 4000 ct | 1000 | 1.5 | .9 | .03 | 5 | 32 | 380 | 95 | 1:3.16 | 1:1.58 | 9.97 |
| R-20142 | 500 ct | 12.8 ct | 3.2 | 1.5 | .9 | .03 | 4.5 | 40 | 1.22 | .3 | 6.25:1 | 12.5:1 | 9.97 |
| R-20144 | 500 ct | 16 ct | 4 | 1.5 | .9 | .03 | 4.5 | 40 | 1.52 | .38 | 5.6:1 | 11.2:1 | 9.97 |
| R-20145 | 500 ct | 50 ct | 12.5 | 1.5 | .9 | .03 | 4.5 | 40 | 4.75 | 1.19 | 3.16:1 | 6.32:1 | 9.97 |
| R-20147 | 500 ct | 150 ct | 37.5 | 1.5 | .9 | .03 | 4.5 | 40 | 14.25 | 3.56 | 1.83:1 | 3.65:1 | 9.97 |
| R-20150 | 500 ct | 500 ct | 125 | 1.5 | .9 | .03 | 4.5 | 40 | 47.5 | 11.88 | 1:1 | 2:1 | 9.97 |
| R-20155 | *500 ct | 500 ct | - | 1.5 | .9 | .03 | 4.5 | 40 | 47.5 | - | 1:1 | - | 10.38 |
| R-20160 | 500 ct | 600 ct | 150 | 1.5 | .9 | .03 | 4.5 | 40 | 57 | 14.25 | 1:1.1 | 1.83:1 | 9.97 |
| R-20165 | 600 ct | 12.8 ct | 3.2 | 1.5 | .9 | .03 | 4 | 48 | 1.22 | .3 | 6.85:1 | 12.7:1 | 9.97 |
| R-20167 | 600 ct | 30 ct | 7.5 | 1.5 | .9 | .03 | 4 | 48 | 2.85 | .71 | 4.47:1 | 8.94:1 | 9.97 |
| R-20170 | 600 ct | 48 ct | 12 | 1.5 | .9 | .03 | 4 | 48 | 4.56 | 1.14 | 3.54:1 | 7.07:1 | 9.97 |
| R-20175 | 600 ct | 200 ct | 50 | 1.5 | .9 | .03 | 4 | 48 | 19 | 4.75 | 1.73:1 | 3.46:1 | 9.97 |
| R-20180** | 600 ct | 600 ct | 150 | 1.5 | .9 | .03 | 4 | 48 | 57 | 14.25 | 1:1 | 2:1 | 9.97 |
| R-20185** | *600 ct | 600 ct | - | 1.5 | .9 | .03 | 4 | 48 | 57 | - | 1:1 | - | 10.38 |
| R-20186** | *600 ct | 900 ct | - | 1.5 | .9 | .03 | 4 | 48 | 85.5 | - | 1:1.22 | - | 10.38 |
| R-20187** | 600 ct | 1200 ct | 300 | 1.5 | .9 | .03 | 4 | 48 | 114 | 28.5 | 1:1.41 | 1.41:1 | 9.97 |
| R-20190 | 640 ct | 12.8 ct | 3.2 | 1.5 | .9 | .03 | 4 | 51.2 | 1.22 | .3 | 7.07:1 | 14.14:1 | 9.97 |
| R-20195 | 700 ct | 100 ct | 25 | 1.5 | .9 | .03 | 3.5 | 56 | 9.5 | 2.38 | 2.65:1 | 5.29:1 | 9.97 |
| R-20200 | 800 ct | 12.8 ct | 3.2 | 1.5 | .9 | .03 | 3.5 | 64 | 1.22 | .3 | 7.91:1 | 15.8:1 | 9.97 |
| R-20205 | 800 ct | 48 ct | 12 | 1.5 | .9 | .03 | 3.5 | 64 | 4.56 | 1.14 | 4.08:1 | 8.16:1 | 9.97 |
| R-20210 | 800 ct | 800 ct | 200 | 1.5 | .9 | .03 | 3.5 | 64 | 76 | 19 | 1:1 | 2:1 | 9.97 |
| R-20215 | 900 ct | 600 ct | 150 | 1.5 | .9 | .03 | 3 | 72 | 57 | 14.3 | 1.23:1 | 2.45:1 | 9.97 |
| R-20217** | *900 ct | 900 ct | - | 1.5 | .9 | .03 | 3 | 72 | 85.5 | - | 1:1 | - | 10.38 |
| R-20220 | 1000 ct | 12 ct | 3 | 1.5 | .9 | .03 | 3 | 80 | 1.14 | .29 | 9.13:1 | 18.26:1 | 9.97 |
| R-20225 | 1000 ct | 50 ct | 12.5 | 1.5 | .9 | .03 | 3 | 80 | 4.75 | 1.19 | 4.47:1 | 8.94:1 | 9.97 |
| R-20230 | 1000 ct | 1000 ct | 250 | 1.5 | .9 | .03 | 3 | 80 | 95 | 23.8 | 1:1 | 2:1 | 9.97 |
| R-20235 | 1060 ct | 12.8 ct | 3.2 | 1.5 | .9 | .03 | 3 | 85 | 1.22 | .3 | 9.1:1 | 18.2:1 | 9.97 |
| R-20240 | 1200 ct | 12.8 ct | 3.2 | 1.5 | .9 | .03 | 3 | 96 | 1.22 | .3 | 9.68:1 | 19.4:1 | 9.97 |
| R-20245 | 1200 ct | 500 ct | 125 | 1.5 | .9 | .03 | 3 | 96 | 47.5 | 11.88 | 1.55:1 | 3.1:1 | 9.97 |
| R-20250 | 1200 ct | 1200 ct | 300 | 1.5 | .9 | .03 | 3 | 96 | 114 | 28.5 | 1:1 | 2:1 | 9.97 |
| R-20255 | *1200 ct | 1200 ct | - | 1.5 | .9 | .03 | 3 | 96 | 114 | - | 1:1 | - | 10.38 |
| R-20260 | 1500 ct | 12 ct | 3 | 1.5 | .9 | .03 | 2.5 | 120 | 1.14 | .29 | 11.18:1 | 22.36:1 | 9.97 |
| R-20265 | 1500 ct | 500 ct | 125 | 1.5 | .9 | .03 | 2.5 | 120 | 47.5 | 11.88 | 1.73:1 | 3.46:1 | 9.97 |
| R-20270 | *1500 ct | 600 ct | - | 1.5 | .9 | .03 | 2.5 | 120 | 57 | - | 1.58:1 | - | 10.38 |
| R-20275 | *1500 ct | 1500 ct | - | 1.5 | .9 | .03 | 2.5 | 120 | 142 | - | 1:1 | - | 10.38 |
| R-20280 | 1600 ct | 12.8 ct | 3.2 | 1.5 | .9 | .03 | 2.5 | 128 | 1.22 | 3 | 11.18:1 | 22.36:1 | 9.97 |
| R-20283 | 2000 ct | 8 ct | 2 | 1.5 | .9 | .03 | 2.2 | 160 | .76 | .19 | 15.8:1 | 31.6:1 | 9.97 |
| R-20285 | 2000 ct | 2000 ct | 500 | 1.5 | .9 | .03 | 2.2 | 160 | 190 | .75 | 1:1 | 2:1 | 9.97 |
| R-20290 | *2000 ct | 2000 ct | - | 1.5 | .9 | .03 | 2.2 | 160 | 190 | - | 1:1 | - | 10.38 |
| R-20295 | 2000 ct | 8000 ct | 2000 | 1.5 | .9 | .03 | 2.2 | 160 | 760 | 190 | 1:2 | 1:1 | 9.97 |
| R-20297 | 2500 ct | 2500 ct | 625 | 1.5 | .9 | .03 | 2 | 200 | 238 | 59.5 | 1:1 | 2:1 | 9.97 |
| R-20300 | 3000 ct | 3000 ct | 750 | 1.5 | .9 | .03 | 1.8 | 240 | 285 | 71.3 | 1:1 | 2:1 | 9.97 |
| R-20305 | *3000 ct | 3000 ct | - | 1.5 | .9 | .03 | 1.8 | 240 | 285 | - | 1:1 | - | 10.38 |

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

*Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

| PICO PART NUMBER R-Series Plug-in | PRIMARY IMPEDANCE OHMS | SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER | PAR | POWER WATTS 1KHz and HIGHER | 300 Hz | 75 Hz | PRIMARY UNBAL DC CURRENT ma | PRIMARY DC RESIST OHMS | SECONDARY DC RESISTANCE OHMS SER CONN | PAR CONN | TURNS RATIO PRIM/SEC SEC SER CONN | SEC PAR CONN | PICO PRICES 1-9* R-Series |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R-20310 | 3600 ct | 3600 ct | 900 | 1.5 | .9 | .03 | 1.7 | 288 | 342 | 86 | 1:1 | 2:1 | 9.97 |
| R-20312 | 4000 ct | 16 ct | 4 | 1.5 | .9 | .03 | 1.6 | 320 | 1.52 | .38 | 15.8:1 | 31.6:1 | 9.97 |
| R-20314** | 4000 ct | 600 ct | 150 | 1.5 | .9 | .03 | 1.6 | 320 | 57 | 14.3 | 2.58:1 | 5.16:1 | 9.97 |
| R-20315 | 4000 ct | 1000 ct | 250 | 1.5 | .9 | .03 | 1.6 | 320 | 95 | 23.8 | 2:1 | 4:1 | 9.97 |
| R-20320 | *4000 ct | 8000 ct | - | 1.5 | .9 | .03 | 1.6 | 320 | 760 | - | 1:1.41 | - | 10.38 |
| R-20325 | 5000 ct | 500 ct | 125 | 1.5 | .9 | .03 | 1.4 | 400 | 47.5 | 11.88 | 3.16:1 | 6.32:1 | 9.97 |
| R-20330 | .5000 ct | 5000 ct | 1250 | 1.5 | .9 | .03 | 1.4 | 400 | 475 | 119 | 1:1 | 2:1 | 9.97 |
| R-20335 | 7500 ct | 50 ct | 12.5 | 1.3 | .9 | .03 | 1.2 | 600 | 4.75 | 1.19 | 12.25:1 | 24.5:1 | 11.06 |
| R-20340 | 7500 ct | 100 ct | 25 | 1.3 | .9 | .03 | 1.2 | 600 | 9.5 | 2.38 | 8.66:1 | 17.32:1 | 11.06 |
| R-20345 | 7500 ct | 600 ct | 150 | 1.3 | .9 | .03 | 1.2 | 600 | 57 | 14.3 | 3.54:1 | 7.07:1 | 11.06 |
| R-20350 | 7500 ct | 2500 ct | 625 | 1.3 | .9 | .03 | 1.2 | 600 | 238 | 59.5 | 1.73:1 | 3.46:1 | 11.06 |
| R-20355 | *7500 ct | 7500 ct | - | 1.3 | .9 | .03 | 1.2 | 600 | 713 | - | 1:1 | - | 11.85 |
| R-20360 | 8000 ct | 12.8 ct | 3.2 | 1.2 | .9 | .03 | 1.1 | 640 | 1.22 | .3 | 25:1 | 50:1 | 11.06 |
| R-20365 | 8000 ct | 1000 ct | 250 | 1.2 | .9 | .03 | 1.1 | 640 | 95 | 23.8 | 2.83:1 | 5.66:1 | 11.06 |
| R-20370 | *8000 ct | 1200 ct | - | 1.2 | .9 | .03 | 1.1 | 640 | 114 | - | 2.58:1 | - | 11.85 |
| R-20375 | *9000 ct | 9000 ct | - | 1.1 | .9 | .03 | 1.1 | 720 | 855 | - | 1:1 | - | 11.85 |
| R-20380 | 10,000 ct | 12.8 ct | 3.2 | 1.0 | .9 | .03 | 1 | 800 | 1.22 | .3 | 28:1 | 56:1 | 11.06 |
| R-20385 | 10,000 ct | 16 ct | 4 | 1.0 | .9 | .03 | 1 | 800 | 1.52 | .38 | 25:1 | 50:1 | 11.06 |
| R-20390 | 10,000 ct | 100 ct | 25 | 1.0 | .9 | .03 | 1 | 800 | 9.5 | 2.38 | 10:1 | 20:1 | 11.06 |
| R-20395 | 10,000 ct | 200 ct | 50 | 1.0 | .9 | .03 | 1 | 800 | 19 | 4.75 | 7.07:1 | 14.14:1 | 11.06 |
| R-20400 | 10,000 ct | 500 ct | 125 | 1.0 | .9 | .03 | 1 | 800 | 47.5 | 11.88 | 4.47:1 | 8.94:1 | 11.06 |
| R-20405 | 10,000 ct | 600 ct | 150 | 1.0 | .9 | .03 | 1 | 800 | 57 | 14.25 | 4.08:1 | 8.16:1 | 11.06 |
| R-20410 | 10,000 ct | 1000 ct | 250 | 1.0 | .9 | .03 | 1 | 800 | 95 | 23.8 | 3.16:1 | 6.32:1 | 11.06 |
| R-20415 | 10,000 ct | 1200 ct | 300 | 1.0 | .9 | .03 | 1 | 800 | 114 | 28.5 | 2.89:1 | 5.77:1 | 11.06 |
| R-20420 | 10,000 ct | 1500 ct | 375 | 1.0 | .9 | .03 | 1 | 800 | 143 | 35.8 | 2.58:1 | 5.16:1 | 11.06 |
| R-20425 | 10,000 ct | 2000 ct | 500 | 1.0 | .9 | .03 | 1 | 800 | 190 | 47.5 | 2.24:1 | 4.47:1 | 11.06 |
| R-20430 | 10,000 ct | 5000 ct | 1250 | 1.0 | .9 | .03 | 1 | 800 | 475 | 119 | 1.41:1 | 2.83:1 | 11.06 |
| R-20435 | 10,000 ct | 7500 ct | 1875 | 1.0 | .9 | .03 | 1 | 800 | 713 | 178 | 1.16:1 | 2.31:1 | 11.06 |
| R-20440 | 10,000 ct | 10,000 ct | 2500 | 1.0 | .9 | .03 | 1 | 800 | 950 | 238 | 1:1 | 2:1 | 11.06 |
| R-20445 | *10,000 ct | 10,000 ct | - | 1.0 | .9 | .03 | 1 | 800 | 950 | - | 1:1 | - | 11.85 |
| R-20450 | 15,000 ct | 400 ct | 100 | .66 | .66 | .03 | .8 | 1200 | 38 | 9.5 | 6.12:1 | 12.25:1 | 11.06 |
| R-20452 | 15,000 ct | 500 ct | 125 | .66 | .66 | .03 | .8 | 1200 | 48 | 12 | 5.48:1 | 10.95:1 | 11.06 |
| R-20455 | 15,000 ct | 600 ct | 150 | .66 | .66 | .03 | .8 | 1200 | 57 | 14.3 | 5:1 | 10:1 | 11.06 |
| R-20460 | 15,000 ct | 10,000 ct | 2500 | .66 | .66 | .03 | .8 | 1200 | 950 | 238 | 1.22:1 | 2.45:1 | 11.06 |
| R-20465 | *15,000 ct | 15,000 ct | - | .66 | .66 | .03 | .8 | 1200 | 1430 | - | 1:1 | - | 11.85 |
| R-20470 | 15,000 ct | 15,000 ct | 3750 | .66 | .66 | .03 | .8 | 1200 | 1430 | 357 | 1:1 | 2:1 | 11.06 |
| R-20475 | 16,000 ct | 1000 ct | 250 | .62 | .62 | .03 | .8 | 1280 | 95 | 23.8 | 4:1 | 8:1 | 11.06 |
| R-20480 | 20,000 ct | 500 ct | 125 | .5 | .5 | .03 | .7 | 1600 | 47.5 | 11.88 | 6.32:1 | 12.65:1 | 11.85 |
| R-20485 | 20,000 ct | 600 ct | 150 | .5 | .5 | .03 | .7 | 1600 | 57 | 14.25 | 5.77:1 | 11.55:1 | 11.85 |
| R-20490 | 20,000 ct | 800 ct | 200 | .5 | .5 | .03 | .7 | 1600 | 76 | 19 | 5:1 | 10:1 | 11.85 |
| R-20495 | 20,000 ct | 1000 ct | 250 | .5 | .5 | .03 | .7 | 1600 | 95 | 23.8 | 4.47:1 | 8.94:1 | 11.85 |
| R-20500 | 20,000 ct | 5000 ct | 1250 | .5 | .5 | .03 | .7 | 1600 | 475 | 119 | 2:1 | 4:1 | 11.85 |
| R-20505 | 20,000 ct | 10,000 ct | 2500 | .5 | .5 | .03 | .7 | 1600 | 950 | 238 | 1.41:1 | 2.83:1 | 11.85 |
| R-20510 | *20,000 ct | 20,000 ct | - | .5 | .5 | .03 | .7 | 1600 | 1900 | - | 1:1 | - | 12.31 |
| R-20515 | 25,000 ct | 500 ct | 125 | .4 | .4 | .03 | .6 | 2000 | 47.5 | 11.88 | 7.07:1 | 14.14:1 | 11.85 |
| R-20520 | 25,000 ct | 1000 ct | 250 | .4 | .4 | .03 | .6 | 2000 | 95 | 23.8 | 5:1 | 10:1 | 11.85 |
| R-20525 | 30,000 ct | 50 ct | 12.5 | .33 | .33 | .03 | .6 | 2400 | 4.75 | 1.19 | 24.5:1 | 49:1 | 12.31 |
| R-20530 | 30,000 ct | 1200 ct | 300 | .33 | .33 | .03 | .6 | 2400 | 114 | 28.5 | 5:1 | 10:1 | 12.31 |
| R-20532 | 30,000 ct | 500 ct | 125 | .33 | .33 | .03 | .6 | 2400 | 47.5 | 11.88 | 7.7:1 | 15.5:1 | 12.31 |
| R-20534 | 30,000 ct | 200 ct | 50 | .33 | .33 | .03 | .6 | 2400 | 19 | 47.5 | 12.2:1 | 24.5:1 | 12.31 |
| R-20535 | 30,000 ct | 5000 ct | 1250 | .33 | .33 | .03 | .6 | 2400 | 475 | 119 | 2.45:1 | 4.9:1 | 12.31 |
| R-20540 | 30,000 ct | 10,000 ct | 2500 | .33 | .33 | .03 | .6 | 2400 | 950 | 238 | 1.73:1 | 3.46:1 | 12.31 |
| R-20545 | *30,000 ct | 30,000 ct | - | .33 | .33 | .03 | .6 | 2400 | 2.85 | - | 1:1 | - | 13.22 |
| R-20550 | 40,000 ct | 400 ct | 100 | .25 | .25 | .03 | .5 | 3200 | 38 | 9.5 | 10:1 | 20:1 | 13.22 |
| R-20555 | 40,000 ct | 2000 ct | 500 | .25 | .25 | .03 | .5 | 3200 | 190 | 47.5 | 4.47:1 | 8.94:1 | 13.22 |
| R-20560 | 40,000 ct | 4000 ct | 1000 | .25 | .25 | .03 | .5 | 3200 | 380 | 95 | 3.16:1 | 6.32:1 | 13.22 |
| R-20565 | 40,000 ct | 20,000 ct | 5000 | .25 | .25 | .03 | .5 | 3200 | 1900 | 475 | 1.41:1 | 2.83:1 | 13.22 |
| R-20570 | *40,000 ct | 40,000 ct | - | .25 | .25 | .03 | .5 | 3200 | 3800 | - | 1:1 | - | 14.73 |
| R-20575 | 50,000 ct | 200 ct | 50 | .2 | .2 | .03 | .4 | 4000 | 19 | 47.5 | 15.8:1 | 31.6:1 | 14.73 |
| R-20577 | 50,000 ct | 500 ct | 125 | .2 | .2 | .03 | .4 | 4000 | 47.5 | 11.88 | 10:1 | 20:1 | 14.73 |
| R-20578 | 50,000 ct | 600 ct | 150 | .2 | .2 | .03 | .4 | 4000 | 57 | 14.3 | 9.13:1 | 18.26:1 | 14.73 |
| R-20579 | 50,000 ct | 50,000 ct | 12,500 | .2 | .2 | .03 | .4 | 4000 | 4750 | 1190 | 1:1 | 2:1 | 14.73 |
| R-20580 | 60,000 ct | 15,000 ct | 3750 | .16 | .16 | .03 | .4 | 4800 | 1430 | 358 | 2:1 | 4:1 | 15.90 |
| R-20585 | 62,500 ct | 50 ct | 12.5 | .16 | .16 | .03 | .4 | 5000 | 4750 | 1190 | 35.4:1 | 70.7:1 | 15.90 |
| R-20587 | 80,000 ct | 15,000 ct | 3750 | .12 | .12 | .03 | .3 | 6400 | 1430 | 358 | 2.3:1 | 4.6:1 | 15.90 |
| R-20590 | 90,000 ct | 10,000 ct | 2500 | .11 | .11 | .03 | .3 | 7200 | 950 | 238 | 3:1 | 6:1 | 16.70 |
| R-20595 | 95,000 ct | 15,000 ct | 3750 | .1 | .1 | .03 | .3 | 7600 | 1430 | 358 | 2.5:1 | 5:1 | 16.70 |
| R-20600 | 100,000 ct | 60 ct | 15 | .1 | .1 | .03 | .3 | 8000 | 5.7 | 1.43 | 40.8:1 | 81.6:1 | 16.70 |
| R-20605 | 100,000 ct | 100 ct | 25 | .1 | .1 | .03 | .3 | 8000 | 9.5 | 2.38 | 31.6:1 | 63.2:1 | 16.70 |
| R-20610 | 100,000 ct | 500 ct | 125 | .1 | .1 | .03 | .3 | 8000 | 47.5 | 11.88 | 14.1:1 | 28.3:1 | 16.70 |
| R-20613 | 100,000 ct | 1000 ct | 250 | .1 | .1 | .03 | .3 | 8000 | 95 | 23.8 | 10:1 | 20:1 | 16.70 |
| R-20614 | 100,000 ct | 2000 ct | 500 | .1 | .1 | .03 | .3 | 8000 | 190 | 47.5 | 7.07:1 | 14.14:1 | 16.70 |
| R-20615 | 100,000 ct | 10,000 ct | 2500 | .1 | .1 | .03 | .3 | 8000 | 950 | 238 | 3.16:1 | 6.32:1 | 16.70 |
| R-20620 | 135,000 ct | 82 ct | 20.5 | .07 | .07 | .03 | .2 | 10,800 | 7.8 | 1.9 | 40.6:1 | 81.2:1 | 17.45 |

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%**

**Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon. New York. P.O. Box 1206**


**PICO's ultra-miniature transformers**

**R SERIES**
**Plug-In**

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

*(All PICO Products are patented)*

**Send for new 68 page Pico Catalog**

**Delivery— stock to one week**

**PICO Electronics, Inc.**

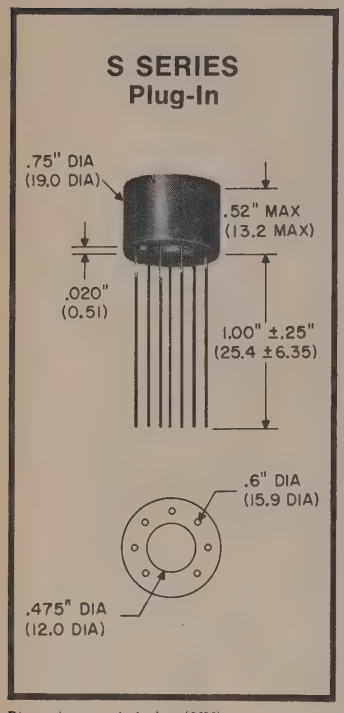
P.O. Box 1206
Mt. Vernon
New York 10551

phone
914-699-5514

For immediate engineering assistance or to place an order—

**Call Toll Free 800-431-1064**

# PICO's ultra-miniature transformers




Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27: . . . . . All Units Are Designed to MIL-T-27 And Are Hermetically Sealed in a Metal Case, Audio Transformers Are Type TF5R21ZZ.
- FREQUENCY RESPONSE: . . . ± 3 db, 50 Hz - 30 KHz at 1.0 Milliwatt.
- MAXIMUM DISTORTION: . . . 5% With Rated Power Level at 1 KHz, 300 Hz and 50 Hz.
- DIELECTRIC STRENGTH: . . . All Units Tested at 200 V RMS.
- INSULATION RESISTANCE: . . Greater Than 10,000 Megohms at 300 V DC.
- WEIGHT: . . . . . 17 Grams
- OPERATING TEMPERATURE: . -55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c Maximum).
- TERMINALS: . . . . . Solid .016 Diameter Conductor. Conductor is Gold Plated, Nickel-Iron Core Wire (Dumet) in Accordance With MIL-STD-1276 Type D.
- THERMAL SHOCK: . . . . . 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

*(All PICO Products are patented)*

**Send for new 68 page Pico Catalog**

| PICO PART NUMBER S-Series Plug-in | PRIMARY IMPEDANCE OHMS | SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER | PAR | POWER WATTS 1KHz and HIGHER | 300 Hz | 50 Hz | PRIMARY UNBAL DC CURRENT ma | PRIMARY DC RESIST OHMS | SECONDARY DC RESISTANCE OHMS SER CONN | PAR CONN | TURNS RATIO PRIM/SEC SEC SER CONN | SEC PAR CONN | PICO PRICES 1-9* S-Series |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S-21003 | 20 ct | 8 ct | 2 | 2.0 | 1.5 | .03 | 22 | 1.6 | .88 | .22 | 1.58:1 | 3.16:1 | 9.97 |
| S-21005 | 20 ct | 20 ct | 5 | 2.0 | 1.5 | .03 | 22 | 1.6 | 2.2 | .55 | 1:1 | 2:1 | 9.97 |
| S-21010 | 32 ct | 32 ct | 8 | 2.0 | 1.5 | .03 | 17.5 | 2.56 | 3.52 | .88 | 1:1 | 2:1 | 9.97 |
| S-21015 | 40 ct | 40 ct | 10 | 2.0 | 1.5 | .03 | 16 | 3.2 | 4.4 | 1.1 | 1:1 | 2:1 | 9.97 |
| S-21018 | 48 ct | 16 ct | 4 | 2.0 | 1.5 | .03 | 14.5 | 3.84 | 1.76 | .44 | 1.73:1 | 3.46:1 | 9.97 |
| S-21020 | 50 ct | 50 ct | 12.5 | 2.0 | 1.5 | .03 | 14 | 4 | 5.5 | 1.38 | 1:1 | 2:1 | 9.97 |
| S-21025 | 80 ct | 32 ct | 8 | 2.0 | 1.5 | .03 | 11 | 6.4 | 3.52 | .88 | 1.58:1 | 3.16:1 | 9.97 |
| S-21028 | 100 ct | 40 ct | 10 | 2.0 | 1.5 | .03 | 10 | 8 | 4.4 | 1.1 | 1.58:1 | 3.16:1 | 9.97 |
| S-21030 | 100 ct | 100 ct | 25 | 2.0 | 1.5 | .03 | 10 | 8 | 11 | 2.75 | 1:1 | 2:1 | 9.97 |
| S-21035 | 120 ct | 12.8 ct | 3.2 | 2.0 | 1.5 | .03 | 9 | 9.6 | 1.41 | .35 | 3.06:1 | 6.12:1 | 9.97 |
| S-21040 | 120 ct | 60 ct | 15 | 2.0 | 1.5 | .03 | 9 | 9.6 | 6.6 | 1.65 | 1.41:1 | 2.83:1 | 9.97 |
| S-21045 | 120 ct | 120 ct | 30 | 2.0 | 1.5 | .03 | 9 | 9.6 | 13.2 | 3.3 | 1:1 | 2:1 | 9.97 |
| S-21050 | 150 ct | 12 ct | 3 | 2.0 | 1.5 | .03 | 8 | 12 | 1.32 | .33 | 3.54:1 | 7.08:1 | 9.97 |
| S-21055 | 150 ct | 50 ct | 12.5 | 2.0 | 1.5 | .03 | 8 | 12 | 5.5 | 1.38 | 1.73:1 | 3.46:1 | 9.97 |
| S-21060 | 150 ct | 100 ct | 25 | 2.0 | 1.5 | .03 | 8 | 12 | 11 | 2.75 | 1.22:1 | 2.44:1 | 9.97 |
| S-21065 | 150 ct | 150 ct | 37.5 | 2.0 | 1.5 | .03 | 8 | 12 | 16.5 | 4.13 | 1:1 | 2:1 | 9.97 |
| S-21070 | 150 ct | 600 ct | 150 | 2.0 | 1.5 | .03 | 8 | 12 | 66 | 16.5 | 1:2 | 1:1 | 9.97 |
| S-21075 | 200 ct | 200 ct | 50 | 2.0 | 1.5 | .03 | 7 | 16 | 22 | 5.5 | 1:1 | 2:1 | 9.97 |
| S-21080 | 300 ct | 12 ct | 3 | 2.0 | 1.5 | .03 | 5.5 | 24 | 1.32 | .33 | 5:1 | 10:1 | 9.97 |
| S-21085 | 300 ct | 50 ct | 12.5 | 2.0 | 1.5 | .03 | 5.5 | 24 | 5.5 | 1.38 | 2.45:1 | 4.9:1 | 9.97 |
| S-21090 | 300 ct | 150 ct | 37.5 | 2.0 | 1.5 | .03 | 5.5 | 24 | 16.5 | 4.13 | 1.41:1 | 2.83:1 | 9.97 |
| S-21095 | 300 ct | 300 ct | 75 | 2.0 | 1.5 | .03 | 5.5 | 24 | 33 | 8.25 | 1:1 | 2:1 | 9.97 |
| S-21100 | 300 ct | 600 ct | 150 | 2.0 | 1.5 | .03 | 5.5 | 24 | 66 | 16.5 | 1:1.41 | 1.41:1 | 9.97 |
| S-21105 | 320 ct | 12.8 ct | 3.2 | 2.0 | 1.5 | .03 | 5.5 | 25.6 | 1.41 | .35 | 5:1 | 10:1 | 9.97 |
| S-21110 | 400 ct | 40 ct | 10 | 2.0 | 1.5 | .03 | 5 | 32 | 4.4 | 1.1 | 3.16:1 | 6.32:1 | 9.97 |
| S-21115 | 400 ct | 120 ct | 30 | 2.0 | 1.5 | .03 | 5 | 32 | 13.2 | 3.3 | 1.83:1 | 3.65:1 | 9.97 |
| S-21120 | 400 ct | 200 ct | 50 | 2.0 | 1.5 | .03 | 5 | 32 | 22 | 5.5 | 1.41:1 | 2.83:1 | 9.97 |
| S-21125 | 400 ct | 400 ct | 100 | 2.0 | 1.5 | .03 | 5 | 32 | 44 | 11 | 1:1 | 2:1 | 9.97 |
| S-21130 | 400 ct | 1000 ct | 250 | 2.0 | 1.5 | .03 | 5 | 32 | 110 | 27.5 | 1:1.58 | 1.26:1 | 9.97 |
| S-21135 | 400 ct | 2000 ct | 500 | 2.0 | 1.5 | .03 | 5 | 32 | 220 | 55 | 1:2.24 | 1:1.12 | 9.97 |
| S-21140 | 400 ct | 4000 ct | 1000 | 2.0 | 1.5 | .03 | 5 | 32 | 440 | 110 | 1:3.16 | 1:1.58 | 9.97 |
| S-21142 | 500 ct | 12.8 ct | 3.2 | 2.0 | 1.5 | .03 | 4.5 | 40 | 1.41 | .35 | 6.25:1 | 12.5:1 | 9.97 |
| S-21144 | 500 ct | 16 ct | 4 | 2.0 | 1.5 | .03 | 4.5 | 40 | 1.76 | .44 | 5.6:1 | 11.2:1 | 9.97 |
| S-21145 | 500 ct | 50 ct | 12.5 | 2.0 | 1.5 | .03 | 4.5 | 40 | 5.5 | 1.38 | 3.16:1 | 6.32:1 | 9.97 |
| S-21147 | 500 ct | 150 ct | 37.5 | 2.0 | 1.5 | .03 | 4.5 | 40 | 16.5 | 4.13 | 1.83:1 | 3.65:1 | 9.97 |
| S-21150 | 500 ct | 500 ct | 125 | 2.0 | 1.5 | .03 | 4.5 | 40 | 55 | 13.75 | 1:1 | 2:1 | 9.97 |
| S-21155 | *500 ct | 500 ct | - | 2.0 | 1.5 | .03 | 4.5 | 40 | 55 | - | 1:1 | - | 10.38 |
| S-21160 | 500 ct | 600 ct | 150 | 2.0 | 1.5 | .03 | 4.5 | 40 | 66 | 16.5 | 1:1.1 | 1.83:1 | 9.97 |
| S-21165 | 600 ct | 12.8 ct | 3.2 | 2.0 | 1.5 | .03 | 4 | 48 | 1.41 | .35 | 6.85:1 | 12.7:1 | 9.97 |
| S-21167 | 600 ct | 30 ct | 7.5 | 2.0 | 1.5 | .03 | 4 | 48 | 3.3 | .83 | 4.47:1 | 8.94:1 | 9.97 |
| S-21170 | 600 ct | 48 ct | 12 | 2.0 | 1.5 | .03 | 4 | 48 | 5.28 | 1.37 | 3.54:1 | 7.07:1 | 9.97 |
| S-21175 | 600 ct | 200 ct | 50 | 2.0 | 1.5 | .03 | 4 | 48 | 22 | 5.5 | 1.73:1 | 3.46:1 | 9.97 |
| S-21180** | 600 ct | 600 ct | 150 | 2.0 | 1.5 | .03 | 4 | 48 | 66 | 16.5 | 1:1 | 2:1 | 9.97 |
| S-21185** | *600 ct | 600 ct | - | 2.0 | 1.5 | .03 | 4 | 48 | 66 | - | 1:1 | - | 10.38 |
| S-21186** | *600 ct | 900 ct | - | 2.0 | 1.5 | .03 | 4 | 48 | 99 | - | 1:1.22 | - | 10.38 |
| S-21187** | 600 ct | 1200 ct | 300 | 2.0 | 1.5 | .03 | 4 | 48 | 132 | 33 | 1:1.41 | 1.41:1 | 9.97 |
| S-21190 | 640 ct | 12.8 ct | 3.2 | 2.0 | 1.5 | .03 | 4 | 51 | 1.41 | .35 | 7.07:1 | 14.14:1 | 9.97 |
| S-21195 | 700 ct | 100 ct | 25 | 2.0 | 1.5 | .03 | 3.5 | 56 | 11 | 2.75 | 2.65:1 | 5.29:1 | 9.97 |
| S-21200 | 800 ct | 12.8 ct | 3.2 | 2.0 | 1.5 | .03 | 3.5 | 64 | 1.41 | .35 | 7.91:1 | 15.8:1 | 9.97 |
| S-21205 | 800 ct | 48 ct | 12 | 2.0 | 1.5 | .03 | 3.5 | 64 | 5.28 | 1.32 | 4.08:1 | 8.16:1 | 9.97 |
| S-21210 | 800 ct | 800 ct | 200 | 2.0 | 1.5 | .03 | 3.5 | 64 | 88 | 22 | 1:1 | 2:1 | 9.97 |
| S-21215 | 900 ct | 600 ct | 150 | 2.0 | 1.5 | .03 | 3 | 72 | 66 | 16.5 | 1.23:1 | 2.45:1 | 9.97 |
| S-21217** | *900 ct | 900 ct | - | 2.0 | 1.5 | .03 | 3 | 72 | 99 | - | 1:1 | - | 10.38 |
| S-21220 | 1000 ct | 12 ct | 3 | 2.0 | 1.5 | .03 | 3 | 80 | 1.32 | .33 | 9.13:1 | 18.26:1 | 9.97 |
| S-21225 | 1000 ct | 50 ct | 12.5 | 2.0 | 1.5 | .03 | 3 | 80 | 5.5 | 1.38 | 4.47:1 | 8.94:1 | 9.97 |
| S-21230 | 1000 ct | 1000 ct | 250 | 2.0 | 1.5 | .03 | 3 | 80 | 110 | 27.5 | 1:1 | 2:1 | 9.97 |
| S-21235 | 1060 ct | 12.8 ct | 3.2 | 2.0 | 1.5 | .03 | 3 | 85 | 1.41 | .35 | 9.1:1 | 18.2:1 | 9.97 |
| S-21240 | 1200 ct | 12.8 ct | 3.2 | 2.0 | 1.5 | .03 | 3 | 96 | 1.41 | .35 | 9.68:1 | 19.4:1 | 9.97 |
| S-21245 | 1200 ct | 500 ct | 125 | 2.0 | 1.5 | .03 | 3 | 96 | 55 | 13.75 | 1.55:1 | 3.1:1 | 9.97 |
| S-21250 | 1200 ct | 1200 ct | 300 | 2.0 | 1.5 | .03 | 3 | 96 | 132 | 33 | 1:1 | 2:1 | 9.97 |
| S-21255 | *1200 ct | 1200 ct | - | 2.0 | 1.5 | .03 | 3 | 96 | 132 | - | 1:1 | - | 10.38 |
| S-21260 | 1500 ct | 12 ct | 3 | 2.0 | 1.5 | .03 | 2.5 | 120 | 1.32 | .33 | 11.18:1 | 22.36:1 | 9.97 |
| S-21265 | 1500 ct | 500 ct | 125 | 2.0 | 1.5 | .03 | 2.5 | 120 | 55 | 13.75 | 1.73:1 | 3.46:1 | 9.97 |
| S-21270 | *1500 ct | 600 ct | - | 2.0 | 1.5 | .03 | 2.5 | 120 | 66 | - | 1.58:1 | - | 10.38 |
| S-21275 | *1500 ct | 1500 ct | - | 2.0 | 1.5 | .03 | 2.5 | 120 | 165 | - | 1:1 | - | 10.38 |
| S-21280 | 1600 ct | 12.8 ct | 3.2 | 2.0 | 1.5 | .03 | 2.5 | 128 | 1.41 | .35 | 11.18:1 | 22.36:1 | 9.97 |
| S-21283 | 2000 ct | 8 ct | 2 | 2.0 | 1.5 | .03 | 2.2 | 160 | .88 | .22 | 15.8:1 | 31.6:1 | 9.97 |
| S-21285 | 2000 ct | 2000 ct | 500 | 2.0 | 1.5 | .03 | 2.2 | 160 | 220 | 55 | 1:1 | 2:1 | 9.97 |
| S-21290 | *2000 ct | 2000 ct | - | 2.0 | 1.5 | .03 | 2.2 | 160 | 220 | - | 1:1 | - | 10.38 |
| S-21295 | 2000 ct | 8000 ct | 2000 | 2.0 | 1.5 | .03 | 2.2 | 160 | 880 | 220 | 1:2 | 1:1 | 9.97 |
| S-21297 | 2500 ct | 2500 ct | 625 | 2.0 | 1.5 | .03 | 2 | 200 | 275 | 69 | 1:1 | 2:1 | 9.97 |
| S-21300 | 3000 ct | 3000 ct | 750 | 2.0 | 1.5 | .03 | 1.8 | 240 | 330 | 83 | 1:1 | 2:1 | 9.97 |
| S-21305 | *3000 ct | 3000 ct | - | 2.0 | 1.5 | .03 | 1.8 | 240 | 330 | - | 1:1 | - | 10.38 |

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

*Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

**PICO Electronics, Inc.**
P.O. Box 1206, Mt. Vernon, New York 10551 • phone 914-699-5514

| PICO PART NUMBER S-Series Plug-in | PRIMARY IMPEDANCE OHMS | SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER | SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR | POWER WATTS 1KHz and HIGHER | POWER WATTS 300 Hz | POWER WATTS 50 Hz | PRIMARY UNBAL DC CURRENT ma | PRIMARY DC RESIST OHMS | SECONDARY DC RESISTANCE OHMS SER CONN | SECONDARY DC RESISTANCE OHMS PAR CONN | TURNS RATIO PRIM/SEC SEC SER CONN | TURNS RATIO PRIM/SEC SEC PAR CONN | PICO PRICES 1-9* S-Series |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S-21310 | 3600 ct | 3600 ct | 900 | 2.0 | 1.5 | .03 | 1.7 | 288 | 396 | 99 | 1:1 | 2:1 | 9.97 |
| S-21312 | 4000 ct | 16 ct | 4 | 2.0 | 1.5 | .03 | 1.6 | 320 | 1.76 | .44 | 15.8:1 | 31.6:1 | 9.97 |
| S-21314** | 4000 ct | 600 ct | 150 | 2.0 | 1.5 | .03 | 1.6 | 320 | 66 | 16.5 | 2.58:1 | 5.16:1 | 9.97 |
| S-21315 | 4000 ct | 1000 ct | 250 | 2.0 | 1.5 | .03 | 1.6 | 320 | 110 | 27.5 | 2:1 | 4:1 | 9.97 |
| S-21320 | *4000 ct | 8000 ct | - | 2.0 | 1.5 | .03 | 1.6 | 320 | 880 | - | 1:1.41 | - | 10.38 |
| S-21325 | 5000 ct | 500 ct | 125 | 2.0 | 1.5 | .03 | 1.4 | 400 | 55 | 13.8 | 3.16:1 | 6.32:1 | 9.97 |
| S-21330 | 5000 ct | 5000 ct | 1250 | 2.0 | 1.5 | .03 | 1.4 | 400 | 550 | 138 | 1:1 | 2:1 | 9.97 |
| S-21335 | 7500 ct | 50 ct | 12.5 | 1.3 | 1.3 | .03 | 1.2 | 600 | 5.5 | 1.38 | 12.25:1 | 24.5:1 | 11.06 |
| S-21340 | 7500 ct | 100 ct | 25 | 1.3 | 1.3 | .03 | 1.2 | 600 | 11 | 2.75 | 8.66:1 | 17.32:1 | 11.06 |
| S-21345 | 7500 ct | 600 ct | 150 | 1.3 | 1.3 | .03 | 1.2 | 600 | 66 | 16.5 | 3.54:1 | 7.07:1 | 11.06 |
| S-21350 | 7500 ct | 2500 ct | 625 | 1.3 | 1.3 | .03 | 1.2 | 600 | 275 | 69 | 1.73:1 | 3.46:1 | 11.06 |
| S-21355 | *7500 ct | 7500 ct | - | 1.3 | 1.3 | .03 | 1.2 | 600 | 825 | - | 1:1 | - | 11.85 |
| S-21360 | 8000 ct | 12.8 ct | 3.2 | 1.2 | 1.2 | .03 | 1.1 | 640 | 1.4 | .35 | 25:1 | 50:1 | 11.06 |
| S-21365 | 8000 ct | 1000 ct | 250 | 1.2 | 1.2 | .03 | 1.1 | 640 | 110 | 27.5 | 2.83:1 | 5.66:1 | 11.06 |
| S-21370 | *8000 ct | 1200 ct | - | 1.2 | 1.2 | .03 | 1.1 | 640 | 132 | - | 2.58:1 | - | 11.85 |
| S-21375 | *9000 ct | 9000 ct | - | 1.1 | 1.1 | .03 | 1.1 | 720 | 990 | - | 1:1 | - | 11.85 |
| S-21380 | 10,000 ct | 12.8 ct | 3.2 | 1.0 | 1.0 | .03 | 1 | 800 | 1.4 | .35 | 28:1 | 56:1 | 11.06 |
| S-21385 | 10,000 ct | 16 ct | 4 | 1.0 | 1.0 | .03 | 1 | 800 | 1.76 | .44 | 25:1 | 50:1 | 11.06 |
| S-21390 | 10,000 ct | 100 ct | 25 | 1.0 | 1.0 | .03 | 1 | 800 | 11 | 2.75 | 10:1 | 20:1 | 11.06 |
| S-21395 | 10,000 ct | 200 ct | 50 | 1.0 | 1.0 | .03 | 1 | 800 | 22 | 5.5 | 7.07:1 | 14.14:1 | 11.06 |
| S-21400 | 10,000 ct | 500 ct | 125 | 1.0 | 1.0 | .03 | 1 | 800 | 55 | 13.75 | 4.47:1 | 8.94:1 | 11.06 |
| S-21405 | 10,000 ct | 600 ct | 150 | 1.0 | 1.0 | .03 | 1 | 800 | 66 | 16.5 | 4.08:1 | 8.16:1 | 11.06 |
| S-21410 | 10,000 ct | 1000 ct | 250 | 1.0 | 1.0 | .03 | 1 | 800 | 110 | 27.5 | 3.16:1 | 6.32:1 | 11.06 |
| S-21415 | 10,000 ct | 1200 ct | 300 | 1.0 | 1.0 | .03 | 1 | 800 | 132 | 33 | 2.89:1 | 5.77:1 | 11.06 |
| S-21420 | 10,000 ct | 1500 ct | 375 | 1.0 | 1.0 | .03 | 1 | 800 | 165 | 41.3 | 2.58:1 | 5.16:1 | 11.06 |
| S-21425 | 10,000 ct | 2000 ct | 500 | 1.0 | 1.0 | .03 | 1 | 800 | 220 | 55 | 2.24:1 | 4.47:1 | 11.06 |
| S-21430 | 10,000 ct | 5000 ct | 1250 | 1.0 | 1.0 | .03 | 1 | 800 | 550 | 138 | 1.41:1 | 2.83:1 | 11.06 |
| S-21435 | 10,000 ct | 7500 ct | 1875 | 1.0 | 1.0 | .03 | 1 | 800 | 825 | 206 | 1.16:1 | 2.31:1 | 11.06 |
| S-21440 | 10,000 ct | 10,000 ct | 2500 | 1.0 | 1.0 | .03 | 1 | 800 | 1100 | 275 | 1:1 | 2:1 | 11.06 |
| S-21445 | *10,000 ct | 10,000 ct | - | 1.0 | 1.0 | .03 | 1 | 800 | 1100 | - | 1:1 | - | 11.85 |
| S-21450 | 15,000 ct | 400 ct | 100 | .65 | .65 | .03 | .8 | 1200 | 44 | 11 | 6.12:1 | 12.25:1 | 11.06 |
| S-21452 | 15,000 ct | 500 ct | 125 | .65 | .65 | .03 | .8 | 1200 | 55 | 13.8 | 5.48:1 | 10.95:1 | 11.06 |
| S-21455 | 15,000 ct | 600 ct | 150 | .65 | .65 | .03 | .8 | 1200 | 66 | 16.5 | 5:1 | 10:1 | 11.06 |
| S-21460 | 15,000 ct | 10,000 ct | 2500 | .65 | .65 | .03 | .8 | 1200 | 1100 | 275 | 1.22:1 | 2.45:1 | 11.06 |
| S-21465 | *15,000 ct | 15,000 ct | - | .65 | .65 | .03 | .8 | 1200 | 1650 | - | 1:1 | - | 11.85 |
| S-21470 | 15,000 ct | 15,000 ct | 3750 | .65 | .65 | .03 | .8 | 1200 | 1650 | 413 | 1:1 | 2:1 | 11.06 |
| S-21475 | 16,000 ct | 1000 ct | 250 | .62 | .62 | .03 | .8 | 1280 | 110 | 27.5 | 4:1 | 8:1 | 11.06 |
| S-21480 | 20,000 ct | 500 ct | 125 | .5 | .5 | .03 | .7 | 1600 | 55 | 13.8 | 6.32:1 | 12.65:1 | 11.85 |
| S-21485 | 20,000 ct | 600 ct | 150 | .5 | .5 | .03 | .7 | 1600 | 66 | 16.5 | 5.77:1 | 11.55:1 | 11.85 |
| S-21490 | 20,000 ct | 800 ct | 200 | .5 | .5 | .03 | .7 | 1600 | 88 | 22 | 5:1 | 10:1 | 11.85 |
| S-21495 | 20,000 ct | 1000 ct | 250 | .5 | .5 | .03 | .7 | 1600 | 110 | 27.5 | 4.47:1 | 8.94:1 | 11.85 |
| S-21500 | 20,000 ct | 5000 ct | 1250 | .5 | .5 | .03 | .7 | 1600 | 550 | 138 | 2:1 | 4:1 | 11.85 |
| S-21505 | 20,000 ct | 10,000 ct | 2500 | .5 | .5 | .03 | .7 | 1600 | 1100 | 275 | 1.41:1 | 2.83:1 | 11.85 |
| S-21510 | *20,000 ct | 20,000 ct | - | .5 | .5 | .03 | .7 | 1600 | 2200 | - | 1:1 | - | 12.31 |
| S-21515 | 25,000 ct | 500 ct | 125 | .4 | .4 | .03 | .6 | 2000 | 55 | 13.8 | 7.07:1 | 14.14:1 | 11.85 |
| S-21520 | 25,000 ct | 1000 ct | 250 | .4 | .4 | .03 | .6 | 2000 | 110 | 27.5 | 5:1 | 10:1 | 11.85 |
| S-21525 | 30,000 ct | 50 ct | 12.5 | .33 | .33 | .03 | .6 | 2400 | 5.5 | 1.38 | 24.5:1 | 49:1 | 12.31 |
| S-21530 | 30,000 ct | 1200 ct | 300 | .33 | .33 | .03 | .6 | 2400 | 132 | 33 | 5:1 | 10:1 | 12.31 |
| S-21532 | 30,000 ct | 500 ct | 125 | .33 | .33 | .03 | .6 | 2400 | 55 | 13.8 | 7.7:1 | 15.5:1 | 12.31 |
| S-21534 | 30,000 ct | 200 ct | 50 | .33 | .33 | .03 | .6 | 2400 | 22 | 5.5 | 12.2:1 | 24.5:1 | 12.31 |
| S-21535 | 30,000 ct | 5000 ct | 1250 | .33 | .33 | .03 | .6 | 2400 | 550 | 137.5 | 2.45:1 | 4.9:1 | 12.31 |
| S-21540 | 30,000 ct | 10,000 ct | 2500 | .33 | .33 | .03 | .6 | 2400 | 1100 | 275 | 1.73:1 | 3.46:1 | 12.31 |
| S-21545 | *30,000 ct | 30,000 ct | - | .33 | .33 | .03 | .6 | 2400 | 3300 | - | 1:1 | - | 13.22 |
| S-21550 | 40,000 ct | 400 ct | 100 | .25 | .25 | .03 | .5 | 3200 | 44 | 11 | 10:1 | 20:1 | 13.22 |
| S-21555 | 40,000 ct | 2000 ct | 500 | .25 | .25 | .03 | .5 | 3200 | 220 | 55 | 4.47:1 | 8.94:1 | 13.22 |
| S-21560 | 40,000 ct | 4000 ct | 1000 | .25 | .25 | .03 | .5 | 3200 | 440 | 110 | 3.16:1 | 6.32:1 | 13.22 |
| S-21565 | 40,000 ct | 20,000 ct | 5000 | .25 | .25 | .03 | .5 | 3200 | 2200 | 550 | 1.41:1 | 2.83:1 | 13.22 |
| S-21570 | *40,000 ct | 40,000 ct | - | .25 | .25 | .03 | .5 | 3200 | 4400 | - | 1:1 | - | 14.73 |
| S-21575 | 50,000 ct | 200 ct | 50 | .2 | .2 | .03 | .4 | 4000 | 22 | 5.5 | 15.8:1 | 31.6:1 | 14.73 |
| S-21577 | 50,000 ct | 500 ct | 125 | .2 | .2 | .03 | .4 | 4000 | 55 | 13.8 | 10:1 | 20:1 | 14.73 |
| S-21578 | 50,000 ct | 600 ct | 150 | .2 | .2 | .03 | .4 | 4000 | 66 | 16.5 | 9.13:1 | 18.26:1 | 14.73 |
| S-21579 | 50,000 ct | 50,000 ct | 12,500 | .2 | .2 | .03 | .4 | 4000 | 5500 | 1380 | 1:1 | 2:1 | 14.73 |
| S-21580 | 60,000 ct | 15,000 ct | 3750 | .16 | .16 | .03 | .4 | 4800 | 1650 | 413 | 2:1 | 4:1 | 15.90 |
| S-21585 | 62,500 ct | 50 ct | 12.5 | .16 | .16 | .03 | .4 | 5000 | 5.5 | 1.38 | 35.4:1 | 70.7:1 | 15.90 |
| S-21587 | 80,000 ct | 15,000 ct | 3750 | .12 | .12 | .03 | .3 | 6400 | 1650 | 413 | 2.3:1 | 4.6:1 | 15.90 |
| S-21590 | 90,000 ct | 10,000 ct | 2500 | .11 | .11 | .03 | .3 | 7200 | 1100 | 275 | 3:1 | 6:1 | 16.70 |
| S-21595 | 95,000 ct | 15,000 ct | 3750 | .1 | .1 | .03 | .3 | 7600 | 1650 | 413 | 2.5:1 | 5:1 | 16.70 |
| S-21600 | 100,000 ct | 60 ct | 15 | .1 | .1 | .03 | .3 | 8000 | 6.6 | 1.65 | 40.8:1 | 81.6:1 | 16.70 |
| S-21605 | 100,000 ct | 100 ct | 25 | .1 | .1 | .03 | .3 | 8000 | 11 | 2.75 | 31.6:1 | 63.2:1 | 16.70 |
| S-21610 | 100,000 ct | 500 ct | 125 | .1 | .1 | .03 | .3 | 8000 | 55 | 13.8 | 14.1:1 | 28.3:1 | 16.70 |
| S-21613 | 100,000 ct | 1000 ct | 250 | .1 | .1 | .03 | .3 | 8000 | 110 | 27.5 | 10:1 | 20:1 | 16.70 |
| S-21614 | 100,000 ct | 2000 ct | 500 | .1 | .1 | .03 | .3 | 8000 | 220 | 155 | 7.07:1 | 14.14:1 | 16.70 |
| S-21615 | 100,000 ct | 10,000 ct | 2500 | .1 | .1 | .03 | .3 | 8000 | 1100 | 275 | 3.16:1 | 6.32:1 | 16.70 |
| S-21620 | 135,000 ct | 82 ct | 20.5 | .07 | .07 | .03 | .2 | 10,800 | 9 | 2.25 | 40.6:1 | 81.2:1 | 17.45 |

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%**

**Ordering Instructions: No minimum. Net 30 days. F.O.B. Mt. Vernon, New York. P.O. Box 1206**


# PICO's ultra-miniature transformers

## S SERIES Plug-In

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

*(All PICO Products are patented)*

**Send for new 68 page Pico Catalog**

**Delivery— stock to one week**

**PICO Electronics, Inc.**

P.O. Box 1206
Mt. Vernon
New York 10551

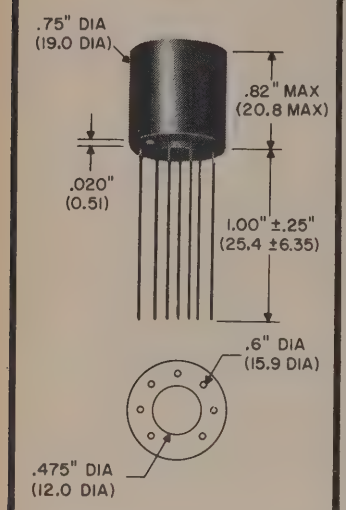
phone
914-699-5514

For immediate engineering assistance or to place an order—

**Call Toll Free 800-431-1064**

# PICO's ultra-miniature transformers

## T SERIES Plug-In




Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27: . . . . . All Units Are Designed to MIL-T-27 And Are Hermetically Sealed in a Metal Case, Audio Transformers Are Type TF5R21ZZ.
- FREQUENCY RESPONSE: . . . ± 3 db, 20 Hz - 25 KHz at 1.0 Milliwatt.
- MAXIMUM DISTORTION: . . . 5% With Rated Power Level at 1 KHz and 300 Hz. 10% Distortion at 20 Hz.
- DIELECTRIC STRENGTH: . . . All Units Tested at 200 V RMS.
- INSULATION RESISTANCE: . . Greater Than 10,000 Megohms at 300 V DC.
- WEIGHT: . . . . . 28 Grams
- OPERATING TEMPERATURE: . -55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c Maximum).
- TERMINALS: . . . . . Solid Diameter Conductor. Conductor is Gold Plated, Nickel-Iron Core Wire (Dumet) in Accordance With MIL-STD-1276 Type D.
- THERMAL SHOCK: . . . . . 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

*(All PICO Products are patented)*

**Send for new 68 page Pico Catalog**

**Delivery— stock to one week**

| PICO PART NUMBER T-Series Plug-In | PRIMARY IMPEDANCE OHMS | SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER | PAR | POWER WATTS 1KHz and HIGHER | 300 Hz | 20 Hz | PRIMARY UNBAL DC CURRENT ma | PRIMARY DC RESIST OHMS | SECONDARY DC RESISTANCE OHMS SER CONN | PAR CONN | TURNS RATIO PRIM/SEC SEC SER CONN | SEC PAR CONN | PICO PRICES 1-9* T-Series |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T-22003 | 20 ct | 8 ct | 2 | 3.0 | 2.0 | .006 | 22 | 1.6 | .8 | .2 | 1.58:1 | 3.16:1 | 10.96 |
| T-22005 | 20 ct | 20 ct | 5 | 3.0 | 2.0 | .006 | 22 | 1.6 | 2 | .5 | 1:1 | 2:1 | 10.96 |
| T-22010 | 32 ct | 32 ct | 8 | 3.0 | 2.0 | .006 | 17.5 | 2.56 | 3.2 | .8 | 1:1 | 2:1 | 10.96 |
| T-22015 | 40 ct | 40 ct | 10 | 3.0 | 2.0 | .006 | 16 | 3.2 | 4 | 1 | 1:1 | 2:1 | 10.96 |
| T-22018 | 48 ct | 16 ct | 4 | 3.0 | 2.0 | .006 | 14.5 | 3.84 | 1.6 | .4 | 1.73:1 | 3.46:1 | 10.96 |
| T-22020 | 50 ct | 50 ct | 12.5 | 3.0 | 2.0 | .006 | 14 | 4 | 5 | 1.25 | 1:1 | 2:1 | 10.96 |
| T-22025 | 80 ct | 32 ct | 8 | 3.0 | 2.0 | .006 | 11 | 6.4 | 3.2 | .8 | 1.58:1 | 3.16:1 | 10.96 |
| T-22028 | 100 ct | 40 ct | 10 | 3.0 | 2.0 | .006 | 10 | 8 | 4 | 1 | 1.58:1 | 3.16:1 | 10.96 |
| T-22030 | 100 ct | 100 ct | 25 | 3.0 | 2.0 | .006 | 10 | 8 | 10 | 2.5 | 1:1 | 2:1 | 10.96 |
| T-22035 | 120 ct | 12.8 ct | 3.2 | 3.0 | 2.0 | .006 | 9 | 9.6 | 1.3 | .32 | 3.06:1 | 6.12:1 | 10.96 |
| T-22040 | 120 ct | 60 ct | 15 | 3.0 | 2.0 | .006 | 9 | 9.6 | 6 | 1.5 | 1.41:1 | 2.83:1 | 10.96 |
| T-22045 | 120 ct | 120 ct | 30 | 3.0 | 2.0 | .006 | 9 | 9.6 | 12 | 3 | 1:1 | 2:1 | 10.96 |
| T-22050 | 150 ct | 12 ct | 3 | 3.0 | 2.0 | .006 | 8 | 12 | 1.2 | .3 | 3.54:1 | 7.08:1 | 10.96 |
| T-22055 | 150 ct | 50 ct | 12.5 | 3.0 | 2.0 | .006 | 8 | 12 | 5 | 1.25 | 1.73:1 | 3.46:1 | 10.96 |
| T-22060 | 150 ct | 100 ct | 25 | 3.0 | 2.0 | .006 | 8 | 12 | 10 | 2.5 | 1.22:1 | 2.44:1 | 10.96 |
| T-22065 | 150 ct | 150 ct | 37.5 | 3.0 | 2.0 | .006 | 8 | 12 | 15 | 3.75 | 1:1 | 2:1 | 10.96 |
| T-22070 | 150 ct | 600 ct | 150 | 3.0 | 2.0 | .006 | 8 | 12 | 60 | 15 | 1:2 | 1:1 | 10.96 |
| T-22075 | 200 ct | 200 ct | 50 | 3.0 | 2.0 | .006 | 7 | 16 | 20 | 5 | 1:1 | 2:1 | 10.96 |
| T-22080 | 300 ct | 12 ct | 3 | 3.0 | 2.0 | .006 | 5.5 | 24 | 1.2 | .3 | 5:1 | 10:1 | 10.96 |
| T-22085 | 300 ct | 50 ct | 12.5 | 3.0 | 2.0 | .006 | 5.5 | 24 | 5 | 1.25 | 2.45:1 | 4.9:1 | 10.96 |
| T-22090 | 300 ct | 150 ct | 37.5 | 3.0 | 2.0 | .006 | 5.5 | 24 | 15 | 3.75 | 1.41:1 | 2.83:1 | 10.96 |
| T-22095 | 300 ct | 300 ct | 75 | 3.0 | 2.0 | .006 | 5.5 | 24 | 30 | 7.5 | 1:1 | 2:1 | 10.96 |
| T-22100 | 300 ct | 600 ct | 150 | 3.0 | 2.0 | .006 | 5.5 | 24 | 60 | 15 | 1:1.41 | 1.41:1 | 10.96 |
| T-22105 | 320 ct | 12.8 ct | 3.2 | 3.0 | 2.0 | .006 | 5.5 | 25.6 | 1.3 | .32 | 5:1 | 10:1 | 10.96 |
| T-22110 | 400 ct | 40 ct | 10 | 3.0 | 2.0 | .006 | 5 | 32 | 4 | 1 | 3.16:1 | 6.32:1 | 10.96 |
| T-22115 | 400 ct | 120 ct | 30 | 3.0 | 2.0 | .006 | 5 | 32 | 12 | 3 | 1.83:1 | 3.65:1 | 10.96 |
| T-22120 | 400 ct | 200 ct | 50 | 3.0 | 2.0 | .006 | 5 | 32 | 20 | 5 | 1.41:1 | 2.83:1 | 10.96 |
| T-22125 | 400 ct | 400 ct | 100 | 3.0 | 2.0 | .006 | 5 | 32 | 40 | 10 | 1:1 | 2:1 | 10.96 |
| T-22130 | 400 ct | 1000 ct | 250 | 3.0 | 2.0 | .006 | 5 | 32 | 100 | 25 | 1:1.58 | 1.26:1 | 10.96 |
| T-22135 | 400 ct | 2000 ct | 500 | 3.0 | 2.0 | .006 | 5 | 32 | 200 | 50 | 1:2.24 | 1:1.12 | 10.96 |
| T-22140 | 400 ct | 4000 ct | 1000 | 3.0 | 2.0 | .006 | 5 | 32 | 400 | 100 | 1:3.16 | 1:1.58 | 10.96 |
| T-22142 | 500 ct | 12.8 ct | 3.2 | 3.0 | 2.0 | .006 | 4.5 | 40 | 1.3 | .32 | 6.25:1 | 12.5:1 | 10.96 |
| T-22144 | 500 ct | 16 ct | 4 | 3.0 | 2.0 | .006 | 4.5 | 40 | 1.6 | .4 | 5.6:1 | 11.2:1 | 10.96 |
| T-22145 | 500 ct | 50 ct | 12.5 | 3.0 | 2.0 | .006 | 4.5 | 40 | 5 | 1.25 | 3.16:1 | 6.32:1 | 10.96 |
| T-22147 | 500 ct | 150 ct | 37.5 | 3.0 | 2.0 | .006 | 4.5 | 40 | 15 | 3.75 | 1.83:1 | 3.65:1 | 10.96 |
| T-22150 | 500 ct | 500 ct | 125 | 3.0 | 2.0 | .006 | 4.5 | 40 | 50 | 12.5 | 1:1 | 2:1 | 10.96 |
| T-22155 | *500 ct | 500 ct | - | 3.0 | 2.0 | .006 | 4.5 | 40 | 50 | - | 1:1 | - | 11.42 |
| T-22160 | 500 ct | 600 ct | 150 | 3.0 | 2.0 | .006 | 4.5 | 40 | 60 | 15 | 1:1.1 | 1.83:1 | 10.96 |
| T-22165 | 600 ct | 12.8 ct | 3.2 | 3.0 | 2.0 | .006 | 4 | 48 | 1.3 | .32 | 6.85:1 | 13.7:1 | 10.96 |
| T-22167 | 600 ct | 30 ct | 7.5 | 3.0 | 2.0 | .006 | 4 | 48 | 3 | .75 | 4.47:1 | 8.94:1 | 10.96 |
| T-22170 | 600 ct | 48 ct | 12 | 3.0 | 2.0 | .006 | 4 | 48 | 4.8 | 1.2 | 3.54:1 | 7.07:1 | 10.96 |
| T-22175 | 600 ct | 200 ct | 50 | 3.0 | 2.0 | .006 | 4 | 48 | 20 | 5 | 1.73:1 | 3.46:1 | 10.96 |
| T-22180** | 600 ct | 600 ct | 150 | 3.0 | 2.0 | .006 | 4 | 48 | 60 | 15 | 1:1 | 2:1 | 10.96 |
| T-22185** | *600 ct | 600 ct | - | 3.0 | 2.0 | .006 | 4 | 48 | 60 | - | 1:1 | - | 11.42 |
| T-22186** | *600 ct | 900 ct | - | 3.0 | 2.0 | .006 | 4 | 48 | 90 | - | 1:1.22 | - | 11.42 |
| T-22187** | 600 ct | 1200 ct | 300 | 3.0 | 2.0 | .006 | 4 | 48 | 120 | 30 | 1:1.41 | 1.41:1 | 10.96 |
| T-22190 | 640 ct | 12.8 ct | 3.2 | 3.0 | 2.0 | .006 | 4 | 51 | 1.3 | .32 | 7.07:1 | 14.14:1 | 10.96 |
| T-22195 | 700 ct | 100 ct | 25 | 3.0 | 2.0 | .006 | 3.5 | 56 | 10 | 2.5 | 2.65:1 | 5.29:1 | 10.96 |
| T-22200 | 800 ct | 12.8 ct | 3.2 | 3.0 | 2.0 | .006 | 3.5 | 64 | 1.3 | .32 | 7.91:1 | 15.8:1 | 10.96 |
| T-22205 | 800 ct | 48 ct | 12 | 3.0 | 2.0 | .006 | 3.5 | 64 | 4.8 | 1.2 | 4.08:1 | 8.16:1 | 10.96 |
| T-22210 | 800 ct | 800 ct | 200 | 3.0 | 2.0 | .006 | 3.5 | 64 | 80 | 20 | 1:1 | 2:1 | 10.96 |
| T-22215 | 900 ct | 600 ct | 150 | 3.0 | 2.0 | .006 | 3 | 72 | 60 | 15 | 1.22:1 | 2.45:1 | 10.96 |
| T-22217** | *900 ct | 900 ct | - | 3.0 | 2.0 | .006 | 3 | 72 | 90 | - | 1:1 | - | 11.42 |
| T-22220 | 1000 ct | 12 ct | 3 | 3.0 | 2.0 | .006 | 3 | 80 | 1.2 | .3 | 9.13:1 | 18.26:1 | 10.96 |
| T-22225 | 1000 ct | 50 ct | 12.5 | 3.0 | 2.0 | .006 | 3 | 80 | 5 | 1.25 | 4.47:1 | 8.94:1 | 10.96 |
| T-22230 | 1000 ct | 1000 ct | 250 | 3.0 | 2.0 | .006 | 3 | 80 | 100 | 25 | 1:1 | 2:1 | 10.96 |
| T-22235 | 1060 ct | 12.8 ct | 3.2 | 3.0 | 2.0 | .006 | 3 | 85 | 1.3 | .32 | 9.1:1 | 18.2:1 | 10.96 |
| T-22240 | 1200 ct | 12.8 ct | 3.2 | 3.0 | 2.0 | .006 | 3 | 96 | 1.3 | .32 | 9.68:1 | 19.4:1 | 10.96 |
| T-22245 | 1200 ct | 500 ct | 125 | 3.0 | 2.0 | .006 | 3 | 96 | 50 | 12.5 | 1.55:1 | 3.1:1 | 10.96 |
| T-22250 | 1200 ct | 1200 ct | 300 | 3.0 | 2.0 | .006 | 3 | 96 | 120 | 30 | 1:1 | 2:1 | 10.96 |
| T-22255 | *1200 ct | 1200 ct | - | 3.0 | 2.0 | .006 | 3 | 96 | 120 | - | 1:1 | - | 11.42 |
| T-22260 | 1500 ct | 12 ct | 3 | 3.0 | 2.0 | .006 | 2.5 | 120 | 1.2 | .3 | 11.18:1 | 22.36:1 | 10.96 |
| T-22265 | 1500 ct | 500 ct | 125 | 3.0 | 2.0 | .006 | 2.5 | 120 | 50 | 12.5 | 1.73:1 | 3.46:1 | 10.96 |
| T-22270 | *1500 ct | 600 ct | - | 3.0 | 2.0 | .006 | 2.5 | 120 | 60 | - | 1.58:1 | - | 11.42 |
| T-22275 | *1500 ct | 1500 ct | - | 3.0 | 2.0 | .006 | 2.5 | 120 | 150 | - | 1:1 | - | 11.42 |
| T-22280 | 1600 ct | 12.8 ct | 3.2 | 3.0 | 2.0 | .006 | 2.5 | 128 | 1.3 | .32 | 11.18:1 | 22.36:1 | 10.96 |
| T-22283 | 2000 ct | 8 ct | 2 | 3.0 | 2.0 | .006 | 2.2 | 160 | .8 | .2 | 15.8:1 | 31.6:1 | 10.96 |
| T-22285 | 2000 ct | 2000 ct | 500 | 3.0 | 2.0 | .006 | 2.2 | 160 | 200 | 50 | 1:1 | 2:1 | 10.96 |
| T-22290 | *2000 ct | 2000 ct | - | 3.0 | 2.0 | .006 | 2.2 | 160 | 200 | - | 1:1 | - | 11.42 |
| T-22295 | 2000 ct | 8000 ct | 2000 | 3.0 | 2.0 | .006 | 2.2 | 160 | 800 | 200 | 1:2 | 1:1 | 10.96 |
| T-22297 | 2500 ct | 2500 ct | 625 | 3.0 | 2.0 | .006 | 2 | 200 | 250 | 63 | 1:1 | 2:1 | 10.96 |
| T-22300 | 3000 ct | 3000 ct | 750 | 3.0 | 2.0 | .006 | 1.8 | 240 | 300 | 75 | 1:1 | 2:1 | 10.96 |
| T-22305 | *3000 ct | 3000 ct | - | 3.0 | 2.0 | .006 | 1.8 | 240 | 300 | - | 1:1 | - | 11.42 |

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

*Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

*For immediate engineering assistance or to place an order—**Call Toll Free 800-431-1064***

| PICO PART NUMBER T-Series Plug-in | PRIMARY IMPEDANCE OHMS | SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER | PAR | POWER WATTS 1KHz and HIGHER | 300 Hz | 20 Hz | PRIMARY UNBAL DC CURRENT ma | PRIMARY DC RESIST OHMS | SECONDARY DC RESISTANCE OHMS SER CONN | PAR CONN | TURNS RATIO PRIM/SEC SEC SER CONN | SEC PAR CONN | PICO PRICES 1-9* T-Series |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T-22310 | 3600 ct | 3600 ct | 900 | 2.7 | 2.0 | .006 | 1.7 | 288 | 360 | 90 | 1:1 | 2:1 | 10.96 |
| T-22312 | 4000 ct | 16 ct | 4 | 2.5 | 2.0 | .006 | 1.6 | 320 | 1.6 | .4 | 15.8:1 | 31.6:1 | 10.96 |
| T-22314** | 4000 ct | 600 ct | 150 | 2.5 | 2.0 | .006 | 1.6 | 320 | 60 | 15 | 2.58:1 | 5.16:1 | 10.96 |
| T-22315 | 4000 ct | 1000 ct | 250 | 2.5 | 2.0 | .006 | 1.6 | 320 | 100 | 25 | 2:1 | 4:1 | 10.96 |
| T-22320 | *4000 ct | 8000 ct | - | 2.5 | 2.0 | .006 | 1.6 | 320 | 800 | - | 1:1.41 | - | 11.42 |
| T-22325 | 5000 ct | 500 ct | 125 | 2.0 | 2.0 | .006 | 1.4 | 400 | 50 | 12.5 | 3.16:1 | 6.32:1 | 10.96 |
| T-22330 | 5000 ct | 5000 ct | 1250 | 2.0 | 2.0 | .006 | 1.4 | 400 | 500 | 125 | 1:1 | 2:1 | 10.96 |
| T-22335 | 7500 ct | 50 ct | 12.5 | 1.3 | 1.3 | .006 | 1.2 | 600 | 5 | 1.25 | 12.25:1 | 24.5:1 | 12.16 |
| T-22340 | 7500 ct | 100 ct | 25 | 1.3 | 1.3 | .006 | 1.2 | 600 | 10 | 2.5 | 8.66:1 | 17.32:1 | 12.16 |
| T-22345 | 7500 ct | 600 ct | 150 | 1.3 | 1.3 | .006 | 1.2 | 600 | 60 | 15 | 3.54:1 | 7.07:1 | 12.16 |
| T-22350 | 7500 ct | 2500 ct | 625 | 1.3 | 1.3 | .006 | 1.2 | 600 | 250 | 63 | 1.73:1 | 3.46:1 | 12.16 |
| T-22355 | *7500 ct | 7500 ct | - | 1.3 | 1.3 | .006 | 1.2 | 600 | 750 | - | 1:1 | - | 13.03 |
| T-22360 | 8000 ct | 12.8 ct | 3.2 | 1.2 | 1.2 | .006 | 1.1 | 640 | 1.3 | .32 | 25:1 | 50:1 | 12.16 |
| T-22365 | 8000 ct | 1000 ct | 250 | 1.2 | 1.2 | .006 | 1.1 | 640 | 100 | 25 | 2.83:1 | 5.66:1 | 12.16 |
| T-22370 | *8000 ct | 1200 ct | - | 1.2 | 1.2 | .006 | 1.1 | 640 | 120 | - | 2.58:1 | - | 13.03 |
| T-22375 | *9000 ct | 9000 ct | - | 1.1 | 1.1 | .006 | 1.1 | 720 | 900 | - | 1:1 | - | 13.03 |
| T-22380 | 10,000 ct | 12.8 ct | 3.2 | 1.0 | 1.0 | .006 | 1 | 800 | 1.3 | .32 | 28:1 | 56:1 | 12.16 |
| T-22385 | 10,000 ct | 16 ct | 4 | 1.0 | 1.0 | .006 | 1 | 800 | 1.6 | .4 | 25:1 | 50:1 | 12.16 |
| T-22390 | 10,000 ct | 100 ct | 25 | 1.0 | 1.0 | .006 | 1 | 800 | 10 | 2.5 | 10:1 | 20:1 | 12.16 |
| T-22395 | 10,000 ct | 200 ct | 50 | 1.0 | 1.0 | .006 | 1 | 800 | 20 | 50 | 7.07:1 | 14.14:1 | 12.16 |
| T-22400 | 10,000 ct | 500 ct | 125 | 1.0 | 1.0 | .006 | 1 | 800 | 50 | 12.5 | 4.47:1 | 8.94:1 | 12.16 |
| T-22405 | 10,000 ct | 600 ct | 150 | 1.0 | 1.0 | .006 | 1 | 800 | 60 | 15 | 4.08:1 | 8.16:1 | 12.16 |
| T-22410 | 10,000 ct | 1000 ct | 250 | 1.0 | 1.0 | .006 | 1 | 800 | 100 | 25 | 3.16:1 | 6.32:1 | 12.16 |
| T-22415 | 10,000 ct | 1200 ct | 300 | 1.0 | 1.0 | .006 | 1 | 800 | 120 | 30 | 2.89:1 | 5.77:1 | 12.16 |
| T-22420 | 10,000 ct | 1500 ct | 375 | 1.0 | 1.0 | .006 | 1 | 800 | 150 | 38 | 2.58:1 | 5.16:1 | 12.16 |
| T-22425 | 10,000 ct | 2000 ct | 500 | 1.0 | 1.0 | .006 | 1 | 800 | 200 | 50 | 2.24:1 | 4.47:1 | 12.16 |
| T-22430 | 10,000 ct | 5000 ct | 1250 | 1.0 | 1.0 | .006 | 1 | 800 | 500 | 125 | 1.41:1 | 2.83:1 | 12.16 |
| T-22435 | 10,000 ct | 7500 ct | 1875 | 1.0 | 1.0 | .006 | 1 | 800 | 750 | 188 | 1.16:1 | 2.31:1 | 12.16 |
| T-22440 | 10,000 ct | 10,000 ct | 2500 | 1.0 | 1.0 | .006 | 1 | 800 | 1000 | 250 | 1:1 | 2:1 | 12.16 |
| T-22445 | *10,000 ct | 10,000 ct | - | 1.0 | 1.0 | .006 | 1 | 800 | 1000 | - | 1:1 | - | 13.03 |
| T-22450 | 15,000 ct | 400 ct | 100 | .66 | .66 | .006 | .8 | 1200 | 40 | 10 | 6.12:1 | 12.25:1 | 12.16 |
| T-22452 | 15,000 ct | 500 ct | 125 | .66 | .66 | .006 | .8 | 1200 | 50 | 12.5 | 5.48:1 | 10.95:1 | 12.16 |
| T-22455 | 15,000 ct | 600 ct | 150 | .66 | .66 | .006 | .8 | 1200 | 60 | 15 | 5:1 | 10:1 | 12.16 |
| T-22460 | 15,000 ct | 10,000 ct | 2500 | .66 | .66 | .006 | .8 | 1200 | 1000 | 250 | 1.22:1 | 2.45:1 | 12.16 |
| T-22465 | *15,000 ct | 15,000 ct | - | .66 | .66 | .006 | .8 | 1200 | 1500 | - | 1:1 | - | 13.03 |
| T-22470 | 15,000 ct | 15,000 ct | 3750 | .66 | .66 | .006 | .8 | 1200 | 1500 | 375 | 1:1 | 2:1 | 12.16 |
| T-22475 | 16,000 ct | 1000 ct | 250 | .62 | .62 | .006 | .8 | 1280 | 100 | 25 | 4:1 | 8:1 | 12.16 |
| T-22480 | 20,000 ct | 500 ct | 125 | .5 | .5 | .006 | .7 | 1600 | 50 | 12.5 | 6.32:1 | 12.65:1 | 13.03 |
| T-22485 | 20,000 ct | 600 ct | 150 | .5 | .5 | .006 | .7 | 1600 | 60 | 15 | 5.77:1 | 11.55:1 | 13.03 |
| T-22490 | 20,000 ct | 800 ct | 200 | .5 | .5 | .006 | .7 | 1600 | 80 | 20 | 5:1 | 10:1 | 13.03 |
| T-22495 | 20,000 ct | 1000 ct | 250 | .5 | .5 | .006 | .7 | 1600 | 100 | 25 | 4.47:1 | 8.94:1 | 13.03 |
| T-22500 | 20,000 ct | 5000 ct | 1250 | .5 | .5 | .006 | .7 | 1600 | 500 | 125 | 2:1 | 4:1 | 13.03 |
| T-22505 | 20,000 ct | 10,000 ct | 2500 | .5 | .5 | .006 | .7 | 1600 | 1000 | 250 | 1.41:1 | 2.83:1 | 13.03 |
| T-22510 | *20,000 ct | 20,000 ct | - | .5 | .5 | .006 | .7 | 1600 | 2000 | - | 1:1 | - | 13.54 |
| T-22515 | 25,000 ct | 500 ct | 125 | .4 | .4 | .006 | .6 | 2000 | 50 | 12.5 | 7.07:1 | 14.14:1 | 13.03 |
| T-22520 | 25,000 ct | 1000 ct | 250 | .4 | .4 | .006 | .6 | 2000 | 100 | 25 | 5:1 | 10:1 | 13.03 |
| T-22525 | 30,000 ct | 50 ct | 12.5 | .33 | .33 | .006 | .6 | 2400 | 5 | 1.25 | 24.5:1 | 49:1 | 13.54 |
| T-22530 | 30,000 ct | 1200 ct | 300 | .33 | .33 | .006 | .6 | 2400 | 120 | 30 | 5:1 | 10:1 | 13.54 |
| T-22532 | 30,000 ct | 500 ct | 125 | .33 | .33 | .006 | .6 | 2400 | 50 | 12.5 | 7.7:1 | 15.5:1 | 13.54 |
| T-22534 | 30,000 ct | 200 ct | 50 | .33 | .33 | .006 | .6 | 2400 | 20 | 5 | 12.2:1 | 24.5:1 | 13.54 |
| T-22535 | 30,000 ct | 5000 ct | 1250 | .33 | .33 | .006 | .6 | 2400 | 500 | 125 | 2.45:1 | 4.9:1 | 13.54 |
| T-22540 | 30,000 ct | 10,000 ct | 2500 | .33 | .33 | .006 | .6 | 2400 | 1000 | 250 | 1.73:1 | 3.46:1 | 13.54 |
| T-22545 | *30,000 ct | 30,000 ct | - | .33 | .33 | .006 | .6 | 2400 | 3000 | - | 1:1 | - | 14.54 |
| T-22550 | 40,000 ct | 400 ct | 100 | .25 | .25 | .006 | .5 | 3200 | 40 | 10 | 10:1 | 20:1 | 14.54 |
| T-22555 | 40,000 ct | 2000 ct | 500 | .25 | .25 | .006 | .5 | 3200 | 200 | 50 | 4.47:1 | 8.94:1 | 14.54 |
| T-22560 | 40,000 ct | 4000 ct | 1000 | .25 | .25 | .006 | .5 | 3200 | 400 | 100 | 3.16:1 | 6.32:1 | 14.54 |
| T-22565 | 40,000 ct | 20,000 ct | 5000 | .25 | .25 | .006 | .5 | 3200 | 2000 | 500 | 1.41:1 | 2.83:1 | 14.54 |
| T-22570 | *40,000 ct | 40,000 ct | - | .25 | .25 | .006 | .5 | 3200 | 4000 | - | 1:1 | - | 16.20 |
| T-22575 | 50,000 ct | 200 ct | 50 | .2 | .2 | .006 | .4 | 4000 | 20 | 5 | 15.8:1 | 31.6:1 | 16.20 |
| T-22577 | 50,000 ct | 500 ct | 125 | .2 | .2 | .006 | .4 | 4000 | 50 | 12.5 | 10:1 | 20:1 | 16.20 |
| T-22578 | 50,000 ct | 600 ct | 150 | .2 | .2 | .006 | .4 | 4000 | 60 | 15 | 9.13:1 | 18.26:1 | 16.20 |
| T-22579 | 50,000 ct | 50,000 ct | 12,500 | .2 | .2 | .006 | .4 | 4000 | 5000 | 1250 | 1:1 | 2:1 | 16.20 |
| T-22580 | 60,000 ct | 15,000 ct | 3750 | .16 | .16 | .006 | .4 | 4800 | 1500 | 375 | 2:1 | 4:1 | 17.49 |
| T-22585 | 62,500 ct | 50 ct | 12.5 | .16 | .16 | .006 | .4 | 5000 | 5 | 1.25 | 35.4:1 | 70.7:1 | 17.49 |
| T-22587 | 80,000 ct | 15,000 ct | 3750 | .12 | .12 | .006 | .3 | 6400 | 1500 | 375 | 2.3:1 | 4.6:1 | 17.49 |

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

*Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

# PICO's ultra-miniature transformers

## T SERIES Plug-In

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

*(All PICO Products are patented)*

**Send for new 68 page Pico Catalog**

For immediate engineering assistance or to place an order—

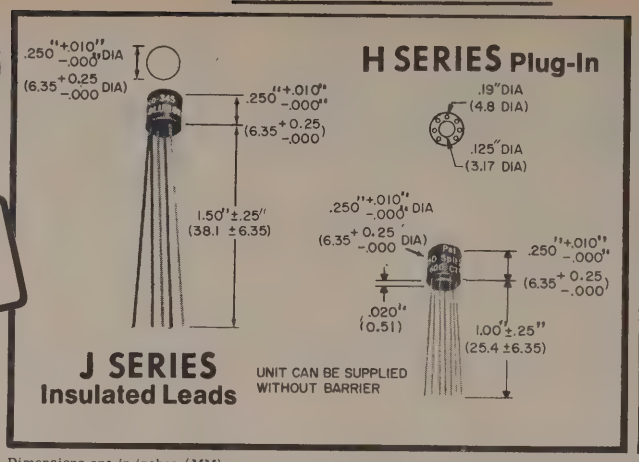
**Call Toll Free 800-431-1064**

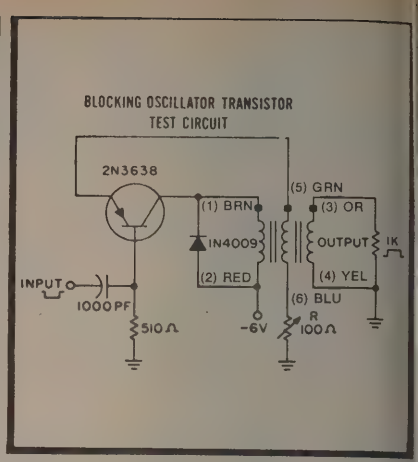
Delivery— stock to one week

**PICO Electronics, Inc.**
P.O. Box 1206, Mt. Vernon, New York 10551 • phone 914-699-5514

# PICO's ultra-miniature PULSE transformers

1/4" x 1/4"




Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-21038: All Units are Designed to MIL-T-21038 and are Hermetically Sealed in a Metal Case
- DIELECTRIC STRENGTH: All Units tested at 200 V RMS
- INSULATION RESISTANCE: Greater than 10,000 Megohms at 300 V DC
- WEIGHT: 1.1 Grams
- OPERATING TEMPERATURE: -55°c to 105°c (All Units Can be Supplied to Class S Requirements 130°c maximum)
- TERMINALS: Solid .012 Diameter Conductor. Conductor is Gold Plated, Nickel-Iron Core Wire (Dumet) in Accordance with MIL-STD-STD-1276 Type D
- THERMAL SHOCK: 25 Cycles, Method 107C, MIL-STD-202D. Test Conduction A-1

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- BUILT TO MIL-T-21038
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

**Send for new 68 page Pico Catalog**

*(All PICO Products are patented)*

MILITARY DESIGNATION TP7RX4410CZ TURNS RATIO 4:4:1

| PICO PART NUMBER | | COUPLING CIRCUIT CHARACTERISTICS | | | | | | | BLOCKING OSCILLATOR CIRCUIT | | | | | PICO PRICES 1-9 * | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H-Series Plug-In | J-Series Insulated Leads | P Width μSec | Volt Out | Rise Time | % Over Shoot | Droop % | % Back Swing | Imp* in/out, | P Width μSec | Rise Time | % Over Shoot | Droop % | % Back Swing | H-Series | J-Series |
| H-5400 | J-5600 | 0.05 | 0.2 | 0.01 | 0 | 0 | 20 | 50 | 0.05 | 0.01 | 0 | 0 | 35 | 9.60 | 8.88 |
| H-5405 | J-5605 | 0.1 | 0.5 | 0.015 | 0 | 0 | 20 | 50 | 0.1 | 0.012 | 0 | 0 | 25 | 9.60 | 8.88 |
| H-5410 | J-5610 | 0.2 | 1.2 | 0.02 | 0 | 0 | 20 | 100 | 0.2 | 0.02 | 0 | 0 | 15 | 9.60 | 8.88 |
| H-5415 | J-5615 | 0.5 | 1.5 | 0.023 | 0 | 5 | 25 | 100 | 0.5 | 0.023 | 0 | 5 | 15 | 9.60 | 8.88 |
| H-5420 | J-5620 | 1 | 1.5 | 0.025 | 0 | 20 | 28 | 100 | 1 | 0.03 | 0 | 10 | 15 | 9.60 | 8.88 |
| H-5425 | J-5625 | 2 | 1.5 | 0.028 | 0 | 15 | 23 | 100 | 2 | 0.035 | 0 | 10 | 15 | 9.60 | 8.88 |
| H-5430 | J-5630 | 3 | 1.5 | 0.030 | 0 | 15 | 28 | 100 | 3 | 0.04 | 0 | 10 | 15 | 9.60 | 8.88 |
| H-5435 | J-5635 | 5 | 2 | 0.035 | 0 | 20 | 20 | 200 | 5 | 0.040 | 0 | 15 | 15 | 9.60 | 8.88 |
| H-5440 | J-5640 | 10 | 2 | 0.05 | 0 | 25 | 25 | 200 | 10 | 0.060 | 0 | 15 | 10 | 9.60 | 8.88 |
| H-5445 | J-5645 | 15 | 2 | 0.06 | 0 | 25 | 18 | 200 | 15 | 0.07 | 0 | 15 | 15 | 9.60 | 8.88 |
| H-5450 | J-5650 | 25 | 3 | 0.1 | 0 | 30 | 30 | 500 | 25 | 0.08 | 0 | 15 | 15 | 9.60 | 8.88 |
| H-5455 | J-5655 | 50 | 3 | 0.3 | 0 | 20 | 20 | 500 | 50 | 0.2 | 0 | 10 | 5 | 9.60 | 8.88 |
| H-5460 | J-5660 | 100 | 6 | 0.4 | 0 | 15 | 18 | 500 | 100 | 0.35 | 0 | 10 | 15 | 9.60 | 8.88 |

*Coupling circuit measurements made with (1) BRN—(2) RED as input and (3) OR—(4) YEL as output, (5) GRN—(6) BLU winding is open: Input Voltage = 1V*

* Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

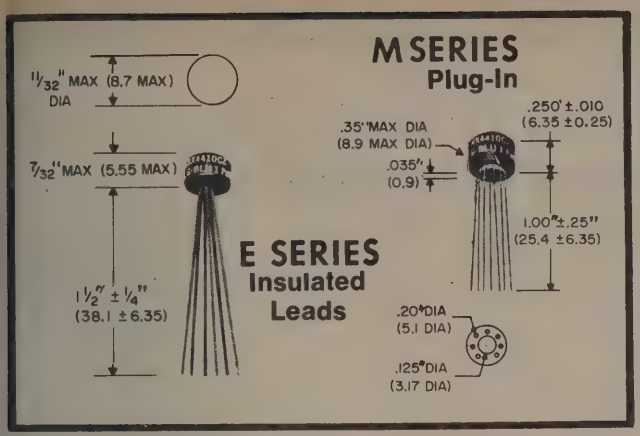
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

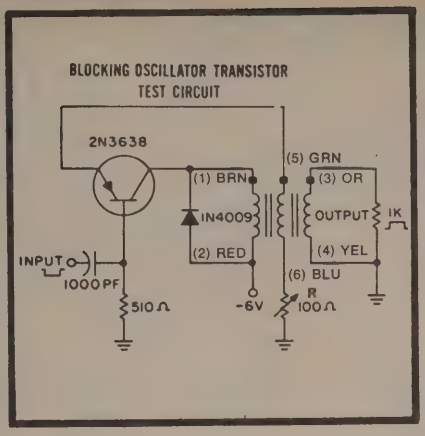
Delivery— stock to one week

*For immediate engineering assistance or to place an order—* ***Call Toll Free 800-431-1064***

## PICO Electronics, Inc.

P.O. Box 1206, Mt. Vernon, New York 10551 • phone 914-699-5514




# PICO's ultra-miniature PULSE transformers

Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-21038: All Units are Designed to MIL-T-21038 and are Hermetically Sealed in a Metal Case
- DIELECTRIC STRENGTH: All Units tested at 200 V RMS
- INSULATION RESISTANCE: Greater than 10,000 Megohms at 300 V DC
- WEIGHT: 1/20 Ounce
- OPERATING TEMPERATURE: -55°c to 105°c (All Units Can be Supplied to Class S Requirements 130°c maximum)
- TERMINALS: Solid .012 Diameter Conductor. Conductor is Gold Plated, Nickel-Iron Core. Wire (Dumet) in Accordance with MIL-STD-STD-1276 Type D
- THERMAL SHOCK: 25 Cycles, Method 107C, MIL-STD-202D. Test Conduction A-1

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- BUILT TO MIL-T-21038
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

**Send for new 68 page Pico Catalog**

*(All PICO Products are patented)*

MILITARY DESIGNATION TP6RX4410CZ TURNS RATIO 4:4:1

| PICO PART NUMBER | | COUPLING CIRCUIT CHARACTERISTICS | | | | | | | | BLOCKING OSCILLATOR CIRCUIT | | | | | D.C. RESISTANCE | | | PICO PRICES 1-9 * | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E-Series Insulated Leads | M-Series Plug-In | P. WIDTH μ SEC. | VOLT OUT | RISE TIME μ SEC. | % OVER SHOOT | DROOP % | % BACK SWING | IMP IN/OUT | FREQ RESP. WITHIN 2DB | P. WIDTH μ SEC. | RISE TIME μ SEC. | % OVER SHOOT | DROOP % | % BACK SWING | 4 TNS BRN RED | 4 TNS OR YEL | 1 TURN GRN BLU | E-Series | M-Series |
| E5020 | M5300 | 0.05 | 10 | 0.018 | 0 | 0 | 10 | 50 | 150 KHz-30 MHz | 0.05 | 0.02 | 0 | 0 | 35 | 0.21 | 0.23 | 0.13 | 6.68 | 7.40 |
| E5040 | M5305 | 0.1 | 10 | 0.02 | 0 | 0 | 5 | 50 | 100 KHz-17 MHz | 0.1 | 0.025 | 0 | 0 | 25 | 0.47 | 0.56 | 0.17 | 6.68 | 7.40 |
| E5060 | M5310 | 0.2 | 8 | 0.035 | 0 | 0 | 5 | 100 | 16 KHz-10 MHz | 0.2 | 0.030 | 0 | 0 | 15 | 1.0 | 1.25 | 0.37 | 6.68 | 7.40 |
| E5080 | M5315 | 0.5 | 8 | 0.06 | 0 | 0 | 0 | 100 | 7 KHz-3.3 MHz | 0.5 | 0.05 | 0 | 0 | 15 | 1.5 | 1.80 | 0.54 | 6.68 | 7.40 |
| E5100 | M5320 | 1 | 8 | 0.15 | 0 | 0 | 5 | 100 | 7 KHz-2.3 MHz | 1 | 0.08 | 0 | 0 | 15 | 2.5 | 3.1 | 0.9 | 6.68 | 7.40 |
| E5120 | M5325 | 2 | 8 | 0.17 | 0 | 0 | 10 | 100 | 2.2 KHz-1.3 MHz | 2 | 0.10 | 0 | 0 | 15 | 3.0 | 3.7 | 1.1 | 6.68 | 7.40 |
| E5140 | M5330 | 3 | 8 | 0.20 | 0 | 0 | 10 | 100 | 1.7 KHz-1.5 MHz | 3 | 0.20 | 0 | 0 | 15 | 4.9 | 6.0 | 1.8 | 6.68 | 7.40 |
| E5160 | M5335 | 5 | 8 | 0.20 | 0 | 15 | 25 | 200 | 1.8 KHz-1.5 MHz | 5 | 0.30 | 0 | 0 | 3 | 8.0 | 9.7 | 2.9 | 6.68 | 7.40 |
| E5180 | M5340 | 10 | 8 | 0.4 | 0 | 15 | 20 | 200 | 1.5 KHz-1.2 MHz | 10 | 0.35 | 0 | 5 | 10 | 13.0 | 15.8 | 4.7 | 6.68 | 7.40 |

MILITARY DESIGNATION TP6RX5310CZ TURNS RATIO 5:3:1

| | | | | | | | | | | | | | | | 5 TURNS | 3 TURNS | 1 TURN | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E5200 | M5345 | 0.1 | 8 | 0.01 | 0 | 0 | 5 | 140/50 | 170 KHz-32 MHz | 0.1 | 0.01 | 0 | 0 | 20 | 0.55 | 0.40 | 0.15 | 6.68 | 7.40 |
| E5220 | M5350 | 1 | 8 | 0.05 | 0 | 6 | 10 | 280/100 | 12.5 KHz-3.3 MHz | 1 | 0.02 | 5 | 5 | 5 | 3.0 | 2.2 | 0.9 | 6.68 | 7.40 |
| E5240 | M5355 | 5 | 8 | 0.09 | 0 | 12 | 25 | 560/200 | 15 KHz-4 MHz | 5 | 0.05 | 0 | 10 | 10 | 9.5 | 7.0 | 2.6 | 6.68 | 7.40 |

MILITARY DESIGNATION TP6RX4440CZ TURNS RATIO 4:4.4

| PICO PART NUMBER | | COUPLING CIRCUIT CHARACTERISTICS | | | | | | | | | | | PICO PRICES 1-9 * | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E-Series Insulated Leads | M-Series Plug-In | P. WIDTH μ SEC. | VOLT OUT | RISE TIME μ SEC. | % OVER SHOOT | DROOP % | % BACK SWING | IMP IN OUT | FREQ RESP. WITHIN 2DB | 4 TNS BRN RED | 4 TNS OR YEL | 4 TURNS GRN BLU | E-Series | M-Series |
| E5181 | M-5356 | 0.05 | 10 | 0.018 | 0 | 0 | 10 | 50 | 150 KHz-30 MHz | 0.21 | 0.23 | 0.25 | 7.40 | 7.40 |
| E5182 | M-5357 | 0.1 | 10 | 0.02 | 0 | 0 | 5 | 50 | 100 KHz-17 MHz | 0.47 | 0.56 | 0.67 | 7.40 | 7.40 |
| E5183 | M-5358 | 0.2 | 8 | 0.035 | 0 | 0 | 5 | 100 | 16 KHz-10 MHz | 1.0 | 1.25 | 1.56 | 7.40 | 7.40 |
| E5184 | M-5359 | 0.5 | 8 | 0.06 | 0 | 0 | 0 | 100 | 7 KHz-3.3 MHz | 1.5 | 1.80 | 2.2 | 7.40 | 7.40 |
| E5185 | M-5360 | 1 | 8 | 0.15 | 0 | 0 | 5 | 100 | 7 KHz-2.3 MHz | 2.5 | 3.1 | 3.9 | 7.40 | 7.40 |
| E5186 | M-5361 | 2 | 8 | 0.17 | 0 | 0 | 10 | 100 | 2.2 KHz-1.3 MHz | 3.0 | 3.7 | 4.6 | 7.40 | 7.40 |
| E5187 | M-5362 | 3 | 8 | 0.20 | 0 | 0 | 10 | 100 | 1.7 KHz-1.5 MHz | 4.9 | 6.0 | 7.4 | 7.40 | 7.40 |
| E5188 | M-5363 | 5 | 8 | 0.20 | 0 | 15 | 25 | 200 | 1.8 KHz-1.5 MHz | 8.0 | 9.7 | 11.8 | 7.40 | 7.40 |
| E5189 | M-5364 | 10 | 8 | 0.4 | 0 | 15 | 20 | 200 | 1.5 KHz-1.2 MHz | 13.0 | 15.8 | 19.2 | 7.40 | 7.40 |

**Coupling circuit measurements made with (1) BRN—(2) RED as input and (3) OR—(4) YEL as output, (5) GRN—(6) BLU winding is open: Input Voltage = 1V*

* Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

*For immediate engineering assistance or to place an order—* ***Call Toll Free 800-431-1064***

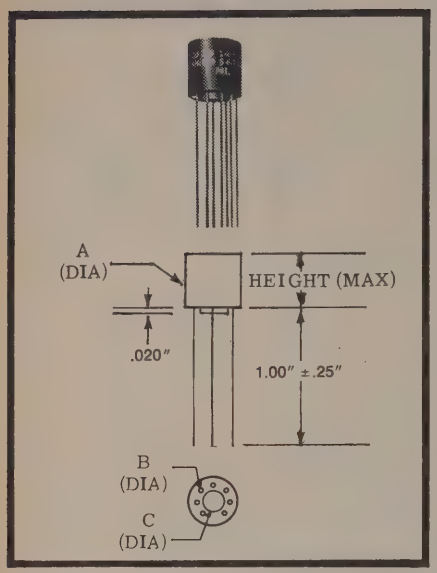
Delivery— stock to one week

# PICO Electronics, Inc.

P.O. Box 1206, Mt. Vernon, New York 10551 • phone 914-699-5514

# PICO's miniature 400 Hz transformers

## 115V/26V Primary Printed Circuit Construction



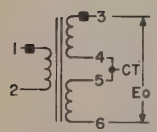

| CASE SIZE | HEIGHT (MAX) | A (DIA) MAX | B (DIA) | C (DIA) |
|---|---|---|---|---|
| L | .35 | .51 | .35 | .218 |
| N | .5 | .51 | .35 | .218 |
| R | .375 | .75 | .6 | .475 |
| S | .52 | .75 | .6 | .475 |
| T | .82 | .75 | .75 | .475 |

FEATURES

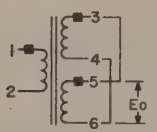
- 400 Hz Aerospace Application
- Smallest Possible Size
- Printed Circuit Plug-In Construction
- Secondary Has Split Winding (Secondary can Be Used at Half Voltage Twice the Current.)

SPECIFICATIONS

- MIL-T-27D (TF5S03ZZ)
- 100°c Ambient
- Input Primary 115v-400 Hz ±20 Hz or 26V-400HZ-±20 Hz (Your Choice-Just Choose The Proper Part No.)
- Regulation is 24% (T Units Have Regulation of 17%)
- Secondary Voltage Adjusted to Nominal Value at Half Load.




SERIES CONNECTED SECONDARY




PARALLEL CONNECTED SECONDARY

**Send for new 68 page Pico Catalog**

*(All PICO Products are patented)*

| SEC/ VOLT | SEC/ CURRENT ma | SIZE | MODEL NUMBER 115V PRIMARY | MODEL NUMBER 26V PRIMARY | PICO PRICES 1-9* |
|---|---|---|---|---|---|
| 5.0 CT | 75 | L | L-8948 | L-8951 | 13.22 |
| | 150 | N | N-6948 | N-6951 | 13.22 |
| | 204 | R | R-20650 | R-20815 | 14.54 |
| | 338 | S | S-21650 | S-21815 | 15.86 |
| | 480 | T | T-22650 | T-22815 | 16.53 |
| 6.3 CT | 59.5 | L | L-8947 | L-8952 | 13.22 |
| | 119 | N | N-6947 | N-6952 | 13.22 |
| | 162 | R | R-20655 | R-20820 | 14.54 |
| | 268 | S | S-21655 | S-21820 | 15.86 |
| | 381 | T | T-22655 | T-22820 | 16.53 |
| 8.0 CT | 47 | L | L-8946 | L-8953 | 13.22 |
| | 94 | N | N-6946 | N-6953 | 13.22 |
| | 128 | R | R-20660 | R-20825 | 14.54 |
| | 211 | S | S-21660 | S-21825 | 15.86 |
| | 300 | T | T-22660 | T-22825 | 16.53 |
| 10 CT | 37.5 | L | L-8945 | L-8954 | 13.22 |
| | 75 | N | N-6945 | N-6954 | 13.22 |
| | 102 | R | R-20665 | R-20830 | 14.54 |
| | 169 | S | S-21665 | S-21830 | 15.86 |
| | 240 | T | T-22665 | T-22830 | 16.53 |
| 12.8 CT | 29 | L | L-8940 | L-8956 | 13.22 |
| | 58.6 | N | N-6940 | N-6956 | 13.22 |
| | 79.7 | R | R-20670 | R-20835 | 14.54 |
| | 132 | S | S-21670 | S-21835 | 15.86 |
| | 188 | T | T-22670 | T-22835 | 16.53 |
| 14 CT | 26.8 | L | L-8937 | L-8957 | 13.22 |
| | 53.6 | N | N-6937 | N-6957 | 13.22 |
| | 72.9 | R | R-20675 | R-20840 | 14.54 |
| | 121 | S | S-21675 | S-21840 | 15.86 |
| | 171 | T | T-22675 | T-22840 | 16.53 |
| 16 CT | 23 | L | L-8935 | L-8958 | 13.22 |
| | 47 | N | N-6935 | N-6958 | 13.22 |
| | 63.8 | R | R-20680 | R-20845 | 14.54 |
| | 106 | S | S-21680 | S-21845 | 15.86 |
| | 150 | T | T-22680 | T-22845 | 16.53 |
| 18 CT | 20.8 | L | L-8934 | L-8959 | 13.22 |
| | 41.7 | N | N-6934 | N-6959 | 13.22 |
| | 56.7 | R | R-20685 | R-20850 | 14.54 |
| | 93.9 | S | S-21685 | S-21850 | 15.86 |
| | 133 | T | T-22685 | T-22850 | 16.53 |
| 20 CT | 18.8 | L | L-8933 | L-8961 | 13.22 |
| | 37 5 | N | N-6933 | N-6961 | 13.22 |
| | 51 | R | R-20690 | R-20855 | 14.54 |
| | 84.5 | S | S-21690 | S-21855 | 15.86 |
| | 120 | T | T-22690 | T-22855 | 16.53 |
| 22 CT | 17 | L | L-8932 | L-8962 | 13.22 |
| | 34 | N | N-6932 | N-6962 | 13.22 |
| | 46.4 | R | R-20695 | R-20860 | 14.54 |
| | 76.8 | S | S-21695 | S-21860 | 15.86 |
| | 109 | T | T-22695 | T-22860 | 16.53 |
| 24 CT | 15.5 | L | L-8930 | L-8963 | 13.22 |
| | 31 | N | N-6930 | N-6963 | 13.22 |
| | 42.5 | R | R-20700 | R-20865 | 14.54 |
| | 70.4 | S | S-21700 | S-21865 | 15.86 |
| | 100 | T | T-22700 | T-22865 | 16.53 |
| 28 CT | 13.4 | L | L-8929 | L-8964 | 13.22 |
| | 26.8 | N | N-6929 | N-6964 | 13.22 |
| | 36.4 | R | R-20705 | R-20870 | 14.54 |
| | 60.4 | S | S-21705 | S-21870 | 15.86 |
| | 85.7 | T | T-22705 | T-22870 | 16.53 |
| 31 CT | 12 | L | L-8927 | L-8966 | 13.22 |
| | 24 | N | N-6927 | N-6966 | 13.22 |
| | 32.9 | R | R-20710 | R-20875 | 14.54 |
| | 54.5 | S | S-21710 | S-21875 | 15.86 |
| | 77.4 | T | T-22710 | T-22875 | 16.53 |
| 36 CT | 10.4 | L | L-8925 | L-8967 | 13.22 |
| | 20.8 | N | N-6925 | N-6967 | 13.22 |
| | 28.3 | R | R-20715 | R-20880 | 14.54 |
| | 46.9 | S | S-21715 | S-21880 | 15.86 |
| | 66.7 | T | T-22715 | T-22880 | 16.53 |
| 39 CT | 9.6 | L | L-8924 | L-8968 | 13.22 |
| | 19.2 | N | N-6924 | N-6968 | 13.22 |
| | 26.2 | R | R-20720 | R-20885 | 14.54 |
| | 43.3 | S | S-21720 | S-21885 | 15.86 |
| | 61.5 | T | T-22720 | T-22885 | 16.53 |

| SEC/ VOLT | SEC/ CURRENT ma | SIZE | MODEL NUMBER 115V PRIMARY | MODEL NUMBER 26V PRIMARY | PICO PRICES 1-9* |
|---|---|---|---|---|---|
| 43 CT | 8.7 | L | L-8923 | L-8969 | 13.22 |
| | 17.4 | N | N-6923 | N-6969 | 13.22 |
| | 23.7 | R | R-20725 | R-20890 | 14.54 |
| | 39.3 | S | S-21725 | S-21890 | 15.86 |
| | 55.8 | T | T-22725 | T-22890 | 16.53 |
| 48 CT | 7.8 | L | L-8922 | L-8971 | 13.22 |
| | 15.6 | N | N-6922 | N-6971 | 13.22 |
| | 21.1 | R | R-20730 | R-20895 | 14.54 |
| | 35.2 | S | S-21730 | S-21895 | 15.86 |
| | 50 | T | T-22730 | T-22895 | 16.53 |
| 56 CT | 6.6 | L | L-8920 | L-8972 | 13.22 |
| | 13.2 | N | N-6920 | N-6972 | 13.22 |
| | 18.2 | R | R-20735 | R-20900 | 14.54 |
| | 30.2 | S | S-21735 | S-21900 | 15.86 |
| | 42.9 | T | T-22735 | T-22900 | 16.53 |
| 63 CT | 6 | L | L-8917 | L-8973 | 13.22 |
| | 11.9 | N | N-6917 | N-6973 | 13.22 |
| | 16.2 | R | R-20740 | R-20905 | 14.54 |
| | 26.9 | S | S-21740 | S-21905 | 15.86 |
| | 38.2 | T | T-22740 | T-22905 | 16.53 |
| 68 CT | 5.5 | L | L-8915 | L-8974 | 13.22 |
| | 11 | N | N-6915 | N-6974 | 13.22 |
| | 15 | R | R-20745 | R-20910 | 14.54 |
| | 24.9 | S | S-21745 | S-21910 | 15.86 |
| | 35.3 | T | T-22745 | T-22910 | 16.53 |
| 80 CT | 4.6 | L | L-8910 | L-8976 | 13.22 |
| | 9.4 | N | N-6910 | N-6976 | 13.22 |
| | 12.1 | R | R-20750 | R-20915 | 14.54 |
| | 21.1 | S | S-21750 | S-21915 | 15.86 |
| | 30 | T | T-22750 | T-22915 | 16.53 |
| 88 CT | 4.2 | L | L-8905 | L-8977 | 13.22 |
| | 8.5 | N | N-6905 | N-6977 | 13.22 |
| | 11.6 | R | R-20755 | R-20920 | 14.54 |
| | 19.2 | S | S-21755 | S-21920 | 15.86 |
| | 27.3 | T | T-22755 | T-22920 | 16.53 |
| 100 CT | 3.7 | L | L-8902 | L-8978 | 13.22 |
| | 8.5 | N | N-6902 | N-6978 | 13.22 |
| | 10.2 | R | R-20760 | R-20925 | 14.54 |
| | 16.9 | S | S-21760 | S-21925 | 15.86 |
| | 24 | T | T-22760 | T-22925 | 16.53 |
| 115 CT | 3.2 | L | L-8900 | L-8979 | 13.22 |
| | 6.5 | N | N-6900 | N-6979 | 13.22 |
| | 8.9 | R | R-20765 | R-20930 | 14.54 |
| | 14.7 | S | S-21765 | S-21930 | 15.86 |
| | 20.9 | T | T-22765 | T-22930 | 16.53 |
| 123 CT | 8.3 | R | R-20770 | R-20935 | 14.54 |
| | 13.7 | S | S-21770 | S-21935 | 15.86 |
| | 19.5 | T | T-22770 | T-22935 | 16.53 |
| 138 CT | 7.4 | R | R-20775 | R-20940 | 14.54 |
| | 12.2 | S | S-21775 | S-21940 | 15.86 |
| | 17.4 | T | T-22775 | T-22940 | 16.53 |
| 157 CT | 6.5 | R | R-20780 | R-20945 | 14.54 |
| | 10.8 | S | S-21780 | S-21945 | 15.86 |
| | 15.3 | T | T-22780 | T-22945 | 16.53 |
| 175 CT | 5.8 | R | R-20785 | R-20950 | 14.54 |
| | 9.6 | S | S-21785 | S-21950 | 15.86 |
| | 13.7 | T | T-22785 | T-22950 | 16.53 |
| 200 CT | 5.1 | R | R-20790 | R-20955 | 14.54 |
| | 8.4 | S | S-21790 | S-21955 | 15.86 |
| | 12 | T | T-22790 | T-22955 | 16.53 |
| 220 CT | 7.7 | S | S-21795 | S-21960 | 16.65 |
| | 10.9 | T | T-22795 | T-22960 | 17.36 |
| 250 CT | 6.8 | S | S-21800 | S-21965 | 17.45 |
| | 9.6 | T | T-22800 | T-22965 | 18.18 |
| 275 CT | 6.1 | S | S-21805 | S-21970 | 18.24 |
| | 8.7 | T | T-22805 | T-22970 | 19.00 |
| 310 CT | 5.4 | S | S-21810 | S-21975 | 19.03 |
| | 7.7 | T | T-22810 | T-22975 | 19.84 |

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

* Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

*For immediate engineering assistance or to place an order—* ***Call Toll Free 800-431-1064***

Delivery— stock to one week

# PICO Electronics, Inc.

P.O. Box 1206. Mt. Vernon. New York 10551 • phone 914-699-5514

# Dot and Dit Interchangeable Listing

# PICO vs UTC/TRW

The following part numbers are electrically and mechanically interchangeable with units produced by United Transformer Company, division of TRW Inc. Every Pico Electronics device has the added reliability feature of being guaranteed for thermal shock (MIL-STD 202D, method 107C, test condition A1, 25 cycles).

Contact factory for PIL, PIP AND BIT-250 information.

| | |
|---|---|
| DO-T1 | PICO-A1460 |
| DO-T2 | PICO-A1150 |
| DO-T3 | PICO-A1230 |
| DO-T4 | PICO-A1175 |
| DO-T5 | PICO-A1255 |
| DO-T6 | PICO-A1370 |
| DO-T7 | PICO-A1560 |
| DO-T8 | PICO-A1850 |
| DO-T9 | PICO-A1380 |
| DO-T10 | PICO-A1395 |
| DO-T11 | PICO-A1425 |
| DO-T12 | PICO-A1045 |
| DO-T13 | PICO-A1070 |
| DO-T14 | PICO-A1180 |
| DO-T15 | PICO-A1205 |
| DO-T16 | PICO-A1220 |
| DO-T17 | PICO-A1265 |
| DO-T18 | PICO-A1320 |
| DO-T19 | PICO-A1090 |
| DO-T20 | PICO-A1165 |
| DO-T21 | PICO-A1215 |
| DO-T22 | PICO-A1275 |
| DO-T23 | PICO-A1465 |
| DO-T24 | PICO-A1565 |
| DO-T25 | PICO-A1405 |
| DO-T26 | PICO-A1860 |
| DO-T27 | PICO-A1840 |
| DO-T28 | PICO-A1830 |
| DO-T29 | PICO-A1030 |
| DO-T30 | PICO-A1095 |
| DO-T31 | PICO-A1190 |
| DO-T32 | PICO-A1200 |
| DO-T33 | PICO-A1250 |
| DO-T34 | PICO-A1290 |
| DO-T35 | PICO-A1350 |
| DO-T36 | PICO-A1440 |
| DO-T37 | PICO-A1305 |
| DO-T38 | PICO-A1415 |
| DO-T39 | PICO-A1475 |
| DO-T40 | PICO-A1510 |
| DO-T41 | PICO-A1125 |
| DO-T42 | PICO-A1115 |
| DO-T43 | PICO-A1105 |
| DO-T44 | PICO-A1025 |
| DO-T45 | PICO-A1300 |
| DO-T46 | PICO-A1550 |
| DO-T47 | PICO-A1365 |
| DO-T48 | PICO-A1360 |
| DO-T49 | PICO-A1920 |
| DO-T50 | PICO-A1880 |
| DO-T51 | PICO-A1295 |
| DO-T52 | PICO-A1315 |
| DO-T53 | PICO-A1140 |
| DO-T54 | PICO-A1525 |
| DO-T55 | PICO-A1187 |
| DO-T255 | PICO-D4235 |
| DO-T275 | PICO-D4405 |
| DO-T277 | PICO-D4415 |
| DO-T278 | PICO-D4425 |
| DO-T283 | PICO-D4440 |
| DO-T288 | PICO-D4465 |
| DO-T297 | PICO-D4565 |
| DO-T400 | PICO-A1710 |
| DO-T410 | PICO-A1705 |
| DO-T420 | PICO-A1715 |
| D1-T1 | PICO-B2460 |
| D1-T2 | PICO-B2150 |
| D1-T3 | PICO-B2230 |
| D1-T5 | PICO-B2255 |
| D1-T8 | PICO-B2580 |
| D1-T9 | PICO-B2380 |
| D1-T10 | PICO-B2395 |
| D1-T11 | PICO-B2425 |
| D1-T19 | PICO-B2090 |
| D1-T20 | PICO-B2165 |
| D1-T21 | PICO-B2215 |
| D1-T22 | PICO-B2275 |
| D1-T23 | PICO-B2465 |
| D1-T25 | PICO-B2405 |
| D1-T26 | PICO-B2585 |
| D1-T27 | PICO-B2575 |
| D1-T28 | PICO-B2570 |
| D1-T36 | PICO-B2440 |
| D1-T37 | PICO-B2305 |
| D1-T38 | PICO-B2415 |
| D1-T41 | PICO-B2125 |
| D1-T43 | PICO-B2105 |
| D1-T44 | PICO-B2025 |
| D1-T51 | PICO-B2295 |
| D1-T52 | PICO-B2315 |
| D1-T53 | PICO-B2140 |
| D1-T55 | PICO-B2187 |
| D1-T204 | PICO-C3590 |
| D1-T208 | PICO-C3595 |
| D1-T212 | PICO-C3600 |
| D1-T216 | PICO-C3605 |
| D1-T225 | PICO-C3025 |
| D1-T230 | PICO-C3091 |
| D1-T235 | PICO-C3105 |
| D1-T240 | PICO-C3125 |
| D1-T245 | PICO-C3145 |
| D1-T250 | PICO-C3170 |
| D1-T255 | PICO-C3225 |
| D1-T260 | PICO-C3270 |
| D1-T265 | PICO-C3305 |
| D1-T270 | PICO-C3385 |
| D1-T273 | PICO-C3400 |
| D1-T276 | PICO-C3420 |
| D1-T278 | PICO-C3415 |
| D1-T283 | PICO-C3440 |
| D1-T288 | PICO-C3465 |
| D1-T290 | PICO-C3187 |
| 1-DO-T101 | PICO-X14600 |
| 1-DO-T102 | PICO-X11500 |
| 1-DO-T103 | PICO-X12300 |
| 1-DO-T104 | PICO-X11750 |
| 1-DO-T105 | PICO-X12550 |
| 1-DO-T106 | PICO-X13700 |
| 1-DO-T107 | PICO-X15600 |
| 1-DO-T108 | PICO-X18500 |
| 1-DO-T109 | PICO-X13800 |
| 1-DO-T110 | PICO-X13950 |
| 1-DO-T111 | PICO-X14250 |
| 1-DO-T112 | PICO-X10450 |
| 1-DO-T113 | PICO-X10700 |
| 1-DO-T114 | PICO-X11800 |
| 1-DO-T115 | PICO-X12050 |
| 1-DO-T116 | PICO-X12200 |
| 1-DO-T117 | PICO-X12650 |
| 1-DO-T118 | PICO-X13200 |
| 1-DO-T119 | PICO-X10900 |
| 1-DO-T120 | PICO-X11650 |
| 1-DO-T121 | PICO-X12150 |
| 1-DO-T122 | PICO-X12750 |
| 1-DO-T123 | PICO-X14650 |
| 1-DO-T124 | PICO-X15650 |
| 1-DO-T125 | PICO-X14050 |
| 1-DO-T126 | PICO-X18600 |
| 1-DO-T127 | PICO-X18400 |
| 1-DO-T128 | PICO-X18300 |
| 1-DO-T129 | PICO-X10300 |
| 1-DO-T130 | PICO-X10950 |
| 1-DO-T131 | PICO-X11900 |
| 1-DO-T132 | PICO-X12000 |
| 1-DO-T133 | PICO-X12500 |
| 1-DO-T134 | PICO-X12900 |
| 1-DO-T135 | PICO-X13500 |
| 1-DO-T136 | PICO-X14400 |
| 1-DO-T137 | PICO-X13050 |
| 1-DO-T138 | PICO-X14150 |
| 1-DO-T139 | PICO-X14750 |
| 1-DO-T140 | PICO-X15100 |
| 1-DO-T141 | PICO-X11250 |
| 1-DO-T142 | PICO-X11150 |
| 1-DO-T143 | PICO-X11050 |
| 1-DO-T144 | PICO-X10250 |
| 1-DO-T145 | PICO-X13000 |
| 1-DO-T146 | PICO-X15500 |
| 1-DO-T147 | PICO-X13650 |
| 1-DO-T148 | PICO-X13600 |
| 1-DO-T149 | PICO-X19200 |
| 1-DO-T150 | PICO-X18800 |
| 1-DO-T151 | PICO-X12950 |
| 1-DO-T152 | PICO-X13150 |
| 1-DO-T153 | PICO-X11400 |
| 1-DO-T154 | PICO-X15250 |
| 1-DO-T155 | PICO-X11870 |
| 1-DI-T301 | PICO-B2460 |
| 1-DI-T302 | PICO-B2150 |
| 1-DI-T303 | PICO-B2230 |
| 1-DI-T305 | PICO-B2255 |
| 1-DI-T308 | PICO-B2580 |
| 1-DI-T309 | PICO-B2380 |
| 1-DI-T310 | PICO-B2395 |
| 1-DI-T311 | PICO-B2425 |
| 1-DI-T319 | PICO-B2090 |
| 1-DI-T320 | PICO-B2165 |
| 1-DI-T321 | PICO-B2215 |
| 1-DI-T322 | PICO-B2275 |
| 1-DI-T323 | PICO-B2465 |
| 1-DI-T325 | PICO-B2405 |
| 1-DI-T326 | PICO-B2585 |
| 1-DI-T327 | PICO-B2575 |
| 1-DI-T328 | PICO-B2570 |
| 1-DI-T336 | PICO-B2440 |
| 1-DI-T337 | PICO-B2305 |
| 1-DI-T338 | PICO-B2415 |
| 1-DI-T341 | PICO-B2125 |
| 1-DI-T343 | PICO-B2105 |
| 1-DI-T344 | PICO-B2025 |
| 1-DI-T351 | PICO-B2295 |
| 1-DI-T352 | PICO-B2315 |
| 1-DI-T353 | PICO-B2140 |
| 1-DI-T355 | PICO-B2187 |
| 1-DI-T504 | PICO-C3590 |
| 1-DI-T508 | PICO-C3595 |
| 1-DI-T512 | PICO-C3600 |
| 1-DI-T516 | PICO-C3605 |
| 1-DI-T525 | PICO-C3025 |
| 1-DI-T530 | PICO-C3091 |
| 1-DI-T535 | PICO-C3105 |
| 1-DI-T540 | PICO-C3125 |
| 1-DI-T545 | PICO-C3145 |
| 1-DI-T550 | PICO-C3170 |
| 1-DI-T555 | PICO-C3225 |
| 1-DI-T560 | PICO-C3270 |
| 1-DI-T565 | PICO-C3305 |
| 1-DI-T570 | PICO-C3385 |
| 1-DI-T573 | PICO-C3400 |
| 1-DI-T578 | PICO-C3415 |
| 1-DI-T583 | PICO-C3440 |
| 1-DI-T588 | PICO-C3465 |

| | | | |
|---|---|---|---|
| DO-TSH | PICO-A SHIELD | DO-T200SH PICO-D SHIELD | D1-TSH PICO-B SHIELD | D1-T200SH PICO-C SHIELD |

Delivery—stock to one week

*For immediate engineering assistance or to place an order—* ***Call Toll Free 800-431-1064***

## PICO Electronics, Inc.

P.O. Box 1206, Mt. Vernon, New York 10551 • phone 914-699-5514

# CATALOGUE DE L'ELECTRONIQUE POUR LES INGENIEURS
# DER PRODUKTKATALOG FÜR ELEKTRONIKER
# ELECTRONIC ENGINEERS CATALOGUE

## The 1978 edition is out...and the response is in...
## IMMEDIATE AND OVERWHELMING

# ACCEPTANCE

The ELECTRONIC ENGINEERS CATALOGUE is the only comprehensive, trilingual catalogue/source-directory of electronic products available to—and from—Western Europe.

It is divided into three distinct sections: 1. **The Product Index and Directory,** which lists more than 3,000 product headings & cross-references alphabetically in English with their French and German equivalents. 2. **The Manufacturers' Catalogue Section,** which is a compilation of Manufacturers' Catalogues in alphabetical order. 3. **The Manufacturers' Sales Offices and Trade Marks Directory,** which alphabetically includes country, address, telex or TWX numbers of the Manufacturers' main and local sales offices and/or agents.

The ELECTRONIC ENGINEERS CATALOGUE offers U.S. manufacturers the most cost-efficient method of distributing their catalogue data to **25,000** electronic engineers and buyers throughout Western Europe. It represents the carefully conceived application of the time-proven **eem** "cataloging" concept to the elusive European marketplace.

United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Avenue, Garden City, New York 11530 / 516 222-2500

# p.c. board transformers for triple-output regulated supplies

## IDEAL FOR MICROPROCESSOR APPLICATIONS

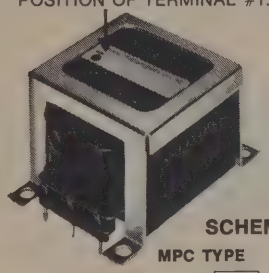
"MP" types have been developed specifically for use in triple-output regulated DC supplies that are commonly used in **Microprocessor Circuits** and other logic, op-amp combinations. Two output combinations have been provided, namely 5V and ±12V, and 5V and ±15V.

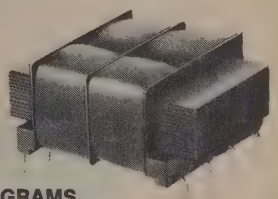
All "MP" units are rated in terms of the final **DC** output after a standard three terminal IC regulator. They are designed to provide these outputs with AC line inputs of 100 to 130V 50/60 Hz (or 200 to 260V for nominal 230V lines).

Two basic mechanical configurations are available. Standard PC types (MPC or DMPC) are tested to pass 1500V RMS hipot. Optional mounting brackets are available. MPL types are based on Signal's "flat-head" style and feature low profile, 115/230V primaries, hum-bucking construction, 1500V RMS hipot and the advantages of non-concentric winding (low inter-winding capacitance, high isolation, and no need for an electro-static shield).

All MP's are stocked in depth for immediate delivery. In addition, special variations can be supplied with reasonable delivery times.

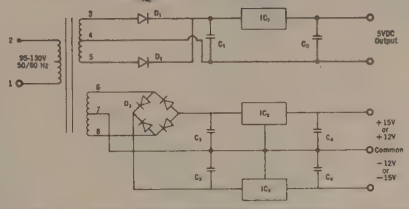
BLACK DOT ON LABEL INDICATES POSITION OF TERMINAL #1.



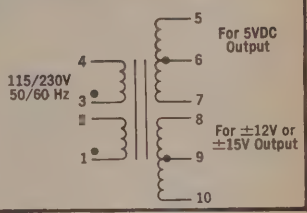


**SCHEMATIC DIAGRAMS**

**MPC TYPE**




**DMPC & MPL TYPES**

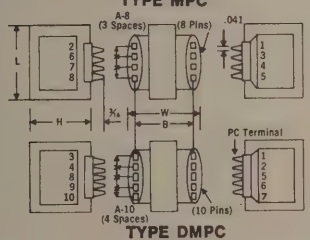



### MPC & DMPC TYPES

| PART NUMBER PRIMARY 50/60 Hz | | DC OUTPUT | | Size | SUGGESTED COMPONENTS | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 115V (8 Pin) | 115/230V (10 Pin) | Regulator I | Regulator II | | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $D_1$(2) | $D_2$(4) | $IC_1$* | $IC_2$* |
| MPC-V-12 | Not Available | 5VDC 180ma | ±12VDC 35ma | V | 1000MFD 15V | 2.7MFD 20V | 150MFD 50V | 10MFD 20V | 1N4001 | 1N4002 | LM342P-5.0 | LM326N |
| MPC-V-15 | Not Available | 5VDC 180ma | ±15VDC 30ma | V | 1000MFD 15V | 2.7MFD 20V | 150MFD 50V | 10MFD 20V | 1N4001 | 1N4002 | LM342P-5.0 | LM325N |
| MPC-X-12 | DMPC-X-12 | 5VDC 360ma | ±12VDC 60ma | X | 2100MFD 30V | 2.7MFD 20V | 250MFD 50V | 10MFD 20V | 1N4001 | 1N4002 | LM341P-5.0 | LM326N |
| MPC-X-15 | DMPC-X-15 | 5VDC 360ma | ±15VDC 50ma | X | 2100MFD 30V | 2.7MFD 20V | 250MFD 50V | 10MFD 20V | 1N4001 | 1N4002 | LM341P-5.0 | LM325N |
| MPC-Y-12 | DMPC-Y-12 | 5VDC 835ma | ±12VDC 150ma | Y | 4000MFD 10V | 2.7MFD 20V | 1000MFD 50V | 2.7MFD 20V | 1N4001 | 1N4002 | LM340K-5.0 | LM326N |
| MPC-Y-15 | DMPC-Y-15 | 5VDC 835ma | ±15VDC 130ma | Y | 4000MFD 10V | 2.7MFD 20V | 1000MFD 50V | 2.7MFD 20V | 1N4001 | 1N4002 | LM340K-5.0 | LM325N |
| **MPL TYPES (Dual 115/230V Primary is Standard)** | | | | | | | | | | | | |
| MPL- 6-12 | | 5VDC 135ma | ±12VDC 40ma | 6 | 1000MFD 15V | 2.7MFD 20V | 150MFD 50V | 10MFD 20V | 1N4001 | 1N4002 | LM342P-5.0 | LM326N |
| MPL- 6-15 | | 5VDC 135ma | ±15VDC 35ma | 6 | 1000MFD 15V | 2.7MFD 20V | 150MFD 50V | 10MFD 20V | 1N4001 | 1N4002 | LM342P-5.0 | LM325N |
| MPL-12-12 | | 5VDC 270ma | ±12VDC 85ma | 12 | 2100MFD 30V | 2.7MFD 20V | 250MFD 50V | 10MFD 20V | 1N4001 | 1N4002 | LM341P-5.0 | LM326N |
| MPL-12-15 | | 5VDC 270ma | ±15VDC 70ma | 12 | 2100MFD 30V | 2.7MFD 20V | 250MFD 50V | 10MFD 20V | 1N4001 | 1N4002 | LM341P-5.0 | LM325N |

*National Semiconductor

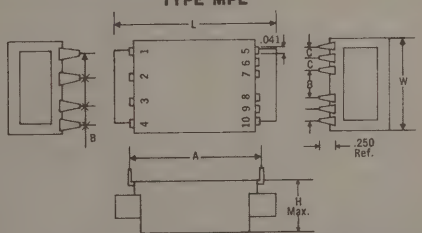
**TYPE MPC**




**TYPE DMPC**

| Size | L | W | H | A-8 (8 Pin) | A-10 (10 Pin) | B | Lbs. | Optional Bracket No. | MW | MD |
|---|---|---|---|---|---|---|---|---|---|---|
| V | 1⅝ | 1¼ | 1⅜ | .250 | 2.00 | 1.100 | .31 | — | — | — |
| X | 1⅞ | 1⅞₁₆ | 1⅝ | .250 | 2.00 | 1.300 | .56 | 10-BR | 1¹⁄₁₆ | 1⅛ |
| Y | 1⅝ | 2¼ | 1⅜ | .250 | 2.00 | 2.100 | .75 | 24-BR | 1⅜ | 2 |

**TYPE MPL**




| Size | L | W | H | A | B | C | Lbs. |
|---|---|---|---|---|---|---|---|
| 6 | 1⅞ | 1⅞₁₆ | 0.850 | 1.600 | 0.375 | 0.187 | .43 |
| 12 | 2½ | 2. | 1.065 | 2.000 | 0.500 | 0.250 | .68 |

Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

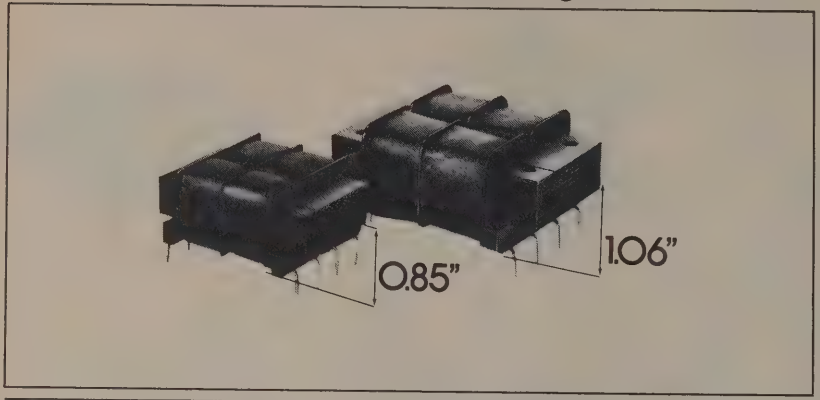
"See page 4403 for prices"

**signal TRANSFORMER**

Dept. EM, 500 Bayview Ave., Inwood, N.Y. 11696
Telephone: (516) 239-7200

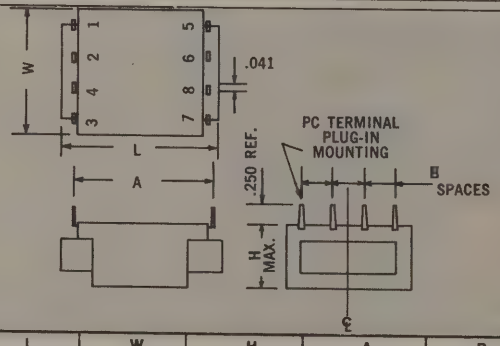
# flathead® plug in power transformers

## FOR PRINTED CIRCUIT APPLICATIONS
## 2 SIZES — 6VA — 0.850 inches high
## 12VA — 1.065 inches high




| Part No. | Size | SECONDARY* Series | SECONDARY* Parallel |
|---|---|---|---|
| LP 10-600 | 6 | 10V C.T. @ 600MA | 5V @ 1.2A |
| LP 10-1200 | 12 | 10V C.T. @ 1200MA | 5V @ 2.4A |
| LP 12-450 | 6 | 12.6V C.T. @ 450MA | 6.3V @ 900MA |
| LP 12-900 | 12 | 12.6V C.T. @ 900MA | 6.3V @ 1.8A |
| LP 16-350 | 6 | 16V C.T. @ 350MA | 8V @ 700MA |
| LP 16-700 | 12 | 16V C.T. @ 700MA | 8V @ 1.4A |
| LP 20-300 | 6 | 20V C.T. @ 300MA | 10V @ 600MA |
| LP 20-600 | 12 | 20V C.T. @ 600MA | 10V @ 1.2A |
| LP 24-250 | 6 | 24V C.T. @ 250MA | 12V @ 500MA |
| LP 24-500 | 12 | 24V C.T. @ 500MA | 12V @ 1A |
| LP 34-170 | 6 | 34V C.T. @ 170MA | 17V @ 340MA |
| LP 34-340 | 12 | 34V C.T. @ 340MA | 17V @ 680MA |
| LP 40-150 | 6 | 40V C.T. @ 150MA | 20V @ 300MA |
| LP 40-300 | 12 | 40V C.T. @ 300MA | 20V @ 600MA |
| LP 56-100 | 6 | 56V C.T. @ 100MA | 28V @ 200MA |
| LP 56-200 | 12 | 56V C.T. @ 200MA | 28V @ 400MA |
| LP 88-65 | 6 | 88V C.T. @ 65MA | 44V @ 130MA |
| LP 88-130 | 12 | 88V C.T. @ 130MA | 44V @ 260MA |
| LP 120-50 | 6 | 120V C.T. @ 50MA | 60V @ 100MA |
| LP 120-100 | 12 | 120V C.T. @ 100MA | 60V @ 200MA |
| LP 230-25 | 6 | 230V C.T. @ 25MA | 115V @ 50MA |
| LP 230-50 | 12 | 230V C.T. @ 50MA | 115V @ 100MA |

* Regulation of Size 6 units is 30%, i.e., no load-secondary voltage is 30% higher than full load. Regulation of Size 12 units is 20%.




| Size | L | W | H | A | B | Oz. |
|---|---|---|---|---|---|---|
| 6 | 1⅞ | 1⅝ | 0.850 | 1.600 | 0.375 | 7 |
| 12 | 2½ | 2 | 1.065 | 2.000 | 0.500 | 11 |

LOW PROFILE: Allows 1 inch card spacing for 6va units or 1¼ inch card spacing for 12va units.

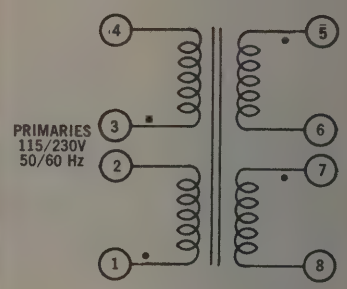
DUAL PRIMARIES: 115/230v, 50/60 Hz.

NON-CONCENTRIC WINDING: Where secondary is wound alongside primary rather than directly over it. This added isolation reduces inter-winding capacitance and **eliminates the need for an electro-static shield.**

1500V. RMS HIPOT: Is standard because of the advantage of non-concentric windings.

HUM-BUCKING CONSTRUCTION: (Semi-toroidal) results in reduced radiated magnetic field and balanced windings.

The LP line of transformers is ideal for low height, critical pc board power applications in semi-conductor control and instrumentation. They are used extensively in single or dual output dc supplies and isolated control circuit and reference supplies.




*INDICATES LIKE POLARITY

Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

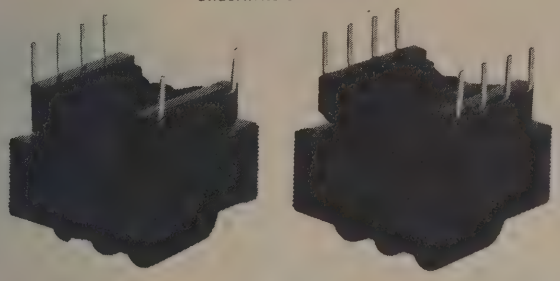
**signal TRANSFORMER**
Dept. EM, 500 Bayview Ave., Inwood, N.Y. 11696
Telephone: (516) 239-7200

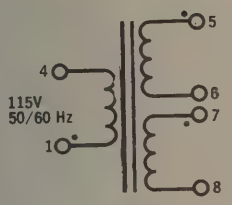
"See page 4403 for prices"

# split/tran® p.c. board transformers

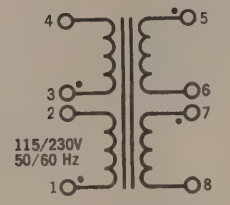
## SPLIT BOBBIN—HIGHLY ISOLATED

Recognized Component
Underwriters Labs Inc.

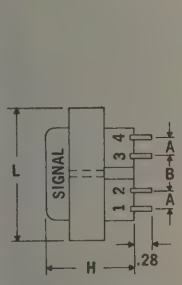




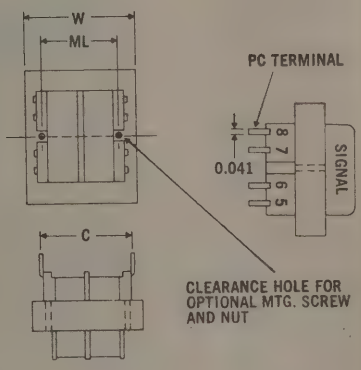

6 PIN
TYPE ST




8 PIN
TYPE DST




NOTE: PINS 2 & 3
OMITTED ON SINGLE
PRIMARY VERSIONS




| Size | VA | L | W | H | ML | A | B | C | Optional Mtg. Screw & Nut* | Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 2.4 | 1 3/8 | 1 1/8 | 1 3/16 | 15/16 | .250 | .250 | 1.200 | None | 0.25 |
| 4 | 6 | 1 5/8 | 1 5/16 | 1 5/16 | 1 1/16 | .250 | .350 | 1.280 | 4-40 x 1 3/8 Nylon | 0.44 |
| 5 | 12 | 1 7/8 | 1 1/16 | 1 7/16 | 1 1/4 | .300 | .400 | 1.410 | 4-40 x 1 3/8 Nylon | 0.70 |
| 6 | 20 | 2 1/4 | 1 7/8 | 1 7/16 | 1 1/2 | .300 | .400 | 1.600 | 4-40 x 1 3/8 Nylon | 0.80 |

* Available from Signal: Part No. ST-MS (Screw) & Part No. ST-MN (Nut).

"Split-Tran" transformers combine the best features of our "2-4-1" Series and Signal's pioneering line of pc board miniature transformers.

The use of a "split bobbin" allows the primaries and secondaries to be wound non-concentrically, i.e., side by side rather than one over the other. This results in cost savings and superior performance, namely:

- High isolation — 2500V hipot is standard.
- Low capacitive coupling — no electro-static shield necessary.
- Less manufacturing time — no cross-overs of primary and secondary leads.
- PC pins — allow direct insertion in PC boards.
- Class S insulation — 130°C.

Each transformer is available with single 115V or dual 115/230V primaries. In addition, secondaries are split so that they can be series or parallel connected.

**Special variations will be quoted and shipped promptly.**

| PART NUMBER* | | SECONDARY RMS RATING | |
|---|---|---|---|
| Single 115V 6 Pin | Dual 115/230V 8 Pin | Series | Parallel |
| ST 3-10 | DST 3-10 | 10V C.T. @ 0.25A | 5V @ 0.5A |
| ST 4-10 | DST 4-10 | 10V C.T. @ 0.6A | 5V @ 1.2A |
| ST 5-10 | DST 5-10 | 10V C.T. @ 1.2A | 5V @ 2.4A |
| ST 6-10 | DST 6-10 | 10V C.T. @ 2A | 5V @ 4A |
| ST 3-12 | DST 3-12 | 12.6V C.T. @ 0.2A | 6.3V @ 0.4A |
| ST 4-12 | DST-4-12 | 12.6V C.T. @ 0.5A | 6.3V @ 1.0A |
| ST 5-12 | DST 5-12 | 12.6V C.T. @ 1.0A | 6.3V @ 2.0A |
| ST 6-12 | DST 6-12 | 12.6V C.T. @ 1.6A | 6.3V @ 3.2A |
| ST 3-16 | DST 3-16 | 16V C.T. @ 0.15A | 8V @ 0.3A |
| ST 4-16 | DST 4-16 | 16V C.T. @ 0.4A | 8V @ 0.8A |
| ST 5-16 | DST 5-16 | 16V C.T. @ 0.8A | 8V @ 1.6A |
| ST 6-16 | DST 6-16 | 16V C.T. @ 1.25A | 8V @ 2.5A |
| ST 3-20 | DST 3-20 | 20V C.T. @ 0.12A | 10V @ 0.24A |
| ST 4-20 | DST 4-20 | 20V C.T. @ 0.3A | 10V @ 0.6A |
| ST 5-20 | DST 5-20 | 20V C.T. @ 0.6A | 10V @ 1.2A |
| ST 6-20 | DST 6-20 | 20V C.T. @ 1A | 10V @ 2A |
| ST 3-24 | DST 3-24 | 24V C.T. @ 0.1A | 12V @ 0.2A |
| ST 4-24 | DST 4-24 | 24V C.T. @ 0.25A | 12V @ 0.5A |
| ST 5-24 | DST 5-24 | 24V C.T. @ 0.5A | 12V @ 1.0A |
| ST 6-24 | DST 6-24 | 24V C.T. @ 0.8A | 12V @ 1.6A |
| ST 3-28 | DST 3-28 | 28V C.T. @ 0.085A | 14V @ 0.17A |
| ST 4-28 | DST 4-28 | 28V C.T. @ 0.2A | 14V @ 0.4A |
| ST 5-28 | DST 5-28 | 28V C.T. @ 0.42A | 14V @ 0.84A |
| ST 6-28 | DST 6-28 | 28V C.T. @ 0.7A | 14V @ 1.4A |
| ST 3-36 | DST 3-36 | 36V C.T. @ 0.065A | 18V @ 0.13A |
| ST 4-36 | DST 4-36 | 36V C.T. @ 0.17A | 18V @ 0.34A |
| ST 5-36 | DST 5-36 | 36V C.T. @ 0.35A | 18V @ 0.7A |
| ST 6-36 | DST 6-36 | 36V C.T. @ 0.55A | 18V @ 1.1A |
| ST 3-48 | DST 3-48 | 48V C.T. @ 0.05A | 24V @ 0.1A |
| ST 4-48 | DST 4-48 | 48V C.T. @ 0.125A | 24V @ 0.25A |
| ST 5-48 | DST 5-48 | 48V C.T. @ 0.25A | 24V @ 0.5A |
| ST 6-48 | DST 6-48 | 48V C.T. @ 0.4A | 24V @ 0.8A |
| ST 3-56 | DST 3-56 | 56V C.T. @ 0.045A | 28V @ 0.09A |
| ST 4-56 | DST 4-56 | 56V C.T. @ 0.11A | 28V @ 0.22A |
| ST 5-56 | DST 5-56 | 56V C.T. @ 0.22A | 28V @ 0.44A |
| ST 6-56 | DST 6-56 | 56V C.T. @ 0.35A | 28V @ 0.7A |
| ST 3-120 | DST 3-120 | 120V C.T. @ 0.02A | 60V @ 0.04A |
| ST 4-120 | DST 4-120 | 120V C.T. @ 0.05A | 60V @ 0.1A |
| ST 5-120 | DST 5-120 | 120V C.T. @ 0.1A | 60V @ 0.2A |
| ST 6-120 | DST 6-120 | 120V C.T. @ 0.16A | 60V @ 0.32A |

* Explanation of Part Number: Series - ST; Size 4; Series Secondary Volts - 36

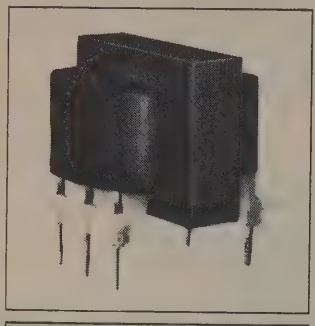
Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

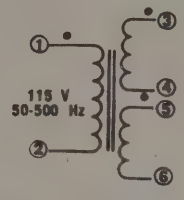
**signal** TRANSFORMER
Dept. EM, 500 Bayview Ave., Inwood, N.Y. 11696
Telephone: (516) 239-7200

"See page 4403 for prices"

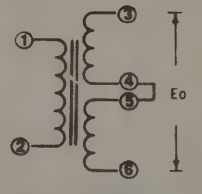
# miniature plug in power transformers

## SINGLE 115V PRIMARY TYPE PC 6 PINS

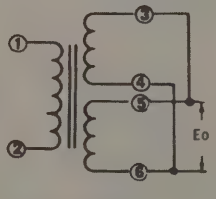





BASIC SCHEMATIC




SERIES CONNECTED

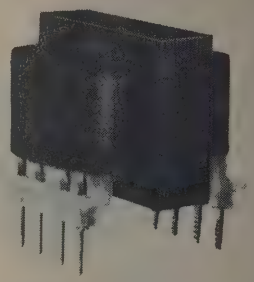


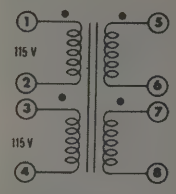

PARALLEL CONNECTED

| PRIMARY 50/500 Hz | | SECONDARY RMS RATING* | | |
|---|---|---|---|---|
| Single 115V (6 Pin) | Dual 115/230V (8 Pin) | Series | Parallel | Size (VA) |
| PC 10-90 | DPC 10-90 | 10V C.T. @ 90MA | 5V @ 180MA | 1.0 |
| PC 10-120 | DPC 10-120 | 10V C.T. @ 120MA | 5V @ 240MA | 1.2 |
| PC 10-440 | DPC 10-440 | 10V C.T. @ 440MA | 5V @ 880MA | 4.4 |
| PC 10-1000 | DPC 10-1000 | 10V C.T. @ 1A | 5V @ 2A | 10 |
| PC 10-2400 | DPC 10-2400 | 10V C.T. @ 2.4A | 5V @ 4.8A | 24 |
| PC 12-70 | DPC 12-70 | 12.6V C.T. @ 70MA | 6.3V @ 140MA | 1.0 |
| PC 12-100 | DPC 12-100 | 12.6V C.T. @ 100MA | 6.3V @ 200MA | 1.2 |
| PC 12-350 | DPC 12-350 | 12.6V C.T. @ 350MA | 6.3V @ 700MA | 4.4 |
| PC 12-800 | DPC 12-800 | 12.6V C.T. @ 800MA | 6.3V @ 1.6A | 10 |
| PC 12-2000 | DPC 12-2000 | 12.6V C.T. @ 2A | 6.3V @ 4A | 24 |
| PC 16-55 | DPC 16-55 | 16V C.T. @ 55MA | 8V @ 110MA | 1.0 |
| PC 16-75 | DPC 16-75 | 16V C.T. @ 75MA | 8V @ 150MA | 1.2 |
| PC 16-260 | DPC 16-260 | 16V C.T. @ 260MA | 8V @ 520MA | 4.4 |
| PC 16-640 | DPC 16-640 | 16V C.T. @ 640MA | 8V @ 1.28A | 10 |
| PC 16-1500 | DPC 16-1500 | 16V C.T. @ 1.5A | 8V @ 3A | 24 |
| PC 20-45 | DPC 20-45 | 20V C.T. @ 45MA | 10V @ 90MA | 1.0 |
| PC 20-60 | DPC 20-60 | 20V C.T. @ 60MA | 10V @ 120MA | 1.2 |
| PC 20-220 | DPC 20-220 | 20V C.T. @ 220MA | 10V @ 440MA | 4.4 |
| PC 20-500 | DPC 20-500 | 20V C.T. @ 500MA | 10V @ 1A | 10 |
| PC 20-1200 | DPC 20-1200 | 20V C.T. @ 1.2A | 10V @ 2.4A | 24 |
| PC 24-35 | DPC 24-35 | 24V C.T. @ 35MA | 12V @ 70MA | 1.0 |
| PC 24-50 | DPC 24-50 | 24V C.T. @ 50MA | 12V @ 100MA | 1.2 |
| PC 24-180 | DPC 24-180 | 24V C.T. @ 180MA | 12V @ 360MA | 4.4 |
| PC 24-450 | DPC 24-450 | 24V C.T. @ 450MA | 12V @ 900MA | 10 |
| PC 24-1000 | DPC 24-1000 | 24V C.T. @ 1A | 12V @ 2A | 24 |
| PC 28-30 | DPC 28-30 | 28V C.T. @ 30MA | 14V @ 60MA | 1.0 |
| PC 28-40 | DPC 28-40 | 28V C.T. @ 40MA | 14V @ 80MA | 1.2 |
| PC 28-160 | DPC 28-160 | 28V C.T. @ 160MA | 14V @ 320MA | 4.4 |
| PC 28-360 | DPC 28-360 | 28V C.T. @ 360MA | 14V @ 720MA | 10 |
| PC 28-800 | DPC 28-800 | 28V C.T. @ 800MA | 14V @ 1.6A | 24 |
| PC 34-25 | DPC 34-25 | 34V C.T. @ 25MA | 17V @ 50MA | 1.0 |
| PC 34-35 | DPC 34-35 | 34V C.T. @ 35MA | 17V @ 70MA | 1.2 |
| PC 34-125 | DPC 34-125 | 34V C.T. @ 125MA | 17V @ 250MA | 4.4 |
| PC 34-300 | DPC 34-300 | 34V C.T. @ 300MA | 17V @ 600MA | 10 |
| PC 34-700 | DPC 34-700 | 34V C.T. @ 700MA | 17V @ 1.4A | 24 |
| PC 40-20 | DPC 40-20 | 40V C.T. @ 20MA | 20V @ 40MA | 1.0 |
| PC 40-30 | DPC 40-30 | 40V C.T. @ 30MA | 20V @ 60MA | 1.2 |
| PC 40-110 | DPC 40-110 | 40V C.T. @ 110MA | 20V @ 220MA | 4.4 |
| PC 40-250 | DPC 40-250 | 40V C.T. @ 250MA | 20V @ 500MA | 10 |
| PC 40-600 | DPC 40-600 | 40V C.T. @ 600MA | 20V @ 1.2A | 24 |
| PC 56-15 | DPC 56-15 | 56V C.T. @ 15MA | 28V @ 30MA | 1.0 |
| PC 56-20 | DPC 56-20 | 56V C.T. @ 20MA | 28V @ 40MA | 1.2 |
| PC 56-80 | DPC 56-80 | 56V C.T. @ 80MA | 28V @ 160MA | 4.4 |
| PC 56-180 | DPC 56-180 | 56V C.T. @ 180MA | 28V @ 360MA | 10 |
| PC 56-420 | DPC 56-420 | 56V C.T. @ 420MA | 28V @ 840MA | 24 |
| PC 88-10 | DPC 88-10 | 88V C.T. @ 10MA | 44V @ 20MA | 1.0 |
| PC 88-15 | DPC 88-15 | 88V C.T. @ 15MA | 44V @ 30MA | 1.2 |
| PC 88-50 | DPC 88-50 | 88V C.T. @ 50MA | 44V @ 100MA | 4.4 |
| PC 88-120 | DPC 88-120 | 88V C.T. @ 120MA | 44V @ 240MA | 10 |
| PC 88-270 | DPC 88-270 | 88V C.T. @ 270MA | 44V @ 540MA | 24 |
| PC 120-8 | DPC 120-8 | 120V C.T. @ 8MA | 60V @ 16MA | 1.0 |
| PC 120-10 | DPC 120-10 | 120V C.T. @ 10MA | 60V @ 20MA | 1.2 |
| PC 120-35 | DPC 120-35 | 120V C.T. @ 35MA | 60V @ 70MA | 4.4 |
| PC 120-85 | DPC 120-85 | 120V C.T. @ 85MA | 60V @ 170MA | 10 |
| PC 120-200 | DPC 120-200 | 120V C.T. @ 200MA | 60V @ 400MA | 24 |
| PC 180-6 | DPC 180-6 | 180V C.T. @ 6MA | 90V @ 12MA | 1.2 |
| PC 180-24 | DPC 180-24 | 180V C.T. @ 24MA | 90V @ 48MA | 4.4 |
| PC 180-55 | DPC 180-55 | 180V C.T. @ 55MA | 90V @ 110MA | 10 |
| PC 180-130 | DPC 180-130 | 180V C.T. @ 130MA | 90V @ 260MA | 24 |
| PC 230-5 | DPC 230-5 | 230V C.T. @ 5MA | 115V @ 10MA | 1.2 |
| PC 230-20 | DPC 230-20 | 230V C.T. @ 20MA | 115V @ 40MA | 4.4 |
| PC 230-40 | DPC 230-40 | 230V C.T. @ 40MA | 115V @ 80MA | 10 |
| PC 230-100 | DPC 230-100 | 230V C.T. @ 100MA | 115V @ 200MA | 24 |

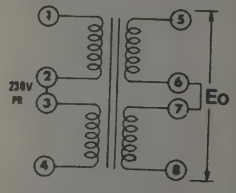
* See Table on opposite page for method of determining RMS Secondary Current.

## DUAL 115/230V PRIMARY TYPE DPC 8 PINS

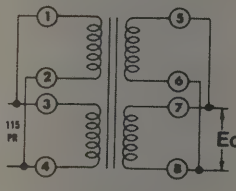





BASIC SCHEMATIC




SERIES CONNECTED




PARALLEL CONNECTED

Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

**signal** TRANSFORMER

Dept. EM, 500 Bayview Ave., Inwood, N.Y. 11696
Telephone: (516) 239-7200

"See page 4403 for prices"

# for printed circuits applications

Signal has the most complete and diversified selection of miniature plug-in power transformers. **All items are stocked in depth for immediate off-the-shelf delivery.**

Primary ratings of 115V (Style PC - 6 Pin) or Dual 115/230V (Style DPC -8 Pin) are standard for the entire line. 1000V. Hipot is standard.

Size 1.0 is used extensively where height is a limiting factor since its height of 0.83 inches allows 1 inch spacing of PC boards. Size 24 is unusual since 24 watt PC transformers are not readily available, especially with a height of 1⅜ inches.

The RMS current ratings are based on a load regulation of 15-20% and not on temperature rise (except for the largest item, size 24). Therefore, these ratings may be exceeded without overheating, if the additional drop in full load voltage is acceptable. There is, of course, a limit and it would be best to check with our engineering department on specific units.

BLACK DOT ON LABEL INDICATES POSITION OF TERMINAL #1.

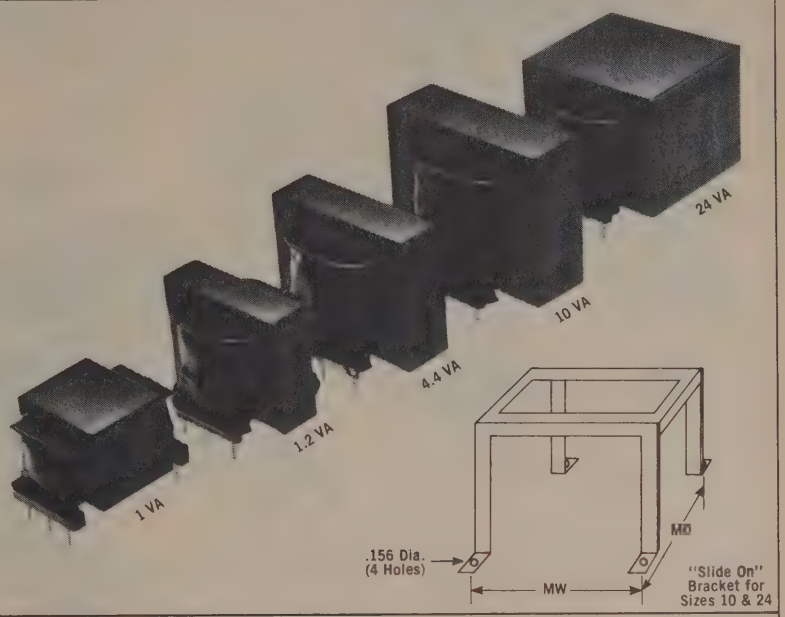
SIZE 24 (24VA) UNIT WITH 24-BR SLIDE-ON MOUNTING BRACKET

METHOD OF DETERMINING SECONDARY CURRENT RATINGS

The secondary currents shown in the tables are RMS ratings. Depending upon rectifier circuit configurations, the RMS secondary current is different than the DC output current. This is indicated in the chart below:

| Rectifier Type | Filter Type | RMS Secondary Current Is |
|---|---|---|
| Full Wave Center-Tap | Choke Input | = 0.7 x DC Amps |
| Full Wave Center-Tap | Capacitor Input | = 1 to 1.2 x DC Amps |
| Full Wave Bridge | Choke Input | = DC Amps |
| Full Wave Bridge | Capacitor Input | = 1.6 to 1.8 x DC Amps |

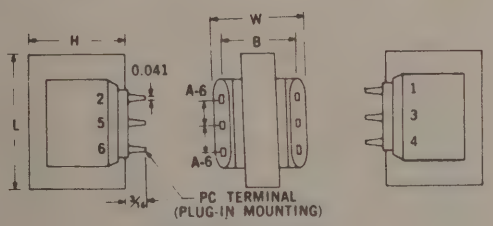
For example, in a F.W. Bridge circuit with a capacitive filter, if the load is 1 Amp DC, the RMS Secondary current is 1.6 to 1.8 Amp RMS.



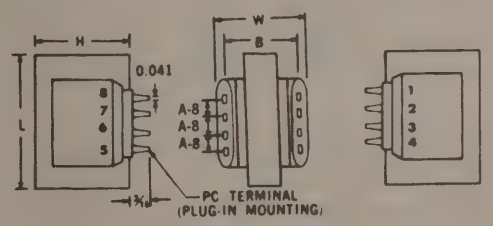

DIMENSIONS

| Size (VA) | L | W | H | A-6 (6 Pin) | A-8 (8 Pin) | B | WT. (oz.) | OPTIONAL BRACKET* No. | MW | MD |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.0 | 1 | 1⅜ | 0.83 | 0.250 | 0.200 | 1.200 | 2.5 | — | — | — |
| 1.2 | 1⅜ | 1⅛ | 1 3/16 | 0.312 | 0.200 | 1.000 | 3 | — | — | — |
| 4.4 | 1⅝ | 1¼ | 1⅜ | 0.400 | 0.250 | 1.100 | 5 | — | — | — |
| 10 | 1⅞ | 1 1/16 | 1⅝ | 0.400 | 0.250 | 1.300 | 9 | 10-BR | 1 41/64 | 1⅛ |
| 24 | 1⅝ | 2¼ | 1⅜ | 0.400 | 0.250 | 2.100 | 12 | 24-BR | 1⅜ | 2 |

* An optional "Slide On" Mounting Bracket is available for sizes 10 and 24. The brackets do not use up any extra "Floor Space" but add 1/32" to the height of the transformer.




TYPE PC 6 PINS




TYPE DPC 8 PINS

Always in Stock —"THE PRONTO CHALLENGE":—We ship your prototypes (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

**signal** TRANSFORMER

Dept. EM, 500 Bayview Ave., Inwood, N.Y. 11696
Telephone: (516) 239-7200

"See page 4403 for prices"

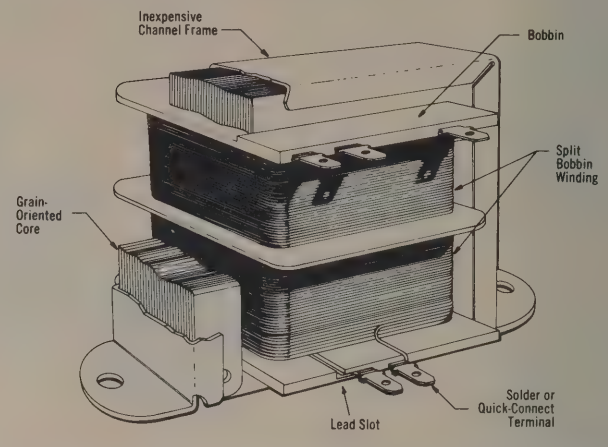
# cut size and weight with "2-4-1"

The 2-4-1 series is an illustration of the use of creative design applied to small power transformers. The result is a line where, for a given va rating, size and weight are reduced almost 50%. Hence the name "241" series.

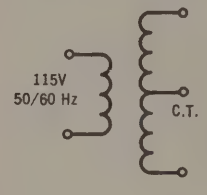
- GRAIN ORIENTED CORE — High Saturation Density — Lower Core Loss — Less Steel and Copper.
- BOBBIN WOUND — Maximum Utilization of Winding Area — Space and Size Reduced.
- SPLIT BOBBIN — NON-CONCENTRIC WINDING — Lower Capacitance — Better Insulation — 2500V RMS Hipot — No need for Electro-Static Shield — High Isolation and Insulation Resistance. No Cross-Overs of Primary and Secondary Leads.
- SPECIAL TERMINAL — Solder or Quick-Connect.

The series is available with single 115V or dual 115/230V primary, rated 50/60 Hz. Class S insulation is used for a maximum total temperature rating of 130°C continuous.

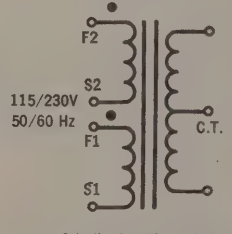
## AVAILABLE WITH SINGLE (115V) OR DUAL (115/230V) PRIMARIES



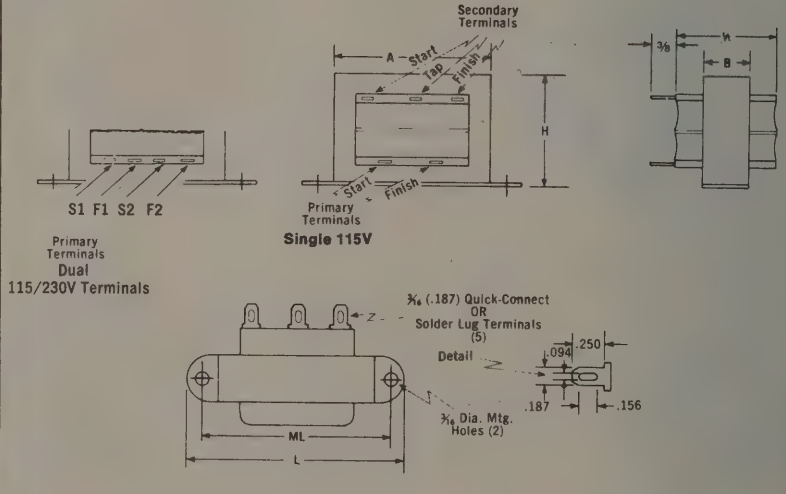

SINGLE PRIMARY




DUAL PRIMARY




● Indicates like polarity




**DIMENSIONS**

| Size | VA | L | W | H | A | B | ML | Lbs. |
|---|---|---|---|---|---|---|---|---|
| 3 | 2.4 | 2 1/16 | 1 1/16 | 1 3/16 | 1 5/8 | 9/16 | 1 3/4 | 0.25 |
| 4 | 6 | 2 3/8 | 1 1/4 | 1 3/8 | 1 11/16 | 11/16 | 2 | 0.44 |
| 5 | 12 | 2 13/16 | 1 3/8 | 1 5/8 | 1 15/16 | 13/16 | 2 3/8 | 0.7 |
| 6 | 30 | 3 1/4 | 1 11/16 | 1 15/16 | 2 5/16 | 1 1/16 | 2 13/16 | 1.1 |
| 7 | 56 | 3 11/16 | 1 13/16 | 2 1/4 | 2 11/16 | 1 1/16 | 3 1/8 | 1.7 |
| 8 | 100 | 4 1/32 | 2 1/4 | 2 9/16 | 3 1/16 | 1 5/16 | 3 9/16 | 2.75 |

Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

**signal TRANSFORMER**

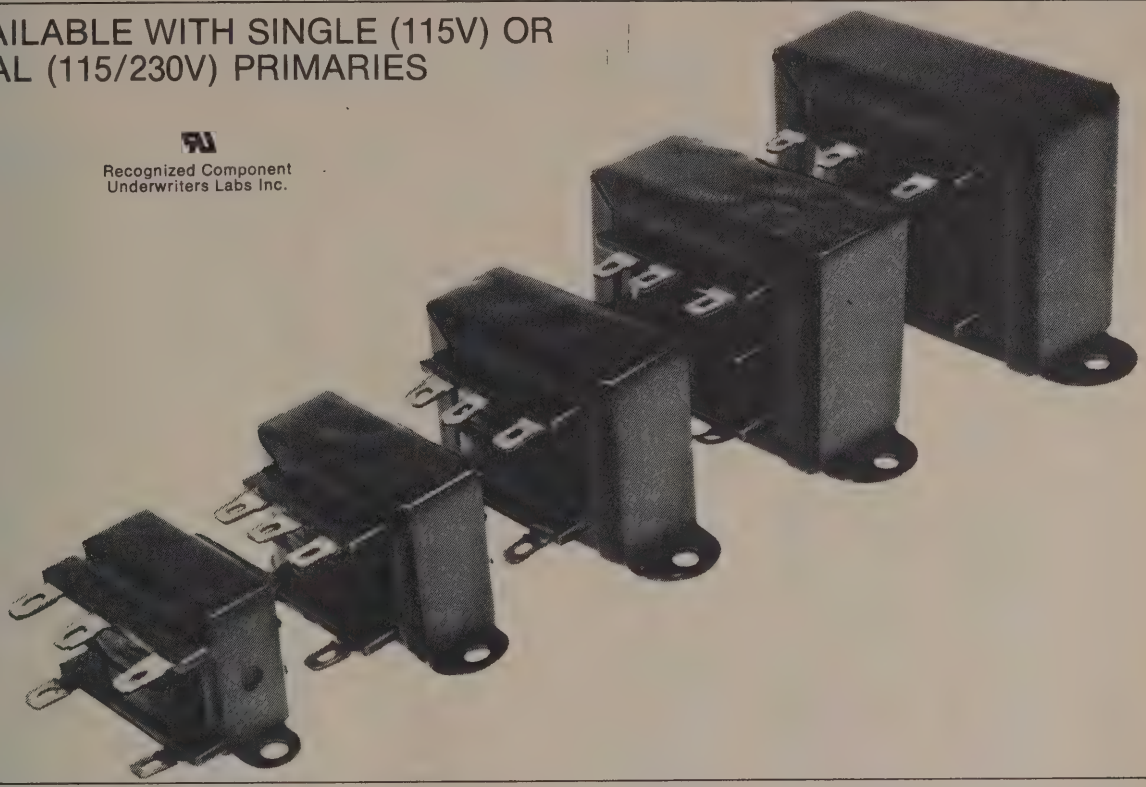
Dept. EM, 500 Bayview Ave., Inwood, N.Y. 11696
Telephone: (516) 239-7200

"See page 4403 for prices"

# series of small power transformers

## AVAILABLE WITH SINGLE (115V) OR DUAL (115/230V) PRIMARIES

Recognized Component
Underwriters Labs Inc.



METHOD OF DETERMINING SECONDARY CURRENT RATINGS

The secondary currents shown in the tables are RMS ratings. Depending upon rectifier circuit configurations, the RMS secondary current is different than the DC output current. This is indicated in the chart below:

| Rectifier Type | Filter Type | RMS Secondary Current Is |
|---|---|---|
| Full Wave Center-Tap | Choke Input | = 0.7 x DC Amps |
| Full Wave Center-Tap | Capacitor Input | = 1 to 1.2 x DC Amps |
| Full Wave Bridge | Choke Input | = DC Amps |
| Full Wave Bridge | Capacitor Input | = 1.6 to 1.8 x DC Amps |

For example, in a F. W. Bridge circuit with a capacitive filter, if the load is 1 Amp DC, the RMS Secondary current is 1.6 to 1.8 Amp RMS.

CUSTOM VARIATIONS

Signal is equipped to quite on Custom Variations of "241" types. The secondary combinations are restricted by the number of secondary terminals available, as follows:

| Size | Maximum Number of Secondary Terminals | VA Rating |
|---|---|---|
| 3 | 3 | 2.4 |
| 4 | 4 | 6 |
| 5 | 4 | 12 |
| 6 | 5 | 30 |
| 7 | 3 | 56 |
| 8 | 5 | 100 |

We answer requests promptly and can deliver prototypes in one to three weeks. Production lead times can be scheduled with very reasonable lead times.

| Part Number Single 115V | Part Number Dual 115/230V | Secondary RMS Ratng | Part Number Single 115V | Part Number Dual 115/230V | Secondary RMS Rating |
|---|---|---|---|---|---|
| 241-3-10 | Not Available | 10V C.T. @ 0.25A | 241-3-28 | Not Available | 28V C.T. @ 0.085A |
| 241-4-10 | DP 241-4-10 | 10V C.T. @ 0.6A | 241-4-28 | DP 241-4-28 | 28V C.T. @ 0.2A |
| 241-5-10 | DP 241-5-10 | 10V C.T. @ 1.2A | 241-5-28 | DP 241-5-28 | 28V C.T. @ 0.42A |
| 241-6-10 | DP 241-6-10 | 10V C.T. @ 3.0A | 241-6-28 | DP 241-6-28 | 28V C.T. @ 1.1A |
| 241-7-10 | DP 241-7-10 | 10V C.T. @ 5.0A | 241-7-28 | DP 241-7-28 | 28V C.T. @ 2.0A |
| 241-8-10 | DP 241-8-10 | 10V C.T. @ 10A | 241-8-28 | DP 241-8-28 | 28V C.T. @ 3.6A |
| 241-3-12 | Not Available | 12.6V C.T. @ 0.2A | 241-3-36 | Not Available | 36V C.T. @ 0.065A |
| 241-4-12 | DP 241-4-12 | 12.6V C.T. @ 0.5A | 241-4-36 | DP 241-4-36 | 36V C.T. @ 0.17A |
| 241-5-12 | DP 241-5-12 | 12.6V C.T. @ 1.0A | 241-5-36 | DP 241-5-36 | 36V C.T. @ 0.35A |
| 241-6-12 | DP 241-6-12 | 12.6V C.T. @ 2.5A | 241-6-36 | DP 241-6-36 | 36V C.T. @ 0.85A |
| 241-7-12 | DP 241-7-12 | 12.6V C.T. @ 4.0A | 241-7-36 | DP 241-7-36 | 36V C.T. @ 1.5A |
| 241-8-12 | DP 241-8-12 | 12.6V C.T. @ 8.0A | 241-8-36 | DP 241-8-36 | 36V C.T. @ 2.8A |
| 241-3-16 | Not Available | 16V C.T. @ 0.15A | 241-3-48 | Not Available | 48V C.T. @ 0.05A |
| 241-4-16 | DP 241-4-16 | 16V C.T. @ 0.4A | 241-4-48 | DP 241-4-48 | 48V C.T. @ 0.125A |
| 241-5-16 | DP 241-5-16 | 16V C.T. @ 0.8A | 241-5-48 | DP 241-5-48 | 48V C.T. @ 0.25A |
| 241-6-16 | DP 241-6-16 | 16V C.T. @ 2.0A | 241-6-48 | DP 241-6-48 | 48V C.T. @ 0.63A |
| 241-7-16 | DP 241-7-16 | 16V C.T. @ 3.5A | 241-7-48 | DP 241-7-48 | 48V C.T. @ 1.2A |
| 241-8-16 | DP 241-8-16 | 16V C.T. @ 6.25A | 241-8-48 | DP 241-8-48 | 48V C.T. @ 2.0A |
| 241-3-20 | Not Available | 20V C.T. @ 0.12A | 241-3-56 | Not Available | 56V C.T. @ 0.045A |
| 241-4-20 | DP 241-4-20 | 20V C.T. @ 0.3A | 241-4-56 | DP 241-4-56 | 56V C.T. @ 0.11A |
| 241-5-20 | DP 241-5-20 | 20V C.T. @ 0.6A | 241-5-56 | DP 241-5-56 | 56V C.T. @ 0.22A |
| 241-6-20 | DP 241-6-20 | 20V C.T. @ 1.5A | 241-6-56 | DP 241-6-56 | 56V C.T. @ 0.54A |
| 241-7-20 | DP 241-7-20 | 20V C.T. @ 2.8A | 241-7-56 | DP 241-7-56 | 56V C.T. @ 1.0A |
| 241-8-20 | DP 241-8-20 | 20V C.T. @ 5.0A | 241-8-56 | DP 241-8-56 | 56V C.T. @ 1.8A |
| 241-3-24 | Not Available | 24V C.T. @ 0.1A | 241-3-120 | Not Available | 120V C.T. @ 0.02A |
| 241-4-24 | DP 241-4-24 | 24V C.T. @ 0.25A | 241-4-120 | DP 241-4-120 | 120V C.T. @ 0.05A |
| 241-5-24 | DP 241-5-24 | 24V C.T. @ 0.5A | 241-5-120 | DP 241-5-120 | 120V C.T. @ 0.1A |
| 241-6-24 | DP 241-6-24 | 24V C.T. @ 1.25A | 241-6-120 | DP 241-6-120 | 120V C.T. @ 0.25A |
| 241-7-24 | DP 241-7-24 | 24V C.T. @ 2.4A | 241-7-120 | DP 241-7-120 | 120V C.T. @ 0.5A |
| 241-8-24 | DP 241-8-24 | 24V C.T. @ 4.0A | 241-8-120 | DP 241-8-120 | 120V C.T. @ 0.85A |

Explanation of part number series 241 Size-4 Sec. Volts - 36 Prefix "DP" used for dual primary versions

Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

**signal** TRANSFORMER

Dept. EM, 500 Bayview Ave., Inwood, N.Y. 11696
Telephone: (516) 239-7200

"See page 4403 for prices"

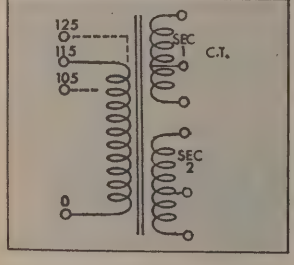
# rectifier power transformers

## CHOICE OF SINGLE 115V OR DUAL 115/230V PRIMARIES

| Primary 50/60 Hz | | Secondary RMS Rating* | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Single 115V. | Dual* 115/230V. | Series | Parallel | Mtg. Style | L | W | H | ML | MW | Mtg. Screw | Approx. Lbs. |
| 10-0.1 | DL 10-0.1 | 10V C.T. @ 0.1A | 5V C.T. @ 0.2A | C | 2 | 1½ | 1¾ | 1 23/32 | — | #8 | 0.3 |
| 10-0.25 | DL 10-0.25 | 10V C.T. @ 0.25A | 5V C.T. @ 0.5A | C | 2⅜ | 1½ | 2 | 2 | — | #8 | 0.5 |
| 10-0.5 | DL 10-0.5 | 10V C.T. @ 0.5A | 5V C.T. @ 1A | C | 2⅜ | 1¾ | 2 | 2 | — | #8 | 0.8 |
| 10-1 | DL 10-1 | 10V C.T. @ 1A | 5V C.T. @ 2A | C | 2⅞ | 1¾ | 2 5/16 | 2⅜ | — | #8 | 1.0 |
| 10-2 | DL 10-2 | 10V C.T. @ 2A | 5V C.T. @ 4A | C | 3⅛ | 2⅛ | 2¾ | 2 13/16 | — | #8 | 1.5 |
| 10-4 | DL 10-4 | 10V C.T. @ 4A | 5V C.T. @ 8A | C | 3 5/16 | 2⅜ | 3 1/16 | 3⅛ | — | #8 | 2.3 |
| 10-6 | DL 10-6 | 10V C.T. @ 6A | 5V C.T. @ 12A | B | 3⅜ | 2¾ | 2 13/16 | 2 13/16 | 2⅛ | #8 | 3.3 |
| 10-8 | DL 10-8 | 10V C.T. @ 8A | 5V C.T. @ 16A | B | 3⅜ | 3⅛ | 2 13/16 | 2 13/16 | 2½ | #8 | 4.0 |
| 10-12 | DL 10-12 | 10V C.T. @ 12A | 5V C.T. @ 24A | B | 3¾ | 3¼ | 3⅛ | 3⅛ | 2½ | #8 | 5.0 |
| 10-25 | DL 10-25 | 10V C.T. @ 25A | 5V C.T. @ 50A | B | 4½ | 3¾ | 3¾ | 3¾ | 2¾ | #10 | 8.7 |
| 10-50‡ | DL 10-50 | 10V C.T. @ 50A | 5V C.T. @ 100A | B | 5¼ | 5½ | 4⅜ | 4⅜ | 3⅝ | ¼ | 17.0 |
| 10-100‡ | DL 10-100 | 10V C.T. @ 100A | 5V C.T. @ 200A | B | 6⅜ | 7¼ | 5 5/16 | 5 5/16 | 4⅜ | ¼ | 34.5 |
| 12.8-0.1 | DL 12.8-0.1 | 12.8V C.T. @ 0.1A | 6.4V C.T. @ 0.2A | C | 2 | 1½ | 1¾ | 1 23/32 | — | #8 | 0.3 |
| 12.8-0.25 | DL 12.8-0.25 | 12.8V C.T. @ 0.25A | 6.4V C.T. @ 0.5A | C | 2⅜ | 1½ | 2 | 2 | — | #8 | 0.5 |
| 12.8-0.5 | DL 12.8-0.5 | 12.8V C.T. @ 0.5A | 6.4V C.T. @ 1A | C | 2⅞ | 1⅝ | 2 5/16 | 2⅜ | — | #8 | 0.8 |
| 12.8-1 | DL 12.8-1 | 12.8V C.T. @ 1A | 6.4V C.T. @ 2A | C | 2⅞ | 2 | 2 5/16 | 2⅜ | — | #8 | 1.2 |
| 12.8-2A | DL 12.8-2A | 12.8V C.T. @ 2A | 6.4V C.T. @ 4A | C | 3⅛ | 2⅛ | 2¾ | 2 13/16 | — | #8 | 1.5 |
| 12.8-2 | DL 12.8-2 | 12.8V C.T. @ 2A | 6.4V C.T. @ 4A | B | 3 | 2½ | 2½ | 2½ | 2 | #8 | 2.3 |
| 12.8-4 | DL 12.8-4 | 12.8V C.T. @ 4A | 6.4V C.T. @ 8A | B | 3 | 2⅞ | 2½ | 2½ | 2⅜ | #8 | 2.8 |
| 12.8-6 | DL 12.8-6 | 12.8V C.T. @ 6A | 6.4V C.T. @ 12A | B | 3⅜ | 3 1/16 | 2 13/16 | 2 13/16 | 2½ | #8 | 4.0 |
| 12.8-8 | DL 12.8-8 | 12.8V C.T. @ 8A | 6.4V C.T. @ 16A | B | 3¾ | 3⅛ | 3⅛ | 3⅛ | 2¼ | #8 | 4.5 |
| 12.8-12 | DL 12.8-12 | 12.8V C.T. @ 12A | 6.4V C.T. @ 24A | B | 4⅛ | 3¼ | 3 7/16 | 3 7/16 | 2⅜ | #10 | 6.0 |
| 12.8-25 | DL 12.8-25 | 12.8V C.T. @ 25A | 6.4V C.T. @ 50A | B | 5¼ | 4¼ | 4⅜ | 4⅜ | 2⅞ | #10 | 12.5 |
| 12.8-50‡ | DL 12.8-50 | 12.8V C.T. @ 50A | 6.4V C.T. @ 100A | B | 5¼ | 6 | 4⅜ | 4⅜ | 4⅛ | ¼ | 20.7 |
| 12.8-100‡ | DL 12.8-100 | 12.8V C.T. @ 100A | 6.4V C.T. @ 200A | B | 6⅜ | 7¼ | 5 5/16 | 5 5/16 | 4⅜ | ¼ | 34.5 |
| 16-0.1 | DL 16-0.1 | 16V C.T. @ 0.1A | 8V C.T. @ 0.2A | C | 2 | 1⅝ | 1¾ | 1 23/32 | — | #8 | 0.4 |
| 16-0.25 | DL 16-0.25 | 16V C.T. @ 0.25A | 8V C.T. @ 0.5A | C | 2⅜ | 1¾ | 2 | 2 | — | #8 | 0.7 |
| 16-0.5 | DL 16-0.5 | 16V C.T. @ 0.5A | 8V C.T. @ 1A | C | 2⅞ | 1⅝ | 2 5/16 | 2⅜ | — | #8 | 0.8 |
| 16-1 | DL 16-1 | 16V C.T. @ 1A | 8V C.T. @ 2A | C | 2⅞ | 2 | 2 5/16 | 2⅜ | — | #8 | 1.2 |
| 16-2 | DL 16-2 | 16V C.T. @ 2A | 8V C.T. @ 4A | C | 3⅛ | 2¼ | 2¾ | 2 13/16 | — | #8 | 1.7 |
| 16-4 | DL 16-4 | 16V C.T. @ 4A | 8V C.T. @ 8A | B | 3⅜ | 2¾ | 2 13/16 | 2 13/16 | 2⅛ | #8 | 3.3 |
| 16-6 | DL 16-6 | 16V C.T. @ 6A | 8V C.T. @ 12A | B | 3¾ | 3⅛ | 3⅛ | 3⅛ | 2¼ | #10 | 4.5 |
| 16-8 | DL 16-8 | 16V C.T. @ 8A | 8V C.T. @ 16A | B | 3¾ | 3½ | 3⅛ | 3⅛ | 2⅝ | #10 | 5.4 |
| 16-12 | DL 16-12 | 16V C.T. @ 12A | 8V C.T. @ 24A | B | 4⅛ | 3⅞ | 3 3/16 | 3 3/16 | 3 | #10 | 7.9 |
| 16-25 | DL 16-25 | 16V C.T. @ 25A | 8V C.T. @ 50A | B | 4½ | 5⅜ | 3¾ | 3¾ | 4 | #10 | 14.5 |
| 16-50‡ | DL 16-50 | 16V C.T. @ 50A | 8V C.T. @ 100A | B | 6⅜ | 5¾ | 5 5/16 | 5 5/16 | 3¾ | ¼ | 26.5 |
| 16-100‡ | DL 16-100 | 16V C.T. @ 100A | 8V C.T. @ 200A | B | 7½ | 7½ | 6⅜ | 6¾ | 4⅝ | ¼ | 50.0 |
| 24-0.1 | DL 24-0.1 | 24V C.T. @ 0.1A | 12V C.T. @ 0.2A | C | 2⅜ | 1½ | 2 | 2 | — | #8 | 0.5 |
| 24-0.25 | DL 24-0.25 | 24V C.T. @ 0.25A | 12V C.T. @ 0.5A | C | 2⅞ | 1¾ | 2 5/16 | 2⅜ | — | #8 | 1.0 |
| 24-0.5 | DL 24-0.5 | 24V C.T. @ 0.5A | 12V C.T. @ 1A | C | 2⅞ | 2 | 2 5/16 | 2⅜ | — | #8 | 1.2 |
| 24-1A | DL 24-1A | 24V C.T. @ 1A | 12V C.T. @ 2A | C | 3⅛ | 2⅛ | 2¾ | 2 13/16 | — | #8 | 1.5 |
| 24-1 | DL 24-1 | 24V C.T. @ 1A | 12V C.T. @ 2A | B | 3 | 2½ | 2½ | 2½ | 2 | #8 | 2.3 |
| 24-2 | DL 24-2 | 24V C.T. @ 2A | 12V C.T. @ 4A | B | 3 | 2⅞ | 2½ | 2½ | 2⅜ | #8 | 2.9 |
| 24-4 | DL 24-4 | 24V C.T. @ 4A | 12V C.T. @ 8A | B | 3¾ | 3⅛ | 3⅛ | 3⅛ | 2¼ | #8 | 4.5 |
| 24-6 | DL 24-6 | 24V C.T. @ 6A | 12V C.T. @ 12A | B | 4⅛ | 3¼ | 3 7/16 | 3 7/16 | 2⅜ | #10 | 5.8 |
| 24-8 | DL 24-8 | 24V C.T. @ 8A | 12V C.T. @ 16A | B | 4⅛ | 3⅞ | 3 7/16 | 3 7/16 | 3 | #10 | 7.9 |
| 24-12‡ | DL 24-12 | 24V C.T. @ 12A | 12V C.T. @ 24A | B | 4½ | 4½ | 3¾ | 3¾ | 3⅜ | #10 | 11.0 |
| 24-20‡ | DL 24-20 | 24V C.T. @ 20A | 12V C.T. @ 40A | B | 5¼ | 4¾ | 4⅜ | 4⅜ | 3⅜ | ¼ | 15.3 |
| 24-25‡ | DL 24-25 | 24V C.T. @ 25A | 12V C.T. @ 50A | B | 5¼ | 5⅝ | 4⅜ | 4⅜ | 4⅛ | ¼ | 19.5 |
| 24-50‡ | DL 24-50 | 24V C.T. @ 50A | 12V C.T. @ 100A | B | 6⅜ | 6¼ | 5 5/16 | 5 5/16 | 4⅜ | ¼ | 31.3 |
| —— | 24-100 △ | 24V C.T. @ 100A | 12V C.T. @ 200A | B | 7½ | 7 | 6⅜ | 6¾ | 4⅛ | ¼ | 43.0 |
| 36-0.1 | DL 36-0.1 | 36V C.T. @ 0.1A | 18V C.T. @ 0.2A | C | 2⅜ | 1⅝ | 2 | 2 | — | #8 | 0.5 |
| 36-0.25 | DL 36-0.25 | 36V C.T. @ 0.25A | 18V C.T. @ 0.5A | C | 2⅞ | 1⅝ | 2 5/16 | 2⅜ | — | #8 | 0.8 |
| 36-0.5 | DL 36-0.5 | 36V C.T. @ 0.5A | 18V C.T. @ 1A | C | 3⅛ | 2 | 2¾ | 2 13/16 | — | #8 | 1.3 |
| 36-1A | DL 36-1A | 36V C.T. @ 1A | 18V C.T. @ 2A | C | 3 1/16 | 2⅜ | 3 1/16 | 3⅛ | — | #8 | 2.3 |
| 36-1 | DL 36-1 | 36V C.T. @ 1A | 18V C.T. @ 2A | B | 3 | 2¾ | 2½ | 2½ | 2¼ | #8 | 2.6 |
| 36-2 | DL 36-2 | 36V C.T. @ 2A | 18V C.T. @ 4A | B | 3⅜ | 2 13/16 | 2 13/16 | 2 13/16 | 2⅜ | #8 | 3.8 |
| 36-4 | DL 36-4 | 36V C.T. @ 4A | 18V C.T. @ 8A | B | 4⅛ | 3⅜ | 3 7/16 | 3 7/16 | 2⅝ | #10 | 6.8 |
| 36-6 | DL 36-6 | 36V C.T. @ 6A | 18V C.T. @ 12A | B | 4½ | 3¾ | 3¾ | 3¾ | 2¾ | #10 | 8.7 |
| 36-8‡ | DL 36-8 | 36V C.T. @ 8A | 18V C.T. @ 16A | B | 4½ | 4½ | 3¾ | 3¾ | 3⅜ | #10 | 11.0 |
| 36-12‡ | DL 36-12 | 36V C.T. @ 12A | 18V C.T. @ 24A | B | 5¼ | 5 | 4⅜ | 4⅜ | 3⅜ | ¼ | 15.0 |
| 36-20‡ | DL 36-20 | 36V C.T. @ 20A | 18V C.T. @ 40A | B | 6⅜ | 5⅜ | 5 5/16 | 5 5/16 | 3⅜ | ¼ | 22.8 |
| 36-25‡ | DL 36-25 | 36V C.T. @ 25A | 18V C.T. @ 50A | B | 6⅜ | 5¾ | 5 5/16 | 5 5/16 | 3¾ | ¼ | 26.5 |
| 36-30‡ | DL 36-30 | 36V C.T. @ 30A | 18V C.T. @ 60A | B | 6⅜ | 6 | 5 5/16 | 5 5/16 | 4⅜ | ¼ | 31.5 |
| —— | 36-50△ | 36V C.T. @ 50A | 18V C.T. @ 100A | B | 6⅜ | 7¼ | 5 5/16 | 5 5/16 | 5⅛ | ¼ | 40.0 |
| —— | 36-100△ | 36V C.T. @ 100A | 18V C.T. @ 200A | B | 7½ | 9 | 6¼ | 6¾ | 5 5/16 | ¼ | 63.5 |
| 56-0.1 | DL 56-0.1 | 56V C.T. @ 0.1A | 28V C.T. @ 0.2A | C | 2⅜ | 1¾ | 2 | 2 | — | #8 | 0.8 |
| 56-0.25 | DL 56-0.25 | 56V C.T. @ 0.25A | 28V C.T. @ 0.5A | C | 2⅞ | 2 | 2 5/16 | 2⅜ | — | #8 | 1.2 |
| 56-0.5 | DL 56-0.5 | 56V C.T. @ 0.5A | 28V C.T. @ 1A | C | 3⅛ | 2¼ | 2¾ | 2 13/16 | — | #8 | 1.7 |
| 56-1 | DL 56-1 | 56V C.T. @ 1A | 28V C.T. @ 2A | B | 3⅜ | 2⅞ | 2 13/16 | 2 13/16 | 2¼ | #8 | 3.5 |
| 56-2 | DL 56-2 | 56V C.T. @ 2A | 28V C.T. @ 4A | B | 3¾ | 3¼ | 3⅛ | 3⅛ | 2½ | #8 | 5.0 |
| 56-4 | DL 56-4 | 56V C.T. @ 4A | 28V C.T. @ 8A | B | 4⅛ | 3¾ | 3 7/16 | 3 7/16 | 3 | #10 | 7.7 |
| 56-6 | DL 56-6 | 56V C.T. @ 6A | 28V C.T. @ 12A | B | 5¼ | 4¼ | 4⅜ | 4⅜ | 2⅞ | #10 | 12.0 |
| 56-8‡ | DL 56-8 | 56V C.T. @ 8A | 28V C.T. @ 16A | B | 5¼ | 5 | 4⅜ | 4⅜ | 3⅝ | ¼ | 17.0 |
| 56-12† | DL 56-12 | 56V C.T. @ 12A | 28V C.T. @ 24A | B | 6⅜ | 5¼ | 5 5/16 | 5 5/16 | 3⅜ | ¼ | 22.0 |
| 56-25‡ | DL 56-25 | 56V C.T. @ 25A | 28V C.T. @ 50A | B | 6⅜ | 7⅛ | 5 5/16 | 5 5/16 | 5⅛ | ¼ | 38.0 |
| —— | 56-50△ | 56V C.T. @ 50A | 28V C.T. @ 100A | B | 7½ | 7½ | 6¼ | 6¾ | 4⅞ | ¼ | 56.3 |
| —— | 56-100△ | 56V C.T. @ 100A | 28V C.T. @ 200A | B | 7½ | 11¼ | 6¼ | 6¾ | 8¼ | ¼ | 95.0 |

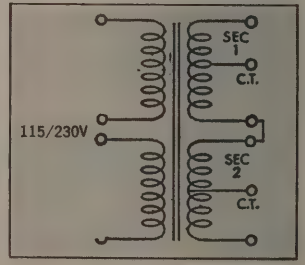
△Available with dual primary only. Therefore, prefix "DL" is not required.
‡ Nominal 115V primary has added taps, I.E., 105/115/125V, Dual (DL) version is 115/230V only.

*The DL (Dual Primary versions) are not stock items but are standard designs generally available on 2-3 week delivery.




All transformers are designed conservatively for a max of 45°C rise above ambient and are rated for 50/60 Hz. Only prime raw materials are used. Units are thoroughly impregnated and baked with Signal's own high gloss black baking varnish. The transformers and chokes are rugged in construction, well insulated, and have a consistently uniform appearance. All ratings are at full load current continuous operation. Hipot rating of 1500V RMS is standard.

Electrical ratings have been chosen to cover a wide range of applications. All transformers have two center-tapped secondary windings, which may be series or parallel connected as indicated in rating chart.



# rectifier power transformers

## IDEAL FOR USE IN SINGLE OR DUAL DC POWER SUPPLIES

| Primary 50/60 Hz | | Secondary RMS Rating* | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Single 115V. | Dual* 115/230V. | Series | Parallel | Mtg. Style | L | W | H | ML | MW | Mtg. Screw | Approx. Lbs. |
| 68-0.1 | DL 68-0.1 | 68V C.T. @ 0.1A | 34V C.T. @ 0.2A | C | 2⅞ | 1⅝ | 2⅝ | 2⅜ | — | #8 | 0.8 |
| 68-0.25 | DL 68-0.25 | 68V C.T. @ 0.25A | 34V C.T. @ 0.5A | C | 2⅞ | 2 | 2⅝ | 2⅜ | — | #8 | 1.2 |
| 68-0.5A | DL-68-0.5A | 68V C.T. @ 0.5A | 34V C.T. @ 1A | C | 3⅛ | 2¼ | 2¾ | 2 13/16 | — | #8 | 1.7 |
| 68-0.5 | DL 68-0.5 | 68V C.T. @ 0.5A | 34V C.T. @ 1A | B | 3 | 2¾ | 2½ | 2½ | 2¼ | #8 | 2.7 |
| 68-1 | DL 68-1 | 68V C.T. @ 1A | 34V C.T. @ 2A | B | 3⅜ | 2 15/16 | 2 13/16 | 2 13/16 | 2⅜ | #8 | 3.8 |
| 68-2 | DL 68-2 | 68V C.T. @ 2A | 34V C.T. @ 4A | B | 4⅛ | 3⅜ | 3 7/16 | 3 7/16 | 2⅝ | #10 | 6.8 |
| 68-4 | DL 68-4 | 68V C.T. @ 4A | 34V C.T. @ 8A | B | 4½ | 4½ | 3¾ | 3¾ | 3⅜ | #10 | 11.5 |
| 68-6‡ | DL 68-6 | 68V C.T. @ 6A | 34V C.T. @ 12A | B | 5¼ | 5 | 4⅜ | 4⅜ | 3⅜ | ¼ | 15.0 |
| 68-8‡ | DL 68-8 | 68V C.T. @ 8A | 34V C.T. @ 16A | B | 5¼ | 5½ | 4⅜ | 4⅜ | 3⅞ | ¼ | 19.0 |
| 68-12‡ | DL 68-12 | 68V C.T. @ 12A | 34V C.T. @ 24A | B | 6⅜ | 5¾ | 5 5/16 | 5 5/16 | 3¾ | ¼ | 26.5 |
| —— | 68-25△ | 68V C.T. @ 25A | 34V C.T. @ 50A | B | 6⅜ | 7¼ | 5 5/16 | 5 5/16 | 5⅛ | ¼ | 39.7 |
| —— | 68-50△ | 68V C.T. @ 50A | 34V C.T. @ 100A | B | 7½ | 9 | 6¼ | 6¾ | 5 7/16 | ¼ | 58.5 |
| 80-0.1 | DL 80-0.1 | 80V C.T. @ 0.1A | 40V C.T. @ 0.2A | C | 2⅞ | 1⅝ | 2 5/16 | 2⅜ | — | #8 | 0.8 |
| 80-0.25 | DL 80-0.25 | 80V C.T. @ 0.25A | 40V C.T. @ 0.5A | C | 3⅛ | 2 | 2¾ | 2 13/16 | — | #8 | 1.3 |
| 80-0.5A | DL 85-0.5A | 80V C.T. @ 0.5A | 40V C.T. @ 1A | C | 3 5/16 | 2⅜ | 3 1/16 | 3⅛ | — | #8 | 2.2 |
| 80-0.5 | DL 80-0.5 | 80V C.T. @ 0.5A | 40V C.T. @ 1A | B | 3 | 2¾ | 2½ | 2½ | 2¼ | #8 | 2.8 |
| 80-1 | DL 80-1 | 80V C.T. @ 1A | 40V C.T. @ 2A | B | 3⅜ | 3 1/16 | 2 13/16 | 2 13/16 | 2½ | #8 | 4.0 |
| 80-2 | DL 80-2 | 80V C.T. @ 2A | 40V C.T. @ 4A | B | 4⅛ | 3⅜ | 3 7/16 | 3 7/16 | 2⅝ | #10 | 6.8 |
| 80-4 | DL 80-4 | 80V C.T. @ 4A | 40V C.T. @ 8A | B | 5¼ | 4¼ | 4⅜ | 4⅜ | 2⅞ | ¼ | 12.3 |
| 80-6‡ | DL 80-6 | 80V C.T. @ 6A | 40V C.T. @ 12A | B | 5¼ | 5½ | 4⅜ | 4⅜ | 3⅞ | ¼ | 19.0 |
| 80-8‡ | DL 80-8 | 80V C.T. @ 8A | 40V C.T. @ 16A | B | 6⅜ | 5¼ | 5 5/16 | 5 5/16 | 3¼ | ¼ | 20.5 |
| 80-12‡ | DL 80-12 | 80V C.T. @ 12A | 40V C.T. @ 24A | B | 6⅜ | 6 | 5 5/16 | 5 5/16 | 4⅛ | ¼ | 29.0 |
| —— | 80-25△ | 80V C.T. @ 25A | 40V C.T. @ 50A | B | 7½ | 6½ | 6¼ | 6¾ | 3⅞ | ¼ | 40.3 |
| —— | 80-50△ | 80V C.T. @ 50A | 40V C.T. @ 100A | B | 7½ | 9 | 6¼ | 6¾ | 6½ | ¼ | 78.0 |
| 88-0.1 | DL 88-0.1 | 88V C.T. @ 0.1A | 44V C.T. @ 0.2A | C | 2⅞ | 1¾ | 2 5/16 | 2⅜ | — | #8 | 1.0 |
| 88-0.25 | DL 88-0.25 | 88V C.T. @ 0.25A | 44V C.T. @ 0.5A | C | 3⅛ | 2⅛ | 2¾ | 2 13/16 | — | #8 | 1.5 |
| 88-0.5 | DL 88-0.5 | 88V C.T. @ 0.5A | 44V C.T. @ 1A | C | 3 5/16 | 2⅜ | 3 1/16 | 3⅛ | — | #8 | 2.2 |
| 88-1 | DL 88-1 | 88V C.T. @ 1A | 44V C.T. @ 2A | B | 3¾ | 3 | 3⅛ | 3⅛ | 2¼ | #8 | 4.5 |
| 88-2 | DL 88-2 | 88V C.T. @ 2A | 44V C.T. @ 4A | B | 4⅛ | 3⅜ | 3 7/16 | 3 7/16 | 2⅝ | #10 | 6.8 |
| 88-4 | DL 88-4 | 88V C.T. @ 4A | 44V C.T. @ 8A | B | 5¼ | 4½ | 4⅜ | 4⅜ | 3⅛ | ¼ | 13.4 |
| 88-6‡ | DL 88-6 | 88V C.T. @ 6A | 44V C.T. @ 12A | B | 5¼ | 5½ | 4⅜ | 4⅜ | 3⅞ | ¼ | 19.0 |
| 88-8‡ | DL 88-8 | 88V C.T. @ 8A | 44V C.T. @ 16A | B | 6⅜ | 5⅜ | 5 5/16 | 5 5/16 | 3⅜ | ¼ | 22.8 |
| 88-12‡ | DL 88-12 | 88V C.T. @ 12A | 44V C.T. @ 24A | B | 6⅜ | 6½ | 5 5/16 | 5 5/16 | 4⅝ | ¼ | 35.0 |
| —— | 88-25△ | 88V C.T. @ 25A | 44V C.T. @ 50A | B | 7½ | 8 | 6¼ | 6¾ | 5⅝ | ¼ | 62.0 |
| —— | 88-50△ | 88V C.T. @ 50A | 44V C.T. @ 100A | B | 7½ | 11 | 6¼ | 6¾ | 8⅝ | ¼ | 100.0 |
| 120-0.5 | DL 120-0.5 | 120V C.T. @ 0.5A | 60V C.T. @ 1A | B | 3⅜ | 2⅞ | 2 13/16 | 2 13/16 | 2¼ | #8 | 3.2 |
| 120-1 | DL 120-1 | 120V C.T. @ 1A | 60V C.T. @ 2A | B | 3¾ | 3⅜ | 3⅛ | 3⅛ | 2¾ | #8 | 5.8 |
| 120-2 | DL 120-2 | 120V C.T. @ 2A | 60V C.T. @ 4A | B | 4½ | 3¾ | 3¾ | 3¾ | 2¾ | #10 | 8.5 |
| 120-4 | DL 120-4 | 120V C.T. @ 4A | 60V C.T. @ 8A | B | 5¼ | 5½ | 4⅜ | 4⅜ | 3⅞ | ¼ | 17.0 |
| 120-6‡ | DL 120-6 | 120V C.T. @ 6A | 60V C.T. @ 12A | B | 6⅜ | 6 | 5 5/16 | 5 5/16 | 3⅞ | ¼ | 27.0 |
| 120-8‡ | DL 120-8 | 120V C.T. @ 8A | 60V C.T. @ 16A | B | 6⅜ | 6½ | 5 5/16 | 5 5/16 | 4⅝ | ¼ | 34.0 |
| 120-12‡ | DL 120-12 | 120V C.T. @ 12A | 60V C.T. @ 24A | B | 6⅜ | 7¼ | 5 5/16 | 5 5/16 | 5⅜ | ¼ | 42.0 |
| 120-20‡ | DL 120-20 | 120V C.T. @ 20A | 60V C.T. @ 40A | B | 7½ | 8 | 6¼ | 6¾ | 5⅜ | ¼ | 57.0 |
| 160-0.5 | DL 160-0.5 | 160V C.T. @ 0.5A | 80V C.T. @ 1A | B | 3⅜ | 3 1/16 | 2 13/16 | 2 13/16 | 2½ | #8 | 4.0 |
| 160-1 | DL 160-1 | 160V C.T. @ 1A | 80V C.T. @ 2A | B | 4⅛ | 3⅝ | 3 7/16 | 3 7/16 | 2⅝ | #10 | 6.5 |
| 160-2 | DL 160-2 | 160V C.T. @ 2A | 80V C.T. @ 4A | B | 4½ | 4⅜ | 3¾ | 3¾ | 3⅜ | #10 | 11.0 |
| 160-4‡ | DL 160-4 | 160V C.T. @ 4A | 80V C.T. @ 8A | B | 6⅜ | 5¼ | 5 5/16 | 5 5/16 | 3¼ | ¼ | 21.0 |
| 160-8‡ | DL 160-8 | 160V C.T. @ 8A | 80V C.T. @ 16A | B | 6⅜ | 6¾ | 5 5/16 | 5 5/16 | 4⅞ | ¼ | 36.0 |
| —— | 160-12△ | 160V C.T. @ 12A | 80V C.T. @ 24A | B | 7½ | 6½ | 6¼ | 6¾ | 3⅞ | ¼ | 39.8 |
| 180-0.5 | DL 180-0.5 | 180V C.T. @ 0.5A | 90V C.T. @ 1A | B | 3¾ | 3⅜ | 3⅛ | 3⅛ | 2¾ | #8 | 5.8 |
| 180-1 | DL 180-1 | 180V C.T. @ 1A | 90V C.T. @ 2A | B | 4⅛ | 3⅞ | 3 7/16 | 3 7/16 | 3 | #10 | 8.2 |
| 180-2 | DL 180-2 | 180V C.T. @ 2A | 90V C.T. @ 4A | B | 5¼ | 5 | 4⅜ | 4⅜ | 3⅝ | ¼ | 15.8 |
| 180-4 | DL 180-4 | 180V C.T. @ 4A | 90V C.T. @ 8A | B | 6⅜ | 5¾ | 5 5/16 | 5 5/16 | 3¾ | ¼ | 27.0 |
| 180-6‡ | DL 180-6 | 180V C.T. @ 6A | 90V C.T. @ 12A | B | 6⅜ | 7¼ | 5 5/16 | 5 5/16 | 5⅛ | ¼ | 37.0 |
| 180-8‡ | DL 180-8 | 180V C.T. @ 8A | 90V C.T. @ 16A | B | 6⅜ | 7¾ | 5 5/16 | 5 5/16 | 5⅝ | ¼ | 42.0 |
| 180-12‡ | DL 180-12 | 180V C.T. @ 12A | 90V C.T. @ 24A | B | 7½ | 8¼ | 6¼ | 6¾ | 5⅝ | ¼ | 62.0 |
| 230-0.5 | DL 230-0.5 | 230V C.T. @ 0.5A | 115V C.T. @ 1A | B | 3¾ | 3⅝ | 3⅛ | 3⅛ | 3 | #8 | 6.5 |
| 230-1 | DL 230-1 | 230V C.T. @ 1A | 115V C.T. @ 2A | B | 4½ | 3¾ | 3¾ | 3¾ | 3 | #10 | 9.4 |
| 230-2 | DL 230-2 | 230V C.T. @ 2A | 115V C.T. @ 4A | B | 5¼ | 4¾ | 4⅜ | 4⅜ | 3⅜ | ¼ | 14.5 |
| 230-4‡ | DL 230-4 | 230V C.T. @ 4A | 115V C.T. @ 8A | B | 6⅜ | 6 | 5 5/16 | 5 5/16 | 4⅛ | ¼ | 28.4 |
| 230-6‡ | DL 230-6 | 230V C.T. @ 6A | 115V C.T. @ 12A | B | 6⅜ | 7¼ | 5 5/16 | 5 5/16 | 5⅛ | ¼ | 38.0 |
| 300-0.5 | DL 300-0.5 | 300V C.T. @ 0.5A | 150V C.T. @ 1A | B | 4½ | 3½ | 3¾ | 3¾ | 2½ | #10 | 7.0 |
| 300-1 | DL 300-1 | 300V C.T. @ 1A | 150V C.T. @ 2A | B | 5¼ | 4⅛ | 4⅜ | 4⅜ | 3 | ¼ | 12.8 |
| 300-2 | DL 300-2 | 300V C.T. @ 2A | 150V C.T. @ 4A | B | 5¼ | 5¾ | 4⅜ | 4⅜ | 4½ | ¼ | 21.0 |
| 300-4‡ | DL 300-4 | 300V C.T. @ 4A | 150V C.T. @ 8A | B | 6⅜ | 5¾ | 5 5/16 | 5 5/16 | 3⅞ | ¼ | 27.5 |

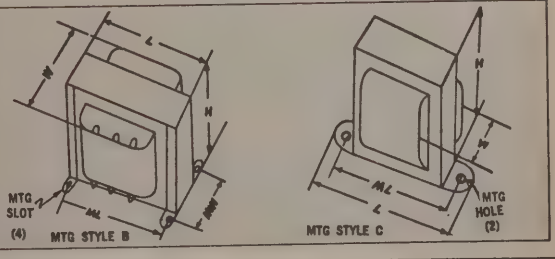
△Available with dual primary only. Therefore, prefix "DL" is not required.
‡ Nominal 115V primary has added taps, I.E., 105/115/125V, Dual (DL) version is 115/230V only.

*The DL (Dual Primary versions) are not stock items but are standard designs generally available on 2-3 week delivery, plus there will be a $20 set-up charge per order.

*The secondary currents shown in the tables are RMS ratings. Depending upon rectifier circuit configurations, the RMS secondary current is different than the DC output current. This is indicated in the chart below:

| Rectifier Type | Filter Type | RMS Secondary Current Is |
|---|---|---|
| Full Wave Center-Tap | Choke Input | = 0.7 x DC Amps |
| Full Wave Center-Tap | Capacitor Input | = 1 to 1.2 x DC Amps |
| Full Wave Bridge | Choke Input | = DC Amps |
| Full Wave Bridge | Capacitor Input | = 1.6 to 1.8 x DC Amps |

For example, in a F.W. Bridge circuit with a capacitive filter, if the load is 1 Amp DC, the RMS Secondary current is 1.6 to 1.8 Amp RMS.




Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

**signal TRANSFORMER**

Dept. EM, 500 Bayview Ave., Inwood, N.Y. 11696
Telephone: (516) 239-7200

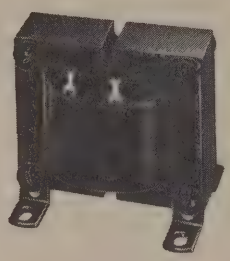
"See page 4403 for prices"

# filter chokes

## 0.5 TO 1000 AMPS

Signal's line of filter chokes is the most extensive available. It is designed to complement the selection of Rectifier Power Transformers so that a set may be specified for power supplies using inductive filters.

The inductance ratings given are minimum values guaranteed at full DC current. All resistance ratings are maximum values. Special variations or intermediate values of inductance, current, or resistance can be supplied promptly and accurately.

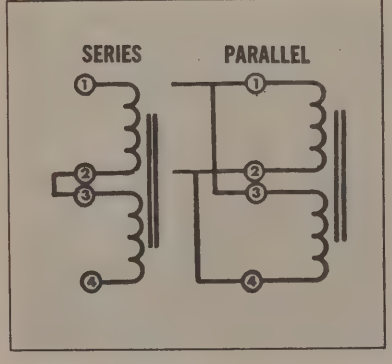


FOR MECHANICAL DIMENSIONS REFER TO TRANSFORMER OUTLINES ON PREVIOUS PAGE

| Part No. | Inductance (MHY) | Current (Amps) | Resistance (Ohms) | Mtg. Style | L | W | H | ML | MW | Mtg. Screw | Approx. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CH-0.5 | 400 | 0.5 | 4.0 | C | 3⅛ | 2⅛ | 2¾ | 2 13/16 | — | #8 | 1.5 |
| CH-1 | 100 | 1 | 1.5 | B | 3 | 2½ | 2½ | 2½ | 2 | #8 | 2.3 |
| CH-2 | 70 | 2 | 0.9 | B | 3⅜ | 2¾ | 2⅞ | 2 13/16 | 2⅛ | #8 | 3.2 |
| CH-4 | 70 | 4 | 0.6 | B | 3¾ | 3⅛ | 3¼ | 3⅛ | 2½ | #8 | 5.3 |
| CH-6 | 40 | 6 | 0.4 | B | 3¾ | 3⅝ | 3¼ | 3⅛ | 3 | #8 | 6.5 |
| CH-8 | 30 | 8 | 0.3 | B | 4⅛ | 3⅝ | 3½ | 3 7/16 | 3 | #10 | 8 |
| CH-12 | 15 | 12 | 0.1 | B | 5¼ | 4 | 4 7/16 | 4⅜ | 3⅛ | #10 | 13.7 |
| CH-16 | 15 | 16 | 0.08 | B | 5¼ | 4⅝ | 4 7/16 | 4⅜ | 3⅝ | #10 | 17.5 |
| CH-20 | 7 | 20 | 0.05 | B | 5¼ | 4 | 4 7/16 | 4⅜ | 3⅛ | #10 | 13.3 |
| CH-25 | 5 | 25 | 0.025 | B | 5¼ | 4¾ | 4 7/16 | 4⅜ | 3⅞ | #10 | 17.8 |
| CH-30 | 4 | 30 | 0.01 | B | 6⅜ | 5 | 5⅜ | 5 5/16 | 3⅜ | ¼ | 24.4 |
| CH-50 | 1.4 | 50 | 0.01 | B | 6⅜ | 5¼ | 5⅜ | 5 5/16 | 3¾ | ¼ | 26.7 |
| CH-100 | 0.5 | 100 | 0.005 | B | 6⅜ | 6¼ | 5⅜ | 5 5/16 | 4⅛ | ¼ | 31.4 |
| CH-200 | 0.3 | 200 | 0.001 | B | 7½ | 7 | 6½ | 6¾ | 4⅛ | ¼ | 48.0 |
| CH-250 | 0.3 | 250 | 0.00115 | B | 7½ | 8 | 6½ | 6¾ | 5⅛ | ¼ | 56.0 |
| CH-500 | 0.055 | 500 | 0.00027 | B | 7½ | 6½ | 6½ | 6¾ | 4⅛ | ¼ | 50.0 |
| CH-1000 | 0.015 | 1,000 | 0.000065 | B | 7½ | 6½ | 6½ | 6¾ | 4⅜ | ¼ | 70.0 |

# dual chokes

## FOR LOWER INDUCTANCE APPLICATIONS




| Part No. | Series Connected Ind. (MHY) | Series Connected Curr. (Amps) | Series Connected Res. Ω | Parallel Connected Ind. (MHY) | Parallel Connected Curr. (Amps) | Parallel Connected Res. Ω | Mtg. Style | Dimensions L | W | H | ML | MW | Mtg. Screw | Appr. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CL-1-2 | 72 | 1 | 1.4 | 18 | 2 | 0.35 | C | 2⅞ | 1¾ | 2 5/16 | 2⅜ | — | #8 | 0.9 |
| CL-2-4 | 40 | 2 | 0.7 | 10 | 4 | 0.18 | C | 3⅛ | 2⅛ | 2¾ | 2 13/16 | — | #8 | 1.5 |
| CL-4-8 | 20 | 4 | 0.3 | 5 | 8 | 0.075 | B | 3 | 2⅞ | 2½ | 2½ | 2½ | #8 | 3.0 |
| CL-6-12 | 12 | 6 | 0.15 | 3 | 12 | 0.038 | B | 3⅜ | 3 1/16 | 2 13/16 | 2 13/16 | 2½ | #8 | 4.0 |
| CL-12-24 | 4.8 | 12 | 0.052 | 1.2 | 24 | 0.013 | B | 3⅜ | 3 1/16 | 2 13/16 | 2 13/16 | 3 | #8 | 5.3 |
| CL-25-50 | 1.2 | 25 | 0.012 | 0.3 | 50 | 0.003 | B | 3¾ | 3⅜ | 3⅜ | 3⅛ | 2¾ | #8 | 6.0 |
| CL-50-100 | 0.5 | 50 | 0.0043 | 0.12 | 100 | 0.0011 | B | 4½ | 3¾ | 3¾ | 3¾ | 2½ | #8 | 8.0 |

Signal's Dual Chokes are supplied with 2 windings which may be series or parallel connected with rating shown on chart. This line is basically designed for applications requiring lower inductance values at high currents, such as low voltage, DC supplies or SCR filters.

Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

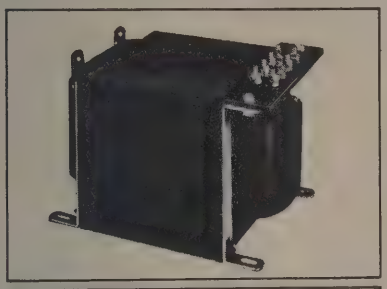
**signal** TRANSFORMER

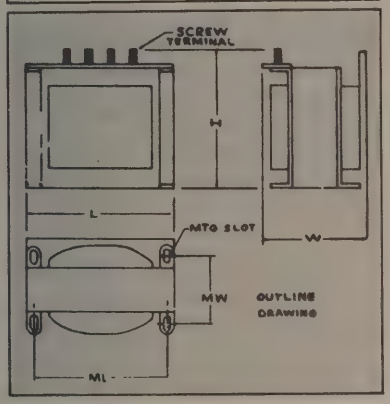
Dept. EM, 500 Bayview Ave., Inwood, N.Y. 11696
Telephone: (516) 239-7200

"See page 4403 for prices"

# very high current transformers/chokes

## 6 TO 24 VOLTS
## 250 TO 1400 AMPERES






TRANSFORMERS

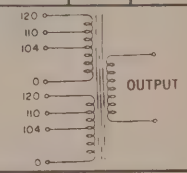
| Part No. | Secondary Volts | Secondary Amps. Nominal (45°C rise) | Secondary Amps. Max. (100°C rise) | Dimensions L | W | H | ML | MW | Mtg. Screw | Approx. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|
| 6-250 | 6 | 250 | 350 | 7½ | 5 | 7¼ | 6¾ | 3⅜ | ¼ | 32 |
| 9-250 | 9 | 250 | 350 | 7½ | 5¾ | 7¼ | 6¾ | 4⅝ | ¼ | 40 |
| 12-250 | 12 | 250 | 350 | 7½ | 6¼ | 7¼ | 6¾ | 4 13/16 | ¼ | 48 |
| 24-250 | 24 | 250 | 350 | 7½ | 9 | 7¼ | 6¾ | 7⅜ | ¼ | 80 |
| 6-500 | 6 | 500 | 700 | 7½ | 6 | 7¼ | 6¾ | 4⅜ | ¼ | 40 |
| 9-500 | 9 | 500 | 700 | 7½ | 8½ | 7¼ | 6¾ | 6⅛ | ¼ | 60 |
| 12-500 | 12 | 500 | 700 | 7½ | 9 | 7¼ | 6¾ | 7⅜ | ¼ | 80 |
| 24-500 | 24 | 500 | 700 | 9 | 13 | 8 | 7½ | 8½ | ¼ | 140 |
| 3-1000 | 3 | 1000 | 1400 | 7½ | 6 | 7¼ | 6¾ | 4⅜ | ¼ | 40 |
| 6-1000 | 6 | 1000 | 1400 | 7½ | 9 | 7¼ | 6¾ | 7⅜ | ¼ | 80 |
| 12-1000 | 12 | 1000 | 1400 | 9 | 13 | 8 | 7½ | 8½ | ¼ | 140 |

CHOKES

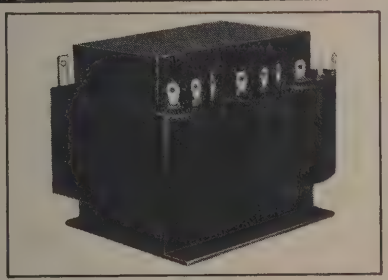
| Part No. | Induc-tance (Milli-hy) | Current (Am-peres) | Resis. (Ohms) | Dimensions L | W | H | ML | MW | Mtg. Screw | Approx. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|
| CH-250 | .3 | 250 | .00115 | 7½ | 8 | 6¼ | 6¾ | 5⅛ | ¼ | 56 |
| CH-500 | .055 | 500 | .00027 | 7½ | 6½ | 6¼ | 6¾ | 4⅛ | ¼ | 50 |
| CH-1000 | .015 | 1000 | .000065 | 7½ | 7½ | 6¼ | 6¾ | 5⅛ | ¼ | 70 |

As shown on the schematic diagram dual primaries are provided. This permits parallel connection for 104, 110, or 120 volts or series connection for 208, 214, 220, 230, and 240 volts. Frequency range is 50 to 500 cps.

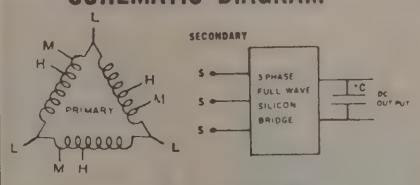
It is important to note that primary taps may be used to adjust the secondary voltages. Line voltages up to 125V (parallel) or 250V (series) may be used on the lowest primary tap. Nickel plated screw terminals are provided on a heavy phenolic board for easy primary connections.




# 3 phase high current rectifier transformers

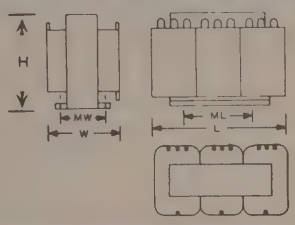


## SCHEMATIC DIAGRAM




*C — Optional, no capacitor will give DC output shown at approx. 5% ripple.

## MECHANICAL DIMENSIONS




DC OUTPUT VOLTAGE

| Part No. | Pri Tap "L" Supply Voltage 208 | Pri Tap "L" Supply Voltage 220 | Pri Tap "M" Supply Voltage 208 | Pri Tap "M" Supply Voltage 220 | Pri. Tap "H" Supply Voltage 208 | Pri. Tap "H" Supply Voltage 220 | DC Rated Amps | Approximate Dimensions L | W | H | ML | MW | Approx. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3PH 24-50 | 24 | 25 | 26 | 27.5 | 28 | 30 | 50 | 7¾ | 6 | 5½ | 4.8 | 4⅞ | 35 |
| 3PH 24-100 | 24 | 25 | 26 | 27.5 | 28 | 30 | 100 | 11½ | 5 | 8¼ | 7.2 | 4 | 62 |
| 3PH 24-200 | 24 | 25 | 26 | 27.5 | 28 | 30 | 200 | 11½ | 8⅝ | 8¼ | 7.2 | 6¼ | 90 |
| 3PH 48-30 | 42 | 44 | 47 | 50 | 52 | 55 | 30 | 7¾ | 6 | 5½ | 4.8 | 4⅞ | 35 |
| 3PH 48-60 | 42 | 44 | 47 | 50 | 52 | 55 | 60 | 11½ | 5 | 8¼ | 7.2 | 4 | 62 |
| 3PH 48-120 | 42 | 44 | 47 | 50 | 52 | 55 | 120 | 11½ | 8⅝ | 8¼ | 7.2 | 6¼ | 90 |

At higher power loads (above 2-3 KVA) it becomes inefficient to use single phase 115 or 230 volt standard lines. With this in mind, our engineering staff has developed a line of 3 phase transformers for use off 208 or 220V 3 phase power lines. These offer the significantly higher conversion efficiency and lighter power line drain of 3 phase systems. Since the principal applicaiton of these items is in high power dc power supplies, output ratings are given in dc voltage and current assuming the use of a 3 phase full wave rectifier.

Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

signal TRANSFORMER
Dept. EM, 500 Bayview Ave., Inwood, N.Y. 11696
Telephone: (516) 239-7200

"See page 4403 for prices"

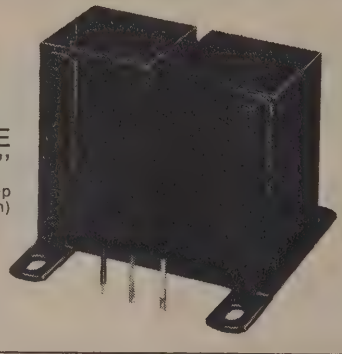
# step down auto transformers

## 50/60 Hz · 100-2000 VA — 230/115V

ENCLOSED
STYLE "EB"

UL APPROVED 2 PRONG LINE CORD
RECEPTACLE — LOW REGULATION
BLACK ENAMEL FINISH

| VA | Cat. No. | Width | Depth | Height | Mtg. Centers | Lbs. |
|---|---|---|---|---|---|---|
| 100 | 110 | 1⅞ | 2⅜ | 2½ | 1½ x 1 11/16 | 1.5 |
| 120 | 112 | 2⅞ | 2⅛ | 3½ | 2¼ x 1¾ | 3.0 |
| 150 | 115 | 2⅞ | 3⅜ | 3½ | 2¼ x 2 | 3.5 |
| 200 | 120 | 2⅞ | 3½ | 3½ | 2¼ x 2⅛ | 4.0 |
| 250 | 125 | 2⅞ | 3⅞ | 3½ | 2¼ x 2½ | 4.8 |
| 300 | 130 | 3¼ | 3⅞ | 3⅞ | 2½ x 2 7/16 | 5.5 |
| 500 | 150 | 3¼ | 4⅞ | 3⅞ | 2½ x 3 7/16 | 8 |
| 750 | 175 | 3¼ | 5⅞ | 3⅞ | 2½ x 4 7/16 | 11 |
| 1000 | 1100 | 4½ | 5⅛ | 5½ | 3½ x 3½ | 14 |
| 1500 | 1150 | 4½ | 6⅛ | 5½ | 3½ x 4½ | 20 |
| 2000 | 1200 | 4½ | 7⅛ | 5½ | 3½ x 5½ | 26 |

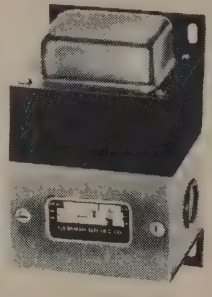


OPEN FRAME
STYLE "OF"
(May be used step-up or step-down)

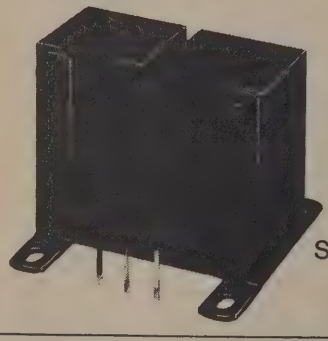
BLACK ENAMEL FINISH. 8" LEADS
INEXPENSIVE VERSION FOR USE IN EQUIPMENT

| VA | Cat. No. | Width | Depth | Height | Mtg. Centers | Lbs. |
|---|---|---|---|---|---|---|
| 100 | 110-OF | 2¼ | 2 | 1 15/16 | 2 13/16 | 1.3 |
| 120 | 112-OF | 3⅜ | 2½ | 2⅞ | 2 13/16 x 1⅞ | 2.5 |
| 150 | 115-OF | 3⅜ | 2¾ | 2⅞ | 2 13/16 x 2⅛ | 3.0 |
| 200 | 120-OF | 3⅜ | 2⅞ | 2⅞ | 2 13/16 x 2¼ | 3.5 |
| 250 | 125-OF | 3⅜ | 3¼ | 2⅞ | 2 13/16 x 2⅝ | 4.2 |
| 300 | 130-OF | 3¾ | 3¼ | 3⅛ | 3⅛ x 2½ | 5.0 |
| 500 | 150-OF | 3¾ | 4¼ | 3⅛ | 3⅛ x 3½ | 8.0 |
| 750 | 175-OF | 3¾ | 5¼ | 3⅛ | 3⅛ x 4½ | 11 |
| 1000 | 1100-OF | 5¼ | 4½ | 4⅜ | 4⅜ x 3⅛ | 14 |
| 1500 | 1150-OF | 5¼ | 5½ | 4⅜ | 4⅜ x 4⅛ | 19 |
| 2000 | 1200-OF | 5¼ | 6½ | 4⅜ | 4⅜ x 5⅛ | 25 |

## HEAVY DUTY — 3 TO 6 KVA
230/115V OR 115/230V.
MAY BE USED STEP-UP OR
STEP-DOWN



STYLE "JB"



STYLE "OF"

"JB." VERY LOW REGULATION. BLACK ENAMEL
ENCLOSURES — PANEL MOUNTED
KNOCKOUTS ON ALL SIDES OF JUNCTION BOX.

| KVA | Cat. No. | Width | Depth | Height | Mtg. Centers | Lbs. |
|---|---|---|---|---|---|---|
| 3 | 1300 | 9⅛ | 9 | 6⅝ | 8⅛ x 4¼ | 34 |
| 4 | 1400 | 9⅛ | 9½ | 6⅝ | 8⅛ x 4¾ | 41 |
| 5 | 1500 | 9⅛ | 10⅝ | 6⅝ | 8⅛ x 6 | 55 |
| 6 | 1600 | 9⅛ | 11¼ | 6⅝ | 8⅛ x 6½ | 60 |

"OF." BLACK ENAMEL FINISH. OPEN FRAME.
8" LEADS. INEXPENSIVE VERSION FOR
USE IN EQUIPMENT.

| KVA | Cat. No. | Width | Depth | Height | Mtg. Centers | Lbs. |
|---|---|---|---|---|---|---|
| 3 | 1300-OF | 7⅛ | 5½ | 6⅛ | 5 13/16 x 3¾ | 30 |
| 4 | 1400-OF | 7⅛ | 6 | 6⅛ | 5 13/16 x 4¼ | 36 |
| 5 | 1500-OF | 7⅛ | 7 | 6⅛ | 5 13/16 x 5½ | 51 |
| 6 | 1600-OF | 7⅛ | 8½ | 6⅛ | 5 13/16 x 6 | 54 |

Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

**signal** TRANSFORMER
Dept. EM, 500 Bayview Ave., Inwood, N.Y. 11696
Telephone: (516) 239-7200

"See page 4403 for prices"

# voltage regulators

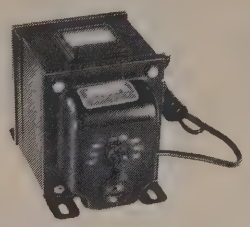
## MANUALLY CONTROLLED LINE VOLTAGE ADJUSTMENT 65 TO 145V OR 145 TO 245V. OUTPUTS 115V OR 230V.

Easy Line Voltage Adjustment: Switch provided for 65 to 145V or 145 to 245V inputs, 50/60 cycle.

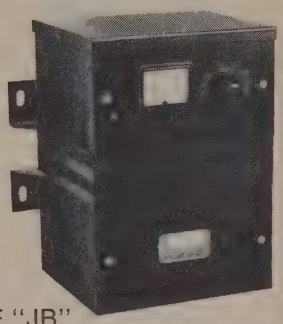
Built-in Meter: Output continuously monitored with Red Line at 115V or 230V output, as required.

Simple Installation: Up to 2KVA (Style EB): Receptacle and Line Cord with Plug.

Over 2KVA (Style JB): Enclosed Junction Box, Panel Mounted with Leads. Knockouts provided on all sides.



STYPE "EB"



STYLE "JB"

| | VA | Cat. No. | Style | Width | Depth | Height | Mtg. Centers | Lbs. |
|---|---|---|---|---|---|---|---|---|
| | 150 | 315 | EB | 3⅞ | 7 | 4⅞ | 3 x 5 | 5.5 |
| | 350 | 335 | EB | 3⅞ | 7⅝ | 4⅞ | 3½ x 5⅝ | 8 |
| "300" SERIES | 500 | 350 | EB | 3⅞ | 7⅝ | 4⅞ | 3½ x 5⅞ | 9 |
| INPUT RANGE: | 750 | 375 | EB | 3⅞ | 9⅛ | 4⅞ | 3½ x 7⅛ | 14.2 |
| 65-75-90-100-115-130-145V. | 1000 | 3100 | EB | 4½ | 9 | 5⅝ | 3½ x 7⁹⁄₁₆ | 15.5 |
| OUTPUT: | 1500 | 3150 | EB | 4½ | 10½ | 5⅝ | 3½ x 8 | 23.5 |
| 115V. — 50/60 CYCLE | 2000 | 3200 | JB | 9⅛ | 10⅛ | 7½ | 8⅛ x 4 | 32 |
| | 3000 | 3300 | JB | 9⅛ | 10⅝ | 7½ | 8⅛ x 4½ | 37 |
| | 5000 | 3500 | JB | 9⅛ | 12½ | 7½ | 8⅛ x 6½ | 60 |
| "400" SERIES | 150 | 415 | EB | 3⅞ | 7¼ | 4⅞ | 3 x 5¼ | 5 |
| INPUT RANGE: | 350 | 435 | EB | 3⅞ | 8¼ | 4⅞ | 3½ x 6¼ | 10 |
| 65-75-90-100-115-130-145V. | 500 | 450 | EB | 3⅞ | 8⅞ | 4⅞ | 3½ x 6⅞ | 13 |
| OUTPUT: | 750 | 475 | EB | 3⅞ | 9⅝ | 4⅞ | 3½ x 7⁹⁄₁₆ | 17 |
| 230V. — 50/60 CYCLE | 1000 | 4100 | EB | 4½ | 10 | 5 | 3½ x 7½ | 22 |
| | 150 | 515 | EB | 3⅞ | 7 | 4⅞ | 3 x 5 | 5.5 |
| | 350 | 535 | EB | 3⅞ | 7⅝ | 4⅞ | 3½ x 5⅝ | 8 |
| "500" SERIES | 500 | 550 | EB | 3⅞ | 7⅞ | 4⅞ | 3½ x 5⅞ | 9 |
| INPUT RANGE: | 750 | 575 | EB | 3⅞ | 9⅛ | 4⅞ | 3½ x 7⅛ | 14.2 |
| 145-160-175-190-210-225-245V. | 1000 | 5100 | EB | 4½ | 9 | 5⅝ | 3½ x 7⁹⁄₁₆ | 15.5 |
| OUTPUT: | 1500 | 5150 | EB | 4½ | 10½ | 5⅝ | 3½ x 8 | 23.5 |
| 115V. — 50/60 CYCLE | 2000 | 5200 | JB | 9⅛ | 10⅛ | 7½ | 8⅛ x 4 | 32 |
| | 3000 | 5300 | JB | 9⅛ | 10⅝ | 7½ | 8⅛ x 4½ | 37 |
| | 5000 | 5500 | JB | 9⅛ | 12½ | 7½ | 8⅛ x 6½ | 60 |
| "600" SERIES | 150 | 615 | EB | 3⅞ | 7 | 4⅞ | 3 x 4¹⁵⁄₁₆ | 5 |
| INPUT RANGE: | 350 | 635 | EB | 3⅞ | 7⅜ | 4⅞ | 3 x 5⁵⁄₁₆ | 6.5 |
| 145-160-175-190-210-225-245V. | 500 | 650 | EB | 3⅞ | 7⅝ | 4⅞ | 3 x 5⁹⁄₁₆ | 8 |
| OUTPUT: | 750 | 675 | EB | 3⅞ | 8⅜ | 4⅞ | 3 x 6⁵⁄₁₆ | 13 |
| 230V. — 50/60 CYCLE | 1000 | 6100 | EB | 3⅞ | 9⅛ | 4⅞ | 3 x 7⅛ | 14.5 |

Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

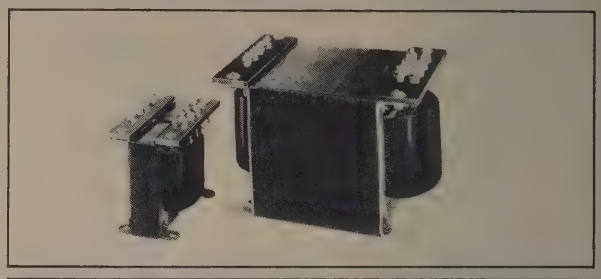
**signal** TRANSFORMER

Dept. EM, 500 Bayview Ave., Inwood, N.Y. 11696
Telephone: (516) 239-7200

"See page 4403 for prices"

# power isolation transformers

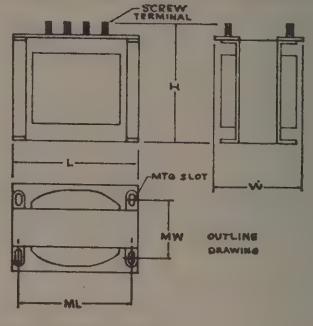
## INDUSTRIAL GRADE/STEP-UP OR STEP-DOWN. MANY POSSIBLE VOLTAGE RATINGS.



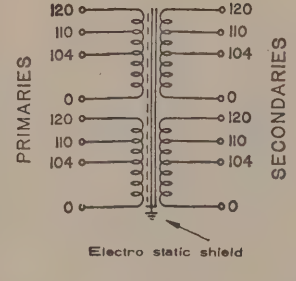
AVAILABLE FROM STOCK FOR IMMEDIATE SHIPMENT

The "DU" and "SU" lines are designed for a maximum of 55°C rise above ambient for use on standard power lines from 50 to 500 Cps. Only prime raw materials are used. Units are thoroughly impregnated and baked with Signal's own high gloss black baking varnish. The transformers are rugged in construction, well-insulated and have a consistently uniform appearance. All ratings are at full load current, continuous operation. 2500V. RMS Hipot is standard.

Heavy ¼ inch phenolic terminal boards are provided with plated brass screws and flat washers (10-32 on ¼ and ½ KVA, ¼-20 on larger sizes). Connections can be easily made with a nut driver. It is also simple to alter the interconnections to change transformer ratings. **Electro static shields are provided grounded to the core.** The connection is made with a lug to ground and may be opened if an ungrounded shield is desired.




## DU SERIES 110/220 Dual Primary to 110/220V. Dual Sec. (Primary & Secondary may be reversed)

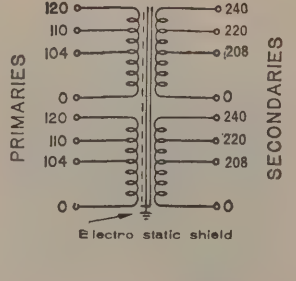



As shown on the schematic diagram the "DU" line is designed with dual primaries and secondaries. All four windings are identically rated at 0/104/110/120 volts. This permits series or parallel connections on either primary or secondary. Therefore, a nominal 110 to 110 volt, 220 to 220 volt, 110 to 220 volt, or 220 to 110 volt transformer can be set up. The winding taps permit intermediate series ratings such as 208, 214, or 230 volts. It is also possible to make auto-transformer connections by connecting a primary group in series with a secondary group. Such nominal ratings as 440 to 220 volts or 220 to 440 volts can be set-up, in addition to the standard ratings described above. A further advantage to auto-transformer connection is the fact that the KVA rating of a particular type is doubled.

| Part No. | KVA | Series Secondaries Volts | Series Secondaries Max. Amps | Parallel Secondaries Volts | Parallel Secondaries Max. Amps | Mechanical Dimensions L * | W * | H * | ML † | MW ‡ | Mtg. & Term. Screw | Appr. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DU-¼ | ¼ | 0/208/220/240 | 1.1 | 0/104/110/120 | 2.2 | 5 5/16 | 4¼ | 5¼ | 4⅜ | 2½ | #10 | 12 |
| DU-½ | ½ | 0/208/220/240 | 2.3 | 0/104/110/120 | 4.6 | 5 5/16 | 5 5/16 | 5¼ | 4⅜ | 3⅝ | #10 | 18 |
| DU-1 | 1 | 0/208/220/240 | 4.5 | 0/104/110/120 | 9 | 7 3/16 | 6¼ | 7¼ | 6¾ | 4⅛ | ¼ | 33 |
| DU-2 | 2 | 0/208/220/240 | 9 | 0/104/110/120 | 18 | 7 3/16 | 8¼ | 7¼ | 6¾ | 6 | ¼ | 56 |
| DU-3 | 3 | 0/208/220/240 | 14 | 0/104/110/120 | 28 | 7 3/16 | 9¼ | 7¼ | 6¾ | 7 | ¼ | 70 |
| DU-5 | 5 | 0/208/220/240 | 23 | 0/104/110/120 | 46 | 7 3/16 | 10¾ | 7¼ | 6¾ | 8½ | ¼ | 89 |
| DU-7.5 | 7.5 | 0/208/220/240 | 31 | 0/104/110/120 | 62 | 9 | 9 | 8 | 7½ | 6½ | ¼ | 105 |
| DU-10 | 10 | 0/208/220/240 | 41 | 0/104/110/120 | 83 | 9 | 13 | 8 | 7½ | 9 | ¼ | 150 |

* Maximum. † ±1/32. ‡ ±1/16.

## SU SERIES 110/220 Dual Primary to 220/440V. Dual Sec. (Primary & Secondary may be reversed)




"SU" transformers are similar to "DU" types except that a 220/240V secondary is provided.

| Part No. | KVA | Series Secondaries Volts | Series Secondaries Max. Amps | Parallel Secondaries Volts | Parallel Secondaries Max. Amps | Mechanical Dimensions L * | W * | H * | ML † | MW ‡ | Mtg. & Term. Screw | Appr. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SU-¼ | ¼ | 0/416/440/480 | 0.55 | 0/208/220/240 | 1.1 | 5 5/16 | 4¼ | 5¼ | 4⅜ | 2½ | #10 | 12 |
| SU-½ | ½ | 0/416/440/480 | 1.15 | 0/208/220/240 | 2.3 | 5 5/16 | 5 5/16 | 5¼ | 4⅜ | 3⅝ | #10 | 18 |
| SU-1 | 1 | 0/416/440/480 | 2.25 | 0/208/220/240 | 4.5 | 7 3/16 | 6¼ | 7¼ | 6¾ | 4⅛ | ¼ | 33 |
| SU-2 | 2 | 0/416/440/480 | 4.5 | 0/208/220/240 | 9 | 7 3/16 | 8¼ | 7¼ | 6¾ | 6 | ¼ | 56 |
| SU-3 | 3 | 0/416/440/480 | 7 | 0/208/220/240 | 14 | 7 3/16 | 9¼ | 7¼ | 6¾ | 7 | ¼ | 70 |
| SU-5 | 5 | 0/416/440/480 | 11.5 | 0/208/220/240 | 23 | 7 3/16 | 10¾ | 7¼ | 6¾ | 8½ | ¼ | 89 |
| SU-7.5 | 7.5 | 0/416/440/480 | 15.5 | 0/208/220/240 | 31 | 9 | 9 | 8 | 7½ | 6½ | ¼ | 105 |
| SU-10 | 10 | 0/416/440/480 | 20.5 | 0/208/220/240 | 41 | 9 | 13 | 8 | 7½ | 9 | ¼ | 150 |

* Maximum. † ±1/32. ‡ ±1/16.

Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

**signal** TRANSFORMER

Dept. EM, 500 Bayview Ave., Inwood, N.Y. 11696
Telephone: (516) 239-7200

"See page 4403 for prices"

# price list

JANUARY 1, 1978

| Part No. | Net |
|---|---|
| 10-0.1 | $7.34 |
| 10-0.25 | 7.68 |
| 10-0.5 | 7.90 |
| 10-1 | 8.56 |
| 10-2 | 10.45 |
| 10-4 | 13.28 |
| 10-6 | 17.38 |
| 10-8 | 17.98 |
| 10-12 | 20.16 |
| 10-25 | 30.63 |
| 10-50 | 48.47 |
| 10-100 | 82.00 |
| 12.8-0.1 | 7.42 |
| 12.8-0.25 | 7.86 |
| 12.8-0.5 | 8.46 |
| 12.8-1 | 9.15 |
| 12.8-2A | 10.35 |
| 12.8-2 | 12.46 |
| 12.8-4 | 14.61 |
| 12.8-6 | 16.80 |
| 12.8-8 | 17.07 |
| 12.8-12 | 22.92 |
| 12.8-25 | 34.37 |
| 12.8-50 | 50.67 |
| 12.8-100 | 83.15 |
| 16-0.1 | 7.68 |
| 16-0.25 | 8.00 |
| 16-0.5 | 8.32 |
| 16-1 | 9.27 |
| 16-2 | 10.74 |
| 16-4 | 15.90 |
| 16-6 | 18.82 |
| 16-8 | 20.03 |
| 16-12 | 24.02 |
| 16-25 | 43.30 |
| 16-50 | 75.12 |
| 16-100 | 98.04 |
| 24-0.1 | 7.73 |
| 24-0.25 | 8.35 |
| 24-0.5 | 8.95 |
| 24-0.1A | 10.00 |
| 24-1 | 12.24 |
| 24-2 | 13.84 |
| 24-4 | 16.94 |
| 24-6 | 22.53 |
| 24-8 | 27.23 |
| 24-12 | 34.26 |
| 24-20 | 45.16 |
| 24-25 | 51.44 |
| 24-50 | 80.95 |
| 24-100 | 117.80 |
| 36-0.1 | 7.80 |
| 36-0.25 | 8.62 |
| 36-0.5 | 9.66 |
| 36-1A | 11.18 |
| 36-1 | 12.42 |
| 36-2 | 15.83 |
| 36-4 | 22.81 |
| 36-6 | 28.89 |
| 36-8 | 32.55 |
| 36-12 | 41.18 |
| 36-20 | 71.39 |
| 36-25 | 80.97 |
| 36-30 | 84.38 |
| 36-50 | 92.53 |
| 36-100 | 179.50 |
| 56-0.1 | 8.12 |
| 56-0.25 | 9.57 |
| 56-0.5 | 10.17 |
| 56-1 | 14.84 |
| 56-2 | 18.54 |
| 56-4 | 29.22 |
| 56-6 | 37.75 |
| 56-8 | 42.74 |
| 56-12 | 68.96 |
| 56-25 | 89.78 |
| 56-50 | 165.24 |
| 56-100 | 247.80 |
| 68-0.1 | 8.40 |
| 68-0.25 | 9.85 |
| 68-0.5A | 10.40 |
| 68-0.5 | 13.35 |
| 68-1 | 14.95 |
| 68-2 | 20.81 |
| 68-4 | 35.87 |
| 68-6 | 38.97 |
| 68-8 | 43.62 |
| 68-12 | 74.91 |
| 68-25 | 92.53 |
| 68-50 | 169.65 |
| 80-0.1 | 8.51 |
| 80-0.25 | 10.74 |
| 80-0.5A | 11.23 |
| 80-0.5 | 13.62 |
| 80-1 | 16.00 |
| 80-2 | 23.36 |
| 80-4 | 39.85 |
| 80-6 | 45.17 |
| 80-8 | $54.64 |
| 80-12 | 84.27 |
| 80-25 | 109.06 |
| 80-50 | 198.29 |
| 88-0.1 | 8.74 |
| 88-0.25 | 11.12 |
| 88-0.5 | 11.57 |
| 88-1 | 16.49 |
| 88-2 | 23.75 |
| 88-4 | 41.41 |
| 88-6 | 46.05 |
| 88-8 | 56.18 |
| 88-12 | 84.56 |
| 88-25 | 112.36 |
| 88-50 | 202.67 |
| 120-0.5 | 15.57 |
| 120-1 | 22.02 |
| 120-2 | 29.22 |
| 120-4 | 45.39 |
| 120-6 | 68.63 |
| 120-8 | 81.52 |
| 120-12 | 90.88 |
| 120-20 | 126.68 |
| 160-0.5 | 16.46 |
| 160-1 | 23.70 |
| 160-2 | 34.98 |
| 160-4 | 52.59 |
| 160-8 | 80.42 |
| 160-12 | 102.45 |
| 180-0.5 | 16.92 |
| 180-1 | 26.25 |
| 180-2 | 37.86 |
| 180-4 | 59.78 |
| 180-6 | 81.52 |
| 180-8 | 86.37 |
| 180-12 | 121.18 |
| 230-0.5 | 22.25 |
| 230-1 | 29.56 |
| 230-2 | 46.27 |
| 230-4 | 80.42 |
| 230-6 | 87.03 |
| 300-0.5 | 22.47 |
| 300-1 | 37.24 |
| 300-2 | 51.56 |
| 300-4 | 84.82 |
| DL-10-0.1 | 8.25 |
| DL-10-0.25 | 9.24 |
| DL-10-0.5 | 9.46 |
| DL-10-1 | 10.13 |
| DL-10-2 | 12.02 |
| DL-10-4 | 14.85 |
| DL-10-6 | 18.93 |
| DL-10-8 | 19.55 |
| DL-10-12 | 21.73 |
| DL-10-25 | 32.19 |
| DL-10-50 | 50.00 |
| DL-10-100 | 83.65 |
| DL-12.8-0.1 | 9.00 |
| DL-12.8-0.25 | 9.43 |
| DL-12.8-0.5 | 10.02 |
| DL-12.8-1 | 10.71 |
| DL-12.8-2A | 11.91 |
| DL-12.8-2 | 14.04 |
| DL-12.8-4 | 16.18 |
| DL-12.8-6 | 18.37 |
| DL-12.8-8 | 18.64 |
| DL-12.8-12 | 24.48 |
| DL-12.8-25 | 35.93 |
| DL-12.8-50 | 52.24 |
| DL-12.8-100 | 84.78 |
| DL-16-0.1 | 9.24 |
| DL-16-0.25 | 9.56 |
| DL-16-0.5 | 9.88 |
| DL-16-1 | 10.83 |
| DL-16-2 | 12.30 |
| DL-16-4 | 17.47 |
| DL-16-6 | 20.39 |
| DL-16-8 | 21.60 |
| DL-16-12 | 25.59 |
| DL-16-25 | 44.86 |
| DL-16-50 | 76.69 |
| DL-16-100 | 99.61 |
| DL-24-0.1 | 9.30 |
| DL-24-0.25 | 9.92 |
| DL-24-0.5 | 10.52 |
| DL-24-1A | 11.58 |
| DL-24-1 | 13.80 |
| DL-24-2 | 15.40 |
| DL-24-4 | 18.50 |
| DL-24-6 | 24.09 |
| DL-24-8 | 28.79 |
| DL-24-12 | 35.82 |
| DL-24-20 | 46.73 |
| DL-24-25 | 53.00 |
| DL-24-50 | 82.53 |
| DL-36-0.1 | 9.35 |
| DL-36-0.25 | 10.18 |
| DL-36-0.5 | $11.22 |
| DL-36-1A | 12.74 |
| DL-36-1 | 13.99 |
| DL-36-2 | 17.40 |
| DL-36-4 | 24.38 |
| DL-36-6 | 30.46 |
| DL-36-8 | 34.12 |
| DL-36-12 | 42.75 |
| DL-36-20 | 72.95 |
| DL-36-25 | 82.53 |
| DL-36-30 | 85.95 |
| DL-56-0.1 | 9.69 |
| DL-56-0.25 | 11.13 |
| DL-56-0.5 | 11.74 |
| DL-56-1 | 16.41 |
| DL-56-2 | 20.11 |
| DL-56-4 | 30.79 |
| DL-56-6 | 39.31 |
| DL-56-8 | 44.30 |
| DL-56-12 | 70.52 |
| DL-56-25 | 91.35 |
| DL-68-0.1 | 9.97 |
| DL-68-0.25 | 11.42 |
| DL-68-0.5A | 11.97 |
| DL-68-0.5 | 14.91 |
| DL-68-1 | 16.51 |
| DL-68-2 | 22.38 |
| DL-68-4 | 37.43 |
| DL-68-6 | 40.53 |
| DL-68-8 | 45.19 |
| DL-68-12 | 76.47 |
| DL-80-0.1 | 10.08 |
| DL-80-0.25 | 12.30 |
| DL-80-0.5A | 12.80 |
| DL-80-0.5 | 15.18 |
| DL-80-1 | 17.56 |
| DL-80-2 | 24.93 |
| DL-80-4 | 41.42 |
| DL-80-6 | 46.73 |
| DL-80-8 | 56.20 |
| DL-80-12 | 85.84 |
| DL-88-0.1 | 10.30 |
| DL-88-0.25 | 12.69 |
| DL-88-0.5 | 13.13 |
| DL-88-1 | 18.06 |
| DL-88-2 | 25.32 |
| DL-88-4 | 42.97 |
| DL-88-6 | 47.62 |
| DL-88-8 | 57.75 |
| DL-88-12 | 86.13 |
| DL-120-0.5 | 17.14 |
| DL-120-1 | 23.59 |
| DL-120-2 | 30.79 |
| DL-120-4 | 46.96 |
| DL-120-6 | 70.20 |
| DL-120-8 | 83.08 |
| DL-120-12 | 92.45 |
| DL-120-20 | 128.25 |
| DL-160-0.5 | 18.03 |
| DL-160-1 | 25.26 |
| DL-160-2 | 36.55 |
| DL-160-4 | 54.15 |
| DL-160-8 | 81.98 |
| DL-180-0.5 | 18.48 |
| DL-180-1 | 27.82 |
| DL-180-2 | 39.43 |
| DL-180-4 | 61.34 |
| DL-180-6 | 83.08 |
| DL-180-8 | 87.93 |
| DL-180-12 | 122.80 |
| DL-230-0.5 | 23.81 |
| DL-230-1 | 31.13 |
| DL-230-2 | 47.83 |
| DL-230-4 | 81.98 |
| DL-230-6 | 88.59 |
| DL-300-0.5 | 24.04 |
| DL-300-1 | 38.80 |
| DL-300-2 | 53.13 |
| DL-300-4 | 86.40 |
| CH-0.5 | 7.02 |
| CH-1 | 9.78 |
| CH-2 | 11.12 |
| CH-4 | 16.63 |
| CH-6 | 20.27 |
| CH-8 | 25.67 |
| CH-12 | 33.49 |
| CH-16 | 37.79 |
| CH-20 | 34.81 |
| CH-25 | 48.47 |
| CH-30 | 58.38 |
| CH-50 | 67.20 |
| CH-100 | 76.01 |
| CH-200 | 121.18 |
| CH-250 | 131.08 |
| CH-500 | 141.00 |
| CH-1000 | 157.53 |
| CL-1-2 | 6.70 |
| CL-2-4 | $8.12 |
| CL-4-8 | 13.39 |
| CL-6-12 | 15.39 |
| CL-12-24 | 22.68 |
| CL-25-50 | 23.90 |
| CL-50-100 | 29.47 |
| 6-250 | 115.00 |
| 9-250 | 148.70 |
| 12-250 | 159.80 |
| 24-250 | 283.00 |
| 6-500 | 157.50 |
| 9-500 | 206.00 |
| 12-500 | 280.00 |
| 24-500 | 459.00 |
| 3-1000 | 168.00 |
| 6-1000 | 272.00 |
| 12-1000 | 454.00 |
| 3PH-24-50 | 160.00 |
| 3PH-24-100 | 229.00 |
| 3PH-24-200 | 365.00 |
| 3PH-48-30 | 160.00 |
| 3PH-48-60 | 229.00 |
| 3PH-48-120 | 365.00 |
| DU-¼ | 47.63 |
| DU-½ | 60.59 |
| DU-1 | 101.90 |
| DU-2 | 146.50 |
| DU-3 | 207.00 |
| DU-5 | 273.10 |
| DU-7.5 | 351.00 |
| DU-10 | 428.00 |
| SU-¼ | 48.92 |
| SU-½ | 62.48 |
| SU-1 | 103.90 |
| SU-2 | 148.70 |
| SU-3 | 210.40 |
| SU-5 | 275.40 |
| SU-7.5 | 354.00 |
| SU-10 | 432.00 |
| 110 | 12.68 |
| 112 | 15.24 |
| 115 | 16.35 |
| 120 | 17.36 |
| 125 | 18.80 |
| 130 | 21.58 |
| 150 | 26.70 |
| 175 | 34.93 |
| 1100 | 45.84 |
| 1150 | 56.73 |
| 1200 | 69.97 |
| 1300 | 111.20 |
| 1400 | 133.50 |
| 1500 | 144.60 |
| 1600 | 161.30 |
| 110-OF | 9.58 |
| 112-OF | 11.57 |
| 115-OF | 12.33 |
| 120-OF | 13.33 |
| 125-OF | 14.98 |
| 130-OF | 17.18 |
| 150-OF | 22.47 |
| 175-OF | 29.08 |
| 1100-OF | 38.77 |
| 1150-OF | 52.11 |
| 1200-OF | 63.01 |
| 1300-OF | 89.64 |
| 1400-OF | 109.10 |
| 1500-OF | 123.40 |
| 1600-OF | 137.70 |
| 315 | 40.00 |
| 335 | 45.30 |
| 350 | 53.50 |
| 375 | 63.00 |
| 3100 | 69.30 |
| 3150 | 83.60 |
| 3200 | 123.40 |
| 3300 | 142.00 |
| 3500 | 192.20 |
| 415 | 40.80 |
| 435 | 46.20 |
| 450 | 54.00 |
| 475 | 63.70 |
| 4100 | 70.20 |
| 515 | 40.00 |
| 535 | 45.30 |
| 550 | 53.50 |
| 575 | 63.00 |
| 5100 | 69.30 |
| 5150 | 83.60 |
| 5200 | 123.40 |
| 5300 | 142.00 |
| 5500 | 192.20 |
| 615 | 40.80 |
| 635 | 46.20 |
| 650 | 54.00 |
| 675 | 63.70 |
| 6100 | 70.20 |
| PC-10-90 | 5.65 |
| PC-10-120 | 5.45 |
| PC-10-440 | 5.76 |
| PC-10-1000 | $6.10 |
| PC-10-2400 | 8.04 |
| PC-12-70 | 5.65 |
| PC-12-100 | 5.45 |
| PC-12-350 | 5.76 |
| PC-12-800 | 6.10 |
| PC-12-2000 | 8.04 |
| PC-16-55 | 5.65 |
| PC-16-75 | 5.45 |
| PC-16-260 | 5.76 |
| PC-16-640 | 6.10 |
| PC-16-1500 | 8.04 |
| PC-20-45 | 5.65 |
| PC-20-60 | 5.45 |
| PC-20-220 | 5.76 |
| PC-20-500 | 6.10 |
| PC-20-1200 | 8.04 |
| PC-24-35 | 5.65 |
| PC-24-50 | 5.45 |
| PC-24-180 | 5.76 |
| PC-24-450 | 6.10 |
| PC-24-1000 | 8.04 |
| PC-28-30 | 5.65 |
| PC-28-40 | 5.45 |
| PC-28-160 | 5.76 |
| PC-28-360 | 6.10 |
| PC-28-800 | 8.04 |
| PC-34-25 | 5.65 |
| PC-34-35 | 5.45 |
| PC-34-125 | 5.76 |
| PC-34-300 | 6.10 |
| PC-34-700 | 8.04 |
| PC-40-20 | 5.65 |
| PC-40-30 | 5.45 |
| PC-40-110 | 5.76 |
| PC-40-250 | 6.10 |
| PC-40-600 | 8.04 |
| PC-56-15 | 5.65 |
| PC-56-20 | 5.45 |
| PC-56-80 | 5.76 |
| PC-56-180 | 6.10 |
| PC-56-420 | 8.04 |
| PC-88-10 | 5.65 |
| PC-88-15 | 5.45 |
| PC-88-50 | 5.76 |
| PC-88-120 | 6.10 |
| PC-88-270 | 8.04 |
| PC-120-8 | 5.65 |
| PC-120-10 | 5.45 |
| PC-120-35 | 5.76 |
| PC-120-85 | 6.10 |
| PC-120-200 | 8.04 |
| PC-180-6 | 6.25 |
| PC-180-24 | 6.40 |
| PC-180-55 | 6.60 |
| PC-180-130 | 8.90 |
| PC-230-5 | 6.60 |
| PC-230-20 | 6.74 |
| PC-230-40 | 6.90 |
| PC-230-100 | 9.10 |
| DPC-10-90 | 7.00 |
| DPC-10-120 | 6.50 |
| DPC-10-440 | 6.76 |
| DPC-10-1000 | 7.16 |
| DPC-10-2400 | 9.06 |
| DPC-12-70 | 7.00 |
| DPC-12-100 | 6.50 |
| DPC-12-350 | 6.76 |
| DPC-12-800 | 7.16 |
| DPC-12-2000 | 9.06 |
| DPC-16-55 | 7.00 |
| DPC-16-75 | 6.50 |
| DPC-16-260 | 6.76 |
| DPC-16-640 | 7.16 |
| DPC-16-1500 | 9.06 |
| DPC-20-45 | 7.00 |
| DPC-20-60 | 6.50 |
| DPC-20-220 | 6.76 |
| DPC-20-500 | 7.16 |
| DPC-20-1200 | 9.06 |
| DPC-24-35 | 7.00 |
| DPC-24-50 | 6.50 |
| DPC-24-180 | 6.76 |
| DPC-24-450 | 7.16 |
| DPC-24-1000 | 9.06 |
| DPC-28-30 | 7.00 |
| DPC-28-40 | 6.50 |
| DPC-28-160 | 6.76 |
| DPC-28-360 | 7.16 |
| DPC-28-800 | 9.06 |
| DPC-34-25 | 7.00 |
| DPC-34-35 | 6.50 |
| DPC-34-125 | 6.76 |
| DPC-34-300 | 7.16 |
| DPC-34-700 | 9.06 |
| DPC-40-20 | 7.00 |
| DPC-40-30 | 6.50 |
| DPC-40-110 | $6.76 |
| DPC-40-250 | 7.16 |
| DPC-40-600 | 9.06 |
| DPC-56-15 | 7.00 |
| DPC-56-20 | 6.50 |
| DPC-56-80 | 6.76 |
| DPC-56-180 | 7.16 |
| DPC-56-420 | 9.06 |
| DPC-88-10 | 7.00 |
| DPC-88-15 | 6.50 |
| DPC-88-50 | 6.76 |
| DPC-88-120 | 7.16 |
| DPC-88-270 | 9.06 |
| DPC-120-8 | 7.00 |
| DPC-120-10 | 6.50 |
| DPC-120-35 | 6.76 |
| DPC-120-85 | 7.16 |
| DPC-120-200 | 9.06 |
| DPC-180-6 | 7.24 |
| DPC-180-24 | 7.60 |
| DPC-180-55 | 7.90 |
| DPC-180-130 | 9.96 |
| DPC-230-5 | 7.56 |
| DPC-230-20 | 7.80 |
| DPC-230-40 | 8.26 |
| DPC-230-100 | 10.28 |
| 10-BR | .44 |
| 24-BR | .44 |
| LP-10-600 | 8.90 |
| LP-10-1200 | 11.00 |
| LP-12-450 | 8.90 |
| LP-12-900 | 11.00 |
| LP-16-350 | 8.90 |
| LP-16-700 | 11.00 |
| LP-20-300 | 9.10 |
| LP-20-600 | 11.26 |
| LP-24-250 | 9.10 |
| LP-24-500 | 11.26 |
| LP-34-170 | 9.10 |
| LP-34-340 | 11.26 |
| LP-40-150 | 9.10 |
| LP-40-300 | 11.50 |
| LP-56-100 | 9.30 |
| LP-56-200 | 11.50 |
| LP-88-65 | 9.30 |
| LP-88-130 | 11.80 |
| LP-120-50 | 9.30 |
| LP-120-100 | 11.80 |
| LP-230-25 | 9.30 |
| LP-230-50 | 11.80 |
| MPC-V-12 | 7.28 |
| MPC-V-15 | 7.28 |
| MPC-X-12 | 7.48 |
| MPC-X-15 | 7.48 |
| MPC-Y-12 | 9.30 |
| MPC-Y-15 | 9.30 |
| DMPC-X-12 | 8.60 |
| DMPC-X-15 | 8.60 |
| DMPC-Y-12 | 10.38 |
| DMPC-Y-15 | 10.38 |
| MPL-6-12 | 10.00 |
| MPL-6-15 | 10.00 |
| MPL-12-12 | 12.50 |
| MPL-12-15 | 12.50 |
| 241-3- (ANY) | 4.90 |
| 241-4- | 5.24 |
| 241-5- | 5.82 |
| 241-6- | 7.22 |
| 241-7- | 8.96 |
| 241-8- | 11.88 |
| DP-241-4- (ANY) | 6.14 |
| DP-241-5- | 6.84 |
| DP-241-6- | 8.18 |
| DP-241-7- | 9.90 |
| DP-241-8- | 12.70 |
| ST-3- (ANY) | 5.30 |
| ST-4- | 5.40 |
| ST-5- | 5.94 |
| ST-6- | 7.44 |
| DST-3- (ANY) | 6.25 |
| DST-4- | 6.38 |
| DST-5- | 6.98 |
| DST-6- | 8.50 |
| ST-MS | 6.40/C |
| ST-MN | 6.40/C |

DISCOUNT SCHEDULE*

| Quantity | Discount |
|---|---|
| 1-4 | Net |
| 5-9 | 10% |
| 10-24 | 25% |
| 25-49 | 34% |
| 50-99 | 42% |
| 100-249 | 50% |

* Different part numbers may not be aggregated to obtain quantity discount. Terms: Net 30 days on approved credit, FOB Factory, Inwood, NY. Prices subject to change without notice!

All items on this price schedule are stocked with the exception of the DL Series (shaded area). Normal lead time for the DL Series is 2 to 3 weeks and orders require a $20.00 set-up charge per item.

signal TRANSFORMER

500 Bayview Ave., Inwood, NY 11696 • Telephone: (516) 239-7200

500 Bayview Ave., Inwood, NY 11696 • Telephone: (516) 239-7200

# STACO INCORPORATED variable

FIG. A

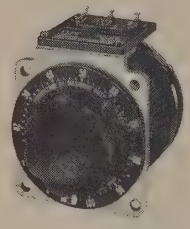


FIG. B

FIG. C

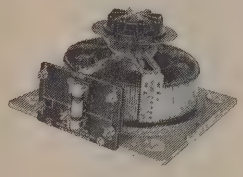


FIG. D

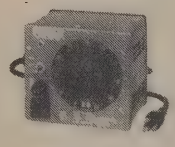


FIG. E

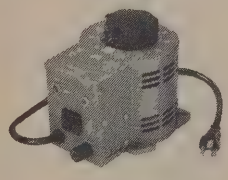


FIG. F

FIG. G

FIG. H

Staco variable transformers offer the versatility and reliability you want from variable voltage controls. Staco controls are used worldwide for industrial and laboratory applications to control voltage, current, power, heat, speed, light and electro-mechanical force. Staco variable transformers provide continuously adjustable output voltage from AC power sources without wave form distortions or SCR generated noise. Outstanding features include precious metal-plated commutators, precise regulation, high efficiency, conservative ratings and rugged construction.

You can select from panel mounted types, cord and plug types, ganged and/or motor driven types, metered types, and fully portable power supplies with or without meters, and ratings from 0.8 amps to 540 amps, 40 volts to 560 volts for single or three phase applications.

Staco has a nationwide network of distributors qualified to offer technical assistance whenever you need it. Additionally, the Staco Engineering Staff is available to help you with special or non-standard applications. Staco's Variable Voltage Controls handbook will be sent to you upon request ... it's loaded with illustrations, engineering data, specifications and ordering information on standard voltage controls. Prices shown are list prices. Contact your local Staco distributor or representative for quantity discounts.

## PANEL OR BENCH MOUNTING MODELS *120 VOLT INPUT SINGLE PHASE*

Available in cased or uncased units designed for mounting on panels ¼" to ⅝" thick. Most units also can be bench mounted.

| MFG. TYPE NO. | FIG. | OUTPUT VOLTS | OUTPUT AMPS | KVA | SIZE (INCHES) H x W x D | WT. LBS. | PRICE EACH |
|---|---|---|---|---|---|---|---|
| 171 | A | *0-120/132 | 1.75 | 0.23 | 2 13/16 x 1⅞ | 3.0 | $ 16.00 |
| 201 | A | *0-120/132 | 2.0 | 0.26 | 2 13/16 x 1⅞ | 3.0 | 16.25 |
| 221 | A | *0-120/132 | 2.25 | 0.30 | 2 13/16 x 2⅛ | 3.2 | 17.25 |
| 251 | A | *0-120/132 | 2.5 | 0.33 | 2 13/16 x 2 5/16 | 3.5 | 18.10 |
| 291 | A | *0-120/132 | 3.0 | 0.40 | 2 13/16 x 2 5/16 | 3.5 | 18.60 |
| 371 | B | *0-120/140 | 3.75 | 0.53 | 3¾ x 3¾ x 3¼ | 5.0 | 27.20 |
| 501 | B | 0-120/140 | 5.0 | 0.70 | 3¾ x 3¾ x 3 5/16 | 6.0 | 27.30 |
| 1010 | B | 0-120/140 | 10.0 | 1.4 | 5 5/16 x 5 x 4 3/16 | 12.0 | 36.20 |
| 1010CT | J | 0-120/140 | 10.0 | 1.4 | 6⅞ x 5 x 4 7/16 | 12.0 | 53.00 |
| SQ1010 | B | 0-120/140 | 10.0 | 1.4 | 5 3/16 x 4¼ x 4 5/32 | 12.0 | 37.70 |
| 1210 | B | **0-120 | 12.0 | 1.4 | 5 5/16 x 5 x 4 3/16 | 12.0 | 39.90 |
| 1210CT | J | **0-120 | 12.0 | 1.4 | 6⅞ x 5 x 4 7/16 | 12.0 | 51.60 |
| SQ1210 | B | **0-120 | 12.0 | 1.4 | 5 3/16 x 4¼ x 4 5/32 | 12.0 | 41.40 |
| 1510 | C | 0-120/140 | 15.0 | 2.1 | 6⅛ x 6⅝ x 4⅜ | 20.0 | 68.00 |
| 1510CT | C | 0-120/140 | 15.0 | 2.1 | 8 31/32 x 6 3/16 x 4½ | 20.0 | 91.20 |
| 2510 | C | 0-120/140 | 25.0 | 3.5 | 8 3/16 x 7⅝ x 4⅛ | 23.0 | 99.00 |
| 2510CT | K | 0-120/140 | 25.0 | 3.5 | 9⅝ x 7⅝ x 4⅛ | 26.0 | 121.30 |
| 5010 | D | 0-140 | 50.0 | 7.0 | 15⅜ x 13⅞ x 5¼ | 60.0 | 237.20 |
| 5010CT | D | 0-140 | 50.0 | 7.0 | 17 15/16 x 14 x 7⅛ | 66.0 | 265.10 |
| 6010 | D | 0-120/140 | 60.0 | 8.4 | 15⅜ x 13⅞ x 5¼ | 67.0 | 279.90 |
| 6010C | D | 0-120/140 | 60.0 | 8.4 | 15⅜ x 13⅞ x 7⅛ | 67.0 | 290.50 |
| 6010CT | D | 0-120/140 | 60.0 | 8.4 | 17 15/16 x 14 x 7⅛ | 67.0 | 318.20 |

CT refers to enclosed coil and terminals *60 cycle operation only at overvoltage
**60 cycle operation only C refers to enclosed coil only

## PANEL OR BENCH MOUNTING MODELS *240 VOLT INPUT SINGLE PHASE*

| MFG. TYPE NO. | FIG. | OUTPUT VOLTS | OUTPUT AMPS | KVA | SIZE (INCHES) H x W x D | WT. LBS. | PRICE EACH |
|---|---|---|---|---|---|---|---|
| 252 | A | 0-240/264 | 0.8 | 0.19 | 2 13/16 x 2 7/16 | 3.5 | $ 28.10 |
| 1020 | B | 0-240/280 | 3.5 | 0.98 | 5 5/16 x 5 x 4 3/16 | 12.0 | 44.60 |
| 1020CT | J | 0-240/280 | 3.5 | 0.98 | 6⅞ x 5 x 4 7/16 | 12.0 | 56.30 |
| SQ1020 | B | 0-240/280 | 3.5 | 0.98 | 5 3/16 x 4¼ x 4 5/32 | 12.0 | 46.10 |
| 1220 | B | **0-240 | 5.0 | 1.2 | 5 5/16 x 5 x 4 3/16 | 12.0 | 47.50 |
| 1220CT | J | **0-240 | 5.0 | 1.2 | 6⅞ x 5 x 4 7/16 | 12.0 | 58.50 |
| SQ1220 | B | **0-240 | 5.0 | 1.2 | 5 3/16 x 4¼ x 4 5/32 | 12.0 | 49.00 |
| 1520 | C | 0-240/280 | 9.5 | 2.7 | 6⅛ x 6⅝ x 4 13/16 | 20.0 | 68.00 |
| 1520CT | K | 0-240/280 | 9.5 | 2.7 | 6⅜ x 9⅛ x 5 | 23.0 | 91.20 |
| 2520 | C | 0-240/280 | 10.0 | 2.8 | 8 3/16 x 7⅝ x 4⅛ | 23.0 | 99.00 |
| 2520CT | K | 0-240/280 | 10.0 | 2.8 | 9⅝ x 7⅝ x 4⅛ | 26.0 | 121.30 |
| 5020 | D | 0-240/280 | 28.0 | 7.8 | 15⅜ x 13⅞ x 5¼ | 60.0 | 229.10 |
| 5020CT | D | 0-240/280 | 28.0 | 7.8 | 17 15/16 x 14 x 7⅛ | 66.0 | 265.10 |
| 6020 | D | 0-240/280 | 35.0 | 9.8 | 15⅜ x 13⅞ x 5¼ | 63.0 | 270.40 |
| 6020C | D | 0-240/280 | 35.0 | 9.8 | 15⅜ x 13⅞ x 7⅛ | 63.0 | 290.50 |
| 6020CT | D | 0-240/280 | 35.0 | 9.8 | 17 15/16 x 14 x 7⅛ | 63.0 | 318.20 |

**60 cycle operation only C refers to enclosed coil only

## PORTABLE MODELS *120 VOLT INPUT SINGLE PHASE*

Cord, matching receptacle, switch, pilot light, fuse and all models connected for clockwise knob rotation. Models available with 2 conductor line cord and receptacle (2PF) or a 3-conductor grounded line cord and receptacle (3PN)

| MFG. TYPE NO. | FIG. | OUTPUT VOLTS | OUTPUT AMPS | KVA | SIZE (INCHES) H x W x D | WT. LBS. | PRICE EACH |
|---|---|---|---|---|---|---|---|
| 2PF171 | E | **0-132 | 1.75 | 0.23 | 3 15/16 x 3 15/16 x 3½ | 3.5 | $ 34.45 |
| 3PN171 | E | **0-132 | 1.75 | 0.23 | 3 15/16 x 3 15/16 x 3½ | 3.5 | 41.50 |
| 2PF371 | E | *0-120/140 | 3.75 | 0.53 | 5⅜ x 6 1/16 x 5⅝ | 7.0 | 41.50 |
| 3PN371 | E | *0-120/140 | 3.75 | 0.53 | 5⅜ x 6 1/16 x 5⅝ | 7.0 | 48.20 |
| 2PF501 | E | 0-120/140 | 5.0 | 0.70 | 5⅜ x 6 1/16 x 5⅝ | 9.0 | 45.40 |
| 3PN501 | E | 0-120/140 | 5.0 | 0.70 | 5⅜ x 6 1/16 x 5⅝ | 9.0 | 52.40 |
| 2PF1010 | F | 0-120/140 | 10.0 | 1.4 | 5 x 6⅞ x 5⅝ | 12.0 | 49.90 |
| 3PN1010 | F | 0-120/140 | 10.0 | 1.4 | 5 x 6⅞ x 5⅝ | 12.0 | 55.70 |
| 2PF1210 | F | **0-120 | 12.0 | 1.4 | 5 x 6⅞ x 5⅝ | 12.0 | 58.60 |
| 3PN1210 | F | **0-120 | 12.0 | 1.4 | 5 x 6⅞ x 5⅝ | 12.0 | 65.30 |
| 2PF1510 | G | 0-120/140 | 15.0 | 2.1 | 5⅞ x 6⅜ x 9 | 21.0 | 103.80 |
| 3PN1510 | G | 0-120/140 | 15.0 | 2.1 | 5⅞ x 6⅜ x 9 | 21.0 | 103.80 |
| 2PF2210 | G | 0-140 | 22.0 | 2.4 | 5⅝ x 7⅝ x 10¾ | 24.0 | 145.40 |
| 3PN2210 | G | 0-140 | 22.0 | 2.4 | 5⅝ x 7⅝ x 10¾ | 24.0 | 145.40 |

*60 cycle operation only on overvoltage **60 cycle operation only

# transformers

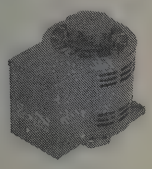


FIG. J

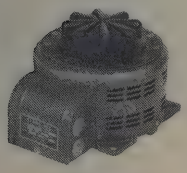


FIG. K

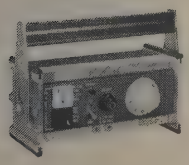


FIG. L

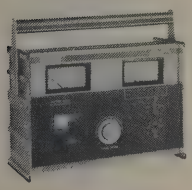


FIG. M

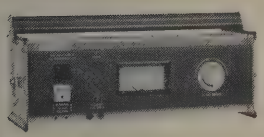


FIG. N

FIG. O

FIG. P

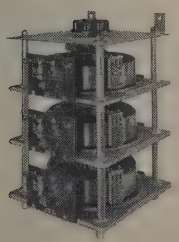


FIG. Q

## PORTABLE MODELS *240 VOLT INPUT SINGLE PHASE*

Same physical specifications as 120 volt portable types.

| MFG. TYPE NO. | FIG. | OUTPUT VOLTS | OUTPUT AMPS | KVA | SIZE (INCHES) H x W x D | WT. LBS. | PRICE EACH |
|---|---|---|---|---|---|---|---|
| 2PF1020 | F | 0-240/280 | 3.5 | 0.98 | 5 x 6⅞ x 5⅝ | 12.0 | $ 59.70 |
| 3PN1020 | F | 0-240/280 | 3.5 | 0.98 | 5 x 6⅞ x 5⅝ | 12.0 | 68.80 |
| 2PF1220 | F | **0-240 | 5.0 | 1.2 | 5 x 6⅞ x 5⅝ | 12.0 | 66.10 |
| 3PN1220 | F | **0-240 | 5.0 | 1.2 | 5 x 6⅞ x 5⅝ | 12.0 | 72.80 |
| 2PF1520 | G | 0-240/280 | 9.5 | 2.7 | 5⅞ x 6⅜ x 9 | 21.0 | 103.80 |
| 3PN1520 | G | 0-240/280 | 9.5 | 2.7 | 5⅞ x 6⅜ x 9 | 21.0 | 103.80 |
| 2PF2520 | G | 0-280 | 10.0 | 2.8 | 5⅝ x 7⅝ x 10¾ | 24.0 | 145.40 |
| 3PN2520 | G | 0-280 | 10.0 | 2.8 | 5⅝ x 7⅝ x 10¾ | 24.0 | 145.40 |

**60 cycle operation only

## METERED PORTABLE MODELS *120 VOLT & 240 VOLT INPUT SINGLE PHASE*

Staco's new series of Metered Cord & Plug type variable transformers eliminate the need for separate metering. Featuring an accurate, high quality pivot and jewel meter conveniently located atop the enclosure for easy, accurate readout. 120V models have 0-150V meter, 240V models have 0-300V meter.

| MFG. TYPE NO. | FIG. | INPUT VOLTS | OUTPUT VOLTS | OUTPUT AMPS | KVA | SIZE (INCHES) H x W x D | WT. LBS. | PRICE EACH |
|---|---|---|---|---|---|---|---|---|
| 2PF1010V | H | 120 | 0-140 | 10.0 | 1.4 | 5 x 6⅞ x 5⅝ | 12.0 | $79.60 |
| 3PN1010V | H | 120 | 0-140 | 10.0 | 1.4 | 5 x 6⅞ x 5⅝ | 12.0 | 82.25 |
| 2PF1020V | H | 240 | 0-280 | 3.5 | 0.98 | 5 x 6⅞ x 5⅝ | 12.0 | 90.95 |
| 3PN1020V | H | 240 | 0-280 | 3.5 | 0.98 | 5 x 6⅞ x 5⅝ | 12.0 | 93.60 |

## VARIABLE ISOLATION TRANSFORMERS *120 VOLT INPUT SINGLE PHASE*

An exclusive by STACO, for use where the safety of isolation is required. The output voltage is completely isolated from the power line (input voltage). Additional outputs are available on uncased models. When proper external connections are made between windings, it is possible to increase the voltage or current ratings of the isolated variable through non-isolated, voltage doubler, or series connection.

| MFG. TYPE NO. | FIG. | OUTPUT VOLTS | OUTPUT AMPS | KVA | SIZE (INCHES) H x W x D | WT. LBS. | PRICE EACH |
|---|---|---|---|---|---|---|---|
| J201 | B | 0-140 | 2.0 | 0.28 | 5 5/16 x 5 x 4¾ | 13.0 | $ 74.60 |
| J401 | B | 0-140 | 4.0 | 0.56 | 6⅛ x 6⅝ x 4 7/16 | 20.0 | 139.00 |
| J901 | C | 0-140 | 9.0 | 1.26 | 8 5/16 x 7⅝ x 4¾ | 32.0 | 179.50 |

## AC POWER SUPPLIES *120 VOLT SINGLE PHASE*

Portable AC Power Supplies are ideal for labs or test bench use. Housed in a ventilated steel and aluminum enclosure with carrying handle, each model is complete with a three-conductor line cord, plug & matching receptacle, pilot light, switch and circuit breaker. Metered models are available with Voltmeter, Ammeter or a Wattmeter (or a combination of meters).

| MFG. TYPE NO. | FIG. | INPUT VOLTS | OUTPUT VOLTS | OUTPUT AMPS | KVA | SIZE (INCHES) H x W x D | WT. LBS. | PRICE EACH |
|---|---|---|---|---|---|---|---|---|
| E171 | L | **120 | 0-132 | 1.75 | 0.23 | 4⅜ x 10 13/16 x 3⅝ | 13.0 | $ 52.50 |
| E371 | L | 120 | 0-120/140 | 3.75 | 0.52 | 6⅛ x 11¼ x 5 | 15.0 | 63.00 |
| E501 | L | 120 | 0-120/140 | 5.0 | 0.7 | 6⅛ x 11¼ x 5 | 16.0 | 66.00 |
| E501V | N | 120 | 0-120/140 | 5.0 | 0.7 | 6⅛ x 17⅝ x 5⅞ | 20.0 | 120.00 |
| E501VA | M | 120 | 0-120/140 | 5.0 | 0.7 | 10 x 15 1/16 x 5⅞ | 25.0 | 198.50 |
| E501VAW | M | 120 | 0-120/140 | 5.0 | 0.7 | 10 x 15 1/16 x 5⅞ | 28.0 | 312.50 |
| E1010 | L | 120 | 0-120/140 | 10.0 | 1.4 | 6⅛ x 11 15/16 x 5⅞ | 20.0 | 116.80 |
| E1010V | N | 120 | 0-120/140 | 10.0 | 1.4 | 6 3/16 x 17⅝ x 5⅞ | 27.0 | 147.80 |
| E1010VA | M | 120 | 0-120/140 | 10.0 | 1.4 | 10 x 15 1/16 x 5⅞ | 33.0 | 236.00 |
| E1010VAW | M | 120 | 0-120/140 | 10.0 | 1.4 | 10 x 15 1/16 x 5⅞ | 35.0 | 347.00 |

V = Voltmeter VA = Voltmeter-Ammeter VAW = Voltmeter, Ammeter, Wattmeter **60 cycle operation only

## ISOLATED AC/DC POWER SUPPLIES *120 VOLT SINGLE PHASE*

The isolated variable transformer used in these AC/DC Power Supplies have a separate primary winding which is electrically isolated from the secondary or output winding. There is no common connection between the input and output of the transformers; either side of the output can be grounded independently of the supply line. Each unit has all the features of the AC Power Supplies, plus a 0-150V direct rating output voltmeter. 0-140V AC and 0-120V DC isolated outputs at full rated current available from banana jacks located on front panel.

| MFG. TYPE NO. | FIG. | OUTPUT VOLTS | OUTPUT AMPS | KVA | SIZE (INCHES) H x W x D | WT. LBS. | PRICE EACH |
|---|---|---|---|---|---|---|---|
| EJ201V | N | 0-140 | 2.0 | 0.28 | 6 3/16 x 17⅝ x 5⅞ | 20.0 | $144.00 |
| EJ401V | N | 0-140 | 4.0 | 0.56 | 10 x 15½ x 5⅞ | 30.0 | 186.25 |
| EJ901V | N | 0-140 | 9.0 | 1.26 | 10 x 16 5/32 x 7½ | 43.0 | 263.50 |

## THREE PHASE MODELS *240 VOLTS OR 480 VOLTS INPUT*

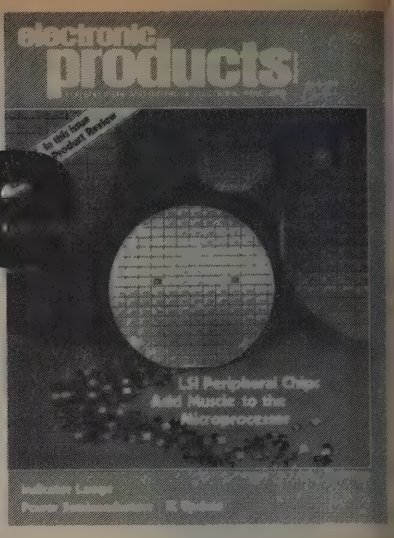
Three phase types are three individual units driven by a common shaft and electrically connected in three-phase wye configuration.

| MFG. TYPE NO. | FIG. | INPUT VOLTS | INPUT FREQ. HZ | OUTPUT VOLTS | OUTPUT AMPS | KVA | SIZE (INCHES) H x W x D | WT. LBS. | PRICE EACH |
|---|---|---|---|---|---|---|---|---|---|
| 221-3 | O | 240 | 60 | 0-240 | 2.25 | 0.94 | 3⅞ x 3⅞ x 8⅛ | 9 | $ 89.75 |
| 1010-3 | P | 240 | 50/60* | 0-240/280 | 10.0 | 4.85 | 6⅛ x 5 x 14 19/32 | 36 | 140.30 |
| 1510-3 | P | 240 | 50/60* | 0-240/280 | 15.0 | 6.22 | 7 1/16 x 6⅛ x 14 9/16 | 56 | 256.30 |
| 2510-3 | P | 240 | 50/60* | 0-240/280 | 25.0 | 12.10 | 8⅝ x 7⅝ x 14⅝ | 72 | 358.50 |
| 5010-3Y | Q | 240 | 60 | 0-280 | 50.0 | 24.2 | 15 9/16 x 13⅞ x 19⅝ | 225 | 836.00 |
| 252-3 | O | 480 | 50/60* | 0-480/528 | 0.8 | 0.73 | 3⅞ x 3⅞ x 8⅛ | 9 | 132.90 |
| 1020-3 | P | 480 | 50/60* | 0-480/560 | 3.5 | 4.85 | 6⅛ x 5 x 14 19/32 | 36 | 165.90 |
| 1520-3 | P | 480 | 50/60* | 0-480/560 | 9.5 | 7.90 | 7 1/16 x 6⅛ x 15 1/16 | 56 | 256.30 |
| 2520-3 | P | 480 | 50/60* | 0-480/560 | 10.0 | 9.70 | 8⅝ x 7⅝ x 14⅝ | 72 | 358.50 |
| 5020-3Y | Q | 480 | 50/60* | 0-480/560 | 28.0 | 27.2 | 15 9/16 x 13⅞ x 19⅝ | 225 | 836.00 |

*60HZ Only on Overvoltage Connection

STACO INCORPORATED
301 Gaddis Blvd • Dayton, Ohio 45403
(513) 253-1191 • TWX 810 459-1798 • TELEX 288-032

# stay up to date



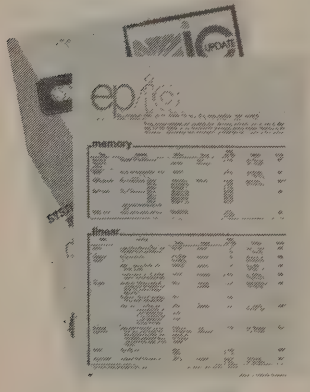

**SUBSCRIBE TO ELECTRONIC PRODUCTS MAGAZINE. IT'S YOUR *COMPLETE* GUIDE TO EVERYTHING THAT'S NEW IN THE FAST-CHANGING WORLD OF ELECTRONIC PRODUCTS AND SYSTEMS.**

**FEATURE STORIES** every month on electronic products, applications and availability.

**FORUMS**—Reports on meetings of manufacturers, users and distributors. Get the very latest news on a wide variety of products.

**NEW PRODUCT NEWS**—Hundreds of new products are introduced each month. You'll get the facts on not only what the new product is, but also where to get it, basic prices and current delivery.

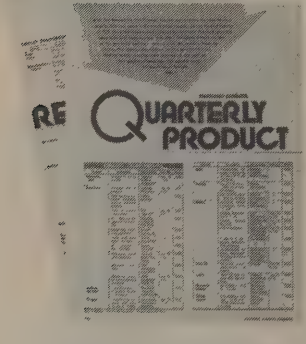
**EP/IC UPDATE**—Exclusive in ELECTRONIC PRODUCTS. A monthly report on *everything* that's new in the fast-moving world of integrated circuits.



**QUARTERLY PRODUCT REVIEW**—Another exclusive in ELECTRONIC PRODUCTS. A complete report of *every* new electronic product introduced in the previous quarter. This feature is in the January, April, July and October issues.

**QUARTERLY PRODUCT PLANNING DIRECTORY**—A compilation of the latest catalogs of a wide variety of electronic products and systems.

**OUTLOOK**—Important industry news affecting electronic products and systems.




**COMPONENT CAPERS**—A humorous look at the strange and wonderful world of electronics.

**MINI-GLOSSARIES,** Quizzes and more—Each and every month for over twenty years the readers of ELECTRONIC PRODUCTS learn something new about the products they work with and specify.

***If you are not now a subscriber, write to:***
***Dorothy Renoud, ELECTRONIC PRODUCTS MAGAZINE, 645 Stewart Avenue, Garden City, NY 11530.***
***Ask for a free qualification card.***

United Technical Publications, Inc., Div. of Cox Broadcasting Corp., 645 Stewart Ave., Garden City, NY 11530/(516) 222-2500

STERLING TRANSFORMER

# *step-up/step-down* ISOLATION – AUTO *transformers*

## STEP-DOWN ISOLATION TRANSFORMERS

**PRIMARY:** 240 Volts • 50/60 HZ • Line Cord and Plug*
**SECONDARY:** 120 Volts • Standard Female Receptacle
• Electrostatic Shield • UL Approved Cord and Plug.

| Cat No. | VA Watts | Style | DIMENSIONS L | W | H | Mounting Centers M1 | M2 | Appr. Wt. | Net Price |
|---|---|---|---|---|---|---|---|---|---|
| S2-50 | 50 | A | 2 29/32 | 3 7/16 | 3 1/2 | 2 1/4 | 1 13/16 | 3 | $16.29 |
| S2-100 | 100 | A | 3 7/32 | 3 7/8 | 3 7/8 | 2 1/2 | 2 3/16 | 5 | 21.07 |
| S2-150 | 150 | A | 3 17/32 | 4 3/8 | 4 1/4 | 2 3/4 | 2 13/16 | 7 | 23.91 |
| S2-220 | 220 | A | 3 27/32 | 4 5/8 | 4 5/8 | 3 | 3 1/16 | 9.5 | 26.59 |
| S2-330 | 330 | A | 4 17/32 | 5 1/4 | 5 7/16 | 3 1/2 | 3 1/4 | 14.5 | 38.97 |
| S2-500 | 500 | A | 4 17/32 | 6 1/4 | 5 7/16 | 3 1/2 | 4 1/4 | 21 | 42.50 |
| S2-700 | 700 | A | 5 1/2 | 5 15/16 | 6 9/16 | 4 1/4 | 3 1/2 | 25 | 50.01 |
| S2-1000 | 1000 | A | 5 1/2 | 6 15/16 | 6 9/16 | 4 1/4 | 4 1/2 | 35 | 84.51 |
| S2-1500 | 1500 | B | 9 | 7 3/4 | 6 5/16 | 8 1/4 | 4 3/8 | 42 | 100.99 |
| S2-2200 | 2200 | B | 9 | 9 3/8 | 6 5/16 | 8 1/4 | 6 | 65 | 124.01 |
| S2-3300 | 3300 | B | 9 | 11 5/8 | 6 5/16 | 8 1/4 | 8 1/4 | 95 | 194.88 |

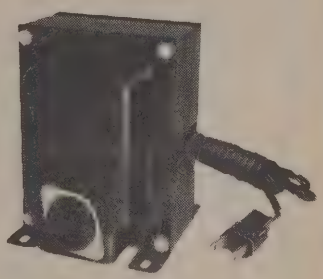
**Style A Only; Style B — Knockouts for Conduit Connectors.*

## ISOLATION TRANSFORMERS

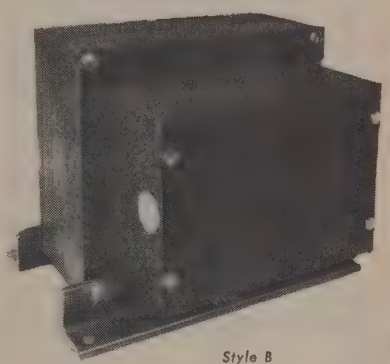
**PRIMARY:** 120 Volts • 50/60 HZ • Line Cord and Plug*
**SECONDARY:** 120 Volts • Standard Female Receptacle
• Electrostatic Shield • UL Approved Cord and Plug.

| Cat No. | VA Watts | Style | DIMENSIONS L | W | H | Mounting Centers M1 | M2 | Appr. Wt. | Net Price |
|---|---|---|---|---|---|---|---|---|---|
| S1-50 | 50 | A | 2 29/32 | 3 7/16 | 3 1/2 | 2 1/4 | 1 13/16 | 3 | $16.29 |
| S1-100 | 100 | A | 3 7/32 | 3 7/8 | 3 7/8 | 2 1/2 | 2 3/16 | 5 | 21.07 |
| S1-150 | 150 | A | 3 17/32 | 4 3/8 | 4 1/4 | 2 3/4 | 2 13/16 | 7 | 23.91 |
| S1-220 | 220 | A | 3 27/32 | 4 5/8 | 4 5/8 | 3 | 3 1/16 | 9.5 | 26.59 |
| S1-330 | 330 | A | 4 17/32 | 5 1/4 | 5 7/16 | 3 1/2 | 3 1/4 | 14.5 | 38.97 |
| S1-500 | 500 | A | 4 17/32 | 6 1/4 | 5 7/16 | 3 1/2 | 4 1/4 | 21 | 42.38 |
| S1-700 | 700 | A | 5 1/2 | 5 15/16 | 6 9/16 | 4 1/4 | 3 1/2 | 25 | 50.01 |
| S1-1000 | 1000 | A | 5 1/2 | 6 15/16 | 6 9/16 | 4 1/4 | 4 1/2 | 35 | 84.52 |
| S1-1500 | 1500 | B | 9 | 7 3/4 | 6 5/16 | 8 1/4 | 4 3/8 | 42 | 101.00 |
| S1-2200 | 2200 | B | 9 | 9 3/8 | 6 5/16 | 8 1/4 | 6 | 65 | 124.01 |
| S1-3300 | 3300 | B | 9 | 11 5/8 | 6 5/16 | 8 1/4 | 8 1/4 | 95 | 194.88 |

**Style A Only; Style B — Knockouts for Conduit Connectors.*



*Style A*



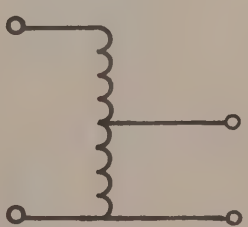
*Style B*

## STEP-DOWN AUTO TRANSFORMERS

**PRIMARY:** 240 Volts • 50/60 HZ • Line Cord and Plug*
**SECONDARY:** 120 Volts • Standard Female Receptacle
• UL Approved Cord and Plug.

| Cat No. | VA Watts | Style | DIMENSIONS L | W | H | Mounting Centers M1 | M2 | Appr. Wt. | Net Price |
|---|---|---|---|---|---|---|---|---|---|
| SA-100 | 100 | A | 2 29/32 | 3 7/16 | 3 1/2 | 2 1/4 | 1 13/16 | 3 | $14.52 |
| SA-150 | 150 | A | 2 29/32 | 3 3/4 | 3 1/2 | 2 1/4 | 2 1/8 | 4 | 16.65 |
| SA-200 | 200 | A | 3 7/32 | 3 7/8 | 3 7/8 | 2 1/4 | 2 3/16 | 5 | 21.26 |
| SA-300 | 300 | A | 3 17/32 | 4 3/8 | 4 1/4 | 2 3/4 | 2 13/16 | 7 | 27.10 |
| SA-450 | 450 | A | 3 27/32 | 4 5/8 | 4 5/8 | 3 | 3 1/8 | 9 1/2 | 30.29 |
| SA-650 | 650 | A | 4 17/32 | 5 1/4 | 5 7/16 | 3 1/2 | 3 1/4 | 14 1/2 | 35.78 |
| SA-1000 | 1000 | A | 4 17/32 | 6 1/4 | 5 7/16 | 3 1/2 | 4 1/4 | 21 | 41.62 |
| SA-1500 | 1500 | A | 5 1/2 | 5 15/16 | 6 9/16 | 4 1/4 | 3 1/2 | 25 | 60.23 |
| SA-2000 | 2000 | A | 5 1/2 | 6 15/16 | 6 9/16 | 4 1/4 | 4 1/2 | 35 | 74.58 |
| SA-3000 | 3000 | B | 9 | 7 3/4 | 6 5/16 | 8 1/4 | 4 3/8 | 42 | 102.75 |
| SA-4500 | 4500 | B | 9 | 9 3/8 | 6 5/16 | 8 1/4 | 6 | 65 | 132.87 |
| SA-6500 | 6500 | B | 9 | 11 5/8 | 6 5/16 | 8 1/4 | 8 1/4 | 95 | 186.02 |
| SA-8000** | 8000 | B | 10 5/8 | 9 5/8 | 8 1/4 | 9 5/8 | 6 1/8 | 90 | 212.59 |
| SAB-5300† | 5300 | A | 5 3/4 | 8 5/16 | 4 | 3 3/4 | 6 1/2 | 17.5 | 95.67 |

**Style A Only **60 HZ Only Style B — Knockouts for Conduit Connector*
*†Step-up/down Auto Transformer. Connections for 208/230 V or 230/208 V, 23 Amp 50/60 HZ*



STERLING TRANSFORMER CORP.
DEPT. EM, 510 DRIGGS AVENUE • BROOKLYN, NEW YORK 11211 • TELEPHONE: (212) 782-4200

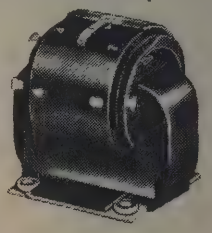
STERLING TRANSFORMER

# ENCAPSULATED 400 cps transformers

## CLIPPER SERIES

| Fig. | Cat. No. | Sec. Volts | Sec. Amp | Insul. Volts (RMS) | Pri. Volts | Mold Size | Net Price |
|---|---|---|---|---|---|---|---|
| 19 | 4C1 | 6.3 CT | 0.8 | 1500 | 115 | SM3 | $24.44 |
| 19 | 4C2 | 6.3 CT | 1.2 | 1500 | 115 | SM2 | 24.44 |
| 19 | 4C3 | 6.3 CT | 6.8 | 1500 | 110/115/120 | 2 | 39.24 |
| 20 | 4C4 | 6.3<br>6.3 | 4.9<br>2.7 | 1500 | 115 | 3 | 35.08 |
| 19 | 4C5 | 6.3 CT | 7.2 | 1500 | 115 | 35 | 40.74 |
| 21 | 4C6 | 6.3<br>6.3<br>6.3 | 7<br>7<br>1.5 | 1500<br>1500<br>1500 | 120 | 35 | 39.68 |
| 22 | 4C7 | 6.3 CT<br>6.3 CT | 7<br>7 | 1500<br>1500 | 120 | 4 | 52.23 |
| 21 | 4C8 | 6.3<br>6.3<br>6.3 | 13.7<br>2.9<br>0.3 | 1500<br>1500<br>1500 | 115 | 4 | 52.23 |
| 19 | 4C9 | 6.3 CT | 12.3 | 1500 | 115 | 5 | 43.67 |
| 21 | 4C11 | 6.3<br>6.3<br>6.3 | 2.4<br>2.5<br>2.7 | 1500 | 115 | 3 | 43.67 |
| 19 | 4C26 | 6.3 CT | 2 | 1500 | 115 | SM1 | 31.09 |
| 19 | 4C27 | 6.3 CT | 3 | 1500 | 115 | 1A | 32.33 |
| 19 | 4C28 | 6.3 CT | 5 | 1500 | 115 | 2 | 33.48 |
| 19 | 4C29 | 5 CT | 3 | 2500 | 115 | SM1 | 31.10 |
| 19 | 4C30 | 5 CT | 6 | 2500 | 115 | 2 | 33.48 |
| 19 | 4C31 | 8.5 CT | 12 | 1500 | 115 | 5 | 43.63 |
| 19 | 4C32 | 8.5 CT | 23 | 1500 | 115 | 7 | 48.36 |
| 19 | 4C33 | 8.5 CT | 35 | 1500 | 115 | 8 | 52.71 |
| 19 | 4C34 | 8.5 CT | 45 | 1500 | 115 | 9 | 63.59 |
| 18 | 4C12 | 14.1 | 3 | 1500 | 115 | 3 | 33.28 |
| 19 | 4C35 | 21 CT | 4.5 | 1500 | 115 | 5 | 43.63 |
| 19 | 4C13 | 21 CT | 9 | 1500 | 115 | 7 | 37.74 |
| 19 | 4C36 | 21 CT | 18 | 1500 | 115 | 9 | 63.59 |
| 19 | 4C10 | 20 CT | 0.6 | 1500 | 115 | SM1 | 31.10 |

FREQUENCY
380-1000 cps



FOR MINIMUM SIZE & MINIMUM WEIGHT
- CONTOUR MOLDED
- HIPERSIL CORES

MIL-T27C Specifications

MIL Type TF5SX01ZZ
85°C Max. Ambient
130°C Max. Oper. Temp.

HIGH SHOCK EXTREME ENVIRONMENT CONDITIONS
LIGHTWEIGHT FOR AIRBORNE USE
10,000 HOUR PLUS-LIFE SERVO APPLICATIONS
ISOLATIONS
POWER SUPPLIES
AIRBORNE CONTROL CIRCUITS
MISSILE CIRCUITS

FIG. 18

FIG. 19

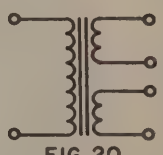


FIG. 20

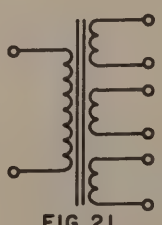


FIG. 21

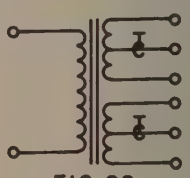


FIG. 22

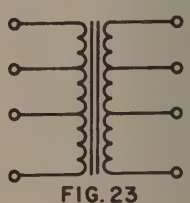


FIG. 23

STERLING TRANSFORMER CORPORATION
DEPT. EM, 510 DRIGGS AVENUE • BROOKLYN, NEW YORK 11211 • TELEPHONE: (212) 782-4200

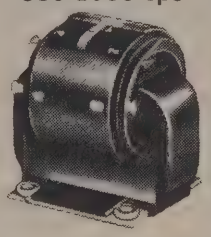
STERLING TRANSFORMER

# ENCAPSULATED 400 cps transformers

## CLIPPER SERIES

| Fig. | Cat. No. | Sec. Volts | Sec. Amp. | Insul. Volts (RMS) | Pri. Volts | Mold Size | Net Price |
|---|---|---|---|---|---|---|---|
| 19 | 4C37 | 21 CT | 24 | 1500 | 115 | 10 | $76.36 |
| 19 | 4C38 | 24 CT | 4 | 1500 | 115 | 5 | 43.63 |
| 19 | 4C39 | 24 CT | 8 | 1500 | 115 | 7 | 48.36 |
| 19 | 4C40 | 24 CT | 16 | 1500 | 115 | 9 | 63.59 |
| 19 | 4C41 | 24 CT | 21 | 1500 | 115 | 10 | 76.36 |
| 18 | 4C14 | 26 | 0.5 | 1500 | 115 | SM1 | 30.33 |
| 19 | 4C15 | 26 CT | 1.5 | 1500 | 115 | 3 | 31.35 |
| 19 | 4C23 | 26 CT | 3 | 1500 | 115 | 4 | 37.74 |
| 19 | 4C24 | 26 CT | 5 | 1500 | 115 | 6 | 44.03 |
| 22 | 4C16 | 28 CT<br>6.3 CT | 0.8<br>7 | 1500 | 115 | 3 | 47.15 |
| 19 | 4C42 | 41 CT | 2.3 | 1500 | 115 | 5 | 43.63 |
| 19 | 4C43 | 41 CT | 4.5 | 1500 | 115 | 7 | 48.36 |
| 19 | 4C44 | 41 CT | 9 | 1500 | 115 | 9 | 63.59 |
| 19 | 4C45 | 41 CT | 12 | 1500 | 115 | 10 | 76.36 |
| 19 | 4C46 | 48 CT | 2 | 1500 | 115 | 5 | 43.63 |
| 19 | 4C47 | 48 CT | 4 | 1500 | 115 | 7 | 48.36 |
| 19 | 4C48 | 48 CT | 8 | 1500 | 115 | 9 | 63.59 |
| 19 | 4C49 | 48 CT | 10 | 1500 | 115 | 10 | 76.36 |
| 19 | 4C25 | 52 CT | 2 | 1500 | 115 | 5 | 43.63 |
| 19 | 4C17 | 52 CT | 0.2 | 1500 | 115 | SM1 | 33.84 |
| 19 | 4C18 | 90 CT | 4.5 | 1500 | 115 | 9 | 63.59 |
| 18 | 4C19 | 115 | .05 | 1500 | 115 | SM2 | 24.99 |
| 18 | 4C21 | 115 | 2.8 | 1500 | 115 | 8 | 51.79 |
| 23 | 4C20 | 105/115/125 | 0.4 | 1500 | 105/115/125 | 2 | 35.96 |
| 23 | 4C50 | 105/115/125 | 1 | 1500 | 105/115/125 | 6 | 45.62 |
| 23 | 4C51 | 105/115/125 | 2.4 | 1500 | 105/115/125 | 8 | 53.49 |
| 23 | 4C52 | 105/115/125 | 3.2 | 1500 | 105/115/125 | 9 | 58.63 |
| 23 | 4C53 | 105/115/125 | 4 | 1500 | 105/115/125 | 10 | 77.46 |
| 18 | 4C22 | 334 | 025 | 1500 | 115 | SM1 | 28.56 |

FREQUENCY
380-1000 cps



FOR MINIMUM SIZE & MINIMUM WEIGHT
- CONTOUR MOLDED
- HIPERSIL CORES

MIL-T27C Specifications

MIL Type TF5SX01ZZ
85°C Max. Ambient
130°C Max. Oper. Temp.

HIGH SHOCK
EXTREME ENVIRONMENT CONDITIONS
LIGHTWEIGHT FOR AIRBORNE USE
10,000 HOUR PLUS-LIFE
SERVO APPLICATIONS
ISOLATIONS
POWER SUPPLIES
AIRBORNE CONTROL CIRCUITS
MISSILE CIRCUITS

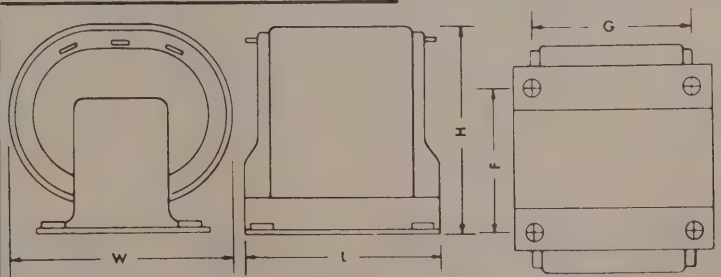
| Mold No. | Overall Dimen. L | W | H | Mtg. Dimen. F | G | App. Wt. (Lbs.) | Mtg. Meth. |
|---|---|---|---|---|---|---|---|
| SM3 | 1 1/32 | 1 5/16 | 1 1/4 | 1 | Note 1 | 0.06 | Note 1 |
| SM2 | 1 1/2 | 1 1/4 | 1 11/16 | 1 | Note 1 | 0.10 | Note 1 |
| SM1 | 1 1/2 | 1 1/2 | 1 11/16 | 1 1/8 | Note 1 | 0.16 | Note 1 |
| 1 | 1 13/16 | 1 7/8 | 1 13/16 | 1 1/4 | 1 7/16 | 0.25 | Note 2 |
| 1A | 1 11/16 | 1 17/32 | 1 13/16 | 1 5/32 | 1 1/8 | 0.25 | Note 2 |
| 2 | 2 | 1 15/16 | 2 1/8 | 1 9/32 | 1 1/4 | 0.40 | Note 2 |
| 3 | 2 5/16 | 1 13/16 | 2 1/8 | 1 9/32 | 1 7/16 | 0.45 | Note 2 |
| 35 | 2 1/16 | 2 3/8 | 2 3/16 | 1 17/32 | 1 11/16 | 0.70 | Note 2 |
| 4 | 2 5/16 | 2 3/8 | 2 5/16 | 1 17/32 | 1 11/16 | 0.90 | Note 2 |
| 5 | 2 3/4 | 2 3/8 | 2 7/8 | 1 17/32 | 2 3/16 | 1.20 | Note 2 |
| 6 | 2 3/4 | 2 5/8 | 3 1/8 | 1 17/32 | 2 3/16 | 1.50 | Note 2 |
| 7 | 3 | 2 7/8 | 3 3/8 | 1 25/32 | 2 1/2 | 2.00 | Note 2 |
| 8 | 3 3/8 | 2 7/8 | 3 3/8 | 1 25/32 | 2 1/2 | 2.50 | Note 2 |
| 83 | 3 3/4 | 3 1/4 | 3 3/8 | 2 1/4 | 3 | 3.25 | Note 3 |
| 86 | 3 3/4 | 3 3/4 | 3 3/8 | 2 3/4 | 3 1/8 | 4.25 | Note 3 |
| 9 | 4 1/16 | 3 3/8 | 3 7/8 | 2 3/16 | 3 1/2 | 5.00 | Note 3 |
| 10 | 4 1/2 | 3 15/16 | 3 15/16 | 2 3/4 | 3 1/8 | 6.00 | Note 3 |

Note 1 —
SM Series are two hole mounting with holes on center line. #4-40 Pem nuts are fastened to the bracket.

Note 2 —
#6-32 Pem nuts on bracket are standard.

Note 3 —
#8-32 Pem nuts on bracket are standard.

- All primaries 380-1000 cps
- Dielectric test voltages:
  PRIMARIES 1500 Volts RMS
  SECONDARIES 1500 Volts RMS
- Epoxy resin used as encapsulant
- Prices subject to change without notice




STERLING TRANSFORMER CORPORATION
DEPT. EM, 510 DRIGGS AVENUE • BROOKLYN, NEW YORK 11211 • TELEPHONE: (212) 782-4200

# transistor transformers

STERLING TRANSFORMER

## UNIVERSAL DC POWER MODULE TRANSFORMERS

High reliability transformers having a tapped primary and single or dual secondary windings which may be connected F.W. bridge or F.W. center tap so as to obtain a wide range of DC voltages and current ratings.

**INPUT PRIMARY 115 volts 50-500 cps**

| TYPE | FIG. | | F.W. BRIDGE | | | | | | | | F.W. CT | | | MIL STD'D* HERM SEAL TF 45x02 | | INDUST. OPEN FRAME | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AC VOLT | 40 5 | 32.25 | 28.5 | 24 | 20.25 | 16 5 | 12 | 8.25 | 40.5 | 24 | 16.5 | | | | |
| | | DC VOLT | 53.0 | 41.0 | 34 | 25 | 24 | 18 | 12 | 6 | 24 | 12 | 6.6 | Style | Net Pr. | Style | Net Pr. |
| 7K1 | 1 | DC AMP | .025 | .035 | .040 | .042 | .055 | .042 | .070 | .085 | .042 | .055 | .068 | H | $22.85 | F | $13.99 |
| | | INPUT CAP | (.1) | (.1) | (.1) | (.1) | (.2) | (.2) | (.2) | (.2) | (.2) | (.2) | (.2) | | | | |
| 7K2 | 1 | DC AMP | .085 | .12 | .13 | .14 | .18 | .14 | .23 | .23 | .14 | .17 | .21 | H | 25.16 | L | 16.29 |
| | | INPUT CAP | (.1) | (.1) | (.1) | (.1) | (.2) | (.2) | (.2) | (.2) | (.2) | (.2) | (.2) | | | | |
| 7K3 | 1 | DC AMP | .48 | .60 | .60 | .64 | 1.0 | .8 | 1.2 | 1.52 | .8 | .883 | .92 | H | 28.08 | F | 14.44 |
| | | INPUT CAP | (.5) | (.5) | (.5) | (.5) | (1.0) | (1.0) | (2.0) | (2.0) | (1.0) | (1.0) | (2.0) | | | | |
| 7K4 | 1 | DC AMP | 1.2 | 1.5 | 1.5 | 1.6 | 2.5 | 2.0 | 3.0 | 3.8 | 2.0 | 2.2 | 2.8 | H | 38.61 | L | 23.73 |
| | | INPUT CAP | (.5) | (.5) | (.5) | (.5) | (1.0) | (1.0) | (2.0) | (2.0) | (1.0) | (1.0) | (2.0) | | | | |
| 7K5 | 1 | DC AMP | 3.0 | 3.5 | 3.8 | 4.0 | 6.0 | 4.5 | 7.5 | 9.0 | 4.5 | 5.5 | 6.7 | H | 56.16 | L | 40.14 |
| | | INPUT CAP | (1.0) | (1.0) | (1.0) | (1.0) | (2.0) | (2.0) | (4) | (4) | (2.0) | (2.0) | (2.0) | | | | |
| 7K6 | 1 | DC AMP | 7.5 | 8.5 | 9.5 | 10 | 15 | 11 | 19 | 23 | 11 | 13.5 | 17 | H | 93.53 | L | 64.10 |
| | | INPUT CAP | (4.0) | (4.0) | (4.0) | (4.0) | (4.0) | (6.0) | (12) | (12) | (6) | (6) | (12) | | | | |
| TYPE | FIG. | AC VOLTS | 81 | 64.5 | 57.0 | 48 | 40.5 | 33 | 24 | 16 5 | 81 | 48 | 33 | | | | |
| | | DC VOLT | 106 | 82 | 68 | 50 | 48 | 36 | 24 | 12 | 48 | 24 | 13 | | | | |
| 7K7 | 2 | DC AMP | 0.6 | 0.75 | 0.75 | 0.8 | 1.25 | 1.0 | 1.5 | 1.9 | 1.0 | 1.1 | 1.4 | H | 39.73 | L | 24.81 |
| | | INPUT CAP | (.125) | (.125) | (.125) | (.125) | (.25) | (.25) | (.5) | (0.5) | (.25) | (.25) | (.5) | | | | |

| TYPE | FIG. | PRI TAP | F.W. BRIDGE SEC. AC Volt | SEC. AC Amp | CHOKE INPUT DC Volt | CHOKE INPUT DC Amp | CAP INPUT DC Volt | CAP INPUT DC Amp | CAP INPUT Cap | F.W. CT CHOKE INPUT DC Volt | CHOKE INPUT DC Amp | CAP INPUT DC Volt | CAP INPUT DC Amp | CAP INPUT Cap | MIL STD * HERM SEAL Style | MIL STD * HERM SEAL Net Pr. | INDUST. OPEN FRAME Style | INDUST. OPEN FRAME Net Pr. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7K8 | 3 | — | 20CT | 0.3 | 16.5 | 0.3 | 26 | 0.2 | (.2) | 8 | 0.43 | 12 | 0.3 | (.5) | H | $19.93 | F | $10.09 |
| 7K9 | 3 | — | 20CT | 0.6 | 16.5 | 0.6 | 26 | 0.4 | (.4) | 9 | 0.85 | 13 | 0.6 | (1.0) | H | 25.16 | F | 15.33 |

| | | | F.W. BRIDGE SEC. in PARALLEL CONN. | | | | | | SEC. in SERIES CONN. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7K10 | 4 | L | 17 | 1.5 | 14 | 3.0 | 18.5 | 2.0 | (1.0) | 28 | 1.5 | 45 | 1 | (.5) | H | $36.31 | L | $23.73 |
| | | H | 21.5 | 1.5 | 17.5 | 3.0 | 25 | 2.0 | (1.0) | 35 | 1.5 | 36 | 1 | (.5) | | | | |
| 7K11 | 4 | L | 17 | 4 | 14 | 8.0 | 18.5 | 5.0 | (2.0) | 28 | 4.0 | 45 | 2.5 | (1.0) | H | 58.45 | L | 41.81 |
| | | H | 21.5 | 4 | 17.5 | 8.0 | 25 | 5.0 | (2.0) | 35 | 4.0 | 36 | 2.5 | (1.0) | | | | |
| 7K12 | 4 | L | 17 | 9 | 14 | 18.0 | 18.5 | 12.0 | (6.0) | 28 | 9.0 | 45 | 6 | (4.0) | H | 89.45 | L | 65.72 |
| | | H | 21.5 | 9 | 17.5 | 18.0 | 25 | 12.0 | (6.0) | 35 | 9.0 | 36 | 6 | (4.0) | | | | |
| 7K13 | 4 | L | 34 | 4.5 | 28 | 9.0 | 43 | 6.0 | (4.0) | 56 | 4.5 | 85 | 3 0 | (1.0) | H | 89.45 | L | 65.73 |
| | | H | 43 | 4.5 | 35 | 9.0 | 56 | 6.0 | (4.0) | 70 | 4.5 | 110 | 3.0 | (1.0) | | | | |
| 7K14 | 4 | L H | 10 | 20 | 8.2 | 20 | 10 | 13 | (12) | — | — | — | — | — | H | 52.60 | L | 40.67 |

*FOR MILITARY USE REDUCE DC AMP 20%. Note Input Cap = (K) 1000 MFD. in Rectifier Circuit.

## HIGH CURRENT TRANSFORMERS AND CHOKES

115V. 50-500 CPS

### TRANSFORMERS

| TYPE | FIG. | SEC. IN PARALLEL AC Volt | SEC. IN PARALLEL AC Amp | SEC. IN SERIES AC Volt | SEC. IN SERIES AC Amp | Net Price |
|---|---|---|---|---|---|---|
| 7K15 | 5 | 3.2/6.4 | 16 | 3.2/6.4/9.6/12.8 | 8 | $15.20 |
| 7K16 | 5 | 3.2/6.4 | 24 | 3.2/6.4/9.6/12.8 | 12 | 18.01 |
| 7K17 | 5 | 3.2/6.4* | 50 | 3.2/6.4/9.6/12.8 | 25 | 38.06 |
| 7K18 | 5 | 3.2/6.4 | 100 | 3.2/6.4/9.6/12.8 | 50 | 52.28 |
| 7K19 | 5 | 6/12 | 16 | 6/12/18/24 | 8 | 25.27 |
| 7K20 | 5 | 6/12 | 24 | 6/12/18/24 | 12 | 31.61 |

| TYPE | FIG. | SEC. IN PARALLEL AC Volt | SEC. IN PARALLEL AC Amp | SEC. IN SERIES AC Volt | SEC. IN SERIES AC Amp | Net Price |
|---|---|---|---|---|---|---|
| 7K21 | 5 | 6/12 | 50 | 6/12/18/24 | 25 | $50.54 |
| 7K22 | 5 | 6/12 | 100 | 6/12/18/24 | 50 | 75.78 |
| 7K23 | 5 | 9/18 | 16 | 9/18/27/36 | 8 | 33.31 |
| 7K24 | 5 | 9/18 | 24 | 9/18/27/36 | 12 | 32.10 |
| 7K25 | 5 | 9/18 | 50 | 9/18/27/36 | 25 | 62.60 |
| 7K26 | 5 | 9/18 | 100 | 9/18/27/36 | 50 | 90.60 |

### CHOKES

| TYPE | FIG. | INDUCTANCE (Millihenries) | D.C. Amps | DCR (Ω) | Net Price |
|---|---|---|---|---|---|
| 7K27 | 9 | 30 | 8 | 0.3 | $22.85 |
| 7K28 | 9 | 15 | 12 | 0.1 | 29.49 |

| TYPE | FIG. | INDUCTANCE (Millihenries) | D.C. Amps | DCR (Ω) | Net Price |
|---|---|---|---|---|---|
| 7K29 | 9 | 5 | 25 | 0.025 | $46.30 |
| 7K30 | 9 | 1.4 | 50 | 0.01 | 63.00 |

STERLING TRANSFORMER CORP.
DEPT. EM, 510 DRIGGS AVENUE • BROOKLYN, NEW YORK 11211 • TELEPHONE: (212) 782-4200

STERLING TRANSFORMER

# transistor transformers

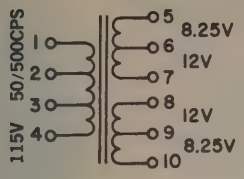


FIG. 1

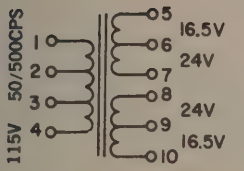


FIG. 2

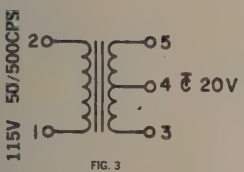


FIG. 3

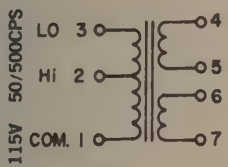


FIG. 4

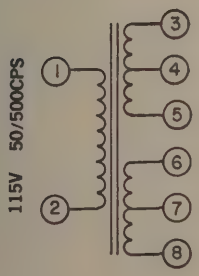


FIG. 5

| TYPE | STYLE | FIG. | L | W | H | M1 | M2 | MTG. HOLES | STUDS |
|---|---|---|---|---|---|---|---|---|---|
| 7K1 | H | 8 | 1 5/16 | 1 5/16 | 1 3/4 | 1 1/4 | — | — | (2) 6-32 |
| | F | 6 | 2 1/8 | 1 1/4 | 1 1/4 | 1 3/4 | — | (2) 3/16 | — |
| 7K2 | H | 8 | 1 5/8 | 1 5/8 | 2 3/8 | 1 3/16 | 1 3/16 | — | (4) 6-32 |
| | L | 7 | 1 3/8 | 1 5/8 | 2 1/8 | 1 1/16 | 1 3/8 | (4) 5/32 | — |
| 7K3 | H | 8 | 2 5/16 | 2 1/16 | 3 1/8 | 1 11/16 | 1 7/16 | — | (4) 6-32 |
| | F | 6 | 3 3/4 | 2 | 2 5/16 | 3 1/8 | — | (2) 3/16 | — |
| 7K4 | H | 8 | 3 1/16 | 2 5/8 | 4 1/4 | 2 19/64 | 1 55/64 | — | (4) 8-32 |
| | L | 7 | 2 7/8 | 2 5/8 | 3 7/16 | 2 1/4 | 2 1/8 | (4) 13/64 | — |
| 7K5 | H | 8 | 3 15/16 | 3 3/8 | 5 1/4 | 3 | 2 7/16 | — | (4) 10-32 |
| | L | 7 | 3 7/8 | 3 1/2 | 4 5/8 | 3 | 2 1/2 | (4) 13/64 | — |
| 7K6 | H | 8 | 5 1/2 | 4 1/2 | 6 3/4 | 3 3/4 | 3 | — | (4) 1/4-20 |
| | L | 7 | 4 7/16 | 4 1/2 | 5 3/8 | 3 1/2 | 3 3/8 | (4) 9/32 | — |
| 7K7 | H | 8 | 3 1/16 | 2 5/8 | 4 1/4 | 2 19/64 | 1 55/64 | — | (4) 8-32 |
| | L | 7 | 2 7/8 | 2 5/8 | 3 7/16 | 2 1/4 | 2 1/8 | (4) 13/64 | — |
| 7K8 | H | 8 | 1 15/16 | 1 13/16 | 2 7/16 | 1 3/8 | 1 1/4 | — | (4) 6-32 |
| | F | 6 | 2 7/8 | 1 1/2 | 1 11/16 | 2 3/8 | — | (2) 3/16 | — |
| 7K9 | H | 8 | 1 15/16 | 1 13/16 | 2 3/4 | 1 3/8 | 1 1/4 | — | (4) 6-32 |
| | F | 6 | 3 5/16 | 2 1/4 | 2 | 2 13/16 | — | (2) 3/16 | — |
| 7K10 | H | 8 | 3 1/16 | 2 5/8 | 4 1/4 | 2 19/64 | 1 55/64 | — | (4) 8-32 |
| | L | 7 | 2 7/8 | 2 1/2 | 3 7/16 | 2 1/4 | 2 | (4) 13/64 | — |
| 7K11 | H | 8 | 4 5/16 | 3 11/16 | 5 9/16 | 3 5/16 | 2 11/16 | — | (4) 10-32 |
| | L | 7 | 3 7/8 | 3 5/8 | 4 5/8 | 3 5/16 | 2 3/4 | (4) 13/64 | — |
| 7K12 | H | 8 | 5 7/8 | 4 3/4 | 6 11/16 | 4 1/8 | 3 1/2 | — | (4) 1/4-20 |
| | L | 7 | 4 1/2 | 5 1/4 | 5 3/8 | 3 1/2 | 4 1/8 | (4) 9/32 | — |
| 7K13 | H | 8 | 5 7/8 | 4 3/4 | 6 11/16 | 4 1/8 | 3 1/2 | — | (4) 1/4-20 |
| | L | 7 | 4 1/2 | 5 1/4 | 5 3/8 | 3 1/2 | 4 1/8 | (4) 9/32 | — |
| 7K14 | H | 8 | 3 15/16 | 3 3/8 | 5 1/4 | 3 | 2 7/16 | — | (4) 10-32 |
| | L | 7 | 3 7/8 | 3 1/2 | 4 5/8 | 3 | 2 1/2 | (4) 13/64 | — |
| 7K15 | L | 9 | 3 13/16 | 3 | 3 3/16 | 3 1/8 | 2 1/4 | (4) 13/64 | — |
| 7K16 | L | 9 | 4 3/16 | 3 1/4 | 3 1/2 | 3 7/16 | 2 3/8 | (4) 13/64 | — |
| 7K17 | L | 9 | 5 3/8 | 4 1/4 | 4 5/8 | 4 3/8 | 2 7/8 | (4) 9/32 | — |
| 7K18 | L | 9 | 5 3/8 | 5 3/4 | 4 5/8 | 4 3/8 | 4 1/8 | (4) 9/32 | — |
| 7K19 | L | 9 | 4 3/16 | 3 7/8 | 3 1/2 | 3 7/16 | 3 | (4) 13/64 | — |
| 7K20 | L | 9 | 4 9/16 | 4 1/2 | 3 7/8 | 3 3/4 | 3 3/8 | (4) 13/64 | — |
| 7K21 | L | 9 | 5 3/8 | 5 3/4 | 4 5/8 | 4 3/8 | 4 1/8 | (4) 9/32 | — |
| 7K22 | L | 9 | 6 1/2 | 6 3/8 | 5 5/8 | 5 5/16 | 4 3/8 | (4) 9/32 | — |
| 7K23 | L | 9 | 4 9/16 | 4 3/8 | 3 7/8 | 3 3/4 | 3 3/8 | (4) 13/64 | — |
| 7K24 | L | 9 | 5 3/8 | 4 7/8 | 4 5/8 | 4 3/8 | 3 3/8 | (4) 9/32 | — |
| K725 | L | 9 | 6 1/2 | 6 | 5 5/8 | 5 5/16 | 3 3/4 | (4) 9/32 | — |
| 7K26 | L | 9 | 6 1/2 | 7 3/4 | 5 5/8 | 5 5/16 | 5 1/8 | (4) 9/32 | — |
| 7K27 | L | 9 | 4 3/16 | 3 5/8 | 3 1/2 | 3 7/16 | 3 | (4) 13/64 | — |
| 7K28 | L | 9 | 5 3/8 | 4 1/4 | 4 5/8 | 4 3/8 | 3 1/8 | (4) 9/32 | — |
| 7K29 | L | 9 | 5 3/8 | 4 3/4 | 4 5/8 | 4 3/8 | 3 7/8 | (4) 9/32 | — |
| 7K30 | L | 9 | 6 1/2 | 5 3/4 | 5 5/8 | 5 5/16 | 4 1/8 | (4) 9/32 | — |

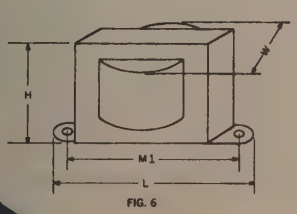


FIG. 6

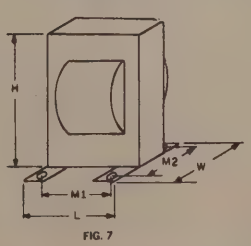


FIG. 7

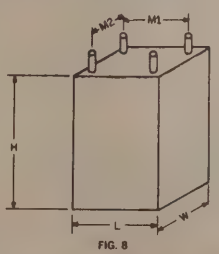


FIG. 8

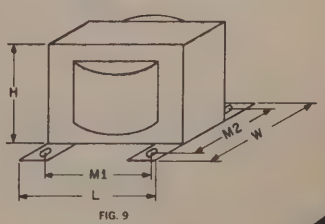


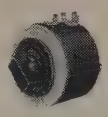
FIG. 9

STERLING TRANSFORMER CORP.
DEPT. EM, 510 DRIGGS AVENUE • BROOKLYN, NEW YORK 11211 • TELEPHONE: (212) 782-4200

# POWERSTAT® Variable Transformers now

New epoxy-coated POWERKOTE Coils make the POWERSTAT line the most outstanding value in variable transformers today. *Without increase in price, size or weight,* only POWERSTAT Variable Transformers give an average of 20% higher current ratings, 10:1 greater overload capability, longer life, greater resistance to fungus, salt spray and other contaminating atmospheres. POWERKOTE Coil commutator bars are embedded in place preventing steady-state operating temperature and severe overloads from distorting the commutator.

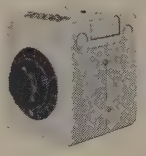
POWERSTAT Variable Transformers are designed to deliver continuously adjustable voltage from a-c power lines. They introduce no waveform distortion and feature rugged construction, precious metal plated commutators, excellent regulation, high efficiency and conservative ratings. All manually operated types listed in the charts except the 10B-12, EN116B-EN216B and EN117B-EN217B Series are available with motor drives if desired. Motor-driven speeds are 5, 15, 30 or 60 seconds for full range travel on all except types having -4, -5, or -6 suffixes which do not offer the 5-second speed. Single types in the 116B-216B, 117B-217B, 126-226 and 136B-236B Series are also offered with 2- or 3-wire cord-plug sets. 1156D-1256D Series types are available in ratings to 244 kva.



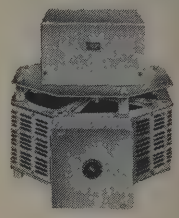
TYPE 10B

TYPE 21

TYPE 136BT



TYPE EN216B



TYPE 5MB1156DT

## RATINGS AND SPECIFICATIONS

| INPUT Volts | INPUT Hertz | OUTPUT Volts | Const. Current Load Max. Amp. | Const. Current Load Max. KVA | Const. Impedance Load Max. Amp. | Const. Impedance Load Max. KVA | TYPE | Ship. Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|
| **10B-12 SERIES** | | | | | | | | |
| **Single Phase** | | | | | | | | |
| 120 | 50/60 | 0-120 | 2.25* | 0.27 | 3. | 0.36 | ✓ 10B | 2½ |
| 120 | 60 | 0-132 | 2.25* | 0.30 | — | — | | |
| 240 | 50/60 | 0.240 | 0.7* | 0.17 | 0.9‡ | 0.22 | ✓ 12 | 2½ |
| 240 | 50/60 | 0-264 | 0.5** | 0.13 | — | — | | |
| 240 | 50/60 | 0.240 | 2.25* | 0.54 | 3‡ | 0.72 | 10B-2 | 6 |
| 240 | 60 | 0-264 | 2.25* | 0.59 | — | — | | |
| 480 | 50/60 | 0-480 | 0.7* | 0.34 | 0.9‡ | 0.43 | 12-2 | 6 |
| 480 | 50/60 | 0-528 | 0.5** | 0.26 | — | — | | |
| **Three Phase** | | | | | | | | |
| 120 | 50/60 | 0-120 | 2.25* | 0.47 | 3‡ | 0.62 | 10B-2 | 6 |
| 120 | 60 | 0-132 | 2.25* | 0.51 | — | — | | |
| 240 | 50/60 | 0-240 | 0.7* | 0.29 | 0.9‡ | 0.37 | 12-2 | 6 |
| 240 | 50/60 | 0-264 | 0.5** | 0.23 | — | — | | |
| 240 | 60 | 0-240 | 2.25* | 0.94 | 3‡ | 1.2 | 10B-3 | 8½ |
| 480 | 50/60 | 0.480 | 0.7* | 0.58 | 0.9‡ | 0.75 | 12-3 | 8½ |
| 480 | 60 | 0-528 | 0.5** | 0.46 | — | — | | |
| **21-22 SERIES** | | | | | | | | |
| **Single Phase** | | | | | | | | |
| 120 | 50/60 | 0-120 | 4.5 | 0.54 | 6.5 | 0.78 | ✓ 21 | 6 |
| 120 | 50/60 | 0-140 | 4.5 | 0.63 | — | — | | |
| 240 | 50/60 | 0.240 | 2.25 | 0.54 | 3.25 | 0.78 | ✓ 22 | 6 |
| 240 | 50/60 | 0.280 | 2.25 | 0.63 | — | — | | |
| 240 | 50/60 | 0-240 | 4.5 | 1.1 | 6.5 | 1.6 | ✓ 21-2 | 13½ |
| 240 | 50/60 | 0-280 | 4.5 | 1.3 | — | — | | |
| 480 | 50/60 | 0-480 | 2.25 | 1.1 | 3.25 | 1.6 | 22-2 | 13½ |
| 480 | 50/60 | 0-560 | 2.25 | 1.3 | — | — | | |
| **Three Phase** | | | | | | | | |
| 120 | 50/60 | 0-120 | 4.5 | 0.94 | 6.5 | 1.4 | 21-2 | 13½ |
| 120 | 50/60 | 0-140 | 4.5 | 1.1 | — | — | | |
| 240 | 50/60 | 0-240 | 2.25 | 0.94 | 3.25 | 1.4 | 22-2 | 13½ |
| 240 | 50/60 | 0-280 | 2.25 | 1.1 | — | — | | |
| 240 | 50/60 | 0-240 | 4.5 | 1.9 | 6.5 | 2.7 | 21-3 | 19 |
| 240 | 60 | 0-280 | 4.5 | 2.2 | — | — | | |
| 480 | 50/60 | 0-480 | 2.25 | 1.9 | 3.25 | 2.7 | ✓ 22-3 | 19 |
| 480 | 60 | 0-560 | 2.25 | 2.2 | — | — | | |

| INPUT Volts | INPUT Hertz | OUTPUT Volts | Const. Current Load Max. Amp. | Const. Current Load Max. KVA | Const. Impedance Load Max. Amp. | Const. Impedance Load Max. KVA | TYPE | Ship. Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|
| **116B-216B and 117B-217B SERIES†** | | | | | | | | |
| **Single Phase** | | | | | | | | |
| 120 | 50/60 | 0-120 | 10 | 1.2 | 13 | 1.6 | ✓ 116B | 12 |
| 120 | 50/60 | 0-140 | 10 | 1.4 | — | — | | |
| 120 | 60 | 0-120 | 12 | 1.4 | 15 | 1.8 | ✓ 117BT | 12 |
| 240 | 50/60 | 0-240 | 3.5 | 0.84 | 5 | 1.2 | ✓ 216B | 12 |
| 240 | 50/60 | 0-280 | 3.5 | 0.98 | — | — | | |
| 240 | 60 | 0-240 | 5 | 1.2 | 7 | 1.7 | ✓ 217BT | 12 |
| 240 | 50/60 | 0-240 | 10 | 2.4 | 13 | 3.1 | ✓ 116BT-2 | 24 |
| 240 | 50/60 | 0-280 | 10 | 2.8 | — | — | | |
| 240 | 60 | 0-240 | 12 | 2.9 | 15 | 3.6 | 117BT-2 | 24 |
| 480 | 50/60 | 0-480 | 3.5 | 1.7 | 5 | 2.4 | 216BT-2 | 24 |
| 480 | 50/60 | 0-560 | 3.5 | 2.0 | — | — | | |
| 480 | 60 | 0-480 | 5 | 2.4 | 7 | 3.4 | 217BT-2 | 24 |
| **Three Phase** | | | | | | | | |
| 120 | 50/60 | 0-120 | 10 | 2.1 | 13 | 2.7 | ✓ 116BT-2 | 24 |
| 120 | 50/60 | 0-140 | 10 | 2.4 | — | — | | |
| 120 | 60 | 0-120 | 12 | 2.5 | 15 | 3.1 | 117BT-2 | 24 |
| 240 | 50/60 | 0-240 | 3.5 | 1.5 | 5 | 2.1 | 216BT-2 | 24 |
| 240 | 50/60 | 0-280 | 3.5 | 1.7 | — | — | | |
| 240 | 60 | 0-240 | 5 | 2.1 | 7 | 2.9 | 217BT-2 | 24 |
| 240 | 50/60 | 0-240 | 10 | 4.2 | 13 | 5.4 | ✓ 116BT-3 | 36 |
| 240 | 60 | 0-280 | 10 | 4.8 | — | — | | |
| 240 | 60 | 0-240 | 12 | 5.0 | 15 | 6.2 | 117BT-3 | 36 |
| 480 | 50/60 | 0-480 | 3.5 | 2.9 | 5 | 4.2 | ✓ 216BU-3 | 36 |
| 480 | 60 | 0-560 | 3.5 | 3.4 | — | — | | |
| 480 | 60 | 0-480 | 5 | 4.2 | 7 | 5.8 | ✓ 217BU-3 | 36 |
| **EN116B-EN216B and EN117B-EN217B SERIES** | | | | | | | | |
| **Single Phase** | | | | | | | | |
| 120 | 50 60 | 0-120 | 8 | 0.96 | 13 | 1.6 | ✓ EN116B | 15 |
| 120 | 50 60 | 0-140 | 8 | 1.1 | — | — | | |
| 120 | 60 | 0-120 | 10 | 1.2 | 14.5 | 1.7 | ✓ EN117B | 15 |
| **Three Phase** | | | | | | | | |
| 480 | 50 60 | 0-480 | 3 | 2.5 | 4.5 | 3.7 | ✓ EN216B-3 | 39 |
| 480 | 60 | 0-560 | 3 | 2.9 | — | — | | |
| **40-VOLT SERIES** | | | | | | | | |
| **Single Phase** | | | | | | | | |
| 40 | 60 | 0-40 | 7 | 0.28 | 9 | 0.36 | ✓ 10B-40 | 3½ |
| | | | 18 | 0.72 | 22 | 0.88 | ✓ 21-40 | 6 |

**LW136B SERIES**

| INPUT Volts | INPUT Hertz | OUTPUT‡‡ Volts | Max. Amps. | Max. KVA | TYPE | Ship. Wt. Lbs. |
|---|---|---|---|---|---|---|
| **Single Phase** | | | | | | |
| 120 240 | 50 60 | 15-0-15 | 35 | 0.52 | ✓ LW136B | 25 |
| 120 240 | 50 60 | 0 30 | 25 | 0.75 | | |

‡‡LW136B Series ratings are for use as low voltage isolated output transformer

*Rating when mounted on metal panel. On bracket or nonmetallic panel, derate 10B Series to 1.75 amp., 12 Series to 0.5 amp.

‡Rating when mounted on metal panel. On bracket or nonmetallic panel, derate 10B Series to 2.5 amp., 12 Series to 0.75 amp.

**0.7 amp. maximum in range from 0 to line voltage when mounted on metal panel

†Also available with open construction. Suffix U when ordering

THE SUPERIOR ELECTRIC COMPANY

1000 MIDDLE STREET, BRISTOL, CONN. 06010
PHONE: (203) 582-9561

✓ AVAILABLE OFF-THE-SHELF FROM DISTRIBUTOR STOCK

# *with* POWERKOTE® COILS

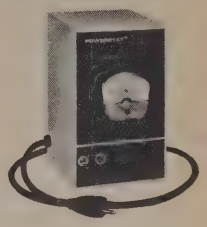
## STATIONARY METERED KNOB TYPES

Single units (those listed in charts without -2 or -3 suffixes) in the 116B-216B, 117B-217B, 126-226, 136B-236B and 146-246 series are also available with metered knobs. Stationary voltmeter does not turn with knob. Voltmeter accurate within ±3% of full scale and insensitive to stray magnetic fields. When ordering, add VS prefix to type number. *Back-of-panel* mounted types in the 21-22 through 146-246 series can be combined with Metered Knob Assemblies. Existing models can be retrofitted also. Assembly type VS150 has a 0-150 volt scale and type VS300 has 0-300. Types VS116B, VS3PN116B and VS3PN136B are available off-the-shelf from distributor stock.

| INPUT | | OUTPUT | | | | | | Ship. Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|
| | | | Const. Current Load | | Const. Impedance Load | | | |
| Volts | Hertz | Volts | Max. Amp. | Max. KVA | Max. Amp. | Max. KVA | TYPE | |
| **126-226 SERIES†** | | | | | | | | |
| **Single Phase** | | | | | | | | |
| 120 | 50/60 | 0-120 | 15 | 1 8 | 20 | 2 4 | ✓ 126 | 17 |
| 120 | 50/60 | 0-140 | 15 | 2.1 | — | — | | |
| 240 | 50/60 | 0-240 | 7.5 | 1.8 | 10 | 2.4 | ✓ 226 | 17 |
| 240 | 50/60 | 0-280 | 7.5 | 2.1 | — | — | | |
| 240 | 50/60 | 0-240 | 15 | 3.6 | 20 | 4.8 | 126-2 | 32 |
| 240 | 50/60 | 0 280 | 15 | 4.2 | — | — | | |
| 480 | 50/60 | 0-480 | 7 5 | 3.6 | 10 | 4 8 | ✓ 226U-2 | 32 |
| 480 | 50/60 | 0-560 | 7 5 | 4.2 | — | — | | |
| **Three Phase** | | | | | | | | |
| 120 | 50/60 | 0-120 | 15 | 3 1 | 20 | 4 2 | 126-2 | 32 |
| 120 | 50/60 | 0-140 | 15 | 3 6 | — | — | | |
| 240 | 50/60 | 0-240 | 7 5 | 3 1 | 10 | 4.2 | ✓ 226U-2 | 32 |
| 240 | 50/60 | 0-280 | 7 5 | 3 6 | — | — | | |
| 240 | 50/60 | 0-240 | 15 | 6 2 | 20 | 8.3 | 126-3 | 49 |
| 240 | 60 | 0-280 | 15 | 7 3 | — | — | | |
| 480 | 50/60 | 0-480 | 7.5 | 6 2 | 10 | 8.3 | ✓ 226T-3 | 49 |
| 480 | 60 | 0-560 | 7.5 | 7.3 | — | — | | |
| **136B-236B SERIES†** | | | | | | | | |
| **Single Phase** | | | | | | | | |
| 120 | 50/60 | 0-120 | 22 | 2 6 | 28 | 3 4 | ✓ 136B | 25 |
| 120 | 50/60 | 0 140 | 22 | 3.1 | — | — | | |
| 120 | 50/60 | 0-120 | 44 | 5.3 | 56 | 6 7 | 136B-2 § | 52 |
| 120 | 50/60 | 0-140 | 44 | 6 2 | — | — | | |
| 240 | 50/60 | 0-240 | 10 | 2.4 | 13 | 3 1 | ✓ 236B | 25 |
| 240 | 50/60 | 0-280 | 10 | 2 8 | — | — | | |
| 240 | 50/60 | 0-240 | 22 | 5.3 | 28 | 6 7 | ✓ 136B-2 | 52 |
| 240 | 50/60 | 0-280 | 22 | 6.2 | — | — | | |
| 480 | 50/60 | 0-480 | 20 | 4 8 | 26 | 6 2 | ✓ 236B-2 | 52 |
| 480 | 50/60 | 0-560 | 20 | 5.6 | — | — | | |
| **Three Phase** | | | | | | | | |
| 120 | 50/60 | 0-120 | 22 | 4 6 | 28 | 5 8 | ✓ 136B-2 | 52 |
| 120 | 50/60 | 0 140 | 22 | 5 3 | — | — | | |
| 240 | 50/60 | 0-240 | 10 | 4 2 | 13 | 5 4 | ✓ 236B-2 | 52 |
| 240 | 50/60 | 0-280 | 10 | 4 8 | — | — | | |
| 240 | 50/60 | 0-240 | 22 | 9 1 | 28 | 11 6 | ✓ 136B-3 | 76 |
| 240 | 60 | 0-280 | 22 | 10 7 | — | — | | |
| 480 | 50/60 | 0-480 | 10 | 8 3 | 13 | 10 8 | ✓ 236B-II | 76 |
| 480 | 60 | 0 560 | 10 | 9 7 | — | — | | |
| **146-246 SERIES†** | | | | | | | | |
| **Single Phase** | | | | | | | | |
| 120 | 50/60 | 0-120 | 30 | 3.6 | 35 | 4 2 | ✓ 146 | 38 |
| 120 | 50/60 | 0-140 | 30 | 4.2 | — | — | | |
| 120 | 50/60 | 0-120 | 60 | 7.2 | 70 | 8.4 | 146-2 §§ | 83 |
| 120 | 50/60 | 0-140 | 60 | 8.4 | — | — | | |
| 240 | 50/60 | 0-240 | 15 | 3 6 | 19 | 4.6 | ✓ 246 | 38 |
| 240 | 50/60 | 0-280 | 15 | 4 2 | — | — | | |
| 240 | 50/60 | 0-240 | 30 | 7.2 | 35 | 8.4 | 146-2 | 83 |
| 240 | 50/60 | 0-280 | 30 | 8.4 | — | — | | |
| 480 | 50/60 | 0-480 | 15 | 7.2 | 19 | 9 1 | 246-2 | 83 |
| 480 | 50/60 | 0-560 | 15 | 8.4 | — | — | | |

## ENCLOSED LABORATORY TYPES

TYPE N116B



TYPE N116BK

Portable 120 volt, single-phase units having grounded NEMA cord-plug assembly, on-off switch, output receptacle, pilot light and fuse, recessed panel controls and integral handle. Slot at rear for wall hanger brackets. Type N10B rated 0-132 volts, 1.75 amp; type N21 rated 0-140 volts, 4.5 amp; type N116B and N116BK rated 0-140 volts, 10 amp. Type N116BK has knob with nonturning voltmeter to conveniently measure load voltage without necessity of providing separate units. All available off-the-shelf from distributor stock.

| INPUT | | OUTPUT | | | | | | Ship. Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|
| | | | Const. Current Load | | Const. Impedance Load | | | |
| Volts | Hertz | Volts | Max. Amps. | Max. KVA | Max. Amps. | Max. KVA | TYPE | |
| **146-246 SERIES† (contd.)** | | | | | | | | |
| **Three Phase** | | | | | | | | |
| 120 | 50/60 | 0-120 | 30 | 6 2 | 35 | 7 3 | 146 2 | 83 |
| 120 | 50/60 | 0 140 | 30 | 7 3 | — | — | | |
| 240 | 50/60 | 0-240 | 15 | 6 2 | 19 | 7 9 | 246 2 | 83 |
| 240 | 50/60 | 0 280 | 15 | 7 3 | — | — | | |
| 240 | 50/60 | 0 240 | 30 | 12 5 | 35 | 14 5 | 146 3 | 125 |
| 240 | 60 | 0 280 | 30 | 14 5 | — | — | | |
| 480 | 50/60 | 0 480 | 15 | 12 5 | 19 | 15 8 | 246 3 | 125 |
| 480 | 60 | 0 560 | 15 | 14 5 | — | — | | |
| **1156D-1256D SERIES†** | | | | | | | | |
| **Single Phase** | | | | | | | | |
| 120 | 50/60 | 0 120 | 50 | 6 0 | 55 | 6 6 | ✓ 1156D | 82 |
| 120 | 50/60 | 0 140 | 50 | 7 0 | — | — | | |
| 120 | 50/60 | 0 120 | 100 | 12 0 | 110 | 13 2 | 1156D 2P | 169 |
| 120 | 50/60 | 0 140 | 100 | 14 0 | — | — | | |
| 120 | 50/60 | 0 120 | 150 | 18 0 | 165 | 19 8 | 1156D 3P | 272 |
| 120 | 50/60 | 0 140 | 150 | 21 0 | — | — | | |
| 240 | 50/60 | 0 240 | 28 | 6 7 | 28 | 6 7 | ✓ 1256D | 82 |
| 240 | 50/60 | 0 280 | 28 | 7 8 | — | — | | |
| 240 | 50/60 | 0 240 | 50 | 12 0 | 55 | 13 2 | 1156D 2S | 156 |
| 240 | 50/60 | 0 280 | 50 | 14 0 | — | — | | |
| 240 | 50/60 | 0 240 | 56 | 13 4 | 56 | 13 4 | ✓ 1256D 2P | 169 |
| 240 | 50/60 | 0 280 | 56 | 15 7 | — | — | | |
| 240 | 50/60 | 0 240 | 84 | 20 2 | 84 | 20 2 | 1256D 3P | 272 |
| 240 | 50/60 | 0 280 | 84 | 23 5 | — | — | | |
| 240 | 50/60 | 0 240 | 100 | 24 0 | 110 | 26 4 | 1156D 4PS | 361 |
| 240 | 50/60 | 0 280 | 100 | 28 0 | — | — | | |
| 480 | 50/60 | 0 480 | 28 | 13 4 | 28 | 13 4 | ✓ 1256D 2S | 156 |
| 480 | 50/60 | 0 560 | 28 | 15 7 | — | — | | |
| 480 | 50/60 | 0 480 | 56 | 26 9 | 56 | 26 9 | 1256D 4PS | 361 |
| 480 | 50/60 | 0 560 | 56 | 31 4 | — | — | | |
| **Three Phase** | | | | | | | | |
| 120 | 50/60 | 0 120 | 50 | 10 4 | 55 | 11 4 | 1156D 2D | 155 |
| 120 | 50/60 | 0-140 | 50 | 12 1 | — | — | | |
| 240 | 50/60 | 0 240 | 28 | 11 6 | 28 | 11 6 | ✓ 1256D 2D | 155 |
| 240 | 50/60 | 0 280 | 28 | 13 6 | — | — | | |
| 240 | 50/60 | 0 240 | 50 | 20 8 | 55 | 22 9 | ✓ 1156D 3Y | 230 |
| 240 | 60 | 0-280 | 50 | 24 2 | — | — | | |
| 240 | 50/60 | 0 240 | 100 | 41 6 | 110 | 45 7 | 1156D 6Y | 507 |
| 240 | 50/60 | 0 280 | 100 | 48 5 | — | — | | |
| 480 | 50/60 | 0 480 | 28 | 23 3 | 28 | 23 3 | ✓ 1256D-3Y | 235 |
| 480 | 60 | 0 560 | 28 | 27 2 | — | — | | |
| 480 | 50/60 | 0 480 | 56 | 46 6 | 56 | 46 6 | 1256D 6Y | 507 |
| 480 | 60 | 0 560 | 56 | 54 3 | — | — | | |

†Also available with open construction. Suffix U when ordering.
§Requires also one paralleling choke type T5000.
§§Requires also one paralleling choke type T6053.

✓ AVAILABLE OFF-THE-SHELF FROM DISTRIBUTOR STOCK

*other series:*

LINE CORRECTORS • OIL-COOLED •

# *Technitrol* -TOTAL TRANSFORMER CAPABILITIES

For over 30 years, Technitrol and its merged groups have originated many advanced transformer designs, and are constantly pushing the state-of-the-art. Recent examples of this are the **three-phase ferroresonant,** the DIP concept and inhouse original transformer computer design programs. When a critical component means the difference between a clean circuit design and a compromised functional approach, you'll welcome the Technitrol engineering ability on your team.

Technitrol's size and excellence means the following to you: availability of the latest technology, total manufacturing capability and that can-do factor that gets you the component you need, on time, meeting specifications and at a competitive price.

Contact the Technitrol Rep nearest you or the factory direct and see how Technitrol can best supply your transformer needs.

**Transformers and Inductors**

Audio (input, interstage, output)
Autotransformers
Bell
Bias
Bridging
Chopper
Communications Line
Constant-voltage
Control (synchro)
CRT (horizontal, vertical, power)
Current (instrument, limiting)
Decade
Differential
Discriminator
Donut (toroidal)
Ferroresonant (one $\phi$, three $\phi$)
Filament
Foil Wound
High Voltage
Hum Reducing
Inductance Neutralizing
Instrument
Inverter
Isolator
Low Frequency
Magnetic Amplifiers
Multiple Wound
Matching (impedance)
Microphone
Miniature (and microminiature)
Mixing
Modulation
PC Mounting
Phase
Photoflash
Plate
Plug-in
Power
Power-line
Pulse
Rotary
Saturable
Scott-T
Servo
Subminiature Pulse
Synchro (control)
Telephone (coupling)
Toroidal
Trigger
Ultrasonic
Vibrator
Voltage (dividing, regulating)
X-rays

**TYPICAL TECHNITROL QUALITY ASSURANCE PROGRAMS**

MIL-T-27
MIL-C-45662 (Calibration)
MIL-C-15305
MIL-T-21038
MIL-STD-105
MIL-I-45208
NHB 5300.4 (1C)

**. . . and other applicable military and commercial standards**

**TYPICAL TECHNITROL COMPONENT APPLICATIONS**

- **Avionics/Aerospace**
- **Commercial/Consumer (UL, CSA, CEE)**
- **Communications**
- **Computers/Peripherals**
- **Industrial Controls**
- **Instrumentation**
- **Medical Electronics**
- **Military (MIL-T)**

**ACTIVE ASSISTANCE BEFORE, DURING AND AFTER RECEIVING YOUR ORDER.**

*Technitrol, Inc.*

DEPT. EM 1952 E. Allegheny Avenue
Philadelphia, Pa. 19134 (215) 426-9105

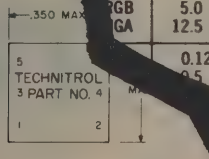
# Technitrol, Inc.

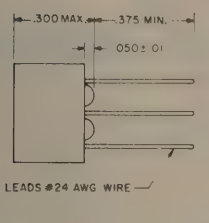
## CASES

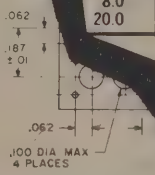
### G CASE TRANSFORM

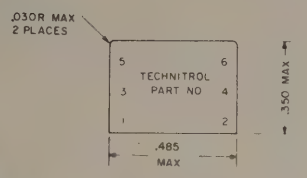
**Standard** (Designed for optimum

| Turns Ratio / Tolerance ± 5% | Part No. | Lm mh ± 20% | Leakage Inductance Max. Value in μh $L_1$ ($N_1$-$N_2$) | $L_1$ ($N_1$-$N_3$) | Ma… R($N_1$) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1:1:1 | 11GGA | 0.12 | 0.5 | 0.5 | 1.0 | 1.… | | | | |
| | 11KGB | 0.5 | 0.7 | 0.7 | 1.9 | 1.9 | | | | |
| | 11NGB | 1.4 | 0.9 | 0.9 | 2.9 | 2.9 | | | | |
| | 11RGD | 5.0 | 2.2 | 2.2 | 5.3 | 5.3 | 5.… | | | |
| | 11UGA | 12.5 | 3.0 | 3.0 | 8.9 | 8.9 | 8.9 | | | |
| 2:1:1 | 21GGA | 0.12 | 1.4 | 1.5 | 1.0 | 0.6 | 0.6 | | | |
| | 21KGA | 0.5 | 2.4 | 2.5 | 1.9 | 1.0 | 1.0 | | | |
| | 21NGB | 1.4 | 2.6 | 2.7 | 2.9 | 1.6 | 1.6 | | | |
| | 21RGA | 5.0 | 7.0 | 9.1 | 5.3 | 2.9 | 2.9 | | | |
| | 21UGA | 12.5 | 12.0 | 14.5 | 8.9 | 4.6 | 4.6 | 57.5 | 3… | |
| | 31GGA | 0.12 | 2.0 | 2.1 | 1.0 | 0.5 | 0.5 | 7.9 | 7.… | |
| | …KGA | 0.5 | 3.8 | 3.9 | 1.9 | 0.8 | 0.8 | 13.8 | 12.4 | |
| | …NGA | 1.3 | 5.1 | 5.2 | 2.9 | 1.2 | 1.2 | 15.9 | 14.1 | |
| | …GB | 5.0 | 6.7 | 7.8 | 5.3 | 2.0 | 2.0 | 31.6 | 26.1 | |
| | …GA | 12.5 | 13.3 | 15.0 | 8.9 | 3.2 | 3.2 | 43.5 | 36.2 | 15 |
| | | 0.12 | 1.3 | 2.4 | 1.0 | 1.0 | 0.5 | 11.1 | 6.9 | 5 |
| | | 0.5 | 1.4 | 2.5 | 1.9 | 1.9 | 0.8 | 19.9 | 11.4 | 7 |
| | | | 1.5 | 3.6 | 2.9 | 2.9 | 1.2 | 28.6 | 14.8 | 8 |
| | | | 4.5 | 9.0 | 5.3 | 5.3 | 2.0 | 49.5 | 24.7 | 13 |
| | | | 12.5 | 14.0 | 8.9 | 8.9 | 3.2 | 75.0 | 40.0 | 16 |
| | | | 1.2 | 2.8 | 1.0 | 0.6 | 0.5 | 8.9 | 6.5 | 5 |
| | | | | 3.4 | 1.9 | 1.0 | 0.6 | 13.4 | 9.0 | 6 |
| | | | | 6.5 | 2.9 | 1.6 | 0.9 | 20.3 | 12.8 | 8 |
| | | | | 8.0 | 5.3 | 2.9 | 1.4 | 34.1 | 20.1 | 11 |
| | | | | 20.0 | 8.9 | 4.6 | 2.4 | 55.0 | 30.0 | 12 |

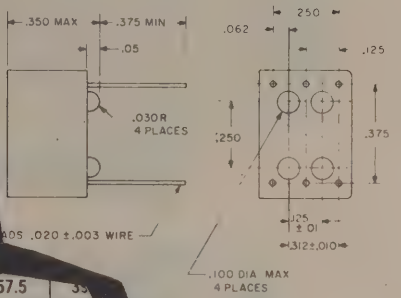


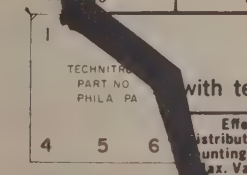

Z CASE




CASE

### …ICED CENTER TAPPED TRANSFORMERS

| …Resistance | Interwinding Cap. Max. Value in pf $C_1$ ($N_1$-$N_3$) | Effective Distributed Capacity Shunting winding $N_1$ Max. Value in pf $C_{11}$ (1, 6 gnd) | ET Rating volt-μsec Minimum | |
|---|---|---|---|---|
| | …30 | 9 | 30 | |
| | …54 | 11 | 55 | |
| | …25 | 14 | 96 | |
| | …40 | 21 | 180 | |




…with temperature.)

| Effective …istributed Capacity …unting winding $N_1$ …ax. Value in pf $C_{11}$ (2 gnd) | ET Rating volt-μsec Minimum | CASES other cases available on applicati… |
|---|---|---|
| 6.5 | 213 | A, K |
| 8.5 | 340 | A, K |
| 3.0 | 470 | A, K |
| 6.5 | 213 | A, K |
| 2.0 | 340 | A, K |
| 6.0 | 470 | A, K |
| .0 | 213 | A, K |
| .0 | 340 | A, K |
| | 470 | A, K |
| | | A, K |

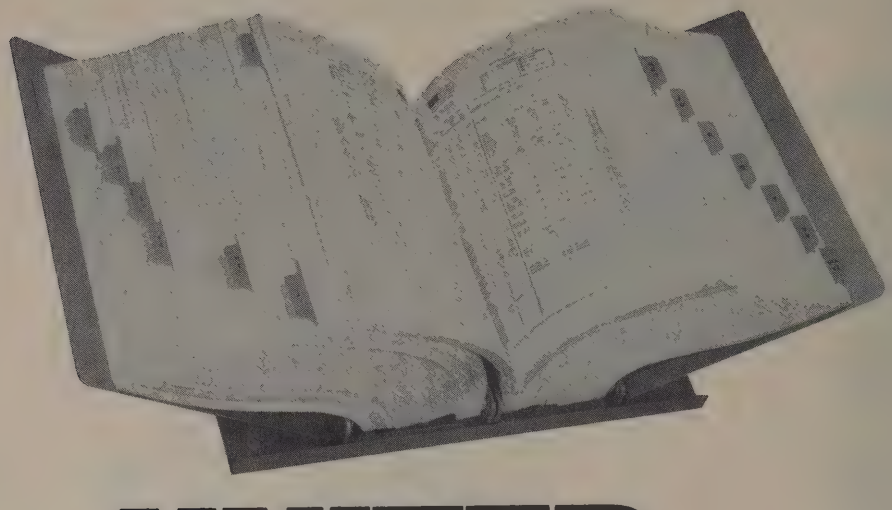
NOTE
LEADS # 22 AWG WIRE

The Technitrol catalog lists a wide variety of general use miniature and subminiature transformers in a number of form factors. Write for it or contact our nearest representative. We can design a unit for your individual application in computers, data communications, avionics, industrial control, etc.

For transformers from commercial to tough hi-rel military types, simple to stringent electrical and environmental requirements, units packaged individually or in multiples, Technitrol's engineers are as close as your telephone.

Call us.

Technitrol, Inc. DEPT. EM, 1952 E. Allegheny Avenue
Philadelphia, Pa. 19134 • (215) 426-9105 • TELEX 834245



# UNITED PRICING REPORTS

## the single source that speeds up invoicing, pricing, quoting, purchasing and estimating

Electronic component prices change so fast, you'd need a team of people just to keep up.

United Pricing Reports is the better way. When you subscribe to Pricing Reports you receive 1500 pricing sheets (3000 pages) of the latest prices, as of the date we ship them to you.

This gives you, in a single source, up-to-the minute selling prices on more than 500,000 electronic components.

United Pricing Reports gives you accurate resale prices at the exact moment you need them. Not hours or days later. So it helps you eliminate frantic phone calls, letter writing and catalog scanning to check on prices when you write an invoice or type a purchase order.

## Twice weekly price updates.

One week after you receive your Pricing Reports source book (1500 pricing sheets) you begin receiving twice weekly price updates. You simply take these new price pages and replace the now obsolete pages with them.

The whole process is simple. All information is organized alphabetically by manufacturer. And each manufacturer's price schedule is listed by part number in numerical/alphabetical sequence.

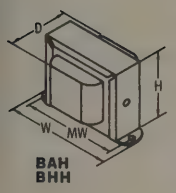
One more thing. When we promise twice weekly updates, we deliver. 52 weeks a year, consistently. Not monthly or every other month. We have a tradition of delivery on our promises, and we're certainly not going to stop now.

*UNITED TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500 TWX-510/222-*

# AUDIO TRANSFORMERS

THORDARSON

## OUTPUT AND INPUT/INTERSTAGE Listed in Order of Increasing Primary Impedance



BAH
BHH

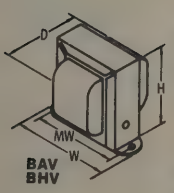
| TM Part No. | Application | Impedance in Ohms Pri. | Impedance in Ohms Sec. | Audio Watts | Normal DC Resistance Pri. Ohms | Normal DC Resistance Sec. Ohms | Overall Turns Ratio | Frequency Response ±3 DB | RMS Test Volts | Style | Termination Pri. | Termination Sec. | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20A07 | Line to Line | 50/125/200/333/500 | 50/125/200/333/500 | 30 | 27 | 29 | 1:1 | 200-15000 | 500 | BHH | Lugs | Lugs | 2 | 3 1/4 | 1 3/4 | 2 1 3/16 | — | 1.0 |
| 24S75 | Line to Voice Coil | 500 | 3.2/6/8 | 5 | 50 | 0.85 | 8.1:1 | 60-20000 | 1000 | BAH | Leads | Lugs | 1 3/8 | 2 3/8 | 1 1/4 | 2 | — | 0.45 |
| 20A102 | Line to Grids | 500/600 C.T. | 60000 C.T. | 1 | 24 | 1325 | 1:10 | 100-10000 | 1500 | BAH | Leads | Leads | 1 3/8 | 2 3/8 | 1 3/8 | 2 | — | 0.5 |
| 24S64 | Univ Output | 1500 to 10000 | .02 to .30 | 10 | 230 | 1.2 | 18.3:1 | — | 1600 | BHH | Lugs | Lugs | 1 5/8 | 2 7/8 | 1 1/2 | 2 3/8 | — | 0.7 |
| 24S50 | Output | 2000 | 3.5 | 5 | 90 | 0.4 | 23.7:1 | 50-20000 | 2000 | BAH | Leads | Leads | 1 3/8 | 2 3/8 | 1 1/4 | 2 | — | 0.5 |
| 24S53 | Output | 2000 | 3.5 | 3 | 130 | 0.42 | 25:1 | 200-1000 | 1000 | BAH | Leads | Leads | 1 3/16 | 2 1/8 | 1 1/8 | 1 3/4 | — | 0.2 |
| 24S174 | Univ Output | 3000/10000 C.T. | .09 to 65.4 | 20 | 160 | 0.7 | 18.1:1 | — | 1000 | BHV | Leads | Leads | 2 3/4 | 3 1/8 | 2 1/8 | 2 1 3/16 | — | 1.8 |
| 24S48 | Univ Output | 4000-5000 | 3.5 | 5 | 240 | 0.42 | 39.5:1 | 30-20000 | 1000 | BAH | Leads | Leads | 1 1/4 | 2 1/8 | 1 | 1 3/4 | — | 0.4 |
| 24S60 | Univ Output | 4000 to 14000 C.T. | 0.1 to 30 | 4 | 350 | 0.81 | 21.9:1 | — | 500 | BHH | Leads | Lugs | 1 3/8 | 2 3/8 | 1 1/4 | 2 | — | 0.5 |
| 24S06 | Univ Output | 4000 to 14000 C.T. | 0.1 to 50 | 8 | 500 | 2.1 | 18.1:1 | — | 1500 | BHH | Leads | Lugs | 1 5/8 | 2 7/8 | 1 1/2 | 2 3/8 | — | 0.75 |
| 24S04 | Univ Output | 4000 to 14000 C.T. | 0.1 to 50 | 4 | 300 | 1.1 | 18.3:1 | — | 1500 | BHH | Leads | Lugs | 1 3/8 | 2 3/8 | 1 1/4 | 2 | — | 0.5 |
| 24S61 | Univ Output | 4000 to 14000 C.T. | 0.1 to 30 | 8 | 182 | 0.835 | 22:1 | — | 1500 | BHH | Lugs | Lugs | 1 5/8 | 2 7/8 | 2 | 2 3/8 | — | 1.0 |
| 24S51 | Output | 5000 | 3.5 | 5 | 280 | 0.38 | 37.8:1 | 200-20000 | 1000 | BAH | Leads | Leads | 1 3/8 | 2 3/8 | 1 1/4 | 2 | — | 0.5 |
| 24S51A | Output | 5000† | 3.5 | 5 | 260 | 0.43 | 39.9:1 | 200-20000 | 1100 | BAH | Leads | Leads | 1 3/8 | 2 3/8 | 1 1/4 | 2 | — | 0.5 |
| 24S52 | Output | 7000-10000 | 3.5 | 5 | 350 | 0.41 | 44.5:1 | 200-20000 | 500 | BAH | Leads | Leads | 1 3/8 | 2 3/8 | 1 1/4 | 2 | — | 0.5 |
| 24S49 | Output | 7000-8000 | 3.5 | 3 | 372 | 0.44 | 47.6:1 | 200-15000 | 1000 | BAH | Leads | Leads | 1 1/4 | 2 1/16 | 1 1/8 | 1 3/4 | — | 0.4 |
| 24S98 | Output | 10000 | 4 | 5 | 290 | 0.26 | 57.1:1 | 200-20000 | 1000 | BAH | Leads | Leads | 1 3/8 | 2 3/8 | 1 1/4 | 2 | — | 0.5 |
| 20A16 | Line to Grids | 7000-15000 | 28000-60000 C.T. | 10 | 431 | 1158 | 1:2 | 100-10000 | 750 | BAH | Leads | Leads | 1 3/8 | 2 3/8 | 1 1/4 | 2 | — | 0.4 |
| 24S19 | Output | 10000 C.T. | 4/8/16 3.5/8/16 | 12 | 575 | 1.2 | 24.1:1 | 100-15000 | 1500 | BAV | Leads | Leads | 2 3/8 | 2 7/8 | 1 3/4 | 2 3/8 | — | 1.0 |
| 24S80 | Transceiver Output | 10000 | 2000 and 50 | 2 | 670 | 250 and 5 | 2.2:1 and 14.1:1 | 200-20000 | 500 | BAH | Leads | Leads | 1 3/8 | 2 3/8 | 1 3/8 | 2 | — | 0.5 |
| 24S99 | Output | 25000 | 4 | 5 | 1160 | 0.6 | 80.3:1 | 200-25000 | 1000 | BAH | Leads | Leads | 1 3/8 | 2 3/8 | 1 1/4 | 2 | — | 0.5 |

†3% and 6% primary humbucking tap.

## 25 VOLT LINE TO VOICE COIL (SPEAKER)

| TM Part No. | Impedance in Ohms Pri. | Impedance in Ohms Sec. | Audio Watts | Overall Turns Ratio | DC Resistance Pri. Ohms | DC Resistance Sec. Ohms | Frequency Response ±3 DB | RMS Test Volts | Style | Termination Pri. | Termination Sec. | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24S22 | 39/78/156/312.5/625/1250 | 4/8/16 | 16/8/4/2/1/0.5 | 8.8:1 | 70 | 1.8 | 100-6000 | 1500 | BHV | Lugs | Lugs | 2 3/4 | 3 1/4 | 2 1/8 | 2 1 3/16 | — | 1.75 |
| 24S21 | 78/156/312.5/625/1250 | 4/8/16 | 8/4/2/1.5 | 8.8:1 | 125 | 1.1 | 100-10000 | 1000 | BHV | Lugs | Lugs | 2 | 2 3/8 | 1 3/4 | 2 | — | 1.0 |
| 24S24 | 125/250/500/1000/2000 | 4/8 | 5/2.5/1.25/0.62/0.31 | 15.8:1 | 85 | 0.50 | 30-20000 | 500 | BHH | Lugs | Lugs | 1 3/8 | 2 3/8 | 1 1/4 | 2 | — | 0.4 |
| 24S169 | 125/312/625/1250 | 4/8 | 5/2/1/0.5 | 12.8:1 | 65 | 0.75 | — | 900 | BAH | Leads | Leads | 1 5/8 | 2 1 3/16 | 1 3/8 | 2 3/8 | — | 0.7 |
| 24S109 | 312/625/1250 | 4/8 | 2/1/0.5 | 12.4:1 | 80 | 0.62 | 40-15000 | 1500 | BAH | Leads | Leads | 1 3/8 | 2 3/8 | 1 3/8 | 2 | — | 0.45 |

## 70.7 VOLT LINE TO VOICE COIL (SPEAKER)



BAV
BHV

| TM Part No. | Impedance in Ohms Pri. | Impedance in Ohms Sec. | Audio Watts | Overall Turns Ratio | DC Resistance Pri. Ohms | DC Resistance Sec. Ohms | Frequency Response ±3 DB | RMS Test Volts | Style | Termination Pri. | Termination Sec. | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24S171 | 166/312/625/1250 | 8 | 30/15/7.5/3.8 | 12.6:1 | 27 | 0.5 | — | 1000 | BAH | Leads | Leads | 2 5/8 | 4 | 2 1/4 | 3 1/16 | — | 2.5 |
| 24S166 | 166/250/500/1000 | 4/8/16 | 30/20/10/5 | 7.9:1 | 36 | 9.1 | 40-20000 | 1500 | BAV | Lugs | Lugs | 2 3/8 | 2 7/8 | 1 3/4 | 2 3/8 | — | 1.2 |
| 24S72 | 312.5/625/1250/2500/5000/10000 | 4/8/16 | 16/8/4/2/1/0.5 | 25.1:1 | 480 | 0.88 | 100-5000 | 1000 | BHV | Lugs | Lugs | 2 5/8 | 3 1/8 | 2 1/4 | 2 1 3/16 | — | 1.75 |
| 24S124 | 500/555/625/715/833 | 8/16 | 10/9/8/7/6 | 6.9:1 | 69 | 1.2 | 50-20000 | 1000 | BHV | Lugs | Lugs | 2 | 2 3/8 | 1 5/8 | 2 | — | 0.7 |
| 24S170 | 500/1000/2000/4000 | 8 | 10/5/2.5/1.25 | 22.2:1 | 200 | 1.2 | — | 1000 | BAV | Leads | Leads | 2 1/4 | 3 1/16 | 1 3/4 | 2 3/8 | — | 1.0 |
| 24S71 | 625/1250/2500/5000/10000 | 4/8/16 | 8/4/2/1/0.5 | 25:1 | 830 | 1.4 | 50-20000 | 1000 | BHV | Lugs | Lugs | 2 | 2 1/2 | 1 5/8 | 2 | — | 1.0 |
| 24S168 | 1000/2500/5000/10000 | 8 | 5/2/1/0.5 | 35.1:1 | 600 | 0.73 | — | 900 | BAH | Leads | Leads | 1 5/8 | 2 1 3/16 | 1 3/8 | 2 3/8 | — | 0.7 |
| 24S74 | 1000/2000/4000/8000/16000 | 4/8 | 5/2.5/1.25/0.62/0.31 | 44.7:1 | 850 | 0.54 | 50-20000 | 1000 | BHH | Lugs | Lugs | 1 3/8 | 2 3/8 | 1 1/4 | 2 | — | 0.5 |
| 24S125 | 1000/1250/1667/2500/5000 | 8/16 | 5/4/3/2/1 | 79.1:1 | 265 | 1.9 | 50-20000 | 1000 | BHH | Lugs | Lugs | 1 3/8 | 2 3/8 | 1 3/8 | 2 | — | 0.5 |
| 24S128 | 1250/2500/5000/10000/20000/40000 | 8 | 4/2/1/0.5/0.25/0.12 | 64.6:1 | 1820 | 1.1 | 50-20000 | 1000 | BAH | Leads | Leads | 1 5/8 | 2 7/8 | 1 1/2 | 2 3/8 | — | 0.7 |
| 24S176 | 2500/5000/10000 | 8 | 2/1/0.5 | 34.6:1 | 650 | 0.74 | 50-2000 | 1000 | BAH | Leads | Leads | 1 3/8 | 2 3/8 | 1 1/2 | 2 | — | 0.4 |

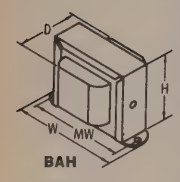
THORDARSON

**THORDARSON MEISSNER INC.**
DEPT. EM, ELECTRONIC CENTER,
MT. CARMEL, ILLINOIS 62863
PHONE: (618) 262-5121
TWX 510-525-2254

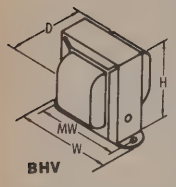
# THORDARSON TRANSISTOR TRANSFORMERS

## TRANSISTOR TRANSFORMERS — AUDIO/LOW LEVEL GENERAL USE

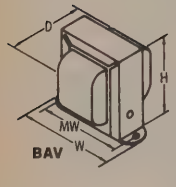
### Listed in Order of Increasing Primary Impedance



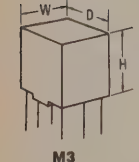
BAH



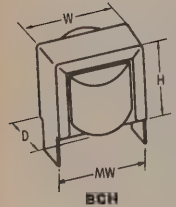
BHV



BAV



M3



BCH

| TM Part No. | Application | Impedance in Ohms | | DC Resistance | | Overall Turns Ratio | Max. Unbal. Pri. MADC | Audio Watts | Style | Outline Dimensions | | | Mounting Dimensions | | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Primary | Secondary | Pri. Ohms | Sec. Ohms | | | | | H | W | D | MW | MD | |
| TR300 | Output | 20 C.T. | 8 | .55 | .35 | — | 500 | 10 | BAH | 1⅜ | 2 1/16 | 1½ | 2 | — | 0.45 |
| TR60 | Output† | 48 C.T. | 3.2/8/16 | 3.6 | 1.4 | — | 550 | 10 | BHV | 2 5/16 | 2⅞ | 2 | 2⅜ | — | 0.90 |
| TR196 | Output | 48 C.T. | 8/16 | 4.5 | 1.4 | — | 275 | 8 | BAH | 1 13/16 | 3⅛ | 1⅜ | 2 13/16 | — | 1.0 |
| TR111 | Output | 100 C.T. | 4/8/16 | 11 | 1.5 | 2.5:1 | 2 | 0.3 | BAH | ¾ | 1⅝ | 13/16 | 1⅜ | — | 0.07 |
| TR195 | Driver | 100 | 100 C.T. | 9.1 | 10 | — | 100 | 4 | BAH | 1⅝ | 2 13/16 | 1½ | 2⅜ | — | 0.60 |
| TR296 | Interstage | 100 C.T. | 10 C.T. | 4.3 | 0.8 | — | 100 | 0.25 | BAH | 1¼ | 2⅛ | 1 1/16 | 1¾ | — | 0.25 |
| TR257 | Interstage | 100 | 1000 C.T. | 5.5 | 60 | — | 100 | 1 | BAH | 1⅜ | 2⅜ | 1½ | 2 | — | 0.35 |
| TR63 | Output | 100 C.T. | 3.2/8/16 | 6.6 | 1.5 | — | 500 | 10 | BAV | 2 5/16 | 2⅞ | 2 | 2⅜ | — | 0.95 |
| 27S93 | TR or Voice Coil | 150 C.T. | 12 | 16 | 3.0 | 3.4:1 | 10 | 0.05 | M3‡ | — | — | — | — | — | 0.01 |
| TR246 | Interstage | 200 C.T. | 2000 C.T. | 29 | 233 | — | 2 | 0.2 | BAH | ¾ | 1⅝ | 1 | 1⅜ | — | 0.08 |
| TR113 | Output | 400 C.T. | 4/8/16 | 32 | 1.5 | 2.5:1 | — | — | BAH | ¾ | 1⅝ | 13/16 | 1⅜ | — | 0.12 |
| TR5 | Driver | 490 C.T. | 150 C.T. | 30 | 16 | 1.8:1 | — | — | BCH | 1 1/16 | 1 3/16 | ⅝ | 1 3/16 | — | .05 |
| TR102 | Output | 500 C.T. | 4/8/16 | 75 | 3.5 | 5.52:1 | — | — | BCH | 1 1/16 | 1 3/16 | ⅝ | 1 3/16 | — | .06 |
| TR114 | Output | 500 C.T. | 4/8/16 | 47 | 0.85 | 2.78:1 | 2 | 0.3 | BAH | ¾ | 1⅝ | 13/16 | 1⅜ | — | 0.07 |
| TR240 | Output | 500 C.T. | 125/500* | 50 | 55 | 1:1.1 | 5 | 0.02 | BAH | ⅝ | 1 17/32 | ¾ | 1 | — | 0.02 |
| TR66 | Driver | 500 C.T. | 200 C.T. | 50 | 37 | — | 17 | 0.5 | BAH | 1¼ | 2⅛ | 1 | 1¾ | — | 0.20 |
| TR1 | Output | 500 C.T. | 500 C.T. | 40 | 55 | 1:1 | — | — | BAH | ¾ | 1⅝ | 13/16 | 1⅜ | — | 0.12 |
| 27S100 | Output or Mixing | 500 C.T. | 600 | 60 | 90 | 1:1.1 | 3 | 0.05 | M3‡ | — | — | — | — | — | 0.01 |
| TR259 | Interstage | 500 C.T. | 5000 C.T. | 40 | 245 | — | 12‡ | 1 | BAH | 1⅜ | 2⅜ | 1⅜ | 2 | — | 0.35 |
| 27S111 | TR or Line/Line | 600 C.T. | 600 C.T. | 65 | 85 | 1:1 | 3.0 | .05 | M3‡ | — | — | — | — | — | 0.01 |
| 27S101 | TR to Line | 900 C.T. | 600 | 100 | 90 | 1.2:1 | 4.0 | 0.05 | M3‡ | — | — | — | — | — | 0.01 |
| TR116 | Output | 1000 | 4/8/16 | 10 | 120 | — | 1.6 | 0.3 | BAH | ¾ | 1⅝ | 1 | 1⅜ | — | 0.07 |
| TR119 | Input | 1000 C.T. | 200000 C.T. | 123 | 1815 | 1:14.1 | — | — | BAH | ¾ | 1⅝ | 13/16 | 1⅜ | — | 0.12 |
| TR4 | Output | 1500 | 500 C.T. | 100 | 45 | 1.73:1 | — | — | BCH | 1 1/16 | 1 1/16 | ⅝ | 1 3/16 | — | .05 |
| TR106 | Interstage | 1200 | 20000 C.T. | 142 | 1860 | 1:4.1 | — | — | BCH | 1 1/16 | 1 1/16 | ⅝ | 1 3/16 | — | .05 |
| 27S102 | TR to Line | 1500 C.T. | 600 | 150 | 100 | 1.6:1 | 3 | 0.05 | M3‡ | — | — | — | — | — | 0.01 |
| TR258 | Output | 2000 C.T. | 4/8/16 | 10 | 260 | — | 4 | 0.2 | BAH | ¾ | 1⅝ | 1 | 1⅜ | — | 0.08 |
| TR260 | Driver | 2000 C.T. | 200 C.T. | 5.0 | 748 | — | 120 | 0.1 | BAH | ⅝ | 1 9/32 | 1 1/16 | 1 1/16 | — | 0.05 |
| TR249 | Interstage | 2000 | 1500 C.T. | 165 | 40 | 1.15:1 | 2 | 0.2 | BAH | ¾ | 1⅝ | 1 | 1⅜ | — | 0.07 |
| TR250 | Interstage | 2000 C.T. | 8000 C.T. | 200 | 550 | 1:2 | 4 | 0.2 | BAH | ¾ | 1⅝ | 1 | 1⅜ | — | 0.07 |
| TR107 | Output | 2500 | 4/16 | 370 | 2.3 | 11.81:1 | — | — | BCH | 1 1/16 | 1 3/16 | ⅝ | 1 3/16 | — | .06 |
| TR3 | Interstage | 5000 C.T. | 10000 C.T. | 550 | 1100 | 1:1.4 | — | — | BCH | 1 1/16 | 1 3/16 | ⅝ | 1 3/16 | — | .05 |
| TR108 | Interstage | 5000 C.T. | 80000 C.T. | 573 | 5740 | 1:4 | — | — | BCH | 1 1/16 | 1 3/16 | ⅝ | 1 3/16 | — | .05 |
| TR109 | Output | 10000 C.T. | 4/8/16 | 1174 | 2.6 | 24.54:1 | — | — | BCH | 1 1/16 | 1 3/16 | ⅝ | 1 3/16 | — | .06 |
| 27D39 | Driver | 10000 C.T. | 500 C.T. | 1100 | 75 | 4.5:1 | 0.5 | 0.05 | M3‡ | — | — | — | — | — | 0.01 |
| 27D37 | Driver | 10000 C.T. | 1200 C.T. | 1100 | 400 | 2.9:1 | 1 | 0.05 | M3‡ | — | — | — | — | — | 0.01 |
| 27D38 | Driver | 10000 C.T. | 2000 C.T. | 1100 | 500 | 2.2:1 | 1 | 0.05 | M3‡ | — | — | — | — | — | 0.01 |
| TR23 | Output | 10000 | 2000 | 900 | 11 | 7.05:1 | — | — | BCH | 1 3/16 | 1 1/16 | 1 | 1⅜ | — | .05 |
| TR7 | Interstage | 10000 | 2000 C.T. | 740 | 300 | 2.24:1 | — | — | BCH | 1 1/16 | 1 3/16 | ⅝ | 1 3/16 | — | .04 |
| TR6 | Interstage | 10000 | 3000 C.T. | 820 | 660 | 1.8:1 | — | — | BCH | 1 1/16 | 1 3/16 | ⅝ | 1 3/16 | — | .05 |
| 27S110 | Output or Isolation | 10000 C.T. | 10000 C.T. | 1050 | 1100 | 1:1 | 1 | 0.5 | M3‡ | — | — | — | — | — | 0.01 |
| TR17 | Interstage | 20000 | 800 C.T. | 1300 | 95 | 5:1 | — | — | BCH | 1 1/16 | 1 3/16 | ⅝ | 1 3/16 | — | .05 |
| 27A111 | TR Interstage | 25000 C.T. | 1000 C.T. | 1500 | 100 | 5:1 | 0.5 | 0.04 | M3‡ | — | — | — | — | — | 0.01 |
| 27A108 | TR Interstage | 50000 C.T. | 1000 C.T. | 3500 | 70 | 7.1:1 | 0 | 0.025 | M3‡ | — | — | — | — | — | 0.01 |
| TR24 | Interstage | 100000 | 1500 C.T. | 3000 | 45 | 8.6:1 | — | — | BAH | ¾ | 1⅝ | 13/16 | 1⅜ | — | 0.12 |
| 27A109 | Input | 200000 | 1000 | 4870 | 90 | 14.1:1 | 0 | 0.01 | M3‡ | — | — | — | — | — | 0.01 |
| 27A107 | Chopper Input | 200000 C.T. | 1000 C.T. | 4870 | 90 | 14.1:1 | 0 | 0.01 | M3‡ | — | — | — | — | — | 0.01 |
| 27C80 | Inductor | 1.25 Hys. | — | 180 | — | — | 2 | — | M3‡ | — | — | — | — | — | 0.01 |
| 27C79 | Inductor | 6 Hys. | — | 1700 | — | — | 2 | — | M3‡ | — | — | — | — | — | 0.01 |

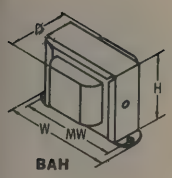
‡M3 Style: H-0.465, W-0.410, D-0.310 mounting is P.C. with 3/32" grid spacing. *Split center tap winding. †Has lugs on secondary.

THORDARSON MEISSNER INC.
DEPT. EM, ELECTRONIC CENTER,
MT. CARMEL, ILLINOIS 62863
PHONE: (618) 262-5121
TWX 510-525-2254

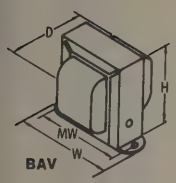
# FILAMENT TRANSFORMERS

THORDARSON

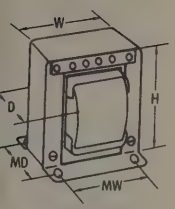
## FILAMENT TRANSFORMERS — SINGLE SECONDARY



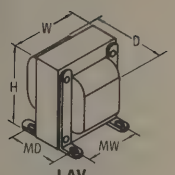
BAH



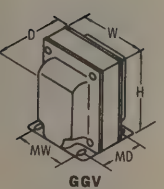
BAV



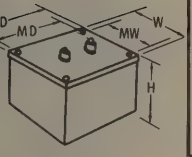
CTV
CAV



LAV
LHV



GGV



KTV

| TM Part No. | Secondary Volts | Secondary Amps | Primary Volts | RMS Test Volts | Style | Termination Primary | Termination Secondary | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21F191 | 2.5 C.T. | 0.3 | 117 | 1500 | BAH | Leads | Leads | 1¼ | 2⅛ | 1⅝ | 1¾ | — | 0.3 |
| 21F34 | 2.5 | 1.5 | 117 | 1500 | BAH | Leads | Leads | 1⅝ | 2⅞ | 1½ | 2⅜ | — | 0.7 |
| 21F120 | 2.5 C.T. | 3.0 | 117 | 1500 | BAH | Leads | Leads | 1⅝ | 2⅞ | 1¾ | 2⅜ | — | 0.6 |
| 21F165 | 2.5 C.T. | 3.0 | 115/230 | 1500 | BAH | Leads | Leads | 1¾ | 2⅞ | 1⅝ | 2⅜ | — | 0.6 |
| 21F31 | 2.5 C.T. | 5.0 | 117 | 7500 | BAV | Leads | Leads | 2 1/16 | 3⅝ | 2¼ | 2 13/16 | — | 1.5 |
| 21F92 | 2.5 C.T. | 6.0 | 117 | 1500 | BAH | Leads | Leads | 2 | 3⅝ | 1⅞ | 2 13/16 | — | 1.0 |
| 21F166 | 2.5 C.T. | 6.0 | 115/230 | 1500 | BAH | Leads | Leads | 2 | 3⅝ | 2 | 2 13/16 | — | 1.0 |
| 21F93 | 2.5 C.T. | 10.0 | 117 | 1500 | BAH | Leads | Leads | 2 5/16 | 3¾ | 2⅛ | 3⅛ | — | 1.5 |
| 21F103 | 2.5 C.T. | 10.0 | 107/117 | 7500 | BAV | Leads | Leads | 3⅛ | 3⅝ | 2½ | 3⅛ | — | 2.5 |
| 21F02 | 2.5 C.T. | 10.0 | 117 | 10000 | CAV | Leads | Leads | 3⅛ | 2½ | 2¼ | 2 | 1¾ | 2.75 |
| 21F94 | 5.0 C.T. | 3.0 | 117 | 1500 | BAH | Leads | Leads | 2 | 3⅝ | 2 | 2 13/16 | — | 1.3 |
| 21F13 | 5.0 C.T. | 10.0 | 117 | 2500 | CAV | Leads | Leads | 3⅛ | 2⅞ | 2½ | 2 | 2⅜ | 3.0 |
| 26F66 | 5.0 C.T. | 15.0 | 117 | 2500 | CAV | Leads | Leads | 3 | 2½ | 2⅞ | 2 | 2⅛ | 3.5 |
| 21F20 | 5.0 C.T. | 15.0 | 117 | 10000 | CAV | Leads | Leads | 4⅝ | 3¾ | 3¼ | 3 | 2½ | 6.75 |
| 21F39 | 5.0 C.T. | 22.0 | 107/117 | 10000 | KTV | Terms. | Terms. | 5⅛ | 4⅝ | 8½ | 2¾ | 6 | 13.5 |
| 21F69 | 6.3/5.0 Tap† | 2.0 | 117 | 5000 | BAH | Leads | Leads | 2 | 3⅝ | 2 | 2 13/16 | — | 1.25 |
| 26F73 | 6.3 C.T. | 0.3 | 117 | 1500 | BAH | Leads | Leads | 1¼ | 2⅛ | 1⅝ | 1¾ | — | 0.3 |
| 21F21 | 6.3 | 0.6 | 117 | 1500 | BAH | Leads | Leads | 1⅜ | 2⅜ | 1¼ | 2 | — | 0.75 |
| 21F162 | 6.3 C.T. | 0.6 | 117 | 1500 | BAH | Leads | Leads | 1⅜ | 2⅜ | 1½ | 2 | — | 0.4 |
| 21F167 | 6.3 | 0.6 | 115/230 | 1500 | BAH | Leads | Leads | 1⅜ | 2⅜ | 1⅜ | 2 | — | 0.6 |
| 21F200 | 6.3 C.T. | 0.6 | 230 | 1500 | BAH | Leads | Leads | 1⅜ | 2⅝ | 1½ | 2 | — | 0.4 |
| 21F143 | 6.3 C.T. | 1.0 | 117 | 1500 | BAH | Leads | Leads | 1⅝ | 2⅞ | 1½ | 2⅜ | — | 0.6 |
| 21F06 | 6.3 C.T. | 1.2 | 117 | 2500 | BAV | Leads | Leads | 2 | 2⅜ | 1½ | 2 | — | 0.7 |
| 21F08 | 6.3 C.T. | 1.2 | 117 | 2500 | BAH | Leads | Leads | 1⅝ | 2⅞ | 1½ | 2⅜ | — | 0.7 |
| 21F212 | *6.3 | 1.2 | 117 | 2500 | BAH | *Leads | Leads | 1⅝ | 2⅞ | 1½ | 2⅜ | — | 0.7 |
| 26F60 | 6.3 | 1.2 | 117 | 7000 | BAH | Leads | Leads | 2 | 3¼ | 2 | 2 13/16 | — | 1.25 |
| 21F168 | 6.3 C.T. | 1.2 | 115/230 | 2500 | BAH | Leads | Leads | 1⅝ | 2 13/16 | 1⅝ | 2⅜ | — | 0.5 |
| 26F65 | 6.3 | 1.2 | 6.3 | 5000 | BAH | Leads | Leads | 2 | 3¼ | 2 | 2 13/16 | — | 1.25 |
| 21F10 | 6.3 C.T. | 3.0 | 117 | 2500 | BAH | Leads | Leads | 2 | 3¼ | 2⅛ | 2 13/16 | — | 1.25 |
| 21F169 | 6.3 C.T. | 3.0 | 115/230 | 2500 | BAH | Leads | Leads | 1 15/16 | 3⅝ | 2 | 2 13/16 | — | 1.3 |
| 21F71 | 6.3 | 4.0 | 117 | 1500 | BAH | Leads | Leads | 2 | 3⅝ | 2 | 2 13/16 | — | 1.25 |
| 21F70 | 6.3 | 4.0 | 117 | 5000 | BAH | Leads | Leads | 2 5/16 | 4 | 2¼ | 3 1/16 | — | 2.1 |
| 21F203 | 6.3 C.T. | 4.0 | 117 | 1500 | BAH | Leads | Leads | 2⅜ | 3¾ | 2⅛ | 3⅛ | — | 1.6 |
| 21F204 | 6.3 C.T. | 5.0 | 117 | 1500 | BAH | Leads | Leads | 2⅜ | 3¾ | 2⅛ | 3⅛ | — | 1.8 |
| 21F59 | 6.3 C.T. | 6.0 | 117 | 2500 | LHV | Lugs | Lugs | 3⅛ | 2⅞ | 2½ | 2 | 2 | 2.75 |
| 21F11 | 6.3 C.T. | 6.0 | 117 | 1500 | CAV | Leads | Leads | 3⅛ | 2½ | 2½ | 2 | 1¾ | 2.5 |
| 21F42 | 6.3 C.T. | 6.0 | 107/117 | 2500 | GGV | Leads | Leads | 3⅝ | 3 | 3⅛ | 2 | 2¼ | 3.5 |
| 21F72 | 6.3 C.T. | 6.0 | 107/117 | 2000 | BAH | Leads | Leads | 2¼ | 3⅝ | 2½ | 3⅛ | — | 2.0 |
| 21F170 | 6.3 C.T. | 6.0 | 115/230 | 1500 | BAH | Leads | Leads | 2 15/32 | 4 | 2¼ | 3 1/16 | — | 2.3 |
| 21F96 | 6.3 C.T. | 8.0 | 117 | 1500 | BAH | Leads | Leads | 2⅝ | 4 | 2½ | 3 1/16 | — | 2.5 |
| 21F74 | 6.3 C.T. | 10.0 | 117 | 1500 | GGV | Leads | Leads | 3½ | 3 | 3⅛ | 2¼ | 2 | 3.8 |
| 21F12 | 6.3 C.T. | 10.0 | 117 | 2500 | CAV | Leads | Leads | 3⅛ | 2½ | 2½ | 2 | 2 | 3.25 |
| 21F43 | 6.3 C.T. | 10.0 | 107/117 | 2500 | LAV | Leads | Leads | 3½ | 2⅞ | 2¾ | 2¼ | 2 5/16 | 3.5 |
| 21F109 | *6.0/6.5 C.T., 7.0 C.T. | 13 | 117 | 2000 | LHV | Lugs | Cu. Tabs | 3⅜ | 2 13/16 | 3⅜ | 2¼ | 2 11/16 | 4.5 |
| 21F76 | 6.3 C.T. | 15.0 | 117 | 10000 | LAV | Leads | Leads | 4¼ | 3½ | 3 5/16 | 2¾ | 2 13/16 | 7.5 |
| 21F77 | 6.3 C.T. | 20.0 | 117 | 2500 | GGV | Leads | Leads | 3⅞ | 3 9/32 | 4¼ | 2½ | 2 15/16 | 7.0 |
| 21F25 | 6.3 C.T. | 20.0 | 107/117 | 2500 | LAV | Leads | Leads | 4⅝ | 3 13/16 | 3¼ | 3 | 2⅜ | 6.7 |
| 21F79 | *6.3/7.5 C.T. | 25.0 | 117 | 3000 | LHV | Leads | Lugs | 4⅝ | 3 13/16 | 3 7/16 | 3 | 3 1/16 | 7.5 |
| 21F45 | 7.5 C.T. | 4.0 | 117 | 2500 | LHV | Lugs | Lugs | 3⅛ | 2⅝ | 2¾ | 2 | 2⅛ | 2.7 |
| 21F62 | 7.5 C.T. | 8.0 | 117 | 2500 | LAV | Leads | Leads | 3⅞ | 3⅛ | 2⅞ | 2½ | 2⅜ | 4.7 |
| 21F205 | 10.0 C.T. | 1.0 | 117 | 1500 | BAH | Leads | Leads | 2 | 3¼ | 1⅝ | 2 13/16 | — | 0.9 |
| 21F206 | 10.0 C.T. | 2.0 | 117 | 1500 | BAH | Leads | Leads | 2 | 3¼ | 2 | 2 13/16 | — | 1.3 |
| 26F71 | 10.0 C.T. | 3.0 | 117 | 1500 | BAH | Leads | Leads | 2⅜ | 3¾ | 2¼ | 3⅛ | — | 1.6 |
| 21F207 | 10.0 C.T. | 4.0 | 117 | 1500 | BAH | Leads | Leads | 2⅝ | 4 | 2⅛ | 3 1/16 | — | 2.3 |
| 21F61 | 10.0 C.T. | 4.0 | 117 | 2500 | LHV | Lugs | Lugs | 3 1/16 | 2⅞ | 2⅝ | 2¼ | 2⅛ | 3.25 |
| 21F172 | 10.0 C.T. | 5.0 | 117 | 2000 | LAV | Leads | Leads | 3 | 2½ | 2⅝ | 2 1/16 | 2 | 2.5 |
| 21F18 | 10.0 C.T. | 5.0 | 117 | 2500 | CAV | Leads | Leads | 3⅛ | 2 5/16 | 2½ | 2 | 1¾ | 2.25 |
| 21F208 | 10.0 C.T. | 6.0 | 117 | 1500 | LAV | Leads | Leads | 3⅛ | 2½ | 2¾ | 2 | 2 5/16 | 3.1 |
| 21F209 | 10.0 C.T. | 8.0 | 117 | 1500 | LAV | Leads | Leads | 3 7/16 | 2 13/16 | 3 | 2¼ | 2½ | 4.1 |
| 21F28 | 10.0 C.T. | 8.0 | 117 | 2500 | CAV | Leads | Leads | 3⅞ | 3⅛ | 2½ | 2⅜ | 4.9 | |

*Secondary voltage varied by means of primary taps. †Fused primary.

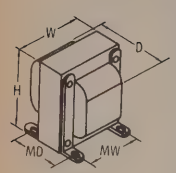
Listing continued on next page

THORDARSON

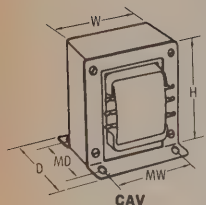
**THORDARSON MEISSNER INC.**
DEPT. EM, ELECTRONIC CENTER,
MT. CARMEL, ILLINOIS 62863
PHONE: (618) 262-5121
TWX 510-525-2254

# THORDARSON FILAMENT TRANSFORMERS

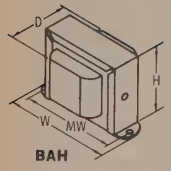
## FILAMENT TRANSFORMERS — SINGLE SECONDARY (Cont'd)



LAV



CAV

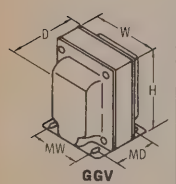


BAH

| TM Part No. | Secondary Volts | Secondary Amps | Primary Volts | RMS Test Volts | Style | Termination Primary | Termination Secondary | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21F173 | 10.0 C.T. | 10.0 | 117 | 2000 | LAV | Leads | Leads | 4 1/8 | 3 1/2 | 3 1/4 | 2 3/4 | 2 7/16 | 7.5 |
| 21F68 | *10.0 C.T./ 11.0 C.T./ 12.0 C.T. | 11.0 | 115 | 3000 | LAV | Leads | Leads | 4 3/8 | 3 1/2 | 3 1/16 | 2 3/4 | 2 5/16 | 6.5 |
| 21F19 | *10.0 C.T. or 11.0 C.T. | 12.0 10.0 | 117 | 2500 | CAV | Leads | Leads | 3 7/8 | 3 3/16 | 2 7/8 | 2 1/2 | 2 1/4 | 6.0 |
| 21F174 | 12.6 C.T. | 1.0 | 117 | 1500 | BAH | Leads | Leads | 1 13/16 | 3 5/16 | 1 3/4 | 2 13/16 | — | 0.9 |
| 26F72 | 12.6 C.T. | 1.0 | 117 | 1500 | BAH | Leads | Leads | 2 | 3 1/4 | 1 3/4 | 2 13/16 | — | 0.9 |
| 21F149 | 12.6 C.T. | 1.5 | 117 | 1500 | BAH | Leads | Leads | 2 | 3 1/4 | 2 | 2 13/16 | — | 1.0 |
| 21F175 | 12.6 C.T. | 1.5 | 115/230 | 1500 | BAH | Leads | Leads | 2 | 3 1/4 | 2 | 2 13/16 | — | 1.0 |
| 26F67 | 12.6 C.T. | 2.0 | 117 | 1500 | BAH | Leads | Leads | 2 | 3 1/4 | 2 | 2 13/16 | — | 1.1 |
| 21F176 | 12.6 C.T. | 2.0 | 115/230 | 1500 | BAH | Leads | Leads | 2 | 3 1/4 | 2 | 2 13/16 | — | 1.1 |
| 21F177 | 12.6 C.T. | 2.5 | 115/230 | 1500 | BAH | Leads | Leads | 2 5/16 | 3 11/16 | 2 | 3 3/8 | — | 1.5 |
| 21F81 | 12.6 C.T. | 2.5 | 117 | 1500 | BAH | Leads | Leads | 2 1/4 | 3 5/8 | 2 1/8 | 3 1/8 | — | 1.6 |
| 21F150 | 12.6 C.T. | 3.0 | 117 | 1500 | BAH | Leads | Leads | 2 5/16 | 3 11/16 | 2 1/4 | 3 1/8 | — | 1.2 |
| 21F193 | 12.6 C.T. | 4.0 | 117 | 1500 | BAH | Leads | Leads | 2 5/8 | 4 | 2 3/8 | 3 5/16 | — | 2.5 |
| 21F194 | 12.6 C.T. | 6.0 | 117 | 1500 | GGV | Leads | Leads | 3 1/2 | 2 13/16 | 3 3/8 | 2 1/8 | 2 1/4 | 3.5 |
| 21F195 | 12.6 C.T. | 8.0 | 117 | 1500 | GGV | Leads | Leads | 3 7/8 | 3 1/8 | 3 3/8 | 2 3/16 | 2 1/2 | 4.5 |
| 21F196 | 12.6 C.T. | 10.0 | 117 | 1500 | GGV | Leads | Leads | 4 1/4 | 3 7/16 | 3 7/8 | 2 11/16 | 2 3/4 | 5.5 |
| 21F84 | 24.0 C.T. | 1.0 | 117 | 1500 | BAH | Leads | Leads | 2 | 3 1/4 | 2 | 2 13/16 | — | 1.5 |
| 26F68 | 24.0 | 1.0 | 117 | 2500 | BAH | Leads | Leads | 2 | 3 1/4 | 2 | 2 13/16 | — | 1.5 |
| 21F181 | 24.0 C.T. | 1.0 | 115/230 | 1500 | BAH | Leads | Leads | 2 | 3 1/4 | 2 | 2 13/16 | — | 1.5 |
| 21F100 | *24.5 to 29.0 C.T. | 0.04 | 117 | 1500 | BAH | Leads | Leads | 1 1/4 | 2 1/8 | 1 3/8 | 1 3/4 | — | 0.25 |
| 21F101 | *24.5 to 29.0 C.T. | 0.25 | 117 | 1500 | BAH | Leads | Leads | 1 5/8 | 2 13/16 | 1 5/8 | — | — | 0.6 |
| 21F51 | 25.2 | 1.0 | 117 | 1500 | BAH | Leads | Leads | 2 | 3 1/4 | 2 1/8 | 2 13/16 | — | 1.5 |
| 21F142 | 25.2 C.T. | 1.0 | 117 | 1500 | BAH | Leads | Leads | 2 | 3 1/4 | 2 1/8 | 2 13/16 | — | 1.5 |
| 21F83 | 25.2 C.T. | 2.0 | 117 | 1500 | BAH | Leads | Leads | 2 5/16 | 4 | 2 1/4 | 3 5/16 | — | 2.2 |
| 21F180 | 25.2 C.T. | 2.0 | 115/230 | 1500 | BAH | Leads | Leads | 2 5/16 | 4 | 2 1/4 | 3 5/16 | — | 2.2 |
| 21F114 | 25.2 C.T. | 3.0 | 117 | 1500 | BAH | Leads | Leads | 2 5/16 | 4 | 2 1/4 | 3 5/16 | — | 2.2 |
| 21F197 | 25.2 C.T. | 5.0 | 117 | 1500 | GGV | Leads | Leads | 4 1/4 | 3 7/16 | 3 7/8 | 2 3/4 | 2 11/16 | 5.5 |
| 21F198 | 25.2 C.T. | 7.5 | 117 | 1500 | GGV | Leads | Leads | 4 1/4 | 3 7/16 | 4 1/4 | 2 3/4 | 3 1/16 | 7.5 |
| 21F199 | 25.2 C.T. | 10.0 | 117 | 1500 | GGV | Leads | Leads | 4 5/16 | 3 3/4 | 5 | 3 | 3 13/16 | 10.0 |
| 21F27 | 26.5 C.T. | 0.6 | 117 | 3000 | BAH | Leads | Leads | 2 | 3 1/4 | 2 1/8 | 2 13/16 | — | 1.6 |
| 21F82 | 26.8 C.T. | 1.0 | 117 | 1500 | BAH | Leads | Leads | 2 | 3 1/4 | 2 | 2 13/16 | — | 1.6 |
| 21F178 | 26.8 C.T. | 1.0 | 115/230 | 1500 | BAH | Leads | Leads | 2 | 3 1/4 | 2 1/8 | 2 13/16 | — | 1.7 |
| 23V270 | 26.8 C.T. | 1.7 | 115 | 1500 | BAH | Leads | Leads | 2 5/8 | 4 | 2 1/4 | 3 5/16 | — | 3.5 |
| 21F190 | 30.0 | 3.0 | 117 | 1500 | GGV | Leads | Leads | 3 1/2 | 2 13/16 | 3 5/8 | 2 1/4 | 2 7/16 | 4.2 |
| 21F187 | *45 to 54 C.T. | 1.0 | 117 | 2500 | BAH | Leads | Leads | 2 5/8 | 4 | 2 3/8 | 3 5/16 | — | 2.3 |

*Secondary voltage varied by means of primary taps.

## FILAMENT TRANSFORMERS — WITH MULTIPLE SECONDARIES



GGV

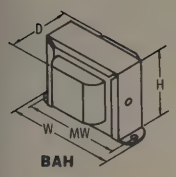
| TM Part No. | Secondary Volts | Secondary Amps | RMS Test Volts | Primary Volts 50/60 Hz | Style | Termination Primary | Termination Secondary | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21F56 | 5.0 C.T.<br>6.3 C.T. | 6.0<br>6.0 | 1765<br>1765 | 107/117 | GGV | Leads | Leads | 3 7/8 | 3 1/4 | 3 3/8 | 2 1/2 | 2 5/16 | 4.8 |
| 21F88 | 6.3<br>6.3<br>6.3<br>6.3 C.T. | 1.75<br>1.75<br>1.75<br>1.75 | 1500<br>1500<br>1500<br>1500 | 115 | GGV | Leads | Leads | 3 1/8 | 2 5/8 | 3 | 2 | 2 1/4 | 3.5 |
| 21F87 | 6.3 C.T.<br>6.3 C.T. | 3.0<br>3.0 | 1500<br>1500 | 117 | GGV | Leads | Leads | 3 1/32 | 2 31/32 | 2 5/8 | 2 | 1 7/8 | 2.5 |
| 21F24 | 6.3<br>6.3<br>6.3<br>6.3 | 3.0<br>3.0<br>3.0<br>3.0 | 2500<br>2500<br>2500<br>2500 | 117 | GGV | Leads | Leads | 3 7/8 | 3 1/4 | 3 3/8 | 2 1/2 | 2 1/4 | 5.0 |
| 21F97 | 24.0 C.T.<br>or 12.0 | 2.0<br>4.0 | 1500<br>— | 117 | BAH | Leads | Leads | 2 11/16 | 4 | 2 5/8 | 3 5/16 | — | 2.5 |
| 21F90 | 12.6<br>12.6 C.T. | 2.5<br>2.5 | 1500<br>1500 | 115 | GGV | Leads | Leads | 3 1/2 | 3 | 3 1/8 | 2 1/4 | 2 | 3.7 |
| 21F52 | 12.6<br>12.6 | 3.5<br>3.5 | 2500<br>— | 117 | GGV | Leads | Leads | 3 1/2 | 2 7/8 | 3 7/8 | 2 1/4 | 2 5/8 | 5.0 |
| 21F91 | 12.6 C.T.<br>12.6 C.T. | 5.0<br>5.0 | 2000<br>2000 | 105/115/125 | GGV | Leads | Leads | 3 7/8 | 3 7/32 | 3 1/2 | 2 1/2 | 2 5/8 | 6.0 |

THORDARSON MEISSNER INC.
DEPT. EM, ELECTRONIC CENTER,
MT. CARMEL, ILLINOIS 62863
PHONE: (618) 262-5121
TWX 510-525-2254

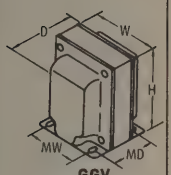
# INDUCTORS

THORDARSON

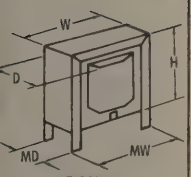
## FILTER CHOKES — SMOOTHING



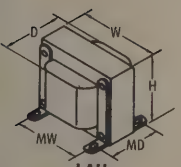
BAH



GGV



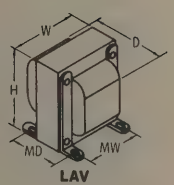
BCH-1



LAH
LHH

| TM Part No. | MADC | Nominal Inductance Hz | DC Res. Ohms | RMS Test Volts | Style | Termination | Outline Dimensions H | W | D | Mounting Dimensions MW | MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26C40 | 10 | 1.5 | 95 | 2500 | BAH | Leads | 1¼ | 2⅛ | 1⅛ | 1¾ | — | 0.5 |
| 20C102 | 15 | 2.0 | 70 | 1500 | BAH | Leads | 1 3/16 | 2 3/16 | 1¼ | 1¾ | — | 0.4 |
| 20C43 | 15 | 20 | 900 | 1500 | BAH | Leads | 1⅝ | 2⅞ | 1½ | 2⅜ | — | 0.75 |
| 20C51 | 15 | 35 | 1850 | 1200 | BAH | Leads | 1⅜ | 2⅜ | 1¼ | 2 | — | 0.5 |
| 20C04 | 15 | 50 | 3500 | 1500 | BAH | Leads | 1⅜ | 2⅜ | 1½ | 2 | — | 0.5 |
| 20C05 | 20 | 15 | 1000 | 1000 | BAH | Leads | 1⅝ | 2 13/16 | 1¾ | 2⅜ | — | 0.6 |
| 20C185 | 30 | 12 | 400 | 2000 | BAH | Leads | 1⅜ | 2⅜ | 1 5/16 | 2 | — | 0.5 |
| 20C52 | 40 | 8.0 | 450 | 1500 | BAH | Leads | 1⅜ | 2⅜ | 1¼ | 2 | — | 0.5 |
| 20C47 | 50 | 4.5 | 300 | 1500 | BAH | Leads | 1⅜ | 2⅜ | 1⅜ | 2 | — | 0.5 |
| 20C59 | 55 | 7.0 | 200 | 1600 | BAH | Leads | 1⅝ | 2⅞ | 1⅝ | 2⅜ | — | 0.75 |
| 20C84 | 50 | 7.0 | 550 | 1500 | BAH | Leads | 1⅜ | 2⅜ | 1⅜ | 2 | — | 0.5 |
| 20C81 | 50 | 8.5 | 400 | 1500 | BAH | Leads | 1⅝ | 2⅞ | 1½ | 2⅜ | — | 0.75 |
| 20C66 | 50 | 9.0 | 500 | 2500 | BAH | Leads | 1⅝ | 2⅞ | 1½ | 2⅜ | — | 0.75 |
| 26C87 | 50 | 16 | 580 | 1500 | BAH | Leads | 2 | 3¼ | 2⅛ | 2 13/16 | — | 1.2 |
| 26C86 | 75 | 15 | 400 | 1500 | BAH | Leads | 2¼ | 3¼ | 2⅝ | 3⅛ | — | 1.5 |
| 20C53 | 80 | 12 | 375 | 2000 | BAH | Leads | 2 | 3¼ | 2⅛ | 2 13/16 | — | 1.5 |
| 20C71 | 80 | 16 | 360 | 1500 | GGV | Leads | 3 3/16 | 2⅝ | 2⅝ | 2 | 1 11/16 | 2.5 |
| 20C48 | 80 | 8.0 | 250 | 2000 | BAH | Leads | 2 | 3¼ | 2⅛ | 2 13/16 | — | 1.5 |
| 20C08 | 90 | 10 | 270 | 1000 | BAH | Leads | 2 | 3 5/16 | 2 | 2 13/16 | — | 1.3 |
| 20C07 | 90 | 4.0 | 100 | 1500 | BAH | Leads | 2 | 3 5/16 | 1¾ | 2 13/16 | — | 1.0 |
| 26C85 | 110 | 10.5 | 225 | 3000 | BAH | Leads | 2⅝ | 4 | 2½ | 3 1/16 | — | 1.75 |
| 26C83 | 125 | 7.0 | 300 | 1500 | BAH | Leads | 2 | 3¼ | 2⅛ | 2 13/16 | — | 1.5 |
| 26C88 | 130 | 2.5 | 100 | 2000 | BAH | Leads | 2 | 3¼ | 1¾ | 2 13/16 | — | 1.2 |
| 26C89 | 150 | 2.3 | 60 | 1500 | BAH | Leads | 2 | 3¼ | 1¾ | 2 13/16 | — | 1.0 |
| 20C54 | 150 | 8 | 145 | 1700 | GGV | Leads | 3⅛ | 2 1/16 | 2¾ | 2 | 1 11/16 | 2.2 |
| 26C41 | 200 | 1.5 | 90 | 1600 | BAH | Leads | 1⅝ | 2⅞ | 1⅝ | 2⅜ | — | 0.75 |
| 26C43 | 200 | 2.0 | 50 | 1500 | BAH | Leads | 2 | 3⅛ | 1⅝ | 2 13/16 | — | 1.0 |
| 20C13 | 200 | 6.0 | 150 | 1500 | GGV | Leads | 3 1/32 | 2 21/32 | 2⅝ | 2 | 1⅞ | 2.5 |
| 20C14 | 200 | 6.0 | 150 | 1500 | BAH | Leads | 2⅝ | 4 | 2¼ | 3 1/16 | — | 2.3 |
| 26C45 | 200 | 10 | 140 | 3000 | GGV | Leads | 3½ | 2⅞ | 4⅛ | 2⅞ | 2¼ | 4.9 |
| 26C76 | 240 | 1.0 | 50 | 1500 | BAH | Leads | 1⅝ | 2⅞ | 1½ | 2⅜ | — | 0.75 |
| 26C80 | 300 | 0.5 | 30 | 1500 | BAH | Leads | 1⅜ | 2⅜ | 1½ | 2 | — | 0.5 |
| 26C77 | 290 | 0.7 | 30 | 1500 | BAH | Leads | 1⅝ | 2 13/16 | 1½ | 2⅜ | — | 0.75 |
| 26C78 | 350 | 0.6 | 35 | 1500 | BAH | Leads | 1⅝ | 2 13/16 | 1½ | 2⅜ | — | 0.6 |
| 26C75 | 350 | 1.0 | 35 | 1500 | BAH | Leads | 2 | 3 5/16 | 2 | 2 13/16 | — | 1.35 |
| 26C92 | 375 | 0.8 | 25 | 1500 | BAH | Leads | 2 5/16 | 3 11/16 | 2 | 3⅛ | — | 1.5 |
| 20C21 | 375 | 1.5 | 50 | 1500 | BAH | Leads | 2 5/16 | 3 11/16 | 2 | 3⅛ | — | 1.5 |
| 26C81 | 600 | 0.32 | 10 | 1500 | BAH | Leads | 2 | 3¼ | 2 | 2 13/16 | — | 1.3 |

## HIGH CURRENT CHOKES



LAV

| TM Part No. | Notes | Amps DC | Induct. M.H. | DC Res. Ohms | RMS Test Volts | Style | Termination | Outline Dimensions H | W | D | Mounting Dimensions MW | MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TR153 | — | 1.0 | 3 | 0.25 | 1000 | BCH-1 | Leads | 1¼ | 1½ | 1 | 1¼ | 7/16 | 0.2 |
| TR154 | — | 1.0 | 11 | 0.75 | 1000 | BCH-1 | Leads | 1¼ | 1½ | 1 | 1¼ | 7/16 | 0.2 |
| 20C25 | Dual Winding* | 1.0<br>2.0 | 300<br>75 | 3.0<br>0.75 | 1500 | LAV | Leads | 3½ | 2⅞ | 3 3/16 | 2¼ | 2⅝ | 3.5 |
| 20C00 | — | 2.0 | 35 | 0.75 | 1500 | LAH | Leads | 2⅜ | 2⅝ | 2¾ | 2 3/16 | 2 | 1.9 |
| 20C26 | Dual Winding* | 2.5<br>5.0 | 80<br>20 | 0.60<br>0.15 | 1500 | LAV | Leads | 3 1/16 | 3 3/16 | 3 3/16 | 2½ | 3 1/16 | 6.0 |
| 20C01 | — | 4.0 | 25 | 0.425 | 1500 | LHH | Lugs | 3 | 3⅜ | 2⅞ | 2 13/16 | 2⅛ | 3.4 |
| 20C27 | Dual Winding* | 5.0<br>10.0 | 32<br>8 | 0.20<br>0.05 | 1500 | LAV | Leads | 4¼ | 3½ | 3 3/16 | 2¾ | 3 1/16 | 7.5 |
| 20C02 | — | 8.0 | 10 | 0.15 | 1500 | LAH | Leads | 3¼ | 3¾ | 3 3/16 | 3⅛ | 2½ | 5.3 |
| 20C03 | — | 12.5 | 10 | 0.11 | 1500 | LAH | Leads | 3½ | 4⅛ | 3 1/16 | 3 1/16 | 2⅜ | 5.9 |

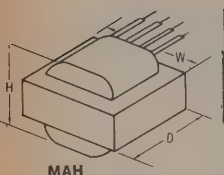
*May be connected in "Series" or "Parallel" for values listed.

THORDARSON

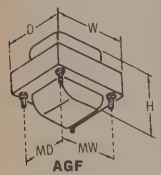
**THORDARSON MEISSNER INC.**
DEPT. EM, ELECTRONIC CENTER,
MT. CARMEL, ILLINOIS 62863
PHONE: (618) 262-5121
TWX 510-525-2254

# THORDARSON POWER TRANSFORMERS

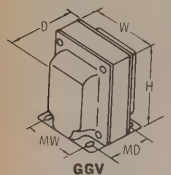
## PLATE AND FILAMENT — PRIMARY 117V 50/60 Hz WITH LEADS



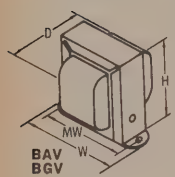
MAH



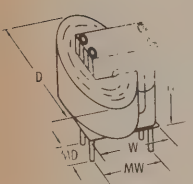
AGF



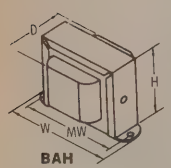
GGV



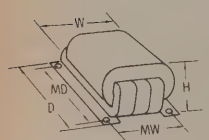
BAV BGV



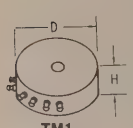
DAH



BAH



TYL



TM1

| TM Part No | Plate Supply Volts AC | Plate Supply MADC | Other Windings Volts | Other Windings Amps | Rectifier Fil. Volts | Rectifier Fil. Amps | Style | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 23V378 | 54 C.T. | 500 | 6.3 | 0.5 | — | — | GGV | 2⅝ | 2¼ | 2 1/16 | 1¾ | 1⅝ | 1.7 |
| 26R37 | 125 | 15 | 6.3 | 0.6 | — | — | BAV | 2 | 2⅜ | 1⅝ | 2 | — | 0.7 |
| 24R155 | 125 | 15 | — | — | 12.6 | 0.3 | BAV | 1 15/16 | 2⅜ | 1⅝ | 2 | — | 0.7 |
| 26R38 | 125 | 50 | 6.3 | 2.0 | — | — | BAH | 2¼ | 3 1/16 | 2⅛ | 3⅛ | — | 1.5 |
| 24R167 | 125 | 50 | — | — | 12.6 | 1.0 | BAH | 2¼ | 3 1/16 | 2⅛ | 3⅛ | — | 1.5 |
| 26R60 | 150 | 25 | 6.3 | .5 | — | — | BGV | 2 | 2⅜ | 1 13/16 | 2 | — | 0.7 |
| 24R168 | 150 | 25 | — | — | 12.6 | 0.3 | GGV | 1 15/16 | 2⅜ | 1 13/16 | 2 | — | 0.8 |
| 22R39 | 125-0-125 | 25 | 6.3 | 1.0 | — | — | BAV | 2⅜ | 2⅞ | 1¾ | 2⅜ | — | 1.0 |
| 24R166 | 125-0-125 | 25 | — | — | 12.6 | 0.6 | BAV | 2 1/16 | 2 13/16 | 1¾ | 2⅜ | — | 1.0 |
| 24R11 | 230-0-230 | 50 | 6.3 | 2.5 | — | — | AGF | 2⅝ | 3 | 2½ | 2 | 1 1/16 | 2.2 |
| 24R11U | 230-0-230 | 50 | 6.3 | 2.5 | — | — | GGV | 3 1/16 | 2⅝ | 2⅝ | 2 | 2½ | 2.2 |
| 24R19U | 240-0-240 | 55 | 5.0 | 2.0 | 6.3 C.T. | 2.0 | GGV | 3⅛ | 2⅝ | 2¾ | 2 | 1 13/16 | 2.5 |
| 24R12U | 240-0-240 | 70 | 6.3 | 3.0 | — | — | GGV | 3⅛ | 2½ | 2⅞ | 2 | 1 13/16 | 2.6 |
| 24R66U | 250-0-250 | 70 | 5.0 | 2.0 | 6.3 C.T. | 2.5 | GGV | 3⅛ | 2⅝ | 3⅛ | 2 | 2 1/16 | 3.2 |
| 24R13U | 260-0-260 | 90 | 5.0 | 2.0 | 6.3 C.T. | 3.0 | GGV | 3½ | 2⅞ | 3⅝ | 2¼ | 2¼ | 4.0 |
| 24R20U | 270-0-270 | 120 | 5.0 | 3.0 | 6.3 C.T | 3.5 | GGV | 3⅞ | 3⅛ | 3½ | 2½ | 2 3/16 | 5.0 |
| 26R160 | 270-0-270 | 260 | 5.0 | 3.0 | 6.3 | 8.8 | GGV | 3⅞ | 3⅛ | 3½ | 2½ | 2¼ | 5.5 |
| 26R51 | 281-0-281 | 250 | 5.0 | 3.0 | 6.3 | 9.5 | GGH | 3⅝ | 4⅛ | 4⅜ | 1 13/16 | 2⅜ | 6.2 |
| 24R96 | 300-0-300 | 65 | — | — | 6.3 C.T | 2.7 | GGV | 3⅛ | 2⅝ | 2½ | 2 | 1¾ | 2.7 |
| 22R65U | 300-0-300 | 120 | 5.0 | 3.0 | 6.3 C.T | 5.0 | GGV | 3⅞ | 3¼ | 3⅜ | 2½ | 2 3/16 | 4.2 |
| 24R94U | 325-0-325 | 55 | 5.0 | 2.0 | 6.3 C.T | 2.0 | GGV | 3⅛ | 2½ | 3⅛ | 2 | 2 1/16 | 3.2 |
| 24R22 | 360-0-360 | 120 | 5.0 | 3.0 | 6.3 C.T. | 3.5 | AGF | 3¾ | 3⅛ | 3¾ | 2½ | 3⅛ | 5.5 |
| 24R07U | 400-0-400 | 200 | 5.0 | 3.0 | 6.3 C.T. | 5.0 | GGV | 4⅝ | 3¾ | 4½ | 3 | 3⅜ | 9.2 |

## INVERTER/CONVERTER — TRANSISTOR POWER SUPPLY

| Part No. | Application | Style | DC Input Volts | Output Volts | Output MADC | Output PWR | Mounting Dimensions MW | Mounting Dimensions MD | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Termination | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TR269 | Converter | TMI | 12.6 | 250/125 | 100/200 | 25 | 1 1/64 | — | ¾ | — | 1¾ | Lug | .4 |
| TR270 | Converter | TMI | 12.6 | 300/150 | 200/400 | 60 | 1 1/64 | — | 1 | — | 1¾ | Lug | .4 |
| TR271 | Converter | TMI | 12.6 | 325/162.5 | 150/300 | 49 | 1 1/64 | — | 1 | — | 1¾ | Lug | .4 |
| TR272 | Converter | TMI | 12.6 | 375/187.5 | 200/400 | 75 | 1 1/64 | — | 1 | — | 2 | Lug | .5 |
| TR273 | Converter | TMI | 12.6 | 450/225 | 150/300 | 68 | 1 1/64 | — | 1 | — | 2 | Lug | .5 |
| TR274 | Converter | TMI | 12.6 | 500/250 | 250/500 | 125 | 3/16 | — | 1⅜ | — | 2¾ | Lug | .6 |
| TR275 | Converter | TMI | 12.6 | 600/300 | 200/400 | 120 | 3/16 | — | 1⅜ | — | 2¾ | Lug | .6 |
| TR483 | Converter | TMI | 12.6 | 600/300 | 350 | 105 | 13/64 | — | 1⅞ | — | 2⅞ | Lug | 1.2 |
| TR484 | Converter | TMI | 12.6 | 425/212.5 | 350 | 75 | 3/16 | — | 1⅜ | — | 2¾ | Lug | .6 |
| TR276 | Converter | TMI | 28 | 250/125 | 80/160 | 20 | 7/64 | — | 5/16 | — | 1 5/16 | Lug | .4 |
| TR277 | Converter | TMI | 28 | 300/150 | 100/200 | 30 | 1 1/64 | — | ¾ | — | 1¾ | Lug | .4 |
| TR278 | Converter | TMI | 28 | 325/162.5 | 200/400 | 65 | 1 1/64 | — | 1 | — | 1¾ | Lug | .4 |
| TR279 | Converter | TMI | 28 | 375/187.5 | 200/400 | 75 | 1 1/64 | — | 1 | — | 2 | Lug | .5 |
| TR280 | Converter | TMI | 28 | 450/225 | 200/400 | 90 | 1 1/64 | — | 1 | — | 2 | Lug | .5 |
| TR287 | Inverter | TYL | 28 | 110/115/125V | 400 Hz | 60 | 1⅞ | 1⅜ | 1⅞ | 2¼ | 2 | Leads | .6 |
| TR288 | Inverter | TYL | 12 | 110/115/125V | 400 Hz | 60 | 1⅞ | 1⅜ | 1⅞ | 2¼ | 2 | Leads | .6 |
| TR355 | Inverter | GGV | 12 | 110/115/125V | 60 Hz | 115 | 2½ | 2⅜ | 3⅞ | 3 3/32 | 3¼ | Leads | 4 |
| TR354 | Inverter | GGV | 12 | 110/115/125V | 60 Hz | 60 | 2 | 1⅞ | 3⅛ | 2⅝ | 2⅝ | Leads | 3 |
| TR78 | Converter | DAH | 12 | 250/125 | 65/130 | 16.5 | 1½ | — | 1¾ | 1¾ | 1⅜ | Leads | .50 |
| TR95 | Converter | DAH | 12 | 600/300 | 200/400 | 120 | 3¾ | — | 2 | 4⅛ | 3 | Self | 1.1 |
| *TR485 | Converter | DAH | 12 | 670/335 | 180/360 | 60 | 3¾ | — | 2 | 4⅛ | 3 | Leads | 1.1 |
| TR462 | Converter | BAH | 3 | 1000 (½ wave) | — | 25 ma | 1⅜ | — | ¾ | 1⅝ | 1 3/16 | Leads | .13 |
| TR464 | Converter | MAH | 4 | 425/500 | — | 50 μa | — | — | 7/16 | 7/16 | ½ | Leads | .025 |
| TR465 | Converter | BAH | 3 | 535 (½ wave) | — | 90 μa | 1⅜ | — | ¾ | 1⅝ | 1 3/16 | Leads | .13 |

*Has separate bias winding for SSB transmitter.

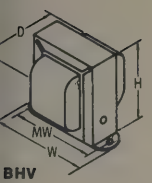
THORDARSON

**THORDARSON MEISSNER INC.**
DEPT. EM, ELECTRONIC CENTER,
MT. CARMEL, ILLINOIS 62863
PHONE: (618) 262-5121
TWX 510-525-2254

# RECTIFIER TRANSFORMERS

THORDARSON

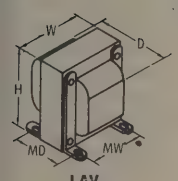
## UNIVERSAL RECTIFIER—117V 50/60 Hz PRIMARY-LUG TERMINATIONS—STYLE LHV



BHV

| TM Part No. | Fullwave Rectifier Circuits | Secondary AC Volts | Res. or Ind. Load DC Volts | Res. or Ind. Load DC Amps | Capacitive Load DC Volts | Capacitive Load DC Amps | Recommended Capacitor | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 23V60 | C.T.<br>Bridge | 11.7 to 29.4<br>11.1 to 28.5 | 3.3 to 11.2<br>7.4 to 23.0 | 2.0<br>1.25 | 3.5 to 12.8<br>8.7 to 30.0 | 2.0<br>1.25 | 1000 mfd<br>500 mfd | 3⅛ | 2⅜ | 2⅞ | 2 | 2⅛ | 2.5 |
| 23V61 | C.T.<br>Bridge | 12.2 to 29.7<br>12.2 to 29.7 | 3.7 to 11.1<br>8.9 to 24.3 | 4.0<br>2.0 | 4.0 to 14.7<br>10.8 to 33.0 | 4.0<br>2.0 | 2000 mfd<br>1000 mfd | 3 7/16 | 2 13/16 | 3⅛ | 2¼ | 2⅜ | 3.75 |
| 23V62 | C.T.<br>Bridge | 11.7 to 29.2<br>11.8 to 29.2 | 4.3 to 12.0<br>8.8 to 24.0 | 8.0<br>4.0 | 4.5 to 14.5<br>11.4 to 32.4 | 8.0<br>4.0 | 4000 mfd<br>2000 mfd | 3 13/16 | 3 5/16 | 4⅛ | 2½ | 3⅜ | 6.5 |
| 23V63 | C.T.<br>Bridge | 12.0 to 29.8<br>12.0 to 29.6 | 3.4 to 11.5<br>8.4 to 24.0 | 12.0<br>6.0 | 3.9 to 14.4<br>10.0 to 32.0 | 12.0<br>6.0 | 6000 mfd<br>3000 mfd | 4¼ | 3 9/16 | 4¼ | 2¾ | 3¼ | 8.0 |
| 23V406 | C.T.<br>Bridge | 23.5 to 60.0<br>23.5 to 60.0 | 9.0 to 25.0<br>20.5 to 53.0 | 1.0<br>0.5 | 11.0 to 34.0<br>27.0 to 74.0 | 1.0<br>0.5 | 1500 mfd<br>600 mfd | 3⅛ | 2½ | 3⅜ | 2 | 2¼ | 2.7 |
| 23V407 | C.T.<br>Bridge | 24.0 to 59.0<br>24.0 to 59.0 | 9.0 to 25.0<br>20.5 to 52.5 | 2.0<br>1.0 | 11.5 to 34.0<br>28.5 to 73.5 | 2.0<br>1.0 | 2500 mfd<br>1500 mfd | 3 7/16 | 2 13/16 | 3 11/16 | 2¼ | 2½ | 4.1 |
| 23V408 | C.T.<br>Bridge | 23.0 to 58.0<br>23.0 to 58.0 | 9.0 to 25.0<br>20.0 to 51.5 | 4.0<br>2.0 | 11.0 to 33.5<br>27.0 to 72.5 | 4.0<br>2.0 | 3000 mfd<br>1500 mfd | 3 13/16 | 3⅛ | 4½ | 2½ | 3 1/16 | 6.9 |

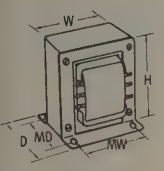
## 117V 50/60 Hz PRIMARY — TAPPED SECONDARY — WITH LEADS



LAV
LHV

| TM Part No. | Secondary Volts | Secondary Amps | RMS Test Volts | Style | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|
| 23V100 | 17.0/18.0 | 3.0 | 1500 | LAV | 3⅛ | 2 9/16 | 2 13/16 | 2 | 2⅜ | 3.2 |
| 23V101 | 17.0/18.0 | 6.0 | 1500 | LAV | 3 13/16 | 3 5/16 | 3 3/16 | 2½ | 2 11/16 | 5.5 |
| 23V383 | 20.0 C.T. | 1.0 | 1500 | BAH | 2 | 3¼ | 2⅞ | 2 13/16 | — | 1.4 |
| 23V122 | 80.0 C.T. | 1.2 | 1500 | GGV | 3½ | 2⅞ | 3½ | 2½ | 2⅜ | 4.5 |

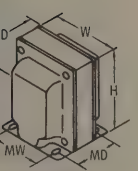
## 115/230V 50/60 Hz PRIMARY — TAPPED SECONDARY — WITH LEADS



CAV
CHV

| TM Part No. | Secondary Volts | Secondary Amps | RMS Test Volts | Style | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|
| 23V357 | 17.0/18.0 | 3.0 | 1500 | CAV | 3⅛ | 2 9/16 | 2 13/16 | 1⅜ | 2⅜ | 3.2 |
| 23V358 | 6.5/13.0/19.5/26.0 | 3.0 | 1500 | LAV | 3½ | 2⅞ | 2 11/16 | 2¼ | 2 5/16 | 3.5 |

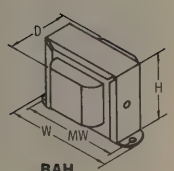
## SIGNALING — 115V 60 Hz PRIMARY — TAPPED SECONDARY — WITH LEADS



GGV

| Part No. TM | Secondary Volts | Secondary Amps | RMS Test Volts | Style | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|
| 23V03 | 4/8/12/16/20/24 | 2.0 to 2.8 | 1500 | BAH | 2¼ | 3 11/16 | 2½ | 3⅛ | — | 1.7 |
| 23V04 | 4/8/12/16/20/24 | 4.0 to 5.6 | 1500 | LAV | 3½ | 2⅞ | 2 5/16 | 2¼ | 2 1/16 | 3.1 |

## DUAL SECONDARIES — 115/230V 50/60 Hz PRIMARY



BAH

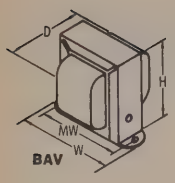
| TM Part No. | Secondary Outputs: Each Winding Volts | Each Winding Amps | Sec. in Series Volts | Sec. in Series Amps | Sec. in Parallel Volts | Sec. in Parallel Amps | VA Capacity | Style | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 23V50 | 6.0 | 1.0 | 12 | 1.0 | 6.0 | 2.0 | 12 | BHV | 2⅜ | 2⅛ | 1⅛ | 2⅜ | — | 1.0 |
| 23V51 | 6.0 | 2.0 | 12 | 2.0 | 6.0 | 4.0 | 24 | BHV | 2¾ | 3⅛ | 2⅛ | 2 13/16 | — | 1.5 |
| 23V52 | 12 | 2.0 | 24 | 2.0 | 12 | 4.0 | 48 | BHV | 3⅛ | 3 9/16 | 2⅜ | 3⅛ | — | 2.5 |
| 23V53 | 12 | 4.0 | 24 | 4.0 | 12 | 8.0 | 96 | CHV | 3 7/16 | 2⅛ | 3⅛ | 2¼ | 2⅜ | 4.3 |
| 23V54 | 12 | 8.0 | 24 | 8.0 | 12 | 16 | 192 | CHV | 4 3/16 | 3½ | 3½ | 2¾ | 2⅞ | 8.0 |
| 23V388 | 24 | 0.25 | 48 | 0.25 | 24 | 0.5 | 12 | BHV | 2⅜ | 2⅛ | 1⅛ | 2⅜ | — | 1.0 |
| 23V389 | 24 | 0.50 | 48 | 0.50 | 24 | 1.0 | 24 | BHV | 2¾ | 3⅛ | 2⅛ | 2 13/16 | — | 1.5 |
| 23V390 | 24 | 1.0 | 48 | 1.0 | 24 | 2.0 | 48 | BHV | 3⅛ | 3 9/16 | 2⅜ | 3⅛ | — | 2.5 |
| 23V391 | 24 | 2.0 | 48 | 2.0 | 24 | 4.0 | 96 | CHV | 3 7/16 | 2⅛ | 3⅛ | 2¼ | 2⅜ | 4.3 |
| 23V392 | 24 | 4.0 | 48 | 4.0 | 24 | 8.0 | 192 | CHV | 4 3/16 | 3½ | 3½ | 2¾ | 2⅞ | 8.0 |

THORDARSON

**THORDARSON MEISSNER INC.**
DEPT. EM, ELECTRONIC CENTER,
MT. CARMEL, ILLINOIS 62863
PHONE: (618) 262-5121
TWX 510-525-2254

# THORDARSON RECTIFIER TRANSFORMERS

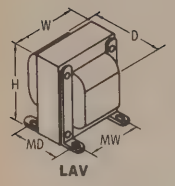
## TRIPLE SECONDARIES — 117V 50/60 Hz PRIMARY — WITH LEADS



BAV

| TM Part No. | Each Secondary | | Secondaries in Series | | Secondaries in Parallel | | Style | Outline Dimensions | | | Mounting Dimensions | | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Volts | Amps | Volts | Amps | Volts | Amps | | H | W | D | MW | MD | |
| 23V236 | 12 | 0.10 | 36 | 0.10 | 12 | 0.30 | BAV | 1¾ | 2 | 1½ | 1¾ | — | 0.36 |
| 23V237 | 12 | 0.15 | 36 | 0.15 | 12 | 0.45 | BAV | 2 | 2⅜ | 1¾ | 2 | — | 0.60 |
| 23V238 | 12 | 0.25 | 36 | 0.25 | 12 | 0.75 | BAV | 2⅜ | 2⅞ | 2 | 2⅜ | — | 0.85 |
| 23V239 | 12 | 0.50 | 36 | 0.50 | 12 | 1.50 | BAV | 2⅜ | 2⅞ | 2¼ | 2⅜ | — | 1.25 |

## 117V 50/60 Hz PRIMARY — MULTI-TAPPED SECONDARY — WITH LEADS

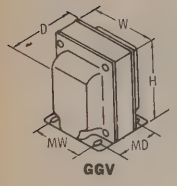


LAV

| TM Part No. | Secondary | | RMS Test Volts | Style | Outline Dimensions | | | Mounting Dimensions | | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Volts | Amps | | | H | W | D | MW | MD | |
| 23V103 | 6.3/13/19.5/26 | 3.0 | 1500 | LAV | 3½ | 2⅞ | 2 11/16 | 2¼ | 2 3/16 | 3.5 |
| 23V107 | 7/8/9 | 7.0 | 1500 | LAV | 3½ | 2⅞ | 2 11/16 | 2¼ | 2 3/16 | 3.5 |
| 23V396* | 18/20/22 | 2.0 | 1500 | BHV* | 3⅛ | 3 9/16 | 2¼ | 3⅛ | — | 2.5 |
| 23V104 | 24/27/30/33/36 | 3.0 | 1500 | LAV | 3 13/16 | 3 9/16 | 3 9/16 | 2½ | 2 11/16 | 5.6 |
| 23V394 | 24/26/28/30 | 15.0 | 1500 | LAH▲ | 3 13/16 | 4½ | 5½ | 3¾ | 4⅜ | 17.0 |

*Secondary has Solder Lug Terminals.
▲Secondary Leads have Terminals attached.

## 117V 50/60 Hz PRIMARY — DUAL SECONDARIES — WITH LEADS

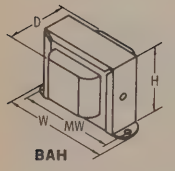


GGV

| TM Part No. | Primary Volts | Secondary 1 | | Secondary 2 | | RMS Test Volts | Style | Outline Dimensions | | | Mounting Dimensions | | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Volts | Amps | Volts | Amps | | | H | W | D | MW | MD | |
| 23V121* | 117 | *13/18* | .900 | 13/18* | .900 | 1500 | GGV | 3⅛ | 3 | 2½ | 2 | 2 | 2.7 |
| 23V102 | 117 | 36 | 3.0 | 36 | 3.0 | 1500 | LAV | 4⅝ | 3¾ | 3¾ | 3 | 3 1/16 | 9.7 |

*Secondary Voltage varied by means of Primary Taps.

## MULTIPLE PRIMARY AND SECONDARY TAPS — WITH LEADS



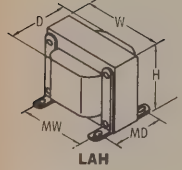
BAH

| TM Part No. | Primary Volts (Blk/Blk/Yel) | Secondary | | Style | Outline Dimensions | | | Mounting Dimensions | | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Volts* | Amps | | H | W | D | MW | MD | |
| 23V115 | 117 | 10-20-40* | 0.035 | BAH | 1⅜ | 2⅜ | 1⅜ | 2 | — | .5 |
| 23V116 | 117 | 10-20-40* | 0.100 | BAH | 1⅝ | 2 13/16 | 1¾ | 2⅜ | — | .7 |
| 23V117 | 117 | 10-20-40* | 0.300 | BAH | 2¼ | 3 1/16 | 2 | 3⅛ | — | 1.5 |
| 23V118 | 117 | 10-20-40* | 0.750 | BAH | 2⅝ | 4 | 2¼ | 3 3/16 | — | 2.4 |
| 23V119 | 117 | 10-20-40* | 1.0 | GGV | 3¼ | 2 1/16 | 3 | 2 | 2⅛ | 3.2 |
| 23V411 | 117 | 6 to 42* | 1.0 | GGV | 3⅛ | 2½ | 3⅛ | 2 | 2⅛ | 3.2 |
| 23V410 | 117 | 6 to 42* | 0.750 | BAH | 2⅝ | 4 | 2⅜ | 3 3/16 | — | 2.3 |
| 23V409 | 117 | 6 to 42* | 0.035 | BAH | 1⅜ | 2⅜ | 1 7/16 | 2 | — | .45 |

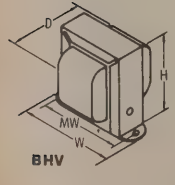
*Additional secondary voltages available in ranges provided by applying primary voltage to other taps.

## 117V 50/60 Hz PRIMARY — SINGLE SECONDARY — WITH LEADS

### 12 VOLTS



LAH



BHV

| TM Part No. | Secondary | | RMS Test Volts | Style | Outline Dimensions | | | Mounting Dimensions | | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Volts | Amps | | | H | W | D | MW | MD | |
| 23V252 | 12 | 0.150 | 1500 | BAH | 1¼ | 2⅛ | 1¼ | 1¾ | — | 0.25 |
| 23V253 | 12 | 0.300 | 1500 | BAH | 1⅜ | 2⅜ | 1⅜ | 2 | — | 0.35 |
| 23V254 | 12 | 0.700 | 1500 | BAH | 1⅝ | 2⅞ | 1½ | 2⅜ | — | 0.6 |
| 23V255 | 12 | 1.2 | 1500 | BAH | 2 | 3¼ | 1⅝ | 2 13/16 | — | 0.85 |
| 23V415 | 12 | 2.0 | 1500 | BAH | 2 | 3¼ | 2⅛ | 2 13/16 | — | 1.3 |
| 23V416 | 12 | 4.0 | 1500 | BAH | 2⅝ | 4 | 2¼ | 3 3/16 | — | 2.3 |
| 23V417 | 12 | 6.0 | 1500 | LAV | 3 3/16 | 2 13/16 | 2⅝ | 2¼ | 2⅛ | 3.4 |
| 23V418 | 12 | 8.0 | 1500 | LAV | 3 13/16 | 3⅛ | 2¾ | 2½ | 2⅛ | 4.3 |

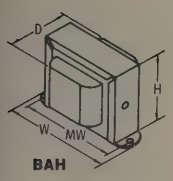
Listing continued on next page

THORDARSON MEISSNER INC.
DEPT. EM, ELECTRONIC CENTER,
MT. CARMEL, ILLINOIS 62863
PHONE: (618) 262-5121
TWX 510-525-2254

# RECTIFIER TRANSFORMERS

THORDARSON

## 117V 50/60 Hz PRIMARY — SINGLE SECONDARY — WITH LEADS (Cont'd)



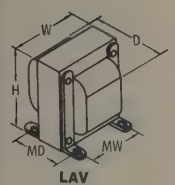
BAH

### 24 VOLTS

| TM Part No. | Secondary Volts | Secondary Amps | RMS Test Volts | Style | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|
| 23V257 | 24 C.T. | 0.200 | 1500 | BAH | 1⅜ | 2⅜ | 1⅜ | 2 | — | 0.35 |
| 23V258 | 24 C.T. | 0.400 | 1500 | BAH | 1⅝ | 2⅜ | 1⅜ | 2 | — | 0.6 |
| 23V259 | 24 C.T. | 0.700 | 1500 | BAH | 2 | 3¼ | 1¾ | 2 13/16 | — | 0.85 |
| 23V419 | 24 C.T. | 4.0 | 1500 | LAV | 3 13/16 | 3⅛ | 2 13/16 | 2½ | 2⅛ | 4.0 |
| 23V420 | 24 C.T. | 6.0 | 1500 | LAV | 4 3/16 | 3 7/16 | 3.0 | 2¾ | 2¼ | 5.7 |
| 23V421 | 24 C.T. | 8.0 | 1500 | LAV | 4 3/16 | 3 7/16 | 3⅜ | 2¾ | 2¼ | 7.3 |
| 23V422 | 24 C.T. | 12.0 | 1500 | LAV | 4 9/16 | 3¼ | 4⅜ | 3.0 | 3¼ | 11.5 |

### 28 VOLTS

| TM Part No. | Secondary Volts | Secondary Amps | RMS Test Volts | Style | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|
| 23V379 | 28 C.T. | 0.085 | 1500 | BAH | 1¼ | 2⅛ | 1¼ | 1¾ | — | 0.25 |
| 23V380 | 28 C.T. | 0.175 | 1500 | BAH | 1⅜ | 2⅜ | 1⅜ | 2 | — | 0.35 |
| 23V381 | 28 C.T. | 0.300 | 1500 | BAH | 1⅝ | 2⅞ | 1½ | 2⅜ | — | 0.6 |
| 23V382 | 28 C.T. | 0.800 | 1500 | BAH | 2 | 3¼ | 2 | 2 1/16 | — | 1.0 |
| 23V423 | 28 C.T. | 1.0 | 1500 | BAH | 2.0 | 3¼ | 2⅛ | 2 13/16 | — | 1.4 |
| 23V424 | 28 C.T. | 2.0 | 1500 | LAV | 3⅛ | 2½ | 2½ | 2.0 | 2 3/16 | 2.9 |
| 23V425 | 28 C.T. | 4.0 | 1500 | LAV | 3 13/16 | 3⅛ | 3¼ | 2½ | 2½ | 5.3 |
| 23V426 | 28 C.T. | 6.0 | 1500 | LAV | 4 3/16 | 3 7/16 | 3½ | 2¾ | 2⅝ | 7.0 |



LAV

### 30 VOLTS

| TM Part No. | Secondary Volts | Secondary Amps | RMS Test Volts | Style | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|
| 21F190 | 30 | 3.0 | 1500 | GGV | 3½ | 2 13/16 | 3⅝ | 2¼ | 2 7/16 | 4.2 |

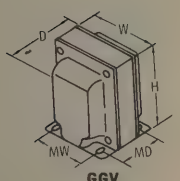
### 36 VOLTS

| TM Part No. | Secondary Volts | Secondary Amps | RMS Test Volts | Style | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|
| 23V384 | 36 C.T. | 0.065 | 1500 | BAH | 1¼ | 2⅛ | 1¼ | 1¾ | — | 0.25 |
| 23V385 | 36 C.T. | 0.135 | 1500 | BAH | 1⅜ | 2⅜ | 1⅜ | 2 | — | 0.35 |
| 23V386 | 36 C.T. | 0.300 | 1500 | BAH | 1⅝ | 2⅞ | 1½ | 2⅜ | — | 0.6 |
| 23V387 | 36 C.T. | 0.550 | 1500 | BAH | 2 | 3¼ | 1⅜ | 2 13/16 | — | 1.0 |
| 23V427 | 36 C.T. | 1.0 | 1500 | BAH | 2⅜ | 3¼ | 2¼ | 3⅛ | — | 2.0 |
| 23V428 | 36 C.T. | 2.0 | 1500 | LAV | 3 1/16 | 2 13/16 | 2¾ | 2¼ | 2⅛ | 3.5 |
| 23V429 | 36 C.T. | 4.0 | 1500 | LAV | 4 3/16 | 3 7/16 | 2⅞ | 2¾ | 2⅜ | 6.0 |
| 23V430 | 36 C.T. | 6.0 | 1500 | LAV | 4 9/16 | 3¼ | 3½ | 3 | 2⅝ | 8.3 |

### 48 VOLTS

| TM Part No. | Secondary Volts | Secondary Amps | RMS Test Volts | Style | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|
| 21F187 | 48 C.T.† | 1.0 | 2500 | BAH | 2⅛ | 4 | 2⅛ | 3 9/16 | — | 2.3 |

†Primary tapped to provide secondary voltage of 45 C.T. or 48 C.T. or 51 C.T. or 54 C.T.



GGV

### 50 VOLTS

| TM Part No. | Secondary Volts | Secondary Amps | RMS Test Volts | Style | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|
| 23V377 | 50 C.T. | 1.0 | 1500 | GGV | 3⅛ | 2½ | 2¾ | 2 | 1¾ | 2.3 |

### 64 VOLTS

| TM Part No. | Secondary Volts | Secondary Amps | RMS Test Volts | Style | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|
| 23V215 | 64 C.T. | 0.9 | 1500 | BAH | 2 11/16 | [illegible] | 2½ | 3 1/16 | — | 1.75 |

### 72 VOLTS

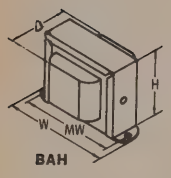
| TM Part No. | Secondary Volts | Secondary Amps | RMS Test Volts | Style | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|
| 23V89 | 72 C.T. | 0.075 | 1500 | BAH | 1⅝ | 2 13/16 | 1⅝ | 2⅜ | — | 0.6 |

THORDARSON

**THORDARSON MEISSNER INC.**
DEPT. EM, ELECTRONIC CENTER,
MT. CARMEL, ILLINOIS 62863
PHONE: (618) 262-5121
TWX 510-525-2254

# THORDARSON RECTIFIER TRANSFORMERS

## 230V 50/60 Hz PRIMARY — SINGLE SECONDARY



BAH

### 24 VOLTS

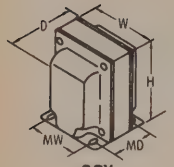
| TM Part No. | Secondary | | RMS Test Volts | Style | Outline Dimensions | | | Mounting Dimensions | | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Volts | Amps | | | H | W | D | MW | MD | |
| 23V401 | 24 C.T. | 0.085 | 1500 | BAH | 1¼ | 2⅛ | 1¼ | 1¾ | — | 0.25 |
| 23V402 | 24 C.T. | 0.200 | 1500 | BAH | 1⅜ | 2⅜ | 1⅜ | 2 | — | 0.35 |
| 23V403 | 24 C.T. | 0.400 | 1500 | BAH | 1⅝ | 2⅞ | 1⅝ | 2⅜ | — | 0.60 |
| 23V404 | 24 C.T. | 0.700 | 1500 | BAH | 2 | 3¼ | 1¾ | 2 13/16 | — | 0.85 |

### 36 VOLTS

| TM Part No. | Secondary | | RMS Test Volts | Style | Outline Dimensions | | | Mounting Dimensions | | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Volts | Amps | | | H | W | D | MW | MD | |
| 23V405 | 36 C.T. | 0.065 | 1500 | BAH | 1¼ | 2⅛ | 1¼ | 1¾ | — | 0.25 |

## SILICON RECTIFIER — 117V 50/60 Hz PRIMARY

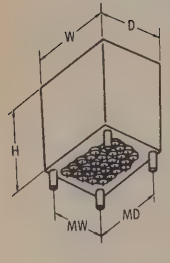
These transformers have been designed to fill the gap between the electronic tube — high voltage, low current — type of transformer and the transistor — low voltage, high current — type unit. The two 6.3 volt windings may be connected in series or in parallel to provide either 6.3 volts or 12.6 volts C.T. They may also be used with suitable rectifiers to supply a low voltage DC source.



GGV

| TM Part No. | Secondary No. 1 | | Secondary No. 2 | | Secondary No. 3 | | Termination | | Style | Outline Dimensions | | | Mounting Dimensions | | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Volts | Amps RMS | Volts | Amps RMS | Volts | Amps RMS | Pri. | Sec. | | H | W | D | MW | MD | |
| 24R100 | 400 C.T. | 400 | 6.3 | 3.0 | 6.3 | 3.0 | Leads | Leads | GGV | 4¼ | 3 7/16 | 4¼ | 2¾ | 3 1/16 | 7.1 |
| 24R101 | 300 C.T. | 600 | 6.3 | 2.5 | 6.3 | 2.5 | Leads | Leads | GGV | 4¼ | 3 7/16 | 4¼ | 2¾ | 3 1/16 | 7.1 |
| 23V376 | 54 C.T. | 500 | 6.3 | 0.5 | — | — | Leads | Leads | GGV | 2⅝ | 2¼ | 2 1/16 | 1¾ | 1⅝ | 1.7 |
| 24R102 | 200 C.T. | 800 | 6.3 | 2.0 | 6.3 | 2.0 | Leads | Leads | GGV | 4¼ | 3 7/16 | 4⅛ | 2¾ | 2 13/16 | 6.9 |
| 24R103 | 100 C.T. | 1600 | 6.3 | 1.5 | 6.3 | 1.5 | Leads | Leads | GGV | 4¼ | 3 7/16 | 3⅞ | 2¾ | 2 11/16 | 6.0 |
| 24R104 | 80 C.T. | 2000 | 6.3 | 1.5 | 6.3 | 1.5 | Leads | Leads | GGV | 4¼ | 3 7/16 | 4 | 2¾ | 2 13/16 | 6.5 |
| 24R105 | 60 C.T. | 2500 | 6.3 | 1.5 | 6.3 | 1.5 | Leads | Leads | GGV | 4¼ | 3 7/16 | 4 | 2¾ | 2 13/16 | 6.5 |

## UNIVERSAL RECTIFIER — ENCASED MILITARY — PRIMARY 115V 50/60 Hz — DUAL SECONDARY — TAPPED PRIMARY




| TM Part No. | MIL-T-27 Classification | Military DC Range | Industrial DC Range | MIL Case | Mounting Dimensions | Case Dimensions | | | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | H | W | D | |
| 27V60 | TF4RX02AH | 6V—.065A to 53V—.025A | 6V—.085A to 53V—.025A | AH | 1¼ | 1¾ | 1 1/16 | 1 1/16 | .37 |
| 27V61 | TF4RX02AJ | 6V—.22A to 53V—.07A | 6V—.028A to 53V—.085A | AJ | 1 1/16 x 1 1/16 | 2⅜ | 1⅝ | 1⅝ | .6 |
| 27V62 | TF4RX02FA | 6V—1.2A to 53V—.4A | 6V—1.52A to 53V—.48A | FA | 1 11/16 x 1 7/16 | 3⅛ | 2 1/16 | 2 5/16 | 1.75 |
| 27V63 | TF4RX02HA | 6V—3A to 53V—1A | 6V—3.8A to 53V—1.2A | HA | 2 13/64 x 1 55/64 | 4¼ | 2⅝ | 3 1/16 | 4.5 |
| 27V64 | TF4RX02KA | 6V—7.5A to 53V—2.5A | 6V—9A to 53V—2.5A | KA | 3 x 2 7/16 | 5¼ | 3⅜ | 3 15/16 | 8.5 |

## REPLACEMENT PARTS

THORDARSON maintains the most complete line of replacement transformers in the industry. Television flybacks, yokes, vertical output and power transformers are stocked in-depth plus thousands of other hard-to-get transformers and chokes for consumer, commercial, industrial, medical, and military applications. Your THORDARSON distributor has up-to-date TV replacement info.

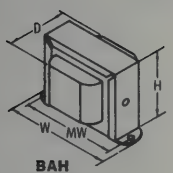
THORDARSON

**THORDARSON MEISSNER INC.**
DEPT. EM, ELECTRONIC CENTER,
MT. CARMEL, ILLINOIS 62863
PHONE: (618) 262-5121
TWX 510-525-2254

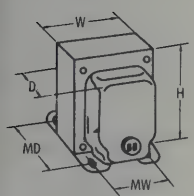
# LINE ADJUSTING TRANSFORMERS

THORDARSON

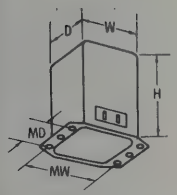
## STEP-DOWN AND STEP-UP AUTOFORMERS — INPUT 50/60 Hz WITH 2 CONDUCTOR LINE CORD AND PLUG. OUTPUT 2 CONDUCTOR FEMALE RECEPTACLE.



BAH



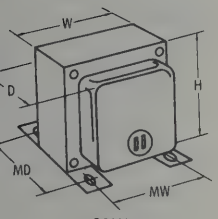
GMV



TMV

| TM Part No. | Output VA | Primary Voltage | Secondary Voltage | RMS Test Volts | Style | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 23V393 | 50 | 230 | 115 | 1500 | BAH | 2 5/16 | 3 11/1 | 1 3/8 | 3 1/8 | — | 1.5 |
| 23V338 | 85 | 230 | 115 | 1500 | GMV | 3 1/2 | 2 5/8 | 2 3/4 | 2 | 1 3/4 | 2.5 |
| 23V397 | 85 | 115 | 230 | 1500 | GMV | 3 | 2 1/2 | 2 3/4 | 2 | 1 3/4 | 2.5 |
| 23V344 | 125 | 230 | 115 | 1500 | GMV | 3 | 2 5/8 | 3 | 2 | 2 | 3.0 |
| 23V398 | 125 | 115 | 230 | 1500 | GMV | 3 | 2 1/2 | 3 | 2 | 2 | 3.0 |
| 23V22 | 150 | 230 | 115 | 1500 | GMV | 3 1/8 | 3 1/4 | 3 3/8 | 2 1/2 | 2 1/16 | 3.0 |
| 23V339 | 200 | 230 | 115 | 1500 | GMV | 3 1/8 | 3 3/16 | 3 5/16 | 2 1/2 | 2 | 4.2 |
| 23V23 | 250 | 230 | 115 | 1500 | GMV | 4 5/8 | 3 1/8 | 3 1/2 | 3 | 2 5/8 | 6.2 |
| 23V343 | 300 | 230 | 115 | 1500 | GMV | 3 1/8 | 3 3/16 | 3 11/16 | 2 1/2 | 2 5/8 | 5.2 |
| 23V399 | 300 | 115 | 230 | 1500 | GMV | 3 1/8 | 3 3/16 | 3 11/16 | 2 1/2 | 2 5/8 | 5.2 |
| 23V340 | 400 | 230 | 115 | 1500 | GMV | 3 1/8 | 3 3/16 | 4 3/8 | 2 1/2 | 3 1/16 | 7.0 |
| 23V342 | 500 | 230 | 115 | 1500 | GMV | 4 9/16 | 3 13/16 | 4 5/8 | 3 | 3 7/16 | 10.3 |
| 23V400 | 500 | 115 | 230 | 1500 | GMV | 4 9/16 | 3 13/16 | 4 5/8 | 3 | 3 7/16 | 10.3 |
| 23V341 | 1000 | 230 | 115 | 1500 | GMV | 4 9/16 | 3 13/16 | 6 1/8 | 3 | 4 15/16 | 17.0 |
| 25V15 | 1000 | 230 | 115 | 1500 | TMV | 7 1/16 | 6 1/8 | 6 1/2 | 6 | 4 1/4 | 22.0 |
| 23V84 | 1200 | 230 | 115 | 1500 | GMV | 4 5/8 | 3 5/8 | 6 5/8 | 3 | 5 1/2 | 18.0 |
| 23V120 | 2000 | 230 | 115 | 1500 | GMV | 5 5/16 | 4 1/2 | 7 3/8 | 3 1/2 | 6 5/8 | 33.0 |
| 23V46 | 3000 | 230/208 | 208/230 | 1750 | GMH | 4 | 4 1/2 | 6 | 3 3/4 | 2 1/2 | 10.0 |

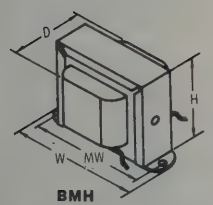
## STEP-DOWN AUTOFORMERS — INPUT 230 VOLTS 50/60 Hz WITH LINE CORD AND 3 CONDUCTOR PLUG. OUTPUT 115 VOLTS WITH 3 CONDUCTOR RECEPTACLE. CORE AND FRAME GROUNDED TO THIRD CONDUCTOR OF NEMA STANDARD CORD.



GMH

| TM Part No. | Output VA | Primary Voltage | Secondary Voltage | RMS Test Volts | Style | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 23V290 | 75 | 230 | 115 | 1500 | GMV | 3 1/8 | 3 3/16 | 2 3/4 | 2 1/2 | 1 1/2 | 3.0 |
| 23V413 | 100 | 230 | 115 | 1500 | BMH* | 2 1/4 | 3 11/16 | 2 3/8 | 3 1/8 | 1 1/2 | 1.75 |
| 23V284 | 100 | 230 | 115 | 1500 | GMV | 3 1/8 | 3 3/16 | 3 | 2 1/2 | 1 3/4 | 3.7 |
| 23V291 | 150 | 230 | 115 | 1500 | GMV | 3 1/8 | 3 3/16 | 3 1/4 | 2 1/2 | 2 | 4.4 |
| 23V292 | 250 | 230 | 115 | 1500 | GMV | 4 5/8 | 3 13/16 | 3 3/4 | 3 | 2 5/8 | 7.6 |
| 23V293 | 350 | 230 | 115 | 1500 | GMV | 4 5/8 | 3 13/16 | 3 3/4 | 3 | 2 5/8 | 7.4 |
| 23V285 | 500 | 230 | 115 | 1500 | GMV | 4 5/8 | 3 13/16 | 4 3/16 | 3 | 3 1/16 | 9.6 |
| 23V295 | 750 | 230 | 115 | 1500 | GMV | 5 1/2 | 4 5/8 | 4 1/2 | 3 1/2 | 2 3/8 | 12.1 |
| 23V294 | 1000 | 230 | 115 | 1500 | GMV | 5 1/2 | 4 5/8 | 5 3/8 | 3 1/2 | 3 3/4 | 16.5 |
| 23V296 | 1500 | 230 | 115 | 1500 | GMV | 5 1/2 | 4 5/8 | 5 7/8 | 3 1/2 | 4 1/4 | 20.1 |

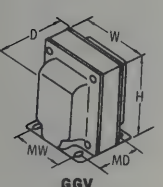
*2 conductor line cords, plug and receptacle.



BMH

## ISOLATION—PRIMARY 50/60 Hz WITH 2 CONDUCTOR LINE CORD. SECONDARY—2 CONDUCTOR RECEPTACLE AND ELECTROSTATIC SHIELD GROUNDED TO CORE.

| TM Part No. | Output VA | Primary Voltage | Secondary Voltage | RMS Test Volts | Style | Outline Dimensions H | Outline Dimensions W | Outline Dimensions D | Mounting Dimensions MW | Mounting Dimensions MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 23V86 | 40 | 110-120 | 110-120 | 1500 | GMV | 3 1/8 | 2 5/8 | 3 1/8 | 2 | 1 3/8 | 4.0 |
| 23V45 | 50 | 115 | 115 | 1500 | GMV | 3 3/8 | 3 1/4 | 3 1/4 | 2 1/2 | 1 15/16 | 4.25 |
| 23V25 | 100 | 105/115/125 † | 115 | 1500 | GMV | 4 1/4 | 3 1/2 | 3 3/8 | 2 3/4 | 3 1/16 | 6.2 |
| 23V49 | 150 | 115 | 115 | 1500 | GMV | 4 3/4 | 3 3/8 | 3 3/4 | 3 | 2 9/16 | 7.0 |
| 23V74 | 150 | 115-230 | 115 | 1500 | GGV | 3 3/8 | 3 9/32 | 3 3/8 | 2 1/2 | 3 | 7.0 |
| 23V58 | 250 | 115 | 115 | 1500 | GMV | 4 3/4 | 3 3/8 | 5 3/4 | 3 | 3 9/16 | 12.5 |
| 23V126 | 250 | 105/115/125 * | 115 | 1500 | GMV | 4 3/4 | 4 | 5 3/8 | 3 | 4 5/16 | 14.2 |
| 23V129 | 250 | 210/230/250 * | 115 | 1500 | GMV | 4 3/4 | 4 | 5 3/8 | 3 | 4 5/16 | 14.2 |
| 23V19 | 350 | 115 | 105/115/1 | 1500 | GMV | 5 3/8 | 4 1/2 | 5 3/4 | 3 1/2 | 3 3/8 | 13.0 |
| 23V44 | 600 | 115 | 115 | 1500 | GMV | 4 5/8 | 3 3/8 | 7 3/16 | 3 | 6 | 16.0 |



GGV

†Has receptacle for voltage adjustment. *Complete with tap switch for voltage adjustment.

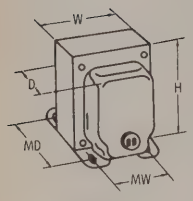
## FLYBACKS AND YOKES FOR DISPLAY INFORMATION SYSTEMS AND MONITORS

THORDARSON designs and manufactures flybacks and yokes to customer specifications for a broad range of display applications. Our high voltage transformers feature flame retardant construction in all configurations. Contact factory with your display requirements.

THORDARSON MEISSNER INC. • DEPT. EM, ELECTRONIC CENTER, MT. CARMEL, ILLINOIS 62863 • PHONE: (618) 262-5121
TWX: 510-525-2254

# THORDARSON LINE ADJUSTING TRANSFORMERS

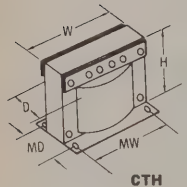
## ISOLATION — PRIMARY 50/60 Hz WITH 3 CONDUCTOR LINE CORD. SECONDARY — 3 CONDUCTOR RECEPTACLE. CORE AND FRAME GROUNDED TO THIRD CONDUCTOR OF NEMA STANDARD CORD.



GMV

| TM Part No. | Output VA | Primary Voltage | Secondary Voltage | RMS Test Volts | Style | Outline Dimensions H | W | D | Mounting Dimensions MW | MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 23V365 | 150 | 115 | 115 | 1500 | GMV | 3⅜ | 3 3/16 | 4 3/16 | 2½ | 2 15/16 | 7.0 |
| 23V366 | 250 | 115 | 115 | 1500 | GMV | 4 11/16 | 3¾ | 4⅜ | 3 | 3 3/16 | 9.3 |
| 23V371 | 250 | 230 | 115 | 1500 | GMV | 4 11/16 | 3¾ | 4¼ | 3 | 3 3/16 | 9.0 |
| 23V367 | 500 | 115 | 115 | 1500 | GMV | 4 11/16 | 3¾ | 6 | 3 | 4 13/16 | 16.5 |
| 23V372 | 500 | 230 | 115 | 1500 | GMV | 4 11/16 | 3¾ | 6 | 3 | 4 13/16 | 16.0 |
| 23V368 | 1000 | 115 | 115 | 1500 | GMV | 5½ | 4 9/16 | 8⅛ | 3½ | 6½ | 31.5 |
| 23V373 | 1000 | 230 | 115 | 1500 | GMV | 5½ | 4 9/16 | 8⅛ | 3½ | 6½ | 31.0 |

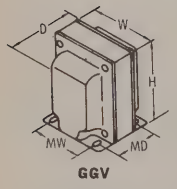
## ISOLATION — UNIVERSAL VOLTAGE CONTROL 50/60 Hz WITH 4-115 VOLT WINDINGS AND PRIMARY/SECONDARY LUGS ISOLATION CONNECTIONS 115 TO 115 VOLT, 115 TO 230 VOLT, 230 TO 115 VOLT. AUTOFORMER CONNECTIONS 115 TO 230 VOLT, 115 TO 460 VOLTS, 230 TO 460 VOLTS.



CTH

| TM Part No. | Output VA | Primary Voltage | Secondary Voltage | RMS Test Volts | Style | Outline Dimensions H | W | D | Mounting Dimensions MW | MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 23V34 | 50 | 115/230 | 115/230 | 1500 | CTH | 2⅝ | 3 | 3⅝ | 2½ | 2⅛ | 2.75 |
| 23V35 | 100 | 115/230 | 115/230 | 1500 | CTH | 3¼ | 3¾ | 2⅞ | 3⅛ | 2⅛ | 5.0 |
| 23V36 | 200 | 115/230 | 115/230 | 1500 | CTH | 2⅞ | 4½ | 3⅝ | 3¾ | 2¾ | 9.0 |
| 23V37 | 300 | 115/230 | 115/230 | 1500 | CTH | 4⅛ | 4⅞ | 3¾ | 4⅛ | 2⅞ | 11.0 |
| 23V38 | 500 | 115/230 | 115/230 | 1500 | CTH | 4⅛ | 4⅞ | 5 | 4⅛ | 4⅛ | 17.0 |

## ISOLATION — 50/60 Hz WIRE — IN TYPE WITH LEAD WIRES FOR PERMANENT INSTALLATION (SHIELDED).

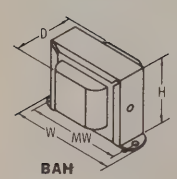


GGV

| TM Part No. | Output VA | Primary Voltage | Secondary Voltage | RMS Test Volts | Style | Outline Dimensions H | W | D | Mounting Dimensions MW | MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 23V376 | 0.6 | 115 | 115 | 1500 | BAH | 1¼ | 2⅛ | 1¼ | 1¾ | — | 0.25 |
| 23V374 | 15 | 115 | 115 | 1500 | BAH | 2 | 3¼ | 1⅞ | 2 13/16 | — | 1.0 |
| 23V17 | 35 | 115 | 115 | 1500 | BAH | 2¼ | 3 13/16 | 2½ | 3⅛ | — | 1.75 |
| 23V80 | 50 | 115 | 115 | 1500 | BAH | 2¼ | 3 13/16 | 2½ | 3⅛ | — | 1.75 |
| 23V18 | 80 | 115 | 115 | 1500 | GGV | 3⅜ | 3 3/16 | 3½ | 2½ | 2 5/16 | 5.0 |
| 23V395 | 150 | 115 | 115/230¶ | 1500 | GMV | 3⅜ | 3 3/16 | 4 | 2½ | 2¾ | 6.2 |
| 23V94 | 250 | 115/230 | 115 | 1500 | GGV | 4⅝ | 3 15/16 | 4¾ | 3 | 3⅝ | 11.0 |

¶Secondary has two separate windings.

## ISOLATION — 50/60 Hz MACHINE TOOL CONTROL TYPE — PRIMARY/SECONDARY SCREW TERMINALS



BAH

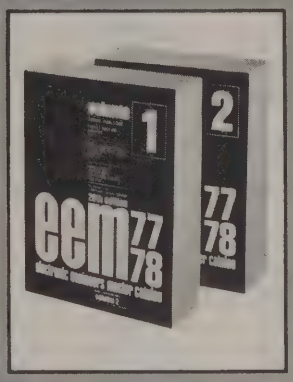
| TM Part No. | Output VA | Primary Voltage | Secondary Voltage | RMS Test Volts | Style | Outline Dimensions H | W | D | Mounting Dimensions MW | MD | Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| G342 | 50 | 230/460 | 115 | 2000 | CTH | 3 3/16 | 3¾ | 3 3/16 | 3⅛ | 1½ | 3.0 |
| G343 | 75 | 230/460 | 115 | 2000 | CTH | 3 3/16 | 3¾ | 3 7/16 | 3⅛ | 1¾ | 4.0 |
| G344 | 150 | 230/460 | 115 | 2000 | CTH | 3⅜ | 4⅝ | 3 15/16 | 3¾ | 2⅜ | 7.5 |
| G345 | 300 | 230/460 | 115 | 2000 | CTH | 3⅜ | 4⅝ | 5 9/16 | 3¾ | 4 | 13.5 |
| G346 | 500 | 230/460 | 115 | 2000 | CTH | 4 13/16 | 5¼ | 5 | 4⅜ | 3 9/16 | 13.5 |
| G347 | 750 | 230/460 | 115 | 2000 | CTH | 4 13/16 | 5¼ | 6 7/16 | 4⅜ | 5 | 21.0 |
| G348 | 1000 | 230/460 | 115 | 1500 | CTH | 6⅛ | 6¾ | 5⅞ | 5½ | 3½ | 26.5 |

THORDARSON MEISSNER INC.
DEPT. EM, ELECTRONIC CENTER,
MT. CARMEL, ILLINOIS 62863
PHONE: (618) 262-5121
TWX 510-525-2254

# WE KNOW OUR STUFF

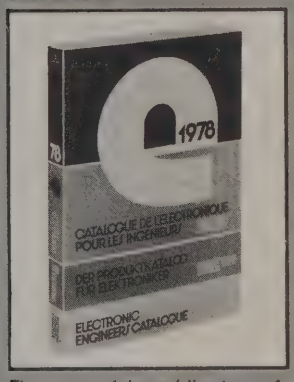
## 41 YEARS OF EXPERIENCE IN CATALOGING, 21 EDITIONS OF eem

### eem/ELECTRONIC ENGINEERS MASTER CATALOG —



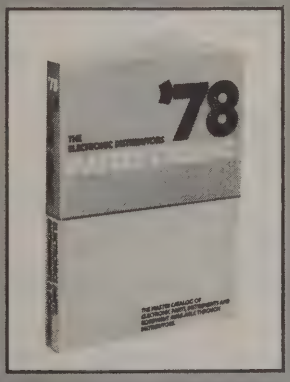

The "blue-ribbon" catalog/directory that has become "the standard of the industry" for electronic engineers, buyers and specifiers.

### ELECTRONIC ENGINEERS CATALOGUE



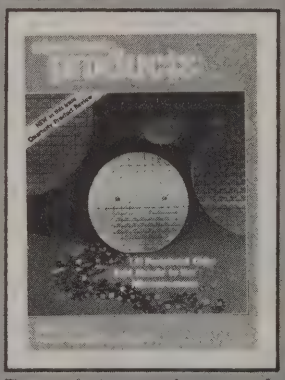

The new catalogue/directory of electronic products available to and from Western Europe and the United Kingdom. Designed especially for the European electronics engineer.

### ELECTRONIC DISTRIBUTORS MASTER CATALOG —




The only national catalog designed exclusively for distributors and their customers featuring electronic parts, instruments and equipment.

### ELECTRONIC PRODUCTS MAGAZINE —



The products magazine . . . A 100% product-oriented magazine including hundreds of new products and special features every month.

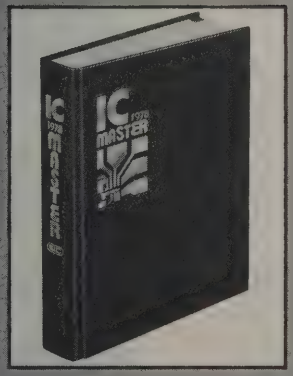
### eem FILE SYSTEM —

The only filing system designed especially for the electronics engineer. Instant retrieval and organization of data sheets and catalogs.

### UNITED COST AND PRICING SERVICES —

The electronic distributors' proven method of being up to the minute on his cost and selling prices.

### IC MASTER AND THE UPDATES —




The only complete single-source directory including all IC devices manufactured in the United States. Updated three times yearly with accumulative supplements.

### UTP CUSTOM CATALOGS —

The Cadillac of individualized catalogs for the electronic parts distributor, featuring solely his lines and services.

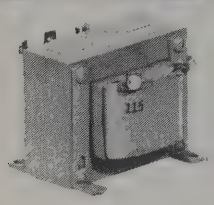
*United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Ave., Garden City, N.Y. 11530 / (516) 222-2500 TWX 510-222-1673*

**TODD ENGINEERED**

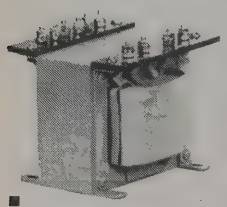
• NAME PLATES • WIRING DIAGRAMS

# HIGH CURRENT TRANSFORMERS

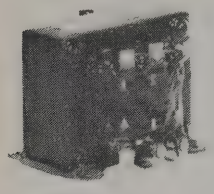
• 45° TEMP. RISE • MINIMUM REGULATION



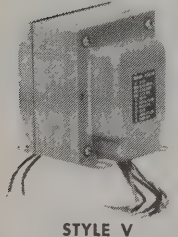
STYLE B



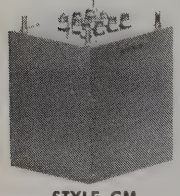
STYLE B (OVER 700 VA)



STYLE BE



STYLE V



STYLE CM

**FOUR STYLES STOCKED IN DEPTH**

| SECONDARY VOLTS TAP VOLTS | PART NO. | PRIMARY VOLTS 50-500 Hz | RATING VA | SECONDARY AMPS (RMS) SERIES HOOKUP | SECONDARY AMPS (RMS) PARALLEL HOOKUP |
|---|---|---|---|---|---|
| **10 VOLTS** Series 2.5 - 5 - 7.5 - 10 Parallel 2.5 - 5 | 10 02 | 115 | 20 | 2 | 4 |
| | 10 05 | 115 | 50 | 5 | 10 |
| | 10 10 | 115 | 100 | 10 | 20 |
| | 10 20 | 115 | 200 | 20 | 40 |
| **12.6 VOLTS** Series 3.1 - 6.3 - 9.4 - 12.6 Parallel 3.1 - 6.3 | 12 02 | 115 | 24 | 2 | 4 |
| | 12 05 | 115 | 60 | 5 | 10 |
| | 12 10 | 115 | 120 | 10 | 20 |
| | 12 20 | 115 | 240 | 20 | 40 |
| **24 VOLTS** Series 6 - 12 - 18 - 24 Parallel 6 - 12 | 24 01 | 115 | 24 | 1 | 2 |
| | 24 02 | 115 | 48 | 2 | 4 |
| | 24 04 | 115 | 96 | 4 | 8 |
| | 24 06 | 115 | 144 | 6 | 12 |
| | 24 08 | 115 | 192 | 8 | 16 |
| | 24 12 | 105, 115, 125 | 288 | 12 | 24 |
| | 24 20 | 105, 115, 125 | 480 | 20 | 40 |
| | 24 25 | 105, 115, 125 | 600 | 25 | 50 |
| | 24 30 | 105, 115, 125 | 720 | 30 | 60 |
| | 24 50 | 105, 115, 125 | 1200 | 50 | 100 |
| | 24 100 | 115, 230 | 2400 | 100 | 200 |
| **36 VOLTS** Series 9 - 18 - 27 - 36 Parallel 9 - 18 | 36 00 | 115 | 18 | 0.5 | 1 |
| | 36 01 | 115 | 36 | 1 | 2 |
| | 36 02 | 115 | 72 | 2 | 4 |
| | 36 04 | 115 | 144 | 4 | 8 |
| | 36 06 | 115 | 216 | 6 | 12 |
| | 36 08 | 105, 115, 125 | 288 | 8 | 16 |
| | 36 12 | 105, 115, 125 | 432 | 12 | 24 |
| | 36 20 | 105, 115, 125 | 720 | 20 | 40 |
| | 36 25 | 105, 115, 125 | 900 | 25 | 50 |
| | 36 30 | 105, 115, 125 | 1080 | 30 | 60 |
| | 36 50 | 115, 230 | 1800 | 50 | 100 |
| | 36 100 | 115, 230 | 3600 | 100 | 200 |
| **56 VOLTS** Series 14 - 28 - 42 - 56 Parallel 14 - 28 | 56 00 | 115 | 28 | 0.5 | 1 |
| | 56 01 | 115 | 56 | 1 | 2 |
| | 56 02 | 115 | 112 | 2 | 4 |
| | 56 04 | 115 | 224 | 4 | 8 |
| | 56 06 | 115 | 336 | 6 | 12 |
| | 56 08 | 105, 115, 125 | 448 | 8 | 16 |
| | 56 12 | 105, 115, 125 | 672 | 12 | 24 |
| | 56 25 | 105, 115, 125 | 1400 | 25 | 50 |
| | 56 50 | 115, 230 | 2800 | 50 | 100 |
| | 56 100 | 115, 230 | 5600 | 100 | 200 |
| **64 VOLTS** Series 16 - 32 - 48 - 64 Parallel 16 - 32 | 64 00 | 115 | 32 | 0.5 | 1 |
| | 64 01 | 115 | 64 | 1 | 2 |
| | 64 02 | 115 | 128 | 2 | 4 |
| | 64 04 | 115 | 256 | 4 | 8 |
| | 64 06 | 115 | 384 | 6 | 12 |
| | 64 08 | 105, 115, 125 | 512 | 8 | 16 |
| | 64 12 | 105, 115, 125 | 768 | 12 | 24 |
| | 64 25 | 105, 115, 125 | 1600 | 25 | 50 |
| | 64 50 | 115, 230 | 3200 | 50 | 100 |
| **80 VOLTS** Series 20 - 40 - 60 - 80 Parallel 20 - 40 | 80 00 | 115 | 40 | 0.5 | 1 |
| | 80 01 | 115 | 80 | 1 | 2 |
| | 80 02 | 115 | 160 | 2 | 4 |
| | 80 05 | 115 | 400 | 5 | 10 |
| | 80 10 | 105, 115, 125 | 800 | 10 | 20 |
| | 80 25 | 115, 230 | 2000 | 25 | 50 |
| | 80 50 | 115, 230 | 4000 | 50 | 100 |
| **120 VOLTS** Series 30 - 60 - 90 - 120 Parallel 30 - 60 | 120 00 | 115 | 60 | 0.5 | 1 |
| | 120 01 | 115 | 120 | 1 | 2 |
| | 120 02 | 115 | 240 | 2 | 4 |
| | 120 04 | 115 | 480 | 4 | 8 |
| | 120 08 | 105, 115, 125 | 960 | 8 | 16 |
| | 120 12 | 105, 115, 125 | 1400 | 12 | 24 |
| | 120 20 | 105, 115, 125 | 2400 | 20 | 40 |
| **180 VOLTS** Series 45 - 90 - 135 - 180 Parallel 45 - 90 | 180 00 | 115 | 90 | 0.5 | 1 |
| | 180 01 | 115 | 180 | 1 | 2 |
| | 180 02 | 115 | 360 | 2 | 4 |
| | 180 05 | 115 | 640 | 5 | 10 |
| | 180 10 | 105, 115, 125 | 1800 | 10 | 20 |
| **230 VOLTS** Series 57.5 - 115 - 172.5 - 230 Parallel 57.5 - 115 | 230 00 | 115 | 115 | 0.5 | 1 |
| | 230 01 | 115 | 230 | 1 | 2 |
| | 230 02 | 115 | 460 | 2 | 4 |
| | 230 05 | 105, 115, 125 | 1150 | 5 | 10 |
| | 230 08 | 115, 230 | 1840 | 8 | 16 |
| **300 VOLTS** Series 75 - 150 - 225 - 300 Parallel 175 - 150 | 300 00 | 115 | 150 | 0.5 | 1 |
| | 300 01 | 115 | 300 | 1 | 2 |
| | 300 02 | 115 | 600 | 2 | 4 |
| | 300 05 | 105, 115, 125 | 1500 | 5 | 10 |

**DC TO RMS CONVERSION CHART**

| SECONDARY RMS CURRENT = DC CURRENT × FACTOR BELOW | | | |
|---|---|---|---|
| | Choke Input Filter or Inductive Load | Resistive Load | Capacitor Input Filter or Capacitive Load |
| FULL WAVE BRIDGE | 1.0 | 1.0 | 1.8 |
| FULL WAVE C.T. | .7 | 1.0 | 1.15 |

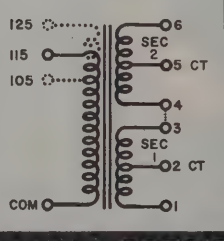
CERTIFIED DATA AVAILABLE

**CUSTOM VARIATIONS QUOTED PROMPTLY**

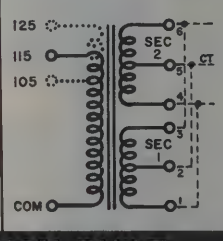
TODD SYSTEMS "HIGH CURRENT TRANSFORMERS & CHOKES" are designed for use in high power rectifier circuits, and high current A.C. applications. "TODD ENGINEERED" designs feature a nominal temperature rise of 45°C., at full load, thus providing outstanding overload capacity. All designs utilize extremely low regulation, varying from 10% in the smallest to 1% in the larger units.
Four styles . . . select the type best suited for your lab, test rigs, OEM or production equipment

**ALL PRICES AND DATA SUBJECT TO CHANGE WITHOUT NOTICE**

SERIES HOOKUP




PARALLEL HOOKUP




QUALITY ENGINEERED • • •

TODD ENGINEERED

# HIGH CURRENT TRANSFORMERS

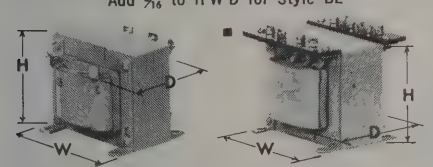
MECHANICAL SPECIFICATIONS • • • • • • • • • • • • • SPECIFY STYLE REQUIRED

| • BRACKET MTD. (STYLE B) • ENCAPSULATED (STYLE BE) | | | | | | STYLE B PRICE | STYLE BE PRICE |
|---|---|---|---|---|---|---|---|
| H | W | D | MW | MD | WGT. | | |
| 2½ | 3 | 2⅛ | 2½ | 1½ | 1¼ | 10.35 | 35.20 |
| 2½ | 3 | 2⅝ | 2½ | 2⅛ | 2½ | 14.70 | 43.60 |
| 3⅛ | 3¾ | 3¼ | 3⅛ | 2⅜ | 4¼ | 25.40 | 61.55 |
| 3¾ | 4½ | 3⅞ | 3¾ | 2⅝ | 8¼ | 32.30 | 79.90 |
| 2½ | 3 | 2⅛ | 2½ | 1⅝ | 1½ | 12.40 | 37.40 |
| 2½ | 3 | 3 | 2½ | 2⅜ | 3 | 15.90 | 45.70 |
| 3¼ | 3¾ | 3⅝ | 3⅛ | 2⅛ | 5¼ | 27.25 | 66.65 |
| 3¾ | 4½ | 4⅛ | 3¾ | 2¾ | 9 | 34.30 | 87.40 |
| 2½ | 3 | 2⅛ | 2½ | 1¾ | 1¾ | 12.35 | 37.10 |
| 2½ | 3 | 2½ | 2½ | 2 | 2¼ | 14.65 | 43.30 |
| 3⅛ | 3¾ | 3⅜ | 3⅛ | 2⅛ | 4¼ | 18.65 | 50.95 |
| 3½ | 4⅛ | 3⅜ | 3 1/16 | 2 5/16 | 6¼ | 25.50 | 65.20 |
| 3½ | 4⅛ | 4 | 3 1/16 | 3 | 9 | 28.75 | 71.30 |
| 3¾ | 4½ | 4⅞ | 3¾ | 3⅜ | 12 | 37.55 | 93.05 |
| 4⅜ | 5¼ | 5 | 4⅜ | 3½ | 16½ | 48.90 | 112.30 |
| 4⅜ | 5¼ | 5⅝ | 4⅜ | 3⅞ | 19½ | 77.00 | 159.95 |
| ■ 4⅜ | 5¼ | 6 | 4⅜ | 4⅜ | 21¼ | 80.95 | 169.10 |
| ■ 5⅜ | 6⅜ | 6⅜ | 5 5/16 | 5⅜ | 39 | 104.22 | 206.00 |
| ■ 6⅛ | 7 1/16 | 8 | 5⅞ | 6½ | 64 | 150.84 | 302.95 |
| 2 3/16 | 2⅝ | 1⅜ | 2 3/16 | 1½ | 1 | 10.10 | 33.55 |
| 2½ | 3 | 2⅛ | 2½ | 1⅞ | 1⅞ | 13.40 | 38.65 |
| 2⅞ | 3⅜ | 2¾ | 2 13/16 | 2¼ | 3¼ | 16.20 | 46.50 |
| 3½ | 4⅛ | 3½ | 3 1/16 | 2½ | 6¾ | 22.40 | 58.50 |
| 3¾ | 4½ | 4¼ | 3¾ | 2⅝ | 8¼ | 32.85 | 81.05 |
| 3¾ | 4½ | 5⅛ | 3¾ | 3½ | 12½ | 37.55 | 93.10 |
| 4 1/16 | 5¼ | 5¼ | 4⅜ | 3⅝ | 16¾ | 46.30 | 109.40 |
| ■ 5⅜ | 6⅜ | 4⅝ | 5 5/16 | 3¾ | 24 | 78.70 | 146.55 |
| ■ 5⅜ | 6⅜ | 5½ | 5 5/16 | 4 | 30 | 90.15 | 181.85 |
| ■ 5⅜ | 6⅜ | 6 | 5 5/16 | 4¾ | 33 | 96.75 | 197.80 |
| ■ 6¼ | 7 1/16 | 7½ | 5⅞ | 6⅛ | 55 | 127.30 | 257.60 |
| ■ 7½ | 9 | 9 | 7½ | 7 | 105 | 212.35 | 454.65 |
| 2 13/16 | 2⅝ | 1½ | 2 13/16 | 1⅝ | 1¼ | 12.71 | 37.70 |
| 2½ | 3 | 2⅞ | 2½ | 2¼ | 2⅞ | 15.00 | 44.20 |
| 3⅛ | 3¾ | 3¼ | 3⅛ | 2⅜ | 4¼ | 19.45 | 52.60 |
| 3½ | 4⅛ | 4 | 3 1/16 | 3 | 9 | 29.25 | 71.85 |
| 4⅜ | 5¼ | 4½ | 4⅜ | 2⅞ | 12 | 40.95 | 98.90 |
| 4⅜ | 5¼ | 5 | 4⅜ | 3⅝ | 16¾ | 61.05 | 110.75 |
| ■ 5 5/16 | 6⅜ | 4⅝ | 5 5/16 | 3 7/16 | 24 | 71.70 | 142.60 |
| ■ 5 5/16 | 6⅜ | 6⅜ | 5 5/16 | 5 5/16 | 39 | 110.00 | 222.35 |
| ■ 6¼ | 7 1/16 | 8½ | 5⅞ | 7¼ | 78 | 167.75 | 351.80 |
| ■ 7½ | 9 | 11 | 7½ | 9 | 140 | 262.45 | 604.95 |
| 2½ | 3 | 2¼ | 2½ | 1⅞ | 2 | 13.40 | 41.05 |
| 2½ | 3 | 2¾ | 2½ | 2⅜ | 3 | 16.40 | 45.85 |
| 3⅛ | 3¾ | 3¼ | 3⅛ | 2⅜ | 5 | 20.80 | 55.75 |
| 3¾ | 4½ | 4⅜ | 3¾ | 3⅛ | 10 | 31.85 | 76.55 |
| 3¾ | 4½ | 5½ | 3¾ | 4⅜ | 15 | 43.30 | 103.70 |
| 4⅜ | 5¼ | 5⅛ | 4⅜ | 3¾ | 18 | 52.70 | 131.95 |
| ■ 5½ | 6⅜ | 4⅞ | 5 5/16 | 3¾ | 27 | 83.60 | 172.00 |
| ■ 6¼ | 7 1/16 | 7¼ | 5 13/16 | 5⅜ | 50 | 117.25 | 238.40 |
| ■ 7⅝ | 9 | 8¼ | 7½ | 6⅜ | 95 | 187.35 | 398.28 |
| 2½ | 3 | 2⅝ | 2½ | 2⅛ | 2½ | 14.40 | 42.10 |
| 2 13/16 | 3⅜ | 2⅞ | 2 13/16 | 2¼ | 3½ | 17.05 | 47.95 |
| 3 1/16 | 4⅛ | 3¼ | 3 1/16 | 2½ | 6½ | 24.10 | 61.65 |
| 4⅜ | 5¼ | 5 | 4⅜ | 3½ | 17 | 44.55 | 105.40 |
| ■ 5½ | 6⅜ | 5 | 5⅜ | 3⅞ | 30 | 85.70 | 178.10 |
| ■ 6¼ | 7⅛ | 5⅞ | 5 13/16 | 4½ | 44 | 134.31 | 271.50 |
| ■ 7⅝ | 9 | 9¼ | 7½ | 7⅜ | 115 | 232.65 | 510.10 |
| 2 13/16 | 3⅜ | 2⅝ | 2 13/16 | 2⅛ | 3 | 15.40 | 45.10 |
| 3⅛ | 3¾ | 3⅜ | 3⅛ | 2⅜ | 5 | 20.20 | 54.00 |
| 3¾ | 4½ | 4⅝ | 3¾ | 3⅜ | 11 | 30.85 | 74.80 |
| 4⅜ | 5¼ | 4⅞ | 4⅜ | 3½ | 16 | 48.40 | 111.25 |
| ■ 5⅜ | 6⅜ | 6½ | 5 5/16 | 4½ | 35 | 93.15 | 180.80 |
| ■ 5⅜ | 6⅜ | 6⅞ | 5 5/16 | 5¾ | 45 | 112.95 | 228.27 |
| ■ 6¼ | 7⅛ | 8¼ | 5 13/16 | 6⅜ | 64 | 150.85 | 302.95 |
| 3⅛ | 3¾ | 3⅜ | 3⅛ | 2⅛ | 4¼ | 18.72 | 57.25 |
| 3 1/16 | 4⅛ | 3⅜ | 3 1/16 | 2½ | 5¾ | 26.35 | 74.70 |
| 4⅜ | 5¼ | 4¾ | 4⅜ | 3¼ | 15 | 41.85 | 110.05 |
| ■ 5 5/16 | 6⅜ | 5¾ | 5 5/16 | 4⅜ | 34 | 88.60 | 190.90 |
| ■ 6¼ | 7 1/16 | 7½ | 5⅞ | 6⅛ | 54 | 171.22 | 257.60 |
| 3⅛ | 3¾ | 3⅜ | 3⅛ | 2½ | 5 | 20.55 | 62.05 |
| 3½ | 4⅛ | 4 | 3 1/16 | 3⅛ | 9½ | 30.50 | 83.35 |
| 4⅜ | 5¼ | 5¼ | 4⅜ | 4 | 18 | 50.45 | 127.05 |
| ■ 5⅜ | 6⅜ | 6 | 5 5/16 | 4¾ | 36 | 99.00 | 202.35 |
| ■ 6¼ | 7 1/16 | 7½ | 5⅞ | 6⅛ | 54 | 130.55 | 262.10 |
| 3¾ | 4½ | 3½ | 3¾ | 2¼ | 6 | 23.95 | 69.70 |
| 4⅜ | 5¼ | 4 | 4⅜ | 3⅛ | 12½ | 35.80 | 96.50 |
| 4⅜ | 5¼ | 5⅝ | 4 5/16 | 4¾ | 23 | 57.50 | 135.40 |
| ■ 5 5/16 | 6⅜ | 7⅛ | 5 5/16 | 6¼ | 49 | 115.80 | 233.90 |

| • FULLY MTD. SHELLS (STYLE V) | | | | | | STYLE V PRICE |
|---|---|---|---|---|---|---|
| H | W | D | MW | MD | WGT. | |
| 3 | 2½ | 2¼ | 2 | 1¼ | 1¼ | 10.00 |
| 3 | 2½ | 2⅞ | 2 | 1⅞ | 2½ | 13.20 |
| 3⅞ | 3¼ | 3⅝ | 2½ | 2⅜ | 4¾ | 22.15 |
| 4½ | 3¾ | 4⅛ | 3 | 3 | 8¾ | 28.25 |
| 3⅛ | 2½ | 2⅜ | 2 | 1¼ | 1¾ | 12.35 |
| 3⅛ | 2½ | 3⅛ | 2 | 2 | 3¼ | 13.80 |
| 3⅞ | 3¼ | 3⅝ | 2½ | 2½ | 5¼ | 24.35 |
| 4½ | 3¾ | 4⅛ | 3 | 3⅛ | 9½ | 31.20 |
| 3⅛ | 2½ | 2⅝ | 2 | 1½ | 2¼ | 12.15 |
| 3⅛ | 2½ | 2⅞ | 2 | 1¾ | 2½ | 13.85 |
| 3¾ | 3½ | 3⅜ | 2½ | 2⅛ | 4¼ | 16.50 |
| 4⅛ | 3½ | 3⅝ | 2¾ | 2½ | 6¾ | 22.50 |
| 4¼ | 3½ | 4⅜ | 3 | 3⅜ | 8½ | 26.15 |
| 4½ | 3¾ | 5 | 3 | 3¾ | 12½ | 33.85 |
| 5¼ | 4⅜ | 5½ | 3½ | 3⅞ | 17 | 44.70 |
| 5¼ | 4⅜ | 6 | 3½ | 4⅜ | 20 | 63.50 |
| 5¼ | 4⅜ | 6⅜ | 3½ | 4¾ | 22 | 67.00 |
| 6½ | 5½ | 7⅜ | 4¼ | 5 5/16 | 43 | 92.20 |
| 2¾ | 2¼ | 2¼ | 1¾ | 1½ | 1¼ | 9.80 |
| 3⅛ | 2½ | 2¾ | 2 | 1⅝ | 2 | 12.85 |
| 3½ | 2⅞ | 3¼ | 2¼ | 2 3/16 | 3⅝ | 14.45 |
| 4¼ | 3½ | 4 | 2¾ | 2⅞ | 6¾ | 19.45 |
| 4⅝ | 3⅞ | 4⅛ | 3 | 2⅞ | 9¼ | 29.80 |
| 4⅝ | 3⅞ | 5 | 3 | 3⅞ | 12¼ | 33.85 |
| 5½ | 4½ | 5¾ | 3½ | 4 1/16 | 17¼ | 42.25 |
| 6½ | 5½ | 5¾ | 4¼ | 3¾ | 25 | 65.15 |
| 6½ | 5½ | 6 | 4¼ | 4 | 28 | 76.35 |
| 6½ | 5½ | 6¾ | 4¼ | 4¾ | 36 | 84.90 |
| 2¾ | 2¼ | 2⅜ | 1¾ | 1¾ | 1 5/16 | 11.75 |
| 3 | 2⅝ | 2⅞ | 2 | 2 | 3¼ | 13.20 |
| 3⅞ | 3¼ | 3½ | 2½ | 2 5/16 | 4¾ | 16.95 |
| 4¼ | 3½ | 4½ | 2¾ | 3⅜ | 8½ | 24.90 |
| 5⅛ | 4½ | 4¾ | 3½ | 3⅛ | 12½ | 36.15 |
| 5 7/16 | 4½ | 5⅝ | 3½ | 4 | 18 | 42.55 |
| 6½ | 5½ | 5½ | 4¼ | 3½ | 25 | 63.85 |
| 6½ | 5½ | 7¼ | 4¼ | 5¼ | 39 | 99.85 |
| 2¾ | 2¼ | 2⅝ | 2 | 1¾ | 2 | 12.35 |
| 3⅛ | 2⅝ | 3⅛ | 2 | 2⅛ | 2⅛ | 14.30 |
| 3⅞ | 3⅛ | 3⅝ | 2½ | 2⅜ | 4¾ | 20.30 |
| 4⅝ | 3¾ | 4½ | 3 | 3⅜ | 11 | 28.00 |
| 4⅝ | 3¾ | 4⅞ | 3 | 3⅝ | 16 | 40.15 |
| 5½ | 4½ | 5⅞ | 3½ | 4¼ | 19¼ | 48.85 |
| 6½ | 5½ | 5¾ | 4¼ | 3¾ | 27 | 70.00 |
| 3⅛ | 2½ | 2⅞ | 2 | 2 | 2½ | 13.70 |
| 3½ | 2⅞ | 3¼ | 2¼ | 2¼ | 3⅝ | 15.25 |
| 4¼ | 3½ | 4 | 2¾ | 2⅞ | 6¾ | 20.75 |
| 5⅛ | 4½ | 5½ | 3½ | 3¾ | 17½ | 40.17 |
| 6½ | 5½ | 6 | 4¼ | 4 | 31 | 71.50 |
| 3 7/16 | 2⅞ | 3⅛ | 2¼ | 2 | 3 | 14.10 |
| 3⅞ | 3¼ | 3½ | 2½ | 2¼ | 4⅞ | 18.20 |
| 4⅝ | 3⅞ | 4⅝ | 3 | 3⅜ | 10½ | 27.40 |
| 5½ | 4½ | 5½ | 3 7/16 | 4 | 17 | 45.50 |
| 6⅜ | 5 7/16 | 6⅜ | 4¼ | 4½ | 34 | 81.75 |
| 6⅜ | 5 7/16 | 7⅝ | 4¼ | 5¾ | 47 | 105.25 |
| 3⅞ | 3 3/16 | 3½ | 2½ | 2¼ | 4¾ | 16.15 |
| 4¼ | 3½ | 3⅞ | 2¾ | 2⅞ | 6½ | 22.80 |
| 5 7/16 | 4½ | 5⅜ | 3½ | 3⅛ | 15¾ | 35.85 |
| 6⅜ | 5 7/16 | 6⅜ | 4¼ | 4⅜ | 32 | 76.10 |
| 3⅞ | 3⅛ | 3⅝ | 2½ | 2½ | 5¼ | 17.80 |
| 4¼ | 3½ | 4⅝ | 2¾ | 3½ | 8½ | 26.50 |
| 5 7/16 | 4½ | 5⅞ | 3½ | 3⅝ | 18 | 43.65 |
| 6⅜ | 5 7/16 | 6⅞ | 4¼ | 4⅞ | 36 | 89.60 |
| 4½ | 3¾ | 3¾ | 3 | 2⅝ | 6½ | 20.65 |
| 5½ | 4½ | 5 | 3½ | 3⅜ | 13½ | 30.85 |
| 5½ | 4½ | 6⅝ | 3½ | 5 | 24 | 52.00 |
| 6½ | 5½ | 8 | 4¼ | 6 | 48 | 107.95 |

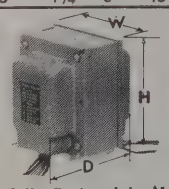
| • HERMETIC SEALED MIL-T (STYLE CM) | | | | | | STYLE CM PRICE | PART NO. |
|---|---|---|---|---|---|---|---|
| H | W | D | MW | MD | WGT. | | |
| 3 13/16 | 3½ | 3 | 2⅝ | 2⅛ | 2⅛ | 60.30 | 10 02 |
| 3 13/16 | 3½ | 3 | 2⅝ | 2⅛ | 3½ | 67.50 | 10 05 |
| 4 7/16 | 4½ | 3⅝ | 3 5/16 | 2 11/16 | 6½ | 77.90 | 10 10 |
| 5 7/16 | 5 | 4¼ | 4 1/16 | 3 5/16 | 12 | 102.90 | 10 20 |
| 3 13/16 | 3½ | 3 | 2⅝ | 2⅛ | 2¾ | 62.65 | 12 02 |
| 3 13/16 | 3½ | 3 | 2⅝ | 2⅛ | 4¾ | 69.35 | 12 05 |
| 4 7/16 | 4¼ | 3⅝ | 3 5/16 | 2 11/16 | 7½ | 87.80 | 12 10 |
| 6¼ | 5¾ | 4⅞ | 4⅜ | 3½ | 12½ | 107.95 | 12 20 |
| 3 13/16 | 3½ | 3 | 2⅝ | 2⅛ | 3⅜ | 62.20 | 24 01 |
| 3 13/16 | 3½ | 3 | 2⅝ | 2⅛ | 3¾ | 66.65 | 24 02 |
| 4 7/16 | 4¼ | 3⅝ | 3 5/16 | 2 11/16 | 6¼ | 73.05 | 24 04 |
| 4⅞ | 4⅝ | 3 15/16 | 3 11/16 | 3 | 9½ | 87.05 | 24 06 |
| 4⅞ | 4⅝ | 3 15/16 | 3 11/16 | 3 | 11½ | 95.10 | 24 08 |
| 5 7/16 | 5 | 4¼ | 4 1/16 | 3 5/16 | 16 | 111.90 | 24 12 |
| 6¼ | 5¾ | 4⅞ | 4⅜ | 3½ | 22 | 127.55 | 24 20 |
| 6¼ | 5¾ | 4⅞ | 4⅜ | 3½ | 24½ | 171.90 | 24 25 |
| 7½ | 6⅞ | 5 13/16 | 5 5/16 | 4¼ | 27½ | 182.20 | 24 30 |
| 7½ | 6⅞ | 5 13/16 | 5 5/16 | 4¼ | 52 | 227.40 | 24 50 |
| 8¾ | 8 | 6¾ | 6¾ | 5½ | 74 | 338.45 | 24 100 |
| 3 13/16 | 3½ | 3 | 2⅝ | 2⅛ | 2 | 59.20 | 36 00 |
| 3 13/16 | 3½ | 3 | 2⅝ | 2⅛ | 3 | 64.75 | 36 01 |
| 4¼ | 3⅞ | 3 5/16 | 3 | 2 7/16 | 5¼ | 70.50 | 36 02 |
| 4⅞ | 4⅝ | 3 15/16 | 3 11/16 | 3 | 9½ | 80.85 | 36 04 |
| 5 7/16 | 5 | 4¼ | 4 1/16 | 3 5/16 | 13 | 103.95 | 36 06 |
| 5 7/16 | 5 | 4¼ | 4 1/16 | 3 5/16 | 17 | 111.90 | 36 08 |
| 6¼ | 5¾ | 4⅞ | 4⅜ | 3½ | 22 | 125.45 | 36 12 |
| 7½ | 6⅞ | 5 13/16 | 5 5/16 | 4¼ | 31 | 182.20 | 36 20 |
| 7½ | 6⅞ | 5 13/16 | 5 5/16 | 4¼ | 34 | 227.55 | 36 25 |
| 7½ | 6⅞ | 5 13/16 | 5 5/16 | 4¼ | 43 | 245.85 | 36 30 |
| 8¼ | 7 1/16 | 6⅝ | 5 13/16 | 4¾ | 61 | 327.85 | 36 50 |
| | | | | | | | 36 100 |
| 3 13/16 | 3½ | 3 | 2⅝ | 2⅛ | 2¾ | 63.10 | 56 00 |
| 3 13/16 | 3½ | 3 | 2⅝ | 2⅛ | 4 | 68.20 | 56 01 |
| 4 7/16 | 4¼ | 3⅝ | 3 5/16 | 2 11/16 | 7½ | 75.80 | 56 02 |
| 4⅞ | 4⅝ | 3 15/16 | 3 11/16 | 3 | 12½ | 107.75 | 56 04 |
| 6¼ | 5¾ | 4⅞ | 4⅜ | 3½ | 16 | 135.60 | 56 06 |
| 6¼ | 5¾ | 4⅞ | 4⅜ | 3½ | 22½ | 144.03 | 56 08 |
| 7½ | 6⅞ | 5 13/16 | 5 5/16 | 4¼ | 31 | 205.65 | 56 12 |
| 7½ | 6⅞ | 5 13/16 | 5 5/16 | 4¼ | 45 | 285.80 | 56 25 |
| 8¾ | 8 | 6¾ | 6¾ | 5½ | 85 | 428.34 | 56 50 |
| | | | | | | | 56 100 |
| 3 13/16 | 3½ | 3 | 2⅝ | 2⅛ | 3¼ | 64.70 | 64 00 |
| 4 7/16 | 4¼ | 3⅝ | 3 5/16 | 2 11/16 | 3¾ | 69.50 | 64 01 |
| 5 13/16 | 4⅝ | 3 15/16 | 3 11/16 | 4⅞ | 7¼ | 78.80 | 64 02 |
| 5 7/16 | 5 | 4¼ | 4 1/16 | 3 5/16 | 15½ | 97.80 | 64 04 |
| 6¼ | 5¾ | 4⅞ | 4⅜ | 3½ | 22 | 121.10 | 64 06 |
| 6¼ | 5¾ | 4⅞ | 4⅜ | 3½ | 25 | 149.90 | 64 08 |
| 7½ | 6⅞ | 5 13/16 | 5 5/16 | 4¼ | 32½ | 217.50 | 64 12 |
| 7½ | 6⅞ | 5 13/16 | 5 5/16 | 4¼ | 57 | 345.47 | 64 25 |
| 10 3/16 | 8 | 6¾ | 6¾ | 5½ | 103 | 467.80 | 64 50 |
| 3 13/16 | 3½ | 3 | 2⅝ | 2⅛ | 3¾ | 65.80 | 80 00 |
| 4¼ | 3⅞ | 3 5/16 | 3 | 2 7/16 | 5¼ | 71.55 | 80 01 |
| 4⅞ | 4⅝ | 3 15/16 | 3 11/16 | 3 | 9 | 84.35 | 80 02 |
| 4 7/16 | 4¼ | 3⅝ | 3 5/16 | 2 11/16 | 21½ | 122.05 | 80 05 |
| 7½ | 6⅞ | 5 13/16 | 5 5/16 | 4¼ | 36½ | 222.15 | 80 10 |
| 8¼ | 7 1/16 | 6⅝ | 5 13/16 | 4¾ | 48½ | 344.75 | 80 25 |
| | | | | | | | 80 50 |
| 4¼ | 3⅞ | 3 5/16 | 3 | 2 7/16 | 4¾ | 68.90 | 120 00 |
| 4⅞ | 4¼ | 3⅝ | 3 5/16 | 2 11/16 | 6¾ | 77.15 | 120 01 |
| 5 7/16 | 5 | 4¼ | 4 1/16 | 3 5/16 | 14 | 97.37 | 120 02 |
| 6¼ | 5⅜ | 4⅞ | 4⅜ | 3½ | 21¼ | 126.30 | 120 04 |
| 7½ | 6⅞ | 5 13/16 | 5 5/16 | 4¼ | 40½ | 238.10 | 120 08 |
| 7½ | 6⅞ | 5 13/16 | 5 5/16 | 4¼ | 51½ | 290.25 | 120 12 |
| 8¼ | 7 1/16 | 6⅝ | 5 13/16 | 4¾ | 70½ | 390.80 | 120 20 |
| 4⅞ | 4⅝ | 3 15/16 | 3 11/16 | 3 | 8¾ | 100.85 | 180 01 |
| 6¼ | 5¾ | 4⅞ | 4⅜ | 3½ | 19½ | 132.55 | 180 02 |
| 7½ | 6⅞ | 5 13/16 | 5 5/16 | 4¼ | 39¼ | 226.95 | 180 05 |
| 7½ | 6⅞ | 5 13/16 | 5 5/16 | 4¼ | 57½ | 327.85 | 180 10 |
| 4 7/16 | 4¼ | 3⅝ | 3 5/16 | 2 11/16 | 7½ | 89.20 | 230 00 |
| 4⅞ | 4⅝ | 3 15/16 | 3 11/16 | 3 | 11¼ | 109.35 | 230 01 |
| 6¼ | 5¾ | 4⅞ | 4⅜ | 3½ | 21¾ | 154.20 | 230 02 |
| 7½ | 6⅞ | 5 13/16 | 5 5/16 | 4¼ | 41 | 254.95 | 230 05 |
| 8¼ | 7 1/16 | 6½ | 5 13/16 | 4¾ | 59¼ | 332.52 | 230 08 |
| 4⅞ | 4⅝ | 3 15/16 | 3 11/16 | 3 | 9 | 95.70 | 300 00 |
| 6¼ | 5¾ | 4⅞ | 4⅜ | 3½ | 16¾ | 120.30 | 300 01 |
| 6¼ | 5¾ | 4⅞ | 4⅜ | 3½ | 27½ | 107.40 | 300 02 |
| 7½ | 6⅞ | 5 13/16 | 5 5/16 | 4¼ | 52½ | 298.25 | 300 05 |

Add 3/16 to H W D for Style BE

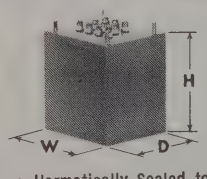



**STYLE B:** • "Open Frame" Bracket Mounted • Double Vacuum Varnish Impregnated

**STYLE BE:** • Conforms to MIL-T-27B • Epoxy Encapsulation added to Style B




**STYLE V:** • Fully Enclosed in Metal Shells • Ease of "Wiring with Leads" • Attractive Appearance • Dbl Vacuum Varnish Impregnated




**STYLE CM:** • Hermetically Sealed to MIL-T-27B • Environment Proof • Attractive Gray Finish • Permanent Name Plate

QUALITY ENGINEERED • • • • • • • • • • • • •

TODD ENGINEERED

# LINE ISOLATION . . . . . HIGH CURRENT CHOKES

## LINE ISOLATION — OUTPUT 115 VOLTS — 50/60 HERTZ — UL COMPONENTS

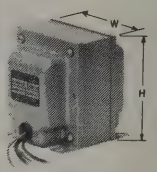
### STRAIGHT ISOLATION

ELECTROSTATIC SHIELD CONNECTED TO CORE

TWO STYLES

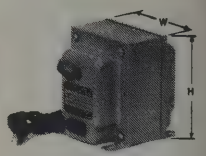
| CATALOG NUMBER | WATTS (VA) | INPUT VOLTS | HIPOT TEST VOLTS | DIMENSIONS H | W | D | MW | MD | WGT. | STYLE LO PRICE | STYLE LRG PRICE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LI-25 | 25 | 115 | 1500 | 3 1/8 | 2 5/8 | 2 1/2 | 2 | 1 1/2 | 1 5/8 | 19.20 | 24.25 |
| LI-50 | 50 | 115 | 1500 | 3 1/2 | 2 7/8 | 3 | 2 1/4 | 1 7/8 | 3 | 20.80 | 26.80 |
| LI-100 | 100 | 115 | 1500 | 3 1/2 | 2 7/8 | 3 1/2 | 2 1/4 | 2 1/4 | 4 | 27.40 | 33.00 |
| LI-175 | 175 | 115 | 1500 | 4 5/8 | 3 7/8 | 3 7/8 | 3 | 2 3/4 | 7 | 29.80 | 37.80 |
| LI-250 | 250 | 115 | 1500 | 4 5/8 | 3 7/8 | 4 3/8 | 3 | 3 1/4 | 10 | 41.85 | 49.55 |
| LI-350 | 350 | 115 | 1500 | 4 5/8 | 3 7/8 | 5 1/4 | 3 | 4 1/8 | 14 | 56.45 | 63.50 |
| LI-500 | 500 | 115 | 1500 | 6 | 4 3/8 | 5 1/8 | 3 1/16 | 3 3/8 | 17 1/2 | 71.45 | 80.35 |
| LI-750 | 750 | 115 | 1500 | 6 | 4 3/8 | 6 3/8 | 3 1/16 | 4 1/2 | 24 | 123.10 | 132.10 |
| LI-1000 | 1000 | 115 | 1500 | 6 | 4 3/8 | 7 1/4 | 3 1/16 | 5 1/2 | 30 | 136.70 | 146.85 |
| LI-1500 | 1500 | 115 | 1500 | 6 1/2 | 5 1/2 | 7 1/2 | 4 1/4 | 5 3/8 | 42 | 164.40 | 173.30 |
| LI-2000 | 2000 | 115 | 1500 | 6 1/2 | 5 1/2 | 9 | 4 1/4 | 6 7/8 | 58 | 199.45 | 211.35 |
| LI-100-1 | 100 | 230 | 2000 | 3 1/2 | 2 7/8 | 3 1/2 | 2 1/4 | 2 1/4 | 4 | 26.80 | 34.10 |
| LI-250-1 | 250 | 230 | 2000 | 4 5/8 | 3 7/8 | 4 3/8 | 3 | 3 1/4 | 10 | 41.40 | 50.23 |
| LI-500-1 | 500 | 230 | 2000 | 6 | 4 3/8 | 5 1/8 | 3 1/16 | 3 3/8 | 17 1/2 | 73.55 | 83.90 |
| LI-1000-1 | 1000 | 230 | 2000 | 6 | 4 3/8 | 7 1/4 | 3 1/16 | 5 1/2 | 30 | 145.80 | 158.90 |
| LI-1500-1 | 1500 | 230 | 2000 | 6 1/2 | 5 1/2 | 7 1/2 | 4 1/4 | 5 3/8 | 42 | 168.10 | 179.85 |
| LI-2000-1 | 2000 | 230 | 2000 | 6 1/2 | 5 1/2 | 9 | 4 1/4 | 6 7/8 | 58 | 197.75 | 212.50 |

STYLE LO




LEAD WIRE TERMINALS

STYLE LRG




LINE CORD RECEPTACLE (W/GROUND)

### ADJUSTABLE ISOLATION

ELECTROSTATIC SHIELD CONNECTED TO CORE

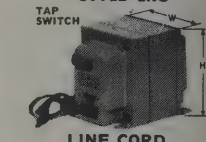
- PRIMARY TAPPED
- TWO STYLES

| CATALOG NUMBER | WATTS (VA) | INPUT VOLTS | HIPOT TEST VOLTS | DIMENSIONS H | W | D | MW | MD | WGT. | STYLE LO PRICE | STYLE LRG PRICE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LI-50-2 | 50 | 105/115/125 | 1500 | 3 1/2 | 2 7/8 | 3 7/8 | 2 1/4 | 2 1/2 | 3 | 26.30 | 31.60 |
| LI-100-2 | 100 | 105/115/125 | 1500 | 3 1/2 | 2 7/8 | 4 3/8 | 2 1/4 | 3 | 4 1/2 | 35.65 | 42.10 |
| LI-250-2 | 250 | 105/115/125 | 1500 | 4 5/8 | 3 7/8 | 5 1/8 | 3 | 4 | 11 1/2 | 46.90 | 54.95 |
| LI-500-2 | 500 | 105/115/125 | 1500 | 6 | 4 3/8 | 5 7/8 | 3 1/4 | 4 1/8 | 19 | 87.50 | 96.90 |
| LI-1000-2 | 1000 | 105/115/125 | 1500 | 6 | 4 3/8 | 8 1/8 | 3 1/16 | 6 3/8 | 34 | 189.30 | 200.15 |
| LI-50-3 | 50 | 210/230/250 | 2000 | 3 1/2 | 2 7/8 | 3 7/8 | 2 1/4 | 2 1/2 | 3 | 30.55 | 35.60 |
| LI-100-3 | 100 | 210/230/250 | 2000 | 3 1/2 | 2 7/8 | 4 3/8 | 2 1/4 | 3 | 4 1/2 | 41.20 | 46.30 |
| LI-250-3 | 250 | 210/230/250 | 2000 | 4 5/8 | 3 7/8 | 5 1/8 | 3 | 4 | 11 1/2 | 45.85 | 54.80 |
| LI-500-3 | 500 | 210/230/250 | 2000 | 6 | 4 3/8 | 5 7/8 | 3 1/16 | 4 1/8 | 19 | 87.15 | 95.95 |
| LI-1000-3 | 1000 | 210/230/250 | 2000 | 6 | 4 3/8 | 8 1/8 | 3 1/16 | 6 3/8 | 34 | 187.75 | 198.05 |

STYLE LO

LEAD WIRE TERMINALS

STYLE LRG




LINE CORD RECEPTACLE (W/GROUND)

### HI-POWER ISOLATION

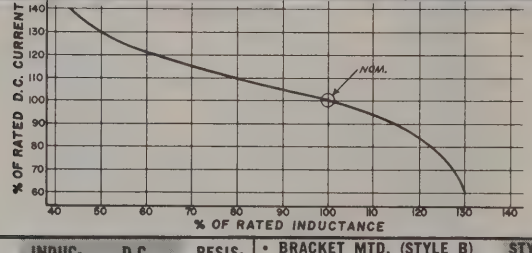
ELECTROSTATIC SHIELD CONNECTED TO CORE

BRACKET MOUNTED

| CATALOG NUMBER | WATTS (VA) | INPUT VOLTS | HIPOT TEST VOLTS | DIMENSIONS H | W | D | MW | MD | WGT. | PRICE |
|---|---|---|---|---|---|---|---|---|---|---|
| LI-2500-4 | 2500 | 115/230 | 2000 | 6 1/8 | 7 1/8 | 8 3/4 | 5 7/8 | 7 | 60 | 221.20 |
| LI-3000-4 | 3000 | 115/230 | 2000 | 7 1/2 | 9 | 7 7/8 | 7 1/2 | 6 1/2 | 95 | 396.25 |
| LI-4000-4 | 4000 | 115/230 | 2000 | 7 1/2 | 9 | 9 | 7 1/2 | 7 5/8 | 113 | 471.55 |
| LI-5000-4 | 5000 | 115/230 | 2000 | 7 1/2 | 9 | 10 1/4 | 7 1/2 | 8 7/8 | 135 | 502.10 |
| LI-6000-4 | 6000 | 115/230 | 2000 | 7 1/2 | 9 | 11 3/4 | 7 1/2 | 10 1/4 | 168 | 512.95 |
| LI-2500-5 | 2500 | 230/460 | 2500 | 6 1/8 | 7 1/8 | 8 3/4 | 5 7/8 | 7 | 60 | 234.10 |
| LI-3000-5 | 3000 | 230/460 | 2500 | 7 1/2 | 9 | 7 7/8 | 7 1/2 | 6 1/2 | 95 | 415.25 |
| LI-4000-5 | 4000 | 230/460 | 2500 | 7 1/2 | 9 | 9 | 7 1/2 | 7 5/8 | 113 | 500.75 |
| LI-5000-5 | 5000 | 230/460 | 2500 | 7 1/2 | 9 | 10 1/4 | 7 1/2 | 8 7/8 | 135 | 534.70 |
| LI-6000-5 | 6000 | 230/460 | 2500 | 7 1/2 | 9 | 11 3/4 | 7 1/2 | 10 1/4 | 168 | 567.95 |

SCREW TERMINALS

## HIGH CURRENT CHOKES — 50/500 HERTZ — DIMENSIONS REFER TO HIGH CURRENT XFMR SKETCHES




- **Matching styles complement high current transformers**
- **Wide variety of compatible current ratings**

### INDUCTANCE VARIATION

Graph indicates typical variation of inductance (%) when used at D.C. currents (%) other than the rated values.

Chokes operated at D. C. currents higher than rated value must be run on an intermittent basis to avoid overheating.

| CATALOG NUMBER | INDUCTANCE (mh) | D.C. CURRENT (AMPS) | RESISTANCE (OHMS) | • BRACKET MTD. (STYLE B) • ENCAPSULATED (STYLE BE) H | W | D | MW | MD | WGT. | STYLE B PRICE | STYLE BE PRICE | • FULLY MTD. SHELLS (STYLE V) H | W | D | MW | MD | WGT. | STYLE V PRICE | • HERMETICALLY SEALED MIL-T (STYLE CM) H | W | D | MW | MD | WGT. | STYLE CM PRICE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CH-00 | 200 | .5 | 3.00 | 2 1/4 | 2 5/8 | 2 | 2 | 1 3/4 | 1 1/2 | 8.20 | 22.40 | 2 5/8 | 2 1/4 | 2 1/4 | 1 3/4 | 1 5/8 | 1 3/4 | 8.50 | 3 1/8 | 3 | 2 5/16 | 2 5/16 | 1 7/8 | 2 1/8 | 39.90 |
| CH-01 | 100 | 1 | 1.50 | 2 1/2 | 2 | 2 1/8 | 2 1/2 | 2 | 2 1/4 | 9.00 | 26.45 | 3 1/8 | 2 1/2 | 2 5/8 | 2 | 1 3/4 | 2 1/4 | 9.45 | 3 1/16 | 3 1/2 | 3 | 2 5/8 | 2 1/8 | 3 1/4 | 46.60 |
| CH-02 | 80 | 2 | .95 | 2 1/2 | 3 | 2 1/2 | 2 1/2 | 2 | 2 1/2 | 9.85 | 32.65 | 3 1/8 | 2 1/2 | 2 1/2 | 2 | 1 3/4 | 2 1/2 | 10.50 | 3 1/16 | 3 1/2 | 3 | 2 5/8 | 2 1/8 | 3 1/2 | 52.40 |
| CH-04 | 60 | 4 | .65 | 3 1/8 | 3 3/4 | 3 1/4 | 3 1/8 | 2 1/2 | 5 1/4 | 16.65 | 39.65 | 3 7/8 | 3 1/16 | 3 3/4 | 2 1/2 | 2 1/4 | 6 | 17.25 | 4 1/16 | 4 1/4 | 3 5/8 | 3 5/16 | 2 11/16 | 7 1/4 | 58.15 |
| CH-05 | 50 | 5 | .40 | 3 1/8 | 3 3/4 | 3 3/8 | 3 1/8 | 2 3/4 | 5 3/4 | 17.40 | 43.30 | 3 7/8 | 3 3/16 | 4 | 2 1/2 | 3 | 6 1/2 | 18.00 | 4 7/16 | 4 1/4 | 3 5/8 | 3 5/16 | 2 11/16 | 8 | 65.45 |
| CH-06 | 40 | 6 | .30 | 3 1/8 | 3 3/4 | 3 3/8 | 3 1/8 | 2 3/4 | 6 | 18.00 | 44.65 | 3 7/8 | 3 3/16 | 4 | 2 1/2 | 3 | 6 1/2 | 18.55 | 4 7/16 | 4 1/4 | 3 5/8 | 3 5/16 | 2 11/16 | 8 5/8 | 68.15 |
| CH-08 | 30 | 8 | .20 | 3 1/2 | 4 1/8 | 3 7/8 | 3 3/8 | 3 | 8 | 18.75 | 47.70 | 4 1/8 | 3 1/2 | 4 3/8 | 2 3/4 | 3 3/8 | 8 1/2 | 19.60 | 4 7/8 | 4 5/8 | 4 | 3 11/16 | 3 | 11 1/8 | 74.90 |
| CH-12 | 20 | 12 | .10 | 4 7/16 | 5 1/4 | 4 1/2 | 4 3/8 | 3 3/8 | 15 1/2 | 42.85 | 79.60 | 5 7/16 | 4 1/2 | 5 | 3 1/2 | 3 1/2 | 14 | 41.85 | 6 1/4 | 5 3/4 | 4 7/8 | 4 3/8 | 3 1/2 | 21 | 95.35 |
| CH-16 | 15 | 16 | .08 | 4 7/16 | 5 1/4 | 4 5/8 | 4 3/8 | 3 3/8 | 14 1/4 | 45.90 | 89.70 | 5 7/16 | 4 1/2 | 5 1/4 | 3 1/2 | 3 3/4 | 15 | 45.25 | 6 1/4 | 5 3/4 | 4 7/8 | 4 3/8 | 3 1/2 | 22 1/2 | 120.05 |
| CH-20 | 10 | 20 | .055 | 4 7/16 | 5 1/4 | 4 1/2 | 4 3/8 | 3 1/2 | 15 1/2 | 49.70 | 98.80 | 5 7/16 | 4 1/2 | 5 3/8 | 3 1/2 | 3 7/8 | 16 | 48.30 | 6 1/4 | 5 3/4 | 4 7/8 | 4 3/8 | 3 1/2 | 24 | 133.85 |
| CH-25 | 7 | 25 | .03 | 4 7/16 | 5 1/4 | 5 | 4 3/8 | 4 | 18 1/2 | 51.90 | 106.15 | 5 7/16 | 4 1/2 | 5 7/8 | 3 1/2 | 4 3/8 | 19 1/2 | 50.45 | 6 1/4 | 5 3/4 | 4 7/8 | 4 3/8 | 3 1/2 | 26 1/2 | 154.60 |
| CH-30 | 5 | 30 | .02 | 5 3/8 | 6 3/8 | 4 1/2 | 5 1/4 | 3 1/4 | 21 | 67.30 | 140.40 | 6 1/2 | 5 7/16 | 5 1/2 | 4 1/4 | 3 1/4 | 24 | 68.45 | 7 1/2 | 6 7/8 | 5 13/16 | 5 5/16 | 4 1/4 | 29 1/2 | 182.55 |
| CH-40 | 3 1/2 | 40 | .018 | 5 3/8 | 6 3/8 | 4 5/8 | 5 1/4 | 3 1/2 | 23 | 74.80 | 159.20 | 6 1/2 | 5 7/16 | 5 3/4 | 4 1/4 | 3 1/2 | 25 | 75.20 | 7 1/2 | 6 7/8 | 5 13/16 | 5 5/16 | 4 1/4 | 32 1/2 | 201.85 |
| CH-50 | 2 | 50 | .010 | 5 3/8 | 6 3/8 | 4 3/4 | 5 1/4 | 3 5/8 | 25 | 76.00 | 166.00 | 6 1/2 | 5 7/16 | 5 3/4 | 4 1/4 | 3 1/2 | 26 | 76.65 | 7 1/2 | 6 7/8 | 5 13/16 | 5 5/16 | 4 1/4 | 34 | 209.35 |
| CH-100 | .7 | 100 | .004 | 5 3/8 | 6 3/8 | 5 | 5 1/4 | 3 7/8 | 29 | 83.55 | 178.20 | 6 1/2 | 5 7/16 | 6 1/8 | 4 1/4 | 3 7/8 | 31 | 85.20 | 7 1/2 | 6 7/8 | 5 13/16 | 5 5/16 | 4 1/4 | 41 | 223.50 |
| CH-200 | .35 | 200 | .0007 | 6 1/8 | 7 1/8 | 6 3/4 | 5 7/8 | 5 1/2 | 43 | 102.00 | 205.60 | | | | | | | | | | | | | | |

QUALITY ENGINEERED . . . . . PRECISION BUILT

TODD SYSTEMS INC.

4 RADFORD PLACE YONKERS, N. Y., U.S.A. (914) 963-3400

TODD ENGINEERED

# STEPDOWN AUTOTRANSFORMERS

CONVERT DOMESTIC APPLIANCES FOR USE ON FOREIGN VOLTAGES

## 50/60 HERTZ—*UL* COMPONENTS • FOR STEP-UP USE MOST UNITS CAN BE REVERSED OR REWIRED

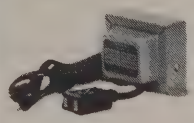
### PORTABLE MODEL — 220/240 INPUT 110/120 OUTPUT

| CATALOG NUMBER | RATING WATTS | WEIGHT LBS. | DIMENSIONS H | W | D | PRICE |
|---|---|---|---|---|---|---|
| SD-35 | 20 | 7/8 | 1 1/2 | 2 | 2 5/8 | 12.60 |
| SD-36 | 40 | 1 1/4 | 1 7/16 | 2 1/8 | 3 1/2 | 14.40 |
| SD-37 | 60 | 1 5/16 | 1 7/16 | 2 1/8 | 3 1/2 | 16.60 |
| SD-41 | 80 | 1 7/16 | 1 7/16 | 2 1/8 | 3 1/2 | 17.25 |

LINE CORD • RECEPTACLE

### NORMAL DUTY MODEL — 220/240 INPUT 110/120 OUTPUT

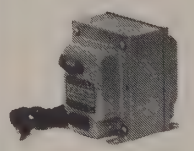
| CATALOG NUMBER | RATING WATTS | WEIGHT LBS. | DIMENSIONS H | W | D | PRICE |
|---|---|---|---|---|---|---|
| SD-24 | 50 | 1 5/8 | 2 1/4 | 2 3/4 | 2 1/4 | 11.15 |
| SD-21 | 65 | 1 5/8 | 2 1/4 | 2 3/4 | 2 1/4 | 11.60 |
| SD-25 | 80 | 1 3/4 | 2 1/4 | 2 3/4 | 2 3/8 | 12.50 |
| SD-23 | 100 | 1 3/4 | 2 1/4 | 2 3/4 | 2 3/8 | 13.25 |
| SD-26 | 125 | 2 3/8 | 2 5/8 | 3 1/16 | 2 1/2 | 14.80 |
| SD-27 | 150 | 2 3/8 | 2 5/8 | 3 1/16 | 2 1/2 | 15.40 |



LINE CORD • PIGTAIL

### HEAVY DUTY MODEL — 220/240 INPUT 110/120 OUTPUT

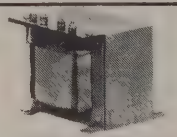
| CATALOG NUMBER | RATING WATTS | WEIGHT LBS. | DIMENSIONS H | W | D | PRICE |
|---|---|---|---|---|---|---|
| SD-15 | 75 | 2 | 3 1/8 | 2 5/8 | 3 1/8 | — |
| SD-16 | 100 | 2 1/4 | 3 1/8 | 2 5/8 | 3 1/4 | 16.40 |
| SD-17 | 150 | 3 1/2 | 3 1/8 | 2 5/8 | 3 7/8 | 18.40 |
| SD-38 | 200 | 3 3/4 | 3 1/8 | 2 5/8 | 4 | 20.80 |
| SD-12 | 250 | 5 1/2 | 4 5/8 | 3 7/8 | 3 3/8 | 24.95 |
| SD-18 | 350 | 6 1/2 | 4 5/8 | 3 7/8 | 3 5/8 | 28.80 |
| SD-11 | 500 | 9 3/4 | 4 5/8 | 3 7/8 | 4 1/4 | 34.90 |
| SD-19 | 750 | 12 | 4 5/8 | 3 7/8 | 5 | 42.75 |
| SD-13 | 1000 | 13 3/4 | 4 5/8 | 3 7/8 | 5 1/4 | 56.20 |
| SD-14 | 1500 | 19 | 4 5/8 | 3 7/8 | 6 5/8 | 67.00 |
| SD-20 | 2000 | 24 1/2 | 6 | 4 3/8 | 6 3/8 | 127.50 |
| SD-39 | 2500 | 35 1/2 | 6 1/2 | 5 1/2 | 6 5/8 | 227.50 |



LINE CORD • RECEPTACLE

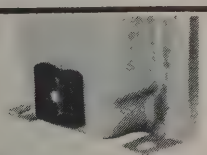
### INDUSTRIAL MODEL — 208/220/240 INPUT 110/120 OUTPUT

| CATALOG NUMBER | RATING WATTS | WEIGHT LBS. | DIMENSIONS H | W | D | PRICE |
|---|---|---|---|---|---|---|
| SD-28 | 3000 | 47 | 6 1/8 | 7 1/16 | 6 1/4 | 302.90 |
| SD-29 | 4000 | 54 | 6 1/8 | 7 1/16 | 7 1/8 | 360.80 |
| SD-22 | 5000 | 59 | 6 1/8 | 7 1/16 | 7 1/2 | 422.20 |
| SD-30 | 6000 | 70 | 6 1/8 | 7 1/16 | 8 1/2 | 499.00 |



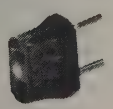
SCREW TERMINALS

### ACCESSORIES — AVAILABLE FOR USE WHERE APPLICABLE

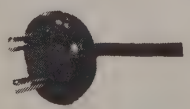


3 WIRE RECEPTACLE

3 WIRE LINE CORD



PLUG ADAPTERS



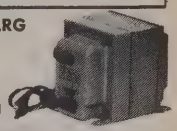
FOREIGN PLUGS

### 3 TAP REFRIGERATION — 188/210 210/236 236/260 → 105V-50Hz 115V-60Hz

| CATALOG NUMBER | RATING WATTS | WEIGHT LBS. | DIMENSIONS H | W | D | PRICE |
|---|---|---|---|---|---|---|
| SD-31LRG | 350 | 6 1/2 | 4 5/8 | 3 7/8 | 4 3/8 | 48.50 |
| SD-32LRG | 550 | 9 1/4 | 4 5/8 | 3 7/8 | 5 | 51.90 |
| SD-33LRG | 750 | 12 | 4 5/8 | 3 7/8 | 5 3/4 | 57.30 |
| SD-34LRG | 1000 | 16 1/4 | 4 5/8 | 3 7/8 | 7 | 74.90 |
| SD-40LRG | 1500 | 23 | 4 5/8 | 3 7/8 | 8 1/2 | 99.80 |

STYLE LRG

TAP SWITCH



LINE CORD • RECEPTACLE (GROUNDED)

| CATALOG NUMBER | RATING WATTS | WEIGHT LBS. | DIMENSIONS H | W | D | PRICE |
|---|---|---|---|---|---|---|
| SD-31LO | 350 | 6 1/4 | 4 5/8 | 3 7/8 | 4 1/2 | 46.25 |
| SD-32LO | 550 | 9 | 4 5/8 | 3 7/8 | 5 1/8 | 50.50 |
| SD-33LO | 750 | 12 | 4 5/8 | 3 7/8 | 5 1/2 | 56.50 |
| SD-34LO | 1000 | 16 | 4 5/8 | 3 7/8 | 6 1/2 | 73.75 |
| SD-40LO | 1500 | 22 | 4 5/8 | 3 7/8 | 8 | 96.50 |

STYLE LO

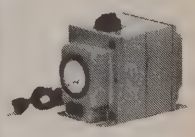
JUNCTION BOX

LEAD WIRE TERMINALS

### MULTI-TAPPED VOLTAGE REGULATOR — METER • SWITCH

| TYPE | PRIMARY VOLTS (SELECTOR SWITCH TAPS) | | | | | | | | OUTPUT VOLTS |
|---|---|---|---|---|---|---|---|---|---|
| 11 | 84 | 92 | 100 | 108 | 115 | 122 | 130 | 138 | 115 |
| 12 | 84 | 92 | 100 | 108 | 115 | 122 | 130 | 138 | 208, 230 |
| 21 | 170 | 185 | 200 | 215 | 230 | 245 | 260 | 275 | 115 |
| 22 | 170 | 185 | 200 | 215 | 230 | 245 | 260 | 275 | 208, 230 |

| CATALOG NUMBER | TYPE | RATING WATTS | WGT. LBS. | DIMENSIONS H | W | D | PRICE |
|---|---|---|---|---|---|---|---|
| MVR-17 | 11 or 22 | 150 | 4 5/8 | 4 5/8 | 3 7/8 | 5 | 71.25 |
| MVR-18 | 11 or 22 | 350 | 6 1/2 | 4 5/8 | 3 7/8 | 5 1/2 | 77.50 |
| MVR-11 | 11 or 22 | 500 | 8 | 4 5/8 | 3 7/8 | 5 3/4 | 81.00 |
| MVR-19 | 11 or 22 | 750 | 11 | 4 5/8 | 3 7/8 | 6 5/8 | 86.50 |
| MVR-13 | 11 or 22 | 1000 | 13 1/4 | 4 5/8 | 3 7/8 | 7 1/8 | 116.00 |
| MVR-14 | 11 or 22 | 1500 | 17 | 6 | 4 3/8 | 7 3/8 | 165.50 |
| MVR-20 | 11 or 22 | 2000 | 22 | 6 | 4 3/8 | 8 1/4 | 212.50 |
| MVR-17 | 12 or 21 | 150 | 6 | 4 5/8 | 3 7/8 | 5 1/8 | 75.00 |
| MVR-18 | 12 or 21 | 350 | 9 | 4 5/8 | 3 7/8 | 5 7/8 | 83.50 |
| MVR-11 | 12 or 21 | 500 | 12 1/2 | 4 5/8 | 3 7/8 | 6 3/4 | 92.50 |
| MVR-19 | 12 or 21 | 750 | 15 | 4 5/8 | 3 7/8 | 7 1/4 | 100.25 |
| MVR-13 | 12 or 21 | 1000 | 18 3/4 | 6 | 4 3/8 | 7 1/2 | 139.75 |
| MVR-14 | 12 or 21 | 1500 | 24 | 6 | 4 3/8 | 8 1/2 | 188.75 |
| MVR-20 | 12 or 21 | 2000 | 30 1/2 | 6 | 4 3/8 | 9 1/4 | 255.75 |

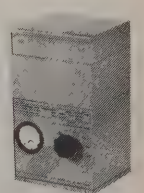


*UL* LINE CORD & RECEPTACLE

### PANEL MOUNTED VOLTAGE REGULATOR — METER • SWITCH JUNCTION BOX

| TYPE | PRIMARY VOLTS (SELECTOR SWITCH TAPS) | | | | | | | | OUTPUT VOLTS |
|---|---|---|---|---|---|---|---|---|---|
| 11 | 84 | 92 | 100 | 108 | 115 | 122 | 130 | 138 | 115 |
| 12 | 84 | 92 | 100 | 108 | 115 | 122 | 130 | 138 | 208, 230 |
| 21 | 170 | 185 | 200 | 215 | 230 | 245 | 260 | 275 | 115 |
| 22 | 170 | 185 | 200 | 215 | 230 | 245 | 260 | 275 | 208, 230 |

| CATALOG NUMBER | TYPE | RATING WATTS | WGT. LBS. | DIMENSIONS H | W | D | PRICE |
|---|---|---|---|---|---|---|---|
| PVR-20 | 11 or 22 | 2000 | 29 | 5 3/8 | 6 3/8 | 11 1/4 | 542.00 |
| PVR-28 | 11 or 22 | 3000 | 40 | 5 3/8 | 6 3/8 | 12 1/4 | 598.00 |
| PVR-29 | 11 or 22 | 4000 | 49 | 5 3/8 | 6 3/8 | 13 3/8 | 645.00 |
| PVR-22 | 11 or 22 | 5000 | 57 | 5 3/8 | 6 3/8 | 14 5/8 | 695.00 |
| PVR-30 | 11 or 22 | 6000 | 63 | 6 1/8 | 7 1/8 | 13 3/4 | 760.00 |
| PVR-20 | 12 or 21 | 2000 | 44 | 6 1/8 | 7 1/8 | 13 | 625.00 |
| PVR-28 | 12 or 21 | 3000 | 58 | 6 1/8 | 7 1/8 | 14 | 695.00 |
| PVR-29 | 12 or 21 | 4000 | 78 | 6 1/8 | 7 1/8 | 15 1/2 | 760.00 |
| PVR-22 | 12 or 21 | 5000 | 91 | 6 1/8 | 7 1/8 | 16 1/2 | 820.00 |
| PVR-30 | 12 or 21 | 6000 | 105 | 6 1/8 | 7 1/8 | 18 | 895.00 |



• JUNCTION BOX
• LEAD TERMINALS

QUALITY ENGINEERED • • •

TOROTEL INC.

13402 SOUTH 71 HIGHWAY, GRANDVIEW, MO. 64030
PHONE: (816) 761-6314 TWX 910-777-7037

# 400 HZ MINIATURE POWER TRANSFORMERS

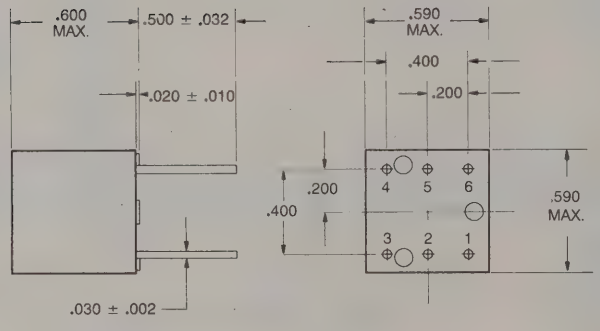
## Reference for all Industrial and Military Standard 400 Hz Miniature Power Transformers

These 400 Hz Miniature Power Transformers are selected for use in all Military and Industrial applications requiring high performance in the smallest possible package size. They conform to all of the requirements of MIL-T-27, Class S (−55 °C to +130 °C). The minimum continuous operating life expectancy is 10,000 hours. This series is available having power ratings of 0.5 VA through 250 VA. The primaries are 115 Vrms with secondary voltages ranging from 5 Vrms through 300 Vrms.

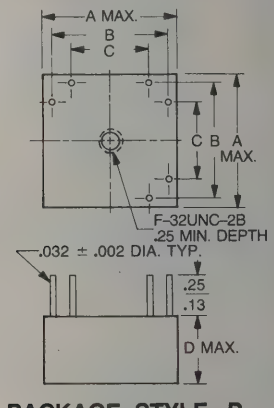
**It is recommended that these transformers be specified for all applications where space, weight, and cost effectiveness are prime considerations.**

## OUTLINE DRAWINGS

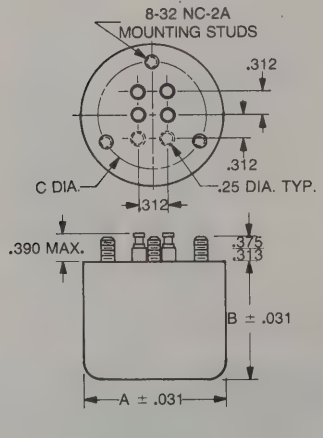
### PACKAGE STYLE S



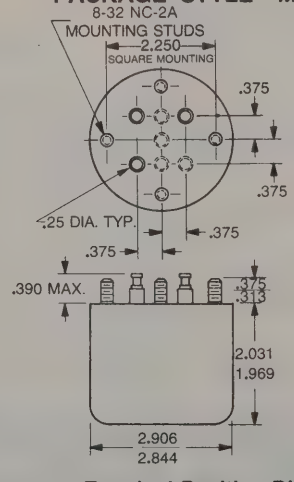

### PACKAGE STYLE E



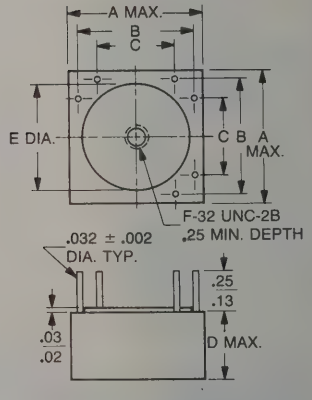

### PACKAGE STYLE H




### PACKAGE STYLE M




### PACKAGE STYLE P



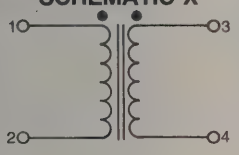

**Tolerance on Terminal Position Dimensions**
Package Styles E, P, and S: ± .005 Package Styles H and M: ± .015

TOROTEL INC.
13402 SOUTH 71 HIGHWAY, GRANDVIEW, MO. 64030
PHONE: (816) 761-6314 TWX 910-777-7037

# 400 HZ MINIATURE POWER TRANSFORMERS

## SCHEMATIC AND TERMINAL CONFIGURATIONS

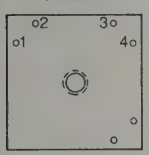
### SCHEMATIC X



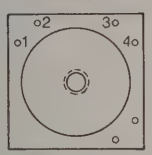

### TERMINAL LAYOUTS

STYLE S

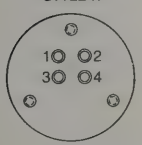
STYLE E




STYLE P

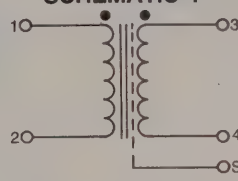



STYLE H




STYLE M

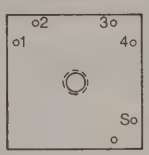
### SCHEMATIC Y



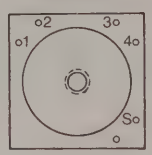

### TERMINAL LAYOUTS

STYLE S

STYLE E



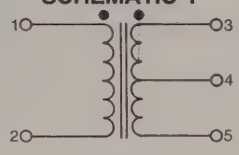

STYLE P




STYLE H

STYLE M

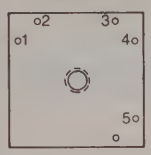
### SCHEMATIC T



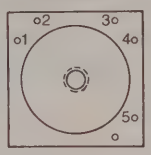

### TERMINAL LAYOUTS

STYLE S

STYLE E

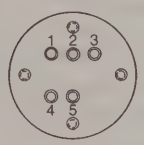



STYLE P

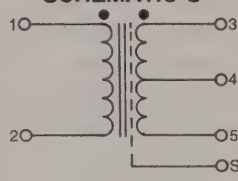



STYLE H

STYLE M



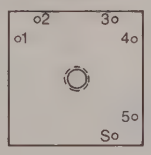

### SCHEMATIC S



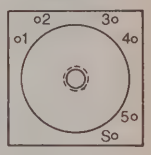

### TERMINAL LAYOUTS

STYLE S

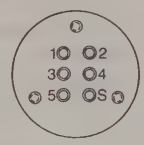
STYLE E



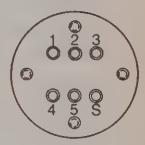

STYLE P




STYLE H




STYLE M




## PART NUMBER INFORMATION

Specify the Industrial Standard (IS) 400 Hz Miniature Power Transformer for your application by using the part number:

Example: **0.5ST26**

| 0.5 | S | T | 26 |
|---|---|---|---|
| VA Rating (See Table I) | Package Style (See Table I and Outline Drawings) | Schematic and Terminal Configuration | Full Load Secondary Voltage (See Table II) |

### TABLE I. VA Ratings and Electrical Specifications

| VA RATING | PACKAGE STYLE | SCHEMATIC | REGULATION (%) | | AVAILABLE SECONDARY VOLTAGES (VRMS) ① | | EXCITING CURRENT (MA) | EFFICIENCY (%) | | TEMP. RISE (°C) MIL-T-27 NO HEAT SINK | | WEIGHT (OZ.) | | DIMENSIONS (INCHES) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | NOM. | MAX. | MIN. | MAX. | MAX. | MIN. | NOM. | NOM. | MAX. | NOM. | MAX. | A | B | C | D | E | F |
| 0.5 | S | T,X | 15 | 18 | 5 | 300 | 1 | 65 | 70 | 10 | 15 | 0.38 | 0.4 | | | | | | |
| 0.5 | S | S,Y | 17 | 21 | 5 | 300 | 1 | 65 | 70 | 12 | 17 | 0.38 | 0.4 | | | | | | |
| 1.5 | E,P | T,X | 20 | 23 | 5 | 300 | 1.5 | 70 | 76 | 13 | 17 | 0.76 | 0.85 | 1.090 | .800 | .600 | 0.47 | 0.75 | 0.138 |
| 1.5 | E,P | S,Y | 15 | 18 | 5 | 300 | 3 | 70 | 76 | 13 | 17 | 0.97 | 1.1 | 1.090 | .800 | .600 | 0.59 | 0.75 | 0.138 |
| 2 | E,P | T,X | 3 | 3.7 | 5 | 300 | 6 | 72 | 87 | 10 | 15 | 1.5 | 1.65 | 1.090 | .800 | .600 | 0.78 | 0.75 | 0.138 |
| 2.4 | E,P | S,Y | 3 | 3.8 | 5 | 300 | 9 | 73 | 88 | 11 | 16 | 1.9 | 2.2 | 1.090 | .800 | .600 | 1.03 | 0.75 | 0.138 |
| 3 | E,P | T,X | 15 | 18 | 5 | 300 | 3 | 75 | 84 | 15 | 20 | 0.97 | 1.1 | 1.090 | .800 | .600 | 0.59 | 0.75 | 0.138 |
| 3 | E,P | S,Y | 10 | 12 | 5 | 300 | 6 | 75 | 84 | 15 | 20 | 1.5 | 1.65 | 1.090 | .800 | .600 | 0.78 | 0.75 | 0.138 |
| 3.6 | E,P | T,X | 3 | 3.8 | 5 | 300 | 9 | 76 | 87 | 10 | 15 | 1.9 | 2.2 | 1.090 | .800 | .600 | 1.03 | 0.75 | 0.138 |
| 6 | E,P | T,X | 10 | 12 | 5 | 300 | 6 | 81 | 88 | 18 | 25 | 1.5 | 1.65 | 1.090 | .800 | .600 | 0.78 | 0.75 | 0.138 |
| 6 | E,P | S,Y | 8 | 10 | 5 | 300 | 9 | 80 | 88 | 18 | 25 | 1.9 | 2.2 | 1.090 | .800 | .600 | 1.03 | 0.75 | 0.138 |
| 7.3 | E,P | S,T,X,Y | 3 | 3.5 | 5 | 300 | 16 | 84 | 92 | 15 | 23 | 3.2 | 3.4 | 1.400 | 1.100 | .900 | 0.97 | 1.00 | 0.164 |
| 9 | E,P | T,X | 8 | 10 | 5 | 300 | 9 | 83 | 89 | 23 | 30 | 1.9 | 2.2 | 1.090 | .800 | .600 | 1.03 | 0.75 | 0.138 |
| 13 | E,P | S,T,X,Y | 3 | 3.6 | 5 | 300 | 25 | 87 | 93 | 21 | 28 | 4.2 | 4.4 | 1.400 | 1.100 | .900 | 1.20 | 1.00 | 0.164 |
| 16 | E,P | S,T,X,Y | 7 | 8 | 5 | 300 | 16 | 87 | 92 | 25 | 32 | 3.2 | 3.4 | 1.400 | 1.100 | .900 | 0.97 | 1.00 | 0.164 |
| 25 | E,P | S,T,X,Y | 6 | 7 | 5 | 300 | 25 | 88 | 93 | 36 | 45 | 4.2 | 4.4 | 1.400 | 1.100 | .900 | 1.20 | 1.00 | 0.164 |
| 50 | H | S,T,X,Y | 2.5 | 3 | 5 | 300 | 45 | 92 | 94 | 26 | 35 | 10.0 | 11.0 | 2.000 | 1.500 | .781 | | | |
| 75 | H | S,T,X,Y | 2.5 | 3 | 10 | 300 | 60 | 92 | 94 | 32 | 40 | 12.0 | 13.5 | 2.000 | 1.750 | .781 | | | |
| 100 | H | S,T,X,Y | 2 | 2.5 | 12 | 300 | 75 | 93 | 95 | 35 | 43 | 17.0 | 18.7 | 2.250 | 2.000 | .875 | | | |
| 250 | M | S,T,X,Y | 1.5 | 2 | 26 | 300 | 125 | 95 | 96 | 47 | 55 | 27.5 | 30.0 | | | | | | |

① See Table II, on the following page for Industry Standard secondary values within this range.

TOROTEL INC.

13402 SOUTH 71 HIGHWAY, GRANDVIEW, MO. 64030

PHONE: (816) 761-6314 TWX 910-777-7037

# 400 HZ MINIATURE POWER TRANSFORMERS

## PHYSICAL SPECIFICATIONS

**Size:**
Sizes for Standard VA Types are given in Table I, and Outline Drawings on the preceding pages.

**Construction:**
Package Styles E, P, and S: Encapsulated, Epoxy (MIL-T-27, Grade 5).
Package Styles H and M: Hermetically sealed in drawn steel case (MIL-T-27, Grade 4).

**Terminals:**
Package Styles E, P, and S: Printed circuit pins—tinned brass.
Package Styles H and M: Ceramic-silicone rubber.

**Terminal Strength (Method 211 of MIL-STD-202, test condition A):**
Package Styles E, P, and S: 2.0 pounds
Package Styles H and M: 4.5 pounds

**Finish:**
Package Styles E, P, and S: Epoxy, black.
Package Styles H and M: MIL-F-14072 with grey color in accordance with No. 26152, Federal Standard No. 595.

**Marking:**
Includes MIL-T-27 Type Designation, winding ratings, maximum working voltage, maximum altitude, schematic, Torotel name, and part number.

## ELECTRICAL SPECIFICATIONS

**Primary Voltage:**
115 Volts RMS ± 10%.

**Frequency:** 400 Hz ± 5%

**Secondary Voltage and Tolerance:**
Standard Secondary Voltage: See Table II.
Secondary Voltage Tolerance: ± 3% at full load and 115 volts, 400 Hz applied to primary.

**Electrostatic Shielding (Schematics S and X):**
5 to 1 minimum voltage ratio at 20 kHz.

**Phase Shift:**
1.0 electrical degree between primary and secondary voltage at rated load, maximum.

**Insulation Resistance:**
10,000 megohms minimum at 500 VDC.

**Dielectric Strength:**
At sea level: 2.8 times the maximum working voltage.
At reduced barometric pressure: 1.25 times the maximum working voltage.

## ENVIRONMENTAL SPECIFICATIONS

**Operating Temperature Range:**
−55 °C to +130 °C (ambient plus temperature rise).

**Altitude:**
70,000 feet, maximum.

**Vibration:**
MIL-STD-202, method 204, test condition C.

**Life Expectancy:**
10,000 hours, minimum.

**Other Environmental Specifications:**
In accordance with MIL-T-27, Grade 4 (Package Style H and M) and Grade 5 (Package Style E, P, and S), Class S, Family 03.

**TABLE II. Industry Standard Secondary Voltages**

| Available Secondary voltages (Vrms) ±3% | Working voltage (Vrms max) | Available Secondary voltages (Vrms) ±3% | Working voltage (Vrms max) | Available Secondary voltages (Vrms) ±3% | Working voltage (Vrms max) | Available Secondary voltages (Vrms) ±3% | Working voltage (Vrms max) |
|---|---|---|---|---|---|---|---|
| 5 | 325 | 13 | 325 | 36 | 325 | 110 | 325 |
| 5.5 | 325 | 15 | 325 | 39 | 325 | 115 | 325 |
| 6 | 325 | 16 | 325 | 43 | 325 | 120 | 325 |
| 6.3 | 325 | 18 | 325 | 47 | 325 | 130 | 325 |
| 7 | 325 | 20 | 325 | 51 | 325 | 150 | 325 |
| 7.5 | 325 | 22 | 325 | 56 | 325 | 180 | 325 |
| 8 | 325 | 24 | 325 | 62 | 325 | 200 | 440 |
| 9 | 325 | 26 | 325 | 68 | 325 | 220 | 440 |
| 10 | 325 | 28 | 325 | 75 | 325 | 240 | 440 |
| 11 | 325 | 30 | 325 | 82 | 325 | 270 | 580 |
| 12 | 325 | 33 | 325 | 91 | 325 | 300 | 580 |
| 12.6 | 325 | | | 100 | 325 | | |

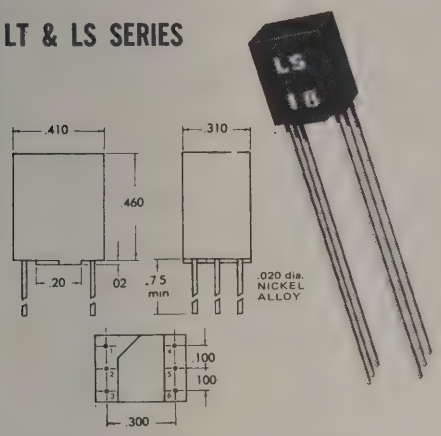
TOROTEL INC.

13402 SOUTH 71 HIGHWAY, GRANDVIEW, MO. 64030
PHONE: (816) 761-6314 TWX 910-777-7037

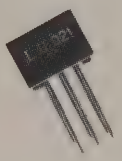
# SUBMINIATURE AUDIO TRANSFORMERS

## PROTOTYPES IN 48 HOURS UPON REQUEST

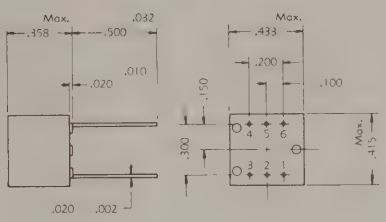
### LT & LS SERIES

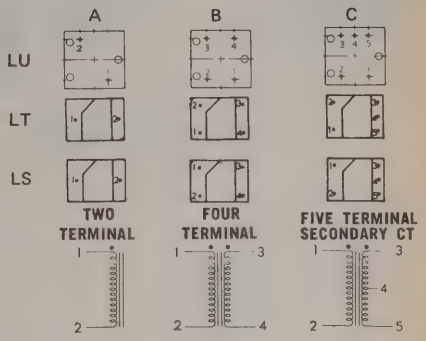


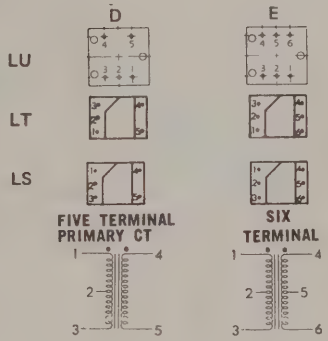

### LU SERIES



Wt. 0.1 oz.




The LS Series is electrically and mechanically the same as the LT Series except for phase relationships between terminals.

LS, LT, and LU Series transformers have successfully passed the rigid requirements of MIL-T-27, Class R, Grade 5.

Subminiature in size, weighing less than 0.1 ounce, these transformers have tenth inch grid spacing between terminals and are ideally suited for transistor circuit applications which utilize printed circuit board design. All three series have risers on mounting surfaces to facilitate inspection and board cleaning, and also to prevent moisture traps.

A wide range of standard designs are available which meet the requirements of most common applications and allow for rapid delivery of prototype quantities. Special designs are also available in all three types.

The new LU Series exhibits the same electrical characteristics as the LS and LT Series but has been packaged in a "thin line" configuration to allow for closer board spacing for "card cage" applications or where height dimensions are critical.

### MAGNETIC SHIELDING

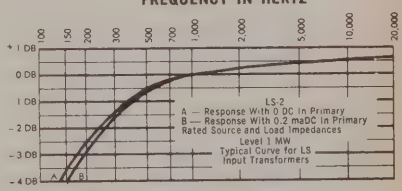
LS and LT Series transformers are available with magnetic shields when required. Overall dimensions of transformers with the magnetic shield added are .365 max. x .465 max. x .531 max.

To order transformers with shields installed add 500 to dash numbers shown in the table below. For example: to order an LS-22 with shield, specify LS-522.

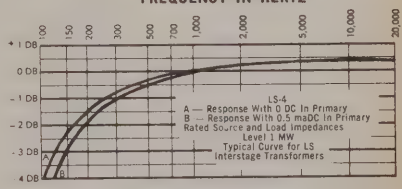
| LS, LT or LU No. | MIL-T-27 Designation | Application | Primary Impedance | DC Res. Pri. Ohms | DC ma Pri. | Secondary Impedance | Max. Power MW | Term. Layout |
|---|---|---|---|---|---|---|---|---|
| 2 | TF5S21ZZ | Input | 50,000-CT | 3800 | .2 | 1000-CT | 25 | E |
| 4 | TF5S21ZZ | Interstage | 20,000/30,000 | 1700 | .5 | 800/1200 | 40 | B |
| 5 | TF5S21ZZ | Interstage | 20,000/30,000-CT | 1700 | .5 | 800/1200-CT | 40 | E |
| 6 | TF5S21ZZ | Interstage | 10,000/12,000-CT | 1050 | 1 | 1500/1800-CT | 50 | E |
| 7 | TF5S21ZZ | Driver | 10,000/12,000-CT | 1050 | 1 | 1200/1500-CT | 50 | E |
| (T) 8 | TF5S21ZZ | Driver | 10,000/12,000-CT | 1050 | 1 | 2000/2500-CT | 50 | E |
| 9 | TF5S21ZZ | Driver | 10,000/12,000-CT | 1050 | 1 | 500/600-CT | 50 | E |
| 10 | TF5S21ZZ | Output | 500/600 | 60 | 3 | 50/60 | 50 | B |
| 11 | TF5S21ZZ | Output | 1000/1200 | 145 | 3 | 50/60 | 50 | B |
| 12 | TF5S21ZZ | Output | 600 | 70 | 3 | 3.2 | 50 | B |
| 13 | TF5S21ZZ | Output | 1200 | 120 | 2 | 3.2 | 50 | B |
| 14 | TF5S21ZZ | Output | 10,000 | 1160 | 1 | 3.2 | 50 | B |
| 15 | TF5S21ZZ | Output | 150/200-CT | 18 | 10 | 12/16 | 50 | D |
| 16 | TF5S21ZZ | Output | 300/400-CT | 38 | 7 | 12/16 | 50 | D |
| 17 | TF5S21ZZ | Output | 600/800-CT | 75 | 4.5 | 12/16 | 50 | D |
| 18 | TF5S21ZZ | Output | 1000/1330-CT | 120 | 3.5 | 12/16 | 50 | D |
| 19 | TF5S21ZZ | Output | 1500/2000-CT | 180 | 3 | 12/16 | 50 | D |
| 20 | TF5S21ZZ | Output | 7500/10,000-CT | 820 | 1 | 12/16 | 50 | D |
| 21 | TF5S21ZZ | Output | 300-CT | 37 | 7 | 600 | 50 | D |
| 22 | TF5S21ZZ | Output | 500-CT | 60 | 3 | 600 | 50 | D |
| 23 | TF5S21ZZ | Output | 900-CT | 100 | 4 | 600 | 50 | D |
| 24 | TF5S21ZZ | Output | 1500-CT | 170 | 3 | 600 | 50 | D |
| 25 | TF5S21ZZ | Output | 120/150-CT | 15 | 10 | 3.2/4 | 50 | D |
| 26 | TF5S21ZZ | Output | 320/400-CT | 40 | 6 | 3.2/4 | 50 | D |
| 27 | TF5S21ZZ | Output | 600/750-CT | 70 | 4.5 | 3.2/4 | 50 | D |
| 28 | TF5S21ZZ | Output | 800/1000-CT | 100 | 4 | 3.2/4 | 50 | D |
| 29 | TF5S21ZZ | Output | 1200/1500-CT | 125 | 3 | 3.2/4 | 50 | D |
| 30 | TF5S21ZZ | Output | 1600/2000-CT | 190 | 2.5 | 3.2/4 | 50 | D |
| 31 | TF5S21ZZ | Output | 8000/10,000-CT | 820 | 1 | 3.2/4 | 50 | D |
| (T) 32 | TF5S21ZZ | Output | 10,000-CT | 1000 | 1 | 10,000-CT | 50 | E |
| 33 | TF5S21ZZ | Driver | 10,000/12,000 | 1050 | 1 | 500/600-CT | 50 | C |
| 34 | TF5S21ZZ | Driver | 20,000 | 1700 | .3 | 1000 | 50 | B |
| 35 | TF5S21ZZ | Output | 1000 | 135 | 3 | 50 | 50 | B |
| 36 | TF5S21ZZ | Output | 400-CT | 40 | 3 | 11 | 50 | D |
| (T,U) 37 | TF5S21ZZ | Driver | 10,000/12,000 | 1050 | 1 | 2000/2500-CT | 50 | C |
| 38 | TF5S21ZZ | Output | 600-CT | 72 | 3 | 600-CT | 50 | E |
| (T) 39 | TF5S21ZZ | Output | 10,000 | 1000 | 1 | 10,000 split | 50 | * |
| 40 | TF5S21ZZ | Output | 600 | 72 | 3 | 600 split | 50 | * |
| 41 | TF5S21ZZ | Input | 25,000-CT | 4300 | 0.6 | 1000-CT | 30 | E |
| (U) 42 | TF5S21ZZ | Isolation | 600-CT | 90 | 4 | 600-CT | 30 | E |
| 101 | TF5S20ZZ | Choke | 6 H @ 2 ma | 1700 | | | | A |
| 102 | TF5S20ZZ | Choke | 1.25 H @ 2 ma | 180 | | | | A |
| 103 | TF5S20ZZ | Choke | 3.5 H @ 2 ma | 1100 | | | | A |
| 104 | TF5S20ZZ | Choke | .3 H @ 4 ma | 42 | | | | A |

*PRIMARY TERM. 1-2; SECONDARY TERM. 3-4, 5-6 (U) LU (T) LT } Distributor Item

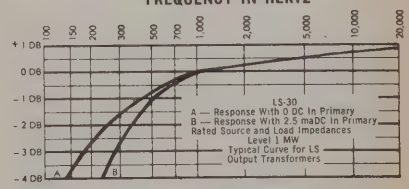
FREQUENCY IN HERTZ



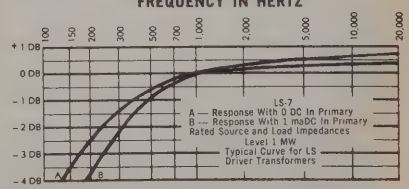

FREQUENCY IN HERTZ




FREQUENCY IN HERTZ




FREQUENCY IN HERTZ




The above are typical response curves up to 20 kHz however many items in this series have useful frequency ranges up to 100 kHz and beyond.

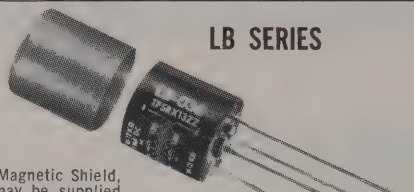
TOROTEL INC.

13402 SOUTH 71 HIGHWAY, GRANDVIEW, MO. 64030

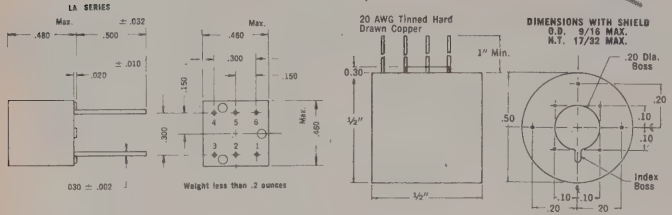
PHONE: (816) 761-6314 TWX 910-777-7037

## LA SERIES

## LB SERIES



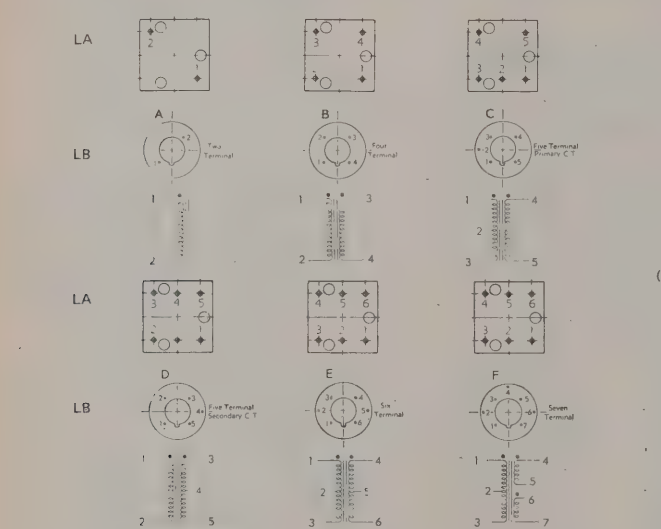
The LB-500 Magnetic Shield, as shown, may be supplied for all LB Types. Add 500 to Dash Number (i.e. LB-001 with Shield. Order LB-501).

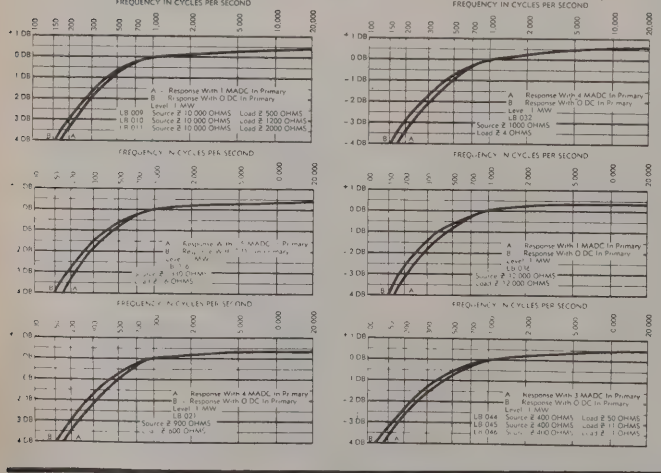



Torotel LA and LB Series Transformers are manufactured to MIL-T-27, Grade 5, Class S specification. These series have 0.1 grid spaced terminals for printed circuit application. Both types have risers on mounting surfaces to prevent the formation of moisture traps and to facilitate cleaning of board assemblies.

The LA Series is electrically the same as the LB Series, but is packaged in a .460 inch cube with smaller outline dimensions for application where this configuration is more suitable.

Leads are made of 20 AWG Tinned Hard Drawn Copper. Units utilizing Dumet Wire are available on special request.





FREQUENCY IN CYCLES PER SECOND
FREQUENCY IN CYCLES PER SECOND
FREQUENCY IN CYCLES PER SECOND
FREQUENCY IN CYCLES PER SECOND
FREQUENCY IN CYCLES PER SECOND
FREQUENCY IN CYCLES PER SECOND

| | LA, LB No. | MIL Designation | Application | Primary Impedance | DC mA in Pri. | Secondary Impedance | Nom. Pri. Res. | MW Level @ 1 kHz | Term. Lay-out |
|---|---|---|---|---|---|---|---|---|---|
| | 001 | TF5S21ZZ | Interstage | 20,000 | .5 | 800 | 850 | 50 | B |
| | | | | 30,000 | .5 | 1200 | | | |
| | 002 | TF5S21ZZ | Output | 500 | 3 | 50 | 60 | 100 | B |
| | | | | 600 | 3 | 60 | | | |
| | 003 | TF5S21ZZ | Output | 1000 | 3 | 50 | 115 | 100 | B |
| | | | | 1200 | 3 | 60 | | | |
| | 004 | TF5S21ZZ | Output | 600 | 3 | 3.2 | 60 | 100 | B |
| | 005 | TF5S21ZZ | Output | 1200 | 2 | 3.2 | 115 | 100 | B |
| | 006 | TF5S21ZZ | Output | 10,000 | 1 | 3.2 | 790 | 100 | B |
| | 007 | TF5S21ZZ | Input | 200,000 | 0 | 1000 | 8500 | 25 | B |
| | | | Other Application | 500 | 0 | 100,000 | | | |
| | 008 | TF5S20ZZ | Reactor 3.5 H @ 2 maDC, 1 H @ 5 maDC | | | | 630 | | A |
| | 009 | TF5S21ZZ | Output or Driver | 10,000 | 1 | 500-CT | 800 | 100 | D |
| | | | | 12,000 | 1 | 600-CT | | | |
| | 010 | TF5S21ZZ | Driver | 10,000 | 1 | 1200-CT | 800 | 100 | D |
| | | | | 12,000 | 1 | 1500-CT | | | |
| (B) | 011 | TF5S21ZZ | Driver | 10,000 | 1 | 2000-CT | 800 | 100 | D |
| | | | | 12,000 | 1 | 2500-CT | | | |
| | 012 | TF5S21ZZ | Single or PP Output | 150-CT | 10 | 12 | 11 | 500 | C |
| | | | | 200-CT | 10 | 16 | | | |
| | 013 | TF5S21ZZ | Single or PP Output | 300-CT | 7 | 12 | 20 | 500 | C |
| | | | | 400-CT | 7 | 16 | | | |
| (B) | 014 | TF5S21ZZ | Single or PP Output | 600-CT | 5 | 12 | 43 | 500 | C |
| | | | | 800-CT | 5 | 16 | | | |
| | 015 | TF5S21ZZ | Single or PP Output | 800-CT | 4 | 12 | 51 | 500 | C |
| | | | | 1070-CT | 4 | 16 | | | |
| | 016 | TF5S21ZZ | Single or PP Output | 1000-CT | 3.5 | 12 | 71 | 500 | C |
| | | | | 1330-CT | 3.5 | 16 | | | |
| | 017 | TF5S21ZZ | Single or PP Output | 1500-CT | 3 | 12 | 108 | 500 | C |
| | | | | 2000-CT | 3 | 16 | | | |
| | 018 | TF5S21ZZ | Single or PP Output | 7500-CT | 1 | 12 | 505 | 500 | C |
| | | | | 10,000-CT | 1 | 16 | | | |
| (B) | 019 | TF5S21ZZ | Output to Line | 300-CT | 7 | 600 | 19 | 500 | C |
| (B) | 020 | TF5S21ZZ | Output to Line to Line or Mixing | 500-CT | 5.5 | 600 | 31 | 500 | C |
| (A) | 021 | TF5S21ZZ | Output to Line | 900-CT | 4 | 600 | 53 | 500 | C |
| (B) | 022 | TF5S21ZZ | Output to Line | 1500-CT | 3 | 600 | 86 | 500 | C |
| | 023 | TF5S21ZZ | Interstage | 20,000-CT | .5 | 800-CT | 850 | 100 | E |
| | | | | 30,000-CT | .5 | 1200-CT | | | |
| (B) | 024 | TF5S21ZZ | Input | 200,000-CT | 0 | 1000-CT | 8500 | 25 | E |
| | | | Other Application | 500-CT | 0 | 100,000-CT | | | |
| (B) | 025 | TF5S21ZZ | Interstage | 10,000-CT | 1 | 1500-CT | 800 | 100 | E |
| | | | | 12,000-CT | 1 | 1800-CT | | | |
| | 026 | TF5S20ZZ | Reactor 6 H @ 2 maDC 1.5 H @ 5 maDC | | | | 2100 | | A |
| | 027 | TF5S20ZZ | Reactor 1.2 H @ 2 maDC, .5 H @ 11 maDC | | | | 100 | | A |
| | 028 | TF5S20ZZ | Reactor .3 H @ 4 maDC .15 H @ 20 maDC | | | | 31 | | A |
| | 029 | TF5S21ZZ | Single or PP Output | 120-CT | 10 | 3.2 | 10 | 500 | C |
| | | | | 150-CT | 10 | 4 | | | |
| | 030 | TF5S21ZZ | Single or PP Output | 320-CT | 7 | 3.2 | 20 | 500 | C |
| | | | | 400-CT | 7 | 4 | | | |
| | 031 | TF5S21ZZ | Single or PP Output | 640-CT | 5 | 3.2 | 43 | 500 | C |
| | | | | 800-CT | 5 | 4 | | | |
| | 032 | TF5S21ZZ | Single or PP Output | 800-CT | 4 | 3.2 | 51 | 500 | C |
| | | | | 1000-CT | 4 | 4 | | | |
| | 033 | TF5S21ZZ | Single or PP Output | 1060-CT | 3.5 | 3.2 | 71 | 500 | C |
| | | | | 1330-CT | 3.5 | 4 | | | |
| | 034 | TF5S21ZZ | Single or PP Output | 1600-CT | 3 | 3.2 | 109 | 500 | C |
| | | | | 2000-CT | 3 | 4 | | | |
| | 035 | TF5S21ZZ | Single or PP Output | 8000-CT | 1 | 3.2 | 505 | 100 | C |
| | | | | 10,000-CT | 1 | 4 | | | |
| (A)(B) | 036 | TF5S21ZZ | Isolation or Interstage | 10,000-CT | 1 | 10,000-CT | 950 | 100 | E |
| | | | | 12,000-CT | | 12,000-CT | | | |
| | 037 | TF5S21ZZ | Driver | 10,000-CT | 1 | 1200-CT | 800 | 100 | E |
| | | | | 12,000-CT | 1 | 1500-CT | | | |
| | 038 | TF5S21ZZ | Driver | 10,000-CT | 1 | 2000-CT | 800 | 100 | E |
| | | | | 12,000-CT | 1 | 2500-CT | | | |
| (B) | 039 | TF5S21ZZ | Driver | 10,000-CT | 1 | 500-CT | 800 | 100 | E |
| | | | | 12,000-CT | 1 | 600-CT | | | |
| | 040 | TF5S21ZZ | Input | 100,000 | 0 | 1000 | 1700 | 70 | B |
| | 041 | TF5S21ZZ | Driver | 20,000 | .5 | 1000 | 1000 | 100 | B |
| | 042 | TF5S21ZZ | Driver | 20,000 | .5 | 1200-CT | 1000 | 100 | D |
| | 043 | TF5S21ZZ | Output | 1000 | 3 | 50 | 60 | 100 | B |
| | 044 | TF5S21ZZ | Output | 400 | 3 | 50 | 30 | 100 | B |
| | 045 | TF5S21ZZ | Output | 400 | 3 | 11 | 30 | 100 | B |
| | 046 | TF5S21ZZ | Single or PP Output | 400-CT | 3 | 11 | 30 | 500 | C |
| | 047 | TF5S20ZZ | Reactor 10 H @ 0 maDC, 8 H @ .5 maDC | | | | 650 | | A |
| | 048* | TF5S21ZZ | Isolation or Interstage Ratio 1:1:1 | 2000-CT | 3 | 8000 split | 195 | 100 | F |
| | | | | 2500-CT | 3 | 10,000 split | | | |
| | 049* | TF5S21ZZ | Interstage | 10,000-CT | 1 | 2000 split | 560 | 100 | F |
| | | | | 12,000-CT | 1 | 2400 split | | | |
| | 050* | TF5S21ZZ | Interstage | 20,000-CT | .5 | 1000 split | 800 | 100 | F |
| | | | | 30,000-CT | .5 | 1500 split | | | |
| | 051* | TF5S21ZZ | Interstage | 40,000-CT | .25 | 400 split | 1700 | 50 | F |
| | | | | 50,000-CT | .25 | 500 split | | | |
| | 052* | TF5S21ZZ | Interstage or Output | 400-CT | 8 | 400 split | 46 | 500 | F |
| | | | | 500-CT | 6 | 500 split | | | |
| | 053* | TF5S21ZZ | Interstage | 400-CT | 8 | 120 split | 46 | 500 | F |
| | | | | 500-CT | 6 | 150 split | | | |
| | 054* | TF5S21ZZ | Interstage | 400-CT | 8 | 40 split | 46 | 500 | F |
| | | | | 500-CT | 6 | 50 split | | | |
| | 055* | TF5S21ZZ | Interstage | 80-CT | 12 | 32 split | 9.8 | 500 | F |
| | | | | 100-CT | 10 | 40 split | | | |
| | 056 | TF5S21ZZ | Input | 50,000-CT | .3 | 1000-Ct | 1900 | 50 | E |
| | 057 | TF5S21ZZ | Output | 600-CT | 4.5 | 3.2 | 40 | 500 | C |
| | | | | 750-CT | | 4.0 | | | |
| | 058 | TF5S21ZZ | Output | 1200-CT | 3 | 3.2 | 100 | 500 | C |
| | | | | 1500-CT | | 4 | | | |
| | 059 | TF5S21ZZ | Input | 100K-CT | 0 | 1000-CT | 3300 | 25 | E |
| | 060 | TF5S21ZZ | Driver | 10K-CT | 1 | 600-CT | 1100 | 100 | E |
| | 061 | TF5S21ZZ | Interstage | 4K-CT | 2 | 10K-CT | 440 | 500 | E |
| | 062 | TF5S21ZZ | Output to Line | 1000-CT | 3 | 600-CT | 110 | 500 | E |
| | 063 | TF5S21ZZ | Input | 600-CT | 4 | 25K-CT | 65 | 100 | E |
| (A) | 064 | TF5S21ZZ | Isolation | 600-CT | 4 | 600-CT | 67 | 100 | E |
| | 065 | TF5S21ZZ | Output | 600-CT | 4 | 60 | 65 | 100 | C |
| (B) | 066 500 | TF5S21ZZ | Output Magnetic Shielding Case | 600-CT | 4 | 4 | 65 | 100 | C |

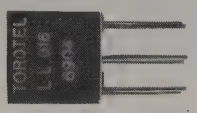
*These LA Types have no Primary C-T (A) LA (B) LB } Distributor Item

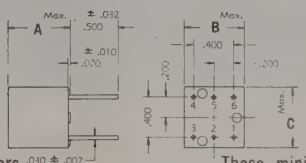
TOROTEL INC.

13402 SOUTH 71 HIGHWAY, GRANDVIEW, MO. 64030

PHONE: (816) 761-6314 TWX 910-777-7037

## AUDIO TRANSFORMERS LL & LR SERIES






| Series | A | B | C |
|---|---|---|---|
| LL | .600 | .590 | .590 |
| LR | .925 | .800 | .710 |

These tiny, versatile "LL" transformers are provided with .020 risers and 0.1 grid spacing for printed circuit board applications and are manufactured to MIL-T-27, Grade 5, Class S specifications.

RESPONSE: ±1 db 200 to 50,000 Hz
DISTORTION: 10% Max. at rated power, 200 to 50,000 HZ
WEIGHT: 0.4 OZ

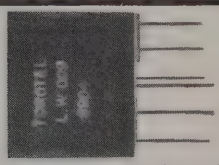
| LL No. | MIL-T-27 Designation | Application | Impedance Ohms Pri | Impedance Ohms Sec. | DC Resistance Ohms Pri | DC Resistance Ohms Sec | Max. Pri DC (ma) | Max. 200 Hz Pwr* (mw) |
|---|---|---|---|---|---|---|---|---|
| 001 | TF5S21ZZ | Input | 100K-CT | 1000-CT | 6000 | 60 | 0 | 150 |
| 002 | TF5S21ZZ | Interstage | 25K-CT | 1000-CT | 2800 | 120 | 0 | 150 |
| 003 | TF5S21ZZ | Interstage | 10K-CT | 10K-CT | 1100 | 1200 | 1 | 150 |
| 004 | TF5S21ZZ | Driver | 10K-CT | 1500-CT | 1100 | 200 | 1 | 150 |
| 005 | TF5S21ZZ | Output to Line | 10K-CT | 600-CT | 1100 | 75 | 1 | 150 |
| 006 | TF5S21ZZ | Interstage | 4000-CT | 10K-CT | 440 | 1200 | 1.5 | 150 |
| * 007 | TF5S21ZZ | Output to Line | 1000-CT | 600-CT | 100 | 60 | 3 | 150 |
| 008 | TF5S21ZZ | Output | 1000-CT | 4 | 100 | 0.4 | 3 | 150 |
| 009 | TF5S21ZZ | Input | 600-CT | 25K-CT | 65 | 3500 | 4 | 150 |
| * 010 | TF5S21ZZ | Isolation | 600-CT | 600-CT | 65 | 75 | 4 | 150 |
| 011 | TF5S21ZZ | Output | 600-CT | 60 | 65 | 7 | 4 | 150 |
| 012 | TF5S21ZZ | Output | 600-CT | 4 | 65 | 0.5 | 4 | 150 |
| 013 | TF5S21ZZ | Driver | 10K-CT | 2000-CT | 1100 | 240 | 1 | 150 |
| 014 | TF5S21ZZ | Driver | 10K-CT | 500-CT | 1100 | 65 | 1 | 150 |
| 015 | TF5S21ZZ | Line to Line | 500-CT | 600-CT | 55 | 75 | 4.5 | 150 |
| 016 | TF5S21ZZ | Output to Line | 300-CT | 600-CT | 33 | 75 | 5.5 | 150 |

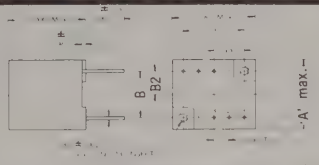
These miniaturized "LR" transformers are manufactured to MIL-T-27, Grade 5, Class S specifications and are ideally suited for a wide range of printed circuit applications.

RESPONSE: ±1 db 200 to 20,000 Hz
DISTORTION: 10% Max. at rated power, 200 to 20,000 Hz
WEIGHT: 1.0 OZ

| LR No. | MIL-T-27 Designation | Application | Impedance Ohms Pri | Impedance Ohms Sec. | DC Resistance Ohms Pri | DC Resistance Ohms Sec | Max. Pri DC (ma) | Max. 200 Hz Pwr* (mw) |
|---|---|---|---|---|---|---|---|---|
| 001 | TF5S21ZZ | Interstage | 25K-CT | 1000-CT | 2600 | 110 | 0.5 | 750 |
| 002 | TF5S21ZZ | Interstage | 10K-CT | 10K-CT | 1000 | 1100 | 1 | 750 |
| 003 | TF5S21ZZ | Driver | 10K-CT | 1500-CT | 1000 | 165 | 1 | 750 |
| 004 | TF5S21ZZ | Output to Line | 10K-CT | 600-CT | 1000 | 70 | 1 | 750 |
| 005 | TF5S21ZZ | Output | 10K-CT | 4 | 1000 | 0.5 | 1 | 750 |
| 006 | TF5S21ZZ | Interstage | 4000-CT | 10K-CT | 400 | 1100 | 1.5 | 750 |
| 007 | TF5S21ZZ | Output | 1500-CT | 15 | 150 | 2 | 2.5 | 750 |
| 008 | TF5S21ZZ | Output to Line | 1000-CT | 600-CT | 100 | 70 | 3 | 750 |
| 009 | TF5S21ZZ | Output | 1000-CT | 4 | 100 | 0.5 | 3 | 750 |
| 010 | TF5S21ZZ | Input | 600-CT | 25K-CT | 60 | 2900 | 4 | 750 |
| 011 | TF5S21ZZ | Isolation | 600-CT | 600-CT | 60 | 70 | 4 | 750 |
| ** 012 | TF5S21ZZ | Output | 600-CT | 60 | 60 | 6.5 | 4 | 750 |
| 013 | TF5S21ZZ | Output | 600-CT | 15 | 60 | 2 | 4 | 750 |
| 014 | TF5S21ZZ | Output | 600-CT | 4 | 60 | 0.5 | 4 | 750 |
| 015 | TF5S21ZZ | Output to Line | 250 | 600-CT | 25 | 70 | 7 | 750 |
| 016 | TF5S21ZZ | Driver | 10K-CT | 2000-CT | 1000 | 110 | 1 | 750 |
| 017 | TF5S21ZZ | Driver | 10K-CT | 500-CT | 1000 | 110 | 1 | 750 |
| 018 | TF5S21ZZ | Line to Line | 500-CT | 600-CT | 50 | 70 | 4.5 | 750 |
| 019 | TF5S21ZZ | Output to Line | 300-CT | 600-CT | 30 | 70 | 5.5 | 750 |

## AUDIO TRANSFORMERS LW & LY SERIES






| Series | A | B | $B_2$ |
|---|---|---|---|
| LW | .900 | .600 | .300 |
| LY | 1.125 | .800 | .400 |

"LW" series transformers are manufactured to MIL-T-27, Grade 5, Class S specifications. Riser areas and 0.1 grid spacing make these units ideal for printed circuit board applications.

RESPONSE: ±1 db 100 to 10,000 Hz
DISTORTION: 1.5% Max. at 60 MW, 200 to 10,000 Hz
WEIGHT: 2.0 OZ.

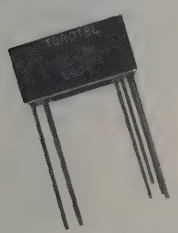
| LW No. | MIL-T-27 Designation | Application | Impedance Ohms Pri | Impedance Ohms Sec. | DC Resistance Ohms Pri | DC Resistance Ohms Sec | Max. Pri DC (ma) | Max. 200 Hz Pwr* (watt) |
|---|---|---|---|---|---|---|---|---|
| 001 | TF5S21ZZ | Interstage | 10K-CT | 10K-CT | 800 | 1050 | 1 | 3.5 |
| 002 | TF5S21ZZ | Output to Line | 10K-CT | 600-CT | 800 | 60 | 1 | 3.5 |
| 003 | TF5S21ZZ | Output | 10K-CT | 4 | 800 | 0.5 | 1 | 3.5 |
| 004 | TF5S21ZZ | Output | 1500-CT | 15 | 110 | 1.5 | 2.5 | 3.5 |
| * 005 | TF5S21ZZ | Output to Line | 1000-CT | 600-CT | 75 | 60 | 3 | 3.5 |
| 006 | TF5S21ZZ | Output | 1000-CT | 4 | 75 | 0.5 | 3 | 3.5 |
| 007 | TF5S21ZZ | Input | 600-CT | 25K-CT | 45 | 2700 | 4 | 2.5 |
| 008 | TF5S21ZZ | Isolation | 600-CT | 600-CT | 45 | 60 | 4 | 3.5 |
| 009 | TF5S21ZZ | Output | 600-CT | 60 | 45 | 6.5 | 4 | 3.5 |
| 010 | TF5S21ZZ | Output | 600-CT | 15 | 45 | 1.5 | 4 | 3.5 |
| 011 | TF5S21ZZ | Output | 600-CT | 4 | 45 | 0.5 | 4 | 3.5 |
| 012 | TF5S21ZZ | Output to Line | 250 | 600-CT | 20 | 60 | 7 | 3.5 |
| 013 | TF5S21ZZ | Interstage | 25K-CT | 1000-CT | 2500 | 85 | 0.5 | 2.5 |
| 014 | TF5S21ZZ | Driver | 10K-CT | 2000-CT | 800 | 170 | 1 | 3.5 |
| 015 | TF5S21ZZ | Driver | 10K-CT | 500-CT | 800 | 50 | 1 | 3.5 |
| 016 | TF5S21ZZ | Line to Line | 500-CT | 600-CT | 50 | 60 | 4.5 | 3.5 |
| 017 | TF5S21ZZ | Output to Line | 300-CT | 600-CT | 30 | 60 | 5.5 | 3.5 |
| 018 | TF5S21ZZ | Interstage | 2500-CT | 10K-Split | 200 | 900 | 1.5 | 3.5 |

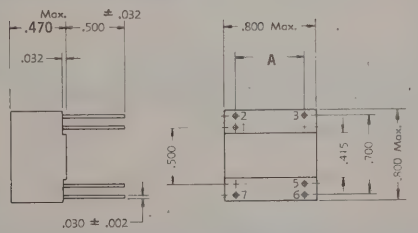
"LY" series transformers are highly compact, efficient units with power output ratings to 7.5 watts. These transformers are manufactured to MIL-T-27, Grade 5, Class S specifications.

RESPONSE: ±1 db 60 to 10,000 Hz
DISTORTION: 1% Max. at 250 MW, 200 to 10,000 Hz
10% Max. at rated power, 200 to 10,000 Hz
WEIGHT: 2.5 OZ.

| LY No. | MIL-T-27 Designation | Application | Impedance Ohms Pri | Impedance Ohms Sec. | DC Resistance Ohms Pri | DC Resistance Ohms Sec | Max. Pri DC (ma) | Max. 200 Hz Pwr* (watt) |
|---|---|---|---|---|---|---|---|---|
| 001 | TF5S21ZZ | Interstage | 10K-CT | 10K-CT | 700 | 900 | 1 | 6 |
| 002 | TF5S21ZZ | Output to Line | 10K-CT | 600-CT | 700 | 55 | 1 | 6 |
| 003 | TF5S21ZZ | Output | 10K-CT | 4 | 700 | 0.4 | 1 | 6 |
| 004 | TF5S21ZZ | Output | 1500-CT | 15 | 100 | 1.5 | 2.5 | 7.5 |
| 005 | TF5S21ZZ | Output to Line | 1000-CT | 600-CT | 65 | 55 | 3 | 7.5 |
| 006 | TF5S21ZZ | Output | 1000-CT | 4 | 65 | 0.4 | 3 | 7.5 |
| ** 007 | TF5S21ZZ | Isolation | 600-CT | 600-CT | 40 | 55 | 4 | 7.5 |
| 008 | TF5S21ZZ | Output | 600-CT | 60 | 40 | 6 | 4 | 7.5 |
| 009 | TF5S21ZZ | Output | 600-CT | 15 | 40 | 1.5 | 4 | 7.5 |
| 010 | TF5S21ZZ | Output | 600-CT | 4 | 40 | 0.4 | 4 | 7.5 |
| 011 | TF5S21ZZ | Output to Line | 250 | 600-CT | 16 | 55 | 7 | 7.5 |
| 012 | TF5S21ZZ | Driver | 10K-CT | 2000-CT | 700 | 150 | 1 | 6 |
| 013 | TF5S21ZZ | Driver | 10K-CT | 500-CT | 700 | 45 | 1 | 6 |
| 014 | TF5S21ZZ | Line to Line | 500-CT | 600-CT | 45 | 55 | 4.5 | 7.5 |
| 015 | TF5S21ZZ | Output to Line | 300-CT | 600-CT | 27 | 55 | 5.5 | 7.5 |
| 016 | TF5S21ZZ | Interstage | 2500-CT | 10K-Split | 170 | 800 | 1.5 | 7.5 |

## AUDIO TRANSFORMERS — LH & LK SERIES






"LK/LH" Series transformers are the ultimate in compactness and their .470 HT and 0.1 grid spacing provide a most efficient .5" board spacing unit. Designed to meet MIL-T-27C, Grade 5, Class S.

RESPONSE: ±1 db 200 to 10,000 Hz
DISTORTION: 10% Max. at rated power, 200 to 10,000 Hz
WEIGHT: 0.75 OZ

| Series | A |
|---|---|
| LK | .700 |
| LH | .600 |

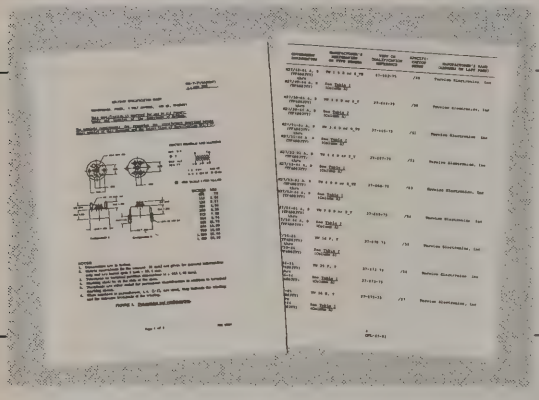
| LJ No. | Application | Impedance Ohms Pri | Impedance Ohms Sec | DC Resistance Ohms Pri | DC Resistance Ohms Sec | Max. Pri DC (ma) | Max. 200 Hz Pwr* (mw) |
|---|---|---|---|---|---|---|---|
| 001 | Interstage | 25K-CT | 1000-CT | 1325 | 53 | 0.5 | 300 |
| 002 | Interstage | 10K-CT | 10K-CT | 510 | 525 | 1 | 325 |
| 003 | Driver | 10K-CT | 1500-CT | 510 | 80 | 1 | 325 |
| ** 004 | Output to Line | 10K-CT | 600-CT | 510 | 31 | 1 | 325 |
| 005 | Output | 10K-CT | 4 | 510 | 0.3 | 1 | 325 |
| 006 | Interstage | 4000-CT | 10K-CT | 200 | 525 | 1.5 | 325 |
| 007 | Output | 1500-CT | 15 | 75 | 1 | 2.5 | 325 |
| 008 | Output to Line | 1000-CT | 600-CT | 50 | 31 | 3 | 325 |
| 009 | Output | 1000-CT | 4 | 50 | 0.3 | 3 | 325 |
| 010 | Input | 600-CT | 25K-CT | 30 | 1500 | 4 | 300 |
| ** 011 | Isolation | 600-CT | 600-CT | 30 | 31 | 4 | 325 |
| 012 | Output | 600-CT | 60 | 30 | 3 | 4 | 325 |
| 013 | Output | 600-CT | 15 | 30 | 1 | 4 | 325 |
| 014 | Output | 600-CT | 4 | 30 | 0.3 | 4 | 325 |
| 015 | Output to Line | 250 | 600-CT | 13 | 31 | 7 | 325 |
| 016 | Driver | 10K-CT | 2000-CT | 510 | 106 | 1 | 325 |
| 017 | Driver | 10K-CT | 500-CT | 510 | 26 | 1 | 325 |
| 018 | Line to Line | 500-CT | 600-CT | 25 | 31 | 4.5 | 325 |
| 019 | Output to Line | 300-CT | 600-CT | 15 | 31 | 5.5 | 325 |
| 020 | Isolation-Ratio 1:1:1 | 2000-CT | 8K Split | 100 | 425 | 2 | 300 |
| 021 | Isolation | 10K-CT | 2K Split | 510 | 106 | 1 | 300 |

* These power ratings are based upon lowest frequency operation. Much higher ratings are possible at higher operating frequencies.
** Distributor Item

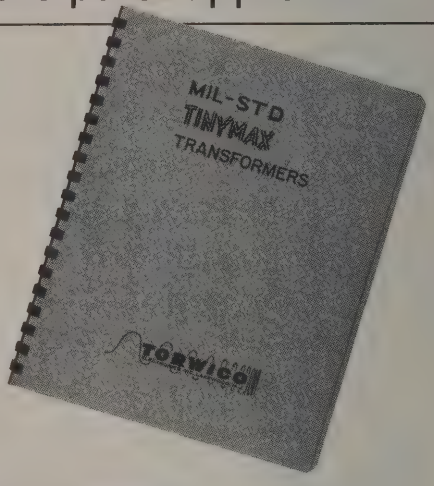
TORWICO ELECTRONICS INC.

LEADER IN MAGNETIC COMPONENTS

# TINYMAX Transformers have QPL Status on Qualified Product List 27.



## Now you can specify Military Standard Transformers without the need for Qualification Testing or requests for non-standard parts approval.




These miniature transformers are of toroidal construction and offer a size and weight reduction when compared to conventional laminated and "C" core designs. Yet, the prices on these custom engineered transformers are competitive with off-the-shelf stock items.

So, when you need a 115V, 400 Hz transformer having a specific secondary voltage don't settle for an off-the-shelf item that may only approximate your requirement. Torwico has over 2,000 MIL/STD units and an almost infinite selection of STD TINYMAX.

What's more, Torwico offers fast delivery and competitive pricing. Selection, delivery and price--Torwico has it all.

**STD TINYMAX -- MIL-T-27,** Grade 4 and Grade 5, Class S, 115 volt, 400 Hz transformers available in power ratings ranging from 1.5 VA through 250 VA, with an almost infinite combination of secondary voltages of 6V through 300V.

**MIL-STD TINYMAX** -- Grade 4 and Grade 5, Class S, 115 Volt, 400 Hz transformers. Reference M27/37 through M27/66. Over 2,000 choices of secondary voltages.

**EXTENSION OF APPROVAL** -- Any design selected directly from, or based, on our MIL/STD TINYMAX transformer may be qualified to MIL-T-27 by similarity.

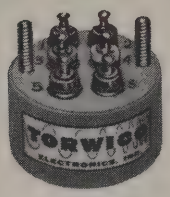
**PROCUREMENT NOTE** -- Catalog information and cross referenced sheets may be obtained from the factory or for MIL-STD units, refer directly to specification sheets M27/37 through M27/66.

**PROTOTYPE DELIVERIES** -- A large assortment of TINYMAX transformers is always maintained in stock for immediate delivery. Others can be shipped within 10 days.

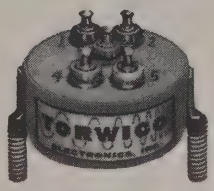
For a copy of Towico's MIL-STD TINYMAX catalog, contact your local Torwico representative. He'll show you why Torwico is the easy way to deal with military standards.

TORWICO ELECTRONICS INC. LEADER IN MAGNETIC COMPONENTS

# TINYMAX 400 HZ Power Transformers



This Case style available in 1.5 through 250 VA



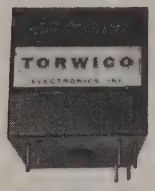
This Case style available in 1.5 through 9 VA

## TINYMAX

**CONDENSED PERFORMANCE DATA FOR "STANDARD" GRADE 4 TINYMAX 400 HZ TRANSFORMERS MIL-T-27 DESIGNATION TF4S03YY**

| VA RATING | SELECTED FULL LOAD SEC. V (RMS) ±3% (from range shown) with 115V PRI. | O.D ±.031" | HT. ±.031" | WEIGHT MAX. | REGULATION MAX. | TEMP. RISE MAX. |
|---|---|---|---|---|---|---|
| 1.5 | 6.0 to 300 | 1.000 | .469 | 1.00 oz. | 23% | 17°C |
| 1.5 (With Electrostatic Shield) | 6.0 to 300 | 1.000 | .594 | 1.25 oz. | 18% | 17°C |
| 3 | 6.0 to 300 | 1.000 | .594 | 1.25 oz. | 18% | 20°C |
| 3 (With Electrostatic Shield) | 6.0 to 300 | 1.000 | .812 | 1.70 oz. | 12% | 20°C |
| 6 | 6.0 to 300 | 1.000 | .812 | 1.70 oz. | 12% | 25°C |
| 6 (With Electrostatic Shield) | 6.0 to 300 | 1.000 | 1.062 | 2.30 oz. | 10% | 25°C |
| 9 | 6.0 to 300 | 1.000 | 1.062 | 2.30 oz. | 10% | 30°C |
| 9 (With Electrostatic Shield) | 6.0 to 300 | 1.375 | 1.125 | 3.80 oz. | 8% | 32°C |
| 16 | 6.0 to 300 | 1.375 | 1.125 | 3.80 oz. | 8% | 32°C |
| 25 | 6.0 to 300 | 1.375 | 1.375 | 4.95 oz. | 7% | 45°C |
| 50 | 6.0 to 300 | 2.000 | 1.500 | 11.00 oz. | 3% | 35°C |
| 75 | 10 to 300 | 2.000 | 1.750 | 13.50 oz. | 3% | 40°C |
| 100 | 12 to 300 | 2.250 | 2.000 | 18.70 oz. | 2.5% | 43°C |
| 250 | 26 to 300 | 2.875 | 2.000 | 30.00 oz. | 2% | 55°C |

WITH OR WITHOUT ELECTROSTATIC SHIELD



## TINYMAX

**CONDENSED PERFORMANCE DATA FOR "STANDARD" GRADE 5 TINYMAX 400 HZ TRANSFORMERS MIL-T-27 DESIGNATION TF5S03ZZ**

| VA RATING | SELECTED FULL LOAD SEC. V (RMS) ±3% (from range shown) with 115V PRI | SIZE MAX. INCHES | WEIGHT MAX. | REGULATION MAX. | TEMP. RISE MAX. |
|---|---|---|---|---|---|
| 1.5 | 6.0 to 300 | 1.09 Sq. X .47 ht. | .85 oz. | 23% | 17°C |
| 1.5 (With Electrostatic Shield) | 6.0 to 300 | 1.09 Sq. X .59 ht. | 1.10 oz. | 18% | 17°C |
| 3 | 6.0 to 300 | 1.09 Sq. X .59 ht. | 1.10 oz. | 18% | 20°C |
| 3 (With Electrostatic Shield) | 6.0 to 300 | 1.09 Sq. X .78 ht. | 1.65 oz. | 12% | 20°C |
| 6 | 6.0 to 300 | 1.09 Sq. X .78 ht. | 1.65 oz. | 12% | 25°C |
| 6 (With Electrostatic Shield) | 6.0 to 300 | 1.09 Sq. X 1.03 ht. | 2.20 oz. | 10% | 25°C |
| 9 | 6.0 to 300 | 1.09 Sq. X 1.03 ht. | 2.20 oz. | 10% | 30°C |
| 9 (With Electrostatic Shield) | 6.0 to 300 | 1.40 Sq. X .97 ht. | 3.40 oz. | 8% | 32°C |
| 16 WITH OR WITHOUT | 6.0 to 300 | 1.40 Sq. X .97 ht. | 3.40 oz. | 8% | 32°C |
| 25 ELECTROSTATIC SHIELD | 6.0 to 300 | 1.40 Sq. X 1.20 ht. | 4.40 oz. | 7% | 45°C |

TORWICO ELECTRONICS INC.

NEW HAMPSHIRE AVENUE & ROUTE 70, LAKEWOOD, N.J. 08701 201•364-1800

TRIAD-UTRAD
Litton Distributor Services

# POWER TRANSFORMERS

## FOR POWER SUPPLY, CONTROL AND FILAMENT CIRCUITS

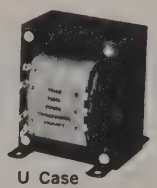
### 115V PRIMARY—SINGLE SECONDARY/50-60 Hz UNLESS NOTED (‡)

**LISTED IN ORDER OF INCREASING SECONDARY VOLTAGES**

| Triad Part No. | Secondary Volts | Secondary Amps | RMS Test Voltage | Case Type | Connections or Lead Holes Used | Case Dimension H | Case Dimension W | Case Dimension D | Mounting Dimension MW | Mounting Dimension MD | Mounting Hole Size | Max. Unit Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F-1X‡ | 2.5 CT | 3 | 1500 | X | Leads | 1 5/8 | 2 13/16 | 1 5/8 | 2 3/8 | — | 3/16 | .68 |
| F-72Z‡ | 2.5 CT | 5 | Sec. 7500 | Z | Sec.-Lugs | 2 23/32 | 3 1/8 | 2 1/8 | 2 13/16 | — | 3/16 | 1.7 |
| F-6X‡ | 2.5 CT | 6 | Sec. 2500 | X | Leads | 1 15/16 | 3 5/16 | 1 3/4 | 2 13/16 | — | 3/16 | 1 |
| F-3X‡ | 2.5 CT | 10 | Sec. 3000 | X | Leads | 2 9/32 | 3 3/4 | 2 1/8 | 3 1/8 | — | 3/16 | 1.7 |
| F-5U | 2.5 CT | 10 | Sec. 7500 | U | Leads | 3 1/16 | 2 1/2 | 2 7/16 | 2 | 1 7/8 | 5/16 x 3/16 | 2.2 |
| F-7X | 5.0 CT | 3 | 1500 | X | Leads | 1 15/16 | 3 5/16 | 2 | 2 13/16 | — | 3/16 | 1.3 |
| F-8X | 5.0 CT | 6 | 1500 | X | Leads | 2 9/32 | 3 3/4 | 2 1/8 | 3 1/8 | — | 3/16 | 1.7 |
| F-12X | 5.0 CT | 8 | 2500 | X | Leads | 2 19/32 | 4 | 2 1/4 | 3 5/16 | — | 3/16 | 2.5 |
| F-10U‡ | 5.0 CT | 14 | Sec.10,000 | U | Leads | 3 13/16 | 3 5/16 | 3 1/4 | 2 1/2 | 2 5/16 | 5/16 x 3/16 | 4.75 |
| F-15U‡ | 5.0 CT | 15 | Sec. 3000 | U | Lugs | 3 1/2 | 2 7/8 | 2 11/16 | 2 1/4 | 2 3/16 | 5/16 x 3/16 | 3.25 |
| F-9U | 5.2 CT | 13 | 1500 | U | Leads | 3 7/16 | 2 13/16 | 3 1/4 | 2 1/4 | 2 3/8 | 5/16 x 3/16 | 4 |
| F-11U | 5.2 CT | 24 | 1500 | U | Leads | 3 13/16 | 3 5/16 | 3 7/8 | 2 1/2 | 3 1/16 | 5/16 x 3/16 | 6.75 |
| F-13X | 6.3 | .6 | 1500 | X | Leads | 1 3/8 | 2 3/8 | 1 3/8 | 2 | — | 3/16 | .37 |
| R-84K | 6.3§ | .6 | Sec. 3500 | K | 2-Leads | 2 3/4 | 2 1/4 | 2 11/16 | 1 1/2 | 2 3/8 | 3/16 | 1.5 |
| F-14X‡ | 6.3 CT | 1.2 | Sec. 2500 | X | Leads | 1 5/8 | 2 13/16 | 1 5/8 | 2 3/8 | — | 3/16 | .7 |
| F-14Z‡ | 6.3 CT | 1.2 | Sec. 2500 | Z | Leads | 1 15/16 | 2 3/8 | 1 5/8 | 2 | — | 3/16 | .7 |
| F-52X | 6.3§ | 1.2 | Sec. 5000 | X | Leads | 1 15/16 | 3 5/16 | 1 3/4 | 2 13/16 | — | 3/16 | 1 |
| F-51X‡ | 6.3§ | 2 | Sec. 5000 | X | Leads | 1 15/16 | 3 5/16 | 2 | 2 13/16 | — | 3/16 | 1.25 |
| F-16X | 6.3 CT | 3 | Sec. 2500 | X | Leads | 1 15/16 | 3 5/16 | 2 | 2 13/16 | — | 3/16 | 1.3 |
| F-53X | 6.3 | 4 | Sec. 5000 | X | Leads | 2 19/32 | 4 | 2 1/4 | 3 5/16 | — | 3/16 | 2.1 |
| F-43X‡ | 6.3 | 4 | 1500 | X | Leads | 1 15/16 | 3 5/16 | 2 | 2 13/16 | — | 3/16 | 1.25 |
| F-18A | 6.3 CT | 6 | 1500 | A | 1-Leads | 3 3/16 | 2 21/32 | 2 5/8 | 2 | 1 11/16 | 3/8 x 3/16 | 2.5 |
| F-18X | 6.3 CT | 6 | 1500 | X | Leads | 2 13/32 | 4 | 2 1/4 | 3 5/16 | — | 3/16 | 2.3 |
| F-69X | 6.3 CT | 8 | 1500 | X | Leads | 2 5/16 | 4 | 2 1/4 | 3 5/16 | — | 3/16 | 2.3 |
| F-21A | 6.3 CT | 10 | 1500 | A | 1-Leads | 3 19/32 | 2 31/32 | 3 1/8 | 2 1/4 | 2 | 3/8 x 3/16 | 3.8 |
| F-20U† | 6.3 CT-6 CT | 11 | Sec. 3000 | U | Leads | 3 1/2 | 2 7/8 | 3 | 2 1/4 | 2 7/16 | 5/16 x 3/16 | 4 |
| F-17U‡ | 6.3 CT | 15 | Sec.10,000 | U | Pri. Leads | 4 1/4 | 3 1/2 | 3 3/4 | 2 3/4 | 2 13/16 | 5/16 x 3/16 | 7.5 |
| F-22A | 6.3 CT | 20 | 2000 | A | 2-Leads | 3 7/8 | 3 9/32 | 4 1/8 | 2 1/2 | 3 | 3/8 x 3/16 | 7 |
| F-24U† | 7.5 CT-6.3 CT | 8 | Sec. 3000 | U | 2-Leads | 3 1/2 | 2 7/8 | 2 13/16 | 2 1/4 | 2 5/16 | 5/16 x 3/16 | 3.65 |
| F-28U† | 7.5 CT-6.3 CT | 25 | Sec. 3000 | U | Leads/Lugs | 4 5/8 | 3 13/16 | 3 5/8 | 3 | 3 1/16 | 5/16 x 3/16 | 7.5 |
| F-180X | 10.0 CT | 1 | 1500 | X | Leads | 1 15/16 | 3 5/16 | 1 3/4 | 2 13/16 | — | 3/16 | .9 |
| F-31X | 10.0 CT | 3 | 2000 | X | Leads | 2 9/32 | 3 3/4 | 2 1/8 | 3 1/8 | — | 3/16 | 1.7 |
| F-95X | 10.0 CT | 4 | 1500 | X | Leads | 2 5/16 | 4 | 2 1/4 | 3 5/16 | — | 3/16 | 2.3 |
| F-33U | 10.0 CT | 5 | 2000 | U | Leads | 3 | 2 1/2 | 2 5/8 | 2 | 2 1/16 | 3/16 x 3/8 | 2.5 |
| F-96U | 10.0 CT | 6 | 1500 | U | Leads | 3 | 2 1/2 | 2 3/4 | 2 | 2 5/16 | 3/8 x 3/16 | 3.5 |
| F-23U | 10.0 CT | 7 | 1500 | U | Leads | 3 1/2 | 2 7/8 | 2 15/16 | 2 1/4 | 2 7/16 | 5/16 x 3/16 | 3.9 |
| F-97U | 10.0 CT | 8 | 1500 | U | Leads | 3 7/16 | 2 13/16 | 3 | 2 1/4 | 2 1/2 | 3/8 x 3/16 | 5 |
| F-35U | 10.0 CT | 10 | 2000 | U | Leads | 4 1/8 | 4 1/2 | 3 1/4 | 2 3/4 | 2 7/16 | 3/16 x 3/8 | 9.1 |
| F-113X | 12.0 | 0.15 | 1500 | X | Leads | 1 3/8 | 2 3/8 | 1 3/8 | — | 2 | 3/16 | .4 |
| F-216X‡ | 12.0 | .35 | 1500 | X | Leads | 1 3/8 | 2 3/8 | 1 3/8 | 2 | — | 3/16 | .45 |
| F-114X | 12.0 | 0.7 | 1500 | X | Leads | 1 5/8 | 2 13/16 | 1 5/8 | — | 2 3/8 | 3/16 | .8 |
| F-217X‡ | 12.0 | 1.2 | 1500 | X | Leads | 1 15/16 | 3 1/4 | 1 5/8 | 2 13/16 | — | 3/16 | 1.4 |
| F-218X‡ | 12.0 | 2 | 1500 | X | Leads | 2 1/4 | 3 11/16 | 2 1/8 | 3 1/8 | — | 3/16 | 1.6 |
| F-219X‡ | 12.0 | 4 | 1500 | X | Leads | 2 5/16 | 4 | 2 1/4 | 3 5/16 | — | 3/16 | 2.3 |
| F-220U‡ | 12.0 | 6 | 1500 | U | Leads | 3 7/16 | 2 13/16 | 2 5/8 | 2 1/4 | 2 1/8 | 3/8 x 3/16 | 4 |
| F-221U‡ | 12.0 | 8 | 1500 | U | Leads | 3 13/16 | 3 1/8 | 2 3/4 | 2 1/2 | 2 1/8 | 3/8 x 3/16 | 4.2 |
| F-29U† | 12 CT-11 CT 10.0 CT | 11 | Sec. 3000 | U | Leads | 4 3/8 | 3 1/2 | 3 3/8 | 2 3/4 | 2 5/16 | 5/16 x 3/16 | 6.5 |
| F-70X | 12.6 CT | 1.0 | 1500 | X | Leads | 1 15/16 | 3 5/16 | 1 3/4 | 2 13/16 | — | 3/16 | 1.3 |
| F-25X | 12.6 CT | 1.5 | 1500 | X | Leads | 1 15/16 | 3 5/16 | 2 | 2 13/16 | — | 3/16 | 1.3 |
| F-44X‡ | 12.6 CT | 2 | 1500 | X | Leads | 1 15/16 | 3 5/16 | 2 | 2 13/16 | — | 3/16 | 1.25 |
| F-26X‡ | 12.6 CT | 2.5 | 1500 | X | Leads | 2 9/32 | 3 11/16 | 2 | 3 1/8 | — | 3/16 | 1.55 |
| F-224X‡ | 12.6 | 3 | 1500 | X | Leads | 2 1/4 | 3 | 2 1/4 | 3 1/8 | — | 3/16 | 1.6 |
| F-225X‡ | 12.6 | 4 | 1500 | X | Leads | 2 5/16 | 4 | 2 | 3 5/16 | — | 3/16 | 2.3 |
| F-181U | 12.6 CT | 4 | 1500 | U | Leads | 3 1/16 | 2 5/16 | 2 3/16 | 2 | 2 | 3/16 | 2.3 |
| F-182U | 12.6 CT | 6 | 1500 | U | Leads | 3 3/8 | 2 13/16 | 2 7/16 | 2 1/4 | 2 3/8 | 5/16 x 3/16 | 3.8 |

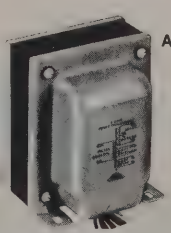
§ Static shield. † Tapped primary to produce lower voltages. ‡ 60 cycle operation.

X Case



U Case

A Case



Z Case

# POWER TRANSFORMERS

Litton TRIAD-UTRAD Distributor Services

## 115V PRIMARY—SINGLE SECONDARY/50-60 Hz UNLESS NOTED (‡) CONTINUED

| Triad Part No. | Secondary Volts | Secondary Amps | RMS Test Voltage | Case Type | Connections or Lead Holes Used | Case Dimension H | Case Dimension W | Case Dimension D | Mounting Dimension MW | Mounting Dimension MD | Mounting Hole Size | Max. Unit Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F-183U | 12.6 CT | 8 | 1500 | U | Leads | 3 13/16 | 3 3/16 | 2 15/16 | 2 1/2 | 2 1/4 | 5/16 x 3/16 | 5 |
| F-112X | 14.0 CT | 0.25 | 1500 | X | Leads | 1 3/8 | 2 3/8 | 1 3/8 | 2 | — | 3/16 | .4 |
| F-250X | 14.0 CT | 1 | 1500 | X | Leads | 1 15/16 | 3 1/4 | 1 3/4 | 2 13/16 | — | 3/16 | 1.2 |
| F-251X | 14.0 CT | 2 | 1500 | X | Leads | 2 1/4 | 3 11/16 | 1 15/16 | 3 1/8 | 3/16 | — | 1.5 |
| F-252U | 14.0 CT | 4 | 1500 | U | Leads | 3 | 2 1/2 | 2 7/16 | 2 | 2 1/4 | 5/16 x 3/16 | 3 |
| F-253U | 14.0 CT | 6 | 1500 | U | Leads | 3 3/8 | 2 13/16 | 2 7/8 | 2 1/4 | 2 3/8 | 5/16 x 3/16 | 4 |
| F-254X | 20.0 CT | 1 | 1500 | X | Leads | 2 1/4 | 3 11/16 | 1 15/16 | 3 1/8 | — | 3/16 | 1.5 |
| F-255X | 20.0 CT | 2 | 1500 | X | Leads | 2 9/16 | 4 | 2 1/4 | 3 9/16 | — | 3/16 | 2.5 |
| F-256U | 20.0 CT | 4 | 1500 | U | Leads | 3 3/8 | 2 13/16 | 2 7/8 | 2 1/4 | 2 3/8 | 5/16 x 3/16 | 4 |
| F-257U | 20.0 CT | 6 | 1500 | U | Leads | 3 3/4 | 3 1/8 | 3 1/8 | 2 1/2 | 2 5/8 | 5/16 x 3/16 | 5.7 |
| F-258U | 20.0 CT | 8 | 1500 | U | Leads | 3 3/4 | 3 1/8 | 3 1/2 | 2 1/2 | 2 7/8 | 5/16 x 3/16 | 6.4 |
| F-259U | 20.0 CT | 10 | 1500 | U | Leads | 4 1/8 | 3 7/16 | 3 1/2 | 2 3/4 | 2 3/4 | 5/16 x 3/16 | 7.4 |
| F-115X | 24.0 CT | 0.085 | 1500 | X | Leads | 1 3/16 | 2 1/16 | 1 1/4 | 1 3/4 | — | 3/16 | 3 |
| F-116X | 24.0 CT | 0.2 | 1500 | X | Leads | 1 3/8 | 2 3/8 | 1 1/2 | 2 | — | 3/16 | .45 |
| F-117X | 24.0 CT | 0.4 | 1500 | X | Leads | 1 5/8 | 2 13/16 | 1 5/8 | 2 3/8 | — | 3/16 | .8 |
| F-118X | 24.0 CT | 0.7 | 1500 | X | Leads | 1 15/16 | 3 1/4 | 2 | 2 13/16 | — | 3/16 | 1.3 |
| F-45X‡ | 24.0 CT | 1 | 1500 | X | Leads | 1 15/16 | 3 5/16 | 2 | 2 13/16 | — | 3/16 | 1.3 |
| F-46X‡ | 24.0 | 1 | 1500 | X | Leads | 1 15/16 | 3 11/16 | 2 1/8 | 2 13/16 | — | 3/16 | 1.4 |
| F-192X | 24.0 CT | 2 | 1500 | X | Leads | 2 19/32 | 4 | 2 1/4 | 3 9/16 | — | 3/16 | 2.3 |
| F-229X‡ | 24.0 | 2 | 1500 | X | Leads | 2 9/16 | 4 | 1 7/8 | 3 9/16 | — | 3/16 | 2.3 |
| F-193U | 24.0 CT | 4 | 1500 | U | Leads | 3 13/16 | 3 1/8 | 2 13/16 | 2 1/2 | 2 1/8 | 5/16 x 3/16 | 4 |
| F-260U | 24.0 CT | 6 | 1500 | U | Leads | 3 3/4 | 3 1/8 | 3 1/2 | 2 1/2 | 2 7/8 | 5/16 x 3/16 | 6.4 |
| F-261U | 24.0 CT | 8 | 1500 | U | Leads | 4 1/8 | 3 7/16 | 3 1/2 | 2 3/4 | 2 3/4 | 5/16 x 3/16 | 7.4 |
| F-226U | 24.0 CT | 12 | 1500 | U | Leads | 4 9/16 | 3 3/4 | 4 5/8 | 3 | 3 1/4 | 3/8 x 3/16 | 12 |
| F-57X | 25.2 CT | 1 | 1500 | X | Leads | 1 15/16 | 3 5/16 | 2 | 2 13/16 | — | 3/16 | 1.5 |
| F-41X | 25.2 CT | 2 | 1500 | X | Leads | 2 19/32 | 4 | 2 1/4 | 3 9/16 | — | 3/16 | 2.2 |
| F-56X | 25.2 CT | 2.8 | 1500 | X | Leads | 2 21/32 | 4 | 2 1/4 | 3 9/16 | — | 3/16 | 2.5 |
| F-119X | 26.8 CT | 0.15 | 1500 | X | Leads | 1 3/8 | 2 3/8 | 1 1/2 | 2 | — | 3/16 | .45 |
| F-120X | 26.8 CT | 0.5 | 1500 | X | Leads | 1 15/16 | 3 1/4 | 2 | 2 13/16 | — | 3/16 | 1.3 |
| F-40X‡ | 26.8 CT | 1 | 1500 | X | Leads | 1 15/16 | 3 5/16 | 2 | 2 13/16 | — | 3/16 | 1.3 |
| F-55X | 26.8 CT | 1.7 | 1500 | X | Leads | 2 19/32 | 4 | 2 1/4 | 3 9/16 | — | 3/16 | 2.3 |
| F-121X | 28.0 CT | .085 | 1500 | X | Leads | 1 3/16 | 2 1/16 | 1 3/8 | 1 3/4 | — | 3/16 | .25 |
| F-122X | 28.0 CT | .175 | 1500 | X | Leads | 1 3/8 | 2 3/8 | 1 1/2 | 2 | — | 3/16 | .35 |
| F-123X | 28.0 CT | .300 | 1500 | X | Leads | 1 5/8 | 2 13/16 | 1 5/8 | 2 3/8 | — | 3/16 | .6 |
| F-124X | 28.0 CT | .800 | 1500 | X | Leads | 1 15/16 | 3 1/4 | 2 | 2 13/16 | — | 3/16 | 1 |
| F-184X | 28.0 CT | 1 | 1500 | X | Leads | 2 9/32 | 3 3/4 | 2 1/8 | 2 13/16 | — | 3/16 | 1.4 |
| F-185U | 28.0 CT | 2 | 1500 | U | Leads | 3 1/16 | 2 1/2 | 2 7/16 | 2 | 2 1/4 | 3/16 x 3/8 | 2.9 |
| F-187U | 28.0 CT | 4 | 1500 | U | Leads | 3 1/2 | 2 7/8 | 3 1/16 | 2 1/4 | 2 3/4 | 5/16 x 3/16 | 5.3 |
| F-262X | 30.0 CT | 1 | 1500 | X | Leads | 2 1/4 | 3 11/16 | 1 15/16 | 3 1/8 | — | 3/16 | 1.5 |
| F-210X | 30.0 CT | 1.7 | 1500 | X | Leads | 2 19/32 | 4 | 2 1/4 | 3 9/16 | — | 3/16 | 1.55 |
| F-263U | 30.0 CT | 2 | 1500 | U | Leads | 3 | 2 1/2 | 2 9/16 | 2 | 2 3/8 | 5/16 x 3/16 | 3.2 |
| F-264U | 30.0 CT | 4 | 1500 | U | Leads | 3 3/4 | 3 1/8 | 3 1/8 | 2 1/2 | 2 5/8 | 5/16 x 3/16 | 5.7 |
| F-265U | 30.0 CT | 6 | 1500 | U | Leads | 4 1/8 | 3 7/16 | 3 1/2 | 2 3/4 | 2 3/4 | 5/16 x 3/16 | 7.4 |
| F-266U | 30.0 CT | 8 | 1500 | U | Leads | 4 1/2 | 3 3/4 | 4 | 3 | 3 | 5/16 x 3/16 | 10 |
| F-227X‡ | 35.0 CT | .065 | 1500 | X | Leads | 1 7/32 | 2 1/16 | 1 1/4 | 1 3/4 | — | 3/16 | .3 |
| F-188X | 35.0 CT | .1 | 1500 | X | Leads | 1 3/8 | 2 13/16 | 1 7/16 | 2 3/8 | — | 3/16 | .35 |
| F-228X‡ | 35.0 CT | .3 | 1500 | X | Leads | 1 5/8 | 2 13/16 | 1 3/8 | 2 3/8 | — | 3/16 | .6 |
| F-189X | 35.0 CT | .5 | 1500 | X | Leads | 2 5/16 | 3 11/16 | 1 15/16 | 3 1/8 | — | 3/16 | 1 |
| F-54X | 35.0 CT | 1.5 | 1500 | X | Leads | 2 19/32 | 4 | 2 1/4 | 3 9/16 | — | 3/16 | 2.2 |
| F-190U | 35.0 CT | 2 | 1500 | U | Leads | 3 3/8 | 2 13/16 | 2 3/4 | 2 1/4 | 2 3/8 | 5/16 x 3/16 | 3.5 |
| F-191U | 35.0 CT | 4 | 1500 | U | Leads | 3 13/16 | 3 3/16 | 3 3/16 | 2 3/4 | 2 1/2 | 5/16 x 3/16 | 6 |
| F-267U | 35.0 CT | 6 | 1500 | U | Leads | 4 1/8 | 3 7/16 | 3 1/2 | 2 3/4 | 2 3/4 | 5/16 x 3/16 | 7.4 |
| F-268U | 35.0 CT | 8 | 1500 | U | Leads | 4 1/2 | 3 3/4 | 4 1/4 | 3 | 3 1/4 | 5/16 x 3/16 | 11 |
| F-269U | 35.0 CT | 10 | 1500 | U | Leads | 5 1/4 | 4 3/8 | 4 1/8 | 3 1/2 | 2 3/4 | 5/16 x 3/16 | 12 |
| F-270X | 40.0 CT | 1 | 1500 | X | Leads | 2 9/16 | 4 | 2 1/4 | 3 9/16 | — | 3/16 | 2.6 |
| F-271U | 40.0 CT | 2 | 1500 | U | Leads | 3 3/8 | 2 13/16 | 2 7/8 | 2 1/4 | 2 3/8 | 5/16 x 3/16 | 4 |
| F-272U | 40.0 CT | 4 | 1500 | U | Leads | 3 3/4 | 3 1/8 | 3 1/2 | 2 1/2 | 2 7/8 | 5/16 x 3/16 | 6.4 |
| F-273U | 40.0 CT | 6 | 1500 | U | Leads | 4 1/2 | 3 3/4 | 4 | 3 | 3 | 5/16 x 3/16 | 10 |
| F-274U | 40.0 CT | 8 | 1500 | U | Leads | 4 1/2 | 3 3/4 | 4 1/4 | 3 | 3 5/8 | 5/16 x 3/16 | 10.5 |
| F-275U | 40.0 CT | 10 | 1500 | U | Leads | 5 1/4 | 4 3/8 | 4 1/2 | 3 1/2 | 3 1/4 | 5/16 x 3/16 | 14.5 |
| F-276X | 50.0 CT | 1 | 1500 | X | Leads | 2 9/16 | 4 | 2 1/4 | 3 9/16 | — | 3/16 | 2.4 |
| F-277U | 50.0 CT | 2 | 1500 | U | Leads | 3 3/4 | 3 1/8 | 2 7/8 | 2 1/2 | 2 3/8 | 5/16 x 3/16 | 4.7 |
| F-278U | 50.0 CT | 4 | 1500 | U | Leads | 4 1/8 | 3 7/16 | 3 1/2 | 2 3/4 | 2 3/4 | 5/16 x 3/16 | 7.4 |
| F-58A | 50.0 CT | 5 | 1500 | A | Leads | 4 5/8 | 3 15/16 | 4 1/2 | 3 | 3 3/8 | 3/8 x 3/16 | 10 |
| F-59X | 60.0 CT | .4 | 1500 | X | Leads | 1 15/16 | 3 5/16 | 2 | 2 13/16 | — | 3/16 | 1.3 |
| F-279U | 60.0 CT | 1 | 1500 | U | Leads | 3 | 2 1/2 | 2 5/8 | 2 | 2 3/8 | 5/16 x 3/16 | 3.4 |
| F-280U | 60.0 CT | 2 | 1500 | U | Leads | 3 3/4 | 3 1/8 | 3 1/8 | 2 1/2 | 2 5/8 | 5/16 x 3/16 | 5.6 |
| F-281U | 60.0 CT | 4 | 1500 | U | Leads | 4 1/2 | 3 3/4 | 4 | 3 | 3 | 5/16 x 3/16 | 10 |
| F-282U | 60.0 CT | 6 | 1500 | U | Leads | 5 1/4 | 4 3/8 | 4 1/8 | 3 1/2 | 2 7/8 | 5/16 x 3/16 | 12.5 |
| F-283U | 70.0 CT | 1 | 1500 | U | Leads | 3 3/8 | 2 13/16 | 2 5/8 | 2 1/4 | 2 1/4 | 5/16 x 3/16 | 4 |
| F-284U | 70.0 CT | 2 | 1500 | U | Leads | 3 3/4 | 3 1/8 | 3 1/2 | 2 1/2 | 2 7/8 | 5/16 x 3/16 | 6 |

§ Static shield. † Tapped primary to produce lower voltages. ‡ 60 cycle operation.

TRIAD-UTRAD
Litton Distributor Services

# POWER TRANSFORMERS

## MULTIPLE SECONDARY/PRIMARY 115V/50-60 Hz UNLESS NOTED (‡)

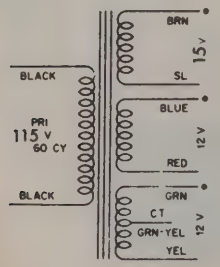
| Triad Part No. | Secondary Volts | Secondary Amps | RMS Test Voltage | Case Type | Connections or Lead Holes Used | Case Dimension H | Case Dimension W | Case Dimension D | Mounting Dimension MW | Mounting Dimension MD | Mounting Hole Size | Max. Unit Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F-32A | 6.3 CT* | 3 | 1500 | A | 1-Leads | 3 3/16 | 2 21/32 | 2 5/8 | 2 | 1 11/16 | 3/8 x 3/16 | 2.5 |
| F-34A | 6.3 CT*<br>6.3 | 1.75<br>1.75 | 1500 | A | 2-Leads | 3 3/16 | 2 21/32 | 3 | 2 | 2 1/16 | 3/8 x 3/16 | 3.3 |
| F-36A | 6.3 CT*<br>6.3* | 3.5<br>3.5 | 1500 | A | 1-Leads | 3 7/8 | 3 9/32 | 3 1/2 | 2 1/2 | 2 3/8 | 3/8 x 3/16 | 5 |
| F-38A | 6.3 CT*<br>6.3*<br>6.3*<br>5.0 CT | 5<br>5<br>1<br>2<br>4 | 1500 | A | 2-Leads | 3 7/8 | 3 9/32 | 3 3/4 | 2 1/2 | 2 5/8 | 3/8 x 3/16 | 6 |
| F-42A | 12.6 CT*<br>12.6* | 2.5<br>2.5 | 1500 | A | 1-Leads | 3 1/32 | 2 21/32 | 3 1/8 | 2 1/4 | 2 | 3/8 x 3/16 | 3.7 |
| F-83A¶‡ | 12.6 CT* | 5 | Sec. 2500 | A | 2-Leads | 3 7/8 | 3 9/32 | 3 3/4 | 2 1/2 | 2 5/8 | 3/8 x 3/16 | 6 |

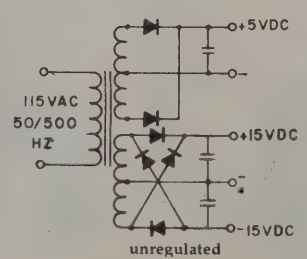
## DUAL C.T. SECONDARIES 115V PRIMARY/60 Hz MICROPROCESSOR POWER TRANSFORMERS

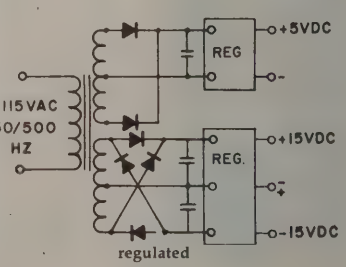
**F234Z-F245U HAVE 2 ISOLATED WINDINGS**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F-234Z | 12.0 CT | .1 | 1500 | Z | Lugs | 1 11/16 | 2 | 1 3/8 | 1 23/32 | — | 3/16 | .6 |
| F-235Z | 12.0 CT | .25 | 1500 | Z | Lugs | 1 15/16 | 2 3/8 | 1 7/16 | 2 | — | 3/16 | .65 |
| F-236Z | 12.0 CT | .5 | 1500 | Z | Lugs | 2 5/16 | 2 7/8 | 1 3/4 | 2 3/8 | — | 3/16 | .8 |
| F-237Z | 12.0 CT | 1 | 1500 | Z | Lugs | 2 11/16 | 3 1/8 | 2 1/16 | 2 13/16 | — | 3/16 | 1.8 |
| F-238U | 12.0 CT | 2 | 1500 | U | Lugs | 2 1/2 | 3 | 2 1/2 | 2 1/2 | 2 | 3/8 x 3/16 | 5 |
| F-239U | 12.0 CT | 4 | 1500 | U | Lugs | 3 1/8 | 3 3/4 | 3 | 3 1/8 | 2 3/4 | 3/8 x 3/16 | 8.5 |
| F-240U | 12.0 CT | 6 | 1500 | U | Lugs | 3 1/2 | 4 1/8 | 3 1/16 | 3 7/16 | 2 1/4 | 3/8 x 3/16 | 9.5 |
| F-241U | 18.0 CT | 1 | 1500 | U | Lugs | 2 1/2 | 3 | 2 1/2 | 2 1/2 | 2 | 3/8 x 3/16 | 3 |
| F-242U | 18.0 CT | 2 | 1500 | U | Lugs | 3 1/8 | 3 13/16 | 3 1/8 | 3 1/8 | 2 1/8 | 3/8 x 3/16 | 6 |
| F-243U | 18.0 CT | 4 | 1500 | U | Lugs | 3 7/16 | 4 1/8 | 3 | 3 7/16 | 2 1/4 | 3/8 x 3/16 | 7 |
| F-244U | 18.0 CT | 8 | 1500 | U | Lugs | 3 3/4 | 4 1/2 | 4 1/8 | 3 3/4 | 2 3/4 | 3/8 x 3/16 | 10 |
| F-245U | 18.0 CT | 12 | 1500 | U | Lugs | 4 1/16 | 4 7/8 | 4 1/8 | 3 11/16 | 2 3/4 | 3/8 x 3/16 | 11 |
| F-194X | 32.0 CT<br>15.5 CT | .050<br>.200 | 1500 | X | Leads | 1 5/8 | 2 7/8 | 1 3/8 | 2 3/8 | — | 3/16 | .45 |
| F-195X | 32.0 CT<br>15.5 CT | .250<br>.750 | 1500 | X | Leads | 2 1/4 | 3 3/4 | 1 7/8 | 3 1/8 | — | 3/16 | 1.3 |
| F-196U | 32.0 CT<br>15.0 CT | 1<br>2 | 1500 | U | Leads | 3 3/8 | 2 13/16 | 2 5/8 | 2 1/4 | 2 1/4 | 5/16 x 3/16 | 4 |
| F-197U | 32.0 CT<br>15.0 CT | 1<br>4 | 1500 | U | Leads | 3 3/4 | 3 1/8 | 2 15/16 | 2 1/2 | 2 1/4 | 5/16 x 3/16 | 4.7 |
| F-198U | 32.0 CT<br>15.0 CT | 1<br>6 | 1500 | U | Leads | 3 3/4 | 3 1/8 | 3 3/16 | 2 1/2 | 2 3/4 | 5/16 x 3/16 | 6.2 |
| F-199U | 32.0 CT<br>15.0 CT | 1<br>10 | 1500 | U | Leads | 4 1/8 | 3 7/16 | 3 1/2 | 2 3/4 | 2 3/4 | 5/16 x 3/16 | 7.4 |

* Windings may be connected in series to obtain their combined voltage when properly phased. Current will be equal to the current of the lowest winding. Example: Two 6.3V windings @ 2A in series would be 12.6V @ 2A. Windings may also be connected in parallel to obtain combined current. Example: Two 6.3V windings @ 2A in parallel would be 6.3V @ 4A. ¶ Tapped primary 105-115-125. ‡ 60 cycle operation.



TRIAD-UTRAD
Litton Distributor Services

## MICROPROCESSOR POWER TRANSFORMERS (Cont'd)

## TRIPLE SECONDARIES, 115V PRIMARY, 60 Hz ONLY (3 ISOLATED WINDINGS)

| Type No. | Secondary Volts | Secondary Amps | RMS Test Voltage | Case Type | Connections | Case Dimensions H | W | D | MW | Mtg. Hole Size | Max. Unit Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| F-295Z | 12VCT-12V 15V | .1 | 1500 | Z | Leads | 1 11/16 | 2 | 1 1/3 | 1 23/32 | 3/16 | .7 |
| F-296Z | | .15 | 1500 | Z | Leads | 1 15/16 | 2 3/8 | 1 7/16 | 2 | 3/16 | .7 |
| F-297Z | | .25 | 1500 | Z | Leads | 1 15/16 | 2 7/16 | 1 1/2 | 2 | 3/16 | .7 |
| F-298Z | | .5 | 1500 | Z | Leads | 2 1/4 | 3 3/4 | 1 7/8 | 3 1/8 | 3/16 | 2.0 |
| F-299X | | 1.5 | 1500 | X | Leads | 2 9/16 | 4 1/32 | 2 1/4 | 3 9/16 | 3/16 | 2.3 |

## TRIPLE SECONDARIES, 115-230V PRIMARY, 50-60 Hz (3 ISOLATED WINDINGS)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| F-3295Z | 12VCT-12V 15V | .1 | 1500 | Z | Leads | 1 11/16 | 2 | 1 3/8 | 1 23/32 | 3/16 | .6 |
| F-3297Z | | .25 | 1500 | Z | Leads | 1 15/16 | 2 7/16 | 1 1/2 | 2 | 3/16 | .65 |
| F-3298Z | | .5 | 1500 | Z | Leads | 2 1/4 | 3 3/4 | 1 7/8 | 3 1/8 | 3/16 | 2.0 |

## 115-230V DUAL PRIMARY—SINGLE SECONDARY/50-60 Hz UNLESS NOTED (‡)

| Type No. | Secondary Volts | Secondary Amps | RMS Test Voltage | Case Type | Connections | Case Dimensions H | W | D | MW | Mtg. Hole Size | Max. Unit Wt. Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| F-301X | 2.5 CT | 3 | 1500 | X | Leads | 1 5/8 | 2 13/16 | 1 5/8 | 2 3/8 | 3/16 | .68 |
| F-306X | 2.5 CT | 6 | 2500 | X | Leads | 1 15/16 | 3 5/16 | 1 3/4 | 2 13/16 | 3/16 | 1 |
| F-313X | 6.3 | .6 | 1500 | X | Leads | 1 3/8 | 2 3/8 | 1 3/8 | 2 | 3/16 | .37 |
| F 314X | 6.3 CT | 1.2 | 2500 | X | Leads | 1 5/8 | 2 13/16 | 1 5/8 | 2 3/8 | 3/16 | .7 |
| F-316X | 6.3 CT | 3 | 2500 | X | Leads | 1 15/16 | 3 5/16 | 2 | 2 3/16 | 3/16 | 1.3 |
| F-318X | 6.3 CT | 6 | 1500 | X | Leads | 2 19/32 | 4 | 2 1/4 | 3 9/16 | 3/16 | 2.3 |
| F-325X | 12.6 CT | 1.5 | 1500 | X | Leads | 1 15/16 | 3 5/16 | 2 | 2 13/16 | 3/16 | 1.3 |
| F-344X | 12.6 CT | 2 | 1500 | X | Leads | 1 15/16 | 3 5/16 | 2 | 2 13/16 | 3/16 | 1.25 |
| F-326X | 12.6 CT | 2.5 | 1500 | X | Leads | 2 5/32 | 3 1/16 | 2 | 3 1/8 | 3/16 | 1.55 |
| F-3181U | 12.6 CT | 4 | 1500 | U | Leads | 3 1/16 | 2 7/16 | 2 3/16 | 2 | 3/16 | 2.3 |
| F-3112X | 14 CT | .25 | 1500 | X | Leads | 1 3/8 | 2 3/8 | 1 1/2 | 2 | 3/16 | .45 |
| F-3115X | 24 CT | .085 | 1500 | X | Leads | 1 7/32 | 2 1/16 | 1 1/4 | 1 3/4 | 3/16 | .3 |
| F-3116X | 24 CT | .2 | 1500 | X | Leads | 1 3/8 | 2 3/8 | 1 1/2 | 2 | 3/16 | .45 |
| F-3117X | 24 CT | .4 | 1500 | X | Leads | 1 5/8 | 2 13/16 | 1 1/2 | 2 3/8 | 3/16 | .75 |
| F-3118X | 24 CT | .7 | 1500 | X | Leads | 1 15/16 | 3 1/4 | 2 | 2 13/16 | 3/16 | 1.4 |
| F-345X | 24 CT | 1 | 1500 | X | Leads | 1 15/16 | 3 5/16 | 2 | 2 13/16 | 3/16 | 1.3 |
| F-346X | 24 | 1 | 1500 | X | Leads | 2 1/4 | 3 11/16 | 2 1/8 | 3 1/8 | 3/16 | 1.6 |
| F-340X | 26.8 CT | 1 | 1500 | X | Leads | 1 15/16 | 3 5/16 | 2 | 2 13/16 | 3/16 | 1.3 |
| F-341X | 25.2 CT | 2 | 1500 | X | Leads | 2 19/32 | 4 | 2 1/4 | 3 9/16 | 3/16 | 2.2 |
| F-355X | 26.8 CT | 1.7 | 1500 | X | Leads | 2 19/32 | 4 | 2 1/4 | 3 9/16 | 3/16 | 2.3 |
| F-31854X | 28.0 CT | 2 | 1500 | U | Leads | 3 1/16 | 2 1/2 | 2 7/16 | 2 | 3/16 x 3/8 | 2.9 |
| F-354X | 35 CT | 1.5 | 1500 | X | Leads | 2 19/32 | 4 | 2 1/4 | 3 9/16 | 3/16 | 2.2 |
| F-357X | 25.2 CT | 1 | 1500 | X | Leads | 2 1/4 | 3 11/16 | 2 1/8 | 3 1/8 | 3/16 | 1.6 |

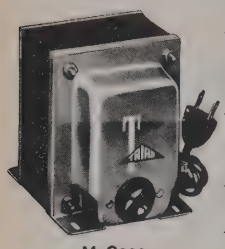
## ISOLATION/50-60 Hz ALL ISOLATION UNITS HAVE STATIC SHIELDS

| Type No. | Output Watts (VA) | Primary Volts | Secondary AC Volts ±5% | Secondary AC Amps | RMS Test Voltage | Case Type | Connections | Lead Holes Used | Case Dimensions H | W | D | Mounting Dimensions MW | MD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N-48X | 15 | 115 | 115 | .13 | 1500 | X | Leads | — | 1 15/16 | 3 5/16 | 2 | 2 13/16 | — |
| N-51X‡ | 35 | 115 | 115 | .3 | 1500 | X | Leads | — | 2 5/32 | 3 11/16 | 2 1/8 | 3 1/8 | — |
| N-68X | 50 | 115-230§ | 115 | .435 | 1500 | X | Leads | — | 2 5/32 | 3 11/16 | 2 1/8 | 3 1/8 | — |
| N-53M | 85 | 115 | 115 | .74 | 1500 | M | 6' Cord, Plug & Socket | — | 3 1/32 | 2 31/32 | 3 5/8 | 2 1/4 | 2 3/8 |
| N-54M | 150 | 115 | 115 | 1.3 | 1500 | M | 6' Cord, Plug & Socket | — | 3 7/8 | 3 3/32 | 4 1/4 | 2 1/2 | 3 |
| N-73A | 150 | 115 | 115-230§ | .65 | 1500 | A | Leads | 1 | 3 7/8 | 3 3/32 | 3 7/8 | 2 1/2 | 2 3/4 |
| N-67A | 150 | 115-230§ | 115 | 1.3 | 1500 | A | Leads | 2 | 3 7/8 | 3 3/32 | 4 1/8 | 2 1/2 | 3 |
| N-55M | 250 | 115 | 115 | 2.17 | 1500 | M | 6' Cord, Plug & Socket | — | 4 5/8 | 3 15/16 | 5 | 3 | 3 7/8 |
| N-55MG† | — | 115 | — | — | — | — | — | — | — | — | — | — | — |
| N-66A | 250 | 115-230§ | 115 | 2.17 | 1500 | A | Leads | 2 | 4 5/8 | 3 15/16 | 4 5/8 | 3 | 3 5/8 |
| N-469A‡ | 50 | 220-440§ | 115 | .435 | 1500 | A | Leads | 1 | 3 3/16 | 2 21/32 | 2 1/2 | 2 | 1 9/16 |
| N-471A‡ | 300 | 220-440§ | 115 | 2.6 | 2000 | A | Leads | 1 | 4 5/8 | 3 15/16 | 4 3/8 | 3 | 3 3/8 |

* Windings may be connected in series to obtain their combined voltage when properly phased. Current will be equal to the current of the lowest winding. CT for Center Tap. ¶ Tapped primary 105-115-125. § Split winding. ‡ 60 cycle operation. † Tapped primary to produce lower voltages.

Litton TRIAD-UTRAD Distributor Services

# TRANSFORMERS



M Case

## STEPDOWN AUTOFORMERS/50-60 Hz

| Triad Part No. | Output Watts (VA) | Primary Volts | Secondary Volts ±5% | Secondary RMS Amps | RMS Test Voltage | Case Type | Connections | Mounting Dimension MW | Mounting Dimension MD |
|---|---|---|---|---|---|---|---|---|---|
| N-1X | 50 | 230 | 115 | .435 | 1500 | X | Leads | 3⅛ | — |
| N-3M | 85 | 230 | 115 | .74 | 1500 | M | 6′ Cord & Plug & Socket | 2¼ | 1⅝ |
| N-2X | 100 | 230 | 115 | .87 | 1500 | X | Leads | 3⁹⁄₁₆ | — |
| N-4M | 150 | 230 | 115 | 1.3 | 1500 | M | 6′ Cord & Plug & Socket | 2¼ | 2⅜ |
| N-6U | 200 | 230 | 115 | 1.7 | 1500 | U | Leads | 2¹³⁄₁₆ | 2¼ |
| N-5M | 250 | 230 | 115 | 2.17 | 1500 | M | 6′ Cord & Plug & Socket | 2½ | 3 |
| N-7M | 600 | 230 | 115 | 5.22 | 1500 | M | 6′ Cord & Plug & Socket | 3 | 3⅞ |
| N-39X | 50 | 0-100-115-127-135 | 115 | .43 | 1500 | X | Lugs | 2¹³⁄₁₆ | — |
| N-40X | 100 | 0-100-115-127-135 | 115 | .87 | 1500 | X | Lugs | 2¹³⁄₁₆ | — |

## LOW VOLTAGE RECTIFIER/TRANSISTOR DRIVE VOLTAGE, 50-60 Hz

| Triad Part No. | Primary Volts | Secondary AC Volts | DC Volts Amps | DC Volts Half Wave | DC Volts Bridge | RMS Test Voltage | Case Type | Connections | Case Dimension H | Case Dimension W | Case Dimension D | Mounting Dimension MW | Mounting Dimension MD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F-94X | 115† | 10-20 CT—40 CT | .035 | 15 | 30 | 1500 | X | Leads | 1⅜ | 2⅜ | 1⅜ | 2 | — |
| F-90X | 115† | 10-20 CT—40 CT | .1 | 15 | 30 | 1500 | X | Leads | 1⅝ | 2¹³⁄₁₆ | 1⅝ | 2⅜ | — |
| F-91X | 115† | 10-20 CT—40 CT | .3 | 15 | 30 | 1500 | X | Leads | 2²⁄₃₂ | 3¹¹⁄₁₆ | 2 | 3⅛ | — |
| F-93X | 115† | 10-20 CT—40 CT | .75 | 15 | 30 | 1500 | X | Leads | 2¹⁹⁄₃₂ | 4 | 2¼ | 3⁹⁄₁₆ | — |
| F-92A | 115† | 10-20 CT—40 CT | 1.0 | 15 | 30 | 1500 | A | Leads (2 Holes) | 3⅜ | 2²¹⁄₃₂ | 3 | 2 | 2¹⁄₁₆ |
| F-394X | 230 | 10-20 CT—40 CT | .035 | 15 | 30 | 1500 | X | Leads | 1⅜ | 2⅜ | 1⅜ | 2 | — |
| F-390X | 230 | 10-20 CT—40 CT | .1 | 15 | 30 | 1500 | X | Leads | 1⅝ | 2¹³⁄₁₆ | 1⅝ | 2⅜ | — |
| F-391X | 230 | 10-20 CT—40 CT | .3 | 15 | 30 | 1500 | X | Leads | 2¼ | 3¹¹⁄₁₆ | 2 | 3⅛ | — |
| F-393X | 230 | 10-20 CT—40 CT | .75 | 15 | 30 | 1500 | X | Leads | 2¹⁹⁄₃₂ | 4 | 2¼ | 3⁹⁄₁₆ | — |
| F-392A | 230 | 10-20 CT—40 CT | 1.0 | 15 | 30 | 1500 | A | Leads | 3⅜ | 2²¹⁄₃₂ | 3 | 2 | 2¹⁄₁₆ |

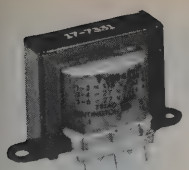
## UNIVERSAL RECTIFIER POWER/PRIMARY 117V, 50-60 Hz

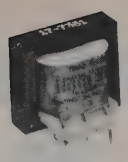
| Triad Part No. | Secondary No. 1 AC Volts | Secondary DC Amps Full Wave CT | Secondary DC Amps Bridge | Secondary No. 2 AC Volts | Secondary No. 2 DC Amps | RMS Test Volts | Case Type | Connections | Case Dimension H | Case Dimension W | Case Dimension D | Mounting Dimension MW | Mounting Dimension MD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F-202U | 11.0 to 29.5 | 2.0 | 1.25 | — | — | 1000 | U | Lugs | 3 | 2½ | 3 | 2 | 2⅛ |
| F-203U | 12.0 to 30.0 | 4.0 | 2.0 | — | — | 1000 | U | Lugs | 3⅜ | 2¹³⁄₁₆ | 3¼ | 2¼ | 2⅜ |
| F-204U | 11.5 to 29.0 | 8.0 | 4.0 | — | — | 1000 | U | Lugs | 3¾ | 3⅛ | 4⅛ | 2½ | 2⅞ |
| F-205U | 12.0 to 29.5 | 12.0 | 6.0 | — | — | 1000 | U | Lugs | 4⅛ | 3⁷⁄₁₆ | 5⅛ | 2¾ | 3¼ |

| Triad Part No. | Primary Volts | Secondary AC Volts | Secondary AC Amps | DC Volts Half Wave | DC Volts Bridge | RMS Test Voltage | Case Type | Connections | Case Dimension H | Case Dimension W | Case Dimension D | Mounting Dimension MW | Mounting Dimension MD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F-47U<br>F-347U | 115<br>115/230 | 0-17-18 | 3 | 6-7 | 13-14 | 1500 | U | Leads | 3 | 2½ | 2¾ | 1⅝ | 2⅜ |
| F-48U | 115 | 0-17-18 | 6 | 6-7 | 13-14 | 1500 | U | Leads | 3¹³⁄₁₆ | 3⅜ | 3⅜ | 2½ | 2¹¹⁄₁₆ |
| F-49U | 115 | 36*<br>36* | 3<br>3 | 13<br>13 | 26<br>26 | 1500 | U | Leads | 4⅝ | 3¹³⁄₁₆ | 3¾ | 3 | 3¹⁄₁₆ |
| F-60U | 115 | 0-6.5-13-19.5-26 | 3 | 9 | 18 | 1500 | U | Leads | 3⅜ | 2¹³⁄₁₆ | 2⅝ | 2¼ | 2³⁄₁₆ |
| F-360U | 115/230 | — | — | — | — | — | — | — | — | — | — | — | — |
| F-61U | 115 | 0-24-27-30-33-36 | 3 | 13 | 26 | 1500 | U | Leads | 3¾ | 3⅛ | 3¼ | 2½ | 2⅝ |
| F-361U | 115/230 | — | — | — | — | — | — | — | — | — | — | — | — |
| F-67U‡ | 110-120 | 0-24-27-30-33-36 | 8 | 13 | 26 | 1500 | U | Leads | 4⅝ | 3¹³⁄₁₆ | 4⅜ | 3 | 3⁵⁄₁₆ |
| F-64U | 115 | 0-7-8-9 | 7 | — | 5-6-7 | 1500 | U | Leads | 3⅜ | 2¹³⁄₁₆ | 2¾ | 2¼ | 2³⁄₁₆ |

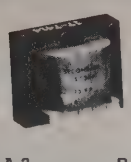
## CONTROL TRANSFORMERS/6V, 12V, 24V SECONDARIES

| Triad Part No. | Primary | Secondary Parallel | Secondary Series | VA Rating | Case Type | Connections | Height Overall | Base Area | Mounting Dimension | Shpg. Wt in Lbs. |
|---|---|---|---|---|---|---|---|---|---|---|
| F-105Z | 115V/230V 50/60 CPS on all | 6V @ 2A | 12V @ 1A | 12 | Z | Lugs | 2⅜ | 2⅞ x 1¾ | 2⅜ | 1 |
| F-106Z | | 6V @ 4A | 12V @ 2A | 24 | Z | Lugs | 2¾ | 3⅛ x 2 | 2¹³⁄₁₆ | 1½ |
| F-107Z | | 12V @ 4A | 24V @ 2A | 48 | Z | Lugs | 3⅛ | 3⅝ x 2⅜ | 3⅛ | 2½ |
| F-108U | | 12V @ 8A | 24V @ 4A | 96 | U | Lugs | 3½ | 2⅞ x 3 | 2¼ x 2¼ | 4¼ |
| F-109U | | 12V @ 16A | 24V @ 8A | 192 | U | Lugs | 4⅛ | 3¾ x 3½ | 3 x 2¾ | 8 |
| F-211Z | | 24V @ .5A | 48V @ .25A | 12 | Z | Lugs | 2⁵⁄₁₆ | 2¹³⁄₁₆ x 1½ | 2⅜ | .678 |
| F-212Z | | 24V @ 1.0A | 48V @ .50A | 24 | Z | Lugs | 2¾ | 3⅛ x 2¼ | 2¹³⁄₁₆ | 1.05 |
| F-213Z | | 24V @ 2.0A | 48V @ 1.0A | 48 | Z | Lugs | 3¹⁄₁₆ | 3⅝ x 2⅜ | 3⅛ | 1.55 |
| F-214U | | 24V @ 4.0A | 48V @ 2.0A | 96 | U | Lugs | 3³¹⁄₃₂ | 3¹⁄₁₆ x 2³⁄₁₆ | 2¼ x 2⅝ | 3.24 |
| F-215U | | 24V @ 8.0A | 48V @ 4.0A | 192 | U | Lugs | 4⁵⁄₃₂ | 3¾ x 3⁷⁄₁₆ | 2¾ x 3 | 6.06 |


A


B

A-1, A-2


B-1

TRIAD-UTRAD
Litton Distributor Services

# LOW-VOLTAGE, LOW-CURRENT PLUG-IN PRINTED CIRCUIT POWER
## 115V, 50-60 Hz PRIMARY/DUAL SECONDARIES*

| Cat. No. | Fig. | Output Watts | Secondary | | Dimensions | | | | | | Mtg. Dim. | Wt. Oz. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Series Connection | Parallel Connection | H | W | D | L | A | B | | |
| F-131P | B | 1½ | 8V CT @ .188A | 4V @ .376A | 1⅛ | 1 25/64 | 1 5/32 | 1 25/64 | 5/16 | 1 | — | 3.5 |
| F-139P | B | 1½ | 12.6V CT @ .12A | 6.3V @ .24A | 1⅛ | 1 25/64 | 1 5/32 | 1 25/64 | 5/16 | 1 | — | 3.5 |
| F-132P | B | 1½ | 15V CT @ .100A | 7.5V @ .200A | 1⅛ | 1 25/64 | 1 5/32 | 1 25/64 | 5/16 | 1 | — | 3.5 |
| F-150P | B | 1½ | 17V CT @ .085A | 8.5V @ .170A | 1⅛ | 1 25/64 | 1 5/32 | 1 25/64 | 5/16 | 1 | — | 3.5 |
| F-138P | B | 1½ | 25.2V CT @ .06A | 12.6V @ .12A | 1⅛ | 1 25/64 | 1 5/32 | 1 25/64 | 5/16 | 1 | — | 3.5 |
| F-133P | B | 1½ | 30V CT @ .050A | 15V @ .100A | 1⅛ | 1 25/64 | 1 5/32 | 1 25/64 | 5/16 | 1 | — | 3.5 |
| F-160P | B | 1½ | 34V CT @ .045A | 17V @ .090A | 1⅛ | 1 25/64 | 1 5/32 | 1 25/64 | 5/16 | 1 | — | 3.5 |
| F-135P | B | 1½ | 76V CT @ .020A | 38V @ .040A | 1⅛ | 1 25/64 | 1 5/32 | 1 25/64 | 5/16 | 1 | — | 3.5 |
| F-149XP | A | 4½ | 12.6V CT @ .35A | 6.3V @ .70A | 1 25/64 | 2 3/8 | 1 1/4 | 1 45/64 | 13/32 | 1 3/32 | 2 | 7.5 |
| F-142XP | A | 4½ | 15V CT @ .300A | 7.5V @ .600A | 1 25/64 | 2 3/8 | 1 1/4 | 1 45/64 | 13/32 | 1 3/32 | 2 | 7.5 |
| F-161XP | A | 4½ | 17V CT @ .264A | 8.5V @ .528A | 1 25/64 | 2 3/8 | 1 1/4 | 1 45/64 | 13/32 | 1 3/32 | 2 | 7.5 |
| F-148XP | A | 4½ | 25.2V CT @ .178A | 12.6V @ .356A | 1 25/64 | 2 3/8 | 1 1/4 | 1 45/64 | 13/32 | 1 3/32 | 2 | 7.5 |
| F-143XP | A | 4½ | 30V CT @ .150A | 15V @ .300A | 1 25/64 | 2 3/8 | 1 1/4 | 1 45/64 | 13/32 | 1 3/32 | 2 | 7.5 |
| F-162XP | A | 4½ | 34V CT @ .132A | 17V @ .264A | 1 25/64 | 2 3/8 | 1 1/4 | 1 45/64 | 13/32 | 1 3/32 | 2 | 7.5 |
| F-147XP | A | 4½ | 40V CT @ .112A | 20V @ .224A | 1 25/64 | 2 3/8 | 1 1/4 | 1 45/64 | 13/32 | 1 3/32 | 2 | 7.5 |
| F-144XP | A | 4½ | 54V CT @ .084A | 27V @ .168A | 1 25/64 | 2 3/8 | 1 1/4 | 1 45/64 | 13/32 | 1 3/32 | 2 | 7.5 |
| F-159XP | A | 7½ | 12.6V CT @ .60A | 6.3V @ 1.2A | 1 41/64 | 2 13/16 | 1 15/32 | 1 61/64 | 13/32 | 1 5/16 | 2 3/8 | 10.5 |
| F-152XP | A | 7½ | 15V CT @ .500A | 7.5V @ 1.000A | 1 41/64 | 2 13/16 | 1 15/32 | 1 61/64 | 13/32 | 1 5/16 | 2 3/8 | 10.5 |
| F-163XP | A | 7½ | 17V CT @ .441A | 8.5V @ .882A | 1 41/64 | 2 13/16 | 1 15/32 | 1 61/64 | 13/32 | 1 5/16 | 2 3/8 | 10.5 |
| F-158XP | A | 7½ | 25.2V CT @ .30A | 12.6V @ .60A | 1 41/64 | 2 13/16 | 1 15/32 | 1 61/64 | 13/32 | 1 5/16 | 2 3/8 | 10.5 |
| F-153XP | A | 7½ | 30V CT @ .250A | 15V @ .500A | 1 41/64 | 2 13/16 | 1 15/32 | 1 61/64 | 13/32 | 1 5/16 | 2 3/8 | 10.5 |
| F-164XP | A | 7½ | 34V CT @ .220A | 17V @ .440A | 1 41/64 | 2 13/16 | 1 15/32 | 1 61/64 | 13/32 | 1 5/16 | 2 3/8 | 10.5 |
| F-154XP | A | 7½ | 54V CT @ .140A | 27V @ .280A | 1 41/64 | 2 13/16 | 1 15/32 | 1 61/64 | 13/32 | 1 5/16 | 2 3/8 | 10.5 |

## 115-230V, 50-60 Hz DUAL PRIMARY*/DUAL SECONDARIES*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F-3132P | B-1 | 1½ | 15V CT @ .1A | 7.5V @ .200A | 1⅛ | 1 25/64 | 1⅛ | 1 3/8 | 13/64 | 1 | 1 3/8 | 4.0 |
| F-3142XP | A-1 | 4½ | 15V CT @ .3A | 7.5V @ .600A | 1 25/64 | 2 3/8 | 1 1/4 | 1 5/8 | 1/4 | 1 7/64 | 2 | 6.5 |
| F-3152XP | A-1 | 7½ | 15V CT @ .5A | 7.5V @ .100A | 1 5/8 | 2 13/16 | 1 3/8 | 1 5/8 | 1/4 | 1 7/64 | 2 3/8 | 11.0 |
| F-3133P | B-1 | 1½ | 30V CT @ .050A | 15V @ .100A | 1⅛ | 1 25/64 | 1⅛ | 1 3/8 | 13/64 | 1 | 1 3/8 | 4.0 |
| F-3143XP | A-1 | 4½ | 30V CT @ .150A | 15V @ .300A | 1 25/64 | 2 3/8 | 1 1/4 | 1 5/8 | 1/4 | 1 7/64 | 2 | 6.5 |
| F-3153XP | A-1 | 7½ | 30V CT @ .250A | 15V @ .500A | 1 41/64 | 2 13/16 | 1 15/32 | 1 5/8 | 1/4 | 1 7/64 | 2 3/8 | 11.0 |
| F-333P | B-1 | 1½ | 30V CT @ .050A | 15V @ .100A | 1⅛ | — | 1⅛ | 1 3/8 | 13/64 | 1 | — | 4.0 |
| F-349XP | A-1 | 4½ | 16V CT @ .280A | 8V @ .560A | 1 3/8 | 2 3/8 | 1 1/4 | 1 5/8 | 1/4 | 1 7/64 | 2 | 6.5 |
| F-359XP | A-2 | 10 | 24V CT @ .450A | 12V @ .900A | 1 5/8 | 1 7/16 | 2 13/16 | 1 7/8 | 1/4 | 1 5/16 | 2 3/8 | 11.0 |
| F-362XP | A-2 | 10 | 20V CT @ .500A | 10V @ 1.0A | 1 5/8 | 1 7/16 | 2 13/16 | 1 7/8 | 1/4 | 1 5/16 | 2 3/8 | 11.0 |

# PLUG-IN PRINTED CIRCUIT POWER TRANSFORMERS/
## 115V, 50-60 Hz PRIMARY/TRIPLE OUTPUT SECONDARIES FOR ±15V AND ±5V DC

| Cat. No. | Fig. | Output Watts | Secondary | | Dimensions | | | | | | Mtg. Dim. | Wt. Oz. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Series Connection | Parallel Connection | H | W | D | L | A | B | | |
| F-165P | B | 1½ | 24V CT @ .025A | 9V CT @ .100A | 1⅛ | 1 25/64 | 1 5/32 | 1 25/64 | 5/16 | 1 | — | 3.5 |
| F-167P | B | 1½ | 32V CT @ .020A | 15V CT @ .060A | 1⅛ | 1 25/64 | 1 5/32 | 1 25/64 | 5/16 | 1 | — | 3.5 |
| F-168XP | A | 4½ | 32V CT @ .050A | 15V CT @ .195A | 1 25/64 | 2 3/8 | 1 1/4 | 1 45/64 | 13/32 | 1 3/32 | 2 | 7.5 |
| F-166XP | A | 7½ | 24V CT @ .125A | 9V CT @ .500A | 1 41/64 | 2 13/16 | 1 15/32 | 1 61/64 | 13/32 | 1 5/16 | 2 3/8 | 10.5 |
| F-169XP | A | 7½ | 32V CT @ .100A | 15V CT @ .287A | 1 41/64 | 2 13/16 | 1 15/32 | 1 61/64 | 13/32 | 1 5/16 | 2 3/8 | 10.5 |

# PLUG-IN PRINTED CIRCUIT AUDIO TRANSFORMERS

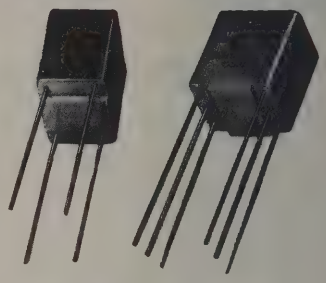
| Cat. No. | Fig. | Output M.W. | Primary Impedance | Secondary Impedance | Primary D.C. Unbalance | Dimensions | | | Pin Dimension | | Wt. Oz. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | H | W | D | | | |
| TY-141P | B | 100 | 10,000 CT | 10,000 CT | 4 ma. | 5/8 | 13/16 | 19/32 | 3/16 | .042 | 1 |
| TY-142P | B | 100 | 10,000 CT | 2,000 CT | 4 ma. | 5/8 | 13/16 | 19/32 | 3/16 | .042 | 1 |
| TY-147P | B | 10 | 150 CT | 600 CT | 15 ma. | 5/8 | 13/16 | 19/32 | 3/16 | .042 | 5 |

* Two isolated windings.

Litton **TRIAD-UTRAD** Distributor Services

# TRANSFORMERS

## RED SPEC TRANSISTOR TRANSFORMERS

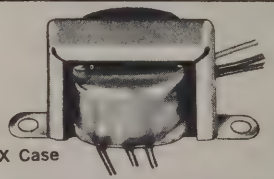


All Red Spec transformers are designed and constructed to conform to the rigid requirements of Specification MIL-T-27B. Features are: solid epoxy molded case . . . legible, permanent circuit data on every unit . . . base mounting pad for ready inspection of all solder joints . . . High-strength .020-diameter nickel alloy leads . . . no stripping or tinning required . . . operating voltage: 150V DC . . . exceptional operation from 100 to 100,000 cycles . . . base dimensions of only .310 by .410 inch . . . total height of just .465 inch . . . weight: 1/10 ounce . . . lowest possible fatigue factor . . . dry hydrogen-annealed Trialloy, deep-drawn .020-inch case (SP-310) available for providing as much as 20 to 45 db magnetic shielding.

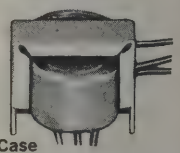
| Type No. | Mil Type Number | Power Level In MW | Application | Matching Impedance | | Max. MA DC Unbalanced In Primary | DC Resistance | |
|---|---|---|---|---|---|---|---|---|
| | | | | Primary | Secondary | | Primary | Secondary |
| **SP-4** | TF5SX16ZZ | 10 | Input | 200,000 CT | 1,000 CT | 0 | 5300 | 100 |
| **SP-5** | TF5SX16ZZ | 25 | Input | 50,000 CT | 1,000 CT | 0 | 3800 | 75 |
| **SP-13** | TF5SX13ZZ | 40 | Interstage | 25,000 CT/20,000 CT | 1,000 CT/800 CT | .5 | 1700 | 115 |
| **SP-15** | TF5SX13ZZ | 50 | Interstage | 10,000 CT | 1,500 CT | 1 | 1050 | 300 |
| **SP-20** | TF5SX13ZZ | 50 | Driver | 10,000 CT | 1,200 CT | 1 | 1050 | 200 |
| **SP-21** | TF5SX13ZZ | 50 | Driver | 10,000 CT | 2,000 CT | 1 | 1050 | 330 |
| **SP-22** | TF5SX13ZZ | 50 | Driver | 10,000 | 2,000 CT/500§ | 1 | 1050 | 146/168§ |
| **SP-29** | TF5SX13ZZ | 50 | Driver | 10,000 CT | 500 CT | 1 | 1050 | 80 |
| **SP-33** | TF5SX17ZZ | 50 | Output | 1,000 | 50 | 3 | 145 | 8 |
| **SP-42** | TF5SX17ZZ | 50 | Output | 150 CT | 12 | 10 | 18 | 2.7 |
| **SP-50** | TF5SX17ZZ | 50 | Output | 500 CT | 600 | 3 | 67 | 98 |
| **SP-51** | TF5SX17ZZ | 50 | Output | 900 CT | 600 | 4 | 104 | 96 |
| **SP-52** | TF5SX13ZZ | 50 | Output | 1,500 CT | 600 | 3 | 168 | 92 |
| **SP-66** | TF5SX13ZZ | 50 | Output-Isolation | 10,000 CT | 10,000 CT | 1 | 1000 | 1300 |
| **SP-67** | TF5SX17ZZ | 50 | Output-Isolation | 600 CT | 600 CT | 3 | 72 | 92 |
| **SP-69** | TF5SX17ZZ | 50 | Output-Isolation | 600 | 600 CT/150§ | 3 | 72 | 40/45§ |
| **SP-70** | TF5SX17ZZ | 50 | Output-Isolation | 600 | 600 | 3 | 72 | 92 |

CT for Center Tap. § Split Secondary.

## MINIATURE AUDIO TRANSFORMERS



X Case



XT Case

| Type No. | Power Output | Application | Matching Impedance | | DC Resistance | | Overall Turns Ratio | Frequency Response ±3DB | RMS Test Volts | Case Type | Case Dimension | | | Mtg. Dimen. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Primary | Secondary | Primary | Secondary | | | | | H | W | D | MW |
| **T-1X‡** | 1MW | Line or Mike to Grid | 600/250/50 | 50,000 | 80 | 3200 | 1:9.16 | 60-15,000 | 500 | X | 5/8 | 1 7/32 | 3/4 | 1 |
| **T-31X‡** | 10MW | Line to Line | 600/250/50 | 600/250/50 | 55 | 80 | 1:1 | 50-15,000 | 500 | X | 5/8 | 1 7/32 | 3/4 | 1 |
| **T-34X** | 20MW | Transistor or Line to Transistor or Line | 500 CT 2 MA. D.C. | 500 CT/ 125§ | 45 | 55 | 1:1.03 | 50-20,000 | 500 | X | 5/8 | 1 9/32 | 11/16 | 1 1/16 |
| **T-35X** | 10MW | Transistor or Line to Transistor | 600 CT 1 MA. D.C. | 2000 CT/ 500§ | 68 | 200 | 1:1.7 | 50-20,000 | 500 | X | 5/8 | 1 7/32 | 3/4 | 1 |

## TELEPHONE COUPLING TRANSFORMERS

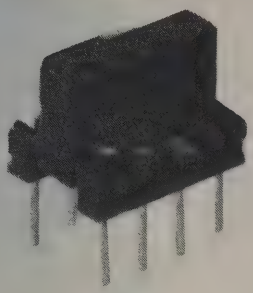
| Cat. No. | Fig. No. | Application | Primary Impedance | Secondary Impedance | Dimensions | | | | | | | | | | Wt. Oz. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | A | B | C | D | E | F | G | H | I | J | |
| **TY-300P** | B | Hybrid* | 600 | 600/600† | .63 | .75 | .55 | .421 | .187 | .375 | .25 | .203 | .020 | .041 | .5 |
| **TY-301P** | B | Coupling | 600 | 900 | .63 | .75 | .55 | .421 | | .375 | .25 | .203 | .020 | .041 | .5 |
| **TY-302P** | B | Hybrid* | 600 | 600/600 | .75 | 1.00 | .94 | .781 | .200 | .400 | .26 | .203 | .020 | .041 | 1.2 |
| **TY-303P** | B | Bridging | 4000 | 600 | .63 | .75 | .55 | .421 | | .375 | .25 | .203 | .020 | .041 | .5 |
| **TY-304P** | B | Coupling | 600 CT | 600 CT | .63 | .75 | .55 | .421 | .187 | .375 | .25 | .188 | .018 | .041 | .5 |
| **TY-350P** | B | Holding Coil | 2.0 hy @ 60 ma. 1.3 hy @ 100 maDC, 180 ohms DCR | | 1.19 | 1.44 | .98 | 1.00 | | .63 | .25 | | .020 | .040 | 3.5 |

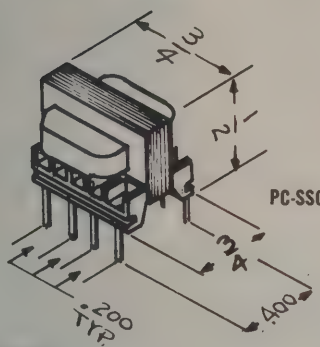
* Two required for hybrid operation. † Split winding; one wide band, one narrow band.

# TRW UTC TRANSFORMERS

# TRANSFORMERS

## SSO LINE






**INDUCTORS**

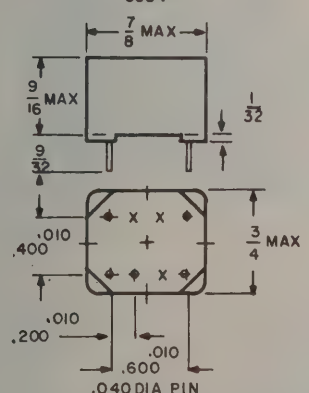
| | |
|---|---|
| SSO-5 | 50 Hys @ 1 MADC, 4400 Ohms DC Res. |
| SSO-23 | 8 Hys @ 2 MADC, 4 Hys @ 5 MADC, 650 Ohms |
| SSO-24 | 3.5 Hys @ 2 MADC, 1.5 Hys @ 5 MADC, 160 Ohms |
| PC-SSO SO-5P | Split Series: 100 Hys @ 0 MADC, 50 Hys @ 1 MADC, 4400 Ohms<br>Parallel: 25 Hys @ 0 MADC, 12 Hys @ 2 MADC, 1100 Ohms |
| PC-SSO SO-23P | Split Series: 8 Hys @ 2 MADC, 4 Hys @ 5 MADC, 600 Ohms<br>Parallel: 2 Hys @ 4 MADC, 1 Hy @ 10 MADC, 150 Ohms |
| PC-SSO SO-24P | Split Series: 3.5 Hys @ 2 MADC, 1.5 Hy @ 5 MADC, 160 Ohms<br>Parallel: 0.9 Hy @ 4 MADC, 0.4 Hy @ 10 MADC |
| PC-SSO SSO-100P | Split Series: 0.3 Hy @ 9 MADC, 0.2 Hy @ 18 MADC, 20 Ohms<br>Parallel: 0.75 Hy @ 18 MADC, .05 Hy @ 36 MADC, 5 Ohms |

## AUDIO AND HIGH FREQUENCY TRANSFORMERS AND INDUCTORS (CONT'D)

| Line | Type No. SSO- | E.T. Product Unbal. DC MA | In Winding Millivolt Sec. | Primary Input-Matching Impedance (Ohms) Electro-static Shielding Bifilar;* (Split) S | Secondary Output-Matching Impedance (Ohms) Electro-static Shielding Bifilar;* (Split) S | Maximum Level DBM | Maximum Level M.W. |
|---|---|---|---|---|---|---|---|
| 38 | 15 | 8.5 | 5 | 800 CT<br>1200 CT | 20K CT<br>30K CT | +20 | 100 |
| 39 | 42 * | 8.5 | 5 | 800/200<br>1200/300<br>Split | 20K/5K<br>30K/7.5K<br>Split | +17 | 50 |
| 40 | 12 | 11 | 3 | 1000<br>1200 | 50<br>60 | +20 | 100 |
| 41 | 34 * | — | 6 | 1K/250<br>1200/300<br>Split* | 200/50<br>240/60<br>Split* | +20 | 100 |
| 42 | 13 | 3.2 | 0 | 1000 | 200K | +7 | 5 |
| 43 | 21 | 3.2 | 0 | 1000 CT | 200K CT | +7 | 5 |
| 44 | 45 * | 3.25 | 0 | 1000/250<br>Split S | 200K CT | +7 | 5 |
| 45 | 16 | 22 | 3 | 1200<br>1500 | 3.2<br>4.0 | +20 | 100 |
| 46 | 20 | 23 | 7 | 1.5K CT | 600 CT | +20 | 100 |
| 47 | 22 | 32 | 7 | 1500 CT<br>1800 CT | 10K CT<br>12K CT | +20 | 100 |
| 48 | 35 * | 25 | 2.5 | 2K/500<br>Split* | 600/150<br>Split* | +20 | 100 |
| 49 | 8 | 10 | 2.2 | 2K CT | 10K | +20 | 100 |
| 50 | 27 | 16 | 2.5 | 4K CT | 600 Split | +20 | 100 |
| 51 | 36 * | 44 | 2.6 | 4K/1K<br>5K/1.25<br>Split | 12.8/3.2<br>16/4<br>Split* | +20 | 100 |
| 52 | 38 * | 63 | 2 | 8K/2K<br>10/2.5K<br>Split | 12.8/3.2<br>16/4<br>Split* | +20 | 100 |
| 53 | 37 * | 30 | .6 | 8K CT S | 600/150<br>Split* | +7 | 50 |
| 54 | 9 | 82 | 2 | 10K | 16 | +20 | 100 |
| 55 | 18 | 79 | 4 | 10K CT<br>12K CT | 3.2<br>4.0 | +20 | 100 |
| 56 | 3 | 55 | 3<br>1.5 | 10K<br>25K | 200<br>500 | +20 | 100 |
| 57 | 39 * | 55 | 3<br>1.5 | 10K/2.5K<br>25K/6.25K<br>Split | 200/50<br>500/125<br>Split* | +20 | 100 |
| 58 | 14 | 33 | 2<br>1 | 10K CT<br>25K CT | 200 CT<br>500 CT | +20 | 100 |
| 59 | 17 | 82 | 2 | 10K<br>12K | 500 CT<br>600 CT | +20 | 100 |
| 60 | 40 * | 82 | 4 | 10K/2.5<br>12K/3.0K<br>Split | 500/125<br>600/150<br>Split | +20 | 100 |
| 61 | 8 | 23 | 1 | 10K | 2K CT | +20 | 100 |
| 62 | 22 | 82 | 4 | 10K CT<br>12K CT | 1500 CT<br>1800 CT | +20 | 100 |
| 63 | 25 | 60 | 1 | 10K CT<br>12K CT | 10K CT<br>12K CT | +20 | 100 |
| 64 | 41 * | 60 | 1 | 10K/2.5K<br>12K/3.0K<br>Split | 10K/2.5K<br>12K/3.0K<br>Split | +20 | 100 |
| 65 | 2 | 13 | .25 | 10K | 90K | +15 | 30 |
| 66 | 7 | 42 | .5 | 20K<br>30K | 800<br>1200 | +20 | 100 |
| 67 | 15 | 42 | 1 | 20K CT<br>30K CT | 800CT<br>1200 CT | +20 | 100 |
| 68 | 42 * | 42 | 1 | 20K/5K<br>30K/7.5K<br>Split | 800/200<br>1200/300<br>Split | +17 | 50 |
| 69 | 4 | 64 | 1 | 30K | 50 | +20 | 100 |
| 70 | 26 | 57 | .5 | 40K CT<br>50K CT | 400/100<br>500/125<br>Split | +20 | 100 |
| 71 | 43 * | 57 | .5 | 40K/10K<br>50K/25K<br>Split | 400/100<br>500/125<br>Split | +20 | 100 |
| 72 | 2 | 38 | — | 90K | 10K | +15 | 30 |
| 73 | 6 | 79 | .5 | 100K | 60 | +20 | 100 |
| 74 | 44 * | 40 | 0 | 100K CT S<br>200K CT | 100/25<br>200/50<br>Split | +7 | 5 |
| 75 | 13 | 48 | 0 | 200K | 1000 | +7 | 5 |
| 76 | 21 | 48 | 0 | 200K CT | 1K CT | +7 | 5 |
| 77 | 45 * | 48 | 0 | 200K CT S | 1K/250<br>Split | +7 | 5 |
| 78 | 1 | 44 | 0 | 250K<br>62.5K | 200<br>50 | +7 | 5 |

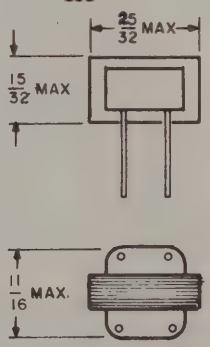
*Available in PCSSO and SSOP Style only.

**SSO-P**



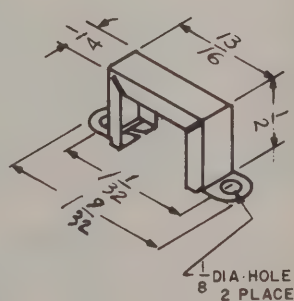

.040 DIA PIN
UP TO 8
.200 APART (TYP.)

**SSO**




WEIGHT - .02 LBS
LEADS: 4" LONG
FINISH: BLACK

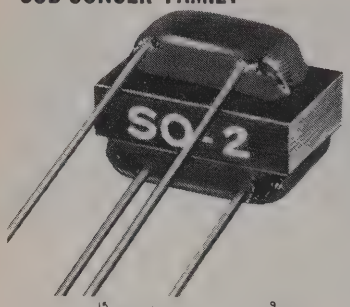
**SSO-CH**

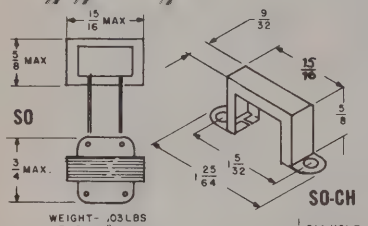


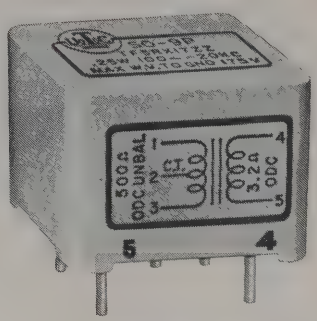
# TRW UTC TRANSFORMERS

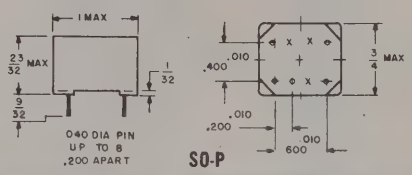
# TRANSFORMERS

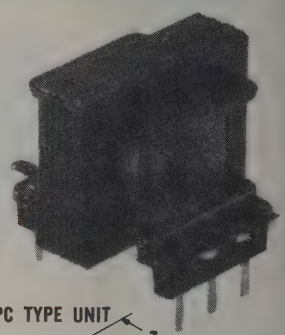
## SUB-OUNCER FAMILY



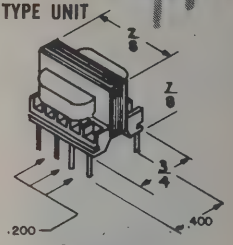



PC TYPE UNIT




| Type No. SO SO-P PC-SO | E.T. Product Millivolt Sec. | Unbal. DC ma In Winding | Input-Matching Impedance Primary (Ohms) | Output-Matching Impedance Secondary (Ohms) | Maximum Level DBM | Maximum Level MW | Series Connected DCR ±25% Ohms In Pri. | Series Connected DCR ±25% Ohms Out Sec. |
|---|---|---|---|---|---|---|---|---|
| 9 | 1.5 | 0 | 3.2 | 500 CT | +24 | 250 | 0.35 | 15 |
| 19 | 3.3 | 60 | 8 split* 16 split* | 250 split 500 split | +24 | 250 | 7 | 23 |
| 10 | 4.6 | 60 | 8 16 | 2000 CT 4000 CT | +24 | 250 | 2 | 290 |
| 14 | 5.2 | 10 | 32 split 40 split | 80 CT 100 CT | +24 | 250 | 3.2 | 4.9 |
| 13 | 5.8 | 2.5 | 40 split 50 split | 400 CT 500 CT | +24 | 250 | 4.5 | 20 |
| 4 | 3.7 | 24 | 50 | 30K | +23 | 200 | 3.8 | 1850 |
| 6 | 3.2 | 20 | 60 | 100K | +23 | 200 | 3.7 | 3400 |
| 14 | 8.3 | 16 | 80 CT 100 CT | 32 split 40 split | +24 | 250 | 4.9 | 3.2 |
| 12 | 10 | 14 | 120 split 150 split | 400 C 500 CT | +24 | 250 | 12.6 | 20 |
| 1 | 1.2 | 0 | 200 50 | 250K 62.5K | +10 | 10 | 2500 | 16 |
| 3 | 10 | 21 10 | 200 500 | 10K 25K | +23 | 200 | 30 | 1225 |
| 19 | 18 | 10 | 250 split* 500 split* | 8 split* 16 split* | +24 | 250 | 23 | .7 |
| 13 | 18 | 8 | 400 CT 500 CT | 40 split 50 split | +24 | 250 | 20 | 4.5 |
| 12 | 18 | 8 | 400 CT 500 CT | 120 split 150 split | +24 | 250 | 20 | 12.5 |
| 11 | 18 | 8 | 400 CT 500 CT | 400 split 500 split | +24 | 250 | 20 | 45 |
| 9 | 19 | 0 | 500 CT | 3.2 | +24 | 250 | 15 | .35 |
| 15 | 23 | 6 | 600 CT | 600 split | +24 | 250 | 35 | 60 |

| Type No. SO SO-P PC-SO | E.T. Product Millivolt Sec. | Unbal. DC ma In Winding | Input-Matching Impedance Primary (Ohms) | Output-Matching Impedance Secondary (Ohms) | Maximum Level DBM | Maximum Level MW | Series Connected DCR ±25% Ohms In Pri. | Series Connected DCR ±25% Ohms Out Sec. |
|---|---|---|---|---|---|---|---|---|
| 20 | 32 | 9 | 600 split† | 10K CT | +23 | 200 | 80 | 1050 |
| 18 | 23 | 9 | 600 split | 50K CT | +24 | 250 | 63 | 2400 |
| 7 | 9.2 | 2.5 | 800 1200 | 20K 30K | +23 | 200 | 32 | 450 |
| 10 | 7.4 | 4 2 | 2K CT 4K CT | 8 16 | +24 | 250 | 290 | 2 |
| 8 | 15 | 2.2 | 2K CT | 10K | +23 | 200 | 40 | 1000 |
| 16 | 46 | 4 | 2500 CT | 2500 split | +24 | 250 | 140 | 300 |
| 3 | 74 | 3 1.5 | 10K 25K | 200 500 | +23 | 200 | 1225 | 30 |
| 20 | 133 | 1 | 10K CT† | 600 split | +23 | 200 | 1050 | 80 |
| 8 | 34 | 1 | 10K | 2000 CT | +23 | 200 | 1000 | 40 |
| 21 | 111 | 1 | 10K CT† 12K CT† | 10K split 12K split | +23 | 200 | 855 | 1080 |
| 2 | 10 | .25 | 10K | 90K | +20 | 100 | 215 | 1850 |
| 7 | 46 | .5 | 20K 30K | 800 1200 | +23 | 200 | 450 | 32 |
| 4 | 91 | 1 | 30K | 50 | +23 | 200 | 1850 | 3.8 |
| 18 | 100 | 1 | 50K CT | 600 split | +24 | 250 | 2400 | 63 |
| 2 | 29 | 0 | 90K | 10K | +20 | 100 | 1850 | 215 |
| 6 | 130 | .5 | 100K | 60 | +23 | 200 | 3400 | 3.7 |
| 1 | 44 | 0 | 250 K 62.5K | 200 50 | +10 | 10 | 2500 | 16 |

† Electrostatic Shield *Bifilar

## INDUCTORS

| | | | |
|---|---|---|---|
| 35 | SO-5 | Inductor, 50 Hys @ 1 maDC, 2675 ohms DC res. | |
| 36 | SO-5P PC-SO5 | Split Inductor | Series: 40 Hys @ 1 maDC, 20 Hys @ 2 maDC, 2675 ohms Parallel: 10 Hys @ 2 maDC, 5 Hys @ 4 maDC, 6700 ohms |
| 37 | SO-17P PC-SO17 | Split Inductor | Series: 16 Hys @ 2 maDC, 8 Hys @ 4 maDC, 1100 ohms Parallel: 4 Hys @ 4 maDC, 2 Hys @ maDC, 275 ohms |

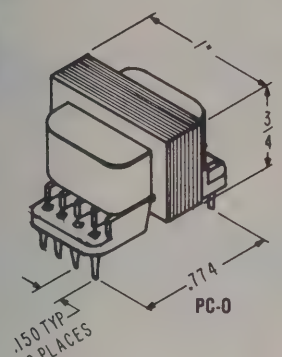
# TRW UTC TRANSFORMERS

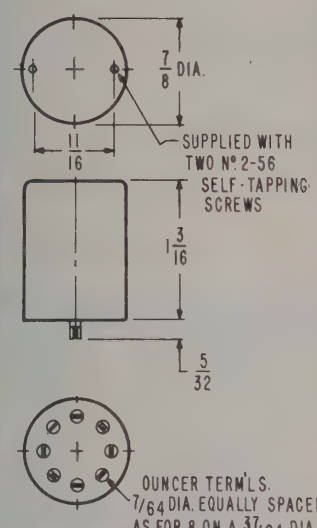


## OUNCER FAMILY (CONTINUED)
## PC-0 LINE

Key

| 0 PC-0 Type | Line |
|---|---|
| 1 | 3 |
| 2 | 4 |
| 3 | 1 |
| 4 | 23 |
| 5 | 24 |
| 6 | 25 |
| 7 | 26 |
| 8 | 21 |
| 9 | 22 |
| 10 | 27 |
| 11 | 28 |
| 12 | 2 |
| 13 | 37 |
| 14 | 5 |
| 15 | 20 |
| 16 | 32 |
| 17 | 38 |
| 18 | 17 |
| 19 | 18 |
| 20 | 13 |
| 21 | 14 |
| 22 | 6 |
| 23 | 35 |
| 24 | 36 |
| 25 | 12 |
| 26 | 19 |
| 27 | 16 |
| 28 | 29 |
| 29 | 30 |
| 30 | 10 |
| 31 | 9 |
| 32 | 7 |
| 33 | 8 |
| 34 | 34 |
| 35 | 11 |
| 36 | 33 |
| 37 | 15 |
| 38 | 31 |





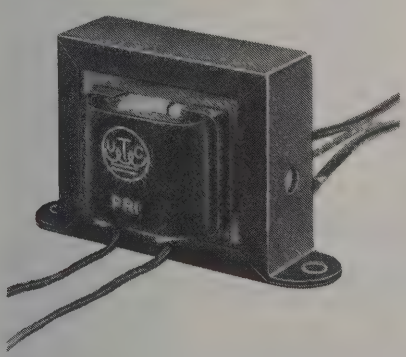


**STANDARD "O" LINE UNIT**

| Line | Type 0/ PC-0 | Primary Matching Impedance (Ohms) | Unbal. DC M.A. | Secondary Matching Impedance (Ohms) | Maximum Level DBM | Maximum Level M.W. |
|---|---|---|---|---|---|---|
| 1 | 3 | 7.5/30 | 0 | 50K | +8 | 6.3 |
| 2 | 12 | 50, 200/250 | 0 | 50, 200/259 500/600 | +8 | 6.3 |
| 3 | 1 | 50, 200/250 500/600 | 0 | 50K | +8 | 6.3 |
| 4 | 2 | 50, 200/250 500/600 | 0 | 50K CT | +8 | 6.3 |
| 5 | 14 | 200 | 0 | ½ Megohm | +8 | 6.3 |
| 6 | 22 | 400 CT 500 CT | 20 | 3.2 4 | +30 | 1W |
| 7 | 32 | 500/125 Split | 20 | 50/12.5 Split | +30 | 1W |
| 8 | 33 | 500/125 Split | 40 | 50/12.5 Split | +30 | 1W |
| 9 | 31 | 500/125 Split | 20 | 150/37.5 Split | +30 | 1W |
| 10 | 30 | 500/125 Split | 20 | 500/125 Split | +30 | 1W |
| 11 | 35 | Hybrid 600 | 0 | 600 CT 600 CT | +24 | 250 |
| 12 | 25 | 600/150 Split | 0 | 2K/500 Split | +15 | 30 |
| 13 | 20 | 1500 CT | 8 | 500/125 Split | +20 | 100 |
| 14 | 21 | 2000 CT 4000 CT | 4 | 8 16 | +20 | 100 |
| 15 | 37 | 4K/1K Split | 4 | 600/150 Split | +30 | 1W |
| 16 | 27 | 10K CT | 4 | 500/125 Split | +20 | 100 |
| 17 | 18 | 10/2.5K Split | 4 | 2K/500 Split | +20 | 100 |
| 18 | 19 | 10/2.5K Split | 4 | 4K/1K Split | +20 | 100 |
| 19 | 26 | 10K CT | 4 | 10K CT | +20 | 100 |
| 20 | 15 | 10K | 0 | 1 Megohm | +8 | 6.3 |
| 21 | 8 | 15K | 0 | 50, 200/250 500/600 | +8 | 6.3 |
| 22 | 9 | 15K | 4 | 50, 200/250 500/600 | +8 | 6.3 |
| 23 | 4 | 15K | 0 | 60K | +8 | 6.3 |

| Line | Type 0/ PC-0 | Primary Matching Impedance (Ohms) | Unbal. DC M.A. | Secondary Matching Impedance (Ohms) | Maximum Level DBM | Maximum Level M.W. |
|---|---|---|---|---|---|---|
| 24 | 5 | 15K | 4 | 60K | +8 | 6.3 |
| 25 | 6 | 15K | 0 | 95K CT | +8 | 6.3 |
| 26 | 7 | 15K | 4 | 95K CT | +8 | 6.3 |
| 27 | 10 | 30K CT | 0 | 50, 200/250 500/600 | +8 | 6.3 |
| 28 | 11 | 50K | 0 | 50, 200/250 500/600 | +8 | 6.3 |
| 29 | 28 | 50K CT | 2 | 500/125 Split | +20 | 100 |
| 30 | 29 | 100K CT | 1 | 500/125 Split | +20 | 100 |
| 31 | 38 | Autotransformer Speaker Matching | | 0, 4, 8, 16.0 DC | +30 | 1W |
| 32 | 16 * | Low Imp. to Grid | | 250 CT | — | 1W |
| | | Uses two heavy gauge hipermalloy shields for very low hum pick-up plus orientable mounting. Primary CT is balanced to 1% can be used for 150, 200, 250, 500 or 600 ohm source — 200:1 imped. ratio, 3 oz. | | | | |
| 33 | 36 | Split Inductor | | Series Connection: 1 Hy, 200 MADC, 60 Ohms Parallel Connection: 25 Hy, 40 MADC, 15 Ohms | | |
| 34 | 34 | Split Inductor | | Series Connection: 60 Mhy, 80 MADC, 4 Ohms Parallel Connection: 15 Mhy, 160 MADC, 1 Ohm | | |
| 35 | 23 | Inductor | | 7 Hys @ 3 MADC, 3.5 Hys @ 10 MADC, 230 Ohms | | |
| 36 | 24 | Inductor | | 1.6 Hys @ 3 MADC, 8 Hys @ 10 MADC, 25 Ohms | | |
| 37 | 13 | Inductor | | 300 Hys @ 0 DC, 50 Hys @ 3 MADC, 600 Ohms | | |
| 38 | 17 | Hipermalloy shield, split fit over Ouncer, 1" O. dia. provides 25 db shielding. | | | | |

*Not available in PC Style.



**PACKAGING** High lustre black enamel.

**APPLICATION** Industrial type. Primary 117 V 50/60 Hz.

**CONSTRUCTION** Designed for low temp. rise. Vacuum sealed against humidity. Special impregnation prevents corrosion and electrolysis.

### CHANNEL FRAME FILAMENT/TRANSISTOR TRANSFORMERS

**Primary 115 V 50/60 Hz — Test Volts RMS: 1500**

| Type No. | Secondary | W | D | H | M | Lbs. |
|---|---|---|---|---|---|---|
| FT-1 | 2.5 VCT-3A | 2⅞ | 1⅝ | 1 11/16 | 2⅜ | ¾ |
| FT-2 | 6.3 VCT-1.2A | 2⅞ | 1⅝ | 1 11/16 | 2⅜ | ¾ |
| FT-3 | 2.5 VCT-6A | 3 5/16 | 1⅞ | 2 | 2 13/16 | 1 |
| FT-4 | 6.3 VCT-3A | 3 5/16 | 1⅞ | 2 | 2 13/16 | 1 |
| FT-6 | 5 VCT-3A | 3¾ | 2⅛ | 2 5/16 | 3⅛ | 1½ |
| FT-7 | 7.5 VCT-3A | 3¾ | 2⅛ | 2 5/16 | 3⅛ | 1½ |
| FT-8 | 6.3 VCT-8A | 4 | 2½ | 2⅝ | 3 5/16 | 2½ |
| FT-10 | 25 VCT-2A or 12 V-4A | 4 | 2⅝ | 2 11/16 | 3 5/16 | 2½ |
| FT-11 | 24 VCT-1A or 12 V-2A | 3¾ | 2⅛ | 2 5/16 | 3⅛ | 1½ |
| FT-12 | 36 VCT-1.3A or 18 V-2.6A | 4 | 2⅝ | 2⅝ | 3 5/16 | 2½ |

**Taps on primary of FT-13, FT-14, FT-15 and FT-16 to modify secondary nominal V, −6%, +6%, +12%**

| | | | | | | |
|---|---|---|---|---|---|---|
| FT-13 | 26 VCT-.04A | 2⅛ | 1⅜ | 1¼ | 1¾ | ¼ |
| FT-14 | 26 VCT-.25A | 2⅞ | 1⅝ | 1 11/16 | 2⅜ | ¾ |
| FT-15 | 48 VCT-1A | 4 | 2½ | 2⅝ | 3 5/16 | 2½ |
| FT-16* | 11 VCT-2.5A or 5.5 V-5A | 3¾ | 2⅛ | 2 5/16 | 3⅛ | 1½ |

*For 120 V input, use −6% tap.

# TRW UTC TRANSFORMERS

# TRANSFORMERS

## ULTRA-COMPACT AUDIO UNITS

**TYPE A CASE**
Length .....1½″
Width .....1½″
Height .....2″
Mounting .....1⅝″ sq.
Screws .....4-40
Cutout .....1⅜″ dia.
Unit Weight .....½ lb.

**PACKAGING** High quality rugged die cast zinc alloy case with both top and bottom mounting facilities. Asterisked items (see Type No.) have multiple alloy shield.

**APPLICATIONS** Compact amplifiers and equipments.

**APPLICATION NOTE** Included in line are filament/transistor supply units.

**NOTE** All units except those carrying DC in primary employ a true hum bucking coil structure, which provides electrical balance and effects good inductive shielding.

### INPUT AND MATCHING TRANSFORMERS

| Type No. | Application | Primary Impedance (Ohms) | Unbalanced DC | Secondary Impedance (Ohms) | Response ±2 db (Hz) | Pri. Res. (Ohms) | Max. Level dbm | Max. Level MW |
|---|---|---|---|---|---|---|---|---|
| A-10 | Low imp. to grid | 50, 125/150, 200/250, 333, 500/600 | 0 | 50,000 (split) | 20-20,000 | 59 | +15 | 30 |
| A-11* | Low imp. to 1 or 2 grids | 50, 200, 500 | 0 | 50,000CT | 20-20,000 | 52 | + 5 | 3 |
| A-12 | Low imp. to PP grids | 50, 125/150, 200/250, 333, 500/600 | 0 | 80,000 (split) | 20-20,000 | 60 | +15 | 30 |
| A-20† | Mixing, matching | 50, 125/150, 200/250, 333, 500/600 | 0 | 50, 125/150, 200/250, 333, 500/600 | 10-50,000 | 64 | +15 | 30 |
| A-21*† | Mixing, matching | 50, 200/250, 500/600 | 0 | 50, 200/250, 500/600 | 30-30,000 | 28 | +15 | 30 |
| A-27 | Xtal/hi. imp. to line | 100,000 (split) | 0 | 50, 125/150, 200/250, 333, 500/600 | 30-20,000 meas. with res. source | 3700 | +15 | 30 |
| A-39* | Line to transistor | 600/150 (split) | 0 | 2000/500 (split) | 20-20,000 | 70 | +10 | 10 |
| A-43† | Mixing, matching line or transistor to 2 simultaneously loaded lines or transistors | 600/150 (split) | 0 | 2 secondaries each 600/150 (split) | 20-30,000 | 45 | +15 | 30 |

* = Multiple alloy shield for extremely low hum pick-up. † = High electrostatic shielding.

### INTERSTAGE AND OUTPUT TRANSFORMERS

| Type No. | Application | Primary Impedance (Ohms) | Unbalanced DC | Secondary Impedance (Ohms) | Response ±2 db (Hz) | Pri. Res. (Ohms) | Max. Level dbm | Max. Level MW |
|---|---|---|---|---|---|---|---|---|
| A-15 | Transistor interstage | 10,000/2500 (split) | 8 ma | 2000/500 (split) | 40-20,000 | 600 | — | 1w |
| A-16 | Plate to grid | 15,000 | 0 | 60,000 | 20-20,000 | 800 | +15 | 30 |
| A-18 | Single or PP plates to PP grids | 15,000 (split) | 0 | 80,000 (split) | 20-20,000 | 1040 | +15 | 30 |
| A-19 | Plate to PP grids | 15,000 | 8 ma | 80,000 (split) | 40-20,000 | 2900 | +15 | 30 |
| A-22 | Tr. interstage or output | 500 CT | 20 ma | 500/125 (split) | 40-20,000 | 36 | — | 1w |
| A-23 | Tr. interstage or output | 500 CT | 20 ma | 16/4 (split) | 40-20,000 | 36 | — | 1w |
| A-24 | Single or PP plates to line | 15,000 (split) | 0 | 50, 125/150, 200/250, 333, 500/600 | 20-40,000 | 1430 | +15 | 30 |
| A-25 | Plate to line | 15,000 | 8 ma | 50, 125/150, 200/250, 333, 500/600 | 40-20,000 | 1580 | +15 | 30 |
| A-26 | Single or PP plates to line | 30,000 (split) | 0 | 50, 125/150, 200/250, 333, 500/600 | 20-40,000 | 2520 | +15 | 30 |
| A-28 | Transistor to V.C. | 48 CT | 750 ma Bal | 16 (split) 8, 4 | 40-20,000 | 5 | — | 5w |
| A-34 | Transistor interstage | 25,000/6250 (split) | 3 ma | 500/125 (split) | 30-20,000 | 1620 | — | 1w |
| A-35 | Transistor interstage | 10,000/2500 (split) | 8 ma | 500/125 (split) | 30-20,000 | 610 | — | 1w |
| A-36 | Transistor interstage | 500/125 (split) | 20 ma | 150/37.5 (split) | 40-20,000 | 36 | — | 1w |
| A-37 | Transistor interstage | 500/125 (split) | 20 ma | 50/12.5 (split) | 40-20,000 | 36 | — | 1w |
| A-38 | Transistor interstage | 100/25 (split) | 40 ma | 40/10 (split) | 40-20,000 | 6.2 | — | 1w |
| A-44 | Tr. interstage or output | 4K/1K (split) | 12 ma | 600/150 (split) | 30-20,000 | 310 | — | 1w |

### SPECIAL APPLICATION TRANSFORMERS

| Type No. | Application | Pri. Imp. Ohms | Unbal. DC | ±2 db From | Pri. Res. Ohms | Max. Level |
|---|---|---|---|---|---|---|
| A-45 | Autotransformer, speaker matching | 4, 8, 16 | 0 | 40 Hz/20 kHz | 1.2 | 1w @ 40 Hz; 4w @ 80 Hz |

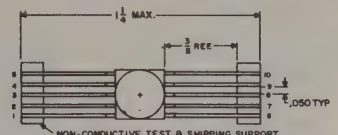
| Type No. | Application | Pri. Imp. Ohms | Unbal. DC | Sec. Imp. Ohms | ±2 db From | Pri. Res. Ohms | Max. Level |
|---|---|---|---|---|---|---|---|
| A-47 | Hybrid transformer 3 balanced windings CT | 500/600 CT | 0 | 500/600 CT<br>500/600 CT | 40 Hz/20 kHz | 39 | +10 dbm, 10 mw |

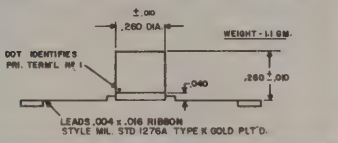
| Type No. | Application | Pri. Imp. Ohms | Unbal. DC | Sec. Imp. Ohms | ±2 db From | Max. Level |
|---|---|---|---|---|---|---|
| A-48 | "2 wire to 4 wire" hybrid circuit. Two transformers in one case for hybrid circuit use. Includes electromagnetic shielding. Hybrid circuit will provide 60 db minimum circuit isolation. | 500/600 | 0 | 500/600<br>500/600<br>} 2 wdgs. plus winding for balance loading. | 40 Hz/20 kHz | +10 dbm, 10 mw |

# TRW UTC TRANSFORMERS — TRANSFORMERS

## THE BIT-250™ LINE-A COMPLETELY NEW DEVELOPMENT IN TRANSFORMER TECHNOLOGY

BIT-250 ACTUAL SIZE



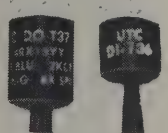

### INDUCTORS

| BIT-250 Type No. | MIL Type | Connections | Inductance Hys Min @ 1 kHz 5 V | @ ma DC | DC Res Ω | Ratio of Wdgs. |
|---|---|---|---|---|---|---|
| BIT-250-03 (2 Wdgs) | TF5R20ZZ | Series | 8.6<br>2.5 | 0<br>2 | 2260 | 1:1 |
| | | Parallel | 2.4<br>.63 | 0<br>4 | 565 | |
| BIT-250-05 (1 Wdg) | TF5R20ZZ | | 5.5<br>1.5 | 0<br>2 | 1000 | |
| BIT-250-06 (1 Wdg) | TF5R20ZZ | | .80<br>.25 | 1<br>6 | 250 | |
| BIT-250-09 (2 Wdgs) | TF5R20ZZ | Series | .60<br>.15 | 0<br>5 | 146 | 1:1 |
| | | Parallel | .15<br>.038 | 0<br>10 | 37 | |

### TRANSFORMERS

| BIT-250 Type No. | MIL Type | Pri Imp Ω (CT) | Sec Imp Ω (Split Wdg) Series/ Par | Power Level mW for 5% Max Dist @ 1 kHz | Pri DCR Ω | (Series Conn.) Sec DCR Ω | Turns Ratio Pri/ Sec/ Sec | Turns Ratio Pri/ Overall Sec | Typical Application |
|---|---|---|---|---|---|---|---|---|---|
| BIT-250-14 | TF5R21ZZ | 150 | 12/3 | 80 | 16 | 1.85 | 7.1:1:1 | 3.54:1 | Output |
| BIT-250-18 | TF5R21ZZ | 300 | 600/150 | 80 | 30 | 65 | 1.4:1:1 | 1:1.4 | Output or Matching |
| BIT-250-20 | TF5R21ZZ | 400 | 400/100 | 80 | 45 | 45 | 2:1:1 | 1:1 | Matching or Interstage |
| BIT-250-26 | TF5R21ZZ | 500 | 50/12.5 | 80 | 58 | 5.5 | 6.32:1:1 | 3.16:1:1 | Output |
| BIT-250-30 | TF5R21ZZ | 600 | 600/150 | 80 | 65 | 65 | 2:1:1 | 1:1 | Isolation or Matching |
| BIT-250-36 | TF5R21ZZ | 1000 | 1000/250 | 80 | 110 | 100 | 2:1:1 | 1:1 | Output or Matching |
| BIT-250-40 | TF5R21ZZ | 1500 | 600/150 | 75 | 150 | 65 | 3.16:1:1 | 1.58:1 | Output |
| BIT-250-48 | TF5R21ZZ | 2000 | 8000/2000 | 75 | 177 | 745 | 1:1:1 | 1:2 | Isolation or Interstage |
| BIT-250-56 | TF5R21ZZ | 10K | 500/125 | 75 | 900 | 45 | 8.92:1:1 | 4.46:1 | Output or Driver |
| BIT-250-60 | TF5R21ZZ | 10K | 1200/300 | 75 | 900 | 100 | 5.78:1:1 | 2.89:1 | Driver |
| BIT-250-64 | TF5R21ZZ | 10K | 2000/500 | 75 | 900 | 160 | 4.48:1:1 | 2.24:1 | Interstage |
| BIT-250-70 | TF5R21ZZ | 10K | 10K/2500 | 75 | 900 | 750 | 2:1:1 | 1:1 | Isolation or Interstage |
| BIT-250-90 | TF5R21ZZ | 25K | 1000/250 | 40 | 2400 | 78 | 10:1:1 | 5:1 | Interstage |

## TRANSISTOR TRANSFORMERS
## DO-T* AND DI-T*



DO-T (Actual Size) DI-T

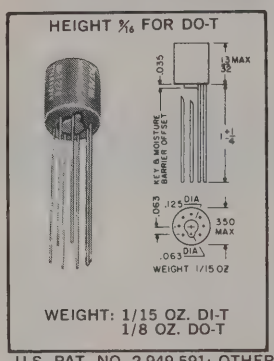
Revolutionary transistor transformers hermetically sealed to MIL-T-27C specs. Plastic insulated solderable leads, firmly anchored to withstand 10 pound pull. Ideal for printed circuits. DO-T: 5/16" dia. x 13/32" long, wt., 1/10 oz. DI-T: 5/16" dia. x 1/4" long, wt., 1/15 oz. These compact units provide frequency response, high efficiency and low distortion. U.S. Pat. No. 2,949,591.

| DO-T Type | DI-T Type | Application | Primary Impedance (Ohms) | Secondary Impedance (Ohms) |
|---|---|---|---|---|
| DO-T1 | DI-T1 | a | 20K/30K, 0.5 MA | 800/1200 |
| DO-T2 | DI-T2 | b | 500/600, 3 MA | 50/60 |
| DO-T3 | DI-T3 | b | 1K/1.2K, 3 MA | 50/60 |
| DO-T4 | — | b | 600, 3 MA | 3.2 |
| DO-T5 | DI-T5 | b | 1.2K, 2 MA | 3.2 |
| DO-T6 | — | b | 10K, 1 MA | 3.2 |
| DO-T7 | — | c | 200K | 1K |
| DO-T8 | DI-T8 | d• | 3.5 Hys @ 2 MA | 2.5 Hys‡‡ |
| DO-T9 | DI-T9 | e | 10K/12K, 1 MA | 500/600 CT |
| DO-T10 | DI-T10 | f | 10K/12.5K, 1 MA | 1.2K/1.5K CT |
| DO-T11 | DI-T11 | f | 10K/12.5K, 1 MA | 2K/2.5K CT |
| DO-T12 | — | b | 150/200 CT, 10 MA | 12/16 |
| DO-T13 | — | b | 300/400 CT, 7 MA | 12/16 |
| DO-T14 | — | b | 600/800 CT, 5 MA | 12/16 |
| DO-T15 | — | b | 800/1070 CT, 4 MA | 12/16 |
| DO-T16 | — | b | 1l'/1330 CT, 3.5 MA | 12/16 |
| DO-T17 | — | b | 1.5K/2K CT, 3 MA | 12/16 |
| DO-T18 | — | b | 7.5K/10K CT, 1 MA | 12/16 |
| DO-T19 | DI-T19 | b | 300 CT, 7 MA | 600 |
| DO-T20 | DI-T20 | b | 500 CT, 5.5 MA | 600 |
| DO-T21 | DI-T21 | b | 900 CT, 4 MA | 600 |
| DO-T22 | DI-T22 | b | 1500 CT, 3 MA | 600 |
| DO-T23 | DI-T23 | a | 20K/30K CT, .5 MA | 0.8K/1.2K CT |
| DO-T24 | — | c | 200K CT | 1K CT |
| DO-T25 | DI-T25 | a | 10K/12K CT, 1 MA | 1.5K/1.8K CT |
| DO-T26 | DI-T26 | d† | 6 Hys @ 2 MA | 4.5 Hys‡‡ |
| DO-T27 | DI-T27 | d‡ | 1.25 Hys @ 2 MA | 0.9 Hy‡‡ |
| DO-T28 | DI-T28 | d§ | 0.3 Hy @ 4 MA | 0.1 Hy‡‡ |
| DO-T29 | — | b | 120/150 CT, 10 MA | 3.2/4 |
| DO-T30 | — | b | 320/400 CT, 7 MA | 3.2/4 |
| DO-T31 | — | b | 640/800 CT, 5 MA | 3.2/4 |
| DO-T32 | — | b | 800/1K CT, 4 MA | 3.2/4 |
| DO-T33 | — | b | 1060/1330 CT, 3.5 MA | 3.2/4 |
| DO-T34 | — | b | 1.6K/2K CT, 3 MA | 3.2/4 |
| DO-T35 | — | b | 8K/10K CT, 1 MA | 3.2/4 |
| DO-T36 | DI-T36 | a | 10K/12K CT, 1 MA | 10K/12K CT |
| DO-T37 | DI-T37 | a | 2K/2.5K CT, 3 MA | 8K/10K Split |
| DO-T38 | DI-T38 | a | 10K/12K CT, - MA | 2K/2.4K Split |
| DO-T39 | — | a | 20K/30K CT, .5 MA | 1K/1.5K Split |
| DO-T40 | — | a | 40K/50K CT, .25 MA | 400/500 Split |
| DO-T41 | DI-T41 | a | 400/500 CT, 8/6 MA | 400/500 Split |
| DO-T42 | — | a | 400/500 CT, 8/6 MA | 120/150 Split |
| DO-T43 | DI-T43 | a | 400/500 CT, 8/6 MA | 40/50 Split |
| DO-T44 | DI-T44 | a | 80/100 CT, 12/10 MA | 32/40 Split |
| DO-T45 | — | a | 1K/1.25K CT, 3.5 MA | 16K/20K Split |
| DO-T46 | — | c | 100K CT | 500 CT |
| DO-T47 | — | a | 9K10K, 1 MA | 9K/10K CT |
| DO-T48 | — | a | 8K/10K, 1 MA | 1.2K/1.5K CT |
| DO-T49 | — | d§§ | Series: 20 Hys @ 1 MA, 5100Ω<br>Parallel: 5 Hys @ 2 MA, 1275Ω | |
| DO-T50 | — | d§§ | Series: .075 Hys @ 10 MA, 10.5Ω<br>Parallel: .018 Hys @ 20 MA, 2.6Ω | |
| DO-T51 | DI-T51 | a | 2K/2.5K CT, 3 MA | 2K/2.5K Split |
| DO-T52 | DI-T52 | a | 4K/5K CT, 2 MA | 8K/10K CT |
| DO-T53 | DI-T53 | | 400/500 CT, 8 MA | 4K/5K CT |
| DO-T54 | — | | 40K/50K CT, .25 MA | 4K/5K CT |
| DO-T55 | DI-T55 | a | 600 CT, 4 MA | 600 CT |
| DO-T400 | — | h | 28 V, 380-1 kHz | 6.3 V, 60 MA |
| DO-T410 | — | h | 28 V, 380-1 kHz | Two 6.3 V, 30 MA |
| DO-T420 | — | h | 28 V, 380-1 kHz | 28 V, 10 MA |
| DO-TSH | DI-TSH | | High MU shield and cover; 25 db | |

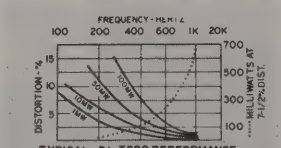
•630 ohms. † 2100 ohms. ‡100 ohms. §25 ohms.
‡‡DI-T primary impedance. §§2 Wdgs.
a-Interstage; b-Output; c-Input; d-Inductor; e-Driver or Output; f-Driver; g-Matching; h-Power Unit.

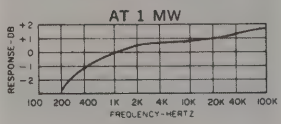
# TRW UTC TRANSFORMERS — TRANSFORMERS

## DO-T200 AND DI-T200 SERIES TRANSFORMERS AND INDUCTORS




WEIGHT: 1/15 OZ. DI-T
1/8 OZ. DO-T




**PACKAGING** Metal encased. DO-T family unit. See page 10.

**MIL SPECS** To complete MIL-T-27D Specs. Ruggedized, metal encased to MIL Grade 5, Class R. See pages 80, 81.

**FREQUENCY RESPONSE** At 1 mw ±3 db, 300 Hz to 20 kHz, DO Type; ±3 db, 400 Hz to 100 kHz, DI Type.

**TERMINALS** Leads are .016 Dumet wire, gold plated, and may be either welded or soldered. They are uninsulated and are spaced on a .1" radius circle, conforming to the termination pattern of the "TO-76" cased semiconductors and micrologic elements.

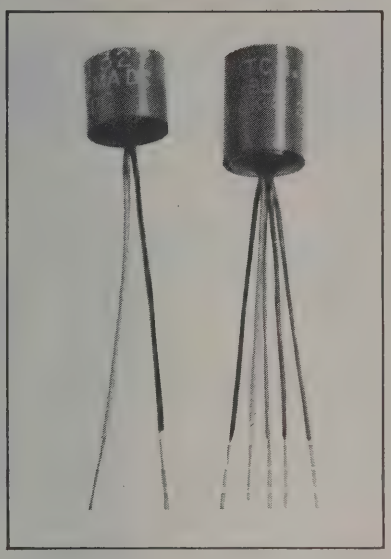
U.S. PAT. NO. 2,949,591: OTHERS PENDING.

| Type No. | MIL Type | Pri. Imp. Ω | ma D.C.† In Pri. | Sec. Imp. Ω | Pri. DCR Ω | mw Level* | Application |
|---|---|---|---|---|---|---|---|
| DO-T255 | TF5R21ZZ | 1000 CT<br>1200 CT | 3<br>3 | 50<br>60 | 115 | 100 | Output or matching |
| DO-T275 | TF5R21ZZ | 10,000 CT<br>12,000 CT | 1<br>1 | 1500 CT<br>1800 CT | 780 | 100 | Interstage |
| DO-T277 | TF5R21ZZ | 10,000 CT<br>12,000 CT | 1<br>1 | 2000 split<br>2400 split | 560 | 100 | Interstage |
| DO-T278 | TF5R21ZZ | 10,000<br>12,500 | 1<br>1 | 2000 CT<br>2500 CT | 780 | 100 | Driver |
| DO-T283 | TF5R21ZZ | 10,000 CT<br>12,000 CT | 1<br>1 | 10,000 CT<br>12,000 CT | 975 | 100 | Isolation or Interstage (Ratio 1:1) also pulse application |
| DO-T288 | TF5R21ZZ | 20,000 CT<br>30,000 CT | .5<br>.5 | 800 CT<br>1200 CT | 830 | 50 | Interstage |
| DO-T297 | TF5R21ZZ | 200,000 CT | 0 | 1000 CT | 8500 | 25 | Input and Chopper |
| DO-T200SH | Drawn Hipermalloy shield provides 15 to 20 db shielding through side of case, 37/64 h x 3/8" dia, no cover | | | | | | |
| DI-T225 | TF5R21ZZ | 80 CT<br>100 CT | 12<br>10 | 32 split<br>40 split | 11.5 | 500 | Interstage |
| DI-T230 | TF5R21ZZ | 300 CT | 7 | 600 CT | 20 | 500 | Output or line to line or matching |
| DI-T235 | TF5R21ZZ | 400 CT<br>500 CT | 8<br>6 | 40 split<br>50 split | 50 | 500 | Interstage |
| DI-T240 | TF5R21ZZ | 400 CT<br>500 CT | 8<br>6 | 400 split<br>500 split | 50 | 500 | Interstage or output (Ratio 2:1:1) also wide pulse application |
| DI-T245 | TF5R21ZZ | 500 CT<br>600 CT | 3<br>3 | 50 CT<br>60 CT | 65 | 500 | Output or matching |
| DI-T250 | TF5R21ZZ | 500 CT | 5.5 | 600 CT | 32 | 500 | Output or line to line or mixing or matching |
| DI-T255 | TF5R21ZZ | 1000 CT<br>1200 CT | 3<br>3 | 50 CT<br>60 CT | 110 | 500 | Output or matching |
| DI-T260 | TF5R21ZZ | 1500 CT | 3 | 600 CT | 87 | 500 | Output to line or matching |
| DI-T265 | TF5R21ZZ | 2000 CT<br>2500 CT | 3<br>3 | 8000 split<br>10,000 split | 180 | 100 | Isol. or interstage (Ratio 1:1:1) also wide pulse application |
| DI-T270 | TF5R21ZZ | 10,000 CT<br>12,000 CT | 1<br>1 | 500 CT<br>600 CT | 870 | 100 | Output or driver |
| DI-T273 | TF5R21ZZ | 10,000 CT<br>12,500 CT | 1<br>1 | 1200 CT<br>1500 CT | 870 | 100 | Output or driver |
| DI-T276 | TF5R21ZZ | 10,000 CT<br>12,000 CT | 1<br>1 | 2000 CT<br>2400 CT | 870 | 100 | Interstage or driver |
| DI-T278 | TF5R21ZZ | 10,000 CT<br>12,500 CT | 1<br>1 | 2000 split<br>2500 split | 620 | 100 | Interstage or driver |
| DI-T283 | TF5R21ZZ | 10,000 CT<br>12,000 CT | 1<br>1 | 10,000 CT<br>12,000 CT | 970 | 100 | Isol. or interstage (Ratio 1:1) also wide pulse application |
| DI-T288 | TF5R21ZZ | 20,000 CT<br>30,000 CT | .5<br>.5 | 800 CT<br>1200 CT | 815 | 50 | Interstage or driver |
| DI-T290 | TF5R21ZZ | 600 CT | 4 | 600 CT | 47 | 500 | Isol. or interstage (Ratio 1:1) also wide pulse application |
| DI-T204 | TF5R20ZZ | Split Inductor (2 wdgs) | | Series connected: .1 Hy @ 4 ma DC, .08 Hy @ 10 ma DC, DCR 25 ohms<br>Parallel connected: .025 Hy @ 8 ma DC, .02 Hy @ 20 ma DC, DCR 6 ohms | | | |
| DI-T208 | TF5R20ZZ | Split Inductor (2 wdgs) | | Series connected: .9 Hy @ 2 ma DC, .5 Hy @ 6 ma DC, DCR 105 ohms<br>Parallel connected: .2 Hy @ 4 ma DC, .1 Hy @ 12 ma DC, DCR 26 ohms | | | |
| DI-T212 | TF5R20ZZ | Split Inductor (2 wdgs) | | Series connected: 2.5 Hys @ 2 ma DC, .9 Hy @ 4 ma DC, DCR 630 ohms<br>Parallel connected: .6 Hy @ 4 ma DC, .2 Hy @ 8 ma DC, DCR 157 ohms | | | |
| DI-T216 | TF5R20ZZ | Split Inductor (2 wdgs) | | Series connected: 4.5 Hys @ 2 ma DC, 1.2 Hys @ 4 ma DC, DCR 2300 ohms<br>Parallel connected: 1.1 Hys @ 4 ma DC, .3 Hy @ 8 ma DC, DCR 575 ohms | | | |
| DI-T200SH | Drawn Hipermalloy shield provides 15 to 20 db shielding through side of case, 27/64 h x 3/8" dia, no cover | | | | | | |

* For 5% maximum distortion @ 1 kHz.
† ma DC shown is for single ended usage. For push-pull, ma DC can be any balanced value taken by .5W transistors. Where windings are listed as split, ¼ of the listed impedance is available by paralleling the winding.

# TRW UTC TRANSFORMERS — TRANSFORMERS

## I-DOT™ AND I-DIT™ TRANSFORMERS AND INDUCTORS



### TRANSFORMERS

| I-DO-T Type No. | Pri. Pulse Voltage Time-Product Millivolt Sec. | Pri. Imp. | Unbal. DC ma in Pri. | Sec. Imp. (Split*) | P. Max. in mw @ 1 kHz 5% Dist. | DCR ±25% Pri. | DCR ±25% Sec. Ser. Conn. | Turns Ratio ±3% Pri. | Turns Ratio ±3% Sec. Ser. Conn. |
|---|---|---|---|---|---|---|---|---|---|
| 101 | 27.0 | 20K/30K | .5 | 800/1200 | 50 | 830 | 115 | 5 | 1 |
| 102 | 4.3 | 500/600 | 3 | 50/60 | 100 | 60 | 8 | 3.16 | 1 |
| 103 | 6.0 | 1K/1.2K | 3 | 50/60 | 100 | 115 | 8 | 4.46 | 1 |
| 104 | 4.7 | 600 | 3 | 3.2 | 100 | 60 | .58 | 13.7 | 1 |
| 105 | 6.7 | 1200 | 2 | 3.2 | 100 | 105 | .58 | 19.35 | 1 |
| 106 | 19.0 | 10K | 1 | 3.2 | 100 | 790 | .68 | 55.7 | 1 |
| 107 | 43.0 | 200K | 0 | 1K | 25 | 8500 | 100 | 14.14 | 1 |
| 108 | See Inductors | | | | | | | | |
| 109 | 19.0 | 10K/12K | 1 | 500/600 CT | 100 | 780 | 50 | 4.48 | 1 |
| 110 | 19.0 | 10K-12.5K | 1 | 1200/1500 CT | 100 | 780 | 115 | 2.89 | 1 |
| 111 | 19.0 | 10K-12.5K | 1 | 2000/2500 CT | 100 | 780 | 190 | 2.24 | 1 |
| 112 | 2.3 | 150/200 CT | 10 | 12/16 | 500 | 11 | 1.5 | 3.54 | 1 |
| 113 | 3.3 | 300/400 CT | 7 | 12/16 | 500 | 20 | 1.63 | 5 | 1 |
| 114 | 5.1 | 600/800 CT | 5 | 12/16 | 500 | 43 | 1.5 | 7.07 | 1 |
| 115 | 5.4 | 800/1070 CT | 4 | 12/16 | 500 | 51 | 1.5 | 8.15 | 1 |
| 116 | 6.0 | 1K/1.33K | 3.5 | 12/16 | 500 | 71 | 1.5 | 9.15 | 1 |
| 117 | 7.5 | 1.5K/2K CT | 3 | 12/16 | 500 | 108 | 1.5 | 11.2 | 1 |
| 118 | 16.0 | 7.5K/10K CT | 1 | 12/16 | 100 | 505 | 1.6 | 25 | 1 |
| 119 | 3.3 | 300 CT | 7 | 600 | 500 | 19 | 89 | 1 | 1.41 |
| 120 | 4.3 | 500 CT | 5.5 | 600 | 500 | 31 | 90 | 1 | 1.1 |
| 121 | 5.8 | 900 CT | 4 | 600 | 500 | 53 | 89 | 1.22 | 1 |
| 122 | 7.5 | 1.5K CT | 3 | 600 | 500 | 85 | 89 | 1.58 | 1 |
| 123 | 27.0 | 20K/30K CT | .5 | 800/1200 CT | 50 | 830 | 115 | 5 | 1 |
| 124 | 43.0 | 200K CT | 0 | 1K CT | 25 | 8500 | 100 | 14.14 | 1 |
| 125 | 7.5 | 10K/12K CT | 1 | 1500/1800 CT | 100 | 780 | 126 | 2.58 | 1 |
| 126 | | | | | | | | | |
| 127 | See Inductors | | | | | | | | |
| 128 | | | | | | | | | |
| 129 | 2.0 | 120/150 CT | 10 | 3.2/4 | 500 | 10 | .46 | 6.12 | 1 |
| 130 | 3.4 | 320/400 CT | 7 | 3.2/4 | 500 | 20 | .46 | 10 | 1 |
| 131 | 5.2 | 640/800 CT | 5 | 3.2/4 | 500 | 43 | .46 | 14.1 | 1 |
| 132 | 5.4 | 800/1000 CT | 4 | 3.2/4 | 500 | 51 | .46 | 15.8 | 1 |
| 133 | 6.0 | 1060/1330 CT | 3.5 | 3.2/4 | 500 | 71 | .46 | 18.2 | 1 |
| 134 | 7.5 | 1.6K/2K | .3 | 3.2/4 | 500 | 109 | .46 | 22.4 | 1 |
| 135 | 17.0 | 8K/10K CT | 1 | 3.2/4 | 100 | 505 | .46 | 50 | 1 |
| 136 | 19.0 | 10K/12K CT | 1 | 10K/12K CT | 100 | 975 | 1175 | 1 | 1 |
| 137 | 8.6 | 2K/2.5K CT | 3 | 8K/10K* | 100 | 195 | 455 | 1 | 2 |
| 138 | 19.0 | 10K/12K CT | 1 | 2K/2.4K* | 100 | 560 | 230 | 2.24 | 1 |
| 139 | 27.0 | 20K/30K CT | .5 | 1K/1.5K* | 50 | 800 | 113 | 4.47 | 1 |
| 140 | 38.7 | 40K/50K CT | .25 | 400/500* | 50 | 1700 | 60 | 10 | 1 |
| 141 | 3.8 | 400/500 CT | 8/6 | 400/500* | 500 | 46 | 74 | 1 | 1 |
| 142 | 3.8 | 400/500 CT | 8/6 | 120/150* | 500 | 46 | 26 | 1.82 | 1 |
| 143 | 3.8 | 400/500 CT | 8/6 | 40/50* | 500 | 46 | 8 | 3.16 | 1 |

**PACKAGING** TRW/UTC's plastic casing is designed for protection to 85°C. The bobbin is completely rigid and the wire turns are circular to reduce turn corner stress and assure uniform wire lay. External leads are rigidly anchored internally. No tapes are used. Insulated leads are .016" diameter tinned copper. Units mount vertically or on side and can be wave soldered.

**I-DO-T** and **I-DI-T** transformers are industrial quality counterparts of TRW/UTC's DO-T and DI-T line of MIL-Spec transformers. Environmental specifications, such as hermetic sealing, have been relaxed to reduce the cost. Electrical performance is identical. See pages 11 and 12.

**WORKING VOLTAGE** All units = 50 V.

**FREQUENCY RESPONSE** Frequency response is ±3 db, 300 Hz to 20 kHz (I-DO-T). Frequency response is ±3 db, 400 Hz to 100 kHz (I-DI-T).

**TEMPERATURE RANGE** Maximum operating temperature is +85°C.

**SHIELDING** Hipermalloy electromagnetic shield is available from stock for all I-DO-T and I-DI-T units.

**PERFORMANCE** In power handling capability and reliability coupled with small size, I-DO-T and I-DI-T transformers are unprecedented for industrial use. Electrical parameters and areas of application exceed conventional transformer capabilities.

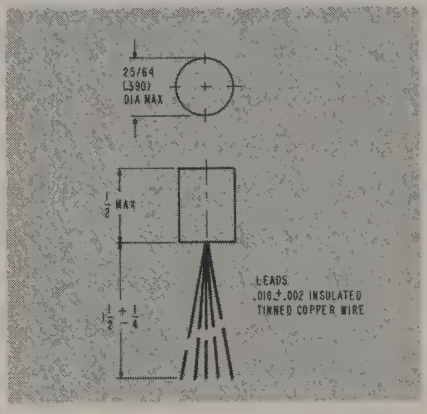
### INDUCTORS

| I-DO-T Type No. | Connections | Inductance Hys Min @ 1 kHz 5 V | @ DC ma | DCR ±25% Ohms | Ratio of Wdgs. | I-DI-T Type No. | Inductance Hys Min. @ 1 kHz 5 V | @ DC ma | DCR ±25% Ohms | Max. Wkg. Volts Peak |
|---|---|---|---|---|---|---|---|---|---|---|
| 150 | Series | .075H | 10 | 10.5 | | 308 | 2.5 | 2 | 630 | 49 V |
| (2 Wdgs) | Parallel | .018 | 20 | 2.6 | 1:1 | | .9 | 4 | | |
| 128 | | .3 | 4 | 25 | | 326 | 4.5 | 2 | 2300 | 49 V |
| 127 | | 1.25 | 2 | 100 | | | 1.2 | 4 | | |
| 108 | | 3.5 | 2 | 560 | | 327 | .9 | 2 | 105 | 49 V |
| 126 | | 6.0 | 2 | 2100 | | | .5 | 6 | | |
| 149 | Series | 20.0 | 1 | 5100 | | 328 | .1 | 4 | 25 | 49 V |
| (2 Wdgs) | Parallel | 5.0 | 2 | 1275 | 1:1 | | .08 | 10 | | |

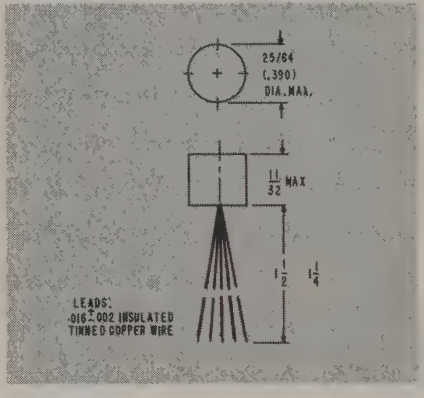
# TRW UTC TRANSFORMERS — TRANSFORMERS

## I-DOT™ AND I-DIT™ TRANSFORMERS AND INDUCTORS (continued)

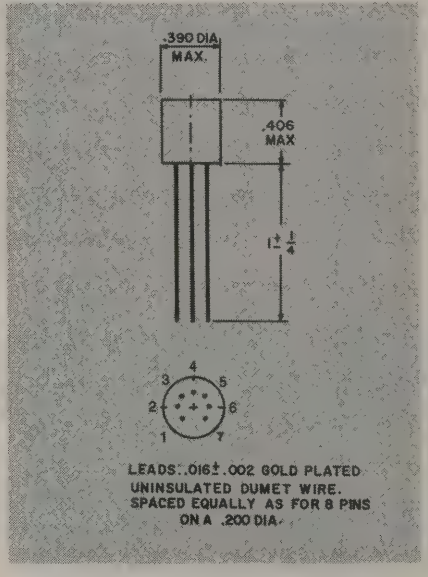
### I-DOT




### I-DIT




### I-DIT-500




| Type No. | Pri. Pulse Voltage Time-Product Millivolt Sec. | Pri. Imp. Electrostatic Shield (A) | Unbal. DC ma in Pri. | Sec. Imp. (Split*) | P. Max. in mw @ 1 kHz 5% Dist. | DCR ±25% Pri. | DCR ±25% Sec. Ser. Conn. | Turns Ratio ±3% Pri. | Turns Ratio ±3% Sec. Ser. Conn. |
|---|---|---|---|---|---|---|---|---|---|
| **I-DO-T** | | | | | | | | | |
| 144 | 1.7 | 80/100 CT | 12/10 | 32/40* | 500 | 9.8 | 6 | 1.58 | 1 |
| 145 | 6.0 | 1K/1.25K CT | 3.5 | 16K/20K* | 100 | 120 | 940 | 1 | 4 |
| 146 | 30.6 | 100K CT(A) | 0 | 500 CT | 25 | 7900 | 85 | 14.14 | 1 |
| 147 | 18.0 | 9K/10K CT (A) | 1 | 9K/10K CT | 100 | 850 | 1080 | 1 | 1 |
| 148 | 17.0 | 8K/10K CT (A) | 1 | 1.2K/1.5K CT | 100 | 640 | 110 | 2.58 | 1 |
| 149 | See Inductors | | | | | | | | |
| 150 | | | | | | | | | |
| 151 | 8.6 | 2K/2.5K CT | 3 | 2K/2.5K* | 100 | 195 | 125 | 1 | 1 |
| 152 | 12.0 | 4K/5K CT (A) | 2 | 8K/10K CT | 100 | 316 | 590 | 1 | 1.41 |
| 153 | 3.8 | 400/500 CT | 8/6 | 4K/5K CT | 500 | 46 | 550 | 1 | 3.33 |
| 154 | 38.7 | 40K/50K CT | .25 | 4K/5K CT | 50 | 1800 | 450 | 3.33 | 1 |
| 155 | 6.0 | 600 CT | 4 | 600 CT | 500 | 47 | 47 | 1 | 1 |
| **I-DO-TSH** | Drawn Hipermalloy shield and cover for I-DO-T's provides 20 to 30 db shielding, ½h x 13/32" dia., ⅛" hole in cover | | | | | | | | |
| **I-DI-T** | | | | | | | | | |
| 301 | 15.0 | 20K/30K | .5 | 800/1200 | 50 | 815 | 140 | 5 | 1 |
| 302 | 2.4 | 500/600 | 3 | 50/60 | 100 | 65 | 9 | 3.16 | 1 |
| 303 | 3.4 | 1000/1200 | 3 | 50/60 | 100 | 110 | 9 | 4.46 | 1 |
| 305 | 3.8 | 1200 | 2 | 3.2 | 100 | 110 | .53 | 19.35 | 1 |
| 308 | See Inductors | | | | | | | | |
| 309 | 10.8 | 10K/12K | 1 | 500/600 | 100 | 870 | 50 | 4.48 | 1 |
| 310 | 10.8 | 10K/12.5K | 1 | 1.2K/1.5K CT | 100 | 870 | 130 | 2.89 | 1 |
| 311 | 4.9 | 10K/12.5K | 1 | 2K/2.5K CT | 100 | 870 | 180 | 2.24 | 1 |
| 319 | 1.9 | 300 CT | 7 | 600 | 500 | 20 | 89 | 1 | 1.41 |
| 320 | 2.4 | 500 CT | 5.5 | 600 | 500 | 32 | 89 | 1 | 1.1 |
| 321 | 3.3 | 900 CT | 4 | 600 | 500 | 53 | 90 | 1.22 | 1 |
| 322 | 4.3 | 1500 CT | 3 | 600 | 500 | 87 | 90 | 1.58 | 1 |
| 323 | 15.0 | 20K/30K CT | .5 | 800/1.2K CT | 50 | 815 | 140 | 5 | 1 |
| 325 | 10.8 | 10K/12K CT | 1 | 1.5K/1.8K CT | 100 | 870 | 105 | 2.58 | 1 |
| 326 | | | | | | | | | |
| 327 | See Inductors | | | | | | | | |
| 328 | | | | | | | | | |
| 336 | 10.8 | 10K/12K CT | 1 | 10K/12K CT | 100 | 970 | 1270 | 1 | 1 |
| 337 | 4.8 | 2K/2.5K CT | 3 | 8K/10K* | 100 | 180 | 440 | 1 | 2* |
| 338 | 10.8 | 10K/12K CT | 1 | 2K/2.4K* | 100 | 620 | 220 | 2.24 | 1 |
| 341 | 2.1 | 400/500 CT | 8/6 | 400/500* | 500 | 50 | 89 | 1 | 1 |
| 343 | 2.1 | 400/500 CT | 8/6 | 40/50* | 500 | 50 | 6.5 | 3.12 | 1 |
| 344 | .96 | 80/100 CT | 12/10 | 32/40* | 500 | 11.5 | 4 | 1.58 | 1 |
| 351 | 4.8 | 2K/2.5K CT | 3 | 2K/2.5K* | 100 | 180 | 110 | 1 | 1 |
| 352 | 6.8 | 4K/5K CT (A) | 2 | 8K/10K CT | 100 | 300 | 530 | 1 | 1.4 |

### PC I-DI-T LINE — Line Performance Characteristics:

**TRANSFORMERS Freq. Resp.: ±3 db, 400 Hz @ 1 mw. Ref. Level 1 kHz**

| I-DI-T Type No. | Pri. Pulse Voltage Time-Product Millivolt Sec. | Pri. Imp. Electrostatic Shield (A) | Unbal. DC ma in Pri. | Sec. Imp. (Split*) | P. Max. in mw @ 1 kHz 5% Dist. | DCR ±25% Pri. | DCR ±25% Sec. Ser. Conn. | Turns Ratio ±3% Pri. | Turns Ratio ±3% Sec. Ser. Conn. |
|---|---|---|---|---|---|---|---|---|---|
| 525 | .96 | 80/100 CT | 12/10 | 32/40* | 500 | 11.5 | 4 | 1.58 | 1 |
| 530 | 1.9 | 300 CT | 7 | 600 CT | 500 | 20 | 89 | 1 | 1.41 |
| 535 | 2.1 | 400/500 CT | 8/6 | 40/50* | 500 | 50 | 6.5 | 3.12 | 1 |
| 540 | 2.1 | 400/500 CT | 8/6 | 400/500* | 500 | 50 | 89 | 1 | 1 |
| 545 | 2.4 | 500/600 CT | 3 | 50/60 CT | 500 | 65 | 9 | 3.16 | 1 |
| 550 | 2.4 | 500 CT | 5.5 | 600 CT | 500 | 32 | 89 | 1 | 1.1 |
| 555 | 3.4 | 1000/1200 CT | 3 | 50/60 CT | 500 | 110 | 9 | 4.46 | 1 |
| 560 | 4.3 | 1500 CT | 3 | 600 CT | 500 | 87 | 90 | 1.58 | 1 |
| 565 | 6.8 | 2K/2.5K CT (A) | 3 | 8K/10K* | 100 | 180 | 440 | 1 | 2 |
| 570 | 10.8 | 10K/12K CT | 1 | 500/600 CT | 100 | 870 | 50 | 4.48 | 1 |
| 573 | 10.8 | 10K/12.5K CT | 1 | 1.2K/1.5K CT | 100 | 870 | 130 | 2.89 | 1 |
| 578 | 10.8 | 10K/12K CT | 1 | 2K/2.5K* | 100 | 620 | 220 | 2.24 | 1 |
| 583 | 10.8 | 10K/12K CT | 1 | 10K/12K CT | 100 | 970 | 1270 | 1 | 1 |
| 588 | 15.0 | 20K/30K CT | .5 | 800/1.2K CT | 50 | 815 | 140 | 5 | 1 |

### INDUCTORS

| I-DI-T Type No. | Connection | Inductance Hys Min. @ 1 kHz 5 V | @ DC ma | Lead Code Conn. to | Lead Code Join | DCR ±25% Ohms | Ratio of Wdgs. | Peak Wkg. Volts |
|---|---|---|---|---|---|---|---|---|
| 504 | Series | .1 | 4 | 1-4 | 2-3 | 25 | 1:1 | 50 V |
| | Parallel | .025 | 8 | 1-4 | 1-2 & 3-4 | 6 | | |
| 508 | Series | .9 | 2 | 1-4 | 2-3 | 105 | 1:1 | 50 V |
| | Parallel | .2 | 4 | 1-4 | 1-2 & 3-4 | 26 | | |
| 512 | Series | 2.5 | 2 | 1-4 | 2-3 | 630 | 1:1 | 50 V |
| | Parallel | 6 | 4 | 1-4 | 1-2 & 3-4 | 157 | | |
| 516 | Series | 4.5 | 2 | 1-4 | 2-3 | 2300 | 1:1 | 50 V |
| | Parallel | 1.1 | 4 | 1-4 | 1-2 & 3-4 | 575 | | |

# TRW UTC TRANSFORMERS — TRANSFORMERS

## PIP* SERIES TRANSISTOR PULSE TRANSFORMERS

UTC's PIP series of subminiature transistor type pulse transformers is designed to give a maximum of component density in equipments, their configuration being especially compatible with transistors. The design is based on the UTC DO-T and DI-T series to impart exceptional reliability. PIP-1 through PIP-9 have a ratio of 4:4:1, PIP-10 through PIP-12 have a ratio of 5:3:1. All units are checked and adjusted in a transistor test circuit to give the required pulse width.

Hermetically sealed, manufactured and guaranteed to MIL-T-20138B by full environmental testing . . . all units, completely METAL CASED, MIL Type TP6RX4410CZ. See UTC page 3015 for other miniature pulse transformers.

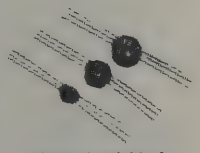
U.S. Pat. No. 2,949,591

5/16" Dia. x 3/16" high. Weight 1/20 oz.

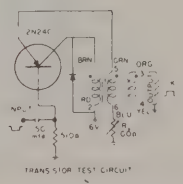
**All Units Individually Adjusted to Parameters Shown in Table**

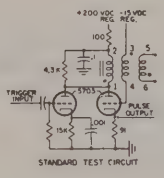
| Type No. | APPROXIMATELY DCR, OHMS 1-Brown 2-Red | 3-Orange 4-Yellow | 5-Green 6-Blue | BLOCKING OSCILLATOR PULSE Width μSec. | Rise Time | % Over Shoot | Droop % | % Back Swing | COUPLING CIRCUIT CHARACTERISTICS P-Width μSec. | Volt Out | Rise Time | % Over Shoot | Droop % | Back Swing | Imp. In, Out Ohms |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PIP-1 | .18 | .20 | .07 | .05 | .02 | 0 | 0 | 37 | .05 | 9 | .018 | 0 | 0 | 12 | 50 |
| PIP-2 | .47 | .56 | .17 | .1 | .025 | 0 | 0 | 25 | .1 | 8 | .02 | 0 | 0 | 5 | 50 |
| PIP-3 | 1.01 | 1.25 | .37 | .2 | .030 | 2 | 0 | 15 | .2 | 7 | .035 | 0 | 0 | 5 | 100 |
| PIP-4 | 1.5 | 1.85 | .54 | .5 | .05 | 0 | 0 | 15 | .5 | 7 | .06 | 0 | 0 | 0 | 100 |
| PIP-5 | 2.45 | 3.1 | .9 | 1 | .08 | 0 | 0 | 14 | 1 | 6.8 | .15 | 0 | 0 | 5 | 100 |
| PIP-6 | 3.0 | 3.7 | 1.1 | 2 | .10 | 0 | 0 | 15 | 2 | 6.6 | .18 | 0 | 2 | 10 | 100 |
| PIP-7 | 4.9 | 6.05 | 1.8 | 3 | .20 | 0 | 0 | 14 | 3 | 6.8 | .20 | 0 | 2 | 10 | 100 |
| PIP-8 | 8.0 | 9.7 | 2.9 | 5 | .30 | 0 | 0 | 3 | 5 | 7.9 | .22 | 0 | 13 | 25 | 200 |
| PIP-9 | 13.1 | 15.9 | 4.7 | 10 | .35 | 0 | 5 | 12 | 10 | 6.5 | .4 | 0 | 15 | 20 | 200 |
| PIP-10 | .55 | .41 | .15 | .1 | .01 | 0 | 0 | 20 | .1 | 8 | .01 | 0 | 0 | 5 | 140/50 |
| PIP-11 | 2.9 | 2.2 | .82 | 1 | .02 | 4 | 4 | 6 | 1 | 6.6 | .05 | 0 | 6 | 12 | 280/100 |
| PIP-12 | 9.4 | 7.1 | 2.6 | 5 | .05 | 0 | 12 | 12 | 5 | 8 | .09 | 2 | 12 | 25 | 560/200 |
| PIP-SH | Draw Hipermalloy shield and cover for PIP's provides 20 to 30 db shielding. | | | | | | | | | | | | | | |

## PRECISION MINIATURE WIDE APPLICATION PULSE TRANSFORMERS



Size and weight of these units same as H-45.




**MANUFACTURED AND GUARANTEED TO COMPLETE MIL-T-21038B**

UTC miniature, wound core, pulse transformers are indivdually precision adjusted in standard test circuits to close tolerances. They are high reliability units, hermetically sealed by vacuum molding and suited for service from −70°C to +130°C. Wound core structure provides excellent temperature stability (unlike ferrite). Designs are high inductance type to provide minimum of droop and assure true pulse width. H-45 thru H-57 ratio 1:1:1. Others ratio 4:4:1 and 5:3:1.

**ALL UNITS INDIVIDUALLY ADJUSTED TO PARAMETERS SHOWN IN TABLES**

### SCR AND VACUUM TUBE PULSE TRANSFORMERS

| Type No. | APPROX. DCR, OHMS 1-2 | 3-4 | 5-6 | BLOCKING OSCILLATOR PULSE Width μSec. | Rise Time | % Over Shoot | Droop % | % Back Swing | COUPLING CIRCUIT CHARACTERISTICS P Width μSec. | Volts Out | Rise Time | % Over Shoot | Droop % | % Back Swing | Imp. In, Out Ohms | DIMENSIONS L in. | W in. | Wt. Grams |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H-45 | 3 | 3.5 | 4 | .05 | .022 | 0 | 20 | 10 | .05 | 17 | .01 | 20 | 0 | 35 | 250 | 3/8 | 3/8 | 1 |
| H-46 | 5.5 | 6.5 | 7 | .10 | .024 | 0 | 25 | 10 | .10 | 19 | .01 | 30 | 10 | 50 | 250 | 3/8 | 3/8 | 1 |
| H-47 | 3.7 | 4.0 | 4 | .20 | .026 | 0 | 25 | 8 | .20 | 18 | .01 | 30 | 15 | 65 | 500 | 5/16 | 5/16 | 4 |
| H-48 | 5.5 | 5.8 | 6 | .50 | .03 | 0 | 20 | 5 | .50 | 20 | .01 | 30 | 20 | 65 | 500 | 5/16 | 5/16 | 4 |
| H-49 | 8 | 8.5 | 9 | 1 | .04 | 0 | 20 | 10 | 1 | 24 | .02 | 15 | 15 | 65 | 500 | 5/16 | 5/16 | 4 |
| H-50 | 20 | 21 | 22 | 2 | .05 | 0 | 20 | 10 | 2 | 27 | .05 | 10 | 15 | 35 | 500 | 5/16 | 5/16 | 4 |
| H-51 | 28 | 31 | 33 | 3 | .10 | 1 | 20 | 8 | 3 | 26 | .07 | 10 | 10 | 35 | 500 | 5/16 | 5/16 | 4 |
| H-52 | 36 | 41 | 44 | 5 | .13 | 1 | 25 | 8 | 5 | 23 | .15 | 10 | 10 | 45 | 1000 | 5/16 | 5/16 | 4 |
| H-53 | 37 | 44 | 49 | 7 | .28 | 0 | 25 | 8 | 7 | 24 | .20 | 10 | 10 | 50 | 1000 | 5/8 | 5/8 | 6 |
| H-54 | 50 | 58 | 67 | 10 | .30 | 0 | 20 | 8 | 10 | 24 | .25 | 10 | 10 | 50 | 1000 | 5/8 | 5/8 | 6 |
| H-55 | 78 | 96 | 112 | 16 | .75 | 0 | 20 | 10 | 16 | 23 | .40 | 5 | 15 | 20 | 1000 | 5/8 | 5/8 | 6 |
| H-56 | 93 | 116 | 138 | 20 | 1.25 | 0 | 25 | 10 | 20 | 23 | .6 | 5 | 10 | 10 | 1000 | 5/8 | 5/8 | 6 |
| H-57 | 104 | 135 | 165 | 25 | 2.0 | 0 | 30 | 10 | 25 | 24 | 1.5 | 5 | 10 | 10 | 1000 | 5/8 | 5/8 | 6 |
| H-58 | Pulse transformer kit. Consisting of H-45 thru H-57 in a partitioned plastic case. | | | | | | | | | | | | | | | | | |

# TRW UTC TRANSFORMERS



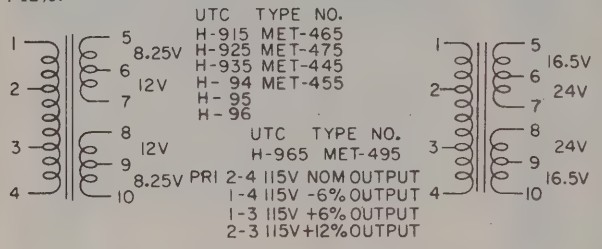
## UNIVERSAL TRANSISTOR SUPPLY TRANSFORMERS

**PACKAGING** Hermetically sealed. Drawn metal case to Mil Grade 4.

**MIL SPECS.** To complete MIL-T-27 Specs. Mil Type: TF4SX02 plus two letter case code.

**NOTES** Chart, below, shows the secondary AC voltages available, and the approximate DC voltages resulting, in typical capacitive filter silicon rectifier circuits (at the indicated currents). Since the capacitor following the rectifier affects the DC, voltage values used (in 1000 mfd) are shown in parenthesis ( ) after each current rating.

Primary taps can modify nominal AC voltages by −6%, +6%, and +12%.




**INCLUDING MET™ SERIES**

**Primary 115 Volts, 50/60 Hz Nominal Sec. Volts, 8.25 to 40.5**

| Type No. | MIL DC Range | Industrial DC Range | MIL Case |
|---|---|---|---|
| H-915 | 6V-.065A to 53V-.02A | 6V-.085A to 53V-.025A | AH |
| H-925 | 6V-.22A to 53V-.07A | 6V-.28A to 53V-.085A | AJ |
| H-935 | 6V-1.2A to 53V-.4A | 6V-1.52A to 53V-.48A | FA |
| H-94 | 6V-3A to 53V-1A | 6V-3.8A to 53V-1.2A | HA |
| H-95 | 6V-7.5A to 53V-2.5A | 6V-9A to 53V-3A | KA |
| H-96 | 6V-18A to 53V-6A | 6V-23A to 53V-7.5A | OA |

**Primary 115 Volts, 50/60 Hz Nominal Sec. Volts, 16.5 to 81**

| | | | |
|---|---|---|---|
| H-965 | 12V-1.5A to 106V-.5A | 12V-1.9A to 106V-.6A | HA |

**Primary 115 Volts 400 Hz Nominal Sec. Volts, 8.25 to 40.5**

| | | | |
|---|---|---|---|
| MET-445 | 6V-.6A to 53V-.2A | 6V-.75A to 53V-.24A | AH |
| MET-455 | 6V-1.2A to 53V-.4A | 6V-1.52A to 53V-.48A | AJ |
| MET-465 | 6V-3A to 53V-1A | 6V-3.8A to 53V-1.2A | FA |
| MET-475 | 6V-7.5A to 53V-2.5A | 6V-9A to 53V-3A | HA |

**Primary 115 Volts, 400 Hz Nominal Sec. Volts, 16.5 to 81**

| | | | |
|---|---|---|---|
| MET-495 | 12V-.6A to 106V-.2A | 12V-.76A to 106V-.24A | AJ |

## AC AND DC VOLTAGES @ INDUCATED CURRENTS

MIL-T-27 RATINGS IN REGULAR TYPE, **INDUSTRIAL RATINGS IN BOLD TYPE**

Full Wave Bridge Silicon Rectifier — Full Wave CT

Secondary AC Voltages and Approximate DC Voltages

| Nom. AC Volts* | 40.5 | 32.25 | 28.5 | 24 | 20.25 | 16.5 | 12 | 8.25 | 40.5 CT | 24 CT | 16.5 CT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Appr. DC Volts* | 53 | 41 | 34 | 25 | 24 | 18 | 12 | 6 | 24 | 12 | 6.6 |

**DC AMPERES (Capacitance in Parenthesis) 60 Hz TYPES**

| Type No. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| H-915 | .02 (.1) | .023(.1) | .025(.1) | .027(.1) | .042(.2) | .035(.2) | .055(.2) | .065(.2) | .035(.2) | .040(.2) | .055(.2) |
| **H-915** | **.025(.1)** | **.035(.1)** | **.040(.1)** | **.042(.1)** | **.055(.2)** | **.042(.2)** | **.070(.2)** | **.085(.2)** | **.042(.2)** | **.055(.2)** | **.068(.2)** |
| H-925 | .07 (.1) | .08 (.1) | .085(.1) | .09 (.1) | .14 (.2) | .11 (.2) | .18 (.2) | .22 (.2) | .11 (.2) | .13 (.2) | .17 (.2) |
| **H-925** | **.085(.1)** | **.12 (.1)** | **.13 (.1)** | **.14 (.1)** | **.18 (.2)** | **.14 (.2)** | **.23 (.2)** | **.28 (.2)** | **.14 (.2)** | **.17 (.2)** | **.21 (.2)** |
| H-935 | .4 (.5) | .44 (.5) | .48 (.5) | .52 (.5) | .8 (1.0) | .6 (1.0) | 1.0 (2.0) | 1.2 (2.0) | .6 (1) | .72 (1) | .92 (2) |
| **H-935** | **.48 (.5)** | **.6 (.5)** | **.6 (.5)** | **.64 (.5)** | **1.0 (1.0)** | **.8 (1.0)** | **1.2 (2.0)** | **1.52 (2)** | **.8 (1)** | **.88 (1)** | **1.12 (2)** |
| H-94 | 1 (.5) | 1.1 (.5) | 1.2 (.5) | 1.3 (.5) | 2 (1) | 1.5 (1) | 2.5 (2) | 3 (2) | 1.5 (1) | 1.8 (1) | 2.3 (2) |
| **H-94** | **1.2 (.5)** | **1.5 (.5)** | **1.5 (.5)** | **1.6 (.5)** | **2.5 (1)** | **2 (1)** | **3 (2)** | **3.8 (2)** | **2 (1)** | **2.2 (1)** | **2.8 (2)** |
| H-95 | 2.5 (1) | 3 (1) | 3 (1) | 3.5 (1) | 5 (2) | 3.7 (2) | 6 (4) | 7.5 (4) | 3.7 (2) | 4.5 (2) | 5.5 (4) |
| **H95** | **3 (1)** | **3.5 (1)** | **3.8 (1)** | **4 (1)** | **6 (2)** | **4.5 (2)** | **7.5 (4)** | **9 (4)** | **4.5 (2)** | **5.5 (2)** | **6.7 (4)** |
| H-96 | 6 (4) | 7 (4) | 7.5 (4) | 8 (4) | 12 (6) | 9 (6) | 15 (12) | 18 (12) | 9 (6) | 11 (6) | 13.5 (12) |
| **H-96** | **7.5 (4)** | **8.5 (4)** | **9.5 (4)** | **10 (4)** | **15 (6)** | **11 (6)** | **19 (12)** | **23 (12)** | **11 (6)** | **13.5 (6)** | **17 (12)** |

**400 Hz TYPES**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MET-445 | .2 (.15) | .22 (.15) | .24 (.15) | .26 (.15) | .4 (.25) | .3 (.25) | .5 (.5) | .6 (.5) | .3 (.25) | .36 (.25) | .46 (.5) |
| **MET-445** | **.24 (.15)** | **.3 (.15)** | **.3 (.15)** | **.32 (.15)** | **.5 (.25)** | **.4 (.25)** | **.6 (.5)** | **.75 (.5)** | **.4 (.25)** | **.44 (.25)** | **.56 (.5)** |
| MET-455 | .4 (.15) | .44 (.15) | .48 (.15) | .52 (.15) | .8 (.25) | .6 (.25) | 1.0 (.5) | 1.2 (.5) | .6 (.25) | .72 (.25) | .92 (.5) |
| **MET-455** | **.48 (.15)** | **.6 (.15)** | **.6 (.15)** | **.64 (.15)** | **1.0 (.25)** | **.8 (.25)** | **1.2 (.5)** | **1.52 (.5)** | **.8 (.25)** | **.88 (.25)** | **1.12 (.5)** |
| MET-465 | 1 (.15) | 1.1 (.15) | 1.2 (.15) | 1.3 (.15) | 2 (.25) | 1.5 (.25) | 2.5 (.5) | 3 (.5) | 1.5 (.25) | 1.8 (.25) | 2.3 (.5) |
| **MET-465** | **1.2 (.15)** | **1.5 (.15)** | **1.5 (.15)** | **1.6 (.15)** | **2.5 (.25)** | **2 (.25)** | **3 (.5)** | **3.8 (.5)** | **2 (.25)** | **2.2 (.25)** | **2.8 (.5)** |
| MET-475 | 2.5 (.25) | 3 (.25) | 3 (.25) | 3.5 (.25) | 5 (.5) | 3.7 (.5) | 6 (1) | 7.5 (1) | 3.7 (.5) | 4.5 (.5) | 5.5 (1) |
| **MET-475** | **3 (.25)** | **3.5 (.25)** | **3.8 (.25)** | **4 (.25)** | **6 (.5)** | **4.5 (.5)** | **7.5 (1)** | **9 (1)** | **4.5 (.5)** | **5.5 (.5)** | **6.7 (1)** |

**SECONDARY AC VOLTAGES AND APPROXIMATE DC VOLTAGES**

| Nom. AC Volts* | 81 | 64.5 | 57 | 48 | 40.5 | 33 | 24 | 16.5 | 81 CT | 48 CT | 33 CT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Appr. DC Volts* | 106 | 82 | 68 | 50 | 48 | 36 | 24 | 12 | 48 | 24 | 13 |

**DC AMPERES (Capacitance in Parenthesis) 60 Hz TYPE**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| H-965 | 0.5 (.125) | 0.55(.125) | 0.6 (.125) | 0.65(.125) | 1.0 (.25) | 0.75 (.25) | 1.25 (.5) | 1.5 (.5) | 0.75 (.25) | 0.9 (.25) | 1.15 (.5) |
| **H-965** | **0.6 (.125)** | **0.75(.125)** | **0.75(.125)** | **0.8 (.125)** | **1.25 (.25)** | **1.0 (.25)** | **1.5 (.5)** | **1.9 (.5)** | **1.0 (.25)** | **1.1 (.25)** | **1.4 (.5)** |

**400 Hz TYPE**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| MET-495 | 2 (.04) | .22(.04) | .24(.04) | .26 (.04) | .4 (.06) | .3 (.06) | .5 (.06) | .6 (.06) | .3 (.06) | .36 (.06) | .46 (.06) |
| **MET-495** | **.24(.04)** | **.3 (.04)** | **.3 (.04)** | **.32 (.04)** | **.5 (.06)** | **.4 (.06)** | **.6 (.06)** | **.76 (.06)** | **.4 (.06)** | **.44 (.06)** | **.56 (.06)** |

*Nom. AC and DC volts are at 115 volt input . . . primary taps can modify −6%, +6%, and +12%.

# CLINTON ELECTRONICS CORPORATION

6701 Clinton Rd., Rockford, Ill. 61131
Phone 815-633-1444 Telex 257-484


*THE ANSWER PEOPLE IN CRT'S.*

Over the years Clinton has developed more than 500 distinct tube types with over 200,000 variations to meet a wide variety of applications including Alpha-Numeric Data Displays, Video Monitors, Electronic Games, Projection, Photography and others. It would be virtually impossible to include in details the specifications for each of these pre-engineered designs. Therefore, we have included in this brochure some of the most commonly used tube types and their basic characteristics. When your application calls for a CRT which varies from those listed, contact our Sales or Engineering departments. In many cases there is a tube already designed which will meet your exact needs.

We will be most happy to supply complete specifications on the tube sizes listed. Whether your needs can be filled by one of the hundreds of current designs, or your requirement calls for a special design, our engineers welcome the opportunity to work with you on any project you may have.

## ELECTRICAL CONSIDERATIONS:

To achieve the optimum performance for each application, the electrical characteristics of both the Cathode Ray Tube and the chassis must be carefully chosen to complement each other. CRT cutoff voltage, Grid #2 voltage, resolution, and drive characteristics are all interrelated and must be considered for each specific design.

Charts 1 and 2 illustrate the possible ranges of operation.

CHART 1 used for Alpha-Numeric Data Displays, Video Monitors, Electronic Games, and Waveform Monitors.

CHART 2 used for Flying Spot Scanners and Projection Tubes.

Our engineering staff can supply complete specifications on existing tube types or develop new designs and specifications to fit your specific requirements. We welcome the opportunity to work with your design group on any project you may have.

## CHART #1

| Tube Neck Size | Anode Voltage Ranges | Focus Voltage Ranges | Grid #2 Voltage Ranges | Available Heater Ratings |
|---|---|---|---|---|
| 20 mm Neck Diameter | 4KV to 12KV | 0 to 400V | 100 to 1000V | 6.3V @ 300ma<br>6.3V @ 450ma<br>12.6V @ 83ma<br>12.6V @ 150ma<br>(Quick Heat)<br>11.0V @ 140ma<br>12.0V @ 75ma |
| 29mm Neck Diameter | 8KV to 18KV | 0 to 500V | 100 to 1000V | 6.3V @ 300ma<br>6.3V @ 450ma<br>12.6V @ 150ma<br>(Quick Heat)<br>11.0V @ 140ma<br>12.0V @ 75ma |
| 35mm or 37mm Neck Diameter | 8KV to 20KV | 0 to 500V (Low Voltage Focus Designs)<br>2KV to 6KV (High Voltage Focus Designs | 100 to 1000V | 6.3V @ 450ma<br>6.3V @ 600ma |

## CHART #2

| Tube Neck Size | Anode Voltage Ranges | Focus Voltage Ranges | Grid #2 Voltage Ranges | Available Heater Ratings |
|---|---|---|---|---|
| 35mm or 37mm Neck Diameter | 12K to 30KV | 0 to 500V (Low Voltage Focus Designs)<br>2KV to 7KV (High Voltage Focus Designs) | 100 to 1000V | 6.3V @ 450ma |

## IMPLOSION PROTECTION AND MOUNTING HARDWARE:

Many Clinton tubes can be supplied with a wide choice of implosion protection systems; Kimcode, Shelbond, laminated panel or tension band with or without mounting ears. Laminated panels are available in a variety of colors and light transmissions for contrast enhancement. Etched or coated panels are also available for glare reduction. All Clinton tubes using these implosion protection systems meet UL and CSA standards.

In addition to mounting features available on the Shelbond and Kimcode, Clinton Electronics has designed special mounting ears which are used in conjunction with the tension band. These mounting ears facilitate tube mounting in chassis and are available on most sizes.

5" & 6" Diagonal Bulb with Ears

7" & 9" Diagonal Bulb with Ears

9" & 12" Diagonal Bulb with Shelbond

12" Diagonal Bulb with Ears

15" Diagonal Bulb with Ears

20" & 23" Diagonal Bulb with Kimcode and Ears

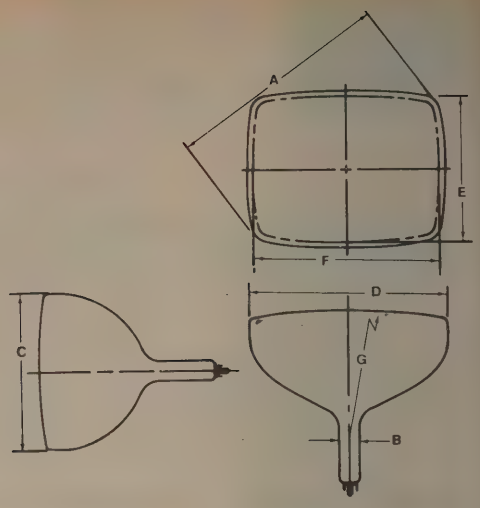
Low Profile Bulb with Ears

## PHOSPHORS:

Clinton Electronics Corporation offers one of the broadest selections of Phosphors for standard and unique applications. In addition to the standard E.I.A. phosphors available Clinton offers many special proprietary phosphors with characteristics to meet special requirements, including our new Datastar™ high contrast phosphor.

CLINTON
ELECTRONICS
CORPORATION
6701 Clinton Rd., Rockford, Ill. 61131
Phone 815-633-1444 Telex 257-484

*THE ANSWER PEOPLE IN CRT'S.*



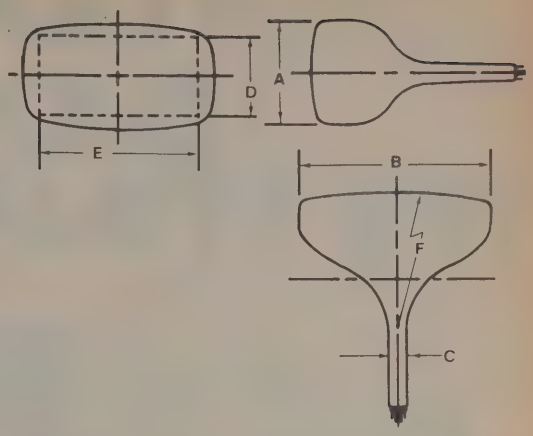

# COMMON BULB DESIGNS
# AVAILABLE RECTANGULAR BULB SIZES

| JEDEC No. or Glass Supplier No. | Bulb Size | Diagonal Size (A) In Inches | Deflection Angle (DIAG) | Neck Dia. (B) In Inches | (C) In Inches | (D) In Inches | (E) In Inches | (F) In Inches | (G) In Inches | Available Mounting Hardware |
|---|---|---|---|---|---|---|---|---|---|---|
| — | 3" | 3.33 (84.6) | 50° | .788 (20) | 2.16 (27.5) | 2.76 (70.1) | 1.77 (45.0) | 2.36 (59.9) | Flat | None Available |
| J43 1/2 C1 | 5" | 5.406 (137.2) | 62° | .788 (20) | 3.75 (95.3) | 4.75 (120.6) | 3.35 (85.0) | 4.36 (110.7) | 14.187 (360.3) | Mounting Ears |
| LEA1171 | 6" | 5.65 (143 5 | 55° | 870 (22) | 4.0 (101.6) | 5 0 (127.0) | 3.5 (88.9) | 4.5 (114.3) | Flat | Mounting Ears |
| LEA1303 | 7" | 7.65 (194.3) | 85° | .788 (20) | 5.25 (133.3) | 6.375 (162.0) | 4.718 (119.8) | 5.843 (148.0) | 78.75 (2000) | Mounting Ears |
| J67 1/2 A | 8" | 8.44 (214.4) | 90° | 1.438 (37) | 6.06 (154) | 7.87 (200.0) | 5.37 (136.4) | 7.18 (182.8) | 27 (685.8) | None Available |
| J76 1/4 A1 | 9" | 9.524 (242.0) | 85° | .788 (20) | 6.4 (162.6) | 8.33 (211.6) | 5.85 (148.6) | 7.81 (198.4) | 27 (685.8) | Mounting Ears |
| J75A1 | 9" | 9.421 (239 3) | 110° | 1.125 (29) | 6.523 (165.7) | 8.25 (209.5) | 5.69 (144.5) | 7.62 (193.5) | 14 (355.6) | Mounting Ears or Shelbond |
| J99F1A or J99AB2 | 12" | 12.375 (314.3) | 90° | .788 (20) | 8.54 (216.9) | 10.94 (277 8) | 7.69 (195.3) | 10.12 (257.0) | 25 (635) | Mounting Ears or Shelbond |
| J99Z1 | 12" | 12.375 (314.3) | 90° | 1.125 (29) | 8.54 (216.9) | 10.94 (277.8) | 7.69 (195.3) | 10.12 (257.0) | 25 (635) | Mounting Ears or Shelbond |
| J99Y1 | 12" | 12.375 (314.3) | 70° | 1.438 (37) | 8.54 (216.9) | 10.94 (277.8) | 7.74 (196.6) | 10.2 (259.0) | 22 (558 8) | Shelbond |
| J99H1 | 12" | 12.375 (314 3) | 110° | 1.125 (29) | 8.54 (216.9) | 10.94 (277.8) | 7.69 (195.3) | 10.12 (257.0) | 25 (635) | Mounting Ears or Shelbond |
| LEA1518 | 15" | 14.772 (375.3) | 70° | 1.125 (29) | 10.128 (257.2) | 12.562 (319.0) | 8.58 (218.0) | 11.31 (287.3) | 25 (635) | Mounting Ears |
| J118 1/4 B1 | 15" | 14.772 (375.3) | 70° | 1.438 (37) | 10.128 (257.2) | 12.562 (319.0) | 8.58 (218.0) | 11.31 (287.3) | 25 (635) | Mounting Ears |
| LEA1404 | 15" | 14.772 (375.3) | 90° | 1.438 (37) | 10.128 (257.2) | 12.562 (319.0) | 8.58 (218.0) | 11.31 (287.3) | 25 (635) | Mounting Ears |
| LEA1721 | 15" | 14.772 (375.3) | 90° | 1.125 (29) | 10.128 (257.2) | 12.562 (319.0) | 8.58 (218.0) | 11.31 (287.3) | 25 (635) | Mounting Ears |
| J118 1/4 A1 | 15" | 14.772 (375.3) | 110° | 1.125 (29) | 10.128 (257.2) | 12.562 (319.0) | 8.58 (218.0) | 11.31 (287.3) | 25 (635) | Mounting Ears |
| J157 1/2 A1 | 20" | 19.686 (500.0) | 114° | 1.125 (29) | 13.478 (342.3) | 16.726 (424.8) | 12.125 (307.9) | 15.5 (393.7) | 37 (939.8) | Kimcode With Ears |
| J187K1 | 23" | 23.390 (594.1) | 110° | 1.125 (29) | 16.5 (416.1) | 20.5 (520.7) | 15.125 (384.2) | 19.25 (488.9) | Compound Radius | Kimcode With Ears |

( ) Denotes Millimeters
Dimensions Given are Without Mounting or Implosion Protection Hardware.
The bulb sizes listed represent the most commonly used sizes today. As requirements change in the future other sizes will become available. Clinton's engineering department should be contacted for special bulbs not listed.

CLINTON ELECTRONICS CORPORATION
6701 Clinton Rd., Rockford, Ill. 61131
Phone 815-633-1444 Telex 257-484

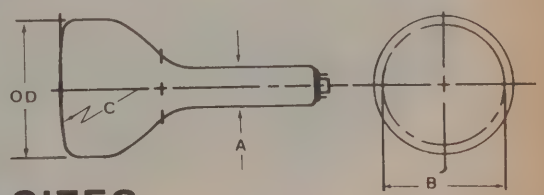
*THE ANSWER PEOPLE IN CRT'S.*




# AVAILABLE LOW PROFILE BULB SIZES

| JEDEC No. or Glass Supplier No. | Outside Dimensions (A x B) In Inches | Deflection Angle (DIAG) | Neck Dia. (C) In Inches | Max Alpha-Numeric Screen Size (D x E) In Inches | Face Plate Curvature (Spherical) (F) In Inches | Available Mounting Hardware |
|---|---|---|---|---|---|---|
| LEA1401 | 4.75 x 10.00 (120.6) x (254) | 85° | .788 (20) | 3.0 x 8.75 (76.2) x (222.3) | 25 (635) | Mounting Ears |
| LEA1421 | 5.5 x 13.0 (139.7) x (330.2) | 90° | 1.438 (37) | 3.0 x 12.0 (76.2) x (304.8) | 36 (914.4) | Mounting Ears |
| LEA1571 | 5.5 x 13.0 (190.5) x (330.20) | 90° | 1.125 (29) | 3.0 x 12.0 (76.2) x (304.8) | 36 (914.4) | Mounting Ears |
| LEA1537 | 7.5 x 13.0 (190.5) x (330.20) | 90° | 1.125 (29) | 5.25 x 11.25 (133.4) x (285.7) | 25 (635) | Mounting Ears |

( ) Denotes Millimeters
Dimensions Given are Without Mounting or Implosion Protection Hardware.
The bulb sizes listed represent the most commonly used sizes today. As requirements change in the future other sizes will become available. Clinton's engineering department should be contacted for special bulbs not listed.

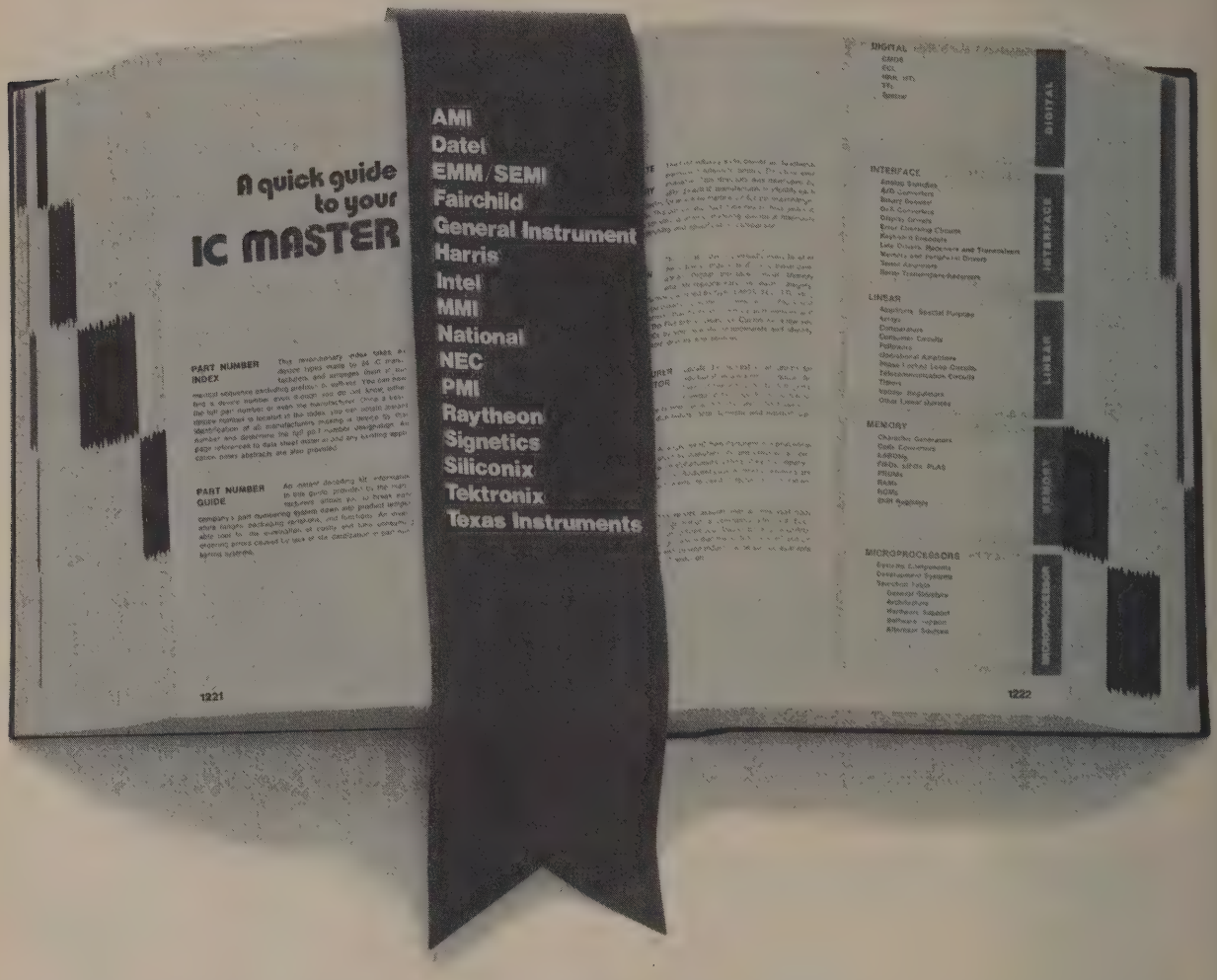



# COMMONLY USED ROUND BULB SIZES

| JEDEC No. or Glass Supplier No. | Bulb Size | Outside Diameter In Inches | Deflection Angle | Neck Dia. (A) In Inches | (B) In Inches | Face Plate Curvature Spherical (C) In Inches |
|---|---|---|---|---|---|---|
| J39 1/2 R1A | 5" | 4.95 (125.7) | 70° | .870 (22) | 4.25 (108) | 24 (609.6) |
| J39 1/2 L1A | 5" | 4.95 (125.7) | 53° | 1.375 (35) | 4.25 (108) | 24 (609.6) |
| — | 5" | 4.95 (125.7) | 53° | 1.375 (35) | 4.25 (108) | Flat Non-Browning |
| LEA807 | 7" | 7.18 (182.4) | 70° | 1.438 (37) | 6.25 (158.8) | 24 (609.6) |
| LEX-9001 | 7" | 7.44 (188.9) | 50° | 1.438 (37) | 6.50 (165) | Flat, Optical Quality |

( ) Denotes Millimeters
The bulb sizes listed represent the most commonly used sizes today. As requirements change in the future other sizes will become available. Clinton's engineering department should be contacted for special bulbs not listed.

# A GOOD BOOK IS KNOWN BY THE COMPANIES IT KEEPS.




These manufacturers have invested in the IC MASTER to bring you the most complete information on their newest standard products.

WHEN USING THE IC MASTER, REFER TO THESE MANUFACTURERS' COMPLETE DATA SHEETS TO HELP YOU IN YOUR IC SELECTION . . .

## THE WHOLE WORLD FOLLOWS THE MASTER.

**IC Master**
**1333 Lawrence Expressway, Suite 420**
**Santa Clara, CA 95051**
**(408) 248-8044**

***It's Faster With the Master***

# The INTER-TECHNICAL Group, Inc.

P. O. BOX 23
IRVINGTON, N.Y. 10533
TEL: (914) 591-8822
TWX: 710-564-0802

BRIMAR

## high quality INSTRUMENT TUBES

**TWENTY-ONE DIFFERENT PHOSPHORS / INTERNAL & EXTERNAL GRATICULES / FLASHOVER PROTECTION / IMPLOSION PROTECTION (5 Different Constructions)**

Accessories offered for Brimar cathode ray tubes include sockets, connectors, yokes, focusing coils and twist coils. Substantial savings can be offered when Magnetic Shields and Tubes are purchased as assemblies.

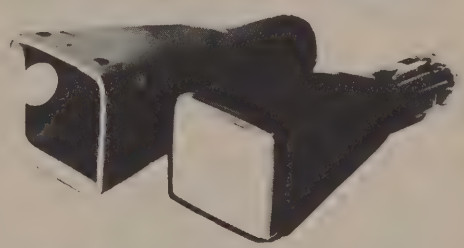
Thorn Radio Valves and Tubes Limited is one of Britain's largest manufacturers of industrial cathode ray tubes. Examine a BRIMAR catalog and you will find about the widest range of tubes, one of which is likely to be a perfect fit for your requirement. But if you have something unusual in mind it is probable that BRIMAR can make it.

### PARTIAL LISTING OF AVAILABLE TYPES

| Selected Types | Application and Description | Face Shape & Dia. (Min.) | Useful Min. Screen Area (Inch) |
|---|---|---|---|
| **FLYING SPOT SCANNER TUBES** | | | |
| Q7-100GU | Electrostatic focus. High resolution. | 3 ● | 4.7 |
| Q13-202GS | Electrostatic focus. Document readers or telecine EHT connection by CT8 socket. | 5 ● | 3.5x2.7 |
| **SMALL ELECTROSTATIC DISPLAY TUBES** | | | |
| D3-130 | General purpose indicating device. | 1 ● | 1.1 |
| D7-200 | Indicators. Oscilloscopes. CCTV. Alpha-numerical readout. | 3 ■ | 2x1.6 |
| D7-201 | Low power, 8 to 10 mil spot. Inexpensive. For portable scopes. | 3 ■ | 2x1.6 |
| D9-110 | Low power, letter box format. | 3½ ■ | 2.6x1.6 |
| **INSTRUMENT TUBES — SINGLE GUN** | | | |
| D10-210 | Compact, low power, mesh p.d.a. | 4 ■ | 2.75x2 |
| D10-230 | Low cost, high quality, flat face. Short (10.25″), low X deflection voltage requirement. | 4 ● | 3.15x2.5 |
| D10-240 | Low power, short (10.25″), spiral p.d.a., good line width and deflection coefficients, deflection blanking. | 4 ■ | 2.75x2 |
| D10-293 | High bandwidth. Portable small compact size. | 4 ■ | 2.75x2 |
| D13-47 | Medium bandwidth. For transistor scan circuits. Spiral p.d.a. | 5 ■ | 4x2.4 |
| D13-471 | Low voltage heater version of D13-47. | 5 ■ | 4x2.4 |
| D13-600 | General purpose. Short length. Large screen area. | 5 ● | 4x3.1 |
| D13-601 | Same as D13-600 but with low wattage heater. | 5 ● | 4x3.1 |
| D13-610 | Medium bandwidth for transistor scan circuits. Spiral p.d.a. | 5 ● | 4x3.1 |
| D13-611 | General purpose, medium bandwidth, spiral p.d.a. | 5 ● | 4x3.1 |
| D13-630 | Short length monoaccelerator. | 5 ● | 4x3.1 |
| D14-172 | General purpose. Short length. | 5½ ■ | 4x3.1 |
| D14-173 | Low wattage heater version of D14-172. | 5½ ■ | 4x3.1 |
| D14-180 | Medium bandwidth for transistor scan circuits. | 5½ ■ | 4x3.1 |
| D14-200 | High bandwidth, mesh p.d.a., squared-off face-plate. | 5½ ■ | 4x3.1 |
| D14-270 | Short, low cost monoaccelerator. | 5½ ■ | 4x3.1 |
| D14-280 | Medium to high bandwidth, mesh p.d.a. | 5½ ■ | 4x3.1 |
| D14-310 | High bandwidth, superior spot size. | 5½ ■ | 4x3.1 |
| D16-100 | X-Y plotter. Square faced tube. | 5½ ■ | 4x4 |
| D18-130 | Short (12.2″), large screen, spiral p.d.a. General purpose applications. | 7 ■ | 4.7x3.9 |

### INSTRUMENT TUBES

### D14-172/D18-130 SHORT RECTANGULAR TUBES



Short overall lengths (12 and 12.2 inches) / Rectangular 3.9 x 3.15- and 4.7 x 3.9-inch displays (10 x 8- and 12 x 10-cm / Spiral p.d.a. for bright trace / Internal graticules available / For general purpose applications/Shown above with TELFORM shield.

### ALSO AVAILABLE

## Magnetically-deflected tubes for:

Alpha-numeric and graphic displays
Medical waveforms
Airborne displays
Closed circuit TV
Security surveillance
Mobile monitors
PPI display radars
Sector display radars
Self-labeling radars

### MAGNETIC SHIELDS UP TO 30″ DIAMETER FOR CATHODE RAY TUBES & TRANSFORMERS by Telcon Metals Ltd.

Telcon Metals, Ltd., has its own in-plant facilities to handle every phase of the magnetic shield manufacturing process from start to finish. This means 100% Telcon supervision all the way — from the melting and rolling of the raw material to the fabrication and annealing of the magnetic shield. Telcon's total production method is based on a century of experience in the manufacture of alloys. All these factors are your assurance that you get a sensibly priced, high quality product.

### A NEW CONCEPT IN MAGNETIC SHIELD CONSTRUCTION

Specially developed for quantity production of high efficiency complex shields, new TELFORM construction utilizes precision drawn segments to drastically reduce welded seams. The result is extra close fitting shields with improved shielding characteristics. This new technique is applicable for CRT tubes up to approximately 20″ long. No premium charge even though dimensions, finish and appearance are far more uniform throughout batches than conventionally fabricated shields. Rapid delivery after initial tooling. Available in 80%, 50% and 36% nickel-iron alloys.

**Extremely Competitive Prices on Custom Shields.**
**Send for Illustrated Catalog and Ask for a Quotation.**

# THE BROADEST PRODUCT LINE IN THE COUNTRY

alpha

Alpha is the one-stop source for your requirements in communications, control, military, aerospace, installation maintenance and repair • Widest selection of wire, cable and tubing in electronics industry • 3 styles of flat cable for mass termination; 80 styles of matching connectors including new card edge series • Bonded and laminated ribbon cables • New line of over 400 UL listed, CSA certified, OSHA acceptable cables; over 1000 types of instrumentation cables • Revolutionary plastic blade wire stripper • Tubing: shrinkable, non-shrinkable, zipper • Widest selection of sizes, packages, spools and colors to suit your technical and economic needs • Alpha has the necessary MIL, UL, CSA and OSHA approvals to meet your most stringent requirements.

## PRODUCT INDEX

Aircraft Wire
Airport Lighting Cable
Antenna Wire
Appliance Wire
Asbestos Wire
Audio Cable

Braid
Bus Bar

Coaxial Cable
Coaxial Microminiature
Communications Cable
Computer Cable
Control Cable
Cordage
Cord Sets
CSA Certified Cables

Data Cable
Diesel and Car Cable

Extension Cords

Flat Cable
Flat Cable Connectors
Fixture Wire
Foil Shielded Cable

Headset Cable
Hook-up Wire

Instrumentation Cable
Intercom Cable
Irradiated Wire and Cable

Kynar Wire

Lacing Cord
Lamp Cord
Language Lab Cable

Medical Safety Cable
Microphone Cable
MIL Spec Wire and Cable
MIL Spec Tubing
Mine Cable
Motor Lead Wire

Neoprene Cables

OSHA Cables

Phonograph Wire
Power Cable
Power Cords
Polyethylene Cable
PVC Wire, Cable and Tubing

Replacement Cords
Retractile Cords
Ribbon Cable
Rubber Cable

Shielding
Speaker Cable
Spiral Shielded Cable
Stereo Cable
Switchboard Wire

Teflon Wire, Cable and Tubing
Tefzel Wire
Telephone Station Cable
Telemetering Cable
Test Lead Wire
Thermostat Cable

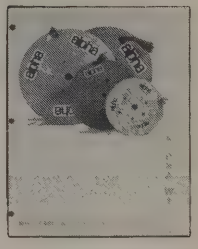
UL Listed Wire, Cable and Tubing
UL/OSHA Cables

Welding Cable
Wire Wrap

Zipper Tubing

TUBING
- Jackets
- Markers
- MIL Spec
- Plastic Impregnated Fiberglass
- PVC
- Shrinkable Tubing (PVC, Polyolefin, Neoprene, Teflon)
- Sleeving
- Spiral Wrap Tubing
- Teflon
- UL Listed
- Zipper Tubing

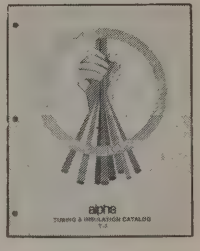
**THESE CATALOGS MAY BE OBTAINED FROM YOUR LOCAL ALPHA DISTRIBUTOR OR DIRECTLY FROM ALPHA.**



## FULL-LINE CATALOG

The electronic industry's broadest line of wire, cable and tubing is detailed in Alpha's full-line catalog. 128 pages, over 2500 different items in more than 13,000 sizes, packages and colors.

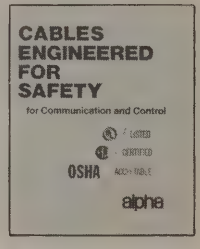
Ask for W-8.



## TUBING CATALOG

Solve all your tubing needs with Alpha. Catalog contains industry's largest selection of tubing — shrinkable, non-shrinkable, zipper, caps, boots, seals, markers, heating devices.

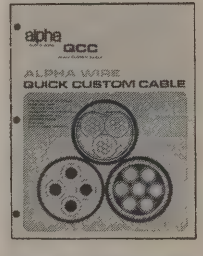
Ask for T-2.




## UL/OSHA/CABLES

The industry's broadest line of UL listed, CSA certified, OSHA acceptable multiconductor and multipair electronic cables.

Ask for UL-1.




## QUICK CUSTOM CABLE

Solve your special prototype and custom cable needs. Alpha can make virtually any type of cable you need, in quantities from one foot to production runs. And expect fast delivery.

Ask for 722.

## FLAT CABLE AND CONNECTORS

Alpha Flat Cable and Connector System includes 3 styles of flat cable — Gray Laminated, Color-Coded, Ground Plane — in 10 to 60 conductor sizes with a full complement of insulation displacement connectors and assembly tools.

Ask for FC-2.

**ALPHA WIRE Corporation** Elizabeth, N.J. 07207 Telephone: (201) 925-8000

alpha

# COMPUTER CABLES

## 80°C MULTICONDUCTOR COMPUTER CABLES UL2343

UL® LISTED
CSA CERTIFIED
OSHA ACCEPTABLE

### UNSHIELDED

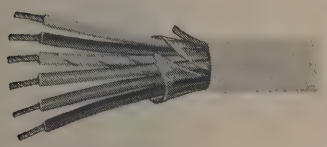
**Description:** Each conductor stranded tinned copper, color coded PVC insulation, mylar wrap, nylon rip cord, gray PVC jacket overall with measurement indicator at 1′ intervals.

**Characteristics:** 80°C maximum operating temperature. UL rates maximum only; cable is suitable for use at −40°C. No UL specified operating voltage. CSA rated at 80°C, 300 volts. Passes FR-1 flame test.

### SHIELDED

**Description:** Each conductor stranded tinned copper, color coded PVC insulation, shield 85-90% coverage, mylar wrap, nylon rip cord, PVC jacket overall with measurement indicator at 1′ intervals.

**Characteristics:** 80°C maximum operating temperature. UL rates maximum only; cable is suitable for use at −40°C. No UL specified operating voltage. CSA rated at 80°C, 300 volts. Passes FR-1 flame test.



### 24 AWG (7/32)

| Alpha No. | No. Conductors | Nominal Jacket Thickness Inch | (mm) | Nominal O.D. Inch | (mm) |
|---|---|---|---|---|---|
| 5200 | 5 | .063 | (1.60) | .250 | (6.35) |
| 5201 | 7 | .063 | (1.60) | .265 | (6.73) |
| 5202 | 12 | .063 | (1.60) | .320 | (8.13) |
| 5203 | 15 | .063 | (1.60) | .340 | (8.64) |
| 5204 | 19 | .063 | (1.60) | .360 | (9.15) |
| 5205 | 27 | .063 | (1.60) | .410 | (10.41) |
| 5206 | 37 | .063 | (1.60) | .445 | (11.30) |
| 5207 | 48 | .063 | (1.60) | .495 | (12.57) |
| 5208 | 60 | .063 | (1.60) | .535 | (13.59) |

### 24 AWG (7/32)

| Alpha No. | No. Conductors | Nominal Jacket Thickness Inch | (mm) | Nominal O.D. Inch | (mm) |
|---|---|---|---|---|---|
| 5300 | 5 | .063 | (1.60) | .275 | (6.99) |
| 5301 | 7 | .063 | (1.60) | .290 | (7.37) |
| 5302 | 12 | .063 | (1.60) | .345 | (8.76) |
| 5303 | 15 | .063 | (1.60) | .365 | (9.27) |
| 5304 | 19 | .063 | (1.60) | .380 | (9.65) |
| 5305 | 27 | .063 | (1.60) | .430 | (10.92) |
| 5306 | 37 | .063 | (1.60) | .470 | (11.94) |
| 5307 | 48 | .063 | (1.60) | .520 | (13.21) |
| 5308 | 60 | .063 | (1.60) | .555 | (14.10) |

### 22 AWG (7/30)

| | | | | | |
|---|---|---|---|---|---|
| 5210 | 5 | .063 | (1.60) | .270 | (6.86) |
| 5211 | 7 | .063 | (1.60) | .285 | (7.24) |
| 5212 | 12 | .063 | (1.60) | .345 | (8.76) |
| 5213 | 15 | .063 | (1.60) | .370 | (9.40) |
| 5214 | 19 | .063 | (1.60) | .390 | (9.91) |
| 5215 | 27 | .063 | (1.60) | .440 | (11.18) |
| 5216 | 37 | .063 | (1.60) | .490 | (12.45) |
| 5217 | 48 | .063 | (1.60) | .545 | (13.84) |
| 5218 | 60 | .063 | (1.60) | .580 | (14.73) |

### 22 AWG (7/30)

| | | | | | |
|---|---|---|---|---|---|
| 5310 | 5 | .063 | (1.60) | .290 | (7.37) |
| 5311 | 7 | .063 | (1.60) | .310 | (7.87) |
| 5312 | 12 | .063 | (1.60) | .380 | (9.65) |
| 5313 | 15 | .063 | (1.60) | .390 | (9.91) |
| 5314 | 19 | .063 | (1.60) | .410 | (10.41) |
| 5315 | 27 | .063 | (1.60) | .470 | (11.94) |
| 5316 | 37 | .063 | (1.60) | .510 | (12.95) |
| 5317 | 48 | .063 | (1.60) | .570 | (14.48) |
| 5318 | 60 | .063 | (1.60) | .610 | (15.49) |

### 20 AWG (19/32)

| | | | | | |
|---|---|---|---|---|---|
| 5220 | 5 | .063 | (1.60) | .295 | (7.49) |
| 5221 | 7 | .063 | (1.60) | .320 | (8.13) |
| 5222 | 12 | .063 | (1.60) | .390 | (9.91) |
| 5223 | 15 | .063 | (1.60) | .415 | (10.54) |
| 5224 | 19 | .063 | (1.60) | .440 | (11.18) |
| 5225 | 27 | .063 | (1.60) | .510 | (12.95) |
| 5226 | 37 | .063 | (1.60) | .560 | (14.22) |
| 5227 | 48 | .063 | (1.60) | .630 | (16.00) |
| 5228 | 60 | .063 | (1.60) | .680 | (17.27) |

Nom. Insul. Wall Thick.: .009″ (.23mm)
Std. Put-up: 100 Ft., 500 Ft., 1000 Ft.

### 20 AWG (19/32)

| | | | | | |
|---|---|---|---|---|---|
| 5320 | 5 | .063 | (1.60) | .325 | (8.26) |
| 5321 | 7 | .063 | (1.60) | .345 | (8.76) |
| 5322 | 12 | .063 | (1.60) | .410 | (10.41) |
| 5323 | 15 | .063 | (1.60) | .440 | (11.18) |
| 5324 | 19 | .063 | (1.60) | .465 | (11.81) |
| 5325 | 27 | .063 | (1.60) | .530 | (13.46) |
| 5326 | 37 | .063 | (1.60) | .585 | (14.86) |
| 5327 | 48 | .063 | (1.60) | .660 | (16.76) |
| 5328 | 60 | .063 | (1.60) | .715 | (18.16) |

Nom. Insul. Wall Thick.: .009″ (.23mm)
Std. Put-up: 100 Ft., 500 Ft., 1000 Ft.

## 80°C TWISTED PAIRS COMPUTER CABLES UL2343, 2344

UL® LISTED
CSA CERTIFIED
OSHA ACCEPTABLE

### UNSHIELDED

**Description:** Each conductor stranded tinned copper, color coded PVC insulation, conductors twisted, mylar wrap, nylon rip cord, gray PVC jacket overall with measurement indicator at 1′ intervals.

**Characteristics:** 80°C maximum operating temperature. UL rates maximum only; cable is suitable for use at −40°C. No UL specified operating voltage. CSA rated at 80°C, 300 volts. Passes FR-1 flame test.

### SHIELDED

**Description:** Each conductor stranded tinned copper, color coded PVC insulation, conductors twisted, mylar wrap, braided tinned copper shield 85-90% coverage, nylon rip cord, gray PVC jacket overall with measurement indicator at 1′ intervals.

**Characteristics:** 80°C maximum operating temperature. UL rates maximum only; cable is suitable for use at −40°C. No UL specified operating voltage. CSA rated at 80°C, 300 volts. Passes FR-1 flame test.

### 24 AWG (7/32)

| Alpha No. | No. Pairs | Nominal Jacket Thickness Inch | (mm) | Nominal O.D. Inch | (mm) |
|---|---|---|---|---|---|
| 5230 | 5 | .063 | (1.60) | .345 | (8.76) |
| 5231 | 7 | .063 | (1.60) | .355 | (9.02) |
| 5232 | 12 | .063 | (1.60) | .445 | (11.31) |
| 5233 | 15 | .063 | (1.60) | .485 | (12.32) |
| 5234 | 19 | .063 | (1.60) | .505 | (12.83) |
| 5235 | 27 | .063 | (1.60) | .575 | (14.61) |
| 5236 | 37 | .063 | (1.60) | .640 | (16.26) |
| 5237 | 48 | .063 | (1.60) | .710 | (18.03) |
| 5238 | 60 | .063 | (1.60) | .760 | (19.30) |

### 24 AWG (7/32)

| Alpha No. | No. Pairs | Nominal Jacket Thickness Inch | (mm) | Nominal O.D. Inch | (mm) |
|---|---|---|---|---|---|
| 5330 | 5 | .063 | (1.60) | .365 | (9.27) |
| 5331 | 7 | .063 | (1.60) | .380 | (9.66) |
| 5332 | 12 | .063 | (1.60) | .465 | (11.81) |
| 5333 | 15 | .063 | (1.60) | .510 | (12.95) |
| 5334 | 19 | .063 | (1.60) | .525 | (13.34) |
| 5335 | 27 | .063 | (1.60) | .595 | (15.11) |
| 5336 | 37 | .063 | (1.60) | .670 | (17.02) |
| 5337 | 48 | .063 | (1.60) | .740 | (18.80) |
| 5338 | 60 | .063 | (1.60) | .815 | (20.70) |

### 22 AWG (7/30)

| | | | | | |
|---|---|---|---|---|---|
| 5240 | 5 | .063 | (1.60) | .370 | (9.40) |
| 5241 | 7 | .063 | (1.60) | .385 | (9.78) |
| 5242 | 12 | .063 | (1.60) | .485 | (12.32) |
| 5243 | 15 | .063 | (1.60) | .535 | (13.59) |
| 5244 | 19 | .063 | (1.60) | .565 | (14.35) |
| 5245 | 27 | .063 | (1.60) | .645 | (16.38) |
| 5246 | 37 | .063 | (1.60) | .735 | (18.67) |
| 5247 | 48 | .063 | (1.60) | .815 | (20.70) |
| 5248 | 60 | .080 | (2.03) | .915 | (23.24) |

### 22 AWG (7/30)

| | | | | | |
|---|---|---|---|---|---|
| 5340 | 5 | .063 | (1.60) | .395 | (10.03) |
| 5341 | 7 | .063 | (1.60) | .410 | (10.41) |
| 5342 | 12 | .063 | (1.60) | .510 | (12.95) |
| 5343 | 15 | .063 | (1.60) | .555 | (14.10) |
| 5344 | 19 | .063 | (1.60) | .590 | (14.99) |
| 5345 | 27 | .063 | (1.60) | .680 | (17.27) |
| 5346 | 37 | .063 | (1.60) | .770 | (19.56) |
| 5347 | 48 | .080 | (2.03) | .890 | (22.61) |
| 5348 | 60 | .080 | (2.03) | .950 | (24.13) |

### 20 AWG (19/32)

| | | | | | |
|---|---|---|---|---|---|
| 5250 | 5 | .063 | (1.60) | .420 | (10.67) |
| 5251 | 7 | .063 | (1.60) | .435 | (11.05) |
| 5252 | 12 | .063 | (1.60) | .555 | (14.10) |
| 5253 | 15 | .063 | (1.60) | .610 | (15.49) |
| 5254 | 19 | .063 | (1.60) | .650 | (16.51) |
| 5255 | 27 | .063 | (1.60) | .750 | (19.05) |
| 5256 | 37 | .080 | (2.03) | .890 | (20.61) |
| 5257 | 48 | .080 | (2.03) | .990 | (25.15) |
| 5258 | 60 | .080 | (2.03) | 1.065 | (27.05) |

Nom. Insul. Wall Thick.: .009″ (.23mm)
Std. Put-up: 100 Ft., 500 Ft., 1000 Ft.

### 20 AWG (19/32)

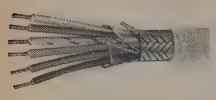
| | | | | | |
|---|---|---|---|---|---|
| 5350 | 5 | .063 | (1.60) | .440 | (11.18) |
| 5351 | 7 | .063 | (1.60) | .460 | (11.68) |
| 5352 | 12 | .063 | (1.60) | .580 | (14.73) |
| 5353 | 15 | .063 | (1.60) | .645 | (16.38) |
| 5354 | 19 | .063 | (1.60) | .680 | (17.27) |
| 5355 | 27 | .063 | (1.60) | .785 | (19.94) |
| 5356 | 37 | .080 | (2.03) | .930 | (23.62) |
| 5357 | 48 | .080 | (2.03) | 1.030 | (26.16) |
| 5358 | 60 | .080 | (2.03) | 1.100 | (27.94) |

Nom. Insul. Wall Thick.: .009″ (.23mm)
Std. Put-up: 100 Ft., 500 Ft., 1000 Ft.

# UL/CSA/OSHA CABLES

alpha

## MULTICONDUCTOR SHIELDED CABLE



Wiring cable suitable for industrial control equipment, business machines and many other uses. Conductor is stranded, annealed, tinned copper; insulation is PVC rated at 80°C (105°C for Type 2501) and 300 volts (600V for Type 2501); tape wrap is 0.001″ clear mylar; nylon rip cord; jacket is gray PVC thickness as listed and marked at one foot intervals.

### UL STYLE 2464, 300V, 80°C

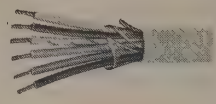
| Alpha No. | No. of Conds. | Nominal Jacket Thickness, Inches | Nominal O.D., Inches |
|---|---|---|---|
| **20 AWG — 10/30 STRAND** | | | |
| 5152 | 2 | .032 | .235 |
| 5153 | 3 | .032 | .245 |
| 5154 | 4 | .032 | .265 |
| 5156 | 6 | .032 | .315 |
| 5158 | 8 | .032 | .335 |
| 5160 | 10 | .032 | .385 |
| 5160/15 | 15 | .032 | .425 |
| 5160/20 | 20 | .032 | .470 |
| 5160/25 | 25 | .032 | .535 |
| 5160/30 | 30 | .032 | .565 |
| 5160/40 | 40 | .050 | .665 |
| 5160/50 | 50 | .050 | .735 |
| 5160/60 | 60 | .050 | .790 |
| 5160/70 | 70 | .080 | .925 |
| 5160/80 | 80 | .080 | .955 |
| 5160/90 | 90 | .080 | 1.000 |
| 5160/00 | 100 | .080 | 1.070 |
| **18 AWG — 16/30 STRAND** | | | |
| 5162 | 2 | .032 | .255 |
| 5163 | 3 | .032 | .265 |
| 5164 | 4 | .032 | .290 |
| 5166 | 6 | .032 | .340 |
| 5168 | 8 | .032 | .365 |
| 5170 | 10 | .032 | .420 |
| 5170/15 | 15 | .032 | .470 |
| 5170/20 | 20 | .032 | .530 |
| 5170/25 | 25 | .050 | .625 |
| 5170/30 | 30 | .050 | .660 |
| 5170/40 | 40 | .050 | .735 |
| 5170/50 | 50 | .050 | .805 |
| 5170/60 | 60 | .080 | .935 |
| 5170/70 | 70 | .080 | 1.015 |
| 5170/80 | 80 | .080 | 1.050 |
| 5170/90 | 90 | .080 | 1.095 |
| **16 AWG — 26/30 STRAND** | | | |
| 5172 | 2 | .032 | .285 |
| 5173 | 3 | .032 | .300 |
| 5174 | 4 | .032 | .330 |
| 5176 | 6 | .032 | .385 |
| 5178 | 8 | .032 | .415 |
| 5180 | 10 | .032 | .480 |
| 5180/15 | 15 | .032 | .545 |
| 5180/20 | 20 | .050 | .645 |
| 5180/25 | 25 | .050 | .720 |
| 5180/30 | 30 | .050 | .760 |
| 5180/40 | 40 | .080 | .910 |
| 5180/50 | 50 | .080 | 1.000 |
| 5180/60 | 60 | .080 | 1.070 |

### UL STYLE 2501, 600V, 105°C

| | | | |
|---|---|---|---|
| **22 AWG — 7/30 STRAND** | | | |
| 5504 | 4 | .063 | .390 |
| 5505 | 5 | .063 | .420 |
| 5507 | 7 | .063 | .450 |
| 5509 | 9 | .063 | .510 |
| 5509/12 | 12 | .063 | .555 |
| 5509/15 | 15 | .063 | .610 |
| 5509/19 | 19 | .063 | .650 |
| 5509/25 | 25 | .063 | .745 |
| **20 AWG — 10/30 STRAND** | | | |
| 5514 | 4 | .063 | .410 |
| 5515 | 5 | .063 | .440 |
| 5517 | 7 | .063 | .470 |
| 5519 | 9 | .063 | .535 |
| 5519/12 | 12 | .063 | .595 |
| 5519/15 | 15 | .063 | .640 |
| 5519/19 | 19 | .063 | .685 |
| 5519/25 | 25 | .063 | .735 |
| **18 AWG — 16/30 STRAND** | | | |
| 5524 | 4 | .063 | .435 |
| 5525 | 5 | .063 | .465 |
| 5527 | 7 | .063 | .500 |
| 5529 | 9 | .063 | .570 |
| 5529/12 | 12 | .063 | .635 |
| 5529/15 | 15 | .063 | .685 |
| 5529/19 | 19 | .063 | .735 |
| 5529/25 | 25 | .080 | .885 |

**UL STYLE 2501 IS ALSO AVAILABLE IN #16 AND #14 AWG**

## MULTICONDUCTOR UNSHIELDED CABLE



Appliance wiring cable; suitable for interconnection of business machines, switch gear, intercoms, air conditioners and many other uses. Stranded, annealed, tinned copper conductors. PVC insulation; rated 80°C (105°C for Type 2501); 300V (600V for Type 2501). .001″ thick, clear mylar tape wrap. Gray PVC jacket; thickness as listed. Cable marked at 1′ intervals.

### UL STYLE 2464, 300V, 80°C

| Alpha No. | No. of Conds. | Nominal Jacket Thickness, Inches | Nominal O.D., Inches |
|---|---|---|---|
| **20 AWG — 10/30 STRAND** | | | |
| 5052 | 2 | .032 | .220 |
| 5053 | 3 | .032 | .225 |
| 5054 | 4 | .032 | .245 |
| 5056 | 6 | .032 | .285 |
| 5058 | 8 | .032 | .315 |
| 5060 | 10 | .032 | .360 |
| 5060/15 | 15 | .032 | .405 |
| 5060/20 | 20 | .032 | .450 |
| 5060/25 | 25 | .032 | .500 |
| 5060/30 | 30 | .032 | .535 |
| 5060/40 | 40 | .050 | .635 |
| 5060/50 | 50 | .050 | .695 |
| 5060/60 | 60 | .050 | .750 |
| 5060/70 | 70 | .080 | .885 |
| 5060/80 | 80 | .080 | .915 |
| 5060/90 | 90 | .080 | .955 |
| 5060/00 | 100 | .080 | 1.030 |
| **18 AWG — 16/30 STRAND** | | | |
| 5062 | 2 | .032 | .230 |
| 5063 | 3 | .032 | .245 |
| 5064 | 4 | .032 | .265 |
| 5066 | 6 | .032 | .320 |
| 5068 | 8 | .032 | .345 |
| 5070 | 10 | .032 | .395 |
| 5070/15 | 15 | .032 | .445 |
| 5070/20 | 20 | .032 | .495 |
| 5070/25 | 25 | .032 | .555 |
| 5070/30 | 30 | .050 | .625 |
| 5070/40 | 40 | .050 | .700 |
| 5070/50 | 50 | .050 | .770 |
| 5070/60 | 60 | .080 | .895 |
| 5070/70 | 70 | .080 | .975 |
| 5070/80 | 80 | .080 | 1.010 |
| 5070/90 | 90 | .080 | 1.055 |
| 5070/00 | 100 | .080 | 1.135 |
| **16 AWG — 26/30 STRAND** | | | |
| 5072 | 2 | .032 | .260 |
| 5073 | 3 | .032 | .275 |
| 5074 | 4 | .032 | .300 |
| 5076 | 6 | .032 | .365 |
| 5078 | 8 | .032 | .395 |
| 5080 | 10 | .032 | .455 |
| 5080/15 | 15 | .032 | .515 |
| 5080/20 | 20 | .050 | .610 |
| 5080/25 | 25 | .050 | .680 |
| 5080/30 | 30 | .050 | .725 |
| 5080/40 | 40 | .080 | .875 |
| 5080/50 | 50 | .080 | .960 |
| 5080/60 | 60 | .080 | 1.030 |

### UL STYLE 2501, 600V, 105°C

| | | | |
|---|---|---|---|
| **22 AWG — 7/30 STRAND** | | | |
| 5404 | 4 | .063 | .370 |
| 5405 | 5 | .063 | .395 |
| 5407 | 7 | .063 | .425 |
| 5409 | 9 | .063 | .485 |
| 5409/12 | 12 | .063 | .535 |
| 5409/15 | 15 | .063 | .575 |
| 5409/19 | 19 | .063 | .615 |
| 5409/25 | 25 | .063 | .710 |
| **20 AWG — 10/30 STRAND** | | | |
| 5414 | 4 | .063 | .385 |
| 5415 | 5 | .063 | .415 |
| 5417 | 7 | .063 | .445 |
| 5419 | 9 | .063 | .510 |
| 5419/12 | 12 | .063 | .565 |
| 5419/15 | 15 | .063 | .610 |
| 5419/19 | 19 | .063 | .650 |
| 5419/25 | 25 | .063 | .750 |
| **18 AWG — 16/30 STRAND** | | | |
| 5424 | 4 | .063 | .410 |
| 5425 | 5 | .063 | .445 |
| 5427 | 7 | .063 | .475 |
| 5429 | 9 | .063 | .555 |
| 5429/12 | 12 | .063 | .605 |
| 5429/15 | 15 | .063 | .655 |
| 5429/19 | 19 | .063 | .700 |
| 5429/25 | 25 | .063 | .810 |

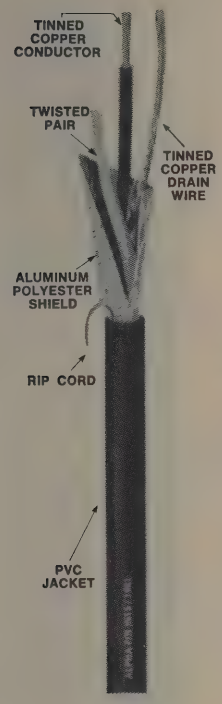
**UL STYLE 2501 IS ALSO AVAILABLE IN #16 AWG**

**ALPHA WIRE Corporation** Elizabeth, N.J. 07207 Telephone (201) 925-8000

alpha

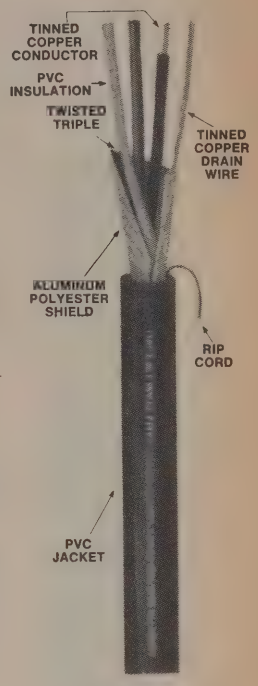
# INSTRUMENTATION CABLES

## SINGLE PAIR AND TRIPLE SHIELDED AND UNSHIELDED




Instrumentation cables act as an important link between sensing devices and read-out equipment or as external interconnection of process control stations. Alpha instrumentation cables utilize stranded tinned copper conductors and extruded black PVC jackets. All pairs are color coded black and white; triples are black, white and red.

Aluminum-polyester tape shield and drain wire provides 100% coverage. This page details a wide variety of AWG sizes, insulation materials, and temperature and voltage ratings. The particular advantages of each type are as follows.




**90°C 300 Volt PVC** — An economical, general purpose, flame retardant construction with good chemical and abrasion resistance. These cables pass the FR-1 vertical flame test, are UL listed under Subject 13, and comply with NEC Article 725.

**80°C 300 Volt PE** — Polyethylene insulation offers superior electrical characteristics minimizing at the same time cable diameter and capacitance. These cables are listed under UL Style 2667 approved for general electronic use in non-hazardous locations.

**90°C 600 Volt PVC/Nylon** — This construction offers a minimum diameter cable with 600 volt rating. Nylon jacketing of each conductor provides increased chemical and abrasion resistance as well as added electrical strength. Listed as tray cable under UL Subject 1277 and NEC Article 340.

**80°C 600 Volt PE** — Same excellent electrical characteristics as 300 volt construction but with increased capability for heavy duty control applications.

### 90°C 300 VOLT PVC SINGLE PAIR UNSHIELDED

| Alpha P/N | AWG | Stranding | Nominal Insulation Thickness (Inch) | Nominal Jacket Thickness (Inch) | Nominal O.D. (Inch) |
|---|---|---|---|---|---|
| 5600/2001 | 20 | 7/28 | .013 | .035 | .205 |
| 5600/1801 | 18 | 7/26 | .016 | .035 | .237 |
| 5600/1601 | 16 | 19/29 | .016 | .035 | .255 |

### 90°C 300 VOLT PVC SINGLE PAIR SHIELDED

| | | | | | |
|---|---|---|---|---|---|
| 5610/2401* | 24 | 7/32 | .010 | .030 | .159 |
| 5610/2201 | 22 | 7/30 | .013 | .035 | .191 |
| 5610/2001 | 20 | 7/28 | .013 | .035 | .207 |
| 5610/1801 | 18 | 7/26 | .016 | .035 | .239 |
| 5610/1601 | 16 | 19/29 | .016 | .035 | .257 |
| 5610/1401* | 14 | 19/27 | .020 | .040 | .309 |
| 5610/1201* | 12 | 19/25 | .020 | .040 | .347 |

### 80°C 300 VOLT PE SINGLE PAIR SHIELDED

| | | | | | |
|---|---|---|---|---|---|
| 5611/2401 | 24 | 7/32 | .015 | .020 | .151 |
| 5611/2201 | 22 | 7/30 | .015 | .020 | .165 |
| 5611/2001 | 20 | 7/28 | .015 | .020 | .181 |
| 5611/1801 | 18 | 7/26 | .015 | .020 | .201 |

### 80°C 600 VOLT PE SINGLE PAIR SHIELDED

| | | | | | |
|---|---|---|---|---|---|
| 5615/1601 | 16 | 19/29 | .030 | .040 | .301 |
| 5615/1401 | 14 | 19/27 | .030 | .040 | .349 |
| 5615/1201 | 12 | 19/25 | .030 | .045 | .397 |

### 90°C 600 VOLT PVC/NYLON SINGLE PAIR UNSHIELDED

| | | | | | |
|---|---|---|---|---|---|
| 5606/2001* | 20 | 7/28 | .016 | .035 | .217 |
| 5606/1801 | 18 | 7/26 | .021 | .045 | .277 |
| 5606/1601 | 16 | 19/29 | .021 | .045 | .295 |

### 90°C 600 VOLT PVC/NYLON SINGLE PAIR SHIELDED

| | | | | | |
|---|---|---|---|---|---|
| 5616/2001* | 20 | 7/28 | .016 | .035 | .219 |
| 5616/1801 | 18 | 7/26 | .021 | .045 | .279 |
| 5616/1601 | 16 | 19/29 | .021 | .045 | .297 |
| 5616/1401 | 14 | 19/27 | .021 | .045 | .327 |
| 5616/1201 | 12 | 19/25 | .021 | .045 | .365 |

*Not UL listed.

### 90°C 300 VOLT PVC SINGLE TRIPLE UNSHIELDED

| Alpha P/N | AWG | Stranding | Nominal Insulation Thickness (Inch) | Nominal Jacket Thickness (Inch) | Nominal O.D. (Inch) |
|---|---|---|---|---|---|
| 5630/2001 | 20 | 7/28 | .013 | .035 | .215 |
| 5630/1801 | 18 | 7/26 | .016 | .035 | .250 |
| 5630/1601 | 16 | 19/29 | .020 | .035 | .269 |

### 90°C 300 VOLT PVC SINGLE TRIPLE SHIELDED

| | | | | | |
|---|---|---|---|---|---|
| 5640/2201 | 22 | 7/30 | .013 | .035 | .200 |
| 5640/2001 | 20 | 7/28 | .013 | .035 | .217 |
| 5640/1801 | 18 | 7/26 | .016 | .035 | .252 |
| 5640/1601 | 16 | 19/29 | .020 | .035 | .271 |
| 5640/1401* | 14 | 19/27 | .020 | .040 | .326 |

### 80°C 300 VOLT PE SINGLE TRIPLE SHIELDED

| | | | | | |
|---|---|---|---|---|---|
| 5641/2201 | 22 | 7/30 | .015 | .020 | .175 |
| 5641/2001 | 20 | 7/28 | .015 | .020 | .192 |
| 5641/1801 | 18 | 7/26 | .015 | .020 | .213 |

### 80°C 600 VOLT PE SINGLE TRIPLE SHIELDED

| | | | | | |
|---|---|---|---|---|---|
| 5645/1601 | 16 | 19/29 | .030 | .040 | .318 |
| 5645/1401 | 14 | 19/27 | .030 | .040 | .370 |

### 90°C 600 VOLT PVC/NYLON SINGLE TRIPLE UNSHIELDED

| | | | | | |
|---|---|---|---|---|---|
| 5636/2001* | 20 | 7/28 | .016 | .035 | .228 |
| 5636/1801 | 18 | 7/26 | .021 | .045 | .291 |
| 5636/1601 | 16 | 19/29 | .021 | .045 | .311 |

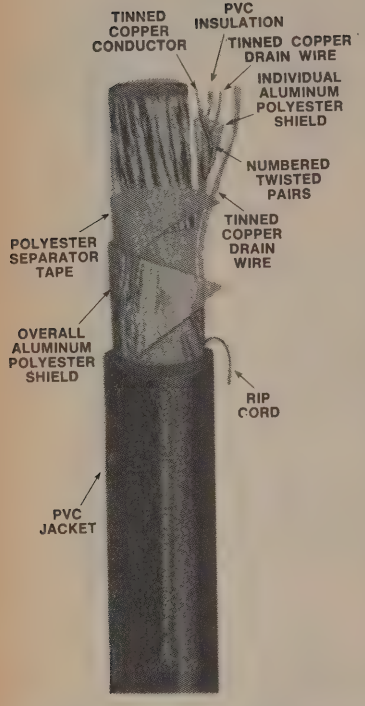
### 90°C 600 VOLT PVC/NYLON SINGLE TRIPLE SHIELDED

| | | | | | |
|---|---|---|---|---|---|
| 5646/1801 | 18 | 7/26 | .021 | .045 | .293 |
| 5646/1601 | 16 | 19/29 | .021 | .045 | .313 |
| 5646/1401 | 14 | 19/27 | .021 | .045 | .345 |

# INSTRUMENTATION CABLES

alpha

## MULTIPAIR AND MULTI-TRIPLE SHIELDED



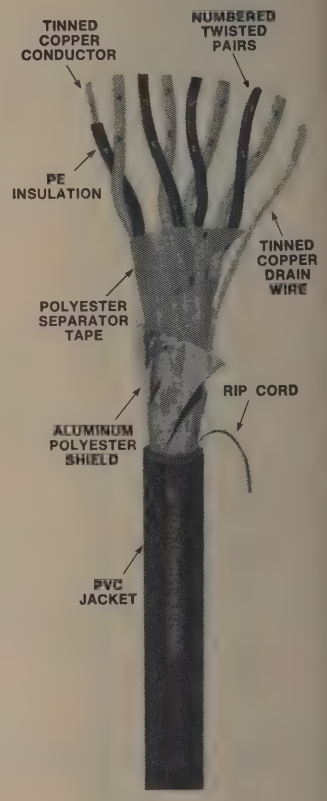

Instrumentation cables act as an important link between sensing devices and read-out equipment or as external interconnection of process control stations. Alpha instrumentation cables utilize stranded tinned copper conductors and extruded black PVC jackets. All pairs are color coded black and white with numbering; triples are black, white and red with numbering.

Aluminum-polyester tape shield and drain wire provides 100% coverage. This page details a wide variety of AWG sizes, insulation materials, and temperature and voltage ratings. The particular advantages of each type are as follows.

**90°C 300 Volt PVC** — An economical, general purpose, flame retardant construction with good chemical and abrasion resistance. These cables pass the FR-1 vertical flame test, are UL listed under Subject 13, and comply with NEC Article 725.

**80°C 300 Volt PE** — Polyethylene insulation offers superior electrical characteristics minimizing at the same time cable diameter and capacitance. These cables are listed under UL Style 2667 approved for general electronic use in non-hazardous locations.

**90°C 600 Volt PVC/Nylon** — This construction offers a minimum diameter cable with 600 volt rating. Nylon jacketing of each conductor provides increased chemical and abrasion resistance as well as added electrical strength. Listed as tray cable under UL Subject 1277 and NEC Article 340.




### 90°C 300 VOLT PVC MULTIPAIR OVERALL SHIELDED

| Alpha P/N | No. Pairs | AWG | Stranding | Nom. Insul. Thick. (In.) | Nom. Jacket Thick. (In.) | Nominal O.D. (In.) |
|---|---|---|---|---|---|---|
| 5610/2002 | 2 | 20 | 7/28 | .013 | .040 | .310 |
| 5610/2004 | 4 | 20 | 7/28 | .013 | .050 | .409 |
| 5610/2008 | 8 | 20 | 7/28 | .013 | .050 | .486 |
| 5610/2010 | 10 | 20 | 7/28 | .013 | .050 | .540 |
| 5610/2012 | 12 | 20 | 7/28 | .013 | .050 | .566 |
| 5610/2016 | 16 | 20 | 7/28 | .013 | .060 | .650 |
| 5610/2020 | 20 | 20 | 7/28 | .013 | .060 | .702 |
| 5610/2024 | 24 | 20 | 7/28 | .013 | .060 | .755 |
| 5610/2036 | 36 | 20 | 7/28 | .013 | .070 | .914 |
| 5610/2050 | 50 | 20 | 7/28 | .013 | .070 | 1.048 |
| 5610/1802 | 2 | 18 | 7/26 | .016 | .040 | .363 |
| 5610/1804 | 4 | 18 | 7/26 | .016 | .050 | .481 |
| 5610/1808 | 8 | 18 | 7/26 | .016 | .050 | .577 |
| 5610/1812 | 12 | 18 | 7/26 | .016 | .060 | .698 |
| 5610/1820 | 20 | 18 | 7/26 | .016 | .060 | .843 |
| 5610/1824 | 24 | 18 | 7/26 | .016 | .070 | .929 |
| 5610/1836 | 36 | 18 | 7/26 | .016 | .070 | 1.102 |
| 5610/1602 | 2 | 16 | 19/29 | .016 | .050 | .415 |
| 5610/1604 | 4 | 16 | 19/29 | .016 | .050 | .522 |
| 5610/1608 | 8 | 16 | 19/29 | .016 | .060 | .648 |
| 5610/1612 | 12 | 16 | 19/29 | .016 | .060 | .760 |
| 5610/1616 | 16 | 16 | 19/29 | .016 | .060 | .849 |
| 5610/1624 | 24 | 16 | 19/29 | .016 | .070 | 1.015 |
| 5610/1636 | 36 | 16 | 19/29 | .016 | .070 | 1.208 |

### 90°C 300 VOLT PVC MULTIPAIR INDIVIDUALLY SHIELDED

| | | | | | | |
|---|---|---|---|---|---|---|
| 5620/2002 | 2 | 20 | 7/28 | .013 | .040 | .365 |
| 5620/2004 | 4 | 20 | 7/28 | .013 | .050 | .442 |
| 5620/2008 | 8 | 20 | 7/28 | .013 | .050 | .561 |
| 5620/2012 | 12 | 20 | 7/28 | .013 | .060 | .693 |
| 5620/2016 | 16 | 20 | 7/28 | .013 | .060 | .766 |
| 5620/2020 | 20 | 20 | 7/28 | .013 | .060 | .847 |
| 5620/2024 | 24 | 20 | 7/28 | .013 | .070 | .959 |
| 5620/2036 | 36 | 20 | 7/28 | .013 | .070 | 1.092 |
| 5620/2050 | 50 | 20 | 7/28 | .013 | .070 | 1.245 |
| 5620/1802 | 2 | 18 | 7/26 | .016 | .050 | .451 |
| 5620/1804 | 4 | 18 | 7/26 | .016 | .050 | .519 |
| 5620/1808 | 8 | 18 | 7/26 | .016 | .060 | .687 |
| 5620/1812 | 12 | 18 | 7/26 | .016 | .060 | .826 |
| 5620/1820 | 20 | 18 | 7/26 | .016 | .070 | 1.037 |
| 5620/1824 | 24 | 18 | 7/26 | .016 | .070 | 1.151 |
| 5620/1836 | 36 | 18 | 7/26 | .016 | .080 | 1.336 |
| 5620/1602 | 2 | 16 | 19/29 | .016 | .050 | .487 |
| 5620/1604 | 4 | 16 | 19/29 | .016 | .050 | .563 |
| 5620/1608 | 8 | 16 | 19/29 | .016 | .060 | .747 |
| 5620/1612 | 12 | 16 | 19/29 | .016 | .070 | .920 |
| 5620/1616 | 16 | 16 | 19/29 | .016 | .070 | 1.021 |
| 5620/1624 | 24 | 16 | 19/29 | .016 | .080 | 1.279 |

### 90°C 600 VOLT PVC/NYLON MULTIPAIR OVERALL SHIELDED

| Alpha P/N | No. Pairs | AWG | Stranding | Nominal Insulation Thickness (Inch) | Nominal Jacket Thickness (Inch) | Nominal O.D. (Inch) |
|---|---|---|---|---|---|---|
| 5616/1602 | 2 | 16 | 19/29 | .021 | .045 | .436 |
| 5616/1604 | 4 | 16 | 19/29 | .021 | .060 | .587 |
| 5616/1608 | 8 | 16 | 19/29 | .021 | .060 | .705 |
| 5616/1612 | 12 | 16 | 19/29 | .021 | .080 | .870 |
| 5616/1624 | 24 | 16 | 19/29 | .021 | .080 | 1.131 |

### 80°C 300 VOLT PE MULTIPAIR OVERALL SHIELDED

| | | | | | | |
|---|---|---|---|---|---|---|
| 5611/2002 | 2 | 20 | 7/28 | .015 | .040 | .319 |
| 5611/2004 | 4 | 20 | 7/28 | .015 | .050 | .421 |
| 5611/2008 | 8 | 20 | 7/28 | .015 | .050 | .503 |
| 5611/2012 | 12 | 20 | 7/28 | .015 | .050 | .588 |
| 5611/2024 | 24 | 20 | 7/28 | .015 | .060 | .788 |

### 90°C 300 VOLT PVC MULTI-TRIPLE OVERALL SHIELDED

| | | | | | | |
|---|---|---|---|---|---|---|
| 5640/2004 | 4 | 20 | 7/28 | .013 | .050 | .454 |
| 5640/2012 | 12 | 20 | 7/28 | .013 | .060 | .651 |
| 5640/2024 | 24 | 20 | 7/28 | .013 | .070 | .899 |

### 90°C 300 VOLT PVC MULTI-TRIPLE INDIVIDUALLY SHIELDED

| | | | | | | |
|---|---|---|---|---|---|---|
| 5650/2004 | 4 | 20 | 7/28 | .013 | .050 | .466 |
| 5650/2012 | 12 | 20 | 7/28 | .013 | .060 | .734 |
| 5650/2024 | 24 | 20 | 7/28 | .013 | .070 | 1.019 |

alpha

# UNSHIELDED INTERCOM CABLES

## UNSHIELDED INTERCOM CABLE

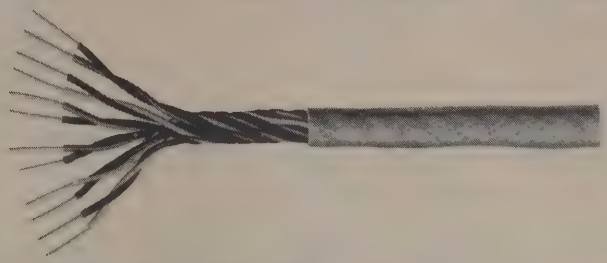
### Paired Conductors — Plastic Jacket

**Passes FR-1 Vertical Flame Test**

**DESCRIPTION:** Each conductor tinned copper, color coded polyvinylchloride insulation, conductors twisted into pairs, gray polyvinylchloride jacket overall.

**APPLICATIONS:** Balanced Intercom Systems, Annunciators, Telephones, Nurses Call Systems, Control Circuit Cable, Electronic Computer Cable, Multiple Speaker Cable, Signal Systems, Alarm Systems.

**CHARACTERISTICS:** Suggested Operating Temperature: −20°C to +80°C.



**22 GAUGE** — SOLID CONDUCTORS — UL 2576, 80°C, 150 VOLTS

| Alpha No. | No. of Pairs | No. of Cond. | Cond. Size | Cond. Strand | Nom. Wall Thickness | Nom. Jkt. Thickness | Nom. O.D. |
|---|---|---|---|---|---|---|---|
| 1300© | 1 | 2 | 22 Solid | 1 | .010″ | .032″ | .154″ |
| 1302© | 2 | 4 | 22 Solid | 1 | .010″ | .032″ | .222″ |
| 1304© | 3 | 6 | 22 Solid | 1 | .010″ | .032″ | .234″ |
| 1305 | 4 | 8 | 22 Solid | 1 | .010″ | .032″ | .252″ |
| 1307 | 6 | 12 | 22 Solid | 1 | .010″ | .032″ | .289″ |
| 1307/9 | 9 | 18 | 22 Solid | 1 | .010″ | .032″ | .334″ |
| 1308/11 | 11 | 22 | 22 Solid | 1 | .010″ | .032″ | .354″ |
| 1309 | 13 | 26 | 22 Solid | 1 | .010″ | .032″ | .374″ |
| 1309/15 | 15 | 30 | 22 Solid | 1 | .010″ | .032″ | .397″ |
| 1310 | 16 | 32 | 22 Solid | 1 | .010″ | .032″ | .425″ |
| 1311 | 19 | 38 | 22 Solid | 1 | .010″ | .032″ | .440″ |
| 1312 | 23 | 46 | 22 Solid | 1 | .010″ | .032″ | .481″ |
| 1313 | 27 | 54 | 22 Solid | 1 | .010″ | .040″ | .521″ |

**22 GAUGE** — STRANDED CONDUCTORS — UL 2576, 80°C, 150 VOLTS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1316 | 1 | 2 | 22 | 7/30 | .010″ | .032″ | .164″ |
| 1317 | 2 | 4 | 22 | 7/30 | .010″ | .032″ | .239″ |
| 1318 | 3 | 6 | 22 | 7/30 | .010″ | .032″ | .252″ |
| 1319 | 4 | 8 | 22 | 7/30 | .010″ | .032″ | .274″ |
| 1320 | 5 | 10 | 22 | 7/30 | .010″ | .032″ | .304″ |
| 1322 | 6 | 12 | 22 | 7/30 | .010″ | .035″ | .320″ |
| 1323 | 9 | 18 | 22 | 7/30 | .010″ | .035″ | .370″ |
| 1324 | 11 | 22 | 22 | 7/30 | .010″ | .035″ | .400″ |
| 1327 | 15 | 30 | 22 | 7/30 | .010″ | .040″ | .450″ |
| 1327/19 | 19 | 38 | 22 | 7/30 | .010″ | .040″ | .480″ |
| 1328 | 23 | 46 | 22 | 7/30 | .010″ | .040″ | .530″ |
| 1329 | 27 | 54 | 22 | 7/30 | .010″ | .040″ | .708″ |
| 1329/41 | 41 | 82 | 22 | 7/30 | .010″ | .040″ | .710″ |
| 1330 | 51 | 102 | 22 | 7/30 | .010″ | .045″ | .800″ |

**18 GAUGE** — STRANDED CONDUCTORS — UL 2464, 80°C, 300 VOLTS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1133 | 3 | 6 | 18 | 16/30 | .016″ | .037″ | .356″ |
| 1136 | 6 | 12 | 18 | 16/30 | .016″ | .045″ | .540″ |
| 1139 | 9 | 18 | 18 | 16/30 | .016″ | .055″ | .616″ |
| 1142 | 12 | 24 | 18 | 16/30 | .016″ | .055″ | .654″ |
| 1145 | 15 | 30 | 18 | 16/30 | .016″ | .060″ | .760″ |
| 1149 | 19 | 38 | 18 | 16/30 | .016″ | .070″ | .830″ |
| 1151 | 27 | 54 | 18 | 16/30 | .016″ | .070″ | .965″ |

**STANDARD SPOOL PUT-UP:** 100 FT., 500 FT., 1000 FT.

| PAIR NO. | COLOR COMBINATION |
|---|---|
| 1 | Black paired with Red |
| 2 | Black paired with White |
| 3 | Black paired with Green |
| 4 | Black paired with Blue |
| 5 | Black paired with Brown |
| 6 | Black paired with Yellow |
| 7 | Black paired with Orange |
| 8 | Red paired with Green |
| 9 | Red paired with White |
| 10 | Red paired with Blue |
| 11 | Red paired with Yellow |
| 12 | Red paired with Brown |
| 13 | Red paired with Orange |
| 14 | Green paired with Blue |
| 15 | Green paired with White |
| 16 | Green paired with Brown |
| 17 | Green paired with Orange |
| 18 | Green paired with Yellow |
| 19 | White paired with Blue |
| 20 | White paired with Brown |
| 21 | White paired with Orange |
| 22 | White paired with Yellow |
| 23 | Blue paired with Brown |
| 24 | Blue paired with Orange |
| 25 | Blue paired with Yellow |
| 26 | Brown paired with Orange |
| 27 | Brown paired with Yellow |
| 28 | Purple paired with Red |
| 29 | Purple paired with White |
| 30 | Purple paired with Green |
| 31 | Purple paired with Blue |
| 32 | Purple paired with Brown |
| 33 | Purple paired with Yellow |
| 34 | Purple paired with Orange |
| 35 | Purple paired with Slate |
| 36 | Purple paired with Black |
| 37 | Slate paired with Red |
| 38 | Slate paired with White |
| 39 | Slate paired with Green |
| 40 | Slate paired with Blue |
| 41 | Slate paired with Brown |
| 42 | Slate paired with Yellow |
| 43 | Slate paired with Orange |
| 44 | Slate paired with Black |
| 45 | White/Black paired with Red |
| 46 | White/Black paired with Green |
| 47 | White/Black paired with Blue |
| 48 | White/Black paired with Brown |
| 49 | White/Black paired with Yellow |
| 50 | White/Black paired with Orange |
| 51 | White/Black paired with Purple |

**ALPHA WIRE Corporation** Elizabeth, N.J. 07207 Telephone (201) 925-8000

# UNSHIELDED AUDIO CABLE

alpha

## UNSHIELDED AUDIO CABLE

### Multi-Conductor — Plastic Jacket

### UL 2509, 80°C, 300 Volts

**Passes FR-1 Vertical Flame Test —**

**DESCRIPTION:** Each conductor tinned copper, color coded polyvinylchloride insulation, conductors twisted, gray polyvinylchloride jacket overall.

**APPLICATIONS:** Intercoms, Interconnecting Cables, Remote Control Circuits, Telephones, Telemetering Connecting Cable, "Baby Sitter" Intercom.

**CHARACTERISTICS:** Suggested Operating Temperature: −20°C to +80°C.

### SOLID

| Alpha No. | No. of Cond. | Conductor Size | Conductor Strand | Nom. Wall Thickness | Nominal Jacket | Nominal O.D. | Sugg. Oper. Voltage |
|---|---|---|---|---|---|---|---|
| 1793* | 2 | 22 | 1 | .010″ | .020″ | .130″ | 200V |
| 1794* | 3 | 22 | 1 | .010″ | .020″ | .140″ | 200V |
| 1794/4* | 4 | 22 | 1 | .010″ | .020″ | .160″ | 200V |
| 1795 | 2 | 20 | 1 | .016″ | .020″ | .170″ | 300V |
| 1796 | 3 | 20 | 1 | .016″ | .020″ | .180″ | 300V |
| 1796/4 | 4 | 20 | 1 | .016″ | .020″ | .200″ | 300V |
| 1797 | 2 | 18 | 1 | .016″ | .020″ | .190″ | 300V |
| 1798 | 3 | 18 | 1 | .016″ | .020″ | .200″ | 300V |
| 1798/4 | 4 | 18 | 1 | .016″ | .020″ | .220″ | 300V |
| 1799 | 2 | 16 | 1 | .016″ | .020″ | .215″ | 300V |
| 1799/3 | 3 | 16 | 1 | .016″ | .020″ | .230″ | 300V |
| 1799/4 | 4 | 16 | 1 | .016″ | .020″ | .250″ | 300V |

**STANDARD SPOOL PUT-UP:** 100 FT., 500 FT., 1000 FT.

### STRANDED

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1893† | 2 | 22 | 7/30 | .010″ | .032″ | .135″ | 150V |
| 1894† | 3 | 22 | 7/30 | .010″ | .032″ | .145″ | 150V |
| 1894/4† | 4 | 22 | 7/30 | .010″ | .032″ | .170″ | 150V |
| 1895© | 2 | 20 | 10/30 | .016″ | .020″ | .180″ | 300V |
| 1896 | 3 | 20 | 10/30 | .016″ | .020″ | .190″ | 300V |
| 1896/4 | 4 | 20 | 10/30 | .016″ | .020″ | .215″ | 300V |
| 1896/6 | 6 | 20 | 10/30 | .016″ | .020″ | .255″ | 300V |
| 1896/8 | 8 | 20 | 10/30 | .016″ | .020″ | .270″ | 300V |
| 1896/10 | 10 | 20 | 10/30 | .016″ | .020″ | .335″ | 300V |
| 1896/12 | 12 | 20 | 10/30 | .016″ | .020″ | .350″ | 300V |
| 1897© | 2 | 18 | 16/30 | .016″ | .020″ | .200″ | 300V |
| 1898 | 3 | 18 | 16/30 | .016″ | .020″ | .210″ | 300V |
| 1898/6 | 6 | 18 | 16/30 | .016″ | .020″ | .290″ | 300V |
| 1898/8 | 8 | 18 | 16/30 | .016″ | .025″ | .315″ | 300V |
| 1898/4 | 4 | 18 | 16/30 | .016″ | .020″ | .240″ | 300V |
| 1898/10 | 10 | 18 | 16/30 | .016″ | .025″ | .370″ | 300V |
| 1898/12 | 12 | 18 | 16/30 | .016″ | .025″ | .385″ | 300V |
| 1898/15 | 15 | 18 | 16/30 | .016″ | .030″ | .445″ | 300V |
| 1898/19 | 19 | 18 | 16/30 | .016″ | .030″ | .470″ | 300V |
| 1898/25 | 25 | 18 | 16/30 | .016″ | .035″ | .558″ | 300V |
| 1899 | 2 | 16 | 26/30 | .016″ | .020″ | .225″ | 300V |
| 1899/3 | 3 | 16 | 26/30 | .016″ | .020″ | .245″ | 300V |
| 1899/4 | 4 | 16 | 26/30 | .016″ | .020″ | .270″ | 300V |
| 1891* | 2 | 14 | 41/30 | .016″ | .020″ | .260″ | 350V |
| 1891/3* | 3 | 14 | 41/30 | .016″ | .020″ | .280″ | 350V |
| 1892* | 2 | 12 | 65/30 | .016″ | .020″ | .300″ | 350V |
| 1892/3* | 3 | 12 | 65/30 | .016″ | .020″ | .320″ | 350V |

**STANDARD SPOOL PUT-UP:** 100 FT., 500 FT., 1000 FT.

**COLOR CODE OF CONDUCTORS**

1—Black
2—Red
3—White
4—Green
5—Orange
6—Blue
7—Brown
8—Yellow
9—Purple
10—Slate
11—Pink
12—Tan
13—Red/Green
14—Red/Yellow
15—Red/Black
16—White/Black
17—White/Red
18—White/Green
19—White/Yellow
20—White/Blue
21—White/Brown
22—White/Orange
23—White/Gray
24—White/Violet
25—White/Black/Red

*THESE ITEMS NOT LISTED BY UL
† UL 2576, 80°C, 150V

**ALPHA WIRE Corporation** Elizabeth, N.J. 07207 Telephone (201) 925-8000

alpha

# FOIL SHIELDED CABLES

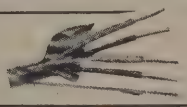
## FOIL SHIELDED JACKETED CABLE

### UL STYLE 2092, 2093 & 2094*

**MYLAR SUPPORTED ALUMINUM FOIL SHIELD**

**DESCRIPTION:** Each conductor stranded tinned copper, color coded polyethylene insulation, conductors cabled, wrapped mylar supported aluminum foil shield, 100% coverage with drain wire laid parallel, aluminum foil facing outward to provide maximum ground, gray PVC jacket overall.

**CHARACTERISTICS:** Operating Temperature: −20°C to +60°C. Operating Voltage: 300 volts. Lightweight, reduces cable diameter, and provides 100% shield coverage.



| Alpha No. | No. of Cond. | Conductor Size | Conductor Strand | Nom. Wall Thick. (Inch) | Nom. Jkt. Thick. (Inch) | Nom. O.D. (Inch) | Cond. Color Code |
|---|---|---|---|---|---|---|---|
| 2400 | 2 | 24 | 7/32 | .016 | .020 | .160 | 1, 3 |
| 2401© | 2 | 22 | 7/30 | .016 | .020 | .170 | 1, 3 |
| 2402© | 2 | 22 | 7/30 | .016 | .020 | .170 | 1, 2 |
| 2403© | 3 | 22 | 7/30 | .016 | .020 | .185 | 1, 2, 3 |
| 2404 | 4 | 22 | 7/30 | .016 | .020 | .210 | 1, 2, 3, 4 |
| 2411© | 2 | 20 | 10/30 | .016 | .020 | .186 | 1, 3 |
| 2412© | 2 | 20 | 10/30 | .016 | .020 | .186 | 1, 2 |
| 2413 | 3 | 20 | 10/30 | .016 | .020 | .205 | 1, 2, 3 |
| 2414 | 4 | 20 | 10/30 | .016 | .020 | .225 | 1, 2, 3, 4 |
| 2421© | 2 | 18 | 16/30 | .016 | .020 | .210 | 1, 3 |
| 2422© | 2 | 18 | 16/30 | .016 | .020 | .210 | 1, 2 |
| 2423 | 3 | 18 | 16/30 | .016 | .020 | .230 | 1, 2, 3 |
| 2424 | 4 | 18 | 16/30 | .016 | .020 | .255 | 1, 2, 3, 4 |
| 2432 | 2 | 16 | 26/30 | .016 | .020 | .245 | 1, 2 |
| 2433 | 3 | 16 | 26/30 | .016 | .020 | .270 | 1, 2, 3 |
| 2442† | 2 | 14 | 41/30 | .020 | .030 | .310 | 1, 3 |
| 2444† | 2 | 12 | 65/30 | .020 | .030 | .350 | 1, 3 |

**Color Code of Conductors:** 1—Black, 2—Red, 3—Clear, 4—Green
**STANDARD SPOOL PUT-UP:** 100 FT., 500 FT., 1000 FT.
*2 Cond.—2092 3 Cond.—2093 4 Cond.—2094
†Not UL Listed

## MINIATURE FOIL SHIELDED CABLE

### TWO 22 GAUGE CONDUCTORS

**DESCRIPTION:** Each conductor tinned solid or stranded copper, color coded polypropolene insulation, aluminum/Mylar foil shield, drain wire, gray vinyl jacket overall.

**APPLICATIONS:** Designed for space-saving in miniature and subminiature instrumentation and audio applications.

**200 VOLTS, −55°C, +105°C**

| Alpha No. | Conductor Size | Conductor Strand | Nom. Wall Thickness (Inch) | Nom. Jkt. Thickness (Inch) | Nom. O.D. (Inch) |
|---|---|---|---|---|---|
| 2460 | 22 | Solid | .008 | .018 | .118 |
| 2461 | 22 | 7/30 | .008 | .020 | .135 |

**Color Code of Conductors:** Black, Red
**STANDARD SPOOL PUT-UP:** 100 FT., 500 FT., 1000 FT.

## FOIL SHIELDED AUDIO AND DATA CABLE UL 2493 60°C

**INDIVIDUALLY SHIELDED MULTIPLE PAIRS — PLASTIC JACKET**

**DESCRIPTION:** Each conductor, tinned copper, color coded, high density polyethylene conductors twisted into pairs, tinned copper drain wire. Mylar supported aluminum foil shield, aluminum facing inward. Chrome gray PVC jacket overall.

**CHARACTERISTICS:** Mutual capacitance between conductors of a pair, 25 pf/ft. Capacitance of a single conductor to shield, 45 pf/ft.

**APPLICATIONS:** For audio, R.F. and pulse applications requiring superior circuit isolation.

### #22 — SOLID

| Alpha No. | No. of Pairs | No. of Cond. | Cond. Strand | Nom. Wall Thick. (Inch) | Nom. Jkt. Thick. (Inch) | Nom. O.D. (Inch) |
|---|---|---|---|---|---|---|
| 6000 | 3 | 6 | 1 | .010 | .045 | .275 |
| 6002 | 6 | 12 | 1 | .010 | .045 | .348 |
| 6004 | 9 | 18 | 1 | .010 | .045 | .401 |
| 6006 | 11 | 22 | 1 | .010 | .045 | .434 |
| 6008 | 15 | 30 | 1 | .010 | .045 | .495 |

### #22 — STRANDED

| Alpha No. | No. of Pairs | No. of Cond. | Cond. Strand | Nom. Wall Thick. (Inch) | Nom. Jkt. Thick. (Inch) | Nom. O.D. (Inch) |
|---|---|---|---|---|---|---|
| 6010 | 3 | 6 | 7/30 | .010 | .045 | .292 |
| 6012 | 6 | 12 | 7/30 | .010 | .045 | .372 |
| 6014 | 9 | 18 | 7/30 | .010 | .045 | .430 |
| 6016 | 11 | 22 | 7/30 | .010 | .045 | .467 |
| 6018 | 15 | 30 | 7/30 | .010 | .060 | .563 |
| 6020 | 19 | 38 | 7/30 | .010 | .060 | .590 |
| 6022 | 27 | 54 | 7/30 | .010 | .060 | .697 |

### #20 — STRANDED

| Alpha No. | No. of Pairs | No. of Cond. | Cond. Strand | Nom. Wall Thick. (Inch) | Nom. Jkt. Thick. (Inch) | Nom. O.D. (Inch) |
|---|---|---|---|---|---|---|
| 6023 | 3 | 6 | 10/30 | .016 | .045 | .392 |
| 6024 | 6 | 12 | 10/30 | .016 | .060 | .585 |
| 6025 | 9 | 18 | 10/30 | .016 | .060 | .630 |
| 6026 | 12 | 24 | 10/30 | .016 | .070 | .765 |
| 6027 | 15 | 30 | 10/30 | .016 | .070 | .830 |

**STANDARD SPOOL PUT-UP:** 100 FT., 500 FT., 1000 FT.

| Pair No. | Color Combination of Pairs |
|---|---|
| 1 | Black p.w. Red |
| 2 | Black p.w. White |
| 3 | Black p.w. Green |
| 4 | Black p.w. Blue |
| 5 | Black p.w. Brown |
| 6 | Black p.w. Yellow |
| 7 | Black p.w. Orange |
| 8 | Red p.w. Green |
| 9 | Red p.w. White |
| 10 | Red p.w. Blue |
| 11 | Red p.w. Yellow |
| 12 | Red p.w. Brown |
| 13 | Red p.w. Orange |
| 14 | Green p.w. Blue |
| 15 | Green p.w. White |
| 16 | Green p.w. Brown |
| 17 | Green p.w. Orange |
| 18 | Green p.w. Yellow |
| 19 | White p.w. Blue |
| 20 | White p.w. Brown |
| 21 | White p.w. Orange |
| 22 | White p.w. Yellow |
| 23 | Blue p.w. Brown |
| 24 | Blue p.w. Orange |
| 25 | Blue p.w. Yellow |
| 26 | Brown p.w. Orange |
| 27 | Brown p.w. Yellow |

**NOTE:** p.w.— paired with

## MULTIPLE PAIRS FOIL SHIELDED OVERALL

### 22 GAUGE, 38, 51 PAIRS

**DESCRIPTION:** Tinned solid copper conductors, with vinyl or polypropolene color coded insulation, cabled in pairs. Aluminum/Mylar foil shield overall. Stranded copper drain wire, chrome vinyl jacket.

**APPLICATIONS:** Communications, telephone and sound systems, control and instrumentation cables.

| Alpha No. | No. of Pairs | Cond. Size | Insulation Type | Insulation Thick. (Inch) | Nom. Jkt. Thickness (Inch) | Nom. O.D. (Inch) |
|---|---|---|---|---|---|---|
| 2450 | 38 | 22 | PP | .008 | .045 | .605 |
| 2451 | 51 | 22 | Vinyl | .010 | .050 | .728 |

| Pair No. | Color Combination |
|---|---|
| 1 | Blue p.w. White |
| 2 | Orange p.w. White |
| 3 | Green p.w. White |
| 4 | Brown p.w. White |
| 5 | Slate p.w. White |
| 6 | Blue-White striped p.w. White |
| 7 | Blue-Orange p.w. White |
| 8 | Blue-Green striped p.w. White |
| 9 | Blue-Brown striped p.w. White |
| 10 | Blue-Slate striped p.w. White |
| 11 | Orange-White striped p.w. White |
| 12 | Orange-Green striped p.w. White |
| 13 | Orange-Brown striped p.w. White |
| 14 | Orange-Slate striped p.w. White |
| 15 | Green-White striped p.w. White |
| 16 | Green-Brown striped p.w. White |
| 17 | Green-Slate striped p.w. White |
| 18 | Brown-White striped p.w. White |
| 19 | Brown-Slate striped p.w. White |
| 20 | Slate-White striped p.w. White |
| 21 | Blue p.w. Red |
| 22 | Orange p.w. Red |
| 23 | Green p.w. Red |
| 24 | Brown p.w. Red |
| 25 | Slate p.w. Red |

**NOTE:** p.w. — paired with

| Pair No. | Color Combination |
|---|---|
| 26 | Blue-White striped p.w. Red |
| 27 | Blue-Orange striped p.w. Red |
| 28 | Blue-Green striped p.w. Red |
| 29 | Blue-Brown striped p.w. Red |
| 30 | Blue-Slate striped p.w. Red |
| 31 | Orange-White striped p.w. Red |
| 32 | Orange-Green striped p.w. Red |
| 33 | Orange-Brown striped p.w. Red |
| 34 | Orange-Slate striped p.w. Red |
| 35 | Green-White striped p.w. Red |
| 36 | Green-Brown striped p.w. Red |
| 37 | Green-Slate striped p.w. Red |
| 38 | Brown-White striped p.w. Red |
| 39 | Brown-Slate striped p.w. Red |
| 40 | Slate-White striped p.w. Red |
| 41 | Blue p.w. Black |
| 42 | Orange p.w. Black |
| 43 | Green p.w. Black |
| 44 | Brown p.w. Black |
| 45 | Slate p.w. Black |
| 46 | Blue-White striped p.w. Black |
| 47 | Blue-Orange striped p.w. Black |
| 48 | Blue-Green striped p.w. Black |
| 49 | Blue-Brown striped p.w. Black |
| 50 | Blue-Slate striped p.w. Black |
| 51 | Orange-White striped p.w. Black |

**ALPHA WIRE Corporation** Elizabeth, N.J. 07207 Telephone (201) 925-8000

# SPIRAL—BRAIDED SHIELDED CABLES

alpha

## UL 1108 (Single Conductor)
## SPIRAL SHIELDED PLASTIC JACKETED CABLE

**Passes FR-1 Vertical Flame Test**

**DESCRIPTION:** Each conductor stranded or solid tinned copper, color coded polyvinylchloride insulation, conductors twisted, spiral wrapped copper shield, gray polyvinylchloride jacket. Nominal Jacket Thickness: .020.

**CHARACTERISTICS:** Use of spiral pigtailing off extremely simple and fast. Excellent for production line work. Provides 95% shielded coverage for audio and RF frequencies. Suggested Operating Temperature: −20°C to +80°C.

| Alpha No. | No. of Cond. | Conductor Size | Conductor Strand | Nom. Wall Thickness (Inch) | Nom. O.D. (Inch) | Sugg. Working Voltage |
|---|---|---|---|---|---|---|
| 2255 | 2 | 22 | Solid | .016 | .170 | 300V |
| 2254/1 | 1 | 22 | 7/30 | .016 | .115 | 300V |
| 2254© | 2 | 22 | 7/30 | .016 | .175 | 300V |
| 2254/3 | 3 | 22 | 7/30 | .016 | .190 | 300V |
| 2254/4 | 4 | 22 | 7/30 | .016 | .200 | 300V |
| 2254/6 | 6 | 22 | 7/30 | .016 | .235 | 300V |
| 2256/1 | 1 | 20 | 10/30 | .016 | .130 | 300V |
| 2256© | 2 | 20 | 10/30 | .016 | .195 | 300V |
| 2256/3 | 3 | 20 | 10/30 | .016 | .210 | 300V |
| 2256/4 | 4 | 20 | 10/30 | .016 | .225 | 300V |
| 2256/6 | 6 | 20 | 10/30 | .016 | .265 | 300V |
| 2258/1 | 1 | 18 | 16/30 | .016 | .135 | 300V |
| 2258© | 2 | 18 | 16/30 | .016 | .230 | 300V |
| 2258/3 | 3 | 18 | 16/30 | .016 | .235 | 300V |
| 2258/4 | 4 | 18 | 16/30 | .016 | .245 | 300V |
| 2260 | 2 | 16 | 26/30 | .016 | .240 | 300V |
| 2260/3 | 3 | 16 | 26/30 | .016 | .245 | 300V |
| 2265* | 2 | 14 | 41/30 | .020 | .285 | 450V |
| 2265/3* | 3 | 14 | 41/30 | .020 | .290 | 450V |
| 2268* | 2 | 12 | 65/30 | .020 | .325 | 450V |
| 2268/3 | 3 | 12 | 65/30 | .020 | .330 | 450V |

* Not UL Listed

## UL 2095 (Multi-Conductor), 80°C, 300 Volts
## BRAIDED SHIELDED JACKETED CABLE

**Passes FR-1 Vertical Flame Test**

**DESCRIPTION:** Each conductor tinned copper, color coded polyvinylchloride insulation, conductors twisted, braided copper shield, gray polyvinylchloride jacket overall.

**CHARACTERISTICS:** A conventional type of braided shield providing approximately 75% coverage is particularly desirable where flexibility is required. The copper shield allows ease of pigtail soldering. Shield construction provides additional cable strength. Operating Temperature: −20°C to +80°C. Nominal Jacket Thickness: .020.

### STRANDED

| Alpha No. | No. of Cond. | Conductor Size | Conductor Strand | Nom. Wall Thickness (Inch) | Nom. O.D. (Inch) | Sugg. Working Voltage |
|---|---|---|---|---|---|---|
| 1735 | 1 | 22 | 7/30 | .016 | .125 | 300V |
| 1736© | 2 | 22 | 7/30 | .016 | .185 | 300V |
| 1737 | 3 | 22 | 7/30 | .016 | .200 | 300V |
| 1738 | 4 | 22 | 7/30 | .016 | .210 | 300V |
| 1740 | 1 | 20 | 10/30 | .016 | .135 | 300V |
| 1741© | 2 | 20 | 10/30 | .016 | .200 | 300V |
| 1742 | 3 | 20 | 10/30 | .016 | .220 | 300V |
| 1743 | 4 | 20 | 10/30 | .016 | .230 | 300V |
| 1745 | 1 | 18 | 16/30 | .016 | .145 | 300V |
| 1746© | 2 | 18 | 16/30 | .016 | .235 | 300V |
| 1747 | 3 | 18 | 16/30 | .016 | .245 | 300V |
| 1747/4 | 4 | 18 | 16/30 | .016 | .255 | 300V |
| 1748 | 2 | 16 | 26/30 | .016 | .250 | 300V |
| 1749 | 3 | 16 | 26/30 | .016 | .255 | 300V |
| 1750 † | 2 | 14 | 41/30 | .020 | .290 | 450V |
| 1751 † | 3 | 14 | 41/30 | .020 | .295 | 450V |
| 1760 † | 2 | 12 | 65/30 | .020 | .335 | 450V |
| 1761 † | 3 | 12 | 65/30 | .020 | .340 | 450V |

### SOLID

| | | | | | | |
|---|---|---|---|---|---|---|
| 1775* | 2 | 22 | 1 | .016 | .175 | 300V |
| 1779 | 2 | 20 | 1 | .016 | .210 | 300V |
| 1783 | 2 | 18 | 1 | .016 | .220 | 300V |

*With 22 AWG solid tinned copper ground wire under braided copper shield.
† Not UL Listed

**STANDARD SPOOL PUT-UP:** 100 FT., 500 FT., 1000 FT.

**COLOR CODE OF CONDUCTORS:** **1**—Black, **2**—Red, **3**—White, **4**—Green, **5**—Yellow, **6**—Blue

**ALPHA WIRE Corporation** Elizabeth, N.J. 07207 Telephone (201) 925-8000

alpha

# RIBBON CABLES

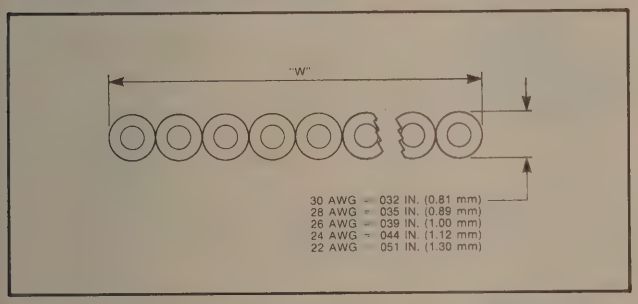
## BONDED RIBBON CABLE

**DESCRIPTION:** 22, 24, 26, 28 and 30 AWG stranded tinned copper conductors insulated with either .010″ or .016″ of PVC, insulated conductors are bonded into a flat configuration to form a ribbon cable. This configuration allows easy termination, ease of location and simplifies routing, while saving space over typical round cable.

- 22 AWG 19/34; 22 AWG 7/30; 24 AWG 19/36; 26 AWG 7/34; 28 AWG 7/36; and 30 AWG 7/38 stranded tinned copper conductors.
- 22 AWG 7/30 insulated with .016″ of PVC.
- 22 AWG 19/34; 24 AWG 19/36; 26 AWG 7/34; 28 AWG 7/36; and 30 AWG 7/38 insulated with .010″ of PVC.
- 10, 15, 20 and 30 conductor size.

**CHARACTERISTICS:**

- Temperature Rating: −55°C to 105°C
- Voltage Rating: .010 (MIL-W-16878 Type B) 600V
  .016 (MIL-W-16878 Type C) 1000V
- Passes FR-1 Vertical Flame Test
- Color Code: Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, Black (repeat)




| Alpha No. | No. Conds. | Gauge (AWG) | Strands | Nominal O.D. Width x Thickness (in Inches) |
|---|---|---|---|---|
| **3530** | 10 | 22 | 19/34 | .510 x .051 |
| **3531** | 15 | 22 | 19/34 | .765 x .051 |
| **3532** | 20 | 22 | 19/34 | 1.020 x .051 |
| **3533** | 30 | 22 | 19/34 | 1.530 x .051 |
| **3530/7** | 10 | 22 | 7/30 | .510 x .051 |
| **3531/7** | 15 | 22 | 7/30 | .765 x .051 |
| **3532/7** | 20 | 22 | 7/30 | 1.020 x .051 |
| **3533/7** | 30 | 22 | 7/30 | 1.530 x .051 |
| **3540** | 10 | 24 | 19/36 | .440 x .044 |
| **3541** | 15 | 24 | 19/36 | .660 x .044 |
| **3542** | 20 | 24 | 19/36 | .880 x .044 |
| **3543** | 30 | 24 | 19/36 | 1.320 x .044 |
| **3540/7** | 10 | 24 | 7/32 | .440 x .044 |
| **3541/7** | 15 | 24 | 7/32 | .660 x .044 |
| **3542/7** | 20 | 24 | 7/32 | .880 x .044 |
| **3543/7** | 30 | 24 | 7/32 | 1.320 x .044 |
| **3550** | 10 | 26 | 7/34 | .392 x .039 |
| **3550/14** | 14 | 26 | 7/34 | .546 x .039 |
| **3551** | 15 | 26 | 7/34 | .587 x .039 |
| **3551/16** | 16 | 26 | 7/34 | .624 x .039 |
| **3552** | 20 | 26 | 7/34 | .783 x .039 |
| **3553** | 30 | 26 | 7/34 | 1.190 x .039 |
| **3560** | 10 | 28 | 7/36 | .351 x .035 |
| **3561** | 15 | 28 | 7/36 | .523 x .035 |
| **3562** | 20 | 28 | 7/36 | .701 x .035 |
| **3563** | 30 | 28 | 7/36 | 1.060 x .035 |
| **3570** | 10 | 30 | 7/38 | .311 x .032 |
| **3571** | 15 | 30 | 7/38 | .482 x .032 |
| **3572** | 20 | 30 | 7/38 | .625 x .032 |
| **3573** | 30 | 30 | 7/38 | .965 x .032 |

## TWISTED PAIR LAMINATED RIBBON CABLE

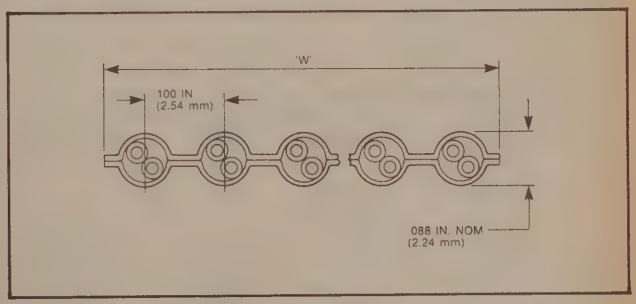
**DESCRIPTION:** 26 AWG stranded tinned copper conductors insulated with .010″ of PVC, twisted into pairs and intermittently laminated between layers of .005″ clear PVC film. The intermittent laminations allow easy access to the pairs while maintaining the shape and integrity of the cable.

- 26 AWG (7/34) stranded tinned copper conductor
- Conductors insulated with 0.010″ (.13mm) PVC rated FR-1
- Conductors twisted into pairs
- Pairs are laminated between two .005″ strips of clear PVC film
- Laminating interval .750″ (19mm) nominal
- Conductors pairs are .100″ apart (2.54mm)

**CHARACTERISTICS:**

- Temperature Rating: 80°C
- Voltage Rating: 300 Volts
- Capacitance: 21 pf/ft (69 pf/m)
- Propagation Delay: 1.7 ns/ft (5.6 ns/m)
- Impedance: 95 ohms nominal
- Cross Talk: 10 ft. (30.48cm) with two adjacent lines driven and a 1.3 ns rise time, 12% near end, 13% far end
- Color Code: Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White, Black (repeat). First conductor, common conductor is tan.

**APPLICATIONS:** Used in situations where reduced cross-talk is necessary, such as high speed data transmission in computers and communications equipment, but where easy mass termination is not necessary.




| Alpha No. | No. Conds. | No. Pairs | Overall Width (in.) | Overall Width (mm) | Weight/100A (lbs.) | Weight/100A (kg) |
|---|---|---|---|---|---|---|
| **3586/14** | 14 | 7 | 0.8 | 20 | 2.5 | 1.13 |
| **3586/16** | 16 | 8 | 0.9 | 23 | 2.9 | 1.32 |
| **3586/20** | 20 | 10 | 1.1 | 28 | 3.6 | 1.63 |
| **3586/26** | 26 | 13 | 1.4 | 36 | 4.7 | 2.13 |
| **3586/34** | 34 | 17 | 1.8 | 36 | 6.2 | 2.81 |
| **3586/40** | 40 | 20 | 2.1 | 53 | 7.3 | 3.31 |
| **3586/50** | 50 | 25 | 2.6 | 66 | 9.1 | 4.13 |
| **3586/60** | 60 | 30 | 3.1 | 79 | 10.9 | 4.95 |

**STANDARD SPOOL PUT-UP:** 100 FT.

**ALPHA WIRE Corporation** Elizabeth, N.J. 07207 Telephone (201) 925-8000

# FCC* FLAT CABLES

alpha

## FCC* COLOR-CODED FLAT CABLE

*Flat Cable and Connectors

Termination flexibility is the unique property of Alpha's FCC Color-Coded Flat Cable. Precise conductor spacing allows you to terminate this cable to any major brand of insulation displacement connectors on .050 in. (1.27mm) centers, including Alpha's. Color-coded insulation and excellent teardown characteristics permit you to terminate it like conventional hookup wire. Or take the best of both worlds and use both techniques on the same cable. Alpha FCC Color-Coded Flat Cable lets you expand your design capabilities.

**DESCRIPTION:** Alpha Color-Coded Laminated Ribbon Cable consists of PVC insulated round conductors on .050 in. (1.27mm) centers laminated between two sheets of clear PVC film. The lamination process results in controlled electrical characteristics with the advantage of color-coding, ease of separation and mass termination. Cable can be terminated with any major brand of IDC (insulation displacement connectors) on .050 in. (1.27mm) centers.

- 28 AWG (7/36) stranded tinned copper conductor
- .010 in. (.25mm) nom. wall PVC
- Conductors laminated to a sheet of .005 in. (0.13mm) nom. clear PVC film
- Color Code: Brown, Red, Orange, Yellow, Green, Blue, Violet, Gray, White, Black. Color code repeats beyond 10 conductors.
- UL listed
- Passes FR-1 Vertical Flame Test

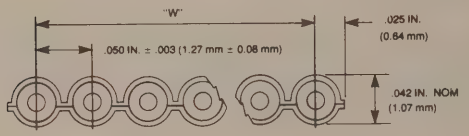
**CHARACTERISTICS:**

- Temperature Rating: 80°C
- Voltage Rating: 300 volts
- Capacitance: 14 pf/ft. nom.
- Propagation Delay: 1.4 ns/ft.
- Impedance: 103 ohms nom.
- Cross Talk: Nom. between two adjacent signal lines @ 5 ns rise time over 10 ft. (3.05m) length; near end 5.2%, far end 7.3%
- Environmental: Resists acids, alkalis, oils, moisture, solvents, ozone and fungus

**APPLICATIONS:** Ideal for applications in digital data and signal transmission system where termination speed and termination flexibility are required.

**SPECIAL CONSTRUCTIONS:**

- Other color combinations available




**ALPHA FCC COLOR-CODED FLAT CABLE**

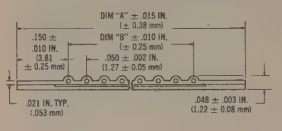
| Alpha No. | No. of Conductors | Nom. Width "W" (Inch) | Approx. Wt./Roll (Lbs.) |
|---|---|---|---|
| 3581/10 | 10 | .45 | 1.10 |
| 3581/14 | 14 | .65 | 1.50 |
| 3581/16 | 16 | .75 | 1.70 |
| 3581/20 | 20 | .95 | 2.20 |
| 3581/24 | 24 | 1.15 | 2.60 |
| 3581/26 | 26 | 1.25 | 2.90 |
| 3581/34 | 34 | 1.65 | 3.70 |
| 3581/40 | 40 | 1.95 | 4.40 |
| 3581/50 | 50 | 2.45 | 5.50 |
| 3581/60 | 60 | 2.95 | 6.60 |

**STANDARD PACKAGE:**
100 foot (30.48m) spools with exclusive footage remaining window

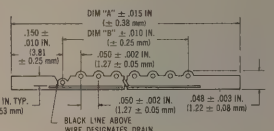
## GROUND PLANE GRAY LAMINATED FLAT CABLE

Alpha Ground Plane Flat Cable is applicable for computer and communications utilizing high speed logic signals. This construction results in reduced crosstalk, thereby assuring transmission integrity.

**ALPHA 3583 AND 3584 SERIES**




**ALPHA 3585 SERIES**




**DESCRIPTION:** Grounded gray laminated flat cable consists of laminated gray flat cable with a copper mesh shield laminated to the bottom. This cable has all the characteristics of gray laminated flat cable plus reduced cross-talk and better high speed data transmission.

- 28 AWG (7/36) stranded or 30 AWG solid tinned copper conductor
- Conductor laminated between layers of PVC film
- 0.005" (0.13mm) expanded copper mesh laminated to the cable with PVC sheet
- Choice of either with drain wire or without
- Gray PVC with black edge (drain wire) or red edge (no drain wire)
- UL listed

**CHARACTERISTICS:**

- Temperature rating: 105°C
- Voltage rating: 300 volts
- Capacitance: 25.3 pf/ft (83.0 pf/m) for 28 AWG (7/36); 25.7 pf/ft (84.3 pf/m) for 30 AWG solid
- Propagation delay: 1.65 ns/ft (5.6 ns/m)
- Impedance: 65 ohms nominal for 28 AWG (7/36); 93 ohms for 30 AWG solid
- Environmental: resists acids, alkalis, oil, moisture, solvents, ozone, and fungus

**APPLICATIONS:**
Used in situations where reduced cross-talk is necessary such as high speed data transmission in computers and communications equipment.

**SPECIAL CONSTRUCTION:**
Other conductor configurations available upon request.

**ALPHA FCC GROUND PLANE FLAT CABLE**

| No. of Cond. | Alpha P/N | Dimension A In. (mm) | Dimension B In. (mm) | Approximate Wt./Roll lb. (kg.) |
|---|---|---|---|---|
| AWG 30 SOLID | | | | |
| 40 | 3583/40 | 2.250 (57.15) | 1.950 (49.53) | 13.3 (6.0) |
| 50 | 3583/50 | 2.750 (69.85) | 2.450 (62.23) | 16.7 (7.6) |
| AWG 28 STRANDED | | | | |
| 10 | 3584/10 | 0.750 (19.05) | 0.450 (11.43) | 3.6 (1.6) |
| 14 | 3584/14 | 0.950 (24.13) | 0.650 (16.51) | 5.0 (2.3) |
| 16 | 3584/16 | 1.050 (26.67) | 0.750 (19.05) | 5.7 (2.6) |
| 20 | 3584/20 | 1.250 (31.75) | 0.950 (24.13) | 7.2 (3.3) |
| 24 | 3584/24 | 1.450 (36.83) | 1.150 (29.21) | 8.6 (3.9) |
| 26 | 3584/26 | 1.550 (39.37) | 1.250 (31.75) | 9.3 (4.2) |
| 34 | 3584/34 | 1.950 (49.53) | 1.650 (41.91) | 12.2 (5.5) |
| 40 | 3584/40 | 2.250 (57.15) | 1.950 (49.53) | 14.3 (6.5) |
| 50 | 3584/50 | 2.750 (69.85) | 2.450 (62.23) | 17.9 (8.1) |
| 60 | 3584/60 | 3.250 (82.55) | 2.950 (74.93) | 21.5 (9.8) |
| WITH DRAIN WIRE AWG 28 STRANDED | | | | |
| 10 | 3585/10 | 0.750 (19.05) | 0.450 (11.43) | 3.6 (1.6) |
| 14 | 3585/14 | 0.950 (24.13) | 0.650 (16.51) | 5.0 (2.3) |
| 16 | 3585/16 | 1.050 (26.67) | 0.750 (19.05) | 5.7 (2.6) |
| 20 | 3585/20 | 1.250 (31.75) | 0.950 (24.13) | 7.2 (3.3) |
| 24 | 3585/24 | 1.450 (36.83) | 1.150 (29.21) | 8.6 (3.9) |
| 26 | 3585/26 | 1.550 (39.37) | 1.250 (31.75) | 9.3 (4.2) |
| 34 | 3585/34 | 1.950 (49.53) | 1.650 (41.91) | 12.2 (5.5) |
| 40 | 3585/40 | 2.250 (57.15) | 1.950 (49.53) | 14.3 (6.5) |
| 50 | 3585/50 | 2.750 (69.85) | 2.450 (62.23) | 17.9 (8.1) |
| 60 | 3585/60 | 3.250 (82.55) | 2.950 (74.93) | 21.5 (9.8) |

**STANDARD PACKAGING:**
100 foot (30.48m) spools with exclusive footage remaining window.

## FCC* GRAY LAMINATED FLAT CABLE

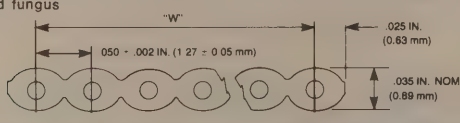
*Flat Cable and Connectors

**DESCRIPTION:** Laminated Gray Flat Cable consisting of stranded conductors laminated between layers of gray PVC film to form a flat ribbon. The laminate is formed precisely around the conductors so that wires, each surrounded by insulation film, may be easily and quickly separated or terminated with any major brand of IDC (insulation displacement connectors) on .050 in. (1.27mm) centers.

- 28 AWG (7/36) stranded tinned copper conductor
- Conductors laminated between layers of PVC film
- Gray PVC with Red stripe on leading edge
- UL listed
- Passes FR-1 Vertical Flame Test

**CHARACTERISTICS:**

- Temperature Rating: 105°C
- Voltage Rating: 300 volts
- Capacitance: 14 pf/ft. nom.
- Propagation Delay: 1.4 ns/ft.
- Impedance: 105 ohms nom.
- Cross Talk: Nom. between two adjacent signal lines @ 5 ns rise time over 10 ft. (3.05mm) length; near end 5.2%, far end 6.5%
- Environmental: Resists acids, alkalis, oil, moisture, solvents, ozone and fungus




**APPLICATIONS:** A general purpose flat cable designed for use in electronic products such as computers and business machines where speed of termination and economy is required.

**SPECIAL CONSTRUCTIONS:**

- 30 AWG solid tinned copper available

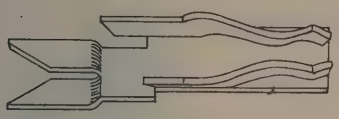
Here's the cable that started the whole system of flat cable design for mass termination. Alpha's Gray Laminated Flat Cable is designed for general purpose interconnections. It combines low-cost with consistently reliable performance. It features excellent tear-down characteristics with high flexibility for applications requiring intricate cable routing. Mirror image profile permits reverse plane termination ability on same cable length. Alpha's Gray Laminated Flat Cable fits your all-around design requirements.

**ALPHA FCC GRAY LAMINATED FLAT CABLE**

| Alpha No. | No. of Conductors | Nom. Width "W" (Inch) | Approx. Wt./Roll (Lbs.) |
|---|---|---|---|
| 3580/10 | 10 | .45 | 1.2 |
| 3580/14 | 14 | .65 | 1.7 |
| 3580/16 | 16 | .75 | 2.0 |
| 3580/20 | 20 | .95 | 2.4 |
| 3580/24 | 24 | 1.15 | 2.90 |
| 3580/26 | 26 | 1.25 | 3.2 |
| 3580/34 | 34 | 1.65 | 4.2 |
| 3580/40 | 40 | 1.95 | 4.9 |
| 3580/50 | 50 | 2.45 | 6.1 |
| 3580/60 | 60 | 2.95 | 7.3 |

**STANDARD PACKAGING:**
100 foot (30.48m) spools with exclusive footage remaining window

# alpha FLAT CABLE CONNECTORS



**OFF-SET TINES**
Patented off-set tines place forces on the conductor in opposite directions in two different planes, keeping the conductor under constant tension, ensuring a gas-tight connection.

**DUAL CANTILEVERED CONTACTS**
The Female Socket Connectors feature dual cantilevered contacts insuring good electrical contact when inserted into a header. The design provides two surfaces for wiping action which will remove any oxides or dirt that may have built up on the contacts.

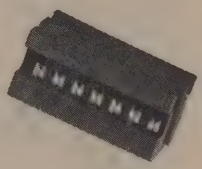
**FAST** Alpha Connectors simultaneously terminate up to 50 conductors in seconds.

**LOW COST** Simultaneous termination reduces labor cost and error by eliminating the need for individual crimping and stripping conductors.

**RELIABLE** Alpha's patented off-set tine design pieces, separates, strips the insulation from the conductor and holds it under tension, assuring a gas-tight connection. Each tine is micro-etched to remove any burrs or rough edges which could sever strands of the conductors.

**UNIQUE PACKAGING** Alpha DIP, PCB and Female Socket Connectors are packaged in specially designed clear plastic tubes to protect them in transit and storage. Your connector inventory is easy to check and always in perfect condition. Four connectors are packed in each tube. Header connectors and Card Edge connectors are individually protected in extra-thick airtight clear polyethylene. All connector tubes and bags are then packed in shipping containers for added protection.

## DIP CONNECTORS



DIP (Dual-In Line-Package) Connectors are compatible with standard IC component spacing and will mate with standard 14 and 16 pin IC sockets. A low cost hand tool or bench press can be used for assembly. DIP Connectors will accept 28-30 AWG stranded or solid conductors.

**SPECIFICATIONS:**

Contacts: Phosphor Bronze
Plating: 10μ in. Gold over 50μ in. Nickel
Material: UL 94 V-O flame retardant thermoplastic
Color: Blue
Temperature: −55°C to +105°C
Current Rating: 1 Amp (maximum)
Dielectric Withstand Voltage: Greater than 500 Volts DC at sea level
Insulation Resistance: 5 x $10^6$ Ohms

| No. of Pins | Part No. |
|---|---|
| 14 | FCC-130-14 |
| 16 | FCC-130-16 |
| 24 | FCC-130-24 |

Put-Up: 20 connectors per box, packed in 5 four-pack protective tubes. Also available in bulk pack.

## PCB CONNECTORS

The PCB (Printed Circuit Board) Connector is designed to make a permanent connection. It is used where the application calls for the cable to be directly terminated to the Printed Circuit Board. After the cable is crimped onto the connector, the connector is soldered to the PC Board. A detailed hole pattern is shown on the following page. The PCB Connectors will accept 28-30 AWG stranded or solid conductors.

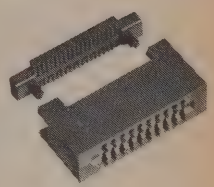
**SPECIFICATIONS:**

Contacts: 725 Nickel Silver alloy
Material: UL 94 V-O flame retardant plastic
Color: Blue
Temperature: −55°C to +105°C
Current Rating: 1 Amp (maximum)
Dielectric Withstand Voltage: Greater than 500 Volts DC at sea level
Insulation Resistance: 5 x $10^6$ Ohms

| No. of Pins | Part No. |
|---|---|
| 10 | FCC-140-10 |
| 20 | FCC-140-20 |
| 26 | FCC-140-26 |
| 34 | FCC-140-34 |
| 40 | FCC-140-40 |
| 50 | FCC-140-50 |

Put-Up: 20 conductors per box, packed in 5 four-pack protective tubes.
Also available in bulk pack.

## CARD EDGE CONNECTORS



Alpha card edge connectors are mateable with stranded .062″ (1.57mm) printed circuit boards and will mate with boards ranging in thickness from .032″ (.81mm) to .075″ (1.91mm). The connectors will accept 28 or 30 AWG solid or stranded conductors on .050″ (1.27mm) centers providing a direct, reliable access to PCB pads on .100″ (2.54mm) centers. Alpha card edge connectors are available with and without mounting flanges.

**SPECIFICATIONS:**

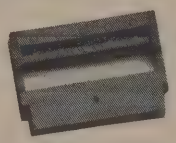
Contacts: Phosphor Bronze
Plating: 20μ in. Gold over 50μ in. Nickel
Material: UL 94 V-O flame retardant thermoplastic
Color: Blue
Temperature: −55°C to +105°C
Current Rating: 1 Amp (maximum)
Dielectric Withstand Voltage: Greater than 500 Volts DC at sea level
Insulation Resistance: 5 x $10^6$ Ohms

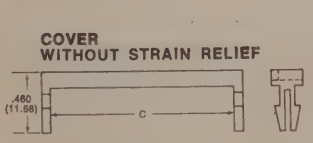
| No. of Contacts | Part No. Without Mounting Flanges | Part No. With Mounting Flanges |
|---|---|---|
| 10 | FCC-170-10 | FCC-171-10 |
| 20 | FCC-170-20 | FCC-171-20 |
| 26 | FCC-170-26 | FCC-171-26 |
| 34 | FCC-170-34 | FCC-171-34 |
| 40 | FCC-170-40 | FCC-171-40 |
| 50 | FCC-170-50 | FCC-171-50 |

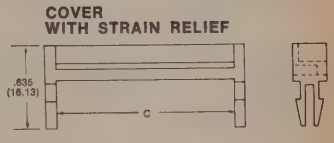
## FEMALE SOCKET CONNECTORS

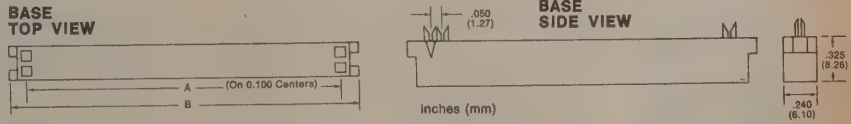
**FEATURES:**

- 10, 20, 26, 34, 50 pin versions
- Mates with all standard headers and 0.025″ wire wrap posts
- Available with or without integral strain relief
- Recessed cover design allows cable to remain within connector profile
- Self-locking removable cover
- Patented off-set tine design insures reliable gas tight termination
- Gold plated phosphor bronze contacts
- Terminations can be inspected before cover is put on






**SPECIFICATIONS:**

Contacts: Phosphor Bronze
Plating: 20μ in. Gold over 50μ in. Nickel
Insertion Force: 0.50 lbs. (.23kg) per contact
Withdrawal Force: 0.50 lbs. (.23kg) per contact
Material: UL 94 V-O flame retardant thermoplastic
Color: Blue
Temperature: −55°C to +105°C
Current Rating: 1 Amp (maximum)
Dielectric Withstand Voltage: Greater than 500 Volts DC at sea level
Insulation Resistance: 5 x $10^6$ Ohms

**FEMALE SOCKET CONNECTORS**

| No. of Pins | Part No. With Strain Relief | Part No. Without Strain Relief | A Inches (mm) | B Inches (mm) | C Inches (mm) |
|---|---|---|---|---|---|
| 10 | FCC-110-10 | FCC-120-10 | .400 (10.16) | .575 (17.15) | .520 (13.21) |
| 20 | FCC-110-20 | FCC-120-20 | .900 (22.86) | 1.175 (29.85) | 1.020 (25.91) |
| 26 | FCC-110-26 | FCC-120-26 | 1.200 (30.48) | 1.475 (37.47) | 1.320 (33.53) |
| 34 | FCC-110-34 | FCC-120-34 | 1.600 (40.64) | 1.875 (47.63) | 1.720 (43.59) |
| 40 | FCC-110-40 | FCC-120-40 | 1.900 (48.26) | 2.175 (55.25) | 2.020 (51.31) |
| 50 | FCC-110-50 | FCC-120-50 | 2.400 (60.96) | 2.675 (67.95) | 2.520 (64.01) |

Put-Up: 20 connectors per box, packed in 5 four-pack protective tubes. Also avail. in bulk pack.

**ALPHA WIRE Corporation** Elizabeth, N.J. 07207 Telephone (201) 925-8000

# FLAT CABLE CONNECTORS

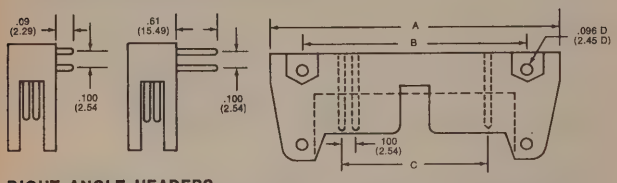
alpha

## HEADER CONNECTOR
## RIGHT ANGLE STYLE

**FEATURES:**

- Mates with all standard female socket connectors
- Available with solder or wire wrap terminals
- Available in 10, 20, 26, 34, 40, 50 pin versions
- Available with or without locking tabs
- Gold plated phosphor bronze contacts (20μ inches over 50μ inches nickel)
- UL 94 V-O flame retardant thermoplastic body

**Solder and Wire Wrap Termination**




**RIGHT ANGLE HEADERS**

| No. of Pins | Part No. Solder Terminals | Part No. Wire Wrap Terminals | A Inches (mm) | B Inches (mm) | C Inches (mm) |
|---|---|---|---|---|---|
| 10 | FCC-151-10 | FCC-152-10 | 1.26 (32.00) | .86 (21.84) | .40 (10.16) |
| 20 | FCC-151-20 | FCC-152-20 | 1.76 (44.70) | 1.36 (34.54) | .90 (22.86) |
| 26 | FCC-151-26 | FCC-152-26 | 2.06 (52.32) | 1.66 (42.16) | 1.20 (30.48) |
| 34 | FCC-151-34 | FCC-152-34 | 2.46 (62.48) | 2.06 (52.32) | 1.60 (40.64) |
| 40 | FCC-151-40 | FCC-152-40 | 2.76 (70.10) | 2.36 (59.94) | 1.90 (48.26) |
| 50 | FCC-151-50 | FCC-152-50 | 3.26 (82.80) | 2.86 (72.64) | 2.40 (60.96) |

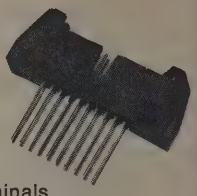
**RIGHT ANGLE HEADERS WITH LOCKING TABS**

| No. of Pins | Part No. Solder Terminals | Part No. Wire Wrap Terminals |
|---|---|---|
| 10 | FCC-153-10 | FCC-154-10 |
| 20 | FCC-153-20 | FCC-154-20 |
| 26 | FCC-153-26 | FCC-154-26 |
| 34 | FCC-153-34 | FCC-154-34 |
| 40 | FCC-153-40 | FCC-154-40 |
| 50 | FCC-153-50 | FCC-154-50 |

Designed for use with female socket connectors with strain relief. (F.C.C. — 110 Series)

Put-Up: 10 per box, individually packaged. Also available in bulk pack.

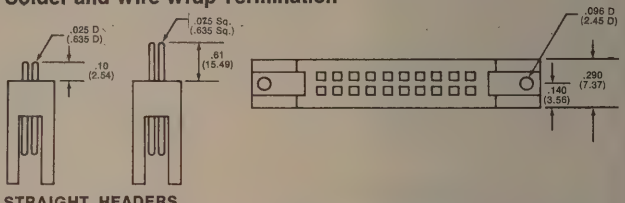
## HEADER CONNECTOR
## STRAIGHT STYLE



**FEATURES:**

- Mates with all standard female socket connectors
- Available with solder or wire wrap terminals
- Available in 10, 20, 26, 34, 40, 50 pin versions
- Available with or without locking tabs
- Gold plated phosphor bronze contacts (20μ inches over 50μ inches nickel)
- UL 94 V-O flame retardant thermoplastic body

**Solder and Wire Wrap Termination**




**STRAIGHT HEADERS**

| No. of Pins | Part No. Solder Terminals | Part No. Wire Wrap Terminals | A Inches (mm) | B Inches (mm) | C Inches (mm) |
|---|---|---|---|---|---|
| 10 | FCC-161-10 | FCC-162-10 | 1.26 (32.00) | .86 (21.84) | .40 (10.16) |
| 20 | FCC-161-20 | FCC-162-20 | 1.76 (44.70) | 1.36 (34.54) | .90 (22.86) |
| 26 | FCC-161-26 | FCC-162-26 | 2.06 (52.32) | 1.66 (42.16) | 1.20 (30.48) |
| 34 | FCC-161-34 | FCC-162-34 | 2.46 (62.48) | 2.06 (52.32) | 1.60 (40.64) |
| 40 | FCC-161-40 | FCC-162-40 | 2.76 (70.10) | 2.36 (59.94) | 1.90 (48.26) |
| 50 | FCC-161-50 | FCC-162-50 | 3.26 (82.80) | 2.86 (72.64) | 2.40 (60.96) |

**STRAIGHT HEADERS WITH LOCKING TABS**

| No. of Pins | Part No. Solder Terminals | Part No. Wire Wrap Terminals |
|---|---|---|
| 10 | FCC-163-10 | FCC-164-10 |
| 20 | FCC-163-20 | FCC-164-20 |
| 26 | FCC-163-26 | FCC-164-26 |
| 34 | FCC-163-34 | FCC-164-34 |
| 40 | FCC-163-40 | FCC-164-40 |
| 50 | FCC-163-50 | FCC-164-50 |

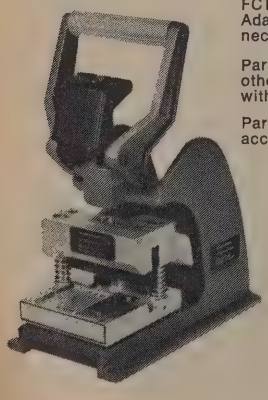
Designed for use with female socket connectors with strain relief. (F.C.C. — 110 Series)

Put-Up: 10 per box, individually packaged. Also available in bulk pack.

## ASSEMBLY TOOLS

Alpha has designed the easiest to use assembly system available. One universal adaptor accepts **all** connectors without additional components or adjustments. Any Alpha connector of any size can be inserted and crimped in seconds. The Alpha flat cable system offers you this feature. It will save valuable time, particularly in the operations where a variety of short run or complex harnesses are used.

A low cost hand tool designed to accept DIP Connectors is also available. Ideal for field replacement.



FCT-10 Bench Press complete with Universal Adapter, designed to accept all Alpha Connectors.

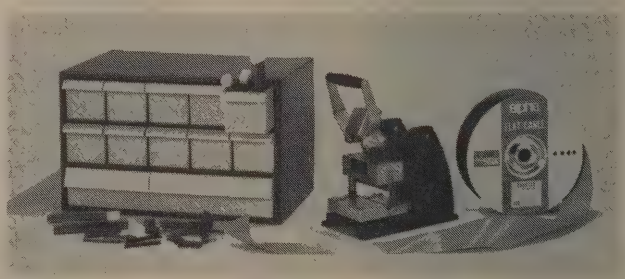
Part No. FCT-60 Universal Adapter adapts other bench presses to the Alpha System without modification.

Part No. FCT-61DIP Adaptor required to accept 24 Pin DIP Connectors.

Part No. FCT-30 designed to accept Alpha 14 and 16 pin DIP Connectors.

## DESIGNER KIT

The designer kits make it easy to have available all the components needed to make a wide range of flat cable assemblies. It is ideal for use in schools, research labs and design groups for prototype applications.



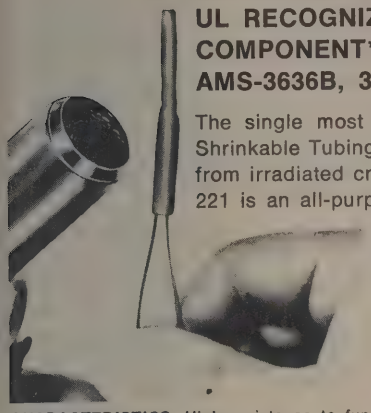
The Alpha System Designer Kit, FCT-80, includes cables, over 140 connectors, and termination tooling. You get a representative sample of all connector types, 100 feet of 50 conductor flat cable, and a bench press with Alpha's exclusive universal adapter. The Designer Kit is packaged in its own storage cabinet, made with a gray baked enamel finish and heavy-duty welded steel frame. The molded styrene drawers are virtually unbreakable and will not crack, break or dent.

**ALPHA WIRE Corporation** Elizabeth, N.J. 07207 Telephone (201) 925-8000

alpha

# SHRINKABLE TUBING

## IRRADIATED POLYOLEFIN SHRINKABLE TUBING



### MIL-I-23053C/5A
### UL RECOGNIZED COMPONENT*
### AMS-3636B, 3637B

The single most widely used type of FIT Shrinkable Tubing, FIT-221 is manufactured from irradiated cross-linked polyolefin. FIT-221 is an all-purpose tubing with excellent physical, chemical and electrical properties. It meets the most stringent military and industrial requirements for a highly reliable, thin wall insulation.

**CHARACTERISTICS:** High resistance to fungus and chemicals. Self-extinguishing. Will not crack or peel.

**APPLICATIONS:** General purpose insulation, strain relief, jacketing material and as component insulation. Material is easily and permanently marked.

**SPECIFICATIONS:** Operating Temperature: −55°C to +135°C. Shrinkage Temperature: 135°C. Tensile Strength: 2500 psi. Ultimate Elongation: 400%. Longitudinal Shrinkage: 5% maximum. Dielectric Strength: 1300 volts/mil. Non-flammable — self-extinguishing. Specific Gravity: 1.3 maximum.

| Alpha No. and Size (Inch) | Min. I.D. Before Shrink. (Inch) | Recovered I.D. After Shrink. (Inch) | Recovered Nom. Wall Thick. (Inch) | Standard Package 4′ Lgths. Total Ftg. | Standard Package 2′ Lgths. Total Ftg. | Standard Package 6″ Lgths. Total Ftg. | Bulk Pkg. 4′Lgth. Total Ftg. |
|---|---|---|---|---|---|---|---|
| FIT-221-3/64 | .046 | .023 | .016 | 100 | 100 | 20 | 1,000 |
| FIT-221-1/16 | .063 | .031 | .017 | 100 | 100 | 18 | 1,000 |
| FIT-221-3/32 | .093 | .046 | .020 | 100 | 100 | 16 | 1,000 |
| FIT-221-1/8 | .125 | .062 | .020 | 100 | 100 | 14 | 1,000 |
| FIT-221-3/16 | .187 | .093 | .020 | 100 | 100 | 12 | 1,000 |
| FIT-221-1/4 | .250 | .125 | .025 | 100 | 100 | 10 | 1,000 |
| FIT-221-3/8 | .375 | .187 | .025 | 100 | 100 | 8 | 1,000 |
| FIT-221-1/2 | .500 | .250 | .025 | 20 | 20 | 7 | 200 |
| FIT-221-3/4 | .750 | .375 | .030 | 20 | 20 | 6 | 200 |
| FIT-221-1 | 1.000 | .500 | .035 | 20 | 20 | 4 | 200 |
| FIT-221-1 1/2 | 1.500 | .750 | .040 | 20 | 20 | 2.5 | 200 |
| FIT-221-2 | 2.000 | 1.000 | .045 | 20 | 20 | 1.5 | 200 |
| FIT-221-3 | 3.000 | 1.500 | .050 | 8 | 8 | 1 | 100 |
| FIT-221-4 | 4.000 | 2.000 | .055 | 8 | 8 | 5 | 100 |

**STOCK COLORS:** Black, White, Red, Yellow, Blue, Clear
**STANDARD PACKAGE FIT-221.** Tubing is available ONLY in specified pkgs. When ordering, indicate package desired.
*UL marked tubing available on request.

**MAY BE CUT AND MARKED TO YOUR SPECIFICATIONS**

### PACKAGED ASSORTMENTS

FIT-221 — Assorted sizes and colors per box — contains an assortment of 6″ lengths in various sizes and colors. Every length identified as to size and supplied in Black, White, Red, Yellow, Blue and clear.

| Alpha No. | Tubing Size Range | Lengths Per Box |
|---|---|---|
| FIT-221 MS-1 | 3/64″ thru 3/16″ | 30 |
| FIT-221 MS-2 | 1/4″ thru 3/4″ | 16 |
| FIT-221 MS-3 | 1″ thru #4 | 10 |

Pre-cut lengths of FIT-221 in the two most popular cut sizes. Packaged in poly bags and boxes. Specify size.

| Alpha No. and Size (Inch) | No. Cut Pcs. 1/2″ or 1″ | Alpha No. and Size (Inch) | No. Cut Pcs. 1/2″ or 1″ |
|---|---|---|---|
| FIT-221-3/64 | 1000 | FIT-221-3/8 | 1000 |
| FIT-221-1/16 | 1000 | FIT-221-1/2 | 100 |
| FIT-221-3/32 | 1000 | FIT-221-3/4 | 100 |
| FIT-221-1/8 | 1000 | FIT-221-1 | 100 |
| FIT-221-3/16 | 1000 | FIT-221-1 1/2 | 100 |
| FIT-221-1/4 | 1000 | FIT-221-2 | 100 |

## IRRADIATED VINYL SHRINKABLE TUBING

### MINIMAL LONGITUDINAL SHRINKAGE
### MIL-I-23053C/2C, AMS-3582

A specially formulated polyvinylchloride tubing, that is mechanically strong, extremely flexible and significantly different from non-irradiated heat shrinkable tubing. Unlike non-irradiated PVC tubing, FIT-105 shrinks evenly and will not split when shrunk. Non-irradiated tubing has a much greater waste factor, with longitudinal shrinkage approximately 20%. FIT-105 will shrink less than 10% of its original length.

**CHARACTERISTICS:** Extremely flexible. Will not cold flow or melt. Easily marked.

**SHRINKAGE RATIO:** To 50% of original size (2:1) when temperature of 175°C (347°F) is applied.

Controlled shrinkage within seven seconds at 166°C (325°F).

**LONGITUDINAL SHRINKAGE:** Less than 10%.

**APPLICATIONS:** Jacketing of cable harnesses, insulation and covering of components, bus bar insulation, tab disconnects, jacketing of cable cores with many of the qualities of the finest extruded plastic jackets.

**SPECIFICATIONS:** Temperature Operating Range: −35°C to +105°C. Minimum Shrink Temperature: 175°C. Tensile Strength: 2600 PSI. Elongation: 250%. Dielectric Strength: 750 volts/mil. Flame Resistance: Non-burning. Fungus Resistant; Fluid Resistant To: Hydrocarbons, solvents, aqueous solutions, acids, bases.

| Alpha No. and Size (Inch) | Minimum I.D. Before Shrinking (Inch) | Recovered I.D. After Shrinking (Inch) | Nominal Wall Thickness (Inches) | Standard Put-up (Feet) |
|---|---|---|---|---|
| FIT-105-3/64 | .046 | .023 | .020 | 25, 100, 500 |
| FIT-105-1/16 | .062 | .031 | .020 | 25, 100, 500 |
| FIT-105-3/32 | .093 | .046 | .020 | 25, 100, 200 |
| FIT-105-1/8 | .125 | .062 | .025 | 25, 100, 200 |
| FIT-105-3/16 | .187 | .093 | .025 | 25, 100, 200 |
| FIT-105-1/4 | .250 | .125 | .025 | 25, 100, 200 |
| FIT-105-3/8 | .375 | .187 | .030 | 25, 100, 200 |
| FIT-105-1/2 | .500 | .250 | .030 | 25, 100 |
| FIT-105-3/4 | .775 | .375 | .035 | 25, 100 |
| FIT-105-1 | 1.000 | .500 | .040 | 25, 100 |
| FIT-105-1 1/2 | 1.500 | .750 | .045 | 25, 100 |
| FIT-105-2 | 2.000 | 1.000 | .050 | 10, 25, 50 |

**STOCK COLOR:** Black

**LONG LENGTHS — PACKAGING:** Maximum Three Lengths Per Put-up

### PACKAGED ASSORTMENTS

FIT-105-MS — Assorted sizes per box — contains an assortment of 6″ lengths in various sizes. Every length identified as to size and supplied in Black only.

| Alpha No. | Tubing Size Range | Lengths Per Box |
|---|---|---|
| FIT-105-MS-1 | 3/64″ thru 1/4″ (6 sizes) | 10 lengths per size (60 lengths) |
| FIT-105-MS-2 | 3/8″ thru 1″ (4 sizes) | 10 lengths per size (40 lengths) |

**MAY BE CUT AND MARKED TO YOUR SPECIFICATIONS.**

**ALPHA WIRE Corporation** Elizabeth, N.J. 07207 Telephone (201) 925-8000

# PVC AND TFE TUBING

alpha

## PVC-105 POLYVINYLCHLORIDE PLASTIC TUBING

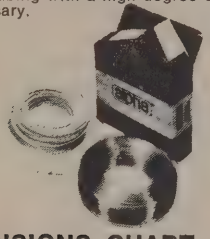
### UL LISTED, ASTMD-876, D-9222 MIL-I-631D TYPE F, FORM U, GRADE C, CLASS 1, CATEGORY 1

**DESCRIPTION:** The superior mechanical, thermal, and electrical properties of Alpha PVC-105, coupled with its economical cost have led to an ever increasing use of this all-purpose insulating material. Another major advantage of Alpha PVC-105 is its high degree of flexibility, which is maintained even under severe environmental conditions.

Rated for temperatures as high as 105°C, PVC-105 has a high dielectric strength that remains unaffected by increasing temperature throughout its range. PVC-105 maintains a high resistance to the agents of heat, oil, chemical corrosion and fungi with no loss in tensile strength, or flexibility. Other features include an exceptional resistance to abrasion and indefinite shelf life.

Alpha PVC-105 is compounded with first quality, non-migratory resinous type plasticizers. Carefully selected stabilizers and modifiers added in the manufacturing process, counteract chemical and environmental degradation. Under adverse conditions Alpha PVC-105 retains its flexibility which permits it to cling to and protect irregular shapes. An unusually simple to handle insulating material, PVC-105 "snakes" well under all environmental conditions.

**APPLICATIONS:** Designed and manufactured for general electronic, aircraft and electrical applications involving temperatures as high as 105°C. Especially useful to protect wires and cables subject to abrasion or where a flexible tubing with a high degree of resistivity to oil, chemicals or solvents is necessary.



### CUT-PIECES

Pre-cut, ready to use tubing pieces in ½″ and 1″ lengths are available from stock. Cut pieces are available from stock in packages of 100, 500, 1000 pieces. When ordering specify Alpha No., add suffix CP, lgth. of cut piece, ½″ or 1″ and quantity (100, 500, 1000).

### DIMENSIONS CHART

| Alpha No. and Size (Inch) | Nom. Inside Dia. (Inch) | Nom. Wall Thickness (Inch) | Stock Colors | Standard Put-ups (Feet) |
|---|---|---|---|---|
| PVC-105-24 | .022 | .013 | 1-6 | 100, 1000 Spools |
| PVC-105-22 | .027 | .012 | 1-6 | 100, 1000 Spools |
| PVC-105-20 | .034 | .016 | 1-6 | 100, 1000 Spools |
| PVC-105-19 | .038 | .016 | 1-6 | 100, 1000 Spools |
| PVC-105-18 | .042 | .016 | 1-6 | 100, 1000 Spools |
| PVC-105-17 | .047 | .016 | 1-6 | 100, 1000 Spools |
| PVC-105-16 | .053 | .016 | 1-6 | 100, 1000 Spools |
| PVC-105-15 | .059 | .016 | 1-6 | 100, 1000 Spools |
| PVC-105-14 | .066 | .016 | 1-6 | 100, 500 Spools |
| PVC-105-13 | .076 | .016 | 1-6 | 100, 500 Spools |
| PVC-105-12 | .085 | .016 | 1-6 | 100, 500 Spools |
| PVC-105-11 | .095 | .016 | 1-6 | 100, 500 Spools |
| PVC-105-10 | .106 | .016 | 1-6 | 100, 500 Spools |
| PVC-105-9 | .118 | .020 | 1-6 | 100, 500 Spools |
| PVC-105-8 | .133 | .020 | 1-6 | 100, 500 Spools |
| PVC-105-7 | .148 | .020 | 1-6 | 100, 500 Spools |
| PVC-105-6 | .166 | .020 | 1-6 | 100, 500 Spools |
| PVC-105-5 | .186 | .020 | 1-6 | 100, 500 Spools |
| PVC-105-4 | .208 | .020 | 1-6 | 100, 250 Coils |
| PVC-105-3 | .234 | .020 | 1-6 | 100, 250 Coils |
| PVC-105-2 | .263 | .020 | 1-6 | 100, 250 Coils |
| PVC-105-1 | .294 | .020 | 1, 2, 3 | 100, 250 Coils |
| PVC-105-0 | .330 | .020 | 1, 2, 3 | 100, 250 Coils |
| PVC-105-5/16 | .312 | .025 | 1, 2, 3 | 100, 250 Coils |
| PVC-105-3/8 | .375 | .025 | 1, 2, 3 | 100, 250 Coils |
| PVC-105-7/16 | .438 | .025 | 1, 2, 3 | 100 Coils |
| PVC-105-½A | .500 | .025 | 1, 2, 3 | 100 Coils |
| PVC-105-9/16 | .562 | .030 | 1, 2, 3 | 100 Coils |
| PVC-105-5/8 | .625 | .030 | 1, 2, 3 | 100 Coils |
| PVC-105-¾ | .750 | .035 | 1, 2, 3 | 50 Coils |
| PVC-105-⅞ | .875 | .035 | 1, 2, 3 | 50 Coils |
| PVC-105-1 | 1.000 | .035 | 1, 2, 3 | 50 Coils |
| PVC-105-1⅛ | 1.125 | .035 | 1, 2 | 50 Coils |
| PVC-105-1¼ | 1.250 | .040 | 1, 2 | 50 Coils |
| PVC-105-1⅜ | 1.375 | .040 | 1, 2 | 50 Coils |
| PVC-105-1½ | 1.500 | .045 | 1, 2 | 50 Coils |
| PVC-105-1¾ | 1.750 | .055 | 1, 2 | 50 Coils |
| PVC-105-2 | 2.000 | .060 | 1, 2 | 50 Coils |
| PVC-105-2¼ | 2.250 | .065 | 1, 2 | 50 Coils |
| PVC-105-2½ | 2.500 | .070 | 1, 2 | 50 Coils |

***STOCK COLORS:**
1—Clear, 2—Black, 3—White, 4—Yellow, 5—Red, 6—Green
**NOTE: UL FILE NO. ON REQUEST**

## TFT 200-250 EXTRUDED TEFLON TUBING (TFE)

### MIL-I-22129C, AMS-3651B, 3655, 3653 — FED. SPEC. P-403A OPERATING TEMPERATURE: −65°C TO +260°C

Alpha Teflon Tubing offers all the unique thermal, electrical and mechanical properties of Teflon. Teflon Tubing is rated for continuous operation at 260°C and retains an exceptional toughness and flexibility throughout its range. At high frequencies, the dielectric strength of Teflon is many times that of other insulating materials. Teflon Tubing is completely inert and has zero moisture absorbtion. Standard wall Teflon (TFT-250) has the same characteristics as thin wall tubing (TFT-200) but is used where higher dielectric values and additional mechanical strength is required.

**CHARACTERISTICS:** Operating Temperature: −65°C to +260°C. High dielectric strength. Chemically inert. Zero moisture absorbtion.

**APPLICATIONS:** Insulation of components, connectors, all electrical and electronic apparatus requiring high thermal insulation and superior dielectric qualities.

**SPECIFICATIONS:** Tensile Strength: 5000-75000 PSI. Completely non-flammable. Min. Vol. Res.: $10^{17}$ Ohm-cm. Ultimate Elongation: 300-500%. Dielectric Strength: 1400V/Mil. Dielectric Constant: 2.2. Abrasion Resistance: Fair.

### TFT-200 THIN WALL

| Alpha No. and Size (Inch) | Nom. Inside Dia. (Inch) | Nom. Wall Thick. (Inch) | Standard Put-ups (Feet) |
|---|---|---|---|
| †TFT-200-30 | .012 | .009 | 100, 1000 |
| †TFT-200-28 | .015 | .009 | 100, 1000 |
| †TFT-200-26 | .018 | .010 | 100, 1000 |
| †TFT-200-24 | .022 | .010 | 100, 1000 |
| †TFT-200-22 | .027 | .010 | 100, 1000 |
| †TFT-200-20 | .034 | .012 | 100, 1000 |
| †TFT-200-19 | .038 | .012 | 100, 1000 |
| †TFT-200-18 | .042 | .012 | 100, 1000 |
| †TFT-200-17 | .047 | .012 | 100, 1000 |
| †TFT-200-16 | .053 | .012 | 100, 1000 |
| †TFT-200-15 | .059 | .012 | 100, 1000 |
| †TFT-200-14 | .066 | .012 | 100, 500 |
| †TFT-200-13 | .076 | .012 | 100, 500 |
| †TFT-201-12 | .085 | .012 | 100, 500 |
| †TFT-200-11 | .095 | .012 | 100, 500 |
| †TFT-200-10 | .106 | .012 | 100, 500 |
| †TFT-200-9 | .118 | .015 | 100, 500 |
| ‡TFT-200-8 | .133 | .015 | 100 Coils* |
| ‡TFT-200-7 | .148 | .015 | 100 Coils* |
| ‡TFT-200-6 | .166 | .015 | 100 Coils* |
| ‡TFT-200-5 | .186 | .015 | 100 Coils* |
| ‡TFT-200-4 | .208 | .015 | 100 Coils* |
| ‡TFT-200-3 | .234 | .015 | 100 Coils* |
| ‡TFT-200-2 | .263 | .015 | 100 Coils* |
| ‡TFT-200-1 | .294 | .015 | 100 Coils* |
| ‡TFT-200-0 | .330 | .015 | 100 Coils* |

**STOCK COLORS:** †Natural, Black ‡Natural Only
***RANDOM LENGTHS PACKED IN 100′ COILS**

### TFT-250 STANDARD WALL

| Alpha No. and Size (Inch) | Nom. Inside Dia. (Inch) | Nom. Wall Thick. (Inch) | Standard Put-ups (Feet) |
|---|---|---|---|
| TFT-250-24 | .022 | .012 | 100, 1000 |
| TFT-250-22 | .027 | .012 | 100, 1000 |
| TFT-250-20 | .034 | .016 | 100, 1000 |
| TFT-250-19 | .038 | .016 | 100, 1000 |
| TFT-250-18 | .042 | .016 | 100, 1000 |
| TFT-250-17 | .047 | .016 | 100, 1000 |
| TFT-250-16 | .053 | .016 | 100, 1000 |
| TFT-250-15 | .059 | .016 | 100, 1000 |
| TFT-250-14 | .066 | .016 | 100, 500 |
| TFT-250-13 | .076 | .016 | 100, 500 |
| TFT-250-12 | .085 | .016 | 100, 500 |
| TFT-250-11 | .095 | .016 | 100, 500 |
| TFT-250-10 | .106 | .016 | 100, 500 |
| TFT-250-9 | .118 | .020 | 100, 500 |
| TFT-250-8 | .133 | .020 | 100 Coils* |
| TFT-250-7 | .148 | .020 | 100 Coils* |
| TFT-250-6 | .166 | .020 | 100 Coils* |
| TFT-250-5 | .186 | .020 | 100 Coils* |
| TFT-250-4 | .208 | .020 | 100 Coils* |
| TFT-250-3 | .234 | .020 | 100 Coils* |
| TFT-250-2 | .263 | .020 | 100 Coils* |
| TFT-250-1 | .294 | .020 | 100 Coils* |
| TFT-250-0 | .330 | .020 | 100 Coils* |

**STOCK COLORS:** Natural
***RANDOM LENGTHS PACKED IN 100′ COILS**

**ALPHA WIRE Corporation** Elizabeth, N.J. 07207 Telephone (201) 925-8000

alpha

# ZIPPER TUBING

## MAKE A CABLE JACKET IN JUST SECONDS

Standard

Loc-Trac

With Alpha Zipper Tubing, you can protect or jacket any group of wires or cables in only seconds. Zipper tubing is supplied on spools in a flat ribbon configuration. Both edges of the zipper tubing have a special plastic track. The zipper tubing is cut to the size required, folded around the wires or cable to be jacketed so that the two tracks face each other. A special slider (zipper) is affixed at one end of the track and as it is pulled, it draws the two tracks together and locks them in much the same way an ordinary zipper operates. The result is a permanent jacket, or protective cover.

Zipper tubing is available in two types of tracks. Standard track allows the material to be easily opened at any point to make breakouts, or bring other cable lines into the cable line being jacketed.

Now, Alpha has dveloped a new type of track, Loc-Trac®, that provides a permanent, flex-resistant track. This track will not pop open even when the jacketed material is bent in a U-shape. It requires no sealant or any adhesive to hold together.

Passes FR-1 flame test

- UL Listed • Easy to Use
- Ideal for prototypes — short run cables
- Adds extra mechanical protection
- Eliminates tape-wrapping, or other 'make-do' jacketing material
- Available in wide selection of types and tracks

**SPECIFICATIONS FOR ALL TYPES OF ALPHA ZIPPER TUBING:**

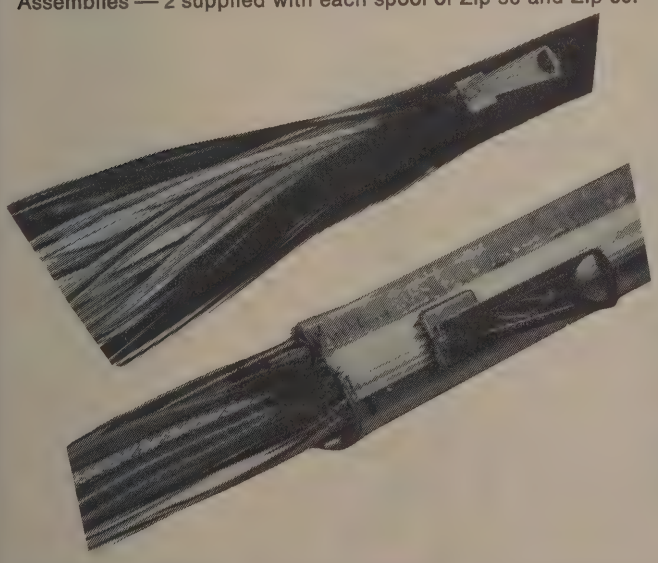
| | |
|---|---|
| Material | Polyvinylchloride |
| Track Thickness (when closed) | Std. .092" Loc. Trac® .150 |
| Dielectric Strength V/mil | 759 |
| Tensile Strength P.S.I. | 3810 |
| Ultimate Elongation | 255% |
| Operating Temperature Upper Limit | 106°C |
| Cold Brittleness | −86°C |
| Fungus-proof | will not support fungus |
| Flammability | self-extinguishing |
| Lateral Pull Strength (unsealed) | 42.7 pounds/inch |
| Lateral Pull Strength (permanently sealed) | 59.8 pounds/inch |

**ACCESSORIES:**

**PB-200** Special Compound Liquid Sealer. Available in sizes: 1 oz., 2 oz., 4 oz., 1 pt., 1 qt., 1 gal. Each container is supplied with a brush for easy application of the sealer. 4 oz. of PB-200 will seal approximately 1000 ft.

**AB-295** — Standard Track. **AB-395** — Loc-Trac® Metal Sliders. 1 supplied free with every 25 feet. Additional sliders may be ordered separately.

**ZIP-CLIP** — Package of 10 additional Shield Termination Assemblies — 2 supplied with each spool of Zip 50 and Zip 60.



## STANDARD ZIP-31 LOC-TRAC® ZIP-41 — ALL PURPOSE

**.020 WALL THICKNESS**

| Std. Track Alpha No. | Loc-Trac Alpha No. | Diameter (Inches) | Approx. Flat Width (Inches) | Stock Colors |
|---|---|---|---|---|
| ZIP-31-¼"† | —— | ¼ | 1 5/16 | Clear, Black |
| ZIP-31-⅜"† | —— | ⅜ | 1 5/8 | Clear, Black |
| ZIP-31-½" | ZIP-41-½" | ½ | 2 | Clear, Black |
| ZIP-31-⅝" | ZIP-41-⅝" | ⅝ | 2 3/8 | Clear, Black |
| ZIP-31-¾" | ZIP-41-¾" | ¾ | 2¾ | Clear, Black |
| ZIP-31-⅞" | ZIP-41-⅞" | ⅞ | 3⅛ | Clear, Black |
| ZIP-31-1" | ZIP-41-1" | 1 | 3 5/16 | Clear, Black |
| ZIP-31-1⅛" | ZIP-41-1⅛" | 1⅛ | 3 15/16 | Clear, Black |
| ZIP-31-1¼" | ZIP-41-1¼" | 1¼ | 4⅛ | Clear, Black |
| ZIP-31-1½" | ZIP-41-1½" | 1½ | 4⅞ | Clear, Black |
| ZIP-31-1¾" | ZIP-41-1¾" | 1¾ | 5⅝ | Clear, Black |
| ZIP-31-2" | ZIP-41-2" | 2 | 6⅜ | Clear, Black |
| ZIP-31-2¼" | ZIP-41-2¼" | 2¼ | 7½ | Clear, Black |
| ZIP-31-2½" | ZIP-41-2½" | 2½ | 8¼ | Clear, Black |
| ZIP-31-2¾" | ZIP-41-2¾" | 2¾ | 9⅛ | Clear, Black |
| ZIP-31-3" | ZIP-41-3" | 3 | 10 | Clear, Black |
| ZIP-31-3¼" | ZIP-41-3¼" | 3¼ | 10¾ | Clear, Black |
| ZIP-31-3½" | ZIP-41-3½" | 3½ | 11½ | Clear, Black |
| ZIP-31-3¾" | ZIP-41-3¾" | 3¾ | 12¼ | Clear, Black |
| ZIP-31-4" | ZIP-41-4" | 4 | 13 | Clear, Black |

**STANDARD PUT-UP:** 25 FT./50 FT./100 FT.

## STANDARD ZIP-31M LOC-TRAC® ZIP-41M — HEAVY DUTY

**.040 WALL THICKNESS**

| Std. Track Alpha No. | Loc-8rac Alpha No. | Diameter (Inches) | Approx. Flat Width (Inches) | Stock Colors |
|---|---|---|---|---|
| ZIP-31M-¼"† | —— | ¼ | 1 5/16 | Clear, Black |
| ZIP-31M-⅜"† | —— | ⅜ | 1 5/8 | Clear, Black |
| ZIP-31M-½" | ZIP-41M-½" | ½ | 2 | Clear, Black |
| ZIP-31M-⅝" | ZIP-41M-⅝" | ⅝ | 2⅜ | Clear, Black |
| ZIP-31M-¾" | ZIP-41M-¾" | ¾ | 2¾ | Clear, Black |
| ZIP-31M-⅞" | ZIP-41M-⅞" | ⅞ | 3⅛ | Clear, Black |
| ZIP-31M-1" | ZIP-41M-1" | 1 | 3 5/16 | Clear, Black |
| ZIP-31M-1⅛" | ZIP-41M-1⅛" | 1⅛ | 3 15/16 | Clear, Black |
| ZIP-31M-1¼" | ZIP-41M-1¼" | 1¼ | 4⅛ | Clear, Black |
| ZIP-31M-1½" | ZIP-41M-1½" | 1½ | 4⅞ | Clear, Black |
| ZIP-31M-1¾" | ZIP-41M-1¾" | 1¾ | 5⅝ | Clear, Black |
| ZIP-31M-2" | ZIP-41M-2" | 2 | 6⅜ | Clear, Black |
| ZIP-31M-2¼" | ZIP-41M-2¼" | 2¼ | 7½ | Clear, Black |
| ZIP-31M-2½" | ZIP-41M-2½" | 2½ | 8¼ | Clear, Black |
| ZIP-31M-2¾" | ZIP-41M-2¾" | 2¾ | 9⅛ | Clear, Black |
| ZIP-31M-3" | ZIP-41M-3" | 3 | 10 | Clear, Black |
| ZIP-31M-3¼" | ZIP-41M-3¼" | 3¼ | 10¾ | Clear, Black |
| ZIP-31M-3½" | ZIP-41M-3½" | 3½ | 11½ | Clear, Black |
| ZIP-31M-3¾" | ZIP-41M-3¾" | 3¾ | 12¼ | Clear, Black |
| ZIP-31M-4" | ZIP-41M-4" | 4 | 13 | Clear, Black |

**STANDARD PUT-UP:** 100 FT.

## STANDARD ZIP-50 LOC-TRAC® ZIP-60 — FOIL SHIELDED

**.020 WALL THICKNESS**

| Std. Track Alpha No. | Loc-8rac Alpha No. | Diameter (Inches) | Approx. Flat Width (Inches) | Stock Colors |
|---|---|---|---|---|
| ZIP-50-¼"† | —— | ¼ | 1 5/16 | Gray |
| ZIP-50-⅜"† | —— | ⅜ | 1 5/8 | Gray |
| ZIP-50-½" | ZIP-60-½" | ½ | 2 | Gray |
| ZIP-50-⅝" | ZIP-60-⅝" | ⅝ | 2⅜ | Gray |
| ZIP-50-¾" | ZIP-60-¾" | ¾ | 2¾ | Gray |
| ZIP-50-⅞" | ZIP-60-⅞" | ⅞ | 3⅛ | Gray |
| ZIP-50-1" | ZIP-60-1" | 1 | 3 5/16 | Gray |
| ZIP-50-1⅛" | ZIP-60-1⅛" | 1⅛ | 3 15/16 | Gray |
| ZIP-50-1¼" | ZIP-60-1¼" | 1¼ | 4⅛ | Gray |
| ZIP-50-1½" | ZIP-60-1½" | 1½ | 4⅞ | Gray |
| ZIP-50-1¾" | ZIP-60-1¾" | 1¾ | 5⅝ | Gray |
| ZIP-50-2" | ZIP-60-2" | 2 | 6⅜ | Gray |
| ZIP-50-2¼" | ZIP-60-2¼" | 2¼ | 7½ | Gray |
| ZIP-50-2½" | ZIP-60-2½" | 2½ | 8¼ | Gray |
| ZIP-50-2¾" | ZIP-60-2¾" | 2¾ | 9⅛ | Gray |
| ZIP-50-3" | ZIP-60-3" | 3 | 10 | Gray |
| ZIP-50-3¼" | ZIP-60-3¼" | 3¼ | 10¾ | Gray |
| ZIP-50-3½" | ZIP-60-3½" | 3½ | 11½ | Gray |
| ZIP-50-3¾" | ZIP-60-3¾" | 3¾ | 12¼ | Gray |
| ZIP-50-4" | ZIP-60-4" | 4 | 13 | Gray |

**STANDARD PUT-UP:** 100 FT.

**ALPHA WIRE Corporation** Elizabeth, N.J. 07207 Telephone (201) 925-8000

BELDEN | multi-conductor unshielded cable

**Applications:**
- Control systems
- Processing equipment
- Audio (not paired)

# Multi-conductor Unshielded Cable

## VINYL CONTROL & AUDIO CABLE

### 22 GAGE
### SOLID CONDUCTORS .64 mm diam.

**PRODUCT DESCRIPTION:** *Bare copper, polyethylene insulated. Conductors cabled, rose gray vinyl jacket.*

| Description | Trade & U.L. Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond. | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **8795** UL LISTED **90V Max.** **Wires, Misc.** | U-500<br>U-1000<br>1000 | U-152.4<br>U-304.8<br>304.8 | **96074**<br>**96073**<br>**96072** | 2 | .016 | .41 | .022 | .56 | .160 | 4.06 |
| | | | | | *Color code: Red, Green.* | | | | | | |
| | **8794** UL LISTED **90V Max.** **Wires, Misc.** | U-500<br>U-1000<br>1000 | U-152.4<br>U-304.8<br>304.8 | **96078**<br>**96077**<br>**96076** | 3 | .016 | .41 | .022 | .56 | .168 | 4.27 |
| | | | | | *Color code: Red, Green, Yellow.* | | | | | | |
| | **9794** UL LISTED **90V Max.** **Wires, Misc.** | P-100<br>U-500<br>U-1000<br>1000 | P-30.5<br>U-152.4<br>U-304.8<br>304.8 | **94929**<br>**94927**<br>**94926**<br>**94925** | 4 | .016 | .41 | .025 | .64 | .190 | 4.83 |
| | | | | | *Color code: Green, Red, Yellow, Black.* | | | | | | |

### 22 GAGE
### STRANDED CONDUCTORS (7x30) .76 mm diam.

**PRODUCT DESCRIPTION:** *tinned copper, vinyl insulated, twisted pair, vinyl jacket.*

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **8442**† UL LISTED **2508** | 100 Chrome | 30.5 | **98051** | 2 | .015 | .38 | .025 | .64 | .165 | 4.19 |
| | | P-100 Chrome | P-30.5 | **98056** | | | | | | | |
| | | U-500 Chrome | U-152.4 | **98055** | | | | | | | |
| | | U-500 Lt. Beige | U-152.4 | **98054** | | | | | | | |
| | | 500 Chrome | 152.4 | **98050** | | | | | | | |
| | | 500 Lt. Beige | 152.4 | **98049** | | | | | | | |
| | | U-1000 Chrome | U-304.8 | **98053** | | | | | | | |
| | | U-1000 Lt. Beige | U-304.8 | **98052** | | | | | | | |
| | | 1000 Chrome | 304.8 | **98047** | | | | | | | |
| | | 1000 Lt. Beige | 304.8 | **98046** | | | | | | | |

***Suggested working voltage: 350***

*Color code: Black, Red.*

†***Passes the FR-1 vertical flame test.***

multi-conductor unshielded cable | BELDEN

# VINYL CONTROL & AUDIO CABLE (cont'd)

## 22 GAGE
## STRANDED CONDUCTORS (7x30) .76 mm diam. (cont'd.)

**PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, conductors cabled.*

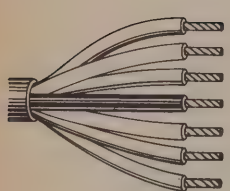
| Description | Trade & U.L. Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond. | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **8443**<br>UL LISTED<br>**2576**<br>150V | 25<br>100<br>P-100<br>250<br>U-500<br>500<br>U-1000<br>1000 | 7.6<br>30.5<br>P-30.5<br>76.2<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **98041**<br>**98040**<br>**98044**<br>**98039**<br>**98043**<br>**98038**<br>**98042**<br>**98037** | 3 | .010 | .25 | .032 | .81 | .164 | 4.17 |
| | | | | | *Chrome vinyl jacket.*<br>***Suggested working voltage: 200***<br>*Color code: Black, Red, Green.* | | | | | | |
| | **8444†**<br>UL LISTED<br>**2576**<br>150V | 25<br>100<br>250<br>U-500<br>500<br>U-1000<br>1000 | 7.6<br>30.5<br>76.2<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **98034**<br>**98033**<br>**98032**<br>**98036**<br>**98031**<br>**98035**<br>**98030** | 4 | .010 | .25 | .032 | .81 | .182 | 4.62 |
| | | | | | *Chrome vinyl jacket. Color code chart No. 1, page 6.*<br>***Suggested working voltage: 200*** | | | | | | |
| | **8445†**<br>UL LISTED<br>**2576**<br>150V | 25<br>100<br>250<br>U-500<br>500<br>U-1000<br>1000 | 7.6<br>30.5<br>76.2<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **98027**<br>**98026**<br>**98025**<br>**98029**<br>**98024**<br>**98028**<br>**98023** | 5 | 010 | .25 | .032 | .81 | .194 | 4.93 |
| | | | | | *Chrome vinyl jacket. Color code chart No. 1, page 6.*<br>***Suggested working voltage: 200*** | | | | | | |
| | **9430†**<br>UL LISTED<br>**2576**<br>150V | U-500<br>500<br>U-1000<br>1000 | U-152.4<br>152.4<br>U-304.8<br>304.8 | **95403**<br>**95401**<br>**95402**<br>**95400** | 7 | .010 | .25 | .032 | .81 | .214 | 5.44 |
| | | | | | *Chrome vinyl jacket. Color code chart No. 1, page 6.*<br>***Suggested working voltage: 200*** | | | | | | |
| | **★9421**<br>UL LISTED<br>**2576**<br>150V | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **87810**<br>**87812**<br>**87809**<br>**87811**<br>**87808** | 8 | .010 | .25 | .032 | .81 | .229 | 5.82 |
| | | | | | *Chrome vinyl jacket. Color code chart No. 1, page 6.*<br>***Suggested working voltage: 200*** | | | | | | |
| | **★9423**<br>UL LISTED<br>**2576**<br>150V | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **87805**<br>**87807**<br>**87804**<br>**87806**<br>**87803** | 9 | .010 | .25 | .032 | .81 | .229 | 5.82 |
| | | | | | *Chrome vinyl jacket. Color code chart No. 1, page 6.*<br>***Suggested working voltage: 200*** | | | | | | |
| | **8456†**<br>UL LISTED<br>**2576**<br>150V | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **97950**<br>**97952**<br>**97949**<br>**97951**<br>**97948** | 10 | .010 | .25 | .032 | .81 | .264 | 6.71 |
| | | | | | *Chrome vinyl jacket. Color code chart No. 1, page 6.*<br>***Suggested working voltage: 200*** | | | | | | |
| | **8457†**<br>UL LISTED<br>**2576**<br>150V | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **97945**<br>**97947**<br>**97944**<br>**97946**<br>**97943** | 12 | .010 | .25 | .032 | .81 | .264 | 6.71 |
| | | | | | *Chrome vinyl jacket. Color code chart No. 1, page 6.*<br>***Suggested working voltage: 200*** | | | | | | |
| | **8458†**<br>UL LISTED<br>**2576**<br>150V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **97942**<br>**97941**<br>**97940** | 15 | .010 | .25 | .040 | 1.02 | .320 | 8.13 |
| | | | | | *Chrome vinyl jacket. Color code chart No. 2R, page 6.*<br>***Suggested working voltage: 200*** | | | | | | |
| | **9431†**<br>UL LISTED<br>**2576**<br>150V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **87802**<br>**95399**<br>**95398** | 20 | .010 | .25 | .040 | 1.02 | .345 | 8.76 |
| | | | | | *Chrome vinyl jacket. Color code chart No. 2R, page 6.*<br>***Suggested working voltage: 200*** | | | | | | |

★ New Item

†***Passes the FR-1 vertical flame test.***

BELDEN | multi-conductor unshielded cable

# VINYL CONTROL & AUDIO CABLE (cont'd)

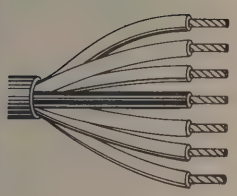
| Description | Trade & U.L. Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond. | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **22 GAGE** **STRANDED CONDUCTORS (7x30) .76 mm diam. (cont'd.)** | | | | | | | | | | | |
| **PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, conductors cabled.* | | | | | | | | | | | |
| | **8459†** UL LISTED **2576** 150V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | 97939<br>97938<br>97937 | 25 | .010 | .25 | .040 | 1.02 | .370 | 9.40 |
| | *Chrome vinyl jacket. Color code chart No. 2R, page 6.* ***Suggested working voltage: 200*** | | | | | | | | | | |
| | **9432†** UL LISTED **2576** 150V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | 87801<br>95397<br>95396 | 30 | .010 | .25 | .040 | 1.02 | .400 | 10.16 |
| | *Chrome vinyl jacket. Color code chart No. 2R, page 6.* ***Suggested working voltage: 200*** | | | | | | | | | | |
| | **9433†** UL LISTED **2576** 150V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | 87800<br>95395<br>95394 | 40 | .010 | .25 | .040 | 1.02 | .455 | 11.56 |
| | *Chrome vinyl jacket. Color code chart No. 2R, page 6.* ***Suggested working voltage: 200*** | | | | | | | | | | |
| | **9434†** UL LISTED **2576** 150V | 500<br>1000 | 152.4<br>304.8 | 95393<br>95392 | 50 | .010 | .25 | .045 | 1.14 | .500 | 12.70 |
| | *Chrome vinyl jacket. Color code chart No. 2R, page 6.* ***Suggested working voltage: 200*** | | | | | | | | | | |
| **20 GAGE** **STRANDED CONDUCTORS (10 x 30) .94 mm diam.** | | | | | | | | | | | |
| **PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, conductors cabled, chrome vinyl jacket.* ***Suggested working voltage: 300*** | | | | | | | | | | | |
|  | **9444†** UL LISTED **2464** | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | 95353<br>95355<br>95352<br>95354<br>95351 | 4 | .013 | .33 | .032 | .81 | .217 | 5.51 |
| | *Color code chart No. 1, page 6.* | | | | | | | | | | |
| | **9445†** UL LISTED **2464** | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | 95348<br>95350<br>95347<br>95349<br>95346 | 5 | .013 | .33 | .032 | .81 | .239 | 6.07 |
| | *Color code chart No. 1, page 6.* | | | | | | | | | | |
| | **9439†** UL LISTED **2464** | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | 95382<br>86289<br>95381<br>86288<br>95380 | 7 | .013 | .33 | .032 | .81 | .260 | 6.60 |
| | *Color code chart No. 1, page 6.* | | | | | | | | | | |
| | **9455†** UL LISTED **2464** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | 95335<br>95334<br>95333 | 9 | .013 | .33 | .035 | .89 | .317 | 8.05 |
| | *Color code chart No. 1, page 6.* | | | | | | | | | | |
| | **9457†** UL LISTED **2464** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | 95332<br>95331<br>95330 | 12 | .013 | .33 | .035 | .89 | .338 | 8.58 |
| | *Color code chart No. 1, page 6.* | | | | | | | | | | |
| | **9458†** UL LISTED **2464** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | 95329<br>95328<br>95327 | 15 | .013 | .33 | .040 | 1.02 | .389 | 9.88 |
| | *Color code chart No. 2, page 6.* | | | | | | | | | | |

*2R same as IPCEA except ring band striping.*

***†Passes the FR-1 vertical flame test.***

multi-conductor unshielded cable | BELDEN

## VINYL CONTROL & AUDIO CABLE (cont'd)

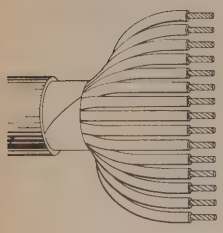
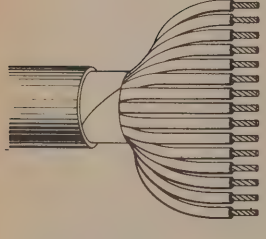
| Description | Trade & U.L. Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond. | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **19 GAGE**<br>**SOLID CONDUCTORS .91 mm diam.** | | | | | | | | | | | |
| | **8487**† | U-500<br>500<br>U-1000<br>1000 | U-152.4<br>152.4<br>U-304.8<br>304.8 | 97819<br>97817<br>97818<br>97816 | 3 | .015 | .38 | .025 | .64 | .180 | 4.57 |
| | | **PRODUCT DESCRIPTION:** *Bare copper, vinyl insulated, conductors cabled. Chrome vinyl jacket. Color coding: Brown, Gray, Tan.* ***Suggested working voltage: 300*** | | | | | | | | | |
| **18 GAGE**<br>**STRANDED CONDUCTORS (16 x 30) 1.17 mm diam.** | | | | | | | | | | | |
| | | **PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, conductors cabled. Chrome vinyl jacket.* ***Suggested working voltage: 400*** | | | | | | | | | |
|  | **8489**†<br>UL LISTED<br>**2598**<br>**300V** | 100<br>250<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>76.2<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | 97808<br>97807<br>97810<br>97806<br>97809<br>97805 | 4 | .018 | .46 | .032 | .81 | .254 | 6.45 |
| | | *Color code chart No. 1, page 6.* | | | | | | | | | |
| | **8465**†<br>UL LISTED<br>**2598**<br>**300V** | 100<br>250<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>76.2<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | 97904<br>97903<br>97906<br>97902<br>97905<br>97901 | 5 | .018 | .46 | .037 | .94 | .286 | 7.26 |
| | | *Color code chart No. 1, page 6.* | | | | | | | | | |
| | **8467**†<br>UL LISTED<br>**2598**<br>**300V** | 100<br>250<br>500<br>1000 | 30.5<br>76.2<br>152.4<br>304.8 | 97896<br>97895<br>97894<br>97893 | 7 | .018 | .46 | .037 | .94 | .324 | 8.23 |
| | | *Color code chart No. 1, page 6.* | | | | | | | | | |
| | **8469**†<br>UL LISTED<br>**2598**<br>**300V** | 100<br>250<br>500<br>1000 | 30.5<br>76.2<br>152.4<br>304.8 | 97889<br>97888<br>97887<br>97886 | 9 | .018 | .46 | .037 | .94 | .379 | 9.63 |
| | | *Color code chart No. 1, page 6* | | | | | | | | | |
| | **8466**†<br>UL LISTED<br>**2598**<br>**300V** | 100<br>250<br>500<br>1000 | 30.5<br>76.2<br>152.4<br>304.8 | 97900<br>97899<br>97898<br>97897 | 12 | .018 | .46 | .040 | 1.02 | .412 | 10.46 |
| | | *Color code chart No. 2R, page 6.* | | | | | | | | | |
| | **8468**†<br>UL LISTED<br>**2598**<br>**300V** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | 97892<br>97891<br>97890 | 15 | .018 | .46 | .045 | 1.14 | .505 | 12.83 |
| | | *Color code chart No. 2R, page 6.* | | | | | | | | | |
| | **8619**†<br>UL LISTED<br>**2598**<br>**300V** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | 87877<br>96519<br>96518 | 19 | .018 | .46 | .045 | 1.14 | .505 | 12.83 |
| | | *Color code chart No. 2R, page 6.* | | | | | | | | | |
| | **9626**†<br>UL LISTED<br>**2598**<br>**300V** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | 87699<br>95040<br>95039 | 25 | .018 | .46 | .060 | 1.52 | .600 | 15.24 |
| | | *Color code chart No. 2R, page 6.* | | | | | | | | | |

*2R Same as IPCEA except ring band striping.*

†***Passes the FR-1 vertical flame test.***

BELDEN | multi-conductor unshielded cable

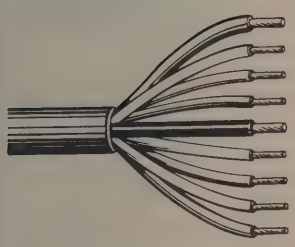
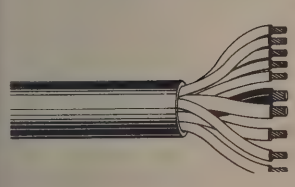
# VINYL CONTROL & AUDIO CABLE (cont'd)

| Description | Trade & U.L. Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond. | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **16 GAGE** **STRANDED CONDUCTORS (19 x 29) 1.42 mm diam.** | | | | | | | | | | | |
| PRODUCT DESCRIPTION: *Tinned copper, vinyl insulated, conductors cabled. Chrome vinyl jacket.* ***Suggested working voltage: 600*** | | | | | | | | | | | |
|  | **8620†** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **96517**<br>**96516**<br>**96515** | 4 | .030 | .76 | .045 | 1.14 | .375 | 9.53 |
| | | *Color code chart No. 2, page 6.* | | | | | | | | | |
| | **9620†** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **95050**<br>**95049**<br>**95048** | 5 | .030 | .76 | .045 | 1.14 | .405 | 10.29 |
| | | *Color code chart No. 2, page 6* | | | | | | | | | |
| | **8621†** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **96514**<br>**96513**<br>**96512** | 7 | .030 | .76 | .045 | 1.14 | .455 | 11.56 |
| | | *Color code chart No. 2R, page 6.* | | | | | | | | | |
| | **9621†** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **87700**<br>**95047**<br>**95046** | 9 | .030 | .76 | .045 | 1.14 | .510 | 12.95 |
| | | *Color code chart No. 2R, page 6* | | | | | | | | | |
| | **8622†** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **96511**<br>**96510**<br>**96509** | 12 | .030 | .76 | .060 | 1.52 | .600 | 15.24 |
| | | *Color code chart No. 2R, page 6.* | | | | | | | | | |
| | **8623†** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **96508**<br>**96507**<br>**96506** | 15 | .030 | .76 | .060 | 1.52 | .685 | 17.40 |
| | | *Color code chart No. 2R, page 6.* | | | | | | | | | |
| | **8624†** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **96505**<br>**96504**<br>**96503** | 19 | .030 | .76 | .065 | 1.65 | .715 | 18.16 |
| | | *Color code chart No. 2R, page 6.* | | | | | | | | | |
| | **9622†** | 500<br>1000 | 152.4<br>304.8 | **95045**<br>**95044** | 25 | .030 | .76 | .065 | 1.65 | .820 | 20.83 |
| | | *Color code chart No. 2R, page 6.* | | | | | | | | | |
| **14 GAGE** **STRANDED CONDUCTORS (19 x 27) 1.80 mm diam.** | | | | | | | | | | | |
| PRODUCT DESCRIPTION: *Tinned copper, vinyl insulated, conductors cabled. Chrome vinyl jacket.* ***Suggested working voltage: 600*** | | | | | | | | | | | |
|  | **8627†** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **96502**<br>**96501**<br>**96500** | 4 | .047 | 1.19 | .045 | 1.14 | .495 | 12.57 |
| | | *Color code chart No. 2, page 6.* | | | | | | | | | |
| | **9623†** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **95043**<br>**95042**<br>**95041** | 5 | .047 | 1.19 | .060 | 1.52 | .545 | 13.84 |
| | | *Color code chart No. 2, page 6.* | | | | | | | | | |
| | **8628†** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **96499**<br>**96498**<br>**96497** | 7 | .047 | 1.19 | .060 | 1.52 | .615 | 15.62 |
| | | *Color code chart No. 2R, page 6.* | | | | | | | | | |
| | **8629†** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **96496**<br>**96495**<br>**96494** | 12 | .047 | 1.19 | .065 | 1.65 | .755 | 19.18 |
| | | *Color code chart No. 2R, page 6.* | | | | | | | | | |

*2R Same as IPCEA except ring band striping.*

†***Passes the FR-1 vertical flame test.***

# VINYL CONTROL & AUDIO CABLE (cont'd)

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond | AWG (Strand-ing) [Diam. in mm] | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Color Coding | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **COMBINATION GAGES**<br>**STRANDED CONDUCTORS**<br>**PRODUCT DESCRIPTION:** *tinned copper, vinyl insulated, conductors cabled, chrome vinyl jacket.* | | | | | | | | | | | | | | | | | |
|  | **8446**† LISTED **2576** 150V | 15<br>100<br>250<br>U-500<br>500<br>U-1000<br>1000 | 4.6<br>30.5<br>76.2<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **98020**<br>**98019**<br>**98018**<br>**98022**<br>**98017**<br>**98021**<br>**98016** | 6 | 4-22 (7x30) [.76]<br>***Suggested working voltage: 200***<br>2-18 (16x30) [1.17]<br>***Suggested working voltage: 400*** | .010<br><br>.018 | .25<br><br>.46 | .032 | .81 | .236 | 5.99 | Chart No. 1 Page 6 | | | | |
| | **8447**† LISTED **2576** 150V | 100<br>250<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>76.2<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **98013**<br>**98012**<br>**98015**<br>**98011**<br>**98014**<br>**98010** | 7 | 5-22 (7x30) [.76]<br>***Suggested working voltage: 200***<br>2-18 (16x30) [1.17]<br>***Suggested working voltage: 400*** | .010<br><br>2-18<br>.018 | .25<br><br>.018<br>.46 | .032 | .81 | .254 | 6.45 | Chart No. 1 Page 6 | | | | |
| | **8448**† LISTED **2576** 150V | 15<br>P-50<br>P-75<br>100<br>P-100<br>250<br>U-500<br>500<br>U-1000<br>1000 | 4.6<br>P-15.2<br>P-22.9<br>30.5<br>P-30.5<br>76.2<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **98004**<br>**98009**<br>**98008**<br>**98003**<br>**98007**<br>**98002**<br>**98006**<br>**98001**<br>**98005**<br>**98000** | 8 | 6-22 (7x30) [.76]<br>***Suggested working voltage: 200.***<br>2-18 (16x30) [1.19]<br>***Suggested working voltage: 400*** | .010<br><br>.018 | .25<br><br>.46 | .030 | .76 | .254 | 6.45 | Chart No. 1 Page 6 | | | | |
| | ★**9405**† LISTED **2464** 300V | 250<br>500<br>1000 | 76.2<br>152.4<br>304.8 | **87818**<br>**87817**<br>**87816** | 8 | 6-18 (16x30) [1.17]<br>2-16 (26x30) [1.54] | .018<br><br>.018 | .46<br><br>.46 | .032 | .81 | .377 | 9.58 | Chart No. 1 Page 6 | | | | |
| | **8449**† LISTED **2576** 150V | 15<br>100<br>250<br>U-500<br>500<br>U-1000<br>1000 | 4.6<br>30.5<br>76.2<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **97997**<br>**97996**<br>**97995**<br>**97999**<br>**97994**<br>**97998**<br>**97993** | 9 | 7-22 (7x30) [.76]<br>***Suggested working voltage: 200***<br>2-18 (16x30) [1.17]<br>***Suggested working voltage: 400*** | .010<br><br>.018 | .25<br><br>.46 | .032 | .81 | .269 | 6.83 | Chart No. 1 Page 6 | | | | |
| **COMBINATION GAGE**<br>**STRANDED CONDUCTORS**<br>**PRODUCT DESCRIPTION:** *tinned copper, vinyl insulated, conductors cabled, chrome vinyl jacket.* | | | | | | | | | | | | | | | | | |
|  | **8784**† LISTED **2464** 300V | U-500<br>500 | U-152.4<br>152.4 | **86342**<br>**96093** | 10 | 2-16 (26x30) [1.54]<br>1-20 (10x30) [.94]<br>7-22 (7x30) [.76] | .016<br><br>.013<br><br>.013 | .41<br><br>.33<br><br>.33 | .032 | .81 | .304 | 7.72 | Blk.<br>Wht.<br>Gray<br>Red<br>Grn.<br>Org.<br>Yel.<br>Blu.<br>Vio.<br>Brn. | | | | |

★New Item

†***Passes the FR-1 vertical flame test.***

BELDEN | paired, unshielded cable

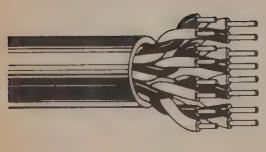
**Applications:**
- Sound systems
- Control systems

# Paired, Unshielded Cable

## SOUND AND CONTROL CABLES

**22 GAGE**
**SOLID CONDUCTORS .64 mm diam.**

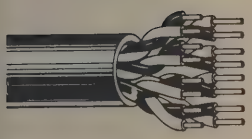
**PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, twisted pairs, chrome vinyl jacket.*
*For color coding please refer to page 6.*



| Description | Trade & U.L. Style Number | Standard Lengths ft. | Standard Lengths .m | U.P.C. No. | No. of Pairs | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **8740**† UL LISTED 90V Max. Wires, Misc. | 100<br>U-500<br>U-1000 | 30.5<br>U-152.4<br>U-304.8 | **96289**<br>**96291**<br>**96290** | 1 | .015 | .38 | .025 | .64 | .150 | 3.81 |
| | | | | | *Suggested working voltage: 300* | | | | | | |
| | **8741**† UL LISTED **2464** 300V | 100<br>U-500<br>T-500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>T-152.4<br>U-304.8<br>304.8 | **96285**<br>**96287**<br>**96288**<br>**96286**<br>**96284** | 2 | .015 | .38 | .032 | .81 | .209 | 5.31 |
| | **8742**† UL LISTED **2464** 300V | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **96281**<br>**96283**<br>**96280**<br>**96282**<br>**96279** | 3 | .015 | .38 | .032 | .81 | .244 | 6.20 |
| | **8757**† UL LISTED **2464** 300V | U-500<br>500<br>U-1000<br>1000 | U-152.4<br>152.4<br>U-304.8<br>304.8 | **96233**<br>**96231**<br>**96232**<br>**96230** | 4 | .015 | .38 | .032 | .81 | .259 | 6.58 |
| | **9158**† UL LISTED **2464** 300V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **86845**<br>**95783**<br>**95782** | 5 | .013 | .33 | .040 | 1.02 | .307 | 7.80 |
| | **8743**† UL LISTED 90V Max. Wires, Misc. | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **96276**<br>**96278**<br>**96275**<br>**96277**<br>**96274** | 6 | .010 | .25 | .035 | .89 | .305 | 7.75 |
| | | | | | *Suggested working voltage: 200* | | | | | | |
| | **9160**† UL LISTED **2464** 300V | 500<br>1000 | 152.4<br>304.8 | **95779**<br>**95778** | 8 | .013 | .33 | .040 | 1.02 | .346 | 8.79 |
| | **8744**† UL LISTED 90V Max. Wires, Misc. | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **96273**<br>**96272**<br>**96271** | 9 | .010 | .25 | .037 | .94 | .354 | 8.99 |
| | | | | | *Suggested working voltage: 200* | | | | | | |

†*Passes the FR-1 vertical flame test.*

# SOUND AND CONTROL CABLES (cont'd.)

| Description | Trade & U.L. Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Pairs | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **22 GAGE** SOLID CONDUCTORS .64 mm diam. (cont'd.) | | | | | | | | | | | |
| **PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, twisted pairs, chrome vinyl jacket. For color coding please refer to page 6.* | | | | | | | | | | | |
|  | **8753†** UL LISTED 90V Max. Wires, Misc. | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **96243**<br>**96242**<br>**96241** | 11 | .010 | .25 | .037 | .94 | .369 | 9.37 |
| | | | | | *Suggested working voltage: 200* | | | | | | |
| | **8754†** UL LISTED 90V Max. Wires, Misc. | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **96240**<br>**96239**<br>**96238** | 13 | .010 | .25 | .037 | .94 | .394 | 10.01 |
| | | | | | *Suggested working voltage: 200* | | | | | | |
| | **8745†** UL LISTED 90V Max. Wires, Misc. | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **96270**<br>**96269**<br>**96268** | 15 | .010 | .25 | .040 | 1.02 | .405 | 10.29 |
| | | | | | *Suggested working voltage: 200* | | | | | | |
| | **8755†** UL LISTED 90V Max. Wires, Misc. | 100<br>1000 | 30.5<br>304.8 | **87866**<br>**96236** | 19 | .010 | .25 | .040 | 1.02 | .430 | 10.92 |
| | | | | | *Suggested working voltage: 200* | | | | | | |
| | **8756†** UL LISTED 90V Max. Wires, Misc. | 500<br>1000 | 152.4<br>304.8 | **96235**<br>**96234** | 23 | .010 | .25 | .040 | 1.02 | .495 | 12.57 |
| | | | | | *Suggested working voltage: 200* | | | | | | |
| | **8746†** UL LISTED 90V Max. Wires, Misc. | 250<br>500<br>1000<br>2000 | 76.2<br>152.4<br>304.8<br>609.6 | **96267**<br>**96266**<br>**96265**<br>**96264** | 27 | .010 | .25 | .045 | 1.14 | .535 | 13.59 |
| | | | | | *All lengths + 20% −0 length tolerance.*<br>*Suggested working voltage: 200* | | | | | | |
| **22 GAGE** STRANDED CONDUCTORS (7x30) .76 mm diam. | | | | | | | | | | | |
| **PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, twisted pair, chrome vinyl jacket. For color coding please refer to page 6.* | | | | | | | | | | | |
| | **8442†** UL LISTED **2508** Wires, Misc. | 100 Chrome | 30.5 | **98051** | 1 | .015 | .38 | .025 | .64 | .165 | 4.19 |
| | | P-100 Chrome | P-30.5 | **98056** | *Suggested working voltage: 350* | | | | | | |
| | | U-500 Chrome | U-152.4 | **98055** | | | | | | | |
| | | U-500 Lt. Beige | U-152.4 | **98054** | | | | | | | |
| | | 500 Chrome | 152.4 | **98050** | | | | | | | |
| | | 500 Lt. Beige | 152.4 | **98049** | | | | | | | |
| | | U-1000 Chrome | U-304.8 | **98053** | | | | | | | |
| | | U-1000 Lt. Beige | U-304.8 | **98052** | | | | | | | |
| | | 1000 Chrome | 304.8 | **98047** | | | | | | | |
| | | 1000 Lt. Beige | 304.8 | **98046** | | | | | | | |

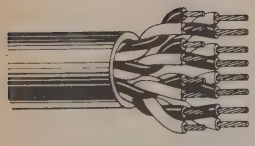
†*Passes the FR-1 vertical flame test.*

BELDEN | paired, unshielded cable

## SOUND & CONTROL CABLES (cont'd)

### 22 GAGE
### STRANDED CONDUCTORS (7x30) .76 mm diam. (cont'd.)

**PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, twisted pairs, chrome vinyl jacket. For color coding please refer to page 6.*



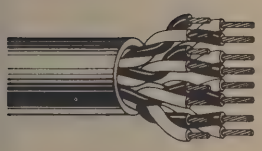
| Description | Trade & U.L. Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Pairs | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **9744†** LISTED **2464** 300V | | U-500<br>500<br>U-1000<br>1000 | U-152.4<br>152.4<br>U-304.8<br>304.8 | **94994**<br>**94992**<br>**94993**<br>**94991** | 2 | .015 | .38 | .032 | .81 | .238 | 6.04 |
| **9745†** LISTED **2464** 300V | | U-500<br>500<br>U-1000<br>1000 | U-152.4<br>152.4<br>U-304.8<br>304.8 | **94990**<br>**94988**<br>**94989**<br>**94987** | 3 | .015 | .38 | .032 | .81 | .284 | 7.21 |
| **9746†** LISTED **2464** 300V | | 500<br>1000 | 152.4<br>304.8 | **94986**<br>**94985** | 4 | .015 | .38 | .032 | .81 | .299 | 7.59 |
| **8747†** LISTED **2576** 150V | | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **96263**<br>**96262**<br>**96261** | 6 | .010 | .25 | .035 | .89 | .320 | 8.13 |
| | | | | | ***Suggested working voltage: 200*** | | | | | | |
| **8748†** LISTED **2576** 150V | | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **96260**<br>**96259**<br>**96258** | 9 | .010 | .25 | .037 | .94 | .389 | 9.88 |
| | | | | | ***Suggested working voltage: 200*** | | | | | | |
| **9747†** LISTED **2576** 150V | | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **87652**<br>**94984**<br>**94983** | 12 | .010 | .25 | .040 | 1.02 | .425 | 10.80 |
| | | | | | ***Suggested working voltage: 200*** | | | | | | |
| **8749†** LISTED **2576** 150V | | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **96257**<br>**96256**<br>**96255** | 15 | .010 | .25 | .040 | 1.02 | .440 | 11.18 |
| | | | | | ***Suggested working voltage: 200*** | | | | | | |
| **9748†** LISTED **2576** 150V | | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **87651**<br>**94982**<br>**94981** | 19 | .010 | .25 | .040 | 1.02 | .505 | 12.83 |
| | | | | | ***Suggested working voltage: 200*** | | | | | | |
| **9749†** LISTED **2576** 150V | | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **87650**<br>**94980**<br>**94979** | 23 | .010 | .25 | .045 | 1.14 | .555 | 14.10 |
| | | | | | ***Suggested working voltage: 200*** | | | | | | |
| **8750†** LISTED **2576** 150V | | 250<br>500<br>1000<br>2000 | 76.2<br>152.4<br>304.8<br>609.6 | **96254**<br>**96253**<br>**96252**<br>**96251** | 27 | .010 | .25 | .045 | 1.14 | .580 | 14.73 |
| | | | | | *Length tolerance: +20%, −0%. Chrome vinyl jacket.*<br>***Suggested working voltage: 200*** | | | | | | |

***†Passes the FR-1 vertical flame test.***

# SOUND & CONTROL CABLES (cont'd)

## 20 GAGE
### STRANDED CONDUCTORS (10 x 30) .94 mm diam.

**PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, twisted pairs, chrome vinyl jacket. For color coding please refer to page 6.*



| Description | Trade & U.L. Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Pairs | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **8205** † UL LISTED **90V Max. Wires, Misc.** | 100 Chrome | 30.5 | **98408** | 1 | .018 | .46 | .025 | .64 | .190 | 4.83 |
| | | U-500 Chrome | U-152.4 | **98411** | | | | | | | |
| | | U-500 Lt. Beige | U-152.4 | **98410** | | | | | | | |
| | | 500 Chrome | 152.4 | **98407** | | | | | | | |
| | | 500 Lt. Beige | 152.4 | **98406** | | | | | | | |
| | | U-1000 Chrome | U-304.8 | **98409** | | | | | | | |
| | | 1000 Chrome | 304.8 | **98404** | | | | | | | |
| | | 1000 Lt. Beige | 304.8 | **98403** | | | | | | | |
| | | | | | | *Color code: Black, Red.* ***Suggested working voltage: 350*** | | | | | |
| | **9750** † UL LISTED **2464 300V** | 100 500 1000 | 30.5 152.4 304.8 | **94978 94977 94976** | 3 | .013 | .33 | .040 | 1.02 | .309 | 7.85 |
| | **9751** † UL LISTED **2464 300V** | 100 500 1000 | 30.5 152.4 304.8 | **94975 94974 94973** | 6 | .013 | .33 | .040 | 1.02 | .376 | 9.55 |
| | **9752** † UL LISTED **2464 300V** | 100 500 1000 | 30.5 152.4 304.8 | **94972 94971 94970** | 9 | .013 | .33 | .040 | 1.02 | .439 | 11.15 |
| | **9755** † UL LISTED **2464 300V** | 100 500 1000 | 30.5 152.4 304.8 | **94964 94963 94962** | 15 | .013 | .33 | .040 | 1.02 | .531 | 13.49 |

## 19 GAGE
### SOLID CONDUCTORS .91 mm diam.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **8486**† | U-500 500 U-1000 1000 | U-152.4 152.4 U-304.8 304.8 | **97823 97821 97822 97820** | 1 | .015 | .38 | .025 | .64 | .162 | 4.11 |

**PRODUCT DESCRIPTION:**
*Bare copper, vinyl insulated, twisted pair, chrome vinyl jacket.*
*Color coding: Brown, Tan.*
***Suggested working voltage: 350***

†***Passes the FR-1 vertical flame test.***

BELDEN | paired, unshielded cable

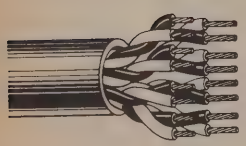
## SOUND & CONTROL CABLES (cont'd)

| Description | Trade & U.L. Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Pairs | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **18 GAGE**<br>**STRANDED CONDUCTORS (7 x 26) 1.22 mm diam.** | | | | | | | | | | | |
| | **8461†**<br>UL LISTED<br>**90V Max. Wires, Misc.** | 100<br>Chrome | 30.5 | **97927** | 1 | .020 | .51 | .028 | .71 | .226 | 5.74 |
| | | U-500<br>Chrome | U-152.4 | **97931** | | | | | | | |
| | | U-500<br>Lt. Beige | U-152.4 | **97930** | | | | | | | |
| | | 500<br>Chrome | 152.4 | **97926** | | | | | | | |
| | | 500<br>Lt. Beige | 152.4 | **97925** | | | | | | | |
| | | U-1000<br>Chrome | U-304.8 | **97929** | | | | | | | |
| | | U-1000<br>Lt. Beige | U-304.8 | **97928** | | | | | | | |
| | | 1000<br>Chrome | 304.8 | **97923** | | | | | | | |
| | | 1000<br>Lt. Beige | 304.8 | **97922** | | | | | | | |

**PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, twisted pair, vinyl jacket. Conductor color coding: Black, White.* ***Suggested working voltage: 450***

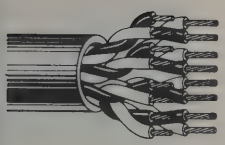
**18 GAGE**
**STRANDED CONDUCTORS (16 x 30) 1.17 mm diam.**

**PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, twisted pair, chrome vinyl jacket. For color coding please refer to page 6.*

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **9740†**<br>UL LISTED<br>**2464**<br>**300V** | U-500<br>500<br>U-1000<br>1000 | U-152.4<br>152.4<br>U-304.8<br>304.8 | **95004**<br>**95002**<br>**95003**<br>**95001** | 1 | .018 | .46 | .032 | .81 | .224 | 5.69 |
| | | | | | *Conductor color coding: Black, Red.* ***Suggested working voltage: 400*** | | | | | | |
|  | **9156**<br>UL LISTED<br>**2464**<br>**300V** | U-500<br>500<br>U-1000<br>1000 | U-152.4<br>152.4<br>U-304.8<br>304.8 | **95789**<br>**95787**<br>**95788**<br>**95786** | 2 | .013 | .33 | .035 | .89 | .287 | 7.29 |
| | **8690†**<br>UL LISTED<br>**2464**<br>**300V** | 100<br>U-500<br>500<br>1000 | 30.5<br>U-152.4<br>152.4<br>304.8 | **96393**<br>**96394**<br>**96392**<br>**96391** | 3 | .018 | .46 | .037 | .94 | .362 | 9.19 |
| | | | | | ***Suggested working voltage: 400*** | | | | | | |
| | **9157**<br>UL LISTED<br>**2464**<br>**300V** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **86846**<br>**95785**<br>**95784** | 4 | .013 | .33 | .040 | 1.02 | .358 | 9.09 |
| | **9159†**<br>UL LISTED<br>**2464**<br>**300V** | 500<br>1000 | 152.4<br>304.8 | **95781**<br>**95780** | 5 | .013 | .33 | .050 | 1.27 | .416 | 10.56 |
| | **8691†**<br>UL LISTED<br>**2464**<br>**300V** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **96390**<br>**96389**<br>**96388** | 6 | .018 | .46 | .045 | 1.14 | .475 | 12.07 |
| | | | | | ***Suggested working voltage: 400*** | | | | | | |
| | **9161†**<br>UL LISTED<br>**2464**<br>**300V** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **86844**<br>**95777**<br>**95776** | 8 | .013 | .33 | .050 | 1.27 | .478 | 12.14 |

†***Passes the FR-1 vertical flame test.***

# SOUND & CONTROL CABLES (cont'd)

| Description | Trade & U.L. Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Pairs | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **18 GAGE** **STRANDED CONDUCTORS (16 x 30) 1.17 mm diam. (cont'd.)** | | | | | | | | | | | |
| **PRODUCT DESCRIPTION:** *tinned copper, vinyl insulated, twisted pair, chrome vinyl jacket.* | | | | | | | | | | | |
|  | **8692**† UL LISTED **2464** 300V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **96387**<br>**96386**<br>**96385** | 9 | .018 | .46 | .055 | 1.40 | .575 | 14.61 |
| | ***Suggested working voltage: 400*** | | | | | | | | | | |
| | **9741**† UL LISTED **2464** 300V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **87655**<br>**95000**<br>**94999** | 12 | .018 | .46 | .055 | 1.40 | .675 | 17.15 |
| | ***Suggested working voltage: 400*** | | | | | | | | | | |
| | **9742**† UL LISTED **2464** 300V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **87654**<br>**94998**<br>**94997** | 15 | .018 | .46 | .060 | 1.52 | .785 | 19.94 |
| | ***Suggested working voltage: 400*** | | | | | | | | | | |
| | **9743**† UL LISTED **2464** 300V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **87653**<br>**94996**<br>**94995** | 19 | .018 | .46 | .070 | 1.78 | .865 | 21.97 |
| | ***Suggested working voltage: 400*** | | | | | | | | | | |
| **16 GAGE** **STRANDED CONDUCTORS (19 x 29) 1.42 mm diam.** | | | | | | | | | | | |
| | **8471**† UL LISTED **2271** 300V | U-500<br>500<br>U-1000<br>1000 | U-152.4<br>152.4<br>U-304.8<br>304.8 | **97881**<br>**97879**<br>**97880**<br>**97878** | 1 | .023 | .58 | .030 | .76 | .256 | 6.50 |
| | **PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, twisted pair, chrome vinyl jacket. Conductor color coding: Black, White.* ***Suggested working voltage: 600*** | | | | | | | | | | |
| **14 GAGE** **STRANDED CONDUCTORS (19 x 27) 1.80 mm diam.** | | | | | | | | | | | |
| | **8473**† | U-500<br>500<br>1000 | U-152.4<br>152.4<br>304.8 | **97875**<br>**97874**<br>**97873** | 1 | .031 | .79 | .035 | .89 | .332 | 8.43 |
| | **PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, twisted pair, chrome vinyl jacket. Conductor color coding: Black, White.* ***Suggested working voltage: 600*** | | | | | | | | | | |
| **12 GAGE** **STRANDED CONDUCTORS (19 x 25) 2.29 mm diam.** | | | | | | | | | | | |
| | **8477**† | U-500<br>500<br>1000 | U-152.4<br>152.4<br>304.8 | **97870**<br>**97869**<br>**97868** | 1 | .031 | .79 | .040 | 1.02 | .384 | 9.75 |
| | **PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, twisted pair, chrome vinyl jacket. Conductor color coding: Black, White.* ***Suggested working voltage: 600*** | | | | | | | | | | |

***†Passes the FR-1 vertical flame test.***

BELDEN | multi-conductor, overall Beldfoil shield cable

**Applications:**
- Sound
- Broadcast
- Audio
- Instrumentation

# Multi-Conductor, Overall Beldfoil Shield cable

## SOUND, BROADCAST AUDIO & INSTRUMENTATION CABLES

### 28 GAGE
**SOLID CONDUCTORS**
**.32 mm diam.**

BELDFOIL
100% Shield Coverage

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond | (Strand-ing) [Diam. in mm] | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Color Coding | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **8640**† | 250<br>U-500<br>500 | 76.2<br>U-152.4<br>152.4 | **96492**<br>**96493**<br>**96491** | 2 | Solid [.32] | .0025 | .064 | .020 | .51 | .090 | 2.29 | Blk.<br>Red | 55 | 180 | 105 | 344 |

**PRODUCT DESCRIPTION:** *solid copper, GEOSOL™ insulated (solderable —no stripping required), twisted pair, BELDFOIL aluminum-polyester shield, 30 AWG solid tinned copper covered steel drain wire, WHITE vinyl jacket. Maximum operating temperature 105°C. 100% shield coverage.*

*Ideal for Instrumentation and Audio Console Work where Subminiaturization is Required. The BELDFOIL shield combines high cable reliability with ease of termination.*

***Suggested working voltage: 100***

### 24 GAGE
**STRANDED CONDUCTORS**
**(7 x 32) .61 mm diam.**

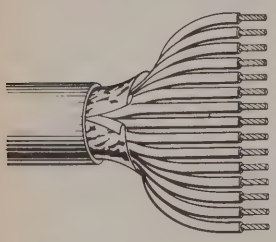
BELDFOIL
100% Shield Coverage

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond | (Strand-ing) [Diam. in mm] | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Color Coding | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **8641•**<br>LISTED<br>**2092**<br>**300V** | 100<br>U-500<br>500<br>U-1000<br>1000<br>2000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8<br>609.6 | **96488**<br>**96490**<br>**96487**<br>**96489**<br>**96486**<br>**96485** | 2 | (7 x 32) [.61] | .015 | .38 | .025 | .64 | .168 | 4.27 | Blk.<br>Clear | 22 | 72 | 42 | 138 |

**PRODUCT DESCRIPTION:** *tinned copper, polyethylene insulated, twisted pair, BELDFOIL aluminum-polyester shield, 24 AWG stranded tinned copper drain wire chrome vinyl jacket. 100% shield coverage.*

*The BELDFOIL shield combines high cable reliability with ease of termination.*

***Suggested working voltage: 350***



BELDFOIL
100% Shield Coverage

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond | (Strand-ing) [Diam. in mm] | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Color Coding | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **★9533**†<br>LISTED<br>**2464**<br>**300V**<br>CSA<br>S-R PVC | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>152.4<br>152.4<br>304.8<br>304.8 | **87786**<br>**87788**<br>**87785**<br>**87787**<br>**87784** | 3 | (7x32) [.61] | .010 | .25 | .035 | .89 | .168 | 4.27 | 1<br>*page 6.* | 30 | 98.4 | | |

**PRODUCT DESCRIPTION:** *tinned copper, PVC insulated, conductors cabled, BELDFOIL aluminum-polyester shield with #24 AWG drain wire, chrome PVC jacket*

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond | (Strand-ing) [Diam. in mm] | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Color Coding | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **★9534**†<br>LISTED<br>**2464**<br>**300V**<br>CSA<br>S-R PVC | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>152.4<br>152.4<br>304.8<br>304.8 | **87781**<br>**87783**<br>**87780**<br>**87782**<br>**87779** | 4 | (7x32) [.61] | .010 | .25 | .035 | .89 | .180 | 4.57 | 1<br>*page 6.* | 30 | 98.4 | | |

**PRODUCT DESCRIPTION:** *tinned copper, PVC insulated, conductors cabled, BELDFOIL aluminum-polyester shield with #24 AWG drain wire, chrome PVC jacket*

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond | (Strand-ing) [Diam. in mm] | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Color Coding | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **★9535**†<br>LISTED<br>**2464**<br>**300V**<br>CSA<br>S-R PVC | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>152.4<br>152.4<br>304.8<br>304.8 | **87776**<br>**87778**<br>**87775**<br>**87777**<br>**87774** | 5 | (7x32) [.61] | .010 | .25 | .035 | .89 | .190 | 4.83 | 1<br>*page 6.* | 30 | 98.4 | | |

**PRODUCT DESCRIPTION:** *tinned copper, PVC insulated, conductors cabled, BELDFOIL aluminum-polyester shield with #24 AWG drain wire, chrome PVC jacket*

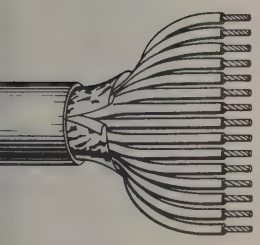
★New Item
*Capacitance between conductors.
**Capacitance between 1 conductor and other conductor connected to shield.
• Belden U.S. Patent 3,032,604. †Passes the FR-1 vertical flame test.

multi-conductor, overall Beldfoil shield cable | BELDEN

# SOUND, BROADCAST AUDIO & INSTRUMENTATION CABLES (cont'd)

## 24 GAGE
### STRANDED CONDUCTORS
### (7 x 32) .61 mm (cont'd.)

**PRODUCT DESCRIPTION:** *tinned copper, PVC insulated, conductors cabled, BELDFOIL aluminum-polyester shield with #24 AWG drain wire, chrome PVC jacket*



**BELDFOIL**
**100% Shield Coverage**

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond | (Strand-ing) [Diam. in mm] | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Color Coding | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ★**9536**† LISTED **2464** 300V S-R PVC | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>152.4<br>152.4<br>304.8<br>304.8 | **87771**<br>**87773**<br>**87770**<br>**87772**<br>**87769** | 6 | (7x32) [.61] | .010 | .25 | .035 | .89 | .205 | 5.21 | 1 *page 6.* | 30 | 98.4 | | |
| | ★**9537**† LISTED **2464** 300V S-R PVC | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>152.4<br>152.4<br>304.8<br>304.8 | **87766**<br>**87768**<br>**87765**<br>**87767**<br>**87764** | 7 | (7x32) [.61] | .010 | .25 | .035 | .89 | .205 | 5.21 | 1 *page 6* | 30 | 98.4 | | |
| | ★**9538**† LISTED **2464** 300V S-R PVC | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>152.4<br>152.4<br>304.8<br>304.8 | **87761**<br>**87763**<br>**87760**<br>**87762**<br>**87759** | 8 | (7x32) [.61] | .010 | .25 | .035 | .89 | .220 | 5.59 | 1 *page 6.* | 30 | 98.4 | | |
| | ★**9539**† LISTED **2464** 300V S-R PVC | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>152.4<br>152.4<br>304.8<br>304.8 | **87756**<br>**87758**<br>**87755**<br>**87757**<br>**87754** | 9 | (7x32) [.61] | .010 | .25 | .035 | .89 | .240 | 6.10 | 1 *page 6* | 30 | 98.4 | | |
| | ★**9540**† LISTED **2464** 300V S-R PVC | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>152.4<br>152.4<br>304.8<br>304.8 | **87751**<br>**87753**<br>**87750**<br>**87752**<br>**87749** | 10 | (7x32) [.61] | .010 | .25 | .035 | .89 | .250 | 6.35 | 1 *page 6.* | 30 | 98.4 | | |
| | ★**9541**† LISTED **2464** 300V S-R PVC | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>152.4<br>152.4<br>304.8<br>304.8 | **87746**<br>**87748**<br>**87745**<br>**87747**<br>**87744** | 15 | (7x32) [.61] | .010 | .25 | .035 | .89 | .280 | 7.11 | 2 *page 6.* | 30 | 98.4 | | |
| | ★**9542**† LISTED **2464** 300V S-R PVC | 100<br>U-500<br>500<br>1000 | 30.5<br>152.4<br>152.4<br>304.8 | **87741**<br>**87743**<br>**87740**<br>**87739** | 20 | (7x32) [.61] | .010 | .25 | .035 | .89 | .310 | 7.87 | 2 *page 6.* | 30 | 98.4 | | |
| | ★**9543**† LISTED **2464** 300V S-R PVC | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **87738**<br>**87737**<br>**87736** | 25 | (7x32) [.61] | .010 | .25 | .040 | 1.02 | .370 | 9.40 | 2 *page 6.* | 30 | 98.4 | | |

★New Item

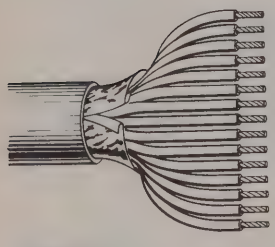
**Capacitance between conductors.*

***Capacitance between 1 conductor and other conductor connected to shield.*

• *Belden U.S. Patent 3,032,604.* †*Passes the FR-1 vertical flame test.*

BELDEN | multi-conductor, overall Beldfoil shield cable

# SOUND, BROADCAST AUDIO & INSTRUMENTATION CABLES (cont'd)

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond | (Stranding) (Diam. in mm) | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Color Coding | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **24 GAGE**<br>**STRANDED CONDUCTORS (cont'd)**<br>**(7 x 32) .61 mm (cont'd.)**<br>**PRODUCT DESCRIPTION:** *tinned copper, PVC insulated, conductors cabled, BELDFOIL aluminum-polyester shield with #24 AWG drain wire, chrome PVC jacket* | | | | | | | | | | | | | | | | | |
|  <br>**BELDFOIL**<br>100% Shield Coverage | **★9544†**<br>UL LISTED<br>**2464**<br>300V<br>CSA<br>S-R PVC | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **87735**<br>**87734**<br>**87733** | 30 | 24<br>(7x32)<br>[.61] | .010 | .25 | .040 | 1.02 | .390 | 9.91 | 2 | 30 | 98.4 | | |
| | **★9545†**<br>UL LISTED<br>**2464**<br>300V<br>CSA<br>S-R PVC | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **87732**<br>**87731**<br>**87730** | 40 | 24<br>(7x32)<br>[.61] | .010 | .25 | .040 | 1.02 | .440 | 11.18 | 2 | 30 | 98.4 | | |
| | **★9546†**<br>UL LISTED<br>**2464**<br>300V<br>CSA<br>S-R PVC | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **87729**<br>**87728**<br>**87727** | 50 | 24<br>(7x32)<br>[.61] | .010 | .25 | .045 | 1.14 | .490 | 12.45 | 2 | 30 | 98.4 | | |
| **24 GAGE**<br>**STRANDED CONDUCTORS (19 x 36) .64 mm diam.** | | | | | | | | | | | | | | | | | |
| <br>**BELDFOIL**<br>100% Shield Coverage | **9452** | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **95340**<br>**95342**<br>**95339**<br>**95341**<br>**95338** | 2 | (19 x 36)<br>[.64] | .008 | .20 | .020 | .51 | .135 | 3.43 | Blk.<br>Red | 30 | 98 | 58 | 190 |
| | **PRODUCT DESCRIPTION:** *tinned copper, polypropylene insulated, twisted pair, noise reducing tape, 24 AWG stranded tinned copper drain wire, BELDFOIL aluminum-polyester shield, BLACK vinyl jacket. 100% shield coverage.*<br>*Balanced pair instrumentation cable featuring short lay cabling to minimize pick-up of electromagnetic interference and special conductive textile tape to minimize microphonic noise.*<br>***Suggested working voltage: 200.*** | | | | | | | | | | | | | | | | |
| **22 GAGE**<br>**SOLID CONDUCTORS (7 x 30) .64 mm diam.** | | | | | | | | | | | | | | | | | |
| <br>**BELDFOIL**<br>100% Shield Coverage | **8450•†** | 100<br>Gray | 30.5 | **97986** | 2 | Solid<br>[.64] | .006 | .15 | .018 | .46 | .118 | 3.00 | Blk.<br>Red | 40 | 131 | 76 | 24 |
| | | 100<br>Black | 30.5 | **97985** | | | | | | | | | | | | | |
| | | 250<br>Gray | 76.2 | **97984** | | | | | | | | | | | | | |
| | | 250<br>Black | 76.2 | **97983** | | | | | | | | | | | | | |
| | | U-500<br>Gray | U-152.4 | **97990** | | | | | | | | | | | | | |
| | | U-500<br>Black | U-152.4 | **97989** | | | | | | | | | | | | | |
| | | 500<br>Gray | 152.4 | **97982** | | | | | | | | | | | | | |
| | | 500<br>Black | 152.4 | **97981** | | | | | | | | | | | | | |
| | | U-1000<br>Gray | U-304.8 | **97988** | | | | | | | | | | | | | |
| | | U-1000<br>Black | U-304.8 | **97987** | | | | | | | | | | | | | |
| | **PRODUCT DESCRIPTION:** *tinned copper, polypropylene insulated, twisted pair, solid tinned copper drain wire, BELDFOIL aluminum-polyester shield, paper wrap, vinyl jacket. 100% shield coverage.*<br>*Belden's Miniature Type Broadcast Audio and Instrumentation Cables occupy ½ to ⅔ less space than standard cables. The BELDFOIL shield combines high cable reliability with ease of termination.*<br>***Suggested working voltage: 200.*** | | | | | | | | | | | | | | | | |

*★New Item *Capacitance between conductors.
**Capacitance between 1 conductor and other conductor connected to shield. • Belden U.S. Patent 3,032,604. †Passes the FR-1 vertical flame test.

multi-conductor, overall Beldfoil shield cable

BELDEN

# SOUND, BROADCAST AUDIO & INSTRUMENTATION CABLES (cont'd)

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond | (Strand-ing) [Diam. in mm] | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Color Coding | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

## 22 GAGE

### STRANDED CONDUCTORS (7 x 30) .76 mm diam. (cont'd.)

**BELDFOIL**
**100% Shield Coverage**

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond | (Strand-ing) [Diam. in mm] | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Color Coding | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **8451•†** | 100 Gray | 30.5 | 97974 | 2 | (7x30) [.76] | .008 | .20 | .020 | .51 | .135 | 3.43 | Blk. Red | 34 | 111 | 67 | 220 |
| | | 100 Black | 30.5 | 97973 | | | | | | | | | | | | | |
| | | 250 Gray | 76.2 | 97972 | | | | | | | | | | | | | |
| | | 250 Black | 76.2 | 97971 | | | | | | | | | | | | | |
| | | U-500 Gray | U-152.4 | 97978 | | | | | | | | | | | | | |
| | | U-500 Black | U-152.4 | 97977 | | | | | | | | | | | | | |
| | | 500 Gray | 152.4 | 97970 | | | | | | | | | | | | | |
| | | 500 Black | 152.4 | 97969 | | | | | | | | | | | | | |
| | | U-1000 Gray | U-304.8 | 97976 | | | | | | | | | | | | | |
| | | U-1000 Black | U-304.8 | 97975 | | | | | | | | | | | | | |
| | | T-1000 Gray | T-304.8 | 97980 | | | | | | | | | | | | | |
| | | T-1000 Black | T-304.8 | 97979 | | | | | | | | | | | | | |

**PRODUCT DESCRIPTION:** *tinned copper, polypropylene insulated, twisted pair, 24 AWG stranded tinned copper drain wire, BELDFOIL aluminum-polyester shield, paper wrap, 100% shield coverage*

*Belden's Miniature Type Broadcast Audio and Instrumentation Cables occupy ½ to ⅔ less space than standard cables. The BELDFOIL shield combines high cable reliability with ease of termination.*

***Suggested working voltage: 200***

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **9451•†** | U-500 | U-152.4 | 95344 | 2 | (7x30) [.76] | .008 | .20 | .020 | .51 | .135 | 3.43 | Blk. Red | 34 | 111 | 67 | 220 |
| | | 500 | 152.4 | 95343 | | | | | | | | | | | | | |
| | | T-1000 | T-304.8 | 95345 | | | | | | | | | | | | | |

**PRODUCT DESCRIPTION:** *The jacket and shield are bonded so both can be removed on automatic stripping equipment*

*Tinned copper, polypropylene insulated, twisted pair, 24 AWG stranded tinned copper drain wire BELDFOIL aluminum-polyester shield, paper wrap, 9451 GRAY vinyl jacket. 100% shield coverage*

*Belden's Miniature Type Broadcast Audio and Instrumentation Cables occupy ½ to ⅔ less space than standard cables. The BELDFOIL shield combines high cable reliability with ease of termination*

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **8761•** | U-500 | U-152.4 | 96218 | 2 | (7x30) [.76] | .016 | .41 | .025 | .64 | .175 | 4.45 | Blk. Clear | 24 | 79 | 47 | 154 |
| | UL LISTED | 500 | 152.4 | 96216 | | | | | | | | | | | | | |
| | | U-1000 | U-304.8 | 96217 | | | | | | | | | | | | | |
| | **2092** | 1000 | 304.8 | 96215 | | | | | | | | | | | | | |
| | **300V** | 2000 | 609.6 | 96214 | | | | | | | | | | | | | |

**PRODUCT DESCRIPTION:** *tinned cooper, polyethylene insulated, twisted pair, BELDFOIL aluminum-polyester shield, 22 AWG stranded tinned copper drain wire, chrome vinyl jacket. 100% shield coverage. Chrome vinyl jacket.*

*The BELDFOIL shield combines high cable reliability with ease of termination*

**Suggested working voltage: 350.**

### STRANDED CONDUCTORS (7 x 30). 76 mm diam.

**BELDFOIL**
**100% Shield Coverage**

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond | (Strand-ing) [Diam. in mm] | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Color Coding | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **9770•†** | 250 | 76.2 | 94951 | 3 | (7x30) [.76] | .008 | .20 | .020 | .51 | .145 | 3.68 | Blk. Red Wht. | 32 | 102 | 60 | 191 |
| | | U-500 | U-152.4 | 94953 | | | | | | | | | | | | | |
| | | 500 | 152.4 | 94950 | | | | | | | | | | | | | |
| | | U-1000 | U-304.8 | 94952 | | | | | | | | | | | | | |
| | | 1000 | 304.8 | 94949 | | | | | | | | | | | | | |

**PRODUCT DESCRIPTION:** *tinned copper, polypropylene insulated, conductors cabled, BELDFOIL aluminum-polyester shield, stranded tinned copper drain wire, brown vinyl jacket. 100% shield coverage. Brown vinyl jacket.*

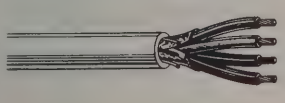
***Suggested working voltage: 200.***

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **8771•** | 250 | 76.2 | 96176 | 3 | (7x30) [.76] | .016 | .41 | .025 | .64 | .183 | 4.65 | Blk. Red Clear | 23 | 75 | 41 | 134 |
| | UL LISTED | U-500 | U-152.4 | 96178 | | | | | | | | | | | | | |
| | | 500 | 152.4 | 96175 | | | | | | | | | | | | | |
| | | U-1000 | U-304.8 | 96177 | | | | | | | | | | | | | |
| | **2093** | 1000 | 304.8 | 96174 | | | | | | | | | | | | | |
| | **300V** | | | | | | | | | | | | | | | | |

**PRODUCT DESCRIPTION:** *tinned copper, polyethylene insulated, conductors cabled, BELDFOIL aluminum-polyester shield, 22 AWG stranded tinned copper drain wire, chrome vinyl jacket, 100% shield coverage. Chrome vinyl jacket.*

***Suggested working voltage: 350.***

### STRANDED CONDUCTORS (19 x 34) .79 mm diam.



**BELDFOIL**
**100% Shield Coverage**

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond | (Strand-ing) [Diam. in mm] | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Color Coding | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **8729•** | U-500 | U-152.8 | 96344 | 4 | (19x34) [.79] | .016 | .41 | .050 | 1.27 | .265 | 6.73 | Red Blk. Grn. Clear | 22 | 72 | 42 | 138 |
| | UL LISTED | 500 | 152.8 | 96332 | | | | | | | | | | | | | |
| | | U-1000 | U-304.8 | 96333 | | | | | | | | | | | | | |
| | | 1000 | 304.8 | 96331 | | | | | | | | | | | | | |
| | **2493** | | | | | | | | | | | | | | | | |
| | **300V** | | | | | | | | | | | | | | | | |

**PRODUCT DESCRIPTION:** *tinned copper, polyethylene insulated, conductors cabled, BELDFOIL aluminum-polyester shield, 3—23 AWG solid tinned copper coated steel and 1—25 AWG stranded tinned copper coated steel drain wires, white vinyl jacket. Belden U.S. Patent 3,673,315 and Belden Canadian Patent 875,187. 100% shield coverage.*

***Suggested working voltage: 600.***

*†Passes the FR-1 vertical flame test.*
*•Belden U.S. Patent 3,032,604.*
**Capacitance between conductors.*
***Capacitance between 1 conductor and other conductors connected to shield.*

BELDEN multi-conductor, overall Beldfoil shield cable

# SOUND, BROADCAST AUDIO & INSTRUMENTATION CABLES (cont'd)

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond | (Strand-ing) [Diam. in mm] | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Color Coding | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **20 GAGE** STRANDED CONDUCTORS (7 x 28) .97 mm diam. | | | | | | | | | | | | | | | | | |
| BELDFOIL 100% Shield Coverage | **8762•** UL LISTED **2092** 300V | 100<br>250<br>U-500<br>500<br>U-1000<br>1000<br>2000 | 30.5<br>76.2<br>U-152.4<br>152.4<br>U-304.8<br>304.8<br>609.6 | 96211<br>96210<br>96213<br>96209<br>96212<br>96208<br>96207 | 2 | (7x28) [.97] | .016 | .41 | .028 | .71 | .204 | 5.18 | Blk. Clear | 27 | 89 | 49 | 161 |
| | **PRODUCT DESCRIPTION:** *tinned copper, polyethylene insulated, twisted pair, BELDFOIL aluminum-polyester shield, 20 AWG stranded tinned copper drain wire, chrome vinyl jacket. 100% shield coverage.* ***Suggested working voltage: 350.*** | | | | | | | | | | | | | | | | |
| | **9154•†** UL LISTED **2464** 300V | U-500<br>500<br>U-1000<br>1000 | U-152.4<br>152.4<br>U-304.8<br>304.8 | 95798<br>95796<br>95797<br>95794 | 2 | (7x28) [.97] | .013 | .33 | .031 | .79 | .198 | 5.03 | Blk. Red | 60 | 197 | 100 | 328 |
| | **PRODUCT DESCRIPTION:** *tinned copper, vinyl insulated, twisted pair, BELDFOIL aluminum-polyester shield, 22 AWG stranded tinned copper drain wire, beige vinyl jacket. 100% shield coverage.* | | | | | | | | | | | | | | | | |
| | **8772•** UL LISTED **2093** 300V | U-500<br>Chrome<br>500<br>Chrome<br>500<br>Lt. Beige<br>U-1000<br>Chrome<br>1000<br>Chrome<br>1000<br>Lt. Beige | U-152.4<br><br>152.4<br><br>152.4<br><br>U-304.8<br><br>304.8<br><br>304.8 | 96173<br><br>96171<br><br>96170<br><br>96172<br><br>96168<br><br>96167 | 3 | (7x28) [.97] | .016 | .41 | .028 | .71 | .208 | 5.28 | Blk. Red Clear | 27 | 89 | 51 | 167 |
| | **PRODUCT DESCRIPTION:** *tinned copper, polyethylene insulated, conductors cabled, BELDFOIL aluminum-polyester shield, 20 AWG stranded tinned copper drain wire, chrome vinyl jacket.* ***Suggested working voltage: 350.*** | | | | | | | | | | | | | | | | |
| **18 GAGE** STRANDED CONDUCTORS (16 x 30) 1.17 mm diam. | | | | | | | | | | | | | | | | | |
| BELDFOIL 100% Shield Coverage | **8760•** UL LISTED **2092** 300V | 250<br>U-500<br>500<br>U-1000<br>1000<br>2000 | 76.2<br>U-152.4<br>152.4<br>U-304.8<br>304.8<br>609.6 | 96222<br>96224<br>96221<br>96223<br>96220<br>96219 | 2 | (16x30) [1.17] | .018 | .46 | .028 | .71 | .222 | 5.64 | Blk. Clear | 27 | 89 | 49 | 161 |
| | **PRODUCT DESCRIPTION:** *tinned copper, polyethylene insulated, twisted pair, BELDFOIL aluminum-polyester shield, 20 AWG stranded copper drain wire, chrome vinyl jacket. 100% shield coverage.* *The BELDFOIL shield combines high cable reliability with ease of termination.* ***Suggested working voltage: 450.*** | | | | | | | | | | | | | | | | |
| | **8770•** UL LISTED **2093** 300V | U-500<br>500<br>U-1000<br>1000 | U-152.4<br>152.4<br>U-304.8<br>304.8 | 96182<br>96180<br>96181<br>96179 | 3 | (16x30) [1.17] | .018 | .46 | .028 | .71 | .236 | 5.99 | Blk. Red Clear | 24 | 79 | 48 | 157 |
| | **PRODUCT DESCRIPTION:** *tinned copper, polyethylene insulated, conductors cabled, BELDFOIL aluminum-polyester shield, 20 AWG stranded tinned copper drain wire, chrome vinyl jacket. 100% shield coverage.* ***Suggested working voltage: 450.*** | | | | | | | | | | | | | | | | |
| | **★9418** UL LISTED **2464** 300V CSA S-R PVC | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.4<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | 87815<br>86291<br>87814<br>86290<br>87813 | 4 | (16x30) [1.17] | .010 | .25 | .035 | .89 | .245 | 6.22 | Blk. Red Clear, Grn. | 60 | 200 | 110 | 360 |
| | **PRODUCT DESCRIPTION:** *tinned copper, vinyl insulated, conductors cabled, BELDFOIL aluminum-polyester shield overall, 20 AWG stranded tinned copper drain wire, chrome vinyl jackets, 100% shield coverage.* | | | | | | | | | | | | | | | | |
| **16 GAGE** STRANDED CONDUCTORS (19 x 29) 1.42 mm diam. | | | | | | | | | | | | | | | | | |
| BELDFOIL 100% Shield Coverage | **8719** UL LISTED **2106** 600V | U-500<br>500<br>U-1000<br>1000<br>2000 | U-152.4<br>152.4<br>U-304.8<br>304.8<br>609.6 | 96373<br>96371<br>96372<br>96370<br>96369 | 2 | (19x29) [1.42] | .032 | .81 | .032 | .81 | .304 | 7.72 | Blk. Clear | 24 | 79 | 47 | 154 |
| | **PRODUCT DESCRIPTION:** *tinned copper, polyethylene insulated, twisted pair, BELDFOIL aluminum-polyester shield, 18 AWG stranded tinned copper drain wire, chrome vinyl jacket. 100% shield coverage.* *The BELDFOIL shield combines high cable reliability with ease of termination.* | | | | | | | | | | | | | | | | |
| | **8618•** UL LISTED **2107** 600V | U-500<br>500<br>1000 | U-152.4<br>152.4<br>304.8 | 96522<br>96521<br>96520 | 3 | (19x29) [1.42] | .032 | .81 | .031 | .79 | .318 | 8.08 | Blk. Red Clear | 26 | 85 | 60 | 164 |
| | **PRODUCT DESCRIPTION:** *Polyethylene insulated, conductors cabled, BELDFOIL aluminum-polyester shield, 18 AWG stranded tinned copper drain wire, chrome vinyl jacket. 100% shield coverage.* | | | | | | | | | | | | | | | | |

★New Item

*Capacitance between conductors

**Capacitance between 1 conductor and other conductor connected to shield.

•Belden U.S. Patent 3,032,604

†Passes the FR-1 vertical flame test

paired, overall Beldfoil shield cable

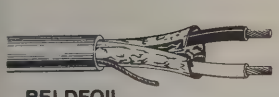
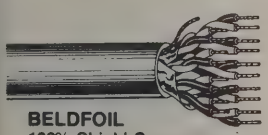
BELDEN

**Applications:**
- Instrumentation
- Computer
- Point of sale

# Paired, Overall Beldfoil Shielded Cable

| Description | Trade & U.L.Style Number | Standard Length ft. | Standard Length m | U.P.C. No. | No. of Pairs | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **28 GAGE** SOLID CONDUCTORS .32 mm diam. | | | | | | | | | | | | | | | |
| BELDFOIL 100% Shield Coverage | **8640**† | 250<br>U-500<br>500 | 76.2<br>U-152.4<br>152.4 | **96492**<br>**96493**<br>**96491** | 1 | .0025 | .064 | .020 | .51 | .090 | 2.29 | 55 | 180 | 105 | 344 |
| **24 GAGE** STRANDED CONDUCTORS (19 x 36) .64 mm diam. | | | | | | | | | | | | | | | |
| BELDFOIL 100% Shield Coverage | **9452** | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **95340**<br>**95342**<br>**95339**<br>**95341**<br>**95338** | 1 | .008 | .020 | .20 | .51 | .135 | 3.43 | 30 | 98 | 58 | 190 |

## INSTRUMENTATION, COMPUTER & P.O.S. CABLES

| Description | Trade & U.L.Style Number | Standard Length ft. | Standard Length m | U.P.C. No. | No. of Pairs | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **24 GAGE** STRANDED CONDUCTORS (7 x 32) .61 mm diam. | | | | | | | | | | | | | | | |
|  BELDFOIL 100% Shield Coverage | **8641**• UL LISTED **2092** 300V | 100<br>U-500<br>500<br>U-1000<br>1000<br>2000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8<br>609.6 | **96488**<br>**96490**<br>**96487**<br>**96489**<br>**96486**<br>**96485** | 1 | .016 | .38 | .025 | .64 | .168 | 4.27 | 22 | 72 | 42 | 138 |
|  BELDFOIL 100% Shield Coverage | **9501** UL LISTED **2464** 300V CSA S-R PVC | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **95291**<br>**95293**<br>**95290**<br>**95292**<br>**95289** | 1 | .010 | .25 | .032 | .81 | .156 | 3.96 | 41 | 135 | 75 | 246 |
| | **9502** UL LISTED **2464** 300V CSA S-R PVC | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **95286**<br>**95288**<br>**95285**<br>**95287**<br>**95284** | 2 | .010 | .25 | .032 | .81 | .222 | 5.64 | 30 | 98 | 52 | 170 |

**PRODUCT DESCRIPTION:**

*Solid copper, GEOSOL™ insulated (solderable–no stripping required), twisted pair, BELDFOIL aluminum-polyester shield, 30 AWG solid tinned copper covered steel drain wire, white vinyl jacket. Maximum operating temperature 105°C. Ideal for Instrumentation and Audio Console Work where Subminiaturization is Required. The BELDFOIL shield combines high cable reliability with ease of termination. Color code: Black, Red.* ***Suggested working voltage: 100***

**PRODUCT DESCRIPTION:**

*Tinned copper, polypropylene insulated, twisted pair, noise reducing tape, 24 AWG stranded tinned copper drain wire, BELDFOIL aluminum-polyester shield, black vinyl jacket. Balanced pair instrumentation cable featuring short lay cabling to minimize pick-up of electromagnetic interference and special conductive textile tape to minimize microphonic noise. Color code: Black, Red.* ***Suggested working voltage: 200***

**PRODUCT DESCRIPTION:**

*Tinned copper, polyethylene insulated, twisted pair, BELDFOIL aluminum-polyester shield, stranded tinned copper drain wire, chrome vinyl jacket. The BELDFOIL shield combines high cable reliability with ease of termination. Color code: Black, Clear.* ***Suggested working voltage: 350***

**PRODUCT DESCRIPTION:**

*Tinned copper, vinyl insulated, twisted pairs, overall BELDFOIL aluminum-polyester shield, stranded tinned copper drain wire, chrome vinyl jacket. For color coding, please refer to page 6.*

**PRODUCT DESCRIPTION:**

*Tinned copper, vinyl insulated, twisted pairs, overall BELDFOIL aluminum-polyester shield, stranded tinned copper drain wire, chrome vinyl jacket. For color coding, please refer to page 6.*

*Capacitance between conductors.
**Capacitance between 1 conductor and other conductor connected to shield.

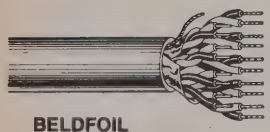
•Belden U.S. Patent 3,032,604.
†***Passes the FR-1 vertical flame test.***

BELDEN | paired, overall Beldfoil shield cable

# INSTRUMENTATION, COMPUTER & P.O.S. CABLES (cont'd)

**PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, twisted pairs, overall BELDFOIL aluminum-polyester shield, stranded tinned copper drain wire, chrome vinyl jacket. For color coding, please refer to page 6.*

## 24 GAGE
### STRANDED CONDUCTORS (7 x 32) .61 mm diam. (cont'd.)



**BELDFOIL**
100% Shield Coverage

| Description | Trade & U.L.Style Number | Standard Length ft. | Standard Length m | U.P.C. No. | No. of Pairs | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **9503**† UL LISTED **2464** 300V CSA S-R PVC | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **95281**<br>**95283**<br>**95280**<br>**95282**<br>**95279** | 3 | .010 | .25 | .032 | .81 | .232 | 5.64 | 30 | 98 | 52 | 170 |
| | **9504**† UL LISTED **2464** 300V CSA S-R PVC | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **95276**<br>**95278**<br>**95275**<br>**95277**<br>**95274** | 4 | .010 | .25 | .032 | .81 | .265 | 6.73 | 30 | 98 | 50 | 164 |
| | **9505**† UL LISTED **2464** 300V CSA S-R PVC | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **95271**<br>**95273**<br>**95270**<br>**95272**<br>**95269** | 5 | .010 | .25 | .035 | .89 | .295 | 7.49 | 30 | 98 | 48 | 157 |
| | **9506**† UL LISTED **2464** 300V CSA S-R PVC | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **95268**<br>**86283**<br>**95267**<br>**86282**<br>**95266** | 6 | .010 | .25 | .035 | .89 | .295 | 7.49 | 30 | 98 | — | — |
| | **9507**† UL LISTED **2464** 300V CSA S-R PVC | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **95265**<br>**86281**<br>**95264**<br>**86280**<br>**95263** | 7 | .010 | .25 | .035 | .89 | .300 | 7.62 | 30 | 98 | — | — |
| | **9508**† UL LISTED **2464** 300V CSA S-R PVC | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **95262**<br>**95261**<br>**95260** | 8 | .010 | .25 | .035 | .89 | .330 | 8.38 | 30 | 98 | — | — |
| | **9509**† UL LISTED **2464** 300V CSA S-R PVC | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **95259**<br>**95258**<br>**95257** | 9 | .010 | .25 | .035 | .89 | .340 | 8.64 | 30 | 98 | — | — |

*Capacitance between conductors.
**Capacitance between 1 conductor and other conductor connected to shield. †***Passes the FR-1 vertical flame test.*

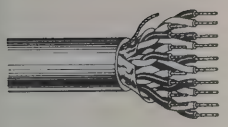
multi-paired, overall Beldfoil shield cable

BELDEN

# INSTRUMENTATION, COMPUTER & P.O.S. CABLE (cont'd)

## 24 GAGE
### STRANDED CONDUCTORS (7 x 32) .61 mm diam. (cont'd.)

**PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, twisted pairs, overall BELDFOIL aluminum-polyester shield, stranded tinned copper drain wire, chrome vinyl jacket. For color coding, please refer to page 6.*

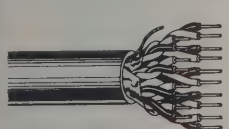


**BELDFOIL**
**100% Shield Coverage**

| Description | Trade & U.L.Style Number | Standard Length ft. | Standard Length m | U.P.C. No. | No. of Pairs | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **9510**† UL LISTED **2464** 300V CSA S-R PVC | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **95256**<br>**95255**<br>**95254** | 10 | .010 | .25 | .040 | 1.02 | .380 | 9.65 | 30 | 98 | — | — |
| | **9515**† UL LISTED **2464** 300V CSA S-R PVC | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **95253**<br>**95252**<br>**95251** | 15 | .010 | .25 | .040 | 1.02 | .425 | 10.80 | 30 | 98 | — | — |
| | **★9519**† UL LISTED **2464** 300V CSA S-R PVC | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **86279**<br>**86278**<br>**86277** | 19 | .010 | .25 | .040 | 1.02 | .450 | 11.43 | 30 | 98 | — | — |
| | **9525**† UL LISTED **2464** 300V CSA S-R PVC | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **95250**<br>**95249**<br>**95248** | 25 | .010 | .25 | .045 | 1.14 | 5.15 | 13.08 | 30 | 98 | — | — |
| | **9550**† UL LISTED **2464** 300V CSA S-R PVC | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **95245**<br>**95244**<br>**95243** | 50 | .010 | .25 | .050 | 1.27 | .700 | 17.78 | 30 | 98 | — | — |

## 22 GAGE
### SOLID CONDUCTORS .64 mm diam.

**PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, twisted pairs, overall BELDFOIL aluminum-polyester shield, stranded tinned copper drain wire, chrome vinyl jacket. For color coding, please refer to page 6.*



**BELDFOIL**
**100% Shield Coverage**

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **9302**† UL LISTED **2464** 300V | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **95501**<br>**86303**<br>**95500**<br>**86302**<br>**95499** | 2 | .013 | .33 | .032 | .81 | .224 | 5.69 | 35 | 115 | — | — |
| | **9305**† UL LISTED **2464** 300V | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **95494**<br>**86301**<br>**95493**<br>**86300**<br>**95492** | 4 | .013 | .33 | .032 | .81 | .265 | 6.73 | 35 | 115 | — | — |

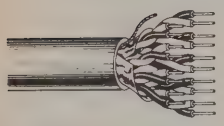
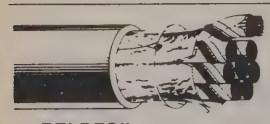
★ New Item

*Capacitance between conductors.
**Capacitance between 1 conductor and other conductor connected to shield.

†Passes the FR-1 vertical flame test.

BELDEN | multi-paired, overall Beldfoil shield cable

# INSTRUMENTATION, COMPUTER & P.O.S. CABLE (cont'd)

| Description | Trade & U.L.Style Number | Standard Length ft. | Standard Length m | U.P.C. No. | No. of Pairs | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **22 GAGE**<br>**SOLID CONDUCTORS .64 mm diam. (cont'd.)**<br>**PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, twisted pairs, overall BELDFOIL aluminum-polyester shield, stranded tinned copper drain wire, chrome vinyl jacket. For color coding, please refer to page 6.* | | | | | | | | | | | | | | | |
|  <br>**BELDFOIL**<br>100% Shield Coverage | **9306**†<br>UL LISTED<br>**2464**<br>300V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **95491**<br>**95490**<br>**95489** | 6 | .013 | .33 | .035 | .89 | .321 | 8.15 | 35 | 115 | — | — |
| | **9309**†<br>UL LISTED<br>**2464**<br>300V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **95488**<br>**95487**<br>**95486** | 9 | .013 | .33 | .037 | .94 | .373 | 9.47 | 35 | 115 | — | — |
| | **9315**†<br>UL LISTED<br>**2464**<br>300V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **95479**<br>**95478**<br>**95477** | 15 | .013 | .33 | .040 | 1.02 | .437 | 11.10 | 35 | 115 | — | — |
| | **9319**†<br>UL LISTED<br>**2464**<br>300V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **95476**<br>**95475**<br>**95474** | 19 | .013 | .33 | .040 | 1.02 | .475 | 12.07 | 35 | 115 | — | — |
| | **9327**†<br>UL LISTED<br>**2464**<br>300V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **95473**<br>**95472**<br>**95471** | 27 | .013 | .33 | .045 | 1.14 | .571 | 14.50 | 35 | 115 | — | — |
| <br>**BELDFOIL**<br>100% Shield Coverage | **8752**•† | 250<br>500<br>1000 | 76.2<br>152.4<br>304.8 | **96246**<br>**95245**<br>**96244** | 38 | .008 | .20 | .045 | 1.14 | .585 | 14.86 | — | — | — | — |
| **PRODUCT DESCRIPTION:** *Tinned copper, polypropylene insulated, twisted pairs, BELDFOIL aluminum-polyester shield overall, 22 AWG (7 x 30) stranded drain wire, chrome vinyl jacket. For color coding information write for Technical Data Bulletin T/8-4. All lengths + 20% – 0 length tolerance.* ***Suggested working voltage: 200*** | | | | | | | | | | | | | | | |
| **BELDFOIL**<br>100% Shield Coverage | **8751**•† | 250<br>500<br>1000<br>1500 | 76.2<br>152.4<br>304.8<br>457.2 | **96250**<br>**96249**<br>**96248**<br>**96247** | 51 | .010 | .25 | .050 | 1.27 | .685 | 17.40 | — | — | — | — |
| **PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, twisted pairs, BELDFOIL aluminum-poylester shield overall, 22 AWG (7 x 30) stranded drain wire, chrome vinyl jacket. For color coding information write for Techinal Data Bulletin T/8-4. All lengths + 20% – 0 length tolerance.* ***Suggested working voltage: 200*** | | | | | | | | | | | | | | | |
|  <br>**BELDFOIL**<br>100% Shield Coverage | **9753**† | 250<br>500<br>1000<br>1500 | 76.2<br>152.4<br>304.8<br>457.2 | **94969**<br>**94968**<br>**94967**<br>**94966** | 102 | .010 | .25 | .085 | 2.16 | 1.085 | 27.56 | — | — | — | — |
| **PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, twisted pairs, BELDFOIL aluminum-polyester shield overall, 22 AWG (7 x 30) stranded drain wire, chrome vinyl jacket. For color coding information write for Technical Data Bulletin T/8-22. All lengths + 20% – 0 length tolerance.* ***Suggested working voltage: 200*** | | | | | | | | | | | | | | | |
| **22 GAGE**<br>**STRANDED CONDUCTORS (7 x 30) .76 mm diam.** | | | | | | | | | | | | | | | |
| <br>**BELDFOIL**<br>100% Shield Coverage | **9462**†<br>UL LISTED<br>**2464**<br>300V | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **95324**<br>**95326**<br>**95323**<br>**95325**<br>**95322** | 1 | .013 | .33 | .031 | .79 | .178 | 4.52 | 50 | 164 | 90 | 295 |
| **PRODUCT DESCRIPTION** *Tinned copper, vinyl insulated, twisted pair, BELDFOIL aluminum-polyester shield, stranded tinned copper drain wire, chrome vinyl jacket. Color code: Black, Red.* ***Suggested working voltage: 300*** | | | | | | | | | | | | | | | |

*Capacitance between conductors.
**Capacitance between 1 conductor and other conductors connected to shield.
•Belden U.S. Patent 3,032,604.
†***Passes the FR-1 vertical flame test.***

individually shielded pair cables

BELDEN

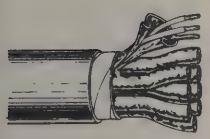
**Applications:**
- Audio systems
- Process control systems

# Individually Shielded Pair Cables

## SHIELDED AUDIO AND CONTROL CABLES

### 22 GAGE
### SOLID CONDUCTORS .64 mm diam.

**PRODUCT DESCRIPTION:** *22 AWG tinned copper, vinyl insulated, twisted pairs, each pair and its drain wire under BELDFOIL aluminum-polyester shield, overall chrome vinyl jacket. Color code chart on page 00. Insulation resistance between shields. 100 megohms/M nom. Capacitance between adjacent shields. 1500 pF/ft. nom. Voltage breakdown between adjacent shields. 115 volts nom. Working voltage between adjacent shields. 50 volts max. Vinyl insulation is used for ease of stripping and soldering. Recommended for audio frequency applications requiring excellent circuit isolation.* ***Suggested working voltage: 300*** *Color code: page 6.*



**BELDFOIL**
100% Shield Coverage

| Description | Trade & U.L.Style Number | Standard Length ft. | Standard Length m | U.P.C. No. | No. of Pairs | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **8767•†** UL LISTED **2464** 300V | 100<br>U-500<br>500<br>1000 | 30.5<br>U-152.4<br>152.4<br>304.8 | **96193**<br>**86347**<br>**96191**<br>**96190** | 3 | .013 | .33 | .037 | .94 | .279 | 7.09 | 40 | 131 | 77 | 252 |
| | **8768•†** UL LISTED **2464** 300V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **96189**<br>**96188**<br>**96187** | 6 | .013 | .33 | .037 | .94 | .379 | 9.63 | 40 | 131 | 77 | 252 |
| | **8764•†** UL LISTED **2464** 300V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **96202**<br>**96201**<br>**96200** | 9 | .013 | .33 | .040 | 1.02 | .425 | 10.80 | 40 | 131 | 77 | 252 |
| | **8765•†** UL LISTED **2464** 300V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **96199**<br>**96198**<br>**96197** | 11 | .013 | .33 | .040 | 1.02 | .470 | 11.94 | 40 | 131 | 77 | 252 |
| | **8766•†** UL LISTED **2464** 300V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **96196**<br>**96195**<br>**96194** | 15 | .013 | .33 | .045 | 1.14 | .525 | 13.34 | 40 | 131 | 77 | 252 |

## SHIELDED AUDIO AND DATA CABLES

### 22 GAGE
### STRANDED CONDUCTORS (7 x 30) .076 mm diam.

**BELDFOIL**
100% Shield Coverage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **8723•** | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **96354**<br>**96356**<br>**96353**<br>**96355**<br>**96352** | 2 | .008 | .20 | .019 | .48 | .165 | 4.19 | 35 | 115 | 62 | 203 |

**PRODUCT DESCRIPTION:**
*Tinned copper, polypropylene insulated, black and red under a BELDFOIL aluminum-polyester shield, green and white under a BELDFOIL aluminum-polyester shield, 24 AWG stranded tinned copper common drain wire, chrome vinyl jacket, pairs cabled on common axis to reduce diameter.*
*Color code: Red, Black, Green, White.* ***Suggested working voltage: 400***

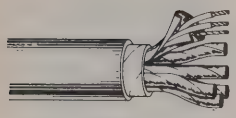
*Capacitance between conductors.
**Capacitance between 1 conductor and other conductors connected to shield.

***†Passes the FR-1 vertical flame test.***
•Belden U.S. Patent 3,032,604

BELDEN | individually shielded pair cables

# SHIELDED AUDIO AND DATA CABLES (cont'd)

| Description | Trade & U.L. Style Number | Standard Length ft. | Standard Length m | U.P.C. No. | No. of Pairs | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **22 GAGE STRANDED CONDUCTORS (7 x 30) .76 mm diam. (cont'd)** | | | | | | | | | | | | | | | |
| | **8777•†** UL LISTED **2493** | 100<br>U-250<br>250<br>U-500<br>500<br>1000 | 30.5<br>U-76.2<br>76.2<br>U-152.4<br>152.4<br>304.8 | **96149**<br>**86346**<br>**96148**<br>**86345**<br>**96147**<br>**96146** | 3 | .010 | .25 | .048 | 1.22 | .301 | 7.65 | 30 | 98 | 55 | 180 |
| | **8778•†** UL LISTED **2493** | 100<br>250<br>500<br>1000 | 30.5<br>76.2<br>152.4<br>304.8 | **96145**<br>**96144**<br>**96143**<br>**96142** | 6 | .010 | .25 | .048 | 1.22 | .416 | 10.57 | 30 | 98 | 55 | 180 |
| | **8774•†** UL LISTED **2493** | 100<br>250<br>500<br>1000 | 30.5<br>76.2<br>152.4<br>304.8 | **96161**<br>**96160**<br>**96159**<br>**96158** | 9 | .010 | .25 | .048 | 1.22 | .443 | 11.26 | 30 | 98 | 55 | 180 |
| | **8775•†** UL LISTED **2493** | 100<br>250<br>500<br>1000 | 30.5<br>76.2<br>152.4<br>304.8 | **96157**<br>**96156**<br>**96155**<br>**96154** | 11 | .010 | .25 | .048 | 1.22 | .486 | 12.34 | 30 | 98 | 55 | 180 |
| | **9768•†** UL LISTED **2493** | 100<br>250<br>500<br>1000 | 30.5<br>76.2<br>152.4<br>304.8 | **94961**<br>**94960**<br>**94959**<br>**94958** | 12 | .010 | .25 | .048 | 1.22 | .486 | 12.34 | 30 | 98 | 55 | 180 |
| | **8776•†** UL LISTED **2493** | 100<br>250<br>500<br>1000 | 30.5<br>76.2<br>152.4<br>304.8 | **96153**<br>**96152**<br>**96151**<br>**96150** | 15 | .010 | .25 | .065 | 1.65 | .565 | 14.35 | 30 | 98 | 55 | 180 |
| | **9769•†** UL LISTED **2493** | 100<br>250<br>500<br>1000 | 30.5<br>76.2<br>152.4<br>304.8 | **94957**<br>**94956**<br>**94955**<br>**94954** | 17 | .010 | .25 | .065 | 1.65 | .615 | 15.62 | 30 | 98 | 55 | 180 |
| | **8769•†** UL LISTED **2493** | 100<br>250<br>500<br>1000 | 30.5<br>76.2<br>152.4<br>304.8 | **96186**<br>**96185**<br>**96184**<br>**96183** | 19 | .010 | .25 | .065 | 1.65 | .625 | 15.88 | 30 | 98 | 55 | 180 |
| | **8773•†** UL LISTED **2493** | 100<br>250<br>500<br>1000 | 30.5<br>76.2<br>152.4<br>304.8 | **96165**<br>**96164**<br>**96163**<br>**96162** | 27 | .010 | .25 | .070 | 1.78 | .745 | 18.92 | 30 | 98 | 55 | 180 |



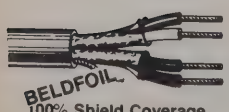
**BELDFOIL**
**100% Shield Coverage**

**PRODUCT DESCRIPTION:** *Tinned copper, polypropylene insulated, twisted pairs, each pair and its stranded tinned copper drain wire (22 AWG on 22 AWG and 20 AWG series, 20 AWG on 18 AWG series) under BELDFOIL aluminum-polyester shield, overall chrome vinyl jacket. Color code chart on page 6.*

*250, 500 & 1000 ft. lengths + 20% – 0 length tolerance.*

**20 GAGE STRANDED CONDUCTORS (10 x 30) .94 mm diam.**

**PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, twisted pairs, each pair BELDFOIL aluminum-polyester shielded, #22 AWG stranded tinned copper drain wire, chrome vinyl jacket. Color code: 1 pair Red, Black, 1 pair Green, White.*

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  **BELDFOIL 100% Shield Coverage** | **★9402†** UL LISTED CSA **2464** **300V** | U-500<br>U-1000 | U-152.4<br>U-304.8 | **87820**<br>**87819** | 2 | .010 | .25 | .035 | .89 | .300 | 7.62 | 55 | 180 | 95 | 312 |

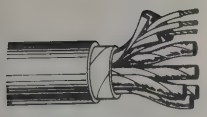
★New Item *Capacitance between conductors.
**Capacitance between 1 conductor and other conductor connected to shield.
†***Passes the FR-1 vertical flame test.***
•Belden U.S. Patent 3,032,604.

# SHIELDED AUDIO AND DATA CABLES (cont'd)

| Description | Trade & U.L.Style Number | Standard Length ft. | Standard Length m | U.P.C. No. | No. of Pairs | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

## 20 GAGE
### STRANDED CONDUCTORS (10 x 30) .94 mm diam. (cont'd.)

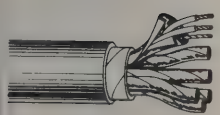
**PRODUCT DESCRIPTION:**
*Tinned copper, polypropylene insulated, twisted pairs, each pair and its stranded tinned copper drain wire (22 AWG on 22 AWG and 20 AWG series, 20 AWG on 18 AWG series) under BELDFOIL aluminum-polyester shield, overall chrome vinyl jacket. Color code chart on page 6. Insulation resistance between shields. 100 megohms/M nom. Capacitance between adjacent shields. 115 pF/ft. nom. Voltage breakdown between adjacent shields. 1500 volts nom. Working voltage between adjacent shields. 50 volts max. U.L. voltage rating not specified.* ***Suggested working voltage: 300V for 22 AWG: 350V for 20 AWG: 400V for 18 AWG*** *Recommended for audio, pulse and radio frequency applications requiring superior ciruit isolation. Polypropylene insulation is used for excellent high frequency properties and mechanical toughness.*



**BELDFOIL**
**100% Shield Coverage**

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **9873•†** UL LISTED **2493** | 100<br>250<br>500<br>1000 | 30.5<br>76.2<br>152.4<br>304.8 | **94818**<br>**94817**<br>**94816**<br>**94815** | 3 | .013 | .33 | .048 | 1.22 | .356 | 9.04 | 30 | 98 | 55 | 180 |
| **9874•†** UL LISTED **2493** | 100<br>250<br>500<br>1000 | 30.5<br>76.2<br>152.4<br>304.8 | **94814**<br>**94813**<br>**94812**<br>**94811** | 6 | .013 | .33 | .048 | 1.22 | .471 | 11.96 | 30 | 98 | 55 | 180 |
| **9875•†** UL LISTED **2493** | 100<br>250<br>500<br>1000 | 30.5<br>76.2<br>152.4<br>304.8 | **94810**<br>**94809**<br>**94808**<br>**94807** | 9 | .013 | .33 | .065 | 1.65 | .555 | 14.10 | 30 | 98 | 55 | 180 |
| **9876•†** UL LISTED **2493** | 100<br>250<br>500<br>1000 | 30.5<br>76.2<br>152.4<br>304.8 | **94806**<br>**94805**<br>**94804**<br>**94803** | 11 | .013 | .33 | .065 | 1.65 | .580 | 14.73 | 30 | 98 | 55 | 180 |
| **9877•†** UL LISTED **2493** | 100<br>250<br>500<br>1000 | 30.5<br>76.2<br>152.4<br>304.8 | **94802**<br>**94801**<br>**94800**<br>**94799** | 12 | .013 | .33 | .065 | 1.65 | .600 | 15.24 | 30 | 98 | 55 | 180 |
| **9879•†** UL LISTED **2493** | 100<br>250<br>500<br>1000 | 30.5<br>76.2<br>152.4<br>304.8 | **94794**<br>**94793**<br>**94792**<br>**94791** | 15 | .013 | .33 | .065 | 1.65 | .655 | 16.64 | 30 | 98 | 55 | 180 |

## 18 GAGE
### STRANDED CONDUCTORS (16 x 30) 1.19 mm diam.



**BELDFOIL**
**100% Shield Coverage**

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **9773•†** UL LISTED **2483** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **94946**<br>**94945**<br>**94944** | 3 | .016 | .41 | .048 | 1.22 | .392 | 9.96 | 30 | 98 | 55 | 180 |
| **9774•†** UL LISTED **2493** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **94943**<br>**94942**<br>**94941** | 6 | .016 | .41 | .065 | 1.65 | .570 | 14.48 | 30 | 98 | 55 | 180 |
| **9775•†** UL LISTED **2493** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **94940**<br>**94939**<br>**94938** | 9 | .016 | .41 | .065 | 1.65 | .625 | 15.88 | 30 | 98 | 55 | 180 |
| **9776•†** UL LISTED **2493** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **94937**<br>**94936**<br>**94935** | 12 | .016 | .41 | .070 | 1.78 | .750 | 19.05 | 30 | 98 | 55 | 180 |
| **9777•†** UL LISTED **2493** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **94934**<br>**94933**<br>**94932** | 15 | .016 | .41 | .070 | 1.78 | .820 | 20.83 | 30 | 98 | 55 | 180 |

***†Passes the FR-1 vertical flame test.***
*•Belden U.S. Patent 3,032,604.*

**Capacitance between conductors.*
***Capacitance between 1 conductor and other conductor connected to shield.*

BELDEN | telephone cables

# Telephone Cables

| Description | Trade & U.L. Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Pairs | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|

## 24 GAGE
### SOLID CONDUCTORS .51 mm diam.

**PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, conductors cabled, silver gray vinyl jacket.*

**COLOR CODE CHART for paired telephone cables**

| Pair | Color |
|---|---|
| 1st | White/Blue |
| 2nd | White/Orange |
| 3rd | White/Green |
| 4th | White/Brown |
| 5th | White/Slate |
| 6th | Red/Blue |
| 7th | Red/Orange |
| 8th | Red/Green |
| 9th | Red/Brown |
| 10th | Red/Slate |
| 11th | Black/Blue |
| 12th | Black/Orange |
| 13th | Black/Green |
| 14th | Black/Brown |
| 15th | Black/Slate |
| 16th | Yellow/Blue |
| 17th | Yellow/Orange |
| 18th | Yellow/Green |
| 19th | Yellow/Brown |
| 20th | Yellow/Slate |
| 21st | Violet/Blue |
| 22nd | Violet/Orange |
| 23rd | Violet/Green |
| 24th | Violet/Brown |
| 25th | Violet/Slate |

| Description | Trade & U.L. Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Pairs | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **9561** UL LISTED **2576** 150V | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **95242**<br>**86276**<br>**95241**<br>**86275**<br>**95240** | 1 | .010 | .25 | .032 | .81 | .154 | 3.91 |
| | **9562** UL LISTED **2576** 150V | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **95239**<br>**85992**<br>**95238**<br>**85991**<br>**95237** | 2 | .010 | .25 | .032 | .81 | .199 | 5.05 |
| | **9566** UL LISTED **2576** 150V | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **95236**<br>**85990**<br>**95235**<br>**85989**<br>**95234** | 6 | .010 | .25 | .032 | .81 | .289 | 7.34 |
| | **9568** UL LISTED **2576** 150V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **95233**<br>**95232**<br>**95231** | 8 | .010 | .25 | .035 | .89 | .300 | 7.62 |
| | **9570** UL LISTED **2576** 150V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **95230**<br>**95229**<br>**95228** | 10 | .010 | .25 | .035 | .89 | .350 | 8.89 |
| | **9585** UL LISTED **2576** 150V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **95227**<br>**95226**<br>**95225** | 25 | .010 | .25 | .040 | 1.02 | .480 | 12.19 |

| Description | Trade & U.L. Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond. | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|

## 22 GAGE
### SOLID CONDUCTORS .64 mm diam.

**PRODUCT DESCRIPTION:** *Bare copper, polyethylene insulated, conductors cabled, rose gray vinyl jacket.*

**COLOR CODE CHART for unpaired telephone cables**

| Conductor | Color |
|---|---|
| 1st | Red |
| 2nd | Green |
| 3rd | Yellow |
| 4th | Black |

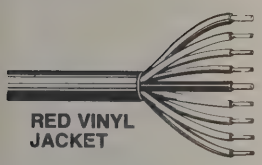
| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **8795** UL LISTED **Wires, Misc.** **90V Max.** | U-500<br>U-1000<br>1000 | U-152.4<br>U-304.8<br>304.8 | **96074**<br>**96073**<br>**96072** | 2 | .016 | .41 | .022 | .56 | .160 | 4.06 |
| | **8794** UL LISTED **Wires, Misc.** **90V Max.** | U-500<br>U-1000<br>1000 | U-152.4<br>U-304.8<br>304.8 | **96078**<br>**96077**<br>**96076** | 3 | .016 | .41 | .022 | .56 | .168 | 4.27 |
| | **9794** UL LISTED **Wires, Misc.** **90V Max.** | P-100<br>U-500<br>U-1000<br>1000 | P-30.5<br>U-152.4<br>U-304.8<br>304.8 | **94929**<br>**94927**<br>**94926**<br>**94925** | 4 | .016 | .41 | .025 | .64 | .190 | 4.83 |

SUBJECT 13 fire alarm and trav cables BELDEN

# Fire Alarm & Tray Cables

## POWER LIMITED 105°C-300°C
## FIRE PROTECTIVE SIGNALING CIRCUIT CABLE

Power limited fire protective signaling circuit cable for use in accordance with NEC article 760 power limited circuits and also suitable for use as a power limited circuit cable for use in accordance with NEC article 725 class 2 or 3 circuits, but these cables are marked as suitable for appropriate tray cable installations. All cables in this section pass the UL 70,000 BTU flame and tray cable test which is comparable to IEEE 383 flame test. All cables in this section are listed by the California State Fire Marshall listing service.

| Description | Trade & U.L. Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond. | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **22 GAGE** SOLID TINNED COPPER CONDUCTORS .91 mm diam. | | | | | | | | | | | |
|  RED VINYL JACKET | ★9576†○ UL LISTED E64959 1464 | U-500 U-1000 | U-152.4 U-304.8 | 87718 87717 | 6 | .013 | .33 | .039 | .99 | .234 | 5.94 |
| | ★9577†○ UL LISTED E64959 2464 | U-500 U-1000 | U-152.4 U-304.8 | 87716 87715 | 9 | .013 | .33 | .039 | .99 | .267 | 6.78 |
| | ★9584†○ UL LISTED E64959 2464 | 500 1000 | 152.4 304.8 | 87702 87701 | 12 | .013 | .33 | .043 | 1.09 | .302 | 7.67 |

PRODUCT DESCRIPTION: *Bare copper, vinyl insulated, conductors cabled, red vinyl jacket.*
*Color code: 1st Black 2nd White 3rd Red 4th Green 5th Brown 6th Blue 7th Orange 8th Yellow 9th Violet 10th Gray 11th Pink 12th Tan*
***Suggested working voltage: 300***

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **19 GAGE** SOLID CONDUCTORS .91 mm diam. | | | | | | | | | | | |
| RED VINYL JACKET | 9596†○ UL LISTED 300V E64959 2464 | U-500 500 1000 | U-152.4 152.4 304.8 | 86269 95224 95223 | 2 | .030 | .76 | — | — | .100 x .190 | 2.54 x 4.83 |
| RED VINYL JACKET | 9597†○ UL LISTED 300V E64959 2464 | U-500 500 U-1000 1000 | U-152.4 152.4 U-304.8 304.8 | 86268 95222 86267 95221 | 4 | .061 | .41 | .041 | 1.04 | .242 | 6.15 |
| | 9598†○ UL LISTED 300V E64959 2464 | U-500 500 U-1000 1000 | U-152.4 152.4 U-304.8 304.8 | 86266 95220 86265 95219 | 6 | .016 | .41 | .042 | 1.07 | .282 | 7.16 |

PRODUCT DESCRIPTION: *Bare copper, vinyl insulated, conductors cabled, red vinyl jacket.*
***Color code:*** *1st Black 2nd Red 3rd Yellow 4th Blue*
***Color code:*** *1st Black 2nd Red 3rd Yellow 4th Blue 5th Brown 6th Orange*

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **18 GAGE** SOLID CONDUCTORS 1.02 mm diam. | | | | | | | | | | | |
| RED VINYL JACKET | ★9571†○ UL LISTED 300V E64959 2464 | U-500 U-1000 | U-152.4 U-304.8 | 87726 87725 | 2 | .017 | .43 | .037 | .94 | .224 | 5.69 |
| RED VINYL JACKET | ★9574†○ UL LISTED 300V E64959 2464 | U-500 U-1000 | U-152.4 U-304.8 | 87722 87721 | 2 | .017 | .43 | .037 | .94 | .228 | 5.79 |

***Color code:*** *Red, Black*

PRODUCT DESCRIPTION:
*Solid bare copper, vinyl insulated, conductors cabled, red vinyl jacket.*

PRODUCT DESCRIPTION:
*Solid bare copper, vinyl insulated conductors cabled with Beldfoil aluminum-polyester shield and #22 AWG drain wire, red vinyl jacket.*

★ New Item †*Passes the FR-1 vertical flame test.* ○*Passes the UL 70,000 BTU flame and tray test and is listed by the California Fire Marshall*

BELDEN | fire alarm & tray cables

# POWER LIMITED 105°C-300°C FIRE PROTECTIVE SIGNALING CIRCUIT CABLE (cont'd.)

| Description | Trade & U.L. Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond. | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **18 GAGE** SOLID CONDUCTORS 1.02 mm diam. (cont'd.) | | | | | | | | | | | |
| | ★9578† UL LISTED 300V E64959 2464 | U-500 U-1000 | U-152.4 U-304.8 | 87714 87713 | 4 | .017 | .43 | .037 | .94 | .263 | 6.68 |
| **16 GAGE** SOLID CONDUCTORS 1.29 mm diam. | | | | | | | | | | | |
| | ★9572† UL LISTED 300V E64959 2464 | U-500 U-1000 | U-152.4 U-304.8 | 87724 87723 | 2 | .017 | .43 | .037 | .94 | .244 | 6.20 |
| | ★9575† UL LISTED 300V E64959 2464 | U-500 U-1000 | U-152.4 U-304.8 | 87720 87719 | 2 | .017 | .43 | .037 | .94 | .278 | 7.06 |
| | ★9579† UL LISTED 300V E64959 2464 | U-500 U-1000 | U-152.4 U-304.8 | 87712 87711 | 4 | .017 | .43 | .042 | 1.07 | .293 | 7.44 |
| **14 GAGE** SOLID CONDUCTORS 1.68 mm diam. | | | | | | | | | | | |
| | ★9580† UL LISTED 300V E64959 | U-500 U-1000 | U-152.4 U-304.8 | 87710 87709 | 2 | .022 | .56 | .042 | 1.07 | .302 | 7.67 |
| | ★9581† UL LISTED 300V E64959 | U-500 U-1000 | U-152.4 U-304.8 | 87708 87707 | 2 | .022 | .56 | .042 | 1.07 | .306 | 7.77 |
| **12 GAGE** SOLID CONDUCTORS 2.06 mm diam. | | | | | | | | | | | |
| | ★9582† UL LISTED 300V E64959 | U-500 U-1000 | U-152.4 U-304.8 | 87706 87705 | 2 | .022 | .56 | .042 | 1.07 | .334 | 8.48 |
| | ★9583† UL LISTED 300V E64959 | U-500 1000 | U-152.4 304.8 | 87704 87703 | 2 | .022 | .56 | .042 | 1.07 | .338 | 8.59 |

**Color code:** *1st Red 2nd Black 3rd Yellow 4th Blue*

**PRODUCT DESCRIPTION:**
*Solid bare copper, vinyl insulated, conductors cabled with beldfoil aluminum polyester shield and #22 AWG drain wire, red vinyl jacket.*

**Color code:** *1st Black 2nd Red 3rd Yellow 4th Blue*

**PRODUCT DESCRIPTION:**
*Solid bare copper, vinyl insulated, conductors cabled, red vinyl jacket.*

**Color code:** *1st Red 2nd Black 3rd Yellow 4th Blue*

**PRODUCT DESCRIPTION:**
*Solid bare copper, vinyl insulated, conductors cabled with beldfoil aluminum polyester shield and #22 AWG drain wire, red vinyl jacket.*

**Color code:** *Red, Black*

**PRODUCT DESCRIPTION:**
*Solid bare copper, vinyl insulated, conductors cabled, red vinyl jacket.*

**Color code:** *Red, Black*

**PRODUCT DESCRIPTION:**
*Solid bare copper, vinyl insulated, conductors cabled with beldfoil aluminum polyester shield with #16 AWG drain wire, red vinyl jacket.*

**Color code:** *Red, Black*

**PRODUCT DESCRIPTION:**
*Solid bare copper, vinyl insulated, conductors cabled, red vinyl jacket.*

**PRODUCT DESCRIPTION:**
*Solid bare copper, vinyl insulated, conductors cabled with beldfoil aluminum polyester shield and #16 AWG drain wire, red vinyl jacket.*

★ New Item †*Passes the FR-1 vertical flame test.*

# Power-Limited Circuit Cable
## UL SUBJECT 13

Power Limited Circuit Cable Tri-rated UL Subject 13, and Appliance Wiring Material Style 2464.
Certified to CSA standards as Appliance Wiring Material TR-64.

105°, 300V meets Article 725 of the NEC. Also marked as Tray Cable suitable for class 2 & 3 circuits.
Passes the UL 70,000 BTU Flame and Tray Cable test which is comparable to the IEEE 383 Flame Test.

## TWO CONDUCTOR UNSHIELDED CABLES

**PRODUCT DESCRIPTION:** *Tinned copper, PVC insulation, conductors cabled, chrome Color code: Black, Red. PVC jacket.*

**LISTED**
**E34972**
**300V and UL 2464 AWM**
**CSA TR-64 Appliance Wiring Material**
**California State Fire Marshall Listed**

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | AWG (Stranding) [Dia. in mm] | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ★**9407**†○ | 100<br>U-500<br>U-1000 | 30.5<br>U-152.4<br>U-304.5 | **86133**<br>**86135**<br>**86134** | 22 (7x30)<br>[.76] | .016 | .41 | .038 | .97 | .200 | 5.08 |
| | ★**9408**†○ | 100<br>U-500<br>U-1000 | 30.5<br>U-152.4<br>U-304.5 | **86130**<br>**86132**<br>**86131** | 20 (10x30)<br>[.94] | .016 | .41 | .038 | .97 | .214 | 5.44 |
| | ★**9409**†○ | 100<br>U-500<br>U-1000 | 30.5<br>U-152.4<br>U-304.5 | **86127**<br>**86129**<br>**86128** | 18 (16x30)<br>[1.17] | .016 | .41 | .038 | .97 | .230 | 5.84 |
| | ★**9410**†○ | 100<br>U-500<br>U-1000 | 30.5<br>U-152.4<br>U-304.5 | **86124**<br>**86126**<br>**86125** | 16 (26x30)<br>[1.52] | .016 | .41 | .038 | .97 | .260 | 6.60 |
| | ★**9411**†○ | 100<br>U-500<br>1000 | 30.5<br>U-152.4<br>304.5 | **86121**<br>**86123**<br>**86122** | 14 (41x30)<br>[1.91] | .020 | .51 | .043 | 1.09 | .324 | 8.23 |
| | ★**9412**†○ | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | **86120**<br>**86119**<br>**86118** | 12 (65x30)<br>[2.41] | .020 | .51 | .043 | 1.09 | .364 | 9.25 |

## TWO CONDUCTOR SHIELDED CABLES

**PRODUCT DESCRIPTION:** *Tinned copper, PVC insulation, conductors cabled with BELDFOIL tape shield and #22 AWG drain wire, chrome PVC jacket. Color code: Black, Red.*

**LISTED**
**E34972**
**300V and UL 2464 AWM**
**CSA TR-64 Appliance Wiring Material**

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | AWG (Stranding) [Dia. in mm] | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ★**9322**†○ | 100<br>U-500<br>U-1000 | 30.5<br>U-152.4<br>U-304.5 | **85891**<br>**85893**<br>**85892** | 22 (7x30)<br>[.76] | .016 | .41 | .038 | .97 | .202 | 5.13 |
| | ★**9320**†○ | 100<br>U-500<br>U-1000 | 30.5<br>U-152.4<br>U-304.5 | **85894**<br>**85896**<br>**85895** | 20 (10x30)<br>[.94] | .016 | .41 | .038 | .97 | .216 | 5.49 |
| | ★**9318** | 100<br>U-500<br>U-1000 | 30.5<br>U-152.4<br>U-304.5 | **86220**<br>**86222**<br>**86221** | 18 (16x30)<br>[1.17] | .016 | .41 | .038 | .97 | .236 | 5.99 |
| | ★**9316** | 100<br>U-500<br>U-1000 | 30.5<br>U-152.4<br>U-304.5 | **86223**<br>**86225**<br>**86224** | 16 (26x30)<br>[1.52] | .016 | .41 | .038 | .97 | .262 | 6.65 |

★ New Item †***Passes the FR-1 vertical flame test.*** ○*Passes the UL 70,000 BTU flame and tray test and is listed by the California Fire Marshall*

BELDEN | power-limited circuit cables

# POWER-LIMITED CIRCUIT CABLES (cont'd.)

## TWO CONDUCTOR SHIELDED CABLES

**PRODUCT DESCRIPTION:** *Tinned copper, PVC insulation, conductors cabled with BELDFOIL tape shield and #22 AWG drain wire, chrome PVC jacket.*

UL LISTED E34972 300V and UL 2464 AWM

CSA TR-64 Appliance Wiring Material

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | AWG (Stranding) [Dia. in mm] | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ★9314 | 100<br>U-500<br>1000 | 30.5<br>U-152.4<br>304.5 | 86226<br>86228<br>85856 | 14 (41x30) [1.91] | .022 | .56 | .043 | 1.09 | .326 | 8.28 |
| | ★9312 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86231<br>86230<br>86229 | 12 (65x30) [2.41] | .022 | .56 | .043 | 1.09 | .366 | 9.30 |

## THREE CONDUCTOR UNSHIELDED CABLES

**PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, conductors cabled, chrome vinyl jacket.*

UL LISTED E34972 300V and UL 2464 AWM

CSA TR-64 Appliance Wiring Material

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | AWG (Stranding) [Dia. in mm] | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ★9491 | 100<br>U-500<br>U-1000 | 30.5<br>U-152.4<br>U-304.5 | 86103<br>86105<br>86104 | 22 (7x30) [.76] | .016 | .41 | .038 | .97 | .210 | 5.33 |
| | ★9492 | 100<br>U-500<br>U-1000 | 30.5<br>U-152.4<br>U-304.5 | 86100<br>86102<br>86101 | 20 (10x30) [.94] | .016 | .41 | .038 | .97 | .225 | 5.72 |
| | ★9493 | 100<br>U-500<br>U-1000 | 30.5<br>U-152.4<br>U-304.5 | 86097<br>86099<br>86098 | 18 (16x30) [1.17] | .016 | .41 | .038 | .97 | .246 | 6.25 |
| | ★9494 | 100<br>U-500<br>U-1000 | 30.5<br>U-152.4<br>U-304.5 | 86094<br>86096<br>86095 | 16 (26x30) [1.52] | .016 | .41 | .038 | .97 | .274 | 6.96 |
| | ★9495 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86093<br>86092<br>86091 | 14 (41x30) [1.91] | .022 | .56 | .043 | 1.09 | .342 | 8.69 |

*Color code: Black, Red, White.*

## THREE CONDUCTOR SHIELDED CABLES

**PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, conductors cabled, overall BELDFOIL tape and drain wire, chrome vinyl jacket.*

UL LISTED E34972 300V and UL 2464 AWM

CSA TR-64 Appliance Wiring Material

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | AWG (Stranding) [Dia. in mm] | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ★9363 | 100<br>U-500<br>U-1000 | 30.5<br>U-152.4<br>U-304.5 | 86169<br>86171<br>86170 | 22 (7x30) [.76] | .016 | .41 | .038 | .97 | .212 | 5.38 |
| | ★9364 | 100<br>U-500<br>U-1000 | 30.5<br>U-152.4<br>U-304.5 | 86166<br>86168<br>86167 | 20 (10x30) [.94] | .016 | .41 | .038 | .97 | .227 | 5.77 |
| | ★9365 | 100<br>U-500<br>U-1000 | 30.5<br>U-152.4<br>U-304.5 | 86163<br>86165<br>86164 | 18 (16x30) [1.17] | .016 | .41 | .038 | .97 | .248 | 6.30 |
| | ★9366 | 100<br>U-500<br>U-1000 | 30.5<br>U-152.4<br>U-304.5 | 86160<br>86162<br>86161 | 16 (26x30) [1.52] | .020 | .51 | .038 | .97 | .276 | 7.01 |
| | ★9367 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86159<br>86158<br>86157 | 14 (41x30) [1.91] | .020 | .51 | .043 | 1.09 | .344 | 8.74 |

*Color code: Black, Red, White.*

★ New Item †Passes the FR-1 vertical flame test.

power-limited circuit cables | BELDEN

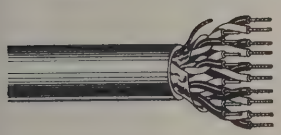
# POWER-LIMITED CIRCUIT CABLES (cont'd.)

## OVERALL SHIELDED PAIRED CABLE

**22 AWG (7x30) .76 mm diam.**

**PRODUCT DESCRIPTION:** *Tinned copper vinyl insulation, conductors cabled with overall BELDFOIL shield and drain wire, chrome PVC jacket.*

***Conductor pairs are color coded black and red. Multipairs are numbered at one inch intervals.***



UL LISTED
E34972
300V and UL 2464 AWM

CSA TR-64 Appliance Wiring Material

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Pairs | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ★9512 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86090<br>86089<br>86088 | 2 | .016 | .41 | .043 | 1.09 | .310 | 7.87 |
| | ★9513 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86087<br>86086<br>86085 | 3 | .016 | .41 | .043 | 1.09 | .326 | 8.28 |
| | ★9514 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86084<br>86083<br>86082 | 4 | .016 | .41 | .043 | 1.09 | .353 | 8.97 |
| | ★9516 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86081<br>86080<br>86079 | 6 | .016 | .41 | .053 | 1.09 | .425 | 10.80 |
| | ★9520 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86078<br>86077<br>86076 | 9 | .016 | .41 | .053 | 1.09 | .488 | 12.40 |
| | ★9521 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86075<br>86074<br>86073 | 11 | .016 | .41 | .053 | 1.09 | .536 | 13.61 |
| | ★9524 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86072<br>86071<br>86070 | 15 | .016 | .41 | .053 | 1.09 | .594 | 15.09 |
| | ★9526 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86069<br>86068<br>86067 | 19 | .016 | .41 | .063 | 1.60 | .631 | 16.03 |
| | ★9527 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86066<br>86065<br>86064 | 27 | .016 | .41 | .063 | 1.60 | .761 | 19.33 |
| | ★9551 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86028<br>86027<br>86026 | 51 | .016 | .41 | .075 | 1.91 | .950 | 24.13 |

*500 & 1000 ft. lengths +20% -0 lengths tolerance.*

★ New Item

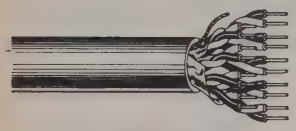
†***Passes the FR-1 vertical flame test.***

BELDEN | power limited circuit cables

# POWER LIMITED CIRCUIT CABLES (cont'd.)

## OVERALL SHIELDED PAIRED CABLE
**18 AWG (16x30) 1.17 mm diam.**

**PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, conductors cabled, overall BELDFOIL shield & drain wire, chrome vinyl jacket.*
***Conductor pairs are color coded black and red. Multipairs are numbered at one inch intervals.***



**BELDFOIL**
**100% Shield Coverage**

UL LISTED
**E34972**

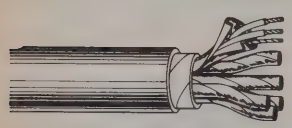
**300V and UL 2464 AWM**

CSA
**CSA TR-64 Appliance Wiring Material**

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Pairs | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ★9552† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86063<br>86062<br>86061 | 2 | .016 | .41 | .043 | 1.09 | .376 | 9.55 |
| | ★9553† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86060<br>86059<br>86058 | 3 | .016 | .41 | .053 | 1.35 | .416 | 10.57 |
| | ★9554† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86057<br>86056<br>86055 | 4 | .016 | .41 | .053 | 1.35 | .451 | 11.46 |
| | ★9556† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86054<br>86053<br>86052 | 6 | .016 | .41 | .053 | 1.35 | .516 | 13.11 |
| | ★9559† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86051<br>86050<br>86049 | 9 | .016 | .41 | .053 | 1.35 | .596 | 15.14 |
| | ★9563† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86048<br>86047<br>86046 | 11 | .016 | .41 | .063 | 1.60 | .676 | 17.17 |
| | ★9565† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86045<br>86044<br>86043 | 15 | .016 | .41 | .063 | 1.60 | .751 | 19.08 |

## MULTI PAIR, INDIVIDUALLY SHIELDED CABLE
**22 AWG (7x30) .76 mm diam.**

**PRODUCT DESCRIPTION:** *Tinned copper PVC insulation, twisted pairs each with BELDFOIL shield & drain wire, chrome PVC jacket.*
***Conductor pairs are color coded black and red. Multipairs are numbered at one inch intervals.***



**BELDFOIL**
**100% Shield Coverage**

UL LISTED
**E34972**

**300V and UL 2464 AWM**

CSA
**CSA TR-64 Appliance Wiring Material**

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Pairs | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ★9328† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 85890<br>85889<br>85888 | 2 | .016 | .41 | .043 | 1.09 | .316 | 8.03 |
| | ★9329† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 85887<br>85886<br>85885 | 3 | .016 | .41 | .043 | 1.09 | .331 | 8.41 |
| | ★9330† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 85884<br>85883<br>85882 | 4 | .016 | .41 | .043 | 1.09 | .360 | 9.14 |
| | ★9331† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 85881<br>85880<br>85879 | 6 | .016 | .41 | .053 | 1.35 | .431 | 10.95 |
| | ★9332† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 85878<br>85877<br>86199 | 9 | .016 | .41 | .053 | 1.35 | .500 | 12.70 |
| | ★9333† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 85876<br>85875<br>86196 | 11 | .016 | .41 | .053 | 1.35 | .551 | 14.00 |

✦ New Item †***Passes the FR-1 vertical flame test.***

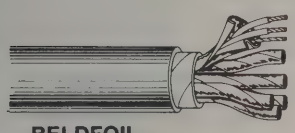
# POWER LIMITED CIRCUIT CABLES (cont'd.)

## MULTI PAIR, INDIVIDUAL SHIELDED CABLE (cont'd.)

**22 AWG (7x30) .76 mm diam. (cont'd.)**

**PRODUCT DESCRIPTION:** *Tinned copper PVC insulation, twisted pairs each with BELDFOIL shield & drain wire, chrome PVC jacket.*

***Conductor pairs are color coded black and red. Multipairs are numbered at one inch intervals.***



**BELDFOIL 100% Shield Coverage**

UL LISTED **E34972**

**300V and UL 2464 AWM**

CSA TR-64 **Appliance Wiring Material**

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Pairs | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ★9334† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86195<br>86194<br>86193 | 15 | .016 | .41 | .053 | 1.35 | .606 | 15.39 |
| | ★9335† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86192<br>86191<br>86190 | 19 | .016 | .41 | .063 | 1.60 | .646 | 16.41 |
| | ★9336† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86189<br>86188<br>86187 | 27 | .016 | .41 | .063 | 1.60 | .776 | 19.71 |
| | ★9337† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86186<br>86185<br>86184 | 51 | .016 | .41 | .075 | 1.91 | .970 | 24.64 |

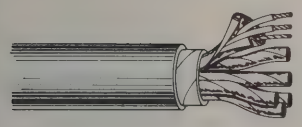
*500 & 1000 ft. lengths +20% -0 lengths tolerance.*

## MULTI PAIR, INDIVIDUALLY SHIELDED CABLE

**18 AWG (16x30) 1.17 mm diam.**

**PRODUCT DESCRIPTION:** *Tinned copper PVC insulation, twisted pairs, each with BELDFOIL shield and drain wire, chrome PVC jacket.*

***Conductor pairs are color coded black and red. Multipairs are numbered at one inch intervals.***



**BELDFOIL 100% Shield Coverage**

UL LISTED **E34972**

**300V and UL 2464 AWM**

CSA TR-64 **Appliance Wiring Material**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ★9368† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86156<br>86155<br>86154 | 2 | .016 | .41 | .043 | 1.09 | .381 | 9.68 |
| | ★9369† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86153<br>86152<br>86151 | 3 | .016 | .41 | .053 | 1.35 | .421 | 10.69 |
| | ★9388† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86150<br>86149<br>86148 | 4 | .016 | .41 | .053 | 1.35 | .456 | 11.58 |
| | ★9389† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86147<br>86146<br>86145 | 6 | .016 | .41 | .053 | 1.35 | .526 | 13.36 |
| | ★9390† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86144<br>86143<br>86142 | 9 | .016 | .41 | .063 | 1.60 | .628 | 15.95 |
| | ★9391† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86141<br>86140<br>86139 | 11 | .016 | .41 | .063 | 1.60 | .686 | 17.42 |
| | ★9392† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86138<br>86137<br>86136 | 15 | .016 | .41 | .063 | 1.60 | .766 | 19.46 |

★ New Item †*Passes the FR-1 vertical flame test.*

BELDEN | tray cables

# Tray Cable

## SUBJECT 1277

Tray Cable 90°C, 600V UL Listed as Tray Cable under Subject 1277 for use as Tray Cable in accordance with NEC Article 340.

Passes the UL 70,000 BTU Flame Test which is comparable to the IEEE 383 Flame Test. Also suitable for outdoor use.

## TWO CONDUCTOR UNSHIELDED

**PRODUCT DESCRIPTION:** *Stranded, tinned copper, PVC insulation nylon overcoat, conductors cabled, black PVC jacket.*
***Conductor pairs are color coded black and red. Multipairs are numbered at one inch intervals.***

LISTED
E64067
600V

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | AWG (Stranding) [Dia. in mm] | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ★9486† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86117<br>86116<br>86115 | 18(16x30)<br>[1.17] | .016 PVC<br>.005 Nylon | .41<br>.13 | .048 | 1.22 | .279 | 7.09 |
| | ★9487† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86114<br>86113<br>86112 | 16(26x30)<br>[1.52] | .016 PVC<br>.005 Nylon | .41<br>.13 | .048 | 1.22 | .306 | 7.77 |
| | ★9488† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86111<br>86110<br>86109 | 14(41x30)<br>[1.91] | .022 PVC<br>.005 Nylon | .56<br>.13 | .048 | 1.22 | .359 | 9.12 |
| | ★9489† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86108<br>86107<br>86106 | 12(65x30)<br>[2.41] | .022 PVC<br>.005 Nylon | .56<br>.13 | .048 | 1.22 | .399 | 10.13 |

## TWO CONDUCTOR SHIELDED

**PRODUCT DESCRIPTION:** *Stranded, tinned copper conductor, PVC insulation, nylon overcoat, conductors cabled, BELDFOIL shield & drain wire, black PVC jacket.*
***Conductor pairs are color coded black and red. Multipairs are numbered at one inch intervals.***

BELDFOIL
100% Shield
Coverage

LISTED
E64067
600V

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ★9341† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86183<br>86182<br>86181 | 18(16x30)<br>[1.17] | .016 PVC<br>.005 Nylon | .41<br>.13 | .048 | 1.22 | .278 | 7.06 |
| | ★9342† | 100<br>500<br>1000 | 30.5<br>152<br>304.5 | 86180<br>86179<br>86178 | 16(26x30)<br>[1.52] | .016 PVC<br>.005 Nylon | .41<br>.13 | .048 | 1.22 | .304 | 7.72 |
| | ★9343† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86177<br>86176<br>86175 | 14(41x30)<br>[1.91] | .022 PVC<br>.005 Nylon | .41<br>.13 | .048 | 1.22 | .358 | 9.09 |
| | ★9344† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.5 | 86174<br>86173<br>86172 | 12(65x30)<br>[2.41] | .022 PVC<br>.005 Nylon | .56<br>.13 | .048 | 1.22 | .398 | 10.11 |

★ New Item †*Passes the F.R.-1 vertical flame test.*

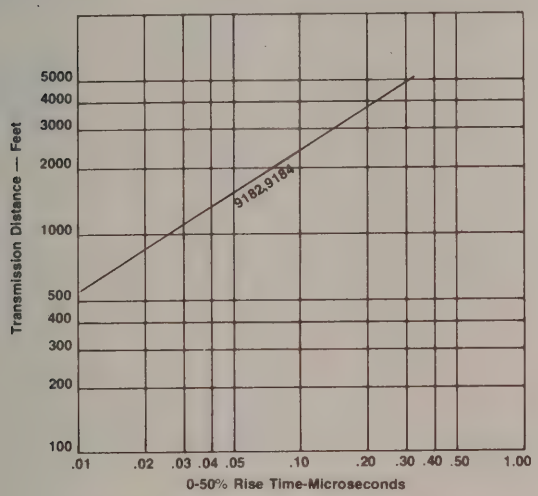
computer cables | BELDEN

# Datalene™ Cables

## INDIVIDUALLY SHIELDED PAIRS

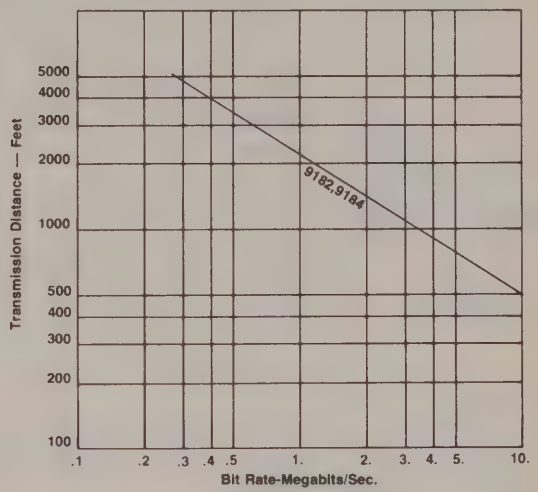
### RISE TIME

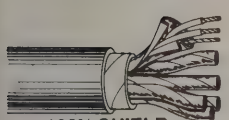
Cables are terminated in their characteristic impedance. Balanced signal source electrical characteristics: 50 ohms and 10% to 90% rise time less than 5 seconds.




### BIT RATE

Charts assume 5% peak to peak jitter as determined by eye pattern measurements.




| Description | Trade & UL Style No. | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | Nom. D.C.R. Center Cond. | Nom. D.C.R. Shield | No. of Pairs | Nominal O.D. Inch | Nominal O.D. mm | Nom. Imp. (ohms) | Nom. Vel. of Prop. | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m | 6dbv length limit in thousands of ft. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **22 GAGE STRANDED CONDUCTORS (19 x 34) .79 mm diam.** | | | | | | | | | | | | | | | | |
| | ★9182† UL LISTED 2772 | 500<br>1000 | 152.4<br>304.8 | 88690<br>88689 | 22 (19x34) tinned copper [.79] 14Ω/M' 46Ω/km | Duofoil w/stranded tinned copper drain wire 6.3Ω/M' 20.7Ω/km | 1 | .350 | 8.89 | 150 | 78% | 8.8 | 28.9 | – | – | 5.4 |
| **22 GAGE SOLID** | | | | | | | | | | | | | | | | |
| | ★9184 UL LISTED 2772 | 500<br>1000 | 152.4<br>304.8 | 87862<br>87861 | tinned copper [.64 mm] 16.1Ω/M' 52.8Ω/km | Duofoil w/stranded tinned copper drain wire 6.3Ω/M' 20.7Ω/km | 2 | .420 | 10.67 | 150 | 78% | 8.7 | 28.5/ pf/m | – | – | 4.7 |
| **24 GAGE STRANDED CONDUCTORS (7 x 32) .61 mm diam.** | | | | | | | | | | | | | | | | |
|  100% SHIELD COVERAGE | ★9730† UL LISTED 2493 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | 87682<br>87681<br>87680 | 24 (7x32) 24Ω/M' 78.7Ω/km | 18Ω/M' 59.1Ω/km | 3 | .370 | 9.40 | 100 | 78 | 12.5 | 41.0 | – | – | 2.1 |

★ New Item †Passes the FR-1 vertical flame test. *Capacitance between conductors. **Capacitance between 1 conductor and other conductors connected to shield.

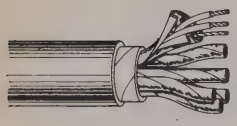
Color coding: see page 6, General line 878 Catalog.

BELDEN computer cables

# DATALENE INDIVIDUALLY SHIELDED PAIRS (cont'd.)

## 24 GAGE (cont'd.)

### STRANDED CONDUCTORS (7 x 32) .61 mm diam.



100% SHIELD COVERAGE

| Description | Trade & UL Style No. | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | Nom. D.C.R. Center Cond. | Nom. D.C.R. Shield | No. of Pairs | Nominal O.D. Inch | Nominal O.D. mm | Nom. Imp. (ohms) | Nom. Vel. of Prop. | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m | 6dbv length limit in thousands of ft. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ★9731† UL LISTED 2493 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | 87679<br>87678<br>87677 | 24Ω/M'<br>78.7Ω/km | 18Ω/M'<br>18Ω/km | 6 | .486 | 12.34 | 100 | 78 | 12.5 | 41.0 | – | – | 2.1 |
| | ★9732† UL LISTED 2493 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | 87676<br>87675<br>87674 | 24Ω/M'<br>78.7Ω/km | 18Ω/M'<br>59.1Ω/km | 9 | .600 | 15.24 | 100 | 78 | 12.5 | 41.0 | – | – | 2.1 |
| | ★9733† UL LISTED 2493 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | 87673<br>87672<br>87671 | 24Ω/M'<br>78.7Ω/km | 18Ω/M'<br>59.1Ω/km | 11 | .650 | 16.51 | 100 | 78 | 12.5 | 41.0 | – | – | 2.1 |
| | ★9734† UL LISTED 2493 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | 87670<br>87669<br>87668 | 24Ω/M'<br>78.7Ω/km | 18Ω/M'<br>59.1Ω/km | 12 | .670 | 17.02 | 100 | 78 | 12.5 | 41.0 | – | – | 2.1 |
| | ★9735† UL LISTED 2493 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | 87667<br>87666<br>87665 | 24Ω/M'<br>78.7Ω/km | 18Ω/M'<br>59.1Ω/km | 15 | .745 | 18.92 | 100 | 78 | 12.5 | 41.0 | – | – | 2.1 |
| | ★9736† UL LISTED 2493 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | 87664<br>87663<br>87662 | 24Ω/M'<br>78.7Ω/km | 18Ω/M'<br>59.1Ω/km | 17 | .780 | 19.81 | 100 | 78 | 12.5 | 41.0 | – | – | 2.1 |
| | ★9737† UL LISTED 2490 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | 87661<br>87660<br>87659 | 24Ω/M'<br>78.7Ω/km | 18Ω/M'<br>59.1Ω/km | 19 | .780 | 19.81 | 100 | 78 | 12.5 | 41.0 | – | – | 2.1 |
| | ★9738† UL LISTED 2490 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | 87658<br>87657<br>87656 | 24Ω/M'<br>78.7Ω/km | 18Ω/M<br>59.1Ω/km | 27 | .800 | 20.32 | 100 | 78 | 12.5 | 41.0 | – | – | 2.1 |

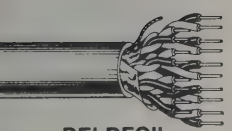
★ New Item †Passes the FR-1 vertical flame test. *Capacitance between conductors. **Capacitance between 1 conductor and other conductors connected to shield.

Color coding: see page 6, General line 878 Catalog.

## MULTIPLE PAIR OVERALL SHIELDED (cont'd.)

| Description | Trade & U.L.Style Number | Standard Length ft. | Standard Length m | U.P.C. No. | No. of Pairs | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **24 GAGE (cont'd.)** SOLID CONDUCTORS .64 mm | | | | | | | | | | | | | | | |
| | **9315†** LISTED 2464 300V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **95479**<br>**95478**<br>**95477** | 15 | .013 | .33 | .040 | 1.02 | .437 | 11.10 | 35 | 115 | — | — |
| | **9319†** LISTED 2464 300V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **95476**<br>**95475**<br>**95474** | 19 | .013 | .33 | .040 | 1.02 | .475 | 12.07 | 35 | 115 | — | — |
| | **9327†** LISTED 2464 300V | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **95473**<br>**95472**<br>**95471** | 27 | .013 | .33 | .045 | 1.14 | .571 | 14.50 | 35 | 115 | — | — |

**PRODUCT DESCRIPTION:** *tinned copper, vinyl insulated, twisted pairs, overall BELDFOIL aluminum-polyester shield, stranded tinned copper drain wire, chrome vinyl jacket. For coding, please refer to page 6*



BELDFOIL

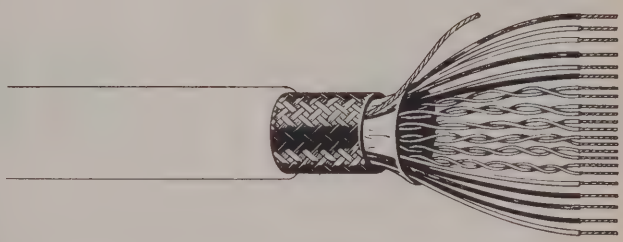
# GPIB Cables

**General Purpose Interface Bus Cable**

**IEEE 488**

Belden GPIB cables provide a fast, simple way to interface computer power with test and measurement hardware — without resorting to time-consuming patchwork wiring. Belden IEEE 488 UL recognized GPIB cables are fast becoming essential tools in research and development, quality control and on-the-job troubleshooting.

Belden GPIB cables can be used to interconnect up to 15 programmable instruments at one time in star or daisy chain networks. They're especially recommended for applications involving counters, signal generators, calculators, digital multimeters — in fact, any instrument equipped with standard IEEE 488 interfaces. Complete UL approved molded cable assemblies are available in five standard lengths, the longest of which is 16 m (52.5′). Bulk put-ups are also available.



| Trade No. | Length ft. | Length m | U.P.C. No. |
|---|---|---|---|
| **Molded Cable Assemblies*** | | | |
| **★9642** | 3.3 | 1 | **87698** |
| **★9643** | 6.6 | 2 | **87697** |
| **★9644** | 13.1 | 4 | **87696** |
| **★9645** | 26.2 | 8 | **87695** |
| **★9646** | 52.5 | 16 | **87694** |
| **Bulk put-ups**** | | | |
| **★9641** | 100 | 30.5 | **88363** |
| | 500 | 152.4 | **87362** |
| | 1000 | 304.8 | **88361** |

*Special lengths on request*

**Component recognized–Underwriters Laboratories, Inc. File #E38804-Wiring Harness*

***Underwriters Laboratories, Inc. File #E12683-AWM. CSA Certified, File #LR 16556-Appliance Wiring Material*

### Physical Specifications

24 conductor cable (including all functions)

6 pair (26 AWG)
10 single conductor (26 AWG) 1 single conductor (26 AWG)
Braid shield with 24 AWG drain wire (91% coverage)

Semi-rigid PVC insulation and PVC jacket (gray) O.D.: 8.9 mm (.350″)

24-pin AMP connectors—male and female—at ends (U.L. recognized)

Contact pins: Gold over nickel-plated beryllium copper
Connectors: Self-extinguishing plastic

Mounting screws: Metric cadmium-plated finish

### Electrical/Electronic Specifications

| | | |
|---|---|---|
| Capacitance— | 10 single conductor: | 35 pF/ft nom. |
| | 6 pair: | 38 pF/ft nom. |
| Impedance— | 10 single conductor: | 70 ohms nom. |
| | 6 pair: | 75 ohms nom. |

Pin-to-pin voltage rating: 300 vdc/conductor

Maximum effective cable length: 20 m (66′)

### Conductor Functions

| | |
|---|---|
| General interface management | 8 conductors (3 pairs, 2 single): 5 lines 3 grounds |
| Date byte transfer control | 6 conductors (3 pair): 3 lines 3 grounds |
| Data input/output | 8 conductors (all single): 8 lines |
| Logic ground | 1 conductor (24 AWG) |
| Earth ground | 1 conductor (drain wire) |
| Total | 24 |

★ New Item

BELDEN | microphone cables

# Microphone Cables

Belden microphone cables are designed for flexibility, service and reliable signal transmission at audio frequencies. They are not only used for microphones, but also for home entertainment equipment, musical instruments, tape recorders and shielded power supplies.

Shielded single conductor cables are used in high impedance systems, while multiple conductor cables are generally used in low impedance applications.

All cables are precision engineered to transmit clear signals while cancelling out hum and cross-talk interference. They're especially designed to withstand the flexing and normal abuse of studio, laboratory and home usage.

*PLASTIC CABLES RECOMMENDED FOR: Lower capacitance, lower loss, greater ozone and oil resistance, lighter weight, smaller diameter.*
*RUBBER CABLES RECOMMENDED FOR: Greater abrasion and impact resistance and extra limpness so cable will lie flat on stage or studio floor.*
*NEOPRENE AND HYPALON CABLES RECOMMENDED FOR: Outside use, cold weather applications. Resistant to effects of sun, oil and ozone.*

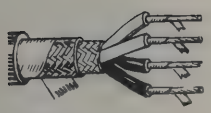
| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond. | AWG (Strand-ing) [Diam. in mm] | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **25 GAGE** | | | | | | | | | | | | | | | | |
| SINGLE CONDUCTOR | **8410** | 25 | 7.6 | **98165** | 1 | 25 (7x33) [.53] | .063 | 1.60 | .025 | .64 | .245 | 6.22 | — | — | 33 | 108 |
| | | 50 | 15.2 | **98164** | | | | | | | | | | | | |
| | | 100 | 30.5 | **98163** | | | | | | | | | | | | |
| | | 250 | 76.2 | **98162** | | | | | | | | | | | | |
| | | U-500 | U-152.4 | **98166** | | | | | | | | | | | | |
| | | 500 | 152.4 | **98161** | | | | | | | | | | | | |
| | | | | | | **PRODUCT DESCRIPTION:** *3 strands copper, 4 strands copper covered steel tinned, cellulose yarn braid, rubber insulated, rayon braid, tinned copper braid shield, cotton yarn wrap, black rubber jacket. Impedance (Ohms): 52. 80% shield coverage.* ***Suggested working voltage: 3000 DC*** | | | | | | | | | |
| | | | | | | **PRODUCT DESCRIPTION:** *Tinned cadmium bronze, cotton serve, rubber insulated, cabled with fillers, 100% coverage conductive textile wrap shield, tinned copper braid shield, cotton serve, black rubber jacket. 100% shield coverage.* ***Suggested working voltage: 300*** | | | | | | | | | |
| **24 GAGE** | | | | | | | | | | | | | | | | |
| MINIATURE CONDUCTOR | **8413** | 15 | 4.6 | **98143** | 2 | 24 (45x40) [.61] | .019 | .48 | .025 | .64 | .190 | 4.83 | 30 | 98 | 55 | 180 |
| | | 25 | 7.6 | **98142** | | | | | | | | | | | | |
| | | 50 | 15.2 | **98141** | | | | | | | | | | | | |
| | | 100 | 30.5 | **98140** | | | | | | | | | | | | |
| | | 250 | 76.2 | **98139** | | | | | | | | | | | | |
| | | U-500 | U-152.4 | **98144** | | | | | | | | | | | | |
| | | 500 | 152.4 | **98138** | | | | | | | | | | | | |
| | **8406** | 100 | 30.5 | **98173** | 3 | 24 (45x40) [.61] | .019 | .48 | .025 | .64 | .223 | 5.66 | 35 | 114 | 60 | 197 |
| | UL LISTED | U-500 | U-152.4 | **98174** | | | | | | | | | | | | |
| | | 500 | 152.4 | **98172** | | | | | | | | | | | | |
| | **9399** | 100 | 30.5 | **95437** | 2 | 24 (45x40) [.61] | .017 | .43 | .030 | .76 | .195 | 4.95 | 30 | 98 | 55 | 180 |
| | | 500 | 152.4 | **95436** | | | | | | | | | | | | |
| | | 1000 | 304.8 | **95435** | | | | | | | | | | | | |
| | | | | | | **PRODUCT DESCRIPTION:** *Bare cadmium copper conductor, cotton serve, rubber insulated, cable with fillers, 100% coverage conductive textile wrap shield, tinned copper braid shield, cotton serve, brown rubber jacket. 100% shield coverage.* ***Suggested working voltage: 300*** | | | | | | | | | |
| **20 GAGE** | | | | | | | | | | | | | | | | |
| | **★9394** | 500 | 152.4 | **87838** | 1 | 20 (26x34) [.94] | .030 | .76 | .035 | .89 | .190 | 4.83 | — | — | 55 | 180 |
| | | 1000 | 304.8 | **87837** | | | | | | | | | | | | |
| | | | | | | **PRODUCTION DESCRIPTION:** *Tinned copper conductor, 100% coverage. Conductive textile wrap shield, tinned copper served shield, black neoprene jacket.* | | | | | | | | | |

★New Item *CONDUCTOR COLOR CODING: (1) White, (2) Black, (3) Red, (4) Green, (5) Blue, (6) Brown, (7) Yellow, (8) Orange.*

**Capacitance between conductors.*
***Capacitance between 1 conductor and remaining conductors (if any) connected to shield.*

# MICROPHONE CABLES (cont'd.)

## 20 GAGE (cont'd.)



MULTIPLE CONDUCTOR

**PRODUCT DESCRIPTION:** *Tinned copper, cotton wrap, rubber insulated, conductors cabled, rayon braid, tinned copper braid shield, cotton wrap, black rubber jacket. 85% shield coverage.*
***Suggested working voltage: 600.***

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond. | AWG (Stranding) [Diam. in mm] | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **8412** | 25<br>50<br>100<br>250<br>500<br>1000 | 7.6<br>15.2<br>30.5<br>76.2<br>152.4<br>304.8 | **98150**<br>**98149**<br>**98148**<br>**98147**<br>**98146**<br>**98145** | 2 | 20 (26x34) [.94] | .020 | .51 | .043 | 1.09 | .263 | 6.68 | 30 | 98 | 55 | 180 |
| | **8402†** | 100<br>250<br>500 | 30.5<br>76.2<br>152.4 | **98193**<br>**98192**<br>**98191** | 2 | 20 (26x34) [.94] *Brown Hypalon jacket.* | .020 | .51 | .040 | 1.02 | .263 | 6.68 | 30 | 98 | 55 | 180 |
| | **8423** | 50<br>100<br>250 | 15.2<br>30.5<br>76.2 | **98099**<br>**98098**<br>**98097** | 3 | 20 (26x34) [.94] | .020 | .51 | .040 | 1.02 | .272 | 6.91 | 35 | 115 | 60 | 197 |
| | **8424** | 50<br>100<br>250<br>500<br>1000 | 15.2<br>30.5<br>76.2<br>152.4<br>304.8 | **98094**<br>**98093**<br>**98092**<br>**98091**<br>**98090** | 4 | 20 (26x34) [.94] | .020 | .51 | .040 | 1.02 | .290 | 7.37 | 35 | 115 | 60 | 197 |
| | **8425** | 100<br>250 | 30.5<br>76.2 | **98089**<br>**98088** | 5 | 20 (26x34) [.94] | .020 | .51 | .040 | 1.02 | .318 | 8.08 | 35 | 115 | 60 | 197 |
| | **8426** | 100<br>250 | 30.5<br>76.2 | **98087**<br>**98086** | 6 | 20 (26x34) [.94] | .020 | .51 | .040 | 1.02 | .344 | 8.74 | 35 | 115 | 60 | 197 |
| | **8427** | 100<br>250 | 30.5<br>76.2 | **98085**<br>**98084** | 7 | 20 (26x34) [.94] | .020 | .51 | .040 | 1.02 | .355 | 9.02 | 35 | 115 | 60 | 197 |
| | **8418** | 100<br>250 | 30.5<br>76.2 | **98125**<br>**98124** | 8 | 20 (26x34) [.94] | .020 | .51 | .040 | 1.02 | .381 | 9.68 | 35 | 115 | 60 | 197 |

## 18 GAGE

**PRODUCTION DESCRIPTION:** *Tinned copper conductor, 100% coverage. Conductive textile wrap shield, tinned copper served shield, black neoprene jacket.*

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **★9395** | 500<br>1000 | 152.4<br>304.8 | **87836**<br>**87835** | 1 | 18 (41x34) [.119] | .045 | 1.14 | .040 | .102 | .235 | 5.97 | — | — | 55 | 180 |
| | **8428** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **98083**<br>**98082**<br>**98081** | 2 | 18 (41x34) [1.19] | .022 | .56 | .038 | .97 | .290 | 7.37 | 35 | 115 | 60 | 197 |
| | **8408†** | 100<br>500 | 30.5<br>152.4 | **98169**<br>**98168** | 2 | 16 (65x34) [1.47] *Brown Hypalon jacket–Heavy Duty.* | .032 | .81 | .040 | 1.02 | .385 | 9.78 | 30 | 98 | 55 | 180 |

★New Item †***Passes the FR-1 vertical flame test.***

*CONDUCTOR COLOR CODING: (1) White, (2) Black, (3) Red, (4) Green, (5) Blue, (6) Brown, (7) Yellow, (8) Orange.*

**Capacitance between conductors.*
***Capacitance between 1 conductor and remaining conductors (if any) connected to shield.*

BELDEN | microphone cables

# MICROPHONE CABLES (cont'd.)

| Description | Trade & UL Style Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | No. of Cond. | AWG (Strand-ing) [Diam. in mm] | Insulation Thickness Inch | Insulation Thickness mm | Jacket Thickness Inch | Jacket Thickness mm | Nominal O.D. Inch | Nominal O.D. mm | Nominal Capacitance * pF/ft. | Nominal Capacitance * pF/m | Nominal Capacitance ** pF/ft. | Nominal Capacitance ** pF/m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **16 GAGE** | | | | | | | | | | | | | | | | |
| | **8407†** | 100<br>250 | 30.5<br>76.2 | **98171**<br>**98170** | 4 | 16 (65x34) [1.47] | .032 | .81 | .043 | 1.09 | .416 | 10.57 | 30 | 98 | 55 | 180 |
| | | | | | | *Black neoprene jacket–Heavy Duty.* | | | | | | | | | | |
| | | | | | | **PRODUCT DESCRIPTION:** *Tinned copper, cotton wrap, rubber insulated, conductors cabled, rayon braid, tinned copper braid shield, cotton wrap, black rubber jacket. 85% shield coverage.* ***Suggested working voltage: 600.*** | | | | | | | | | | | |

## VINYL MICROPHONE AND SHIELDED POWER CONTROL CABLES

**25 GAGE**

SINGLE CONDUCTOR

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **8411** | 15<br>25<br>P-25<br>50<br>100<br>250<br>U-500<br>500<br>U-1000<br>1000 | 4.6<br>7.6<br>P-7.6<br>15.2<br>30.5<br>76.2<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **98157**<br>**98156**<br>**98160**<br>**98155**<br>**98154**<br>**98153**<br>**98159**<br>**98152**<br>**98158**<br>**98151** | 1 | 25 (7x33) [.53] | .020 | .51 | .020 | 1.02 | .144 | 3.66 | — | — | 40 | 129.7 |
| | | | | | *Impedance (Ohms): 52. 72% shield coverage.* ***Suggested working voltage: 3500 DC.*** | | | | | | | | | | |
| **8401•** | 15<br>25<br>P-25<br>50<br>100<br>250<br>U-500<br>500<br>U-1000<br>1000 | 4.6<br>7.6<br>P-7.6<br>15.2<br>30.5<br>76.2<br>U-154.2<br>152.4<br>U-304.8<br>304.8 | **98200**<br>**98199**<br>**98203**<br>**98198**<br>**98197**<br>**98153**<br>**98202**<br>**98195**<br>**98201**<br>**98194** | 1 | 25 (7x33) [.53] | .043 | 1.09 | .025 | .64 | .200 | 5.08 | — | — | 25 | 81.1 |
| | | | | | *Impedance (Ohms): 57. 74% shield coverage.* ***Suggested working voltage: 5000 DC*** | | | | | | | | | | |
| **★9396** | 100<br>250 | 30.5<br>76.2 | **00000**<br>**00000** | 1 | 25 (7x33) [.53] | .007 | .43 | .017 | .43 | .100 | 2.54 | — | — | 75 | 246 |
| | | | | | **PRODUCT DESCRIPTION:** *3 strands copper, 4 copperweld. Tinned copper serve shield, PVC insulation and PVC jacket.* ***Suggested working voltage: 1000*** | | | | | | | | | | |

**24 GAGE**

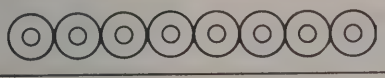
MINIATURE CONDUCTOR

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **8420†** | 15<br>25<br>50<br>100<br>250<br>U-500<br>500 | 4.6<br>7.6<br>15.2<br>30.5<br>76.2<br>U-152.4<br>152.4 | **98119**<br>**98118**<br>**98117**<br>**98116**<br>**98115**<br>**98120**<br>**98114** | 1 | 24 (45x40) [.61] | .015 | .38 | .020 | .51 | .185 | 4.70 | 22 | 71.3 | 40 | 129.7 |
| | | | | | **PRODUCT DESCRIPTION:** *Tinned cadmium bronze, cotton wrap, polyethylene insulated, cabled with fillers, rayon braid, tinned copper braid shield, chrome vinyl jacket. 77% shield coverage.* ***Suggested working voltage: 500*** | | | | | | | | | | |
| **★9397** | 100<br>White<br>Gray<br>500<br>White<br>Gray<br>1000<br>White<br>Gray | 30.5<br><br><br>152.4<br><br><br>304.8<br><br> | <br>**86215**<br>**86212**<br><br>**86214**<br>**86211**<br><br>**86213**<br>**86210** | 2 | (105x44) [.61] | .012 | .30 | .031 | .79 | .176 | 4.48 | 40 | 127 | 70 | 222 |
| | | | | | *Conductor color code: White, green.* | | | | | | | | | | |
| **★9398** | 100<br>White<br>Gray<br>500<br>White<br>Gray<br>1000<br>White<br>Gray | 30.5<br><br><br>152.4<br><br><br>304.8<br><br> | <br>**86209**<br>**86206**<br><br>**86208**<br>**86205**<br><br>**86207**<br>**86204** | 3 | (105x44) [.61] | .012 | .30 | .031 | .79 | .186 | 4.72 | 40 | 127 | 70 | 222 |
| | | | | | **PRODUCT DESCRIPTION:** *Tinned copper, vinyl insulated, conductors cabled with fillers, bar copper spiral shield, gray or white vinyl jacket. Conductor color code: White, green, brown.* ***Suggested working voltage: 300*** | | | | | | | | | | |

•*See 8421 page 52 for spiral wrapped shield version of 8401–Recommended for Hi-Fi use.* †***Passes the FR-1 vertical flame test.***
**Capacitance between conductors.* ***Capacitance between 1 conductor and other conductor connected to shield*

bonded flat cable | BELDEN

# Bonded Flat Cable



**UL LISTED 2697**

Belden Bonded Flat Cable meets Underwriters Laboratories, Inc. Listed Style No. 2697. Passes FR-1 Vertical Flame Test.

**Conductors:**
Available in stranded tinned copper conductors. 10 to 30 conductors per cable.
22 AWG STRANDED
24 AWG STRANDED
26 AWG STRANDED

**Temperature Rating:** 80°C.

**Voltage Rating:** 300V.

**Conductor Insulation:**
.010" (.25mm)

**Color Code:**
Brown / Red / Orange / Yellow / Green / Blue / Violet / Grey / White / Black. Colors repeat.

**Lengths:**
Standard 100' put-ups. Other lengths available on a special order basis.

### 7 STRAND CONSTRUCTIONS

| Trade No. | Standard Length | U.P.C. No. | AWG (Stranding) [Dia. in mm] | No. of Cond. | Nom. Width Inch | Nom. Width mm | Nom. Thickness Inch | Nom. Thickness mm |
|---|---|---|---|---|---|---|---|---|
| ★ 9A22010 | 100' | 89253 | 22 (7x30) [.76] | 10 | .51 | 12.94 | .051 | 1.3 |
| ★ 9A22014 | 100' | 86261 | 22 (7x30) [.76] | 14 | .71 | 18.03 | .051 | 1.3 |
| ★ 9A22015 | 100' | 89252 | 22 (7x30) [.76] | 15 | .77 | 19.43 | .051 | 1.3 |
| ★ 9A22016 | 100' | 86260 | 22 (7x30) [.76] | 16 | .82 | 20.83 | .051 | 1.3 |
| ★ 9A22020 | 100' | 89251 | 22 (7x30) [.76] | 20 | 1.01 | 25.91 | .051 | 1.3 |
| ★ 9A22030 | 100' | 89250 | 22 (7x30) [.76] | 30 | 1.53 | 38.86 | .051 | 1.3 |
| ★ 9A24010 | 100' | 89249 | 24 (7x32) [.61] | 10 | .44 | 11.18 | .044 | 1.12 |
| ★ 9A24014 | 100' | 86259 | 24 (7x32) [.61] | 14 | .62 | 15.75 | .044 | 1.12 |
| ★ 9A24015 | 100' | 89248 | 24 (7x32) [.61] | 15 | .66 | 16.76 | .044 | 1.12 |
| ★ 9A24016 | 100' | 86258 | 24 (7x32) [.61] | 16 | .70 | 17.78 | .044 | 1.12 |
| ★ 9A24020 | 100' | 89247 | 24 (7x32) [.61] | 20 | .88 | 22.35 | .044 | 1.12 |
| ★ 9A24030 | 100' | 89246 | 24 (7x32) [.61] | 30 | 1.32 | 33.53 | .044 | 1.12 |
| ★ 9A26010 | 100' | 89245 | 26 (7x34) [.48] | 10 | .39 | 9.91 | .039 | 1.00 |
| ★ 9A26014 | 100' | 86257 | 26 (7x34) [.48] | 14 | .55 | 13.97 | .039 | 1.00 |
| ★ 9A26015 | 100' | 89244 | 26 (7x34) [.48] | 15 | .59 | 14.99 | .039 | 1.00 |
| ★ 9A26016 | 100' | 86256 | 26 (7x34) [.48] | 16 | .62 | 15.75 | .039 | 1.00 |
| ★ 9A26020 | 100' | 89243 | 26 (7x34) [.48] | 20 | .78 | 19.81 | .039 | 1.00 |
| ★ 9A26030 | 100' | 89242 | 26 (7x34) [.48] | 30 | 1.17 | 29.72 | .039 | 1.00 |

### 19 STRAND CONSTRUCTIONS

| Trade No. | Standard Length | U.P.C. No. | AWG (Stranding) [Dia. in mm] | No. of Cond. | Nom. Width Inch | Nom. Width mm | Nom. Thickness Inch | Nom. Thickness mm |
|---|---|---|---|---|---|---|---|---|
| ★ 9B22010 | 100' | 89241 | 22 (19x34) [.80] | 10 | .51 | 12.94 | .051 | 1.3 |
| ★ 9B22015 | 100' | 89240 | 22 (19x34) [.80] | 15 | .77 | 19.43 | .051 | 1.3 |
| ★ 9B22020 | 100' | 89239 | 22 (19x34) [.80] | 20 | 1.02 | 25.91 | .051 | 1.3 |
| ★ 9B22030 | 100' | 89238 | 22 (19x34) [.80] | 30 | 1.53 | 38.86 | .051 | 1.3 |
| ★ 9B24010 | 100' | 89237 | 22 (19x36) [.64] | 10 | .45 | 11.43 | .045 | 1.14 |
| ★ 9B24015 | 100' | 89236 | 22 (19x36) [.64] | 15 | .68 | 17.15 | .045 | 1.14 |
| ★ 9B24020 | 100' | 89235 | 22 (19x36) [.64] | 20 | .90 | 22.86 | .045 | 1.14 |
| ★ 9B24030 | 100' | 89234 | 22 (19x36) [.64] | 30 | 1.35 | 34.29 | .045 | 1.14 |

## CROSS TALK & TIME DELAY

**Conditions of test.** Cable Connected: G,D,G,S,G,D,G; 1 MHz Pulse Frequency Rise Time; Length of Sample 10';
Termination of cable in its characteristic impedance;
Cable driving voltage amplitude: 1 volt.

G = Ground
D = Drive Line
S = Sampling Line

**NEAR END OF SCOPE PICTURE**

| PART NUMBER | PULSE WIDTH (NANOSECONDS) 1.5 | 3.0 | 5.0 | 10.0 |
|---|---|---|---|---|
| | CROSS TALK | | | |
| 9A22010 9B22010 | 1.6% | 1.3% | 1.18% | 10.8% |
| 9A24015 9B24015 | 1.8% | 1.6% | 1.4% | 1.3% |
| 9A26030 | 2.3% | 2.2% | 2.1% | 2.0% |

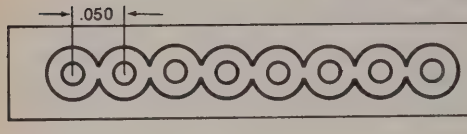
**FAR END OF SCOPE PICTURE**

| PART NUMBER | PULSE WIDTH (NANOSECONDS) 1.5 | 3.0 | 5.0 | 10.0 |
|---|---|---|---|---|
| | CROSS TALK | | | |
| 9A22010 9B22010 | 6.4% | 3.5% | 2.1% | 1.1% |
| 9A24015 9B24015 | 7.2% | 4.2% | 2.6% | 1.2% |
| 9A26030 | 8.8% | 5.5% | 3.3% | 1.6% |

★ New Item

BELDEN | laminated flat cable

# Laminated Flat Cable




**UL LISTED 2651**

Vinyl jacket 300V-105°C. Underwriters Laboratories, Inc. Listed Style No. 2651. Passes FR-1 Vertical Flame Test.

**Conductors:**
Available in tinned copper stranded conductors. 10 to 60 conductors per cable. 28 AWG STRANDED

**Temperature Rating:** 105°C.

**Voltage Rating:** 300V

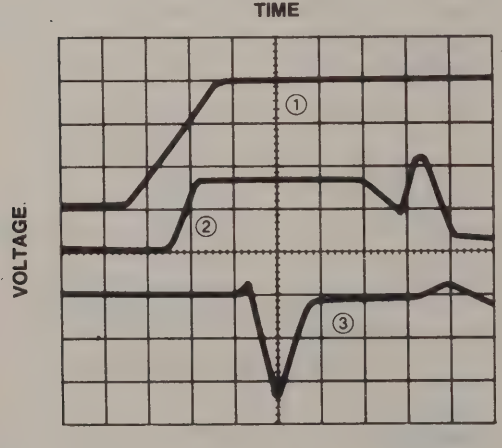
**Color Code:**
Blue line on edge of cable indicates "polarity."

**Lengths:**
Standard 100' put-ups. Other lengths available on a special order basis.

| Trade No. | Standard Length | U.P.C. No. | AWG (Stranding) [Dia. in mm] | No. of Cond. | Nom. Width In. | Nom. Width mm | Nom. Thickness In. | Nom. Thickness mm |
|---|---|---|---|---|---|---|---|---|
| ★9L28010 | 100' | 89233 | 28 (7x36) [.38] | 10 | .50 | 12.70 | .034 | .86 |
| ★9L28014 | 100' | 89231 | 28 (7x36) [.38] | 14 | .70 | 17.78 | .034 | .86 |
| ★9L28016 | 100' | 89229 | 28 (7x36) [.38] | 16 | .80 | 20.32 | .034 | .86 |
| ★9L28020 | 100' | 89227 | 28 (7x36) [.38] | 20 | 1.00 | 25.40 | .034 | .86 |
| ★9L28024 | 100' | 89225 | 28 (7x36) [.38] | 24 | 1.20 | 30.48 | .034 | .86 |
| ★9L28025 | 100' | 89223 | 28 (7x36) [.38] | 25 | 1.25 | 31.75 | .034 | .86 |
| ★9L28026 | 100' | 89221 | 28 (7x36) [.38] | 26 | 1.30 | 33.02 | .034 | .86 |
| ★9L28034 | 100' | 89219 | 28 (7x36) [.38] | 34 | 1.70 | 43.18 | .034 | .86 |
| ★9L28037 | 100' | 89217 | 28 (7x36) [.38] | 37 | 1.85 | 46.99 | .034 | .86 |
| ★9L28040 | 100' | 89215 | 28 (7x36) [.38] | 40 | 2.00 | 58.80 | .034 | .86 |
| ★9L28050 | 100' | 89213 | 28 (7x36) [.38] | 50 | 2.50 | 63.50 | .034 | .86 |
| ★9L28060 | 100' | 89211 | 28 (7x36) [.38] | 60 | 3.00 | 76.20 | .034 | .86 |

## LAMINATED PULSE CROSS TALK

**3 NANOSECONDS PULSE TR(10-90) = 3NS**

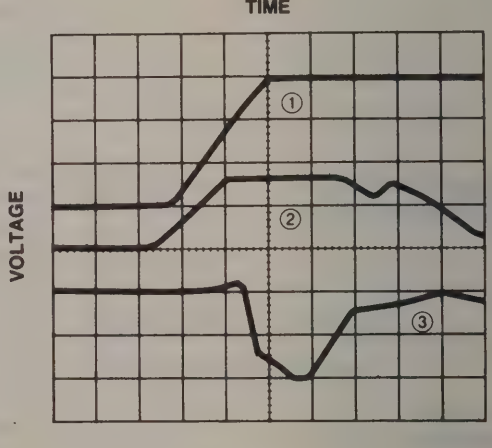



① Drive pulse of 300 millivolts. Vertical is 100 mv/division and horizontal is 2 nanoseconds per division.

② Near end cross talk of 3.6%. Vertical is 5 mv/division and horizontal is 5 nanoseconds per division.

③ Far end cross talk of 7.3%. Vertical is 10 mv/division and horizontal is 5 nanoseconds per division.

**7 NANOSECONDS PULSE TR(10-90) = 7NS**



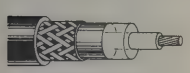

① Drive pulse of 300 millivolts. Vertical is 100 mv/division and horizontal is 5 nanoseconds per division.

② Near end cross talk of 2.5%. Vertical is 5 mv/division and horizontal is 5 nanoseconds per division.

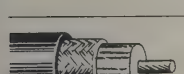
③ Far end cross talk of 3.3%. Vertical is 5 mv/division and horizontal is 5 nanoseconds per division.

# Coaxial Cables

## LOW NOISE COAXIAL CABLES

| Description | Trade & UL Type Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | AWG (Strand-ing) [Dia. in mm] Nom. D.C.R. | Insulation & Nominal Core O.D. Inch | Insulation & Nominal Core O.D. mm | Nominal O.D. Inch | Nominal O.D. mm | No. of Shields and Material Nom. D.C.R. | Nom. Imp. (ohms) | Nom. Vel. of Prop. | Nominal Capacitance pF/ft. | Nominal Capacitance pF/m | Nominal Attenuation MHz | Nominal Attenuation db/100 ft. | Nominal Attenuation db/100 m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 174/U TYPE | ★9239 UL LISTED 174/4 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | 86253<br>86252<br>86251 | 26 (7x34) [.48] bare copper covered steel 97Ω/M' 318.3Ω/km | Poly-ethylene .048 | 1.22 | .101 | 2.57 | 1 tinned copper 88% shield coverage | — | 62% | 39.3 | 12.9 | — | — | — |
| | | | | | | | | | | | **PRODUCT DESCRIPTION:** *Bare copper covered steel conductor, polyethylene insulation, conductive layer, tinned copper braid shield. Black vinyl jacket.* | | | | | | | |
|  58/U TYPE | 9223 | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | 95740<br>95739<br>95738 | 22 (7x30) [.76] tinned copper | .112 | — | .195 | 4.95 | 95% shield coverage | 43 | 50 | 47 | 154 | — | — | — |
| | | | | | | | | | | | **PRODUCT DESCRIPTION:** *Tinned copper conductor, conductive polyethylene, polyethylene. Duobond®, tinned copper braid shield. Nom. Core O.D. .112". Black vinyl jacket.* | | | | | | | |
| 59/U TYPE | ★9224 | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | 87849<br>86318<br>87848<br>86317<br>87847 | 22 (Solid) [.64] bare copper covered steel 65Ω/M' 213.3Ω/km | Poly-ethylene .146 | 3.71 | .242 | 6.15 | 1 bare copper 93% shield coverage | | | | | | | |
| | | | | | | | | | | | **PRODUCT DESCRIPTION:** *Bare copper covered steel conductor, polyethylene insulation, conductive layer, bare copper braid.* *Black vinyl jacket.* | | | | | | | |

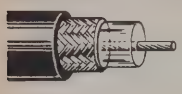
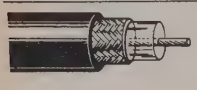
## COAXIAL CABLES

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8/U JAN-C-17A | 8237† | 50<br>100<br>400<br>500<br>1000 | 15.2<br>30.5<br>121.9<br>152.4<br>304.8 | 98294<br>98293<br>98292<br>98291<br>98290 | 13 (17x21) [2.16] bare copper 1.87Ω/M' 6.1Ω/km | Poly-ethylene .285 | 7.24 | .405 | 10.29 | 1 bare copper 1.2Ω/M' 3.9Ω/km 97% shield coverage | 52 | 66% | 29.5 | 96.8 | 100<br>200<br>400<br>900 | 2.0<br>3.0<br>4.7<br>7.8 | 6.6<br>9.8<br>15.4<br>25.6 |
| | | | | | | | | | | | *Black vinyl jacket.* | | | | | | | |
| 8/U MIL-C17D | 9251† UL LISTED 1354 | 100<br>400<br>500<br>1000 | 30.5<br>121.9<br>152.4<br>304.8 | 95675<br>95674<br>95673<br>95672 | 13 (7x21) [2.16] bare copper 1.87Ω/M' 6.1Ω/km | Poly-ethylene .285 | 7.24 | .405 | 10.29 | 1 bare copper 1.2Ω/M' 3.9Ω/km 97% shield coverage | 52 | 66% | 29.5 | 96.8 | 100<br>200<br>400<br>900 | 2.0<br>3.0<br>4.7<br>7.8 | 6.6<br>9.8<br>15.4<br>25.6 |
| | | | | | | | | | | | *Black non-contaminating vinyl jacket.* | | | | | | | |
|  8/U TYPE | 8214† UL LISTED 1354 | 50<br>100<br>400<br>500<br>1000 | 15.2<br>30.5<br>121.9<br>152.4<br>304.8 | 98388<br>98387<br>98386<br>98385<br>98384 | 11 (7x19) [2.74] bare copper 1.15Ω/M' 3.8Ω/km | Cellular Poly-ethylene .285 | 7.24 | .405 | 10.29 | 1 bare copper 1.1Ω/M' 3.6Ω/km 97% shield coverage | 50 | 78% | 26.0 | 85.3 | 50<br>100<br>200<br>300<br>400 | 1.2<br>1.8<br>2.6<br>3.3<br>3.8 | 3.9<br>5.9<br>8.5<br>10.8<br>12.5 |
| | | | | | | | | | | | *Black vinyl jacket.* | | | | | | | |
| | 9208 | 100<br>White<br>Black<br>500<br>White<br>Black<br>1000<br>White<br>Black | 30.5<br><br><br>152.4<br><br><br>304.8<br><br> | <br><br>95763<br>95762<br><br>95761<br>95760<br><br>95759<br>95758 | 13 (7x21) [2.17] bare copper 1.87Ω/M' 6.1Ω/km | Cellular Poly-ethylene .274 | | .397 | 10.1 | 80% bare copper 80% shield coverage | 57 | 78% | 22.6 | 74.1 | 50<br>100<br>200<br>400<br>900 | 1.2<br>1.8<br>2.7<br>4.3<br>7.1 | 3.9<br>6.0<br>9.0<br>14.0<br>23.3 |
| | | | | | | | | | | | **PRODUCT DESCRIPTION:** *Bare stranded copper, cellular polyethylene case, bare copper braid, black on white vinyl jacket.* | | | | | | | |

★ New Item †Passes the FR-1 vertical flame test **REQUEST QUOTATIONS OF RG/U CABLES NOT LISTED**

BELDEN | coaxial cables

## COAXIAL CABLES (cont'd.)

| Description | Trade & UL Type Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | AWG (Stranding) [Dia. in mm] Nom. D.C.R. | Insulation & Nominal Core O.D. Inch | Insulation & Nominal Core O.D. mm | Nominal O.D. Inch | Nominal O.D. mm | No. of Shields and Material Nom. D.C.R. | Nom. Imp. (ohms) | Nom. Vel. of Prop. | Nominal Capacitance pF/ft. | Nominal Capacitance pF/m | Nominal Attenuation MHz | Nominal Attenuation db/100 ft. | Nominal Attenuation db/100 m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9/U JAN-C-17A | **8242**† | 100<br>1000 | 30.5<br>304.8 | **98271**<br>**98270** | 13 (7x21) [2.17] silver coated copper 1.87Ω/M' 6.1Ω/km | Polyethylene .280 | 7.11 | .420 | 10.67 | 2-inner-silver coated outer-bare copper 0.7Ω/M' 2.3Ω/km 97% shield coverage | 51 | 66% | 30.0 | 98.4 | 100<br>200<br>400<br>900 | 1.9<br>2.8<br>4.1<br>6.5 | 6.2<br>9.2<br>13.5<br>21.3 |
| | | | | | | | | | | *Gray non-contaminating vinyl jacket.* | | | | | | | |
|  11/U JAN-C-17A | **8238**† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **98289**<br>**98288**<br>**98287** | 18 (7x26) [1.22] tinned copper 6.06Ω/M' 19.9Ω/km | Polyethylene .285 | 7.24 | .405 | 10.29 | 1 bare copper 1.24Ω/M' 4.1Ω/km 97% shield coverage | 75 | 66% | 20.5 | 67.3 | 100<br>200<br>400<br>900 | 2.0<br>2.9<br>4.2<br>6.9 | 6.6<br>9.5<br>13.8<br>22.6 |
| | | | | | | | | | | *Black vinyl jacket.* | | | | | | | |
|  11 A/U MIL-C-17D | **8261**† | 500<br>1000 | 152.4<br>304.8 | **98253**<br>**98252** | 18 (7x26) [1.22] tinned copper 6.06Ω/M' 19.9Ω/km | Polyethylene .285 | 7.24 | .405 | 10.29 | 1 bare copper 1.24Ω/M' 97% shield coverage | 75 | 66% | 20.5 | 67.3 | 100<br>200<br>400<br>900 | 2.0<br>2.9<br>4.2<br>6.9 | 6.6<br>9.5<br>13.8<br>22.6 |
| | | | | | | | | | | *Black non-contaminating vinyl jacket.* | | | | | | | |
| 58/U JAN-C-17A | **8240** UL LISTED **1354** | 25<br>50<br>100<br>U-500<br>500<br>U-1000<br>1000 | 7.6<br>15.2<br>30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **98284**<br>**98283**<br>**98282**<br>**98286**<br>**98281**<br>**98285**<br>**98280** | 20 (Solid) [.81] bare copper 10.1Ω/M' 33.1Ω/km | Polyethylene .116 | 2.95 | .195 | 4.95 | 1 tinned copper 4.1Ω/M' 13.5Ω/km 95% shield coverage | 53.5 | 66% | 28.5 | 93.5 | 100<br>200<br>400<br>900 | 4.1<br>6.2<br>9.5<br>14.5 | 13.5<br>20.3<br>31.2<br>47.6 |
| | | | | | | | | | | *Black vinyl jacket.* | | | | | | | |
| | ★**9201** | 100<br>White<br>Black<br>U-500<br>White<br>Black<br>500<br>White<br>Black<br>U-1000<br>White<br>Black<br>1000<br>White<br>Black | 30.5<br><br><br>U-152.4<br><br><br>152.4<br><br><br>U-304.8<br><br><br>304.8 | <br><br>**95769**<br>**95768**<br><br><br>**95773**<br>**95772**<br><br>**95767**<br>**95766**<br><br>**95771**<br>**95770**<br><br>**95765**<br>**95764** | 20 (Solid) [.81] bare copper 10.1Ω/M' 33.1Ω/km | Polyethylene .116 | 2.95 | .193 | 4.90 | 80% bare copper 78% shield coverage | 53 | 66% | 28.5 | 92.4 | 100<br>200<br>400<br>900 | 4.1<br>6.2<br>9.5<br>14.5 | 13.5<br>20.3<br>31.2<br>47.6 |
| | | | | | | | | | | **PRODUCT DESCRIPTION:** *Bare copper conductor, solid polyethylene core, bare copper braid, black or white vinyl jacket.* | | | | | | | |
| 58/U TYPE | **9310** UL LISTED **1354** | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **95485**<br>**86299**<br>**95484**<br>**86298**<br>**95483** | 20 (Solid) [.81] bare copper 10.1Ω/M' 33.1Ω/km | Polyethylene .116 | 2.95 | .195 | 4.95 | 2 Duobond & 56% tinned copper braid 14.0Ω/M' 45.9Ω/km 100% shield coverage | 53.5 | 66% | 28.5 | 93.5 | 100<br>200<br>400<br>900 | 4.1<br>6.2<br>9.5<br>14.5 | 13.5<br>20.3<br>31.2<br>47.6 |
| | | | | | | | | | | *Black vinyl jacket.* | | | | | | | |
| 58A/U JAN-C-17A | **8259** | 25<br>50<br>100<br>U-500<br>500<br>U-1000<br>1000 | 7.6<br>15.2<br>30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **98258**<br>**98257**<br>**98256**<br>**98260**<br>**98255**<br>**98259**<br>**98254** | 20 (19x.0071) [.89] tinned copper 10.8Ω/M' 35.4Ω/km | Polyethylene .116 | 2.95 | .195 | 4.95 | 1 tinned copper 4.1Ω/M' 13.5Ω/km 96% shield coverage | 50 | 66% | 30.8 | 101.0 | 100<br>200<br>400<br>900 | 5.3<br>8.2<br>12.6<br>20.0 | 17.4<br>26.9<br>41.3<br>65.6 |
| | | | | | | | | | | *Black vinyl jacket.* | | | | | | | |

★ New Item **REQUEST QUOTATIONS OF RG/U CABLES NOT LISTED**

## COAXIAL CABLES (cont'd.)

| Description | Trade & UL Type Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | AWG (Stranding) [Dia. in mm] Nom. D.C.R. | Insulation & Nominal Core O.D. Inch | Insulation & Nominal Core O.D. mm | Nominal O.D. Inch | Nominal O.D. mm | No. of Shields and Material Nom. D.C.R. | Nom. Imp. (ohms) | Nom. Vel. of Prop. | Nominal Capacitance pF/ft. | Nominal Capacitance pF/m | Nominal Attenuation MHz | Nominal Attenuation db/ 100 ft. | Nominal Attenuation db/ 100 m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 58 C/U MIL-C-17D | **8262** UL LISTED | U-500<br>500<br>U-1000<br>1000 | U-152.4<br>152.4<br>U-304.8<br>304.8 | **98251**<br>**98249**<br>**98250**<br>**98248** | 20 (19x.0071) [.89] tinned copper 10.8Ω/M' 35.4Ω/km | Polyethylene .116 | 2.95 | .195 | 4.95 | 1 tinned copper 4.1Ω/M' 13.5Ω/km 95% shield coverage | 50 | 66% | 30.8 | 101.0 | 100<br>200<br>400<br>900 | 5.3<br>8.2<br>12.6<br>20.0 | 17.4<br>26.9<br>41.3<br>65.6 |
| | | | | | | | | | | *Black non-contaminating vinyl jacket.* | | | | | | | |
| 58 A/U TYPE | **8219** UL LISTED **1354** | 100<br>White<br>Black<br>U-500<br>White<br>Black<br>500<br>White<br>Black<br>U-1000<br>White<br>Black<br>1000<br>White<br>Black | 30.5<br><br><br>U-152.4<br><br><br>152.4<br><br><br>U-304.8<br><br><br>304.8 | <br><br>**98369**<br>**98368**<br><br>**98373**<br>**98372**<br><br>**98367**<br>**98366**<br><br>**98371**<br>**78370**<br><br>**98365**<br>**98364** | 20 (19x32) [.94] tinned copper 8.8Ω/M' 28.9Ω/km | Cellular Polyethylene .116 | 2.95 | .195 | 4.95 | 1 tinned copper 4.1Ω/M' 13.5Ω/km 96% shield coverage | 50 | 78% | 26.0 | 85.3 | 100<br>200<br>400<br>900 | 4.8<br>6.9<br>10.1<br>15.5 | 15.8<br>22.6<br>33.1<br>50.9 |
| | | | | | | | | | | *Black or white vinyl jacket.* | | | | | | | |
| 58 A/U TYPE | **9311** UL LISTED **1354** | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **95482**<br>**86297**<br>**95481**<br>**86296**<br>**95480** | 20 (19x32) [.94] tinned copper 8.8 /M' 28.9 /km | Cellular Polyethylene .114 | 2.90 | .195 | 4.95 | 2 Duobond & 56% tinned copper braid 17Ω/M' 55.8Ω/km | 50 | 78% | 26.0 | 85.3 | 100<br>200<br>400<br>900 | 4.8<br>6.9<br>10.1<br>15.5 | 15.8<br>22.6<br>33.4<br>50.9 |
| | | | | | | | | | | *Black vinyl jacket.* | | | | | | | |
| 59/U JAN-C-17A | **8241*** UL LISTED **1354** | 25<br>50<br>100<br>U-500<br>500<br>U-1000<br>1000 | 7.6<br>15.2<br>30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **98277**<br>**98276**<br>**98275**<br>**98279**<br>**98274**<br>**98278**<br>**98273** | 22 (Solid) [.64] bare copper covered steel 55Ω/M' 180.5Ω/km | Polyethylene .146 | 3.71 | .242 | 6.15 | 1 bare copper 2.7Ω/M' 8.9Ω/km 95% shield coverage | 73 | 66% | 21.0 | 68.9 | 100<br>200<br>400 | 3.4<br>4.9<br>7.1 | 11.2<br>16.1<br>23.3 |
| | | | | | | | | | | *Black vinyl jacket.* | | | | | | | |
| | **9244** UL LISTED **1354** | U-500<br>500<br>U-1000<br>1000 | U-152.4<br>152.4<br>U-304.8<br>304.8 | **95694**<br>**95692**<br>**95693**<br>**95691** | 22 (Solid) [.64] bare copper covered steel 55.0Ω/M' 180.5Ω/km | Polyethylene .146 | 3.71 | .240 | 6.10 | bare copper braid 4.5Ω/M' 14.8Ω/km 86% shield coverage | 73 | 66% | 21.0 | 68.9 | 50<br>100<br>200<br>500<br>900 | 2.4<br>3.4<br>4.9<br>9.1<br>13.9 | 7.9<br>11.2<br>16.7<br>26.9<br>45.6 |
| | | | | | | | | | | *Black vinyl jacket.*<br>***100% SWEEP TESTED*** | | | | | | | |
| | **8221** | 100<br>Gray<br>White<br>Black<br>U-500<br>Gray<br>White<br>Black<br>500<br>Gray<br>White<br>Black<br>U-1000<br>Gray<br>White<br>Black<br>1000<br>Gray<br>White<br>Black | 30.5<br><br><br><br>U-152.4<br><br><br><br>152.4<br><br><br><br>U-304.8<br><br><br><br>304.8 | <br><br><br>**98357**<br>**98356**<br>**98355**<br><br>**98363**<br>**98362**<br>**98361**<br><br>**98354**<br>**98353**<br>**98352**<br><br>**98360**<br>**98359**<br>**98358**<br><br>**98351**<br>**98350**<br>**98349** | 22 (Solid) [.64] bare copper covered steel 55.0Ω/M' 180.5Ω/km | Cellular Polyethylene .146 | 3.71 | .242 | 6.15 | bare copper braid 2.6Ω/M' 8.5Ω/km 95% shield coverage | 80 | 78% | 16.3 | 53.5 | 50<br>100<br>200<br>500<br>900 | 2.1<br>2.9<br>4.1<br>6.6<br>8.8 | 6.9<br>9.5<br>13.5<br>21.7<br>28.9 |
| | | | | | | | | | | *Gray, white or black vinyl jacket.*<br>***100% SWEEP TESTED*** | | | | | | | |

**Sweep tested 8241 is available on special order*
*†Passes the FR-1 vertical flame test*

**REQUEST QUOTATIONS OF RG/U CABLES NOT LISTED**

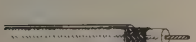
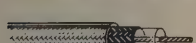
BELDEN | coaxial cables

## COAXIAL CABLES (Cont'd)

| Description | Trade & UL Type Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | AWG (Stranding) [Dia. in mm] Nom. D.C.R. | Insulation & Nominal Core O.D. Inch | Insulation & Nominal Core O.D. mm | Nominal O.D. Inch | Nominal O.D. mm | No. of Shields and Material Nom. D.C.R. | Nom. Imp. (ohms) | Nom. Vel. of Prop. | Nominal Capacitance pF/ft. | Nominal Capacitance pF/m | Nominal Attenuation MHz | Nominal Attenuation db/100 ft. | Nominal Attenuation db/100 m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 59B/U MIL-C-17D | **8263** | U-500<br>500<br>U-1000<br>1000 | U-152.4<br>152.4<br>U-304.8<br>304.8 | **98247**<br>**98245**<br>**98246**<br>**98244** | .023 (Solid)<br>[.57]<br>bare copper covered steel<br>65Ω/M'<br>213.3Ω/km | Poly-ethylene<br>.146 | <br>3.71 | .242 | 6.15 | 1<br>bare copper<br>2.57Ω/M'<br>8.4Ω/km<br>95% shield coverage | 75 | 66% | 20.5 | 67.3 | 100<br>200<br>400<br>900 | 3.5<br>5.1<br>7.5<br>12.0 | 11.5<br>16.7<br>24.6<br>39.4 |
| | | | | | | | | | | *Black non-contaminating vinyl jacket.* | | | | | | | |
| 59/U TYPE | **9259** UL LISTED **1354** | 50<br>100<br>U-500<br>500<br>U-1000<br>1000 | 15.2<br>30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **95640**<br>**95639**<br>**95642**<br>**95638**<br>**95641**<br>**95637** | 22 (7x30)<br>(1x29)<br>[.76]<br>bare copper<br>15.0Ω/M'<br>49.2Ω/km | Cellular Poly-ethylene<br>.146 | <br>3.71 | .242 | 6.15 | 1<br>bare copper<br>2.6Ω/M'<br>8.5Ω/km<br>95% shield coverage | 75 | 78% | 17.3 | 56.8 | 100<br>200<br>400 | 3.0<br>4.4<br>6.5 | 9.7<br>14.5<br>21.4 |
| | | | | | | | | | | *Black vinyl jacket.*<br>***For CCTV applications. 100% SWEEP TESTED.*** | | | | | | | |
| 62/U Jan-C-17A | **8254** | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **98267**<br>**86370**<br>**98266**<br>**86369**<br>**98265** | 22 (Solid)<br>[.64]<br>bare copper covered steel<br>55Ω/M'<br>180.5Ω/km | Semi-solid Poly-ethylene<br>.146 | <br>3.71 | .242 | 6.15 | 1<br>bare copper<br>2.6Ω/M'<br>8.5Ω/km<br>95% shield coverage | 93 | 84% | 13.5 | 44.3 | 100<br>200<br>400<br>900 | 3.1<br>4.4<br>6.3<br>11.0 | 10.2<br>14.4<br>20.7<br>36.1 |
| | | | | | | | | | | *Black vinyl jacket.* | | | | | | | |
| 62B/U MIL-C-17D | **8255** UL LISTED **1381** | U-500<br>500<br>U-1000<br>1000 | U-152.4<br>152.4<br>U-304.8<br>304.8 | **86368**<br>**98262**<br>**86367**<br>**98261** | 24 (7x32)<br>[.61]<br>bare copper covered steel<br>53.4Ω/M'<br>175.2Ω/km | Semi-solid Poly-ethylene<br>.146 | <br>3.71 | .242 | 6.15 | 1<br>bare copper<br>2.6Ω/M'<br>8.5Ω/km<br>95% shield coverage | 93 | 84% | 13.5 | 44.3 | 100<br>200<br>400<br>900 | 3.3<br>4.6<br>6.6<br>11.4 | 10.8<br>15.1<br>21.7<br>37.4 |
| | | | | | | | | | | *Black non-contaminating vinyl jacket.* | | | | | | | |
| 62A/U TYPE | **9268**† UL LISTED **1381** | U-500<br>500<br>U-1000<br>1000<br>2000 | U-152.4<br>152.4<br>U-304.8<br>304.8<br>609.6 | **86314**<br>**95605**<br>**86313**<br>**95604**<br>**95603** | 22 (Solid)<br>[.64]<br>bare copper covered steel<br>41.2Ω/M'<br>135.2Ω/km | Semi-solid Poly-ethylene<br>.146 | <br>3.71 | .260 | 6 60 | 1<br>bare copper<br>2.6Ω/M'<br>8.5Ω/km<br>95% shield coverage | 93 | 84% | 14.5 | 47.6 | 100<br>200<br>400<br>900 | 3.1<br>4.4<br>6.3<br>11.0 | 10.2<br>14.4<br>20.7<br>36.1 |
| | | | | | | | | | | *Black vinyl jacket.* | | | | | | | |
| 62A/U TYPE | **9269** UL LISTED **1381** | U-500<br>500<br>U-1000<br>1000<br>2000 | U-152.4<br>152.4<br>U-304.8<br>304.8<br>609.6 | **86312**<br>**95600**<br>**86311**<br>**95599**<br>**95598** | 22 (Solid)<br>[.64]<br>bare copper covered steel<br>41.2Ω/M'<br>135.2Ω/km | Semi-solid Poly-ethylene<br>.146 | <br>3.71 | .242 | 6.15 | 1<br>bare copper<br>2.6Ω/M'<br>8.5Ω/km<br>95% shield coverage | 93 | 84% | 13.5 | 44.3 | 100<br>200<br>400<br>900 | 3.1<br>4.4<br>6.3<br>11.0 | 10.2<br>14.4<br>20.7<br>36.1 |
| | | | | | | | | | | *Black vinyl jacket.* | | | | | | | |
| 122/U MIL-C-17D | **9252** UL LISTED **1354** | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **95669**<br>**95671**<br>**95668**<br>**95670**<br>**95667** | 22 (27x36)<br>[.71]<br>tinned copper<br>17.1Ω/M'<br>56.1Ω/km | Poly-ethylene<br>.096 | <br>2.44 | .160 | 4.06 | 1<br>tinned copper<br>5.2Ω/M'<br>17.1Ω/km<br>97% shield coverage | 50 | 66% | 30.8 | 101.0 | 100<br>200<br>400<br>900 | 7.0<br>11.0<br>16.5<br>28.0 | 23.0<br>36.1<br>54.1<br>91.9 |
| | | | | | | | | | | *Black non-contaminating vinyl jacket.* | | | | | | | |

*†Passes the FR-1 vertical flame test* **REQUEST QUOTATIONS OF RG/U CABLES NOT LISTED**

## COAXIAL CABLES (Cont'd)

| Description | Trade & UL Type Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | AWG (Stranding) [Dia. in mm] Nom. D.C.R. | Insulation & Nominal Core O.D. Inch | Insulation & Nominal Core O.D. mm | Nominal O.D. Inch | Nominal O.D. mm | No. of Shields and Material Nom. D.C.R. | Nom. Imp. (ohms) | Nom. Vel. of Prop. | Nominal Capacitance pF/ft. | Nominal Capacitance pF/m | Nominal Attenuation MHz | Nominal Attenuation db/100 ft. | Nominal Attenuation db/100 m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 141A/U MIL-C-17D | **83241**† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **93925**<br>**93924**<br>**93923** | 18 (Solid) [1.02] silver coated copper covered steel 16.3Ω/M' 53.5Ω/km | TFE Teflon .116 | 2.95 | .190 | 4.83 | 1 silver coated copper 4.26Ω/M' 14.0Ω/km 97% shield coverage | 50 | 69.5% | 29.0 | 95.1 | 400 | 9.0 Max. | 29.5 |
| | | | | | | | | | | *Brown fiber glass jacket.* | | | | | | | |
| 142B/U MIL-C-17D | **83242**† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **93922**<br>**93921**<br>**93920** | 18 (Solid) [1.02] silver coated copper covered steel 16.3Ω/M' 53.5Ω/km | TFE Teflon .116 | 2.95 | .195 | 4.95 | 2 silver coated copper 2.28Ω/M' 7.5Ω/km 98% shield coverage | 50 | 69.5% | 29.0 | 95.1 | 400 | 9.0 Max. | 29.5 |
| | | | | | | | | | | *Tin[illegible]brown FEP jacket.* | | | | | | | |
| 174/U MIL-C-17D | **8216**<br>**1354** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **98381**<br>**98380**<br>**98379** | 26 (7x34) [.48] bare copper covered steel 97Ω/M' 318.3Ω/km | Polyethylene .060 | 1.52 | .100 | 2.54 | 1 tinned copper 10.3Ω/M' 33.8Ω/km 88% shield coverage | 50 | 66% | 30.8 | 101.0 | 100<br>200<br>400 | 8.8<br>13.0<br>20.0 | 28.9<br>42.7<br>65.6 |
| | | | | | | | | | | *Black vinyl jacket.* | | | | | | | |
| 178B/U MIL-C-17D | **83265**† | 100<br>500 | 30.5<br>152.4 | **93916**<br>**93915** | 30 (7x38) [.31] silver coated copper covered steel 250Ω/M' 820.2Ω/km | TFE Teflon .034 | .86 | .070 | 1.78 | 1 silver coated copper 14.6Ω/M' 47.9Ω/km 96% shield coverage | 50 | 69.5% | 29.0 | 95.1 | 400 | 29.0 Max. | 95.1 |
| | | | | | | | | | | *Tinted brown FEP jacket* | | | | | | | |
|  179B/U MIL-C-17D | **83264**† | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **93919**<br>**93918**<br>**93917** | 30 (7x38) [.31] silver coated copper covered steel 250Ω/M' 820.3Ω/km | TFE Teflon .063 | 1.60 | .100 | 2.54 | 1 silver coated copper 8.5Ω/M' 27.9Ω/km 94% shield coverage | 75 | 69.5% | 19.5 | 64.0 | 400 | 21.0 Max. | 68.9 |
| | | | | | | | | | | *Tinted brown FEP jacket.* | | | | | | | |
|  180B/U MIL-C-17D | **83266**† | 100<br>500 | 30.5<br>152.4 | **93914**<br>**93913** | 30 (7x38) [.31] silver coated copper covered steel 250Ω/M' 820.3Ω/km | TFE Teflon .102 | 2.6 | .140 | 3.56 | 1 silver coated copper 6.5Ω/M' 21.3Ω/km 93% shield coverage | 95 | 69.5% | 15.0 | 49.21 | 400 | 17.0 Max. | 55.8 |
| | | | | | | | | | | *Tinted brown FEP jacket.* | | | | | | | |

*†Passes the FR-1 vertical flame test*

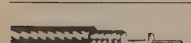
**REQUEST QUOTATIONS OF RG/U CABLES NOT LISTED**

BELDEN | coaxial cables

## COAXIAL CABLES (Cont'd)

| Description | Trade & UL Type Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | AWG (Stranding) [Dia. in mm] Nom. D.C.R. | Insulation & Nominal Core O.D. Inch | Insulation & Nominal Core O.D. mm | Nominal O.D. Inch | Nominal O.D. mm | No. of Shields and Material Nom. D.C.R. | Nom. Imp. (ohms) | Nom. Vel. of Prop. | Nominal Capacitance pF/ft. | Nominal Capacitance pF/m | Nominal Attenuation MHz | Nominal Attenuation db/100 ft. | Nominal Attenuation db/100 m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 213/U MIL-C-17D | **8267**† UL LISTED **1354** | 500<br>1000 | 152.4<br>304.8 | **98243**<br>**98242** | 13(7x21) [2.17] bare copper 1.87Ω/M' 6.1Ω/km | Polyethylene .285 | 7.24 | .405 | 10.29 | 1 bare copper 1.2Ω/M' 3.9Ω/km 97% shield coverage | 50 | 66% | 30.8 | 101.0 | 100<br>200<br>400<br>900 | 2.0<br>3.0<br>4.7<br>7.8 | 6.6<br>9.8<br>15.4<br>25.6 |
| | | | | | | | | | | *Black non-contaminating vinyl jacket.* | | | | | | | |
| 214/U MIL-C-17D | **8268**† UL LISTED **1354** | 500<br>1000 | 152.4<br>304.8 | **98241**<br>**98240** | 13 (7x.0296) [2.26] silver coated copper 1.73Ω/M' 5.7Ω/km | Polyethylene .285 | 7.24 | .425 | 10.80 | 2 silver coated copper .7Ω/M' 2.3Ω/km 98% shield coverage | 50 | 66% | 30.8 | 101.0 | 100<br>200<br>400<br>900 | 2.0<br>3.0<br>4.7<br>7.8 | 6.6<br>9.8<br>15.4<br>25.6 |
| | | | | | | | | | | *Black non-contaminating vinyl jacket.* | | | | | | | |
| 223/U MIL-C-17D | **9273** UL LISTED **1354** | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **95587**<br>**95589**<br>**95586**<br>**95588**<br>**95585** | 19 (Solid) [.91] silver coated copper 8.05Ω/M' 26.4Ω/km | Polyethylene .116 | 2.95 | .206 | 5.23 | 2 silver coated copper 2.53Ω/M' 8.3Ω/km 97% shield coverage | 50 | 66% | 30.8 | 101.0 | 100<br>200<br>400<br>900 | 4.5<br>6.4<br>9.2<br>14.3 | 14.8<br>21.0<br>30.2<br>46.9 |
| | | | | | | | | | | *Black non-contaminating vinyl jacket.* | | | | | | | |
| 316/U MIL-C-17D | **83284**† **TEFLON** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **93912**<br>**93911**<br>**93910** | 26 (7x.0067) [.51] silver coated copper covered steel 91.2Ω/M' 299.4Ω/km | TEF Teflon .060 | 1.52 | .098 | 2.49 | 1 silver coated copper 8.51Ω/M' 27.9Ω/km 95% shield coverage | 50 | 69.5% | 29.0 | 95.2 | 400 | 20.0 Max. | 65.5 |
| | | | | | | | | | | *Tinted Brown FEP jacket.* | | | | | | | |

## MINIATURE COAX CABLES

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **8700** | 25<br>50<br>100<br>250 | 7.6<br>15.2<br>30.5<br>76.2 | **96384**<br>**96383**<br>**96382**<br>**96381** | 28 (Solid) [.32] tinned copper 68.5Ω/M' 224.7Ω/km | Polypropylene .023 | .58 | .054 | 1.37 | 1 bare copper 41.5Ω/M' 136.2Ω/km 91 Percent shield coverage | .32 | 66% | 48.0 | 157.5 | 400 | 55.0 | 180.5 |
| | | | | | | | | | | *Black vinyl jacket.* | | | | | | | |
| | **9221** UL LISTED **1375** | 25<br>100<br>U-500<br>500 | 7.6<br>30.5<br>U-152.4<br>152.4 | **95746**<br>**95745**<br>**95747**<br>**95744** | 30 (7x38) [.30] tinned copper 100.0Ω/M' 328.0Ω/km | Cellular Polypropylene .056 | .142 | .097 | 2.46 | 1 tinned copper 8.5Ω/M' 27.9Ω/km 89% shield coverage | 75 | 78% | 17.3 | 56.7 | 100<br>200<br>400<br>900 | 10.5<br>17.0<br>26.5<br>49.0 | 34.5<br>55.8<br>87.0<br>160.8 |
| | | | | | | | | | | *Black vinyl jacket.* | | | | | | | |
|  | **8218** | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **98376**<br>**98378**<br>**98375**<br>**98377**<br>**98374** | 27 (7x35) [.43] bare copper covered steel 112.0Ω/M' 367.5Ω/km | Polyethylene .100 | 2.54 | .150 | 3.81 | 1 tinned copper 6.5Ω/M' 21.3Ω/km 93% shield coverage | 75 | 66% | 20.5 | 67.3 | 100<br>200<br>400<br>900 | 5.7<br>8.4<br>12.5<br>23.0 | 18.7<br>27.6<br>41.0<br>75.5 |
| | | | | | | | | | | *Black vinly jacket.* | | | | | | | |

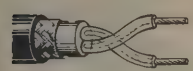
†*Passes the FR-1 vertical flame test* **REQUEST QUOTATIONS OF RG/U CABLES NOT LISTED**

## MINIATURE COAX CABLES (Cont'd)

| Description | Trade & UL Type Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | AWG (Stranding) [Dia. in mm] Nom. D.C.R. | Insulation & Nominal Core O.D. Inch | Insulation & Nominal Core O.D. mm | Nominal O.D. Inch | Nominal O.D. mm | No. of Shields and Material Nom. D.C.R. | Nom. Imp. (ohms) | Nom. Vel. of Prop. | Nominal Capacitance pF/ft. | Nominal Capacitance pF/m | Nominal Attenuation MHz | Nominal Attenuation db/100 ft. | Nominal Attenuation db/100 m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **9264†** UL LISTED **1511** | 100<br>250<br>500<br>1000 | 30.5<br>76.2<br>152.4<br>304.8 | **95621**<br>**95620**<br>**95619**<br>**95618** | 24 (7x32) [.64] Unistrand® 23.6Ω/M' 77.4Ω/km | Flame Retardant Polyethylene .078 | 1.98 | .122 X .146 | 3.10 X 3.71 | 1 Beldfoil® aluminum-polyester 23.6Ω/M' 77.4Ω/km 100% shield coverage | 50 | 62% | 34.0 | 111.5 | — | — | — |
| | | | | | | | | | | | *Black vinyl jacket .020" (.51 mm)* ***This is a tear-drop machine strippable coax cable.*** | | | | | | |
| | **★9393** UL LISTED **1354** | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | **87841**<br>**87840**<br>**87839** | 30 (Solid) coated copper [.25] 108Ω/M' Max. 354.3Ω/km Max. | Cellular Polyethylene .064 | 1.63 | .110 X .115 | 2.79 X 2.92 | BELDFOIL & Drain Wire 108Ω/M' Max. 354.3Ω/km Max. 100% shield coverage | 93 | 78% | 14.0 | 45.9 | 100 | 9 Max. | 29.5 |
| | | | | | | | | | | | *Red vinyl jacket.* | | | | | | |

## TWINAXIAL CABLES

**PRODUCT DESCRIPTION:** *Twinaxial transmission line cables offer low-loss signal transmission which remains unaffected by outside signals or noise fields. Recommended for RF applications requiring a cross-talk free. Balanced operation.*

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **22B/U MIL-C-17D** | **9250†** UL LISTED | 100<br>500<br>1000 | 30.5<br>†52.4<br>304.8 | **95678**<br>**95677**<br>**95676** | 2 cond. 18 (17x.0152) [1.16] bare copper, one conductor has tinned center strand 6.55Ω/M' 21.5Ω/km | Polyethylene .285 | 7.24 | .420 | 10.67 | 2 tinned copper .88Ω/M' 2.9Ω/km 96% shield coverage | 95 | 66% | 16.0 | 52.5 | 1<br>10<br>20<br>50 | .3<br>.9<br>1.3<br>2.1 | .98<br>3.0<br>4.3<br>6.9 |
| | | | | | | | | | | | *Black non-contaminating vinyl jacket.* | | | | | | |
|  | **8227†** UL LISTED **2498** | 500<br>1000<br>2000 | 152.4<br>304.8<br>609.6 | **98330**<br>**98329**<br>**98328** | 20 (7x28) [.97] 1 tinned copper 1 bare copper 9.46Ω/M' 31.04Ω/km | Polyethylene .240 | 6.10 | .325 | 8.26 | 1 tinned copper 2.69Ω/M' 8.8Ω/km 85% shield coverage | 100 | 66% | 15.5 | 50.9 | 1<br>10<br>20<br>50 | .4<br>1.1<br>1.5<br>2.5 | 1.3<br>3.6<br>4.9<br>8.2 |
| | | | | | | | | | | | *Black vinyl jacket.* | | | | | | |
| | **★9207** UL LISTED **2498** | 100<br>U-500<br>500<br>1000<br>2000 | 30.5<br>U-152.4<br>152.4<br>304.8<br>609.6 | **86319**<br>**86219**<br>**87856**<br>**87855**<br>**87854** | 20 (7x28) [.97] 1 tinned copper 1 bare copper 9.46Ω/M' 31.04Ω/km | Polyethylene .240 | 6.10 | .325 | 8.26 | 1 tinned copper 3.81Ω/M' 12.5Ω/km 96% shield coverage | 100 | 66% | 15.5 | 50.9 | 1<br>10<br>20<br>50 | .4<br>1.1<br>1.5<br>2.5 | 1.3<br>3.6<br>4.9<br>8.2 |
| | | | | | | | | | | | *Black vinyl jacket.* | | | | | | |
| | **9272** UL LISTED **2092** | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | **95592**<br>**95594**<br>**95591**<br>**95593**<br>**95590** | 20 (7x28) [.97] tinned copper 9.46Ω/M' 31.04Ω/km | Polyethylene color coded — | — | .242 | 6.15 | 1 tinned copper 3.81Ω/M' 12.5Ω/km 93% shield | 78 | 66% | 19.7 | 64.6 | 1<br>10<br>20<br>50 | .6<br>2.1<br>3.0<br>5.0 | 2.0<br>6.9<br>9.8<br>16.4 |
| | | | | | | | | | | | *Blue vinyl jacket.* | | | | | | |
| | **★9182†** UL LISTED **2772** | U-500<br>500<br>1000 | U-152.4<br>152.4<br>304.8 | **86320**<br>**88690**<br>**88689** | 22 (19x34) tinned copper [.79] 14Ω/M' 46Ω/km | | | .350 | 8.89 | Duofoil w/stranded tinned copper drain wire 6.3Ω/M' 20.7Ω/km 100% shield coverage | 150 | 78% | 8.8 | 28.9 | 1<br>10<br>20 | .3<br>1.3<br>2.3 | 9.8<br>4.3<br>7.5 |
| | | | | | | | | | | | *Black vinyl jacket.* | | | | | | |

★New Item

*†Passes the FR-1 vertical flame test*

**REQUEST QUOTATIONS OF RG/U CABLES NOT LISTED**

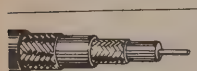
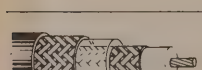
BELDEN | twinaxial and triaxial cable

## TWINAXIAL CABLES (Cont'd)

**PRODUCT DESCRIPTION:** *Twinaxial transmission line cables offer low-loss signal transmission which remains unaffected by outside signals or noise fields. Recommended for RF applications requiring a cross-talk free. Balanced operation.*

| Description | Trade & UL Type Number | Standard Lengths. ft. | Standard Lengths. m | U.P.C. No. | AWG (Stranding) [Dia. in mm] Nom. D.C.R. | Insulation & Nominal Core O.D. Inch | Insulation & Nominal Core O.D. mm | Nominal O.D. Inch | Nominal O.D. mm | No. of Shields and Material Nom. D.C.R. | Nom. Imp. (ohms) | Nom. Vel. of Prop. | Nominal Capacitance pF/ft. | Nominal Capacitance pF/m | Nominal Attenuation MHz | Nominal Attenuation db/ 100 ft. | Nominal Attenuation db/ 100 m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ★9271† UL LISTED 2092 | 100<br>U-500<br>500<br>U-1000<br>1000 | 30.5<br>U-152.4<br>152.4<br>U-304.8<br>304.8 | 95597<br>86310<br>95596<br>86309<br>95595 | 2 Cond.<br>25 (7x33)<br>[.53]<br>tinned copper<br>31.8Ω/M'<br>104.3Ω/km | Polyethylene color coded — \| — | | .242 | 6.15 | BELDFOIL* with stranded tinned copper drain wire<br>12.0Ω/M'<br>39.4Ω/km<br>100% shield coverage | 124<br>*Blue vinyl jacket.* | 66% | 12.2 | 40.0 | 1<br>10<br>20<br>50 | .6<br>1.7<br>2.3<br>3.6 | 2.0<br>5.6<br>7.6<br>11.8 |
| | ★9860 UL LISTED 2704 | 500<br>1000<br>2000 | 152.4<br>304.8<br>609.6 | 94830<br>94829<br>94828 | 2 Cond.<br>16 (Solid)<br>[1.29]<br>bare copper<br>4.2Ω/M'<br>13.8Ω/km | Foam Polyethylene color coded — \| — | | .440 | 11.18 | 1 Duofoil tape<br>1 tinned copper braid<br>1.38Ω/M'<br>4.53Ω/km<br>100% shield coverage | 124<br>*Black vinyl jacket.* | 78.8% | Between Cond. 10.9<br>Shield ungrn'd | 35.8 | 1<br>10<br>20<br>50 | .2<br>.7<br>1.0<br>1.7 | 1.3<br>2.3<br>3.3<br>5.6 |

## TRIAXIAL CABLES

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 9222 | 100<br>U-500<br>500 | 30.5<br>U-152.4<br>152.4 | 95742<br>95743<br>95741 | 20 (7x28)<br>[.97]<br>tinned copper<br>9.46Ω/M'<br>31.04Ω/km | Polyethylene<br>.116 | 2.95 | .242 | 6.15 | 2 tinned copper Inner<br>4.73Ω/M'<br>15.5Ω/km<br>Outer<br>4.30Ω/M'<br>14.1Ω/km | 50 | 66% | 30.8 | 101.0 | 100<br>200<br>400<br>900 | 5.0<br>7.0<br>10.3<br>16.2 | 16.4<br>23.0<br>33.8<br>53.1 |
| | 9267<br>59/U TYPE DOUBLE SHIELD 100% Sweep Tested | 100<br>500<br>1000 | 30.5<br>152.4<br>304.8 | 95610<br>95609<br>95608 | 20 (Solid)<br>[.81]<br>bare copper<br>10.1Ω/M'<br>33.1Ω/km | Cellular Polyethylene<br>.146 | 3.71 | .360 | 9.14 | 2 bare copper Inner<br>2.54Ω/M'<br>8.3Ω/km<br>Outer<br>2.62Ω/M'<br>8.6Ω/km<br>96% shield coverage | 75<br>*Black neoprene jacket.* | 78% | 17.3 | 56.8 | 1<br>50<br>100<br>300 | 0.3<br>1.8<br>2.6<br>4.8 | 1.0<br>5.9<br>8.5<br>15.7 |
| | 9232 UL LISTED 1641<br>11/U TYPE DOUBLE SHIELD | 500<br>1000 | 152.4<br>304.8 | 95729<br>95728 | 14<br>(19x26½)<br>[1.63]<br>bare copper<br>2.4Ω/M'<br>7.9Ω/M' | Cellular Polyethylene<br>.312 | 7.92 | .520 | 13.2 | 2<br>bare copper Inner<br>1.55Ω/M'<br>5.1Ω/km<br>Outer<br>1.65Ω/M'<br>5.4Ω/km<br>90% shield coverage | 75<br>**PRODUCT DESCRIPTION:**<br>*Bare copper conductor, cellular polyethylene insulated, bare copper braid shield, polyethylene insulated, bare copper braid shield, black neoprene jacket.*<br>***100% SWEEP TESTED*** | 78% | 17.3 | 56.8 | 50<br>100<br>200<br>300<br>400 | 1.0<br>1.5<br>2.2<br>2.8<br>3.3 | 3.3<br>4.9<br>7.2<br>9.2<br>10.8 |
| | 8232<br>59/U TYPE DOUBLE SHIELD | 500<br>1000<br>2000 | 152.4<br>304.8<br>609.6 | 98302<br>98301<br>98300 | 20 (Solid)<br>[.81]<br>bare copper covered steel<br>34.5Ω/M'<br>113.2Ω/km | Cellular Polyethylene<br>.146 | 3.71 | .315 | 8.00 | 2<br>bare copper<br>2.6Ω/M'<br>8.5Ω/km<br>Per shield<br>96% shield coverage | 75<br>*Black polyethylene jacket.* | 78% | 17.3 | 56.8 | 50<br>100<br>200<br>300<br>400 | 1.8<br>2.6<br>3.8<br>4.8<br>5.6 | 5.9<br>8.5<br>12.5<br>15.8<br>18.4 |
|  | 8233<br>11/U TYPE DOUBLE SHIELD | 500<br>1000<br>2000 | 152.4<br>304.8<br>609.6 | 98299<br>98298<br>98297 | 14 (Solid)<br>[1.63]<br>bare copper<br>2.6Ω/M'<br>8.5Ω/km | Cellular Polyethylene<br>.285 | 7.24 | .475 | 12.07 | 2<br>bare copper<br>1.4Ω/M'<br>4.6Ω/km<br>Per shield<br>93% shield coverage | 75<br>**PRODUCT DESCRIPTION:**<br>*Conductor, cellular polyethylene insulated, bare copper braid shield, polyethylene insulated, bare copper braid shield, black polyethylene jacket.* | 78% | 17.3 | 56.8 | 50<br>100<br>200<br>300<br>400 | 1.0<br>1.5<br>2.2<br>2.8<br>3.3 | 3.3<br>4.9<br>7.2<br>9.2<br>10.8 |
|  | 9888<br>8/U TYPE DOUBLE SHIELD | 500<br>1000 | 152.4<br>304.8 | 94786<br>94785 | 11 (7x19)<br>[2.74]<br>bare copper<br>1.17Ω/M'<br>3.80Ω/km | Cellular Polyethylene<br>.285 | 7.24 | .480 | 12.19 | 2 bare copper Inner<br>1.2Ω/M'<br>3.9Ω/km<br>Outer<br>2.1Ω/M'<br>6.9Ω/km<br>98% shield coverage | 50<br>*Black polyethylene jacket.* | 78% | 26.0 | 85 | 50<br>100<br>200<br>300<br>400 | 1.2<br>1.8<br>2.6<br>3.3<br>3.8 | 3.9<br>5.9<br>8.5<br>10.8<br>12.5 |

★ New Item REQUEST QUOTATIONS OF RG/U CABLES NOT LISTED †*Passes the FR-1 vertical flame test.*

# MATV Coaxial Cables

Belden has a wide variety of coaxial cables to satisfy the requirements of CATV-MATV applications. One or more of the cables in this group will fulfill the physical and electrical requirements of your system. We offer a range of cable sizes including a variety of materials to meet your exact needs — copper and copper covered steel center conductors, Duofoil® and braid shields, polyvinyl-chloride and polyethylene jackets and galvanized steel messengers for overhead runs.

All of the cables in this group, except 8241, are sweep tested using the Structural Return Loss Method (5 to 300 Mhz) to insure consistent cable performance and uniform electrical characteristics.

## 59/U TYPE DUOFOIL® +BRAID

| Description | Trade & UL Type Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | AWG (Stranding) [Dia. in mm] Nom. D.C.R. | Insulation & Nominal Core O.D. Inch | Insulation & Nominal Core O.D. mm | Nominal O.D. Inch | Nominal O.D. mm | No. of Shields and Material Nom. D.C.R. | Nom. Imp. (ohms) | Nom. Vel. of Prop. | Nominal Capacitance pF/ft. | Nominal Capacitance pF/m | Nominal Attenuation MHz | Nominal Attenuation db/100 ft. | Nominal Attenuation db/100 m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **20 GAGE SOLID CONDUCTOR** | | | | | | | | | | | | | | | | | |
| 100% SWEEP TESTED 5 to 300 mhz | **9275** | 500 Black<br>U-1000 White<br>Black<br>Beige<br>1000 Black | 152.4<br>U-304.8<br><br><br>304.8 | **95579**<br>**88391**<br>**95580**<br>**88390**<br>**95578** | 20 (Solid) [.81] bare copper covered steel 61.5Ω/M' 201.8Ω/km | Cellular Polyethylene .146 | 3.71 | .242 | 6.15 | Duofoil + 40% aluminum braid 17.Ω/M' 55.8Ω/km 100% shield coverage | 75 | 78% | 17.3 | 56.8 | 50<br>100<br>200<br>500<br>900 | 1.8<br>2.6<br>3.8<br>6.2<br>8.4 | 5.9<br>8.5<br>12.5<br>20.3<br>27.6 |
| | | | | | | | | | | *Black vinyl jacket.* | | | | | | | |
| | **9276** | 1000 | 304.8 | **89838** | 20 (Solid) [.81] bare copper covered steel 61.5Ω/M' 201.8Ω/km | Cellular Polyethylene .146 | 3.71 | .242 X .375 | 6.15 X 9.53 | Duofoil + 40% aluminum braid 17.0Ω/M' 55.8Ω/km 100% shield coverage | 75 | 78% | 17.3 | 56.8 | 50<br>100<br>200<br>500<br>900 | 1.8<br>2.6<br>3.8<br>6.2<br>8.4 | 5.9<br>8.5<br>12.5<br>20.3<br>27.6 |
| | | *MESSENGERED – .051" (1.3 mm) Galvanized steel messenger.* | | | | | | | | *Black vinyl jacket.* | | | | | | | |
| 100% SWEEP TESTED (5 to 300 mhz) | **9243** | U-500 Black<br>500 Black<br>U-1000 White<br>Black<br>Beige<br>1000 Black | U-152.4<br>152.4<br>U-304.8<br><br><br>304.8 | **95701**<br>**95698**<br>**89359**<br>**95700**<br>**95699**<br>**95697** | 20 (Solid) [.81] bare copper covered steel 61.5Ω/M' 201.8Ω/km | Cellular Polyethylene .146 | 3.71 | .242 | 6.15 | Duofoil + 67% aluminum braid 14.0Ω/M' 45.9Ω/km 100% shield coverage | 75 | 78% | 17.3 | 56.8 | 50<br>100<br>200<br>500<br>900 | 1.8<br>2.6<br>3.8<br>6.2<br>8.4 | 5.9<br>8.5<br>12.5<br>20.3<br>27.6 |
| | | | | | | | | | | *Black vinyl jacket.* | | | | | | | |
| | **9266** | U-500<br>500<br>U-1000<br>1000 | U-152.4<br>152.4<br>U-304.8<br>304.8 | **95615**<br>**95613**<br>**95614**<br>**95612** | 20 (Solid) [.81] bare copper covered steel 61.5Ω/M' 201.8Ω/km | Cellular Polyethylene .146 | 3.71 | .242 | 6.15 | Duofoil + 61% tinned copper braid 6.8Ω/M' 22.3Ω/km 100% shield coverage | 75 | 78% | 17.3 | 56.8 | 50<br>100<br>200<br>500<br>900 | 1.8<br>2.6<br>3.8<br>6.2<br>8.4 | 5.9<br>8.5<br>12.5<br>20.3<br>27.6 |
| | | | | | | | | | | *Black vinyl jacket.* | | | | | | | |
| **22 GAGE SOLID CONDUCTOR** | | | | | | | | | | | | | | | | | |
| 100% SWEEP TESTED 5 to 300 mhz | **9291** | 500<br>U-1000<br>1000 | 152.4<br>U-304.8<br>304.8 | **95532**<br>**95533**<br>**95531** | 22 (Solid) [.64] bare copper covered steel 55.0Ω/M' 180.5Ω/km | Cellular Polyethylene .140 | 3.56 | .242 | 6.15 | Duofoil + 40% aluminum braid 17.0Ω/M' 55.8Ω/km 100% shield coverage | 80 | 78% | 16.3 | 53.5 | 50<br>100<br>200<br>500<br>900 | 1.9<br>2.6<br>4.0<br>6.5<br>9.0 | 6.23<br>8.53<br>13.12<br>21.32<br>29.53 |
| | | | | | | | | | | *Black vinyl jacket.* | | | | | | | |

REQUEST QUOTATIONS ON RG/U CABLES NOT LISTED

BELDEN

MATV coaxial cables

## 59/U TYPE DUOFOIL® +BRAID (cont'd)

| Description | Trade & UL Type Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | AWG (Strand-ing) [Dia. in mm] Nom. D.C.R. | Insula-tion & Nominal Core O.D. Inch | Insula-tion & Nominal Core O.D. mm | Nominal O.D. Inch | Nominal O.D. mm | No. of Shields and Material Nom. D.C.R. | Nom. Imp. (ohms) | Nom. Vel. of Prop. | Nominal Capacitance pF/ft. | Nominal Capacitance pF/m | Nominal Attenuation MHz | Nominal Attenuation db/ 100 ft. | Nominal Attenuation db/ 100 m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **22 GAGE** SOLID CONDUCTOR (cont'd.) | | | | | | | | | | | | | | | | | |
| 100% SWEEP TESTED 5 to 300 mhz | **9242** | U-500<br>500<br>U-1000<br>1000 | U-152.4<br>152.4<br>U-304.8<br>304.8 | **95706**<br>**95704**<br>**95705**<br>**95703** | 22 (Solid) [.64] bare copper covered steel 55.0Ω/M' 180.5Ω/km | Cellular Poly-ethylene .140 | | .242 | 6.15 | Duofoil + 67% aluminum braid 14.0Ω/M' 45.9Ω/km 100% shield coverage | 80 | 78% | 16.3 | 53.5 | 50<br>100<br>200<br>500<br>900 | 1.9<br>2.6<br>4.0<br>6.5<br>9.0 | 6.23<br>8.53<br>13.12<br>21.32<br>29.53 |
| | | | | | | | 3.56 | | | | *Black vinyl jacket.* | | | | | | |

## 59/U TYPE DUOBOND® +BRAID

### 20 GAGE

SOLID CONDUCTOR

| Description | Trade & UL Type Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | AWG (Strand-ing) [Dia. in mm] Nom. D.C.R. | Insula-tion & Nominal Core O.D. Inch | Insula-tion & Nominal Core O.D. mm | Nominal O.D. Inch | Nominal O.D. mm | No. of Shields and Material Nom. D.C.R. | Nom. Imp. (ohms) | Nom. Vel. of Prop. | Nominal Capacitance pF/ft. | Nominal Capacitance pF/m | Nominal Attenuation MHz | Nominal Attenuation db/ 100 ft. | Nominal Attenuation db/ 100 m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALL 100% SWEEP TESTED (5 to 300 mhz) | **9282** | U-500 Black | U-152.4 | **86308** | 20 (Solid) [.81] bare copper covered steel 61.5Ω/M' 201.8 Ω/km | Cellular Poly-ethylene .146 | | .242 | 6.15 | Duobond + 40% aluminum braid 17.0Ω/M' 55.8Ω/km 100% shield coverage | 75 | 78% | 17.3 | 56.8 | 50<br>100<br>200<br>500<br>900 | 1.8<br>2.6<br>3.8<br>6.2<br>8.4 | 5.9<br>8.5<br>12.5<br>20.3<br>27.6 |
| | | U-500 White | U-152.4 | **86307** | | | 3.71 | | | | | | | | | | |
| | | 500 Black | 152.4 | **95555** | | | | | | | | | | | | | |
| | | U-1000 White | U-304.8 | **95558** | | | | | | | | | | | | | |
| | | Black | | **95557** | | | | | | | *Vinyl jacket.* | | | | | | |
| | | Beige | | **95556** | | | | | | | | | | | | | |
| | | 1000 White | 304.8 | **95554** | | | | | | | | | | | | | |
| | | Black | | **95553** | | | | | | | | | | | | | |
| | | Beige | | **95552** | | | | | | | | | | | | | |
| | | | | **95551** | | | | | | | | | | | | | |
| | **9377** | 1000 | 304.8 | **89811** | 20 (Solid) [.81] bare copper covered steel 61.5 Ω/M' 201.8 Ω/km | Cellular Poly-ethylene .146 | 3.71 | .242 X .375 | 6.15 X 9.53 | Duobond + 40% aluminum braid 17.0Ω/M' 55.8Ω/km 100% shield coverage | 75 | 73% | 17.3 | 56.8 | 50<br>100<br>200<br>500<br>900 | 1.8<br>2.6<br>3.8<br>6.2<br>8.4 | 5.9<br>8.5<br>12.5<br>20.3<br>27.6 |
| | | | | | | | | | | | *Black vinyl jacket.* | | | | | | |

*MESSENGERED – .051" (1.3 mm) Galvanized steel messenger.*

## 59/U TYPE DUOBOND II® +BRAID

### 20 GAGE

SOLID CONDUCTOR

| Description | Trade & UL Type Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | AWG (Strand-ing) [Dia. in mm] Nom. D.C.R. | Insula-tion & Nominal Core O.D. Inch | Insula-tion & Nominal Core O.D. mm | Nominal O.D. Inch | Nominal O.D. mm | No. of Shields and Material Nom. D.C.R. | Nom. Imp. (ohms) | Nom. Vel. of Prop. | Nominal Capacitance pF/ft. | Nominal Capacitance pF/m | Nominal Attenuation MHz | Nominal Attenuation db/ 100 ft. | Nominal Attenuation db/ 100 m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| All 100% SWEEP TESTED (5 to 300 mhz) | ★**9100** | U-500 White | U-152.4 | **86019** | 20 (Solid) .032 [.81] bare copper covered steel 61.5 Ω/M' 201.8 Ω/km | Cellular Poly-ethylene .146 | | .242 | 6.15 | Duobond II +40% aluminum braid 17.0Ω/M' 55.8Ω/km 100% shield coverage | 75 | 78% | 17.3 | 56.7 | 50<br>100<br>200<br>500<br>900 | 1.8<br>2.6<br>3.8<br>6.2<br>8.4 | 5.9<br>8.5<br>12.5<br>20.3<br>27.6 |
| | | Black | | **86018** | | | 3.71 | | | | | | | | | | |
| | | Lt. Beige | | **86017** | | | | | | | | | | | | | |
| | | U-1000 White | U-304.8 | **87146** | | | | | | | | | | | | | |
| | | Black | | **87144** | | | | | | | | | | | | | |
| | | Lt. Beige | | **87141** | | | | | | | *Black vinyl jacket.* | | | | | | |

★ New Item **REQUEST QUOTATIONS OF RG/U CABLES NOT LISTED**

MATV coaxial cables | BELDEN

# 59/U TYPE BRAID

| Description | Trade & UL Type Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | AWG (Strand-ing) [Dia. in mm] Nom. D.C.R. | Insulation & Nominal Core O.D. Inch | Insulation & Nominal Core O.D. mm | Nominal O.D. Inch | Nominal O.D. mm | No. of Shields and Material Nom. D.C.R. | Nom. Imp. (ohms) | Nom. Vel. of Prop. | Nominal Capacitance pF/ft. | Nominal Capacitance pF/m | Nominal Attenuation MHz | Nominal Attenuation db/100 ft. | Nominal Attenuation db/100 m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **20 GAGE SOLID CONDUCTOR** | | | | | | | | | | | | | | | | | |
| ALL 100% SWEEP TESTED (5 to 300 mhz) | **8212** | U-500<br>500<br>U-1000<br>1000 | U-152.4<br>152.4<br>U-304.8<br>304.8 | **98396**<br>**98394**<br>**98395**<br>**98393** | 20 (Solid) [.81] bare copper covered steel 61.5Ω/M′ 201.8Ω/km | Cellular Poly-ethylene .146 | 3.71 | .242 | 6.15 | 95% bare copper braid 2.6Ω/M′ 8.5Ω/km | 75 | 78% | 17.3 | 56.8 | 50<br>100<br>200<br>500<br>900 | 1.8<br>2.6<br>3.8<br>6.2<br>8.4 | 5.9<br>8.5<br>12.5<br>20.3<br>27.6 |
| | | | | | | | | | | | *Black polyethylene jacket.* | | | | | | |
| | **9274** | 500<br>U-1000<br>1000<br>2000 | 152.4<br>U-304.8<br>304.8<br>609.6 | **95583**<br>**95584**<br>**95582**<br>**95581** | 20 (Solid) [.81] bare copper covered steel 61.5Ω/M′ 201.8Ω/km | Cellular Poly-ethylene .146 | 3.71 | .242 | 6.15 | 95% bare copper braid 3.5Ω/M′ 11.5Ω/km | 75 | 78% | 17.3 | 56.8 | 50<br>100<br>200<br>500<br>900 | 1.8<br>2.6<br>3.8<br>6.2<br>8.4 | 5.9<br>8.5<br>12.5<br>20.3<br>27.6 |
| | | | | | | | | | | | *Black vinyl jacket.* | | | | | | |
| **22 GAGE SOLID CONDUCTOR** | | | | | | | | | | | | | | | | | |
| *SWEEP TESTED only on special order.* | **8241** UL LISTED **1354** | 25<br>50<br>100<br>U-500<br>500<br>1000<br>U-1000 | 7.6<br>15.2<br>30.5<br>U-152.4<br>152.4<br>304.8<br>U-304.8 | **98277**<br>**98276**<br>**98275**<br>**98279**<br>**98274**<br>**98273**<br>**98278** | 22 (Solid) [.64] bare copper covered steel 55.0Ω/M′ 180.5Ω/km | Poly-ethylene .146 | 3.71 | .242 | 6.15 | 95% bare copper braid 2.7Ω/M′ 8.9Ω/km | 73 | 66% | 21.0 | 68.9 | 50<br>100<br>200<br>500<br>900 | 2.4<br>3.4<br>4.9<br>9.1<br>13.9 | 7.9<br>11.2<br>16.1<br>29.9<br>45.6 |
| | | | | | | | | | | | *Black vinyl jacket.* | | | | | | |
| 100% SWEEP TESTED 5 to 300 mhz | **9244** UL LISTED **1354** | U-500<br>500<br>U-1000<br>1000 | U-152.4<br>152.4<br>U-304.8<br>304.8 | **95694**<br>**95692**<br>**95693**<br>**95691** | 22 (Solid) [.64] bare copper covered steel 55.0Ω/M′ 180.5Ω/km | Poly-ethylene .146 | 3.71 | .240 | 6.10 | 86% bare copper braid 4.5Ω/M′ 14.8Ω/km | 73 | 66% | 21.0 | 68.9 | 50<br>100<br>200<br>500<br>900 | 2.4<br>3.4<br>4.9<br>9.1<br>13.9 | 7.9<br>11.2<br>16.7<br>26.9<br>45.6 |
| | | | | | | | | | | | *Black vinyl jacket.* | | | | | | |
| | **8221** | 100<br>Gray<br>White<br>Black | 30.5 | **98357**<br>**98356**<br>**98355** | 22 (Solid) [.64] bare copper covered steel 55.0Ω/M′ 180.5Ω/km | Cellular Poly-ethylene .146 | 3.71 | .242 | 6.15 | 95% bare copper braid 2.6Ω/M′ 8.5Ω/km | 80 | 78% | 16.3 | 53.5 | 50<br>100<br>200<br>500<br>900 | 2.1<br>2.9<br>4.1<br>6.6<br>8.8 | 6.9<br>9.5<br>13.5<br>21.7<br>28.9 |
| | | U-500<br>Gray<br>White<br>Black | U-152.4 | **98363**<br>**98362**<br>**98361** | | | | | | | *Vinyl jacket.* | | | | | | |
| | | 500<br>Gray<br>White<br>Black | 152.4 | **98354**<br>**98353**<br>**98352** | | | | | | | | | | | | | |
| | | U-1000<br>Gray<br>White<br>Black | U-304.8 | **98360**<br>**98359**<br>**98358** | | | | | | | | | | | | | |
| | | 1000<br>Gray<br>White<br>Black | 304.8 | **98351**<br>**98350**<br>**98349** | | | | | | | | | | | | | |

REQUEST QUOTATIONS OF RG/U CABLES NOT LISTED

BELDEN | MATV coaxial cables

# 59/U TYPE DUOFOIL® +DRAIN

| Description | Trade & UL Type Number | Standard Lengths ft. | Standard Lengths m | U.P.C. No. | AWG (Stranding) [Dia. in mm] Nom. D.C.R. | Insulation & Nominal Core O.D. Inch | Insulation & Nominal Core O.D. mm | Nominal O.D. Inch | Nominal O.D. mm | No. of Shields and Material Nom. D.C.R. | Nom. Imp. (ohms) | Nom. Vel. of Prop. | Nominal Capacitance pF/ft. | Nominal Capacitance pF/m | Nominal Attenuation MHz | Nominal Attenuation db/100 ft. | Nominal Attenuation db/100 m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **22 GAGE** SOLID CONDUCTOR | | | | | | | | | | | | | | | | | |
| | **9233**[P] | U-500 | U-152.4 | | 22 (Solid) [.64] bare copper covered steel 55.0Ω/M' 180.4Ω/km | Cellular Polyethylene | | .216 | 5.49 | Duofoil + drain 22.5Ω/M' 73.8Ω/km | 80 | 78% | 16.3 | 63.5 | 50 | 1.9 | 6.2 |
| | | White | | **95727** | | | | | | | | | | | 100 | 2.8 | 9.2 |
| | | Black | | **95726** | | | | | | | | | | | 200 | 4.0 | 13.1 |
| | | 500 | 152.4 | | | 140 | 3.56 | | | | | | | | 500 | 6.6 | 21.7 |
| | | White | | **95723** | | | | | | | | | | | 900 | 8.8 | 28.9 |
| | | Black | | **95722** | | | | | | | | | | | | | |
| | | U-1000 | U-304.8 | | | | | | | | | | | | | | |
| | | White | | **95725** | | | | | | | | | | | | | |
| | | Black | | **95724** | | | | | | | *Vinyl Jacket* | | | | | | |
| | | 1000 | 304.8 | | | | | | | | | | | | | | |
| | | White | | **95721** | | | | | | | | | | | | | |
| | | Black | | **95720** | | | | | | | | | | | | | |
| **20 GAGE** SOLID CONDUCTOR | | | | | | | | | | | | | | | | | |
| 100% SWEEP TESTED 5 to 300 mhz | **9234**[P] | U-500 | U-152.4 | | 20 (Solid) [.81] bare copper covered steel 34.5Ω/M' 113.2Ω/km | Cellular Polyethylene | | .225 | 5.72 | Duofoil + drain 22.5Ω/M' 73.8Ω/km | 75 | 78% | 17.3 | 56.8 | 50 | 1.8 | 5.9 |
| | | White | | **95718** | | | | | | | | | | | 100 | 2.7 | 8.9 |
| | | Black | | **95717** | | | | | | | | | | | 200 | 3.8 | 12.5 |
| | | 500 | 152.4 | | | 146 | 3.71 | | | | | | | | 500 | 6.2 | 20.3 |
| | | White | | **95714** | | | | | | | | | | | 900 | 8.6 | 28.2 |
| | | Black | | **95713** | | | | | | | | | | | | | |
| | | U-1000 | 304.8 | | | | | | | | | | | | | | |
| | | White | | **95716** | | | | | | | | | | | | | |
| | | Black | | **95715** | | | | | | | *Vinyl jacket.* | | | | | | |
| | | 1000 | 304.8 | | | | | | | | | | | | | | |
| | | White | | **95712** | | | | | | | | | | | | | |
| | | Black | | **95711** | | | | | | | | | | | | | |

# 6/U TYPE DUOFOIL® +BRAID

## 18 GAGE
SOLID CONDUCTOR

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100% SWEEP TESTED 5 to 300 mhz | **9248** | U-500 | U-152.4 | | 18 (Solid) [.95] bare copper 7.5Ω/M' 24.6Ω/km | Cellular Polyethylene | | .270 | 6.86 | Duofoil + 61% tinned copper braid 5.2Ω/M' 17.1Ω/km | 75 | 78% | 17.3 | 56.8 | 50 | 1.5 | 4.9 |
| | | 500 | 152.4 | **95681** | | | | | | | | | | | 100 | 2.1 | 6.9 |
| | | U-1000 | U-304.8 | | | | | | | | | | | | 200 | 3.1 | 10.2 |
| | | 1000 | 304.8 | **95680** | | 180 | 4.57 | | | | | | | | 500 | 5.0 | 16.4 |
| | | | | | | | | | | | | | | | 900 | 6.9 | 22.6 |
| | | | | | | | | | | | *Black vinyl jacket.* | | | | | | |

# 6/U TYPE DUOBOND® +BRAID

## 18 GAGE
SOLID CONDUCTOR

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100%*SWEEP TESTED 5 to 300 mhz | **9283** | U-500 | U-152.4 | | 18 (Solid) [.95] bare copper covered steel 45.5Ω/M' 149.3Ω/km | Cellular Polyethylene | | .275 | 6.99 | Duobond + 40% aluminum braid 17.5Ω/M' 57.4Ω/km | 75 | 78% | 17.3 | 56.8 | 50 | 1.5 | 4.9 |
| | | 500 | 152.4 | **95550** | | | | | | | | | | | 100 | 2.1 | 6.9 |
| | | U-1000 | U-304.8 | | | | | | | | | | | | 200 | 3.1 | 10.2 |
| | | 1000 | 304.8 | **95549** | | 180 | 4.57 | | | | | | | | 500 | 5.0 | 16.4 |
| | | 2000 | 609.6 | **95548** | | | | | | | | | | | 900 | 6.9 | 22.6 |
| | | | | | | | | | | | *Black vinyl jacket.* | | | | | | |

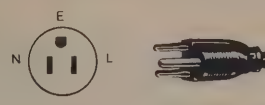
*P-Belden U.S. Patent 3,927,247, Canadian Patent #875,188* **REQUEST QUOTATIONS OF RG/U CABLES NOT LISTED**

shielded and unshielded electronic cords | BELDEN

# Cords

## 3 CONDUCTOR ELECTRONIC POWER SUPPLY CORDS

| Trade Number | Length of Cord ft. | Length of Cord m | Pack-aging | U.P.C. Number | AWG (Stranding) [Dia. in mm] | Nominal O.D. Inch | Nominal O.D. mm | Rating | Type of Cordage | Color |
|---|---|---|---|---|---|---|---|---|---|---|




NEMA 5-15P

MOLDED VINYL GROUNDING PLUG PH-290B*

OUTER JACKET STRIPPED 2"
CONDUCTORS STRIPPED AND TWISTED 5/8"

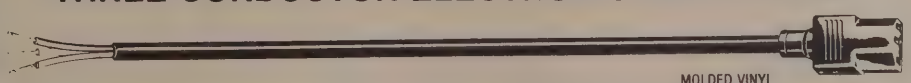
### SHIELDED

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ★17740 | 6'6" | 2 | B<br>C | 87237<br>87236 | 18 (41x34) [1.19] | .270 | 6.86 | 1250 Watts 10A—125V | SVT Shielded | Black |
| ★17741 | 9'8" | 3 | B<br>C | 87235<br>87234 | 18 (41x34) [1.19] | .270 | 6.86 | 1250 Watts 10A—125V | SVT Shielded | Black |
| ★17612 | 6'6" | 2 | B<br>C | 88523<br>88522 | 18 (41x34) [1.19] | .337 | 8.56 | 1250 Watts 10A—125V | SJT Beldfoil® Shielded | Black |
| ★17613 | 9'8" | 3 | B<br>C | 88521<br>88520 | 18 (41x34) [1.19] | .337 | 8.56 | 1250 Watts 10A—125V | SJT Beldfoil® Shielded | Black |
| ★17614 | 6'6" | 2 | B<br>C | 88519<br>88518 | 16 (65x34) [1.47] | .367 | 9.32 | 1625 Watts 13A—125V | SJT Beldfoil® Shielded | Black |
| ★17615 | 9'8" | 3 | B<br>C | 88517<br>88516 | 16 (65x34) [1.47] | .367 | 9.32 | 1625 Watts 13A—125V | SJT Beldfoil® Shielded | Black |
| ★17616 | 6'6" | 2 | B<br>C | 88515<br>88514 | 14 (41x30) [1.91] | .406 | 10.31 | 1875 Watts 15A—125V | SJT Beldfoil® Shielded | Black |
| ★17617 | 9'8" | 3 | B<br>C | 88513<br>88512 | 14 (41x30) [1.91] | .406 | 10.31 | 1875 Watts 15A—125V | SJT Beldfoil® Shielded | Black |

### UNSHIELDED

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ★17512 | 6'6" | 2 | B<br>C | 88644<br>88643 | 18 (41x34) [1.19] | .328 | 8.33 | 1250 Watts 10A—125V | SJT Vinyl | Black |
| ★17513 | 9'8" | 3 | B<br>C | 88642<br>88641 | 18 (41x34) [1.19] | .328 | 8.33 | 1250 Watts 10A—125V | SJT Vinyl | Black |
| ★17514 | 6'6" | 2 | B<br>C | 88640<br>88639 | 16 (65x34) [1.47] | .353 | 8.96 | 1625 Watts 13A—125V | SJT Vinyl | Black |
| ★17515 | 9'8" | 3 | B<br>C | 88638<br>88637 | 16 (65x34) [1.47] | .353 | 8.96 | 1625 Watts 13A—125V | SJT Vinyl | Black |
| ★17516 | 6'6" | 2 | B<br>C | 88565<br>88564 | 14 (41x30) [1.91] | .385 | 9.78 | 1875 Watts 15A—125V | SJT Vinyl | Black |
| ★17517 | 9'8" | 3 | B<br>C | 88563<br>88562 | 14 (41x30) [1.91] | .385 | 9.78 | 1875 Watts 15A—125V | SJT Vinyl | Black |

## THREE CONDUCTOR ELECTRONIC LINE CORDS



OUTER JACKET STRIPPED 2"
CONDUCTORS STRIPPED AND TWISTED 5/8"

MOLDED VINYL GROUNDING CONNECTOR SPH-386

CONTACT VIEW

### SHIELDED

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ★17749 | 6'6" | 2 | B<br>C | 87225<br>87224 | 18 (41x34) [1.19] | .270 | 6.86 | 1250 Watts 10A—125V | SVT Beldfoil® Shielded | Black |
| ★17750 | 9'8" | 3 | B<br>C | 87223<br>87226 | 18 (41x34) [1.19] | .270 | 6.86 | 1250 Watts 10A—125V | SVT Beldfoil® Shielded | Black |
| ★17618 | 6'6" | 2 | B<br>C | 88511<br>88510 | 18 (41x34) [1.19] | .337 | 8.56 | 1250 Watts 10A—125V | SJT Beldfoil® Shielded | Black |

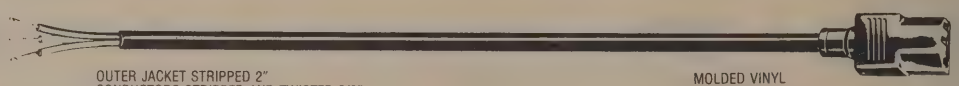
★ New Item

BELDEN | shielded and unshielded electronic cords

## THREE CONDUCTOR ELECTRONIC LINE CORDS (Cont'd)

| Trade Number | Length of Cord ft. | Length of Cord m | Pack-aging | U.P.C. Number | AWG (Stranding) [Dia. in mm] | Nominal O.D. Inch | Nominal O.D. mm | Rating | Type of Cordage | Color |
|---|---|---|---|---|---|---|---|---|---|---|

UL LISTED CSA



OUTER JACKET STRIPPED 2"
CONDUCTORS STRIPPED AND TWISTED 5/8"

MOLDED VINYL
GROUNDING
CONNECTOR SPH-386

CONTACT VIEW

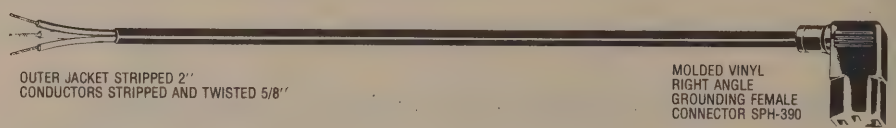
### SHIELDED (Cont'd)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ★17619 | 9'8" | 3 | B<br>C | 88509<br>88508 | 18 (41x34) [1.19] | .337 | 8.56 | 1250 Watts 10A—125V | SJT Beldfoil® Shielded | Black |
| ★17620 | 6'6" | 2 | B<br>C | 88507<br>88506 | 16 (65x34) [1.47] | .367 | 9.32 | 1625 Watts 13A—125V | SJT Beldfoil® Shielded | Black |
| ★17621 | 9'8" | 3 | B<br>C | 88505<br>88504 | 16 (65x34) [1.47] | .367 | 9.32 | 1625 Watts 13A—125V | SJT Beldfoil® Shielded | Black |
| ★17622 | 6'6" | 2 | B<br>C | 88503<br>88502 | 14 (41x30) [1.91] | .406 | 10.31 | 1875 Watts 15A—125V | SJT Beldfoil® Shielded | Black |
| ★17623 | 9'8" | 3 | B<br>C | 88501<br>88500 | 14 (41x30) [1.91] | .406 | 10.31 | 1875 Watts 15A—125V | SJT Beldfoil® Shielded | Black |

### UNSHIELDED

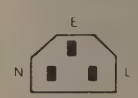
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 17254 | 7'8" | 2.29 | | 93310 Blk | 18 (41x34) [1.19] | .253 | 6.43 | 1250 Watts 10A—125V | SVT Vinyl | Black |
| ★17518 | 6'6" | 2 | B<br>C | 88636<br>88635 | 18 (41x34) [1.19] | .328 | 8.33 | 1250 Watts 10A—125V | SJT Vinyl | Black |
| ★17519 | 9'8" | 3 | B<br>C | 88634<br>88633 | 18 (41x34) [1.19] | .328 | 8.33 | 1250 Watts 10A—125V | SJT Vinyl | Black |
| ★17520 | 6'6" | 2 | B<br>C | 88632<br>88631 | 16 (65x34) [1.47] | .353 | 8.96 | 1625 Watts 13A—125V | SJT Vinyl | Black |
| ★17521 | 9'8" | 3 | B<br>C | 88630<br>88629 | 16 (65x34) [1.47] | .353 | 8.96 | 1625 Watts 13A—125V | SJT Vinyl | Black |
| ★17522 | 6'6" | 2 | B<br>C | 88561<br>88560 | 14 (41x30) [1.91] | .385 | 9.78 | 1875 Watts 15A—125V | SJT Vinyl | Black |
| ★17523 | 9'8" | 3 | B<br>C | 88559<br>88558 | 14 (41x30) [1.91] | .385 | 9.78 | 1875 Watts 15A—125V | SJT Vinyl | Black |

UL LISTED CSA



OUTER JACKET STRIPPED 2"
CONDUCTORS STRIPPED AND TWISTED 5/8"

MOLDED VINYL
RIGHT ANGLE
GROUNDING FEMALE
CONNECTOR SPH-390



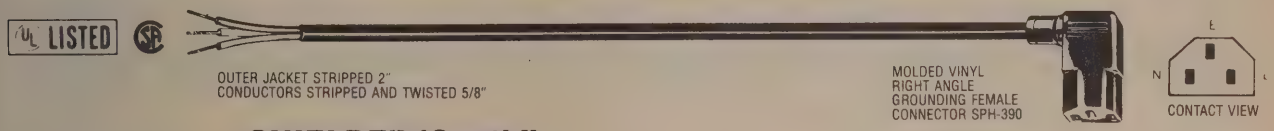

CONTACT VIEW

### SHIELDED

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ★17751 | 6'6" | 2 | B<br>C | 87221<br>87220 | 18 (41x34) [1.19] | .270 | 6.86 | 1250 Watts 10A—125V | SVT Beldfoil® Shielded | Black |
| ★17752 | 9'8" | 3 | B<br>C | 87219<br>87218 | 18 (41x34) [1.19] | .270 | 6.86 | 1250 Watts 10A—125V | SVT Beldfoil® Shielded | Black |
| ★17636 | 6'6" | 2 | B<br>C | 88481<br>88480 | 18 (41x34) [1.19] | .337 | 8.56 | 1250 Watts 10A—125V | SJT Beldfoil® Shielded | Black |
| ★17637 | 9'8" | 3 | B<br>C | 88479<br>88478 | 18 (41x34) [1.19] | .337 | 8.56 | 1250 Watts 10A—125V | SJT Beldfoil® Shielded | Black |
| ★17638 | 6'6" | 2 | B<br>C | 88477<br>88476 | 16 (65x34) [1.47] | .367 | 9.32 | 1625 Watts 13A—125V | SJT Beldfoil® Shielded | Black |

★ New Item

# THREE CONDUCTOR ELECTRONIC LINE CORDS (Cont'd)



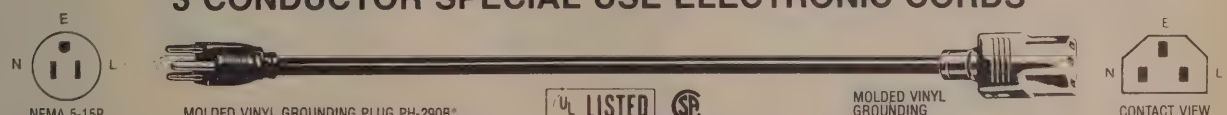

## SHIELDED (Cont'd)

| Trade Number | Length of Cord ft. | Length of Cord m | Packaging | U.P.C. Number | AWG (Stranding) [Dia. in mm] | Nominal O.D. Inch | Nominal O.D. mm | Rating | Type of Cordage | Color |
|---|---|---|---|---|---|---|---|---|---|---|
| ★17639 | 9'8" | 3 | B<br>C | 88475<br>88474 | 16 (65x34) [1.47] | .367 | 9.32 | 1625 Watts 13A—125V | SJT Beldfoil® Shielded | Black |
| ★17641 | 6'6" | 2 | B<br>C | 88473<br>88472 | 14 (41x30) [1.91] | .406 | 10.31 | 1875 Watts 15A—125V | SJT Beldfoil® Shielded | Black |
| ★17642 | 9'8" | 3 | B<br>C | 88471<br>88470 | 14 (41x30) [1.91] | .406 | 10.31 | 1875 Watts 15A—125V | SJT Beldfoil® Shielded | Black |

## UNSHIELDED

| Trade Number | Length of Cord ft. | Length of Cord m | Packaging | U.P.C. Number | AWG (Stranding) [Dia. in mm] | Nominal O.D. Inch | Nominal O.D. mm | Rating | Type of Cordage | Color |
|---|---|---|---|---|---|---|---|---|---|---|
| ★17536 | 6'6" | 2 | B<br>C | 88616<br>88615 | 18 (41x34) [1.19] | .328 | 8.33 | 1250 Watts 10A—125V | SJT Vinyl | Black |
| ★17537 | 9'8" | 3 | B<br>C | 88614<br>88613 | 18 (41x34) [1.19] | .328 | 8.33 | 1250 Watts 10A—125V | SJT Vinyl | Black |
| ★17538 | 6'6" | 2 | B<br>C | 88612<br>88611 | 16 (65x34) [1.47] | .353 | 8.96 | 1625 Watts 13A—125V | SJT Vinyl | Black |
| ★17539 | 9'6" | 2 | B<br>C | 88610<br>88609 | 16 (65x34) [1.47] | .353 | 8.96 | 1625 Watts 13A—125V | SJT Vinyl | Black |
| ★17541 | 6'6" | 2 | B<br>C | 88551<br>88550 | 14 (41x30) [1.91] | .385 | 9.78 | 1875 Watts 15A—125V | SJT Vinyl | Black |
| ★17542 | 9'8" | 3 | B<br>C | 88549<br>88548 | 14 (41x30) [1.91] | .385 | 9.78 | 1875 Watts 15A—125V | SJT Vinyl | Black |

# 3 CONDUCTOR SPECIAL USE ELECTRONIC CORDS




## SHIELDED

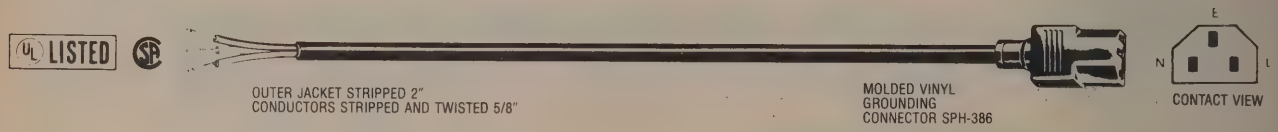
| Trade Number | Length of Cord ft. | Length of Cord m | Packaging | U.P.C. Number | AWG (Stranding) [Dia. in mm] | Nominal O.D. Inch | Nominal O.D. mm | Rating | Type of Cordage | Color |
|---|---|---|---|---|---|---|---|---|---|---|
| ★17742 | 6'6" | 2 | B<br>C | 87233<br>87232 | 18 (41x34) [1.19] | .270 | 6.86 | 1250 Watts 10A—125V | SVT Beldfoil® Shielded Vinyl | Black |
| ★17743 | 9'8" | 3 | B<br>C | 87231<br>87230 | 18 (41x34) [1.19] | .270 | 6.86 | 1250 Watts 10A—125V | SVT Beldfoil® Shielded Vinyl | Black |
| ★17600 | 6'6" | 2 | B<br>C | 88547<br>88546 | 18 (41x34) [1.19] | .337 | 8.56 | 1250 Watts 10A—125V | SJT Beldfoil® Shielded Vinyl | Black |
| ★17601 | 9'8" | 3 | B<br>C | 88545<br>88544 | 18 (41x34) [1.19] | .337 | 8.56 | 1250 Watts 10A—125V | SJT Beldfoil® Shielded Vinyl | Black |
| ★17602 | 6'6" | 2 | B<br>C | 88543<br>88542 | 16 (65x34) [1.47] | .367 | 9.32 | 1625 Watts 13A—125V | SJT Beldfoil® Shielded Vinyl | Black |
| ★17603 | 9'8" | 3 | B<br>C | 88541<br>88540 | 16 (65x34) [1.47] | .367 | 9.32 | 1625 Watts 13A—125V | SJT Beldfoil® Shielded Vinyl | Black |
| ★17604 | 6'6" | 2 | B<br>C | 88573<br>88572 | 14 (41x30) [1.91] | .406 | 10.31 | 1875 Watts 15A—125V | SJT Beldfoil® Shielded Vinyl | Black |
| ★17605 | 9'8" | 3 | B<br>C | 88571<br>88570 | 14 (41x30) [1.91] | .406 | 10.31 | 1875 Watts 15A—125V | SJT Beldfoil® Shielded Vinyl | Black |

★ New Item

BELDEN | shielded and unshielded electronic cords

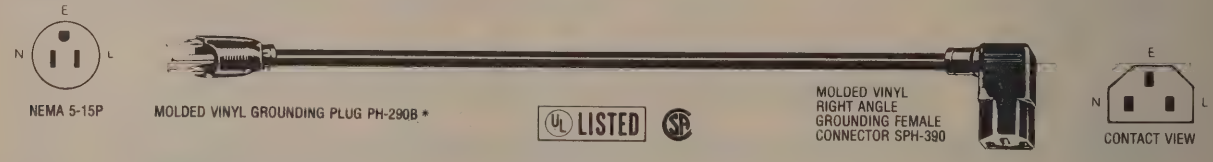
# THREE CONDUCTOR SPECIAL USE ELECTRONIC CORD SETS (Cont'd)

| Trade Number | Length of Cord ft. | Length of Cord m | Pack-aging | U.P.C. Number | AWG (Stranding) [Dia. in mm] | Nominal O.D. Inch | Nominal O.D. mm | Rating | Type of Cordage | Color |
|---|---|---|---|---|---|---|---|---|---|---|




## UNSHIELDED

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ★17500 | 6'6" | 2 | B<br>C | 88660<br>88659 | 18 (41x34) [1.19] | .328 | 8.33 | 1250 Watts 10A—125V | SJT Vinyl | Black |
| 17251 | 7'8" | 2.29 | | 93312 | 18 (41x34) [1.19] | .253 | 6.43 | 1250 Watts 10A—125V | SVT Vinyl | Black |
| ★17501 | 9'8" | 3 | B<br>C | 88658<br>88657 | 18 (41x34) [1.19] | .328 | 8.33 | 1250 Watts 10A—125V | SJT Vinyl | Black |
| ★17502 | 6'6" | 2 | B<br>C | 88656<br>88655 | 16 (65x34) [1.47] | .353 | 8.96 | 1625 Watts 13A—125V | SJT Vinyl | Black |
| ★17503 | 9'8" | 3 | B<br>C | 88654<br>88653 | 16 (65x34) [1.47] | .353 | 8.96 | 1625 Watts 13A—125V | SJT Vinyl | Black |
| ★17504 | 6'6" | 2 | B<br>C | 88573<br>88572 | 14 (41x30) [1.91] | .385 | 9.78 | 1875 Watts 15A—125V | SJT Vinyl | Black |
| ★17505 | 9'8" | 3 | B<br>C | 88571<br>88570 | 14 (41x30) [1.91] | .385 | 9.78 | 1875 Watts 15A—125V | SJT Vinyl | Black |




## SHIELDED

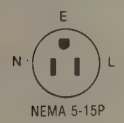
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ★17745 | 6'6" | 2 | B<br>C | 87229<br>87228 | 18 (41x34) [1.19] | .270 | 6.86 | 1250 Watts 10A—125V | SVT Beldfoil® Shielded Vinyl | Black |
| ★17746 | 9'8" | 3 | B<br>C | 87227<br>87226 | 18 (41x34) [1.19] | .270 | 6.86 | 1250 Watts 10A—125V | SVT Beldfoil® Shielded Vinyl | Black |
| ★17606 | 6'6" | 2 | B<br>C | 88535<br>88534 | 18 (41x34) [1.19] | .337 | 8.56 | 1250 Watts 10A—125V | SJT Beldfoil® Shielded Vinyl | Black |
| ★17607 | 9'8" | 3 | B<br>C | 88533<br>88532 | 18 (41x34) [1.19] | .337 | 8.56 | 1250 Watts 10A—125V | SJT Beldfoil® Shielded Vinyl | Black |
| ★17608 | 6'6" | 2 | B<br>C | 88531<br>88530 | 16 (65x34) [1.47] | .367 | 9.32 | 1625 Watts 13A—125V | SJT Beldfoil® Shielded Vinyl | Black |
| ★17609 | 9'8" | 3 | B<br>C | 88529<br>88528 | 16 (65x34) [1.47] | .367 | 9.32 | 1625 Watts 13A—125V | SJT Beldfoil® Shielded Vinyl | Black |
| ★17610 | 6'6" | 2 | B<br>C | 88527<br>88526 | 14 (41x30) [1.91] | .406 | 10.31 | 1875 Watts 15A—125V | SJT Beldfoil® Shielded Vinyl | Black |
| ★17611 | 9'8" | 3 | B<br>C | 88525<br>88524 | 14 (41x30) [1.91] | .406 | 10.31 | 1875 Watts 15A—125V | SJT Beldfoil® Shielded | Black |

★ New Item

shielded and unshielded electronic cords | BELDEN

## THREE CONDUCTOR SPECIAL USE ELECTRONIC CORD SETS (Cont'd)

| Trade Number | Length of Cord ft. | Length of Cord m | Pack-aging | U.P.C. Number | AWG (Stranding) [Dia. in mm] | Nominal O.D. Inch | Nominal O.D. mm | Rating | Type of Cordage | Color |
|---|---|---|---|---|---|---|---|---|---|---|



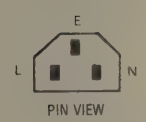
NEMA 5-15P

CONTACT VIEW

### UNSHIELDED (Cont'd)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ★17506 | 6'6" | 2 | B<br>C | 88652<br>88651 | 18 (41x34) [1.19] | .328 | 8.33 | 1250 Watts 10A—125V | SJT Vinyl | Black |
| ★17507 | 9'8" | 3 | B<br>C | 88650<br>88649 | 18 (41x34) [1.19] | .328 | 8.33 | 1250 Watts 10A—125V | SJT Vinyl | Black |
| ★17508 | 6'6" | 2 | B<br>C | 88648<br>88647 | 16 (65x34) [1.47] | .353 | 8.96 | 1625 Watts 13A—125V | SJT Vinyl | Black |
| ★17509 | 9'8" | 3 | B<br>C | 88646<br>88645 | 16 (65x34) [1.47] | .353 | 8.96 | 1625 Watts 13A—125V | SJT Vinyl | Black |
| ★17510 | 6'6" | 2 | B<br>C | 88569<br>88568 | 14 (41x30) [1.91] | .385 | 9.78 | 1875 Watts 15A—125V | SJT Vinyl | Black |
| ★17511 | 9'8" | 3 | B<br>C | 88567<br>88566 | 14 (41x30) [1.91] | .385 | 9.78 | 1875 Watts 15A—125V | SJT Vinyl | Black |

## THREE CONDUCTOR ELECTRONIC JUMPER CORDS



PIN VIEW

CONTACT VIEW

### SHIELDED

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ★17753 | 3'3" | 1 | B<br>C | 87217<br>87216 | 18 (41x32) [1.19] | .270 | 6.86 | 1250 Watts 10A—125V | SVT Beldfoil® Shielded Vinyl | Black |
| ★17624 | 3'3" | 1 | B<br>C | 88499<br>88498 | 18 (41x34) [1.19] | .337 | 8.56 | 1250 Watts 10A—125V | SJT Beldfoil® Shielded Vinyl | Black |
| ★17625 | 3'3" | 1 | B<br>C | 88497<br>88496 | 16 (65x34) [1.47] | .367 | 9.32 | 1625 Watts 13A—125V | SJT Beldfoil® Shielded Vinyl | Black |
| ★17626 | 3'3" | 1 | B<br>C | 88495<br>88494 | 14 (41x30) [1.91] | .406 | 10.31 | 1875 Watts 15A—125V | SJT Beldfoil® Shielded Vinyl | Black |

### UNSHIELDED

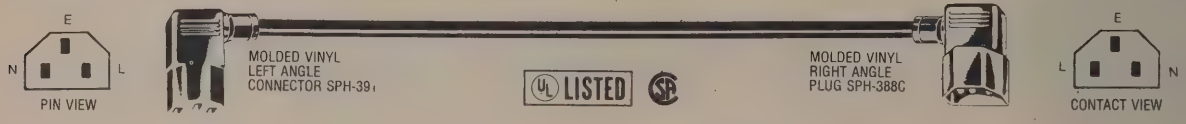
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ★17524 | 3'3" | 1 | B<br>C | 88628<br>88627 | 18 (41x34) [1.19] | .328 | 8.33 | 1250 Watts 10A—125V | SJT Vinyl | Black |
| ★17525 | 3'3" | 1 | B<br>C | 88626<br>88625 | 16 (65x34) [1.47] | .353 | 8.96 | 1625 Watts 13A—125V | SJT Vinyl | Black |
| ★17526 | 3'3" | 1 | B<br>C | 88557<br>88556 | 14 (41x30) [1.91] | .385 | 9.78 | 1875 Watts 15A—125V | SJT Vinyl | Black |

★ New Item

BELDEN | shielded and unshielded electronic cords

## THREE CONDUCTOR ELECTRONIC JUMPER CORDS (Cont'd)

| Trade Number | Length of Cord ft. | Length of Cord m | Packaging | U.P.C. Number | AWG (Stranding) [Dia. in mm] | Nominal O.D. Inch | Nominal O.D. mm | Rating | Type of Cordage | Color |
|---|---|---|---|---|---|---|---|---|---|---|




### SHIELDED

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ★17754 | 3'3" | 1 | B<br>C | 87215<br>87214 | 18 (41x34) [1.19] | .270 | 6.86 | 1250 Watts<br>10A—125V | SVT Beldfoil®<br>Shielded Vinyl | Black |
| ★17627 | 3'3" | 1 | B<br>C | 88493<br>88492 | 18 (41x34) [1.19] | .337 | 8.56 | 1250 Watts<br>10A—125V | SJT Beldfoil®<br>Shielded Vinyl | Black |
| ★17628 | 3'3" | 1 | B<br>C | 88491<br>88490 | 16 (65x34) [1.47] | .367 | 9.32 | 1625 Watts<br>13A—125V | SJT Beldfoil®<br>Shielded Vinyl | Black |
| ★17630 | 3'3" | 1 | B<br>C | 88487<br>88488 | 14 (41x30) [1.91] | .406 | 10.31 | 1875 Watts<br>15A—125V | SJT Beldfoil®<br>Shielded Vinyl | Black |

### UNSHIELDED

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ★17527 | 3'3" | 1 | B<br>C | 88624<br>88623 | 18 (41x34) [1.19] | .328 | 8.33 | 1250 Watts<br>10A—125V | SJT Vinyl | Black |
| ★17528 | 3'3" | 1 | B<br>C | 88622<br>88621 | 16 (65x34) [1.47] | .353 | 8.96 | 1625 Watts<br>13A—125V | SJT Vinyl | Black |
| ★17530 | 3'3" | 1 | B<br>C | 88489<br>88488 | 14 (41x30) [1.91] | .385 | 9.78 | 1875 Watts<br>15A—125V | SJT Vinyl | Black |

### SHIELDED

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ★17755 | 3'3" | 1 | B<br>C | 87213<br>87212 | 18 (41x34) [1.19] | .270 | 6.86 | 1250 Watts<br>10A—125V | SVT Beldfoil®<br>Shielded Vinyl | Black |
| ★17631 | 3'3" | 1 | B<br>C | 88487<br>88486 | 18 (41x34) [1.19] | .337 | 8.56 | 1250 Watts<br>10A—125V | SJT Beldfoil®<br>Shielded Vinyl | Black |
| ★17632 | 3'3" | 1 | B<br>C | 88485<br>88484 | 16 (65x34) [1.47] | .367 | 9.35 | 1625 Watts<br>13A—125V | SJT Beldfoil®<br>Shielded Vinyl | Black |
| ★17633 | 3'3" | 1 | B<br>C | 88483<br>88482 | 14 (41x30) [1.91] | .406 | 10.31 | 1875 Watts<br>15A—125V | SJT Beldfoil®<br>Shielded Vinyl | Black |

### UNSHIELDED

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ★17531 | 3'3" | 1 | B<br>C | 88620<br>88619 | 18 (41x34) [1.19] | .328 | 8.33 | 1250 Watts<br>10A—125V | SJT Vinyl | Black |
| ★17532 | 3'3" | 1 | B<br>C | 88618<br>88617 | 16 (65x34) [1.47] | .353 | 8.96 | 1625 Watts<br>13A—125V | SJT Vinyl | Black |
| ★17533 | 3'3" | 1 | B<br>C | 88553<br>88552 | 14 (41x30) [1.91] | .385 | 9.78 | 1875 Watts<br>15A—125V | SJT Vinyl | Black |

★ New Item

power supply cords BELDEN

# 3 CONDUCTOR POWER SUPPLY CORDS (Cont'd)

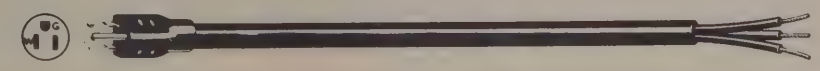
| Trade Number | Length of Cord ft. | Length of Cord m | Pack-aging | U.P.C. Number | AWG (Stranding) [Dia. in mm] | Nominal O.D. Inch | Nominal O.D. mm | Rating | Type of Cordage |
|---|---|---|---|---|---|---|---|---|---|

NEMA 5-15P — MOLDED VINYL GROUNDING PLUG PH-290B — OUTER JACKET STRIPPED 1½", CONDUCTORS STRIPPED AND TWISTED 5/8"

## TYPE SV RUBBER AND SVT VINYL

*Three conductor SV and SVT cords may now be used on some small tools, business machines and instruments.*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **17236** | 6'<br>Blk.<br>Blk. | 1.83 | <br>S<br>B | <br>**93318**<br>**89139** | 18 (41x34)<br>[1.19] | .265 | 6.74 | 1250 Watts<br>10A—125V | SV Rubber |
| **17238** | 8'<br>Blk.<br>Blk. | 2.44 | <br>S<br>B | <br>**93316**<br>**89137** | 18 (41x34)<br>[1.19] | .265 | 6.74 | 1250 Watts<br>10A—125V | SV Rubber |
| **17237** | 6'<br>Gry.<br>Gry. | 1.83 | <br>S<br>B | <br>**93317**<br>**89138** | 18 (41x34)<br>[1.19] | 253 | 6 43 | 1250 Watts<br>10A—125V | SVT Vinyl |
| **17239** | 8'<br>Gry.<br>Gry. | 2 44 | <br>S<br>B | <br>**93315**<br>**89136** | 18 (41x34)<br>[1.19] | .253 | 6.43 | 1250 Watts<br>10A—125V | SVT Vinyl |



NEMA 5-15P — MOLDED VINYL GROUNDING PLUG PH-173 — OUTER JACKET STRIPPED 2", CONDUCTORS STRIPPED AND TWISTED 3/4"

## TYPE SJ RUBBER

*For heavy duty power tools and equipment*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **17629** | 9'<br>Blk<br>Blk. | 2 74 | <br>S<br>B | <br>**93273**<br>**89115** | 14 (41x30)<br>[1.91] | .380 | 9.66 | 1875 Watts<br>15A—125V | SJ Rubber |
| **17635** | 15'<br>Blk.<br>Blk. | 4.57 | <br>S<br>C | <br>**93272**<br>**88482** | 14 (41x30)<br>[1.91] | .380 | 9.66 | 1875 Watts<br>15A—125V | SJ Rubber |

| Trade Number | Length of Cord ft. | Length of Cord cm | Pack-aging | U.P.C. Number | AWG (Stranding) [Dia. in mm] | Nominal O.D. Inch | Nominal O.D. mm | Rating | Type of Cordage |
|---|---|---|---|---|---|---|---|---|---|

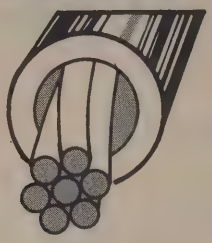
NEMA 5-15P — MOLDED VINYL GROUNDING PLUG PH-185 — OUTER JACKET STRIPPED 1½", CONDUCTORS STRIPPED 1/2" AND TINNED

## TYPE SJO NEOPRENE (RETRACTILE)

*CONVENIENCE AND SAFETY. Dangling cords can be messy, troublesome and unsafe. Retractile cords stay neat, allow free movement of the appliance or tool, and prevent accidents. Rubber insulation and neoprene jackets retain full retracting memory through thousands of stretching cycles.*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **17447** | 1'<br>Blk.<br>Practical extended length—6' (1.83m) | 30.5 | S | **93289** | 18 (41x34)<br>[1.19] | .360 | 9.14 | 1250 Watts<br>10A—125V | SJO Neoprene |

# Berk-Tek



## UL 1061 - CSA SR-PVC
## UL 1007 - CSA TR-64
## UL 1015 - CSA TEW

**Back Panel Wire**

- Kynar®
- Tefzel®

U.L. and C.S.A. APPROVED

### UL 1061/CSA SR-PVC 80°C-300V. (VW-1 rated)

| BERK-TEK PART NO. | AWG. | STRANDING | NOM. O.D. | NOM. WALL |
|---|---|---|---|---|
| BTC6-738-1F-I | 30 | 7/38 | .032 | .010 |
| BTC6-736-1F-I | 28 | 7/36 | .035 | .010 |
| BTC6-734-1F-I | 26 | 7/34 | .039 | .010 |
| BTC6-732-1F-I | 24 | 7/32 | .044 | .010 |
| BTC6-730-1F-I | 22 | 7/30 | .050 | .010 |
| BTC6-1030-1F-I | 20 | 10/30 | .057 | .010 |
| BTC6-1630-1F-I | 18 | 16/30 | .068 | .010 |
| BTC6-2630-1F-I | 16 | 26/30 | .080 | .010 |
| BTC6-30-1F-I | 30 | Solid | .030 | .010 |
| BTC6-28-1F-I | 28 | Solid | .033 | .010 |
| BTC6-26-1F-I | 26 | Solid | .036 | .010 |
| BTC6-24-1F-I | 24 | Solid | .040 | .010 |
| BTC6-22-1F-I | 22 | Solid | .046 | .010 |
| BTC6-20-1F-I | 20 | Solid | .052 | .010 |
| BTC6-18-1F-I | 18 | Solid | .060 | .010 |

PUT UPS - STANDARD AND BULK REELS, DRUM PACK AVAILABLE UPON REQUEST. STOCK COLORS: ALL POPULAR AVAILABLE COLORS. STRIPE COLORS AVAILABLE; FOR DETAILS CONTACT FACTORY.

### UL 1007/CSA TR-64 80°C-300V. (VW-1 rated)

| BERK-TEK PART NO. | AWG. | STRANDING | NOM. O.D. | NOM. WALL |
|---|---|---|---|---|
| BTC6-734-1P-I | 26 | 7/34 | .053 | .017 |
| BTC6-732-1P-I | 24 | 7/32 | .058 | .017 |
| BTC6-730-1P-I | 22 | 7/30 | .064 | .017 |
| BTC6-1030-1P-I | 20 | 10/30 | .071 | .017 |
| BTC6-1630-1P-I | 18 | 16/30 | .081 | .017 |
| BTC6-2630-1P-I | 16 | 26/30 | .091 | .017 |
| BTC6-28-1P-I | 28 | Solid | .047 | .017 |
| BTC6-26-1P-I | 26 | Solid | .050 | .017 |
| BTC6-24-1P-I | 24 | Solid | .054 | .017 |
| BTC6-22-1P-I | 22 | Solid | .059 | .017 |
| BTC6-20-1P-I | 20 | Solid | .066 | .017 |
| BTC6-18-1P-I | 18 | Solid | .074 | .017 |

### UL 1015/CSA TEW 105°C-600V. (VW-1 rated)

| BERK-TEK PART NO. | AWG. | STRANDING | NOM. O.D. | NOM. WALL |
|---|---|---|---|---|
| BTC9-734-1L-I | 26 | 7/34 | .083 | .031 |
| BTC9-732-1L-I | 24 | 7/32 | .089 | .031 |
| BTC9-730-1L-I | 22 | 7/30 | .094 | .031 |
| BTC9-1030-1L-I | 20 | 10/30 | .100 | .031 |
| BTC9-1630-1L-I | 18 | 16/30 | .110 | .031 |
| BTC9-2630-1L-I | 16 | 26/30 | .124 | .031 |
| BTC9-4130-1L-I | 14 | 41/30 | .135 | .031 |
| BTC9-6530-1L-I | 12 | 65/30 | .154 | .031 |
| BTC9-10530-1L-I | 10 | 105/30 | .194 | .031 |
| **UL STYLE 1028, 1283 105°C-600V. (VW-1 rated)** | | | | |
| BTC9-13329-1X-I | 8 | 133/29 | .255 | .045 |
| BTC9-13327-1X-I | 6 | 133/27 | .335 | .060 |

### KYNAR® 105°C - No Voltage UL 1423/1422: CSA 105°C-150V. PVF-2

| BERK-TEK PART NO. | AWG. | FINISHED DIAMETER (inches) | STANDARD PUTUP QTY. | SPOOL |
|---|---|---|---|---|
| BTK-30-3B-I | 30 | .0195 + .001 | 15M' | 16" |
| BTK-28-3B-I | 28 | .023 + .001 | 10M' | 16" |
| BTK-26-3B-I | 26 | .027 + .0015 | 10M' | 12" |
| BTK-24-3B-I | 24 | .030 + .0015 | 5M' | 12" |

### TEFZEL® 105°C - No Voltage UL 1523/1516: CSA 105°C-150V. ETFE

| BERK-TEK PART NO. | AWG. | FINISHED DIAMETER (inches) | STANDARD PUTUP QTY. | SPOOL |
|---|---|---|---|---|
| BTZ-30-3B-I | 30 | .0195 + .001 | 10M' | 16" |
| BTZ-28-3B-I | 28 | .023 + .001 | 10M' | 16" |
| BTZ-26-3B-I | 26 | .027 + .0015 | 10M' | 12" |
| BTZ-24-3B-I | 24 | .030 + .0015 | 5M' | 12" |

**Berk-Tek Packaging**

| KYNAR® | NOM. DIA. | FOOTAGE PER 10½" HIGH DRUM |
|---|---|---|
| BTK-28-3B-I | 023 | 35,000 |
| BTK-26-3B-I | 027 | 30,000 |
| BTK-24-3B-I | 030 | 25,000 |

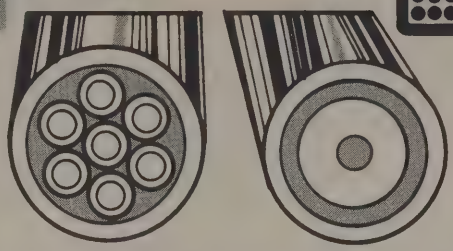
| TEFZEL® | NOM. DIA. | FOOTAGE PER 10½" HIGH DRUM |
|---|---|---|
| BTZ-28-3B-I | 023 | 35,000 |
| BTZ-26-3B-I | 027 | 30,000 |
| BTZ-24-3B-I | 030 | 25,000 |

®Dupont
®Pennwalt

Berk-Tek, Inc., Box 60, Morgantown Rd., Reading, Pa. 19607 • Phone (215) 376-8071

# Berk-Tek

## CRT Terminal Cables - Coaxial
## Micro-Miniature Coax-Wire Wrappable
## UL/CSA Computer Cable
## PVC Bonded Ribbon Cable



### CRT TERMINAL CABLES - COAXIAL

| IMPED. (OHMS) | UL STYLE | BERK-TEK PART NO. | INNER COND. | DIELECTRIC MATERIAL | TYPE OF SHIELDING | JACKET MATERIAL | O.D. (INCH) | PROP. VEL. | NOMINAL CAPACI-TANCE (pf/ft.) | MAX. OP. TEMP. RANGE (C°) | MAX. OP. VOLTAGE (VOLTS RMS) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 75 | 1354 | CRT-59 | #22 CW | CELLULAR POLYETHYLENE | BC | BLACK VINYL | .242 | 78% | 17.3 | 60°C | 300V. |
| 93 | 1381 | CRT-62★ | #22 CW | AIR SPACE PE | BC | ″ | .242 | 84% | 13.5 | 80°C | 600V. |
| 93 | 1381 | CRT-62S★ | #22 CW | AIR SPACE PE | BC | ″ | .260 | 84% | 13.5 | 80°C | 600V. |
| 100 | 2498 | CRT-100† | 2-7/28 TC & BC | PE | TC | ▼ | .325 | 66% | 16.2 | 80°C | 300V. |

### MICRO-MINIATURE COAX - WIRE WRAPPABLE

| IMPED. (OHMS) | UL STYLE | BERK-TEK PART NO. | INNER COND. | DIELECTRIC MATERIAL | TYPE OF SHIELDING | JACKET MATERIAL | O.D. (INCH) | PROP. VEL. | NOMINAL CAPACI-TANCE (pf/ft.) | MAX. OP. TEMP. RANGE (C°) | MAX. OP. VOLTAGE (VOLTS RMS) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 | 1354 | BTX 32-4050 | 32 AWG. SPOFHC | TEFLON® 100 | 1 AL- MYLAR | VYLEX | .040 | 68% | 30.0 | 150°C | 30V. |
| 50 | 1354 | BTX 30-5050 | 30 AWG. SPOFHC | ▼ | ″ | ″ | .050 | 68% | 30.0 | 105°C | 30V. |
| 75 | 1375 | BTX 30-6875 | 30 AWG. SPOFHC | FOAM PP | ″ | ″ | .068 | 78% | 17.0 | 60°C | 30V. |
| 100 | 1375 | BTX 32-85100 | 32 AWG. SPOFHC | ▼ | ▼ | ▼ | 085 | 78% | 13.5 | 60°C | 30V. |

### UL listed COMPUTER CABLE CSA certified

| | PRIMARY TYPES OR INSULATION | JACKET & SURFACE PRINTING | APPLICATION |
|---|---|---|---|
| 2343<br>80°C-No Spec. Voltage | .009" nominal wall thickness semi-rigid PVC UL Style 1061, CSA Type SR-PVC, 80°C-300V. | Gray 80°C PVC Berk-Tek E-42477 UL AWM LR-35832 CSA AWM SR-PVC 80° C. Max. cable diameter under Jkt .700. Jkt Wall .060" nom. | Appliance wiring material suitable for use with electronic computers and business machines. |
| 2344<br>80°C-No Spec. Voltage | .009" nominal wall thickness semi-rigid PVC UL Style 1061, CSA Type SR-PVC, 80°C-300V. | Identical to 2343 except cable dia. under Jkt .701" to 1.500". Jkt wall .080" nom. | Appliance wiring material suitable for use with electronic computers and business machines. |
| 2464<br>80°C-300 Voltage | .009" nominal wall thickness semi-rigid UL Style 1061, CSA Type SR-PVC at 80°C-300V.<br>.016" nominal wall thickness PVC UL Style 1007, CSA Type TR-64 80°C-300V. | Gray 80°C PVC AWG: Berk-Tek E-42477 UL AWM LR-35832 CSA AWM SR-PVC 80°C AWG:<br>Berk-Tek E-42477 UL AWM LR-35832 CSA AWM TR-64 80°C-300V. | Internal wiring or external interconnection of electronic equipment. |
| 2501<br>105°C-600 Voltage | .032" nominal wall thickness 105°C PVC UL Style 1015, CSA Type TEW, rated at 105°C-600V. | Gray 105°C PVC Berk-Tek E-42477 UL AWM, CSA AWM TEW 105°C-600V. | Internal wiring or external interconnection of electronic equipment at temperatures not exceeding 105°C. |

### Berk-Tek Bonded PVC Ribbon Cable

| PART NO. | AWG. | NO. COND | STR | NOM. WIDTH (inch) |
|---|---|---|---|---|
| BTR-736-IF-10 | 28 | 10 | 7/36 | .35 |
| BTR-736-IF-15 | 28 | 15 | 7/36 | .53 |
| BTR-736-IF-20 | 28 | 20 | 7/36 | .70 |
| BTR-736-IF-30 | 28 | 30 | 7/36 | 1.05 |
| BTR-734-IF-10 | 26 | 10 | 7/34 | .39 |
| BTR-734-IF-14 | 26 | 14 | 7/34 | .55 |
| BTR-734-IF-15 | 26 | 15 | 7/34 | .59 |
| BTR-734-IF-16 | 26 | 16 | 7/34 | .63 |
| BTR-734-IF-20 | 26 | 20 | 7/34 | .78 |
| BTR-734-IF-30 | 26 | 30 | 7/34 | 1.17 |
| BTR-732-IF-10 | 24 | 10 | 7/32 | .44 |
| BTR-732-IF-15 | 24 | 15 | 7/32 | .66 |
| BTR-732-IF-20 | 24 | 20 | 7/32 | .88 |
| BTR-732-IF-30 | 24 | 30 | 7/32 | 1.32 |
| BTR-730-IF-10 | 22 | 10 | 7/30 | .51 |
| BTR-730-IF-15 | 22 | 15 | 7/30 | .77 |
| BTR-730-IF-20 | 22 | 20 | 7/30 | 1.01 |
| BTR-730-IF-30 | 22 | 30 | 7/30 | 1.53 |

★ Compatible with Model 3270 CRT Terminals.
† Compatible with System 34 CRT Terminals.

Berk-Tek, Inc., Box 60, Morgantown Rd., Reading, Pa. 19607 • Phone (215) 376-8071

BREEZE-ILLINOIS, INCORPORATED
Designs and Manufactures
Interconnector assemblies
that are Shielded Against
EMI, EMP, RFI, Nuclear
Radiation, Compromising
Eminations (TEMPEST),
Mechanical Stressing,
Chemical Environments,
Weather and Temperature

Breeze-Illinois, Inc. has over 50 years experience in the manufacture of quality interconnection systems including design, development, manufacturing and evaluation for wide-ranging applications in industry, NASA, and the military. The company specializes in protected cable assemblies. These systems include all types of electrical and optical systems, pneumatic links and hybrid combinations. They are produced under the Breeze-Illinois trade names of:

- **Bi-LINK**™ Complete interconnector systems custom designed to fulfill the requirements of specific customer applications.
- **BiSHIELD**™ Cable assemblies designed to customer specifications or Breeze-Illinois standards to fulfill specific protection requirements.
- **Bi-PRO**™ Metallic and non-metallic flexible convoluted conduit wire-ways that protects transfer media against all outside influences.
- **Bi-OPTIC**™ Fiber optic interconnectors and hybrid systems using combinations of fiber optics and conventional transfer media.
- **Bi-TEST**™ Precision test cables specifically consturcted to fulfill the rigid requirements of test environments.
- **Bi-SHELL**™ Backshell terminations and other hardware that pertains to the termination of protective wire coverings.

Interconnectors are our only product line. We offer quality components off-the-shelf or we can study your systems requirements and prepare trouble-free, reliable and efficient interconnections for you. We will prepare proposals, write reports, build prototypes and make complete test and evaluation studies.

So contact us for any interconnector need—large or small. Breeze-Illinois can save you money, space, weight and time and eliminate or avoid your interference and/or environmental protection problems too.

## The name Breeze-Illinois is synonymous with wiring protection.

Our experience in manufacturing our own hardware such as coupling nuts, backshell assemblies, junction boxes, branches and connectors has established the name Breeze as the standard in the protected cable assembly field. We are highly competitive and best qualified to construct custom designed assemblies for our customers—from one assembly to thousands of copies. If you wish to assemble your own interconnectors, we manufacture individual components and can supply many off-the-shelf items for your interconnector needs. We also braid textiles such as Nylon and Dacron to wire bundles from your simplest design to your most complicated system.

We have a nationwide network of sales representatives anxious to serve you—Call or write us today.

BREEZE ILLINOIS FOR PROTECTED INTERCONNECTOR ASSEMBLIES

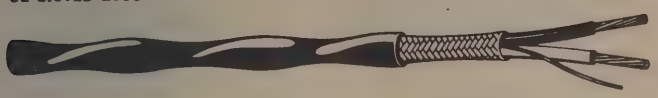
*Need more information? Call or write for our product and facilities brochures.*
*Breeze-Illinois, Incorporated, Main and Agard Sts. Wyoming, Illinois 61491*
*Phone, (309) 695-2511 TWX, 510 390 3691*

COLUMBIA ELECTRONIC CABLES • Dept. EM, 11 Cove St., New Bedford, Mass. 02744 • Phone: (617) 999-4451 • Telex: 92-9411
Los Angeles, CA 90058 • Phone (213) 583-9825
HOT LINE 800-225-8540

## SHIELDED AUDIO CABLE

### BRAID SHIELD, PVC JACKET, DRAIN WIRE

**UL LISTED 2095**



**Stock Color:** Black jacket.

**Construction:** Tinned copper conductors, color-coded PVC insulation, conductors cabled, tinned copper braid shield, tinned copper drain wire, PVC jacket overall.

**Specifications:** −20°C to +60°C. Entire cable passes VW-1 vertical flame test.

**Color Code:** Black, Red.

**Applications:** Shielded cable for recording studios, radio transmitters, sound systems, broadcast use.

**Put-up:** 100′, 500′ and 1000′ spools (other Put-ups also available).

| Columbia No. | No. of Cond. | Size AWG | Stranding | Nom. Insul. Thck. | Nom. Jkt. Thck. | Nom. O.D. In. |
|---|---|---|---|---|---|---|
| C2676 | 2 | 22 | Solid | .015 | .025 | .200 |
| C2677 | 2 | 22 | 16/34 | .015 | .025 | .210 |

### BRAID SHIELD, PVC JACKET

**Stock Color:** Chrome gray jacket.

**Construction:** Tinned copper conductors, color-coded PVC insulation, conductors cabled, tinned copper braid shield, PVC jacket overall.

**Specifications:** −20°C to +60°C. Entire cable passes VW-1 vertical flame test.

**Color Code:** Black, Red, White, Green.

**Applications:** Shielded cable for recording studios, radio transmitters, sound systems and electronic circuits where shielding is required.

**Put-up:** 100′, 500′ and 1000′ spools (other Put-ups also available).

| Columbia No. | No. of Cond. | Size AWG | Stranding | Nom. Insul. Thck. | Nom. Jkt. Thck. | Nom. O.D. In. |
|---|---|---|---|---|---|---|
| C2695 | 2 | 20 | Solid | .015 | .025 | .205 |
| C2696 | 2 | 18 | Solid | .015 | .025 | .220 |
| C2679 | 2 | 22 | 7/30 | .015 | .025 | .200 |
| C2678* | 3 | 22 | 7/30 | .015 | .025 | .210 |
| C2680 | 4 | 22 | 7/30 | .015 | .025 | .225 |
| C2681 | 2 | 20 | 10/30 | .015 | .025 | .215 |
| C1332 | 3 | 20 | 10/30 | .015 | .025 | .225 |
| C2683 | 4 | 20 | 10/30 | .015 | .025 | .245 |
| C2686 | 2 | 18 | 16/30 | .018 | .025 | .245 |
| C2687 | 3 | 18 | 16/30 | .018 | .025 | .260 |
| C2688 | 4 | 18 | 16/30 | .018 | .025 | .280 |
| C2689 | 2 | 16 | 26/30 | .018 | .025 | .270 |
| C2690 | 3 | 16 | 26/30 | .018 | .025 | .285 |
| C2691 | 2 | 14 | 41/30 | .020 | .030 | .320 |
| C2692 | 3 | 14 | 41/30 | .020 | .030 | .335 |
| C2693 | 2 | 12 | 65/30 | .020 | .030 | .360 |
| C2694 | 3 | 12 | 65/30 | .020 | .030 | .380 |

*** UL Listed 2096**

### SPIRAL SHIELD, PVC JACKET

**Stock Color:** Chrome gray jacket.

**Construction:** Tinned copper conductors, color-coded PVC insulation, conductors cabled, tinned copper spiral wrapped shield, PVC jacket overall.

### SPIRAL SHIELD, PVC JACKET (CONT'D)

**Specifications:** −20°C to +60°C. Entire cable passes VW-1 vertical flame test.

**Color Code:** Black, Red, White, Green, Yellow, Blue.

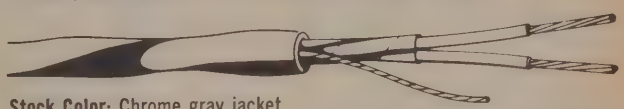
**Applications:** Cable for recording studios, radio transmitters, sound systems and electronic circuits where shielding is required. Spiral shield allows ease of pigtail soldering.

**Put-up:** 100′, 500′ and 1000′ spools (other Put-ups also available).

| Columbia No. | No. of Cond. | Size AWG | Stranding | Nom. Insul. Thck. | Nom. Jkt. Thck. | Nom. O.D. In. |
|---|---|---|---|---|---|---|
| C2884* | 2 | 22 | Solid | .015 | .025 | .175 |
| C2885 | 3 | 22 | Solid | .015 | .025 | .180 |
| C2882* | 2 | 22 | 7/30 | .015 | .025 | .185 |
| C1335 | 3 | 22 | 7/30 | .015 | .025 | .190 |
| C1337 | 4 | 22 | 7/30 | .015 | .025 | .210 |
| C1341 | 6 | 22 | 7/30 | .015 | .025 | .245 |
| C2888* | 2 | 20 | 10/30 | .015 | .025 | .200 |
| C2893 | 3 | 20 | 10/30 | .015 | .025 | .210 |
| C2769 | 4 | 20 | 10/30 | .015 | .025 | .225 |
| C2770 | 6 | 20 | 10/30 | .015 | .025 | .265 |
| C2892 | 2 | 18 | 16/30 | .020 | .025 | .240 |
| C2768 | 3 | 18 | 16/30 | .020 | .025 | .250 |
| C2894 | 4 | 18 | 16/30 | .020 | .025 | .275 |
| C2895 | 2 | 16 | 26/30 | .020 | .025 | .265 |
| C2896 | 3 | 16 | 26/30 | .020 | .025 | .280 |
| C2897 | 2 | 14 | 41/30 | .020 | .025 | .290 |
| C2898 | 3 | 14 | 41/30 | .020 | .030 | .320 |
| C2899 | 2 | 12 | 65/30 | .020 | .030 | .345 |
| C2900 | 3 | 12 | 65/30 | .020 | .030 | .365 |

*** UL Listed 2095**

### MYLAR/ALUMINUM FOIL SHIELDED AUDIO CABLE



**Stock Color:** Chrome gray jacket.

**Construction:** Tinned copper conductors, color-coded polyethylene insulation, conductors cabled, wrapped with Flexfoil® mylar supported aluminum foil shield with foil facing to outside, stranded tinned copper drain wire, PVC jacket overall.

**Specifications:** −20°C to +60°C. Entire cable passes VW-1 vertical flame test.

**Color Code:** Black, Clear, Red, Green.

**Applications:** 100% shielded cable for recording studios, broadcast sound systems and electronic circuits where RF shielding is required.

**Put-up:** 100′, 500′ and 1000′ spools (other Put-ups also available).

| Columbia No. | No. of Cond. | AWG (Stranding) | Jacket Thck. In. | Nom. Insul. In. | Nom. O.D. In. | UL Style |
|---|---|---|---|---|---|---|
| C2513 | 2 | 24 (7/32) | .025 | .015 | .160 | 2092 |
| C2514 | 2 | 22 (7/30) | .025 | .015 | .170 | 2092 |
| C2526 | 3 | 22 (7/30) | .025 | .015 | .180 | 2093 |
| C2523 | 4 | 22 (7/30) | .025 | .015 | .195 | 2094 |
| C2524 | 2 | 20 (10/30) | .025 | .015 | .190 | 2092 |
| C2525 | 3 | 20 (10/30) | .028 | .015 | .205 | 2093 |
| C2534 | 2 | 18 (16/30) | .028 | .018 | .225 | 2092 |
| C2535 | 3 | 18 (16/30) | .028 | .018 | .240 | 2093 |
| C2536 | 2 | 16 (26/30) | .030 | .025 | .285 | 2106 |
| C2537 | 3 | 16 (26/30) | .030 | .025 | .300 | 2107 |
| C2538 | 2 | 14(41/30) | .035 | .032 | .350 | 2106 |
| C2539 | 2 | 12(65/30) | .037 | .040 | .420 | 2106 |

**MINIATURE SIZE**

Requires ½ to ⅔ less space than standard broadcast cables. Same construction as above, but with color-coded polypropylene insulation, .011″ thick. Color Code: 1, Black; 2, Red; 3, White.

| Columbia No. | No. of Cond. | AWG (Stranding) | Jacket Thck. In. | Nom. Insul. In. | Nom. O.D. In. |
|---|---|---|---|---|---|
| C2515 | 2 | 22 (Solid) | .018 | .011 | .135 |
| C2516 | 2 | 22 (7/70) | .020 | .011 | .145 |
| C2517 | 3 | 22 (7/30) | .020 | .011 | .155 |

**COLUMBIA ELECTRONIC CABLES** • Dept. EM, 11 Cove St., New Bedford, Mass. 02744 • Phone: (617) 999-4451 • Telex: 92-9411
Los Angeles, CA 90058 • Phone (213) 583-9825
**HOT LINE 800-225-8540**

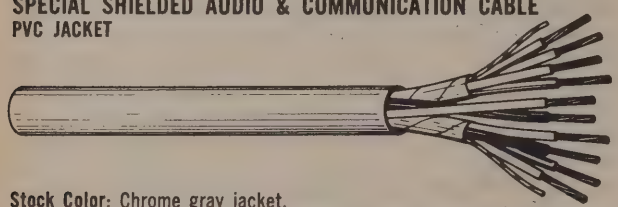
## SPECIAL SHIELDED AUDIO & COMMUNICATION CABLE
**PVC JACKET**

**Stock Color:** Chrome gray jacket.
**Construction:** Tinned copper conductors, color-coded PVC insulation, 4 conductors cabled, Flexfoil® aluminum/polyester shield over 4 cabled conductors, 22 gauge TC drain wire, 2 conductors unshielded, PVC jacket overall.
**Specifications:** −20°C to +60°C.
**Color Code: Shielded** — Black, Green, Red, Yellow.
**Unshielded** — Blue, White.
**Applications:** Special cable for audio and communications use.
**Put-up:** 100′, 500′ and 1000′ spools. (Other put-ups also available.)

| Cat. No. | No. of Cond. | Cond. Size | Cond. Strand. | Nom. Insul. Thck. (In.) | Nom. Jkt. Thck. (In.) | % Shld. Cov. | Sugg. Work. Volt. | Nom. O.D. (In.) |
|---|---|---|---|---|---|---|---|---|
| C1345 | 6 | 4-24 shielded<br>2-22 unshielded | 7/32<br>7/30 | .015 | .025 | 100 | 350V | .230 |

■ **PASSES THE VW-1 VERTICAL FLAME TEST.**

## SPECIAL SHIELDED AUDIO & COMMUNICATION CABLE
**PVC JACKET**

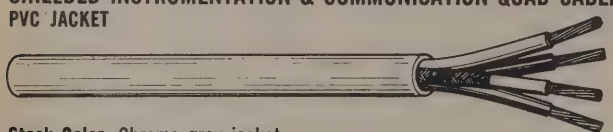


**Stock Color:** Chrome gray jacket.
**Construction:** Tinned copper conductors, color-coded PVC insulation, cabled in 2 quads, each quad with 24 gauge tinned drain wire, Flexfoil® shield over each quad, plus 2 unshielded conductors, PVC jacket overall. Foil facing to inside.
**Specifications:** −20°C to +60°C.
**Color Code: 1st Quad** — Gray, White, Blue, Green.
**2nd Quad** — Red, Brown, Yellow, Orange.
**Unshielded** — White, Blue.
**Applications:** Special cable for audio and communications use.
**Put-up:** 100′ and 500′ spools. (Other put-ups also available.)

| Cat. No. | No. of Cond. | Cond. Size | Cond. Strand. | Nom. Insul. Thck. (In.) | Nom. Jkt. Thck. (In.) | % Shld. Cov. | Sugg. Work. Volt. | Nom. O.D. (In.) |
|---|---|---|---|---|---|---|---|---|
| C4086 | 10 | 4-24 shielded<br>4-24 shielded<br>2-22 unshielded | 7/32<br>7/32<br>7/30 | .012<br>.012<br>.015 | .030 | 100<br>100 | 350V | .310 |

■ **PASSES THE VW-1 VERTICAL FLAME TEST.**

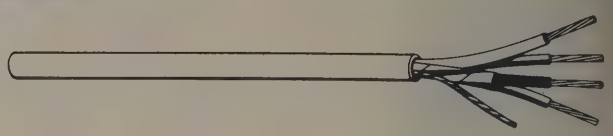
## SHIELDED INSTRUMENTATION & COMMUNICATION QUAD CABLE
**PVC JACKET**



**Stock Color:** Chrome gray jacket.
**Construction:** Tinned copper conductors, color-coded PVC insulation, tinned copper braid shield over one conductor, conductors cabled, PVC jacket overall.
**Specifications:** −20°C to +60°C.
**Color Code: Shielded** — White.
**Unshielded** — Black, Red, Green.
**Applications:** Special cable for audio, communications and instrumentation use.
**Put-up:** 100′, 250′ and 500′ spools. (Other put-ups also available.)

| Cat. No. | No. of Cond. | Cond. Size | Cond. Strand. | Nom. Insul. Thck. (In.) | Nom. Jkt. Thck. (In.) | App. % Shld. Cov. | Sugg. Work. Volt. | Nom. O.D. (In.) |
|---|---|---|---|---|---|---|---|---|
| C1336 | 4 | 1-20 shielded<br>3-20 unshielded | 10/30 | .015 | .025 | 82 | 300V | .220 |

## SHIELDED INSTRUMENTATION & COMMUNICATION QUAD CABLE
**PVC JACKET**

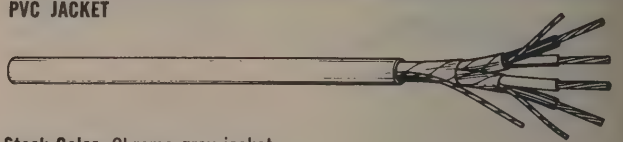


**Stock Color:** Chrome gray jacket.
**Construction:** Tinned copper conductors, color-coded polypropylene insulation, each pair shielded with Flexfoil® aluminum polyester shield, stranded tinned copper drain wire, cables paired on common axis to reduce O.D., PVC jacket overall. Foil facing to outside. Drain wire 24 gauge, 7/32.
**Specifications:** −20°C to +60°C.
**Color Code: No. 1 Pair** — Black, Red.
**No. 2 pair** — Green, White.
**Applications:** Special cable for audio, communications and instrumentation use.
**Put-up:** 100′, 500′ and 1000′ spools. (Other put-ups also available.)

| Cat. No. | No. of Cond. | Cond. Size | Cond. Strand. | Nom. Insul. Thck. (In.) | Nom. Jkt. Thck. (In.) | % Shld. Cov. | Sugg. Work. Volt. | Nom. O.D. (In.) | Nom. Cap.* PF/ Ft. | Nom. Cap.** PF/ Ft. |
|---|---|---|---|---|---|---|---|---|---|---|
| C1352 | 4 | 22 | 7/30 | .011 | .025 | 100 | 400V | .185 | 28 | 51 |

*Capacitance between conductors.
**Capacitance between one conductor and other conductor connected to shield.

## SHIELDED INSTRUMENTATION & COMMUNICATION QUAD CABLE
**PVC JACKET**



**Stock Color:** Chrome gray jacket.
**Construction:** Tinned copper conductors, color-coded polypropylene insulation, cabled in pairs, each pair Flexfoil® alumuminum/polyester shielded, with stranded tinned copper drain wire, overall Flexfoil® aluminum fail/polyester shields and stranded, 24 gauge, 7/32, tinned copper drain wire, cabled on common axis to reduce O.D., PVC jacket overall.
**Specifications:** −20°C to +60°C.
**Color Code: No. 1 Pair** — Black, Red.
**No. 2 pair** — Green, White.
**Applications:** Special cable for audio, communications and instrumentation use.
**Put-up:** 500′ and 1000′ spools. (Available put-ups also available.)

| Cat. No. | No. of Cond. | Cond. Size | Cond. Strand. | Nom. Insul. Thck. (In.) | Nom. Jkt. Thck. (In.) | % Shld. Cov. | Sugg. Work. Volt. | Nom. O.D. (In.) | Nom. Cap.* PF/ Ft. | Nom. Cap.** PF/ Ft. |
|---|---|---|---|---|---|---|---|---|---|---|
| C1353 | 4 | 22 | 7/30 | .011 | .025 | 100 | 400V | .200 | 28 | 51 |

*Capacitance between conductors.
**Capacitance between one conductor and other conductor connected to shield.

### CONDUCTOR COLOR CODE CHART I

| No. Prs. | Paired Colors | No. Prs. | Paired Colors | No. Prs. | Paired Colors |
|---|---|---|---|---|---|
| 1 | Black, Red | 18 | Green, Orange | 35 | Purple, Slate |
| 2 | Black, White | 19 | White, Blue | 36 | Purple, Black |
| 3 | Black, Green | 20 | White, Yellow | 37 | Slate, Red |
| 4 | Black, Blue | 21 | White, Brown | 38 | Slate, White |
| 5 | Black, Yellow | 22 | White, Orange | 39 | Slate, Green |
| 6 | Black, Brown | 23 | Blue, Yellow | 40 | Slate, Blue |
| 7 | Black, Orange | 24 | Blue, Brown | 41 | Slate, Brown |
| 8 | Red, White | 25 | Blue, Orange | 42 | Slate, Yellow |
| 9 | Red, Green | 26 | Brown, Yellow | 43 | Slate, Orange |
| 10 | Red, Blue | 27 | Brown, Orange | 44 | Slate, Black |
| 11 | Red, Yellow | 28 | Purple, Red | 45 | W/B*, Red |
| 12 | Red, Brown | 29 | Purple, White | 46 | W/B*, Green |
| 13 | Red, Orange | 30 | Purple, Green | 47 | W/B*, Blue |
| 14 | Green, White | 31 | Purple, Blue | 48 | W/B*, Brown |
| 15 | Green, Blue | 32 | Purple, Brown | 49 | W/B*, Yellow |
| 16 | Green, Yellow | 33 | Purple, Yellow | 50 | W/B*, Orange |
| 17 | Green, Brown | 34 | Purple, Orange | 51 | W/B*, Purple |

* White body with black stripe.

COLUMBIA ELECTRONIC CABLES • Dept. EM, 11 Cove St., New Bedford, Mass. 02744 • Phone: (617) 999-4451 • Telex: 92-9411
Los Angeles, CA 90058 • Phone (213) 583-9825
**HOT LINE 800-225-8540**

## SHIELDED INSTRUMENTATION & COMMUNICATION QUAD CABLE
### PVC JACKET

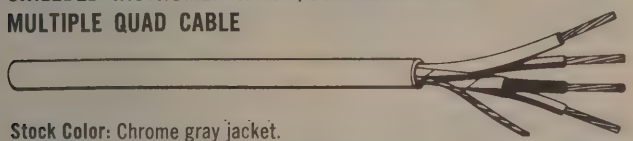
**UL 2094**

**Stock Color:** Chrome gray jacket.
**Construction:** Tinned copper conductors, color-coded polyethylene insulation, cabled, filled where required, clear mylar wrap, tinned copper braid shield, PVC jacket overall.
**Specifications:** −20°C to +60°C. Suggested working voltage 600V.
**Color Code:** Black, white, red, green.
**Applications:** Special cable for audio, communications and instrumentation use.
**Put-up:** 100′, 500′ and 1000′ spools. (Other put-ups also available.)

| Cat. No. | No. of Cond. | Cond. Size | Cond. Strand. | Nom. Insul. Thck. (In.) | Nom. Jkt. Thck. (In.) | App. % Shld. Cov. | Sugg. Work. Volt. | Nom. O.D. (In. | Nom. Cap. * PF/ FT. | Nom. Cap. ** PF/ FT. |
|---|---|---|---|---|---|---|---|---|---|---|
| C1644 | 4 | 20 | 26/34 | .015 | .045 | 87 | 600V | .290 | 26 | 48 |

*Capacitance between conductors.
**Capacitance between one conductor and other conductor connected to shield.

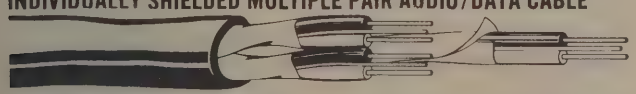
## SHIELDED INSTRUMENTATION/COMMUNICATION MULTIPLE QUAD CABLE



**Stock Color:** Chrome gray jacket.
**Construction:** Tinned copper conductors. Cat. No. C1340 color-coded polypropylene insulation, Cat. No. C1331 color coded PVC insulation. Cat. No. C1343 color coded polyethylene insulation. Flexfoil® aluminum foil/polyester shield (foil facing to outside) over 2 conductors, stranded tinned copper drain wire (Cat. No. C1340 - 24 gauge, Cat. No. C1331 and C1343 - 22 gauge), one shielded pair and 2 singles cabled on common axis to reduce O.D., PVC jacket overall.
**Specifications:** −20°C to +60°C. Suggested working voltage: Cat. No. C1340—200V, Ca. No. C1331 and C1343—350V, Cat. No. C1331 entire cable passes VW-1, Cat. Nos. C1340 and C1343 jacket only passes VW-1.
**Color Code:** Shielded – Black Red; Unshielded – Green White.
**Applications:** Special cable for audio, communications and instrumentation use.
**Put-up:** 100′, 250′, 500′ and 1000′ spools (other Put-ups also available).

| Columbia No. | No. of Cond. | AWG (Stranding) | Nom. Insul. In. | Jacket Thck. In. | Nom. O.D. In. |
|---|---|---|---|---|---|
| C1340 | 4 | 22 (7/30) | .011 | .025 | .185 |
| C1331 | 4 | 20 (10/30) | .015 | .025 | .215 |
| C1343 | 4 | 2-20 (10/30) Shld | .018 | .030 | .255 |
| | | 2-18 (16/30) Unshld | .018 | | |

## INDIVIDUALLY SHIELDED MULTIPLE PAIR AUDIO/DATA CABLE

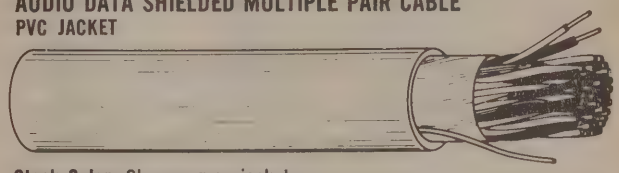


**Stock Color:** Chrome gray jacket.
**Construction:** Tinned copper conductors, color-coded polypropylene insulation, cabled in pairs, each pair and its drain wire under Flexfoil® aluminum foil/polyester shield, PVC jacket overall.
**Jacket:** +60°C. Conductors: +105°C. Suggested working voltage: 22 gauge — 300V; 20 gauge — 350V: 18 gauge — 400V. 100 Megohms/M insulation resistance between shields. 115PF/FT. capacitance between adjacent shields. 1500V voltage breakdowns between adjacent shields. 50V working voltage between adjacent shields. 22 gauge and 20 gauge series — 22 gauge drain wire; 18 gauge series — 20 gauge drain wire. JACKET ONLY PASSES VW-1 VERTICAL FLAME TEST.
**Color Code:** Chart I, Page 4544.
**Applications:** For audio RF and pulse applications requiring superior circuit isolation. The use of polypropylene insulation results in excellent high frequency properties and mechanical durability.
**Put-up:** 100′, 500′ and 1000′ spools.**

## INDIVIDUALLY SHIELDED MULTIPLE PAIR AUDIO/DATA CABLE (CONT'D)

| Columbia No. | No. of Pairs | No. of Cond. | AWG (Stranding) | Nom. Insul. Thick. | Jacket Thick. In. | Nom. O.D. In. |
|---|---|---|---|---|---|---|
| C6040 | 3 | 6 | 22 (7/30) | .011 | .030 | .260 |
| C6041 | 6 | 12 | 22 (7/30) | .011 | .030 | .340 |
| C6042 | 9 | 18 | 22 (7/30) | .011 | .035 | .405 |
| C6043 | 11 | 22 | 22 (7/30) | .011 | .035 | .440 |
| C6059 | 12 | 24 | 22 (7/30) | .011 | .035 | .455 |
| C6044 | 15 | 30 | 22 (7/30) | .011 | .040 | .520 |
| C6060 | 17 | 34 | 22 (7/30) | .011 | .040 | .545 |
| C6045 | 19 | 38 | 22 (7/30) | .011 | .040 | .575 |
| C6046 | 27 | 54 | 22 (7/30) | .011 | .050 | .675 |
| C6052 | 3 | 6 | 20 (10/30) | .013 | .035 | .315 |
| C6053 | 6 | 12 | 20 (10/30) | .013 | .040 | .420 |
| C6054 | 9 | 18 | 20 (10/30) | .013 | .045 | .500 |
| C6055 | 11 | 22 | 20 (10/30) | .013 | .045 | .545 |
| C5056 | 12 | 24 | 20 (10/30) | .013 | .045 | .560 |
| C6057 | 13 | 26 | 20 (10/30) | .013 | .055 | .610 |
| C6058 | 15 | 30 | 20 (10/30) | .013 | .055 | .640 |
| C6047 | 3 | 6 | 18 (16/30) | .016 | .035 | .375 |
| C6048 | 6 | 12 | 18 (16/30) | .016 | .045 | .495 |
| C6049 | 9 | 18 | 18 (16/30) | .016 | .055 | .575 |
| C6050 | 12 | 24 | 18 (16/30) | .016 | .070 | .705 |
| C6051 | 15 | 30 | 18 (16/30) | .016 | .070 | .785 |

## AUDIO DATA SHIELDED MULTIPLE PAIR CABLE
### PVC JACKET

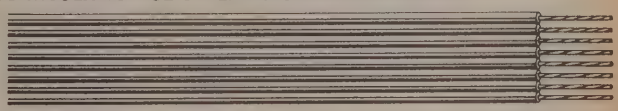


**Stock Color:** Chrome gray jacket.
**Construction:** Tinned copper conductors, color-coded PVC insulation, cabled in pairs, overall Flexfoil® aluminum foil/polyester shield, stranded tinned copper drain wire, PVC jacket overall.
**Specifications:** −20°C to +60°C. UL listed (Wires Misc.). 90V max.
**Color Code:** Chart I, Page 4544.
**Put-up:** 100′, 500′ and 1000′ spools. (Other put-ups also available.)

| Cat. No. | No. of Pairs | No. of Cond. | Cond. Size | Cond. Strand. | Nom. Insul. Thck. (In.) | Nom. Jkt. Thck. (In.) | Nom. O.D. (In.) | Nom. Cap.* PF/ FT. |
|---|---|---|---|---|---|---|---|---|
| C1670 | 2 | 4 | 22 | Solid | .012 | .025 | .210 | 35 |
| C1671 | 6 | 12 | 22 | Solid | .012 | .025 | .285 | 35 |
| C1672 | 9 | 18 | 22 | Solid | .012 | .030 | .340 | 35 |
| C1673 | 15 | 30 | 22 | Solid | .012 | .035 | .435 | 35 |
| C1674 | 19 | 38 | 22 | Solid | .012 | .035 | .465 | 35 |
| C1675 | 27 | 54 | 22 | Solid | .012 | .040 | .570 | 35 |

*Capacitance between conductors.

## CONTROL CABLE MULTI-CONDUCTOR FLAT RIBBON PVC INSULATION UL STYLE 2476 AND MIL-W-16878



**Stock Color:** See table Page 4546.
**Construction UL 2476:** Tinned copper conductors, color-coded PVC insulation per UL 1061, conductors bonded to form flat ribbon cable. Nominal insulation thickness .010″.
**Construction MIL-W-16878:** Tinned copper conductors, color-coded PVC insulation per MIL-W-16878 Type B, conductors bonded to form flat ribbon cable. Nominal insulation thickness .010″.
**Specifications UL 2476:** −55°C to +80°C. Suggested working voltage, 300V.
**Specifications MIL-W-16878:** −55°C to +105°C. Suggested working voltage 600V.
**Applications:** Circuit connections, interconnecting assemblies; wiring harnesses for sliding drawers, drop panels and racks. Reduces installation time, space and weight. Conductors easily separated for termination. Resistant to oil, flame, acids, moisture, fungus and solvents. Contact factory for custom designed ribbon cables consisting of different gauge sizes and number of conductors.
**Put-up:** 100′, 500′ and 1000′ spools. (Other put-ups also available.)

COLUMBIA ELECTRONIC CABLES • Dept. EM, 11 Cove St., New Bedford, Mass. 02744 • Phone: (617) 999-4451 • Telex: 92-9411
Los Angeles, CA 90058 • Phone (213) 583-9825
HOT LINE 800-225-8540

## CONTROL CABLE MULTI-CONDUCTOR
### FLAT RIBBON PVC INSULATION (CONT'D)

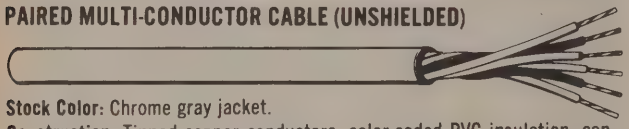
| UL 2476 Catalog Number | MIL-W-16878 Catalog Number | No. of Cond. | Size Cond. | Stranding Cond. | Nom. O.D. (Inches) |
|---|---|---|---|---|---|
| C6700 | C6600 | 10 | 28 | 7/36 | .035 x .350 |
| C6701 | C6601 | 14 | 28 | 7/36 | .035 x .490 |
| C6702 | C6602 | 15 | 28 | 7/36 | .035 x .525 |
| C6703 | C6603 | 16 | 28 | 7/36 | .035 x .560 |
| C6704 | C6604 | 20 | 28 | 7/36 | .035 x .700 |
| C6705 | C6605 | 24 | 28 | 7/36 | .035 x .840 |
| C6706 | C6606 | 25 | 28 | 7/36 | .035 x .875 |
| C6707 | C6607 | 30 | 28 | 7/36 | .035 x 1.050 |
| C6708 | C6608 | 10 | 26 | 7/34 | .039 x .390 |
| C6709 | C6609 | 14 | 26 | 7/34 | .039 x .546 |
| C6710 | C6610 | 15 | 26 | 7/34 | .039 x .585 |
| C6711 | C6611 | 16 | 26 | 7/34 | .039 x .624 |
| C6712 | C6612 | 20 | 26 | 7/34 | .039 x .780 |
| C6713 | C6613 | 24 | 26 | 7/34 | .039 x .930 |
| C6714 | C6614 | 25 | 26 | 7/34 | .039 x .975 |
| C6715 | C6615 | 30 | 26 | 7/34 | .039 x 1.170 |
| C6716* | C6616* | 10 | 24 | 7/32 | .044 x .440 |
| C6717* | C6617* | 15 | 24 | 7/32 | .044 x .660 |
| C6730* | C6630* | 20 | 24 | 7/32 | .044 x .880 |
| C6719* | C6619* | 25 | 24 | 7/32 | .044 x 1.110 |
| C6720* | C6620* | 30 | 24 | 7/32 | .044 x 1.320 |
| C6725 | C6625 | 4 | 22 | 7/30 | .051 x .204 |
| C6726 | C6626 | 8 | 22 | 7/30 | .051 x .408 |
| C6721 | C6621 | 10 | 22 | 7/30 | .051 x .510 |
| C6727 | C6627 | 12 | 22 | 7/30 | .051 x .612 |
| C6722 | C6622 | 15 | 22 | 7/30 | .051 x .765 |
| C6728 | C6628 | 16 | 22 | 7/30 | .051 x .816 |
| C6729 | C6629 | 20 | 22 | 7/30 | .051 x 1.020 |
| C6723 | C6623 | 25 | 22 | 7/30 | .051 x 1.275 |
| C6724 | C6624 | 30 | 22 | 7/30 | .051 x 1.530 |

* 24 AWG also available in 19 strand. Consult factory. Also consult factory for paired ribbon cable.

**COLOR CONDUCTOR CODE**

| Cond. | Color | Cond. | Color | Cond. | Color | Cond. | Color |
|---|---|---|---|---|---|---|---|
| 1 | Brown | 6 | Blue | 11 | Brown | 16 | Blue |
| 2 | Red | 7 | Violet | 12 | Red | 17 | Violet |
| 3 | Orange | 8 | Gray | 13 | Orange | 18 | Gray |
| 4 | Yellow | 9 | White | 14 | Yellow | 19 | White |
| 5 | Green | 10 | Black | 15 | Green | 20 | Black |

## PAIRED MULTI-CONDUCTOR CABLE (UNSHIELDED)



**Stock Color:** Chrome gray jacket.

**Construction:** Tinned copper conductors, color-coded PVC insulation, conductors paired with a short lay twist for conductor balance providing a circuit free from cross talk, pairs cabled, PVC jacket overall.

**Specifications:** −20°C to +60°C. Entire cable passes VW-1 vertical flame test.

**Color Code:** See Chart II, this page.

**Applications:** Heavy-duty intercom and audio cable for intercom systems, signal systems, annunciators, nurse's call systems, multiple speaker systems, control circuit cables.

**Put-up:** 100′, 500′ and 1000′ spools.**

| Columbia No. | No. of Pairs | No. of Cond. | AWG (Stranding) | Jacket Thick. In. | Nom. Insul. Thick. | Nom. O.D. In. |
|---|---|---|---|---|---|---|
| **SOLID CONDUCTORS** UL listed (Wires, Misc.) 90V max. | | | | | | |
| C4008 | 1 | 2 | 22 (Solid) | .025 | .012 200V | .150 |
| C4010 † | 2 | 4 | 22 (Solid) | .025 | .012 300V | .210 |
| C4014 † | 3 | 6 | 22 (Solid) | .025 | .012 300V | .225 |
| C4015 † | 4 | 8 | 22 (Solid) | .025 | .012 300V | .240 |
| C4016 † | 5 | 10 | 22 (Solid) | .025 | .012 300V | .260 |
| C4017 | 6 | 12 | 22 (Solid) | .025 | .012 200V | .280 |
| C4018 | 7 | 14 | 22 (Solid) | .025 | .012 200V | .295 |
| C4019 | 8 | 16 | 22 (Solid) | .025 | .012 300V | .305 |
| C4020 | 9 | 18 | 22 (Solid) | .030 | .012 200V | .335 |
| C4022 | 11 | 22 | 22 (Solid) | .030 | .012 200V | .370 |
| C4024 | 13 | 26 | 22 (Solid) | .035 | .012 200V | .410 |
| C4026 | 15 | 30 | 22 (Solid) | .035 | .012 200V | .430 |
| C4028 | 16 | 32 | 22 (Solid) | .035 | .012 200V | .440 |
| C4029 | 19 | 38 | 22 (Solid) | .035 | .012 200V | .460 |
| C4031 | 23 | 46 | 22 (Solid) | .040 | .012 200V | .525 |
| C4030 | 27 | 54 | 22 (Solid) | .040 | .012 200V | .565 |
| C4032 | 41 | 82 | 22 (Solid) | .045 | .012 200V | .685 |
| C4038 | 51 | 102 | 22 (Solid) | .060 | .012 200V | .765 |
| † UL 2464 **STRANDED CONDUCTORS** UL listed (Wires, Misc.) 90 V max. | | | | | | |
| C6010 | 2 | 4 | 22 (7/30) | .025 | .010 300V | .210 |
| C6014 | 3 | 6 | 22 (7/30) | .025 | .010 300V | .230 |

## PAIRED MULTI-CONDUCTOR CABLE (Cont'd)

| Columbia No. | No. of Pairs | No. of Cond. | AWG (Stranding) | Jacket Thick. In. | Nom. Insul. Thick. | Nom. O.D. In. |
|---|---|---|---|---|---|---|
| **STRANDED CONDUCTORS (CONT'D)** | | | | | | |
| C6015 | 4 | 8 | 22 (7/30) | .025 | .010 300V | .250 |
| C6017 | 6 | 12 | 22 (7/30) | .025 | .010 200V | .275 |
| C6019 | 9 | 18 | 22 (7/30) | .030 | .010 200V | .340 |
| C6023 | 12 | 24 | 22 (7/30) | .030 | .010 200V | .385 |
| C6026 | 15 | 30 | 22 (7/30) | .035 | .010 200V | .435 |
| C6027 | 19 | 38 | 22 (7/30) | .035 | .010 200V | .470 |
| C6028 | 23 | 46 | 22 (7/30) | .040 | .010 200V | .530 |
| C6030 | 27 | 54 | 22 (7/30) | .040 | .010 200V | .570 |
| C6032 | 31 | 62 | 22 (7/30) | .050 | .010 200V | .635 |
| C6033 | 41 | 82 | 22 (7/30) | .060 | .010 200V | .730 |
| C6025 | 51 | 102 | 22 (7/30) | .060 | .010 200V | .780 |
| UL listed 2464 | | | | | | |
| C6113 | 3 | 6 | 20 (10/30) | .025 | .015 300V | .260 |
| C6114 | 6 | 12 | 20 (10/30) | .030 | .015 300V | .350 |
| C6115 | 9 | 18 | 20 (10/30) | .035 | .015 300V | .445 |
| C6116 | 15 | 30 | 20 (10/30) | .040 | .015 300V | .585 |
| C6101 | 1 | 2 | 18 (16/30) | .025 | .018 400V | .220 |
| C6118 | 2 | 4 | 18 (16/30) | .035 | .018 400V | .310 |
| C6103 | 3 | 6 | 18 (16/30) | .035 | .018 400V | .330 |
| C6119 | 4 | 8 | 18 (16/30) | .035 | .018 400V | .370 |
| C6120 | 5 | 10 | 18 (16/30) | .035 | .018 400V | .400 |
| C6106 | 6 | 12 | 18 (16/30) | .035 | .018 400V | .440 |
| C6121 | 8 | 16 | 18 (16/30) | .040 | .018 400V | .500 |
| C6109 | 9 | 18 | 18 (16/30) | .040 | .018 400V | .545 |
| C6110 | 12 | 24 | 18 (16/30) | .050 | .018 400V | .640 |
| C6111 | 15 | 30 | 18 (16/30) | .060 | .018 400V | .750 |
| C6112 | 19 | 38 | 18 (16/30) | .060 | .018 400V | .795 |

## CONDUCTOR COLOR CODE CHART II

| No. Prs. | Paired Colors | No. Prs. | Paired Colors | No. Prs. | Paired Colors |
|---|---|---|---|---|---|
| 1 | Black, Red | 18 | Green, Orange | 35 | Purple, Slate |
| 2 | Black, White | 19 | White, Blue | 36 | Purple, Black |
| 3 | Black, Green | 20 | White, Yellow | 37 | Slate, Red |
| 4 | Black, Blue | 21 | White, Brown | 38 | Slate, White |
| 5 | Black, Yellow | 22 | White, Orange | 39 | Slate, Green |
| 6 | Black, Brown | 23 | Blue, Yellow | 40 | Slate, Blue |
| 7 | Black, Orange | 24 | Blue, Brown | 41 | Slate, Brown |
| 8 | Red, White | 25 | Blue, Orange | 42 | Slate, Yellow |
| 9 | Red, Green | 26 | Brown, Yellow | 43 | Slate, Orange |
| 10 | Red, Blue | 27 | Brown, Orange | 44 | Slate, Black |
| 11 | Red, Yellow | 28 | Purple, Red | 45 | W/B*, Red |
| 12 | Red, Brown | 29 | Purple, White | 46 | W/B*, Green |
| 13 | Red, Orange | 30 | Purple, Green | 47 | W/B*, Blue |
| 14 | Green, White | 31 | Purple, Blue | 48 | W/B*, Brown |
| 15 | Green, Blue | 32 | Purple, Brown | 49 | W/B*, Yellow |
| 16 | Green, Yellow | 33 | Purple, Yellow | 50 | W/B*, Orange |
| 17 | Green, Brown | 34 | Purple, Orange | 51 | W/B*, Purple |

* White body with black stripe.

## TWO-CONDUCTOR MICROPHONE CABLE
### SPIRAL SHIELD

**Stock Color:** Silver gray jacket.

**Construction:** Tinned copper conductors, color-coded polyethylene insulation, cabled with fillers, textile wrap, spiral tinned copper shield, high gloss Flexlife® jacket.

**Specifications:** −20°C to +60°C.

**Color Code:** White, Black.

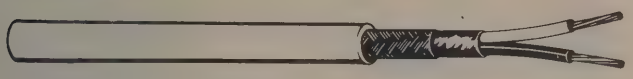
**Applications:** For use with low impedance microphones. Flexlife jacket provides extreme flexibility, high abrasion resistance and outstanding appearance.

**Put-up:** 100′, 250′, 500′ and 1000′spools (other Put-ups also available).

| Columbia No. | Impedance | AWG (Stranding) | Nom. Insul. Thick. In. | Jkt. Thick. In. | Nom. O.D. In. |
|---|---|---|---|---|---|
| C1323 | Low | 22 (16/34) | .025 | .025 | .225 |
| C1328 | Min. Low | 24 (10/34) | .016 | .030 | .190 |

COLUMBIA ELECTRONIC CABLES • Dept. EM, 11 Cove St., New Bedford, Mass. 02744 • Phone: (617) 999-4451 • Telex: 92-9411
Los Angeles, CA 90058 • Phone (213) 583-9825
**HOT LINE 800-225-8540**

## BRAIDED SHIELD



**Stock Color:** Silver gray jacket.

**Construction:** Tinned copper conductors, color-coded polyethylene insulation, cabled with fillers, textile wrap, braided tinned copper shield, high gloss Flexlife jacket.

**Specifications:** −20°C to +60°C.

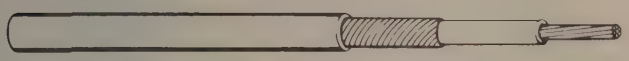
**Color Code:** White, Black.

**Applications:** For use with low impedance microphones. Flexlife jacket provides extreme flexibility, high abrasion resistance and outstanding appearance.

**Put-up:** 100′, 250′, 500′ and 1000′ spools (other Put-ups also available).

| Columbia No. | Impedance | AWG (Stranding) | Nom. Insul. Thick. In. | Jkt. Thick. In. | Nom. O.D. In. |
|---|---|---|---|---|---|
| **C1322** | Low | 22 (16/34) | .025 | .025 | .235 |

## ONE-CONDUCTOR MICROPHONE CABLE
### SPIRAL SHIELD



**Stock Color:** Silver gray jacket. (Cat. No. C1359 available in black jacket.)

**Construction:** Single conductor 3/33 strands tinned copper, 4/33 strands tinned copperweld, white foam polyethylene dielectric, spiral tinned copper shield, high gloss Flexlife® jacket.

**Specifications:** −20°C to +60°C.

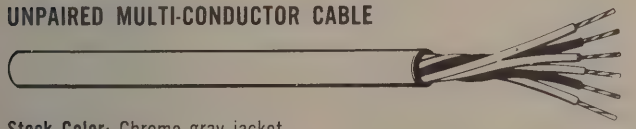
**Applications:** For use with high impedance microphones and hi-fi interconnecting cables. Flexfoam dielectric (foam polyethylene) provides as much as 35% lower capacitance than the best standard solid polyethylene dielectric microphone cables. Flexfoam cables are the most flexible plastic microphone cable available, with limpness almost equal to rubber and with better abrasion resistance.

**Put-up:** 100′, 250′, 500′ and 1000′ spools (other Put-ups also available).

| Columbia No. | Microphone Type | Thick. In. | | Nom. Cap. MMF/Ft. | Nom. O.D. In. |
|---|---|---|---|---|---|
| | | Insulation | Jacket | | |
| **C1359** | Min. | .016 | .012 | 29 | .085 |
| **C1369** | Lapel | .030 | .020 | 19 | .130 |
| **C1389** | Crystal | .050 | .025 | 15 | .185 |
| **C1395** | Crystal | .075 | .030 | 13 | .245 |
| **C1314*** | Crystal | .040 | .020 | 25 | .155 |

* Solid polyethylene dielectric.

## UNPAIRED MULTI-CONDUCTOR CABLE



**Stock Color:** Chrome gray jacket.

**Construction:** Tinned copper conductors (Cat. Nos. C2754 and C2755 are bare copper), color-coded PVC insulation, PVC jacket overall, conductors cabled.

**Specifications:** −20°C to +60°C. All items pass VW-1 vertical flame test.

**Color Code:** Chart III.

**Applications:** PA systems, unbalanced intercom systems, interconnecting cables, remote control circuits, telephones, low-voltage relay control cables.

**Put-up:** 100′, 500′ and 1000′ spools (other Put-ups also available).

### SOLID CONDUCTORS — UL listed (Wires, Misc.) 90V max.

| Columbia No. | No. of Cond. | AWG (Stranding) | Nom. Insul. Thick. In. | Nom. Jacket Thick. In. | Nom. O.D. In. |
|---|---|---|---|---|---|
| **C4008** | 2 | 22 (1) | .012 | .025 | .150 |
| **C4310** | 3 | 22 (1) | .012 | .025 | .160 |
| **C4311** | 2 | 20 (1) | .015 | .025 | .175 |
| **C2754** | 2 | 19 (1) | .015 | .025 | .180 |
| **C2755** | 3 | 19 (1) | .015 | .025 | .190 |

### STRANDED CONDUCTORS

| Columbia No. | No. of Cond. | AWG (Stranding) | Nom. Insul. Thick. In. | Nom. Jacket Thick. In. | Nom. O.D. In. |
|---|---|---|---|---|---|
| **UL LISTED** (WIRES MISC.) 90V MAX. | | | | | |
| **C6348** | 2 | 22 (7/30) | .015 | .025 | .160 |
| **UL 2576** | | | | | |
| **C4062** | 3 | 22 (7/30) | .010 | .025 | .165 |
| **C4063** | 4 | 22 (7/30) | .010 | .025 | .170 |
| **C4064** | 5 | 22 (7/30) | .010 | .025 | .185 |
| **C4066** | 6 | 22 (7/30) | .010 | .025 | .200 |
| **C4088** | 7 | 22 (7/30) | .010 | .025 | .205 |
| **C4065** | 8 | 22 (7/30) | .010 | .025 | .215 |
| **C4070** | 9 | 22 (7/30) | .010 | .025 | .230 |
| **C4071** | 10 | 22 (7/30) | .010 | .025 | .250 |
| **C4067** | 12 | 22 (7/30) | .010 | .025 | .260 |
| **C4073** | 15 | 22 (7/30) | .015 | .025 | .315 |
| **C4069** | 18 | 22 (7/30) | .010 | .030 | .320 |
| **C4075** | 20 | 22 (7/30) | .010 | .030 | .330 |
| **C4076** | 25 | 22 (7/30) | .010 | .030 | .370 |
| **C4077** | 30 | 22 (7/30) | .010 | .035 | .385 |
| **C4078** | 40 | 22 (7/30) | .010 | .035 | .455 |
| **C4079** | 50 | 22 (7/30) | .010 | .040 | .500 |
| **C4087** | 60 | 22 (7/30) | .010 | .040 | .535 |
| **UL 2464** | | | | | |
| **C6351** | 2 | 20 (10/30) | .015 | .025 | .190 |
| **C6352** | 3 | 20 (10/30) | .015 | .025 | .200 |
| **C6353** | 1 | 20 (10/30) | .015 | .025 | .215 |
| **C6355** | 5 | 20 (10/30) | .015 | .030 | .240 |
| **C6356** | 7 | 20 (10/30) | .015 | .030 | .265 |
| **C6357** | 9 | 20 (10/30) | .015 | .035 | .310 |
| **C6358** | 15 | 20 (10/30) | .015 | .040 | .395 |
| **C2830** | 2 | 18 (16/30) | .018 | .025 | .220 |
| **C2831** | 3 | 18 (16/30) | .018 | .025 | .230 |
| **C2404** | 4 | 18 (16/30) | .018 | .025 | .255 |
| **NOT UL LISTED** | | | | | |
| **C2405** | 2 | 16 (26/30) | .023 | .025 | .250 |
| **C2406** | 3 | 16 (26/30) | .023 | .025 | .265 |
| **C2409** | 2 | 15 (41/30) | .030 | .030 | .332 |
| **C2410** | 2 | 12 (65/30) | .030 | .030 | .370 |

**CONDUCTOR COLOR CODE CHART III.**

No. C2754 has red and white conductors; No. C2755 has red, white and green; Nos. C2830, C2405, C2409 and C2410 have black and white. All other cables above have conductors as indicated in this table. First color is body; second or third colors are stripes.

| No. | Color | No. | Color | No. | Color | No. | Color |
|---|---|---|---|---|---|---|---|
| 1 | Black | 7 | Brown | 13 | Red/Green | 19 | White/Yellow |
| 2 | Red | 8 | Yellow | 14 | Red/Yellow | 20 | White/Blue |
| 3 | White | 9 | Purple | 15 | Red/Black | 21 | White/Brown |
| 4 | Green | 10 | Gray | 16 | White/Black | 22 | White/Orange |
| 5 | Orange | 11 | Pink | 17 | White/Red | 23 | White/Gray |
| 6 | Blue | 12 | Tan | 18 | White/Green | 24 | White/Violet |
| | | | | | | 25 | White/Black/Red |

## SHIELDED CONTROL CABLE

**Stock Color:** Black jacket.

**Construction:** Tinned copper conductors, color-coded rubber insulation, cabled, filled where required, clear mylar wrap, tinned copper braided shield, cotton wrap, neoprene jacket or rubber jacket.

**Specifications:** −20°C to +60°C. Suggested working voltage 350V.

**Color Code:** Chart IV, Page 4548.

**Applications:** Control circuits, video and audio interconnecting cables, broadcast and studio use. Precision engineered to prevent cross-talk and eliminate hum pick-up. Neoprene and rubber jackets are resistant to impact and abrasion and have extra limpness. For outside installations, neoprene is recommended being resistant to oil, ozone, moisture and sunlight.

**Put-up:** 100′, 500′ and 1000′ spools (other Put-ups also available).

### RUBBER JACKET — HEAVY DUTY

| Columbia No. | No. of Cond. | AWG (Stranding) | Nom. Insul. Thick. In. | Nom. Jacket Thick. In. | Nom. O.D. In. |
|---|---|---|---|---|---|
| **C1303** | 2 | 18 (41/34) | .020 | .035 | .295 |
| **C1300** | 1 | 20 (26/34) | .040 | .035 | .230 |
| **C1302** | 2 | 20 (26/34) | .020 | .035 | .270 |
| **C1304** | 3 | 20 (26/34) | .020 | .035 | .285 |
| **C1305** | 4 | 20 (26/34) | .020 | .035 | .305 |
| **C1308** | 5 | 20 (26/34) | .020 | .035 | .330 |
| **C1310** | 6 | 20 (26/34) | .020 | .035 | .345 |
| **C1312** | 7 | 20 (26/34) | .020 | .035 | .360 |
| **C1313** | 8 | 20 (26/34) | .020 | .035 | .385 |
| **C1315** | 10 | 20 (26/34) | .020 | .035 | .440 |
| **C1316** | 12 | 20 (26/34) | .020 | .065 | .525 |
| **C1317** | 15 | 20 (26/34) | .020 | .065 | .595 |
| **C1325** | 20 | 20 (26/34) | .020 | .065 | .660 |

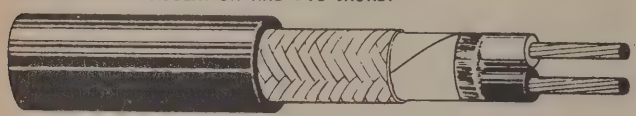
Shielded Control Cables continued on following page.

COLUMBIA ELECTRONIC CABLES • Dept. EM, 11 Cove St., New Bedford, Mass. 02744 • Phone: (617) 999-4451 • Telex: 92-9411
Los Angeles, CA 90058 • Phone (213) 583-9825
**HOT LINE 800-225-8540**

## SHIELDED CONTROL CABLES (CONT'D)
### NEOPRENE JACKET — HEAVY DUTY

| | | | | | |
|---|---|---|---|---|---|
| **C1201** | 1 | 18 (41/34) | .040 | .035 | .240 |
| **C1202** | 2 | 18 (41/34) | .020 | .035 | .295 |
| **C1203** | 3 | 18 (41/34) | .020 | .035 | .305 |
| **C1204** | 4 | 18 (41/34) | .020 | .035 | .330 |
| **C1206** | 6 | 18 (41/34) | .020 | .035 | .370 |
| **C1208** | 8 | 18 (41/34) | .020 | .035 | .420 |
| **C1210** | 10 | 18 (41/34) | .020 | .035 | .480 |
| **C1212** | 12 | 18 (41/34) | .020 | .065 | .555 |
| **C1215** | 15 | 18 (41/34) | .020 | .065 | .640 |
| **C1220** | 20 | 18 (41/34) | .020 | .065 | .730 |
| **C1602** | 2 | 16 (65/34) | .025 | .035 | .335 |
| **C1603** | 3 | 16 (65/34) | .025 | .035 | .355 |
| **C1604** | 4 | 16 (65/34) | .025 | .035 | .385 |
| **C1606** | 6 | 16 (65/34) | .025 | .040 | .445 |
| **C1608** | 8 | 16 (65/34) | .025 | .040 | .510 |
| **C1610** | 10 | 16 (65/34) | .025 | .040 | .575 |
| **C1612** | 2 | 14 (41/30) | .030 | .040 | .395 |
| **C1613** | 3 | 14 (41/30) | .030 | .040 | .425 |
| **C1614** | 4 | 14 (41/30) | .030 | .040 | .455 |
| **C1616** | 6 | 14 (41/30) | .030 | .040 | .515 |
| **C1622** | 2 | 12 (65/30) | .030 | .040 | .440 |
| **C1623** | 3 | 12 (65/30) | .030 | .040 | .465 |
| **C1624** | 4 | 12 (65/30) | .030 | .040 | .505 |
| **C1632** | 2 | 10 (105/30) | .030 | .040 | .495 |
| **C1633** | 3 | 10 (105/30) | .030 | .040 | .520 |

### POLYETHYLENE INSULATION AND PVC JACKET



**Stock Color:** Chrome gray jacket.
**Construction:** Tinned copper conductors, color-coded polyethylene insulation, cabled, filled where required, clear mylar wrap, tinned copper braid shield, PVC jacket overall.
**Specifications:** −20°C to +60°C. Suggested working voltage 600V. Jacket only passes VW-1 vertical flame test.
**Color Code:** Chart IV.
**Applications:** Low capacity cable for control circuits, video and audio interconnecting cables, broadcast and studio use. Precision engineered to prevent cross-talk and eliminate hum pick-up. Low capacitance, light weight.
**Put-up:** 100′, 500′ and 1000′ spools. (Other put-ups also available.)

### CONDUCTORS 20 GA 26/34 STR T.C.

| Columbia No. | No. of Cond. | Nom. Insul. Thick. In. | Nom. Jacket Thick. In. | Nom. O.D. In. |
|---|---|---|---|---|
| **C1642** | 2 | .015 | .040 | .250 |
| **C1643** | 3 | .015 | .045 | .270 |
| **C1644** | 4 | .015 | .045 | .290 |
| **C1645** | 5 | .015 | .045 | .310 |
| **C1646** | 6 | .015 | .045 | .325 |
| **C1648** | 8 | .015 | .045 | .350 |
| **C1650** | 10 | .015 | .045 | .390 |
| **C1652** | 12 | .015 | .045 | .405 |
| **C1655** | 15 | .015 | .045 | .440 |
| **C1660** | 20 | .015 | .045 | .480 |

## UNSHIELDED CONTROL CABLE
### RUBBER INSULATION AND RUBBER JACKET

**Stock Color:** Black jacket.
**Construction:** Tinned copper conductors, color-coded rubber insulation, cabled, filled where required, cotton wrap, rubber jacket.
**Specifications:** −20°C to +60°C. Suggested working voltage 350V.
**Color Code:** Chart IV.
**Applications:** Control circuits, broadcast and studio use, traffic and fire alarm control, temperature control systems, other multiple control applications. Resistant to impact and abrasion. Extra limpness.
**Put-up:** 100′, 500′ and 1000′ spools (other Put-ups also available).

### CONDUCTORS 20 GA 26/34 STR T.C.

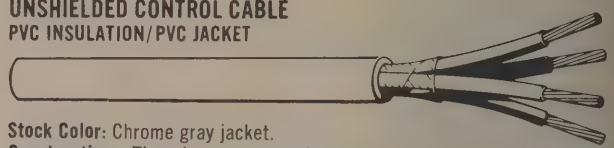
| Columbia No. | No. of Cond. | Nom. Insul. Thick. In. | Nom. Jacket Thick. In. | Nom. O.D. In. |
|---|---|---|---|---|
| **C3602** | 2 | .020 | .035 | .240 |
| **C3603** | 3 | .020 | .035 | .255 |
| **C3604** | 4 | .020 | .035 | .275 |
| **C3605** | 5 | .020 | .035 | .300 |
| **C3606** | 6 | .020 | .035 | .315 |
| **C3607** | 7 | .020 | .035 | .325 |
| **C3608** | 8 | .020 | .035 | .360 |
| **C3610** | 10 | .020 | .035 | .410 |
| **C3612** | 12 | .020 | .035 | .435 |
| **C3615** | 15 | .020 | .035 | .505 |
| **C3620** | 20 | .020 | .035 | .570 |

### CONDUCTOR COLOR CODE CHART IV.

First color is body color; second color is stripe.

| No. | Color | No. | Color | No. | Color |
|---|---|---|---|---|---|
| 1 | Black | 8 | Orange | 15 | White/Blue |
| 2 | White | 9 | Gray (Slate) | 16 | White/Brown |
| 3 | Red | 10 | Purple | 17 | White/Purple |
| 4 | Green | 11 | White/Black | 18 | White/Gray |
| 5 | Yellow | 12 | White/Red | 19 | Black/Red |
| 6 | Blue | 13 | White/Green | 20 | Black/Yellow |
| 7 | Brown | 14 | White/Yellow | | |

## UNSHIELDED CONTROL CABLE
### PVC INSULATION/PVC JACKET



**Stock Color:** Chrome gray jacket.
**Construction:** Tinned copper conductors, color-coded PVC insulation, mylar binder overall (no mylar binder on Cat. Nos. C2404, C2420, C2421, C2422), PVC jacket, conductors cabled.
**Specifications:** −20°C to +60°C. Suggested working voltage: 18GA — 400V, 16GA - 12GA — 600V. Pass VW-1 vertical flame test. 18GA cables UL listed (Wires, misc.).
**Color Code:** Chart V.
**Applications:** Interconnecting cables for electronic equipment, control circuits, broadcast and studio use, temperature control systems.
**Put-up:** 100′, 500′ and 1000′ spools (other Put-ups also available).

| Columbia No. | No. of Cond. | AWG (Stranding) | Nom. Insul. In. | Jacket Thck. In. | Nom. O.D. In. |
|---|---|---|---|---|---|
| **C2404** | 4 | 18 (16/30) | .018 | .025 | .255 |
| **C2420** | 5 | 18 (16/30) | .018 | .037 | .300 |
| **C2421** | 7 | 18 (16/30) | .018 | .037 | .325 |
| **C2422** | 9 | 18 (16/30) | .018 | .037 | .375 |
| **C2412** | 12 | 18 (16/30) | .018 | .040 | .430 |
| **C2423** | 15 | 18 (16/30) | .018 | .045 | .485 |
| **C2424** | 19 | 18 (16/30) | .018 | .045 | .510 |
| **C2433** | 25 | 18 (16/30) | .018 | .060 | .625 |
| **C2425** | 4 | 16 (19/29) | .030 | .045 | .380 |
| **C2434** | 5 | 16 (19/29) | .030 | .045 | .410 |
| **C2426** | 7 | 16 (19/29) | .030 | .045 | .445 |
| **C2435** | 9 | 16 (19/29) | .030 | .045 | .510 |
| **C2427** | 12 | 16 (19/29) | .030 | .060 | .610 |
| **C2428** | 15 | 16 (19/29) | .030 | .060 | .675 |
| **C2429** | 19 | 16 (19/29) | .030 | .065 | .725 |
| **C2436** | 25 | 16 (19/29) | .030 | .065 | .830 |
| **C2430** | 4 | 14 (19/27) | .045 | .045 | .480 |
| **C2437** | 5 | 14 (19/27) | .045 | .060 | .555 |
| **C2431** | 7 | 14 (19/27) | .045 | .060 | .605 |
| **C2438** | 9 | 14 (19/27) | .045 | .065 | .715 |
| **C2432** | 12 | 14 (19/27) | .045 | .065 | .800 |
| **C2439** | 15 | 14 (19/27) | .045 | .080 | .920 |
| **C2440** | 4 | 12 (65/30) | .045 | .045 | .540 |
| **C2442** | 7 | 12 (65/30) | .045 | .060 | .675 |
| **C2444** | 10 | 12 (65/30) | .045 | .080 | .900 |

### CONDUCTOR COLOR CODE CHART V

| No. | Color | No. | Color | No. | Color |
|---|---|---|---|---|---|
| 1 | Black | 10 | Orange/Black | 19 | Blue/Red |
| 2 | White | 11 | Blue/Black | 20 | Red/Green |
| 3 | Red | 12 | Black/White | 21 | Orange/Green |
| 4 | Green | 13 | Red/White | 22 | Black/White/Red |
| 5 | Orange | 14 | Green/White | 23 | White/Black/Red |
| 6 | Blue | 15 | Blue/White | 24 | Red/Black/White |
| 7 | White/Black | 16 | Black/Red | 25 | Green/Black/White |
| 8 | Red/Black | 17 | White/Red | | |
| 9 | Green/Black | 18 | Orange/Red | | |

COLUMBIA ELECTRONIC CABLES • Dept. EM, 11 Cove St., New Bedford, Mass. 02744 • Phone: (617) 999-4451 • Telex: 92-9411
Los Angeles, CA 90058 • Phone (213) 583-9825
HOT LINE 800-225-8540

## UNSHIELDED COMPUTER & CONTROL CABLE

### MULTI-CONDUCTOR AND PAIRED CABLES

UL 2343
CSA SR-PVC 80°C

**Stock Color:** Chrome gray jacket.

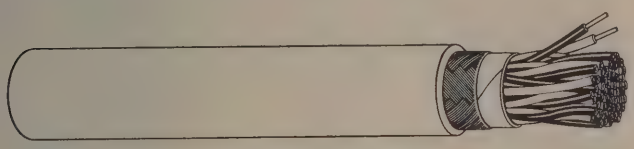
**Construction:** Tinned copper conductors, semi-rigid PVC insulation to UL Style 1061, CSA Type SR-PVC. Cabled in pairs. Clear mylar wrap, nylon ripcord. PVC jacket overall. Nominal insulation thickness, .010 inches.

**Specifications:** 80°C, no specified voltage*. Individual conductors rated at 80°C, 300 volts. Entire cable passes VW-1 Vertical Flame Test.

**Color Code:** Multiconductor, Chart VI; Paired, Chart VII.

**Applications:** For control and signal application in computers, industrial equipment and instrumentation.

**Put-up:** 100′, 500′ and 1000′ spools (no deposit). Other Put-ups available.



PAIRED CABLES, UNSHIELDED

### MULTI-CONDUCTOR & PAIRED UNSHIELDED CABLES

| Columbia No. | | No. of Cond. or Pairs | Cond. Size | Cond. Strand | Nom. Jacket Thick. | Nom. O.D. | |
|---|---|---|---|---|---|---|---|
| Multi-Cond. | Paired | | | | | Multi-Cond. | Paired |
| C4200 | C4230 | 5 | 24 | 7/32 | .060 | .243 | .308 |
| C4201 | C4231 | 7 | 24 | 7/32 | .060 | .258 | .343 |
| C4202 | C4232 | 12 | 24 | 7/32 | .060 | .308 | .410 |
| C4203 | C4233 | 15 | 24 | 7/32 | .060 | .333 | .444 |
| C4204 | C4234 | 19 | 24 | 7/32 | .060 | .346 | .484 |
| C4205 | C4235 | 27 | 24 | 7/32 | .060 | .396 | .555 |
| C4206 | C4236 | 37 | 24 | 7/32 | .060 | .434 | .629 |
| C4207 | C4237 | 48 | 24 | 7/32 | .060 | .486 | .700 |
| C4208 | C4238 | 60 | 24 | 7/32 | .060 | .524 | .766 |
| C4210 | C4240 | 5 | 22 | 7/30 | .060 | .261 | .335 |
| C4211 | C4241 | 7 | 22 | 7/30 | .060 | .273 | .374 |
| C4212 | C4242 | 12 | 22 | 7/30 | .060 | .333 | .453 |
| C4213 | C4243 | 15 | 22 | 7/30 | .060 | .361 | .491 |
| C4214 | C4244 | 19 | 22 | 7/30 | .060 | .376 | .539 |
| C4215 | C4245 | 27 | 22 | 7/30 | .060 | .433 | .619 |
| C4216 | C4246 | 37 | 22 | 7/30 | .060 | .476 | .703 |
| C4217 | C4247 | 48 | 22 | 7/30 | .060 | .535 | .796 |
| C4218 | C4248 | 60 | 22 | 7/30 | .060† | .578 | .905 |
| C4220 | C4250 | 5 | 20 | 19/32 | .060 | .288 | .384 |
| C4221 | C4251 | 7 | 20 | 19/32 | .060 | .306 | .433 |
| C4222 | C4252 | 12 | 20 | 19/32 | .060 | .575 | .530 |
| C4223 | C4253 | 15 | 20 | 19/32 | .060 | .409 | .578 |
| C4224 | C4254 | 19 | 20 | 19/32 | .060 | .427 | .636 |
| C4225 | C4255 | 27 | 20 | 19/32 | .060 | .496 | .734 |
| C4226 | C4256 | 37 | 20 | 19/32 | .060† | .548 | .880 |
| C4227 | C4257 | 48 | 20 | 19/32 | .060† | .618 | .990 |
| C4228 | C4258 | 60 | 20 | 19/32 | .060† | .669 | 1.065 |

* Although computer cables are not voltage rated by UL, inner conductors rated at 300 volts.

## SHIELDED COMPUTER & CONTROL CABLE

### MULTI-CONDUCTOR AND PAIRED CABLES

UL 2343
CSA SR-PVC 80°C

**Stock Color:** Chrome gray jacket.

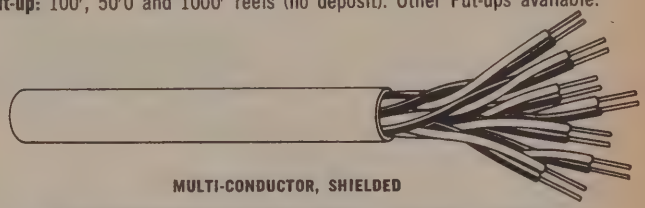
**Construction:** Tinned copper conductors, semi-rigid PVC insulation to UL Style 1061, CSA Type SR-PVC. Cabled in pairs. Clear mylar wrap, nylon ripcord. Braided, tinned copper shield. PVC jacket overall. Nominal insulation thickness, .010 inches.

**Specifications:** 80°C, no specified voltage*. Individual conductors rated at 80°C, 300 volts. Entire cable passes VW-1 Vertical Flame Test.

**Color Code:** Multiconductor, Chart VI; Paired, Chart VII.

**Applications:** For control and signal application in computers, industrial equipment and instrumentation.

**Put-up:** 100′, 50′0 and 1000′ reels (no deposit). Other Put-ups available.



MULTI-CONDUCTOR, SHIELDED

### MULTI-CONDUCTOR & PAIRED OVERALL SHIELDED CABLES

| Columbia No. | | No. of Cond. or Pairs | Cond. Size | Cond. Strand | Nom. Jacket Thick. | Nom. O.D. | |
|---|---|---|---|---|---|---|---|
| Multi-Cond. | Paired | | | | | Multi-Cond. | Paired |
| C5300 | C5330 | 5 | 24 | 7/32 | .060 | .266 | .331 |
| C5301 | C5331 | 7 | 24 | 7/32 | .060 | .281 | .372 |
| C5302 | C5332 | 12 | 24 | 7/32 | .060 | .331 | .433 |
| C5303 | C5333 | 15 | 24 | 7/32 | .060 | .356 | .464 |
| C5304 | C5334 | 19 | 24 | 7/32 | .060 | .375 | .507 |
| C5305 | C5335 | 27 | 24 | 7/32 | .060 | .426 | .584 |
| C5306 | C5336 | 37 | 24 | 7/32 | .060 | .464 | .658 |
| C5307 | C5337 | 48 | 24 | 7/32 | .060 | .516 | .743 |
| C5308 | C5338 | 60 | 24 | 7/32 | .060 | .553 | .811 |
| C5310 | C5340 | 5 | 22 | 7/30 | .060 | .284 | .364 |
| C5311 | C5341 | 7 | 22 | 7/30 | .060 | .296 | .404 |
| C5312 | C5342 | 12 | 22 | 7/30 | .060 | .356 | .482 |
| C5313 | C5343 | 15 | 22 | 7/30 | .060 | .390 | .521 |
| C5314 | C5344 | 19 | 22 | 7/30 | .060 | .406 | .568 |
| C5315 | C5345 | 27 | 22 | 7/30 | .060 | .457 | .648 |
| C5316 | C5346 | 37 | 22 | 7/30 | .060 | .501 | .747 |
| C5317 | C5347 | 41 | 22 | 7/30 | .060† | .564 | .827 |
| C5318 | C5248 | 60 | 22 | 7/30 | .060† | .608 | .947 |
| C5320 | C5350 | 5 | 20 | 19/32 | .060 | .311 | .414 |
| C5321 | C5351 | 7 | 20 | 19/32 | .060 | .330 | .463 |
| C5322 | C5352 | 12 | 20 | 19/32 | .060 | .405 | .559 |
| C5323 | C5353 | 15 | 20 | 19/32 | .060 | .432 | .608 |
| C5324 | C5354 | 19 | 20 | 19/32 | .060 | .450 | .679 |
| C5325 | C5355 | 27 | 20 | 19/32 | .060 | .526 | .777 |
| C5326 | C5356 | 37 | 20 | 19/32 | .060† | .577 | .943 |
| C5327 | C5357 | 48 | 20 | 19/32 | .060† | .647 | 1.030 |
| C5328 | C5358 | 60 | 20 | 19/32 | .060† | .698 | 1.100 |

† Paired Dim. .080

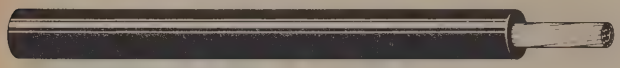
### MULTI-CONDUCTOR COLOR CODE CHART VI

| No. | Color | No. | Color | No. | Color | No. | Color | No. | Color | No. | Color |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Black | 11 | White/Black | 21 | White/Black/Red | 31 | White/Brown/Green | 41 | White/Orange/Yellow | 51 | White/Green/Violet |
| 2 | Brown | 12 | White/Brown | 22 | White/Black/Orange | 32 | White/Brown/Blue | 42 | White/Orange/Green | 52 | White/Green Gray |
| 3 | Red | 13 | White/Red | 23 | White/Black/Yellow | 33 | White/Brown/Violet | 43 | White/Orange/Blue | 53 | White/Blue/Violet |
| 4 | Orange | 14 | White/Orange | 24 | White/Black/Green | 34 | White/Brown/Gray | 44 | White/Orange/Violet | 54 | White/Blue/Gray |
| 5 | Yellow | 15 | White/Yellow | 25 | White/Black/Blue | 35 | White/Red/Orange | 45 | White/Orange Gray | 55 | White/Violet/Gray |
| 6 | Green | 16 | White/Green | 26 | White/Black/Violet | 36 | White/Red/Yellow | 46 | White/Yellow/Green | 56 | White/Black/Brown/Red |
| 7 | Blue | 17 | White/Blue | 27 | White/Black/Gray | 37 | White/Red/Green | 47 | White/Yellow/Blue | 57 | White/Black/Brown/Orange |
| 8 | Violet | 18 | White/Violet | 28 | White/Brown/Red | 38 | White/Red/Blue | 48 | White/Yellow/Violet | 58 | WhiteBlack/Brown/Yellow |
| 9 | Gray | 19 | White/Gray | 29 | White/Brown/Orange | 39 | White/Red/Violet | 49 | White/Yellow/Gray | 59 | White/Black/Brown/Green |
| 10 | White | 20 | White/Black/Brown | 30 | White/Brown/Yellow | 40 | White/Red/Gray | 50 | White/Green/Blue | 60 | White/Black/Brown/Blue |

### PAIRED CONDUCTOR COLOR CODE CHART VII

| No. | Color | No. | Color | No. | Color | No. | Color | No. | Color | No. | Color |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | White with Black | 11 | Black with Red | 21 | Brown with Green | 31 | Orange with Yellow | 41 | Green with Violet | 51 | White/Black with Green |
| 2 | White with Brown | 12 | Black with Orange | 22 | Brown with Blue | 32 | Orange with Green | 42 | Green with Gray | 52 | White/Black with Blue |
| 3 | White with Red | 13 | Black with Yellow | 23 | Brown with Violet | 33 | Orange with Blue | 43 | Blue with Violet | 53 | White/Black with Violet |
| 4 | White with Orange | 14 | Black with Green | 24 | Brown with Grey | 34 | Orange with Violet | 44 | Blue with Gray | 54 | White/Black with Gray |
| 5 | White with Yellow | 15 | Black with Blue | 25 | Red with Orange | 35 | Orange with Gray | 45 | Violet with Gray | 55 | White/Brown with Black |
| 6 | White with Green | 16 | Black with Violet | 26 | Red with Yellow | 36 | Yellow with Green | 46 | White/Black with Black | 56 | White/Brown with Brown |
| 7 | White with Blue | 17 | Black with Gray | 27 | Red with Green | 37 | Yellow with Blue | 47 | White/Black with Brown | 57 | White/Brown with Red |
| 8 | White with Violet | 18 | Brown with Red | 28 | Red with Blue | 38 | Yellow with Violet | 48 | White/Black with Red | 58 | White/Brown with Orange |
| 9 | White with Gray | 19 | Brown with Orange | 29 | Red with Violet | 39 | Yellow with Gray | 49 | White/Black with Orange | 59 | White/Brown with Yellow |
| 10 | Black with Brown | 20 | Brown with Yellow | 30 | Red with Gray | 40 | Green with Blue | 50 | White/Black with Yellow | 60 | White/Brown with Green |

COLUMBIA ELECTRONIC CABLES • Dept. EM, 11 Cove St., New Bedford, Mass. 02744 • Phone: (617) 999-4451 • Telex: 92-9411
Los Angeles, CA 90058 • Phone (213) 583-9825
HOT LINE 800-225-8540



## UL HOOK UP WIRE STYLE 1015, CSA TYPE TEW

**Stock Colors:** See table below. Chart VIII.

**Construction:** Tinned copper conductor, color-coded PVC insulation.

**Specifications:** —40°C to +105°C, 600V. Resistant to acids, oil, alkalis, flame, moisture and fungus. Entire cable passes VW-1 vertical flame test.

**Applications:** Internal wiring of electronic and electrical equipment.

**Put-up:** 100′ and 1000′ spools (other Put-ups also available).

| Columbia No. | AWG (Stranding) | Nom. Insul. Thick. In. | Voltage Rating | Nom. O.D. In. |
|---|---|---|---|---|
| C2117 | 22 (1) | .031 | 600 | .088 |
| C2118 | 20 (1) | .031 | 600 | .094 |
| C2119 | 18 (1) | .031 | 600 | .102 |
| C2100 | 24 (7/32) | .031 | 600 | .086 |
| C2101 | 22 (7/30) | .031 | 600 | .092 |
| C2102 | 20 (10/30) | .031 | 600 | .100 |
| C2103 | 18 (16/30) | .031 | 600 | .110 |
| C2104 | 16 (26/30) | .031 | 600 | .122 |
| C2105 | 14 (41/30) | .031 | 600 | .136 |

## UL HOOK UP WIRE UL STYLE 1007 CSA TR-64

**Stock Colors:** See table below Chart VIII.

**Construction:** Tinned copper conductor, color-coded PVC insulation.

**Specifications:** —40°C to +80°C, 300V. Resistant to acids, oil, alkalis, flame, moisture and fungus. Entire cable passes VW-1.

**Applications:** Internal wiring of electronic and electrical equipment.

**Put-up:** 100′ and 1000′ spools (other Put-ups also available).

| Columbia No. | AWG (Stranding) | Nom. Insul. Thick. In. | Voltage Rating | Nom. O.D. In. |
|---|---|---|---|---|
| C2003 | 24 (1) | .016 | 300 | .054 |
| C2004 | 22 (1) | .016 | 300 | .060 |
| C2028 | 20 (1) | .016 | 300 | .066 |
| C2052 | 18 (1) | .016 | 300 | .072 |
| C2053 | 16 (1) | .016 | 300 | .085 |
| C2015 | 24 (7/32) | .016 | 300 | .056 |
| C2016 | 22 (7/30) | .016 | 300 | .064 |
| C2040 | 20 (10/30) | .016 | 300 | .072 |
| C2064 | 18 (16/30) | .016 | 300 | .082 |
| C2065 | 16 (26/30) | .016 | 300 | .094 |

**STOCK COLOR CHART VIII**

| No. | Color | No. | Color | No. | Color | No. | Color | No. | Color |
|---|---|---|---|---|---|---|---|---|---|
| 1 | White | 3 | Red | 5 | Yellow | 7 | Brown | 9 | Gray (slate) |
| 2 | Black | 4 | Green | 6 | Light Blue | 8 | Orange | 10 | Violet (purple) |

Stripe combinations also available — consult factory.

## RUBBER TEST LEAD WIRE

**Stock Color:** Black or Red. (Other colors available on special order.)

**Construction:** Extra flexible stranded tinned soft annealed copper conductor, color-coded rubber insulation.

**Specifications:** —20°C to +60°C. All breakdown voltages and suggested working voltages are AC RMS values.

**Applications:** Test lead wire for use in multimeters, analyzers, oscillators and other applications requiring extra flexible insulated wire.

**Put-up:** 250′, 500′ and 1000′ spools (other Put-ups also available).

| Columbia No. | Color* | AWG (Stranding) | Nom. Insul. Thick. In. | Sug. Working Voltage | Nom. O.D. In. |
|---|---|---|---|---|---|
| C1326 | " | 20 (41/36) | .040 | 1,500V | .125 |
| C1319 | " | 20 (41/36) | .047 | 3,000V | .140 |
| C1321 | " | 18 (65/36) | .045 | 5,000V | .140 |
| C1318 | " | 18 (65/36) | .088 | 10,000V | .230 |

* Available in red or black; please specify.

## PLASTIC TEST LEAD WIRE

**Stock Color:** Black or red. (Other colors available on special order.)

**Construction:** Extra flexible stranded tinned soft annealed copper conductor, color-coded extra flexible, high gloss Flexlife® plastic insulation.

**Specifications:** —20°C to +60°C, 5000V. Insulation resistant to acids, oil, alkalis, flame, moisture and fungus. All breakdown voltages and suggested working are AC RMS values.

**Applications:** Test lead wire for use in multimeters, analyzers, oscillators, and other applications requiring extra flexible insulated wire. Flexlife plastic insulation is durable and has a high-gloss finish.

## PLASTIC TEST LEAD WIRE (CONT'D)

**Put-up:** 250′ and 500′ spools (other Put-ups also available).

| Columbia No. | Color* | AWG (Stranding) | Nom. Insul. Thick. In. | Sug. Working Voltage | Nom. O.D. In. |
|---|---|---|---|---|---|
| C1320 | Black or Red | 18 (65/36) | .045 | 5,000V | .140 |

## PORTABLE SERVICE AND POWER CORD

**Copper:** Bare soft annealed. Stranding per ASTM-B-174 and ASTM-B-172.

**Insulation of inner conductors:** Synthetic Rubber (SBR) per IPCEA Pub. No. S-19-81 (5th Edition) Part 3.7.1 (SBR); N.E.M.A. Publication No. WC-3-1969; and UL Subject 62, Class 3.

**Temperature Range:** 60°C (140°F) to —37°C (—35°F).

**Color Code Conductors:** 2 conductor — Black, White; 3 conductor — Black, White, Green; 4 conductor — Black, White, Green, Red.

**Foundation:** Conductors twisted together with fillers to make a round core; separator over core.

**Neoprene Jacket:** Black Neoprene: 60°C (140°F to —37°C (—35°F) per IPCEA Pub. No. S-19-81 (5th Edition) Part 7.7.5.1; NEMA Pub. No. WC-3-1969, ASTM D-752; and UL Subject 62, Class 15.

**Rubber Jacket:** Black Synthetic Rubber (SBR) 60°C (140°F) to —37°C (—35°F) per IPCEA Pub. No. S-19-81 (5th Edition) Part 7.7.5.1; NEMA Pub. No. WC-3-1969, and UL Subject 62, Class 6.

**Jacket Marking:** All sizes surface printed* showing gauge, number of conductors, voltage and type.

**Neoprene Use:** For heavy (SO) and light (SJO) service such as tools, power extensions, motor and welding leads, portable machinery, floor polishers and sanders, battery chargers, portable stage light, garage portable lights, sound equipment, washing machines, refrigerators, sewing machines, and other electrical equipment. Type SVO — for vacuum cleaners, home food mixers, office equipment, and other light duty requirements.

**Rubber Use:** For heavy (S) and light (SJ) service such as tools, power extensions, motor and welding leads, portable machinery, floor polishers and sanders, battery chargers, portable stage lights, garage portable lights, sound equipment, washing machines, refrigerators, sewing machines, and other electrical equipment. Type SV — For vacuum cleaners, home food mixers, office equipment, and other light duty requirements.

**Neoprene Environment:** For use in areas where exposed to oil, ozone, grease, chemicals or solvents.

**Rubber Environment:** Useful cord life is reduced where exposed to oil, ozone, grease, chemicals or solvents. Cords to be used in such environments are Neoprene SO.

**NEOPRENE JACKET**

| Columbia No. | No. of Cond. | Size AWG | Type | Volt Rating | Nom. Insul. | Current Amps | Nom. O.D. In. |
|---|---|---|---|---|---|---|---|
| C1477 | 2 | 18 | SVO | 300V | 1/64 | 10 | .245 |
| C1478 | 2 | 18 | SJO | 300V | 2/64 | 10 | .300 |
| C1479 | 3 | 18 | SJO | 300V | 2/64 | 7 | .325 |
| C1481 | 2 | 16 | SJO | 300V | 2/64 | 13 | .325 |
| C1482 | 3 | 16 | SJO | 300V | 2/64 | 10 | .350 |
| C1484 | 2 | 18 | SO | 600V | 2/64 | 10 | .375 |
| C1485 | 3 | 18 | SO | 600V | 2/64 | 7 | .390 |
| C1487 | 2 | 16 | SO | 600V | 2/64 | 13 | .400 |
| C1488 | 3 | 16 | SO | 600V | 2/64 | 10 | .420 |

**RUBBER JACKET**

| Columbia No. | No. of Cond. | Size AWG | Type | Volt Rating | Nom. Insul. | Current Amps | Nom. O.D. In. |
|---|---|---|---|---|---|---|---|
| C1420 | 2 | 18 | SV | 300V | 1/64 | 10 | .245 |
| C1425 | 2 | 18 | SJ | 300V | 2/64 | 10 | .300 |
| C1435 | 3 | 18 | SJ | 300V | 2/64 | 7 | .325 |
| C1438 | 4 | 18 | SJ | 300V | 2/64 | 7 | .355 |
| C1445 | 2 | 16 | SJ | 300V | 2/64 | 13 | .325 |
| C1450 | 3 | 16 | SJ | 300V | 2/64 | 10 | .350 |
| C1446 | 4 | 16 | SJ | 300V | 2/64 | 10 | .385 |
| C1500 | 2 | 14 | S | 600V | 3/64 | 18 | .527 |
| C1505 | 3 | 14 | S | 600V | 3/64 | 15 | .557 |
| C1509 | 4 | 14 | S | 600V | 3/64 | 15 | .602 |
| C1510 | 2 | 12 | S | 600V | 3/64 | 25 | .597 |
| C1515 | 3 | 12 | S | 600V | 3/64 | 20 | .632 |

Continued on Page 4551

COLUMBIA ELECTRONIC CABLES • Dept. EM, 11 Cove St., New Bedford, Mass. 02744 • Phone: (617) 999-4451 • Telex: 92-9411
Los Angeles, CA 90058 • Phone (213) 583-9825
**HOT LINE 800-225-8540**

## RUBBER JACKET (CONT'D)

| Columbia No. | No. of Cond. | Size AWG | Type | Volt Rating | Nom. Insul. | Current Amps | Nom. O.D. In. |
|---|---|---|---|---|---|---|---|
| C1517 | 2 | 10 | S | 600V | 3/64 | 30 | .637 |
| C1519 | 3 | 10 | S | 600V | 3/64 | 25 | .687 |

## PLASTIC JACKET CONSTRUCTION

**Copper:** Bare soft drawn annealed, Class K stranding per ASTM-B-174 and ASTM-B-172.

**Insulation:** Polyvinyl chloride, resistant to oils, water, acids, alkalies and ozone. 60°C — UL Class II. Black, gray and white SVT.

**Temperature Range:** 60°C (140°F) to −20°C (−4°F).

**Color Code Conductors:** 2 conductor — black, white.
3 conductor — black, white, green.

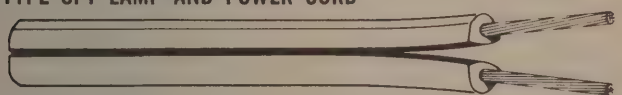
**Foundation:** Conductors twisted together with fillers to make a round core; separator over core.

**Jacket:** 60°C. Black, gray or white (SVT) or black (SJT) UL Class II, non marking 60°C (140°F) to −20°C (−4°F) polyvinyl chloride, resistant to oil, water, acid, alkali, ozone and abrasion. Jacket meets specifications per ASTM-D-1047. SVT jacket ribbed to help cord remain clean.

| Columbia No. | No. of Cond. | Size AWG | Type | Voltage Ra. ng | Nom. Insul. | Current Amps | Nom. O.D. In. |
|---|---|---|---|---|---|---|---|
| C1554 | 2 | 18 | SVT | 300V | 1/64 | 10 | .245 |
| C1556 | 3* | 18 | SVT | 300V | 1/64 | 7 | .255 |
| C1496 | 2 | 18 | SJT | 300V | 2/64 | 10 | .300 |
| C1497 | 3 | 18 | SJT | 300V | 2/64 | 7 | .325 |
| C1498 | 2 | 16 | SJT | 300V | 2/64 | 13 | .325 |
| C1499 | 3 | 16 | SJT | 300V | 2/64 | 10 | .350 |

*Two Conductor W/3rd Conductor for Grounding Only.

## TYPE SPT LAMP AND POWER CORD

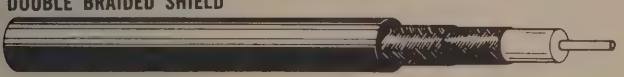


Plastic lamp cord with polarity ridge over one conductor. Rip type construction. UL Listed. For fans, lamps, radios, TV, stereo speakers, signs, etc. Specify Brown, White, Gray or Black.

| Columbia No. | No. of Cond. | AWG (Strand) | Type | Current Amps | Nom. O.D. In. |
|---|---|---|---|---|---|
| C1415 | 2 | 18 (41/34) | SPT-1 | 10 | .105 x .205 |
| C1402 | 2 | 16 (65/34) | SPT-2 | 13 | .155 x .296 |

## RG TYPE COAXIAL CABLES

### DOUBLE BRAIDED SHIELD



| RG/U No. | Cat. No. | Jkt. | Shld. | Di-elec. Matl. | Cond. Ea. | Nom. O.D. (In.) | Nom. % of Vel. | Nom. Cap. | Features |
|---|---|---|---|---|---|---|---|---|---|
| 6A | C1168 | PVC | Double Brd BC | PE | 21 BCW | .336 | 66 | 20.5 | Flexlife® |

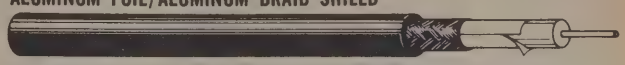
• Max. Shield Coverage • Nom. Impedance 75 ohms • Tested for 100% Sweep

### DOUBLE BRAIDED SHIELD WITH INNER PE JACKET

| RG/U No. | Cat. No. | Jkt. | Shld. | Di-elec. Matl. | Cond. Ea. | Nom. O.D. (In.) | Nom. % of Vel. | Nom. Cap. | Features |
|---|---|---|---|---|---|---|---|---|---|
| 11 | C5027 | PE | Double Brd BC | FPE | 14 BC | .475 | 78 | 17.3 | Permaline® |

• Max. Shield Coverage • Nom. Impedance 75 ohms • Tested for 100% Sweep

### ALUMINUM FOIL/ALUMINUM BRAID SHIELD



| RG/U No. | Cat. No. | Jkt. | Shld. | Di-elec. Matl. | Cond. Ea. | Nom. O.D. (In.) | Nom. % of Vel. | Nom. Cap. | Features |
|---|---|---|---|---|---|---|---|---|---|
| 6 | C5775 | PVC | — | FPE | 18 BC | .270 | 78 | 17.5 | |
| 59 | C5776 | PVC | — | FPE | 20 BCW | .242 | 78 | 17.3 | |
| 59 | C5780 | PVC | — | FPE | 20 BCW | .242 | 78 | 17.3 | UL 1594 |
| 59 | C5770 | PVC | — | FPE | 22 BCW | .242 | 78 | 16.3 | 100% Swept |

• Max. Shield Coverage • Nom. Impedance 75 ohms •

## RG TYPE COAXIAL CABLES (CONT'D)

### ALUMINUM FOIL WITH SOLID TINNED COPPERWELD DRAIN WIRES

| RG/U No. | Cat. No. | Jkt. | Shld. | Di-elec. Matl. | Cond. Ea. | Nom. O.D. (In.) | Nom. % of Vel. | Nom. Cap.* | Features |
|---|---|---|---|---|---|---|---|---|---|
| 11 | C5026 | PVC | — | FPE | 14 BC | .380 | 78 | 17.3 | UL 1594 |
| 59 | C5750 | PVC | — | PE | 22 BCW | .242 | 66 | 21.0 | Dura Color® |
| 59 | C5755 | PVC | — | FPE | 22 BCW | .242 | 78 | 16.3 | Foam Dura Color® |
| 59/6 | C5760 | PVC | — | FPE | 18 BC | .242 | 78 | 17.3 | Super Dura Color® |

• Max. Shield Coverage • Nom. Impedance 75 ohms • Tested for 100% Sweep

### BRAID SHIELD

| RG/U No. | Catalog No. | Shield Coverage | Jkt. | Shld. | Di-electric Mat'l. | Condr. Ga. | Nom. O.D. (Ins.) | Nom. Imp. (Ω) | Nom. % Vel. of Prop. | Nom. Cap. mmf/ft. | Features | Tested |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | C1154 | MIL | PVC | BC | PE | 13(7x21)BC | .405 | 52 | 66 | 29.5 | JANC17A | — |
| 8 | C1198 | Max. | PVC | BC | FPE | 11(7x19)BC | .405 | 50 | 78 | 26 | Super flex® | — |
| 8 | C5015 | Max. | PE | BC | FPE | 11(7x19)BC | .405 | 50 | 78 | 26 | Perma-foam® | — |
| 8 | C1113 | Comm'l | PVC | BC | PE | 13(7x21)BC | .405 | 50 | 66 | 29.5 | — | — |
| 8 | C1109 | Comm'l | PVC | BC | FPE | 13(7x21)BC | .405 | 50 | 78 | 26 | — | — |
| 8 | C5013 | Comm'l | PE | BC | FPE | 13(7x21)BC | .405 | 50 | 78 | 26 | — | — |
| 11 | C1160 | MIL | PVC | BC | PE | 18(7x26)TC | .405 | 75 | 66 | 20.5 | — | — |
| 11 | C5025 | Max. | PE | BC | FPE | 14BC | .405 | 75 | 78 | 17.3 | Perma-line | 100% Sweep |
| 58 | C1166 | MIL | PVC | TC | PE | 20BC | .195 | 53.5 | 66 | 28.5 | UL1594 | — |
| 58 | C5045 | Max. | PE | TC | FPE | 20BC | .195 | 53 | 78 | 22 | Perma-line® | — |
| 58A | C1178 | MIL | PVC | TC | PE | 20(19str)TC | .195 | 50 | 66 | 30.8 | JANC17A | — |
| 58A | C1188 | Max. | PVC | TC | FPE | 20(19str)TC | .195 | 50 | 78 | 26 | Super-flex® | — |
| 58 | C1117 | Comm'l | PVC | TC | PE | 20BC | .195 | 50 | 66 | 28.5 | — | — |
| 58 | C1116 | Comm'l | PVC | TC | FPE | 20BC | .195 | 50 | 78 | 22 | — | — |
| 59 | C1104 | MIL | PVC | BC | PE | 22BCW | .242 | 73 | 66 | 21 | UL1594 | 100% Sweep |
| 59 | C1102 | Max. | PE | BC | FPE | 20BCW | .242 | 75 | 78 | 17.3 | — | — |
| 59 | C1103 | Max. | PVC | BC | FPE | 22strBC | .242 | 75 | 78 | 17.3 | UL1594 | 100% Sweep |
| 59 | C1105 | Max. | PVC | BC | FPE | 22BCW | .242 | 75 | 78 | 16.3 | UL1594 | 100% Sweep |
| 59 | C1135 | Max. | PVC | BC | FPE | 22BCW | .242 | 75 | 78 | 16.3 | Super-flex® | 100% Sweep |
| 59 | C5035 | Max. | PE | BC | FPE | 22BCW | .242 | 75 | 78 | 16.3 | Perma-foam® | 100% Sweep |
| 59 | C1110 | Comm'l | PVC | BC | PE | 22BCW | .242 | 75 | 66 | 21 | — | — |
| 59 | C1112 | Comm'l | PVC | BC | FPE | 22BCW | .242 | 75 | 78 | 16.3 | — | — |
| 59 | C5136 | Comm'l | PE | BC | FPE | 22BCW | .242 | 75 | 78 | 16.3 | — | — |
| 62AU | C1162 | MIL | NCV | BC | SPE | 22BCW | .242 | 93 | 84 | 13.5 | — | — |
| 174 | C1156 | Max. | PVC | TC | PE | 26(7x34) BCW | .100 | 50 | 66 | 30.8 | — | — |

| | | | |
|---|---|---|---|
| Max. | = Maximum Coverage | BRD | = Braid |
| Mil. | = Military | BC | = Bare Copper |
| Comm'l. | = Commercial | BCW | = Bare Copperweld |
| PE | = Polyethylene | TC | = Tinned Copper |
| FPE | = Foam Polyethylene | STR | = Stranded |
| PVC | = Polyvinyl Chloride | | |
| NCV | = Non-Contaminating Vinyl | | |
| SPE | = Semi-Solid Polyethylene | | |

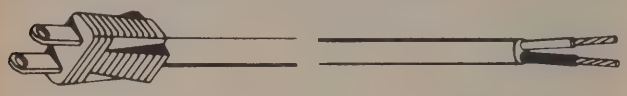
COLUMBIA ELECTRONIC CABLES • Dept. EM, 11 Cove St., New Bedford, Mass. 02744 • Phone: (617) 999-4451 • Telex: 92-9411
Los Angeles, CA 90058 • Phone (213) 583-9825
**HOT LINE 800-225-8540**

## POWER SUPPLY AND REPLACEMENT CORDS

Molded plastic male cap on one end. Other end has outer jacket removed, conductors stripped; all cords hanked. UL Listed. Rated for 125 VAC. For portable tools, appliances, etc.

### TWO-CONDUCTOR

Outer Jacket Stripped 1½", Conductors Stripped ⅝" — UL Listed.



| Columbia No. | AWG Size | Type | Length Ft. | Rating Amps | Color |
|---|---|---|---|---|---|
| 20250 | 18 | SV | 6 | 10 | Black |
| 20254 | 18 | SV | 12 | 10 | Black |
| 20327 | 18 | SVT | 6 | 10 | Black |
| 24516 | 18 | SJ | 6 | 10 | Black |
| 20258 | 18 | SJ | 10 | 10 | Black |
| 24546 | 18 | SJT | 6 | 10 | Gray |
| 24549 | 18 | SJT | 9 | 10 | Gray |
| 20260 | 16 | SJ | 8 | 13 | Black |
| 20262 | 16 | SJ | 10 | 13 | Black |

### THREE-CONDUCTOR

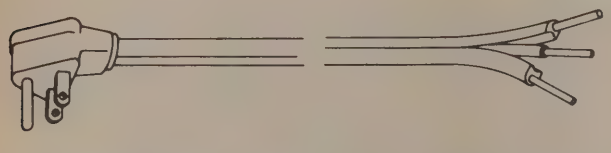
SV and SVT Cords — Outer Jacket Stripped 1½", Conductors Stripped ⅝". SJ and SJT Cords — Outer Jacket Stripped 2". Conductors Stripped ⅝". S Cords — Outer Jacket Stripped 2". Conductors Stripped ¾". UL Listed and Meet OSHA Requirements.

| Columbia No. | AWG Size | Type | Length Ft. | Rating Amps | Color |
|---|---|---|---|---|---|
| 20330* | 18 | SVT | 6 | 10 | Gray |
| 20331* | 18 | SVT | 8 | 10 | Gray |
| 20264 | 18 | SJ | 6 | 10 | Black |
| 20314 | 18 | SJ | 8 | 10 | Black |
| 20317 | 18 | SJ | 12 | 10 | Black |
| 24936 | 18 | SJT | 6 | 10 | Gray |
| 24939 | 18 | SJT | 9 | 10 | Gray |
| 24926 | 16 | SJ | 6 | 13 | Black |
| 20324 | 16 | SJ | 8 | 13 | Black |
| 24929 | 16 | SJ | 9 | 13 | Black |
| 24932 | 16 | SJ | 12 | 13 | Black |
| 24946 | 16 | SJT | 6 | 13 | Gray |
| 24949 | 16 | SJT | 9 | 13 | Gray |
| 20332 | 14 | S | 9 | 15 | Black |

*Also available in rubber (Type SV).

## POWER SUPPLY CORDS — GENERAL PURPOSE

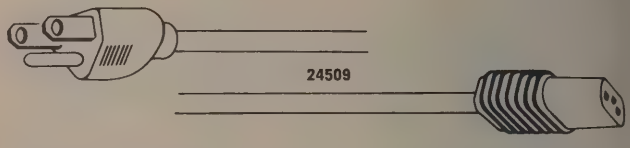
Right angle cap, free end split 1¼", Stripped ⅝", Grounding Conductor — UL Listed.



| Columbia No. | Cord Type | Length Ft. | Color | Type Package | Rating |
|---|---|---|---|---|---|
| 24108 | 16/3 SPT | 8 | Gray | Bulk | 13A-125V |

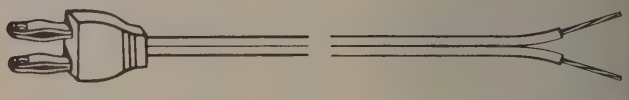
## BUSINESS MACHINE POWER SUPPLY CORDS

UL Listed.




| Columbia No. | Cord Type | Length Ft. | Color | Type Package | Rating |
|---|---|---|---|---|---|
| 24507 | 18/3 SVT | 8 | Gray | Hanked | 7A-125V |
| 24509 | 18/3 SVT | 8 | Gray | Hanked | 7A-125V |

## SMALL APPLIANCE CORDS



| Columbia No. | AWG Size | Type | Length Ft. | Rating Amps | Color |
|---|---|---|---|---|---|
| 24586 | 18/2 | SPT-1 | 6 | 10 | Brown or White |
| 24589 | 18/2 | SPT-1 | 9 | 10 | |
| 24597 | 18/3 | SPT-1 | 8 | 10 | |

## EXTENSION CORDS

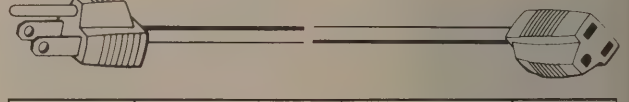
Molded plastic cap and connector. UL Listed. For portable cord appliances, business machines, etc. Rated at 125 VAC. All cords hanked.

### TWO-CONDUCTOR

| Columbia No. | AWG Size | Type | Length Ft. | Rating Amps | Color |
|---|---|---|---|---|---|
| 20272 | 18 | SV | 6 | 10 | Black |
| 26010 | 18 | SJ | 10 | 10 | Black |
| 26025 | 18 | SJ | 25 | 10 | Black |
| 26110 | 16 | SJ | 10 | 13 | Black |

### THREE-CONDUCTOR

Rubber — UL Listed — Meets OSHA Requirements. For Indoor Use.



| Columbia No. | AWG Size | Type | Length Ft. | Rating Amps | Color |
|---|---|---|---|---|---|
| 20288 | 18 | SJ | 10 | 10 | Black |
| 26525 | 18 | SJ | 25 | 10 | Black |
| 20294 | 16 | SJ | 15 | 13 | Black |
| 26625 | 16 | SJ | 25 | 13 | Black |

# for prompt service and "off-the-shelf" availability, call... DIPLOMAT

FOR OUR COMPLETE COMPREHENSIVE INVENTORY SELECTION

## SEMICONDUCTORS AND IC's
Alpha (Microwave)
AmPower
Carter Semiconductor
CDI Compensated Devices
Computer Diode
Crystalonics/Teledyne
Delco
EDI
Exar
General Instrument
General Semiconductor
ITT
Intersil
Kertron Semiconductor
Microsemiconductor Corp.
Microwave Associates
Monolithic Memories
Mostek
NAE North American Electronics
NEC Microcomputer Inc.
Optron
Semicon
Semtech
Sensitron
Signetics
Silicon General
Silicon Transistor Corp.
Solid Power Corp.
Solid State Devices
Solid State Scientific
Solitron Devices
SMC Microsystems Corp.
Syntron
Teledyne
Texas Instruments
Western Digital
Xciton

## CAPACITORS AND FILTERS
ARCO
Capar
CAL-R
Cornel Dubilier
ITT
Johanson
Mallory
NCI
San Fernando/Westcap
Sangamo

## CONNECTORS AND SOCKETS
Amphenol
Cinch
Robinson Nugent
Sullins
Texas Instruments

## CONTROLS AND SWITCHES
Alco Switch
Cherry
CTS
Hamlin
Mallory
Omron

## FANS & BLOWERS
Howard Industries

## FUSES AND HOLDERS
Bussman
Littelfuse

## HARDWARE AND CABINETS
Bud Radio
Hammond
H.H. Smith
Hollingsworth
Ungar

## METERS OF TEST EQUIPMENT
Simpson
Triplett

## OPTOELECTRONICS
Chicago Miniature
General Electric
Monsanto
Optron
Xciton

## POTENTIOMETERS AND TRIMMERS
Clarostat
CTS
Spectrol
Weston/Sangamo
VRN (IRC)

## RELAYS
Allied Controls
Deltrol
Electrol
Guardian
Hamlin
IDEC
Potter & Brumfield
Omron

## RESISTORS
American Corp.
CAL-R
Capar
Clarostat
Mallory
Memcor
RCL
Shallcross
Stackpole
Ward-Leonard

## R.F. CHOKES
J.W. Miller

## THERMISTORS AND RF FILTERS
CORCOM
Fenwal
Gulton Industries

## TRANSFORMERS AND POWERSTATS
Chicago Stancor

## TUBES
Amperex

## WIRE, CABLE, INSULATION PRODUCTS
Alpha
Belden
Cable-Tech
Cimco
Coleflex
Columbia
Dearborn
DeWire
Electronized Chemical Corp.
Harbor Industries
Hi Temp
Insultab
ITT
Manhattan
Norflex
Rainbow

**Each of the Above Listed Lines are Franchised at one or more of the Following Locations.**

DIPLOMAT

**DIPLOMAT ELECTRONICS, INC.**
Woodbury, N.Y.
(516) 921-9373

**DIPLOMAT ELECTRONICS, INC.**
Farmington, Mich.
(313) 477-3200

**DIPLOMAT ELECTRONICS, INC.**
Totowa, N.J.
(201) 785-1830

**DIPLOMAT ELECTRONICS, INC.**
Elk Grove Village, Ill.
(312) 595-1000

**DIPLOMAT ELECTRONICS, INC.**
Chicopee Falls, Mass.
(413) 592-9441

**DIPLOMAT ELECTRONICS, INC.**
Minneapolis, Minn.
(612) 788-8601

**DIPLOMAT ELECTRONICS, INC.**
Mt. Laurel, N.J.
(609) 234-8080

**DIPLOMAT ELECTRONICS, INC.**
Salt Lake City, Utah
(801) 486-4134

**DIPLOMAT ELECTRONICS, INC.**
St. Louis, Mo.
(314) 645-8550

**DIPLOMAT ELECTRONICS, INC.**
Holliston, Mass.
(617) 429-4120

**DIPLOMAT ELECTRONICS, INC.**
Sunnyvale, Calif.
(408) 734-1900

**DIPLOMAT ELECTRONICS, INC.**
Clearwater, Fla.
(813) 443-4514

**DIPLOMAT ELECTRONICS, INC.**
Ft. Lauderdale, Fla.
(305) 771-0440

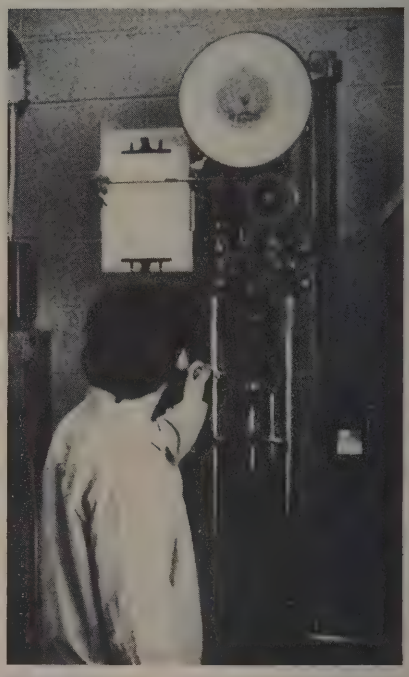
**DIPLOMAT ELECTRONICS, INC.**
Woodbury, N.Y.
(516) 921-7920

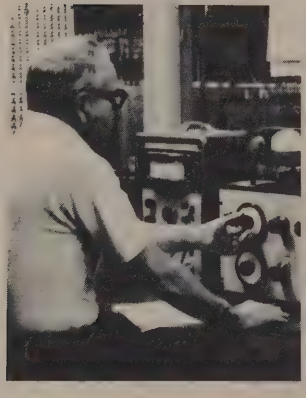
MORE THAN
2000 WIRE AND
CABLE PRODUCTS
IN STOCK
1633 S. CLINTON STREET
(312) 421-4441
Cable Address: "CON WIRE"
CHICAGO, ILL. 60616

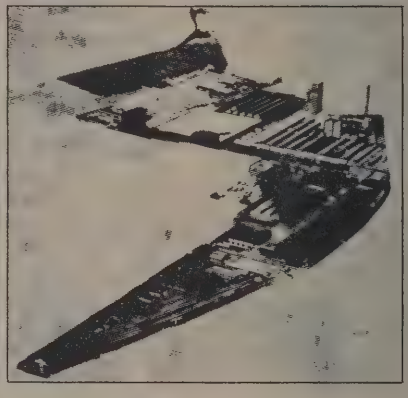
CONSOLIDATED

MORE THAN
11,000 DIFFERENT
SIZES, PACKAGES
AND COLORS
IN STOCK

# RESEARCH AND DEVELOPMENT... PRODUCTION...







Consolidated's recognized reputation for high-quality merchandise and its own engineering and testing facilities are supported by the modern research and development laboratories at Cyprus' R&D Center. Here metallurgists, electrical engineers, chemists and scientists of many disciplines combine their talents to develop better products for you.

The never-ending search for new and better materials for Consolidated Wire products is a way of life at Cyprus' R&D Laboratories. This is where the quality control we're so proud of begins.

Supporting this program of research and development at the laboratory level, every foot of wire that leaves the plant must pass rigid inspections. These products meet or exceed all relevant Underwriters Laboratories, IPCEA, NEMA and other standards.

# INTERCOMMUNICATION AND SOUND SYSTEM CABLES (UL) LISTED

**STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.**

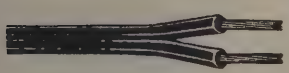
CONSOLIDATED

**SHIELDED 2 AND 3 CONDUCTOR**

| Catalog Number | Type | Size & Stranding | Specifications and General Applications | Insul. Thick. (Inch) | Cond. Color Code | U.L. Style | Nom. Jkt. Thickness (Inches) | Nom. Dia. (Inches) |
|---|---|---|---|---|---|---|---|---|
| 5572 | 2 Condr. | 22 7x30 | Tinned copper conductors. Polyethylene insulation. Mylar aluminum shield stranded tinned copper drain wire gray vinyl jacket. | .015 | Black Red | 2552† | .025 | .170 |
| 5573 | 2 Condr. | 20 10x30 | Tinned copper conductors. Polyethylene insulation. Mylar aluminum shield stranded tinned copper drain wire gray vinyl jacket. | .015 | Black White | 2552† | .025 | .200 |
| 5574 | 2 Condr. | 18 16x30 | Tinned copper conductors. Polyethylene insulation. Mylar aluminum shield stranded tinned copper drain wire gray vinyl jacket. | .018 | Black White | 2092† | .028 | .225 |
| 5575 | 2 Condr. | 16 26x30 | Tinned copper conductors. Polyethylene insulation. Mylar aluminum shield stranded tinned copper drain wire gray vinyl jacket. | .018 | Black White | 2092† | .020 | .250 |
| 5589 | 2 Condr. | 14 41x30 | Tinned copper conductors. Polyethylene insulation. Mylar aluminum shield stranded tinned copper drain wire gray vinyl jacket. | .032 | Black White | 2106† | .035 | .340 |
| 5596 | 2 Condr. | 12 19x25 | Tinned copper conductors. Polyethylene insulation. Mylar aluminum shield stranded tinned copper drain wire gray vinyl jacket. | .037 | Black White | 2106† | .040 | .400 |
| 5576 | 3 Condr. | 22 7x30 | Tinned copper conductors. Polyethylene insulation. Mylar aluminum shield stranded tinned copper drain wire gray vinyl jacket. | .016 | Black White Red | 2093† | .025 | .190 |
| 5577 | 3 Condr. | 20 10x30 | Tinned copper conductors. Polyethylene insulation. Mylar aluminum shield stranded tinned copper drain wire gray vinyl jacket. | .016 | Black White Red | 2093† | .028 | .210 |
| 5578 | 3 Condr. | 18 16x30 | Tinned copper conductors. Polyethylene insulation. Mylar aluminum shield stranded tinned copper drain wire gray vinyl jacket. | .018 | Black White Red | 2093† | .028 | .240 |
| 5590 | 3 Condr. | 16 26x30 | Tinned copper conductors. Polyethylene insulation. Mylar aluminum shield stranded tinned copper drain wire gray vinyl jacket. | .018 | Black White Red | 2093† | .030 | .260 |
| 5591 | 3 Condr. | 14 41x30 | Tinned copper conductors. Polyethylene insulation. Mylar aluminum shield stranded tinned copper drain wire gray vinyl jacket. | .018 | Black White Red | 2093† | .035 | .300 |

**UNSHIELDED WITH JACKET.**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 5579 | 2 Condr. | 22 7x30 | Tinned copper conductors. Vinyl insulation. | .012 | Black Red | 2335† | .020 | .155 |
| 5580 | 2 Condr. | 20 10x30 | Tinned copper conductors. Vinyl insulation. | .015 | Black White | 2508† | .025 | .190 |
| 5581 | 2 Condr. | 18 16x30 | Tinned copper conductors. Vinyl insulation. | .015 | Black White | 2092† | .030 | .220 |
| 5582 | 2 Condr. | 16 26x30 | Tinned copper conductors. Vinyl insulation. | .015 | Black White | 2508† | .020 | .240 |
| 5583 | 2 Condr. | 14 19x27 | Tinned copper conductors. Vinyl insulation. | .020 | Black White | 2508† | .035 | .310 |
| 5597 | 2 Condr. | 12 19x25 | Tinned copper conductors. Vinyl insulation. | .030 | Black White | 2463† | .040 | .385 |

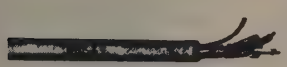


**SPEAKER CABLE**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 5547 | 2 Condr. | 24 7x32 | Stranded 1 condr. bare copper — 1 condr. tinned copper. 2 condrs. parallel vinyl insulation. | .015 | Brown Clear Gray White | – | – | .058x .115 |

**WITHOUT JACKET**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 5584 | 2 Condr. | 22 Solid | Tinned copper conductors. Vinyl insulation twisted. | .015 | Brown Tan | 1007† | – | .115 |
| 5585 | 2 Condr. | 18 16x30 | Tinned copper conductors. Vinyl insulation twisted. | .018 | Black White | 1007† | – | .175 |
| 5586 | 2 Condr. | 16 26x30 | Tinned copper conductors. Vinyl insulation twisted. | .020 | Black White | 1007† | – | .200 |



**MINIATURE BROADCAST AUDIO CABLE**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 5570 | 2 Condr. | 22 7x30 | Tinned copper Polyethylene insulation. Mylar aluminum shield stranded tinned copper drain wire gray vinyl jacket. | .010 | Black Red | 2552† | .016 | .135 |
| 5588 | 2 Condr. | 22 Solid | Tinned copper Polyethylene insulation. Mylar aluminum shield stranded tinned copper drain wire gray vinyl jacket. | .010 | Black Red | 2552† | .016 | .125 |

**2 PAIR MINIATURE AUDIO AND SOUND CABLE**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 5594 | 2 Pair | 22 7x30 | Tinned copper polypropylene insulation. Each pair shielded. Mylar aluminum shield and drain wire. | .008 | Black Red White Green | 2725† | .019 | .165 |
| 5571 | 2 Pair | 22 7x30 | Tinned copper Polyethylene insulation 1 pair black and red with Mylar aluminum shield. 1 pair white and green both pairs twisted with stranded tinned copper ground wire gray vinyl jacket. | .009 | Black Red White Green | 2552† | .019 | .185 |

† UL LISTED

## CONTROL CABLES SHIELDED AND UNSHIELDED (UL) LISTED

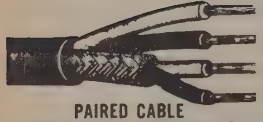
CONSOLIDATED

### SHIELDED PLASTIC JACKET

| Catalog Number | No. of Cond. | Size & (Stranding) | Specifications | Insul. Thick. | Jkt. Thick. | U.L. Style | Finished O.D. (Inches) | Nom. Capac. per ft. (mmf) |
|---|---|---|---|---|---|---|---|---|
| 1721 | 1 | 24 7x32 | Tinned copper polyethylene insulation spiral tinned copper shield. Gray vinyl plastic jacket. | .032 | .025 | †1150 | .140 | 29. |
| 1461 | 1 | 22 16x34 | Tinned copper polyethylene insulation spiral tinned copper shield. Gray vinyl plastic jacket. | .028 | .020 | †1107 | .130 | 36. |
| 1457 | 1 | 22 16x34 | Tinned copper polyethylene, insulation spiral tinned copper shield. Gray vinyl plastic jacket. | .050 | .020 | †1150 | .185 | 25. |
| 1458 | 2 | 22 16x34 | Tinned copper conductors polyethylene insulation conductors; black and clear. Cabled with fillers rayon serve, spiral tinned copper shield. Gray vinyl plastic jacket. | .023 | .023 | †2092 | .225 | 32. |
| 1459 | 1 | 20 26x34 | Tinned copper conductors polyethylene tinned copper shielded braid, and a heavy black plastic jacket overall. | .023 | .032 | †1546 | .175 | 40. |
| 1722 | 2 | 20 26x34 | Tinned copper conductors polyethylene insulation cabled fillers and wrap overall braided tin copper shield gray vinyl jacket. | .015 | .020 | †2092 | .235 | 32. |
| 1723 | 3 | 20 26x34 | Same as 1722 | .015 | .020 | †2725 | .220 | 45. |
| 1724 | 4 | 20 26x34 | Same as 1722 | .015 | .020 | †2725 | .240 | 45. |
| 1725 | 5 | 20 26x34 | Same as 1722 | .015 | .020 | †2725 | .260 | 45. |
| 1726 | 6 | 20 26x34 | Same as 1722 | .015 | .020 | †2725 | .280 | — |
| 1727 | 7 | 20 26x34 | Same as 1722 | .015 | .020 | †2725 | .290 | — |
| 1728 | 8 | 20 26x34 | Same as 1722 | .015 | .020 | †2725 | .300 | — |
| 1740 | 10 | 20 26x34 | Same as 1722 | .015 | .045 | †2725 | .380 | — |
| 1741 | 12 | 20 26x34 | Same as 1722 | .015 | .045 | †2725 | .385 | — |
| 1742 | 15 | 20 26x34 | Same as 1722 | .015 | .045 | †2725 | .415 | — |
| 1743 | 20 | 20 26x34 | Same as 1722 | .015 | .045 | †2725 | .455 | — |

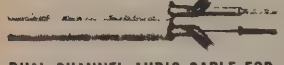
**Cond. Color Code 1722 Thru 1743**

1 Black
2 White
3 Red
4 Green
5 Yellow
6 Blue
7 Brown
8 Orange
9 Gray (slate)
10 Purple
11 White/Black
12 White/Red
13 White/Green
14 White/Yellow
15 White/Blue
16 White/Brown
17 White/Purple
18 White/Gray
19 Black/Red
20 Black/Yellow



PAIRED CABLE SHIELDED — PLASTIC JACKET

EXTENSION SPEAKERS SHIELDED — PLASTIC JACKET



DUAL CHANNEL AUDIO CABLE FOR STEREO & LANGUAGE LABORATORIES

| Catalog Number | Type | Size & Stranding | Specifications | Insul. Thick. | Jkt. Thick. | U.L. Style | Finished O.D. (Inches) | |
|---|---|---|---|---|---|---|---|---|
| 5511 | 2 Condr. | 22 Solid | Tin copper conductors vinyl insulation spiral tin copper shield gray vinyl jacket. | .016 | .020 | †2095 | .170 | Black Red |
| 5516 | 2 Pair 4 Condr. | 22 7x30 | Tinned copper vinyl insulation, 1 pair black & white with braided tinned copper shield mylar type — 1 pair black & brown unshielded — gray vinyl plastic jacket overall. | .015 | .020 | †2095 | .250 | Black White Black Brown |
| 5568 | 2 Condr. | 22 7x30 | Tinned copper vinyl plastic insulation — cabled tinned copper spiral wrapped shield chrome vinyl plastic jacket. | .012 | .020 | †2552 | .160 | Black Red |
| 5569 | 3 Condr. | 22 7x30 | Tinned copper vinyl insulation — cabled — tinned copper spiral shield — chrome vinyl jacket. | .015 | .025 | †2096 | .195 | Black Red White |
| 5538 | 2 Condr. | 18 16x30 | Tinned copper vinyl insulation, wires twisted together. Spiral tinned copper shield gray vinyl jacket. | .012 | .020 | †2552 | .205 | Red White |
| 5543 | 2 Condr. | 20 10x30 | Same as 5538 | .012 | .020 | †2552 | .180 | Black Red |
| 5541 | 2 Condr. | 18 16x30 | Tinned copper vinyl insulation, twisted together. Braided tinned copper shield gray vinyl plastic jacket. | .016 | .020 | †2095 | .225 | Red White |
| 5587 | 2 Condr. | 24 7x32 | Tinned copper conductor. Spiral tinned copper individual shield, gray vinyl jacket. | .017 | .020 | †2629 | .130 .260 | Red White |
| 5551 | 1 Condr. | 22 16x34 | Stranded tinned copper polyethylene insulation spiral tinned copper shield gray vinyl jacket. | .028 | .020 | †1107 | .130 | Clear |

† UL LISTED

# SHIELDED AND JACKETED CABLES CONTROL AND MICROPHONE TYPE

CONSOLIDATED

## SHIELDED RUBBER JACKET

| Catalog Number | No. of Condr. | Size & (Stranding) | Special Use | Specifications | Finished O.D. (Inches) | Nom. Capac. per ft. (mmf) |
|---|---|---|---|---|---|---|
| 1460 | 1 | 20(26x34) | Crystal microphone | Tinned copper, wall of live rubber; cotton fillers and wrap; tinned copper braid shield; cotton wrap rubber jacket overall. | .240 | 33. |
| 1462 | 2 | 20(26x34) | Low impedance microphones | Same as 1460; color coded | .268 | 68. |
| 1456 | 2 | 18(41x34) | Heavy duty studio cable | Same as 1460; color coded | .304 | 80. |
| 1463 | 3 | 20(26x34) | Low impedance microphones | Same as 1460; color coded | .277 | 85. |
| 1464 | 4 | 20(26x34) | Low impedance microphones | Same as 1460; color coded | .295 | 95. |
| 1465 | 5 | 20(26x34) | Interconnecting power cable for all electronic uses | Same as 1460; color coded | .323 | |
| 1466 | 6 | 20(26x34) | Same as 1465 | Same as 1460; color coded | .349 | |
| 1467 | 7 | 20(26x34) | Same as 1465 | Same as 1460; color coded | .360 | |
| 1455 | 8 | 20(26x34) | Same as 1465 | Same as 1460; color coded | .386 | |

## SHIELDED NEOPRENE JACKET

| Catalog Number | No. of Condr. | Size & (Stranding) | Specifications | Finished O.D. (Inches) |
|---|---|---|---|---|
| 1701 | 1 | 18(41x34) | Tinned copper, yarn serve; wall of live rubber; cotton fillers and wrap; tinned copper braid shield; cotton wrap neoprene jacket overall. | .235 |
| 1702 | 2 | 18(41x34) | Same as 1701, color coded | .295 |
| 1703 | 3 | 18(41x34) | Same as 1701, color coded | .305 |
| 1704 | 4 | 18(41x34) | Same as 1701, color coded | .330 |
| 1708 | 6 | 18(41x34) | Same as 1701, color coded | .430 |
| 1709 | 8 | 18(41x34) | Same as 1701, color coded | .465 |
| 1710 | 10 | 18(41x34) | Same as 1701, color coded | .480 |
| 1711 | 12 | 18(41x34) | Same as 1701, color coded | .550 |
| 1712 | 15 | 18(41x34) | Same as 1701, color coded | .630 |
| 1713 | 20 | 18(41x34) | Same as 1701, color coded | .725 |

## SHIELDED NEOPRENE JACKET

| | | | | |
|---|---|---|---|---|
| 1705 | 2 | 16(65x34) | Same as 1701, color coded | .320 |
| 1706 | 3 | 16(65x34) | Same as 1701, color coded | .340 |
| 1707 | 4 | 16(65x34) | Same as 1701, color coded | .355 |
| 1714 | 2 | 14(41x30) | Same as 1701, color coded | .395 |
| 1715 | 3 | 14(41x30) | Same as 1701, color coded | .425 |
| 1716 | 4 | 14(41x30) | Same as 1701, color coded | .450 |
| 1717 | 2 | 12(65x30) | Same as 1701, color coded | .440 |
| 1718 | 3 | 12(65x30) | Same as 1701, color coded | .465 |
| 1719 | 4 | 12(65x30) | Same as 1701, color coded | .500 |

**Stock Colors**

1 Black
2 White
3 Red
4 Green
5 Yellow
6 Blue
7 Brown
8 Orange
9 Gray (slate)
10 Purple
11 White/Black
12 White/Red
13 White/Green
14 White/Yellow
15 White/Blue
16 White/Brown
17 White/Purple
18 White/Gray (slate)
19 Black/Red
20 Black/Yellow

STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.

(UL) LISTED

CONSOLIDATED

# MULTIPLE PAIR INDIVIDUALLY SHIELDED AUDIO AND DATA CABLE

**22 AWG SOLID**

SHIELDED PAIRS

| Catalog Number | Type | Size & Stranding | Specifications and General Applications | Insul. Thick. (inch) | U.L. Style | Nom. Jkt. Thickness (Inches) | Nom. Dia. (Inches) |
|---|---|---|---|---|---|---|---|
| 5303 | 3 Pair | 22 Solid | Tinned copper conductor. Polypropylene insulation. Mylar aluminum shield and tinned copper drain wire, each pair. Overall gray vinyl jacket. | .010 | †2725 | .030 | .250 |
| 5306 | 6 Pair | 22 Solid | Same as 5303 | .010 | †2725 | .037 | .330 |
| 5309 | 9 Pair | 22 Solid | Same as 5303 | .010 | †2725 | .040 | .390 |
| 5311 | 11 Pair | 22 Solid | Same as 5303 | .010 | †2725 | .040 | .420 |
| 5315 | 15 Pair | 22 Solid | Same as 5303 | .010 | †2725 | .045 | .485 |

**22 AWG STRANDED**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5323 | 3 Pair | 22 7x30 | Tinned copper polypropylene insulation. Mylar aluminum shield and tinned copper drain wire each pair. Overall gray vinyl jacket. | .010 | †2725 | .030 | .265 |
| 5326 | 6 Pair | 22 7x30 | Same as 5323 | .010 | †2725 | .037 | .355 |
| 5329 | 9 Pair | 22 7x30 | Same as 5323 | .010 | †2725 | .040 | .425 |
| 5331 | 11 Pair | 22 7x30 | Same as 5323 | .010 | †2725 | .040 | .455 |
| 5335 | 15 Pair | 22 7x30 | Same as 5323 | .010 | †2725 | .045 | .525 |
| 5339 | 19 Pair | 22 7x30 | Same as 5323 | .010 | †2725 | .050 | .575 |
| 5347 | 27 Pair | 22 7x30 | Same as 5323 | .010 | †2725 | .070 | .705 |

**18 AWG STRANDED**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5353 | 3 Pair | 18 16x30 | Tin copper polypropylene insulation. Mylar aluminum shield and tinned copper drain wire each pair. Overall gray vinyl jacket. | .016 | †2493 | .045 | .405 |
| 5356 | 6 Pair | 18 16x30 | Same as 5353 | .016 | †2493 | .055 | .575 |
| 5359 | 9 Pair | 18 16x30 | Same as 5353 | .016 | †2493 | .065 | .660 |
| 5362 | 12 Pair | 18 16x30 | Same as 5353 | .016 | †2493 | .070 | .765 |
| 5365 | 15 Pair | 18 16x30 | Same as 5353 | .016 | †2493 | .070 | .820 |

**18 AWG STRANDED**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5601 | 1 Pair | 18 16x30 | Tin copper vinyl insulation cabled into pairs. Gray vinyl jacket. | .016 | †2095 | .020 | .200 |
| 5603 | 3 Pair | 18 16x30 | Same as 5601 | .016 | †2095 | .035 | .362 |
| 5606 | 6 Pair | 18 16x30 | Same as 5601 | .016 | †2095 | .045 | .495 |
| 5609 | 9 Pair | 18 16x30 | Same as 5601 | .016 | †2095 | .055 | .595 |
| 5612 | 12 Pair | 18 16x30 | Same as 5601 | .016 | †2095 | .055 | .650 |
| 5615 | 15 Pair | 18 16x30 | Same as 5601 | .016 | †2095 | .060 | .715 |
| 5619 | 19 Pair | 18 16x30 | Same as 5601 | .016 | †2095 | .070 | .785 |
| 5627 | 27 Pair | 18 16x30 | Same as 5601 | .016 | †2095 | .070 | .930 |

† UL LISTED

**Color Coding For Paired Intercom Cables**

**PAIRED INTERCOMMUNICATING CABLES COLOR CODING**
Identification is simple with Consolidated Intercom Cables because they are all color coded. See chart below.

1 Black paired with Red
2 Black paired with White
3 Black paired with Green
4 Black paired with Blue
5 Black paired with Yellow
6 Black paired with Brown
7 Black paired with Orange
8 Red paired with White
9 Red paired with Green
10 Red paired with Blue
11 Red paired with Yellow
12 Red paired with Brown
13 Red paired with Orange
14 Green paired with White
15 Green paired with Blue
16 Green paired with Yellow
17 Green paired with Brown
18 Green paired with Orange
19 White paired with Blue
20 White paired with Yellow
21 White paired with Brown
22 White paired with Orange
23 Blue paired with Yellow
24 Blue paired with Brown
25 Blue paired with Orange
26 Brown paired with Yellow
27 Brown paired with Orange

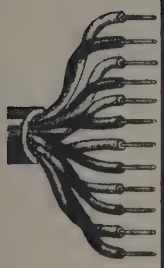
STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.

## (UL) LISTED UNSHIELDED PAIRED INTERCOM CABLE

CONSOLIDATED

**PAIRED CONDUCTORS SOLID AND STRANDED PLASTIC JACKET**

| Catalog Number | Type | Size & (Stranding) | Specications and General Applications | Insul. Thick. | Jkt. Thickness | U.L. Style | Nominal Diameter (Inches) |
|---|---|---|---|---|---|---|---|
| **SOLID – UL 2508** | | | | | | | |
| 5201 | 1 Pr. 2 Condr. | 22 Solid | Tinned copper conductor vinyl insulation. Cabled, gray plastic jacket. | .010 | .020 | † 2508 | .130 |
| 5205 | 2 Pr. 4 Condr. | 22 Solid | Same as 5201 | .010 | .020 | † 2508 | .205 |
| 5211 | 3 Pr. 6 Condr. | 22 Solid | Same as 5201 | .010 | .020 | † 2508 | .230 |
| 5221 | 5 Pr. 10 Condr. | 22 Solid | Same as 5201 | .010 | .020 | † 2508 | .250 |
| 5226 | 6 Pr. 12 Condr. | 22 Solid | Same as 5201 | .010 | .020 | † 2508 | .265 |
| 5231 | 7 Pr. 14 Condr. | 22 Solid | Same as 5201 | .010 | .020 | † 2508 | .280 |
| 5236 | 8 Pr. 16 Condr. | 22 Solid | Same as 5201 | .010 | .020 | † 2508 | .300 |
| 5241 | 9 Pr. 18 Condr. | 22 Solid | Same as 5201 | .010 | .020 | † 2508 | .320 |
| 5251 | 11 Pr. 22 Condr. | 22 Solid | Same as 5201 | .010 | .020 | † 2508 | .340 |
| 5271 | 15 Pr. 30 Condr. | 22 Solid | Same as 5201 | .010 | .020 | † 2508 | .390 |
| 5286 | 27 Pr. 54 Condr. | 22 Solid | Same as 5201 | .010 | .020 | † 2508 | .485 |
| 5289 | 31 Pr. 62 Condr. | 22 Solid | Same as 5201 | .010 | .020 | † 2508 | .505 |
| 5292 | 41 Pr. 82 Condr. | 22 Solid | Same as 5201 | .010 | .035 | † 2508 | .600 |
| 5297 | 51 Pr. 102 Condr. | 22 Solid | Same as 5201 | .010 | .040 | † 2508 | .665 |
| **STRANDED – UL 2508** | | | | | | | |
| 5151 | 1 Pr. 2 Condr. | 22(7x30) | Tinned copper conductor plastic insulation. Cabled, gray plastic jacket. | .010 | .020 | † 2508 | .140 |
| 5152 | 2 Pr. 4 Condr. | 22(7x30) | Same as 5151 | .010 | .020 | † 2508 | .210 |
| 5153 | 3 Pr. 6 Condr. | 22(7x30) | Same as 5151 | .010 | .020 | † 2508 | .230 |
| 5155 | 5 Pr. 10 Condr. | 22(7x30) | Same as 5151 | .010 | .020 | † 2508 | .280 |
| 5156 | 6 Pr. 12 Condr. | 22(7x30) | Same as 5151 | .010 | .020 | † 2508 | .290 |
| 5157 | 7 Pr. 14 Condr. | 22(7x30) | Same as 5151 | .010 | .020 | † 2508 | .300 |
| 5158 | 8 Pr. 16 Condr. | 22(7x30) | Same as 5151 | .010 | .020 | † 2508 | .320 |
| 5159 | 9 Pr. 18 Condr. | 22(7x30) | Same as 5151 | .010 | .020 | † 2508 | .345 |
| 5161 | 11 Pr. 22 Condr. | 22(7x30) | Same as 5151 | .010 | .025 | † 2508 | .370 |
| 5165 | 15 Pr. 30 Condr. | 22(7x30) | Same as 5151 | .010 | .025 | † 2508 | .415 |
| 5167 | 27 Pr. 54 Condr. | 22(7x30) | Same as 5151 | .010 | .025 | † 2508 | .535 |
| 5171 | 31 Pr. 62 Condr. | 22(7x30) | Same as 5151 | .010 | .040 | † 2508 | .595 |
| 5181 | 41 Pr. 82 Condr. | 22(7x30) | Same as 5151 | .010 | .040 | † 2508 | .665 |
| 5191 | 51 Pr. 102 Condr. | 22(7x30) | Same as 5151 | .010 | .045 | † 2508 | .740 |



**Color Coding For Paired Intercom Cables**

**PAIRED INTERCOMMUNICATING CABLES COLOR CODING**

Identification is simple with Consolidated Intercom Cables because they are all color coded. See chart below.

1 Black prd. w. Red
2 Black prd. w. White
3 Black prd. w. Green
4 Black prd. w. Blue
5 Black prd. w. Brown
6 Black prd. w. Yellow
7 Black prd. w. Orange
8 Red prd. w. Green
9 Red prd. w. White
10 Red prd. w. Blue
11 Red prd. w. Yellow
12 Red prd. w. Brown
13 Red prd. w. Orange
14 Green prd. w. Blue
15 Green prd. w. White
16 Green prd. w. Brown
17 Green prd. w. Orange
18 Green prd. w. Yellow
19 White prd. w. Blue
20 White prd. w. Brown
21 White prd. w. Orange
22 White prd. w. Yellow
23 Blue prd. w. Brown
24 Blue prd. w. Orange
25 Blue prd. w. Yellow
26 Brown prd. w. Orange
27 Brown prd. w. Yellow
28 Purple prd. w. Red
29 Purple prd. w. White
30 Purple prd. w. Green
31 Purple prd. w. Blue
32 Purple prd. w. Brown
33 Purple prd. w. Yellow
34 Purple prd. w. Orange
35 Purple prd. w. Slate
36 Purple prd. w. Black
37 Slate prd. w. Red
38 Slate prd. w. White
39 Slate prd. w. Green
40 Slate prd. w. Blue
41 Slate prd. w. Brown
42 Slate prd. w. Yellow
43 Slate prd. w. Orange
44 Slate prd. w. Black
45 White/Black prd. w. Red
46 White/Black prd. w. Green
47 White/Black prd. w. Blue
48 White/Black prd. w. Brown
49 White/Black prd. w. Yellow
50 White/Black prd. w.
51 White/Black prd. w. Purple

## SHIELDED PAIRED CONTROL CABLE

**SHIELDED PAIRED CONTROL CABLE**

| Catalog Number | Type | Size & Stranding | Specifications and General Applications | Insul. Thick. | Nom. Dia. (Inches) |
|---|---|---|---|---|---|
| 5901 | 38 Pair | 22 Solid | Tin copper polypropylene insulation. Color Coded twisted pairs. Overall mylar aluminum foil shield. 22 AWG (7x30) T.C. drain. .045" gray plastic jacket. | .008 | .600 |
| 5902 | 51 Pair | 22 Solid | Tin copper vinyl insulation. Color coded. Same as 5901 except .050" gray plastic jacket. | .010 | .700 |

STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT. ALL ITEMS.

† UL LISTED

(UL) LISTED

CONSOLIDATED

## UNSHIELDED AUDIO CABLE MULTICONDUCTOR – PLASTIC JACKET

STRANDED CONDUCTORS — 300 VOLTS

| Catalog Number | Type | Size & Stranding | Specifications and General Applications | Insul. Thick. (Inch) | Nom. Jkt. Thickness (Inches) | U.L. Style | Nom. Dia. (Inches) |
|---|---|---|---|---|---|---|---|
| 22 AWG | | | | | | | |
| 5400 | 2 Cond. | 22 7x30 | Tinned copper conductor plastic insulation cabled gray plastic jacket. | .010 | .020 | † 2335 | .140 |
| 5401 | 3 Cond. | 22 7x30 | Same as 5400 | .010 | .020 | † 2335 | .150 |
| 5406 | 4 Cond. | 22 7x30 | Same as 5400 | .010 | .020 | † 2335 | .160 |
| 5411 | 5 Cond. | 22 7x30 | Same as 5400 | .010 | .020 | † 2335 | .175 |
| 5416 | 6 Cond. | 22 7x30 | Same as 5400 | .010 | .020 | † 2335 | .200 |
| 5421 | 7 Cond. | 22 7x30 | Same as 5400 | .010 | .020 | † 2335 | .210 |
| 5426 | 8 Cond. | 22 7x30 | Same as 5400 | .010 | .020 | † 2335 | .215 |
| 5431 | 9 Cond. | 22 7x30 | Same as 5400 | .010 | .020 | † 2335 | .225 |
| 5432 | 10 Cond. | 22 7x30 | Same as 5400 | .010 | .020 | † 2335 | .235 |
| 5434 | 12 Cond. | 22 7x30 | Same as 5400 | .010 | .020 | † 2335 | .250 |
| 5438 | 15 Cond. | 22 7x30 | Same as 5400 | .010 | .020 | † 2335 | .268 |
| 5440 | 20 Cond. | 22 7x30 | Same as 5400 | .010 | .020 | † 2335 | .300 |
| 5442 | 25 Cond. | 22 7x30 | Same as 5400 | .010 | .020 | † 2335 | .330 |
| 5446 | 30 Cond. | 22 7x30 | Same as 5400 | .010 | .028 | † 2335 | .375 |
| 5448 | 40 Cond. | 22 7x30 | Same as 5400 | .010 | .035 | † 2335 | .435 |
| 5450 | 50 Cond. | 22 7x30 | Same as 5400 | .010 | .045 | † 2335 | .500 |
| 5460 | 60 Cond. | 22 7x30 | Same as 5400 | .010 | .045 | † 2335 | .530 |

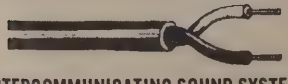
* Catalog No.'s 5400 thru 5434 Color Coding Chart 1 – See Page 13
** Catalog No.'s 5438 thru 5460 Color Coding Chart 2 – See Page 13

STRANDED CONDUCTORS — 600 VOLTS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 20 AWG | | | | | | | |
| 5640 | 2 Cond. | 20 10x30 | Tin copper PVC ins. gray PVC jacket. | .015 | .025 | † 2095 | .180 |
| 5641 | 3 Cond. | 20 10x30 | Same as 5640 | .015 | .025 | † 2095 | .190 |
| 5642 | 4 Cond. | 20 10x30 | Same as 5640 | .015 | .025 | † 2095 | .208 |
| 5643 | 5 Cond. | 20 10x30 | Same as 5640 | .015 | .025 | † 2095 | .225 |
| 5644 | 7 Cond. | 20 10x30 | Same as 5640 | .015 | .025 | † 2095 | .240 |
| 5645 | 9 Cond. | 20 10x30 | Same as 5640 | .015 | .030 | † 2095 | .300 |
| 5646 | 12 Cond. | 20 10x30 | Same as 5640 | .015 | .030 | † 2095 | .320 |

Catalog No.'s 5640 thru 5646 Color Coding Chart 1 See Page 13

INTERCOMMUNICATING SOUND SYSTEM



INTERCOMMUNICATING SOUND SYSTEM

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 19 AWG | | | | | | | |
| 5556 | 2 Cond. | 19 Solid | Bare copper vinyl insulation, wires twisted gether – 1 condr. brown – 1 condr. tan. | .015 | – | – | .115 |
| 5561 | 3 Cond. | 19 Solid | Same as 5556 – 1 condr. brown – 1 condr. tan – 1 condr. gray | .015 | – | – | .132 |
| 557 | 2 Cond. | 19 Solid | Same as 5556 except .025" gray PVC jacket. | .015 | .025 | – | .162 |

† UL LISTED

STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.

(UL) LISTED

CONSOLIDATED

# UNSHIELDED AUDIO CABLE MULTICONDUCTOR – PLASTIC JACKET

## STRANDED CONDUCTORS — 400 VOLTS

| Catalog Number | Type | Size & Stranding | Specifications and General Applications | Nom. Diam. (Inches) |
|---|---|---|---|---|
| **18 AWG – UL STYLE 2464 †** | | | | |
| 5470 | 4 Condr. | 18 16x30 | Tin copper .018" PVC cabled .030" Gray outer PVC Jkt. | .250 |
| 5471 | 5 Condr. | 18 16x30 | Same as 5470 Except .037" Jacket | .295 |
| 5472 | 7 Condr. | 18 16x30 | Same as 5470 Except .037" Jacket | .324 |
| 5473 | 9 Condr. | 18 16x30 | Same as 5470 Except .037" Jacket | .379 |
| 5474 | 12 Condr. | 18 16x30 | Same as 5470 Except .040" Jacket | .412 |
| 5475 | 15 Condr. | 18 16x30 | Same as 5470 Except .045" Jacket | .465 |
| 5476 | 19 Condr. | 18 16x30 | Same as 5470 Except .045" Jacket | .505 |
| 5477 | 25 Condr. | 18 16x30 | Same as 5470 Except .060" Jacket | .600 |

## STRANDED CONDUCTORS — 600 VOLTS

| Catalog Number | Type | Size & Stranding | Specifications and General Applications | Nom. Diam. (Inches) |
|---|---|---|---|---|
| **16 AWG – UL STYLE 2570 †** | | | | |
| 5480 | 4 Condr. | 16 19x29 | Tin Copper .030" PVC cables .045" Gray outer PVC Jkt. | .375 |
| 5488 | 5 Condr. | 16 19x29 | Same as 5480 | .405 |
| 5481 | 7 Condr. | 16 19x29 | Same as 5480 | .455 |
| 5489 | 9 Condr. | 16 19x29 | Same as 5480 | .510 |
| 5482 | 12 Condr. | 16 19x29 | Same as 5480 Except .060" Jacket | .600 |
| 5483 | 15 Condr. | 16 19x29 | Same as 5480 Except .060" Jacket | .650 |
| 5484 | 19 Condr. | 16 19x29 | Same as 5480 Except .065" Jacket | .715 |
| 5490 | 25 Condr. | 16 19x29 | Same as 5480 Except .065" Jacket | .820 |
| **14 AWG – UL SYTLE 2463 †** | | | | |
| 5485 | 4 Condr. | 14 19x27 | Tin copper .045" PVC cabled .045" Gray outer PVC Jkt. | .495 |
| 5491 | 5 Condr. | 14 19x27 | Same as 5485 Except .060" Jacket | .560 |
| 5486 | 7 Condr. | 14 19x27 | Same as 5485 Except .060" Jacket | .630 |
| 5492 | 9 Condr. | 14 19x27 | Same as 5485 Except .065" Jacket | .750 |
| 5487 | 12 Condr. | 14 19x27 | Same as 5485 Except .065" Jacket | .770 |
| 5493 | 15 Condr. | 14 19x27 | Same as 5485 Except .080" Jacket | .900 |

**Color Code Chart**

**CHART 1***

1 Black
2 Red
3 Green
4 White
5 Brown
6 Blue
7 Orange
8 Yellow
9 Purple
10 Slate
11 Pink
12 Tan

**CHART 2****

1 Black
2 White
3 Red
4 Green
5 Orange
6 Blue
7 White/Black
8 Red/Black
9 Green/Black
10 Orange/Black
11 Blue/Black
12 Black/White
13 Red/White
14 Green/White
15 Blue/White
16 Black/Red
17 White/Red
18 Orange/Red
19 Blue/Red
20 Red/Green
21 Orange/Green
22 Black/White/Red
23 White/Black/Red
24 Red/Black/White
25 Green/Black/White
26 Orange/Black/White
27 Blue/Black/White
28 Black/Red/Green
29 White/Red/Green
30 Red/Black/Green
31 Green/Black/Orange
32 Orange/Black/Green
33 Blue/White/Orange
34 Black/White/Orange
35 White/Red/Orange
36 Orange/White/Blue
37 White/Red/Blue
38 Black/White/Green
39 White/Black/Green
40 Red/White/Green
41 Green/White/Blue
42 Orange/Red/Green
43 Blue/Red/Green
44 Black/White/Blue
45 White/Black/Blue
46 Red/White/Blue
47 Green/Orange/Red
48 Orange/Red/Blue
49 Blue/Red/Orange
50 Black/Orange/Red
51 White/Black/Orange
52 Red/Orange/Black
53 Green/Red/Blue
54 Orange/Black/Blue
55 Blue/Black/Orange
56 Black/Orange/Green
57 White/Orange/Green
58 Red/Orange/Green
59 Green/Black/Blue
60 Orange/Green/Blue

† UL LISTED

* Catalog No's 5470 thru 5473 Color Coding Chart 1
** Catalog No.'s 5474 thru 5493 Color Coding Chart 2
STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.

## (UL) LISTED
## FIRE ALARM CABLES

### 19 AWG (UL) LISTED "LIMITED ENERGY CIRCUIT CABLES"*

| Catalog Number | Type | Size & Stranding | Specifications | Insul. Thick. (Inch) | Jacket Thickness (Inches) | Color | Voltage | Nom. O.D. (Inch) |
|---|---|---|---|---|---|---|---|---|
| 5650* | 2 Condr. | 19 Solid | Bare copper, red vinyl parallel. | .030 | — | Red | 300 | 100x .190 |
| 5654* | 4 Condr. | 19 Solid | Bare copper vinyl insulation cabled red vinyl jacket. | .015 | .040 | Black Red Yellow Blue | 300 | .230 |
| 5656* | 6 Condr. | 19 Solid | Same as 5654 | .015 | .040 | Black Red Yellow Blue Brown Orange | 300 | .278 |

*These cables meet requirements of UL Subject 13, low energy circuit cable. Cables are rated at 105°C. They are suitable for fire protection alarm circuit wiring.
STANDARD SPOOL PUT-UP: 500 FT., 1000 FT.

## LOW LEAKAGE
## MEDICAL SAFETY CABLE
## (UL) TYPE SJT*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 4390* | 3 Condr. | 18 41x34 | Bare copper insulation, Polyethylene fillers, paper tape PVC jacket. | .031 | .050 | Black White Green | 300 | .430 |
| 4391* | 3 Condr. | 16 65x34 | Same as 4390 | .031 | .050 | Black White Green | 300 | .475 |

*Low leakage power cable, greatly reduces danger of electrical shock for medical and dental applications.

## COMPUTER INSTALLATION
## COAXIAL CABLE
## (UL) LISTED

| Catalog Number | RG Type | AWG and Stranding | Dielectric O.D. | Shield | Nom. O.D. (Inch) | Nom. Imp. Ohms | V.P. % | Cap. Mmfd./Ft. | U.L. Style |
|---|---|---|---|---|---|---|---|---|---|
| 4452 | 62/U | 22Solid/CW | Semi Solid Poly .146 | Bare Copper | .242 | 93 | 84 | 13.5 | — |
| 4453 | 62A/U | 22Solid/CW | Semi Solid Poly .146 | Bare Copper | .242 | 93 | 84 | 13.5 | — |
| 4499* | 62A/U Modified | 22Solid/CW | Semi Solid Flame Retardant Poly .146 | Bare Copper | .260 | 93 | 80 | 14.5 | † 1381 |
| 4472 | 62B/U | 24(7x32)/CW | Semi Solid Poly. 146 | Bare Copper | .242 | 93 | 84 | 13.5 | — |

** Semi-Solid Dielectric  N—Nichrome  C—Copper  S—Silvered Copper  CW—Copperweld  T—Tinned Copper  F—Formvar

★NEW ITEMS

† UL LISTED

## "CB" TYPE COAXIAL CABLES

CONSOLIDATED

| Catalog No. | RG Type | AWG & Stranding | Dielectric Type | Shield Coverage | Nom. O.D. | Nom. Imp. Ohms. | Jacket Color |
|---|---|---|---|---|---|---|---|
| 4477 | 8/U | 13(7x21)C | Foam Poly .285" | 85% | .405 | 50 | Black |
| 4400* | 8/U | 13(7x21)C | Foam Poly .285" | 95% | .405 | 50 | White |
| 4407* | Modified 8/U | 16(19x29)C | Foam Poly. 154" | 85% | .242 | 50 | Gray |
| 4405 | 58/U | 20Solid/C | Solid Poly .116" | 87% | .195 | 53.5 | Black |
| 4498 | 58/U | 20Solid/C | Foam Poly .116" | 87% | .195 | 53.5 | Black |
| 4449 | 58A/U | 20(19x0071)T | Solid Poly .116" | 90% | .195 | 50 | Black |
| 4401 | 59/U | .023/CW | Solid Poly .146" | 85% | .242 | 73 | Black |
| 4402 | 59/U | .023/CW | Solid Poly .146" | 85% | .242 | 73 | Gray |
| 4403 | 59/U | .023/CW | Solid Poly .146" | 85% | .242 | 73 | White |
| 4478 | 59/U | 22Solid/CW | Foam Poly .107 | 87% | .242 | 72 | Black |

* Semi-Solid Dielectric  N—Nichrome  C—Copper  S—Silvered Copper  CW—Copperweld  T—Tinned Copper  F-Formvar

## MATV – CATV COAXIAL CABLE – 75 ohm 82 channel

| AWG and Stranding | Primary Insulation | Shield and Material | Jacket | Nom. O.D. (Inches) | Nom. Imp. Ohms | Nom. Vel. of Prop. | Nom. Cap. |
|---|---|---|---|---|---|---|---|
| **4575 82 CHANNEL COLOR COAX 75 OHMS – RG 6/U TYPE** | | | | | | | |
| 18 Solid Bare Copper | Cellular Polyethylene | Mylar Aluminum Foil Shield & 4 Drain Wires | White, Black Gray, PVC | .242 | 75 | 78% | 17.3 |
| **4585 82 CHANNEL COLOR COAX 75 OHMS – RG 6/U TYPE** | | | | | | | |
| 18 Solid Bare Copper | Cellular Polyethylene | Mylar Aluminum Foil Shield & Aluminum Braid | Black PVC | .242 | 75 | 78% | 17.3 |
| **4559 82 CHANNEL COLOR COAX 75 OHMS – RG 59/U TYPE** | | | | | | | |
| 22 Solid Bare Copperweld | Cellular Polyethylene | Mylar Aluminum Foil Shield & 4 Drain Wires | White, Black PVC | .242 | 75 | 78% | 16.8 |
| **4569 82 CHANNEL COLOR COAX 75 OHMS – RG 59/U TYPE** | | | | | | | |
| 22 Solid Bare Copperweld | Cellular Polyethylene | Mylar Aluminum Foil Shield & Aluminum Braid | Black PVC | .242 | 75 | 78% | 16.3 |

100% Sweep Tested to provide quality free operation.

Conco-Color—AX is manufactured for distribution systems carrying both UHF and VHF. Cable loss is about half of ordinary RG59/U coax and less than twin lead. Ideal for homes and stores.

| AWG and Stranding | Primary Insulation | Dielectric O.D. (Inches) | Shield | Jacket | Nominal O.D. (Inches) | Spool Put-Up |
|---|---|---|---|---|---|---|
| **4582 CONCO-COLOR – AX 82 CHANNEL CABLE – RG 6/U TYPE** | | | | | | |
| 18 Solid Bare Copper | Foam Polyethylene | .184 | 34 AWG Braid Bare Copper | Black PVC | .270 | 500', 1000' |

★NEW ITEM

# RG TYPE COAXIAL CABLES

CONSOLIDATED

| Non-Contaminating Low Temp. Black Jkt. | | Vinyl & Poly. Jackets | | Armor O.D. | Jacket O.D. | Vinyl Jacket | Shields | | Dielectric O.D. | Center Conductor | V.P. % | Cap. Mmfd./ Ft. | Max. Oper. Volts Rms. | Nom. Imp. Ohms |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number RG/U | Catalog Number | Number RG/U | Catalog Number | | | | Outer | Inner | | | | | | |
| 5B | 4432 | | | | .332 | Black | S | S | .185 | .053S | 65.9 | 29.5 | 3000 | 50 |
| 6A | 4433 | | | | .332 | Black | C | C | .185 | 21CW | 65.9 | 20 | 2700 | 75 |
| | | 8 | 4415 | | .405 | Black | | C | .285 | 7/21 | 65.9 | 29.5 | 4000 | 52 |
| 8A | 4435 | | | | .405 | Black | | C | .285 | 7/.0296 | 65.9 | 30.5 | 4000 | 52 |
| 9A | 4437 | | | | .420 | Gray | S | S | .280 | 7/21S | 65.9 | 30 | 4000 | 51 |
| 9B | 4438 | | | | .425 | Black | S | S | .285 | 7/.0296S | 65.9 | 30.5 | 4000 | 50 |
| 10A | 4439 | | | .475 | .405 | Black | | C | .285 | 7/.0296 | 65.9 | 30.5 | 4000 | 50 |
| | | 11 | 4419 | | .405 | Black | | C | .285 | 7/26T | 65.9 | 20.5 | 4000 | 75 |
| 11A | 4440 | | | | .405 | Black | | C | .285 | 7/26T | 65.9 | 20.5 | 4000 | 75 |
| 12A | 4441 | | | .475 | .405 | Black | | C | .285 | 7/26T | 65.9 | 20.5 | 4000 | 75 |
| 13A | 4443 | | | | .425 | Black | C | C | .285 | 7/26T | 65.9 | 20.5 | 4000 | 75 |
| 14A | 4468 | | | | .545 | Black | C | C | .370 | .106 | 65.9 | 30 | 5500 | 52 |
| 17A | 4482 | | | | .870 | Black | | C | .680 | .188C | 65.9 | 29.5 | 11000 | 52 |
| 18A | 4483 | | | .945 | .870 | Black | | C | .680 | .188C | 65.9 | 29.5 | 11000 | 52 |
| | | 21 | 4444 | | .322 | Gray | S | S | .185 | 16N | 65.9 | 29 | 2700 | 53 |
| 21A | 4445 | | | | .332 | Black | S | S | .185 | .053N | 65.9 | 30 | 2700 | 50 |
| | | 22 | 4471 | | .405 | Black | | T | .285 | Two 7/.0152 | 65.9 | 16 | 1000 | 95 |
| 22B | 4475 | | | | .420 | Black | T | T | .285 | Two 7/.0152 | 65.9 | 16 | 1000 | 95 |
| | | 29 | 4446 | | .184 | Poly | | T | .116 | 20 | 65.9 | 28.5 | 1900 | 53.5 |
| | | 54A | 4469 | | .250 | Poly | | T | .178 | 7/.0152 | 65.9 | 26.5 | 3000 | 58 |
| | | 55 | 4447 | | .206 | Poly | T | T | .116 | 20 | 65.9 | 28.5 | 1900 | 53.5 |
| 55A | 4448 | | | | .216 | Black | S | S | .116 | .035S | 65.9 | 29.5 | 1900 | 50 |
| 55B | 4484 | | | | .206 | Black | T | T | .116 | 20S | 65.9 | 28.5 | 1900 | 53.5 |
| | | 58 | 4405 | | .195 | Black | | T | .116 | 20 | 65.9 | 28.5 | 1900 | 53.5 |
| 58A | 4449 | | | | .195 | Black | | T | .116 | 19/.0071T | 65.9 | 29.5 | 1900 | 50 |
| 58B | 4474 | | | | .195 | Black | | T | .116 | 20 | 65.9 | 28.5 | 1900 | 53.5 |
| 58C | 4450 | | | | .195 | Black | | T | .116 | 19/.0071T | 65.9 | 29.5 | 1900 | 50 |
| | | 59 | 4401 | | .242 | Black | | C | .146 | 22CW | 65.9 | 21 | 2300 | 73 |
| | | 59 | 4402 | | .242 | Gray | | C | .146 | 22CW | 65.9 | 21 | 2300 | 73 |
| 59 | 4403 | | | | .242 | White | | C | .146 | 22CW | 65.9 | 21 | 2300 | 73 |
| 59A | 4451 | | | | .242 | Black | | C | .146 | .023CW | 65.9 | 20.5 | 2300 | 75 |
| 59B | 4470 | | | | .242 | Black | | C | .146 | .023CW | 65.9 | 20.5 | 2300 | 75 |
| | | 62 | 4452 | | .242 | Black | | C | .146** | 22CW | 84 | 13.5 | 750 | 93 |
| 62A | 4453 | | | | .242 | Black | | C | .146** | 22CW | 84 | 13.5 | 750 | 93 |
| 62B | 4472 | | | | .242 | Black | | C | .146 | 7x32CW | 84 | 13.5 | 750 | 93 |
| | | 63 | 4454 | | .405 | Black | | C | .285** | 22CW | 84 | 10 | 1000 | 125 |
| 63B | 4455 | | | | .405 | Black | | C | .285** | 22CW | 84 | 10 | 1000 | 125 |
| 71A | 4466 | | | | .245 | Black | T | T or C | .146** | 22CW | 84 | 13.5 | 750 | 93 |
| 71B | 4485 | | | | .250 | Black | T | C | .146 | 22CW | 84 | 13.5 | 750 | 93 |
| 74A | 4486 | | | .615 | .545 | Black | C | C | .370 | 10C | 65.9 | 29.5 | 7000 | 52 |
| 79B | 4487 | | | .475 | .405 | Black | | C | .285 | 22CW | 84 | 10 | 1000 | 125 |
| | | 100 | 4412 | | .242 | Black | | C | .146 | 19/.0147C | 65.9 | 44 | 2000 | 35 |

** Semi-Solid Dielectric  N—Nichrome  C—Copper  S—Silvered Copper  CW—Copperweld  T—Tinned Copper  F—Formvar

# RG TYPE COAXIAL CABLES

CONSOLIDATED

| Non-Contaminating Low Temp. Black Jkt. | | Vinyl & Poly. Jackets | | | | | Shields | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number RG/U | Catalog Number | Number RG/U | Catalog Number | Armor O.D. | Jacket O.D. | Vinyl Jacket | Outer | Inner | Dielectric O.D. | Center Conductor | V.P. % | Cap. Mmfd./ Ft. | Max. Oper. Volts Rms. | Nom. Imp. Ohms |
| | | 108 | 4464 | | .235 | Black | | T | .079 ea. | Two 7/28T | 68 | 23.5 | 1000 | 78 |
| 108A | 4465 | | | | .235 | Black | | T | .079 ea. | Two 7/28T | 65.9 | 23.5 | 1000 | 78 |
| | | 111 | 4422 | .480 | .420 | Gray | T | T | .285 | Two 7/.152T | 65.9 | 16 | 1000 | 95 |
| 111A | 4423 | | | .490 | .420 | Gray | T | T | .285 | Two 7/.152T | 65.9 | 16 | 1000 | 95 |
| | | 114 | 4426 | | .405 | Black | | C | .285 | .007CW | | 6.8 | 1000 | 185 |
| 114A | 4427 | | | | .405 | Black | | C | .285 | .007CW | | 6.8 | 1000 | 185 |
| 122 | 4457 | | | | .160 | Black | | T | .096 | 27/36T | 65 9 | 29.5 | 1900 | 50 |
| 130 | 4428 | | | | .625 | Black | | T | .472 | Two 7/21C | 65.9 | 17 | 3000 | 95 |
| 131 | 4429 | | | .710 | .625 | Black | | T | .472 | Two 7/21C | 65.9 | 17 | 3000 | 95 |
| 133A | 4430 | | | | .405 | Black | | C | .285 | 21C | 65.9 | 16.2 | 1000 | 95 |
| | | 164 | 4404 | | .870 | Black | | C | .680 | .1045C | | | 10000 | 75 |
| | | 177 | 4406 | | .895 | Black | S | S | .680 | .195C | | | 11000 | 50 |
| 212 | 4488 | | | | .332 | Black | S | S | .185 | .0556S | 65.9 | 29.5 | 3000 | 50 |
| 213 | 4489 | | | | .405 | Black | | C | .285 | 7X.0296C | 65.9 | 29.5 | 5000 | 50 |
| 214 | 4490 | | | | .425 | Black | S | S | .285 | 7X.0296C | 65.9 | 29.5 | 5000 | 50 |
| 215 | 4497 | | | | .475 | Black | | C | .285 | 7/.029C | 65.9 | 29.5 | 4000 | 50 |
| 216 | 4491 | | | | .425 | Black | C | C | .285 | 7X26TC | 65.9 | 20.5 | 5000 | 75 |
| 217 | 4492 | | | | .545 | Black | C | C | .370 | .106C | 65.9 | 29.5 | 7000 | 50 |
| 218 | 4493 | | | | .870 | Black | | C | .680 | .195C | 65.9 | 29.5 | 11000 | 50 |
| 219 | 4494 | | | .945 | .870 | Black | | C | .680 | .195C | 65.9 | 29.5 | 11000 | 50 |
| | | 220 | 4408 | | 1.120 | Black | | C | .910 | .260C | 65.9 | 29.5 | 14000 | 50 |
| | | 221 | 4409 | 1.195 | 1.120 | Black | | C | .910 | .260C | 65.9 | 29.5 | 14000 | 50 |
| 222 | 4495 | | | | .332 | Black | S | S | .185 | .0556N | 65.9 | 29.0 | 2700 | 50 |
| 223 | 4496 | | | | .216 | Black | S | S | .116 | .035S | 65.9 | 29.5 | 1900 | 50 |
| | | 224 | 4411 | .615 | .545 | Gray | C | C | .370 | .106C | 65.9 | 29.5 | 5500 | 52 |

## MINIATURE COAXIAL CABLE

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 174 | 4459 | | .105 | Black | | T | .060** | 7/.0063CW | | 30 | | 50 |

## FOAM POLYETHYLENE COAXIAL CABLE

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 8 | 4477 | | .405 | Black | | C | .285 | 7/21C | 80 | 24.5 | 1500 | 50 |
| 11 | 4476 | | | | .405 | Black | | C | .285 | 14C | 80 | 16.5 | 3000 | 75 |
| | | 58 | 4498 | | .195 | Black | | C | .116 | 20C | 80 | 28.5 | 1900 | 53.5 |
| | | 59 | 4478 | | .242 | Black | | C | .107 | 22CW | 80 | 17 | 500 | 72 |
| 62 | 4479 | | | | .242 | Black | | C | .146 | .023CW | 80 | 14.5 | 700 | 93 |

## FOAM POLYETHYLENE TRIAXIAL CABLE DOUBLE SHIELD DOUBLE JACKET

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | 4480 | | | | .460 | Black | C | C | .285 | 14C | 80 | 16.5 | 3000 | 75 |
| 59 | 4481 | | | | .315 | Black | C | C | .107 | .032CW | 80 | 17 | 500 | 72 |

## TRIAXIAL CABLE DOUBLE SHIELD DOUBLE JACKET

| RG/U Type | Catalog Number | Impedance In Ohms | Jacket Diameter | Vinyl Jacket | Shields | | O.D. Dielectric | Inner Conductor | V.P. % | Cap. Mmfd./Ft. | Max. Oper. Volts Rms. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1st | 2nd | | | | | |
| Triaxial 58A | 4463 | 50 | .285 | Black | T | T | .116 | 19 .0071T | 65.9 | 28.5 | 1900 |
| Triaxial 59 | 4460 | 73 | .325 | Black | C | C | .146 | 22CW | 65.9 | 21.0 | 2300 |
| Triaxial 11 | 4461 | 75 | .460 | Black | C | C | .285 | 14C | 65.9 | 20.5 | 4000 |
| Triaxial 8 | 4462 | 52 | .490 | Black | C | C | .285 | 7/21C | 65.9 | 29.5 | 4000 |

** Semi-Solid Dielectric  N—Nichrome  C—Copper  S—Silvered Copper  CW—Copperweld  T—Tinned Copper  F—Formvar

## TEFLON COAXIAL CABLE

CONSOLIDATED

| Number RG/U | Catalog Number | Inner Conductor | Dielectric Material | Nominal Diameter of Dielectric (Inch) | Type of Shielding Braids | Protective Covering | Nominal Over-all Diameter (Inch) | Nominal Capacitance (Mmfd/Ft.) | Maximum Operating Voltage (Volts Rms) | Nominal Imped. (Ohms) |
|---|---|---|---|---|---|---|---|---|---|---|
| 62C | 4700 | .0253 Silver Covered Copper Steel | F-3 | .146 | Silver Covered Copper Single Braid | V | .242 | 14.5 | 750 | 93 |
| 87A | 4701 | 7/.032 Silver Covered Copper | F-1 | .280 | Silver Coated Copper Double Braid | V | .425 | 29.5 | 5000 | 50 |
| 94 | 4702 | 19/.0025 Silver Covered Copper | F-2 | .292 | Copper Double Braid | V | .445 | 29.0 | 7000 | 50 |
| 94A | 4703 | 19/.0254 Silver Plated Copper | F-2 | .370 | Copper Double Braid | V | .500 | 27.0 | 7000 | 50 |
| 115 | 4704 | 7/.028 Silver Covered Copper | F-2 | .250 | Silver Coated Copper Double Braid | V | .375 | 29.5 | 5000 | 50 |
| 115A | 4705 | 7/.028 Silver Covered Copper | F-2 | .255 | Silver Coated Copper Double Braid | V | .415 | 29.5 | 5000 | 50 |
| 116 | 4706 | 7/.032 Silver Covered Copper | F-1 | .280 | Silver Coated Copper Double Braid | V with armor | .490 | 29.5 | 5000 | 50 |
| 117 | 4707 | .188 Copper | F-1 | .620 | Copper Single Braid | V | .730 | 29.0 | 7000 | 50 |
| 117A | 4708 | .188 Copper | F-1 | .620 | Copper Single Braid | V | .730 | | 7000 | 50 |
| 118 | 4709 | .188 Copper | F-1 | .620 | Copper Single Braid | V with armor | .795 | 29.0 | 7000 | 50 |
| 118A | 4710 | .188 Copper | F-1 | .620 | Copper Single Braid | V with armor | .780 | | 7000 | 50 |
| 119 | 4711 | .102 Copper | F-1 | .332 | Copper Double Braid | V | .465 | 29.0 | 6000 | 50 |
| 120 | 4712 | .102 Copper | F-1 | .332 | Copper Double Braid | V with armor | .525 | 29.0 | 6000 | 50 |
| 126 | 4713 | 7/.0203 Karma or Equal | F-1 | .185 | Karma or Equal Single Braid | V | .280 | 29.0 | 3000 | 50 |
| 140 | 4714 | .025 Silver Coated Copper Steel | F-1 | .146 | Silver Coated Copper Single Braid | V | .233 | 21.0 | 2300 | 75 |
| 141 | 4715 | .0359 Silver Plated Copper Weld | F-1 | .116 | Silver Coated Copper Single Braid | V | .190 | 28.5 | 1900 | 50 |
| 141A | 4716 | .039 Silver Covered Copper Steel | F-1 | .116 | Silver Coated Copper Single Braid | V | .190 | 28.5 | 1900 | 50 |
| 142 | 4717 | .0359 Silver Covered Copper Steel | F-1 | .116 | Silver Coated Copper Double Braid | V | .206 | 28.5 | 1900 | 50 |
| 142A | 4718 | .039 Silver Covered Copper Steel | F-1 | .116 | Silver Coated Copper Double Braid | V | .206 | 28.5 | 1900 | 50 |
| 142B | 4719 | .039 Silver Covered Copper Steel | F-1 | .116 | Silver Coated Copper Double Braid | FEP | .195 | 28.5 | 1900 | 50 |
| 143 | 4720 | .057 Silver Plated Copper Weld | F-1 | .185 | Silver Coated Copper Double Braid | V | .325 | 28.5 | 3000 | 50 |
| 143A | 4721 | .059 Silver Covered Copper Steel | F-1 | .185 | Silver Coated Copper Double Braid | V | .325 | 28.5 | 3000 | 50 |
| 144 | 4722 | 7/.0179 Silver Covered Copper Steel | F-1 | .285 | Silver Coated Copper Single Braid | V | .410 | 20.5 | 5000 | 75 |
| 146 | 4723 | .007 Copper Covered Steel | F-3 | .285 | Copper Single Braid | V | .375 | 6.0 | 1000 | 190 |
| 161 | 4724 | 7/38 Silver Plated Cadmium Bronze | F-1 | .057 | Single Silver Copper | Extruded Black Nylon | .090 | 20.0 | 1000 | 70 |
| 165 | 4725 | 7/.032 Silver Covered Copper | F-1 | .285 | Silver Covered Copper Single Braid | V | .410 | | 5000 | 50 |
| 166 | 4726 | 7/.032 Silver Covered Copper | F-1 | .285 | Silver Covered Copper Single Braid | V with armor | .460 | | 5000 | 50 |
| 178 | 4727 | 7/.0039 Silver Plated Copper Weld | F-1 | .036 | Silver Plated Copper Single Braid | KEL-F | .079 | 27.9 | 1000 | 50 |
| 178A | 4728 | 7/.004 Silver Covered Copper Steel | F-1 | .034 | Silver Plated Copper Single Braid | KEL-F | .075 | 27.9 | 1000 | 50 |
| 178B | 4729 | 7/.004 Silver Covered Copper Steel | F-1 | .034 | Silver Covered Copper Single Braid | FEP | .075 | | 1000 | 50 |
| 179 | 4761 | 7/.004 Silver Covered Copper Steel | F-1 | .063 | Silver Covered Copper Single Briad | KEL-F | .100 | | 1200 | 75 |

**Continued on following page**

F-1 — Solid Teflon F-2 — Taped Teflon F-3 — Air Spaced Teflon
V — High Temperature Lacquer Impregnated Fiberglass Braid with Teflon Tape Between Shield and Jacket.
VI — Polyester Fiber Impregnated with High Temperature Lacquer over Wrapped or Extruded Silicone Impregnated Fiberglass
IIA — Low Temperature Black Polyvinylchloride Non-Contaminating
FEP — Fluorinated Ethylene Propylene Copolymar, 200° Teflon
TFE — Tertafluoride Ethylene Propylene Copolymar, 250°C Teflon

## TEFLON COAXIAL CABLE

CONSOLIDATED

| Number RG/U | Catalog Number | Inner Conductor | Dielectric Material | Nominal Diameter of Dielectric (Inch) | Type of Shielding Braids | Protective Covering | Nominal Over-all Diameter (Inch) | Nominal Capacitance (Mmfd/Ft.) | Maximum Operating Voltage (Volts Rms) | Nominal Imped. (Ohms) |
|---|---|---|---|---|---|---|---|---|---|---|
| 179A | 4730 | 7/.004 Silver Covered Copper Steel | F-1 | .063 | Silver Plated Copper Single Briad | KEL-F | .105 | 20.0 | 1200 | 75 |
| 179B | 4731 | 7/.004 Silver Covered Copper Steel | F-1 | .063 | Silver Covered Copper Single Braid | FEP | .105 | | 1200 | 75 |
| 180 | 4732 | 7/.0039 Silver Covered Copper Steel | F-1 | .103 | Silver Plated Copper Single Braid | KEL-F | .141 | 15.3 | 1500 | 93 |
| 180A | 4733 | 7/.004 Silver Covered Copper Steel | F-1 | .102 | Silver Plated Copper Single Braid | KEL-F | .145 | 14.5 | 1500 | 95 |
| 180B | 4734 | 7/.004 Silver Covered Copper Steel | F-1 | .102 | Silver Covered Copper Single Braid | FEP | .145 | | 1500 | 95 |
| 187 | 4735 | 7/.004 Silver Covered Copper Steel | F-1 | .060 | Silver Covered Copper Single Braid | Teflon | .110 | | 1200 | 75 |
| 187A | 4736 | 7/.004 Silver Covered Copper Steel | F-1 | .060 | Silver Covered Copper Single Braid | TFE | .110 | | 1200 | 75 |
| 188 | 4737 | 7/.0067 Silver Covered Copper Steel | F-1 | .060 | Silver Covered Copper Single Braid | Teflon | .110 | | 1200 | 50 |
| 188A | 4738 | 7/.0067 Silver Covered Copper Steel | F-1 | .060 | Silver Covered Copper Single Braid | TFE | .110 | | 1200 | 50 |
| 195 | 4739 | 7/.004 Silver Covered Copper Steel | F-1 | .102 | Silver Covered Copper Single Braid | Teflon | .155 | | 1500 | 95 |
| 195A | 4740 | 7/.004 Silver Covered Copper Steel | F-1 | .102 | Silver Covered Copper Single Braid | TFE | .155 | | 1500 | 95 |
| 196 | 4741 | 7/.004 Silver Covered Copper Steel | F-1 | .034 | Silver Covered Copper Single Braid | Teflon | .080 | | 1000 | 50 |
| 196A | 4742 | 7/.004 Silver Covered Copper Steel | F-1 | .034 | Silver Covered Copper Single Braid | TFE | .080 | | 1000 | 50 |
| 209 | 4743 | 19/.037 Silver Covered Copper | F-3 | .500 | Silver Covered Copper Double Braid | VI | .750 | | 3200 | 50 |
| 210 | 4744 | .0253 Silver Covered Copper Steel | F-3 | .146 | Silver Covered Copper Single Braid | V | .242 | 14.5 | 750 | 93 |
| 211 | 4745 | .190 Copper | F-1 | .620 | Copper Single Braid | V | .730 | | 7000 | 50 |
| 211A | 4746 | .190 Copper | F-1 | .620 | Copper Single Braid | V | .730 | | 7000 | 50 |
| 225 | 4747 | 7/.0312 Silver Covered Copper | F-1 | .285 | Silver Covered Copper Double Braid | V | .430 | | 5000 | 50 |
| 226 | 4748 | 19/.0254 Silver Covered Copper | F-2 | .370 | Copper Double Braid | V | .500 | | 7000 | 50 |
| 227 | 4749 | 7/.0312 Silver Covered Copper | F-1 | .285 | Silver Covered Copper Double Braid | V with armor | .490 | | 5000 | 50 |
| 228 | 4750 | .190 Copper | F-1 | .620 | Copper Single Braid | V with armor | .795 | | 7000 | 50 |
| 228A | 4751 | .190 Copper | F-1 | .620 | Copper Single Braid | V with armor | .795 | | 7000 | 50 |
| 235 | 4752 | 7/.028 Copper | F-2 | .255 | Silver Covered Copper Double Braid | VI | .490 | | 5000 | 50 |
| 279 | 4762 | 19/.005 Silver Covered Copper Steel | F-1 | .110 | Silver Covered Copper Single Braid | V | .145 | 17.3 | 1500 | 75 |
| 280 | 4753 | .1144 Copper | F-2 | .327 | Silver Covered Copper Double Braid | IIA | .480 | 27.5 | 4000 | 50 |
| 281 | 4754 | 19/.0378 Silver Covered Copper | F-2 | .500 | Silver Covered Copper Double Braid | VI | .750 | 29.5 | 4000 | 50 |
| 301 | 4755 | 7/.0203 Karma | F-1 | .185 | Karma Single Braid | FEP | .245 | 29.0 | 3000 | 50 |
| 302 | 4756 | .025 Silver Covered Copper Steel | F-1 | .146 | Silver Covered Copper Single Braid | FEP | .206 | 21.0 | 2300 | 75 |
| 303 | 4757 | .039 Silver Covered Copper Steel | F-1 | .116 | Silver Covered Copper Single Braid | FEP | .170 | 28.5 | 1900 | 50 |
| 304 | 4758 | .059 Silver Covered Copper Steel | F-1 | .185 | Silver Covered Copper Double Braid | FEP | .280 | 28.5 | 3000 | 50 |
| 316 | 4759 | 7/.0067 Silver Covered Copper Steel | F-1 | .060 | Silver Covered Copper Single Braid | FEP | .102 | | 1200 | 50 |

F-1 — Solid Teflon  F-2 — Taped Teflon  F-3 — Air Spaced Teflon

V — High Temperature Lacquer Impregnated Fiberglass Braid with Teflon Between Shield and Jacket.

VI — Polyester Fiber Impregnated with High Temperature Lacquer over Wrapped or Extruded Silicone Impregnated Fiberglass

IIA — Low Temperature Black Polyvinylchloride Non-Contaminating

FEP — Fluorinated Ethylene Propylene Copolymar, 200° Teflon

TFE — Tertafluoride Ethylene Propylene Copolymar, 250°C Teflon

CONSOLIDATED

# UNSHIELDED STATION CONTROL CABLE

## HEAVY DUTY MULTI-CONDUCTOR PLASTIC JACKET — TYPE CT-B CONTROL CABLE — 600 VOLTS

| Catalog Number | No. of Cond. | Nom. Jkt. Thick. (Inches) | Nom. O.D. (Inches) | Catalog Number | No. of Cond. | Nom. Jkt. Thick. (Inches) | Nom. O.D. (Inches) |
|---|---|---|---|---|---|---|---|
| **16 GAUGE — 26/30 BARE COPPER** | | | | | | | |
| 7502 | 2 | .045 | .330 | 7519 | 19 | .060 | .690 |
| 7503 | 3 | .045 | .350 | 7521 | 21 | .060 | .730 |
| 7505 | 5 | .045 | .410 | 7522 | 22 | .060 | .760 |
| 7506 | 6 | .045 | .440 | 7524 | 24 | .060 | .810 |
| 7507 | 7 | .045 | .440 | 7526 | 26 | .060 | .820 |
| 7508 | 8 | .045 | .480 | 7530 | 30 | .060 | .900 |
| 7510 | 10 | .045 | .580 | 7537 | 37 | .060 | .960 |
| 7512 | 12 | .045 | .600 | 7540 | 40 | .060 | 1.00 |
| 7514 | 14 | .045 | .630 | 7550 | 50 | .080 | 1.10 |
| 7516 | 16 | .045 | .660 | 7560 | 60 | .080 | 1.19 |
| **14 GAUGE — 7/22 BARE COPPER** | | | | | | | |
| 7602 | 2 Twin | .045 | * | 7614 | 14 | .060 | .744 |
| 7603 | 3 Rd. | .045 | .419 | 7616 | 16 | .060 | .798 |
| 7604 | 4 | .045 | .425 | 7619 | 19 | .060 | .808 |
| 7605 | 5 | .045 | .462 | 7624 | 24 | .080 | .947 |
| 7606 | 6 | .045 | .481 | 7627 | 27 | .080 | 1.002 |
| 7607 | 7 | .045 | .502 | 7630 | 30 | .080 | 1.110 |
| 7608 | 8 | .060 | .556 | 7634 | 34 | .080 | 1.118 |
| 7609 | 9 | .060 | .622 | 7637 | 37 | .080 | 1.124 |
| 7610 | 10 | .060 | .657 | 7640 | 40 | .080 | 1.290 |
| 7612 | 12 | .060 | .696 | | | | |
| **12 GAUGE — 7/20 BARE COPPER** | | | | | | | |
| 7702 | 2 Twin | .045 | ** | 7715 | 15 | .060 | .832 |
| 7703 | 3 Rd. | .045 | .460 | 7716 | 16 | .060 | .901 |
| 7704 | 4 | .045 | .471 | 7718 | 18 | .080 | .928 |
| 7705 | 5 | .045 | .523 | 7719 | 19 | .080 | .943 |
| 7706 | 6 | .045 | .564 | 7720 | 20 | .080 | .966 |
| 7707 | 7 | .060 | .599 | 7722 | 22 | .080 | 1.01 |
| 7708 | 8 | .060 | .644 | 7725 | 25 | .080 | 1.09 |
| 7709 | 9 | .060 | .690 | 7727 | 27 | .080 | 1.129 |
| 7710 | 10 | .060 | .727 | 7730 | 30 | .080 | 1.168 |
| 7712 | 12 | .060 | .775 | 7734 | 34 | .080 | 1.201 |
| 7714 | 14 | .060 | .807 | 7737 | 37 | .080 | 1.257 |
| **10 GAUGE — 7/18 BARE COPPER** | | | | | | | |
| 7802 | 2 | .045 | .27x.45 | 7809 | 9 | .060 | .777 |
| 7803 | 3 | .045 | .483 | 7810 | 10 | .060 | .830 |
| 7804 | 4 | .060 | .569 | 7812 | 12 | .080 | .915 |
| 7805 | 5 | .060 | .618 | 7815 | 15 | .080 | .93 |
| 7806 | 6 | .060 | .640 | 7816 | 16 | .080 | .99 |
| 7807 | 7 | .060 | .671 | 7820 | 20 | .080 | 1.11 |
| 7808 | 8 | .060 | .700 | | | | |
| **9 GAUGE — 19/22 BARE COPPER** | | | | | | | |
| 7902 | 2 | .045 | .29x.48 | 7909 | 9 | .060 | .831 |
| 7903 | 3 | .045 | .526 | 7910 | 10 | .060 | .900 |
| 7904 | 4 | .060 | .604 | 7912 | 12 | .080 | .978 |
| 7905 | 5 | .060 | .659 | 7915 | 15 | .080 | .99 |
| 7906 | 6 | .060 | .670 | 7916 | 16 | .080 | 1.10 |
| 7907 | 7 | .060 | .716 | 7920 | 20 | .080 | 1.70 |
| 7908 | 8 | .060 | .760 | | | | |

DESCRIPTION: Each conductor, stranded bare copper, .020" polyethylene insulation, .010" polyvinylchloride jacket over each conductor, color coded, cabled with fillers where necessary, moisture resistant tape, black polyvinylchloride jacket overall. 600 volt operating voltage. Approved per IPCEA-NEMA standards.

* Flat Dimension .233" x .366"

** Flat Dimension .252" x .404"

# TELEPHONE AND COMMUNICATION CABLE

CONSOLIDATED

## AERIAL AND DUCT INSTALLATION — MEETS REA-PE-22

**DESCRIPTION:** Each conductor bare solid copper, color coded polyethylene insulation, insulated conductors paired, pairs cabled with non-hygroscopic tape wrap, .008" corrugated aluminum shield, black polyethylene jacket overall.

**CHARACTERISTICS:** Average mutual capacitance — .083 microfarads/mile. Minimal cross talk.

**APPLICATIONS:** A tough, long lasting communication cable that can withstand moisture, ultra-violet and weathering.

| Catalog Number | No. of Pairs | Nom. Jkt. Thick. (Inches) | Nom. O.D. (Inches) | Ship. Wt. Lbs. M/Ft. |
|---|---|---|---|---|
| **#22 AWG — SOLID** | | | | |
| 6606 | 6 | .060 | .420 | 95 |
| 6612 | 12 | .060 | .490 | 137 |
| 6618 | 18 | .060 | .560 | 201 |
| 6625 | 25 | .060 | .630 | 245 |
| 6650 | 50 | .060 | .800 | 420 |
| 6675 | 75 | .060 | .980 | 596 |
| 6610 | 100 | .070 | 1.120 | 807 |
| 6615 | 150 | .070 | 1.320 | 1,083 |
| 6620 | 200 | .070 | 1.500 | 1,485 |
| 6630 | 300 | .080 | 1.810 | 2,160 |
| 6640 | 400 | .090 | 2.050 | 2,705 |
| **#19 AWG — SOLID** | | | | |
| 6706 | 6 | .060 | .500 | 136 |
| 6712 | 12 | .060 | .630 | 235 |
| 6718 | 18 | .060 | .730 | 318 |
| 6725 | 25 | .060 | .820 | 419 |
| 6750 | 50 | .070 | 1.120 | 753 |
| 6775 | 75 | .070 | 1.320 | 1,070 |
| 6710 | 100 | .080 | 1.520 | 1,455 |
| 6715 | 150 | .080 | 1.790 | 2,051 |
| 6720 | 200 | .090 | 2.090 | 2,657 |

## DIRECT BURIAL INSTALLATION — MEETS REA-PE-23

**DESCRIPTION:** Each conductor bare solid copper, color coded polyethylene insulation, insulated conductors paired, pairs cabled with non-tygroscopic tape wrap, polyethylene inner jacket, .005" corrugated copper, or .010" corrugated aluminum shield, black polyethylene jacket overall.

**CHARACTERISTICS:** Average mutual capacitance .166 microfarads/mile. Minimal cross talk.

**APPLICATIONS:** Impervious to moisture, abrasion resistant, suitable for direct burial.

| | | | | |
|---|---|---|---|---|
| **#22 AWG — SOLID** | | | | |
| 6006 | 6 | .040 | .480 | 150 |
| 6012 | 12 | .040 | .550 | 170 |
| 6018 | 18 | .040 | .620 | 241 |
| 6025 | 25 | .040 | .690 | 302 |
| 6050 | 50 | .040 | .860 | 478 |
| 6075 | 75 | .040 | 1.040 | 680 |
| 6100 | 100 | .040 | 1.180 | 886 |
| 6150 | 150 | .050 | 1.400 | 1,258 |
| 6200 | 200 | .050 | 1.560 | 1,557 |
| 6300 | 300 | .060 | 1.890 | 2,173 |
| 6400 | 400 | .060 | 2.130 | 2,853 |
| **#19 AWG — SOLID** | | | | |
| 6106 | 6 | .040 | .560 | 168 |
| 6112 | 12 | .040 | .690 | 290 |
| 6118 | 18 | .040 | .790 | 367 |
| 6125 | 25 | .040 | .880 | 480 |
| 6170 | 50 | .050 | 1.180 | 871 |
| 6175 | 75 | .050 | 1.400 | 1,246 |
| 6110 | 100 | .050 | 1.580 | 1,568 |
| 6250 | 150 | .060 | 1.890 | 2,236 |
| 6220 | 200 | .060 | 2.170 | 2,986 |

STANDARD PUT-UP: CUT TO SPECIFICATION — MIN. 25 FT. — COLOR CODE — per IPCEA.

# TELEMETERING AND DATA SHIELDED CONTROL CABLE

CONSOLIDATED

**DESCRIPTION:** Each conductor bare solid copper, high molecular weight polyethylene insulation, color coded, twisted into pairs, cabled with a non-hygroscopic binder tape .008" aluminum shield, black polyethylene jacket overall. Operating voltage 300 volts.

Double jacketed types (8306-8420 below), same except for additional inner black polyethylene jacket over binder, and .005" copper shield, or .010" aluminum shield.

**APPLICATIONS:** Remote control of rocket recording data and test-firing control, transmission of signals which telemeter temperature, voltage pressure, etc. control of multiple circuits, measuring devices, quality control equipment, radar antenna. For aerial, duct and conduit installations.

Double jacketed types have higher dielectric strength and suited for direct burial installations.

| Catalog Number | No. of Pairs | Nom. Insul. Thick. (Inches) | Nom. Jkt. Thick. (Inches) | Nom. O.D. (Inches) | Approx. Lbs. M/Ft. |
|---|---|---|---|---|---|
| **#22 AWG — SOLID** | | | | | |
| 8006 | 6 | .012 | .060 | .420 | 95 |
| 8012 | 12 | .012 | .060 | .490 | 137 |
| 8018 | 18 | .012 | .060 | .560 | 201 |
| 8025 | 25 | .012 | .060 | .630 | 245 |
| 8050 | 50 | .012 | .060 | .800 | 420 |
| 8100 | 100 | .012 | .060 | 1.120 | 807 |
| 8200 | 200 | .012 | .060 | 1.500 | 1,485 |
| **#19 AWG — SOLID** | | | | | |
| 8016 | 6 | .015 | .060 | .500 | 136 |
| 8112 | 12 | .015 | .060 | .630 | 235 |
| 8118 | 18 | .015 | .060 | .730 | 318 |
| 8125 | 25 | .015 | .060 | .820 | 419 |
| 8150 | 50 | .015 | .060 | 1.120 | 753 |
| 8110 | 100 | .015 | .060 | 1.520 | 1,455 |
| 8220 | 200 | .015 | .060 | 2.090 | 2,657 |

## DOUBLE JACKET — HEAVY DUTY

| Catalog Number | No. of Pairs | Nom. Insul. Thick. (Inches) | Nom. Jkt. Thick. (Inches) | | Nom. O.D. (Inches) | Approx. Lbs. M/Ft. |
|---|---|---|---|---|---|---|
| | | | Inner | Outer | | |
| **#22 AWG — SOLID** | | | | | | |
| 8306 | 6 | .012 | .047 | .040 | .480 | 150 |
| 8312 | 12 | .012 | .047 | .040 | .550 | 170 |
| 8318 | 18 | .012 | .047 | .040 | .620 | 241 |
| 8325 | 25 | .012 | .047 | .040 | .690 | 302 |
| 8350 | 50 | .012 | .047 | .040 | .860 | 478 |
| 8310 | 100 | .012 | .047 | .050 | 1.180 | 886 |
| 8320 | 200 | .012 | .047 | .050 | 1.560 | 1,597 |
| **#19 AWG — SOLID** | | | | | | |
| 8406 | 6 | .015 | .047 | .040 | .560 | 168 |
| 8412 | 12 | .015 | .047 | .040 | .690 | 290 |
| 8418 | 18 | .015 | .047 | .040 | .790 | 367 |
| 8425 | 25 | .015 | .047 | .040 | .880 | 480 |
| 8450 | 50 | .015 | .047 | .040 | 1.180 | 871 |
| 8410 | 100 | .015 | .047 | .050 | 1.580 | 1,568 |
| 8420 | 200 | .015 | .047 | .050 | 2.220 | 2,986 |

STANDARD PUT-UP: CUT TO SPECIFICATION — MIN. 25 FT.

# (UL) LISTED

# STEREO, PHONO, AND SPEAKER CABLES

CONSOLIDATED

## SPEAKER CABLE

| Catalog Number | Type | Size & Stranding | Special Use | Specifications | Finished O.D. (Inches) |
|---|---|---|---|---|---|
| 5137 | 2 Condr. | 24 7x32 | Speaker Cable | Stranded 1 conductor bare copper — 1 conductor tinned copper — 2 conductors parallel .015 vinyl plastic insulation. Colors: gray, brown, white clear. | .058 x .115 |
| 5142 | 2 Condr. | 22 7x30 | Speaker Cable UL Style "PLT" | Same as 5148. Colors: clear, gray, brown, black, white. | .060 x .120 |
| 5140 | 2 Condr. | 20 10x30 | Lamp Cord "PLT" UL Style "PLT" | Two conductors bare copper parallel .015 vinyl insulation. Colors: black, gray, brown, white clear. 1 conductor ribbed for identification. | .080 x .165 |
| 5144 | 2 Condr. | 20 26x34 | Lamp Cord UL Style "XT" | Same as 5140 except .032 vinyl insulation. | .100 x .190 |
| 5148 | 2 Condr. | 18 16x30 | Speaker Cable UL Style "PLT" | Stranded 1 conductor bare copper — 1 conductor tinned copper — 2 conductors parallel .016 vinyl insulation. Color: clear. | .090 x .185 |

| Catalog Number | Type | Size & Stranding | U.L. Type | Nom. Insulation Thickness (Inches) | Nom. O.D. (Inches) |
|---|---|---|---|---|---|
| **RUBBER PARALLEL PORTABLE CORDAGE** | | | | | |
| 4072 | 2 Condr. | 18(41x34) | † SP-1 | 1/32 | .220 x .120 |
| 4074 | 2 Condr. | 16(65x34) | † SP-2 | 3/64 | .300 x .160 |
| **NEOPRENE PARALLEL PORTABLE CORDAGE** | | | | | |
| 4081★ | 2 Condr. | 18(41x34) | † HPN | 3/64 | .285x.148 |
| 4083★ | 2 Condr. | 16(65x34) | † HPN | 3/64 | .310x.161 |
| **PLASTIC PARALLEL PORTABLE CORDAGE** | | | | | |
| 4077 | 2 Condr. | 18(41x34) | † SPT-1 | 1/32 | .215 x .115 |
| 4079 | 2 Condr. | 16(65x34) | † SPT-2 | 3/64 | .300 x .160 |

Colors: Black, Brown, White, Gray.
STANDARD SPOOL PUT-UP: 25 FT., 50 FT., 100 FT., 250 FT., 500 FT., 1000 FT.

## STEREO CABLE — HI-FI, STEREO

| Catalog Number | Type | Size & Stranding | Specifications | Insul. Thick. (Inches) | Finished O.D. (Inches) |
|---|---|---|---|---|---|
| 1470 | 1 Condr. | 24 16x.005 | Bare copper; flexible stranding; vinylite plastic insulation; tinned copper braid — SHIELDED. | .010 | .070 |
| 1478 | 2 Condr. | 32 7x40 | Tinned copper: flexible stranding. Vinyl Plastic insulation; Black and Red. | .009 | .050 |
| 1401 | 3 Condr. | 32 7x40 | Same as 1478. Black, Red, White. | .009 | .055 |
| 1402 | 4 Condr. | 32 7x40 | Same as 1478. Black, Red, Green, White. | .009 | .070 |
| 1479 | 2 Condr. | 32 7x40 | Same as 1478 and tinned copper braid — SHIELDED. | .009 | .057 |
| 1406 | 3 Condr | 32 7x40 | Same as 1401 and tinned copper braid — SHIELDED. | .009 | .063 |
| 1407 | 4 Condr. | 32 7x40 | Same as 1402 and tinned copper braid — SHIELDED. | .009 | .070 |
| 1410 | 2 Condr. | 32 7x40 | Individually SHIELDED and twisted conductors. | .009 | .055 x .055 |

STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.

★NEW ITEMS

† UL LISTED

## UNSHIELDED RUBBER CONTROL CABLE

CONSOLIDATED

### UNSHIELDED RUBBER JACKET

| Catalog Number | No. of Cond. | Size & (Stranding) | Insulation Thickness (Inches) | Jacket Thickness (Inches) | Finished O.D. (Inches) |
|---|---|---|---|---|---|
| 1733 | 3 | 20(26x34) | .020 | .035 | .255 |
| 1734 | 4 | 20(26x34) | .020 | .035 | .275 |
| 1735 | 5 | 20(26x34) | .020 | .035 | .300 |
| 1736 | 6 | 20(26x34) | .020 | .035 | .315 |
| 1737 | 7 | 20(26x34) | .020 | .035 | .325 |
| 1738 | 8 | 20(26x34) | .020 | .035 | .360 |

STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.

## ELECTRICAL CORDAGES – (UL) LISTED

### RUBBER SHEATHED SERVICE CORD
**UNDERWRITERS APPROVED**

| Catalog Number | Type | AWG Size | U.L. Type | Current Carrying Capacity | Voltage Rating | Nom. O.D. (Inches) |
|---|---|---|---|---|---|---|
| 4202 | 2 Condr. | 18 | † SV | 5 Amps. | 300 | .250 |
| 4207 | 2 Condr. | 18 | † SJ | 5 Amps. | 300 | .310 |
| 4212 | 3 Condr. | 18 | † SJ | 5 Amps. | 300 | .345 |
| 4214 | 4 Condr. | 18 | † SJ | 5 Amps. | 300 | .360 |
| 4217 | 2 Condr. | 16 | † SJ | 7 Amps. | 300 | .340 |
| 4222 | 3 Condr. | 16 | † SJ | 7 Amps. | 300 | .375 |
| 4224 | 4 Condr. | 16 | † SJ | 7 Amps. | 600 | .395 |
| 4227 | 2 Condr. | 18 | † S | 5 Amps. | 600 | .390 |
| 4232 | 3 Condr. | 18 | † S | 5 Amps. | 600 | .405 |
| 4234 | 4 Condr. | 18 | † S | 5 Amps. | 600 | .435 |
| 4237 | 2 Condr. | 16 | † S | 7 Amps. | 600 | .410 |
| 4242 | 3 Condr. | 16 | † S | 7 Amps. | 600 | .430 |
| 4244 | 4 Condr. | 16 | † S | 7 Amps. | 600 | .485 |
| 4247 | 2 Condr. | 14 | † S | 15 Amps. | 600 | .540 |
| 4252 | 3 Condr. | 14 | † S | 15 Amps. | 600 | .560 |
| 4254 | 4 Condr. | 14 | † S | 15 Amps. | 600 | .605 |
| 4257 | 2 Condr. | 12 | † S | 20 Amps. | 600 | .605 |
| 4262 | 3 Condr. | 12 | † S | 20 Amps. | 600 | .635 |
| 4264 | 4 Condr. | 12 | † S | 20 Amps. | 600 | .665 |
| 4267 | 2 Condr. | 10 | † S | 25 Amps. | 600 | .640 |
| 4272 | 3 Condr. | 10 | † S | 25 Amps. | 600 | .690 |
| 4274 | 4 Condr. | 10 | † S | 25 Amps. | 600 | .745 |

#### SPECIFICATIONS AND APPLICATION

Extra flexible bare copper cotton served. 1/32" rubber insulation color coded conductors cable with fillers, cotton wrap and black, tough rubber jacket.

For all electronic equipment, household appliances, garden and power tools.

### NEOPRENE SHEATHED SERVICE CORD
**UNDERWRITERS APPROVED**

| Catalog Number | Type | AWG Size | U.L. Type | Current Carrying Capacity | Voltage Rating | Nom. O.D. (Inches) |
|---|---|---|---|---|---|---|
| 4307 | 2 Condr. | 18 | † SJO | 5 Amps. | 300 | .310 |
| 4312 | 3 Condr. | 18 | † SJO | 5 Amps. | 300 | .345 |
| 4314 | 4 Condr. | 18 | † SJO | 5 Amps. | 300 | .360 |
| 4317 | 2 Condr. | 16 | † SJO | 7 Amps. | 300 | .340 |
| 4322 | 3 Condr. | 16 | † SJO | 7 Amps. | 300 | .375 |
| 4324 | 4 Condr. | 16 | † SJO | 7 Amps. | 600 | .395 |
| 4327 | 2 Condr. | 18 | † SO | 5 Amps. | 600 | .390 |
| 4332 | 3 Condr. | 18 | † SO | 5 Amps. | 600 | .405 |
| 4334 | 4 Condr. | 18 | † SO | 5 Amps. | 600 | .435 |
| 4337 | 2 Condr. | 16 | † SO | 7 Amps. | 600 | .410 |
| 4342 | 3 Condr. | 16 | † SO | 7 Amps. | 600 | .430 |
| 4344 | 4 Condr. | 16 | † SO | 7 Amps. | 600 | .485 |
| 4347 | 2 Condr. | 14 | † SO | 15 Amps. | 600 | .540 |
| 4352 | 3 Condr. | 14 | † SO | 15 Amps. | 600 | .560 |
| 4354 | 4 Condr. | 14 | † SO | 15 Amps. | 600 | .605 |
| 4357 | 2 Condr. | 12 | † SO | 20 Amps. | 600 | .605 |
| 4362 | 3 Condr. | 12 | † SO | 20 Amps. | 600 | .635 |
| 4364 | 4 Condr. | 12 | † SO | 20 Amps. | 600 | .665 |
| 4367 | 2 Condr. | 10 | † SO | 25 Amps. | 600 | .640 |
| 4372 | 3 Condr. | 10 | † SO | 25 Amps. | 600 | .690 |
| 4374 | 4 Condr. | 10 | † SO | 25 Amps. | 600 | .745 |

STANDARD PUT-UP: 25 FT., 50 FT., 100 FT., 250 FT.

#### SPECIFICATIONS AND APPLICATION

Same specifications as 4200 Series except black Neoprene jacket.

For all types of equipment exposed to oils, acid and excessive moisture.

† UL LISTED

CONSOLIDATED

## TELEVISION AND ROTOR CABLE

| Catalog Number | Type | Size & Stranding | Specifications and General Applications | Nom. Diam. (Inches) | Nominal Electrical Properties: Frequency (mc) | Attenuation Per 100 Ft. | Impedance (Ohms) | Velocity of Propagation (%) | Capacitance Per Ft. (Mmf) |
|---|---|---|---|---|---|---|---|---|---|
| 4500 | 2 Condr. | 22 7x30 | Both conductors bare copper; flexible stranding; conductors parallel; insulated with brown polyethylene. | .055 x .365 | 50 | .72 | 300 | 85 | 4.6 |
| 4503 | 2 Condr. | 20 7x28 | Same as 4500 | .072 x .400 | 50 | .72 | 300 | 85 | 4.6 |
| 4504 | 2 Condr. | 20 7x28 | Same as 4500 | .080 x .400 | 50 | .72 | 300 | 85 | 4.6 |
| 4506 | 2 Condr. | 20 7x28 | Same as 4500 | .100 x .400 | 50 | .72 | 300 | 85 | 4.6 |
| 4509 | 4 Condr. | 20 7x28 | Same as 4503 except three conductors bare copper, one conductor tinned. Brown polyethylene insulation overall. USE: Rotor Aerials. | .072 x .400 | 50 | .72 | 300 | 85 | 4.6 |
| 4517 | 5 Condr. | 20 7x28 | Same as 4509 | .072 x .400 | 50 | .72 | 300 | 85 | 4.6 |
| 4515 | 4 Condr. | 22 7x30 | Copper conductors. .010 thermoplastic insulation over each conductor color coded with gray jacket overall. USE: Rotor Aerials. | .160 | | | | | |
| 4518 | 5 Condr. | 22 7x30 | Same as 4515 | .170 | | | | | |
| 4521 | 8 Condr. | 22 7x30 | Same as 4515 | .205 | | | | | |
| 4524 | 4 Condr. | 20 7x28 | Same as 4515 | .180 | | | | | |
| 4525 | 5 Condr. | 20 7x28 | Same as 4515 | .190 | | | | | |
| 4538 | 8 Condr. | 6x22 7x30 2x18 16x30 | Same as 4515 For heavy duty rotors. | .250 | | | | | |

STANDARD SPOOL PUT-UP: 100 FT., 500 FT., 1000 FT.

## SHIELDED AND UNSHIELDED – "CONCO-FOAM"
## (Low Loss Foam Polyethylene All Channel Color TV Cable)

Conco-Foam assures excellent VHF, UHF, Color and B/W TV reception in uncongested and fringe regions. Will provide far greater signal than any other unshielded twin lead cable. Assures highest efficiency even when exposed to weathering and atmospheric conditions.

Conco-Foam assures excellent VHF, UHF, Color and B/W TV reception in crowded areas where reception is critical. Mylar-aluminum shielding provides strong and clean signals, eliminating electrical noise and ghost signals. Conco-Foam can be attached to mast, installed in gutters, conduit, or underground.

| AWG and Stranding | Color | Nom. O.D. (Inches) | Nom. Velocity of Propagation | Nom. Cap. (Mmf/Ft.) | Nom. Attenuation Per 100' | Spool Put-Up* |
|---|---|---|---|---|---|---|
| **4530 "CONCO-FOAM"** | | | | | | |
| 20 - 7 Strands | Black | .150 x .410 | 80.3% | 4.9 | 100MC/1.04 DB<br>500MC/3.5 DB<br>900MC/4.5 DB | **50', 100'<br>**75'<br>500', 1000' |
| **4532 "CONCO-FOAM"** | | | | | | |
| 22 - 7 Strands | Black | .160 x .400 | 80% | 5.3 | 100MC/1.4 DB<br>500MC/3.8 DB<br>900MC/5.6 DB | 500', 1000' |

Bare Copper, 2 conductors parallel, white Conco-Foam insulation, overall Black polyethylene jacket with web.
** Furnished individually packed coils.

**4535 SHIELDED "CONCO-FOAM"**

| | | | | | | |
|---|---|---|---|---|---|---|
| 22 - 7 Strands | Black | .275 x .455 | 76.5% | 6.8 | 50MC/2.0 DB<br>100MC/2.8 DB<br>200MC/4.1 DB<br>400MC 5.9 DB<br>675MC/7.5 DB | **50', 100'<br>**75'<br>500', 1000' |

Copperweld, 2 conductors, white Conco-Foam insulation, mylar aluminum foil shield, stranded tin copper drain wire, outer Black polyethylene jacket.
* Spade terminals available with Catalog 4535.
** Furnished individually packed coils.

## TEST PROD WIRE

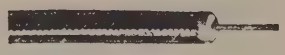
CONSOLIDATED

Single conductor, extra flexible stranded tinned soft annealed copper, wrap, color coded rubber insulation.

STANDARD SPOOL PUT-UP: 10 FT., 100 FT., 250 FT., 500 FT., 1000 FT.

| Catalog Number | Size | Stranding | Nom. Wall Thickness (Inches) | Voltage Breakdown | UL Styles | Nom. O.D. (Inches) |
|---|---|---|---|---|---|---|
| 1001 | 20 | 41x36 | .043 | 10,000 | – | .140 |
| 1002 | 18 | 65x36 | .045 | 12,000 | – | .140 |
| 1006 | 18 | 65x36 | .088 | 25,000 | – | .230 |
| (UL) LISTED TEST PROD WIRE | | | | | | |
| 1009* | 18 | 65x36 | .047 | 15,000 | †3325 | .145 |
| MILITARY TYPE MIL-W-131169B | | | | | | |
| 1007 | 18 | 65x36 | .047 | 12,000 | – | .150 |

## HIGH VOLTAGE AND ANODE LEAD CABLE



Flame Retardant Polyethylene Plastic Insulation for high voltage leads to cathode-ray tubes in television receivers, oscilloscopes, power supplies and other uses, requiring a high-voltage cable. Special features: minimum surface leakage, corona resistance and high dielectric strength.

STANDARD SPOOL PUT-UP: 25 FT., 100 FT., 250 FT., 500 FT., 1000 FT.

| Catalog Number | Size | Stranding | Description | Ins. | Working Volts | Nom. O.D. (Inches) |
|---|---|---|---|---|---|---|
| 4601 | 20 | 7x28 | Extra flexible tinned copper wire; Flame retardant Polyethylene Plastic Insulation; red cellulose acetate yarn braid with 2 white tracers; lacquer coating. | .035 | 10,000 | .136 |
| 4611 | 20 | 7x28 | Same as No. 4601 except heavier insulation; solid red braid. | .065 | 20,000 | .198 |
| 4616 | 20 | 10x30 | Extra flexible tinned copper flame retardant polyethylene insulation, white. | .035 | 10,000 | .108 |
| 4621 | 20 | 10x30 | Same as No. 4616 except heavier insulation, white and red. | .065 | 20,000 | .168 |
| 4622 | 18 | 41x34 | Same as No. 4621 except .015" red PVC outer jacket. | .057 | 40,000 | .195 |
| 4623 | 22 | 7x30 | Same as No. 4622 except outer .020" PVC jacket. Colors: black, red and blue. | .030 | 17,000 | .130 |

## U.L. STYLE 3239 (FR-1)†

| | | | | | | |
|---|---|---|---|---|---|---|
| 4624* | 22 | 7x30 | Tin copper rulan insulation Black PVC jacket UL style 3239 "FR–1". | .025 | 20,000 | .130 |
| 4625* | 22 | 7x30 | Same as 4624 White PVC Jacket | .038 | 30,000 | .146 |
| 4626* | 22 | 7x30 | Same as 4624 Red PVC Jacket | .045 | 40,000 | .160 |

* Can also furnish pre-bond overcoat and topcoat conductor on catalog numbers 4624, 4625, and 4626.

★NEW ITEM † UL LISTED

## AUTOMOTIVES CABLES

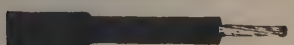
**Manufactured to meet all specifications (S.A.E.) Standards Society of Automotive Engineers**

CONSOLIDATED

## PLASTIC INSULATED AUTOMOTIVE WIRE

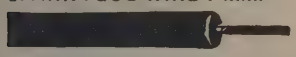
**PRIMARY WIRE**

**SPARK PLUG WIRE 7 MM.**



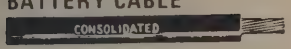
**Black Hypalon Sheathed**

**SPARK PLUG WIRE 7 MM.**



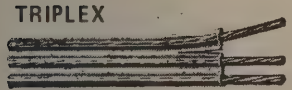
**RED PLASTIC**

**PVC JACKETED BATTERY CABLE**




**DUPLEX**

**TRIPLEX**



**RUBBER INSULATED BATTERY CHARGING WIRE**

| Catalog Number | Size & Stranding | Description and Application | Colors Available (Specify) | Nom. Dia. (Inches) |
|---|---|---|---|---|
| 4026 | 18 16x30 | Bare Copper Flexible Stranding Tough Plastic Insulation. Resistant to Flame, Oil, Gasoline, Grease, Acid, Fungus and most solvents. | Red-Black | .092 |
| 4027 | 16 19x29 | Same as 4026 | Red-Blue-Black-Green-Yellow-Brown-White | .105 |
| 4028 | 14 19x27 | Same as 4026 | Red-Blue | .123 |
| 4029 | 12 19x23 | Same as 4026 | Black-Green-Red-Blue | .183 |
| 4030 | 10 19x23 | Same as 4026 | Black | .183 |
| 4038 | 8 19x21 | Same as 4026 | Black | .215 |
| 4036 | 6 37x21 | Same as 4026 | Black | .283 |
| 4031 | 16 19x29 | Tinned Copper – Black Hypalon Sheathed. Recommended for all Passenger Cars, Light Trucks, Tractors and Marine Engines. | Black | .276 |
| 4032 | 16 19x29 | Red Plastic Jacket. Recommended where excessive exposure to Oil, Acid and Alkali is encountered. | Red | .276 |
| STANDARD SPOOL PUT-UP: 25 FT., 100 FT., 1000 FT. | | | | |
| 4045★ | 6 49x23 | Stranded copper, separator PVC insulation per SAE. | Red-Black | .370 |
| 4059★ | 4 70x24 | Same as 4045 | Red-Black | .370 |
| 4060★ | 2 84x24 | Same as 4045 | Red-Black | .450 |
| 4061★ | 1/0 133x21 | Same as 4045 | Red-Black | .530 |
| 4062★ | 2/0 133x20 | Same as 4045 | Red-Black | .595 |
| 4063★ | 4/0 259x21 | Same as 4045 | Red-Black | .750 |
| STANDARD SPOOL: 500 FT. | | | | |
| 4064★ | 14 19x27 | 2 Conductors Flat | Black-White | .180x .300 |
| 4065★ | 12 19x25 | 2 Conductors Flat | Black-White | .210x .360 |
| 4066★ | 14 19x27 | 3 Conductors Flat | Black-White-Green | .162x .365 |
| 4067★ | 12 19x25 | 3 Conductors Flat | Black-White-Green | .180x .420 |
| STANDARD SPOOL: 1000 FT. | | | | |
| 4041 | 12 65x30 | Bare Copper Paper Wrapped Tough Rubber Compound Resistant to Acid, etc. | Black | .205 |
| 4042 | 10 105x30 | Same as 4041 | Black | .228 |
| 4043 | 8 49x25 | Same as 4041 | Black | .253 |
| 4044 | 6 49x23 | Same as 4041 | Black | .314 |
| STANDARD SPOOL PUT-UP: 25 FT., 100 FT., 1000 FT. | | | | |

★NEW ITEMS

# TINNED COPPER SHIELDING

## SHIELDING AND BONDING TYPE CABLE

CONSOLIDATED

### FLAT BRAID

### TUBULAR BRAID PER QQ-B-575

### OVAL COMMERCIAL BRAID

| Catalog Number | Approx. I.D. (Inches) | Size & Number of Wires | Approx. AWG | Carrying Capacity in Amperes |
|---|---|---|---|---|
| 1386 | 1/32 | 16x36 | 24 | 7 |
| 1387 | 3/64 | 24x36 | 23 | 7 |
| 1388 | 3/32 | 48x36 | 19 | 12 |
| 1389 | 7/64 | 72x36 | 18 | 14 |
| 1390 | 1/8 | 96x36 | 18 | 15 |
| 1391 | 3/16 | 120x36 | 15 | 23 |
| 1392 | 1/4 | 168x36 | 14 | 30 |
| 1393 | 3/8 | 288x36 | 11 | 50 |
| 1394 | 1/2 | 386x36 | 10 | 55 |
| 1395 | 5/8 | 528x36 | 10 | 61 |
| 1396 | 3/4 | 832x36 | 7 | 80 |
| 1397 | 25/32 | 832x36 | 7 | 80 |
| 1398 | 1 | 912x36 | 7 | 84 |
| 1399 | 1 3/8 | 336x30 | 7 | 105 |
| 1310 | 1/32 | 24x36 | 22 | 7 |
| 1311 | 1/16 | 48x36 | 19 | 11 |
| 1312 | 5/64 | 72x36 | 18 | 16 |
| 1314 | 7/64 | 96x36 | 16 | 19 |
| 1315 | 1/8 | 120x36 | 15 | 25 |
| 1316 | 5/32 | 240x36 | 12 | 40 |
| 1317 | 11/64 | 168x36 | 14 | 32 |
| 1318 | 13/64 | 192x34 | 11 | 46 |
| 1319 | 1/4 | 384x36 | 10 | 53 |
| 1320 | 9/32 | 120x30 | 9 | 60 |
| 1321 | 3/8 | 384x36 | 10 | 53 |
| 1322 | 7/16 | 240x30 | 6 | 90 |
| 1323 | 1/2 | 528x36 | 9 | 62 |
| 1324 | 9/16 | 480x30 | 3 | 145 |
| 1325 | 21/32 | 768x30 | 1 | 190 |
| 1326 | 25/32 | 864x36 | 7 | 88 |
| 1340 | 1/32 | 24x34 | 20 | 9 |
| 1341 | 1/16 | 32x34 | 19 | 11 |
| 1342 | 7/64 | 64x34 | 16 | 20 |
| 1343 | 1/8 | 72x34 | 15 | 25 |
| 1344 | 11/64 | 120x34 | 14 | 32 |
| 1345 | 3/16 | 144x34 | 13 | 38 |
| 1346 | 1/4 | 168x34 | 12 | 41 |
| 1347 | 3/8 | 192x34 | 11 | 46 |
| 1348 | 1/2 | 336x34 | 9 | 62 |
| 1349 | 5/8 | 384x34 | 8 | 64 |
| 1350 | 11/16 | 480x34 | 7 | 81 |
| 1351 | 25/32 | 528x34 | 7 | 85 |

STANDARD SPOOL PUT-UP: 50 FT., 100 FT., 250 FT., 500 FT., 1000 FT.

# UL LISTED HOOK-UP WIRE

CONSOLIDATED

## ROME SYNTHINOL — UL TYPE HOOK-UP AND LEAD WIRES

### TINNED COPPER

**UL-300V-80C (CSA — TR-64) FR-1 Flame Test — UL Style 1007†**

| Catalog Number | Size AWG | Stranding | Nom. Ins. Thickness | Volts | Max. Dia. (Inches) |
|---|---|---|---|---|---|
| 803 | 24 | Solid | 1/64 | 300 | .055 |
| 801 | 22 | Solid | 1/64 | 300 | .065 |
| 811 | 20 | Solid | 1/64 | 300 | .071 |
| 841 | 18 | Solid | 1/64 | 300 | .080 |
| 817 | 16 | Solid | 1/64 | 300 | .094 |
| 819 | 24 | 7 x No. 32 | 1/64 | 300 | .059 |
| 821 | 22 | 7 x No. 30 | 1/64 | 300 | .069 |
| 831 | 20 | 10 x No. 30 | 1/64 | 300 | .078 |
| 846 | 18 | 16 x No.30 | 1/64 | 300 | .085 |
| 816 | 16 | 26 x No. 30 | 1/64 | 300 | .095 |
| 881 | 20 2/Condr. | 10 x No. 30 | .025 | 300 | .170 |

**UL-600V-105C (CSA-TEW) FR-1 Flame Test — UL Style 1015†**

| Catalog Number | Size AWG | Stranding | Nom. Ins. Thickness | Volts | Max. Dia. (Inches) |
|---|---|---|---|---|---|
| 851 | 22 | Solid | 1/32 | 600 | .097 |
| 856 | 20 | Solid | 1/32 | 600 | .104 |
| 861 | 18 | Solid | 1/32 | 600 | .112 |
| 866 | 22 | 7 x No. 30 | 1/32 | 600 | .102 |
| 871 | 20 | 10 x No. 30 | 1/32 | 600 | .110 |
| 876 | 18 | 16 x No. 30 | 1/32 | 600 | .119 |
| 890 | 16 | 26 x No. 30 | 1/32 | 600 | .127 |
| 891 | 14 | 41 x No. 30 | 1/32 | 600 | .141 |
| 892 | 12 | 65 x No. 30 | 1/32 | 600 | .160 |
| 893 | 10 | 105 x No. 30 | 1/32 | 600 | .194 |
| 894 | 8 | 133 x No. 29 | 3/64 | 600 | .255 |

### *"TOPCOAT" COPPER CONDUCTOR

**UL-300V-80C (CSA — TR-64) FR-1 Flame Test — UL Style 1007†**

*Stranded copper conductor passed through molten tin bath bonding individual strands together.

| Catalog Number | Size AWG | Stranding | Nom. Ins. Thickness | Volts | Max. Dia. (Inches) |
|---|---|---|---|---|---|
| 813 | 24 | 7 x No. 32 | 1/64 | 300 | .059 |
| 823 | 22 | 7 x No. 30 | 1/64 | 300 | .069 |
| 833 | 20 | 10 x No. 30 | 1/64 | 300 | .078 |
| 843 | 18 | 16 x No. 30 | 1/64 | 300 | .085 |

**UL-600V-105C (CSA-TEW) FR-1 Flame Test — UL Style 1015†**

| Catalog Number | Size AWG | Stranding | Nom. Ins. Thickness | Volts | Max. Dia. (Inches) |
|---|---|---|---|---|---|
| 865 | 22 | 7 x No. 30 | 1/32 | 600 | .102 |
| 875 | 20 | 10 x No. 30 | 1/32 | 600 | .110 |
| 885 | 18 | 16 x No. 30 | 1/32 | 600 | .119 |

## IRRADIATED PVC

**U.L. STYLE 1429 AND 1534 — FLAME RETARDANT †**

| Catalog Number | AWG Size | Stranding | U.L. Style | Insul. Thick. (Inch) | Nom. O.D. (Inch) |
|---|---|---|---|---|---|
| 920 | 26 | 7x34T.C. | † 1429 | .010 | .039 |
| 921 | 24 | 7x32T.C. | † 1429 | .010 | .044 |
| 922 | 22 | 7x30T.C. | † 1429 | .010 | .050 |
| 923 | 20 | 7x28T.C. | † 1429 | .010 | .058 |
| 924 | 18 | 7x26T.C. | †1429 | .010 | .068 |
| 925 | 16 | 19x29T.C. | †1429 | .010 | .077 |
| 926 | 14 | 19x27T.C. | †1534 | .016 | .091 |

## HIGH VOLTAGE AND ANODE LEAD CABLE

**U.L. STYLE 3239 — FLAME RETARDANT †**

| Catalog Number | AWG Size | Stranding* | Rulan Insul. (Inch) | PVC Jacket (Inch) | Nom. O.D. (Inch) | Jacket Color |
|---|---|---|---|---|---|---|
| 4624 | 22 | 7x30T.C. | .025 | .020 | .130 | Black |
| 4625 | 22 | 7x30T.C. | .030 | .020 | .145 | White |
| 4626 | 22 | 7x30T.C. | .045 | .020 | .160 | Red |

## KYNAR INSULATED HOOK-UP WIRE FOR WIRE WRAP APPLICATIONS

Especially suited for computer, business machine usage and other areas where space is limited. (For automatic point to point application.)

The conductor is OFHC (Oxygen Free High Conductivity) Annealed Copper, Silver Plated.

The insulation is Kynar, a Vinylidene Fluoride Plastic with unique characteristics.

Mechanically Tough; Operating Temperature Up to 125°C Continuous, Assigned U.L. Rating 105°C.

| Catalog Number | AWG Size | Stranding | Insul. Thick. (Inch) | Nom. O.D. (Inch) | U.L. Style | Catalog Number | AWG Size | Stranding | Insul. Thick. (Inch) | Nom. O.D. (Inch) | U.L. Style |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 901 | 30 | Solid | .005 | .020 | † 1422 & 1426 | 903 | 26 | Solid | .005 | .026 | † 1422 & 1426 |
| 902 | 28 | Solid | .005 | .023 | † 1422 & 1426 | 904 | 24 | Solid | .005 | .030 | † 1422 & 1426 |

Stock Colors: Black, Blue, Brown, Green, Orange, Pink, Red, Gray, Violet, White, Yellow.

Standard spool size available subject to manufacturing put-up.

† UL LISTED

# MIL SPEC HOOK UP WIRE
## MIL-W-16878 TYPES B, BN, C, CN, D

CONSOLIDATED

| Catalog Number | Type Designation | Size & (Stranding) | Insul. Thick. (Inch) | Nom. O.D. (Inch) |
|---|---|---|---|---|
| **TYPE B – VINYL – 600V – 105C** | | | | |
| 9300 | B-32 | 32(7x40) | .010 | .029 |
| 9301 | B-30 | 30(7x38) | .010 | .032 |
| 9302 | B-28 | 28(7x36) | .010 | .035 |
| 9303 | B-26 | 26(7x34) | .010 | .039 |
| 9304 | B-24 | 24(19x36) | .010 | .045 |
| 9305 | B-24 | 24(7x32) | .010 | .044 |
| 9306 | B-22 | 22(19x34) | .010 | .051 |
| 9307 | B-22 | 22(7x30) | .010 | .050 |
| 9308 | B-20 | 20(19x32) | .010 | .059 |
| 9309 | B-20 | 20(7x28) | .010 | .058 |
| 9310 | B-18 | 18(19x30) | .010 | .069 |
| 9311 | B-18 | 18(7x26) | .010 | .068 |
| 9312 | B-16 | 16(19x29) | .010 | .077 |

### TYPE B – VINYL – NYLON JACKET – 600V – 115C

| | | | | |
|---|---|---|---|---|
| 9313 | B-32 | 32(7x40) | .010 | .035 |
| 9314 | B-30 | 30(7x38) | .010 | .038 |
| 9315 | B-28 | 28(7x36) | .010 | .041 |
| 9316 | B-26 | 26(7x34) | .010 | .045 |
| 9317 | B-24 | 24(19x36) | .010 | .051 |
| 9318 | B-24 | 24(7x32) | .010 | .050 |
| 9319 | B-22 | 22(19x34) | .010 | .057 |
| 9320 | B-22 | 22(7x30) | .010 | .056 |
| 9321 | B-20 | 20(19x32) | .010 | .065 |
| 9322 | B-20 | 20(7x28) | .010 | .064 |
| 9323 | B-18 | 18(19x30) | .010 | .075 |
| 9324 | B-18 | 18(7x26) | .010 | .074 |
| 9325 | B-16 | 16(19x29) | .010 | .083 |

### TYPE C – VINYL – 1000V – 105C

| | | | | |
|---|---|---|---|---|
| 9400 | C-24 | 24(7x23) | .018 | .060 |
| 9401 | C-22 | 22(7x30) | .018 | .066 |
| 9402 | C-20 | 20(7x28) | .018 | .074 |
| 9403 | C-18 | 18(7x26) | .018 | .084 |
| 9404 | C-16 | 16(19x29) | .018 | .093 |
| 9405 | C-14 | 14(19x27) | .018 | .017 |

### TYPE C – VINYL – NYLON JACKET – 1000V – 115C

| | | | | |
|---|---|---|---|---|
| 9410 | C-24 | 24(7x32) | .018 | .066 |
| 9411 | C-22 | 22(7x30) | .018 | .072 |
| 9412 | C-20 | 20(7x28) | .018 | .080 |
| 9413 | C-18 | 18(7x26) | .018 | .091 |
| 9414 | C-16 | 16(19x29) | .018 | .100 |
| 9415 | C-14 | 14(19x27) | .018 | .114 |

| Catalog Number | Type Designation | Size & (Stranding) | Insul. Thick. (Inch) | Nom. O.D. (Inch) |
|---|---|---|---|---|
| **TYPE D – VINYL – 3000V – 105C** | | | | |
| 9500 | D-24 | 24(7x23) | .030 | .084 |
| 9501 | D-22 | 22(7x30) | .030 | .090 |
| 9502 | D-20 | 20(7x28) | .030 | .098 |
| 9503 | D-18 | 18(7x26) | .030 | .108 |
| 9504 | D-16 | 16(19x29) | .030 | .117 |
| 9505 | D-14 | 14(19x27) | .030 | .131 |
| 9506 | D-12 | 12(19x25) | .035 | .160 |
| 9507 | D-10 | 10(37x26) | .035 | .181 |
| 9508 | D-8 | 8(133x29) | .040 | .245 |
| 9509 | D-6 | 6(133x27) | .040 | .290 |

**Stock Colors**

0 Black
1 Brown
2 Red
3 Orange
4 Yellow
5 Green
6 Dark Blue
7 Violet (Purple)
8 Gray (Slate)
9 White
90 White/Black
91 White/Brown
92 White/Red
93 White/Orange
94 White/Yellow
95 White/Green
96 White/Blue
97 White/Violet
98 White/Gray

### MIL-W 16878/1 – TYPE B*
### IRRADATED PVC

| | | | | |
|---|---|---|---|---|
| **105° – 600 VRMS** | | | | |
| 920 | B-26 | 26(7x34) | .010 | .039 |
| 921 | B-24 | 24(7x32) | .010 | .044 |
| 927* | B-24 | 24(19x36) | .010 | .045 |
| 922 | B-22 | 22(7x30) | .010 | .050 |
| 928* | B-22 | 22(19x34) | .010 | .051 |
| 923 | B-20 | 20(7x28) | .010 | .058 |
| 929* | B-20 | 20(19x32) | .010 | .059 |
| 924 | B-18 | 18(7x26) | .010 | .068 |
| 930* | B-18 | 18(19x30) | .010 | .068 |
| 925 | B-16 | 16(19x29) | .010 | .078 |

### MIL-W-16878/2 – TYPE C**
### IRRADATED PVC

| | | | | |
|---|---|---|---|---|
| **105° 1000V** | | | | |
| 931* | C-24 | 24(7x32) | .016 | .058 |
| 932* | C-22 | 22(7x30) | .016 | .064 |
| 933* | C-20 | 20(7x28) | .016 | .072 |
| 934* | C-18 | 18(19x30) | .016 | .082 |
| 935* | C-16 | 16(19x29) | .016 | .092 |
| 926 | C-14 | 14(19x27) | .016 | .105 |
| 936* | C-12 | 12(19x25) | .016 | .124 |

Color Numbers in accordance to Military Type Designation and EIA Color Coding.
* UL Listed UL1429 300V–80°C
** UL Listed UL1430 600V–105°C
★NEW ITEM

# TEFLON MIL SPEC HOOK-UP WIRE AND CABLES
## MIL-W-16878 TYPE E, EE, MULTICONDUCTOR
## SHIELDED TEFLON CABLES

| Catalog Number | Number of Conductors | Size & (Stranding) | Nom. O.D. (Inch) |
|---|---|---|---|

Each conductor stranded silver plated copper Type E extruded Teflon .010" insulation. 90% braided silver copper shield supplied with either a Teflon impregnated Fiberglass braid or Teflon fused tape overall jacket. Voltage rating 600 volts. Temperature rating –65°C to +260°C.

### TEFLON IMPREGNATED BRAID OVER SHIELD

| | | | |
|---|---|---|---|
| 9840 | 1 | 24(19x36) | .081 |
| 9841 | 2 | 24(19x36) | .126 |
| 9842 | 3 | 24(19x36) | .133 |
| 9843 | 4 | 24(19x36) | .144 |
| 9844 | 1 | 22(19x34) | .088 |
| 9845 | 2 | 22(19x34) | .137 |
| 9846 | 3 | 22(19x34) | .144 |
| 9847 | 4 | 22(19x34) | .158 |
| 9848 | 1 | 20(19x32) | .097 |
| 9849 | 2 | 20(19x32) | .154 |
| 9850 | 3 | 20(19x32) | .163 |
| 9851 | 4 | 20(19x32) | .180 |
| 9852 | 1 | 18(19x30) | .106 |
| 9853 | 2 | 18(19x30) | .174 |
| 9854 | 3 | 18(19x30) | .185 |
| 9855 | 4 | 18(19x30) | .205 |
| 9856 | 1 | 16(19x29) | .120 |
| 9857 | 2 | 16(19x29) | .195 |
| 9858 | 3 | 16(19x29) | .213 |
| 9859 | 4 | 16(19x29) | .228 |

### TEFLON TAPE WRAP JACKET OVER SHIELD

| | | | |
|---|---|---|---|
| 9820 | 1 | 24(19x36) | .084 |
| 9821 | 2 | 24(19x36) | .128 |
| 9822 | 3 | 24(19x36) | .135 |
| 9823 | 4 | 24(19x36) | .148 |
| 9824 | 1 | 22(19x34) | .090 |
| 9825 | 2 | 22(19x34) | .140 |
| 9826 | 3 | 22(19x34) | .148 |
| 9827 | 4 | 22(19x34) | .162 |
| 9828 | 1 | 20(19x32) | .099 |
| 9829 | 2 | 20(19x32) | .158 |
| 9830 | 3 | 20(19x32) | .167 |
| 9831 | 4 | 20(19x32) | .184 |
| 9832 | 1 | 18(19x30) | .109 |
| 9833 | 2 | 18(19x30) | .178 |
| 9834 | 3 | 18(19x30) | .189 |
| 9835 | 4 | 18(19x30) | .208 |
| 9836 | 1 | 16(19x29) | .123 |
| 9837 | 2 | 16(19x29) | .200 |
| 9838 | 3 | 16(19x29) | .218 |
| 9839 | 4 | 16(19x29) | .235 |

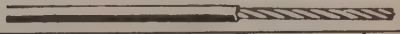
**Stock Colors:** **1** – Black; **2** – White; **3** – Red; **4** – Green.

## TEFLON HOOK-UP WIRE

| Catalog Number | Type Designation | Size & (Stranding) | Insulation Thickness (Inch) | Nom. O.D. (Inch) |
|---|---|---|---|---|

### TYPE E MIL-W-16878 – 600 VOLTS

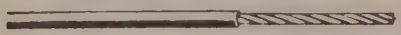
Concentrically stranded silver coated copper conductor, extruded TFE Teflon insulated. –65°C to +200°C.



| | | | | |
|---|---|---|---|---|
| 9600 | E-32 | 32(7x40) | .010 | .032 |
| 9601 | E-30 | 30(7x38) | .010 | .032 |
| 9602 | E-28 | 28(7x36) | .010 | .035 |
| 9603 | E-26 | 26(19x38) | .010 | .039 |
| 9604 | E-26 | 26(7x34) | .010 | .039 |
| 9605 | E-24 | 24(19x36) | .010 | .044 |
| 9606 | E-24 | 24(7x32) | .010 | .044 |
| 9607 | E-22 | 22(19x34) | .010 | .050 |
| 9608 | E-22 | 22(7x30) | .010 | .050 |
| 9609 | E-20 | 20(19x32) | .010 | .058 |
| 9610 | E-20 | 20(7x28) | .010 | .058 |
| 9611 | E-18 | 18(19x30) | .010 | .069 |
| 9612 | E-18 | 18(7x20) | .010 | .069 |
| 9613 | E-16 | 16(19x29) | .011 | .080 |
| 9614 | E-14 | 14(19x27) | .011 | .095 |
| 9615 | E-12 | 12(19x25) | .012 | .115 |
| 9616 | E-10 | 10(37x26) | .012 | .131 |

### TYPE EE MIL-W-16878 – 1000 VOLTS

Concentrically stranded silver coated copper conductor, extruded TFE Teflon insulated. –65°C to +200°C.



| | | | | |
|---|---|---|---|---|
| 9620 | EE-32 | 32(7x40) | .015 | .042 |
| 9621 | EE-20 | 30(7x38) | .015 | .042 |
| 9622 | EE-28 | 28(7x36) | .015 | .045 |
| 9623 | EE-26 | 26(19x38) | .015 | .049 |
| 9624 | EE-26 | 26(7x34) | .015 | .049 |
| 9625 | EE-24 | 24(19x36) | .015 | .054 |
| 9626 | EE-24 | 24(7x32) | .015 | .054 |
| 9627 | EE-22 | 22(19x34) | .015 | .060 |
| 9628 | EE-22 | 22(7x30) | .015 | .060 |
| 9629 | EE-20 | 20(19x32) | .015 | .068 |
| 9630 | EE-20 | 20(7x28) | .015 | .068 |
| 9631 | EE-18 | 18(19x30) | .015 | .079 |
| 9632 | EE-18 | 18(7x26) | .015 | .079 |
| 9633 | EE-16 | 16(19x29) | .016 | .089 |
| 9634 | EE-14 | 14(19x27) | .017 | .110 |
| 9635 | EE-12 | 12(19x25) | .017 | .129 |
| 9636 | EE-10 | 10(37x26) | .017 | .149 |

**Stock Colors Hook-up Wire**

**0** Black
**1** Brown
**2** Red
**3** Orange
**4** Yellow
**5** Green
**6** Dark Blue
**7** Violet (Purple)
**8** Gray (Slate)
**9** White
**90** White/Black
**91** White /Brown
**92** White/Red
**93** White/Orange
**94** White/Yellow
**95** White/Green
**96** White/Blue
**97** White/Violet
**98** White/Gray

## MIL-W-5086 AIRCRAFT WIRE & CABLE TYPES 1 & 2 – 600 VOLT

CONSOLIDATED

### UNSHIELDED

| Catalog Number | Type Designation | Size & (Stranding) | Nom. O.D. (Inch) | Spec. Type | Stock Colors on Standard Spools 100 | 500′ | 1000′ | Stock Color* |
|---|---|---|---|---|---|---|---|---|
| **Additional Description — MIL-W-5086 Type I — AN-22 thru AN-12** Stranded tinned copper, white polyvinylchloride, clear nylon jacket insulation. | | | | | | | | White only (9) |
| 9700 | AN-22 | 22(19x34) | .068 | No. 1 | 9 | 9 | 9 | |
| 9701 | AN-20 | 20(19x32) | .078 | No. 1 | 9 | 9 | 9 | |
| 9702 | AN-18 | 18(19x30) | .088 | No. 1 | 9 | 9 | 9 | |
| 9703 | AN-16 | 16(19x29) | .098 | No. 1 | 9 | 9 | 9 | |
| 9704 | AN-14 | 14(19x27) | .117 | No. 1 | 9 | 9 | 9 | |
| 9705 | AN-12 | 12(37-28) | .137 | No. 1 | 9 | 9 | 9 | |
| **Additional Description — MIL-W-5086 Type II — AN-22 thru AN-12** Stranded tinned copper, white polyvinylchloride insulation, saturated glass braid, clear nylon jacket. | | | | | | | | |
| 9706 | AN-22 | 22(19x34) | .075 | No. 2 | 9 | 9 | 9 | |
| 9707 | AN-20 | 20(19x32) | .085 | No. 2 | 9 | 9 | 9 | |
| 9708 | AN-18 | 18(19x30) | .095 | No. 2 | 9 | 9 | 9 | |
| 9709 | AN-16 | 16(19x29) | .105 | No. 2 | 9 | 9 | 9 | |
| 9710 | AN-14 | 14(19x27) | .125 | No. 2 | 9 | 9 | 9 | |
| 9711 | AN-12 | 12(37x28) | .143 | No. 2 | 9 | 9 | 9 | |
| **Additional Description — MIL-W-5086 Type II — AN-10 thru AN-00** Stranded tinned copper, white polyvinylchloride insulation, saturated glass braid, nylon braid, nylon lacquer. | | | | | | | | |
| 9713 | AN-10 | 10(37x26) | .189 | No. 2 | 9 | 9 | 9 | |
| 9714 | AN-8 | 8(133x29) | .240 | No. 2 | 9 | 9 | 9 | |
| 9715 | AN-6 | 6(133x27) | .293 | No. 2 | 9 | 9 | 9 | |
| 9716 | AN-4 | 4(133x25) | .355 | No. 2 | 9 | 9 | 9 | |
| 9717 | AN-2 | 2(665x30) | .425 | No. 2 | 9 | 9 | 9 | |
| 9718 | AN-0 | 0(1045x30) | .525 | No. 2 | 9 | 9 | 9 | |
| 9719 | AN-00 | 00(1330x30) | .590 | No. 2 | 9 | 9 | 9 | |

## MIL-C-7078 – TYPE II – 600 VOLT

### SHIELDED

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Additional Description — MIL-W-5086 Type I — AN-22 thru AN-12** Stranded tinned copper, white polyvinylchloride insulation, nylon jacket, braided tinned copper shield. Nylon outer jacket. | | | | | | | | |
| 9720 | AN-22 | 22(19x34) | .092 | No. II | 9 | 9 | 9 | |
| 9721 | AN-20 | 20(19x32) | .102 | No. II | 9 | 9 | 9 | |
| 9722 | AN-18 | 18(19x30) | .112 | No. II | 9 | 9 | 9 | |
| 9723 | AN-16 | 16(19x29) | .122 | No. II | 9 | 9 | 9 | |
| 9724 | AN-14 | 14(19x27) | .141 | No. II | 9 | 9 | 9 | |
| 9725 | AN-12 | 12(19x25) | .161 | No. II | 9 | 9 | 9 | |

* Stock Color Numbers in Accordance to Military Type Designation and EIA Color Coding.

# (UL) LISTED AND MILITARY HI TEMP WIRE

CONSOLIDATED

| Catalog Number | Size & (Stranding) | Insul. Thick. (Inch.) | Braid | Nom. O.D. (Inch) |
|---|---|---|---|---|
| **SF-2 600 VOLTS 200°C (UL) LISTED TINNED COPPER, SILICON RUBBER INSULATION, GLASS BRAID JACKET** | | | | |
| 9900* | 18(7x26) | .031 | .009 | .126 |
| 9901* | 16(7x24) | .031 | .009 | .135 |
| 9902* | 14(7x22) | .031 | .009 | .153 |
| 9903* | 12(19x20) | .031 | .009 | .176 |
| 9904* | 10(19x24) | .031 | .009 | .234 |
| Colors: Black, White, Red, Blue. MINIMUM ORDER 1000 FT. | | | | |
| **SFF2 600 VOLTS 150°C (UL) LISTED (SRML) NON (UL) 180°C FLEXIBLE TINNED COPPER, SILICON RUBBER INSULATION, GLASS BRAID JACKET** | | | | |
| 9905* | 22(7x30) | .031 | .099 | .107 |
| 9906* | 20(10x30) | .031 | .099 | .114 |
| 9907* | 18(16x30) | .031 | .099 | .123 |
| 9908* | 16(26x30) | .031 | .099 | .135 |
| 9910* | 14(41x30) | .031 | .099 | .153 |
| 9911* | 12(65x30) | .031 | .099 | .173 |
| Colors: Black, White, Red, Blue. MINIMUM ORDER 1000 FT. | | | | |
| **TAGT 600 VOLTS 250°C (UL) LISTED NICKEL CLAD COPPER, FUSED TEFLON TAPE INSULATION, IMPREGNATED FELTED ASBESTOS, TEFLON IMPREGNATED GLASS BRAID JACKET** | | | | |
| 9912* | 18(16x30) | .015 | .005 | .110 |
| 9913* | 16(26x30) | .015 | .005 | .120 |
| 9914* | 14(41x30) | .015 | .005 | .140 |
| 9915* | 12(65x30) | .015 | .005 | .160 |
| 9916* | 10(105x30) | .015 | .005 | .185 |
| 9917* | 8(133x29) | .015 | .005 | .230 |
| Colors: Natural Only. MINIMUM ORDER 500 FT. | | | | |
| **MIL-W-25038 600 VOLTS 399°C NICKEL CLAD COPPER, INORGANIC BARRIER, ASBESTOS BARRIER, TEFLON INSULATION, TEFLON IMPREGNATED GLASS BRAID JACKET** | | | | |
| 9918* | 22(19x34) | .034 | .005 | .108 |
| 9919* | 20(19x32) | .034 | .005 | .117 |
| 9920* | 18(19x30) | .034 | .005 | .127 |
| 9921* | 16(19x29) | .034 | .005 | .137 |
| 9922* | 14(19x27) | .038 | .005 | .160 |
| 9923* | 12(19x25) | .038 | .005 | .175 |
| 9924* | 10(7x7x27) | .047 | .005 | .220 |
| 9925* | 8(19x7x25) | .055 | .005 | .268 |
| Colors: Natural Only. MINIMUM ORDER 500 FT. | | | | |

★NEW ITEMS

CONSOLIDATED

## PROTECTA-METAL SPOOLS

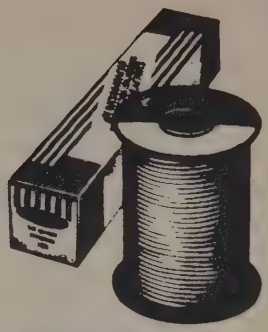
Popular, profitable specialty wire packaged for easy selling in radio-electrical, scientific, specialty and hardware.

Wide variety of sizes and insulations.

Keeps stock in perfect order, always saleable.

Supplied on spools as shown and in heavier weights.

Here is a handy and convenient way to stock small quantities of wire. It prevents wire from matting or tangling.



## MAGNET WIRE No. 2000

The correct wire for practically any application. Magnet wire is indispensible in the manufacture and repair of both radio and audio frequency coils, transformers, chokes, speaker field coils, short wave coils, tuners, transmitters, etc. Also widely used in the construction and repair of motors, generators, dynamos, etc.

**Larger Quantities At Same Per Pound List**

**SPECIAL MAGNET WIRES**

In addition to the standard listing shown here, we maintain an extensive stock of all other sizes in round rectangular and square magnet wire.

| | Plain Enamel | | | Single Formvar | | | Heavy Formvar | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Size | ¼ Lb. | ½ Lb. | 1 Lb. | ¼ Lb. | ½ Lb. | 1 Lb. | ¼ Lb. | ½ Lb. | 1 Lb. | Size |
| 14 | $0.85 | $1.40 | $ 2.51 | $1.10 | $ 1.90 | $ 3.40 | $1.20 | $ 2.00 | $ 3.65 | 14 |
| 15 | $0.86 | $1.45 | $ 2.55 | $1.15 | $ 2.00 | $ 3.40 | $1.20 | $ 2.10 | $ 3.70 | 15 |
| 16 | $0.90 | $1.50 | $ 2.60 | $1.20 | $ 2.10 | $ 3.50 | $1.30 | $ 2.10 | $ 3.75 | 16 |
| 17 | $0.92 | $1.55 | $ 2.60 | $1.22 | $ 2.15 | $ 3.50 | $1.30 | $ 2.25 | $ 3.80 | 17 |
| 18 | $0.95 | $1.60 | $ 2.60 | $1.30 | $ 2.20 | $ 3.60 | $1.35 | $ 2.30 | $ 3.85 | 18 |
| 19 | $0.97 | $1.62 | $ 2.65 | $1.35 | $ 2.25 | $ 3.60 | $1.40 | $ 2.35 | $ 3.90 | 19 |
| 20 | $0.98 | $1.65 | $ 2.70 | $1.38 | $ 2.30 | $ 3.74 | $1.40 | $ 2.40 | $ 3.90 | 20 |
| 21 | $1.00 | $1.70 | $ 2.80 | $1.40 | $ 2.30 | $ 3.75 | $1.45 | $ 2.40 | $ 4.00 | 21 |
| 22 | $1.02 | $1.71 | $ 2.85 | $1.40 | $ 2.35 | $ 4.00 | $1.48 | $ 2.50 | $ 4.10 | 22 |
| 23 | $1.04 | $1.72 | $ 3.00 | $1.42 | $ 2.40 | $ 4.10 | $1.50 | $ 2.50 | $ 4.15 | 23 |
| 24 | $1.06 | $1.74 | $ 3.15 | $1.45 | $ 2.45 | $ 4.20 | $1.55 | $ 2.55 | $ 4.75 | 24 |
| 25 | $1.08 | $1.85 | $ 3.30 | $1.50 | $ 2.55 | $ 4.40 | $1.70 | $ 2.75 | $ 5.00 | 25 |
| 26 | $1.10 | $1.90 | $ 3.40 | $1.55 | $ 2.60 | $ 4.65 | $1.80 | $ 2.85 | $ 5.50 | 26 |
| 27 | $1.12 | $1.94 | $ 3.50 | $1.60 | $ 2.70 | $ 4.85 | $1.90 | $ 3.00 | $ 5.60 | 27 |
| 28 | $1.15 | $2.00 | $ 3.70 | $1.70 | $ 2.80 | $ 5.00 | $2.00 | $ 3.05 | $ 5.80 | 28 |
| 29 | $1.17 | $2.07 | $ 3.80 | $1.75 | $ 2.85 | $ 5.20 | $2.02 | $ 3.20 | $ 5.90 | 29 |
| 30 | $1.26 | $2.14 | $ 3.85 | $1.80 | $ 3.00 | $ 5.25 | $2.04 | $ 3.40 | $ 6.00 | 30 |
| 31 | $1.38 | $2.20 | $ 4.00 | $2.00 | $ 3.10 | $ 5.50 | $2.40 | $ 3.60 | $ 6.60 | 31 |
| 32 | $1.39 | $2.26 | $ 4.02 | $2.00 | $ 3.20 | $ 5.65 | $2.40 | $ 3.75 | $ 6.75 | 32 |
| 33 | $1.43 | $2.40 | $ 4.20 | $2.05 | $ 3.40 | $ 5.85 | $2.50 | $ 3.95 | $ 7.00 | 33 |
| 34 | $1.46 | $2.70 | $ 4.35 | $2.20 | $ 3.80 | $ 6.05 | $2.60 | $ 4.25 | $ 7.25 | 34 |
| 35 | $1.66 | $2.90 | $ 4.85 | $2.40 | $ 4.00 | $ 6.75 | $2.80 | $ 4.55 | $ 8.00 | 35 |
| 36 | $2.45 | $3.95 | $ 7.00 | $3.60 | $ 5.65 | $ 9.75 | $4.25 | $ 6.75 | $10.00 | 36 |
| 37 | $2.61 | $4.40 | $ 7.80 | $4.00 | $ 6.00 | $10.25 | $4.75 | $ 7.25 | $12.00 | 37 |
| 38 | $2.81 | $4.75 | $ 8.70 | $4.65 | $ 6.90 | $11.75 | $5.60 | $ 7.50 | $14.00 | 38 |
| 39 | $3.16 | $5.65 | $ 9.50 | $5.00 | $ 8.00 | $13.00 | $6.00 | $ 9.50 | $16.00 | 39 |
| 40 | $4.01 | $8.00 | $13.00 | $7.60 | $11.75 | $17.50 | $8.50 | $13.10 | $22.00 | 40 |

## VARIOUS OTHER INSULATIONS

| Film | Technical Classification |
|---|---|
| **ENAMEL** | — oleoresinous |
| **FORMVAR** | — poly vinyl acetal |
| **POLY THERMALEZE** | |
| **SODEREZE** | — polyurethane |
| **THERMALEZE** | — epoxide polyester |
| **NYFORM** | — formvar, nylon sheath |
| **NYLEZE** | — polyurethane nylon sheath |
| **NYLON** | |
| **BONDEZE** | |
| **GRIPEZE** | |
| **LECTRON** | — acrylic |
| **ISONSEL** | — terephthalic polyester |
| **ALKANVAR** | — terephthalic polyester |
| **SYLKYD ENAMELED** | |
| **COTTON AND COMBINATIONS** | |
| **SILK AND COMBINATIONS** | |
| **CELANESE AND COMBINATIONS** | |
| **GLASS AND COMBINATIONS** | |
| **PAPER AND COMBINATIONS** | |

| | Double Cotton Covered | | | Single Nyleze | | | Heavy Nyleze | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Size | ¼ Lb. | ½ Lb. | 1 Lb. | ¼ Lb. | ½ Lb. | 1 Lb. | ¼ Lb. | ½ Lb. | 1 Lb. | Size |
| 14 | $1.25 | $2.40 | $ 4.35 | $1.20 | $ 2.00 | $ 3.60 | $1.20 | $ 2.00 | $ 3.75 | 14 |
| 15 | $1.30 | $2.65 | $ 4.40 | $1.24 | $ 2.15 | $ 3.75 | $1.25 | $ 2.10 | $ 3.80 | 15 |
| 16 | $1.35 | $2.70 | $ 4.75 | $1.30 | $ 2.25 | $ 3.85 | $1.30 | $ 2.20 | $ 4.00 | 16 |
| 17 | $1.38 | $2.75 | $ 4.80 | $1.35 | $ 2.30 | $ 3.95 | $1.35 | $ 2.30 | $ 4.10 | 17 |
| 18 | $1.40 | $2.80 | $ 4.95 | $1.37 | $ 2.35 | $ 4.00 | $1.40 | $ 2.40 | $ 4.15 | 18 |
| 19 | $1.44 | $2.85 | $ 5.25 | $1.40 | $ 2.40 | $ 4.00 | $1.45 | $ 2.50 | $ 4.20 | 19 |
| 20 | $1.46 | $2.95 | $ 5.50 | $1.45 | $ 2.45 | $ 4.05 | $1.50 | $ 2.60 | $ 4.30 | 20 |
| 21 | $1.64 | $3.15 | $ 5.75 | $1.48 | $ 2.50 | $ 4.10 | $1.55 | $ 2.65 | $ 4.40 | 21 |
| 22 | $1.72 | $3.25 | $ 6.00 | $1.50 | $ 2.51 | $ 4.20 | $1.60 | $ 2.70 | $ 4.50 | 22 |
| 23 | $1.84 | $3.45 | $ 6.25 | $1.54 | $ 2.58 | $ 4.40 | $1.62 | $ 2.75 | $ 4.60 | 23 |
| 24 | $1.92 | $3.65 | $ 6.70 | $1.58 | $ 2.60 | $ 4.60 | $1.65 | $ 2.80 | $ 5.00 | 24 |
| 25 | ..... | ..... | ..... | $1.65 | $ 2.70 | $ 4.75 | $1.75 | $ 3.00 | $ 5.50 | 25 |
| 26 | ..... | ..... | ..... | $1.67 | $ 2.75 | $ 5.10 | $1.85 | $ 3.10 | $ 5.60 | 26 |
| 27 | ..... | ..... | ..... | $1.70 | $ 2.85 | $ 5.25 | $1.90 | $ 3.20 | $ 5.80 | 27 |
| 28 | ..... | ..... | ..... | $1.75 | $ 2.90 | $ 5.50 | $1.95 | $ 3.30 | $ 6.10 | 28 |
| 29 | ..... | ..... | ..... | $1.80 | $ 3.00 | $ 5.70 | $2.00 | $ 3.50 | $ 6.30 | 29 |
| 30 | ..... | ..... | ..... | $1.88 | $ 3.15 | $ 5.80 | $2.10 | $ 3.60 | $ 6.50 | 30 |
| 31 | ..... | ..... | ..... | $2.00 | $ 3.25 | $ 5.95 | $2.40 | $ 3.75 | $ 7.00 | 31 |
| 32 | ..... | ..... | ..... | $2.15 | $ 3.35 | $ 6.00 | $2.45 | $ 4.00 | $ 7.30 | 32 |
| 33 | ..... | ..... | ..... | $2.20 | $ 3.60 | $ 6.25 | $2.60 | $ 4.10 | $ 7.50 | 33 |
| 34 | ..... | ..... | ..... | $2.30 | $ 3.80 | $ 6.75 | $2.70 | $ 4.50 | $ 7.75 | 34 |
| 35 | ..... | ..... | ..... | $2.40 | $ 4.15 | $ 7.25 | $2.90 | $ 5.00 | $ 8.25 | 35 |
| 36 | ..... | ..... | ..... | $2.80 | $ 5.75 | $ 8.00 | $4.00 | $ 6.50 | $11.75 | 36 |
| 37 | ..... | ..... | ..... | $3.40 | $ 6.50 | $ 9.75 | $4.50 | $ 7.50 | $12.50 | 37 |
| 38 | ..... | ..... | ..... | $4.00 | $ 7.25 | $11.25 | $5.50 | $ 8.25 | $14.00 | 38 |
| 39 | ..... | ..... | ..... | $4.75 | $ 8.25 | $12.50 | $6.10 | $ 9.75 | $14.50 | 39 |
| 40 | ..... | ..... | ..... | $9.00 | $17.40 | $31.75 | $8.75 | $11.00 | $16.00 | 40 |

CONSOLIDATED

# RESISTANCE WIRE

## BARE NICKEL CHROMIUM — No. 2000

| Size | ¼ Lb. | ½ Lb. | 1 Lb. | Size | ¼ Lb. | ½ Lb. | 1 Lb. |
|---|---|---|---|---|---|---|---|
| 14 | $3.96 | $ 6.60 | $10.55 | 28 | $ 6.58 | $10.95 | $17.52 |
| 15 | $4.00 | $ 6.65 | $10.65 | 29 | $ 7.26 | $12.09 | $19.33 |
| 16 | $4.02 | $ 6.69 | $10.70 | 30 | $ 8.04 | $13.40 | $21.44 |
| 17 | $4.07 | $ 6.77 | $10.83 | 31 | $ 8.40 | $14.02 | $22.45 |
| 18 | $4.13 | $ 6.87 | $11.00 | 32 | $ 8.82 | $14.71 | $23.53 |
| 19 | $4.26 | $ 7.09 | $11.33 | 33 | $ 9.06 | $15.11 | $24.17 |
| 20 | $4.42 | $ 7.36 | $11.78 | 34 | $10.08 | $16.81 | $26.85 |
| 21 | $4.56 | $ 7.59 | $12.13 | 35 | $11.92 | $18.85 | $30.15 |
| 22 | $4.90 | $ 8.15 | $12.63 | 36 | $12.72 | $21.19 | $33.90 |
| 23 | $4.98 | $ 8.29 | $13.25 | 37 | $13.44 | $22.39 | $35.82 |
| 24 | $5.28 | $ 8.79 | $14.08 | 38 | $15.32 | $25.54 | $40.85 |
| 25 | $5.59 | $ 9.32 | $14.92 | 39 | $17.87 | $29.78 | $47.65 |
| 26 | $5.69 | $ 9.47 | $15.17 | 40 | $20.94 | $34.90 | $55.83 |
| 27 | $6.30 | $10.50 | $16.80 | | | | |

## BARE NICKEL CHROMIUM RESISTANCE CHART

| B & S Gauge | Ohms Per Ft. 68°F | B & S Gauge | Ohms Per Ft. 68°F |
|---|---|---|---|
| 14 | .1648 | 28 | 4.251 |
| 15 | .2078 | 29 | 5.286 |
| 16 | .2595 | 30 | 6.750 |
| 17 | .3333 | 31 | 8.523 |
| 18 | .4219 | 32 | 10.55 |
| 19 | .5208 | 33 | 13.39 |
| 20 | .6592 | 34 | 17.00 |
| 21 | .8310 | 35 | 21.52 |
| 22 | 1.055 | 36 | 27.00 |
| 23 | 1.322 | 37 | 33.33 |
| 24 | 1.671 | 38 | 42.19 |
| 25 | 2.107 | 39 | 55.10 |
| 26 | 2.670 | 40 | 70.24 |
| 27 | 3.348 | | |

## BUS BAR WIRE — No. 2000

| BARE COPPER WIRE | | | | TINNED COPPER WIRE | | | |
|---|---|---|---|---|---|---|---|
| Size | ¼ Lb. | ½ Lb. | 1 Lb. | Size | ¼ Lb. | ½ Lb. | 1 Lb. |
| 14 | $0.90 | $1.68 | $2.70 | 14 | $1.05 | $1.85 | $2.90 |
| 15 | $0.95 | $1.70 | $2.76 | 15 | $1.15 | $1.90 | $3.00 |
| 16 | $1.00 | $1.80 | $3.10 | 16 | $1.20 | $2.10 | $3.20 |
| 17 | $1.01 | $1.88 | $3.15 | 17 | $1.25 | $2.15 | $3.30 |
| 18 | $1.02 | $1.90 | $3.16 | 18 | $1.30 | $2.25 | $3.35 |
| 19 | $1.05 | $1.92 | $3.20 | 19 | $1.35 | $2.30 | $3.45 |
| 20 | $1.06 | $1.94 | $3.25 | 20 | $1.40 | $2.35 | $3.55 |
| 21 | $1.06 | $1.96 | $3.35 | 21 | $1.44 | $2.40 | $3.60 |
| 22 | $1.07 | $1.98 | $3.45 | 22 | $1.46 | $2.45 | $3.65 |
| 23 | $1.10 | $2.00 | $3.50 | 23 | $1.48 | $2.47 | $3.70 |
| 24 | $1.12 | $2.04 | $3.56 | 24 | $1.50 | $2.48 | $3.80 |
| 25 | $1.12 | $2.04 | $3.58 | 25 | $1.55 | $2.50 | $3.82 |
| 26 | $1.14 | $2.10 | $3.62 | 26 | $1.57 | $2.52 | $3.85 |
| 27 | $1.20 | $2.18 | $3.66 | 27 | $1.59 | $2.54 | $4.00 |
| 28 | $1.24 | $2.20 | $3.75 | 28 | $1.60 | $2.65 | $4.40 |
| 29 | $1.26 | $2.22 | $3.85 | 29 | $1.65 | $2.75 | $4.50 |
| 30 | $1.28 | $2.26 | $3.90 | 30 | $1.68 | $2.80 | $4.55 |
| 31 | $1.30 | $2.30 | $3.94 | 31 | $1.75 | $2.90 | $4.65 |
| 32 | $1.32 | $2.32 | $3.96 | 32 | $1.77 | $3.00 | $4.70 |
| 33 | $1.34 | $2.34 | $4.06 | 33 | $1.80 | $3.50 | $4.84 |
| 34 | $1.36 | $2.35 | $4.25 | 34 | $1.85 | $3.55 | $4.86 |
| 35 | $1.37 | $2.40 | $4.40 | 35 | $1.90 | $3.60 | $5.00 |
| 36 | $1.38 | $3.00 | $5.75 | 36 | $2.40 | $4.20 | $6.75 |
| 37 | $1.90 | $3.40 | $6.00 | 37 | $2.50 | $4.50 | $7.00 |
| 38 | $1.92 | $3.60 | $6.25 | 38 | $2.55 | $4.70 | $7.40 |
| 39 | $1.94 | $3.75 | $6.50 | 39 | $2.60 | $4.80 | $7.50 |
| 40 | $2.00 | $4.25 | $6.60 | 40 | $2.65 | $4.90 | $7.75 |

## MAGNET WIRE — No. 2010

| Size Wire | Plain Enameled | Size Wire | Plain Enameled | Size Wire | Plain Enameled | Size Wire | Plain Enameled |
|---|---|---|---|---|---|---|---|
| 14 | 25 Ft. | 22 | 133 Ft. | 30 | 590 Ft. | 38 | 1980 Ft. |
| 16 | 40 Ft. | 24 | 200 Ft. | 32 | 805 Ft. | 40 | 2430 Ft. |
| 18 | 48 Ft. | 26 | 292 Ft. | 34 | 1150 Ft. | | |
| 20 | 85 Ft. | 28 | 420 Ft. | 36 | 1560 Ft. | | |

## ANNUNCIATOR (BELL) WIRE

SUPPLIED IN ASSORTED COLORS

An all around utility wire consisting of a single and two conductors of No. 18 wire, plastic insulation.

| Catalog Number | Type |
|---|---|
| 1450 | Single Conductor |
| 1445 | Two Conductor Twisted |

STANDARD SPOOL PUT-UP:
¼ LB., ½ LB., 1 LB., 7 LB.

## PHOSPHOR BRONZE DIAL CABLE

BRAIDED phosphor bronze over a pure black linen, lubricated core for exceptional strength and wearing qualities.

| Cat. No. | Size (Ins.) | Stranding | Dia. (Ins.) |
|---|---|---|---|
| 1436 | ⅛ | 16x36 | .125 |

STRANDED phosphor bronze over a concealed white nylon core for exceptional flexibility. Manufactured to highest precision standards, insuring utmost accuracy.

| Cat. No. | Size (Ins.) | Stranding | Dia. (Ins.) |
|---|---|---|---|
| 1440 | ⅛ | 42x35 | .125 |

STANDARD SPOOL PUT-UP:
25 FT., 100 FT., 500 FT., 1000 FT.

## AERIAL WIRE

### COPPER

CONSOLIDATED

| | Catalog Number | Size | Stranding | Breaking Strength Pounds | Type | Nom. Dia. (Inches) |
|---|---|---|---|---|---|---|
| STRANDED BARE | 3501 | 18 | 7x26 | 67 Lbs. | Bare Copper | .046 |
| | 3521 | 16 | 7x24 | 106 Lbs. | Bare Copper | .057 |
| | 3551 | 14 | 7x22 | 167 Lbs. | Bare Copper | .072 |
| | 3561 | 12 | 7x20 | 262 Lbs. | Bare Copper | .092 |
| STRANDED TINNED | 3661 | 12 | 7x20 | 262 Lbs. | Tinned Copper | .092 |
| SOLID BARE | 3801 | 15 | Solid | 98 Lbs. | Bare Copper | .057 |
| | 3811 | 14 | Solid | 124 Lbs. | Bare Copper | .064 |
| | 3786 | 12 | Solid | 197 Lbs. | Bare Copper | .080 |
| | 3791 | 10 | Solid | 314 Lbs. | Bare Copper | .102 |
| | 3796 | 8 | Solid | 480 Lbs. | Bare Copper | .128 |
| AERIAL AND BUS BAR SOLID TINNED | 3848 | 30 | Solid | ..... | Tinned Copper | .010 |
| | 3847 | 28 | Solid | ..... | Tinned Copper | .013 |
| | 3846 | 26 | Solid | ..... | Tinned Copper | .016 |
| | 3819 | 24 | Solid | 12 Lbs. | Tinned Copper | .020 |
| | 3818 | 22 | Solid | 20 Lbs. | Tinned Copper | .025 |
| | 3817 | 20 | Solid | 31 Lbs. | Tinned Copper | .032 |
| | 3816 | 18 | Solid | 49 Lbs. | Tinned Copper | .040 |
| | 3815 | 16 | Solid | 73 Lbs. | Tinned Copper | .051 |
| | 3821 | 14 | Solid | 124 Lbs. | Tinned Copper | .064 |
| | 3831 | 12 | Solid | 197 Lbs. | Tinned Copper | .081 |
| | 3841 | 10 | Solid | 314 Lbs. | Tinned Copper | .102 |
| | 3845 | 8 | Solid | 480 Lbs. | Tinned Copper | .128 |
| SOLID ENAMELED | 3851 | 14 | Solid | 124 Lbs. | Enameled | .064 |
| | 3861 | 12 | Solid | 197 Lbs. | Enameled | .082 |
| | 3871 | 10 | Solid | 314 Lbs. | Enameled | .102 |
| | STANDARD PUT-UP: 50 FT., 75 FT., 100 FT., 1000 FT. | | | | | |

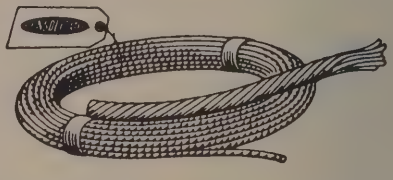
### PHOSPHOR BRONZE

Recommended for short wave and transmitting aerials.

Tested and used by Army and Navy.

Amazing improvement for reception and transmission.

Phosphor bronze is recognized as the most efficient, practical wire obtainable for short wave and transmitting aerials. It will not stretch or sag and is superinductive.



| | | | | | | |
|---|---|---|---|---|---|---|
| PHOSPHOR BRONZE | 3421 | 16 | 7x24 | 230 Lbs. | Bronze | .058 |
| | 3451 | 14 | 7x22 | 360 Lbs. | Bronze | .073 |
| | 3461 | 12 | 7x20 | 570 Lbs. | Bronze | .092 |
| | 3465 | 10 | 7x18 | 895 Lbs. | Bronze | .116 |
| | 3466 | 8 | 7x16 | 1400 Lbs. | Bronze | .146 |
| | 3467 | 6 | 7x14 | 2200 Lbs. | Bronze | .184 |
| | 3468 | 4 | 7x12 | 3400 Lbs. | Bronze | .232 |
| | STANDARD PUT-UP: 500 FT., 1000 FT. | | | | | |

# RETRACTILE COIL CORDS

CONSOLIDATED

## POWER CORDS (Underwriters' Approved)

ALL JACKETING NEOPRENE — ALL CORDS 48" RETRACTED, APPROX. 25' EXTENDED

| Catalog Number | Condr. AWG | Stranding | U.L. Type | Cordage O.D. (Inches) | Coil O.D. (Inches) | Amp Rating | Max. Working Voltage |
|---|---|---|---|---|---|---|---|
| 2801 | 2/18 | 41x34 | SVO | .250 | 1 | 7 | 300 |
| 2802 | 2/18 | 41x34 | SJO | .310 | 1¼ | 7 | 300 |
| 2803 | 3/18 | 41x34 | SJO | .330 | 1½ | 7 | 300 |
| 2804 | 4/18 | 41x34 | SJO | .360 | 1½ | 5.6 | 300 |
| 2805 | 2/16 | 65x34 | SJO | .330 | 1½ | 10 | 300 |
| 2806 | 3/16 | 65x34 | SJO | .365 | 1½ | 10 | 300 |
| 2807 | 3/16 | 65x34 | SO | .470 | 1⅞ | 10 | 600 |
| 2808 | 4/16 | 65x34 | SJO | .395 | 1⅝ | 8 | 300 |
| 2809 | 4/16 | 65x34 | SO | .500 | 1⅞ | 8 | 600 |
| 2810 | 5/16 | 65x34 | SO | .550 | 1⅞ | 8 | 600 |
| 2811 | 2/14 | 41x30 | SO | .535 | 2 | 15 | 600 |
| 2812 | 3/14 | 41x30 | SO | .560 | 2⅛ | 15 | 600 |
| 2813 | 4/14 | 41x30 | SO | .605 | 2¼ | 12 | 600 |
| 2814 | 2/12 | 65x30 | SO | .605 | 2¼ | 20 | 600 |
| 2815 | 3/12 | 65x30 | SO | .635 | 2⅜ | 20 | 600 |
| 2816 | 4/12 | 65x30 | SO | .665 | 2½ | 16 | 600 |

* Conductor Color Coding: **1**—Black, **2**—White, **3**—Green, **4**—Red, **5**—Blue

## POWER CORDS

ALL JACKETING NEOPRENE — ALL CORDS 48" RETRACTED, APPROX. 25' EXTENDED

| Catalog Number | Condr. AWG | Stranding | Cordage O.D. (Inches) | Coil O.D. (Inches) | Amp Rating | Max. Working Voltage |
|---|---|---|---|---|---|---|
| 2820 | 5/18 | 41x34 | .440 | 1¾ | 5.6 | 300 |
| 2821 | 7/18 | 41x34 | .500 | 1⅞ | 5.6 | 300 |
| 2822 | 2/12<br>4/18 | 65x30<br>41x34 | .610 | 2¼ | 17<br>6 | 600<br>600 |
| 2824 | 6/16 | 65x34 | .545 | 2 | 8 | 600 |
| 2825 | 6/16<br>1/14 | 65x34<br>41x30 | .575 | 2⅛ | 8 | 600 |
| 2827 | 7/12 | 65x30 | .775 | 2¾ | 16 | 300 |

## TEST LEADS (Red or Black)

24" RETRACTED, APPROX. 12' EXTENDED

| Catalog Number | Condr. AWG | Cordage O.D. (Inches) | Coil O.D. (Inches) | Amp Rating | Max. Working Voltage |
|---|---|---|---|---|---|
| 2830 | 1/20 Black | .165 | ¾ | 4 | 1000 |
| 2831 | 1/20 Red | .165 | ¾ | 4 | 1000 |

## SHIELDED AND TINSEL MICROPHONE CORDS

ALL JACKETING NEOPRENE

ALL CORDS 48" RETRACTED, APPROX. 25' EXTENDED

| Catalog Number | Condr. AWG | Cordage O.D. (Inches) | Coil O.D. (Inches) |
|---|---|---|---|
| 2850 | 1/24 (S) | .160 | ⅝ |
| 2852 | 1/23<br>1/24 (S) | .200 | 13/16 |
| 2854 | 2/23<br>1/24 (S) | .240 | ⅞ |
| 2856 | 2/23<br>1/24 (S) | .270 | 1¼ |
| 2857 | 3 Tinsel | .201 | 13/16 |
| 2858 | 4 Tinsel | .220 | ⅞ |
| 2859 | 5 Tinsel | .285 | 1 |

* Conductor Color Coding: **1**—Black, **2**—White, **3**—Red, **4**—Green, **5**—Blue
(S) SHIELDED

## COMMUNICATION AND ELECTRONIC CONTROL CORDS

ALL JACKETING NEOPRENE

ALL CORDS 48" RETRACTED, APPROX. 25' EXTENDED

Multi-conductors stranded communication cord No. 23 AWG, tinned copper wire. Lengths can be cut to exact requirement. Maximum working voltage 120 volts. Current carrying capacity 1 ampere Nom. cond. resistance .022 ohms per linear foot.

| Catalog Number | Condr. AWG | Stranding | Cordage O.D. (Inches) | Coil O.D. (Inches) |
|---|---|---|---|---|
| 2870 | 2/23 | 21x36 | .200 | ¾ |
| 2871 | 3/23 | 21x36 | .210 | ¾ |
| 2872 | 4/23 | 21x36 | .240 | ⅞ |
| 2873 | 5/23 | 21x36 | .285 | 1 |
| 2874 | 6/23 | 21x36 | .305 | 1⅛ |
| 2875 | 7/23 | 21x36 | .320 | 1¼ |

* Conductor Color Coding: **1**—Black, **2**—White, **3**—Red, **4**—Green, **5**—Blue, **6**—Yellow, **7**—Brown

## MILITARY AND GOVERNMENT SPECIFICATIONS
## WIRES AND CABLES

CONSOLIDATED

**WE WELCOME YOUR INQUIRIES FOR THE FOLLOWING, SPECIFY TYPE DESIGNATION**

| SPECIFICATION | SPECIFICATION | SPECIFICATION |
|---|---|---|
| MIL-C-17C | MIL-C-11097A | MIL-C-27212A |
| MIL-W-76B | MIL-C-11311 | MIL-C-27300A |
| MIL-C-442B | MIL-C-11440 | MIL-C-27500 |
| MIL-W-583B | MIL-C-11540 | MIL-C-55036 |
| MIL-I-631D | MIL-C-12349 | MIL-C-55040 |
| MIL-C-915A | MIL-C-12432B | |
| MIL-C-1892 | MIL-C-12881 | BUR. YARDS & DOCKS |
| MIL-C-1907 | MIL-W-12995 | SPEC. 9YG |
| MIL-C-2194D | MIL-C-13017 | |
| MIL-C-2486C | MIL-C-13021 | AIR FORCE MANUAL |
| MIL-C-2681 | MIL-W-13074 | AFM-88-15 |
| MIL-C-3078 | MIL-W-13075 | |
| MIL-W-3093 | MIL-C-13077 | J-C-90a |
| MIL-W-3104 | MIL-W-13169B | J-C-94 |
| MIL-C-3162A | MIL-C-13268 | J-C-98 |
| MIL-C-3432B | MIL-C-13273 | J-C-103b |
| MIL-C-3458A | MIL-W-13276 | J-C-129a |
| MIL-C-3849 | MIL-C-13294B | J-C-138 |
| MIL-W-3861 | MIL-C-13486A | |
| MIL-C-3883 | MIL-C-13745 | |
| MIL-C-3884 | MIL-C-13770 | |
| MIL-L-3930B | MIL-C-13777C | INTERIM |
| MIL-C-4921 | MIL-C-13892 | J-C-129b |
| MIL-W-5086A | MIL-C-15479C | J-C-0094a |
| MIL-C-5136B | MIL-C-16839C | J-C-00103c |
| MIL-C-5186 | MIL-W-16878D | J-C-00115 |
| MIL-C-5252B | MIL-C-17235 | |
| MIL-W-5274A | MIL-C-17621 | |
| MIL-C-5756B | MIL-C-17818 | CORPS. of ENGRS. |
| MIL-C-5898A | MIL-C-18266 | GUIDE SPEC. 303-01 |
| MIL-L-6477B | MIL-C-18869A | 1404.04 |
| MIL-C-7072A | MIL-C-18913 | |
| MIL-C-7078A | MIL-C-18959A | |
| MIL-W-7139A | MIL-C-18961A | QQ-W-343 |
| MIL-W-8777A | MIL-C-18962A | QQ-A-351d |
| MIL-C-8817 | MIL-W-19150A | QQ-A-365b |
| MIL-E-9085A | MIL-W-19381A | QQ-B-575 |
| MIL-E-9088A | MIL-C-19547 | |
| MIL-C-9660 | MIL-W-19583 | |
| MIL-C-10065A | MIL-C-19654 | CAA-701c |
| MIL-C-10255 | MIL-C-19787B | CAA-893b |
| MIL-P-10255 | MIL-C-19883A | |
| MIL-C-10392B | MIL-C-21609 | |
| MIL-C-10581B | MIL-C-22759 | L-824 |
| MIL-P-10582 | MIL-C-23206 | |
| MIL-C-10769 | MIL-C-25038 | |
| MIL-C-10820B | MIL-C-25326 | |
| MIL-C-10993A | MIL-C-25622 | |
| MIL-C-11060 | MIL-C-27072 | |

DABURN

# DABURN electronics & cable corp.

WIRE • CABLE • TUBING • MIL/COMM • SWITCHES • ELECTRONIC HARDWARE

## HEAT SHRINKABLE TEFLON* TUBING • FEP • TFE • DUAL WALL

### DUAL-WALL TEFLON* ENCAPSULATING SHRINKABLE TUBING

**NEW** DAFLON SM-450 is a new dual wall shrink and melt Teflon tubing which gives a tight, moisture-proof seal. It is made from two types of Teflon. The outer wall is TFE Teflon and the inner lining is FEP Teflon. When heated to 400°F the FEP melts and at 621°F the TFE shrinks tightly. The FEP is squeezed into a solid or near solid mechanical encapsulation. DAFLON SM-450 tubing protects against most environmental hazards involving pull, vibration, moisture, chemicals, etc. It may be used over wires, terminals, splices, connectors and as a strain relief and end cap.

**Operating Temperature:** 450°F.

| DAFLON Cat. No. | Nom. I.D. Size | Nom. Expanded I.D. | Nom. Expanded Wall | Recovered I.D. |
|---|---|---|---|---|
| SM-450-1 | 1/32" | .036" .92mm | .022" | .000"** |
| SM-450-2 | 1/16" | .060" 1.52mm | .028" | .000"** |
| SM-450-3 | 1/8" | .130" 3.30mm | .031" | .000"** |
| SM-450-4 | 5/32" | .160" 4.06mm | .032" | .000"** |
| SM-450-5 | 3/16" | .190" 4.83mm | .035" | .062" |
| SM-450-7 | 1/4" | .250" 6.35mm | .036" | .125" |
| SM-450-9 | 11/32" | .350" 8.89mm | .036" | .190" |
| SM-450-11 | 7/16" | .450" 11.43mm | .055" | .312" |
| SM-450-13 | 11/16" | .700" 17.78mm | .055" | .440" |
| SM-450-16 | 1" | .950" 24.13mm | .065" | .680" |

**Standard Package:** 100' in 1 to 3 ft. lengths. Special lengths available to order.
**Will fully close off.

## DAFLON SH-400 (FEP)

Made with Modified TEFLON‡ FEP will shrink over inserted objects upon exposure to moderate heat. Heretofore, many joints, parts, components, devices could not be protected because of hi temperature required for shrinkage. FEP TEFLON‡, which has a continuous service temperature of 400°F., will shrink at 300°F. Supplied in natural (transparent) color. Complete shrinkage at 350°F. Now, many heat sensitive products can use the permanent protection of TEFLON.* Will not burn or support flame, long lengths available. Will not split or melt. Extruded. Meets MIL-I-23053/11.

| DABURN Cat. No. | Size | I.D. | Min. Exp. I.D. | Recovered Max. I.D. | Recovered Wall Thickness* |
|---|---|---|---|---|---|
| SH-400-24 | 24 | .023" | .031" | .027" | .008" |
| SH-400-22 | 22 | .028" | .036" | .032" | .008" |
| SH-400-20 | 20 | .034" | .045" | .039" | .008" |
| SH-400-18 | 18 | .042" | .060" | .049" | .008" |
| SH-400-16 | 16 | .053" | .075" | .061" | .009" |
| SH-400-14 | 14 | .066" | .092" | .072" | .009" |
| SH-400-12 | 12 | .085" | .115" | .089" | .009" |
| SH-400-10 | 10 | .108" | .141" | .114" | .010" |
| SH-400-9 | 9 | .118" | .158" | .124" | .010" |
| SH-400-8 | 8 | .136" | .180" | .143" | .010" |
| SH-400-7 | 7 | .148" | .197" | .158" | .011" |
| SH-400-6 | 6 | .170" | .225" | .180" | .011" |
| SH-400-5 | 5 | .186" | .248" | .198" | .011" |

*All items on this page are available cut to length or cut and marked.

| DABURN Cat. No. | Size | I.D. | Min. Exp. I.D. | Recovered Max. I.D.* | Recovered Wall Thickness* |
|---|---|---|---|---|---|
| SH-400-4 | 4 | .214" | .290" | .226" | .011" |
| SH-400-3 | 3 | .234" | .310" | .249" | .011" |
| SH-400-2 | 2 | .268" | .365" | .280" | .012" |
| SH-400-1 | 1 | .294" | .400" | .311" | .012" |
| SH-400-0 | 0 | .336" | .440" | .349" | .012" |
| SH-400-3/8 | 3/8" | .375" | .500" | .383" | .015" |
| SH-400-7/16 | 7/16" | .437" | .580" | .448" | .020" |
| SH-400-1/2 | 1/2" | .500" | .666" | .510" | .020" |
| SH-400-5/8 | 5/8" | .625" | .830" | .637" | .025" |
| SH-400-3/4 | 3/4" | .750" | 1.000" | .764" | .030" |
| SH-400-7/8 | 7/8" | .875" | 1.170" | .891" | .035" |
| SH-400-1" | 1" | 1.000" | 1.330" | 1.020" | .035" |

**STANDARD PACKAGE: 100 Ft., 4 Ft. Min. Length.** ‡ DUPONT
*When full recovery permitted.

## DAFLON SHRINK SERIES SH-621

### TFE TUBING MIL-I-23053/12

Made of modified TEFLON‡ polytetrafluorethylene will shrink when heated to 621°F. Suitable where hi temp protection is required. Extruded. Will not support combustion, dielectric strength (20 Mil Wall) 850 V/M, low temp. brittle point −66°F, superior chemical resistance. Operating Temp: −67°C to +250°C.

| DAFLON Cat. No. | Nominal Tubing Size | Recovered Dimensions: Minimum Expanded I.D. | Maximum I.D. | Wall Thickness |
|---|---|---|---|---|
| SH-621-26 | 26 | .046" | .022" | .009" |
| SH-621-24 | 24 | .050" | .027" | .010" |
| SH-621-22 | 22 | .055" | .032" | .010" |
| SH-621-20 | 20 | .060" | .039" | .012" |
| SH-621-19 | 19 | .065" | .043" | .012" |
| SH-621-18 | 18 | .076" | .049" | .012" |
| SH-621-17 | 17 | .085" | .054" | .012" |
| SH-621-16 | 16 | .093" | .061" | .012" |
| SH-621-15 | 15 | .110" | .067" | .012" |
| SH-621-14 | 14 | .120" | .072" | .012" |
| SH-621-13 | 13 | .140" | .080" | .012" |
| SH-621-12 | 12 | .150" | .089" | .012" |
| SH-621-11 | 11 | .170" | .101" | .012" |
| SH-621-10 | 10 | .191" | .112" | .012" |

| DAFLON Cat. No. | Nominal Tubing Size | Recovered Dimensions: Minimum Expanded I.D. | Maximum I.D. | Wall Thickness |
|---|---|---|---|---|
| SH-621-9 | 9 | .205" | .124" | .015" |
| SH-621-8 | 8 | .240" | .141" | .015" |
| SH-621-7 | 7 | .270" | .158" | .015" |
| SH-621-6 | 6 | .302" | .178" | .015" |
| SH-621-5 | 5 | .320" | .198" | .015" |
| SH-621-4 | 4 | .370" | .224" | .015" |
| SH-621-3 | 3 | .390" | .249" | .015" |
| SH-621-2 | 2 | .430" | .278" | .015" |
| SH-621-1 | 1 | .450" | .311" | .015" |
| SH-621-0 | 0 | .470" | .347" | .015" |
| SH-621-3/8 | 3/8" | .560" | .399" | .020" |
| SH-621-7/16 | 7/16" | .655" | .462" | .020" |
| SH-621-1/2 | 1/2" | .750" | .524" | .020" |

**STANDARD PACKAGE:** 100 Feet. Additional Sizes and Colors to Order.
**STANDARD PUT-UP:** 36" Straight Lengths — One Foot Minimums Size 13 thru 1/2"; Size 26-14 3' Min. Length.
**WALL TOLERANCES:** 26 thru 22 ± .002; 20 thru 10 ± .003; 9 thru 0 ± .004.

## DAFLON 4:1 SHRINKABLE PTFE TUBING

DAFLON SH-421 Shrinkable Teflon Tubing recovers to approximately 25% of its expanded size when heated to the gel point (621°F). Thus it is now possible to use shrinkable Teflon tubing, with its excellent chemical and physical properties, over objects which require more than the standard 2:1 shrinkdown ratio (see SH-621).

NOTE: Tubing should be allowed to recover **at least 50%.**
Conforms to MIL-I-23053/12 and AMS-3584. **Operating Temp.:** −85°F to +500°F.

| DAFLON Cat. No. | Nom. Size | Expanded Min. I.D. | Recovered Max. I.D. | Recovered Nom. Wall |
|---|---|---|---|---|
| SH-421-5/64 | 5/64" | .078" | .025" | .009" |
| SH-421-1/8 | 1/8" | .125" | .038" | .010" |
| SH-421-3/16 | 3/16" | .187" | .050" | .012" |

| DAFLON Cat. No. | Nom. Size | Expanded Min. I.D. | Recovered Max. I.D. | Recovered Nom.* Wall |
|---|---|---|---|---|
| SH-421-1/4 | 1/4" | .250" | .063" | .012" |
| SH-421-5/16 | 5/16" | .312" | .079" | .012" |
| SH-421-3/8 | 3/8" | .375" | .096" | .012" |
| SH-421-1/2 | 1/2" | .500" | .144" | .015" |
| SH-421-5/8 | 5/8" | .625" | .178" | .015" |
| SH-421-3/4 | 3/4" | .750" | .225" | .015" |
| SH-421-7/8 | 7/8" | .875" | .244" | .015" |
| SH-421-1 | 1" | 1.000" | .278" | .015" |
| SH-421-1 1/4 | 1 1/4" | 1.250" | .347" | .015" |

**Standard Package:** 100' in 4 ft. lengths. Tubing may be ordered cut to length.
**STANDARD COLOR:** Natural (Clear). *When full recovery is allowed.

**DABURN No. HG1 — Heat Gun for SH-162, SH-265, SH-267, SH-275, SH-290, ST-275, SH-300 Series.**
**DABURN No. HG2 — Heat Gun for SH-400, SH-421, SH-621, SH-450, SH-350 Series. SEND FOR OUR COMPLETE CATALOG**

DABURN ELECTRONICS & CABLE CORP. • 2360A HOFFMAN ST., BRONX, N.Y. 10458 (212) 295-0050 TWX 710-593-4145

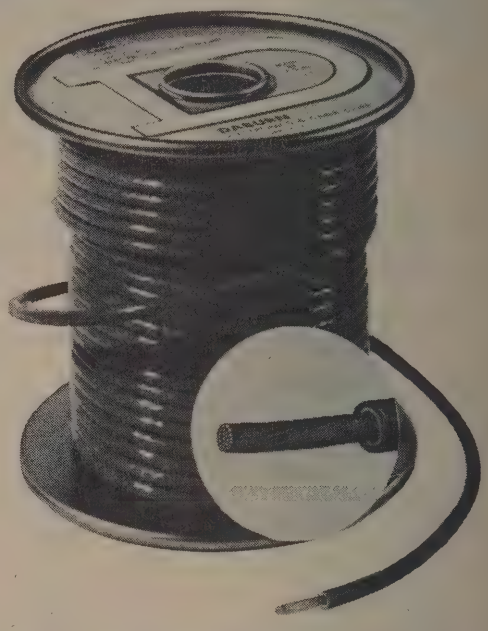
DABURN

# DABURN electronics & cable corp.

WIRE • CABLE • TUBING • MIL/COMM • SWITCHES • ELECTRONIC HARDWARE

## HI-VOLT CORONA RESISTANT TEFLON* CABLE©

Voltage Rating at Sea Level • Voltage Rating at 80,000 feet, approximately 1/3 lower • Minimum life expectancy: 10,000 hours.

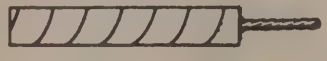


**SMALL SIZE:**
You do not need bulky, thick, insulation jacketing as used with silicone rubber and polyethylene insulations to get your hi-voltage requirements. Wire used is MIL-SPEC QQ-W-343 and MIL-W-16878D. Insulation used conforms to and surpasses MIL-SPEC-W-16878D

**AVOID CORONA PROBLEMS:**
Corona Resistant Teflon construction is specifically designed to retard and prevent corona penetration. Temperature variations from −60° to +300°C have no life effect on the corona resistant Teflon. In addition, there is no stress or crack failure under severe, adverse conditions including mechanical strain, moisture, corona or chemical conditions.

**DESCRIPTION:**
Single Conductor, Stranded Silver Plated Copper, Corona Resistant Teflon* Insulation.

**TEMPERATURE RATING:**
−90°C to +250°C.



**VOLTAGE RATING:**
Based on insulation thickness.

**AVAILABLE COLORS:**
White, Black, Red, Green, Yellow, Lt. Blue, Brown, Orange, Gray, Violet. (Also available in tracer colors)

**PUT-UP:** 250′, 500′, 1000′

*DUPONT

### ADDITIONAL SIZES AND VOLTAGES AVAILABLE

| DABURN No. | AWG Size | Strand | Voltage Rating AC | Voltage Rating DC | Max. O.D. |
|---|---|---|---|---|---|
| CRT-12-2 | 12 | 19/25 | 2500 | 10,000 | .142″ |
| CRT-12-2.5 | 12 | 19/25 | 3750 | 12,500 | .152″ |
| CRT-12-3 | 12 | 19/25 | 4500 | 15,000 | .162″ |
| CRT-12-3.5 | 12 | 19/25 | 5300 | 17,500 | .172″ |
| CRT-12-4 | 12 | 19/25 | 6000 | 20,000 | .182″ |
| CRT-12-5 | 12 | 19/25 | 7500 | 25,000 | .202″ |
| CRT-12-6.5 | 12 | 19/25 | 10,000 | 32,500 | .232″ |
| CRT-12-8 | 12 | 19/25 | 12,000 | 40,000 | .262″ |
| CRT-12-10 | 12 | 19/25 | 15,000 | 50,000 | .302″ |
| CRT-14-2 | 14 | 19/27 | 2500 | 10,000 | .124″ |
| CRT-14-2.5 | 14 | 19/27 | 3750 | 12,500 | .134″ |
| CRT-14-3 | 14 | 19/27 | 4500 | 15,000 | .144″ |
| CRT-14-3.5 | 14 | 19/27 | 5300 | 17,500 | .154″ |
| CRT-14-4 | 14 | 19/27 | 6000 | 20,000 | .164″ |
| CRT-14-5 | 14 | 19/27 | 7500 | 25,000 | .184″ |
| CRT-14-6.5 | 14 | 19/27 | 10,000 | 32,500 | .214″ |
| CRT-14-8 | 14 | 19/27 | 12,000 | 40,000 | .244″ |
| CRT-14-10 | 14 | 19/27 | 15,000 | 50,000 | .284″ |
| CRT-16-2 | 16 | 19/29 | 2500 | 10,000 | .109″ |
| CRT-16-2.5 | 16 | 19/29 | 3750 | 12,500 | .119″ |
| CRT-16-3 | 16 | 19/29 | 4500 | 15,000 | .129″ |
| CRT-16-3.5 | 16 | 19/29 | 5300 | 17,500 | .139″ |
| CRT-16-4 | 16 | 19/29 | 6000 | 20,000 | .149″ |
| CRT-16-5 | 16 | 19/29 | 7500 | 25,000 | .169″ |
| CRT-16-6.5 | 16 | 19/29 | 10,000 | 32,500 | .199″ |
| CRT-16-8 | 16 | 19/29 | 12,000 | 40,000 | .229″ |
| CRT-16-10 | 16 | 19/29 | 15,000 | 50,000 | .269″ |
| CRT-18-2 | 18 | 19/30 | 2500 | 10,000 | .102″ |
| CRT-18-2.5 | 18 | 19/30 | 3750 | 12,500 | .112″ |
| CRT-18-3 | 18 | 19/30 | 4500 | 15,000 | .122″ |
| CRT-18-3.5 | 18 | 19/30 | 5300 | 17,500 | .132″ |
| CRT-18-4 | 18 | 19/30 | 6000 | 20,000 | .142″ |
| CRT-18-5 | 18 | 19/30 | 7500 | 25,000 | .162″ |
| CRT-18-6.5 | 18 | 19/30 | 10,000 | 32,500 | .192″ |
| CRT-18-8 | 18 | 19/30 | 12,000 | 40,000 | .222″ |
| CRT-18-10 | 18 | 19/30 | 15,000 | 50,000 | .262″ |
| CRT-20-2 | 20 | 19/32 | 2500 | 10,000 | .092″ |
| CRT-20-2.5 | 20 | 19/32 | 3750 | 12,500 | .102″ |
| CRT-20-3 | 20 | 19/32 | 4500 | 15,000 | .112″ |
| CRT-20-3.5 | 20 | 19/32 | 5300 | 17,500 | .122″ |
| CRT-20-4 | 20 | 19/32 | 6000 | 20,000 | .132″ |
| CRT-20-5 | 20 | 19/32 | 7500 | 25,000 | .152″ |
| CRT-20-6.5 | 20 | 19/32 | 10,000 | 32,500 | .192″ |
| CRT-20-8 | 20 | 19/32 | 12,000 | 40,000 | .212″ |
| CRT-20-10 | 20 | 19/32 | 15,000 | 50,000 | .252″ |
| CRT-22-2 | 22 | 19/34 | 2500 | 10,000 | .084″ |
| CRT-22-2.5 | 22 | 19/34 | 3750 | 12,500 | .094″ |
| CRT-22-3 | 22 | 19/34 | 4500 | 15,000 | .104″ |
| CRT-22-3.5 | 22 | 19/34 | 5300 | 17,500 | .114″ |
| CRT-22-4 | 22 | 19/34 | 6000 | 20,000 | .124″ |
| CRT-22-5 | 22 | 19/34 | 7500 | 25,000 | .144″ |
| CRT-22-6.5 | 22 | 19/34 | 10,000 | 32,500 | .174″ |
| CRT-22-8 | 22 | 19/34 | 12,000 | 40,000 | .204″ |
| CRT-22-10 | 22 | 19/34 | 15,000 | 50,000 | .244″ |
| CRT-24-2 | 24 | 19/36 | 2500 | 10,000 | .077″ |
| CRT-24-2.5 | 24 | 19/36 | 2750 | 12,500 | .087″ |
| CRT-24-3 | 24 | 19/36 | 4500 | 15,000 | .097″ |
| CRT-24-3.5 | 24 | 19/36 | 5300 | 17,500 | .107″ |
| CRT-24-4 | 24 | 19/36 | 6000 | 20,000 | .117″ |
| CRT-24-5 | 24 | 19/36 | 7500 | 25,000 | .137″ |
| CRT-24-6.5 | 24 | 19/36 | 10,000 | 32,500 | .167″ |
| CRT-24-8 | 24 | 19/36 | 12,000 | 40,000 | .197″ |
| CRT-24-10 | 24 | 19/36 | 15,000 | 50,000 | .237″ |
| CRT-26-2 | 26 | 7/34 | 2500 | 10,000 | .071″ |
| CRT-26-2.5 | 26 | 7/34 | 3750 | 12,500 | .081″ |
| CRT-26-3 | 26 | 7/34 | 4500 | 15,000 | .091″ |
| CRT-26-3.5 | 26 | 7/34 | 5300 | 17,500 | .101″ |
| CRT-26-4 | 26 | 7/34 | 6000 | 20,000 | .111″ |
| CRT-26-5 | 26 | 7/34 | 7500 | 25,000 | .131″ |
| CRT-26-6.5 | 26 | 7/34 | 10,000 | 32,500 | .161″ |
| CRT-26-8 | 26 | 7/34 | 12,000 | 40,000 | .191″ |
| CRT-26-10 | 26 | 7/34 | 15,000 | 50,000 | .231″ |
| CRT-28-2 | 28 | 7/36 | 2500 | 10,000 | .067″ |
| CRT-28-2.5 | 28 | 7/36 | 3750 | 12,500 | .077″ |
| CRT-28-3 | 28 | 7/36 | 4500 | 15,000 | .087″ |
| CRT-28-3.5 | 28 | 7/36 | 5300 | 17,500 | .097″ |
| CRT-28-4 | 28 | 7/36 | 6000 | 20,000 | .117″ |
| CRT-28-5 | 28 | 7/36 | 7500 | 25,000 | .127″ |
| CRT-28-6.5 | 28 | 7/36 | 10,000 | 32,500 | .157″ |
| CRT-28-8 | 28 | 7/36 | 12,000 | 40,000 | .187″ |
| CRT-28-10 | 28 | 7/36 | 15,000 | 50,000 | .227″ |

© Copyright Daburn 1968. *Dupont

**Send for our complete catalog.**

DABURN ELECTRONICS & CABLE CORP. • 2360A HOFFMAN ST., BRONX, N.Y. 10458 (212) 295-0050 TWX 710-593-4145

DABURN

# DABURN electronics & cable corp.

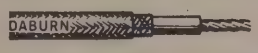
WIRE • CABLE • TUBING • MIL/COMM • SWITCHES • ELECTRONIC HARDWARE

## TFE • FEP TEFLON* CABLES • H FILM KAPTON* WIRE

### MIL-W-16878D INSTRUMENTATION — SHIELDED • UNSHIELDED

**DESCRIPTION:** One or more conductors, each conductor silver plated concentrically stranded copper wire, Type E Extruded TFE .010″ insulation. When shielded, braided silver plated copper shield over conductor(s), 90% shield coverage. When covered, either a TEFLON* impregnated fiberglass braid or a .010″ TEFLON* fused, double tape jacket overall. Fungus, solvent, moisture, flame, acid, alkali and oil resistant. Multiconductors are twisted. **TEMP. RATING:** −65°C to +260°C. **VOLT. RATING:** 600V.

#### TEFLON* IMPREGNATED BRAID OVER SHIELD




| Daburn No. | Conds. | AWG Size | Strand | Nom. O.D. | Daburn No. | Conds. | AWG Size | Strand | Nom. O.D. |
|---|---|---|---|---|---|---|---|---|---|
| 2444 | 1 | 26 | 7/34 | .075″ | 2447 | 1 | 20 | 19/32 | .093″ |
| 2444/2 | 2 | 26 | 7/34 | .119″ | 2447/2 | 2 | 20 | 19/32 | .154″ |
| 2445 | 1 | 24 | 19/36 | .081″ | 2447/3 | 3 | 20 | 19/32 | .163″ |
| 2445/2 | 2 | 24 | 19/36 | .126″ | 2447/4 | 4 | 20 | 19/32 | .180″ |
| 2445/3 | 3 | 24 | 19/36 | .133″ | 2447/5 | 5 | 20 | 19/32 | .195″ |
| 2445/4 | 4 | 24 | 19/36 | .144″ | 2448 | 1 | 18 | 19/30 | .097″ |
| 2445/5 | 5 | 24 | 19/36 | .156″ | 2448/2 | 2 | 18 | 19/30 | .162″ |
| 2446 | 1 | 22 | 19/34 | .088″ | 2448/3 | 3 | 18 | 19/30 | .172″ |
| 2446/2 | 2 | 22 | 19/34 | .137″ | 2448/4 | 4 | 18 | 19/30 | .192″ |
| 2446/3 | 3 | 22 | 19/34 | .144″ | 2448/5 | 5 | 18 | 19/30 | .207″ |
| 2446/4 | 4 | 22 | 19/34 | .158″ | 2449 | 1 | 16 | 19/29 | .117″ |
| 2446/5 | 5 | 22 | 19/34 | .172″ | 2449/2 | 2 | 16 | 19/29 | .196″ |

**STANDARD SPOOL PUT-UPS:** 250 Ft., 500 Ft., 1000 Ft.
**CONDUCTOR COLOR CODE:** 1—White, 2—Black, 3—Red, 4—Green, 5—Yellow.

#### SHIELDED BRAID OVERALL

| Daburn Cat. No. | Conds. | AWG Size | Strand | Nom. O.D. | Daburn Cat. No. | Conds. | AWG Size | Strand | Nom. O.D. |
|---|---|---|---|---|---|---|---|---|---|
| 2434 | 1 | 26 | 7/34 | .066″ | 2437 | 1 | 20 | 19/32 | .082″ |
| 2434/2 | 2 | 26 | 7/34 | .104″ | 2437/2 | 2 | 20 | 19/32 | .142″ |
| 2435 | 1 | 24 | 19/36 | .068″ | 2437/3 | 3 | 20 | 19/32 | .151″ |
| 2435/2 | 2 | 24 | 19/36 | .112″ | 2437/4 | 4 | 20 | 19/32 | .168″ |
| 2435/3 | 3 | 24 | 19/36 | .120″ | 2437/5 | 5 | 20 | 19/32 | .180″ |
| 2435/4 | 4 | 24 | 19/36 | .132″ | 2438 | 1 | 18 | 19/30 | .093″ |
| 2435/5 | 5 | 24 | 19/36 | .140″ | 2438/2 | 2 | 18 | 19/30 | .162″ |
| 2436 | 1 | 22 | 19/34 | .075″ | 2438/3 | 3 | 18 | 19/30 | .172″ |
| 2436/2 | 2 | 22 | 19/34 | .124″ | 2438/4 | 4 | 18 | 19/30 | .191″ |
| 2436/3 | 3 | 22 | 19/34 | .132″ | 2438/5 | 5 | 18 | 19/30 | .210″ |
| 2436/4 | 4 | 22 | 19/34 | .146″ | 2439 | 1 | 16 | 19/29 | .103″ |
| 2436/5 | 5 | 22 | 19/34 | .154″ | 2439/2 | 2 | 16 | 19/29 | .184″ |

**STANDARD SPOOL PUT-UPS:** 250 Ft., 500 Ft., 1000 Ft.
**CONDUCTOR COLOR CODE:** 1—White, 2—Black, 3—Red, 4—Green, 5—Yellow.

### H FILM KAPTON* WIRE — DALITE™

#### HIGH TEMPERATURE HOOK-UP AND AIRFRAME WIRE 200°C CONTINUOUS TEMPERATURE RATING (a)

**INSULATED WITH DUPONT KAPTON* POLYIMIDE FILM WITH TEFLON* — FEP HEAT SEALED COATING CONFORMS TO MIL-W-60904 & MIL-W-81381.**
**CHARACTERISTICS:** Dalite™ insulated wire provides high temperature stability, low temperature flexibility, high radiation resistance, resistance to cold flow, impervious to most chemicals, high dielectric strength, low dielectric constant, smaller diameters and lighter weight than any other comparable wire used for continuous operation up to 200°C. This hook-up wire meets the test requirements of MIL-W-16878 for 300 V, 600 V and 1000 V with **smaller wall thicknesses, weight and dimensions.**
(a) Temperature based on lowest temperature rating of materials in the insulation — FEP 200°C. Will pass 96 hour heat age tests at 250°C per MIL-W-16878.
**DESCRIPTION:** Single conductor, silver plated annealed copper conductors, Type H* Polyimide film with Teflon* FEP coating tape wrapped.

| DABURN No. | Type Designation | Size AWG | Strand | Voltage Rating (rms) | Nom. Wall | Nom. O.D. | Weight Per 1000′ (lbs.) |
|---|---|---|---|---|---|---|---|
| 2490/30 | HF 30 | 30 | 7/38 | 600 | .0045″ | .021″ | 0.52 |
| 2495/30 | HHF 30 | 30 | 7/38 | 1000 | .006″ | .024″ | 0.57 |
| 2490/28 | HF 28 | 28 | 7/36 | 600 | .0045″ | .024″ | 0.75 |
| 2495/28 | HHF 28 | 28 | 7/36 | 1000 | .006″ | .027″ | 0.83 |
| 2490/26 | HF 26 | 26 | 7/34 | 600 | .0045″ | .028″ | 1.11 |
| 2495/26 | HHF 26 | 26 | 7/34 | 1000 | .006″ | .031″ | 1.21 |
| 2490/24 | HF 24 | 24 | 19/36 | 600 | .0045″ | .034″ | 1.78 |
| 2495/24 | HHF 24 | 24 | 19/36 | 1000 | .006″ | .037″ | 1.90 |
| 2490/22 | HF 22 | 22 | 19/34 | 600 | .0045″ | .041″ | 2.71 |
| 2495/22 | HHF 22 | 22 | 19/34 | 1000 | .006″ | .044″ | 2.86 |
| 2490/20 | HF 20 | 20 | 19/32 | 600 | .0045″ | .049″ | 4.18 |
| 2495/20 | HHF 20 | 20 | 19/32 | 1000 | .006″ | .052″ | 4.35 |
| 2490/18 | HF 18 | 18 | 19/30 | 600 | .0045″ | .059″ | 6.46 |
| 2495/18 | HHF 18 | 18 | 19/30 | 1000 | .006″ | .062″ | 6.67 |
| 2490/16 | HF 16 | 16 | 19/29 | 600 | .0045″ | .066″ | 8.16 |
| 2495/16 | HHF 16 | 16 | 19/29 | 1000 | .006″ | .069″ | 8.39 |

**STD. COLOR:** Natural Gold. Striping and solid colors available. Variations of conductor material—to special order.
**STD. PUT-UP:** 1000 Ft.
*DUPONT

#### TEFLON* TAPE WRAP JACKET OVER SHIELD

| Daburn No. | Conds. | AWG Size | Strand | Nom. O.D. | Daburn No. | Conds. | AWG Size | Strand | Nom. O.D. |
|---|---|---|---|---|---|---|---|---|---|
| 2454 | 1 | 26 | 7/34 | .078″ | 2457 | 1 | 20 | 19/32 | .099″ |
| 2454/2 | 2 | 26 | 7/34 | .125″ | 2457/2 | 2 | 20 | 19/32 | .158″ |
| 2455 | 1 | 24 | 19/36 | .084″ | 2457/3 | 3 | 20 | 19/32 | .167″ |
| 2455/2 | 2 | 24 | 19/36 | .128″ | 2457/4 | 4 | 20 | 19/32 | .184″ |
| 2455/3 | 3 | 24 | 19/36 | .135″ | 2457/5 | 5 | 20 | 19/32 | .204″ |
| 2455/4 | 4 | 24 | 19/36 | .148″ | 2458 | 1 | 18 | 19/30 | .109″ |
| 2455/5 | 5 | 24 | 19/36 | .162″ | 2458/2 | 2 | 18 | 19/30 | .178″ |
| 2456 | 1 | 22 | 19/34 | .090″ | 2458/3 | 3 | 18 | 19/30 | .189″ |
| 2456/2 | 2 | 22 | 19/34 | .140″ | 2458/4 | 4 | 18 | 19/30 | .208″ |
| 2456/3 | 3 | 22 | 19/34 | .148″ | 2458/5 | 5 | 18 | 19/30 | .230″ |
| 2456/4 | 4 | 22 | 19/34 | .162″ | 2459 | 1 | 16 | 19/29 | .130″ |
| 2456/5 | 5 | 22 | 19/34 | .183″ | 2459/2 | 2 | 16 | 19/29 | .230″ |

**STANDARD SPOOL PUT-UPS:** 250 Ft., 500 Ft., 1000 Ft.
**CONDUCTOR COLOR CODE:** 1—White, 2—Black, 3—Red, 4—Green, 5—Yellow.

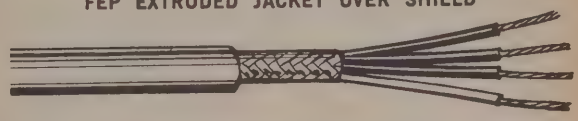
#### NO SHIELD—TEFLON* IMPREGNATED FIBERGLASS OVERALL

| Daburn Cat. No. | Conds. | AWG Size | Strand | Nom. O.D. | Daburn Cat. No. | Conds. | AWG Size | Strand | Nom. O.D. |
|---|---|---|---|---|---|---|---|---|---|
| 2464 | 1 | 26 | 7/34 | .040″ | 2467 | 1 | 20 | 19/32 | .058″ |
| 2464/2 | 2 | 26 | 7/34 | .080″ | 2467/2 | 2 | 20 | 19/32 | .118″ |
| 2465 | 1 | 24 | 19/36 | .044″ | 2467/3 | 3 | 20 | 19/32 | .127″ |
| 2465/2 | 2 | 24 | 19/36 | .088″ | 2467/4 | 4 | 20 | 19/32 | .144″ |
| 2465/3 | 3 | 24 | 19/36 | .096″ | 2467/5 | 5 | 20 | 19/32 | .156″ |
| 2465/4 | 4 | 24 | 19/36 | .108″ | 2468 | 1 | 18 | 19/30 | .069″ |
| 2465/5 | 5 | 24 | 19/36 | .116″ | 2468/2 | 2 | 18 | 19/30 | .138″ |
| 2466 | 1 | 22 | 19/34 | .051″ | 2468/3 | 3 | 18 | 19/30 | .148″ |
| 2466/2 | 2 | 22 | 19/34 | .100″ | 2468/4 | 4 | 18 | 19/30 | .167″ |
| 2466/3 | 3 | 22 | 19/34 | .108″ | 2468/5 | 5 | 18 | 19/30 | .186″ |
| 2466/4 | 4 | 22 | 19/34 | .122″ | 2469 | 1 | 16 | 19/29 | .086″ |
| 2466/5 | 5 | 22 | 19/34 | .131″ | 2469/2 | 2 | 16 | 19/29 | .172″ |

**STANDARD SPOOL PUT-UPS:** 250 Ft., 500 Ft., 1000 Ft.
**CONDUCTOR COLOR CODE:** 1—White, 2—Black, 3—Red, 4—Green, 5—Yellow.
**Special cable constructions and colors available.**

### FEP TEFLON* CABLE

#### FEP EXTRUDED JACKET OVER SHIELD



**DESCRIPTION:** Each conductor silver plated stranded copper wire, Type E extruded TFE .010″ insulation. Color coded, cabled, braided silver plated copper shield — 90% coverage, FEP white teflon jacket overall.
**TEMPERATURE RATING:** −65°C to +200°C.

**TEMPERATURE RATING:** −65°C to +200°C. **VOLTAGE RATING:** 600 V.

| DABURN No. | Conds. | AWG Size | Strand | Nom. O.D. |
|---|---|---|---|---|
| 2480 | 1 | 24 | 19/36 | .085″ |
| 2480/2 | 2 | 24 | 19/36 | .130″ |
| 2480/3 | 3 | 24 | 19/36 | .135″ |
| 2480/4 | 4 | 24 | 19/36 | .148″ |
| 2481 | 1 | 22 | 19/34 | .091″ |
| 2481/2 | 2 | 22 | 19/34 | .150″ |
| 2481/3 | 3 | 22 | 19/34 | .158″ |
| 2481/4 | 4 | 22 | 19/34 | .172″ |
| 2482 | 1 | 20 | 19/32 | .100″ |
| 2482/2 | 2 | 20 | 19/32 | .168″ |
| 2482/3 | 3 | 20 | 19/32 | .178″ |
| 2482/4 | 4 | 20 | 19/32 | .193″ |
| 2483 | 1 | 18 | 19/30 | .110″ |
| 2483/2 | 2 | 18 | 19/30 | .188″ |
| 2483/3 | 3 | 18 | 19/30 | .207″ |
| 2483/4 | 4 | 18 | 19/30 | .222″ |
| 2484 | 1 | 16 | 19/29 | .123″ |
| 2484/2 | 2 | 16 | 19/29 | .220″ |

**CONDUCTOR COLOR CODE:** 1—White, 2—Black, 3—Red, 4—Green *Dupont
**STD. PUT-UP:** 500 Ft., 1000 Ft.

Send for our complete catalog. All items on this page available cut to length.

DABURN ELECTRONICS & CABLE CORP. • 2360A HOFFMAN ST., BRONX, N.Y. 10458 (212) 295-0050 TWX 710-593-4145

# DABURN electronics & cable corp.

WIRE • CABLE • TUBING • MIL/COMM • SWITCHES • ELECTRONIC HARDWARE

## RETRACTILE POWER & COMMUNICATION CORDS — UL & CSA

Long Lasting Service — useful wherever cords must change length or position. Extend to approximately six times its retracted length. Returns to its original shape or length when released. Eliminates tangling, twisting or knots. Cords are UL and CSA approved.

### POWER CORDS

**RETRACTED LENGTHS: 1, 2, 3 & 4 FT. EXTENDED LENGTHS: 6, 12, 18 & 25 FT.**
**UL APPROVED — NEOPRENE JACKETED CORD**
Operating Temperature: −20°C to +60°C

| DABURN No. & Retracted Lengths 4 Ft.* Length | 3 Ft. Length | 2 Ft. Length | 1 Ft. Length | No. Cond. | Size | Strand | UL‡ & CSA Type | Amps | Volt Rating | Coil Nom. O.D. in. | Coil Nom. O.D. mm | Cord Nom. O.D. in. | Cord Nom. O.D. mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 986-4 | 986-3 | 986-2 | 986-1 | 2 | 18 | 41/34 | SVO | 7 | 300 | ⅞ | 22 | .250 | 7 |
| 986/3-4 | 986/3-3 | 986/3-2 | 986/3-1 | 3 | 18 | 41/34 | SVO | 7 | 300 | 1 | 25 | .275 | 7 |
| 989-4 | 989-3 | 989-2 | 989-1 | 2 | 18 | 41/34 | SJO | 7 | 300 | 1⅜ | 30 | .310 | 8 |
| 989/3-4 | 989/3-3 | 989/3-2 | 989/3-1 | 3 | 18 | 41/34 | SJO | 7 | 300 | 1⅜ | 35 | .330 | 9 |
| 989/4-4 | 989/4-3 | 989/4-2 | 989/4-1 | 4 | 18 | 41/34 | SJO | 5.6 | 300 | 1¼ | 37 | .360 | 10 |
| 989/5-4 | — | 989/5-2 | — | 5 | 18 | 41/34 | — | 5.6 | 300 | 1¼ | 37 | .360 | 10 |
| 989/7-4 | — | 989/7-2 | — | 7 | 18 | 41/34 | — | 5.6 | 300 | 1⅜ | 41 | .440 | 11 |
| 990/3-4 | — | 990/3-2 | — | 3 | 18 | 41/34 | SO | 7 | 600 | 1⅞ | 48 | .500 | 13 |
| 990/4-4 | — | 990/4-2 | — | 4 | 18 | 41/34 | SO | 5.6 | 600 | 1⅝ | 40 | .405 | 10 |
| 991-4 | 991-3 | 991-2 | 991-1 | 2 | 16 | 65/34 | SJO | 10 | 300 | 1⅝ | 41 | .435 | 11 |
| 991/3-4 | 991/3-3 | 991/3-2 | 991/3-1 | 3 | 16 | 65/34 | SJO | 10 | 300 | 1⅜ | 35 | .330 | 9 |
| 991/4-4 | 991/4-3 | 991/4-2 | — | 4 | 16 | 65/34 | SJO | 10 | 300 | 1¾ | 37 | .365 | 10 |
| 991/5-4 | — | 991/5-2 | — | 5 | 16 | 65/34 | SJO | 8 | 300 | 1½ | 38 | .395 | 11 |
| 991/6-4 | — | 991/6-2 | — | 6 | 16 | 65/34 | SO | 8 | 600 | 2 | 54 | .540 | 14 |
| | | | | | 6/16 | 65/34 | — | 8 | 600 | 2⅛ | 51 | .550 | 14 |
| 991/7-4 | — | 991/7-2 | — | 7 | 1/14 | #16-65/34 | — | #16-8 | | | | | |
| 992/3-4 | — | 992/3-2 | — | 3 | 16 | #14-41/30 | SJO | #14-2 | 600 | 2¼ | 57 | .600 | 15 |
| 992/4-4 | — | 992/4-2 | — | 4 | 16 | 65/34 | SO | 10 | 600 | 1⅞ | 46 | .470 | 12 |
| 993-4 | 993-3 | 993-2 | — | 2 | 14 | 41/30 | SO | 8 | 600 | 1⅞ | 48 | .500 | 13 |
| 993/3-4 | 993/3-3 | 993/3-2 | — | 3 | 14 | 41/30 | SO | 15 | 600 | 2 | 54 | .535 | 14 |
| 993/4-4 | 993/4-3 | 993/4-2 | — | 4 | 14 | 41/30 | SO | 15 | 600 | 2⅛ | 54 | .560 | 14 |
| 994-4 | 994-3 | 994-2 | — | 2 | 12 | 41/30 | SO | 12 | 600 | 2¼ | 57 | .605 | 15 |
| 994/3-4 | 994/3-3 | 994/3-2 | — | 3 | 12 | 65/30 | SO | 20 | 600 | 2¼ | 57 | .605 | 15 |
| 994/4-4 | 994/4-3 | 994/4-2 | — | 4 | 12 | 65/30 | SO | 20 | 600 | 2⅜ | 60 | .635 | 16 |
| | | | | | 12 | 65/30 | SO | 16 | 600 | 2½ | 60 | .665 | 17 |
| | | | | | 2/12 | #12-65/30 | — | #12-17 | | | | | |
| 994/6-4 | — | 994/6-2 | — | 6 | 4/18 | #18-41/34 | — | #18-6 | 600 | 2¼ | 57 | .605 | 15 |
| 994/7-4 | — | 994/7-2 | — | 7 | 12 | 65/30 | — | 16 | 600 | 2⅝ | 67 | .775 | 20 |

‡Wherever UL Type is shown, approved by CSA Testing Laboratories.
*Preferred Put-up.
Standard Package: 5

**Conductor Color Code:** 1-Black, 2-White, 3-Green, 4-Red, 5-Blue, 6-Brown, 7-Yellow.

### RETRACTILE TEST LEAD WIRE

Stretch coiled kinkless test lead wire description. 12" coil — stretches to approximately 6 feet. One conductor #20 stranded copper rubber insulation .165 O.D. Colors: Red, Black.
Coil O.D. ¾".
Working Voltage: 1000V, 4 Amps.

| DABURN No. | Length in. | Size | Strand | Coil O.D. in. | Coil O.D. mm | Cord O.D. in. | Cord O.D. mm |
|---|---|---|---|---|---|---|---|
| 984A | 12 | 20 | 41/36 | ¾ | 19 | .165 | 4.2 |
| 984 | 24 | 20 | 41/36 | ¾ | 19 | .165 | 4.2 |

12" Extends Approx. 6 Ft.
24" Extends Approx. 12 Ft.
Specify Color, Red or Black.
Standard Package: 6

### DABURN MINIATURE RETRACTILE COMMUNICATION CORDS

**1, 2 Ft. Retracted — 5, 10 Ft. Extended**

Miniature size. Suitable for compact equipment. Black plastic jacket overall.
Operating Tem.: −20°C to +60°C
Std. Pkg.: 10

| DABURN No. 2 Ft. | 1 Ft. | Cond. | Size | Strand | Coil O.D. in. | Coil O.D. mm | Cond. O.D. in. | Cond. O.D. mm |
|---|---|---|---|---|---|---|---|---|
| 975/28 | 975/28A | 2 | 28 | 19/40TC | ½ | 13 | .135 | 3.4 |
| 977/28 | 977/28A | 4 | 28 | 19/40TC | ½ | 13 | .150 | 3.8 |

### UL APPROVED RETRACTILE POWER CORD SETS

**18" Retracted — Approx. 9 Ft. Extended — 300V — UL Approved**

For portable use. Mobile and office equipment. Neoprene jacketed cord sets with molded male plug on one end. Operating Voltage: 300 Volts.

| DABURN No. | Cond. | AWG Size | Strand | Type UL | Coil O.D. in. | Coil O.D. mm | Cord O.D. in. | Cord O.D. mm |
|---|---|---|---|---|---|---|---|---|
| 980 | 2 | 18 | 41/34 | SVO | ⅞ | 22 | .250 | 7 |
| 980/3 | 3 | 18 | 41/34 | SVO | 1 | 25 | .275 | 7 |
| 981 | 2 | 18 | 41/34 | SJO | 1⅛ | 30 | .310 | 8 |
| 981/3 | 3 | 18 | 41/34 | SJO | 1⅜ | 35 | .330 | 9 |
| 982 | 2 | 16 | 65/34 | SJO | 1⅜ | 35 | .330 | 9 |
| 982/3 | 3 | 16 | 65/34 | SJO | 1⅛ | 37 | .365 | 10 |

**Conductor Color Code:** 1-Black, 2-White, 3-Green. Standard Package: 10

### RETRACTILE COMMUNICATION CORDS

**Retracted Lengths 2, 3 & 4 Ft. — Extended Lengths 12, 18 & 25 Ft.**

Multi-conductors stranded extra flexible #23 AWG 21/36 tinned soft copper for long flex life. Neoprene or "Danyon" plastic jacketed cable for long life. 120 volt working, current carrying capacity 1 amp. Nom. cond. resist. .022 ohms per linear foot, .185 ohms per retracted foot. For communication equipment such as ham operations, telephone car carriers, radio equipment, head sets, etc.
Operating Temp: −20°C to +60°C
Maximum Voltage: 100V

#### DANYON PLASTIC JACKETED

| DABURN No. - Retracted Lengths 4 Ft.† | 3 Ft. | 2 Ft. | No. Cond. | Size | Strand | Nom. Coil O.D. in. | Nom. Coil O.D. mm | Nom. Cord O.D. in. | Nom. Cord O.D. mm |
|---|---|---|---|---|---|---|---|---|---|
| 975D-4** | 975D-3 | 975D-2 | 2 | 23 | 21/36 | 5/8 | 16 | .220 | 5.6 |
| 976D-4** | 976D-3 | 976D-2 | 3 | 23 | 21/36 | ¾ | 19 | .230 | 5.8 |
| 977D-4** | 977D-3 | 977D-2 | 4 | 23 | 21/36 | ⅞ | 22 | .255 | 6.5 |
| 978D-4** | 978D-3 | 978D-2 | 5 | 23 | 21/36 | 1 | 25 | .265 | 6.7 |
| 978D/6-4** | 978D/6-3 | 978D/6-2 | 6 | 23 | 21/36 | 1⅛ | 29 | .305 | 7.7 |
| 978D/7-4** | 978D/7-3 | 978D/7-2 | 7 | 23 | 21/36 | 1¼ | 30 | .325 | 8.3 |
| 978D/8-4 | 978D/8-3 | 978D/8-2 | 8 | 23 | 21/36 | 1¼ | 32 | .360 | 9.1 |
| 978D/10-4 | 978D/10-3 | 978D/10-2 | 10 | 23 | 21/36 | 1⅜ | 35 | .380 | 9.7 |
| 978D/12-4 | 978D/12-3 | — | 12 | 23 | 21/36 | 1½ | 38 | .390 | 9.9 |
| 978D/15-4** | 978D/15-3 | 978D/15-2 | 15 | 23 | 21/36 | 1⅝ | 41 | .400 | 10.2 |

**Conductor Color Code:** 1-Black, 2-White, 3-Red, 4-Green, 5-Blue, 6-Yellow, 7-Brown, 8-Orange, 9-White/Black Tracer, 10-White/Red Tracer, 11-White/Green Tracer, 12-White/Blue Tracer, 13-White/Yellow Tracer, 14-White/Brown Tracer, 15-White/Orange Tracer.
†Preferred Put-up
**Stocked in Neoprene Jacket; O.D.'s slightly different; Cat. No. omits "D" i.e. 975-4
Standard Package: 5

### RETRACTILE COMMUNICATION CORD

**Prepared — Retracted Length 12" — Extended Length 6 Ft.**

Same as our regular communication cord but each end is prepared, stripped and tinned as indicated.

| DABURN No. | No. Cond. | Size & Strand | Coil O.D. in. | Coil O.D. mm | Cord O.D. in. | Cord O.D. mm | Prepaired |
|---|---|---|---|---|---|---|---|
| 966 | 3 | #23-21/36 | 13/16 | 21 | .220 | 5.6 | **I END:** Length 1½". Conductor stripped and tinned. Other end: Total Length 1½" jacket removed. |
| 967 | 4 | #23-21/36 | 15/16 | 24 | .250 | 6.4 | **I END:** Total length 1". Conductors stripped and tinned. Other end: Total Length 1½" jacket removed. |
| 968 | 5 | #23-21/36 | 1 1/16 | 27 | .285 | 7.2 | **I END:** Total length 4½". Conductors stripped and tinned. Other end: Total length 4½" conds. stripped and tinned. |

**Conductor Color Code:** 1-Black, 2-White, 3-Red, 4-Green, 5-Blue. Standard Package:10

### UL APP'D RETRACTILE COMMUNICATION CORDS

**Retracted Lengths 2, 3, & 4 Ft. — Extended Lengths 10, 15 & 20 Ft.**

Multi-conductor stranded, flexible #22AWG 26/36 tinned soft copper, "Danyon" plastic jacketed cords UL and CSA Approved for 1 Amp, 120V. For use on movable communications equipment where cords must change position or lengths.

| DABURN No. & Retracted Lengths 4 Ft.** | 3 Ft. | 2 Ft. | No. Cond. | Nom. Area Cond. mm² | Nom. O.D. Cable in. | Nom. O.D. Cable mm | Nom. O.D. Coil in. | Nom. O.D. Coil mm |
|---|---|---|---|---|---|---|---|---|
| 875D-4 | 875D-3 | 875D-2 | 2 | .325 | .242 | 6.1 | ⅞ | 22 |
| 876D-4 | 876D-3 | 876D-2 | 3 | .325 | .237 | 6.0 | ¾ | 19 |
| 877D-4 | 877D-3 | 877D-2 | 4 | .325 | .255 | 6.5 | 1⅜ | 24 |
| 878D-4 | 878D-3 | 878D-2 | 5 | .325 | .275 | 7.0 | 1 | 25 |
| 878D/6-4 | 878D/6-3 | 878D/6-2 | 6 | .325 | .295 | 7.5 | 1¼ | 27 |
| 878D 7-4 | 878D/7-3 | 878D/7-2 | 7 | .325 | .315 | 8.0 | 1⅜ | 30 |
| 878D/8-4 | 878D/8-3 | 878D/8-2 | 8 | .325 | .335 | 8.5 | 1¼ | 32 |
| 878D/10-4 | 878D/10-3 | 878D/10-2 | 10 | .325 | .360 | 9.1 | 1⅜ | 35 |
| 878D/12-4 | 878D/12-3 | 878D/12-2 | 12 | .325 | .370 | 9.4 | 1½ | 38 |
| 878D/15-4 | 878D/15-3 | 878D/15-2 | 15 | .325 | .408 | 10.4 | 1⅝ | 41 |

**Conductor Color Code:** 1-Black, 2-White, 3-Red, 4-Green, 5-Orange, 6-Blue, 7-Yellow, 8-Brown, 9-White/Black, 10-Red/Black, 11-Green/Black, 12-Orange/Black, 13-Blue/Black, 14-Yellow/Black, 15-Red/White.

*1 ft. available to order **Preferred Put-up Standard Package: 5

### SHIELDED RETRACTILE COMMUNICATION CORDS

**Retracted Lengths 1, 2 & 4 Ft.— Extended Lengths 6, 12 & 25 Ft.**

Single and multi-conductors. Shielded mike cables. Neoprene or "Danyon" plastic jacketed shielded conductors are individually shielded. Shield can be pigtailed for soldering. Safe — Reliable.

#### DANYON PLASTIC JACKETED

| DABURN No. & Retracted Lengths 4 Ft.† | 2 Ft. | 1 Ft. | No. Cond. | Size | Strand | Nom. Coil O.D. in. | Nom. Coil O.D. mm | Nom. Cord O.D. in. | Nom. Cord O.D. mm | Volt Rating | Capacitance MMF Lin. Ft. | Capacitance MMF Retr. Ft. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 995D-4 | 995D-2 | 995D-1 | 1 | 24(S) | 41/40 | 5/8 | 16 | .160 | 4.1 | 75 | 56 | 440 |
| 999D-4 | 999D-2 | 999D-1 | 2 | 2-23 (Ind. S & J) | 21/36 | ⅞ | 22 | .225 | 5.7 | 100 | 56 | 450 |
| 997D-4 | 997D-2 | 997D-1 | 3 | 2-23<br>1-23(S) | 21/36 | 1⅛ | 29 | .250 | 6.4 | 100 | 56 | 450 |
| 998D-4 | 998D-2 | 998D-1 | 4 | 2-23<br>2-23 (Ind. S & J) | 21/36 | 1⅛ | 29 | .290 | 7.4 | 100 | 56 | 450 |

#### NEOPRENE JACKETED

| DABURN No. & Retracted Lengths 4 Ft. | No. Cond. | Size | Strand | Nom. Coil O.D. in. | Nom. Coil O.D. mm | Nom. Cord O.D. in. | Nom. Cord O.D. mm | Volt Rating | Capacitance Lin. Ft. MMF | Capacitance Retr. Ft. MMF |
|---|---|---|---|---|---|---|---|---|---|---|
| 995-4 | 1 | 24(S) | 41/40 | 5/8 | 16 | .160 | 4.1 | 75 | 56 | 440 |
| 996-4 | 2 | 1-23<br>1-24(S) | 21/36<br>41/40 | ¾ | 19 | .210 | 5.1 | 100<br>75 | 56 | 450 |
| 997-4 | 3 | 2-23<br>1-24(S) | 21/36<br>41/40 | ⅞ | 22 | .240 | 6.1 | 100<br>75 | 56 | 450 |
| 998-4 | 4 | 2-23<br>2-24(S**) | 21/36<br>41/40 | 1 | 25 | .270 | 6.9 | 100<br>75 | 56 | 450 |

**Individually shielded †Preferred Put-up Standard Package: 10 **Conductors Are Color Coded.**

**Additional Shielded & Unshielded Retractile Communication Cables Stocked. Send for Your Own Copy of Our Full Catalog.**

DABURN

# DABURN electronics & cable corp.

WIRE • CABLE • TUBING • MIL/COMM • SWITCHES • ELECTRONIC HARDWARE

## FLAT RIBBON CABLE • TYPES B & C PER MIL-W-16878D•UL FR-1 • STIK KLIPS

**DESCRIPTION:** Each conductor is stranded tinned copper with extruded PVC insulation bonded together to Form A Flat Ribbon Cable. Conductors separate easily for clean terminations with standard wire connectors, jacks and pins. Ribbon cable saves space and time on circuit interconnecting assemblies, wiring harnesses, sliding draws and drop assemblies, and simplifies identification. Resists acid, alkalis, flame, moisture, oil, solvents and fungus. Insulation passes U/L FR-1 Flame Test.

**TEMPERATURE RATING:** −55°C to +105°C.

### SOLID COLOR CODE

Per MIL-W-16878D — TYPE B — 600 V

| DABURN No. | Cond. | Size | Strand | Nom. Wall | Nom. O.D. |
|---|---|---|---|---|---|
| 1805/10 | 10 | 22 | 19/34 | .010″ | .510″ x .051″ |
| 1805/15 | 15 | 22 | 19/34 | .010″ | .765″ x .051″ |
| 1805/20 | 20 | 22 | 19/34 | .010″ | 1.02″ x .051″ |
| 1805/30 | 30 | 22 | 19/34 | .010″ | 1.53″ x .051″ |
| 1806/10 | 10 | 24 | 19/36 | .010″ | .430″ x .043″ |
| 1806/15 | 15 | 24 | 19/36 | .010″ | .645″ x .043″ |
| 1806/20 | 20 | 24 | 19/36 | .010″ | .860″ x .043″ |
| 1806/30 | 30 | 24 | 19/36 | .010″ | 1.30″ x .043″ |
| 1807/10 | 10 | 26 | 7/34 | .010″ | .370″ x .037″ |
| 1807/15 | 15 | 26 | 7/34 | .010″ | .555″ x .037″ |
| 1807/20 | 20 | 26 | 7/34 | .010″ | .740″ x .037″ |
| 1807/30 | 30 | 26 | 7/34 | .010″ | 1.11″ x .037″ |
| 1808/10 | 10 | 28 | 7/36 | .010″ | .340″ x .034″ |
| 1808/15 | 15 | 28 | 7/36 | .010″ | .510″ x .034″ |
| 1808/20 | 20 | 28 | 7/36 | .010″ | .680″ x .034″ |
| 1808/30 | 30 | 28 | 7/36 | .010″ | 1.020″ x .034″ |
| 1809/10 | 10 | 30 | 7/38 | .010″ | .310″ x .031″ |
| 1809/15 | 15 | 30 | 7/38 | .010″ | .465″ x .031″ |
| 1809/20 | 20 | 30 | 7/38 | .010″ | .620″ x .031″ |
| 1809/30 | 30 | 30 | 7/38 | .010″ | .930″ x .031″ |

Per MIL-W-16878D — TYPE C — UL2444

| DABURN No. | Cond. | Size | Strand | Nom. Wall | Nom. O.D. |
|---|---|---|---|---|---|
| 1823/5 | 5 | 22 | 7/30 | .016″ | .065″ x .325″ |
| 1823/10 | 10 | 22 | 7/30 | .016″ | .065″ x .650″ |
| 1823/15 | 15 | 22 | 7/30 | .016″ | .065″ x .975″ |
| 1823/20 | 20 | 22 | 7/30 | .016″ | .065″ x 1.300″ |

**STANDARD PUT-UP:** 100 Ft. Larger P-U's available on request.

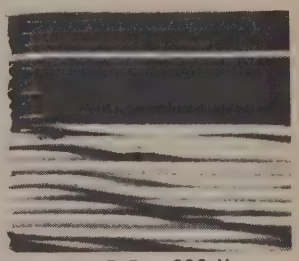
**COLOR CODE:** Solid Colors.

**COLOR CODE:** 1—Brown, 2—Red, 3—Orange, 4—Yellow, 5—Green, 6—Blue, 7—Violet, 8—Gray, 9—White, 10†—Black.

†Beyond 10 conductors, code is repeated.

ADDITIONAL SIZES & TYPES AVAILABLE TO ORDER

### INDIVIDUALLY COLOR CODED WITH STRIPES



Per MIL-W-16878D — TYPE B — 600 V

| DABURN No. | Cond. | Size | Strand | Nom. Wall | Nom. O.D. |
|---|---|---|---|---|---|
| 1804/4 | 4 | 24 | 7/32 | .010″ | .043″ x .172″ |
| 1804/8 | 8 | 24 | 7/32 | .010″ | .043″ x .344″ |
| 1804/12 | 12 | 24 | 7/32 | .010″ | .043″ x .516″ |
| 1804/16 | 16 | 24 | 7/32 | .010″ | .043″ x .688″ |
| 1804/20 | 20 | 24 | 7/32 | .010″ | .043″ x .860″ |

**STD. PUT-UP:** 250 Ft., 500 Ft., 1000 Ft.

**CONDUCTOR COLOR CODE:** Same as noted below for C-22 Series.

Per MIL-W-16878D TYPE C

VOLTAGE RATING: 1000 VOLTS

| DABURN No. | Cond. | Size | Strand | Nom. Wall | Nom. O.D. |
|---|---|---|---|---|---|
| 1822/4 | 4 | 22 | 7/30 | .016″ | .065″ x .260″ |
| 1822/8 | 8 | 22 | 7/30 | .016″ | .065″ x .520″ |
| 1822/12 | 12 | 22 | 7/30 | .016″ | .065″ x .780″ |
| 1822/16 | 16 | 22 | 7/30 | .016″ | .065″ x 1.040″ |
| 1822/20 | 20 | 22 | 7/30 | .016″ | .065″ x 1.300″ |

**STD. PUT-UP:** 250 Ft., 500 Ft., 1000 Ft.

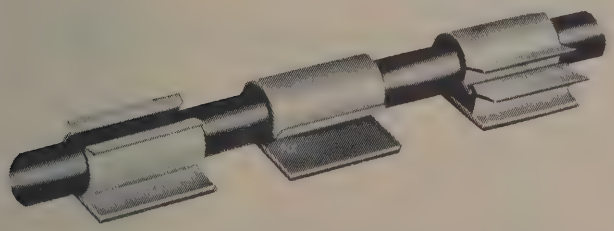
**CONDUCTOR COLOR CODE — INDIVIDUALLY CODED:**

| | | | |
|---|---|---|---|
| 1—White | 6—Lt. Blue | 11—Wh/Black | 16—Wh/Brown |
| 2— Black | 7—Brown | 12—Wh/Red | 17—Wh/Orange |
| 3—Red | 8—Orange | 13—Wh/Green | 18—Wh/Gray |
| 4—Green | 9—Gray | 14—Wh/Yellow | 19—Wh/Violet |
| 5—Yellow | 10—Violet | 15—Wh/Blue | 20—Wh/Blk/Red |

**RIBBON CABLE STIK KLIPS AVAILABLE FROM STOCK**

## STIK KLIPS™ • TENSION CLIPS • COMPONENT CLIPS

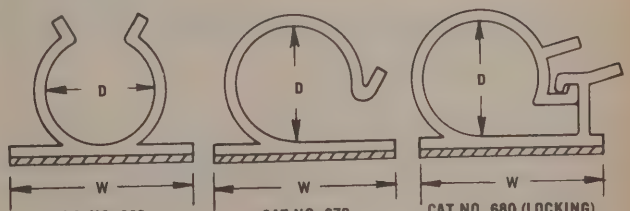
### DABURN STIK KLIPS™ — SELF ADHESIVE



For fast secure mounting on smooth surfaces. No need to screw, nail or staple in place. Fastens in a flash — just peel off the protective backing and press in place on a clean, dry surface. For best results allow a few seconds for adhesive to set before applying load.

These plastic clips are insulating, strong and elastic. They have many uses, such as keeping telephone wires off the floor, holding wire, cable, tubing, rods, etc. in position.

Material: PVC
Color: Gray
Temp. Range: −10°F to +175°F




CAT. NO. 660 | CAT NO. 670 | CAT NO. 680 (LOCKING)

| DABURN Cat. No. | D | W | Std. Pkg. |
|---|---|---|---|
| 660-⅛ | ⅛″ | ¾″ | 100, 1000 |
| 660-¼ | ¼″ | ¾″ | 100, 1000 |
| 660-⅜ | ⅜″ | ¾″ | 100, 1000 |
| 660-½ | ½″ | 1″ | 100, 1000 |
| 660-¾ | ¾″ | 1″ | 100, 1000 |
| 670-⅛ | ⅛″ | ¾″ | 100, 1000 |
| 670-¼ | ¼″ | ¾″ | 100, 1000 |
| 670-⅜ | ⅜″ | ¾″ | 100, 1000 |
| 670-½ | ½″ | 1″ | 100, 1000 |
| 670-¾ | ¾″ | 1″ | 100, 1000 |
| 680-¼ | ¼″ | ¾″ | 100, 1000 |
| 680-½ | ½″ | 1″ | 100, 1000 |
| 680-¾ | ¾″ | 1″ | 100, 1000 |

**ADDITIONAL STIK KLIPS CONSTRUCTIONS ARE AVAILABLE FROM STOCK**
**SEND FOR OUR COMPLETE FASTENING DEVICES CATALOG**

DABURN ELECTRONICS & CABLE CORP. • 2360A HOFFMAN ST., BRONX, N.Y. 10458 (212) 295-0050 TWX 710-593-4145

# DEARBORN WIRE AND CABLE

**We Stock one of the most comprehensive inventories of wire, cable and insulation in the United States. In most cases we can ship your needs within 24 hours.**

Dearborn will also custom fabricate to your specifications. Our services include Special Cables, Neoprene Jacketing, Striping, Marking, Numbering, Lettering, Cutting and Stripping, Terminating, Harness Assemblies, Molded Plugs and Cord Sets, and Cabling. Any combination of conductors with special braids or shields can be made into a cable to your exact requirements by our special order department. We will be pleased to quote on your blueprints, sketches, or job specifications.

**Yes. We Have It!** The vast selection of merchandise listed on the following pages represents only a partial amount of the thousands of wire, cable and insulation items stocked by Dearborn.

Our 52 page catalog will give you full details on the complete Dearborn line. Send for it, or call us for information on stock or special constructions.

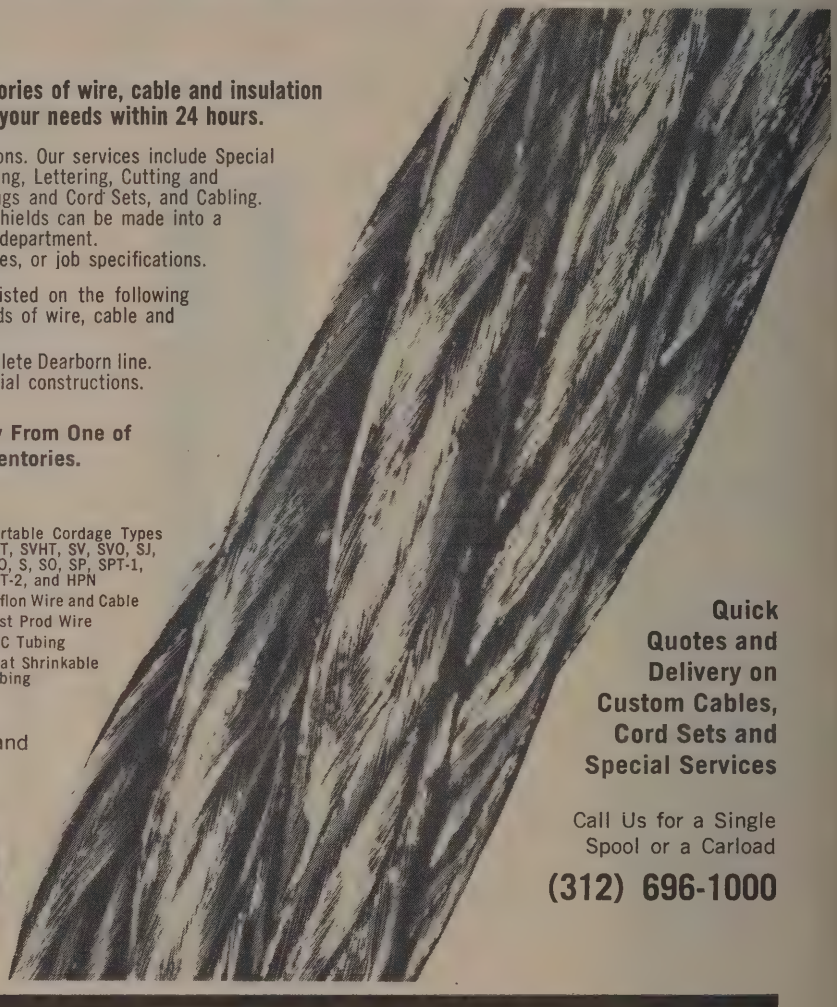
**Remember, Dearborn Offers Immediate Delivery From One of the Industry's Most Complete Wire & Cable Inventories.**

**MIL-SPEC, U.L. AND CSA APPROVED**

- Aircraft Wire
- Appliance Wire
- Audio Cable
- Automotive Wire
- Coaxial Cable
- Computer Cable
- Control Cable
- Foil Shielded Cable
- Hookup Wire
- Instrumentation Cable
- Intercom Cable
- Kynar Hookup Wire
- Lacing Cord and Twine
- Microphone Cable
- Replacement Cords
- Retractile Cords
- Portable Cordage Types SVT, SVHT, SV, SVO, SJ, SJO, S, SO, SP, SPT-1, SPT-2, and HPN
- Teflon Wire and Cable
- Test Prod Wire
- PVC Tubing
- Heat Shrinkable Tubing

Call or Write for New Engineering Data Guide and Full Line Catalog.

YOUR FULL SERVICE SOURCE
DEARBORN
FOR WIRE CABLE, INSULATION



**Quick Quotes and Delivery on Custom Cables, Cord Sets and Special Services**

Call Us for a Single Spool or a Carload

**(312) 696-1000**

## Product Index For eem Pages


| | Page |
|---|---|
| Aircraft Wire & Cable | 10 |
| Appliance & Fixture Wire | |
| AA, AF; Asbestos Insulated Hookup Wire | 15 |
| Braidless Silicone Hookup Wire | 15 |
| Silicone, Glass Braid Hookup Wire | 15 |
| Lacquered Cotton Braid, Hookup Wire | 15 |
| Audio Cables | |
| Foil Shielded, Plastic Jacketed | 7 |
| Individually Shielded, Multi-Conductor, Plastic Jacketed | 7 |
| Shielded Audio Cables, Plastic Jacket | 6 |
| Shielded Audio Cables, Rubber Jacket | 2 |
| Shielded Audio Cables, Neoprene Jacket | 2 |
| Unshielded Multi-Conductor, Plastic Jacket | 5 |
| Unshielded Multi-Conductor, Rubber Jacket | 6 |
| Unshielded Paired Cables, Plastic Jacket | 5 |
| Automotive Wire | 12 |
| Braid — Flat, Oval & Round | 9 |
| Bus Bar Wire | 9 |
| Business Machine Wire & Cable | 13 |
| Circuit Monitor | 8 |
| Coaxial Cable | 11 |
| Computer Cables, U.L. | |
| Multi-Conductor, Unshielded | 2 |
| Multi-Conductor, Shielded | 2 |
| Pairs, Unshielded | 2 |
| Pairs, Shielded | 2 |
| Control Cables | 7 |
| Cordage, U.L. and CSA | 12 |
| Cords & Cord Sets | 6 |
| Hookup Wire, U.L. | |
| 1007 | 13 |
| 1009 | 15 |
| 1015-TEW | 13 |
| 1028 | 13 |
| 1061 | 13 |
| 1429 | 3 |
| 1430 | 3 |
| 1283 | 13 |
| 1284 | 13 |
| Irradiated Hookup Wire | 3 |
| Kynar | 5 |
| Lacing Cord | 9 |
| Microphone Cables | 6 |
| Multi-Conductor Cables | 2, 5,6, 7 |
| Neoprene Jacketed Control Cables | 7 |
| S, SJ, SJT, SO, SVO, SV, SVT, SPT and HPN Cordage | 12 |
| Teflon | |
| Cables Shielded | 4 |
| Wire & Cables, U.L. and CSA | 14 |
| Welding & Welding Supply Cable | 12 |
| Tubing | |
| MIL-SPEC Tubing | 8 |
| Heat Shrinkable Tubing | 8 |
| PVC Tubing | 8 |
| Teflon Tubing | 8 |


**DEARBORN WIRE AND CABLE CO.** DEPT. EM, 9299 EVENHOUSE AVE., ROSEMONT, ILLINOIS 60018

All Phones: (312) 696-1000 • Our TWX Number is 910-253-0343 (DEARBORN RSMT)

# DEARBORN WIRE AND CABLE COMPANY

# Multi-conductor Shielded and Unshielded Control Cables

**• RUBBER • NEOPRENE • PLASTIC**

### RUBBER — UNSHIELDED

Stranded tinned copper conductors, color coded rubber insulation. Cabled with fillers; cotton wrapped; tough rubber jacket overall. These cables are extremely flexible and are suitable for heavy duty usage. **Temperature rating:** −20°C to +60°C. Insulation thickness on individual conductors is .020″.

### RUBBER — SHIELDED

**RUBBER JACKETED.** Conductors of stranded tinned copper, with color coded .020″ rubber insulation*. Cabled with fillers; cotton wrapped; braided tinned copper shield. Cotton wrap and tough black rubber jacket overall. Used for control circuit, studios, audio circuits, etc., where shielded cable is necessary. **Temperature rating:** −20° to +60°C.
* .040 on single conductor.

### PLASTIC SHIELDED

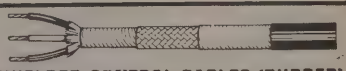
**PLASTIC JACKETED.** Conductors of stranded tinned copper, with color coded .014″ thick Polythylene insulation. Cabled with fillers; wrapped with rayon; shielded with braided tinned copper shield. Covered with chrome grey Polyvinylchloride jacket overall. **Temperature rating:** −20°C to +60°C. **Operating voltage:** 600 volts.

### NEOPRENE — SHIELDED

**NEOPRENE JACKETED.** Stranded tinned copper conductors, with color coded .020″ rubber insulation*. Cabled with fillers; cotton wrapped; braided tinned copper shield. Cotton wrap and tough black neoprene jacket overall. Used for control circuits, studios, audio circuits, etc., where shielded cable is necessary. **Temperature rating:** −20°C to +60°C
* .040 on single conductor.

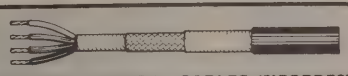
### UNSHIELDED CONTROL CABLES (RUBBER)

| DEARBORN NO. | NO. COND. | SIZE OF COND. AWG | STRAND-ING | NOM. JKT. THICK. | NOM. O.D. | STOCK PUT UP (FT.) |
|---|---|---|---|---|---|---|
| 652002 | 2 | 20 | 26/34 | .035 | .240 | 100, 500 & 1000 |
| 652003 | 3 | 20 | 26/34 | .035 | .255 | 100, 500 & 1000 |
| 652004 | 4 | 20 | 26/34 | .035 | .275 | 100, 500 & 1000 |
| 652005 | 5 | 20 | 26/34 | .035 | .300 | 100, 500 & 1000 |
| 652006 | 6 | 20 | 26/34 | .035 | .315 | 100, 500 & 1000 |
| 652007 | 7 | 20 | 26/34 | .035 | .325 | 100, 500 & 1000 |
| 652008 | 8 | 20 | 26/34 | .035 | .360 | 100, 500 & 1000 |
| 652010 | 10 | 20 | 26/34 | .035 | .410 | 100, 500 & 1000 |
| 652012 | 12 | 20 | 26/34 | .035 | .435 | 100, 500 & 1000 |
| 652015 | 15 | 20 | 26/34 | .035 | .505 | 100, 500 & 1000 |
| 652020 | 20 | 20 | 26/34 | .035 | .570 | 100, 500 & 1000 |



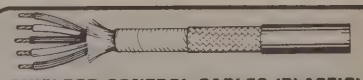
### SHIELDED CONTROL CABLES (RUBBER)

| DEARBORN NO. | NO. COND. | SIZE OF COND. AWG | STRAND-ING | NOM. JKT. THICK. | NOM. O.D. | STOCK PUT UP (FT.) |
|---|---|---|---|---|---|---|
| 661801 | 1 | 18 | 41/34 | .035 | .240 | 100, 500 & 1000 |
| 661802 | 2 | 18 | 41/34 | .035 | .295 | 100, 500 & 1000 |
| 662001 | 1 | 20 | 26/34 | .035 | .230 | 100, 500 & 1000 |
| 662002 | 2 | 20 | 26/34 | .035 | .270 | 100, 500 & 1000 |
| 662003 | 3 | 20 | 26/34 | .035 | .285 | 100, 500, & 1000 |
| 662004 | 4 | 20 | 26/34 | .035 | .305 | 100, 500 & 1000 |
| 662005 | 5 | 20 | 26/34 | .035 | .330 | 100, 500 & 1000 |
| 662006 | 6 | 20 | 26/34 | .035 | .345 | 100, 500 & 1000 |
| 662007 | 7 | 20 | 26/34 | .035 | .355 | 100, 500 & 1000 |
| 662008 | 8 | 20 | 26/34 | .035 | .385 | 100, 500 & 1000 |
| 662010 | 10 | 20 | 26/34 | .035 | .440 | 100, 500 & 1000 |
| 662012 | 12 | 20 | 26/34 | .065 | .525 | 100, 500 & 1000 |
| 662015 | 15 | 20 | 26/34 | .065 | .595 | 100, 500 & 1000 |
| 662020 | 20 | 20 | 26/34 | .065 | .660 | 100, 500 & 1000 |



### SHIELDED CONTROL CABLES (NEOPRENE)

| DEARBORN NO. | NO. COND. | SIZE OF COND. AWG | STRAND-ING | NOM. JKT. THICK. | NOM. O.D. | STOCK PUT UP (FT.) |
|---|---|---|---|---|---|---|
| 601801 | 1 | 18 | 41/34 | .035 | .240 | 100, 500 & 1000 |
| 601802 | 2 | 18 | 41/34 | .035 | .295 | 100, 500 & 1000 |
| 601803 | 3 | 18 | 41/34 | .035 | .305 | 100, 500 & 1000 |
| 601804 | 4 | 18 | 41/34 | .035 | .330 | 100, 500 & 1000 |
| 601806 | 6 | 18 | 41/34 | .035 | .370 | 100, 500 & 1000 |
| 601808 | 8 | 18 | 41/34 | .035 | .420 | 100, 500 & 1000 |
| 601810 | 10 | 18 | 41/34 | .035 | .480 | 100, 500 & 1000 |
| 601812 | 12 | 18 | 41/34 | .065 | .555 | 100, 500 & 1000 |
| 601815 | 15 | 18 | 41/34 | .065 | .640 | 100, 500 & 1000 |
| 601820 | 20 | 18 | 41/34 | .065 | .730 | 100, 500 & 1000 |



### SHIELDED CONTROL CABLES (PLASTIC)

| DEARBORN NO. | NO. COND | SIZE OF COND AWG | STRAND-ING | NOM. JKT. THICK. | NOM. O.D. | STOCK PUT UP (FT.) |
|---|---|---|---|---|---|---|
| 682002 | 2 | 20 | 26/34 | .030 | .245 | 100, 500 & 1000 |
| 682003 | 3 | 20 | 26/34 | .035 | .250 | 100, 500 & 1000 |
| 682004 | 4 | 20 | 26/34 | .035 | .260 | 100, 500 & 1000 |
| 682005 | 5 | 20 | 26/34 | .035 | .275 | 100, 500 & 1000 |
| 682006 | 6 | 20 | 26/34 | .035 | .300 | 100, 500 & 1000 |
| 682008 | 8 | 20 | 26/34 | .035 | .330 | 100, 500 & 1000 |
| 682010 | 10 | 20 | 26/34 | .035 | .375 | 100, 500 & 1000 |
| 682012 | 12 | 20 | 26/34 | .035 | .380 | 100, 500 & 1000 |
| 682015 | 15 | 20 | 26/34 | .035 | .410 | 100, 500 & 1000 |
| 682020 | 20 | 20 | 26/34 | .035 | .455 | 100,500 & 1000 |

**COLOR CODE:** 1—Black • 2—White • 3—Red • 4—Green • 5—Yellow • 6—Blue • 7—Brown • 8—Orange • 9—Slate • 10—Purple • 11—White/Black • 12—White/Red • 13—White/Green • 14—White/Yellow • 15—White/Blue • 16—White/ Brown • 17—White/Purple • 18—White/Slate • 19—Black/Red • 20—Black/Yellow

# Computer Type Control Cables Miniature Styles 2343 and 2344

The cables listed below, either cabled pairs or multiconductor (not paired), with or without shield are suited for computer use.

The individual conductors are stranded tinned copper. Numbers 22, 24 are 7 strand, No. 20 is 19 strand. Insulated with .010″ wall of PVC to MIL-W-16878D Type B. On this usage, conductors are rated 105°C and 600 V. working voltage. The conductors also meet UL Style 1061, rated 80°C, 300 V. working voltage.

Conductors are cabled by the planetary method and laid contrahelically for best flexibility, with a Mylar tape barrier placed under shields. All shielded cables are of tinned copper braid overall of 85% - 90% coverage per MIL-C-7078.

The jacket over the shield is black 105°C Vinyl per MIL-I-631 Type F. All materials are fungus resistant and self extinguishing.

All items approved under UL STYLE 2343 or 2344* for computer usage: +80°C, 300 volts. On non-UL service can be used at 40°C to +105°C, 600 volts.

### MULTI-CONDUCTOR UNSHIELDED CABLES

| DEARBORN NO. | NO. OF COND. | COND. SIZE | COND. O.D. | JACKET WALL | NOM. O.D. | PUT UP (FT.) |
|---|---|---|---|---|---|---|
| 562405 | 5 | 24 | .044 | .062 | .220 | 500, 1000 |
| 562407 | 7 | 24 | .044 | .062 | .250 | 500, 1000 |
| 562412 | 12 | 24 | .044 | .062 | .300 | 500, 1000 |
| 562415 | 15 | 24 | .044 | .062 | .330 | 500, 1000 |
| 562419 | 19 | 24 | .044 | .062 | .340 | 500, 1000 |
| 562427 | 27 | 24 | .044 | .062 | .390 | 500, 1000 |
| 562437 | 37 | 24 | .044 | .062 | .420 | 500, 1000 |
| 562448 | 48 | 24 | .044 | .062 | .470 | 500, 1000 |
| 562460 | 60 | 24 | .044 | .062 | .510 | 500, 1000 |
| 562205 | 5 | 22 | .050 | .062 | .200 | 500, 1000 |
| 562207 | 7 | 22 | .050 | .062 | .270 | 500, 1000 |
| 562212 | 12 | 22 | .050 | .062 | .330 | 500, 1000 |
| 562215 | 15 | 22 | .050 | .062 | .350 | 500, 1000 |
| 562219 | 19 | 22 | .050 | .062 | .370 | 500, 1000 |
| 562227 | 27 | 22 | .050 | .062 | .430 | 500, 1000 |
| 562237 | 37 | 22 | .050 | .062 | .480 | 500, 1000 |
| 562248 | 48 | 22 | .050 | .062 | .530 | 500, 1000 |
| 562260 | 60 | 22 | .050 | .062 | .570 | 500, 1000 |
| 562005 | 5 | 20 | .058 | .062 | .275 | 500, 1000 |
| 562007 | 7 | 20 | .058 | .062 | .290 | 500, 1000 |
| 562012 | 12 | 20 | .058 | .062 | .360 | 500, 1000 |
| 562015 | 15 | 20 | .058 | .062 | .390 | 500, 1000 |
| 562019 | 19 | 20 | .058 | .062 | .410 | 500, 1000 |
| 562027 | 27 | 20 | .058 | .062 | .490 | 500, 1000 |
| 562037 | 37 | 20 | .058 | .062 | .520 | 500, 1000 |
| 562048 | 48 | 20 | .058 | .062 | .580 | 500, 1000 |
| 562060 | 60 | 20 | .058 | .062 | .640 | 500, 1000 |

### PAIRED CABLES, UNSHIELDED

| DEARBORN NO. | NO. OF PAIRS | COND. SIZE | COND. O.D. | JACKET WALL | NOM. O.D. | PUT UP (FT.) |
|---|---|---|---|---|---|---|
| 582405 | 5 | 24 | .044 | .062 | .330 | 500, 1000 |
| 582407 | 7 | 24 | .044 | .062 | .350 | 500, 1000 |
| 582412 | 12 | 24 | .044 | .062 | .435 | 500, 1000 |
| 582415 | 15 | 24 | .044 | .062 | .485 | 500, 1000 |
| 582419 | 19 | 24 | .044 | .062 | .505 | 500, 1000 |
| 582427 | 27 | 24 | .044 | .062 | .590 | 500, 1000 |
| 582437 | 37 | 24 | .044 | .062 | .660 | 500, 1000 |
| 582448 | 48 | 24 | .044 | .062 | .745 | 500, 1000 |
| 582460 | 60 | 24 | .044 | .062 | .815 | 500, 1000 |
| 582205 | 5 | 22 | .050 | .062 | .365 | 500, 1000 |
| 582207 | 7 | 22 | .050 | .062 | .390 | 500, 1000 |
| 582212 | 12 | 22 | .050 | .062 | .470 | 500, 1000 |
| 582215 | 15 | 22 | .050 | .062 | .545 | 500, 1000 |
| 582219 | 19 | 22 | .050 | .062 | .560 | 500, 1000 |
| 582227 | 27 | 22 | .050 | .062 | .600 | 500, 1000 |
| 582237 | 37 | 22 | .050 | .062 | .750 | 500, 1000 |
| *582248 | 48 | 22 | .050 | .062 | .850 | 500, 1000 |
| *582260 | 60 | 22 | .050 | .062 | .980 | 500, 1000 |
| 582005 | 5 | 20 | .058 | .062 | .395 | 500, 1000 |
| 582007 | 7 | 20 | .058 | .062 | .440 | 500, 1000 |
| 582012 | 12 | 20 | .058 | .062 | .540 | 500, 1000 |
| 582015 | 15 | 20 | .058 | .062 | .600 | 500, 1000 |
| 582019 | 19 | 20 | .058 | .062 | .630 | 500, 1000 |
| 582027 | 27 | 20 | .058 | .062 | .745 | 500, 1000 |
| *582037 | 37 | 20 | .058 | .062 | .820 | 500, 1000 |
| *582048 | 48 | 20 | .058 | .080 | .950 | 500, 1000 |
| *582060 | 60 | 20 | .058 | .080 | 1.040 | 500, 1000 |

### MULTI-CONDUCTOR, OVERALL SHIELDED CABLES

| DEARBORN NO. | NO. OF COND. | COND. SIZE | COND. O.D. | JACKET WALL | NOM. O.D. | PUT UP (FT.) |
|---|---|---|---|---|---|---|
| 572405 | 5 | 24 | .044 | .062 | .245 | 500, 1000 |
| 572407 | 7 | 24 | .044 | .062 | .275 | 500, 1000 |
| 572412 | 12 | 24 | .044 | .062 | .325 | 500, 1000 |
| 572415 | 15 | 24 | .044 | .062 | .350 | 500, 1000 |
| 572419 | 19 | 24 | .044 | .062 | .365 | 500, 1000 |
| 572427 | 27 | 24 | .044 | .062 | .415 | 500, 1000 |
| 572437 | 37 | 24 | .044 | .062 | .445 | 500, 1000 |
| 572448 | 48 | 24 | .044 | .062 | .495 | 500, 1000 |
| 572460 | 60 | 24 | .044 | .062 | .535 | 500, 1000 |
| 572205 | 5 | 22 | .050 | .062 | .285 | 500, 1000 |
| 572207 | 7 | 22 | .050 | .062 | .295 | 500, 1000 |
| 572212 | 12 | 22 | .050 | .062 | .355 | 500, 1000 |
| 572215 | 15 | 22 | .050 | .062 | .380 | 500, 1000 |
| 572219 | 19 | 22 | .050 | .062 | .395 | 500, 1000 |
| 572227 | 27 | 22 | .050 | .062 | .455 | 500, 1000 |
| 572237 | 37 | 22 | .050 | .062 | .510 | 500, 1000 |
| 572248 | 48 | 22 | .050 | .062 | .560 | 500, 1000 |
| 572260 | 60 | 22 | .050 | .062 | .600 | 500, 1000 |
| 572005 | 5 | 20 | .058 | .062 | .300 | 500, 1000 |
| 572007 | 7 | 20 | .058 | .062 | .315 | 500, 1000 |
| 572012 | 12 | 20 | .058 | .062 | .385 | 500, 1000 |
| 572015 | 15 | 20 | .058 | .062 | .415 | 500, 1000 |
| 572019 | 19 | 20 | .058 | .062 | .435 | 500, 1000 |
| 572027 | 27 | 20 | .058 | .062 | .515 | 500, 1000 |
| 572037 | 37 | 20 | .058 | .062 | .550 | 500, 1000 |
| 572048 | 48 | 20 | .058 | .062 | .610 | 500, 1000 |
| 572060 | 60 | 20 | .058 | .062 | .670 | 500, 1000 |

### PAIRED CABLES WITH OVERALL SHIELD

| DEARBORN NO. | NO. OF PAIRS | COND. SIZE | COND. O.D. | JACKET WALL | NOM. O.D. | PUT UP (FT.) |
|---|---|---|---|---|---|---|
| 592405 | 5 | 24 | .044 | .062 | .355 | 500, 1000 |
| 592407 | 7 | 24 | .044 | .062 | .375 | 500, 1000 |
| 592412 | 12 | 24 | .044 | .062 | .460 | 500, 1000 |
| 592415 | 15 | 24 | .044 | .062 | .510 | 500, 1000 |
| 592419 | 19 | 24 | .044 | .062 | .530 | 500, 1000 |
| 592427 | 27 | 24 | .044 | .062 | .620 | 500, 1000 |
| 592437 | 37 | 24 | .044 | .062 | .690 | 500, 1000 |
| 592448 | 48 | 24 | .044 | .062 | .775 | 500, 1000 |
| *592460 | 60 | 24 | .044 | .062 | .845 | 500, 1000 |
| 592205 | 5 | 22 | .050 | .062 | .390 | 500, 1000 |
| 592207 | 7 | 22 | .050 | .062 | .415 | 500, 1000 |
| 592212 | 12 | 22 | .050 | .062 | .495 | 500, 1000 |
| 592215 | 15 | 22 | .050 | .062 | .575 | 500, 1000 |
| 592219 | 19 | 22 | .050 | .062 | .580 | 500, 1000 |
| 592227 | 27 | 22 | .050 | .062 | .670 | 500, 1000 |
| 592237 | 37 | 22 | .050 | .062 | .780 | 500, 1000 |
| *592248 | 48 | 22 | .050 | .062 | .880 | 500, 1000 |
| *592260 | 60 | 22 | .050 | .062 | .960 | 500, 1000 |
| 592005 | 5 | 20 | .058 | .062 | .420 | 500, 1000 |
| 592007 | 7 | 20 | .058 | .062 | .465 | 500, 1000 |
| 592012 | 12 | 20 | .058 | .062 | .570 | 500, 1000 |
| 592015 | 15 | 20 | .058 | .062 | .630 | 500, 1000 |
| 592019 | 19 | 20 | .058 | .062 | .660 | 500, 1000 |
| 592027 | 27 | 20 | .058 | .062 | .775 | 500, 1000 |
| *592037 | 37 | 20 | .058 | .080 | .850 | 500, 1000 |
| *592048 | 48 | 20 | .058 | .080 | .980 | 500, 1000 |
| *592060 | 60 | 20 | .058 | .080 | 1.070 | 500, 1000 |

**Color Code:** Ten solid colors and white with stripes per MIL-STD-681

**DEARBORN WIRE AND CABLE CO.** Dept. EM, 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

# DEARBORN WIRE AND CABLE COMPANY

### 105°C TYPE B, 600 VOLT

| DEARBORN NO. | MIL TYPE | SIZE | STRANDING | NOM. O.D. | WALL THICKNESS | STOCK COLORS |
|---|---|---|---|---|---|---|
| 173207 | B-32 | 32 | 7/40 | .028 | .010 | 0-9 |
| 173007 | B-30 | 30 | 7/38 | .032 | .010 | 0-9 |
| 172807 | B-28 | 28 | 7/36 | .034 | .010 | 0-9 & 90-98 |
| 172607 | B-26 | 26 | 7/34 | .038 | .010 | 0-9 & 90-98 |
| 172619 | B-26 | 26 | 19/38 | .038 | .010 | 0-9 & 90-98 |
| 172407 | B-24 | 24 | 7/32 | .044 | .010 | 0-9 & 90-98 |
| 172419 | B-24 | 24 | 19/36 | .044 | .010 | 0-9 & 90-98 |
| 172207 | B-22 | 22 | 7/30 | .051 | .010 | 0-9 & 90-98 |
| 172219 | B-22 | 22 | 19/34 | .051 | .010 | 0-9 & 90-98 |
| 172007 | B-20 | 20 | 7/28 | .058 | .010 | 0-9 & 90-98 |
| 172019 | B-20 | 20 | 19/32 | .058 | .010 | 0-9 & 90-98 |
| 171807 | B-18 | 18 | 7/26 | .068 | .010 | 0-9 & 90-98 |
| 171819 | B-18 | 18 | 19/30 | .068 | .010 | 0-9 & 90-98 |
| 171619 | B-16 | 16 | 19/29 | .077 | .010 | 0-9 & 90-98 |
| 171419 | B-14 | 14 | 19/27 | .091 | .010 | 0-9 & 90-98 |

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

### 105°C TYPE B, BONDED CONDUCTOR, 600V.

| DEARBORN NO. | MIL TYPE | SIZE | STRANDING | NOM. O.D. | WALL THICKNESS | STOCK COLORS |
|---|---|---|---|---|---|---|
| 192407 | B-24 | 24 | 7/32 | .043 | .010 | 0-9 & 90-98 |
| 192207 | B-22 | 22 | 7/30 | .050 | .010 | 0-9 & 90-98 |
| 192007 | B-20 | 20 | 7/28 | .058 | .010 | 0-9 & 90-98 |
| 191807 | B-18 | 18 | 7/26 | .068 | .010 | 0-9 & 90-98 |

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

### 115°C TYPE B, NYLON JACKET (.003"), 600 V.

| DEARBORN NO. | MIL TYPE | SIZE | STRANDING | NOM. O.D. | WALL THICKNESS | STOCK COLORS |
|---|---|---|---|---|---|---|
| 183207 | B-32 | 32 | 7/40 | .035 | .010 | 0-9 & 90-98 |
| 183007 | B-30 | 30 | 7/38 | .039 | .010 | 0-9 & 90-98 |
| 182807 | B-28 | 28 | 7/36 | .041 | .010 | 0-9 & 90-98 |
| 182607 | B-26 | 26 | 7/34 | .044 | .010 | 0-9 & 90-98 |
| 182619 | B-26 | 26 | 19/38 | .044 | .010 | 0-9 & 90-98 |
| 182407 | B-24 | 24 | 7/32 | .050 | .010 | 0-9 & 90-98 |
| 182419 | B-24 | 24 | 19/36 | .050 | .010 | 0-9 & 90-98 |
| 182207 | B-22 | 22 | 7/30 | .057 | .010 | 0-9 & 90-98 |
| 182219 | B-22 | 22 | 19/34 | .057 | .010 | 0-9 & 90-98 |
| 182007 | B-20 | 20 | 7/28 | .064 | .010 | 0-9 & 90-98 |
| 182019 | B-20 | 20 | 19/32 | .064 | .010 | 0-9 & 90-98 |
| 181807 | B-18 | 18 | 7/26 | .074 | .010 | 0-9 & 90-98 |
| 181819 | B-18 | 18 | 19/30 | .074 | .010 | 0-9 & 90-98 |
| 181619 | B-16 | 16 | 19/29 | .085 | .010 | 0-9 & 90-98 |
| 181419 | B-14 | 14 | 19/27 | .099 | .010 | 0-9 & 90-98 |

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

## MIL-SPEC MIL-W-16878D Hookup Wire Types B & C

**Single conductor, stranded tinned copper**

**TYPE B**
Insulation PVC .010" wall thickness, color coded. **Temperature rating:** −55°C to +105°C. **Voltage rating:** 600 volts.

**TYPE B — NYLON**
Same as above but with clear nylon jacket (.003" wall) over PVC insulation increasing temperature rating to +115°C.

**TYPE B — PREBONDED**
Double tinned strands are heated which fuses the individual strands together in order to prevent fraying. Allows easy stripping and insertion in holes in lugs, circuit boards, etc. Color coded .010" PVC insulation to MIL-W-16878D. **Temperature rating:** −55°C to +105°C. **Voltage rating:** 600 volts.

**TYPE C**
Insulation PVC .017" wall thickness. **Temperature rating:** −55°C to +105°C. **Voltage rating:** 1000 volts.

**TYPE C — NYLON**
Same as above but with clear nylon jacket which increases temperature rating to +115°C.

**TYPE C — SHIELD AND NYLON JACKET**
Basic type C with 90% coverage braided tinned copper shield and clear nylon .005" jacket overall.

**COLOR CODE ON HOOKUP WIRE:** 0—Black • 1—Brown • 2—Red • 3—Orange • 4—Yellow • 5—Green • 6—Blue • 7—Violet • 8—Grey • 9—White • 90—White/Black • 91—White/Brown • 92—White/Red • 93—White/Orange • 94—White/Yellow • 95—White/Green • 96—White/Blue • 97—White/Violet • 98—White/Gray

OTHER COLORS AND STRIPE COMBINATIONS AVAILABLE UPON REQUEST

### 105°C TYPE C, 1000 VOLT

| DEARBORN NO. | MIL TYPE | SIZE | STRANDING | NOM. O.D. | WALL THICKNESS | STOCK COLORS |
|---|---|---|---|---|---|---|
| 202407 | C-24 | 24 | 7/32 | .058 | .017 | 0-9 & 90-98 |
| 202419 | C-24 | 24 | 19/36 | .058 | .017 | 0-9 & 90-98 |
| 202207 | C-22 | 22 | 7/30 | .065 | .017 | 0-9 & 90-98 |
| 202219 | C-22 | 22 | 19/34 | .065 | .017 | 0-9 & 90-98 |
| 202007 | C-20 | 20 | 7/28 | .072 | .017 | 0-9 & 90-98 |
| 202019 | C-20 | 20 | 19/32 | .072 | .017 | 0-9 & 90-98 |
| 201807 | C-18 | 18 | 7/26 | .082 | .017 | 0-9 & 90-98 |
| 201819 | C-18 | 18 | 19/30 | .082 | .017 | 0-9 & 90-98 |
| 201619 | C-16 | 16 | 19/29 | .092 | .017 | 0-9 & 90-98 |
| 201419 | C-14 | 14 | 19/27 | .105 | .017 | 0-9 & 90-98 |

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

### 115°C TYPE C, NYLON JACKET (.003"), 1000 V.

| DEARBORN NO. | MIL TYPE | GAUGE SIZE | STRANDING | NOM. O.D. | WALL THICKNESS | STOCK COLORS |
|---|---|---|---|---|---|---|
| 212407 | C-24 | 24 | 7/32 | .064 | .017 | 0-9 & 90-98 |
| 212419 | C-24 | 24 | 19/36 | .064 | .017 | 0-9 & 90-98 |
| 212207 | C-22 | 22 | 7/30 | .071 | .017 | 0-9 & 90-98 |
| 212219 | C-22 | 22 | 19/34 | .071 | .017 | 0-9 & 90-98 |
| 212007 | C-20 | 20 | 7/28 | .079 | .017 | 0-9 & 90-98 |
| 212019 | C-20 | 20 | 19/32 | .079 | .017 | 0-9 & 90-98 |
| 211807 | C-18 | 18 | 7/26 | .090 | .017 | 0-9 & 90-98 |
| 211819 | C-18 | 18 | 19/30 | .090 | .017 | 0-9 & 90-98 |
| 211619 | C-16 | 16 | 19/29 | .100 | .017 | 0-9 & 90-98 |
| 211419 | C-14 | 14 | 19/27 | .113 | .017 | 0-9 & 90-98 |

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

### 115°C TYPE C, SHIELDED, NYLON JACKET, 1000 V.

| DEARBORN NO. | MIL TYPE | GAUGE SIZE | STRANDING | NOM. O.D. | WALL THICKNESS | STOCK COLORS |
|---|---|---|---|---|---|---|
| 222407 | C-24 | 24 | 7/32 | .086 | .017 | 9 Only |
| 222207 | C-22 | 22 | 7/30 | .093 | .017 | 9 Only |
| 222007 | C-20 | 20 | 7/28 | .102 | .017 | 9 Only |
| 221819 | C-18 | 18 | 19/30 | .112 | .017 | 9 Only |
| 221619 | C-16 | 16 | 19/29 | .122 | .017 | 9 Only |
| 221419 | C-14 | 14 | 19/27 | .138 | .017 | 9 Only |

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

## THE XLV IS ESPECIALLY SUITABLE FOR AEROSPACE, MILITARY AND INDUSTRIAL ELECTRONIC EQUIPMENT

Dual service hook-up wire insulated with a polyvinyl chloride which has been cross-linked by an irradiation process. This process changes the linear molecular configuration of the PVC and connects molecules through a network of chemical bonds. This specially processed insulation "XLV" becomes extremely burn-thru and heat resistant. The shrinkback or heat flow normally encountered when applying a hot soldering iron does not occur when using "XLV" hook-up wire.

This resistance to heat also prevents distortion of the insulation when the wire is subjected to temporary overloads and high temperatures.

Cross linking the PVC by irradiation also increases the abrasion resistance and makes it much superior to regular vinyl insulations.

The table below lists both the UL and military specifications to which "XLV" wire is manufactured.

**Note** that since the military and U.L. specifications vary, the temperature and voltage ratings assigned differ for the same wire as per the chart.

| SPECIFICATIONS | MAX. OPER. TEMPS. | MAXIMUM VOLTAGE |
|---|---|---|
| MIL-W-16878/1 TYPE B | 105°C | 600 V. RMS |
| U.L. AWM STYLE 1429 | 80°C | Voltage not specified for general appliance hook-up usage. 300 volt peak for electronic use only. |
| MIL-W-16878/2 TYPE C | 105°C | 1000 V. RMS. |
| U.L. AWM STYLE 1430 | 105°C | 300 VOLT RMS<br>600 VOLT PEAK<br>For electronic use only. |

See other U.L. & CSA products starting with page 13

## Cross-Linked Irradiated Hookup Wire

## XLV Dual Service Hookup Wire

## UL and MIL-SPEC Hookup and Lead Wire

**Cross-Linked Polyvinyl Chloride Insulation**

### MIL-W-16878/2 — TYPE C

**XLV U.L. STYLE 1430**

| DEARBORN NO. | MIL TYPE | U.L. STYLE | AWG SIZE STRANDING | NOM. INSUL. THICK'S | NOM. O.D. | STOCK COLORS | STOCK PUT UP (FT) |
|---|---|---|---|---|---|---|---|
| 272407 | C-24 | 1430 | 24 (7/32) | .016 | .058 | 0-9 | 1000 |
| 272407F | C-24 | 1430 | 24 (7/32) | .016 | .058 | 0-9 | 1000 |
| 272207 | C-22 | 1430 | 22 (7/30) | .016 | .064 | 0-9 | 1000 |
| 272207F | C-22 | 1430 | 22 (7/30) | .016 | .064 | 0-9 | 1000 |
| 272007 | C-20 | 1430 | 20 (7/28) | .016 | .072 | 0-9 | 1000 |
| 272007F | C-20 | 1430 | 20 (7/28) | .016 | .072 | 9 only | 1000 |
| 271819 | C-18 | 1430 | 18 (19/30) | .016 | .082 | 9 only | 1000 |
| 271807F | C-18 | 1430 | 18 (7/26) | .016 | .082 | 9 only | 1000 |
| 271619 | C-16 | 1430 | 16 (19/29) | .016 | .092 | 9 only | 1000 |
| 271419 | C-14 | | 14 (19/27) | .016 | .105 | 9 only | 1000 |
| 271219 | C-12 | | 12 (19/25) | .016 | .124 | 9 only | 1000 |

F — SUFFIX INDICATES FUSED OR PREBONDED STRANDS

### MIL-W-16878/1 — TYPE B

**XLV U.L. STYLE 1429**

| DEARBORN NO. | MIL TYPE | U.L. STYLE | AWG SIZE STRANDING | NOM. INSUL. THICK'S | NOM. O.D. | STOCK COLORS | STOCK PUT UP (FT) |
|---|---|---|---|---|---|---|---|
| 252807 | B-28 | 1429 | 28 (7/36) | .010 | .035 | 0-9 | 1000 |
| 252607 | B-26 | 1429 | 26 (7/34) | .010 | .039 | 0-9 | 1000 |
| 252607F | B-26 | 1429 | 26 (7/34) | .010 | .039 | 0-9 | 1000 |
| 252407 | B-24 | 1429 | 24 (7/32) | .010 | .044 | 0-9 | 1000 |
| 252407F | B-24 | 1429 | 24 (7/32) | .010 | .044 | 0-9 | 1000 |
| 252419 | B-24 | 1429 | 24 (19/36) | .010 | .045 | 0-9 | 1000 |
| 252207 | B-22 | 1429 | 22 (7/30) | .010 | .050 | 0-9 | 1000 |
| 252207F | B-22 | 1429 | 22 (7/30) | .010 | .050 | 0-9 | 1000 |
| 252219 | B-22 | 1429 | 22 (19/34) | .010 | .051 | 0-9 | 1000 |
| 252007 | B-20 | 1429 | 20 (7/28) | .010 | .058 | 0-9 | 1000 |
| 252007F | B-20 | 1429 | 20 (7/28) | .010 | .058 | 0-9 | 1000 |
| 252019 | B-20 | 1429 | 20 (19/32) | .010 | .059 | 0-9 | 1000 |
| 251819 | B-18 | 1429 | 18 (19/30) | .010 | .068 | 9 only | 1000 |
| 251807 | B-18 | 1429 | 18 (7/26) | .010 | .068 | 9 only | 1000 |
| 251807F | B-18 | 1429 | 18 (7/26) | .010 | .068 | 9 only | 1000 |
| 251619 | B-16 | 1429 | 16 (19/29) | .010 | .078 | 9 only | 1000 |
| 252601 | NOT MIL SPEC TYPE | 1429 | 26 (1) | .010 | .039 | 0-9 | 1000 |
| 252401 | | 1429 | 24 (1) | .010 | .044 | 0-9 | 1000 |
| 252201 | | 1429 | 22 (1) | .010 | .050 | 0-9 | 1000 |

F — SUFFIX INDICATES FUSED OR PREBONDED STRANDS

All above can be supplied in multi-conductor, with shield and XLV jacket or multi-conductor, and XLV jacket.

**COLOR CODE ON HOOKUP WIRE:** 0—Black • 1—Brown • 2—Red • 3—Orange • 4—Yellow • 5—Green • 6—Blue • 7—Violet • 8—Grey • 9—White

OTHER COLORS AND STRIPE COMBINATIONS AVAILABLE UPON REQUEST

**DEARBORN WIRE AND CABLE CO.** Dept. EM, 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

# DEARBORN WIRE AND CABLE COMPANY

## CORONA RESISTANT HIGH VOLTAGE WIRE

- High Dielectric Strength
- Abrasion Resistant
- Flame Retardant
- Easy to Strip

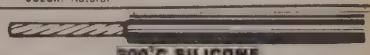
**CONSTRUCTION**

**Conductors:** All conductors are tinned copper, flexible stranding. Also available on special order with: silver plated copper conductors, nickel plated copper conductors and pure nickel conductors. Pure nickel increases rating to 260°C (500°F). **Insulation:** High temperature, high voltage silicone rubber for easy stripping. High dielectric strength, flame retardant.

**APPLICATIONS**

Recommended for stoves, heaters, furnaces, dryers, motors, therapeutic devices, signs, lighting fixtures and special electronic devices where high temperatures are incurred. Military applications include use on jet aircraft, atomic submarines and related equipment

**COLOR:** Natural



**200°C SILICONE HIGH TEMPERATURE, HIGH VOLTAGE WIRE**

| DEARBORN NO. | AWG SIZE | WALL THICKNESS | NOM. O.D. | D.C. VOLTAGE LISTING |
|---|---|---|---|---|
| 392245 | 22 (STR'D) | .045" | .120 | 10 KV. |
| 392250 | 22 (STR'D) | .050" | .130 | 12 KV. |
| 392260 | 22 (STR'D) | .060" | .150 | 15 KV |
| 392275 | 22 (STR'D) | .075" | .180 | 20 KV. |
| 392045 | 20 (STR'D) | .045" | .126 | 10 KV. |
| 392060 | 20 (STR'D) | .060" | .156 | 15 KV. |
| 392075 | 20 (STR'D) | .075" | .186 | 20 KV |
| 391845 | 18 (STR'D) | .045" | .137 | 10 KV. |
| 391875 | 18 (STR'D) | .075" | .197 | 20 KV. |
| 391890 | 18 (STR'D) | .090" | .227 | 30 KV. |
| 391645 | 16 (STR'D) | .045" | .149 | 10 KV. |
| 391660 | 16 (STR'D) | .060" | .179 | 15 KV. |
| 391675 | 16 (STR'D) | .075" | .209 | 20 KV. |
| 391690 | 16 (STR'D) | .090" | .239 | 30 KV. |
| 391445 | 14 (STR'D) | .045" | .163 | 10 KV. |
| 391460 | 14 (STR'D) | .060" | .193 | 15 KV. |
| 391475 | 14 (STR'D) | .075" | .223 | 20 KV |
| 391490 | 14 (STR'D) | .090" | .253 | 30 KV. |
| 391245 | 12 (STR'D) | .045" | .185 | 10 KV. |
| 391290 | 12 (STR'D) | .090" | .275 | 30 KV. |
| 391045 | 10 (STR'D) | .045" | .206 | 10 KV. |
| 391090 | 10 (STR'D) | .090" | .296 | 30 KV. |
| 390860 | 8 (STR'D) | .060" | .267 | 15 KV |
| 390660 | 6 (STR'D) | .060" | .304 | 15 KV. |
| 390460 | 4 (STR'D) | .060" | .352 | 15 KV. |
| 390260 | 2 (STR'D) | .060" | 412 | 15 KV. |

**TYPE E, 600 VOLT**
Single conductor, stranded or solid silver plated copper, extruded TFE Teflon insulation. **Voltage rating:** 600 volts. **Temperature rating:** −65°C to +200°C.

# MIL-W-16878D Teflon* Hookup Wire

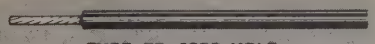
**TYPE E, 600 VOLT**

| DEARBORN NO. | TYPE & CONDUCTOR AWG SIZE & STRAND'G | NOM. WALL THICKNESS | NOM. O.D. | STOCK COLORS 100' | STOCK COLORS 1000' |
|---|---|---|---|---|---|
| 13207 | E-32 | 7/40 | .010 | .029 | 0-9 | 0-9 |
| 13007 | E-30 | 7/38 | .010 | .032 | 0-9 | 0-9 |
| 12807 | E-28 | 7/36 | .010 | .036 | 0-9 | 0-9 |
| 12619 | E-26 | 19/38 | .010 | .040 | 0-9 | 0-9 & 90-98 |
| 12607 | E-26 | 7/34 | .010 | .039 | 0-9 | 0-9 & 90-98 |
| 12419 | E-24 | 19/36 | .010 | .045 | 0-9 | 0-9 & 90-98 |
| 12407 | E-24 | 7/32 | .010 | .044 | 0-9 | 0-9 & 90-98 |
| 12219 | E-22 | 19/34 | .010 | .052 | 0-9 | 0-9 & 90-98 |
| 12207 | E-22 | 7/30 | .010 | .050 | 0-9 | 0-9 & 90-98 |
| 12019 | E-20 | 19/32 | .010 | .060 | 0-9 | 0-9 & 90-98 |
| 12007 | E-20 | 7/28 | .010 | .058 | 0-9 | 0-9 & 90-98 |
| 11819 | E-18 | 19/30 | .010 | .070 | 0-9 | 0-9 & 90-98 |
| 11807 | E-18 | 7/26 | .010 | .068 | 0-9 | 0-9 & 90-98 |
| 11619 | E-16 | 19/29 | .011 | .077 | 0-9 | 0-9 & 90-98 |
| 11419 | E-14 | 19/27 | .011 | .094 | 0-9 | 0-9 & 90-98 |
| 11219 | E-12 | 19/25 | .012 | .113 | 0-9 | 0-9 & 90-98 |
| 11037 | E-10 | 37/26 | .012 | .135 | 0-9 | 0-9 & 90-98 |
| | **SOLID CONDUCTOR | | | | | |
| 13201 | E-32 | 1/32 | .010 | .029 | 0-9 | 0-9 |
| 13001 | E-30 | 1/30 | .010 | .032 | 0-9 | 0-9 |
| 12801 | E-28 | 1/28 | .010 | .035 | 0-9 | 0-9 |
| 12601 | E-26 | 1/26 | .010 | .039 | 0-9 | 0-9 |
| 12401 | E-24 | 1/24 | .010 | .044 | 0-9 | 0-9 |
| 12201 | E-22 | 1/22 | .010 | .050 | 0-9 | 0-9 |
| 12001 | E-20 | 1/20 | .010 | .058 | 0-9 | 0-9 |

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

**Not MIL Spec.

**TYPE EE, 1000 VOLT**
Same as Type E, except for insulation thickness and voltage rating of 1000 volts.



**TYPE EE, 1000 VOLT**

| DEARBORN NO. | TYPE & CONDUCTOR AWG SIZE & STRAND'G | NOM. WALL THICKNESS | NOM. O.D. | STOCK COLORS 100' | STOCK COLORS 1000' |
|---|---|---|---|---|---|
| 23207 | EE-32 | 7/40 | .015 | .039 | 0-9 | 0-9 |
| 23007 | EE-30 | 7/38 | .015 | .042 | 0-9 | 0-9 |
| 22807 | EE-28 | 7/36 | .015 | .045 | 0-9 | 0-9 |
| 22607 | EE-26 | 7/34 | .015 | .049 | 0-9 | 0-9 & 90-98 |
| 22619 | EE-26 | 19/38 | .015 | .050 | 0-9 | 0-9 & 90-98 |
| 22407 | EE-24 | 7/32 | .015 | .054 | 0-9 | 0-9 & 90-98 |
| 22419 | EE-24 | 19/36 | .015 | .055 | 0-9 | 0-9 & 90-98 |
| 22207 | EE-22 | 7/30 | .015 | .060 | 0-9 | 0-9 & 90-98 |
| 22219 | EE-22 | 19/34 | .015 | .062 | 0-9 | 0-9 & 90-98 |
| 22007 | EE-20 | 7/28 | .015 | .068 | 0-9 | 0-9 & 90-98 |
| 22019 | EE-20 | 19/32 | .015 | .070 | 0-9 | 0-9 & 90-98 |
| 21819 | EE-18 | 19/30 | .015 | .079 | 0-9 | 0-9 & 90-98 |
| 21619 | EE-16 | 19/29 | .016 | .089 | 0-9 | 0-9 & 90-98 |
| 21419 | EE-14 | 19/27 | .017 | .105 | 0-9 | 0-9 & 90-98 |
| 21219 | EE-12 | 19/25 | .017 | .124 | 0-9 | 0-9 & 90-98 |
| 21037 | EE-10 | 37/26 | .017 | .145 | 0-9 | 0-9 & 90-98 |
| 28133 | EE-8 | 133/29 | .020 | .207 | 0,2,9 | 0,2,9 |

STOCK PUT UP: 100 FT., 1000 FT., AND BULK

**COLOR CODE ON HOOKUP WIRE:** 0—Black • 1—Brown • 2—Red • 3—Orange • 4—Yellow • 5—Green • 6—Blue • 7—Violet • 8—Grey • 9—White • 90—White/Black • 91—White/Brown • 92—White/Red • 93—White/Orange • 94—White/Yellow • 95—White/Green • 96—White/Blue • 97—White/Violet • 98—White/Gray

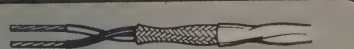
OTHER COLORS AND STRIPE COMBINATIONS AVAILABLE UPON REQUEST

* Du Pont T.M.

# MIL-W-16878D Shielded Teflon* Cables

Each conductor stranded silver plated copper, Type E extruded TFE Teflon .010" color coded insulation. Braided silver plated copper shield, 90% coverage. **Voltage rating:** 600 volts. **Temperature rating:** −65°C to +200°C. Resistant to acids, alkalis, oil, flame, moisture, solvents and fungus. *Dupont T.M.

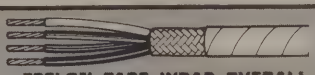
- **FEP EXTRUDED JACKET OVER SHIELD**
  Tough abrasion resistant extruded white FEP Teflon jacket overall.



**EXTRUDED JACKET OVER SHIELD**

| DEARBORN NO. | NO. OF COND. | CONDUCTOR AWG SIZE | CONDUCTOR STRANDING | NOM O.D. AT MAX. WIDTH HIGH POINT | PUT UP (FT.) |
|---|---|---|---|---|---|
| 72401 | 1 | 24 | 19/36 | .085 | 100 & 1000 |
| 72402 | 2 | 24 | 19/36 | .130 | 100 & 1000 |
| 72403 | 3 | 24 | 19/36 | .135 | 100 & 1000 |
| 72201 | 1 | 22 | 19/34 | .091 | 100 & 1000 |
| 72202 | 2 | 22 | 19/34 | .150 | 100 & 1000 |
| 72203 | 3 | 22 | 19/34 | .158 | 100 & 1000 |
| 72001 | 1 | 20 | 19/32 | .100 | 100 & 1000 |
| 72002 | 2 | 20 | 19/32 | .168 | 100 & 1000 |
| 72003 | 3 | 20 | 19/32 | .178 | 100 & 1000 |
| 71801 | 1 | 18 | 19/30 | .110 | 100 & 1000 |
| 71802 | 2 | 18 | 19/30 | .188 | 100 & 1000 |
| 71803 | 3 | 18 | 19/30 | .207 | 100 & 1000 |
| 71601 | 1 | 16 | 19/29 | .123 | 100 & 1000 |
| 71602 | 2 | 16 | 19/29 | .220 | 100 & 1000 |
| 71603 | 3 | 16 | 19/29 | .235 | 100 & 1000 |

- **TEFLON TAPE WRAP JACKET OVER SHIELD**
  Sintered wrapped white Teflon tape jacketed overall.



**TEFLON TAPE WRAP OVERALL**

| DEARBORN NO. | NO. OF COND. | CONDUCTOR AWG SIZE | CONDUCTOR STRANDING | NOM O.D. AT MAX. WIDTH HIGH POINT | PUT UP (FT.) |
|---|---|---|---|---|---|
| 62401 | 1 | 24 | 19/36 | .095 | 100 & 1000 |
| 62402 | 2 | 24 | 19/36 | .140 | 100 & 1000 |
| 62403 | 3 | 24 | 19/36 | .147 | 100 & 1000 |
| 62404 | 4 | 24 | 19/36 | .159 | 100 & 1000 |
| 62201 | 1 | 22 | 19/34 | .102 | 100 & 1000 |
| 62202 | 2 | 22 | 19/34 | .154 | 100 & 1000 |
| 62203 | 3 | 22 | 19/34 | .162 | 100 & 1000 |
| 62204 | 4 | 22 | 19/34 | .176 | 100 & 1000 |
| 62001 | 1 | 20 | 19/32 | .110 | 100 & 1000 |
| 62002 | 2 | 20 | 19/32 | .170 | 100 & 1000 |
| 62003 | 3 | 20 | 19/32 | .175 | 100 & 1000 |
| 62004 | 4 | 20 | 19/32 | .213 | 100 & 1000 |
| 61801 | 1 | 18 | 19/30 | .120 | 100 & 1000 |
| 61802 | 2 | 18 | 19/30 | .190 | 100 & 1000 |
| 61803 | 3 | 18 | 19/30 | .219 | 100 & 1000 |
| 61804 | 4 | 18 | 19/30 | .237 | 100 & 1000 |
| 61601 | 1 | 16 | 19/29 | .130 | 100 & 1000 |
| 61602 | 2 | 16 | 19/29 | .230 | 100 & 1000 |
| 61603 | 3 | 16 | 19/29 | .240 | 100 & 1000 |
| 61604 | 4 | 16 | 19/29 | .270 | 100 & 1000 |

- **TEFLON IMPREGNATED BRAID OVER SHIELD**
  Braided natural or white Teflon impregnated fiberglass braid overall.

**TEFLON IMPREGNATED BRAID OVERALL**

| DEARBORN NO. | NO. OF COND. | CONDUCTOR AWG SIZE | CONDUCTOR STRANDING | NOM O.D. AT MAX. WIDTH HIGH POINT | PUT UP (FT.) |
|---|---|---|---|---|---|
| 52401 | 1 | 24 | 19/36 | .081 | 100 & 1000 |
| 52402 | 2 | 24 | 19/36 | .126 | 100 & 1000 |
| 52403 | 3 | 24 | 19/36 | .133 | 100 & 1000 |
| 52404 | 4 | 24 | 19/36 | .144 | 100 & 1000 |
| 52201 | 1 | 22 | 19/34 | .088 | 100 & 1000 |
| 52202 | 2 | 22 | 19/34 | .137 | 100 & 1000 |
| 52203 | 3 | 22 | 19/34 | .144 | 100 & 1000 |
| 52204 | 4 | 22 | 19/34 | .158 | 100 & 1000 |
| 52001 | 1 | 20 | 19/32 | .097 | 100 & 1000 |
| 52002 | 2 | 20 | 19/32 | .154 | 100 & 1000 |
| 52003 | 3 | 20 | 19/32 | .163 | 100 & 1000 |
| 52004 | 4 | 20 | 19/32 | .180 | 100 & 1000 |
| 51801 | 1 | 18 | 19/30 | .106 | 100 & 1000 |
| 51802 | 2 | 18 | 19/30 | .174 | 100 & 1000 |
| 51803 | 3 | 18 | 19/30 | .185 | 100 & 1000 |
| 51804 | 4 | 18 | 19/30 | .205 | 100 & 1000 |
| 51601 | 1 | 16 | 19/29 | .117 | 100 & 1000 |
| 51602 | 2 | 16 | 19/29 | .196 | 100 & 1000 |
| 51603 | 3 | 16 | 19/29 | .225 | 100 & 1000 |
| 51604 | 4 | 16 | 19/29 | .255 | 100 & 1000 |

**COLOR CODE OF CONDUCTORS:** 1st Conductor—White • 2nd Conductor—Black • 3rd Conductor—Red • 4th Conductor—Green

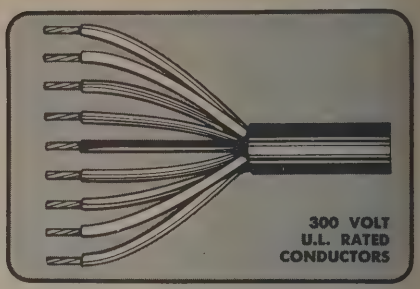
**DEARBORN WIRE AND CABLE CO.** Dept. EM, 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

# DEARBORN WIRE AND CABLE COMPANY

## Unshielded Audio Cable

**MULTICONDUCTOR PLASTIC JACKETED**
Stranded or solid tinned copper conductors. Color coded polyvinylchloride insulation. Conductors cabled and covered with a gray PVC jacket overall. Suitable for outdoor usage. Recommended for P.A. systems, intercom connecting cables, remote control circuits, relay circuits, telephones, and telemetering circuits.

**All inner conductors are U.L. styles as follows: No. 22 - Style 1061, Nos. 20, 18 and 16 are Style 1007, No. 14 and No. 12 are Styles 1335 and 1336.**
**Temperature ratings**
On Style 1061 and 1007 are −10°C to +80°C; on Styles 1335 and 1336 ratings are −10°C to +90°C.




**NO. 22 AWG MULTI-CONDUCTOR**

| DEARBORN NO. | NO. OF COND. | SIZE | STRAND-ING | NOM. WALL THICK. | NOM. JKT. THICK. | NOM. O.D. | COLOR CODE CHART |
|---|---|---|---|---|---|---|---|
| 832202 | 2 | 22 | 7/30 | .010 | .020 | .140 | 1 |
| 832203 | 3 | 22 | 7/30 | .010 | .020 | .145 | 1 |
| 832204 | 4 | 22 | 7/30 | .010 | .020 | .170 | 1 |
| 832205 | 5 | 22 | 7/30 | .010 | .020 | .175 | 1 |
| 832206 | 6 | 22 | 7/30 | .010 | .020 | .185 | 1 |
| 832207 | 7 | 22 | 7/30 | .010 | .020 | .190 | 1 |
| 832208 | 8 | 22 | 7/30 | .010 | .020 | .200 | 1 |
| 832209 | 9 | 22 | 7/30 | .010 | .020 | .225 | 1 |
| 832210 | 10 | 22 | 7/30 | .010 | .020 | .235 | 1 |
| 832212 | 12 | 22 | 7/30 | .010 | .020 | .255 | 1 |
| 832215 | 15 | 22 | 7/30 | .010 | .020 | .280 | 2 |
| 832220 | 20 | 22 | 7/30 | .010 | .020 | .310 | 2 |
| 832224 | 24 | 22 | 7/30 | .010 | .020 | .325 | 2 |
| 832225 | 25 | 22 | 7/30 | .010 | .020 | .330 | 2 |
| 832230 | 30 | 22 | 7/30 | .010 | .020 | .365 | 2 |
| 832240 | 40 | 22 | 7/30 | .010 | .025 | .452 | 2 |
| 832250 | 50 | 22 | 7/30 | .010 | .035 | .500 | 2 |
| 832260 | 60 | 22 | 7/30 | .010 | .035 | .530 | 2 |

**NO. 20 AWG MULTI-CONDUCTOR**

| DEARBORN NO. | NO. OF COND. | SIZE | STRAND-ING | NOM. WALL THICK. | NOM. JKT. THICK. | NOM. O.D. | COLOR CODE CHART |
|---|---|---|---|---|---|---|---|
| 832002 | 2 | 20 | 10/30 | .016 | .020 | .180 | 1 |
| 832003 | 3 | 20 | 10/30 | .016 | .020 | .190 | 1 |

**NO. 18 AWG MULTI-CONDUCTOR**

| DEARBORN NO. | NO. OF COND. | SIZE | STRAND-ING | NOM. WALL THICK. | NOM. JKT. THICK. | NOM. O.D. | COLOR CODE CHART |
|---|---|---|---|---|---|---|---|
| 831802 | 2 | 18 | 16/30 | .018 | .020 | .200 | 2 |
| 831803 | 3 | 18 | 16/30 | .018 | .025 | .210 | 2 |
| 831804 | 4 | 18 | 16/30 | .018 | .030 | .250 | 1 |
| 831805 | 5 | 18 | 16/30 | .018 | .037 | .286 | 1 |
| 831806 | 6 | 18 | 16/30 | .018 | .037 | .310 | 1 |
| 831807 | 7 | 18 | 16/30 | .018 | .037 | .325 | 1 |
| 831808 | 8 | 18 | 16/30 | .018 | .037 | .350 | 1 |
| 831809 | 9 | 18 | 16/30 | .018 | .037 | .379 | 1 |
| 831812 | 12 | 18 | 16/30 | .018 | .040 | .417 | 2 |
| 831815 | 15 | 18 | 16/30 | .018 | .045 | .490 | 2 |
| 831819 | 19 | 18 | 16/30 | .018 | .045 | .505 | 2 |

**NO. 16 AWG MULTI-CONDUCTOR**

| DEARBORN NO. | NO. OF COND. | SIZE | STRAND-ING | NOM. WALL THICK. | NOM. JKT. THICK. | NOM. O.D. | COLOR CODE CHART |
|---|---|---|---|---|---|---|---|
| 831602 | 2 | 16 | 19/29 | .030 | .025 | .256 | 2 |
| 831603 | 3 | 16 | 19/29 | .030 | .030 | .300 | 2 |
| 831604 | 4 | 16 | 19/29 | .030 | .045 | .375 | 2 |

**NO. 14 AWG MULTI-CONDUCTOR**

| DEARBORN NO. | NO. OF COND. | SIZE | STRAND-ING | NOM. WALL THICK. | NOM. JKT. THICK. | NOM. O.D. | COLOR CODE CHART |
|---|---|---|---|---|---|---|---|
| 831402 | 2 | 14 | 19/27 | .031 | .035 | .332 | 2 |
| 831403 | 3 | 14 | 19/27 | .031 | .035 | .400 | 2 |
| 831404 | 4 | 14 | 19/27 | .045 | .045 | .495 | 2 |

**NO. 12 AWG MULTI-CONDUCTOR**

| DEARBORN NO. | NO. OF COND. | SIZE | STRAND-ING | NOM. WALL THICK. | NOM. JKT. THICK. | NOM. O.D. | COLOR CODE CHART |
|---|---|---|---|---|---|---|---|
| 831202 | 2 | 12 | 19/25 | .031 | .040 | .384 | 2 |
| 831203 | 3 | 12 | 19/25 | .031 | .040 | .425 | 2 |

**COLOR CODE CHART NO. 1**

| | | |
|---|---|---|
| 1—Black | 11—Pink | 21—White/Brown |
| 2—Red | 12—Tan | 22—White/Orange |
| 3—Green | 13—Red/Green | 23—White/Gray |
| 4—White | 14—Red/Yellow | 24—White/Violet |
| 5—Brown | 15—Red/Black | 25—White/Black/Red |
| 6—Blue | 16—White/Black | 26—White/Black/Green |
| 7—Orange | 17—White/Red | 27—White/Black/Yellow |
| 8—Yellow | 18—White/Green | 28—White/Black/Blue |
| 9—Purple | 19—White/Yellow | 29—White/Black/Brown |
| 10—Slate | 20—White/Blue | 30—White/Black/Orange |

**COLOR CODE CHART NO. 2 (IPCEA)**

| | | |
|---|---|---|
| 1—Black | 21—Orange/Green | 41—Green/White/Blue |
| 2—White | 22—Black/White/Red | 42—Orange/Red/Green |
| 3—Red | 23—White/Black/Red | 43—Blue/Red/Green |
| 4—Green | 24—Red/Black/White | 44—Black/White/Blue |
| 5—Orange | 25—Green/Black/White | 45—White/Black/Blue |
| 6—Blue | 26—Orange/Black/White | 46—Red/White/Blue |
| 7—White/Black | 27—Blue/Black/White | 47—Green/Orange/Red |
| 8—Red/Black | 28—Black/Red/Green | 48—Orange/Red/Blue |
| 9—Green/Black | 29—White/Red/Green | 49—Blue/Red/Orange |
| 10—Orange/Black | 30—Red/Black/Green | 50—Black/Orange/Red |
| 11—Blue/Black | 31—Green/Black/Orange | 51—White/Black/Orange |
| 12—Black/White | 32—Orange/Black/Green | 52—Red/Orange/Black |
| 13—Red/White | 33—Blue/White/Orange | 53—Green/Red/Blue |
| 14—Green/White | 34—Black/White/Orange | 54—Orange/Black/Blue |
| 15—Blue/White | 35—White/Red/Orange | 55—Blue/Black/Orange |
| 16—Black/Red | 36—Orange/White/Blue | 56—Black/Orange/Green |
| 17—White/Red | 37—White/Red/Blue | 57—White/Orange/Green |
| 18—Orange/Red | 38—Black/White/Green | 58—Red/Orange/Green |
| 19—Blue/Red | 39—White/Black/Green | 59—Green/Black/Blue |
| 20—Red/Green | 40—Red/White/Green | 60—Orange/Green/Blue |

STANDARD PUT UP FOR ALL ABOVE — 100′, 500′, 1000′

## Unshielded Paired Conductors Intercom Cables, Plastic Jacketed

Stranded or solid tinned copper conductors. Color coded polyvinylchloride .010″ insulation. Conductors are twisted into pairs, cabled and jacketed overall with a gray PVC jacket. Temperature rating: −20°C to +80°C. Conductors are **U.L. Style 1061.**

Suitable for outdoor usage. Recommended for remote control circuits, relay circuits, balanced intercom systems, multiple speaker cable, telephones, call systems, etc. **Suggested operating voltage:** 300 volts maximum.

| DEARBORN NO. | NO. OF PAIRS | NO. OF COND. | COND. SIZE | STRAND-ING | NOM. JKT. THICK. | NOM. O.D. |
|---|---|---|---|---|---|---|
| 862201 | 1 | 2 | 22 | 7/30 | .020 | .145 |
| 862202 | 2 | 4 | 22 | 7/30 | .020 | .210 |
| 862203 | 3 | 6 | 22 | 7/30 | .020 | .225 |
| 862204 | 4 | 8 | 22 | 7/30 | .020 | .240 |
| 862205 | 5 | 10 | 22 | 7/30 | .020 | .265 |
| 862206 | 6 | 12 | 22 | 7/30 | .020 | .290 |
| 862209 | 9 | 18 | 22 | 7/30 | .020 | .355 |
| 862211 | 11 | 22 | 22 | 7/30 | .020 | .365 |
| 862215 | 15 | 30 | 22 | 7/30 | .025 | .450 |
| 862219 | 19 | 38 | 22 | 7/30 | .025 | .480 |
| 862223 | 23 | 46 | 22 | 7/30 | .030 | .530 |
| 862227 | 27 | 54 | 22 | 7/30 | .035 | .570 |
| 862231 | 31 | 62 | 22 | 7/30 | .040 | .635 |
| 862241 | 41 | 82 | 22 | 7/30 | .040 | .710 |
| 862251 | 51 | 102 | 22 | 7/30 | .045 | .800 |

**COLOR CODING OF PAIRS**

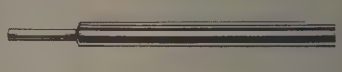
| PAIR NO. | COLOR COMBINATION |
|---|---|
| 1 | Black paired with Red |
| 2 | Black paired with White |
| 3 | Black paired with Green |
| 4 | Black paired with Blue |
| 5 | Black paired with Yellow |
| 6 | Black paired with Brown |
| 7 | Black paired with Orange |
| 8 | Red paired with White |
| 9 | Red paired with Green |
| 10 | Red paired with Blue |
| 11 | Red paired with Yellow |
| 12 | Red paired with Brown |
| 13 | Red paired with Orange |
| 14 | Green paired with White |
| 15 | Green paired with Blue |
| 16 | Green paired with Yellow |
| 17 | Green paired with Brown |
| 18 | Green paired with Orange |
| 19 | White paired with Blue |
| 20 | White paired with Yellow |
| 21 | White paired with Brown |
| 22 | White paired with Orange |
| 23 | Blue paired with Yellow |
| 24 | Blue paired with Brown |
| 25 | Blue paired with Orange |
| 26 | Brown paired with Yellow |
| 27 | Brown paired with Orange |
| 28 | Purple paired with Red |
| 29 | Purple paired with White |
| 30 | Purple paired with Green |
| 31 | Purple paired with Blue |
| 32 | Purple paired with Brown |
| 33 | Purple paired with Yellow |
| 34 | Purple paired with Orange |
| 35 | Purple paired with Slate |
| 36 | Purple paired with Black |
| 37 | Slate paired with Red |
| 38 | Slate paired with White |
| 39 | Slate paired with Green |
| 40 | Slate paired with Blue |
| 41 | Slate paired with Brown |
| 42 | Slate paired with Yellow |
| 43 | Slate paired with Orange |
| 44 | Slate paired with Black |
| 45 | White/Black paired with Red |
| 46 | White/Black paired with Green |
| 47 | White/Black paired with Blue |
| 48 | White/Black paired with Brown |
| 49 | White/Black paired with Yellow |
| 50 | White/Black paired with Orange |
| 51 | White/Black paired with Purple |

## KYNAR (UL)

## Insulated Hookup Wire for Wire Wrap Applications

Especially suited for computer, business machine usage and other areas where space is limited. (For automatic point to point application.)

The miniaturization of computers and business machines has created special problems in the wiring of components and associated programming equipment. Essentially there is a need for wire with a tough insulation that is resistant to abrasion and cold flow. It should function at operating temperatures up to 125°C. The Wire-Wrap type of termination requires a high conductivity low corrosive surface on the conductor. Dearborn Kynar insulated wire fulfills these needs.



**KYNAR HOOK-UP WIRE**

| DEARBORN NO. | AWG SIZE | INSUL. THICK. | NOM. O.D. | U.L. STYLE | STOCK COLORS AVAILABLE |
|---|---|---|---|---|---|
| 773001 | 30(1) | .005″ | .0195″ | 1422 | 0, 1, 2, 3, 4, 5, 6, 8, 9 |
| 772801 | 28(1) | .0035″ | .020″ | 1432 | 0, 1, 2, 5, 6, 9 |
| 772601 | 26(1) | .005″ | .027″ | 1422 | 2, 4, 5, 6, 8, 9 |
| 772401 | 24(1) | .010″ | .042″ | 1327 | 2, 4, 5, 6, 9 |

ALL SUPPLIED ON SPECIALLY DESIGNED LARGE HUB REELS, 1,000′ MINIMUM
CODE COLORING: 0—Black • 1—Brown • 2—Red • 3—Orange • 4—Yellow 5—Green • 6—Blue • 7 –Violet • 8—Gray • 9—White

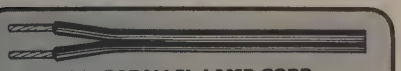
DEARBORN WIRE AND CABLE CO. 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

# DEARBORN WIRE AND CABLE COMPANY

## Service, Power and Replacement Cords and Cordage

### U.L. PARALLEL LAMP CORD

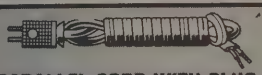
Stranded extra-flexible bare copper, parallel conductors, insulated with Rubber, (SP-1), or Polyvinyl (SPT-1 -SPT-2) or Neoprene (HPN). JACKET OVERALL. Slit in jacket between conductors for ease in separation. Applications: Small appliances, radios, clocks; the HPN is suitable for coffeemakers, fry pans, soldering irons, etc.
**Temperature Rating:** 20°C to +60°C. **Suggested Operating Voltage:** 300 V.



**U.L. PARALLEL LAMP CORD**

| DEARBORN NO. | SIZE & NO. OF COND. | STRAND-ING | TYPE OF INSUL. | NOM. WALL | U.L. TYPE | NOM. O.D. |
|---|---|---|---|---|---|---|
| 1182S | 18/2 | 41/34 | Rubber | .032 | SP-1 | .220 x .120 |
| 1182T | 18/2 | 41/34 | Plastic | .032 | SPT-1 | .215 x .115 |
| 1182T2 | 18/2 | 41/34 | Plastic | .048 | SPT-2 | .255 x .143 |
| 3182N | 18/2 | 41/34 | Neoprene | .048 | HPN | .272 x .142 |
| 3162N | 16/2 | 65/34 | Neoprene | .048 | HPN | .295 x .150 |

**Stock Colors:** 1182S — Available Brown, Black, White. 1182T — Available Brown, Black, White, Gray, Tan, Clear. 1182T2 — Available Brown, Black. 3182N & 3162N —Black only. 1182T2 3182N 3162N — Stock Putups 250 - 1000. 1182S - 1182T — Stock Putups: 25, 100, 500, 1000.



**PARALLEL CORD WITH PLUG**

| DEARBORN NO. | SIZE & NO. OF COND. | STRAND-ING | TYPE OF INSUL. | NOM. O.D. | U.L. TYPE | CORD LENGTH |
|---|---|---|---|---|---|---|
| 9650 | 18/2 | 41/34 | Plastic, Brn. | .110x.207 | SPT-1 | 6 ft. |
| 9651 | 18/2 | 41/34 | Plastic, Brn. | .110x.207 | SPT-1 | 9 ft. |
| 9652 | 18/2 | 41/34 | Neoprene | .140x.276 | HPN | 6 ft. |

Construction: 18/2 SPT-1 or HPN cord with a molded plastic plug on one end and other end conductor split 1" stripped; twisted 5/8"

### EXTENSION CORD SETS

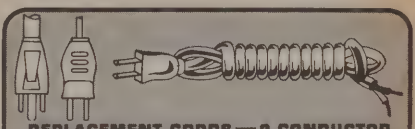
Flexible, 2 or 3 conductor, high quality black rubber cords. Black molded plastic male plug on one end, molded plastic female plug on other end. Will fit conventional sockets and plugs. **Voltage rating:** 300 volts. The 3 conductor cord is used where 1 conductor requires grounding, such as for hand tools, garden edgers, etc.
* This item supplied in grey.

**EXTENSION CORDS — 2 CONDUCTOR**

| DEARBORN NO. | COND. SIZE | COND STRANDING | RATING (AMPS.) | U.L. STYLE | NOM. O.D. | CORD LENGTH FT. |
|---|---|---|---|---|---|---|
| 9620 | 18/2 | 41/34 | 7 | SV | .245 | 6 |
| 9622 | 18/2 | 41/34 | 7 | *SV | .245 | 9 |
| 9624 | 18/2 | 16/30 | 7 | SJ | .300 | 10 |
| 9626 | 18/2 | 16/30 | 7 | SJ | .300 | 25 |
| 9628 | 16/2 | 26/30 | 10 | SJ | .325 | 10 |
| 9630 | 16/2 | 26/30 | 10 | SJ | .325 | 25 |
| 9632 | 16/2 | 26/30 | 10 | SJ | .325 | 50 |
| 9634 | 16/2 | 26/30 | 10 | SJ | .325 | 100 |
| **3 CONDUCTOR** | | | | | | |
| 9636 | 18/3 | 16/30 | 7 | SJ | .330 | 10 |
| 9638 | 18/3 | 16/30 | 7 | SJ | .330 | 25 |
| 9639 | 18/3 | 16/30 | 7 | SJ | .330 | 50 |
| 9640 | 16/3 | 26/30 | 10 | SJ | .365 | 15 |
| 9641 | 16/3 | 26/30 | 10 | SJ | .365 | 10 |
| 9642 | 16/3 | 26/30 | 10 | SJ | .365 | 25 |
| 9644 | 16/3 | 26/30 | 10 | SJ | .365 | 50 |

### REPLACEMENT CORDS

Flexible high quality black Rubber, Plastic and Neoprene Cords. Types SV and SJ are rubber insulated and jacketed. Types SVT and SJT are plastic insulated and jacketed. Type SJO is rubber insulated and neoprene jacketed. One end has molded black plastic straight plug (either 2 prong or 3 prong depending on 2 or 3 conductor cable). The other end of the jacket is stripped back 1½" with 5/8" of the conductors stripped. **Voltage rating:** 300 volts. The 3 conductor cord is used where 1 conductor is required for grounding.
* This item supplied in grey.



**REPLACEMENT CORDS — 2 CONDUCTOR**

| DEARBORN NO. | COND. SIZE | COND STRANDING | RATING (AMPS.) | U.L. STYLE | NOM. O.D. | CORD LENGTH FT. |
|---|---|---|---|---|---|---|
| 9600 | 18/2 | 41/34 | 7 | *SV | .245 | 6 |
| 9602 | 18/2 | 41/34 | 7 | *SVT | .245 | 6 |
| 9604 | 18/2 | 41/34 | 7 | SVT | .245 | 6 |
| 9606 | 18/2 | 16/30 | 7 | SJ | .300 | 8 |
| 9608 | 18/2 | 16/30 | 7 | SJ | .300 | 10 |
| 9610 | 16/2 | 26/30 | 10 | SJ | .325 | 8 |
| 9612 | 16/2 | 26/30 | 10 | SVT | .325 | 10 |
| **3 CONDUCTOR** | | | | | | |
| 9601 | 18/3 | 41/34 | 7 | SV | .255 | 6 |
| 9603 | 18/3 | 41/34 | 7 | SV | .255 | 8 |
| 9609 | 18/3 | 41/34 | 7 | *SVT | .255 | 6 |
| 9615 | 18/3 | 16/30 | 7 | SJ | .330 | 6 |
| 9617 | 18/3 | 16/30 | 7 | SJ | .330 | 8 |
| 9637 | 18/3 | 16/30 | 7 | *SJT | .330 | 8 |
| 9643 | 18/3 | 16/30 | 7 | SJO | .330 | 8 |
| 9619 | 16/3 | 26/30 | 10 | SJ | .365 | 9 |

## Shielded Microphone, Sound and Intercom Cables

### SOUND AND INTERCOM CABLES

Each conductor is solid or stranded tinned copper (See Chart), insulated with color coded polyvinylchloride. Conductors are twisted and shielded with either a spiral wrapped tinned copper shield or a tinned copper braided shield —20°C to +60°C. Ideal for all types of public address or sound work, recording studios, and other types of audio circuits requiring shielding. Sizes 16 thru 22 rated at 350 V working voltage. Sizes 14 and 12 are rated at 450 Volts working voltage. **.020" nom. jacket,** thk. of chrome PVC.

**SPIRAL SHIELDED INTERCOM CABLE**

| DEARBORN NO. | NO. OF COND. | COND. SIZE | STRANDING | NOM. WALL THICK. | NOM. O.D. |
|---|---|---|---|---|---|
| 692202 | 2 | 22 | 7/30 | .016 | .175 |
| 692203 | 3 | 22 | 7/30 | .016 | .190 |
| 692204 | 4 | 22 | 7/30 | .016 | .200 |
| 692206 | 6 | 22 | 7/30 | .016 | .235 |
| 692001 | 1 | 20 | 10/30 | .016 | .130 |
| 692002 | 2 | 20 | 10/30 | .016 | .195 |
| 692003 | 3 | 20 | 10/30 | .016 | .210 |
| 692004 | 4 | 20 | 10/30 | .016 | .225 |
| 692006 | 6 | 20 | 10/30 | .016 | .265 |
| 691801 | 1 | 18 | 16/30 | .016 | .135 |
| 691802 | 2 | 18 | 16/30 | .016 | .230 |
| 691803 | 3 | 18 | 16/30 | .016 | .235 |
| 691804 | 4 | 18 | 16/30 | .016 | .245 |
| 691602 | 2 | 16 | 26/30 | .016 | .240 |
| 691603 | 3 | 16 | 26/30 | .016 | .245 |
| 691402 | 2 | 14 | 41/30 | .020 | .285 |
| 691403 | 3 | 14 | 41/30 | .020 | .290 |
| 691202 | 2 | 12 | 65/30 | .020 | .325 |
| 691203 | 3 | 12 | 65/30 | .020 | .330 |

STANDARD PUT UPS: 100 FT., 500 FT., 1000 FT.

**BRAIDED SHIELD INTERCOM CABLE**

| DEARBORN NO. | NO. OF COND. | COND SIZE | STRANDING | NOM. WALL THICK. | NOM. O.D. |
|---|---|---|---|---|---|
| 812202 | 2 | 22 | Solid | .016 | .175 |
| 742202 | 2 | 22 | 7/30 | .016 | .185 |
| 742203 | 3 | 22 | 7/30 | .016 | .200 |
| 742204 | 4 | 22 | 7/30 | .016 | .210 |
| 742001 | 1 | 20 | 10/30 | .016 | .135 |
| 812002 | 2 | 20 | Solid | .016 | .210 |
| 742002 | 2 | 20 | 10/30 | .016 | .210 |
| 742003 | 3 | 20 | 10/30 | .016 | .220 |
| 742004 | 4 | 20 | 10/30 | .016 | .230 |
| 741801 | 1 | 18 | 16/30 | .016 | .145 |
| 811802 | 2 | 18 | Solid | .016 | .220 |
| 741802 | 2 | 18 | 16/30 | .016 | .235 |
| 741803 | 3 | 18 | 16/30 | .016 | .245 |
| 741804 | 4 | 18 | 16/30 | .016 | .255 |
| 741602 | 2 | 16 | 26/30 | .016 | .250 |
| 741603 | 3 | 16 | 26/30 | .016 | .255 |
| 741402 | 2 | 14 | 41/30 | .020 | .290 |
| 741403 | 3 | 14 | 41/30 | .020 | .295 |
| 741202 | 2 | 12 | 65/30 | .020 | .335 |
| 741203 | 3 | 12 | 65/30 | .020 | .340 |

STANDARD PUT UP: 100 FT., 500 FT., 1000 FT.

### MICROPHONE CABLE

**PLASTIC OR NEOPRENE JACKETED MIKE CABLE** — Stranded tinned copper conductor with color coded rubber insulation. Cotton wrap, braided tinned copper shield; cotton wrap, tough black neoprene or rubber jacket overall.

**NEOPRENE JACKETED MIKE CABLE**

| | | | | | | |
|---|---|---|---|---|---|---|
| 601801 | 1-18 | 41/34 | .040 | 69 MMF | .035 | .240 |
| 601802 | 2-18 | 41/34 | .020 | 78 MMF | .035 | .295 |
| 601602 | 2-16 | 65/34 | .025 | 82 MMF | .035 | .335 |

STANDARD PUT UP: 100 FT., 500 FT., 1000 FT.
CAPACITY MEASURED BETWEEN 1 CONDUCTOR AND SHIELD AND ANY OTHER REMAINING CONDUCTORS.

**BRAIDED SHIELD MIKE CABLE**

| DEARBORN NO. | NO. OF COND. & SIZE | STRAND-ING | WALL THICK. | NOM. CAP. PER FT. | NOM. JKT. THICK. | NOM. O.D. |
|---|---|---|---|---|---|---|
| 732001 | 1-20 | 26/34 | .030 | 36 MMF | .030 | .175 |
| 682002 | 2-20 | 26/34 | .014 | 45 MMF | .030 | .245 |

### MINIATURE CABLE

**SHIELDED CLEAR PLASTIC JACKET**

Tinned copper conductors, insulated with color coded polyvinylchloride. Conductors are twisted and shielded with a fine braided tinned copper shield. Clear, .010" polyvinylchloride jacket overall. **Suggested maximum operating voltage:** 200 V. **Temperature rating:** —20°C to +60°C.

| DEARBORN NO. | NO. OF COND. | COND. SIZE | STRAND-ING | NOM. WALL THICK. | NOM. O.D. | STOCK PUT UP (FT.) |
|---|---|---|---|---|---|---|
| 942802 | 2 | 28 | 7/36 | .010 | .105 | 100, 500 & 1000 |
| 942803 | 3 | 28 | 7/36 | .010 | .115 | 100, 500 & 1000 |
| 942804 | 4 | 28 | 7/36 | .010 | .120 | 100, 500 & 1000 |

COLOR CODE OF CONDUCTORS: 1—Black • 2—Red • 3—White • 4—Green.

**COLOR CODE OF CONDUCTORS:** 1—Black • 2—Red • 3—White • 4—Green • 5—Yellow • 6—Blue

**DEARBORN WIRE AND CABLE CO.** 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

# DEARBORN WIRE AND CABLE COMPANY

## Multi-Conductor Unshielded Control Cable

## Neoprene or Plastic

### PLASTIC JACKETED 15/5 CONTROL CABLES, 600 VOLT, VN20, 90°C

Stranded bare copper conductors, insulated with .015"* PVC color coded insulation and .005" Nylon jacket over each conductor; cabled with fillers. Moisture resistant tape, and a black Polyvinyl-chloride jacket overall. Used for controlling temperature, voltage, pressure and relay circuits and many other electronic and electrical circuits. **All conductors color coded to IPCEA Standards (see bottom, this page).**

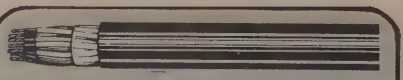
* .020" on sizes 14 and 12; .015" on size 16.

### RUBBER INSULATED CONDUCTORS, NEOPRENE JACKETED

Stranded bare copper conductors, with color coded rubber insulation; cabled with fillers; cotton wrapped; tough Neoprene jacket overall. Used for remote control circuits. Flexible stranding and heavy duty Neoprene jacket combined, make this cable suitable for outdoor usage under extreme conditions. Neoprene jacket resists sunlight, oil, moisture, ozone, abrasion and impact.

**NEC COLOR CODE FOR CONTROL CABLES:** 1—Black • 2—White • 3—Red • 4—Green • 5—Orange • 6—Blue • 7—Yellow • 8—Brown • 9—Slate • 10—Purple • 11—Black/White • 12—Red/White • 13—Orange/White • 14—Blue/White • 15—Yellow/White • 16—Brown/White • 17—Slate/White • 18—Purple/White • 19—Red/Black • 20 Orange/Black • 21—Blue/Black • 22—Yellow/Black • 23—Brown/Black • 24—Slate/Black • 25—Purple/Black • 26—Black/Red • 27—Blue/Red • 28—Yellow/Red • 29—Brown/Red • 30—Slate/Red • 31—Purple/Red • 32—Black/Orange • 33—Blue/Orange • 34—Yellow/Orange • 35—Brown/Orange • 36—Slate/Orange • 37—Purple/Orange • 38—Black/Blue • 39—Red/Blue • 40—Orange/Blue

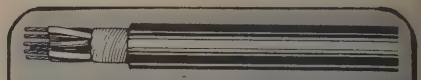
**IPCEA COLOR CODING:** 1—Black • 2—White • 3—Red • 4—Green • 5—Orange • 6—Blue • 7—White/Black • 8—Red/Black • 9—Green/Black • 10—Orange/Black • 11—Blue/Black • 12—Black/White • 13—Red/White • 14—Green/White • 15—Blue/White • 16—Black/Red • 17—White/Red • 18—Orange/Red • 19—Blue/Red • 20—Red/Green



### UNSHIELDED CONTROL CABLE (PLASTIC)

| DEARBORN NO. | NO. CONDUCTOR | AWG SIZE | JKT. THICKNESS | NOM. O.D. |
|---|---|---|---|---|
| 701602 | 2 | 16 | .045 | .295 |
| 701603 | 3 | 16 | .045 | .310 |
| 701604 | 4 | 16 | .045 | .335 |
| 701605 | 5 | 16 | .045 | .360 |
| 701606 | 6 | 16 | .045 | .395 |
| 701607 | 7 | 16 | .045 | .395 |
| 701608 | 8 | 16 | .045 | .420 |
| 701609 | 9 | 16 | .045 | .455 |
| 701610 | 10 | 16 | .045 | .490 |
| 701611 | 11 | 16 | .045 | .505 |
| 701612 | 12 | 16 | .045 | .505 |
| 701614 | 14 | 16 | .060 | .560 |
| 701616 | 16 | 16 | .060 | .595 |
| 701620 | 20 | 16 | .060 | .650 |
| 701402 | 2 | 14 | .045 | .325 |
| 701403 | 3 | 14 | .045 | .345 |
| 701404 | 4 | 14 | .045 | .375 |
| 701405 | 5 | 14 | .045 | .405 |
| 701406 | 6 | 14 | .045 | .440 |
| 701407 | 7 | 14 | .045 | .440 |
| 701408 | 8 | 14 | .045 | .475 |
| 701409 | 9 | 14 | .045 | .510 |
| 701410 | 10 | 14 | .060 | .585 |
| 701411 | 11 | 14 | .060 | .605 |
| 701412 | 12 | 14 | .060 | .605 |
| 701414 | 14 | 14 | .060 | .630 |
| 701416 | 16 | 14 | .060 | .665 |
| 701420 | 20 | 14 | .060 | .735 |
| 701202 | 2 | 12 | .045 | .365 |
| 701203 | 3 | 12 | .045 | .385 |
| 701204 | 4 | 12 | .045 | .420 |
| 701205 | 5 | 12 | .045 | .460 |
| 701206 | 6 | 12 | .060 | .500 |
| 701207 | 7 | 12 | .060 | .500 |
| 701208 | 8 | 12 | .060 | .570 |
| 701209 | 9 | 12 | .060 | .615 |
| 701210 | 10 | 12 | .060 | .665 |
| 701211 | 11 | 12 | .060 | .685 |
| 701212 | 12 | 12 | .060 | .685 |
| 701214 | 14 | 12 | .060 | .720 |
| 701216 | 16 | 12 | .080 | .760 |
| 701220 | 20 | 12 | .080 | .880 |

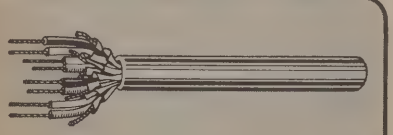
25 Ft. MINIMUM ORDER — CUT TO LENGTH — NO RETURNS



### UNSHIELDED CONTROL CABLES(NEOPRENE)

| DEARBORN NO. | NO. COND. | SIZE AWG | INSULATION THICKNESS | JACKET THICKNESS | NOMINAL O.D. |
|---|---|---|---|---|---|
| 711805 | 5 | 18 | 1/32 | 5/64 | .490 |
| 711806 | 6 | 18 | 1/32 | 5/64 | .525 |
| 711808 | 8 | 18 | 1/32 | 5/64 | .570 |
| 711809 | 9 | 18 | 1/32 | 5/64 | .620 |
| 711810 | 10 | 18 | 1/32 | 5/64 | .630 |
| 711814 | 14 | 18 | 1/32 | 6/64 | .710 |
| 711605 | 5 | 16 | 1/32 | 5/64 | .530 |
| 711606 | 6 | 16 | 1/32 | 5/64 | .570 |
| 711607 | 7 | 16 | 1/32 | 5/64 | .570 |
| 711608 | 8 | 16 | 1/32 | 5/64 | .605 |
| 711610 | 10 | 16 | 1/32 | 6/64 | .740 |
| 711612 | 12 | 16 | 1/32 | 6/64 | .760 |
| 711614 | 14 | 16 | 1/32 | 6/64 | .785 |
| 711616 | 16 | 16 | 1/32 | 6/64 | .820 |
| 711620 | 20 | 16 | 1/32 | 6/64 | .920 |
| 711622 | 22 | 16 | 1/32 | 6/64 | .930 |
| 711624 | 24 | 16 | 1/32 | 7/64 | 1.010 |
| 711626 | 26 | 16 | 1/32 | 7/64 | 1.030 |
| 711630 | 30 | 16 | 1/32 | 7/64 | 1.050 |
| 711637 | 37 | 16 | 1/32 | 7/64 | 1.140 |
| 711640 | 40 | 16 | 1/32 | 7/64 | 1.175 |
| 711650 | 50 | 16 | 1/32 | 7/64 | 1.520 |
| 711660 | 60 | 16 | 1/32 | 7/64 | 1.610 |
| 711405 | 5 | 14 | 3/64 | 6/64 | .695 |
| 711406 | 6 | 14 | 3/64 | 6/64 | .750 |
| 711407 | 7 | 14 | 3/64 | 6/64 | .760 |
| 711408 | 8 | 14 | 3/64 | 6/64 | .820 |
| 711409 | 9 | 14 | 3/64 | 6/64 | .925 |
| 711410 | 10 | 14 | 3/64 | 6/64 | .930 |
| 711412 | 12 | 14 | 3/64 | 6/64 | .935 |
| 711205 | 5 | 12 | 3/64 | 6/64 | .750 |
| 711206 | 6 | 12 | 3/64 | 6/64 | .810 |
| 711207 | 7 | 12 | 3/64 | 6/64 | .870 |
| 711208 | 8 | 12 | 3/64 | 6/64 | .920 |
| 711209 | 9 | 12 | 3/64 | 7/64 | 1.000 |
| 711210 | 10 | 12 | 3/64 | 7/64 | 1.000 |
| 711212 | 12 | 12 | 3/64 | 7/64 | 1.050 |
| 711216 | 16 | 12 | 3/64 | 7/64 | 1.160 |
| 711005 | 5 | 10 | 3/64 | 6/64 | .830 |
| 711006 | 6 | 10 | 3/64 | 6/64 | .890 |
| 711008 | 8 | 10 | 3/64 | 7/64 | 1.060 |
| 711010 | 10 | 10 | 3/64 | 7/64 | 1.160 |

25 FT. MINIMUM ORDER — CUT TO LENGTH — NO RETURNS



### INDIVIDUALLY SHIELDED PAIRS

### STRANDED CONDUCTORS

| DEARBORN NO. | NO. OF PAIRS | NO. COND. | SIZE & STRANDING | NOM. JKT. THICK. | NOM. O.D. | STOCK PUT UP (FT.) |
|---|---|---|---|---|---|---|
| 962201 | 1 | 2 | 22-7/30 ‡ | .020 | .135 | 100, 500 & 1000 |
| 962203 | 3 | 6 | 22-7/30 | .025 | .252 | 100, 500 & 1000 |
| 962206 | 6 | 12 | 22-7/30 | .030 | .342 | 100, 500 & 1000 |
| 962209 | 9 | 18 | 22-7/30 | .035 | .410 | 100, 500 & 1000 |
| 962211 | 11 | 22 | 22-7/30 | .040 | .457 | 100, 500 & 1000 |
| 962215 | 15 | 30 | 22-7/30 | .040 | .523 | 100, 500 & 1000 |
| 962219 | 19 | 38 | 22-7/30 | .050 | .570 | 100, 500 & 1000 |
| 962227 | 27 | 54 | 22-7/30 | .055 | .687 | 100, 500 & 1000 |
| 961803 | 3 | 6 | 18-16/30 | .035 | .372 | 1000 |
| 961806 | 6 | 12 | 18-16/30 | .045 | .555 | 1000 |
| 961809 | 9 | 18 | 18-16/30 | .055 | .620 | 1000 |
| 961812 | 12 | 24 | 18-16/30 | .070 | .765 | 1000 |
| 961815 | 15 | 30 | 18-16/30 | .070 | .830 | 1000 |

**COLOR COMBINATION OF PAIRS**

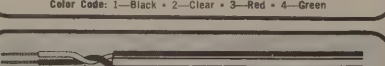
| Pair No. | Pair No. | Pair No. |
|---|---|---|
| 1—Black and Red | 10—Red and Blue | 19—White and Blue |
| 2—Black and White | 11—Red and Yellow | 20—White and Yellow |
| 3—Black and Green | 12—Red and Brown | 21—White and Brown |
| 4—Black and Blue | 13—Red and Orange | 22—White and Orange |
| 5—Black and Yellow | 14—Green and White | 23—Blue and Yellow |
| 6—Black and Brown | 15—Green and Blue | 24—Blue and Brown |
| 7—Black and Orange | 16—Green and Yellow | 25—Blue and Orange |
| 8—Red and White | 17—Green and Brown | 26—Brown and Yellow |
| 9—Red and Green | 18—Green and Orange | 27—Brown and Orange |

‡ .008" Polypropylene insulation ▲ Grey or Black Jacket - Specify Color

### FOIL SHIELDED, MULTI-CONDUCTOR CABLE

| DEARBORN NO. | NO. COND. | AWG SIZE | STRANDING | NOM. JKT. THICK. | NOM. O.D. | STOCK PUT UP (FT.) |
|---|---|---|---|---|---|---|
| 972202 | 2 | 22 | 7/30 | .025 | .167 | 100, 500 & 1000 |
| 972203 | 3 | 22 | 7/30 | .025 | .175 | 100, 500 & 1000 |
| 972204 | 4 | 22 | 7/30 | .025 | .190 | 100, 500 & 1000 |
| 972002 | 2 | 20 | 10/30 | .025 | .195 | 100, 500 & 1000 |
| 972003 | 3 | 20 | 10/30 | .025 | .200 | 100, 500 & 1000 |
| 972004 | 4 | 20 | 10/30 | .028 | .215 | 100, 500 & 1000 |
| 971802 | 2 | 18 | 16/30 | .028 | .223 | 100, 500 & 1000 |
| 971803 | 3 | 18 | 16/30 | .028 | .236 | 100, 500 & 1000 |
| 971804 | 4 | 18 | 16/30 | .028 | .250 | 100, 500 & 1000 |
| 971602 | 2 | 16 | 26/30 | .030 | .275 | 100, 500 & 1000 |
| 971603 | 3 | 16 | 26/30 | .030 | .300 | 100, 500 & 1000 |
| 971402 | 2 | 14 | 41/30 | .035 | .340 | 100, 500 & 1000 |
| 971403 | 3 | 14 | 41/30 | .035 | .400 | 100, 500 & 1000 |

**Color Code:** 1—Black • 2—Clear • 3—Red • 4—Green



### 2 PAIR MINIATURE AUDIO AND SOUND CABLE
**1 - Shielded — 1 - Unshielded**

| DEARBORN NO. | NO. OF PAIRS | NO. COND. | SIZE & STRANDING | NOM. JKT. O.D. | PUT UP (FT.) |
|---|---|---|---|---|---|
| 970001 | 2 | 4 | 22-7/30 | .165 | 100, 500 & 1000 |
| 970002 | 2 | 4 | 20-10/30 | .230 | 100, 500 & 1000 |

## Data and Audio Cable Miniature Sound Cable

### INDIVIDUALLY SHIELDED MULTIPLE PAIRS

Tinned copper conductors, either stranded or solid (see tables), insulated with high density color coded *.010" Polyethylene, conductors twisted into pairs. Along with a †22 gauge stranded tinned copper drain wire, each pair is shielded with a Mylar supported aluminum foil shield. Covered with a Grey PVC jacket overall. Used for all circuits requiring isolation between pairs. Especially suitable for multiple audio and data control circuits. Mylar Wrap between shields and jacket.

* .016" on #18 gauge † #20 on #18 gauge

### FOIL SHIELDED, PLASTIC JACKETED, MULTI-CONDUCTOR CABLE

Stranded tinned copper conductors, insulated with .015"‡ thick color coded Polyethylene insulation. Conductors are cabled and, along a No. 22§ tinned copper stranded drain wire laid parallel, are shielded with aluminum foil Mylar backed shield. Gray PVC jacket overall. This type of shielding provides 100% effective shielding and is suitable for audio and data work where cross talk must be reduced to a minimum. **Temperature rating:** −20°C to +60°C. **Operating voltage rating:** 400 volts.

§ No. 20 on No. 18, No. 16, No. 14.
‡.025" on No. 16, .032" on No. 14.

### 2 PAIR MINIATURE AUDIO AND SOUND CABLE

Tinned copper, .009"¶ Polypropylene insulation on 970001. 1 pair of black and red shielded with Mylar aluminum shield. Other pair of white and green twisted, not shielded. Both pairs twisted with #22 stranded T.C. drain wire and chrome vinyl jacket overall.

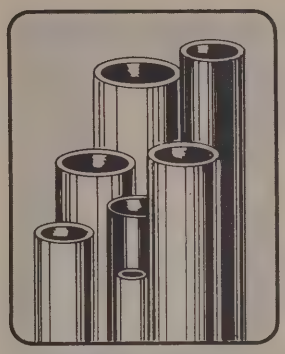
¶ .015" PVC on 970002

DEARBORN WIRE AND CABLE CO. 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

# DEARBORN WIRE AND CABLE COMPANY

## Extruded Tubing

- Plastic
- Polyvinyl Chloride
- High and Low Temperature
- MIL-Spec and U.L.
- TFE Teflon* (MIL-I-22129B)
- Lightwall
- Thinwall
- Standard Wall



### "PVC" U.L./MIL 105°C

| Dearborn No. | Size | Nom. I.D. Inches | Nom. Wall Thickness | Stock Put Up (Ft.) |
|---|---|---|---|---|
| SM24 | 24 | .022 | .012 | 100 & 1000 |
| SM22 | 22 | .027 | .012 | 100 & 1000 |
| SM20 | 20 | .034 | .016 | 100 & 1000 |
| SM19 | 19 | .038 | .016 | 100 & 1000 |
| SM18 | 18 | .042 | .016 | 100 & 1000 |
| SM17 | 17 | .047 | .016 | 100 & 1000 |
| SM16 | 16 | .053 | .016 | 100 & 1000 |
| SM15 | 15 | .059 | .016 | 100 & 1000 |
| SM14 | 14 | .066 | .016 | 100 & 500 |
| SM13 | 13 | .076 | .016 | 100 & 500 |
| SM12 | 12 | .085 | .016 | 100 & 500 |
| SM11 | 11 | .095 | .016 | 100 & 500 |
| SM10 | 10 | .106 | .016 | 100 & 500 |
| SM9 | 9 | .118 | .020 | 100 & 500 |
| SM8 | 8 | .133 | .020 | 100 & 500 |
| SM7 | 7 | .148 | .020 | 100 & 500 |
| SM6 | 6 | .166 | .020 | 100 & 500 |
| SM5 | 5 | .186 | .020 | 100 & 200 |
| SM4 | 4 | .208 | .020 | 100 & 200 |
| SM3 | 3 | .234 | .020 | 100 & 200 |
| SM2 | 2 | .263 | .020 | 100 & 200 |
| SM1 | 1 | .294 | .020 | 100 & 200 |
| SM0 | 0 | .330 | .020 | 100 & 200 |
| SM516 | 5/16 | .312 | .025 | 100 & 200 |
| SM380 | 3/8 | .375 | .025 | 50 & 100 |
| SM716 | 7/16 | .438 | .025 | 50 & 100 |
| SM120 | 1/2 | .500 | .025 | 50 & 100 |
| SM916 | 9/16 | .562 | .030 | 50 |
| SM580 | 5/8 | .625 | .030 | 50 |
| SM340 | 3/4 | .750 | .035 | 50 |
| SM780 | 7/8 | .875 | .035 | 50 |
| SM100 | 1 | 1.000 | .035 | 50 |
| SM114 | 1-1/4 | 1.250 | .040 | 25 |
| SM138 | 1-3/8 | 1.375 | .040 | 25 |
| SM112 | 1-1/2 | 1.500 | .045 | 25 |
| SM134 | 1-3/4 | 1.750 | .055 | 25 |
| SM200 | 2 | 2.000 | .060 | 25 |
| SM214 | 2-1/4 | 2.250 | .065 | 25 |
| SM212 | 2-1/2 | 2.500 | .070 | 25 |

STOCK COLORS: Black, White, Red, Yellow, Blue, Green and Clear.

### THINWALL / TEFLON

| Dearborn No. | Size | Nom. I.D. Inches | Nom. Wall Thickness | Stock Put Up (Ft.) |
|---|---|---|---|---|
| | | | | Spools |
| TW30 | 30 | .013 | .009 | 100 & 1000 |
| TW28 | 28 | .015 | .009 | 100 & 1000 |
| TW26 | 26 | .018 | .009 | 100 & 1000 |
| TW24 | 24 | .022 | .009 | 100 & 1000 |
| TW22 | 22 | .027 | .009 | 100 & 1000 |
| TW20 | 20 | .034 | .012 | 100 & 1000 |
| TW19 | 19 | .038 | .012 | 100 & 1000 |
| TW18 | 18 | .042 | .012 | 100 & 1000 |
| TW17 | 17 | .047 | .012 | 100 & 1000 |
| TW16 | 16 | .053 | .012 | 100 & 1000 |
| TW15 | 15 | .059 | .012 | 100 & 1000 |
| TW14 | 14 | .066 | .012 | 100 & 500 |
| TW13 | 13 | .076 | .012 | 100 & 500 |
| TW12 | 12 | .085 | .012 | 100 & 500 |
| TW11 | 11 | .095 | .012 | 100 & 500 |
| TW10 | 10 | .106 | .012 | 100 & 500 |
| TW9 | 9 | .118 | .015 | 100 & 500 |
| TW180 | 1/8 | .125 | .015 | 100 & 500 |
| | | Items below on Coils | | |
| TW8 | 8 | .138 | .015 | 100 |
| TW7 | 7 | .148 | .015 | 100 |
| TW6 | 6 | .166 | .015 | 100 |
| TW5 | 5 | .188 | .015 | 100 |
| TW4 | 4 | .208 | .015 | 100 |
| TW3 | 3 | .234 | .015 | 50 |
| TW140 | 1/4 | .250 | .015 | 50 |
| TW2 | 2 | .263 | .015 | 50 |
| TW1 | 1 | .294 | .015 | 50 |
| TW516 | 5/16 | .312 | .015 | 50 |
| TW0 | 0 | .330 | .015 | 50 |

■ **POLYVINYL CHLORIDE "SM" 105°C U.L./MIL** This is a high temperature tubing meeting both U.L. and MIL-I-631C, Type F, Form U, Grade C, Class 1, (FUNGUS RESISTANT), Category 1 requirements. **Temperature rating:** −20°C to +105°C. **Specs:** MIL-I-631C, ASTM D-922 Grade C. U.L. File number on request.

■ **TFE TEFLON TUBING** Extruded TFE Teflon in three Wall Thicknesses. Lightwall: (.006" to .012"), Thinwall: (.009" to .015"), Standard: (.010" to .020").
**Operating Temperature Range:** −65°C to +250°C. Unaffected by soldering iron temperatures. Dearborn extruded Teflon tubing is chemically inert, has zero moisture absorption and its dielectric strength at high frequencies surpasses other types of insulation even at maximum operating temperatures.
These three wall thicknesses offer an excellent choice for use in miniaturization and compactness of design, especially where high heat, and a chemical solvent and corrosion resistant material is desired.
Meets requirements of— MIL-I-22129B, MIL-P-14077, MIL-P-14078, AMS-3651, AMS-3653.
**COLOR CODE:** 1—Clear or Natural • 2—Black • 3—Red • Other colors available on Special Order.
* Du Pont Trademark.

## Heat Shrinkable Tubing

## Style ST-301

STYLE ST-301

| DEARBORN NO. | EXP. SIZE | MIN. I.D. | REC. I.D. | WALL THICK. | NO. OF LENGTHS PER BOX |
|---|---|---|---|---|---|
| 100' — 25 x 4' LENGTHS PER BOX | | | | | 6" LENGTHS |
| ST-301-3/64 | 3/64" | .046" | .023" | .016" | 40 |
| ST-301-1/16 | 1/16" | .063" | .031" | .017" | 36 |
| ST-301-3/32 | 3/32" | .093" | .046" | .020" | 32 |
| ST-301-1/8 | 1/8" | .125" | 062" | .020" | 28 |
| ST-301-3/16 | 3/16" | .187" | .093" | .020" | 24 |
| ST-301-1/4 | 1/4" | .250" | .125" | .025" | 20 |
| ST-301-3/8 | 3/8" | .375" | .187" | .025" | 16 |
| 20' — 5 x 4' LENGTHS PER BOX | | | | | 6" LENGTHS |
| ST-301-1/2 | 1/2" | .500" | .250" | .025" | 14 |
| ST-301-3/4 | 3/4" | .750" | .375" | .030" | 12 |
| ST-301-1 | 1" | 1.00" | .500" | .035" | 8 |
| ST-301-1½ | 1½" | 1.50" | .750" | .040" | 5 |
| ST-301-2 | 2" | 2.00" | 1.00" | .045" | 3 |
| 8' — 2 x 4' LENGTHS PER BOX | | | | | 6" LENGTHS |
| ST-301-3 | 3" | 3.00" | 1.50" | .050" | 2 |
| ST-301-4 | 4" | 4.00" | 2.00" | .055" | 1 |

Specify 4' or 6" Box When Ordering
Stock Colors: Clear, Black, Red and White — Specify Color.

**STYLE ST-301 POLYOLEFIN HEAT SHRINKABLE TUBING TO MIL-I-23053B/5, U.L. APPROVED**

Dearborn Style ST-301 Heat Shrinkable Tubing is an irradiated, thermally stabilized, polyolefin product which meets or exceeds MIL-I-23053B/5, AMS 3636B and AMS 3637B. ST-301 shrinks to 50% of diameter at 121°C (250°F) in 7 seconds, and has an operating temperature range of −55°C (−67°F) to +135°C (+275°F).
MIL-I-23053/5 — CLASS I (COLORED INSULATION)
MIL-I-23053/5 — CLASS II (CLEAR INSULATION)

All sizes are shown and supplied in expanded inside diameters. Stock Colors: Black, Red, White and Clear. Clear is Non-Flame Retardant. All other colors are Flame Retardant under MIL-I-23053B/5. Additional colors available on special order. Supplied in either 4 Ft. or 6 Inch lengths, and 6 Inch Assortments. Suitable for all military applications as well as industrial and commercial uses.
**ST-301 Kit Assortments Available in 6" lengths. Assorted colors AST-301-1-6 — 3/64" thru 3/16" (30) Lengths. AST-301-2-6 — 1/4" thru 3/4" (16) Lengths.**

## Detects Faulty Circuits Instantly!

## CIRCUIT MONITOR

**HELPS PREVENT FIRE DAMAGE, AND LOSS!**

The Circuit Monitor detects whether or not proper ground and AC polarity are available from 115 Volt 3 wire power outlets for safe operation of power tools, appliances, office machines, lab and other electrical equipment. It does the job instantly and accurately without the inconvenience of handling probes and meters.

| Dearborn No. | Description |
|---|---|
| 5102B | Circuit Monitor in Box. |
| 5012C | Circuit Monitor on Card for Display Rack. |

**EASY TO USE.** Simply plug into 3 wire receptacle and lights on Circuit Monitor will indicate the following:

- **O & K** Circuit Okay
- **O only** Improper Ground
- **K only** Improper Neutral
- **O & X** Reversed Polarity
- **K & X** Reversed Ground
- **None** Power is OFF

DEARBORN WIRE AND CABLE CO. 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

# DEARBORN WIRE AND CABLE COMPANY

## MIL-W-3861 Type S, QQ-W-343 Type S, ASTM B-33 Uninsulated Tinned or Silver Plated Copper Wire

### FLAT BRAID
Tinned copper strands, woven and rolled flat to specific width depending on construction, number of strands, etc.
Used for bonding, straps, grounding, or connecting moving parts. Recommended for high current usage.

***FLAT TINNED COPPER BRAID**

| DEARBORN NO. | NOM. FLAT WIDTH (INCHES) | TOT. NO. INDIV. STRANDS | SIZE EACH STRAND AWG | NOM. CIRCULAR MIL AREA | STOCK PUT UPS (FT.) |
|---|---|---|---|---|---|
| 91221 | .025 | 8 | 36 | 200 | 100, 500 & 1000 |
| 91222 | 1/32 | 16 | 36 | 400 | 100, 500 & 1000 |
| 91223 | 3/64 | 24 | 36 | 600 | 100, 500 & 1000 |
| 91224 | 3/32 | 48 | 36 | 1200 | 100, 500 & 1000 |
| 91229 | 1/8 | 72 | 36 | 1800 | 100, 500 & 1000 |
| 91230 | 3/16 | 120 | 36 | 3000 | 100, 500 & 1000 |
| 91231 | 1/4 | 168 | 36 | 4200 | 100, 500 & 1000 |
| 91232 | 3/8 | 288 | 36 | 7200 | 100, 500 & 1000 |
| 91233 | 1/2 | 384 | 36 | 9600 | 100, 500 & 1000 |
| 91234 | 3/4 | 832 | 36 | 20,800 | 100, 500 & 1000 |
| 91235 | 1 | 832 | 36 | 20,800 | 100, 500 & 1000 |
| 91239 | 1-3/8 | 336 | 30 | 33,700 | 100, 500 & 1000 |
| 91240 | 1-1/2 | 528 | 30 | 53,064 | 100, 500 & 1000 |
| 91241 | 1-3/4 | 1248 | 30 | 125,424 | 100, 500 & 1000 |
| 91242 | 2 | 1536 | 30 | 154,368 | 100, 500 & 1000 |

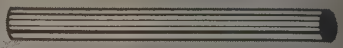
*Commercial Type.

### TUBULAR BRAID
Tinned copper braid woven in completely round configuration as outlined in MIL-SPEC QQ-B-575. All strands soft drawn tinned copper. Shielding is 95% or more when placed over equivalent diameter mandrel to the inside diameter of the tubular braid. Used as both shielding and protective covering.

**TINNED COPPER TUBULAR BRAID**

| DEARBORN P/N | SIZE I.D. INCHES | TOTAL NO. INDIVIDUAL STRANDS | SIZE EACH STRAND AWG | NOM. CIRCULAR MIL AREA | STOCK PUT UPS (FT.) |
|---|---|---|---|---|---|
| 92160 | 1/32 | 24 | 36 | 600 | 100 |
| 92162 | 1/16 | 48 | 36 | 1200 | 100 |
| 92164 | 7/64 | 96 | 36 | 2400 | 100 |
| 92166 | 1/8 | 120 | 36 | 3000 | 100 |
| 92168 | 11/64 | 168 | 36 | 4200 | 100 |
| 92170 | 13/64 | 192 | 34 | 7630 | 100 |
| 92171 | 1/4 | 384 | 36 | 9600 | 100 |
| 92172 | 3/8 | 384 | 36 | 9600 | 100 |
| 92174 | 1/2 | 528 | 36 | 13,200 | 100 |
| 92175 | 9/16 | 480 | 30 | 48,240 | 100 |
| 92176 | 25/32 | 864 | 36 | 21,600 | 100 |
| 92177 | * 7/8 | 336 | 30 | 33,700 | 50 & 100 |
| 92178 | *1 | 384 | 30 | 38,600 | 50 & 100 |
| 92179 | *1-1/8 | 432 | 30 | 43,330 | 50 & 100 |
| 92180 | *1-1/4 | 480 | 30 | 48,150 | 50 & 100 |
| 92181 | *1-3/8 | 528 | 30 | 53,000 | 50 & 100 |
| 92182 | *1-1/2 | 576 | 30 | 57,775 | 50 & 100 |

### SOFT DRAWN SOLID WIRE
Properly annealed, pure electrolytic soft, drawn, solid, tinned or silver plated copper wire used for applications such as point to point wiring, component leads, and ground wire.



**UNINSULATED TINNED COPPER WIRE**

| DEARBORN NO. | CONDUCTOR SIZE | NOM. CIRCULAR MIL AREA | NOM. O.D. | STOCK PUT UPS (FT.) |
|---|---|---|---|---|
| 938 | 38 | 16.0 | .004 | 100 & 1000 |
| 936 | 36 | 25.0 | .005 | 100 & 1000 |
| 934 | 34 | 39.7 | .006 | 100 & 1000 |
| 932 | 32 | 64.0 | .008 | 100 & 1000 |
| 930 | 30 | 100.5 | .010 | 100 & 1000 |
| 928 | 28 | 159.8 | .013 | 100 & 1000 |
| 926 | 26 | 254.1 | .016 | 100 & 1000 |
| 924 | 24 | 404.0 | .020 | 100 & 1000 |
| 922 | 22 | 642.4 | .025 | 100 & 1000 |
| 920 | 20 | 1,022.0 | .033 | 100 & 1000 |
| 918 | 18 | 1,642.0 | .040 | 100 & 1000 |
| 916 | 16 | 2,583.0 | .051 | 100 & 1000 |
| 914 | 14 | 4,107.0 | .065 | 100 & 1000 |
| 912 | 12 | 6,530.0 | .082 | 100 & 1000 |
| 910 | 10 | 10,380.0 | .103 | 100 & 1000 |
| 908 | 8 | 16,510.0 | .129 | 100 & 1000 |
| 906 | 6 | 26,250.0 | .162 | 100 & 1000 |

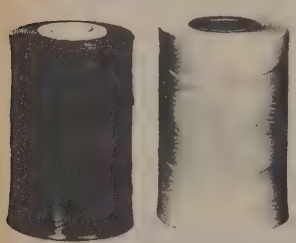
**UNINSULATED SILVER PLATED WIRE**

| | | | | |
|---|---|---|---|---|
| 922SPC | 22 | 642.4 | .025 | 100 & 1000 |
| 920SPC | 20 | 1,022.0 | .033 | 100 & 1000 |
| 918SPC | 18 | 1,642.0 | .040 | 100 & 1000 |
| 916SPC | 16 | 2,583.0 | .051 | 100 & 1000 |
| 914SPC | 14 | 4,107.0 | .065 | 100 & 1000 |

Suffix SPC denotes Silver Plated Copper

## Lacing Tapes and Twine Meeting and Exceeding Military and Commercial Specifications

**NYLON LACING TAPE MIL-T-43435 TYPE I**



- **INDUSTRIAL PRICING!**
- **SAME DAY SHIPMENT!**

Designed to Meet and Exceed MIL-T-713D, Type P, and MIL-T-43435 Types I, II, and IV, also AMS 3815, AMS 3816, AMS 3817.

**FINISHES AND COATINGS**

- **W — WAX, MIL SPEC "B"**

A microcrystalline fungicidal wax which exceeds military specifications, provides excellent knot retention and is suitable for either lacing or spot ties.

- **G — SYNTHETIC RUBBER, MIL SPEC "C"**

A special continuous coating of fungicidal synthetic elastomer (rubber) which exceeds Mil Spec requirements, ties easily and exhibits outstanding knot holding characteristics.

- **A — SYNTHETIC RESIN, MIL SPEC "E"**

A synthetic rubber-like resin formulated with fungicidal ingredients. Handling characteristics are excellent, knot retention is outstanding; meets or exceeds Mil Spec requirements. Operational Temperature Ranges: −67°F to +250°F on all items.

**NYLON LACING TWINE MIL-T-713D TYPE P**
Round twisted nylon fiber impregnated with microcrystalline fungicidal wax.

**POLYESTER LACING TAPE MIL-T-43335 TYPE II**
Flat braided polyester yarn impregnated with special finishes to military specifications. **Available in 500-yard spools.**

**NYLON LACING TAPE MIL-T-43435 TYPE I**
Flat braided high-tenacity nylon yarn impregnated with microcrystalline fungicidal wax or impregnations to meet military specifications. **Available in 500-yard spools.**

**NYLON LACING TAPE MIL-T-43435 TYPE I**
Flat braided high-tenacity nylon yarn impregnated with microcrystalline fungicidal wax or impregnations to meet military specifications. Available in 500-yard spools.

| MIL SPEC SIZE | DEARBORN PART NO. | TEST TENSILE STRENGTH | WIDTH | COLOR | FINISH | MIL SPEC FINISH |
|---|---|---|---|---|---|---|
| 3 | 805032W | 50 lbs. | .090″ | Natural | A | E |
| 3 | 805032B | 50 lbs. | .090″ | Black | A | E |
| 4 | 802534W | 25 lbs. | .062″ | Natural | W | B |
| 4 | 802534B | 25 lbs. | .062″ | Black | W | B |
| 3 | 805036W | 50 lbs. | .090″ | Natural | W | B |
| 3 | 805036B | 50 lbs. | .090″ | Black | W | B |
| 3 | 805040W | 50 lbs. | .090″ | Natural | G | C |
| 3 | 805040B | 50 lbs. | .090″ | Black | G | C |

**POLYESTER LACING TAPE MIL-T-43335 TYPE II**
Flat braided polyester yarn impregnated with special finishes to military specifications. Available in 500-yard spools.

| MIL SPEC SIZE | DEARBORN PART NO. | TEST TENSILE STRENGTH | WIDTH | COLOR | FINISH | MIL SPEC FINISH |
|---|---|---|---|---|---|---|
| 3 | 805058W | 50 lbs. | .090″ | Natural | A | E |
| 3 | 805058B | 50 lbs. | .090″ | Black | A | E |
| 3 | 805062W | 50 lbs. | .090″ | Natural | W | B |
| 3 | 805062B | 50 lbs. | .090″ | Black | W | B |

**NYLON LACING TWINE MIL-T-713D TYPE P**
Round twisted nylon fiber impregnated with microcrystalline fungicidal wax.

| MIL SPEC CLASS | DEARBORN PART NO. | TEST TENSILE STRENGTH | NOM. DIAM. | PUT-UP 1 LB. SPOOL (LENGTH) | COLOR | FINISH | MIL SPEC FINISH |
|---|---|---|---|---|---|---|---|
| 1 | 807013W | 70 lbs. | .039″ | 550 yds. | Natural | W | B |
| 1 | 807013B | 70 lbs. | .039″ | 550 yds. | Black | W | B |
| 2 | 804814W | 48 lbs. | .029″ | 750 yds. | Natural | W | B |
| 2 | 804814B | 48 lbs. | .029″ | 750 yds. | Black | W | B |
| 3 | 803215W | 32 lbs. | .025″ | 1100 yds. | Natural | W | B |
| 3 | 803215B | 32 lbs. | .025″ | 1100 yds. | Black | W | B |

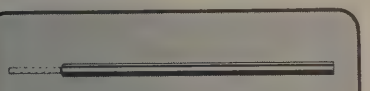
DEARBORN WIRE AND CABLE CO. 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

# DEARBORN WIRE AND CABLE COMPANY

## Teflon* Insulated Aircraft, Missile and Electronic Wire and Cable

### MIL-W-16878D, TYPE ET

**Voltage Rating:** 250 volts. **Temperature Rating:** −65°C to +200°C. Single conductor stranded silver plated copper, extruded TFE Teflon insulation.



MIL-W-16878D, TYPE ET, TEFLON

| DEARBORN P/N | TYPE & CONDUCTOR AWG SIZE & STRAND. | | NOM. WALL THICKNESS | NOM. O.D. | STOCK P.U. (FT.) | STOCK COLORS |
|---|---|---|---|---|---|---|
| 33207 | ET-32 | 7/40 | .006 | .021 | 500 & 1000 | 0-9 |
| 33219 | ET-32 | 19/44 | .006 | .023 | 500 & 1000 | 0-9 |
| 33007 | ET-30 | 7/38 | .006 | .024 | 500 & 1000 | 0-9 |
| 33019 | ET-30 | 19/42 | .006 | .024 | 500 & 1000 | 0-9 |
| 32807 | ET-28 | 7/36 | .006 | .027 | 500 & 1000 | 0-9 |
| 32819 | ET-28 | 19/40 | .006 | .027 | 500 & 1000 | 0-9 |
| 32607 | ET-26 | 7/34 | .006 | .031 | 500 & 1000 | 0-9 |
| 32619 | ET-26 | 19/38 | 006 | 031 | 500 & 1000 | 0-9 |
| 32407 | ET-24 | 7/32 | .006 | 036 | 500 & 1000 | 0-9 |
| 32419 | ET-24 | 19/36 | .006 | .036 | 500 & 1000 | 0-9 |
| 32207 | ET-22 | 7/30 | 006 | .042 | 500 & 1000 | 0-9 |
| 32219 | ET-22 | 19/34 | 006 | 042 | 500 & 1000 | 0-9 |
| 32007 | ET-20 | 7/28 | 006 | .050 | 500 & 1000 | 0-9 |
| 32019 | ET-20 | 19/32 | .006 | .050 | 500 & 1000 | 0-9 |

### MIL-W-7139B, CLASS I WIRE

**Voltage Rating:** 600 volts. **Temperature Rating:** −65°C to +200°C. Silver plated copper, insulated with layers of TFE Teflon, interspersed with layers of Teflon impregnated fiberglass. Color is white with blue tracer. Teflon impregnated fiberglass braid overall.

MIL-W-7139B, CLASS I WIRE

| DEARBORN P/N | CONDUCTOR AWG SIZE & STRANDING | | NOMINAL O.D. FINISHED WIRE | STOCK PUT UP (FT.) |
|---|---|---|---|---|
| 82219 | 22 | 19/34 | .087 | 500 & 1000 |
| 82019 | 20 | 19/32 | .097 | 500 & 1000 |
| 81819 | 18 | 19/30 | .112 | 500 & 1000 |
| 81619 | 16 | 19/29 | .132 | 500 & 1000 |
| 81419 | 14 | 19/27 | .147 | 500 & 1000 |
| 81219 | 12 | 19/25 | .167 | 500 & 1000 |
| 81037 | 10 | 37/26 | .197 | 500 & 1000 |
| 88133 | 8 | 133/29 | .250 | 500 & 1000 |
| 86133 | 6 | 133/27 | .293 | 500 & 1000 |
| 84133 | 4 | 133/25 | .350 | 500 & 1000 |
| 82665 | 2 | 665/30 | .435 | 500 & 1000 |
| 81817 | 1 | 817/30 | .480 | 500 & 1000 |
| 80001 | 0 | 1045/30 | .540 | 500 & 1000 |
| 80002 | 00 | 1330/30 | .590 | 500 & 1000 |
| 80003 | 000 | 1665/30 | .654 | 500 & 1000 |
| 80004 | 0000 | 2109/30 | .743 | 500 & 1000 |

### MIL-W-7139B, CLASS II WIRE

**Voltage Rating:** 600 volts. **Temperature Rating:** −65°C to +260°C. Nickel coated copper, insulated with layers of TFE Teflon, interspersed with layers of Teflon impregnated fiberglass. Color is white with orange tracer. Teflon impregnated fiberglass braid overall.

MIL-W-7139B, CLASS II WIRE

| DEARBORN P/N | CONDUCTOR AWG SIZE & STRANDING | | NOMINAL O.D. FINISHED WIRE | STOCK PUT UP (FT.) |
|---|---|---|---|---|
| 82219N | 22 | 19/34 | .087 | 500 & 1000 |
| 82019N | 20 | 19/32 | .097 | 500 & 1000 |
| 81819N | 18 | 19/30 | .112 | 500 & 1000 |
| 81619N | 16 | 19/29 | .132 | 500 & 1000 |
| 81419N | 14 | 19/27 | .147 | 500 & 1000 |
| 81219N | 12 | 19/25 | .167 | 500 & 1000 |
| 81037N | 10 | 37/26 | .197 | 500 & 1000 |
| 88133N | 8 | 133/29 | .250 | 500 & 1000 |
| 86133N | 6 | 133/27 | .293 | 500 & 1000 |
| 84133N | 4 | 133/25 | .350 | 500 & 1000 |
| 82665N | 2 | 665/30 | .435 | 500 & 1000 |
| 81817N | 1 | 817/30 | .480 | 500 & 1000 |
| 80001N | 0 | 1045/30 | .540 | 500 & 1000 |
| 80002N | 00 | 1330/30 | .590 | 500 & 1000 |
| 80003N | 000 | 1665/30 | .654 | 500 & 1000 |
| 80004N | 0000 | 2109/30 | .743 | 500 & 1000 |

**COLOR CODE ON HOOKUP WIRE:** 0—Black, 1—Brown, 2—Red, 3—Orange, 4—Yellow, 5—Green, 6—Blue, 7—Violet, 8—Grey, 9—White. Other Colors and Stripe Combinations Available Upon Request.

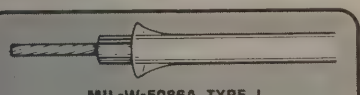
## MIL-W-5086A Unshielded Aircraft Wire

For use as airframe wire at temperatures within the range of −55°C to +105°C. Voltage rating is 600 volts. Both types are resistant to water, aircraft fuels, hydraulic fluid, oils, skydral, ethyleneglycol dilute acids, alcohol, alkalis, fungus and abrasion

**TYPE I — AN-22 THRU AN-12**
Single conductor stranded tinned copper with white PVC insulation and a clear (polyamide) nylon jacket overall.

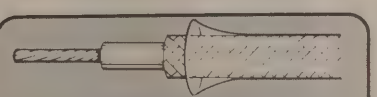
**TYPE II — AN-22 THRU AN-12**
Single conductor stranded tinned copper with white PVC insulation white glass braid and a clear nylon jacket overall

**TYPE II — AN-10 THRU AN-0000**
Single conductor stranded tinned copper with white PVC insulation, white glass braid, flame retardant nylon lacquered nylon braid overall



MIL-W-5086A TYPE I

| DEARBORN P/N | MIL P/N | AWG SIZE | STRANDING | NOM O.D | PUT UP (FT.) |
|---|---|---|---|---|---|
| 102219 | AN-22 | 22 | 19/34 | .068 | 100 & 1000 |
| 102019 | AN-20 | 20 | 19/32 | .078 | 100 & 1000 |
| 101819 | AN-18 | 18 | 19/30 | .088 | 100 & 1000 |
| 101619 | AN-16 | 16 | 19/29 | .098 | 100 & 1000 |
| 101419 | AN-14 | 14 | 19/27 | .117 | 100 & 1000 |
| 101219 | AN-12 | 12 | 19/25 | .137 | 100 & 1000 |

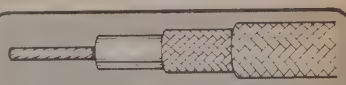


MIL-W-5086A TYPE II

| DEARBORN P/N | MIL P/N | AWG SIZE | STRANDING | NOM O.D. | PUT UP (FT.) |
|---|---|---|---|---|---|
| AN-22 THROUGH AN-12 | | | | | |
| 112219 | AN-22 | 22 | 19/34 | .075 | 100 & 1000 |
| 112019 | AN-20 | 20 | 19/32 | .085 | 100 & 1000 |
| 111819 | AN-18 | 18 | 19/30 | .095 | 100 & 1000 |
| 111619 | AN-16 | 16 | 19/29 | .105 | 100 & 1000 |
| 111419 | AN-14 | 14 | 19/27 | .125 | 100 & 1000 |
| 111219 | AN-12 | 12 | 19/25 | .143 | 100 & 1000 |
| AN-10 THROUGH AN-0000 | | | | | |
| 111049 | AN-10 | 10 | 49/27 | .189 | 100 & 1000 |
| 118133 | AN-8 | 8 | 133/29 | .240 | 100 & 1000 |
| 116133 | AN-6 | 6 | 133/27 | .293 | 100 & 1000 |
| 114133 | AN-4 | 4 | 133/25 | .355 | 100 & 1000 |
| 112665 | AN-2 | 2 | 665/30 | .425 | 100 & 1000 |
| 111817 | AN-1 | 1 | 817/30 | .470 | 100 & 1000 |
| 110001 | AN-0 | 0 | 1045/30 | .525 | 100 & 1000 |
| 110002 | AN-00 | 00 | 1330/30 | .590 | 100 & 1000 |
| 110003 | AN-000 | 000 | 1661/30 | .645 | 100 & 1000 |
| 110004 | AN-0000 | 0000 | 2104/30 | .715 | 100 & 1000 |

## MIL-W-8777B- MS 25471 Silicone Aircraft Wire

These wires are intended for installation in aircraft electrical systems where potential does not exceed 600 volts (RMS). Temperature limits are −55°C to +200°C. Single conductor silver plated copper, silicone rubber insulation, glass and dacron braid impregnated with high temperature lacquer and a white dacron braid and high temperature lacquer overall. Resistant to aircraft fuels, hydraulic fluid, oils, water, skydral, ethyleneglycol, dilute acids, alcohol, alakalis, fungus and abrasion.



MIL-W-8777B - MS 25471 SILICONE AIRCRAFT WIRE

| DEARBORN P/N | MIL P/N | AWG SIZE | STRANDING | NOM O.D. | PUT UP (FT.) |
|---|---|---|---|---|---|
| 162219 | MS 25471-22 | 22 | 19/34 | .085 | 100 & 1000 |
| 162019 | MS 25471-20 | 20 | 19/32 | .095 | 100 & 1000 |
| 161819 | MS 25471-18 | 18 | 19/30 | .110 | 100 & 1000 |
| 161619 | MS 25471-16 | 16 | 19/29 | .125 | 100 & 1000 |
| 161419 | MS 25471-14 | 14 | 19/27 | .143 | 100 & 1000 |
| 161219 | MS 25471-12 | 12 | 19/25 | .163 | 100 & 1000 |
| 161049 | MS 25471-10 | 10 | 49/27 | .193 | 100 & 1000 |
| 168133 | MS 25471-8 | 8 | 133/29 | .248 | 100 & 1000 |
| 166133 | MS 25471-6 | 6 | 133/27 | .303 | 100 & 1000 |
| 164133 | MS 25471-4 | 4 | 133/25 | .360 | 100 & 1000 |

ALSO AVAILABLE
MIL-W-5086A — TYPE III
MIL-W-5274A — TYPE I, CLASS A
MIL-W-5274A — TYPE II, CLASS A
MIL-W-22759 — TYPE I
MS — 21985
MS — 21986
NAS 702, TYPES U AND S, CLASSES A, B, C
NAS 703, TYPES U, S, SJ, CLASSES A AND C

CALL DEARBORN ON ALL YOUR WIRE REQUIREMENTS

## Consult Us for MIL-W-5086A - MIL-C-7078A Shielded Aircraft Wire for Electrical Systems

**BASE WIRE, MIL-W-5086A, TYPE I, MIL-C-7078A, TYPE I**
Stranded tinned copper conductors, with color coded Polyvinylchloride insulation and a clear Nylon jacket on each conductor; cabled, with a braided tinned copper shield (85% coverage) overall.

**BASE WIRE, MIL-W-5086A, TYPE II, MIL-C-7078A, TYPE I**
Stranded tinned copper conductors, insulated with white PVC, color coded glass braid on each conductor. Each conductor has clear Nylon jacket over glass braid insulation. Conductors are cabled and have braided tinned copper shield (85% coverage) overall.

**BASE WIRE, MIL-W-5086A, TYPE I, MIL-C-7078A, TYPE II**
Same as MIL-C-7078A, Type I, Base Wire, MIL-W-5086A, Type I, with addition of a clear Nylon jacket over the shield

**BASE WIRE, MIL-W-5086A, TYPE II, MIL-C-7078A, TYPE II**
Same as MIL-C-7078A, Type I, Base Wire, MIL-W-5086A, Type II, with addition of clear Nylon jacket over the shield.

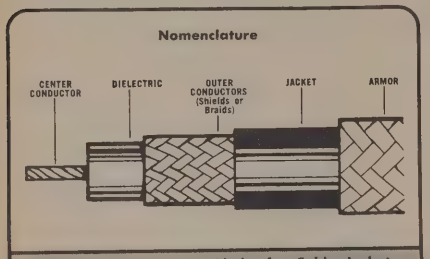
**GENERAL CHARACTERISTICS** —Temperature rating: −55°C to +105°C. Voltage rating: 600 Volts. Resistant to effects of oil, water, hydraulic fuel, skydrol aircraft fuels, ethyleneglycol, alcohol, dilute acids, alkalis, fungus, and abrasion

**DEARBORN WIRE AND CABLE CO.** 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

# DEARBORN WIRE AND CABLE COMPANY

## RG Coaxial Cable

Dearborn has the most complete selection of RG Coaxial Cable in the nation, manufactured to meet the needs of government and industry . . . backed by America's most dependable quality warranty.




**Operating Temperature Limits for Cable Jackets**

| MILITARY DESIGNATION | JACKET TYPE | TEMPERATURE LIMITS |
|---|---|---|
| TYPE I | Black Polyvinylchloride | −40°C to +80°C |
| TYPE II | Grey Polyvinylchloride | −25°C to +80°C |
| TYPE IIa | Black or Grey Polyvinylchloride | Under ¼" O.D. −55°C to +90°C<br>Over ¼" O.D. −40°C to +90°C |
| TYPE IIIa | Black Polyethylene | −55°C to +85°C |
| TYPE IV | Black Synthetic Rubber | Under ½" −55°C to +80°C<br>Over ½" −40°C to +80°C |
| TYPE V | Fiberglas Braid | −55°C to +250°C |
| TYPE VI | Silicon-Rubber Dacron Braid | −55°C to +175°C |
| TYPE VII | Teflon (PTFE) | −55°C to +250°C |
| TYPE VIII | Synthetic Rubber | −55°C to +75°C |
| TYPE IX | Teflon (FEP) | −55°C to +200°C |

### EXPLANATION OF NOMENCLATURE

### CENTER CABLE CONDUCTORS

Center cable conductors may be solid or stranded wires, or in some cases, a tube. Selection is made on the mechanical and electrical properties desired. Solid wires result in lowest cable attentuation. Stranding permits increased cable flexibility but also increases attenuation. Bare, tinned, or silver plated copper wire is usually used for center conductors. Other materials are Copperweld, Cadmium Bronze, Aluminum, Nichrome and Karma.

### DIELECTRICS (CABLE)

#### EXTRUDED POLYETHYLENE

Low cost, flexibility, ease of application, high dielectric strength and low dielectric constant make it well suited for RF applications. It is the most commonly used low temperature cable dielectric.

#### FOAM CORE (CELLULAR POLYETHYLENE)

An excellent low temperature dielectric formed by expanding polyethylene with millions of bubbles of an inert gas. Its low dielectric constant of 1.5 for Foam Core compared to 2.26 for solid polyethylene permits the design of lower attenuation and low capacity cables.

#### TEFLON

Teflon will withstand high temperature applications. It has high dielectric strength and a very low dielectric constant. Its ability to withstand exposure to gases and liquids makes it the dielectric selected where other materials would be inadequate.

### CABLE OUTER CONDUCTORS

#### SHIELDS† OR BRAID

The outer conductor is usually made of a metal braid but it can be a solid tube. The braid is used where flexibility is a vital factor; the tubular construction is used where a high degree of shielding is required. Tubular construction also provides lower cable attenuation. Two adjacent braids offer better shielding action than one braid. Generally speaking braids are either copper, tinned copper or silver plated copper.

† Armor

## OVER 200 COAXIAL CABLES FOR IMMEDIATE USE

**CONSULT FACTORY FOR PHYSICAL AND ELECTRICAL PROPERTIES**

| RG/U No. | Dearborn No. | RG/U No. | Dearborn No. | RG/U No. | Dearborn No. | RG/U No. | Dearborn No. | RG/U No. | Dearborn No. |
|---|---|---|---|---|---|---|---|---|---|
| 5 | 6005 | 35B | 6035B | 116 | 6116 | 188A | 6188A | 324 | 6324 |
| 5A | 6005A | 54 | 6054 | 117 | 6117 | 195 | 6195 | 325 | 6325 |
| 5B | 6005B | 54A | 6054A | 117A | 6117A | 195A | 6195A | 326 | 6326 |
| 6 | 6006 | 55 | 6055 | 118 | 6118 | 196 | 6196 | 327 | 6327 |
| 6A | 6006A | 55A | 6055A | 118A | 6118A | 196A | 6196A | 328 | 6328 |
| 7 | 6007 | 55B | 6055B | 119 | 6119 | 209 | 6209 | 329 | 6329 |
| 8 | 6008 | 57 | 6057 | 120 | 6120 | 210 | 6210 | 330 | 6330 |
| 8A | 6008A | 57A | 6057A | 122 | 6122 | 211 | 6211 | 331 | 6331 |
| 9 | 6009 | 58 | 6058 | 126 | 6126 | 211A | 6211A | 332 | 6332 |
| 9A | 6009A | 58A | 6058A | 130 | 6130 | 212 | 6212 | 333 | 6333 |
| 9B | 6009B | 58B | 6058B | 131 | 6131 | 213 | 6213 | 334 | 6334 |
| 10 | 6010 | 58C | 6058C | 133 | 6133 | 214 | 6214 | 335 | 6335 |
| 10A | 6010A | 59 | 6059 | 133A | 6133A | 215 | 6215 | 336 | 6336 |
| 11 | 6011 | 59A | 6059A | 140 | 6140 | 216 | 6216 | 337 | — |
| 11A | 6011A | 59B | 6059B | 141 | 6141 | 217 | 6217 | 359 | — |
| 12 | 6012 | 62 | 6062 | 141A | 6141A | 218 | 6218 | 360 | 6360 |
| 12A | 6012A | 62A | 6062A | 142 | 6142 | 219 | 6219 | 366 | 6366 |
| 13 | 6013 | 62B | 6062B | 142A | 6142A | 220 | 6220 | 367 | 6367 |
| 13A | 6013A | 62C | 6062C | 142B | 6142B | 221 | 6221 | 369 | 6369 |
| 14 | 6014 | 63 | 6063 | 143 | 6143 | 222 | 6222 | 370 | 6370 |
| 14A | 6014A | 63B | 6063B | 143A | 6143A | 223 | 6223 | 372 | — |
| 15 | 6015 | 71 | 6071 | 144 | 6144 | 224 | 6224 | 373 | — |
| 17 | 6017 | 71A | 6071A | 146 | 6146 | 225 | 6225 | 374 | 6374 |
| 17A | 6017A | 71B | 6071B | 149 | 6149 | 226 | 6226 | 375 | — |
| 18 | 6018 | 74 | 6074 | 150 | 6150 | 227 | 6227 | 376 | 6376 |
| 18A | 6018A | 74A | 6074A | 161 | 6161 | 228 | 6228 | 377 | 6377 |
| 19 | 6019 | — | 6075sm | 164 | 6164 | 228A | 6228A | 378 | 6378 |
| 19A | 6019A | 79 | 7679 | 165 | 6165 | 235 | 6235 | 379 | — |
| 20 | 6020 | 79A | 6079A | 166 | 6166 | 264 | 6264 | 381 | — |
| 20A | 6020A | 79B | 6079B | 174 | 6174 | 264A | 6264A | 382 | — |
| 21 | 6021 | 83 | 6083 | 174A | 6174A | 280 | 6280 | 383 | 6383 |
| 21A | 6021A | 85A | 6085A | 177 | 6177 | 281 | 6281 | 384 | 6384 |
| 22 | 6022 | 87A | 6087A | 178 | 6178 | 298 | 6298 | 385 | 6385 |
| 22A | 6022A | 88A/LP | 6088A | 178A | 6178A | 301 | 6301 | 386 | 6386 |
| 22B | 6022B | 94 | 6094 | 178B | 6178B | 302 | 6302 | 388 | 6388 |
| 23 | 6023 | 94A | 6094A | 179 | 6179 | 303 | 6303 | 389 | 6389 |
| 23A | 6023A | 100 | 6100 | 179A | 6179A | 304 | 6304 | 391 | 6391 |
| 24 | 6024 | 108 | 6108 | 179B | 6179B | 307A | 6307A | 392 | 6392 |
| 24A | 6024A | 108A | 6108A | 180 | 6180 | 316 | 6316 | 393 | 6393 |
| 29 | 6029 | 111 | 6111 | 180A | 6180A | 317 | 6317 | 397 | 6397 |
| 34 | 6034 | 111A | 6111A | 180B | 6180B | 318 | 6318 | 400 | 6400 |
| 34A | 6034A | 114 | 6114 | 181 | 6181 | 319 | 6319 | 401 | 6401 |
| 34B | 6034B | 114A | 6114A | 187 | 6187 | 321 | 6321 | 402 | 6402 |
| 35 | 6035 | 115 | 6115 | 187A | 6187A | 322 | 6322 | 403 | 6403 |
| 35A | 6035A | 115A | 6115A | 188 | 6188 | 323 | 6323 | 404 | 6404 |

## Cable Jacket Types

**TYPE I (MIL-C-17)—Description:** Black Polyvinylchloride. **Characteristics:** Excellent weathering and abrasion properties, but is of the contaminating type and will cause cable attenuation to increase with age. Can be used for direct burial.

**TYPE II (JAN-C-17A)—Description:** Grey Polyvinylchloride. **Characteristics:** A semi-noncontaminating jacket.

**TYPE IIA (MIL-C-17)—Description:** Black or Grey Polyvinylchloride. **Characteristics:** Noncontaminating. Good weathering and abrasion resistant properties. Can be used for direct burial.

**TYPE IIIA (MIL-C-17)—Description:** Black Polyethylene. **Characteristics:** Moisture resistant, abrasion resistant, defies ultra violet damage. Noncontaminating; recommended for direct burial.

**TYPE IV (MIL-C-17)—Description:** Black Synthetic Rubber. **Characteristics:** This jacket material is used only on high voltage pulse cables. The basic material is polymerized chloroprene.

**TYPE V (MIL-C-17)—Description:** Fiberglas Braid. **Characteristics:** Impregnated with silicone varnish to provide abrasion resistance and a moisture seal.

**TYPE VI (MIL-C-17—Description:** Silicone Rubber Dacron Braid. **Characteristics:** Two wraps of silicone rubber impregnated fiberglass tape which is fused into a homogeneous layer. A dacron braid is applied, followed by a high temperature fluorocarbon lacquer.

**TYPE VII (MIL-C-17)—Description:** Teflon (Polytetrafluordethyene). **Characteristics:** Either extruded or tape wrapped. Withstands high temperatures; chemically inert; insoluble in liquids and gases.

**TYPE VIII (MIL-C-17)—Description::** Synthetic Rubber. **Characteristics:** This material is a polychloroprene compound and is used with only a few pulse cables. Its primary use is as a jacket material for multiconductor cables.

**TYPE IX (MIL-C-17)—Description:** Teflon (Fluorinated Ethylene Propylene). **Characteristics:** Excellent weathering properties and chemically inert. Maximum operating temperature of 200°C.

# DEARBORN WIRE AND CABLE COMPANY

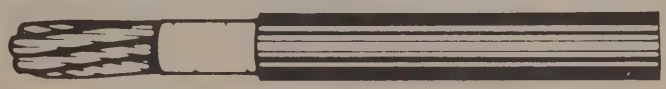
## Automotive Wire

**TYPE G.P.T. — SAE, TYPE I, PRIMARY WIRE**
Single conductor, stranded bare copper. Color coded polyvinylchloride insulation. Resistant to grease, oil, gasoline, acid and ageing.

**G.P.T. SAE TYPE 1 AUTOMOTIVE WIRE**

| DEARBORN NO. | AWG SIZE | STRAND-ING | NOM. WALL THICK-NESS | NOM. O.D. | STOCK COLORS | STOCK PUT UP (FT.) |
|---|---|---|---|---|---|---|
| 992007 | 20 | 7/28 | .023 | .084 | 2, 0 | 100 & 1000 |
| 991816 | 18 | 16/30 | .023 | .093 | 2, 0 | 100 & 1000 |
| 991619 | 16 | 19/29 | .023 | .102 | 0, 1, 2, 4, 5, 6, 9 | 100 & 1000 |
| 991419 | 14 | 19/27 | .023 | .117 | 0, 1, 2, 4, 5, 6, 9 | 100 & 1000 |
| 991219 | 12 | 19/25 | .026 | .142 | 0, 1, 2, 4, 5, 6, 9 | 100 & 1000 |
| 991019 | 10 | 19/23 | .031 | .175 | 2, 9, 0 | 100 & 500 |
| 990865 | 8 | 65/26 | .040 | .230 | 2, 0 | 100 & 500 |
| 990649 | 6 | 49/23 | .049 | .282 | 2, 0 | 100 & 500 |

## Welding Cable



**INDUSTRO-FLEX NEOPRENE WELDING CABLE**
The Industro-Flex Neoprene Series is a new development which utilizes No. 30 stranding. It has a smaller O.D. and still retains flexibility at lower prices than the standard Neoprene welding cable.

**NEOPRENE AND RUBBER WELDING CABLES**
These cables are constructed of stranded bare copper conductors, with a tape wrap and either a neoprene or rubber jacket overall as specified in tables at right. All have extra fine stranding, are extremely flexible and have high resistance to abrasion, impact, flexing and twisting.

**INDUSTRO-FLEX NEOPRENE WELDING CABLE**

| DEARBORN NO. | AWG SIZE | STRAND-ING | NOM. O.D. | CURRENT CARRYING CAP. (AMPS) | PUT UP SOLD PER FT. |
|---|---|---|---|---|---|
| 820600 | 6 | 259/30 | .376 | 75 | 25' Min. |
| 820400 | 4 | 413/30 | .420 | 100 | 25' Min |
| 820300 | 3 | 532/30 | .455 | 150 | 25' Min. |
| 820200 | 2 | 665/30 | .495 | 200 | 25' Min. |
| 820100 | 1 | 840/30 | .550 | 250 | 25' Min |
| 820001 | 1/0 | 1050/30 | .615 | 300 | 25' Min. |
| 820002 | 2/0 | 1323/30 | .690 | 375 | 25' Min. |
| 820003 | 3/0 | 1680/30 | .740 | 450 | 25' Min. |
| 820004 | 4/0 | 2121/30 | 835 | 500 | 25' Min |

**NEOPRENE WELDING CABLE**

| DEARBORN NO. | AWG SIZE | STRAND-ING | NOM. O.D. | CURRENT CARRYING CAP. (AMPS) | PUT UP SOLD PER FT. |
|---|---|---|---|---|---|
| 500600 | 6 | 1050/36 | .400 | 75 | 25' Min. |
| 500400 | 4 | 1057/34 | .450 | 100 | 25' Min. |
| 500300 | 3 | 1344/34 | .490 | 150 | 25' Min |
| 500200 | 2 | 1680/34 | .560 | 200 | 25' Min. |
| 500100 | 1 | 2142/34 | .610 | 250 | 25' Min |
| 500001 | 1/0 | 2667/34 | .680 | 300 | 25' Min |
| 500002 | 2/0 | 3360/34 | .730 | 375 | 25' Min |
| 500003 | 3/0 | 4270/34 | .810 | 450 | 25' Min. |
| 500004 | 4/0 | 5355/34 | .900 | 500 | 25' Min. |

**RUBBER WELDING CABLE**

| DEARBORN NO. | AWG SIZE | STRAND-ING | NOM. O.D. | CURRENT CARRYING CAP. (AMPS) | PUT UP SOLD PER FT. |
|---|---|---|---|---|---|
| 510600 | 6 | 1050/36 | .400 | 75 | 25' Min. |
| 510400 | 4 | 1057/34 | .450 | 100 | 25' Min. |
| 510300 | 3 | 1344/34 | .490 | 150 | 25' Min. |
| 510200 | 2 | 1680/34 | .560 | 200 | 25' Min. |
| 510100 | 1 | 2142/34 | .610 | 250 | 25' Min. |
| 510010 | 1/0 | 2667/34 | .680 | 300 | 25' Min. |
| 510002 | 2/0 | 3360/34 | .730 | 375 | 25' Min. |
| 510003 | 3/0 | 4270/34 | .810 | 450 | 25' Min. |
| 510004 | 4/0 | 5355/34 | .900 | 550 | 25' Min. |

## Service and Power Cords — Rubber Neoprene and Plastic

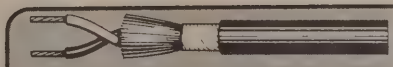
**GENERAL CHARACTERISTICS**

**Temperature Rating:** −20°C to +60°C.
**Voltage Rating:** Types SV, SVT, SJ, SJT, and SJO are 300 V rated; Type S and SO are 600 V rated. On SJO two types are listed: Stationary and Constant Service. Constant Service has more flexible stranding.

**TYPES SV, SJ AND S/RUBBER CORD CONSTRUCTION**
Conductors are stranded bare copper. Separator, color coded rubber insulation, cabled with fillers. Separator and tough rubber jacket overall.

**TYPES SVT AND SJT PLASTIC CORDS**
Types SVT and SJT are plastic insulated and plastic jacketed. Construction is same as SV and SJ. Jacket is black.

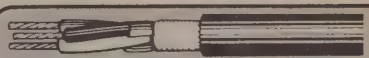
**TYPES SJO AND SO/NEOPRENE CORD CONSTRUCTION**
Conductors are stranded bare copper. Separator, color coded rubber insulation cabled with fillers. Separator and black neoprene jacket overall. Resistant to oil, grease, ozone, acid and moisture.



**300 VOLT, RUBBER & NEOPRENE CORDS**

| DEARBORN NO. | U.L. TYPE | SIZE & NO. OF COND. | NOM. INSUL. THICK. | NOM JKT. THICK. | NOM O.D. | STOCK PUT UP (FT.) |
|---|---|---|---|---|---|---|
| **SV & SJ RUBBER (STATIONARY SERVICE)** | | | | | | |
| 1182V | SV | 18/2 | .016 | .032 | .245 | 50, 100, 250 & 1000 |
| 1183V | SV | 18/3 | .016 | .032 | .255 | 50, 100, 250 & 1000 |
| 1182 | SJ | 18/2 | .032 | .032 | .305 | 50, 100, 250 & 1000 |
| 1183 | SJ | 18/3 | .032 | .032 | .330 | 50, 100, 250 & 1000 |
| 1184 | SJ | 18/4 | .032 | .032 | .370 | 50, 100, 250 & 1000 |
| 1162 | SJ | 16/2 | .032 | .032 | .330 | 50, 100, 250 & 1000 |
| 1163 | SJ | 16/3 | .032 | .032 | .360 | 50, 100, 250 & 1000 |
| 1164 | SJ | 16/4 | .032 | .032 | .400 | 50, 100, 250 & 1000 |
| 1142 | SJ | 14/2 | .032 | .032 | .370 | 50, 100, 250 & 1000 |
| 1143 | SJ | 14/3 | .032 | .032 | .390 | 50, 100, 250 & 1000 |
| 1144 | SJ | 14/4 | .032 | .032 | .420 | 50, 100, 250 & 1000 |
| **SVT & SJT PLASTIC CORDS** | | | | | | |
| 8182 | SVT | 18/2 | .016 | .032 | .245 | 50, 100, 250 & 1000 |
| 8183 | SVT | 18/3 | .016 | .032 | .255 | 50, 100, 250 & 1000 |
| *8184 | SVT | 18/4 | .016 | .032 | .265 | 50, 100, 250 & 1000 |
| 7183 | SJT | 18/3 | .032 | .032 | .330 | 50, 100, 250 & 1000 |
| 7163 | SJT | 16/3 | .032 | .032 | .360 | 500 & 1000 |
| **SJO/SVO NEOPRENE (STATIONARY SERVICE)** | | | | | | |
| 3182 | SJO | 18/2 | .032 | .032 | .305 | 50, 100, 250 & 1000 |
| 3182V | SVO | 18/2 | .032 | .032 | .305 | 50, 100, 250 & 1000 |
| 3183 | SJO | 18/3 | .032 | .032 | .330 | 50, 100, 250 & 1000 |
| 3184 | SJO | 18/4 | .032 | .032 | .370 | 50, 100, 250 & 1000 |
| 3162 | SJO | 16/2 | .032 | .032 | .330 | 50, 100, 250 & 1000 |
| 3163 | SJO | 16/3 | .032 | .032 | .360 | 50, 100, 250 & 1000 |
| 3164 | SJO | 16/4 | .032 | .032 | .400 | 50, 100, 250 & 1000 |
| 3142 | SJO | 14/2 | .032 | .032 | .370 | 50, 100, 250 & 1000 |
| 3143 | SJO | 14/3 | .032 | .032 | .390 | 50, 100, 250 & 1000 |
| 3144 | SJO | 14/4 | .032 | .032 | .420 | 50, 100, 250 & 1000 |
| **SJO NEOPRENE (CONSTANT SERVICE)** | | | | | | |
| 3182C | SJO | 18/2 | .032 | .032 | .305 | 50, 100, 250 & 1000 |
| 3183C | SJO | 18/3 | .032 | .032 | .330 | 50, 100, 250 & 1000 |
| 3184C | SJO | 18/4 | .032 | .032 | .370 | 50, 100, 250 & 1000 |
| 3162C | SJO | 16/2 | .032 | .032 | .330 | 50, 100, 250 & 1000 |
| 3163C | SJO | 16/3 | .032 | .032 | .360 | 50, 100, 250 & 1000 |
| 3164C | SJO | 16/4 | .032 | .032 | .400 | 50, 100, 250 & 1000 |

*NOT UL LISTED.



**600 VOLT RUBBER & NEOPRENE HEAVY DUTY CORDS**

| DEARBORN NO. | U.L. TYPE | SIZE & NO. OF COND. | NOM. INSUL. THICK. | NOM. JKT. THICK. | NOM. O.D. | STOCK PUT UP (FT.) |
|---|---|---|---|---|---|---|
| **TYPE S, RUBBER** | | | | | | |
| 2182 | S | 18/2 | .030 | .060 | .390 | 50, 100, 250 & 1000 |
| 2183 | S | 18/3 | .030 | .060 | .405 | 50, 100, 250 & 1000 |
| 2184 | S | 18/4 | .030 | .060 | .435 | 50, 100, 250 & 1000 |
| 2162 | S | 16/2 | .030 | .060 | .405 | 50, 100, 250 & 1000 |
| 2163 | S | 16/3 | .030 | .060 | .430 | 50, 100, 250 & 1000 |
| 2164 | S | 16/4 | .030 | .060 | .485 | 50, 100, 250 & 1000 |
| 2142 | S | 14/2 | .045 | .075 | .530 | 50, 100, 250 & 1000 |
| 2143 | S | 14/3 | .045 | .075 | .560 | 50, 100, 250 & 1000 |
| 2144 | S | 14/4 | .045 | .075 | .605 | 50, 100, 250 & 1000 |
| 2122 | S | 12/2 | .045 | .090 | .600 | 50, 100 & 250 |
| 2123 | S | 12/3 | .045 | .090 | .635 | 50, 100 & 250 |
| 2124 | S | 12/4 | .045 | .090 | .665 | 50, 100 & 250 |
| 2102 | S | 10/2 | .045 | .090 | .640 | 50, 100 & 250 |
| 2103 | S | 10/3 | .045 | .090 | .690 | 50, 100 & 250 |
| 2104 | S | 10/4 | .045 | .090 | .745 | 50, 100 & 250 |
| 2082 | S* | 8/2 | .050 | .090 | .700 | 50 & 100 |
| 2083 | S* | 8/3 | .050 | .090 | .750 | 50 & 100 |
| 2084 | S* | 8/4 | .050 | .090 | .820 | 50 & 100 |
| 2062 | S* | 6/2 | .050 | 100 | .820 | 50 & 100 |
| 2063 | S* | 6/3 | .050 | .100 | .885 | 50 & 100 |
| 2064 | S* | 6/4 | .050 | .100 | .975 | 50 & 100 |

| DEARBORN NO. | U.L. TYPE | SIZE & NO. OF COND. | NOM. INSUL. THICK. | NOM. JKT. THICK. | NOM. O.D. | STOCK PUT UP (FT.) |
|---|---|---|---|---|---|---|
| **TYPE SO, NEOPRENE** | | | | | | |
| 4182 | SO | 18/2 | .030 | .060 | .390 | 50, 100, 250 & 1000 |
| 4183 | SO | 18/3 | .030 | .060 | .405 | 50, 100, 250 & 1000 |
| 4184 | SO | 18/4 | .030 | .060 | .435 | 50, 100, 250 & 1000 |
| 4162 | SO | 16/2 | .030 | .060 | .405 | 50, 100, 250 & 1000 |
| 4163 | SO | 16/3 | .030 | .060 | .430 | 50, 100, 250 & 1000 |
| 4164 | SO | 16/4 | .030 | .060 | .485 | 50, 100, 250 & 1000 |
| 4142 | SO | 14/2 | .045 | .075 | .530 | 50, 100, 250 & 1000 |
| 4143 | SO | 14/3 | .045 | .075 | .560 | 50, 100, 250 & 1000 |
| 4144 | SO | 14/4 | .045 | .075 | .605 | 50, 100, 250 & 1000 |
| 4122 | SO | 12/2 | .045 | .090 | .600 | 50, 100 & 250 |
| 4123 | SO | 12/3 | .045 | .090 | .635 | 50, 100 & 250 |
| 4124 | SO | 12/4 | .045 | .090 | .665 | 50, 100 & 250 |
| 4102 | SO | 10/2 | .045 | .090 | .640 | 50, 100 & 250 |
| 4103 | SO | 10/3 | .045 | .090 | .690 | 50, 100 & 250 |
| 4104 | SO | 10/4 | .045 | .090 | .745 | 50, 100 & 250 |
| 4082 | SO | 8/2 | .050 | .090 | .700 | 50 & 100 |
| 4083 | SO | 8/3 | .050 | .090 | .750 | 50 & 100 |
| 4084 | SO | 8/4 | .050 | .090 | .820 | 50 & 100 |
| 4062 | SO | 6/2 | .050 | .090 | .820 | 50 & 100 |
| 4063 | SO | 6/3 | .050 | .090 | .885 | 50 & 100 |
| 4064 | SO | 6/4 | .050 | .090 | .975 | 50 & 100 |

DEARBORN WIRE AND CABLE CO. 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

# DEARBORN WIRE AND CABLE COMPANY

### STYLE 1007, U.L. HOOK-UP WIRE

**Voltage rating:** 300 Volts. **Temperature rating:** −10°C to +80°C. 1/64" Polyvinylchloride insulation over stranded tinned copper.

### STYLE 1061, U.L. SEMI-RIGID BUSINESS MACHINE WIRE

**Voltage rating:** 300 Volts. **Temperature rating:** −10°C to +80°C. .009" Polyvinylchloride insulation over solid or stranded tinned copper.

### "TEW" FLAME RETARDANT, FR-1 STYLES 1015, 1028, 1283, 1284 600 VOLT, 105°C AND FR-1 STYLE 1007, 300 VOLT, 80°C

The polyvinylchloride insulation used on this series has the necessary additives that enable the wire to pass the Vertical Flame Test as prescribed by the Underwriter Laboratories for this UL style. All this wire is imprinted with the symbol FR-1 indicating it is covered by the above specifications.

## Thermoplastic Insulated Hookup Wire

U.L. AND C.S.A. APPROVED

### X-L POLYETHYLENE, U.L. STYLES 3173, 3199, 125°C — 600 VOLT, 105°C — 300 VOLT

The Polyethylene insulation used on this series of lead wire is chemically cross-linked, which increases the moisture resistance, solvent resistance and aging characteristics. When momentary high temperatures caused by overloads or shorts occur, the insulation does not deform as quickly as if not cross-linked. Typical applications include small motors, control panels, dry transformers, etc. **Recommended maximum baking cycles:** 300°F for 24 hrs. — 325°F for 12 hrs. — 350°F for 8 hours.

### 300 VOLT, 80°C, U.L. STYLE 1007

| DEARBORN PART NO. | AWG SIZE | STRAND-ING | NOM. O.D. | NOM. WALL THICK. |
|---|---|---|---|---|
| 402801 | 28 | 1/28 | .047 | 1/64 |
| 402807 | 28 | 7/36 | .049 | 1/64 |
| 402601 | 26 | 1/26 | .050 | 1/64 |
| 402607 | 26 | 7/34 | .052 | 1/64 |
| 402607F | 26 | 7/34 | .052 | 1/64 |
| 402401 | 24 | 1/24 | .055 | 1/64 |
| 402407 | 24 | 7/32 | .058 | 1/64 |
| 402407F | 24 | 7/32 | .058 | 1/64 |
| 402201 | 22 | 1/22 | .059 | 1/64 |
| 402207 | 22 | 7/30 | .065 | 1/64 |
| 402207F | 22 | 7/30 | .065 | 1/64 |
| 402001 | 20 | 1/20 | .066 | 1/64 |
| 402010 | 20 | 10/30 | .070 | 1/64 |
| 402010F | 20 | 10/30 | .070 | 1/64 |
| 401801 | 18 | 1/18 | .074 | 1/64 |
| 401816 | 18 | 16/30 | .080 | 1/64 |
| 401816F | 18 | 16/30 | .080 | 1/64 |
| 401601 | 16 | 1/16 | .085 | 1/64 |
| 401626 | 16 | 26/30 | .094 | 1/64 |

PUT UP: 500 FT., 1000 FT., AND BULK
STOCK COLORS: 0-9

### U.L. SEMIRIGID STYLE 1061

| DEARBORN NO. | AWG SIZE | STRAND-ING | NOM. WALL | NOM. O.D. | STANDARD PUT UP (FT.) | STOCK COLORS |
|---|---|---|---|---|---|---|
| 422601 | 26 | 1/26 | .009 | .036 | 500, 1000 & 5000 | 0-9 |
| 422607 | 26 | 7/34 | .009 | .037 | 500, 1000 & 5000 | 0-9 |
| 422401 | 24 | 1/24 | .009 | .041 | 500, 1000 & 5000 | 0-9 |
| 422407 | 24 | 7/32 | .009 | .042 | 500, 1000 & 5000 | 0-9 |
| 422201 | 22 | 1/22 | .009 | .046 | 500, 1000 & 5000 | 0-9 |
| 422207 | 22 | 7/30 | .009 | .049 | 500, 1000 & 5000 | 0-9 |
| 422001 | 20 | 1/20 | .009 | .052 | 500, 1000 & 5000 | 0-9 |
| 422007 | 20 | 7/28 | .009 | .057 | 500, 1000 & 5000 | 0-9 |
| 422010 | 20 | 10/30 | .009 | .057 | 500, 1000 & 5000 | 0-9 |
| 421801 | 18 | 1/18 | .009 | .060 | 500, 1000 & 5000 | 0-9 |
| 421807 | 18 | 7/26 | .009 | .067 | 500, 1000 & 5000 | 0-9 |
| 421816 | 18 | 16/30 | .009 | .067 | 500, 1000 & 5000 | 0-9 |
| 421626 | 16 | 26/30 | .009 | .076 | 500, 1000 & 5000 | 0-9 |

### XL - 125°C - 600 VOLT U.L. STYLE 3173

| DEARBORN NO. | AWG SIZE | STRAND-ING | NOM. WALL | NOM. O.D. | STANDARD PUT UP (FT.) | STOCK COLORS |
|---|---|---|---|---|---|---|
| 752207 | 22 | 7/30 | 1/32 | .094 | 1000 & 5000 | 0 only |
| 752010 | 20 | 10/30 | 1/32 | .102 | 1000 & 5000 | 0 only |
| 751816 | 18 | 16/30 | 1/32 | .112 | 1000 & 5000 | 0 only |
| 751626 | 16 | 26/30 | 1/32 | .125 | 1000 & 5000 | 0 only |
| 751441 | 14 | 41/30 | 1/32 | .143 | 1000 & 5000 | 0 only |
| 751265 | 12 | 65/30 | 1/32 | .164 | 1000 & 3000 | 0 only |
| 751065 | 10 | 65/28 | 1/32 | .187 | 1000 & 2000 | 0 only |

### XL - 105°C - 300 VOLTS U.L. STYLE 3199

| | | | | | | |
|---|---|---|---|---|---|---|
| 762207 | 22 | 7/30 | 1/64 | .066 | 1000 & 5000 | 0, 2, 4, 5, 9 |
| 762010 | 20 | 10/30 | 1/64 | .072 | 1000 & 5000 | 0, 2, 4, 5, 9 |
| 761816 | 18 | 16/30 | 1/64 | .082 | 1000 & 5000 | 0, 2, 4, 5, 9 |
| 761626 | 16 | 26/30 | 1/64 | .109 | 1000 & 5000 | 0, 2, 4, 5, 9 |

### FR-1 105°C — 600 VOLT, U.L. STYLES 1015, 1028, 1283, 1284

| DEARBORN NO. | AWG SIZE | STRAND-ING | NOM. O.D. | NOM. WALL THICK. | UL TYPE |
|---|---|---|---|---|---|
| 782601 | 26 | 1/26 | .080 | 1/32 | 1015 |
| 782607 | 26 | 7/34 | .083 | 1/32 | 1015 |
| 782607F | 26 | 7/34 | .083 | 1/32 | 1015 |
| 782401 | 24 | 1/24 | .085 | 1/32 | 1015 |
| 782407 | 24 | 7/32 | .088 | 1/32 | 1015 |
| 782407F | 24 | 7/32 | .088 | 1/32 | 1015 |
| 782201 | 22 | 1/22 | .093 | 1/32 | 1015 |
| 782207 | 22 | 7/30 | .095 | 1/32 | 1015 |
| 782207F | 22 | 7/30 | .095 | 1/32 | 1015 |
| 782001 | 20 | 1/20 | .098 | 1/32 | 1015 |
| 782010 | 20 | 10/30 | .100 | 1/32 | 1015 |
| 782010F | 20 | 10/30 | .100 | 1/32 | 1015 |
| 781801 | 18 | 1/18 | .104 | 1/32 | 1015 |
| 781816 | 18 | 16/30 | .110 | 1/32 | 1015 |
| 781816F | 18 | 16/30 | .110 | 1/32 | 1015 |
| 781601 | 16 | 1/16 | .115 | 1/32 | 1015 |
| 781626 | 16 | 26/30 | .124 | 1/32 | 1015 |
| 781401 | 14 | 1/14 | .130 | 1/32 | 1015 |
| 781441 | 14 | 41/30 | .141 | 1/32 | 1015 |
| 781201 | 12 | 1/12 | .145 | 1/32 | 1015 |
| 781265 | 12 | 65/30 | .160 | 1/32 | 1015 |
| 781001 | 10 | 1/10 | .166 | 1/32 | 1015 |
| 781000 | 10 | 105/30 | .194 | 1/32 | 1015 |
| 788133 | 8 | 133/29 | .255 | 3/64 | 1028 |
| 786133 | 6 | 133/27 | .335 | 4/64 | 1283 |
| 784133 | 4 | 133/25 | .390 | 4/64 | 1283 |
| 782133 | 2 | 133/23 | .460 | 4/64 | 1283 |
| 782665 | 2 | 665/30 | .470 | 4/64 | 1283 |
| 781259 | 1 | 259/25 | .525 | 5/64 | 1284 |
| 781836 | 1 | 836/30 | .535 | 5/64 | 1284 |
| 780001 | 1/0 | 1045/30 | .580 | 5/64 | 1284 |
| 780002 | 2/0 | 1330/30 | .640 | 5/64 | 1284 |
| 780003 | 3/0 | 1661/30 | .680 | 5/64 | 1284 |
| 780004 | 4/0 | 2107/30 | .785 | 5/64 | 1284 |

### FR-1 80°C — 300 VOLT, STYLE 1007

| | | | | | |
|---|---|---|---|---|---|
| 792407 | 24 | 7/32 | .057 | 1/64 | 1007 |
| 792207 | 22 | 7/30 | .065 | 1/64 | 1007 |
| 792010 | 20 | 10/30 | .071 | 1/64 | 1007 |
| 791816 | 18 | 16/30 | .080 | 1/64 | 1007 |
| 791626 | 16 | 26/30 | .095 | 1/64 | 1007 |

(F) After number indicates fused or prebonded.

PUT UP: STYLES 1015 AND 1028: 500 FT., 1000 FT., AND BULK; STYLES 1283 AND 1284: 100 FT. AND 1000 FT.; STYLE 1007: 1000 FT. AND 5000 FT.
STOCK COLORS: STYLES 1015 AND 1028: 0-9; STYLES 1283 AND 1284: 0, 2, 9; STYLE 1007: 0-9.

COLOR CODE ON HOOKUP WIRE: 0—Black • 1—Brown • 2—Red • 3—Orange • 4—Yellow • 5—Green • 6—Blue • 7—Violet • 8—Grey • 9—White

Consult Factory for Further Details on Striped Colors

DEARBORN WIRE AND CABLE CO. Dept. EM, 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

# DEARBORN WIRE AND CABLE COMPANY

## U.L. Listed
## High Temperature Teflon* Wire

Dearborn supplies a variety of high temperature insulated wires that are listed by the Underwriters Laboratories. The types shown here fall into the category of appliance wiring material (AWM) and are covered by the Flexible Cord and Fixture Wire Standard and UL Standard 758.1 for insulated single conductor appliance wiring material. Among a variety of requirements, the latter document assigns ratings regarding the duty group, flame retardance, temperature rating, voltage rating, service flexibility, resistance to abnormal temperature, oil resistance, water resistance and gasoline resistance where applicable. All of the following Underwriters styles are flame retardant and will satisfy the FR-1 designation of UL.

This section lists only the most commonly used conductors. In many instances, the Underwriter's Laboratories allow the use of other materials. Consult factory for further details.

*DuPont TM

U.L. LISTED

### U.L. STYLES 1164 & 1180

| DEARBORN NO. | AWG SIZE | STRAND-ING | NOM. O.D. OVER INSULATION INCH (MM) |
|---|---|---|---|
| 22801UL3 | 28 | Solid | .042(1.07) |
| 22807UL3 | 28 | 7/36 | .045(1.14) |
| 22819UL3 | 28 | 19/40 | .045(1.14) |
| 22601UL3 | 26 | Solid | .045(1.14) |
| 22607UL3 | 26 | 7/34 | .048(1.22) |
| 22619UL3 | 26 | 19/38 | .048(1.22) |
| 22401UL3 | 24 | Solid | .049(1.24) |
| 22407UL3 | 24 | 7/32 | .053(1.35) |
| 22419UL3 | 24 | 19/36 | .053(1.35) |
| 22201UL3 | 22 | Solid | .054(1.37) |
| 22207UL3 | 22 | 7/30 | .060(1.52) |
| 22219UL3 | 22 | 19/34 | .060(1.52) |
| 22001UL3 | 20 | Solid | .061(1.55) |
| 22007UL3 | 20 | 7/28 | .068(1.73) |
| 22019UL3 | 20 | 19/32 | .068(1.73) |
| 21807UL3 | 18 | 7/26 | .079(2.00) |
| 21819UL3 | 18 | 19/30 | .079(2.00) |
| 21619UL3 | 16 | 19/29 | .086(2.18) |
| 21419UL3 | 14 | 19/27 | .102(2.59) |
| 21219UL3 | 12 | 19/25 | .120(3.05) |

STOCK COLORS: 0-9

**UL STYLES 1164 AND 1180**

**CONDUCTOR:** Silver plated copper. On special order nickel plated copper conductors are available. **INSULATION:** Extruded "Teflon" TFE, .013" min. (average) wall. **TEMPERATURE RATING:** UL 1180-200°C. **VOLTAGE RATING:** 300 volts rms. **USE:** For internal wiring of appliances, also suitable for immersion in gasoline, gasoline vapor and 80°C oil. **TEMPERATURE IDENTIFICATION MARKER:** UL 1164-Brown, UL 1180-Black. Dearborn standard temperature identification is a longitudinally applied stripe in size 18 AWG and larger. Sizes 20 AWG and smaller do not require temperature identification. Upon request and at an additional charge, surface printing can be provided.

### U.L. STYLES 1198 & 1199

| DEARBORN NO. | AWG SIZE | STRAND-ING | NOM. O.D. OVER INSULATION INCH (MM) |
|---|---|---|---|
| 22601UL6 | 26 | Solid | .060(1.52) |
| 22607UL6 | 26 | 7/34 | .063(1.60) |
| 22619UL6 | 26 | 19/38 | .063(1.60) |
| 22401UL6 | 24 | Solid | .064(1.63) |
| 22407UL6 | 24 | 7/32 | .068(1.73) |
| 22419UL6 | 24 | 19/36 | .068(1.73) |
| 22201UL6 | 22 | Solid | .069(1.75) |
| 22207UL6 | 22 | 7/30 | .077(1.96) |
| 22219UL6 | 22 | 19/34 | .077(1.96) |
| 22001UL6 | 20 | Solid | .079(2.00) |
| 22007UL6 | 20 | 7/28 | .083(2.11) |
| 22019UL6 | 20 | 19/32 | .083(2.11) |
| 21807UL6 | 18 | 7/26 | .093(2.36) |
| 21819UL6 | 18 | 19/30 | .093(2.36) |
| 21619UL6 | 16 | 19/29 | .101(2.57) |
| 21419UL6 | 14 | 19/27 | .116(2.95) |
| 21219UL6 | 12 | 19/25 | .136(3.45) |
| 21037UL6 | 10 | 37/26 | .157(3.99) |
| 28133UL6 | 8 | 133/29 | .237(5.94) |
| 26133UL6 | 6 | 133/27 | .268(6.81) |
| 24133UL6 | 4 | 133/25 | .321(8.15) |
| 22665UL6 | 2 | 665/30 | .401(10.2) |
| 21836UL6 | 1 | 836/30 | .474(12.1) |

STOCK COLORS: 0-2-9

**UL STYLES 1198 AND 1199**

**CONDUCTOR:** Silver plated copper. On special order nickel plated copper conductors are available under series 3XTN-UL. **INSULATION:** Extruded "Teflon" TFE, .020" min. (average) wall. **TEMPERATURE RATING:** UL 1198-150°C. UL 1199-200°C. **VOLTAGE RATING:** 600 volts rms, 2500 volts peak for electronic use. **USE:** Internal wiring of appliances, also suitable for immersion in gasoline, gasoline vapor and 80°C oil. **TEMPERATURE IDENTIFICATION MARKER:** UL 1198-Brown, UL 1199-Black. Dearborn standard temperature identification is a longitudinally applied stripe in size 18 AWG and larger. Sizes 20 AWG and smaller do not require temperature identification. Upon request and at an additional charge, surface printing can be provided. Consult factory for availability of sizes 1/0 thru 4/0.

### OTHER U.L. STYLES AVAILABLE UPON REQUEST

| UL STYLE | VOLT-AGE | TEMP. (C) | INSULA-TION | UL STYLE | VOLT-AGE | TEMP. (C) | INSULA-TION |
|---|---|---|---|---|---|---|---|
| 1609 | 125 | 105° | Tetzel | 1516 | | 105° | Tetzel |
| 1332 | 300 | 200° | FEP | 1517 | | 105° | Tetzel |
| 1333 | 300 | 150° | FEP | 1523 | | 105° | Tetzel |
| 1335 | | 200° | FEP-H | 1538 | 90 | 105° | FEP |
| 1371 | | 105° | TFE | 1558 | | 125° | Tetzel |
| 1394 | | 200° | TFE-H | 1570 | 600 | 250° | TFE |
| 1508 | 30 | 105° | Tetzel | 1586 | | 105° | Tetzel |
| 1512 | | 105° | TFE | 1609 | 125 | 105° | Tetzel |
| 1513 | | 105° | Tetzel | | | | |

### U.L. STYLES 1212 & 1213

| DEARBORN NO. | AWG SIZE | STRAND-ING | NOM. O.D. OVER INSULATION INCH (MM) |
|---|---|---|---|
| 13201UL | 32 | Solid | .027(.686) |
| 13207UL | 32 | 7/40 | .029(.734) |
| 13219UL | 32 | 19/44 | .029(.734) |
| 13001UL | 30 | Solid | .029(.734) |
| 13007UL | 30 | 7/38 | .032(.813) |
| 13019UL | 30 | 19/42 | .032(.813) |
| 12801UL | 28 | Solid | .032(.813) |
| 12807UL | 28 | 7/36 | .035(.889) |
| 12819UL | 28 | 19/40 | .035(.889) |
| 12601UL | 26 | Solid | .035(.889) |
| 12607UL | 26 | 7/34 | .038(.965) |
| 12619UL | 26 | 19/38 | .038(.965) |
| 12401UL | 24 | Solid | .040(1.02) |
| 12407UL | 24 | 7/32 | .043(1.09) |
| 12419UL | 24 | 19/36 | .043(1.09) |
| 12201UL | 22 | Solid | .046(1.17) |
| 12207UL | 22 | 7/30 | .050(1.27) |
| 12219UL | 22 | 19/34 | .050(1.27) |
| 12001UL | 20 | Solid | .054(1.37) |
| 12007UL | 20 | 7/28 | .058(1.47) |
| 12019UL | 20 | 19/32 | .058(1.47) |

STOCK COLORS: 0-9

**UL STYLES 1212 AND 1213**

**CONDUCTOR:** Silver plated copper. On special order, nickel plated copper or silver plated high strength high conductivity copper alloy conductors are available. **INSULATION:** Extruded "Teflon" TFE, .008" min. (average) wall. **TEMPERATURE RATING:** UL 1212 and UL 1213-105°C. **VOLTAGE RATING:** Not specified. **USE:** In office appliances where exposed to temperatures not exceeding 80°C or 105°C or to oil at temperatures not exceeding 60°C, and where not subjected to undue mechanical abuse. Temperature identification on the wire is not required on these styles. Consult factory for tracer or stripe on special.

### U.L. STYLES 1226 & 1227

| DEARBORN NO. | AWG SIZE | STRAND-ING | NOM. O.D. OVER INSULATION INCH (MM) |
|---|---|---|---|
| 13201AUL | 32 | Solid | .027(.686) |
| 13207AUL | 32 | 7/40 | .029(.734) |
| 13001AUL | 30 | Solid | .029(.734) |
| 13007AUL | 30 | 7/38 | .032(.813) |
| 12801AUL | 28 | Solid | .032(.813) |
| 12807AUL | 28 | 7/36 | .035(.889) |
| 12601AUL | 26 | Solid | .035(.889) |
| 12607AUL | 26 | 7/34 | .038(.965) |
| 12619AUL | 26 | 19/38 | .038(.965) |
| 12401AUL | 24 | Solid | .040(1.02) |
| 12407AUL | 24 | 7/32 | .043(1.09) |
| 12419AUL | 24 | 19/36 | .043(1.09) |
| 12201AUL | 22 | Solid | .046(1.17) |
| 12207AUL | 22 | 7/30 | .050(1.27) |
| 12219AUL | 22 | 19/34 | .050(1.27) |
| 12001AUL | 20 | Solid | .054(1.37) |
| 12007AUL | 20 | 7/28 | .058(1.47) |
| 12019AUL | 20 | 19/32 | .058(1.47) |

STOCK COLORS: 0-9

**UL STYLES 1226 AND 1227**

**CONDUCTOR:** Tin plated copper. Constructions with silver plated copper or silver plated high strength high conductivity copper alloy are available on request. **INSULATION:** Extruded "Teflon" FEP, .008" min. (average) wall. **TEMPERATURE RATING:** UL 1226-80°C. UL 1227-105°C. **VOLTAGE RATING:** Not specified. **USE:** In office appliances where exposed to temperatures not exceeding 80°C and 105°C or oil at temperatures not exceeding 60°C, and where not subjected to undue mechanical abuse. Temperature identification of the wire is not required for these styles.

### U.L. STYLES 1330 & 1331

| DEARBORN NO. | AWG SIZE | STRAND-ING | NOM. O.D. OVER INSULATION INCH (MM) |
|---|---|---|---|
| 22601AUL6 | 26 | Solid | .060(1.52) |
| 22607AUL6 | 26 | 7/34 | .063(1.60) |
| 22619AUL6 | 26 | 19/38 | .063(1.60) |
| 22401AUL6 | 24 | Solid | .064(1.63) |
| 22407AUL6 | 24 | 7/32 | .068(1.73) |
| 22419AUL6 | 24 | 19/36 | .068(1.73) |
| 22201AUL6 | 22 | Solid | .069(1.75) |
| 22207AUL6 | 22 | 7/30 | .077(1.96) |
| 22219AUL6 | 22 | 19/34 | .077(1.96) |
| 22001AUL6 | 20 | Solid | .079(2.00) |
| 22007AUL6 | 20 | 7/28 | .083(2.11) |
| 22019AUL6 | 20 | 19/32 | .083(2.11) |
| 21807AUL6 | 18 | 7/26 | .093(2.36) |
| 21819AUL6 | 18 | 19/30 | .093(2.36) |
| 21619AUL6 | 16 | 19/29 | .101(2.57) |
| 21419AUL6 | 14 | 19/27 | .116(2.95) |
| 21219AUL6 | 12 | 19/25 | .136(3.45) |
| 21037AUL6 | 10 | 37/26 | .157(3.99) |
| 28133AUL6 | 8 | 133/29 | .237(5.94) |
| 26133AUL6 | 6 | 133/27 | .268(6.81) |
| 24133AUL6 | 4 | 133/25 | .321(8.15) |
| 22665AUL6 | 2 | 665/30 | .401(10.2) |
| 21836AUL6 | 1 | 836/30 | .474(12.1) |

STOCK COLORS: 0-9

**UL STYLES 1330 AND 1331**

**CONDUCTOR:** Tin plated copper. **INSULATION:** Extruded "Teflon" FEP, .020" min. (average) wall, sizes 26-10 AWG, .030" min. (average) wall, sizes 8-2 AWG. **TEMPERATURE RATING:** UL 1330-200°C, may be used with tin plated copper conductors only where the individual strand diameter is .015" (26 AWG) or larger. UL 1331-150°C. **VOLTAGE RATING:** 600 volts rms. **USE:** For general appliance wiring where not subjected to temperatures exceeding 200°C for style 1330 (see above limiting note), or 150°C for style 1331. Suitable for immersion in gasoline, gasoline vapor and 80°C oil. Constructions with silver plated copper are available on request; this version has an unrestricted 200°C temperature rating for style 1330. For sizes 18 AWG and larger, temperature identification is indicated by a black marker thread for style 1330 and a brown marker thread for style 1331, located under the insulation. Sizes 20 AWG and smaller do not require temperature identification.

# DEARBORN WIRE AND CABLE COMPANY

## Approved High Temperature Teflon Appliance Wire

### THIN WALL

| DEARBORN NO. | AWG SIZE | STRANDING | NOM. O.D. OVER INSULATION INCH (MM) |
|---|---|---|---|
| 13201CSA | 32 | Solid | .031(.787) |
| 13207CSA | 32 | 7/40 | .032(.813) |
| 13219CSA | 32 | 19/44 | .033(.838) |
| 13001CSA | 30 | Solid | .033(.838) |
| 13007CSA | 30 | 7/38 | .035(.889) |
| 13019CSA | 30 | 19/42 | .035(.889) |
| 12801CSA | 28 | Solid | .036(.914) |
| 12807CSA | 28 | 7/36 | .038(.965) |
| 12819CSA | 28 | 19/40 | .038(.965) |
| 12601CSA | 26 | Solid | .039(.991) |
| 12607CSA | 26 | 7/34 | .042(1.06) |
| 12619CSA | 26 | 19/38 | .042(1.06) |
| 12407CSA | 24 | 7/32 | .047(1.19) |
| 12419CSA | 24 | 19/36 | .047(1.19) |
| 12207CSA | 22 | 7/30 | .053(1.34) |
| 12219CSA | 22 | 19/34 | .053(1.34) |
| 12007CSA | 20 | 7/28 | .061(1.54) |
| 12019CSA | 20 | 19/32 | .061(1.54) |
| 11819CSA | 18 | 19/30 | .070(1.77) |
| 11619CSA | 16 | 19/0117 | .079(2.01) |

### THIN WALL INSULATION RATED AT 150 VOLTS AND 150°C

**CONDUCTOR:** Silver plated copper. Constructions with nickel plated copper or nickel conductor can be supplied. Consult factory for details. **INSULATION:** Extruded "Teflon "TFE, .010" (0.25mm) min. average wall thickness. Surface printed for product identification in sizes 24 AWG and larger. **USE:** For internal wiring of process control and computer equipment.

**STOCK COLORS: AWG SIZES 16 THROUGH 24 = 0-2-9. AWG SIZES 26 THROUGH 32 = 0-9.**

* For availability of other color and stripe combinations, consult factory.

### STANDARD WALL

| DEARBORN NO. | AWG SIZE | STRANDING | NOM. O.D. OVER INSULATION INCH (MM) |
|---|---|---|---|
| 22801CSA | 28 | Solid | .048(1.29) |
| 22807CSA | 28 | 7/36 | .050(1.34) |
| 22819CSA | 28 | 19/40 | .050(1.34) |
| 22601CSA | 26 | Solid | .051(1.37) |
| 22607CSA | 26 | 7/34 | .054(1.45) |
| 22619CSA | 26 | 19/38 | .054(1.45) |
| 22401CSA | 24 | Solid | .055(1.40) |
| 22407CSA | 24 | 7/32 | .059(1.59) |
| 22419CSA | 24 | 19/36 | .059(1.59) |
| 22201CSA | 22 | Solid | .060(1.52) |
| 22207CSA | 22 | 7/30 | .065(1.75) |
| 22219CSA | 22 | 19/34 | .065(1.75) |
| 22001CSA | 20 | Solid | .068(1.73) |
| 22007CSA | 20 | 7/28 | .073(1.96) |
| 22019CSA | 20 | 19/32 | .073(1.96) |
| 21819CSA | 18 | 19/30 | .082(2.21) |
| 21619CSA | 16 | 19/.0117 | .089(2.26) |
| 21419CSA | 14 | 19/.0147 | .103(2.62) |
| 21219CSA | 12 | 19/.0185 | .122(3.10) |

### STANDARD WALL INSULATION RATED AT 300 VOLTS AND 200°C

**CONDUCTOR:** Silver plated copper; constructions with nickel plated copper or nickel conductors can be supplied. Consult factory for details. **INSULATION:** Extruded "Teflon" TFE, ¼" (0.4mm) minimum wall thickness. Surface printed for product identification in sizes 24 AWG and larger. **USE:** For internal wiring of electronic, photographic, refrigeration and air conditioning equipment, ballast and incandescent lampholder leads, ovens, flood lights, business machines, clothes dryers and electric stoves.

**STOCK COLORS: AWG SIZES 12 THROUGH 24 = 0-2-9. AWG SIZES 26 THROUGH 28 = 0-9.**

### HEAVY WALL

| DEARBORN NO. | AWG SIZE | STRANDING | NOM. O.D. OVER INSULATION INCH (MM) |
|---|---|---|---|
| 22801CSA6 | 28 | Solid | .078(2.10) |
| 22807CSA6 | 28 | 7/36 | .080(2.15) |
| 22819CSAC | 28 | 19/40 | .080(2.15) |
| 22601CSA6 | 26 | Solid | .081(2.18) |
| 22607CSA6 | 26 | 7/34 | .084(2.26) |
| 22619CSA6 | 26 | 19/38 | .084(2.26) |
| 22401CSA6 | 24 | Solid | .085(2.16) |
| 22407CSA6 | 24 | 7/32 | .089(2.39) |
| 22419CSA6 | 24 | 19/36 | .089(2.39) |
| 22201CSA6 | 22 | Solid | .090(2.28) |
| 22207CSA6 | 22 | 7/30 | .095(2.55) |
| 22219CSA6 | 22 | 19/34 | .095(2.55) |
| 22001CSA6 | 20 | Solid | .097(2.46) |
| 22007CSA6 | 20 | 7/28 | .103(2.77) |
| 22019CSA6 | 20 | 19/32 | .103(2.77) |
| 21819CSA6 | 18 | 19/30 | .112(3.01) |
| 21619CSA6 | 16 | 19/0117 | .120(3.05) |
| 21419CSA6 | 14 | 19/0147 | .134(3.40) |
| 21219CSA6 | 12 | 19/0185 | .153(3.88) |

### HEAVY WALL INSULATION RATED AT 600 VOLTS AND 200°C

**CONDUCTOR:** Silver plated copper. Constructions with nickel plated copper or nickel conductor can be supplied. Consult factory for details. **INSULATION:** Extruded "Teflon" TFE, 1/32" (0.79mm) min. wall thickness. Surface printed for product identification in sizes 24 AWG and larger. **USE:** For internal wiring of electronic, photographic, refrigeration and air conditioning equipment, ballast and incandescent lampholder leads, infrared ovens, flood lights, business machines, clothes dryers and electric stoves.

**STOCK COLORS: 0-2-9.**

**COLOR CODE:** 0—Black • 1—Brown • 2—Red • 3—Orange • 4—Yellow • 5—Green • 6—Blue • 7—Violet • 8—Grey • 9—White

### 200°C, SILICONE, GLASS BRAID. 600 VOLT

| DEARBORN NO. | AWG SIZE | STRAND-ING | WALL THICKNESS | NOM. O.D. | STOCK COLORS | STOCK PUT UP (FT.) |
|---|---|---|---|---|---|---|
| 431816 | 18 | 16 x 30 | 1/32 | .131 | 0, 9 | 500 |
| 431626 | 16 | 26 x 30 | 1/32 | .144 | 0, 9 | 500 |
| 431441 | 14 | 41 x 30 | 1/32 | .159 | 0, 9 | 500 |
| 431241 | 12 | 41 x 28 | 1/32 | .180 | 0, 9 | 500 |
| 431065 | 10 | 65 x 28 | 3/64 | .236 | 0, 9 | 500 |

### 150°C TYPE AA, ASBESTOS, 300 VOLT

| DEARBORN NO. | AWG SIZE | STRAND-ING | WALL THICKNESS | NOM. O.D. | STOCK COLORS | STOCK PUT UP (FT.) |
|---|---|---|---|---|---|---|
| 451665 | 16 | 65/34 | .075 | .210 | White | 250 |
| 451400 | 14 | 104/34 | .075 | .230 | White | 250 |
| 451200 | 12 | 168/34 | .075 | .250 | White | 250 |
| 451000 | 10 | 261/34 | .085 | .285 | White | 250 |
| 450800 | 8 | 471/34 | .085 | .335 | White | 250 |
| 450600 | 6 | 665/34 | .090 | .390 | White | 250 |
| 450400 | 4 | 1057/34 | .090 | .425 | White | 250 |
| 450200 | 2 | 1680/34 | .090 | .500 | White | 250 |

### 150°C TYPE AF, 300 VOLT

| DEARBORN NO. | AWG SIZE | STRAND-ING | WALL THICKNESS | NOM. O.D. | STOCK COLORS | STOCK PUT UP (FT.) |
|---|---|---|---|---|---|---|
| 481816 | 18 | 16/30 | 1/32 | .111 | 0, 2, 9 | 500 |
| 481626 | 16 | 26/30 | 1/32 | .123 | 0, 2, 9 | 500 |
| 481441 | 14 | 41/30 | 1/32 | .141 | 0, 2, 9 | 500 |
| 481265 | 12 | 65/30 | 3/64 | .191 | 0, 2, 9 | 500 |
| 481000 | 10 | 105/30 | 3/64 | .217 | 0, 2, 9 | 250 |

**COLOR CODE:** 0—Black • 1—Brown • 2—Red • 3—Orange • 4—Yellow • 5—Green • 6—Blue • 7—Violet • 8—Gray • 9—White.

OTHER COLORS AVAILABLE ON SPECIAL ORDER

## Appliance and Fixture Wire

U.L. LISTED

### SILICONE RUBBER TYPES

#### HIGH TEMPERATURE BRAIDLESS SILICONE RUBBER WIRE

Braidless silicone is easy stripping, and has excellent physical strength and mechanical properties. Recommended for stoves, dryers, motors and electronic devices where high temperatures are incurred. All conductors are of stranded tinned copper. U.L. Style 3212 — Sizes 10 thru 22; U.L. Style 3213 — Sizes 2 thru 8; Style 3214 — Sizes 00 thru 1.

#### HIGH TEMPERATURE SILICONE RUBBER WIRE WITH GLASS BRAID

High temperature silicone rubber insulation for easy stripping. Lacquered glass braid overall gives additional abrasion resistance. Lacquer prevents fraying of braid. Used for appliance and hookup wire. U.L. Style 3071 on AWG Sizes: Nos. 18, 16, 14, and 12. U.L. Style 3075 on AWG Size No. 10.

### ASBESTOS INSULATED TYPES

#### TYPE AA

U.L. Style C-2130, 150°C; 300 Volts. Designed for wiring of electric ranges, grills, space heaters and other types of electrical heating devices where heat but not moisture is present. Maximum copper temperature is 200°C (392°F).

#### TYPE AF

U.L. Style AF 3200, 150°C; 300 Volts. Stranded copper conductor; tape, felted asbestos insulation — flame, heat and moisture resistant. Approved for all types of interior illumination, particularly fluorescent devices, and all high wattage units, especially where socket temperatures exceed 90°C (194°F).

### 150°C, BRAIDLESS SILICONE, 600 VOLT

| DEARBORN NO. | AWG SIZE | STRAND-ING | WALL THICKNESS | NOM. O.D. | STOCK COLORS | STOCK PUT UP (FT.) |
|---|---|---|---|---|---|---|
| 392207 | 22 | 7/30 | 3/64 | .129 | 9 | 500 |
| 392010 | 20 | 10/30 | 3/64 | .135 | 0, 9 | 500 |
| 391816 | 18 | 16/30 | 3/64 | .143 | 0, 2, 9 | 500 |
| 391626 | 16 | 26/30 | 3/64 | .156 | 0, 2, 9 | 500 |
| 391441 | 14 | 41/30 | 3/64 | .173 | 0, 2, 9 | 100 & 500 |
| 391265 | 12 | 65/30 | 3/64 | .194 | 0, 2, 9 | 100 & 500 |
| 391065 | 10 | 65/28 | 3/64 | .228 | 0, 9 | 100 & 500 |
| 390854 | 8 | 54/25 | 4/64 | .295 | 0, 9 | 100 & 500 |
| 390684 | 6 | 84/25 | 4/64 | .338 | 0, 9 | 100 & 500 |
| 394133 | 4 | 133/25 | 4/64 | .397 | 0, 9 | 100 & 250 |
| 392259 | 2 | 259/26 | 4/64 | .467 | 0, 9 | 100 & 250 |
| 391259 | 1 | 259/25 | 5/64 | .542 | 0, 9 | 100 & 250 |
| 390001 | 0 | 259/24 | 5/64 | .594 | 0, 9 | 100 & 250 |
| 390002 | 00 | 259/23 | 5/64 | .674 | 0, 9 | 100 & 250 |

### VINYL, LACQ'D COTTON BRAID

| DEARBORN NO. | SIZE AWG | STRANDING | PVC INSUL. THK. | NOM. O.D. | UL STYLE | STOCK COLOR | STOCK PUT UP (FT.) |
|---|---|---|---|---|---|---|---|
| **90°C — 300 VOLT** | | | | | | | |
| 472207F | 22 | 7/30 | 1/64 | .091 | 1009 | 0-6, 9 | 250 & 1000 |
| 472207 | 22 | 7/30* | 1/64 | .091 | 1009 | 0-6, 9 | 250 & 1000 |
| 472010F | 20 | 10/30 | 1/64 | .098 | 1009 | 0-6, 9 | 250 & 1000 |
| 472010 | 20 | 10/30* | 1/64 | .098 | 1009 | 0-6, 9 | 250 & 1000 |
| 471816 | 18 | 16/30 | 1/64 | .113 | 1009 | 0-6, 9 | 250 & 1000 |
| 471626 | 16 | 26/30 | 1/64 | .126 | 1009 | 0-6, 9 | 250 & 1000 |
| **90°C — 600 VOLT** | | | | | | | |
| 471441 | 14 | 41/30 | 1/32 | .177 | 1014 | 0,2,4,5,9 | 250 & 1000 |
| 471265 | 12 | 65/30 | 1/32 | .199 | 1014 | 0, 2 | 250 |
| 471065 | 10 | 65/28 | 1/32 | .222 | 1014 | 0 Only | 250 |
| 470884 | 8 | 84/27 | 3/64 | .293 | 1025 | 0 Only | 250 |
| 470684 | 6 | 84/25 | 4/64 | .369 | 1265 | 0 Only | 250 |

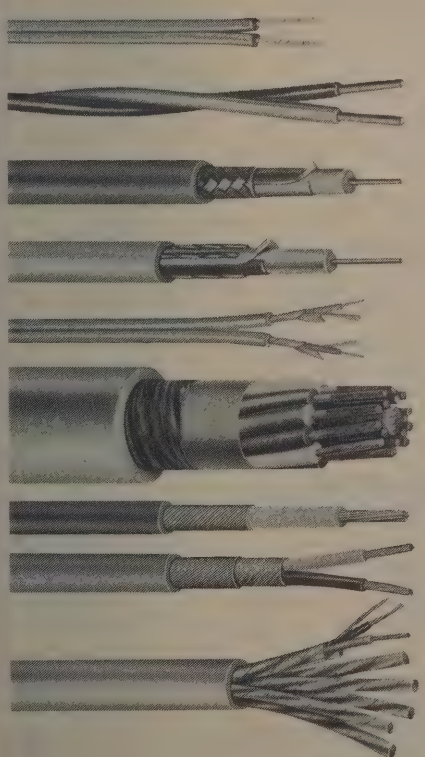
* Bonded

DEARBORN WIRE AND CABLE CO. 9299 Evenhouse Avenue, Rosemont, Illinois 60018 • Phone (312) 696-1000

# DEARBORN

## Wire, Cable and Insulation

Serving You From The Crossroads Of The Nation



Our Easy-To-Remember Phone Number is

Area Code 312

# 696-1000

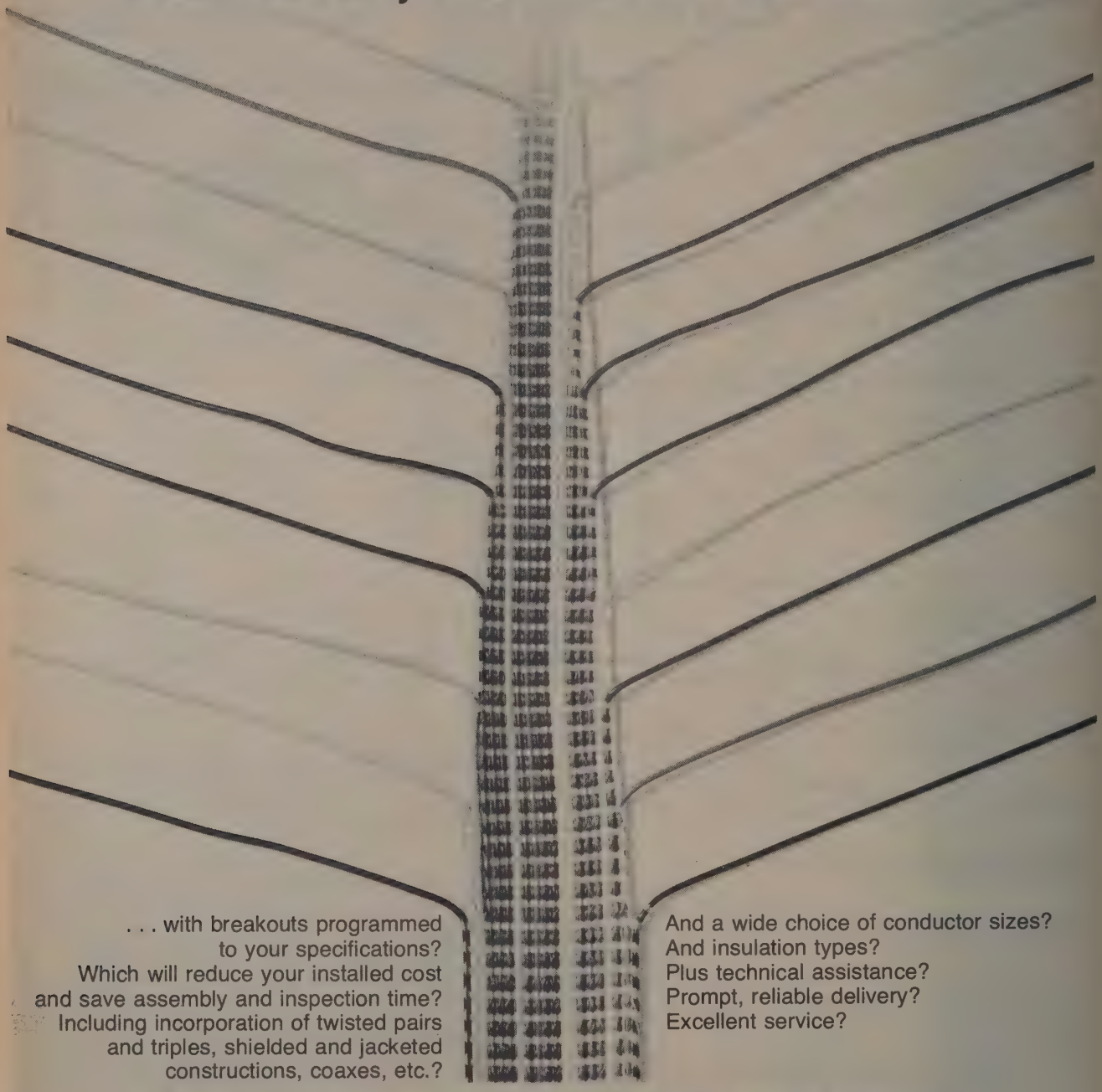
Our TWX Number is 910 - 253-0343
(DEARBORN RSMT)

DEPEND ON **DEARBORN**

For Quick Quotes, Super Service and Value

# are you looking for

## Flat-woven, multi-conductor cable?



. . . with breakouts programmed to your specifications?
Which will reduce your installed cost and save assembly and inspection time?
Including incorporation of twisted pairs and triples, shielded and jacketed constructions, coaxes, etc.?

And a wide choice of conductor sizes?
And insulation types?
Plus technical assistance?
Prompt, reliable delivery?
Excellent service?

# You've got our number!

# 401-724-3000

Call Richard Planchet

**Electroweave, Inc.**

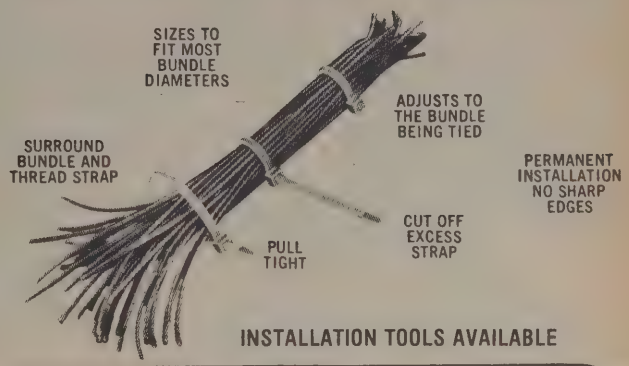
27E Foundry Street, Central Falls, R. I. 02863

Grayhill

# FASTRAPS™ CABLE TIES AND CLAMPS

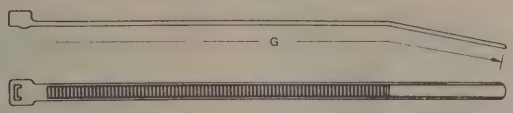
## PERMANENT WIRE AND CABLE TIES
## A QPL TIE AT A LOWER COST

- HIGH DIELECTRIC STRENGTH, HIGH TENSILE STRENGTH AND OUTSTANDING RESILIENCE
- RESISTANCE TO ABSORPTION AND ABRASION, AND CHEMICAL DETERIORATION FROM SOLVENTS, OIL, GREASE
- MOLDED FROM NYLON — WHITE (NATURAL) AND BLACK ARE STANDARD COLORS — OTHER COLORS AVAILABLE
- MEETS MS-3367 AND MIL-S-23190

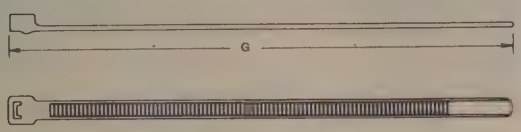

SIZES TO FIT MOST BUNDLE DIAMETERS
ADJUSTS TO THE BUNDLE BEING TIED
SURROUND BUNDLE AND THREAD STRAP
PERMANENT INSTALLATION NO SHARP EDGES
CUT OFF EXCESS STRAP
PULL TIGHT

INSTALLATION TOOLS AVAILABLE

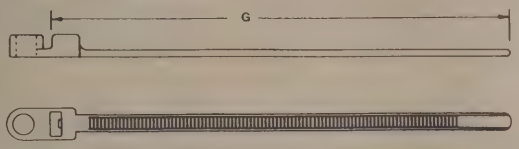
**FASTRAPS Bent Tip Cable Tie Designed for Easy Threading**
Standard Duty (Model 6005)




**FASTRAPS Straight Tip Cable Tie... Provides Maximum Strength**
Heavy Duty (Model 6006)




**FASTRAPS Cable Tie with Mounting Hole**
Heavy Duty, Straight Tip (Model 6007) .250" mounting hole
Standard Duty, Bent Tip (Model 6008) .205" mounting hole

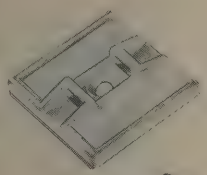



| Part No. Stem Length Color | Max. Bundle Dia. | Price/100 | Price 1M To 10M |
|---|---|---|---|
| 6005 — 0350 NAT | ¾" | $ 1.58 | $ 10.50 |
| 6005 — 0400 NAT | 1" | 2.10 | 14.00 |
| 6005 — 0550 NAT | 1¼" | 2.78 | 18.50 |
| 6005 — 0675 NAT | 1¾" | 3.24 | 21.60 |
| 6005 — 0800 NAT | 2" | 3.16 | 21.10 |
| 6005 — 1100 NAT | 3" | 6.82 | 45.40 |
| 6005 — 1400 NAT | 4" | 8.02 | 53.50 |
| 6006 — 0800 NAT | 2" | $11.78 | $ 67.72 |
| 6006 — 1400 NAT | 3½" | 13.10 | 87.30 |
| 6006 — 1700 NAT | 5" | 21.31 | 142.09 |
| 6006 — 2100 NAT | 6" | 24.56 | 163.70 |
| 6006 — 2800 NAT | 8" | 26.97 | 179.75 |
| 6007 — 1400 NAT | 3½" | $19.68 | $131.15 |
| 6007 — 2100 NAT | 6" | 26.40 | 176.00 |
| 6007 — 2800 NAT | 8" | 29.97 | 199.75 |
| 6008 — 0550 NAT | 1¼" | $ 5.07 | $ 33.85 |
| 6008 — 0675 NAT | 1¾" | 5.16 | 34.40 |

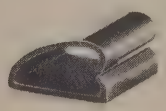
**ORDERING INFORMATION**
Color: NAT = Natural Nylon White
BLK = Pigmented Black
For Other Colors See FASTRAPS Catalog
Lengths (G in Drawing): 0350 = 3½", 0400 = 4" Etc.
Basic Model Number

PRICES AND DISCOUNTS SUBJECT TO CHANGE WITHOUT NOTICE

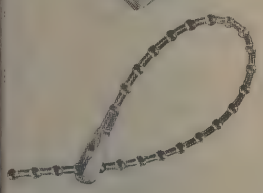
## ADDITIONAL FASTRAPS™ FASTENING PRODUCTS



**TIE MOUNT**
Molded Nylon. Adhesive Back and Screw Hole. Tie Slips Through Slots and Around Bundle. Available in Natural Nylon Color and Black. Approx. 1⅛" Square.



**CONVENIENCE CLAMP**
Adhesive Backed for Sure, Fast Mounting. Easily Opened to Add or Remove Wires. Approx. ¾" sq. and ½" High.



**BEADED CHAIN TIE**
Economical. Reusable. Easy to Use. Available in Nylon in Natural White and Polyethylene in Natural, Red, Yellow and Blue. 4, 5, 6, 8 and 10 Inch Lengths.

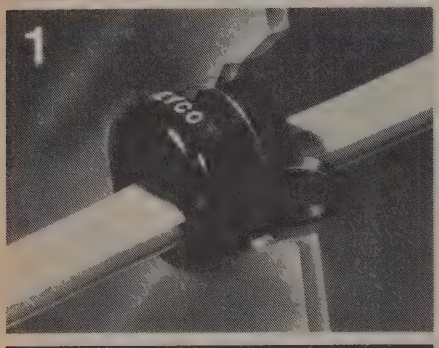
**PUSH MOUNT CLIPS**
Quick, Easy Method of Routing Wire or Cable. Easily Hand Installed. Tension Lock or Self Locking Styles. Accommodates up to 1" Diameters. Natural Nylon or Fire Retardant Nylon.

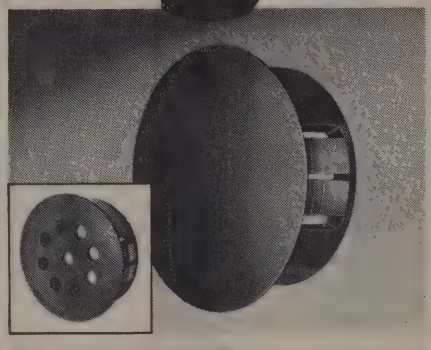
**CABLE CLAMPS**
Screw Down Clamp Provides Secure Fastening of Cable Bundles to Chassis. Choice of 26 Sizes That Accept From ⅛" to 1½" Bundles. Nylon, Fire Retardant Nylon or Polypropylene Materials.

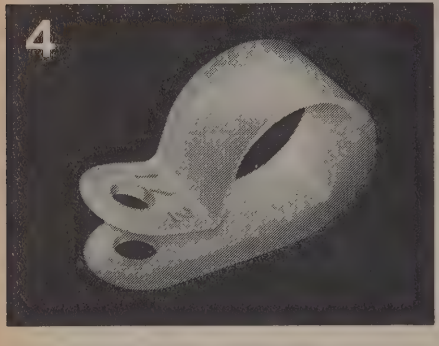
FOR COMPLETE DESCRIPTION OF ALL FASTRAPS PLASTIC FASTENING PRODUCTS, SEE FASTRAPS CATALOG

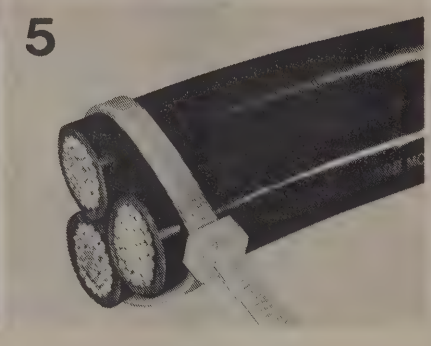
**Grayhill, Inc. / 569 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040 / TWX: 910-683-1850**

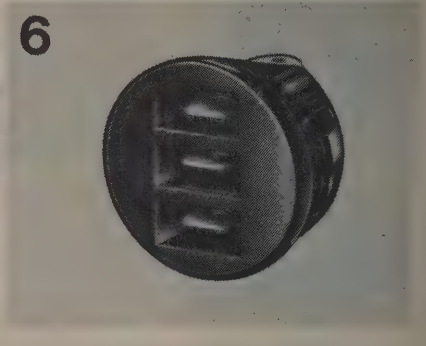
# Heyco® nylon bushings






**1. STRAIN RELIEF BUSHINGS**
Inexpensive way to securely anchor, insulate and protect cable at point of entry into chassis. Completely absorb push, pull and twist on wire. Approved for use in elevated temperatures. 58 sizes—for chassis holes from 3/8" through 1-3/16". Available for straight through, right angle or flexing applications.

**2. HOLE PLUGS**
For neat, low-cost closures of factory adjustment holes, wiring outlets and unnecessary openings. Snap-lock installation by finger pressure provides the quickest hole-closing method for assembly lines. Unaffected by elevated temperatures. 20 sizes—for panels up to 1/8" thickness, holes from 3/16" through 2" diameter. Also 2 sizes available with perforated head for ventilation.

**3. INSULATING BUSHINGS**
Convert sharp-edged metal holes to smooth, neat insulated holes. Quick, snap assembly with finger-tip pressur Will withstand 35 pound pushback tes Meets specifications for insulation anc mechanical protection of tubing, cables, etc.
Available in 51 sizes for 3/16" to 2-1/2" diameter holes with various I.D 5 sizes also available with split side.

**4. CABLE CLAMPS**
Anchor, insulate and direct cable, wiring, tubing and piping. Open ended for easy assembly. Fully radiused edges. 26 sizes—available in both standard and heavy duty types with inside diameters ranging from 1/8" to 1-1/2".

**5. WIRE TIES**
Nytye® self-locking wire ties for standard and heavy duty, regular and mountable applications. 21 sizes for bundling and holding cables, wires, hoses, etc. of 1/16" to 8-1/8" in diameter. Mounting platforms also available.

**6. TERMINAL BUSHINGS**
Provide low cost, fully insulated, quicl connecting and disconnecting of wire through panels or housing. Six sizes with 1, 2 or 3 terminals, in 8 colors for color coding. Choice of solder, double male or crimp terminals which mate with 3/16" or 1/4" standard female quick-connect terminals.

## Heyco Labkits®

**LABKIT No.1**
**Strain Relief Bushings**
188 piece working assortment for prototype and lab use.
**$12.50**

**Assembly Plier**
**$15.00**

**LABKIT No. 2**
**Insulating Bushings**
258 Snap and Shorty Bushings in 18 popular sizes.
**$12.50**

**LABKIT NO. 3**
**Hole Plug Assortment**
255 of the 18 most popular sizes instantly available for product design use.
**$12.50**

**LABKIT No. 4**
**Assortment for K. O.'s**
125 Insulating Bushings, Plugs and Strain Relief Bushings for ½ KO (⅞") and ¾ KO (1-3/32") holes. **$12.50**
**Strain Relief Assembly Plier**
**$15.00**

**LABKIT No. 5**
**Cable Clamps**
285 clamps of 18 different sizes, both standard and heavy duty for ⅛" to 1½" diameter applications.
**$12.50**

**Heyman Manufacturing Company**
**Box 160B, Kenilworth, N.J. 07033 • (201) 245-2345 • TWX: 710-996-5986**
**Box 408B, Waukesha, Wis. 53187 • (414) 542-7155 • TWX: 910-265-3668**
**Call Toll-Free (800) 558-0917 Except From Wisconsin • If Calling From Wisconsin Use (800) 242-0985**
In Europe: Heyman Mfg. GmbH, Zu den Mühlen 17, D-63 Giessen, Germany

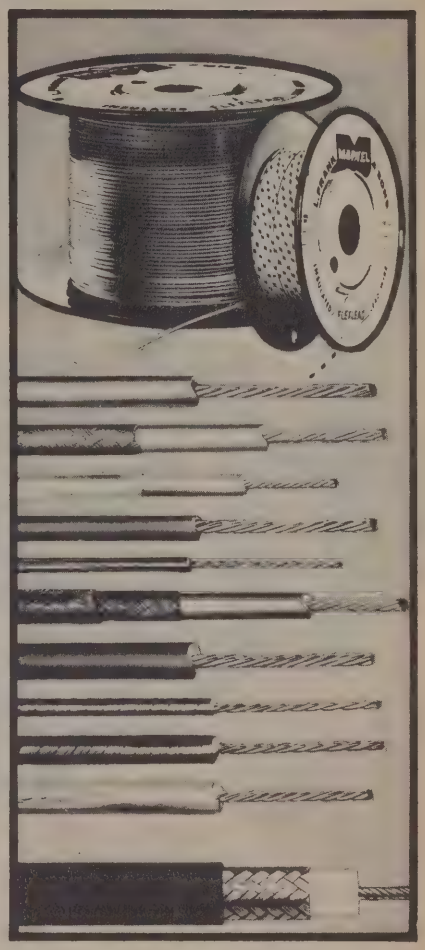
HEYCO®

255D

# MARKEL CORPORATION

## Insulating Tubings and Sleevings — High Temperature Wire and Cable

With Today's higher temperature requirements MARKEL can provide you — the customer — with insulated leadwire that delivers the protection and performance no other standard material can supply.



### FLEXLEAD SILICONE RUBBER WIRE AND CABLE

Flexlead Silicone Rubber Leadwire is recommended for high temperature applications in motors, heaters, high voltage power supplies, switches, consumer appliances, medical equipment, nuclear plant wiring, and fire resistant control cables.

- A diversified Standard Product Line
- Economy and Reliability
- Compliance with UL, CSA and Military Requirements
- Special Tailor-Made Constructions
- Ultra Flexible, Wide Temperature Range

### FLEXLEAD FLUOROCARBON WIRE AND CABLE

Flexlead Fluorocarbons (PFA, TFE, FEP, ETFE) are recommended for personal care and home appliances, aircraft, commercial and private communication systems, computers, business machines, electric motors and traction equipment — Anywhere the ultimate in performance is required.

- Inert to Lubricants, Solvents, and Reagents
- Non-Flammable in Normal Atmospheres
- Servicable in —70° to 260°C Environments
- Unsurpassed Electrical Performance
- Substantial Weight and Space Savings Over Conventional Insulations

*WRITE FOR FURTHER INFORMATION, OR CALL FOR ASSISTANCE AT ANY OF THE FOLLOWING LOCATIONS:*

| | | |
|---|---|---|
| MARKEL CORPORATION | NORRISTOWN, PA 19404 | PHONE: (215) 272-8960 |
| J. J. GLENN & CO. | CHICAGO, IL 60632 | PHONE: (312) 847-6400 |
| MARFLEX LTD. | MISSISSAUGA, ONT L5L 1J9 | PHONE: (416) 828-0220 |
| NATIONAL WIRE & CABLE | LOS ANGELES, CA 90031 | PHONE: (213) 225-5611 |

# NATIONAL WIRE AND CABLE CORPORATION

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

As a manufacturer of wire and cable products . . . with warehouses on both East and West coasts, National Wire & Cable is ready to fill your immediate needs. Choose from our standard lines of wire or cable . . . OR let us design and custom manufacture exactly what you require for your application.

**Our wire inventory is now over 160 million feet, and our 500 different standard multi-conductor cables total in excess of 1.3 million feet!**

When you call National Wire, you'll find we are especially well equipped to handle your large as well as minimal requirements. If our "standard" items won't meet your application, we have the wire inventory, the machinery, the expertise to come up with exactly what you need. 86,000 square feet of manufacturing area and our expert engineering staff are at your disposal!!! All cable components are produced within our own facility in order to assure complete quality control.

Review the following catalog pages. If you need some assistance with your specific requirement, call our factory direct, or call our representative nearest you. See Manufacturers and Sales Office Directory Yellow Pages.

# NATIONAL WIRE AND CABLE CORPORATION

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

# U/L Listed Wire

# CSA Listed Wire

- Wires listed by the Underwriter's Laboratories, Inc. for operation in an air or an oil environment. U.L. File #E35793.
- Wires listed by the Canadian Standards Association for radio or electronic uses. CSA File #LR-20482 & LR-32511.

## U/L Style 1061

Appliance wiring material available as FR-1 rated 80-degree C Service. .009" semi-rigid vinyl insulation U/L rated: 300-volt service. Meets Mil-W-16878D Type B, and CSA S-R PVC. Also available with solid conductors.

| GAUGE (AWG) | NATIONAL CATALOG NUMBER | NO. OF STRANDS | GA. OF STRANDS (AWG) | NOM. DIAM. OF STRANDED CONDUCTOR (INCHES) | NOM. FIN. WIRE DIAM. (INCHES) | MAX. RESISTANCE (dc) AT 25°C OHMS/1000 FT. | NOM. WT. PER 1000 FT. (LBS.) |
|---|---|---|---|---|---|---|---|
| 28 | N304-736U | 7 | 36 | .015 | .034 | 69.0 | 1.0 |
| 26 | N304-1938U | 19* | 38 | .019 | .038 | 42.9 | 1.5 |
| 24† | N304-1936U | 19* | 36 | .024 | .043 | 26.8 | 2.0 |
| 22† | N304-1934U | 19* | 34 | .030 | .050 | 16.7 | 3.0 |
| 20 | N304-1932U | 19* | 32 | .038 | .057 | 10.5 | 4.75 |
| 18 | N304-1930U | 19 | 30 | .048 | .068 | 6.57 | 6.5 |
| 16 | N304-1929U | 19 | 29 | .057 | .077 | 4.85 | 9.0 |

## U/L Style 1007

Appliance wiring available as FR-1 rated 80-degree C Service. 1/64" vinyl insulation U/L rated: 300 volt appliance, use 600 volt electronic use. Meets Mil-W-16878D Type C. Also approved by CSA as Type TR-64 radio wiring for 90-degree C Service. Colors: 10 standard colors plus tracers on solid colors. Also available with solid conductors.

| GAUGE (AWG) | NATIONAL CATALOG NUMBER | NO. OF STRANDS | GA. OF STRANDS (AWG) | NOM. DIAM. OF STRANDED CONDUCTOR (INCHES) | NOM. FIN. WIRE DIAM. (INCHES) | MAX. RESISTANCE (dc) AT 25°C OHMS/1000 FT. | NOM. WT. PER 1000 FT. (LBS.) |
|---|---|---|---|---|---|---|---|
| 24 † | N303-732U | 7 | 32 | .024 | .058 | 26.8 | 2.75 |
| 22 † | N303-1934U | 19* | 34 | .030 | .063 | 16.7 | 3.75 |
| 20 | N303-1932U | 19* | 32 | .038 | .072 | 10.5 | 5.50 |
| 18 | N303-1930U | 19 | 30 | .048 | .082 | 6.57 | 8.0 |
| 16 | N303-1929U | 19 | 29 | .057 | .090 | 4.85 | 10.0 |

## U/L Style 1015

Appliance wiring material available as FR-1 rated 105-degree C Service 1/32" vinyl insulation U/L rated, 2500 volts electronic use, 600 volt appliance use. Meets Mil-W-16878D Type D. Colors: 10 standard colors plus tracers on solid colors.

| GAUGE (AWG) | NATIONAL CATALOG NUMBER | NO. OF STRANDS | GA. OF STRANDS (AWG) | NOM. DIAM. OF STRANDED CONDUCTOR (INCHES) | NOM. FIN. WIRE DIAM. (INCHES) | MAX. RESISTANCE (dc) AT 25°C OHMS/1000 FT. | NOM. WT. PER 1000 FT. (LBS.) |
|---|---|---|---|---|---|---|---|
| 24† | N600-732U | 7 | 32 | .024 | .082 | 26.8 | 4.0 |
| 22† | N600-730U | 7 | 30 | .030 | .090 | 16.7 | 5.2 |
| 20† | N600-728U | 7 | 28 | .038 | .098 | 10.5 | 7.3 |
| 18 | N600-1930U | 19 | 30 | .048 | .108 | 6.57 | 10.0 |
| 16 | N600-1929U | 19 | 29 | .057 | .117 | 4.85 | 12.0 |
| 14 | N600-1927U | 19 | 27 | .071 | .130 | 3.05 | 17.1 |
| 12 | N600-1925U | 19 | 25 | .090 | .162 | 1.92 | 27.4 |
| 10 | N600-4927U | 49 | 27 | .111 | .181 | 1.24 | 38.6 |

## CSA/Type TR-32 Radio Wire

Rated: 90-degree C 600 volt, 1/32" vinyl insulation. Also listed as CSA Appliance Wiring Material 90-degree 600 V. Meets U/L Style 1015 & Mil-W-16878D Type D.

| GAUGE (AWG) | NATIONAL CATALOG NUMBER | NO. OF STRANDS | GA. OF STRANDS (AWG) | NOM. DIAM. OF STRANDED CONDUCTOR (INCHES) | NOM. FIN. WIRE DIAM. (INCHES) | MAX. RESISTANCE (dc) AT 25°C OHMS/1000 FT. | NOM. WT. PER 1000 FT. (LBS.) |
|---|---|---|---|---|---|---|---|
| 24 † | N307-732U | 7 | 32 | .024 | .082 | 26.8 | 4.0 |
| 22 † | N307-730U | 7 | 30 | .030 | .090 | 16.7 | 5.2 |
| 20† | N307-728U | 7 | 28 | .038 | .098 | 10.5 | 7.3 |
| 18 | N307-1930U | 19 | 30 | .048 | .108 | 6.57 | 10.0 |
| 16 | N307-1929U | 19 | 29 | .057 | .117 | 4.85 | 12.0 |
| 14 | N307-1927U | 19 | 27 | .071 | .130 | 3.05 | 17.1 |
| 12 | N307-1925U | 19 | 25 | .090 | .162 | 1.92 | 27.4 |
| 10 | N307-4927U | 49 | 27 | .111 | .181 | 1.24 | 38.6 |

*Also available in 7 strands

## CSA Listed Type TR-64 Radio Wire

Rated 90-degree C 300 volt, 1/64" vinyl insulation. Meets U/L Style 1007 & Mil-W-16878D Type C.

| GAUGE (AWG) | NATIONAL CATALOG NUMBER | NO. OF STRANDS | GA. OF STRANDS (AWG) | NOM. DIAM. OF STRANDED CONDUCTOR (INCHES) | NOM. FIN. WIRE DIAM. (INCHES) | MAX. RESISTANCE (dc) AT 25°C OHMS/1000 FT. | NOM. WT. PER 1000 FT. (LBS.) |
|---|---|---|---|---|---|---|---|
| 24† | N308-732U | 7 | 32 | .024 | .058 | 28.4 | 2.75 |
| 22† | N308-1934U | 19* | 34 | .030 | .063 | 19.0 | 3.50 |
| 20 | N308-1932U | 19* | 32 | .038 | .072 | 13.12 | 5.25 |
| 18 | N308-1930U | 19 | 30 | .048 | .082 | 7.89 | 6.75 |
| 16 | N308-1929U | 19 | 29 | .057 | .090 | 4.97 | 10.0 |

†Also available as NABOND  Also available with Nylon Jacket

# NATIONAL WIRE AND CABLE CORPORATION

# Military Electronic Hookup Wire

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

## MIL-W-16878/1
### Type BU

For internal wiring of electronic equipment. .010" wall vinyl primary insulation. No outer covering. —54-degree C to +105-degree C, 600 V, R.M.S. (working). Also available as NABOND. Meets U/L Style 1061, and CSA S-R PVC.

| GAUGE (AWG) | NATIONAL CATALOG NUMBER | NO. OF STRANDS | GA. OF STRANDS (AWG) | NOM. DIAM. OF STRANDED CONDUCTOR (INCHES) | NOM. FIN. WIRE DIAM. (INCHES) | MAX. RESISTANCE (dc) AT 25°C OHMS/1000 FT. | NOM. WT. PER 1000 FT. (LBS.) |
|---|---|---|---|---|---|---|---|
| 32 | NB740U | 7 | 40 | .009 | .028 | 179.0 | 0.70 |
| 30 | NB738U | 7 | 38 | .012 | .031 | 111.0 | 0.75 |
| 28 | NB736U | 7 | 36 | .015 | .034 | 69.0 | 1.0 |
| 26 | NB1938U | 19* | 38 | .019 | .038 | 42.9 | 1.5 |
| 24 | NB1936U | 19* | 36 | .024 | .043 | 26.8 | 2.0 |
| 22 | NB1934U | 19* | 34 | .030 | .050 | 16.7 | 3.0 |
| 20 | NB1932U | 19* | 32 | .038 | .057 | 10.5 | 4.5 |
| 18 | NB1930U | 19 | 30 | .048 | .068 | 6.57 | 6.5 |
| 16 | NB1929U | 19 | 29 | .057 | .077 | 4.85 | 9.0 |
| 14 | NB1927U | 19 | 27 | .071 | .091 | 3.05 | 14.0 |

*Also available in 7 strands

## MIL-W-16878/1
### Type BN

For internal wiring of electronic equipment. Vinyl primary insulation with Nylon jacket overall. —54-degree C to +115-degree C, 600 V, R.M.S. (working). Meets U/L Style 1006.

| GAUGE (AWG) | NATIONAL CATALOG NUMBER | NO. OF STRANDS | GA. OF STRANDS (AWG) | NOM. DIAM. OF STRANDED CONDUCTOR (INCHES) | NOM. FIN. WIRE DIAM. (INCHES) | MAX. RESISTANCE (dc) AT 25°C OHMS/1000 FT. | NOM. WT. PER 1000 FT. (LBS.) |
|---|---|---|---|---|---|---|---|
| 32 | NB740N | 7 | 40 | .009 | .032 | 179.0 | 0.75 |
| 30 | NB738N | 7 | 38 | .012 | .036 | 111.0 | 1.0 |
| 28 | NB736N | 7 | 36 | .015 | .039 | 69.0 | 1.25 |
| 26 | NB1938N | 19* | 38 | .019 | .044 | 42.9 | 1.75 |
| 24 | NB1936N | 19* | 36 | .024 | .049 | 26.8 | 2.25 |
| 22 | NB1934N | 19* | 34 | .030 | .056 | 16.7 | 3.25 |
| 20 | NB1932N | 19* | 32 | .038 | .063 | 10.5 | 4.75 |
| 18 | NB1930N | 19 | 30 | .048 | .074 | 6.57 | 7.0 |
| 16 | NB1929N | 19 | 29 | .057 | .083 | 4.85 | 9.0 |
| 14 | NB1927N | 19 | 27 | .071 | .098 | 3.05 | 14.7 |

*Also available in 7 strands

## MIL-W-16878/2
### Type CU

For internal wiring of meters, panels & electronic equipment, .015" Wall Vinyl primary insulation (no outer covering). —54° C to +105° C, 1000 Volts, R.M.S. (working). Also available as NABOND. Meets U/L Style 1007 and CSA TR-64.

| GAUGE (AWG) | NATIONAL CATALOG NUMBER | NO. OF STRANDS | GA. OF STRANDS (AWG) | NOM. DIAM. OF STRANDED CONDUCTOR (INCHES) | NOM. FIN. WIRE DIAM. (INCHES) | MAX. RESISTANCE (dc) AT 25°C OHMS/1000 FT. | NOM. WT. PER 1000 FT. (LBS.) |
|---|---|---|---|---|---|---|---|
| 24 | NC732U | 7 | 32 | .024 | .058 | 26.8 | 2.75 |
| 22 | NC1934U | 19* | 34 | .030 | .063 | 16.7 | 3.75 |
| 20 | NC1932U | 19* | 32 | .038 | .072 | 10.5 | 5.50 |
| 18 | NC1930U | 19 | 30 | .048 | .082 | 6.57 | 8.0 |
| 16 | NC1929U | 19 | 29 | .057 | .090 | 4.85 | 10.0 |
| 14 | NC1927U | 19 | 27 | .071 | .104 | 3.05 | 15.0 |
| 12 | NC1925U | 19 | 25 | .090 | .124 | 1.92 | 24.0 |

*Also available in 7 strands

## MIL-W-16878/3
### Type DU

Resists the effect of salt water, aviation fuel, motor oil, ethylene glycol and alcohols (methyl or ethyl). .031" Wall Vinyl primary insulation. No outer covering. —54-degree C to +105-degree, 3000 V, R.M.S. (working). Meets U/L Style 1015 and CSA TR-32.

| GAUGE (AWG) | NATIONAL CATALOG NUMBER | NO. OF STRANDS | GA. OF STRANDS (AWG) | NOM. DIAM. OF STRANDED CONDUCTOR (INCHES) | NOM. FIN. WIRE DIAM. (INCHES) | MAX. RESISTANCE (dc) AT 25°C OHMS/1000 FT. | NOM. WT. PER 1000 FT. (LBS.) |
|---|---|---|---|---|---|---|---|
| 24 | ND732U | 7 | 32 | .024 | .082 | 26.8 | 4.0 |
| 22 | ND730U | 7 | 30 | .030 | .090 | 16.7 | 5.2 |
| 20 | ND728U | 7 | 28 | .038 | .098 | 10.5 | 7.3 |
| 18 | ND1930U | 19 | 30 | .048 | .108 | 6.57 | 10.0 |
| 16 | ND1929U | 19 | 29 | .057 | .117 | 4.85 | 12.0 |
| 14 | ND1927U | 19 | 27 | .071 | .130 | 3.05 | 17.1 |
| 12 | ND1925U | 19 | 25 | .090 | .162 | 1.92 | 27.4 |
| 10 | ND4927U | 49 | 27 | .111 | .181 | 1.24 | 38.6 |
| 8 | ND13329U | 133 | 29 | .167 | .246 | 0.726 | 70.5 |
| 6 | ND13327U | 133 | 27 | .210 | .290 | 0.444 | 104.0 |

*Also available in 7 strands.

**NOTE: THE ABOVE WIRES COME IN 10 STANDARD COLORS PLUS TRACERS ON SOLID COLORS.**

**NATIONAL WIRE**
**AND CABLE CORPORATION**

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

# Nafoil Kleen-Strip® Foil-Shielded Audio & Instrumentation Cables (NKS Series)

## COMPUTER GRADE U.L. LISTED SELF-STRIPPING FOIL SHIELD

**Self stripping feature saves preparation time . . . increases production.**

National Wire and Cable Corporation manufactures a full line of small shielded instrumentation cables using our "NAFOIL KLEEN-STRIP" self stripping foil shield construction, plus non-fraying NABOND bonded stranded conductors.

Since the foil shield of "NAFOIL KLEEN-STRIP" is integrally fusion-bonded to the cable jacket, stripping the jacket from the end of the cable automatically removes the foil shield in the same operation.

This eliminates hand untwisting and trimming of foil shields. Excellent for automatic machine stripping.

Insulated conductor and "drain" wire use National's "NABOND" bonded stranded wire which eliminates frayed wire ends. The "NABOND" process lightly bonds the tinning of all strands. "NABOND" wire acts like a solid wire during stripping and wiring operations. Subsequent flexure breaks the bonding and the wire returns to its flexible condition. Offers the convenience of solid wire during manufacture, with the reliability of stranded wire for normal use.

All wires are stranded, bonded, tinned copper with .010" vinyl insulation for use up to +80.C @ 300 volts (U.L. Style 1061). Also rated 105.C @ 600 volts per MIL-W-16878/1.

Foil shield is ½ MIL Mylar with .00035" Aluminum, 50% overlap. Bare drain wire is the same as used in insulated conductors.

Overall jacket is 105 C. polyvinyl chloride thermoplastic per MIL-I-631 Class B and exceeds U.L. requirements. Jacket wall thickness .031". For extra flexible applications, these cables are also available with .022" jacket wall.

### TECHNICAL DATA

| | |
|---|---|
| **U.L. Voltage Rating:** | 300. Volts RMS AC (U.L. Style 1061) |
| **Military Rating:** | 600. Volts RMS AC (Mil-W-16878/1) |
| **Breakdown Voltage:** | Greater than 3000. Volts RMS AC |
| **Insulation Leakage Resistance:** | Higher than 200. Megohms per 1000 ft at 500. V.D.C. from any conductor to all else. |
| **Jacket Leakage Resistance:** | Higher than 10 Megohms per 1000 ft at 500. V.D.C. from shield through Jacket to water bath. |
| **Capacitance:** | See Table Below. |
| **Shield Leakage Capacitance:** | Nominal "Look-Through" capacitance from conductor group through the shield to water bath is less than 2.pf/1000 ft. Reinforcing action of bonded jacket reduces "Window" effects caused by flexure. |
| **Usable Temp. Range:** | U.L. +80°<br>Military: −40° to +105°C |
| **Cold Bend:** | All cables are suitable for flexing to a circle diameter of approx. 6 cable diameters from +80°C to −40°C. |

## STANDARD "KLEEN-STRIP" SHIELDED CABLES

| | CONDUCTOR AWG & STRANDING | NATIONAL PART NO. | INSULATION DIAMETER | DRAIN WIRE AWG & STRANDING | JACKET THICKNESS | DIAMETER OVER JKT. | CAPACITANCE PF/FT W-S | CAPACITANCE PF/FT W-W | RESISTANCE OHMS/MFT |
|---|---|---|---|---|---|---|---|---|---|
| **SINGLE CONDUCTOR SHIELDED & JACKETED** | 26 (7) | NKS-261 | .038 | 26 (7) | .031 | .125 | 97.8 | — | 42.9 |
| | 24 (7) | NKS-241 | .043 | 24 (7) | .031 | .135 | 170.9 | — | 26.8 |
| | 22 (7) | NKS-221 | .050 | 22 (7) | .031 | .148 | 131.5 | — | 16.7 |
| | 20 (7) | NKS-201 | .057 | 20 (7) | .031 | .163 | 167.2 | — | 10.5 |
| **2-CONDUCTOR SHIELDED & JACKETED (U.L. STYLE 2464)** | 26 (7) | NKS-262 | .038 | 26 (7) | .031 | .144 | 85.6 | 46.9 | 42.9 |
| | 24 (7) | NKS-242 | .043 | 24 (7) | .031 | .154 | 94.4 | 51.8 | 26.8 |
| | 22 (7) | NKS-222 | .050 | 22 (7) | .031 | .168 | 115.1 | 63.1 | 16.7 |
| | 20 (7) | NKS-202 | .057 | 20 (7) | .031 | .182 | 146.29 | 46.9 | 10.5 |
| **3-CONDUCTOR SHIELDED & JACKETED (U.L. STYLE 2464)** | 26 (7) | NKS-263 | .038 | 26 (7) | .031 | .150 | 80.8 | 44.0 | 42.9 |
| | 24 (7) | NKS-243 | .043 | 24 (7) | .031 | .165 | 89.2 | 48.6 | 26.8 |
| | 22 (7) | NKS-223 | .050 | 22 (7) | .031 | .176 | 108.7 | 59.2 | 16.7 |
| | 20 (7) | NKS-203 | .057 | 20 (7) | .031 | .191 | 138.3 | 75.2 | 10.5 |
| **4-CONDUCTOR SHIELDED & JACKETED (U.L. STYLE 2464)** | 26 (7) | NKS-264 | .038 | 26 (7) | .031 | .159 | 79. | 42. | 42.9 |
| | 24 (7) | NKS-244 | .043 | 24 (7) | .031 | .176 | 88. | 46. | 26.8 |
| | 22 (7) | NKS-224 | .050 | 22 (7) | .031 | .188 | 107. | 57. | 16.7 |
| | 20 (7) | NKS-204 | .057 | 20 (7) | .031 | .205 | 136. | 73. | 10.5 |

**NATIONAL WIRE AND CABLE CORPORATION**

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

# Miniature Signal & Control Cables Single Conductors (NX Series)

(NX1922SJ shown)

National Wire & Cable Corporation manufactures a complete line of MINIATURE low voltage signal and control cable. Available as cabled pairs or cabled singles, with optional overall shield. Conductors are stranded tinned copper with .010" wall of vinyl primary insulation for use up to 105°C per MIL-W-16878 Type B. Insulated for 600 volts working voltage. (Also meets U.L. AWM Type 1061; 300 volt, 80°C.) All are coded using 10 standard colors plus stripes on white per MIL-STD-681.

All conductors are planetary cabled and contra-helically laid for optimum flexibility, with a Mylar tape barrier under shields. Shielded cables have a tinned copper braid overall, of 85-90% coverage per MIL-C-7078; and braid angles below 40° for easy pushback.

The outer jacket is black abrasion-resistant 105°C. vinyl meeting MIL-I-631 Type F. All materials are self-extinguishing and fungus resistant. All items are U.L. LISTED STYLE 2343 COMPUTER CABLE; rated 80°C. (Higher temp. ratings apply for any non-U.L. service.)

Standard Putups: 500 and 1000 ft. No-deposit reels. For shorter quantities or specific lengths, consult factory.

## IN STOCK

**MIL-SPEC U.L. LISTED COMPUTER GRADE STYLE 2343**

For light duty, gray jacketed version of these cables in the U.L. Style 2464, see Pages 4680-4683 NQ Series.

### TECHNICAL DATA (all cables)

**Insulation Breakdown Voltage:** Greater than 5000 volts AC RMS, 60 cps.

**Capacitance:** Nominal capacitance from a wire to all else in a cable ranges from 45. to 70. pf/ft. at 1. kc, depending on gauge and position.

**Insulation Leakage:** 200. megohms/1000 ft. min. @ 500. VDC from any conductor to all else in cable.

**Sheath Leakage:** 10. megohms/1000 ft. min. @ 500 VDC from shield or conductor group through sheath to ground.

**Temperature Range:** Suitable for continuous use from −40°C. to +105°C. (U.L. Service limited to +80°C.)

**Bending Characteristics:** All cables are suitable for flexing to a circle diameter of 6. cable diameters from +105°C. to −20°C. Recommended flex diameter should be greater than 20 cable diameters for flexing at −40°C.

## MULTICONDUCTOR STOCK CABLED SINGLES

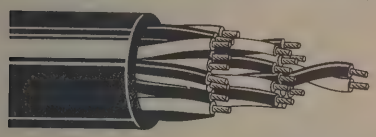
Cond: 22, 24 are 7 strand; 20 AWG is 19 strand

| UNSHIELDED | | | | | | | OVERALL SHIELDED | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PART NO. | NO. COND. | COND. AWG | COND. O.D. | JKT. WALL | CABLE O.D. | WEIGHT LB/M' | PART NO. | NO. COND. | COND. AWG | COND. O.D. | JKT. WALL | SHIELD AWG | CABLE O.D. | WEIGHT LB/M' |
| NX-524 J | 5 | 24 | .045 | .062 | .220 | 32 Lbs. | NX-524 SJ | 5 | 24 | .045 | .062 | 36 | .245 | 44 Lbs. |
| NX-724 J | 7 | 24 | .045 | .062 | .250 | 40 Lbs. | NX-724 SJ | 7 | 24 | .045 | .062 | 36 | .275 | 55 Lbs. |
| NX-1224J | 12 | 24 | .045 | .062 | .300 | 53 Lbs. | NX-1224SJ | 12 | 24 | .045 | .062 | 36 | .325 | 68 Lbs. |
| NX-1524J | 15 | 24 | .045 | .062 | .330 | 65 Lbs. | NX-1524SJ | 15 | 24 | .045 | .062 | 36 | .350 | 80 Lbs. |
| NX-1924J | 19 | 24 | .045 | .062 | .340 | 73 Lbs. | NX-1924SJ | 19 | 24 | .045 | .062 | 36 | .365 | 88 Lbs. |
| NX-2724J | 27 | 24 | .045 | .062 | .390 | 85 Lbs. | NX-2724SJ | 27 | 24 | .045 | .062 | 36 | .415 | 102 Lbs. |
| NX-3724J | 37 | 24 | .045 | .062 | .420 | 120 Lbs. | NX-3724SJ | 37 | 24 | .045 | .062 | 36 | .445 | 140 Lbs. |
| NX-4824J | 48 | 24 | .045 | .062 | .470 | 142 Lbs. | NX-4824SJ | 48 | 24 | .045 | .062 | 36 | .495 | 172 Lbs. |
| NX-6024J | 60 | 24 | .045 | .062 | .510 | 170 Lbs. | NX-6024SJ | 60 | 24 | .045 | .062 | 36 | .535 | 205 Lbs. |
| NX-522 J | 5 | 22 | .050 | .062 | .265 | 40 Lbs. | NX-522 SJ | 5 | 22 | .050 | .062 | 36 | .285 | 50 Lbs. |
| NX-722 J | 7 | 22 | .050 | .062 | .270 | 48 Lbs. | NX-722 SJ | 7 | 22 | .050 | .062 | 36 | .295 | 58 Lbs. |
| NX-1222J | 12 | 22 | .050 | .062 | .330 | 72 Lbs. | NX-1222SJ | 12 | 22 | .050 | .062 | 36 | .355 | 87 Lbs. |
| NX-1522J | 15 | 22 | .050 | .062 | .350 | 85 Lbs. | NX-1522SJ | 15 | 22 | .050 | .062 | 36 | .380 | 101 Lbs. |
| NX-1922J | 19 | 22 | .050 | .062 | .370 | 96 Lbs. | NX-1922SJ | 19 | 22 | .050 | .062 | 36 | .395 | 111 Lbs. |
| NX-2722J | 27 | 22 | .050 | .062 | .430 | 130 Lbs. | NX-2722SJ | 27 | 22 | .050 | .062 | 36 | .455 | 150 Lbs. |
| NX-3722J | 37 | 22 | .050 | .062 | .480 | 163 Lbs. | NX-3722SJ | 37 | 22 | .050 | .062 | 34 | .510 | 193 Lbs. |
| NX4822J | 48 | 22 | .050 | .062 | .530 | 210 Lbs. | NX-4822SJ | 48 | 22 | .050 | .062 | 34 | .560 | 245 Lbs. |
| NX-6022J | 60 | 22 | .050 | .062 | .570 | 255 Lbs. | NX-6022SJ | 60 | 22 | .050 | .062 | 34 | .600 | 295 Lbs. |
| NX-520 J | 5 | 20 | .057 | .062 | .275 | 49 Lbs. | NX-520 SJ | 5 | 20 | .057 | .062 | 36 | .300 | 59 Lbs. |
| NX-720 J | 7 | 20 | .057 | .062 | 290 | 59 Lbs. | NX-720 SJ | 7 | 20 | .057 | .062 | 36 | .315 | 69 Lbs. |
| NX-1220J | 12 | 20 | .057 | .062 | .360 | 90 Lbs. | NX-1220SJ | 12 | 20 | .057 | .062 | 36 | .385 | 105 Lbs. |
| NX-1520J | 15 | 20 | .057 | .062 | .390 | 110 Lbs. | NX-1520SJ | 15 | 20 | .057 | .062 | 36 | .415 | 137 Lbs. |
| NX-1920J | 19 | 20 | .057 | .062 | .410 | 128 Lbs. | NX-1920SJ | 19 | 20 | .057 | .062 | 36 | .435 | 158 Lbs. |
| NX-2720J | 27 | 20 | .057 | .062 | .490 | 166 Lbs. | NX-2720SJ | 27 | 20 | .057 | .062 | 36 | .515 | 196 Lbs. |
| NX-3720J | 37 | 20 | .057 | .062 | .520 | 220 Lbs. | NX-3720SJ | 37 | 20 | .057 | .062 | 34 | .550 | 255 Lbs. |
| NX-4820J | 48 | 20 | .057 | .062 | .580 | 275 Lbs. | NX-4820SJ | 48 | 20 | .057 | .062 | 34 | .610 | 320 Lbs. |
| NX-6020J | 60 | 20 | .057 | .062 | .640 | 335 Lbs. | NX-6020SJ | 60 | 20 | .057 | .062 | 34 | .670 | 385 Lbs. |

**NATIONAL WIRE AND CABLE CORPORATION**

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

# Miniature Signal & Control Cables Twisted Pairs (NXP Series)



(NXP1924J shown)

**IN STOCK MIL-SPEC**

**U.L. LISTED COMPUTER GRADE STYLE 2343 & 2344**

For light duty, gray jacketed version of these cables in the U.L. Style 2464, see Pages 4670-4683 NQ Series.

National Wire & Cable Corporation manufactures a complete line of MINIATURE low voltage signal and control cable. Available as cabled pairs or cabled singles, with optional overall shield. Conductors are stranded tinned copper with .010" wall of vinyl primary insulation for use up to 105°C per MIL-W-16878 Type B. Insulated for 600 volts working voltage. (Also meets U.L. AWM Type 1061; 300 volt, 80°C.) All are coded using 10 standard colors plus stripes on white per table below.

All conductors are planetary cabled and contra-helically laid for optimum flexibility, with a Mylar tape barrier under shields. Shielded cables have a tinned copper braid overall, of 85-90% coverage per MIL-C-7078; and braid angles below 40° for easy pushback.

The outer jacket is black abrasion-resistant 105°C. vinyl meeting MIL-I-631 Type F. All materials are self-extinguishing and fungus resistant. All items are U.L. LISTED STYLE 2343 COMPUTER CABLE; rated 80°C. (Higher temp. ratings apply for any non-U.L. service.)

Standard Putups: 500 and 1000 ft. No-deposit reels. For shorter quantities or specific lengths, consult factory.
* Denotes U.L. Style 2344.

## TECHNICAL DATA (all cables)

**Insulation Breakdown Voltage:** Greater than 5000 volts AC RMS, 60 cps.

**Capacitance:** Nominal capacitance from a wire to all else in a cable ranges from 45. to 70. pf/ft. at 1. kc, depending on gauge and position.

**Insulation Leakage:** 200. megohms/1000 ft. min. @ 500. VDC from any conductor to all else in cable.

**Sheath Leakage:** 10. megohms/1000 ft. min. @ 500 VDC from shield or conductor group through sheath to ground.

**Temperature Range:** Suitable for continuous use from −40°C. to +105°C. (U.L. Service limited to +80°C.)

**Bending Characteristics:** All cables are suitable for flexing to a circle diameter of 6. cable diameters from +105°C. to −20°C. Recommended flex diameter should be greater than 20 cable diameters for flexing at −40°C.

**Impedance: (24. AWG pairs)** **Balanced: 87. ohms ±5%** **Unbalanced: 52. ohms ±5%**

## MULTI-CONDUCTOR STOCK CABLED PAIRS

Cond: 22, 24 are 7 strand; 20 AWG is 19 strand

| UNSHIELDED | | | | | | | OVERALL SHIELDED | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PART NO. | NO. PAIRS | COND. AWG | COND. O.D. | JKT. WALL | CABLE O.D. | WEIGHT LB/M′ | PART NO. | NO. PAIRS | COND. AWG | COND. O.D. | JKT. WALL | SHLD. AWG | CABLE O.D. | WEIGHT LB/M′ |
| NXP-524 J | 5 | 24 | .045 | .062 | .330 | 52 Lbs. | NXP-524 SJ | 5 | 24 | .045 | .062 | 36 | .355 | 67 Lbs. |
| NXP-724 J | 7 | 24 | .045 | .062 | .350 | 60 Lbs. | NXP-724 SJ | 7 | 24 | .045 | .062 | 36 | .375 | 75 Lbs. |
| NXP-1224J | 12 | 24 | .045 | .062 | .435 | 90 Lbs. | NXP-1224SJ | 12 | 24 | .045 | .062 | 36 | .460 | 115 Lbs. |
| NXP-1524J | 15 | 24 | .045 | .062 | .485 | 110 Lbs. | NXP-1524SJ | 15 | 24 | .045 | .062 | 36 | .510 | 140 Lbs. |
| NXP-1924J | 19 | 24 | .045 | .062 | .505 | 126 Lbs. | NXP-1924SJ | 19 | 24 | .045 | .062 | 36 | .530 | 161 Lbs. |
| NXP-2724J | 27 | 24 | .045 | .062 | .590 | 167 Lbs. | NXP-2724SJ | 27 | 24 | .045 | .062 | 34 | .620 | 211 Lbs. |
| NXP-3724J | 37 | 24 | .045 | .062 | .660 | 216 Lbs. | NXP-3724SJ | 37 | 24 | .045 | .062 | 34 | .690 | 266 Lbs. |
| NXP-4824J | 48 | 24 | .045 | .062 | .745 | 270 Lbs. | NXP-4824SJ | 48 | 24 | .045 | .062 | 34 | .775 | 330 Lbs. |
| NXP-6024J | 60 | 24 | .045 | .062 | .815 | 325 Lbs. | NXP-6024SJ* | 60 | 24 | .045 | .062 | 34 | .845 | 390 Lbs. |
| NXP-522 J | 5 | 22 | .050 | .062 | .365 | 56 Lbs. | NXP-522 SJ | 5 | 22 | .050 | .062 | 36 | .390 | 77 Lbs. |
| NXP-722 J | 7 | 22 | .050 | .062 | .390 | 82 Lbs. | NXP-722 SJ | 7 | 22 | .050 | .062 | 36 | .415 | 100 Lbs. |
| NXP-1222J | 12 | 22 | .050 | .062 | .470 | 120 Lbs. | NXP-1222SJ | 12 | 22 | .050 | .062 | 36 | .495 | 150 Lbs. |
| NXP-1522J | 15 | 22 | .050 | .062 | .545 | 145 Lbs. | NXP-1522SJ | 15 | 22 | .050 | .062 | 34 | .575 | 185 Lbs. |
| NXP-1922J | 19 | 22 | .050 | .062 | .550 | 170 Lbs. | NXP-1922SJ | 19 | 22 | .050 | .062 | 34 | .580 | 210 Lbs. |
| NXP-2722J | 27 | 22 | .050 | .062 | .640 | 230 Lbs. | NXP-2722SJ | 27 | 22 | .050 | .062 | 34 | .670 | 280 Lbs. |
| NXP-3722J | 37 | 22 | .050 | .062 | .750 | 300 Lbs. | NXP-3722SJ | 37 | 22 | .050 | .062 | 34 | .780 | 357 Lbs. |
| NXP-4822J* | 48 | 22 | .050 | .080 | .850 | 375 Lbs. | NXP-4822SJ* | 48 | 22 | .050 | .080 | 34 | .880 | 445 Lbs. |
| NXP-6022J* | 60 | 22 | .050 | .080 | .930 | 460 Lbs. | NXP-6022SJ* | 60 | 22 | .050 | .080 | 34 | .960 | 535 Lbs. |
| NXP-520 J | 5 | 20 | .057 | .062 | .395 | 82 Lbs. | NXP-520 SJ | 5 | 20 | .057 | .062 | 36 | .420 | 102 Lbs. |
| NXP-720 J | 7 | 20 | .057 | .062 | .440 | 108 Lbs. | NXP-720 SJ | 7 | 20 | .057 | .062 | 36 | .465 | 123 Lbs. |
| NXP-1220J | 12 | 20 | .057 | .062 | .540 | 163 Lbs. | NXP-1220SJ | 12 | 20 | .057 | .062 | 34 | .570 | 203 Lbs. |
| NXP-1520J | 15 | 20 | .057 | .062 | .600 | 196 Lbs. | NXP-1520SJ | 15 | 20 | .057 | .062 | 34 | .630 | 241 Lbs. |
| NXP-1920J | 19 | 20 | .057 | .062 | .630 | 235 Lbs. | NXP-1920SJ | 19 | 20 | .057 | .062 | 34 | .660 | 280 Lbs. |
| NXP-2720J | 27 | 20 | .057 | .062 | .745 | 320 Lbs. | NXP-2720SJ | 27 | 20 | .057 | .062 | 34 | .775 | 380 Lbs. |
| NXP-3720J | 37 | 20 | .057 | .062 | .820 | 420 Lbs. | NXP-3720SJ* | 37 | 20 | .057 | .080 | 34 | .850 | 490 Lbs. |
| NXP-4820J* | 48 | 20 | .057 | .080 | .950 | 530 Lbs. | NXP-4820SJ* | 48 | 20 | .057 | .080 | 34 | .980 | 605 Lbs. |
| NXP-6020J* | 60 | 20 | .057 | .080 | 1.040 | 650 Lbs. | NXP-6020SJ* | 60 | 20 | .057 | .080 | 34 | 1.070 | 735 Lbs. |

## COLOR CODING USED IN TWISTED PAIRS

| PR# | PAIR COLORS | PR# | PAIR COLORS | PR# | PAIR COLORS | PR# | PAIR COLORS | PR# | PAIR COLORS | PR# | PAIR COLORS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | White with Black | 11 | Black with Red | 21 | Brown with Green | 31 | Orange with Yellow | 41 | Green with Violet | 51 | Wht/Blk with Green |
| 2 | White with Brown | 12 | Black with Orange | 22 | Brown with Blue | 32 | Orange with Green | 42 | Green with Gray | 52 | Wht/Blk with Blue |
| 3 | White with Red | 13 | Black with Yellow | 23 | Brown with Violet | 33 | Orange with Blue | 43 | Blue with Violet | 53 | Wht/Blk with Violet |
| 4 | White with Orange | 14 | Black with Green | 24 | Brown with Gray | 34 | Orange with Violet | 44 | Blue with Grey | 54 | Wht/Ik with Gray |
| 5 | White with Yellow | 15 | Black with Blue | 25 | Red with Orange | 35 | Orange with Gray | 45 | Violet with Gray | 55 | Wht/Brn with Black |
| 6 | White with Green | 16 | Black with Violet | 26 | Red with Yellow | 36 | Yellow with Green | 46 | Wht/Blk with Black | 56 | Wht/Brn with Brown |
| 7 | White with Blue | 17 | Black with Gray | 27 | Red with Green | 37 | Yellow with Blue | 47 | Wht/Blk with Brown | 57 | Wht/Brn with Red |
| 8 | White with Violet | 18 | Brown with Red | 28 | Red with Blue | 38 | Yellow with Violet | 48 | Wht/Blk with Red | 58 | Wht/Brn with Orange |
| 9 | White with Gray | 19 | Brown with Orange | 29 | Red with Violet | 39 | Yellow with Gray | 49 | Wht/Blk with Orange | 59 | Wht/Brn with Yellow |
| 10 | Black with Brown | 20 | Brown with Yellow | 30 | Red with Gray | 40 | Green with Blue | 50 | Wht/Blk with Yellow | 60 | Wht/Brn with Green |

# NATIONAL WIRE AND CABLE CORPORATION

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

# Heavy Duty Signal & Control Cables Single Conductors (NW Series)

(NW1918SJ shown)

**IN STOCK**

**MIL-SPEC U.L. LISTED — STYLE 2343 & 2344**

National Wire & Cable Corporation manufactures a complete line of multiple conductor control cable. Conductors are stranded tinned copper with 1/64" wall of vinyl primary insulation for use up to 105°C per MIL-W-16878 Type C.* Insulated for 1000 volts working voltage. Color coded using 10 standard colors plus stripes on white per MIL-STD-681.

All conductors are planetary cabled and contra-helically laid for optimum flexibility, with a Mylar tape serve over cable bundle. Shielded cables have a tinned copper braid overall, of 85-90% coverage per MIL-C-7078, and braid angles below 40° for easy pushback.

The outer jacket is black abrasion-resistant 105°C vinyl meeting MIL-I-631 Class F. All materials are self-extinguishing and fungus resistant. All cables are U. L. LISTED STYLE 2343; rated 80°C. (Higher temp. ratings apply to any non-U.L. service.) Specify polyurethane sheath for extreme rough usage or low-temp. service.

Standard Putups: 100, 500 and 1000 ft. No-deposit reels. For shorter quantities or specific lengths, consult factory.

* Insulated wires also meet U.L. style 1007 and CSA type TR-64.
† Denotes U.L. Style 2344.

## TECHNICAL DATA (all cables)

**Insulation Breakdown Voltage:** Greater than 8000 volts AC RMS, 60 cps.

**U.L. Voltage Rating:** 300 volts RMS AC (appliance use). 600 volts RMS AC (electronic use).

**Military Voltage Rating:** 1000 volts RMS.

**Capacitance:** Nominal capacitance from a wire to all else in the cable ranges from 40 to 65 mmfd per ft., @ 1000 cps; dependent on gauge and position.

**Insulation Leakage Res.:** 200. megohms/1000 ft. min. at 500 VDC from any conductor to all else in cable.

**Sheath Leakage Res.:** 10. megohms/1000 ft. min. at 500 VDC from overall shield through sheath to outside world.

**Usable Temp. Range:** Suitable for continuous use from +105°C to −55°C.

**Cold Bending Capability:** All cables are suitable for flexing to a circle diam. of approx. 6 cable diameters from +105°C to −20°C; Recommended flex diameter should be greater than 20 cable diam. for flexing at −40°C. For continuous flexing applications consult factory.

Conductor sizes 22, 20, 18, 16, 14 & 12 gauge. 22 AWG is 7 strand. All others 19 strand.

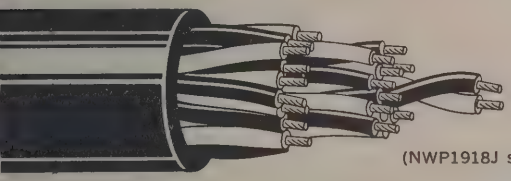
| UNSHIELDED | | | | | | OVERALL SHIELDED | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PART NO. | NO. COND. | COND. AWG | JKT. THICK | CABLE O.D. | WEIGHT PER M' | PART NO. | NO. COND | COND AWG | T.C. SHIELD | JKT. THICK | CABLE O.D. | WEIGHT PER M' |
| NW-722 J | 7 | 22 | .060 | .315 | 40 Lbs. | NW-722 SJ | 7 | 22 | No. 36 | .060 | .340 | 55 Lbs. |
| NW-1222J | 12 | 22 | .060 | .385 | 70 Lbs. | NW-1222SJ | 12 | 22 | No. 34 | .060 | .410 | 90 Lbs. |
| NW-1922J | 19 | 22 | .060 | .440 | 110 Lbs. | NW-1922SJ | 19 | 22 | No. 34 | .060 | .465 | 145 Lbs. |
| NW-2722J | 27 | 22 | .060 | .510 | 160 Lbs. | NW-2722SJ | 27 | 22 | No. 34 | .060 | .535 | 200 Lbs. |
| NW-3722J | 37 | 22 | .060 | .565 | 200 Lbs. | NW-3722SJ | 37 | 22 | No. 34 | .060 | .590 | 245 Lbs. |
| NW-4822J | 48 | 22 | .060 | .635 | 245 Lbs. | NW-4822SJ | 48 | 22 | No. 34 | .060 | .660 | 300 Lbs. |
| NW-6022J | 60 | 22 | .060 | .695 | 300 Lbs. | NW-6022SJ | 60 | 22 | No. 34 | .060 | .720 | 355 Lbs. |
| NW-7222J | 72 | 22 | .060 | .755 | 360 Lbs. | NW-7222SJ | 72 | 22 | No. 34 | .060 | .780 | 425 Lbs. |
| NW-8822J | 88 | 22 | .060 | .820 | 425 Lbs. | NW-8822SJ | 88 | 22 | No. 34 | .080 | .895† | 500 Lbs. |
| NW-10222J | 102 | 22 | .080 | .920† | 485 Lbs. | NW-10222SJ | 102 | 22 | No. 34 | .080 | .945† | 560 Lbs. |
| NW-720 J | 7 | 20 | .060 | .340 | 50 Lbs. | NW-720 SJ | 7 | 20 | No. 34 | .060 | .365 | 68 Lbs. |
| NW-1220J | 12 | 20 | .060 | .420 | 105 Lbs. | NW-1220SJ | 12 | 20 | No. 34 | .060 | .445 | 125 Lbs. |
| NW-1920J | 19 | 20 | .060 | .485 | 160 Lbs. | NW-1920SJ | 19 | 20 | No. 34 | .060 | .510 | 195 Lbs. |
| NW-2720J | 27 | 20 | .060 | .565 | 210 Lbs. | NW-2720SJ | 27 | 20 | No. 34 | .060 | .590 | 250 Lbs. |
| NW-3720J | 37 | 20 | .060 | .630 | 280 Lbs. | NW-3720SJ | 37 | 20 | No. 34 | .060 | .655 | 325 Lbs. |
| NW-4820J | 48 | 20 | .060 | .710 | 360 Lbs. | NW-4820SJ | 48 | 20 | No. 34 | .060 | .735 | 415 Lbs. |
| NW-6020J | 60 | 20 | .060 | .775 | 435 Lbs. | NW-6020SJ | 60 | 20 | No. 34 | .060 | .800 | 500 Lbs. |
| NW-7220J | 72 | 20 | .080 | .885† | 485 Lbs. | NW-7220SJ | 72 | 20 | No. 34 | .080 | .910† | 555 Lbs. |
| NW-8820J | 88 | 20 | .080 | .960† | 580 Lbs. | NW-8820SJ | 88 | 20 | No. 34 | .080 | 1.035† | 660 Lbs. |
| NW-10220J | 102 | 20 | .080 | 1.030† | 670 Lbs. | NW-10220SJ | 102 | 20 | No. 34 | .080 | 1.055† | 750 Lbs. |
| NW-718 J | 7 | 18 | .060 | .370 | 75 Lbs. | NW-718 SJ | 7 | 18 | No. 34 | .060 | .395 | 95 Lbs. |
| NW-1218J | 12 | 18 | .060 | .460 | 135 Lbs. | NW-1218SJ | 12 | 18 | No. 34 | .060 | .485 | 170 Lbs. |
| NW-1918J | 19 | 18 | .060 | .535 | 225 Lbs. | NW-1918SJ | 19 | 18 | No. 34 | .060 | .560 | 265 Lbs. |
| NW-2718J | 27 | 18 | .060 | .625 | 300 Lbs. | NW-2718SJ | 27 | 18 | No. 34 | .060 | .650 | 350 Lbs. |
| NW-3718J | 37 | 18 | .060 | .700 | 390 Lbs. | NW-3718SJ | 37 | 18 | No. 34 | .060 | .725 | 445 Lbs. |
| NW-4818J | 48 | 18 | .060 | .790 | 510 Lbs. | NW-4818SJ | 48 | 18 | No. 34 | .060 | .815 | 575 Lbs. |
| NW-6018J | 60 | 18 | .080 | .905† | 600 Lbs. | NW-6018SJ | 60 | 18 | No. 34 | .080 | .930† | 680 Lbs. |
| NW-7218J | 72 | 18 | .080 | .985† | 720 Lbs. | NW-7218SJ | 72 | 18 | No. 34 | .080 | 1.010† | 820 Lbs. |
| NW-716 J | 7 | 16 | .060 | .395 | 95 Lbs. | NW-716 SJ | 7 | 16 | No. 34 | .060 | .420 | 125 Lbs. |
| NW-1216J | 12 | 16 | .060 | .495 | 155 Lbs. | NW-1216SJ | 12 | 16 | No. 34 | .060 | .520 | 195 Lbs. |
| NW-1916J | 19 | 16 | .060 | .575 | 230 Lbs. | NW-1916SJ | 19 | 16 | No. 34 | .060 | .600 | 275 Lbs. |
| NW-2716J | 27 | 16 | .060 | .615 | 320 Lbs. | NW-2716SJ | 27 | 16 | No. 34 | .060 | .640 | 375 Lbs. |
| NW-3716J | 37 | 16 | .060 | .755 | 430 Lbs. | NW-3716SJ | 37 | 16 | No. 34 | .060 | .780 | 500 Lbs. |
| NW-4816J | 48 | 16 | .080 | .895† | 625 Lbs. | NW-4816SJ | 48 | 16 | No. 34 | .080 | .920† | 700 Lbs. |
| NW-6016J | 60 | 16 | .080 | .975† | 750 Lbs. | NW-6016SJ | 60 | 16 | No. 34 | .080 | 1.000† | 830 Lbs. |
| NW-714 J ** | 7 | 14 | .060 | .435 | 150 Lbs. | NW-714 SJ | 7 | 14 | No. 34 | .060 | .465 | 180 Lbs. |
| NW-1214J ** | 12 | 14 | .060 | .555 | 240 Lbs. | NW-1214SJ | 12 | 14 | No. 34 | .060 | .580 | 280 Lbs. |
| NW-1914J ** | 19 | 14 | .060 | .645 | 370 Lbs. | NW-1914SJ | 19 | 14 | No. 34 | .060 | .670 | 420 Lbs. |
| NW-2714J ** | 27 | 14 | .060 | .760 | 515 Lbs. | NW-2714SJ | 27 | 14 | No. 34 | .060 | .785 | 575 Lbs. |
| NW-512 J ** | 5 | 12 | .060 | .460 | 175 Lbs. | NW-512 SJ | 5 | 12 | No. 34 | .060 | .485 | 210 Lbs. |
| NW-712 J ** | 7 | 12 | .060 | .500 | 225 Lbs. | NW-712 SJ | 7 | 12 | No. 34 | .060 | .525 | 265 Lbs. |
| NW-1212J ** | 12 | 12 | .060 | .680 | 375 Lbs. | NW-1212SJ | 12 | 12 | No. 34 | .060 | .705 | 430 Lbs. |
| NW-1912J ** | 19 | 12 | .060 | .745 | 560 Lbs. | NW-1912SJ | 19 | 12 | No. 34 | .060 | .770 | 625 Lbs. |

**Not listed under UL styles 2343 or 2344 in these gauges.

**NATIONAL WIRE**
**AND CABLE CORPORATION**

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

# Heavy Duty Signal & Control Cables Twisted Pairs (NWP Series)



(NWP1918J shown)

**IN STOCK MIL-SPEC**
**U.L. LISTED**

**Identical to National's NW-Series Cables except offered as twisted pairs.**

National Wire & Cable Corporation manufactures a complete line of multiple pair control cables. Conductors are of tinned copper strand with 1/64" vinyl primary insulation for use up to 105°C per MIL-W-16878D Type C. Insulated for **1000** volts working voltage. Conductors are color coded using 10 standard basic colors, plus spiral tracers on white per table below.

All pairs are planetary cabled and contra-helically laid with a Mylar tape serve over the cable bundle. The overall jacket is a 105°C black vinyl plastic per MIL-I-631; or may be Neoprene to MIL-R-6855 Class 2 Grade 60 specification. (Neoprene at added cost).

## SHIELDED CABLES

National Multiple Conductor SHIELDED CABLES are to the same specifications as above with addition of tinned copper braided shield over cable complex with 85-90% coverage to MIL-C-7078A.

## TECHNICAL DATA (all cables)

**Insulation Breakdown Voltage:** Greater than 8,000 volts AC RMS, 60 cps.

**Capacitance:** Nominal capacitance wire to wire for a pair ranges from 27. to 40. mmfd/ft. Capacitance from both wires tied together measured to all else in common ranges from 35. to 60. mmfd/ft. dependent on gauge and position. Overall shield has negligible effect on W-W capacitance.

**Insulation Leakage Res.:** 200. megohms / 1000 ft. min. at 500 VDC from any conductor to all else in cable.

**Sheath Leakage Res.:** 10. megohms / 1000 ft. min. at 500 VDC from overall shield through sheath to outside world.

**Usable Temp. Range:** Suitable for continuous use from +105°C to −55°C.

**Cold Bending Capability:** All cables are suitable for flexing to a circle diam. of approx. 6 cable diameters from +105°C to −20°C; Recommended flex diameter should be greater than 20 cable diam. for flexing at −40°C. For continuous flexing applications consult factory.

| UNSHIELDED OVERALL | | | | | | OVERALL SHIELDED | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PART NO. | NO. OF PAIRS | COND. GA. | JKT. THICK | O.D. | WEIGHT | PART NO. | NO. OF PAIRS | COND. GA. | JKT. THICK | O.D. | WEIGHT |
| NWP-722 J | 7 | 22 | .045 | .470 | 90 Lbs. | NWP-722 SJ | 7 | 22 | .045 | .495 | 135 Lbs. |
| NWP-1222J | 12 | 22 | .050 | .600 | 150 Lbs. | NWP-1222SJ | 12 | 22 | .050 | .630 | 206 Lbs. |
| NWP-1922J | 19 | 22 | .050 | .700 | 200 Lbs. | NWP-1922SJ | 19 | 22 | .050 | .730 | 260 Lbs. |
| NWP-2722J | 27 | 22 | .055 | .830 | 280 Lbs. | NWP-2722SJ | 27 | 22 | .055 | .860 | 358 Lbs. |
| NWP-3722J | 37 | 22 | .060 | .960 | 370 Lbs. | NWP-3722SJ | 37 | 22 | .060 | .990 | 460 Lbs. |
| NWP-4822J | 48 | 22 | .060 | 1.080 | 470 Lbs. | NWP-4822SJ | 48 | 22 | .060 | 1.110 | 570 Lbs. |
| NWP-6022J | 60 | 22 | .060 | 1.200 | 560 Lbs. | NWP-6022SJ | 60 | 22 | .060 | 1.230 | 675 Lbs. |
| NWP-720 J | 7 | 20 | .050 | .520 | 120 Lbs. | NWP-720 SJ | 7 | 20 | .050 | .550 | 170 Lbs. |
| NWP-1220J | 12 | 20 | .050 | .660 | 200 Lbs. | NWP-1220SJ | 12 | 20 | .050 | .690 | 260 Lbs. |
| NWP-1920J | 19 | 20 | .050 | .800 | 290 Lbs. | NWP-1920SJ | 19 | 20 | .050 | .830 | 355 Lbs. |
| NWP-2720J | 27 | 20 | .060 | .960 | 420 Lbs. | NWP-2720SJ | 27 | 20 | .060 | .990 | 510 Lbs. |
| NWP-3720J | 37 | 20 | .060 | 1.100 | 500 Lbs. | NWP-3720SJ | 37 | 20 | .060 | 1.130 | 603 Lbs. |
| NWP-4820J | 48 | 20 | .060 | 1.240 | 620 Lbs. | NWP-4820SJ | 48 | 20 | .060 | 1.270 | 735 Lbs. |
| NWP-6020J | 60 | 20 | .060 | 1.380 | 750 Lbs. | NWP-6020SJ | 60 | 20 | .060 | 1.410 | 880 Lbs. |
| NWP-718 J | 7 | 18 | .050 | .580 | 150 Lbs. | NWP-718 SJ | 7 | 18 | .050 | .610 | 205 Lbs. |
| NWP-1218J | 12 | 18 | .050 | .740 | 290 Lbs. | NWP-1218SJ | 12 | 18 | .050 | .770 | 360 Lbs. |
| NWP-1918J | 19 | 18 | .060 | .920 | 400 Lbs. | NWP-1918SJ | 19 | 18 | .060 | .950 | 487 Lbs. |
| NWP-2718J | 27 | 18 | .060 | 1.080 | 560 Lbs. | NWP-2718SJ | 27 | 18 | .060 | 1.110 | 660 Lbs. |
| NWP-3718J | 37 | 18 | .060 | 1.240 | 750 Lbs. | NWP-3718SJ | 37 | 18 | .060 | 1.270 | 865 Lbs. |
| NWP-4818J | 48 | 18 | .060 | 1.400 | 900 Lbs | NWP-4818SJ | 48 | 18 | .060 | 1.430 | 1030 Lbs. |
| NWP-716 J | 7 | 16 | .050 | .640 | 180 Lbs. | NWP-716 SJ | 7 | 16 | .050 | .670 | 240 Lbs. |
| NWP-1216J | 12 | 16 | .060 | .840 | 300 Lbs. | NWP-1216SJ | 12 | 16 | .060 | .870 | 377 Lbs. |
| NWP-1916J | 19 | 16 | .060 | 1.020 | 430 Lbs. | NWP-1916SJ | 19 | 16 | .060 | 1.050 | 520 Lbs. |
| NWP-2716J | 27 | 16 | .060 | 1.200 | 720 Lbs. | NWP-2716SJ | 27 | 16 | .060 | 1.230 | 830 Lbs. |
| NWP-3716J | 37 | 16 | .060 | 1.380 | 1000 Lbs. | NWP-3716SJ | 37 | 16 | 060 | 1.410 | 1330 Lbs. |

## COLOR CODING USED ON TWISTED PAIRS

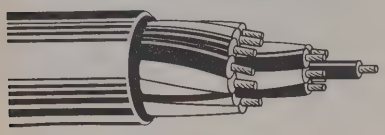
| PR # | PAIR COLORS | PR # | PAIR COLORS | PR # | PAIR COLORS | PR # | PAIR COLORS | PR # | PAIR COLORS | PR # | PAIR COLORS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | WHITE WITH BLACK | 11. | BLACK WITH RED | 21. | BROWN WITH GREEN | 31. | ORANGE WITH YELLOW | 41. | GREEN WITH VIOLET | 51. | WHT/BLK WITH GREEN |
| 2. | WHITE WITH BROWN | 12. | BLACK WITH ORANGE | 22. | BROWN WITH BLUE | 32. | ORANGE WITH GREEN | 42. | GREEN WITH GRAY | 52. | WHT/BLK WITH BLUE |
| 3. | WHITE WITH RED | 13. | BLACK WITH YELLOW | 23. | BROWN WITH VIOLET | 33. | ORANGE WITH BLUE | 43. | BLUE WITH VIOLET | 53. | WHT/BLK WITH VIOLET |
| 4. | WHITE WITH ORANGE | 14. | BLACK WITH GREEN | 24. | BROWN WITH GRAY | 34. | ORANGE WITH VIOLET | 44. | BLUE WITH GREY | 54. | WHT/BLK WITH GRAY |
| 5. | WHITE WITH YELLOW | 15. | BLACK WITH BLUE | 25. | RED WITH ORANGE | 35. | ORANGE WITH GRAY | 45. | VIOLET WITH GRAY | 55. | WHT/BRN WITH BLACK |
| 6. | WHITE WITH GREEN | 16. | BLACK WITH VIOLET | 26. | RED WITH YELLOW | 36. | YELLOW WITH GREEN | 46. | WHT/BLK WITH BLACK | 56. | WHT/BRN WITH BROWN |
| 7. | WHITE WITH BLUE | 17. | BLACK WITH GRAY | 27. | RED WITH GREEN | 37. | YELLOW WITH BLUE | 47. | WHT/BLK WITH BROWN | 57. | WHT/BRN WITH RED |
| 8. | WHITE WITH VIOLET | 18. | BROWN WITH RED | 28. | RED WITH BLUE | 38. | YELLOW WITH VIOLET | 48. | WHT/BLK WITH RED | 58. | WHT/BRN WITH ORANGE |
| 9. | WHITE WITH GRAY | 19. | BROWN WITH ORANGE | 29. | RED WITH VIOLET | 39. | YELLOW WITH GRAY | 49. | WHT/BLK WITH ORANGE | 59. | WHT/BRN WITH YELLOW |
| 10. | BLACK WITH BROWN | 20. | BROWN WITH YELLOW | 30. | RED WITH GRAY | 40. | GREEN WITH BLUE | 50. | WHT/BLK WITH YELLOW | 60. | WHT/BRN WITH GREEN |

**NATIONAL WIRE**
**AND CABLE CORPORATION**

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

# Miniature Signal & Control Cables Single Conductors (NQ Series)

## *EXTRA FLEXIBLE — GRAY PVC JACKET*



(NQ1928J shown)

GRAY PVC JACKET

National Wire & Cable Corporation manufactures a complete line of highly flexible micro-miniature low-voltage instrument control cable. These are available as cabled pairs or singles, with optional overall shield of either foil with drain or a braided shield. Stocked with braided shields.

Conductors are stranded tinned copper with .010" wall of tough extruded polyvinyl chloride primary insulation, rated for 300 volt use at +80°C under U. L. listed style 1061.* All are color coded using ten standard colors plus white with stripes per MIL-STD-681. Coded pairs use the same sequence as type NXP and NWP.

Conductors are planetary cabled and helically laid for optimum flexibility, with a barrier under braids. Shielded cables have a tinned copper braid of 90% coverage per MIL-C-7078, with braid angles below 40° for easy pushback; or have a 100% coverage foil shield in intimate contact with a drain wire for easy termination. See Section 3 of our master catalog for relative shield effectiveness.

Outer jacket is highly flexible abrasion-resistant gray polyvinyl chloride thermoplastic, meeting the requirements of U.L. listed style 2464.** C.S.A. listing on request.

All materials are flame retardant and fungus resistant.

Standard Putups: 500 and 1000 ft. No-deposit reels. For shorter quantities or specific lengths, consult factory.

* Wire also meets MIL-W-16878 type B, rated 600 volts, +105°C.

** Jacket material is military rated for +105°C; meets MIL-I-631, Class F.

## MIL-SPEC & U.L. LISTED — STYLE 2464

**TECHNICAL DATA (all cables)**

| | |
|---|---|
| **Insulation breakdown voltage:** | Greater than 3000 volts AC RMS, 60cps. |
| **Capacitance:** | Nominal capacitance from a wire to all else in a cable ranges from 25 to 45 pf/ft at 1kc, depending on gauge and position. |
| **Insulation Leakage:** | 200 megohms/1000 feet minimum @ 500VDC from conductor to all else in cable. |
| **Sheath Leakage:** | 10 megohms/1000 feet minimum @ 500VDC from shield or conductor group through sheath to ground. |
| **Temperature Range:** | U.L. rating: +80°C per U.L. style 2464. Military: Continuous use from −40°C to +105°C. |
| **Bending Characteristics:** | All cables are suitable for flexing to a circle diameter of 6 cable diameters from +105°C to −20°C. Recommended flex diameter should be greater than 20 cable diameters for flexing at −40°. For continuous flexing applications consult the factory. |
| **Foil Shielded Cables:** | The nominal overall diameter of foil shielded cables will be .006" greater than the non-shielded cables of the same conductor count and wire size. |
| **Characteristic Impedance: (NQP Paired Cables)** | Ranges from 150 ohms to 45 ohms, dependent on wire size (AWG), geometry and drive method. Consult our technical staff for data on specific cable types. |

## MULTI-CONDUCTOR STOCK CABLED SINGLES

Conductor sizes 28, 26, 24, 22 are 7 strand. All others 19 strand.

### UNSHIELDED CABLES

| Part No. | No. Cond. | Cond. AWG | Cond. Diam. | Jkt. Wall | Nom. O/A Diam. | Wght. LB/M' |
|---|---|---|---|---|---|---|
| NQ-228 J | 2 | 28 | .034 | .031 | .135 | 8 |
| NQ-328 J | 3 | 28 | .034 | .031 | .142 | 9 |
| NQ-428 J | 4 | 28 | .034 | .031 | .150 | 11 |
| NQ-528 J | 5 | 28 | .034 | .031 | .161 | 12 |
| NQ-628 J | 6 | 28 | .034 | .031 | .171 | 13 |
| NQ-728 J | 7 | 28 | .034 | .031 | .171 | 14 |
| NQ-828 J | 8 | 28 | .034 | .031 | .196 | 19 |
| NQ-928 J | 9 | 28 | .034 | .031 | .206 | 22 |
| NQ-1028 J | 10 | 28 | .034 | .031 | .206 | 23 |
| NQ-1228 J | 12 | 28 | .034 | .031 | .212 | 25 |
| NQ-1528 J | 15 | 28 | .034 | .031 | .231 | 28 |
| NQ-1928 J | 19 | 28 | .034 | .031 | .241 | 33 |
| NQ-2728 J | 27 | 28 | .034 | .031 | .282 | 42 |
| NQ-3728 J | 37 | 28 | .034 | .031 | .311 | 55 |
| NQ-226 J | 2 | 26 | .038 | .031 | .144 | 9 |
| NQ-326 J | 3 | 26 | .038 | .031 | .150 | 11 |
| NQ-426 J | 4 | 26 | .038 | .031 | .160 | 13 |
| NQ-526 J | 5 | 26 | .038 | .031 | .171 | 15 |
| NQ-626 J | 6 | 26 | .038 | .031 | .183 | 17 |
| NQ-726 J | 7 | 26 | .038 | .031 | .183 | 18 |
| NQ-826 J | 8 | 26 | .038 | .031 | .210 | 23 |
| NQ-926 J | 9 | 26 | .038 | .031 | .222 | 25 |
| NQ-1026 J | 10 | 26 | .038 | .031 | .222 | 26 |
| NQ-1226 J | 12 | 26 | .038 | .031 | .228 | 30 |
| NQ-1526 J | 15 | 26 | .038 | .031 | .249 | 35 |
| NQ-1926 J | 19 | 26 | .038 | .031 | .261 | 42 |
| NQ-2726 J | 27 | 26 | .038 | .031 | .306 | 55 |
| NQ-3726 J | 37 | 26 | .038 | .031 | .339 | 70 |
| NQ-4826 J | 48 | 26 | .038 | .031 | .384 | 92 |

### OVERALL SHIELDED CABLES

| Part No. | No. Cond. | Cond. AWG | Cond. Diam. | Jkt. Wall | Nom. O/A Diam. | Wght. LB/M' |
|---|---|---|---|---|---|---|
| NQ-228 SJ | 2 | 28 | .034 | .031 | .159 | 16 |
| NQ-328 SJ | 3 | 28 | .034 | .031 | .165 | 17 |
| NQ-428 SJ | 4 | 28 | .034 | .031 | .173 | 20 |
| NQ-528 SJ | 5 | 28 | .034 | .031 | .184 | 21 |
| NQ-628 SJ | 6 | 28 | .034 | .031 | .194 | 23 |
| NQ-728 SJ | 7 | 28 | .034 | .031 | .194 | 24 |
| NQ-828 SJ | 8 | 28 | .034 | .031 | .219 | 31 |
| NQ-928 SJ | 9 | 28 | .034 | .031 | .229 | 35 |
| NQ-1028SJ | 10 | 28 | .034 | .031 | .229 | 36 |
| NQ-1228SJ | 12 | 28 | .034 | .031 | .235 | 38 |
| NQ-1528SJ | 15 | 28 | .034 | .031 | .254 | 42 |
| NQ-1928SJ | 19 | 28 | .034 | .031 | .264 | 48 |
| NQ-2728SJ | 27 | 28 | .034 | .031 | .305 | 60 |
| NQ-3728SJ | 37 | 28 | .034 | .031 | .333 | 75 |
| NQ-226 SJ | 2 | 26 | .038 | .031 | .167 | 17 |
| NQ-326 SJ | 3 | 26 | .038 | .031 | .173 | 20 |
| NQ-426 SJ | 4 | 26 | .038 | .031 | .183 | 22 |
| NQ-526 SJ | 5 | 26 | .038 | .031 | .194 | 25 |
| NQ-626 SJ | 6 | 26 | .038 | .031 | .205 | 28 |
| NQ-726 SJ | 7 | 26 | .038 | .031 | .205 | 29 |
| NQ-826 SJ | 8 | 26 | .038 | .031 | .233 | 36 |
| NQ-926 SJ | 9 | 26 | .038 | .031 | .245 | 39 |
| NO-1026SJ | 10 | 26 | .038 | .031 | .245 | 40 |
| NQ-1226SJ | 12 | 26 | .038 | .031 | .251 | 44 |
| NQ-1526SJ | 15 | 26 | .038 | .031 | .272 | 51 |
| NQ-1926SJ | 19 | 26 | .038 | .031 | .284 | 58 |
| NQ-2726SJ | 27 | 26 | .038 | .031 | .329 | 75 |
| NQ-3726SJ | 37 | 26 | .038 | .031 | .362 | 92 |
| NQ-4826SJ | 48 | 26 | .038 | .031 | .407 | 117 |

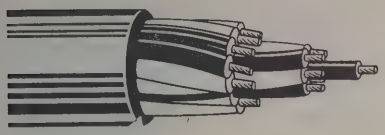
(continued on following page)

**NATIONAL WIRE**
**AND CABLE CORPORATION**

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

# Miniature Signal & Control Cables Single Conductors (NQ Series)

## *EXTRA FLEXIBLE — GRAY PVC JACKET*



(NQ1928J shown)

**MIL-SPEC & U.L. LISTED** **STYLE 2464**

## MULTI-CONDUCTOR STOCK CABLED SINGLES continued from previous page.

### UNSHIELDED CABLES

| Part No. | No. Cond. | Cond. AWG | Cond. Diam. | Jkt. Wall | Nom. O/A Diam. | Wght. LB/M' |
|---|---|---|---|---|---|---|
| NQ-224 J | 2 | 24 | .043 | .031 | .154 | 11 |
| NQ-324 J | 3 | 24 | .043 | .031 | .161 | 13 |
| NQ-424 J | 4 | 24 | .043 | .031 | .172 | 15 |
| NQ-524 J | 5 | 24 | .043 | .031 | .185 | 18 |
| NQ-624 J | 6 | 24 | .043 | .031 | .198 | 21 |
| NQ-724 J | 7 | 24 | .043 | .031 | .198 | 23 |
| NQ-824 J | 8 | 24 | .043 | .031 | .229 | 27 |
| NQ-924 J | 9 | 24 | .043 | .031 | .242 | 30 |
| NQ-1024 J | 10 | 24 | .043 | .031 | .242 | 32 |
| NQ-1224 J | 12 | 24 | .043 | .031 | .249 | 37 |
| NQ-1524 J | 15 | 24 | .043 | .031 | .273 | 44 |
| NQ-1924 J | 19 | 24 | .043 | .031 | .286 | 53 |
| NQ-2724 J | 27 | 24 | .043 | .031 | .337 | 70 |
| NQ-3724 J | 37 | 24 | .043 | .031 | .374 | 93 |
| NQ-4824 J | 48 | 24 | .043 | .031 | .425 | 120 |
| NQ-6024 J | 60 | 24 | .043 | .031 | .462 | 145 |
| NQ-222 J | 2 | 22 | .050 | .031 | .166 | 13 |
| NQ-322 J | 3 | 22 | .050 | .031 | .174 | 17 |
| NQ-422 J | 4 | 22 | .050 | .031 | .186 | 20 |
| NQ-522 J | 5 | 22 | .050 | .031 | .201 | 25 |
| NQ-622 J | 6 | 22 | .050 | .031 | .216 | 28 |
| NQ-722 J | 7 | 22 | .050 | .031 | .216 | 31 |
| NQ-822 J | 8 | 22 | .050 | .031 | .251 | 36 |
| NQ-922 J | 9 | 22 | .050 | .031 | .266 | 40 |
| NQ-1022 J | 10 | 22 | .050 | .031 | .266 | 43 |
| NQ-1222 J | 12 | 22 | .050 | .031 | .274 | 50 |
| NQ-1522 J | 15 | 22 | .050 | .031 | .301 | 60 |
| NQ-1922 J | 19 | 22 | .050 | .031 | .316 | 73 |
| NQ-2722 J | 27 | 22 | .050 | .031 | .374 | 100 |
| NQ-3722 J | 37 | 22 | .050 | .031 | .416 | 142 |
| NQ-4822 J | 48 | 22 | .050 | .031 | .474 | 169 |
| NQ-6022 J | 60 | 22 | .050 | .031 | .590 | 210 |
| NQ-220 J | 2 | 20 | .057 | .031 | .182 | 17 |
| NQ-320 J | 3 | 20 | .057 | .031 | .191 | 23 |
| NQ-420 J | 4 | 20 | .057 | .031 | .205 | 28 |
| NQ-520 J | 5 | 20 | .057 | .031 | .223 | 33 |
| NQ-620 J | 6 | 20 | .057 | .031 | .240 | 39 |
| NQ-720 J | 7 | 20 | .057 | .031 | .240 | 43 |
| NQ-820 J | 8 | 20 | .057 | .031 | .281 | 51 |
| NQ-920 J | 9 | 20 | .057 | .031 | .298 | 55 |
| NQ-1020 J | 10 | 20 | .057 | .031 | .298 | 60 |
| NQ-1220 J | 12 | 20 | .057 | .031 | .307 | 70 |
| NQ-1520 J | 15 | 20 | .057 | .031 | .339 | 85 |
| NQ-1920 J | 19 | 20 | .057 | .031 | .356 | 103 |
| NQ-2720 J | 27 | 20 | .057 | .031 | .423 | 143 |
| NQ-3720 J | 37 | 20 | .057 | .031 | .472 | 190 |
| NQ-218 J | 2 | 18 | .068 | .031 | .202 | 23 |
| NQ-318 J | 3 | 18 | .068 | .031 | .213 | 29 |
| NQ-418 J | 4 | 18 | .068 | .031 | .229 | 37 |
| NQ-518 J | 5 | 18 | .068 | .031 | .250 | 44 |
| NQ-618 J | 6 | 18 | .068 | .031 | .270 | 52 |
| NQ-718 J | 7 | 18 | .068 | .031 | .270 | 59 |
| NQ-818 J | 8 | 18 | .068 | .031 | .318 | 68 |
| NQ-918 J | 9 | 18 | .068 | .031 | .338 | 75 |
| NQ-1018 J | 10 | 18 | .068 | .031 | .338 | 82 |
| NQ-1218 J | 12 | 18 | .068 | .031 | .349 | 96 |
| NQ-1518 J | 15 | 18 | .068 | .031 | .386 | 117 |
| NQ-1918 J | 19 | 18 | .068 | .031 | .406 | 144 |
| NQ-2718 J | 27 | 18 | .068 | .031 | .484 | 206 |

### OVERALL SHIELDED CABLES

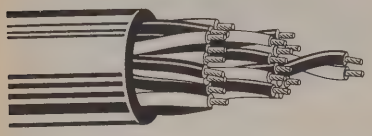
| Part No. | No. Cond. | Cond. AWG | Cond. Diam. | Jkt. Wall | Nom. O/A Diam. | Wght. LB/M' |
|---|---|---|---|---|---|---|
| NQ-224 SJ | 2 | 24 | .043 | .031 | .177 | 20 |
| NQ-324 SJ | 3 | 24 | .043 | .031 | .184 | 22 |
| NQ-424 SJ | 4 | 24 | .043 | .031 | .195 | 25 |
| NQ-524 SJ | 5 | 24 | .043 | .031 | .208 | 29 |
| NQ-624 SJ | 6 | 24 | .043 | .031 | .221 | 33 |
| NQ-724 SJ | 7 | 24 | .043 | .031 | .221 | 35 |
| NQ-824 SJ | 8 | 24 | .043 | .031 | .252 | 41 |
| NQ-924 SJ | 9 | 24 | .043 | .031 | .265 | 45 |
| NQ-1024SJ | 10 | 24 | .043 | .031 | .265 | 47 |
| NQ-1224SJ | 12 | 24 | .043 | .031 | .272 | 53 |
| NQ-1524SJ | 15 | 24 | .043 | .031 | .296 | 61 |
| NQ-1924SJ | 19 | 24 | .043 | .031 | .309 | 71 |
| NQ-2724SJ | 27 | 24 | .043 | .031 | .360 | 92 |
| NQ-3724SJ | 37 | 24 | .043 | .031 | .397 | 118 |
| NQ-4824SJ | 48 | 24 | .043 | .031 | .453 | 148 |
| NQ-6024SJ | 60 | 24 | .043 | .031 | .490 | 176 |
| NQ-222 SJ | 2 | 22 | .050 | .031 | .189 | 23 |
| NQ-322 SJ | 3 | 22 | .050 | .031 | .197 | 27 |
| NQ-422 SJ | 4 | 22 | .050 | .031 | .209 | 31 |
| NQ-522 SJ | 5 | 22 | .050 | .031 | .224 | 37 |
| NQ-622 SJ | 6 | 22 | .050 | .031 | .239 | 41 |
| NQ-722 SJ | 7 | 22 | .050 | .031 | .239 | 44 |
| NQ-822 SJ | 8 | 22 | .050 | .031 | .274 | 52 |
| NQ-922 SJ | 9 | 22 | .050 | .031 | .289 | 57 |
| NQ-1022SJ | 10 | 22 | .050 | .031 | .289 | 60 |
| NQ-1222SJ | 12 | 22 | .050 | .031 | .297 | 67 |
| NQ-1522SJ | 15 | 22 | .050 | .031 | .324 | 79 |
| NQ-1922SJ | 19 | 22 | .050 | .031 | .339 | 93 |
| NQ-2722SJ | 27 | 22 | .050 | .031 | .397 | 125 |
| NQ-3722SJ | 37 | 22 | .050 | .031 | .434 | 169 |
| NQ-4822SJ | 48 | 22 | .050 | .031 | .502 | 201 |
| NQ-6022SJ | 60 | 22 | .050 | .031 | .618 | 245 |
| NQ-220 SJ | 2 | 20 | .057 | .031 | .205 | 28 |
| NQ-320 SJ | 3 | 20 | .057 | .031 | .214 | 35 |
| NQ-420 SJ | 4 | 20 | .057 | .031 | .228 | 41 |
| NQ-520 SJ | 5 | 20 | .057 | .031 | .246 | 47 |
| NQ-620 SJ | 6 | 20 | .057 | .031 | .263 | 54 |
| NQ-720 SJ | 7 | 20 | .057 | .031 | .263 | 58 |
| NQ-820 SJ | 8 | 20 | .057 | .031 | .304 | 69 |
| NQ-920 SJ | 9 | 20 | .057 | .031 | .321 | 74 |
| NQ-1020SJ | 10 | 20 | .057 | .031 | .321 | 79 |
| NQ-1220SJ | 12 | 20 | .057 | .031 | .330 | 90 |
| NQ-1520SJ | 15 | 20 | .057 | .031 | .362 | 107 |
| NQ-1920SJ | 19 | 20 | .057 | .031 | .379 | 126 |
| NQ-2720SJ | 27 | 20 | .057 | .031 | .451 | 171 |
| NQ-3720SJ | 37 | 20 | .057 | .031 | .500 | 221 |
| NQ-218 SJ | 2 | 18 | .068 | .031 | .225 | 35 |
| NQ-318 SJ | 3 | 18 | .068 | .031 | .236 | 42 |
| NQ-418 SJ | 4 | 18 | .068 | .031 | .252 | 51 |
| NQ-518 SJ | 5 | 18 | .068 | .031 | .273 | 60 |
| NQ-618 SJ | 6 | 18 | .068 | .031 | .293 | 69 |
| NQ-718 SJ | 7 | 18 | .068 | .031 | .293 | 76 |
| NQ-818 SJ | 8 | 18 | .068 | .031 | .341 | 88 |
| NQ-918 SJ | 9 | 18 | .068 | .031 | .361 | 97 |
| NQ-1018SJ | 10 | 18 | .068 | .031 | .361 | 104 |
| NQ-1218SJ | 12 | 18 | .068 | .031 | .372 | 119 |
| NQ-1518SJ | 15 | 18 | .068 | .031 | .409 | 142 |
| NQ-1918SJ | 19 | 18 | .068 | .031 | .434 | 171 |
| NQ-2718SJ | 27 | 18 | .068 | .031 | .513 | 238 |

**NATIONAL WIRE AND CABLE CORPORATION**

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

# Miniature Signal & Control Cables Twisted Pairs (NQP Series)

## *EXTRA FLEXIBLE — GRAY PVC JACKET*



(NQP1928J shown)

**MIL-SPEC & U.L. LISTED** **STYLE 2464**

GRAY PVC JACKET

National Wire & Cable Corporation manufactures a complete line of highly flexible micro-miniature low-voltage instrument control cable. These are available as cabled pairs or singles, with optional overall shield of either foil with drain or a braided shield. Stocked with braided shields.

Conductors are stranded tinned copper with .010" wall of tough extruded polyvinyl chloride primary insulation, rated for 300 volt use at +80°C under U. L. listed style 1061.* All are color coded using ten standard colors plus white with stripes per MIL-STD-681. Coded pairs use the same sequence as type NXP and NWP.

Conductors are planetary cabled and helically laid for optimum flexibility, with a barrier under braids. Shielded cables have a tinned copper braid of 90% coverage per MIL-C-7078, with braid angles below 40° for easy pushback; or have a 100% coverage foil shield in intimate contact with a drain wire for easy termination. See Section 3 of our master catalog for relative shield effectiveness.

Outer jacket is highly flexible abrasion-resistant gray polyvinyl chloride thermoplastic, meeting the requirements of U.L. listed style 2464.** C.S.A. listing on request.

All materials are flame retardant and fungus resistant.

Standard Putups: 500 and 1000 ft. No-deposit reels. For shorter quantities or specific lengths, consult factory.

* Wire also meets MIL-W-16878 type B, rated 600 volts, +105°C.

** Jacket material is military rated for +105°C; meets MIL-I-631, Class F.

**TECHNICAL DATA (all cables)**

| | |
|---|---|
| **Insulation breakdown voltage:** | Greater than 3000 volts AC RMS, 60cps. |
| **Capacitance:** | Nominal capacitance from a wire to all else in a cable ranges from 25 to 45 pf/ft at 1kc, depending on gauge and position. |
| **Insulation Leakage:** | 200 megohms/1000 feet minimum @ 500VDC from conductor to all else in cable. |
| **Sheath Leakage:** | 10 megohms/1000 feet minimum @ 500VDC from shield or conductor group through sheath to ground. |
| **Temperature Range:** | U.L. rating: +80°C per U.L. style 2464. Military: Continuous use from −40°C to +105°C. |
| **Bending Characteristics:** | All cables are suitable for flexing to a circle diameter of 6 cable diameters from +105°C to −20°C. Recommended flex diameter should be greater than 20 cable diameters for flexing at −40°. For continuous flexing applications consult the factory. |
| **Foil Shielded Cables:** | The nominal overall diameter of foil shielded cables will be .006" greater than the non-shielded cables of the same conductor count and wire size. |
| **Characteristic Impedance: (NQP Paired Cables)** | Ranges from 150 ohms to 45 ohms, dependent on wire size (AWG), geometry and drive method. Consult our technical staff for data on specific cable types. |

## MULTI-CONDUCTOR STOCK CABLED PAIRS

### UNSHIELDED CABLES

| Part No. | No. Cond. | Cond. AWG | Cond. Diam. | Jkt. Wall | Nom. O/A Diam. | Wght. LB/M' |
|---|---|---|---|---|---|---|
| NQP- 228J | 2 | 28 | .034 | .031 | .185 | 15 |
| NQP- 328J | 3 | 28 | .034 | .031 | .202 | 16 |
| NQP- 428J | 4 | 28 | .034 | .031 | .217 | 20 |
| NQP- 528J | 5 | 28 | .034 | .031 | .236 | 23 |
| NQP- 628J | 6 | 28 | .034 | .031 | .262 | 29 |
| NQP- 728J | 7 | 28 | .034 | .031 | .262 | 28 |
| NQP- 828J | 8 | 28 | .034 | .031 | .304 | 34 |
| NQP- 928J | 9 | 28 | .034 | .031 | .318 | 41 |
| NQP-1028J | 10 | 28 | .034 | .031 | .318 | 39 |
| NQP-1228J | 12 | 28 | .034 | .031 | .328 | 43 |
| NQP-1528J | 15 | 28 | .034 | .031 | .367 | 55 |
| NQP-1928J | 19 | 28 | .034 | .031 | .381 | 61 |
| NQP- 226J | 2 | 26 | .038 | .031 | .199 | 20 |
| NQP- 326J | 3 | 26 | .038 | .031 | .218 | 21 |
| NQP- 426J | 4 | 26 | .038 | .031 | .234 | 26 |
| NQP- 526J | 5 | 26 | .038 | .031 | .256 | 34 |
| NQP- 626J | 6 | 26 | .038 | .031 | .284 | 37 |
| NQP- 726J | 7 | 26 | .038 | .031 | .284 | 38 |
| NQP- 826J | 8 | 26 | .038 | .031 | .331 | 52 |
| NQP- 926J | 9 | 26 | .038 | .031 | .347 | 60 |
| NQP-1026J | 10 | 26 | .038 | .031 | .347 | 51 |
| NQP-1226J | 12 | 26 | .038 | .031 | .358 | 59 |
| NQP-1526J | 15 | 26 | .038 | .031 | .401 | 75 |
| NQP-1926J | 19 | 26 | .038 | .031 | .417 | 85 |
| NQP-2726J | 27 | 26 | .038 | .031 | .498 | 115 |

### OVERALL SHIELDED CABLES

| Part No. | No. Cond. | Cond. AWG | Cond. Diam. | Jkt. Wall | Nom. O/A Diam. | Wght. LB/M' |
|---|---|---|---|---|---|---|
| NQP- 228SJ | 2 | 28 | .034 | .031 | .208 | 28 |
| NQP- 328SJ | 3 | 28 | .034 | .031 | .225 | 29 |
| NQP- 428SJ | 4 | 28 | .034 | .031 | .240 | 35 |
| NQP- 528SJ | 5 | 28 | .034 | .031 | .259 | 37 |
| NQP- 628SJ | 6 | 28 | .034 | .031 | .285 | 46 |
| NQP- 728SJ | 7 | 28 | .034 | .031 | .285 | 45 |
| NQP- 828SJ | 8 | 28 | .034 | .031 | .327 | 55 |
| NQP- 928SJ | 9 | 28 | .034 | .031 | .341 | 63 |
| NQP-1028SJ | 10 | 28 | .034 | .031 | .341 | 61 |
| NQP-1228SJ | 12 | 28 | .034 | .031 | .351 | 66 |
| NQP-1528SJ | 15 | 28 | .034 | .031 | .390 | 81 |
| NQP-1928SJ | 19 | 28 | .034 | .031 | .404 | 88 |
| NQP- 226SJ | 2 | 26 | .038 | .031 | .222 | 34 |
| NQP- 326SJ | 3 | 26 | .038 | .031 | .241 | 36 |
| NQP- 426SJ | 4 | 26 | .038 | .031 | .257 | 42 |
| NQP- 526SJ | 5 | 26 | .038 | .031 | .279 | 52 |
| NQP- 626SJ | 6 | 26 | .038 | .031 | .307 | 56 |
| NQP- 726SJ | 7 | 26 | .038 | .031 | .307 | 57 |
| NQP- 826SJ | 8 | 26 | .038 | .031 | .355 | 75 |
| NQP- 926SJ | 9 | 26 | .038 | .031 | .370 | 85 |
| NQP-1026SJ | 10 | 26 | .038 | .031 | .370 | 76 |
| NQP-1226SJ | 12 | 26 | .038 | .031 | .381 | 84 |
| NQP-1526SJ | 15 | 26 | .038 | .031 | .424 | 103 |
| NQP-1926SJ | 19 | 26 | .038 | .031 | .440 | 115 |
| NQP-2726SJ | 27 | 26 | .038 | .031 | .521 | 152 |

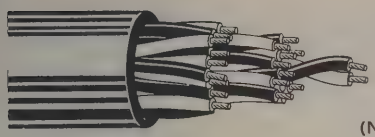
(continued on following page)

**NATIONAL WIRE**
**AND CABLE CORPORATION**

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

# Miniature Signal & Control Cables Twisted Pairs (NQP Series)

***EXTRA FLEXIBLE — GRAY PVC JACKET***



(NQP1928J shown)

**MIL-SPEC & U.L. LISTED** **STYLE 2464**

## MULTI-CONDUCTOR STOCK CABLED PAIRS

continued from previous page.

### UNSHIELDED CABLES

| Part No. | No. Cond. | Cond. AWG | Cond. Diam. | Jkt. Wall | Nom. O/A Diam. | Wght. LB/M' |
|---|---|---|---|---|---|---|
| NQP- 224J | 2 | 24 | .043 | .031 | .216 | 24 |
| NQP- 324J | 3 | 24 | .043 | .031 | .237 | 26 |
| NQP- 424J | 4 | 24 | .043 | .031 | .256 | 32 |
| NQP- 524J | 5 | 24 | .043 | .031 | .280 | 40 |
| NQP- 624J | 6 | 24 | .043 | .031 | .312 | 46 |
| NQP- 724J | 7 | 24 | .043 | .031 | .312 | 47 |
| NQP- 824J | 8 | 24 | .043 | .031 | .365 | 65 |
| NQP- 924J | 9 | 24 | .043 | .031 | .383 | 75 |
| NQP-1024J | 10 | 24 | .043 | .031 | .383 | 65 |
| NQP-1224J | 12 | 24 | .043 | .031 | .395 | 74 |
| NQP-1524J | 15 | 24 | .043 | .031 | .444 | 95 |
| NQP-1924J | 19 | 24 | .043 | .031 | .462 | 108 |
| NQP-2724J | 27 | 24 | .043 | .031 | .554 | 141 |
| NQP- 222J | 2 | 22 | .050 | .031 | .236 | 30 |
| NQP- 322J | 3 | 22 | .050 | .031 | .260 | 33 |
| NQP- 422J | 4 | 22 | .050 | .031 | .282 | 42 |
| NQP- 522J | 5 | 22 | .050 | .031 | .309 | 51 |
| NQP- 622J | 6 | 22 | .050 | .031 | .346 | 62 |
| NQP- 722J | 7 | 22 | .050 | .031 | .346 | 64 |
| NQP- 822J | 8 | 22 | .050 | .031 | .406 | 87 |
| NQP- 922J | 9 | 22 | .050 | .031 | .426 | 100 |
| NQP-1022J | 10 | 22 | .050 | .031 | .426 | 88 |
| NQP-1222J | 12 | 22 | .050 | .031 | .440 | 102 |
| NQP-1522J | 15 | 22 | .050 | .031 | .496 | 131 |
| NQP-1922J | 19 | 22 | .050 | .031 | .516 | 143 |
| NQP-2722J | 27 | 22 | .050 | .031 | .620 | 198 |
| NQP- 220J | 2 | 20 | .057 | .031 | .263 | 39 |
| NQP- 320J | 3 | 20 | .057 | .031 | .292 | 45 |
| NQP- 420J | 4 | 20 | .057 | .031 | .312 | 57 |
| NQP- 520J | 5 | 20 | .057 | .031 | .348 | 70 |
| NQP- 620J | 6 | 20 | .057 | .031 | .391 | 85 |
| NQP- 720J | 7 | 20 | .057 | .031 | .391 | 89 |
| NQP- 820J | 8 | 20 | .057 | .031 | .460 | 121 |
| NQP- 920J | 9 | 20 | .057 | .031 | .484 | 139 |
| NQP-1020J | 10 | 20 | .057 | .031 | .484 | 124 |
| NQP-1220J | 12 | 20 | .057 | .031 | .500 | 144 |
| NQP-1520J | 15 | 20 | .057 | .031 | .565 | 176 |
| NQP-1920J | 19 | 20 | .057 | .031 | .588 | 205 |
| NQP- 218J | 2 | 18 | .068 | .031 | .297 | 52 |
| NQP- 318J | 3 | 18 | .068 | .031 | .330 | 60 |
| NQP- 418J | 4 | 18 | .068 | .031 | .360 | 77 |
| NQP- 518J | 5 | 18 | .068 | .031 | .396 | 96 |
| NQP- 618J | 6 | 18 | .068 | .031 | .447 | 117 |
| NQP- 718J | 7 | 18 | .068 | .031 | .447 | 122 |
| NQP-1218J | 12 | 18 | .068 | .031 | .575 | 188 |

### OVERALL SHIELDED CABLES

| Part No. | No. Cond. | Cond. AWG | Cond. Diam. | Jkt. Wall | Nom. O/A Diam. | Wght. LB/M' |
|---|---|---|---|---|---|---|
| NQP- 224SJ | 2 | 24 | .043 | .031 | .239 | 39 |
| NQP- 324SJ | 3 | 24 | .043 | .031 | .260 | 42 |
| NQP- 424SJ | 4 | 24 | .043 | .031 | .279 | 50 |
| NQP- 524SJ | 5 | 24 | .043 | .031 | .303 | 59 |
| NQP- 624SJ | 6 | 24 | .043 | .031 | .335 | 67 |
| NQP- 724SJ | 7 | 24 | .043 | .031 | .335 | 68 |
| NQP- 824SJ | 8 | 24 | .043 | .031 | .390 | 91 |
| NQP- 924SJ | 9 | 24 | .043 | .031 | .406 | 102 |
| NQP-1024SJ | 10 | 24 | .043 | .031 | .406 | 92 |
| NQP-1224SJ | 12 | 24 | .043 | .031 | .418 | 102 |
| NQP-1524SJ | 15 | 24 | .043 | .031 | .467 | 127 |
| NQP-1924SJ | 19 | 24 | .043 | .031 | .485 | 142 |
| NQP-2724SJ | 27 | 24 | .043 | .031 | .577 | 185 |
| NQP- 222SJ | 2 | 22 | .050 | .031 | .259 | 47 |
| NQP- 322SJ | 3 | 22 | .050 | .031 | .283 | 51 |
| NQP- 422SJ | 4 | 22 | .050 | .031 | .305 | 62 |
| NQP- 522SJ | 5 | 22 | .050 | .031 | .332 | 73 |
| NQP- 622SJ | 6 | 22 | .050 | .031 | .369 | 86 |
| NQP- 722SJ | 7 | 22 | .050 | .031 | .369 | 88 |
| NQP- 822SJ | 8 | 22 | .050 | .031 | .430 | 116 |
| NQP- 922SJ | 9 | 22 | .050 | .031 | .449 | 131 |
| NQP-1022SJ | 10 | 22 | .050 | .031 | .449 | 119 |
| NQP-1222SJ | 12 | 22 | .050 | .031 | .463 | 134 |
| NQP-1522SJ | 15 | 22 | .050 | .031 | .519 | 167 |
| NQP-1922SJ | 19 | 22 | .050 | .031 | .539 | 180 |
| NQP-2722SJ | 27 | 22 | .050 | .031 | .645 | 245 |
| NQP- 220SJ | 2 | 20 | .057 | .031 | .286 | 58 |
| NQP- 320SJ | 3 | 20 | .057 | .031 | .315 | 65 |
| NQP- 420SJ | 4 | 20 | .057 | .031 | .335 | 79 |
| NQP- 520SJ | 5 | 20 | .057 | .031 | .371 | 95 |
| NQP- 620SJ | 6 | 20 | .057 | .031 | .414 | 112 |
| NQP- 720SJ | 7 | 20 | .057 | .031 | .414 | 116 |
| NQP- 820SJ | 8 | 20 | .057 | .031 | .483 | 154 |
| NQP- 920SJ | 9 | 20 | .057 | .031 | .507 | 174 |
| NQP-1020SJ | 10 | 20 | .057 | .031 | .507 | 159 |
| NQP-1220SJ | 12 | 20 | .057 | .031 | .525 | 181 |
| NQP-1520SJ | 15 | 20 | .057 | .031 | .588 | 216 |
| NQP-1920SJ | 19 | 20 | .057 | .031 | .615 | 248 |
| NQP- 218SJ | 2 | 18 | .068 | .031 | .320 | 74 |
| NQP- 318SJ | 3 | 18 | .068 | .031 | .353 | 83 |
| NQP- 418SJ | 4 | 18 | .068 | .031 | .383 | 103 |
| NQP- 518SJ | 5 | 18 | .068 | .031 | .420 | 124 |
| NQP- 618SJ | 6 | 18 | .068 | .031 | .475 | 148 |
| NQP- 718SJ | 7 | 18 | .068 | .031 | .475 | 153 |
| NQP-1218SJ | 12 | 18 | .068 | .031 | .600 | 230 |

These pages are only a partial reproduction of our master catalog. If our "standard" items won't meet your application, let us **CUSTOM DESIGN** and manufacture exactly what you need. Write or call our customer services dept. for technical assistance.

# NATIONAL WIRE AND CABLE CORPORATION

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

Manufactured by our affiliate,
Dynatronic Cable Engineering Corp.

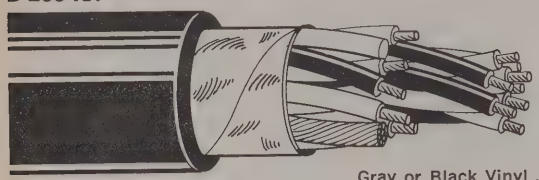
# Digital Data Transmission Cables (D-200 Series)

## Low Voltage Computer Cable

**THE D-200 SERIES CABLES ARE MULTIPLE-PAIR FLEXIBLE CABLES DESIGNED FOR TRANSMISSION OF DIGITAL PULSE SIGNALS BETWEEN A COMPUTER AND ITS PERIPHERAL EQUIPMENT.**

UL LISTED
U.S. Pat. No. 3489844

**D-200 XX** (XX designates number of pairs)



Gray or Black Vinyl Jackets

**D-200 XXRF** (RF designates braided shield)*

### DESIGN FEATURES OF THE D-200 SERIES DIGITAL DATA CABLE

Unlike conventional flexible cable construction, the primary features offered by the D-200 series data cable are the high and accurately controlled characteristic impedance of every pair, regardless of its position in the cable and special geometry chosen to reduce crosstalk.

ADVANTAGES

1. Less crosstalk and noise from mismatched loads, due to proper matching.
2. Uniform light loading on drivers allows direct I.C. drive, accurate prediction of current demands from power supply, and driver power dissipation.
3. Proper load match reduces re-flection and inversion noise where driver end is not matched to line. (Typical of TTL.)
4. Special geometry and pair construction provides exceptionally close capacitance balance between pair wires, reducing differential crosstalk.

USAGE

We recommend use of balanced drive and differential-input line receivers for lowest crosstalk and best pulse reproduction, utilizing the 110 ohm balanced impedance of the pairs. With such a system, TTL and MECL speeds have been used on D-200 cable at 1 mc data rates over 1000 ft.

Where the system is single-ended drive and receive, all pairs exhibit the 78 ohm impedance. Since these line receivers cannot discriminate between noise and the desired signal, crosstalk limits the cable distance over which transmission is reliable. Typical runs for DTL having 50 ns risetimes are 200 ft. Where risetimes can be slowed to longer than 100 ns, run lengths are practical to 500 ft. Without differential line reception, runs over 500 ft are not recommended for D-200 cable due to external noise aspects.

**The D-210 series cable are recommended for high noise or long-run application. (Utilizing individual shields.)**

Although use of balanced drive and differential line reception will avoid most noise problems, there are some installations where the expected external noise is unknown but assumed to be very great. Here, the use of data cables having individually-shielded pairs may be considered as conservative engineering practice. The assurance of a lower received noise may justify the increased size, cost and rise-time.

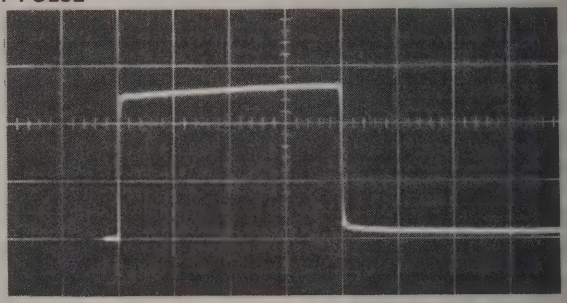
For these high noise-long run applications, Dynatronic Cable Engineering Corp has developed the D-210 series data cables. Electrical performance is essentially the same as the D-200 series cables, which use only an overall shield. *An overall tinned-copper shield braid may be specified on either series by the suffix -RF on the part number. Standard D-200 shield is aluminum-mylar foil.

For runs of 1000-5000 ft. or where extra-fast output pulse risetime is required, we offer the D-220 series cable: a larger version of the D-200 series having improved transmission properties with sufficient mechanical strength for long pulls in conduit. Consult factory for technical data.

PULSE TRANSMISSION LOSS in D-series data cables causes a moderate amplitude loss, with definite rounding of the leading and trailing edges from 50% to 90% amplitude. The photos below (for a 1.25 megabit clock rate) show typical waveforms. The D-220 and D-222 series cables offer even lower losses than the D-200 or D-210 cables for long-run or fast-clocked applications.

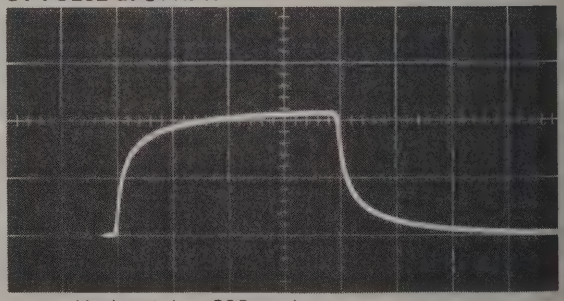
Contact our factory engineering staff for detailed pulse-shape versus distance information, or for special applications.

**INPUT PULSE**



Horizontal: 200. ns/cm
Vertical : 2. volts/cm

**OUTPUT PULSE at 500.FT.**



Horizontal: 200. ns/cm
Vertical : 2. volts/cm

**NATIONAL WIRE AND CABLE CORPORATION**

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569
Manufactured by our affiliate, Dynatronic Cable Engineering Corp.

# Digital Data Transmission Cables (D-200 Series continued)

## Low Voltage Computer Cable

| Part No. Black Jacket | Part No. Extra Flexible Gray Jacket | No. of Pairs | Cond. AWG. | Delay NS/FT | Cable Diam. | Weight (Lbs. per M ft.) |
|---|---|---|---|---|---|---|
| D-200-4 | D-200-4G | 4 | 24 | 1.61 | .315″ | 41. |
| D-200-7 | D-200-7G | 7 | 24 | 1.61 | .410″ | 73. |
| D-200-12 | D-200-12G | 12 | 24 | 1.61 | .455″ | 96. |
| D-200-15 | D-200-15G | 15 | 24 | 1.61 | .510″ | 120. |
| D-200-20 | D-200-20G | 20 | 24 | 1.61 | .635″ | 160. |
| D-200-24 | D-200-24G | 24 | 24 | 1.61 | .660″ | 180. |
| D-200-27 | D-200-27G | 27 | 24 | 1.61 | .690″ | 210. |
| D-200-30 | D-200-30G | 30 | 24 | 1.61 | .710″ | 230. |
| D-200-33 | D-200-33G | 33 | 24 | 1.61 | .750″ | 250. |
| D-200-42 | D-200-42G | 42 | 24 | 1.61 | .840″ | 280. |
| D-200-50 | D-200-50G | 50 | 24 | 1.61 | .910″ | 320. |

### TECHNICAL DATA

| Characteristic | Balanced** | Single-ended* |
|---|---|---|
| Characteristic Impedance | 110. ohms ±5% | 78. ohms ±4% |
| Capacitance | 14. pf/ft. | 21. pf/ft. |
| Signal Delay | 1.61 ns/ft. | 1.61 ns/ft. |
| DC Resistance/100 ft. | 5.6 ohms loop | 2.8 ohms |
| Insulation Breakdown | 6. KV min. DC | 6. KV min. DC |
| Insulation Resistance | > 1000. megohms/M′ | > 1000. megohms/M′ |
| Temperature Range | −20. C up to +80. C (60. C for U.L.) | |
| Min. Bend Radius | 6 x cable diameter | |

*One conductor of each pair tied to common.

### STANDARD DATA CABLE CONSTRUCTIONS — D-210 SERIES INDIVIDUALLY SHIELDED DATA PAIRS

| Part. No. | No. of Pairs | $Z_o$ | Delay NS/FT | Cond. AWG. | Cable Diam. | Sheath |
|---|---|---|---|---|---|---|
| D-210-1 | 1 | 110. | 1.61 | 24 | .220 | PVC |
| D-210-12 | 12 | 110. | 1.61 | 24 | .980 | PVC |
| D-210-15 | 15 | 110. | 1.61 | 24 | 1.06 | PVC |
| D-210-20 | 20 | 110. | 1.61 | 24 | 1.20 | PVC |
| D-210-30 | 30 | 110. | 1.61 | 24 | 1.42 | PVC |
| D-210-40 | 40 | 110. | 1.61 | 24 | 1.69 | PVC |
| D-210-48 | 48 | 110. | 1.61 | 24 | 1.76 | PVC |

### TECHNICAL DATA

All items available in 50 ft. multiples.

| Characteristic | Balanced** | Single-ended* |
|---|---|---|
| Characteristic Impedance | 110. ohms ±5% | 63. ohms ±4% |
| Capacitance | 14. pf/ft. | 23.5 pf/ft. |
| Signal Delay | 1.61 ns/ft. | 1.61 ns/ft. |
| DC Resistance/100 ft. | 5.6 ohms loop | 2.8 ohms |
| Insulation Breakdown | 6. KV min. DC | 6. KV min. DC |
| Insulation Resistance | > 1000. megohms/M′ | > 1000. megohms/M′ |
| Temperature Range | −20. C up to +80. C (60. C for U.L.) | |
| Min. Bend Radius | 9 x cable diameter | |

**Both driven, one inverted. *One conductor of each pair tied to common.

**We invite your telephone inquiries for technical information on data cables. Contact Mr. Frank Motley or Mr. Ralph Wells in our Engineering Dept.**

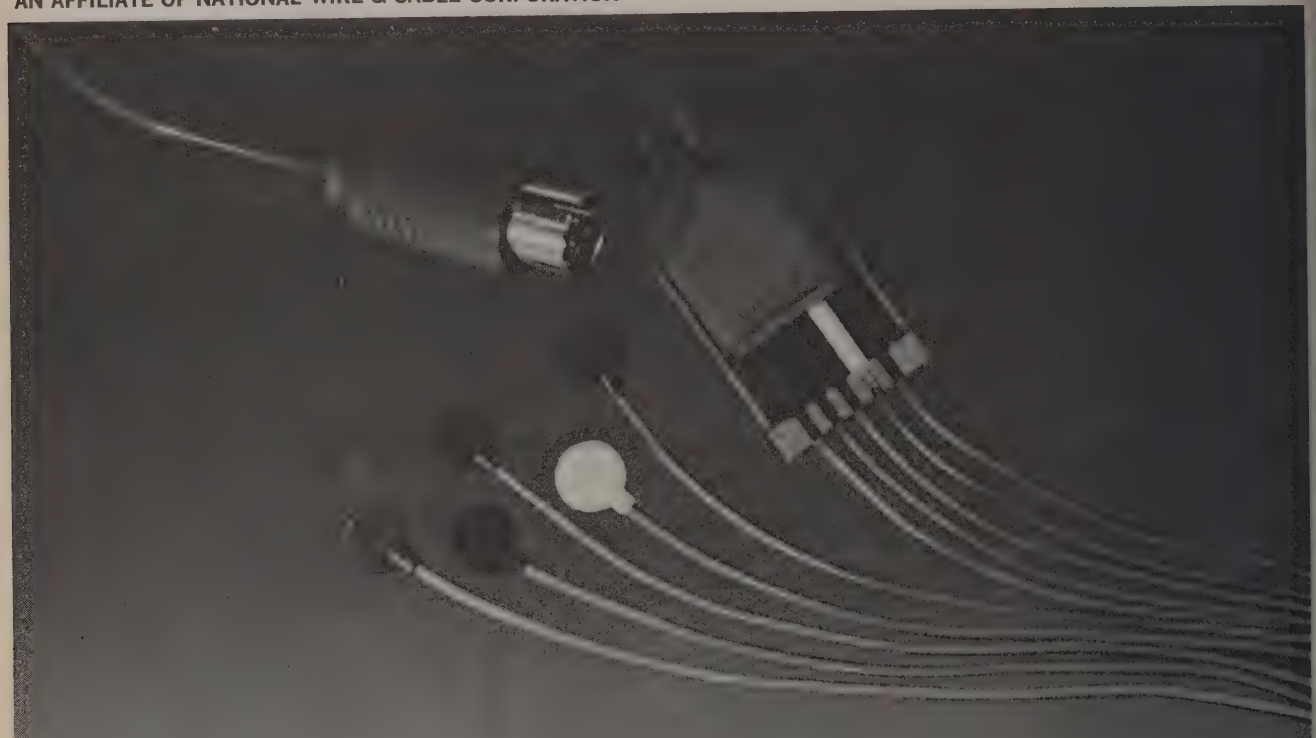
# NATIONAL CABLE MOLDING CORPORATION

AN AFFILIATE OF NATIONAL WIRE & CABLE CORPORATION

Dept. EM, 136 San Fernando Rd., Los Angeles, Calif. 90031
Phone (213) 225-5611, TWX: 910-321-4155, Fed. Stock Code H4-04569

## Molded Instrumentation Cables for all Types of Medical & Electronic Applications

AN AFFILIATE OF NATIONAL WIRE & CABLE CORPORATION



**SPECIALISTS IN INJECTION-MOLDING OF CONNECTORS DIRECTLY ONTO CABLE!**

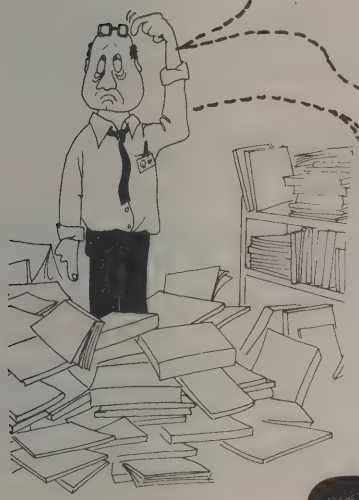
**INTEGRAL-MOLDED ELECTRONIC CABLE/CONNECTOR ASSEMBLIES**

Utilizing integral cable molding techniques, National Cable Molding Corporation (NCM) manufactures all components "in-house" from wire insulation to cable manufacture, connector assembly, tooling and molding the entire unit ready for use!

Write or call Mr. Frank W. Motley today for technical information or assistance. Phone: (213) 225-5611.

*What can I use to keep all the manufacturers' product data I receive in order?*

*What system makes filing or retrieving manufacturers' catalogs fast and easy?*



*Which file system have thousands of engineers purchased because they know it works?*

# eem FILE SYSTEM

## THE ONLY FILE SYSTEM DESIGNED SPECIALLY FOR THE ELECTRONIC ENGINEER!

The publishers of **eem** have put together a unique filing system for electronic product information. The complete system includes: a product index booklet which classifies electronic products into 3,000 listings both alphabetically and by product group, and 45 file folders imprinted with the **eem** product sections (extra gummed labels included for expanding the system.)

As you receive manufacturers' catalog data sheets, technical bulletins, or clip magazine articles, jot down the proper Product Section Numbers from the **eem** PRODUCT-TO-SECTION INDEX. Then simply file in order. When you require information on a specific product, refer to PRODUCT-TO-SECTION INDEX again to locate the correct file folder. It's simple, and you'll always have the necessary data to compare, specify and buy, right at your fingertips.

**Here's how to order your eem FILE SYSTEM:**

For the complete system send $10 (plus tax; N.Y., 8%, CA, 6½%) in check or money order to:

United Technical Publications, Inc.,
645 Stewart Avenue, Garden City, N.Y. 11530
Att: Circulation dept.

For an **eem FILE SYSTEM** without file folders send $7.50 (plus tax; N.Y. 8%; CA, 6½%).

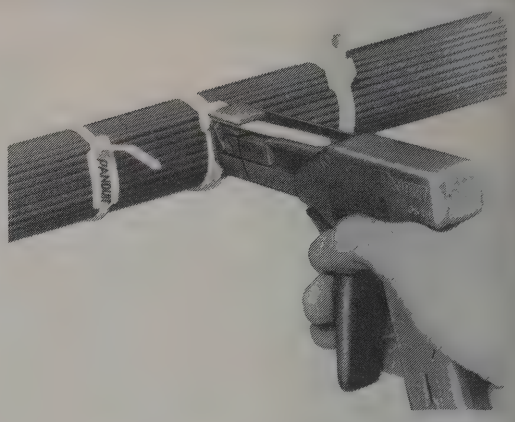
*UNITED TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500*

# PANDUIT® wiring components

## PANDUIT® CABLE TIES

**. . . Engineered to reduce your total installed cost.**

- **The most complete line of Cable Ties, Clamps, Push Mounts and Marker Ties.**
- **Consistent quality assured by tests conducted by military and independent testing labs.**

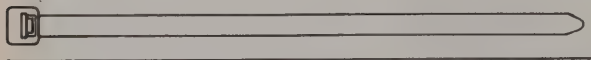


Applicable sizes of PAN-TY and STA-STRAP cable ties are Recognized under Components Program of Underwriters' Laboratories, Inc. and meet applicable Mil Specs.

## PAN-TY® CABLE TIES

- Strong, one-piece, all nylon. Minimum loop tensile strength up to 250 lbs.
- 43 sizes available including lashing ties. For bundle diameters up to 12 inches.
- Fast — install quickly by hand or with PANDUIT® installation tools. Self-locking and releasable types available.
- Economical and versatile. Use to secure wires, cables, hoses.

### Cable Ties



| Part No. & Cross-section | Max. Bundle Dia. | Approx. Length | Min. Loop Tensile Strength |
|---|---|---|---|
| PLT1M Miniature Tie | 3/4" | 3 7/8" | 18 lbs. |
| PLT1.5M Miniature Tie | 1 1/4" | 5 5/8" | 18 lbs. |
| PLT1.5I Intermediate Tie | 1 1/4" | 5 5/8" | 40 lbs. |
| PLT1.5S Standard Tie | 1 1/2" | 6 3/8" | 50 lbs. |
| PLT2M Miniature Tie | 2" | 8" | 18 lbs. |
| PLT2I Intermediate Tie | 2" | 8" | 40 lbs. |
| PLT2S Standard Tie | 1 3/4" | 7 3/8" | 50 lbs. |
| PLT3I Intermediate Tie | 3" | 11 5/8" | 40 lbs. |
| PLT3S Standard Tie | 3" | 11 1/2" | 50 lbs. |
| PLT3H Heavy Tie | 3" | 11 3/8" | 120 lbs. |
| PLT4I Intermediate Tie | 4" | 14 5/8" | 40 lbs. |
| PLT4S Standard Tie | 4" | 14 1/2" | 50 lbs. |
| PLT4H Heavy Tie | 4" | 14 1/2" | 120 lbs. |
| PLT5H Heavy Tie | 5" | 17 3/4" | 175 lbs. |
| PLT6H Heavy Tie | 6" | 20 7/8" | 175 lbs. |
| PLT8H Heavy Tie | 9" | 30 5/8" | 175 lbs. |

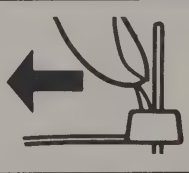
### Clamps

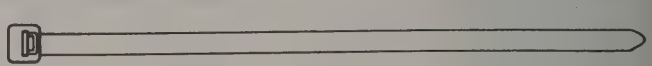
| | | | |
|---|---|---|---|
| PLC1M-S4 Miniature Clamp #4 Screw | 3/4" | 4 3/8" | 18 lbs. |
| PLC1.5I-S8 Intermediate Clamp #8 Screw | 1 1/4" | 6 1/8" | 30 lbs. |
| PLC2S-S6 Standard Clamp #6 Screw<br>PLC2S-S10 Standard Clamp #10 Screw | 1 3/4" | 7 7/8" | 50 lbs. |
| PLC4H-S25 Heavy Clamp 1/4" Screw | 4" | 15 1/4" | 120 lbs. |

ALL SIZES, STANDARD COLOR: NATURAL NYLON. ELEVEN COLORS AVAILABLE.

### Releasable Cable Ties

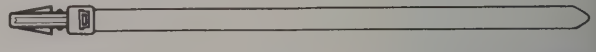
Exclusive design permits fast, easy release and reuse.





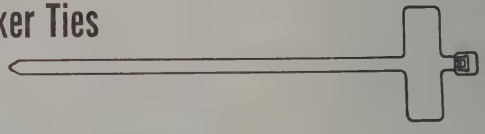
| | | | |
|---|---|---|---|
| PRT1.5S Standard Tie | 1 1/2" | 6 3/8" | 50 lbs. |
| PRT2S Standard Tie | 1 3/4" | 7 3/8" | 50 lbs. |
| PRT4S Standard Tie | 4" | 14 1/2" | 50 lbs. |

### Push Mount Ties

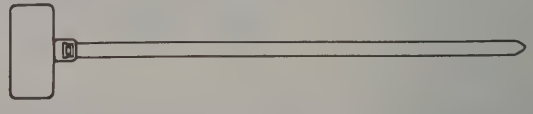


| Part No. & Cross-section | Max. Bundle Dia. | Approx. Length | Min. Loop Tensile Strength |
|---|---|---|---|
| PLP1.5I Intermediate Push Mount Tie | 1 1/4" | 6 1/8" | 30 lbs. |
| PLP2S Standard Push Mount Tie | 1 3/4" | 7 7/8" | 50 lbs. |

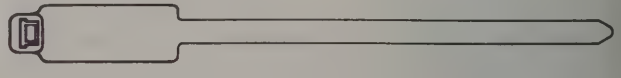
### Marker Ties



| | | | |
|---|---|---|---|
| PLM1M Miniature Marker Tie | 3/4" | 3 7/8" | 18 lbs. |
| PLM2M Miniature Marker Tie | 2" | 8" | 18 lbs. |



| | | | |
|---|---|---|---|
| PLF1M Miniature Flag Marker Tie | 3/4" | 4 3/8" | 18 lbs. |



| | | | |
|---|---|---|---|
| PLM2S Standard Marker Tie | 1 3/4" | 7 3/8" | 50 lbs. |
| PLM4S Standard Marker Tie | 4" | 14 5/8" | 50 lbs. |

PANDUIT CORP.

SOLD THROUGH AUTHORIZED PANDUIT DISTRIBUTORS

DEPT. EM, 17301 RIDGELAND AVENUE, TINLEY PARK, ILLINOIS 60477
PHONE (312) 532-1800 TELEX 25-4560

# PANDUIT® wiring components

## STA-STRAP® CABLE TIES

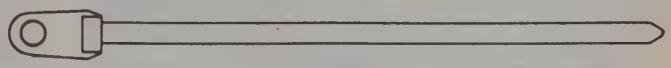
- Strong, all nylon.
- 21 sizes available for bundle diameters up to 8 inches.
- Zero threading force.
- Fast—install quickly by hand or with PANDUIT® installation tools. Self-locking, all are releasable prior to final tensioning.

### Cable Ties

| Part No. & Cross-section | Max. Bundle Dia. | Approx. Length | Min. Loop Tensile Strength |
|---|---|---|---|
| SST1M Miniature Tie | ¾″ | 4″ | 18 lbs. |
| SST1.5M Miniature Tie | 1¼″ | 5½″ | 18 lbs. |
| SST1.5I Intermediate Tie | 1¼″ | 5¼″ | 40 lbs. |
| SST1.5S Standard Tie | 1¼″ | 5¾″ | 50 lbs. |
| SST2I Intermediate Tie | 2″ | 8⅛″ | 40 lbs. |
| SST2S Standard Tie | 1¾″ | 6¾″ | 50 lbs. |
| SST2H Heavy Tie | 2″ | 8″ | 120 lbs. |
| SST3I Intermediate Tie | 3″ | 11″ | 40 lbs. |
| SST3S Standard Tie | 3″ | 11″ | 50 lbs. |
| SST4I Intermediate Tie | 4″ | 14¾″ | 40 lbs. |
| SST4S Standard Tie | 4″ | 15″ | 50 lbs. |
| SST4H Heavy Tie | 4″ | 14¾″ | 120 lbs. |
| SST8H Heavy Tie | 8″ | 27½″ | 120 lbs. |

ALL SIZES, STANDARD COLOR: NATURAL NYLON. ELEVEN COLORS AVAILABLE.

### Clamps



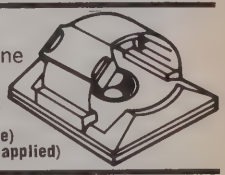
| Part No. & Cross-section | Max. Bundle Dia. | Approx. Length | Min. Loop Tensile Strength |
|---|---|---|---|
| SSC2S-S6 Standard Clamp #6 Screw | 1¾″ | 7⅜″ | 50 lbs. |
| SSC2S-S10 Standard Clamp #10 Screw | 1¾″ | 7⅜″ | 50 lbs. |
| SSC4S-S6 Standard Clamp #6 Screw | 4″ | 15⅝″ | 50 lbs. |
| SSC4S-S10 Standard Clamp #10 Screw | 4″ | 15⅝″ | 50 lbs. |
| SSC4H-S25 Heavy Clamp ¼″ Screw | 4″ | 15½″ | 120 lbs. |

### Marker Ties

| | | | |
|---|---|---|---|
| SSM2S Standard Marker Tie | 1¾″ | 6¾″ | 50 lbs. |
| SSM4S Standard Marker Tie | 4″ | 14⅞″ | 50 lbs. |

## PANDUIT® CLINCHER™ ADJUSTABLE, RELEASABLE CLAMP

- Combines wire bundling and mounting into one easy to use item.
- Available in adhesive or screw applied styles.
- Adjustable sizes, 3⁄16″ up to 1 1⁄16″. Releasable and reusable.



ARC.68-A (Adhesive)
ARC.68-S6 (Screw applied)

## PANDUIT® MOUNTING ACCESSORIES (Part of a Complete Selection)

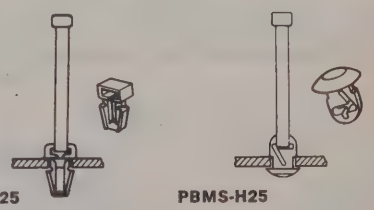
### ADHESIVE BACKED MOUNTS

- Convenient mounting method. Many types for different applications.

ABMM-A ABM2S-A ABMS-A MABMS-A

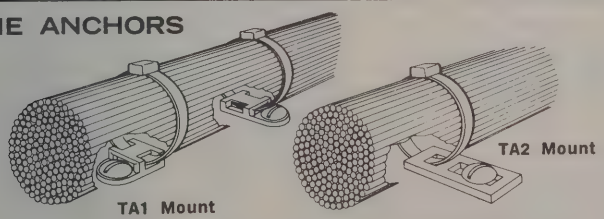
### PUSH MOUNTS

- For panel thickness ⅛″ max. Hole dia. nom. ¼″.



PM2H25 PBMS-H25

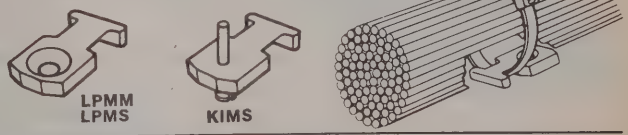
### TIE ANCHORS



TA1 Mount TA2 Mount

### LOW PROFILE MOUNTS

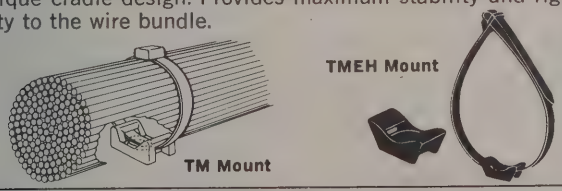
- Provide for low height when securing bundles to panels or other flat surfaces.



LPMM LPMS KIMS

### TIE MOUNTS

- Unique cradle design. Provides maximum stability and rigidity to the wire bundle.

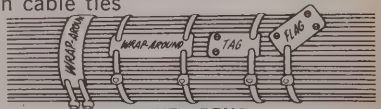


TM Mount TMEH Mount

### MARKER PLATES

- Provide clear, permanent identification
- Secured to bundles with cable ties
- Made of nylon
- 6 sizes available

MP150 — ¾″ x 1½″
MP175 — ¾″ x 1¾″
MP200 — ¾″ x 2″
MP250W175 — 1¾″ x 2½″
MP250 — ¾″ x 2½″
MP350 — ¾″ x 3½″




MARKER PENS
PX-0 Black PX-2 Red

- Used to mark nylon marker plates

PANDUIT CORP.

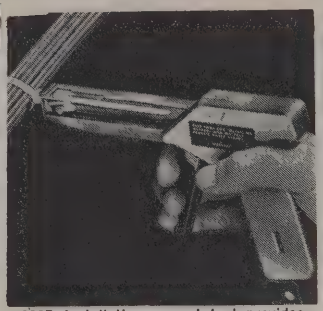
SOLD THROUGH AUTHORIZED PANDUIT DISTRIBUTORS

DEPT. EM, 17301 RIDGELAND AVENUE, TINLEY PARK, ILLINOIS 60477
PHONE (312) 532-1800 TELEX 25-4560

# PANDUIT® wiring components

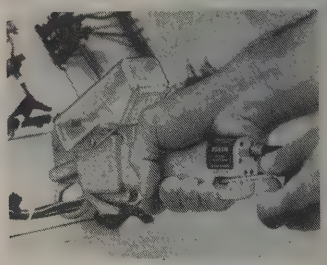
## PANDUIT® CABLE TIE INSTALLATION TOOLS

A complete tooling program to meet all production requirements for fast, neat harnessing.



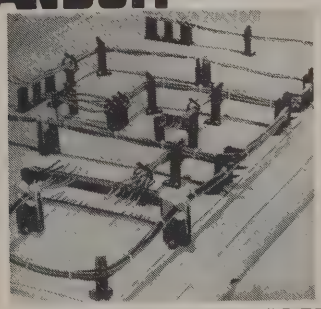
GS2B installation manual tool provides uniform tensioning and cutoff of all PANDUIT® miniature, intermediate and standard cross-section cable ties, clamps and markers; meets MIL-T-81306(AS), MS90387-1. Also available is GS4H manual installation tool for all standard and heavy ties; meets MIL-T-81306(AS), MS-90387-2.

PPTS hand-operated pneumatic cable tie installation tool. Installs all PANDUIT miniature, intermediate and standard cross-section cable ties, clamps and markers. Uses standard 70-80 psi air.



High Speed Production Tooling. PSA1M semi-automatic pneumatic installation tool — installs hand fed PLT1M ties, tensions and cuts off flush. Up to ¾" dia. bundle.
PAT1M automatic pneumatic installation tool — installs PLT1M from dispenser, tensions and cuts off flush, all in less than 1 sec. Up to ¾" dia. bundle.

## PANDUIT® HARNESS BOARD ACCESSORIES



### Elastic Retainers

Automatically form bundles as wires are inserted.
RER.75-S6 — up to ¾" bundle diameter.
RER1.25-S6 — up to 1¼" bundle diameter.

### Bundle Retainers

BR.5-E6 up to ½" bundle diameter.
BR.75-E6 up to ¾" bundle diameter.
Supports bundle above harness board at uniform height.

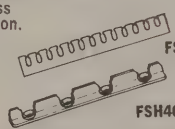
### Corner Posts

CPL.75-S8 (Low)
CPH.75-S8 (High)
Used to route wire bundles up to ¾" around corners on the harness board or a "T" junction.

### Spring Wire Breakout System

PBSC — Springs available in 1", 3", 6", 12" lengths.
SHH — Spring holder. For 1" and 3" PBSC springs.

### Fanning Strip & Holder



FS156 Fanning Strip

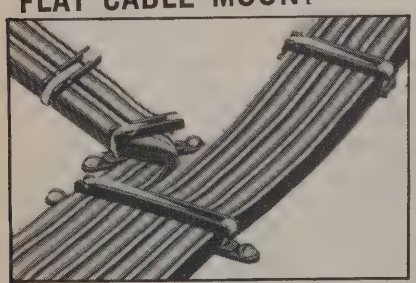
FSH40 Fanning Strip Holder

FSHH

For uniform height use RER.75, BR.75 (BR.5), CPH.75, SHH and FSHH. This height is suitable for use with PAT1M or PSA1M cable tie installation tools. This total system speeds harness fabrication thus lowering your total harness cost.

## ACCESSORIES FOR FLAT CABLE

### FLAT CABLE MOUNT



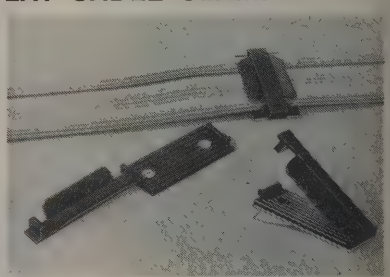
- Combination of PANDUIT® Cable Tie and unique Flat Cable Accessory provides . . . secure method of mounting or bundling flat cable.

- For Bundling use (2) Plates, (1) Tie.
- For Mounting use (1) Plate, (1) Base, (1) Tie.

| | Part No. | For Flat Cable Widths (up to) |
|---|---|---|
| PLATE | FCPI1 | 1" |
| | FCPI2 | 2" |
| | FCPI3 | 3" |
| BASE (Screw Mount) | FCBI1-S10 | 1" |
| | FCBI2-S10 | 2" |
| | FCBI3-S10 | 3" |
| BASE (Adhesive Supplied by User) | FCBI1-A | 1" |
| | FCBI2-A | 2" |
| | FCBI3-A | 3" |
| RIGHT ANGLE BASE (Screw Mount) | RAFCBI1-S10 | 1" |
| | RAFCBI2-S10 | 2" |
| | RAFCBI3-S10 | 3" |

Used with PAN-TY® Cable Tie, intermediate sizes.

### FLAT CABLE CLAMP



- Self-locking clamp for flat cable; width up to 2", height .17".
- Available in adhesive or screw applied style.
- Color: Black.

| Part Number | Mounting Method | For Flat Cable Width (up to) |
|---|---|---|
| FCM2-A-20 | Adhesive | 2" |
| FCM2-S6-20 | #6 Flat Head Screw | 2" |

PANDUIT CORP.

**SOLD THROUGH AUTHORIZED PANDUIT DISTRIBUTORS**

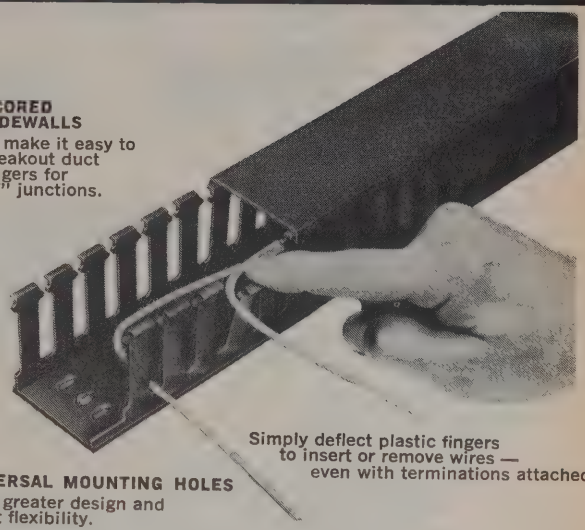
DEPT. EM, 17301 RIDGELAND AVENUE, TINLEY PARK, ILLINOIS 60477
PHONE (312) 532-1800 TELEX 25-4560

# PANDUIT® wiring components

## PANDUCT®

### PLASTIC WIRING DUCT — TYPE "E"

- Reduce your total installed costs with patented snap-in slot design:
  - — Holds breakout wires captive while providing complete accessibility for adding or removing wires — even with terminations attached.
  - — Result: your total cost is reduced during initial installation, wire tracing, trouble shooting and circuit revisions.
- Non-slip cover prevents vibration slippage, yet easy to install or remove.
- Standard color: Light gray. White and dark gray available. Standard length: 6 ft.
- Complete variety of accessories available for installation.
- Also available:
  Type "S" Solid Wall Duct
  Type "D" Round Hole Duct
  Type "NE" & "NS" Chlorine-Free, High-Temperature Duct


SCORED SIDEWALLS
— make it easy to breakout duct fingers for "T" junctions.
Simply deflect plastic fingers to insert or remove wires — even with terminations attached.
UNIVERSAL MOUNTING HOLES
— for greater design and layout flexibility.

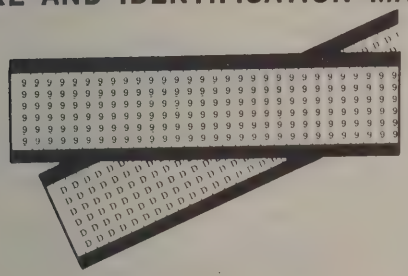
Applicable sizes are recognized under Components Program of Underwriters' Laboratories, Inc.

MEETS J.I.C. REQUIREMENTS

| Nominal Duct Size W x H | Nominal Duct Size W x H | Nominal Duct Size W x H |
|---|---|---|
| .5 x .5 | 1 x 3 | 3 x 1 |
| .5 x .62 | 1 x 4 | 3 x 1.25 |
| .5 x 1 | 1.5 x 1 | 3 x 2 |
| .5 x 1.25 | 1.5 x 1.5 | 3 x 3 |
| .5 x 1.75 | 1.5 x 2 | 3 x 4 |
| .75 x .75 | 1.5 x 3 | 3 x 5 |
| .75 x 1 | 1.5 x 4 | 4 x 1.5 |
| .75 x 1.5 | 2 x 1 | 4 x 2 |
| .75 x 2 | 2 x 2 | 4 x 3 |
| 1 x 1 | 2 x 3 | 4 x 4 |
| 1 x 1.5 | 2 x 4 | 4 x 5 |
| 1 x 2 | 2.5 x 3 | |

## PANDUIT® INSTA-CODE™

### WIRE AND IDENTIFICATION MARKERS



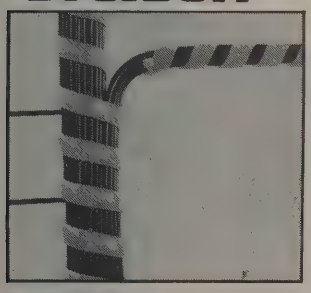
**FAST AND EASY WIRE IDENTIFICATION**

- Self adhesive
- Permanent
- Meet industry standards
- Wide selection

**CONVENIENT DISPENSER CARDS**

Solid numbers: 0-250
Consecutive numbers: 1-33, 34-66, 67-99, 100-124, 125-149, 150-174, 175-199
Solid letters: A-Z
Consecutive letters: A-Z and A-J
Solid symbols: T1, T2, T3, L1, L2, L3, +, −, GRD, GND, SPARE
Solid NEMA colors: 16 colors
Voltage markers: 100V thru 13,800V
Self-laminating wire and cable markers.
Safety signs.
**Plus handy books — with terminal markers. 16 assortments**

## PANDUIT™ SPIRAL WRAPPING



- Versatile. Wires can enter or leave at any point. Follows path of wires easily.
- Reusable.
- Available in three standard materials: Polyethylene, Flame Retardant Polyethylene, Nylon.
- Each available in three sizes: 1/16″-1/2″; 3/16″-2″; 3/4″-4″.
- Easily installed with tool supplied in each package.

**SOLD THROUGH AUTHORIZED PANDUIT DISTRIBUTORS**

PANDUIT CORP.
DEPT. EM, 17301 RIDGELAND AVENUE, TINLEY PARK, ILLINOIS 60477
PHONE (312) 532-1800 TELEX 25-4560

# PANDUIT® wiring components

## PAN-TERM®

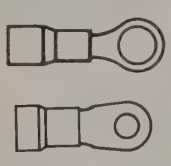
### TERMINALS, SPLICES, DISCONNECTS, WIRE JOINTS and INSTALLATION TOOLS

For specific details on the wide range of PAN-TERM terminal products to meet your requirements, contact your local Panduit Distributor or Sales Office.

Listed by Underwriters' Laboratories, Inc. and approved by Canadian Standards Association. PAN-TERM terminating devices have successfully passed the test requirements of U.L. specification 486 and CSA specification C22.2 No. 65 where indicated in Bulletin T-3 which lists the complete line.

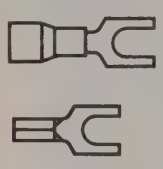
## TERMINALS

**Wire sizes from #26 through #2 AWG and stud sizes through ½".**

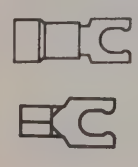


**RING TONGUE**
Nylon Insulated
TEFZEL* Insulated
Vinyl Insulated
Non-insulated
Available for #26-22, #22-18, #16-14, #12-10, #8, #6, and #2 wire. Stud sizes #2, #4, #6, #8, #10, ¼", 5/16", ⅜" and ½".

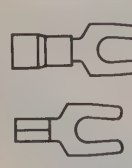
* TEFZEL Fluoropolymer Reg. TM, E. I. Dupont De Nemours Co.



**FORK TONGUE**
Nylon Insulated
Vinyl Insulated
Non-insulated
Available for #26-22, #22-18, #16-14 and #12-10 wire. Stud sizes #2, #4, #6, #8, #10 and ¼"

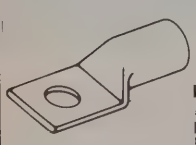


**SHORT LOCKING FORK**
Nylon Insulated
Vinyl Insulated
Non-insulated
Available for #22-18, #16-14 and #12-10 wire. Stud sizes #5, #6, #8, #10, ¼".

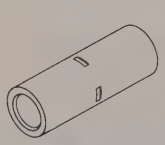


**LOCKING FORK**
Nylon Insulated
Vinyl Insulated
Non-insulated
Available for #22-18, #16-14 and #12-10 wire. Stud sizes #6, #8 and #10. Wide Locking Forks available.

## COMPRESSION CONNECTORS



**LUGS**
#8 AWG through 1000 MCM
For copper
For aluminum/copper



**SPLICES**
For copper

## DISCONNECTS

**Wire sizes from #22 through #10 AWG and tab sizes .250, .187, .145, and .110 by .032 or .020**

### FEMALE DISCONNECTS

**Vinyl Fully Pre-insulated Clear Vinyl**
Available for #22-18, #16-14 and #12-10 wire. Tab sizes .250 x .032 and .187 x .020

**Vinyl Insulated — Funnel Entry Insulation Grip Sleeve**
Available for #22-18 and #16-14 wire. Tab sizes .187 x .032 and .187 x .020

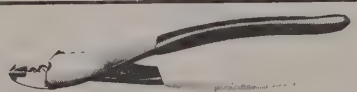
**Nylon Insulated Funnel Entry**
For #16-14 wire. Tab sizes .187 x .032 and .187 x .020

**Sleeved Barrel Vinyl and Non-Insulated**
Available for #22-18, #16-14 and #12-10 wire. Tab sizes .250 x .032, .187 x .020.

**Butted Seam Vinyl and Non-Insulated**
Available for #22-18 and #16-14 wire. Tab sizes .250 x .032 and .187 x .020

### MALE DISCONNECTS

**Vinyl and Non-Insulated Brazed Seam**
Available for #22-18 and #16-14 wire. Tab sizes .250 x .032 and .145 x .032



CT-200 Tool installs non-insulated PAN-TERM terminals, disconnects and splices on wire ranging from #10 to #22.

**Controlled Cycle Tools**

**HAND TOOLS**

**CT-500; CT-510; CT-520; CT-550; CT-570**
Precision made tools to provide TOOL-CONTROLLED crimps for PAN-TERM insulated and non-insulated terminals, splices, disconnects and wire joints on wire ranging from #10 to #22. Color coded handles readily identify the tool needed for parts being crimped.

## SPLICES

**Wire sizes from #26 through #10 AWG**

**Butt Type**
Nylon Insulated
Vinyl Insulated
Clear Vinyl Insulated

**Butt Type**
Non-insulated

**Parallel Type**
Nylon Insulated
Non-insulated

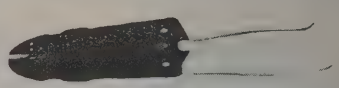
## WIRE JOINTS

**Capacities from (2) #24 to (4) #10 AWG wires**

**Nylon Insulated**
Four sizes. Range from minimum of (2) #24 to maximum of (4) #12 wires

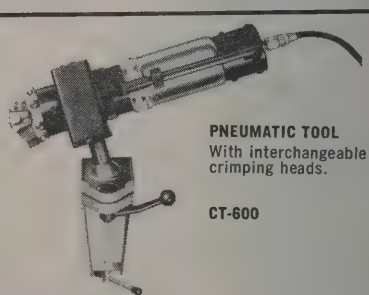
**Non-insulated**
Three sizes. Range from minimum of (2) #14 to maximum of (4) #10 wires

## INSTALLATION TOOLS



CT-100 Tool crimps PAN-TERM insulated and non-insulated terminals, splices, disconnects and wire joints on wire ranging from #10 to #22. Also cuts and strips wire, and cuts popular screws.

**CT-250** Tool installs insulated PAN-TERM terminals, disconnects, and splices on wire ranging from #10 to #22.



**PNEUMATIC TOOL**
With interchangeable crimping heads.

**CT-600**

PANDUIT CORP.

SOLD THROUGH AUTHORIZED PANDUIT DISTRIBUTORS

DEPT. EM, 17301 RIDGELAND AVENUE, TINLEY PARK, ILLINOIS 60477
PHONE (312) 532-1800 TELEX 25-4560

# PHILADELPHIA INSULATED WIRE CO., INC.

Main Office and Factory

**333 NEW ALBANY ROAD / MOORESTOWN, N. J. 08057**
**(609) 235-6700 TOLL FREE 800-257-8357 TWX NO. 710-897-0187**

When P.I.W. was founded in 1820, the original product line was hoop-skirts for the ladies. In 1842, P.I.W. developed insulated wire by wrapping cotton around a bare copper conductor. This first insulated wire was produced for Samuel F. B. Morse, the inventor of the telegraph.

Originally located in Philadelphia, Pennsylvania, P.I.W. produced annunciator wire, litz wire, organ cables, connecting wire, polyvinylchloride hookup wire and cables, and various braided glass and cotton constructions.

In 1959, P.I.W. moved to new facilities in Moorestown, New Jersey, when it was purchased by the Wilbur B. Driver Company of Newark, New Jersey. This move served to establish P.I.W. as a greatly respected producer of high temperature insulated wire for the computer, aerospace and electronics industries.

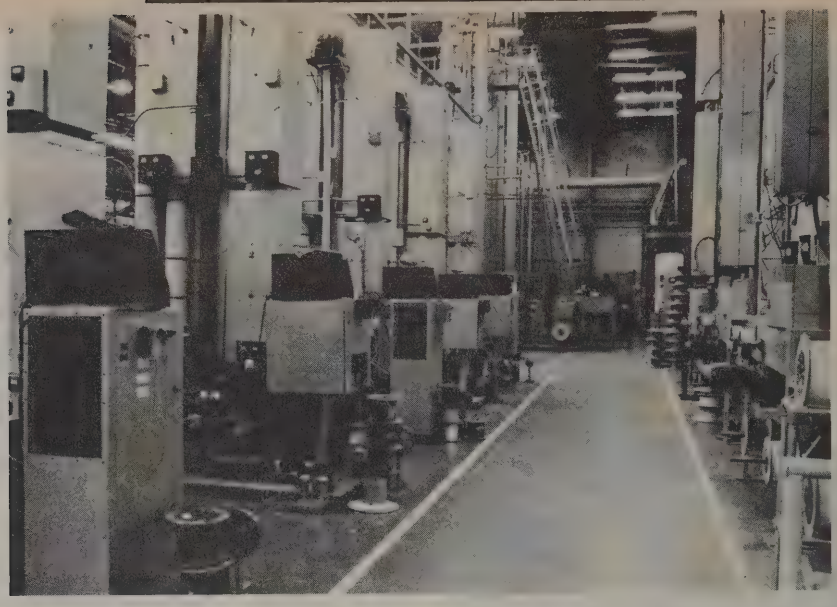
From the beginning, the goal of P.I.W. has been to surpass the exacting standards required in the manufacture of high temperature insulated wire. P.I.W. continues to maintain the skill and proficiency which established a reputation for quality and service that has endured for over a century and a half. Quality products and efficient service remain top priorities at Philadelphia Insulated Wire Company, Inc.

P.I.W. has the capability of producing the following insulations: TFE and FEP Teflon, Polyethylene, Tefzel and Halar. PVC hookup wire and PVC control cables are also produced.

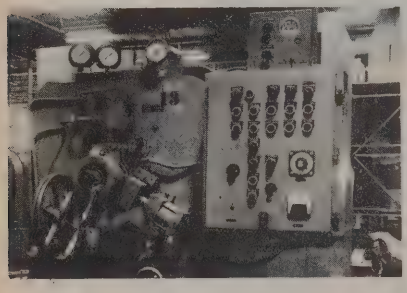
Complete information in P.I.W.'s outstanding line of insulated wire and cable is presented in this catalog, as well as technical descriptions denoting electrical characteristics, applications, packaging, etc. It has been impossible, however, within the confines of a catalog such as this, to set forth all the possible combinations of cable available. For more detailed information, please contact the nearest P.I.W. sales office.

## INDEX


| | Page |
|---|---|
| Production Department | 2 |
| Leadwire-Teflon | 3, 4 |
| Teflon | 5 |
| Teflon 300 Volts | 5 |
| Teflon 600 Volts | 5 |
| UNICABLE | 6 |
| Teflon-FEP Fire Alarm Cable | 7 |
| Aircraft Teflon, TFE Insulation | 8, 9 |
| RG/U Type Coaxial Cables | 8, 9 |
| Shielded Teflon Cables | 10 |
| Teflon-FEP | 11 |
| Quality Control | 11 |
| Glass Hook-up Wire | 12 |
| Teflon (FEP) Control Cable | 12 |
| Fixture Wire ("Teflon" FEP) | 13 |
| General Purpose Wire ("Teflon" FEP) | 13 |
| Hook-up Wire-Tefzel | 14 |
| Hook-up Wire-Halar | 14 |
| Military-PVC Hook-up Wire | 15, 16 |
| UL listings | 17 |
| Back-Panel Wire | 18 |
| Business Machine Wire | 18 |
| Computer and Control Cable (unshielded) | 19 |
| Computer and Control Cable (shielded) | 20 |



# P.I.W.'s Production Department consists of the following operations:



Paste Extrusion — (PTFE compounds)

Melt Extrusion — (FEP, Polyethylene, Tefzel, Halar, PVC, Nylon, etc.)

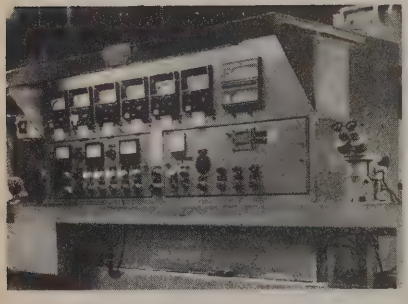
Tape Wrap — (PTFE, Polyester, etc.)

Shielding — (Silver Plated Copper, Tin Plated Copper, Nickel Plated Copper, Stainless Steel, etc.)

Braiding — (Cotton, Nylon, Glass, etc.)

Each department can produce a finished product or can function as an integral operation for more complex insulations.

Secondary operations include cabling, bonding, shielding, impregnating, striping, jacketing, etc., as well as developing insulated conductors for every application.



P.I.W serves as a prime source for the following types of wire and cable:

Air Frame Wire — (MIL-W-22759/9, 10, 11 & 12, Teflon)

Appliance Wire — (Teflon, Thermoplastic)

Business Machine Wire — (Teflon, Thermoplastic)

Building Wire — (Thermoplastic)

Cathodic Protection Cables — (High Molecular Weight Polyethylene, Teflon, Tefzel and Halar)

Coaxial Cables — (MIL-C-17D, Teflon Types)

Computer Wire — (Teflon, Tefzel, Halar, etc.)

Control Cables — (Multiconductor Cables, TFE and FEP Teflon, Tefzel, Halar, etc.)

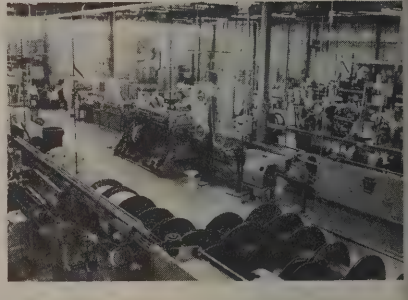
Fire Alarm Cables — (FEP Teflon)

Heating Cables and Electric Heating Wire — (Teflon, Thermoplastic)

Inter-communication Cables — (Thermoplastic)

Motor Lead Wire — (Teflon, Thermoplastic)

Organ Cables — (Thermoplastic)

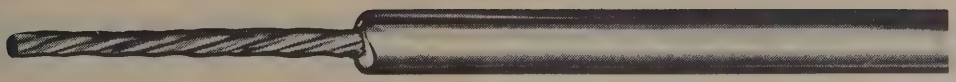


P.I.W. has the ability to insulate a wide range of conductors from 32 gauge to 750 MCM depending upon type of insulation. Flexibility allows P.I.W. to make long high speed production runs, and incorporates design changes to meet rapid technological advances.

Our specialized equipment results in minimum time loss with maximum reliability; a significant factor in holding down costs, and providing optimum deliveries.

The extent of P.I.W.'s manufacturing facilities and equipment are shown in the illustrations on this page.

# PIW LEADWIRE-TEFLON** MILITARY



**Stranded or Solid Silver Plated Copper Conductor Insulated with Extruded Tetrafluoroethylene (TFE)**

**MIL-W-16878****
+260°C Nickel Plated

**TYPE E***

**600 VOLTS**
+200°C Silver Plated

| Size | PIW Part Number | No. of Strands | Conductor Diameter | Finished Wire Diameter | Nominal Weight Lb/M' |
|---|---|---|---|---|---|
| 32 | 100-010-00 | *7 | .009 | .029 ±.004 | 0.80 |
| 30 | 100-012-10 | 1 | .010 | .030 ±.002 | 0.90 |
| 30 | 100-012-00 | *7 | .012 | .032 ±.004 | 1.05 |
| 28 | 100-014-10 | 1 | .013 | .033 ±.002 | 1.20 |
| 28 | 100-014-00 | *7 | .015 | .035 ±.004 | 1.35 |
| 28 | 100-015-99 | 19 | .015 | .035 ±.004 | 1.35 |
| 26 | 100-016-10 | 1 | .016 | .037 ±.002 | 1.60 |
| 26 | 100-016-00 | *7 | .019 | .039 ±.004 | 1.80 |
| 26 | 100-017-99 | 19 | .019 | .039 ±.004 | 1.85 |
| †24 | 100-018-10 | 1 | .020 | .042 ±.002 | 2.40 |
| †24 | 100-018-00 | *7 | .024 | .044 ±.004 | 2.50 |
| †24 | 100-019-99 | 19 | .024 | .044 ±.004 | 2.55 |
| †22 | 100-020-10 | 1 | .025 | .047 ±.002 | 3.15 |
| †22 | 100-020-00 | *7 | .030 | .050 ±.004 | 3.55 |
| †22 | 100-021-99 | 19 | .030 | .050 ±.004 | 3.60 |
| †20 | 100-022-10 | 1 | .032 | .054 ±.002 | 4.55 |
| †20 | 100-022-00 | *7 | .038 | .058 ±.004 | 5.10 |
| †20 | 100-023-99 | 19 | .038 | .058 ±.004 | 5.50 |
| †18 | 100-024-10 | 1 | .040 | .066 ±.002 | 7.00 |
| †18 | 100-024-00 | *7 | .048 | .068 ±.004 | 7.60 |
| †18 | 100-025-99 | 19 | .047 | .068 ±.004 | 7.85 |
| †16 | 100-026-99 | *19 | .053 | .077 ±.004 | 10.05 |
| †14 | 100-028-99 | *19 | .067 | .091 ±.004 | 15.05 |
| †12 | 100-030-99 | *19 | .084 | .110 ±.004 | 23.05 |
| †10 | 100-032-29 | *37 | .110 | .134 ±.004 | 34.05 |

* Minimum number of strands permitted by MIL-W-16878D, Type E.
† Also available in wrapped TFE tape providing long continuous lengths with no loss in properties.
** Also available in nickel plated copper.

**Standard Put Up 1000 Ft. Reels**

**Solid Colors in Stock**

**Striping — 1000 Ft. minimum per item**

**Voltage Rating 600V**
**Temperature Rating 200°C**
**Sparktest 3400V**
**Dielectric Test 2000V**
**Impulse Test 13.5KV Peak**
**Insulation Resistance 5000 Megohms/1000 Ft.**
**Coldbend 2 turns @ —65°C**
**Shrinkage 0.03" max. in 12" @ 290°C**

# PIW LEADWIRE-TEFLON** MILITARY

**P.I.W. Teflon hook-up wire is fabricated utilizing the most advanced techniques in extrusion and process control. The properties of Teflon, when combined with P.I.W. skill result in a product that can be used in severe temperature and environmental conditions. It has proven especially applicable to those situations requiring superior di-electric characteristics.**

## MIL-W-16878** TYPE ET* 250 VOLTS

+260°C Nickel Plated — +200°C Silver Plated

Stranded Silver Plated Copper Conductor Insulated With Extruded Tetrafluoroethylene (TFE)

| AWG | Stranding | PIW Part No. | Nominal Conductor Diameter (inch) | Finished Wire Diameter (inch) | Nominal Weight Lb/M' |
|---|---|---|---|---|---|
| 32 | 7/40 | 050-010-00 | .009 | .021 ±.002 | 0.50 |
| 30 | 7/38 | 050-012-00 | .012 | .024 ±.002 | 0.70 |
| 28 | 7/36 | 050-014-00 | .015 | .027 ±.002 | 0.95 |
| 28 | 19/40 | 050-015-99 | .015 | .027 ±.002 | 1.00 |
| 26 | 7/34 | 050-016-00 | .019 | .031 ±.002 | 1.40 |
| 26 | 19/38 | 050-017-99 | .019 | .031 ±.002 | 1.40 |
| *24 | 7/32 | 050-018-00 | .024 | .036 ±.002 | 2.05 |
| *24 | 19/36 | 050-019-99 | .024 | .036 ±.002 | 2.05 |
| *22 | 7/30 | 050-020-00 | .030 | .042 ±.002 | 3.00 |
| *22 | 19/34 | 050-021-99 | .030 | .042 ±.002 | 3.05 |

* Also available in wrapped TFE tape.

## MIL-W-16878** TYPE EE* 1000 VOLTS

+260°C Nickel Plated — +200°C Silver Plated

Stranded Silver Plated Copper Conductor Insulated With Extruded Tetrafluoroethylene (TFE)

| AWG | Stranding | PIW Part No. | Nominal Conductor Diameter (inch) | Finished Wire Diameter (inch) | Nominal Weight Lb/M' |
|---|---|---|---|---|---|
| 32 | 7/40 | 120-010-00 | .009 | .039 ±.004 | 1.30 |
| 30 | 7/38 | 120-012-00 | .012 | .042 ±.004 | 1.60 |
| 28 | 7/36 | 120-014-00 | .015 | .045 ±.004 | 1.95 |
| 26 | 7/34 | 120-016-00 | .019 | .049 ±.004 | 2.45 |
| 26 | 19/38 | 120-017-99 | .019 | .049 ±.004 | 2.50 |
| *24 | 7/32 | 120-018-00 | .024 | .054 ±.004 | 3.25 |
| *24 | 19/36 | 120-019-99 | .024 | .054 ±.004 | 3.25 |
| *22 | 7/30 | 120-020-00 | .030 | .060 ±.004 | 4.35 |
| *22 | 19/34 | 120-021-99 | .030 | .060 ±.004 | 4.40 |
| *20 | 7/28 | 120-022-00 | .038 | .068 ±.004 | 6.05 |
| *20 | 19/32 | 120-023-99 | .038 | .068 ±.004 | 6.25 |
| *18 | 7/26 | 120-024-00 | .048 | .079 ±.005 | 8.80 |
| *18 | 19/30 | 120-025-99 | .047 | .079 ±.005 | 9.05 |
| *16 | 19/29 | 120-026-99 | .053 | .089 ±.006 | 11.50 |
| *14 | 19/27 | 120-028-99 | .067 | .105 ±.008 | 17.05 |
| *12 | 19/25 | 120-030-99 | .084 | .124 ±.008 | 25.50 |
| *10 | 37/26 | 120-032-29 | .110 | .145 ±.008 | 36.35 |

* Also available in wrapped TFE tape.
** Also available in wrapped TFE tape providing long continuous lengths with no loss in properties.

# PIW TEFLON 80°C — 105°C UL STYLES 1212, 1213* UL

## UL 1212 80°C

| Part No. | Size | Strand | Wall Thick. | Nom. O.D. |
|---|---|---|---|---|
| 170-010-00 | 32 | 7/40 | .010 | .029 |
| 170-012-00 | 30 | 7/38 | .010 | .032 |
| 170-014-00 | 28 | 7/36 | .010 | .035 |
| 170-016-00 | 26 | 7/34 | .010 | .039 |
| 170-017-99 | 26 | 19/38 | .010 | .039 |
| 170-019-99 | 24 | 19/36 | .010 | .044 |
| 170-018-00 | 24 | 7/32 | .010 | .044 |
| 170-021-99 | 22 | 19/34 | .010 | .050 |
| 170-020-00 | 22 | 7/30 | .010 | .050 |
| 170-023-99 | 20 | 19/32 | .010 | .058 |
| 170-022-00 | 20 | 7/28 | .010 | .058 |

## UL 1213 105°C

| Part No. | Size | Strand | Wall Thick. | Nom. O.D. |
|---|---|---|---|---|
| 170-010-00 | 32 | 7/40 | .010 | .029 |
| 170-012-00 | 30 | 7/38 | .010 | .032 |
| 170-014-00 | 28 | 7/36 | .010 | .035 |
| 170-016-00 | 26 | 7/34 | .010 | .039 |
| 170-017-99 | 26 | 19/38 | .010 | .039 |
| 170-019-99 | 24 | 19/36 | .010 | .044 |
| 170-018-00 | 24 | 7/32 | .010 | .044 |
| 170-021-99 | 22 | 19/34 | .010 | .050 |
| 170-020-00 | 22 | 7/30 | .010 | .050 |
| 170-023-99 | 20 | 19/32 | .010 | .058 |
| 170-022-00 | 20 | 7/28 | .010 | .058 |

# PIW TEFLON 300 VOLTS 150°C — 200°C UL STYLES 1164, 1180* UL

## UL 1164 150°C

| Part No. | Size | Strand | Wall Thick. | Nom. O.D. |
|---|---|---|---|---|
| 176-014-00 | 28 | 7/36 | .0155 | .046 |
| 176-016-00 | 26 | 7/34 | .0155 | .050 |
| 176-017-99 | 26 | 19/38 | .0155 | .050 |
| 176-018-00 | 24 | 7/32 | .0155 | .055 |
| 176-019-99 | 24 | 19/36 | .0155 | .055 |
| 176-020-00 | 22 | 7/30 | .0155 | .061 |
| 176-021-99 | 22 | 19/34 | .0155 | .061 |
| 176-022-00 | 20 | 7/28 | .0155 | .069 |
| 176-023-99 | 20 | 19/32 | .0155 | .069 |
| 176-024-00 | 18 | 7/26 | .0155 | .079 |
| 176-025-99 | 18 | 19/30 | .0155 | .078 |
| 176-026-99 | 16 | 19/29 | .0155 | .084 |
| 176-028-99 | 14 | 19/27 | .0155 | .099 |
| 176-030-99 | 12 | 19/25 | .0155 | .116 |

## UL 1180 200°C

| Part No. | Size | Strand | Wall Thick. | Nom. O.D. |
|---|---|---|---|---|
| 176-014-00 | 28 | 7/36 | .0155 | .046 |
| 176-016-00 | 26 | 7/34 | .0155 | .050 |
| 176-017-99 | 26 | 19/38 | .0155 | .050 |
| 176-018-00 | 24 | 7/32 | .0155 | .055 |
| 176-019-99 | 24 | 19/36 | .0155 | .055 |
| 176-020-00 | 22 | 7/30 | .0155 | .061 |
| 176-021-99 | 22 | 19/34 | .0155 | .061 |
| 176-022-00 | 20 | 7/28 | .0155 | .069 |
| 176-023-99 | 20 | 19/32 | .0155 | .069 |
| 176-024-00 | 18 | 7/26 | .0155 | .079 |
| 176-025-99 | 18 | 19/30 | .0155 | .078 |
| 176-026-99 | 16 | 19/29 | .0155 | .084 |
| 176-028-99 | 14 | 19/27 | .0155 | .099 |
| 176-030-99 | 12 | 19/25 | .0155 | .116 |

# PIW TEFLON 600 VOLTS 150°C — 200°C UL STYLES 1198, 1199* UL

## UL 1198 150°C

| Part No. | Size | Strand | Wall Thick. | Nom. O.D. |
|---|---|---|---|---|
| 177-014-10 | 28 | Solid | .023 | .059 |
| 177-014-00 | 28 | 7/36 | .023 | .061 |
| 177-015-99 | 28 | 19/40 | .023 | .061 |
| 177-016-10 | 26 | Solid | .023 | .062 |
| 177-016-00 | 26 | 7/34 | .023 | .065 |
| 177-017-99 | 26 | 19/38 | .023 | .065 |
| 177-018-10 | 24 | Solid | .023 | .066 |
| 177-018-00 | 24 | 7/32 | .023 | .070 |
| 177-019-99 | 24 | 19/36 | .023 | .070 |
| 177-020-00 | 22 | 7/30 | .023 | .076 |
| 177-021-99 | 22 | 19/34 | .023 | .076 |

## UL 1199 200°C

| Part No. | Size | Strand | Wall Thick. | Nom. O.D. |
|---|---|---|---|---|
| 177-014-10 | 28 | Solid | .023 | .059 |
| 177-014-00 | 28 | 7/36 | .023 | .061 |
| 177-015-99 | 28 | 19/40 | .023 | .061 |
| 177-016-10 | 26 | Solid | .023 | .062 |
| 177-016-00 | 26 | 7/34 | .023 | .065 |
| 177-017-99 | 26 | 19/38 | .023 | .065 |
| 177-018-10 | 24 | Solid | .023 | .066 |
| 177-018-00 | 24 | 7/32 | .023 | .070 |
| 177-019-99 | 24 | 19/36 | .023 | .070 |
| 177-020-00 | 22 | 7/30 | .023 | .076 |
| 177-021-99 | 22 | 19/34 | .023 | .076 |

* Available CSA Approved

# ...UNICABLE
# It's the "NEW" idea in WIRE

MANUFACTURED BY

## Philadelphia Insulated Wire Co., Inc.

A revolutionary concept in insulated wire. A unique approach to meet the needs of back plane wire and miniature cable.

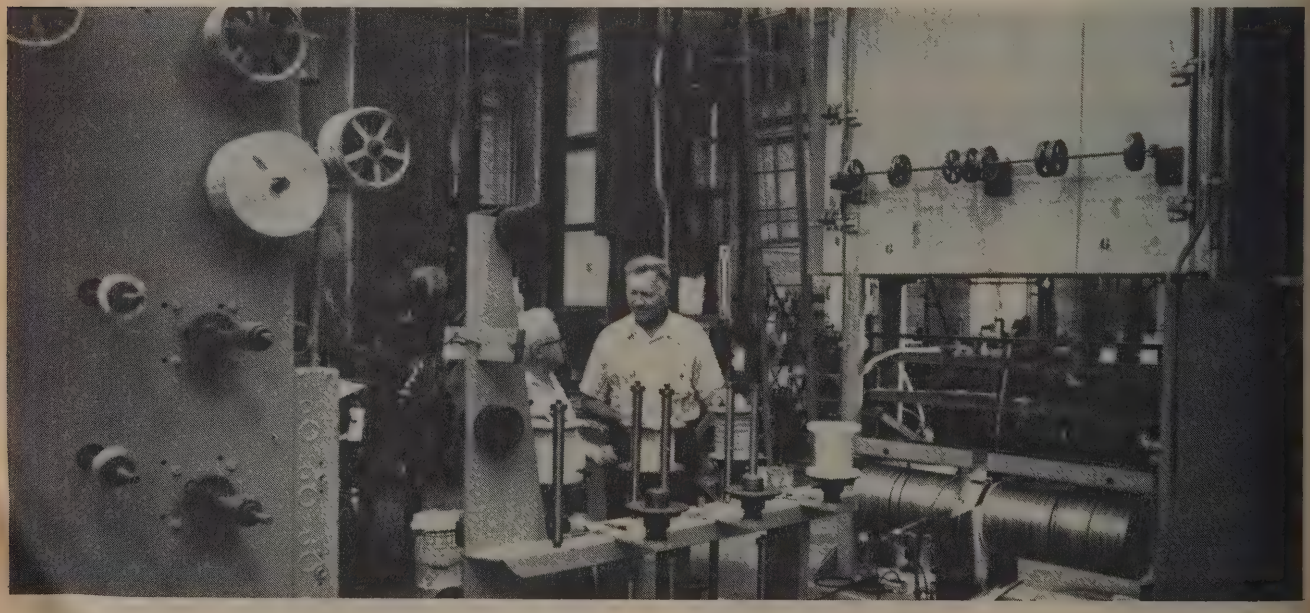
The Unicable Chemex insulation system is a series of thin wall insulated wires exhibiting outstanding mechanical and electrical properties. Its remarkable construction utilized liquid resin applied to the conductor in multiple coats, die wiped and oven cured to solid form.

This original design provides dimensional control and long-length availability which allows the economical operation of automatic solderless wire-wrap machines. It exhibits excellent cut-thru ability on sharp edges of wrap posts and the low-stiffness, low "pop-up" required for high density wiring patterns.

Other outstanding features include diameter tolerance control to well within plus or minus .001 inch and 70% concentricity; temperature rating of 105 degrees C.; dielectric constant not to exceed 3.4; and Oxygen Index ratings in excess of 29%.

This extraordinary wire exhibits no shrink-back on heat exposure of soldering or of high current overload at re-melt temperature of tin. It is available in long lengths on reels, averaging one slice per reel of 20 M ft. There are no limitations on conductor materials.

Unicable Chemex—a wiring system to electrify the industry.



# FIRE ALARM CONTROL CABLES

**INSULATED WITH "TEFLON" FEP**
**600 VOLT — 200°C RATING**

### APPLICATION:

These control cables have been designed for fire alarm and associated control circuits or control apparatus where maximum reliability is required. Typical application of these cables would be, floor warden and fire command control stations, smoke detection, voice communication, supervisory, and all associated systems.

### SPECIFICATIONS

I CONDUCTORS: Solid soft bare copper per ASTM B3. Also available in tin plated copper solid or stranded.

II PRIMARY INSULATION: Extruded Teflon F.E.P. per ASTMD-2116. Minimum insulation wall thickness .018" rated for 600 volt service at 200°C continuous operating temperature and conforming to U.L. approved wire.

### CODING

Individual pairs shall be color coded for easy identification. Coding can also be furnished in accordance with I.P.C.E.A. methods, if desired.

### CABLE LAY-UP

Individual pairs and cable lay are in accordance with standard commercial practice.

### JACKET

The jacket is Teflon F.E.P. .025" minimum wall thickness colored fire department red and is marked Fire Alarm Service at regular intervals for entire length.

### SHIELDING

To meet shielding requirements on individual pairs for voice communication and other applications, a shield consisting of aluminized/mylar plus a solid tin plated copper drain wire shall be applied. A conventional braided shield is also available if desired.

### NOTE:

Additional cable constructions conforming to Class "E" are available upon request.

### NON-SHIELDED CONSTRUCTION

| AWG | PIW Part Number | No. of Pairs | Nom. O.D. (Inches) | Nom. Weight Lbs./M' |
|---|---|---|---|---|
| 22 | 450-220-01 | 1 | .196 | 25 |
| 22 | 450-220-02 | 2 | .297 | 43 |
| 22 | 450-220-03 | 3 | .314 | 54 |
| 22 | 450-220-04 | 4 | .343 | 66 |
| 22 | 450-220-05 | 5 | .384 | 79 |
| 22 | 450-220-06 | 6 | .397 | 90 |
| 18 | 450-224-01 | 1 | .228 | 36 |
| 18 | 450-224-02 | 2 | .352 | 64 |
| 18 | 450-224-03 | 3 | .374 | 83 |
| 18 | 450-224-04 | 4 | .411 | 104 |
| 18 | 450-224-05 | 5 | .460 | 125 |
| 18 | 450-224-06 | 6 | .477 | 145 |
| 16 | 450-226-01 | 1 | .250 | 45 |
| 16 | 450-226-02 | 2 | .379 | 80 |
| 16 | 450-226-03 | 3 | .415 | 108 |
| 16 | 450-226-04 | 4 | .457 | 137 |
| 16 | 450-226-05 | 5 | .513 | 166 |
| 16 | 450-226-06 | 6 | .532 | 193 |
| 14 | 450-228-01 | 1 | .276 | 58 |
| 14 | 450-228-02 | 2 | .437 | 107 |
| 14 | 450-228-03 | 3 | .464 | 144 |
| 14 | 450-228-04 | 4 | .511 | 184 |
| 14 | 450-228-05 | 5 | .576 | 225 |
| 14 | 450-228-06 | 6 | .604 | 263 |

# CATHODIC PROTECTION CABLE

**HIGH MOLECULAR WEIGHT POLYETHYLENE** — Application — Industrial and Utility Plants

Construction — Single conductor, uncoated Copper conductor, Black Polyethylene Uni-Insulation and Jacket 600 Volts IPCEA Specification.

**Halar and High Molecular Weight Polyethylene**

The cable is available in #8 AWG copper conductor with 20 mils of Halar primary insulation and a 40, 50, 60, 70, 80 or 90 mils of H.M.W.P.

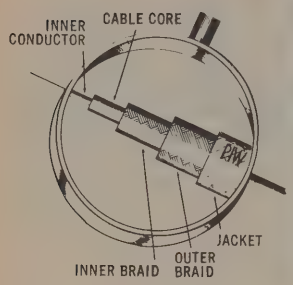
Application — Deep well ground beds where chlorine gas from brakish water attacks and deteriorates cable.

| PIW Product Number | Size AWG | Stranding | Insulation Thickness Inches | Approx. O.D. Inches | Approx. Shipping Weight Lbs./M Ft. |
|---|---|---|---|---|---|
| 370-034-00 | 8 | 7 | 7/64 | .364 | 88 |
| 370-036-00 | 6 | 7 | 7/64 | .402 | 123 |
| 370-038-00 | 4 | 7 | 7/64 | .450 | 179 |
| 370-040-00 | 2 | 7 | 7/64 | .510 | 265 |

PIW's high temperature insulations provide a unique combination of toughness, abrasion and resistance to the chemical reaction of soil corrosives. Whether your system utilizes deep wells or parallel ground beds; no matter what the condition or chemical composition of the soil — PIW's cable is designed to outlast all the other components of your system. These cables are available in 6 and 8 AWG; 7 strand Bare or Tinned Copper, various wall thicknesses. Other sizes available on special request.

* Cathodic Protection Cable also available in various insulations including Tefzel and FEP Teflon. Consult PIW technical staff for further information.

# PIW RG/U TYPE COAXIAL CABLES




| Impedance Group | PIW Part No. | RG/U Type | MIL-C-17 Spec. Sheet | Inner Conductor | Cable Core | Outer Conductor | Moisture Seal |
|---|---|---|---|---|---|---|---|
| a | 160-224-00 | 142B/U | 60B | Type 1 .039 ±.001 In. | Type F-1 .116 ±.005 In. | Double Braid AWG 36 Type 3 | — |
| b | 160-512-12 | 178B/U | 93C | Type 2 7 x .004 In. .012 In. Nom. | Type F-1 .034 ±.002 In. | Single Braid AWG 38 Type 3 | — |
| c | 160-316-11 | 188A/U | 69B | Type 2 7 x .0067 In. .020 In. Nom. | Type F-1 .060 ±.003 In. | Single Braid AWG 38 Type 3 | — |
| d | 160-312-11 | 196A/U | 71B | Type 2 7 x .004 In. .012 In. Nom. | Type F-1 .034 ±.002 In. | Single Braid AWG 38 Type 3 | — |
| e | 160-512-10 | 179B/U | 94D | Type 2 7 x .004 In. .012 In. Nom. | Type F-1 .063 ±.003 In. | Single Braid AWG 38 Type 3 | Two Wraps .005 x .5 In. Type F-2 |
| f | 160-312-10 | 187A/U | 68C | Type 2 7 x .004 In. .012 In. Nom. | Type F-1 .063 ±.003 In. | Single Braid AWG 38 Type 3 | — |

## REQUIREMENTS

1. Dielectric strength
   5,000 volts, rms, minimum.
2. Corona
   1,900 volts, rms, minimum.
3. Attenuation
   9.0 db/100-ft. maximum at 400 mc.
4. Impedance
   50 ±2 ohms.

## CONSTRUCTION DETAILS

**Inner conductor**
Silver-covered copper-covered steel wire. Overall diameter, 0.039 ±0.001 inch.

**Cable core**
Type F-1 Teflon®. Overall diameter, 0.116 ±0.005 inch.

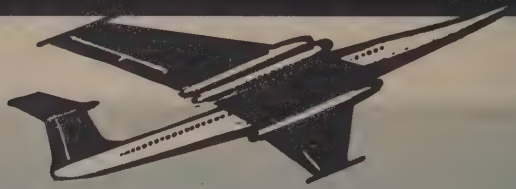
**Outer conductor**
Double braid, AWG size 36 silver-covered copper wire. Overall diameter, 0.171 inch maximum.

**Inner braid**
Carriers ..... 16
Ends ..... 7
Picks/Inch .... 14.5, ±10 percent

**Outer braid**
Carriers ..... 16
Ends ..... 7
Picks/Inch .... 14.5, ±10 percent

**Jacket**
Type IX, Extruded Fluorinated Ethylene Propylene. Overall diameter, 0.195 ±0.005 inch. Minimum wall thickness, 0.012 inch.

# PIW AIRCRAFT TEFLON, TFE INSULATION



In keeping with the PIW policy of upgrading our product lines, we have QPL listing on the following products.

| Government Designation | Manufacturer's Designation | Government Designation | Manufacturer's Designation |
|---|---|---|---|
| MIL-W-22759/9-28 | PIW 192-015-99 | MIL-W-22759/10-18 | PIW 193-025-98 |
| -26 | 017 | -16 | 026 |
| -24 | 019 | -14 | 028 |
| -22 | 021 | -12 | 030 |
| -20 | 023 | -10 | 032 |
| -18 | 025 | MIL-W-22759/20-28 | PIW 194-014-08 |
| -16 | 026 | -26 | 194-017-95 |
| -14 | 028 | -24 | 019-95 |
| -12 | 030 | -22 | 021-95 |
| -10 | 032 | -20 | 023-95 |
| MIL-W-22759/10-28 | PIW 193-015-98 | MIL-W-22759/21-28 | PIW-195-014-04 |
| -26 | 017 | -26 | 017-98 |
| -24 | 019 | -24 | 019-98 |
| -22 | 021 | -22 | 021-98 |
| -20 | 023 | -20 | 023-98 |

# PIW RG/U TYPE COAXIAL CABLES

| Impedance Group | Jacket | Weight Lb/M' | Dielectric Strength Volts (RMS) Min. | Corona Ignition Volts (RMS) Min. | Attenuation db/100' @ 400 Mc. Max. | Capacitance PF/FT Nom. | Velocity % Nom. | Impedance OHMS | Cross Reference |
|---|---|---|---|---|---|---|---|---|---|
| a | Type IX .195 ±.005 In. .012 In. Min. Wall | 45.00 | 5000 | 1900 | 9.0 | 29 | 70 | 50 ±2 | — |
| b | Type IX .075 In. Max. .007 In. Min. Wall | 5.50 | 2000 | 1000 | 29.0 | 30 | 68 | 50 ±2 | Same as RG-196A/U Except Jacket |
| c | Type VII .110 In. Max. .010 In. Min. Wall | 11.50 | 2000 | 1200 | 20.0 | 30 | 68 | 50 ±2 | Same as RG-316/U Except Jacket |
| d | Type VII .080 In. Max. .010 In. Min. Wall | 5.50 | 2000 | 1000 | 29.0 | 30 | 68 | 50 ±2 | Same as RG-178B/U Except Jacket |
| e | Type IX .100 ±.005 In. .007 In. Min. Wall | 10.00 | 2000 | 1200 | 21.0 | 20 | 68 | 75 ±2 | Same as RG-187A/U Except Jacket |
| f | Type VII .110 In. Max. .010 In. Min. Wall | 10.25 | 2000 | 1200 | 21.0 | 20 | 68 | 75 ±3 | Same as RG-179B/U Except Jacket |

### CONDUCTOR TYPE

Type 1 — Silver Covered, Copper Covered, Steel Wire
Type 2 — Silver Covered, Annealed Copper Covered, Steel Wire
Type 3 — Silver Covered, Copper Wire

### INSULATION TYPE

Type F-1 — Solid Polytetrafluoroethylene
Type F-2 — Taped Polytetrafluoroethylene

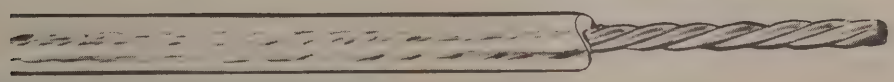
### JACKET TYPE

Type V — Silicone Impregnated Fiberglass
Type VII — Taped Polytetrafluoroethylene
Type IX — Extruded Fluorinated Ethylene Propylene

### POLYTETRAFLUOROETHYLENE DATA

Dielectric Constant* — 2.1 Maximum
Power Factor* — .0005 Maximum
Temperature Range — −70°C to +250°C
* When measured between 50 mc and 100 mc

# PIW AIRCRAFT TEFLON, TFE INSULATION



Wire indicated is normally white that meets all requirements of MIL-STD-104. Other colors must be specified on the purchase order, and when supplied will meet all requirements of MIL-STD-681.

## MIL-W-22759/11** — 600 Volts — MS-21985** — +200°C (SPC)

| AWG | Stranding | Nom. Cond. Diam. (inch) | Max. Cond. Resist. ohms/M' 20°C | Finished Wire Diameter (inch) | Nom. Weight Lb/M' | PIW Part No. |
|---|---|---|---|---|---|---|
| 28 | 7/36 | .015 | 63.80 | .033 ±.002 | 1.25 | 196-014-00 |
| 26 | 19/38 | .019 | 38.40 | .038 ±.002 | 1.80 | 196-016-99 |
| 24 | 19/36 | .024 | 24.30 | .043 ±.002 | 2.45 | 196-019-99 |
| 22 | 19/34 | .030 | 15.10 | .049 ±.002 | 3.50 | 196-021-99 |
| 20 | 19/32 | .038 | 9.19 | .058 ±.002 | 5.30 | 196-023-99 |
| 18 | 19/30 | .047 | 5.79 | .068 ±.002 | 7.85 | 196-025-99 |
| 16 | 19/29 | .053 | 4.52 | .075 ±.002 | 9.80 | 196-026-99 |

## MIL-W-22759/12** — 600 Volts — MS-21986** — +260°C (NPC)

| AWG | Stranding | Nom. Cond. Diam. (inch) | Max. Cond. Resist. ohms/M' 20°C | Finished Wire Diameter (inch) | Max. Weight Lb/M' | PIW Part No. |
|---|---|---|---|---|---|---|
| 28 | 7/36 | .015 | 67.90 | .033 ±.002 | 1.25 | 197-014-04 |
| 26 | 19/38 | .019 | 42.20 | .038 ±.002 | 1.80 | 197-016-98 |
| 24 | 19/36 | .024 | 25.90 | .043 ±.002 | 2.45 | 197-019-98 |
| 22 | 19/34 | .030 | 16.00 | .049 ±.002 | 3.50 | 197-021-98 |
| 20 | 19/32 | .038 | 9.77 | .058 ±.002 | 5.30 | 197-023-98 |
| 18 | 19/30 | .047 | 6.10 | .068 ±.002 | 7.85 | 197-025-98 |
| 16 | 19/29 | .053 | 4.76 | .075 ±.002 | 9.80 | 197-026-98 |

** Latest revision

# PIW SHIELDED TEFLON* CABLES

## TEFLON Impregnated Braid/Over Shield

**DESCRIPTION:** Each conductor stranded silver plated copper, Type E extruded .010" TFE Teflon insulation, color coded, cabled braided silver plated copper shield, 90% coverage, braided white fused Teflon impregnated, fiberglass braid overall.

**CHARACTERISTICS:** Temperature rating −65°C to +200°C. Voltage rating 600 volts. Resistant to acids, alkalis, oil, flame, moisture, solvents and fungus.

| PIW Part No. | No. of Cond. | Conductor Size | Conductor Strand | Nom. O.D. (inch) | Nom. Cap. in MMF Shield to Cond. | Nom. Cap. in MMF Cond. to Cond. |
|---|---|---|---|---|---|---|
| 101-419-02 | 1 | 24 | 19/36 | .083 | 45 | — |
| 102-419-01 | 2 | 24 | 19/36 | .125 | 35 | 25 |
| 103-419-01 | 3 | 24 | 19/36 | .132 | 35 | 20 |
| 104-419-01 | 4 | 24 | 19/36 | .143 | 35 | 20 |
| 101-421-01 | 1 | 22 | 19/34 | .088 | 55 | — |
| 102-421-01 | 2 | 22 | 19/34 | .131 | 45 | 25 |
| 103-421-01 | 3 | 22 | 19/34 | .144 | 35 | 25 |
| 104-421-02 | 4 | 22 | 19/34 | .158 | 35 | 25 |
| 101-423-01 | 1 | 20 | 19/32 | .097 | 55 | — |
| 102-423-02 | 2 | 20 | 19/32 | .153 | 95 | 25 |
| 103-423-01 | 3 | 20 | 19/32 | .162 | 85 | 25 |
| 104-423-02 | 4 | 20 | 19/32 | .177 | 140 | 30 |
| 101-425-01 | 1 | 18 | 19/30 | .108 | 70 | — |
| 102-425-02 | 2 | 18 | 19/30 | .175 | 60 | 35 |
| 103-425-00 | 3 | 18 | 19/30 | .186 | 60 | 35 |
| 104-425-02 | 4 | 18 | 19/30 | .203 | 55 | 35 |
| 101-426-00 | 1 | 16 | 19/29 | .118 | 107 | — |
| 102-426-02 | 2 | 16 | 19/29 | .195 | 67 | 35 |

**STANDARD PUT UP: 1000 FT. SPOOLS**
Color Code of Conductors: 1—White 2—Black 3—Red 4—Green

## TEFLON FEP Extruded Jacket/Over Shield

**DESCRIPTION:** Each conductor stranded silver plated copper, Type E extruded TFE insulation color coded, cabled, braided silver plated copper shield 90% coverage, extruded FEP white Teflon jacket overall.

**CHARACTERISTICS:** Temperature rating −65°C to +200°C. Voltage rating 600 volts. Resistant to acids, alkalis, oil, flame, moisture, solvents and fungus. Extruded FEP Teflon jacket is tough and abrasion resistant.

| PIW Part No. | No. of Cond. | Conductor Size | Conductor Strand | Nom. Wall Thick. (inch) | Nom. Jacket Thick. (inch) | Nom. O.D. (inch) | Nom. Cap. in MMF Shield to Cond. | Nom. Cap. in MMF Cond. to Cond. |
|---|---|---|---|---|---|---|---|---|
| 101-219-15 | 1 | 24 | 19/36 | .010 | .010 | .084 | 45 | — |
| 102-219-10 | 2 | 24 | 19/36 | .010 | .010 | .126 | 35 | 25 |
| 103-219-08 | 3 | 24 | 19/36 | .010 | .010 | .133 | 35 | 20 |
| 101-221-01 | 1 | 22 | 19/34 | .010 | .010 | .090 | 55 | — |
| 102-221-03 | 2 | 22 | 19/34 | .010 | .014 | .146 | 45 | 25 |
| 103-221-09 | 3 | 22 | 19/34 | .010 | .014 | .154 | 35 | 25 |
| 101-223-02 | 1 | 20 | 19/32 | .010 | .014 | .106 | 55 | — |
| 102-223-02 | 2 | 20 | 19/32 | .010 | .014 | .162 | 95 | 25 |
| 103-223-02 | 3 | 20 | 19/32 | .010 | .014 | .171 | 85 | 25 |
| 101-225-03 | 1 | 18 | 19/30 | .010 | .014 | .117 | 70 | — |
| 102-225-03 | 2 | 18 | 19/30 | .010 | .014 | .184 | 60 | 35 |
| 103-225-03 | 3 | 18 | 19/30 | .010 | .014 | .195 | 60 | 35 |
| 101-226-03 | 1 | 16 | 19/29 | .012 | .014 | .127 | 107 | — |
| 102-226-07 | 2 | 16 | 19/29 | .012 | .014 | .204 | 67 | 25 |
| 101-228-01 | 1 | 14 | 19/27 | .012 | .014 | .141 | — | — |
| 102-228-01 | 2 | 14 | 19/27 | .012 | .014 | .232 | — | — |

**STANDARD PUT UP: 1000 FT. SPOOLS**
Color Code of Conductors: 1—White 2—Black 3—Red

* DuPont Registered Trademark

## No Outer Covering Over Shield
## UL Style 1212, 1213 or Type E, MIL-W-16878

**DESCRIPTION:** Each conductor stranded silver plated copper, Type E extruded TFE .010" insulation, braided silver plated copper shield over conductor(s), 90% coverage.

**CHARACTERISTICS:** Temperature rating −65°C to +200°C. Voltage rating 600 volts. Resistant to acids, alkalis, oil, flame, moisture, solvents and fungus.

| PIW Part No. | No. of Cond. | Conductor Size | Conductor Strand | Nom. O.D. (inch) | Nom. Cap. in MMF Shield to Cond. | Nom. Cap. in MMF Cond. to Cond. |
|---|---|---|---|---|---|---|
| 101-119-00 | 1 | 24 | 19/36 | .060 | 45 | — |
| 102-119-00 | 2 | 24 | 19/36 | .106 | 35 | 25 |
| 103-119-00 | 3 | 24 | 19/36 | .113 | 35 | 20 |
| 104-119-00 | 4 | 24 | 19/36 | .124 | 35 | 20 |
| 101-121-00 | 1 | 22 | 19/34 | .070 | 55 | — |
| 102-121-00 | 2 | 22 | 19/34 | .118 | 45 | 25 |
| 103-121-00 | 3 | 22 | 19/34 | .126 | 35 | 25 |
| 104-121-00 | 4 | 22 | 19/34 | .138 | 35 | 25 |
| 101-123-00 | 1 | 20 | 19/32 | .078 | 55 | — |
| 102-123-00 | 2 | 20 | 19/32 | .134 | 95 | 25 |
| 103-123-00 | 3 | 20 | 19/32 | .143 | 85 | 25 |
| 104-123-00 | 4 | 20 | 19/32 | .158 | 140 | 30 |
| 101-125-00 | 1 | 18 | 19/30 | .089 | 70 | — |
| 102-125-00 | 2 | 18 | 19/30 | .156 | 60 | 35 |
| 103-125-00 | 3 | 18 | 19/30 | .167 | 60 | 35 |
| 104-125-00 | 4 | 18 | 19/30 | .184 | 55 | 35 |
| 101-126-00 | 1 | 16 | 19/29 | .099 | 107 | — |
| 102-126-00 | 2 | 16 | 19/29 | .195 | 67 | 35 |

**STANDARD PUT UP: 1000 FT. SPOOLS**
Color Code of Conductors: 1—White 2—Black 3—Red 4—Green

## TEFLON TFE Tape Wrapped Jacket/Over Shield

**DESCRIPTION:** Each conductor stranded silver plated copper, Type E extruded TFE Teflon insulation, color coded, cabled, braided silver plated copper shield, 90% coverage, sintered wrapped white Teflon tape jacketed overall.

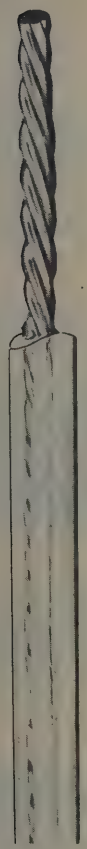
**CHARACTERISTICS:** Temperature rating −65°C to +200°C. Voltage rating 600 volts. Resistant to acids, alkalis, oil, flame, moisture, solvents and fungus.

| PIW Part No. | No. of Cond. | Conductor Size | Conductor Strand | Nom. Jacket Thick. (inch) | Nom. O.D. (inch) | Nom. Cap. in MMF Shield to Cond. | Nom. Cap. in MMF Cond. to Cond. |
|---|---|---|---|---|---|---|---|
| 101-219-14 | 1 | 24 | 19/36 | .010 | .087 | 45 | — |
| 102-219-09 | 2 | 24 | 19/36 | .010 | .129 | 35 | 25 |
| 103-219-07 | 3 | 24 | 19/36 | .010 | .140 | 35 | 20 |
| 104-219-02 | 4 | 24 | 19/36 | .010 | .150 | 35 | 20 |
| 101-221-00 | 1 | 22 | 19/34 | .014 | .093 | 55 | — |
| 102-221-06 | 2 | 22 | 19/34 | .014 | .145 | 45 | 25 |
| 103-221-07 | 3 | 22 | 19/34 | .014 | .153 | 35 | 25 |
| 104-221-02 | 4 | 22 | 19/34 | .014 | .164 | 35 | 25 |
| 101-223-09 | 1 | 20 | 19/32 | .014 | .101 | 55 | — |
| 102-223-01 | 2 | 20 | 19/32 | .014 | .161 | 95 | 25 |
| 103-223-04 | 3 | 20 | 19/32 | .014 | .170 | 85 | 25 |
| 104-223-04 | 4 | 20 | 19/32 | .014 | .186 | 140 | 30 |
| 101-225-04 | 1 | 18 | 19/30 | .014 | .116 | 70 | — |
| 102-225-04 | 2 | 18 | 19/30 | .014 | .183 | 60 | 35 |
| 103-225-04 | 3 | 18 | 19/30 | .014 | .194 | 60 | 35 |
| 104-225-04 | 4 | 18 | 19/30 | .014 | .211 | 55 | 35 |
| 101-226-02 | 1 | 16 | 19/29 | .014 | .126 | 107 | — |
| 102-226-02 | 2 | 16 | 19/29 | .014 | .202 | 67 | 25 |
| 101-228-02 | 1 | 14 | 19/27 | .014 | .140 | — | — |
| 102-228-02 | 2 | 14 | 19/27 | .014 | .230 | — | — |

**STANDARD PUT UP: 1000 FT. SPOOLS**
Color Code of Conductors: 1—White 2—Black 3—Red

# PIW TEFLON-FEP MILITARY

P.I.W. can furnish FEP Insulated wires in multiconductor cables. Shielding and Jacket materials can be selected which will best meet your particular requirements.



## MIL-W-16878** TYPE K 600 VOLTS +200°C Silver Plated

| AWG | Stranding | Nominal Conductor Diameter (inch) | Max. Conductor Resist. ohms/M' 25°C | Finished Wire Diameter (inch) | Nominal Weight Lb/M' | PIW Part No. |
|---|---|---|---|---|---|---|
| 32 | 7/40 | .009 | 179.00 | .029 ±.004 | 0.80 | 400-010-00 |
| 30 | 7/38 | .012 | 111.00 | .032 ±.004 | 1.05 | 400-012-00 |
| 28 | 7/36 | .015 | 69.00 | .035 ±.004 | 1.35 | 400-014-00 |
| 26 | 7/34 | .019 | 42.90 | .039 ±.004 | 1.80 | 400-016-00 |
| 26 | 19/38 | .019 | 42.90 | .039 ±.004 | 1.85 | 400-017-99 |
| 24 | 7/32 | .024 | 26.80 | .044 ±.004 | 2.50 | 400-018-00 |
| 24 | 19/36 | .024 | 26.80 | .044 ±.004 | 2.55 | 400-019-99 |
| 22 | 7/30 | .030 | 16.70 | .050 ±.004 | 3.50 | 400-020-00 |
| 22 | 19/34 | .030 | 16.70 | .050 ±.004 | 3.55 | 400-021-99 |
| 20 | 7/28 | .038 | 10.50 | .058 ±.004 | 5.10 | 400-022-00 |
| 20 | 19/32 | .038 | 10.50 | .058 ±.004 | 5.25 | 400-023-99 |
| 18 | 7/26 | .048 | 6.57 | .068 ±.004 | 7.55 | 400-024-00 |
| 18 | 19/30 | .047 | 6.57 | .068 ±.004 | 7.80 | 400-025-99 |
| 16 | 19/29 | .053 | 4.85 | .077 ±.004 | 10.00 | 400-026-99 |
| 14 | 19/27 | .067 | 3.05 | .091 ±.004 | 15.00 | 400-028-99 |
| 12 | 19/25 | .084 | 1.92 | .110 ±.004 | 23.00 | 400-030-99 |
| 10 | 37/26 | .110 | 1.24 | .132 ±.005 | 34.25 | 400-032-29 |

## MIL-W-16878** TYPE KK 1000 VOLTS +200°C Silver Plated

| AWG | Stranding | Nominal Conductor Diameter (inch) | Max. Conductor Resist. ohms/M' 25°C | Finished Wire Diameter (inch) | Nominal Weight Lb/M' | PIW Part No. |
|---|---|---|---|---|---|---|
| 32 | 7/40 | .009 | 179.00 | .039 ±.004 | 1.30 | 420-010-00 |
| 30 | 7/38 | .012 | 111.00 | .042 ±.004 | 1.60 | 420-012-00 |
| 28 | 7/36 | .015 | 69.00 | .045 ±.004 | 1.90 | 420-014-00 |
| 26 | 7/34 | .019 | 42.90 | .049 ±.004 | 2.45 | 420-016-00 |
| 26 | 19/38 | .019 | 42.90 | .049 ±.004 | 2.50 | 420-017-99 |
| 24 | 7/32 | .024 | 26.80 | .054 ±.004 | 3.20 | 420-018-00 |
| 24 | 19/36 | .024 | 26.80 | .054 ±.004 | 3.25 | 420-019-99 |
| 22 | 7/30 | .030 | 16.70 | .060 ±.004 | 4.30 | 420-020-00 |
| 22 | 19/34 | .030 | 16.70 | .060 ±.004 | 4.35 | 420-021-99 |
| 20 | 7/28 | .038 | 10.50 | .068 ±.004 | 6.00 | 420-022-00 |
| 20 | 19/32 | .038 | 10.50 | .068 ±.004 | 6.20 | 420-023-99 |
| 18 | 7/26 | .048 | 6.57 | .079 ±.005 | 8.75 | 420-024-00 |
| 18 | 19/30 | .047 | 6.57 | .079 ±.005 | 9.00 | 420-025-99 |
| 16 | 19/29 | .053 | 4.85 | .088 ±.005 | 11.30 | 420-026-99 |
| 14 | 19/27 | .067 | 3.05 | .104 ±.007 | 16.80 | 420-028-99 |
| 12 | 19/25 | .084 | 1.92 | .123 ±.007 | 25.20 | 420-030-99 |
| 10 | 37/26 | .110 | 1.24 | .145 ±.008 | 36.25 | 420-032-29 |
| 8 | 133/29 | .161 | 0.68 | .207 ±.010 | 64.50 | 420-034-49 |

** Latest revision
All items also available with Tin Plated Conductors

## PIW QUALITY CONTROL

Each product manufactured by P.I.W. will meet or exceed all customers' specification, standards of reliability, and quality.

To insure this pledge our quality control system is equipped with the latest test equipment. P.I.W.'s Quality Control Department monitors our production process from raw material to finished product. The Philadelphia Insulated Wire Company, Inc., guarantees its product.

The heart of our production operation is the Quality Control Department. The test and measuring equipment throughout P.I.W. facilities is calibrated to comply with Military Specifications.

Standards and production processes are checked and inspected at every key stage of manufacture.

Together with production control, our laboratory engages in advanced product development and government QPL testing. Every procedure is supervised by carefully trained and experienced technicians and inspectors.

# PIW TEFLON GLASS HOOK-UP WIRE MIL-W-16878 — LATEST REVISION

| AWG | Stranding | Nom. O.D. | 600 V. Type E Nom. | 1000 V. Type EE Nom. |
|---|---|---|---|---|
| 28 | 7/36 | .015 | .054 | .064 |
| 26 | 7/34 | .019 | .058 | .068 |
| 26 | 19/38 | .019 | .058 | .068 |
| 24 | 7/32 | .024 | .063 | .073 |
| 24 | 19/36 | .024 | .063 | .073 |
| 22 | 7/30 | .030 | .069 | .079 |
| 22 | 19/34 | .030 | .069 | .079 |
| 20 | 7/28 | .038 | .077 | .087 |
| 20 | 19/32 | .038 | .077 | .087 |
| 18 | 7/26 | .048 | .087 | .097 |
| 18 | 19/30 | .047 | .087 | .097 |
| 16 | 19/29 | .053 | .092 | .102 |
| 16 | 65/34 | .062 | .101 | .111 |
| 14 | 19/27 | .067 | .106 | .116 |
| 14 | 41/30 | .080 | .119 | .129 |
| 12 | 19/25 | .084 | .123 | .133 |
| 12 | 65/30 | .096 | .135 | .145 |
| 10 | 37/26 | .110 | .149 | .159 |
| 10 | 105/30 | .130 | .169 | .179 |

**Fused, spiral tape wrapped wire with a Teflon impregnated glass yarn braid. The glass braid offers additional protection where cut through and added abrasion resistance are particularly important.**

| | |
|---|---|
| **Government Spec** | MIL-W-16878D — Latest Revision |
| **Operating Temperature** | +200°C |
| **Operating Voltage** | Type E — 600 volts RMS<br>Type EE — 1000 volts RMS |
| **Construction** | Conductors - Silver coated copper conductor<br>Insulation - Fused tape wrapped, with Teflon impregnated glass yarn braid.<br>Colors - Standard colors available to MIL-STD 104. Other colors available on request. |
| **Special Constructions** | Available on request. |

# PIW TEFLON (FEP) CONTROL CABLE

**Teflon (FEP) insulated control cables can be used in steel mills, chemical plants, oil refineries and in other industries where control and signal circuits are exposed to high ambient temperature and corrosive chemical environments.**

**The ability of FEP to operate continuously at temperatures up to 400°F and its resistance to water, oil, grease and most chemicals make this an ideal insulation for applications where severe environmental conditions are encountered.**

TEMPERATURE: Continuous service up to 400°F and for short periods up to 550°F.

ELECTRICAL: Excellent electrical properties, low dielectric constant (2.1), exceptionally high insulation resistance.

CHEMICAL: FEP is resistant to all known chemicals and solvents other than molten alkali metals and fluorine at elevated temperatures. Water absorption — .01%.

NYLON JACKET: Either an extruded nylon jacket or a nylon braid and lacquer can be furnished for abrasion protection. The protection afforded by the nylon is effective up to 300°F for a limited time.

CONSTRUCTION: Conductors: #18.

AWG 19/30 Silver-plated or Tin-plated Copper.

Insulation: Teflon 100 FEP.

Cabling: Individual conductors are concentrically cabled with glass fillers to give a uniformly smooth appearance. A glass tape is applied over the cable core when necessary.

Inner Jacket: Teflon 100 FEP.

Outer Jacket: Will be designed to fit the particular application of this cable. Jackets of extruded nylon or braided nylon and lacquer impregnation can be furnished where abrasion is unusually severe and temperatures encountered are below 300°F. Double glass braids can be furnished where abrasion is not severe and continuous service up to 400°F is needed.

## FEP Control Cables #18 AWG 19/30 S.P. Copper - 1/64" FEP FEP — Cabled with Glass Fillers — Glass Tape — FEP Inner Jacket — Outer Jacket

| No. Cond. | Nom. Fin. O.D. |
|---|---|
| 2 | .198 |
| 3 | .211 |
| 4 | .239 |
| 5 | .261 |
| 6 | .284 |
| 7 | .290 |
| 8 | .314 |
| 9 | .338 |
| 10 | .368 |
| 12 | .383 |

Other gauges or constructions can be manufactured to customer specifications or to fit specialized applications. We invite you to call on our technical sales staff for help with your control cable problems.

# PIW FIXTURE WIRE "TEFLON" FEP

Applications: Designed for installation in lighting fixtures and in similar equipment where they are enclosed or protected and not subject to bending or twisting in use. They can also be used for connecting lighting fixtures to the conductors of the circuit that supplies the fixtures but are not intended for use as branch circuit conductors.

## Type PF — 200°C, 600 Volt, Single Conductor

| AWG | Insulation Thickness (inches) | Nominal Wire O.D. (inches) 7 Stranded | Approximate Weight Lb/M' 7 Stranded |
|---|---|---|---|
| 18 | .020 | .088 | 9.85 |
| 16 | .020 | .100 | 13.85 |
| 14 | .020 | .113 | 19.00 |

## Type PFF — 150°C, 600 Volt, Single Conductor

| AWG | Insulation Thickness (inches) | Nominal Wire O.D. (inches) 19 Stranded | Approximate Weight Lb/M' 19 Stranded |
|---|---|---|---|
| 18 | .020 | .087 | 9.95 |
| 16 | .020 | .093 | 12.00 |
| 14 | .020 | .107 | 17.30 |

Conductor — Tin Coated Copper

## Type PGF — 200°C, 600 Volt, Single Conductor

| AWG | Insulation Thickness (inches) FEP | Insulation Thickness (inches) Braid | Nominal Wire O.D. (inches) 7 Stranded | Approximate Weight Lb/M' 7 Stranded |
|---|---|---|---|---|
| 18 | .014 | .006 | .093 | 9.45 |
| 16 | .014 | .006 | .105 | 13.35 |
| 14 | .014 | .006 | .118 | 18.50 |

## Type PGFF — 150°C, 600 Volt, Single Conductor

| AWG | Insulation Thickness (inches) FEP | Insulation Thickness (inches) Braid | Nominal Wire O.D. (inches) 19 Stranded | Approximate Weight Lb/M' 19 Stranded |
|---|---|---|---|---|
| 18 | .014 | .006 | .092 | 9.65 |
| 16 | .014 | .006 | .098 | 11.50 |
| 14 | .014 | .006 | .112 | 16.50 |

Insulation — "Teflon" FEP

# PIW GENERAL PURPOSE WIRE "TEFLON" FEP

Applications: Designed for such industrial applications as infrared ovens, industrial ovens, high-wattage lighting fixtures, motor lead wire, rheostat wire, signal and control wire, locomotive headlight and control wiring around boilers, heaters, drying rooms—and scores of other industrial applications in the 200°C range.

**NATIONAL ELECTRICAL CODE LISTED WIRE**
**Type FEP**
200°C, 600 Volt, Single Conductor

| Wire Size (AWG) | Insulation Thickness (inches) | Nominal Wire O.D. (inches) Stranded | Approximate Weight Lb/M' |
|---|---|---|---|
| 14 | .020 | .112 | 16.50 |
| 12 | .020 | .124 | 25.40 |
| 10 | .020 | .150 | 37.35 |
| 8 | .030 | .202 | 69.00 |
| 6 | .030 | .239 | 87.60 |
| 4 | .030 | .292 | 159.50 |
| 2 | .030 | .356 | 240.60 |

Typical Dimensional Comparisons — 1978 National Electrical Code

| Wire Size (AWG) | Type FEP | Type FEPB | Type SA | Type AIA | RHH |
|---|---|---|---|---|---|
| 14 | .105 | .105 | .243 | .214 | .204 |
| 12 | .121 | .121 | .260 | .231 | .221 |
| 10 | .142 | .142 | .281 | .252 | .242 |
| 8 | .206 | .186 | .340 | .278 | .311 |
| 6 | .244 | .302 | .399 | .394 | .397 |
| 4 | .292 | .350 | .447 | .442 | .452 |
| 2 | .352 | .410 | .507 | .502 | .513 |

Note: #14 - #8 solids; #6 - #2 stranded. Approximate Diameter - Inches.

**NATIONAL ELECTRICAL CODE LISTED WIRE**
**Type FEPB**
200°C, 600 Volt, Single Conductor

Braided glass #14 - #8

| Wire Size (AWG) | Insulation Thickness (inches) | Braid Thickness (inches) | Nominal Wire O.D. (inches) Stranded | Approximate Weight Lb/M' |
|---|---|---|---|---|
| 14 | .014 | .006 | .112 | 16.50 |
| 12 | .014 | .006 | .129 | 24.70 |
| 10 | .014 | .006 | .155 | 33.25 |
| 8 | .014 | .006 | .187 | 66.25 |

Typical Comparisons for Number of Wires in Trade-Size Conduit or Tubing

| Size (AWG) | ½" Conduit 14 | 12 | 10 | 1" Conduit 14 | 12 | 10 | 8 | 6 | 2" Conduit 14 | 10 | 8 | 6 | 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FEP | 13 | 10 | 7 | 39 | 29 | 21 | 12 | 7 | 154 | 84 | 47 | 29 | 13 |
| FEPB | 13 | 10 | 7 | 39 | 29 | 21 | 15 | 4 | 154 | 84 | 59 | 18 | 10 |
| AIA | 3 | 2 | 2 | 9 | 8 | 6 | 5 | 2 | 37 | 26 | 22 | 11 | 6 |
| SA | 2 | 2 | 1 | 7 | 6 | 5 | 3 | 1 | 29 | 21 | 14 | 10 | 6 |
| RHH | 3 | 3 | 2 | 10 | 8 | 7 | 4 | 2 | 41 | 29 | 17 | 10 | 6 |

Note: FEPB and FEP from 1978 National Electrical Code rewiring tables. Other numbers calculated per 1978 National Electrical Code rewiring requirements.

# PIW HOOK-UP WIRE-TEFZEL

## STRANDED or SOLID SILVER PLATED COPPER CONDUCTOR

| Size | PIW Part No. | Conductor Stranding | Conductor Diameter | Diameter Over Insulation Nominal |
|---|---|---|---|---|
| 30 | 630-012-10 | Solid | .010 | .030 |
| 30 | 630-012-00 | 7/38 | .012 | .032 |
| 28 | 630-014-10 | Solid | .013 | .033 |
| 28 | 630-014-00 | 7/36 | .015 | .035 |
| 28 | 630-015-99 | 19/40 | .015 | .035 |
| 26 | 630-016-10 | Solid | .016 | .036 |
| 26 | 630-016-00 | 7/34 | .019 | .039 |
| 26 | 630-017-99 | 19/38 | .019 | .039 |
| 24 | 630-018-10 | Solid | .020 | .040 |
| 24 | 630-018-00 | 7/32 | .024 | .044 |
| 24 | 630-019-99 | 19/36 | .024 | .044 |
| 22 | 630-020-10 | Solid | .025 | .045 |
| 22 | 630-020-00 | 7/30 | .030 | .050 |
| 22 | 630-021-99 | 19/34 | .030 | .050 |
| 20 | 630-022-10 | Solid | .032 | .052 |
| 20 | 630-022-00 | 7/28 | .038 | .058 |
| 20 | 630-023-99 | 19/32 | .038 | .058 |
| 18 | 630-024-00 | 7/26 | .048 | .068 |
| 18 | 630-025-99 | 19/30 | .047 | .067 |
| 16 | 630-026-99 | 19/29 | .053 | .077 |
| 14 | 630-028-99 | 19/27 | .067 | .091 |
| 12 | 630-030-99 | 19/25 | .084 | .108 |
| 10 | 630-032-29 | 37/26 | .110 | .134 |

Sizes larger than 10 AWG available upon request. Also available in Tin Copper Conductor.
* DuPont's Registered Trademark.

**Insulated with Extruded ETFE*. (Ethylene Tetrafluoroethylene)**

**ALSO AVAILABLE IN CONTROL CABLES**

# PIW HOOK-UP WIRE-HALAR*

## STRANDED or SOLID SILVER PLATED COPPER CONDUCTOR

**Insulated with Extruded E-CTFE* (Ethylene-chlorotri-Fluorethylene Copolymer)**

**ALSO AVAILABLE IN CONTROL CABLES**

| Size | Conductor Stranding | Conductor Diameter | Diameter Over Insulation Nominal |
|---|---|---|---|
| 30 | Solid | .010 | .030 |
| 30 | 7/38 | .012 | .032 |
| 28 | Solid | .013 | .033 |
| 28 | 7/36 | .015 | .035 |
| 28 | 19/40 | .015 | .035 |
| 26 | Solid | .016 | .036 |
| 26 | 7/34 | .019 | .039 |
| 26 | 19/38 | .019 | .039 |
| 24 | Solid | .020 | .040 |
| 24 | 7/32 | .024 | .044 |
| 24 | 19/36 | .024 | .044 |
| 22 | Solid | .025 | .045 |
| 22 | 7/30 | .030 | .050 |
| 22 | 19/34 | .030 | .050 |
| 20 | Solid | .032 | .052 |
| 20 | 7/28 | .038 | .058 |
| 20 | 19/32 | .038 | .058 |
| 18 | 7/26 | .048 | .068 |
| 18 | 19/30 | .047 | .067 |
| 16 | 19/29 | .053 | .077 |
| 14 | 19/27 | .067 | .091 |
| 12 | 19/25 | .084 | .108 |
| 10 | 37/26 | .110 | .134 |

Sizes larger than 10 AWG available upon request. Also available in Tin Copper Conductor.
* Allied Chemical's Registered Trademark.

# MILITARY—PVC HOOK-UP WIRE

***Military — PVC MIL-W-16878**

## MIL-W-16878** TYPE B (PVC) 600 Volts - 105°C and TYPE BN (PVC/Nylon Jacket)

| Conductor | | | | Type B Insulation | | Type BN Insulation | |
|---|---|---|---|---|---|---|---|
| AWG | Minimum Stranding* | Nominal Diameter (inch) | Maximum D.C. Res. ohms/M' at 25°C | Insulation Diameter (inch) | PIW Part No. | Nylon Jacket Diameter Increase (inch) | PIW Part No. |
| 32 | 7/40 | .009 | 179.00 | .028 ±.003 | 200-010-01 | .006 ±.002 | 200-210-00N |
| 30 | 7/38 | .012 | 111.00 | .031 ±.003 | 200-012-01 | .006 ±.002 | 200-212-00N |
| 28 | 7/36 | .015 | 69.00 | .034 ±.003 | 200-014-01 | .006 ±.002 | 200-214-00N |
| 26 | 7/34 | .019 | 42.90 | .038 ±.003 | 200-016-01 | .006 ±.002 | 200-216-00N |
| 24 | 7/32 | .024 | 26.80 | .043 +.004 −.003 | 200-018-01 | .006 ±.002 | 200-218-00N |
| 22 | 7/30 | .030 | 16.70 | .049 +.004 −.003 | 200-020-01 | .006 ±.002 | 200-220-00N |
| 20 | 7/28 | .038 | 10.50 | .057 +.004 −.003 | 200-022-01 | .006 ±.002 | 200-222-00N |
| 18 | 7/26 | .048 | 6.57 | .067 +.004 −.003 | 200-024-01 | .006 ±.002 | 200-224-00N |
| 16 | 19/29 | .053 | 4.85 | .077 ±.004 | 200-026-97 | .006 ±.002 | 200-226-00N |
| 14 | 19/27 | .067 | 3.05 | .091 ±.004 | 200-028-97 | .007 ±.002 | 200-228-00N |

## MIL-W-16878** TYPE C (PVC) 1000 Volts - 105°C and TYPE CN (PVC/Nylon Jacket)

| Conductor | | | | Type C Insulation | | Type CN Insulation | |
|---|---|---|---|---|---|---|---|
| AWG | Minimum Stranding* | Nominal Diameter (inch) | Maximum D.C. Res. ohms/M' at 25°C | Insulation Diameter (inch) | PIW Part No. | Nylon Jacket Diameter Increase (inch) | PIW Part No. |
| 26 | 7/34 | .019 | 42.90 | .053 ±.004 | 210-016-01 | .006 ±.002 | 210-216-00N |
| 24 | 7/32 | .024 | 26.80 | .058 ±.004 | 210-018-01 | .006 ±.002 | 210-218-00N |
| 22 | 7/30 | .030 | 16.70 | .064 ±.004 | 210-020-01 | .006 ±.002 | 210-220-00N |
| 20 | 7/28 | .038 | 10.50 | .072 ±.004 | 210-022-01 | .006 ±.002 | 210-222-00N |
| 18 | 7/26 | .048 | 6.57 | .082 ±.004 | 210-024-01 | .007 ±.002 | 210-224-00N |
| 16 | 19/29 | .053 | 4.85 | .091 ±.004 | 210-026-97 | .007 ±.002 | 210-226-00N |
| 14 | 19/27 | .067 | 3.05 | .105 ±.004 | 210-028-97 | .007 ±.002 | 210-228-00N |
| 12 | 19/25 | .084 | 1.92 | .124 ±.004 | 210-030-97 | .009 ±.003 | 210-230-00N |

## MIL-W-16878** TYPE D (PVC) 3000 Volts - 105°C and TYPE DN (PVC/Nylon Jacket)

| Conductor | | | | Type D Insulation | | Type DN Insulation | |
|---|---|---|---|---|---|---|---|
| AWG | Minimum Stranding* | Nominal Diameter (inch) | Maximum D.C. Res. ohms/M' at 25°C | Insulation Diameter (inch) | PIW Part No. | Nylon Jacket Diameter Increase (inch) | PIW Part No. |
| 24 | 7/32 | .024 | 26.80 | .082 +.008 −.007 | 220-018-01 | .007 ±.002 | 220-218-00N |
| 22 | 7/30 | .030 | 16.70 | .088 +.008 −.007 | 220-020-01 | .007 ±.002 | 220-220-00N |
| 20 | 7/28 | .038 | 10.50 | .096 +.008 −.007 | 220-022-01 | .007 ±.002 | 220-222-00N |
| 18 | 7/26 | .048 | 6.57 | .106 +.008 −.007 | 220-024-01 | .007 ±.002 | 220-224-00N |
| 16 | 19/29 | .053 | 4.85 | .115 +.008 −.007 | 220-026-97 | .007 ±.002 | 220-226-00N |
| 14 | 19/27 | .067 | 3.05 | .129 +.008 −.007 | 220-028-97 | .009 ±.003 | 220-228-00N |
| 12 | 19/25 | .084 | 1.92 | .161 +.008 −.007 | 220-030-97 | .012 ±.004 | 220-230-00N |
| 10 | 37/26 | .110 | 1.24 | .181 +.008 −.007 | 220-032-27 | .012 ±.004 | 220-232-00N |
| 8 | 133/29 | .166 | 0.73 | .246 +.008 −.007 | 220-034-47 | .018 ±.006 | 220-234-00N |

** Latest revision

# MILITARY—PVC HOOK-UP WIRE

## MIL-W-76

### MIL-W-76** TYPE MW (PVC) 1000 Volts - 80°C and TYPE MWN (PVC/Nylon Jacket)

| Conductor | | | | Type MW Insulation | | Type MWN Insulation | |
|---|---|---|---|---|---|---|---|
| AWG | Minimum Stranding* | Maximum Diameter (inch) | Maximum D.C. Res.† ohms/M' at 20°C | Insulation Diameter (inch) | PIW Part No. | Nylon Jacket Diameter Increase (inch) | PIW Part No. |
| 24 | 7/32 | .024 | 28.40 | .056 ±.006 | 270-018-01 | .004 $^{+.002}_{-.001}$ | 270-218-00 |
| 22 | 7/30 | .030 | 19.00 | .062 ±.006 | 270-020-01 | .005 $^{+.002}_{-.001}$ | 270-220-00 |
| 20 | 7/28 | .038 | 13.12 | .070 ±.006 | 270-022-01 | .006 ±.002 | 270-222-00 |
| 18 | 16/30 | .050 | 7.89 | .082 ±.006 | 270-024-02 | .007 ±.002 | 270-224-00 |
| 16 | 19/29 | .053 | 4.97 | .085 ±.006 | 270-026-97 | .007 $^{+.003}_{-.002}$ | 270-226-00 |
| 14 | 19/27 | .067 | 3.13 | .099 ±.006 | 270-028-97 | .009 ±.003 | 270-228-00 |
| 12 | 19/25 | .084 | 1.92 | .116 ±.006 | 270-030-97 | .010 $^{+.004}_{-.003}$ | 270-230-00 |
| 10 | 37/26 | .110 | 1.27 | .142 ±.006 | 270-032-27 | .012 ±.004 | 270-232-00 |
| 8 | 133/29 | .166 | 0.73 | .198 ±.006 | 270-034-47 | .018 ±.006 | 270-234-00 |

### MIL-W-76** TYPE LW (PVC) 300 Volts - 80°C and TYPE LWN (PVC/Nylon Jacket)

| Conductor | | | | Type LW Insulation | | Type LWN Insulation | |
|---|---|---|---|---|---|---|---|
| AWG | Minimum Stranding* | Maximum Diameter (inch) | Maximum D.C. Res.† ohms/M' at 20°C | Insulation Diameter (inch) | PIW Part No. | Nylon Jacket Diameter Increase (inch) | PIW Part No. |
| 30 | 7/38 | .012 | 73.60 | .032 ±.004 | 260-012-01 | .004 $^{+.002}_{-.001}$ | 260-212-00 |
| 28 | 7/36 | .015 | 70.00 | .035 ±.004 | 260-014-01 | .004 $^{+.002}_{-.001}$ | 260-214-00 |
| 26 | 7/34 | .019 | 49.00 | .039 ±.004 | 260-016-01 | .004 $^{+.002}_{-.001}$ | 260-216-00 |
| 24 | 7/32 | .024 | 28.40 | .044 ±.004 | 260-018-01 | .004 $^{+.002}_{-.001}$ | 260-218-00 |
| 22 | 7/30 | .030 | 19.00 | .050 ±.004 | 260-020-01 | .004 $^{+.002}_{-.001}$ | 260-220-00 |
| 20 | 7/28 | .038 | 13.12 | .058 ±.004 | 260-022-01 | .004 $^{+.002}_{-.001}$ | 260-222-00 |

### MIL-W-76** TYPE HW (PVC) (AWG 22 to AWG 16) 2500 Volts - 80°C (AWG 14 to AWG 8) 600 Volts - 80°C and TYPE HWN (PVC/Nylon Jacket)

| Conductor | | | | Type HW Insulation | | Type HWN Insulation | |
|---|---|---|---|---|---|---|---|
| AWG | Minimum Stranding* | Maximum Diameter (inch) | Maximum D.C. Res.† ohms/M' at 20°C | Insulation Diameter (inch) | PIW Part No. | Nylon Jacket Diameter Increase (inch) | PIW Part No. |
| 22 | 7/30 | .030 | 19.00 | .092 ±.005 | 280-020-01 | .007 $^{+.003}_{-.002}$ | 280-220-00 |
| 20 | 7/28 | .038 | 13.12 | .100 ±.005 | 280-022-01 | .007 $^{+.003}_{-.002}$ | 280-222-00 |
| 18 | 16/30 | .050 | 7.89 | .112 ±.005 | 280-024-02 | .007 $^{+.003}_{-.002}$ | 280-224-00 |
| 16 | 19/29 | .053 | 4.97 | .115 ±.005 | 280-026-97 | .007 $^{+.003}_{-.002}$ | 280-226-00 |
| 14 | 19/27 | .067 | 3.13 | .129 ±.005 | 280-028-97 | .013 ±.003 | 280-228-00 |
| 12 | 19/25 | .084 | 1.92 | .146 ±.005 | 280-030-97 | .013 ±.003 | 280-230-00 |
| 10 | 37/26 | .110 | 1.27 | .172 ±.005 | 280-032-27 | .013 ±.003 | 280-232-00 |
| 8 | 133/29 | .166 | 0.73 | .228 ±.005 | 280-034-47 | .013 ±.003 | 280-234-00 |

# PIW UL LISTINGS

**BELOW ARE LISTED THE UL APPROVALS MANUFACTURED BY PIW**

**ALL PVC ELECTRONIC HOOK-UP WIRE ALSO AVAILABLE IN CSA STYLE TEW 600V OR 300V TR32 OR TR64**

## TEFLON TFE UL STYLES

| STYLE | DESCRIPTION | SIZE |
|---|---|---|
| 1164 | 150°C 300 Volts 13 Mils Min Avg TFE 12 Mils Any Point | 32-10 |
| 1180 | 200°C 300 Volts 13 Mils Min Avg TFE 12 Mils any Point | 32-10 |
| 1198 | 150°C 600 Volts 20 Mils Min Avg TFE 18 Mils Min Any Point | 30-10 |
| 1199 | 200°C 600 Volts 20 Mils Min Avg TFE 18 Mils Min Any Point | 30-10 |
| 1212 | 80°C No Voltage 8 Mils Min Avg TFE 7 Mils Min Any Point | 32-20 |
| 1213 | 105°C No Voltage 8 Mils Min Avg TFE 7 Mils Min Any Point | 32-20 |
| 1371 | 105°C No Voltage 5.5 Mils Min Avg 5 Mils Min Any Point | 32-20 |
| 1525 | 200°C 150 Volts 8 Mils Min Avg 2 Mils Min Avg ML | 32-16 |
| 1538 | 105°C 125 Volts 5.5 Mils Min Avg 5 Mils Min Any Point | 32-20 |

## TEFLON FEP UL STYLES

| | | |
|---|---|---|
| 1226 | 80°C No Voltage 8 Mils Min Avg FEP 7 Mils Min Any Point | 32-20 |
| 1292 | 105°C No Voltage 6 Mils Min Avg FEP 3 Mils Min Avg Nyl | 30-20 |
| 1293 | 105°C No Voltage 10 Mils Min Avg FEP 2 Mils Min Avg Nyl | 30-20 |
| 1294 | 80°C No Voltage 10 Mils Min Avg FEP 2 Mils Min Any Point | 30-20 |
| 1330 | 200°C 600 Volts 20 Mils Min Avg FEP 18 Mils Min Any Point | 30-10 |
| 1331 | 150°C 600 Volts 20 Mils Min Avg FEP 18 Mils Min Any Point | 30-10 |
| 1332 | 200°C 300 Volts 13 Mils Min Avg FEP 12 Mils Min Any Point | 30-10 |
| 1333 | 150°C 300 Volts 13 Mils Min Avg FEP 12 Mils Any Point | 30-10 |
| 1371 | 105°C No Voltage 5.5 Mils Min Avg FEP 5 Mils Any Point | 32-20 |
| 1419 | 105°C No Voltage 24 Mils Min Avg Shield 8 Mils Min Avg FEP | 30-16 |
| 1538 | 105°C 125 Volts TFE or FEP 5.5 Mils Min Avg 5 Mils Min Any Point | 32-20 |

## PVC UL STYLES

| | | |
|---|---|---|
| 1001 | 80°C 300 Volts 9 Mils Min Avg PVC 7 Mils Any Point | 30-16 |
| 1004 | 80°C No Volts 8 Mils Min Avg PVC 2 Mils Min Nyl or L. B. | 30-16 |
| 1005 | 90°C No Voltage 8 Mils Min Avg PVC 2 Mils Min Nyl or L.B. | 30-16 |
| 1006 | 105°C No Voltage 8 Mils Min Avg PVC 2 Mils Min Nyl or L.B. | 30-16 |
| 1007 | 80°C 300 Volts 15 Mils Min Avg PVC 13 Mils Min Any Point | 32-16 |
| 1008 | 80°C 300 Volts 15 Mils Min Avg PVC 2 Mils Min Nyl or L. B. | 28-16 |
| 1009 | 90°C 300 Volts 15 Mils Min Avg PVC 2 Mils Min Nyl or L. B. | 28-16 |
| 1010 | 105°C 300 Volts 15 Mils Min Avg PVC 2 Mils Min Nyl or L. B. | 28-16 |
| 1011 | 80°C 600 Volts 30 Mils Min Avg PVC 27 Mils Min Any Point | 28-9 |
| 1012 | 80°C 600 Volts 30 Mils Min Avg PVC 2 Mils Min Nyl or L. B. | 28-9 |
| 1013 | 90°C 600 Volts 30 Mils Min Avg PVC 27 Mils Min Any Point | 28-9 |
| 1014 | 90°C 600 Volts 30 Mils Min Avg PVC 2 Mils Min Nyl or L. B. | 28-9 |
| 1015 | 105°C 600 Volts 30 Mils Min Avg PVC 27 Mils Min Any Point | 28-9 |
| 1016 | 105°C 600 Volts 30 Mils Min Avg PVC 2 Mils Min Nyl or L. B. | 28-9 |
| 1017 | 80°C 600 Volts 45 Mils Min Avg PVC | 22-8 |
| 1018 | 80°C 600 Volts 45 Mils Min Avg PVC 2 Mils Nylon | 8-6 |
| 1024 | 90°C 600 Volts 45 Mils Min Avg PVC | 22-8 |
| 1025 | 90°C 600 Volts 45 Mils Min Avg PVC 2 Mils Nylon | 8-6 |
| 1030 | 80°C, 1,000 VAC & 1,200 VDC Nom 30 Mils PVC No Cover | 26-10 |
| 1031 | 80°C, 1,000 VAC & 1,200 VDC Nom 30 Mils PVC 2 Mils Nyl | 26-10 |
| 1061 | 80°C 300 Volts Nom 9 Mils PVC 7 Mils Min Any Point | 30-16 |
| 1083 | 90°C 600 Volts Nom 31 Mils PVC 3 Mils Nylon | Size on wattage |
| 1095 | 80°C 300 Volts 12 Mils Min Avg PVC 9.5 Min Any Point | 30-16 |
| 1096 | 80°C 300 Volts Nom 12 Mils PVC 2 Mils Nylon | 26-16 |
| 1108 | 80°C 300 Volts Nom 15 Mils Tin Copper Braid PVC Jacket | 30-16 |
| 1116 | 80°C 600 Volts Nom 31 Mils PVC 31 Mils PVC Jacket | 28-12 |

## PVC UL STYLES (Cont.)

| | | |
|---|---|---|
| 1194 | 90°C 250 Volts Nom 31 Mils PVC 3 Mils Min Nylon | Size on wattage |
| 1195 | 80°C 300 Volts Nom 15 Mils PVC 13 Mils Min Any Point | 30-14 |
| 1208 | 80°C 300 Volts 13 Mils PVC 12 Mils Min Any Point | 30-16 |
| 1216 | 90°C 250 Volts 30 Mils PVC 27 Mils Min Any Point | Size on wattage |
| 1219 | 90°C 250 Volts 30 Mils PVC 27 Mils Min Any Point | Size on wattage |
| 2095 | 80°C 300 Volts 2 Cond's 15 Mils PVC Shield PVC JKT | 32 Min |
| 2096 | 80°C 300 Volts 2-6 Cond's 15 Mils PVC Shield PVC JKT | 30-16 |
| 2097 | 80°C 300 Volts 4 Cond's 15 Mils PVC Shield PVC JKT | 30-16 |
| 2115 | 80°C 600 Volts 26-16 2 Cond's 31 Mils PVC Sh 31 Mils PVC J | 26-16 |
| 2116 | 80°C 600 Volts 26-16 3 Cond's 31 Mils PVC Sh 31 Mils PVC J | 26-16 |
| 2117 | 80°C 600 Volts 4 Cond's 31 Mils PVC Shld 31 Mils PVC JKT | 26-16 |
| 2343 | 80°C No Voltage Computer Cable PVC Jacket 60 Mils | 30 Min |
| 2344 | 80°C No Voltage Computer Cable PVC Jacket 80 Mils | 30 Min |
| 2345 | 80°C No Voltage Computer Cable PVC Jacket 110 Mils | 30 Min |
| 2346 | 80°C No Voltage Computer Cable PVC Jacket 140 Mils | 30 Min |
| 2384 | 60°C 30 Volts Computer Cable PVC Jacket 35 Mils | 40 Min |
| 2385 | 60°C 30 Volts Computer Cable PVC Jacket 60 Mils | 40 Min |
| 2386 | 60°C 30 Volts Computer Cable PVC Jacket 80 Mils | 40 Min |
| 2387 | 60°C 30 Volts Computer Cable PVC Jacket 110 Mils | 40 Min |
| 2448 | 60°C 30 Volts Computer Cable PVC Jacket | 40 Min |
| 2461 | 80°C 300 Volts 2 to 61 Conds PVC Jacket | 26-16 |
| 2462 | 60°C 300 Volts 2 to 61 Conds PVC Jacket | 24-16 |
| 2463 | 80°C 600 Volts 2 to 100 Conds PVC Jacket | 32-10 |
| 2464 | 80°C 300 Volts Multi Conds Braided PVC Jacket | Not specified |
| 2490 | 60°C No Voltage Multi Conds Braided PVC Jacket | Not specified |
| 2493 | 60°C No Voltage Multi Conds Braided PVC Jacket | 30-16 |
| 2507 | 105°C No Voltage 2 to 100 Conds 7 Mils FEP Teflon | 32-26 |

## POLYETHYLENE UL STYLES

| | | |
|---|---|---|
| 1113 | 60°C 600 Volts 31 Mils Poly Shield 31 Mil PVC Jacket | 26-16 |
| 1354 | 60°C 30 Volts Poly Coaxial Cable | 40 Min |
| 2106 | 60°C 600 Volts 2 Cond's 30 Mils Poly Shield 30 Mils PVC Jkt | 26-12 |
| 2107 | 60°C 600 Volts 3 Cond's 30 Mils Poly Shield 30 Mils PVC Jkt | 26-12 |
| 2108 | 60°C 600 Volts 4 Cond's 30 Mils Poly Shield 30 Mils PVC Jkt | 26-16 |

## TEFZEL UL STYLE

| | | |
|---|---|---|
| 1587 | 125°C No Voltage 4 Mils Min Avg CTFE | 32-20 |

## BRAIDED GLASS HOOK-UP UL STYLES

| | | |
|---|---|---|
| 5002 | 90°C 300 Volts 2 Wraps Butyrate Tape with 7 Mils Min Wall Glass Braid Lacquer | 26-14 |
| 5003 | 90°C 300 Volts 3 Wraps Butyrate Tape with 11 Mils Min Wall 2 Glass Braids Lacquer | 26-14 |
| 5004 | 90°C 300 Volts 2 Wraps Butyrate Tape with 7 Mils Min Wall Soft Cotton Braid Lacquer | 26-14 |
| 5048 | 105°C 600 Volts Lead Wire for Hermetic Motors 0.5 Mylar Tape between Dacron Braids | 20-4 |
| 5058 | 105°C 600 Volts Same as style 5048 except added 2.0 Teflon Tape | 20-8 |

# PIW BUSINESS MACHINE WIRE

| Rating | Conductor | Insulation | Jacket |
|---|---|---|---|
| 80°C, 300V | #30 — #16, Solid or Stranded, Tinned or Bare Copper | .009 Semi-Rigid PVC | None |

## UL STYLE 1061
## PVC Insulation
## STRANDED CONDUCTOR

| PIW Part No. | Size AWG | Conductor Stranding | Nominal Conductor O.D. | Nominal Finished O.D. | Nominal Weight Lb/M' |
|---|---|---|---|---|---|
| 390-012-01 | 30 | 7/38 | .012 | .032 ±.002 | .80 |
| 390-014-01 | 28 | 7/36 | .015 | .035 ±.002 | 1.05 |
| 390-016-01 | 26 | 7/34 | .019 | .039 ±.002 | 1.45 |
| 390-018-01 | 24 | 7/32 | .024 | .044 ±.002 | 2.10 |
| 390-020-01 | 22 | 7/30 | .030 | .050 ±.002 | 3.10 |
| 390-022-01 | 20 | 7/28 | .038 | .058 ±.002 | 4.50 |
| 390-024-01 | 18 | 7/26 | .048 | .068 ±.002 | 6.80 |
| 390-026-97 | 16 | 19/29 | .053 | .073 ±.002 | 8.80 |

## SOLID CONDUCTOR

| PIW Part No. | Size AWG | Conductor Stranding | Nominal Conductor O.D. | Nominal Finished O.D. | Nominal Weight Lb/M' |
|---|---|---|---|---|---|
| 390-012-11 | 30 | Solid | .010 | .030 ±.002 | .70 |
| 390-014-11 | 28 | Solid | .013 | .033 ±.002 | .95 |
| 390-016-11 | 26 | Solid | .016 | .036 ±.002 | 1.25 |
| 390-018-11 | 24 | Solid | .020 | .040 ±.002 | 1.80 |
| 390-020-11 | 22 | Solid | .025 | .045 ±.002 | 2.60 |
| 390-022-11 | 20 | Solid | .032 | .052 ±.002 | 3.90 |
| 390-024-11 | 18 | Solid | .040 | .060 ±.002 | 5.90 |
| 390-026-11 | 16 | Solid | .051 | .071 ±.002 | 8.95 |

## BACK PANEL WIRE TEFLON TFE INSULATION
## UL STYLE — 1371 — 105°C

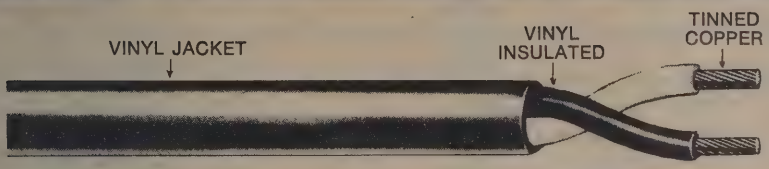
| AWG | Conductor Strand | Nom. Wall Thick. | Nom. O.D. | Min. O.D. | Max. O.D. | Part No. |
|---|---|---|---|---|---|---|
| 30 | Solid SPC | .0055 | .023 | .021 | .025 | 070-012-00 |
| 28 | Solid SPC | .0055 | .026 | .024 | .028 | 070-014-00 |
| 26 | Solid SPC | .0055 | .029 | .027 | .031 | 070-016-00 |
| 24 | Solid SPC | .0055 | .033 | .031 | .035 | 070-018-00 |

## BACK PANEL WIRE TEFLON FEP/NYLON JACKET
## UL STYLE — 1292 — 105°C

| AWG | Conductor Strand | Nom. Wall Thick. | Nom. Jacket Thick. | Nom. O.D. | Min. O.D. | Max. O.D. | Part No. |
|---|---|---|---|---|---|---|---|
| 26 | Solid SPC* | .0065 | .004 | .037 | .035 | .039 | 475-216-00 |
| 24 | Solid SPC* | .0065 | .004 | .041 | .039 | .043 | 475-218-00 |

* Conductor May Be Tin Coated Copper.

# PIW COMPUTER AND CONTROL CABLE UNSHIELDED




**Cable Rated at 80°C, 300 Volts**
**1061 Conductors, 600 Volts, 80°C**

**Stranded tinned copper conductor, .010″ color-coded PVC insulation. Cabled singly or in pairs, gray vinyl jacket overall.**

## UNSHIELDED MULTI-CONDUCTOR CABLES

### 24 GAUGE

NOM. O.D. CONDUCTOR — .044″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 7/32

| PIW Part No. | No. of Conductors | Nom. O.D. |
|---|---|---|
| 396-218-05 | 5 | .245 |
| 396-218-07 | 7 | .258 |
| 396-218-12 | 12 | .309 |
| 396-218-15 | 15 | .333 |
| 396-218-19 | 19 | .346 |
| 396-218-27 | 27 | .397 |
| 396-218-37 | 37 | .434 |
| 396-218-48 | 48 | .485 |
| 396-218-60 | 60 | .506 |

### 22 GAUGE

NOM. O.D. CONDUCTOR — .050″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 7/30

| PIW Part No. | No. of Conductors | Nom. O.D. |
|---|---|---|
| 396-220-05 | 5 | .261 |
| 396-220-07 | 7 | .276 |
| 396-220-12 | 12 | .334 |
| 396-220-15 | 15 | .362 |
| 396-220-19 | 19 | .376 |
| 396-220-27 | 27 | .434 |
| 396-220-37 | 37 | .476 |
| 396-220-48 | 48 | .534 |
| 396-220-60 | 60 | .546 |

### 20 GAUGE

NOM. O.D. CONDUCTOR — .058″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 19/32

| PIW Part No. | No. of Conductors | Nom. O.D. |
|---|---|---|
| 396-222-05 | 5 | .283 |
| 396-222-07 | 7 | .300 |
| 396-222-12 | 12 | .367 |
| 396-222-15 | 15 | .399 |
| 396-222-19 | 19 | .416 |
| 396-222-27 | 27 | .483 |
| 396-222-37 | 37 | .532 |
| 396-222-48 | 48 | .599 |
| 396-222-60 | 60 | .613 |

## UNSHIELDED PAIRED CABLES

### 24 GAUGE

NOM. O.D. CONDUCTOR — .044″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 7/32

| PIW Part No. | No. of Pairs | Nom. O.D. |
|---|---|---|
| 397-218-05 | 5 | .337 |
| 397-218-07 | 7 | .346 |
| 397-218-12 | 12 | .425 |
| 397-218-15 | 15 | .452 |
| 397-218-19 | 19 | .478 |
| 397-218-27 | 27 | .557 |
| 397-218-37 | 37 | .610 |
| 397-218-48 | 48 | .689 |
| 397-218-60 | 60 | .729 |

### 22 GAUGE

NOM. O.D. CONDUCTOR — .050″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 7/30

| PIW Part No. | No. of Pairs | Nom. O.D. |
|---|---|---|
| 397-220-05 | 5 | .366 |
| 397-220-07 | 7 | .376 |
| 397-220-12 | 12 | .466 |
| 397-220-15 | 15 | .496 |
| 397-220-19 | 19 | .526 |
| 397-220-27 | 27 | .616 |
| 397-220-37 | 37 | .676 |
| 397-220-48 | 48 | .766 |
| 397-220-60 | 60 | .814 |

### 20 GAUGE

NOM. O.D. CONDUCTOR — .058″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 19/32

| PIW Part No. | No. of Pairs | Nom. O.D. |
|---|---|---|
| 397-222-05 | 5 | .404 |
| 397-222-07 | 7 | .416 |
| 397-222-12 | 12 | .520 |
| 397-222-15 | 15 | .555 |
| 397-222-19 | 19 | .590 |
| 397-222-27 | 27 | .694 |
| 397-222-37 | 37 | .764 |
| 397-222-48 | 48 | .868 |
| 397-222-60 | 60 | .922 |

APPLICATION: Control and signal application in computers, industrial equipment and instrumentation.

# PIW COMPUTER AND CONTROL CABLE SHIELDED

**Cable Rated at 80°C, 300 Volts — 1061 Conductors, 600 Volts, 105°C**

**Stranded tinned copper conductor, .010″ color-coded PVC insulation.**
**Braided tinned copper shield.**
**Cabled singles or in pairs, gray vinyl jacket overall.**

## MULTI-CONDUCTOR CABLES OVERALL SHIELD

### 24 GAUGE

NOM. O.D. CONDUCTOR — .044″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 7/32

| PIW Part No. | No. of Conductors | Nom. O.D. |
|---|---|---|
| 390-218-61 | 5 | .267 |
| 390-218-62 | 7 | .280 |
| 390-218-63 | 12 | .331 |
| 390-218-64 | 15 | .355 |
| 390-218-65 | 19 | .368 |
| 390-218-66 | 27 | .419 |
| 390-218-67 | 37 | .456 |
| 390-218-68 | 48 | .507 |
| 390-218-69 | 60 | .521 |

### 22 GAUGE

NOM. O.D. CONDUCTOR — .050″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 7/30

| PIW Part No. | No. of Conductors | Nom. O.D. |
|---|---|---|
| 390-220-61 | 5 | .283 |
| 390-220-62 | 7 | .298 |
| 390-220-63 | 12 | .356 |
| 390-220-64 | 15 | .384 |
| 390-220-65 | 19 | .398 |
| 390-220-66 | 27 | .456 |
| 390-220-67 | 37 | .498 |
| 390-220-68 | 48 | .556 |
| 390-220-69 | 60 | .569 |

### 20 GAUGE

NOM. O.D. CONDUCTOR — .058″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 19/32

| PIW Part No. | No. of Conductors | Nom. O.D. |
|---|---|---|
| 390-222-61 | 5 | .305 |
| 390-222-62 | 7 | .322 |
| 390-222-63 | 12 | .387 |
| 390-222-64 | 15 | .421 |
| 390-222-65 | 19 | .438 |
| 390-222-66 | 27 | .505 |
| 390-222-67 | 37 | .554 |
| 390-222-68 | 48 | .621 |
| 390-222-69 | 60 | .635 |

## PAIRED CABLES INDIVIDUALLY SHIELDED

### 24 GAUGE

NOM. O.D. CONDUCTOR — .044″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 7/32

| PIW Part No. | No. of Pairs | Nom. O.D. |
|---|---|---|
| 391-218-05 | 5 | .443 |
| 391-218-07 | 7 | .456 |
| 391-218-12 | 12 | .575 |
| 391-218-15 | 15 | .614 |
| 391-218-19 | 19 | .654 |
| 391-218-27 | 27 | .773 |
| 391-218-37 | 37 | .852 |
| 391-218-48 | 48 | .971 |
| 391-218-60 | 60 | 1.039 |

### 22 GAUGE

NOM. O.D. CONDUCTOR — .050″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 7/30

| PIW Part No. | No. of Pairs | Nom. O.D. |
|---|---|---|
| 391-220-05 | 5 | .472 |
| 391-220-07 | 7 | .486 |
| 391-220-12 | 12 | .616 |
| 391-220-15 | 15 | .659 |
| 391-220-19 | 19 | .702 |
| 391-220-27 | 27 | .832 |
| 391-220-37 | 37 | .918 |
| 391-220-48 | 48 | 1.048 |
| 391-220-60 | 60 | 1.121 |

### 20 GAUGE

NOM. O.D. CONDUCTOR — .058″
NOM. JKT. THICKNESS — .063″
CONDUCTOR STRANDING — 19/32

| PIW Part No. | No. of Pairs | Nom. O.D. |
|---|---|---|
| 391-222-05 | 5 | .510 |
| 391-222-07 | 7 | .526 |
| 391-222-12 | 12 | .670 |
| 391-222-15 | 15 | .718 |
| 391-222-19 | 19 | .766 |
| 391-222-27 | 27 | .910 |
| 391-222-37 | 37 | 1.006 |
| 391-222-48 | 48 | 1.150 |
| 391-222-60 | 60 | 1.226 |

APPLICATION: Control and signal application in computers, industrial equipment and instrumentation.

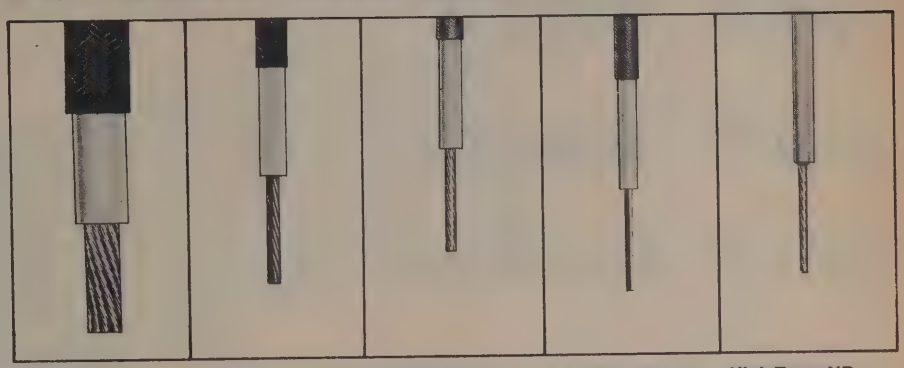
* Available CSA Approved.

ROWE KNOWS WIRE AND CABLE

# High Temperature silicone rubber wire and cable.

Rowe's silicone rubber insulation offers better performance and longer life than natural rubber or thermoplastic insulation. For example, our high temperature wire and cable is: heat stable to 200°C and flexible to −90°C, unaffected by severe thermal cycling, ultraviolet radiation, ozone or corona, resistant to ageing, moisture and chemicals, highly flame retardant and tough enough for unbraided lead wire.

Choose from a variety of UL listed styles or ask us to design one that meets your special requirements.



**Power cable** for 600 volts +.

**Appliance & fixture wire** for 300 volts +.

**Apparatus & motor lead wire** for 600 volts +.

**Lighting wire** for 600 volt transmission with solid tinned copper conductor, silicone rubber insulation and fiberglass braided covering.

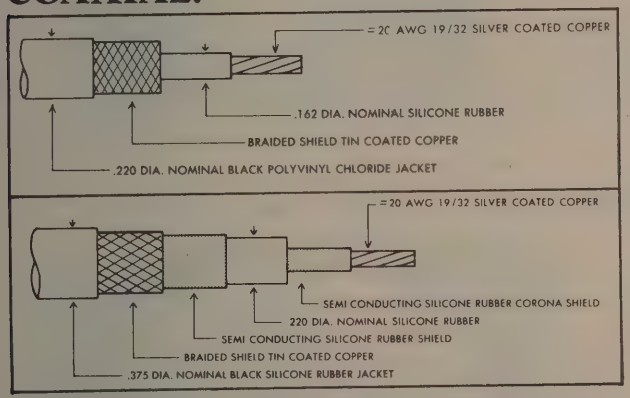
**High Temp NB** especially suited for motor lead wire. No braided covering necessary. Tinned copper, stranded or solid tinned copper conductor.. Silicone rubber insulation in 10 colors.

All the above wire and cable feature tinned copper, stranded conductors, silicone rubber insulation, with fiberglass braided covering.

# Hi-V cable, wire, and interconnections.

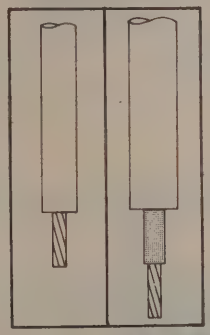
Well suited for a variety of industrial and military applications including accelerators, radar, x-ray, ECM and others. Hi-V combines semi-conducting, corona-suppressing layers with thermosetting materials for noise-free, corona-free cable and wire. It is available in single conductor, coaxial and triaxial configurations.

## COAXIAL.


=20 AWG 19/32 SILVER COATED COPPER
.162 DIA. NOMINAL SILICONE RUBBER
BRAIDED SHIELD TIN COATED COPPER
.220 DIA. NOMINAL BLACK POLYVINYL CHLORIDE JACKET
=20 AWG 19/32 SILVER COATED COPPER
SEMI CONDUCTING SILICONE RUBBER CORONA SHIELD
220 DIA. NOMINAL SILICONE RUBBER
SEMI CONDUCTING SILICONE RUBBER SHIELD
BRAIDED SHIELD TIN COATED COPPER
.375 DIA. NOMINAL BLACK SILICONE RUBBER JACKET

Features: 5-100KV minimum voltage ratings, 8-22 AWG corona-free and ozone resistant, 80°C to 200°C operating temperature range. Excellent for high pulse applications and for use with Rowe high voltage miniature coaxial connector series, G series connectors, Hi-pulse 40KV series and Rowe R75 connector series. All exhibit good corona-free RFI-EMI capabilities and have excellent flexibility properties.

## SINGLE CONDUCTOR, UNSHIELDED.



Features: 5-60 KVDC minimum voltage ratings, 10-20 AWG corona-free, ozone-resistant material, 200°C operating temperature, excellent flexibility at high and low temperatures.

**Call or write: Dept. 111**

**ROWE INDUSTRIES**

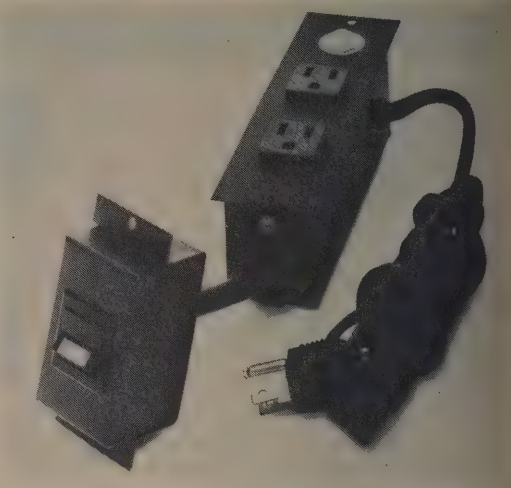
**CONNECTORS • CABLE ASSEMBLIES • ELECTRONIC PRODUCTS**

6225 BENORE ROAD • TOLEDO, OHIO 43612 • (419) 729-9761
WEST COAST OFFICE: (415) 969-4831 OR (213) 235-2070
EAST COAST OFFICE: (617) 879-3250

**For reliability and performance that you can count on, see our wide range of high voltage connectors in the Connectors, Terminals and Sockets section.**

# SGL WABER® Multiple Electrical Outlet Strips

## call it "OEM"
## call it "Special"
## call it "Custom"
## it doesn't matter!



▲ We'll design exactly what you need or ... choose from our extensive stock ▼

What does matter is that we can make that "OEM" . . . "custom" . . . or "special" electrical outlet strip do exactly what you want it to do and go exactly where you want it to go. We've been doing it for years for others. We can do it for you.

If a particular model in our regular line of outlet strips fills the bill . . . fine. We have over 240 stock items from which to choose, and they are readily available from your local electronic distributor. (Check yellow section of eem.)

But there are times when off-the-shelf won't do, and your need is for a unique electrical outlet strip that doesn't exist. That's OK. Tell us about it, and we'll make it exist.

Just call us and tell us what you need. Give us the specifications and we'll design an electrical outlet strip exactly as you want it . . . at no cost to you. Call us today.

**You get these advantages:**

- **Finest quality . . . safety tested**
- **355 models Listed with UL (110 models are stock items)**
- **Meets electrical codes and OSHA standards**
- **20 years of multiple outlet strip design experience**

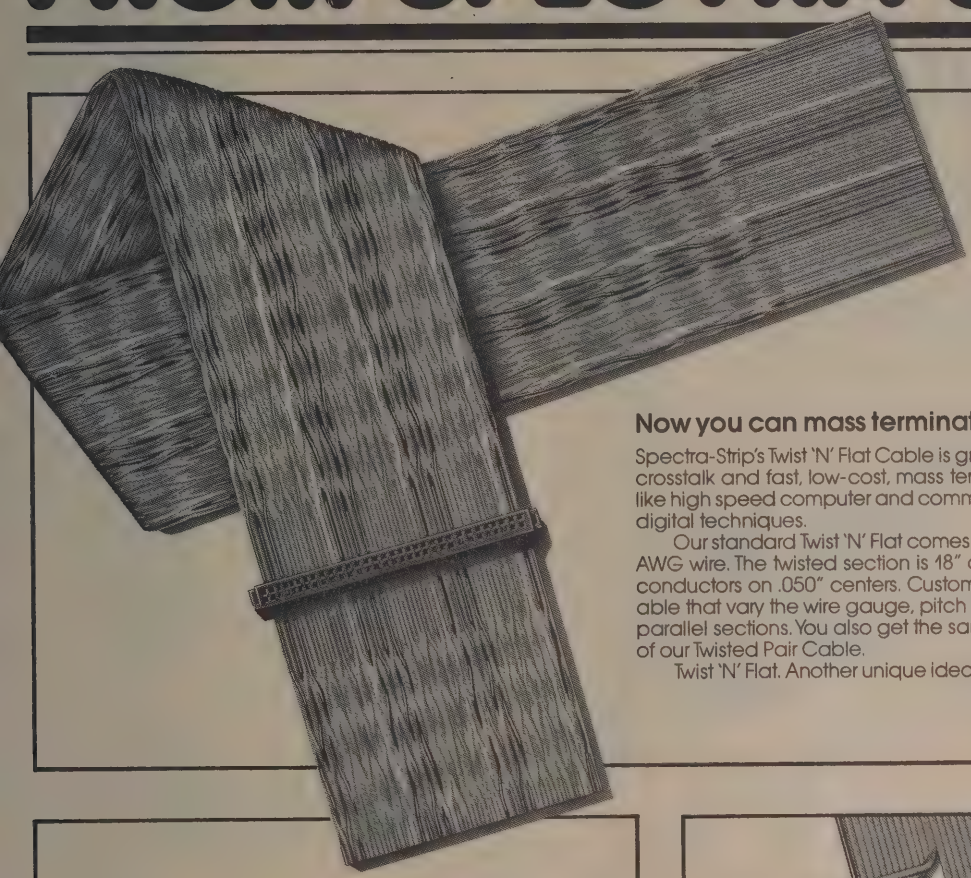
**SEND FOR FREE 24 PAGE CATALOG SHOWING OVER 240 MULTIPLE OUTLET STRIPS**

# SGL WABER ELECTRIC

A division of SGL INDUSTRIES, INC.

300 Harvard Avenue • Westville, NJ 08093 • (609) 456-5400

# CABLEGRAMS FROM SPECTRA·STRIP.



## Now you can mass terminate twisted pair cables.

Spectra-Strip's Twist 'N' Flat Cable is great when you need reduced crosstalk and fast, low-cost, mass termination. In applications like high speed computer and communication equipment using digital techniques.

Our standard Twist 'N' Flat comes with 26 solid or 28 stranded AWG wire. The twisted section is 18" and parallel section is 2" with conductors on .050" centers. Custom configurations are available that vary the wire gauge, pitch and length of the twisted and parallel sections. You also get the same crosstalk characteristics of our Twisted Pair Cable.

Twist 'N' Flat. Another unique idea patented by Spectra-Strip.

## At Spectra-Strip, we'll give you the right connection.

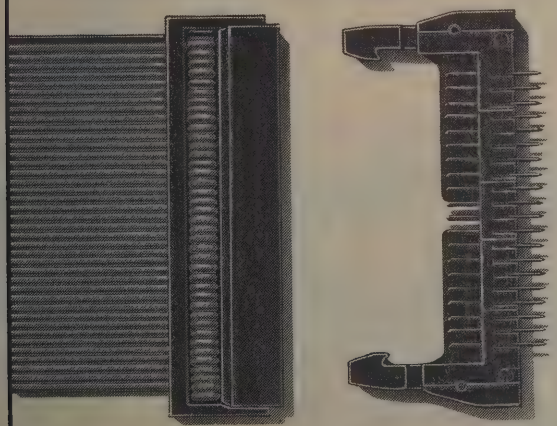
We also make a lot more than ribbon cables.

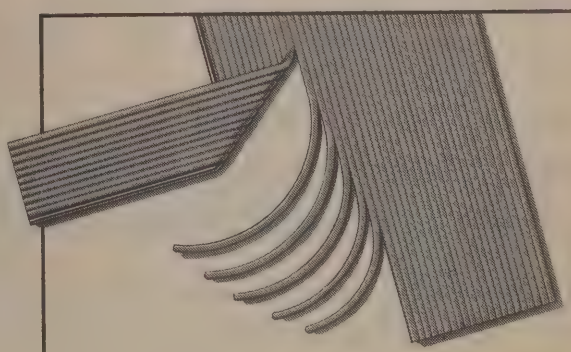
We make a wide range of IDC connectors, headers, and other ribbon cable connectors. Complete planar systems, including standard interconnects and custom assemblies, are our specialty.

Our experience in cable design, development and assembly lets us give you a wider range of planar systems than anyone. In fact, you could call us generalists in an industry full of specialists.

Nobody has a greater variety of ribbon cables and connectors than we do. Nobody.

And we intend to keep it that way.





## Spectra-Zip gives you mass termination. And fast, easy breakouts.

For general purpose interconnection from calculators to computers, Spectra-Zip Laminated Planar Cable offers you economy. Reliable performance. Weight and space savings. Controlled electrical characteristics. And low-cost termination.

Spectra-Zip's convenient double contour feature lets you assemble IDC connectors on either cable surface. And assures you of easy, uniform breakouts.

Every time.

## SPECTRA·STRIP

ALL WE DO IS KEEP EVERYTHING TOGETHER.

P.O. BOX 415, GARDEN GROVE, CA 92642
(714) 892-3361

an Eltra company

# STANDARD WIRE & CABLE CO.

# SOLVES WIRE & CABLE PROBLEMS

PRESIDENT'S "E" AWARD FOR EXCELLENCE IN EXPORT

**DESIGNS . . .**
**DEVELOPS . . . ENGINEERS . . .**
**MANUFACTURES . . . MASSIVE**
**CONFIGURATIONS TO MICROMINIATURE**
**TO YOUR SPECIFIC NEEDS**

***For immediate information call SWC Wire & Cable experts to answer your technical questions that will help you to meet your requirements.***

**FOR QUOTES,** send for **SWC's** specially prepared **"CABLE DESIGN CHECKLIST"** that will assist you to specify details of your custom cable needs quickly and accurately.

Please direct inquiries to Literature Department "E."

FOR QUALITY AND SERVICE RELY ON SWC'S 30-YEAR HISTORY OF ABILITY TO DELIVER.

**Wire, Cable & Cord is available for IMMEDIATE DELIVERY from distribution centers noted below. Sales offices and representatives in all Metropolitan areas.**

***FOR IMMEDIATE DELIVERY CALL YOUR NEAREST DISTRIBUTION CENTER***

HOME OFFICE

## Standard WIRE & CABLE CO.

2345 Alaska Ave. – El Segundo, CA 90245

Area Code (213) 973-2345 · TWX 910-340-6758 · Telex 65-3423 · STANCABLE LSA

**EASTERN MANUFACTURING DIVISION**
40 Townsend Road, Attleboro, Ma. 02703
Phone: (617) 226-1500, Telex 92-7795

**BRANCH OFFICE & WAREHOUSE**
1626 So. 51st Avenue, Phoenix, Arizona 85031
Phone: (602) 269-2501, Telex 66-8441

# TRW HOLYOKE WIRE & CABLE

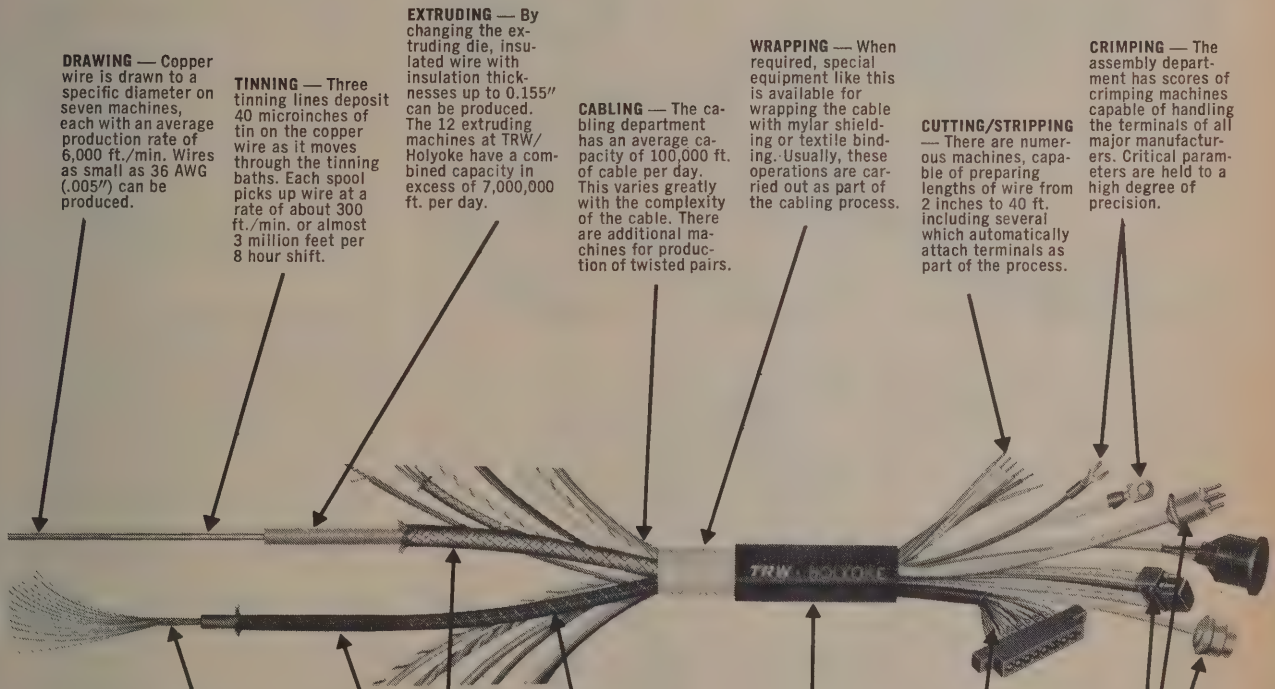
## TOTAL CAPABILITY IN PRECISION CABLE ASSEMBLIES

At TRW/Holyoke Wire and Cable, "total capability" in the manufacture of precision cable assemblies and harnesses is a blend of complete facilities, advanced technology, and wide experience.

Every manufacturing step — from the drawing of individual copper wires to the attaching of hardware and molding of the connector — is performed internally to achieve maximum cost effectiveness and control of product quality.

Through its complete in-house wire and cable manufacturing facilities, TRW/Holyoke is equipped to fabricate any cable assembly or harness, regardless of its complexity.

Laced or textile braided assemblies, with shielded breakouts and solder or crimp attachment of any single or multiple termination can be supplied. Dies for molded connector assemblies are designed and built internally for a wide range of molding materials.




**DRAWING** — Copper wire is drawn to a specific diameter on seven machines, each with an average production rate of 6,000 ft./min. Wires as small as 36 AWG (.005″) can be produced.

**TINNING** — Three tinning lines deposit 40 microinches of tin on the copper wire as it moves through the tinning baths. Each spool picks up wire at a rate of about 300 ft./min. or almost 3 million feet per 8 hour shift.

**EXTRUDING** — By changing the extruding die, insulated wire with insulation thicknesses up to 0.155″ can be produced. The 12 extruding machines at TRW/Holyoke have a combined capacity in excess of 7,000,000 ft. per day.

**CABLING** — The cabling department has an average capacity of 100,000 ft. of cable per day. This varies greatly with the complexity of the cable. There are additional machines for production of twisted pairs.

**WRAPPING** — When required, special equipment like this is available for wrapping the cable with mylar shielding or textile binding. Usually, these operations are carried out as part of the cabling process.

**CUTTING/STRIPPING** — There are numerous machines, capable of preparing lengths of wire from 2 inches to 40 ft. including several which automatically attach terminals as part of the process.

**CRIMPING** — The assembly department has scores of crimping machines capable of handling the terminals of all major manufacturers. Critical parameters are held to a high degree of precision.

**STRANDING** — Depending upon the length of the twist or "lay" as well as the diameter of the wire, these 36 machines each produce stranded wire at a rate of 50-100 ft./min., utilizing the total output of the tinning lines.

**BRAIDING** — The braiding room contains over 400 machines, including "butt" braiders which produce "breakout" textile cables of the type shown on cable assembly page. Capacity is in excess of 2,000,000 ft. per day.

**LACQUERING** — This department can easily match the total capacity of the braiding room. A number of lacquer and saturant formulations are used to impart anti-fray, flame-retardant, moisture and fungus resistant properties.

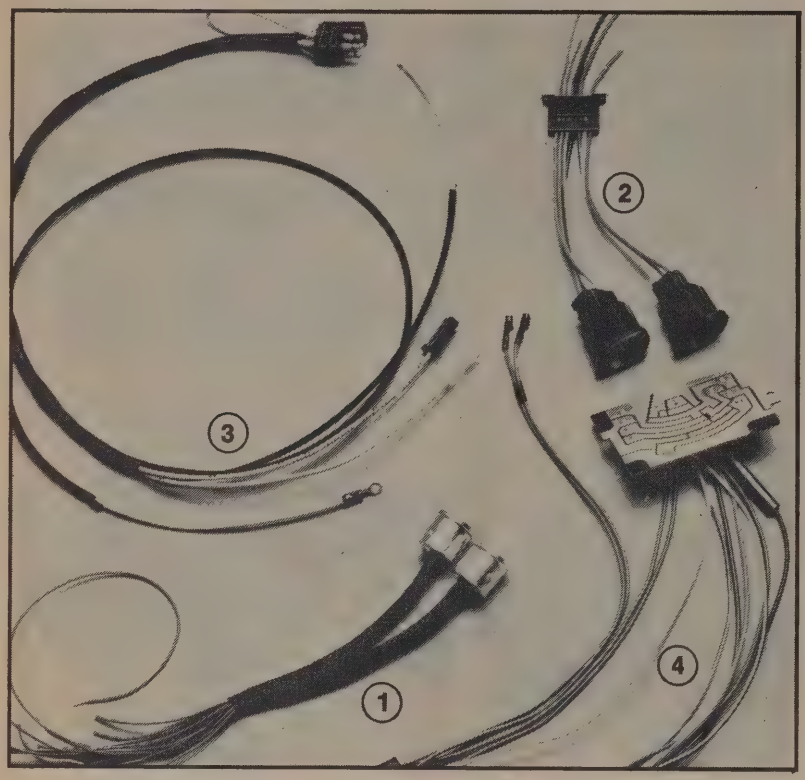
**JACKETING** — Jacketing of cables is accomplished on the extruding machines with the use of appropriately designed extruding dies and adjustment of temperatures, cooling profile, line speed, etc.

**SOLDERING** — Over 4,000 sq. ft., with numerous production lines is devoted to soldering in the assembly area. Internally designed jigs and tools are used to obtain maximum production rates.

**MOLDING** — Fifteen automatic machines, whose output varies with the size and complexity of the part are now in operation. Electrical testing is conducted at the machine as the part is completed.

**TRW/HOLYOKE WIRE & CABLE, AN ELECTRONIC COMPONENTS DIV. OF TRW INC. / 775 NEW LUDLOW RD. / SOUTH HADLEY, MA 01075**

# TRW HOLYOKE WIRE & CABLE



## CABLE ASSEMBLIES

Automotive cable assemblies produced by TRW/Holyoke cover the range from low voltage, low current semiconductor circuit devices to high power, high reliability types — all with the appropriate environmental terminations and connectors.

**1.** Passenger car rear seat control cable assembly incorporating Y-shaped "break-put" nylon braiding to two solder-terminated female connectors.

**2.** Dual connector electronic ignition cable assembly with molded grommet and molded-in blade contacts in pull-apart insulator shells.

**3.** Semi-trailer refrigeration system nylon braided cable assembly, for high reliability control application. Coded aircraft type connectors, terminated with pre-insulated crimped terminals and molded automotive type plug.

**4.** Automobile climate control cable assembly with crimp insertable contacts in male plugs and crimp contacts riveted to a printed circuit board switch panel.

TRW/Holyoke's most complex assemblies are those supplied to the computer industry. The combining of many type of conductors, terminals and connectors in a single harness is not uncommon. TRW/Holyoke can incorporate special PC boards or connectors provided by the customer, or will purchase these for the customer, in addition to producing any special molding dies that may be required.

Complete testing facilities are available — no matter how complex the harness assembly.

**1.** Thirty conductor cable assembly with four molded tapehead connectors, 50 position edge connector and miscellaneous wire terminations.

**2.** Thirty-two conductor cable using unique braiding technique that allows shielding the entire length of each breakout section. Continuous nylon braid to end of breakout combines minimum cable diameter with high flexibility.

**3.** Fifteen crimp-insertable terminations (4 twisted pairs, 7 single) in nylon plug and PC connector assembly.

**4.** Sixty-six conductor harness assembly with four crimp insertable terminal edge connectors, crimp plug and miscellaneous terminals.

**TRW/HOLYOKE WIRE & CABLE, AN ELECTRONIC COMPONENTS DIV. OF TRW INC. / 775 NEW LUDLOW RD. / SOUTH HADLEY, MA 01075**

# TRW HOLYOKE WIRE & CABLE

## WIRE & CABLE

The manufacture of single-insulated conductors is a highly technical process that requires precision control of a variety of production parameters, including temperature, wire diameter, die size, and production rate.

Establishment of these parameters is the result of an intimate knowledge of equipment capabilities and material characteristics. At TRW/Holyoke this knowledge is based on over sixty years of experience.

Critical requirements, such as low cross talk levels in telecommunication and EDP cables, minimum impedance discontinuities in RF cables, and enhanced flame retardancy in home entertainment wires and wiring devices, are regularly engineered into products. The requirements of Underwriters' Laboratories fulfilled through design engineering.

Any combination of single wires, twisted pairs, and coaxial cable, in any number, with necessary fillers and bindings can be incorporated into a cable. The only limitation is that the cable diameter not exceed 1.75″; flat braided (woven) cable, up to 0.5″ width. Flat rainbow (ribbon) cable is available with 2 to 43 parallel conductors.

### Manufacturing Options

**Conductors**

Copper, copper covered steel, cadmium bronze, phosphor bronze, precious metal alloys.
10 through 30 AWG
Solid or Stranded or Tinsel
Stranding from 7 to 500 strands
Bare or Tinned
Topcoat, Overcoat, Heavy Tinned — fused

**Insulations**

Polyethylene
Kynar***
Polypropylene
Polyurethane
Polyvinyl Chloride (PVC)
Silicone Rubber
FEP Teflon**
Nylon
Tefzel**

Insulation wall thickness from .002″ to .155″

**Textile Braids**

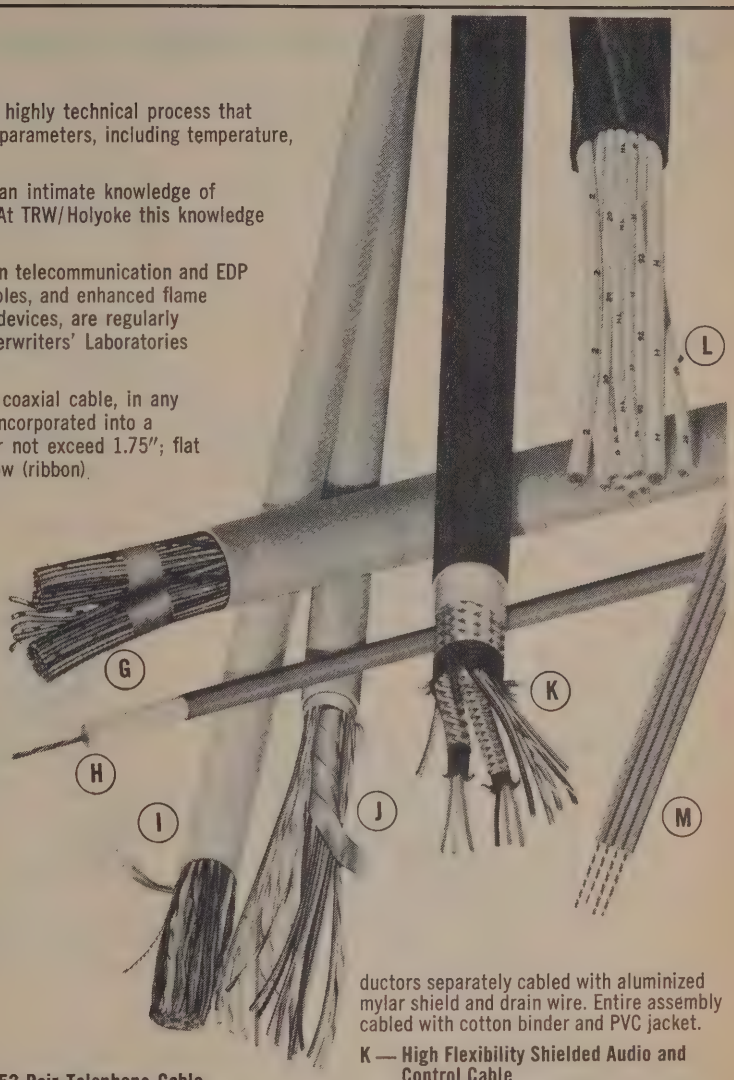
Celanese*
Cotton
Dacron**
Glass
Nylon
Orlon**
Rayon

. . . with or without lacquer

**Shieldings**

Conductive Vinyl
Aluminized Mylar**
Spiral Wrapped and Braided Copper

***Pennwalt Corp. T.M.
**DuPont T.M.
*Celanese Corp. T.M.




**G — 52 Pair Telephone Cable**

Semi-rigid thin wall insulated #24AWG solid conductors with band marked color coding. Conductors paired with programmed lay for minimum cross-talk. Assembled into 25 pair units with coding binders and four spare conductors, with flexible PVC sheath overall. Overall diameter .625″. Rated at 80°C.

**H — High Voltage Lead Wire**

Tinned copper conductors, solid or stranded, covered with flame retardant high dielectric strength insulation with 105°C. PVC jacket. Construction is designated as UL style #3239 and can be provided in a variety of conductors and voltage ratings to 40 KV.

**I — Telephone Distribution Cable**

25 pairs #24AWG solid conductors with thin wall semi-rigid insulation, spiral stripe coded. Pairs cabled with flexible bunch lay. PVC sheath extruded overall with nylon ripcord under sheath. O.C. is 0.375″.

**J — Mini Computer Memory Bank Cable**

36 conductors with flexible stranding, PVC insulation and spiral stripe coding. 12 conductors separately cabled with aluminized mylar shield and drain wire. Entire assembly cabled with cotton binder and PVC jacket.

**K — High Flexibility Shielded Audio and Control Cable**

Cable core of seven #24AWG PVC insulated single conductors and two triple conductor cables of #24AWG stranded conductors PVC insulated with color coded textile braiding. These three conductors are then nylon braided as a unit and copper-braid shielded. The entire cable core is nylon braided and copper shielded with a PVC jacket overall.

**L — Power and Control Cable**

Nine #18AWG and two #12AWG stranded conductors insulated with 105°C. thermoplastic, then covered with lacquered glass braid and extruded nylon. Cabled with extruded thermoplastic jacket overall. Rated 600 volts, −55°C to +105°C. For on-the-road tractor-trailer interconnection.

**M — Environmental Resistant Flat Cable**

Four stranded conductors simultaneously insulated with high performance extruded silicone rubber compound to form an extremely flexible high reliability cable for military applications. Rated at 300V., −100°C. to +200°C., moisture, fungus and radiation resistant.

TRW/HOLYOKE WIRE & CABLE, AN ELECTRONIC COMPONENTS DIV. OF TRW INC. / 775 NEW LUDLOW RD. / SOUTH HADLEY, MA 01075

# TRW HOLYOKE WIRE & CABLE

## SERIES 8000, 8001 FLAT CABLE

### FEATURES:

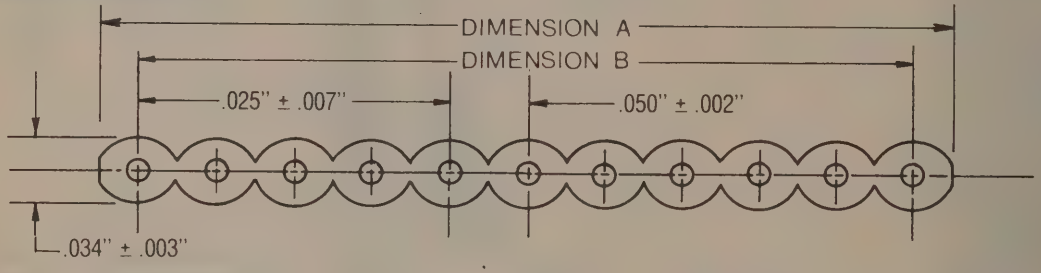
- Efficient, Economical, Reliable Packaging Technique:
  - Up to 50 terminations in one staking operation
  - Wiring errors are eliminated
  - Low profile for space and weight reduction
- Easy to separate conductor groupings for breakouts
- Flexible and rugged—easily folded or bent for efficient installation
- Constant electrical characteristics

### SPECIFICATIONS

| | 8000 | 8001 |
|---|---|---|
| **Configuration** | conductors on .050" spacing | |
| **Conductor** | #28 AWG Stranded (7/36) Soft Annealed Tinned Copper | #30 AWG Solid Annealed Tinned Copper |
| **Insulation** | Gray flame retardant PVC (FR-1) | |
| **Wall Thickness** | .009" Average, .006" Minimum | |
| **Polarization** | Blue Color Band for #1 Position | |
| **Temperature** | −20°C to +105°C | |
| **UL Style** | 2651 | 2651 |
| **Voltage Rating** | 300 V | |

| | 8000 | 8001 |
|---|---|---|
| **Insulation Resistance** | $>10^{10}$ Ohms per 10 feet | |
| **Impedance** | 105 Ohms Balanced; 73 Ohms Unbalanced | |
| **Capacitance** | 9.6 pF per foot-pair 17.0 pF per foot-triplet | |
| **Inductance** | .16 H/ft. | .20 H/ft. |
| **Propagation Delay** | 1.38 nS/ft. | 1.37 nS/ft. |
| **Crosstalk** | 2.4% | 2.9% |
| **Standard Put-Up** | 100 Foot Spools | |

### DIMENSIONAL DATA




| No. of Conductors | Dimension "A" Inches | Dimension "A" mm | Dimension "B" Inches | Dimension "B" mm |
|---|---|---|---|---|
| 10 | .500±.010 | 12.7 ±.25 | .450±.010 | 11.43±.25 |
| 14 | .700±.010 | 17.78±.25 | .650±.010 | 16.51±.25 |
| 16 | .800±.010 | 20.32±.25 | .750±.010 | 19.05±.25 |
| 20 | 1.000±.010 | 25.40±.25 | .950±.010 | 24.13±.25 |

| No. of Conductors | Dimension "A" Inches | Dimension "A" mm | Dimension "B" Inches | Dimension "B" mm |
|---|---|---|---|---|
| 26 | 1.300±.010 | 33.02±.25 | 1.250±.010 | 31.75±.25 |
| 34 | 1.700±.015 | 43.18±.38 | 1.650±.015 | 41.91±.38 |
| 40 | 1.000±.015 | 50.8 ±.38 | 1.950±.015 | 49.53±.38 |
| 50 | 2.500±.015 | 63.5 ±.38 | 2.450±.015 | 62.23±.38 |

### ORDERING INFORMATION

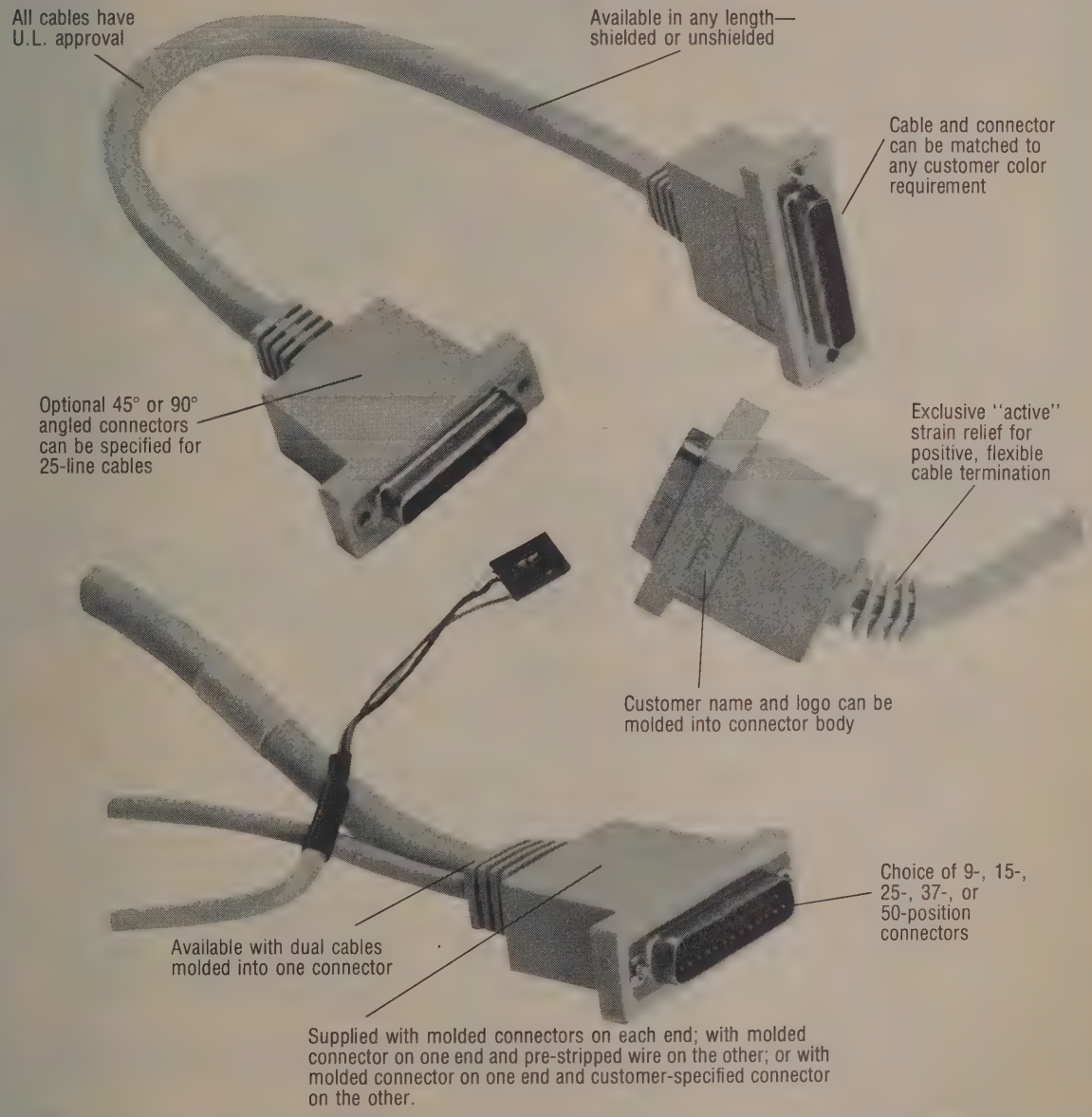
| | #28 AWG STRANDED | | | #30 AWG SOLID | | |
|---|---|---|---|---|---|---|
| No. of Conductors | TRW Part No. | Weight lb./100' | Weight kg/100' | TRW Part No. | Weight lb./100' | Weight kg/100' |
| 10 | 8000-10 | 1.08 | .49 | 8001-10 | 1.15 | .52 |
| 14 | 8000-14 | 1.52 | .69 | 8001-14 | 1.61 | .73 |
| 16 | 8000-16 | 1.73 | .79 | 8001-16 | 1.85 | .84 |
| 20 | 8000-20 | 2.17 | .98 | 8001-20 | 2.31 | 1.05 |
| 26 | 8000-26 | 2.82 | 1.28 | 8001-26 | 3.00 | 1.36 |
| 34 | 8000-34 | 3.68 | 1.67 | 8001-34 | 3.93 | 1.78 |
| 40 | 8000-40 | 4.34 | 1.97 | 8001-40 | 4.62 | 2.10 |
| 50 | 8000-50 | 5.42 | 2.46 | 8001-50 | 5.77 | 2.62 |

# TRW HOLYOKE WIRE & CABLE

## MOLDED D-SUBMINIATURE CABLE ASSEMBLIES

Durable, high-reliability TRW Holyoke D-subminiature cables—with molded external covering and active strain relief—withstand substantial abuse, because nothing can come loose or require adjustment.

All 25-position cable assemblies fulfill the requirements of EIA Specification RS232, while 9- and 37-position assemblies meet EIA Specification RS449.


All cables have U.L. approval
Available in any length—shielded or unshielded
Cable and connector can be matched to any customer color requirement
Optional 45° or 90° angled connectors can be specified for 25-line cables
Exclusive "active" strain relief for positive, flexible cable termination
Customer name and logo can be molded into connector body
Choice of 9-, 15-, 25-, 37-, or 50-position connectors
Available with dual cables molded into one connector
Supplied with molded connectors on each end; with molded connector on one end and pre-stripped wire on the other; or with molded connector on one end and customer-specified connector on the other.

In addition to the D-type connectors shown above, cables can be molded with MIL-specified circular, coaxial or card-edge connectors. Special connectors and strain reliefs can be designed for applications where standard connectors will not fit, and custom pin configurations can be developed to meet specific customer requirements.

These cables are ideal for user-pluggable equipment such as point-of-sale devices, dictation machines, industrial programmers, medical instruments, computer peripheral gear and TV games.

## METHODS DESIGNED FOR BETTER QUALITY AND BETTER SERVICE

An important feature in maintaining the quality of our products is our ability to design and construct the tools necessary to do the job. We guarantee continuous performance of equipment & continuity of production.

The exacting specifications of Whitmor's space-age customers require a stringent quality assurance program. Our Q.C. meets Mil-Q-9858 & Mil-I-45208 with modifications required by customers. The same quality consciousness is applied to commercial work. We guarantee trouble free cable and wire!

**NEW! THERMOPLASTIC RUBBER JACKETS AVAILABLE.**

## Whitmor has what it takes to build cables for tough jobs!

20,000 square feet housing modern, high speed equipment makes it possible to fill orders on a 24 hour basis, if required.

# WHITMOR WIRE AND CABLE CORPORATION

*Manufacturers of custom, multiple conductor, Mil-Spec and U.L. approved cables.*




| UNSHIELDED | | | | | | | SHIELDED** | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| MULTI-CONDUCTOR STOCK CABLES / All wire 19 strand | | | | | DUR-X-THANE® | | STOCK | | DUR-X-THANE® | |
| PART NO. | COND. AWG | NO. COND. | JKT. THICK. | CABLE O.D. | JKT. THICK. | CABLE O.D. | JKT. THICK. | CABLE O.D. | JKT. THICK. | CABLE O.D. |
| W-227* | 22 | 7 | .040 | .280 | .030 | .260 | .040 | .305 | .030 | .285 |
| W-2212* | 22 | 12 | .050 | .380 | .030 | .340 | .050 | .405 | .030 | .365 |
| W-2219* | 22 | 19 | .060 | .450 | .040 | .410 | .060 | .475 | .040 | .435 |
| W-2227* | 22 | 27 | .060 | .530 | .040 | .490 | .060 | .555 | .040 | .515 |
| W-2237* | 22 | 37 | .060 | .580 | .040 | .540 | .060 | .605 | .040 | .565 |
| W-2248* | 22 | 48 | .060 | .660 | .050 | .640 | .060 | .685 | .050 | .665 |
| W-2261* | 22 | 61 | .060 | .710 | .050 | .690 | .060 | .735 | .050 | .715 |
| W-2272* | 22 | 72 | .060 | .775 | .060 | .775 | .060 | .800 | .060 | .800 |
| W-207* | 20 | 7 | .040 | .300 | .030 | .280 | .040 | .325 | .030 | .305 |
| W-2012* | 20 | 12 | .050 | .400 | .030 | .360 | .050 | .425 | .030 | .385 |
| W-2019* | 20 | 19 | .060 | .475 | .040 | .435 | .060 | .500 | .040 | .460 |
| W-2027* | 20 | 27 | .060 | .560 | .040 | .520 | .060 | .585 | .040 | .545 |
| W-2037* | 20 | 37 | .060 | .610 | .040 | .570 | .050 | .640 | .040 | .595 |
| W-2048* | 20 | 48 | .060 | .700 | .050 | .680 | .060 | .725 | .050 | .705 |
| W-2061* | 20 | 61 | .060 | .750 | .060 | .750 | .060 | .775 | .060 | .775 |
| W-2072* | 20 | 72 | .060 | .840 | .060 | .840 | .060 | .865 | .060 | .865 |
| W-187* | 18 | 7 | .040 | .335 | .030 | .315 | .040 | .360 | .030 | .340 |
| W-1812* | 18 | 12 | .050 | .450 | .040 | .430 | .050 | .475 | .040 | .455 |
| W-1819* | 18 | 19 | .060 | .550 | .040 | .510 | .060 | .575 | .040 | .535 |
| W-1827* | 18 | 27 | .060 | .650 | .050 | .630 | .060 | .675 | .050 | .655 |
| W-1837* | 18 | 37 | .060 | .720 | .050 | .700 | .060 | .745 | .050 | .725 |
| W-1848* | 18 | 48 | .060 | .820 | .060 | .820 | .060 | .845 | .060 | .845 |
| W-1861* | 18 | 61 | .060 | .890 | .060 | .890 | .060 | .915 | .060 | .915 |
| W-1872* | 18 | 72 | .060 | .995 | .060 | .995 | .060 | 1.020 | .060 | 1.020 |
| W-167* | 16 | 7 | .040 | .370 | .030 | .350 | .040 | .395 | .030 | .375 |
| W-1612* | 16 | 12 | .050 | .500 | .040 | .480 | .050 | .525 | .040 | .505 |
| W-1619* | 16 | 19 | .060 | .600 | .040 | .560 | .060 | .625 | .040 | .585 |
| W-1627* | 16 | 27 | .060 | .685 | .050 | .665 | .060 | .710 | .050 | .590 |
| W-1637* | 16 | 37 | .060 | .755 | .060 | .755 | .060 | .780 | .060 | .780 |
| W-1648* | 16 | 48 | .060 | .865 | .060 | .865 | .060 | .890 | .060 | .890 |
| W-1661* | 16 | 61 | .060 | .935 | .060 | 935 | .060 | .960 | .060 | .960 |
| W-147* | 14 | 7 | .050 | .420 | .040 | .400 | .050 | .445 | .040 | .425 |
| W-1412* | 14 | 12 | .050 | .550 | .040 | .530 | .050 | .575 | .040 | .555 |
| W-1419* | 14 | 19 | .060 | .645 | .050 | .625 | .060 | .670 | .050 | .650 |
| W-1427* | 14 | 27 | .060 | .775 | .060 | .775 | .060 | .800 | .060 | 800 |
| W-125* | 12 | 5 | .050 | .445 | .040 | .400 | .050 | .470 | .040 | .425 |
| W-127* | 12 | 7 | .050 | .480 | .040 | .460 | .050 | .505 | .040 | .485 |
| W-1212* | 12 | 12 | .060 | .650 | .050 | .650 | .060 | .675 | .050 | .675 |
| W-1219* | 12 | 19 | .060 | .820 | .060 | .820 | .060 | .845 | .060 | .845 |

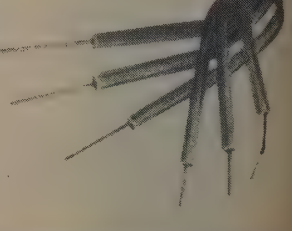
*Designate jacketing desired as follows: V=vinyl X=Dur-X-thane P=polyethylene N=neoprene - Mil-S-6855 - Class 2 - Grade 60
EXAMPLE: W-1827P=Cable w/27 conductors, 18 gauge wire, w/polyethylene jacketing. **Add "S" to PART NO. for Shielded cable.
Other constructions available on request using 1/32" PVC insulation (3000 V, Military Type D); (600 V, Style 1015 U.L. Commercial)

## TECHNICAL DATA

Whitmor Wire and Cable Corporation manufactures a complete line of multiple conductor control cables. All conductors are Type C per MIL-W-16878, insulated for 1000 V and 105° C. Conductors are color coded per MIL-STD 681. All conductors are planetary cabled and contra-helically laid with Mylar tape over the cable bundle.

® Dur-X-thane is Whitmor's Registered T.M. for extruded Polyurethane.

**SHIELDED CABLES:** Same specifications as above with additions of tinned copper braided shield over cable complex with 85%-95% coverage to MIL-C-7078A, cables shipped on non-returnable reels.




WHITMOR WIRE AND CABLE CORPORATION
13161 SHERMAN WAY ■ NORTH HOLLYWOOD, CALIFORNIA 91605 ■ PHONE: (213) 764-6296

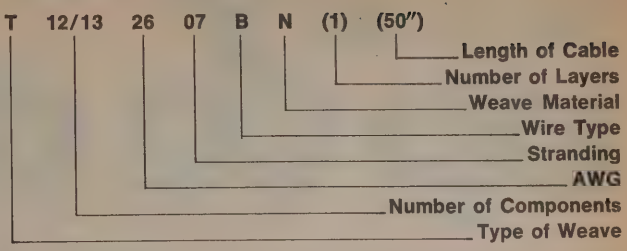
# WOVEN CABLE

**JACKETS AND SHIELDING**
Shielding and extruded jackets for heavy-duty protection.

**CUT AND FOLD LINES**
Woven-in channels for folding and/or cutting. Cut line provides most rapid lead separation technique. Multiple fold lines allow compaction of broad cable to stacked fold for smaller openings, etc.

**ULTRA-FLEXIBLE CABLES**
Withstand continuous flexing without delamination while retaining insulation continuity.

## ORDERING WOVEN CABLE




Six basic characteristics of woven cable are indicated by this numbering code.

**Type of Weave**

- **S** — Standard Weave (Plain and box weave)
- **T** — Twill Weave
- **SpT** — Stack Weave. Number in parenthesis at end of order number designates number of layers.
- **A** — Accordion Fold
- **PS** — Programmed Standard
- **HS** — Woven Harness
- **CIC** — Matched Impedance
- **C** — Covered Cable

**Number of Components.** Fold lines are indicated by /, between the number of components desired on each side of the fold line. More than one fold line may be indicated in this manner: 12/13/26/12. TP following number of components indicates they are Twisted Pairs. TT are Triads.

**AWG.** Size of wire — 22, 24, 26, 30 etc.

**Stranding.** Number of strands required to make up the AWG size.

**Wire Type.** Using letters from MIL-W-16878D, such as Type B, C, E, ET, EE. Or at this point show UL style of wire required — UL-1007, UL-1061, etc.

**Weave Material.** Most commonly specified: N-Nylon NX-Nomex D-Dacron Pp-Polypropylene G-Glass.

**Number of Layers.** When ordering stack-weave cable, number of layers into which designated components are to be formed should be shown in parentheses at the end of the numbering code.

**Length of Cable.** When ordering programmed cable (PS, HS, CIC), show length in inches, in parentheses, at end of numbering code.

**Special Requirements.** For special requirements, drawings and detailed notes may be used. Dimensional drawings are necessary for all harnesses, accordion fold units and programmed lead units, as well as wire run list and bill of materials.

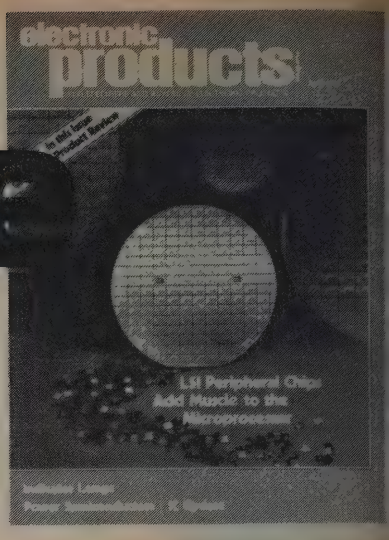
If a special array of conductors is needed, list and number each conductor. Indicate colors required. If using standard NEMA color code and repeat, simply note — "NEMA and repeat."


## WOVEN ELECTRONICS

Telephone (803) 963-5131
TWX-810-287-2091
P.O. Box 189, Mauldin, SC 29662
Plant Location: Old Stage Road
Simpsonville, SC 29681


**WORLD LEADERS IN THE DESIGN, DEVELOPMENT AND PRODUCTION OF WOVEN INTERCONNECT SYSTEMS.**

# stay up to date



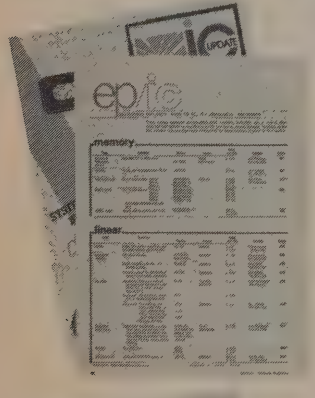

**SUBSCRIBE TO ELECTRONIC PRODUCTS MAGAZINE. IT'S YOUR *COMPLETE* GUIDE TO EVERYTHING THAT'S NEW IN THE FAST-CHANGING WORLD OF ELECTRONIC PRODUCTS AND SYSTEMS.**

**FEATURE STORIES** every month on electronic products, applications and availability.

**FORUMS**—Reports on meetings of manufacturers, users and distributors. Get the very latest news on a wide variety of products.

**NEW PRODUCT NEWS**—Hundreds of new products are introduced each month. You'll get the facts on not only what the new product is, but also where to get it, basic prices and current delivery.

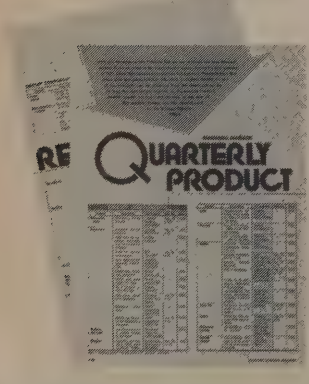
**EP/IC UPDATE**—Exclusive in ELECTRONIC PRODUCTS. A monthly report on *everything* that's new in the fast-moving world of integrated circuits.



**QUARTERLY PRODUCT REVIEW**—Another exclusive in ELECTRONIC PRODUCTS. A complete report of *every* new electronic product introduced in the previous quarter. This feature is in the January, April, July and October issues.

**QUARTERLY PRODUCT PLANNING DIRECTORY**—A compilation of the latest catalogs of a wide variety of electronic products and systems.

**OUTLOOK**—Important industry news affecting electronic products and systems.




**COMPONENT CAPERS**—A humorous look at the strange and wonderful world of electronics.

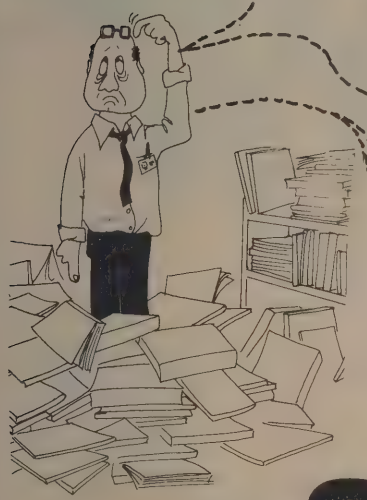
**MINI-GLOSSARIES,** Quizzes and more—Each and every month for over twenty years the readers of ELECTRONIC PRODUCTS learn something new about the products they work with and specify.

***If you are not now a subscriber, write to:***
***Dorothy Renoud, ELECTRONIC PRODUCTS MAGAZINE, 645 Stewart Avenue, Garden City, NY 11530.***
***Ask for a free qualification card.***

United Technical Publications, Inc., Div. of Cox Broadcasting Corp., 645 Stewart Ave., Garden City, NY 11530/(516) 222-2500

***What can I use to keep all the manufacturers' product data I receive in order?***

***What system makes filing or retrieving manufacturers' catalogs fast and easy?***



***Which file system have thousands of engineers purchased because they know it works?***

# eem FILE SYSTEM

## THE ONLY FILE SYSTEM DESIGNED SPECIALLY FOR THE ELECTRONIC ENGINEER!

The publishers of **eem** have put together a unique filing system for electronic product information. The complete system includes: a product index booklet which classifies electronic products into 3,000 listings both alphabetically and by product group, and 45 file folders imprinted with the **eem** product sections (extra gummed labels included for expanding the system.)

As you receive manufacturers' catalog data sheets, technical bulletins, or clip magazine articles, jot down the proper Product Section Numbers from the **eem** PRODUCT-TO-SECTION INDEX. Then simply file in order. When you require information on a specific product, refer to PRODUCT-TO-SECTION INDEX again to locate the correct file folder. It's simple, and you'll always have the necessary data to compare, specify and buy, right at your fingertips.

**Here's how to order your eem FILE SYSTEM:**

For the complete system send $10 (plus tax; N.Y., 8%, CA, 6½%) in check or money order to:

United Technical Publications, Inc.,
645 Stewart Avenue, Garden City, N.Y. 11530
Att: Circulation dept.

For an **eem FILE SYSTEM** without file folders send $7.50 (plus tax; N.Y. 8%; CA, 6½%).

*UNITED TECHNICAL PUBLICATIONS, INC., DIV. OF COX BROADCASTING CORP., 645 STEWART AVE., GARDEN CITY, N.Y. 11530 (516) 222-2500*

# CATALOGUE DE L'ELECTRONIQUE POUR LES INGENIEURS
# DER PRODUKTKATALOG FÜR ELEKTRONIKER
# ELECTRONIC ENGINEERS CATALOGUE

**The 1978 edition is out...and the response is in...**
**IMMEDIATE AND OVERWHELMING**

**ACCEPTANCE**

The ELECTRONIC ENGINEERS CATALOGUE is the only comprehensive, trilingual catalogue/source-directory of electronic products available to—and from—Western Europe.

It is divided into three distinct sections: 1. **The Product Index and Directory,** which lists more than 3,000 product headings & cross-references alphabetically in English with their French and German equivalents. 2. **The Manufacturers' Catalogue Section,** which is a compilation of Manufacturers' Catalogues in alphabetical order. 3. **The Manufacturers' Sales Offices and Trade Marks Directory,** which alphabetically includes country, address, telex or TWX numbers of the Manufacturers' main and local sales offices and/or agents.

The ELECTRONIC ENGINEERS CATALOGUE offers U.S. manufacturers the most cost-efficient method of distributing their catalogue data to **25,000** electronic engineers and buyers throughout Western Europe. It represents the carefully conceived application of the time-proven **eem** "cataloging" concept to the elusive European marketplace.

United Technical Publications, Inc., Div. of Cox Broadcasting Corp. 645 Stewart Avenue, Garden City, New York 11530 / 516 222-2500

# why beg, borrow or steal?

SEND TODAY FOR
YOUR OWN COPY
DOMESTIC EDITION ONLY.

**IC MASTER '78**

☐ Enclosed is my check or money order for $55.00 (postpaid)
(plus sales tax — California, 6%; New York, 7%)

☐ Bill me

Name ..... Title .....

Company .....

Address .....

City ..... State ..... Zip .....

Signature ..... Date .....

INTERNATIONAL EDITION RATES & AVAILABILITY ON REQUEST

---


# why beg, borrow or steal?

SEND TODAY FOR
YOUR OWN COPY
DOMESTIC EDITION ONLY.

**IC MASTER '78**

☐ Enclosed is my check or money order for $55.00 (postpaid)
(plus sales tax — California, 6%; New York, 7%)

☐ Bill me

Name ..... Title .....

Company .....

Address .....

City ..... State ..... Zip .....

Signature ..... Date .....

INTERNATIONAL EDITION RATES & AVAILABILITY ON REQUEST

---

# why beg, borrow or steal?

SEND TODAY FOR
YOUR OWN COPY
DOMESTIC EDITION ONLY.

**IC MASTER '78**

☐ Enclosed is my check or money order for $55.00 (postpaid)
(plus sales tax — California, 6%; New York, 7%)

☐ Bill me

Name ..... Title .....

Company .....

Address .....

City ..... State ..... Zip .....

Signature ..... Date .....

INTERNATIONAL EDITION RATES & AVAILABILITY ON REQUEST

FIRST
CLASS
PERMIT
NO. 2209
GARDEN CITY
NEW YORK

**BUSINESS REPLY MAIL**

NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

POSTAGE WILL BE PAID

**IC MASTER**

645 Stewart Avenue, Garden City, NY 11530
U.S.A.

FIRST
CLASS
PERMIT
NO. 2209
GARDEN CITY
NEW YORK

**BUSINESS REPLY MAIL**

NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

POSTAGE WILL BE PAID

**IC MASTER**

645 Stewart Avenue, Garden City, NY 11530
U.S.A.

FIRST
CLASS
PERMIT
NO. 2209
GARDEN CITY
NEW YORK

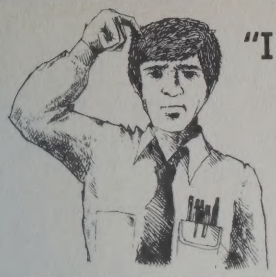
**BUSINESS REPLY MAIL**

NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

POSTAGE WILL BE PAID

**IC MASTER**

645 Stewart Avenue, Garden City, NY 11530
U.S.A.



**"I need to know if this device exists, and if there are any alternate sources. Where do I start?"**

- Memory IC
- RAM
- Static
- 1024x1
- CMOS
- 250 Nanoseconds
- 5 Volts

# If you're spending hours to solve a problem similar to the one above, you're behind the times...

# It only takes a few seconds with "THE MASTER."

**Clear your desk for action with the newly revised 1978 IC Master.** Its all-under-one-cover features include: Over 40,000 standard products from more than 87 different companies . . . over 2,200 pages comprising five different selection guides (memory, microprocessor, interface, linear and digital) . . . almost 1500 design data pages . . . alternate source directory for pin-for-pin, function-for-function replacements . . . applications directory . . . complete military section . . . a complete part numbering guide . . . etc.

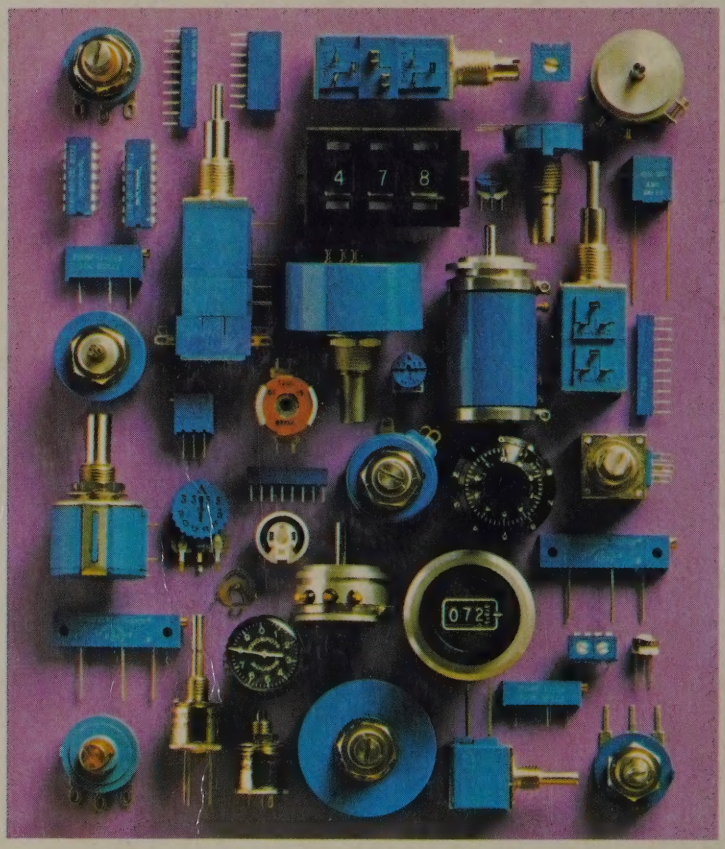
**You don't have to search through stacks of catalogs.** Simply look up the specs and function you need. You don't need a part number to start with.

**All you need is a problem to use The Master.** Does the device exist? Who makes it? Is there an alternate source? What's the part number? Is there an applications note? Who is my closest distributor—etc.

IC MASTER
United Technical Publications
645 Stewart Avenue
Garden City, New York 11530, USA

***It's Faster With the Master***

# The Big Choice in Resistive and Inductive Components



## You'll find it on these EEM pages:


**Resistive Components**

Dials, Turns Counting ..... 3858-3862

Potentiometers:

- High Precisions ..... 3863-3871
- Modulars ..... 3832-3842
- Panel Controls ..... 3829-3831
- Precisions ..... 3843-3857

Resistor Networks ..... 3639-3645

Trimmers ..... 3802-3828

Trimmers, Multi Function ..... 3791-3801

**Inductive Components**

Delay Lines ..... 2383

Inductors, Ferrite Core ..... 1324-1327

Transformers ..... 4331-4336


Sales Offices and Distributors: EEM Yellow Pages

For Quotation or Order Placement: Resistive Components 714 781-5050; Inductive Components 714 657-5195

BOURNS®


TRIMPOT PRODUCTS DIVISION, BOURNS, INC.

1200 Columbia Avenue, Riverside, CA 92507 / TWX 910 332-1252